



HUAWEI

MATLAB EXPO 2018

Milano, 29/05/2018

**Design and Prototype a Wireless
Communication System**

Marco Manfredi



Agenda

HUAWEI

Why?

System Description

Modem: Design and Simulation

Modem: Integration and Verification

Conclusion



180,000
employees



80,000
R&D
employees



Operates in
170+
countries/regions



15
R&D centers



R&D investment
over the past
decade
US\$46.1 bn



No. 83
on the Fortune
Global 500 list



- Keep investing **10%+** of annual revenue in R&D, making Huawei more competitive, pushing the industry forward, and driving technological advances.



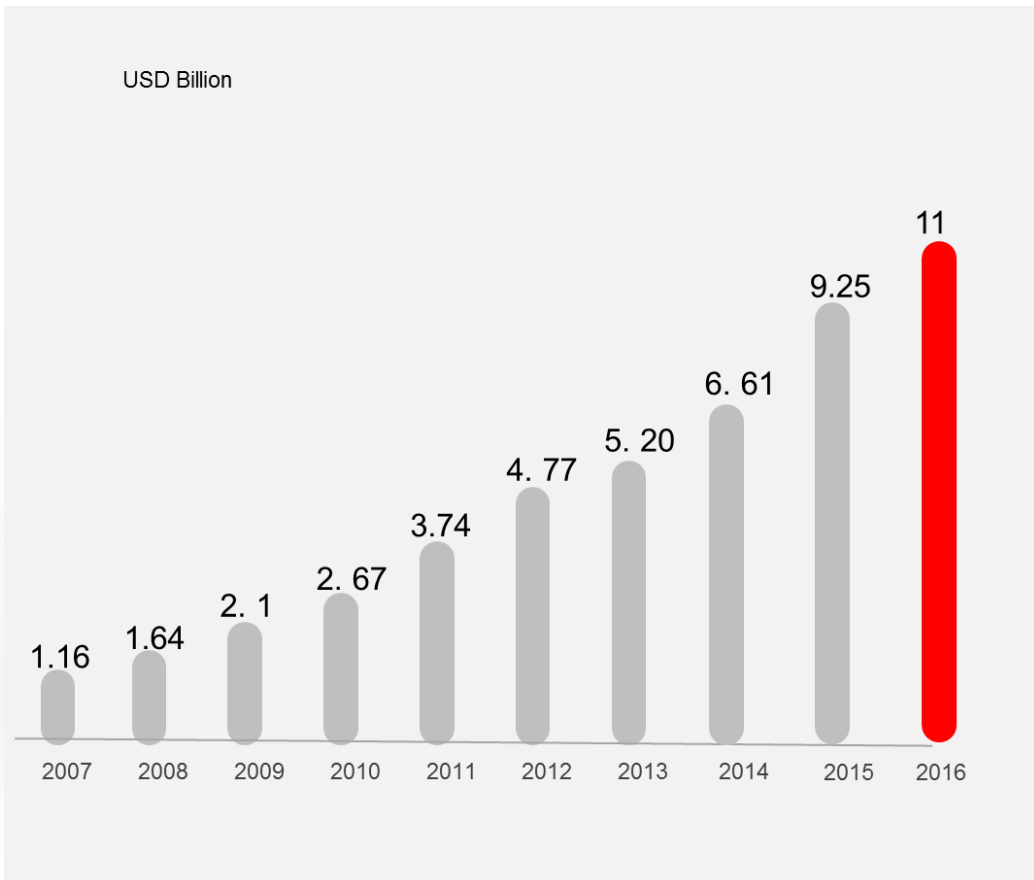
- Total R&D investment over the past decade: over CNY76.3 billion, equivalent to **US\$11** billion



- Annual R&D investment for the future: **US\$10–20** billion



- Increase investment in basic research, exploring the technological architecture of the future intelligent world



Agenda

HUAWEI

Why?



System Description

Modem: Design and Simulation

Modem: Integration and Verification

Conclusion



❑ High level system analysis

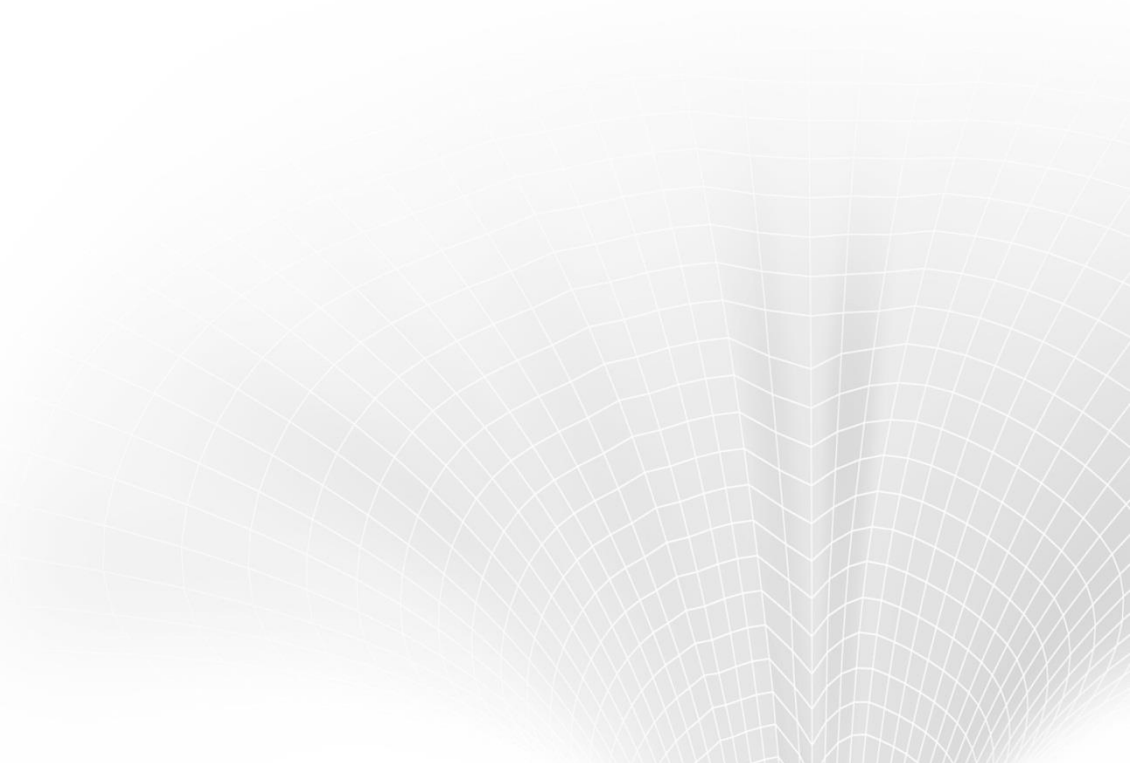
- ✓ Evaluation of:
 - different architectural solutions
 - system performance

