White Paper

Stopped Vehicle Detection (SVD) Why 24 GHz?

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Ogier Electronics SVR-500 stopped vehicle detection (SVD) radar uses 24 GHz operating frequency. This paper describes why 24 GHz is the best choice for affordable, low-risk, high-performance radars.

Minimum operating frequency is determined by the requirements for beam width and equipment size. Every doubling of frequency halves the size of the antenna, hence compact radars typically utilise microwave frequencies of 10 GHz or higher.

The maximum frequency is determined by the cost of the components. As frequency increases the manufacture of circuit boards and integrated circuits becomes more difficult and therefore increasingly expensive.

It is highly desirable to use a license-exempt frequency band as there are no annual fees to be paid, thus reducing operating cost. In addition it also avoids time-consuming and difficult discussions with radio regulators that are required when licensed frequencies are used.

ISM Frequency Bands

The International Telecommunications Union (ITU) allocates some frequencies for worldwide industrial, scientific and medical (ISM) purposes. ISM bands are license-exempt. The most suitable ISM frequency bands for this application are 5.8 GHz, 24 GHz and 61 GHz.

5.8 GHz band: Used heavily for WiFi and radio links so has high risk of interference. Additionally, the antenna would need to be unacceptably large to give the required narrow beam width and angular resolution to measure individual vehicles.

24 GHz band: Used lightly by point-to-point data links, short-range devices and automotive radar. There are relatively few vehicles that are fitted with 24 GHz radars because the market moved to 77 GHz prior to widespread adoption. The antenna would be fairly compact so equipment size would be acceptable, while still having good angular resolution.

61 GHz band: Very high atmospheric attenuation so relatively high gain (large) antennas are required. Equipment may be larger than equivalent 24 GHz radars and more expensive. Interference is unlikely due to the high atmospheric loss and very short-range nature for most applications. The angular and range resolution would be better than at 24 GHz.

Non-ISM Frequency Bands

77 GHz band: Used in some countries for fixed radar. Increased bandwidth and transmit power compared to ISM bands provides the longest range and highest resolution. However the primary use for this frequency allocation is automotive radar, which is problematic as a large number of vehicles are now being fitted with 77 GHz radar modules that can interfere with roadside SVD radars.

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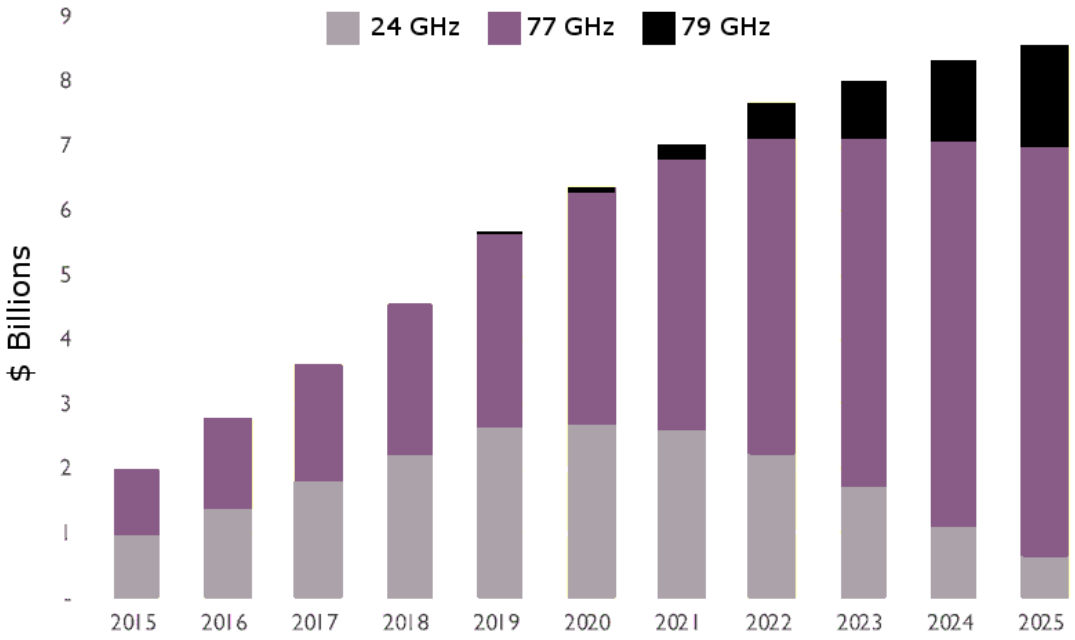
Automotive Radar Market Trends and Predictions



SOURCE: http://www.yole.fr/iso_upload/News/2019/PR_RADAR_for_AUTOMOTIVE_RadarMarketUpdate_YOLE_May2019.pdf

Conclusion

24 GHz represents the "sweet spot" for ISM bands. Although there may be other devices that utilise the same frequency, tests have shown insignificant effects from vehicular interference. Furthermore, this insignificant effect will diminish over time as it is estimated that by 2025, the 24 GHz automotive radar market will have shrunk to around 20% of the 2021 market size.

61 GHz has negligible advantages and higher costs.

77 GHz has significant technical merits, however there is a considerable risk that unsatisfactory interference levels from automotive radar will degrade SVD radar performance. Market trends indicate the automotive 77 GHz market will grow by 50% from 2021 to 2025, which increases future risk. In addition, some countries, such as USA, prohibit the use of fixed radars at 77 GHz due to risk of interference with automotive systems. Therefore operational issues outweigh the technical merits.

Key Advantages of Using 24GHz for SVD Radar

- **Use of affordable technology.**
- **Good angular and range resolution to suit the requirements for vehicle detection.**
- **No license fees: reducing the operating cost and eliminating negotiations with regulators.**
- **Compact and very lightweight antenna for minimal motor loading resulting in very long life.**
- **Ability to implement shaped antenna beam: provides instantaneous coverage from long to very short ranges and allows the radar to be installed higher on masts to minimise obscuration.**
- **Negligible interference with low-risk future outlook.**

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