

Achieving Compliance to TVWS Spectrum Emissions Mask

IEEE P802.22 Wireless RANs

Date: 2011-05-04

Authors:

Name	Company	Address	Phone	email
Roger Merel	Scintera	1517 Maple Knoll Ct, Naperville, IL 60563	+1(630) 355-5751	roger@scintera.com

Notice: This document has been prepared to assist IEEE 802.22. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

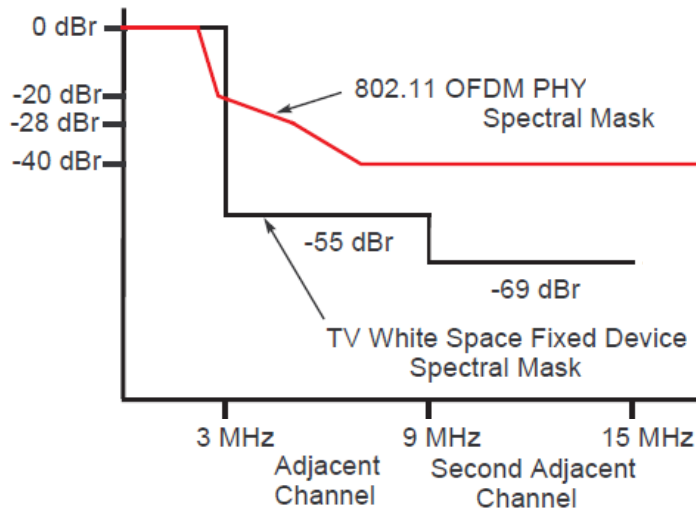
Release: The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.22.

Patent Policy and Procedures: The contributor is familiar with the IEEE 802 Patent Policy and Procedures <http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf> including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair **Apurva Mody** <apurva.mody@ieee.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.22 Working Group. **If you have questions, contact the IEEE Patent Committee Administrator at patcom@iee.org.**

Abstract

One of the most challenging requirements imposed on TV White Space spectrum is not even addressed within the scope of the IEEE 802 standards efforts. Meeting the Spectrum Emissions Mask is extremely difficult even for $\leq 100\text{mW}$ TV Band Devices, but is more difficult for system supporting $\leq 1\text{W}$ into the Antenna (4W EIRP). This presentation provides initial results for an RF PA Linearizer which is easily inserted between the RF Modulator and Power Amplifier to achieve full compliance to the Emissions Mask with margin.

TVWS Emission Mask

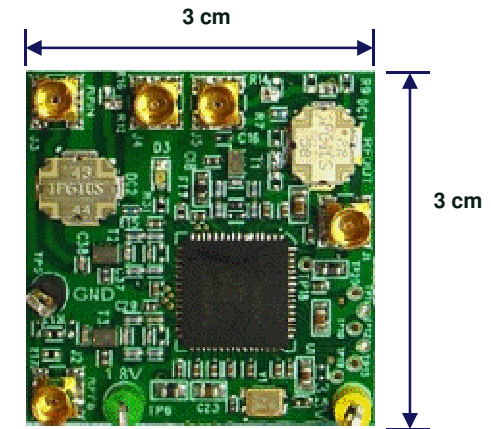


Extracted from: *Technical Challenges for Cognitive Radio in the TV White Space Spectrum*; Stephen J. Shellhammer, Ahmed K. Sadek and Wenyi Zhang; Qualcomm Inc.

- **This requirement relates to Fixed TVBDs for 1W at the antenna, 4W EIRP; however, in the final FCC R&O there were slight changes which limit the power for a 5MHz waveform in a 6MHz channel to 5/6 of a Watt which reduces the -69dBm requirement to -68.2dBm.**

