connect

EMERSON | NI

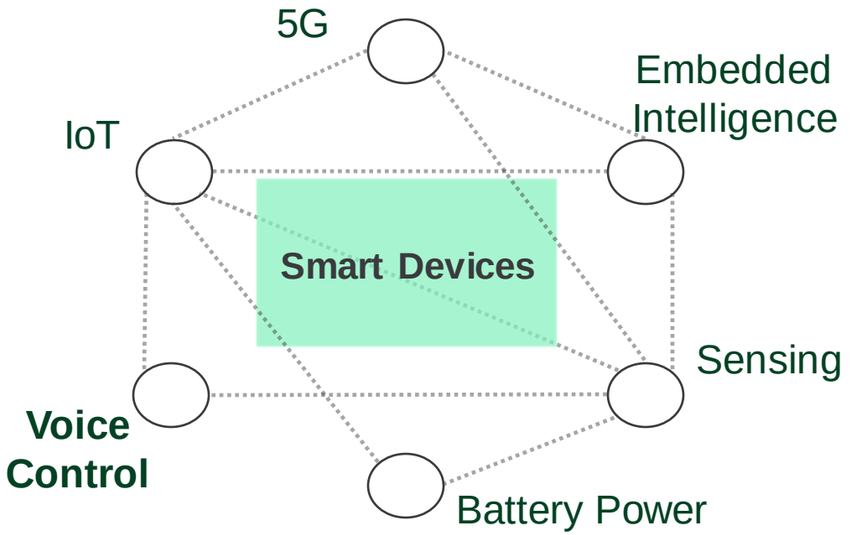
Mastering Audio and Acoustics Testing

Mastering Audio and Acoustics Testing

Min Tang, Offering Manager, SEBU

EMERSON

Overlapping Market Trends - Intensify Pressure on Test



Market Challenges

↓

Test Challenges

Wider Test Coverage	Higher DUT Quality	More Efficient Sustaining	**Faster Test Throughput**	**Compressed Development Schedule**	Tighter Regulations	More Insight from Data

Test Budget

Quiz

How many microphones are there inside your smart phone?

EMERSON

AUDIO & ACOUSTIC TEST

Test Increasingly Complex Sets of Audio Devices

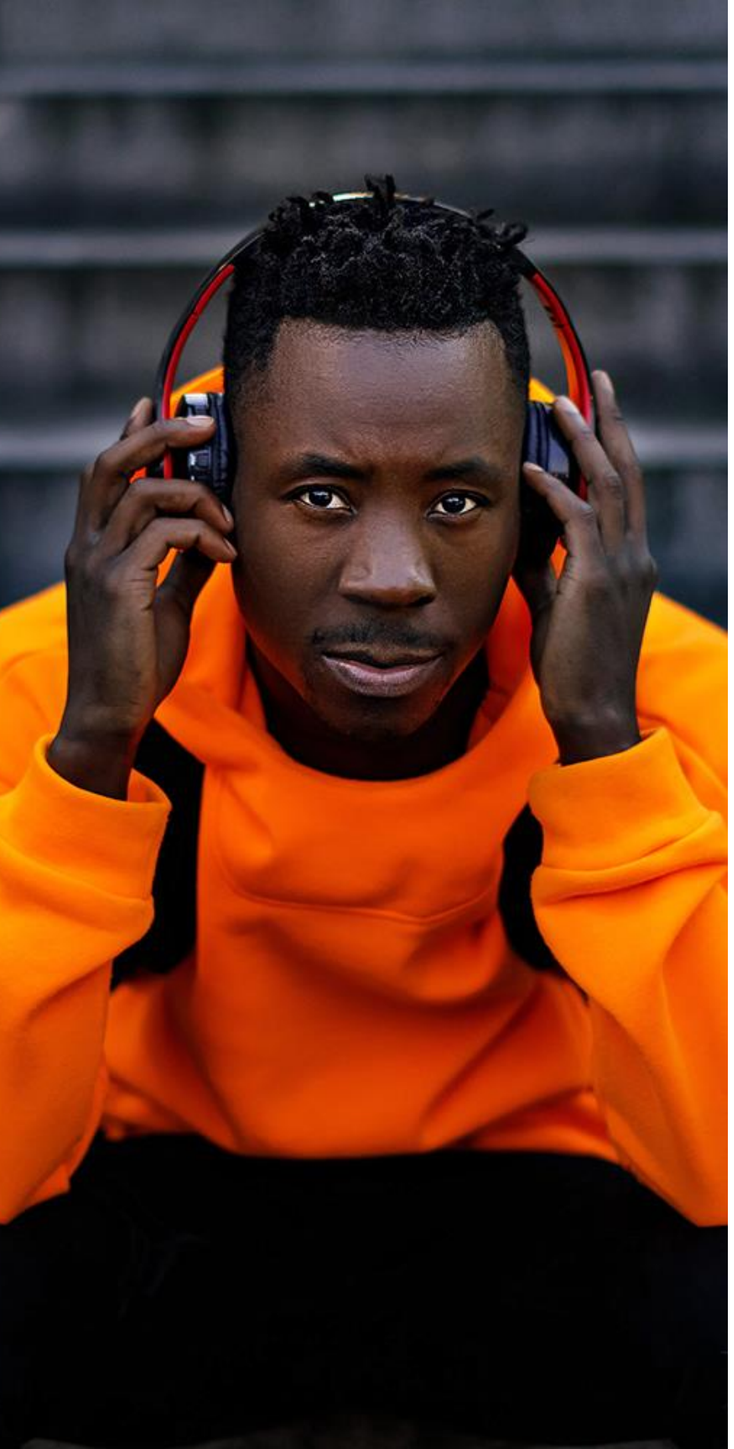
The worldwide **growth** in audio and acoustic testing is being fueled by:

- Rapid growth of IoT devices supporting **voice control** functionality
- Higher consumer expectations in **audio quality** set by popular premium products
- The availability of **high-quality digital microphone** technology at an acceptable cost-of-goods for consumer electronics market.

