MODULAR TELEMETRY RF, DATA RECEIVING AND PROCESSING ENGINE

Design and technology advancements have led to a greatly reduced footprint and weight for a fourth-generation telemetry processing station with increased power and flexibility

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Lumistar has completed engineering development and begun production of a modular fourth-generation digital product that has been primarily designed for applications in testing for fixed ground, mobile and airborne flight test applications.

The LS-28-DRSM series includes all the traditional functions of a full rack mount telemetry processing station in the approximate footprint of a handheld 3.5in PC hard drive. Standard capabilities include two independent digital multiband RF receiver channels, each supporting multiple digital demodulation formats, bit synchronization, forward error correction, data recording, decommutation, graphical displays, baseband data acquisition and Ethernet data distribution.

The flexibility of the design architecture enables adaptability to many other applications, including, for example, remote site spectrum monitoring, command verification receivers, and traditional data acquisition applications, all with minor modifications to the standard device’s factory-installed firmware personality.

Some of the primary design objectives of the LS-28-DRSM product line were to reduce the platform size, to provide an 'OS-less' environment by eliminating the use of commercial software operating systems for functional processing, to provide easy and flexible field upgrade/enhancements capabilities, and to provide a network appliance for device control and data transport.

A comparison with the previous generation Lumistar product line of similar capabilities illustrates the scope of the size, weight and power reduction achieved by...
Data acquisition, monitoring, and spectral and constellation displays with other data-quality indicators. Non-standard options include the addition of up to 64GB per channel data recording at the bit level and UDP data broadcasting of the received telemetry. The receiver can be configured to support Multisymbol PCM/FM, SOQPSK, GMSK, Analog FM Video with or without NTSC de-emphasis, BPSK, QPSK, QOQPSK, AUQPSK, PCM/PM, and Multi-H CPM. Data rates up to 60Mbps are supported. The unit is primarily controlled and monitored using a 1,000/100/10Mbps Ethernet interface with alternate controls being provided by USB and RS-232. Using available documentation from several sources, the customer can develop their own graphic user interface (GUI) or use the provided Lumistar network application.

Beyond excellent RF performance, at the heart of the modular design is a flexible and extensible multicore DSP Engine that can assume one of 12 ‘personalities’. The device construction is via four hardware ‘slices’: RF, IF, signal processing, and a control processing engine. The slices can be configured as a whole set or as a subset to perform targeted functionality.

Operational firmware loads, or ‘personalities’, are retained internally in the device for quick switching between operational requirements. New firmware personalities and/or control processing revisions are easily updated in the field. There is no need to return the unit for most modifications.

When configured as a traditional range telemetry receiver/combiner, the LS-28-DRSM can handle up to six frequency bands per channel from 70MHz to 7GHz. All standard RF receiver functions are provided, including antenna tracking using AM demodulation and AGC feedback, down conversion, diversity combining, multimode demodulation, bit synchronization, IQ video output, Eb/No monitoring, and spectral and constellation displays with other data-quality indicators.

“AT THE HEART OF THE MODULAR DESIGN IS A FLEXIBLE AND EXTENSIBLE MULTICORE DSP ENGINE THAT CAN ASSUME ONE OF 12 ‘PERSONALITIES’”
Data acquisition

The unit constantly performs maintenance monitoring of various environmental parameters and alerts the user to out-of-boundary conditions. The software logs the user settings and important receiver performance parameters as a function of time at up to a 10Hz rate.

If the user wants to convert from receiver mode to a dual-channel bit synchronizer personality, that change can be commanded via software. The unit will be converted to a dual-channel bit sync while the GUI is transformed for that operational mode. The bit sync function operates at 30Mbps and provides several options for PCM code conversion.

Remote Spectrum Monitoring

When configured for remote spectrum monitoring applications (Figure 2), each LS-28-DRSM RF section can be configured with 12 independent RF channels (six per channel x two channels) from 70MHz to 7GHz. Each channel is sampled in a 50MHz bandwidth at the second IF of the receiver, digitized, packetized and converted to the VITA-49 standard for transmission across the LAN. This enables a complete digital reconstruction via software of the RF signature at all remote sites that require 24/7 spectrum monitoring. Special software for this application will display each site’s spectrum in real time, archive the spectrum as a function of time, and provide for user-identified alarm conditions when certain preset limits are exceeded.

Signal Acquisition Network Appliance

The LS-28-DRSM provides the capability to decommutate data from any input source (RF, IF, baseband). The framed data is then broadcast via UDP packets. These packets can be brought in via the network auxiliary input of the Lumistar Data Processing Software (LDPS) suite of tools for real-time display, archive, playback and simulation of telemetry data.

The LS-28-DRSM is capable of handling many modern coding and digital link enhancement schemes, such as Viterbi, Reed-Solomon, LDPC, Space Time Coding and Adaptive Equalization. Each of these has its own special niche, applications and merits (as well as demerits) in modern telemetry flight testing and space telemetry applications.

Command Verification Receiver

The LS-28-DRSM can be configured to provide the functionality of a Command Verification Receiver. This is required for use in Command Destruct applications, where verification of the quality of the transmitted command signals is required. The unit can be configured to receive two channels of UHF command signals, typically between 350-450MHz. These signals contain up to four low-frequency FM modulated ‘tones’ in accordance with the IRIG 208 standard. The command receiver will demodulate the tones and provide discrete tone frequency values and deviation as per the standard’s requirements. The compliance of the tones is then displayed via software GUI. The software can be configured to provide alerts when the received tones are non-compliant.

Owing to the open-ended architecture of the LS-28-DRSM series product, many more personality applications are conceivable and achievable.

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