Sidekiq™ X4

RF Transceiver • High Performance

GETTING STARTED GUIDE

DRAFT - JANUARY 19, 2020

ES024-110

CHANGELOG

Revision	Date	Description	Author
0.5	2020-11-19	initial draft	Barry L

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INTRODUCTION

The ES024-110 Sidekiq X4 PCIe Blade (KU115) includes the following:

- Sidekiq X4 with SMP connectors (ES024-201-02)
- HTG-K800 (KU115) [6]
- GPSDO FMC (ES020-202)
- W.FL cable to interconnect GSPDO clock output and X4 clock input

All documentation and support for Sidekiq X4 is provided through Epiq Solutions' support website which can be found at: https://www.epiqsolutions.com/support

Please note that it is necessary to register prior to accessing the relevant information for your purchase.

PROPER CARE AND HANDLING

Each Sidekiq X4 PCIe Blade is fully tested by Epiq Solutions before shipment, and is guaranteed functional at the time it is received by the customer, and ONLY AT THAT TIME.

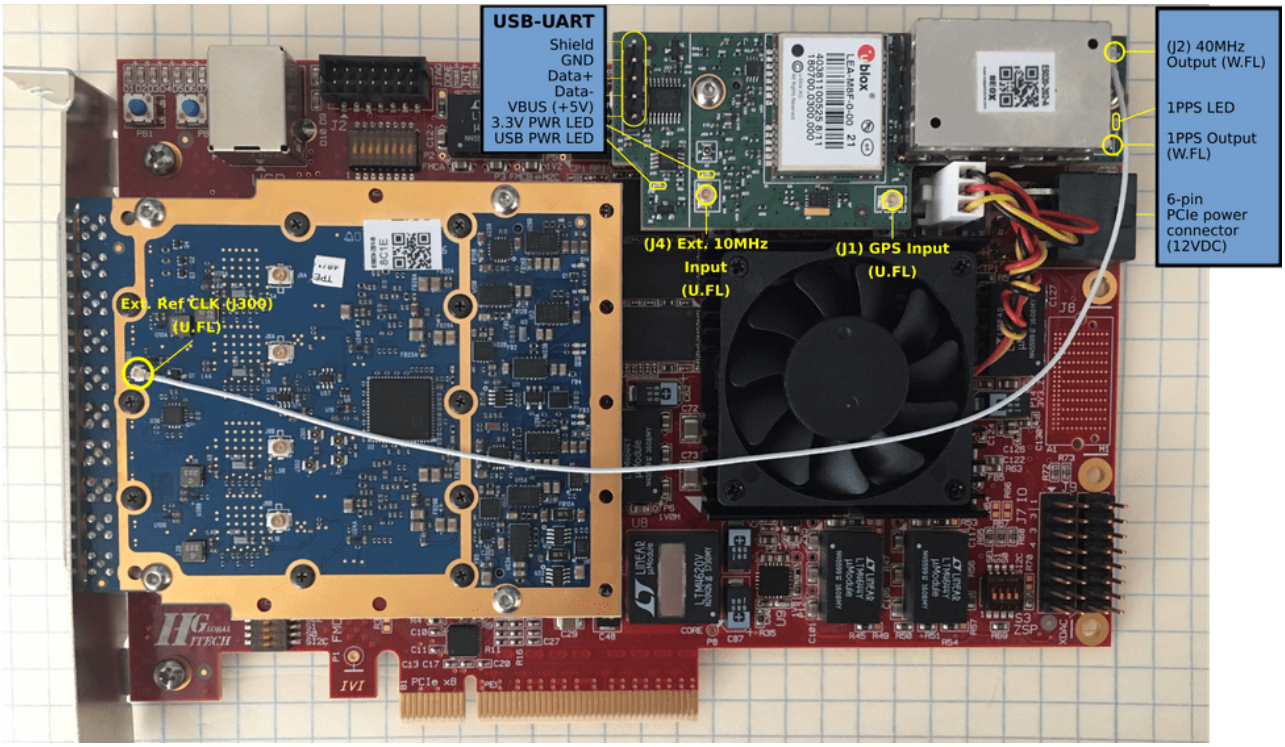
Improper use of Sidekiq can cause it to become non-functional. In particular, a list of actions that may cause damage to the hardware include the following:

