TTC's radio frequency and wireless family of products are high-performance, dependable, economical solutions for many flight test and remote ground based applications requiring accurate transmission of telemetry, digital, wideband and video data.
Teletronics Technology Corporation's Radio Frequency and Wireless family of systems are high performance, dependable and economical solutions for flight test and remote ground-based applications requiring accurate transmission of telemetry, digital, wideband and video data.

RF PRODUCTS & SYSTEMS

Teletronics Technology Corporation expands legacy TTC capabilities with RF products & systems designed to satisfy the data link needs of our present and future telemetry customers.

TTC is heavily invested in the success of its RF and wireless products. To ensure quality and customer satisfaction, our state-of-the-art facility provides an in-house RF design laboratory, a fully-capable screen room, an EMI test chamber, and an FCC approved antenna range.

The primary design requirement for RF systems is ease of use. The airborne telemetry products can be easily programmed with performance requirements using TTCWare setup and configuration software. We design transponders, transmitters and flight termination receivers with our customer in mind, adding features not available in other standard industry products. Our flight safety products development effort is closely tied to the RCC range safety community.

The design philosophy at TTC is to provide high-quality and affordable products that are easily integrated into larger flight test systems.

RF PRODUCTS & SYSTEMS

➤ TTC provides a wide variety of RF products & systems, from ground-based receivers and diversity branch selectors to S-band telemetry transmitters, radar transponders and flight safety equipment. These systems provide the best value to the customer by including features not found in similar industry systems while providing on-time delivery.

➤ RF NETWORK SYSTEMS

Acquired by TTC, RF Network Systems line fills a need for high-speed data modems on AM or FM fiber, broadband coaxial cable and microwave systems. RF Network Systems Model 5960 and 5140 point-to-point RF modems provide dedicated and reliable data paths over RF or HFC media.

The Model 5140 is designed to meet the needs of telephony-based microwave users but is also used with other media. When any of the Series 5000 modems are used with the unmanaged bridge interface or with standard remote bridges or routers, Ethernet LAN connections are possible over coaxial cable, over many miles of AM fiber optic cable or over multiple microwave hops.

Since 1999, RF Network Systems has worked closely with the Advanced Range Telemetry (ARTM) program at Edwards Air Force Base. This relationship influenced development of the Model 2120 Enhanced Telemetry Demodulator, which provides a highly-efficient and very stable means to demodulate tiers 0, 1 and (optionally) II. Model 2120-902 increases the data rate of the telemetry demodulator to up to 60 Mbps.

The Model 2241 Diversity Branch Selector conditions telemetry data using a post-detection, spatially diverse configuration and has nearly-hitless results.

The SK 10155 series consists of three generations of waveform generators provide an economical means of investigating, testing and verifying receiving systems performance. The MTGS-3000 series ground station receivers provide multiple receiver channels, diversity combining, and branch selection into a single compact fully-functioning unit.

A wide variety of rackmount, PCI, PCMCIA and airborne systems are available because of the synergy between RF Network Systems multimode technology and TTC’s wide-spectrum capabilities. The RTAS-2000 is the result of TTC multimode airborne technology combining into a two and four-channel, re-radiation system used in flight test.

RF NETWORK SYSTEMS

➤ RF NETWORK SYSTEMS

RF PRODUCTS & SYSTEMS

➤ RF NETWORK SYSTEMS

RF PRODUCT APPLICATIONS

➤ AIRCRAFT FLIGHT TESTING
➤ FLIGHT LINE CHECKOUT
➤ MISSILE PERFORMANCE TESTING
➤ SPACECRAFT INSTRUMENTATION
➤ RPV CONTROL & COMMUNICATIONS
➤ SECURE VIDEO TRANSMISSION
➤ GROUND STATION RECEPTION

F-22 RAPTOR

TTC RF PRODUCTS & SYSTEMS ARE USED TO RE-RADIATE THE WEAPON SYSTEM TELEMETRY WHEN IT IS SHIELDED BY CLOSED BAY DOORS. THE RTAS-2000 WAS DESIGNED SPECIFICALLY TO PROVIDE THIS RE-RADIANT CAPABILITY WITHIN CLOSED WEAPON BAYS.
**ELEMENTS OF RF TELEMETRY SYSTEMS**

**DATA SOURCE**

Data is measured at the edge of the data acquisition system. Data sources include video, ARINC, IEEE 1394, MIL-STD-1553 buses, accelerometers, strain gauges, pressure and temperature sensors. TTC data acquisition systems can accept data input from almost any single source and from large distributed source sets.

