

Cognitive Sub-Nyquist Collocated MIMO Radar Prototype

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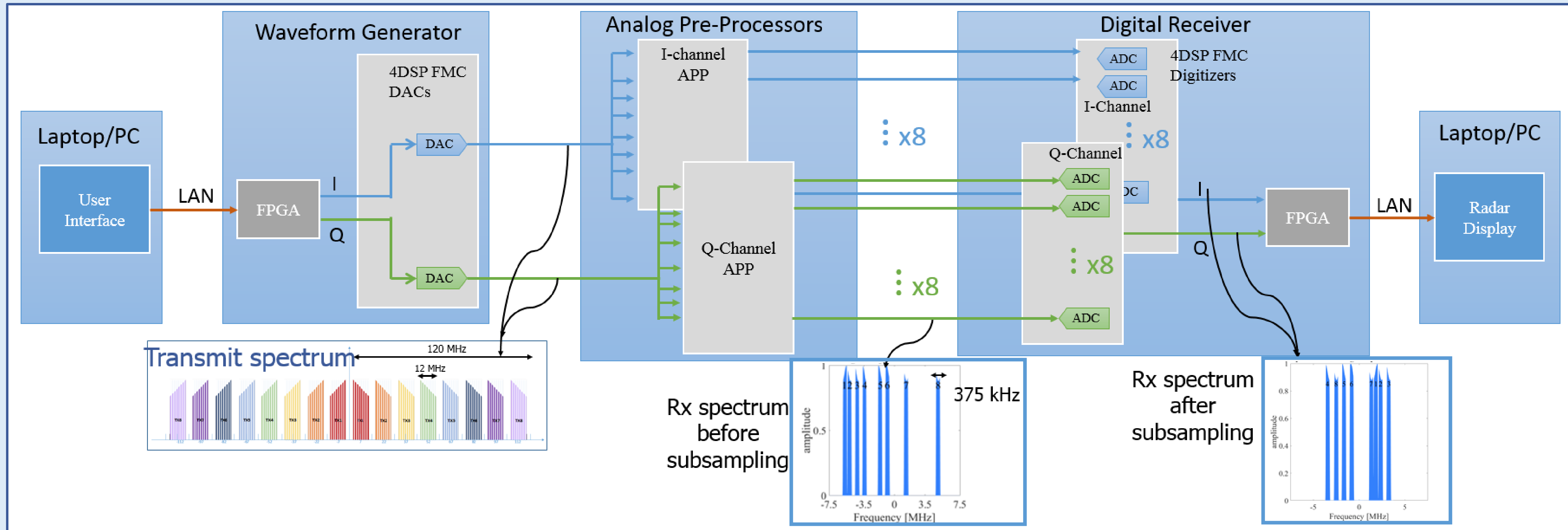
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Overview of Hardware Architecture

- Prototype shows spatial sub-Nyquist sampling of 8x10 ULA with a 4x5 thinned array
- Spectral sub-Nyquist sampling is demonstrated via cognitive transmission



