Broadcast Technology Rundown

Presented to

2014 Broadcasters Clinic

October 22, 2012

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Sr. Director of Engineering & Technology Policy
National Association of Broadcasters

Agenda

- *NAB Technology Department*
- *All Digital AM Radio Project*
- *Automotive Dashboard update*
- *FCC EAS Nationwide Test*
- *Other TV Stuff…*
- *Spectrum Auctions – Repacking*
  - *Wireless Mics*, *Unlicensed devices*, Relocation Fund Reimbursement Form, Interservice interference

NAB Technology Activities

- Technology development and innovation
- Standards-setting
  - TV (ATSC, SMPTE), radio (NRSC)
- Conference planning
- Provide support on technology issues to
  - NAB Board
  - Legal department – FCC
  - GR department – Capitol Hill
- Technical writing

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FOR IMMEDIATE RELEASE
July 1, 2014

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Sam Matheny Named NAB EVP/Chief Technology Officer

Download a high-resolution photo of Sam Matheny

WASHINGTON, D.C. -- The National Association of Broadcasters announced today that Sam Matheny, Vice President of Policy and Innovation at Raleigh-based Capitol Broadcasting Co., will join NAB as Executive Vice President and Chief Technology Officer on July 15, 2014.

Matheny, 42, comes to NAB with a proven record of leadership in advanced digital technology strategies at Capitol Broadcasting, a broadcast company long recognized as an innovation leader in the mobile, broadband and social media space.

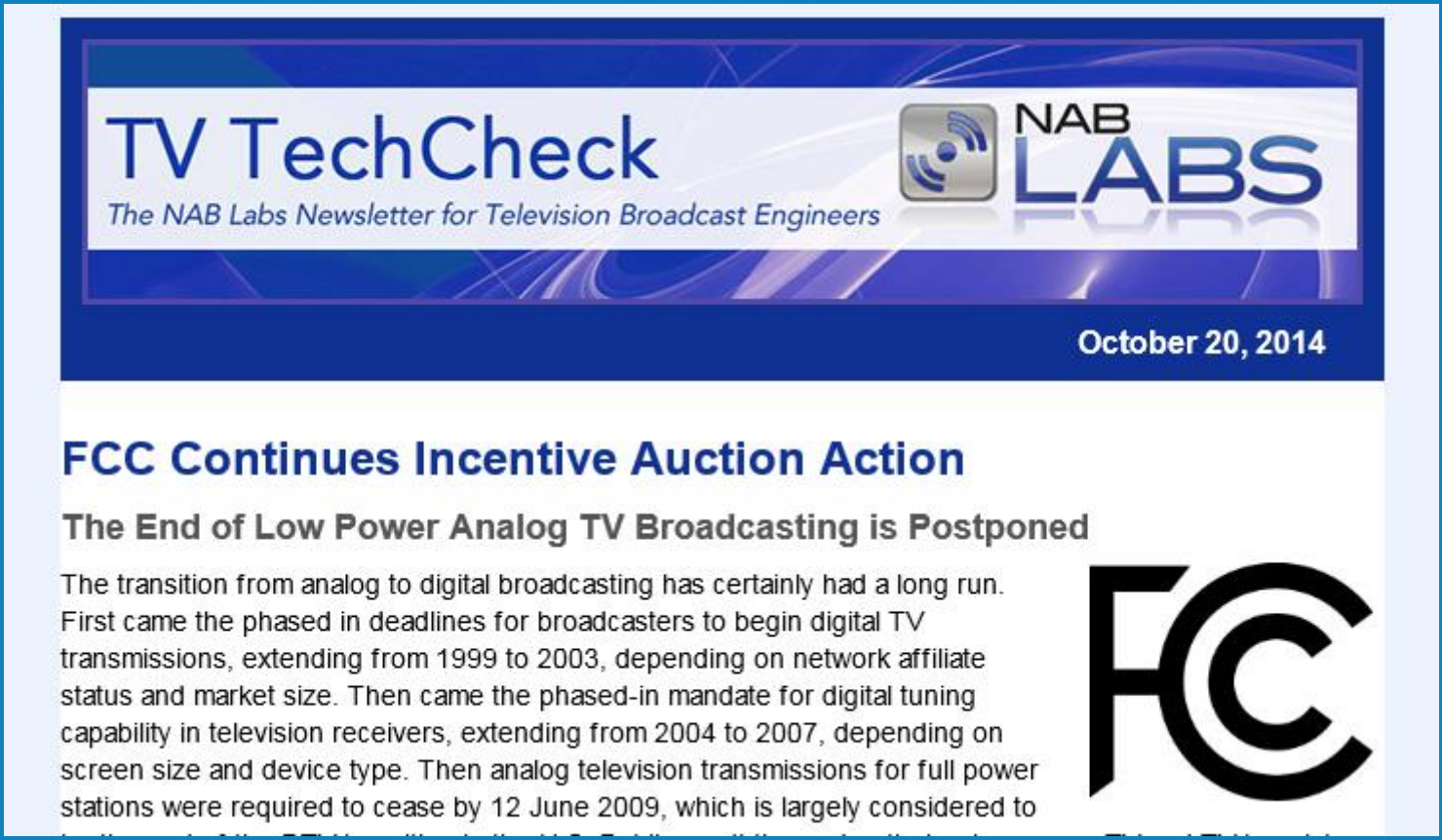
Before joining the corporate staff in 2012, Matheny was a principal in several Capitol Broadcasting media ventures: General Manager at News Over Wireless, which provided the first local television news applications for wireless carriers; Manager of Digital Cinema at Microspace Communications, deploying digital cinema as a viable market for satellite delivery; and Vice President & General Manager at DTV Plus, which developed and launched the nation's first DTV datacasting service.

