Evaluating the differences between FCC Part 15.247 and RSS-139-1

As the use of spread spectrum devices has changed, so have the ways in which regulatory agencies govern these devices.

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Until recently, spread spectrum and wireless local area networks (LAN) devices operating in the U.S. and in Canada have been treated pretty much the same by both the FCC and Industry of Canada. However, as the use of these spread spectrum devices has changed, so has how each agency is setting requirements on approval criteria.

FROM LANS TO WANS

At first, these devices were being developed to replace wired local networks with networks that were more portable and to replace networks in areas where running wire was not cost-effective. The systems operated under Part 15 of the FCC rules and RSS-210 for Low Power Transmitters on an unlicensed basis in the ISM bands of 902–928, 2400–2483.5, and 5725–5850 MHz.

However, in the last couple of years these systems have gone from merely providing LAN systems to providing wide area network (WAN) services or wireless connections to internet service providers (ISPs). As the use of these systems has changed, so has the regulatory requirements governing these devices. The biggest difference between Canadian and U.S. requirements apply to use in the 2450 MHz band.

The changes to the FCC Part 15 rules were made per the NPRM 96-8 that addressed the use of high gain antennas. For Canada, the changes came with the release of RSS-139-1.

Overall, the basic requirements have not changed. The products still must meet the requirements of Part 15.247 for FCC certification and the requirements of RSS-210 (Requirements for Low Power Transmitters) for Canada. This includes spurious emissions limits, transmitter power out, harmonics and power density requirements, as well as the restricted bands limits for the U.S.

The emission limits, power requirements, and out-of-band restrictions are the same for both devices operating in Canada and the U.S. However, the real differences involve how Industry of Canada and the FCC handle the use of high gain antennas with the systems.

CURRENT REQUIREMENTS

To better understand the changes, a basic understanding of the current requirements is needed. Both FCC Part 15.247 and RSS-210, which govern spread spectrum devices, limit the maximum transmitter power to 1 W peak and the total power of the system is limited to 4 W effective isotropic radiated power (EIRP). They also limit the out-of-band spurious emissions at the band edges to 500 μV/m at 3 meters. They both limit the antenna gain to 6 dBi (based on 1 W power) and require a reduction in transmitter power at a ratio of 1 dB for

FCC PART 15.247	RSS-210	RSS-139-1
2400–2483.5 M	2400–2483.5 M	2400–2450*
No License Required	No License Required Indoor use only**	Licensed Required for Outdoor use
TX Power 1 Watt Peak	TX Power 1 Watt Peak	TX Power 1 Watt Peak
4 W EIRP***	4 W EIRP	4 W EIRP****

* RSS-139-1 deals primarily with the 2400–2450 sub-band. However this standard is applicable to the whole ISM band but no license is required for operation above 2450 MHz (indoors or out).

** For the 2400–2450 MHz sub-band

*** For systems operating solely as a point-to-point system, the power reduction is 1 dB transmitter power for every 3 dB antenna gain that exceeds 6 dBi.

**** For licensed system operating in rural areas, antenna with gains over 6 dBi can be used, power reduction of transmitter may not be required.

Table 1. Comparison of standards.

every 1 dB the antenna gain exceeds 6 dBi (Table 1).

FCC

The FCC addressed this with the release of NPRM 96-8 and the changes to FCC Part 15. Under the updated Part 15 rules, it is now possible to use higher gain antennas without drastic power reduction. Under the new requirements in Part 15, the transmitter power is lowered 1 dB for every 3 dB the antenna exceeds 6 dBi. This rule only applies to systems that operate exclusively point-to-point. Systems employing point-to-multipoint or omni-directional antennas are still limited to + 36 dBm EIRP and require the 1 dB reduction for every 1 dB the antenna exceeds 6 dBi.

For example, under the original Part 15 rules:

For a point-to-point system:

- Tx power out = 24 dBm
- Antenna gain = 21 dBi

Transmitter power must be reduced by 3 dB. Therefore, the total EIRP would equal 42 dBm.

For a point-to-multipoint system:

- TX power out = 24 dBm
- Antenna gain = 21 dBi

Transmitter power must be reduced by at least 9 dB, since the EIRP is restricted to + 36 dBm.

Another factor in the use of the high gain directional antennas for point-to-point only systems is that professional installation is recommended by the FCC. This means that either the installer must test and certify the system on the site or that these systems have this restriction placed on their FCC grants.

The pitfall of this is that these systems will usually require some type of filtering at the band edges to avoid exceeding the emission levels of the restricted bands. These restricted bands are located 10 MHz below the lower band edge and at the band edge of the high end in the 2.4 GHz band.

INDUSTRY OF CANADA

By comparison, under the Industry of Canada radio requirements, according to the requirements of RSS-210, devices operating in the 2.4 GHz band may be subject to licensing. This was addressed originally under Guideline 36, which has now evolved into the RSS-139-1 standard. The RSS-139-1 standard addresses only devices operating in the 2450 MHz band, specifically devices running in the 2400–2450 MHz sub-band.

Systems operating partially or completely outdoors in the sub-band of 2400–2450 MHz should be certified to RSS-139-1 and the user must obtain a license to operate the system. The 2400–2450 MHz sub-band is allocated to licensed microwave relay links, and spread spectrum systems operating outdoors in this frequency must obtain a license to use this band. The issuance of the radio license is up to the local Industry of Canada office.

To determine if RSS-210 or RSS-139-1 applies to the system, one needs to look at how the system will be installed or operated. The devices can be certified under RSS-210 if they either:

- Operate from 2400–2483.5 MHz and are installed strictly indoors (including all antennas).
- Operate from 2450–2483.5 MHz and are installed completely indoors or partially outdoors.

The device can be certified under RSS-139-1 if they either:

- Operate from 2400–2483.5 MHz and are installed outdoors (completely or partially).
- Operate from 2400–2450 MHz and are installed completely outdoors.

If the product operates in both sub-bands and could be used in an outdoor environment, obtaining RSS-139-1 approval is recommended, since RSS-139-1 approval does cover the use in indoor environments.

Since the use of the 2400–2450 MHz band requires a license, it is possible to exceed the 6-dBi antenna limitation without any reduction of transmitter power. Systems operating under this license band can employ the use of high gain antennas with the only restrictions being those placed on the system by the license obtained.

The real problem with the use of high gain antennas still lies with meeting the band-spurious emissions and harmonic limits.

Additional changes in the Canadian rules include a reduction in the number of hopping channels required for systems operating from 2450–2483.5 MHz.

CONCLUSION

Both agencies have taken similar approaches to the use of spread spectrum systems in an outdoor environment. Where the FCC limits high gain systems to operate point-to-point

only and recommends professional installation, the Canadians choose the use of licensing for systems operating outdoors.

The limitations placed by the FCC restrict the type of operation the systems can perform by limiting them to being point-to-point links only for high gain systems, and restrict the power of systems used as multi-point systems. The restrictions the Canadians choose limit the frequency range of operation for the systems since most license services are assigned a frequency of operation.

Neither system is perfect. As the use of spread spectrum devices evolve, hopefully so will the regulations.

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