

Ensemble® RFM-4R2G-2T3G-KU

Configurable, low-latency, coherent 3U OpenVPX Rx/Tx module

- Multi-channel, highly configurable Rx/Tx module
- Coherent and spectrally pure for EW applications
- Kintex® UltraScale™ FPGA processing power
- Low-latency ADC and DAC performance
- Multi-channel/Multi-card synchronization
- Built-in IPMI controller



Mercury's Ensemble® RFM-4R2G-2T3G-KU is a versatile Open-VPX Rx/Tx module packaged in an efficient 3U form-factor. These modules are designed for use in ultra-low latency transceivers/DRFMs, GPS receivers and GPS AWGs (Arbitrary Waveform Generator) applications within the EW (EP and EA), ultra-wide-band comms and SAR domains. Each module delivers excellent spectral purity and efficiency, coherent multi-channel/board functionality and excellent LPOI (Low Probability Of Intercept) signal detection capability. The RFM-2R3G-2T3G-KU has the highest spectral efficiency available, blending performance, quick reaction time and processing power within the small 3U form-factor.

Performance of the RFM-4R2G-2T3G-KU is derived from its 12-bit TI (ADC12D2000RF) powered ADC frontend and the processing power of the Kintex UltraScale KU115 FPGA. Both elements represent the most contemporary technology available. The module's conversion characteristics are illustrated in Fig 1 (ADC/DAC performance plots). This level of performance is achieved by ideally pairing the backend digital/analog conversion to the frontend analog/digital conversion, achieving an optimized balance of detection, speed and latency performance. This performance profile is especially suited to EW applications.

Within the domain of EW, it is often difficult to discern small signals within a cluttered environment, continually over a wide bandwidth (e.g. 1 GHz IBW). Discerning the signal of interest and then transmitting an accurate response to the threat compounds the challenge. Best solutions to this type of application require exceptional frontend precision, over a wide, instantaneous bandwidth and the fastest responses. The Ensemble RFM-4R2G-2T3G-KU is engineered to meet these needs which are illustrated by the plot shown in Fig 2 (performance Vs reaction time).

Ensemble RFM-4R2G-2T3G transceivers have configurable ADCs which may be arranged as four units, each with up to 2.0 GSPS (Giga Samples Per Second) in non-DES mode (Dual Edge Sampling). Alternatively, the ADCs may be configured as two interleaved units with up to 3.0 GSPS/ea. (4 GSPS uncharacterized), both operating in DES mode. Each Ensemble RFM-4R2G-2T3G-KU has two, low-latency DACs, each running up to 3.0 GSPS with selectable output modes (return to zero, non-return to zero, narrow return to zero, RF).

The Ensemble RFM-4R2G-2T3G-KU is driven by a powerful Kintex UltraScale FPGA that is supported by 4GB of external DDR4 memory. The KU115 maximizes bandwidth on/off card by way of two x8 full-duplex MGT links on P1 (one defaults to PCIe Gen3 x8) and 32 LVDS pairs on P2 for synchronous, low-latency communications. RFM-4R2G-2T3G-KUs are equipped with an IPMI (Intelligent Platform Management Interface) controller and are available in reliable, compact, rugged air- or conduction cooled 3U OpenVPX packages.

Mercury Systems is the better alternative for affordable, secure processing subsystems designed and made in the USA. These capabilities make us the first commercially based defense electronics company built to meet rapidly evolving next-generation defense challenges.



