January 2, 2012

VIA ELECTRONIC DELIVERY

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Room TWA325
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation
ET Docket Nos. 11-90, 10-28

Dear Ms. Dortch:

The Strategic Automotive Radar Frequency Allocation Group ("SARA") hereby respectfully submits this letter in response to the issues raised by the National Academy of Sciences' National Research Council Committee on Radio Frequencies ("CORF").[1] SARA filed reply comments in this proceeding on August 1, 2011[2] addressing specifically the comments of the National Radio Astronomy Observatory ("NRAO"), which raised arguments similar to those late-filed by CORF. The concerns raised by CORF are unfounded and drastically overstate the potential impact of the Federal Communications Commission's ("Commission") proposals on radio astronomy operations. As discussed below and in SARA's Reply Comments, SARA respectfully requests that the Commission swiftly implement Toyota Motor Corporation's ("Toyota" or "TMC") proposal in this proceeding to modify the Section 15.253 emission limits as proposed in the *Notice*;[3] eliminate the "not-in-motion" restrictions; and defer action on the Commission's proposal for fixed use of the 76-77 GHz band to a future proceeding (or, as an interim measure, permit unlicensed fixed 76-77 GHz radar facilities to illuminate only those areas which are not accessible to motor vehicles, such as airport runways, as proposed by ERA).

[1] *See* Comments of the National Academy of Sciences' Committee on Radio Frequencies, ET Docket Nos. 11-90, 10-28 (filed Aug. 8, 2011) ("CORF Comments").

[2] Reply Comments of The Strategic Automotive Radar Frequency Allocation Group, ET Docket Nos. 11-90, 10-28, 3 (filed Aug. 1, 2011) ("SARA Reply Comments").

[3] *Amendment of Section 15.35 and 15.253 of the Commission's Rules Regarding Operation of Radar Systems in the 76-77 GHz Band*, Notice of Proposed Rulemaking, 26 FCC Rcd 8107 (2011) ("*Notice*").

I. INTRODUCTION

Like NRAO, CORF argues that automotive radars are *potentially* incompatible with radioastronomy in the 76-77 GHz band. Its entire introductory argument is dedicated to establishing the value of radioastronomy in scientific research generally.[4] Nowhere in the *Notice*, or in any of the comments filed in response to the *Notice* to date, has the value of radio astronomy been questioned. Nor is anyone suggesting that radioastronomy using the millimeter wave allocations should be compromised. In its filing, CORF states that the science undertaken by RAS observers cannot be performed without access to "interference-free spectrum."[5] Even that broad assertion is not being questioned in this proceeding. The question, instead, is whether the Commission can enact modified Part 15 vehicular radar rules that eliminate the present "in-motion" and "not-in-motion" distinctions limiting emissions from 76-77 GHz vehicular radars and establish a single emission limit that applies in all directions from a vehicle in that frequency range, without creating harmful interference to the primary radio astronomy allocation at 76-77 GHz. The record in this proceeding firmly establishes that there is now and there will continue to be compatibility between 76-77 GHz radioastronomy and automotive radar systems operating in accordance with the modified Part 15 rules proposed in the *Notice*.

II. THERE HAVE BEEN NO SUBSTANTIATED INSTANCES OF INTERFERENCE TO RADIOASTRONOMY AT 76-77 GHz FROM AUTOMOTIVE RADARS

The protection of radio astronomy observations is not, however, the only public benefit at issue in this proceeding. CORF notes that it "recognizes the importance of maximizing spectrum efficiency through thoughtful sharing of spectrum bands . . . ."[6] Therefore, its claimed entitlement to "interference-free spectrum" apparently does not constitute a request for an *exclusive* allocation for radioastronomy, but only for compatible sharing partners. That is a reasonable position in light of the fact that radioastronomy has been sharing the 76-77 GHz band with automotive radars since 1996,[7] by all accounts compatibly. The comments filed by the BMW Group in this proceeding note that BMW has been offering Advanced Cruise Control ("ACC") systems using 76-77 GHz radars in the U.S. and elsewhere for more than 10 years.[8] The main sensor in these systems is used for collision mitigation and avoidance systems.[9] BMW

[4] CORF Comments at 2-3.

[5] *Id.* at 3.

[6] *Id.* at 4.

[7] *See Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Order and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481 ¶ 17 (1996).

[8] Reply Comments of The BMW Group, ET Docket Nos. 11-90, 10-28 (filed Aug. 1, 2011).