Quiz

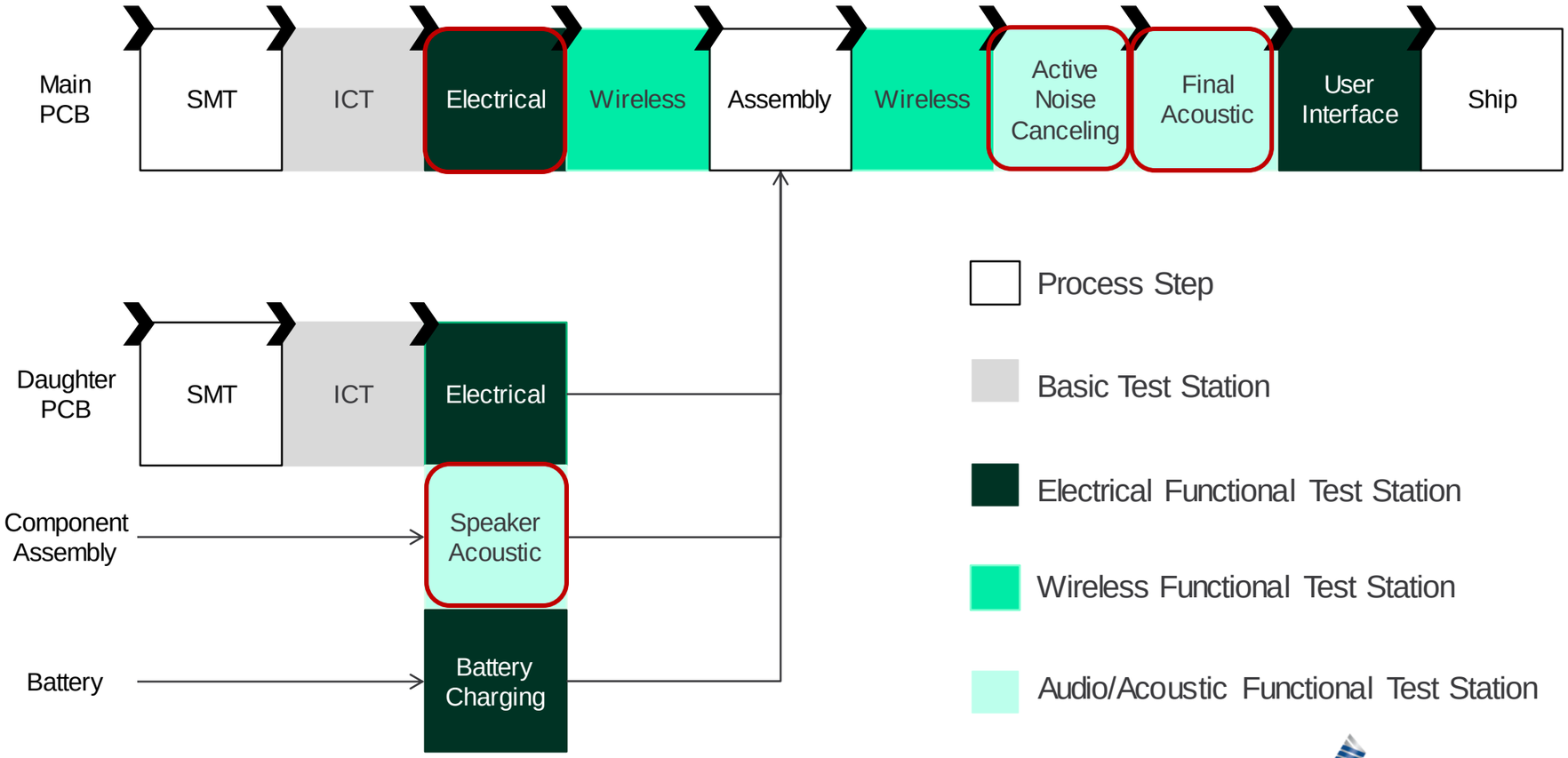
What’s the difference between Audio Test and Acoustic Test?

