

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C.

In the Matter of )  
 )  
Revision of Part 15 of the Commission's ) ET Docket 98-153  
Rules Regarding Ultra-Wideband )  
Transmission Systems )  
 )

REPLY COMMENTS OF SIRIUS SATELLITE RADIO INC.

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Sirius Satellite Radio Inc. ("*Sirius*") hereby submits the following reply comments in response to the Commission's Notice of Proposed Rulemaking ("*NPRM*") in the above-captioned proceeding.

**I. INTRODUCTION AND SUMMARY**

There is a strong thread that runs through the majority of the substantive comments filed in this proceeding, including those filed by Sirius. That thread is an underlying concern that the Commission's overarching approach in the NPRM to investigate the deployment of devices using ultra-wideband ("*UWB*") technology is flawed. The Commission's approach is widely considered to be flawed, first, because it fails to account appropriately for the fundamental difference between UWB technology and the frequency-domain communications technologies that the Commission customarily regulates, and the novel questions and challenges posed by spectrum sharing between those starkly different technologies. The NPRM does not acknowledge and account for the significant amount of data that must be collected, likely in several test phases, on the interaction between specific UWB applications and licensed, frequency-domain communications systems.

The second flaw in the Commission's approach is that the Commission seeks to authorize under a single set of rules a broad variety of UWB applications that have vastly different interference characteristics and potentials, which in most cases are as yet undescribed. Several commenters summed up this second flaw by rightly indicating that the Commission's proposed rules do not reflect that UWB is a technology and not a specific communications service. Many commenters argued, as did Sirius, that the Commission should consider UWB technology in a staged approach by focusing on individual UWB applications or classes of UWB uses with similar interference characteristics as these uses become better defined. In addition, the second flaw in the Commission's approach compounds the first because the need to investigate such a wide variety of undefined UWB applications results in an unbounded and unwieldy inquiry, with numerous variables likely to be left unknown or untested.

Heightening the commenters' concern about the Commission's approach is the impression that many commenters gathered from the NPRM that the Commission feels compelled to authorize the use of UWB technology on a fast track. The NPRM engendered this impression, despite its laudable language to the contrary, by setting what many commenters describe as an overly aggressive timetable for submission of testing results, by setting the comment and reply comment deadlines prior to this submission deadline and by issuing an NPRM with tentative conclusions, but no proposed rule text, when perhaps a Further Notice of Inquiry would have been more appropriate.

Furthermore, these underlying concerns were expressed by many commenters, including Sirius, XM Radio Inc. and various GPS interests, who have no competitive stake in whether the Commission authorizes UWB technology. These commenters' motives are "pure" and deserve special attention because their concerns are based solely on the likelihood of

technical interference and not on the desire to delay potential UWB competitors in the marketplace. In this respect, Sirius and many other commenters expressed their support for authorization of ground-penetrating radar (“*GPR*”) and through-wall imaging devices (“*WID*”), with appropriate rules and limitations, and assuming that testing results confirm that these devices are compatible with currently licensed systems. These devices, unlike potential UWB communications uses, are relatively well-defined, have public safety and other benefits, and, pending the outcome of testing, appear to be compatible with currently licensed systems, assuming certain rules and limitations.

Thus, the initial comments make clear that the Commission must adjust its overall approach to investigating UWB technology. The Commission should take a staged approach to its investigation of the UWB technology by considering specific classes of UWB applications as they develop and are capable of definitive description. Further, the Commission should group the wide variety of UWB applications according to their interference characteristics and tailor appropriate rules and restrictions for those similarly-situated UWB applications. *GPR* and *WID* devices seem to present the first such category of UWB applications for Commission investigation.

The Commission also should regulate UWB devices through a licensing procedure, such as blanket licensing, rather than under Part 15, in order to enable existing licensed systems to review the technical parameters for specific UWB devices, as they are developed, to determine whether the proposed device might interfere with their existing services and to allow the affected parties an opportunity to work out mutually acceptable arrangements to avoid harmful interference. The Commission must also adopt a more measured and realistic timetable for the baseline and application-specific testing of UWB technology. The record in

this proceeding describes a multitude of applications that employ UWB technology – some currently in production, some mere promises of things to come. For all UWB devices, the burden is on the proponents of this technology to demonstrate that the proposed devices will not have harmful effects on currently licensed systems. Even for existing UWB devices, however, this burden has not yet been met and too many unknowns remain: measurement techniques for UWB have yet to be developed, actual applications of UWB technology remain to be accurately described, aggregate effects remain uninvestigated, and additional test phases are necessary to construct a complete technical record. These unknowns cannot be answered in an abbreviated first phase of testing.

This revised approach -- a staged investigation with adequate time for thorough testing, culminating in a licensing procedure -- will benefit *both* the providers of currently licensed services *and* the proponents of UWB by preventing interference to existing licensed services and enabling deployment of UWB applications as they are developed and tested. Furthermore, answers to many of the more specific questions in the NPRM will follow rationally and more smoothly once this overall approach is in place.