In his current role at Capitol, Matheny has guided strategic investment decisions in new media, secured patents enabling distribution of broadcast content via the Internet; engaged North Carolina state emergency management officials in developing emergency services using the ATSC Mobile Alert System (M-EAS) to enhance the use of broadcast airwaves as a lifeline in times of crisis. He is also a member of the board of directors of the Advanced

NAB Radio and TV Technology Committees

- Open to representatives from NAB-member organizations

TechCheck



TV TechCheck

The NAB Labs Newsletter for Television Broadcast Engineers

NAB LABS

October 20, 2014

FCC Continues Incentive Auction Action

The End of Low Power Analog TV Broadcasting is Postponed

The transition from analog to digital broadcasting has certainly had a long run. First came the phased in deadlines for broadcasters to begin digital TV transmissions, extending from 1999 to 2003, depending on network affiliate status and market size. Then came the phased-in mandate for digital tuning capability in television receivers, extending from 2004 to 2007, depending on screen size and device type. Then analog television transmissions for full power stations were required to cease by 12 June 2009, which is largely considered to

https://www.nab.org/isgweb/login.asp

All Digital AM and Auto Dashboard Update

AM radio and electric cars

- New BMW i3 does not have an AM radio

Audio system	
HD Radio™ with "multicast" FM station reception	Pre-wiring for SiriusXM® Satellite Radio Tuner

AM radio and electric cars

- BMW spokesman Dave Buchko:
  - *"We learned from our experience with MINI E and BMW ActiveE that the electric motor causes interference with the AM signal. Rather than frustrate customers with inferior reception, the decision was made to leave it off. HD Radio is standard on the i3 and through multicasting, many traditional AM stations in key markets are available on secondary and tertiary HD signals."*

AM radio and electric cars

- Other electric cars DO have AM radio
  - Nissan Leaf
  - Tesla Model S

Entertainment		
AM/FM/CD audio system with 4.3-inch QVGA color monitor	● Standard	⊗ Not Available
AM/FM/CD audio system with 7-inch QVGA color monitor	⊗ Not Available	● Standard
Bose® Audio System with AM/FM/CD [*]	⊗ Not Available	○ Optional

