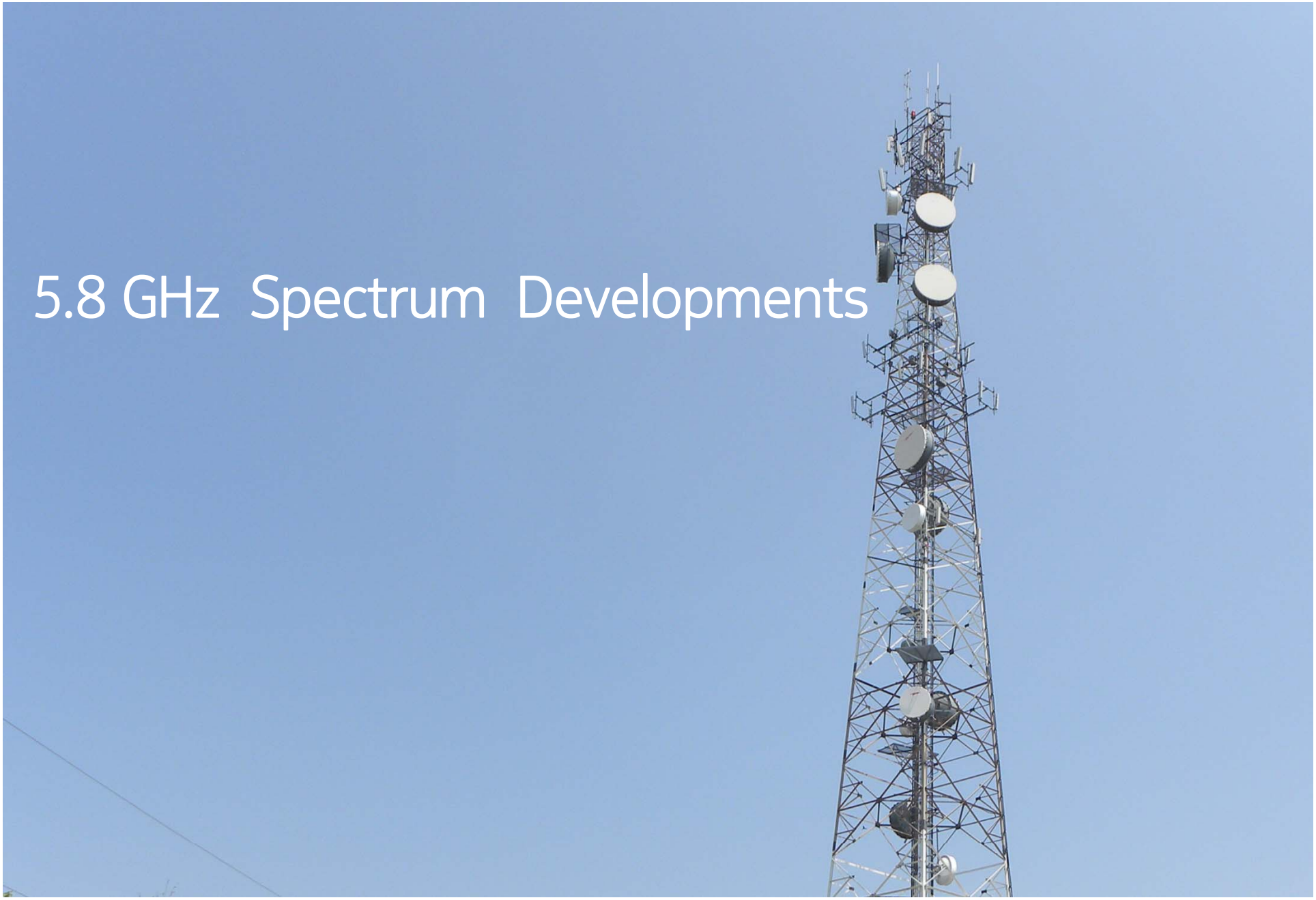
5.8 GHz Spectrum Developments



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Timeline

- FCC Decision Results in 15.407 Rules
- Group Counter-Proposals
- Revised Proposal
- Request for Extension
- Extension Granted
- Memorandum Opinion and Order (MO&O)
- Automotive Manufacturers' Challenge

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FCC Decision Results in 15.407 Rules

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Why Modify the Rules?

