

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

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

**COMMENTS OF AT&T WIRELESS SERVICES, INC**

AT&T Wireless Services, Inc. ("AT&T") hereby submits its comments on the Commission's Notice of Proposed Rule Making in the above-captioned proceeding.<sup>1/</sup> While AT&T agrees with the Commission that ultra-wideband ("UWB") technologies may give rise to a range of promising new applications and high-speed communication services, it is still far from clear how effectively these new systems will be able to share spectrum with the multitude of existing radio services on a widespread basis. More details are needed before interested parties can comment meaningfully on these important issues. Accordingly, AT&T urges the Commission to proceed cautiously and allow all parties the necessary time to finish relevant studies in progress and fully evaluate the results as part of the next stage in this proceeding. Until such testing is complete, and the results fully analyzed as part of this public proceeding, the Commission should adopt no new rules governing the use of UWB technology under Part 15 of the its rules.

AT&T appreciates and wholeheartedly supports the Commission's desire to "ensure that existing and planned radio services, particularly safety services, are adequately protected" from

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

interference by UWB technologies.<sup>2</sup> In particular, AT&T applauds the Commission’s recognition of the relative status of potential UWB devices and systems. As Part 15 users of the spectrum, these devices “are subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of” primary and secondary licensed users of the spectrum.<sup>3</sup> Of primary concern to AT&T is the potential interference that UWB technologies and systems may cause to existing communications systems. AT&T, for example, uses both the cellular and PCS bands to provide its nationwide mobile voice and data services, as well as the 2.3 GHz WCS band to provide its residential fixed wireless access service. AT&T also makes extensive use of the various fixed microwave bands to provide backhaul services for its mobile operations and in support of its local telephone services. Thus, there are a number of different applications and frequency bands that must be protected.

It is worth noting that—although technically not classified as such—commercial mobile services are clearly “safety” services. The vast majority of mobile phone users cite personal safety as one of the primary reasons for purchasing a wireless phone, and there can be no doubt that wireless phones have saved countless lives and aided law enforcement authorities in solving numerous crimes since their introduction.

AT&T appreciates the admittedly conservative approach the Commission has adopted in proposing rules for new UWB technologies and devices. However, even this conservative approach may not serve either existing users or UWB technology proponents well in either the short or long term. By deferring different pieces of the UWB puzzle to later proceedings (e.g.

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<sup>2</sup> Id. at ¶ 1.

<sup>3</sup> Id. at ¶ 2; 47 C.F.R. 15.5(b).

higher power vs. lower power UWB devices, different modulation types),<sup>4</sup> the Commission risks development of overlapping, or even conflicting definitions, limits, and requirements for different UWB technologies. AT&T respectfully suggests that the Commission consider the full range of issues associated with developing and implementing UWB technologies in a single, unified approach. This will minimize the burden on the Commission and ensure that its UWB rules are comprehensive and consistent. Adoption of the proposed rules should therefore be postponed until all aspects of UWB technologies can be assessed.

Given what is known today about potential UWB technologies, AT&T believes that adopting the proposed rules in the near future would be premature and could pose serious practical and technical risks in the short term, while threatening more widespread adoption of UWB technologies in the longer term. Recognizing that the protection of existing services is a critical objective of policy development for unlicensed UWB use, AT&T believes that the current knowledge base on which to formulate generic rules for unlicensed UWB technologies and devices is inadequate at this time. First, as the Commission correctly points out throughout the Notice, there will be a variety of UWB systems operating in a variety of different environments -- in both a location and frequency-specific sense -- and having “a variety of technical characteristics depending on the intended application.”<sup>5</sup> This will make it extremely challenging to develop generic rules to govern unlicensed UWB use. Because the specific implementations of UWB technologies will vary according to application type and frequencies use -- and only a handful have been developed to date -- there is simply not enough information available at this time to predict with any degree of accuracy what interference other types of UWB devices might cause

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<sup>4</sup> Notice, at ¶¶ 19, 21.

<sup>5</sup> Id. at ¶¶ 13, 16.

and to develop rules to protect all existing users. Existing experience with UWB devices is perhaps adequate to set limits and rules for those specific applications, but AT&T expects that development of UWB technologies will continue apace, with new techniques giving rise to potentially new interference concerns. The Commission should not be tempted to generalize from the relatively limited number of applications and experiences brought forth to date to establish general rules governing all UWB technologies and devices.

