

Morgan, Lewis & Bockius LLP
2020 K Street, NW
Washington, District of Columbia 20006-1806
Tel. 202.373.6000
Fax: 202.373.6001
www.morganlewis.com

Morgan Lewis
C O U N S E L O R S A T L A W

June 1, 2015

Via ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

**Re: Notice of *Ex Parte* Meeting: Revision of the Commission's Rules to Permit
Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band,
ET Docket No. 13-49**

Dear Ms. Dortch:

On May 28, 2015, Greg Bedian, Director of Engineering and Hayley M. Nivelles, Chief Corporate and Commercial Counsel with Ubiquiti Networks, Inc. ("Ubiquiti") and Catherine Wang and Timothy L. Bransford of Morgan, Lewis & Bockius LLP, outside counsel to Ubiquiti met with the individuals identified in the attached list from the Office of Engineering and Technology in connection with the above-referenced docket.

During this meeting, we explained that Ubiquiti, as the largest supplier of high-performance networking equipment to service providers in the wireless Internet service provider ("WISP") industry using unlicensed U-NII and ISM bands, is deeply committed to technology that makes affordable broadband Internet access available to all Americans including those in underserved markets and communities. Ubiquiti expressed support for the Commission's efforts in this proceeding to align the rules of the various 5 GHz bands to facilitate more efficient use of this spectrum. However, Ubiquiti supports reconsideration of the new Section 15.407 out-of-band emission limits for the 5725 to 5850 MHz band (the U-NII-3 band), as adopted in the Commission's April 1, 2014 order, to avoid the significantly higher costs and/or significant reductions of services available to consumers that will result from implementation of the new section as adopted. We explained that the rule, as adopted, does not accommodate OFDM modulation that is used by most transmitters in the U-NII-3 band, including WiFi radios.

Mr. Bedian presented Ubiquiti's proposed compromise approach of an emission limit for the U-NII-3 band that would take into account the characteristic spectral shape of OFDM signals while maintaining the -27 dBm/MHz OOB EIRP limit +/- 75 MHz from band edge. In our discussion, Ubiquiti also confirmed that an acceptable alternative approach might be an emission

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mask that employs a slope that gradually tightens the out-of-band limits ultimately arriving at the same -27dBm/MHz OOB EIRP limit at +/- 75 MHz. Ubiquiti also discussed the need for the Commission to clarify the rules to permit U-NII-2C device signals to straddle the U-NII-3 band edge.

Ubiquiti's modified approach relies on compliance verification via technical equipment requirements as confirmed by certified test labs in the equipment authorization process, rather than relying on installers to perform calculations and make technical adjustments to the equipment at each installation site to ensure compliance. As such, Ubiquiti's compromise proposal allows original equipment manufacturers to continue to provide economical broadband devices to operators to service remote communities without increased interference risk due to installation or configuration errors.

If you have any questions regarding this *ex parte* notice, please do not hesitate to contact the undersigned. A copy of the above-referenced slide deck is attached for inclusion in the Commission record.

Very truly yours,

/s/

Catherine Wang
Timothy Bransford

Counsel for Ubiquiti Networks, Inc.

Attachment

CC:

Julius Knapp
Bruce Romano
Mark Settle
Michael Ha
Karen Rackley (by
teleconference)

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FCC Meeting Attendees:

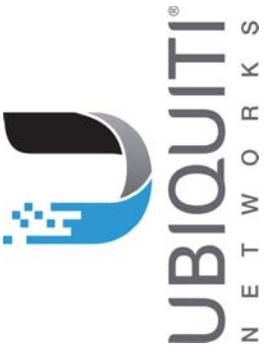
Julius Knapp - Chief, Office of Engineering and Technology (OET)

Bruce Romano - Associate Chief, OET

Mark Settle - Chief, Policy and Rules Division, OET

Michael Ha - Deputy Chief, Policy and Rules Division, OET

Karen Rackley - Technical Rules Branch Chief, Policy and Rules Division , OET (participating by teleconference)



ET Docket No. 13-49

U-NII-3 OOB Proposal

Submitted by Ubiquiti Networks



Summary

- The new 15.407 rules dramatically tighten the out-of-band emissions (OOBE) limits vs. the former 15.247 rules and will particularly impact devices using OFDM modulation
- The new rules will reduce achievable link distances and lead to higher equipment costs and increased in-band interference
- As a result, broadband providers' deployment and operational costs will materially increase, leading to higher costs and/or reduced performance for consumers, particularly in isolated and rural communities
- Ubiquiti Networks offers a compromise proposal that allows PTP devices to achieve EIRPs approaching former 15.247 levels while maintaining existing protections for adjacent services



