Microsemi Corporation
March 6, 2019

Customer Notification No: 098-50620-100

Rev. A

Field Service Bulletin (FSB)

Customer Advisory Notice (CAN)

Subject: April 6, 2019 GPS Week Rollover Workarounds for XLi Time & Frequency Instruments with the 86-8013 GPS Receiver

Models Affected:
XLi Time & Frequency System part number 1510-6x2 <u>WITH</u> GPS receiver 86-8013 installed. This configuration shipped between April of 2003 and June of 2005. See the *Verification* section below to determine the GPS receiver installed.

Summary:
XLi Time & Frequency Instruments with the 86-8013 GPS receiver installed will experience a date change with the GPS Week Rollover on April 6, 2019. This date change will affect NTP, Time Codes (IRIG, HaveQuick, PTTI, etc.), the front panel display, the Programmable Pulse Output, and serial timing outputs that use the date. It will not affect the timing or accuracy of pulses such as the 1PPS, 10 MHz, etc. that are not linked to the date. Depending on when you are reading this FSB there are several steps you can take to minimize the effect of the rollover. In short, either disconnect the GPS antenna prior to the event and have the unit go into holdover, or connect a SyncServer S650 to provide the time to the XLi, or if the rollover event has passed, how to manually set the time in the XLi until you can resolve the situation.

FSB Document Hyperlinks:
1. [Recommended Pre-April 6, 2019 GPS rollover solution](#)
2. [PRE-April 6, 2019 Emergency Solution](#)
3. [POST-April 6, 2019 Emergency Solution](#)
4. [Implementation of using the SyncServer S650 as the time source for the XLi BEFORE the GPS Rollover event](#)
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Verification:
Verify the XLi has the 86-8013 GPS receiver installed by either the F119 command from the front panel, or by entering the F119 command from the Command Line Interface. This assumes that it is prior to April 6, 2019. If it is April 7, 2019 or later, an XLi with the 86-8013 GPS receiver will have the wrong date and time.

![Microsemi logo]

Recommended Pre-April 6, 2019 GPS Rollover Solution:
The best choice is to install a SyncServer S650 with a Timing I/O module between the XLi GPS antenna and the XLi as shown in Figure 1. The S650 will lock to GPS with <15ns RMS accuracy to UTC and provide an extremely accurate IRIG DCLS time code output as a high accuracy input to the XLi. This solution uses the same GPS antenna cable and GPS antenna as the XLi and is the easiest and least impactful solution. All of the systems and devices connected to and interfaced to the XLi will not be impacted and continue to operate as normal. See implementation details further below.

Figure 1: Use the SyncServer S650 to lock to GPS and feed high accuracy IRIG DCLS to the XLi as its timing reference. This solution has minimal impact on all systems interfacing to the XLi.
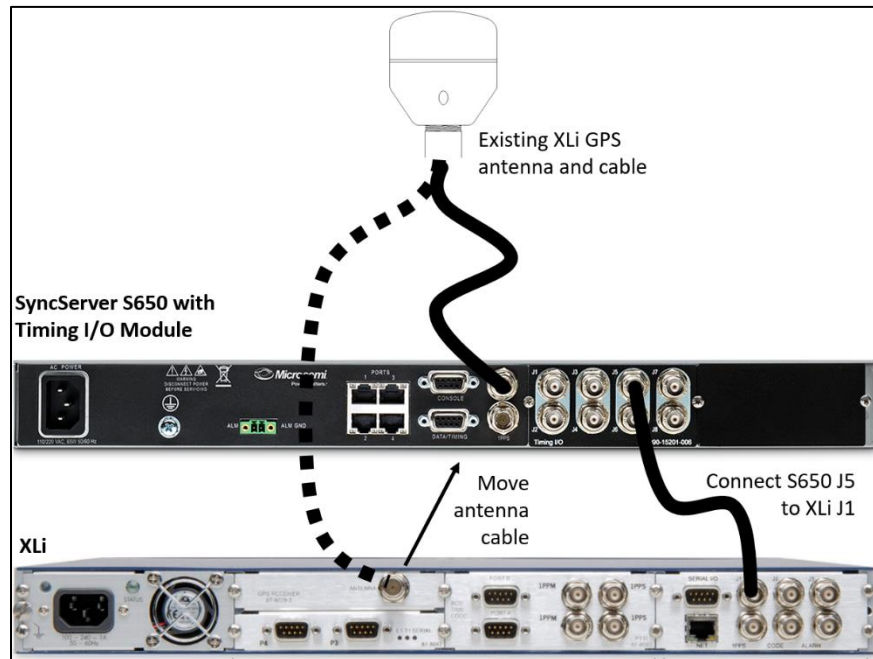
PRE-April 6, 2019 Emergency Solution:
If there is not enough time remaining before April 6, 2019 to implement the *Recommended Solution* above, the next best solution is to disconnect the GPS antenna cable just prior to April 6, 2019. This will put the XLi into holdover allowing it to keep counting the time, though it will be drifting. The amount of drift per day will be a function of the installed oscillator[1]. Regardless, by disconnecting the antenna the XLi will no longer be getting time from the GPS receiver, and thus will not roll back the internal time by 1024 weeks. ***Warning***: once the April 6 to April 7, 2019 GPS week number rollover event has passed, never reconnect the GPS antenna to the XLi again. If you do, it will relock to GPS with a date 19 years in the past.

