TUV Rheinland of North America

Emissions Test Report

EUT Name: Pave Tracker Plus

EUT Model: 2701-B

FCC Title 47, Part 15, Subpart C and RSS-210 Section 5

Prepared for:

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Report/Issue Date: 11 July 2005
Report Number: 30462797.001

Statement of Compliance

Manufacturer:	Troxler Electronic labs, Inc 3008 Cornwallis Rd. RTP NC 27709 919-549-8661
Requester / Applicant:	Phil Fonville
Name of Equipment:	Pave Tracker Plus
Model No.	2701-B
Type of Equipment:	RF Transmitter
Class of Equipment:	Class B
Application of Regulations:	FCC Title 47, Part 15, Subpart C and RSS-210 Section 5
Test Dates:	15 February 2005 to 29 April 2005

Guidance Documents:

Emissions: CFR 47; FCC Part 15, RSS-210, Section 5

Test Methods:

Emissions: CFR 47; FCC Part 15, ANSI C63.4:2003

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

NVLAP Signatory

11 July 2005
Date

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1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, Subpart C and RSS-210 Section 5 based on the results of testing performed on *15 February* 2005 through *29* April 2005 on the *Pave Tracker Plus* Model No. *2701-B* manufactured by Troxler Electronic labs, Inc. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Emission	Test Method(s)	Test Parameters	Result
Radiated Emissions	FCC parts 15.209 and 15.235 and ANSI C63.4:1992	49.86 MHz	compliant
Conducted Emissions	FCC part 15 and ANSI C63.4:2003	150 kHz to 30 MHz, Class B	compliant
Fundamental Bandwidth	47 CFR 15.209 and 15.235	49.82MHz to 49.90 MHz	compliant

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave., Youngsville, N.C 27596 address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.4 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2003, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2).

The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2003, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The test system for radiated immunity is defined as the antenna, amplifier, cables, signal generator field probe and spectrum analyzer. The test system for conducted immunity is defined as the coupling/decoupling device, amplifier, cables, signal generator and spectrum analyzer. The test system for voltage variations and interruptions immunity is defined as the AC power source and the interruptions generator. The test system for electrical fast transient immunity is defined as the AC power output source and the fast transient generator. The test system for lightning surge immunity is defined as the AC power output source and the lightning surge generator. The test system for electrostatic discharge immunity is defined as the air and contact discharge generators. The test system for power frequency magnetic field immunity is defined as the AC voltage source. The test system for the damped oscillatory wave immunity is defined as the AC power output source and the oscillatory wave generator. The test system for harmonic current and voltage flicker test is defined as the AC power source and the detection devices. The conducted emissions test system has a combined standard uncertainty of ± 1.2 dB. The radiated emissions test system has a combined standard uncertainty of ± 1.6 dB. The radiated immunity test system has a combined standard uncertainty of ± 2.7 dB. The conducted immunity test system has a combined standard uncertainty of ± 1.5 dB. The voltage variations and interruptions immunity test system has a combined standard uncertainty of ± 4.3 dB. The electrical fast transients immunity test system has a combined standard uncertainty of ± 5.8 dB. The lightning surge immunity test system has a combined standard uncertainty of ± 8.0 dB. The electrostatic discharge immunity test system has a combined standard uncertainty of ± 4.1 dB. The power frequency magnetic field immunity test system has a combined standard uncertainty of ± 0.58 dB. The damped oscillatory wave immunity test system has a combined standard uncertainty of ± 8.7 dB. The harmonic current and voltage flicker test system has a combined standard uncertainty of ± 11.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 17025:1999.

