TEST RESULT SUMMARY

FCC PART 22 SUBPART H
Sections 22.913, 22.917
FCC Part 15 - Receiver

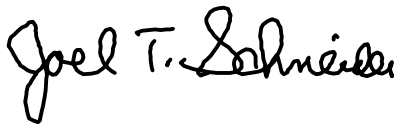
MANUFACTURER'S NAME	Phoenix International® a John Deere Company
NAME OF EQUIPMENT	GPS receiver with cellular transmitter that reports location and engine hours
MODEL NUMBER	**VCA10001**
MANUFACTURER'S ADDRESS	5300 Rising Moon Road Springfield IL 62707
TEST REPORT NUMBER	W0051
TEST DATE	27 January 2000

According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 22.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 22. TUV Product Service's test site is on file with the FCC under Registration number 90983.

Date: 28 January 2000



Location: Taylors Falls MN USA

R. M. Johnson
Test Technician

J. T. Schneider
Lead Engineer

Not Transferable

EMC EMISSION - T E S T R E P O R T

Test Report File No.	:	**WC1G005101**	Date of issue:	29 January 2000

Model / Serial No.	:	**VCA10001 / s/n VCAA001000035**
Product Type	:	GPS receiver with cellular transmitter that reports location and engine hours
Applicant	:	Phoenix International® a John Deere Company
Manufacturer	:	Phoenix International® a John Deere Company
License holder	:	Phoenix International® a John Deere Company
Address	:	5300 Rising Moon Road
	:	Springfield IL 62707
Test Result	:	■ **Positive** ☐ **Negative**
Test Project Number Reference(s)	:	**W0051**
Total pages including Appendices		31

TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.

TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

D I R E C T O R Y - EMISSIONS

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EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

☐ - EN 50081-1 / 1991		
☐ - EN 55011 / 1991	☐ - Group 1 ☐ - Class A	☐ - Group 2 ☐ - Class B
☐ - EN 55013 / 1990		
☐ - EN 55014 / 1987	☐ - Household appliances and similar ☐ - Portable tools ☐ - Semiconductor devices	
☐ - EN 55014 / A2:1990		
☐ - EN 55014 / 1993	☐ - Household appliances and similar ☐ - Portable tools ☐ - Semiconductor devices	
☐ - EN 55015 / 1987		
☐ - EN 55015 / A1:1990		
☐ - EN 55015 / 1993		
☐ - EN 55022 / 1987	☐ - Class A	☐ - Class B
☐ - EN 55022 / 1994	☐ - Class A	☐ - Class B
☐ - BS		
■ - FCC Part 15	☐- Class A	■ - Class B
■ - FCC Part 22 Subpart H Section 22.913, 22.917		
☐ - AS 3548 (1992)	☐ - Class A	☐ - Class B
☐ - CISPR 11 (1990)	☐ - Group 1 ☐ - Class A	☐ - Group 2 ☐ - Class B
☐ - CISPR 22 (1993)	☐ - Class A	☐ - Class B

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Environmental conditions in the lab:

	Actual
Temperature	: 16 °C
Relative Humidity	: 16 %
Atmospheric pressure	: 100.8 kPa
Power supply system	: Vehicle battery

Sign Explanations:

☐ - not applicable
■ - applicable

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Effective Radiated Power Limits – Section 22.913

The Effective Radiated Power measurements were performed at the following test location:

☐ **- Test not applicable**

☐ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)
☐ - Wild River Lab Screen Room
☐ - New Brighton Lab Shielded Room

at a test distance of :

■ - 3 meters
☐ - 10 meters
☐ - 30 meters

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts. The ERP of the EUT was measured to be +28 dBm, or 630 milliwatts, at the 836.01 MHz (mid-range) channel.

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
■ -	EM-6917B	Electro-Metrics	Biconicalog Periodic	106
■ -	8566B	Hewlett-Packard	Spectrum Analyzer	2430A00930
■ -	85662A	Hewlett-Packard	Analyzer Display	2403A08134
■ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2521A01006
■ -	UHAP-10dB	Schwarzbeck	Dipole Antenna	164
■ -	SMY02	Rohde-Schwarz	Signal Generator	DE11277

Use of the calibrated equipment on this list ensures traceability to national and international standards.

The EUT was positioned on a non-conductive turntable, 0.8 meters above the open area test site ground plane. The fundamental frequency was measured with a test antenna set up 3 meters from the EUT, connected to a spectrum analyzer with 100 kHz RBW. This level was maximized by rotating the turntable 360 degrees, raising the test antenna from 1-4 meters above the ground plane, placing the test antenna in vertical and horizontal polarizations, and rotating the EUT through 3 orthogonal axes. This maximum level obtained was 127.1 dBuV/m. The EUT was replaced by a half-wave tuned dipole tuned to the transmitter frequency connected to a signal generator, and the test antenna was raised from 1-4 meters above the ground plane for maximizing. The signal generator level was adjusted until the EUT radiated emission level was matched, which yielded the +28 dBm result. The measurement made at 824.05 MHz (low-range) channel yielded +27.3 dBm. The measurement made at 848.96 MHz (high-range) channel yielded +26.2 dBm. The data sheet with the radiated measurements can be found in Appendix A.

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Out of Band Emissions – Section 22.917 (Field Strength of Spurious Radiation – Section 2.1053)

The Out of Band Spurious Emission measurements were tested at the following test location :

☐ **- Test not applicable**

☐ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

■ - 3 meters
☐ - 10 meters
☐ - 30 meters

The out of band emissions must be 41 dB [43 + (10 log 630 milliwatts)] below the fundamental level. The out of band emissions are a minimum of 69 dB below the fundamental level up to the 10th harmonic of the fundamental (8.5 GHz).

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
■ -	EM-6917B	Electro-Metrics	Biconicalog Periodic	106
■ -	3115	Electro-Metrics	Horn Antenna	2483
■ -	8566B	Hewlett-Packard	Spectrum Analyzer	2430A00930
■ -	85662A	Hewlett-Packard	Analyzer Display	2403A08134
■ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2521A01006
■ -	ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11
■ -	AFT-8434	Avantek	Preamplifier	9112 Z221
■ -	AWT-18037	Avantek	Preamplifier	1001-9226

Use of the calibrated equipment on this list ensures traceability to national and international standards.

