Telecom Regulatory Authority of India

Shri Akhilesh Kumar Trivedi
Advisor (Networks, Spectrum and Licensing)

advmn@trai.gov.in

Robert Bosch (Australia) Pty. Ltd
Locked Bag 66
Clayton South VIC 3169
Visitor:
1555 Centre Road
Clayton VIC 3168
Tel +61 3 9541 5555
www.bosch.com.au

Katrina Velten, XC-DX/ESR1
Katrina.Velten@au.bosch.com

23 October 2023

Consultation Paper No. 21/2023 - on Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range.

Dear Shri Akhilesh Kumar Trivedi,

We at Robert Bosch GmbH welcome the opportunity to give our feedback on the Consultation Paper No. 21/2023 – on Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range.

Our particular area of interest is the 77-81 GHz frequency range and therefore we shall respond to Q4 and Q5 of the above-named consultation.

Q4. Whether there is a need for permitting license-exempt operation in 77-81 GHz band for automotive radar applications? Please provide a detailed response with justification.

The Committee under the Chairmanship of the Wireless Adviser has already recommended that the frequency band 77-81 GHz band be delicensed for automotive radar applications in line with international practice.

As noted in the Committee's recommendation, the 77-81 GHz frequency band is already permitted for use of automotive radars in the USA, Japan, Europe,

and many other countries world-wide, including Egypt, South Africa, Bahrain, Saudi Arabia, UAE, South Korea, Taiwan, Thailand, Australia, Canada, Mexico, Brazil, etc.

It can be concluded that the frequency band 77-81 GHz band is already a globally harmonized band for short range radar applications.

India has recently introduced the Bharat New Car Assessment Programme (BNCAP) which is an amazing step forward for the Indian automotive industry and shows the commitment of the Indian Government to the industry and the people of India.

The car manufacturers can now voluntarily achieve a star rating from 1 to 5 covering three areas:

- Adult occupant protection
- Child occupant protection
- Safety assist technologies (SAE)

Union Road Transport Secretary Anurag Jain said that the BNCAP will help the Indian automotive industry to become more competitive in the export market. However, this outcome is not realistic if vehicles manufactured in India will not be enabled to use the level of radar sensor technology that allows them to compete in the world market. India will be lagging using underperforming technology that does not allow the cars to sense further, react faster, and be safer on the road than their foreign counterparts.

The modern automotive market is moving towards increased driver assistance and autonomy of the vehicles. These systems require detailed information regarding the surrounding environment; therefore, vehicles are being fitted with an ever-increasing range of sensors.

The requirements on future radar generations emphasize even further the need to allow the use of 77-81 GHz radar technology:

- To achieve SAE level 4 and 5 vehicle autonomy, it is essential to use high-resolution imaging radar that can sense the environment at a wide (~100deg) field of view in high resolution at 1-2 degrees in both azimuth and elevation.
- Imaging radars need to also create a detailed image of the road at a range of 300m or more and capture the size, azimuth, elevation, and velocity data of objects surrounding the car.

- Example of future radar detection requirements:

Small objects with low RCS lying on ground, everywhere around ego vehicle, including curbstone Relevant objects: low objects like bicycles lying on floor, garden tools, toys, curbstones Classification between: • Objects ≥ 20cm; not over drivable • Objects < 20cm; over drivable

We concur with the Committee under the Chairmanship of the Wireless Adviser that the frequency band 77-81 GHz band must be delicensed for automotive radar applications in line with international practice.

Q5. In case it is decided to permit license-exempt operations in the 77-81 GHz band for automotive radar applications, what should be the terms and conditions including technical parameters for permitting licensed-exempt operations in this frequency band? Please provide detailed response with justification.

Automotive radar is a key technology for autonomous driving. It can provide detailed information about target bearing, distance and speed. It works equally well during the day and night, and only most severe weather conditions can impair its' functionality.