3 Product Information

Figure 1 – Photo of EUT

Figure 2 – Photo of EUT

Figure 3 – Photo of EUT

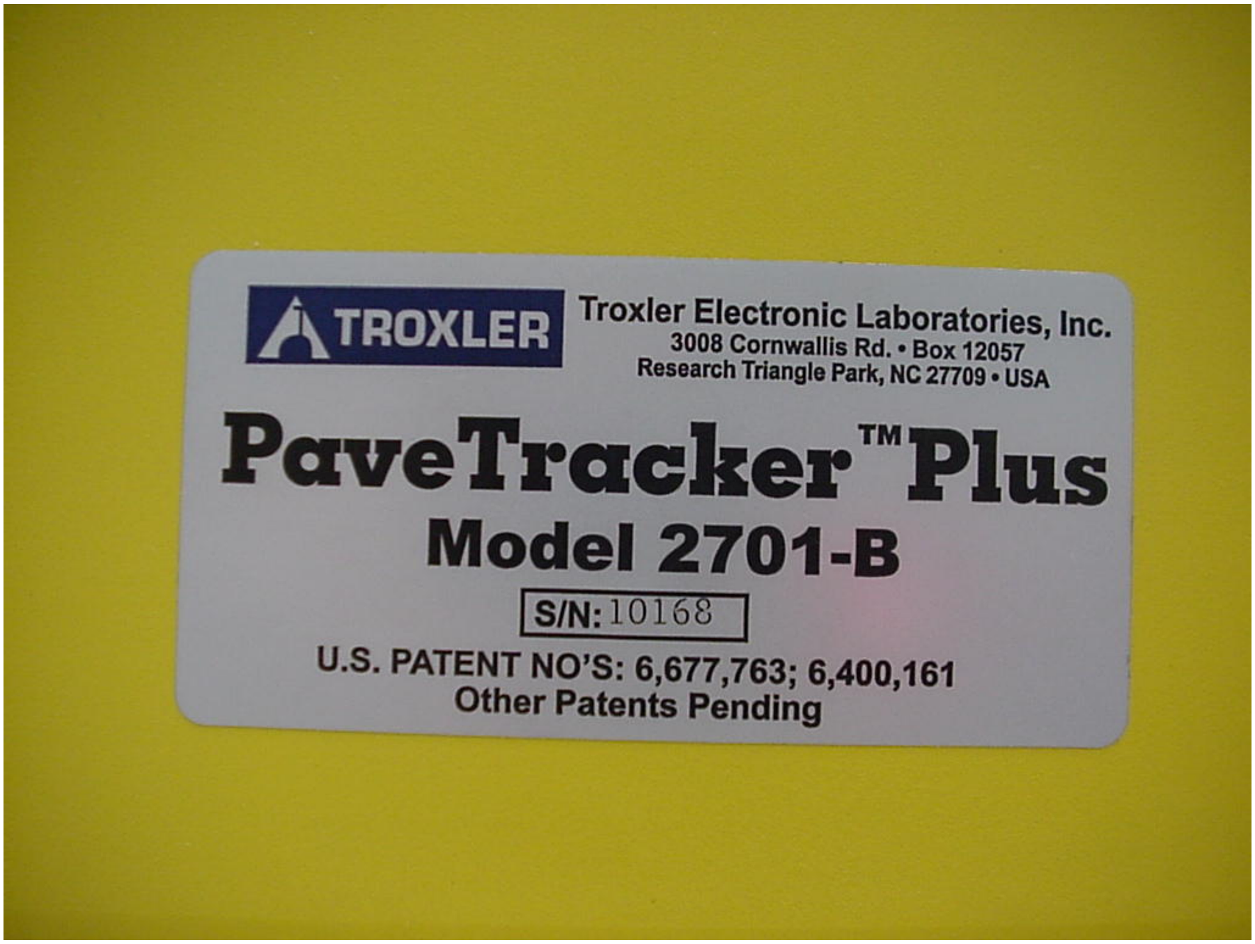

Figure 4 – Photo of EUT

3.1 Product Description

The information for all equipment used in the tested system, including: descriptions of cables, clock and microprocessor frequencies, EMI critical components, and accessory equipment has been supplied by the manufacturer and is listed in the EMC Test Plan found in Section 6.

3.2 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

3.3 Operation Mode

A description and justification of the operation mode is given in the EMC Test Plan.

In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

The EUT is powered from an internal battery during operation. The unit was tested with the battery fully charged and a battery charger attached. The battery charger voltage was varied, in accordance with FCC Part 15.31, from -85% to + 115% of the nominal line voltage, with no effect on the output power or bandwidth.

4 Emissions

4.1 Radiated Emissions

Testing was performed in accordance with FCC parts 15.209 and 15.235 and ANSI C63.4:1992. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.1 Test Methodology

4.1.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.1.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.1.1.3 Deviations

There were no deviations from this test methodology.

