

RF distribution over a White Rabbit link

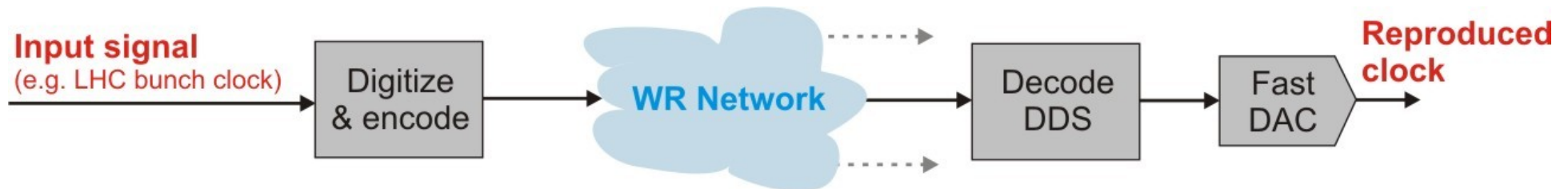
(a proof of concept)

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Genève, 14.05.2013

The idea

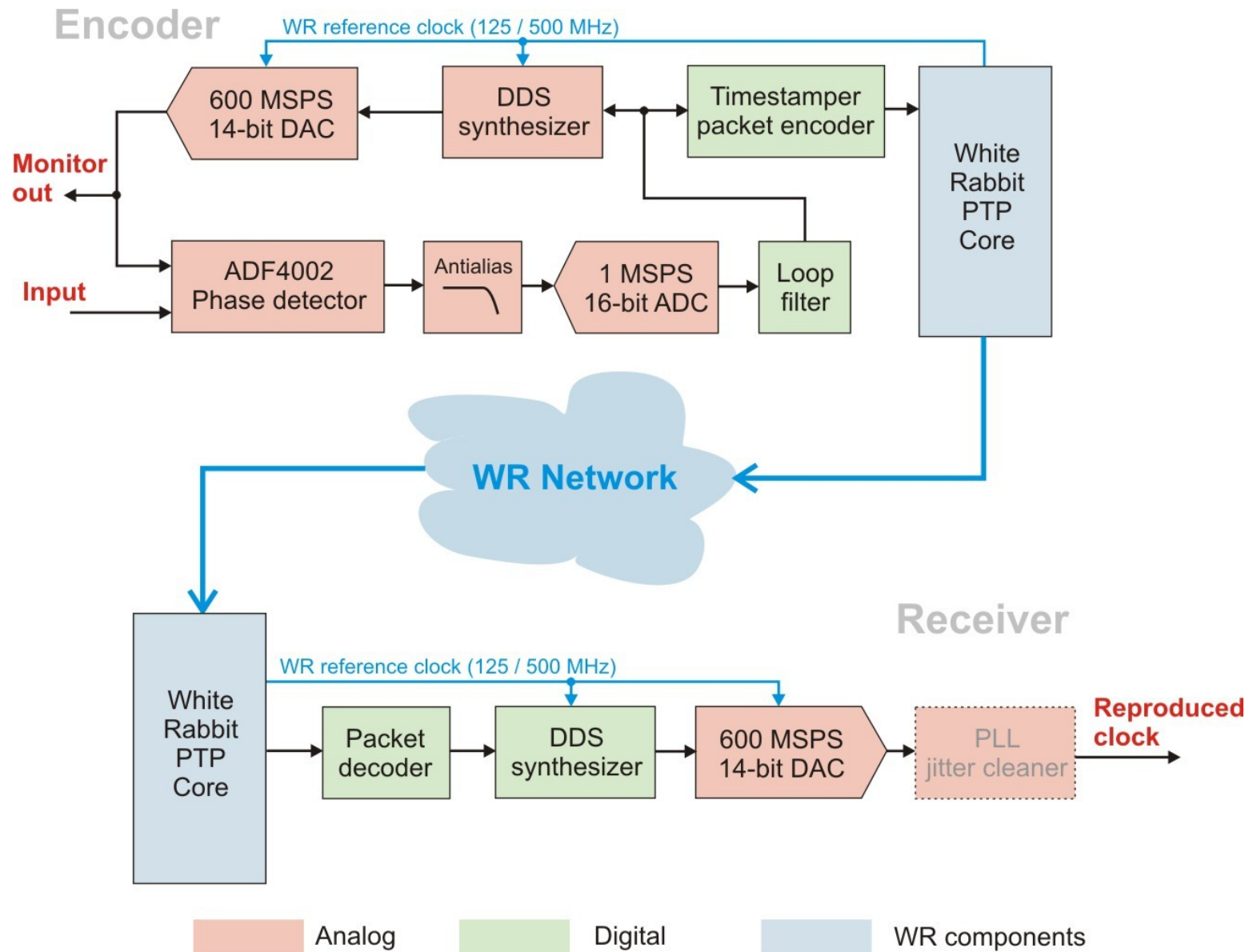
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- Input any reasonably stable (FM bandwidth: ~ 20 kHz) clock signal,
- Digitize it and broadcast over a synchronous network,
- Reproduce the original signal at any number of receivers,
- Share the network with other applications.



