

USE OF RSCS SIM-TEQ® INSTRUMENT SIMULATORS FOR RADIATION SAFETY TRAINING

F.P. Straccia, M.J. Rollins

Radiation Safety & Control Services (RSCS), Inc.

INTRODUCTION

- SIM-Teq is a portable wireless training network of simulated electronic dosimeters, survey meters and probes designed to measure simulated radiation and contamination sources.
- The SIM-Teq system enables trainers to instill the experience, self-assurance, and real understanding they want trainees to achieve - safely.
- The system can support up to 10 simulated radiation sources (unlimited contamination sources) and 16 instruments simultaneously in the same training environment.
- SIM-Teq can operate through most standard construction barriers (i.e., walls).

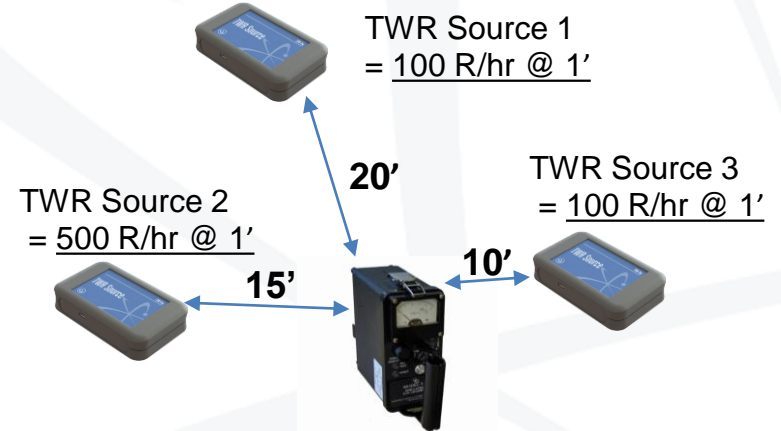


SIM-Teq System Overview

- Portable wireless training
- Dosimeters
- Survey Meters
- Contamination Probes
- Gamma Sources
- Contamination Sources
- Automatic and Manual Control
- Made with OEM Hardware
- Completely Safe
- PC/Tablet based application
- Free firmware upgrades



TWR "Live" Sources



Combined Dose Rate = 4.47 R/hr

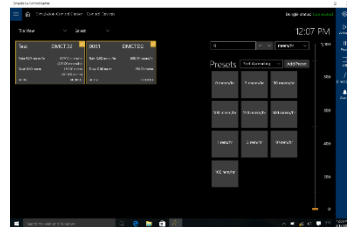
Combined Radiation Field from 3 Simulated Sources

Simulation Control Center (SCC)

- PC/Tablet application to remotely observe, manage, and control all SIM-Teq devices.

Features:

- Wireless interface via USB Dongle.
- Wirelessly update SIM-Teq device firmware.
- Configure devices and sources.



Example SIM-Teq Devices

Dosimeters			
Survey Meters & Probes			
TWR Source (radiation)		RFID Source (contamination)	

UWB Technology & IEEE 802.15.4-2011 Low-Rate Wireless Personal Area Network RFID Tags

The technology responsible for this realistic training includes ultra-wideband (UWB) radio technology for simulated “live” radiation sources.

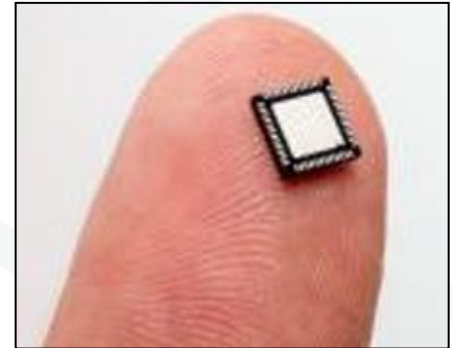
- CMOS IC based on 802.15.4-2011 standard.
- Continual communication between UWB transmitters and receivers used to determine distance between “live” source and instrument and applies inverse square law to provide instrument readings based on proximity to source.
- Benefits of UWB:
 - Position accuracy ~10 cm
 - Range potential 100 m line of site
 - Transmits through non-metallic objects
 - Low power consumption

Instrument response can be manually controlled using SCC.

- PC/Tablet application and dongle provide wireless control of individual or groups of instruments using 802.15.4 protocol.
- SCC application allows trainer to view and control instrument readings remotely, invoke alarms and other simulated faults such as a light leak or low battery condition.

RFID Tags used to simulate contamination on a surface.