4.1.2 Test Results

Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.1.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 1 Radiated Emissions **Tracking #** 30462797.001 Page 1 of 3

EUT Name	Pave Tracker Plus	**Date**	23 March 2005
EUT Model	2701-B	**Temp / Hum in**	70 Deg. F / 40% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	CFR 47; FCC Part 15, RSS-210, Section 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3m / 3110B, SAS-516	**Performed by**	Eugene Moses

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Configuration: EUT in normal operating position. 120 KHz RBW, 300 KHz VBW. Worst Case.										
49.86	H	4	70 Pk	51.55	0.00	0.74	10.32	62.61	80.00	-17.39
49.86	H	4	70 avg	51.51	0.00	0.74	10.32	62.57	80.00	-17.43
49.86	V	1	185 pk	58.92	0.00	0.74	9.60	69.26	80.00	-10.74
49.86	V	1	185 avg	58.88	0.00	0.74	9.60	69.22	80.00	-10.78
Configuration: EUT on side. 120 KHz RBW, 300 KHz VBW										
49.86	H	4	279 pk	47.33	0.00	0.74	10.32	58.39	80.00	-21.61
49.86	H	4	Avg	47.21	0.00	0.74	10.32	58.27	80.00	-21.73
49.86	V	1	177 pk	56.71	0.00	0.74	9.60	67.05	80.00	-12.95
49.86	V	1	Avg	56.60	0.00	0.74	9.60	66.94	80.00	-13.06
Configuration: EUT on end. 120 KHz RBW, 300 KHz VBW										
49.86	H	4	269 pk	49.51	0.00	0.74	10.32	60.57	80.00	-19.43
49.86	H	4	Avg	49.45	0.00	0.74	10.32	60.51	80.00	-19.49
49.86	V	1	178 pk	57.80	0.00	0.74	9.60	68.14	80.00	-11.86
49.86	V	1	Avg	57.75	0.00	0.74	9.60	68.09	80.00	-11.91
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty										
Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence										

SOP 1 Radiated Emissions **Tracking #** 30462797.001 Page 2 of 3

EUT Name	Pave Tracker Plus	**Date**	23 March 2005
EUT Model	2701-B	**Temp / Hum in**	70 Deg. F / 40% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	CFR 47; FCC Part 15, RSS-210, Section 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3m / 3110B, SAS-516	**Performed by**	Eugene Moses

49.86

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Configuration: EUT in normal operating position. 120 KHz RBW, 300 KHz. Quasi-peak detector.										
99.72	H	3.27	67	15.06	0.00	1.05	10.09	26.20	43.50	-17.30
146.58	H	1.12	270	10.77	0.00	1.29	12.33	24.39	43.50	-19.11
199.41	H	1.67	180	11.55	0.00	1.51	14.96	28.03	43.50	-15.47
249.30	H	1	94	25.74	0.00	1.70	12.29	39.73	46.00	-6.27
299.16	H	1	103	18.74	0.00	1.87	14.17	34.78	46.00	-11.22
349.02	H	1	180	14.60	0.00	2.03	16.43	33.06	46.00	-12.94
398.88	H	1	212	9.27	0.00	2.17	16.48	27.91	46.00	-18.09
448.74	H	2	192	14.37	0.00	2.31	17.45	34.13	46.00	-11.87
498.60	H	1.83	263	5.01	0.00	2.44	18.66	26.11	46.00	-19.89

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

SOP 1 Radiated Emissions **Tracking #** 30462797.001 Page 3 of 3

EUT Name	Pave Tracker Plus	**Date**	23 March 2005
EUT Model	2701-B	**Temp / Hum in**	70 Deg. F / 40% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	CFR 47; FCC Part 15, RSS-210, Section 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3m / 3110B, SAS-516	**Performed by**	Eugene Moses

49.86

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Configuration: EUT in normal operating position. 120 KHz RBW, 300 KHz. Quasi-Peak Detector										
99.72	V	1	102	10.47	0.00	1.05	10.91	22.43	43.50	-21.07
146.58	V	1	343	18.95	0.00	1.29	12.63	32.87	43.50	-10.63
199.41	V	1	18	13.06	0.00	1.51	15.38	29.95	43.50	-13.55
249.30	V	2.64	102	14.18	0.00	1.70	12.89	28.77	46.00	-17.23
299.16	V	1.56	212	9.62	0.00	1.87	13.68	25.17	46.00	-20.83
349.02	V	1.74	0	10.40	0.00	2.03	15.81	28.24	46.00	-17.76
398.88	V	1	0	6.21	0.00	2.17	16.60	24.98	46.00	-21.02
448.74	V	1	11	13.10	0.00	2.31	17.32	32.74	46.00	-13.26
498.60	V	1	3	6.02	0.00	2.44	17.30	25.76	46.00	-20.24

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

4.1.3 Photos

Figure 5 - Radiated Emissions Test Setup (Chamber - Front)

Figure 6 - Radiated Emissions Test Setup (Chamber - Back)

4.1.4 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

4.2 Conducted Emissions

Testing was performed in accordance with FCC part 15 and ANSI C63.4:2003. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.2.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with ¼ inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane.

