CHOMERICS TEST SERVICES

TEST REPORT

for

SCULLY SIGNAL COMPANY

COMPANY PRODUCT NAME

VEHICLE DATA COMPUTER

FCC PART 15 SUBPART C CERTIFICATION

Submitted to:
J.J. Thiara
Scully Signal Company
70 Industrial Way
Wilmington, Massachusetts 01887

Prepared by: Richard Barbaro
Date: April 29, 1999
Test Report: TR2081.99
Purchase Order: 8583
Number of Pages: 21

I attest to the accuracy of the test data in this report:

Technician/Test Engineer

Test Services Approved Signatory

Official responsible for marketing this equipment

TEST REPORT
NVLAP Accredited Laboratory

Parker Seals

Chomerics, 77 Dragon Court, Woburn, Massachusetts 01888-4014
(617) 935-4850 FAX: (617) 935-2758

ADMINISTRATIVE DATA

Purpose of Test:	FCC Certification
Test Specification:	FCC Part 15 Subpart C
Manufacturer:	Scully Signal Company
Manufacturer's Type or Model Number:	Vehicle Data Computer
Number of Items Tested:	Two (2)
Date of Test:	April 7, 1999
Test Observed By:	Richard Barbaro
Affiliated With:	Chomerics Test Services
Test Location:	Chomerics Open Area Test Site A
Tests Conducted By:	Richard Barbaro
Condition of Test Equipment Upon Arrival:	Good
Customer's Equipment Returned VIA:	Held for Certification

TEST RESULTS

The Scully Signal Company Vehicle Data Computer meets the FCC Part 15 Subpart C radiated and conducted emissions limits as configured and operated for testing.

Chomerics has tested the version of the device without connectors. Test data for the device with connectors would be the same based on the fact that the addition of connectors would have no impact on the device's EMI characteristics.

Radiated emission measurements were performed to determine compliance with the 2.7" and 5" diameter coil transducers. The 5" coil transducer was the primary test. The 2.7" coil transducer was tested at the frequencies that generated the highest signals from the 5" coil transducer.

The Scully Signal Company Vehicle Data Computer is a device that transmits data of mileage and usage via hand held remote. A 12 Volt DC battery was used for normal operation for emissions tests.

The equipment under test was set up as illustrated on Form-CTS-014.

TEST SERVICES FACILITY INFORMATION

Chomerics' test facility is recognized under the National Voluntary Laboratory Accreditation Program (NVLAP) for NVLAP Codes 12/C01 and 12/R01. Tests within this report not conforming to 12/C01 and 12/R01 NVLAP Codes are not covered under Chomerics NVLAP accreditation.

Chomerics' test facility operates under the current revision of Chomerics Quality Assurance (QA) Manual Document Number QA002.

The QA manual has been constructed to reflect a quality program in accordance with the requirements of the National Institute of Standards and Technology (NIST), ISO 9002, ISO Guide 25, NIST Handbook 150, EN 45001, MIL-I-45208A, MIL-STD-461D, 462D and Chomerics Quality Assurance Program (QAP).

The QA manual outlines and describes the procedures for establishing and maintaining the quality of analysis, research, inspection, and testing within Chomerics Test Service (CTS).

This test report does not represent an endorsement by the U.S. Government.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

Measurements performed for this test are traceable to the National Institute of Standards and Technology (NIST) based on the fact that all test equipment used for the measurements were previously calibrated using standards traceable to NIST.

No deviations, additions to, or exclusions from the test specification(s) were made.

The system amplitude accuracy for the measurements made during the radiated emission tests was $\pm$3dB.

