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**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Telecommunications and**  
**Information Administration**  
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FEDERAL COMMUNICATIONS COMMISSION  
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Ms. Magalie Roman Salas  
Secretary  
Federal Communications Commission  
The Portals  
445 Twelfth Street, S.W.  
Room TW-A325  
Washington, DC 20554

Re: Revision of Part 15 of the Commission's Rules Regarding Ultrawideband  
Transmission Systems, ET Docket No. 98-153.

Dear Ms. Salas:

Forwarded to you for inclusion in the public record of the above-referenced docket, please find enclosed an original and five copies of the Reply Comments of the Interagency Global Positioning System (GPS) Executive Board. In addition, please find enclosed a diskette with the Reply Comments in electronic form.

The Interagency GPS Executive Board requested that the National Telecommunications and Information Administration provide these Reply Comments for the public record and for consideration by the Commission during its deliberations in this proceeding.

Please direct any questions you may have regarding this filing to the undersigned. Thank you for your cooperation.

Respectfully submitted,

Milton Brown  
Acting Chief Counsel

Enclosures

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List A B C D E

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554

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

**Reply Comments of the  
Interagency GPS Executive Board**

**STATEMENT OF INTEREST**

The Interagency Global Positioning System Executive Board (IGEB), established by Presidential Decision Directive, NSTC-6, March 29, 1996 and Co-chaired by the Departments of Defense (DoD) and Transportation (DOT),<sup>1</sup> hereby submits its reply comments in response to the Notice of Proposed Rulemaking (NPRM) in the above-captioned proceeding and all subsequent initial comments received to date with the Federal Communications Commission (Commission). In its NPRM, the Commission proposes to amend Part 15 of its Rules to facilitate the introduction and use of devices incorporating ultra-wideband ("UWB") technology. As the US Government body designated by both Presidential Directive and Public Law<sup>2</sup> to manage the dual civil and military use of the Global Positioning System (GPS) and its US Government-provided augmentations, the IGEB has a vital interest in this proceeding.

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<sup>1</sup> The Departments of State, Commerce, Justice, Interior, and Agriculture, the National Aeronautics and Space Administration, the Joint Chiefs of Staff, and the Central Intelligence Agency (in an advisory role) are also represented on the IGEB.

<sup>2</sup> Public Law 105-85, National Defense Authorization Act for Fiscal Year 1998, sec. 2281, 18 November, 1997

The IGEB notes that a number of non-government organizations, such as the National Association of Broadcasters, the Satellite Industry Association, the Air Transport Association, and the U.S. GPS Industry Council, and firms such as Qualcomm, Boeing, Lockheed-Martin, and Motorola have filed concerns that UWB will interfere with GPS and/or other safety-critical systems.<sup>3</sup> A particular concern of these respondents is the potential classification of ultra-wideband emitters as Part 15 devices, which would enable unlicensed operation of large numbers of UWB devices without ample time to test and analyze the implications of aggregate UWB emissions on existing systems and services, especially those that operate in the restricted bands.

Some UWB advocates<sup>4</sup> have filed comments that argue that their technology does not, and will not create any interference; alternatively, they argue that if UWB does cause some level of interference, it will be indistinguishable from existing background “noise.” However, at least one UWB manufacturer filed comments that explain how a single UWB emitter can be turned into a GPS jammer by bending and detuning the antenna.<sup>5</sup> This manufacturer has been supportive of protecting GPS by keeping UWB emissions above 3 GHz. In addition, preliminary results of testing conducted for the DOT by Stanford University indicate that interference to GPS from UWB emissions can occur.<sup>6</sup>

Within the U.S. Government, comments filed with the Commission by both the DOT and the DoD have emphasized the Commission’s statement that “it is vitally important that critical safety systems operating in the restricted frequency bands, including GPS operations, are protected against interference.”<sup>7</sup> Both Departments have expressed concern that GPS receivers might not be able to acquire and track GPS

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<sup>3</sup> Filed Comments In the Matter of Revision of Part 15 of the Commission’s Rules, Regarding Ultra-Wideband Transmission Systems, ET Docket No. 98-153, from Arthur D Little, September 13, 2000; ARINC/ATA, AOPA, Boeing, Garmin, Motorola, NBAA, Qualcomm, Rockwell Collins, Satellite Industry Association, SiRF, Stanford University, and the USGIC, September 12, 2000; Olle Edvardsson and Mikael Kleman, August 8, 2000.