4.2.1.1 Deviations

There were no deviations from this test methodology.

4.2.2 Test Results

Section 4.2.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

4.2.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 2 Conducted Emissions

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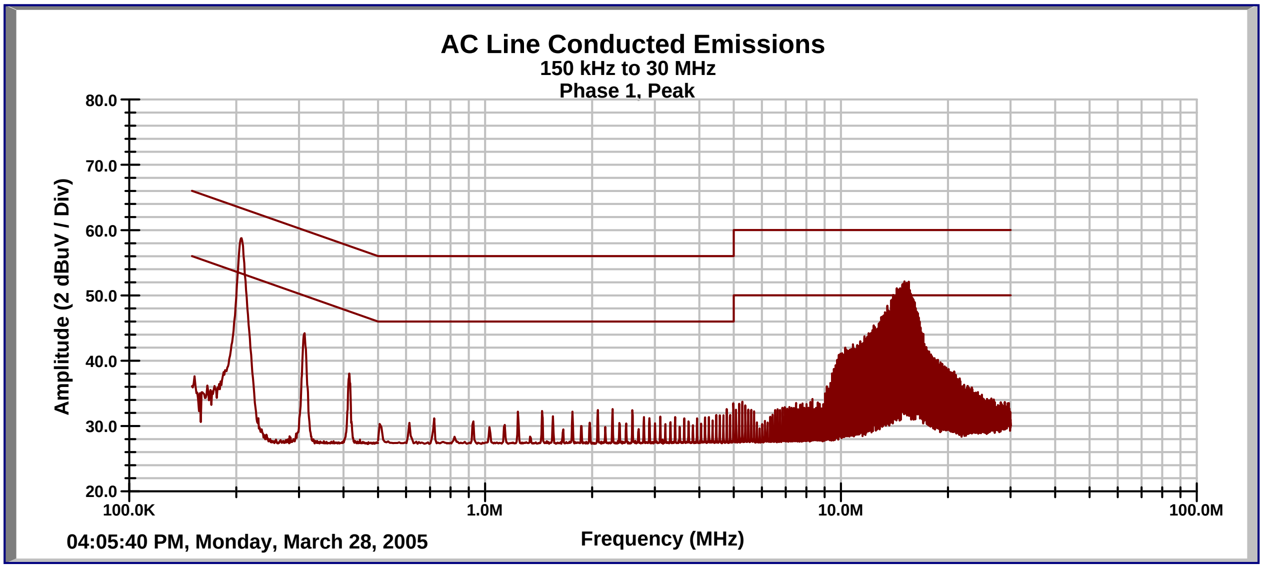
EUT Name	Pave Tracker Plus	**Date**	28 March 2005
EUT Model	2701-B	**Temperature**	70 Deg. F
EUT Serial	None	**Humidity**	40% RH
Standard	CFR 47; FCC Part 15, RSS-210, Section 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	5, 6	**Performed by**	Eugene Moses
Configuration			



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.21	1	44.70	31.90	0.01	10.02	63.17	53.17	-8.44	-11.24
15.42	1	39.70	31.10	0.09	10.46	60.00	50.00	-9.75	-8.35

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

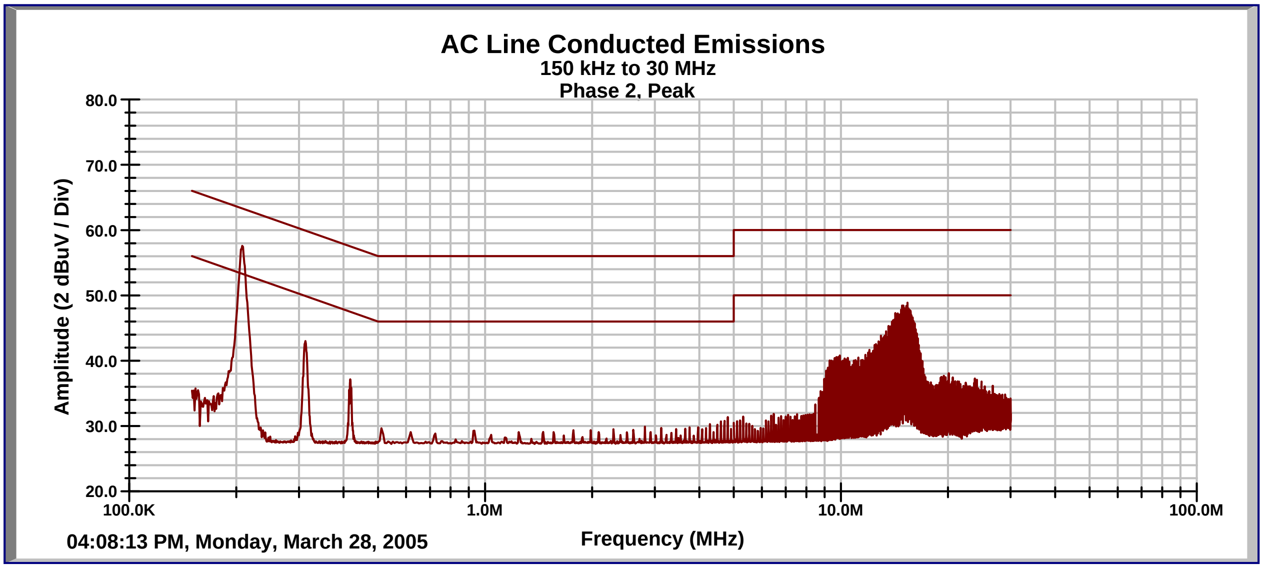
Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

