
Solution Brief

6G Sub-THz Reference Architecture

Enabling the next generation of wireless communications

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6G Sub-THz Reference Architecture

What You Need for Demanding, High-Performance, Sub-THz Test

NI's 6G Sub-THz Reference Architecture is a set of interoperable hardware and software components designed to give users a platform to test and prototype the next generation wireless standards at sub-THz frequencies.

- Measurements including spectrum, power, and modulation at up to 4 GHz bandwidth
- System calibration process and correction, easy to run and built-in
- Real-time, sustained data streaming
- High-performance, open, and real-time [FPGA coprocessors](#) for data processing
- D-band frequency coverage with [Virginia Diodes](#) (VDI) frequency extensions
- Superior timing and synchronization on an integrated [PXI platform](#)
- Exceptional RF performance and dynamic range with [PXI Vector Signal Transceivers](#)
- Out-of-the-box, automated API for full control of test that is compatible with RFmx for standards-based measurements



Why Sub-THz?

The Future of Wireless Communication

With 5G continuing to roll out new capabilities over the next decade, followed closely by 6G, we will see many changes in wireless communications. This includes a move to much higher frequencies (sub-THz bands), to phased-array antenna solutions, to increasing bandwidths and modulation densities, and to the proliferation of new use cases in massive machine-to-machine communication and in new levels of reliability, security, and network response time.

Potential Applications and Use-Cases for 6G:



Wireless Cognition



Wireless Sensing



Immersive XR



Device Location

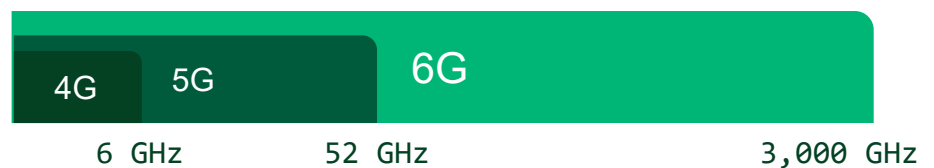


Imaging & Radar



Mobile Hologram

Terahertz Frequencies



Enabling Technologies in 6G:

1. **Extreme MIMO:** new extreme and distributed MIMO techniques will require a much greater level of synchronization
2. **Joint Communications and Sensing:** new use cases by combining sensing and radar functions with communications channels
3. **Spectrum efficiency and sharing:** new and novel techniques to optimize spectrum and usage between cellular, Wi-Fi, and other use-cases
4. **AI and Machine Learning:** native application of AI to improve techniques across all 6G—from the signal chain to the network topology
5. **Non-terrestrial Networks (NTN):** truly global communication will require connections to distributed satellite constellations
6. **New Spectrum:** FR3 (7–24 GHz) and Sub-THz (90 GHz–300 GHz) will open more spectrum for cellular communications

6G Sub-THz Reference Architecture Overview

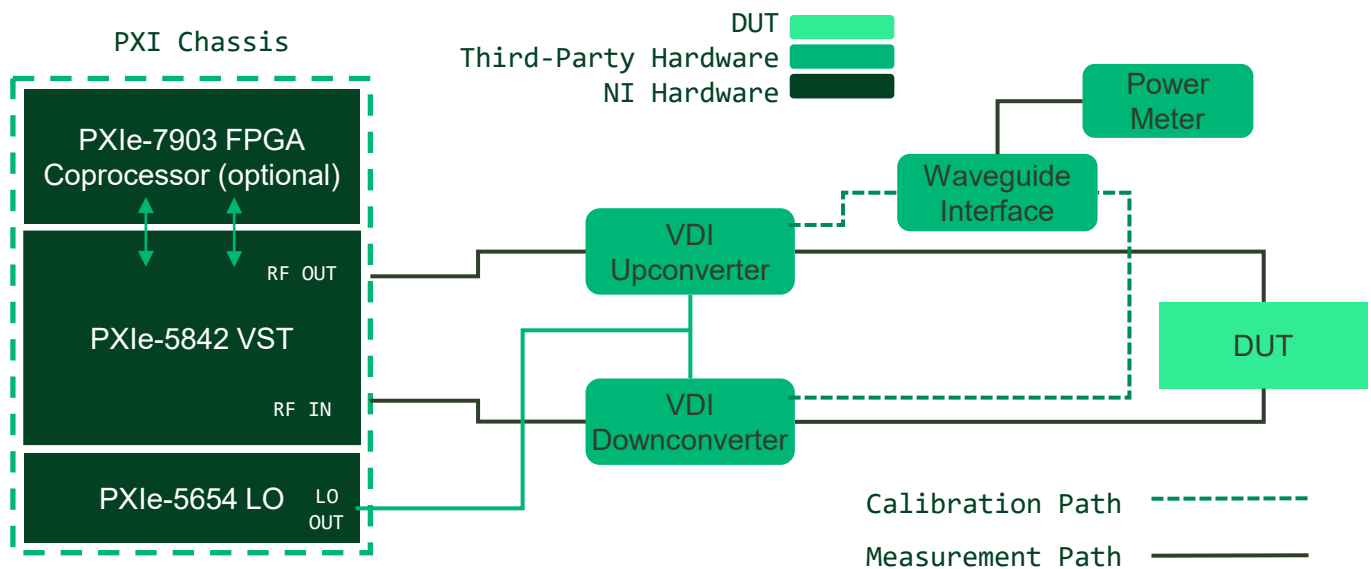


Figure 1. 6G Sub-THz Reference Architecture System Diagram

The 6G Sub-THz Reference Architecture optimizes NI and third-party hardware with easy-to-use software to bring a cost-effective, versatile, and high-performance sub-THz test system capable of a wide range of measurement options. With a high-level starting point for test configurations, quickly begin taking measurements with existing software or use it as a starting point for unique test customizations with software tools built for both parametric test and prototyping applications.

Capable of up to 4 GHz instantaneous bandwidth with real-time, sustained data streaming for both signal generation and analysis, the 6G Sub-THz Reference Architecture allows for power, spectrum, modulation, and calibration measurements in the D-band with Virginia Diodes (VDI) frequency extensions.

Designed with optimized timing and synchronization in mind, NI's PXI Platform allows for sub-nanosecond synchronization between instruments, including the ability to add multiple RF channels with additional PXI VSTs for MIMO applications and the ability to add analog, DC, or digital I/O.

The 6G Sub-THz Reference Architecture is an incredibly cost-effective sub-THz test solution. It enables the unique and complex test considerations required for sub-THz research, prototyping, and validation while providing a platform that can serve as a foundation and critical tool for the continued research and innovation in wireless communication standards development.

Contact your NI product expert to get help solving your test challenges.

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