

EXHIBIT 1

Final Analysis, Inc.¹ ("Final Analysis") hereby submits its applications for experimental authorization for radio facilities in the 153.0000 to 157.5000 MHz (to be used for uplink); 157.5000 to 162.0000 (to be used as downlink) and 400.595 to 400.645 MHz (to be used for downlink to Master Ground Station only) bands as specified herein. A full exposition of the frequencies proposed for each of Final Analysis' applications is set forth in tabular form on "Appendix A" hereto.

As detailed herein, the purpose of the experiment is to determine the ability of NVNG MSS operations to coexist with existing users and operations in the designated spectrum.

I. INTRODUCTION

A. Final Analysis Is An Emerging Leader In The U.S. Mobile Satellite Industry

Final Analysis is a small business which develops innovative commercial satellite technologies, manufactures and sells satellites, and places satellites in orbit. Its scientists, engineers and executive management team are all experienced professionals in the space flight business with backgrounds in developing space platforms for challenging federal government applications. Final Analysis' management team comprises

¹ Final Analysis, Inc. is the parent corporation of Final Analysis Communication Services, Inc., which is an applicant for commercial license in the Non-Voice, Non-Geostationary Mobile Satellite Service ("NVNG MSS").

hands-on managers who participate directly in the fabrication of the company's satellite and ground support equipment detailed in the experimental applications submitted herewith.

In developing its state of the art technology, Final Analysis has utilized U.S. Government-sponsored satellite research and development data, as well as federal government satellite test facilities.

B. Final Analysis' Experimental Application Meets The FCC's Stated Goals For U.S. Leadership And Innovative Satellite Development

The established policy of the United States is to encourage the provision of new technologies and services to the public. *See Communications Act of 1934, as amended, 47 U.S.C. § 157. In its Policy Statement on Experimental Satellite Applications, FCC 92-324 (released July 21, 1992), the Commission stated in unequivocal terms:*

The Commission is committed to ensuring that the U.S. maintains its leadership position in the satellite and communications industries. Therefore, the policy guidelines we set forth today for experimental satellite applications are designed to encourage, to the fullest extent possible, satellite investment, experimentation and innovation and to stimulate the development of the highest quality satellite services for U.S. consumers.

Nevertheless, the Commission has recognized that building and launching a satellite is costly, and that it does not wish to create an expectation that sizable investments mandate any future commitments by

grant of an experimental license.² Accordingly, the Commission designed specific guidelines for grants related to proposed experimental uses.³

Final Analysis' experimental application as detailed herein clearly satisfies these guidelines. Final Analysis' experimental plan cannot be simulated by means other than the launching of its satellite. Moreover, the company intends to minimize the cost of its investment, taking advantage of every possible economy in the design and fabrication of the components of its system, including direct U.S. Government assistance if available. Finally, the requested spectrum is the minimum necessary to conduct the experiments.

²*Id.*

³The guidelines are as follows:

The Commission staff will evaluate the relationship between what is requested (including numbers of satellites, ground stations, and amount of spectrum), and the technical parameters to be tested.

The applicants proposed experimental use of spectrum and orbital slots should be planned efficiently and limited to that which is necessary to the conduct of the experiment.

We will generally avoid granting applications that permit the construction and launching of complete systems.

Market tests will be limited, as envisioned by the rules. This limitation will generally apply to the geographic area to be served as well as the number and monetary investment of people participating in the experimental service.

Grant of the application should be consistent with our general policy to protect against harmful interference to licensed stations.

II. REQUEST FOR EXPEDITED ACTION

Final Analysis' scheduled August, 1995 launch date makes it a matter of great urgency that the Commission accelerate its consideration of these applications. In order to launch its satellite by August, Final Analysis must commence work on the design and manufacturing of the satellite immediately. In particular, certain long-lead items which are part of the experimental satellite must be ordered from subcontractors so that construction may proceed unimpeded.

III. DISCUSSION

A. Background

The United States has taken a leadership position in the development of Low Earth Orbit, Non-Voice, Non-Geostationary Mobile Satellites, and marketing studies demonstrate that there is a huge potential demand for the service. At present, there are eight separate applicants for satellite constellations in this service, three in the first processing round and five in the second. Current analyses indicate that the proposed systems require considerably more spectrum than is available for use, and that an additional 7-10 MHz at the very least will be needed in the near term to actualize the plans which are on the drawing board now.

