New Rules for Unlicensed National Information Infrastructure (U-NII) Bands KDB 789033, KDB 644545

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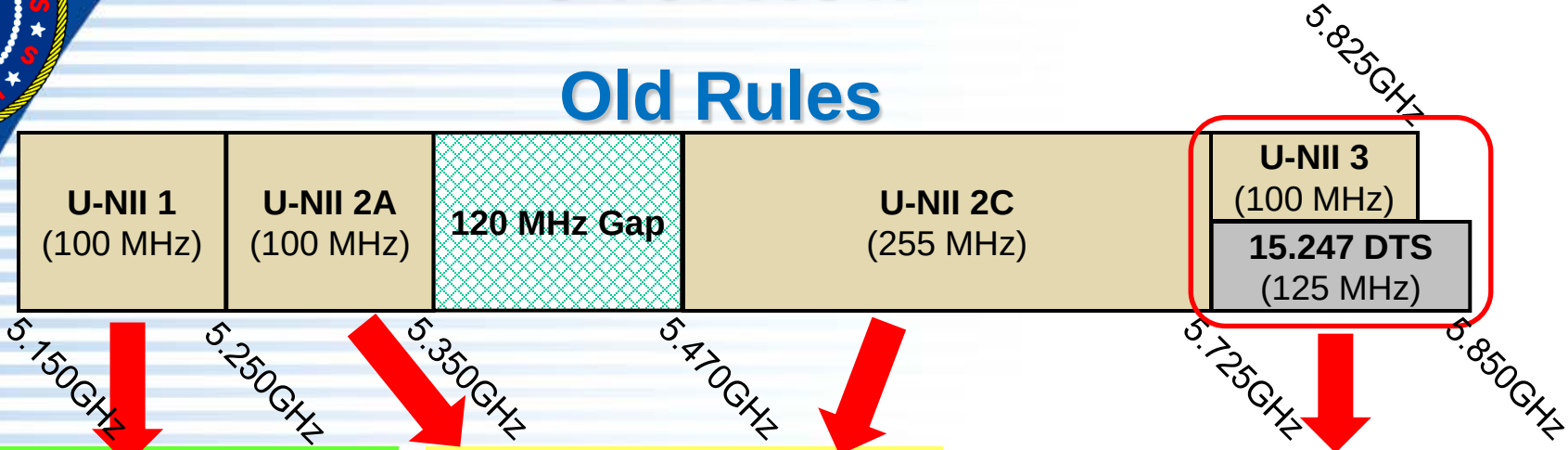
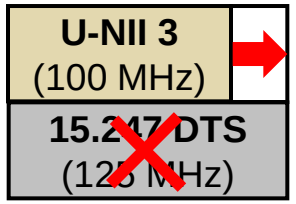
Overview

Old Rules

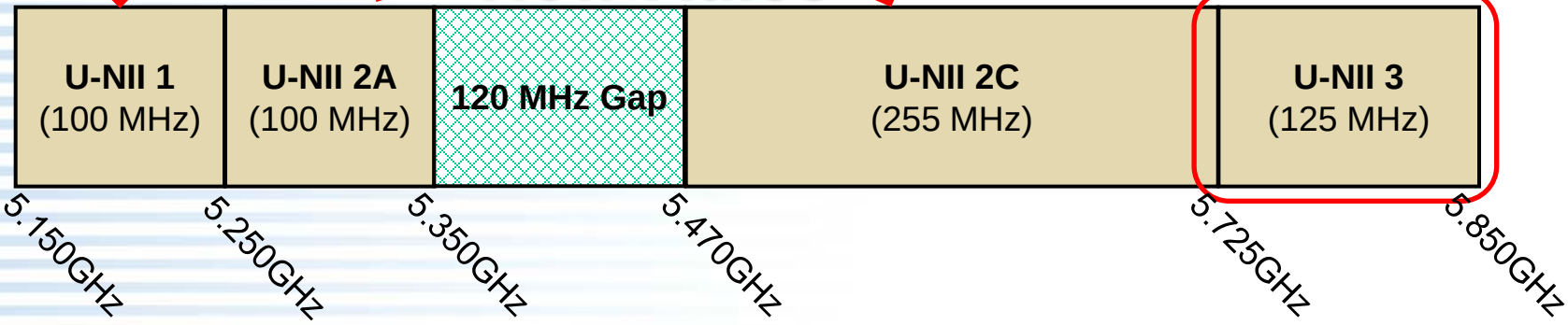


- Power increased
- Separate specifications for master and client
- Outdoor operation allowed
- P-t-P operation allowed

