<u>VIA EMAIL</u>
dgse-uwb@ic.gc.ca

May 6, 2005

Dr. R.W. McCaughern
Director General, Spectrum Engineering Branch
Industry Canada
300 Slater Street
Ottawa, Ontario
K1A 0C8
Canada

<u>Re</u>: **Notice No. SMSE-002-05 -- Consultation Paper on the Introduction of Wireless Systems Using Ultra-wideband Technology**

Dear Sir:

The Satellite Industry Association ("SIA") hereby submits these comments in response to invitation for public comment on the document entitled *Consultation Paper on the Introduction of Wireless Systems Using Ultra-wideband Technology*, announced through Notice No. SMSE-002-05 of January 28, 2005 (the "UWB Consultation").[1] SIA welcomes the opportunity to contribute to the efforts of Industry Canada in adopting a regulatory framework that will both support the development of innovative UWB products and technologies, and adequately protect existing radiocommunication products and services from unacceptable interference.

SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, remote sensing operators and ground equipment suppliers.[2] Several space stations belonging

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[1] *See Canada Gazette*, Part I, Vol. 139, No. 6 (Feb. 5, 2005).

[2] SIA's Executive Members include The Boeing Company; Globalstar LLC.; Hughes Network Systems, Inc.; ICO Global Communications; Intelsat; Iridium Satellite, LLC; Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures; Northrop Grumman Corporation; PanAmSat Corporation; and SES Americom, Inc. SIA's Associate Members include Eutelsat Inc.; Inmarsat Ltd.; New Skies Satellites, Inc.; Stratos Global Corporation; and The DirecTV Group. The association's affiliated members include the Asia-Pacific Satellite Communications Council ("APSCC"); The California Space Authority; Compass Rose International; and Futron Corporation. For more information on SIA, please visit the association's web site at www.sia.org.

to SIA members have been approved by Industry Canada for inclusion on the List of Satellites Approved to Provide Fixed-satellite Services (FSS) in Canada. Further, some SIA members provide end-to-end satellite-based services in Canada. SIA serves as an advocate for the commercial satellite industry on regulatory, policy and legislative issues common to its members. With its member companies providing a broad range of manufactured products and services, SIA represents an important voice for the satellite industry.

As background, the commercial satellite industry generated approximately US$90 billion in revenues in 2003, enabled over US$1 trillion in global economic activity and facilitated hundreds of thousands of jobs. On a daily basis, economic activity depends on the voice, video and data services provided by commercial satellites to fixed and mobile end users, corporations and governments around the world. Commercial satellites deliver critical services for emergency responders and the armed forces -- both mission-critical and logistical. Satellites also provide the telecommunications backbone for television, radio and print media distribution. Over 60 million households worldwide subscribe to direct broadcast satellite services for their television programming, while community cable systems receive nearly all their video feeds from satellite distribution. Given these facts and figures, SIA's interest on the issues raised in the UWB Consultation is apparent.

With respect to Question 1 in Section 5 of the UWB Consultation, SIA shares the concerns identified by Industry Canada, and wishes to underline that the potential for interference to C-band downlinks is a matter of grave concern to the satellite industry. FSS operators use C-band frequencies to serve customers requiring a high degree of reliability. Among other things, these customers use C-band frequencies for program distribution to cable head-ends and radio/TV broadcast stations, broadband communications to vessels, commercial weather data distribution to airlines and pilots, and position location and status for trucking fleets. UWB interference could jeopardize the billions of dollars that FSS operators, customers and distributors have invested in FSS systems, and could interrupt vital FSS services.

SIA's comments will focus on Question 6 (Emission Masks), because the power level authorized to each UWB emitter -- in this case expressed as the EIRP in dBm/MHz -- is the single most important parameter available to the regulator to ensure that adequate protection is granted to other licensed services sharing the same spectrum. In addition, SIA will address the band 23.6-24.0 GHz in view of its critical importance for satellite systems operating in the Earth Exploration Satellite Service (passive) ("EESS (passive)").

1. PRELIMINARY COMMENTS

1.1. Harmful Interference Is Not an Acceptable Benchmark

As Industry Canada is well aware, the design of satellite links involves trade-offs between cost and performance. To minimize costs and to be able to deliver services to customers at the lowest possible price, satellite operators design links based on ITU-R

Recommendations that indicate allowances for interference caused by co-frequency transmissions employed by other telecommunication services and on link margins needed to compensate for propagation effects and other link degradations (*e.g.*, equipment aging and implementation losses). Any sources of uncoordinated interference, such as UWB, that go beyond the levels of co-frequency interference envisioned in ITU-R Recommendations, have not been taken into account in satellite operators' link budgets. These sources of interference, therefore, have the potential to degrade service below that which satellite operators have committed to in their agreements with their customers or to disrupt service entirely.