- FCC Received reports from the FAA regarding interference in the TDWR (Terminal Doppler Weather Radar) band at 5600 MHz to 5650 MHz.
- In 2012 the NTIA (National Telecommunications and Information Administration) determined that unlicensed U-NII devices operating in the bands 5250-5350 and 5470-5725 MHz were the interference source, and released NTIA Report TR-12-486
- The FCC revised the rules for the bands 5150-5250 MHz, 5250-5350, 5470-5725 and 5725-5825 MHz from 15.247 to 15.407
- Part 15.247 rules were based on power into the antenna, whereas part 15.407 rules are based on EIRP (Equivalent Isotropic Radiated Power) which includes antenna gain. Effectively the power reduction in OOBE (Out Of Band Emissions) is about 50 dB for high power systems.
- Because some measured interference to TDWR was identified as end-user modified WiFi equipment, a provision in 15.407 included tamper-proof coding such that a third party could not enable a radio to operate outside of the parameters for which it was certified(security provisions).

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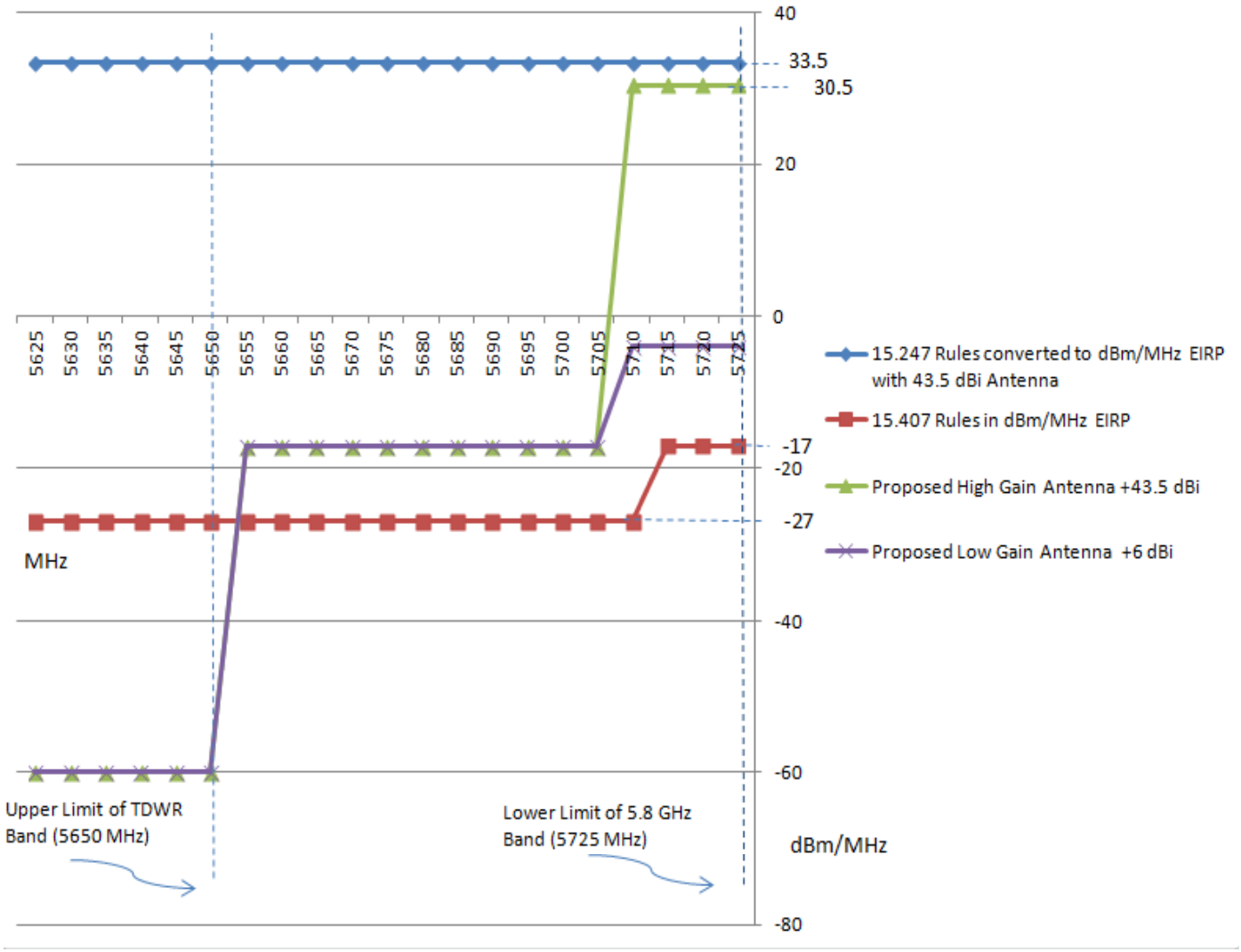
Alcatel-Lucent (Nokia)
American Petroleum Institute
Cambium Networks, Ltd.
Fastback Networks
JAB Wireless, Inc.
Mimosa Networks, Inc.
Zebra Technologies
Wireless Internet Service Providers Association

