

EVK-6

u-blox Evaluation Kits

User Guide

Abstract

This document describes the components and usage of the EVK-6 Evaluation Kits and guides through the evaluation and testing of u-blox 6 GPS Technology.



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1 Product description

The EVK-6H Evaluation Kit with TCXO, EVK-6P Evaluation Kit with Crystal, and EVK-6T Evaluation Kit with Precision Timing make evaluating the high performance of u-blox 6 positioning engines simple. The built-in USB interface provides both power supply and high-speed data transfer, and eliminates the need for an external power supply. u-blox 6 evaluation kits are compact, and their user friendly interface and power supply make them ideally suited for use in laboratories, vehicles and outdoor locations. Furthermore, they can be used with a PDA or a notebook PC, making them the perfect companion through all stages of design-in projects.

1.1 Highlights

- Easy to use
- Extensive visualization and evaluation features
- Supports AssistNow Online and AssistNow Offline A-GPS services
- 1 USB port, 1 UART port
- Power supply and data transfer over USB (USB V2.0 compatible)

1.2 Experience u-blox 6 performance in 3 simple steps

Step 1: Connect the GPS antenna

Step 2: Use the USB cable to connect the evaluation kit to a PC

Step 3: Install the u-center evaluation software

1.3 Kit includes

- Compact 74 x 54 x 24 mm EVK-6 unit
- USB cable
- Active GPS antenna with 5 m cable
- CD-ROM containing:
 - u-center and u-center mobile software
 - USB driver software
 - Extensive documentation
- 2 MMCX to BNC female Pigtail Adapter (only EVK-6T)
- Spare backup battery

1.4 u-center GPS evaluation software

EVK-6 evaluation kits include u-center, an interactive tool for configuration, testing, visualization and data analysis of GPS receivers. It provides useful assistance during all phases of a system integration project.

1.5 System requirements

- PC with USB interface
- Operating system: Windows, Linux
- USB drivers are provided in the evaluation kit CD

2 Getting Started

2.1 Installation



Installation of the EVK-6X software and documentation requires Internet access.

1. Insert the CD-ROM with u-blox EvalKit software in your personal computer. The installation software will automatically start and guide you through the installation process. The installer requires Internet access to ensure that the most up-to-date components are installed on your system; these will be placed under the "u-blox" folder in the Start->Programs menu.

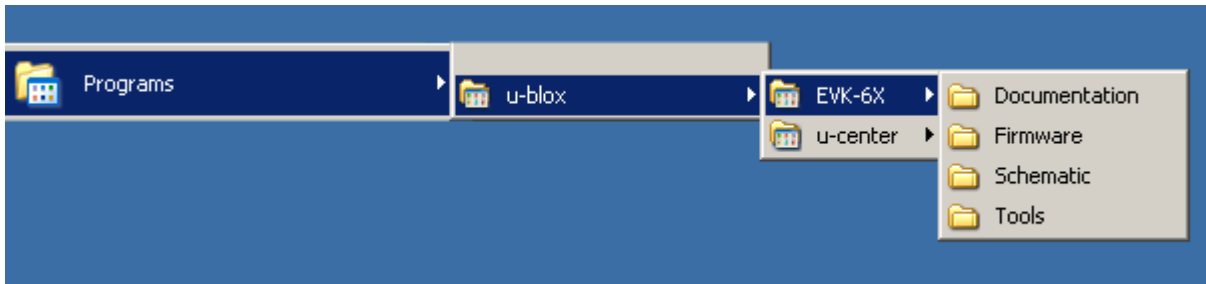


Figure 1: Location of EVK components on start menu

2. Connect the USB port of the evaluation box to a personal computer running Microsoft Windows. An additional RS232 port is available on the back of the EVK unit. When communicating via this port the device must still be powered over the USB.
3. Connect the GPS antenna to the evaluation unit and place the antenna in a location with good view to open sky.
4. Start the u-center GPS Evaluation Software and select corresponding COM port and baud rate (refer to the u-center User Guide [6] for more information).

2.2 Serial port default configuration

Parameter	Description	Remark
UART, Input	UBX and NMEA protocol at 9'600 Baud	
UART, Output	UBX and NMEA protocol at 9'600 Baud	Only NMEA messages are activated
USB, Input	UBX and NMEA protocol	
USB, Output	UBX and NMEA protocol	Only NMEA messages are activated

Table 1: Default configuration

3 Device description

3.1 USB

The EVK-6 features a USB V2.0 compatible serial port for power supply and data communication.