Second, as the Commission correctly notes, questions still exist related to the widespread use of UWB devices.<sup>6</sup> Problems that are not evidenced with extremely low levels of use and minimal deployment may become more severe when such devices are more widely deployed and more intensively used.<sup>7</sup> Despite best analysis, it may not be possible to predict what aggregate effect the operation of a large number of (similar or dissimilar) mass-marketed UWB devices might have on existing communication systems, especially those that are mobile, nor the impact of more geographically widespread use of such devices. The Commission wisely recognized such potential problems in granting waivers for several companies to sell and deploy UWB systems.<sup>8</sup> There are many sharing scenarios that would have to be investigated to provide confidence that a large number of UWB devices could operate simultaneously without causing interference to the wide range of existing systems. AT&T urges the Commission to analyze fully the impacts that the

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<sup>6</sup> Id. at ¶¶ 46-47.

<sup>7</sup> This may also help explain why the level of complaints regarding interference from UWB devices has been low to date. With larger numbers of devices, using a wider range of frequencies, and in more locations, complaint levels may rise. Thus, the current level of complaints is not necessarily indicative of the interference caused by UWB systems.

<sup>8</sup> See U.S. GPS Industry Council, American Airlines and United Airlines, Consolidated Petition for Reconsideration of Waivers Issued under Delegated Authority by the Chief, Office of Engineering and Technology, Order, FCC 00-29, at ¶ 10 (rel. July 14, 2000).

collective use of UWB devices might have on existing services before allowing unlimited, unlicensed UWB operation across broad swaths of frequencies.

In addition to considering the impacts on existing users, the Commission must also consider the potentially negative effects that setting stringent rules might have on the future development of UWB technologies and systems. Locking in requirements and limitations on UWB devices based on today's limited experience and knowledge could potentially disadvantage new forms of UWB technology that use different technical parameters. Consequently, the Commission should give industry additional time to investigate, develop, and test such technologies before prematurely setting rules in place that would act as a barrier to innovation rather than as a stimulant.

In particular, AT&T notes that the Notice focuses on "low-power" UWB technologies and primarily non-communication applications. In setting the rules for low-power UWB technologies, the Commission must be mindful that other types of communication applications are possible that might utilize lower power than that required for wide-area fixed and mobile services. AT&T is actively researching UWB systems to discover how they might best be used for communication, to evaluate interference to existing network services, and to maximize coexistence of UWB with services such as U-NII, for example.

Although interest in UWB technologies is currently highest in specialized applications, which are intermittent, isolated, and found in environments which are inherently RF-noisy, UWB systems used for communications could pose very different interference threats in a mass-market setting. Estimation of potential interference from these UWB communication systems to incumbent services will be critical, because these applications will be less intermittent and more widely deployed than other UWB applications and more likely to occur in areas with existing

services that might be impacted. The Commission should not foreclose the opportunity afforded by such systems by enacting rules that are based on only a limited (non-communications) subset of UWB applications and may unnecessarily constrain the development of emerging UWB communication technologies and systems. Rather, the Commission should promulgate a comprehensive set of UWB rules that would provide an additional spectral resource for extremely high throughput, short-range communication of voice, data, and video services in on-premises and campus environments.

If the Commission nonetheless decides to proceed in a piecemeal fashion and adopt limited rules appropriate only to specific types of UWB applications, AT&T makes the following specific observations and comments in addition to the more general concerns noted above:

- Rules should be based on EIRP (field strength) and power spectral density limit formulation as a function of center frequency. This will determine how close a UWB transmitter has to be to affect an existing/envisioned user device or base station. This will be particularly important -- and difficult to manage -- in a mobile environment. As noted above, an important issue is also how many transmitters operating simultaneously within a specified range will cause an additive power problem. Should UWB use become widespread, it is not inconceivable that the emissions from several devices may combine to produce interference at a given point in time.
- Software defined radio (“SDR” -- the use of computing engines to receive and transmit radio signals in lieu of analog radio techniques) is an emerging technology that will eventually replace current radio transceiver architectures. SDR receivers can admit a whole band, or significant fraction thereof, to an analog-to-digital converter (“ADC”), which responds to and converts all signals to a digital stream. High speed numerical

processing is then used to tune, filter, and demodulate individual signals of interest.

