

# Design of Channelizer-Based DUC for Transmitter Downlink of Combined 3GPP LTE & WCDMA Radios

Xiaofei Chen, Elettra Venosa, fred harris, Chris Dick

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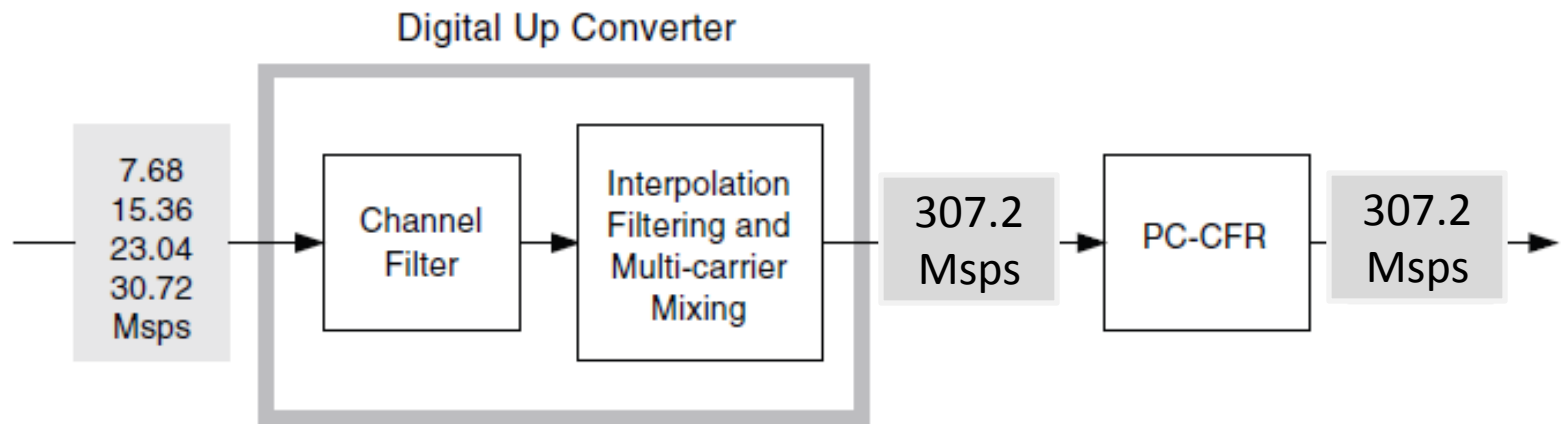
# **Outline:**

- **Motivations**
- **Review of Conventional Approach**
- **Non-Maximally Decimated Filter Bank with Perfect Reconstruction Property**
- **Proposed Architecture**
- **Simulation Results**

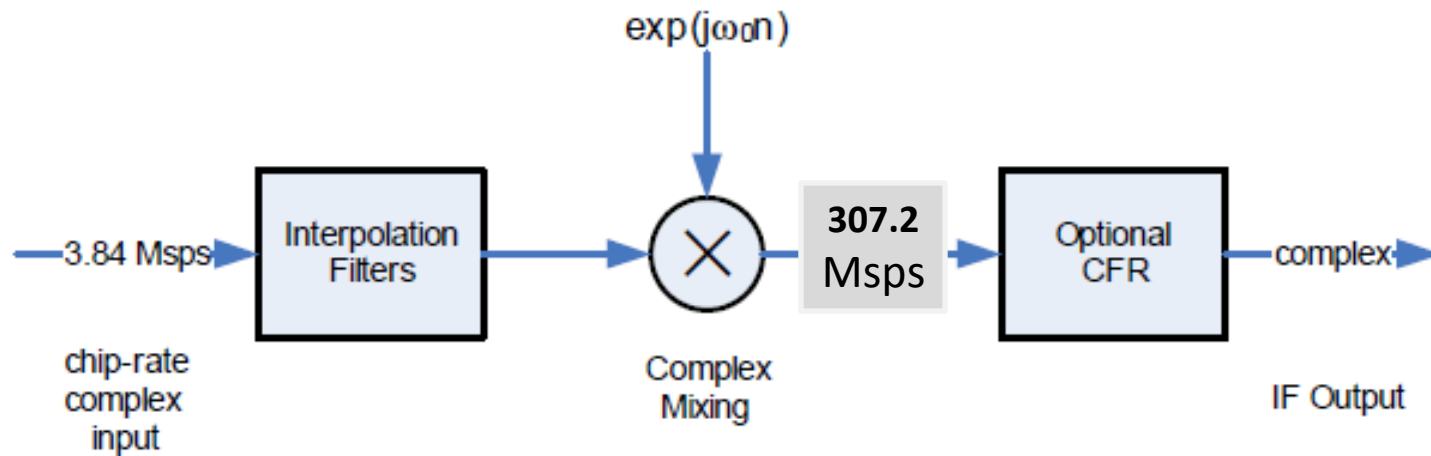
# Motivations and Project Goal:

