

Before the
Federal Communications Commission
Washington DC 20554

In the Matter of)
)
Additional Spectrum for Unlicensed Devices) ET Docket No. 02-380
Below 900 MHz and in the 3 GHz Band)

**JOINT COMMENTS OF
INTERSIL CORPORATION AND SYMBOL TECHNOLOGIES, INC.**

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Intersil Corporation and Symbol Technologies, Inc. file these Comments in response to the Commission's Notice of Inquiry in the above-captioned proceeding.¹

- ***Intersil Corporation*** is a manufacturer of complete wireless LAN chipsets. Worldwide sales for wireless LAN chipsets in 2002 were 22-24 million radios (most sold in the U.S.), expected to double in 2003.
- ***Symbol Technologies, Inc.*** designs and manufactures over \$1.4 billion in wireless (unlicensed, Wi-Fi) products.

A. Summary

Unlicensed operation is one of the Commission's biggest success stories. Every day, tens of millions of technically sophisticated, low-cost devices deliver highly reliable service in densely shared spectrum. The industry generates billions of dollars for the economy and makes invaluable contributions to the public sector, particularly in supporting public safety applications.

The industry has achieved these successes despite having to share spectrum with ISM equipment and other sources of interference. Now, however, the industry's accomplishments justify dedicated spectrum. Information theory restricts how much interference any device can

¹ *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, 17 FCC Rcd 25632 (2002) (Notice).

tolerate, and this in turn limits the number of devices that can operate simultaneously in a given area. Without its own spectrum, continued growth may ultimately threaten the industry's success.

The 3650-3700 MHz band is well suited to unlicensed operation. Protecting the incumbent radar systems and earth stations should be straightforward. We suggest the Commission set protection criteria in terms of power flux density (rather than a fixed radius) and let industry decide how best to meet those criteria. And we encourage the Commission to work closely with industry standards groups in developing protocols or etiquettes to facilitate sharing in the band.

The concept of unlicensed operation in unused TV spectrum is worth exploring. We urge that any implementation be capable of fully protecting TV reception, even in the case of TV stations being moved and modified. If feasible, however, the approach would make valuable use of otherwise wasted spectrum.

B. Unlicensed Devices are Unquestionably in the Public Interest.

Unlicensed operation under Part 15 has matured into a major component of the Nation's telecommunications infrastructure. Not only are unlicensed devices an important industry in their own right, but they contribute to the efficiency, success, and global competitiveness of many other industries, including public safety and law enforcement, manufacturing, retail, transportation, health care, education, energy, communications, finance -- indeed, every sector of the economy.

Even eight years ago, the Commission could point to an impressive range of unlicensed applications:

automatic meter reading and optimized power generation, low-cost broadband access to Internet services and other information networks for schools, libraries, telecommuters and home offices, mobility of telephonic and computer communications within offices and homes without extensive reconstruction and wiring, immediately installable video conferencing . . . health care monitoring . . . safe transport of chemicals and petroleum products through low-cost and easily deployable pipeline monitoring services, and control for potentially tens of thousands of traffic lights"²

Today the list is far longer. Just a few examples:

- **Commercial applications** include wireless LANs and PBXs, retail cash registers and inventory control, airport baggage handling, package delivery, car rental services, automated meter reading and alarm services, and warehouse picking operations, including catalog sales fulfillment.
- **Hospitals** and other health care facilities use unlicensed devices for patient telemetry, inventory and billing, patient records, and bedside checks on medication.³
- **Stock transactions** -- most of the transactions on the New York Stock Exchange are mediated by unlicensed wireless terminals.
- **Internet access** uses wireless communications links for broadband speeds at distance up to 40 km.
- **Ultra-wideband** will soon provide extremely high-speed communications among a wide variety of consumer and office devices.
- **Consumers** use cordless phones, nursery monitors (audio and video), wireless headphones and speakers, cordless computer mice and keyboards, toys of many kinds, and countless other products.
- **"Wi-Fi"** devices power millions of unlicensed home computer networks and provide ubiquitous Internet access in coffee shops, airports, hotels, and the like.

² *Allocation of Spectrum Below 5 GHz*, 10 FCC Rcd 4769, 4786 (1995).

³ The FDA recently proposed to require that all medications be uniformly labeled with bar codes to improve patient safety. Warren Strugatch, *In Health Care, the Future Will Be Bar-Coded*, N.Y. Times, March 23, 2003, Sec. 14LI, p. 6. Adoption this rule will greatly increase the medical use of unlicensed wireless devices.

