

Questions for the Record

The Honorable Henry Waxman

- 1. NAB has highlighted the engineering challenges of employing market variability in the band plan. Could you please explain your concerns with market variability and also explain what the FCC should do to deal with the problem.**

I would like to thank the Subcommittee on Communications and Technology for the opportunity to testify at the July 23, 2013, "Oversight of Incentive Auction Implementation" hearing.

In my testimony, I highlighted the engineering challenges of incorporating "market variability" into the new post-auction 600 MHz band plan. Market variability is a concept whereby the Commission recovers different amounts of broadcast spectrum in different markets. While variable recovery does have a number of positives in theory, in practice it has the strong potential to create widespread harmful interference both to broadcasters and wireless carriers. This is because it requires, for the first time, broadcasters and wireless carriers to share channels in adjacent markets. So, for example, after the auction the FCC could license channel 47 to a high-power TV broadcaster in New York, but license that same channel to a wireless carrier in Philadelphia or New Haven. Without significant mitigation techniques – such as large geographic separation between the services – the result will be a serious impairment of both services.

As I explained in my testimony, due to the inherent interference challenges, I believe that the FCC should do everything it can to avoid using market variability. That approach introduces great complexity into the process and unnecessarily threatens harmful interference and/or will ultimately reduce the value of many licenses across the country.

Several factors animate our concerns with employing market variability. At the outset, if wireless carriers and television broadcasters are to share channels in adjacent markets (e.g., both on channel 47), the Commission must develop rather sizeable "separation distances" to protect one from the other. These protection zones are necessary because the only reliable technique to avoid or mitigate co-channel interference (i.e., interference between services sharing the same channel in adjacent markets) is geographic separation. To get an idea of the impact of market variability, NAB analyzed the separation distances (both co-channel and adjacent channel) required to avoid interference between wireless broadband and television broadcasts:

Wireless Band	Interference		Separation Distance Required to Mitigate Interference	
	From	To	Co-channel	Adjacent Channel
Uplink	Handset transmission	TV receiver	DTV contour + 5 km	DTV contour
	TV transmission	Base station receiver	225 to 375 km	100 to 130 km
Downlink	Base station transmission	TV receiver	150 to 225 km	90 to 130 km
	TV transmission	Handset receiver	130 to 150 km	90 to 130 km

As is apparent from the above chart, where wireless operation is contemplated on the same and/or adjacent channels(s) as broadcast service in adjacent markets, wireless operations will be severely curtailed. For example, in the case of TV stations operating co-channel with wireless carriers in adjacent markets, wireless base stations receivers will be limited to operating as much as 375 km away from the broadcast service. In practical terms, this means that the wireless licensee forced to operate co- or adjacent channel with a TV broadcaster will have a much smaller area, if any, in which it can provide service.

There are two additional elements that augment the challenge of accounting for market variability in the incentive auction context. First, a mismatch in “channelization” between broadcast channels and the future wireless channels means that more blocks of spectrum will be affected by a variable market plan. This is because, as envisioned by the Commission, the new 600 MHz wireless band will utilize 5 MHz channels for mobile broadband, while television broadcasting uses 6 MHz channels. This means that the channelization in any broadband band plan will not align with the current channelization used for digital television. The result is that most wireless carriers forced to share a channel with a broadcaster in an adjacent market will interfere with *two* TV channels and each TV channel will also cause co-channel interference to *two* wireless broadband channels (see Appendix A).

Second, because the service areas for broadband and broadcasting are different, there is a geographic mismatch between the licenses. In this instance, the FCC has proposed to license wireless broadband service on the basis of Economic Areas (EAs). EAs cover different areas than those served by TV stations (i.e., Designated Market Areas). Thus, if the FCC employs market variability, a television market could cover – and thus interfere with – multiple EAs rather than just a single one.

