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<td>SL876Q5-A EVK</td>
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1 INTRODUCTION

1.1 Purpose
The scope of this manual is provide product information for the SL876Q5-A Evaluation Kit (EVK).

1.2 Contact and Support Information
For general contact, technical support services, technical questions, and to report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:
http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:
http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.
Telit appreciates feedback from the users of our information.
1.3 Text Conventions

Dates are in ISO 8601 format, i.e. YYYY-MM-DD.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="stop.png" alt="Stop" /></td>
<td>Danger – This information MUST be followed or catastrophic equipment failure and/or bodily injury may occur.</td>
</tr>
<tr>
<td><img src="warning.png" alt="Warning" /></td>
<td>Caution or Warning – This is an important point about integrating the product into a system. If this information is disregarded, the product or system may malfunction or fail.</td>
</tr>
<tr>
<td><img src="tip.png" alt="Tip" /></td>
<td>Tip – This is advice or suggestion that may be useful when integrating the product.</td>
</tr>
</tbody>
</table>

1.4 Related Documents

- SL876Q5-A Product User Guide

1.4.1 Related Documents Requiring a Non-Disclosure Agreement

- None

2 Evaluation Kit Requirements

To use the SL876Q5-A Evaluation Kit (EVK), you will need:

- USB Drivers (on the included flash drive)
- SiRFLive 2.07P4 or later (on the included flash drive)
- A PC with a USB port that fulfills the minimum software requirements:
  - Windows XP or later
  - NET Framework 2.0 (automatically installed by the SiRFLive package if necessary - internet connection is required).
3 Evaluation Kit (EVK) Description

3.1 EVK Contents

Figure 3-1  EVK photo

<table>
<thead>
<tr>
<th>EVK Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic case</td>
</tr>
<tr>
<td>USB cable</td>
</tr>
<tr>
<td>USB drive with software and documentation</td>
</tr>
<tr>
<td>Evaluation Board</td>
</tr>
</tbody>
</table>

Table 3-1 EVK Contents
3.2 SL876Q5-A Evaluation Board

With default jumpers

*Figure 3-2 SL876Q5-A Evaluation Board*
3.3 SL876Q5-A Module

![Image of SL876Q5-A Module]

*Figure 3-3 SL876Q5-A Module*
3.4 Evaluation Board Layout

See Table 3-5 PL-108 Pin Description for jumper color code.

*Figure 3-4 SL876Q5-A Evaluation Board Layout*
3.5 Evaluation Board Component and Pin Identification

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC 1</td>
<td>SL876Q5-A Module (including chip antenna)</td>
</tr>
<tr>
<td>SO 100</td>
<td>SMA connector - External Antenna</td>
</tr>
</tbody>
</table>
| SW 100 | On-Off Toggle Switch
Applies 1V8 to the Module On-Off pin                                     |
| DL 100 | LED – 1PPS output                                                          |
| DL 101 | LED - TX data output                                                        |
| DL 102 | LED – System ON output                                                     |
| PL 100 | Mini USB connector – Power, ground, Tx, and Rx                             |
| PL 102 | 1 x 5 Header Pins                                                          |
| PL 104 | 1 x 4 Header Pins                                                          |
| PL 108 | 2 x 10 Header Pins                                                         |
| PL 101 | 1 x 10 Header Pins                                                         |

See tables below for Header Pin descriptions

### Table 3-2 Evaluation Board Components

<table>
<thead>
<tr>
<th>Pin</th>
<th>PL-102 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>PL104-4 &amp; 10 KΩ to 1V8 pullup</td>
</tr>
<tr>
<td>3</td>
<td>PL104-3 &amp; 10 KΩ to 1V8 pullup</td>
</tr>
<tr>
<td>4</td>
<td>PL104-2</td>
</tr>
<tr>
<td>5</td>
<td>PL104-1</td>
</tr>
</tbody>
</table>