**TRANSMITTERS**

Telemetry transmitters (L, S, or C Band) send captured data to a ground or airborne receiver. TTC offers a full line of video and multimode transmitters at power output levels from 1 to 20 watts available with either video, analog or digital inputs at bit rates up to 20 Mbps. TTC transmitters are some of the smallest available and have been used in a variety of weapon applications. The new multimode transmitters offer PCM/FM, SOQPSK and Multi-H CPM modulation with a bandwidth efficiency improvement of two to one.

**TELEMETRY RECEIVERS/ BIT SYNCHRONIZERS/ DECOM**

Telemetry receivers are used to receive data from the airborne systems and convert it into digital information for ground processing. Fully-tunable receivers with bit synchronizers that are small enough to fit into a laptop. PCM/CIA card slot are available. Larger receiver cards designed to fit into a computer PCI card slot also include a PCM decommulator. PCI cards are available in PCM/FM or multimode (PCM/ FM & SOQPSK).

**DEMODULATORS**

Telemetry demodulators convert transmitted telemetry signals into clock and data that is used to report vehicle component status while under test. Various modulation transmission techniques are used to balance reliability, data rates and bandwidth. TTC demodulators are available to decode a wide variety of transmission techniques used for today’s ever increasing needs including 30 Mbps PCM/FM and 60 Mbps SOQPSK.

**DIVERSITY BRANCH SELECTOR**

The diversity branch selector is used to reduce errors in telemetry data caused by fading and multipath. Unlike optimal ratio combining, it is no longer necessary to perform complicated initial setup. Multiple antennas can be separated by up to hundreds of meters. Internal buffer alignment provides a nearly hitless data stream even under extreme conditions.

**GROUND STATION RECEIVER MULTI-DEMODULATOR, DIVERSITY BRANCH SELECTOR AND BIT SYNC**

Designed for maximum value, the MTGS Series offers a fully programmable dual receiver coupled with multi-demodulators with bit sync, minimizing rack space requirements while offering outstanding performance. Frequency, polarization and spatial diversity are provided as standard features.

**GROUNDS SUPPORT EQUIPMENT**

The GSE-2000 provides both L-band and S-band receivers, demod and control for the RTAS-2000 system. The unit provides a full loopback test capability for preflight checkout of the Re-Rad system.

**AIRBORNE SUBSYSTEM**

TTC creates the smallest telemetry subsystems on the market by combining an airborne data acquisition system with an airborne transmitter. These subsystems are flexible, easily reprogrammed and as accurate as a full-sized PCM encoding system. The PCM stack is configured and preset, resulting in an optimized transmission platform, that when combined with an auxiliary system, forms the basis for a Telemetry Instrumentation Kit (TIK).

**FLIGHT SAFETY**

Flight termination equipment is used by range safety personnel to protect the public during weapons testing. TTC’s programmable flight termination receiver allows the center frequency of the receiver and the IRIG tone set as specified in RCC-319 to be selected. TTC receivers are power efficient, work over a wide input voltage range and are packaged in a standard three-cubic-inch chassis. Radar transponders are used to provide range position information on a test vehicle. Three versions of a standard radar transponder that meet or exceed the RCC-262-02 requirements are available with outputs of 20, 50, 300 watts and 400 watt version is planned for a future release.

**TELEMETRY RE-RAD**

The RTAS-2000 uses TTC’s airborne, multi-mode technology to provide a full UHF command uplink and S-band to L-band telemetry for re-radiation capability during flight tests. The RTAS-3000 moves this Re-Rad from S-band to the new C-band (4.4 - 4.94 GHz).

**RE-RAD SYSTEM**

The RTAS-2000 uses TTC’s airborne, multi-mode technology to provide a full UHF command uplink and S-band to L-band telemetry for re-radiation capability during flight tests. The RTAS-3000 moves this Re-Rad from S-band to the new C-band (4.4 - 4.94 GHz).
FLIGHT TERMINATION RECEIVERS

The TTC Flight Termination Receiver is the most versatile tone-based receiver available. It contains a microcontroller that electronically controls the tuning of the center frequency over the range of a 420 to 450 MHz band. It also allows the user to set the receiver to three or four tones and define any tone set. These settings will be made prior to receiver certification but allow the receiver to be returned within its lower or upper range. Programming and receiver status is accomplished through an RS-232/485 input line and the receiver contains a serial telemetry output port that communicates a message containing all of the critical range safety parameters.

Suggested products

- FTR-100 (Range Qualified)
  Flight termination receiver
- FTR-200
  Ruggedized flight termination receiver
- EFTR-100
  Enhanced flight termination receiver

AIRBORNE TELEMETRY RECEIVERS

Airborne telemetry receivers by TTC are used for airborne telemetry links such as over-the-horizon telemetry support pods and aircraft monitor and support pods. The receivers can demodulate PCM/FM or SOQPSK and are used for data rates up to 20 Mbps. The receivers are fully programmable in center frequency over S or L band and IF bandwidth.

