**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, D.C. 20554**

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| In the Matter of | ) | |
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| Revision of Part 15 of the Commission's Rules | ) | ET Docket No. 98-153 |
| Regarding Ultra-Wideband Transmission Systems | ) | |
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# SPRINT SUPPLEMENTAL COMMENTS REGARDING NTIA's UWB ANALYSES REPORTS


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**SPRINT SUPPLEMENTAL COMMENTS**
**REGARDING NTIA's UWB ANALYSES REPORTS**

Sprint Corporation, on behalf of its local, long distance, and wireless divisions (collectively, "Sprint"), submits these supplemental comments in response to the reports that the National Telecommunications and Information Administration ("NTIA") has prepared to analyze the impacts that ultra-wideband ("UWB") devices will have on existing radio licensees.[1]

NTIA's work, while focused on government radio operations between 400 MHz and 6 GHz, confirms the conclusions reached in studies performed jointly by Sprint PCS, Time Domain and Telcordia regarding the 1.9 GHz PCS band — namely, that in certain circumstances UWB devices *will* cause harmful interference to users in the spectrum be-

[1] *See Public Notice*, "Comments Requested on Test Data Submitted by the NTIA Regarding Potential Interference from Ultra-Wideband Transmission Systems," ET Docket No. 98-153, DA 01-171 (Jan. 24, 2001). *See also* NTIA, "Assessment of Compatibility Between Ultrawideband Devices and Selected Federal Systems," NTIA Special Publication 01-43 (Jan. 2001)("NTIA Report 01-43"); NTIA, "The Temporal and Spectral Characteristics of Ultrawideband Signals," NTIA Report 01-383 (Jan. 2001)("NTIA Report 01-383").

low 3.1 GHz, including millions of PCS customers.[2] The NTIA study further confirms that *UWB devices can cause harmful interference even at the more stringent power emissions levels discussed in the UWB NPRM*.[3]

## I. NTIA Has Submitted a Useful Analytical Model by Which to Evaluate UWB Devices, and Sprint Agrees That UWB Interference Should Be Measured Using Average RMS Power

NTIA has developed a comprehensive model by which to evaluate UWB devices. While the NTIA model and testing are somewhat different from the model and testing that Sprint PCS/Time Domain/Telcordia used in analyzing UWB devices on PCS networks, the two sets of models and tests reached similar conclusions.

The chief difference between the two sets of models and tests is that Sprint PCS, Time Domain and Telcordia measured UWB emissions by averaging video bandwidths of 100 kHz and resolution bandwidths of 1 MHz (and 5 MHz for specific instances). We used the average of the logarithms of the peak power densities measured with video averaging technique because this is the methodology that the Commission has used for measuring narrowband Part 15 devices.

The NTIA, following a thorough analysis and review, has determined that average power should instead be calculated from the Root Mean Square ("RMS") voltage of the UWB signal, because the RMS detector function "better represents the interference effects of UWB signals than averages of the logarithms of the peak detector output of the

[2] *See* Sprint PCS/Time Domain *Ex Partes*, ET Docket No. 98-153 (Sept. 12, 2000), appending two Telcordia analyses: "Summary of Testing Performed by Sprint PCS and Time Domain to Characterize the Effect of Ultra Wideband (UWB) Devices on an IS-95 PCS System," and "A Model for Calculating the Effect of UWB Interference on a CDMA PCS System." *See also* Sprint PCS Supplemental Comments (Oct. 6, 2000); Sprint PCS *Ex Parte* (Feb. **21**, 2001).

video filtered response."[4] Sprint agrees with the NTIA's conclusion, and it recommends that the Commission use the RMS detector function in evaluating UWB devices. This is because NTIA has demonstrated that the average logarithm is largely insensitive to energy contained in low-duty-cycle, high amplitude signals, with the result that Part 15 measurement values substantially understate actual impacts.[5]

## II. Sprint Agrees With NTIA That the Commission's Proposed Means of Measuring Peak Power Is Inadequate

The Commission has recognized that limits on UWB peak emissions are "necessary" to reduce the potential for UWB emitters to cause harmful interference.[6] It has also recognized that the current Part 15 limits — 20 dB above the average limits — are inadequate for UWB devices:

> [I]t appears that the peak levels for UWB devices could be up to 60 dB higher than the average levels. This difference is significant because these higher peak levels could lead to an increased risk of interference to certain receivers.[7]

The Commission has further recognized that receivers using "wide bandwidths are likely to receive more total energy from UWB devices than from most other existing Part 15 devices" and that as a result, "special consideration is needed to develop emissions limits

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[3] *See UWB NPRM*, ET Docket No. 98-153, FCC 00-163, 15 FCC Rcd 12086 (May 11, 2000).

