Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 2 of the Commission's	)	
Rules to Realign the 76-81 GHz Band	)	ET Docket No. 03-102
and the Frequency Range Above 95 GHz	)	
Consistent with International	)	
Allocation Changes	)	

COMMENTS
of the
SHORT RANGE AUTOMOTIVE RADAR FREQUENCY ALLOCATION GROUP

The Short Range Automotive Radar Frequency Allocation Group ("SARA") 1/ hereby submits these Comments in response to the Notice of Proposed Rulemaking ("*NPRM*") issued in the above-referenced proceeding. 2/ In the *NPRM*, the Commission proposed to amend the U.S. Table of Allocations in the 77–81 GHz

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1/ SARA in an association composed of the world's leading automobile manufacturers and automotive component manufacturers, working to promote the deployment of short-range ultra-wideband vehicular radars that will serve as the key component in next generation collision mitigation systems. SARA is made up of the following automotive component manufacturers: Bosch, Continental Temic (A.D.C.), Delphi Automotive Systems, Hella, InnoSent, Siemens VDO, TRW, Tyco Electronics, Valeo and Visteon. It also includes the following automobile manufacturers: Audi, BMW, DaimlerChrysler, Fiat, Ford, General Motors, Jaguar, MAN, Opel, Porsche, PSA Peugeot Citroën, Saab, Seat, Skoda, Volkswagen and Volvo.

2/ *See* Amendment of Part 2 of the Commission's Rules to Realign the 76-81 GHz band and the Frequency Range Above 95 GHz Consistent with International Allocation Changes, ET Docket No. 03-102, *Notice of Proposed Rulemaking,* FCC 03-90 (rel. Apr. 28, 2003) ("*NPRM*").

band to conform with a realignment of spectrum allocations adopted at the 2000 World Radiocommunication Conference ("WRC-2000"). Under the proposal, radio astronomy service and space research service allocations would be added to the already-existing allocations in the 77–81 GHz band for the radiolocation, amateur and amateur-satellite services.

As the Commission is well aware from SARA's active participation the ultra-wideband ("UWB") proceeding, most of SARA's member companies are in the process of developing and deploying short range automotive radars ("SRRs") that will operate in the 22–29 GHz band ("24 GHz band") pursuant to Section 15.515 of the Commission's rules. 3/ For the reasons explained below, SARA advises the Commission of the likelihood that SARA will, in the near future, request that the Commission authorize the use of the 77–81 GHz band as another possible home for SRRs. SARA believes that a U.S. allocation for space research would be premature at this time. With regard to the other existing and proposed 77–81 GHz services, SARA believes that sharing with SRR should be possible, although this cannot be determined with certainty until compatibility studies are conducted. Nevertheless, because major changes to the 77–81 GHz band are being considered in this proceeding, SARA wanted the Commission to be aware of the likely future needs of SRRs, which the Commission has recognized as important safety devices. 4/ The

3/ 47 C.F.R. § 15.515.

4/ Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, ET Docket 98-153, *First Report and Order*, FCC 02-48 (rel. April 22, 2002) ("*UWB Order*") at ¶ 64.

Commission should take no action in this proceeding that it believes could prevent the future operation of SRRs in this band.

I. European and U.S. Regulatory Decisions Respecting 24 GHz SRR Create a Need for Additional Operational Flexibility, Including Additional Spectrum, by 2014

SARA's probable need to access the 77–81 GHz band is based, in part, on a likely European regulatory decision, expected some time next year, from the Working Group FM and the Short Range Device Maintenance Group ("SRD/MG") of the Electronic Communications Committee ("ECC"). 5/ As currently drafted, the decision recognizes that the 24 GHz band provides an "immediate cost effective solution" that would permit the prompt introduction of 24 GHz SRRs in Europe. 6/ However, the draft decision would require the production of 24 GHz SRRs to cease by 2014, 7/ at which time new SRRs would be limited to the 77 GHz band (*i.e.*, 77–81 GHz), which would become the permanent home of SRRs in Europe. 8/ Under a

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5/ The ECC is a committee of the European Conference of Postal and Telecommunications Administrations' ("CEPT").

6/ *See* Draft Decision ECC/DEC/(0a)xx, "Ultra Wide Band Automotive Short Range Radars."