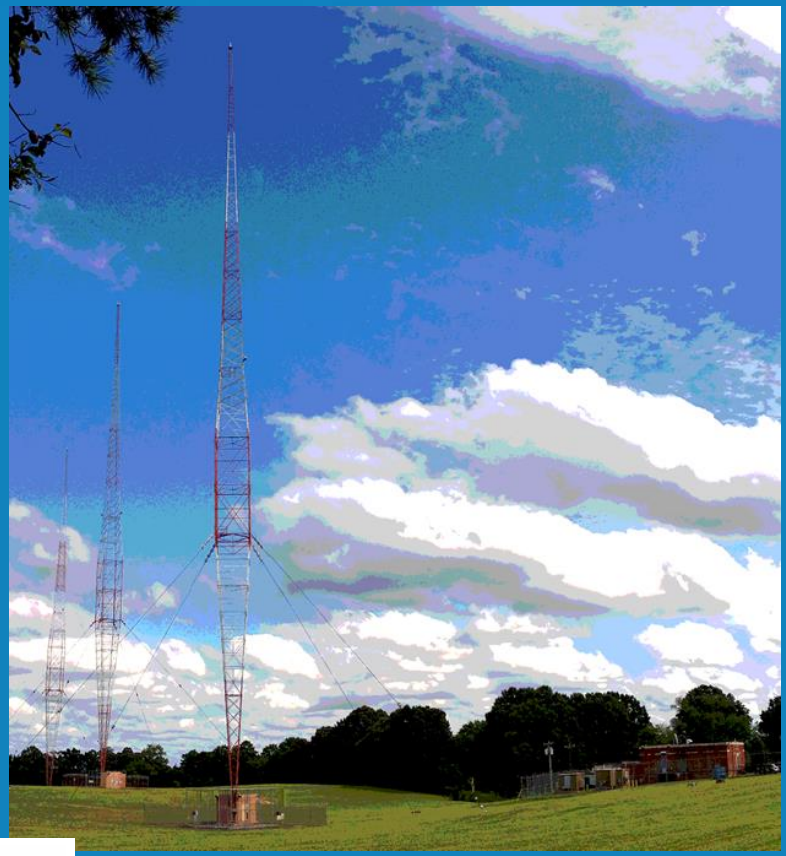
200 watt, seven speaker stereo system with AM/FM/HD radio. Supports MP3, AAC, and MP4 music formats. System includes four speakers, two tweeters and one center channel speaker.

All-digital AM

- All-digital AM may be a long-term solution for AM radio
  - Significantly more immune to noise and interference than either analog or hybrid digital AM
  - Improved audio quality (as good or better than analog FM)
  - Potential to support data services and multicasting
  - **Receivable on EXISTING HD Radio receivers**

All-digital AM

- All-digital AM is significantly better than hybrid digital AM
  - *Hybrid digital AM is currently-authorized HD Radio signal*
- NAB Labs test project to fully characterize all-digital AM is well underway



All-digital AM

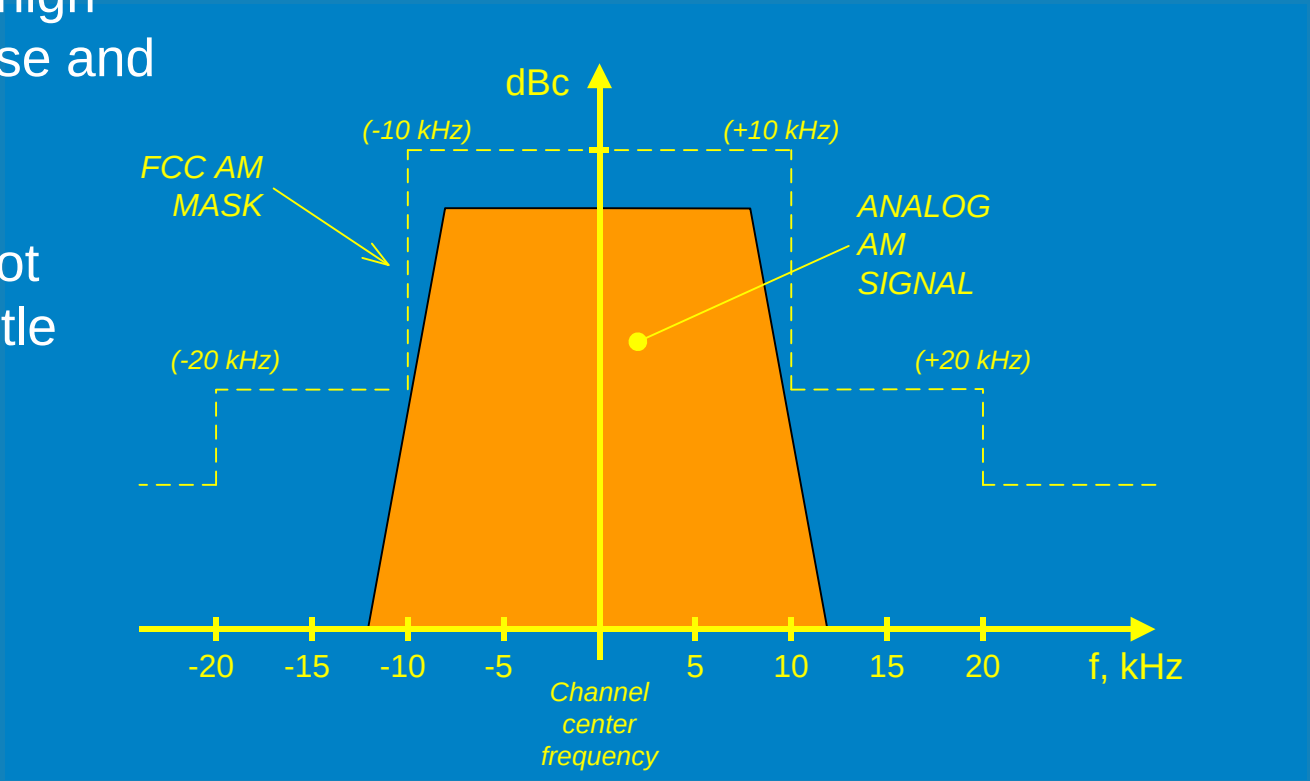
- Principal drawback: all-digital signal not receivable on analog-only radios
  - Introduction of all-digital service requires significant penetration of HD Radio receivers in marketplace
- Another issue: all-digital is not authorized by the FCC
  - Prior to NAB Labs effort, very little testing on all-digital AM
  - First step towards getting FCC authorization is to develop a technical record of all-digital system performance

