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	)	
	)	

PETITION FOR RECONSIDERATION
of
SIEMENS VDO AUTOMOTIVE AG

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SUMMARY

Siemens VDO Automotive AG ("Siemens VDO") seeks reconsideration of certain rules and language adopted in the Commission's recent Ultra-Wideband ("UWB") Report and Order that effectively prevent pulsed frequency hopping vehicular radars from qualifying as UWB devices.

Siemens VDO requests three changes to the current rules, as applied to vehicular radar systems operating in the 22 – 29 GHz band only:

(1) Revise the rules to permit vehicular radar devices to occupy the 500 MHz UWB minimum bandwidth within any 10 millisecond period, rather than "at any point in time," as currently required. Pulsed frequency hopping vehicular radars that require a few milliseconds to complete one full hopping cycle cannot comply with the current rule.

(2) Revise the language in paragraph 32 of the UWB Order that requires measurements of frequency hopping vehicular radar systems to be performed with the frequency hop stopped, as it prevents such devices from demonstrating compliance with the minimum bandwidth requirement. Siemens VDO submits a technical appendix demonstrating that accurate average emission measurements of its device can be obtained with the frequency hop active when using a spectrum analyzer equipped with a root mean square ("RMS") detector.

(3) Revise the UWB rules to permit an averaging time of up to 10 milliseconds, rather than the one millisecond currently allowed, when an RMS detector is employed to measure the average emissions of a pulsed frequency hopping vehicular radar system. The shorter one millisecond averaging time results in overstated measurements that can unnecessarily constrain the design of pulsed frequency hopping vehicular radar systems.

The narrowly tailored amendments described above will provide flexibility for vehicular radar manufacturers and promote competition in this new product market that promises important public safety benefits. Moreover, these changes will not increase the potential for harmful interference to the Earth Exploration Satellite Service in the 23.6 – 24.0 GHz band.

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In the Matter of	)	
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Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)	ET Docket No. 98-153
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PETITION FOR RECONSIDERATION OF SIEMENS VDO AUTOMOTIVE AG

Siemens VDO Automotive AG ("Siemens VDO") 1/ hereby submits this Petition for Reconsideration in the above-referenced matter, pursuant to Section 1.429 of the Commission's rules. 2/ Specifically, Siemens VDO seeks reconsideration of specific rules and language adopted in the Commission's recent Ultra-Wideband ("UWB") Report and Order 3/ that effectively prevent pulsed frequency hopping vehicular radars from qualifying as UWB devices. Siemens VDO requests that the rules, *as applied only to vehicular radar systems in the 22 – 29*

1/ Siemens VDO Automotive is one of the world's leading suppliers of high-tech electronics for automotive applications. The company is active in fields such as cockpit and car communication systems, airbag and ABS electronics, and motor control and fuel injection technology. The current company was formed by a 2001 merger of Siemens Automotive and Mannesmann VDO, resulting in a combined force of some 50,000 employees in 34 countries, including the United States.

2/ 47 C.F.R. § 1.429.

3/ *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*").

GHz band, be amended to permit the operation of pulsed frequency hopping devices that otherwise comply with the peak and average emission limits contained in the *UWB Order*. Such a narrowly tailored amendment will provide flexibility to vehicular radar manufacturers and their automobile manufacturer-customers, and will promote competition in this new product market, without increasing the potential for harmful interference.

I. Background

Siemens VDO is an active member of SARA, an association composed of the world's leading automobile manufacturers and automotive component manufacturers. 4/ SARA is currently working to promote the development and deployment of short-range UWB vehicular radars, operating with a center frequency at 24.125 GHz, that will revolutionize the field of automotive safety. These vehicular radars will serve as the core component of the next generation of collision mitigation systems, which, integrated with an automobile's existing safety systems, will reduce the incidence and severity of automotive accidents. 5/

4/ In addition to Siemens, SARA is made up of the following automotive component manufacturers: *A.D.C., Bosch, Delphi Automotive Systems, Hella, InnoSent, Megamos, 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.*

5/ The public safety benefits of such systems will be significant. Statistics from the National Highway Transportation Safety Administration ("NHTSA") suggest that vehicular radar could address 88 percent of all causes of rear-end collisions.

