

# AUTOMOTIVE RADAR

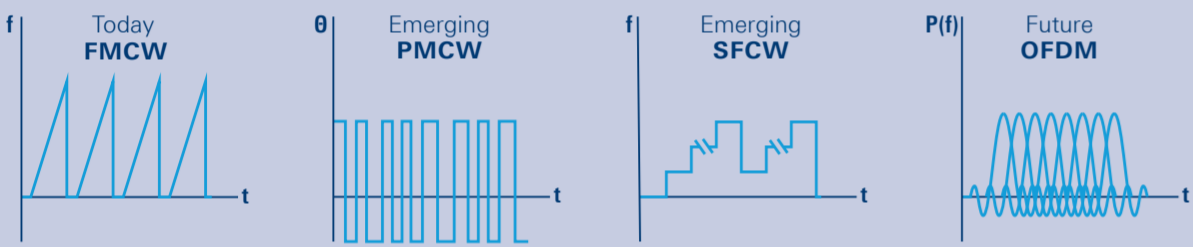
Development of radar as the key sensor for advanced driver assistance systems (ADAS) and autonomous driving (AD)

Chipsets, sensors and vehicles need to be tested thoroughly at each phase of the development and integration process. Radar test solutions from Rohde & Schwarz, ranging from compact to scalable complex target simulators, cover the entire lifecycle from development and validation to production and beyond. We enable the automotive industry to develop high-performance radars and transition seamlessly from R&D to production.

## Radar sensor parameters

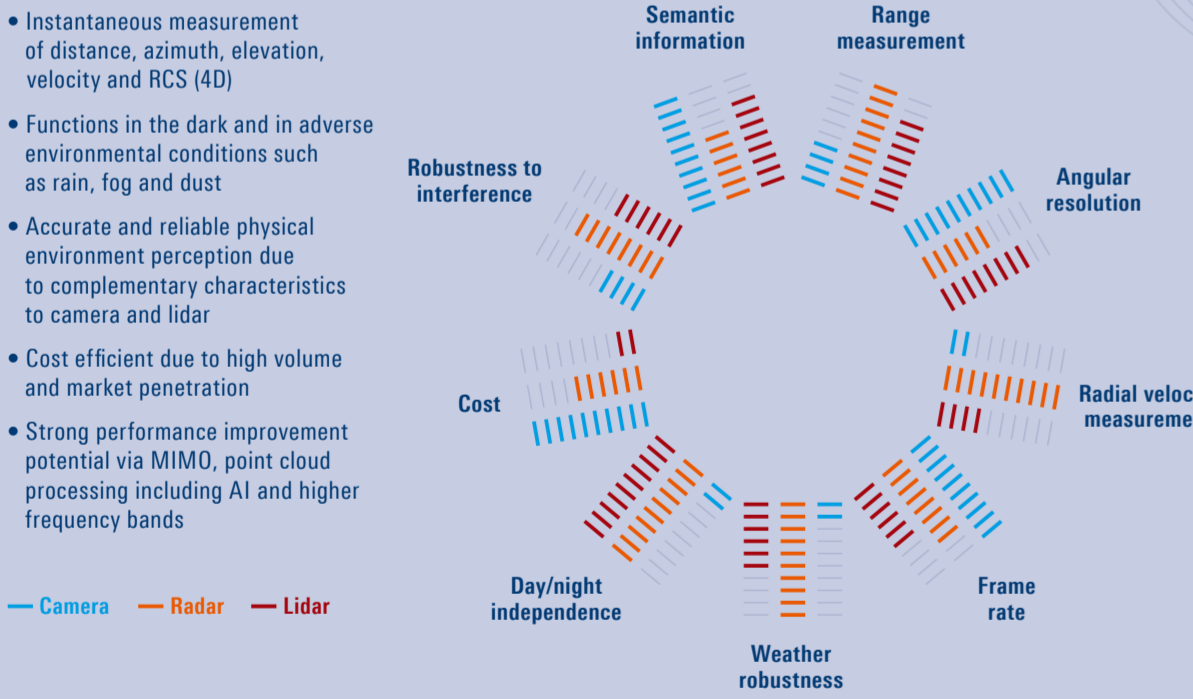
	Short-range radar	Standard mid-range radar	Premium mid-range radar	Standard long-range radar	Premium long-range radar	Imaging radar
Frequency range (GHz)	24, 76–77, 77–81	76–77	77–81	76–77	76–77	76–81
Typical bandwidth (MHz)	200, 1000, 4000	1000	2000	500	1000	2000
Range (m)	80	150	150	250	300	300
Range resolution (cm)	75, 15, 3.75	15	7.5	30	15	7.5
FOV azimuth/elevation (°)	±60/±0	±30/±0	±50/±15	±15/±5	±15/±10	±50/±15
Typical number of channels (transmit/receive)	3 TX/4 RX	4 TX/8 RX	8 TX/12 RX	4 TX/8 RX	12 TX/16 RX	48 TX/48 RX