TEST SITE DESCRIPTIONS

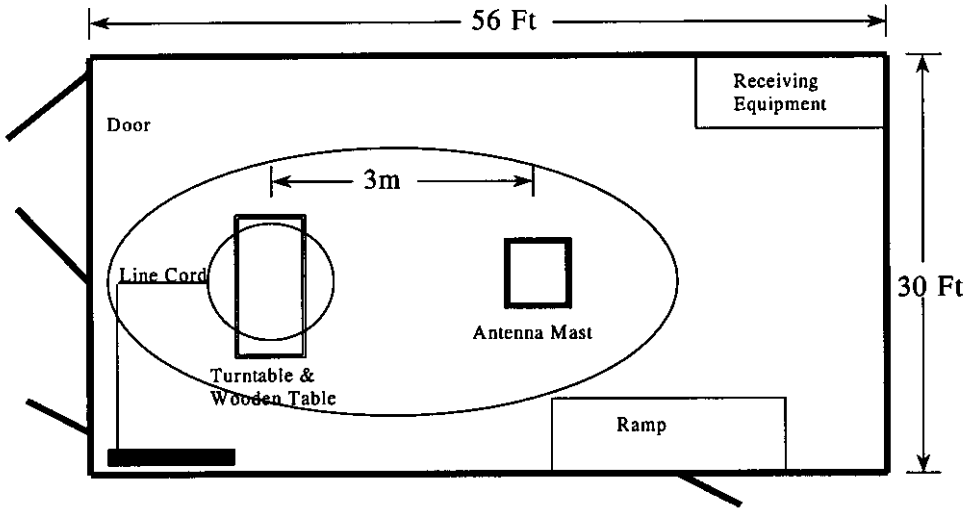
The following is a description of Test Services' Open Area Test Sites. Refer to Administrative Data on page 2; line 9 for the specific test site used for testing.

OPEN AREA TEST SITE A: Chomerics' Open Area Test Site "A" is located in the parking lot behind the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (Figure 1).

The Open Area Test Site "A" enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plate. The structure is sized to allow 3 meter measurements and is heated and/or air conditioned. Photographs of the site and site attenuation data are on file with the Federal Communications Commission.

The supporting structure used for support of the equipment under test is a wooden rotatable platform .8 meters high. A similar supporting structure is used for the measuring equipment. The mast supporting the antenna can be adjusted from one to four meters in height.

OPEN AREA TEST SITE A
Figure 1



Key: ▬ = Power board

OPEN AREA TEST SITE B: Chomerics' Open Area Test Site "B" is located in the lower parking lot behind the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (Figure 2).

