WRC AI 1.18 Vehicular Radar

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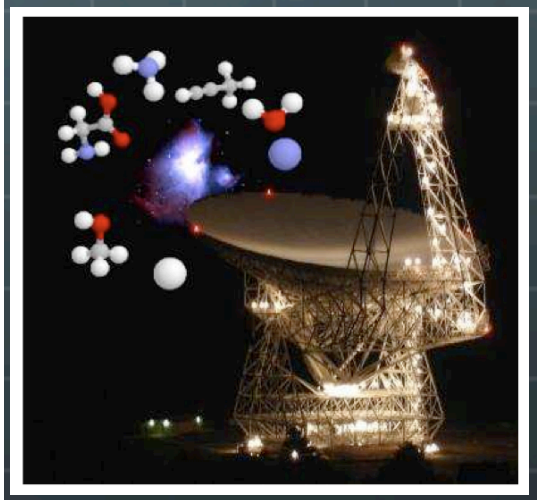
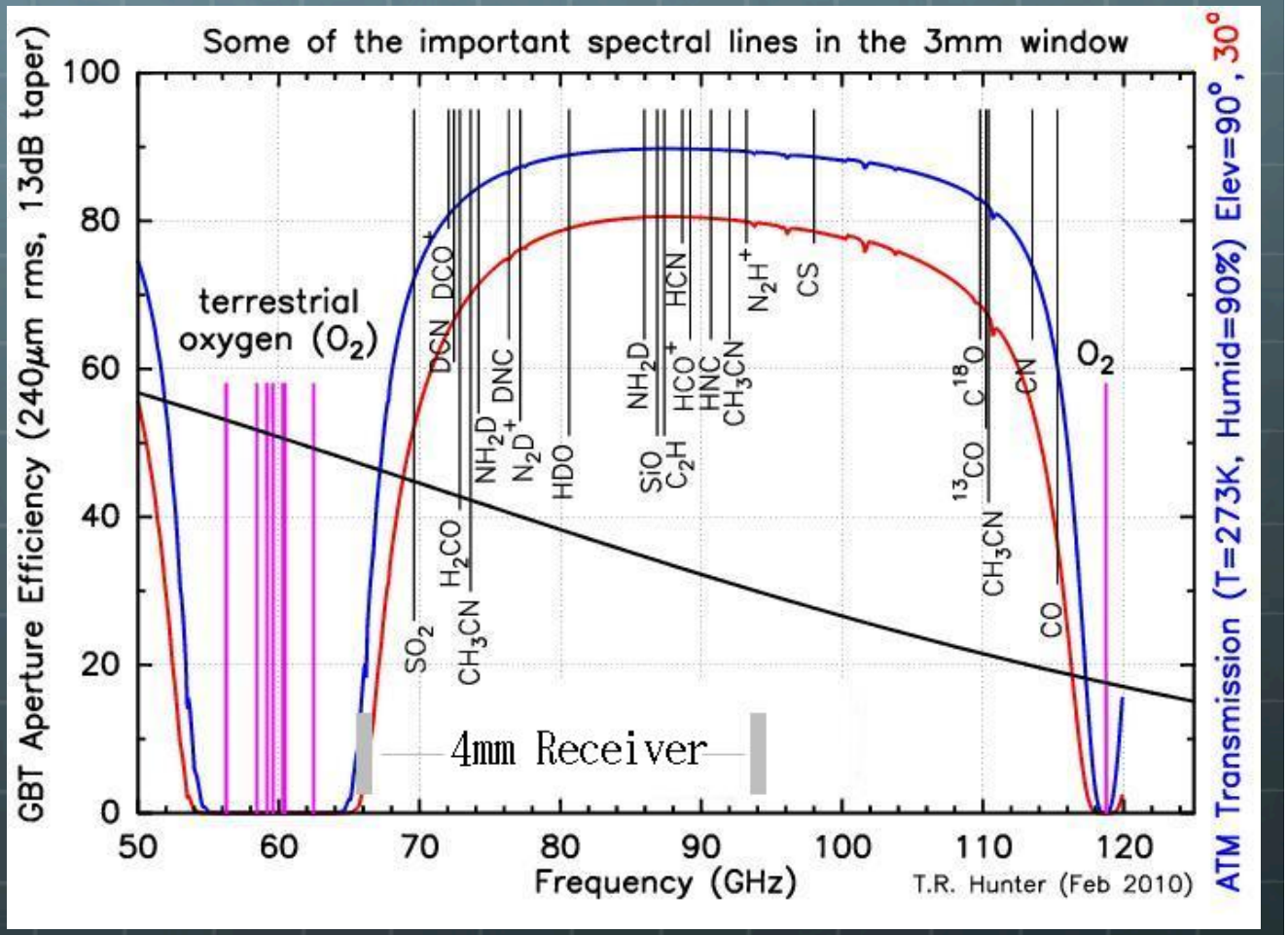
NSF

