CAL CORPORATION

an Electromagnetic Sciences Company

1050 Morrison Drive, Ottawa, Ontario Canada K2H 8K7
(613) 820-8280 Telex: 053-3937 Fax: (613) 820-6474

DATE: February 27, 1997 FILE: 0881/Cert.

Subject: Request for Special Temporary Authority to operate up to 5 Aeronautical Mobile Satellite Service Terminals

Dear Mr. Tycz,

Pursuant to Section 25.119 of the Commission's Rules, CAL Corporation ("CAL") hereby requests Special Temporary Authority ("STA") to operate up to 5, two-channel aeronautical terminals satellite terminals pursuant to the attached technical exhibit. The terminals will operate on space segment provided by AMSC Subsidiary Corporation. CAL requests that the STA become effective March 10, 1997 and remain in effect until September 7. 1997 or until a grant of CAL's type acceptance application , whichever is earlier. Grant of this request will serve the public interest in the continued development of MSS in the United States.

CAL will file a type acceptance with the FCC, pursuant to the Commission's requirements for aeronautical mobile terminals. Report and Order, 7 FCC Red 5895 (1992). CAL also has notified the FAA of its intention to make application for type acceptance, including all the required technical data, and will provide the FAA a copy of the final type acceptance application submitted to the FCC.

The purpose of the authority requested herein is to allow CAL to conduct end-to-end tests of the two-channel terminals, using the AMSC communications ground segment, control systems and satellite. The tests also permit CAL to comply with FAA type acceptance requirements for specific aircraft models. CAL seeks to conduct tests covering system stability and quality, as well as feature and service functionality to provide mobile satellite services. All participants in these tests will be notified that the terminals have not yet been type accepted and are returnable to CAL if type acceptance is denied. Participants will pay AMSC for applicable air-time charges. The equipment trials are to be conducted in the US and in Canada.

Granted
709-SSA-97
date: 3/10/97 – Exp. 9/7/97
authorized by:
signature 3/10/97

Satellite and Radiocommunications Division,
International Bureau,
Federal Communications Commission,
2000 M. Street, N.W., Room 800,
Washington, D.C. 20554
U.S.A.
Attn: Mr. Thomas S. Tycz
(Chief of Division)

CAL™

These tests represent an important step in the continued development of aeronautical mobile services. Currently, general aviation and corporate aircraft have been unable to receive two-channel, high-quality voice, data and fax service at reasonable rates. The authority requested herein will allow CAL to ensure that the terminals are technically sound[1] and meet all operational requirements prior to the full commencement of services to the public. Therefore, CAL respectfully requests temporary authority to operate up to 5 two-channel aeronautical satellite terminals, consistent with the parameters set forth herein. CAL requests that this STA be granted effective March 10, and last for six months, or until grant of the underlying type acceptance application, whichever is earlier.

CAL certifies that no party to this application is subject to a denial of Federal benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 USC § 835(a).

Respectfully submitted,

Alexander J. Mallie

VP, Communications Systems

CAL Corporation

Copy: Frank Peace, JR

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[1] CAL notes that the transceiver portion of the terminal is constructed by Westinghouse Electric Corporation and previously has been licensed by the FCC. Additionally a single-channel system, of similar basic design, has been type accepted under FCC ID: K6KQC100.

(RESERVED)

FEDERAL COMMUNICATIONS COMMISSION

FCC REMITTANCE ADVICE

Approved by OMB
3060-0589
Expires 2/28/97

PAGE NO. 1 OF _____

SPECIAL USE

FCC USE ONLY

(Read instructions carefully BEFORE proceeding.)

PAYOR INFORMATION

(1) FCC ACCOUNT NUMBER: 0 9 8 0 1 3 7 9 9 7

Did you have a number prior to this? Enter it.

(2) TOTAL AMOUNT PAID (dollars and cents): $ 130.00

(3) PAYOR NAME (If paying by credit card, enter name exactly as it appears on your card)

Cal Corporation

(4) STREET ADDRESS LINE NO. 1

1050 Morrison Drive

(5) STREET ADDRESS LINE NO. 2

(6) CITY: Ottawa, Ontario

(7) STATE: Canada

(8) ZIP CODE: K2H 8K7

(9) DAYTIME TELEPHONE NUMBER (Include area code)

(10) COUNTRY CODE (if not U.S.A.)