- Tags programmable for alpha/beta and contamination level at contact.
- SIM-Teq probes detect RFID tags, measure contact levels of contamination and employ distance measuring technology to adjust count rates based on distance of probe from contact.

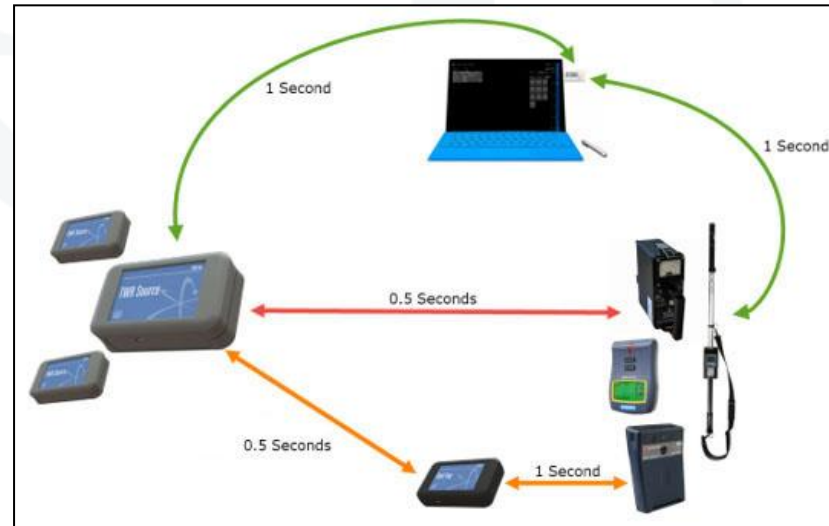


Response Time & Response Variability

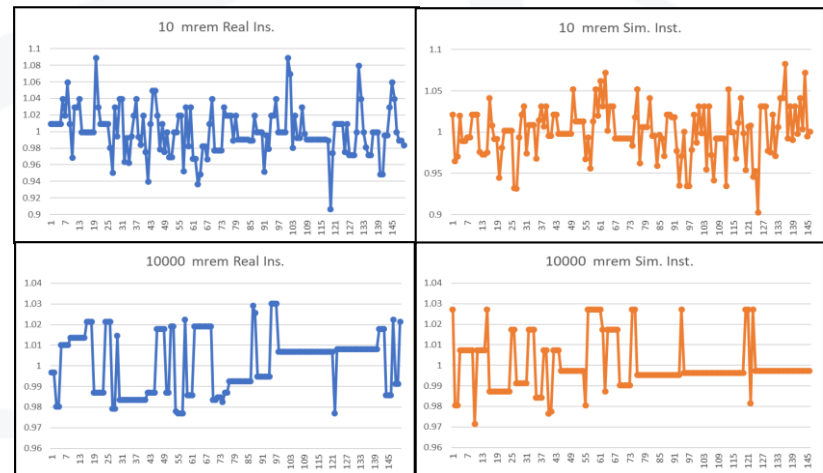
- UWB transmitters and antennas continually communicate at a frequency of 4 Hz providing a realistic and dynamic response of the meter to the simulated sources.
- Response time verified through testing conducted at RSCS ISO/IEC 17025 accredited calibration laboratory and by CERN using traceable reference class radioactive sources.
- Video demonstrating response time:



- Real instrument response to radiation fields are not static measurements. All instruments have unique response variability profiles.
- SIM-Teq instruments are modeled after real instrument response.
- Response characteristics data has been collected from real instrument models when exposed to NIST traceable sources and programmed into the response performance of SIM-Teq models.



Response time between SIM-Teq system elements



Response variability comparison of Mirion DMC-3000 to SIM-Teq DMC-3000TD

Training Benefits

- SIM-Teq systems are currently in use at over 30 nuclear facilities in the United States and Canada.
- Training facilities have successfully used SIM-Teq for:
 - General Training
 - Effectively used in RP initial training as well as RPT and multi-discipline continuing training
 - Emergency Planning
 - Eliminates Controller Intervention
 - Improve decision making under stress
 - ALARA Planning
 - Using mock-ups
 - Body positioning, shielding, work area setup
 - Outage Cost Savings
 - Mock-up training saved 12 critical path hours and 1,500 mrem using redesigned platforms
 - Dose Savings
 - Valve replacement planning
 - Body positioning adjusted for welding
 - Saved 2 rem
 - Remote Monitoring
 - During mock-ups, train HP Technicians on remote monitoring techniques and job coverage using actual WRM2 equipment and software.



Plant mock-up – instructor hiding TWR source



Plant mock-up – student performing survey with SIM-Teq Model 9-4