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FCC MPE Part 24 and 101 TEST REPORT

Applicant	SENSUS METERING SYSTEMS INC.
Address	400 PERIMETER DRIVE, SUITE K MORRISVILLE, NC 27560 USA
Model Number	4500-PCS 4500-MAS
Product Description	Transceiver
Date Sample Received	11/24/2009
Date Tested	12/14/2009
Tested By	Richard Block
Approved By	Mario de Aranzeta
Report Number	2865UT9TestReport.doc
Test Results	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Testing Certificate # 0955-01



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APPLICANT: ADVANCED COMPLIANCE SOLUTIONS

MODEL: 4500-PCS and 4500-MAS

REPORT: A\Advanced_Compliance_Solutions\2865UT9\2865UT9TestReport.doc

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results only relate to the item tested.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669



Authorized Signatory Name:

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: 12/15/2009

REPORT SUMMARY

Applicable Rule(s)	Pt 15.109, Pt 15.107, ANSI C63.4: 2003
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TEST ENVIRONMENT

Test Facility	Timco Engineering, Inc. 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition in the laboratory	Temperature: 26°C Relative humidity: 50%

TEST SETUP SUMMARY

Test Setup Diagram/Description	The DUT was placed on the turntable per setup per ANSI C63.4: 2003. A test set up photo is provided for clarification.
Deviation from the standard/procedure	No deviation
Modification of DUT	No modification

SUPPORTING PERIPHERAL EQUIPMENT

Antenna Model: VXU II Model 3600 Extended Range Antenna

DUT SPECIFICATION

DUT Description	Transceiver
Model Number	4500 -PCS and 4500-MAS
DUT Power Source	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Laboratory Test Conditions	Temperature: 26°C Humidity: 55%
Modifications to DUT:	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (explanation below)

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TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/11/10
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/10
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 3/30/09	3/30/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/3/09	3/3/12
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 4/5/09	4/5/12
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/9/09	5/9/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/14/09	5/14/11
System One	Audio Precision	System One	SYS1-45868	CHAR 2/27/08	2/27/10
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/08	4/25/10

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TEST PROCEDURES

Power line conducted Emission: The test procedure used was ANSI C63.4-2003. The spectrum was scanned from 0.15 to 30 MHz.

Radiation Interference: The test procedure used was ANSI C63.4-2003 using a spectrum analyzer with preselector. The resolution bandwidth used was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The video bandwidth was always greater than or equal to the RBW.

The unit under test was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. The frequency was scanned from 30 MHz to 1.0 GHz. The DUT was measured in three (3) orthogonal planes when necessary.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+CL	= FS
33	20 dBuV	+ 10.36 dB/m	+0.40 dB	=30.36 dBuV/m @ 3m

Product and System Description

The mobile transceiver uses GFSK modulation, to transmit at 12.5 kb/s, in normal operation.

The intended use of the radio is to transmit data while the device is properly installed in a vehicle with an external antenna mounted at the center of the roof or trunk.

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies which can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means.

Accordingly this product is classified as Occupational/Controlled Exposure. However, in accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits.

(Note that "By-standers" as used herein mean people other than the operator)

Measurement and Limit Standards

Measurements were performed according to the recommended guidelines in IEEE/ANSI C95.3-2002 and compared to FCC Limits per 47 CFR 2.1091 (d) for General Population/Uncontrolled Exposure limits.

For test frequencies ranging from 940-941.5 MHz, the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 0.63 mW/cm^2 and calculated using the formula $f/1500$.

Data Collection Consideration

Power density testing was performed with DUT installed in a 2001 Chevy Impala (4-door).

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EME measurements made with roof mounted antenna(s)

External vehicle EME measurement

(Antenna mounted at roof center)

MPE measurements for by-stander conditions are determined by taking the average of (10) measurements in a 2 m vertical line for the test positions indicated in the report with 20cm increments at the test distance of 60cm from the antenna under test. The measurement probe sensor is rotated 180 degrees at each of the ten incremental measurements to ensure the highest result is captured. These measurements are representative of persons other than the operator standing next to the vehicle.

Note: Actual test distance was 110cm (60cm from antenna to roof edge; 30cm from roof edge to edge of car door; 20cm vertical test line to car door); this is the closest distance that can be achieved to an antenna mounted to the center of the vehicle used for MPE compliance assessment.

Test results Summary

The following pages presents detailed MPE measurement information for each test configuration external to the vehicle, TX frequency, antenna (location, model and gain), distance from antenna to probe sensor, E/H field measurements, calibration factor, MPE average over body, initial power, power density calc, power density max calc, IEEE/FCC controlled and uncontrolled limits, and maximum output power.

The average over body test methodology is consistent with IEEE/ANSI C95.3-2002 guidelines

MPE results are based on a 100% duty cycle which is in accordance with manufacturer's specification.

Below is an explanation of how the MPE results are calculated.

External to vehicle- 10 measurements are averaged over the body (body_avg).
Internal to vehicle-3 measurements are averaged over the body (body_avg).
Narda survey meter measures in percent of controlled limit. Therefore the averages over the body used in the calculations below reflect percentages.

MPE results are based on a 100% duty cycle in normal mode.

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Therefore;

Average_over_body=body_avg*controlled_limit

Pwr_density_calc= Average_over body*_duty _cycle

Pwr_density_max_calc=Pwr_density_calc* max_output_power

Initial_output_power

Note: for initial output power > Max_output_power, Max_output_power/initial output power + 1

The tables below summarize the E field test configurations for the radio. See the following pages for the indicated test positions and detailed MPE measurement data.

Conclusion

Depending on the test frequency, the radio assessments were performed with an output power range of 6.3 and 2.9 Watts. The highest power density results for the mobile device scaled to the maximum allowable power output is 0.297mW/cm² (at 940 MHz) external to the vehicle (trunk lid).

The MPE results presented here demonstrate compliance to the applicable FCC/IEEE General population/uncontrolled exposure limits of f/1500 for the frequency range for both passengers and by standers.

RADIATED EMISSIONS

Antenna Location	Frequency (MHz)	Power Setting	Power Out (W)	Probe Distance from Antenna (cm)	Probe Height (cm)	Evolts	E ² Volts	E ² /1.2 π	Power Density (mW/cm ²)	% of Uncontrolled Limit
Roof	940	Part 24	2.9	110	170	2.8	7.84	2.079625	0.00208	0%
Roof	940	Part 24	2.9	110	130	2.8	7.84	2.079625	0.00208	0%
Roof	940	Part 24	2.9	110	90	2.1	4.41	1.169789	0.00117	0%
Roof	941	Part 101	6.3	110	170	3.0	9.00	2.387324	0.00239	0%
Roof	941	Part 101	6.3	110	130	3.3	10.89	2.888662	0.00289	0%
Roof	941	Part 101	6.3	110	90	2.8	7.84	2.079625	0.00208	0%
Trunk	940	Part 24	2.9	50	170	18.0	324.00	85.94367	0.08594	14%
Trunk	940	Part 24	2.9	50	130	4.6	21.16	5.612864	0.00561	1%
Trunk	940	Part 24	2.9	50	90	1.6	2.56	0.679061	0.00068	0%
Trunk	941	Part 101	6.3	50	170	33.5	1122.25	297.6861	0.29769	47%
Trunk	941	Part 101	6.3	50	130	8.8	77.44	20.5416	0.02054	3%
Trunk	941	Part 101	6.3	50	90	3.2	10.24	2.716244	0.00272	0%

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RADIATED EMISSIONS TEST SETUP PHOTO

Antenna on roof



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Antenna on trunk



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