❑ Algorithms

- ✓ Design
- ✓ Test
- ✓ Reuse

❑ System prototyping

- ✓ Construction of test environments
- ✓ Validation of:
 - System architecture
 - Algorithms



Agenda

HUAWEI

Why?

System Description

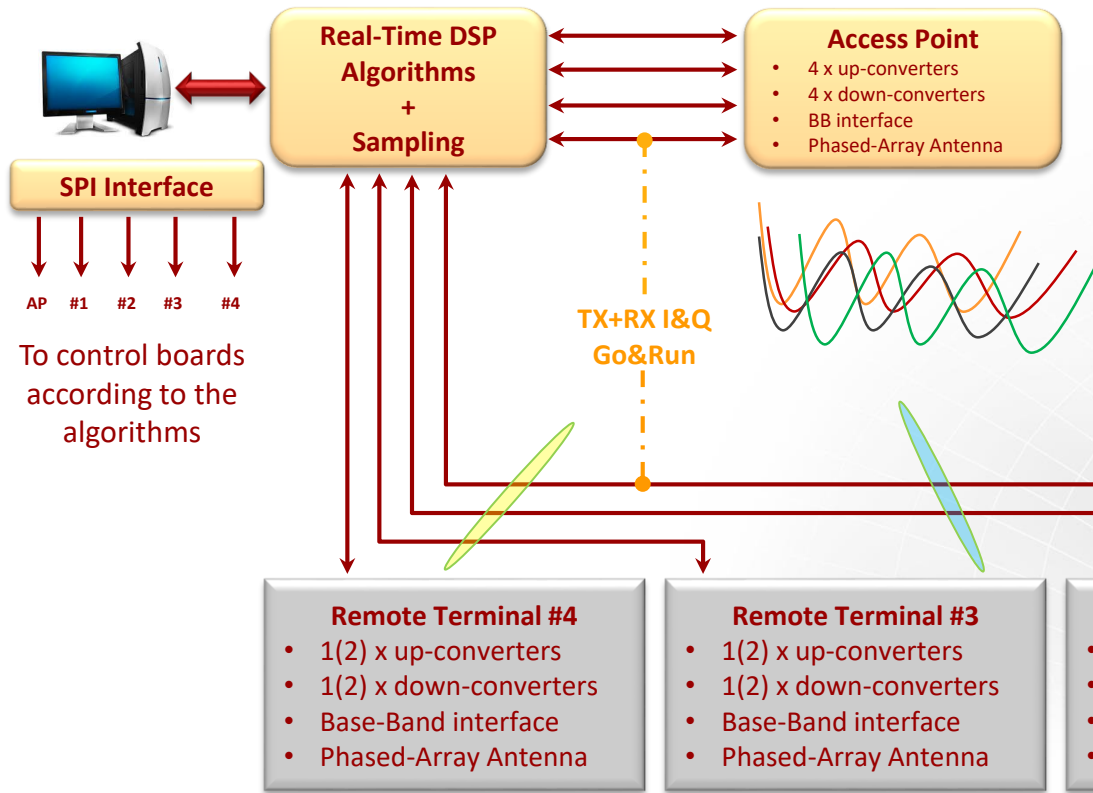
Modem: Design and Simulation

Modem: Integration and Verification

Conclusion



Multi-User System Communication



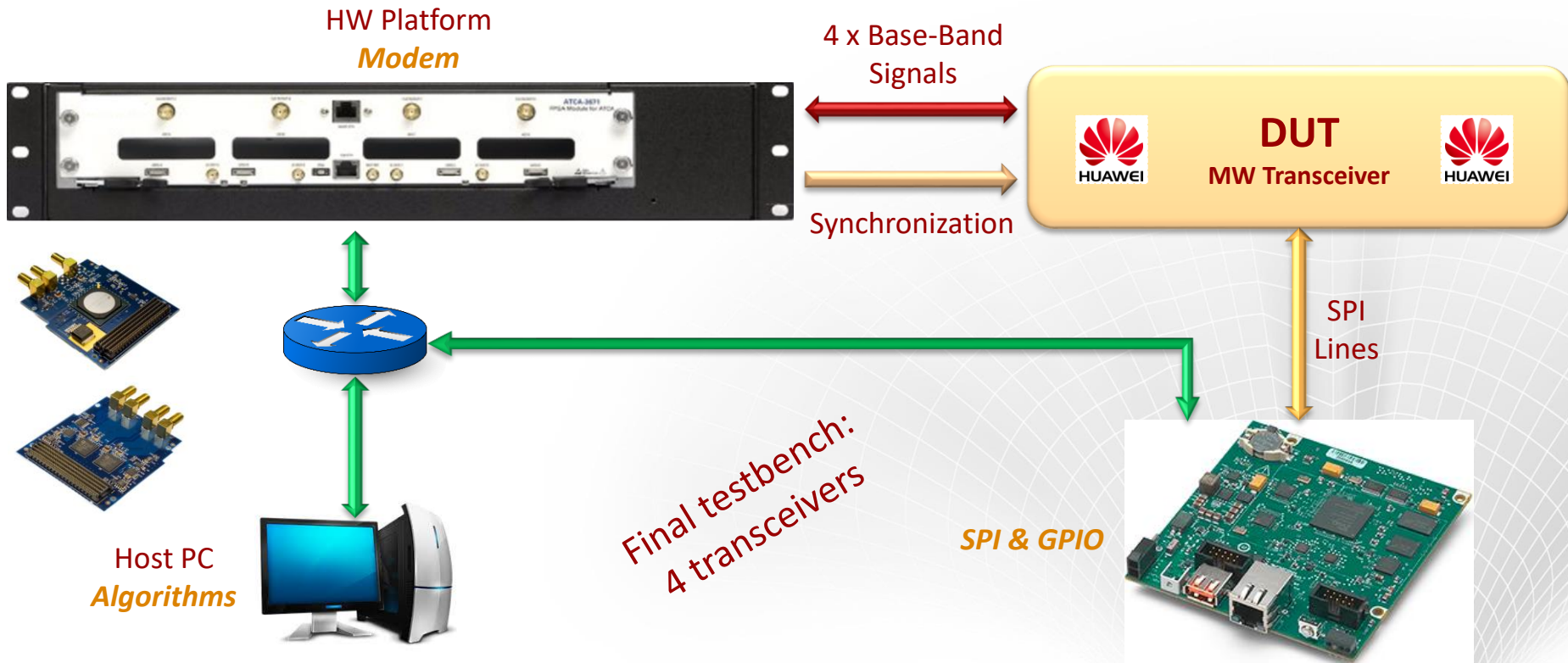
Technological challenges

- ✓ Generation up to 5 I&Q (In-phase & Quadrature) couples:
 - 16 x DAC (Digital to Analog Converter): TX
 - 16 x ADC (Analog to Digital Converter): RX
- ✓ Signal Bandwidth >1 GHz
 - >40 GS/s
- ✓ Real-Time Operation
 - Algorithms for 8 Modem
- ✓ Control of 240+ digital lines
 - SPI (Serial Peripheral Interface)

HUAWEI System Description



□ Testbench with one transceiver



Agenda

HUAWEI

Why?

