



ENGINEER  
NEXT

NIDays

The image features a background of diagonal stripes in various shades of blue, green, orange, and red. The text 'ENGINEER NEXT' is prominently displayed in white, with 'ENGINEER' in a smaller font above 'NEXT'. A yellow geometric shape, resembling a stylized 'X' or a folded ribbon, is positioned between the two words. To the left of 'NEXT', the word 'NIDays' is enclosed in a white rectangular box, tilted to match the angle of the main text.



# R&D Validation and Production testing using the Universal Tester Platform

with Audi's new infotainment system

Matyas Suveg

RF Specialist, NOFFZ Technologies



1989 by W. Noffz > 95 employees > 200 w/partners > 2.000 systems > 8.000 devices





# Automotive Validation Tests

- Reliability Tests
  - 15 years lifetime
  - 300.000 km
- Common base LV 124:
  - VW80000 for VW Group
  - GS 95024 for BMW
  - MBN 10615 for Daimler
  - Audi AG
  - Porsche AG

## VOLKSWAGEN

AKTIENGESELLSCHAFT

Group standard

VW 80000

Issue 2013-06

Class. No.: 8MA00

Descriptors: component, electric component, electronic component, electr. assembly, test condition, LV 124

### Electric and Electronic Components in Motor Vehicles up to 3,5 t General Requirements, Test Conditions and Tests

#### Preface

NOTE 1: The component-specific requirements and tests are defined in the BT-LAH module "Reliability Testing".

NOTE 2: The component-specific EMC requirements and tests are defined in the BT-LAH module "EMC".

This standard in the present issue is based on template LV 124, which was drawn up by representatives of automobile manufacturers Audi AG, BMW AG, Daimler AG, Porsche AG, and Volkswagen AG. Deviations from the LV 124 are listed on the cover sheet of this standard. If modifications to individual test sections become necessary in individual cases, these must be agreed upon separately between the appropriate department and the relevant manufacturer. Test reports are accepted as long as the tests were performed by an independent testing institute that is accredited according to DIN EN ISO/IEC 17025. Acceptance of the test reports does not automatically result in a release.



e.solutions



# What is the mission of e.solutions?

## Infotainment for Audi and VW Group



Audi Virtual Cockpit

MIB including next MMX generation



*„Wir haben keine Vision, sondern ein klares Ziel: Wir entwickeln die besten Infotainment Systeme der Welt!“*

*Dr. Riclef Schmidt-Clausen, Geschäftsführer*



Automotive 10" Tablet



# MIB2+

## Modular Infotainment Building Block



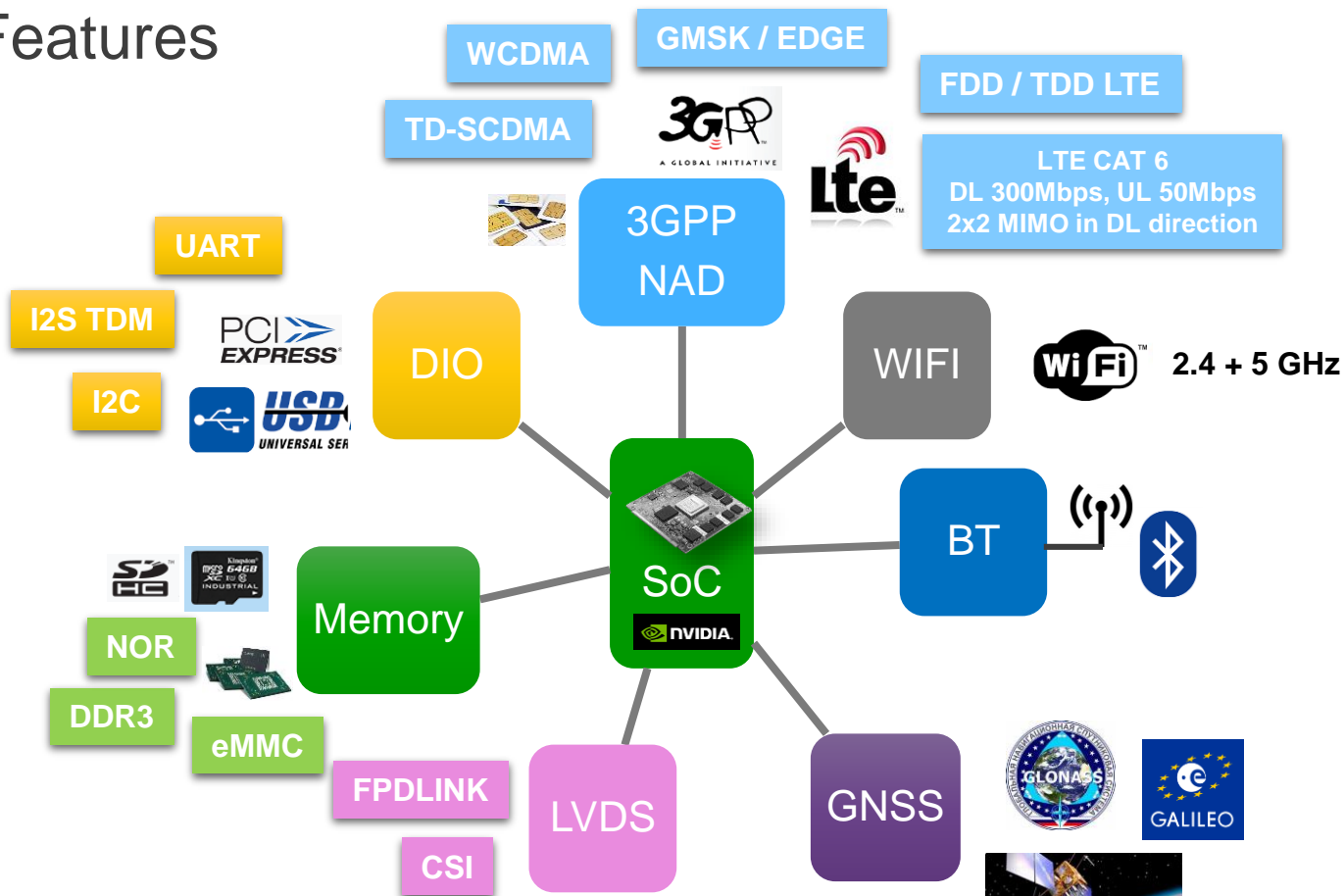
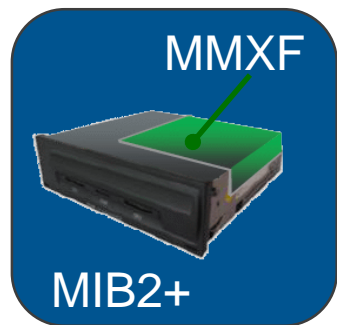
***World premiere of the new Audi A8 flagship  
and introduction of new Infotainment System***