## **II. UNDER THE COMMISSION'S OWN RATIONALE, UWB OPERATIONS SHOULD BE RESTRICTED TO SPECTRUM ABOVE AT LEAST 2.9 GHZ**

The NPRM proposes a cut-off frequency of 2.0 GHz below which UWB devices would be prohibited from radiating or would be subject to more stringent emission limits. The Commission listed three factors for its selection of 2.0 GHz as the cut-off threshold: (1) that many critical safety and public interest services are located below 2.0 GHz, (2) that propagation losses are greater above 2.0 GHz and (3) that most radio services above 2.0 GHz use directional

antennas.<sup>1</sup> Based on these factors, however, the initial comments in this proceeding demonstrate that a cutoff of 2.0 GHz is too low. In fact, the comments demonstrate that the Commission's technical assumptions originally supporting 2.0 GHz as a cutoff were flawed and that a higher cut-off frequency in the range of 2.9 to 3.1 GHz would be required to satisfy the Commission's criteria.<sup>2</sup>

First, the comments show that far too many important services between 2.0 and 2.9 GHz could suffer harmful interference from UWB operations. Comments from the Big LEO MSS, SDARS, WCS, Amateur Radio & Satellite, Aeronautical Radio-Navigation, MDS/ITFS services and other services near 2.0 GHz all express well founded concern about interference from UWB devices and propose a threshold higher than 2.0 GHz.<sup>3</sup> Furthermore, many commenters with interests near 2.0 GHz did not argue for a particular cut-off frequency but instead expressed grave concerns about the lack of adequate information about UWB devices. These commenters urged the Commission to do more testing, noting that much more technical

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<sup>1</sup> NPRM at ¶ 28.

<sup>2</sup> This "cut-off" frequency represents the cut-off point for *emissions*, not center frequency or peak output.

<sup>3</sup> Comments of US GPS Industry Council, ET Docket 98-153, at 25 (filed Sep. 12, 2000) ("*GPS Comments*") (proposing 3.0 GHz); Comments of National Association for Amateur Radio, ET Docket 98-153, at 17 (filed Sep. 12, 2000) ("*AARL Comments*") (proposing >2.5 GHz); Comments of Multispectral Solutions, Inc., ET Docket 98-153, at 2 (filed Sep. 12, 2000) ("*MSSI Comments*") (proposing 3.1 GHz); Comments of AT&T Wireless, ET Docket 98-153, at 7 (filed Sep. 12, 2000) ("*AT&T Wireless Comments*") (proposing 2.6 GHz); Comments of Mobile Communications Holdings, Inc., ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*MCHI Comments*") (proposing 3.0 GHz); Comments of Nortel Networks, ET Docket 98-153, at 7 (filed Sep. 12, 2000) ("*Nortel Networks Comments*") (proposing 5.9 GHz); Comments of Rockwell Collins, ET Docket 98-153, at 5 (filed Sep. 12, 2000) ("*Rockwell Collins Comments*") (proposing 5.15 GHz); Comments of XM Radio Inc., ET Docket 98-153, at 10 (filed Sep. 12, 2000) ("*XM Radio Comments*") (proposing 3.0 GHz).

data are required to enable commenters to even begin to offer intelligent analyses of the threshold issue.<sup>4</sup>

The comments also demonstrate that the Commission's assumptions underlying its second and third factors are also flawed. Sirius' comments noted that there is little difference in propagation losses between 2.0 GHz and 2.3 GHz, where SDARS operates.<sup>5</sup> Similarly, Cisco Systems demonstrated that there is little difference in propagation losses between 2.0 GHz and 2.5 GHz, where MDS operates.<sup>6</sup> These small differences in propagation losses are not sufficient to prevent UWB systems from interfering with existing systems operating between 2.0 and 3.0 GHz.

With regard to the Commission's third factor, Mobile Communications Holdings aptly noted that both Big LEO Mobile Satellite Systems and Satellite Digital Audio Radio

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<sup>4</sup> Comments of Aeronautical Radio and Air Transport Association of America, ET Docket 98-153, at 17-18 (filed Sep. 12, 2000) ("*ARINC/ATA Comments*"); Comments of Aircraft Owners and Pilots Association; ET Docket 98-153, at 1-2 (filed Sep. 12, 2000) ("*AOPA Comments*"); Comments of Arthur D. Little, Inc., ET Docket 98-153, at 2 (filed Sep. 13, 2000) ("*Arthur D. Little Comments*"); Comments of The Boeing Company, ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*Boeing Comments*"); Comments of Cisco Systems, Inc., ET Docket 98-153, at 10 (filed Sep. 12, 2000) ("*Cisco Systems Comments*"); Comments of the United States Department of Transportation, ET Docket 98-153, at 13 (filed Sep. 12, 2000) ("*DOT Comments*"); Comments of GARMIN International, Inc., ET Docket 98-153, at 8 (filed Sep. 12, 2000) ("*GARMIN Comments*"); Lockheed Martin Corporation, ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*Lockheed Martin Comments*"); Comments of Metricom, Inc., ET Docket 98-153, at 6-7 (filed Sep. 12, 2000) ("*Metricom Comments*"); Comments of the National Association of Broadcasters, ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*NAB Comments*"); Comments of Satellite Industry Association, ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*SIA Comments*"); Comments of SiRF Technology, Inc., ET Docket 98-153, at 3-4 (filed Sep. 12, 2000) ("*SiRF Comments*"); Comments of Stanford University GPS Research Lab, ET Docket 98-153, at 2 (filed Sep. 12, 2000) ("*Stanford University Comments*"); Comments of the Wireless Communication Association International, Inc., ET Docket 98-153, at 4 (filed Sep. 12, 2000) ("*Wireless Communication Association Comments*").

