

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 COMMENTS OF

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

3Com Corporation, Clearwire Technologies, Inc., InterWAVE Communications Inc., LinCom Wireless, Inc., Symbol Technologies, Inc., and Vocollect, Inc., collectively the "Joint Commenters," hereby file these Comments in response to the Commission's *Further Notice* in this proceeding.¹ Each of the Joint Commenters manufactures spread spectrum devices and/or provides services using spread spectrum devices.

A. SUMMARY

Digital modulation. The Commission should adopt its proposal to authorize digital modulation systems. Continuation of the present rules on power, power spectral density, out-of-band-emissions, and antenna gain will ensure that digital modulation systems cause no more

¹ *Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, ET Docket No. 99-231, Further Notice of Proposed Rule Making and Order, FCC 01-158 (released May 11, 2001) ("*Further Notice*").

interference than conventional spread spectrum systems. At the same time, however, exemption from the definitional requirements will give manufacturers the flexibility to move new technology to the market quickly, and in some cases to market the same products worldwide.

Processing gain. Similarly, the Commission should adopt its proposal to eliminate the requirement for processing gain in direct sequence systems. This is the fairest way to resolve the long-standing technical debate on the properties that processing gain is supposed to measure. Moreover, the Commission rarely subjects receivers to technical requirements (other than unintentional emissions), and then only for the most compelling reasons of public policy. There are no such reasons here.

Reduced Hopsets. The Commission should also adopt, with a modification, its proposal to permit frequency hopping systems in the 2.4 GHz band to operate a 1 MHz channel over as few as 15 hops. This measure will increase reliability and spectrum efficiency, while reducing interference and congestion.

The Commission should condition the reduced number of hops on a maximum peak power of 125 mW, as proposed. This will more than offset any increased potential for interference caused by the reduced hopset. On the other hand, with the power reduction in place, mandatory adaptive hopping is redundant and should not be required. Manufacturers should have the flexibility to design equipment that best meets customers' needs, free of unnecessary regulatory constraints.

Public interest. With the modification noted here, the Commission's proposals are very much in the public interest. They will enable industry to innovate more freely in response to changing needs, and to move new technology more quickly from laboratory to marketplace,

while providing undiminished interference protection to other users of the spectrum.

B. THE COMMISSION SHOULD ADOPT ITS PROPOSAL TO AUTHORIZE "DIGITAL MODULATION" SYSTEMS.

The Commission proposes to authorize "digital modulation" devices in the 900 MHz, 2.4 GHz, and 5.8 GHz bands. This new category of equipment will be subject to the present rules governing power, power spectral density, out-of-band-emissions, and antenna gain for spread spectrum devices. But it will be exempt from the existing rules that define "spread spectrum" and "direct sequence." This change will allow the certification of devices that use variations on conventional spread spectrum, such as OFDM and PBCC, permitting higher data rates than the Commission now authorizes.

The Joint Commenters support these changes. Retention of the existing rules on power, power spectral density, out-of-band-emissions, and antenna gain will ensure that digital modulation systems are not a greater source of interference to other users (or each other) than conventional spread spectrum systems, while exemption from the definitional requirements will give manufacturers the flexibility to move new technology to the market quickly.

The Commission originally authorized spread spectrum at relatively high power because "the systems being authorized under these rules will be spreading this energy over a wide bandwidth."² A subsequent Report and Order similarly noted that minimizing interference to other users "requires that the signal be spread uniformly over the transmission bandwidth."³ The proposed rules for digital modulation do not change the requirements for spreading energy over

² *Spread Spectrum and Other Wideband Emissions*, 101 F.C.C.2d 419, 427 (1985).

³ *Spread Spectrum Systems*, 5 FCC Rcd 4123, 4130 n.2 (1990).

bandwidth. A victim receiver is affected primarily by the amount of incoming RF energy, and much less (if at all) by the specific form of modulation. Accordingly, the Commission can safely authorize digital modulation systems at a full watt of output power, under the same antenna-gain rules as spread spectrum systems, with no significant increase of interference to other users.