All-digital AM – test project partners

- Broadcasters:
- Equipment manufacturers:
- Others:

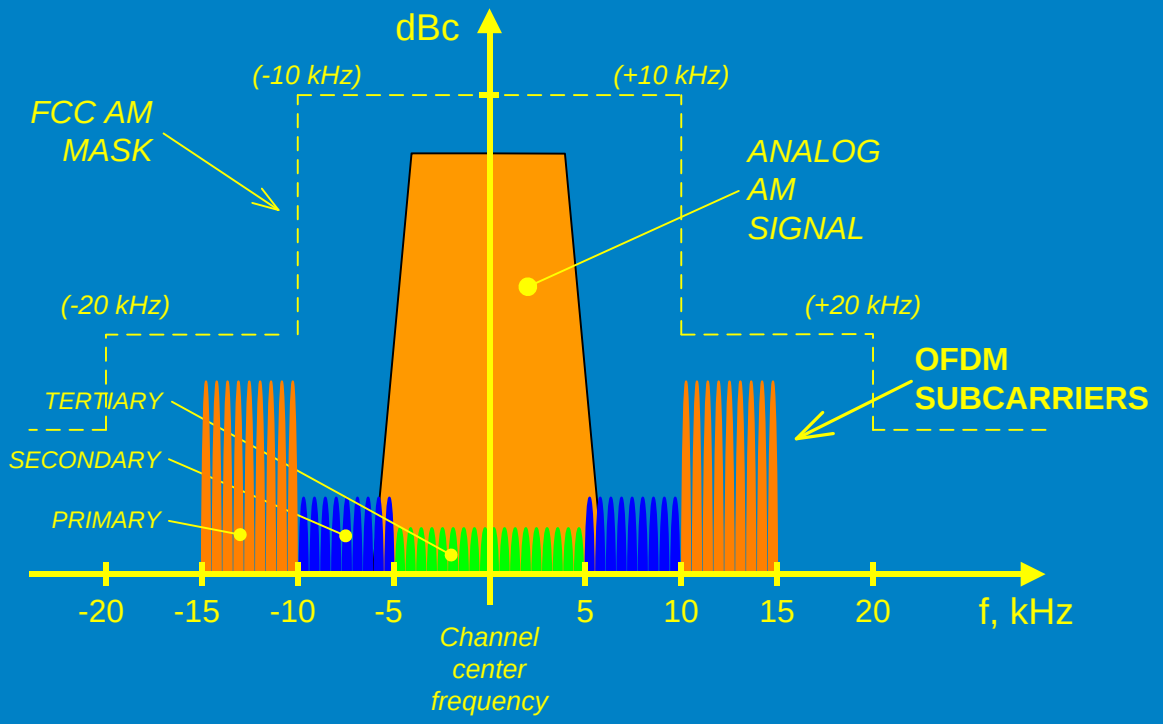
All-digital AM IBOC

- Analog AM signal
  - Plagued by high levels of noise and interference
  - No data capability, not even song title and artist