ITEM #1 INFORMATION

(11A) NAME OF APPLICANT, LICENSEE, REGULATEE, OR DEBTOR: Cal Corporation

FCC USE ONLY

(12A) FCC CALL SIGN/OTHER ID	(13A) ZIP CODE	(14A) PAYMENT TYPE CODE	(15A) QUANTITY	(16A) FEE DUE FOR PAYMENT TYPE CODE IN BLOCK 14
	K2H 8K7	C G X	1	$ 130.00

(17A) FCC CODE 1

(18A) FCC CODE 2

(19A) ADDRESS LINE NO. 1	(20A) ADDRESS LINE NO. 2)	(21A) CITY/STATE OR COUNTRY CODE
1050 Morrison Drive		Ottawa, Ontario Canada

ITEM #2 INFORMATION

(11B) NAME OF APPLICANT, LICENSEE, REGULATEE, OR DEBTOR

FCC USE ONLY

(12B) FCC CALL SIGN/OTHER ID	(13B) ZIP CODE	(14B) PAYMENT TYPE CODE	(15B) QUANTITY	(16B) FEE DUE FOR PAYMENT TYPE CODE IN BLOCK 14
				$

(17B) FCC CODE 1

(18B) FCC CODE 2

(19B) ADDRESS LINE NO. 1	(20B) ADDRESS LINE NO. 2	(21B) CITY/STATE OR COUNTRY CODE

CREDIT CARD PAYMENT INFORMATION

(22) MASTERCARD/VISA ACCOUNT NUMBER:

☐ Mastercard

EXPIRATION DATE: Month ____ Year ____

☐ Visa

(23) **I hereby authorize the FCC to charge my VISA or Mastercard for the service(s)/authorization(s) herein describe.** ☞

AUTHORIZED SIGNATURE DATE

See public burden estimate on reverse.

FCC FORM 159
April 1994

VOUCHER NO	INVOICE DATE	INVOICE NO	INVOICE AMOUNT	DISCOUNT AMOUNT	NET AMOUNT
	02/27/97	022797	130.00		130.00
				TOTAL	130.00

0007252

CAL CORPORATION
1050 MORRISON DRIVE, OTTAWA ONTARIO K2H 8K7
TELEPHONE. (613) 820-8280

CHEQUE NO 7252

0007252

CAL CORPORATION™
an Electromagnetic Sciences Company
1050 MORRISON DRIVE, OTTAWA, ONTARIO K2H 8K7

CHEQUE NO. 7252

THE TORONTO-DOMINION BANK
COMMERCIAL BANKING CENTRE 32866-004
245 STAFFORD ROAD WEST
NEPEAN, ONTARIO K2H 9E8

DATE 27-FEB-97 AMOUNT U.S. $ 130.00

ONE HUNDRED AND THIRTY 00/100 DOLLARS

PAY TO THE ORDER OF
F.C.C.
2000 M. STREET, N.W.
ROOM 800
WASHINTON DC
20554 U.S.

CAL CORPORATION

PER _____

PER _____

⑈0007252⑈ ⑆32866⑉004⑆ 3286⑉7300243⑈

Technical Exhibit in support of application for Special Temporary Authority (STA)

DESCRIPTION OF EQUIPMENT:

Purpose of Equipment

The equipment is intended to provide dual channel voice, FAX and data services in the Aeronautical Mobile Satellite Service. Specifically, it supports the following data rates and services:

- 4800 bps digitized voice using the DVSI IMBE vocoder.
- 2400 bps Group 3 FAX.
- 4800, 2400 and 1200 bps circuit switched data.

These services are made available to the maximum extent practicable during all phases of aircraft operation, both on the ground and in the air.

Equipment Configuration

The equipment will be provided in one of two possible configurations at the customers discretion, single channel or dual channel. The single channel installation has been the subject of a previous Type Acceptance application and received certification under the FCC ID: K6KQC100. The Grant of Equipment Authorization is filed with the FCC under File number 31010/EQU 17.9, dated March 6, 1996. The dual channel configuration is identical to the single channel except that two transceiver subsystems are coupled to the same antenna through a 3dB hybrid coupler. The dual channel configuration is shown in figure 1. The major active elements are as follows:

1. The Antenna Unit
2. The Transceiver Subsystem
3. The High Power Amplifier (HPA)
4. The Two Channel Coupler Unit
5. The Handset(s)

A brief description of each element follows.