3.2 UART

The EVK-6 also includes an RS232 port for serial communication that is compatible with PC serial ports. Connect using a straight RS232 serial cable with male and female connectors to the port on your PC. If you are using a USB to RS232 adaptor cable you can connect it directly to the evaluation kit RS232 port.

3.3 Antenna connector

There is an SMA female jack on the front side of the GPS Evaluation unit for connecting an active or passive antenna. The DC voltage at the RF input is 3.0 V and the current is limited to 65 mA.

3.3.1 Connector pin description

The 9 pin D-SUB female connector is assigned as follows:

Pin	Assignment
1	GPS time pulse output
2	TXD, GPS Transmit Data, serial data to DTE
3	RXD, GPS Receive Data, serial data from DTE
4	GPS ExtInt input
5	GND
6	GPS time pulse output
7-9	not connected

3.4 Active antenna

The EVK-6 Evaluation Kit comes with a u-blox ANN-MS active GPS antenna with 5 m of cable (see the ANN-MS Product Summary [1] for more information). It is possible to connect various active and passive GPS antennas with SMA connector to the GPS Evaluation Box.

3.5 USB cable

The EVK-6 Evaluation Kit comes with one USB cable to connect the evaluation kit to a PC.

3.6 Backup battery

A backup battery is connected to the LEA-6 Module to supply backup part. It is needed to store orbital information between operations and enable faster start-up. It is a 1.55 V silver oxide battery of the type SR1154W (SR44). The battery has a capacity of 190 mA, which should last for approximately 1 year. A spare battery is included in the kit.