EMERSON

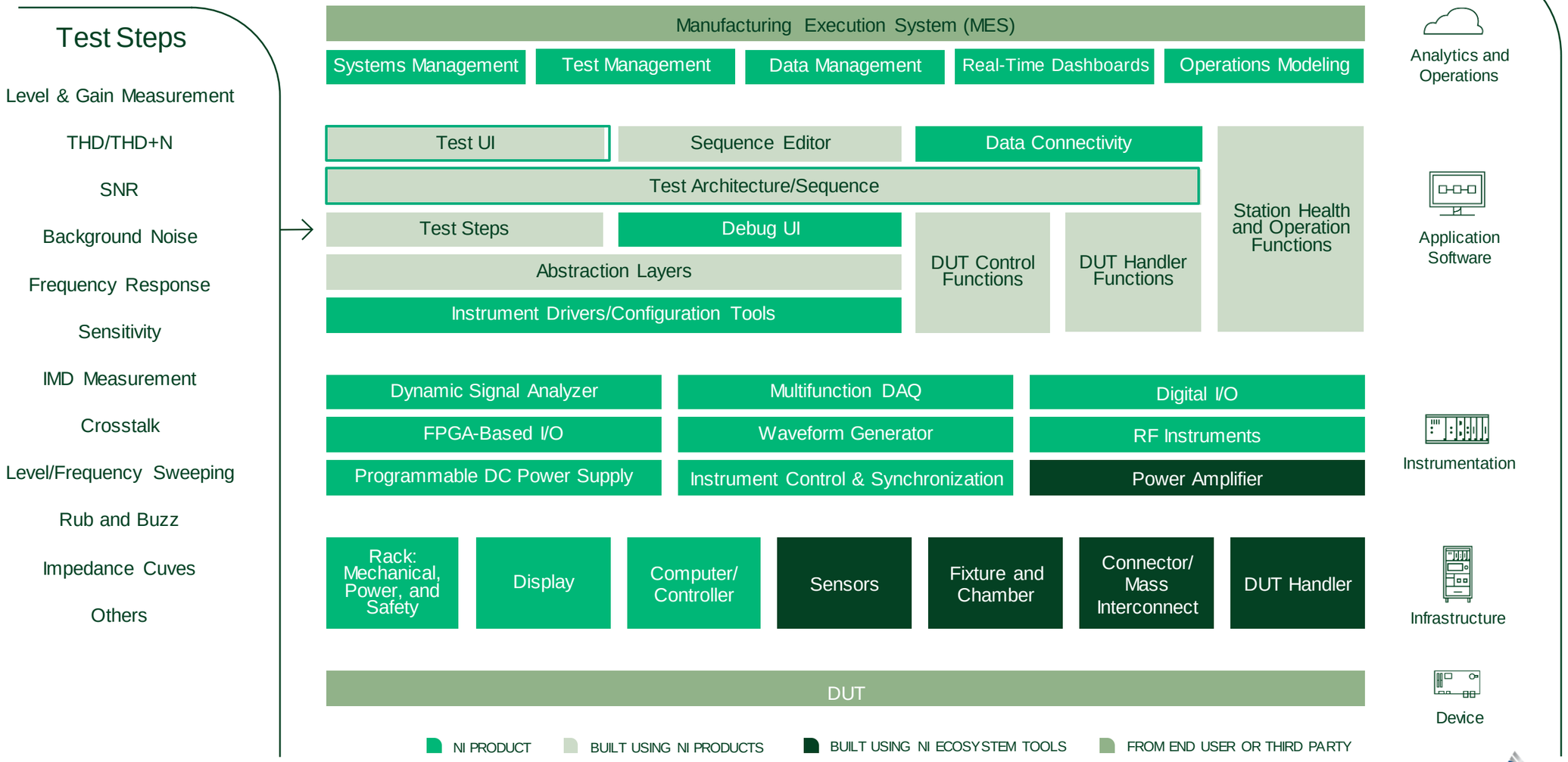


EXAMPLE OF DISTRIBUTED PRODUCTION LINE FOR WIRELESS HEADPHONES

NI Provides Solutions for Each Station in your Line

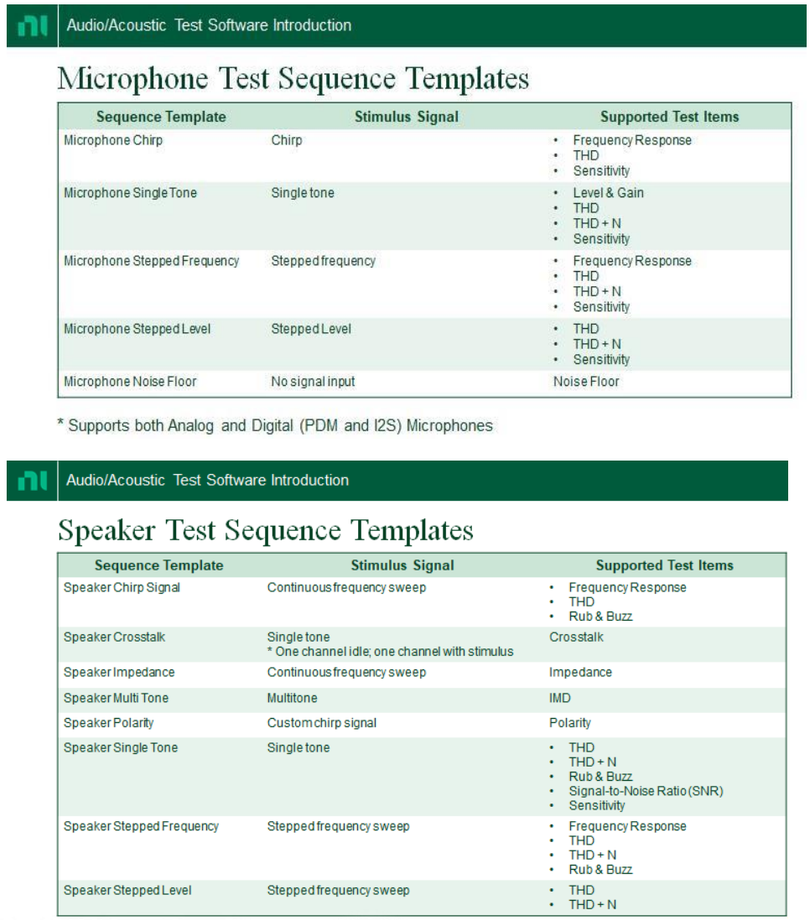


Components for Audio & Acoustic Functional Test



New Features in Audio and Acoustic Test Software

Test Sequence Templates



LabVIEW C# NI TestStand

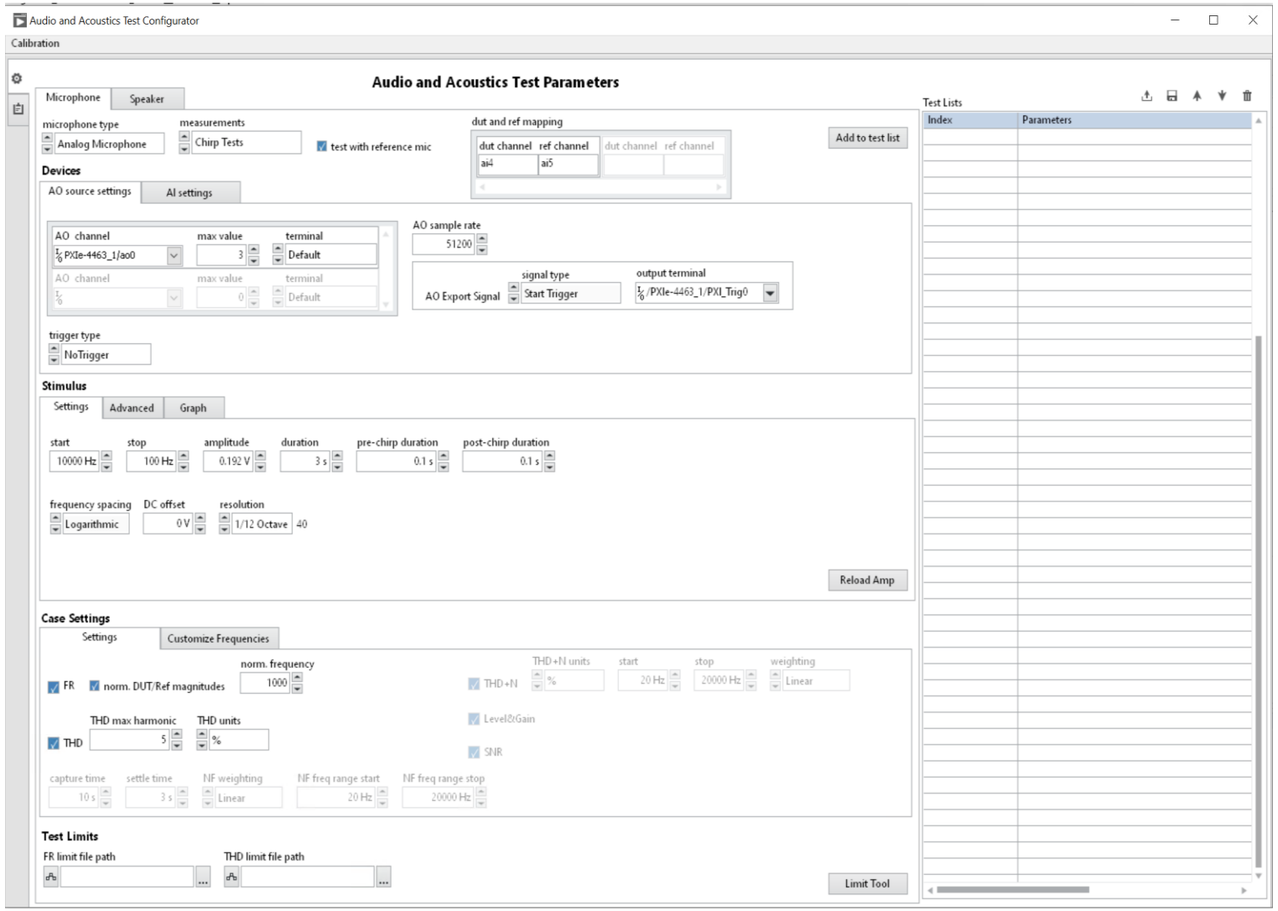
