Test Report Prepared By:

Electronics Test Centre
MPB Technologies Inc.
Unit 100
302 Legget Drive
Kanata Ontario K2K 1Y5

TEST REPORT
ON

Dynastream Speed Sensor Model: sdm-triax100
Foot Piece (Transmitter)

IN ACCORDANCE WITH
FCC Pt 15 Subpart C 1996
And
IC RSS-210 1998

MPBT Report No.: M36R2334 **Customer No.: 1176**

Test Personnel: D. Zanette

Prepared for:

_____
Client Acceptance
Authorized Signatory

Murandi Communications Ltd
240, 6715 – 8 Street NE
Calgary, Alberta
Canada T2E 7H7

_____
–
Dan Zanette
Lab Supervisor
Electromagnetic Services
IC . 3201-1 Electromagnetics
Division

Authorized Signatory

Sept-14-2000
M36r2334
MPB Technologies Inc.

AUSTEL Industry Industrie Canada Canada FC 319 CE NVLAP ISO/IECGuide25: 1990

_____

Reviewed By

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 SCOPE

The purpose of this report is to present the findings and results of compliance testing performed, against FCC Part Subpart C, 15.249 1996 and IC RSS-210 , 1998.

1.2 APPLICANT

This test report has been prepared for Murandi Communications Ltd.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the Murandi Communications Ltd: Dynastream Speed Sensor Model: sdm-triax100 unit, which shall be referred to herein as the Equipment Under Test (**EUT**).

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by NVLAP or the Canadian or US governments.

1.4 TEST SAMPLE DESCRIPTION

The test sample, provided for testing was a **Dynastream Speed Sensor Model: sdm-triax100**.

Pre-production Unit….

Prototype……
Product Type: Low power transmitter
Frequency: 916.5 MHz
Frequency Stability: 120 PPM
Serial Number: NA
Output Power : 25 mV/m Nominal (0.00042W)
Modulation: ASK 100% Modulation Depth (00K)
Model Number: sdm-triax100
Cables: None
Power Requirements: 2 AAA Duracell Batteries
Peripheral Equipment: NA

The EUT is designated as the “foot piece” which can be mounted on the laces of a shoe. The foot piece is an rf transmitter that computes the user’s speed and distance traveled by means of integrating the foot path, and passes the information to a watch display also carried by the user. This report is only applicable to the foot piece.

24.0- . GENERAL TEST CONDITIONS AND ASSUMPTIONS

The EUT was setup and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

All testing, unless otherwise noted, was performed under the following environmental conditions:

Temperature: 17 to 23 °C

Humidity: 45 to 75 %

Barometric Pressure: 68 to 106 kPa

24.0- . SCOPE OF TESTING

Tests were performed in accordance with ANSI 63.4 1992

24.0-24. VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

24.0-24. TEST SAMPLE MODIFICATIONS

There were no equipment modifications during test performance.

24.0- . TEST CONCLUSION

The EUT was subjected to the following tests. Compliance is designated by a **PASS** or **FAIL**.

The following table summarizes the test results and details the tests performed in terms of the specification and class or level applied, the unique test sample identification, and the EUT modification state, the mode of operation, configuration and cable arrangement (if applicable).

Test Case	Test Type	Specification	Class/ Level	Sample Test	Mod State	ENG. / QUAL.	Criteria	**Result**
2.1	Conducted Emissions	FCC Part 15 Subpart C 1996 IC RSS-210 Issue 2, Rev 1, 1998	NA	NA	NA	NA	N/A	**Not Applicable**
2.2	Radiated Emissions	FCC Part 15 Subpart C 1996 IC RSS-210 Issue 2, Rev 1, 1998	A/B	DynaStream Speed Sensor Model: sdm-triax100	None	Qual	Sec.	**Pass**

STATEMENT OF COMPLIANCE
The client equipment referred to in this report was found to comply with the requirements as stated above.

ABBREVIATIONS

CE – Conducted Emissions
CS-Conducted Susceptibility(Immunity)
ESD – Electrostatic Discharge
EFT – Electrical Fast Transient Burst
E-Field – Electric Field
H-Field – Magnetic Field
N/T – Not Tested
N/A – Not Applicable
RE – Radiated Emissions
RS – Radiated Susceptibility(Immunity)

MEASUREMENT UNCERTAINTY

The following measurement uncertainty with 95% confidence level was calculated using the methods defined in NAMAS document NIS81: May 1994.