## Radar signal modulation schemes



## Strength of radar sensors versus other sensor technologies

- Instantaneous measurement of distance, azimuth, elevation, velocity and RCS (4D)
- Functions in the dark and in adverse environmental conditions such as rain, fog and dust
- Accurate and reliable physical environment perception due to complementary characteristics to camera and lidar
- Cost efficient due to high volume and market penetration
- Strong performance improvement potential via MIMO, point cloud processing including AI and higher frequency bands



## Automotive radar technology developments

**Higher resolution**

- MIMO sensors
- Imaging sensors (large aperture)
- High bandwidths
- Distributed sensors and sensor networks

**Interference mitigation**

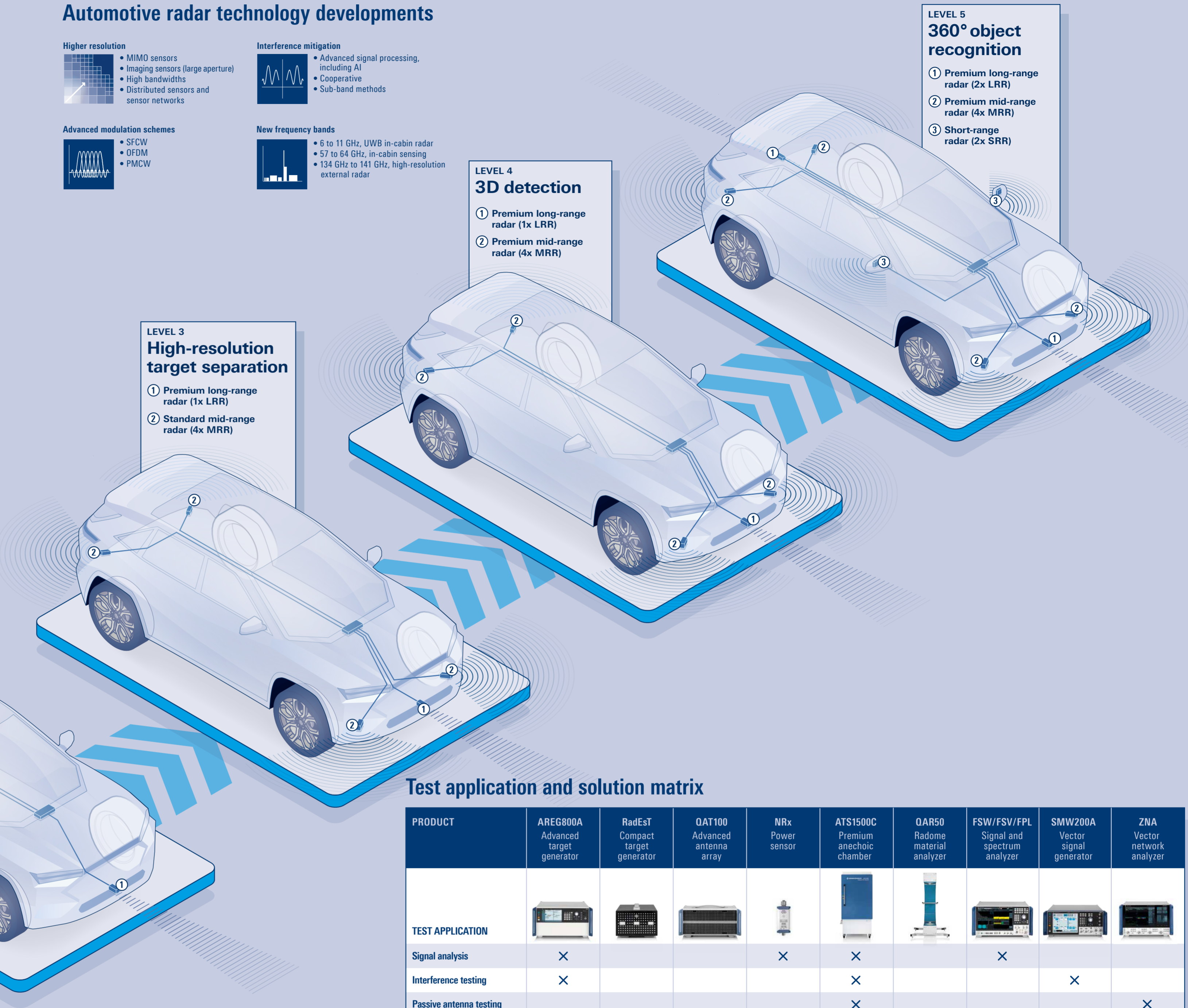
- Advanced signal processing, including AI
- Cooperative
- Sub-band methods