Suggested products

- TRS Series
  1-13 cubic inch telemetry receiver
- TRS-16XX Series
  4 cubic inch SOQPSK multi-mode telemetry receiver
RF PRODUCTS & SYSTEMS: SHORT CATALOG

RADAR TRANSPONDERS
TTC transponders are designed to be fully programmable in receive and transmit center frequency, pulse width, pulse spacing and in single or double pulse response. Programming is accomplished over an RS-232 interface using a TTC-provided GUI. TTC transponders are designed to be compliant with RCC-262 and are qualified to environmental levels that exceed those of most weapons, aircraft and targets. XFT-100 provides field test/verification capability for the XPDR products.

Suggested products
XPDR-21XX
Radar transponder, 20, 50 watts
XFT-1XX
Radar transponder test box

TELEMETRY TRANSMITTERS
TTC has a full line of telemetry transmitters for both L, S and C Band applications. Transmitters are available in PCM/FM, SOQPSK and video models. The transmitters can be programmed via an RS-232 interface to set center frequency. Transmitters are available in 2, 5, 10 and 20 watts output power.

Suggested products
TTS Series TX
0.5 Watts - 20 Watts
TTS-5500, 9600
Multimode transmitter
5-20 watts isolated/non-isolated

RF SYSTEMS PRODUCT LINE
The RF Systems of TTC was a pioneer in advanced telemetry waveforms and continues to bring the latest developments to the telemetering user. The Model 2120-502,-902 demodulators are available in PCM/FM, SOQPSK and ARTM CPM. The Model 2241, 2241-902 diversity branch selectors provide a nearly hitless data path in a spatially diverse post-detection selector. The MTGS-3000 ground station receiver is the most functionally complete ground-based receiver available. Multi-tier waveform generators can be used for testing and training. The series 5XXX modems provide convenient reuse of existing communication links.

Suggested products
Model 2120-502, -902
Demodulator
Model 2241, 2241-902
Diversity branch selector
MTGS-3000
Ground station receiver

XPDR-21XX
Radar transponder, 20, 50 watts
XFT-1XX
Radar transponder test box

PREdATOR
TTC RF PRODUCTS & SYSTEMS ARE USED TO PROVIDE TRACKING, FLIGHT CONTROL AND COMMANDED TERMINATION CAPABILITY ON VARIOUS UNMANNED VEHICLES.
TELEMETRY PC EXPANSION CARDS

TTC manufactures and supports several PC expansion cards for data acquisition systems and each card has functions specifically combined to optimize data acquisition and analysis. The RBDS-120 has PCM/FM receiver, bit synchronization, data decommutation, time code reader and simulation data regeneration functions and is designed for installation in a desktop PC for preflight or lab-based testing. The RMDS-500 combines the functions of a PCM/FM and SOQPSK receiver into a single full-size PCI Bus card. The card can be installed in a desktop PC for preflight or lab test.

Suggested products
- RBDS Series
  - PCM/FM receiver, bit sync, decom, simulator, time code
- RMDS Series
  - PCM/FM & SOQPSK

The DBS-120 is a low-cost PCMCIA Type II card that provides bit synchronization and data decommutation. The RCVR-105 combines the functions of an FM Telemetry Receiver and a PCM Bit Synchronizer and is installed in a portable PC-compatible platform for preflight or lab testing. The RCVR-105 receives and demodulates PCM/FM signals at L or S-band and is supplied by an external antenna or cable. The RCVR-210S provides PCM/FM or SOQPSK Telemetry reception and PCM data and clock recovery.

Suggested products
- DBS Series
  - PCMCIA card, bit sync, decom
- RCVR Series
  - PCM receiver, bit sync
  - PCM/FM or SOQPSK

MULTIMODE MODULATION

Shaped Offset Quadrature Phase Shift Keying, or SOQPSK, is a Tier I waveform defined by the Advanced Range Telemetry (ARTM) Program. ARTM is a program designed to improve the efficiency, reliability, utility, and availability of aeronautical telemetry spectrum for Department of Defense test and training ranges. Using the SOQPSK waveform, data is encoded in a way that allows the signal to be amplified through nonlinear amplifiers without the usual distortion caused by amplitude variation. The resulting signal carries twice the information as the traditional Tier 0 (PCM/FM) waveform commonly used in telemetering applications.

F-35 JOINT STRIKE FIGHTER

TTC RF PRODUCTS & SYSTEMS ARE USED TO PROVIDE TELEMETRY DOWNLINK ON TWO DATA LINKS AND A RE-RAD CAPABILITY ON THE F-35. THE TTS-9660-2 TRANSMITTER PROVIDES 20 WATTS OF RF POWER WITH MULTIMODE MODULATION, SERIAL AND PARALLEL PROGRAMMING FUNCTIONALITY.