ACQUIRE



DIGITIZE



PROCESS



STORAGE

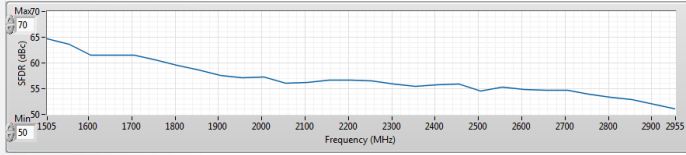


EXPLOIT

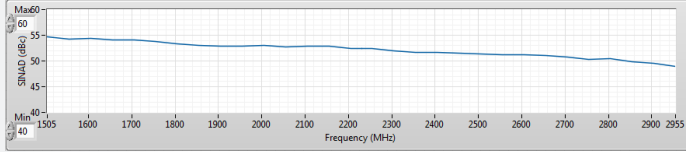


DIGITIZE

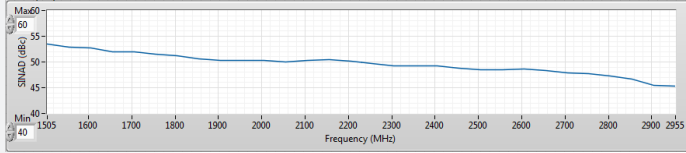
ADC 1 SFDR (dBc)



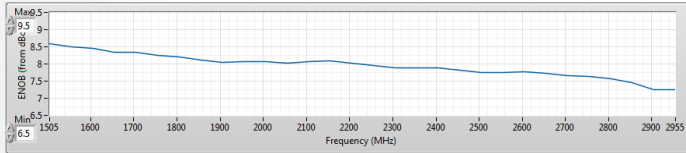
ADC 1 SNR (dBc)



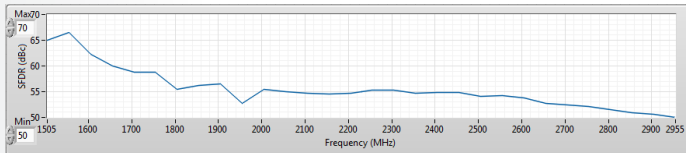
ADC 1 SINAD (dBc)



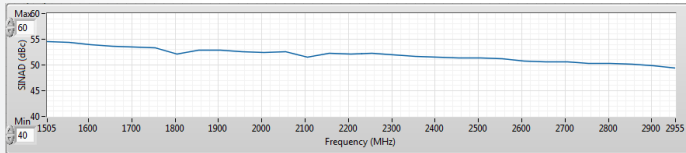
ADC 1 ENOB (from dBc)



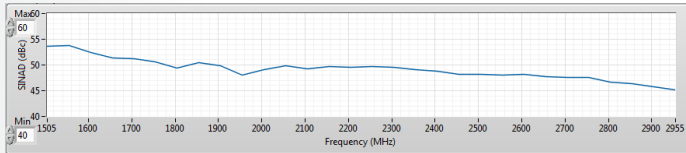
ADC 2 SFDR (dBc)



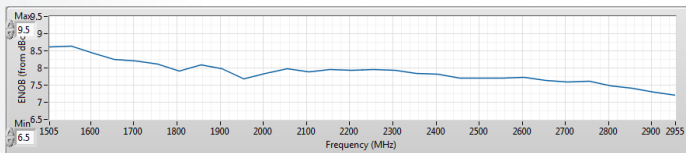
ADC 2 SNR (dBc)



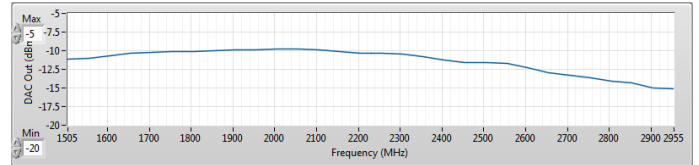
ADC 2 SINAD (dBc)



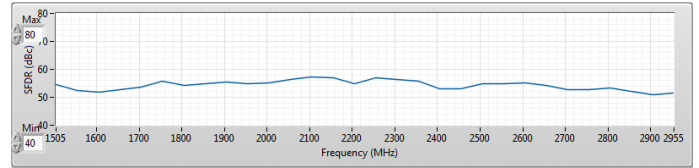
ADC 2 ENOB (from dBc)