At bottom, these factors, taken together, mean that market variability is likely to impair a great number of licenses across the country. NAB’s view is that this kind of impairment and complication threatens the prospects for a successful auction. Employing a national band plan, on the other hand – where all markets recover the same amount of spectrum – helps avoid all of these tricky interference difficulties. By removing these interference variables, we believe that the FCC can focus less on designing the most academically pleasing auction and more on one that will work and will raise the money necessary to help fund the public safety network without guaranteeing years of sorting out novel and difficult interference issues between and among broadcasters and wireless carriers.

APPENDIX A

Interference Challenges of a Variable 600 MHz Band Plan

Agenda

- **Co-channel and Adjacent Channel Interference**
 - Defining primary sources of interference
 - Impact of co- and adjacent channels interference
 - How to mitigate co- and adjacent channels interference
 - Technical Exhibit
- **Variable Band Plan Case Studies**
 - Study of the impact of a simple “shortfall”
 - Study of the impact of multiple “shortfalls”

Defining Interference Cases

There are at least two types of interference that must be addressed under a variable band plan

1. Interference to DTV Reception

- Interference to DTV receiver from handset uplink transmission
- Interference to DTV Receiver from base station downlink transmission

2. Interference from DTV Transmission

- Interference to base station receiver from DTV transmission on the uplink frequencies
- Interference to handset receiver from DTV transmission on the downlink frequencies

Additional Factor: 5 MHz Blocks

- FCC plan to move from 6 MHz to 5 MHz blocks is complicated under a variable plan; it results in multiple TV channels or wireless blocks being affected
 - TV operation on a single channel will cause co-channel interference on two contiguous 5 MHz wireless blocks
 - Except for the first wireless block assigned next to 700 MHz A Block, a single 5 MHz wireless block operation will cause co-channel interference to two TV contiguous channels
 - Adjacent channel interference has a similar impact for television and wireless

Band Plan Misalignment

TV Channels in 1 MHz increment

4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5
7	7	7	7	7	8	8	8	8	8	8	9	9	9	9	9	0	0	0	0	0	0	1	1	1	1	1	1

F	F	F	F	E	E	E	E	E	D	D	D	D	D	C	C	C	C	C	B	B	B	B	B	A	A	A	A	A
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Wireless 5 MHz blocks in 1 MHz increment

Mitigating Interference

- How might co- and adjacent channel interference be mitigated?
 - The only reliable technique is geographic separation
 - In terms of interference from wireless to DTV transmission
 - FCC Part 27 established a methodology to determine separation distances to prevent interference from wireless transmission to TV reception
 - In terms of interference from TV transmission to wireless receivers
 - No separation distances have been proposed or developed; distances are much larger than the reverse interference case

NAB Interference Calculations

Wireless Band	Interference		Separation Distance Required to Mitigate Interference	
	From	To	Co-channel	Adjacent Channel
Uplink	Handset transmission	TV receiver	DTV contour + 5 km	DTV contour
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**Note that the downlink separation distances will depend on power and height of base station and sensitivity and out-of band rejection characteristics of the handheld device*

Interference Concerns Recognized

- Qualcomm calculates co-channel TV can cause interference to uplink operations located more than 310 miles or **500 km** away
 - Substantially limiting market variability in areas such as East coast
- CTIA states that extremely large separation distances will be needed to mitigate co- and adjacent channel interference
- CEA indicates that to the degree spectrum is encumbered by interference undercuts the utility of the spectrum and impacts the interchangeability of spectrum being auctioned
- AT&T states that required separation distances could significantly limit the ability to offer different amounts of spectrum on an EA-by-EA basis

The NAB Plan

- After setting a reasonable spectrum acquisition target (e.g., between 60 and 84 MHz), lay out the various nationwide repacking scenarios to determine the areas in which the Commission must have volunteers and how many it needs
- Determine how much revenue will likely be raised from a forward auction of the target amount of spectrum
- Use those anticipated (and soon to be realized) funds to incentivize broadcasters in areas where spectrum is actually needed, and, where no volunteers are needed to achieve the nationwide goal, then simply repack broadcasters