In these circumstances, SIA wishes to underline that merely considering whether a new source of interference will cause "harmful interference" to satellite receivers is inadequate. Even if UWB devices do not, by themselves, cause harmful interference, they nevertheless reduce or eliminate the margin that satellite operators have set aside, based on allowances set in ITU-R Recommendations to cope with interference from co-frequency sources. If UWB devices, in the aggregate, exceed these allowances they will, in combination with propagation effects and other link degradations, expose satellite systems to levels of interference higher than they have been designed to tolerate.

Clearly, harmful interference cannot be used as a standard for authorizing new users. Harmful interference is an extreme level of interference that "seriously degrades, obstructs or repeatedly disrupts" the operations of a communications system.[3] Harmful interference is rarely seen when properly functioning radio equipment is used in a frequency band by services or systems that operate on a co-primary basis. At the same time, it is clear that just because interference between such services or systems in a band does not rise to the high level of harmful interference it cannot reasonably be concluded that the interference is subjectively acceptable or tolerable to the victim service or users. For these reasons, SIA cautions Industry Canada on the use of harmful interference as a benchmark to define the conditions for introducing additional spectrum sharing in licensed bands.

More specifically, when defining the aggregate level of interference that unlicensed devices can produce to a licensee of the same spectrum, the use of harmful interference as a reference is completely inappropriate. A licensee cannot be expected to accept interference from unlicensed devices that places its operation at the threshold of being seriously degraded, obstructed or repeatedly disrupted.

1.2. Complaint Procedures Will Be Ineffective to Remedy Interference that Can Potentially Be Caused by UWB Devices

SIA wishes to emphasize the importance that power limits imposed on UWB devices be conservative. If a certain power level is authorized and very large number of devices is deployed, there is very little that can be practically done to remedy interference events.

SIA is of the opinion that interference to C-band earth station receivers cannot be redressed through complaint procedures. Even if Industry Canada commits to investigate

[3] S*ee* ITU Radio Regulations, No. 1.169.

any complaints of interference from UWB devices to authorized radiocommunication services, taking steps to ensure that the interference problem is corrected, and taking whatever enforcement actions may be deemed necessary, complaint procedures are an ineffective tool when it comes to interference from unlicensed UWB devices.

Although the cumulative interference effect of UWB devices on an FSS receiver may be quite large, the interference from a single UWB device will be brief and intermittent. It is not feasible in these circumstances for an FSS earth station operator to trace the source of interference from a UWB device, all of which are unlicensed and many of which are mobile. Even if the interference were traceable, moreover, preserving evidence that could be presented to the Industry Canada is virtually impossible.[4]

The same difficulties in enforcement will exist if the cumulative interference effect of UWB devices on an FSS receiver is such that it starts causing unacceptable interference. By the time the number of deployed active devices increases to the point that disruption of services starts to occur, it will be virtually impossible to do anything practical to curb the effects of interference.

2. EMISSION MASKS AND OTHER MEASURES INTENDED TO PROTECT AUTHORIZED RADIOCOMMUNICATION SERVICES

In Question 6, Industry Canada suggests that, when addressing emission masks that would provide protection to authorized services, respondents should take into account the emission masks for UWB systems proposed by the Federal Communications Commission ("FCC") and the European Conference of Telecommunications Administrations ("CEPT").

As a preliminary point, SIA notes that the values presented in Table 4 ("CEPT Draft Emission Masks") of the UWB Consultation do not correspond to the most recent values being considered by CEPT. In its most recent report to the European Commission ("EC"), the CEPT Electronic Communications Committee ("ECC") has proposed that an impact analysis based on a EIRP limit of -55 dBm/MHz in the range 3.1 GHz to 10.6 GHz be conducted.[5] Moreover, as discussed in more detail in Section 2.2 below, the ECC Report explicitly states that the FCC mask "does not by itself provide adequate protection from interference to the existing services."[6]

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[4] The experience with radar detectors in the United States provides a cautionary tale about the dangers of relying on enforcement procedures once unlicensed equipment that causes interference has been deployed. In response to widespread cases of interference to FSS VSAT earth stations, the FCC adopted tighter emission limits for new radar detectors. It acknowledged, however, that its options were limited with respect to radar detectors that already were in the field. *See Review of Part 15 and Other Parts of the Commission's Rules*, First Report and Order, 17 FCC Rcd 14063 at ¶ 15 (2002).

[5] Final Report by the ECC to the EC in Response to the EC Mandate to CEPT to Harmonise Radio Spectrum Use for Ultra-Wideband Systems in the European Union, Mar. 2005.

[6] *Id*. at Executive Summary, p. 4.

In a number of submissions to the FCC, SIA has repeatedly questioned the appropriateness of the -41.3 dBm/MHz limit.[7] The reasons why this limit does not offer the required protection to C-band FSS downlink frequencies (*i.e.*, 3600-3700 MHz and 3700-4200 MHz) are summarized below.

Two steps are required for determining the UWB power limits that are needed to protect C-band FSS downlinks against unacceptable interference:

(1) quantifying the interference-to-noise ("I/N") ratio that is needed to protect C-band FSS downlinks, which makes it possible to calculate the required power density after the receive earth station antenna (P_d); and

(2) quantifying the EIRP density limit (dBm/MHz) for UWB devices ($EIRP_{max}$) that will ensure that P_d is not exceeded.