<https://www.summit.audi/en>

'Audi Summit' in Barcelona July 11<sup>th</sup> 2017



# MMXF Test Features



# Test of IoT Products - Modern Infotainment & Connectivity Modules (Head Units)



Product Validation

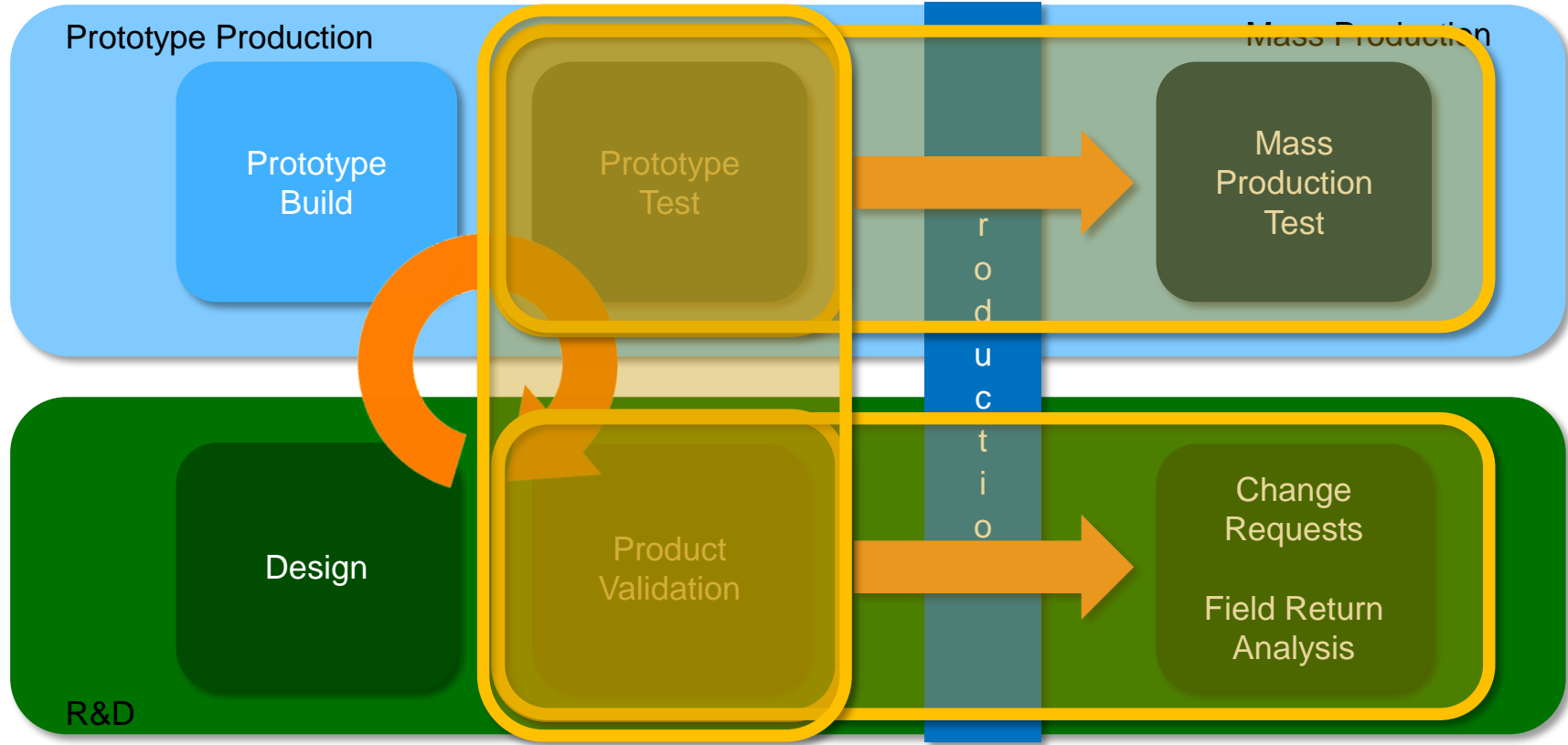


Flashing



Production

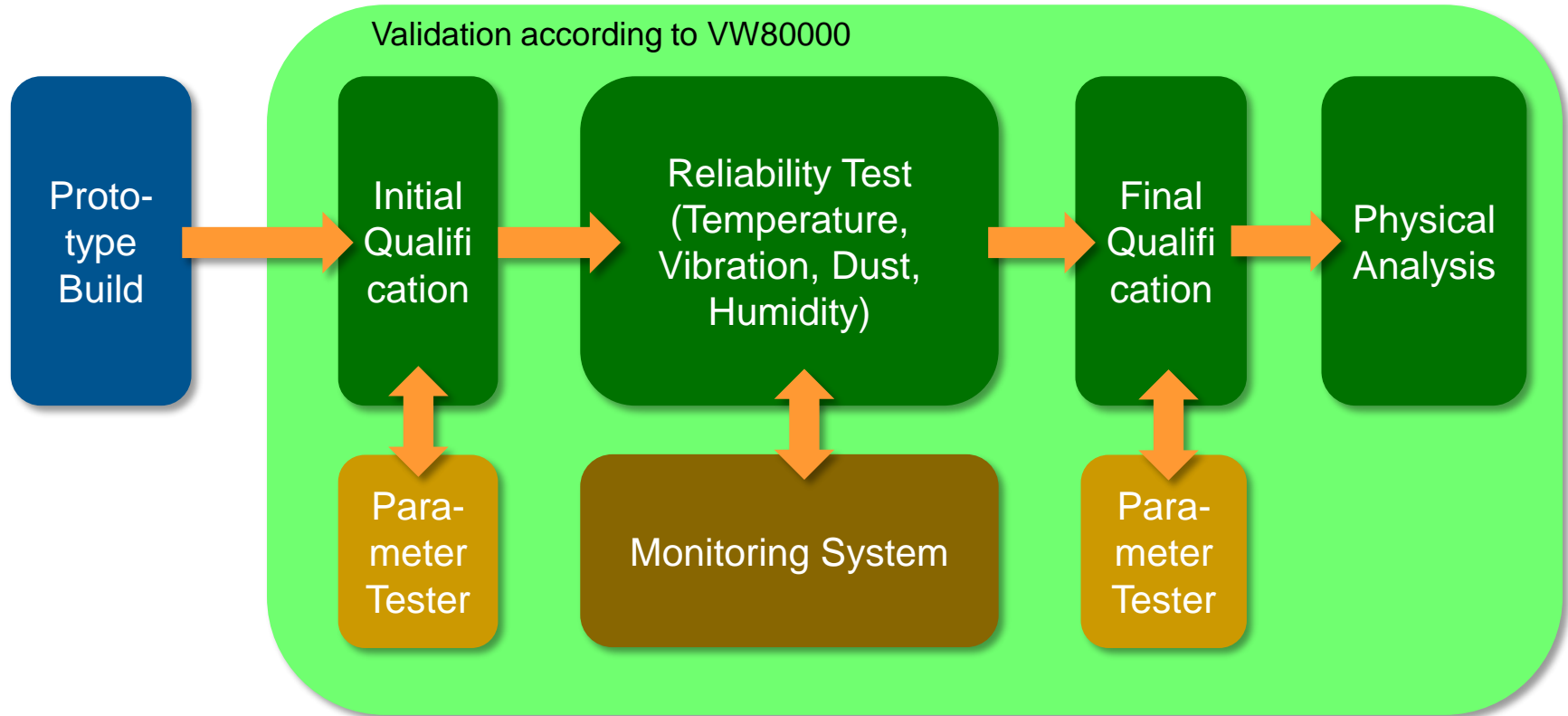
# Test Flow in Validation and Production



