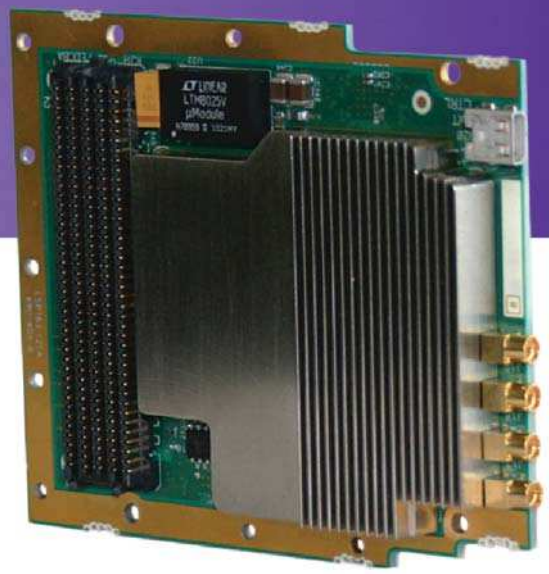
Nutaq
Radio421x

FDD LTE FMC RF transceiver

PRODUCT SHEET



RoHS

FMC

VITA
Open Standards, Open Markets

Nutaq® Wireless

QUEBEC | MONTREAL | NEW YORK | nutaq.com

Nutaq **Radio421x**

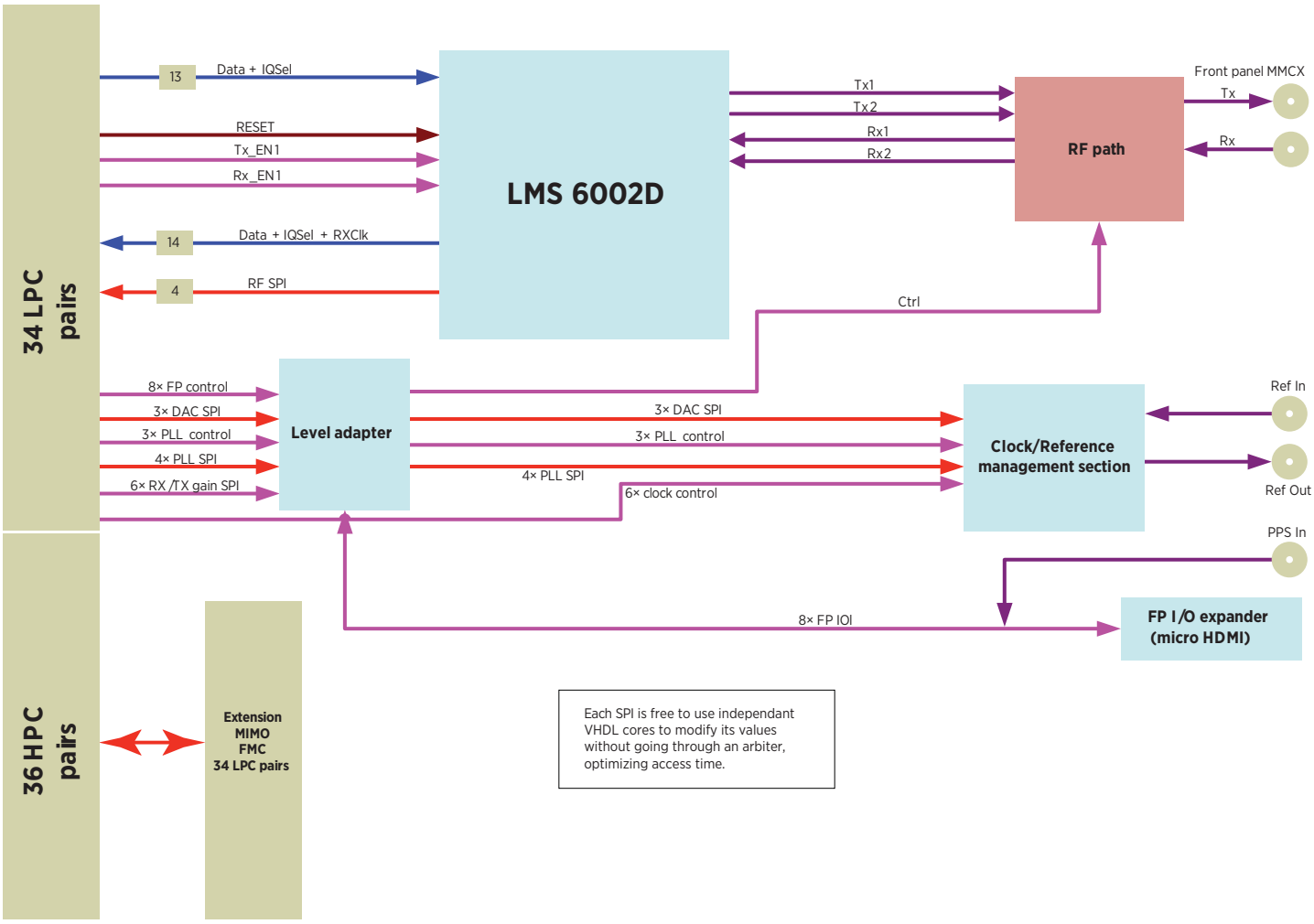
- **SISO, quad-band and 2×2 MIMO RF transceivers**
- **Supports one low and one high bands per TRX**
- **Selectable bandwidth — 1.5–28 MHz**
- **Multiple reference configurations and expansion modes**
- **Individually shielded RX and TX analog paths**
- **VITA 57.1 FMC — LPC one transceiver, HPC two transceiver**

