

Before the  
**Federal Communications Commission**  
Washington DC 20554

In the Matter of )  
)  
Amendment of Part 15 of the Commission's ) ET Docket No. 99-231  
Rules Regarding Spread Spectrum Devices )  
)  
Wi-LAN, Inc. )  
Application for Certification of an Intentional ) DA 00-2317  
Radiator Under Part 15 of the Commission's )  
Rules )

**JOINT REPLY COMMENTS OF**

**3COM CORPORATION  
CLEARWIRE TECHNOLOGIES, INC.  
INTERWAVE COMMUNICATIONS INC.  
LINCOM WIRELESS, INC.  
SYMBOL TECHNOLOGIES, INC.  
VOCOLLECT, INC.**

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Vocollect, Inc.

September 25, 2001

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3Com Corporation, Clearwire Technologies, Inc., InterWAVE Communications Inc., LinCom Wireless, Inc., Symbol Technologies, Inc., and Vocollect, Inc., collectively the "Joint Commenters," hereby file these Reply Comments in response to the Commission's *Further Notice* in this proceeding.<sup>1</sup>

**A. Summary**

For the reasons presented below, the Commission should:

- make adaptive hopping optional, not mandatory, for frequency hopping systems that use reduced hopsets at 125 mW maximum power;
- permit manufacturers to redetermine reduced hopsets as often as they deem necessary, without being held to a 30-second rule;
- permit reduced hopsets immediately, under a waiver;

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<sup>1</sup> *Spread Spectrum Devices*, 16 FCC Rcd 10036 (2001) ("*Further Notice*").

- set the power spectral density limit for digital modulation systems no lower than 23 dBm/MHz; and
- eliminate the processing gain requirement.

**B. ADAPTIVE HOPPING FOR REDUCED HOPSETS SHOULD BE OPTIONAL, NOT MANDATORY.**

The Commission proposes to permit frequency hopping systems in the 2.4 GHz band to operate a 1 MHz channel over as few as 15 hops, reduced from the present 75, subject to the following conditions:

- (1) maximum peak power of 125 mW (reduced from the one watt permitted for 75 hop systems);<sup>2</sup> and
- (2) adaptive hopsets to be redetermined at least once every 30 seconds.<sup>3</sup>

The Commission "particularly invite[s] comment as to whether use of adaptive hopping techniques should be mandatory . . . ."<sup>4</sup>

The Joint Commenters noted earlier that *either* the 125 mW power limit *or* adaptive hopping is adequate to compensate for any increased risk of interference from a 15-74 hop system.<sup>5</sup> The simultaneous application of both measures is superfluous.<sup>6</sup> The Joint Commenters

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<sup>2</sup> *Further Notice* at para. 14; 47 C.F.R. Sec. 15.247(b)(1) (proposed).

<sup>3</sup> 47 C.F.R. Sec. 15.247(a)(1)(iii) (proposed).

<sup>4</sup> *Further Notice* at para. 13.

<sup>5</sup> Joint Commenters at 6-7 (filed Aug. 27, 2001).

<sup>6</sup> The Commission determined earlier in this proceeding that 125 mW, 15-hop systems using channels *5 MHz wide* yield an acceptable risk of interference. *Spread Spectrum Devices*, 15 FCC Rcd 16244 at para. 15 (2000) (First Report and Order). The interference from a 15-hop system at the same power level, but using channels only 1 MHz wide, can be no greater than that from the 5 MHz system.

support the proposed power reduction. With that provision in place, mandatory adaptive hopping becomes redundant, and should not be required.

Several other parties also favor making adaptive hopping optional for reduced hopsets, rather than mandatory.<sup>7</sup> No party favors mandatory adaptive hopping.

The record thus fully supports modifying the Commission's original proposal to allow hopsets in the 2.4 GHz band that use 15-74 hops at 125 mW max, with adaptive hopping permissible at the manufacturer's option. Similarly, manufacturers that choose to implement adaptive hopping should be permitted to redetermine hopsets as often as they deem necessary, without being held to a rigid 30-second rule.<sup>8</sup>

### C. OTHER FREQUENCY HOPPING ISSUES

*Waivers.* The Joint Commenters agree that manufacturers should be permitted to implement reduced hopsets under a waiver, pending the outcome of the rulemaking.<sup>9</sup> Having authorized 5 MHz × 15-hop systems at 125 mW, the Commission has no rational basis not to immediately allow 1 MHz × 15-hop systems at that same power level.

*Limiting interference.* The Commission should deny Proxim's requests for a 50 or 60 percent minimum occupancy and one-watt power level for reduced hopsets.<sup>10</sup> The first measure would limit the benefits of adaptive hopping for the system in question, while the second measure would exacerbate outgoing interference into other systems.