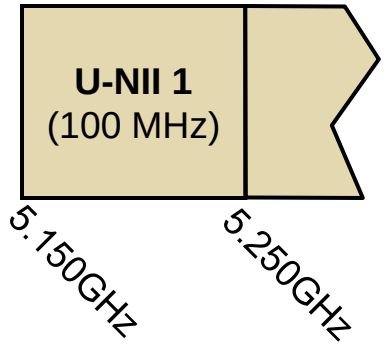
- Wider DFS radar detection bandwidth
- New DFS test procedure
- Operation in TDWR band allowed



New Rules



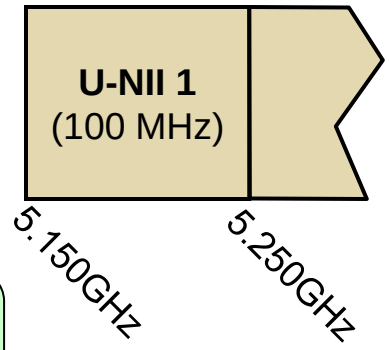
U-NII 1



- Power Limits increased
  - Max Conducted Power: 50 mW ➔ 250 mW for client device,1 W for master device
  - Max Conducted PSD: 4 dBm/MHz ➔ 11 dBm/MHz for client device,17 dBm/MHz for master device
  - Max EIRP: 200 mW ➔ 1 W for client device, 4 W for master device, 200 W for fixed P-t-P
- Operation
  - Indoor-only ➔ Indoor/Outdoor
- TX Power Reduction (dBm-by-dBi) required when Antenna Gain exceeds…
  - > 6 dBi for all applications except fixed P-t-P
  - > 23 dBi for fixed P-t-P application

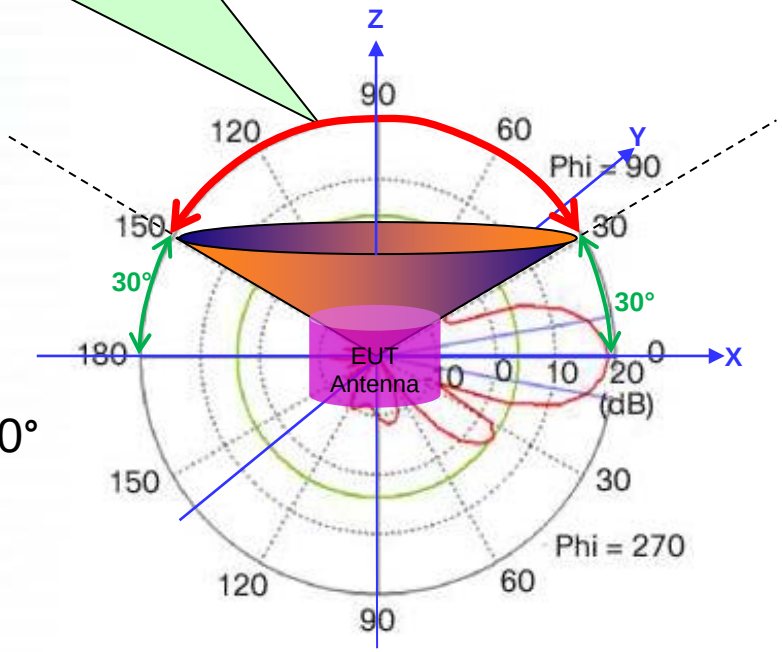
U-NII 1

Additional rule for Access Point operating as outdoor P-t-MP



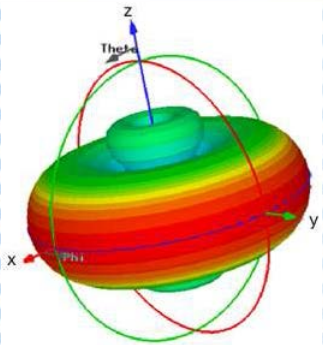
"At any elevation angle > 30° from horizon, max EIRP must be ≤ 125 mW"

