Update on DTS Test Procedures & 802.11ax

Dusmantha Tennakoon

Average Power Measurements for Special Cases

- Several methods for making average measurements for spurious emissions are available provided (see KDB Q3 for full requirements):

  i. Emissions fall in restricted bands
  ii. Emissions are temporally related to fundamental
  iii. Duty cycle is hardwired

If the above are satisfied the following methods maybe used:

a) Duty cycle correction to a Peak measurement
b) Use of an Average detector while EUT transmitting in an operational duty cycle
c) Using an Averaging technique while EUT transmitting continuously and then correcting for operational duty cycle

802.11ax

- Key Features:

1. Operates in the 2.4GHz & 5 GHz bands
2. Backwards compatible with 802.11a/b/g/n/ac
3. Increased avg. throughput (up to 4X) per user in dense environments
4. Allows for single User (SU) or Multi User (MU) operation through OFDMA (legacy 802.11ac MU-MIMO is also supported)
5. Longer OFDM symbols
6. Supports MCS-10 & MCS-11(1024-QAM)
7. Improved power saving techniques

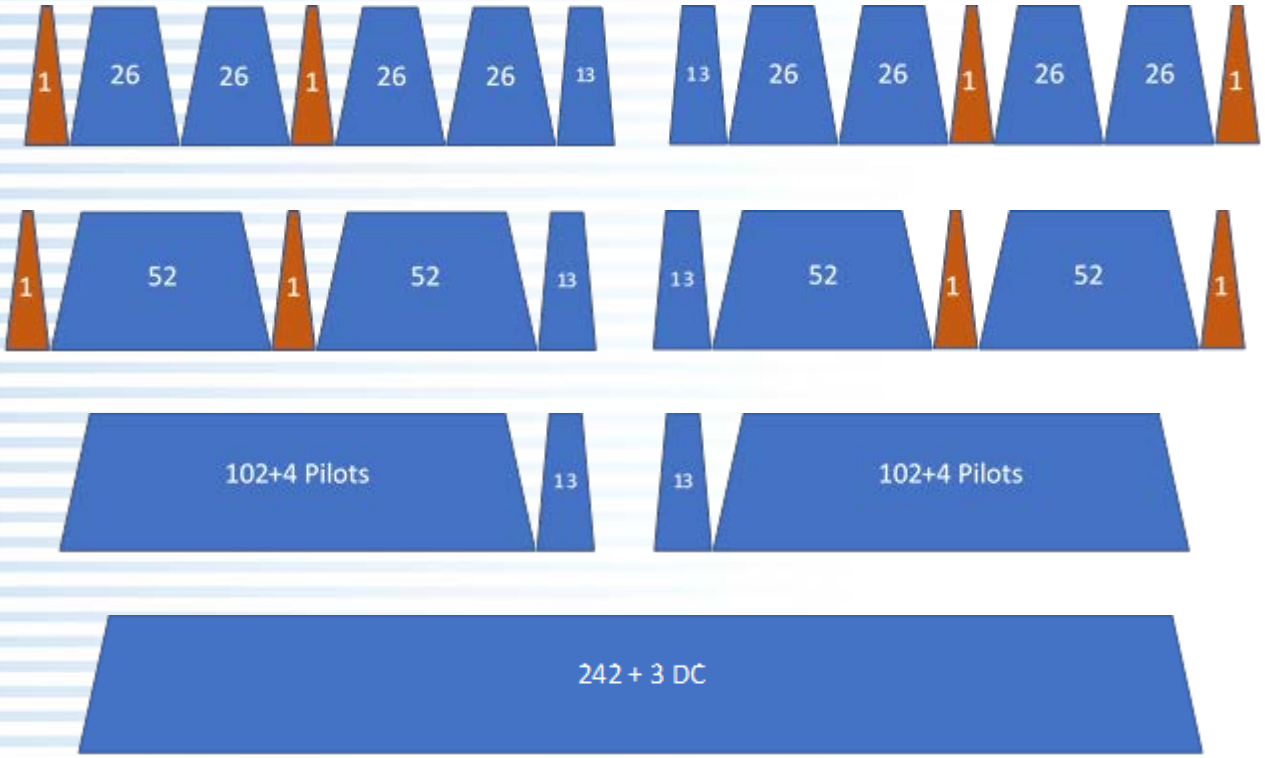
Resource Units (RU)

- 802.11ax adds SU or MU operations using OFDMA. Legacy MU-MIMO also supported (using OFDM).
- OFDMA employs multiple subcarriers. The subcarriers are divided into several groups where each group is denoted as a Resource Unit.
- Following RUs are defined for DL & UL transmission:
  - 26-tone RU
  - 52-tone RU
  - 106-tone RU
  - 242-tone RU
  - 484-tone RU
  - 996-tone RU
  - 2x996-tone RU

A OFDMA transmission can carry a mixture of 26, 52, 106, 242, 484 and 996-tone RUs.