[4] NTIA Report 01-43 at p. vii.

[5] NTIA has determined that traditional Part 15 measurement values can be substantially lower (10-15 dB) than the RMS power in a UWB signal. *See* NTIA Report 01-43 at § 2.2.1, p. 2-1.

[6] *UWB NPRM* at ¶ 42. The need for limits on peak emissions is undisputed. *See, e.g.*, Time Domain Comments at 32 ("Without peak limits, systems theoretically could be developed that meet the average limits, but have very low pulse repetition frequencies and, therefore, have enormous pulses.").

[7] *UWB NPRM* at ¶ 35.

for UWB devices."[8] Inexplicably, however, the Commission has proposed to establish UWB peak power limits using current Part 15 limits — a 20 dB limit for a peak signal measured over a 50 MHz bandwidth.[9] It explained that a bandwidth of 50 MHz would be "comparable to the widest victim receiver that is likely to be encountered."[10]

The Commission's assumption that a bandwidth limited to 50 MHz should be adequate is not supported by the facts. The handsets used by the over nine million Sprint PCS customers are designed to have a front-end bandwidth of 60 MHz (1.93 GHz to 1.99 GHz). Sprint assumes that other PCS licensees use a similar wide front-end bandwidth.

NTIA has correctly noted that the 20 dB factor that the Commission has proposed for peak UWB emission is not adequate:

> For dithered UWB signals, the lowest achievable peak power in a 50 MHz bandwidth to average (RMS) power in a 1 MHz bandwith is 27 dB, and occurs for UWB signal PRFs [Pulse Repetition Frequencies] equal to or greater than 25 MHz. Therefore, for dithered UWB signals, a 20 dB limit of peak power in a 50 MHz bandwidth to average (RMS) power in a 1 MHz bandwidth is not achievable.[11]

Indeed, even UWB proponents acknowledge that the Commission provides "no justification" for its proposed peak power emissions levels.[12]

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[8] *Id.*

[9] *See id.* at ¶¶ 42-43.

[10] *Id.* at ¶ 42.

[11] NTIA Report 01-43, Appendix D, at D-2.

[12] Time Domain Comments at 32. As Metricom has documented, the proposed limit would effectively allow a single UWB device to generate emissions equivalent to 1,000 Part 15 devices. *See* Metricom Comments, UWB NPRM Technical Appendix at 1 ("Allowing the maximum peak power to be 60 dB as proposed in the NPRM would effectively allow a single UWB device to look

According to a UWB vendor's product literature, a 0.5ηs pulse can be achieved (equaling a bandwidth of 2 GHz). Peak UWB emissions above the Commission proposed 20 dB limit with a pulse width of .5ηs (or 2GHz) will definitely impact the front-end bandwidths of PCS handsets. Peak UWB emissions (in-band) that are of higher power than the usable signal emissions from PCS base stations should be viewed as additive noise and, in turn, would degrade the handset's ability to receive a usable signal from a base station. In turn, any negative impacts seen on the front-end of a handset receiver would be amplified into the intermediate frequency circuitry.

## III. The Commission Must Reconsider Its Tentative Conclusion Regarding the Interference Effect of Multiple UWB Devices in Light of the New Evidence That NTIA Has Submitted

NTIA, based largely on the representations of UWB proponents, notes that use of UWB devices could proliferate, with "hundreds, thousands or even more of these devices . . . employed per square kilometer."[13] The Commission, based on four reports prepared by the UWB industry, has tentatively concluded that the cumulative impact of multiple UWB devices in the same area "appears to be negligible."[14] Sprint and other parties expressed concern with this tentative conclusion, noting that it was inconsistent with both

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like a 1000 or more –41 dBm radiators spread across the band thus increasing the probability of interference to licensed receivers in close proximity to an operating UWB device.").