# Product Validation



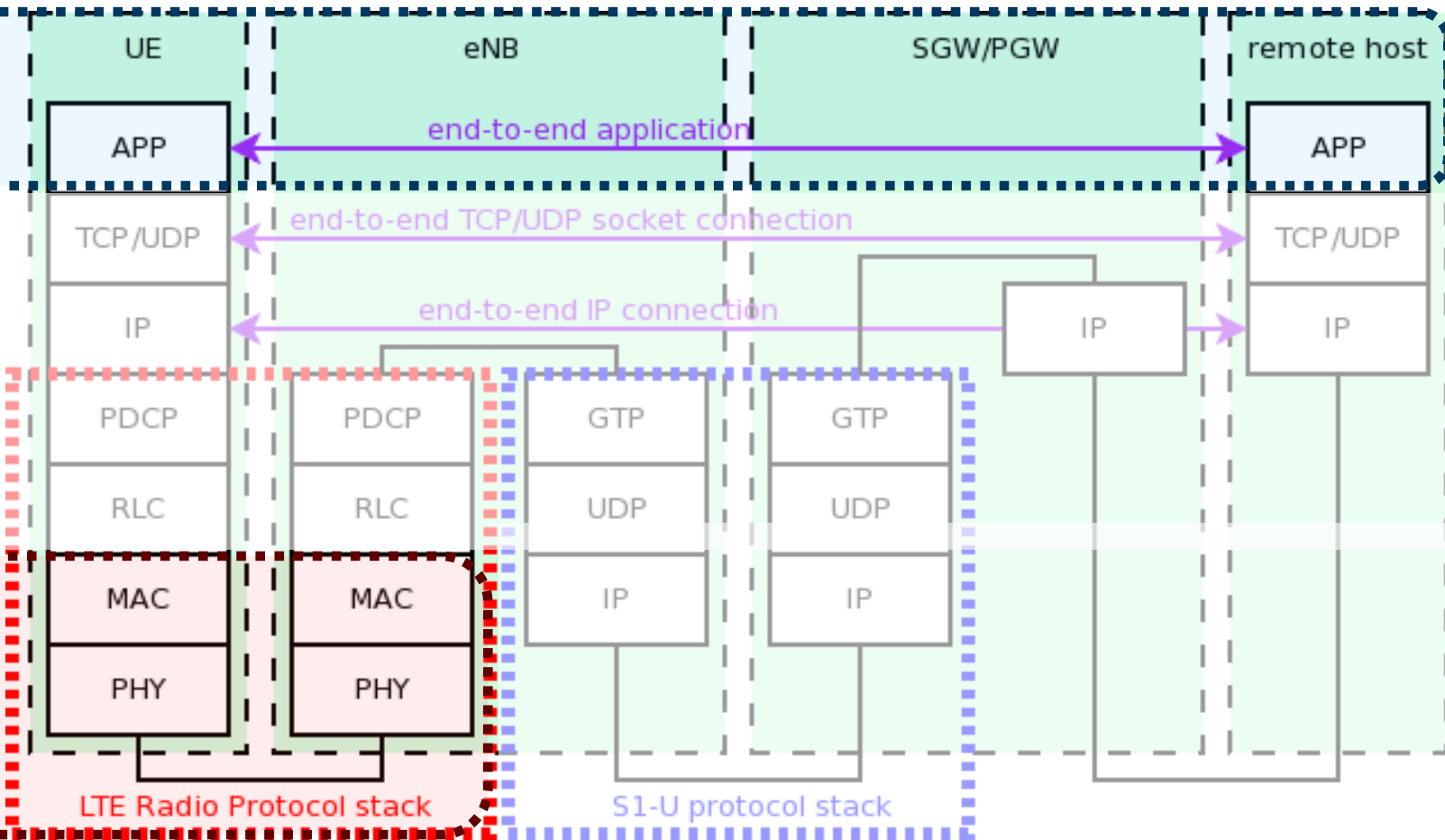
# MMXF Validation Test Process



# How do we test – Signaling / Non-Signaling Test

**PING**

**Non-Signaling Test**





*“It is not acceptable that the first person who initiates a call from the car is the end customer!”*



# Product Validation

- Qualification of DUTs before and after Reliability tests
- Optimized for precision:
  - RF non-signalling mode
  - One DUT per test system
  - Comprehensive functional test