Group Counter-Proposal

- For high power point to point links in the 5.8 GHz band under the 15.247 rules, there was no reduction in EIRP required for increased antenna gain. This was done predominantly to support long rural links that needed higher power and a side benefit was to enable the sharing of antennas with 5.8 and L6 GHz bands, for dual band and rapid deployment options.
- Because filters offer little signal reduction immediately adjacent to the pass band, a +30 dBm signal with a 40 dBi antenna gain cannot be reduced to the required -17 dBm/MHz EIRP at the lower band edge of the 5.8 GHz band.
- Many manufacturers and service providers complained about the more restrictive 15.407 rules and approached the FCC with a proposal to protect the TDWR band while allowing the continued use of high power links in the 5.8 GHz band.
- The idea was to find a common counter proposal to modify the 15.407 rules, satisfying low power and high power systems.

Option: OOBE Mask



Less restrictive OOBE than 15.407 yet not as lenient as 15.247 while imposing levels in the TDWR band that meet the calculated limits from the NTIA study.

Option: DFS (Dynamic Frequency Selection)

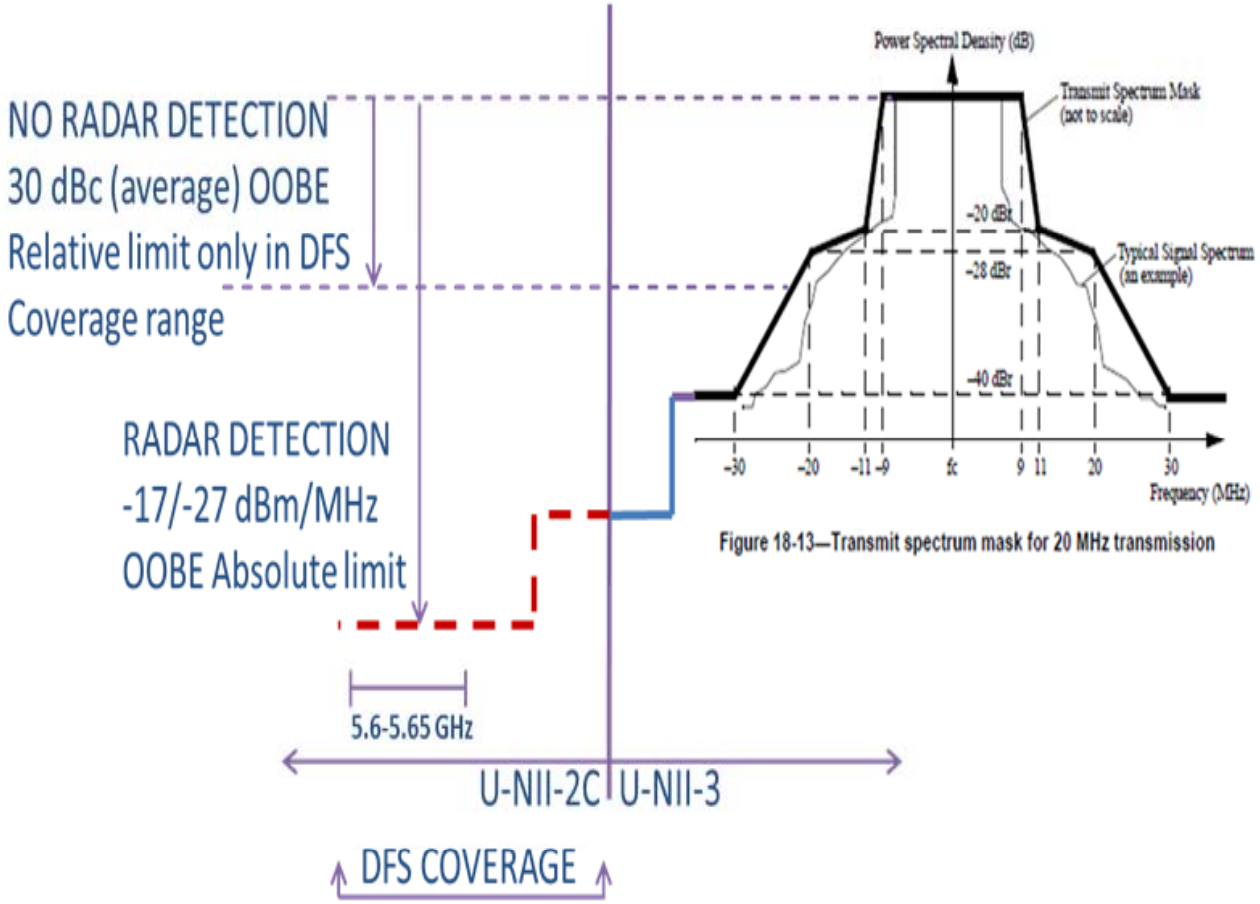


Figure 18-13—Transmit spectrum mask for 20 MHz transmission

A system with a radar detector can operate at a high power with OOBE limits at 30 dBc unless a radar is detected, and then the system will select another channel or reduce output power to comply with the -17 and -27 dBm/MHz EIRP specified in Part 15.407

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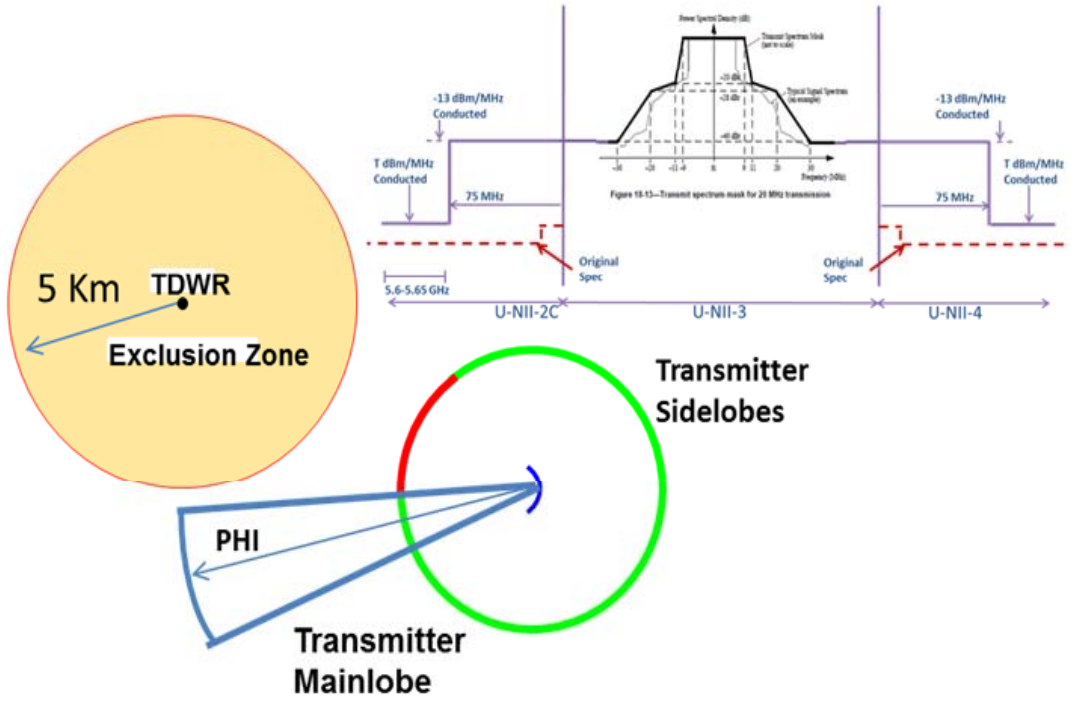
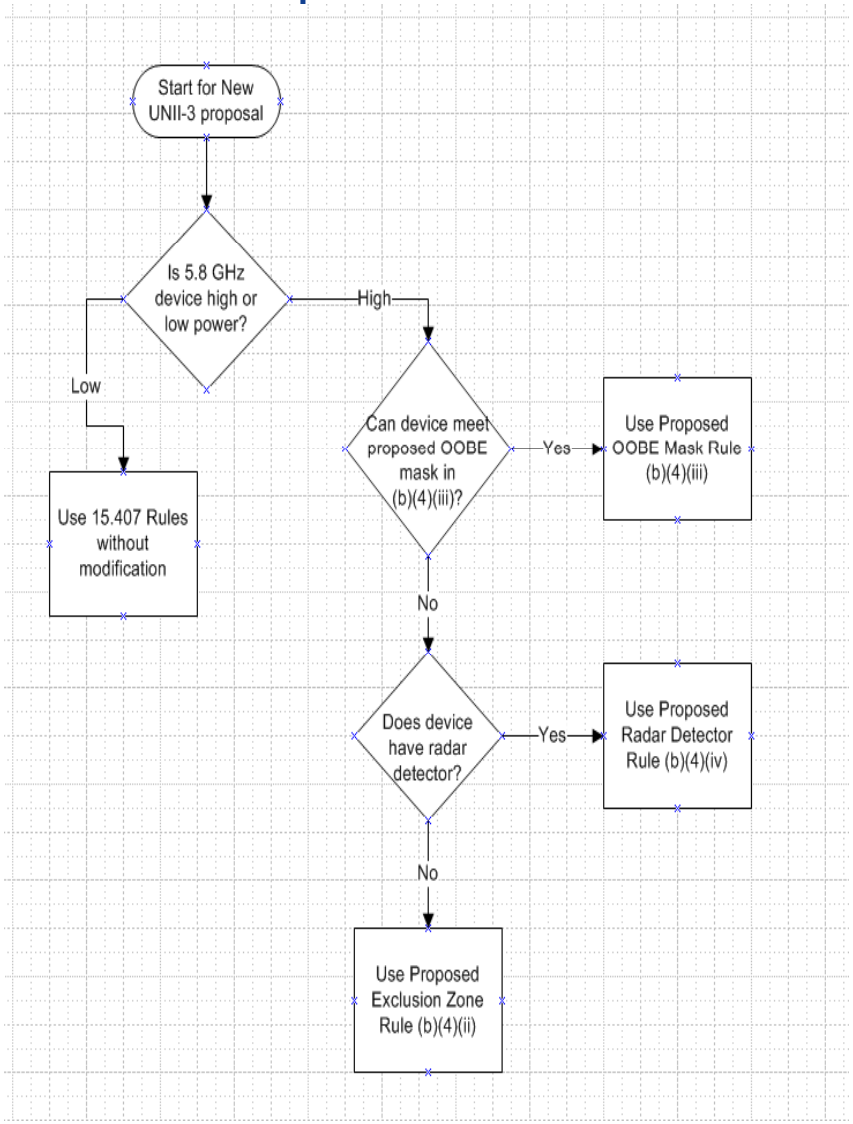
Option: Exclusion Zone