### Table 3-3 PL-102 Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>PL-104 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PL 102-5</td>
</tr>
<tr>
<td>2</td>
<td>PL 102-4</td>
</tr>
<tr>
<td>3</td>
<td>PL 102-3 &amp; 10 KΩ to 1V8 pullup</td>
</tr>
<tr>
<td>4</td>
<td>PL 102-2 &amp; 10 KΩ to 1V8 pullup</td>
</tr>
</tbody>
</table>
### Table 3-5 PL-108 Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>PL-108 Description</th>
<th>Pin</th>
<th>Description</th>
<th>For normal operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V&lt;sub&gt;GPS&lt;/sub&gt;</td>
<td>2</td>
<td>module V&lt;sub&gt;CC&lt;/sub&gt; (module supply current)</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>module BOOT</td>
<td>4</td>
<td>10 KΩ pullup to 1V8</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jumper these pins only if a “hardware” boot is</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>required (e.g. if using SiRFflash).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For SiRFlive re-flashing, do not jumper these</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pins.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Enable 1V8</td>
<td>6</td>
<td>V&lt;sub&gt;USB&lt;/sub&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Enable 3V&lt;sub&gt;ALT&lt;/sub&gt;</td>
<td>8</td>
<td>V&lt;sub&gt;USB&lt;/sub&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Enable V&lt;sub&gt;GPS&lt;/sub&gt;</td>
<td>10</td>
<td>V&lt;sub&gt;USB&lt;/sub&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>V&lt;sub&gt;ANT&lt;/sub&gt; (Antenna Voltage Supply)</td>
<td>12</td>
<td>3V&lt;sub&gt;ALT&lt;/sub&gt; controlled by LNA Enable</td>
<td>Option</td>
</tr>
<tr>
<td>13</td>
<td>module GPIO6</td>
<td>14</td>
<td>10 KΩ pullup to 1V8</td>
<td>UART - Yes</td>
</tr>
<tr>
<td>15</td>
<td>module GPIO7</td>
<td>16</td>
<td>10 KΩ pulldown to Ground</td>
<td>UART - No</td>
</tr>
<tr>
<td>17</td>
<td>USB RXD</td>
<td>18</td>
<td>module TX</td>
<td>Yes</td>
</tr>
<tr>
<td>19</td>
<td>module RX</td>
<td>20</td>
<td>USB TXD</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Table 3-6 PL-101 Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>PL-101 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V8</td>
</tr>
<tr>
<td>2</td>
<td>module 1PPS pulse output (level translated)</td>
</tr>
<tr>
<td>3</td>
<td>module SDA (GPIOB)</td>
</tr>
<tr>
<td>4</td>
<td>module SCL (GPIOC)</td>
</tr>
<tr>
<td>5</td>
<td>module nExternal Ant Enable (input) Connect to ground (e.g. pin 9) to enable an external antenna.</td>
</tr>
<tr>
<td>6</td>
<td>N C</td>
</tr>
<tr>
<td>7</td>
<td>module GPIOA</td>
</tr>
<tr>
<td>8</td>
<td>module nRESET</td>
</tr>
<tr>
<td>9</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>N C</td>
</tr>
</tbody>
</table>
3.6 Evaluation Board Schematic Diagram

Figure 3-5 SL876Q5-A Evaluation Board Schematic Diagram
4 Evaluation Kit Setup

4.1 Installing the USB Drivers

Before connecting the SL876Q5-A Evaluation Kit, install the necessary USB drivers.

- Double-click the USB driver executable CDM v2.12.00 WHQL Certified.exe, and follow the directions to install the USB drivers.

![Figure 4-1 USB Driver Installation](image)

**Figure 4-1 USB Driver Installation**

- Click “Continue Anyway” to install the USB COM port driver
- When the EVK board is connected to a personal computer USB port, the driver will create a COM port.
- Use the Windows “Device Manager” to check the identification of the new COM port. This port identification is necessary for EVK tools to connect to the evaluation kit.
Figure 4-2 Identify new COM port

- In this example, the COM port is assigned as COM5

4.2 Installing SiRFLive

Minimum PC requirements:

- Pentium CPU 2 GHz
- 1 GB of RAM
- 100 MB hard drive

Recommended:

- 2 GB of RAM
- 1280 x 1024 screen resolution

Double-click the SiRFLiveInstaller_MKTG_Lite.msi file to install the SiRFLive program, then follow the installer directions until finished.

It is recommended that SiRFLive be installed to the default location – C:\CSR\SiRFLive.
5 Evaluation Board Operation

1. Verify that the correct jumpers are installed. See Sections 3.4 Evaluation Board Layout and 3.5 Evaluation Board Component Identification.

2. Power will be applied to the SL876Q5-A module when the USB interface is connected to a USB port on a personal computer. When the EVB On-Off switch is turned ON, the module ON_OFF pin will be powered up and the module will begin operation.