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[1] The XLi will process NTP requests up to the point that the estimated drift meets/exceeds 1 millisecond. After that point it will not respond to NTP time requests. XLi units with OCXO and Rubidium upgrades will stay below 1 millisecond of drift for quite some time to allow for system remediation efforts. XLi units with the standard oscillator may exceed the 1 millisecond error in a matter of a few hours. Use the F13 command from the XLi front panel or command line interface to view current estimated time error.

Many XLi time and frequency units are highly integrated into other test and measurement platforms. As there is no 100% form/fit/function replacement for the XLi, Microsemi recommends adding the SyncServer S650 as the time source to the XLi as shown in Figure 1. See implementation details further below.

POST-April 6, 2019 Emergency Solution
In the event the GPS receiver installed in the XLi rolled back in time over 19 years there are two things that must be done immediately:

1) Disconnect the GPS antenna cable from the rear of the XLi, and <u>never</u> reconnect it again. If it is reconnected the GPS receiver/XLi will have the incorrect time by over 19 years.
2) Use the F3 command from the front panel or the Command Line Interface to manually set the time in the XLi. The following is an excerpt from the manual showing how to enter the F3 command to set the time:

   ```
   F3 UTC MM/DD/YYYY HH:MM:SS<CR>
   ```

   Example:

   ```
   F3 UTC 04/07/2019 18:22:30<CR>
   ```

   Once the above command is entered, entering F3 by itself will respond with the current time in the XLi.

The XLi will now be a free running clock and every effort should be made to implement the Recommended GPS Rollover Solution discussed above as soon as possible.

Note: As a free running clock the XLi will output IRIG time codes with no errors reported. However, it will not respond to NTP time requests. As an emergency measure only, and for a short period of time, you can cable the IRIG output as an IRIG input to the XLi. (A BNC T-connector may be required). This creates a timing loop and the clock drift rate of the XLi will accelerate, but at least the unit will be able to operate as an NTP server.

Implementation of using the SyncServer S650 as the time source for the XLi BEFORE the GPS Rollover event

There are two ways to provide minimal disruption to the timing outputs of the XLi when adding the S650 as the source of time for the XLi. The best and least disruptive from a time accuracy standpoint is to use a splitter on the GPS antenna cable and connect both the XLi and the SyncServer S650 to the same antenna. This allows the S650 to lock to GPS and steer in the clock accuracy before becoming the source of time for the XLi. The other method will put the XLi in holdover while the S650 locks to GPS. Regardless, the ultimate objective is to have the S650 providing the time to the XLi as shown in Figure 1.

Technique 1: Using an Antenna Splitter

Step 1) Adding the splitter
Make sure all cables and connectors are ready and at hand to connect in the antenna cable splitter with the least amount to disruption in GPS signal flow to the XLi.
1) Disconnect the antenna cable from the XLi and connect it to the splitter input
2) Using a short cable, connect the XLi to a splitter output
3) Using a short cable, connect the S650 to a splitter output

Step 2) SyncServer S650
-Power up the S650 (this can be completed in advance of Step 1 above)
-Either from the front panel or the web GUI, wait for the unit to lock to GPS.

Step 3) XLi
-Set F74 to **PRI – SEC – SEC**
-Set F2 for both the Display and the IRIG to 24 hour.
-Set F69 for UTC.
-Set F110 to input IRIG-000-1344 by setting F110 to:
    Input Code: IRIG-B000 1344
    Clock source: SECONDARY
    Impedance= 50
    Code Sign: POSITIVE
    Propagation Delay: 0uS
    IRIG Mode: SYNC GEN
    Error bypass: 3 FRAMES

Step 4) SyncServer S650
-Confirm via the web GUI that the Slot A Timing I/O module BNC J5 is set to output IRIG-B 004 DCLS (the default signal out J5)
-Connect a cable between the SyncServer J5 connector and the XLi J1 connector.