Array Modes

Mode 1: Filled uniform array, 8x10

Mode 2: Filled random array, 8x10

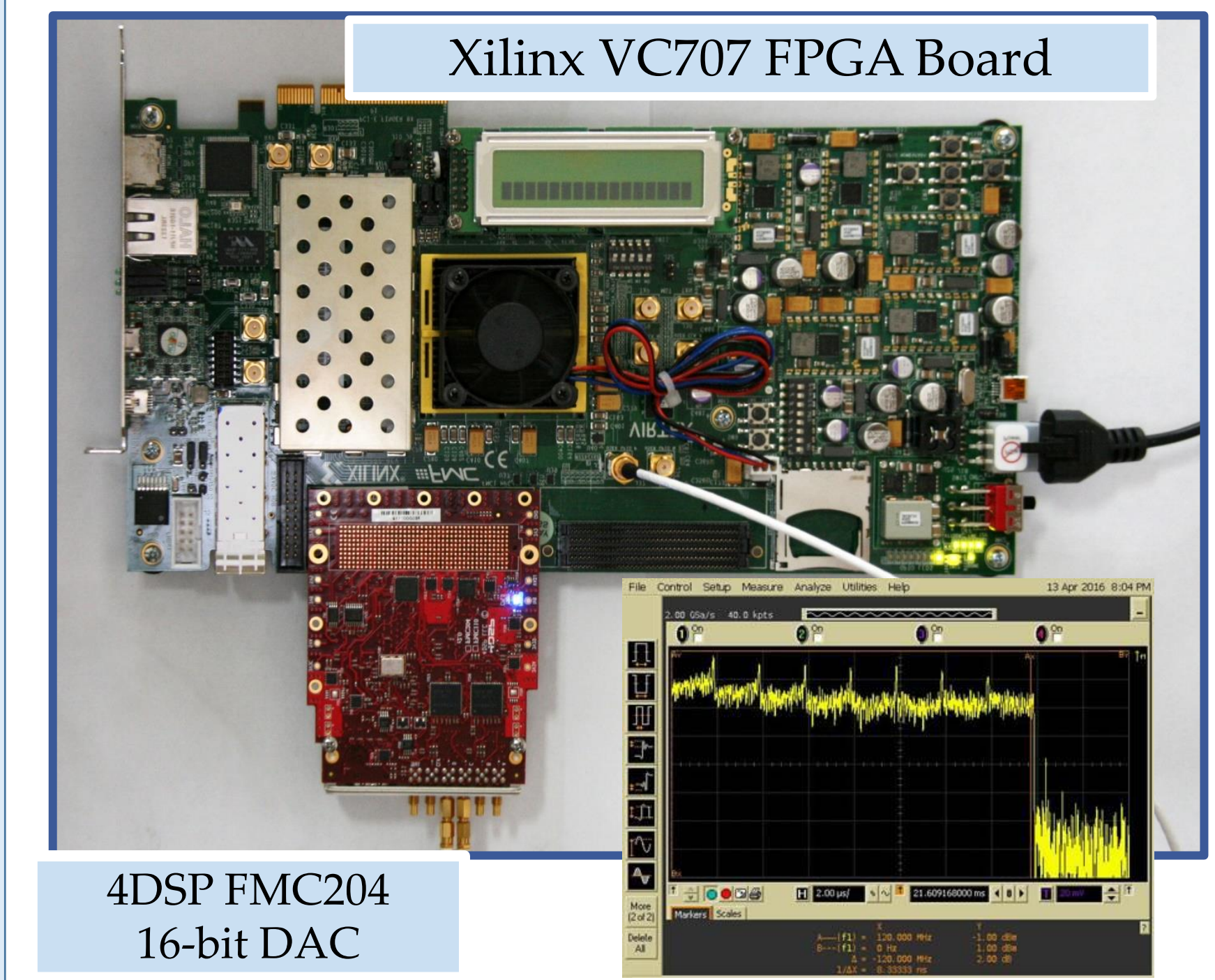
Mode 3: Thinned random array, 4x5 (~Virtual 8x10 ULA)
Spatial sub-Nyquist mode

Mode 4: Thinned random array, 8x10 (~ Virtual 20x20 ULA)

Tx		Rx	
0	0.5	1	
0	2	4	6
Array Aperture [m]			