- Building Flexible Radio Platform for Both 3GPP LTE, & WCDMA systems
- Extend the current approach to more general software defined radio applications

# Transmitter Digital Un-Converter (DUT) for 3GPP LTE



# Transmitter Digital Un-Converter (DUT) for WCDMA



# Review of Existing Approach

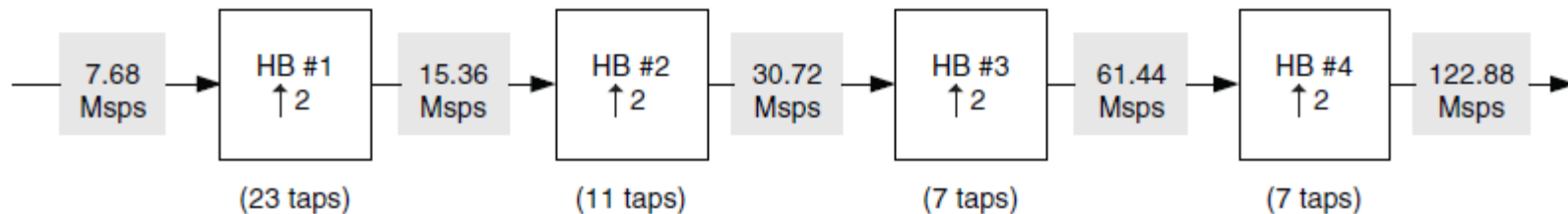
More & More  
Half-band !



Half-band !

⋮

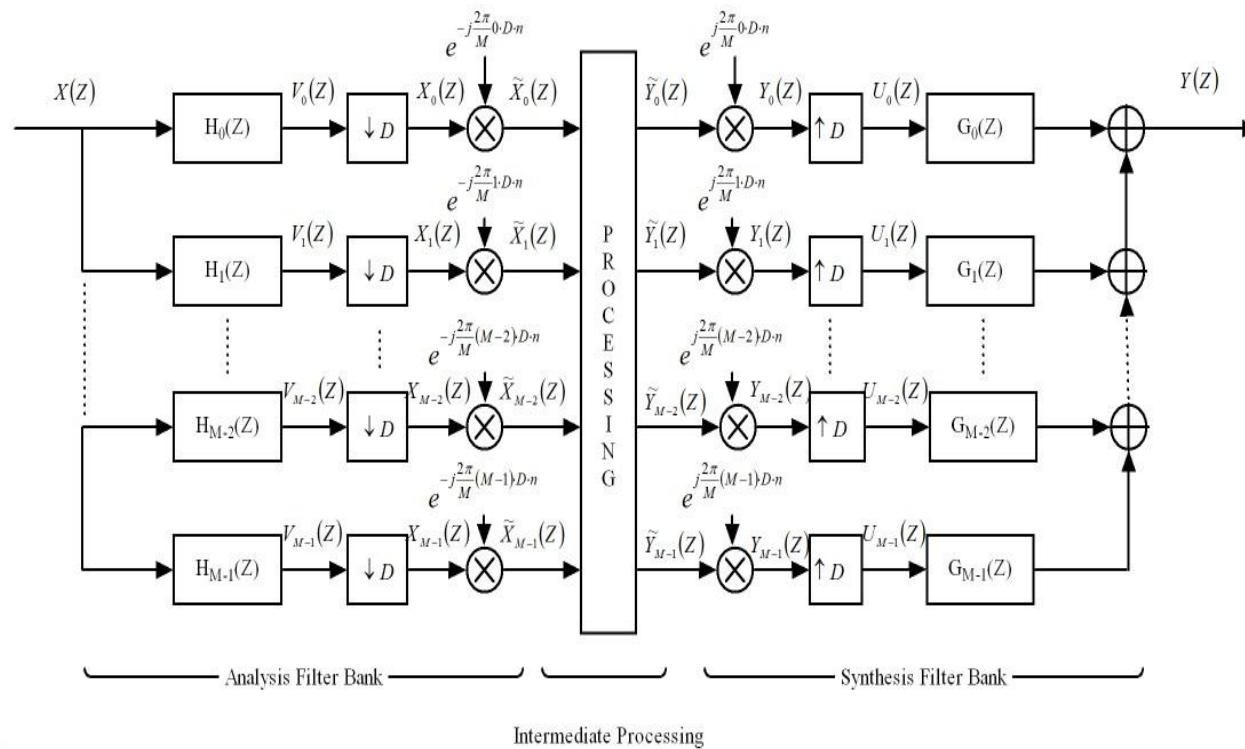
More Half-band !