<sup>5</sup> Comments of Sirius Satellite Radio, Inc., ET Docket 98-153, at 14 (filed Sept. 12, 2000) ("*Sirius Satellite Comments*").

Systems (SDARS) stand as “glaring exceptions” to the NPRM’s statement that most systems operating above 2.0 GHz use directional antennas.<sup>7</sup> Big LEO and SDARS both operate with “low power transmissions into earth terminals that use omnidirectional antennas.”<sup>8</sup> As Sirius explained in its comments, SDARS provides tremendous public service benefits, including bringing a new level of audio-program diversity to more than 45 million consumers located outside urban centers.<sup>9</sup> Cisco Systems also notes that many MDS systems utilize omnidirectional antennas in their operations at 2.1 and 2.5 GHz.<sup>10</sup> Big LEO, MDS and SDARS services are susceptible to interference from UWB devices, and for this reason alone UWB operations should be restricted to spectrum above at least 2.9 GHz.

Moreover, the Commission should take special notice of the fact that even some UWB proponents agree that UWB systems operating below 2.9 GHz present a danger of interference to existing licensed services. Multispectral Solutions, for example, which has been actively involved in the development of UWB hardware for more than fifteen years, argued strenuously in its comments that even filtered UWB systems should be allowed to operate *only above 3.1 GHz*.<sup>11</sup> This position appears to be motivated by the wise view that it is far better to

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<sup>6</sup> Cisco Systems Comments at 5 (noting that there is less than a 2 dB difference in propagation losses between 2.0 GHz and 2.5 GHz).

<sup>7</sup> MCHI Comments at 3; *see also* Sirius Satellite Comments at 14.

<sup>8</sup> MCHI Comments at 3.

<sup>9</sup> Sirius Satellite Comments at 4-5.

<sup>10</sup> Cisco Systems Comments at 5.

<sup>11</sup> MSSSI Comments at 2, 17.

move slowly and approve workable devices as they are developed and tested than to move too quickly and spoil a promising market by causing interference to existing users.<sup>12</sup>

Finally, several UWB proponents indicated that a prohibition on operating in lower frequency spectrum bands will not impact their activities. For example, Fantasma Networks and Multispectral Solutions both indicated that spectrum below 2.0 GHz is not needed for UWB communications services.<sup>13</sup> And although Time Domain argued that spectrum below 2 GHz for UWB communications uses would be desirable for combined WID/communications uses,<sup>14</sup> Time Domain did not indicate that spectrum below 2 GHz is required for UWB communications uses. Furthermore, Time Domain indicated that automotive UWB applications, including pre-crash sensing and air bag deployment, will likely use higher frequency spectrum.<sup>15</sup> Delphi Automotive also indicated that its current vehicle radar sensor systems operate at 17 and 24 GHz and seemed to indicate that spectrum above 5 GHz is of most interest for automotive UWB applications.<sup>16</sup>

Thus, the initial comments in this proceeding demonstrate that according to the Commission's own rationale, the Commission should specify a cut-off frequency of at least 2.9 GHz and should prohibit all UWB applications, with the possible exception GPRs and WIDs,

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<sup>12</sup> Lucent Technologies, another strong proponent of UWB technology, has concluded that "interference distances for burst operations ... will result in a significant increase in interference potential." Comments of Lucent Technologies, Inc., ET Docket 98-153, at 3 (filed Sept. 12, 2000) ("*Lucent Comments*").

<sup>13</sup> Comments of Fantasma Networks, Inc., ET Docket 98-153, at 3 (filed Sept. 12, 2000) ("*Fantasma Comments*"); MSSSI Comments at 17.

<sup>14</sup> Comments of Time Domain Corporation, ET Docket 98-153, at 11 (filed Sep. 12, 2000) ("*Time Domain Comments*").

<sup>15</sup> Time Domain Comments at 14-15 (center frequency of 8 GHz for pre-crash sensing and 6 GHz for air bag deployment).

from radiating below this frequency. Furthermore, a cut-off frequency of at least 2.9 GHz, with appropriate exception for GPRs and WIDs, should not impact the range of proposed UWB services that can be offered because the initial comments in this proceeding make clear that communications, vehicle radar and other UWB applications can utilize spectrum well above 2.9 GHz.

