The ITU-Compliant TCI Model 737 is the highest performance member of TCI’s 700 series of field-proven Spectrum Monitoring Systems (SMS), which addresses the frequency ranges from 9 kHz to 50 GHz. The 737 is a compact system consisting of a spectrum processor, a choice of monitoring and direction finding (DF) antennas covering the complete frequency range, and TCI’s Scorpio client-server software.

The 737’s exclusive, multi-channel wideband architecture provides fast and accurate signal measurements in crowded and complex signal environments. The 737’s high-accuracy metrics and DF performance are achieved through simultaneous DSP analysis of wideband receivers connected to an external multi-element DF antenna array. The TCI Model 737 extends system monitoring and DF capabilities of the 700 series systems by offering 40 MHz instantaneous bandwidth, while maintaining high dynamic range. Each receiver channel is composed of a fully synthesized, high-dynamic-range receiver, high-speed digitizer, and custom digital signal processor. Digital processing provides an extensive selection of measurement bandwidths from 500 Hz to 40 MHz, using wideband receivers with selectable dual IF bandwidths. The narrower IF bandwidth provides maximum dynamic range which is advantageous for measuring weak signals in crowded RF environments. The wider IF bandwidth optimizes processing speed necessary for detecting short-duration and wide-bandwidth signals. Selectable receiver IF bandwidth, combined with a wide selection of processor measurement bandwidths, yields exceptional performance and the ability to measure and analyze a variety of traditional and modern signals in a wide range of signal environments.
737 VLF/LF/HF/VHF/UHF/SHF/EHF Spectrum Monitoring System

Employ maximum wideband processing performance in complex environments.

KEY FEATURES

- Field-proven spectrum monitoring and geolocation solutions used by over 50 regulatory authorities worldwide.
- Fully integrated, ITU-compliant spectrum monitoring and direction finding (DF) system.
- 20 to 3,000 MHz monitoring and DF, with optional extended frequency range down to 9 kHz and up to 50 GHz.
- Choice of multiple wide-aperture direction finding and monitoring antennas.
- Multi-channel receiver and processor are fully integrated to provide exceptional direction finding speed and measurement accuracy.
- Dual IF bandwidth supports high scanning rates and high dynamic range.
- Selectable measurement bandwidths from 500 Hz to 40 MHz.
- Built-in self-test and self-calibration.
- Highly integrated antenna and spectrum processor units.
- Easy operation via client-server architecture with built-in networking capability.
- From stand-alone to nationwide deployment in fixed, mobile and transportable configurations.
- Interoperable with all TCI 700 series spectrum monitoring systems.
- Client software automatically configures itself to each connected server.
- TDOA (Time Difference of Arrival) measurements.
- Hybrid geolocation that combines Angle of Arrival (AOA) and/or TDOA measurements.
- Signal capture in I & Q format with signal analysis.
- High scan speed mode for transient signal capture.
- Optional front panel display for operation and monitoring functions.
System Details

Antennas For Every Application

The TCI 737 system is easily configurable to operate a variety of monitor and DF antennas. All antennas include the DF and monitor elements in a single package. Please refer to separate datasheets for complete technical specifications of compatible antennas for fixed, mobile and transportable applications.

Full Compliance With ITU Recommendations

The 737 system is fully compliant with ITU-R recommendations as outlined in the 2011 International Telecommunications Union Spectrum Monitoring Handbook. The 737 provides comprehensive spectrum monitoring and analysis that meets or exceeds all ITU recommendations for the measurement of frequency, field strength, occupied bandwidth, modulation, direction finding, spectrum occupancy, and automatic violation detection.

Lower Life-Cycle Cost

TCI’s more than 45 years of experience in designing, installing, and maintaining spectrum monitoring equipment has made the 700 series systems best-value solutions that offer the highest performance and reliability. Because all 700 series systems are field-repairable and self-calibrating, they do not require field or factory calibration after repair or extended use. And all utilize the same easy-to-use Scorpio software to minimize training costs, with Built-in Self Test (BIST) capabilities and self-calibrating antenna technology to reduce maintenance costs and achieve the lowest lifecycle ownership cost.