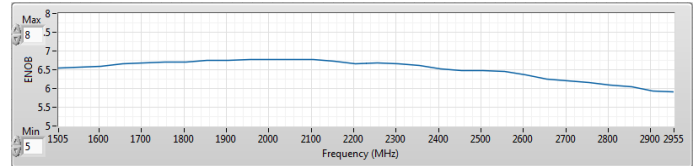
DAC 1 Out Level



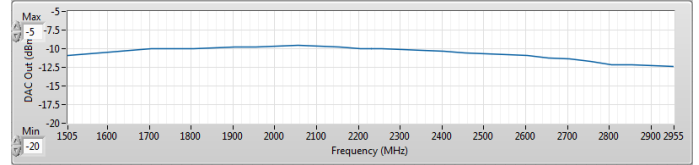
DAC 1 SFDR



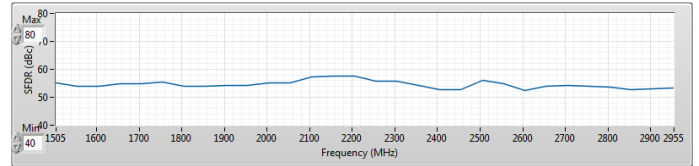
DAC 2 ENOB (based on SINAD_dBc)



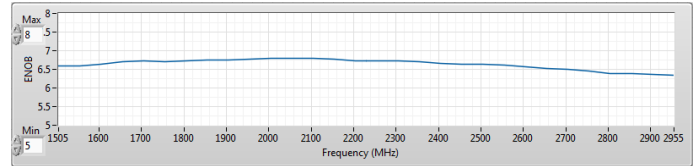
DAC 2 Out Level



DAC 2 SFDR



DAC 2 ENOB (based on SINAD_dBc)



ADCs and DACs are encoding at an effective sample rate of 3GSPS.

Data is plotted in the 2nd Nyquist Zone in all cases.

ADC1 and ADC 2 are in DESI mode.

DAC & DAC 2 are in RF mode.

Figure 1. ADC/DAC performance plots

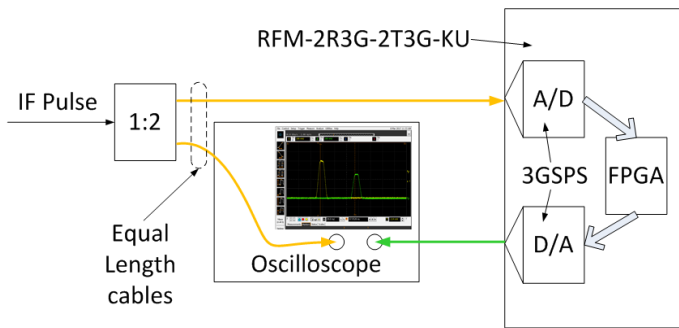
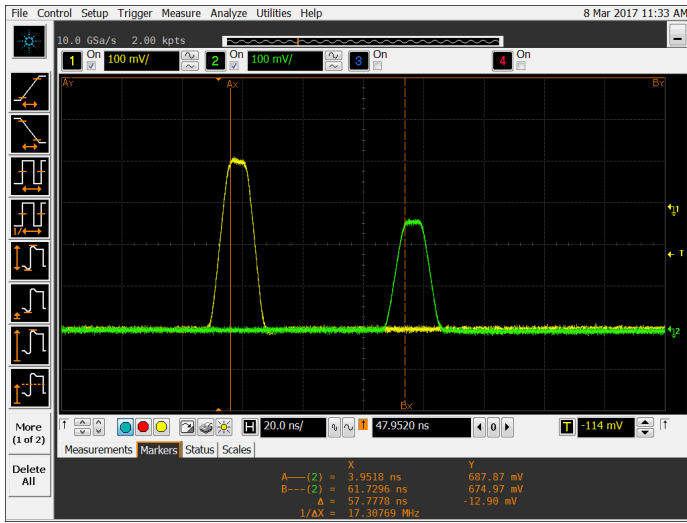


Figure 2. Performance Vs reaction time and equipment setup

EchoCore™ Advantage

EchoCore firmware streamlines the development of FPGA-based applications. These cores are optimized to maximum performance for a range of common operations. They are designed with straightforward interfaces for application-specific algorithm IP, greatly reducing the time required to create complete solutions.