# **Why Using Perfect Reconstruction Channelizer ?**

- Universal Structure V.S Dedicated Half-Band Chains
- Capable of Up-Convert Multiple Signals Simultaneously
- Low Speed Processing
- Equivalent Workload

# Non-maximal Decimated Filter Bank

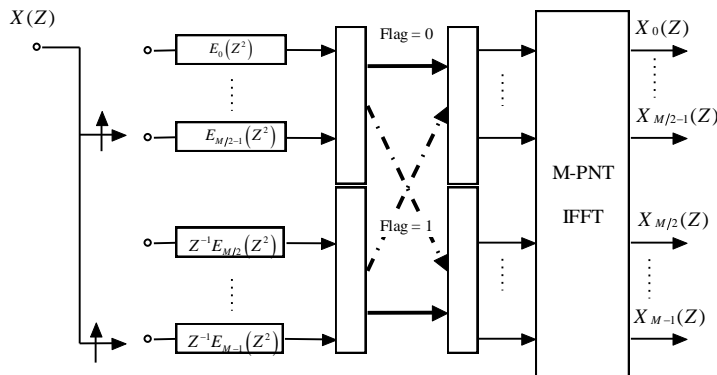


**Or, Channelizer**

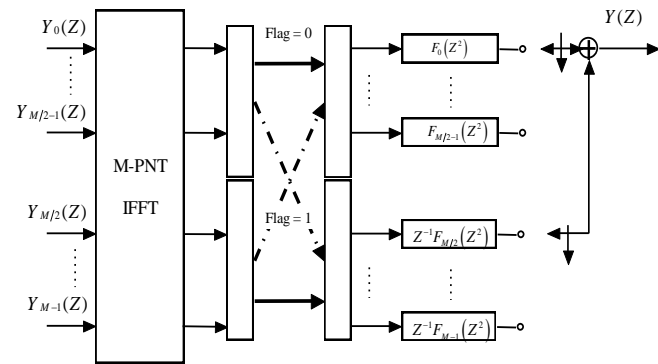




# Polyphase Implementation of Channelizer



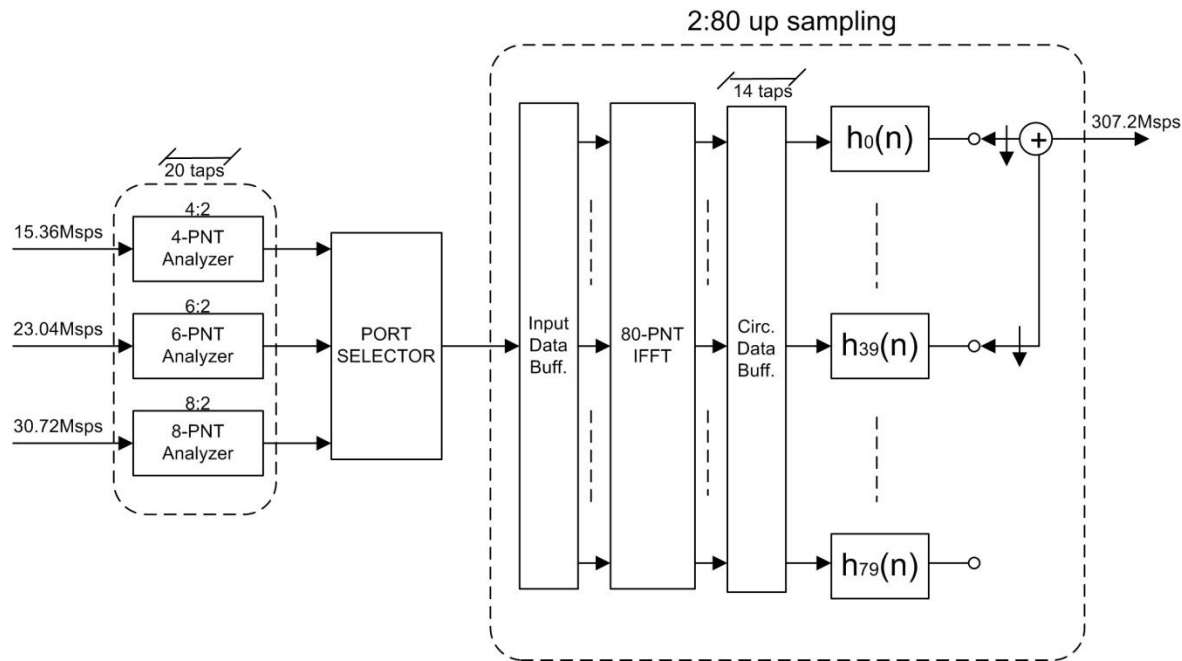
**Analysis Channelizer**



**Synthesis Channelizer**

**1 FIR filter plus 1 FFT**

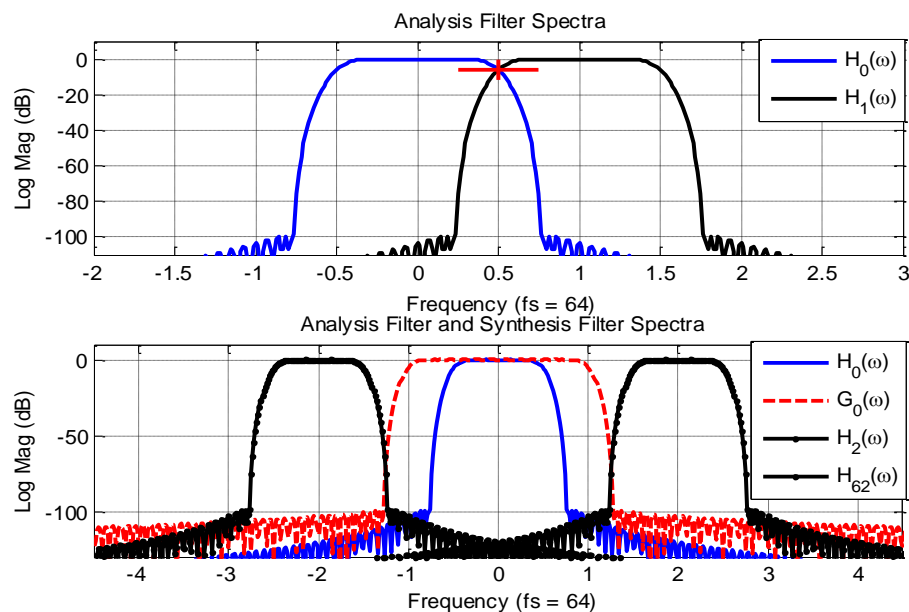
# Proposed Architecture:



**Mini Analysis  
Channelizers**

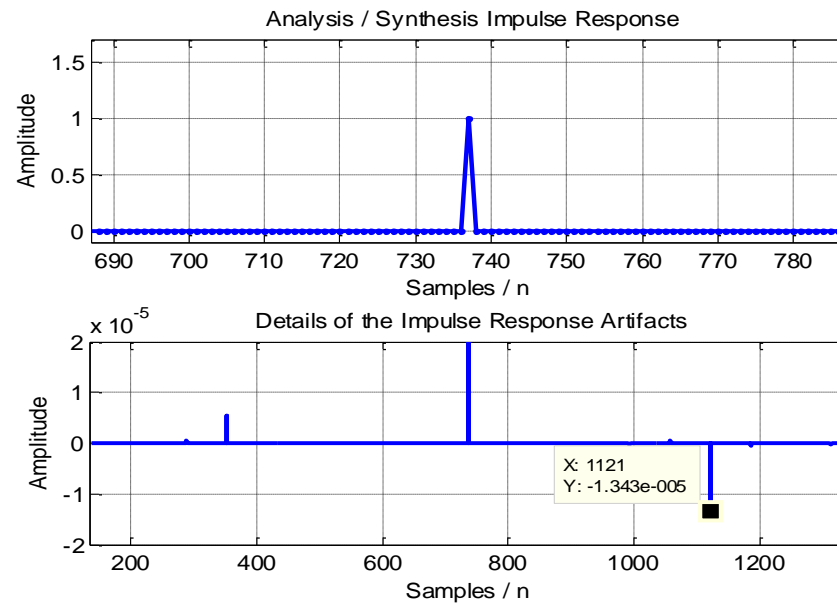
**Grand Synthesis  
Channelizer**

# Simulation Results



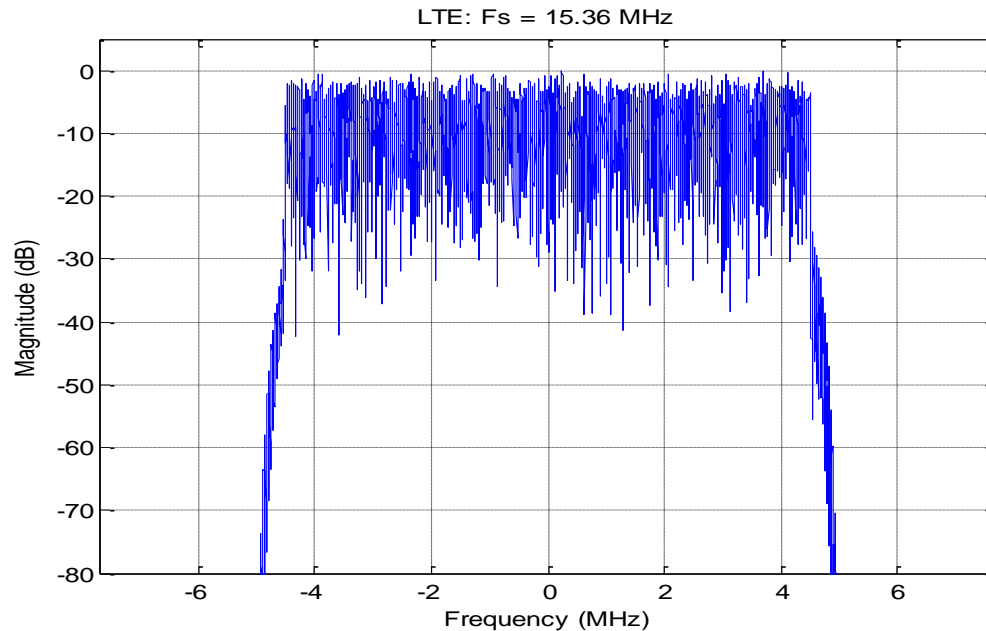
Frequency Responses of Analysis and Synthesis  
Low-Pass Prototype Filter

# Simulation Results (Cont'd):



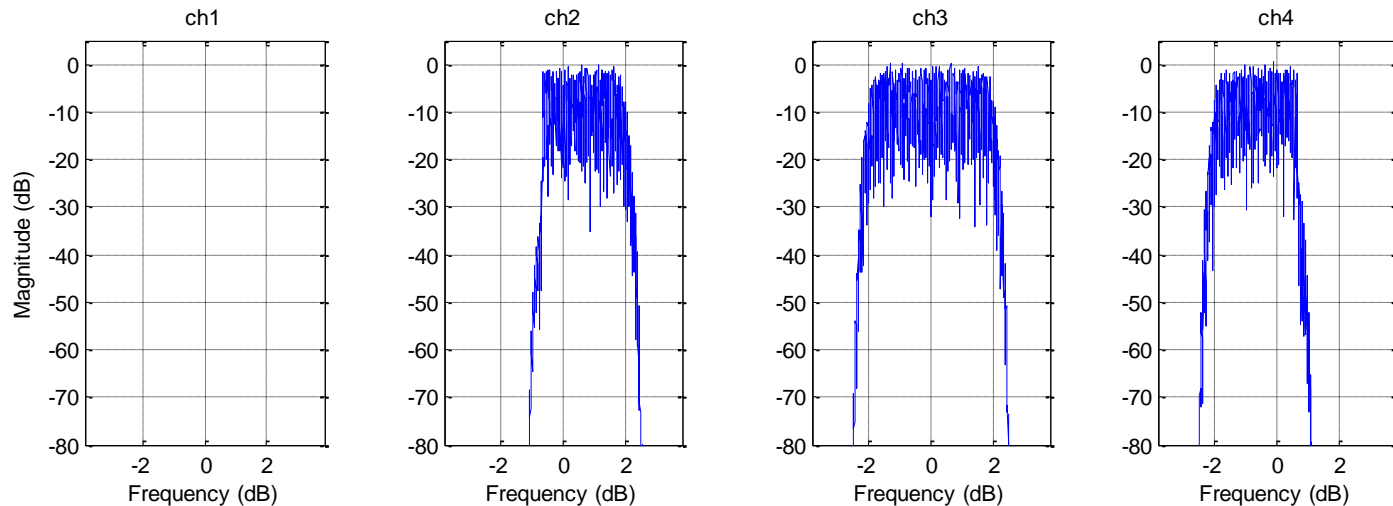
Impulse Response of Analysis and Synthesis Filter Bank