RU Allocation - 20 MHz Fully loaded

- The following are different RU configurations (but not all) for a 20 MHz channel.

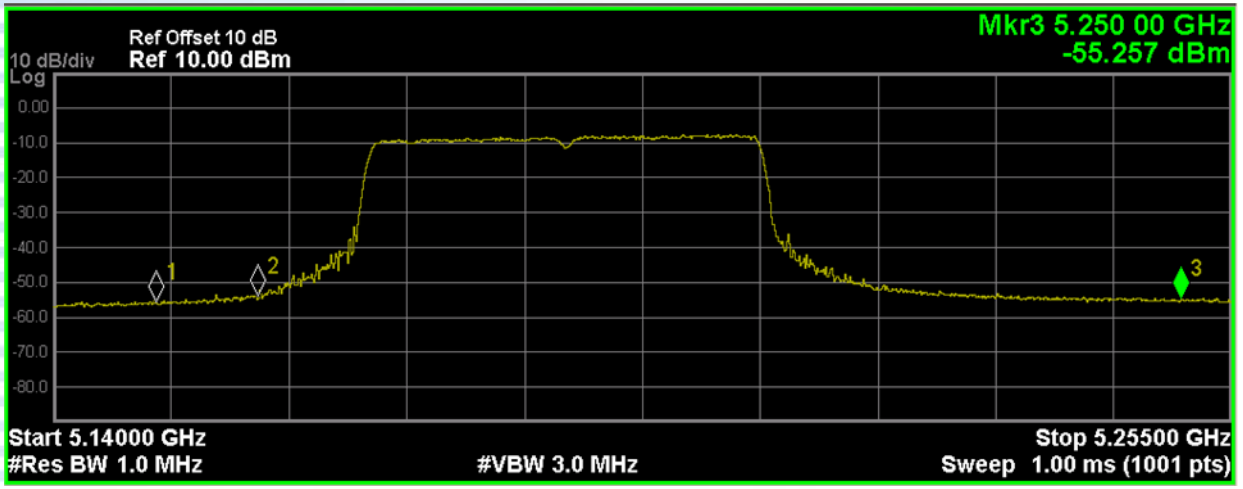


FCC Testing

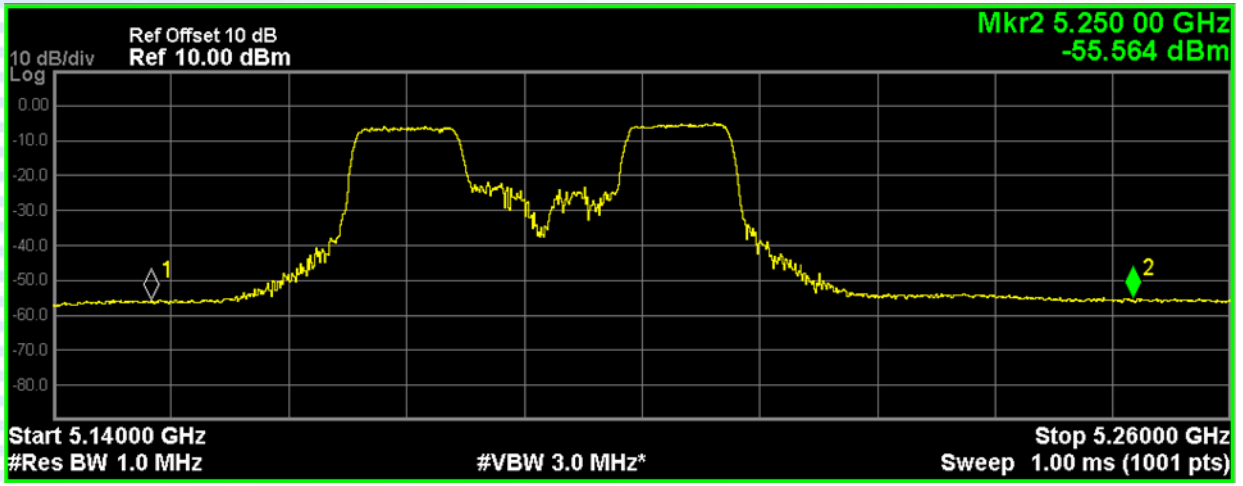
- The data represented here are for reference only and not intended to show performance or compliance to any requirements.
- Test results are based on vendor specific implementations during testing and measurements were made with test software.
- The devices operated at different RF power levels during testing and may not reflect real-world values.