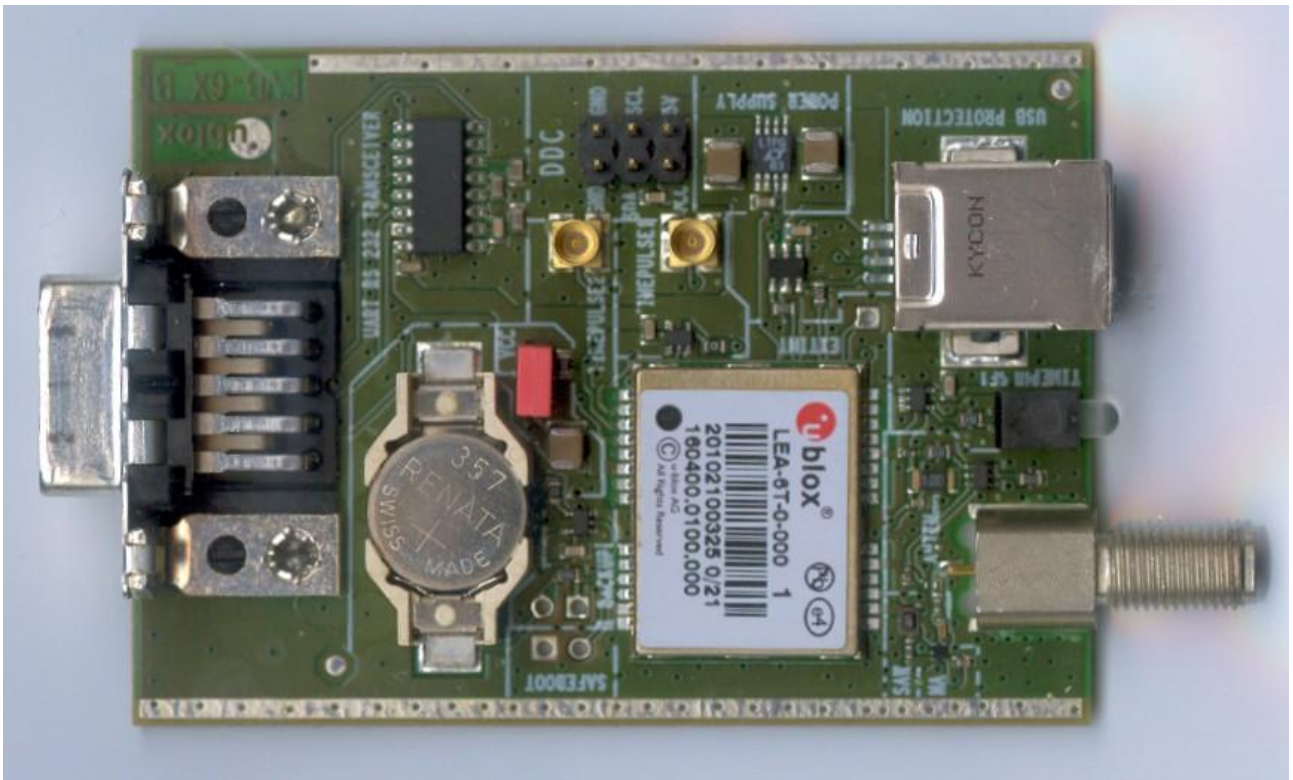


Figure 2: EVK-6T¹

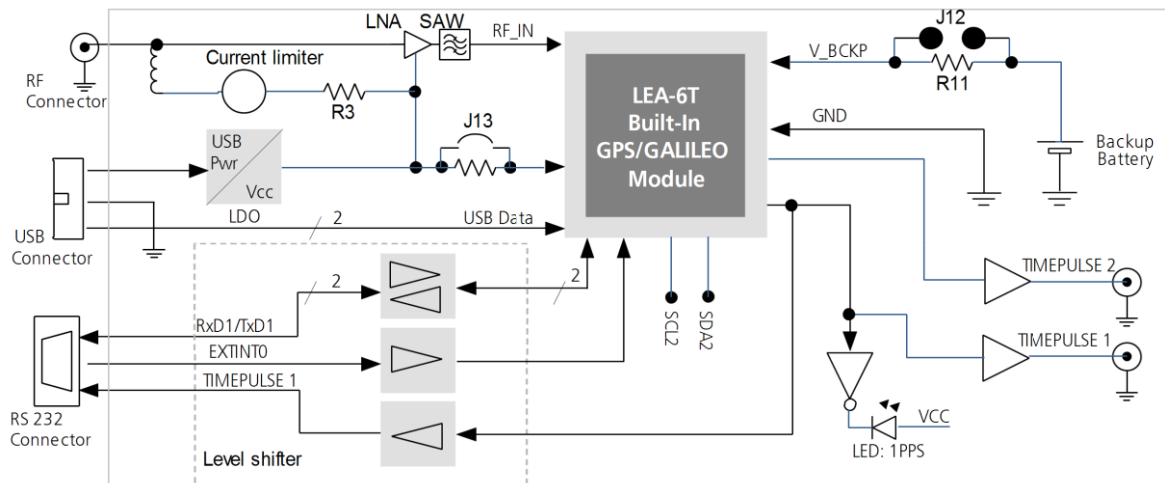


Figure 3: EVK-6T block diagram¹

¹ EVK-6H and EVK-6P have the same PCB, but do not include the Timepulse 2 connector.

4 Specifications

Parameter	Specification
Serial Interfaces	1 RS-232, 1 USB V2.0
Dimensions	74 x 54 x 24 mm
Temperature range with battery	0 to 60 degrees Celsius
Temperature range without battery	-20 to 65 degrees Celsius

5 Measuring tracking current

To measure the tracking current, follow these steps:

1. Remove jumper at J13
2. Connect a true rms multimeter across J13
3. Wait 12 minutes to download all GPS orbital data, or download all the Aiding Data via the AssistNow Online service
4. Read voltage (and average if necessary) at multimeter and convert to current (1 mV equals 1 mA)
5. Perform the test with good signals and clear sky view to ensure that the receiver can acquire the satellite signals.
6. Place the jumper on **J13** after the measurement.