C. THE COMMISSION SHOULD ADOPT ITS PROPOSAL TO ELIMINATE THE REQUIREMENT FOR PROCESSING GAIN.

Separately, the Commission proposes to eliminate the processing gain requirement for direct sequence spread spectrum systems.⁴

The Joint Commenters support this proposal. The Commission established the test for processing gain in 1990 both to ensure that a spread spectrum system actually "spreads" its signal, and as a measure of a system's resistance to interference.⁵ In the years since, however, technical experts both in industry and on the Commission's staff have questioned whether processing gain effectively serves either of these purposes. Intensity of the debate increased with the Commission's proposal to permit a Gaussian jamming margin test, in addition to the present CW test.⁶ It redoubled when a Commission staff member informally mentioned that the

⁴ This step will be unnecessary if the Commission authorizes digital modulation at a full watt of power, as proposed. A device that otherwise qualifies as direct sequence, but does not show the required processing gain, could simply request certification as a digital modulation device. On the other hand, if the Commission authorizes digital modulation only at lower power than spread spectrum, then elimination of the processing gain requirement becomes significant. In that event, a direct sequence device that qualifies except for processing gain could operate at a full one watt if the Commission drops the processing gain requirement, but only at the lesser, digital modulation power if the Commission keeps the processing gain requirement in place.

⁵ *Spread Spectrum Systems*, 5 FCC Rcd at 4123 n.1 (processing gain is a measure of improvement in signal-to-noise ratio due to spreading).

⁶ *Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, 14 FCC Rcd 13046 at paras. 11-14 (1999) (Notice of Proposed Rule Making).

Gaussian test might supplant the CW test, rather than supplement it.

The Joint Commenters agree that dropping the processing gain requirement is the best way to resolve the dilemma. First, it is patently unfair to burden manufacturers with a technical requirement that cannot plainly be shown to accomplish its purpose. Second, the interference threat of a spread spectrum device depends on how it spreads *energy*, while processing gain measures how it spreads *information*. Third, even if processing gain were a valid measure of resistance to interference, that judgment belongs to the marketplace, not the regulatory process. It is customers, not the Commission, who should balance robustness against other desirable properties, such as price, size, throughput, battery life, and range. Finally, the Commission rarely subjects receivers to technical requirements (other than unintentional emissions), and then only for the most compelling reasons of public policy.⁷ The processing gain requirement has always been an anomaly in this regard, and the Commission should take this opportunity to correct it.

D. THE COMMISSION SHOULD MODIFY ITS PROPOSAL FOR ADAPTIVE FREQUENCY HOPPING IN THE 2400-2483.5 MHZ BAND.

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 hops. The following conditions would apply to any number of hops fewer than 75:

- (1) maximum peak power of 125 mW (reduced from the one watt permitted for 75 hop systems);⁸ and
- (2) required use of adaptive hopsets redetermined at least once every

⁷ Examples include scanning radios (prohibiting access to cellular frequencies), and consumer TV receivers (requiring all-channel tuning, V-chip capability, and closed captioning). See 47 C.F.R. Secs. 15.117, 15.120, 15.121, and 15.122.

⁸ *Further Notice* at para. 14; 47 C.F.R. Sec. 15.247(b)(1) (proposed).

30 seconds.⁹

The Joint Commenters support the proposal to permit operation at a reduced number of hops. This measure will increase reliability by permitting systems to avoid congested portions of the band. That in turn will help to reduce interference, and thus bring down the number of re-send packets, which reduces spectrum congestion. At the same time, a reduction in the minimum number of hops serves spectrum efficiency by increasing the number of devices that can operate in close proximity.

The Joint Commenters also support a power reduction to 125 mW for fewer than 75 hops. This measure will more than offset any increase in interference potential caused by the smaller number of hops.

