



Gefle TestteknikTM

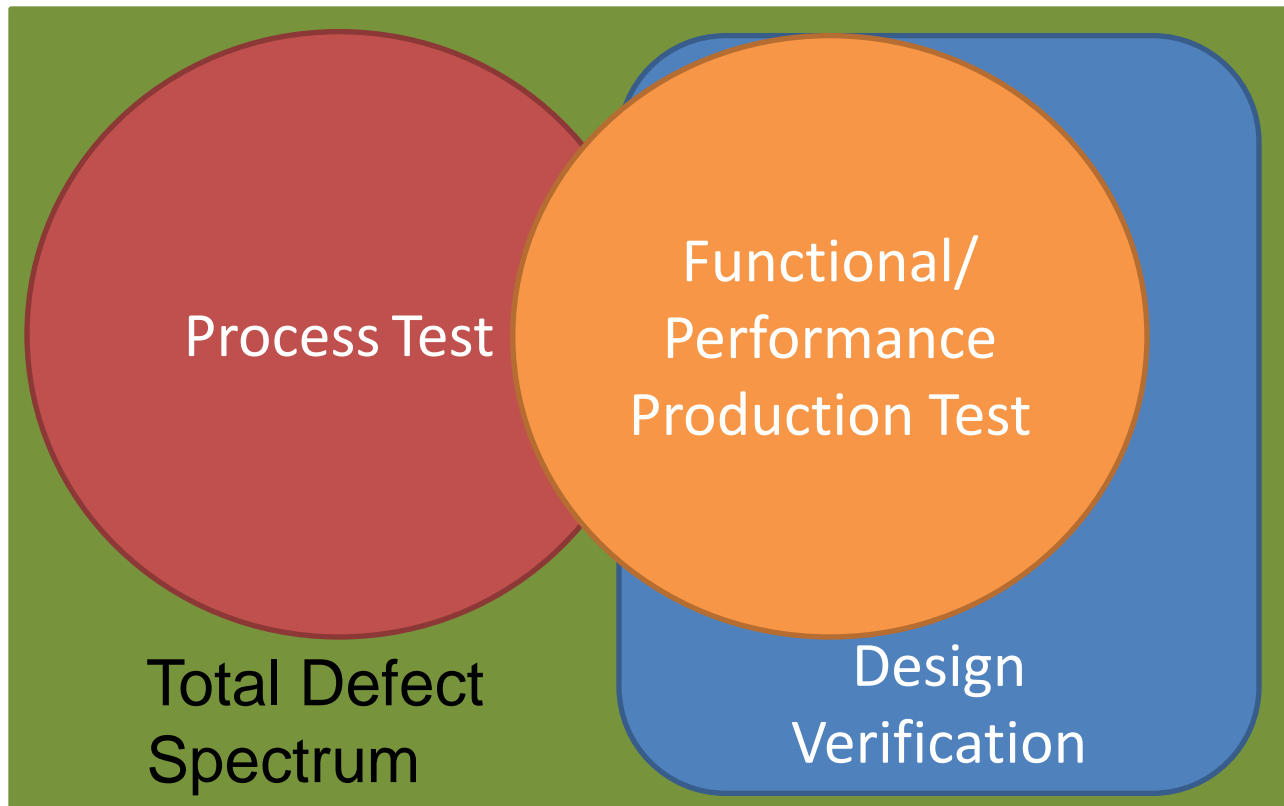
Örjan Eriksson

“Messen ist Wissen, aber messen ohne wissen ist kein wissen“

Werner von Siemens (1816-1892)