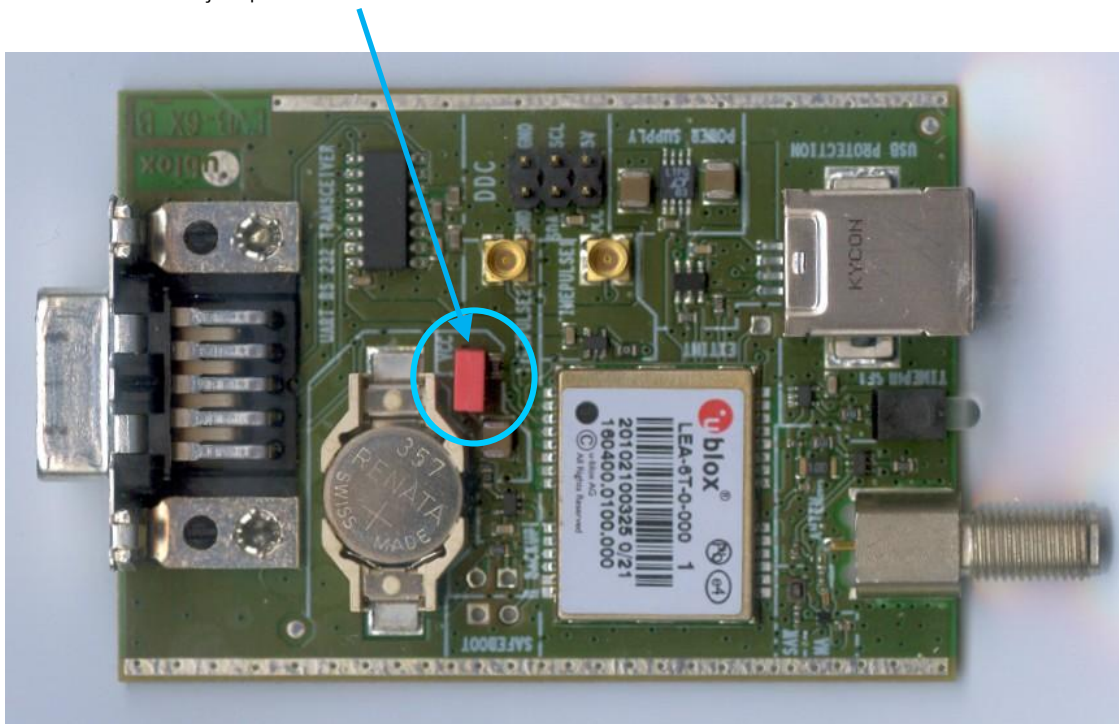


Figure 4: jumper J13 for current measurement

6 Testing Power Save Mode

When testing Power Save Mode observe the following points:

- When configuring Power Save Mode you must setup the parameters using the CFG-PM message first and then enable Power Save Mode using CFG-RXM. The Configuration view or Messages View of the u-center evaluation software can be used to do this. When enabling the mode using CFG-RXM, always save the configuration by checking the “save configuration” box in u-center otherwise the configuration will be lost.
- When you want to alter the Power Save Mode configuration, you must first disable the mode using CFG-RXM first (remember to enable “save configuration” again), before changing the CFG-PM parameters. You can then re-enable Power Save Mode using CFG-PM.
- Communications to the evaluation kit must be via the RS232 (not USB) for FW6.02.
- The evaluation kit may only be supplied over the USB connector. This can be done by either connecting a USB cable from the evaluation kit to a supplied USB hub, or by using a USB power connector (see Figure 5). Do not connect the USB cable to the PC!
- When configuring Power Save Mode set the parameters using the CFG-PM message first and then enable Power Save Mode using CFG-RXM. The Configuration view or Messages View of the u-center evaluation software can be used to do this. When enabling the mode using CFG-RXM, always save the configuration by checking the “save configuration” box in u-center otherwise the configuration will be lost.
- When altering the Power Save Mode configuration, first disable the mode using CFG-RXM first (remember to enable “save configuration” again), before changing the CFG-PM parameters. Then re-enable Power Save Mode using CFG-PM.

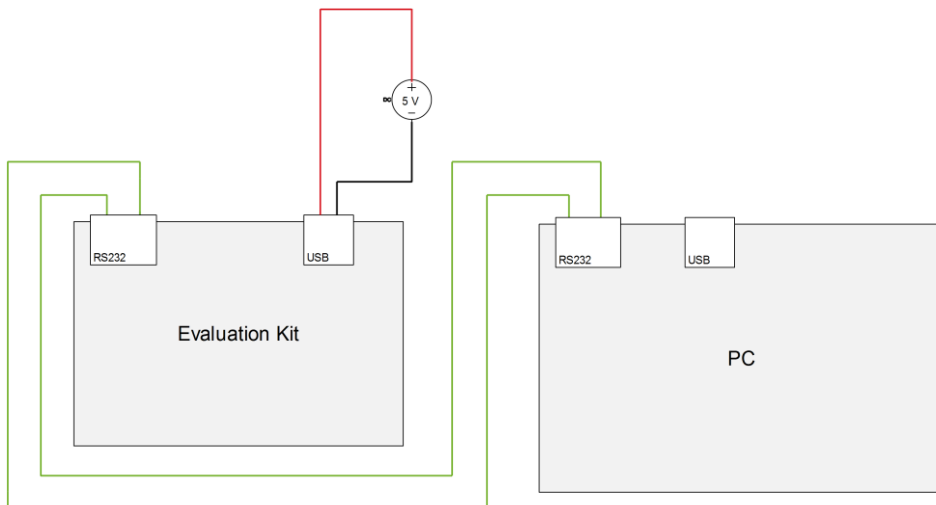


Figure 5: Connecting EVK for supply and communications when testing Power Save Mode

7 Board layout

Figure 6 shows the EVK board layout. See Table 2 for the component list of the EVB-6H.