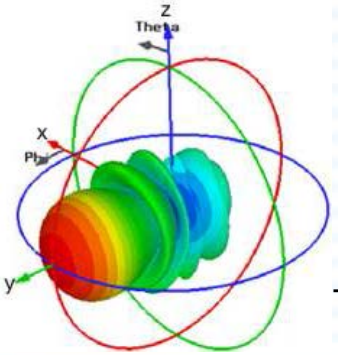
- For fixed infrastructure, not electrical or mechanical steerable beam antenna
  - If elevation radiation pattern is available, submit (1) all information of antenna pattern, (2) mounting elevation angle and (3) calculation showing that any beam >30° elevation angle will have EIRP ≤125 mW
  - If elevation plane radiation pattern is not available… (more on next slides)

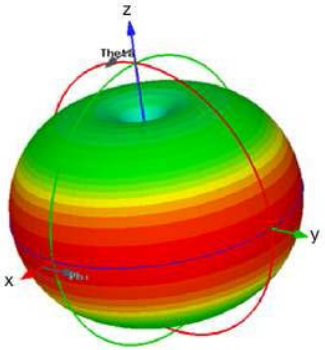


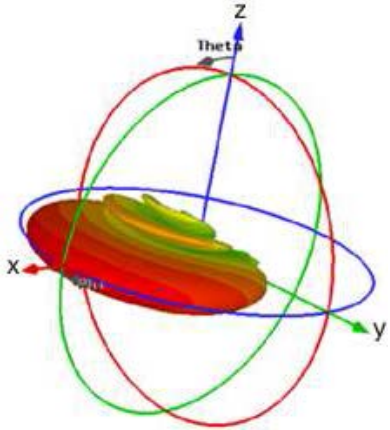
U-NII 1 (cont'd)
Measurement of emission at elevation angle higher than 30° from horizon

- For fixed infrastructure, not electrical or mechanical steerable beam antenna (cont'd)
  - If elevation plane radiation pattern is not available, but the antenna type is known as (1) having symmetrical elevation pattern referenced at main beam **and** (2) all lobes on the main beam elevation plan have highest gains, then measurement is required
    - Transform elevation angle measurement into azimuth angle measurement with consideration of intended mounting elevation angle (see KDB 789033 D02, section II.H.1.b) for detailed measurement procedures)
    - Calculate EIRP of the beam that has maximum gain between 30° and 90° elevation angle and compare to the limit of 125 mW.





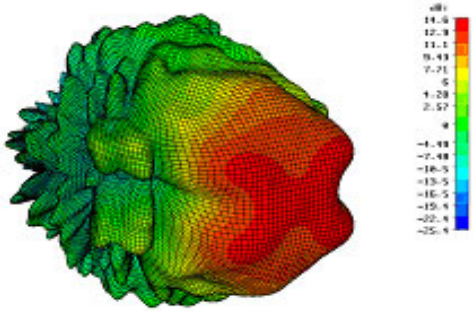




U-NII 1 (cont'd)
Measurement of emission at elevation angle higher than 30° from horizon

- For all other types of antenna which have any combination of followings
  - ❖ Asymmetrical, complex radiation pattern
  - ❖ 2-D or 3-D steerable beam
  - ❖ Portable/mobile, not fixed infrastructure
- ❑ Provide following information in the report
  - ❑ Type of antenna used
  - ❑ Determine all radiation lobes/beams, which have EIRP > 125 mW
  - ❑ Explanation of how these lobes/beams can be controlled below 30° elevation angle