The Radio421X FPGA mezzanine card (FMC) is a powerful LTE RF transceiver module designed around the state-of-the-art, multistandard, multiband Lime Microsystems LMS6002D RF transceiver IC, which supports broadband coverage, as well as TDD and FDD full duplex modes of operation.

The LMS6002D RF transceiver IC's bandwidth (1.5–28 MHz), selectable on-the-fly, makes it suitable for a large number of narrowband and broadband applications with excellent channel selectivity. Combined with multiple references and synchronization modes, the Radio421X is right at home in such applications in advanced long-term evolution telecommunications applications (MIMO and SISO systems).

The Radio421X complies with VITA 57.1, a widely used standard in the digital signal processing industry, making it easier for developers to integrate FPGAs into embedded system designs.

The Radio421X is also completely integrated to the Nutaq µTCA Perseus AMCs, but it can as easily be used on any FMC carrier on the market. It is compatible with low-pin-count (one RF transceiver) and high-pin-count (two RF transceivers) FMC interfaces.



HARDWARE ARCHITECTURE

The VITA 57.1 standard comes to the rescue of complex designs with its unprecedented mechanical and electrical flexibility. It offers standard specifications for small, mezzanine modules designed to adapt an FPGA-based carrier card to different I/O requirements.

FEATURES

Radio421X feature:

Radio421X-A

- Low band: LTE band II
  - Uplink: 824–849 MHz
  - Downlink: 869–894 MHz
- High band: LTE band V
  - Uplink: 1850.5–1909.5 MHz
  - Downlink: 1850.0–1910.0 MHz

Other Radio421X will support different bands. Information available upon request.

COMMON FEATURES

- 1.5–28 MHz programmable modulation bandwidth
- FMC LPC — one RF transceiver
- FMC HPC — two RF transceivers. See specifications for details.
- Maximum 27 dBm output power
- TBD dBm input sensitivity
- Over 80 dB software-programmable RX/TX analog dynamic range
- One antenna per band (low/high)
- One wideband input to listen to the network/ready for predistortion
- Selectable reference input — onboard, front panel, or FMC driven
- Reference output on front panel for synchronized multiboard/multichannel [MIMO] applications
- Equipped with an onboard, low-jitter reference clock, cross-point switch, and synchronization PLL
- Front panel I/O expander for external control (such as interfacing to an external TX PA)
- Shielded for noise immunity