7/ The draft decision indicates that for the period between 2009 and 2014, new 24 GHz SRRs would have to comply with reduced emission limits. *Id.*

8/ The decision also contemplates that the 77 GHz band would first become available for SRR use several years prior to 2014. A System Reference Document for 77 GHz SRRs is being drafted by the European Telecommunications Standards Institute ("ETSI"). This document establishes a mean power limit of 50 dBm EIRP and a peak power limit of 55 dBm EIRP. Multiple modulation techniques, such as pulsed, frequency hopping spread spectrum, binary phase shift keying, and pulsed frequency modulated continuous wave, may be used. *See* Draft ETSI TR 1XX XXX

mandate from the European Commission ("EC"), the ECC is expected to present a decision to the EC's Radio Spectrum Committee by December 2003, and the EC's timetable contemplates a final decision by July 2004. Although an ambitious timetable, the deployment of SRRs is a key component of the EC's traffic safety program. 9/

To achieve the economies of scale necessary to make the widespread deployment of SRRs possible, it is critical that automakers be able to purchase and install the same units regardless of a vehicle's ultimate destination market. The Commission has previously recognized that the economies of scale made possible by the international harmonization of spectrum allocations and operating rules can lower developmental costs of new and innovative technologies, resulting in benefits to consumers. 10/

In addition to the pending European decision, existing U.S. regulations will also make it difficult to maintain and improve upon SRR functionality after

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v1.2.1 (2003-07), "Radio Equipment to be Used in the 77 GHz Band; System Reference Document for Automotive Collision Warning Short Range Radar" ("*ETSI System Reference Document*").

9/ This EC program – known as "eSafety" – could lead to European Union ("EU") legislation making spectrum availability and harmonization for SRR mandatory throughout the EU member states.

10/ *See* Amendment of Part 2 of the Commission's Rules to Allocate Additional Spectrum to the Inter-Satellite, Fixed, and Mobile Services and to Permit Unlicensed Devices to Use Certain Segments in the 50.2-50.4 GHz and 51.4-71.0 GHz Bands, *Report and Order*, 15 FCC Rcd. 25,264 (2000) at ¶ 36; 1998 Biennial Regulatory Review – Conducted Emissions Limits Below 30 MHz for Equipment Regulated Under Parts 15 and 18 of the Commission's Rules, *Report and Order*, 17 FCC Rcd. 10,806 (2002) at ¶ 11.

2014. In its *UWB Order*, the Commission authorized the operation of UWB vehicular radars in the 24 GHz band, recognizing that the devices could "become as essential to passenger safety as air bags." 11/ However, at the insistence of NTIA, the Commission required, for the 23.6-24 GHz band, a sharp attenuation of vehicular radar signals appearing 30° or more above the horizontal plane for the purpose of guaranteeing protection to earth exploration satellite service ("EESS") sensors. 12/ The required level of attenuation at 24 GHz is scheduled to increase to 35 dB by 2014. 13/ Although it is difficult to predict precisely what capabilities future advancements in antenna and system designs will permit, the required attenuation will be difficult to achieve while at the same time maintaining the required SRR functionality which is vital for the enhancement of road safety. Thus, while SARA continues to believe that 24 GHz represents the most ideal home for SRR operations and urges the Commission to maintain the ability of SARA's members indefinitely to operate in the 24 GHz band, the tighter 2014 emission limits applicable to 24 GHz make it necessary for SARA to seek the flexibility to also operate in the 77–81 GHz band in order to ensure that SRR functionality can be maintained and improved after 2014. Accordingly, SARA expects in the near future to make a request for authority to operate in the 77–81 GHz band in addition to the 22-29 GHz band.

11/ *UWB Order* at ¶ 64.

12/ *UWB Order* at ¶ 196. The Commission noted its belief that the NTIA analysis was overly conservative. *Id*.

13/ *See* 47 C.F.R. § 15.515(e).

In the UWB proceeding, SARA explained that the 77 GHz band was not suitable for SRRs, primarily due to the much greater sensor cost which would render the SRRs economically unviable. Because this continues to be the case, European regulators are proposing to permit SRR operations in the 24 GHz band for the immediate future (*i.e.*, until 2014). However, SARA believes that the cost of 77 GHz sensors can be reduced within the next ten years as new manufacturing processes are developed. Research in this area is already underway. 14/ Thus, while operation in the 24 GHz band remains essential for the next decade, SARA is optimistic that technological advances, along with a more mature SRR product, will enable a more cost-effective SRR solution for the 77 GHz band than what is currently available.