The EUT was positioned on a non-conductive turntable, 0.8 meters above the open area test site ground plane, with a 50 ohm load replacing the EUT antenna. The fundamental frequency was measured with a test antenna set up 3 meters from the EUT, connected to a spectrum analyzer with 100 kHz RBW. This level was maximized by rotating the turntable 360 degrees, raising the test antenna from 1-4 meters above the ground plane, placing the test antenna in vertical and horizontal polarizations, and rotating the EUT through 3 orthogonal axes. This procedure was repeated for all out of band emissions, a spectrum analyzer RBW of 1 MHz was used for all measurements above 1 GHz. This measurement was performed with the EUT transmitting at a low, mid and high range channel. The data sheet with the radiated measurements can be found in Appendix A.

Verification of Radiated Emissions in Receive Mode (Part 15)

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 30 MHz - 5 GHz were performed in a horizontal and vertical polarization at the following test location :

☐ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)
☐ - Wild River Lab Screen Room

at a test distance of:

☐ - 1 meters
■ - 3 meters
☐ - 10 meters

☐ **- Test not applicable**

The radiated emissions with the EUT in the receive mode were a minimum of 8 dB below the FCC Part 15 Subpart B Class B limit at 199.7 MHz.

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number	Cal Date
■ -	EM-6917B	Electro-Metrics	Biconicalog Periodic	106	
■ -	3115	Electro-Metrics	Horn Antenna	2483	
■ -	8566B	Hewlett-Packard	Spectrum Analyzer	2430A00930	
■ -	85662A	Hewlett-Packard	Analyzer Display	2403A08134	
■ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2521A01006	
■ -	ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	
■ -	AFT-8434	Avantek	Preamplifier	9112 Z221	

Use of the calibrated equipment on this list ensures traceability to national and international standards.

The EUT was positioned on a non-conductive turntable, 0.8 meters above the open area test site ground plane, with the EUT in the receive mode. The frequencies were measured with a test antenna set up 3 meters from the EUT, connected to a spectrum analyzer with quasi-peak detection. The levels were maximized by rotating the turntable 360 degrees, raising the test antenna from 1-4 meters above the ground plane, and placing the test antenna in vertical and horizontal polarizations. This procedure was repeated for all significant emissions, a spectrum analyzer RBW of 1 MHz (peak detection) was used for all measurements above 1 GHz. The data sheet with the radiated measurements can be found in Appendix A.

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DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:

The transmitter has been tested and certified previously by the FCC as FCC ID: NJICVDM-2000. The only changes from the original submittal are the EUT case and antenna. The pertinent conducted measurements already on file with the FCC are included in Appendix C, but were not remeasured as no changes were made to the basic transmitter.

SUMMARY:

The requirements according to the technical regulations are

■ - met

☐ - **not** met.

The device under test does

■ - fulfill the general approval requirements mentioned on page 3.

☐ - **not** fulfill the general approval requirements mentioned on page 3.

Testing Start Date: 27 January 2000

Testing End Date: 27 January 2000

- TÜV PRODUCT SERVICE INC -

J. T. Schneider
Lead Engineer

Tested By:
R. M. Johnson & J. T. Schneider

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Test-setup photo(s):
Conducted emission 10/150 kHz - 30 MHz

Not Applicable

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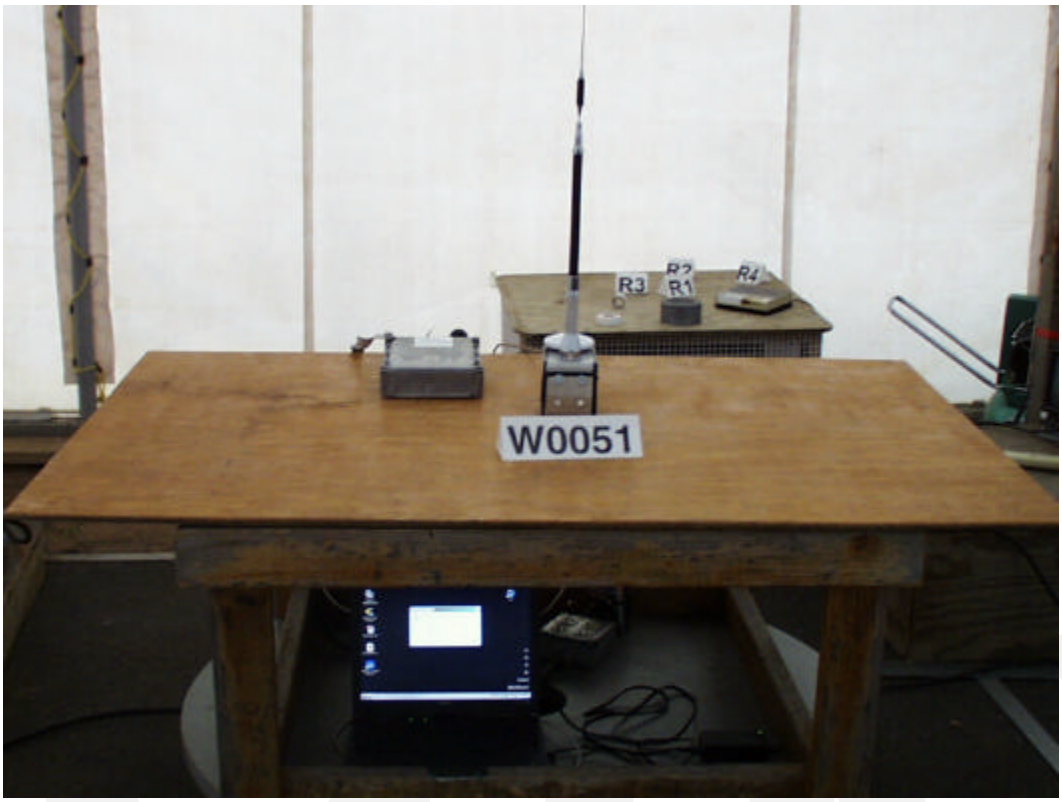
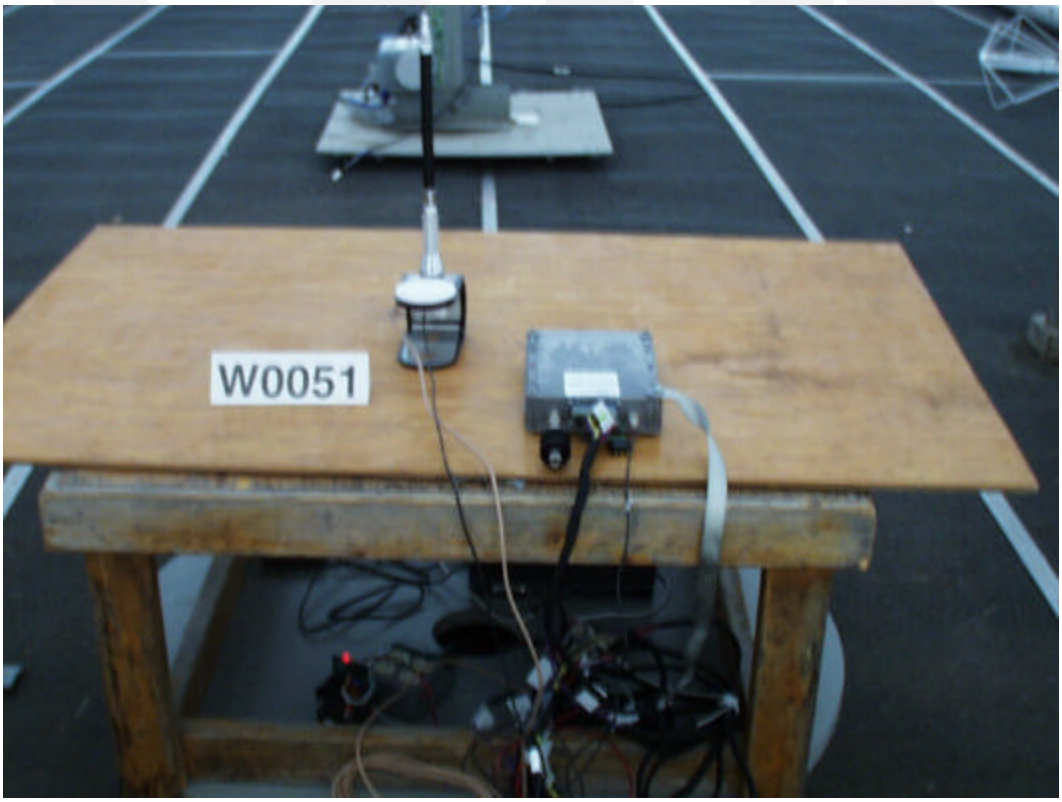
Test-setup photo(s):
Radiated emission 30 MHz – 8.5 GHz





