

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, D.C. 20554

In the Matter of: )  
 )  
Revision of Part 15 of the Commission’s Rules to )  
Permit Unlicensed National Information ) ET Docket No. 13-49  
Infrastructure (U-NII) Devices in the 5 GHz Band )

**COMMENTS OF CAMBIUM NETWORKS LTD**

Cambium Networks Ltd. (Cambium) hereby submits comments in response to the Federal Communications Commission’s Notice of Proposed Rulemaking (FCC 13-22). Our comments relate to four aspects of the NPRM: the joint responsibility of manufacturers and users to ensure that U-NII band devices do not cause interference to Terminal Doppler Weather Radar (TDWR) installations, proposed rule changes to eliminate the disparity between two different routes to type approval in the 5.7 GHz band, future unlicensed operation in the wider 5 GHz band, and the incorporation of information presently published as Office of Engineering and Technology (OET) guidelines.

We accept that TDWR installations must be protected from interference, and we consider that manufacturers, regulators, distributors, installers and operators all share a responsibility to ensure that unlicensed wireless devices do not cause interference to TDWRs. We note that most documented cases of interference to TDWRs in the U-NII 2C band involve wireless devices that were modified or configured so as to operate at higher power than permitted by the U-NII 2C

rules, to operate in the sub-band reserved for TDWR, or to operate without DFS. We welcome the introduction of software security measures described in paragraph 68 and elsewhere in the NPRM, but we recommend that the wording of the proposed rule at 15.407 (j) should be extended to ensure that specific steps are taken to prevent non-compliant operation. We take the view that rules for tighter software security should enforce operation in the approved mode and prevent operation in modes intended for other regulatory domains. Software security should additionally ensure that only authorized software supplied by the manufacturer can be installed in the unlicensed device, and should make it impossible (or practically impossible) for a third party to modify software supplied by the manufacturer. This objective might be achieved by applying the rules presently in force for software defined radios. We consider that there may be some additional development costs for manufacturers that do not presently implement software security, but it is unlikely that there will be any additional manufacturing costs.

We note that the DFS capability of devices certified under the U-NII 2C rules does not always prevent interference to TDWR installations, and that this has given rise to an additional requirement for operators to maintain a minimum frequency separation between the unlicensed system and a nearby TDWR. Given this factor, the limited number of TDWRs, and the geographical extent of the USA, we consider that the FCC should generally permit use of the 5600 MHz to 5650 MHz sub-band for unlicensed devices, but should rigorously enforce frequency planning and device registration for terminals deployed close to TDWRs. We would support introduction of a mandatory database and registration scheme for users of unlicensed devices installed close to TDWRs. However, we consider that it is not reasonable to insist that a wireless terminal must consult such an online database on a continuous or regular basis, or at every restart. Many deployments in fixed infrastructure will have no access from the

management agent of a wireless terminal to the public Internet. There are sound security-related reasons for actively preventing access from the management network to the public Internet. Even if such access was provided, fault conditions in fixed infrastructure might temporarily block database access and thus prevent recovery from the fault condition. For example consider a point-to-point link where the link itself is the only means of access for the terminal at the remote end of the link; here the remote unit could never start if it first needed to access an online database. Furthermore, not all wireless terminals include GPS receivers, and some terminals with integrated GPS receivers will be installed in locations where there is no clear path between the terminal and the sky.

Nevertheless, we consider that manufacturers should be encouraged to provide optional capabilities in their products or associated management systems to simplify or automate the database access and registration process. Manufacturers should also be obliged to provide instructions in User Guides to explain the registration process.

The existing out of band emission limits for devices certified under Section 15.407 are substantially more stringent than for devices certified under Section 15.247. For a device operating at the maximum EIRP of 53 dBm, the Section 15.407 limit is approximately 50 dB lower than the Section 15.247 limit. If devices operating in the 5.7 GHz band are to meet the out of band emission limits from Section 15.407, they must incorporate transmitter sections of considerably greater complexity than those found in Section 15.247 devices, including the use of additional high performance RF filters. The additional complexity would result in higher manufacturing costs, increasing the selling price of unlicensed devices to the extent that many existing applications for lower-tier U-NII band devices may well cease to be cost effective. The transition band of the additional RF filter would reduce the number of channels available for use

in the 5.7 GHz band, resulting in lower utilization of the band and higher congestion of the channels that remain available.

We are not aware of a documented link between out of band emissions for devices certified under Section 15.247 and interference to TDWRs operating at 5600 MHz to 5650 MHz, and we request the Commission to relax the emission rules for the U-NII 3 band to match or approach the existing rules for Section 15.247. We take the view that incumbent systems in the U-NII 2C band are more likely to be affected by the wanted radiation from unlicensed devices in the same band than from unwanted out of band radiation from devices in the U-NII 3 band.