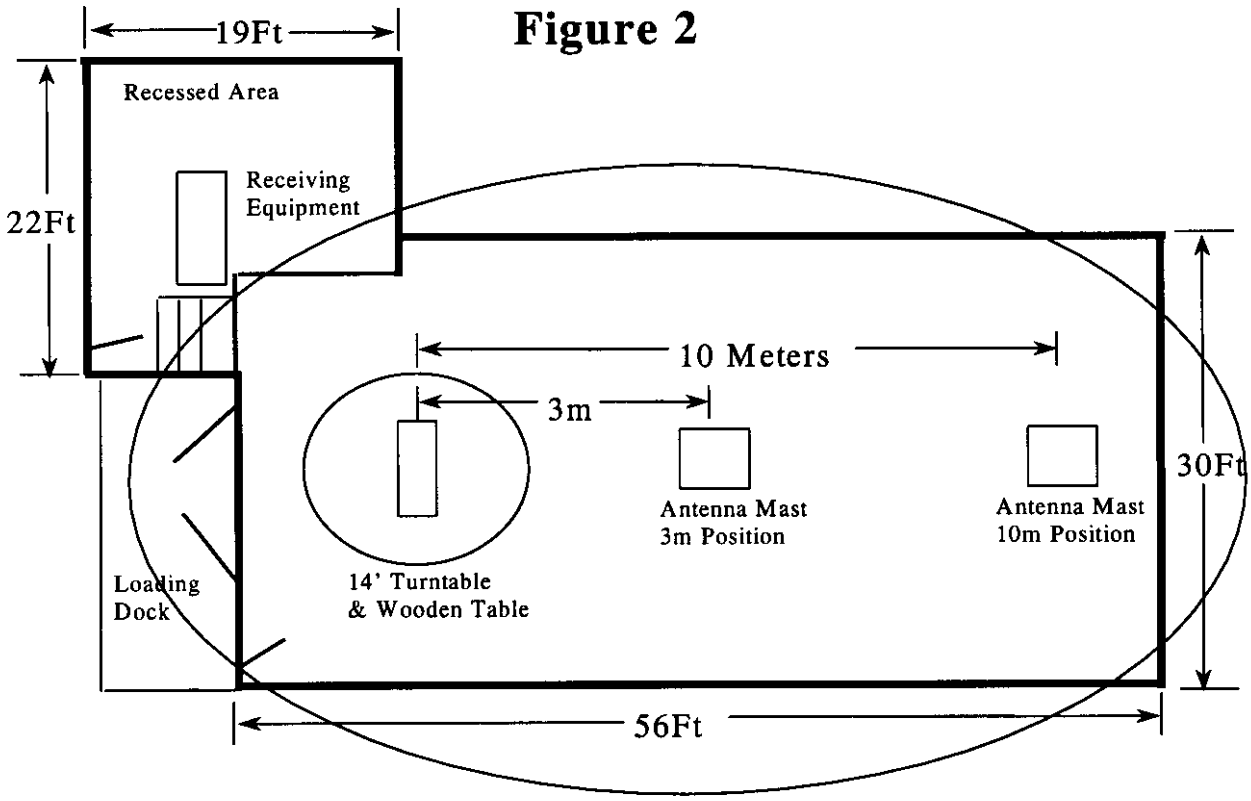
Photographs of the site and site attenuation data are on file with the Federal Communications Commission. Parking is permitted on one side of Test Site "B" at a discrete distance from the imaginary ellipse.

The Open Area Test Site "B" enclosure is a wooden structure measuring 56 X 30 X 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow both 3 and 10 meter measurements and is heated and/or air conditioned. Photographs of the site and site attenuation data are on file with the Federal Communications Commission.

The structure used to support equipment under test is a 14 foot diameter motorized turntable. The sheet metal surface is flush with the ground plane. To ground the turntable, 175 copper fingers (1" x 1.5") are mounted around the outer edge of the turntable using machine screws. The spring fingers are equally spaced and provide a uniform interface between the turntable metal surface and ground plane. When needed for tabletop equipment, a wooden table measuring 3 x 6 feet in size is positioned at the center of the turntable, at the proper height above the ground plane. The addition at the end of the Open Area Test Site "B" is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

Both Test Site A and B are listed with the Federal Communications Commission (FCC).