Test Coverage

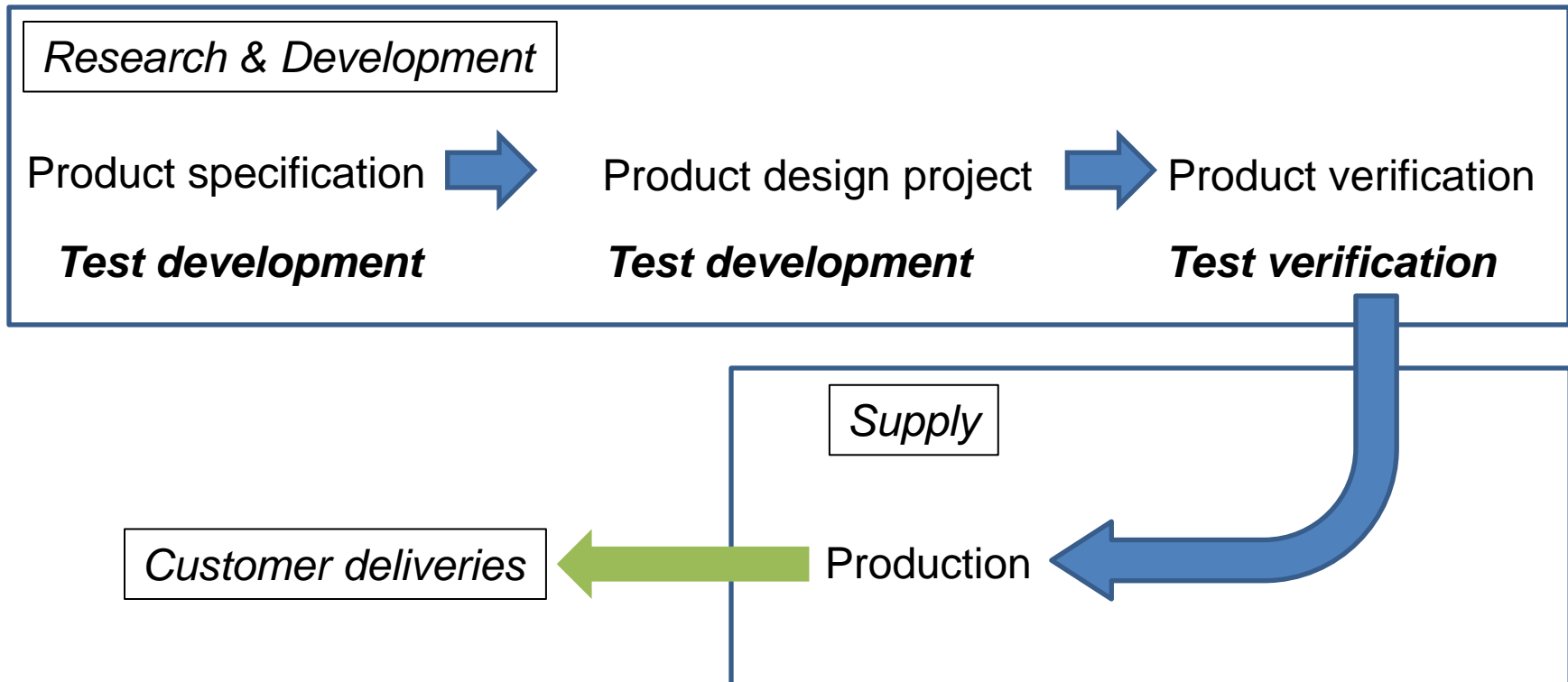


Device Specific Non-standard Test

- What **characteristics** can be effected by the possible defects?
- Is there a possibility to create **test scenarios** that address these defects and the desired performance?
- How to optimize the ratio of observation time and test time i.e. **test efficiency**?
- How to **adapt the test object** for non-standard test?

