

ARNAV Systems, Inc.

16923 Meridian East
P.O. Box 73730
Puyallup, Washington 98375
(253) 848-6060

RCOM-100 SatPhone

FCC Part 25
Certification Report
FCC ID: FEF-453-8050

DOCUMENT NUMBER: ENG-5027 REV -

20 January 2003

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MANUFACTURER

ARNAV Systems, Inc.

16923 Meridian East

Puyallup, WA 98375

Tel: 253-848-6060

REGULATORY ENGINEERING MANAGER

Lynn Johnson

Director of Engineering

Tel: 253-848-6060

Fax: 253-848-3555

e-mail: ljohnson@arnav.com

REGULATORY ENGINEERING SPECIALIST

DeLyle Danner

R & D Manager

Tel: 253-848-6060

Fax: 253-848-3555

e-mail: ddanner@arnav.com

Document Amendment Record

DATE	DETAIL OF CHANGE	REV	APPROVAL
1/20/03	Initial document release	-	DeLyle Danner

January 20, 2003

Federal Communications Commission
Office of Engineering and Technology

Re: Application for Certification of RCOM-100 SatPhone

FCC ID No.: FEF-453-8050

To Whom It May Concern:

This product is a sister product to the Globalstar Analog Fixed User Terminal FCC ID: J9CGSAF1. The only difference between RCOM-100 and the AFUT is packaging, an addition of a power supply, and protection circuitry for the external I/O lines. The following drawings as submitted by Qualcomm and confidential to them are applicable to this certification:

1. Exhibit 14, RAU RF Board Drawings (Files: E.14a 20-81540_X2.PDF, E.14b LD20-81540_X1.PDF, E.14cPL20-81540-1X4.pdf, and E.14d AFUT RF Block Diag.pdf).
2. Exhibit 15, RAU Digital Board Drawings (Files: E.15a 20-81220_X1.PDF, E.14c PLD20-81540-1X4.pdf, E.15d DC20-81220_X1.PDF, and E.15e 25-81220_X2.PDF).
3. Exhibit 16, RAU Interface Board Drawings (Files: E.16a 20-81385_X3.PDF, E.16b LD20-81385_X3.PDF, E.16d DC20-81385_X3.PDF, and E.16e 25-81385_X3.PDF).

The following documentation has been submitted for your review either electronically, by mail, or as part of this document:

1. FCC Form 731 for the RCOM-100 SatPhone was filled out on line and was given a confirmation number EA851428 dated 1/20/2003.
2. A letter for Request of Confidentiality contained in this document.
3. Form 159 was sent via Federal Express on 1/20/2003 with a payment of \$675 in the form of a check number 18750.
4. All test data and support documentation as required for certification under Part 2 and Part 25 of Title 47 of the Code of Federal Regulations.

If any further information is required please contact myself, DeLyle Danner. You may reach me by phone at 253-848-6060 ext. 26, by fax at 253-848-3555, or e-mail at ddanner@arnav.com.

Please advise when the Request for Confidentiality has been accepted and also when certification has been granted.

Sincerely,

DeLyle Danner
R & D Manager

EXHIBIT 2

Federal Communications Commission

Reference: FCC ID: FEF-453-8050

Request for Confidentiality

Pursuant to Sections 0.457 – 0.459 of the Commission's rules, ARNAV Systems, Inc. hereby requests confidentiality for certain aspects of the information accompanying the Application for Certification. Exhibits 1, and 4 -13 shall be classified as confidential.

All items contain trade secrets and other proprietary information not customarily released to the general public. Public disclosure of this information would be harmful to ARNAV Systems, Inc., and Qualcomm incorporated at this time, and would provide unjustified benefits to our competitors. These materials contain proprietary intellectual property that Qualcomm is in the process of filing for patent protection. ARNAV understands that, pursuant to Rule 0.457, disclosure of any information contained in this application will not be made before the date of the grant.

Sincerely,

DeLyle Danner
R & D Manager

LIST OF EXHIBITS

<u>EXHIBIT</u>	<u>DESCRIPTION</u>	<u>FCC REFERENCE</u>
1	Certification Report General Information	2.1033 (c)
2	Confidentiality Letter	0.457 0.459
3	Certification of Test Data	2.911
4	RCOM-100 Compliance Lab Out-of-Band and In-Band Noise and Spurious Emissions Test Data	2.1051, 2.1049
5	RF Exposure Analysis	1.1310, 2.1091
6	Frequency Stability	2.1055
7	RCOM-100 Product Label	2.1033 (c)(11)
8	Pilots Operating Handbook	2.1033 (c)(3)
9	RCOM-100 Installation Guide	2.1033 (c)(3)
10	Antenna Mechanical Drawing	2.1033 (c)(12)
11	345-0180 Power Supply Board Drawings	2.1033 (c)(12)
12	345-0192 PCA, Spine Board Drawings	2.1033 (c)(12)
13	453-8050 RCOM-100 Main Assembly Drawing	2.1033 (c)(12)

LIST OF APPLICABLE EXHIBITS FROM AFUT FCC ID: J9CGSAF1

Please note that this is a sister product to the AFUT FCC ID: J9CGSAF1. Please refer to the following Exhibits under AFUT product.