SOP 2 Conducted Emissions

Tracking # 30462797.001 Page 2 of 2

EUT Name	Pave Tracker Plus	**Date**	28 March 2005
EUT Model	2701-B	**Temperature**	70 Deg. F
EUT Serial	None	**Humidity**	40% RH
Standard	CFR 47; FCC Part 15, RSS-210, Section 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	5, 6	**Performed by**	Eugene Moses
Configuration			



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.21	2	44.40	31.30	0.01	10.11	63.17	53.17	-8.65	-11.75
15.40	2	34.90	26.00	0.09	10.46	60.00	50.00	-14.55	-13.45

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

4.2.3 Photos

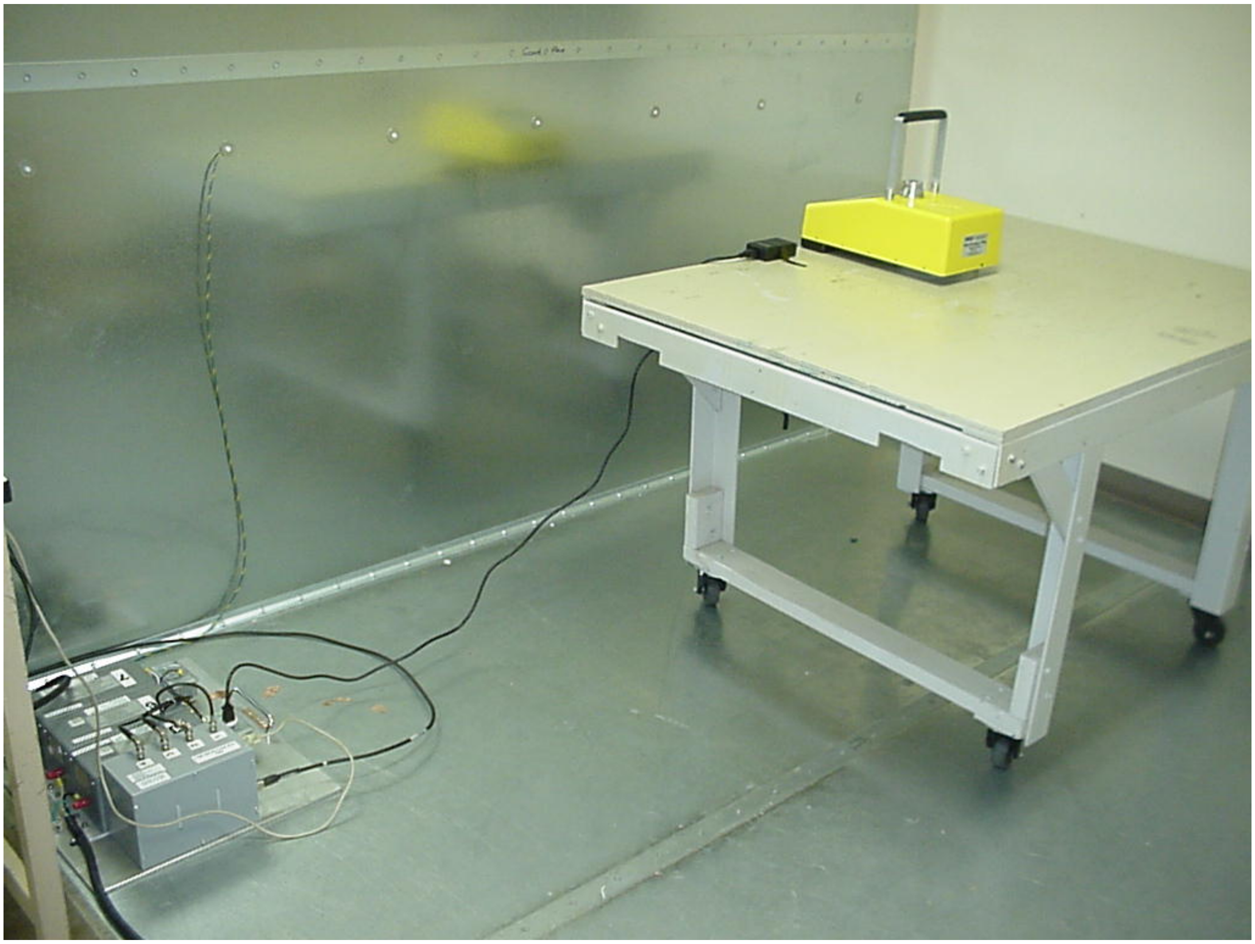


Figure 7 - Conducted Emissions Test Setup (Front)

4.2.4 Sample Calculation

The signal strength is calculated by adding the LISN Correction Factor and Cable Loss to the measured reading. The basic equation is as follows:

$$\text{Field Strength } (dB\mu V/m) = FIM + CBL + LCF$$

Where: FIM = Field Intensity Meter (dBμV)
CBL = Cable Loss (dB)
LCF = LISN Loss (dB)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

