

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

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

**REPLY COMMENTS OF AERONAUTICAL RADIO, INC. AND THE AIR
TRANSPORT ASSOCIATION OF AMERICA, INC.**

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SUMMARY

The record created in response to the Commission's Notice of Proposed Rule Making in this proceeding reveals not only possible benefit from ultra-wideband ("UWB") devices but substantial concern about the potential for such devices to cause harmful interference to Global Positioning Satellite ("GPS"), safety-of-life communications, and other existing operations. Even proponents of UWB recognize the need for the Commission to assess thoroughly the potential impact of UWB devices on existing services and operations. UWB advocates recognize that GPS and other safety-of-life operations must be protected from any increased potential for harmful interference from the deployment of UWB devices. ARINC, ATA and other commenters continue to support the Commission's commitment to require adequate testing and analysis *prior to* determining whether any deployment of UWB devices (in addition to the waivers that have already been granted) in any frequency band can be permitted consistent with the public interest.

The record also highlights the dangers of adopting a "one-size-fits-all" definition of UWB. The comments demonstrate that there is a vast array of applications which various UWB technologies and devices might purport to serve. Different UWB devices in these many applications would have varying potential to cause interference. As a result, the Commission should evaluate these transmissions in operational scenarios on a case-by-case basis categorized by application and frequency band. Only by doing so will the Commission be able to assess whether deployment of these devices will not increase the potential for harmful interference, either individually or cumulatively. If testing persuasively demonstrates that a certain type of UWB device categorized by application cannot create an increased danger of harmful

interference to GPS or other existing licensed operations, then the Commission can consider deployment of such devices, but only on a licensed basis. The FCC should also consider that there may be certain frequency ranges, for example, below 5.5 GHz, where *no* increased risk of interference – and thus *no* deployment of UWB devices – is acceptable due to the nature of and extent of existing operations. The FCC should reiterate its authority to revoke any such licenses if real world experience demonstrates that the devices cause harmful interference. Unlicensed UWB operations should not be considered at this time.

If real world experience supports test results showing that a specific category of UWB devices (defined by application) does not increase the potential for harmful interference and the Commission considers allowing UWB on an unlicensed basis, the Commission should not act to undermine the existing Part 15 paradigm. The Commission distinguishes and treats differently intentional and unintentional radiators. This distinction is part of the Commission’s well-considered spectrum management policies. UWB devices are undoubtedly intentional radiators; and, if at some future time their deployment on an unlicensed basis is permitted, they should be regulated as such, despite any superficial similarities between their spectrum signatures and those of unintentional devices.

Furthermore, the Commission, in considering whether to license certain UWB devices, should consider whether alternative spectrum already allocated or otherwise available (*e.g.*, ISM bands of operation under current Part 15 rules) in which the benefits promised by the UWB devices and applications at issue can be obtained. The “need” supporting a demand for spectrum is a fundamental consideration in any allocation proceeding, and it should also be applied in these circumstances where UWB advocates seek to overlay existing allocations and assignments outside current Part 15 rules.

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Aeronautical Radio, Inc. (“ARINC”) and the Air Transport Association of America, Inc. (“ATA”), by their attorneys, hereby submit their reply to the initial comments filed in response to the Federal Communications Commission’s (“FCC’s” or “Commission’s”) *Notice of Proposed Rulemaking* in the Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems, released May 11, 2000 (“*UWB NPRM*”).¹

I. THE COMMENTS UNDERSCORE THE NEED FOR THOROUGH TESTING AND ANALYSIS OF THE POTENTIAL FOR INTERFERENCE BY UWB DEVICES TO GPS, OTHER SAFETY-OF-LIFE COMMUNICATIONS, AND OTHER EXISTING LICENSED OPERATIONS BEFORE THE COMMISSION ACTS.

In their initial comments, ARINC and ATA expressed reservations about the ability of so-called UWB devices² to overlay existing Global Positioning Satellite (“GPS”) spectrum and

¹ *Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission System*, ET Docket 98-153, Notice of Proposed Rulemaking (rel. May 11, 2000).

² As explained in Section II, given the great variety of devices and technologies that the pro-UWB proponents argue should meet the definition of “ultra wideband,” the treatment of so-called UWB devices through a single approach would be ill advised and gloss over the reality that “UWB devices” in fact cover a vast array of devices and applications with varying potential for interference to existing operations. ARINC and ATA will use the term “UWB devices”

other safety-of-life radio operations without increasing noise levels and the potential for interference, thereby endangering safety. ARINC and ATA recommended that the Commission proceed with caution and study the results of adequate testing before acting. If testing indicates that a certain class of UWB devices as characterized by their application can operate without increasing the potential for interference to GPS and other safety-of-life operations, the Commission should still only consider allowing such a class of devices on a licensed basis.³ By “licensing,” ARINC and ATA do not necessarily mean that a spectrum allocation would be required. A form of licensing which imposes appropriate restrictions based on the allowed bands of operation might be established within the framework of Part 15 (in addition to equipment authorization).⁴

Licensed operation will allow the FCC to obtain real world experience to determine if such a device actually causes harmful interference to vital wireless communications. Licensing will also preserve the necessary control over the devices at issue should interference problems arise.⁵ Further the Commission should limit licensing to bands where the consequences of

herein, but that should not be understood as an agreement that these myriad devices merit homogeneity of treatment.