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Appendix A

Test Data Sheets

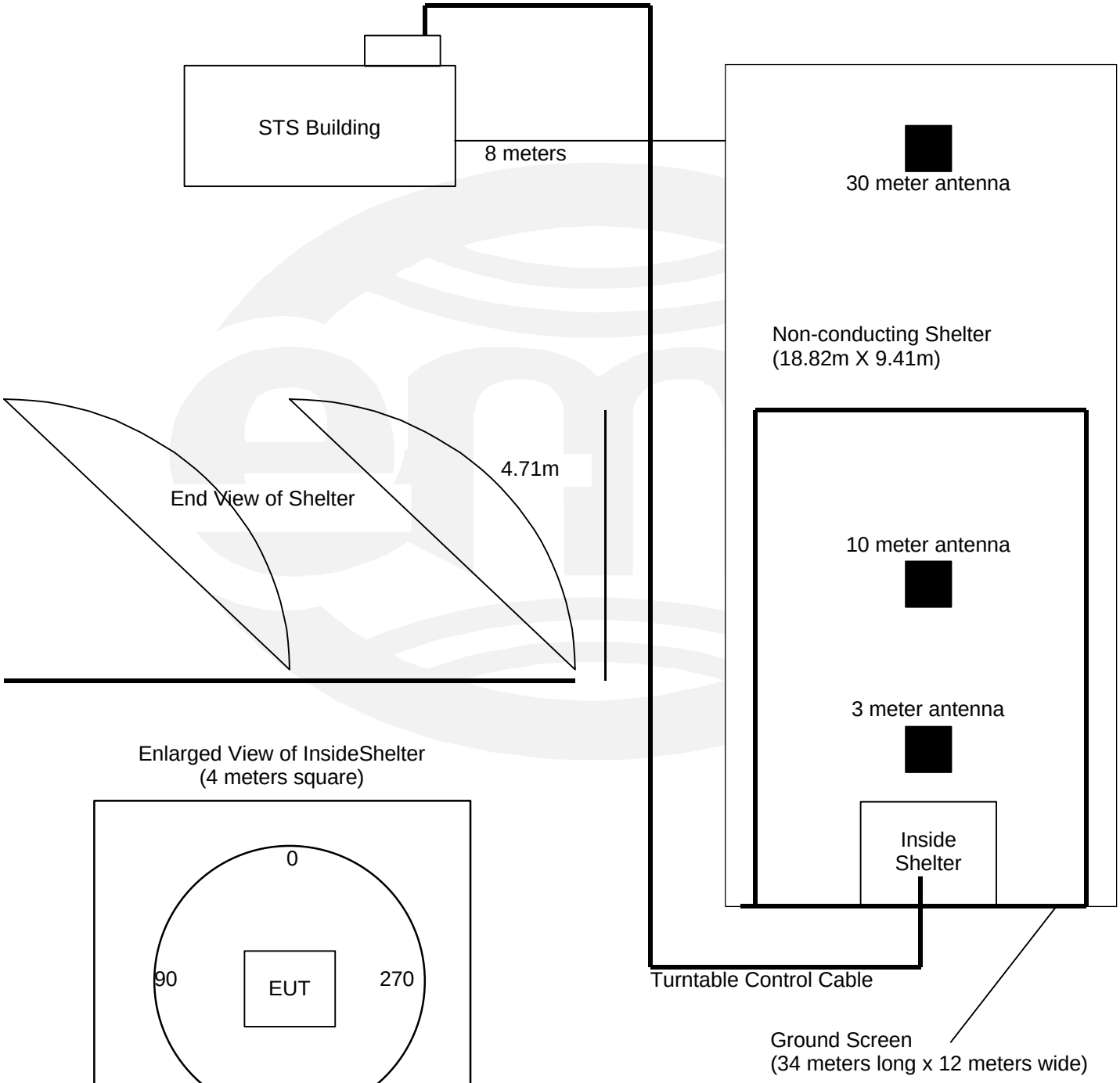
and

Test Setup Drawing(s)