**Advanced modulation schemes**

- SFCW
- OFDM
- PMCW

**New frequency bands**

- 6 to 11 GHz, UWB in-cabin radar
- 57 to 64 GHz, in-cabin sensing
- 134 GHz to 141 GHz, high-resolution external radar



## Test application and solution matrix

PRODUCT	AREG800A Advanced target generator	RadEsT Compact target generator	QAT100 Advanced antenna array	NRx Power sensor	ATS1500C Premium anechoic chamber	QAR50 Radome material analyzer	FSW/FSV/FPL Signal and spectrum analyzer	SMW200A Vector signal generator	ZNA Vector network analyzer
TEST APPLICATION									
Signal analysis	×			×	×		×		
Interference testing	×				×			×	
Passive antenna testing					×				×
Functional validation	×	×	×						
Radome and bumper testing						×			
EOL calibration and production testing	×	×		×		×	×		

Learn more:  
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- Local and personalized
- Customized and flexible
- Improving quality
- Long-term dependability

## AUTOMOTIVE RADAR

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### AUTOMOTIVE RADAR

Development of radar as the key sensor for advanced driver assistance systems (ADAS) and autonomous driving (AD)

Advantages: Precise, reliable, and robust sensor technology for long-range detection and identification of objects. Radar is not affected by weather conditions and provides 360-degree coverage. It is particularly suitable for detecting small objects and pedestrians.

Challenges: High development costs, complex integration into vehicle systems, and the need for precise calibration and validation.

#### Radar sensor parameters

Parameter	77 GHz FMCW	77 GHz FMCW	77 GHz FMCW	77 GHz FMCW	77 GHz FMCW	77 GHz FMCW	77 GHz FMCW
Frequency range	76.5 - 77.5 GHz	76.5 - 77.5 GHz	76.5 - 77.5 GHz	76.5 - 77.5 GHz	76.5 - 77.5 GHz	76.5 - 77.5 GHz	76.5 - 77.5 GHz
Bandwidth	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz
Resolution	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz	150 MHz
Range	0 - 200 m	0 - 200 m	0 - 200 m	0 - 200 m	0 - 200 m	0 - 200 m	0 - 200 m
Angular resolution	1°	1°	1°	1°	1°	1°	1°
Range resolution	1 m	1 m	1 m	1 m	1 m	1 m	1 m
Angular range	120°	120°	120°	120°	120°	120°	120°
Range accuracy	±0.1 m	±0.1 m	±0.1 m	±0.1 m	±0.1 m	±0.1 m	±0.1 m
Angular accuracy	±0.1°	±0.1°	±0.1°	±0.1°	±0.1°	±0.1°	±0.1°

#### Radar signal modulation schemes

Comparison of different modulation schemes for radar signals, showing their respective advantages and disadvantages.

Modulation Scheme	Advantages	Disadvantages
FMCW	High range resolution, good angular resolution	High complexity, high cost
Pulse-Doppler	Good range resolution, good angular resolution	High complexity, high cost
Chirp	Good range resolution, good angular resolution	High complexity, high cost

#### Strength of radar sensors versus other sensor technologies

Comparison of radar sensors with other sensor technologies (Camera, Lidar, Infrared) across various parameters.

Parameter	Radar	Camera	Lidar	Infrared
Range	High	Medium	High	Low
Angular resolution	High	Medium	High	Low
Range resolution	High	Medium	High	Low
Angular range	High	Medium	High	Low
Range accuracy	High	Medium	High	Low
Angular accuracy	High	Medium	High	Low

#### Test application and solution matrix

Test Application	Camera	Lidar	Infrared	Radar
ADAS	X	X	X	X
Autonomous driving	X	X	X	X
ADAS	X	X	X	X
Autonomous driving	X	X	X	X

#### Automotive radar technology developments

Overview of the latest developments in automotive radar technology, including new sensor types and integration solutions.

- 77 GHz FMCW
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Poster  
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