(see KDB 789033 D02, section II.H.2. for details)

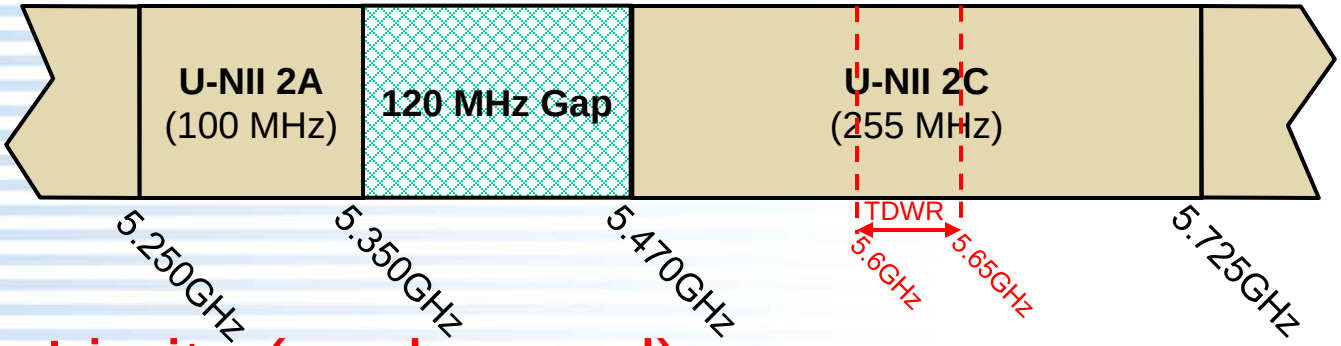


U-NII 1 (cont'd)
Waiver of Section 15.407(a)(1)(i)

- Waiver for fixed outdoor devices without meeting the new antenna requirement can be requested under following circumstances
  - Waiver is issued to operators who have devices already deployed in U-NII 3 band, not manufacturers
  - TX power in U-NII 1 band must be < 250 mW
  - Manufacturer must obtain approval from the operator to submit for a permissive change

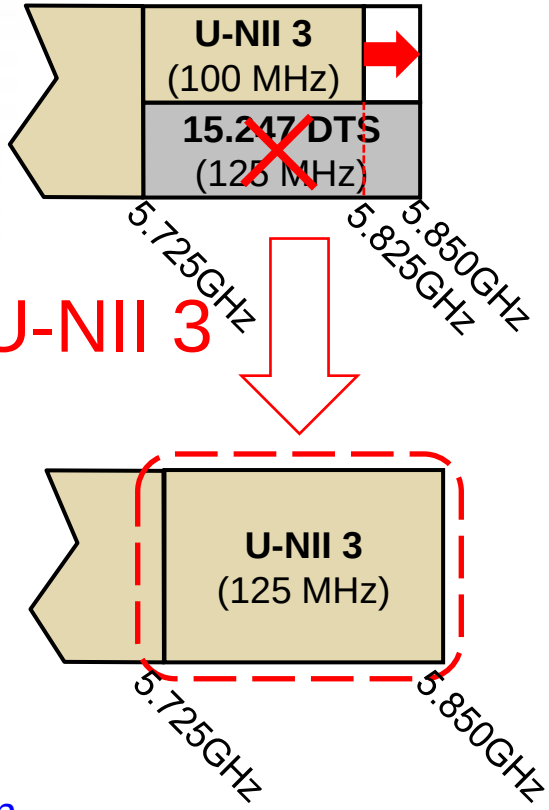
- **Reminder:** AP devices operating outdoor in the U-NII 1 band under 15.407(a)(1)(i) are subject to PBA!