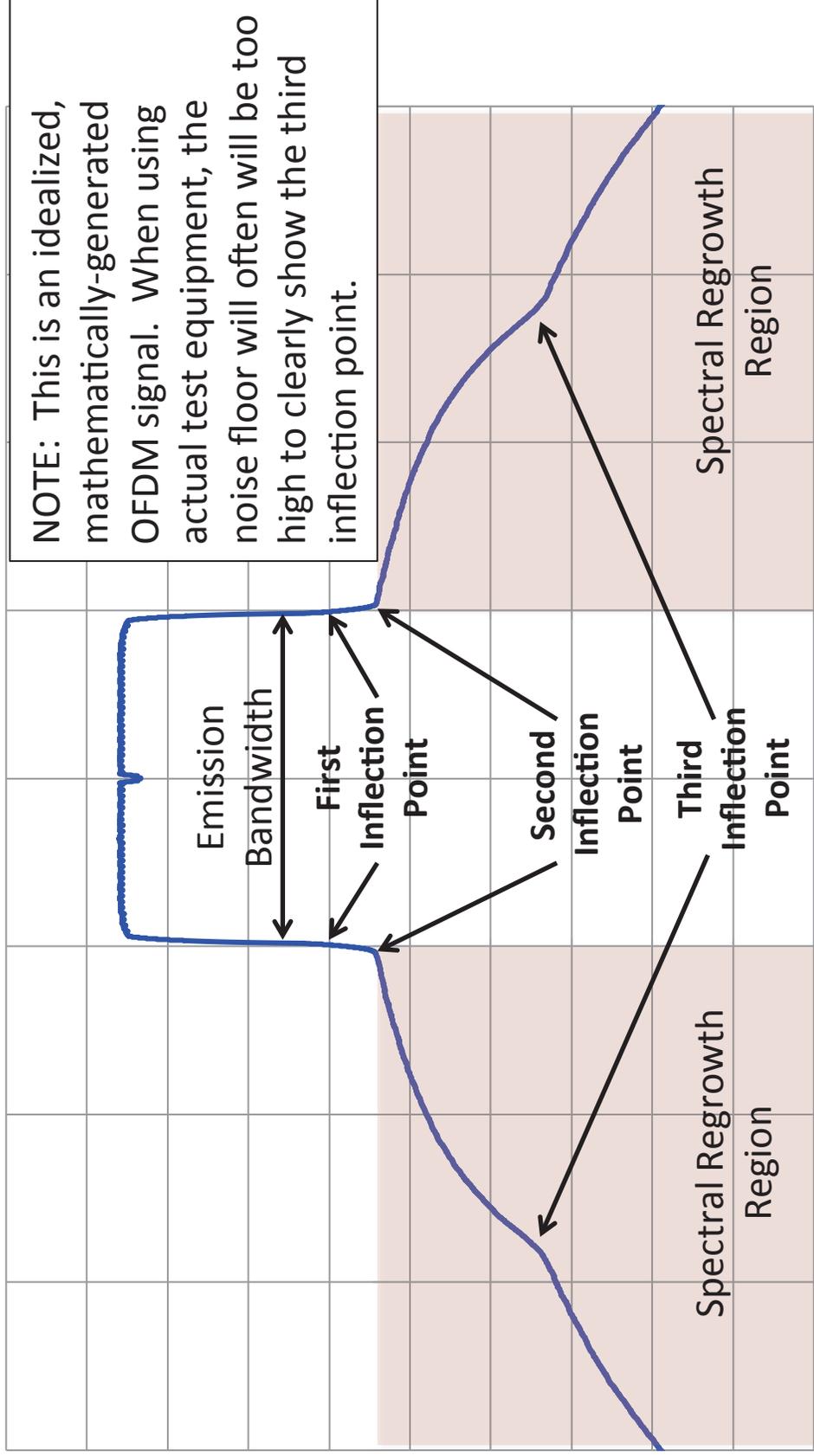
Impact of the new OOB E rules

- The two most attractive aspects of the 5725-5850 MHz ISM band were the lack of a DFS requirement and the high EIRPs that could be achieved for Point-to-Point (PTP) devices
- The new 15.407 rules considerably reduced the out-of-band emissions (OOBE) limits for devices operating in the 5725-5850 MHz band
- To meet these new requirements, PTP devices will need to reduce EIRP, move away from the band edges, and/or employ higher cost components
- All of these accommodations will lead to increased cost for service providers and consumers