Mercury's OpenVPX Ecosystem

Sensor processing chain awareness, building blocks and ecosystem sensor chain awareness is having the technical expertise and resources to design and build capable, compatible solutions along the whole sensor processor chain. From RF/microwave, digital/analog signal manipulation to dense, SWaP optimized processing resources to actionable intelligence dissemination; Mercury's rugged processing subassemblies leverage the best commercial-item technology, enabling prime contractors to win more business. Modern sensor processing subassemblies are customized assemblies of interoperable building blocks built to open standard architectures. Mercury's hardware and software portfolio of building blocks are physically and electrically interoperable as defined by international industrial standards, including OpenVPX.

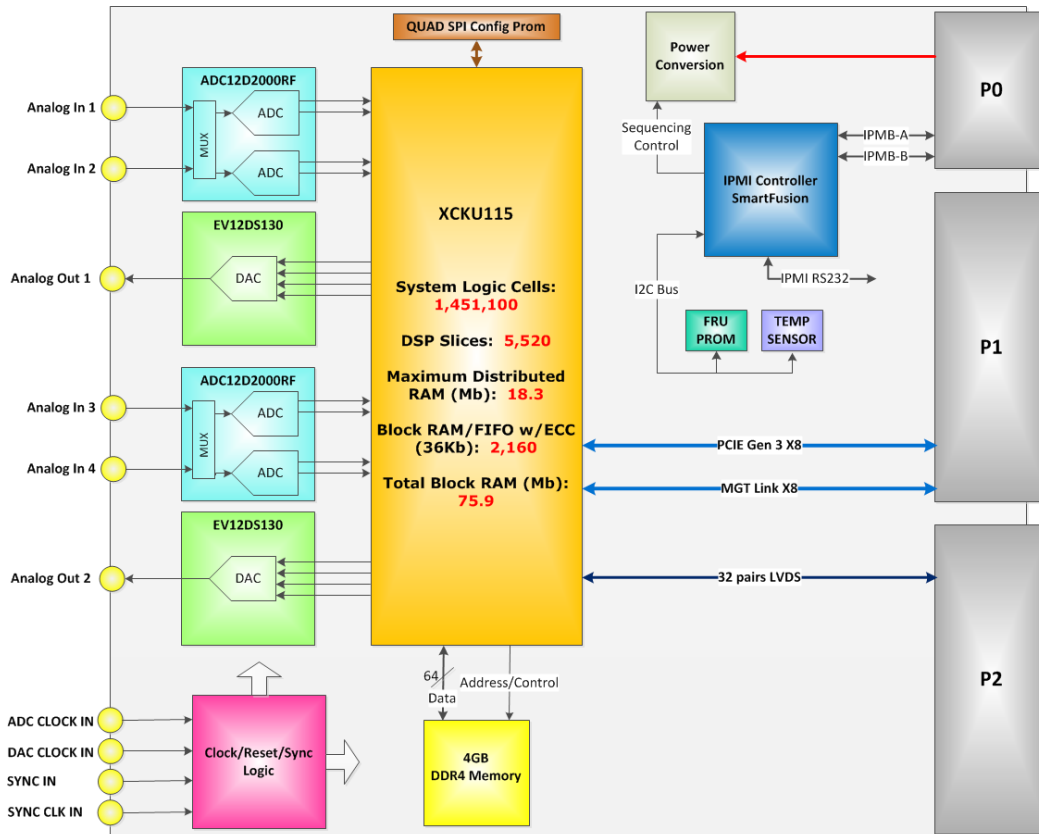


Figure 3. RFM-4R2G-2T3G-KU functional block diagram

Specifications

OpenVPX packaging

OpenVPX System Standard (VITA 65) encompasses:
VITA 46.0, 46.3, 46.4, 46.6, 46.11, and VITA 48.1, 48.2 (REDI)

Processor

Kintex Ultrascale KU115 FPGA
5,520 DSP slices
PCIe Gen 3 x8 to P1
MGT x8 to P1

Memory

4GB DDR4 (512M x 64)

