

# E320

## Contents

- 1 Device Overview
- 2 Key Features
  - ◆ 2.1 E320
- 3 RF Specifications
  - ◆ 3.1 RF Performance
  - ◆ 3.2 Input Power Levels
- 4 Hardware Specifications
  - ◆ 4.1 E320
- 5 Physical Specifications
  - ◆ 5.1 Dimensions
    - ◇ 5.1.1 E320 board-only with heatsink
    - ◇ 5.1.2 E320 Full enclosure
  - ◆ 5.2 Weight
    - ◇ 5.2.1 E320 board-only with heatsink
    - ◇ 5.2.2 E320 Full enclosure
  - ◆ 5.3 Drawings
    - ◇ 5.3.1 E320
    - ◇ 5.3.2 E320 Enclosure
  - ◆ 5.4 CAD/STP Models
    - ◇ 5.4.1 E320
    - ◇ 5.4.2 E320 Enclosure
- 6 Environmental Specifications
  - ◆ 6.1 Operating Temperature Range
  - ◆ 6.2 Non-Operating Temperature Range
  - ◆ 6.3 Operating Humidity Range
  - ◆ 6.4 Non-Operating Humidity Range
- 7 Schematics
- 8 GPSDO
  - ◆ 8.1 Sensors
  - ◆ 8.2 Specifications
  - ◆ 8.3 Datasheet
- 9 Frontend Specifications
  - ◆ 9.1 Tuning
  - ◆ 9.2 Gains
- 10 Interfaces and Connectivity
  - ◆ 10.1 Front Panel
  - ◆ 10.2 Rear Panel
  - ◆ 10.3 Power Connector
    - ◇ 10.3.1 Pin Detail
- 11 Guidance on SFP+ Adapters for Fiber Connectivity on USRP E320
  - ◆ 11.1 Known-Good Adapters
  - ◆ 11.2 Known-Good Cables
- 12 Guidance on 10Gb SFP+ to RJ45 Adapters
  - ◆ 12.1 Known-Good Adapters
- 13 Certifications
  - ◆ 13.1 RoHS
  - ◆ 13.2 China RoHS
- 14 Certificate of Volatility

The USRP E320 brings performance to embedded software defined radios by offering four times more FPGA resources compared to the USRP E31x devices. The USRP E320 also introduces improvements in streaming, synchronization, integration, fault-recovery, and remote management capability. This field deployable SDR continues to use the flexible 2x2 MIMO AD9361 transceiver from Analog Devices, which covers frequencies from 70 MHz ? 6 GHz and provides up to 56 MHz of instantaneous bandwidth.

- Xilinx Zynq 7045 SoC
  - ◆ 7 Series FPGA with 2GB DDR3 RAM
  - ◆ ARM Cortex A9 800 MHz dual-core processor
- Analog Devices AD9361 RFIC direct-conversion transceiver
- Frequency range: 70 MHz - 6 GHz
- Up to 56 MHz of instantaneous bandwidth
- 2x2 MIMO transceiver
- Up to 10 MS/s sample data transfer rate to ARM processor
- Up to 61.44 MS/s sample data transfer to host (10Gb/SFP+)
- RX, TX filter banks
- Integrated GPSDO
- 9-axis inertial measurement unit
- RF Network on Chip (RFNoC?) FPGA



development framework  
support

- Board-only and Full Enclosure Options

- Power Output >10dBm
- IIP3 (@ typical NF) -20dBm
- Typical Receive Noise Figure <8dB

- The maximum input power for the E320 is -15 dBm.

- Ettus Research recommends to always use the latest stable version of UHD
- UHD version on the host computer must match what is running on the E320

- Current Hardware Revision: 1
- Minimum version of UHD required: 3.14.0.0

- 173 x 100 x 36 mm

- 175 x 106 x 38 mm

- 0.16 kg

- 0.86 kg

- Board only

- Enclosure

- Board only

- Enclosure

- 0-45 °C

- -40-85 °C

- 10% to 90% non-condensing

- 5% to 95% non-condensing

- E320: [File:Neon Public.pdf](#)

- Support GPSDO NMEA Strings

You can query the lock status with the `gps_locked` sensor, as well as obtain raw NMEA sentences using the `gps_gprmc`, and `gps_gpgga` sensors. Location information can be parsed out of the `gps_gpgga` sensor by using `gpsd` or another NMEA parser.

