Review of TCB PAG Submissions

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Note: The views expressed in this presentation are those of the authors and may not necessarily represent the views of the Federal Communications Commission.

Overview

- The FCC still has an extensive amount of applications to process.
- The fewer errors an application has, the fewer RTs will be issued by the FCC.
- The issuance of RTs can lead to significant delays in the approval of a PAG application.
- The introduction of checklists has helped with expediting the review of PAGs.
- This session we will be looking at some issues both in general to the PAG process and specific to PAG item UN6GHZ.

General Concerns

- A PAG review is for the item on the PAG list.
  - The TCB is responsible for a complete review of the application.
  - During the course of a PAG review, the reviewing officer may, at their discretion, review exhibits not necessarily germane to the PAG.
  - This is why it is absolutely necessary the full application is first reviewed by the TCB prior to uploading.
  - Do not rely on the FCC for a full and thorough review of all exhibits in a PAG. Especially those which do not pertain to the PAG in question.

General Concerns, Cont'd

- User Manuals for Modules
  - User Manuals aren't always being updated to reflect C2PC.
    - For an unlicensed transmitter, the antenna is an integral part of the system.
    - Some C2PC are to add additional antennas but are not making it to the manual.
  - Some User Manuals for unlicensed modules are coming with a blanket statement which states, "this module may also be used with a different antenna of the same type with equal or lower gain".
    - This is not necessarily an accurate statement.
    - Devices with DFS or CBP capabilities may be adversely affected by using a lower gain antenna.

General Concerns, Cont'd

- Class II Permissive Change Letters
  - As stated in previous presentations, a Class II Permissive Change Letter should be complete enough that the reviewer can read it and understand the full nature of the Permissive Change.
    - "The purpose of this C2PC is to add a different gain antenna" would not be considered descriptive enough.
    - "The transmitter in the original application was certified with a 5 dBi center fed dipole. This C2PC is to add a lower gain 4 dBi PIFA antenna." is much more descriptive.
  - Since the Class II Permissive Change Letter is a public document, the applicant is not expected to include information which is considered sensitive or a trade secret which could potentially put them at a competitive disadvantage. As a recommended best practice, we recommend as much detail as possible.

UN6GHZ

- 26 dB EBW and 99% BW Measurements
  - 47 CFR 15.407(a)(10) The maximum transmitter channel bandwidth for U–NII devices in the 5.925–7.125 GHz band is 320 megahertz.
    - For channels with a nominal bandwidth less than 320 MHz, (e.g., 20, 40, 80, and 160 MHz), compliance is demonstrated by way of the 26 dB EBW.
    - For channels with a nominal bandwidth of 320 MHz, compliance is demonstrated by way of the 99% BW.
  - Measurements of both the 26 dB and 99% BW are to be made on all channels regardless of the nominal BW
  - Summary tables should make it clear which type of BW measurement was used to demonstrate compliance to which channel.

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- 26 dB EBW and 99% BW Measurements
  - We are still seeing reports where the RBW and VBW are not being set in accordance 12.4.1 of ANSI C63.10-2013 for 26 dB EBW.
    - This was brought up in the October 2021 Review of TCB PAG Submissions presentation.
    - There have even been instances where the EBW presented in a test report for a 160 MHz channel has been reported to be GREATER than 320 MHz.
    - Remember that the 26 dB BW is used for the In-Band Emissions Mask.
  - Additionally, make sure that plots presented in the test report are clearly labeled as being either the 26 dB EBW or the 99% BW.

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- 26 dB EBW and In-Band Emissions Mask
  - When making EBW measurements, it is only necessary to make the EBW on channels with a Full RU.
  - In-Band Emissions Masks formed with the EBW from the Full RU then may be used for all the Partial RU configurations for that channel.
  - It is not necessary to measure the EBW of each Partial RU configuration and then build an Emissions Mask based on those measurements.

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- 26 dB EBW and In-Band Emissions Mask
  - In accordance with KDB 987594, when measuring the PSD of the channel, the RBW = same RBW used for the 26 dB EBW measurement.
  - However, as an option, a flat 1 MHz RBW may be used for the measurement of the PSD for placing the channel under the mask so long as 1 MHz is equal or greater than the RBW used for the initial EBW measurement.
    - 20, 40, and 80 MHz channels typically require a RBW of 1 MHz or less.
    - 160 and 320 MHz channels typically require a RBW of greater than 1 MHz.

