CARLSON WIRELESS

Broadband Data and Voice Products

KTS

Product Vision

# White Space Regulatory Issues

**April 6, 2011**

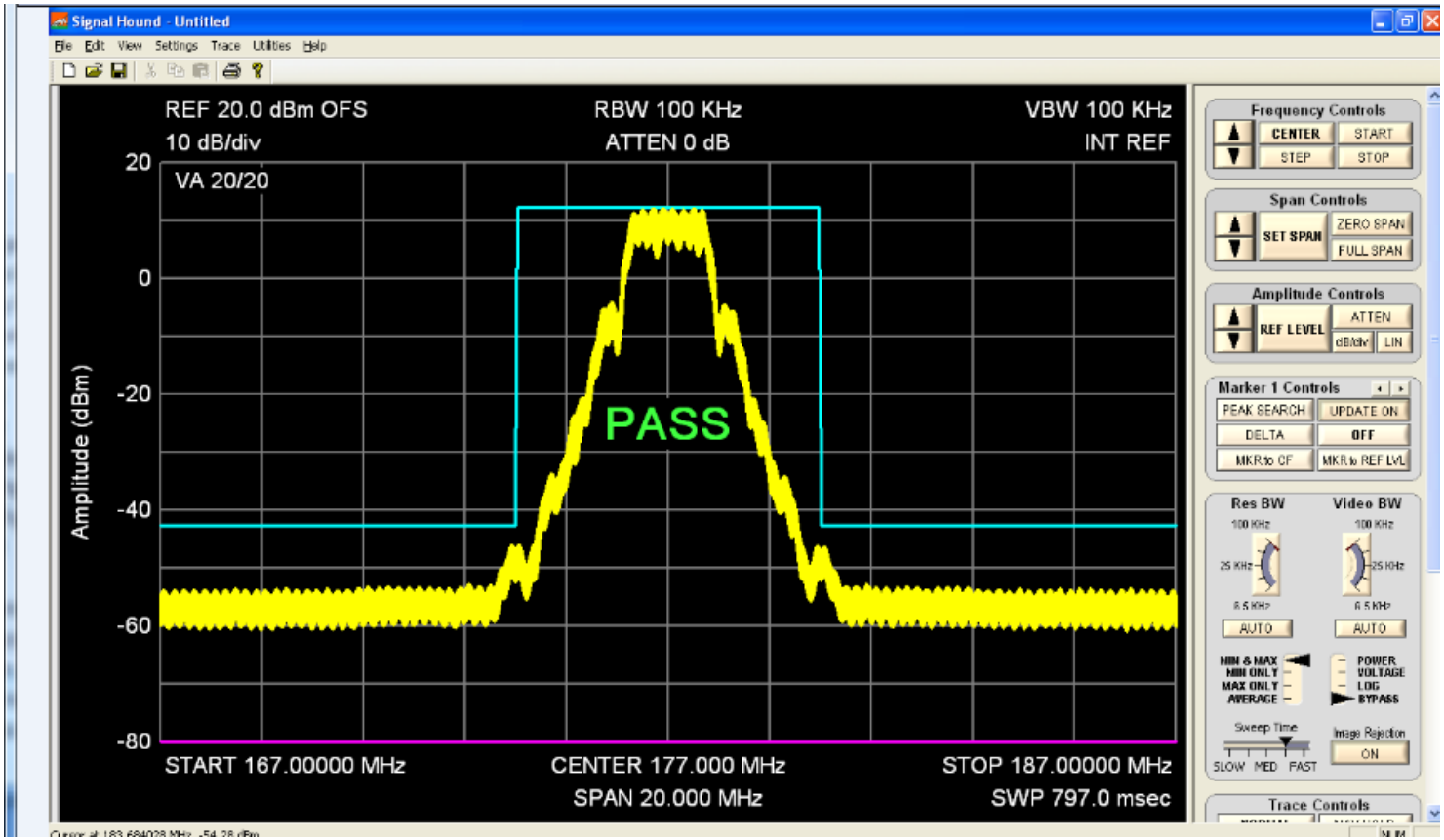
# Our WS Market and Solution

- KTS and CWT have focused on a solution that supports 'challenged links'
  - Failed Wi-Fi links
  - Range more important than maximizing throughput
- The optimum solution is a constant envelop, single carrier solution with equalization
  - Operate at/near Power Amplifier saturation
  - Lowest equipment cost
  - Equalization for Non-LOS links