For Radiated E-Field Emissions

Frequency = $\pm$ $1x10^{-3}$ MHz

Amplitude = $\pm$ 4.01 dB

For Conducted Emissions

Frequency = $\pm$ $1x10^{-3}$ MHz

Amplitude = $\pm$ 3.25 dB

24.0- . CONDUCTED EMISSIONS

Test Summary	
Test Personnel: **Not Applicable**	Test Date: **Not Applicable**

Test Description	
Objectives/Criteria	Specifications
The Conducted E-Field emissions proliferated by a system or sub-system shall not exceed the limits for the specifications as stated. **Emission levels should meet the requirements with a margin of 6dB**. Worst case Emissions:**NA**	**FCC SubPart C Sec.15 249** **IC RSS-210 Sec. 6.2.2 (m)** **Frequency Class A Class B** **NA** *All limits are in Quasi-peak.
Test Result Class: Not Applicable	

Top Six Emissions: **Not Applicable**			
Line 1:		Line 2:	
Freq	dBuV	Freq	dBuV
NA	**NA**	**NA**	**NA**

24.0-24. CONDUCTED EMISSIONS DATA

NOT APPLICABLE

24.0-24. CONDUCTED EMISSIONS SETP PHOTOGRAPH(S)

NOT APPLICABLE

24.0- . RADIATED EMISSIONS

Test Summary	
Test Personnel: D. Zanette	Test Date: Sept 12 2000

Test Description	
Objectives/Criteria	Specifications
The Radiated E-Field emissions proliferated by a system or sub-system, measured at a distance of 3m/10m from the EUT, shall not exceed the limits for the specifications as stated. **Emission levels should meet the requirements with a margin of 6dB**. **Worst case emissions** Worst case was dBuV/m @ Freq this is xx dB below limit	**Intentional Radiators** **FCC SubPart C Sec.15 249** **IC RSS-210 Sec. 6.2.2 (m)** **Frequency** **F_o** **$F_{HARMONIC}$** @3m @3m 902-928 MHz 50mV/m 500µV/m 2400-2483.5 MHz 50mV/m 500µV/m 5725-5875 MHz 50mV/m 500µV/m 24.0-24.25 GHz 250mV/m 2500µV/m Note: Limits converted to dBµV/m for measurements
Test Result Class ----- @ 3 meters	**PASS**

WORST CASE EMISSION: 88.26 dBµV/m

SIX TOP PEAK EMISSIONS

UNIT 1 in CW mode for maximization

Vertical: Polarization		Horizontal: Polarization	
Freq	dBuV/m	Freq	dBuV/m
F_0 = 0.9165	85.97	F_0 = 0.9165	79.07
F_{1st}= 1.832967	60.90	F_{1st} = 1.832967	52.70.
F_{2nd}= 2.748435	70.30	F_{2nd}= 2.748435	64.60

Note: Fundamental Limit: = 50mV/m = 94dBµV/m
Note: Harmonics Limit = 500µV/m = 54dBµV/m

TOP MEASURED EMISSIONS

UNIT 1 in normal PULSED operating mode

	Vertical: Polarization		Horizontal: Polarization	
dBuV/m	Freq (GHz)	dBuV/m		Freq(GHz)
Quasi Peak 88.26	F_0 = 0.9165	85.19	F_0 = 0. 9165	
Average 26.18.	F_{1st}= 1.832967.	33.77	F_{1st} = 1.832967	
Average 32.86	F_{2nd}= 2.749435	33.14	F_{2nd}= 2.749435	

Note: Fundamental Limit: = 50mV/m = 94dBµV/m
Note: Harmonics Limit = 500µV/m = 54dBµV/m

Top Calculated Emissions Using Peak CW Data Values				
UNIT 1 in normal PULSED operating mode				
	Vertical: Polarization		Horizontal: Polarization	
dBuV/m	Freq (GHz)	dBuV/m		Freq(GHz)
Quasi Peak NA	F_0 = 0.9165	NA	F_0 = 0. 9165	
Average 15.62.	F_{1st}= 1.832967.	23.80	F_{1st} = 1.832967	
Average 27.52	F_{2nd}= 2.749435	33.22	F_{2nd}= 2.749435	
Note: Fundamental Limit: = 50mV/m = 94dBµV/m				
Note: Harmonics Limit = 500µV/m = 54dBµV/m				

SAMPLE CALCULATION:

Duty Cycle: 50 bits sent once per second at 2400 baud is equivalent to a 2.08 % transmission time or 20.8 milliseconds
Data is DC balanced to result in a 50 % Duty Cycle over the transmission of 50 bits resulting in an over all Duty Cycle of **1.04 %** .

Average Amplitude = (Peak Amplitude) x (Duty Cycle)

