

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

In the Matter of)
)
Amendment of Part 15 of the Commission’s) **RM-11812**
Rules to Permit High Power Operation for)
P2MP, Consistent With the P2P System Power)
Limits in the 5 GHz Band)

To: The Commission

**COMMENTS OF ARRL,
THE NATIONAL ASSOCIATION FOR AMATEUR RADIO**

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.405 of the Commission’s Rules (47 C.F.R. §1.405), hereby respectfully submits its comments in opposition to the *Petition for Rulemaking*¹ (the Petition) filed on or about June 18, 2018 by Radwin, LTD (Radwin). The Petition proposes to amend Part 15 of the Commission’s Rules to permit point-to-multipoint communication services in portions of the 5 GHz band, at power levels that are now permitted only for point-to-point unlicensed systems. The relief requested by Radwin would allow unlicensed, high-power Part 15 wide-bandwidth systems operating between 5.725-7.850 GHz to transmit on multiple azimuths at once. As the Band 5.65-5.925 GHz is allocated on a secondary basis to the Amateur Service, ARRL has a substantial interest in the compatibility, if any, between the proposed high-power Part 15 devices in this band and incumbent and future Amateur station operation. For its comments in strong opposition to the relief requested in the

¹ On June 29, 2018, the Consumer and Governmental Affairs Bureau released a *Public Notice*, Report No. 3097 listing the Radwin Petition and establishing a comment date 30 days hence (i.e. July 29, 2018, a Sunday). Therefore, these comments are timely filed. See also Section 1.4(j).

Petition, and in the interests of the more than 730,000 Amateur Radio operators licensed by the Commission, ARRL states as follows:

1. The Radwin Petition requests that the Commission modify Section 15.407 of the Commission's Rules to increase the power levels for point-to-multipoint (P2MP) unlicensed systems operating in two segments of the 5 GHz band.² The P2MP systems emit multiple directional beams *simultaneously*. Radwin asserts that power levels permitted for P2MP operation in these 5 GHz bands should be consistent with the power used by unlicensed point-to-point (P2P) systems. Radwin indicates that devices using *sequential* multiple directional beam technology are FCC certified and in use today. However, these devices are subject to power limits established for P2MP systems that are lower than the limits for U-NII P2P systems. Radwin notes that the current approach for the U-NII bands at 5 GHz is different than that for similar devices with multiple directional beam technology operating in the 2.4 GHz band. It states that the rules at 2.4 GHz "recognize the unique characteristics of this technology and allow for more robust power limits permitted for point-to-point devices in the same bands."³ Radwin cites Section 15.247 of the Commission's rules (which is applicable to unlicensed operations at 2.4 GHz) for the proposition that, as Radwin states: "The Commission determined that devices using *sequential* multiple directional beams could operate with an aggregate transmit output power (transmitted simultaneously on all beams) of up to 8 dB above the power limit allowed for individual beams"⁴ [emphasis added]. However, Section 15.247(c)(2)(iii) makes a significant regulatory distinction between fixed systems with *sequential* multiple directional beams and

² The two bands are 5.15-5.25 GHz, which the Petition describes as the U-NII-1 band and 5.725-5.85 GHz, described as the U-NII-3 band. ARRL has no interest in the U-NII-1 band and interposes no objection to the relief requested relative to that band only. ARRL's concern is exclusively with the proposed high-power P2MP operation proposed for the band 5.725-5.850 GHz.

³ Radwin petition at page 2.

⁴ Radwin petition at pages 5 and 6.

those with *simultaneous* multiple directional beams. Radwin's premise for the regulatory change requested in the Petition is therefore flawed in its inception.