4.3 Bandwidth for FCC Part 15.209 and 15.235

Testing was performed in accordance with FCC parts 15.209 and 15.235, ANSI C63.4:2003.

The field strength of any emissions appearing between the band edges and up to 10 kHz above and below the band edges shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in Section 15.209, whichever permits the higher emission levels. The field strength of any emissions removed by more than 10 kHz from the band edges shall not exceed the general radiated emission limits in Section 15.209.

The EUT is powered from an internal battery during operation. The unit was tested with the battery fully charged and a battery charger attached. The battery charger voltage was varied, in accordance with FCC Part 15.31, from -85% to + 115% of the nominal line voltage, with no effect on the output power or bandwidth.

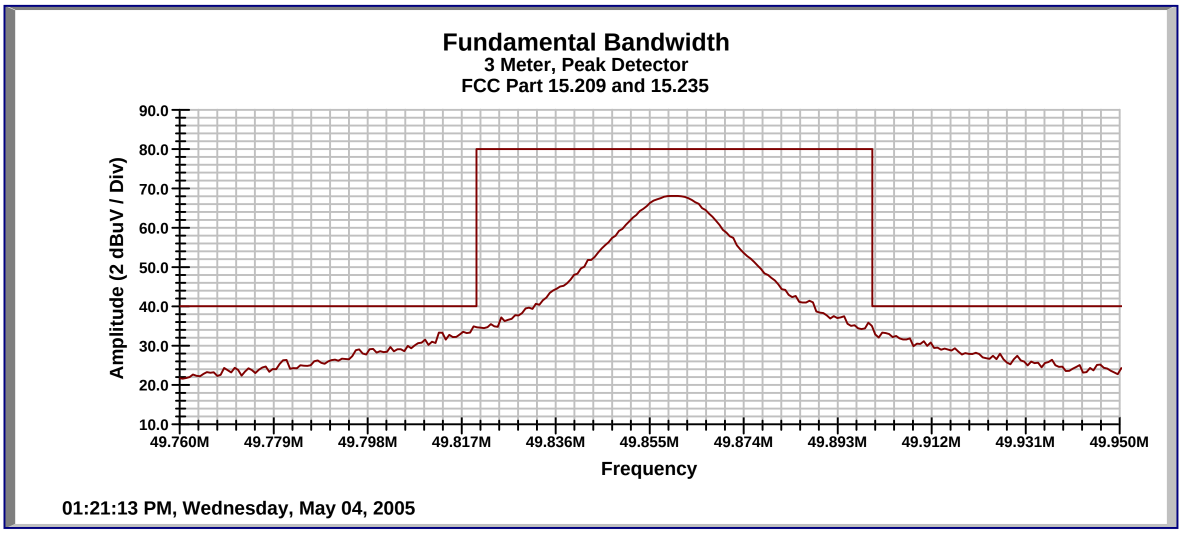


Figure 8 – Fundamental Frequency (49.86 MHz) with FCC Part 15.209 and 15.235 Limit Overlay