Science with 4 mm Rx,

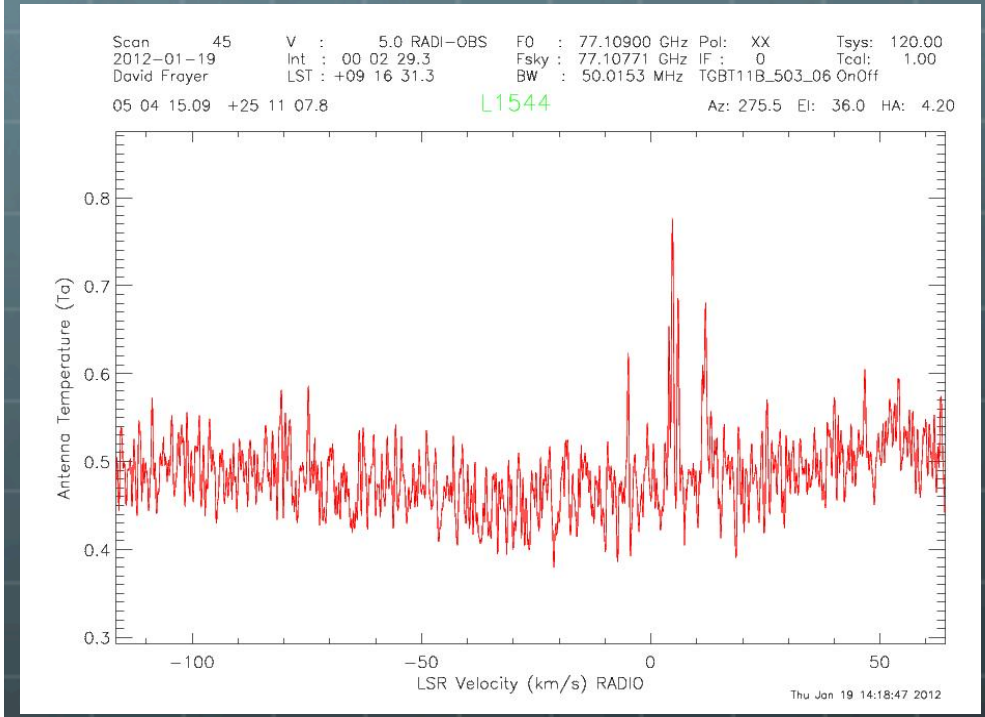
- Dense gas tracers in star-forming regions and nearby galaxies (HCN, HNC, HCO+ all at ~90GHz)
- D-species in cold cloud cores (~70-80GHz)
- Astro/bio-chemistry (throughout the band)