II. Sufficient Evidence Has Not Been Marshalled to Justify the Proposed Space Research Allocation

SARA does not believe that the NPRM in this proceeding provided sufficient justification for adding the proposed U.S. allocation for space-to-earth links in the space research service ("SRS"). SARA was unable to locate any information explaining why additional spectrum is needed for this service. 15/

14/ *See, e.g.,* K.S. von Behren e*t al.*, "77 GHz Harmonic Mixer with Flip-Chip Si-Schottky Diode," May 2002, available at http://www-mwt.ee.tu-berlin.de/pdf/midon2002.pdf (describing methods to reduce the cost of monolithic microwave integrated circuits ("MMICs") for use in automotive radars).

15/ SARA did locate one document from the Jet Propulsion Laboratory stating that, although data rates of over 4 Gb/s can be achieved using the existing 1 GHz SRS allocation at 37-38 GHz, future space VLBI missions requiring higher data rates "will most likely be forced to higher frequencies (W-band, somewhere in the range of 74-84 GHz) and/or the use of greater dimensioned [quadrature amplitude modulation]." This does not specifically indicate that the 77-81 GHz band will be

Moreover, the SRS allocation is proposed on a secondary basis in the same band with a proposed primary allocation for radio astronomy. Thus, the usefulness of this band for SRS operations may be limited by the need to protect radio astronomy. Indeed, the Commission sought comment in the *NPRM* on the viability of radio astronomy and satellite downlinks sharing the same band, stating that "[t]ypically, there are spectrum sharing concerns between RAS and the satellite downlink services . . . because the satellite downlink services can transmit downward directly into sensitive RAS antennas." 16/ Without a better justification of need and assurance of expected usefulness, it would not be prudent to make this allocation of valuable spectrum.

III. SRRs Should Be Able to Share the 77–81 GHz Band with Both Existing and Proposed Services

Assuming, *arguendo*, that the Commission's proposed allocations are made, SARA does not anticipate major 77–81 GHz sharing and compatibility issues with either the existing services or those proposed in the NPRM, for the reasons mentioned below. However, SARA notes that a final answer with regard to sharing compatibility can only be confirmed after the operational parameters of the various services become available.

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required and it also suggests that alternative modulation techniques may make use of the band unnecessary. *See* J.C. Springett, "Achieving Future Space Very Long Baseline Interferometry Gigabits-per-Second Data Rates (May 15, 2002) at 2, *available at*: ipnpr.jpl.nasa.gov/tmo/progress_report/42-149/149G.pdf.

16/ *NPRM* at ¶ 12.

A. Radiolocation

Radiolocation currently has a primary allocation in the 77–81 GHz band. However, the Commission has not promulgated service rules for the radiolocation service in the band. The list of frequencies, contained in Section 90.103 of the Commission's rules, available for assignment to stations in the radiolocation service only covers frequencies up to 36 GHz. 17/ Thus, no radiolocation operations are permitted in the 77–81 GHz band, and no equipment certifications have been issued for the band. Moreover, NTIA's Federal Long Range Spectrum Plan indicates no current or planned government radiolocation operations in the band. 18/

B. Amateur and Amateur-Satellite

In 1998, the Commission determined that there was "little or no use" of the 76–77 GHz band by amateurs. 19/ There is no evidence to suggest that this is not also correct today for the 77–81 GHz band. Not surprisingly, therefore, SARA could locate no sharing criteria useful in preparing a compatibility analysis for SRR/amateur sharing in the millimeter-wave band. 20/

17/ 47 C.F.R. § 90.103.

18/ *See* NTIA, *Federal Long Range Spectrum Plan* (Sept. 2000), available at: <http://www.ntia.doc.gov/osmhome/LRSP/LRSP5c.htm> ("*NTIA Spectrum Plan*").

19/ Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit the Use of Radio Frequencies Above 40 GHz for New Radio Applications, *Third Report and Order*, 13 FCC Rcd 15074 (1998) at ¶ 8 ("*Third R&O*").

