# TCI®

802C HF Wideband Direction Finding System

The TCI Model 802C provides field-proven DF and signal acquisition in an integrated solution for COMINT applications. The 802C is based on an open and flexible client/server architecture that combines fast wideband signal search and direction finding with a complete set of signal analysis tools, including classification, decoding, demodulation and recording. It simultaneously supports automatic and manual signal intercept missions..

The 802C processes any signal activity and performs detailed analysis of specifi c signals of interest in either real-time or delayed (post-facto) mode. The analysis function includes detection, location, recording and archiving of signal activities.

In typical automatic mode, the 802C rapidly searches the spectrum for RF energy using fine frequency resolution parameters. When new energy is detected, the system automatically determines the direction of the energy source, archives it for future analysis and passes it in real time for further processing to automatic and manual intercept processing. The Signal of Interest (SOI) parameters available for future processing include time of intercepts, frequency, bandwidth, signal direction and signal location if system is confi gured to use optional Single Site Location (SSL) processing. SSL processing uses measured elevation data and ionospheric data from an optional sounder processor.

The DF RF chain uses two receiver channels connected to the DF antenna array. With automatic noise and co-channel interference suppression, the system can perform automatic DF and modulation analysis on any type of signal. The analysis function provides transmitter parameters including frequency, direction and/or location, bandwidth, and time of transmission.
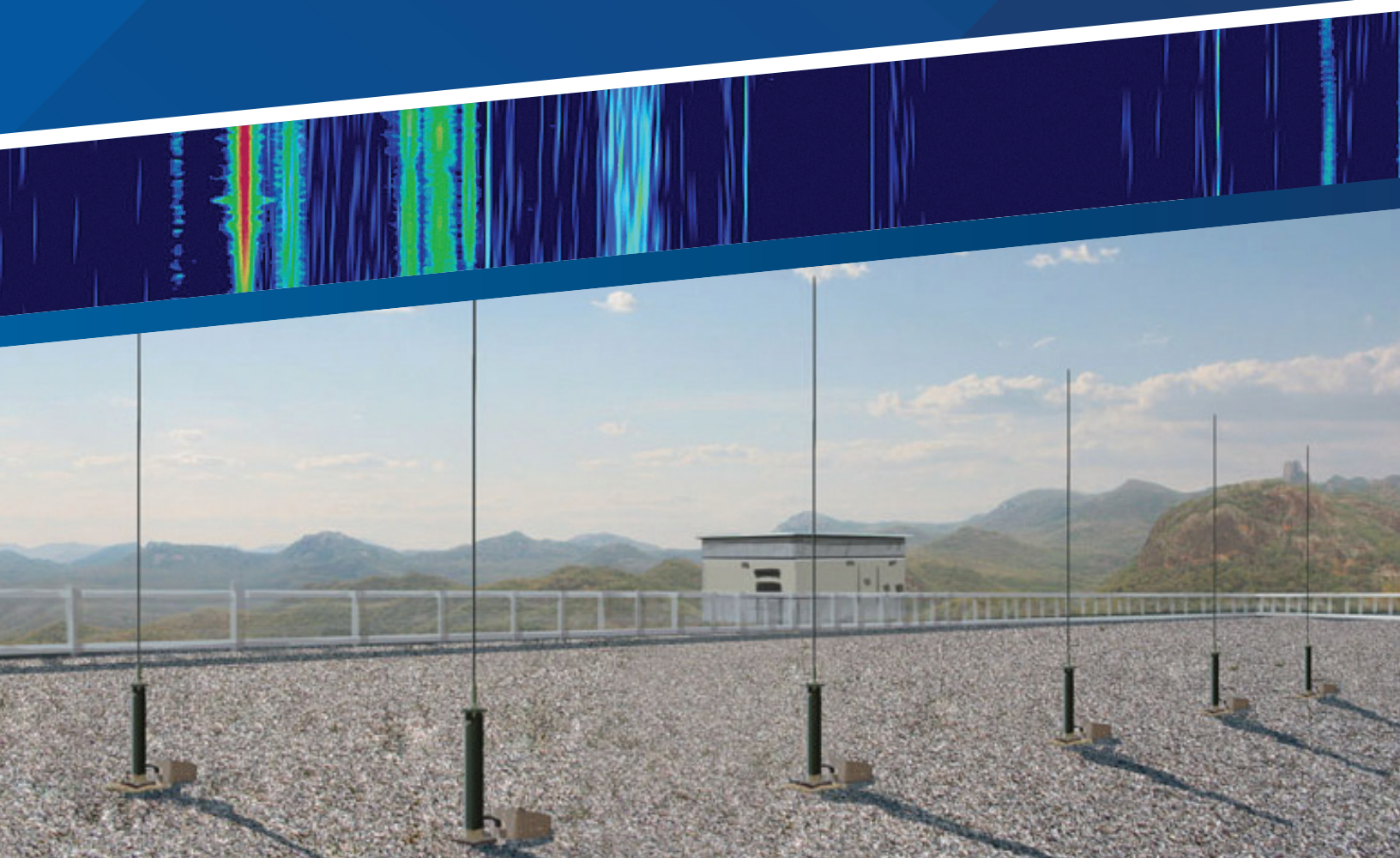
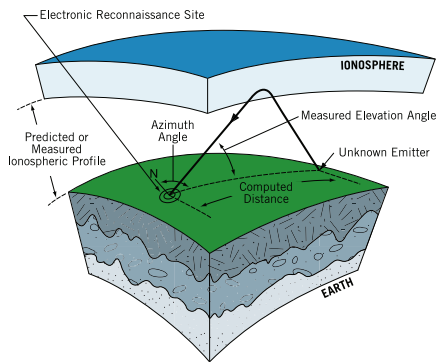# Employ field-proven, integrated technology for signal analysis and DF.

