

Test Report Prepared By:

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MPBT Report No.: I4-R-1835

Customer No.: 710860

**Test Report for FCC Part 15.231:1996
Testing of the Instantel Infant Tag**

Test Personnel: D.Raynes

Prepared for:

Instantel
362 Terry Fox Drive
Kanata, ON K2K 2P5

Revised:
November 18, 1998
I4-R-1835

Client Acceptance
Authorized Signatory

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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 15.231:1996.

1.2 APPLICANT

This test report has been prepared for:

Instantel Inc.
362 Terry Fox Drive
Kanata, ON K2K 2P5

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the Instantel Infant Tag 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 by Instantel Inc., was an Infant Tag.

Product Type: Battery powered microprocessor controlled RF transmitter

Serial Number:

Model Number: PIC16LC558

Cables: N/A

Power Requirements: Battery Powered 3 Volt lithium button cell.

Peripheral Equipment: Detects signals from Instantel "Portal Exciter"

The Infant Tag is used as part of the Instantel Infant Protection System designed to ensure that infants in hospital maternity wards are not abducted.

1.5 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

1.6 SCOPE OF TESTING

Tests were performed in accordance with CFR 47 FCC Part 15.231 1996.

1.6.1 VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

1.6.2 TEST SAMPLE MODIFICATIONS

There were no equipment modifications during test performance.

2.0 TEST CONCLUSION

The EUT was subjected to the following Electromagnetic Interference tests. Compliance status 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).

Summary Chart

Test Case	Test Type	Specification	Class/ Level	Test Sample	Mod. State	Config.	ENG. / QUAL.	Result
2.1	Radiated Emissions	CFR 47 FCC Part 15.231 1996	15.231e	Infant Tag	None	Normal	Qual.	PASS
2.2	Conducted Emissions	CFR 47 FCC Part 15/18: 1996	N/A	N/A	None	N/A	N/A	Not Tested

Test Results are traceable to NIST and NRC

MARGINAL MEASUREMENTS

Marginal measurements were not recorded during testing. Observations are recorded on the attached test report data sheets and noted on the individual test summary.

MEASUREMENT UNCERTAINTY

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

For Radiated E-Field Emissions

Frequency = $\pm 1 \times 10^{-3}$ MHz

Amplitude = ± 4.01 dB

For Conducted Emissions

Frequency = $\pm 1 \times 10^{-3}$ MHz

Amplitude = ± 3.25 dB

TEST SET UP

The photographs in Appendix D show the set up with maximized emission levels for each test.

2.1 RADIATED EMISSIONS

Test Summary	
Test Lab: Electronics Test Centre, Kanata Test Personnel: D.Raynes Test Date: July 6, 1998	Product: Instantel Infant Tag

Test Description				
Objectives/Criteria		Specifications		
The Radiated E-Field emissions proliferated by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for FCC Part 15.231 specifications as stated. Emission levels should meet the requirements with a margin of 6dB. Note: The test receiver employed in performing radiated emissions testing provides emission values in Peak and Quasi Peak. Peak values were used for this application.		FCC Part 15.231e:1996		
		30 MHz to 3 GHz		
		Measurement Distance 3 m		
		Radiated Emissions Limits dBμV/m Avg		
		Frequency MHz	Fundamental	Spurious
		40.66-40.70	60	40
		70-130	54.0	34.0
		130-174	54.0-63.5	34.0-43.5
		174-260	63.5	43.5
		260-470	63.5-74.0	43.5-54.0
>470		74.0	54.0	
Note: All measurements performed were Peak				