20/ *See, e.g.*, "Frequency Sharing Criteria in the Amateur and Amateru-Satellite Services," Recommendation ITU-R M.1044-1 (stating that Recommendation ITU-R F.240 – which only applies to emissions below 30 MHz – should be used for sharing

Similarly, there are currently no amateur-satellite operations in the band. According to the Radio Amateur Satellite Corporation ("AMSAT"), 24 GHz is the highest frequency in use in the amateur-satellite service, and this frequency is currently only available as a downlink on one satellite.21/ AMSAT has explained in prior comments that amateur-satellite designers must avoid using higher frequency bands because the higher bands "present too great a challenge to people in poorer countries."22/

Even if amateurs eventually do use this band, interference from SRRs is unlikely given that amateur antennas are typically highly directional and normally mounted well above the ground, while SRRs are located very near the ground with a flat beamwidth – resulting in emissions that are highly attenuated by ground clutter. 23/

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studies if more specific technical information is not available). *See also* International Amateur Radio Union, "Working Document Towards a Draft New Recommendation – Characteristics of Systems Operating in the Amateur and Amateur-Satellite Services for Use in Sharing Studies," Doc. 8A/224-E (Sept. 9, 2002) (providing representative technical and operational characteristics of systems in the amateur services below 450 MHz only, for use in sharing studies).

21/ *See* AMSAT, "Amateur Satellite Frequency Guide" (April 2003). Most of the twenty domestic and foreign amateur satellites that AMSAT reports as operational use frequencies below 438 MHz.

22/ Comments of the Radio Amateur Satellite Corporation, filed in RM-9267 (Jun. 1, 1998) at 3.

23/ *See ETSI System Reference Document* at 14 ("Due to the low antenna installation height, the low power density, and the narrow vertical beam width, the potential interference (e.g., with airborne or satellite systems) is anticipated to be very low.")

C. Radio Astronomy

SARA believes that SRR/RAS sharing would be feasible in the 77–81 GHz band for the following reasons:

- In the *NPRM*, the Commission correctly observed that constraints on services sharing spectrum bands with RAS should be "minimal" given that "RAS millimeter wave receivers are usually located on high mountains in order to escape atmospheric absorption of incoming signals from space." 24/ According to the Inter-Union Commission on the Allocation of Frequencies for Radio Astronomy and Space Sciences ("IUCAF"), the number of millimeter-wave observatories is expected to remain limited due to costs and the relative lack of suitable sites. 25/

- No frequency within the 77–81 GHz band appears on the list of "radio frequency lines of the greatest importance to radioastronomy," contained in the *Handbook on Radio Astronomy* published by the International Telecommunication Union ("ITU"). 26/ This suggests that there may be limited interest by RAS observatories in making observations in this band, further reducing the number of sites that will require protection.

- As the Commission correctly recognized in the *NPRM* and in previous orders:

> "radio astronomy entities typically control access to their telescopes at a distance of at least one kilometer to provide protection from interference caused by automobile spark plugs and other uncontrolled RFI sources. This implies that radio

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24/ *NPRM* at n.20.

25/ *See* "Frequency Sharing Between The Radio Astronomy Service and Terrestrial Operation in the Fixed and Mobile Services at Frequencies Above 71 GHz," Contribution of IUCAF to ITU-R Working Party 7D, Doc. 7D/11-E (Feb. 17, 1998) at 1 (concluding that "there is but low risk that these [mm-wave] instruments will ever become numerous") ("*IUCAF Sharing Guidelines*"). *See also id.* (explaining that the preferred locations for such observatories are high elevations in desert environments).

26/ ITU, *Handbook on Radio Astronomy* (Radiocomm. Bureau 1995) at 13 ("*RAS Handbook*"). The nearest frequencies listed appear at 72 GHz and 86 GHz.

astronomy observatories could tolerate low-powered emissions, as long as they are not in close proximity to their telescopes." 27/

The evidence suggests that in most cases RAS observatories control access over a wider area than the 1 km radius cited by the Commission. Moreover, as detailed above, mm-wave telescopes in particular are likely to be located in remote areas where it will likely be easier to control access to the observatory.

- SRR radar sensors are mounted in a vehicle's bumper, typically less than one-half meter above the ground. This low height greatly increases signal attenuation attributable to ground clutter. This ground clutter is especially effective given the relatively flat antenna elevation beam width that results in limited above-horizon radiation.

- Because of the narrow beam width of both SRRs and radio telescope receiving antennas, and the unlikely aiming of the telescope at points near the horizon, there is a very low potential for mutual coupling that would result in interference.