OFDM and U-NII-3 OOB

- Most transmitters in the U-NII-3 band, including WiFi radios, use OFDM modulation
- The new rules do not take into account the characteristic shape of OFDM signals due to carrier intermodulation
- OFDM transmitters have a characteristic shape that has nearly square-shaped spectrum that sits upon a broad base
- The broad base of OFDM signals is $\sim 3x$ the occupied bandwidth and is a result of the intermodulation components of the carriers that make up the OFDM spectrum

Typical OFDM Signal (Simulated)



OFDM Band Edge Challenges

- Due to the characteristic shape of the OFDM signals, it will be difficult for OFDM transmitters to operate at the band edge under the new OOB E rules
- For real-world OFDM signals, the first inflection point is often high above the -17dBm/MHz limit
- The spectral regrowth region, which begins at the second inflection point, will also often be above the -17dBm/MHz limit for many real-world transmitters

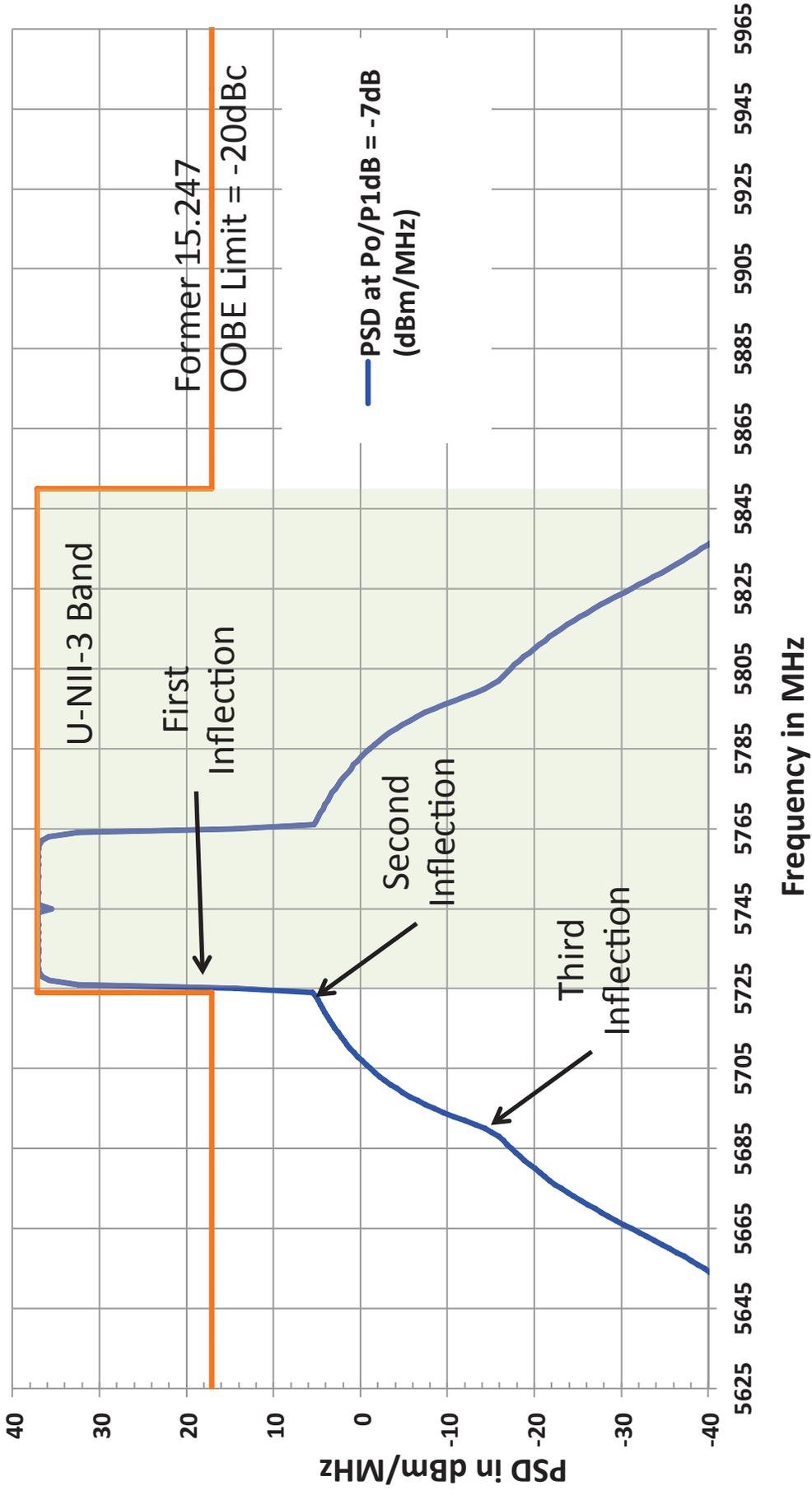
NOTE: The OFDM waveforms represented in the following diagrams are idealized. Real-world OFDM transmitters have reduced performance.