³ If testing suggests that any UWB devices that have been permitted on a waiver basis to date do increase the potential for harmful interference to GPS or other existing licensed operations, the Commission should rescind those waivers. If such tests indicate that UWB devices currently subject to waiver can not increase that potential, then the Commission should adopt appropriate licensing rules, consistent with the other suggestions made herein, and require persons responsible for the operation of those devices to obtain licenses.

⁴ Alternatively, such licensing might proceed under Section 5.3(i) of the Commission’s Rules governing experimental operations. In any event, any such licensing must be on a non-interference or secondary basis to all other licensed operations. Before licensing such devices, the Commission should establish the technical and operating standards appropriate to the UWB devices and applications at issue as necessary to prevent harmful interference to GPS and other safety-of-life applications as well as other existing operations.

⁵ As the FCC has recognized, one of the benefits of licensed operations is that other licensees or the Commission “can locate and contact a licensee to resolve any interference problems that may develop.” *Amendment of Parts 2, 15, 18, and Other Parts of the Commission’s Rules*, ET Docket No. 97-94, 13 FCC Rcd 11, 415, ¶25 (1998).

interference are less critical, *e.g.* above 5.5 GHz (at a minimum) and outside the restricted bands above that frequency.⁶ Until the testing and analysis is completed and real world experience of qualified devices is obtained, the Commission should not permit unlicensed UWB operations outside existing Part 15 rules.

A. The Record Reveals Serious Concerns about the Potential for Interference to a Variety of Existing Licensed Operations

In the initial comments, many commenters raise concerns about the potential interference that UWB devices might pose to established services and urge the Commission to proceed with care. Like ARINC and ATA, these parties do not necessarily oppose the deployment of UWB devices *per se*, provided that it is convincingly demonstrated that such devices do not – and will not – cause harmful interference to GPS, safety-of-life applications, and existing licensed operations.⁷

Several other commenters share ARINC and ATA’s focused concern regarding potential UWB interference to GPS, including the U.S. Department of Transportation (“DOT”), the U.S. GPS Industry Council (“US GPS”), and Garmin.⁸ Other aeronautical concerns, including the Aircraft Owners and Pilots Association (“AOPA”), Boeing, the National Business Aviation Association (“NBAA”), and Lockheed Martin voice alarm about the possible impact to critical aeronautical safety-of-life communications and other operations.⁹ As DOT explains, GPS is “the

⁶ Upon review of the initial comments and preliminary analyses contained therein, ARINC and ATA feel compelled to revise the statements made in their opening comments regarding the possible adequacy of 2 GHz as a threshold below which UWB devices should not be permitted at this time.

⁷ *E.g.*, Comments of Boeing at 2; Comments of ARRL at 2; *see* Comments of ARINC and ATA at 3-4.

⁸ Comments of DOT at 4, 10-15; US GPS at 11-12; Garmin at 4.

⁹ Comments of AOPA at 1; Comments of Boeing at 2; Comments of NBAA; Comments of Lockheed at 4.

cornerstone of the evolving National Airspace System infrastructure,” and the U.S., with all of its major partners, reaffirmed their commitment to protecting GPS signals at this year’s World Radio Communications Conference.¹⁰

Concerns about potentially harmful interference from UWB devices is by no means limited to aeronautical interests. DOT explains the need to understand any potential threats UWB emission could pose to wireless systems supporting both water and ground transportation safety.¹¹ Parties providing a variety of commercial mobile radio services noted the need to ensure that UWB devices do not cause harmful interference to their services.¹² Proponents of other terrestrial wireless services, such as point-to-point communications, which provide vital infrastructure depended on by a variety of companies, also raise concerns.¹³ Other significant users of the radio spectrum, such as over-the-air broadcasters,¹⁴ as well as Digital Audio Radio

¹⁰ Comments of DOT at 4; *see* US GPS at 6-11.

¹¹ Comments of DOT at 5-8.

¹² Comments of Motorola at 1, 35-37; Comments of AT&T Wireless at 1-2; Comments of Nortel at 1; Comments of Qualcomm at 1-2; Supplemental Comments of Sprint PCS. Although commercial land mobile communications systems have not generally been considered safety-of-life services, they are often used for such purposes and have saved many lives. In fact, Congress has enacted 911 legislation to enhance the prompt deployment of a nationwide, seamless communications infrastructure for emergency services. *See* Wireless Communications and Public Safety Act of 1999, Pub. L. No. 106-81, enacted Oct. 26, 1999, 113 Stat. 1286, amending the Communications Act of 1934, 47 U.S.C. §§222, 251 (911 Act); Implementation of 911 Act, *Fourth Report and Order* and *Third Notice of Proposed Rulemaking*, CC Docket No. 92-105 (rel. Aug. 29, 2000). The 911 Act complements extensive efforts by the FCC to bring about wireless-based E911 to improve the public safety response system in answering emergency calls from CMRS customers. *See* decisions from CC Docket No. 94-102 (*Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems*) cited at *id.*, ¶6, n.8. Moreover, companies have spent billions of dollars to bring the United States into the wireless communications era. Many of these telecommunications services help fulfill the goals of Section 706 of the Act to bring advanced services to all people in the United States. Harmful interference from UWB devices could hinder the further development of such services and the advancement of these important statutory goals.

¹³ *See* Comments of Cisco at 2-4; Wireless Communications Association International, Inc. at 1-2 (“WCA”). Amateur services could be adversely effected by harmful interference from UWB devices. *See* Comments of ARRL at 2-3.