Distributed DDS

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Distributed DDS

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- Use a fast DAC driven by a DDS as a tunable oscillator,
- Put it inside a PLL, referenced with the clock that we want to transmit,
- Postprocess, encode and broadcast the oscillator tuning values over the WR network,
- Drive any number of identical DDS cores with the received data stream,
- Since WR ensures phase-compensated 125 MHz reference clock at every node in the network, slave DACs will produce a **copy of the master's clock.**

Test system

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- 2 SPEC cards with 2 DDS FMC mezzanines.

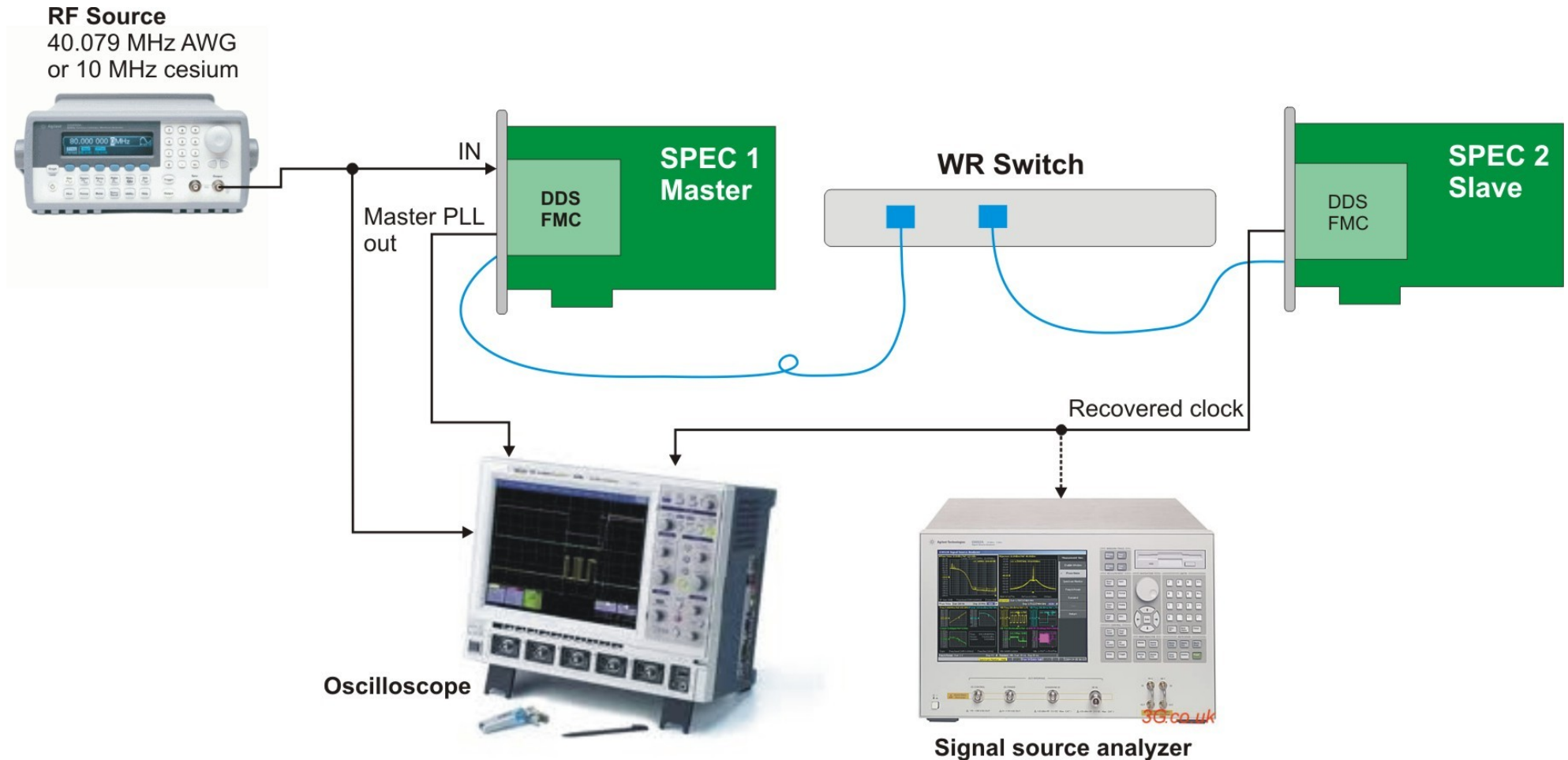
<http://www.ohwr.org/projects/fmc-dac-600m-12b-1cha-dds/wiki>