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Former 15.247 OOB

40MHz, 53dBm EIRP, 37dBm/MHz

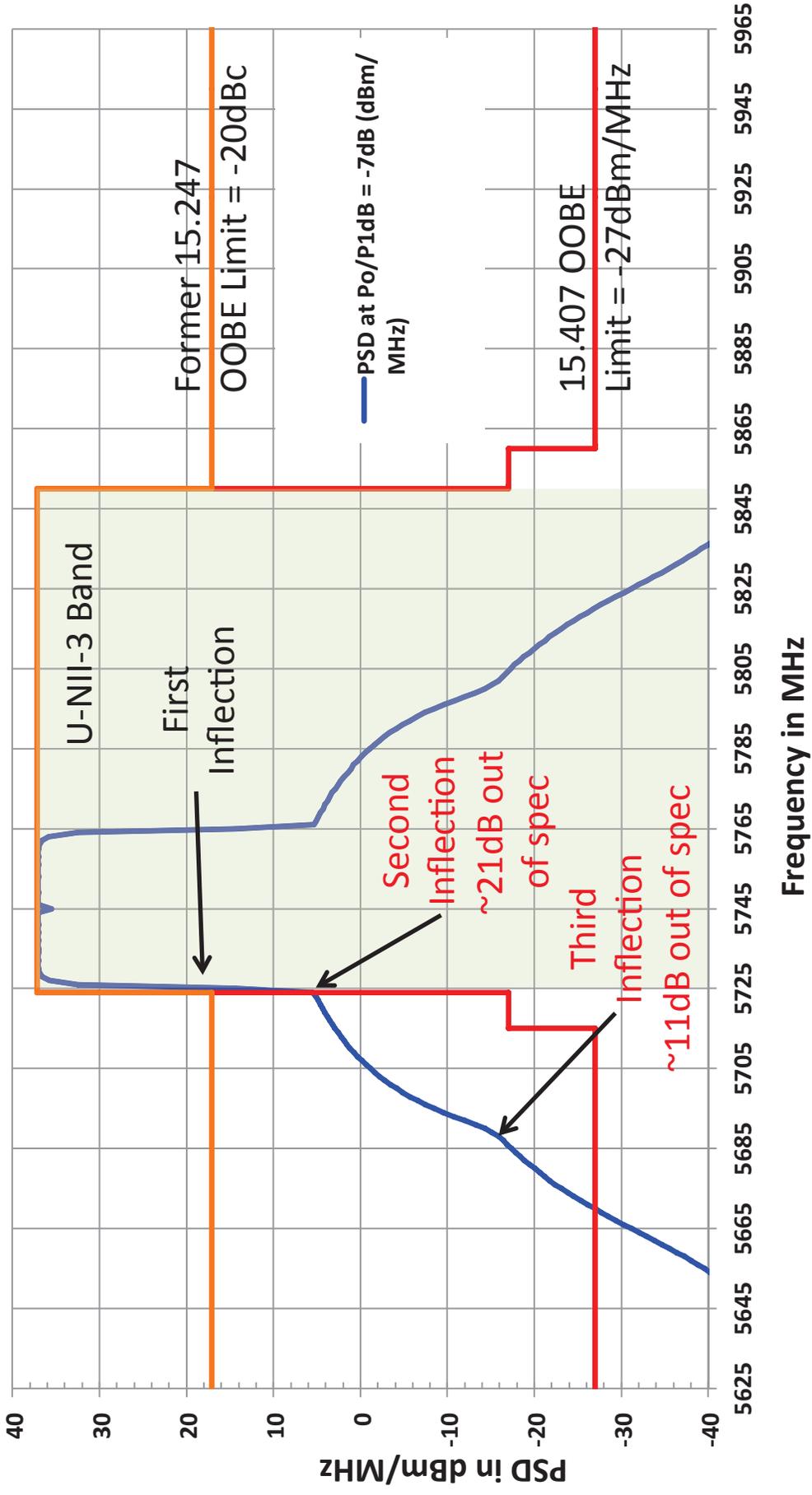




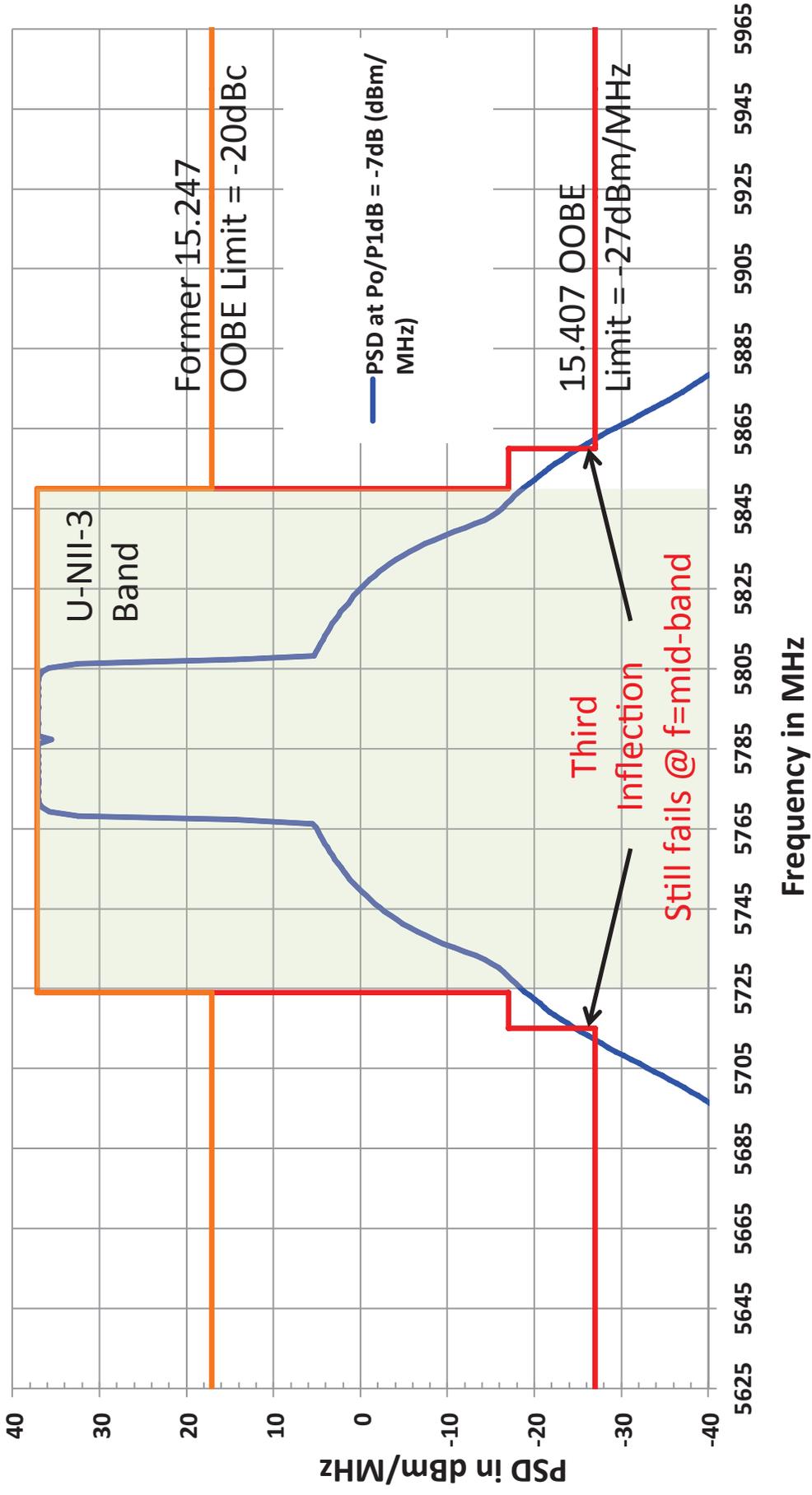
UBIQUITI
NETWORKS

Former 15.247 vs 15.407 OOB

40MHz, 53dBm EIRP, 37dBm/MHz



Shifting the signal to the center of the band does not help



Mitigation Techniques

Not the Solution

- Shift center frequency away from band edge
 - Causes mid-band congestion, reduces usable channels
- Reduce TX power
 - Reduces product range, reduces SNR and throughput
 - Reduces spectral efficiency, lower modulation rates
- Use high-linearity PA, TX/RX switch, etc.
 - Adds cost, requires more DC power and heat dissipation
- Use high-performance, band-pass filters
 - High cost, limits use to a particular channel/bandwidth
 - Limits number of usable channels

Significant Cost Impact on WISPs and Their Customers

- Increased equipment costs due to new U-NII-3 OOB E rules or for licensed-band radios for long distance links
 - Higher linearity PAs, high-performance filters, etc. for new U-NII-3
 - Low-volume, licensed-band radios cannot leverage U-NII band economies of scale
- Increased deployment and operating costs
 - Lower achievable EIRP levels mean shorter links (reduced link budgets)
 - Increased mid-band interference raises the noise floor, limits link range
 - Shorter links need more “hops” to cover the same distance, translating to more radios, more tower space, or new towers
 - More “hops” mean higher maintenance costs, more points of failure and increased latency
- Providing broadband service to remote customers may no longer be economically feasible for network operators



Seeking a middle ground...

- Minor modifications to 15.407 OOB E rules for U-NII-3 and also for U-NII-2C
- Revised U-NII-3 OOB E limits enable continued full-band utilization of high-EIRP PTP devices by easing the close-in OOB E limits while maintaining tighter threshold further removed from band edge
- U-NII-2C clarification is also sought to ensure U-NII-2C transmitters can straddle the U-NII-2C/U-NII-3 boundary in a manner similar to what is already allowed for U-NII-2A transmitters straddling the U-NII-1/U-NII-2A boundary

Proposed U-NII-3 Modifications

Proposal: Part 1 - Modify the text of 15.407(b)(4)