System Description

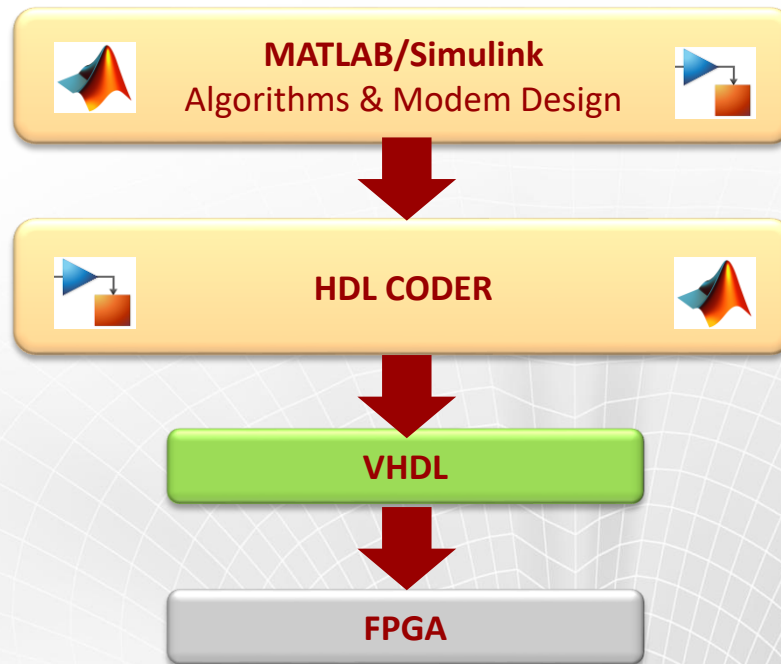
Modem: Design and Simulation

Modem: Integration and Verification

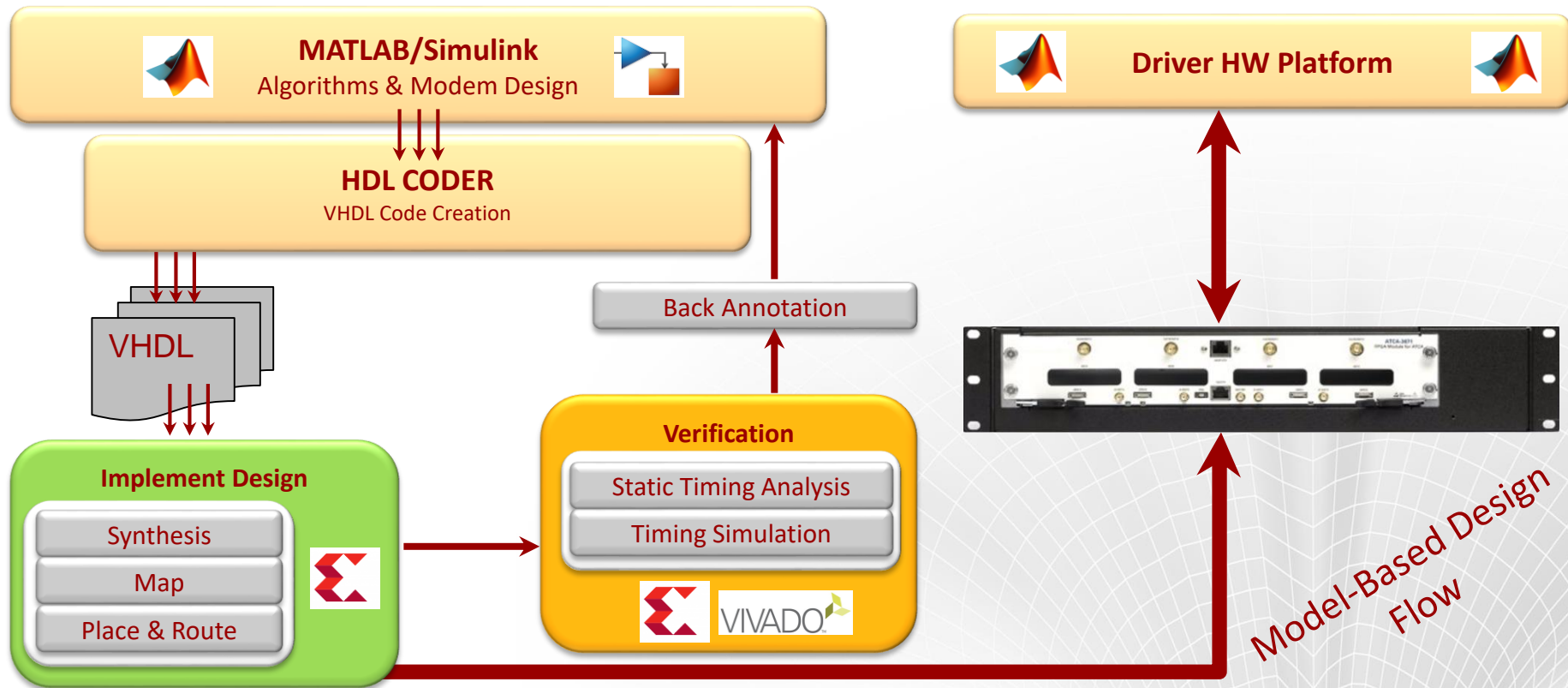
Conclusion



- ❑ Design, execute and verify modem in MATLAB/Simulink
- ❑ Automatically generation of VHDL code
- ❑ Deploy generated code on HW/FPGA