U-NII 2A & U-NII 2C



- Power Limits (unchanged)
  - Power: 250 mW
  - PSD: 11 dBm/MHz
  - Max EIRP: 1 W
- DFS Detection Thresholds (unchanged)
  - -64 dBm for 200 mW ≤ Operating_EIRP ≤ 1 W
  - -62 dBm for Operating_EIRP < 200 mW
- DFS Detection Bandwidth increased
  - 80% ➔ 100%
- Operation in TDWR band (5.6-5.65 GHz)
  - Not allowed ➔ Allowed (Device must pass new DFS test procedure)

U-NII 3



5.8 GHz 15.247 DTS merges into U-NII 3

- 5.8 GHz DTS from 15.247 removed
- U-NII 3 band extended from 100 MHz to 125 MHz
- Max Conducted Power: 1 W
- Max EIRP: 4 W
- For fixed P-t-P:
  - No EIRP Limit (i.e. no Limit of Antenna Gain)
  - Power reduction not required with any Antenna Gain
- Out-of-Band Emission:
  - ≤ -17 dBm/MHz within 5715-5725 MHz and 5850-5860 MHz
  - ≤ -27 dBm outside 5715-5860 MHz
- 6dB-Bandwidth ≥ 500 KHz (see KDB 789033 D02, section II.C.2. for measurement procedure)
- Max PSD ≤ 30dBm/500KHz (see KDB 789033 D02, section II.F.5. for measurement using spectrum analyzer with RBW < 500 KHz)

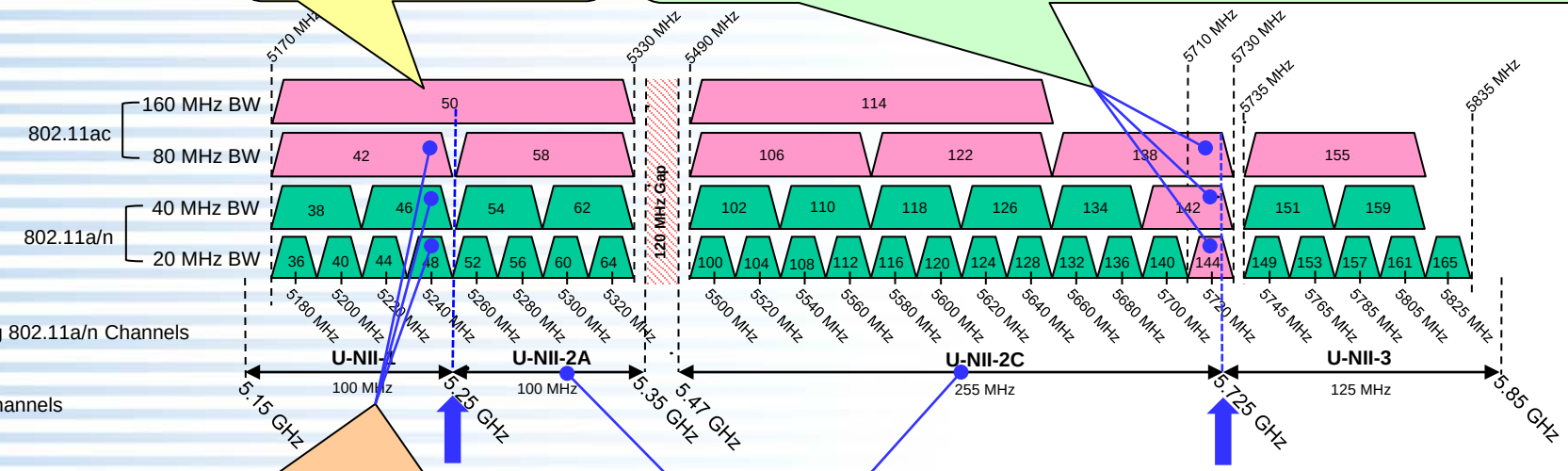
KDB 644545 D03

Guidance for IEEE 802.11ac New Rules v01

Channels that straddle the boundary between the U-NII bands

For this channel, all requirements of the individual band must be satisfied

- Emissions in each band shall comply with the limits applicable only to that band.
- Maximum conducted output power in each band is computed based on the portion of the emission bandwidth contained within that band.