- Handling the unit without proper static precautions (ESD protection) when the housing is removed or opened up
- Inserting or removing Sidekiq from a host system when power is applied to the host system
- Connecting a transmitter to the RX port without proper attenuation – refer to Sidekiq X2 or X4 Hardware Users manual [3] for additional information.
- Executing custom software and/or an FPGA bitstream that was not developed according to guidelines

PRODUCT DOCUMENTATION

- The Sidekiq X4 Hardware User’s manual provides an overview and usage details of the multichannel RF transceiver card.
- The Sidekiq Software Development manual provides the details required to enable a software developer to develop software applications utilizing the Sidekiq SDR.
- The Sidekiq API manual provides an overview and usage details of libsidekiq - Sidekiq Library
- The Sidekiq X4 FPGA Development manual provides an overview of the FPGA reference design, with the intention of empowering the user to build upon the design to create custom applications.

SIDEKIQ X4 PCIE BLADE



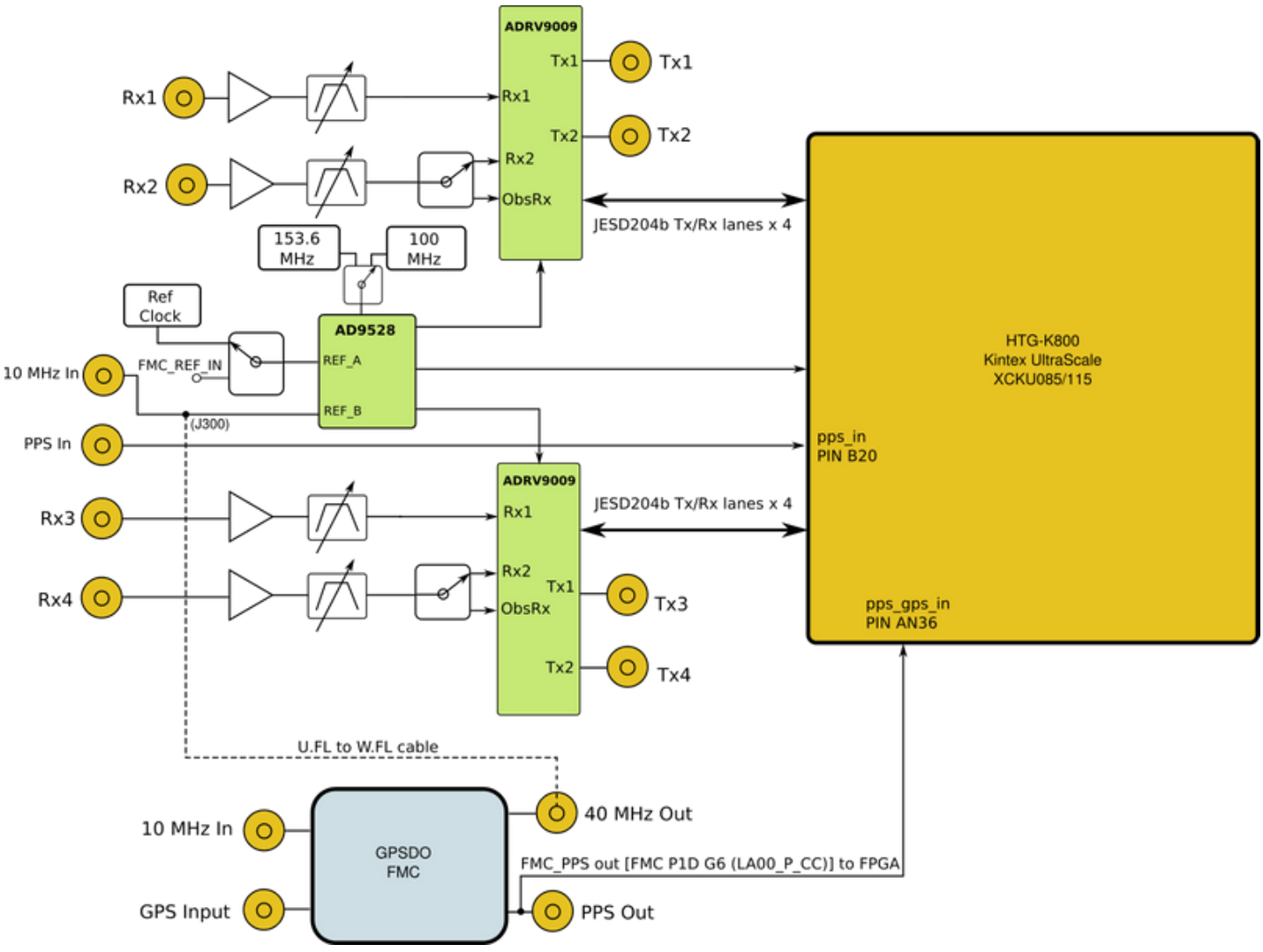


Figure 1: *Sidekiq X4 PCIe Blade Block Diagram*

GPS DISCIPLINED OSCILLATOR (GPSDO)

The Sidekiq X4 PCIe Blade includes a Global Navigation Satellite System (GNSS) add-on card which is based on a uBlox LEA-M8F GNSS module www.u-blox.com/en/product/lea-m8f-module . The GPS module is capable of using GNSS (9BeiDou, GLONASS, GPS/QZSS), external 10 MHz frequency sources, and an internal VCTCXO as its disciplining source.

GNSS, if present, will always be used and if GNSS is lost, then the module has 2 options to fallback on: 1) an external 10 MHz frequency source (if present), and 2) the internal VCTCXO.