On the other hand, the Joint Commenters oppose the requirement that frequency hoppers using less than 75 hops employ adaptive hopping techniques. As a corollary, the Joint Commenters similarly oppose the requirement to re-determine hopsets at least every 30 seconds.

Any increased risk of interference from a smaller number of hops results from the increased proportion of time that the device occupies a given frequency in the hopset. One way to compensate for that risk is to mandate adaptive hopping, which reduces the likelihood that the increased occupancy will affect frequencies in use at locations nearby. Another way, however, is through the proposed power reduction. At an earlier stage of this proceeding, the Commission determined that 125 mW, 15-hop systems using channels 5 MHz wide yield an

⁹ 47 C.F.R. Sec. 15.247(a)(1)(iii) (proposed). Adaptive hopsets are characterized as the "incorporation of intelligence within a frequency hopping system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels." 47 C.F.R. Sec. 15.247(g) (proposed).

acceptable risk of interference.¹⁰ The interference from a 15-hop system at the same power level, but using channels 1 MHz wide, can be no greater, and on average will be much less.

In short, *either* adaptive hopping *or* the 125 mW power limit is adequate to compensate for any increased risk of interference from a 15-74 hop system. The simultaneous application of both measures is superfluous.¹¹ The Joint Commenters support power reduction. With that provision in place, mandatory adaptive hopping becomes redundant, and should not be required. Manufacturers should have the flexibility to design equipment that best meets customers' needs, free of unnecessary regulatory constraints.

E. THE PUBLIC INTEREST FAVORS ADOPTION OF THE COMMISSION'S PROPOSALS, MODIFIED AS SUGGESTED ABOVE.

Almost from the day the spread spectrum rules took effect in 1985, industry has continually pressed the Commission to change them. There are several reasons. First, manufacturers often request rule changes so they can meet customer demand for higher data throughput and greater range. Second, because technology in this area moves very quickly, manufacturers seek rule changes so they can bring the latest advances to market. Third, discrepancies between Commission rules and those of other countries reduce the market for U.S.-authorized equipment, and hence increase costs to U.S. users. Manufacturers sometimes request rule changes so they can sell the same products globally.

¹⁰ *Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices*, 15 FCC Rcd 16244 at para. 15 (2000) (First Report and Order).

¹¹ In the alternative, if the Commission does impose mandatory adaptive hopping, it should permit redetermination of the hopset at maximum intervals of five minutes, rather than 30 seconds, as proposed. Experience shows that the environment does not change significantly faster than this. A mandatory redetermination every 30 seconds, moreover, would require an excessive amount of background processing, and thus would needlessly impair system efficiency.

The use of a separate rulemaking for each cycle of changes has resulted in the Commission's Rules lagging significantly behind the technology. From a manufacturer's rulemaking petition to a final Report and Order typically takes at least two years, and sometimes three years or more. The delay leads to pressure for the next proceeding even before the previous one is finished. Moreover, the recurring cycles of comments, reply comments, and *ex parte* exchanges are a continuing drain on both Commission and industry resources.

These inefficiencies are no fault of the Commission. Rather, they are a consequence of the Administrative Procedure Act, adopted in 1946, when technology evolved much more slowly than it does today. All the same, however, uncertainty about the availability and timing of new rules adds to the risk of investment, and promotes confusion among customers.

The proposed rules will cut through many of these problems. By allowing the certification of systems that need not conform to restrictive definitions of spread spectrum, they will enable industry to innovate more freely in response to changing needs, and to move new technology more quickly from laboratory to marketplace. In some cases, the proposed rules will allow U.S. certification of products that also meet the standards of other countries, thus both reducing costs to U.S. customers and facilitating the global marketing of U.S. products. At the same time, however, the proposed rules also provide undiminished interference protection to other users, both in and outside the band.

CONCLUSION

The Commission should adopt its proposed rules on digital modulation and elimination of the processing gain requirement, and should adopt its proposed rules on minimum number of frequency hops as described above.

Respectfully submitted,

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