Because of the critical importance of UWB approval to the development of these vehicular radars, SARA was an active participant in the UWB proceeding, making multiple oral and written *ex parte* presentations before the Commission to explain the potential of vehicular radars and the technical parameters necessary to permit the operation of each of the several systems under development, including the Siemens VDO device. 6/

In the *UWB Order*, the Commission recognized that vehicular radars will enable "features such as near collision avoidance [and] improved airbag activation," among others. 7/ In acknowledging the important public safety role vehicular radars are likely to play, the Commission stated that it "expects vehicular radar to become as essential to passenger safety as air bags." 8/ Moreover, the Commission recognized that the vehicular radars proposed by SARA would comply with the UWB definition, making an explicit finding "that the SARA and Delphi systems . . . fall under the definition being adopted in this proceeding and that no

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Additionally, vehicular radar will help compensate for visual "blind spots" and will make street crossings safer for pedestrians.

6/ *See, e.g.,* SARA *Ex Parte* Presentation before the Office of Engineering and Technology (Nov. 13, 2001) at 20-27 (explaining the pulsed frequency hopping system being developed by Siemens).

7/ *UWB Order* at ¶ 20.

8/ *UWB Order* at ¶ 64.

further action is necessary." 9/ In addition, the Commission made a determination that "various modulation types" would be permitted. 10/

Despite the encouraging statements quoted above, the *UWB Order* nevertheless contains language in new rule Section 15.503(d) and in paragraph 32 that effectively prohibits the approval of vehicular radars employing pulsed frequency hopping techniques. Moreover, Section 15.521(d) imposes an unjustifiably short averaging time for root mean square ("RMS") average measurements that results in inaccurate power readings, and thereby places an unnecessary restriction on the design of pulsed frequency hopping vehicular radars.

II. Explanation of the Prohibitive Restrictions on Pulsed Frequency Hopping Vehicular Radars and Description of the Rule Revisions Needed

A. Pulsed Frequency Hopping Devices Cannot Occupy the UWB Minimum Bandwidth Instantaneously

Section 15.503(d) defines a UWB transmitter as an intentional radiator that "at any point in time has . . . a UWB bandwidth equal to or greater than 500 MHz." 11/ The Commission explained its rationale for this restriction by stating that "we do not wish to open the restricted bands for operation by any Part 15 device that can operate satisfactorily between the restricted bands." 12/ This

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9/ *UWB Order* at ¶ 270.

10/ *UWB Order* at ¶ 32.

11/ 47 C.F.R. §15.503 (effective July 15, 2002).

12/ *UWB Order* at ¶ 31. The Commission apparently presumed that any device not occupying the full 500 MHz bandwidth instantaneously would not "have

restriction manifests an objective on the part of the Commission to minimize the exposure of potential victim receivers in the restricted bands to the unknown effects of UWB transmitters using alternative modulation techniques. 13/

Pulsed frequency hopping vehicular radars cannot satisfy Section 15.503(d) because they do not instantaneously occupy the minimum UWB bandwidth, but instead fill the required spectrum over a period of time, such as a few milliseconds. Despite the smaller bandwidth that is instantaneously covered, such vehicular radars still occupy a contiguous 1 GHz block of spectrum. Significantly, it is not technically feasible to design the radar systems to "hop over" the restricted band at 23.6 – 24.0 GHz. Thus, UWB classification is required to allow for emissions into the restricted band.

Permitting pulsed frequency hopping vehicular radars to satisfy the minimum bandwidth requirement over the course of 10 milliseconds instead of instantaneously should present no concern regarding the impact of the radars on potential victim receivers. Unlike frequency hopping communications devices

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difficulty finding spectrum to operate without transmitting in one or more of the restricted bands." *Id.*

13/ *See, e.g., Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, ET Docket 98-153, Notice of Proposed Rulemaking, FCC 00-163 (rel. June 14, 2000) at ¶ 21 ("We recognize that other types of modulation, such as linear sweep FM, could be employed to produce UWB equipment. However, we do not believe that we have sufficient information to propose limits and measurement procedures for such systems. Until more experience is gained, we believe that our initial rule making proposals should reflect a conservative approach."). Although the UWB Order on one hand concludes that "various modulation types should be permitted," it also recognizes that "certain types of modulations, such as swept frequency, stepped frequency or frequency hopping systems" may be precluded. *UWB Order* at ¶ 32.

operating in bands below 6 GHz, where there are many victim receivers, vehicular radars need only demonstrate non-interference with EESS in the 23.6 – 24.0 GHz band. As discussed in part IV of this petition, EESS systems are not affected by the type of modulation employed by vehicular radar systems.