# FCC Mask Issue

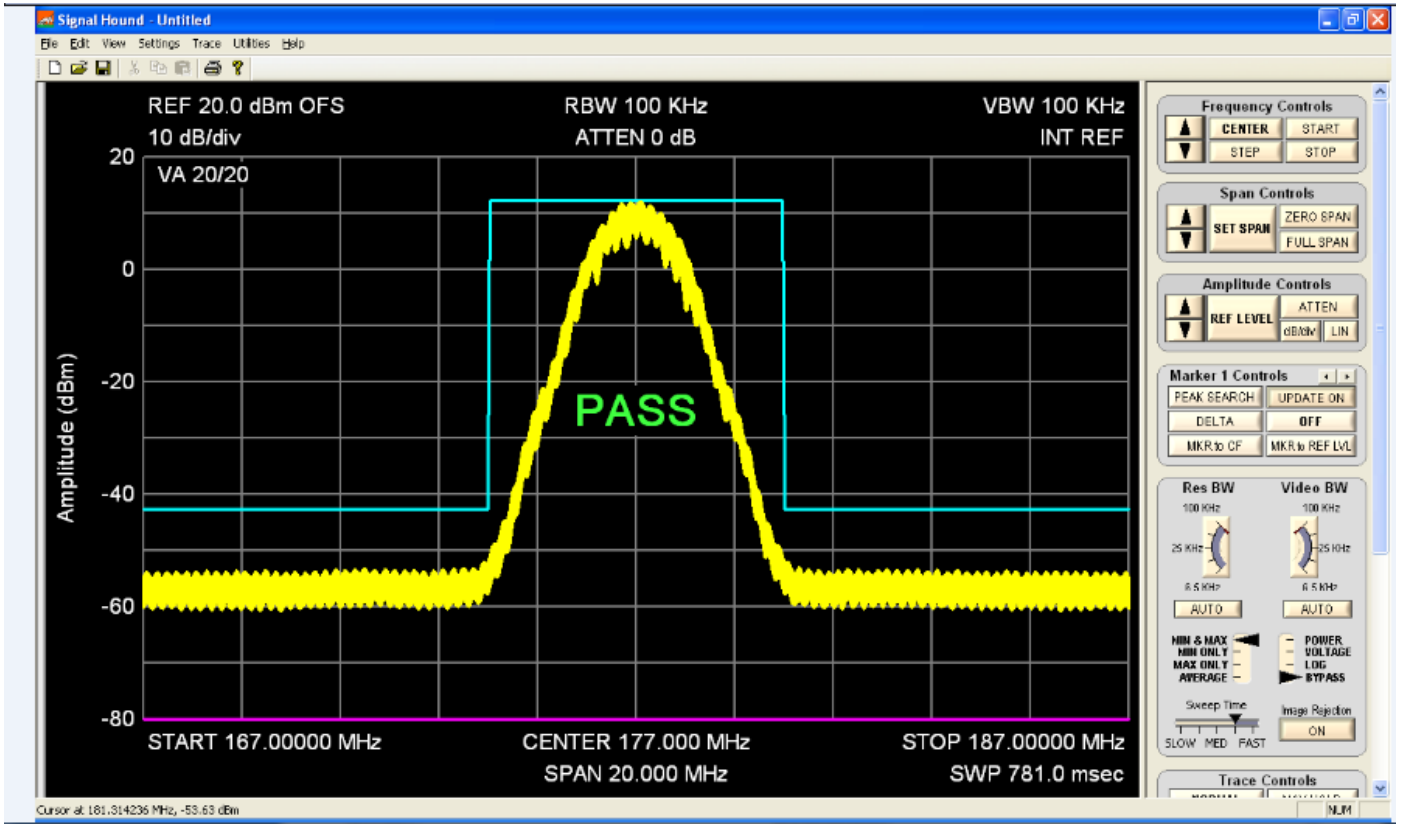
- The current rules for power spectral density for fixed TVBD is specified in Part 15.709(a)(5)(i):
  - (5) The power spectral density conducted from the TVBD to the antenna shall not be greater than the following values when measured in any 100 kHz band during any time interval of continuous transmission:
  - (i) Fixed devices: **12.2 dBm.**
- Favors rectangular-shaped waveforms like OFDM
- Prevents round-shaped waveforms like constant envelop from using more than about 0.2 W

