AGENDA ITEM 1.18

*1.18 to consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band in accordance with Resolution **654 (WRC-12)**;*

Resolution **654 (WRC-12)**: *Allocation of the band 77.5-78 GHz to the radiolocation service to support automotive short-range high-resolution radar operations*

3/1.18/1 Executive summary

The 2012 World Radiocommunication Conference (WRC-12) approved agenda item 1.18 to consider a primary allocation in the frequency band 77.5-78.0 GHz to the radiolocation service (RLS) for automotive applications in accordance with Resolution **654 (WRC-12)**. Resolution 654 invites ITU-R to conduct the appropriate technical, operational and regulatory studies including sharing and compatibility studies taking into account incumbent services and existing uses of the frequency band 77.5-78.0 GHz.

The incumbent services in the frequency band are amateur service (ARS) and amateur satellite service (ARSS) (primary) and radio astronomy service (RAS) and space research service (SRS) (secondary). The sharing studies between the automotive radars and systems operating under allocations to the incumbent services are given in Report ITU-R M.[AUTOMOTIVE RADARS]. Automotive radars, operating in the frequency range 76-81 GHz, were taken as the representative of RLS for the purpose of the studies. Systems characteristics of automotive radars, used in the sharing studies, are given in Recommendation ITU-R M.2057.

Two methods are proposed to satisfy the agenda item 1.18. Both provide a primary allocation to the RLS in frequency band 77.5-78 GHz on a worldwide basis, which can be used by automotive applications. While Method A limits the use of the new allocation to automotive radars, Method B gives an unrestricted allocation which supports the use of automotive radars.

3/1.18/2 Background

Portions of the frequency band 76-81 GHz are allocated to the RAS, ARS, ARSS and RLS on a primary or secondary basis and to the SRS (space-to-Earth) on a secondary basis. At frequencies above 30 GHz, radio propagation decreases more rapidly with distance than at lower frequencies and antennas that can narrowly focus transmitted energy are practical and of modest size. While the limited range of such transmissions might appear to be a major disadvantage for many applications, it does allow the reuse of frequencies over very short distances and, thereby enables a higher concentration of transmitters to be located in a geographical area than is possible at lower frequencies.

The attenuation of the transmissions, however, varies depending on the water vapour content of the atmosphere and other atmospheric factors.

There has been significant growth in the use of automobile radar systems, and these systems are expected to become relatively commonplace within a few years because of consumer demand for increased vehicle safety. Studies have shown that the use of collision avoidance technology can prevent or lessen the severity of a significant number of traffic accidents. In certain parts of the world, automotive radars have successfully operated in this portion of the spectrum, particularly the frequency band 76-77 GHz, for many years without mitigation methods or deactivation methods and without increased reports of interference to other services.

The ITU Council, in adopting Resolution 1318 (Council 2010), stated that information and communication technologies (ICTs), including intelligent transport systems, provide mechanisms

for human and vehicle safety; and invited members of the union to take practical steps to further national and domestic policies, programs and/or educational initiatives in the use of ICTs to improve global road safety.

3/1.18/2.1 Regulatory status of the RLS in the frequency band 76-81 GHz

Currently, the RLS is allocated globally on primary basis in the frequency bands 76-77.5 GHz, and 78-81 GHz. Obtaining a possible global primary radiolocation allocation in the frequency band 77.5-78 GHz provides for a harmonized, contiguous band for radiolocation service, including collision avoidance related automotive radar applications in the frequency band 76-81 GHz. It should be noted that RR No. **5.149** urges administrations to take all practicable steps to protect the radio astronomy service from harmful interference in the band. A primary allocation to the RLS in the frequency band 77.5-78 GHz would establish regulatory priority over the RAS and SRS (space-to-Earth) , which are allocated on a secondary basis. Means to ensure that the provisions of RR No. **5.149** are not diminished may need to be considered.

3/1.18/3 Summary and the analysis of the results of the technical and operational studies relating to the possible methods of satisfying the agenda item, including a list of relevant ITU-R Recommendations

Results of the sharing studies for are given in PDN Report ITU-R M.[AUTOMOTIVE RADARS]. The following studies are considered in this Report:

Sharing studies with the amateur and amateur satellite service

Two different methodologies were used in the sharing studies between automotive radar and ARS and ARSS stations:

a) Geometric analysis methodology:

The conclusions of this study indicate that:

- The operation of the ARS in the mountain top scenario is not expected to be significantly constrained by the RLS.
- It is still possible to operate the radio amateur stations in the building top scenario with a careful choice of the building, where the amateur receiver has to be installed.

Therefore, the study indicates that the allocation of the frequency band 77.5-78 GHz to the RLS is not expected to impose severe constraints on the ARS.

b) Minimum coupling loss methodology:

The conclusions of this study indicate that:

The calculations show that the distances over which interference could be expected are small and are all less than 200 metres for the scenarios considered for both ARS and ARSS stations. In the light of the calculations given in PDN Report ITU-R M.[AUTOMOTIVE RADARS], it can be concluded that the interference probability from automotive radars to ARS and ARSS stations is very low.

Sharing studies with the radio astronomy service

Studies included a theoretical assessment of the necessary separation distances to protect RAS as a function of the density of transmitting automotive radar devices and two case studies: Kitt Peak in the USA which included actual measurements and Plateau de Bure in France.