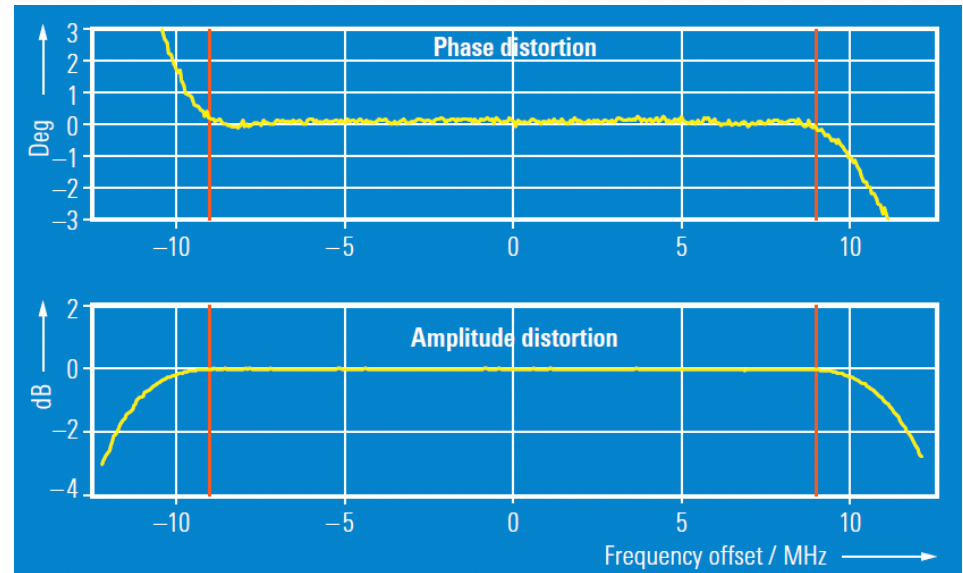


Preferred product and test design process



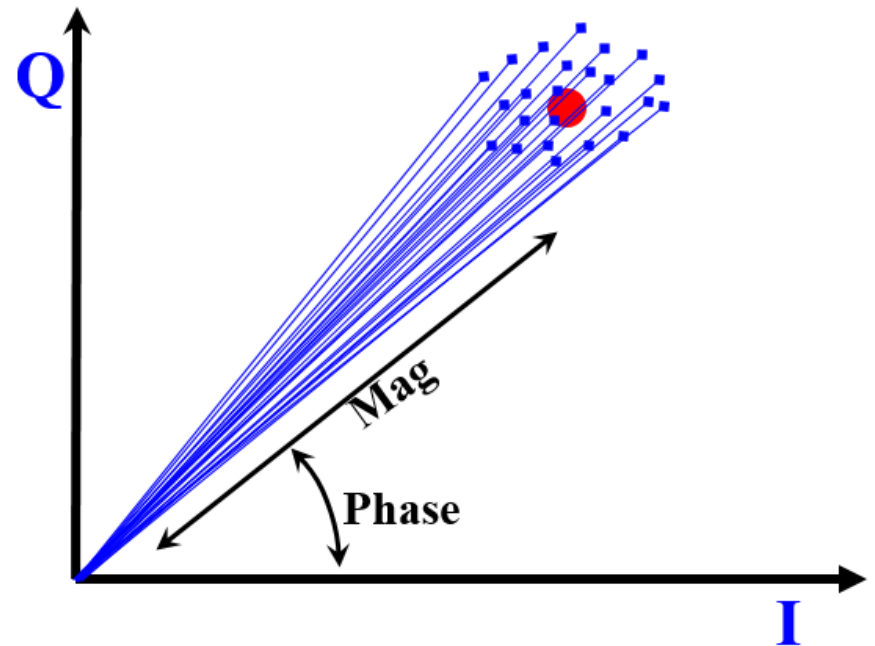
High Quality Instantaneous Bandwidth

- Modern signal generators and analyzers have high bandwidths with excellent performance
- Equalized bandwidth in the instruments can give a frequency response of $\pm 0.1\text{dB}$ / $\pm 1\text{deg}$



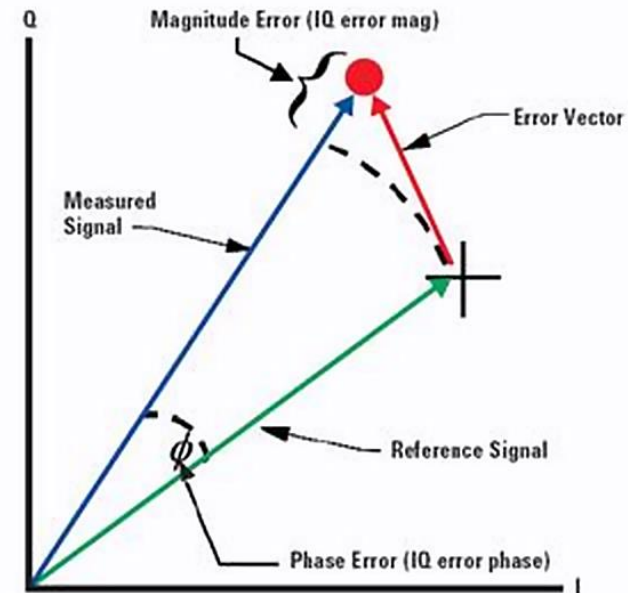
IQ Data

- Voltage vector representation of the signal
- Phase and magnitude information preserved
- Error vector

