31 May, 2001

Steve Becker
StarCom USA LLC
7202 Moon Valley Road
North Bend WA 98053

Dear Mr. Becker,

Enclosed is the FCC Part 90 subpart I report for the Mobile Transceiver, model StarNav. Please check it thoroughly for discrepancies.

This is an official copy of this report complete with the original Acme Testing staff signatures, which should be retained by you as the official record of testing, as it may be required for future verification of compliance. Please be aware that our internal controls require us to keep a historical copy of your report on file for two years only.

Thank you for your business and we look forward to being of service should you require testing services in the future.

Yours Sincerely,

Steve FitzGerald
President

:dp

Enclosures

FCC PART 90 SUBPART I
REPORT OF MEASUREMENTS

DEVICE:	MOBILE TRANSCEIVER
MODEL:	STARNAV
MANUFACTURER:	STARCOM USA LLC
ADDRESS:	7202 MOON VALLEY ROAD NORTH BEND WA 98045

THE DATA CONTAINED IN THIS REPORT WAS
COLLECTED ON 17 AUGUST 1999 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

1. General

1.1 Purpose

These tests were conducted on a sample of the equipment for the purpose of compliance with FCC CFR 47, Parts 2 and 90. This report references the applicable electromagnetic requirements.

1.2 Manufacturer

Company Name:	StarCom USA LLC
Contact:	Steven J. Becker
Street Address:	7202 Moon Valley Road
City/State/Zip:	North Bend WA 98045
Telephone:	425 888-9726
Fax:	425 888-9418

1.3 Test location

Company:	Acme Testing Inc.
Street Address:	2002 Valley Highway
Mailing Address:	PO Box 3
City/State/Zip:	Acme WA 98220-0003
Laboratory:	Test Site 2
Telephone:	888 226-3837
Fax:	360 595-2722
E-mail:	acmetest@acmetesting.com
Web:	www.acmetesting.com
Receipt of EUT:	17 August 1999

1.4 Test Personnel

Paul G. Slavens, Chief EMC Engineer

2. Test Results Summary

Summary of Test Results
Mobile Transceiver, model number StarNav

Para. No.	Test Criteria	Status
2.985	RF Power Output	Pass
2.987	Modulation Characteristics	Pass
2.989	Occupied Bandwidth	Pass
2.991	Spurious Emission at Antenna Terminals	Pass
2.993	Field Strength of Spurious Radiation	Pass
2.995	Frequency Stability	Pass

The signed original of this report, supplied to the client, represents the only "official" copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing's discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

The measurements contained in this report were made in accordance with the referenced standards and all applicable Public Notices received prior to the date of testing. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

Paul G. Slavens
Chief EMC Engineer

Date of Issuance

3. Description of Equipment and Peripherals

3.1 Equipment Under Test (EUT)

Device:	Mobile Transceiver
Model Number:	StarNav
Serial Number:	67184886
Power:	12 VDC
Grounding:	Local
Antenna Distance:	3 m

3.2 EUT Peripherals

Device	Manufacturer	Model Number	FCC ID	Serial Number
Laptop Computer	Toshiba	T213OCT	CJ6UK323	01632682-3

3.3 Description of Interface Cables

EUT/Laptop Computer

Shielded	Unshielded	Flat	Round	Length	Ferrite
Yes	No	No	Yes	1 m	No

ARRANGEMENT OF INTERFACE CABLES: All interface cables were positioned for worst case maximum emissions within the manner assumed to be a typical operation condition (please reference photographs).

4. RF Power Output

4.1 Test Requirement

Sec. 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in Sec. 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

4.2 Test Technical Standard

Sec. 90.205 (b) 25-50 MHz. The maximum transmitter output power is 300 watts.

4.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.1

4.4 Test equipment

Spectrum Analyzer: Hewlett-Packard 8567A, Serial Number 2602A-00165, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

RF Preselector: Hewlett-Packard 85685A, Serial Number 2648A-00392, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

4.5 Test Results

Power Output (Watts)

50.4 dBm or 109.6 watts @100 watts setting
40.2 dBm or 10.5 watts @ 10 watts setting

5. Modulation Characteristics

5.1 Test Requirement

Sec. 2.1047 Measurements required: Modulation characteristics.