Accordingly, both the Commission and representatives of the applicants have been expending considerable efforts to analyze frequency usage in the below 1 GHz band and locate frequencies suitable for allocation to the NVNG MSS service. Although practically any available frequencies

below 1 GHz could be utilized for this service, part of the difficulty involved in this process is that most available frequencies below 1 GHz are heavily utilized by a variety of Government and non-Government users. Consequently, it will be necessary to share with existing users. Sharing between low-earth orbit satellites and existing users is a complex matter which to some extent is subject to theoretical analysis; however, there is a paucity of real-world data that can be employed to discriminate between frequencies that may be suitable for sharing, and those that are unworkable.

A variety of potential bands for the expansion of the NVNG MSS have been investigated and discussed by the Commission, the Government Users and industry groups. To date, these efforts are inconclusive; in the immediate future, spectrum use by the NVNG MSS is a topic for discussion in preparatory meetings and conferences for the 1995 World Radiocommunication Conference in Geneva. In addition, the Commission has recently issued a Notice of Inquiry to determine whether additional frequencies may be obtained for use by this service. As part of this developmental process, Final Analysis is proposing to conduct this experimentation to help obtain hard data on a discrete portion of commercial spectrum, the frequencies from 153.0000 to 162.0000 MHz. Final Analysis hopes to obtain information that will be of critical importance in analyzing the potential for sharing in this band with existing users. Final Analysis will employ unique, remotely-tunable transmitters and scanning receivers on its satellite, so that all of the potentially usable segments of this 9.0 MHz-wide portion of spectrum can be thoroughly investigated for uplink and downlink possibilities.

The objective of the experimental use requested by Final Analysis is to demonstrate that NVNG MSS systems can coexist peacefully with existing users in the indicated band. To this end, a variety of experiments are proposed, using remote mobile terminals ("RTs") in a variety of circumstances, including urban, suburban, mountainous conditions, over bodies of water, etc. These experiments, and the proposed use of RTs, are described hereinbelow.

B. Description Of The Proposed Experimentation

As required by the Commission's Rules, the ensuing discussion sets forth in detail: (i) Final Analysis' proposed program of research and experimentation; (ii) the specific objectives it seeks to accomplish; and (iii) an explanation of how the proposed experimentation has a reasonable promise of making meaningful contributions to the development of communications technologies. *See* 47 C.F.R. § 5.57.

As noted above, market studies performed by various organizations and reported by Task Group 8/3 have indicated the need for an additional 7 to 10 MHz of spectrum for Non-Geostationary Mobile Satellites below 1 GHz. In order to aid the frequency selection process, Final Analysis proposes to launch an experimental satellite and determine the frequency sharing potential. Final Analysis' proposed experiment concerns shared use of radio frequencies between low-earth orbit satellites in the NVNG MSS and existing users in the 153.0000-162.0000 MHz range.

Existing users of these frequencies include various land and maritime mobile services. It is believed that sharing can be accomplished efficaciously due in part to the short duration and low power flux density of the signals utilized in the NVNG MSS.

The proposed satellite will be equipped with transmitters and receivers which are tunable (synthesized) over the full band. The receivers will include a scanning detector capable of determining, on a statistical basis, the global activity in the implicated band. Likewise, the satellite transmitters will be tunable both in frequency *and* output power. Varying both of these operational parameters in a methodical manner will allow a determination of the sharing conditions. This information will be invaluable in determining suitable uplink and downlink frequencies.

Apart from the scanning function, which should demonstrate the theoretical possibility of sharing with existing users, an essential component of the experiment is the deployment and use of the RTs, so that actual data transmission can be attempted on the frequencies identified from time to time by the scanning receiver. Without actual attempts at communications, it will not be possible to establish real-world data on the workability of the NVNG MSS system on the frequencies identified, and in the prevailing circumstances that prospective system users would likely find themselves in.

To this end, Final Analysis proposes the use of a total of 9,240 RTs, to be distributed in 6 different geographic regions over the continental United States, Hawaii and Alaska. An illustrative regional map is attached as

"Appendix B" hereto. Distribution of the RTs would roughly correspond to the concentration of urban population in a given geographic region, as follows:⁴

<u>Region</u>	<u>Description</u>	<u>Number of RTs</u>
1	Northeast	2,725
2	Middle West	2,043
3.	South	2,301
4	West	2,111
5	Alaska	15
6	Hawaii	45
TOTAL		9,240

The use of multiple RTs grouped in potential high-use areas (both for existing terrestrial users and prospective NVNG MSS users) would best illustrate the sharing options for the implicated frequencies. Without high numerical concentrations of RTs in heavy-use areas, reliable real-world data would be difficult if not impossible to obtain.