The FCC mask has been based on an I/N value of 0 dB. As discussed below, there is no justification for using such a value. CEPT has recently conducted a comprehensive study of the protection requirements of different radiocommunication services with respect to the interference generated by UWB devices, and concluded that an I/N ratio of -20 dB is the appropriate protection requirement for FSS systems.[8]

In addition, multiple studies in the ITU have concluded that the 0 dB I/N ratio that underlies the FCC's standards is too high, and should be reduced by 20 dB or more. This is a strong reason why SIA has significant difficulty with the FCC mask, but it is not the only reason. Similarly, multiple studies within and outside the ITU establish that the -41.3 dBm/MHz $EIRP_{max}$ limit adopted by the FCC for UWB devices is way short of what is required to protect C-band downlinks. These studies demonstrate that, to provide adequate protection, the limit might have to be reduced by 30 dB or more.

2.1. An I/N of 0 dB Does Not Protect FSS Earth Stations

As discussed in more details below, an I/N of 0 dB does not protect FSS earth stations, and SIA cautions Industry Canada that the FCC's initial power density analysis was based upon incorrect assumptions and data.

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[7] *See, e.g.,* Petition for Reconsideration of the Satellite Industry Association, *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, ET Docket No. 98-153 (filed Mar. 11, 2005) (seeking reconsideration of the FCC's Second Report and Order and Second Memorandum Opinion and Order in this proceeding, FCC 04-285 (Dec. 16, 2004)).

[8] *See* ECC Report 64, The Protection Requirements of Radiocommunications Systems Below 10.6 GHz from Generic UWB Applications, Helsinki, Feb. 2005. A link to this report can be found at http://www.ero.dk/documentation/docs/doccategory.asp?catid=4&catname=ECC/ERC/ECTRA%20Reports. The overall conclusions of ECC Report 64 are also included in Annex 1 of the Final Report by the ECC to the EC in Response to the EC Mandate to CEPT to Harmonise Radio Spectrum Use for Ultra-Wideband Systems in the European Union, Mar. 2005.

Subsequent to the release of the FCC's First Report and Order on UWB,[9] information has come to light demonstrating that an I/N of 0 dB is inadequate. This information includes an official ITU recommendation, the findings of an ITU working party and an ITU task group, and the results of a study conducted by CEPT. These studies show that an I/N on the order of -20 dB is needed to protect FSS downlinks from interference. Although some parties believe that I/N should be even lower (*e.g.,* -23 dB), a -20 dB protection level is supported by the majority view expressed in ITU and European meetings addressing this subject. The findings of these ITU and European meetings are discussed below.

i. Recommendation ITU-R S.1432

Recommendation ITU-R S.1432 addresses the issues of allotting interference to different sources as a percentage of total noise.[10] In particular, *recommends 4* of this Recommendation[11] sets the interference to be allotted to all non-primary sources at 1% of the total noise.[12]

An I/N of -20 dB means that the allotment of non-primary sources in the interference budget is 1% of the total noise as provided for in Recommendation ITU-R S.1432. An I/N of 0 dB, on the other hand, corresponds to an allotment of 100% of the total noise to interference from all non-primary sources. The use of a 0 dB I/N, therefore, exposes C-band FSS downlinks to 100 times the level of interference from UWB devices than would be the case under Recommendation ITU-R S.1432 (*i.e.*, 100% of the total noise instead of 1% of the total noise).

It is important to note that FSS operators rely on Recommendation ITU-R S.1432 to develop their C-band link budgets. Satellite links operate with margins that are set to guarantee availability levels to which an operator is committed, under contract, to provide to a given customer. These margins will account for variations in propagation conditions (*e.g.*

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[9] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, First Report and Order, ET Docket No. 98-153, FCC 98-153 (rel. Apr. 22, 2002).

[10] Apportionment of the Allowable Error Performance Degradations to Fixed-Satellite Service, ITU-R S.1432 (adopted at ITU Radiocommunication Assembly 2000).

[11] "[T]hat error performance degradation due to interference at frequencies below 15 GHz should be allotted portions of the aggregate interference budget of 32% or 27% of the clear-sky satellite system noise in the following way:

– 25% for other FSS systems for victim systems not practising frequency re-use;
– 20% for other FSS systems for victim systems practising frequency re-use;
– 6% for other systems having co-primary status;
– 1% for all other sources of interference"

[12] Some have proposed that a smaller I/N should be associated with UWB sources since other non-primary sources could also interfere with FSS downlinks. Then the aggregate from all non-primary sources would exceed 1%. For instance, an I/N=-23 dB would correspond to allotting half of the 1% allowance to UWB sources. Despite the solid grounds for using an I/N lower than -20 dB, most analyses conducted internationally have been based on I/N of -20 dB, in part due to the difficulties in apportioning this 1% allowance among several possible sources.