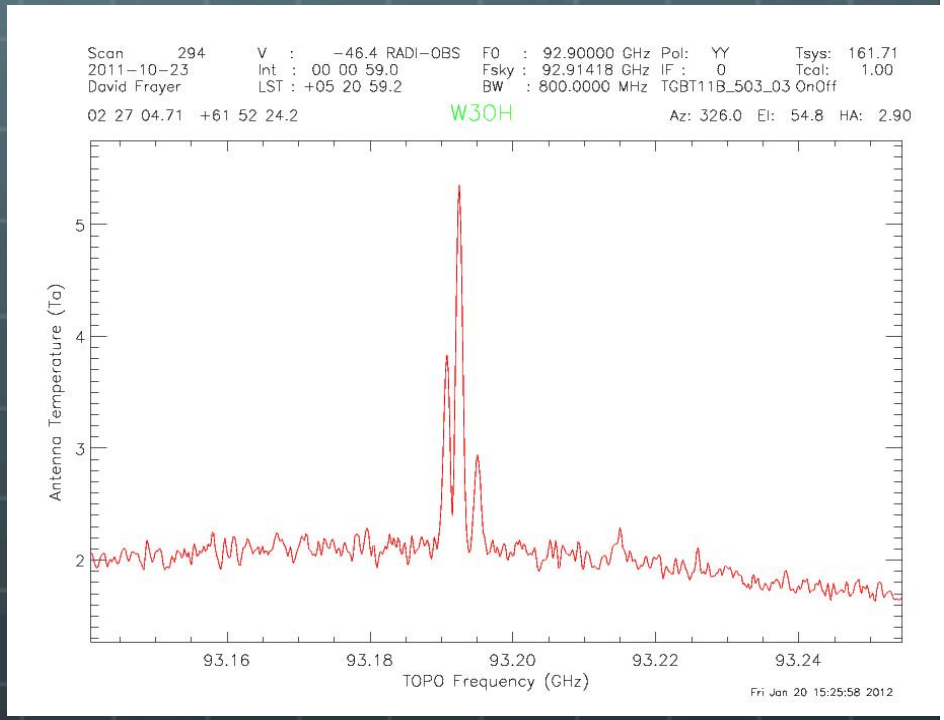


4mm Rx: Cold starless-cores → molecular freeze-out → D-species enhanced

N2D+ in L1544 at 77 GHz (S. Schnee et al.)