2. The Amateur Service allocation at 5725-5850 MHz⁵ in the United States is part of the 5650-5925 MHz band, a secondary Amateur allocation. Domestically, the entire band is allocated to the Government Radiolocation Service (limited to military services) and to the Amateur Service on a secondary basis. By footnote, Amateur-Satellite Service, Earth-to-space operations are permitted in the band 5650-5670 MHz subject to not causing harmful interference to other services operating in accordance with the Radio Regulations. Space-to-Earth applications in the Amateur-Satellite Service are permitted in the segment 5830-5850 MHz, which is secondary as well to the Government Radiolocation service. Thus, there are important paired uplink and downlink segments in the Amateur-Satellite Service at 5.65-5.85 GHz, some of which are in the U-NII-3 subband. Currently, there are at least seven Amateur satellites that use this part of the spectrum: Unitec-1, Estelle and TY-2 to TY-6.⁶ There is terrestrial 5 GHz Amateur operation in the band as well, and it is increasing steadily due to the ready availability of commercial, off-the-shelf equipment for Amateur use in this band.⁷ Amateur Radio operators

⁵ This is actually a subband; the Amateur allocation at 5 GHz extends from 5650-5925 MHz, though the segment above 5850 MHz is under current consideration for use by wireless broadband and by DSRC Vehicle-to-Vehicle and Vehicle-to-Roadside communications. The upper portion of the Amateur allocation at 5 GHz, 5850-5925 MHz, is allocated to the Fixed-Satellite Service for uplinks and the mobile service, on a primary basis with the radiolocation service. In addition, the frequency 5800 MHz, plus and minus 75 MHz, is designated for industrial, scientific and medical (ISM) devices, thus impacting the 5850-5875 MHz segment.

⁶ AMSAT, the Amateur Radio Satellite Corporation is the source of this information, current as of the date hereof. See also: www.ne.jp/asahi/hamradio/je9pel/satslist.htm

⁷ In recent years, surplus equipment has become available for use on this Amateur band. It is observed that activity by Amateurs in this band is increasing. Distributors who sell equipment that operates in the 5 GHz band include the following: DEMI - <https://www.downeastmicrowave.com/category-s/1841.htm> Kuhne - <https://shop.kuhne-electronic.de/kuhne/en/shop/converter-transverte/transverter/MKU+57+G3+146++6+cm+Transverter/?card=1525>

regularly conduct terrestrial, satellite and Earth-moon-Earth (EME)⁸ communications in this band, as well as high speed multimedia data communications.

3. The Amateur Radio allocation in the 5.650-5.925 GHz band has been subjected to a continuing series of overlays domestically in the past twenty-one years. This began with the first U-NII provision in 1997.⁹ The initial purpose of the generic U-NII Part 15 authorization was to encourage wireless Local Area Networks and to further enable mobile broadband access. The 1997 *Report and Order* in Docket No. 96-102 made available for this purpose under Part 15 a total of 300 MHz at 5150-5350 MHz and 5725-5825 MHz. The lower (non-Amateur) segment was intended for, and was made available for higher-power devices. In making this band available for U-NII purposes, the Commission suggested:

With regard to sharing this band with Amateur operations, we believe that U-NII devices will cause little interference to amateur operations because of the relatively low power with which U-NII devices will operate. Further, we note that the amateur service has access to all spectrum within the 5.65-5.925 GHz range. We therefore believe that amateur operation will be able to avoid using frequencies within the 5.725-5.825 GHz band that are available to U-NII devices, in those rare cases where such avoidance may be necessary.

4. The Commission was not wrong in its conclusion; with some exceptions,¹⁰ there has proven to be a good deal of compatibility in practice in the segment 5.725-5.825 GHz, and the reason for that is that there has not been high power Part 15 operation permitted in that segment. ARRL argued in 1997 that the Commission's premises were flawed: the Commission urged that fixed stations in allocated services might have to move in order to avoid interference from

⁸ Radio Amateurs have invested considerable sums to create Earth-Moon-Earth stations, as bouncing signals off the moon works well for this band. Such weak signals must be protected from inferior transmission quality that can mask the weak signal reflections from the moon.