# 1.5 Mb/s FSK



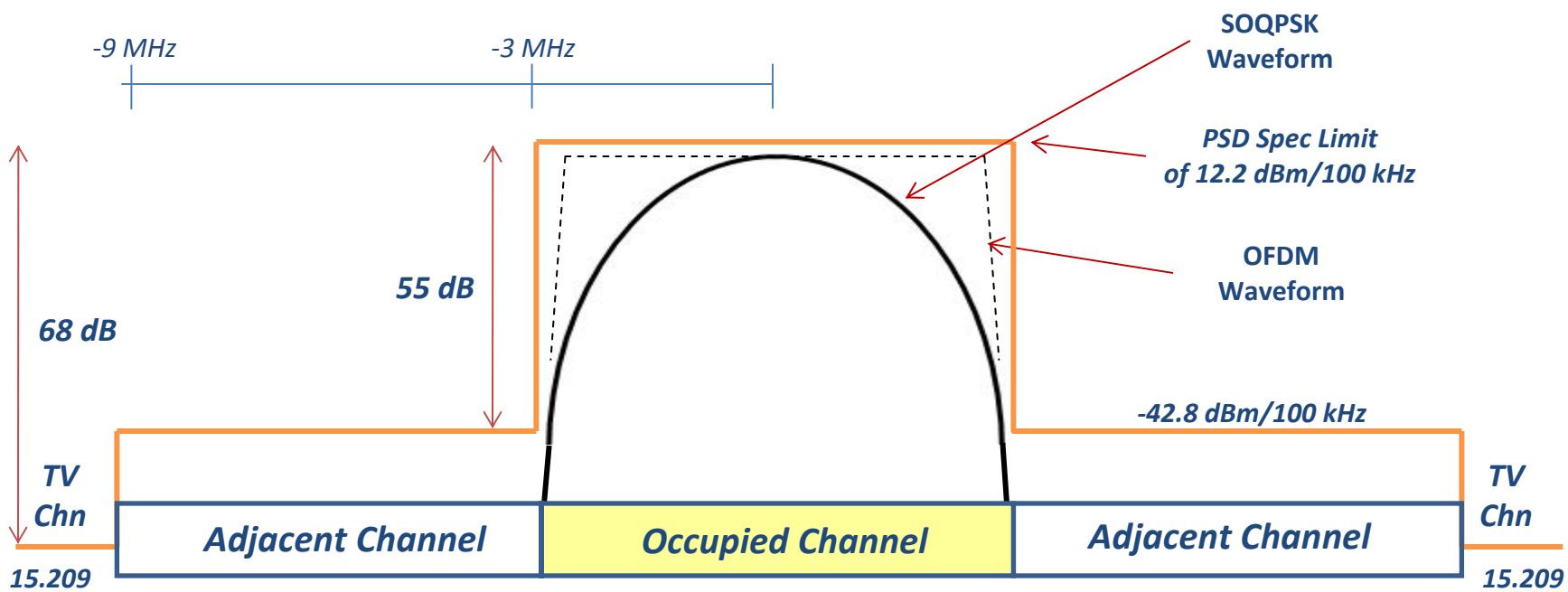

**Only 22 dBm (160 mW) transmit power achievable**

# 3.1 Mb/s SOQPSK




**Only 23 dBm (200 mW) transmit power achievable**

# Mask and Waveform Types




**Currently not possible to use 1 W unless the transmit power is even spread over the entire 6 MHz Chn BW**

# Proposed Change to PSD Rule

- TVBD Fixed Devices: Maximum conducted power delivered to the antenna of 1 W, if the occupied BW is greater than 4 MHz
  - Power reduced if BW less than 4 MHz
  - Discourages narrowband use