¹⁴ Comments of NAB at 1-3, 5-7.

Service (“DARS”) providers, are concerned about harmful interference from UWB devices.¹⁵

XM Radio explains that if UWB devices are permitted to deploy in the near term, this harmful interference could occur before DARS operators obtain sufficient scale to become viable.¹⁶

These commenters urge the Commission to obtain and evaluate the results of the studies currently being conducted and any follow-up before taking the potentially irreversible step of allowing unlicensed operation.¹⁷ According to Stanford University, a single test phase will not provide an adequate basis for any major decisions, and the Commission should plan on additional testing. ARINC and ATA anticipate that preliminary results from the first round will provide increased understanding that generates sharper questions and enables more focused testing.¹⁸ Such iteration is absolutely necessary when safety concerns are at issue, as they are here.¹⁹

B. UWB Proponents Acknowledge the Need to Demonstrate No Increased Potential for Interference Before the Commission can Consider Additional UWB Deployment

Existing licensees are not the only commenters to urge the Commission to move with caution. UWB proponents also recognize the need for testing that demonstrates that there will be no increased potential for harmful interference to GPS, other safety-of-life operations, and existing licensees generally before additional UWB deployment can be considered. Several UWB commenters provided preliminary analyses with their filings that make clear the serious

¹⁵ See Comments of XM at 1; Comments of Sirius Satellite Radio Inc. at 1-2 (“Sirius”).

¹⁶ See Comments of XM at 2-4; Comments of Sirius at 1-6.

¹⁷ See Comments of DOT at 13; Comments of AT&T at 1; Comments of Garmin at 8; Comments of NAB at 2; Comments of Federal Law Enforcement Wireless Users Group at 3.

¹⁸ See Comments of Stanford at 1.

¹⁹ Accord Comments of Stanford at 1-2; Comments of DOT at 11-13.

potential for interference; some even suggest measures that should be taken to ameliorate the potential for interference.

For example, Multispectral Solutions, Inc., (“MSSI”) a developer of UWB hardware for advanced communications and radar systems, principally for U.S. Government and Military use, provided a technical analysis revealing that, *without filtering* of UWB pulsed emissions prior to radiation – a precautionary measure that many UWB proponents have strongly resisted – “it is virtually impossible to prevent *significant* changes in both frequency and bandwidth [resulting from] *accidental* changes or simple *external* modifications to the UWB antenna.”²⁰ Accordingly, MSSI proposes that if unlicensed UWB operations are permitted at all, they should be filtered. MSSI adds that, in order to avoid the majority of the current and potential licensed users of the spectrum, UWB operations should only be considered above 3.1 GHz.²¹ Even then, cognizant of the important safety-of-life and other restricted operations above 3.1 GHz, MSSI acknowledges the wisdom of avoiding such bands altogether and concedes that it may be appropriate to limit UWB operations to 5.47 to 7.25 GHz.²² MSSI also contends that ground penetration radar

²⁰ Comments of MSSI at 3 (emphasis in original). MSSI explains further that “UWB systems which utilize non-filtered, impulse excited antennas can be easily altered or tampered with to *produce significantly narrower band emissions at other than the ‘design’ frequency, and with power levels many dB higher than those contained in the original, unmodified emissions.*” *Id.* (emphasis added)

²¹ *Id.* at 17. MSSI notes that 50% of Federal Government use and 40% of non-Federal Government use is below 3.1 GHz. *Id.* at 10. This means that a substantial percentage of use in both categories is still above 3.1 GHz, much of which warrants protection. Nonetheless, based on MSSI’s information and in light of the critical safety of life operations above 3 GHz, it would be appropriate to consider *licensed* operations only above that (or some higher) frequency – provided testing shows no potential for harmful interference – while not permitting, at this time, any UWB operations, licensed or otherwise, below that frequency, as suggested by several parties in their opening comments. *See e.g.*, Comments of MCHI at 2-4; XM at 10; Lockheed at 8.

²² Comments of MSSI at 17. These include, for example, Aeronautical Telemetry (2.31-2.39 GHz); Airport Surveillance Radars (2.7-2.9 GHz); Radio Altimetry (4.2-4.4 GHz); Microwave Landing Systems (5.03-5.09 GHz); and Airborne Weather Radars (5.35-5.47 GHz); *see* Comments of ARINC/ATA at 7-8.

systems (“GPRS”) be considered only on a licensed basis,²³ and that any other operations be considered only at some later date in a subsequent rulemaking that “more fully addresses the impact of UWB on existing systems and services.”²⁴ As noted above, ARINC and ATA believe that, at a minimum, no UWB operation should be permitted below 5.5 GHz at this time. Furthermore, deployment elsewhere should only be made subject to the other conditions discussed in these comments, *i.e.*, on a licensed basis outside restricted bands.

Time Domain Corporation (“TDC”), a proponent of UWB, recognizes that “this proceeding should ensure that UWB devices will not disrupt important safety of life systems, such as those operated by the FAA. If any UWB uses are found by the Commission to pose a credible risk of causing harmful interference to GPS systems by the FAA or the aviation industry, *TDC fully expects that the Commission will not authorize those UWB uses.*”²⁵ In a somewhat similar vein, Xtreme Spectrum (“XS”), a developer of “last mile” UWB communications systems, warns the Commission of the “need to avoid harmful interference to other radio services, particularly those such as GPS that are vital to safety.”²⁶ Significantly, XS correctly observes that testing, while vital, will *not* “resolve the controversies over interference from ultra-wideband emissions.”²⁷ As XS notes, “[a]ny test necessarily relies on simplifying assumptions about the characteristics of ultra-wideband transmitters, the likely conditions of their use, and the properties of victim receivers.”²⁸

²³ Comments of MSSSI at 12.