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) Equipment, which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) Single sideband and independent sideband radiotelephone transmitters, which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of Sec. 2.1049 for the occupied bandwidth tests.

(d) Other types of equipment. A curve or equivalent data, which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

5.2 Test Technical Standard

Sec. 90.211 Modulation requirements.

Each transmitter must meet the requirements of either paragraph (a) or (b) of this section. The requirements of this paragraph do not apply to mobile stations that are authorized to operate with a maximum power output of 2 watts or less.

(a) Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the emission limitations specified in Sec. 90.210. Testing must be in accordance with the rules specified in part 2 of this chapter.
(b) Transmitters utilizing digital or analog emissions without an audio low-pass filter must be tested for certification using the digital or analog modulating signal or signals specified by the part 2 of this chapter. The certification application must contain such information as may be necessary to demonstrate that the transmitter complies with the emission limitations specified in Sec. 90.210.

5.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.3

5.4 Test equipment

Communication Analyzer: IFR COM 120 A, Serial Number 485002436, Calibrated: 16 June 1999, Calibration due Date: 16 June 2000

5.5 Test Results

The transmitter uses gaussian minimum shift key modulation at a single fixed data rate of 10 kbps. The measured maximum frequency deviation was 4.4 kHz.

6. Occupied Bandwidth

6.1 Test Requirement

Sec. 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques--when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

6.2 Test Technical Standard

Sec. 90.210 Emission masks.

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

Applicable Emission Masks

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
25-50	B	C

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter pursuant to Sec. 90.211(b), the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (*fd* in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (*fd*/5) dB;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (*fd* in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd^2/11) dB or 50 dB, whichever is the lesser attenuation;
(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

6.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.11

6.4 Test equipment

Spectrum Analyzer: Hewlett-Packard 8567A, Serial Number 2602A-00165, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

RF Preselector: Hewlett-Packard 85685A, Serial Number 2648A-00392, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

6.5 Test Plots

7. Spurious Emission At Antenna Terminals

7.1 Test Requirement

Sec. 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified.

7.2 Test Technical Standard

90.210 c(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

7.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.13

7.4 Test equipment

Spectrum Analyzer: Hewlett-Packard 8567A, Serial Number 2602A-00165, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

RF Preselector: Hewlett-Packard 85685A, Serial Number 2648A-00392, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

7.5 Test Results

CALCULATION OF CONDUCTED SPURS LIMIT

100 Watts attenuation = 43 + 10 log 100 = 63 dBc

10 Watts attenuation = 43 + 10 log 10 = 53 dBc

Conducted spurs with transmitter @100 watts setting
Measured power = 50.4 dBm or 109.6 watts

Frequency (MHz)	Level (dBm)	Attenuation (dBc)
42.797	-18.9	-69.3
46.252	-21.0	-71.4
89.034	-19.7	-70.1
135.552	-34.0	-84.4
267.136	-32.1	-82.5

Conducted spurs with transmitter @10 watts setting
Measured power = 40.2 dBm or 10.5 watts

Frequency (MHz)	Level (dBm)	Attenuation (dBc)
42.798	-19.5	-59.7
46.242	-26.2	-66.4
89.044	-28.2	-68.4

8. Field Strength of Spurious Radiation

8.1 Test Requirement

Sec. 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required; with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

8.2 Test Technical Standard

90.210 c(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

8.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.12

8.4 Test equipment

Spectrum Analyzer: Hewlett-Packard 8567A, Serial Number 2602A-00165, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

RF Preselector: Hewlett-Packard 85685A, Serial Number 2648A-00392, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2521A-00689, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

Broadband Biconical Antenna (20 MHz to 200 MHz): EMCO 3110, Serial Number 1180, Calibrated: 29 June 1999, Calibration due Date: 29 June 2000

Broadband Log Periodic Antenna (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2852, Calibrated: 29 June 1999, Calibration due Date: 29 June 2000

EUT Turntable Position Controller: Rothenbuhler Engineering, Custom, No Calibration Required