OPEN AREA TEST SITE B
Figure 2



RADIATED EQUIPMENT LIST

	Equipment Used	Asset #	Serial #	Cal Date
X	Tektronix 496 Spectrum Analyzer	1	B010559	10/99
	Tektronix 496 Spectrum Analyzer	77	B020852	1/00
	Tektronix 496 Spectrum Analyzer	56	B010206	4/99
	Tektronix 494 Spectrum Analyzer	543	B010201	9/99
X	Rhode and Schwartz ESV Test Receiver	15	875931049	9/99
X	Rhode and Schwartz ESH-2 Test Receiver	16	8799631020	9/99
	Hewlett Packard 8559A Spectrum Analyzer	472	2019A00461	1/00
	Hewlett Packard 182T Analyzer Main Frame	352	1931A003349	1/00
	Hewlett Packard 8447D Pre Amp	12	2944A06414	1/00
X	Hewlett Packard 8447D Pre Amp	4	2727A06065	1/00
	Electro Metrics ALR-25M Loop Antenna	17	4706	1/00
	EMCO 3120 Tuned Dipole Antenna B1	477	56	1/00
	EMCO 3121 Tuned Dipole Antenna B2	478	176	1/00
	EMCO 3121 Tuned Dipole Antenna B3	479	728	1/00
X	EMCO 3120 Tuned Dipole Antenna B1	453	42	1/00
X	EMCO 3120 Tuned Dipole Antenna B2	454	65	1/00
X	EMCO 3121 Tuned Dipole Antenna B3	455	9501-1101	1/00
	EMCO 3120 Tuned Dipole Antenna B1	474	21	1/00
	EMCO 3121 Tuned Dipole Antenna B2	475	177	1/00
	EMCO 3121 Tuned Dipole Antenna B3	476	698	1/00
	EMCO 3115 Microwave Horn Antenna	376	2796	1/00
	EMCO 3105 Microwave Horn Antenna	78	2118	1/00
	Polarad MDS21 Absorbing Clamp	435	301404/003	NCR
X	Emco 3301B Vertical Rod Antenna	371	2901	12/99
X	Chomerics Active E-Field Antenna 3301B	426	Proto 1148	12/99

Equipment Calibration: The calibration of Chomerics test facility equipment is controlled under the current revision of Chomerics Laboratory Test Equipment Calibration Manual Document Number QA001.

The test equipment used throughout this test sequence conforms to laboratory calibration standards, MIL-STD-45662A, traceable to the National Institute of Standards and Technology (NIST). The date of the next scheduled calibration is listed in the table above for Chomerics Test Services equipment used during testing.

All test equipment is calibrated in one year intervals.

Test Personnel: The test personnel used to perform or supervise the tests are accredited by the National Association of Radio and Telecommunications Engineers, Inc. (NARTE) as Certified Electromagnetic Compatibility Engineers (N.C.E.) and Technicians (N.C.T.).

RADIATED EMISSIONS
9 kHz to 1000 MHz

Test No: ONE (1)

Equipment Tested: Scully Signal Company Vehicle Data Computer

Configuration: For small devices, the devices were set up on a wooden turntable 3 meters from the tunable dipole antenna.

The support equipment needed to run the Vehicle Data Computer in a normal mode of operation consisted of the following:

1. 12 Volt DC Battery

Any emissions radiating from the Vehicle Data Computer were maximized by rotating the test table and placing the cables in their worst case configuration.

Test Mode: Continuous transmitting of data

Results: The Scully Signal Company Vehicle Data Computer meets the FCC Part 15 Subpart C radiated emissions limits as configured for testing.

Fixes: None

CONDUCTED EMISSIONS

The EUT runs off of DC power, therefore, no conducted emission tests were performed.

CABLE CONFIGURATION

The following is a list of cables that were exiting the equipment under test:

1. Odometer Input
2. Hours Input
3. Coil Output
4. Programming I/O
5. Power/Ground

SUMMARY OF RECOMMENDATIONS

The Scully Signal Company Vehicle Data Computer will require no modifications in order to insure compliance with the FCC Part 15 Subpart C radiated and conducted emission requirements for digital devices.

Please note that if any modifications and or fixes were implemented to the EUT to achieve compliance, other approaches to solving the problem may exist. In addition, any EMI/EMC shielding products listed in this report may be substituted with an equivalent.

APPENDIX A

TEST DATA

TEST LOG

Customer: Scully Signal Company Program: _____

EUT: Vehicle DATA Computer S/N _____

PRE-TEST CHECKLIST

DATE	COMMENTS
	Test Plan/Procedure: FCC Section 15
	Test Specification: Subpart C – Cert.
	Chomerics Procedure: CHO TPEC 3.97
	EUT Power Requirement Verified:
	Voltage 12 VDC Frequency ✓ Phase —
	Voltage _____ Frequency _____ Phase _____
	EUT Functional Operational Check: [✓] Pass [✓] Fail
	Environmental: Ambient Temperature 70 °F
	Humidity: 30 % Atmospheric Pressure: 30.5
	Bonding / Grounding: Yes Safety Issues: no