⁴ The proposed distribution of RTs among regions correlates to the relative values of the sums of the populations in metropolitan areas contained within all states in a given region, based on population estimates. The figure of 9,240 total RTs for the continental United States, Alaska and Hawaii yields a ratio of approximately 20,000 urbanized "pops" per RT. For experimental purposes, it is contemplated that distribution of RTs *within* a given region will be weighted towards the most highly-concentrated urban populations, on the theory that such population concentrations are likely to contain the most existing users of the implicated frequencies, as well as the most likely potential subscribers to NVNG MSS services.

C. The Final Analysis Experiment Meets The Eligibility Requirements Of The Commission's Rules

The Commission's Rules applicable to experimental radio authorizations require that a proposed experiment fall into one or more of eleven distinct categories of experimentation in order to be eligible for grant of a license.⁵ As demonstrated below, the uses specified in Final Analysis' applications clearly meet the requirements of at least three of these categories.

1. Communications Essential To A Research Project

The Commission's Rules with respect to experimental authorizations for communications essential to a research project require: (i) a description of

⁵ These categories, set forth in 47 C.F.R. §§ 5.202(a)-(k) are as follows:

- a. experimentations in scientific or technical radio research
- b. experimentations under contractual agreements with the U.S Government, or for export purposes
- c. communications essential to a research project
- d. technical demonstrations of equipment or techniques
- e. field strength surveys by persons not eligible for authorization in any other service
- f. demonstration of equipment to prospective purchasers for proposed stations in existing services by persons engaged in the business of selling radio equipment
- g. testing of equipment in connection with production or type approval of such equipment
- h. development of radio technique equipment or engineering data not relating to an existing or proposed service, including field or factory testing or calibration of equipment
- i. development of radio technique, equipment, operational data or engineering data related to an existing or proposed radio service
- j. limited market studies
- k. other types of experiments not covered above.

the nature of the research project being conducted; (ii) a showing that communications facilities are necessary for the research project involved; and (iii) a showing that existing communications facilities are inadequate. See 47 C.F.R. § 5.57(d).

As stated above, the research project is an investigation of the ability of NVNG MSS systems to coexist with terrestrial mobile users in the 153.000-162.000 MHz band. Since the communications facilities, and their ability to share on certain frequencies, while maintaining an acceptable level of performance, is at issue in this research project, they are demonstrably necessary. Finally, it is also evident that existing facilities are inadequate, since no other low-earth orbit satellite in the NVNG MSS presently operates on the implicated frequencies. In addition, due to the unique characteristics of non-geostationary satellite communications (e.g., large "footprint," rapid sweeping, short burst communications from space), it is not possible to use existing facilities or simulations.

2. Technical Demonstration Of Equipment Or Techniques

The proposed experiment also constitutes a technical demonstration of techniques, viz., the demonstration that NVNG MSS operations are possible on a shared basis in the 153.0000-162.0000 band.

3. Development Of Radio Technique, Equipment, Operational Data Or Engineering Data Related To An Existing Or Proposed Radio Service

The development of the radio techniques, operational and engineering data by Final Analysis as part of the experiments proposed for the service as

outlined herein relate well to operations in an existing service, the NVNG MSS. Scanning potential frequency bands for sharing possibilities will benefit all potential Little LEO systems.

C. Proposed Frequency Use

1. Uplink Frequencies Proposed By Final Analysis

Final Analysis proposes the use of the 153.0000-157.5000 MHz band for its experimental uplink transmissions. To reduce the potential for interference to and from terrestrial users, the satellite transceiver will incorporate the ability to scan the 153.0000-157.5000 bands in 10 KHz steps and select the lowest interference region to be used for uplink transmission use. Gaussian Minimum Shift Keying ("GMSK") modulation will be employed for its lower side lobes, reducing out-of-band emissions and thereby lowering the potential of harmful interference to adjacent users. The frequencies will be used by both the Master Ground Station and all RTs.

2. Downlink Frequencies Proposed By Final Analysis

Final Analysis also proposes to employ segments of the 157.5000-162.0000 MHz band on two of its satellite transmitters for downlink activities. GMSK modulation will be employed for its lower side lobes, reducing out-of-band emissions and thereby lowering the potential of harmful interference to adjacent users.

The third satellite transmitter will operate on a 50 KHz segment of spectrum from 400.595 to 400.645 MHz. GMSK modulation will also be utilized for these transmissions to minimize potential harmful interference.