fading), equipment aging and other link degradations. An interfering emission may at a given point in time use up most of this margin without causing "harmful" interference, *i.e.*, without producing any noticeable degradation to the link. However, this does not mean that this interference is acceptable as it would put the link in a state in which a minimum variation in the conditions which the margin was intended to compensate for would (in the absence of such margin) severely degrade the link. In summary, satellite links designed to have a certain amount of interference from non-primary sources (1% of the total noise) cannot be expected to work properly with an interference from non-primary sources that is 100 times larger than budgeted. This would be equivalent to allocating to unlicensed devices 4 to 5 times more interference potential than that allocated to the combined effect of all co-primary FSS systems. For that reason alone, it is essential that a 0 dB I/N not be considered by Industry Canada.

ii. <u>Working Party 4A of the ITU Radiocommunication Sector Reaffirmed that Aggregate Interference from UWB Devices Should Be Smaller than 1%</u>

In a liaison statement to Task Group 1/8 (Compatibility between Ultra-Wideband Devices (UWB) and Radiocommunication Services),[13] Working Party 4A stated the following as a result of discussions that took place in its April 2004 meeting:

> WP 4A confirms the allowable interference levels caused by UWB which were previously sent to TG 1/8. Recommendation ITU-R S.1432 contains the allowable degradations to the FSS below 15 GHz. The Recommendation states that for **all** sources of long-term interference that is neither from FSS systems, nor from systems having co-primary status, the allowable interference noise contribution is 1%.
> For ease of calculation, 1% can be assumed on the uplink and 1% can be assumed on the downlink when assessing the long-term interference.
> WP 4A notes that this 1% value is the total of all sources of interference that are not FSS or co-primary. TG 1/8 should note that only a portion of the total of 1% should be apportioned to UWB.
> Short-term interference effects have not been considered by WP 4A.

SIA notes that this conclusion was supported by the vast majority of participants at Working Party 4A.

iii. <u>Task Group 1/8 of the ITU Radiocommunication Sector Has Incorporated the 1% Allowance in Several Texts Addressing Compatibility between UWB and FSS Systems</u>

Consistent with the protection requirements formulated by Working Party 4A, several texts generated at the last meeting of Task Group 1/8 (Geneva, Nov. 2004), and addressing

[13] Annex 26 to Document 4A/78 (10 May 2004), Liaison Statement to Task Group 1/8, Interference Caused by Ultra Wide-Band Devices into the Fixed-Satellite Service below 30 GHz.

the compatibility between UWB and FSS, incorporate the 1% allowance prescribed by Recommendation ITU-R S.1432 as the protection criterion required by FSS systems. For instance, results of compatibility with FSS downlinks are expressed in terms of I/N values and the need for further interference mitigation is concluded on the grounds that these values exceed -20 dB.[14] Moreover, Recommendation ITU-R S.1432 is explicitly quoted as setting the "service protection requirement" for FSS.[15]

In summary, the consensus choice in the ITU for addressing compatibility between UWB and FSS is an I/N of -20 and, at a minimum, this ratio is endorsed by a vast majority of participants.

iv. Studies Conducted within the CEPT also Concluded that I/N = -20 dB Is the Appropriate Protection Requirement for FSS Systems

CEPT has recently concluded a comprehensive study of the protection requirements of different radiocommunication services with respect to the interference generated by UWB devices. The results of these studies are contained in Report 64 of the Electronic Communications Committee ("ECC"),[16] and have concluded that the protection requirement should be based on Recommendation ITU-R S.1432, *i.e.*, should correspond to an I/N value of -20 dB.[17] This study contributes further to the international consensus favoring the -20 dB standard.

v. The Portion of the ITU Radio Regulations Offered by the FCC as a Basis for Choosing I/N=0 dB Is Not Applicable

SIA wishes to note that the FCC based its use of I/N=0 dB on Section 2.3.1 of Appendix 7 of the 1998 edition of the ITU Radio Regulations. It should be apparent from the foregoing discussion, however, that the ITU has not adopted a 0 dB standard for I/N, and that the FCC's reliance on Appendix 7 was misplaced. None of the ITU authorities that have addressed the I/N issue (Study Group 4 in Recommendation ITU-R S.1432, Working Party 4A in its liaison statement to Task Group 1/8, and Task Group 1/8) either looked to Appendix 7 for guidance or even suggested that Appendix 7 is relevant to the I/N issue. The same is true of CEPT.

[14] Attachment 3 to Annex 5 to Document 1-8/256 (17 Dec. 04), Working Document toward a Preliminary Draft New Report, Studies on Impact of Systems Using UWB Technology on Systems Operating Within the Fixed-satellite Service (*see* Section A.3.3.1.2.1).

[15] Annex 5 to Document 1-8/256 (20 Dec. 04), Structure of the Report on Impact of Devices Using UWB Technology on Radiocommunication Services (*see* Table in Section 7 (Conclusions) under A3).

[16] *Supra* fn. 8.

[17] *See* item 11 of the Table included in Section 8 of Report 64 (Overall Conclusions of the Report), or Section A11.2.3 of Annex 11 (Fixed satellite Service - FSS).