Requested Revision: The Commission should insert the following language after the first sentence contained in Section 15.515(b): "Any such radar system will qualify as a UWB device if, during any 10 millisecond period, it occupies a UWB bandwidth of at least 500 MHz, notwithstanding the provisions of section 15.503(d)."

B. Taking Measurements with the Frequency Hop Stopped Prevents Compliance with the UWB Minimum Bandwidth Requirement

On a related issue, in paragraph 32 of the *UWB Order* the Commission stated that for frequency hopping devices, measurements are taken with the frequency hop stopped. Like the "at any point in time" requirement in 15.503(d), this requirement effectively prevents pulsed frequency hopping vehicular radar devices from demonstrating that they satisfy the minimum UWB bandwidth. In imposing the requirement, the Commission explained that:

> the current measurement procedures require that measurements of swept frequency devices be made with the frequency sweep stopped. The sweep is stopped because no measurement procedures have been proposed or established for swept frequency devices nor has the interference aspects of swept frequency devices been evaluated based on the different measurement results that would be obtained from measurements taken with the sweep active. Similarly, measurements on a frequency hopping modulated system are performed with the frequency hop stopped. With the hopping stopped, it is unlikely that frequency hopping systems would comply with the minimum bandwidth

requirements unless an extremely wide bandwidth hopping channel is employed. 14/

Based on the language of paragraph 32, it is evident that the Commission required the hop to be stopped during measurement out of concern that: (1) adequate procedures do not exist to measure accurately the emissions resulting from active hopping transmissions and (2) the interference impact of non-pulsed modulations had not been evaluated sufficiently. With respect to the first concern, the use of a root mean square ("RMS") detector in fact provides true average power measurements that can be taken with the hop active. Siemens VDO has prepared a paper, attached as Appendix A, that illustrates the validity of measurements taken using an RMS detector. In the paper, Siemens VDO first calculated a theoretical expected average power for its pulsed frequency hopping vehicular radar device. Siemens VDO then compared this theoretical average to actual measurements taken with the frequency hop active, using an RMS detector. *See* Appendix A, Figures 4, 7-8. The RMS measurement was within 1.1 dB of the theoretical expected average power spectral density ("PSD"), illustrating that accurate measurements can be made with the frequency hop active.

With respect to the second concern, Appendix A also demonstrates that the Siemens VDO device has no higher interference potential than UWB transmitters employing a pulsed or burst-like modulation technique. Figure 3 of Appendix A illustrates that in the time domain, the emissions of the Siemens VDO vehicular radar are burst-like, very similar to a pulsed UWB transmitter. These

14/ *UWB Order* at ¶ 32.

measurements also show that the Siemens VDO device transmits at peak and average power levels authorized under the UWB rules. Finally, as explained in more detail below, the modulation used by the Siemens VDO vehicular radar does not pose a higher potential for harmful interference to EESS receivers than pure pulse-based vehicular radar devices.

Requested Revision: The Commission should clarify that when using a spectrum analyzer with an RMS detector, mean power measurements on pulsed frequency hopping vehicular radar devices may be taken with the hop active.