Audio and Acoustics Test Software 23.3

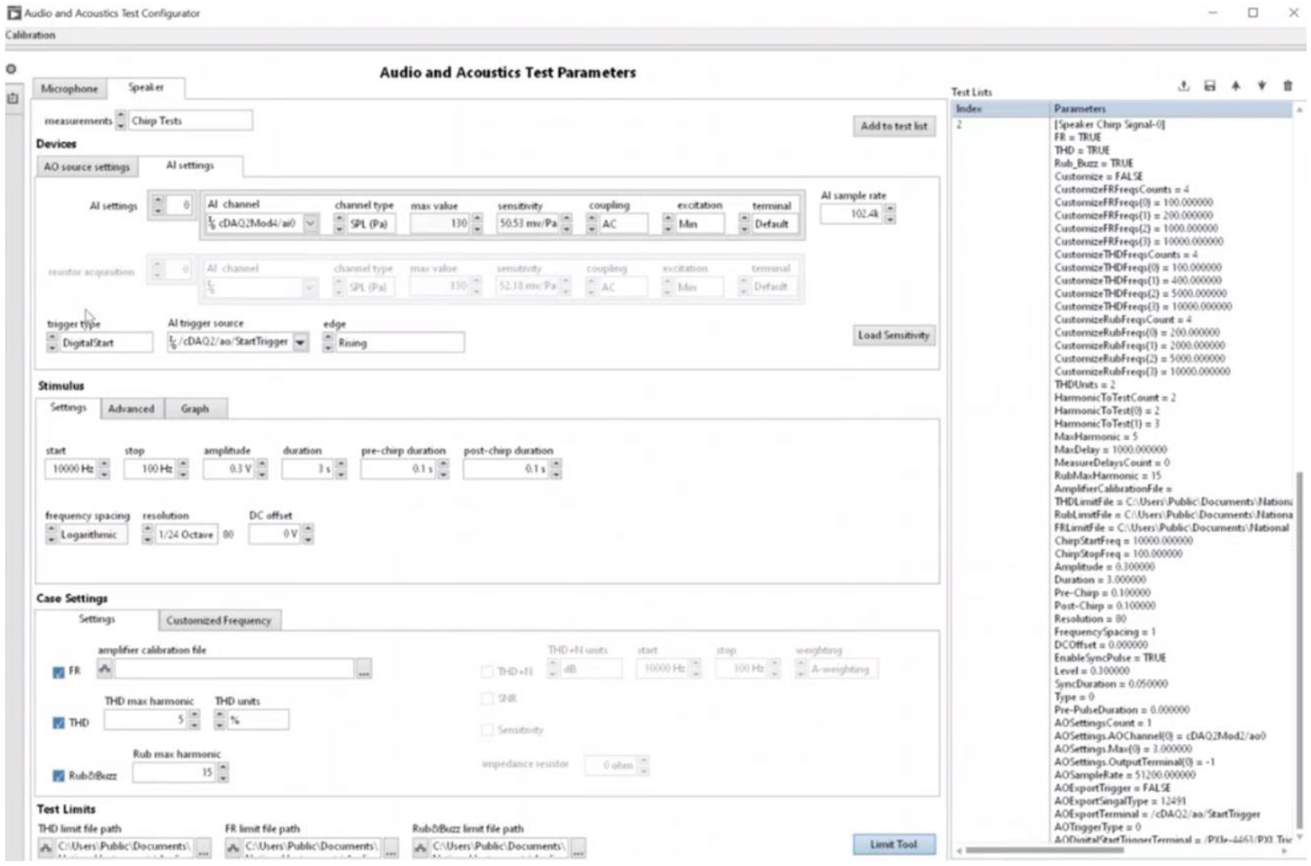
- Ready-to-use test sequence templates and test IP
- Support for both analog and digital audio
- Support for both LabVIEW and C# (New)
- Open modular approach, easy to customize and migrate with existing software architecture
- **Utilities**
  - Audio and Acoustics Test Configurator (New)
  - Calibration exe (New)
  - Interactive Limit setting Tool