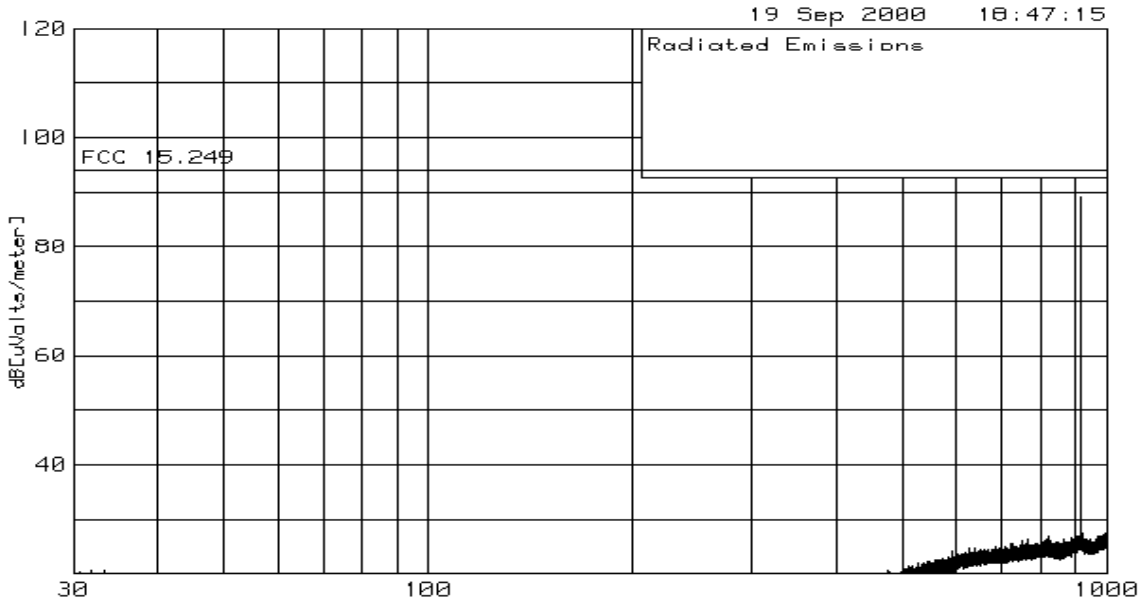
Average Amplitude = 60.9dBµV/m x 1.04 %

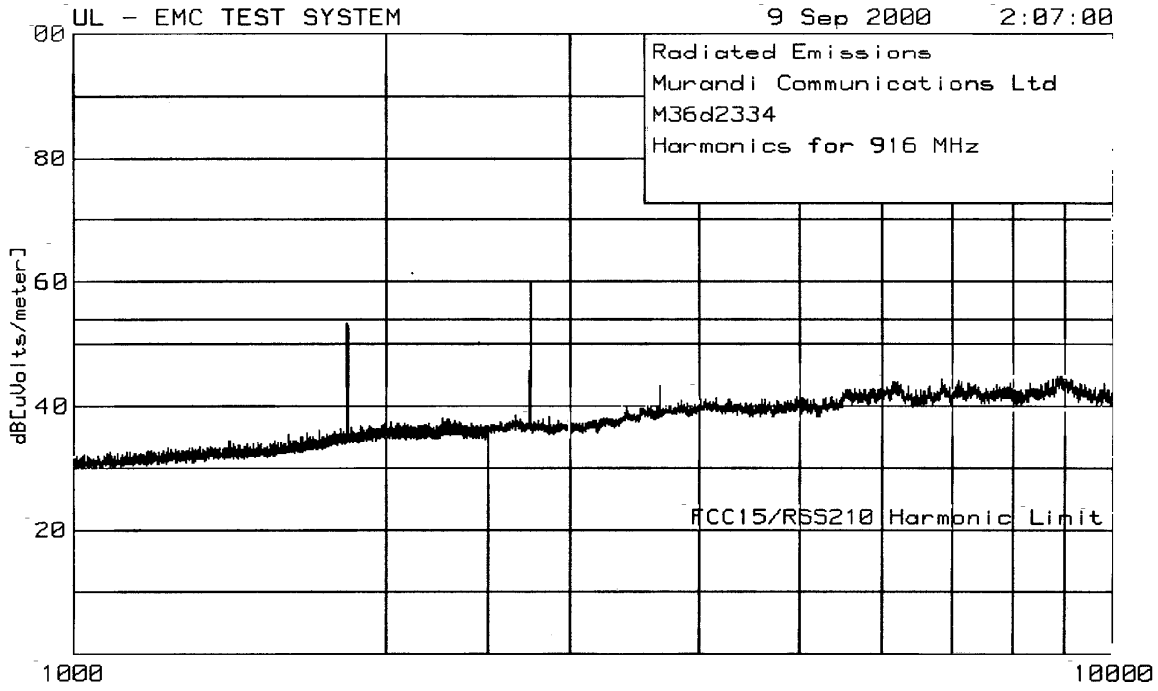
= 60.9dBµV/m x 0.014

= 23.89dBµV/m $_{average}$ for 1.832967 GHz

2.2.1 RADIATED EMISSIONS DATA

PLOTS





Numeric Data

Murandi M36D2334
UNIT 1, FOOT PIECE
Transmitter

Test Frequency [**MHz**]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4
916.5	85.39 qp	-26	25.8	**85.19**	94	N/A	N/A	
Azimuth: 0	Height:103 Vert			Margin [dB]	**-8.81**	N/A	N/A	
916.5	88.46 qp	-26	25.8	**88.26**	94	N/A	N/A	
Azimuth: 127	Height:123 Horz			Margin [dB]	**-5.74**	N/A	N/A	

LIMIT 1: FCC 15.249
qp - Quasi-Peak detector

Murandi M36D2334
UNIT 1, FOOT PIECE
Transmitter

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4
1832.967	47.87 av	-43	28.9	**33.77**	54	N/A	N/A	N/A
Azimuth: 87	Height:113 Vert			Margin [dB]	**-20.23**	N/A	N/A	N/A
1832.97	40.28 av	-43	28.9	**26.18**	54	N/A	N/A	N/A
Azimuth: 87	Height:260 Horz			Margin [dB]	**-27.82**	N/A	N/A	N/A