System Details

All Spectrum Processor functions are controlled by a CPU that is contained within a single, compact 4U, 19-inch rack-mount unit. The spectrum processor includes a solid state disk drive and does not require an Uninterruptible Power Supply (UPS). Robust construction makes the TCI Model 737 system ideal for portable, transportable and mobile applications, as well as fixed locations with unreliable power delivery.
Modular Architecture For Maximum Flexibility

Custom System Configurations

- HF Fixed/Mobile
- HF Fixed
- HF Mobile
- V/U/SHF Portable/Compact Mobile
- V/UHF Fixed/Mobile
- V/U/SHF Dual Polarization
- S/EHF Fixed/Mobile

TCI Spectrum Processor

- Optional HF Extensions
- Scorpio Server Software
- Server CPU
- VHF/UHF Receivers
- DSP
- Optional S/EHF Extensions

Scorpio Software Client

Interior of Mobile Station

Mobile Station configured with Compact 645 antenna
User-Friendly Software

TCI’s Scorpio™ client software controls the 737 system. Scorpio software incorporates a wide variety of powerful graphical displays with easy-to-use features, such as drop-down boxes and automatic default values (where appropriate) to enhance understanding and simplify operations. Scorpio software can be operated interactively, allowing the operator full control of the measurements and displays with instantaneous feedback, or in automatic scheduled mode without operator intervention. In scheduled (calendar) mode for unattended operation, Scorpio automatically initializes and starts operation when power is applied.

Automatic Operation

Scorpio software allows automatic measurements of signal parameters in accordance with ITU recommendations. The Scheduled mode’s calendar feature lets Scorpio Clients reserve time slots on a selected Scorpio Server to make requested measurements. A single Scorpio Server measurement station can handle requests from multiple Scorpio Clients, allowing data collection from multiple systems in different locations. These facilities are used to verify compliance with license requirements on a scheduled basis.

Automatic Violation Detection (AVD), another powerful Scorpio tool, verifies compliance of licensed emitters and detects unlicensed operations. AVD operates in conjunction with license data (frequency assignments) downloaded from the Spectrum Management System database. AVD determines whether a particular transmission complies with tolerances of assigned center frequency and bandwidth, as specified for the allocated band and service in the National Frequency Plan table. It also will report frequencies operated without a corresponding license in the Management database and provide an alarm notification. AVD measurements can be performed on a single-frequency or on a range of frequencies specified by the Operator.
Powerful Tools for Detecting and Analyzing Signals

Scorpio software gives the operator a wide variety of capabilities to find, identify, and record specific emitters—often unlicensed pirate stations or sources of interference. These facilities include extensive direction finding tools to locate the target emitter using both fixed and mobile stations.

The operator can use the Spectrum Panoramic (or Pan) display, an X-Y plot of signal amplitude versus frequency, to view and identify signals and signal relationships in the spectrum, and to investigate interference sources. Several views are also assembled in single screens, such as Pushbutton DF, for comprehensive analysis of signal parameters and their location.

When two or more systems are networked, DF Line of Bearing (LOB) measurements on the signal can be used to triangulate and determine the emitter location. When one system is installed in a vehicle, the Homing DF screen allows quick and effective location of emitters while moving. The software processes the LOB data obtained from DF measurements at different vehicle positions and calculates the position or “FIX” on the transmitted signal. Global Positioning System (GPS) data records the mobile station location and a digital electronic compass reports the vehicle heading. This provides a basic tool to locate emitters and investigate sources of interference around the affected stations.

Model 737
Technical Overview

Single Integrated Monitor/DF Antenna

By combining wide-aperture multi-element DF and monitoring antennas, TCI provides unparalleled performance in an integrated package. This design is optimized for high sensitivity over its full frequency range.

Built-In-Self-Test (BIST)

Comprehensive BIST and self-calibration have been fully integrated into TCI 700 series equipment from the beginning. When BIST is requested, testing starts with the CPU and DSP, and progresses through all system components to the antenna elements. If a component fails BIST, the BIST function continues testing to obtain a complete picture from multiple failures, if they occur. The BIST results can be reviewed either at a high level suitable for Operators, or in a detailed view suitable for Maintenance Technicians. A full BIST report in simple text form can be sent to TCI for expert review, if desired. Self-calibration eliminates the need for additional test and calibration equipment and greatly simplifies system maintenance.

Multi-Channel DF Processing

Using patented automatic receiver matching, the TCI 737 system provides superior performance when compared to single channel systems that utilize the same antenna configuration. TCI’s multi-channel approach is signal modulation independent and offers much faster DF speed than typical single channel systems that must perform four times more switching operations.