### **III. THE COMMISSION SHOULD TAKE A STAGED APPROACH TO INVESTIGATING UWB TECHNOLOGY**

The Department of Transportation is correct to note the UWB is a *technology*, not a *service*.<sup>17</sup> Traditionally, the Commission has authorized particular services as they have been developed. This focus on a service or class of communications uses is rational because of the common interference characteristics of the emissions from the transmitting devices in the service or class. Thus, Sirius, the DOT and other commenters urged the Commission to take a staged approach to its investigation of the UWB technology.<sup>18</sup> Such an approach would allow the Commission to group UWB applications according to their interference characteristics and to tailor appropriate rules and restrictions for those similarly-situated UWB applications. Grouping similar UWB applications will also help to focus the testing efforts necessary to ensure non-interference with existing licensed systems and will allow the Commission to prevent unintended consequences that may occur if the Commission authorizes UWB uses before the baseline and application-specific testing of UWB is completed.

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<sup>16</sup> Comments of Delphi Automotive Systems Corporation, ET Docket 98-153, at 4, 18 (filed Sep. 12, 2000) (“*Delphi Comments*”).

<sup>17</sup> DOT Comments at 11 (“UWB is not just one but a family of new technologies with widely varying implementations and applications”); *accord* GPS Comments at 15.

<sup>18</sup> Sirius Satellite Comments at 19-20; DOT Comments at 15 (suggesting a “modular” approach may be most appropriate); GARMIN Comments at 7 (urging Commission to move forward

At this stage in the present proceeding, however, the question of exactly which UWB devices might be approved is still ambiguous, and the lack of specific proposals in the NPRM frustrates all parties' ability to make meaningful comments.<sup>19</sup> At the very least, the Commission urgently needs to clarify what it means by its stated desire to "accommodate very low power UWB devices within Part 15 of the FCC rules."<sup>20</sup> The Commission's idea of low power UWB devices may differ from industry's, and any miscommunication could have grave consequences.

The NPRM, for example, uses the phrase "low power" repeatedly, and specifically notes that "most of the near-term applications for UWB technology involve relatively low powers and short operating ranges."<sup>21</sup> However "low power" may ultimately be defined, even such low power devices may cause significant interference with licensed services.<sup>22</sup> Furthermore, based on the comments of UWB proponents, some of the devices being promoted for approval *right now* appear to be far more powerful, have a far larger operating range, and present far greater risks of interference than the devices the NPRM may be advocating for unlicensed operation. Aether Wire & Location, for example, states that its forthcoming

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on a "case-by-case basis" to examine specific types of UWB technology); ARRL Comments at 11-12 (recommending UWB devices be classed based on specific performance criteria).

<sup>19</sup> As the National Association for Amateur Radio notes, this NPRM "lists a few generalized, tentative conclusions about UWB configurations, and asks for comment on them. Thus, the Notice in this proceeding is more akin to a further Notice of Inquiry." ARRL Comments (Summary).

<sup>20</sup> NPRM at ¶ 19.

<sup>21</sup> NPRM at ¶ 18. The NPRM, at ¶ 15 for example, specifically cited the Department of Energy's Lawrence Livermore National Laboratory to support an expectation that "low power devices [will have] operating distances of 5 cm."

<sup>22</sup> See DOT Comments at 10 n.7.

UWB devices “will have at least 1 centimeter resolution with 30-60 meters range,”<sup>23</sup> and Fantasma Networks claims to be developing UWB data systems capable of 60 to 100 Mbps over distances of 50 to 100 feet.<sup>24</sup>

In addition to allowing a focus on the interference characteristics of specific devices, a staged approach avoids the need to develop technically awkward, one-size-fits-all regulations for the wide range of diverse UWB applications, which would be extremely time consuming and could necessarily delay the release of any UWB applications already invented and sufficiently tested. For example, Sirius, along with several other commenters, argued that GPR and WID were sufficiently defined to allow detailed consideration and specific testing of those applications.<sup>25</sup> The potential public safety benefits of these technologies further suggest that the Commission should make GPR and WID uses the Commission’s first priority. Sirius will fully participate in further proceedings designed to specify and test the exact parameters under which those UWB uses will operate. Once these potentially lifesaving technologies are appropriately tested and approved, the Commission may then turn its attention to the next phase of UWB devices that are sufficiently defined and ready for consideration.

#### **IV. THE COMMISSION SHOULD LICENSE UWB DEVICES RATHER THAN REGULATE THEM UNDER PART 15**

Several commenters, including Sirius, argued that a licensing procedure, such as blanket licensing, would be more appropriate for UWB devices because of the wide variety of potential UWB applications and the largely undescribed nature of UWB applications at this

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<sup>23</sup> Comments of Aether & Wire Location, Inc., ET Docket 98-153, at 1 (filed Sept. 12, 2000) (“*Aether Comments*”). (Note: 60 meters is 196 feet.)

<sup>24</sup> Fantasma Comments at 2.

<sup>25</sup> See, e.g., Sirius Satellite Comments at 19-20; GPS Industry Comments at 22; GARMIN Comments at 8-9.

time.<sup>26</sup> A licensing procedure, rather than a mere certification process, would permit existing licensed systems the opportunity to review a specific description of the UWB device's technical parameters to determine whether the proposed device might interfere with their existing services. Of course, this opportunity for review and input would come before the UWB device comes on the market, and therefore would allow affected parties to work out a mutually acceptable arrangement to avoid harmful interference before the UWB application disrupts the licensed service.