[13] NTIA Report 01-43 at 5.1-5.2.

[14] *UWB NPRM* at ¶ 47. The Commission did recognize that "further testing and analysis is desirable on this issue." *Id.*

common sense and basic RF engineering principles (at least in the context of narrowband radio transmissions).[15]

The NTIA, after reviewing the UWB industry's cumulative effect studies, has determined that the UWB industry used "unrealistic" assumptions and that the conclusions they drew are "misleading."[16] Based on its own analysis, the NTIA has concluded that "the well-accepted principle of linear addition of average (RMS) power from multiples sources holds equally well for average (RMS) power per unit bandwidth regardless of the nature of the UWB signal":

> Thus, for a ten-fold increase in emitter density, the received aggregate power will increase by ten dB, and for a hundred-fold increase by 20 dB.[17]

NTIA's measurements were admittedly limited, and it recommends that additional study of cumulative effects be undertaken.[18] Sprint supports this recommendation, but it urges that the additional study test one of the assumptions that NTIA has made. Specifically, NTIA's UWBRings model assumes that all UWB emitters are distributed uniformly and have similar emissions outputs.[19] Sprint agrees that UWB devices would likely proliferate, but it believes that a more reasonable assumption would be that different UWB devices operating in the same area will have different emission levels (*e.g.*, one device

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[15] *See, e.g.*, Sprint PCS Supplemental Comments at 8-11; Department of Transportation Comments at 13; U.S. GPS Industry Council Comments at 34. Sprint PCS was unable to test the effect of multiple UWB devices because Time Domain made only one device available for testing.

[16] NTIA Report 01-43 at 6.4 and Executive Summary at x.

[17] *Id.* at 5-3 and 5-25. In contrast, Time Domain denies that "an aggregation of TM-UWB units will significantly increase the probability of harmful interference" because, in its judgment, there are "real-world factors that limit the cumulative impact of many UWB devices operating at Part 15 limits."" Time Domain Reply Comments at 40 and 56. Notably, Time Domain did not explain its position its PCS analysis (Appendix A).

[18] *See* NTIA Report 01-43 at 5-2.

operating with higher peak powers or at wider bandwidths than other devices). Accordingly, the impact of different emissions levels of different UWB devices in the same area should be studied.

## IV. NTIA's Proposed "Indoor Reduction Factor" Is Not Appropriate for PCS, MMDS and Other Licensees That Provide Their Services Indoors

NTIA suggests that the cumulative effect of UWB devices could be minimized if such devices were limited to indoor applications because of the additional propagation losses that would occur from walls and windows:

> [I]f UWB devices are limited to indoor use only . . . , the indicated dB values would be subtracted from any predicted aggregate interference values based on outdoor use.[20]

Sprint does not challenge NTIA's basic analysis. Obviously, a government-operated radar system will be impacted less by a UWB device located indoors than if the same device were located outdoors closer to the radar system.

There are, however, two problems with the NTIA's proposed "indoor reduction factor." First, as the Commission has already acknowledged, "many" of the UWB products being proposed would be mobile devices, and it "hardly seems likely that these products would be operated only within buildings."[21] As a practical matter, the fact that a UWB device may contain a label, "not for outdoor use," will not prevent people from using the devices outside.

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[19] *See id.* at 5-5.

[20] NTIA Report 01-43 at 5-30 to 5-31.

[21] *UWB NPRM* at ¶ 40.

As importantly, even if the Commission were willing to assume that people will use UWB devices only indoors, the fact remains that numerous licensees use their spectrum for indoor use. For example, MMDS licensees use their spectrum to provide "always on" Internet connections to customer personal computers, the very area where multiple UWB devices would likely operate. Likewise, with increasing frequency, consumers purchase PCS instead of a second landline, so they can communicate while using their landline for Internet access, again in the very area where UWB devices would likely be used. Mobile customers also use their service while in the automobile, another area where use of UWB devices could proliferate.

In summary, while a UWB indoors reduction factor may be acceptable to the federal government given its use of spectrum, such a factor is not appropriate for the many licensed services that are used indoors today.