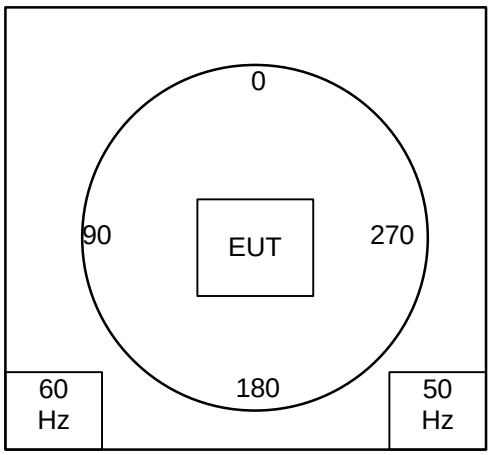
TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Small Test Site (STS)



Enlarged View of InsideShelter
(4 meters square)



Turntable is 1.2 meters in diameter

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Radiated Electromagnetic Emissions

Test Report #:	**W0051 Run 01**	Test Area:	STS 3m		
Test Method:	N/A	Test Date:	27-Jan-2000		
EUT Model #:	VCA10001	EUT Power:			
EUT Serial #:				Temperature:	°C
Manufacturer:	PHOENIX INTERNATIONAL			Relative Humidity:	%
EUT Description:	COMMUNICATIONS CONTROLLER			Air Pressure:	kPa
Notes:				Page:	3 of 2

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV)	POL / HGT / AZ (m) (DEG)	DELTA1 N/A	DELTA2 N/A
836.01	99.1Pk	6.6 / 21.4 / 0.0	127.1	V / 1.3 / 0.0	N/A	N/A
824.05	98.5Pk	6.5 / 21.4 / 0.0	126.4	V / 1.0 / 0.0	N/A	N/A
848.96	97.2Pk	6.6 / 21.5 / 0.0	125.3	V / 1.0 / 0.0	N/A	N/A
1697.92	36.9Pk	10.2 / 25.7 / 27.8	44.9	V / 1.0 / 120.0	N/A	N/A
1672.00	39.0Pk	10.1 / 25.6 / 27.8	46.8	V / 1.0 / 120.0	N/A	N/A
1648.06	40.2Pk	10.1 / 25.5 / 27.8	48.0	V / 1.0 / 120.0	N/A	N/A
2472.14	37.8Pk	12.8 / 28.3 / 27.8	51.1	V / 1.0 / 120.0	N/A	N/A
3296.18	33.9Pk	15.6 / 31.2 / 27.8	52.9	V / 1.0 / 120.0	N/A	N/A
LAST READING NOISE FLOOR						
2508.05	37.4Pk	12.9 / 28.4 / 27.8	50.9	V / 1.0 / 200.0	N/A	N/A
3344.06	33.4Pk	15.7 / 31.3 / 27.8	52.5	V / 1.0 / 200.0	N/A	N/A
LAST READING NOISE FLOOR						
FOLLOWING READINGS ARE NOISE FLOOR						
2546.90	34.1Pk	13.0 / 28.6 / 27.8	48.0	V / 1.0 / 200.0	N/A	N/A
FOLLOWING READING IS NOT NOISE FLOOR						
3395.85	36.3Pk	15.9 / 31.4 / 27.8	55.7	V / 1.0 / 170.0	N/A	N/A
FOLLOWING READINGS ARE NOISE FLOOR						
4244.84	-0.9Pk	18.3 / 32.5 / 0.0	49.8	V / 1.0 / 170.0	N/A	N/A
4180.05	-1.2Pk	18.1 / 32.5 / 0.0	49.4	V / 1.0 / 170.0	N/A	N/A
4120.25	-0.3Pk	18.0 / 32.5 / 0.0	50.2	V / 1.0 / 170.0	N/A	N/A
4944.30	-1.7Pk	20.6 / 33.9 / 0.0	52.8	V / 1.0 / 170.0	N/A	N/A

Radiated Electromagnetic Emissions

Test Report #:	**W0051 Run 01**	Test Area:	STS 3m		
Test Method:	N/A	Test Date:	27-Jan-2000		
EUT Model #:	VCA10001	EUT Power:			
EUT Serial #:				Temperature:	°C
Manufacturer:	PHOENIX INTERNATIONAL			Relative Humidity:	%
EUT Description:	COMMUNICATIONS CONTROLLER			Air Pressure:	kPa
Notes:				Page:	4 of 2

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV)	POL / HGT / AZ (m) (DEG)	DELTA1 N/A	DELTA2 N/A
********** MEASUREMENT SUMMARY **********						
824.05	98.5Pk	6.5 / 21.4 / 0.0	126.4	V / 1.0 / 0.0	N/A	N/A
836.01	99.1Pk	6.6 / 21.4 / 0.0	127.1	V / 1.3 / 0.0	N/A	N/A
848.96	97.2Pk	6.6 / 21.5 / 0.0	125.3	V / 1.0 / 0.0	N/A	N/A
1648.06	40.2Pk	10.1 / 25.5 / 27.8	48.0	V / 1.0 / 120.0	N/A	N/A
1672.00	39.0Pk	10.1 / 25.6 / 27.8	46.8	V / 1.0 / 120.0	N/A	N/A
1697.92	36.9Pk	10.2 / 25.7 / 27.8	44.9	V / 1.0 / 120.0	N/A	N/A
2472.14	37.8Pk	12.8 / 28.3 / 27.8	51.1	V / 1.0 / 120.0	N/A	N/A
2508.05	37.4Pk	12.9 / 28.4 / 27.8	50.9	V / 1.0 / 200.0	N/A	N/A
2546.90	34.1Pk	13.0 / 28.6 / 27.8	48.0	V / 1.0 / 200.0	N/A	N/A
3296.18	33.9Pk	15.6 / 31.2 / 27.8	52.9	V / 1.0 / 120.0	N/A	N/A
3344.06	33.4Pk	15.7 / 31.3 / 27.8	52.5	V / 1.0 / 200.0	N/A	N/A
3395.85	36.3Pk	15.9 / 31.4 / 27.8	55.7	V / 1.0 / 170.0	N/A	N/A
4120.25	-0.3Pk	18.0 / 32.5 / 0.0	50.2	V / 1.0 / 170.0	N/A	N/A
4180.05	-1.2Pk	18.1 / 32.5 / 0.0	49.4	V / 1.0 / 170.0	N/A	N/A
4244.84	-0.9Pk	18.3 / 32.5 / 0.0	49.8	V / 1.0 / 170.0	N/A	N/A
4944.30	-1.7Pk	20.6 / 33.9 / 0.0	52.8	V / 1.0 / 170.0	N/A	N/A