Test Result	
PASS	
Comments	
Vertical: 217 MHz 36.1dBμV/m (313°) 217 MHz 14.9dBμV/m (262°) 79.99 MHz 17.2dBμV/m 160 MHz 17.0 dBμV/m 179.97 MHz 12.5dBμV/m 109.97 MHz 11.5 dBμV/m	Horizontal: 217 MHz 51.7 dBμV/m (201°) 217 MHz 51.4 dBμV/m (358°) 109.97 MHz 18.2 dBμV/m 169.96 MHz 16.4 dBμV/m 129.99 MHz 12.4 dBμV/m 159.96 MHz 11.7 dBμV/m
Emissions were checked to the tenth harmonic of the fundamental (217 MHz) Note: No emissions were detected above 511.11 MHz Refer to Test Report Data sheets in appendix B	
ANSI C63.4 1992 Duty Cycle Calculation: Total Data Train Duration ÷ 100 ms Duty Cycle = 7.54 ms ÷ 100 ms Duty Cycle = 0.0754 (refer to scope plots in data appendix) ----- Sample Calculation: Duty Cycle Correction = 20log (7.54 ms ÷ 100 ms) = -22.45dB Note : maximum averaging correction permitted is -20 dB. Therefore : The Average field strength = Peak Measured Value (dB) + (-20dB) ----- All emissions in both normal and abduction modes are well below the 15.231e field strength limits . The above statement applies to part 15.231b by default. ----- Note: The EUT has three modes of operation and each mode of operation has the same power output. The only key difference is the transmission period ; the alarm mode having the highest rate. Note: All measurements were performed in the alarm mode which is the worst case scenario. The alarm mode has a period of 217.5 ms ,where the EUT transmits a 7.5 ms burst every 210 ms.	
Refer to oscillographs in Appendix B for EUT transmission modes.	

TABLE. 1

Tabulated Emissions Data for the Instantel 217 MHz Infant Tag

FREQ MHz	POL V/H	ANT.	Uncorrected Signal level (dBμv peak)	Antenna Factor (dB)	Duty Cycle (dB)	Corrected Field Strength (dBμV/M) (Average)	Limit (dBμv/M) (15.231e)	Margin (ΔdB)	
217.0	V	BL	23.5	11.4	-20.0	14.9	63.5	-48.6	
217.0	V	BL	44.7	11.4	-20.0	36.1	63.5	-27.4	
79.99	V	BL	29.8	7.4	-20.0	17.2	34.0	-16.8	
160.0	V	BL	25.6	11.4	-20.0	17.0	34.0	-17.0	
179.97	V	BL	21.6	10.9	-20.0	12.5	43.5	-31.0	
109.97	V	BL	18.6	12.9	-20.0	11.5	34.0	-22.5	
217.0	H	BL	59.7	12.0	-20.0	51.7	63.5	-11.8	
217.0	H	BL	60.0	11.4	-20.0	51.4	63.5	-12.1	
109.97	H	BL	25.3	12.9	-20.0	18.2	34.0	-15.8	
169.96	H	BL	25.6	10.8	-20.0	16.4	34.0	-17.6	
129.99	H	BL	19.1	13.3	-20.0	12.4	34.0	-21.6	
159.96	H	BL	20.3	11.4	-20.0	11.7	34.0	-22.3	
			SL + AF + (- DC) = FS _{Avg}					LIM _{15.231e} - FS _{Avg} = Δ	
No emissions were detected above 511.11 MHz									
Having met the criteria of Part 15.231e the EUT also complies to Part 15.231b.									

Note : Antenna Type BL = Biconilog, V = Vertical Polarization, H = Horizontal Polarization.

Note : Cable losses are included in AF data.

Note : All measurements up to 2 GHz were conducted using a 120kHz resolution Bandwidth.

Note : Emissions scans from 2 GHz to 3 GHz used a 1 MHz resolution bandwidth and 40 dB of preamplification gain. The antenna factor was 30.0 dB.
The limit for this segment of the scan was adjusted to reflect gain and antenna factor.

Note : The EUT was tested in alarm mode which is the worst case scenario ie maximum transmission rate. However the power output level remains the same as in all other operational modes.

Note : All data submitted reflects the EUT in its alarm mode .

Sample Calculation of Average Field Strength

Duty Cycle Calculation: Total Data Train Duration $\div$ 100 ms

Duty Cycle = 7.54 ms $\div$ 100 ms

Duty Cycle = 0.0754 (refer to scope plots in data appendix)

Duty Cycle Correction = $20\log(7.54 \text{ ms} \div 100 \text{ ms}) = -22.45\text{dB}$

Note : maximum averaging correction permitted is -20 dB.