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<sup>7</sup> Apple Computer, Inc. at 4-7; Texas Instruments Incorporated at 4; Intersil at 3-4; Adtran at 2; Widcomm at 2.

<sup>8</sup> See Agere Systems at para. 16; Intersil at 4.

<sup>9</sup> See IEEE 802 at 5; Intel Corporation at 2; Widcomm at 2.

<sup>10</sup> Proxim at 5.

**D. THE COMMISSION SHOULD SET THE POWER SPECTRAL DENSITY LIMIT FOR DIGITAL MODULATION SYSTEMS NO LOWER THAN 23 dBm/MHz.**

Direct sequence systems are presently subject to a power spectral density (PSD) limitation of 8 dBm/3 kHz.<sup>11</sup> Some parties have suggested that the Commission impose an additional, per-MHz limitation on digital modulation systems. Otherwise, they fear, the absence of a spreading requirement in the digital modulation rules could result in high concentrations of energy in a narrow bandwidth.<sup>12</sup> Proposed limits range from 10 to 33 dBm/MHz.<sup>13</sup>

The Wireless Communications Association (WCA) noted that systems operating under the IEEE 802.11 direct sequence standards for data rates of 1, 2, 5.5, and 11 Mbps all exhibit a maximum peak power density of 20 dBm/MHz.<sup>14</sup> On that basis the WCA proposed a slightly higher limit for digital modulation systems to allow manufacturers some headroom, at 22 dBm/MHz.<sup>15</sup> In Reply Comments being filed today, WCA shows why limits significantly lower than that value would be incompatible with outdoor point-to-point and point-to-multipoint operation.

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<sup>11</sup> 47 C.F.R. Sec. 15.247(d).

<sup>12</sup> *See* Apple Computer at 8-9; OFDM Forum at para. 2.2.

<sup>13</sup> *See* Apple Computer, Inc. at 9 (10 dBm/MHz); Agere Systems at para. 23 (10 dBm/MHz); OFDM Forum at para. 2.2 (17-20 dBm/MHz); Texas Instruments at 8 (17 or 20 dBm/MHz); IEEE 802 at 6 (20 dBm/MHz); Wireless Communications Ass'n at 2 (22 dBm/MHz). Intersil (at 6-7) proposes adopting the U-NII rules now applied to 5.25-5.35 GHz, which include a PSD limit of 11 dBm/MHz limit. Wi-LAN (at 2-3) requests no limit other than the present 8 dBm/3 kHz, equivalent to 33 dBm/MHz.

<sup>14</sup> Wireless Communications Ass'n at 2-3.

<sup>15</sup> Wireless Communications Ass'n at 3.

The Joint Commenters agree in principle with WCA, but propose 23 dBm/MHz as representing the best balance between freedom for digital modulation manufacturers and protection against interference to other users. This value acknowledges long experience under 802.11, with a small degree of added flexibility, and will ensure that interference from digital modulation systems can be no greater than that from conventional direct sequence systems.

*Other matters.* The Commission should disregard the requests of Agere Systems and Adtran to limit the power of digital modulation systems to 125 and 100 mW, respectively.<sup>16</sup> Agere Systems' recommendations are based on arbitrary (and sometimes incorrect) assumptions about how these systems will be used. For example, Agere Systems believes point-to-point applications will not exceed a range of 1 km, even though at least one of the Joint Commenters achieves a range of 50 km with spread spectrum systems.<sup>17</sup> Similarly, Adtran's only ground is its mistaken assertion that most devices in the 2.4 GHz band are point-to-point transmitters using directional antennas. Adtran not only overlooks an installed base of millions of wireless LAN units, but makes no attempt to show why a 100 mW limitation even on point-to-point systems is necessary to avoid interference. To the contrary, point-to-point systems have routinely operated at higher powers for years without creating an interference hazard.

The Commission should similarly disregard the conflicting request of the OFDM Forum to eliminate all power restrictions on systems using high antenna gains, on the ground that the duty cycle of each device tends to be low.<sup>18</sup> A low duty cycle would not protect receivers in the

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<sup>16</sup> Agere Systems at para. 23; Adtran at 3.

<sup>17</sup> Agere Systems at Appendix A (pages unnumbered).

<sup>18</sup> OFDM Forum at para. 2.4.

boresight, even a long distance away, from recurring bursts of interference. In any event, this request is outside the scope of the *Further Notice*.