Modem: Design and Simulation



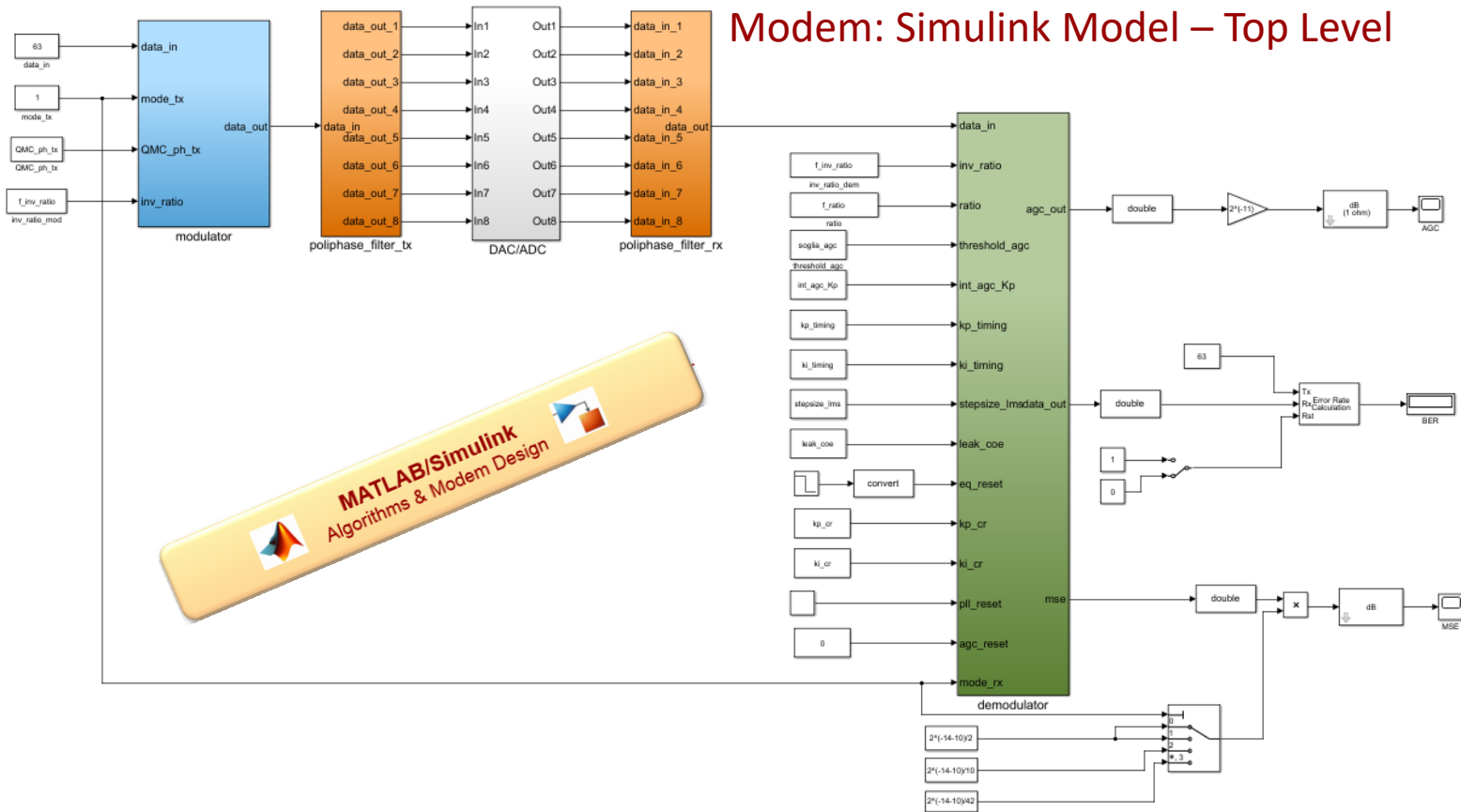


HUAWEI

Modem: Design and Simulation



Modem: Simulink Model – Top Level

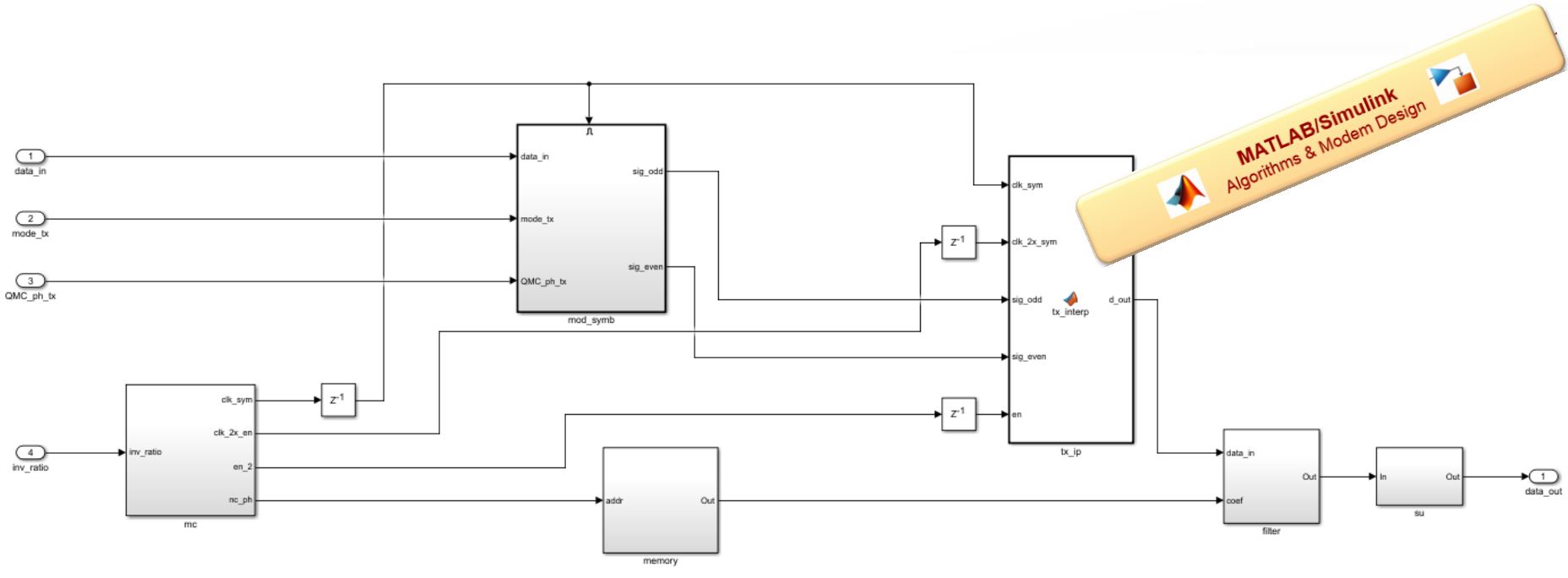




Modem: Design and Simulation