<http://www.ohwr.org/projects/spec>

- Point-to-point link.
- Test frequency: 10 MHz cesium standard, loop bandwidth: 10 kHz, broadcast rate: 110 kHz.
- Encoder PLL performance: 6 ps rms jitter (10 Hz – 5 MHz), -110 dBc/Hz noise floor (@ 100 Hz)
- Recovered clock: 8.5 ps rms jitter.
- Significant part of the jitter likely comes from buggy PCB design (1st prototype)

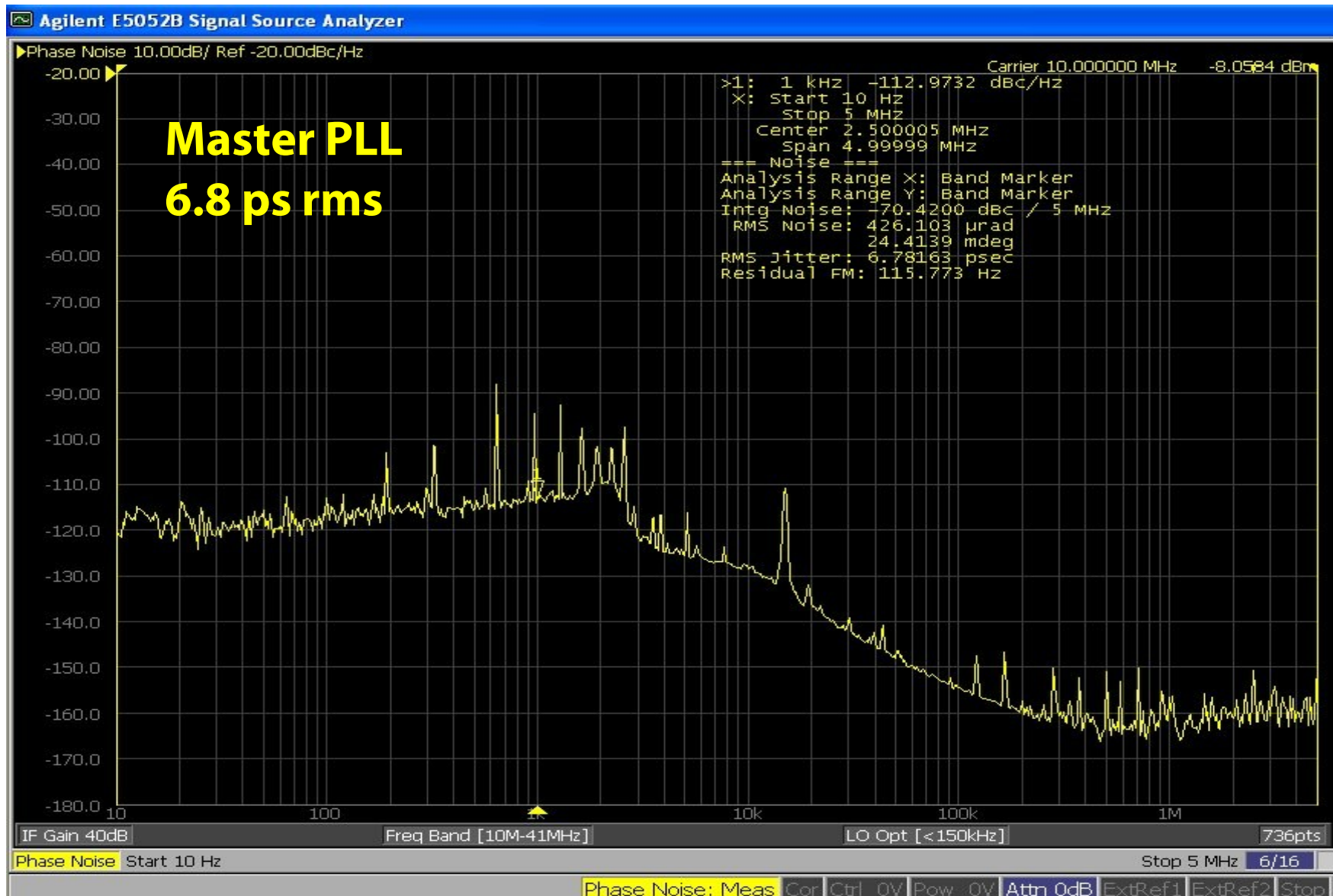
Test system

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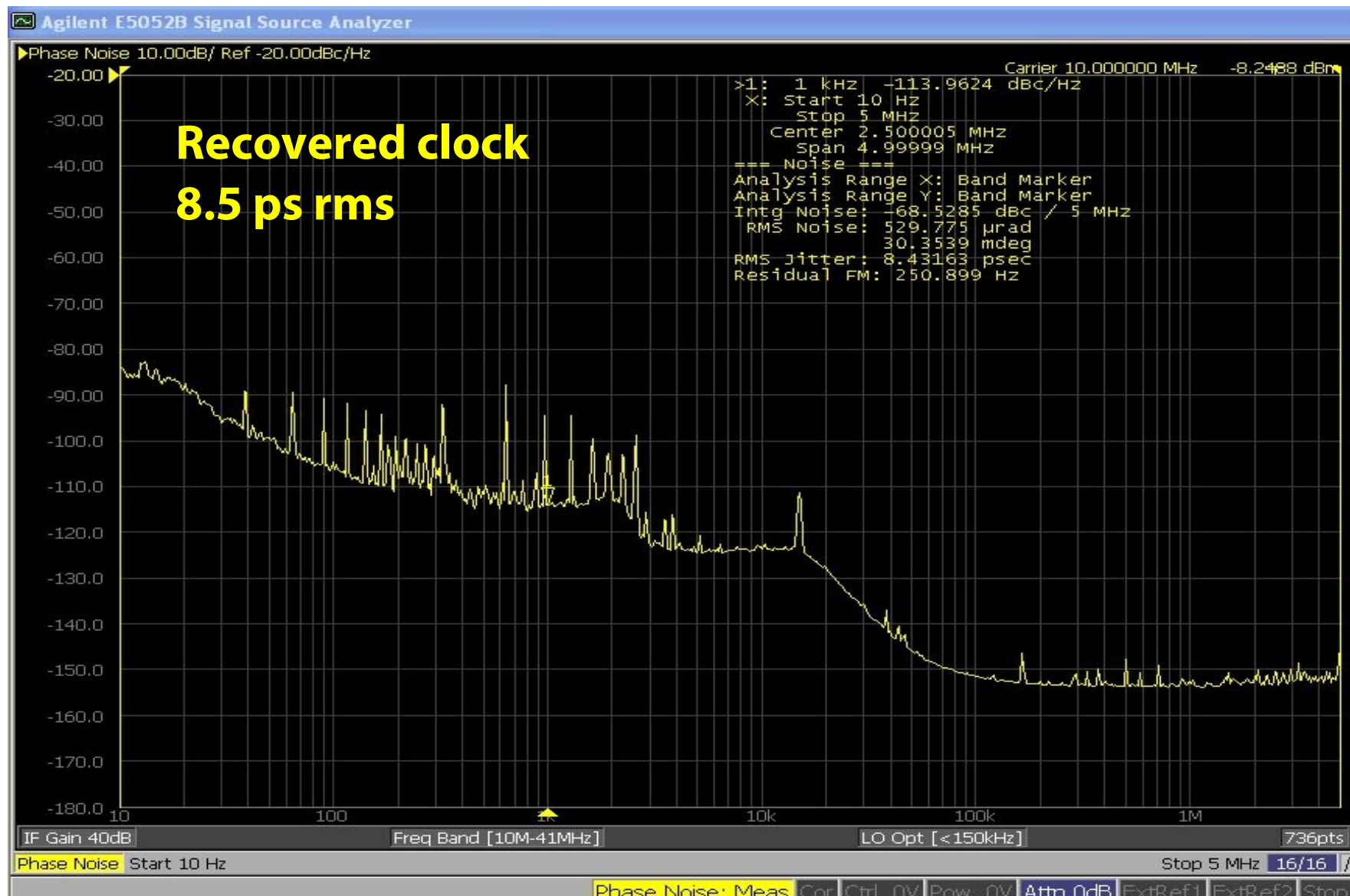
Performance

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Performance

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To do...

- Implement point-to-multipoint transmission and simultaneous encoding of multiple clocks,
- Reduce data bandwidth requirements – better encoding (prediction-correction or jitter-bound lossy compression),
- Optimize jitter: fine-tune PLL filters, deal with PCB issues, check performance with an additional cleaner PLL.

Summary

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- **Proof-of-concept** system with very promising results,
- Possibility of unifying general and beam-synchronous timing (like TTC) with bidirectional data distribution in a **single network**,
- **Extensible** to arbitrary analog signals.