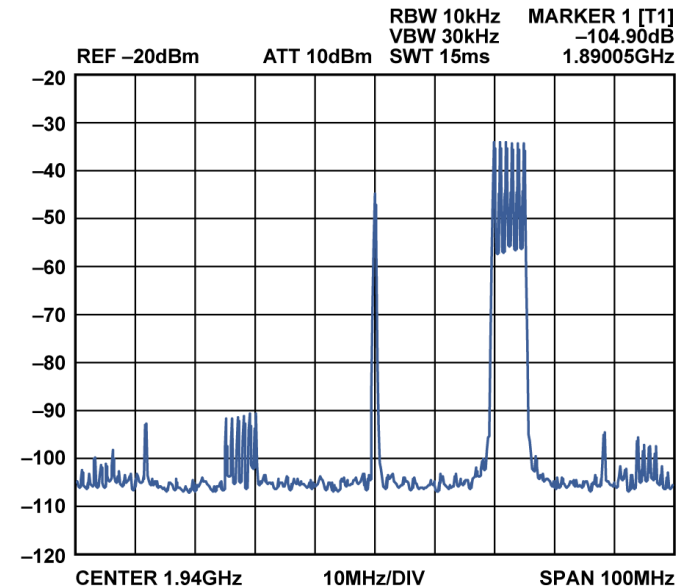
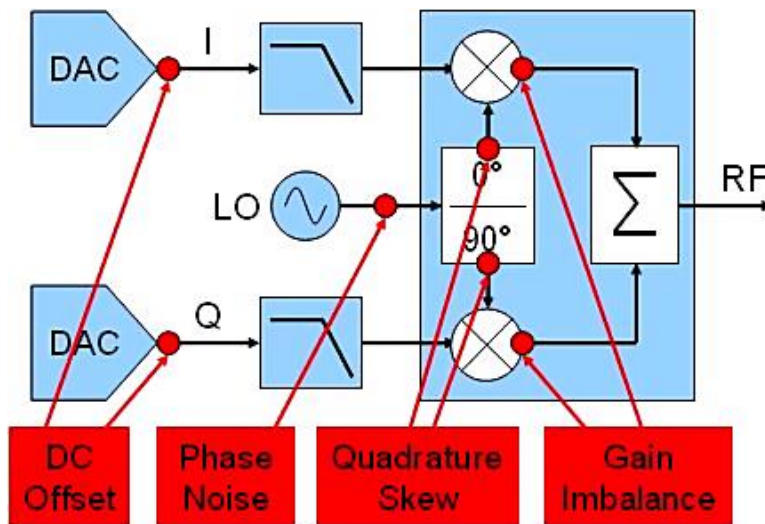


Simple EVM

- No need for demodulation of the signal, only difference from known reference
- Calculate EVM per sample
- Samples with vector length lower than average may e.g. be excluded to highlight vector errors for higher powers due to compression