Because such systems are designed to admit an entire band and process many signals simultaneously, the analog front-end electronics and ADCs are designed to maximize spurious-free dynamic range. These systems cannot use automatic gain control as an effective means of overload control, because its action in response to presence of a strong signal might reduce ability to receive weaker signals throughout the entire band. Because of the inherently wideband nature of these receivers, UWB interference could be more troublesome than with non-SDR systems.

- Aside from receiver desensitization or overload effects with existing radio technologies or SDRs, studies will need to be done on what non-linear effects might be anticipated by particular implementations of UWB. For example, some applications may use high peak-power pulses of short duration to create the ultra-wideband waveform. Protective devices are sometimes applied near the antenna of radio devices to protect them from momentary high-energy overloads. Such devices may be stimulated to conduction by UWB impulses causing undesirable mixing or IM-related effects, which then can cause additional desensitization. In some cases, re-radiation could occur from the antenna causing interference to other close-proximity receivers utilizing bands that might be otherwise unaffected.
- AT&T suggests that the “watershed” point for above-below treatment of emissions limits be made nearer 2 GHz than 1 GHz, to ensure common treatment for cellular/PCS licensed services. The Commission should also keep in mind that frequencies above 2 GHz are currently being considered for use by third generation wireless services. For this reason, AT&T urges the Commission to move the cut-off to 2600 MHz.

- The Commission should carefully consider possible interference to the U-NII band at 5 GHz. This band, made available with the intent of supporting high-speed wireless data (Internet) access for a wide variety of applications, is about to enter widespread use now that the IEEE 802.11a standard is complete, RF hardware and ICs are becoming available, and harmonization of the PHY with HIPERLAN2 in Europe has been achieved. With HIPERLAN2/802.11a PHY convergence and future alignment of this spectrum in the United States, Europe, and Japan, these frequencies might emerge as the first instance of a world-wide common air interface for high-speed data applications. Because frequencies in this part of spectrum may be prime candidates for UWB overlay and the services contemplated in U-NII inherently require wideband channels, the Commission may wish to allow U-NII applications to be deployed and tested before allowing potential interference. Also, usage of U-NII might be similar in function and use environment to UWB, so interference could prove more troublesome.
- In line with the above, for communication (rather than solid body penetration) systems, AT&T suggests that rules with excision of specific segments of spectrum using filters be encouraged, if possible, to minimize impact on incumbent communication services. Based on experiments with overlaid wideband CDMA signals, it seems reasonable to offer inducements to systems which can accommodate such “notching”. An example might be allowance for higher power levels.

Finally, AT&T fully supports the need for additional testing before the adoption of any final rules in this proceeding. The Commission notes:

UWB technology is relatively new. Further testing and analysis is needed before the risks of interference are completely understood. Such testing is already being planned by a number of organizations. We will provide ample opportunity to

complete these tests and ensure that analyses of the test results are submitted in the record for public comment before adopting any final rules in this proceeding.<sup>9</sup>

Once all such tests are completed, a much more rigorous and comprehensive analysis of UWB technologies can take place. Such tests will give interested parties the essential information needed to evaluate the promise and potential disadvantages of UWB systems. It is critical that tests address all the affected radio services, including particularly the mobile services, and that any rules the Commission adopts address the unique protection requirements of each service.

Experience has shown that the best way to evaluate interference to existing systems is to perform first-order experiments. AT&T is in the process of conducting such experiments to determine gross effects, and to model “what-if” circumstances via simulation (such as antenna directionality effects). AT&T is also conducting propagation measurements for UWB channels to support such models, and has initiated a plan to do first-order testing with cellular and PCS receivers as soon as possible. Completion of these studies will take time—it is unlikely that anything but gross effects will be investigated by October 30, 2000, the date by which the Commission has asked parties to submit their results. AT&T urges that this proposed date be extended by at least nine months, and that no final rules be adopted by the Commission until tests are complete and fully analyzed.

#### CONCLUSION

AT&T urges the Commission to take a comprehensive approach to developing UWB rules; one that addresses both high-power and low-power applications, and that is

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<sup>9</sup> Notice at ¶ 1.

based on the different technical characteristics of all types of potential UWB systems, not just those that happen to be available now. As part of that approach, the Commission should formally extend the time for parties to complete ongoing studies and file their results with the Commission to no earlier than July 30, 2001.

Respectfully submitted,

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## Certificate of Service

I, Catherine Carroll, hereby certify that on this 12th day of September 2000, copies of the foregoing Comments of AT&T Wireless Services, Inc. were hand delivered to the following:

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