<sup>4</sup> ANRO Engineering, Inc., Time Domain, Aetherwire, Fantasma, Interlogix, Kohler, Kronhne, Zicron, Endress, Siemens Automotive, Valeo, and Dr. Annan.

<sup>5</sup> Response to FCC Notice of Proposed Rule Making, Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems, ET Docket No. 98-153, submitted by Multispectral Solutions, Inc.

<sup>6</sup> Department of Aeronautics and Astronautics, Stanford University Comments filed in response to Notice of Proposed Rulemaking in the Matter of Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems, ET Docket No. 98-153 (Sept. 12, 2000) at 16.

<sup>7</sup> Comments on ET Docket No. 98-153 from the Department of Defense (MILDEP IRAC Members), 24 September 2000.

satellites in the presence of UWB signals. The DoD also stressed that acceptable emissions levels, protective technical criteria, and subsequent regulatory provisions for UWB devices must be based on credible test planning, test measurements, and the analysis of the resulting data, rather than on arguments emphasizing the lack of historical interference data from Part 15 unintentional radiators or on the past use of a limited number of currently available UWB-type devices.

The IGEB agrees with the above comments, provided by both government and industry regarding the unhindered operation of GPS. Many Departments and Agencies represented on the IGEB recognize the potential value of UWB technology for certain devices important to public safety and law enforcement, such as ground penetrating radar (GPR) and wall imaging devices (WID). However, the IGEB believes the assertion that "UWB devices appear to be able to operate on spectrum already occupied by existing radio services without causing interference, which would permit scarce spectrum resources to be used more efficiently," cannot be proven until the completion of thorough testing and analysis.<sup>8</sup> Undue haste, in the view of the IGEB, is not the appropriate way to balance the possible introduction of promising new technology into the commercial marketplace with the need to protect GPS. GPS is a system which represents an approximately \$18 billion dollar direct taxpayer investment, and provides national security, economic, scientific, and public safety services to millions of users worldwide.<sup>9</sup>

### **SUMMARY OF IGEB RECOMMENDATIONS**

Based on the comments filed to date in these proceedings, the IGEB asks the Commission to consider the following recommendations:

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<sup>8</sup> FCC Notice of Proposed Rule Making, FCC00-163, In the Matter of Revision of Part 15 of the Commission's Rules, Regarding Ultra-Wideband Transmission Systems, ET Docket No. 98-153, May 11, 2000, paragraph 1.

<sup>9</sup> The \$18 billion figure includes \$9 billion that was spent on GPS from 1974 to 1999, and another estimated \$9 billion that will be spent modernizing and sustaining the system up to fiscal year 2016.

*No interim or final rulings on the use of UWB devices in the restricted bands should be made until all testing and analyses are complete and public comments have been obtained.*

*The Commission should allow adequate time to enable the submission and careful analysis of data from on-going Government and private sector testing.*

*Depending on the results of current measurement efforts, a more comprehensive test strategy may be necessary to ensure that adequate rules are adopted to protect GPS and other existing services against potential interference from UWB emissions.*

The IGEB's supporting justification for these recommendations will focus on GPS and the frequency bands it utilizes. However, the IGEB believes that the interests of other existing systems and services could also be well served by its recommendations.

#### **BASIS FOR THE IGEB RECOMMENDATIONS**

- ◆ **As noted by the FCC and many respondents to the NPRM, UWB technology shows great promise. However, the immaturity of this technology could make it difficult to assess the potential for interference to GPS receivers.**

Many proponents of UWB technology that filed comments as part of this rulemaking process have noted the great potential for this area of technology.<sup>10</sup> Indeed, the DoD and DOT have expressed opinions in their filed comments to this effect. However, the IGEB also notes that some applications of UWB technology with potential mass market application, such as precise positioning within structures, wireless data transmissions, and wireless local area networks, are still developing. For example, in its

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<sup>10</sup> In addition to the comments filed by UWB manufacturers, at least 75 parties filed comments that painted the potential prospects for UWB technology in a positive light without any actual technical evidence to justify their enthusiasm.

most recent round of grant awards, the Advanced Technology Program (ATP), a division of the Department of Commerce's National Institute of Standards and Technology, has awarded a grant to Time Domain Corporation, a UWB manufacturer that has filed numerous documents as part of this rulemaking process, for the development of an indoor wireless network that could provide these very services within indoor settings.<sup>11</sup>