ANALOG RF PATHS

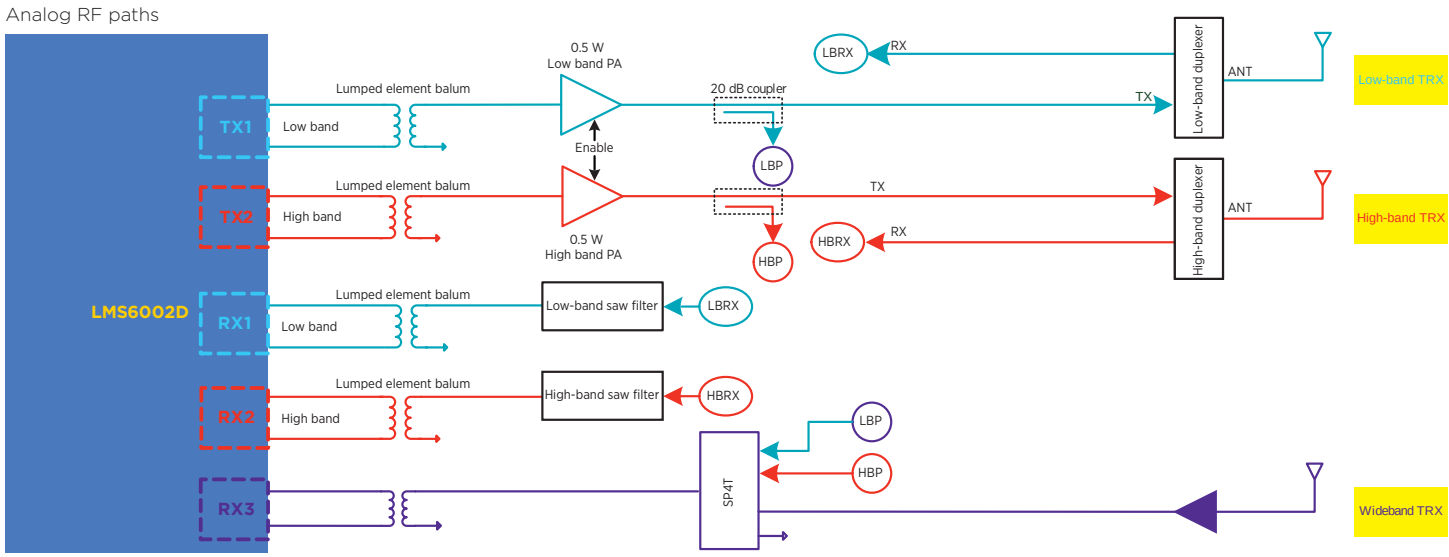
The Radio421X's RX and TX analog paths are designed to offer the best versatility-to-performance ratio, addressing the high demands of LTE RF applications.

Two independent transceiver chains offer the best matching to cover low and high LTE bands. At the end of each transceiver, a dedicated power amplifier supplies up to 27 dBm of RF power.

At the receivers, the duplexer sends the RF to a band filter where it is output directly to the corresponding receiver section. Each section is equipped with an LNA, VGAs, and a mixer to supply the necessary baseband signal to the A/D converters.

At the third input, a duplexer also offers access to the antenna and a coupler allows the wideband receiver to listen to the PA output for calibration and predistortion.

Analog RF paths



CLOCK MANAGEMENT FACILITY

The Radio421X's clock management facility is designed around the CDCE62005 from Texas Instruments, which offers low-phase-noise clock distribution, a PLL core, dividers, dual VCOs, and a jitter cleaner feature. Combining the clock management facility to a very-low-jitter, 4×4 crosspoint switch makes it possible to generate a variety of clocks necessary to the Radio421X. The reference clock can be generated on the FMC, through its carrier or through the front panel external reference input. The selected reference clock is available on the front-panel reference output and is supplied to the FMC carrier.

A PPS signal can also be sent to the carrier's FPGA to dynamically adjust the Radio421X's onboard VCXO through a programmable DAC — something especially useful when a GPS-disciplined clock is needed to drive reference clocks. For details about the GPS-disciplined FPGA core, contact Nutaq at info@nutaq.com.

While the Radio421X natively supports 2×2 MIMO (Radio421M), feeding a common reference clock to several units makes it possible to expand to 4×4 and beyond.