It is important to note that the 1998 edition of Appendix 7 that was used by the FCC is no longer in force. Neither the subsequent 2001 edition, nor the 2004 edition that is currently in force, provides any basis for the use of a 0 dB I/N. Even if the 1998 version were in force, the version would be inapplicable to the I/N issue for several reasons.

First, Appendix 7 concerns coordination between two primary services. As such, it has no relevance to situations in which one of the services does not have an allocation, and therefore lacks coordination status. Second, the FCC relied on the value of the parameter "J" given in Table II of the 1998 version of Appendix 7 (J = 0 dB for digital systems and -8 dB for analog systems). However, "J" is just an intermediate parameter in the calculations and is used with the objective of determining an interference level that is exceeded only for a small percentage of time (short term allowable interference). That is not pertinent here, because what has to be determined is the long-term interference corresponding to the aggregation of several UWB devices. Finally, other assumptions associated with the analysis in Section 2.3.1 of Appendix 7 of the 1998 edition of the ITU Radio Regulations are inapplicable to the current situation (*e.g.*, the number of interfering sources is n = 3). These mismatches provide additional evidence that the superseded version of Appendix 7 was not intended to address the I/N issue.

2.2. <u>Several New Studies Conclude that, in Order to Protect FSS Downlinks, the EIRP Density of Each UWB Device Would Have to Be Much Lower than the -41.3 dBm/MHz Authorized by the FCC</u>

Several expert bodies recently have examined the question of what is the appropriate value of the maximum EIRP density per UWB device ($EIRP_{max}$) that can be permitted consistent with protecting FSS earth stations, i.e. that will ensure that P_d (allowable power density after the receive FSS earth station antenna) is not exceeded. They uniformly have concluded that protection of FSS systems cannot be ensured unless the value of $EIRP_{max}$ for each UWB device is significantly lower than the -41.3 dBm/MHz limit adopted by the FCC.

SIA recognizes that developing an EIRP density limit is a difficult exercise that is dependent on the assumptions that are made concerning various parameters.[18] These uncertainties, however, dictate that Industry Canada err on the side of caution. It is all too possible that the interference generated by UWB devices will exceed what is predicted because the devices will be deployed and operated in a manner that deviates from the assumptions underlying the derivation of the EIRP density limit.

It is highly significant that multiple groups of experts, each examining this issue and applying its own set of assumptions, have determined that an EIRP density limit is needed that is well below -41.3 dBm/MHz. In the remainder of this section, SIA summarizes the

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[18] Without pretending to be exhaustive, parameters that have to be defined include: density of UWB devices; average activity factor of UWB devices; geographic distribution of these devices with respect to the interfered-with earth station; percentages of devices that are indoors and outdoors; and propagation models associated with indoor and outdoor devices. The first two of these parameters can be condensed by multiplying them together to create a single parameter (number of simultaneously active UWB devices).

findings of several studies conducted in the ITU and in CEPT. All these studies have initially assumed that each UWB device is radiating -41.3 dBm/MHz and have concluded that for a wide range of values assigned to other parameters (*e.g.*, UWB density and geographic distribution), the value I/N of -20 dB is significantly exceeded. If an I/N of -20 dB is exceeded by 20 or 30 dB, this means that in order to provide adequate protection to the FSS the permitted EIRP density should be reduced accordingly by 20 or 30 dB.

i. Analysis Contained in United Kingdom Document Submitted to the June Meeting of Task Group 1/8

As an example of a study where assumptions are clearly stated, Exhibit 1 to these comments contains an analysis presented by the United Kingdom to the June 2004 meeting of the ITU-R Task Group 1/8.[19] The effect of outdoor and indoor UWB units is separately considered, and a sensitivity analysis is conducted with respect to the density of active UWB devices, the FSS antenna height and elevation angle.

For indoor devices, a 10 dB building attenuation is included and after the attenuated signal leaves the building a combination of $1/r^2$, $1/r^3$ and $1/r^4$ models is used, depending on the distance from the building (*i.e.*, "r"). The modeling of the UWB density and distribution for the outdoor scenario is simply uniform. For the indoor scenario, a detailed model including a certain number of "hot spots" and residential users is described in detail in Section 2 of the document.

For a wide range of parameters characterizing the interference environment, the study determined that I/N significantly exceeds -20 dB for large percentages of time. Depending on the specific assumptions used, moreover, the I/N value of -20 dB can be exceeded by as much as 30 dB, even if only indoor UWB devices are considered. Therefore, in order to protect the FSS under the latter circumstances, $EIRP_{max}$ would have to be reduced to -71.3 dBm/MHz.

ii. Most Recent Conclusions of Task Group 1/8 on the Compatibility between UWB and FSS

The most recent outcome from ITU-R Task Group 1/8 addressing the compatibility between UWB and FSS contains a summary of several analyses, including that in the U.K. document discussed in the preceding section.[20] All these analyses lead to values of I/N that exceed -20 dB by different amounts that can be as large as 33 dB.