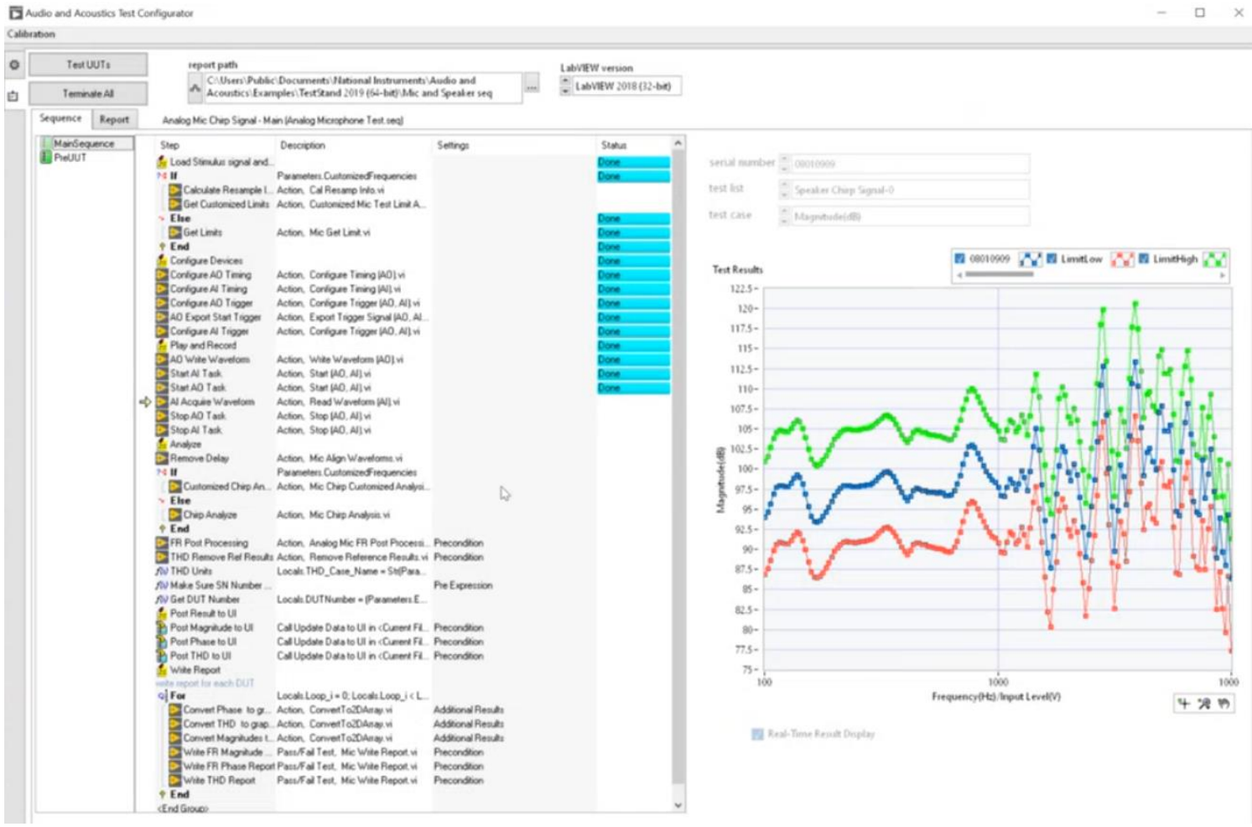
EMERSON

New Feature in Audio and Acoustics Test Configurator

- One-stop parameter configuration, test execution, and test monitoring
- Streamline the workflow for test automation, graphical tool to run and debug customized test steps
  - Config stimulus signals and test cases to customize test steps
  - Provide templates/examples (test sequences) for most of common test cases for speaker and microphone
  - Real time data visualization for test results, snaps ready for review
  - Test report generation
- Easy to load data from calibration files or TEDS







INTERNAL - NI CONFIDENTIAL

Digital Audio Test

NI's Digital Audio Functional Test Solution

Meet your team's goals:

- Reduce engineering effort and risk with benchmarked system level design guide
- Maximize yield with data analytics & systems management configurations.
- Quickly adapt to new requirements with an open, modular architecture
- Free-up budget with lower cost per channel

