Note on using WR Switch in Grandmaster mode

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Requirements

The WR switch can operate as a synchronous PTP grandmaster referenced to externally provided 10 MHz and PPS signals. The signals must meet following electrical requirements:

- PPS input: 50 Ω, LVTTL or TTL levels
- 10 MHz input: 50 Ω, TTL/LVTTL/sine (1 – 5 V rms)
- t_{SETUP} (PPS-to-10MHz) = 10 ns (see fig. 1)

WR grandmasters require both 10 MHz and PPS to work. The 10 MHz is used to produce 125 MHz Sync-E reference and the PPS is used only to ensure the alignment of the edges of both clocks at inter-second boundary. The actual inter-second boundary is the 10 MHz rising edge after the rising edge of the PPS pulse (see fig. 1). PPS input is sampled only once (when the PLL is locking).

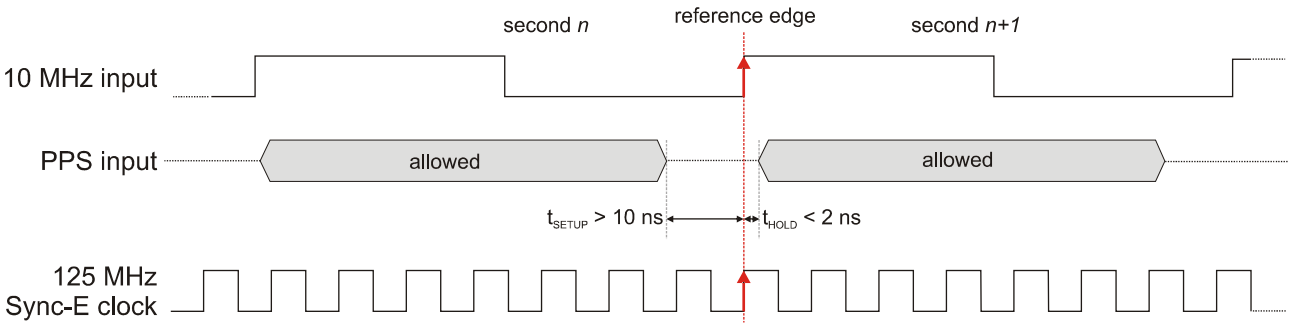

Fig 1. Producing 125 MHz reference from 10 MHz GPS input in the WR Switch

Since the switch must transfer the PPS signal between two clock domains with no metastablity, it is essential that t_{SETUP} and t_{HOLD} values shown on fig 1. are respected. When installing a WR grandmaster, one should first verify the relationship of PPS vs 10 MHz and compensate it if necessary.

Warning 1: The 10 MHz input must not „jump" (i.e. have temporary period different than 100 ns). Some GPS receivers were reported to produce such 10 MHz with such artifacts – these devices cannot be used with WR.

Warning 2: The PPS signal must not change its' phase with respect to the 10 MHz input beyond one 10 MHz clock cycle when the switch is locked.

Supplying time-of-day information

WRS is capable of retreiving time of day information from NMEA messages delivered to its' serial port. This requires configuring the GPS receiver to output a GPRMC message every second (right after the PPS pulse). Serial port transmission parameters are 115200 bps, 8N1.

Setup procedure

- ssh to the switch (default user is `root` with no password),
- edit `/wr/etc/wrsw_hal.conf` and change the line `mode` in `timing` section to `GrandMaster`. If time-of-day NMEA messages are going to be used, uncomment

`use_nmea=1` line too,
- connect the 10 MHz and PPS signals,
- connect the serial port for time of day info (if used),
- reboot the switch,
- check the HAL output (it takes ~10 seconds to lock).

Frequently Asked Questions

Q: *Do you know, what frequent GPS phase jumps of >100ns (PPS/10MHz) would cause for the WR-clock stability? Is there a smoothing algorithm installed on the WRS ? With tunable parameters ?*
A: The Sync-E 125 MHz clock is tightly locked to the 10 MHz input in GM mode. Therefore, any phase jumps in the 10 MHz reference will cause the device to de-lock. This might be the case with low quality GPS receivers which produce the 10 MHz signal using a numerically controlled oscillator.

Q: *I have followed the setup procedure, but my switch does not lock.*
A: First try a setup without NMEA time-of-day (change `use_nmea` to 0). If it is locking now, check the format of the messages and the speed of the serial port used. A good way of testing whether NMEA messages arrive at the switch is to launch a serial terminal: `com /dev/ttyS2 115200`. If the messages appear to be correct, please send us a sample. If the switch still refuses to lock, connect to the right USB port, reboot the switch again and log all the messages outputted by the RT CPU. Then send us a bug report, including the RT log and the HAL messages.