Recent rule changes in ET Docket No. 09-231 greatly increase the speed of these devices.

In short, unlicensed operations provide reliable, inexpensive, high-capacity radios that users can install and move as needed, without the costs and delays of licensing. They are currently one of the few bright spots in an otherwise slow technology sector. A former Commission staffer did not exaggerate in calling Part 15 "the jewel in the FCC's crown."⁴

C. The Commission Can Serve the Public Interest by Allocating Spectrum Exclusively for Part 15 Operations.

Having proved itself many times over in spectrum shared with ISM devices and other sources of interference, Part 15 has earned the right to spectrum of its own. If past experience is any guide, exclusive allocations to Part 15 will extract more economic value from the spectrum than perhaps any other use, and will encourage the industry to continue serving as a catalyst for technological innovation. And yet, these devices are self-regulating in use, consuming no Commission resources either for licensing or for resolving interference disputes.

Part 15 equipment is extremely spectrum efficient in the measure that matters most: total usage per Hertz *per area*. The 2.4 GHz Wi-Fi band, for example, accommodates tens of millions of devices, probably the highest number of devices/MHz anywhere in the spectrum. Despite sharing the band with tens of millions of microwave ovens and many Amateur operators, these devices still pump billions of dollars into the economy, both in equipment sales and in added efficiency of the industries they serve.

⁴ Remarks of Gregory Czumak at "Opportunities for New Wireless Technologies," Federal Communications Commission, Washington DC (Feb. 16, 2000).

Part 15 benefits from some of the best radio engineering reaching the market today. The unlicensed environment is technically demanding, but manufacturers have consistently shown themselves equal to it. Technologies like ultra-wideband and new digital modulations provide extremely high throughput, even in the presence of noise, and without impairing other users nearby.

Early unlicensed equipment was so unreliable as to be useful only for trivial applications -- toys, household conveniences, and the like. But reliability has improved dramatically, helped in large part by the Commission's spread spectrum rules, first adopted in 1985.⁵ Today, unlicensed devices are routinely used for critical applications like stock market transactions, patient telemetry, and corporate networking -- compelling evidence of their robustness.

Unlicensed operation has proved its reliability in the most difficult conditions, under the shadow of microwave ovens and Amateur transmitters, and despite rules that give it the lowest possible interference priority. Because of that success, many users now take Part 15 reliability for granted. But information theory puts a fundamental limit on how much interference any device can tolerate, and this in turn sets limits on how many devices can operate in a given area. Without new spectrum, the continued growth of the industry may threaten its own success.

D. The Commission Should Allocate 3650-3700 MHz for Unlicensed Operation.

The band at 3650-3700 MHz is well suited to unlicensed operation in several respects. The 8 cm wavelength is ideal for portable applications, both because it makes efficient use of conveniently sized antennas and because propagation losses will facilitate spectrum re-use. Yet

⁵ *Spread Spectrum and Other Wideband Emissions*, 101 F.C.C.2d 419 (1985).

equipment for the band should be less expensive than for much higher frequencies. The 50 MHz bandwidth can accommodate large numbers of devices using such standards as IEEE 802.11x, 802.15, 802.16, and doubtless others as well. Unlicensed technologies already in widespread use at 2400 and 5800 MHz can readily be redesigned for this band.

We acknowledge the need to protect Government radar operations around three specified locations, and downlinks at grandfathered fixed satellite earth stations. Because there is no practical way to keep unlicensed devices away from these facilities, the devices may have to disable themselves automatically if they come within interfering distance.

In that connection, we make two requests.

First, the Commission's interference criteria should be framed in terms of power flux density at the protected facility, *not* as a fixed protection radius. This would allow an unlicensed device to operate at diminishing power as it approaches the protected location, rather than having to shut off entirely at some distance.

Second, the Commission should set interference criteria, but let industry decide how best to achieve them. One option, suggested in the Notice,⁶ is a GPS finder in the unlicensed device keyed to a table of protected locations. Radar detection and avoidance capability has already been developed for 802.11 systems operating in unlicensed spectrum in Europe, and this technology can be adapted for the 3650-3700 MHz band. Earth stations might be protected with a low-power, narrowband beacon transmitter. An unlicensed device detecting the beacon signal would reduce its power or turn off entirely, depending on received signal strength. (This

⁶ Notice at para. 21.

approach has the advantage of imposing minor equipment costs on a small number of fixed installations, rather than on a very large number of mobile devices.)