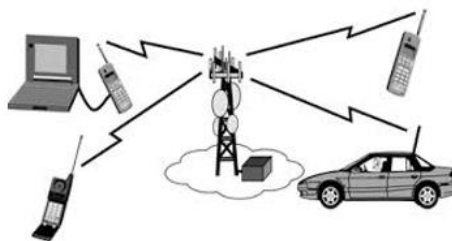
# UTP RF Base Station Emulator

MultiDUT, extensible

MultiProtocol base station emulator



Prototype for eNodeB (LTE)  
under development



## WIRELESS STANDARDS

GSM/EDGE\*

UMTS\*

LTE/LTE-A\*

CDMA2000

Wi-Fi

Bluetooth

Z-Wave

ZigBee

\*Prototype release

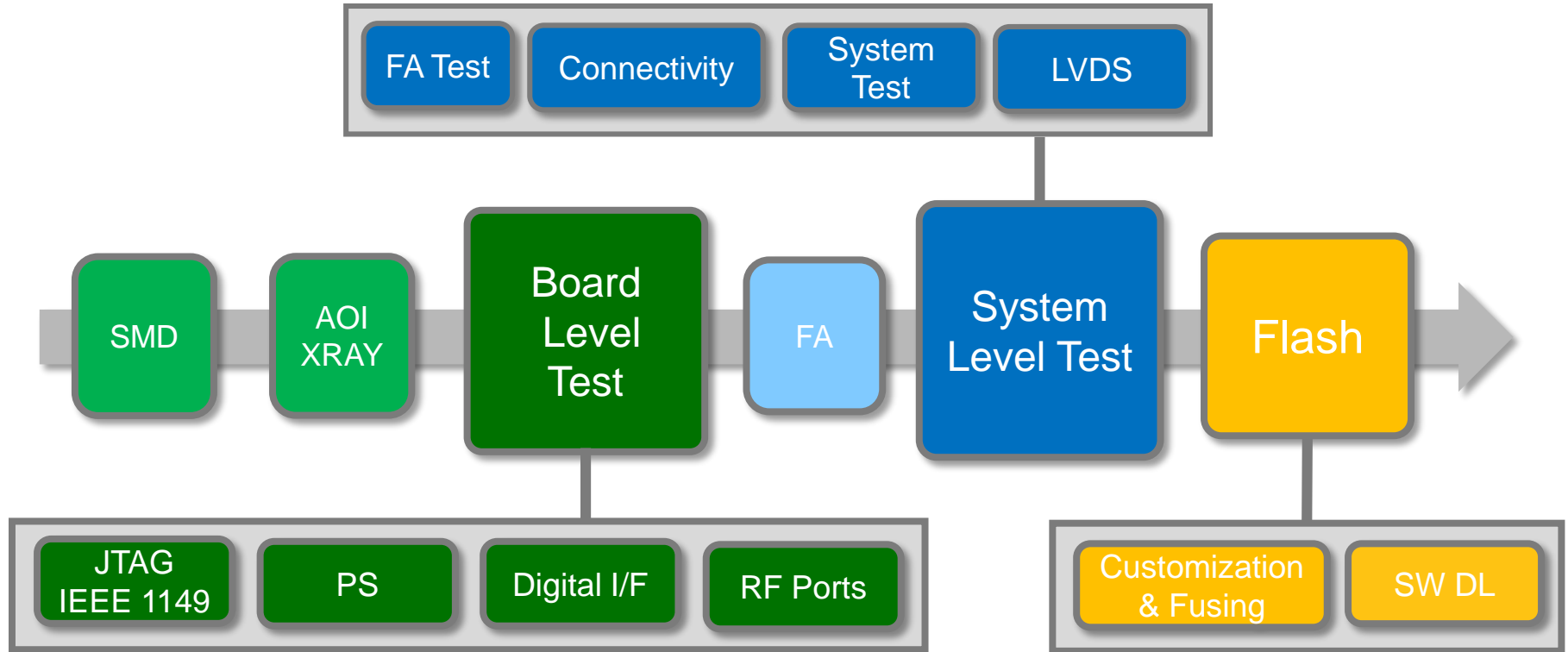


# NOFFZ UTP Base Station Emulator

- LTE:
  - Connectivity to 8x concurrent DUTs in 2x2 MIMO
  - Handover support (X1, S2)
  - Minimum 2x independent LTE cells simultaneously
  - Minimum 2x 10 MHz band with active 50 RBs