Antenna Unit

The Antenna Unit is designed for fuselage top mounting. It includes a mechanically steered radiating element and motor drive, and is covered by an aerodynamically contoured radome. The Antenna Unit and its radome also house: the diplexer and LNA combination, a compass to provide steering information, and an active GPS antenna element.

Transceiver Subsystem

Each Transceiver Subsystem (TS) includes the Transceiver Unit (TU), the High Power Amplifier (HPA), the beam steering unit (BSU), a GPS receiver and a power converter to suit the aircraft supply. The TU performs all the functions defined for this unit in its land mobile configuration plus providing Doppler correction through the use of software specially developed for aeronautical applications. The GPS receiver provides position and velocity information both for Doppler correction and for use by the BSU in steering the antenna. The two Transceiver Subsystems in the two–channel configuration are functionally identical to that used in the single channel configuration and are completely interchangeable. The special configuration required for them to operate as designated units #1 and #2 in this two–channel configuration results from signaling from the micro-processor in the two–channel combiner to the unit installed in the #2 position.

High Power Amplifier

The HPA is required to amplify the transmit signal given out by the TU to the level required to meet the specified EIRP requirements. It is co-located with the Transceiver.

Two Channel Coupler Unit

The Two Channel Combiner Unit provides the RF interface between the two transceivers and the single Antenna. It also provides information, to the transceiver in the # 2 position, on the status of the transceiver in the # 1 position. This allows the #2 Transceiver to disable itself and bypass the hybrid combiner in the #1 transmitted path, when traveling in areas of the coverage where only single channel operation is available.

Number of Handsets

Each of the two transceiver units is to be supplied with a single handset. Provision will also be made for the installation of multiple handsets, all connected to both TS's so that any one of them can be used to communicate through either channel.

Handsets

In addition to their primary communication function, one of the handsets will have keys and a display, and is to be used as the control panel for the equipment.