KEY FEATURES

› Integrated, single-solution HF COMINT platform for direction finding and signal collection

› Wideband signal detection, location, collection, analysis and archiving in manual and automatic modes

› TCI DF First™ signal-acquisition technology combines fast signal search with exceptional DF accuracy and speed

› 0.3 – 30 MHz frequency range

› High dynamic range and excellent co-channel frequency resolution

› High-speed signal search and filtering (alarming) by signal frequency, direction/location, duration, and bandwidth

› Field-proven direction finding, signal collection and analysis algorithms

› Single Site Location (SSL) capability with optional real-time sounder

› Storage of measurement results including signal spectral activity (time and frequency domain), direction, modulation and location data in "raw data" database

› Tools for analysis of raw data results and creation of signal activity reports

› Local and remote control, including full network operation

› Open architecture with all signal data available in real-time on the network, including optional narrowband sampled data

› Modular and scalable architecture for 24/7, multi-user and/or multi-site applications

Subsystems Included

♦ DF/Monitoring Antenna Array

♦ Wideband Dual-channel Signal Search and DF

♦ Processor with 2 MHz Instantaneous Bandwidth

♦ Signal Acquisition and DF Controller

♦ Signal Activity Database

♦ Workstation(s) for system tasking and manual real-time and post-facto signal analysis

♦ Automated real-time signal analysis

♦ Optional monitoring receiver(s) and audio recording

♦ Optional Ionospheric Sounder

♦ Optional Multi-site Interface

Figure labels: Electronic Reconnaissance Site · IONOSPHERE · Azimuth Angle · Measured Elevation Angle · Predicted or Measured Ionospheric Profile · Unknown Emitter · N · Computed Distance · EARTH

DF/Monitoring Antenna Array and RF Distribution

For direction finding and signal acquisition, the system is typically configured with a nine-element Model 632 monopole antenna array. Optional TCI and third-party antenna arrays also are compatible.

Wideband Dual-Channel DF Processor

The TCI Model 6083H wideband DF processor embedded in the 802C employs dual-channel architecture with wide instantaneous bandwidth for high-speed, simultaneous new-signal search for increased probability of intercept (POI), detection and direction finding. This field-proven "DF First™" technology optimizes signal-processing performance, regardless of signal types or signal-propagation conditions. This architecture is complemented by both high instantaneous dynamic range and frequency selectivity (adjacent channel rejection).

Within the 6083H processor resides a TCI 2621 dual-channel wideband HF receiver converter, a high-speed digitizer and a dedicated digital signal processor (FPGA). A single VME-based, 19-inch rack-mount unit contains all components, which are governed by a common controller.