40 MHz channel – sample measurements

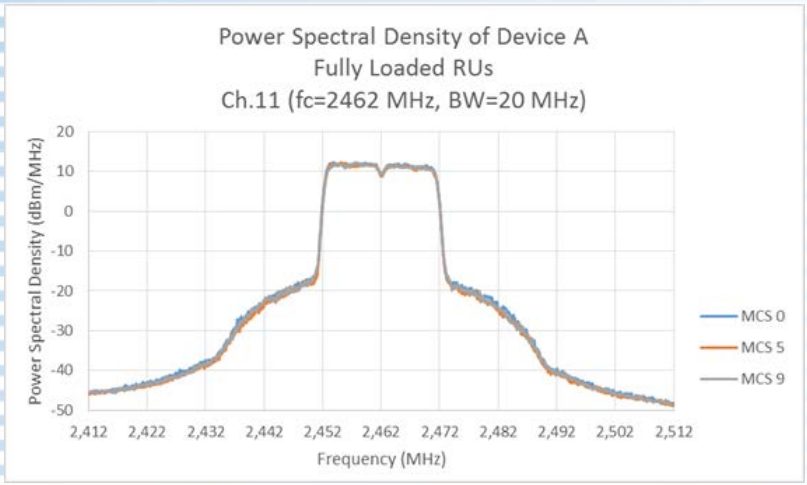
Fully loaded (52+52+26+106+52+52+26+106):

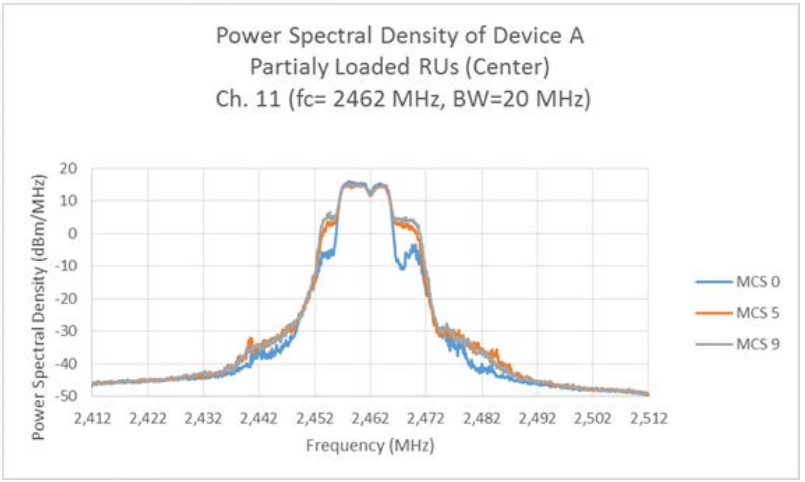


Partially loaded (106+26…..26+106):