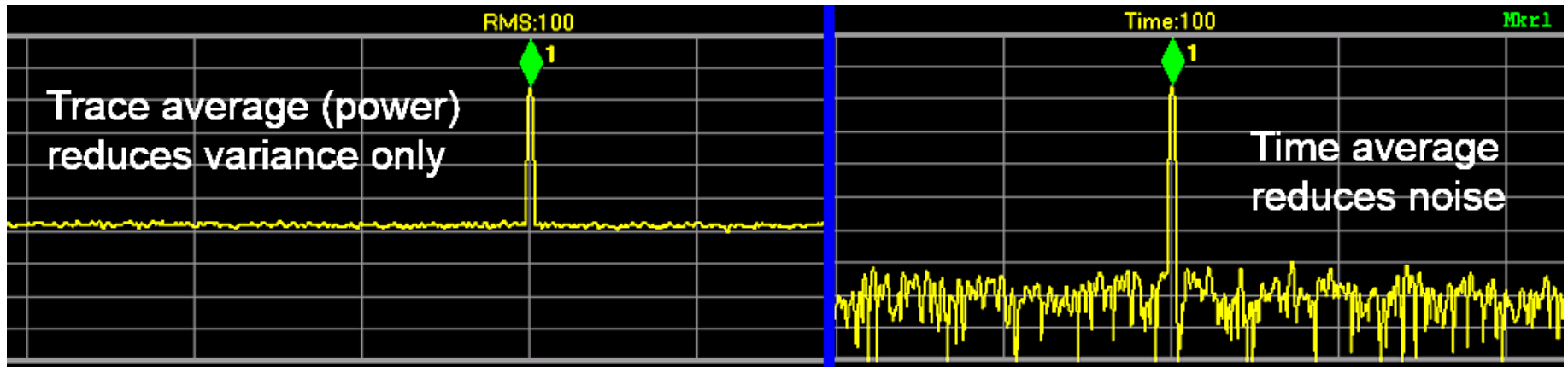
IQ Modulator Impairments



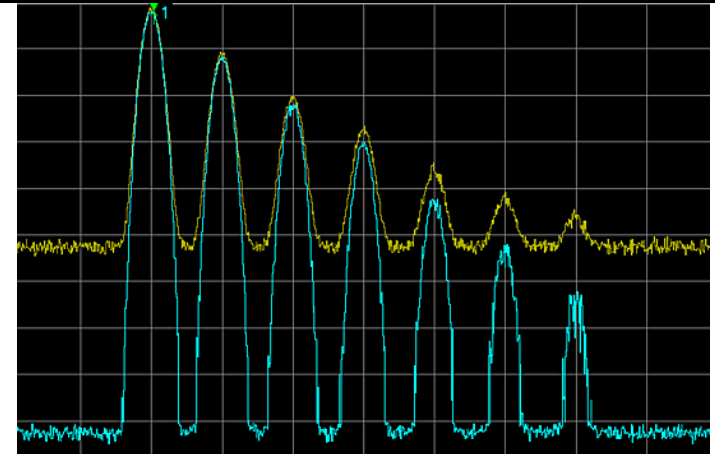
- Don't iterate
- One short signal IQ capture and solve model for LMSE