  - 4x4 MIMO support for 1 band, 4 DUTs
- GSM:
  - 2x simultaneous ARFCNs
  - Upto 8x concurrent DUTs connected
  - Handover support
- WCDMA:
  - 1x simultaneous UARFCN
  - Minimum 8x concurrent DUTs connected

# Production Test

# MMXF Manufacturing Test Process





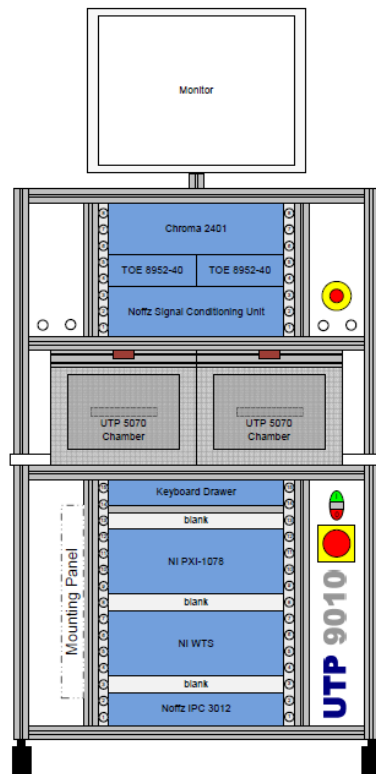
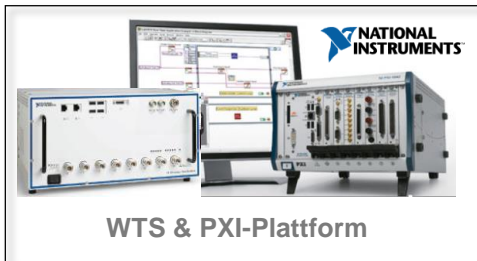
# MMXF Test System HW



Test Socket

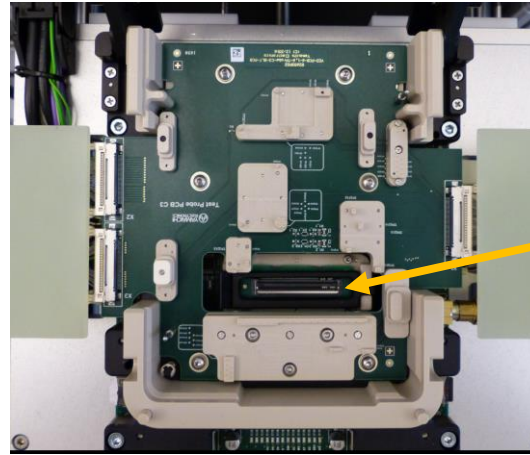
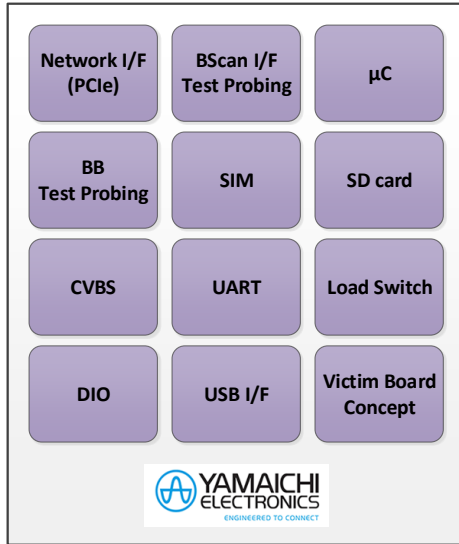


2 x RF chambers

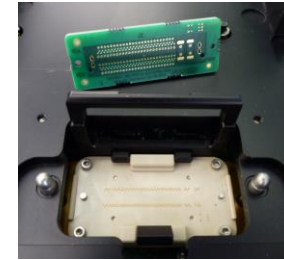
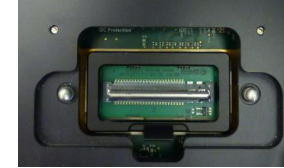


