

# Evolving Automotive Radar - *from the very beginnings into the future*

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## **Brief summary**

Automatic cruise control (ACC) systems based on 77 GHz radar have been under development for several decades. In the early 1970s the first test cars with 35 GHz sensors were road-tested. More than 20 years later in 1998 the Mercedes-Benz *DISTRONIC* system at 77 GHz became operational. 8 years later this was followed by the *DISTRONIC PLUS* system going in series production for premium cars, combining a 77 GHz long range radar sensor (LRR) with two 24 GHz short range radar sensors (SRR) and making the system fit for urban traffic. Today this technology has moved to commercial stage with all major automotive manufacturers worldwide, lately introducing ACC systems also in the small car segment. With the introduction of the new Mercedes-Benz B-Class and A-Class in 2011 and 2012, respectively, "*DISTRONIC PLUS*" became available as a SA (Sonderausstattung: special equipment) product in smaller cars. The "*PRE-SAFE BRAKE*" system of Mercedes-Benz or the "*Intelligent Brake Assist*" from NISSAN take such ACC-systems as a prerequisite for advanced braking-systems, to reduce the number and the severity of road accidents.

Besides 77 GHz for LRR the 24/ 26 GHz frequency range was adopted for short range automotive radar sensors (SRR), being employed for Blind Spot Detection (BSD) or as a Lane Change Warner (LCW). Narrow-Band (NB) Systems, operating in the ISM-Band (24.05 to 24.25 GHz) and Ultra-Wide-Band (UWB) systems between 21.65 to 26.65 GHz with different advantages and disadvantages are on the market today. Very recently Digital Beam Forming (DBF) antenna technology combined with electronic scanning techniques has been introduced. Now existing radar sensors can be easily adjusted for new applications. For example a BSD sensor can easily be adopted to function as a "rear cross traffic alert" (RTCA) sensor. Entirely new market opportunities are opening up. Medium range radar (MRR) systems in the 24/ 26 GHz range are on the market today. In spring 2014, with the introduction of the new Mercedes-Benz C-Class "*COLLISION PREVENTION ASSIST*" (CPA) 3.0 at 24 GHz will become available as a standard series product. Thus, pre-safe braking will be a standard series product for the first time.

Automotive radar in all its facets from LRR via MRR to SRR has shown its capabilities to reduce the number and the severity of road accidents. The frequency switch from 24/ 26 to 77/ 81 GHz is on the move. These days we are actually in the "decade of action for road safety 2011-2020" (EU initiative within Horizon 2020) and furthermore *autonomous driving* has come into direct focus with automotive radar being the workhorse of this future ADAS approach.

Today we are already able to drive with

- "feet off" - using widely deployed ACC systems
- "hands off" - becoming feasible taking the upcoming "Autobahn Pilot" and
- "eyes off" – this has still to be shown by intelligently combining further sensors ...