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June 5, 2001

Ms. Magalie Salas, Secretary
Federal Communications Commission
445 12th Street SW
Washington DC 20554

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

Dear Ms. Salas:

Pursuant to Section 1.1206(b)(1) of the Commission's Rules, on behalf of XtremeSpectrum, Inc., I am posting this letter to report a written ex parte communication in the above-referenced proceeding.

The attached document was transmitted by email to Dr. Michael J. Marcus, Julius P. Knapp, and John A. Reed of the Office of Engineering and Technology.

This filing replaces one made yesterday in this docket by XtremeSpectrum. Kindly substitute this one in its place.

If there are any questions about this filing, please call me at the number above.

Respectfully submitted,

Mitchell Lazarus
Counsel for XtremeSpectrum, Inc.

cc (via email): Michael J. Marcus
Julius P. Knapp
John A. Reed

XtremeSpectrum Technical Analysis of Possible Interference to the Satellite Digital Audio Radio Service from UWB Device Emissions

1. Introduction

In recent filings in these proceedings, both Sirius Satellite Radio, Inc. and XM Radio, Inc.[1] have expressed concern that UWB devices operating under modified Part 15 rules would lead to harmful interference to the satellite digital audio radio service (SDARS). In particular, XM Radio presented an analysis that concludes that a DARS receiver would need a minimum 35-meter separation to protect it from UWB interference. Because of this result, the DARS respondents contend that UWB devices should either be restricted to operate above 3 GHz or be restricted to emission levels of 18 uV/meter in a one MHz bandwidth in the DARS band.[2]

These restrictions, however, are unnecessary. XtremeSpectrum has proposed a set of rules (including a spectral mask and an indoor usage restriction) that prevent any harmful interference to DARS receivers[3]. This filing is intended to briefly explain how the proposed rules will prevent such interference and address the concerns of the DARS license-holders.

2. The proposed spectral mask and other factors provide adequate protection to DARS receivers at four meters separation

In their technical analysis, XM Radio indicates that DARS receivers will require a minimum separation of 35 meters from UWB devices to prevent harmful interference. To protect the DARS receiver, the analysis assumes that received UWB emissions must be at or below the thermal noise floor for the receiver. This noise floor is identified as –110 dBm in a 2 MHz bandwidth (i.e. 300° K). The analysis states that this level of protection would require 69 dB of isolation between the DARS receiver and a UWB device. The analysis assumes that only free-space propagation losses will occur and that the UWB emissions would occur at Part 15 levels. XM Radio concludes that to achieve the desired 69 dB isolation the devices would require a 35 meter minimum separation.[4]

This analysis, however, omits several important factors that lead to significantly lower levels of UWB interference. These are:

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[1] See comments by Sirius Satellite Radio, Inc. and XM Radio, Inc. dated April 10, 2001 and September 12, 2000.

[2] The XM Radio analysis dated September 12, 2000 includes a computation in the Appendix to determine maximum UWB emission levels that would provide a minimum separation distance of one meter for the DARS receiver, based on simplified assumptions of free-space path loss in a noise-free environment. The analysis shows that to support a minimum separation of one meter, the required UWB emission level is –70 dBm in the DARS receiver bandwidth (2 MHz). This result is the apparent source of the maximum UWB emission level proposed by XM Radio of 18 μV/meter in a one MHz bandwidth measured at 3 meters. This value of 18 μV/m would be equivalent to -70 dBm/MHz and is therefore 28.8 dB below the current Part 15 limit for unintentional emissions in the DARS band.

[3] See XtremeSpectrum comments dated May 10, 2001 for a complete discussion of the proposed rules.

[4] See Technical Appendix to Comments by XM Radio Inc, dated September 12, 2000, section II.

- The spectral mask proposed by XtremeSpectrum that reduces emission levels by 6 dB in the DARS band.
- The indoor restrictions proposed by XtremeSpectrum. This would imply an additional 9 dB or more isolation between UWB devices and DARS receivers.
- The 3 dB coupling loss between the circularly polarized DARS antenna and the linearly polarized UWB antenna.
- The real-world noise levels (or actual levels for the onset of harmful interference effects in the DARS receiver)
- The link-margin (or excess power) required for a mobile radio in a fading channel
- The UWB transmitter activity factor.

Ignoring the latter three factors, to be very conservative, the first three considerations lead to a reduction in the required isolation reported by XM Radio to at most (69dB – 6dB – 9dB – 3dB) = 51 dB isolation. This isolation implies a minimum separation of only 4 meters. Given that the mobile DARS users are unlikely to be 4 meters from a building and certainly very transitory at this distance, UWB transmissions would not cause harmful interference to DARS.

3. Addition of the latter three factors to the XM Radio analysis

3.1 Real-world interference and noise

The XM analysis is based on the assumption that the DARS receiver will be operating at the thermal noise floor—in other words, that any UWB emission at or above thermal noise would lead to harmful interference. However, it has been pointed out that DARS is similar to PCS because both systems use omni-directional antennas, receive relatively weak signals and have low link margins.[5] Also, both systems use mobile receivers operating in fading environments and operate in relatively close frequency bands.

Because of these similarities, it is relevant to consider the analysis and testing by Sprint PCS of a PCS handset in the presence of a UWB emitter in both an anechoic chamber and in real-world conditions.[6] The reported real-world testing indicated that actual interference effects were only evident at much shorter ranges than those indicated by anechoic chamber tests or theoretical analysis (1.5 ft instead of 2m). It was clear that the primary cause of the discrepancy was that real-world ambient RF noise was ignored in both the theoretical analysis and chamber measurements. It follows that the minimum separation distance for DARS will be much less than the 4 meters derived above.

3.2 Operation with a power that survives a fading channel

DARS operates in a fading channel, with a great potential for multi-path and shadowing due to obstructions such a buildings and foliage. The fact that the DARS designers needed to provide

[5] Comments of Sirius Satellite Radio, Inc, dated April 25, 2001, page 3.
[6] Original test results were reported in Sprint PCS comments dated September 12, 2000. Subsequent details are provided in Time Domain comments dated October 27, 2000, Appendix A. See also XtremeSpectrum comments dated May 10, 2001for a additional analysis of the testing and analysis.

terrestrial repeaters for their system testifies to the fact that the fading was severe. To counteract a fading channel, the power must be high enough to work through the fades. So operation at the noise floor is very transitory—only in deep fades—not continuous.[7] Therefore in most scenarios, a 4-meter separation distance is not required. Any potential interference is transitory.

3.3 The activity factor for a UWB device is low

UWB devices share a common RF channel and therefore must use time-sharing techniques. Multiple uncoordinated UWB devices cannot transmit simultaneously in proximity without causing UWB-on-UWB interference. This fact has been reported in previous submissions.[8]

Thus for a UWB device to be the limiting factor for a DARS receiver, not only would the mobile DARS receiver need to pass less than 4 meters from a wall of a building, but it would have to pass there at the exact time when a UWB device was transmitting at that same wall, coincidently the DARS receiver would have to be in a deep fade at that location, and the residual noise at this building would have to be below thermal noise. This multi-fold coincidence case is very unlikely and transitory. These arguments clearly show that the rules proposed by XtremeSpectrum prevent any harmful interference to DARS receivers[9].

[7] Comments of XM Radio, Inc, dated September 12, 2000, page 4.
[8] See NTIA Special Publication 01-43, page 5-34. Also comments by XtremeSpectrum dated April 25, 2001.
[9] See XtremeSpectrum comments dated May 10, 2001 for a complete discussion of the proposed rules.