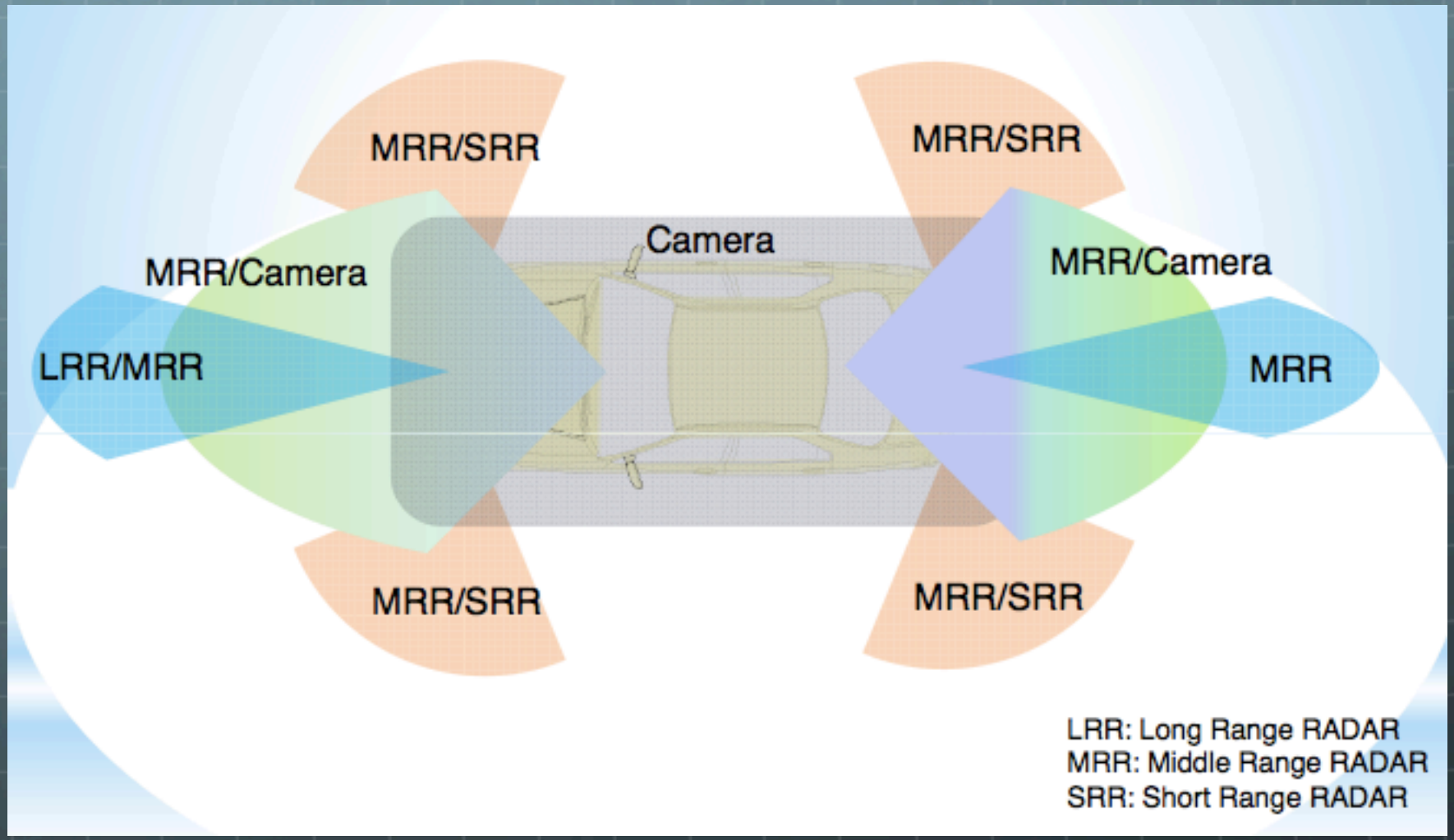


N2H+ in W3OH at 93 GHz



ITS Radiocommunication Services

	Spectrum	Service
VICS — *Vehicle Information and Communications System*	76-90MHz (FM multiplex broadcasting) 2.5GHz (Radio beacon)	・Traffic information
ETC -- *Electronic Toll Collection*	5.8 GHz/ 5.9 GHz	・Collect highway toll (Communication)
DSRC -- *Dedicated Short Range Communication*		・Collect highway toll ・Provide various information (Communication, Broadcast)
Sub-millimeter, Millimeter wave system	24/26GHz 60/76GHz **79GHz**	・Detect obstacles (Sensor)
Vehicle-to-Vehicle communications system	5.8GHz 700MHz	・Safety information (Communications)


MRR/SRR
MRR/SRR
Camera
MRR/Camera
MRR/Camera
LRR/MRR
MRR
MRR/SRR
MRR/SRR
LRR: Long Range RADAR
MRR: Middle Range RADAR
SRR: Short Range RADAR

Comparison between typical RADAR

	24GHzUWB (Closed at several country)	76.5GHz (Band Width<1GHz)	79GHz (Band Width<4GHz)
Maximum Range	~30m	Over 100m	Over 100m
Minimum Range	0.2m(typ.)	1m(typ.)	0.2m(typ.)
Range Resolution	~0.2m	~1m	~0.2m
Minimum target (only by H/W performance)	Pedestrian	Motorcycle	Pedestrian

WRC-15 Agenda Item 1.18

Title of the Agenda Item at the ITU World Radiocommunication Conference (WRC-2015):