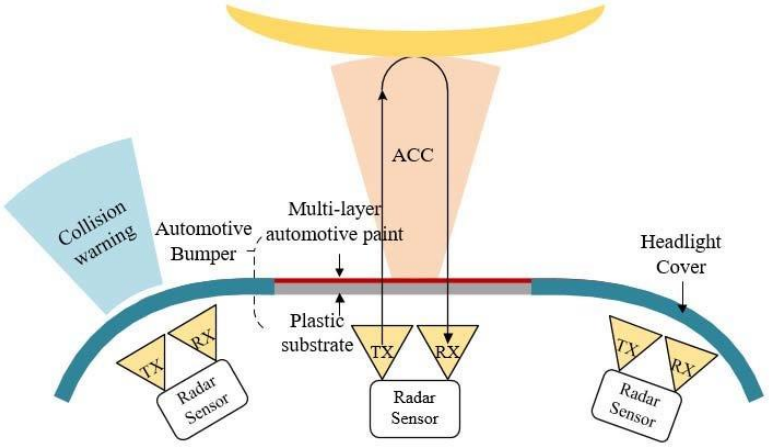
However, automotive radar uses a RF mm-wave transmitter, and it needs to emit at a relatively high power to function properly. Current 77-81 GHz regulations in Europe and the United States allow up to 50dBm average and 55 dBm peak radiated power (EIRP). This power level enables the full functionality of current and future automotive radars.

A lower power limit would result in constraints on the RF emissions of automotive radar sensors and, in effect, radar sensor functionality. This would inhibit the performance of driver assistance systems and autonomous vehicles in the Indian market. i.e., a sensor range reduction and shorter reaction (braking) times.

Union Road Transport Secretary Anurag Jain said that India can emerge as the hub for safety assessment of cars as the cost of their in-country testing under BNCAP will be much less than abroad. However, this goal will not be achievable if sensors with EIRP of up to 55dBm are not allowed to be operated in India. Foreign manufacturers will simply not be able to test their vehicles with higher-powered radar sensors in India, and will therefore look to other countries for a solution.

According to Union Road Transport Minister Nitin Gadkari, every year around 500,000 accidents take place in India and 150,000 deaths are caused due to these accidents. Allowing the use of radar sensors with a higher ERP and therefore greater range could greatly reduce these statistics.

It is also important to consider the possible effects of the EIRP limit on environment & public health.



Factors that negate the risk of a EIRP limit of 55Bm:

- Free space loss causes the most significant reduction of transmitted RF power: 70dB after 1m.
- Due to aesthetics, radars are usually fitted behind the vehicle bumper or fascia (see above). This further reduces RF power by about 5dB.
- Radars do not operate continuously; operation is split between data gathering (active signal emission) and data processing (transmitter off). Typically, a radar sensor is active for ¼ of the time; this causes a further reduction of RF power by 6dB.

Therefore, the total power density of a 55dBm (316W) EIRP signal after just 1m propagation is already reduced to 200µW/cm^2.
Using a EIRP limit of 55dBm has no detrimental effect on the environment or human safety.

The Government of India's timely and historical introduction of the Bharat NCAP showcases its dedication to safeguarding its citizens and advancing road safety. India is now the third largest (behind USA and China) car market in the world, after overtaking Japan in 2022, and is aiming to beat China to become the world's No. 1 automobile maker by 2027, according to Union Road Transport Minister Nitin Gadkari.

In order to realistically achieve this challenging goal, the Indian Government must first create an even playing field for the automotive industry in India on the world stage.

Considering this, as well as the situation worldwide, the low environmental impact, and the ever-growing requirements for radar, we recommend allowing use of the following technical characteristics for automotive radars sensors operating in the 77-81 GHz frequency band.

Technical characteristics		
Frequency band	Maximum Effective Radiated Power limit (ERP)	Maximum Effective Isotropic Radiated Power limit (EIRP)
77 to 81 GHz	193 W (52.85 dBm)	55 dBm

Yours sincerely,

pki, BOSCH, DE, L, U, Lukas.Wassermann

Digitally signed by pki, BOSCH, DE, L, U, Lukas.Wassermann
Date: 2023.11.06 17:32:39 +01'00'

Lukas Wassermann
Department Leader XC-DX/ESR
Robert Bosch GmbH

pki, BOSCH, DE, M, I, Michael.Klar1

Digital unterschrieben von pki, BOSCH, DE, M, I, Michael.Klar1
Datum: 2023.10.30 09:18:40 +01'00'

Michael Klar
Department Leader XC-DX/ECR
Robert Bosch GmbH