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- 26 dB EBW and In-Band Emissions Mask
  - If the lab wishes to use the RBW of the original EBW measurement for the PSD measurement used in the In-Band Emissions Mask, please try to be consistent with the measurements across different channels of the same bandwidth
    - Guidance for the EBW measurement states to set RBW = approximately 1% of the emission bandwidth.
    - Some modern spectrum analyzers allow for a very fine adjustment of the RBW.
    - With this, there have been cases where multiple 20 MHz channels have used different RBW.
    - This makes cross referencing the RBW of the 26 dB EBW measurement to the RBW of the Emissions Mask difficult.

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- In-Band Emissions Mask
  - KDB 987594, figure 5, gives a graphic representation of an emissions mask.

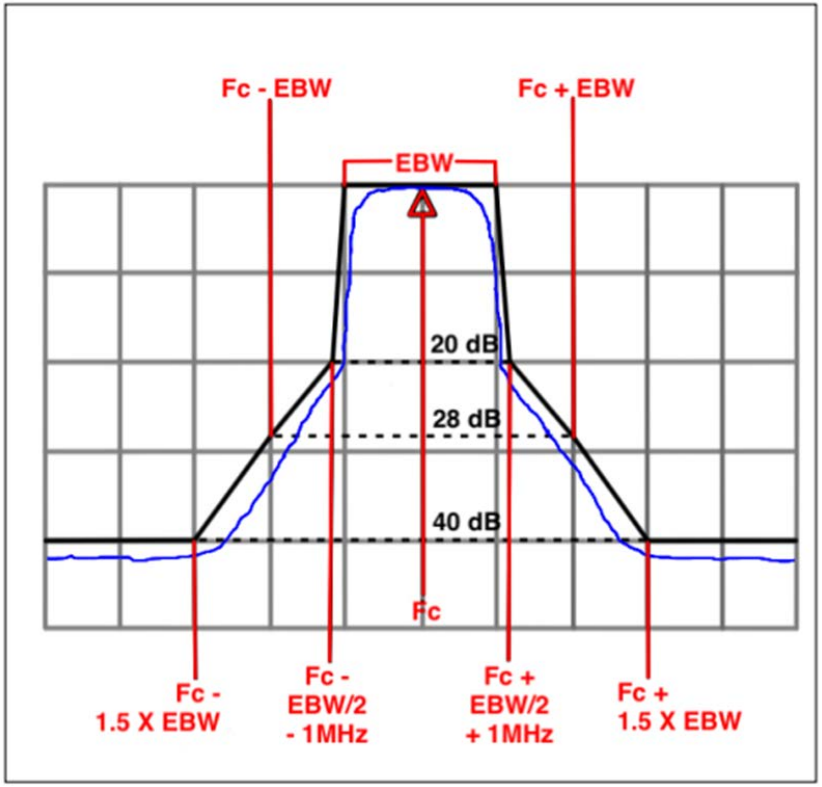

Figure 5. Generic Emission Mask

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- In-Band Emissions Mask
  - To reemphasize, the lower and upper boundaries of the mask extend the entire 5.925–7.125 GHz.
  - § 15.407 General technical requirements (b)(7)….. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

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- Contention Based Protocol
  - In this section of the test report, please clearly state whether or not the device uses either channel puncturing or bandwidth reduction for the purpose of incumbent avoidance.
  - At this time, channel puncturing is not allowed as a method of incumbent avoidance.
  - If the device uses bandwidth reduction, plots for one representative sub-band need to be included.
  - There should also be a detailed description of how the channel reduces when the AWGN is injected at the lower edge, the center, and the upper edge of a channel which uses bandwidth reduction.