²⁴ *Id.* at 2.

²⁵ Comments of TDC at 4 (emphasis added).

²⁶ Comments of XS at 4. XS adds that “[n]o one in the ultra-wideband community disputes the need to protect other users.” *Id.*

²⁷ *Id.* at 9.

²⁸ *Id.* at 9.

Given the seriousness of the stakes, if interference from UWB operations to GPS or other safety-of-life operations occurs, the only sound course, as ARINC, ATA, and others have argued, is to *place the burden on UWB proponents* to demonstrate convincingly through thorough testing and through operational experience that there is no “credible risk” of such interference *before* the Commission considers permitting additional deployment of UWB devices.²⁹ As MSSSI recognizes, even in those circumstances, the Commission should proceed in a very measured fashion, require filtering, avoid the restricted bands altogether, and utilize licensing to control the introduction of UWB devices. Because, as XS observes, testing has a limited ability to give a complete picture of interference potential, licenses for UWB applications should be (1) on a secondary non-interference basis to *all* other licensed stations in the bands of operation, (2) subjected to appropriate conditions on usage which would be developed on a case-by-case basis (restrictions on location of operation, for example), and (3) subject to suspension or revocation if problems develop during real-world use.

Moreover, as amplified further herein, because of the great variety of applications and technologies that claim to be “UWB,” the Commission should avoid any sort of action that indiscriminately opens existing allocations of spectrum to so-called UWB devices. Rather, each class of UWB devices as categorized by application must be evaluated following adequate testing of its potential for interference in the prospective bands of operation before serious consideration of overlaying any existing uses is contemplated.

²⁹ *Accord* Supplemental Comments of Sprint PCS (October 6, 2000) at 8 (burden of proof is on UWB proponents) and Commission decisions quoted and cited therein.

II. THE RECORD UNDERSCORES THE DANGERS OF ADOPTING A ONE-SIZE-FITS-ALL DEFINITION OF “ULTRA-WIDEBAND DEVICE”

In the *Notice*, the Commission raises the prospect that any device meeting a definition for “ultra-wideband device” may be allowed to operate on an unlicensed basis essentially in any part of the radio spectrum, including the restricted bands. As the record developed in the initial round of comments illustrates, the numbers of different types of UWB devices is vast.³⁰ The range of technical parameters that characterize the devices described in the comments – modulation type, spreading technique, and ideal band of operation, to name a few examples³¹ – is so broad that the only real commonality among the UWB proponents is that they all want to operate outside the current bounds of Part 15. In short, the term “ultra-wideband” describes neither a service nor a technology but is simply a moniker that many in this proceeding are willing to adopt to gain the benefit of exceptions from critical Part 15 constraints that are in place for the protection of licensed stations and users.

In light of this diversity, any attempt to adopt generally applicable regulations would be ill advised.³² Although Part 15 itself has generally applicable regulations – and manufacturers are free to develop “ultra-wideband” products that comply with those rules – it also has a variety of special provisions, departing from the general Part 15 rules, that are applicable only to *specific* categories of unlicensed devices.³³ UWB proponents seek what are in essence wholesale

³⁰ TDC alone claims to have developed over 30 UWB prototypes for a wide variety of applications. Comments of TDC at 3-6.

³¹ TDC explains that “different UWB applications operate best at different center frequency ranges. Comments of TDC at 10.

³² The Commission generally acknowledged this as it focused on GPR and WID and lumped the rest of the proposed applications into the “all other” category. *UWB NPRM* at ¶9

³³ See e.g., 47 C.F.R. §§15.211 (tunnel radio systems);15.213 (cable locating equipment); 15.214 and 15.233(b)(2) (cordless telephones); 15.221 (carrier current systems); 15.242 (biomedical telemetry devices); 15.243 (devices that use RF energy to measure the characteristics of a material);15.245 (field disturbance sensors); and 15.247 (spread spectrum

exceptions to the current Part 15 rules on a scale far greater than any exceptions that previous have been codified. The Commission, if it considers them at all, should consider any such departures, as it has in the past, on an *ad hoc* basis, rather than as a group. This is especially the case given that one of the principal exceptions requested is the ability to operate as intentional radiators in the restricted bands. The record developed to date in this proceeding would not justify any such exception for any individual type of UWB device, let alone the lot of them.