The 2621 converts a wide portion of the HF band to a low-band IF frequency that is fed to one of the digitizers. The converter provides exceptional dynamic range performance with high input and output IMD intercepts and a low noise figure. The outputs from the high-speed digitizers are fed to an FPGA processing module, and dualcore Intel processors for final DF processing.

The 6083H processor analyzes all channels within selected frequency ranges to programmable frequency resolutions. It simultaneously and automatically detects signal activity in each channel and automatically performs DF processing for channels that have activity. These "Raw" measurement results, including spectral, signal activity and DF data, are sent to the controller for further processing, including automatic archiving.
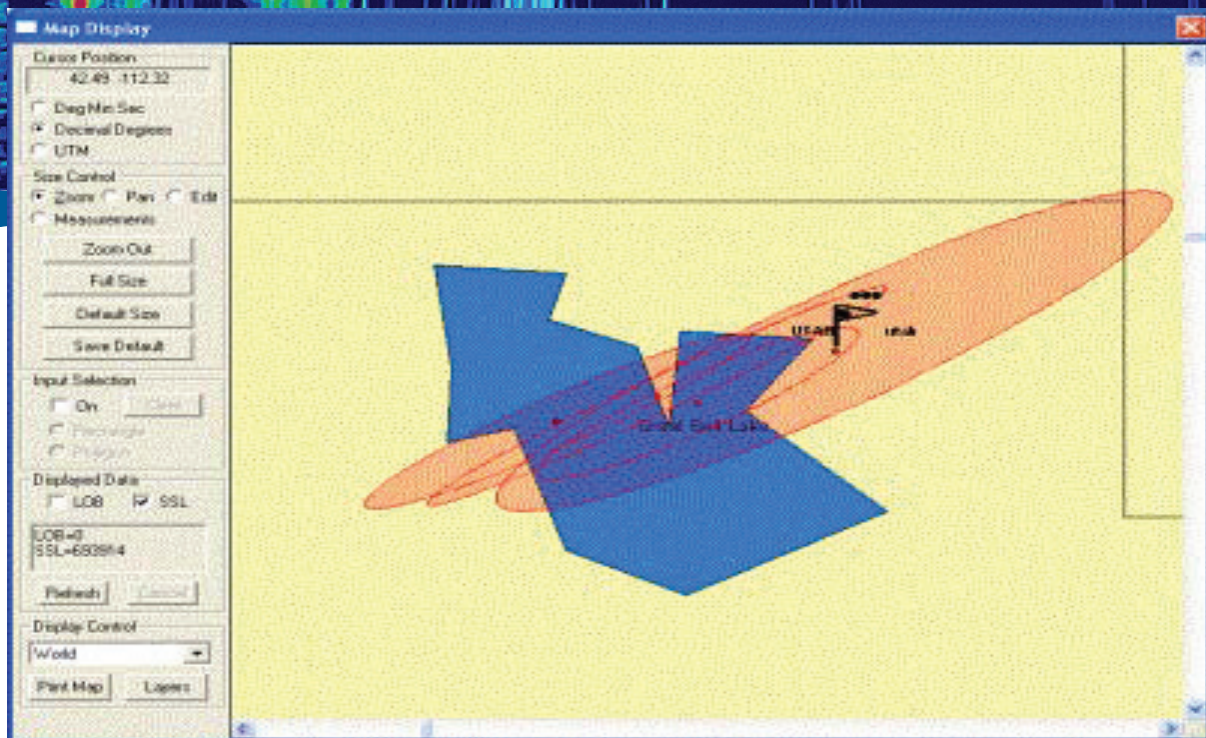
Signal Acquisition and DF Controller

The Signal Acquisition and DF Controller controls the operation of the Signal Acquisition and DF Processor, communicating with them and with clients over a Gigabit Ethernet interface. The controller software has several functions:

Acquisition and DF Processor Setup
Translates mission parameters into setup parameters for the 6083H processor during mission setup.

Client Access
Manages client access to the Acquisition and DF processors for functions including consolidation of client tasking requests consisting of frequency ranges, signal detection, DF setup parameters and signal acquisition parameters.

Data Archiving
Forwards all raw measurement results, consisting of spectral, signal activity, DF data and spectral data, to the raw database server.

Data Distribution
Manages real-time distribution of data among the requesting clients via a Gigabit Ethernet network interface.