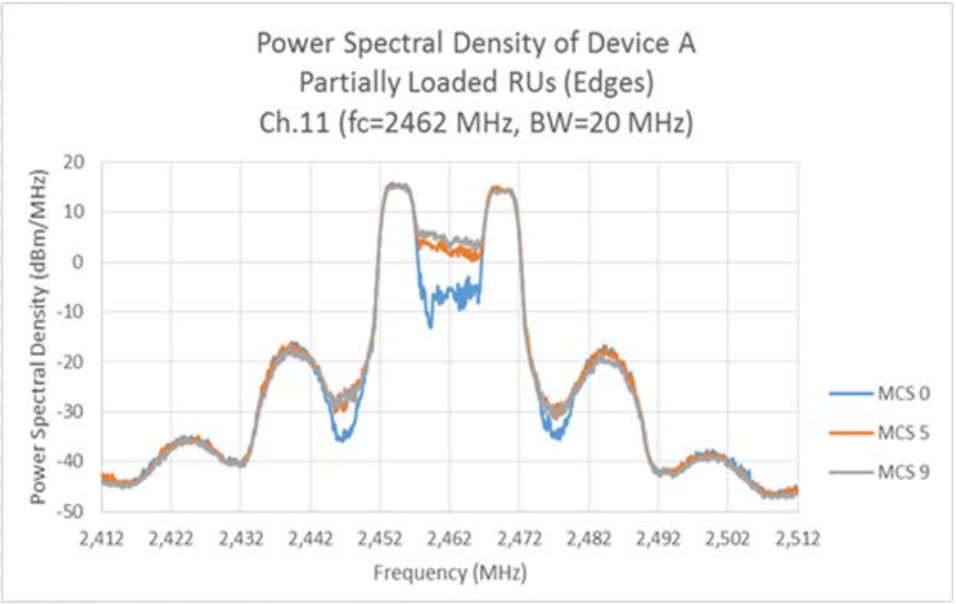


Results (Device A) – sample measurements

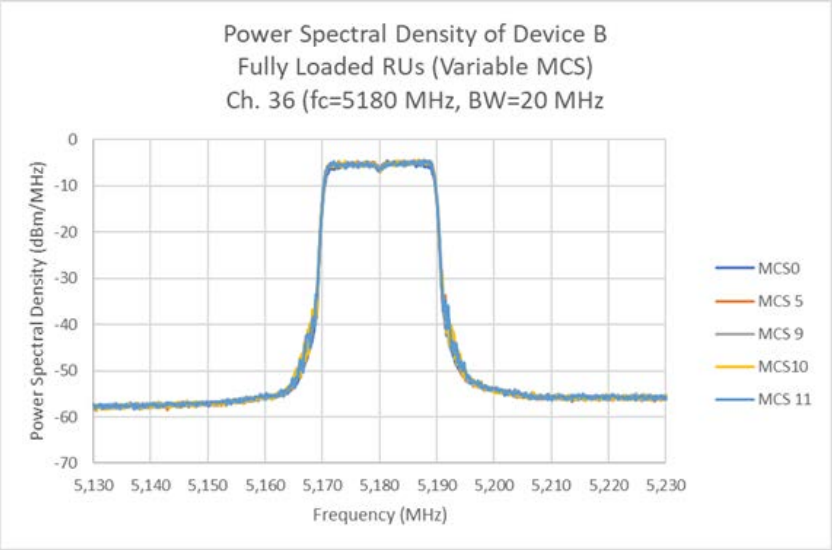


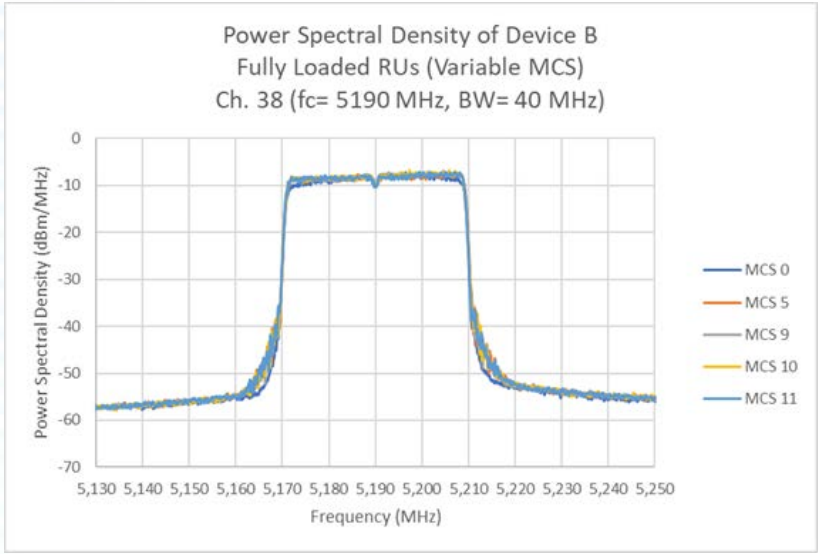


Results (Device A) – sample measurements

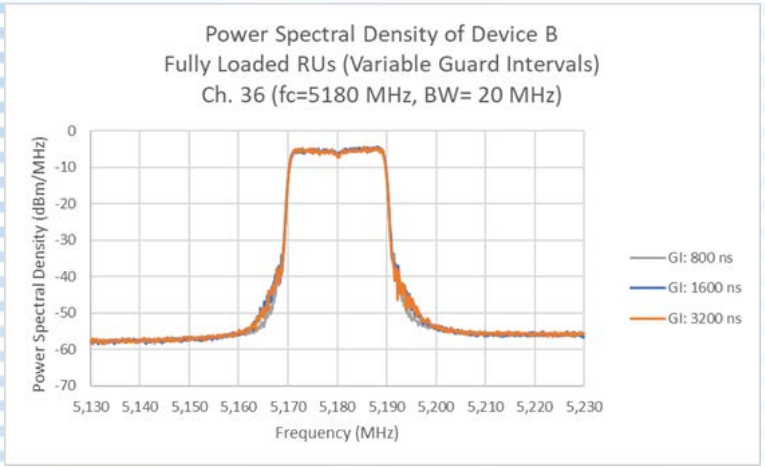


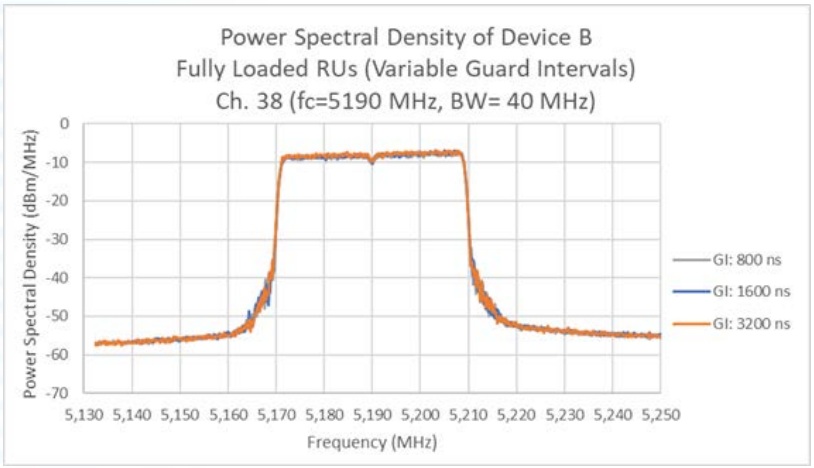
Results (Device B) – sample measurements

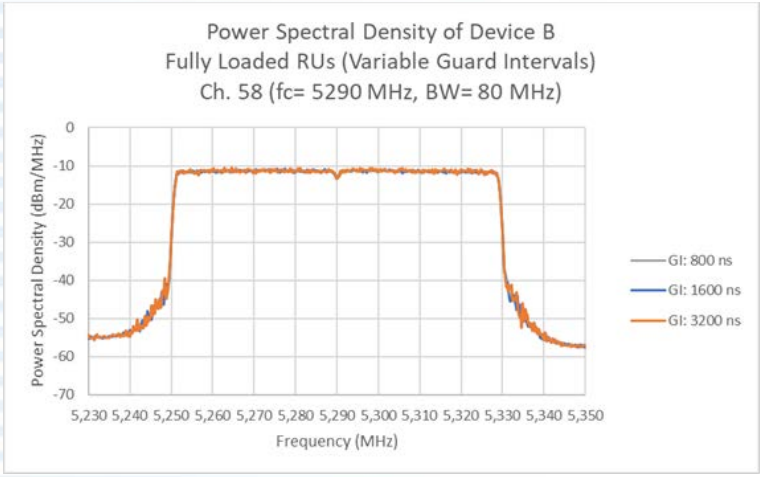




Results (Device B) – sample measurements







Observations

Tested two chips so far. Preliminary results:

- Partially loaded configurations (contiguous and non-contiguous) appear to have highest PSD (approx. 3 dB higher than fully loaded) when tested at same power levels.
- OOBE might be higher when edges of a channel are loaded due to spectral regrowth (see plot on page 8).
- MCS and Guard Interval values do not appear to make a difference in RF levels.
- Investigation of spatial stream configurations and DFS still ongoing.

Interim Guidance

- Test using one of the lower MCS values (ex. MCS 0) and any one GI
- Measure PSD under fully loaded configurations (PSD_{full}) and partially loaded configurations (PSD_{par}). For partially loaded configurations test at least center (contiguous) and edges (non-contiguous).
- Determine $\delta = PSD_{par} - PSD_{full}$.
- If $\delta > 0$ and PSD_{par} can be reduced to PSD_{full} all testing can be done under fully loaded conditions. Spot check for band edges under partial configurations.
- Otherwise, test both fully loaded and partially loaded configurations in its entirety.

We will update KDB in the future once our testing has been completed.