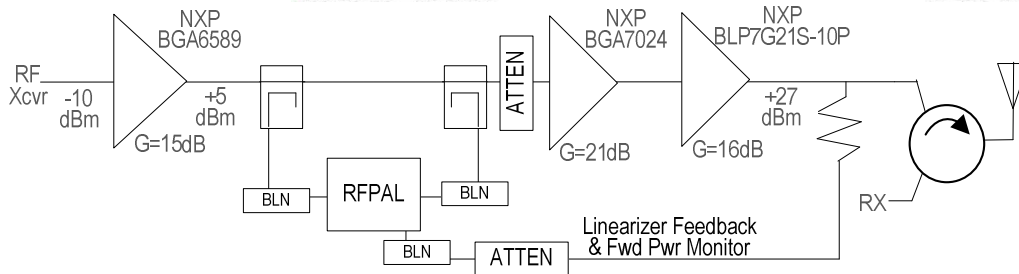
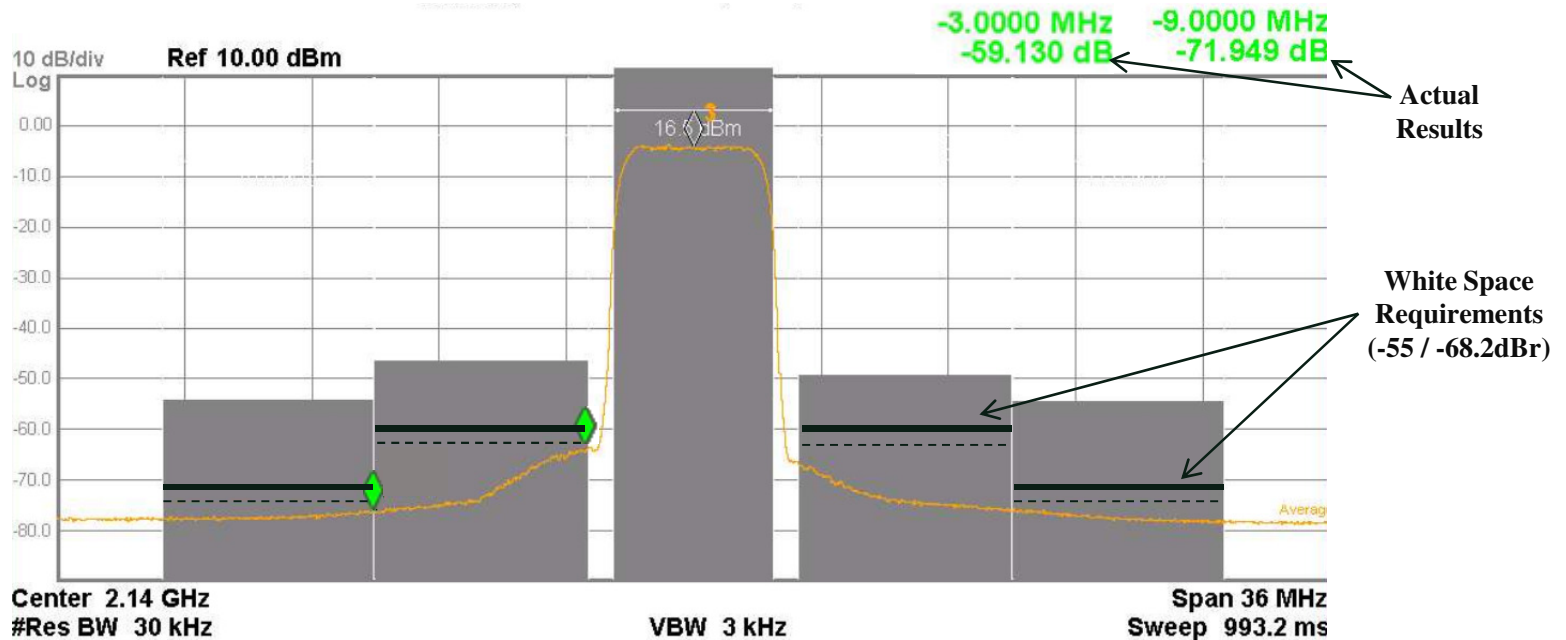
RF Power Amplifier Linearizer (RFPAL)

- Operates over 470-862MHz & beyond.
- Supports various SigBW to >20MHz.
- Easy to use. Simply insert in Tx RF path. No software, algorithms, DSP, FPGA, or digital baseband processing. Nothing to configure. Automatically detects center frequency, signal bandwidth, etc.
- Low-power consumption:
 - <1.1W during initial adaptation Convergence mode.
 - <0.5W in low-power steady-state Tracking mode.
- Low-cost, compact solution.
- Est. 20W saving in supply & dissipation.
- Significant BOM cost savings.
- Measures output power level. Can collect and report the output spectrum.