DACs

2 DACs up to 3.0 GSPS
Selectable output modes (Return to zero, non return to zero, narrow return to zero and RF)

Optional ADC configurations

4 single ADCs up to 2.0 GSPS/ea. (in non-dual edge sampling mode)
2 interleaved ADCs each up to 3.0 GSPS/ea. (in dual edge sampling mode)

Other

Integrated IPMI controller

Environmental

		Environmental Qualification Levels		
		Air-cooled		Conduction-cooled
		Commercial L0	Rugged L1	Rugged L3
Ruggedness		•	••	•••
Moisture/dust protection		•	••	•••
Typical cooling performance		~140W*	~140W*	~150W**
Temperature	Operating*	0°C to +40°C	-25°C to +55°C	-40°C to +71°C
Operating temperature maximum rate of change		N/A	5°C/min	10°C/min
Temperature	Storage	-40°C to +85°C	-55°C to +85°C	-55°C to +125°C
Humidity	Operating*	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing, 100% condensing
	Storage	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing, 100% condensing
Altitude	Operating*	0-10,000ft	0-30,000ft	0-70,000ft
	Storage	0-30,000ft	0-50,000ft	0-70,000ft
Vibration	Random	0.003 g2/Hz; 20-2000 Hz, 1 hr/axis	0.04 g2/Hz; 20-2000 Hz, 1 hr/axis	0.1 g2/Hz; 5-2000 Hz, 1 hr/axis
	Sine	N/A	N/A	10G peak; 5-2000 Hz, 1 hr/axis
	Shock	z-axis: 20g; x and y-axes: 32g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)
Salt/Fog		N/A	Contact Factory	10% NaCl
VITA 47		Contact Factory		

* Customer must maintain required cfm level. Consult factory for the required flow rates.

** Card edge should be maintained below 71°C

Storage Temperature is defined per MIL-STD-810F, Method 502.4, para 4.5.2, where the product under non-operational test is brought to an initial high temperature cycle to remove moisture. Then the unit under non-operational test will be brought to the low storage temperature. The low temperature test is maintained for 2 hours. The product is then brought to the high storage temperature and is maintained for 2 hours. The product is then brought back to ambient temperature. All temperature transitions are at a maximum rate of 10°C/min. One cold/hot cycle constitutes the complete non-operational storage temperature test. This assumes that the board level products are individually packaged in accordance with ASTM-D-3951 approved storage containers. These tests are not performed in Mercury shipping containers, but in an unrestrained condition. Please consult the factory if you would like additional test details.

All products manufactured by Mercury meet elements of the following specifications: MIL-STD-454, MIL-STD-883, MIL-HDBK-217F, and MIL-I-46058 or IPC-CC-830, and various IPC standards. Mercury's inspection system has been certified in accordance with MIL-I-45208A.

WARNING: "600 Series" and/or National Security Controls - These commodities, technology, or software are controlled for export from the United States in accordance with the Export Administration Act of 1979 as amended (Title 50 U.S.C.; App. 2401, et seq.), through the Export Administration Regulations (EAR). Transfers to foreign persons requires prior approval from the U.S. Department of Commerce, Bureau of Industry and Security.

Ensemble is a registered trademark and EchoCore, Innovation That Matters and Mercury Systems are trademarks of Mercury Systems, Inc. Other product and company names mentioned may be trademarks and/or registered trademarks of their respective holders. Mercury Systems, Inc. believes this information is accurate as of its publication date and is not responsible for any inadvertent errors. The information contained herein is subject to change without notice.

Copyright © 2017 Mercury Systems, Inc.

3290.00E-0317-ds-EPS3u



CORPORATE HEADQUARTERS

50 Minuteman Road
Andover, MA 01810 USA
(978) 967-1401 • (866) 627-6951
Fax (978) 256-3599
www.mrcy.com

EUROPE MERCURY SYSTEMS, LTD.

Unit 1 - Easter Park, Benyon Road
Silchester, Reading
RG7 2PQ United Kingdom
+ 44 0 1189 702050 • Fax + 44 0 1189 702321
www.mrcy.com

INNOVATION THAT MATTERS™



MSI Number MSI-17-014117-01