*The GPS module has been set up to always use the 10 MHz source as the disciplining source if it is present on (J4) Ext. 10MHz Input. *

GNSS, if present, will be used if the external 10 MHz is not present. If GNSS is lost, then the M8F will fallback to using the internal VCTCXO.

Connect the GPS antenna to the GPSDO module's (J1) **GPS Input** U.FL connector if you wish to use the GNSS or connect a 10 MHz reference to the as the disciplining source.

Note: Once a GPS fix has been acquired, a 1PPS signal is also provided. The 1PPS persists after a GPS fix has been lost

If you wish to supply an external 10 MHz reference clock and 1PPS signal to the Sidekiq X4 **front-panel **RF connectors, you will need to:

1. Remove the U.FL/W.FL cable connected from the Sidekiq X4's **Ext. Ref CLK** (J300) U.FL and the GPSDO **40MHz Output** (J2) W.FL.

Note: This is due to Sidekiq X4 **REF** 10 MHz Input (J5) sharing the same pad as **Ext. Ref CLK ** (J300).

1. Connect a 10 MHz reference clock to the Sidekiq X4 front-panel **REF** input.
2. Connect 1 PPS signal source to Sidekiq X4 front-panel **PPS** input.
3. Change the X4's reference clock source from *host* to *external* by using the ref_clock test application:

```
./ref_clock -c 0 –source=external
```

The NMEA data stream can be viewed by connecting a USB A-Male to B-Male cable from the host computer's USB port to the 5-pin header USB-UART on the GPSDO.
USB Ports (Ubuntu): /dev/ttyUSB0 is the NMEA data stream. *Note: different serial & GPS drivers might name the port differently.*

```
sudo screen /dev/ttyUSB0
```

