

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Revision of Part 15 of the Commission's)	ET Docket No. 98-153
Rules Regarding Ultra-Wideband)	
Transmission Systems)	
)	

**OPPOSITION
of the
SHORT RANGE AUTOMOTIVE RADAR FREQUENCY
ALLOCATION GROUP**

The Short Range Automotive Radar Frequency Allocation Group (“SARA”) 1/ hereby submits this Opposition in response to petitions for reconsideration filed in the above-referenced docket by Multispectral Solutions, Inc. (“MSSI”) and jointly by Sirius Satellite Radio Inc. and XM Radio Inc. (collectively, “Sirius/XM”). In addition, SARA files this pleading to express support for the petition of Siemens VDO Automotive AG (“Siemens VDO”), which requests

1/ SARA is 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: *A.D.C., Bosch, Delphi Automotive Systems, Hella, InnoSent, Megamos, 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, Renault, Saab, Seat, Skoda, Volkswagen and Volvo*.

narrowly-tailored rule changes that will permit the operation of its pulsed frequency-hopping vehicular radar without causing any greater likelihood of harmful interference.

I. MSSI's Request to Exclude Devices with Modulation-Dependent Bandwidth Should Be Rejected

In its Petition for Reconsideration, MSSI urges the Commission to amend its definition of UWB transmitters to exclude “devices which achieve wide instantaneous bandwidths because of the use of high data rates; *i.e., in which the bandwidth is modulation dependent.*” ^{2/} As an initial matter, SARA submits that taken literally, MSSI's suggested language would rule out *all* transmitters, as all devices, regardless of waveform, have emissions whose bandwidths are directly dependent on modulation. Presumably, such a wholesale prohibition on UWB devices was not MSSI's objective. SARA assumes, based on the discussion contained in MSSI's petition, ^{3/} that MSSI was attempting to prohibit devices employing non-pulsed modulation techniques. ^{4/} As discussed below, SARA opposes such unnecessary restriction, especially to the extent it is applied to vehicular radars.

^{2/} MSSI Petition for Reconsideration (“MSSI Petition”) at 13 (emphasis added).

^{3/} See MSSI Petition at 12-13.

^{4/} As the Commission recently reminded one petitioner, “the precedent is clear that the Commission ‘need not sift pleadings and documents to identify arguments that are not stated with clarity by a petitioner. It is the petitioner that has the burden of clarifying its petition before the agency.’” Amendment of Part 95 of the Commission's Rules, WT Docket No. 98-169, *Third Order on Reconsideration of the Report and Order and Memorandum Opinion and Order*, FCC 02-130 (rel. May 8, 2002) (citing *Bartholdi Cable Co. v. FCC*, 114 F.3d 274, 279-80 (D.C. Cir. 1997)).

MSSI presents no explanation, much less any theoretical calculations or other evidence, purporting to demonstrate that non-pulsed modulation devices are more likely to cause harmful interference than pulsed devices. Moreover, MSSI is incorrect when it suggests that the Commission had an inadequate record on which to base its decision to permit various modulation types. For example, Delphi Automotive Systems Corporation (“Delphi”) established in *ex parte* filings that the pseudo-noise direct sequence binary phase shift key (“PN DS BPSK”) waveform used in its proposed radar device has power spectral densities that are identical to those of pulsed waveforms, and therefore present no greater threat of interference. ^{5/} Siemens VDO also presented evidence in the record that its pulsed frequency hopping system does not cause harmful interference, ^{6/} and, as discussed in more detail below, has established in its petition for reconsideration that only minor modifications to the FCC’s measurement procedures are needed to enable it to take advantage of the Commission’s UWB rules.

For 24 GHz vehicular radars, there is an additional reason why systems employing alternative modulation techniques pose no greater threat of interference. The Earth Exploration Satellite Service (“EESS”) was the only

^{5/} See, e.g., Engineering Study of Delphi Automotive Systems Corporation, *ex parte* filing of July 13, 2001 at 4-5. See also, *ex parte* filing of the Short Range Automotive Radar Frequency Allocation Group, Nov. 14, 2001, at 28. Both filings contain side-by-side graphic comparisons of pulse and PN DS BPSK signal spectra, illustrating that “the difference between the two lies only in the spectral line amplitude at the RF carrier frequency,” which is higher for the pulsed signal. *Id.*

^{6/} See *ex parte* filing of the Short Range Automotive Radar Frequency Allocation Group, Nov. 14, 2001, at 20-27.

incumbent service identified in the UWB proceeding for which any party expressed a concern about the potential of harmful interference from vehicular radars. The integration times of EESS satellites are typically on the order of several milliseconds, ^{7/} which is too long to distinguish between different modulation types, such as pure pulsed, pulsed frequency hopping, and PN DS BPSK waveforms. Moreover, EESS satellites integrate signals over a large footprint (*e.g.*, over several square kilometers), such that signals from up to several thousand individual radar sensor units are averaged together within one footprint. This temporal and spatial integration over both lengthy time periods and large geographic areas results in the EESS receivers being unable to distinguish between different modulation types. Thus, there is no reason to prohibit alternative modulation types for vehicular radars. Such a prohibition would do nothing to reduce the potential for harmful interference to the relevant receivers, but would merely succeed in reducing competition in the vehicular radar market to the detriment of the public. Accordingly, the Commission should reject MSSI's request.