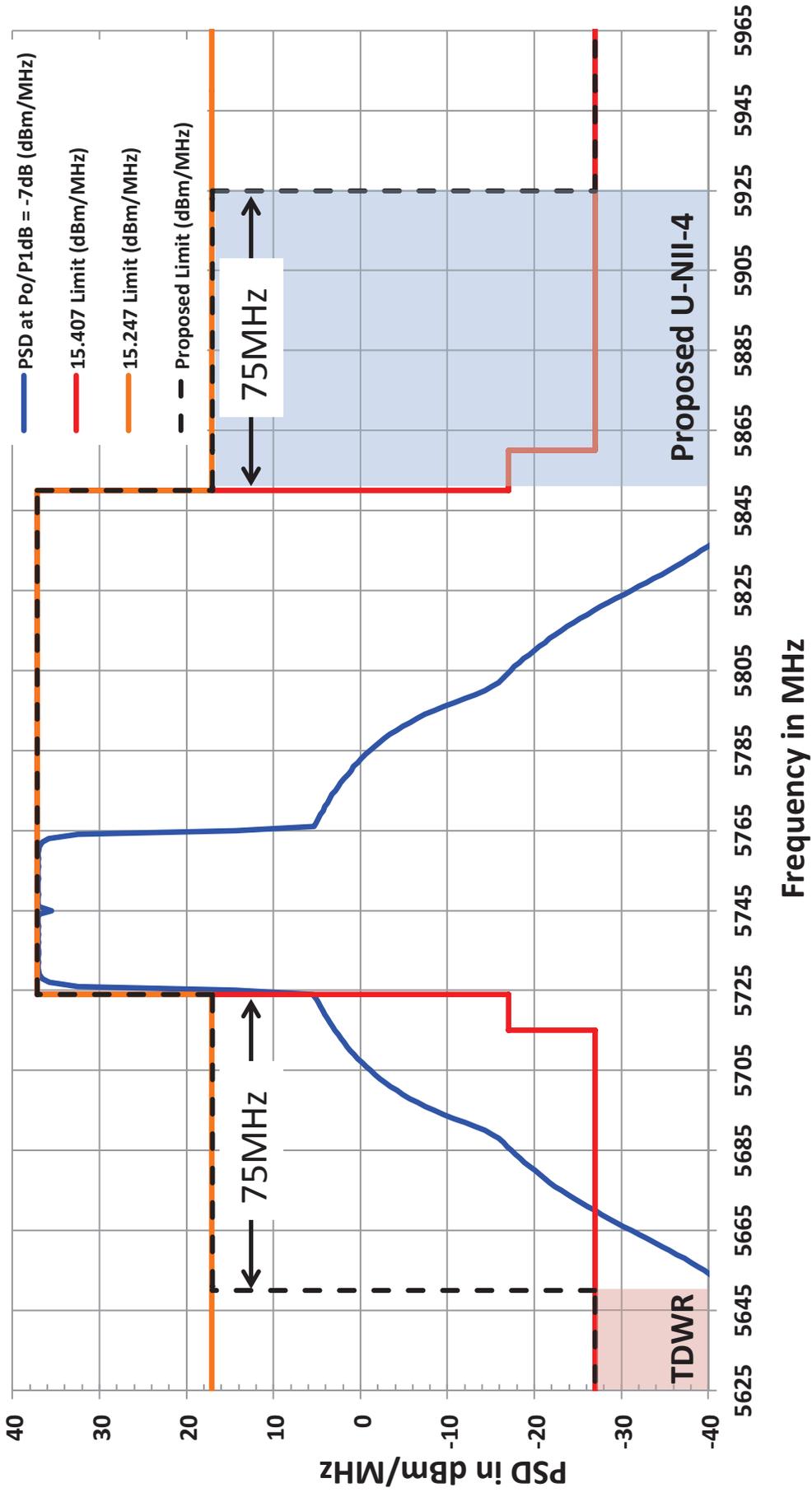
- Existing

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to **10** MHz above or below the band edge shall not exceed an e.i.r.p. of **-17** dBm/MHz; for frequencies **10** MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

- Proposed

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to **75** MHz above or below the band edge shall not exceed an e.i.r.p. of **17** dBm/MHz; for frequencies **75** MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

Proposed Compromise for U-NII-3



U-NII-3 Proposal Explanation

- This proposal takes into account the characteristic spectral shape of OFDM transmitters (~ 3x occupied bandwidth) while maintaining the -27dBm/MHz OOBE EIRP limit
- It aligns the U-NII-3 OOBE with U-NII-1 OOBE rules, which allow a 17dBm/MHz maximum (outside the 26dB emission bandwidth) in the adjacent U-NII-2A band
- It anticipates the approval of a 75 MHz wide U-NII-4 band so U-NII-3 rules do not need to change later

U-NII-3 Proposal Advantages

- Further aligns rules across multiple U-NII bands
- Allows operators to continue to provide economical broadband services to remote communities