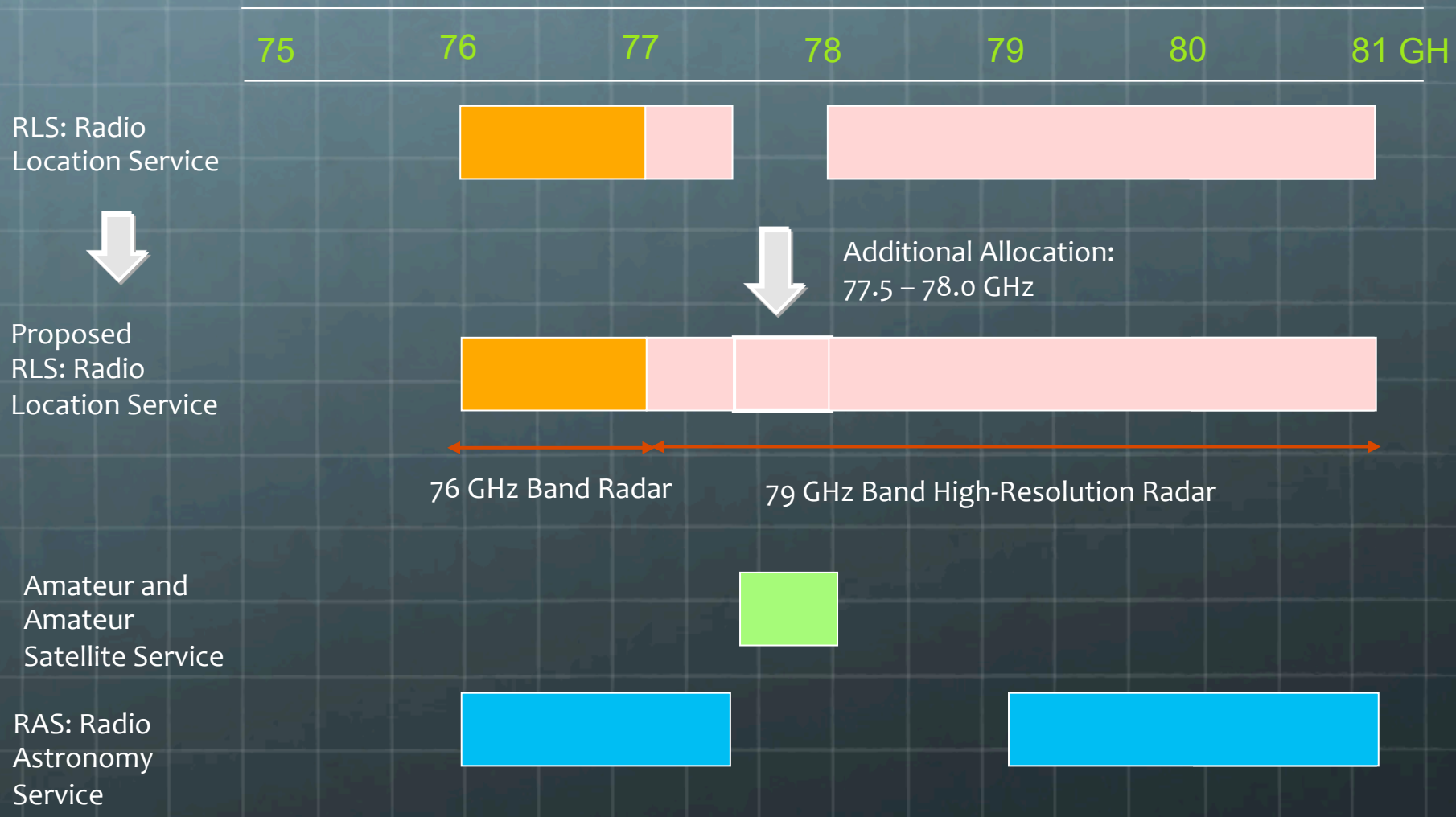
1.18 to consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band in accordance with Resolution **654 (WRC 12)**

Objective:

- To fill a 500 MHz band in the 77.5 to 78 GHz band, in order to achieve global harmonization for ITS Collision Avoidance Radar operating in the 77 to 81 GHz band

- To study other ITS safety-related applications that may benefit from global or regional harmonization

77-81 GHz Spectrum Allocation



76-81 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.XXX** 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	