The following conclusions can be drawn from the conducted studies mentioned above:

– The shape and dimension of the coordination area largely depends on the features of terrain surrounding the RAS site. In principle terrain shape and terrain occupation should be considered.
– Choice of the location may considerably improve the protection of systems operating in the RAS.
– The magnitude of the interference issue could be manageable provided that RAS sites are adequately shielded by terrain relief.

Areas of concern remain and will have to be further analysed and dealt with by administrations.

Based on the above, potential cases of interference would be expected to be localized and could best be resolved by the concerned administration.

Sharing studies with the SRS (space-to-Earth)

No SRS (space-to-Earth) systems have been identified to date in the frequency range 76 GHz to 81 GHz and therefore no sharing studies were performed.

List of relevant ITU-R recommendations

Following recommendations are considered relevant for the studies:

Recommendations ITU-R M.1732, ITU-R RA.769, ITU-R RA.1031, ITU-R RA.1272, ITU-R M.2057, ITU-R P.676, ITU-R P.837, ITU-R SA.1157, ITU-R RA.1513, ITU-R P.452, ITU-R P.833, ITU-R P.620 and ITU-R P.526.

3/1.18/4 Analysis of the results of studies relating to the possible methods of satisfying the agenda item

The analysis of the results of studies is provided in Section 3/1.18/3.

3/1.18/5 Method(s) to satisfy the agenda item

3/1.18/5.1 Method A

Add a primary allocation to the RLS on a worldwide basis, limited to automotive applications, between 77.5 GHz and 78 GHz.

Advantages:

– Provides worldwide harmonization for safety and collision avoidance related automotive radar applications in the frequency band 76-81 GHz, which, if implemented, will very likely result in reduced traffic fatalities and injuries on the road.
– Provides a broader manufacturing base and increased volume of equipment (globalization of markets) resulting in economies of scale and expanded equipment availability
– The nature of these short-range automotive radars along with the propagation characteristics of the frequency band 76-81 GHz will facilitate sharing with incumbent services.

Disadvantages:

– In some areas, mitigation methods such as appropriate emission power limits and antenna height limits may be needed to avoid potential interference to the RAS operating in the frequency band 77.5-78 GHz. It should however be noted that there are already primary allocations to the RLS in the frequency bands 76-77.5 GHz and 78-81 GHz.

– The limitation to the automotive applications may impede the usage of short-range high-resolution radars for other applications and thus result in a different set of regulations and less flexible spectrum usage in the frequency band 76-81 GHz.

3/1.18/5.2 Method B

Add a primary allocation to the RLS on a worldwide basis, supporting automotive radar operations, between 77.5 GHz and 78 GHz.

Some administrations are of the view that this method by expanding the use of the frequency band to applications other than short-range automotive radars may be beyond the scope of the agenda item.

However, some other administrations are of the view that this method is within the scope of the agenda item.

Advantages

– Provides worldwide harmonization for radiolocation in the frequency band 76-81 GHz that would enable short-range high-resolution radar applications, including the safety and collision avoidance related automotive radar applications, which, if implemented, will very likely result in reduced traffic fatalities and injuries on the road. It should also be noted that there are already primary allocations without any restriction on the RLS in the frequency bands 76-77.5 GHz and 78-81 GHz.

– Provides a broader manufacturing base and increased volume of equipment (globalization of markets) resulting in economies of scale and expanded equipment availability.

– The nature of these short-range radars along with the propagation characteristics of the frequency band 76-81 GHz will facilitate sharing with incumbent services.

– Would not limit the future development of short-range high-resolution radar to automotive applications.

Disadvantages

– In some areas, mitigation methods such as appropriate emission power limits and antenna height limits may be needed to avoid potential interference to the RAS operating in the frequency band 77.5-78 GHz.

– To date, the only sharing studies with the incumbent services have been with short-range automotive radars and the technical parameters associated with those radars.

3/1.18/6 Regulatory and procedural considerations

3/1.18/6.1 Method A

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

66-81 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
...		
76-77.5	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) 5.149	
77.5-78	AMATEUR AMATEUR-SATELLITE RADIOLOCATION ADD 5.A118 Radio astronomy Space research (space-to-Earth) 5.149	
78-79	RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth) 5.149 5.560	
79-81	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) 5.149	

Option 1:

ADD

5.A118 The use of the 77.5-78 GHz frequency band by the radiolocation service is limited to automotive applications. The characteristics of the automotive radars are given in Recommendation ITU-R M.2057.

Option 2:

ADD

5.A118 The use of the 77.5-78 GHz frequency band by the radiolocation service is limited to automotive applications.

SUP

RESOLUTION 654 (WRC-12)

Allocation of the band 77.5-78 GHz to the radiolocation service to support automotive short-range high-resolution radar operations

3/1.18/6.2 Method B

The regulatory approach under this Method is to add a primary allocation to RLS in the Table of Frequency Allocations of RR Article **5**. The other consequential action under this method would be to suppress Resolution **654 (WRC-12)**.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

66-81 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
...		
76-77.5	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) 5.149	
77.5-78	AMATEUR AMATEUR-SATELLITE RADIOLOCATION Radio astronomy Space research (space-to-Earth) 5.149	
78-79	RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth) 5.149 5.560	
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