5 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	10-May-04	10-May-05
Ant. Biconical	EMCO	3110B	3367	4-Feb-04	4-Feb-05
Ant. Log Periodic	AH Systems	SAS-516	133	19-Jan-04	19-Jan-05
Antenna Horn	EMCO	3115	2236	23-Dec-04	23-Dec-05
Cable, Coax	Andrew	FSJ1-50A	042	15-Jan-04	15-Jan-06
Cable, Coax	Andrew	FSJ1-50A	045	15-Jan-04	15-Jan-06
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	27-Jan-04	27-Jan-06
Data Table, EMCWin	TUV Rheinland	EMCWin.dll	002	6-Jan-02	6-Jan-06
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	6-Aug-04	6-Aug-05

SOP 2 - Conducted Emissions (AC/DC and Signal I/O)					
Cable, Coax	Belden	RG-213	004	19-Jan-04	19-Jan-06
LISN (5) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990441	6-Aug-04	6-Aug-05
LISN (6) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990442	6-Aug-04	6-Aug-05
LISN Selection Box	TUV Rheinland	CFL-9206	1650	11-May-04	11-May-05
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	6-Aug-04	6-Aug-05

General Laboratory Equipment					
Meter, Multi	Fluke	79-3	69200606	5-Aug-04	5-Aug-05
Meter, Temp/Humid/Barom	Fisher	02-400	01	20-Aug-04	20-Aug-05
Power Supply, AC	California Instruments	1251P	L06429	CNR II	CNR II

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

The attached EMC test plan has been generated by the manufacturer and implemented as recorded in this test report.

6.1 Introduction

This manufacturer-supplied document provides a description of the Equipment Under Test (EUT), configuration(s), operating condition(s), and performance acceptance criteria. It is intended to provide the test laboratory with the essential information needed to perform the requested testing.

6.2 Customer

The information in the following tables is required, as it should appear in the final test report.

Table 2 – Manufacturer Information

Company Name:	Troxler Electronic Laboratories, Inc.
Street Address:	3008 Cornwallis Road, PO Box 12057
City, State, Zip Code:	Research Triangle Park, NC 27709
Tel:	919-549-8661
Fax:	919-549-0272

Table 3 – Technical Contact Information

Contact Name	Telephone	Fax	Email address
Phil Fonville	919-314-2716	919-549-0272	pfonville@troxlerlabs.com
Don McCray	919-314-2718	919-549-0272	troxdsm@troxlerlabs.com

6.3 Equipment Under Test (EUT)

The information provided in the following table should be listed as it should appear in the final report. For those products that have only a model name, list the model number as *non-applicable* and vice-versa.

Table 4 – EUT Designation

Model Name:	PaveTracker Plus
Model Number:	2701-B

6.3.1 Technical Description

Please provide a general description and composition of the EUT. Include what the EUT is designed to do; chassis type and dimensions, modules, boards, subassemblies, marketed configuration.

Please provide a paragraph or two regarding the general description of the EUT. The information provided here is generally satisfied by the marketing literature describing the overall function(s), operation(s), and/or feature(s) of the EUT. It is intended to be read by a relatively non-technical individual and provides the rationale for performing the test(s) on the EUT.

The PaveTracker Plus is intended for measuring, indirectly, the density of asphalt pavement. It consists of the following subassemblies:

- Microntroller-based control pcb
- Source (oscillator) pcb
- Sense (detector) pcb
- Liquid crystal display and keypac
- Battery and battery charging circuitry

In normal operation, the PaveTracker Plus is placed directly on asphalt pavement and it displays a density reading on the liquid crystal display. The density reading is updated about once per second, and the user can store the readings in a nonvolatile memory on the control pcb.

Please see attached product literature for more information.

6.3.2 Configuration(s)

The standards require that the EUT be tested in a "typical" configuration such that the EUT will be set up in a manner consistent with its intended use. Where several configurations are possible, each should be investigated and the worst case tested. In the case of multiple accessory external ports, at least one external accessory, simulator, or cable must be connected to each type of port.