One of the studies in the Task Group 1/8 document concludes that, in order to protect FSS systems to the level corresponding to an I/N of -20 dB, the $EIRP_{max}$ for each UWB

[19] Document 1-8/152 (2 June 2004), FSS/Ultra Wideband Compatibility – Aggregate Interference Studies in the Space-to-Earth Direction.

[20] Attachment 3 to Annex 5 to Document 1-8/256 (17 Dec. 04), Working Document Toward a Preliminary Draft New Report, Studies on Impact of Systems Using UWB Technology on Systems Operating Within the Fixed-satellite Service (*see* Table 6).

device should be limited to -53 dBm/MHz (rural area), -66 dBm/MHz (semi-urban area) and -77 dBm/MHz (urban area). These numbers have also been tentatively included in the conclusions of the Task Group 1/8 document (section A.3.3.1.2.3), but have not been officially adopted by the group since they appear between square brackets.

There is nothing in the Task Group 1/8 outcome that corroborates the value of -41.3 dBm/MHz proposed by the FCC for $EIRP_{max}$. On the contrary, even if the more extreme numbers are discarded, there is overwhelming evidence that in order to protect FSS systems this number has to be significantly reduced.

iii. The ECC of the CEPT Has Recently Issued a Comprehensive Report on the Protection Requirements of Radiocommunication Services Including FSS with Respect to UWB

In February 2005, the ECC completed an extensive report addressing the protection requirements of several radiocommunication services *vis-à-vis* UWB.[21] The conclusions of this report with respect to the protection requirements of FSS downlinks coincide with the tentative conclusions of Task Group 1/8 discussed above.

In particular, the $EIRP_{max}$ value of -53 dBm/MHz for rural areas is associated with a density of 5 active devices per km^2 and a 100 m exclusion zone; the -66 dBm/MHz value for suburban areas is associated with a density of 50 active devices per km^2 and a 50 m exclusion zone; while the -77 dBm/MHz value for a dense urban area is associated with a density of 500 active devices per km^2 and a 10 m exclusion zone.

Once again, there is evidence here calling into question the limit of -41.3 dBm/MHz adopted by the FCC for $EIRP_{max}$.

iv. The ECC Has Produced a Final Report to the EC in Response to a Mandate on UWB

The EC has mandated CEPT "to undertake all necessary work to identify the most appropriate technical and operational criteria for the harmonised introduction of UWB-based applications in the European Union."[22] The final ECC Report was approved in a meeting held between March 14-18, 2005. The Executive Summary of this final report is included here as Exhibit 2.

In an attempt to achieve a compromise between the views of UWB proponents and those of the incumbent services, Task Group 3 has proposed an interim solution based on a value of -55 dBm/MHz for $EIRP_{max}$ and proposed that further work be performed.

In any case, the following text is included in the Executive Summary:

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[21] *Supra* fn. 8.

[22] Annex 7 to Final Report by the ECC to the EC in Response to the EC Mandate to CEPT to Harmonise Radio Spectrum Use for Ultra-Wideband Systems in the European Union, Mar. 2005.

"The main conclusions of the CEPT studies in response to EC Mandate on UWB are:

- the FCC Indoor UWB mask does not by itself provide adequate protection from interference to the existing services,
- the majority of the radio services considered requires more stringent generic limits than defined in the FCC masks, indoor as well as outdoor,
- the solution could be the two step approach as described above."

Although no conclusion is reached with respect to a final value for $EIRP_{max}$, the CEPT studies unequivocally conclude that the -41.3 dBm/MHz limit would not protect the existing services. Moreover, by proposing an interim value of -55 dBm/MHz, these studies give an idea of what a compromise solution that takes into consideration the conflicting interests involved might look like.

SIA wishes to underline that the ECC studies indicate a possible compromise route that permits the introduction of UWB technology while offering a better degree of protection than the flawed FCC mask. SIA urges Industry Canada to take into account a common European framework that may result from the work of the ECC, given the likelihood of integration of UWB systems in consumer and residential appliances in the near future.

2.3. Data Included in Industry Canada's UWB Consultation Corroborates that, in Order to Protect FSS Downlinks, the EIRP Density of Each UWB Device Would Have to Be Much Lower than the -41.3 dBm/MHz Authorized by the FCC

In addition to all the studies mentioned in Section 2.2 above, SIA notes that that Section 4.2.2 of the UWB Consultation includes an aggregate interference analysis conducted by Industry Canada. Based on the results of this analysis, the typical FSS parameters at 4 GHz being used in compatibility studies[23] and a protection requirement defined by an I/N = -20 dB, it is possible to derive the $EIRP_{max}$ that would ensure protection for the various scenarios addressed in the Industry Canada analysis and different off-axis angles. Some of the possible combinations including the most extreme situations (both those corresponding to highest and lowest interference potential) are presented in Table 1 below

[23] As provided by Working Party 4A to Task Group 1/8, *see* Table 1 in Annex 26 to Document 4A/78 (10 May 2004), Liaison Statement to Task Group 1/8, Interference Caused by Ultra Wide-Band Devices into the Fixed-Satellite Service below 30 GHz.