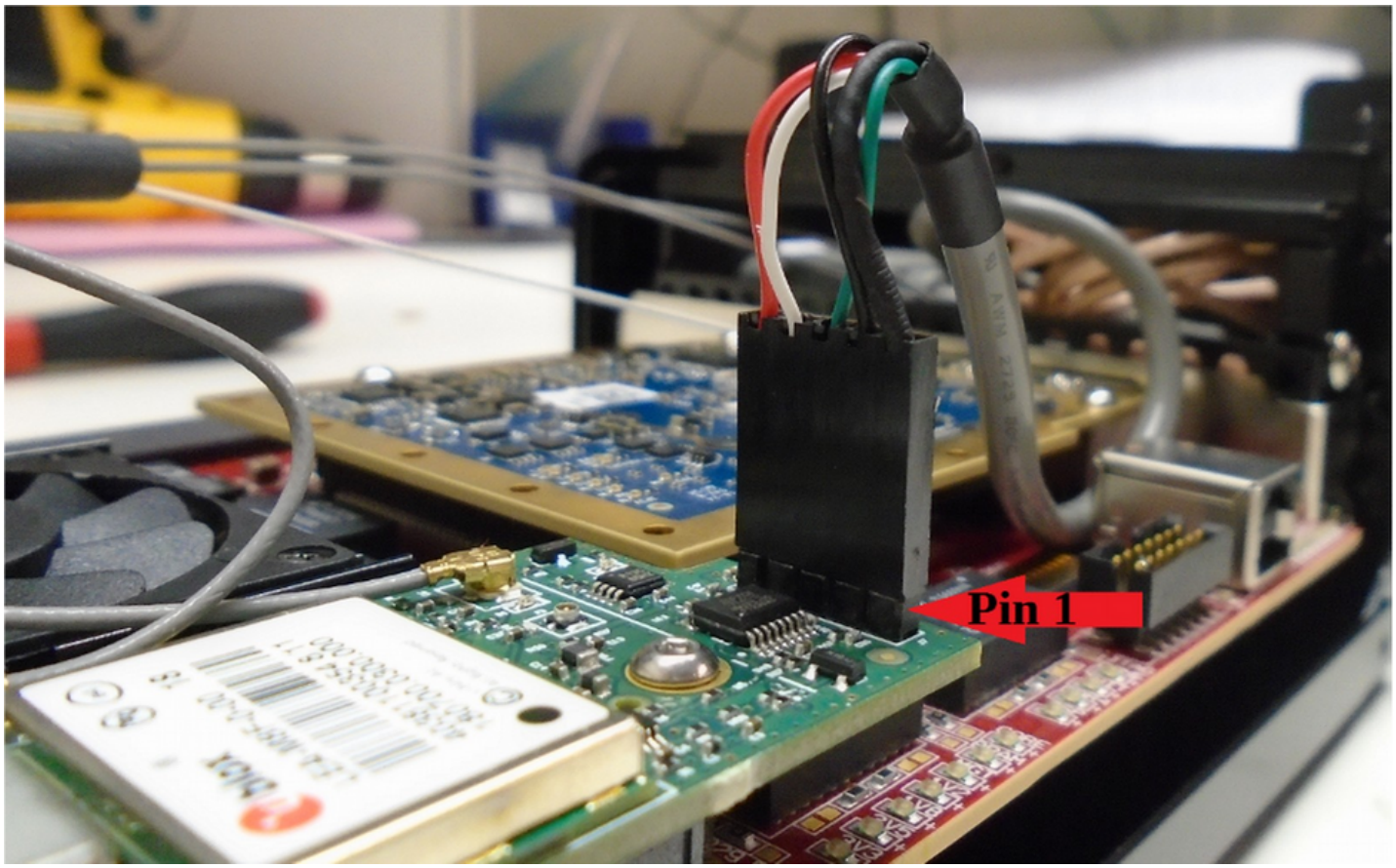


Figure 2: *GPSDO FMC USB-UART 5-pin header*

GPSDO INPUT LEVEL RANGES

(J4) External 10 MHz Input	+2.5 dBm to +8.5 dBm
GPS Input (GPS_IN)	+15 dBm (max). *This port also provides +3 VDC at 50mA for powering an active antenna.*
PPS_IN	0 to 5 V (V_HIGH min. ~1.5 V)

Please refer to the Sidekiq X4 Hardware Users manual for Sidekiq X4 hardware specifications.