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- CBP Bandwidth Reduction Description
  - As a hypothetical example of the description of the bandwidth reduction for a 160 MHz Channel:
    - A 10 MHz AWGN signal (centered at 6910 MHz) is injected. The channel reduces to an 80 MHz channel centered around 7020 MHz.
    - A 10 MHz AWGN signal (centered at 6985 MHz) is injected. The channel completely ceases operation.
    - A 10 MHz AWGN signal (centered at 7060 MHz) is injected. The channel reduces to a 40 MHz channel centered around 6920 MHz.

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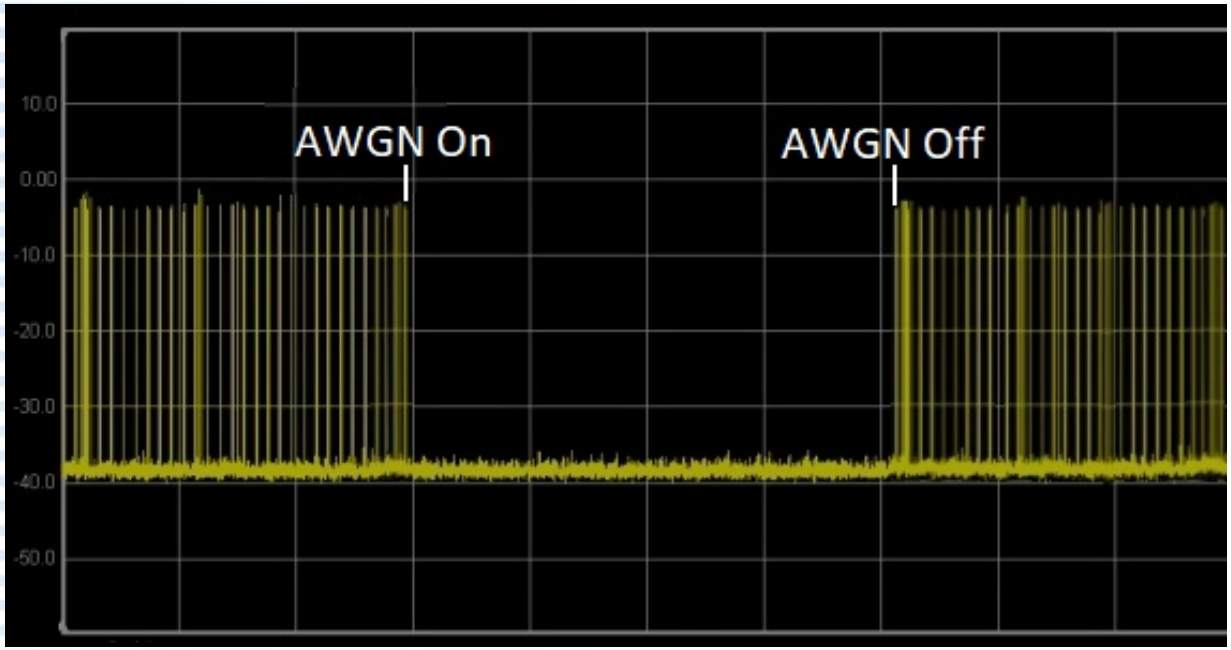
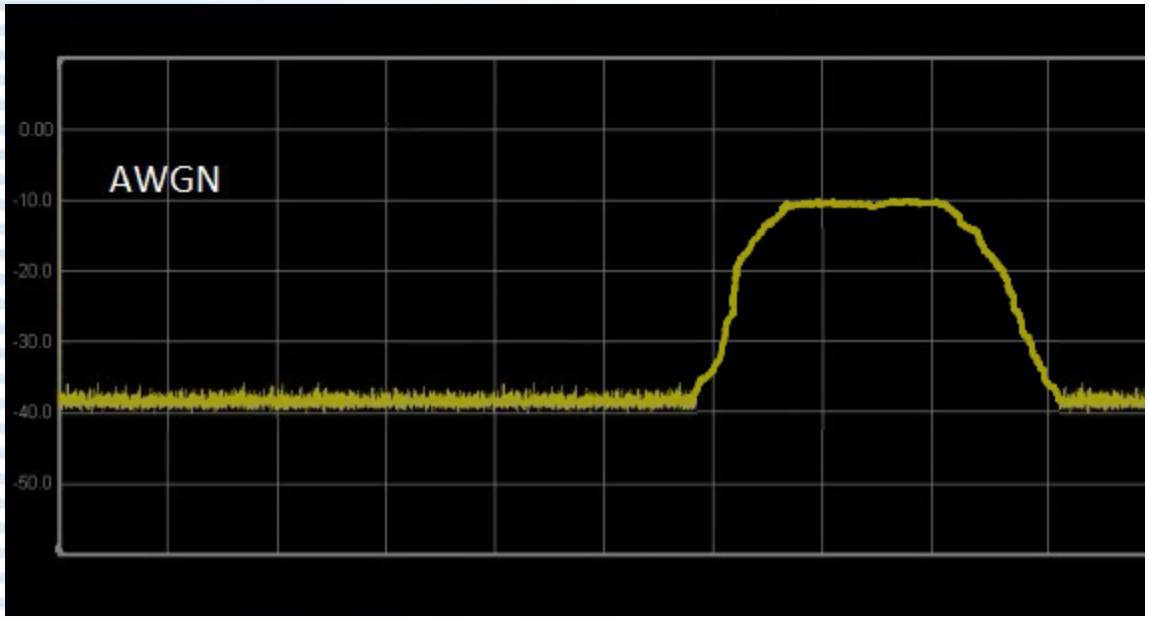
- CBP Bandwidth Reduction Plots
  - Standard timing plot you might expect to see in a test report for CBP:



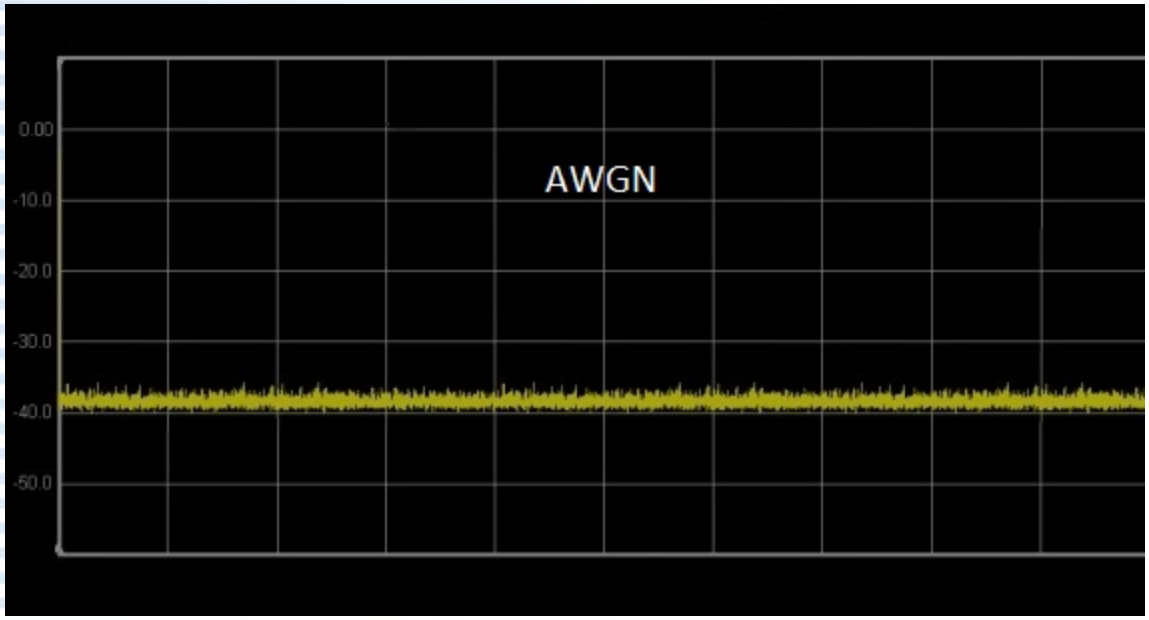
UN6GHZ

- CBP Bandwidth Reduction Plots
  - Bandwidth reduction plots we are looking for in the report. Plots from only a single sub-band are necessary:
    - AWGN injected at low end.