IN-PROCESS TEST CHECKLIST

Date	Test Type	Test Equipment Calibrated	Test Performed Properly- Data Accepted	EUT Setup Check / Operational Check	EUT Pass/Fail
4-7-99	Rad Emm FCC 15	✓	✓	✓	PASS

DOCUMENT #: TR20899
DATE: Apr. 29, 1999

POST TEST CHECKLIST

Date:	EUT Functional Operational Check:	Test Engineer/Tech	Test Services Mgr
4-29-99	[✓] Pass [ ] Fail	Richard Baba	David C Luna

CHOMERICS

Seals

TEST SERVICES

RADIATED E FIELD EMISSION MEASUREMENTS

CUSTOMER: Scully Signal Company

EQUIPMENT: IFT Vehicle DATA computer w/5" coil

TESTED BY: R. BARBARO

BANDWIDTH: [ ] 100 kHz (Peak)/120 kHz (QP)

OTHER (SPECIFY) 9kH-1 GHz

FREQUENCY RANGE: [ ] 30MHz - 1 GHz [ ] 11.76 GHz - 12.7 GHz

OTHER (SPECIFY)

DATE: 4-7-99

TEST NUMBER: ONE (1)

OPERATING MODE: Continuous transmitting

TEST SPEC: FCC Section 15

PROCEDURE: Subpart C

ANTENNA DISTANCE: [~~3~~ 3 METERS [ ] 10 METERS

FREQUENCY MHz	PEAK MEASURED LEVEL -dBm	QUASSI-PEAK MEASURED LEVEL dBuV	ANTENNA HEIGHT (METERS)	TURNTABLE AZIMUTH (DEGREES)	ANTENNA H/V	ANTENNA FAC/CABLE LOSS dB	FIELD LEVEL dBuV/m **	LIMIT dBuV/m (QP)
.009	—	57	1.0	0	V	3.3	60.3	88.5
.017	—	40	1.0	0	V	3.3	43.3	88.5
.035	—	43	1.0	80	V	3.3	46.3	88.5
.072	—	40	1.0	80	V	3.3	43.3	88.5
.085	—	42	1.0	0	V	3.3	45.3	88.5
5.44	—	35	1.0	80	V	3.7	38.7	50.0
35.1	—	24	2.0	0	V	3.6	27.6	40
110.0	—	10	2.0	270	V	11.4	21.4	43.5
116.3	—	14	1.5	25	H	11.9	25.9	43.5
132.7	—	25	2.0	37	H	13.6	38.6	43.5
170.2	—	4	2.0	35	V	16.4	20.4	43.5
429.7	—	3	2.0	0	V	24.2	27.2	46.0
479.2	—	7	2.0	37	V	24.9	31.9	46.0

** All signals greater than 3dB from the limit are calculate to the nearest whole number.

** Field Level (dBuV/m) = [107 - Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 70 °F Humidity: 30 % Atmospheric Pressure: 30.5 "

NOTES:

FORM CTSDS001R

Document #: TR2081.99

Date: April 29, 1999

Chomerics, 77 Dragon Court, Woburn, MA 01801-4014 (781) 935-4850 FAX (781) 935-2758

CHOMERICS

[redacted] Seals

TEST SERVICES

RADIATED E FIELD EMISSION MEASUREMENTS

CUSTOMER: Scully Signal Company

EQUIPMENT: w/small

TESTED BY: R. BARBAR.

