

RFS2000CSREDM - Microwave Receiver

Overview

Mid-Atlantic RF Systems, Inc. has developed a new RX system for a performance upgrade of an LCR100 Tuner/Receiver. The upgrade enables the LCR100 Tuner/Receiver to meet the relevant operating specifications of competitors' receivers at a reduced cost.

The performance upgrade improves the present design of the LCR100 Tuner/Receiver in two areas. The first area is a modification of the design configuration to provide a simultaneous 160 MHz IF output and a 1 GHz IF output.

The second area requires the addition of a low noise preamplifier, variable attenuator, and switched filter bank. Where available, COTS parts are utilized to implement these functions for the Engineering Development Model (EDM). The primary goal of the design effort is to provide a low cost alternative solution that meets the form, fit, and function of the receiver in the specific customer's application.



Electrical Specifications:

Input Frequency Range:	0.5 to 18 GHz
Noise Figure:	13 dB typ
Gain:	22 ± 2 dB
Image Rejection:	60 dB min
Input 1dB Compression Point:	-20 dBm min
LO Re-radiation:	-75 dBm typ
RF Attenuation:	0 to 70 dB, 10dB steps
IF BW:	500 MHz @ 1 GHz 100 MHz @ 160 MHz
Phase Noise @ 1 MHz Offset:	-100 dBc/Hz typ
Tuning Resolution:	1 MHz
Full Band Settling Time:	10 milliseconds
Group Delay Peak to Peak:	4 nanoseconds nominal @ 1 GHz Output over 80% of IF BW
Ext. Reference (optional):	10 MHz
AC Input:	115 VAC nominal 47 to 400 Hz 50W max

Mechanical Specifications:

Dimensions:	3.47"(3U) x 8.5" x 21" (excludes handles and connectors)
Connectors:	RF In – TNC (f) 1 GHz IF Out – SMA (f) 160 MHz IF Out – BNC (f) RS-422 / RS-232 – D-Sub, 9p, (f) AC In – MS3102A-10SL-3P

Environmental Specifications:

Temp, Operating:	0 to +50°C
Temp, Non-Operating:	-40°C to +85°C
Humidity:	30% – 80%, Non-condensing
Cooling:	Forced air, rear intake, Side and top exhaust

Design Approach

The main components of the LCR100 Tuner/Receiver are reconfigured into an arrangement more suitable to the requirements of the EDM. The Noise Figure, Image Rejection, and Lumped Attenuation requirements are accomplished with the addition of commercially available components. Minor redesign efforts were required in the synthesizer circuit to improve phase noise and manufacturability, as well as in the LO modules to phase lock all of the oscillators to a common reference source. An external reference clock option is available upon request.

The RFS2000CSREDM Tuner/Receiver circuitry is enclosed in a single, double-sided housing. The top half of the housing contains the RF and IF circuits while the bottom half contains the synthesizer and LO circuitry. This configuration provides the maximum isolation between circuit boards and minimizes RF leakage and cross talk between functions.

A separate RS-422/RS-232 control interface module translates the command set to the respective RFS2000CSREDM and also sends and receives controlling signals between the variable attenuator and switched filter bank. An Ethernet control option is also available upon request.

A COTS power supply provides the required DC voltages for the RFS2000CSREDM Tuner/Receiver and Front End components. The power supply operates with a nominal input voltage of 115 VAC from 50 to 400Hz.

General Description

The RFS2000CSREDM provides wide band frequency coverage from 0.5 to 18 GHz. The Tuner receives its controls from an RS-422/RS-232 interface. No manual controls are provided except for the power on/off switch. This control interface approach was application specific. The control signals for the RF hardware originate from the microprocessor board, which provides the variable synthesizer tuning controls, lumped attenuator control, switched filter bank and all remaining switch controls.

The RF input passes through a 70dB/10dB lumped attenuator. The operator can step the attenuator in 10dB steps from 0 to 70dB depending on the presence of strong signals. The next component in the cascade is the wideband Low Noise Amplifier. It sets the Noise Figure for the Tuner. The Low Noise Amplifier RF output connects to the seven-channel switched filter bank. The operator must select the desired filter in the filter bank. The filter bank provides pre-selection and Image Rejection for the desired signal.

The RF signal undergoes the first down conversion after passing through the switched filter bank. Two separate and parallel down conversion paths are provided. One for 0.5 to 6 GHz RF input signals and the second for 6 to 18 GHz RF input signals. The operator routes the first IF signal to the next down conversion stage by controlling a SPDT switch. The second stage mixer generates a 1 GHz IF signal. The operator selects between two fixed LO signals for the second mixer. The 1 GHz second IF signal is split into two paths. The first path ends at the rear connector panel 1 GHz output port. It provides the operator with a 500 MHz Bandwidth. The second path splits off to the third down conversion stage.

Options

External Reference

An external reference source option can be added to the RFS2000CSREDM to enable system synchronization. The external reference can be implemented in two ways. An automatic mode, which will utilize the external reference signal whenever the appropriate reference signal is applied to the external reference input connector. Or as switched mode, where that operator can switch between internal and external reference signals by setting a logic bit in the control interface input.

Other

Additional options (listed below) can be added to the RFS2000CSREDM to emulate features of other microwave receivers.

RFS2000CSREDM OPTIONS

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| 1) BITE (self-test) - | Power supply voltages
PLL Phase Lock Status
Internal Temperature |
| 2) Interface Control - | Ethernet, RS-232, RS-488 |
| 3) External Reference - | 10MHz External Reference for synthesizers |
| 4) RF Blanking - | Dual Polarity |
| 5) Selectable IF Frequency - | 70, 140, 160 |
| 6) Selectable IF Bandwidths - | Typical are 50, 85, 100. Narrow bandwidths available for 70MHz IF. |
| 7) Power Supply Input - | 90 to 260 VAC |