⁹ See the *Report and Order, Amendment of the Commission's Rules to Provide for Operation of Unlicensed U-NII Devices in the 5 GHz Frequency Range*, FCC 97-5, released January 9, 1997 in ET Docket No. 96-102.

¹⁰ That segment includes the Amateur Radio national weak-signal calling frequency, 5760.100 MHz, which is used nationwide in the Amateur Service for narrowband propagation research and experimentation. There has been noted a very substantial increase in ambient noise in that frequency range in many areas which has had a substantially adverse effect on Amateur operation in the 200 kHz centered on that frequency. Extremely weak received signal levels are typical in this small segment.

unallocated, unlicensed devices, which is contrary to normal spectrum management policy and contrary to the concept of unlicensed device operation under Part 15. ARRL also expressed concern at the time about the *aggregate* interference potential of these devices, which was neither considered nor quantitatively evaluated in the proceeding. In any case, of the 5650-5925 MHz available to the Amateur Service on a secondary basis (a total of 275 MHz), 100 MHz became considerably less useful than it would be absent the initial U-NII authorization in Docket 96-102.

5. The second major event affecting the Amateur allocation at 5650-5925 MHz occurred in 1999, when the Commission allocated the 5850-5925 MHz segment to Part 90 Intelligent Transportation Services (ITS) direct vehicle-to-vehicle and vehicle-to- roadside, or "Dedicated Short Range Communications" (DSRC).¹¹ This allocation was, again, justified in part on the basis that the Amateur Service has available to it "275 megahertz of spectrum in the 5.650- 5.925 GHz band." Given the mobile characteristics of DSRC operations, it was anticipated that sharing opportunities for Amateurs in that segment would be minimal. The Commission was clear in its instructions to Amateurs in the 1999 *Report and Order* authorizing DSRC: Amateurs could continue to operate in the band, but only to the extent that they do not interfere with DSRC operations. Furthermore, there is a strong safety component of DSRC applications which concerned Amateur licensees. However, due to cooperative efforts between ARRL and ITS America in the years following the 1999 allocation, compatible sharing with DSRC has proven reasonably successful, given the types of Amateur uses of this segment. However, the restrictions were hardly conducive to expansion of Amateur operation.

¹¹ See, the *Report and Order*, FCC 99-305, 14 FCC Rcd. 18221 (released October 22, 1999 in ET Docket No. 98-95).

6. A Petition for Rulemaking (RM-10371) filed by the Wireless Compatibility Alliance (WECA) sought to permit U-NII operation at 5470-5725 MHz. Based on that, the Commission in 2003 made available¹² for U-NII devices an additional 255 MHz of spectrum in that band. The additional Part 15 authorization increased the total amount of spectrum in this frequency range for U-NII devices from 300 MHz to 555 MHz, despite any quantified need for additional U-NII spectrum or any showing of occupancy levels in the 300 MHz already available therefor. In comments filed in 2003 in Docket 03-122, ARRL noted potential compatibility between Amateur Radio and U-NII operation in that additional segment¹³ due to the Commission's proposal to require Dynamic Frequency Selection (DFS), Transmitter Power Control (TPC), and a limitation on the power of U-NII devices to 1 Watt e.i.r.p.¹⁴ ARRL pledged its cooperation with the RLAN industry on sharing related issues regarding this band. However, ARRL remained concerned about potential aggregate interference from U-NII devices in the 5.470-5.725 GHz band to Amateur Radio space stations in the 5.65-5.67 GHz band, and urged limits on

¹² Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) devices in the 5 GHz band, *Report and Order*, ET Docket No. 03-122, 18 FCC Rcd 24484 (2003).

¹³ The necessity for the additional 255 MHz of spectrum for U-NII device deployment at 5 GHz proposed in 2003 was essentially settled from a regulatory perspective at the 2003 World Radiocommunication Conference (WRC-03), which allocated the band 5.47-5.725 GHz internationally to the mobile service for implementation of wireless access systems (WAS) including RLANs, subject to the provisions of Resolution 229. However, WRC-03 Resolution 229 noted the need to protect the existing primary services in the 5 GHz band. In relevant part, it resolved:

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

7 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

8 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems...