[9] *Id.*

reports no interference complaints.[10] Toyota's reply comments note that Toyota "has no information of any documented instances of such interference in areas where these vehicular radar systems have been used for over a decade in proximity to radio astronomy sites – and NRAO has provided none."[11] Similarly, Delphi states that 76-77 GHz automotive radar systems have been implemented in both the U.S. and Europe starting in 1999 without any reports of harmful interference to radio astronomy."[12] SARA's Reply Comments noted that there is over a decade of experience with this technology in Europe, where there is no "vehicle not in motion" emission restriction, and where radio astronomy observatories are located much closer to urban centers than they are in the U.S.[13] To SARA's knowledge, there have been no substantiated claims of harmful interference arising from vehicular radar in the 76-77 GHz band. Neither CORF nor NRAO has cited even one instance of claimed interference from automotive radars at 76-77 GHz to date.

III. THE VALUE OF AUTOMOTIVE RADAR FOR COLLISION AVOIDANCE AND CRASH MITIGATION IS SUBSTANTIAL

The value of automotive radar systems as safety-of-life devices is beyond question, and the statistics supporting that fact are highly compelling. The Commission stated in 2002 when permitting ultra-wideband short-range radars at 24 GHz that it expected "vehicular radar to become as essential to passenger safety as air bags for motor vehicles . . . ."[14] This prediction has been largely validated. Automotive radar systems have been proven to substantially reduce injuries and death due to automobile collisions.[15] The National Highway Traffic Safety Administration ("NHTSA") has

[10] *Id.*

[11] Reply Comments of The Toyota Group, ET Docket Nos. 11-90, 10-28, 4 (filed Aug. 1, 2011).

[12] Comments of Delphi Automotive Systems, ET Docket Nos. 11-90, 10-28, 1-2 (filed July 14, 2011).

[13] SARA Reply Comments at 3.

[14] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, First Report and Order, 17 FCC Rcd 7435 ¶ 18 (2002).

[15] Various studies on the safety benefit of automotive safety systems have been published. At the 21st International Technical Conference on the Enhanced Safety of Vehicles, Stuttgart, held in June of 2009 (www.esv2009.com), the following studies were presented:

Daimler provided a study that showed that with its Brake Assist Plus (collision warning and partial braking) it is possible to prevent 53% of all rear-end collisions that otherwise cause injuries. To support this figure, a comparison of repair parts statistics of cars with and without radar-based functions was made. It could be clearly determined that at speed between 14 and 50 km/h could be reduced by 22%. It was also shown that the impact speed of collisions was reduced (*e.g.*, impact speed between 14 and 45 km/h by 38%). In sum, crashes could be avoided or at least the impact speed can be reduced significantly.

determined that the number one cause of death in age groups from 4 to 34[16] during 2005 were multiple vehicle traffic crashes.[17] According to a 2005 Honda study, the use of its collision mitigation braking systems will reduce the number of rear-end collisions by 38% and the number of fatal rear-end collisions by 44%. Robert Bosch, GmbH completed a 2009 study which concluded that its Predictive Emergency Braking System will reduce personal-injury rear-end collisions by means of collision warning by 39%; that emergency braking assist technology will reduce personal-injury rear-end collisions by 39%; and that automatic emergency braking will reduce personal-injury rear-end collisions by 74%. The Insurance Institute of Highway Safety completed a 2010 study of the effects of forward collision warning radar systems on passenger car collisions. That study found that 20% (*i.e.* 1.2 million) of passenger car collisions can be avoided by the use of forward collision radars; 9% (*i.e.*, 66,000) of accidents with injuries can be prevented by such use; and 3% (*i.e.*, 879) of fatal accidents can be prevented by such use. Daimler made a presentation to the World Automotive Congress in September of 2008, reporting on a study of 66,000 accidents, using the German In-Depth Accident Study database. The study was limited to analysis of rear-end collisions. The study concluded that 20% of all rear end crashes could have been avoided if the cars had been equipped with short-range radar-based intelligent brake assistance. Even in cases where the crash was unavoidable the reduction of crash energy was significant and the severity of the crash consequences would have been mitigated in 25% of the accidents.[18]

Given these high numbers, and the obvious compelling need to incorporate automotive radar technologies in ***all*** passenger vehicles in order to save lives and prevent serious injuries to very large numbers of people, the inability of CORF or any other radioastronomy interest to document even one case of interference to radioastronomy in the years since 1996 when automotive radars were first permitted in the 76-77 GHz band is telling indeed.

The Swedish Road Administration (SRA) published a study that reduction of collision impact speed by 10% would reduce the risk of fatalities by 30%.

The German Insurers Accident Research (UDV) stated that autonomous partial braking could avoid 12% of all accidents. Systems with autonomous emergency (full) braking could avoid 40% of all kinds of collisions.

[16] The age groups in this study between ages 4 and 34 included young children (4-7), children (8-15), teens (16-20), young adults (21-24) and other adults (25-34).

[17] *See* National Highway Traffic Safety Administration, "Evaluation of an Automotive Rear-End Collision Avoidance System, DOT HS 810 569 (March 2006) *available at:* http://www.nhtsa.gov/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2006/HS910569.pdf.