UWB proponent Multispectral Solutions raised another important point that supports the need for a licensing procedure. Multispectral Solutions noted that even an otherwise non-interfering UWB device can cause serious interference to existing devices if the device is allowed to operate near "any metal object or object containing metalization -- e.g., pocket calculator, watch, file cabinet, etc."<sup>27</sup> Other intentional or unintentional modifications of UWB devices may also vastly alter the interference characteristics of these devices.<sup>28</sup> The deployment of such a new and unproven technology may have other unanticipated effects on existing devices.<sup>29</sup> A licensing procedure will allow the Commission to impose conditions designed to prevent or mitigate potential interference problems as real world information becomes available about UWB deployment.

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<sup>26</sup> See, e.g., Sirius Satellite Comments at 20-21; Boeing Comments at 13-14; DOT Comments at 15 (suggesting licenses may be necessary for some UWB uses); MSSSI Comments at 2 (stating GPR should be considered on licensed basis); accord GPS Industry Comments at 50 (asserting UWB devices should not be regulated under Part 15, but that establishing a licensing regime is beyond the scope of this proceeding).

<sup>27</sup> MSSSI Comments at 4.

<sup>28</sup> See *id.* at 3-4. Such end-user modifications might take place accidentally (e.g., by damaging the antenna or using the device near a metal object) or intentionally (e.g., to work around safety switches or to increase power).

Finally, The Boeing Company, which is both a user of currently licensed spectrum and a proponent of UWB development,<sup>30</sup> raised another argument in favor of a licensing approach. Boeing noted that “the potential aggregate impact of ubiquitously deployed UWB systems is too significant for the Commission to authorize using a regulatory structure that provides the Commission with insufficient means to control the number and means of the UWB units in use.”<sup>31</sup> If UWB devices are authorized without licenses, tracking their proliferation will be virtually impossible. A blanket licensing procedure, for example, would allow the Commission to exert some level of control on the proliferation of UWB devices with a view toward controlling any potential aggregate effects from the devices, and would pose a minimal burden on UWB proponents.

**V. ADDITIONAL TESTING AND ANALYSIS IS REQUIRED BEFORE AUTHORIZING UWB DEPLOYMENT**

**A. UWB PROPONENTS HAVE THE BURDEN OF DEMONSTRATING THAT PROPOSED UWB DEVICES WILL NOT INTERFERE WITH CURRENTLY LICENSED SERVICES**

The UWB proponents argue that regulation of their devices under Part 15 is appropriate.<sup>32</sup> As discussed in the previous section, Sirius and other commenters disagree on this point. Nonetheless, the UWB proponents’ advancement of this proposition clearly indicates that they are proposing that their service operate on a non-interference basis to existing licensed

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<sup>29</sup> See e.g., DOT Comments at 12 (noting that some preliminary test results regarding the interplay between UWB and GPS devices are “counter-intuitive”).

<sup>30</sup> Boeing Comments at 2.

<sup>31</sup> *Id.* at 13-14.

<sup>32</sup> See, e.g., Aether Comments at 1; Delphi Comments at 7; Fantasma Comments at 4; Comments of Kohler Co., ET Docket 98-153, at 2 (filed Sept. 12, 2000); Time Domain Comments at 20.

users. Indeed, Time Domain indicated as much in its comments.<sup>33</sup> Furthermore, devices operating under Part 15 are “subject to the condition” that they cause “no harmful interference.”<sup>34</sup> Part 15 is also quite clear as to the solution that must be imposed when a Part 15 device causes interference to other devices: It must *cease operating*.<sup>35</sup>

The Commission’s rules and precedent are clear that spectrum users proposing to operate on a non-interference or secondary basis bear the burden of demonstrating their non-interfering character before the Commission will authorize their operations.<sup>36</sup> The policy underlying this requirement makes sense. Existing licensed spectrum users have made

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<sup>33</sup> Time Domain Comments at 7-8 (stating UWB technology has ability to operate on a “non-interfering secondary basis”).

<sup>34</sup> 47 CFR § 15.5(b) (emphasis added).

<sup>35</sup> 47 CFR § 15.5(c).

<sup>36</sup> “Stations of a secondary service shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date.” 47 CFR § 2.105(c). *See also*, 47 CFR § 74.939(g)(7): “The burden of proving that a facility operated under this section is not causing harmful, unauthorized interference lies on the licensee of the alleged interference facility . . . .” (ITFS); 47 CFR § 21.913(g): “The burden of proving that a high-power MDS signal booster station is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility . . . .” (MDS); *In re AirCell, Inc., Memorandum Opinion and Order, 15 FCC Rcd 9622* (rel. June 9, 2000) (finding AirCell to have carried its initial burden to demonstrate that its system is not likely to cause harmful interference); *In re Amendment of Parts 1, 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions; Request For Declaratory Ruling on the Use of Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations, Report and Order on Reconsideration, 14 FCC Rcd 12764* (1999) (“The burden of proving that a two-way facility is not causing unauthorized interference lies on the two-way licensee . . . .”; *In re Amendment of the Commission’s Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, Report and Order, CC Docket No. 92-166, FCC 94-261* (rel. Oct. 14, 1994) at ¶ 20 (Commission would consider authorizing a GSO system in the same band only upon a showing that the GSO operations would not cause interference to Big LEO systems); *In re David R. Williams, D/B/A Industrial Communications, Inc., 6 FCC Rcd 264* (1991) (“It is the burden of the applicant to demonstrate interference-free operation.”)