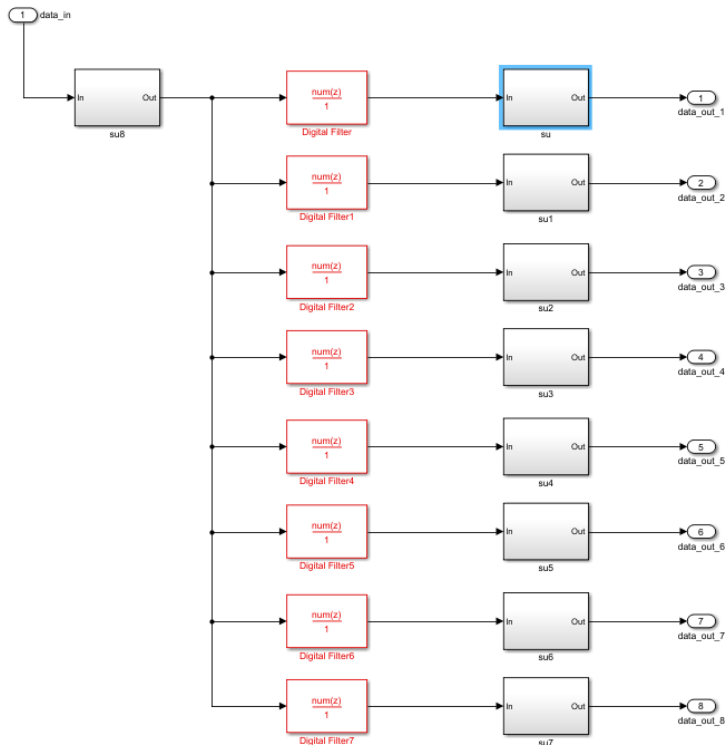


Modem: Simulink Model – Modulator

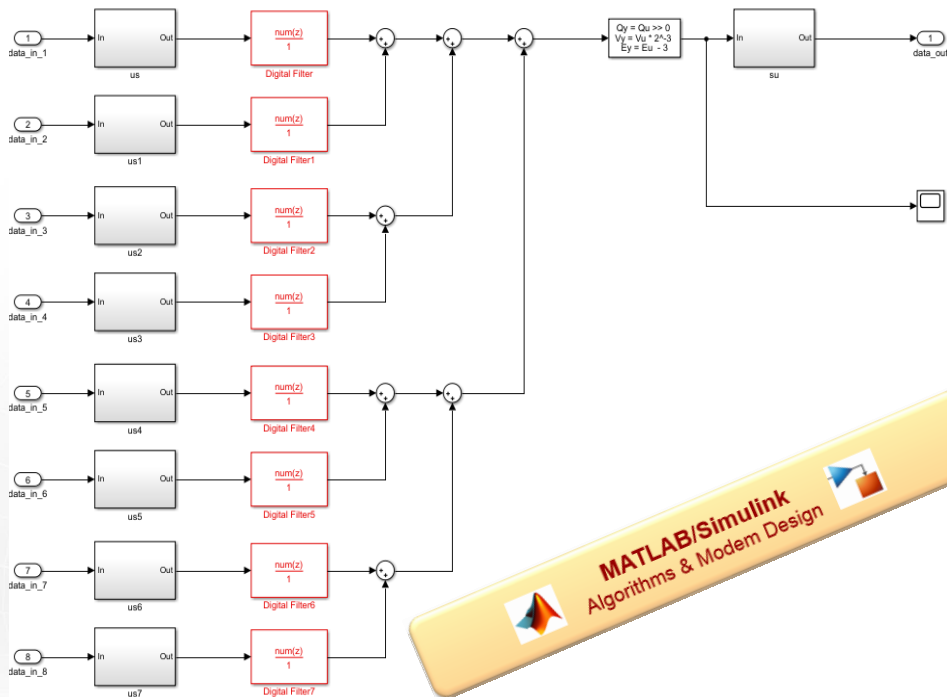




Modem: Design and Simulation

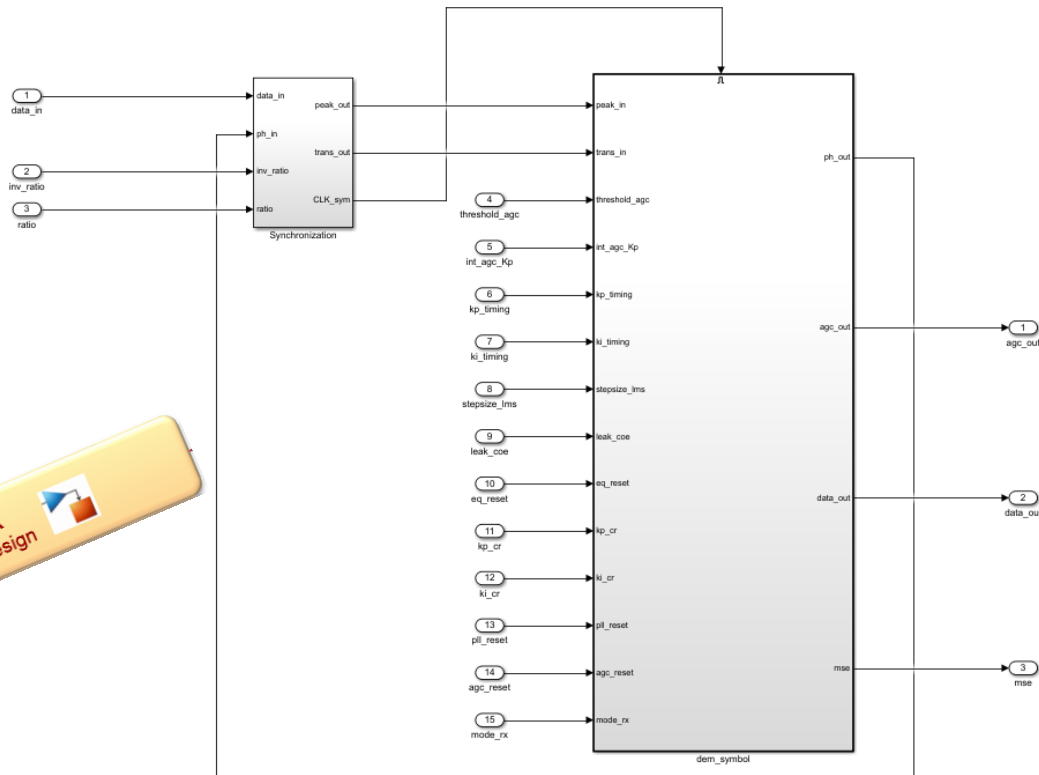