Receiving such a grant award from the ATP indicates the immaturity, uncertainty, and high risk nature of the technology. As the program's web site itself states, "The ATP provides cost-share funding in the critical early stages of R&D, when research risks are too high for other sources of funding."<sup>12</sup>

The continuing development of UWB technology and its applications also makes it difficult to assess the potential interference to GPS receivers from a broad range of UWB signal parameters. All of the on-going measurement efforts are examining a limited range of UWB transmission system parameters to assess the potential interference to GPS receivers. Based on the current understanding of UWB transmission systems, it is possible that these limited parameters may be representative of systems envisioned for commercial use. However, as UWB technology continues to evolve, additional parameters may need to be examined.

- ◆ **Before proposed UWB-based applications can be accommodated it must be shown through measurements and analyses that they do not interfere with existing authorized radio services. This is especially true for UWB applications proposed to operate in the restricted bands used by systems such as GPS that are used to provide critical safety-of-life applications.**

The possible regulation of all UWB technology under Part 15 of the FCC's guidelines was an idea that was criticized by a number of private sector respondents to the NPRM.<sup>13</sup>

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<sup>11</sup> Advanced Technology Program: 2000 Project Award to Time Domain Corporation — [http://www.nist.gov/public\\_affairs/atp/2000project.htm](http://www.nist.gov/public_affairs/atp/2000project.htm)

<sup>12</sup> "Prosperity Through Innovation," NIST, Advanced Technology Program (ATP) — <http://www.atp.nist.gov/atp/brochure.htm>

<sup>13</sup> For example, refer to the comments filed by ARINC/ATA, ARRL, Boeing, Cisco, Delphi, MSSI, and Sirius.

Similarly, DOT's comments stated that "[a]lternatively, a different subpart to Part 15 or even an entirely new part of the FCC's rules could perhaps best address the issues and opportunities posed by UWB technology."<sup>14</sup> The DoD's comments urged the Commission to "base any decisions on acceptable emission levels of UWB devices on credible analyses and measurements, and not on arguments emphasizing the lack of historical interference data from Part 15 unintentional radiators or on the past use of the limited number of currently available UWB-type devices."<sup>15</sup>

Some unintentional emitters, such as electric motor brushes, produce broadband noise. Other unintentional emitters, most notably personal computers, produce spurious emissions that are not like Gaussian noise, but rather manifest themselves as harmonics. However, the potential effects of these radiators on other systems may be significantly different from that expected from UWB devices. Personal computers, hair dryers, and other devices of this sort presently covered by Part 15 are not intended to be networked in a Time Division Multiple Access (TDMA) scheme to maximize band occupancy. However, according to comments filed by some UWB proponents in these proceedings, UWB devices intended to provide communications functions could be used in a network configuration. The networked operation of UWB transmission systems could be particularly deleterious to GPS receivers, which do not exhibit a resistance to pulsed signals when the emissions have a high duty cycle. Thus the impact to GPS receivers from UWB devices designed for networked applications must be evaluated before final rulings are established.

One respondent to the proceedings maintains, based on FCC precedent, that the burden of proof is on the applicants to show that no interference will result to existing authorized radio services from the addition of their systems.<sup>16</sup> As part of the record of this proceeding, UWB proponents have provided no credible technical evidence in their

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<sup>14</sup> DOT comments at 16.

<sup>15</sup> DOD comments at 2.

<sup>16</sup> Sprint PCS Supplemental Comments, October 6, 2000. This specific comment on burden of proof referenced the following citations: *New Channels Communications*, 57 R.R.2d 1600 ¶ 6 (1985)("The burden of demonstrating that there is no potential for interference rests with the applicant."); *Cosmopolitan Enterprises*, 15 F.C.C.2d 659, 674 No. 4 (1967); *Waynesboro Broadcasting*, 1 F.C.C.2d 431, 432-33 ¶ 3 (1965)("[T]he burden of proof is upon the applicants to show that interference will not be caused to the [existing] installation by their proposals."); *Industrial Communications*, 6 FCC Rdc 264, 265 ¶ 12 (1990)("It is the burden of the applicant to demonstrate interference-free operation."); and *Eastern Michigan University*, 45 F.C.C.2d 456, 460 ¶ 11 (1974).

comments filed to date to prove that this is the case. Conversely, a number of parties (including some UWB proponents) filing comments in this proceeding, as previously stated, expressed concern about potential interference to GPS,<sup>17</sup> and some provided preliminary data to justify these concerns.<sup>18</sup> Thus, the IGEB can only conclude that additional evidence is needed to determine if UWB devices can co-exist with GPS and other systems without causing irreparable harm to the services they provide.