# Simulation Results (Cont'd): :



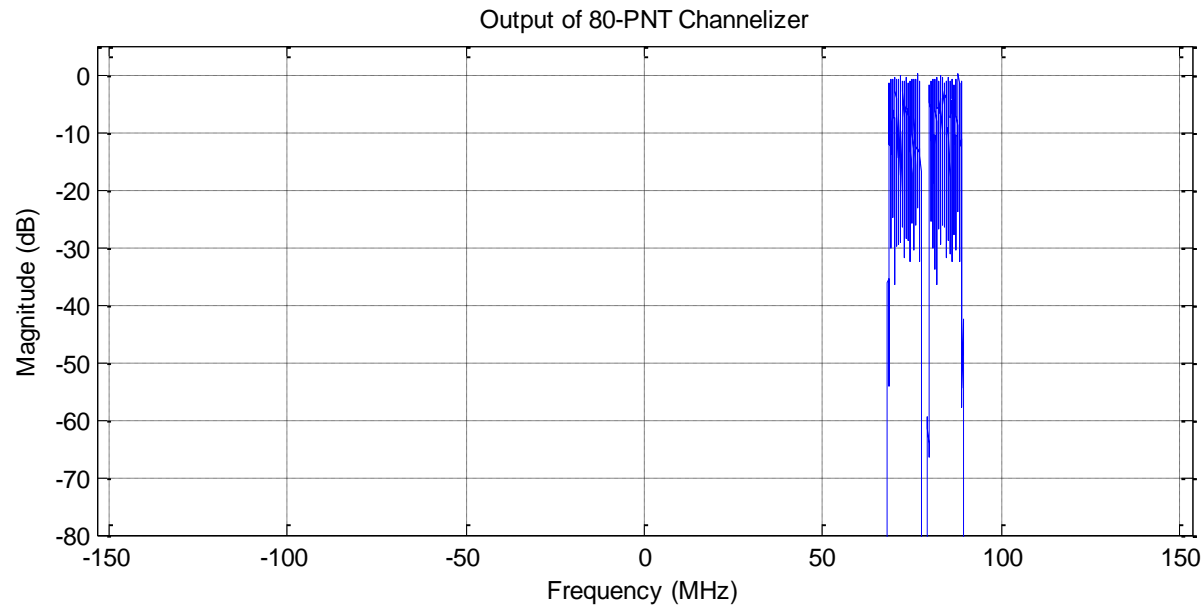
**Input Signal to the Analysis-Synthesis Chain,  
10MHz Bandwidth Sampled at 15.36Msps**

# Simulation Results (Cont'd):



**Outputs from the First Tier, 4:2, Down  
Converter Channelizer; 7.36Msps Sample Rate**

# Simulation Results (Cont'd):



**Final Output of the DUC; Two 10MHz  
Bandwidths Centered at 76.8MHz with an  
Output Sample Rate of 307.2Msps.**

# Conclusion:

- ❑ The Channelizer based DUC is a good candidate for replacing conventional cascade half-band filters
- ❑ The Channelizer based design supports multi-standard, multi-modulation format signal, which is a desired route for SDR development.

**Thank you 😊**  
**We are open for question now!**