MATLAB for Verifying the Hardware Implementation of Automotive Radar Signal Processing

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Agenda

- Automotive RADAR Architecture
- Verification Challenges
- Problem Statement
- Conventional Approach
- DPI-C Approach
- Tools Used
- Benefits
Automotive RADAR Architecture

source: www.nxp.com
Automotive RADAR Architecture
Verification Challenges

Mixed Signal Design

- DSP centric
- Functional and performance parameters

Conventional Verification Flow

- Based on Constrained Randomization
- Highly inefficient
- Involves its own verification cycle

Test-bench implementation

- Need for golden reference DUT models
- High effort in terms of manpower and time
Problem Statement

- Mixed Signal Design
- ISO26262
- Current Verification Drawbacks
- Use-cases

Improved Efficiency & Productivity
Conventional Approach

Measurement only at module i/p & o/p
Verification Metrics

Conventional
- Sample by Sample comparison
- Attenuation

DPI-C
- Signal Reconstruction
- SNR
- PSD
- THD
- Attenuation
DPI-C Approach

Functions written in MATLAB to measure functional & performance parameters

Using MATLAB Coder, shared object library is generated

UVM Components replaced with dpi generated “shared object”

Scoreboard compares the measurement with spec

Functions report all functional & performance parameters to scoreboard

UVM Scoreboard collects sample data and passes it to DPI-C functions generated in MATLAB
DPI-C Approach (contd..)

- Analog RX path
- DUT
  - ADC
    - Sampling & quantizing
    - Decimation & FIR
  - Data Interfaces
  - UVM Test Environment
  - SV wrapper
    - dpi generated functions
  - MATLAB functions
  - HDL Verifier

Measurement at multiple interfaces
DPI-C Approach (contd..)
Tools Used

- MATLAB
- Signal Processing Toolbox
- MATLAB Coder
- Embedded Coder
- HDL Verifier
Benefits

- Reduced verification Effort
- Performed verification at higher level of abstraction → more inline with customer
- Enables signal analysis during regression runs
- Allows metrics measurements at multiple interfaces
- Eliminated human prone errors in modelling by transferring effort to machine
- Testcases reused for post-silicon validation
- Allows for functional & performance parameter measurements at multiple interfaces
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