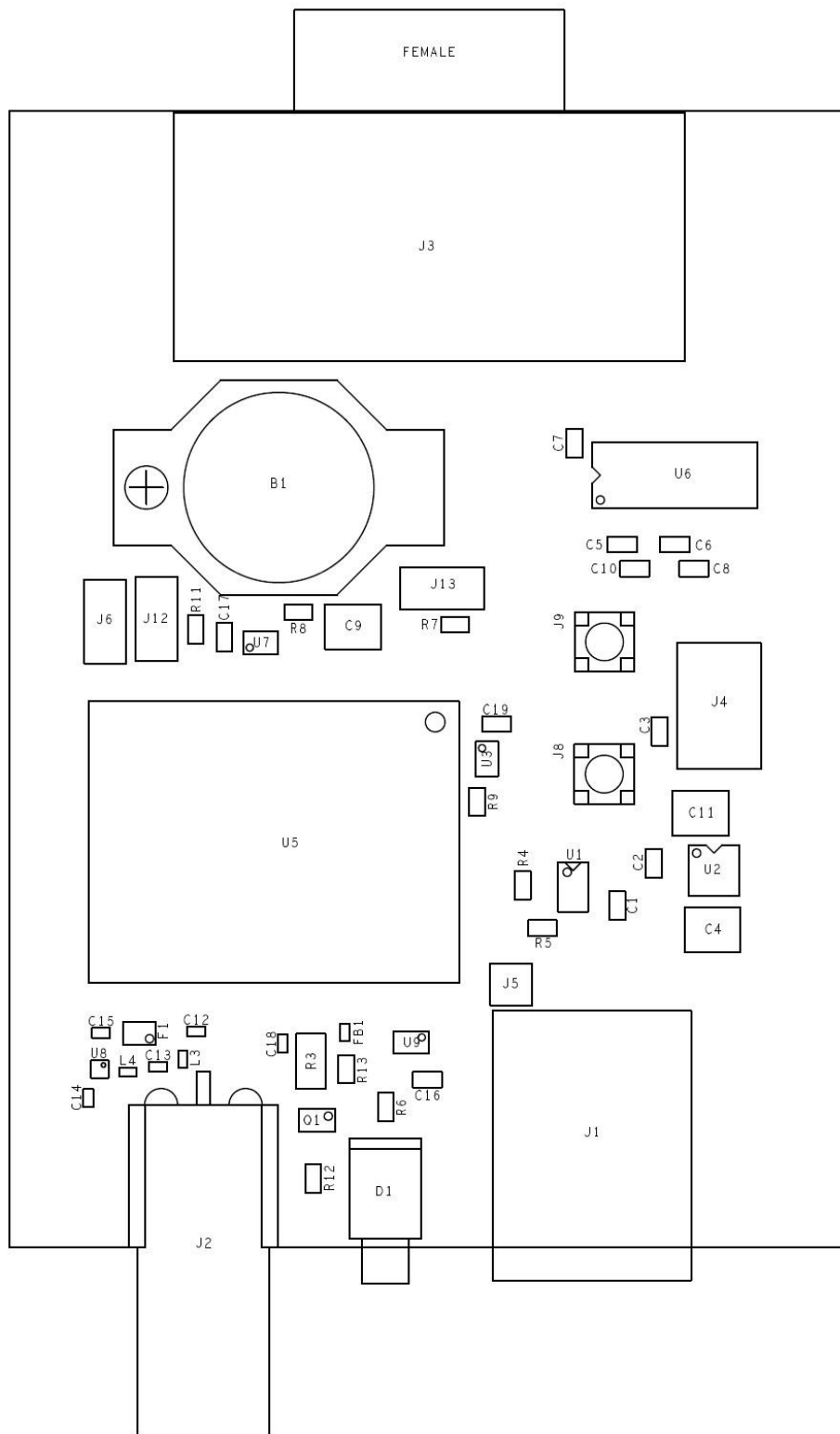


Figure 6: Board layout

Part number	Description	Remarks
C1 C16 C17 C19 C3 C5 C7	CAP CER X7R 0603 100N 10% 10V	
C10 C6 C8	CAP CER X5R 0603 1U0 10% 6.3V	
C11 C4 C9	CAP CER X5R 1210 10U 10% 10V	
C12 C14	CAP CER X5R 0402 100N 10% 10V	
C13 C15	CAP CER COG 0402 8P2 +/-0.5P 25V	
C18	CAP CER X5R 0402 1U0 10% 6.3V	
C2	CAP CER X7R 0603 10N 10% 10V	
D1	LED 3MM DIALIGHT 591-2301 GREEN 0.01A	
D10	BATTERY HOLDER RENATA SMTU357 1V55	
F1	SAW FILTER FOR GPS EPCOS B7839	
FB1	FERRITE BEAD MURATA BLM15HD 0402 1000R@100MHZ	
J1	CON USB RECEPTACLE B TYPE SMD	
J13	CON 1-ROW THT 100MIL GRID 2PINS 0.64MM SQUARE 6.1MM HEIGHT	I_VCC
J2	CON SMA SMD STRAIGHT JACK 11.4MM HEIGHT WITH WASHER AND NUT	
J3	SUB-D CONNECTOR FEMALE	
J4	CON 2-ROWS THT 100MIL GRID 6PINS 0.64MM SQUARE 6.1MM HEIGHT	
J8 J9	SMT MMCX 50 OHMS JACK VERTICAL CONNECTOR	Timepulse (J9 only at EVK-6T)