[18] *See also* Schittenhelm, Dr. Helmut, *Design of Effective Collision Mitigation Systems and Prediction of Their Statistical Efficiency to Avoid or Mitigate Real World Accidents* (Daimler AG), 14 September 2008.

IV. THERE IS ONGOING COOPERATION BETWEEN MANUFACTURERS OF AUTOMOTIVE RADARS AND THE RADIOASTRONOMY COMMUNITY TO ADDRESS CLAIMED POTENTIAL INTERACTION

CORF asks the Commission to condition the "increase in the average power density limit for automotive vehicular radars operating in [the 76-77 GHz] band" upon radar manufacturers being "required to work with representatives of the RAS community to minimize interference with RAS observations." [19] This, CORF says, could be facilitated by the National Science Foundation ("NSF"). While there is no justification for regulations mandating such collaborative efforts, the fact is that there are now, and there have been, ongoing cooperative efforts initiated by SARA members to do exactly as CORF has requested. Robert Bosch, GmbH representatives have met numerous times with NSF staff, with CORF, and with other radioastronomy representatives, and efforts are now underway to test, assess and minimize any potential for interaction between automotive radar systems and radioastronomy observatories in the 77-81 GHz band. None of these ongoing efforts, however, were triggered by the request to eliminate the "in-motion" and "not-in-motion" distinctions contained in Section 15.253 of the Commission's rules as it relates to the 76-77 GHz band, or to harmonize the emission limits as proposed in this proceeding.

V. THE COMMISSION SHOULD INCREASE THE SECTION 15.253 AVERAGE POWER DENSITY LIMIT

In its filing, CORF argues that "principles of efficient spectrum management" dictate that the Commission should not adopt its proposal to increase the permissible average power density for 76-77 GHz vehicular radar, despite the fact that its original rationale for setting a lower limit (*i.e.*, preventing excessive human exposure to radio-frequency radiation) has sense been rejected.[20] In essence, CORF asks the Commission to ignore several years of real-world experience and replace its now discarded rationale for imposing a very low average power density limit with another rationale (potential interference to radio astronomy operations) that the Commission rejected when it first established the limit. Contrary to CORF's suggestions, principles of efficient spectrum management dictate that this proposal be rejected.[21]

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[19] CORF Comments at 1-2.

[20] *Id.* at 6.

[21] As the *Notice* indicates, "[t]he in-motion limits were based on conservative estimates of the minimum power necessary to provide the range required for the radars to operate effectively." *Notice* ¶ 3, *citing Amendment of Parts 2, 15 and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications,* First Report and Order and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481 ¶ 21-27 (1996). Moreover, the Commission is not proposing to increase substantially this minimal power level. It is understood that CORF and NRAO are concerned with average power and not peak power. It is merely attempting to eliminate a distinction that is no longer necessary from a regulatory perspective, and to allow the newer life-saving

VI. THERE IS AN URGENT NEED TO ELIMINATE THE "IN-MOTION" AND "NOT-IN-MOTION" DISTINCTION WITHOUT UNNECESSARY REGULATORY CONDITIONS

CORF states that there is "no reason to authorize full-power radar transmissions from a vehicle when that vehicle is not in motion."[22] In fact, there is a very important and compelling reason. New automotive radar functions such as precrash warnings, rear cross-traffic alerts, and crossing assist for pedestrian protection require a substantial signal-to-noise ratio. Thus, in order to function, the radars must be in operation while the vehicle is not in motion and, indeed, at all times during the vehicle's operation. Furthermore, as SARA and its members have repeatedly noted in this proceeding, the "in-motion" and "not-in-motion" distinctions are implemented only in the U.S. Compliance with this requirement adds substantial cost to the radar systems and therefore limits the deployment of such radars to high-end luxury cars only. It is important that these radars be made available universally for the benefit of all American motorists and their passengers.

CORF argues that increasing the power of potentially interfering transmissions when the radar is not in use "for vehicle protection" would be "inconsistent with a thoughtful approach to sharing spectrum bands."[23] First of all, there is no "unnecessary" increase in power proposed. Automotive radar manufacturers have a strong incentive to minimize the power of radars to the fullest extent possible in order to insure compatibility among radar-equipped vehicles in close proximity to each other. This is carefully calculated and addressed cooperatively within the automotive industry. Furthermore, it is not principally the vehicles that are protected by these radars, but rather their occupants. And with respect to a "thoughtful approach" to spectrum sharing, it is important to note several things:

(1) There are relatively few millimeter-wave radioastronomy observatories in the U.S. Given the very few such observatories, and the complete absence of any validated instances of actual interference to any of them, preserving unnecessary and outmoded restrictions that preclude the installation of life-saving vehicular radars in all passenger vehicles would be poor spectrum management indeed.