Signal Activity and Alarms Using Location Filtering
Maintains a comprehensive signal activity list based on the raw data information. Updated in real time, and available to any client on the network, it can tip clients when signal activity falls within a geographic area identified at operator workstation(s).

Raw and Emitter Database Server

An optional database archives raw data collected by the Acquisition and DF Processors, holding at least three days' worth collected at the highest DF throughput rate. While it is archived, multiple clients can simultaneously retrieve raw data already saved. Raw data query results, filtered according to client-specifi ed criteria, are returned to client for emitter analysis. The results of emitter analysis are saved in the emitter (processed raw data) database.

The Raw and Emitter Database Server is typically hosted on a separate computer specifi cally configured for database operation, including optional disk arrays and multiprocessing.

A typical Raw and Emitter Database Server configuration shares a host computer with the Signal Acquisition and DF Controller application.

Workstations for System Tasking and Manual Real-Time and Post-Facto Signal Analysis

A Master Client running on a workstation sets up initial tasking in terms of signal search criteria and frequency ranges of interest. Additional clients can set up their own frequency ranges according to their mission requirements. Once the signal search criteria and frequency ranges are set, the system automatically produces raw data results (spectral, activity, DF data and signal classifi cation data).

Clients can analyze raw data either in realtime or post-facto mode. In real-time mode, data is processed as it is created, whereas in post-facto mode, raw data is available for retrieval from the raw database up to three days after it is initially processed. In both modes, the client has a large number of tools at its disposal, including spectrograms, azimuthalgram, azimuth vs. frequency displays, azimuth and elevation histograms, map displays, timeline and azimuth/elevation versus frequency displays.

The emitter database serves as storage for newly created emitter reports, and it also supports emitter reports analysis.

Automated Real-Time Geolocation Filtering

Raw data created by the Acquisition and DF Processor(s) are analyzed using automated processing. These automatic analyses include:

› DF integration
› Automatic signal alarms for workstation
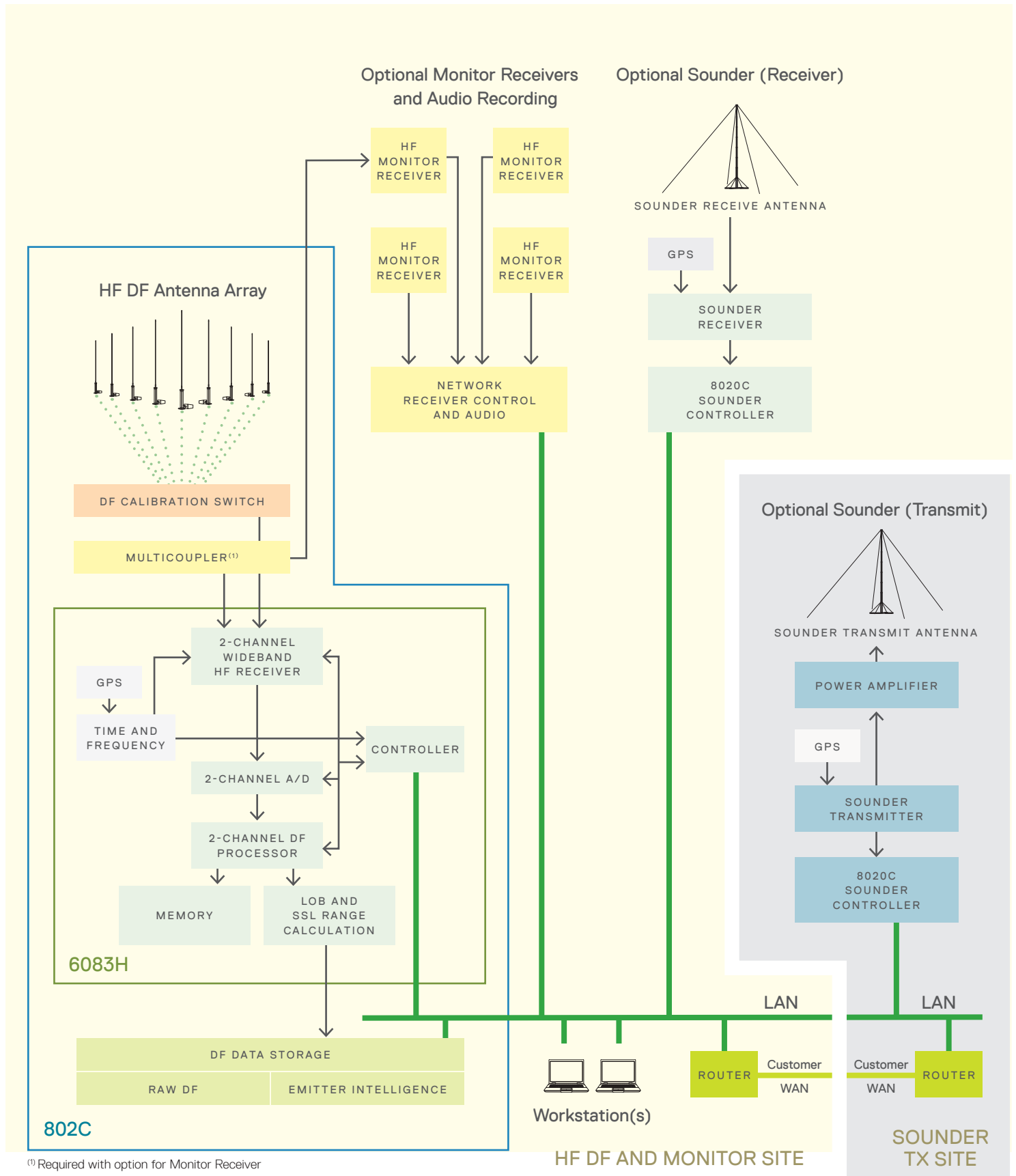› Location filtering of signal alarms (performed at individual workstations)