The Average field strength (dBuV/m) = Peak Measured Value (dBuV) + Antenna Factor
+ (-20dB) Average Correction

For 217 MHz vertical:

$23.5\text{dBuV(Peak)} + 11.4\text{dB (AF)} + (-20\text{dB Avg Corr.}) = 14.9 \text{ dBuV/m (Avg)}$

2.2 BANDWIDTH

Test Summary	
Test Lab: Electronics Test Centre, Kanata Test Personnel: D.Raynes Test Date: July 6, 1998	Product: Instantel Infant Tag

Test Description	
Objectives/Criteria	Specifications
The bandwidth of the EUT shall not exceed specified limits.	FCC Part 15 .231 1996 70 MHz - 900 MHz Bandwidth must be less than 0.25% of centre frequency Using the 20 dB down criteria

Test Result
PASS
Comments
Occupied Bandwidth Calculation: From Bandwidth Plot $A_{BW} : 100(0.350 \text{ MHz} \div 217 \text{ MHz}) = \mathbf{0.16 \%}$ The calculated occupied bandwidth value is the same for all three operational modes of the EUT. Refer to Data Plots in Appendix

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 table 80 cm above the ground plane. The EUT was grounded according to the Clients specifications.

3.3 POWER

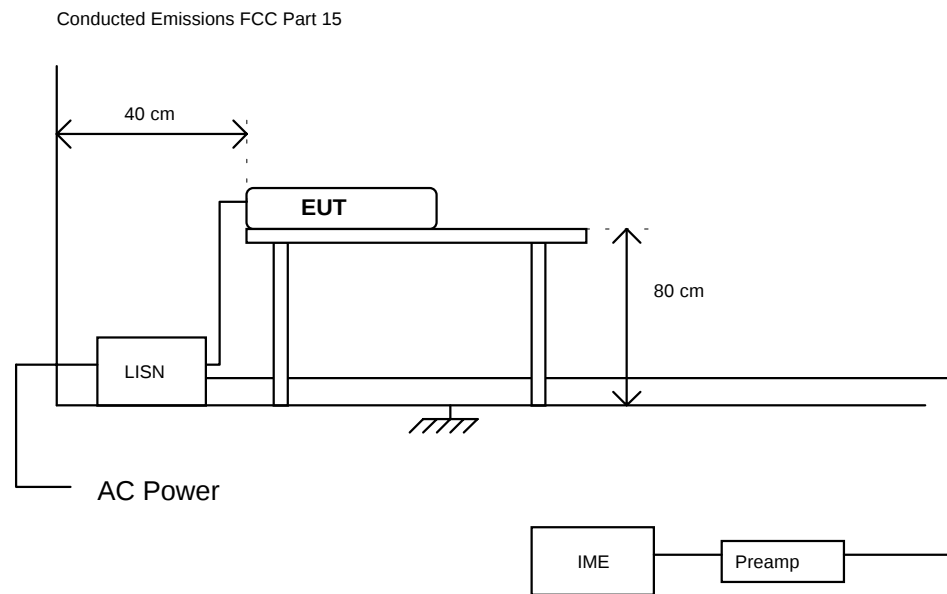
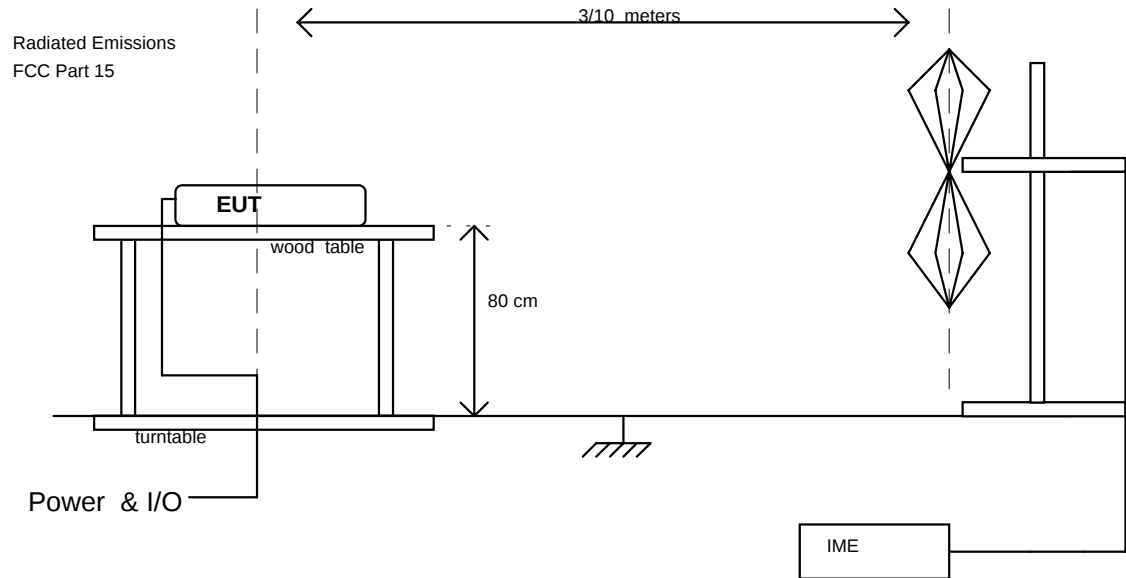
AC power was supplied via a CORCOM RFI feed through, 60 Ampere wall mounted filter. Bonding to hydro ground is via one inch grounding braid straps.