- ◆ **The adoption of interim or final rules regarding the implementation of UWB technology, especially as they relate to the proposed use of restricted bands, must wait for the completion of comprehensive and thorough testing, analysis, and public comment.**

At least two dozen private sector interests that have filed comments to the Commission's NPRM to date made it clear that the adoption of any new rules regarding the use of UWB devices must wait for the completion of comprehensive testing and the subsequent analysis of the resulting data.<sup>19</sup> Of these parties, 14 specifically mentioned concerns about potential interference to GPS.<sup>20</sup> Three UWB manufacturers also commented that concerns about interference to GPS must be taken seriously and/or suggested that additional testing will be necessary before any UWB emissions should be allowed in GPS bands.<sup>21</sup>

The U.S. Government position, as formally stated by the National Telecommunications and Information Administration (NTIA), is equally clear: "NTIA as

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<sup>17</sup> ARINC/ATA, AOPA, Boeing, , Garmin, Motorola, NBAA, Olle Edvardsson, Qualcomm, Rockwell Collins, Satellite Industry Association, SiRF, Stanford University, USGIC, Delphi, MSSI, Xtreme Spectrum.

<sup>18</sup> MSSI, Stanford University

<sup>19</sup> ARINC/ATA, ARRL, AOPA, Arthur D Little, Boeing, Cisco, Garmin, Lockheed Martin, Metricom, Mobile Communications Holdings, Motorola, NAB, NBAA, Nortel Networks, Qualcomm, Rockwell Collins, Satellite Industry Association, SiRF, Sirius, Sprint, Stanford University, USGIC, WCAI, and XM Radio.

<sup>20</sup> ARINC/ATA, AOPA, Arthur D Little, Boeing, Garmin, Motorola, NBAA, Olle Edvardsson, Qualcomm, Rockwell Collins, Satellite Industry Association, SiRF, Stanford University, and the USGIC

<sup>21</sup> MSSI suggested that all UWB emissions be restricted to above 3.1 GHz, Delphi called for additional testing before any rulings on emissions below 2 GHz should be made, and Xtreme Spectrum stated that interference to GPS should be treated on a band-by-band basis.

joint manager of the spectrum that may be used by UWB devices, reserves its decision on whether unlicensed operation of UWB devices can be permitted in the restricted bands until detailed evaluations of the measurements and analyses have been completed.”<sup>22</sup> Supporting this conclusion, recommendations to the Commission regarding this rulemaking filed on behalf of the DoD by NTIA also hinged on the need to complete all on-going tests and analyses and an allowance for further comments and replies based on the resulting data.<sup>23</sup> Specifically, the DoD recommended that: (1) any ruling granting blanket approval of unlicensed UWB device operation in GPS or any restricted bands regardless of type of UWB use be deferred until after comments and replies are offered on all test data and results; and (2) restrictions be placed on UWB devices operating below 2.29 GHz to the extent identified by the results of on-going tests and analyses to ensure protection of sensitive earth station receptions in the 2200-2290 MHz band and to protect reception of GPS navigation signals in the 960-1215, 1215-1300 and 1559-1610 MHz bands; and (3) the Commission adopt rules to ensure that the levels of UWB spurious and out-of-band emissions in bands below 2.29 GHz resulting from UWB devices operating above 2.29 GHz are kept below the levels identified as problematic as a result of testing and associated analyses.

Similarly, comments filed with the Commission by the DOT stressed the need for carefully structured testing programs and the need to fully digest the resulting data before any rulings can be made.<sup>24</sup> These sentiments previously expressed by the private sector and the US Government are fully endorsed by the IGEB.

***No interim or final rulings on the use of UWB devices in the restricted bands should be made until all testing and analyses are complete and public comments have been obtained.***

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<sup>22</sup> Preliminary Comments of the National Telecommunications and Information Administration, September 12, 2000.

<sup>23</sup> DoD comments filed on October 6, 2000 at 2.