investments of millions<sup>37</sup> or even billions<sup>38</sup> of dollars and have a reasonable expectation that the Commission will insist upon a rigorous technical showing before authorizing non-interference uses. Furthermore, it is far more efficient and practical to confirm in advance that interference will not occur to the primary users of a spectrum band than to try to locate and correct thousands of cases of interference once an interfering device has been deployed. This is especially true when dealing with devices that may be mass marketed to consumers. The Commission must not disturb this bedrock foundation of spectrum management policy by allowing UWB proponents to shift the burden away from themselves – either to the Commission or to existing spectrum users.

Time Domain’s comments in this area raise particular cause for concern.

Although Time Domain has supported significant work to assess the impact of UWB devices on PCS and GPS,<sup>39</sup> Time Domain does not offer proof that its technology will not disrupt other spectrum users. Instead, it simply expresses confidence in its developing technology, stating that it “firmly believes that UWB will not cause harmful interference,”<sup>40</sup> that it “believes that its UWB devices will cause the same amount or less interference than unintentional emitters

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<sup>37</sup> Sirius, through its subsidiary Satellite CD Radio, Inc., paid \$83.3 million for its FCC license. *See Satellite CD Radio, Inc., Application for Authority to Construct, Launch and Operate Two Satellites in the Satellite Digital Audio Radio Service, Order and Authorization*, 13 FCC Rcd. 7971 (1997) (“*Satellite CD Radio Authorization*”). The other SDARS licensee, XM Satellite Radio, paid \$89.8 million. *See American Mobile Radio Corporation, Application for Authority to Construct, Launch and Operate Two Satellites in the Satellite Digital Audio Radio Service, Order and Authorization*, 13 FCC Rcd. 8829 (1997).

<sup>38</sup> Sprint PCS, for example, paid approximately \$3 billion for its PCS radio licenses. Supplemental Comments of Sprint PCS, ET Docket 98-153, at 7 (filed Oct. 6, 2000) (“*Sprint PCS Supplemental Comments*”).

<sup>39</sup> *See e.g.*, Comments of Sprint PCS, ET Docket 98-153, (filed Sept. 12, 2000) (“*Sprint PCS Comments*”) and Sprint PCS Supplemental Comments (describing testing and modeling done in conjunction with Time Domain to quantify effects of UWB devices on CDMA systems and finding that UWB devices can cause harmful interference); Ex Parte Notification of Time Domain, ET Docket 98-153 (filed Aug. 14, 2000) (noting Time Domain’s discussions with GPS experts and comments on UWB-GPS test plans).

operating under Part 15 of the Commission’s rules,”<sup>41</sup> and that “[a]t this time TDC firmly believes [sic] that general Part 15 unintentional radiator limits are appropriate.”<sup>42</sup> While Time Domain is no doubt genuine in its beliefs, what is needed is a technical showing, not a “belief.” The relevant question here is whether UWB proponents have demonstrated that their devices can comply with Part 15 by operating without causing any harmful interference. At this stage in the analysis the answer is simply “no.” To the contrary, Time Domain’s own test summary and model, filed jointly with Sprint PCS, confirms that UWB devices *can* cause harmful interference with terrestrial systems operating in the 1850 – 1990 MHz frequency band, even if the UWB devices are operating within the average power limits discussed in the NPRM.<sup>43</sup> Sirius’ satellite system is even more susceptible to the interference that UWB devices may produce than such terrestrial wireless systems.

**B. THE COMMENTS CONFIRM THAT THE CURRENT TESTING PROGRAMS WILL PROVIDE ONLY PRELIMINARY DATA; ADDITIONAL TESTING AND ANALYSIS IS VITAL**

The comments filed in this proceeding make clear that even when the initial round of tests are completed, much more testing will be required before the bulk of UWB devices can be allowed to radiate.<sup>44</sup> The Stanford University GPS Research Lab, which is conducting tests to measure the effect of UWB transmissions on GPS with funding from the Department of Transportation, stressed in its comments that “a *single* test phase will *not* provide an adequate

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<sup>40</sup> Time Domain Comments at ii.

<sup>41</sup> *Id.* at 8.

<sup>42</sup> *Id.* at 30.

<sup>43</sup> Sprint PCS Supplemental Comments at 1.

