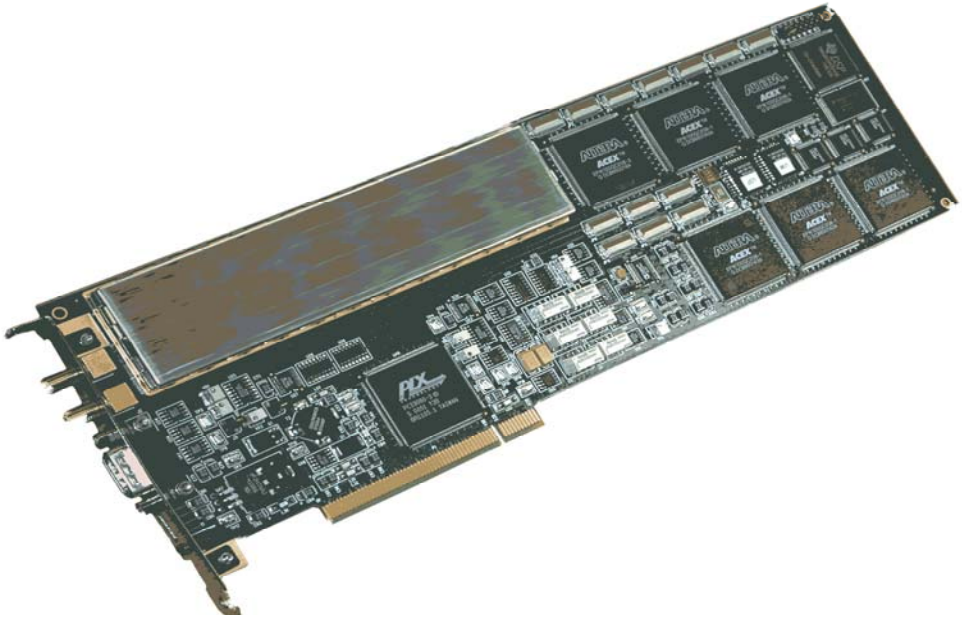
Technical Bulletin

PCI-2070

Digital Telemetry Receiver with Tracking



The PCI-2070 Telemetry Receiver is a fully programmable DSP (Digital Signal Processing) based Upper/Lower L and S band tracking receiver with on-board Multi-Mode Digital Demodulation designed around the PCI form factor. The DSP algorithms are implemented in state-of-the-art FPGAs (Field Programmable Gate Arrays) allowing for rapid enhancements or customization. Versions are available for single RF frequency or full RF coverage for Lower-L, Upper-L and S Bands.

Capable of accepting RF input signals from –10 dBm to –70 dBm, the PCI-2070 will receive the RF signal, condition, and digitally demodulate FM, FSK, PM, BPSK, QPSK, OQPSK data. The IF Bandwidth is programmable from 50 kHz to 30 MHz. The AFC (auto frequency control) tracking feature compensates for Doppler shift and other transmitter anomalies by using DSP algorithms to determine if the input spectrum is centered at the programmed center frequency. If the input spectrum is not symmetrical, the digital downconverter is automatically stepped to track the input frequency. Using these DSP algorithms and other programmable features make the PCI-2070 a key element of any Telemetry or Satellite Communications receiving system.

By using DSP based algorithms including Finite Impulse Response (FIR) filters, multi-stage recursive decimation filters, Modulated Numerically Controlled Oscillators (MNCO) and DSP implemented Phase-Locked Loops (PLL), the PCI-2070 has no need for calibration and tuning. User-friendly Windows based Graphic User Interface (GUI) software is supplied for easy product installation into a Windows based host computer system.

The RF input telemetry frequencies are downconverted to 70 MHz IF prior to digitizing. The final demodulation stage is received by a digital auto gain control circuit and a 14-bit digitizer. The demodulated output is available in both analog and digital formats. AGC testpoints are available from both the AGC detector level as well as the AGC AM signal. The output data is reconstructed using a programmable reconstruction filter, then normalized to user specified output levels and offsets. The digital data is available through a high speed 128 KB DualPort Memory circuit for direct storage to the host computer for FFT analysis.