- Under this option, there is no precision filter and no radar detector, but operation at the full power as authorized under part 15.247 rules would be allowed, as long as no part of the main 3 dB beam width of the antenna would cross a 5 km radius exclusion zone surrounding any TDWR radar installation.
- This option requires a database of all TDWR installations in the US to be maintained, and system designers would have to certify their proposals against it.



Group Counter-Proposal Flowchart



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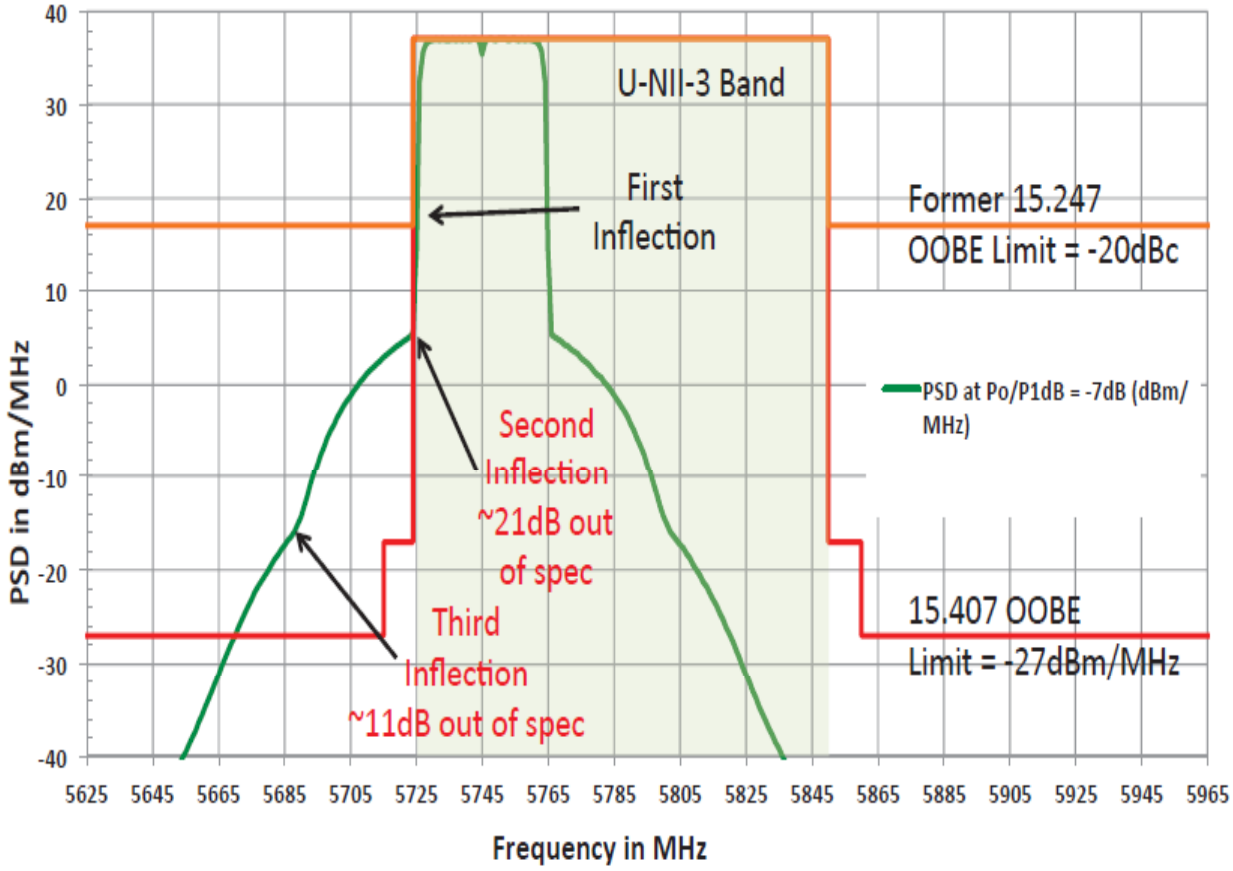
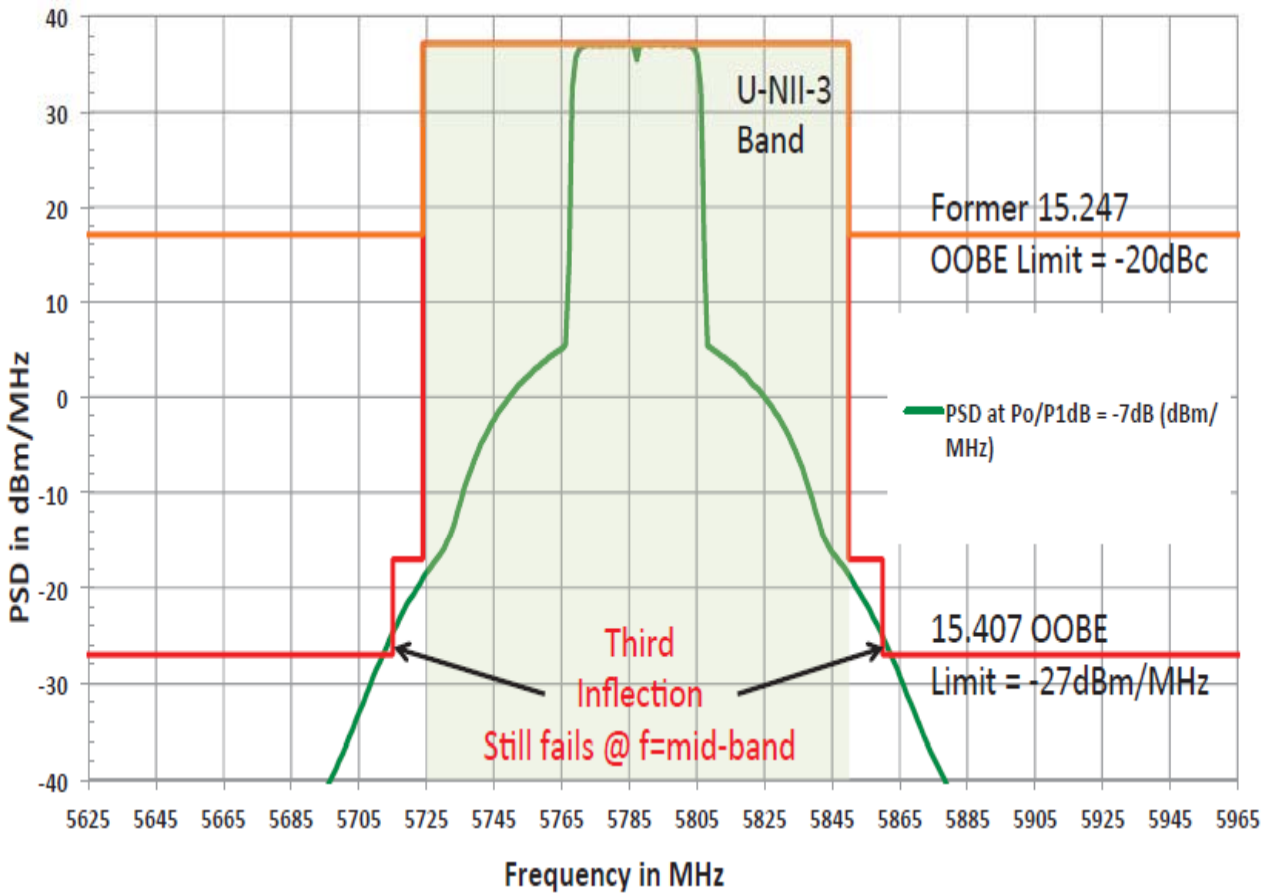
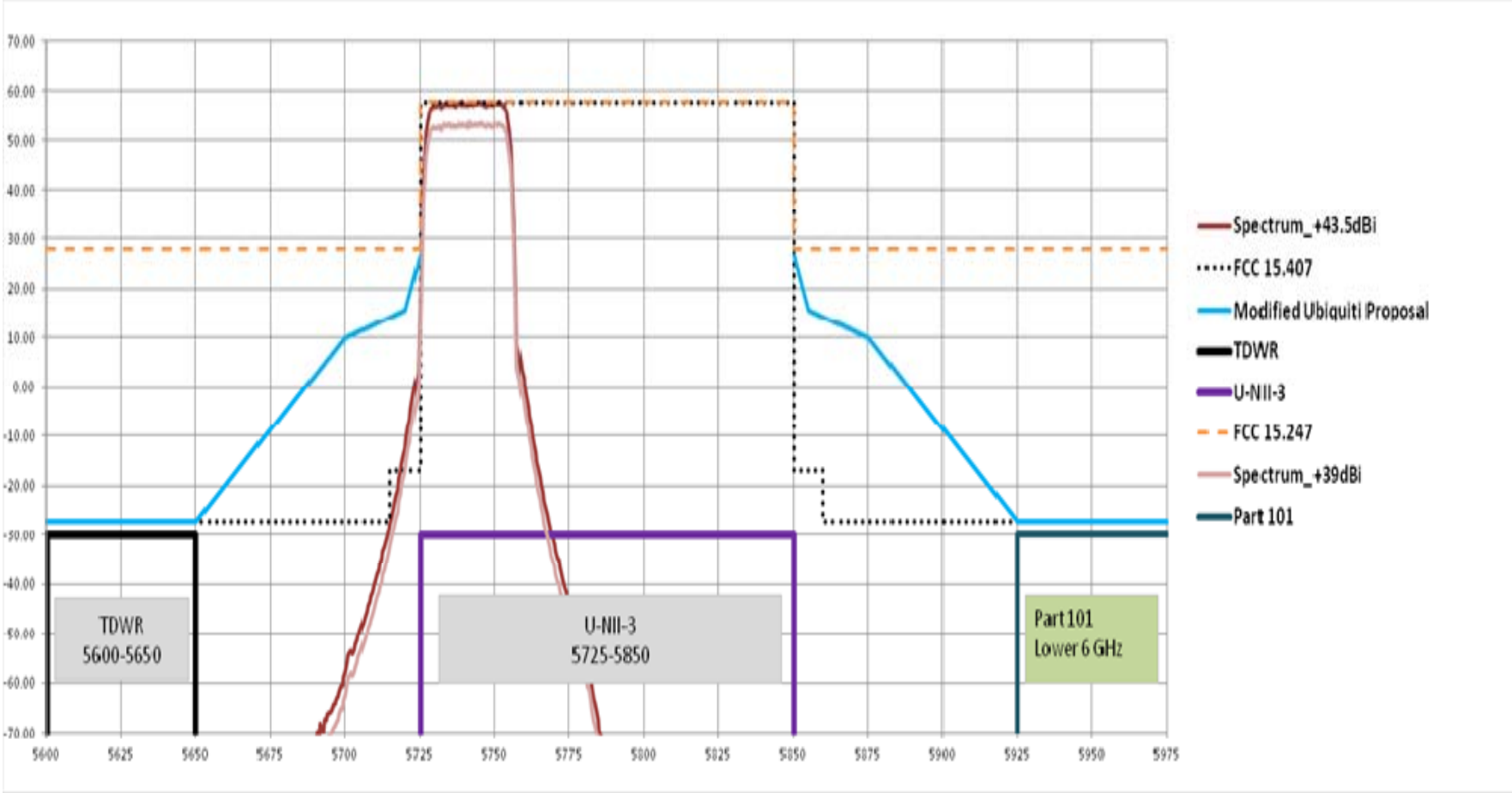
40 MHz 53 dBm EIRP, 37 dBm EIRP/MHz OFDM Spectrum