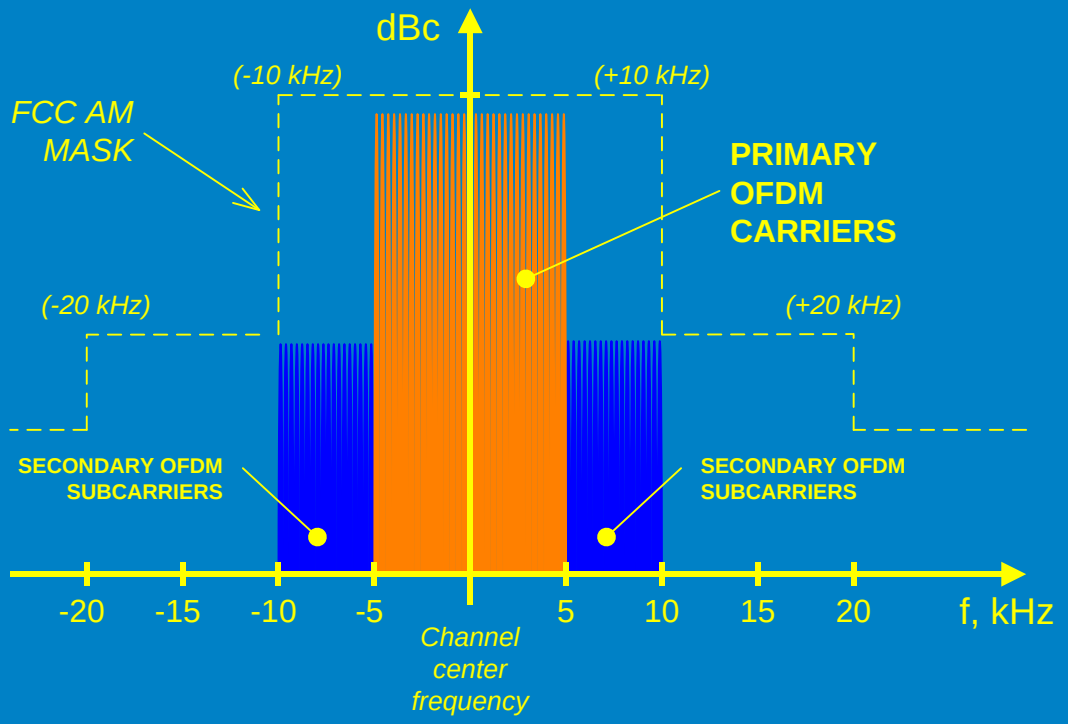
All-digital AM IBOC

- Hybrid AM IBOC signal
  - Authorized by FCC in 2002
  - “HD Radio” is the trademark of iBiquity Digital Corp.
  - Approximately 300 stations licensed for hybrid AM



All-digital IBOC

- All-digital AM IBOC signal
  - Currently requires experimental authority from FCC
  - Not receivable on analog AM radios
  - IS receivable on existing HD Radio receivers