BANDWIDTH: [✓] 100 kHz (PEAK)/120 kHz (QP)

OTHER (SPECIFY) _____

FREQUENCY RANGE: [ ] 30MHz - 1 GHz [ ] 11.76 GHz - 12.7 GHz

OTHER (SPECIFY) _____

DATE: 4-7-99

TEST NUMBER: ONE (1)

OPERATING MODE: Continuous Transmitting

TEST SPEC: _____

PROCEDURE: _____

ANTENNA DISTANCE: [✓] 3 METERS [ ] 10 METERS

FREQUENCY MHz	PEAK MEASURED LEVEL -dBm	QUASSI-PEAK MEASURED LEVEL dBuV	ANTENNA HEIGHT (METERS)	TURNTABLE AZIMUTH (DEGREES)	ANTENNA H/V	ANTENNA FAC/CABLE LOSS dB	FIELD LEVEL dBuV/m **	LIMIT dBuV/m (QP)
.009	—	67	1.0	0	V	3.3	70.3	88.5
.017	—	44	1.0	0	V	3.3	47.3	88.5
.035	—	29	1.0	0	V	3.3	32.3	88.5
.072	—	40	1.0	0	V	3.3	43.3	88.5
.085	—	42	1.0	0	V	3.3	45.3	88.5
7.5	—	32	1.0	0	V	4.1	36.1	50.0
	—							
	—							

** All signals greater than 3dB from the limit are calculate to the nearest whole number.

** Field Level (dBuV/m) = [107 - Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: _____ °F Humidity: _____ % Atmospheric Pressure: _____ "

NOTES:

FORM CTSDS001R

Document #: TR2081.99

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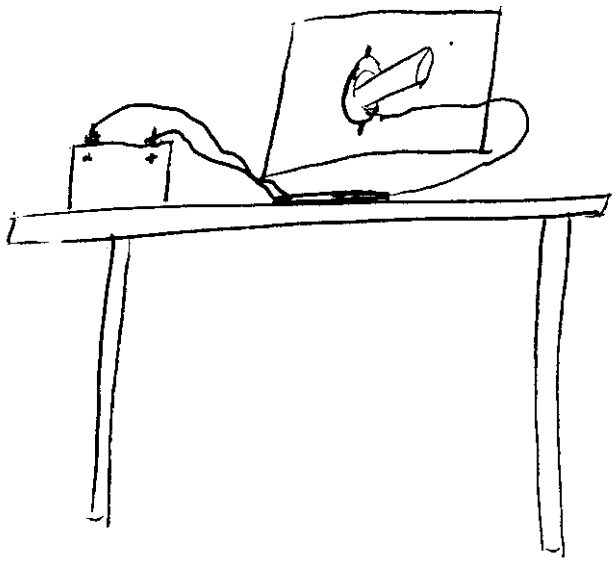
Chomerics, 77 Dragon Court, Woburn, MA 01801-4014 (781) 935-4850 FAX (781) 935-2758

APPENDIX B

SET-UP PHOTOGRAPHS

System Configuration Block Diagram- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.