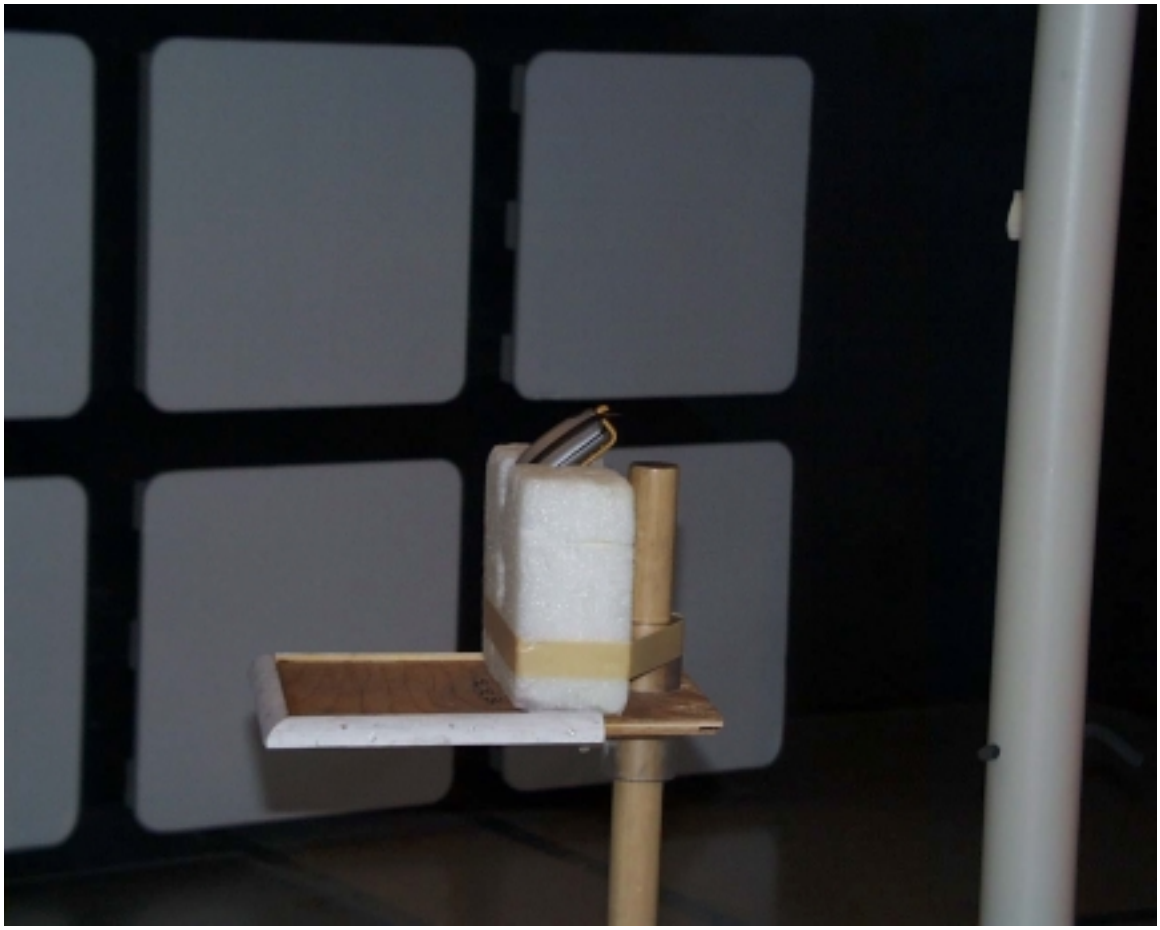
LIMIT 1: FCC15/RSS210
av - Average detector