Radiated Electromagnetic Emissions

Test Report #:	**W0051 Run 02**	Test Area:	STS 3m
Test Method:	FCC Part 15	Test Date:	27-Jan-2000
EUT Model #:	VCA10001	EUT Power:	
EUT Serial #:		Temperature:	°C
Manufacturer:	PHOENIX INTERNATIONAL	Relative Humidity:	%
EUT Description:	COMMUNICATIONS CONTROLLER	Air Pressure:	kPa
Notes:	RECEIVE MODE	Page:	5 of 3

FREQ (kHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 FCC A (< 1GHz)	DELTA2 FCC B (< 1GHz)
49110.0	23.1Qp	1.5 / 13.6 / 27.8	10.3	V / 1.0 / 0.0	-39.2	-29.7
60207.0	38.1Qp	1.6 / 10.9 / 27.8	22.8	V / 1.0 / 0.0	-26.8	-17.2
86287.0	43.1Qp	1.9 / 6.8 / 27.8	24.1	V / 1.0 / 0.0	-25.5	-15.9
98213.0	40.2Pk	2.0 / 8.8 / 27.8	23.2	V / 1.0 / 0.0	-30.8	-20.3
106349.0	39.8Pk	2.1 / 8.2 / 27.8	22.4	V / 1.0 / 0.0	-31.6	-21.1
116379.0	44.7Qp	2.2 / 8.8 / 27.8	27.9	V / 1.0 / 0.0	-26.0	-15.6
134436.0	45.8Qp	2.4 / 8.0 / 27.8	28.4	V / 1.0 / 0.0	-25.6	-15.1
154501.0	46.4Qp	2.5 / 10.2 / 27.8	31.3	V / 1.0 / 0.0	-22.7	-12.2
199734.0	46.2Qp	2.9 / 10.8 / 27.8	32.1	V / 1.0 / 0.0	-21.8	-11.4
216700.0	39.5Qp	3.1 / 10.9 / 27.8	25.6	V / 1.0 / 0.0	-31.2	-20.4
230252.0	42.8Qp	3.1 / 11.3 / 27.8	29.4	V / 1.0 / 0.0	-27.5	-16.6
262579.0	42.1Qp	3.5 / 12.6 / 27.8	30.3	V / 1.0 / 0.0	-26.5	-15.7
276889.0	37.2Qp	3.5 / 12.8 / 27.8	25.7	V / 1.0 / 0.0	-31.1	-20.3
333072.0	40.9Qp	3.9 / 13.9 / 27.8	30.9	V / 1.0 / 0.0	-26.0	-15.1
399466.0	39.0Qp	4.3 / 15.3 / 27.8	30.8	V / 1.0 / 0.0	-26.0	-15.2
433390.0	31.1Qp	4.6 / 16.4 / 27.8	24.4	V / 1.0 / 0.0	-32.5	-21.6
459426.0	33.4Qp	4.7 / 16.8 / 27.8	27.0	V / 1.0 / 0.0	-29.8	-19.0
533706.0	30.5Qp	5.2 / 17.7 / 27.8	25.5	V / 1.0 / 0.0	-31.3	-20.5
557782.0	29.2Qp	5.3 / 18.2 / 27.8	24.9	V / 1.0 / 0.0	-31.9	-21.1
600342.0	28.8Qp	5.5 / 19.0 / 27.8	25.4	V / 1.0 / 0.0	-31.4	-20.6
49110.0	30.1Qp	1.5 / 13.6 / 27.8	17.3	V / 1.0 / 270.0	-32.3	-22.7
134436.0	48.9Qp	2.4 / 8.0 / 27.8	31.4	V / 1.0 / 270.0	-22.5	-12.1
199734.0	47.7Qp	2.9 / 10.8 / 27.8	33.6	V / 1.0 / 270.0	-20.4	-9.9
134436.0	47.7Qp	2.4 / 8.0 / 27.8	30.2	V / 1.0 / 180.0	-23.7	-13.3
333072.0	44.4Qp	3.9 / 13.9 / 27.8	34.4	V / 1.0 / 180.0	-22.5	-11.6
399466.0	41.1Qp	4.3 / 15.3 / 27.8	32.9	V / 1.0 / 180.0	-23.9	-13.1
199734.0	48.7Qp	2.9 / 10.8 / 27.8	34.6	V / 1.0 / 90.0	-19.4	-8.9
199734.0	47.9Pk	2.9 / 10.8 / 27.8	33.7	V / 1.0 / 90.0	-20.2	-9.8
199734.0	47.9Pk	2.9 / 10.8 / 27.8	33.7	V / 1.0 / 90.0	-20.2	-9.8
216700.0	40.2Qp	3.1 / 10.9 / 27.8	26.4	V / 1.0 / 90.0	-30.5	-19.6
199734.0	49.5Qp	2.9 / 10.8 / 27.8	35.4	V / 1.0 / 290.0	-18.5	-8.1

Radiated Electromagnetic Emissions

Test Report #:	**W0051 Run 02**	Test Area:	STS 3m		
Test Method:	FCC Part 15	Test Date:	27-Jan-2000		
EUT Model #:	VCA10001	EUT Power:			
EUT Serial #:				Temperature:	°C
Manufacturer:	PHOENIX INTERNATIONAL			Relative Humidity:	%
EUT Description:	COMMUNICATIONS CONTROLLER			Air Pressure:	kPa
Notes:	RECEIVE MODE			Page:	6 of 3