L3 communications

FEATURES

- User friendly Windows 2000 and Windows XP based setup and operation
- FM, FSK, PM, BPSK, QPSK, OQPSK demodulators
- Programmable from 50 kHz – 30 MHz IF Data Bandwidth
- RF inputs of Upper/Lower-L and S Bands, signal or Tri-Band
- PCI form factor
- High Input Dynamic Range of –70 to –10 dBm for Standard IF
- High speed transfer of the output data to PCI bus for FFT analysis
- IF Tracking feature compensates for Doppler effect and other transmitter anomalies
- Analog reconstructed data is available on BNC connectors for easy user interface
- Fully programmable digital FIR output filter can be bypassed for higher PCM data rates
- User selectable output filter characteristics for analog or digital output data
- Digitally time synchronized sampled output data available for FFT analysis and direct capture capability
- 100 kHz Input Frequency Tuning Resolution
- AM and Level AGC testpoints available for antenna tracking on BNC outputs

SPECIFICATIONS

Input Specifications

• Input Frequency Range	Lower-Band 1429-1545 MHZ Upper L-Band 1700-1850 MHz S-Band 2185-2485 MHz
• IF Bandwidth	50 kHz to 30 MHz, programmable to 4 digital resolution
• Frequency Tunig Resolution	100 kHz steps
• IF Rejection	55 dB minimum > -60 dB typical
• Dynamic Range	-70 dBm to –10 dBm
• VSWR Ratio	2.0:1 maximum, 1.5:1 typical in band
• Noise Figure	10 dB, maximum
• Maximum Safe Input	+10 dBm
• PM Deviation Range	0.3 to 2.5 radians, programmable
• Demodulation Modes	FM/FSK/PM/BPSK/QPSK/OQPSK, selectable
• Locking Threshold	0 dB Eb/N0 (BPSK)
• Nominal Input Impedance	50 Ohms
• Spurious Rejection	50 dB
• AFC Tracking	± 500 kHz of programmed center frequency with 10 kHz frequency resolution
• AGC Time Constants	0.1 msec, 1.0 msec, 100 msec, or 1.0 sec, selectable
• AM AGC BNC Out	AC coupled AM AGC detector output, 50 kHz frequency response, 2 Vp-p for 50%
• AGC Level Detector BNC Out	DC coupled from 0 to –5 VDC for minimum to maximum RF attenuation

SPECIFICATIONS (Continued)

Physical Specifications

- PCI Form Factor — 32 bit PCI form factor, +5 Volt System
- Interface Connectors — 4 RF inputs/outputs: SMA connectors
  Analog Output: DB-15 BNC cable
  AGC Testpoints: DB-15 BNC cable
- Manufacturing — The design utilizes Surface Mount Technology (SMT), manufactured with robotic assembly techniques to IPC-610B Class 2 manufacturing standards
- Temperature Range: — Operating: 0°C to 50°C
  Storage: -20°C to 60°C
- Power Consumption — Less than 25 Watts total, for all supplies