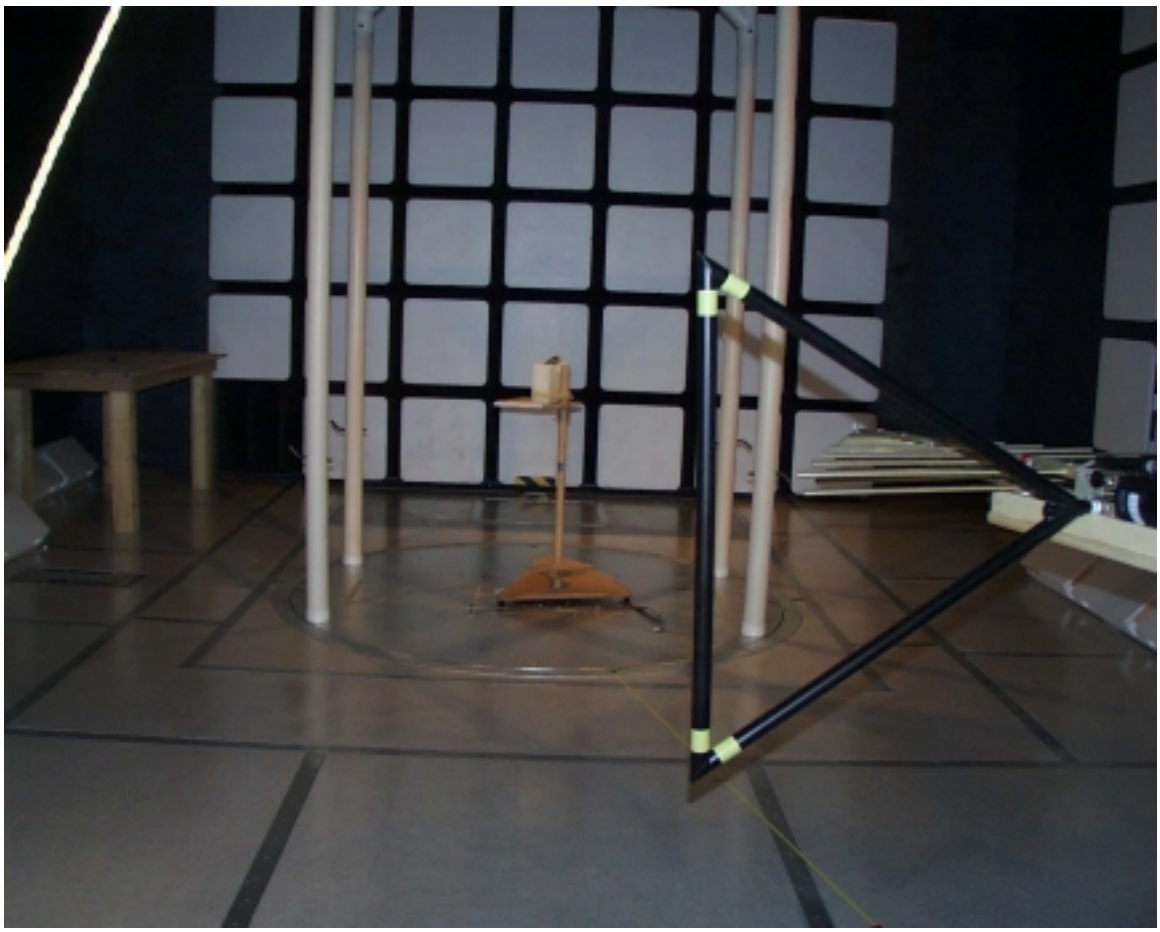
Numeric Data

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4
2749.435	45.34 av	-43	30.8	**33.14**	54	N/A	N/A	N/A
Azimuth: 236	Height:151 Vert			Margin [dB]	**-20.86**	N/A	N/A	N/A
2749.435	45.06 av	-43	30.8	**32.86**	54	N/A	N/A	N/A
Azimuth: 236	Height:151 Horz			Margin [dB]	**-21.14**	N/A	N/A	N/A

LIMIT 1: FCC15/RSS210
av - Average detector

2.2.2 RADIATED EMISSIONS SETUP PHOTOGRAPH(S)





EUT DETAIL PHOTOGRAPHS

FRONT VIEW

SIDE VIEW

REAR VIEW

BATERY COMPARTMENT

REAR VIEW (disassembled)