Table 1
Maximum Off-Axis EIRP (dBm/MHz) To Ensure Protection of FSS Downlinks for a Wide Range of Interference Scenarios

Propagation Model	Number of Emitters per (100m x 100m)	Earth Station Off-Axis Angle		
		5º	20º	≥ 48º
Free-Space	1	-93.4	-78.4	-68.9
	100	-99.4	-83.4	-74.9
Two-Ray or Modified Two-Ray [24]	1	-90.4	-75.4	-65.9
	100	-100.4	-85.4	-75.9
Log-Normal Shadowing	1	-90.4	-75.4	-65.9
	100	-96.4	-81.4	-71.9
Random Propagation Factor	1	-78.4	-63.4	-53.9
	100	-86.4	-71.4	-61.9

As an example of the calculation of the values in Table 1, we consider the situation in which there is 1 emitter in the (100m x 100m) area, the model assumes a random propagation factor (as described in the UWB Consultation), and the earth station looks at the UWB emitter at an angle of 20º. First, we compute the noise level N in 1 MHz, for a noise temperature of 100 K.[25]

$$N = 10\log(kTB) = -228.6 + 110 = -118.6 \text{ dBm/MHz}$$

In order not to exceed an I/N of -20 dB, the interference power in 1 MHz at the antenna terminals has to be limited to

$$I = N - 20 = -138.6 \text{ dBm/MHz}$$

According to Figure 1 in the UWB Consultation, for the random propagation factor model the median power spectral density at the antenna for 1 emitter per (100m x 100m) is approximately -116 dBm/MHz. For an off-axis angle of 20º, the antenna gain G(20º) is -0.5 dB.[26] Therefore, the interfering power at the terminals of the antenna will be

$$-116 + G(20^\circ) = -116 - 0.5 = -116.5 \text{ dBm/MHz}$$

This is 22.1 dB higher than the acceptable level of -138.6 dBm/MHz. Therefore, instead of the -41.3 dBm/MHz level used in the analysis, the $EIRP_{max}$ should be set at

$$EIRP_{max} = -41.3 - 22.1 = -63.4 \text{ dBm/MHz}$$

[24] These two propagation models are addressed together because the corresponding results presented in Figure 2 of the UWB consultation are essentially identical.

[25] *Supra* fn. 23.

[26] *Id*.

that is the value appearing in Table 1.

The results in Table 1 clearly show that the aggregate interference analysis conducted by Industry Canada does not support the limit of -41.3 dBm/MHz proposed by the FCC. On the contrary, if the full range of interference scenarios covered in Table 1 is considered, we conclude that protection is ensured by values of $EIRP_{max}$ that vary from -53.9 dBm/MHz to -100.4 dBm/MHz. Even if the more severe interference scenarios are eliminated, it is reasonable to assume that protection cannot be ensured unless the FCC mask is reduced by an amount in the range of 20 dB to 30 dB.

3. PROTECTION OF EESS (PASSIVE) IN THE BAND 23.6-24.0 GHz

SIA addresses here the potential for vehicular radar systems operating in the 22-29 GHz band to cause unacceptable interference to passive sensors operating in the EESS (passive) in the 23.6-24 GHz band.

Several satellite sensor types use the 23.6-24 GHz band. The Conical Scanning Microwave Imager/Sounder ("CMIS") sensor collects global microwave radiometry and sounding data to produce microwave imagery and other meteorological and oceanographic data. Data types include atmospheric temperature and moisture profiles, clouds, sea surface winds, and all-weather land/water surface. The CMIS detector is critical for short-term weather forecasts and for use in responding to short-term natural disasters and other catastrophic and/or unforeseen events. The Advanced Technology Microwave Sounder ("ATMS") sensor is a passive microwave sounder instrument that provides global atmospheric temperature and water vapor profile. Other sensor types using this band include, for example, the AMSR-E (Advanced Microwave Sounding Unit-E) and AMSU-A (Advanced Microwave Sounding Unit-A) sensors.

The band 23.6-24.0 GHz is used by a number of existing and planned U.S. and European meteorological satellites including POES, AQUA, NPOESS, ADEOS and METOP. The National Polar-Orbiting Operational Environmental Satellite System ("NPOESS"), under development by the U.S. Government and a key part of the Global Earth Observation Satellite System international collaboration, will have both CMIS and ATMS sensor instruments on its satellite for high sensitivity measurements spanning the entire globe. The generation of data from CMIS and ATMS sensors depends on the 23.6-24 GHz band because of the above characteristics. The band 23.6-24 GHz band is absolutely essential to meeting the NPOESS mission requirements.

There is no other frequency band in the spectrum with the same characteristics as the 23.6-24 GHz band. Total water vapor content from ground to the satellite is best measured in this band. The band 23.6-24 GHz band is unique within the microwave spectrum because it covers a small spectral zone where water vapor in the lower levels of the atmosphere is a moderately strong absorber of radiation. It is for this reason that the 23.6-24 GHz band is included in the ITU Radio Regulations under No. 5.340 as a band where all emissions are prohibited. Furthermore, the Radio Regulations Board has also provided guidance in its published "Rules of Procedure" urging administrations to avoid authorizations in the bands included in No. 5.340.