3. Place the board face up in a location with a clear view of open sky.

4. Use SiRFLive or TelitView to send commands to and display output from the module.
6 Using SiRFLive

6.1 Starting SiRFLive

1. Connect the EVK to a USB port on the PC.

2. Turn on (up) the EVK Power switch.

3. Launch the SiRFLive application.

4. Connection Settings window: Use the Receiver drop-down box to select the receiver. This is where you select the COM port that was previously created by the USB driver in Section 4.1 Installing the USB Drivers.

5. If the default Baud Rate is 115200 and Protocol is OSP on your EVK, leave those boxes with their values as presented.
   - If the default Baud Rate is 9600 and Protocol is NMEA on your EVK, change those boxes to match.
   - If you have changed the receiver’s defaults, select them using the Baud Rate and Protocol drop-down boxes.

6. Click OK. The remainder of these screen captures will show NMEA protocol. OSP will present somewhat different data.
7. If necessary, click **Receiver**, then **Connect** on the menu bar.

![Image of Receiver menu bar]

*Figure 6-2 Click Receiver, then Connect on the menu bar*

8. The SL876Q5-A defaults to a power-saving mode called SmartGNSS2, so you may see the GLONASS satellites disappear from the Radar View. This is normal. If you wish to command the full-time use of GLONASS as well as GPS, use the following procedure:
   
   a. Click **Receiver**, **Command**, then **Switch Comm Settings**.

![Image of Switch Comm Settings window]

*Figure 6-3 Switch Comm Settings window*

   b. Verify that **Switch Protocol (to OSP)** and **Baud Rate** of **115200** are selected as shown above.
c. Click **Set**. The receiver and display will both switch to OSP protocol at 115,200 bps.

![Figure 6-4 The OSP protocol window](image)

---

d. Click **Features**, **Power Mode**, then **Advanced**.

![Figure 6-5 Features, Power Mode window](image)
e. Verify that **Full Power** is selected, and click **OK**.

![Figure 6-6 Full Power Mode window](image)

**Figure 6-6 Full Power Mode window**

f. To return to the NMEA display, click **Receiver, Command, Switch Comm Settings**

![Figure 6-7 Verify NMEA window](image)

**Figure 6-7 Verify NMEA window**

g. Verify **NMEA** at **9600** bps (or your desired rate), and click **Set**.

9. There are many additional functions available in SiRFLive. Please refer to the built-in User Manual for further details. Click **Help** in the Menu Bar, then **User Manual**.
6.2 SiRFLive Windows

After a successful connection with the receiver is established, the default SiRFLive windows should be arranged and become filled with data.

If not all the default windows are arranged or opened, under the Main Menu Bar, Click Window, Restore Layout, and Default.

6.2.1 Signal View

(Tool Bar icon)

<table>
<thead>
<tr>
<th>Type of Fix</th>
<th>Satellite Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 6-8 Satellite signal levels](image-url)
6.2.2 Radar View

(Tool Bar icon)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle</td>
<td>GPS</td>
</tr>
<tr>
<td>Square</td>
<td>GLONASS</td>
</tr>
<tr>
<td>Sky blue</td>
<td>SBAS</td>
</tr>
<tr>
<td>Red</td>
<td>$C/N_0 = 0$</td>
</tr>
<tr>
<td>Blue</td>
<td>$C/N_0 \neq 0$ and not used in the navigation solution</td>
</tr>
<tr>
<td>Green</td>
<td>$C/N_0 \neq 0$ and used in the navigation solution</td>
</tr>
<tr>
<td>Orange</td>
<td>ABP is being used to acquire satellites</td>
</tr>
<tr>
<td>Purple</td>
<td>CGEE is being used</td>
</tr>
<tr>
<td>Pink</td>
<td>SGEE is being used</td>
</tr>
</tbody>
</table>

*Figure 6-9 Satellites by azimuth and elevation*
6.2.3 Debug View

(Tool Bar icon)

Displays the messages incoming from the receiver

Figure 6-10 Receiver Messages (OSP)
6.2.4 Location View

(Tool Bar icon)

Map position button requires Internet access.