¹⁴ These requirements were not for the purpose of protecting Amateur Service stations. Rather, they were intended to protect the Earth Exploration Satellite Service (EESS) and Space Research Satellite (SRS) operations.

U-NII operation in the 5.65-5.67 GHz band segment, in order to avoid interference to the Amateur-Satellite service. ARRL also requested expansion of the DFS requirements to take into account more than just radar devices, and adoption of a requirement that all new U-NII devices operating in the 5.650-5.825 GHz band have TPC capability to further protect Amateur facilities.

7. The Commission adopted none of ARRL's proposals, concluding that:

As recognized by ARRL, our DFS and TPC requirements, while not specifically designed to protect amateur operations, will in fact protect amateur operations. In addition, because of the large amount of spectrum we are adding for U-NII devices along with the existing 300 MHz of U-NII spectrum, we expect the density of devices throughout the spectrum to be relatively low. We believe that this low density of devices coupled with our technical requirements will provide adequate protection to all incumbent systems in the band, including amateur satellite uplink systems.

Since 2003, there has been found to be a good deal of compatibility between Amateur Radio operation and U-NII devices in the 5 GHz range. That said, the level of U-NII deployment has not been as high as might be the case in the near future; the predicted low density of operation was not a permanent condition. As the Commission predicted, until now, U-NII operation has been a low density use. The other reason that there has been compatibility between U-NII applications and Amateur Radio is due to the low permitted power levels for U-NII devices at 5 GHz. The Radwin Petition proposes to change that fundamentally, and in doing so makes no valid showing of the individual or aggregate interference potential of these systems going forward.

8. It is quite obvious that Radwin's proposal for simultaneous point-to-multipoint transmission, with higher input power and EIRP, using an electronic steerable antenna system, presents an exceptionally high interference potential to ongoing, weak-signal Amateur Radio Service communications. While this would permit transmitting a beam to specific customers (as

is permitted now for point-to-point communications), if customers are located at all points of the compass from the distribution point, the potential for interference to ongoing Amateur Radio communications in a 360-degree arc is much greater. Furthermore the potential for received interference by users of this system and other Part 15 device from Amateur Service transmissions into the boresite of the Part 15 receive antenna) is potentially far greater than it is under the existing rules.¹⁵ It is unclear at the moment how clean the devices are spectrally. Is their transmit quality (spectrally) clean, with low phase noise?¹⁶ These questions are unanswered anywhere in the four corners of the Petition.¹⁷

9. The simple fact is that the Commission has no idea at all about the aggregate noise levels in the 5 GHz band generally. Amateur Radio operators have for years reported increased ambient noise levels in this band, especially in segments near 5.760 GHz where narrowband, long distance propagation research is conducted using high transmitted power levels and very low received power levels. The same is true of satellite reception in the 5 GHz Amateur Satellite Service bands. Nor is there a word anywhere in the Radwin Petition about compatibility between

¹⁵ In cases of received interference to end users of the Radwin system, the user is unable to determine why their local wireless service is non-functional. With no apparent solution to the interference from primary and secondary allocated services, the only solution for the Radwin user would be to power down. Radio Amateurs frequently operate in this band on high hilltops, with relatively high power. Such transmissions will interfere with RADWIN users over a large geographic area. Amateur rover/mobile/itinerant stations unpredictably move about and may also interfere with Radwin systems, when geographically proximate. Radio Amateurs are allowed by Part 97 rules to utilize RF output power of up to 1,500 Watts PEP into antennas with high-gain patterns that range unpredictably from omnidirectional to highly directional.

¹⁶ Though Radwin's system has apparently been certified under the Commission's Equipment Authorization program, there is no transmit quality data available for their proposed higher output distribution devices. Transmit quality such as phase noise must be considered for studying the impact of this technology on other radio services. Besides co-channel interference, high transmit phase noise can raise the noise floor in the affected area for adjacent channel users.