$$I_{\text{meas}} = G * I_{\text{ref}} + \text{DC}$$

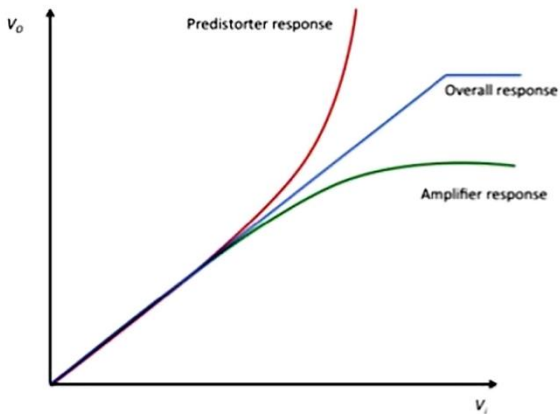
Coherent Average



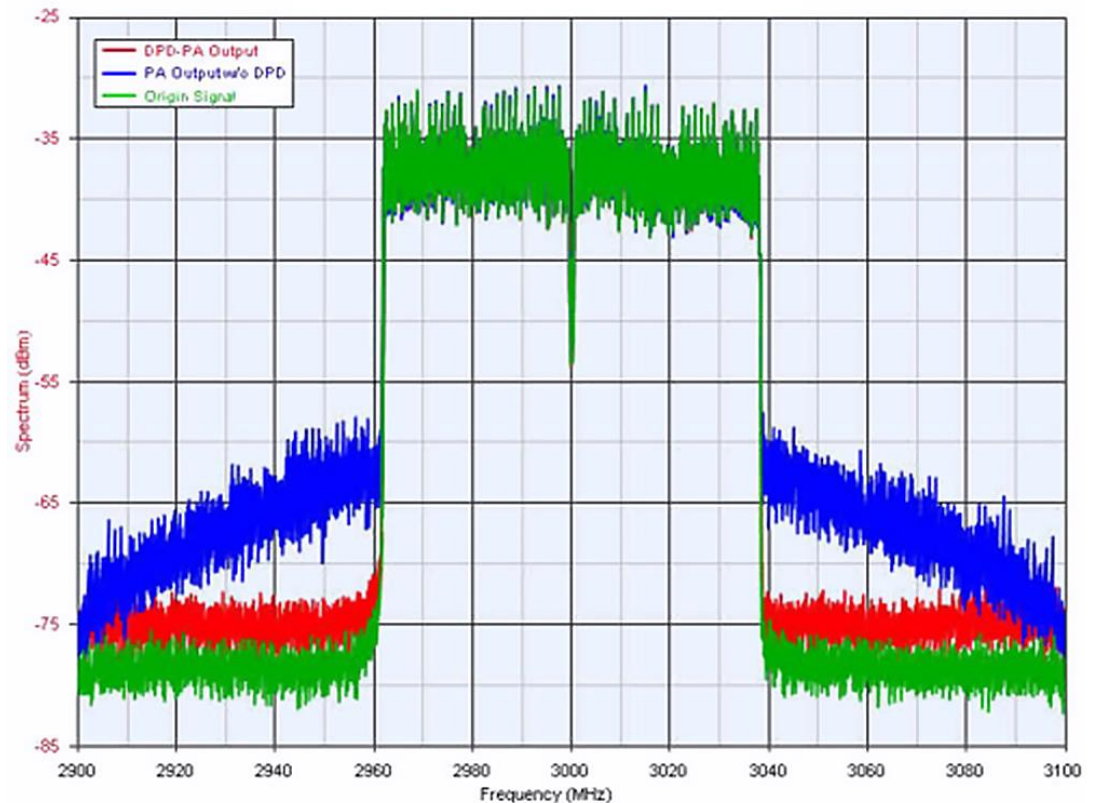
- Average on time series IQ data preserves correlated information in the signal but noise is reduced up to 20dB compared to power averaging



Digital Pre-Distortion

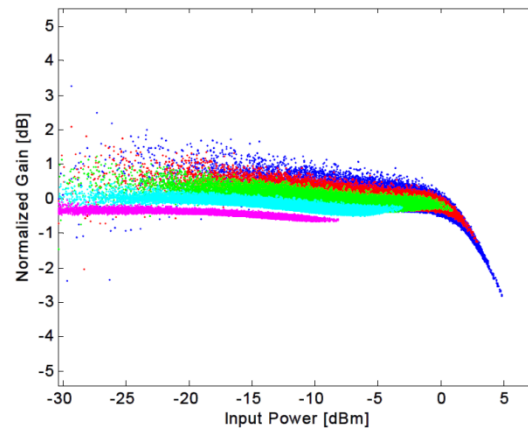


- A fixed DPD is generally enough to improve a signal generator for a specific signal

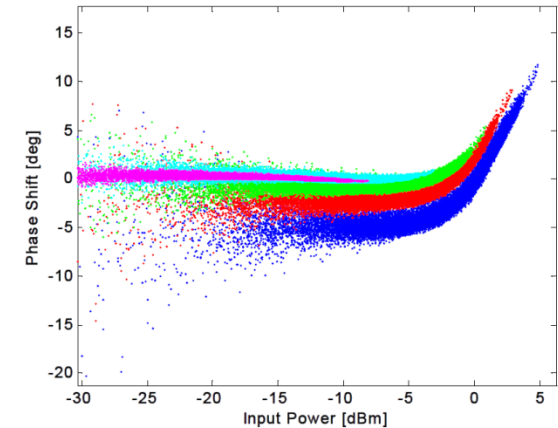


More IQ Applications

- S-parameters
- Equalizer
- Multi tone / multi carrier generation
- AM/AM & AM/PM Analysis