L3	IND MURATA LQG15H 0402 27N 5% 0.3A	
L4	IND MURATA LQP15M 0402 9N1 +/-0.1N 0.1A -40/+85C	
Q1	MBT3906DW1T1G DUAL GENERAL PURPOSE TRANSISTOR 0.2A 0.15W	
R11 R6	RES THICK FILM CHIP 0603 100R 5% 0.1W	
R12	RES THICK FILM CHIP 0603 2K2 5% 0.1W	
R13	RES THICK FILM CHIP 0603 220R 5% 0.1W	
R3	RES THICK FILM CHIP 1206 10R 5% 0.25W	
R4 R5	RES THICK FILM CHIP 0603 22R 5% 0.1W	
R7	RES THICK FILM CHIP 0603 1R0 5% 0.1W	
R8 R9	RES THICK FILM CHIP 0603 51R 1% 0.063W	line termination
U1	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6	
U2	LOW DROPOUT REGULATOR LINEAR LT1962 MS8 3.0V 0.3A	
U3 U7 U9	TINY LOGIC UHS BUFFER OE_N ACTIVE LOW FAIRCHILD NC7SZ125 SC70	
U5	GPS RECEIVER U-BLOX LEA-6T/ LEA-6H/ LEA-6P	
U6	RS-232 TRANSCIVER MAXIM MAX3232 SO16	
U8	LOW NOISE AMPLIFIER GAAS MMIC 1.575 GHZ 1.5V-3.6V JRC EPFFP6-A2 3.6V	