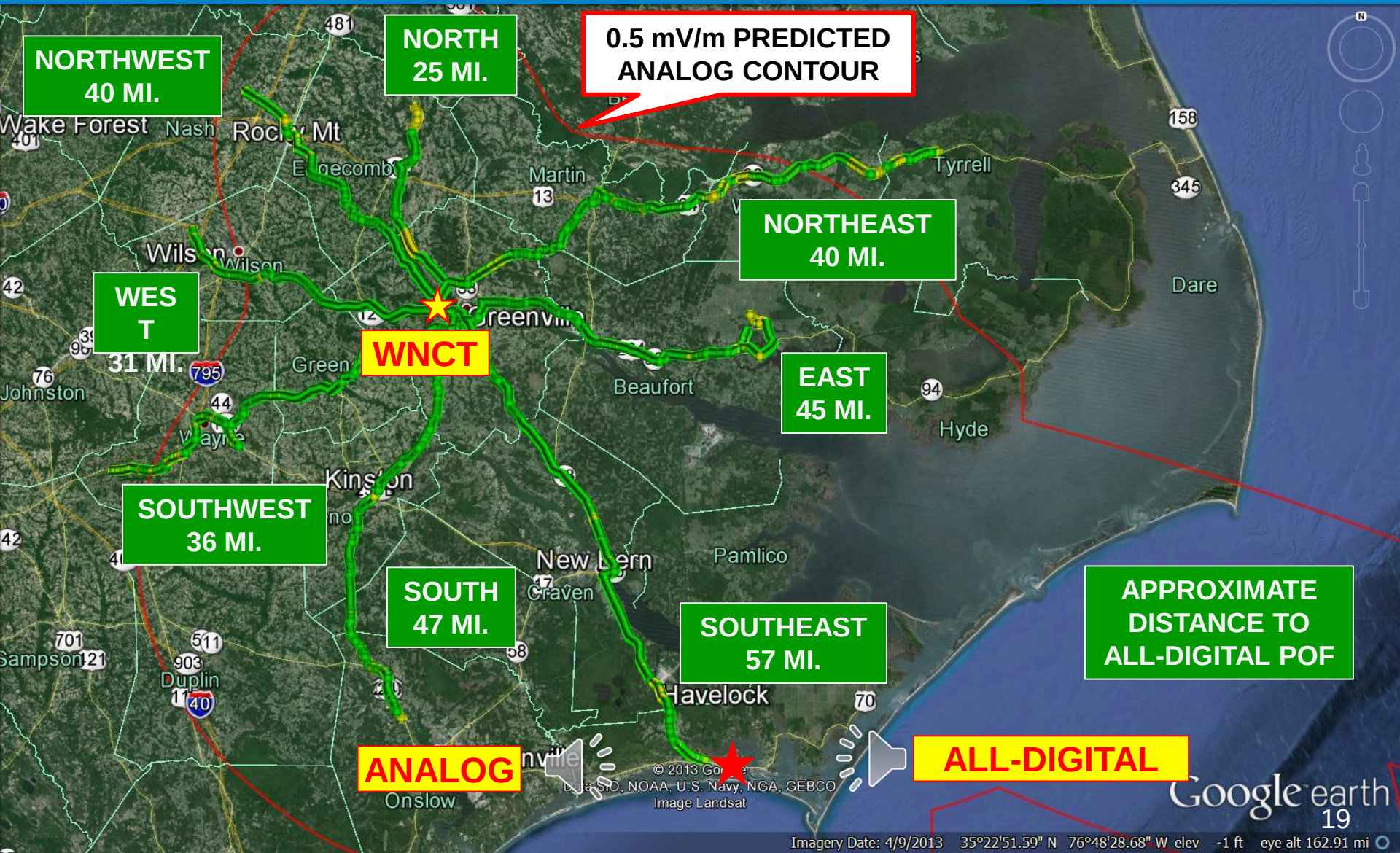


All-digital AM field testing

- Test sites to-date:

Parameter	WBCN	WNCT	WBT	WD2XXM	KTUC	WDGY
Location	Charlotte, NC	Greenville, NC	Charlotte, NC	Frederick, MD	Tucson, AZ	Hudson, WI
Freq (kHz)	1660	1070	1110	1670	1400	740
Class	B	B	A	*EXPERIMENTAL*	C	D
Day pwr (kW)	10.0	25.0	*(not tested)*	3.0	1.0	5.0
Night pwr (kW)	1.0	10.0	50.0	3.0	1.0	n/a
# of towers	1	5	3	1	1	3
Antenna	ND1	DA2	DAN	ND1	ND1	DAD
Date(s) tested	12/12	7/13	8/13, 3/14	10/13, 12/13	2/14	6/14

WNCT daytime (25 kW)



NAB Labs radio test bed

- Built by Cavell, Mertz & Associates
- Goal of testing – characterize interference performance of all-digital AM
  - Expect performance to be better than hybrid AM except for co-channel
  - Will re-do select tests from 2002 to act as a “bridge” between old and new test data
- Goal is to complete lab testing in 2014

NAB Labs radio test bed

- Aftermarket radios
  - iBiquity helped identify chip sets (Pioneer – TI, Kenwood – NXP)

All-digital AM – overall status

- NAB Labs test project consists of three components:
  - Field testing – *Completed* – demonstrates "real-world" coverage, helps to troubleshoot system and educate broadcasters
  - Lab testing – *underway* – establishes interference behavior between stations
  - Allocation studies – *underway* – needed to understand impact on FCC rules