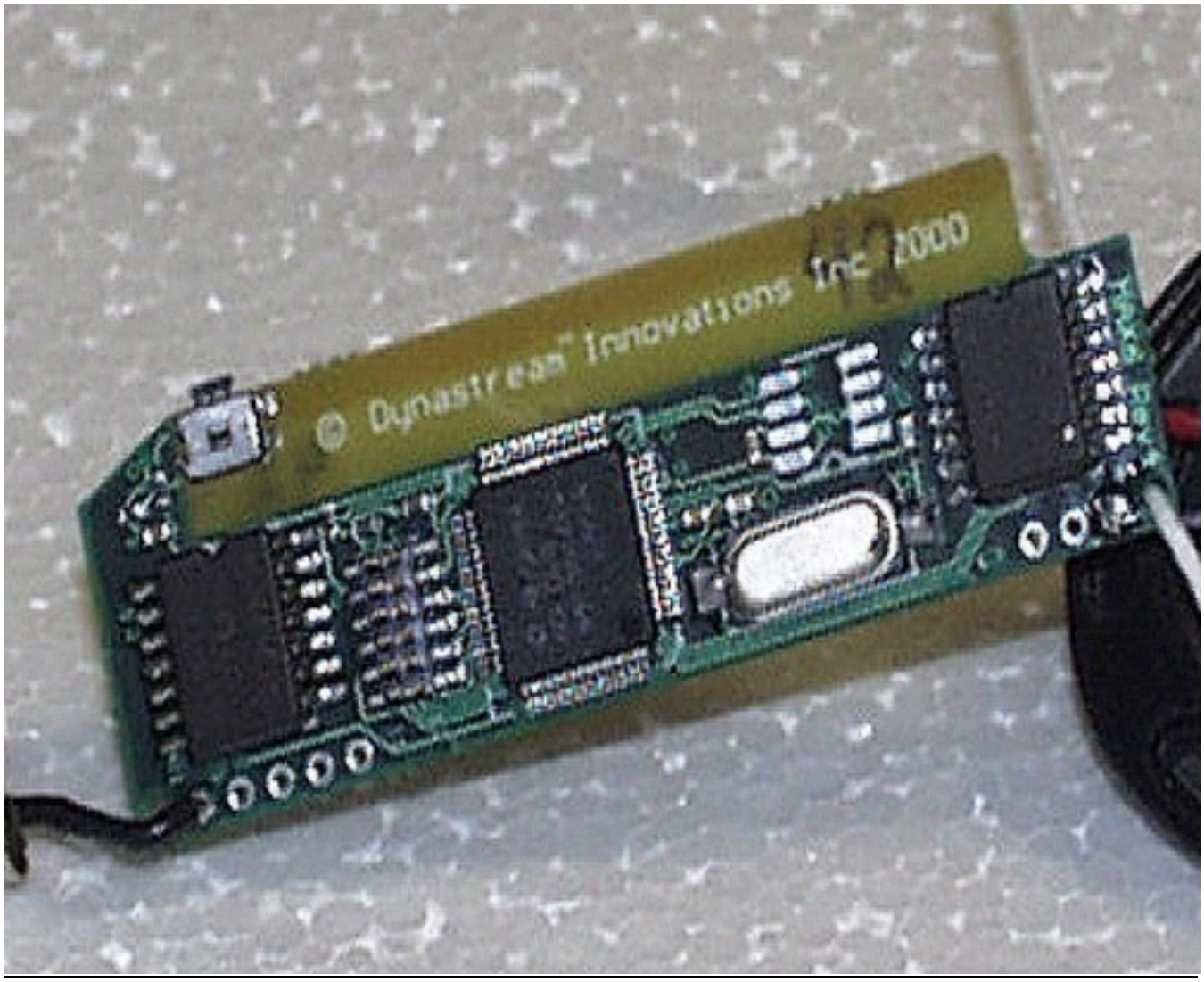
BATTERY COMPARTMENT

(Batteries removed)

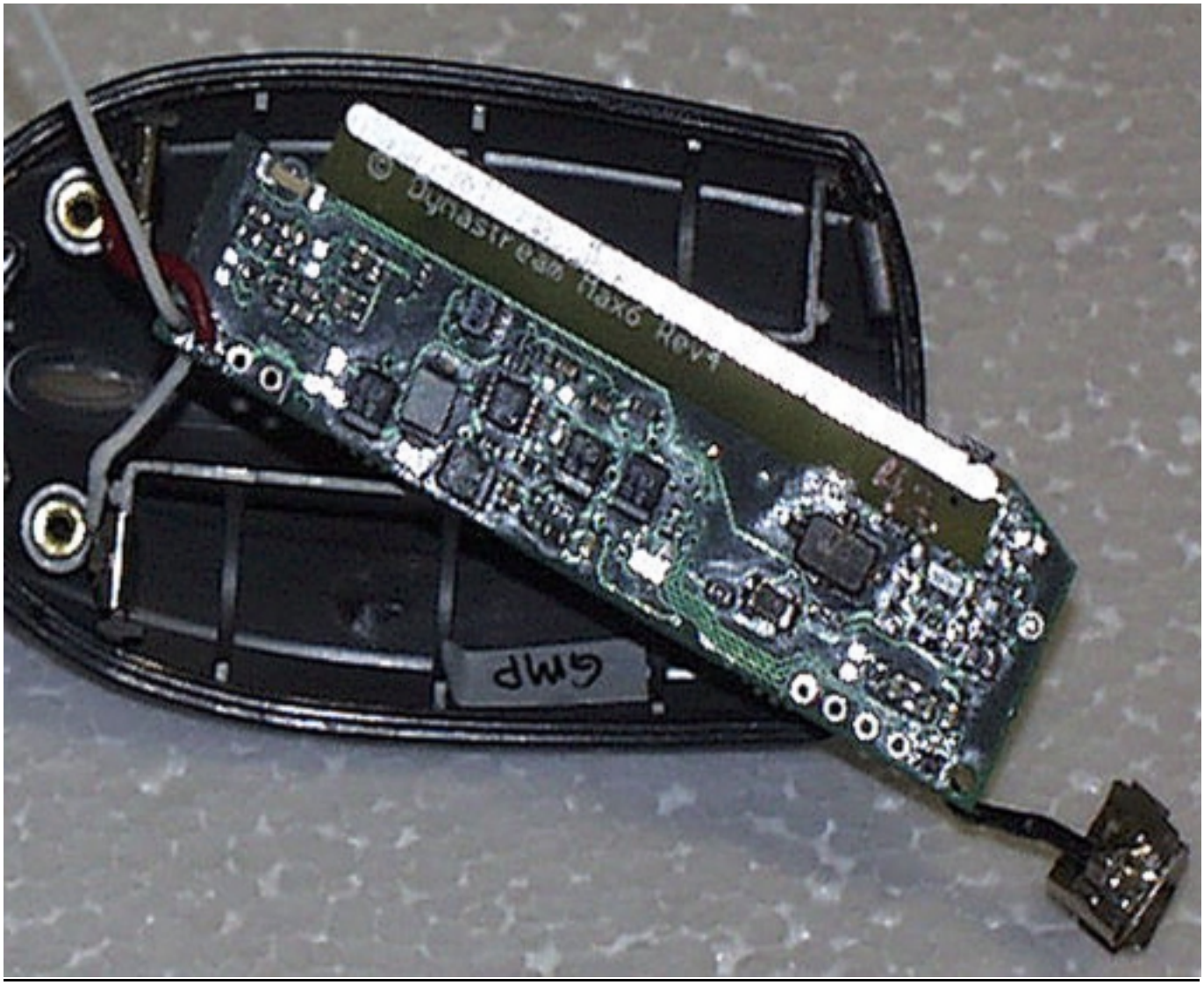
EXPOSED PRINTED CIRCUIT BOARD (Center)