II. No Changes Are Needed to Protect the Satellite Digital Audio Radio Service (“SDARS”)

SARA also opposes the request, relegated to a footnote in the Sirius/XM petition, to tighten the emission limits applicable to vehicular radar emissions in the SDARS band. In their petition, Sirius/XM present starkly

^{7/} See, *e.g.*, National Oceanic and Atmospheric Administration, “KLM User’s Guide,” Sept. 2000 at Appendix J.3 (available at <<http://www2.ncdc.noaa.gov/docs/klm/html/j/app-j3.htm>>) (listing in Table J.3-1 the integration periods for satellite modules AMSU-A1, AMSU-A2, and AMSU-B as 165, 158 and 18 milliseconds, respectively).

contrasting arguments, virtually back-to-back. On the one hand, they correctly argue that:

vehicular radar is highly unlikely to interfere with SDARS. . . . Vehicular radar’s operating band is so far from the SDARS band that there is little possibility of harmful interference from these devices into satellite radio receivers, despite their physical proximity.” [8/](#)

Immediately after making these emphatic statements regarding the lack of any likely interference, Sirius/XM inexplicably turn to argue that dramatically tighter emission limits are required to protect SDARS from vehicular radar. Specifically, Sirius/XM request that the Commission alter its rules and impose a limit of 8.6 microvolts/meter for out-of-band emissions from vehicular radars in the SDARS band. [9/](#)

The Commission’s current limit applicable to radiated emissions from vehicular radars in the 1610 MHz to 22 GHz band is -61.3 dBm. [10/](#) No change to this limit is necessary to ensure adequate protection to SDARS or any other service. The UWB bandwidth for vehicular radars is restricted to the 22 – 29 GHz band by Section 15.515(b). As the Commission logically explained:

Vehicle mounted UWB radar systems . . . are being required to operate in a considerably higher frequency band than that used by DARS. This should result in emissions appearing in the DARS band that would be no more of an interference threat than emissions from

[8/](#) Sirius/XM Joint Petition for Partial Reconsideration at 16 (emphasis in the original).

[9/](#) *Id.*

[10/](#) -61.3 dBm is equivalent to 49.7 microvolts/meter. Thus, the 8.6 microvolts/meter (-76.5 dBm) requested by Sirius/XM represents a limit that is approximately 1/6th of the field strength level currently permitted.

conventional Part 15 devices. . . . Due to the extremely wide frequency separation, it is likely that emissions in the DARS band would be considerably lower than the Part 15 emission limits. [11/](#)

The Commission was correct in its analysis. Indeed, calculations by SARA indicate that, assuming a 4 GHz null to null bandwidth generated by the pulsed UWB modulation, a center frequency at 24.075 GHz or above (as required by the rules), an antenna with limited bandwidth generated by the pulsed UWB modulation capability, and other factors, including linear polarization, emissions from a vehicular radar device operating in the 24 GHz band would roll off so substantially that the signals present in the SDARS band at 2.3 GHz would be well below even the level demanded by XM/Sirius. [12/](#) Indeed, it is virtually impossible to design a functioning antenna at 24 GHz that also radiates with significant efficiency at any frequency below about 17 GHz. Accordingly, no alteration to the Commission's current rules is necessary.

Moreover, as a purely definitional matter, there will in fact be *no* out-of-band emissions from vehicular radar appearing in the SDARS band. The

[11/](#) 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 ¶ 169.

[12/](#) Vehicular radar systems in the 22 – 29 GHz band are restricted to an EIRP average power of –41.3 dBm (the same limit contained in §15.209). For a pulsed UWB system with first sinc/x null to null sidelobe crossings at $24.075 \text{ GHz} \pm 2 \text{ GHz}$, it is the 10th sinc/x sidelobe that will fall into the SDARS band. This sidelobe has an attenuation of >30 dB compared to the mainlobe level of –41.3 dBm. An additional attenuation of many dBs results from other factors such as the polarization, the bandpass character of the circuitry and the antenna that are all specially optimized for the 24 GHz frequency range. Therefore, vehicular radar emissions in the SDARS band cannot possibly produce any harmful interference.

International Telecommunications Union (“ITU”) has established a formula for determining the boundary between out-of-band and spurious emissions. ^{13/} Generally, the boundary is 250% of the necessary bandwidth, as measured out from the center of the necessary bandwidth. Assuming a vehicular radar with a 4 GHz UWB bandwidth and a center frequency at 24.125 GHz, all emissions below 14.125 GHz would be considered spurious. ^{14/} Thus, Sirius/XM’s call for tighter *out-of-band* vehicular radar emissions in the SDARS band is pointless, as none will be present at 2.3 GHz.