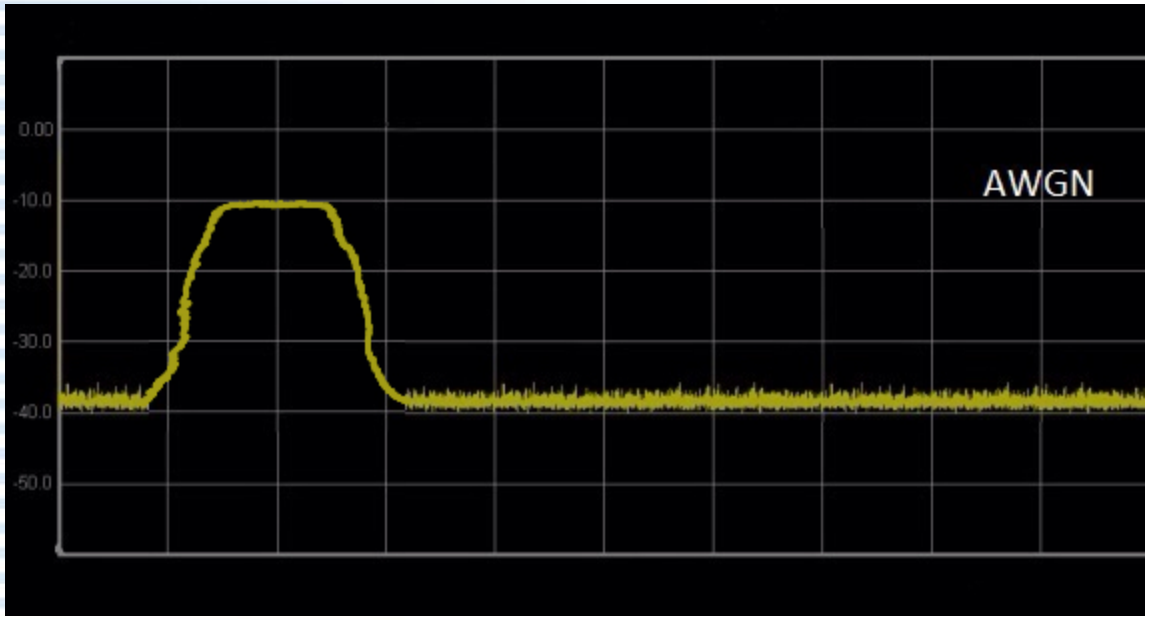
UN6GHZ

- CBP Bandwidth Reduction Plots
  - Bandwidth reduction plots we are looking for in the report. Plots from only a single sub-band are necessary:
    - AWGN injected at center.



UN6GHZ

- CBP Bandwidth Reduction Plots
  - Bandwidth reduction plots we are looking for in the report. Plots from only a single sub-band are necessary:
    - AWGN injected at high end.



UN6GHZ

- CBP Lowest Antenna Gain
  - Old guidance from October 2022
    - The antenna/path evaluated should be the one with the lowest gain.
    - HOWEVER, it needs to be that of an antenna actually evaluated with the radio in the application.
  - **New Guidance for Modules**
    - For CBP testing using the conducted method, the module may be evaluated based upon the lowest gain antenna which the module could support.
    - It does not have to be the actual gain of the antenna(s) marketed with the original grant.
    - User Manual instructions should be clear as to limitations of using alternate antennas.

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- CBP Lowest Antenna Gain
  - As an example

Injected (AWGN) Power (dBm)	Antenna Gain (dBi)	Path Loss (dB)	Adjusted Power (dBm)	Detection Limit (dBm)	EUT Tx Status
-65.5	-3.1	0.2	-62.2	-62	Ceased
-68.2	-3.1	0.2	-64.9	-62	Minimal
-74.0	-3.1	0.2	-70.7	-62	Normal

  - No "mixing and matching" of antenna gains.
    - Has to be the same antenna gain across all four UNII bands.
    - Report needs to make it clear that this evaluation is based upon the lowest gain feasible in order to still have CBP compliance across all the bands.
    - User Manual should also clearly document antenna limitations.

Key Takeaways

- UN6GHZ PAGs have, in general, been improving.
- Applications which are clear and concise without errors greatly facilitate the PAG process.
- Attention to detail with regards to the test reports is a MUST!

Questions?

Thank You!