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

The following diagrams illustrate the configuration of the EUT test and measurement equipment used for FCC 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:

4.1 RADIATED EMISSIONS

- a) Spectrum Analyzer
- b) Receiver with Peak Adapter
- c) Power Isolation Transformers
- d) Biconilog antenna (25 MHz to 2.5 GHz)
- e) Antenna mast positioner, and controller
- f) Flush-mounted turntable, and controller

4.2 CONDUCTED EMISSIONS (NOT REQUIRED)

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

4.3 EMI SPECTRUM ANALYZER AND RECEIVER

Spectrum Analyzer (not tested)

Start Frequency	0.45 MHz
Stop Frequency	30 MHz
Transducer	LISN per ANSI
C63.4	
Quasi-Peak Bandwidth	9 kHz
Spectrum Analyzer BW	9 kHz
Video Bandwidth	100 kHz
Reference Level	100 dB μ V

Receiver

Start Frequency	30 MHz
Stop Frequency	2 GHz
Transducer	Biconilog Antenna
Peak Bandwidth	120 kHz

Spectrum Analyzer

Start Frequency	2 GHz
Stop Frequency	3 GHz
Transducer	DRG Horn
Resolution Bandwidth	1 MHz
Pre-Amp Gain	40 dB

Appendix A

Instantel Infant Tag



CLIENT SAMPLE DESCRIPTION

New		Repeat	
MPBT Personnel	Date	Project/Work Order	
	July 6 / 98		
Contact	Rob McCulloch		Address
Company	Instantel		362 Terry Fox Dr.
			KANATA, ON
Client Code			K2K2P5
			Phone: 592-4642 Fax: 592-4296
Product Application		Product Category	
Military ☐		Telecom ☐ Avionics ☐	
Commercial ☒		Info Tech. ☐ Other ☒	
		Space ☐	
		RADIO Tag	
Product Name/Part No.		Infant Tag	
Serial Number			
Power Requirements: AC/DC, Current		BATTERY POWERED (INTERNAL)	
Operational Frequency		217 MHz	
Typical Installation Instructions or Configuration		WORN AS Ankle Bracelet on an infant	
Ground EUT		Yes ☐ No ☐	
# Interconnecting Leads		Ø	
Internal Clock Frequency		4 MHz	
Peripheral Equipment		Detect Signals from Instantel Portal Exciter (312 MHz)	
Cables			
Functional or Self-Test Duration		~ 1 second	
Brief Functional Description		Sends RF "Supervisory Signal" every 15 secs. Sends RF "Alarm Signals" upon detection of "Portal exciter" or tampering	
Other Remarks			
Prepared By:	Rob H. Cullloch	Title:	ENGINEER
		Date:	July 6 / 98

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Appendix B

Test Report Data Sheets

See submitted attachments

APPENDIX C

Test Equipment Report

See submitted attachments