¹⁷ Part 15 devices do not have a station identification requirement. In the event of harmful interference to the Amateur Service from a P2MP system configured per Radwin's Petition, there would be no way of identifying the station that is causing the interference. There are no provisions in the Petition for this. Thus, the only way to locate the source would be to use radio direction-finding techniques. Given the dynamic nature of the signal over a 360 degree circle, this would be particularly difficult. While the potential impact to government radiolocation is unknown, interference to the Amateur Service will be extremely difficult to find and resolve. Even if it is located, there is no interference resolution plan noted by Radwin. Shutting down the source per Section 15.5 of the Commission's rules is not a practical solution and the Commission has never, to date, ordered such in the case of Part 15 device-generated interference.

Part 15 high-power, simultaneous point-to-multipoint operation at 5.725-5.850 GHz and incumbent and future Amateur Radio operation in that segment. Both the Petition and the technical statement accompanying the Petition are silent on potential interaction between P2MP simultaneous transmission systems operating at high power and any Amateur Radio facility.¹⁸ As a result, the petition is fatally flawed and should be dismissed without further consideration relative to the 5.725-5.850 GHz band.

10. The Commission has no jurisdiction to authorize Part 15 device operation by rule absent a specific finding that the device will not predictably cause interference. Recognizing that the radio spectrum is a finite resource, and that multiple users of spectrum can interfere with each other, Congress charged the Commission with refereeing competing uses of spectrum for communications.¹⁹ The principal tool for that control is the requirement in section 301 of the Communications Act of 1934 that anyone who wishes to operate a device that emits radio frequency (“RF”) energy first obtain a license from the Commission. 47 U.S.C. § 301. Section 301’s licensing requirement contains no exceptions. It forbids the “use or operat[ion of] any apparatus for the transmission of energy or communications or signals by radio [in or affecting interstate commerce], except . . . with a license[.]” Nevertheless, since 1938 the Commission has permitted the use without a license of certain devices that radiate *extremely low levels of RF*

¹⁸ Existing Part 15 rules permit high-power devices to be used for point-to-point communications *only*, with limited interference created outside of the signal (point-to-point) path. Radwin’s proposal is to use a distribution hub, using an electronically steered sectional array antenna, which “beams” a signal to individual users. There is a big difference between what is in use at 2.4 GHz already and the Radwin proposal: there will likely be multiple users, spread out on all points of the compass. This increases the potential terrestrial interference area from a within single, straight line path area to a large, circular area. Furthermore, given the proposed increased power, the radius of that circle of potential interference will be even greater. It appears that Radwin is trying to use one-dimensional thinking for a two-dimensional problem. Interference is spread out over an area, not a range of angles. **Appendix B to Radwin’s Petition is therefore highly misleading, since it only shows single, directional antenna patterns. The potential, cumulative radiated antenna circular patterns of such a multi-user distribution point are not considered.** As an example, a worst case scenario might include signals sent in all directions to users spread out evenly around such a distribution hub.

¹⁹ See 47 U.S.C. §§ 152, 301.

energy, as long as that use does not cause harmful interference to licensed operations.²⁰ The Commission’s rationale for allowing unlicensed operations is that a device that transmits too little RF energy to interfere with licensed uses does not constitute an “apparatus for the transmission of energy” under section 301.²¹ The Commission’s rules governing the use of unlicensed devices are codified in Part 15 of the agency’s rules, 47 C.F.R. Part 15. The rules prescribe technical standards for particular types of unlicensed devices.²² These are prefaced by an overarching command that unlicensed devices and systems may be operated *only* to the extent that they do not harmfully interfere with licensed operations. This command is embodied in three rules. First, “operation of a [Part 15] device is subject to the condition[] that no harmful interference is caused.” 47 C.F.R. § 15.5(b). Second, Part 15 devices operate on an at-sufferance basis: their operators must accept any interference “that may be caused by the operation of an authorized radio station.” *Id.* Finally, “[t]he operator of a [Part 15] device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference.” *Id.* at § 15.5(c). Consistent with the Commission’s legal rationale for allowing unlicensed devices under section 301, the agency’s principal obligation with respect to such devices is to ensure their operation will predictably not interfere with licensed radio services, *ex ante*. Given this obligation, the Commission is without the authority to act on the instant Petition because it fails completely on its face to establish *ex ante* that there exists any level of compatibility with incumbent Amateur Radio operations in the band 5.725-5.850 GHz.