<u>EXHIBIT</u>	<u>DESCRIPTION</u>	<u>FCC REFERENCE</u>
10	Description of the Globalstar System	2.1033 (c)(6)(13)
14	AFUT RF Board Drawings	2.1033 (c)(12)
15	AFUT Digital Board Drawings	2.1033 (c)(12)
16	AFUT Interface Board Drawings	2.1033 (c)(12)

EXHIBIT 1 GENERAL INFORMATION

1.0 INTRODUCTION

This document comprises the Type Approval Support Documentation for Certification of ARNAV's RCOM-100 SatPhone.

It provides the data required by FCC for certification of intentional transmitters, to the requirements, defined in 47 CFR Chapter 1, Part 2, Sections 2.1033, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, and 2.1055, and Part 25 sections 25.202 (f), 25.204, and 25.213 (b) and Section 25.200 (c) (per Report Order FCC 98-338).

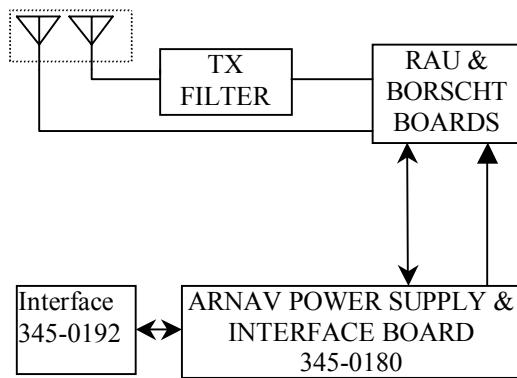
Measured data provided was taken using measurement procedures in accordance with Part 2 Sections 2.1041, and 2.1057. The governing regulations are those applicable in the USA. Much of the content of the technical description called for in Section 2.1033 (c) rules resides in the existing, separately published internal ARNAV documents furnished in Exhibits to this application.

2.0 EQUIPMENT DESCRIPTION

The RCOM-100 SatPhone operates in Globalstar mode only, communicating directly with overhead Globalstar satellites and via those satellites to the nearest Globalstar Gateway, and through the Gateway the rest of the network. The service supports voice and data communications, and provides user position location information.

Physically the RCOM-100 is comprised of Remote Antenna Unit (RAU), RF transmit filter, a Borscht Card, and a power supply interface board. The only difference between Globalstar Analog Fixed User Terminal (AFUT), FCC ID: J9CGSAF1, and the RCOM-100 is packaging, the antenna is remote, insertion of a transmit filter, and a power supply to power the assembly from a 10 to 35VDC power source.

The RAU contains 2 main electronic boards factory mounted by Qualcomm on a heat sink. The Borscht Card interfaces to the RAU to provide standard telephony 2 wire Tip and Ring voice signals. These boards schematics and operation can be found in FCC ID: J9CGSAF1.



Any standard analog telephone deskset may be used with the RCOM-100 SatPhone. The Phone plugs into the Interface board, which is basically a board, that holds the 37 pin circular connector from which signals are routed from the 345-0180 to the outside world.

3.0 SUMMARY TECHNICAL DESCRIPTION

The following provides a roadmap to more detailed descriptions of the RCOM-100 SatPhone and the specific test data which are discussed or presented in this, and or subsequent Exhibits.

3.1 OPERATIONAL FREQUENCIES

Each RCOM-100 is capable of transmitting on any one of the frequency channels defined between 1610 and 1626.5 Mhz, as described in Section 3 of Exhibit 10 of the AFUT. In the US and other countries where one or more TDMA mobile satellite services (MSS) low earth orbit (LEO) systems are authorized to operate in only the lower 9 of 13 channels, operating in the frequency range from 1610 to 1621.35 Mhz. Depending on local Globalstar traffic conditions, a given RCOM-100 may be assigned to operate on any of the authorized channels for a given call. Multiple access and efficient frequency re-use is provided by means of code division multiple access (CDMA) technology.