Map Position  Configuration  Clear Data  Set Reference Location

![Map View](Image)

**Position Information**

- Receiver Time(UTC): 18:33:21
- TOW: 326016.04
- Ext. Week: 1635
- Latitude: 33.670878
- Longitude: -117.653770
- Altitude: 220.29 m
- HDOP: 0.80
- Speed: 0.02 m/s
- Heading: 306.87°
- Mode: 4-SVs KF + Dgps
- Number of SVs used in Fix: 10

Lat: 33.670852, Lng: -117.653742

![Location Fix](Image)

**Figure 6-11 Details of the position fix**
6.3 Logging Data

SiRFLive can record the current message stream (OSP or NMEA) into a log file. From the Menu Bar, click File, Log File, & Start or click the Log File icon on the Tool Bar.

Figure 6-12 Log File command
Enter the desired log file path and filename in the **Log File Path** box, as shown below, then click **Start** to begin logging.

*Figure 6-13 Enter the filename to specify the log file*
6.4 Receiver Commands

Many of the receiver commands can be accessed through the Menu Bar under Receiver, Command. There are also equivalent shortcuts on the Tool Bar for frequently used commands.

![Figure 6-14 Receiver commands](image)

Some receiver commands are available in One Socket Protocol (OSP) only.
6.4.1 Reset commands

Select from the Menu Bar Receiver, Command, Reset or click the Reset icon on the Tool Bar.

Resets are used to measure the TTFF of the receiver. The TTFF/Nav Accuracy window conveniently displays the TTFF in seconds and Navigation accuracy based on the Reference Location.

Reference Location allows the user to change the position used as the reference. This helps determine position accuracy in conjunction with Time-To-First-Fix values.

![Figure 6-15 Reset Window](image)
6.4.2 Switching Protocols

On the Menu Bar, select Receiver, Command, Switch COMM Settings. Click **Set** to apply settings.

OSP has many commands that are not available in NMEA. Therefore, switching to OSP is recommended for testing purposes.

![Switch Comm Settings](image)

*Figure 6-16 Switching to OSP protocol with its default 115200 baud rate*
6.4.3 Setting the Receiver Type

SiRFLive will normally auto-detect the connected chipset, but if not, click **Receiver, Receiver Family**, then the desired family.

![Figure 6-17 Click Receiver, Receiver Family, then the desired family](image)

6.4.4 Enabling 5Hz Update

First, set the baud rate high enough so that characters are not dropped. The default rates (9600 for NMEA and 115.200 for OSP) may be too low depending on the configured message set.

Through the SiRFLive Menu Bar, click **Receiver, Navigation, Set 5Hz Nav** and select **Enable 5Hz Nav**.

![Figure 6-18 Enable 5Hz Nav command](image)
The **Enable 5Hz Nav** command in SiRFLive sends the following OSP:

```
A0 A2 00 0E 88 00 00 04 04 00 00 00 00 00 00 0F 02 00 A1 B0 B3
```

The **Disable 5Hz Nav** command in SiRFLive sends the following OSP:

```
A0 A2 00 0E 88 00 00 04 00 00 00 00 00 00 00 0F 02 00 9D B0 B3
```
### 6.4.5 OSP MID 136 - Mode Control Command

<table>
<thead>
<tr>
<th>Name</th>
<th>Bytes</th>
<th>Binary (Hex)</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID</td>
<td>1 U</td>
<td>Scale</td>
<td>Example</td>
<td>Decimal 136</td>
</tr>
<tr>
<td>Reserved</td>
<td>2 U</td>
<td>0000</td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>Degraded Mode</td>
<td>1 U</td>
<td>01</td>
<td></td>
<td>Controls use of 2-SV and 1-SV solutions</td>
</tr>
<tr>
<td>PositionCalc Mode</td>
<td>1 U</td>
<td>01</td>
<td></td>
<td>Detailed descriptions follow</td>
</tr>
<tr>
<td>Reserved</td>
<td>1 U</td>
<td>00</td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>Altitude</td>
<td>2 S</td>
<td>0000</td>
<td>meters</td>
<td>User specified altitude, range - 1,000 to 10,000</td>
</tr>
<tr>
<td>Alt Hold Mode</td>
<td>1 U</td>
<td>00</td>
<td></td>
<td>Controls use of 3-SV solution</td>
</tr>
<tr>
<td>Alt Hold Source</td>
<td>1 U</td>
<td>00</td>
<td></td>
<td>0 = Use last computed altitude 1 = User user-input altitude</td>
</tr>
<tr>
<td>Reserved</td>
<td>1 U</td>
<td>00</td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>DegradedTime Out</td>
<td>1 U</td>
<td>05</td>
<td>sec</td>
<td>0 = disable degraded mode, 1 to 120 seconds degraded mode time limit</td>
</tr>
<tr>
<td>DR Time Out</td>
<td>1 U</td>
<td>02</td>
<td>sec</td>
<td>0 = disable dead reckoning, 1 to 120 seconds dead reckoning mode time limit</td>
</tr>
<tr>
<td>Measurement and Track Smoothing</td>
<td>1 U</td>
<td>00000011</td>
<td></td>
<td>Detailed descriptions follow</td>
</tr>
</tbody>
</table>