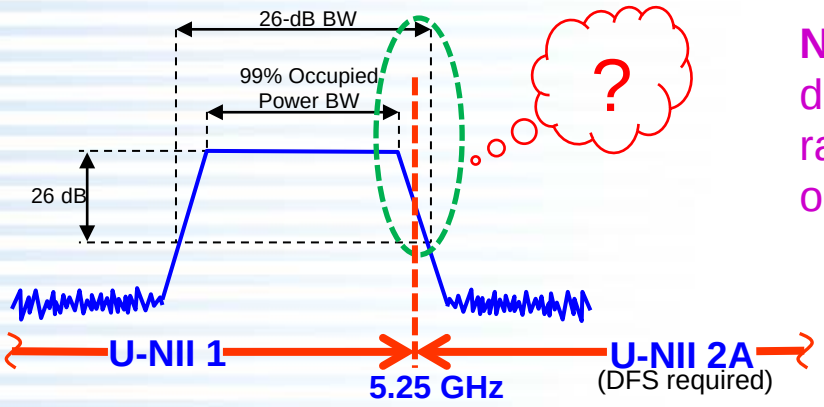


If the 26 dB-bandwidth extends into the U-NII-2A band, device is considered to be operating in both the U-NII-1 and U-NII-2A bands. As a result, implementation of DFS and TPC is required.

DFS and TPC required per §15.407(h)

KDB 644545 D03
Guidance for IEEE 802.11ac New Rules v01 (cont'd)

What if a channel operating in U-NII 1 band has a 26-dB bandwidth that straddles into U-NII 2A band but its 99% occupied power bandwidth does not?



Note: If DFS is required, the device must be able to detect radar signal within its 99% occupied power bandwidth.

- For this rare case, DFS requirement does not apply.
- However, documents in the filling must clearly show that is the case for all bandwidth modes of operation.
- Application will be reviewed on case-by-case basis

KDB 644545 D03 Guidance for IEEE 802.11ac New Rules v01 (cont'd)

A Reminder for Unwanted Emission (Out-of-Band and Spurious) in Restricted Bands

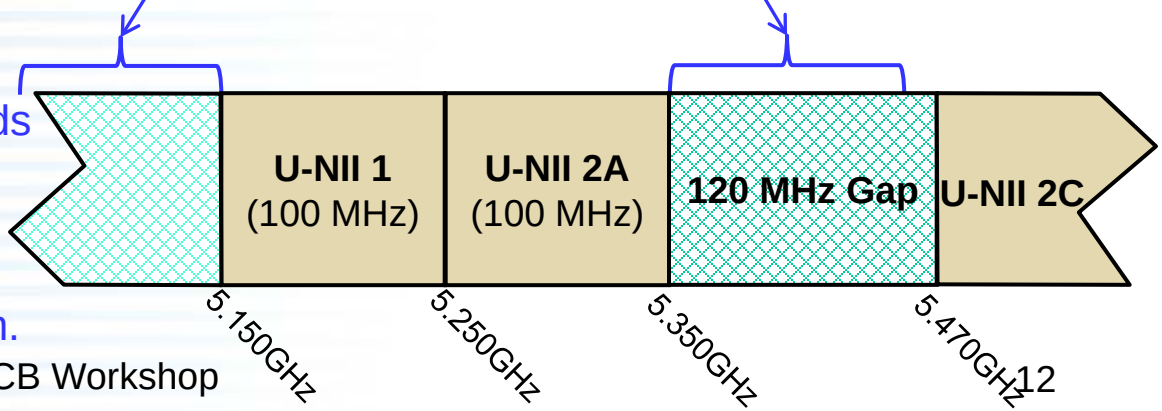
§ 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1] 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
[2] 1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75

- The general limit of -27 dBm EIRP (= 68 dBμV/m) is applied for unwanted emission of U-NII devices, but…
- The field strength of emissions appearing within restricted bands shall not exceed the average limits per §15.209 and peak limits per §15.35(b)

Note: The average limit of 54 dBμV/m in the restricted bands needs to be complied, although the peak limit of 74 dBμV/m (20 dB above 54 dBμV/m) in the restricted bands appear to be higher than 68 dBμV/m.



Questions and Answers

Thanks!