Equipment should be clearly marked as one of the following types (In the case of rack mount equipment, it must be specified whether the equipment will be tested as rack or table top.):

- Table Top
- **Floor Standing**
- Rack Mount

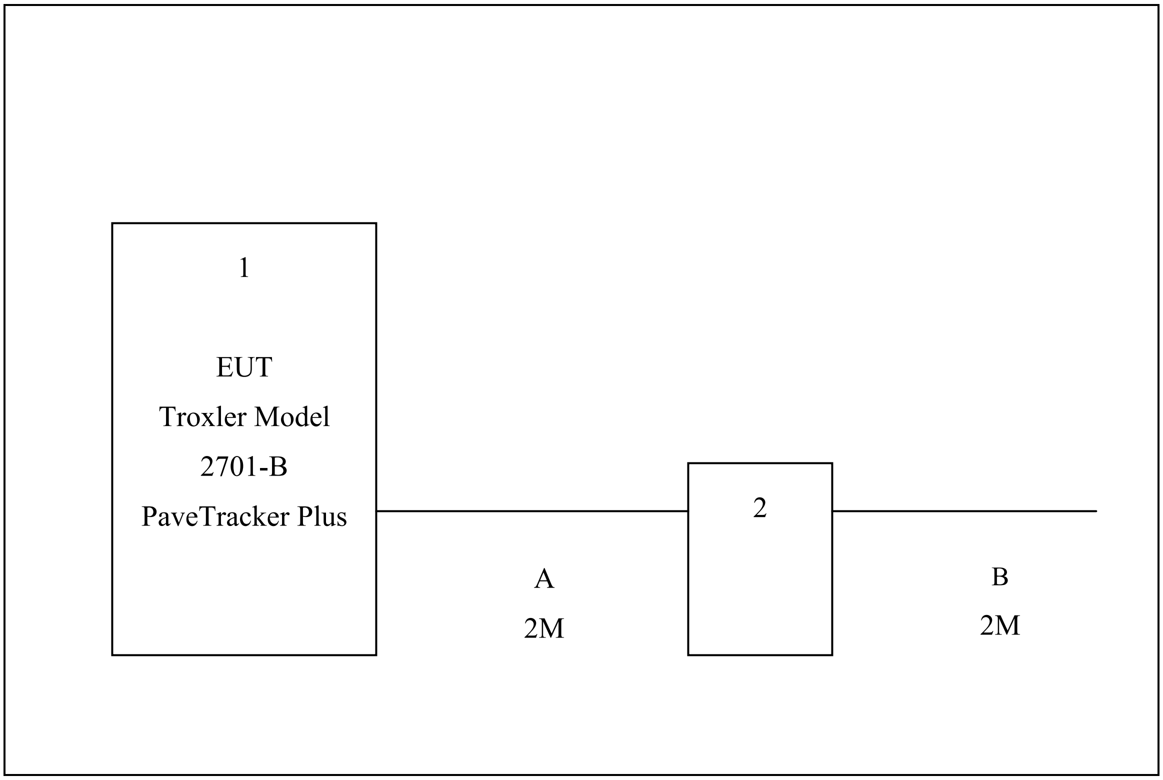


Figure 9 - Block Diagram of EUT Set-Up

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Table 5 – Equipment Chassis Shown in Block Diagram

Des.	Manufacturer	Model No.	Revision	Serial No.	Description
1	Troxler	2701-B	A		Density gauge
2	Sceptre	AD2512B			12 VDC power supply

Table 6 – Cables Shown in Block Diagram

Des.	Cable Function	Type of Cable (Data or Power)	Shielded or Unshielded	Length (m)
A	DC power to PaveTracker Plus	Power	U	2
B	AC power to 12 VDC power supply	Power	U	2

Table 7 – Subassemblies within each Chassis

Des.	Manufacturer	Model No.	Revision	Serial No.	Description
1	Troxler	250102	3 (A)		Control pcb
1	Troxler	250105	3 (A)		Sense pcb
1	Troxler	112109	3 (A)		Source pcb
1	Data Vision	P166-2A			Liquid crystal display

6.3.3 Operating Conditions

6.3.3.1 Software

ARM7 firmware Rev. 1.24

6.3.3.2 Mode(s)

Instructions for setting up and operating the EUT.

Turn PaveTracker Plus on by briefly pressing and releasing power switch.

Ensure current mode is “Continuous.” Change with Mode key if necessary.

Press Start/Enter key and observe density reading on display. Reading is updated at approx. 1 Hz rate.

6.3.4 Power Requirements

Table 8 - Power Requirements

Parameter	Value
Input Voltage	12
Input Frequency	DC
Input Current (rated)	2A (charging)
1ϕ, 3ϕ, or DC	DC

6.3.5 Oscillator / Microprocessor Frequencies

Table 9 - Oscillator Frequency List

Frequency (MHz)	Description of Use
3.6864	Microcontroller
0.032768	Clock/calendar
Unknown	Liquid crystal display
49.86	Induces an electric field in sample being measured
18.0	Microcontroller (internal)

6.4 Equivalent Models

There are no equivalent models.