C. A One Millisecond Integration Time Results in Overstated Average Emission Measurements

The UWB Order and Section 15.521(d) provide that the RMS detector measurement of average emissions be based on a one millisecond or less integration time. 15/ As discussed in more detail in Appendix A (pp. 13, 19-23), a one millisecond averaging time is not long enough to permit an accurate RMS power measurement of pulsed frequency hopping systems that require longer periods of time to complete one entire hopping cycle (the "frame time"). Based on test measurements taken with the RMS detector and statements in the spectrum analyzer documentation, it is evident that a longer averaging time produces more accurate measurements of the average emissions. This results from the fact that a longer averaging time permits a greater number of individual measurements upon

15/ Recognizing that adjustments may be necessary as more experience is gained with UWB measurements, the rule provides that "alternative measurement techniques may be considered by the Commission."

which to calculate the average. 16/ As shown in Appendix A, an averaging time that is too short (i.e., less than the frame time) will result in measurement values that are higher than the true average value (i.e, the shorter the averaging time, the more the measurement value will approach that of a sample or peak detector value). 17/

FCC staff have indicated that the maximum one millisecond period was specified to prevent the use of additional blanking or gating time to obtain a lower mean power measurement, and to coincide with the integration times of certain victim receivers operating below 6 GHz. Permitting a longer averaging time would not undermine the policy underlying Section 15.521(d), as another provision contained in that section already restricts the use of additional blanking or gating time to obtain a lower mean power measurement results. Specifically, the rule states that "If pulse gating is employed where the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition interval, measurements shall be made with the pulse train gated on." 18/

To obtain a more accurate RMS measurement of pulsed frequency hopping vehicular radars, an integration time of at least 10 milliseconds should be permitted. Such a time period corresponds better with the typical integration times

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16/ Siemens recognizes that one millisecond is an adequate period of time for measurements of pulse-based systems, as a greater number of individual measurements can be recorded in this time span on such systems.

17/ *See* Appendix A at 13, 19-23.

18/ 47 C.F.R. § 15.521(d) (effective July 15, 2002).

for most EESS systems operating at 24 GHz (which can be over 160 milliseconds). Because EESS is the only identified potential victim service in the 23.6 – 24.0 GHz restricted band, no shorter period should be required. 19/ Moreover, an integration period of 10 milliseconds still represents a conservative approach. If the recommendations contained in spectrum analyzer documentation were followed, an integration time of at least three to five times the frame time of a particular device would be used, and likely would result in a lower – and presumably more accurate – RMS readings.

Requested Revision: Section 15.515(d) should be amended by adding the following new sentence at the end of that subsection: "An averaging time of up to 10 milliseconds may be used when an RMS detector is employed to measure the average emissions of a pulsed frequency hopping device operating under the provisions of this section, notwithstanding the provisions of Section 15.521(d)."

III. The Siemens VDO Vehicular Radar Requires UWB Classification, Because It Has No Practical Alternative to Emitting into the 23.6 – 24.0 GHz Restricted Band

The ability to emit into the 23.6 – 24.0 GHz restricted band is a critical requirement of the Siemens VDO vehicular radar, as there are no practical alternatives. Siemens VDO is aware of no means by which a vehicular radar could be designed to split its emissions into two blocks, with one portion below and one portion above the 400 MHz restricted band, and still obtain the desired

19/ While a one millisecond integration time might relevant for considering potential interference to GPS receivers, this is not a concern in the 22 – 29 GHz band.

functionality. Such a configuration would be inconsistent with known principals of radar design. Accordingly, a contiguous block of spectrum is required for the entire bandwidth used by vehicular radars.

Moreover, it is essential for the Siemens VDO vehicular radar to be permitted to operate with a center frequency at or near 24.125 GHz, like the other vehicular radar devices being developed by the members of SARA. In its January 30, 2002 *ex parte* letter filed with the Commission in the UWB proceeding, SARA explained in detail why this is the only commercially viable band for vehicular radar devices. Like other SARA devices, the Siemens VDO vehicular radar is a dual mode device that will take advantage of the higher power limits available globally in the ISM band at 24.0 – 24.25 GHz. Shifting the center frequency of the UWB mode operation would increase both the cost and hardware complexity of the device. Notably, Siemens VDO would be unable to rely on high performance, inexpensive "off-the-shelf" 24 GHz components that are widely available due to high volume chip production and a mature market.

As SARA has noted in its filings, vehicular radar devices can only reach their potential to save lives and reduce the damage caused by traffic accidents if they are actually deployed. Deployment, in turn, is dependent on commercial viability, which can only occur if the device is priced low enough to attract more than just the very high-end of the car-buying public.