Waveform Generator

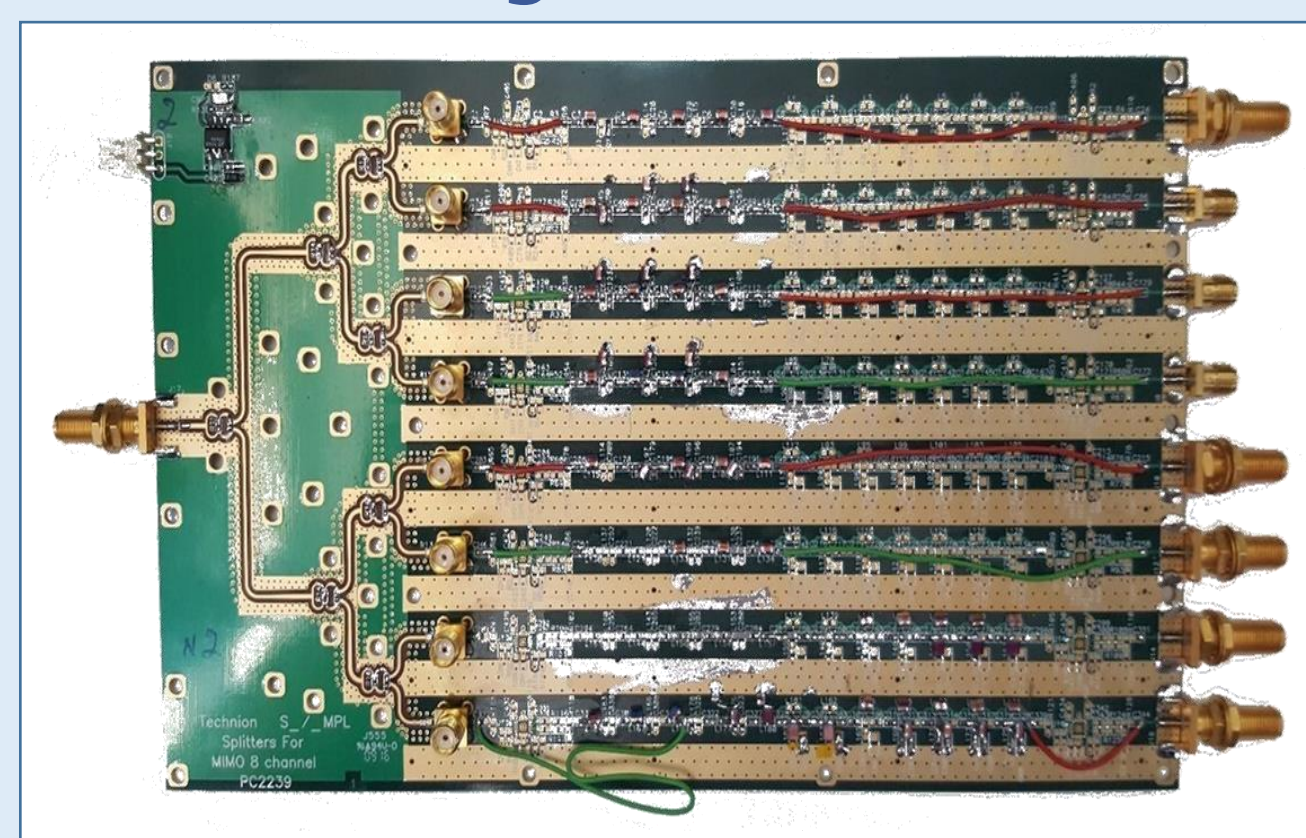
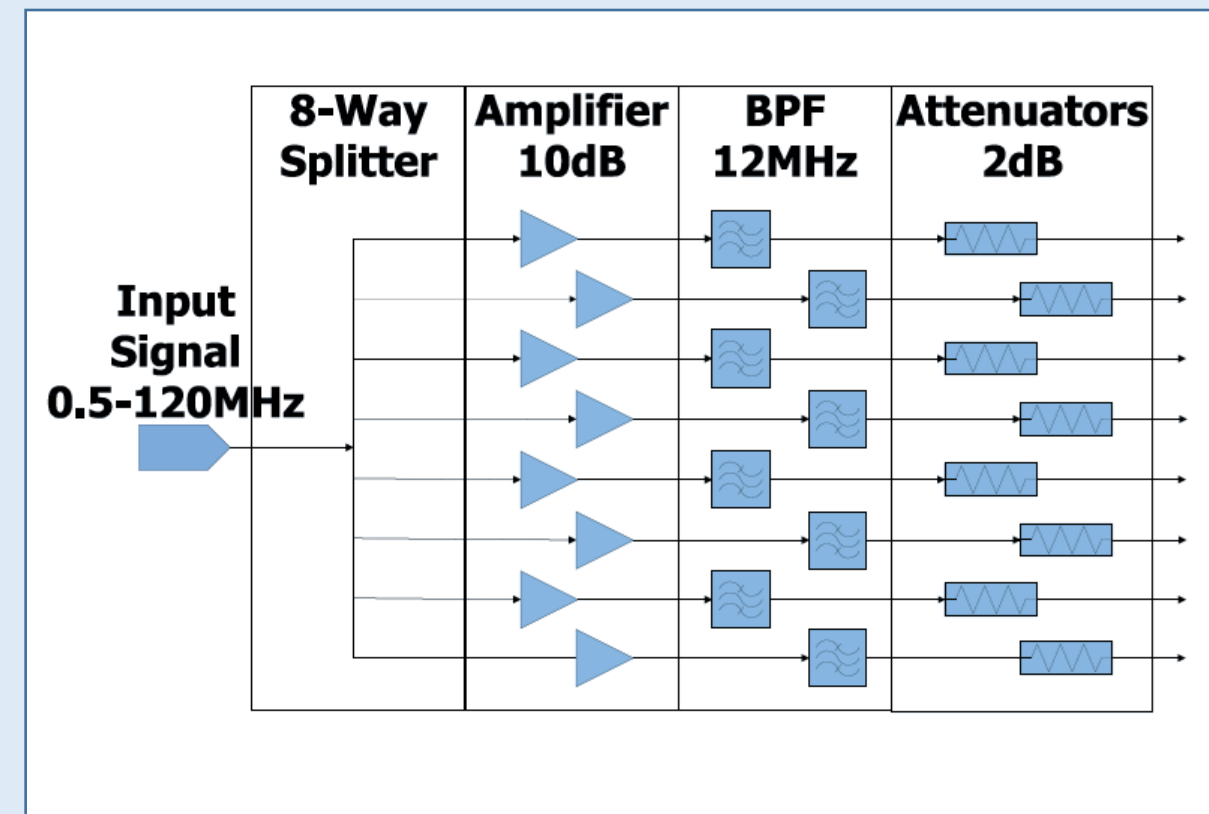
- Total BW, 8 Tx: 120 MHz
3 MHz Guardband
- Cognitive BW, 1 Tx:
3 MHz (= 8 x 375 kHz)
- Cognitive BW, 4 Tx:
12 MHz (= 4x8x375 kHz)
- Reduction Factor:
10% (12 of 120 MHz)