The dangers of taking a generalist approach by adopting a broad UWB definition and then welcoming all who meet it is further highlighted by the plethora of different arguments and rationales for expanding the definition of “ultra-wideband” in the *UWB NPRM*. The Commission proposed to define UWB devices utilizing pulsed emissions as those with either a fractional bandwidth of 25% and above, or with an occupied bandwidth equal to at least 1.5 GHz, measuring bandwidth in both cases at the –10 dB emission points.³⁴ There are many proposals to enlarge the definition to include devices using additional modulation techniques

systems in the 902-928 MHz, 2.4 GHz and 5.8 GHz ISM bands). There are additional examples as well, but a common characteristics of these Part 15 “exceptions” to the general requirements is that they are limited to specifically defined frequency bands and are, in almost all cases, available only for devices used in very specific applications. While the spread spectrum regulations might appear to be an exception, they are an anomaly because the devices operate in the ISM bands. Users of ISM bands can experience a higher level of noise – which users must tolerate – in those bands. As a result, ISM bands are sometimes referred to as “junk” bands. What UWB proponents propose here is a complete rewriting and expansion of the Part 15 rules unlike any that has occurred before. Taken to its extreme, if the Commission adopts such a proposal, it has the possibility to render all bands, even restricted ones, as mere “junk” bands. Needless to say, any prospect that UWB could push restricted bands in this direction is very troubling.

³⁴ *UWB NPRM*, ¶21. TDC questions whether the second criterion of occupied bandwidth is appropriate as systems meeting that criterion may not have signals “with true UWB characteristics “and the attendant benefits, *e.g.*, multipath immunity. Comments of TDC at 24-25. However, TDC’s call to narrow the definition of UWB is not typical among pro-UWB commenters.

(*e.g.*, stepped and swept frequency),³⁵ decrease the fractional bandwidth,³⁶ decrease the minimum occupied bandwidth,³⁷ and use the –20 dB emission points to measure bandwidth.³⁸

Any of these proposals, if adopted, would open the doors even wider to additional devices flooding the spectrum outside the constraints of the current Part 15 regime.³⁹

Whether one fractional bandwidth or another is adopted is not the point. The real issue is whether the Commission should grant wholesale exceptions to the current Part 15 rules under a single broad definition that would apply to a heterogeneous mix of products. The history of Part 15 suggests that, by doing so, the Commission would simply be inviting further attempts to relax Part 15 regulations in a similar manner. The Commission certainly should not go down that road. Indeed, at this stage, at least, it would be premature for the Commission to attempt to define “ultra-wideband” at all.⁴⁰ Rather, the Commission should, through thorough testing and evaluation, ascertain whether particular, narrowly defined types of UWB devices – *e.g.*, pulsed emission ground penetration radar systems – pose a “credible threat” of harmful interference to

³⁵ *E.g.*, Comments of Delphi Automotive Systems Corporation at 11 (Delphi proposes that “all” modulation schemes be allowed, not just pulsed transmission); Comments of Krohne America Inc. at 4 (swept frequency).

³⁶ Comments of Krohne Co. at 4-5 (20 % fractional bandwidth).

³⁷ Comments of Krohne at 2; Comments of Delphi at 10, 12-13 (proposes 500 MHz minimum).

³⁸ *E.g.* Comments of M/A-COM, at 3; Comments of Interlogix, Inc. at 1. Given the gradual attenuation of many UWB signals, the relaxation of the bandwidth definition, as these parties propose, potentially would increase the number of possible interferers in any given band significantly beyond that suggested by the –10 dB emission points.

³⁹ As Delphi implies, and as discussed more thoroughly in Section IV below, the existing rules can accommodate many of these applications, whether on a licensed or unlicensed basis. Notably, Delphi explains that it has been able to develop narrower band radar device compliant with the FCC’s current rules. Comments of Delphi at 14-15; *see* Comments of Aether Wire & Location, Inc. at 2 (“[e]ven though UWB has unique advantages for many radar and communications applications, these categories are well served by narrow-band RF.”).

⁴⁰ As indicated above, many commenters claim – with some basis, in ARINC and ATA’s view – that if devices that meet the definition of ultra-wideband in the *UWB NPRM* are entitled to relief from current Part 15 requirements, then the devices they have developed, too, should be considered ultra wideband.

current and potential⁴¹ licensed systems in the bands in which the UWB devices would operate and can safely be considered for operations outside current Part 15 limits.

Were the Commission to forge ahead with the broad definition contained in its *UWB NPRM* – let alone the even broader definitions urged by some ultra-wideband proponents – the Commission is likely to significantly increase the number of potential interferers, and thus total noise, in the spectrum.⁴² If later experience shows a risk to safety of life and other existing services, the FCC will have trouble “returning the genie to the bottle” and removing the offending devices. Would UWB users remember their promises of non-interference or would they argue that they have equities on their side predicated upon their reliance upon FCC regulations? The best course of action, given the dearth of information about virtually all UWB devices, is not to engender unreasonable expectations through generally applicable rules that permit unlicensed operation.⁴³

For similar reasons, the FCC should reject Krohne’s request to use this rulemaking to delegate to OET the authority to waive the Part 15 rules to permit operation of non-UWB intentional transmitters – read “those that miss the UWB cut-off” – in the restricted bands.⁴⁴

⁴¹ See Comments of Motorola, summary at i; (“UWB devices have the potential to affect *systems that are not yet operational*, limiting the evolution of communication technology generally in the United States.” (emphasis added))

⁴² As the comments and preliminary analyses of Motorola and others make clear, there is a serious concern about the cumulative effect of UWB devices on the potential for interference. See Comments of Motorola; Supplemental Comment of Sprint PCS (Oct. 6, 2000) at 8-11; see also Comments of AT&T at 4; Comments of Boeing at 6, 12; Comments of ARRL at 7; Comments of Forsberg at 1; Comments of Intelligent Automation, Inc. at 1; Comments of Lockheed at 6.