PRINTED CIRCUIT BOARD REMOVED (Front View)

PRINTED CIRCUIT BOARD REMOVED (Rear View)



PRINTED CIRCUIT BOARD REMOVED
FRONT DETAILED VIEW



PRINTED CIRCUIT BOARD REMOVED
REAR DETAILED VIEW

3.0 TEST FACILITY

3.1 LOCATION

The EUT was tested for Electromagnetic Compatibility at the Electronics Test Centre, located in Kanata, Ontario, Canada.

3.2 GROUNDING PLAN

The EUT was located on a wooden Stand 80 cm above the ground plane.

3.3 POWER

The EUT was powered by two new AAA MN2400, LR03 1.5 volt Duracell alkaline batteries.

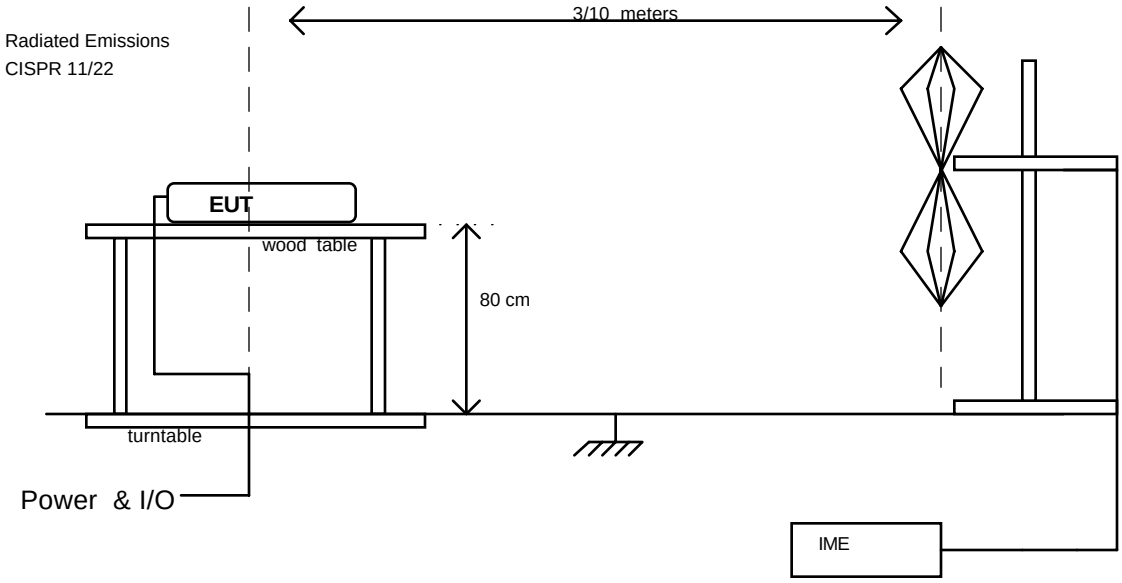
3.4 EMISSIONS PROFILE

Ambient conducted and radiated electromagnetic emission profiles were generated throughout the tests and are included in the Test Report Data sheets.

3.5 TEST CONFIGURATION

3.5.1 TYPICAL SETUP

The following diagrams illustrate the configuration of the EUT test and measurement equipment used for CISPR Radiated and Conducted Emissions Testing.



4.0 TEST EQUIPMENT

The following equipment was utilized for this procedure. All measurement devices are calibrated annually, traceable to NIST. Please refer to Appendix C for calibration data.