Step 5) At this point both the S650 and the XLi are tracking GPS, and the XLi is posed to use the IRIG DCLS signal as an input when GPS is disconnected. If there is time, we suggest waiting a day before proceeding to Step 6. This allows the S650 plenty of time to synchronize to GPS and steer in the local oscillator.

Step 6) This step assumes that you do not plan to leave the splitter attached to the antenna cable (our recommendation if only the S650 will use the GPS antenna). Quickly disconnect the antenna cable from the splitter, disconnect the cable from the S650, and attach the antenna cable directly to the S650 GNSS BNC connector. At this point the XLi will not have a GPS connection and will begin using the IRIG DCLS signal from the S650 for accurate time. The XLi locked to the IRIG signal from the S650 is now UTC synchronized to likely less than 50ns to UTC.

Technique 2: Allowing the XLi to be in holdover while the S650 locks to GPS

Step 1) XLi
- Set F74 to **PRI – SEC – SEC**
- Set F2 for both the Display and the IRIG to 24 hour.
- Set F69 for UTC.
- Set F110 to input IRIG-000-1344 by setting F110 to:
    - Input Code: IRIG-B000 1344
    - Clock source: SECONDARY
    - Impedance= 50
    - Code Sign: POSITIVE
    - Propagation Delay: 0uS
    - IRIG Mode: SYNC GEN
    - Error bypass: 3 FRAMES

Step 2) SyncServer S650
- Bring the SyncServer S650 online and proceed to the Slot A Timing I/O web page.
- Set the J5 squelch setting to "If not locked" and confirm it is IRIG-B 004 DCLS output. Apply the settings.
- Disconnect the antenna cable from the XLi and connect it to the S650.
- Connect a cable between the SyncServer J5 connector and the XLi J1 connector.

Step 3) XLi
As soon as the antenna cable was moved from the XLi to the S650, the XLi was in holdover and the clock was drifting on the internal oscillator. As the S650 was locking to GPS the IRIG DCLS signal out the J5 connector is/was squelched. As soon as the S650 locked to GPS, and had the correct time, the IRIG signal was output. The XLi is configured to move from GPS as the primary to the J1 input as the secondary. As soon as the IRIG DCLS signal is present, the XLi will lock

to it and steer in the local oscillator. Depending on how far apart the time is on the XLi compared to the S650, the XLi might slew the time or jam sync the time. (This is why we recommend using the splitter in Technique 1 above). Once the XLi locked is to the IRIG signal from the S650 it is now UTC synchronized to likely less than 50ns to UTC.

Implementation of using the SyncServer S650 as the time source for the XLi AFTER the GPS Rollover event

In this case the XLi is most likely in holdover or has had the time manually set. The procedure is straightforward and easy to follow once the SyncServer S650 is powered up in close proximity to the XLi.

Step 1) SyncServer S650
-Attach the antenna cable to the GNSS BNC connector on the rear panel.
-Either from the front panel or the web GUI, wait for the unit to lock to GPS.

Step 2) XLi
-Set F74 to **PRI – SEC – SEC**
-Set F2 for both the Display and the IRIG to 24 hour.
-Set F69 for UTC.
-Set F110 to input IRIG-000-1344 by setting F110 to:
Input Code: IRIG-B000 1344
Clock source: SECONDARY
Impedance= 50
Code Sign: POSITIVE
Propagation Delay: 0uS
IRIG Mode: SYNC GEN
Error bypass: 3 FRAMES

Step 3) SyncServer S650
-Confirm via the web GUI that the Slot A Timing I/O module BNC J5 is set to output IRIG-B 004 DCLS (the default signal out J5)
-Connect a cable between the SyncServer J5 and the XLi J1.

The XLi should now lock to the IRIG B DCLS signal from the SyncServer. Once the XLi has had a chance to lock to the IRIG signal from the S650, it is now UTC synchronized to likely less than 50ns to UTC.

Contact Information:

North and South America
Microsemi, Inc.
3870 North First Street
San Jose, CA 95134-1702
Toll-free in North America: 1-888-367-7966, Option 1
Telephone: 408-428-7907
Email: FTD.Support@microsemi.com

Europe, Middle East, and Africa (EMEA)
Microsemi Global Services EMEA
Altlaufstrasse 42
85635 Hoehenkirchen-Siegertsbrunn Germany
Telephone: +49 700 3288 6435
Fax: +49 8102 8961 533
Email: FTD.EMEASupport@microsemi.com
FTDemeasales@microsemi.com

South Asia
Suite A201, 2nd Floor, West Wing, Wisma Consplant 2, No. 7, Jalan SS16/1, 47500
Subang Jaya Selangor, Malaysia
Toll-free in North America: 1-888-367-7966, Option 1
Telephone: 408-428-7907
Email: FTD.Support@microsemi.com