⁴³ As the U.S. Department of Transportation emphasizes, given the little that is known about the effects of UWB emissions on GPS and other protected signals, it is vital to obtain that information “even if the necessary test results are not available as quickly as one would like.” Comments of DOT at 13.

⁴⁴ Comments of Krohne at 5. The Commission should not delegate to OET the authority to waive the rules for those applications and/or devices that fail to meet the requirements of the Commission’s rules.

Such proposals would involve a radical departure from the keystone of spectrum management that has guided Part 15 to date, *i.e.*, to grant waivers judiciously, with full cognizance of the potential negative impact on other spectrum users. Rather, any such proposals should be handled, if at all, through a notice and comment rulemaking. Further, any waiver request must demonstrate that operation of the device outside of the restricted bands, as currently required, “would not serve the underlying purpose [of Part 15].” *See* 47 C.F.R. § 1.925. It is difficult to imagine scenarios in which this would be case, certainly on a scale to justify Krohne’s request. Certainly, at a minimum, the Commission should not take any affirmative action in this proceeding to encourage additional waiver requests and the potential complete evisceration of Section 15.205 of its rules establishing and protecting the restricted bands.

Clearly, the Commission should not adopt a one-size-fits-all regulatory definition for dealing with UWB devices and applications. The potential for causing harmful interference will vary with the particular device and application and the device’s proliferation. As such the Commission should consider thorough testing for each class of devices and/or application that might seek treatment as “UWB.” In testing devices in certain applications to determine whether they pose a risk of harmful interference to vital systems, the Commission must consider not only the individual effect of a single device, but the cumulative effect of the multiple devices that might be involved in the application plus other UWB applications the Commission may previously have allowed.

III. THE COMMISSION SHOULD NOT CHANGE THE PARADIGM OF PART 15 IN THE EVENT IT ALLOWS UNLICENSED UWB OPERATIONS IN THE FUTURE

Despite the fact that several UWB proponents suggest it, the FCC should not, under any circumstances, treat UWB radiators as unintentional radiators.⁴⁵ As an initial matter, there is no doubt that UWB devices intentionally generate and emit RF energy and clearly are intentional radiators:

Intentional radiators [are] defined as devices that intentionally generate and emit radio frequency energy by radiation or induction. Unintentional radiators [are] defined as devices that intentionally generate radio frequency energy for use within the device, or that send signals by conduction to associated equipment via connecting wires, *but which are not intended to emit radio frequency energy by radiation or induction.*⁴⁶

The request by Mr. Annan and others to treat UWB devices as unintentional radiators is a request to rewrite some of the fundamental definitions of Part 15 and would be beyond the scope of this rulemaking.

Moreover, treating intentionally emitting UWB devices as unintentional radiators would turn the spectrum management scheme embodied in Part 15 on its head. When the FCC adopted the current regime governing unlicensed devices in the late 1980's, it made a clear delineation between unintentional and intentional radiators. Because intentional radiators generate and emit radio frequency energy intentionally, the Commission concluded that intentional radiators posed a greater risk of interference to licensed operations than unintentional radiators.⁴⁷ Indeed, two

⁴⁵ See e.g., Comments of A. Peter Annan at 1-2; Comments of TDC at 8-9; Comments of Xtreme Spectrum at 10.

⁴⁶ *Revision of part 15 of the Rules regarding the operation of radio frequency devices without an individual license*, First Report and Order, 4 FCC Rcd 3493, 3495, ¶16 (1989)(*Part 15 Rewrite*)(emphasis added); see also 47 C.F.R. §§15.3(o), (z)(definitions of intentional and unintentional radiators).

⁴⁷ Compare 47 C.F.R. § 15.109 with 47 C.F.R. § 15.209. Unintentional radiators do not seek to emit RF energy; rather, it is a byproduct of their design.

years ago, the Commission refused to relax the equipment authorization requirements for intentional radiators. In declining to amend the rules, the FCC stated that:

a certain “core group” of equipment requires a higher level of oversight than manufacturer’s self-approval, due to a high risk of non-compliance, the potential to create significant interference to safety and other communication services, and the need to ensure compliance with the requirements to protect against radio frequency exposure.⁴⁸

Intentional radiators were thus made subject to more restrictive rules than unintentional radiators, including generally tighter emission limits⁴⁹ and stricter equipment authorization requirements.⁵⁰

Meanwhile, the requirements applicable to unintentional radiators have been relaxed several times in the past few years. Referring to intentional radiators and other devices requiring certification in comparison with unintentional radiators subject to lesser requirements, the FCC said “[f]or certain equipment which poses a *greater risk of interference*, the Commission requires the submission of an application which must be reviewed and approved before the equipment can be marketed.”⁵¹ The Commission also established numerous restricted bands in which the Commission prohibited the operation of Part 15 intentional radiators, except for spurious

⁴⁸ 1998 Biennial Regulatory Review – Amendment of Parts 2, 25, and 68 of the Commission’s Rules to Further Streamline the Equipment Authorization Process of Radio Frequency Equipment, Modify the Equipment Authorization Process for Telephone Terminal Equipment, Implement Mutual Recognition Agreements and Begin Implementation of the Global Mobile Personal Communications by Satellite (“GMPCS”) Arrangements, 13 FCC Rcd 2468, ¶12 (1998).

⁴⁹ Compare 47 C.F.R. § 15.109 (limits for Class A digital devices) with 47 C.F.R. § 15.209.