<sup>24</sup> Initial Comments of the United States Department of Transportation, September 12, 2000.

- ◆ **Testing programs underway within the US Government and industry will not be complete by the October 30, 2000 deadline for submission of test data.**

There are currently two testing efforts underway with Federal Government sponsorship that are attempting to assess the potential for interference to GPS from UWB emissions. Test plans for these efforts, one conducted for the DOT by Stanford University, and the other being accomplished by NTIA's Institute of Telecommunications Sciences (ITS), have been made part of the public record.<sup>25</sup> The DOT currently estimates that their testing might be completed by approximately January 31, 2001, pending the resolution of funding issues. There are also on-going test efforts underway within industry that should provide additional data that will need to be analyzed by US Government authorities prior to making any decisions regarding appropriate rules for UWB emissions. Some of these testing efforts also will not be completed by October 30, 2000 deadline. For example, Metricom is currently conducting a test that will not be completed until the end of November 2000,<sup>26</sup> and AT&T has requested nine additional months to complete their measurement and modeling efforts.<sup>27</sup>

The UWB-to-GPS testing sponsored by one UWB manufacturer and conducted by the University of Texas may be completed by the current October 30, 2000 deadline.<sup>28</sup> However, given the amount and complexity of the data collected, the Commission must allow sufficient time for parties to analyze and provide comments on this data.

***The Commission should allow adequate time to enable the submission and careful analysis of data from on-going Government and private sector testing.***

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<sup>25</sup> The Stanford University test plan, "Potential Interference to GPS from UWB Transmitters: Phase 1 – Accuracy Test for Aviation Receivers and Reacquisition Time Test for Land Receivers, Version 4.5, was submitted to the FCC as attachment 2 of the DOT's September 12 comments. The NTIA test plan was referred to in the Federal Register and in the NTIA's initial comments and can be viewed at the NTIA's web site: <http://www.ntia.doc.gov/osmhome/uwbtestplan/>.

<sup>26</sup> Comments of Metricom, September 12, 2000.

<sup>27</sup> Comments filed by AT&T.

<sup>28</sup> Testing conducted by the University of Texas-Applied Research Laboratory (UT-ARL) under the sponsorship of Time Domain has already resulted in the release of some data for analysis.

- ◆ **Based on the results of on-going measurement efforts, many questions related to the interference-free use of UWB devices may not be fully answered by current test and analysis regimes and, therefore, could require further research.**

Although it is clearly important to defer any rulings on UWB emissions until current UWB-to-GPS interference testing is completed, as discussed above, this testing alone may not provide all the information that is necessary to enable a final and comprehensive ruling. Despite the fact that preliminary results from the DOT-Stanford University testing clearly shows that UWB emissions can interfere with GPS operations, both this testing and the NTIA-ITS tests are limited, and it may not be possible in all cases to extrapolate the results to address the potential interference from many different types of UWB devices to a multitude of GPS applications. After reading the more than 140 comments submitted to the Commission, the IGEB also notes that very little is actually known about the signal characteristics of many devices that fall under the heading of UWB technology. Indeed, many developers and/or manufactures of UWB devices that responded to the NPRM failed to provide any technical data describing the properties of their emissions and emitters.<sup>29</sup> For example, none of the comments to this proceeding provided by UWB proponents have defined their proposed products in terms of peak power per nanosecond, a particularly important characteristic for determining potential interference to GPS.

The NTIA is attempting to address this fundamental lack of knowledge regarding UWB characteristics through an effort to “examine the emissions from several UWB devices to determine how best to characterize the many types of UWB signals and to describe procedures and methods for measuring of UWB signals for developing operable certification standards and criteria for them.”<sup>30</sup> However, the NTIA’s comments make it clear that these are triage-like interference assessments that may simply point out a need for additional measurements and analyses.

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<sup>29</sup> For example, pulsewidth, pulse repetition frequency, frequency range, peak power, peak power per second, and modulation and gating are all important signal properties that should related to specific bands expected to be used for a given UWB application.

<sup>30</sup> NTIA Comments at 3.

*Depending on the results of current measurement efforts, a more comprehensive test strategy may be necessary to ensure that adequate rules are adopted to protect GPS against potential interference from UWB emissions.*

Should additional testing be determined necessary after review and analysis of all test data, the IGEB will work with interested parties to establish an approach that can be used to fully characterize the potential impacts of UWB devices to the use of GPS.