Finally, the Commission should also disregard the request of Sirius Satellite Radio to reduce the out-of-band limits for single Part 15 devices to 14.6 dBuV/m at 3m, and to 16.6 dBuV/m for multiple devices.<sup>19</sup> (This represents a 40 dB cut from the out-of-band levels presently specified for unintentional emissions in restricted bands such as DARS.<sup>20</sup>) The request is defective in several respects. First, the request is outside the scope of the *Further Notice*, and would require a separate rulemaking. Second, Sirius has not offered any evidence that the Section 15.209(a) levels are inadequate to protect its operations. Third, notwithstanding DARS's legal priority over Part 15, a prudent operator will design a system to function properly in its intended environment, which in this case includes Part 15 devices.

**E. THE COMMISSION SHOULD ADOPT ITS PROPOSAL TO ELIMINATE THE PROCESSING GAIN REQUIREMENT.**

The Commission proposes to eliminate the processing gain requirement for direct sequence systems.<sup>21</sup> The Joint Commenters support this proposal, as do most parties that commented on the issue. Only a handful of parties are opposed,<sup>22</sup> and none of those has squarely addressed the Commission's rationale for abandoning the requirement.

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<sup>19</sup> Sirius Satellite Radio, Inc. at 4.

<sup>20</sup> 47 C.F.R. Sec. 15.209(a).

<sup>21</sup> *Further Notice* at para. 22.

<sup>22</sup> Axonn, LLC at 2-3; Agere Systems at paras. 31-32; Intersil at 7-8; Ademco Group (pages unnumbered); ARRL at 2-7.

Specifically, no party has refuted the Commission's contention that the processing gain requirement is no longer needed to identify systems that qualify for spread spectrum treatment. Although some comments restate (or imply) the conventional view that processing gain reflects immunity to interference, none has resolved the Commission's (and the industry's) growing doubts on the validity of this relationship.

ARRL seeks to retain the processing gain requirement on the ground that "[n]othing has occurred, apparently" since 1997, when the Commission last asserted its value.<sup>23</sup> The very next year, however, the Commission's approval of CCK modulation redrew the landscape of spread spectrum technology, not only triggering a massive surge in wireless LAN technology, but also refueling the debate over the significance of processing gain measurements. ARRL continues to assume that eliminating the requirement would reduce Part 15's immunity to interference from Amateur transmissions.<sup>24</sup> As noted above, the proposition is in doubt; but even if it were true, the interference would affect only Part 15 users, not the Amateurs. The Rules require a Part 15 receiver to accept any and all interference from Amateur operations.<sup>25</sup> Even then, ARRL is skeptical of Part 15 manufacturers' incentive to build systems that withstand incoming interference.<sup>26</sup> But ARRL underestimates the sophistication of network designers and other

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<sup>23</sup> ARRL at 6.

<sup>24</sup> ARRL at 6.

<sup>25</sup> 47 C.F.R. Sec. 15.5(b). Although consumers may sometimes blame Amateurs for interference into residential Part 15 devices, such as cordless phones, ARRL at 4 n.1, this does not constrain the Amateurs' freedom to operate their equipment. For the foreseeable future, moreover, the vast majority of devices manufactured under the rules at issue here will be destined for commercial applications, located far from most Amateur equipment.

<sup>26</sup> ARRL at 6.

commercial buyers of this equipment. A system that cannot tolerate interference will not find a commercially viable market.

Separately, no party has disputed the lack of a technical consensus on the system properties that processing gain actually measures. Intersil concedes the uncertainty, but argues that the test is valuable nonetheless, as a means to distinguish between spread spectrum and digital modulation devices.<sup>27</sup> We agree with Intersil that it may be important to make this distinction; but the Commission has had no difficulty doing so in the past, without recourse to processing gain.<sup>28</sup> Specifically, the Commission has often refused certification to systems it deemed not to be spread spectrum, on criteria other than processing gain. The Wi-LAN application referenced in the *Further Notice* is a case in point: even though the original application showed the required processing gain, the Commission nonetheless held the device does not exhibit the characteristics of spread spectrum.<sup>29</sup> In short, processing gain is not necessary to identify spread spectrum.

Most important, it is unreasonable to burden manufacturers with a requirement that cannot plainly be shown to accomplish its purpose. Because the processing gain requirement cannot meet this basic test of regulatory fairness, it should be abolished.

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<sup>27</sup> Intersil at 7.

<sup>28</sup> If the Commission authorizes digital modulation devices at a full watt of power, as proposed, the distinction between digital modulation and direct sequence will lose much of its significance, as the technical rules for both regimes will be very similar.

<sup>29</sup> *Further Notice* at para. 25.

## CONCLUSION

The Commission should adopt its proposed rules on reduced hopsets, digital modulation and elimination of the processing gain requirement, with the qualifications set out above.

Respectfully submitted,

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