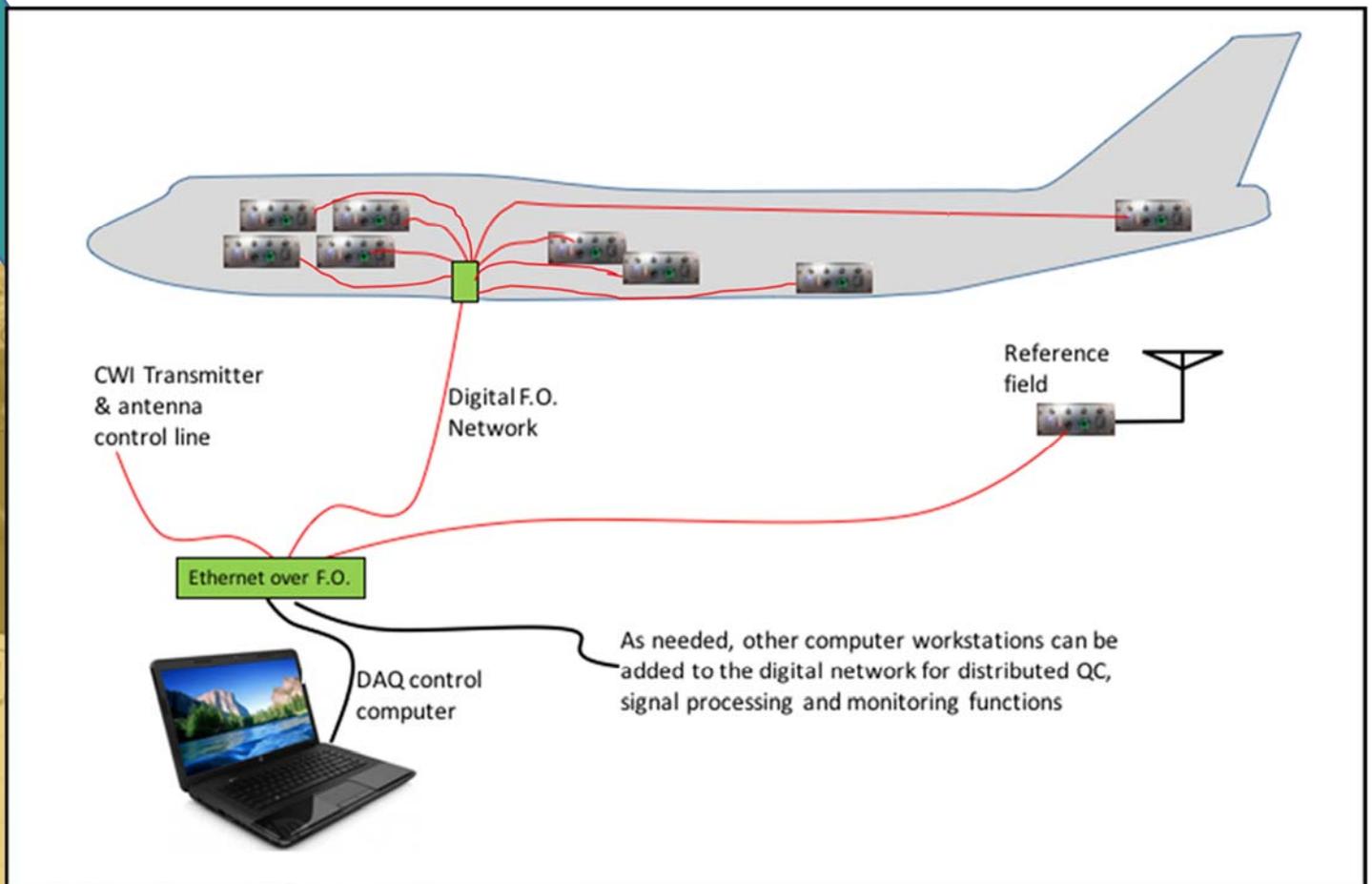


CWI-Net

SARA's DAQ Optimized for Stepped CWI Testing



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The need for CWI Testing

Continuous Wave Illumination (CWI) is a low power, high dynamic range and cost-effective test technique required and recommended by the following HEMP Military Standards:

- MIL-STD-3023 → Aircraft
- MIL-STD-188-125 → Facility (Fixed and Mobile)
- MIL-STD-4023 → Ship

As an example, MIL-STD-3023 requires CWI testing that includes Hardness Surveillance over the life cycle of the operational aircraft as well as HEMP Protection System performance verification during the manufacturing phase.