SIDEKIQ X4 PCIE BLADE SETUP

1. Remove and verify that all the package contents are present.
2. Install the Sidekiq X4 PCIe Blade into system.
3. Connect a 6-pin PCIe power cable to the 6-pin PCIe power connector (12VDC) to power the X4 PCIe Blade.
4. Power-up the system
5. Launch a terminal window from Dash (search for "Terminal") or by pressing Ctrl-Alt-T.
6. Verify that the PCIe connection to the Sidekiq X4 PCIe Blade is established by running the *lspci* command:

```
    $ lspci -d 19aa:
xx:00.0 Signal processing controller: Device 19aa:5832 (rev 04)
```

```
Note, the PCI identifier for the Sidekiq X2 or X4 is 19aa:5832
```

1. If *lspci -d 19aa:* doesn’t return anything, power everything down and repeat steps 4 – 6, if the PCIe interface is still not seen with lspci, please contact Epiq Solutions support [3] for further assistance.

Make sure that you have sufficient airflow over the blade by monitoring the temperature (X4 temperature sensor) with *read_temp* test application located in: */home/sidekiq/sidekiq_image_current/test_apps*

SIDEKIQ X4 RF CAPTURE

```
./version_test
SKIQ[1863]: <INFO> Need to perform full initialization
SKIQ[1863]: <INFO> Performing detection of cards
SKIQ[1863]: <INFO> Sidekiq card detection completed successfully!
SKIQ[1863]: <INFO> Preliminary initialization complete, continue full initialization
1 card(s) found: 0 in use, 1 available!
Card IDs currently used     :
Card IDs currently available: 0
Info: initializing 1 card(s)...
SKIQ[1863]: <INFO> libsidekiq v4.14.0 (g975bb379b)
version_test[1863]: <INFO> Sidekiq card 0 is serial number=XXXX, X4 (rev C) (part ES024201-C1-
01)
version_test[1863]: <INFO> Decimator on card 0 and handle A1 has 6 stages
version_test[1863]: <INFO> Decimator on card 0 and handle A2 has 6 stages, but control is
shared
version_test[1863]: <INFO> Sidekiq card 0 FPGA v3.13.1, (date 20060821, FIFO size 64k)
version_test[1863]: <WARNING> Retried identification command for flash device on card 0
version_test[1863]: <INFO> Sidekiq card 0 is configured for an internal reference clock
version_test[1863]: <INFO> Loading calibration data for Sidekiq X4, card 0
************************************************************
* libsidekiq v4.14.0
************************************************************
************************************************************
* Sidekiq Card 0
  Card
    accelerometer present: false
    part type: X4
    part info: ES024201-C1-01
    serial: XXXX
    xport: PCIe
  FPGA
    version: 3.13.1
    git hash: 0x02986541
    build date (yymmddhh): 20060821
    tx fifo size: 64k samples
  RF
    reference clock: internal
    reference clock frequency: 10000000 Hz
    last calibration year: 2020
    last calibration week number: 42
    recalibration interval: 0 years

version_test[1863]: <INFO> Unlocking card 0
```