Automotive Industry working to obtain all of 77-81 GHz band

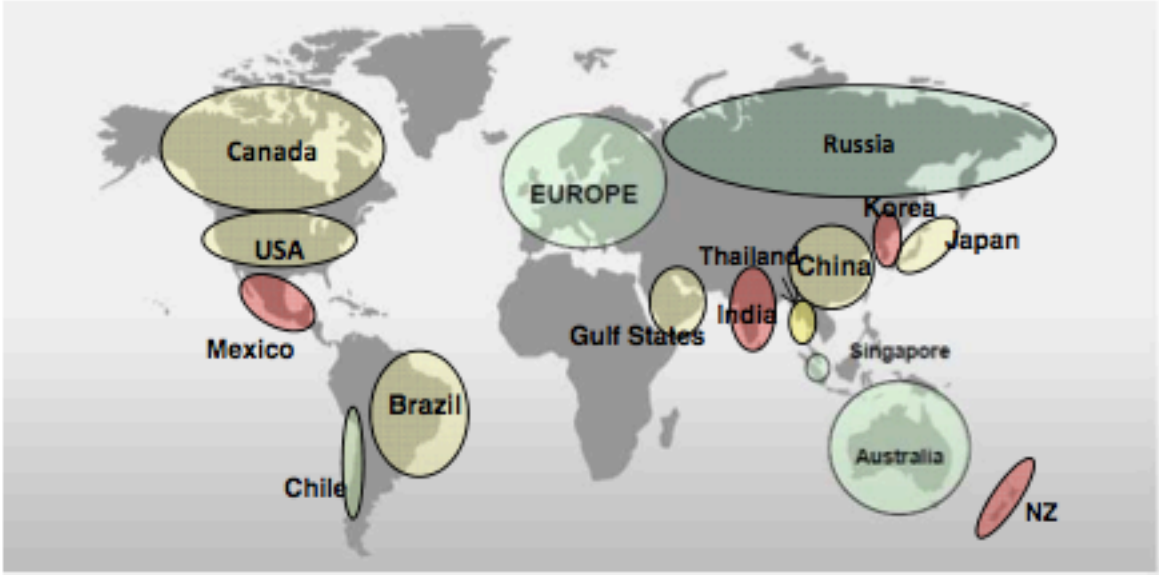
Project Status as at May 2012 (1)

- Availability of the 77-81 GHz band for automotive SRR applications at project start in June 2011

79GHz

Project Status as at June 2013 (2)

- Availability of the 77-81 GHz band for automotive SRR applications as of June 2013



Task 3.1 Activity in USA and Canada

Country	Status	Remarks
USA		FCC issued Report and Order on TREX FOD radars (FCC 13-95). No decision is made on automotive radar in the band. Gives indication that FCC is in favorable view for automotive applications (FODs will be part 90 licensed devices). FCC expresses the view that 'It is a continuation of FCC's prior holdings that radioastronomy is not entitled to any specific protection from other authorized users of this band. '
Canada		The draft Annex 13 to RSS210 was reviewed and prepared to be sent to Industry Canada. Will follow up with lawyer on the progress.

Task 3.2 Asian-Pacific countries (Japan, Thailand, Korea, Singapore, Malaysia, Indonesia)

Country	Status	Remarks
Japan		Regulated in end 2012; 78-81GHz due to the gap of 77.5-78GHz
Thailand		79GHz is allowed but with a limit of 10 mW eirp. The office of *National Broadcasting and Telecommunications Commission* (NBTC) is currently reviewing the petition on modification of the 24-24.25 GHz submitted via Thai Automotive Industry Association (TAIA).
Korea		*Korea Communications Commission* (KCC) initiated a study group with domestic stake holders. Korea will support the WRC2015 action to close 77.5-78 GHz gap. After WRC2015, the allocation of the 77-81 GHz band can be expected.
Singapore		Regulated before start of project
Malaysia		*Malaysian Communications and Multimedia Commission (MCMC)* is reviewing our request put up in January
Indonesia		No direct contact with the Ministry to date