SARA offers the compact, fast, portable, distributed and low maintenance CWI-Net instrumentation system to quickly deploy and instrument multiple test points throughout an asset in support of CWI testing. CWI-Net operates over a closed digital local area network (LAN) using a single inexpensive multimode fiber to each node. CWI-Net's frequency range (10kHz-1GHz), dynamic range (-145dBm to 0dBm) and multiple resolution bandwidth settings satisfy requirements for aircraft, facility and ship CWI testing.

CWI-Net System Level Benefits

The CWI-Net instrumentation system takes full advantage of experience gained through decades of CWI testing. In addition to hardware and software features described in the following sections, the instrumentation system boasts the following advantages over legacy analog systems:

- Developed based on COTS digital networks and single board computer subsystem that will not become obsolete – but get faster, more energy efficient, smaller and more reliable over time
- Easy to setup and operate with fast frequency scanning speed
- Reduced time on asset
- Minimizes operator errors
- Extends to unlimited number of parallel CWI nodes
- Offers integrated voice and data communication to control computer

Key benefits of each CWI-Net node include:

- Small enough to fit in cramped aircraft bays: H: 2.75", L: 15.00", W: 5.00"
- The system can be expanded to arbitrary number of nodes without software modifications
- Distance between nodes can be 100's of meters, thanks to the range of digital fiber optics
- Data is recorded at the test point location thus taking advantage of the full dynamic range of spectrum analyzers
- Fast data acquisition rate – CWI-Net is significantly faster than and outperforms all competing multi-channel systems

The acquisition speed of CWI-Net is achieved by optimized hardware performance, increased hardware reliability in realistic field environments and highly efficient workflow.

In a recent aircraft CWI test trial, the test team managed to clear 1,532 quality controlled internal harness and field measurements in a 24-hour period – an unheard-of record!

CWI-Net utilizes two major components, the transmit (TX) subsystem and the receive (RX) subsystem. CWI-Net control software is tailorable to each facility's existing signal generator, amplifiers, high power RF switches, and antennas, protecting existing investments.

The CWI-Net Node

The CWI-Net node shown in Figure 1 comprises the heart of the RX system, consisting of an RF receiver with preamp and attenuation, on-board data processing, TCP/IP4 communications, battery and power supply, all in a ruggedized RF shielded enclosure designed and proven to withstand harsh in-the-field conditions, yet fit into tight spaces. The CWI-Net DAQ control software steers the TX and RXs to the desired frequency. Each receiver's gain is adjusted on the fly at each node, independently, to ensure sufficient SNR and prevent front-end saturation.



Figure 1: CWI-Net Node Side View.
Dimensions with battery are: H: 2.75", L: 15.00", W: 5.00".

Thanks to SARA's proprietary algorithms, a system of 16 parallel nodes can acquire 6 frequencies per second at 100 Hz RBW; and an impressive 4 frequencies per second at 10 Hz RBW.

Each node has four switchable 50Ω inputs with 80dB isolation, so that up to four probes can be connected at each node location – with one port scanned during each stepped CW sweep. 8- and 12- port nodes can also be delivered. Detachable, rechargeable battery packs are easily removed and replaced in the field by locking clips. The packs are designed for 9 hours of continuous sweeping (100% duty cycle). Front panel lights indicate to the on-board crew that the node is ready (SYS), connected to the network (NET), and whether it is in use and acquiring (DAQ), as well as which port is active.



Figure 2: CWI-Net Node, Front View with Indicators.

CWI-Net Control Software

CWI-Net data acquisition control software is reliable and easy to use (see Figure 2). The CWI-Net data acquisition libraries are robust so that even accidental node disconnects are recoverable in mid-sweep, and there is no required power-up sequence for nodes and LAN. All nodes are identifiable in software by the serial number, which is clearly engraved on the node case. The node libraries are callable from existing high-level mission control software written in languages like MATLAB or LabView. This preserves customer investment in legacy tools which embody detailed operational practices and lessons learned, and minimizes up-front retraining time and cost.

