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Public Comments on Equipment Authorizations:========

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Comment: As written, the rules and recommendations of the commission will prevent the installation of traditional free and open source wireless firmware such as OpenWrt. End-users often use such firmware because it better fits the users needs. Each user is better able to tailor the device to their needs. Users often set up a guest wireless network for their home or business, set up a web server at their home, create IoT hubs and other uses. The changes proposed will make such changes difficult and, in some cases, impossible.

Innovation in network and wireless technology depends on the ability to experiment with software and hardware at the deepest levels. CeroWrt, an open source router firmware, developed a fix for an important form of network congestion called Bufferbloat. This fix is was added to the Linux kernel to be used by the billions of users of Linux. HNCP, a proposed IETF proposed standard for managing home networks, is being developed using OpenWrt. Mesh networking technologies for developing stable distributed internet access are regularly implemented on OpenWrt and much research and implementation on mesh networking has occurred outside of manufacturers. Nearly 7,200 scholarly

articles on wireless networking technologies reference a particular brand of open and modifiable hardware which would be banned under these rules. Without the ability to change the software on the device, these innovations would not have occurred. The innovations done by the community are later often picked up by the home router vendors and being integrated into their normal firmware versions for their next generations of devices.

Millions of dollars of economic activity depend on third-party firmware. Major semiconductor and wireless hardware manufacturers use OpenWrt as the base of their router software.[1][2][3][4][5] At the same time, OpenWrt is managed and developed primarily by a community of individuals modifying their own routers and installing customized versions of OpenWrt on their own routers. Sometimes these routers originally had OpenWrt on them while others did not. Strong industry-community collaboration reduces the costs of maintenance and increases quality for manufacturers. This mutually-beneficial collaboration can only exist if users can replace their firmware on their router with a customized version of OpenWrt. By preventing firmware replacement, these regulations will strangle this community in the US thereby increasing costs to hardware manufacturers which could be passed along to customers and employees.

Additionally, many companies, such as ones involved in creating open wireless networks for retail locations would be hampered by these regulations. Currently, many of these companies install custom firmware on off-the-shelf hardware. Under these regulations, such companies would have to either create their own hardware, an expensive proposition for small software businesses, or receive authorization from a manufacturer under any arbitrary terms the manufacturer so chooses.

Many commercial VPN providers sell wireless routers as part of there product offerings. Denying companies and users the option to purchase more secure routers with support for VPN services will put a variety of users at risk.

Emergency preparedness would be hindered by restrictions on the modification of router hardware. Mesh networking is a key component of disaster response in our modern world. In disasters, amateur radio operators create mesh networks for disaster response. These operators use firmware like Broadband-Hamnet to create mesh networks on low-cost commodity routers operating at frequencies and power levels legally authorized for hams but not for other users. By modifying the device in such ways, wireless networks can be organized to cover much larger swaths of area to first-responders and emergency personnel. These restrictions would delay the exchange of emergency information and put lives at risk. The value of modified router hardware to assist in disaster response is recognized by emergency managers.

Restrictions on replacing router software will have a serious impact on security. Manufacturers are notoriously lax about providing timely security updates where such updates are provided at all. Security

experts routinely recommend users replace manufacturer shipped router firmware with alternative community driven versions as a solution to this problem. In a recent security review of commercial routers, every one had critical security vulnerabilities. In most security instances replacing router firmware with third party peer reviewed firmware is the only option to solving this type of problem. While the security dangers for home users are serious, for large companies security dangers are critical. Without the ability to replace this software, large companies purchasing routers are entirely at the whim of the router maker.

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