

Setup and Performance of Reference Timing at Jammertest

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We present setup and performance data for reference timing generation and distribution to Jammertest 2023. Jammertest is a 5 day long open-air GNSS interference (jamming, spoofing, meaconing) exercise arranged by Norwegian authorities since 2022 at Bleik/Andøya in northern Norway^{1,2}. Undisturbed and accurate reference timing is needed for organizers to create credible coherent GNSS spoofing signals synchronized to actual satellite signals and for test participants to measure the effect of broadcast GNSS interference on timing devices.

Two methods for reference time generation and distribution were set up for Jammertest 2023 (see figure). **(1)** Precision network timing: Timing from a remote ePRTC timing node (a) was distributed over a IEEE1588PTP ('PTP') link in the telecom backhaul network to a remote distribution node (b) in which physical timing signals provided reference input to a PTP White Rabbit (PTPWR) grandmaster. PTPWR timing was transported over alien wavelength in the national DWDM research network to a boundary PTPWR switch at proximate node (c) and bi-directional over CWDM in a dark fiber to test site Bleik (d). **(2)** Precision timing from GNSS over fiber: RF signals from an antenna at proximate node (c), shielded from GNSS interference mountains, were converted to light and sent over the CWDM dark fiber to test site Bleik (d). GNSS RF signals were re-generated and distributed to a prototype GNSS PPP disciplined oscillator (PPPDO) using Fugro AtomiChron, providing nanosecond level stability³. Measured performance of PPPDO versus PTPWR timing (e) are well within the specs of ePRTC. Occasional 4 ns jumps are likely due to the limited resolution of standard PTP in part of the distribution chain.

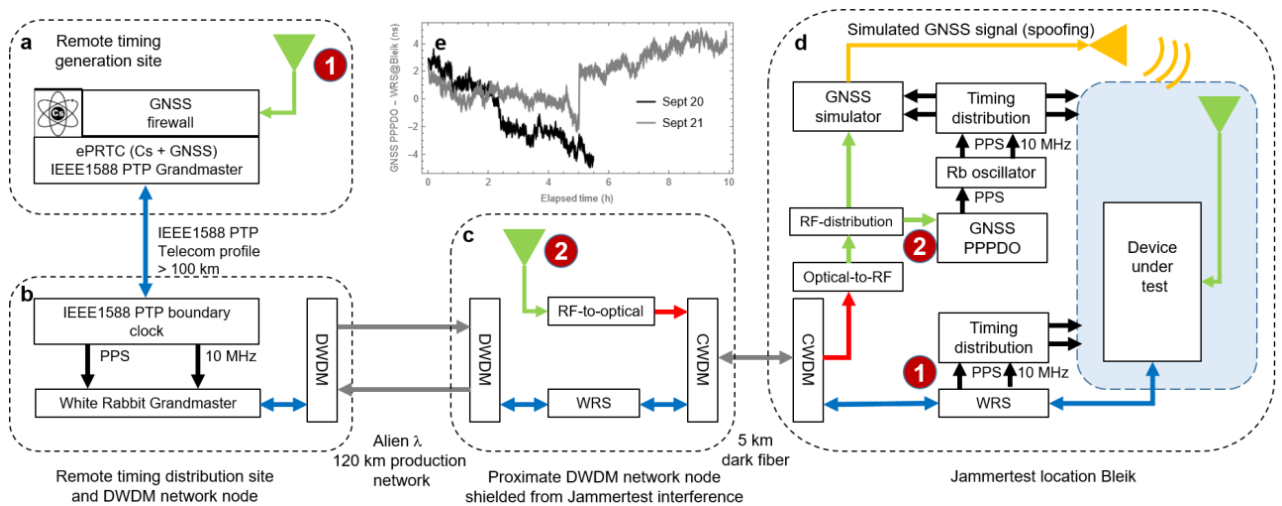


Fig. 1: Setup and performance of reference timing generation and distribution to Jammertest.

¹ <https://jammertest.no/>

² A. Morrison et al., "Jammertest 2022: Jamming and Spoofing Lessons Learned", Engineering Proceedings, vol. 54, issue 1, 2023. <https://doi.org/10.3390/ENC2023-15445>

³ Evaluation of PPPDO performance is a separate submission to EFTF 2024 (Paper ID: 2269).