Table 2: EVB-6x component list

8 Schematic

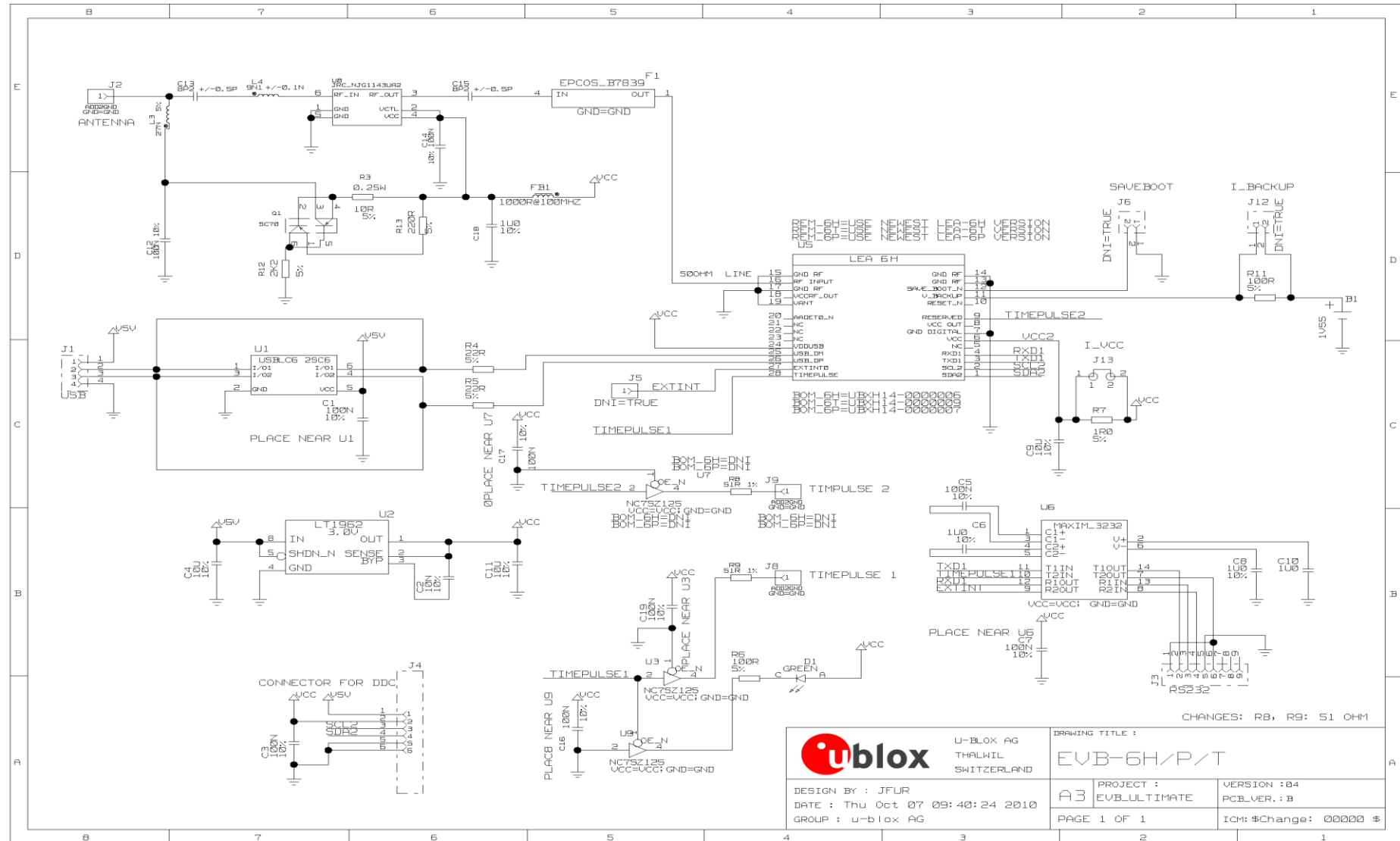


Figure 7: Schematic EVK-6T: DNI=TRUE in the schematic means: DO NOT INSTALL.

The LEA-6T GPS synchronized **Timepulse 1** output has a high accuracy output (see LEA-6 Data Sheet [2] for details). The current design of the EVK-6T uses a MAX3232 driver for the D-SUB connector, which adds a delay of typically 0.15 μ s.

GPS.G6-EK-10040-1

10 Troubleshooting

My application (e.g. u-center) does not receive anything

Check if the green LED on the evaluation box lights up and make sure the USB cable is properly connected to the evaluation box and the PC. By default the evaluation box outputs NMEA protocol on Serial Port 1 at 9600 Baud, or on the USB.

My application (e.g. u-center) does not receive all messages

When using UART, make sure the baudrate is sufficient. If the baudrate is insufficient, GPS receivers based on u-blox 6 GPS Technology will skip excessive messages. Some serial port cards/adapters (i.e. USB to RS232 converter) frequently generate errors. If a communication error occurs while u-center receives a message, the message will be discarded.

My application (e.g. u-center) loses the connection to the GPS receiver

u-blox 6 GPS Technology and u-center have an autobauding feature. If frequent communication errors occur (i.e. due to problems with the serial port), the connection may be lost since u-center and the GPS receiver will autonomously try to adjust the baudrate. Do not enable the u-center autobauding feature if the GPS receiver has the autobauding flag enabled.

Some COM ports are not shown in the port list of my application (e.g. u-center)

Only the COM ports, that are available on your computer, will show up in the COM port drop down list. If a COM Port is gray, another application running on this computer is using it.

The position is off by a few dozen meters

u-blox 6 GPS Technology supports different datums. By default, it starts up with the WGS84 standard GPS datum. If your application expects a different datum, you'll most likely find the positions to be off by a few dozen meters. Find out what kind of datum your application requires and configure the EvalKit accordingly. And don't forget to check the calibration of u-center map files.

The position is off by hundreds of meters

Position drift may also occur when almanac navigation is enabled. The satellite orbit information retrieved from an almanac is much less accurate than the information retrieved from the ephemeris. With an almanac only solution the position will only have an accuracy of a few kilometers but it may startup faster or still navigate in areas with obscured visibility when the ephemeris from one or several satellites have not yet been received. The almanac information is NOT used for calculating a position, if valid ephemeris information is present, regardless of the setting of this flag.