Preliminary Results with RFPAL for up to 1W Fixed TVBD Applications

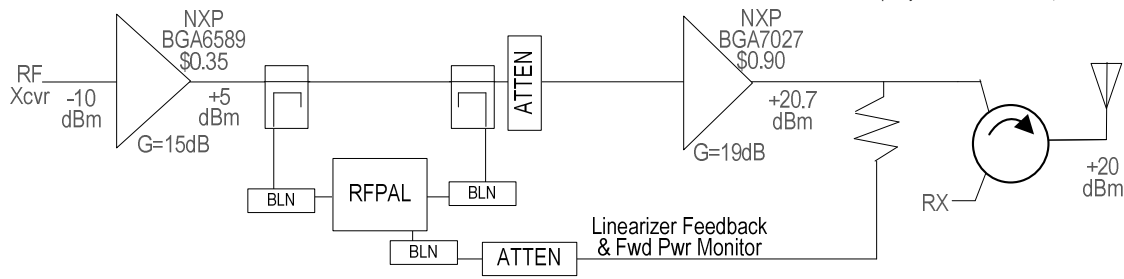
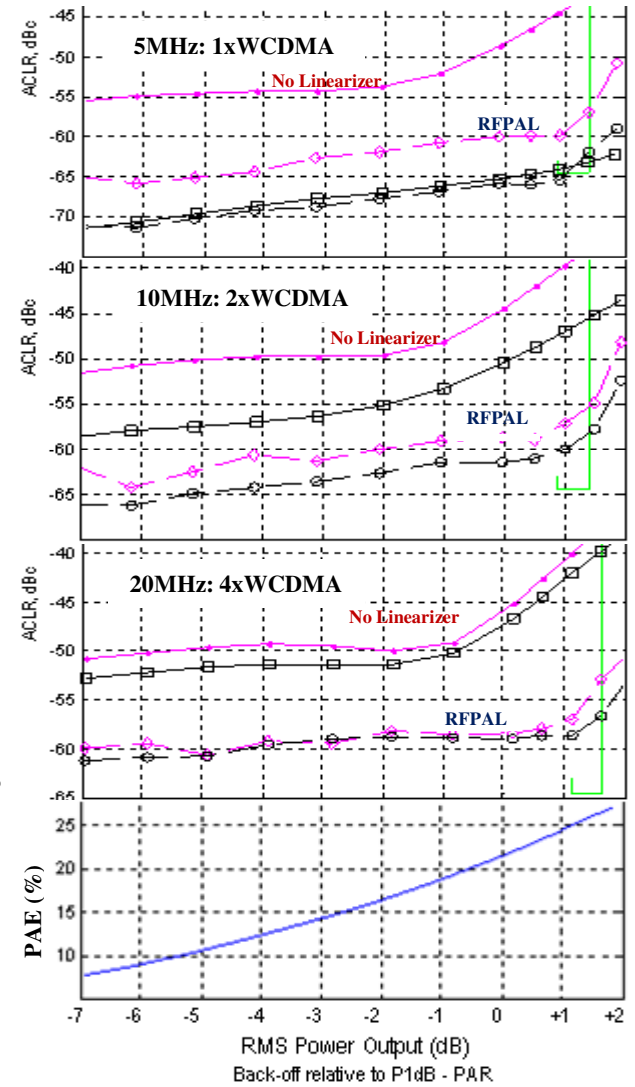
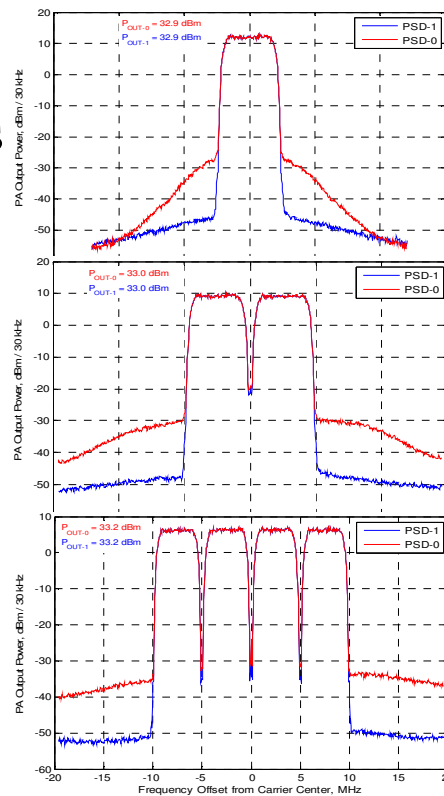
- Reduces “back-off” required by >10dB, & meets mask with 3dB of margin.



White Space Performance Targets are met!
-55.0dBr – 3dB margin = -58.0dBr @ 3MHz offset
-68.2dBr – 3dB margin = -71.2dBr @ 9MHz offset

Results with RFPAL for $\leq 100\text{mW}$ TVBD

- PA can operate at $>P_{1\text{dB-}PAR}$
- Can use low-cost “Handset” PAs
- Supports up 20MHz waveforms



References

- *Technical Challenges for Cognitive Radio in the TV White Space Spectrum;*
Stephen J. Shellhammer, Ahmed K. Sadek and Wenyi Zhang; Qualcomm Inc.