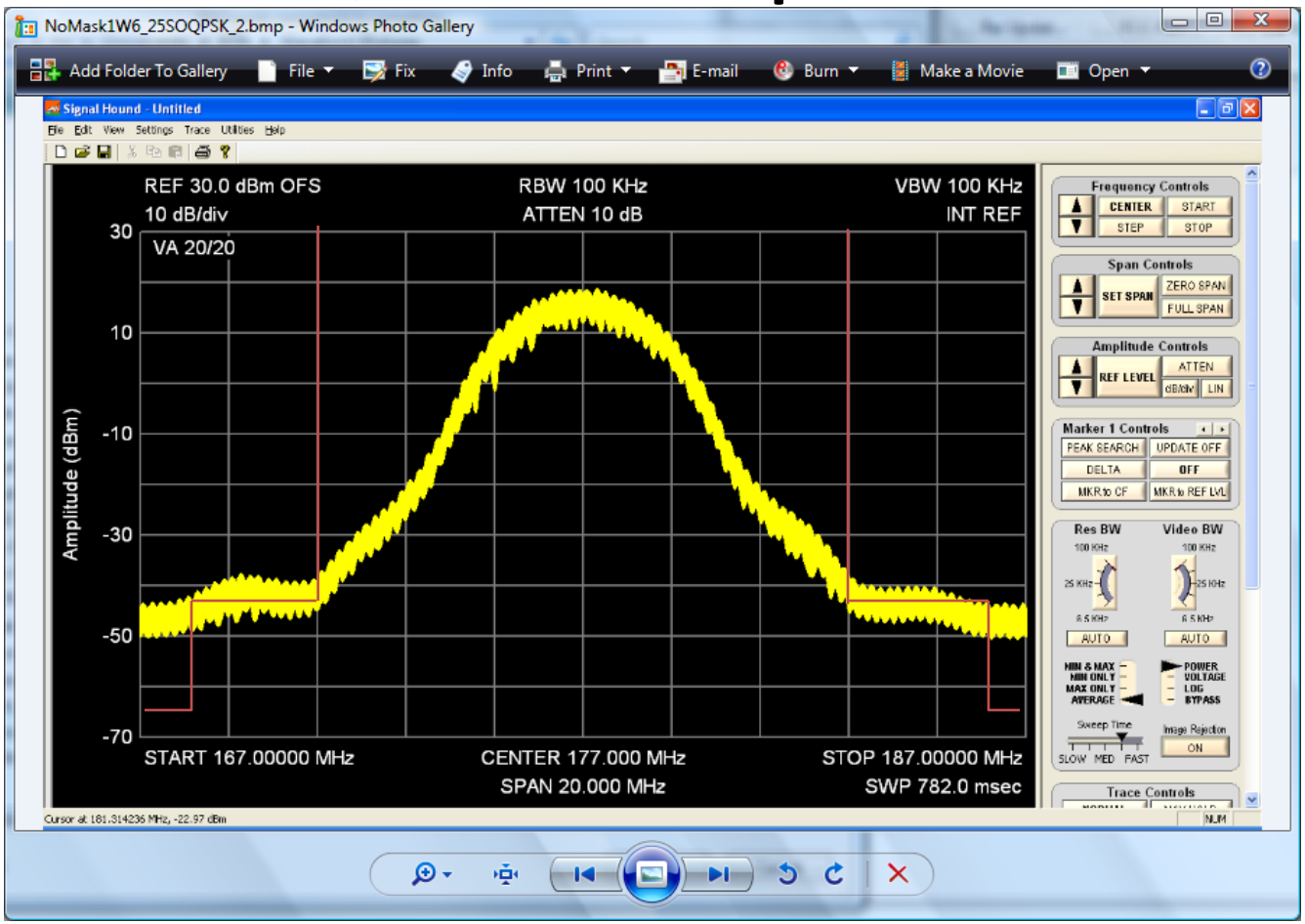
# Current Emission Limits

- 15.709(c):
  - *Emission limits for TVBDs.* (1) In the television channels **immediately adjacent to the channel in which a TVBD is operating**, emissions from the TVBD shall be at least 72.8 dB below the **highest average power** in the TV channel in which the device is operating.
  - 3) At frequencies beyond the television channels immediately adjacent to the channel in which the TVBD is operating, the radiated emissions from TVBDs shall meet the requirements of §15.209.

# Proposed Emission Limits

- Same -72.8 dB but starting at ±6 MHz from the center of the occupied channel (currently ±3 MHz)
  - 15.209 levels starting at ±9 MHz from the center of the occupied channel (no change - same as current)
- ***Would allow us to double the throughput and range compared to existing rules***

# 6.25 Mb/s in Proposed Mask




**Apply the -72.8 dB to TV channel starting at ± 6 MHz.**
**Will work with additional filtering!**

# Summary of Proposed Changes

- Instead of 12.2 dBm/100 kHz (PSD), allow 1W transmit power to the antenna if the occupied (99%) BW is at least 4 MHz
- Instead of requiring -72.8 dB at the TVBD occupied channel band edge, allow it to be at the center of the adjacent channels
- Change the emission limit of -72.8 dB from relative to actual transmit power to relative to 1 W transmit power