In NMEA protocol, position solutions with high deviation (e.g. due to enabling almanac navigation) can be filtered with the Position Accuracy Mask. UBX protocol does not directly support this since it provides a position accuracy estimation, which allows the user to filter the position according to his requirements. However, the 'Position within Limits' flag of the UBX-NAV-STATUS message indicate whether the configured thresholds (i.e. P Accuracy Mask and PDOP) are exceeded.

At startup TTFF times are much longer than specified

At startup (after the first position fix) the GPS receiver performs an RTC calibration to have an accurate internal time source. A calibrated RTC is required to achieve minimal startup time.

Before shutting down the receiver externally, check the status in MON-HW in field 'Real Time Clock Status'. Don't shut down the receiver if the RTC is not calibrated.

The EVK-6 does not meet the TTFF specification

Make sure the antenna has a good sky view. Obstructed view leads to prolonged startup times. In a well-designed system, the average of the C/No ratio of high elevation satellites should be in the range of 44 dBHz to about 50 dBHz. With a standard off-the-shelf active antenna, 47 dBHz should easily be achieved. Low C/No values lead to a prolonged startup time.

EVK-6 does not preserve the configuration in case of reset

u-blox 6 GPS technology uses a slightly different concept than most of the other GPS receivers do. Settings are initially stored to volatile memory. In order to save them permanently, sending a second command is required. This allows testing the new settings and reverting to the old settings by resetting the receiver if the new settings aren't good. This provides safety, as it's no longer possible to accidentally program a bad configuration (e.g. disabling the main communication port).

The Battery Backup Current is much higher than specified in the datasheet.

The battery backup current will be at an undefined level if the backup voltage is applied to the GPS receiver without having the GPS receiver turned on once to put the real-time-clock (RTC) into a known state.

When using the GPS receiver with backup battery connected, turn the GPS receiver on for the first time to bring it into a known state.

Power Save Mode and USB.

When operating the GPS in Power Save Mode the USB cannot be used. For communication in Power Save Mode use the RS232.

10.1 Common evaluation pitfalls

- Parameter may have the same name but a different definition. GPS receivers may have a similar size, price and power consumption but can still have different functionalities (e.g. no support for passive antennas, different temperature range). Also, the definitions of Hot, Warm, Cold Start times may differ between suppliers.
- Verify design-critical parameters; do not base a decision on unconfirmed numbers from datasheets.
- Try to use identical or at least similar settings when comparing the GPS performance of different receivers.
- Data, which has not been recorded at the same time and the same place, should not be compared. The satellite constellation, the number of visible satellites and the sky view might have been different.
- Do not compare momentary measurements. GPS is a non-deterministic system. The satellite constellation changes constantly. Atmospheric effects (i.e. dawn and dusk) have an impact on signal travel time. The position of the GPS receiver is typically not the same between two tests. Comparative tests should therefore be conducted in parallel by using one antenna and a signal splitter; statistical tests shall be run for 24 hours.
- Monitor the Carrier-To-Noise-Ratio. The average C/No ratio of the high elevation satellites should be between 44 dBHz and about 50dBHz. A low C/No ratio will result in a prolonged TTFF and more position drift.
- When comparing receivers side by side, make sure that all receivers have the same signal levels. The best way to achieve this is by using a signal splitter. Comparing results measured with different antenna types (with different sensitivity) will lead to incorrect conclusions.
- Try to feed the same signal to all receivers in parallel (i.e. through a splitter); the receivers won't have the same sky view otherwise. Even small differences can have an impact on the accuracy. One additional satellite can lead to a lower DOP and less position drift.
- When doing reacquisition tests, cover the antenna in order to block the sky view. Do not unplug the antenna since the u-blox 6 GPS Technology continuously performs a noise calibration on idle channels.

Related documents

- [1] ANN-MS Product Summary, Docu. No GPS-X-02022
- [2] LEA-6 Data Sheet, Docu. No GPS.G6-HW-09004
- [3] NEO-6 Data Sheet, Docu. No GPS.G6-HW-09005
- [4] LEA-6/NEO-6/MAX-6 Hardware Integration Manual, Docu. No GPS.G6-HW-09007
- [5] u-blox 6 Receiver Description including Protocol Specification, Docu. No GPS.G6-SW-10018
- [6] u-center – User Guide, Docu. No GPS-SW-08007



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