11. Finally, the entire premise for allowing high power, P2P Part 15 operation is that it is done on a point-to-point basis using narrow beamwidth directional antennas *which do not cover*

²⁰ See Certain Low Power Radio Frequency Electrical Devices, 3 Fed. Reg. 2999 (December 14, 1938).

²¹ See Ultra-Wideband Transmission Systems, 19 FCC Rcd. 24,558, at ¶ 68.

²² *E.g.*, 47 C.F.R. Part 15B (unintentional radiators); *id.* part 15C (intentional radiators).

a large geographic area. In 2001, in Docket 98-156, the Commission amended the Part 15 Rules to allow unlicensed operation of fixed point-to-point transmitters in the 24.05 - 24.25 GHz band with field strengths up to 2500 mV/m.²³ The Commission also adopted strict frequency stability requirements to limit out-of-band emissions to minimal levels²⁴ and stated that such devices must use directional antennas with gains of at least 33 dBi or a main lobe beamwidth not exceeding 3.5 degrees.²⁵ Its sole rationale for allowing high power Part 15 devices on a point-to-point basis in a band used by an allocated radio service was that such high power, unlicensed devices conforming to the specified directional antenna requirements “will not increase the interference potential to licensed amateur services in the band.”²⁶ The Commission found that the use of a directional antenna “would change the shape of the radiated field but not increase the total geographic area being radiated. In other words, while signals will travel further along the narrow path of intended communication, the signals will be limited in all other directions.”²⁷

12. The Radwin Petition throws the entire rationale for high power Part 15 operation out the window, because it corrupts the concept of limited interference area due to directional, P2P operation. Increasing the interference area from a narrow beamwidth antenna in the P2P context to a high-power, 360-degree arc by P2MP emissions vitiates the entire basis for allowing high power, directional operation allowed in the P2P context.

13. This Petition is flawed in its inception and fails to justify the relief requested. In particular, the Petition fails to address the issue of compatibility between high power, P2MP Part 15 operation proposed and individual stations in the incumbent primary and secondary allocated

²³ *Amendment of Part 15 of the Commission’s Rules to allow certification of equipment in the 24.05 – 24.25 GHz band at field strengths up to 2500 mV/m, ET Docket No. 98-156, Report and Order, 16 FCC Rcd. 22,337 (2001)* at ¶ 7. 47 C.F.R. § 15.249 (b) (1).

²⁴ *Id.* at ¶ 15.

²⁵ *Id.*, 47 C.F.R. § 15.249 (b) (3).

²⁶ *Report and Order* at ¶ 7, n. 13, and ¶ 8.

²⁷ *Id.* at ¶ 8.

services. It also fails to address the aggregate effect of the rule change on ambient noise levels in the subject band and the Commission has absolutely no independent data on that subject itself. It is long past time that petitioners such as Radwin provide in their rulemaking petitions dealing with Part 15 rules enough data to allow the Commission to make an evaluation that fulfills its obligation under Sections 152 and 301 of the Communications Act of 1934. Radwin's Petition must be dismissed as one which fails to provide an adequate justification for the relief requested.

Therefore, the foregoing considered, ARRL, the national association for Amateur Radio, respectfully requests that the Commission dismiss or deny this Petition pursuant to the arguments contained in these comments.

Respectfully submitted,

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