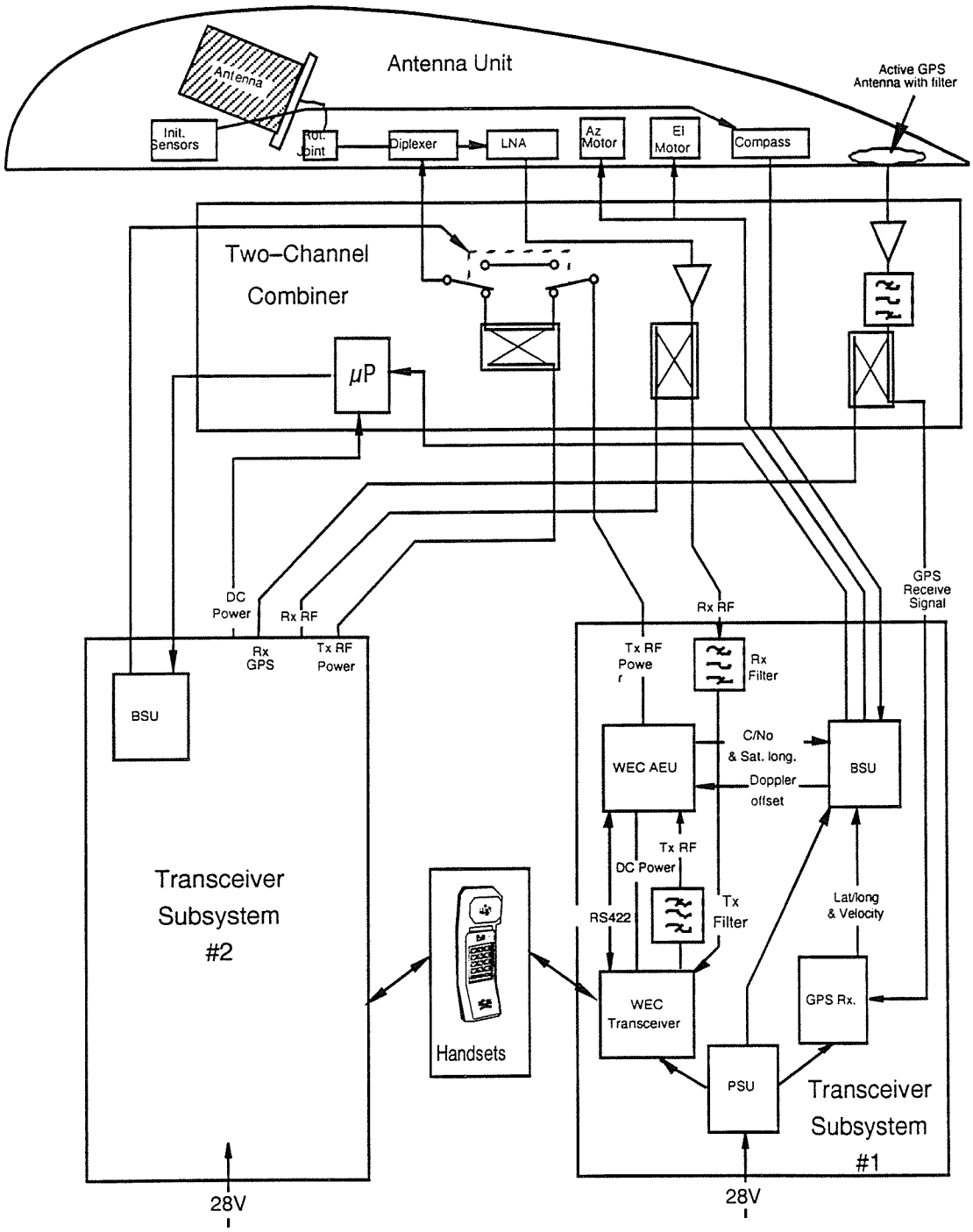


Figure 1: CALQUEST™ CQ200 Two-Channel System Configuration

Installation Issues

The equipment is designed for simple, straightforward installation to minimize the cost of this activity. To this end, the following guidelines are followed:

- Minimize the size and weight of the antenna.
- Minimize the size and weight of the interior equipment.
- Installation will be possible without removal of the antenna from the radome.
- The GPS antenna will be incorporated within the main antenna assembly to avoid having to install a separate unit.

Range of Aircraft Sizes

Provision is made for installing the antenna on fuselages in any one of five size ranges. These ranges encompass most of the commonly used private commuter aircraft in service.

Cabling Details

The system is designed to maximize the length, and minimize the diameter, of the cabling interconnecting the various subsystems.

Power Distribution

Power is processed in the Transceiver Subsystem and then distributed to the other subsystems to avoid the need for more than one supply from the aircraft.

Connector Types

Circular avionics style bayonet connectors are used wherever possible.

Handset Mounting

The handset(s) will normally be cradle mounted on a cabin wall or other vertical surface.

MANUFACTURERS IDENTIFICATION:

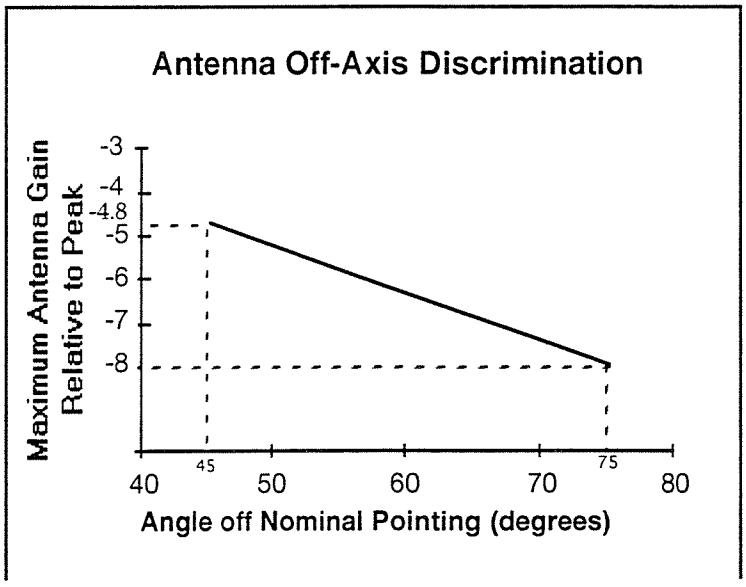
The product will be identified as a: CALQUEST™ Satellite Phone, model CQ200.

