arbe

4D Imaging Radar

The World's First 2K Ultra-High Resolution Radar Platform

Unparalleled high physical resolution radar enabling safe autonomous driving modes from L2 through L5 with always reliable object detection

- 4D Imaging Radar: range, Doppler, azimuth, elevation in high resolution and wide FOV
- Near zero false alarm and false negative rates for low-RCS targets like VRU's
- 4D point cloud output for sensor fusion (over Ethernet)
- SLAM software for real-time, low-latency object detection, classification and tracking of 100's of stationary and moving targets (CAN interface)
- Automatic interference avoidance and mitigation against other FMCW radar systems
- Integrated ISO26262 ASIL – B ready safety system with support for integration in ASIL – D ADAS / AV platforms
- AEC-Q100 qualified proprietary RF chipset and processor, leveraging latest 22nm process technology
- On - board security solution to protect against tampering or unauthorized access
- Compact design for easy vehicle front-grill integration
- Support for on-the-fly calibration

Radar Target Sepcification

Frequency Range	76 – 81GHz
Bandwidth	Up to 2GHz
Resolution (3dB Beamwidth): Range Azimuth Elevation Doppler	 9.5cm@36M, 60@300M 1.25 degree 1.7 degree 0.1m/s
Detections Space Range Azimuth FOV Elevation FOV Doppler	 Up to 300m –50 — + 50 deg –15 — +15 deg –70 — +140 m/s
Point Cloud Data Size Per Frame Max # Tracked Objects	Max 250K detections (Ethernet limitation) 450
Update Rate: Point Cloud update rate	Up to 30FPS (4D mode)
Modulation and MIMO Scheme:	Enhanced FMCW with TD-MIMO
Supported Channels	48 Transmitters, 48 Receivers
Dimensions (WxHxD)	120x96x30mm
Weight	1 kg
Ceretifications Qualitification	ISO – 26262 ASIL – B (D) FCC, ETSI, TELEC–Japan I Arbe's Chipset: AEC–Q100

A new class of radar

Today's automotive radar solutions are limited by low spatial resolution, a disadvantage that has kept radar from being able to separate objects by Direction of Arrival, while maintaining low false alarms. As a result, radars have been relegated to a supportive role in automotive sensor suites.

Arbe has reconditioned radar, eliminating former resolution limitations to deliver an ultra high-resolution 4D imaging radar. This is all accomplished in a wide field of view at long-range with low false alarm rates. With this technological advancement, Arbe has effectively repositioned radar from a supportive role to the backbone of the sensor suite.

TRUE 4D IMAGING

Arbe's radar generates a true 4D radar image with ultra-high resolution in range, azimuth, elevation and Doppler dimensions. This is done with highly reliable object detection, low side lobe levels (SLL), and low false alarm rates.

High-resolution imaging provides more detailed information about tracked objects, such as object orientation and boundaries, in addition to the center and velocity in much higher accuracy, making fusion with other sensors (like camera) more meaningful.

UNPARALLELED PHYSICAL RESOLUTION

Arbe's physical high-resolution relies on 48 transmit and 48 receive antennas to create a 2304 virtual channels array for digital beam forming. Rather than using unreliable synthetic or statistical resolution enhancements, like super resolution, Arbe leverages a wide aperture array to provide a physical 3dB beamwidth of 1.25° in Azimuth and 1.5° in elevation with low SLL for increased reliability and safety at high-dynamic range. Relying on high physical resolution and high-dynamic range provides the ability to separate objects such as riding a motorcycle next to a truck, a car stuck under a bridge and pedestrian standing next to a fence or fixing a flat tire.

Arbe's high physical resolution imaging allows the system to also track moving objects, map the environment and stationary obstacles, generate free-space mapping for easy path planning, and provide accurate localization.

TECHNOLOGY BREAKTHROUGH

- High Resolution Separation by Azimuth & elevation
- Modular & Scalable
- Eliminating False Alarms
- Leveraging Physical Resolution
- Mitigating Mutual Interference

RADAR DEVELOPMENT PLATFORM

The 2K high resolution Imaging Radar Development Platform, or A Sample as referred to in the automotive industry, empowers Tier 1s, OEMs, and new mobility players to revolutionize their imaging radar systems and enhancing their perception algorithms. The development platform includes:

- The entire Arbe imaging radar chipset with RF transmitter and receiver chips of 2K channels (48 receiving by 48 transmitting channels). And the patented imaging radar processor capable of processing 30Gbps of radar data. The patented chipset provides ultra-high resolution and supports over 100,000 detections per frame.
- A radar antenna with the densest channel array in the industry, delivering a form factor designed to perfectly fit automakers' current sizing and vehicle mounting specifications.
- A software layer – that abstracts the hardware access and scheduling.
- A reference design to guide tier-1 and OEM customers' radar system development.

MOST ADVANCED RF CHIPSET

Arbe has developed its own proprietary mm wave automotive grade radar RFIC chipset that includes a transmitter chip with 24 output channels and a receiver chip with 12 input channels. Using the new FDSOI CMOS process 22FDX, Arbe's RF chipset is designed to support TD-MIMO and has best-in-class performance for channel isolation, noise figure, and transmit power. Leveraging the latest RF processing technology, Arbe has achieved state-of-the-art RF performance at the lowest cost per channel in the market.

BREAKTHROUGH IN RADAR PROCESSING

Arbe's unique baseband processor (Everest) integrates proprietary radar processing unit (RPU) architecture with embedded proprietary radar signal processing algorithms to process massive amounts of raw data in real-time while maintaining low silicon power consumption.

Arbe's patented RPU is capable of processing in real-time up to 48 Rx channels in combination with 48 Tx channels, generating 30 frames per second of full 4D image, with equivalent processing throughput of 3 Tb/sec (see also Point Cloud Grid in the technical spec).

MUTUAL INTERFERENCE MITIGATION

More vehicles with radar sensors are in use every year, some with as many as eight sensors and the majority transmitting on the same frequency bands. As a result, radars run the risk of interfering with one another, especially at close range in dense urban environments. When radar interference occurs, detections are missed or are erroneous, and this can again lead to accidents. Arbe's patented FMCW2.0 system innovation avoids and mitigates other FMCW radars transmitters interference, with minimal to no performance degradation.

SAFETY FIRST

Arbe's Everest processor includes a dedicated ASIL-D safety island to supervise the safe operation of the system. Arbe radar is designed with safety in mind, putting extra emphasis on false alarm rate reduction. Arbe follows ISO 26262 and implements continuous continuous built-in radar system self-testing.

POST-PROCESSING & SLAM ALGORITHMS

Additionally, Arbe has developed a proprietary post-processing software stack. This includes a radar-based SLAM solution optimized for enhanced FMCW TD-MIMO imaging radar. SLAM algorithms perform real-time clustering, tracking, and self-localization as well as false-target filtering and radar-based and radar-camera based object classification.

ENHANCING PERCEPTION ALGORITHMS

Arbe's 4D Imaging Radar platform serves as a base for advanced perception capabilities including accurate real time inference of the vehicle's ego-velocity and in lane localization. Post processing the radar data allows tracking and classifying objects in the entire field of view of the vehicle and determines their orientation and motion vector, as well as provides precise and accurate free space mapping to distinguish drivable from non-drivable environments in any weather or lighting condition.