4.1 RADIATED EMISSIONS

a) Spectrum Analyzer
b) Receiver with CISPR Quasi-peak Adapter
c) Power Isolation Transformers
d) Antennas (25 MHz to 10 GHz)
e) Antenna mast positioner, and controller
f) Flush-mounted turntable, and controller

4.2 CONDUCTED EMISSIONS NOT APPLICABLE

a) Spectrum Analyzer
b) Line Impedance Stabilization Network, 50 µH
c) CISPR Quasi-peak Adapter
d) Power Isolation Transformer
e) Personal Computer and EMI/EMC Software

4.3 EMI SPECTRUM ANALYZER AND RECEIVER

4.3.1 SPECTRUM ANALYZER

Range 1 of 2

Start Frequency	30 MHz
Stop Frequency	1 GHz
Transducer	Biconilog Antenna
Quasi-Peak Bandwidth	120 kHz
Spectrum Analyzer BW	1MHz
Video Bandwidth	1MHz
Reference Level	120 dBµV

SPECTRUM ANALYZER

Range 2 of 2

Start Frequency	1 GHz
Stop Frequency	10 GHz
Transducer	DRG Horn
Spectrum Analyzer BW	1 MHz
Video Bandwidth	1 MHz
Reference Level	100 dBµV

4.3.2 RECEIVER NOT APPLICABLE

Transducer	Biconilog Antenna
Quasi-Peak Bandwidth	120 kHz
Measurement Window	20 dBµV

Appendix A

Dynastream Speed Sensor Model: sdm-triax100

EUT

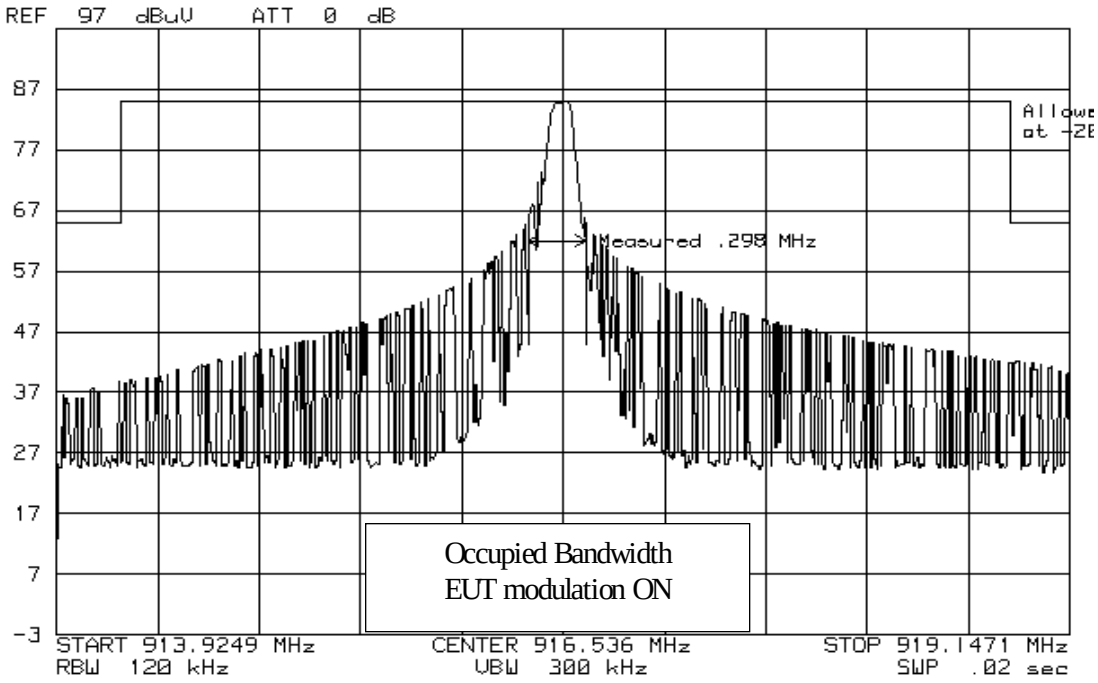
Description to be provided by

The CLIENT

Appendix B

TEST REPORT SUPPLEMENTARY DATA

OCCUPIED BANDWIDTH



Appendix C

TEST EQUIPMENT REPORT

September 11, 2000 - 05:33:25 PM

ELECTRONICS TEST CENTRE
MPB TECHNOLOGIES INC.

Equipment used in test FCC Part15 - Section 247 (SEP1100)

Asset #	De	Characteristi	Manufacturer	Model #	Serial #	Cal Date	Cal Due
2319	antenna	DRG Horn Antenna	Electrometrics	RGA60	2966	Jan 03, 1999	Dec 30, 2000
2366	pre-amplifier	1 GHz - 20 GHz	Miteq	AFS44-01-00220045-8P44	327221	Jul 26, 2000	Jul 26, 2001
2432	antenna	Biconilog Antenna	Antenna Research	LPB-2520	1021	Dec 28, 1999	Dec 28, 2000
2436	adapter	Quasi Peak Adapter	Hewlett Packard	85650A	A208596	Jul 24, 2000	Jul 24, 2001
4269	network	LISN (FCC)	Solar	8012-50-R-24BNC	829038	Dec 31, 1999	Dec 31, 2000
4281	antenna	Biconilog Antenna	Antenna Research	LPB-2520/A	1048	Dec 28, 1999	Dec 28, 2000
4297	analyzer	Spectrum Analyzer	Hewlett Packard	HP8566B	2747A05484	Jul 23, 2000	Jul 23, 2001
4552	amplifier	10 KHz-1 GHz	Electrometrics	BPA-1000	900710B	Jul 26, 2000	Jul 26, 2001
5076	EMC Software	0	Underwriters Laboratories	V3.02	MC106399NK07147	Monitored	Monitored

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