<sup>44</sup> A list of those calling for more testing would include a majority of those commenters offering substantive analysis. A partial listing includes: AOPA Comments at 1; Boeing

basis for any major decisions,” and “urge[s] the Commission to plan on additional test phases before any rule making.”<sup>45</sup> According to Stanford University, additional tests are needed to complete a satisfactory cross-validation of results, to cover new and different interference scenarios, and to explore the potential aggregate effects of UWB devices.<sup>46</sup>

The Department of Transportation, also commenting on its tests underway at Stanford University, notes that that these tests are “incomplete at this time.”<sup>47</sup> For example, the test plan “does not address conditions that might be anticipated with UWB-based communications systems.”<sup>48</sup> Importantly, however, the preliminary results from the DOT/Stanford test plan indicate that UWB emissions *may* interfere with GPS receivers, depending on the UWB parameters and operational scenarios considered.<sup>49</sup> Furthermore, the DOT states that “[s]ome of DOT’s very preliminary results are also counter-intuitive,” and that the initial testing “assesses only the interplay of one GPS receive and one UWB emitter.”<sup>50</sup> Given these preliminary results, the DOT correctly emphasizes the importance of testing other combinations of emitters and receivers, as well as the need for additional testing to assess the potential aggregate effects of multiple UWB emitters.<sup>51</sup>

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Comments at 4; Cisco Comments at 10; DOT Comments at 13; Metricom Comments at 6-7; Nortel Comments at 2; SIA Comments at 4. *See also* footnote 4.

<sup>45</sup> Stanford University Comments at 1 (emphasis original).

<sup>46</sup> *Id.* at 1-2 (noting that additional testing will be required because *UWB to GPS interference is complicated and very variable* (emphasis original)).

<sup>47</sup> DOT Comments at 12.

<sup>48</sup> *Id.* at 11.

<sup>49</sup> *Id.* at 12.

<sup>50</sup> *Id.*

<sup>51</sup> *Id.* at 12-13.

Additional testing is also required to address the issue of potential interference on commercial, non-GPS receivers (including SDARS), which, as Sirius indicated in its comments in this proceeding, are not covered adequately by any of the existing four test plans.<sup>52</sup> The need for additional testing and analysis, especially of the effects of UWB on non-GPS systems, is highlighted in two especially insightful comments made by The Boeing Company:

- i) The Commission should be cautious and refrain from accepting the popular notions that: (1) GPS is the most vulnerable spectrum use implicated in this proceeding and (2) if it can be shown that UWB does not interfere with GPS, then all other systems will likely not suffer from interference. There is in fact no hard evidence that this is the case.<sup>53</sup>
- ii) It is not the comment period, but the entire rule making process that needs extension. Considering the significant risks and the technical complexities, at least six months to a year of additional study and testing is required.<sup>54</sup>

At this stage in the rulemaking, the Commission should examine the available data and bifurcate the proceedings. It should promulgate rules for life-saving devices once they are ready to deploy and have been tested, and wait on enacting regulations on other applications until UWB proponents bring forward actual devices whose specific characteristics can be described and tested accurately.

## **VI. THE COMMISSION MUST FULLY ADDRESS THE POTENTIAL AGGREGATE EFFECTS OF UWB DEVICES ON EXISTING LICENSED SYSTEMS**

Many of the comments filed also echoed Sirius' concerns over the cumulative effect that multiple UWB devices may have on existing services. While the Commission suggested in the NPRM that only the closest transmitter would effect victim receivers, the

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<sup>52</sup> Sirius Satellite Comments at 25.

<sup>53</sup> Boeing Comments at 7.

Commission rightly observed that this conclusion was very preliminary, noting that “the cumulative impact of several UWB devices may be different depending on their individual emission and transmission characteristics.”<sup>55</sup> The comments confirm both that a plethora of different kinds of UWB devices are likely to be developed,<sup>56</sup> each with individual emission and transmission characteristics, and that additional testing and analysis is necessary to gauge the aggregate effect of multiple UWB devices on currently licensed services.<sup>57</sup>

Although a number of UWB proponents assert that the probability of cumulative interference is negligible,<sup>58</sup> other UWB proponents admit that the possibility of harmful

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<sup>54</sup> *Id.* at 5.

<sup>55</sup> NPRM at ¶ 47.

<sup>56</sup> According to the comments, the many potential uses of UWB technology include communications devices, tracking systems, automotive applications, measurement systems, and radar applications, not to mention cybernetic servants and ventilating toilet kits. *See, e.g.,* Time Domain Comments at 3-6 (communications and radar uses); MSSSI Comments at 2 (same); Fantasma Comments at 1 (wireless networking); Delphi Comments at 2 (vehicular radar sensor systems); Comments of M/A-COM, ET Docket 98-153, at 1 (filed Sept. 12, 2000) (automotive object detection systems); Comments of Endress + Hauser GmbH & Co., ET Docket 98-153, at 1,5 (filed Sept. 12, 2000) (“*Endress Hauser Comments*”) (radar level measurement systems), Comments of Krohne America Inc., ET Docket 98-153, at 1 (filed Sept. 12, 2000) (same); Aether Comments at 2 (cybernetic servants); Kohler Comments at 2 (ventilating toilet kits).