⁵⁰ While the Commission’s rules require some unintentional radiators to be authorized, see 47 C.F.R. § 15.101, most are merely subject to verification or the Declaration of Conformity requirements. Generally, the Commission’s rules require intentional radiators to be authorized pursuant to the certification procedures described in Part 2, Subpart J of the Commission’s rules. See 47 C.F.R. §§ 15.201, 15.201 *et. seq.*

⁵¹ See Amendment of Parts 2, 15, 18, and Other Parts of the Commission’s Rules to Simplify and Streamline the Equipment Authorization Process for Radio Frequency Equipment, ET Docket No. 97-94, 13 FCC Rcd 11415, ¶2 (1998) (emphasis added).

emissions.⁵² The Commission included safety-of-life and other services “that are required by the nature of their operation to use signals received at very low received levels” in its “restricted bands.”⁵³

Allowing some intentional radiators, such as UWB devices, to be classified as unintentional radiators would undermine the current, carefully considered, distinctions in Part 15 and undermine the FCC’s spectrum management policies embodied in the rules.⁵⁴ Those parties who suggest that intentional radiators, as defined in the Commission’s rules, should be treated as unintentional radiators, attempt to justify their request based on the spectrum signatures of UWB devices and the alleged similarities to those of some unintentional radiators. Focusing on this characteristic, however, is misplaced. Quite simply, in the Part 15 Rules, the Commission specifically differentiates between intentional and unintentional radiators.⁵⁵ In doing so, the Commission did *not* base its decision on the spectrum signature of the devices or even suggest that the spectrum signature was relevant. Rather the FCC’s regime is appropriately based on the intent to emit RF energy.

Furthermore, TDC observes that, in fact, certain unintentional radiators in recent years “have become more like intentional UWB emitters in the 1 to 2 GHz band,”⁵⁶ *not the other way around*. Assuming that to be the case, it simply does not follow that intentional radiators should be subject to relaxed radiation limits.

⁵² See *Part 15 Rewrite*, 4 FCC Rcd at 3502-05, ¶¶61-74; see also 47 C.F.R. § 15.205.

⁵³ *Part 15 Rewrite*, 4 FCC Rcd at 3503-04, ¶66.

⁵⁴ *Accord* Comments of ARRL at 6; Comments of Cisco at 4. UWB is different from what is traditionally allowed under Part 15 of the Commission’s rules, because: (1) UWB equipment may emit significant power over a large portion of spectrum generating multiple spectral peaks over a large range of frequencies; (2) its pulses could have peak powers that greatly exceed average powers; (3) there could be larger numbers of UWB devices emitting signals at or near permitted limits. Comments of Cisco at 4.

⁵⁵ See *Part 15 Rewrite* at 3495, ¶16.

Rather than rework the entire Part 15 paradigm in order to accommodate demands of UWB proponents who wish to operate outside existing emissions limits, the Commission should only consider deployment of UWB devices and applications on a licensed basis secondary to all co-channel stations in the bands they overlay. Such licensing should only be considered after it has been demonstrated that these devices will not increase the interference potential to existing users in those bands. If, after obtaining real world experience and determining that such devices cannot cause interference to vital operations in those bands, the Commission may consider allowing such devices on an unlicensed basis, but only as intentional radiators.⁵⁷

IV. SHOULD THE COMMISSION IN THE FUTURE CONSIDER LICENSING ANY TYPES OF UWB APPLICATIONS, THE COMMISSION SHOULD TAKE INTO ACCOUNT USE OF EXISTING ALLOCATIONS TO ACCOMPLISH THE SAME OBJECTIVES

As the Commission is well aware, there is a limited amount of spectrum available and the demand for spectrum continues to grow unabated. The Communications Act endows the Commission with the responsibility of managing this resource.⁵⁸ In doing so, the Commission consistently has considered the public interest in making additional spectrum available for a given service or application when other spectrum is already available for similar purposes.

By definition, every UWB device would put additional noise into the spectrum in which it operates. Accordingly, if tests indicate that certain UWB devices operating outside existing rules may be able to operate without compromising existing licensed users, the Commission should still consider whether deployment of the UWB technology is in the public interest before

⁵⁶ Comments of TDC at 28.

⁵⁷ By categorizing UWB devices as intentional radiators, the Commission not only applies the proper designation to such devices, but also takes the precautions appropriate for such devices, such as a broader and more rigorous certification requirement. *See* 47 C.F.R. § 15.201 *et seq.* *Compare* 47 C.F.R. § 15.101 *et seq.*

permitting such deployment.⁵⁹ A chief factor in any such assessment is whether the applications can already be provided under existing rules and/or spectrum allocations. UWB proponents claim that there are many applications that potentially can take advantage of UWB “technology,” everything from ground penetrating radar to high speed broadband communications. As UWB proponent Aether Wire notes, however, many, if not most, of these applications can already be accomplished under current spectrum allocations.⁶⁰

For example, some UWB proponents tout UWB as being able to provide high-speed data communications applications.⁶¹ Although this type of application may be a goal worthy of support in the abstract, the fact is that Commission already has taken several steps to expand the potential for unlicensed broadband data communications in specific bands and to make those applications a reality. For example, on October 25, 2000, rules went into effect permitting unlicensed frequency hopping spread spectrum devices operating in the 2.4 GHz ISM band to increase channel bandwidth by up to 500 percent. The Commission stated that “[t]he wider bandwidths will permit these systems to provide higher data speeds, thereby enabling the development of new and improved consumer products such as wireless computer local area networks and wireless cable modems.”⁶² This action complements the broadband potential of unlicensed direct sequence spread spectrum systems already permitted in the 2.4 and 5.8 GHz bands. The Commission has also made other spectrum available for Part 15 devices to support

⁵⁸ See 47 U.S.C. § 302.