CUSTOMER: Scully Signal

EUT: IFT Vehicle Data Computer

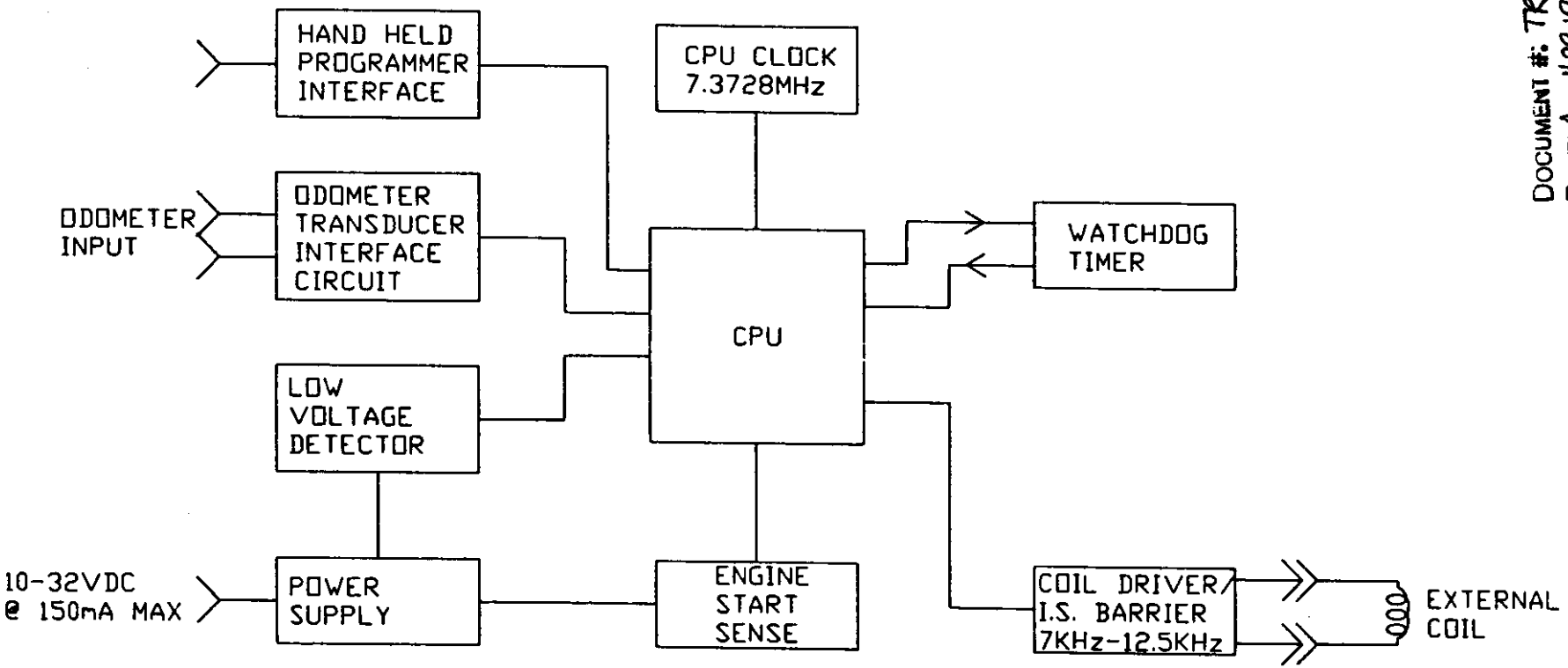
DATE: 4-7-99

S/N: _____

APPENDIX C

CUSTOMER SUPPLIED

REVISIONS						
REV	ECN	DESCRIPTION	DWN	DATE	CHKR	APVD
A		RELEASED	DG			



UNLESS OTHERWISE SPECIFIED:

1. ALL DIMENSIONS ARE IN INCHES
2. DIMENSIONS ARE AFTER MACHINED AND/OR APPLIED FINISHES
3. DO NOT SCALE PRINT
4. REMOVE BURRS, BREAK SHARP EDGES AND CORNERS .005-.020
5. TOLERANCES:
   .XX=±.01
   .XXX=±.005 ANGLES ±0° 30'
6. MIN. SURFACE FINISH √63
7. THDS PER ANSI B1 SERIES
8. GEOMETRIC TOLERANCES PER ANSI Y14.5-1982
9. ELECTRONIC SYMBOLS PER ANSI 32.2

DESIGNER	P Langer	DATE 10/1/93
CHECKER	P Langer	DATE 10/1/93
ENGINEER		DATE 10/1/93
DFTG. SUPV.		DATE

INTEGRATED FLEET TECHNOLOGY
A DIVISION OF SCULLY SIGNAL CO.
WILMINGTON, MA. U.S.A.

TITLE: BLOCK DIAGRAM, FUNCTIONAL,
VEHICLE DATA COMPUTER

MATERIAL:

FINISH:

SIZE	DWG NO.
A	001032
SCALE NONE	SHEET 1 OF 2

DOCUMENT #: TR2881.99
DATE: April 29, 1999