- Relies on FCC's network of certified test labs and TCBs for verification
- Minimizes installation errors associated with manual calculations and adjustment of U-NII-3 equipment
- Requires no additional enforcement resources



U-NII-2C Clarification

Proposal: Part 2 – Clarify U-NII-2C devices permitted to straddle the U-NII-3 band edge

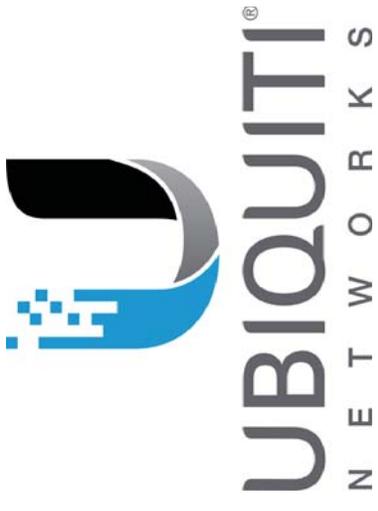
Modify the text of 15.407(b)(3)

- Existing
For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz
- Proposed
For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.850 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

U-NII-2C

Clarification Explanation

- 15.407(b)(3) currently might be interpreted as preventing a U-NII-2C transmitter from straddling the 5725 MHz band edge into the U-NII-3 band
- The proposed change to 15.407(b)(3) would clearly allow U-NII-2C transmitters to straddle the 5725 MHz boundary between U-NII-2C and U-NII-3
- This would make the verbiage consistent with the treatment of the 5250 MHz boundary between U-NII-1 and U-NII-2A boundary in 15.407(b)(1) and (2)
- Has no impact on applicability of DFS rules



Thank You