- As the Commission has noted, interference mitigation for RAS can be accomplished through the erection of fences and other local shielding. 28/ The IUCAF has also recognized that "it may be possible to provide local shielding at the RAS station to minimize incoming signals," in addition to relying on surrounding terrain. 29/

- At 77 GHz, radio wave propagation is essentially line-of-sight. Given the flat beams of SRRs, a SRR sensor would have to point directly at a radio astronomy telescope to cause interference. 30/ Moreover, diffraction losses

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27/ *NPRM* at ¶ 13; *see also* Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit the Use of Radio Frequencies Above 40 GHz for New Radio Applications, *Third Memorandum Opinion and Order*, 15 FCC Rcd 10515 (2000) at ¶ 15 ("*Reconsideration Order*").

28/ *See id.* at ¶ 8.

29/ *IUCAF Sharing Guidelines* at 5.

30/ *See RAS Handbook* at 37 ("Sharing with active services above about 40 GHz will be easier than at lower frequencies for several reasons. First, high transmitting directivity is easily achieved at these frequencies with antennas of modest size; secondly, the atmospheric attenuation is higher at these frequencies; and thirdly, the scattering of signals by the troposphere decreases with increasing frequency.")

caused by the earth's curvature are high at this frequency. 31/

Thus, it should be possible for SRRs and the RAS to share the same spectrum, with interference mitigation measures implemented on a site-by-site basis at the few millimeter wave RAS locations where needed.

D. Space Research Service (Downlinks)

SARA could locate no documentation that could be useful in conducting a technical sharing analysis for space-to-earth space research service operations in the millimeter wave band. The principal ITU document providing protection criteria for the SRS, ITU-R SA.609, only provides data for earth stations operating up to 20 GHz. 32/ As explained above, SARA does not believe sufficient justification for the proposed SRS allocation has been put forth. However, assuming *arguendo* that the Commission adopts the SRS allocation, SARA believes, based on the limited available information, that SRRs could share the band with SRS operations, provided that appropriate compatibility requirements are developed for both SRR and SRS operations. Because the proposed allocation only provides for SRS downlinks, the only question will be whether SRS earth stations can be located in a manner that ensures that they will not be negatively affected by SRR emissions.

31/ As a result, there should be no concern regarding aggregated interference from multiple SRR systems distributed over a large area, as any emissions received at the telescope will be dominated by the few closest emitters. As noted above, site specific mitigation techniques can prevent these "few closest" emitters from causing harmful interference.

32/ *See* "Protection Criteria for Telecommunications Links for Manned and Unmanned Near-Earth Research Satellites," ITU Recommendation 609-1.

Relatively few earth stations are typically involved in SRS operations. 33/ Therefore, as with radio astronomy observatories, local mitigation techniques such as shielding and control over the immediate vicinity can be used to ensure adequate protection. 34/

33/ For example, a 1998 ITU document listed Green Bank, West Virginia and Goldstone, California as the only two current or prospective SRS earth stations in the U.S. to operate in the 32, 37 and/or 40 GHz bands. *See* Chairman, Joint Rapporteurs Group 7D-9D, "Protection Criteria for and Characteristics of Space Research Service earth Station Operating in the Bands 31.8-32.3 and 37-39 GHz," Doc. 7D-9D/26-E (Jun. 5, 1998).

34/ SARA notes that the *NTIA Spectrum Plan* indicates the presence of SRS cloud monitoring operations in the 78–79 GHz band pursuant to footnote 5.560, which permits the operation of radars on space stations. SARA was unable to locate information regarding the operating parameters of such activity. The Commission and NTIA should make such information available so that a compatibility analysis may be performed.

CONCLUSION

As explained above, it appears likely that SRRs will be forced to migrate to the 77–81 GHz band in Europe by 2014. Additionally, the tighter emission limits that will apply to 24 GHz SRRs in the U.S. as of 2014 make it necessary for SARA to seek the flexibility to also operate in the 77–81 GHz band in order to ensure that SRR functionality can be maintained and improved after 2014. Although SARA asks the Commission to keep this future need in mind as it considers the proposed new allocations, SARA believes that it should be possible for SRRs and the existing and proposed services to share the 77–81 GHz band.

Respectfully Submitted,

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