Cambium accepts that the provision of two routes to type approval for unlicensed devices in the 5.7 GHz band is unsatisfactory. However, we consider that the proposed rule changes to Section 15.407 do not go far enough to accommodate the use of the class of unlicensed devices that are satisfactorily certified at the present time under existing Section 15.247 rules.

We are concerned that the addition of a limit in EIRP for fixed point-to-point applications will hamper useful deployment of longer links in hard-to-reach rural areas. Non-line-of-sight (NLOS) links can be operated in the 5.7 GHz band using polarization diversity, in cost-effective deployments where a licensed band link would require one or more repeaters. We encourage the Commission to permit the continued use of higher gain antennas without an output power penalty in areas where interference is unlikely to be a problem.

Out of band emission limits in Section 15.407 are considerably more restrictive than those in Section 15.247, and would necessitate extensive redesign of existing products, with the manufacturing cost and performance implications identified earlier in our comments. At the same time, we believe that the benefits of changing the emission limits are unproven.

Under the proposed rule changes, existing products must be withdrawn from sale within two years. This period is significantly shorter than the typical lifespan of an infrastructure product. We do not believe this is a reasonable deadline to develop and bring to market a portfolio of new U-NII band products, and we request the Commission to allow for a longer transition period.

Cambium welcomes the Commission's efforts to make additional spectrum in the 5 GHz bands available for unlicensed use. We accept that the unlicensed use will be on a secondary basis and recognize the need to protect incumbent licensed users of these bands. We consider that the NTIA 5 GHz Report usefully identifies the incumbent licensed users, provides a sensible list of risk factors, and outlines some spectrum sharing techniques that might help to ensure the co-existence of licensed and unlicensed systems. However, it appears to us that a very great amount of work remains to be done to demonstrate that these (or other) spectrum sharing techniques will provide effective and robust protection for licensed users and a practical framework within which operators can deploy unlicensed devices. We look forward to contributing to a program of theoretical analysis, simulation, lab experiments and field trials to evaluate the effectiveness of spectrum sharing measures, and exchanging results with other interested parties.

At this early stage, it is somewhat difficult to be confident that acceptable co-existence solutions will be identified. Thinking about the sharing techniques already considered by the NTIA, we are concerned that signal sensing might be difficult or expensive where the unlicensed system and the incumbent system use quite different air interfaces. We are concerned that cooperative sensing might necessitate the exchange of sensing data with terminals in the networks of other operators, giving rise to security-related challenges. We are concerned that

geo-location might be problematic where incumbent systems are nomadic or mobile, where there are security-related objections to revealing the location of the incumbent operator, or where the unlicensed terminal cannot access the public Internet. For terminals with directional antennas, there would perhaps be a need to indicate the orientation of the antenna in addition to the location of the terminal, or a need to guarantee the polar performance of a directional antenna.

Thinking about the beacon approach, terminals might need to include one or more additional receivers dedicated to monitoring beacons, particularly where the air interface of the beacon is incompatible with the normal air interface of the terminal itself, leading to additional manufacturing costs. Also, we don't yet understand the operation of the beacon scheme outlined in the NPRM, where detection of the beacon appears to act as an invitation for the unlicensed terminal to transmit, and which seems to preclude unlicensed operation away from the incumbent system. By contrast, the beacon system described in IEEE 802.22 provides a warning to unlicensed systems, so that terminals that detect the beacon must avoid transmitting on a channel occupied by an incumbent system. Furthermore, the scheme described in IEEE 802.22 uses a single beacon to protect one or several low power licensed devices used within a confined area. The beacon scheme is effective because a beacon of modest power output can be detected by unlicensed devices in circumstances where the individual low power devices could not have been detected. The beacon is thus ideal for avoiding interference to wireless microphones used in news gathering or at a music concert, but it is not clear how this approach can be usefully extended to protect a distributed network.

Finally, we request the Commission to consider updating the Section 15 rules to include some of the fundamental information presently provided solely in OET guidelines. For example, it might be possible to include information on the interpretation of out of band emissions from

OET publication 789033, where the OET has clarified that the -17 dBm/MHz and -27 dBm/MHz limits relate to peak emissions (which was not clear in Section 15.407) and have determined that these limits are not intended to be more restrictive than the general peak limit of about -21 dBm/MHz. A more straightforward set of requirements within Commission rules would offer a sounder starting point for manufacturers developing and approving future products.

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