FREQ (kHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 FCC A (< 1GHz)	DELTA2 FCC B (< 1GHz)
NO HIGHER LEVEL WHEN MAXIMIZED 333 MHZ						
333072.0	42.2Qp	3.9 / 13.9 / 27.8	32.3	H / 1.0 / 0.0	-24.6	-13.7
459426.0	35.7Qp	4.7 / 16.8 / 27.8	29.4	H / 1.0 / 0.0	-27.5	-16.6
600342.0	36.8Qp	5.5 / 19.0 / 27.8	33.4	H / 1.0 / 0.0	-23.4	-12.6
294642.0	42.0Qp	3.6 / 13.0 / 27.8	30.7	H / 1.0 / 0.0	-26.1	-15.3
400106.0	33.3Qp	4.3 / 15.3 / 27.8	25.2	H / 1.0 / 0.0	-31.7	-20.8
463463.0	35.6Qp	4.7 / 16.8 / 27.8	29.3	H / 1.0 / 0.0	-27.6	-16.7
590637.0	35.7Qp	5.4 / 18.9 / 27.8	32.2	H / 1.0 / 0.0	-24.6	-13.8
600247.0	37.2Qp	5.5 / 19.0 / 27.8	33.9	H / 1.0 / 0.0	-22.9	-12.1
733618.0	29.3Qp	6.3 / 20.5 / 27.8	28.3	H / 1.0 / 0.0	-28.5	-17.7
867247.0	31.1Qp	6.7 / 21.8 / 27.8	31.9	H / 1.0 / 0.0	-25.0	-14.1
984171.0	30.6Qp	7.3 / 22.8 / 27.8	32.8	H / 1.0 / 0.0	-27.1	-21.2
1000466.0	30.8Qp	7.4 / 22.7 / 27.8	33.1	H / 1.0 / 0.0	N/A	N/A
459426.0	38.6Qp	4.7 / 16.8 / 27.8	32.3	H / 1.0 / 90.0	-24.6	-13.7
463463.0	37.6Qp	4.7 / 16.8 / 27.8	31.3	H / 1.0 / 90.0	-25.5	-14.7
276889.0	41.5Qp	3.5 / 12.8 / 27.8	30.0	H / 1.0 / 180.0	-26.8	-16.0
459426.0	40.3Qp	4.7 / 16.8 / 27.8	34.0	H / 1.0 / 180.0	-22.9	-12.0
463463.0	40.9Qp	4.7 / 16.8 / 27.8	34.6	H / 1.0 / 180.0	-22.3	-11.4
733618.0	32.3Qp	6.3 / 20.5 / 27.8	31.4	H / 1.0 / 270.0	-25.5	-14.6
463463.0	41.6Qp	4.7 / 16.8 / 27.8	35.4	H / 1.0 / 200.0	-21.5	-10.6
END OF SCAN 30 - 1000MHZ.						
CHECKED UP TO 5GHZ FOR SIGNALS AND DID NOT FIND ANY. NO NEED TO GENERATE A RUN 3 TO TAKE READINGS.						

Radiated Electromagnetic Emissions

Test Report #:	**W0051 Run 02**	Test Area:	STS 3m		
Test Method:	FCC Part 15	Test Date:	27-Jan-2000		
EUT Model #:	VCA10001	EUT Power:			
EUT Serial #:				Temperature:	°C
Manufacturer:	PHOENIX INTERNATIONAL			Relative Humidity:	%
EUT Description:	COMMUNICATIONS CONTROLLER			Air Pressure:	kPa
Notes:	RECEIVE MODE			Page:	7 of 3

FREQ (kHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 FCC A (< 1GHz)	DELTA2 FCC B (< 1GHz)
********** MEASUREMENT SUMMARY **********						
49110.0	30.1Qp	1.5 / 13.6 / 27.8	17.3	V / 1.0 / 270.0	-32.3	-22.7
60207.0	38.1Qp	1.6 / 10.9 / 27.8	22.8	V / 1.0 / 0.0	-26.8	-17.2
86287.0	43.1Qp	1.9 / 6.8 / 27.8	24.1	V / 1.0 / 0.0	-25.5	-15.9
98213.0	40.2Pk	2.0 / 8.8 / 27.8	23.2	V / 1.0 / 0.0	-30.8	-20.3
106349.0	39.8Pk	2.1 / 8.2 / 27.8	22.4	V / 1.0 / 0.0	-31.6	-21.1
116379.0	44.7Qp	2.2 / 8.8 / 27.8	27.9	V / 1.0 / 0.0	-26.0	-15.6
134436.0	48.9Qp	2.4 / 8.0 / 27.8	31.4	V / 1.0 / 270.0	-22.5	-12.1
154501.0	46.4Qp	2.5 / 10.2 / 27.8	31.3	V / 1.0 / 0.0	-22.7	-12.2
199734.0	49.5Qp	2.9 / 10.8 / 27.8	35.4	V / 1.0 / 290.0	-18.5	-8.1
216700.0	40.2Qp	3.1 / 10.9 / 27.8	26.4	V / 1.0 / 90.0	-30.5	-19.6
230252.0	42.8Qp	3.1 / 11.3 / 27.8	29.4	V / 1.0 / 0.0	-27.5	-16.6
262579.0	42.1Qp	3.5 / 12.6 / 27.8	30.3	V / 1.0 / 0.0	-26.5	-15.7
276889.0	41.5Qp	3.5 / 12.8 / 27.8	30.0	H / 1.0 / 180.0	-26.8	-16.0
294642.0	42.0Qp	3.6 / 13.0 / 27.8	30.7	H / 1.0 / 0.0	-26.1	-15.3
333072.0	44.4Qp	3.9 / 13.9 / 27.8	34.4	V / 1.0 / 180.0	-22.5	-11.6
399466.0	41.1Qp	4.3 / 15.3 / 27.8	32.9	V / 1.0 / 180.0	-23.9	-13.1
400106.0	33.3Qp	4.3 / 15.3 / 27.8	25.2	H / 1.0 / 0.0	-31.7	-20.8
433390.0	31.1Qp	4.6 / 16.4 / 27.8	24.4	V / 1.0 / 0.0	-32.5	-21.6
459426.0	40.3Qp	4.7 / 16.8 / 27.8	34.0	H / 1.0 / 180.0	-22.9	-12.0
463463.0	41.6Qp	4.7 / 16.8 / 27.8	35.4	H / 1.0 / 200.0	-21.5	-10.6
533706.0	30.5Qp	5.2 / 17.7 / 27.8	25.5	V / 1.0 / 0.0	-31.3	-20.5
557782.0	29.2Qp	5.3 / 18.2 / 27.8	24.9	V / 1.0 / 0.0	-31.9	-21.1
590637.0	35.7Qp	5.4 / 18.9 / 27.8	32.2	H / 1.0 / 0.0	-24.6	-13.8
600247.0	37.2Qp	5.5 / 19.0 / 27.8	33.9	H / 1.0 / 0.0	-22.9	-12.1
733618.0	32.3Qp	6.3 / 20.5 / 27.8	31.4	H / 1.0 / 270.0	-25.5	-14.6
867247.0	31.1Qp	6.7 / 21.8 / 27.8	31.9	H / 1.0 / 0.0	-25.0	-14.1
984171.0	30.6Qp	7.3 / 22.8 / 27.8	32.8	H / 1.0 / 0.0	-27.1	-21.2
1000466.0	30.8Qp	7.4 / 22.7 / 27.8	33.1	H / 1.0 / 0.0	N/A	N/A