Results of studies submitted to the ITU-R Task Group 1/8 by a number of administrations indicate that the vehicular anti-collision short-range radars ("SRRs") operating in the band 23.6-24 GHz band would cause interference to passive sensors located on an EESS (passive) satellite. The actual interference level at the passive sensors located on the satellite would depend on the vehicle or SRR density, emission level, and such other parameters as the reflection coefficient. It is noteworthy that the studies submitted to the ITU-R indicate that emissions from U.S. authorized SRRs operating at a center frequency of 24.125 GHz with numerical densities as low as 9-10 vehicles per km2 could cause interference to the passive sensors on satellites operating in the 23.6-24 GHz band exceeding the sensor's interference threshold.

Under rules adopted for the U.S. by the FCC last year, any vehicular radar employing frequency hopping, stepped frequency or similar modulation methods may be authorized to operate in the 22-29 GHz band, exclusive of the 23.6-24 GHz band. However, the FCC permits the operation of vehicular radar systems in the 22-29 GHz band, including the 23.6-24 GHz band, for pulse or impulse generated UWB vehicular radar on the basis that this type of modulation cannot avoid the 23.6-24 GHz band. SIA urges Industry Canada to prohibit any vehicular radar, whether employing frequency hopping, stepped frequency and similar modulation methods or pulse and/or impulse-based from operating in the 23.6-24 GHz band. SIA believes that Industry Canada can accommodate UWB vehicular radar in a way that avoids usage of this band.

In any case, it should be taken into account that for SRRs that employ pulse and/or impulse modulation methods in the 22-29 GHz band (*i.e.*, for SRRs that are allowed to operate in the 23.6-24 GHz in the U.S.), the FCC has adopted a number of constraints that SIA urges Industry Canada to consider. Specifically, the FCC requires:

- That emissions from SRRs in the 23.6-24 GHz band, at angles of 38 degrees or more above the horizontal plane, must be attenuated an additional 25 dB below the maximum levels of -41.3 dBm/MHz. In addition, for SRRs authorized, manufactured or imported on or after January 1, 2005, the FCC required attenuation of (-41.3-25) dBm/MHz is to apply to emissions at vertical angles of 30 degrees or greater.

- Starting in the year 2010, the required attenuation increases another 5 dB, to 30 dB below the level of -41.3 dBm/MHz.

- Starting in the year 2014, the required attenuation increases an additional 5 dB (to 35 dB more below the level of -41.4 dBm/MHz) for any emissions in the 23.6-24 GHz band that appear 30 degrees or greater above the horizontal plane.

In summary, an interference-free environment in the 23.6-24 GHz band is critical to the NPOESS and other EESS (passive) satellite systems. Protection against unacceptable interference to passive sensors deployed by NPOESS is important because the capabilities of the NPOESS system to offer significant safety of life benefits support for weather prediction, climate modeling, homeland security and other common objectives. SIA respectfully urges Industry Canada to take these comments into consideration when adopting rules and regulations for SRRs in the 22-29 GHz band.

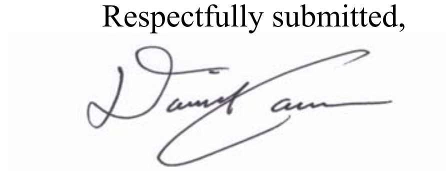
4. CONCLUSIONS

For the reasons discussed in Section 2 above, SIA strongly opposes the adoption of an emission mask of -41.3 dBm/MHz in the band 3400-4200 MHz. As demonstrated from several studies conducted in the ITU and CEPT, as well as Industry Canada's own study included in the UWB Consultation, such a mask does not offer adequate protection to FSS downlinks.

From the studies conducted by Industry Canada, it can be concluded that even if the more severe interference scenarios are disregarded, there are grounds to reduce the -41.3 dBm/MHz number by as much as 30 dB. SIA suggests that Industry Canada consider a -65 dBm/MHz mask in the band 3500-4200 MHz as a possible compromise solution between providing full protection to FSS downlinks and encouraging the development of UWB technology.

Further, SIA emphasizes that an interference-free environment in the 23.6-24 GHz band is critical to the NPOESS and other EESS (passive) satellite systems. Protection against unacceptable interference to passive sensors deployed by NPOESS is important because the capabilities of the NPOESS system to offer significant safety of life benefits support for weather prediction, climate modeling, homeland security and defense objectives. In this respect, SIA respectfully urges Industry Canada to take the comments in Section 3 above into consideration when adopting rules and regulations for SRRs in the 22-29 GHz band.

Respectfully submitted,



David Cavossa
Executive Director
Satellite Industry Association
1730 M Street, N.W. Suite 600
Washington, D.C. 20036
United States of America
Tel.: 202-349-3651

Cc: Larry Shaw
Director General, Telecommunications Policy Branch