Antenna Mast: Compliance Design, model M100/200, No Calibration Required

8.5 Test Results

Field Strength of Spurious Radiation

Frequency of Emissions (MHz)	Polarization (H/V)	Received Signal Field Strength (dBµV @3m)	Effective Radiated Power (dBm)	Radiated Spurs Attenuation (dBc)	Required Attenuation (dBc)
89.025	H	76.0	-21.4	71.4	63.0
133.532	H	51.5	-45.9	95.9	63.0
178.064	H	75.5	-21.9	71.9	63.0
222.587	H	80.1	-17.3	67.3	63.0
267.113	H	82.9	-14.5	64.5	63.0
311.632	H	68.9	-28.5	78.5	63.0
356.132	H	63.1	-34.3	84.3	63.0
400.663	H	63.6	-33.8	83.8	63.0
445.166	H	59.0	-38.4	88.4	63.0

CALCULATION OF RADIATED POWER LIMIT

100 Watts attenuation = 43 + 10 log 100 = 63 dBc

CALCULATION OF RADIATED POWER

All emissions below 1000 MHz are expressed in terms of the equivalent power that would have to be fed into a dipole antenna in order to produce the same electric field strength. All emissions above 1000 MHz are expressed in terms of equivalent isotropic power. The equivalent power was determined by using the following formula: $P_t = E^2R^2/30\ G$

Example:	Electric field strength is	E = 41.1 dBuV/m
	Measured at a distance of	R = 3 m
	The gain of a dipole antenna is	1.64

$P_t = [10^{(41.1/20)}\ X\ 10^{-6}]^2 \times 3^2/30 \times 1.64 = 2.36 \times 10^{-9}$ watts = -56.3 dBm

When calculating equivalent isotropic radiated power for emissions above 1000 MHz the gain is G=1.

Example: If the mean output power of the transmitter is 3 watts.

The minimum attenuation is 43 + l0 Log 3 = 47.8 so the maximum power must not exceed $3 \times 10^{-4.87}$= 4.98×10^{-5}W.

Using the above relation we have $E = (3OGP_t)\ 0.5/R$

For emissions which are less than or equal to 1000 MHz
G =1.64 and $E = (30 \times 1.64 \times 4.98 \times 10^{-5})0.5 / 3$ = 0.0165 V/m
= 84.3 dBuV

Therefore the electric field strength of emissions must not exceed 84.3 dBuV/m at 3m.

Similarly for emissions which are greater than 1000 MHz, G=1 and the field strength must not exceed 82.2 dBµV/m at 3 m.

9. Frequency Stability

9.1 Test Requirement

Sec. 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 deg. to +50 deg. centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 deg. centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point, which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

9.2 Test Technical Standard

Sec. 90.213 Frequency stability.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.

Minimum Frequency Stability
[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
25-50	20	20	50

9.3 Test Procedure

TIA/EIA-603:1993 Section 2.2.1

9.4 Test equipment

Frequency Counter: Optoelectronics Inc. 3000A PLUS, Serial Number 1315018, Calibrated: 23 March 1999, Calibration due Date: 23 March 2000

9.5 Test Results

Frequency vs. Voltage @ 25 Degrees Celsius

Voltage (Vdc)	Frequency (Hertz)	Frequency Error (Hertz)	Frequency Error (ppm)
115% (13.8)	44,517,197	-303	-6.80631
85% (10.2)	44,517,201	-299	-6.71646

Frequency vs. Temperature @ 12.0 Vdc

Temperature (Degrees Celsius)	Frequency (Hertz)	Frequency Error (Hertz)	Frequency Error (ppm)
-30	44,517,105	-395	-8.87292
-20	44,517,162	-338	-7.59252
-10	44,517,120	-380	-8.53597
0	44,517,092	-408	-9.16494
10	44,517,101	-399	-8.96277
20	44,517,147	-353	-7.92947
30	44,517,249	-251	-5.63823
40	44,517,361	-139	-3.12237
50	44,517,445	-55	-1.23547

10. Miscellaneous Comments and Notes

1. None.