ANTENNA CHARACTERISTICS:

The gain of the antenna is measured at the input to the antenna element (i.e., not at the input to the Antenna Unit). The beam peak gain varies with the antenna pointing orientation, but lies within the following ranges:

Receive band	8.3 dBi to 12.3 dBi
Transmit band	9.4 dBi to 12.3 dBi

The relative transmit antenna gain pattern envelope (i.e., spatial discrimination) for the AES antenna is strongly dependent on the mechanical pointing direction of the antenna relative to the fixed ground plane. Although the requirements for off-axis antenna discrimination nominally apply only to the "horizontal" (e.g., equatorial) plane of the antenna gain characteristic, the complex geometry of a mechanically steered antenna mounted on a maneuvering aircraft significantly broadens this requirement when the gain is referenced to the antenna's horizontal and vertical. In order to satisfy all potential geometrys of satellite pointing direction, aircraft orientation and consequent antenna orientation for satellite pointing, the antenna gain envelope contours were analyzed to determine the highest off axis antenna gain at any angle relative to its horizontal / vertical reference planes. These worst case off-axis spatial discrimination gain results were then compared with the maximum allowable off-axis relative gain illustrated in Figure 3 below:



The receive and transmit gains of the antenna at 45° and 75° away from the nominal direction of the desired satellite (i.e. not necessarily the direction of either the peak of the transmit or receive antenna gain patterns) shall be a minimum of 4.8 dB and 8 dB, respectively, below the beam peak value and shall remain below the linearly interpolated mask shown in Figure 3.

Figure 3: Antenna Off-Axis Discrimination

The following plot, Figure 4, illustrates the results of the analysis measured with an antenna elevation angle of 45° where the off axis gain, when measured at the various azimuth pointing angles shown as parameters, was the maximum recorded. In the worst case this indicates there is still a 5° margin in the off-axis discrimination performance.

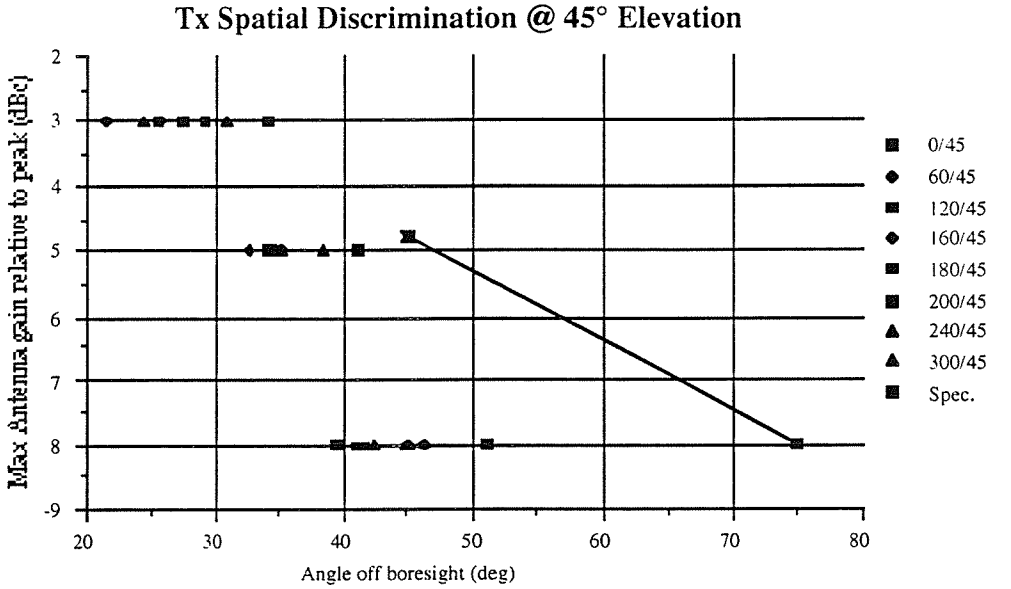


Figure 4: Plot of analyzed maximum off-axis antenna gain when measured with an elevation of 45° to the ground plane.