HTG-K800 STATUS LEDS

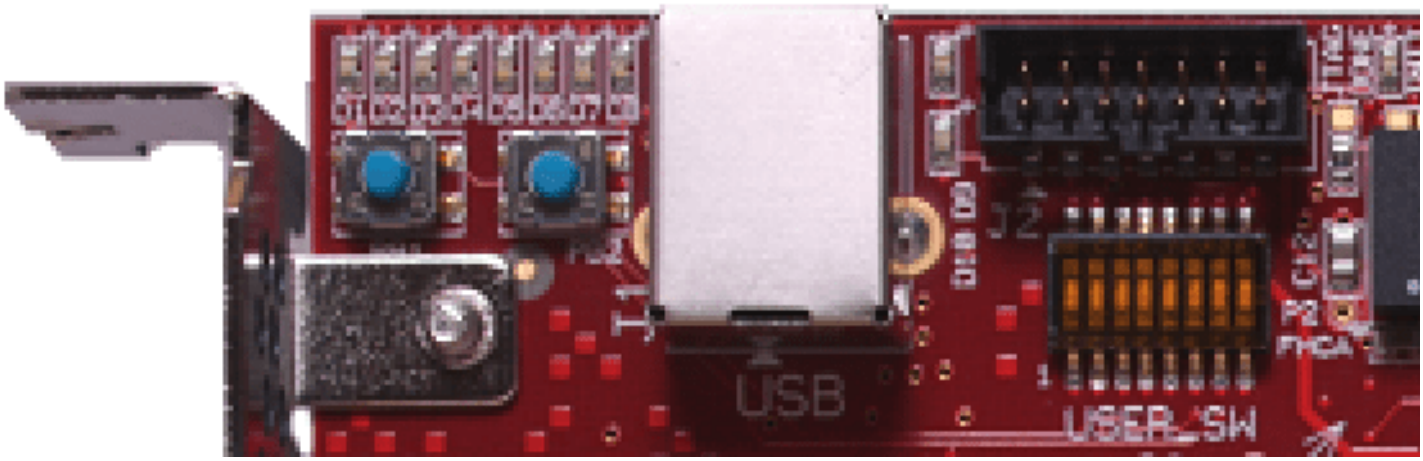


Figure 3: *HTG-K800 User LEDs*

Observing the row of 8 LEDs in the upper left corner (above the blue push button switches) of the HTG-K800 carrier, normal power up sequence and PCIe enumeration for the X4/HTG, the status LEDs indicate the following:

- Initial power-up/reset: ~ 0.5 sec

```
[D1] assign led[0] = off
[D2] assign led[1] = off
[D3] assign led[2] = off
[D4] assign led[3] = off
[D5] assign led[4] = RED
[D6] assign led[5] = RED
[D7] assign led[6] = RED
[D8] assign led[7] = RED
```

- FPGA bitstream loaded from flash:

```
[D1] assign led[0] = off
[D2] assign led[1] = off
[D3] assign led[2] = off
[D4] assign led[3] = off
[D5] assign led[4] = RED
[D6] assign led[5] = RED
[D7] assign led[6] = RED
[D8] assign led[7] = off
```

- OS bootup, X4 PCIe enumerated:

```
[D1] assign led[0] = GREEN
[D2] assign led[1] = GREEN
[D3] assign led[2] = GREEN (c0_sys_clk_heartbeat)
[D4] assign led[3] = GREEN (pcie_clk_heartbeat)
[D5] assign led[4] = off
[D6] assign led[5] = off
[D7] assign led[6] = off
[D8] assign led[7] = off
```

REFERENCES

1. Sidekiq X2 Product Page

   https://epiqsolutions.com/rf-transceiver/sidekiq-x2

2. Sidekiq X4 Product Page

   https://epiqsolutions.com/rf-transceiver/sidekiq-x4

3. Epiq Solutions Support Portal

   https://support.epiqsolutions.com

4. Epiq Solutions Support Portal Registration

   https://epiqsolutions.com/support/ucp.php?mode=register

5. uBlox LEA-M8F GNSS module

   https://www.u-blox.com/en/product/lea-m8f-module

6. HiTech Global HTG-K800

   http://www.hitechglobal.com/boards/kintex-ultrascale.htm