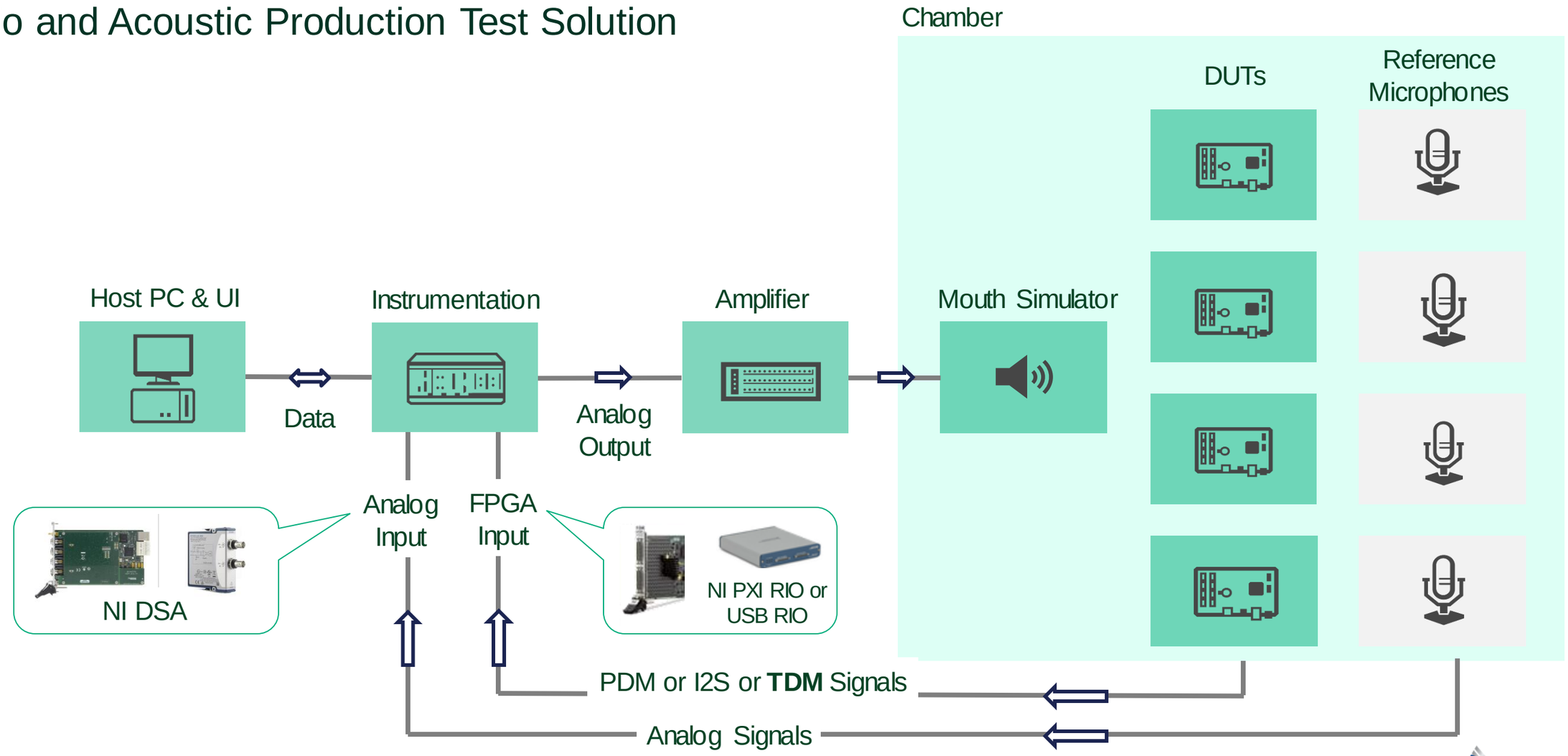
Meet your technical goals:

- Parallel **FPGA** based PDM & I2S acquisition and generation allows high channel count, multi-up test
- **120dB stopband attenuation** optimized for SNR/noise floor test
- Higher measurement accuracy with **pure digital decoding**
- On-the-fly adjustment of decimation factor and rate

EMERSON | NI

Hardware Setup for a Digital Audio Test

Audio and Acoustic Production Test Solution



Digital Audio Test using FPGA

FPGA PDM Demodulation

HIGHER CHANNEL DENSITY

- Never be limited by I/O channel count, with up to 128 digital lines per card.