The automated analysis is done in real-time and also can be recorded in the database.

Built-in Multi-site interface

The volume of data produced by a single 802C can exceed 5 Mb/s when both raw and digitized data archiving is active. Recognizing the difficulty of deploying a network to support these data rates in a multi-site environment, the system architecture offers options for data retrieval and transfer.

In the 802C, automatic processing of raw data dramatically reduces data-fl ow requirements between the sites. For example, using automatically generated alarms, rather than raw data for real-time multi-site triangulation processing, effectively reduces data traffic by a factor of one hundred.

Recognizing it is occasionally necessary to transfer raw or digitized data across a network that has limited bandwidth, the system can adjust the data-transfer rate to accommodate the available network bandwidth at the expense of data-transfer time.

Optional Monitor Receivers and Audio Recording

HF MONITOR RECEIVER

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HF MONITOR RECEIVER

NETWORK RECEIVER CONTROL AND AUDIO

Optional Sounder (Receiver)

SOUNDER RECEIVE ANTENNA

GPS

SOUNDER RECEIVER

8020C SOUNDER CONTROLLER

HF DF Antenna Array

DF CALIBRATION SWITCH

MULTICOUPLER[(1)]

6083H

GPS

TIME AND FREQUENCY

2-CHANNEL WIDEBAND HF RECEIVER

CONTROLLER

2-CHANNEL A/D

2-CHANNEL DF PROCESSOR

MEMORY

LOB AND SSL RANGE CALCULATION

Optional Sounder (Transmit)

SOUNDER TRANSMIT ANTENNA

POWER AMPLIFIER

GPS

SOUNDER TRANSMITTER

8020C SOUNDER CONTROLLER

802C

DF DATA STORAGE

RAW DF

EMITTER INTELLIGENCE

Workstation(s)

LAN

LAN

ROUTER

Customer WAN

Customer WAN

ROUTER

[(1)] Required with option for Monitor Receiver

HF DF AND MONITOR SITE

SOUNDER TX SITE

Signal Processing Flow Description

System operation of the 802C is initiated from the master client workstation that confi gures signal search criteria, such as required signal-to-noise ratio for the detection, frequency resolution, type of DF processing and signal modulation parameters.

Once the search parameters are set, all client workstations can set up frequency ranges of interest. Frequency ranges from multiple workstations are consolidated by the Acquisition and DF Controller, which then tasks the 6083H Processor.

With its signal-search criteria and frequency range set, the Acquisition and DF Processor(s) continuously perform signal detection and DF. The raw measurement results are sent to the Acquisition and DF Controller, which automatically sends data to the raw database. Raw data also is sent to the workstations and automated processing required by those applications. This real-time raw data is automatically processed for everything from displaying a real-time spectrogram to generating an alert when signal is detected.