Task 3.3 BRIC countries (Brazil, Russia, India and China)

Country	Status	Remarks
Brazil		ANATEL is working on an update to the current RES506. 79GHz has emailed AEA a proposal for the new annex on automotive radar. Preliminary Brazilian view on WRC-15 AI1.18 is in line with the US and Canada.
Russia		Regulated in early 2011
India		Established contacts with officers from Wireless & Planning Coordination Wing who is currently revising the NFAP (National Frequency Allocation Plan) for frequency allocation above 10GHz.
China		77-81 GHz is noted in the current draft frequency plan of China. Preliminary discussions with the officers in charge of Action Item 1.18 of WRC15 indicated that they are only likely to regulate 79GHz after WRC-15

Mexico

- Mexico is willing to regulate 77-81 GHz
- But generally awaits for the FCC regulation to be in place first

Chile

- Chile has implemented 79GHz into their frequency plan in June 2013

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Sections 15.35 and 15.253 of the	)	ET Docket No. 11-90
Commission's Rules Regarding Operation of	)	RM-11555
Radar Systems in the 76-77 GHz Band	)	
	)	
Amendment of Section 15.253 of the	)	ET Docket No. 10-28
Commission's Rules to Permit Fixed Use of	)	
Radar in the 76-77 GHz Band	)	

REPORT AND ORDER

Adopted: July 3, 2012 **Released: July 5, 2012**

By the Commission:

FCC reviews all public comments

10. *Comments.* The automotive industry overwhelmingly supports the proposed rules for vehicular radars citing enhanced detecting performance–resulting in improved collision avoidance, driver safety, and convenience–coupled with reduced costs due to global harmonization. However, the National Radio Astronomy Observatory (NRAO) and National Academy of Sciences' Committee on Radio Frequencies (CORF) raise concerns about increased potential interference to radio astronomy operations if the proposed rules are adopted.

11. NRAO states that interference is inevitable and the destruction of radio astronomy receivers is a serious possibility if these "high-powered" vehicular radars operate in sufficient proximity to radio astronomy sites.[22] It further states that GPS-based coordination zones and/or an easily accessible on/off switch would alleviate these dangers but states that it is open to alternative suggestions from the FCC or from industry. NRAO states that fencing roads to keep vehicles away from radio astronomy receivers is an impractical solution given that roads often run directly toward radio astronomy stations as evidenced by the visibility of headlights at observatory sites at night. It argues that vehicular radars may interfere with radio astronomy receivers over distances up to 100 km and that the potential for interference exists with any signal that appears at the victim antenna, not just down its boresight. It states that a single car radar may interfere with radio astronomy observations when seen well off the axis of the radar beam and/or at considerable distances, even in wet air.[23]

12. CORF states that the rules increasing the average power density limits for automotive vehicular radars operating in this band should not be enacted unless radar manufacturers are required to work with representatives of the Radio Astronomy service (RAS) community to find solutions that will minimize interference with RAS observations. CORF states that if the Commission authorizes increased average power density limits for automotive radars operating in this band, it should not authorize full-power radar transmissions from a vehicle when that vehicle is not in motion.[24]