⁵⁹ As XS observed, testing does still not resolve whether interference will, in fact, occur. Comments of XS at 9.

⁶⁰ Comments of Aether Wire at 2.

⁶¹ *E.g.*, Comments of TDC at 6; Comments of XS at i.

⁶² Amendment of Part 15 of the Commission’s Rules Regarding Special Spectrum Devices, ET Docket No. 99-231, FCC 00-312, ¶1 (Aug. 31, 2000).

broadband services, namely the 59-64 GHz band.⁶³ Moreover, in the *Millimeter Wave Notice*, the Commission proposed making another 4 GHz available for such use by proposing to add the 57-59 GHz and 64-66 GHz bands to the already available 59-64 GHz band.⁶⁴ This spectrum could be used to create “ultra-wideband” wireless local area networks or short-range, high-throughput point-to-point communications, and may be appropriate for other applications as well. In addition to these and other bands already supporting unlicensed data communications, there are numerous allocations for licensed operations that can and do support this purposes.

Moreover, the comments of several UWB proponents make clear that many of the devices they propose for UWB treatment are simply more spectrum hungry versions of devices they have developed under existing rules.⁶⁵ Therefore, the Commission must carefully consider whether UWB technologies are necessary to serve the applications that UWB devices claim to advance.⁶⁶ Even assuming *arguendo* that the odds of interference may not be great, a single instance of harm could outweigh all of the marginal benefits gained by introducing the UWB

⁶³ See 47 C.F.R. § 15.255; *Amendment of Parts 2, 15, and 97 of the Commission’s Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481, at 28-36 (1996)(*Above 40 GHz Order*). In that order, the Commission made the 59-64 GHz band available for use by Part 15 unlicensed devices. And stated that it would not adopt service rules for licensed services in that band. *Amendment of Part 2 of the Commission’s Rules to Allocate Additional Spectrum to the Inter-Satellite, Fixed, and Mobile Services and to Permit Unlicensed Devices to Use Certain Segments in the 50.2-50.4 GHz and 51.4-71.0 GHz Bands*, Notice of Proposed Rule Making, 14 FCC Rcd 12473, 12487, n.52 (1999)(*Millimeter Wave Notice*).

⁶⁴ *Millimeter Wave Notice*, 14 FCC Rcd at 12487-88, para. 17. In that proceeding the Commission also sought comment on whether to make the 55.78-57 GHz band also available for use by Part 15 unlicensed devices. *Id.*

⁶⁵ See, e.g., Comments of Delphi at 14-15; see also Comment of TDC at 27 (GPR systems have operated below 1 GHz for three decades).

⁶⁶ TDC admits in its comments that GPR systems can operate below 1 GHz. Comments of TDC at 27. If that is the case, TDC and other GPR advocates bear a heavy burden to demonstrate why spectrum between 1 and 2 GHz (or elsewhere) should be made available for such operations. Of course, testing has yet to determine whether operation of GPR systems below 1 GHz can occur without increasing the threat of harmful interference to critical aeronautical safety allocations in that frequency range.

devices. For example, if a UWB device is intentionally or unintentionally used in a restricted area and as a result there is a serious accident, has the Commission made a good bargain? Even worse, the nature of UWB is that investigators might never be able to determine if UWB interference caused the accident.⁶⁷ As a result, the Commission and other responsible agencies might not be able to determine the cause of or take corrective action on whatever caused the accident, fating it to be repeated.

The foregoing provides only one illustration of the following principles: in considering whether to allow a certain UWB application to overlay existing uses, the FCC must not only assess, based on adequate testing, what the potential is for harmful interference to life-critical applications such as GPS and safety-of-life services, as well as other existing operations. It must also consider whether, given that other spectrum may already be available for applications similar to these offered by the UWB devices, the increased noise and potential interference to existing services is justified.

V. CONCLUSION

For the foregoing reasons and those in their initial comments, ARINC and ATA continue to support the FCC's commitment to require thorough testing and analysis *prior to* taking any action regarding the possible deployment of UWB devices. UWB applications should only be permitted if they are determined to pose no "credible" interference threat to GPS and other safety-of-life operations on overlaid spectrum. Even if test results suggest that certain UWB devices can operate without a threat of harmful interference, such results do not necessarily ensure that there will be adequate protection from harmful interference in the real world. Therefore, ARINC and ATA continue to believe that it would be unwise to allow the

⁶⁷ Comments of Boeing at 4; Comments of WCA at 4; Comments of Peha at 4; *see also* Comments of ARINC and ATA at 12 (describing difficulties of tracking and correcting

introduction of *unlicensed* UWB technologies to overlay existing GPS and other critical safety-of-life radio operations. Accordingly, in the event of promising test results, the Commission should gain real world experience with *licensed* operation of such UWB devices, as described and qualified herein, before considering permitting the deployment of any unlicensed UWB applications that do not meet the current Part 15 regulations.

Respectfully submitted,

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interference from itinerant UWB devices).