#### Module Specifications

1 PPS Timing Accuracy from GPS receiver	<8ns to UTC RMS (1-Sigma) GPS Locked
Holdover Stability (1 week with GPS)	<±50us over 3 Hour Period @+25°C (No Motion, No Airflow)
1 PPS Output	3.3VDC CMOS
Serial Port	TTL Level, GPS NMEA Output with 1Hz or 5Hz update rate, Integrated into UHD
GPS Frequency	L1, C/A 1574MHz
GPS Antenna	Active (3V compatible) or Passive (0dB to +30dB gain)
	65 Channels, QZSS, SBAS WAAS, EGNOS, MSAS capable
GPS Receiver	Supports Position and Hold over-determined clock mode
Sensitivity	Acquisition -148dBm, Tracking -165dBm

TTFF	Cold Start: <32 sec, Warm Start: 1 sec, Hot Start: 1 sec
ADEV	10s: <7E-011
Warm Up Time / Stabilization Time	10Ks: <2E-012 (GPS Locked, 25°C, no motion, no airflow)
Supply Voltage (Vdd)	<10 min at +25C to 1E-09 Accuracy
Power Consumption	3.3V Single-Supply, +0.2V/-0.15V
Operating Temperature	<0.16W
Storage Temperature	-10°C to +70°C
	-45C to 85C

#### Oscillator Specifications (internal)

Frequency	20MHz CMOS 3Vpp
Output of crystal	20MHz
Phase Noise	20MHz After 1 Hour @ 25°C
Crystal	20MHz without GPS
RF	20MHz
Output Amplitude	0Vpp CMOS
Frequency	20MHz
Phase	Phase
Jitter	Jitter 135ps rms
(100Hz to 10MHz)	(100Hz to 10MHz)
Frequency Stability	Frequency Stability
Over Temperature	Over 100m (internal TCXO)
without GPS	without GPS
(0°C to +60°C)	(0°C to +60°C)
Warm Up Time	Warm Up 1 min at +25C
1Hz	-65 dBc/Hz
Phase Noise at 100Hz	-97 dBc/Hz
20MHz	-116 dBc/Hz
10kHz	-136 dBc/Hz
100 kHz	-148 dBc/Hz
	-155 dBc/Hz

- Spec Sheet: [http://www.jackson-labs.com/assets/uploads/main/LTE-Lite\\_specsheet\\_20MHz.pdf](http://www.jackson-labs.com/assets/uploads/main/LTE-Lite_specsheet_20MHz.pdf)
- User Manual: <http://www.jackson-labs.com/assets/uploads/main/LTE-Lite.pdf>

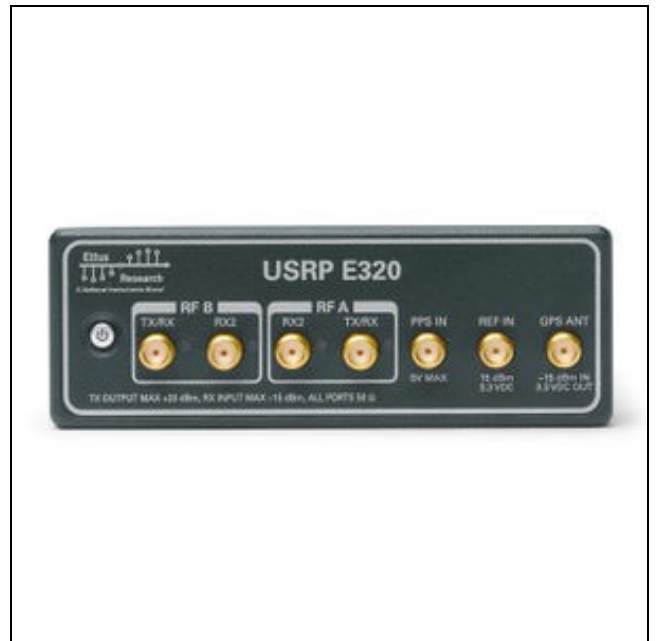
The RF frontend has individually tunable receive and transmit chains. Both transmit and receive can be used in a MIMO configuration. For the MIMO case, both receive frontends share the RX LO, and both transmit frontends share the TX LO. Each LO is tunable between 50 MHz and 6 GHz.

All frontends have individual analog gain controls. The receive frontends have 76 dB of available gain; and the transmit frontends have 89.8 dB of available gain. Gain settings are application specific, but it is recommended that users consider using at least half of the available gain to get reasonable dynamic range.