Modem: Simulink Model – Filter TX & RX





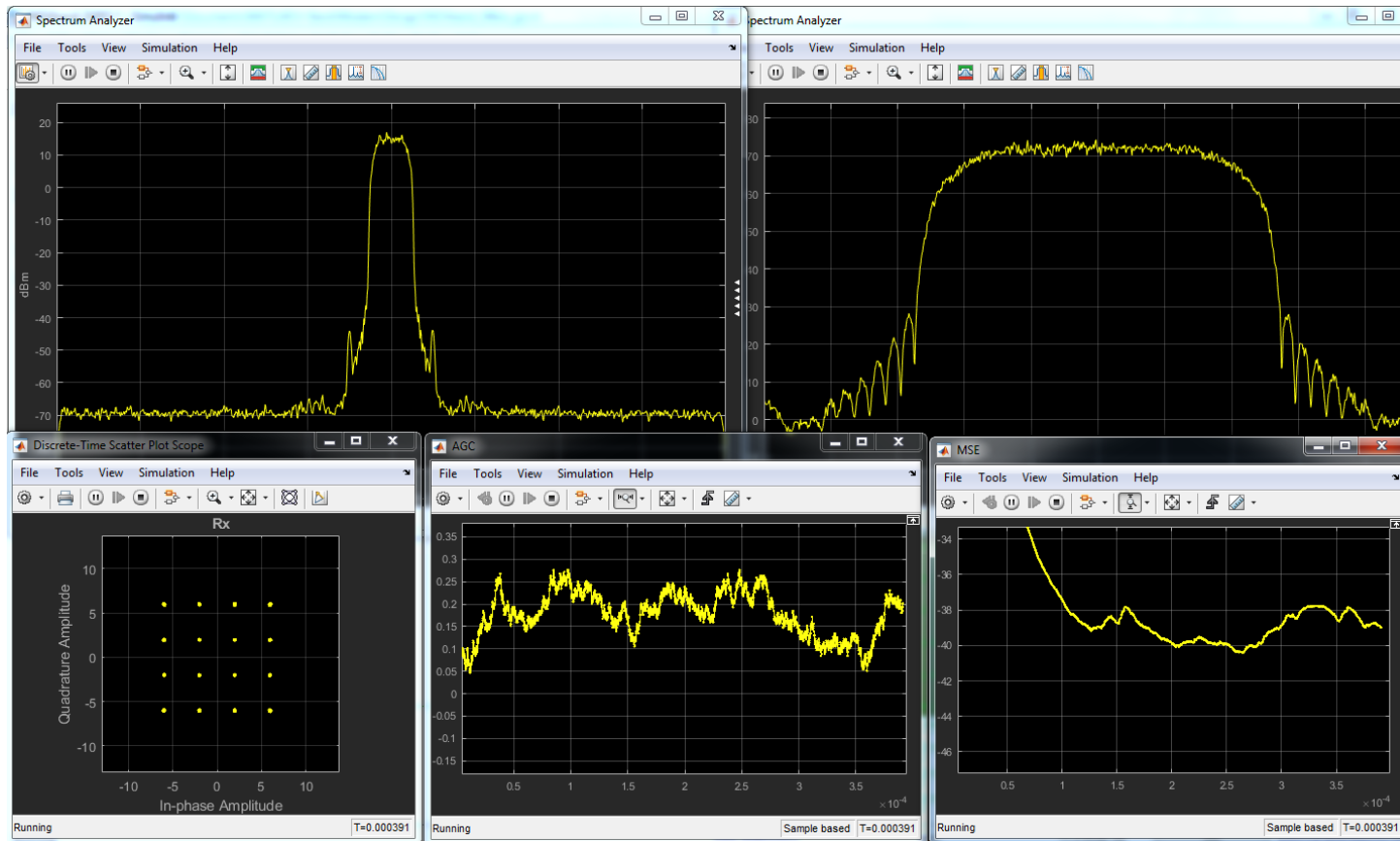
Modem: Simulink Model – Demodulator



MATLAB/Simulink
Algorithms & Modem Design



Modem: Design and Simulation



Agenda

HUAWEI

Why?