NTIA=Executive Commission=Congress

17. The National Telecommunications and Information Administration (NTIA) noted that the National Science Foundation (NSF)-sponsored a study documenting measurements performed jointly by representatives from the radio astronomy community and several vehicular radar manufacturers.[36] The measurements performed using the University of Arizona's 12 Meter Telescope located at Kitt's Peak examined the impact that vehicular radar emissions would have on radio astronomy installations.[37] Emissions of two different vehicular radars manufactured by Robert Bosch GmbH and Continental Corporation were measured in the adjacent 77-80 GHz band. The measurements of the emissions from a single vehicular radar system at two distances (1.7 km and 26.9 km from the radio astronomy installation) indicated that the received signal level at the radio astronomy installation exceeded the protection criteria specified in Recommendation International Telecommunication Union Radiocommunications Sector (ITU-R) RA.769-2.[38] The study acknowledges that mitigation factors such as terrain shielding, orientation of the vehicular radar transmitter antenna with respect to the observatory, or attenuation of the vehicular radar transmitter if mounted behind the vehicle bumper were not taken into account and would tend to reduce the distance at which interference occurred.[39] NTIA requested that this study be included as part of the public record for this proceeding, and asked that we encourage the radio astronomy community and the vehicular radar manufacturers to continue this cooperative effort to examine and implement mitigation techniques that can be employed to address the potential interference concerns. We recognize the concerns of the radio astronomy community in both the 76-77 GHz band at issue in this proceeding and in the 77-80 GHz band examined in the study. As discussed above, the Commission's rules have permitted vehicular radars to operate in the 76-77 GHz band since 1995. Further, we expect any increase in potential interference in the 76-77 GHz band as a result of the technical rules changes we are making here to be negligible when compared to the overall effect caused by the variability in propagation characteristics due to terrain, weather and other propagation factors.[40] We have not found anything in the NSF study that suggests that the increase in the potential for harmful interference resulting from these rule revisions will not be negligible. Further, we always encourage cooperation between parties with respect to compatibility of systems that use the radio spectrum, thus we specifically encourage continued cooperation between the radio astronomy community and the vehicular radar industry.

It == Automotive Industry

13. The automotive industry strongly disagrees with the NRAO's assertions that harmful interference will be caused to RAS operations if the average power density limits are increased. It argues that NRAO's claims are speculative and that NRAO has failed to corroborate its claims with factual support and documented cases of interference.[25] It states that NRAO's interference allegations were contrary to the past ten years of real-world experience with automotive radar systems in the United States and Europe.[26] It continues to believe that no significant potential exists for interference from vehicular radar to radio astronomy receivers and there is simply no evidentiary or well-founded policy basis to support NRAO's proposal to equip vehicles with an on/off switch to protect radio astronomy installations,

We == FCC

15. We find that the new set of emission limits will not measurably increase potential for interference from vehicular radar systems to RAS operations in the 76-77 GHz band. First, the reduced peak limit we adopt for vehicular radars will increase the level of interference protection afforded to RAS system because it is lower than the current peak limit. Second, the average power limit is being increased by only 1.7 dB from the current maximum for vehicular radars in the 76-77 GHz band, *i.e.*, from 48.3 dBm to 50 dBm. Under worst-case free space conditions a 1.7 dB increase is only a 1.2-fold increase in signal range. The very short distances that these radars operate under, plus the propagation characteristics of the band, translate in practice to a minimal increase in interference potential that we do not believe will yield any increase in actual interference to RAS operations. Because the radio astronomy observatories 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, the potential for interference caused by the incremental increase in average power limits at that distance (one kilometer) would be negligible.[33] Furthermore, the effect of an increase in average power level of 1.7 dB is negligible when also taking into account the variability in propagation characteristics due to terrain, weather and other propagation factors.[34]

16. We agree with the automotive industry that given the horizontal direction of vehicular radar beams, the propagation characteristics of terrain and the geographical location of the RAS equipment, the modified emission limits pose no additional risk of interference or damage to the RAS equipment compared to the current rules.[35] Accordingly, we believe that there is no need to restrict vehicular radar systems based on coordination zones or to impose requirements for a GPS-aware automatic or a user

Summary: Vehicular Radar

May prevent Astronomical Observations in 76-81 GHz

Astronomers must

- Demonstrate value of range
- Demonstrate adverse effects of existing systems
- Show benefits of better sharing for other Services

Attempts to protect 76-81 GHz for Astronomy have not been successful (In USA)

Progress difficult unless Astronomers show benefits of protection for other services

Alternate approach; Advocate all new systems must obey strong sharing principles:

- No transmission when not in use
- Adjust power for conditions
- Include short no-transmission periods