- NOFFZ UTP 9010 framework with signal control unit (SCU)
- 2 independent test sockets with RF chamber 5070
- Small footprint of 1 sqm floor space
- Advanced test socket adapter
- NI Infrastructure with PXI System
- NI Wireless Test System
- Boundary Scan Integration
- FPDLINK III test application

# Test Socket Adapter



Board Level Test Adapter

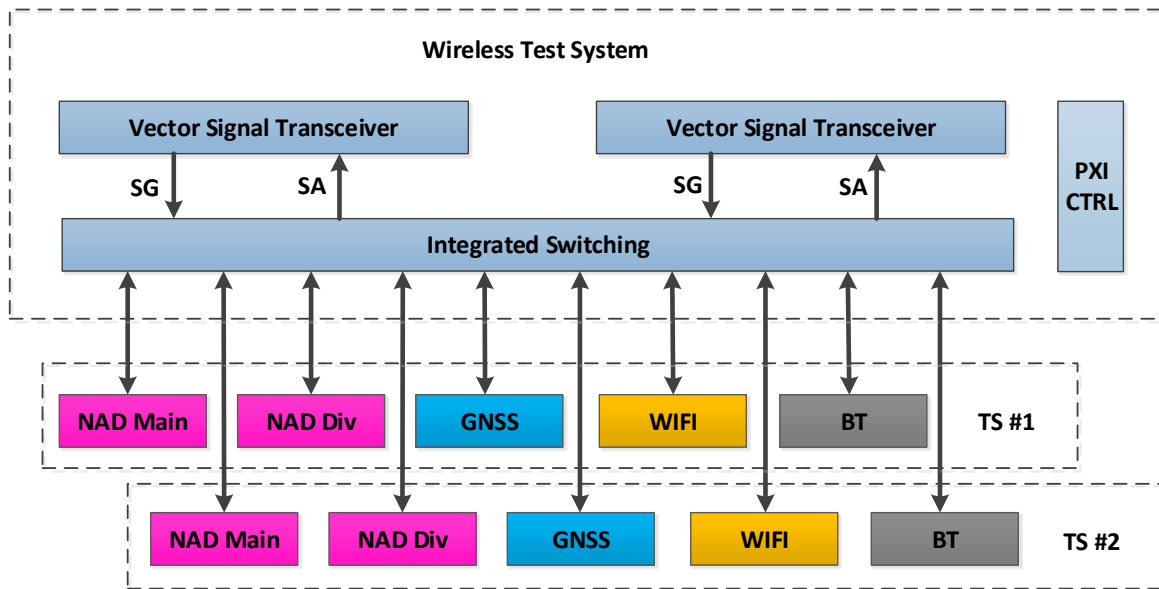


Victim Board Test Socket

- Victim Board Concept for B2B Connector, including traceability
- Impedance controlled PCB design (Boundary Scan, USB, SD, SIM I/F)
- 60+ Test pattern used for JTAG and Base Band test
- Modular test adapter concept, flexibility for design changes / test probing
- μController incl. FW, API for test software driver

# RF Testing with NI WTS

# Motivation for WTS Selection



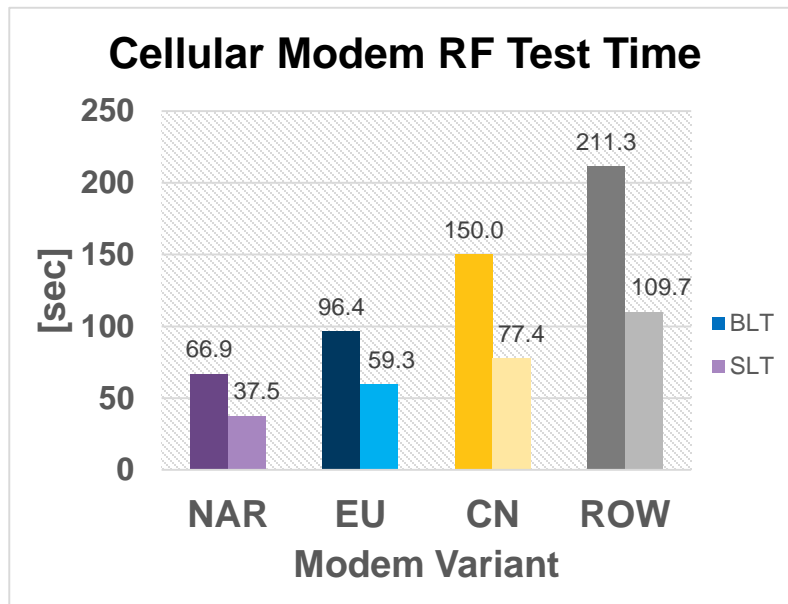
- 80 MHz Bandwidth
- 16 RF port setup for Multi DUT
- Turn key solution for connectivity RF test requirements

- One Vector Signal Transceiver (VST) is dedicated to one test socket
- RF sequence can be executed in parallel, independent execution of test sockets is possible due to RF chamber (test socket isolation ~ 40 dB / ~80 dB between both sockets)