III. SARA Strongly Supports Siemens VDO’s Request for Minor Rule Amendments

SARA is an association composed of a wide variety of automakers and auto component manufacturers working together to promote a regulatory environment that will allow for the deployment of vehicular radars. From its inception, SARA has advocated rules that would permit the operation of a variety of different vehicular radar designs, including those with non-pulsed modulation

^{13/} See, e.g., ITU, *Radio Regulations* (Edition of 2001), Appendix 3 at ¶ 11 (“all emissions . . . which fall at frequencies separated from the centre frequency of the emission by $\pm 250\%$, or more, of the necessary bandwidth of the emission will generally be considered as spurious emissions.” See also FCC’s Advisory Committee for the 2003 World Radiocommunications Conference, *Draft Preliminary View for WRC-03*, 16 FCC Rcd 10283 (2001) (supporting adoption of the proposed boundary definitions).

^{14/} The frequency separation used for defining the out-of-band and spurious domains may vary somewhat depending on the type of modulation used, but under any formula, the nearly 20 GHz separation between the SDARS band and the vehicular radar band is sufficient to ensure that any emissions appearing at 2.3 GHz will be deemed spurious.

techniques. Such rules promote a competitive, level playing field that will provide automakers and their customers with the largest possible selection of devices from which to choose.

Although pleased with the Commission's general determination that the UWB rules should permit various modulation types, [15/](#) SARA was disappointed that certain technical requirements contained in the UWB Order nevertheless prevent the certification of the Siemens VDO pulsed frequency hopping system as a UWB device, without any concomitant increase in interference protection being afforded to the authorized services. As noted above, EESS was the only incumbent service identified in the UWB proceeding for which any party expressed a concern about the potential of interference from vehicular radars. As Siemens VDO substantiated with a compelling technical showing, its pulsed frequency hopping device, like the other SARA systems, poses no threat of harmful interference to EESS. Siemens VDO will be subject to the same requirements to attenuate its emissions appearing 30 degrees or more above the horizon as apply to all UWB vehicular radars. [16/](#) Moreover, certification of the Siemens VDO device will neither increase the overall number of vehicular radars to be deployed, nor in any way alter the assumptions that served as the basis for establishing the attenuation levels mandated by the rules. Finally, as explained in section I, *supra*, EESS receivers are unable to distinguish between the different modulation types. Therefore, pulsed

[15/](#) *UWB Order* at ¶ 32.

[16/](#) *See* 47 C.F.R. § 15.515(c).

frequency hopping devices will have no effect on the potential for harmful interference to EESS.

Importantly, Siemens VDO does not request wholesale changes in the Commission’s carefully crafted UWB regime, but instead seeks narrowly-focused amendments that are specific to vehicular radars in the 22 – 29 GHz band. There would be no negative consequences associated with permitting such devices to occupy the 500 MHz UWB minimum bandwidth within any 10 millisecond period, rather than “at any point in time.” [17/](#) The purpose of the current instantaneous bandwidth requirement is to minimize the exposure of receivers in the restricted bands to harmful interference. [18/](#) As described above, however, adoption of Siemens VDO’s petition would have no impact on the only relevant receivers here – *i.e.*, EESS in the 23.6 - 24.0 GHz band. Likewise, the Commission should have no qualms about permitting measurements of pulsed frequency hopping devices to be taken with the frequency hop active, as Siemens VDO has conclusively demonstrated that accurate mean power measurements can be made using a spectrum analyzer equipped with a root mean square (“RMS”) detector. [19/](#) Based on the specifics of the RMS detector measurement techniques, however, the Commission should permit a longer integration time to be used in order to achieve

[17/](#) See 47 C.F.R. § 15.503(d).

[18/](#) See *UWB Order* at ¶¶ 31-32.

[19/](#) See Siemens VDO Petition for Reconsideration at Appendix A, Figures 4, 7-8.

more accurate measurements. 20/ These three narrowly-crafted rule amendments will permit greater diversity in design and choice in the vehicular radar marketplace while doing nothing to increase the possibility of harmful interference to incumbent services.

V. Conclusion

For the reasons set forth above, SARA respectfully requests that the Commission reject the amendments to rule sections 15.503(d) and 15.515(d) suggested by MSSSI and Sirius/XM, respectively. Moreover, SARA strongly encourages the Commission to amend its rules as described in the petition by Siemens VDO to permit the operation of pulsed frequency hopping vehicular radars in the 22 – 29 GHz band.

Respectfully Submitted,

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Dated: July 31, 2002

20/ Section 15.521(d) specifies a one millisecond or less integration time. Siemens VDO conservatively requests that up to 10 milliseconds be permitted, although the RMS detector user manuals suggest even longer periods. *See* Siemens VDO Petition at 10.

CERTIFICATE OF SERVICE

I, Jean Claire Meikle, do hereby certify that the foregoing Opposition of the Short Range Automotive Radar Frequency Allocation Group was served this 31st day of July, 2002, by first-class U.S. mail or hand delivery on:

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