Demodulator Specifications

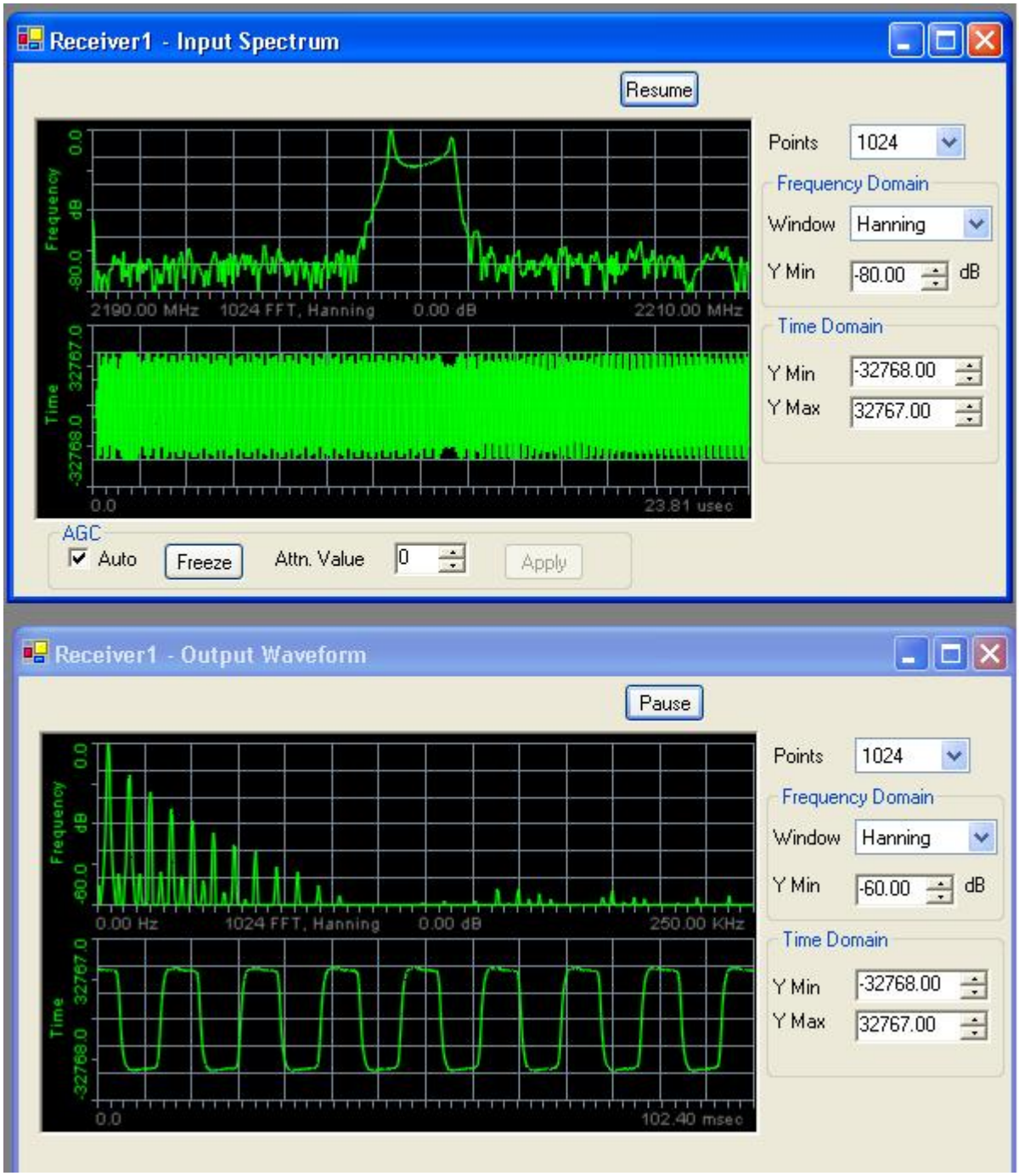
- Data Rates — 20 Mbits or 20 MHz max
- Output Linearity — Less than 1% of the programmed full deviation bandwidth measured from best 3 point straight line
- Output Harmonic Distortion — All FM harmonic terms are below –56 dB for deviation ratios of 2 and –60 dB for deviation ratios above 5
- Output Filtering Modes — ***Analog Linear Data Mode:*** The FIR filter is programmed to be flat within 0.1 dB in the programmed passband and –60 dB attenuation at two times the programmed cutoff frequency.

  Digital (PCM) Data Mode: The FIR filter is programmed to be monotonic in the passband with –3 dB attenuation at the programmed cutoff frequency and down –50 dB at 2.5 to 3.0 times the programmed cutoff frequency.

  Bypass Mode: The digital and analog reconstruction filters are bypassed for maximum digital data throughput. The data frequency throughput is equal to the programmed deviation filter frequency.
- Output Filter Range — Programmable from 1/256 to 1 times the IF Bandwidth, 4 digit resolution with a total range of 100 Hz to 20 MHz.
- Demod Analog Output Level — Programmable from 1.0 Vpp to 10.0 Vpp

Control Software and Spectrum Displays

Control software for operation on Windows 2000 Pro and XP Pro is included with the receiver at no extra cost. The GUI allows operators to monitor the IF spectrum and data output spectrum. Typical spectrums are shown in Figure 1 below.



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