- RJ45 (1 GbE)
- SFP+ (1/10 GbE, *Aurora*)
- Type A USB Host
- Micro-USB (serial console, JTAG)
- GPIO
- Integrated GPSDO
- 9-axis IMU

- **PWR:** Power button
- **RF A Group**
  - ♦ **TX/RX LED:** Indicates that data is streaming on the TX/RX channel on frontend side A
  - ♦ **RX2 LED:** Indicates that data is streaming on the RX2 channel on frontend side A
- **RF B Group**
  - ♦ **TX/RX LED:** Indicates that data is streaming on the TX/RX channel on frontend B
  - ♦ **RX2 LED:** Indicates that data is streaming on the RX2 channel on frontend B
- **PPS IN:** Input port for external PPS signal
- **REF IN:** Input port for external 10 MHz signal

- **GPS ANT:** Connection for the GPS antenna



- **POWER:** 10-14v DC Power connector
- **GPIO:** Mini-HDMI connector for GPIO
- **USB:** USB 2.0 Port
- **1G ETH:** RJ45 port for remote management
- **SFP+:** SFP+ connection for sample streaming
- **CONSOLE JTAG:** Micro USB connection for serial UART/JTAG console

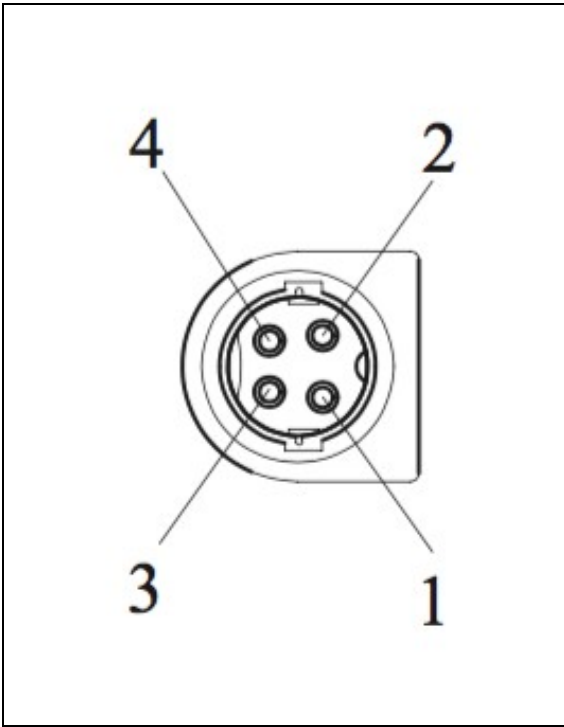


Model: PDP-40 by CUI Inc.

Power plug connectors for custom power harnesses can be purchased here:  
[https://www.digikey.com/products/en?Keywords=CP-7340-ND&WT.z\\_cid=sp\\_102\\_buynow](https://www.digikey.com/products/en?Keywords=CP-7340-ND&WT.z_cid=sp_102_buynow)

Assembly instructions: [Media:pdp-40.pdf](#)

- Pins #1 / #2: 12v
- Pins #3 / #4: Ground



Ettus Research currently offers direct-connect, copper cabling accessories for the USRP E320. However, it is also possible to use multi-mode fiber instead of copper connections for these devices. In this section, we will provide general guidance on the types of fiber adapters and cables that can be used with these products.

The USRP E320 USRP is compatible with most brands of SFP+ fiber adapters. In some cases, other equipment in the systems such as 1/10 Gigabit Ethernet switches are only compatible with specific brands of SFP+ adapters and cables. As a general rule, we recommend checking compatibility with the switches and network cards in your system before purchasing an adapter.

Ettus Research does test the USRP E320 USRP devices with our [10 Gigabit Ethernet Connectivity Kit](#) and a Blade Networks G8124 1/10 GigE switch. Here are is a list of known-good cables and adapters.

Ettus Research has only tested multi-mode fiber accessories.

- [Approved Optics BN-CKM-SP-SR-A](#)
- [Elpeus 10GbE SFP+ AOC Cable, 3 meters](#)

Many new motherboards come equipped with an onboard 10Gb RJ45 NIC. It is possible to use a SFP+ to RJ45 adapter and operate at 10Gb speeds using a Cat6/7 Ethernet cables.

Ettus Research has tested the adapters linked below.

- [10Gtek SFP+ to RJ45 Copper Module](#)
- [ProLabs 10G-SFPP-T-C](#)

As of December 1st, 2010 all Ettus Research products are RoHS compliant unless otherwise noted. More information can be found at <http://ettus.com/legal/rohs-information>

## **Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation**

### **Chinese Customers**

National Instruments is in compliance with the Chinese policy on the Restriction of Hazardous Substances (RoHS) used in Electronic Information Products. For more information about the National Instruments China RoHS compliance, visit [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).

Found on the [NI Product Certifications lookup tool](#) here.