## V. The Commission Needs to Harmonize Its UWB Investigation With the Nation's "3G" Policy

Sprint PCS, with Time Domain and Telcordia, has documented the adverse effects that UWB devices can have to CDMA-based PCS networks. CDMA is a major technology for so-called second generation ("2G") mobile networks, and is used by such carriers as Verizon Wireless, Qwest, Leap, Alltel, and U.S. Cellular. Moreover, other carriers not currently using CDMA (AT&T Wireless, Cingular, and VoiceStream) have announced their intent to use CDMA for their "third generation" ("3G") technology. This uniform movement to CDMA reflects the fact that CDMA is the most spectrally-efficient technology available. Of course, as the most spectrally-efficient technology, CDMA is also most susceptible to interference.

Last October, the President of the United States announced a national policy to facilitate the introduction of 3G technologies to today's 2G mobile networks, a technology that the President noted will create "mobile-commerce (m-commerce) that people will use in ways that are unimaginable today."[22]

The potential of 3G-based services is dramatically demonstrated by the recent PCS re-auction, in which mobile carriers spent $17 billion to acquire less spectrum than Sprint PCS acquired six years ago for $3 billion.

Some (but certainly not all) UWB proponents want to use PCS spectrum to provide telecommunications services that PCS licensees are already providing — and they want to use this PCS spectrum for free. However, even these few UWB proponents concede that their devices will interfere with PCS networks — which would cause the PCS industry to expend untold millions (or billions) in an attempt to offset this new interference.

Even ignoring the substantial legal issue raised by the proposal of a few UWB proponents — the right of the federal government to unilaterally convert exclusive PCS licenses into non-exclusive licenses after the PCS industry has spent billions for its exclusive licenses — the argument made by certain UWB proponents constitutes very bad public policy, given the nation's articulated interest in promoting the rapid deployment of "3G" technologies.

## VI. Conclusion

[22] President Clinton, Memorandum for the Heads of Executive Departments and Agencies, " advance Mobile Communications/Third Generation Wireless Systems" (Oct. 13, 2000).

The NTIA concludes that the operation of UWB devices below 3.1 GHz "will be quite challenging."[23] This conclusion is confirmed by many UWB proponents which acknowledge the interference problems that UWB devices can cause and which accordingly recommend that UWB devices not be permitted to operate in the bands below 3.1 GHz:

> Unfortunately, while some UWB advocates have claimed that UWB operates in the "garbage band" and can superimpose its emissions on existing services without interference thereby "creating spectrum," such statements are without basis in fact and, in fact, have been shown to be false.[24]

There is, moreover, evidence that even the few UWB proponents wanting to use the bands below 3.1 GHz are capable of providing their desired applications above 3.1 GHz.[25]

Given the undisputed evidence that UWB devices operating in the spectrum bands below 3.1 GHz will cause harmful interference to current licensees in these frequency bands, the Commission must decline to authorize UWB applications in these bands.

Respectfully submitted

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[23] NTIA Report at x.

[24] *See* Multispectral Solutions ("MSSI") at 10-12. *See also id.* at 1 (Unfiltered UWB systems "should not be permitted under Part 15," and filtered systems should initially be permitted only "above 3.1 GHz."); at 13 ("[T]here is no compelling reason to operate below 3.1 GHz for the types of applications contemplated for UWB communications and radar."); Delphi Comments at 18 ("[T]he Commission should not attempt to make a determination regarding frequency of operation below 2 GHz until adequate testing of interference potential has been performed."); Fantasma Comments at 3 ("Fantasma agrees with the Commission's concerns relating to the operation of UWB systems on or near frequencies used for GPS services."); Zircon Comments at 7 ("It is possible that UWB devices used for communications purposes . . . may have some interference potential to radio services operating below 2 GHz.").

[25] *See* Multispectral Solutions Reply Comments at 2-3. *See also* Multispectral Solutions Comments at 12 ("[T]he argument from portions of the UWB community that frequencies below 2 GHz are necessary for in-building communications have no basis in fact."); Fantasma Networks at 3 ("UWB communications systems do not require frequencies below 2 GHz.").

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## CERTIFICATE OF SERVICE

I, Anthony Traini, hereby certify on that on this 23d[h] day of February 2001, I served a copy of the foregoing Sprint Reply Comments by U.S. first-class mail, or by hand delivery as indicated with an *, to the following persons:

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