System Description

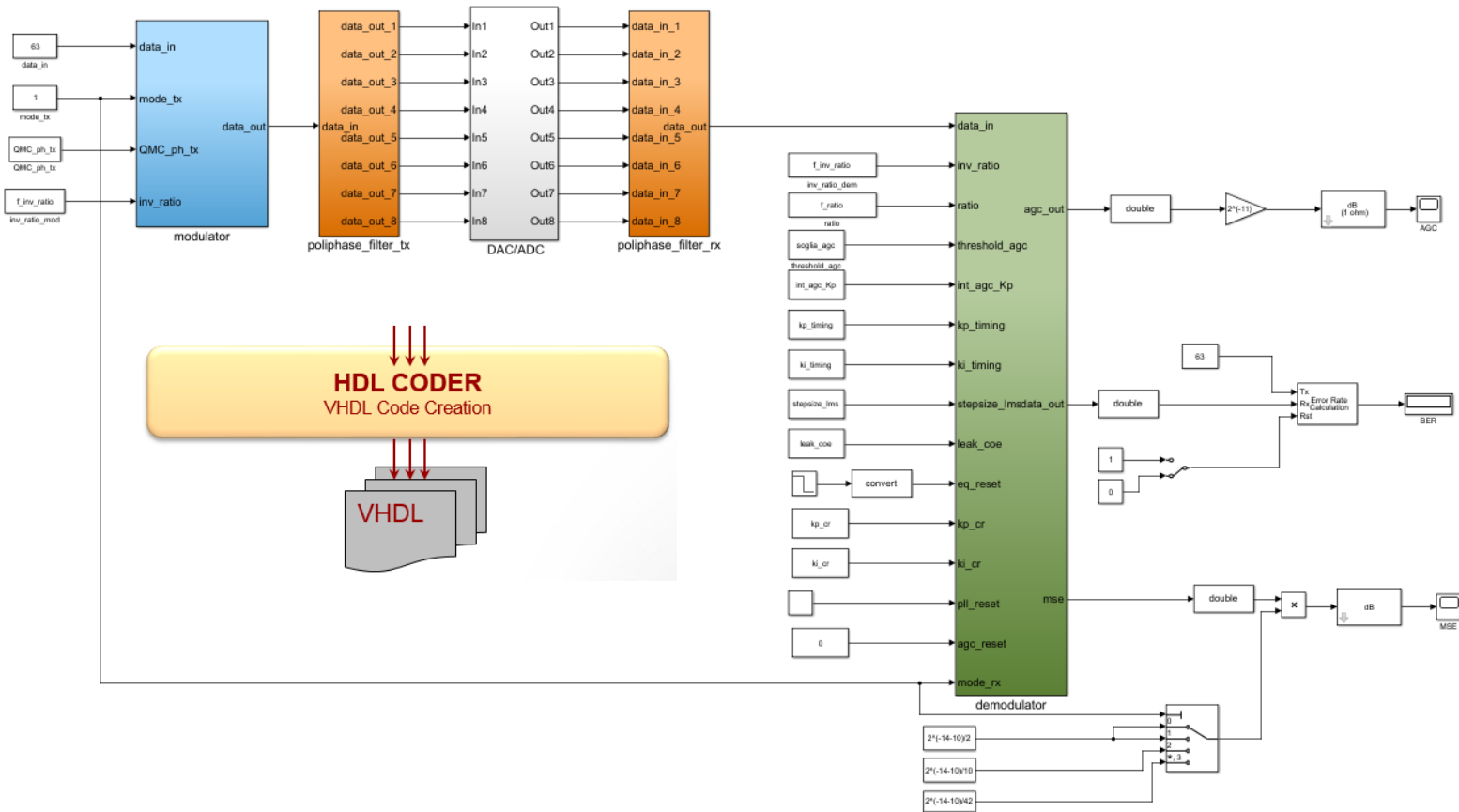
Modem: Design and Simulation

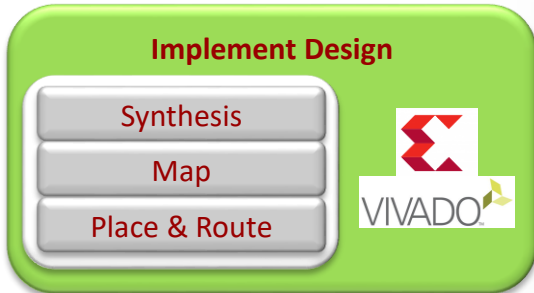
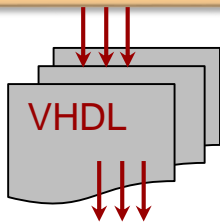
Modem: Integration and Verification

Conclusion

Modem: Integration and Verification

HUAWEI



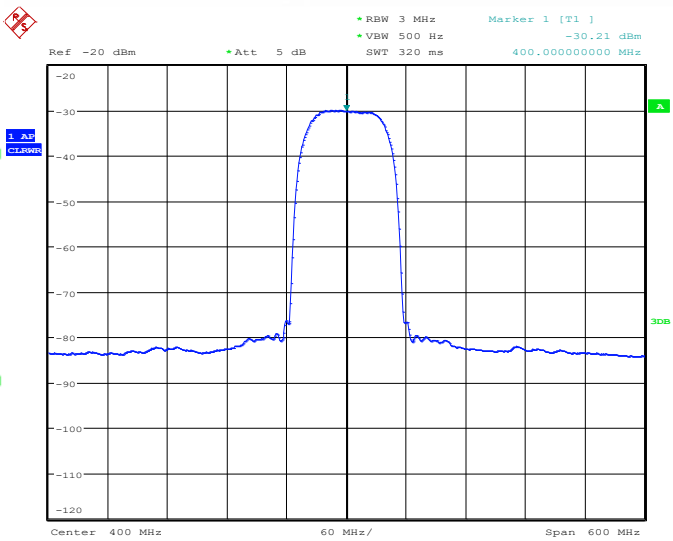
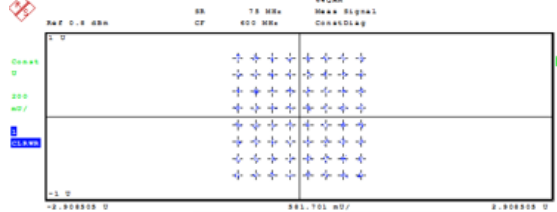
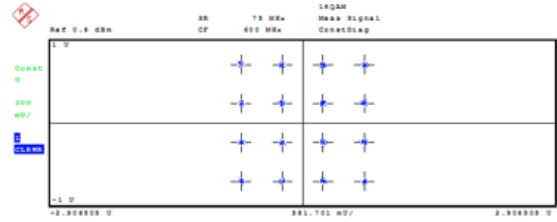
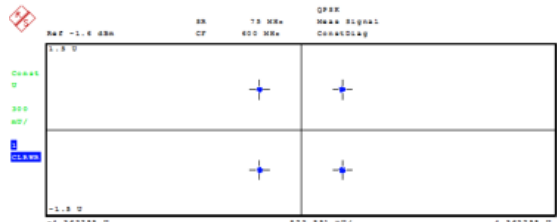
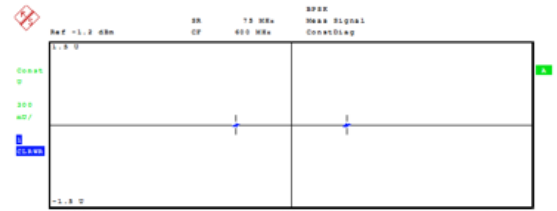
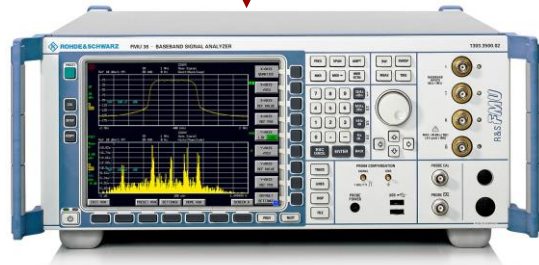


Modem: Integration and Verification

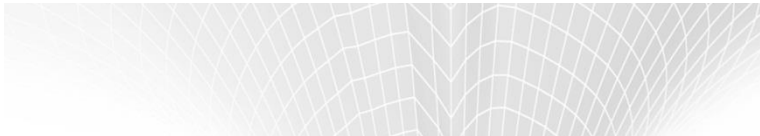
HUAWEI



Driver HW Platform



Date: 5.DEC.2017 17:21:50



Agenda

HUAWEI

Why?

System Description

Modem: Design and Simulation

Modem: Integration and Verification

Conclusion



❑ **The collaboration with The MathWorks Team has allowed:**

✓ A complete workflow to:

- design Modem and Algorithms (MATLAB/Simulink)
- generate fixed-point design through quantization analysis
- generate synthesizable VHDL code (HDL coder): the VHDL code generated is ready to the implementation

❑ **The modem performance, integrated on the hardware platform (Xilinx Virtex-7 based), are perfectly inline with the simulated modem performance (Simulink).**

MATLAB EXPO 2018

Thank you

www.huawei.com

Copyright©2011 Huawei Technologies Co., Ltd. All Rights Reserved.

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.