3. Coexistence With Existing Users Of The Frequencies

a. Downlink

As established above, the purpose of this experiment is to determine the feasibility of NVNG MSS operations in the 153.0000-162.0000 MHz range. Downlink activities are to take place in the 4.5 MHz segment from 157.5000 to 162.0000. The ability to coexist with existing users, while maintaining acceptable performance for system operations, is precisely the matter to be determined. The frequencies used for communications, and the output power will be varied methodically to determine sharing options. Careful planning in the design of the experiment has been employed to avoid certain potential conflicts, however.

The radio astronomy community in Region 1 operates very sensitive terrestrial receivers in the 150.05-153 MHz and 406.1-410 MHz bands. The downlink frequencies utilized by the proposed experimental satellite, 157.5000 to 162.0000 MHz are spaced 4.5 MHz from this use. The use of appropriate filters and GMSK modulation, with minimized side lobes, will reduce the risk of interference from out-of-band emissions.

The proposed satellite downlink beacon in the 400.595-400.645 MHz band is located near the 406.1-410 MHz radio astronomy band. However, this transmitter has been designed to have extremely low phase noise and, therefore, it has very low out-of-band response. GMSK modulation is employed to minimize the potential for interference with adjacent users. The measured transmitter output in the 406.1-410 MHz band is less than -130 dBc/Hz. The resulting power density at the earth's surface due to the satellite transmitter in the 406.1-410 MHz is less than -250 dBW/Hz.

b Uplink

Final Analysis will use selected 25 KHz channels ranging from 153.000-157.5000 MHz for RT uplink, and 50 KHz channels over the same frequency range for the Master Ground Station uplink. To reduce the potential for interference to and from other users in this band, the satellite scanning receiver will scan this 4.5 MHz band in 10 KHz steps and select the lowest interference region to be used for the uplink transmissions.

NVNG-MSS systems must demonstrate that no signal received by a satellite from a source outside of the system shall be retransmitted by the satellite. The proposed experimental satellite does not make use of turn-around transponders. All signal paths through the satellite requires that the received signal is demodulated on-board and remodulated prior to transmission. It is therefore impossible for signals transmitted by the experimental satellite to originate from sources outside the proposed system.

D. Showings Related to the Commission's Rules

1. The Experiments Proposed By Final Analysis Cannot Reasonably Be Simulated By Means Other Than Those Proposed By Final Analysis In Its Application

The only reasonable method to perform the experimentation proposed by Final Analysis is via satellite, for the following reasons:

a. Ground-based towers or airplanes cannot provide the large footprint of over 5,000 km and the high elevation angles required to test the ability to communicate with the RTs spaced over large distances.

b. Since, as viewed from the satellite, RTs will be rapidly moving in and out of the footprint, the ability

to test the system's operation on these frequencies requires a transceiver moving at speeds in excess of 16,000 mph. These speeds are obviously only achieved by satellites.

c. To determine the effects of the Doppler shift for operation in these frequencies, once again speeds in excess of 16,000 mph are required.

2. The Experiments Proposed By Final Analysis Are Not Duplicative Of Experiments By Other Users Of These Bands

Final Analysis' proposed experimentation is unique: no comparable experiment has been conducted to investigate sharing options for low earth-orbit satellite communications in the implicated bands; nor is any other such experiment proposed.

3. The Experiments Proposed By Final Analysis Will Not Result In Harmful Interference To Existing Users

Final Analysis has designed its telemetry system to avoid harmful interference with existing users by meeting the requirements of US Footnote 323.

IV. CONCLUSION

As demonstrated above, the experimentation proposed by Final Analysis is unique, state of the art technology which complies with the Commission's requirements for the grant of experimental licenses. In view of the impending August launch date, it is respectfully requested that the Commission expeditiously grant the subject applications.

APPENDIX A

			Tuning	Center	Channel
	Down	Up	Range	Frequencies	Bandwidth
Description	Link	Link	(MHz)	(MHz)	(KHz)
SATELLITE					
Transmitter #1	√		4.50	157.5125, 157.5225,	25
				157.5325, ... ,161.9625,	
				161.9725, 161.9825	
Transmitter #2	√		4.50	157.5125, 157.5225,	25
				157.5325, ... ,161.9625,	
				161.9725, 161.9825	
Transmitter #3	√		(fixed)	400.6200	50
Master GS		√	4.50	153.0250, 153.0350,	50
				153.0450, ... ,157.4550,	
				157.4650, 157.4750	
RTs		√	4.50	153.0125, 153.0225	25
				153.0325, ... , 157.4625	
				157.4725, 157.4825	

APPENDIX B

Regions of RT Distribution