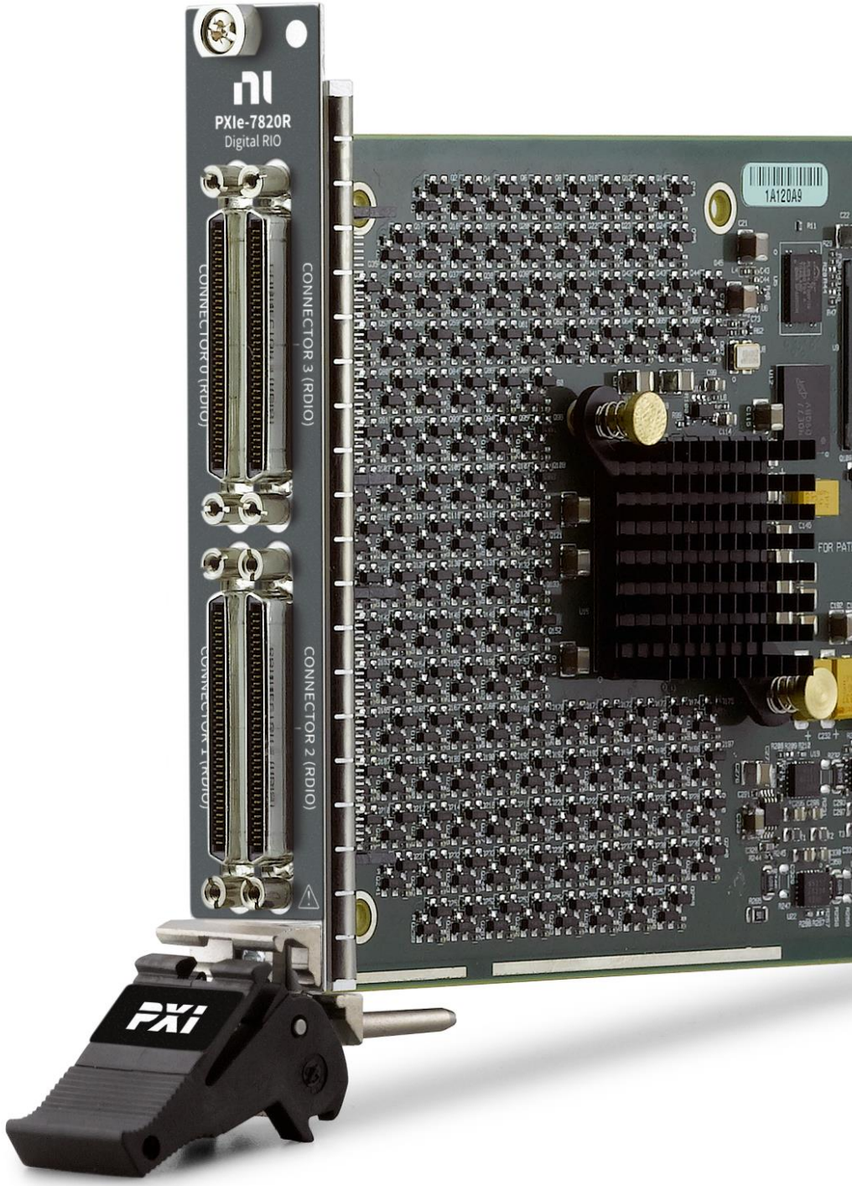
BETTER MEASUREMENT ACCURACY

- Improve measurement accuracy and simplify your signal path with direct digital acquisition (no digital-to-analog converter)

GREATER RESILIENCE TO CHANGE

- Insulate station investment from specification changes by updating test steps with DUT specific parameters such as clock speed and voltage level in software.

RAPID TEST DEVELOPMENT



EMERSON

Digital Audio Solution Details

Production Test - Audio & Acoustic: Digital

PXIe 7820/7821			
Acquisition		**Generation**	
32 **PDM** lines (64 channels)	32 **I2S** lines (64 channels)	16 **PDM** lines (32 channels)	16 **I2S** lines (32 channels)
24 GPIO	16 GPIO	8 GPIO	8 GPIO
W/ triggering	W triggering	W/ triggering	W/ triggering

PXIe 7820/7821

USB 7845/7846			
Acquisition		**Generation**	
8 **PDM** lines(16 channels)	8 **I2S** lines (16 channels)	8 **PDM** lines(16 channels)	8 **I2S** lines (16 channels)
8 GPIO	8 GPIO	8 GPIO	8 GPIO
W/O triggering	W/O triggering	W/O triggering	W/O triggering

USB 7845/7846

EMERSON

Applications Require High Channel Density

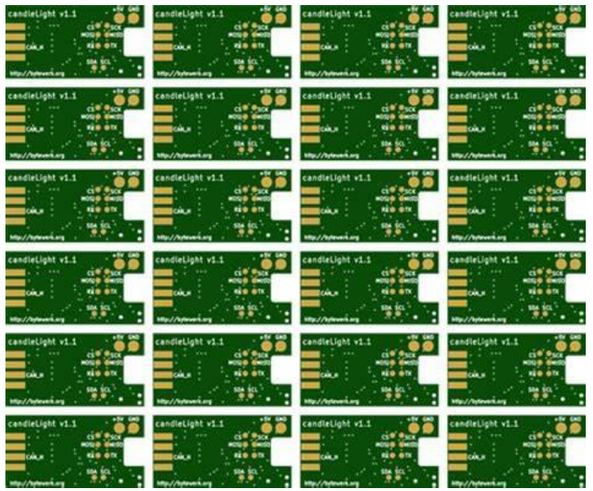
Example 1:

Microphone module Production Test,

16 sites or higher

Example 2:

Panelized PCBA FCT for Wearable device,
AR/VR Device,
Smart Speaker, etc.



https://www.pcbway.com/project/shareproject/CANtact_panalized_boards.html

Digital Audio Acquisition and Generation Toolkit

Key Features

- PDM (pulse-density modulation) acquisition and generation
- Easy-to-use API
  - Similar to DAQmx
- PXI triggering
  - Synchronization between SMU module and PDM acquisition
- Variable clock rate and decimation factor

New Features

- PCM (pulse-code modulation) acquisition and generation APIs
  - I2S, Left-Justified, Right-Justified, TDM (4-Channel, 6-Channel, 8-Channel)
    - Max bit rate 24.576MHz
  - SPDIF (Digital only)
- '**Flexible Block**'
- Increase the maximum total number of timing engines to 4

Demo

Example Test Station

- Configured with a **4-up** architecture
- For **duel digital microphone module** functional test.
- Optimized for both measurement **accuracy** and **throughput**
- At a **lower overall cost** than many other turnkey solutions on the market

Analog reference microphones

Duel digital microphone DUT

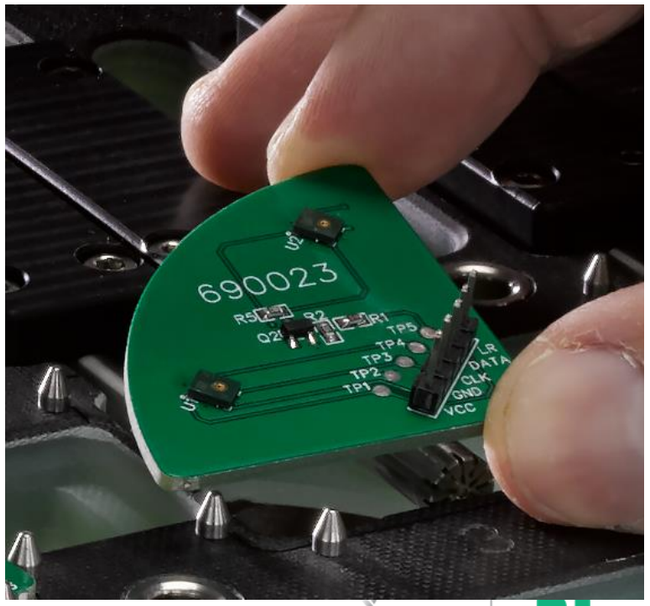
Rackmount IPC

PXI DSA Input Card

PXI DSA Output Card

PXI Digital Input FPGA Card

Amplifier leading to mouth simulator



This system was designed in partnership with NI system integration partner **Booster**.