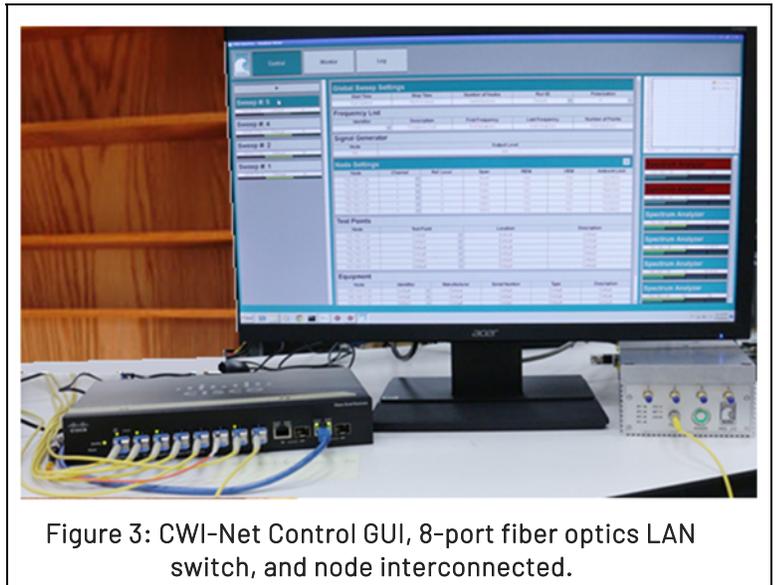


Figure 3: CWI-Net Control GUI, 8-port fiber optics LAN switch, and node interconnected.

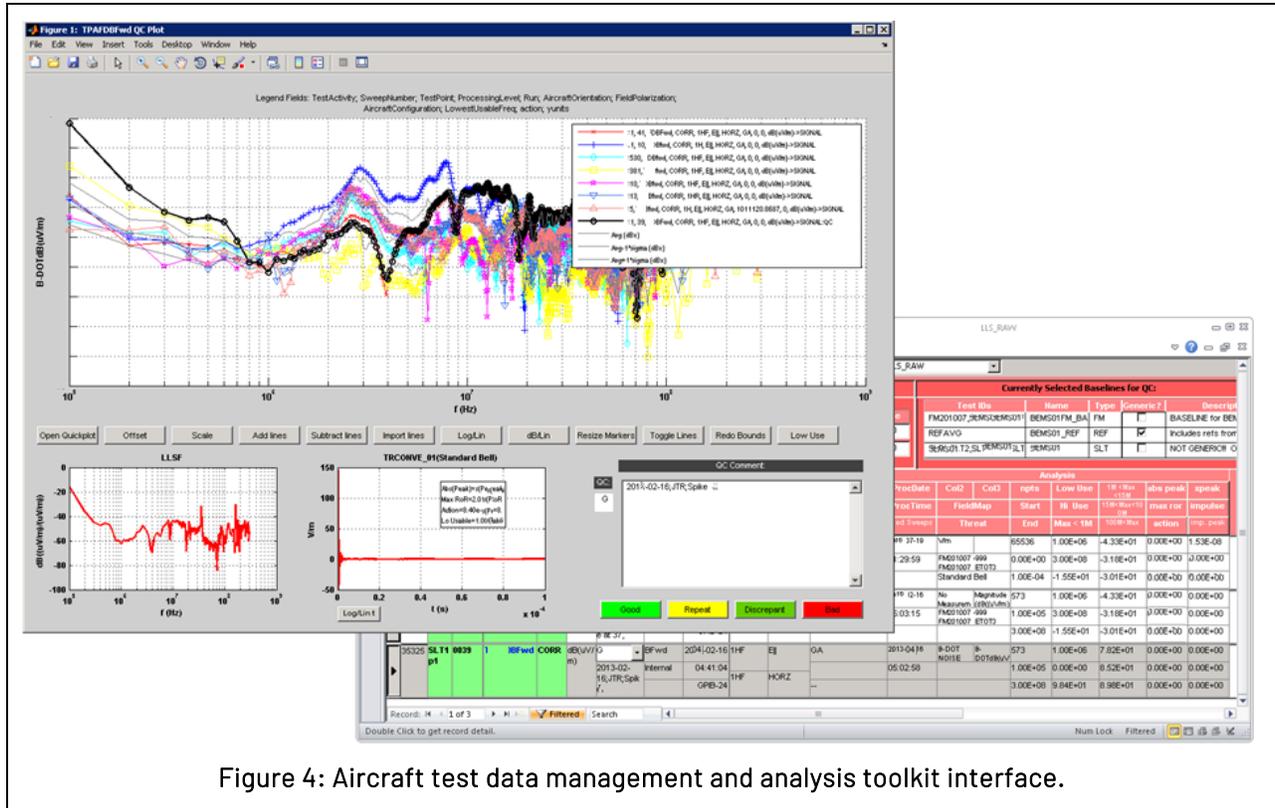
Benefits include:

- Capable of managing dozens of nodes without requiring software updates
- Select nodes to be scanned (if others are not ready)
- Accidental disconnection of a node during a scan does not stop other nodes from completing the scan
- Instant data QC views during and after the scan
- On-board technicians directly interface with setup using tablets via the Tech Node interface

CWI-Net Integrated Data Processing Capabilities

SARA has 24 years of experience developing customized toolboxes for DTRA, NAVAIR, the UK MoD, Qinetiq, DARPA, and Northrop-Grumman based on MATLAB/WIFF/Database software to manage, exchange, QC, and analyze waveforms customizable to facility operational practices. Delivered workstations include Dream, ToDream, IDAWS, TFAWS and CSAWS. These tools are fully integrated with the CWI-Net control software and can run by any computer on the digital network. The benefits of SARA's signal processing toolboxes include:

- Time tested user friendly signal processing and database software
- QC tools to verify signal quality, compare to historical data (for HM/HS) in real time
- Tools for extrapolating CWI scans or transient waveforms to a wide range of HEMP and lightning threat waveforms
- Direct Drive Tools - such as damped sine fit to norms per MIL-STD-3023
- Wide variety of Import/Export



Field Proven

Successfully deployed on CWI test programs since 2016, CWI-Net has demonstrated superior performance and reliability compared to legacy systems that are based on analog fiber optic systems. For example, the hardware failure rate during system level testing was only 6%, versus 22% for the legacy analog system. And the CWI-Net Tech Node application optimized test crew productivity by allowing setup in one compartment and measurement in another to occur simultaneously, clearing 1,532 quality controlled internal harness and field measurements in a 24-hour period.

CWI-Net Datasheet, Pricing, Accessories, Contact Information

The CWI-Net data sheet appears in Table 1. Pricing depends on detailed customer requirements, but hardware will be significantly lower than comparable analog fiber based systems. Recommended accessories include SARA’s hardened LAN switches. For more information, please call or email:

- Mr. Justin Eagan (714) 224-4410, jeagan@sara.com
- Mr. Charlie Anderson (719) 302-3117, canderson@sara.com
- Dr. Parviz Parhami (714) 224-4410, pparhami@sara.com

Table 1. CWI-Net Data Sheet.

Data Rates

	Frequency Steps per Second				
# Nodes	1	4	6	12	16
10 Hz RBW	4.3	4.2	4.1	4.0	3.8
100 Hz RBW	8.2	7.4	7.5	6.7	6.3
	Average Time per Frequency Step (ms)				
# Nodes	1	4	6	12	16
10 Hz RBW	232	237	242	253	261
100 Hz RBW	122	135	133	150	159

Amplitude

Parameter	Conditions	Value
Signal Inputs		50 Ohm, 4-input
3dB Bandwidth	lower	10 kHz
	upper	1400 MHz
Minimum Detectable Signal Level	100 Hz RBW	-135 dBm
Maximum Input		+0 dBm
Bandpass flatness	10 kHz to 1400 MHz	± 1 dB

Environmental

Parameter	Conditions	Value
Operational Temp.	Node with battery	-20C to +50C
Storage Temp.	Node without battery	
		Battery
Power Consumption	Run-Time @ 100% duty cycle	9 hours
	Run-Time Idle	12 hours

Input/Output Connectors

Connector	Type
Node Optical Conn.	ST
Node RF Conn.	SMA(F)
Switch Optical Conn.	SFP Fast Enet

Physical Properties

Inputs	Dimensions	Weight (w/batt.)
4	H: 2.75" L: 15.00" W: 5.00"	11.5 lbs
12	H: 3.75" L: 15.00" W: 6.00"	12.5 lbs

Included Accessories

2 ea BB-2590/U Li-Ion Batteries
4-battery Battery Charger Case
4-node Ruggedized Carrying Case
8-port Fiber<>Ethernet Switch w/ SFPs

Recommended Accessories

MIIIS 1 8-Input Ruggedized LAN Fiber Switch