<sup>57</sup> *See, e.g.,* GARMIN Comments at 5; Lockheed Martin Comments at 6; ARRL Comments at 13-14 (asserting that large amateur radio antenna would very much see a cumulative effects from multiple of UWB devices); Comments of National Business Aviation Association, ET Docket 98-153, at 16 (filed Sept. 12, 2000); Nortel Comments at 3 (stating UWB could cause interference in a 36-foot zone); Comments of Qualcomm Inc., ET Docket 98-153, at 4 (filed Sept. 12, 2000); Rockwell Collins Comments at 6 (noting that cumulative impacts are the “least understood” area of UWB deployment issues); *see also* DOT Comments at 12 (noting the need to test for aggregate effects); Stanford University Comments at 1 (same).

<sup>58</sup> *See, e.g.,* Endress Hauser Comments at 7; Time Domain Comments at 35; Comments of Dr. A. Peter Annan, ET Docket 98-153, at 2 (filed Sept. 12, 2000) (but referring to GPR devices only).

interference from multiple UWB devices is quite real.<sup>59</sup> Unfortunately, the current test plans are simply not broad enough in scope to address adequately the potential aggregate effects of UWB devices. Indeed, in many cases, only one UWB device is even available for testing and, as a result, any aggregate effect cannot be measured at all. In all cases, the range of potential UWB devices that may interact with each other and the existing licensed system are not available. For example, as Sirius pointed out in its comments, the NTIA master plan calls for only two to four UWB devices to be tested. While the NTIA is attempting to develop operational scenarios that will allow it to accurately and comprehensively predict and measure the potential interference impact from multiple UWB devices, the huge variety of potential UWB devices, as well as the many different types of receivers that may potentially receive interference, complicate any such undertaking tremendously.<sup>60</sup>

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<sup>59</sup> See, e.g., Lucent Comments at 7; MSSSI Comments at 11 (noting that the RFI aggregation effects of multiple UWB signals were not even considered in the Stanford tests which nonetheless showed interference from just one UWB device); Comments of XtremeSpectrum, Inc., ET Docket 98-153, at 11 (filed Sept. 12, 2000).

<sup>60</sup> See, e.g., email from Dave Turner, IGEB Executive Secretariat, to Steve Jones, NTIA and NTIA GPR/UWB Operational Scenarios Listserv (Oct. 10, 2000):

[S]urely UWB devices used for GPR and WID applications will use different center frequencies, different bandwidths, different prf's, different duty cycles, different max power levels, etc. than UWB devices embedded in laptops and cell phones that may be used for mass communications purposes. The potential level of interference to GPS must depend on these properties which must change relative to the functional mission of the UWB device (or 100's of devices) in proximity. Isn't this correct?

Further, do you know for sure that the UWB signal parameters that can be generated by the device used in the NTIA testing (as described in your test plan - Table 2) are comprehensive enough to cover all UWB signal parameters that could apply to various operational uses such as GPR, WID, and mass-market communications. If the answer is yes, do you know how to match the signal parameters correctly to each operational use in the scenarios?

In addition, the current tests – including the NTIA’s effort to develop operational scenarios to assess the cumulative impact of UWB devices – are primarily concerned with the interaction of UWB devices and GPS systems. Sirius reiterates that only one plan – the ITS Ultrawideband Measurement Plan – focuses on victim receivers other than GPS systems at all, and this measurement effort calls for the testing of only three or four victim receivers, none of which are SDARS receivers.

The unique technical characteristics of SDARS receivers, which are extremely sensitive, wideband receivers, means that the none of the current test plans will accurately predict the interference potential of UWB devices on SDARS receivers, *even for the UWB devices that are actually part of the formal testing procedures*. None of the UWB proponents address in their comments the SDARS service or the specific impacts that UWB devices will have on SDARS receivers. Attempting to extrapolate and predict the impact on SDARS receivers of other types of devices using UWB technology that are *not* part of the current test plan – and which may not even have been developed yet – is simply impossible. Further, detailed testing and analysis is called for in order to be able to gauge the aggregate effects of multiple, different UWB devices on all the currently licensed systems that may be affected, including SDARS. Thus, while the Commission’s goal of moving forward rapidly to authorize UWB applications is worthwhile, the range and depth of additional testing required counsels strongly for substantial additional time to complete this testing and a staged approach focused on individual UWB applications.

## **VII. CONCLUSION**

The initial comments make clear that the Commission must adjust its overall approach to investigating UWB technology. The NPRM presents a relatively unbounded and unwieldy inquiry because of the wide variety of undescribed UWB devices that the NPRM seeks

to authorize with one set of rules. The NPRM also suffers from an over-ambitious timetable that will not permit the type and extent of baseline and application-specific testing that is necessary to ensure that the Commission authorizes UWB devices on a secondary, non-interference basis. Thus, as set forth in these Reply Comments, Sirius urges the Commission to refocus its NPRM inquiry by (1) considering UWB technology in a staged approach that focuses on individual UWB applications or classes of UWB uses that have similar interference characteristics and (2) adopting a more measured and realistic timetable for testing of UWB technology.

Respectfully submitted,

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