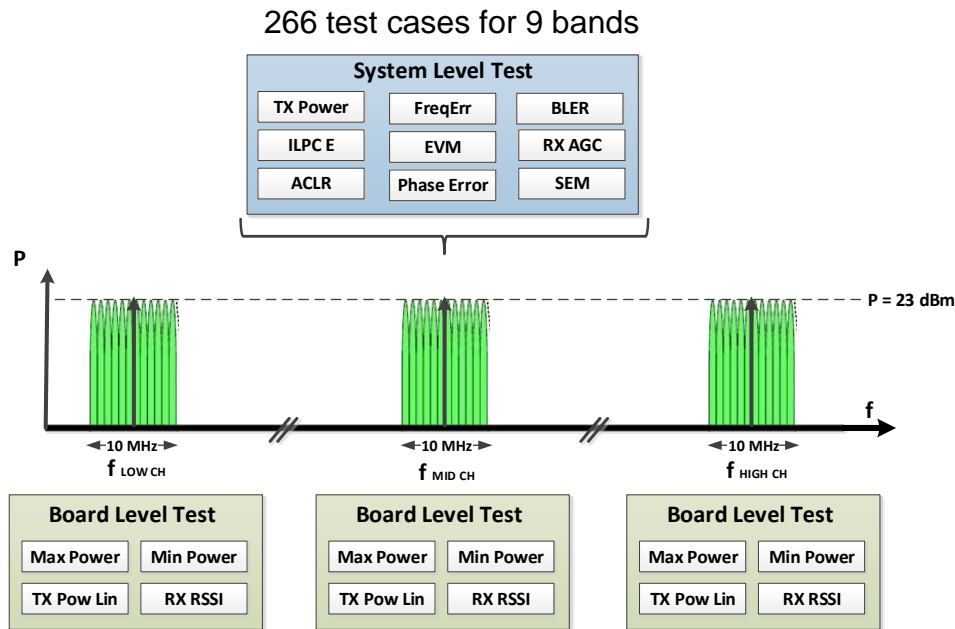
# NAD Test Strategy

Technology	EU	CN	NAR	ROW
GSM / EDGE	2/2	2/2	2/4	2/2
WCDMA	2/3	2/3	2/3	3/5
FDD LTE	5/7	2/4	3/6	6/11
TDD LTE	N/A	3/4	N/A	3/4
TD-SCDMA	N/A	1/2	N/A	1/2
# bands	9/12	10/15	7/13	15/24



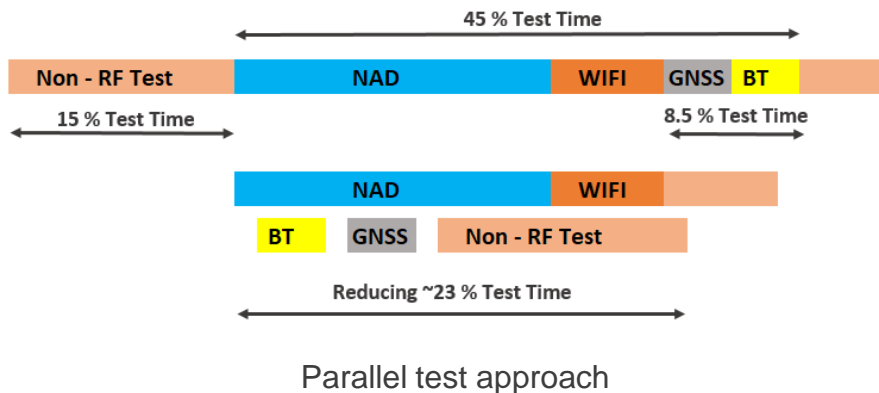
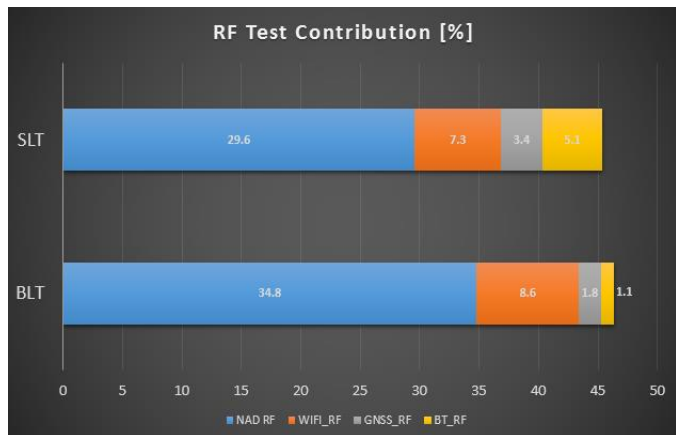
- To reduce test time impact, specific bands are selected for verification to test all major RFFE (RF Front End) components like band filter and TX power amplifiers, duplexer and the wideband transceiver interface
- Example for ROW variant: testing 15 from 24 bands (~ 62%) is sufficient for verification

# NAD Test Content Overview



- Frequency Bands from 800 MHz to 3.5 GHz
- Network Access Device (NAD) is tested with different scope:
- TX Power and RX quality test are done across frequency in Board Level Test (BLT)
- Extensive RF test cases are executed on Mid channel in System Level Test (SLT)
- RX test are performed on both antenna ports, including Throughput (BLER) measurement
- Mid channel is used for comparison purpose to track the system calibration between test stations

# RF Test Time Contribution & Opportunities



- Approx. 45% RF test time contribution
- NAD RF testing consumes a third of test time
- Parallel test execution can further decrease overall test time by 23 %