RATED OUTPUT POWER:

During periods when a single carrier is activated, and within the constraints of the Signal Timing Limits, the EIRP lies within the range +12.0 dBW to +18.3 dBW.

During periods when both carriers are activated, and within the constraints of the Signal Timing Limits, the EIRP lies within the range +9.9 dBW to +15 dBW.

The maximum level is not exceeded even when the antenna peak transmit gain is not in the direction of the desired satellite.

EMISSION TYPE AND CHARACTERISTICS:

The designation of the station's emissions is 6K00G7W when operating in the dual channel configuration.

Description of Modulation (each channel): all Single Carrier per Channel (SCPC),

FES-C:	Outbound communications and in-band signaling channel from an LES to a MET.	Quadrature Phase Shift Keyed (QPSK) at 3375 Symbols per second,	voice activated with periodic signaling bursts.
GC-S:	Outbound signaling channels from the NCC to the METs.	Bi Phase Shift Keying (BPSK) at 3375 Symbols per second continuous	periodic reference bursts.
MT-ST/SR:	Inbound signaling channels from the MET to the NCC.	Bi Phase Shift Keying (BPSK) at 3375 Symbols per second continuous	periodic signaling bursts.
MET-C:	Inbound communications and in-band signaling channel from the MET to an LES.	Quadrature Phase Shift Keyed (QPSK) at 3375 Symbols per second,	voice activated with periodic signaling bursts.

INTERMODULATION PRODUCTS:

When radiating two un-modulated carriers, each 3 dB below the maximum radiated power, no intermodulation product is greater than -24 dB with respect to the mean power of either carrier.

FREQUENCIES OF OPERATION:

The functional transmit and receive frequency ranges are not less than the following:

Receive frequency range: 1525 to 1559 MHz
Transmit frequency range: 1626.5 to 1660.5 MHz (see Note 1)

Note 1: Transmit range quoted is equipment design range. System operator restricts operations to authorized frequencies.

Note 2: channel spacing is 6.0 kHz @ 0.5 kHz increments.

OUT OF BAND EMISSIONS:

The EIRP of any radiated harmonic in any spatial direction is less than -37dBW for any frequency up to 20 GHz.

The composite spurious and noise output EIRP (excluding harmonics) radiated by the AES does not exceed the following values outside the transmit band:

Frequency (MHz)	Spurious Emission Limits
< 1525	-135 dBc/4 kHz
1525 - 1559	Meet G/T with transmitter on
1559 - 1565	–135 dBc/4 kHz
1565 - 1585	–155 dBc/1 MHz *
1585 - 1610	–57 to –53 dBW/1 MHz linearly interpolated
1610 - 1622	–70 to –39 dBW/30 kHz linearly interpolated
1622 - 1626.5	–39 dBW/30 kHz
1626.5 - 1660.5	–60 dBc/4kHz
1660 - 1735	–60 dBc/4kHz
1735 - 12000	–105 dBc/4kHz
12000 - 18000	–70 dBc/4 kHz

* With respect to the maximum two-channel EIRP of 15 dBW.

It is recognized, and so noted in the installation / operators handbook, that this system may not be operated at the same time, and on the same aircraft, as the GLONASS navigation system.

CRITERIA FOR PRIORITY AND PREEMPTIVE ACCESS:

The CALQUEST™ Aircraft Earth Station incorporates a transceiver which is similar to the Westinghouse equipment used in the AMSC Mobile Telephone System(MTS), for which AMSC has previously received operational authority from the FCC and which has been found, by the FCC, to meet its requirements for Priority and Real Time Preemptive Access.

TECHNICAL CERTIFICATION

I hereby certify that I an the technically qualified person responsible for the engineering information in the foregoing Request for Special Temporary Authority, and I an familiar with part 25 of the Commission's Rules, that I have reviewed the engineering information submitted in the foregoing request, and that it is complete and accurate to the best of my knowledge.

By: _____

Mr. Gary Hebb, Director of Engineering

Date: Feb 27/97