Appendix B

Constructional Data Form

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Applicant -- Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company:	Phoenix International Corporation		
Address:	5300 Rising Moon Road Springfield, IL 62707		
Phone:	217-483-9050	Fax:	217-483-7453
Contact:	Tyler Tasset	Position:	**Engineering Project Manager**

General Equipment Description -- Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of Equipment:	TNB – Licensed Non-Broadcast Station Transmitter	Model No.:	VCA10001
Serial No.:	VCAA001000035	FCC ID No.:	OV5-VCA10001

General description:

GPS receiver with cellular transmitter that reports location and engine hours.

Product Variant/Options: N/A

Attachments: (only required for certification)

X External Photographs X Product Literature X High Level Bill of Materials

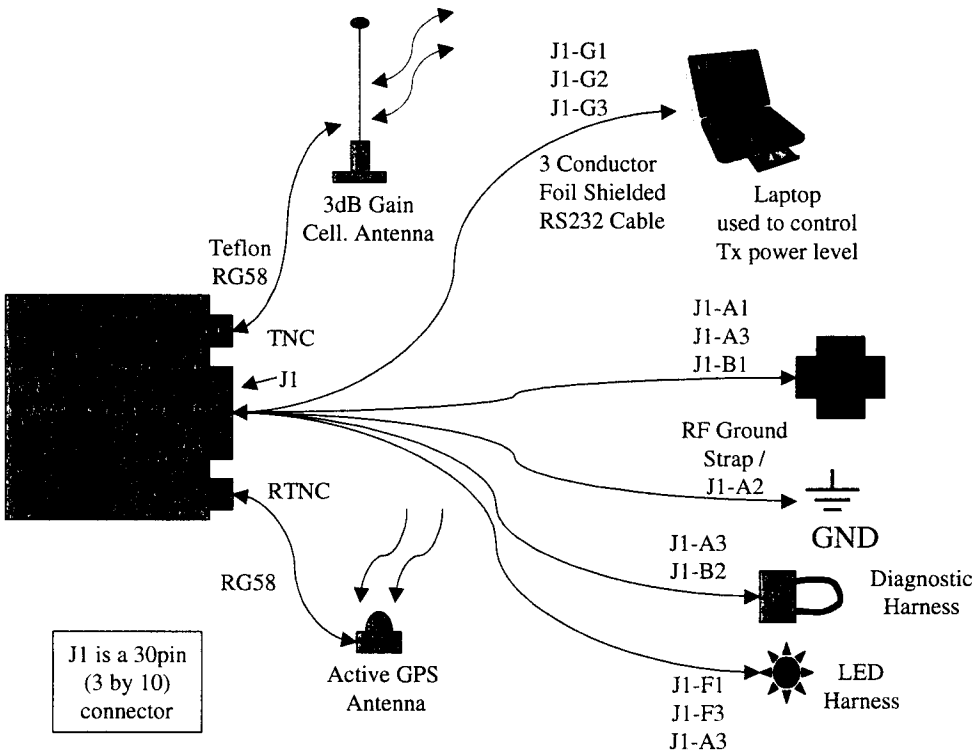
Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **2/10/2000** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

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.



Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 2/10/2000 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

Installation and Environmental Conditions (describe) -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

Power Connections:

Vehicle Batt+ – Main power connection, connected to post on alternator
Vehicle Batt- – Ground connection, connected to post on alternator
RF Ground Strap – Main ground connection, flat braided ground strap connecting box to The vehicle chassis. Alternate grounding method is to bolt EUT directly to the vehicle chassis. Either case the ground strap is recommended.

Environmental Conditions:

EUT is designed for rugged outdoor operation such as the construction equipment industry. Unit is designed for mounting either inside or outside the vehicle's cab as such it will be exposed to the elements.

X Installation manual/instructions (attached, only required for certification)

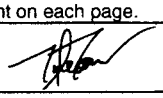
Power Requirements -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage 12 to 24 Volt DC normal operating voltage Rated Input Power _____

Protection Class -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: _____ Class: _____

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 2/10/2000 **Signature of Applicant:** 

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of ≥ 3.0 meters, then it is required to test with a cable of at least 3.0 meters.

I/O Ports and Cables

Description:	RS232 Communications – Used only for diagnostics and programming. Will not be connected in normal operation.			
Type of Port:	Serial		# of ports/cables of type 1	
Exercised during testing?		X Yes	☐	No
Assembly ↔ Assembly Interconnect		☐ Yes	☐	No
Cable shielded:		X Yes	☐	No
Shield Type (describe)	Overall Foil			
Termination: (describe)	360 degree to conductive shell EUT end - DB9 at PC end			
Transmission Type:		☐ Analog	X	Digital
Length of cable: 8 ft	Maximum:	Tested: 8 ft		

I/O Ports and Cables

Description:	Handset – Similar to the handset found on most "Bag Phones" Used for diagnostics. The handset will not be used in the field			
Type of Port:			# of ports/cables of type 1	
Exercised during testing?		☐ Yes	X	No
Assembly ↔ Assembly Interconnect		☐ Yes	X	No
Cable shielded:		☐ Yes	X	No
Shield Type (describe)				
Termination: (describe)	Not currently brought outside the EUT			
Transmission Type:		☐ Analog	X	Digital
Length of cable: n/a	Maximum:	Tested:		

I/O Ports and Cables

Description:				
Type of Port:			# of ports/cables of type	
Exercised during testing?		☐ Yes	☐	No
Assembly ↔ Assembly Interconnect		☐ Yes	☐	No
Cable shielded:		☐ Yes	☐	No
Shield Type (describe)				
Termination: (describe)				
Transmission Type:		☐ Analog	☐	Digital
Length of cable:	Maximum:	Tested:		

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 2/10/2000 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

EUT configurations -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

Current configuration used for testing is stored in a "source safe" file name: GVC1A009T001.cvd

The following modifications were made at test time:

Unit was connected with 18Vdc to J1 pins A1, A3, and B1 (forced into Full Power Mode)
CellCom will not work in Full Power Mode so FPM was manually disabled.
GPS normally shuts off during a cell call – GPS was manually forced on during the test

EUT Software and Operation Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing.