We also respond to other issues raised in the Notice:⁷

- ***Power.*** We think the one watt limit in Section 15.247 is about right for this band. But the rules should allow substantially higher high EIRP with high-gain antennas, possibly using a power/gain trade-off such as that in Section 15.247(b)(4)(i).⁸ This would permit use of the spectrum both for nondirectional LAN-type operations and for limited point-to-point applications. In practice, most unlicensed mobile devices use far less power. Only fixed, point-to-point applications even approach the power limit. But to cover useful distances, even at relatively high antenna gains, generally requires a significant fraction of a watt.
- ***No licensed, fixed operation.*** We oppose licensing fixed operation at 3650-3700 MHz. Although we acknowledge the Fixed Service is suffering a severe spectrum shortage, there is simply not enough bandwidth here to help appreciably, especially in the presence of co-channel earth stations, or even to create an adequate equipment market. Moreover, it is hard to see how large numbers of unlicensed devices could operate on a non-interference basis in the presence of arbitrary numbers of fixed links. These concerns, however, should not prevent unlicensed operators from operating point-to-point links within the unlicensed power limits, on a co-equal basis with other unlicensed users.
- ***Industry-supported standards for sharing.*** The Commission should either let the industry and its standard-setting groups decide on any protocols or etiquettes to facilitate sharing in the band, or else set standards in close collaboration with industry. The popularity and effectiveness of the IEEE 802.11 standards, among others, has shown the importance of widely accepted standards in promoting widespread use.

In short, we strongly support allocating 3650-3700 MHz for unlicensed use, and are confident that technological means can afford adequate protection to facilities that need it.

⁷ Notice at para. 21.

⁸ This rule provides that 2400 MHz systems must reduce the maximum peak output power by 1 dB for every 3 dB that the antenna gain exceeds 6 dBi. 47 C.F.R. Sec. 15.247(b)(4)(i). Alternatively the Commission could allow unlimited antenna gain, as it does for 5.8 GHz systems. 47 C.F.R. Sec. 15.247(b)(4)(ii).

E. The Commission Should Permit Unlicensed Operation in the TV Bands if TV Reception Can Be Fully Protected.

The Commission proposes allowing unlicensed operation on TV bands that are unused in a particular market. The Commission's Rules require that co-channel and most adjacent channel transmitters and, for UHF, those separated by 2, 3, 4, 5, 7, 8, 14, and 15 channels be no closer than specified minimum distances.⁹ This produces several vacant TV channels in every market. All but the co-channel separations arise from various shortcomings common to TV receivers. Because unlicensed devices operate at far lower powers than TV stations, and because unlicensed receivers are designed very differently from TV receivers, it should be possible -- at least in principle -- for unlicensed devices to operate where TV stations cannot, without causing interference to TV reception.

We think this idea is worth exploring, subject to the constraint that protection to TV reception be extremely reliable. Even though fewer than 20% of U.S. homes rely on over-the-air TV, we think both the industry and the Commission must take all prudent steps to avoid the political and public relations fallout that would result from systematic TV interference.

Unlicensed services sharing the TV bands will need a mechanism for "sniffing" the spectrum before transmitting (and the capability of distinguishing a TV signal from other unlicensed signals).¹⁰ Together with its antenna, this mechanism must be at least as sensitive as a TV receiver picking up a minimally useful signal. It would need a fail-safe design, so that failure of the mechanism reliably shuts down the transmitter. In contrast, we do not support the

⁹ 47 C.F.R. Secs. 73.610, 73.698.

¹⁰ See Notice at para. 16.

proposed alternative of a GPS finder keyed to a table of TV stations.¹¹ Stations are added, dropped, moved, and modified from time to time, and all the more often during the current digital transition; and digital stations can sometimes be placed where analog stations would not fit. Moreover, a mobile unlicensed device that is safe in one TV market may be carried to another, where it may cause interference. For all of these reasons, we think relying on any pre-programmed list of vacancies would be too risky.

Nevertheless, it may well be possible to arrive at a technical solution that gives adequate assurance of protection to TV viewers. Any such solution would require careful testing. And if it succeeds, partial use of the TV bands would provide a valuable bank of otherwise wasted spectrum for unlicensed use.

CONCLUSION

Unlicensed devices have proved their value, efficiency, and indispensability to the economy under the most difficult technical and regulatory conditions. Part 15 has earned the chance to operate in spectrum of its own. We support the prompt allocation of 3650-3700 MHz for unlicensed operation, and we favor further exploration into the possible use of unlicensed devices on locally vacant TV channels.

Respectfully submitted,

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¹¹ *Id.*

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