SISO AND 2X2 MIMO CONFIGURATIONS

The Radio421S (S for SISO) is an LPC FMC that complies with all the electrical and mechanical specifications of VITA 57.1, making it possible to use on any FMC-LPC compliant carrier on the market. On Nutaq's Perseus AMC, it fits in a mid-size QTCA slot.

In 2×2 MIMO mode, a Radio421S and Radio421E—a Radio421S HPC with an LPC on top—are stacked to become the Radio421M (M for MIMO). The Radio421M complies with all the electrical specifications of VITA 57.1, but the height of the module fails to comply with the mechanical specifications. An additional 10 mm in height must therefore be allotted when using the Radio421M on an FMC HPC carrier other than Nutaq's Perseus AMC. On the Perseus, it fits in a full-size µTCA slot.

PERFORMANCES

Transmitter

- Maximum output (typical): 27 dBm

SPECIFICATIONS

General

Contact Nutaq for other bands.

Radio421X-A

- LTE band II
  - Uplink: 824–849 MHz
  - Downlink: 869–894 MHz
- LTE band V
  - Uplink: 1850.5–1909.5 MHz
  - Downlink: 1850.0–1910.0 MHz

Common

- Number of channels: 1
- Channel resolution: 12 bits
- Input voltage range: 1 V_{pp}

Referecence clock

- Tunable, 30.72 MHz, temperature-compensated oscillator

Programmable modulation bandwidths

- 1.50 MHz
- 1.75 MHz
- 2.50 MHz
- 2.75 MHz
- 3.00 MHz
- 3.84 MHz
- 5.00 MHz
- 5.50 MHz
- 6.00 MHz
- 7.00 MHz
- 8.75 MHz
- 10.00 MHz
- 12.00 MHz
- 14.00 MHz
- 20.00 MHz
- 28.00 MHz

Nutaq **Radio421x**

FMC connectivity

Radio421S

- Low-pin-count connector
  - LA (00–31)
  - CLK0 (required), CLK1 (optional): M2C clocks

Radio421E

- Low-pin-count connector
  - LA (00–31)
  - CLK0 (required), CLK1 (optional): M2C clocks
- High-pin-count connector
  - LA (00–31), HA (00–18), HB (00–14)
  - CLK0 (required), CLK1 (optional): M2C clocks
  - CLK2, CLK3 (both optional): C2M clocks

Radio421M

- High-pin-count connector
  - LA (00–31), HA (00–18), HB (00–14)
  - CLK0 (required), CLK1 (optional): M2C clocks
  - CLK2, CLK3 (both optional): C2M clocks

Front panel MMCX connectors

Radio421S and Radio421E

- Low-band TX/RX
- High-band TX/RX
- Wideband RX
- External reference input
- External reference output
- PPS input
- Micro-HDMI (8-bit, LVCMOS user I/O)

Radio421M

- Double the Radio421S I/Os

Mechanical

Rugged FMC form factor — designed for conduction cooling, but not tested or implemented.
Contact Nutaq at info@nutaq.com for details.

Radio421S

- Dimensions (W×H×D): 69 mm × 10 mm × 84 mm
- Mass: 80 g

Radio421E

- Dimensions (W×H×D): 69 mm × 15.4 mm × 84 mm
- Mass: 90 g

Radio421M

- Dimensions (W×H×D): 69 mm × 20 mm × 84 mm
- Mass: 170 g

Standards compliance

Radio421S

- VITA 57.1

Radio421E

- VITA 57.1 electrical specifications
- Out of mechanical specifications by H=5.4 mm

Radio421M

- VITA 57.1 electrical specifications
- Out of mechanical specifications by H=10 mm

Electrical

- 12 V
- 3.3 V
- V_{adj} to 2.5 V necessary to power Radio421X ICs

Power consumption

- TBD W on 12 V
- TBD W on V_{adj} (2.5 V)
- TBD W on 3.3 V MP

Nutaq products are constantly being improved; therefore, Nutaq reserves itself the right to modify the information herein at any time and without notice. The FMC logo is a trademark of VITA.

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