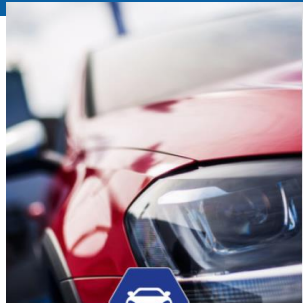


# Achievements

- MMXF test system with small foot print of 2 x 1 sqm for efficient factory layout
- Parallel development in prototyping phase, flexible and optimized adaption to product design cycle changes
- Several thousand samples tested without major line stop; onsite support through NOFFZ staff ensures smooth production
- Seamless integration of WTS turn key test solution into Noffz Test framework including adaption to DUT SW requirements
- Rapid development of test content by utilizing NOFFZ RF and Test library in close collaboration with e.solutions
- Synergies (cost and time) for e2e test systems development from validation to manufacturing

# NOFFZ – Universal Tester Platform





Automotive



White Goods



Telecommunication



Industrial Electronic



Machine  
Building



Medical / Beauty

## NOFFZ UTP Eco System for your application



UTP 6010



UTP 70xx



UTP 901x



UTP 905x



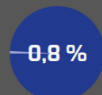
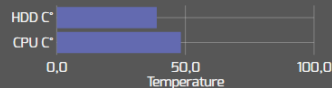
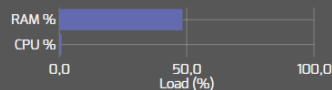
UTP 9065



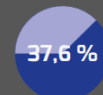
UTP 9085



## System Status



HDD Busy



HDD Free Space



UTP TEF

Run production testing

## System Info

System ID: VM-WIN10-DEV  
OS Version: Microsoft Windows NT 6.2.9200.0

Phone: +49-2151-99878-0  
Email: info@noffz.com

## Get Support



TeamViewer  
Request support

## Configure



## Variant Editor

Create and configure test variations for flexible product testing



## IO Configurator

Configure measurement devices and channels, create groups and tasks

## Debug



## IO Viewer

Debug input/output operation, "sniff" live data, simulate signals



## Log Viewer

View log files, see live log messages and trace execution

## Analyze



## Data Viewer

View and analyze test data

## Develop



## NI TestStand

Create custom steps, custom UI panels, add new functionality



## NI LabVIEW

Edit existing test sequence or create new from a template





Antenna CalTool



RF TEST APP



Test Plan Editor



Report Viewer



UTP RF TEST APP - C:\Noffz\UTP\UTP RF Suite\UTP RF Test App\config\dev\_config\_cell.xml

noffz.com

UTP UNIVERSAL TESTER PLATFORM

Measurements

Settings

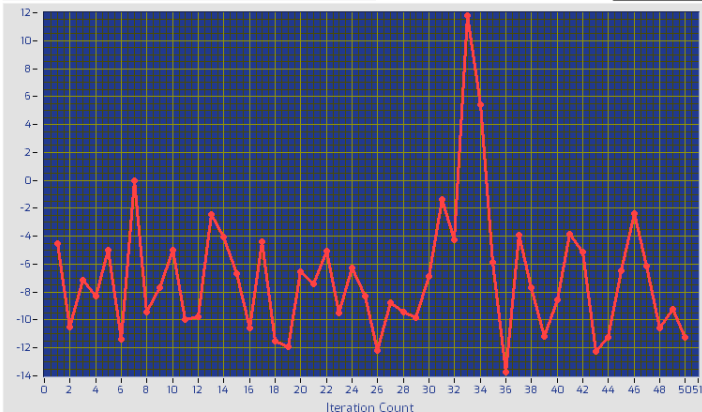
Socket 1

GSM

Start

Mean Frequency Error [Hz]

PCSM



EGSM - Ch 62

Status

Measurements have been finished.

## UTP RF TEST APP

Cellular

WLAN

Bluetooth

GSM	WCDMA	LTE
1 EGSM - Ch: 62		
2 DCS1800 - Ch: 684		
3 EGSM - Ch: 62		
4 DCS1800 - Ch: 684		
5 EGSM - Ch: 62		
6 DCS1800 - Ch: 684		
7 EGSM - Ch: 62		
8 DCS1800 - Ch: 684		
9 EGSM - Ch: 62		
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37 EGSM - Ch: 62		
38 DCS1800 - Ch: 684		
39 EGSM - Ch: 62		
40 DCS1800 - Ch: 684		

GSM

WCDMA

LTE

Header

Enable Tx?	Band	Uplink Center Freq. (Hz)	Downlink Center Freq. (Hz)
<input checked="" type="checkbox"/>	EGSM	9.024E+8	9.474E+8
Enable Rx?	Power Class	Uplink Power Level (dBm)	Downlink Power Level (dBm)
<input checked="" type="checkbox"/>	1	32	-90
	Power Control Level	ARFCN	Modulation Scheme
	5	62	GMSK
Mean Rms Phase Error (deg)	PFER Mean Freq. Error (Hz)	Max Peak Phase Error (deg)	Average Power (dBm)
0	0	0	0
<b>PVT Results</b>	PVT	Average Power (dBm)	NaN
<b>ModAcc: PFER Results</b>		Maximum Power (dBm)	NaN
		Minimum Power (dBm)	NaN
		Burst Threshold (dBm)	NaN
		Burst Width (sec)	NaN
<b>ModAcc: EVM Results</b>		Measurement Fail Status	0.000

Download Quality?

PASSED?

Report Text

## Stay Connected During and After NIDays



[ni.com/niweekcommunity](https://ni.com/niweekcommunity)



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