EMERSON

Video demonstration of this test station can be viewed on YouTube here

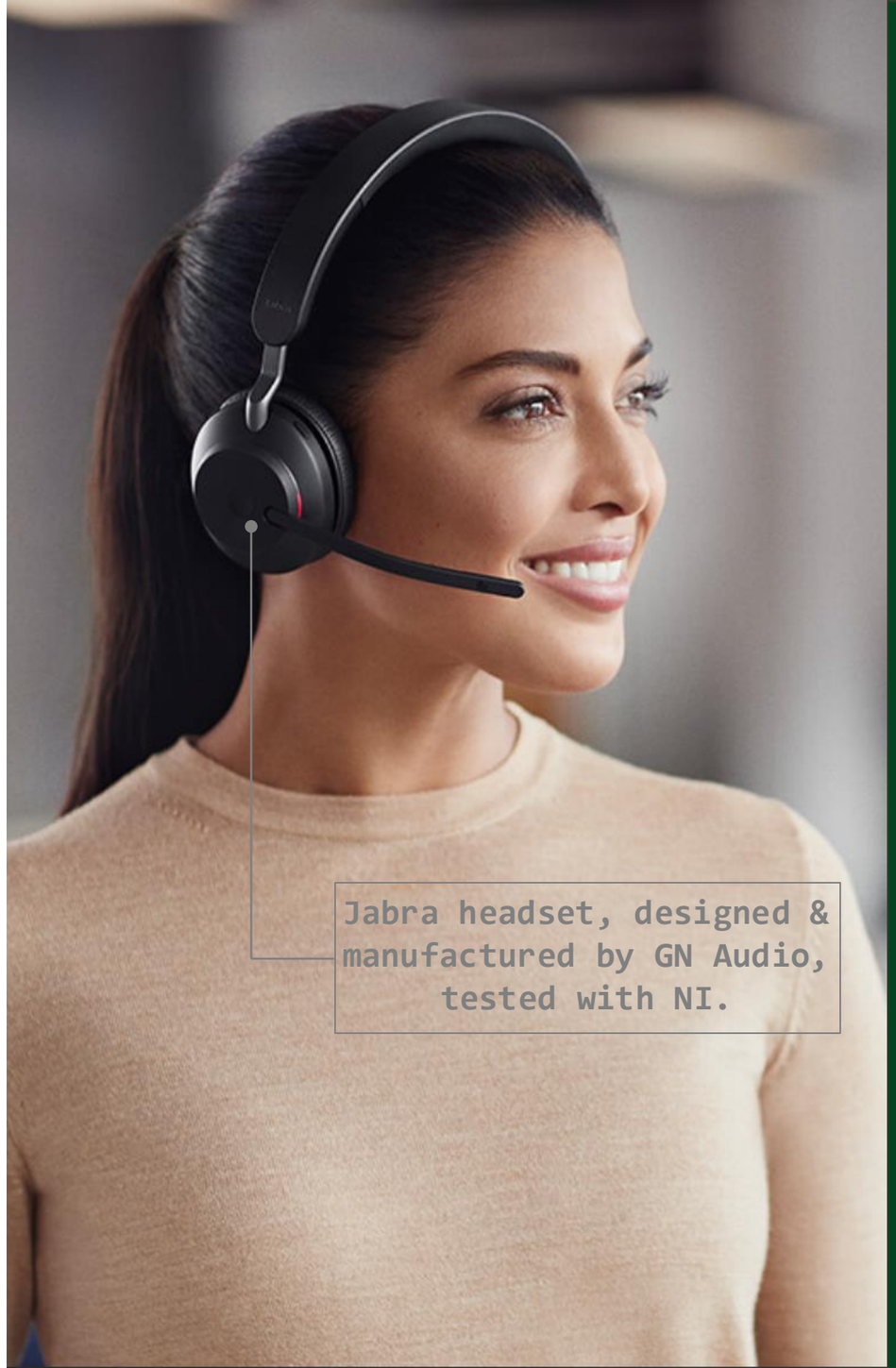
GN Audio Ensure Quality while Speeding Development of Manufacturing Test Systems

Successfully deployed a standardized test platform for more than 80 products and variants, based on NI measurement hardware, NI TestStand, and CATS software from CIM.AS

“We consider NI DAQ hardware the industry standard for production test applications. The close integration with NI software ensures ready access to our coverage requirements.”

Christian Wolf

Global Manufacturing Test Manager, GN Audio



2.5X

TEST COVERAGE INCREASE

2

WEEKS OF TEST DEV. FOR NPI

6

GLOBAL MANUFACTURING SITES

Millions

PRODUCTS TESTED

“Our solution uses LabVIEW and PXI modular instruments, including dynamic signal acquisition, to achieve our test system cost target, meet performance and quality requirements, and improve test throughput by 33 percent.”

Koh Chee Lit

MANUFACTURING TEST, SONY EMCS

INTERNAL - NI CONFIDENTIAL

Questions?

INTERNAL - NI CONFIDENTIAL

EMERSON

NI connect

2024 AUSTIN