**Table 6-1 MID 136 - Mode Control command**
7 Updating Firmware with SiRFLive

7.1 Flashing Requirements

- Personal Computer with a USB/COM port running SiRFLive Firmware file

7.2 Flashing Instructions

⚠ Note: Do NOT use the BOOT pin on the module (leave it floating).

1. Click on Receiver, Update Firmware from the Menu Bar.

![Figure 7-1 Firmware file selection]
2. Enter the filename or browse to the firmware file.

Figure 7-2 Select Firmware file

3. Click Update.

Figure 7-3 Successful firmware installation

4. The new firmware will be installed, and the receiver will begin operation.
8 Software Interface

The host serial I/O port (UART, I²C, or SPI) supports full duplex communication between the receiver and the user.

The default UART configuration is: NMEA, 9600 bps, 8 data bits, no parity, and 1 stop bit.

Two protocols are available for data output and command input:

- NMEA-0183 V4.10
- SiRF One Socket Protocol (OSP)

More information regarding the software interface can be found in the Telit CSR Software User Guide. Access to this document requires a Non-Disclosure Agreement (NDA) with Telit.

8.1 NMEA Output Messages

Defaults:

- NMEA-0183
- 1 Hz fix rate. Maximum is 10 Hz.
- Message Set

### Standard Messages

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMC</td>
<td>GNSS Recommended minimum navigation data</td>
<td>1</td>
</tr>
<tr>
<td>GGA</td>
<td>GNSS position fix data</td>
<td>1</td>
</tr>
<tr>
<td>GSA</td>
<td>GNSS Dilution of Precision (DOP) and active satellites</td>
<td>1</td>
</tr>
<tr>
<td>GSV</td>
<td>GNSS satellites in view.</td>
<td>1 / 5</td>
</tr>
</tbody>
</table>

Note: Multiple GSA and GSV messages may be output per cycle.

*Table 8-1 Default NMEA Output Messages*
The following messages can be enabled by command:

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLL</td>
<td>Geographic Position – Latitude &amp; Longitude</td>
</tr>
<tr>
<td>GNS</td>
<td>GNSS Fix Data</td>
</tr>
<tr>
<td>VTG</td>
<td>Course Over Ground &amp; Ground Speed</td>
</tr>
</tbody>
</table>

Table 8-2 Available Messages

<table>
<thead>
<tr>
<th>Talker ID</th>
<th>Constellation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>Galileo</td>
</tr>
<tr>
<td>GB</td>
<td>BeiDou</td>
</tr>
<tr>
<td>GL</td>
<td>GLONASS</td>
</tr>
<tr>
<td>GP</td>
<td>GPS</td>
</tr>
<tr>
<td>GN</td>
<td>Solutions using multiple constellations</td>
</tr>
</tbody>
</table>

Table 8-3 NMEA Talker IDs

Proprietary Messages
The receiver can issue several proprietary NMEA output messages ($PSRF) which report additional receiver data and status information.
8.2 NMEA Input Commands

The receiver uses NMEA proprietary messages for commands and command responses. This interface provides configuration and control over selected firmware features and operational properties of the module.

The format of a command is:

```
$<command-ID>[,<parameters>]*<cr><lf>
```

Commands are NMEA proprietary format and begin with “$PSRF”.

Parameters, if present, are comma-delimited as specified in the NMEA

8.3 One Socket Protocol (OSP) Output Messages

SiRF One Socket Protocol (OSP) is supported. This is an extension of the existing SiRF Binary protocol. The following messages are output once per second:

- MID 2
- MID 3
- MID 4
- MID 7
- MID 9
- MID 41
- MID 64 SUB ID 2 (One message for each satellite being tracked).
- MID 138
<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2017-03-21</td>
<td>First Issue</td>
</tr>
</tbody>
</table>
SUPPORT INQUIRIES

Link to www.telit.com and contact our technical support team for any questions related to technical issues.