The results of raw-data processing are stored in the emitter database. The emitter results also can be retrieved using multi-parameter query criteria for review and analysis.
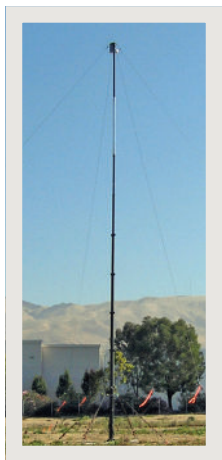
> Optional Ionospheric Sounder

Model 802C Specifications

PARAMETER	VALUE	COMMENTS
Antenna		
TCI 632 Antenna	0.3 - 30 MHz	DF and Monitor Antenna
6085 DF Processor		
Frequency Range	0.3 - 30 MHz	
DF Instrument Accuracy	0.1° RMS	
DF Accuracy	2° RMS	
DF Bearing Resolution	0.1°	
DF Azimuth Coverage	0 - 360°	
DF Elevation Coverage	0° - 90°	
Processor Sensitivity		-110 dBm RF input for 10dB SNR (1 kHz measurement bandwidth, at max gain)
Receiver In-Band Dynamic Range		>90 dB, single tone SNR (1 kHz BW) >90 dB, SFDR (1 kHz BW)
Receiver 3rd Order Intercept		+30 dBm (typ, at +6 dB gain)
Receiver 2nd Order Intercept		+60 dBm (typ, at +6 dB gain)
Receiver Pre-Selector Filters		12 pairs HF band pass filters, Single LF/MF range
Receiver Frequency Accuracy	1 Hz	(when locked to GPS)
A/D Resolution	16 bit	
Processor		Dual Cored Intel Processor
Memory	4 GBytes	
Storage	160 GBytes	
Operating System		Windowns 7 Embedded
Network		Gigabit Ethernet
Phase Noise	-110 dBc	(10 kHz offset) Typical

(Specifications subject to change without notification.)

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Model 802C Specifications

PARAMETER	VALUE	COMMENTS
Optional DF Data Storage Server (typical configuration)		
Processor		Dual Core Intel Processor
Memory	4 GBytes	
Storage	160 GBytes	
Operating System		Windows Server
Database Server		SQL Server
Network		Gigabit Ethernet
Raw Data Storage Capacity	>72 hours	Raw data results
Emitter Report Storage Capacity	>1,000,000	

PARAMETER	VALUE	COMMENTS
Workstations (typical configuration)		
Processor	—	Dual Core Intel Processor
Memory	2 GBytes	
Storage	160 GBytes	
Network		Gigabit Ethernet

PARAMETER	VALUE	COMMENTS
Automatic Processing		
Automatic Signal Filtering with alarms		Automatic filtering by DF and signal parameters with alarms
Automatic signal hand-off		Automatic hand-off of signals of interest to monitor system

PARAMETER	VALUE	COMMENTS
Optional Monitor Receiver and Audio Recording		
TCI or customer supplied HF receivers		Consult factory for customer supplied receiver
Frequency Range	0.3 - 30 MHz	
Number of receivers	4	Expandable if required
Network Receiver Control		All receivers controlled over TCP/IP network
Audio Recording		Network audio with audio recording

PARAMETER	VALUE	COMMENTS
Optional Bistatic Sounder for SSL Support		
Sounder Type		Bistatic, FMCW
Height Measurement	Up to 800 km	1.5 km resolution

Specifications subject to change without notification.

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TCI®

Enabling Partners to Master the Spectrum

TCI International, Inc. is a global supplier of turnkey solutions for Communications Intelligence, ITU-Compliant Spectrum Monitoring & Management, direction finding and geolocation, and antennas for communications and high-power radio broadcasting. For more than 50 years, TCI has applied innovation to development of new capabilities and solutions enabling our partners to address emerging threats in the electronic warfare domain.

TCI's diverse hardware and software engineering capabilities provide field-proven COMINT solutions for force protection, border security, intelligence gathering, and communications traffic for military, intelligence and law enforcement agencies globally. TCI's COMINT, Spectrum Monitoring & Management, and Broadcast Antenna products have been delivered to more than 100 countries. Learn more at www.tcibr.com.

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