IV. Permitting Pulsed Frequency Hopping Vehicular Radars to Qualify as UWB Would Not Result in a Greater Potential for Interference in the 23.6 – 24.0 GHz Band

Grant of this Petition will enable pulsed frequency hopping vehicular radars to emit into the 23.6 – 24.0 GHz band, allocated to passive sensing in the Earth Exploration Satellite Service ("EESS"). EESS is the only system identified in the UWB proceeding as a potential victim of interference from 24 GHz vehicular radars. However, grant of this petition would not result in any greater potential for interference than what was already contemplated prior to adoption of the *UWB Order*.

A. The Overall Level of Vehicular Radar Deployment Would Not Be Increased

In February of this year, Siemens VDO participated as a member of SARA in discussions with NTIA to address concerns relating to the potential of UWB vehicular radars to cause harmful interference to government-operated EESS satellites. Those discussions resulted in the adoption of a phased-in requirement, codified in Section 15.515(c), to attenuate sharply all vehicular radar emissions that appear 30 degrees or more above the horizon. 20/ All vehicular radars, including pulsed frequency hopping vehicular radars, will be subject to this requirement.

20/ By 2014, vehicular radars will be required to attenuate such emissions by 35 dB. The Commission believes the attenuation levels demanded by NTIA may be overly conservative. In its calculations, NTIA failed to consider the attenuating effects of buildings, foliage, terrain and other vehicles. Moreover, NTIA provided no justification for imposing an even tighter protection margin than what was indicated by the already deficient calculations. *See UWB Order* at ¶ 196 and n.289.

NTIA derived the attenuation levels based on explicit assumptions about vehicle densities and the rate of vehicular radar deployment in the new vehicle market. Specifically, NTIA and SARA assumed a worst-case scenario that 40% of all vehicles in use would be equipped with vehicular radars by 2016. 21/ This 40% penetration figure was based on an unrealistically aggressive deployment assumption that every new vehicle after 2005 would be equipped with vehicular radar. As such, it was not based on the number of component manufacturers, nor was it predicated on the types of modulation techniques to be used. The ultimate vehicular radar market penetration will be the same, regardless of the presence of pulsed frequency hopping devices in the market, as any unmet demand would simply be filled by other device designs. Therefore, the grant of this Petition would not change the assumptions that underlay the NTIA's interference calculations, nor increase the potential for harmful interference.

B. EESS Systems Cannot Distinguish Between Pure Pulsed and Pulsed Frequency Hopping Modulation Techniques

The only parameters relevant to an interference analysis for EESS are the mean power of the vehicular radars and the total number of sensors. It is significant to understand that the type of modulation used for the vehicular radars – *i.e.*, pure pulsed or pulsed frequency hopping – is not relevant to the potential for

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21/ *See, e.g.,* SARA's "Assessment of Potential Interference of 24 GHz Automotive Short Range Radar to Passive Sensors Operating in the 23600 – 24000 MHz Band," Feb. 11, 2002 at 7-13. *See also* "Assessment of Potential Interference to the Passive Sensors Operating in the 23600 – 24000 MHz Band from Short Range Radar Systems," (Attachment 2 to Letter from William Hatch, NTIA, to Edmond Thomas, OET) (Feb. 13, 2002) at 5.

interference to EESS. This is true for two reasons. First, the integration time of EESS satellites is typically on the order of several milliseconds (over 160 milliseconds in some cases), which is too long to distinguish between the different modulation types. 22/ Second, EESS satellites integrate signals over a large footprint (*e.g.,* over several square kilometers), meaning that signals from typically several thousand vehicular radar sensor units are averaged together within one footprint. Thus, with integration over both long time periods and large geographic areas, the EESS receivers are unable to distinguish between the different modulation types, and the operation of pulsed frequency hopping vehicular radars would have no impact on the potential for harmful interference to EESS.

22/ *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).

V. Conclusion

For the reasons set forth above, and as supported by the data provided in Appendix A, a grant of this Petition will serve the public interest by improving automobile safety without compromising the policies underlying the relevant rules. Accordingly, Siemens VDO respectfully requests that the Commission amend its rules as described to permit the operation of pulsed frequency hopping vehicular radars in the 22 – 29 GHz band.

Respectfully Submitted,

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