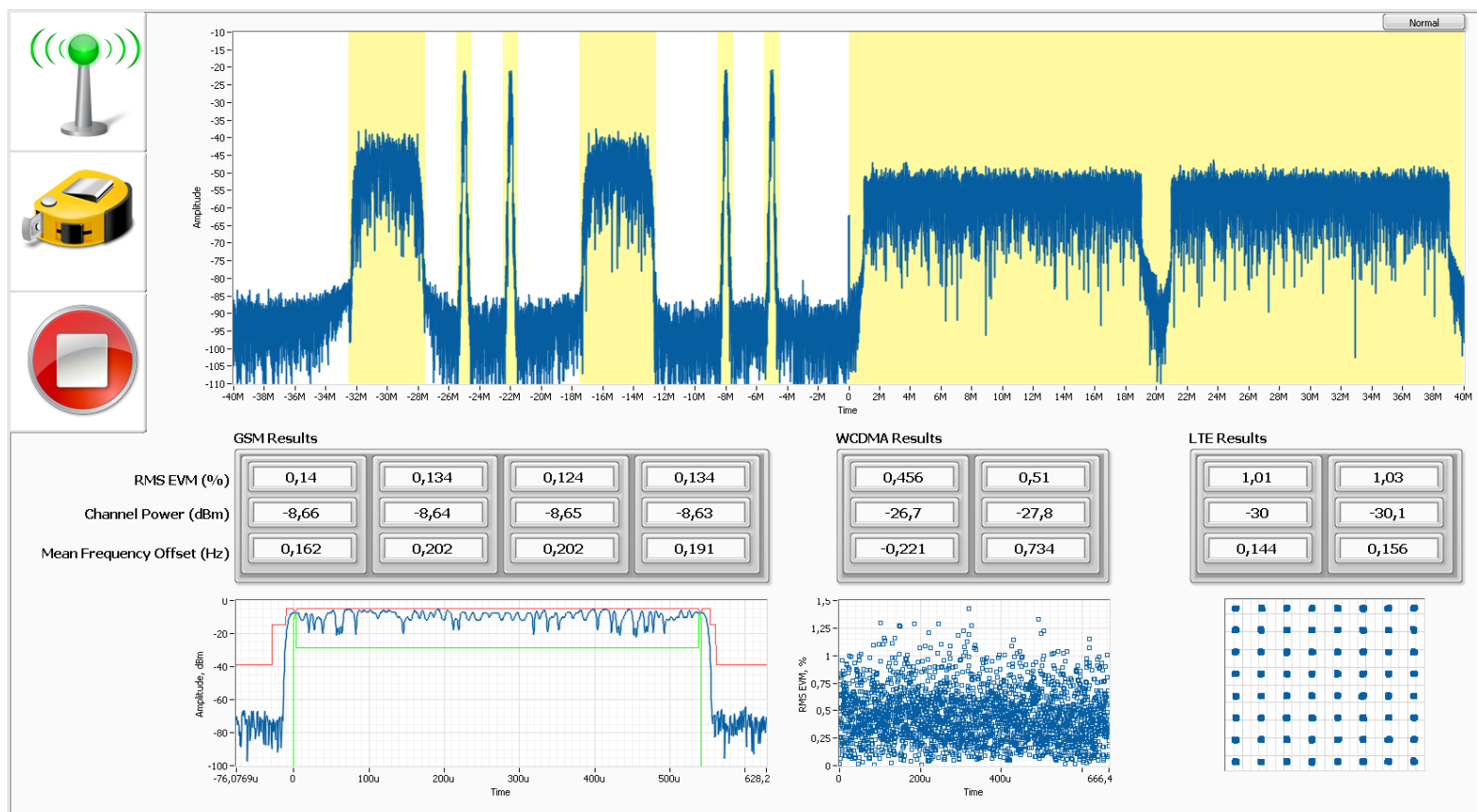


Dynamic AM/AM plots for different input power levels.



Dynamic AM/PM plots for different input power levels.

Multi Standard Radio



From product specification to integrated test system.

Table of Contents	
1 Introduction	4
1.1 Purpose	4
1.2 Document Conventions	4
1.3 Project Scope	4
1.4 References	4
2 System Description	4
3 Functional Requirements	4
3.1 System Features	4
3.1.1 System Feature 1	5
3.1.2 System Feature 2	5
3.2 Use Cases	5
3.2.1 Use Case Diagrams	5
3.2.2 Use Case 1	5
3.2.3 Use Case 2	5
3.3 Entity Relationship Diagrams	5
3.4 Data Dictionary	6
3.4.1 Entity 1	6
3.4.2 Entity 2	6
4 External Interface Requirements	6
5 Technical Requirements (Non functional)	6
5.1 Performance	6
5.2 Scalability	6
5.3 Security	6
5.4 Maintainability	6
5.5 Usability	6
5.6 Multi lingual Support	6
5.7 Auditing and Logging	6
5.8 Availability	6
6 Open Issues	7

Test strategy

Test coverage analysis

Test methodologies

Measurement uncertainty

System design

Engineering

Integration

Commissioning

Life Cycle Support

Upgrades