General Description: (describe)	See Above. The unit was in power save mode acquiring engine hours.
Software Revision Level: (list and describe)	WL: GVC1A009T001 Atmel: V1.01
Operating modes to be tested: (list and describe)	The only change to the operating mode is commanding the radio to transmit or receive as required by part 15 and 22.
***NOTE: Operation Manual/Instructions do not exist – Owner interaction not required.	

☐ Operation manual/instructions (attached)

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **2/10/2000** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

System, Subsystem, Major Subassemblies or Internal Peripherals -- List and describe all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral, internal disk drives or internal circuit boards. It is recommended that circuit diagrams, assembly and subassembly drawings be attached. Please indicate.

Description	*Model #*	*Serial #*	*FCC ID #*
Wireless Link CVDM-2000 OEM equipment	**CVDM-2000**	**236-02005004**	**NJICVDM-2000**

☐ **Technical Drawings attached**

Interfacing Equipment and/or Simulators (which are not part of the EUT) -- List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

Description	*Model #*	*Serial #*	*FCC ID #*
HP Omnibook Notebook computer – used to control the radio for testing	4150	TW94880582	Not printed on PC
Linear Power Supply	N/A	N/A	N/A

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **2/10/2000** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

EMC System Details -- List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01µF, 1 ea. at C12 - C20).

Oscillator Frequencies

Frequency	*Sub-harmonics*	*EUT Location*	*Description of Use*
2 MHz		X1 or X2 See NOTE A on pg. 9	Clock for U2
See NJICVDM-3 and NJICVDM2000 For OEM board info			NJICVDM-2000 is a permissive change to NJICVDM-3

Power Supply

Frequency	*Manufacturer*	*Model #*	*Serial #*	*Type (list frequency)*
N/A				
See NJICVDM-3 and NJICVDM2000 For OEM board info				NJICVDM-2000 is a permissive change to NJICVDM-3

Power Line Filters

Manufacturer	*Model #*	*Qty*	*Location on EUT*
N/A			
See NJICVDM-3 and NJICVDM2000 For OEM board info			NJICVDM-2000 is a permissive change to NJICVDM-3

Critical EMI Components (Capacitors, ferrites, etc.)

Description	*Manufacturer*	*Part # or Value*	*Qty*	*Location on EUT*
Ferrite block	Cinch	581-01-30-001	2	At J1
Ceramic Capacitors	Various	.01uF 100V	28	C3,11,16-24,26,34-38, 41-46,49,51-53,58
See NJICVDM-3 and NJICVDM2000 For OEM board info				NJICVDM-2000 is a permissive change to NJICVDM-3

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 2/10/2000 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

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Other EMI Critical Construction Detail -- Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

Grounding unit with a 1" braid, 2 feet long to the chassis.

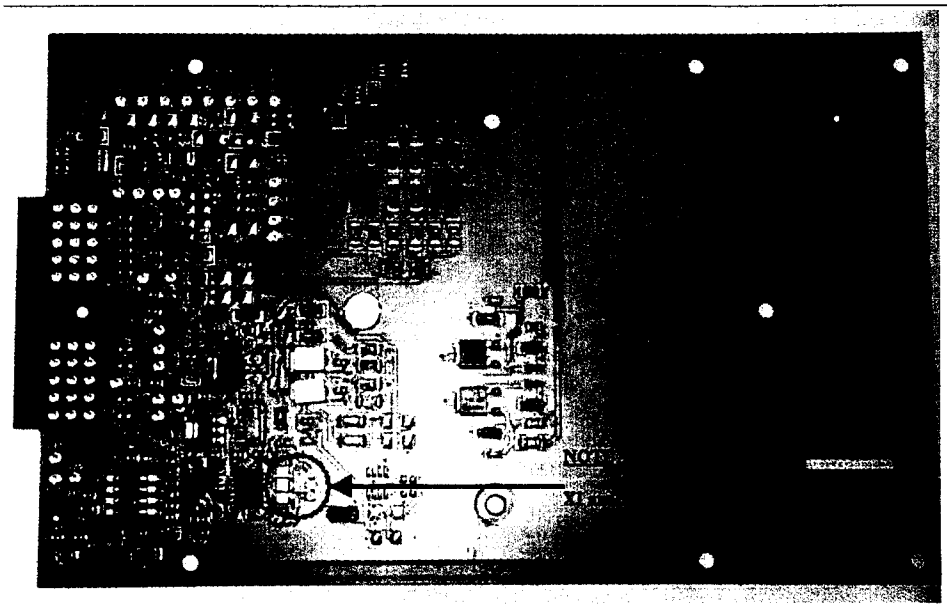
Description of Enclosure -- Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

Unpainted Diecast Aluminum Enclosure with non-conductive silicone (Wacker p/n T-95) gasket between halves.

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **2/10/2000** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing



TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Appendix C

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ±4.5 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dBµV and µV, the following conversions apply:

dBµV = 20(log µV)
µV = Inverse log(dBµV/20)

RADIATED EMISSIONS

The final level, expressed in dBµV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)		Level (dBµV)		Factor & Cable (dB)		Final (dBµV/m)		FCC B Limit (dBµV/m)		Delta FCC B (dB)
32.21		13.9	+	16.3	=	30.2	-	40.0	=	-9.8

For the transmitter fundamental measurements, no preamplifier was used. For transmitter spurious above 4 GHz, the preamplifier gain is not in program memory, and is compensated for by analyzer offset.

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0