DEEPWAVE DIGITAL

Artificial Intelligence Radio Transceiver (AIR-T)

AIR-T Embedded Series Product Line

Overview

Deepwave's AIR-T is the first software defined radio with embedded high performance computing. It contains three unique digital processors for any application:

- **FPGA for strict real-time operations**
- **GPU for highly parallelized processing**
- **CPU for control, I/O, and software applications**

The AIR-T allows users to easily incorporate artificial intelligence into their radio frequency and wireless technologies.

This versatile system can function as a highly parallel SDR, data recorder, or inference engine for deep learning algorithms. The embedded GPU allows for SDR applications to process bandwidths greater than 200 MHz in real-time.

Key Specifications

- **Dual Channel MIMO Transceiver**
  - **300 MHz to 6 GHz**
  - **100 MHz bandwidth Rx (per channel)**
  - **100 MHz bandwidth Tx (per channel)**
- **Digital Signal / Deep Learning Processors**
  - **Xilinx Artix 7 FPGA**
  - **NVIDIA Jetson TX2**
    - **ARM Cortex-A57 CPU (4 core)**
    - **NVIDIA Denver2 CPU (2 core)**
    - **NVIDIA Pascal GPU (256 core)**
    - **8 GB of memory**
- **Connectivity**
  - **GPS Sync via 1 PPS and 10 MHz**
  - **USB 3.0, USB 2.0/3.0, SATA**
  - **High-speed digital I/O (GPIO/UART)**
  - **1 Gbps Ethernet**
- **Dual Power Mode:**
  - **22 / 14 Watts**

Software Support

GPU Acceleration

HPC with CUDA toolkit using C/C++ or Python interfaces

Signal Processing

Support for industry leading SDR development environment

Deep Learning

Train and deploy AI systems using standard frameworks
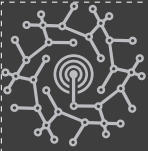
Operating System
Ubuntu 18.04

Mechanical

- **Size - 17.0 x 17.0 x 3.5 cm**
- **Weight - 0.35 kg**

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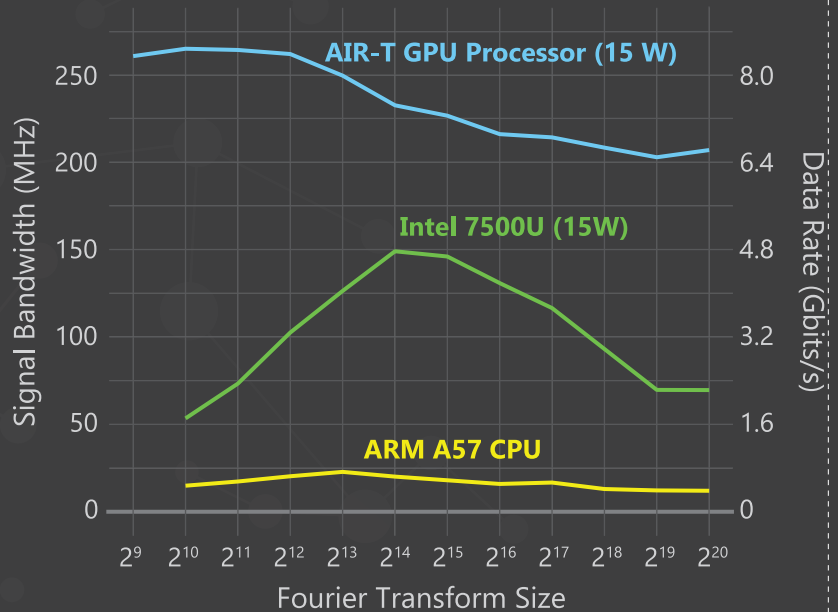
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Performance

The AIR-T uses **256 GPU cores** to create a highly parallel compute environment making wideband processing for software defined radio (SDR) applications obtainable.

Using the embedded NVIDIA Jetson TX2 the AIR-T provides **250% bandwidth improvement** over a power-comparable CPU and **1,350% bandwidth improvement** over an embedded CPU for real-time SDR applications.

The AIR-T uses **zero copy** memory access to overcome the data transfer overhead typically associated with GPU processing.

Real-time DSP Measurements

Chart: Signal Bandwidth (MHz) and Data Rate (Gbits/s) versus Fourier Transform Size (2^9 to 2^{20}), showing AIR-T GPU Processor (15 W), Intel 7500U (15W), and ARM A57 CPU.

Applications

Pre-trained AI Cores	User Developed Applications

AI Frameworks	DSP Frameworks

AIR-T Hardware Abstraction

AIR-T Hardware

Embedded Series Models

	AIR7101-A	AIR7101-B	AIR7201-A	AIR7201-B
GPU Cores	256	256	256	256
CPU Cores	6	6	6	6
Shared Memory	8 GB	8 GB	8 GB	8 GB
FGPA Model	XC7A75T	XC7A75T	XC7A200T	XC7A200T
Logic Cells	75,520	75,520	215,360	215,360
DSP Slices	180	180	740	740
Memory	3,780	3,780	12,140	12,140
Enclosure	No	Yes	No	Yes

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