Analog Pre-Processor (APP)

APP filters the receiver data into eight channels

Dual back-to-back APPs in a single chassis

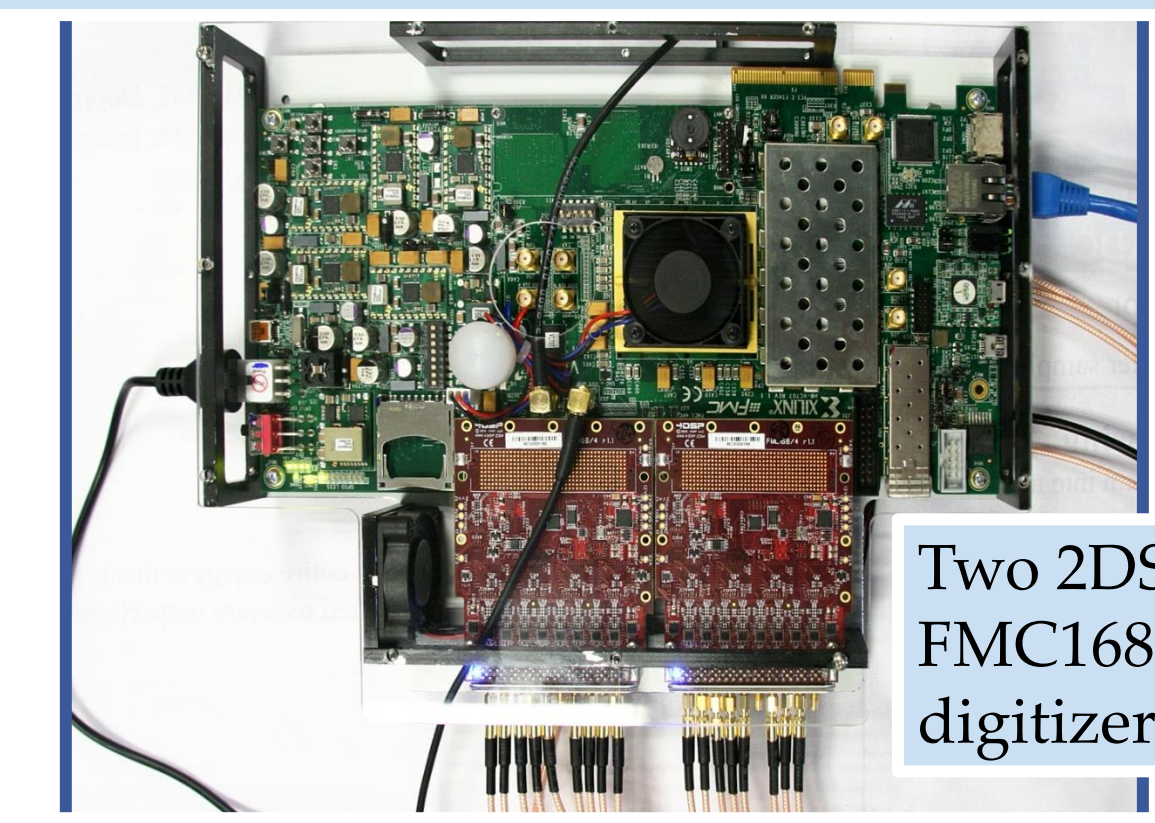


BPFs have ~30 dB stopband attenuation to mitigate subsampling noise

Digital Receiver

- Two 16-bit eight-channel digitizers for I and Q streams
- Sub-Nyquist sampling rate: 7.5 MHz/channel
- Signal BW with guardbands: 30 MHz/channel

Xilinx VC707 FPGA Board



Two 2DSP FMC168 digitizers
16 analog streams (8 I and 8 Q)

User Interface and Radar Display

Measurement Results

4x5 sub-Nyquist array resolution performance same as the ULA

8x10 (mode 4) has better resolution