3.2 CDMA MODULATION TECHNOLOGY

The RCOM-100 uses a modified form of IS-95 to support CDMA. CDMA was selected for Globalstar because it represents a proven technology that can provide efficient modulation scheme for satellite communications. It is relatively interference tolerant, both from a standpoint of generation of interference to other services and toleration of outside interference. As a bonus, there is a level of security inherent in the modulation scheme. It is difficult to listen into conversations or to pirate services from the system. CDMA is able to provide good voice quality while operating at relatively low RF power levels.

For a detailed description of the CDMA technology, see Section 4 of Exhibit 10, AFUT, FCC ID: J9CGSAF1, system.

3.3 OPERATING POWER LEVELS

Active power control is employed in the RCOM-100 system to minimize collateral interference between proximate Globalstar subscribers, since as is true of any multiple access spread spectrum system, other user's signals represent noise to a given user's signal. Thus all signals are automatically reduced to minimum power levels by the system, transparently to the user. As defined in the Globalstar Air Interface (GAI) Specification, 80-25118-1, the effective isotropic radiated power (EIRP) of a fixed UT operating at maximum power output ranges from 1 to 4 Watts, with 3 Watts being typical.

3.4 Occupied Bandwidth and Out-of-Band Emissions (OOBE)

Conducted antenna port occupied bandwidth and out of band emissions measurements for low, mid, and high frequency transmit channels are presented in Exhibit 4, which consists of the Compliance Lab Out-of-Band Noise, and Spurious Emission Test Data, The Compliance Lab In-Band Noise, and Spurious Emissions Test Data, and also the Maximum antenna gain data. The latter provides the means to estimate an upper bound on antenna radiated emissions test results are presented in Exhibit 6, where the emissions were compared against, and show compliance with the more stringent Part 15 radiated emissions limits, which apply to the digital control and receiver functions of the AFUT.

3.5 DC SUPPLY VOLTAGE AND CURRENT

The RCOM-100 is powered by an external DC power source, which provides a nominal 27.5v (10 – 35VDC range) at .1 to 1.09 Amperes current draw, 30 Watts maximum load. Typical power is 22 Watts. Power to the transmitter power amplifier located on the RAU RF board is routed from the digital board, passing through multiple switching, and analog power regulator stages, and the power amplifier never sees any changes in the RAU supply voltage. It is thus virtually immune to any effects of voltage fluctuation within the defined DC power voltage

input range of the RCOM-100. Outside the range the Power Supply, 345-0180, simply shuts down.

3.6 TRANSMITTER ADJUSTMENT AND TUNE-UP PROCEDURE

All frequency adjustments are made at the factory, and no frequency adjustments are made by the user.

3.7 FREQUENCY STABILITY

All RF oscillators are phase-locked to the output signal of a voltage controlled temperature compensated crystal oscillator (TCXO), the master oscillator of the system. It is specified to provide frequency accuracy to better than 10 parts per million over the RCOM-100's 5 year design life, with 5 ppm allocated to TCXO aging. Exhibit 6 summarizes the temperature variation frequency stability test results which have been obtained. Due to the relatively large doppler error inherent to an LEO communications systems, transmit frequencies are locked to the TCXO signal, and are not adjusted based on frequency differences with respect to Gateway transmitted signals.

3.8 CIRCUITRY FOR SUPPRESSION OF SPURIOUS RADIATION

Multiple stage of filtering are employed in the transmit chain from baseband through intermediate frequency (IF) to the RF transmitter output to the external TX filter, as can be seen in the RF Board schematic, and parts list in Exhibit 16 of AFUT FCC ID: J9CGSAF1. Multiple SAW filters are employed in the transmitter (TX) IF and upconverter stages. A discrete ceramic filter and pi LC filter are applied to the output of the transmitter HPA.

3.9 MAXIMUM PERMISSIBLE ELECTROMAGNETIC FIELD EXPOSURE

Since the RCOM-100 is used at distances greater than 20cm from the user's body (generally much greater distances) specific absorption rate (SAR) testing is not required. An analysis of the RCOM-100 EM emissions levels, to conservatively determine the minimum safe approach distance with respect to the FCC uncontrolled environment exposure limits specified in 47 CFR Section 1.1310, is presented in Exhibit 4.

EXHIBIT 3 CERTIFICATION OF TEST DATA

The data, data evaluation, and equipment configuration presented herein are a true and accurate representation of the measurements of the sample's radio frequency interference emissions characteristics as of the date and at the time of the tests under the test conditions specified herein. This applies to all test that were performed that did not require an Open Area Test/Site (OATS). Test that required an OATS were performed by TUV Product Services, with an office out of the San Diego area. Qualcomm's Paul Jayne witnessed the tests.

Equipment Tested: RCOM-100 SatPhone, S/N: 805003

Sincerely,

DeLyle Danner
R & D Manager