(2) Those few such observatories that exist are, as the Commission has noted several times, and most recently in the *Notice*,[24] "usually located on high mountains in

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capabilities of automotive radars to be implemented cost-effectively in a wide variety of passenger vehicles, so that more motorists can be protected.

[22] CORF Comments at 6.

[23] *See id.*

[24] *See Notice* ¶ 6.

rural areas where access to RAS telescopes is controlled at distances of at least one kilometer." [25]

(3) Although CORF attaches to its comments some calculations showing that high fences would be required in order to attenuate the aggregate noise of 50 vehicles located 10 kilometers from the radio telescope, Toyota has explained in calculations submitted to the Commission that the separation distance necessary to protect millimeter-wave radio telescopes is much shorter when all relevant factors are taken into account. Toyota showed that the NRAO grossly overestimates the "potential" for interference to radio telescopes from automotive radars because of its failure to take into account attenuation of the radar signal by trees, other vehicles, guard rails, buildings, diffraction losses, and ground scatter.[26] Finally, data loss of up to 2% by virtue of radio wave interference is accounted for in ITU standards that are well-established.[27]

In a footnote, CORF repeats the argument previously made by NRAO that there should be either on-off switching for automotive radars in vehicles or the capability to turn the radars off when vehicles enter the grounds of a radio astronomy observatory or are being serviced.[28] Such a requirement is neither justified by any showing made by CORF or NRAO, nor possible given the safety functions of the radars (such as emergency braking). For safety reasons, a vehicle operator and its occupants cannot be dependent on the functioning of radars which have any possibility of being deactivated. As to the suggestion that the radars be subject to deactivation when entering the grounds of a radio astronomy observatory, this is something that is exclusively within the control of the observatory. The observatory can regulate whether or not motor vehicles are permitted on the grounds of an observatory in close proximity to the radiotelescope.[29] It is well-established practice for specially-equipped electric vehicles to be used to shuttle

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[25] *See also 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,* Report and Order, 19 FCC Rcd 3212 (2004).

[26] *See Ex Parte* filing by Toyota Motor Corporation, ET Docket Nos. 11-90, 10-28 (filed Oct. 25, 2011).

[27] *See* ITU-R RA 1513-1.

[28] CORF Comments at 6 n.6.

[29] *See, e.g., Notice* ¶ 10; *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*, Report and Order, 19 FCC Rcd 3212 ¶¶ 13-16 (2011); *Amendment of Parts 2 and 15 of the Commission s Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, ET Docket 94-124, Third Memorandum Opinion and Order, 15 FCC Red 10515 ¶ 8 (2000) (noting that radio astronomy observatories in the United States "typically have control over access to a distance of one kilometer from the telescopes to provide protection from interference caused by automobile spark plugs and other uncontrolled RFI sources").

persons to a radio telescope so that motor vehicles do not create electromagnetic interference generally.

VII. CONCLUSION

CORF has not provided justification for further delay in modifying Sections 15.35 and 15.253 of the Commission's rules as proposed in the *Notice*. The current limits on radiated 76-77 GHz vehicular radar emissions, which are based on outmoded concerns about human exposure to radiofrequency energy and which have always been overly conservative, are unnecessary and severely hamper the rollout of new anti-collision vehicular radars. The modest increases in average power (and the reduction in peak power) proposed in the *Notice* are necessary in order to implement in the U.S newer, life-saving automotive radar technology that has the potential to save many human lives and minimize personal injuries from automobile collisions. CORF argues that an asserted *potential* interaction (based on calculations, the premises of which are in dispute) between these radars and a few, remotely located millimeter wave radio observatories (which has not been realized on even one occasion in more than ten years of experience) justifies nationwide restrictions on this important technology. Such an argument is untenable. At stake is the deployment of life-saving radars into the majority of vehicles operating in the U.S.

Automotive radar manufacturers and automobile manufacturers have reached out to the radioastronomy community and engaged (and will continue to engage) in technical dialog, on a cooperative basis, so as to minimize any legitimate concerns about interference to radioastronomy. However, delay in the rollout of new, anti-collision radars on a wider array of vehicles has a very high cost (in terms of human life and safety) that the Commission absolutely should not be willing to bear.

Accordingly, SARA respectfully requests that the Commission swiftly implement Toyota's proposal to modify the Section 15.253 emission limits as proposed in the *Notice*; eliminate the "not-in-motion" restrictions; and defer action on the Commission's proposal for fixed use of the 76-77 GHz band to a future proceeding (or, as an interim measure, permit unlicensed fixed 76-77 GHz radar facilities to illuminate only those areas which are not accessible to motor vehicles, such as airport runways, as proposed by ERA).

Respectfully submitted,

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