Dual Instantaneous Bandwidth (IBW)

As an engineering company, TCI understands the competing challenges involved in designing and manufacturing the widest, fastest, and best-performing wideband receivers for use in its spectrum processors. This is why TCI receivers have TWO operator-selectable RF front ends. The full-wideband front end provides a high-performance receiver suitable for fast scans and working with modern signal modulations such as GSM. The narrower-bandwidth front end effectively lowers the noise floor, making the system more sensitive to low-level signals, particularly in crowded signal environments.
Summary Specifications

Model 737
Specifications Overview

Signal Parameter Measurements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement Method</th>
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</thead>
<tbody>
<tr>
<td>Frequency Measurements</td>
<td>Per ITU-R SM.377</td>
</tr>
<tr>
<td>Occupied Bandwidth Measurements</td>
<td>Per ITU-R SM.443</td>
</tr>
<tr>
<td>Field Strength Measurements</td>
<td>Per ITU-R SM.378</td>
</tr>
<tr>
<td>Modulation Measurements</td>
<td>Per ITU-R SM.328</td>
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Spectrum Occupancy

<table>
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<th>Parameter</th>
<th>Measurement Method</th>
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<tbody>
<tr>
<td>Measurement Method</td>
<td>Per ITU-R SM.1880</td>
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<tr>
<td>Channel Bandwidth</td>
<td>6.25 - 600 kHz (selectable)</td>
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<tr>
<td>Channel Measurement Rate</td>
<td>Variable (depending on channel bandwidth)</td>
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<tr>
<td>Signal Characteristics Record</td>
<td>Signal strength, percent occupancy, message length, and percent occupancy vs. time of day</td>
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</table>

Direction Finding

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Method</td>
<td>Per ITU-R SM.854</td>
</tr>
<tr>
<td>DF Accuracy</td>
<td>0.1° RMS (Instrument accuracy)</td>
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<tr>
<td></td>
<td>2° RMS typical, 1° RMS in scatter free environment</td>
</tr>
<tr>
<td>DF Resolution</td>
<td>0.1°</td>
</tr>
<tr>
<td>DF Method</td>
<td>Optional HF Interferometer or Watson-Watt*</td>
</tr>
<tr>
<td></td>
<td>Multi-channel — Correlative Interferometer (V/UHF)</td>
</tr>
</tbody>
</table>

*10° RMS typical for Watson-Watt

Comprehensive Reporting Capabilities

The 737 system’s comprehensive text and graphical capabilities allow automatic report generation, or access to the data to create reports using MS Office™ (included with the system). Reports are based on measurements, as well as different data records available in the system databases, such as raw trace information, carrier analysis by date or band, channel-occupancy and availability statistics, message-length statistics, and channel-power statistics.

Expandability

The Scorpio system’s modularity and powerful core capability make it easily adaptable to future needs. Future expansion possibilities include:

- Addition of future mobile units and fixed stations by adding them to the flexible network architecture.
- Upgrading hardware and software to extend the frequency range.
- Additional operator workstations.
- Analysis and demodulation of future communication formats through upgrade of analysis algorithms in the TCI Spectrum Processor.

Mobile Station configured with TCI 643 Dual-Polarized antenna
Specialized Expertise in a Global Family

TCI International, Inc., a leading supplier of end-to-end, ITU-compliant RF spectrum monitoring and management products, is a wholly-owned subsidiary of SPX Corporation. Based in Charlotte, North Carolina, SPX Corporation (NYSE: SPXC) is a global, multi-industry manufacturing leader. SPX team members collaborate across business segments and borders to deliver greater efficiencies and better ideas for helping customers succeed.

At TCI, this commitment to innovation supports an array of customers whose missions depend on having a clear picture of their electromagnetic environment. For over 45 years, TCI's technical developments and advanced production capabilities have earned it a reputation for excellence in high-performance communications, spectrum monitoring and signals intelligence systems.

TCI's diverse hardware and software engineering capabilities provide proven solutions for regulatory compliance, monitoring and security, and communications intelligence applications. With advanced spectrum mapping and analytics, data recording and precision geolocation technology, TCI systems provide vital data for government and military agencies in over 100 countries worldwide.