40 MHz 53 dBm EIRP, 37 dBm EIRP/MHz OFDM Spectrum



Revised Proposal Consisting only of a Mask
Comparison of OOBE in Part 15.247 vs. Part 15.407



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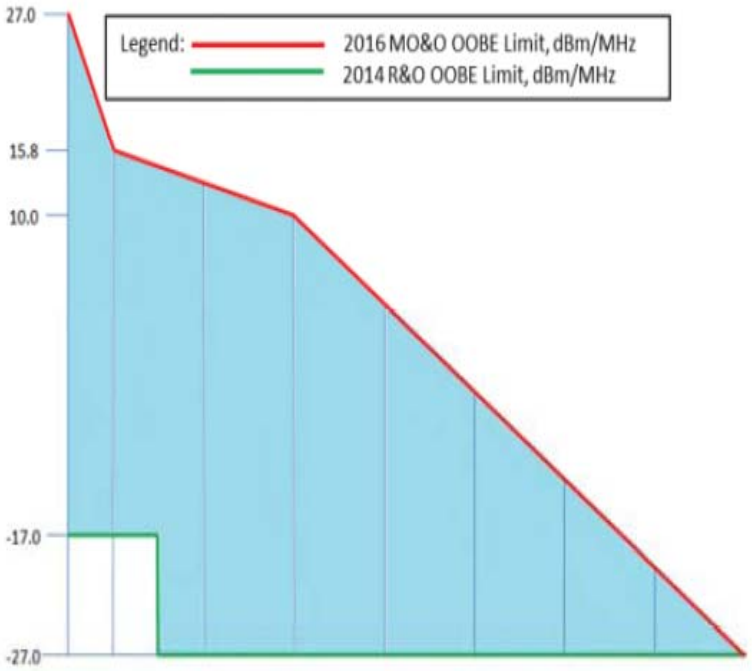
Request for Extension and MO&O

Extensions Granted, Decisions in MO&O

- The FCC was requested to extend deadlines stated in the original 15.407 rules due to the length of time that had passed while the rules were debated. They actually extended the deadlines twice.
- In the final decision published as the Memorandum Opinion and Order (MO&O), the proposed mask was accepted. The proposals for DFS or avoidance mechanisms requiring databases were rejected.
- The enhanced security features must be in place by June 2 2016.
- New devices using antennas with more than 10 dBi of antenna gain must pass the more rigorous 15.407 OOBE by March 2, 2017 and devices originally certified under 15.247 can only be sold until March 2 2018.
- New devices using antennas with 10 dBi or less of antenna gain must pass the more rigorous 15.407 OOBE by March 2, 2018 and devices originally certified under 15.247 can only be sold until March 2 2020.

Automotive Manufacturers

Dedicated Short Range Communications Service (DSRCS)



DSRC Channel Number -->	Ch. 172	Ch. 174	Ch. 176	Ch. 178	Ch. 180	Ch. 182	Ch. 184
Permitted OOBE power (dBm/channel): Top 2016 MO&O,	24.3	21.5	16.8	9.4	2.0	-5.4	-12.8
Bottom 2014 R&O	-9.6	-17.0	-17.0	-17.0	-17.0	-17.0	-17.0
Additional OOBE 2016: Top in dB,	33.9	38.5	33.8	26.4	19.0	11.6	4.2
Bottom as a linear factor	2440x	7038x	2408x	438x	80x	15x	3x

Figure 1: Comparing OOBE limits: 2014 R&O vs. 2016 MO&O

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Thank You