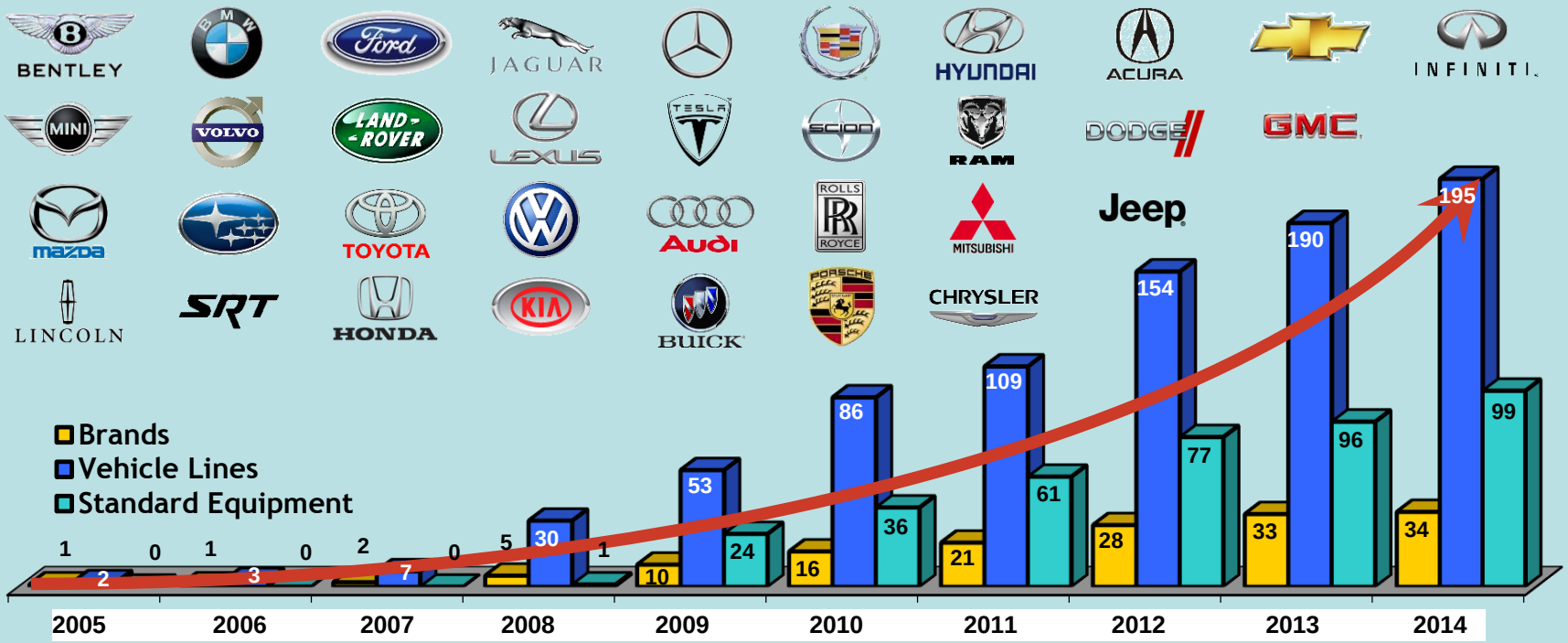
NAB Labs *initiated* and is *leading* the industry evaluation of all-digital AM radio

Automotive Dashboard Update

- Audio entertainment options in automobiles continues to evolve
- Sampling of radio products at 2014 International Consumer Electronics Show (Jan 2014)
  - AFTERMARKET AND OEM
- Other developments
  - ANDROID IN THE CAR
  - APPLE IN THE CAR

HD Radio in the dashboard

- Brands with existing or announced products



SOURCE: IBIQUITY, 3/14


AppRadio® & Digital Media Receivers
Pioneer
International CES
THE GLOBAL STAGE FOR INNOVATION

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Pioneer "AppRadio"

International CES
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JVC

International CES
THE GLOBAL STAGE FOR INNOVATION

JVC


JVC
KW-NT810HDT
PANDORA
Source
HD Radio
SiriusXM
SD
iPod
iHeart RADIO
P
Audio
AV-IN
AV-Off
VOLUME
DISP OFF
AV
MAP
MENU
SRC
iHeart RADIO COMPATIBLE
KW-NT810HDT
Navigation/ DVD/SD
High Speed CPU & SSD
HD Radio Traffic & News Service
Built-in Bluetooth®
iHeartRADIO
WORKS WITH PANDORA
3-Language Text-to-Speech
USB 1A for iPod/iPhone etc.
AAC/WAV/MP3/WMA

JVC


JVC
WMA MP3 WAV FLAC
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KD-X310BT
LOUD
iPod
iHEART WITH
SOURCE
MENU
DISP
PANDORA
iPod MODE
AUX
1
2
3
4
5
6
iHeart
RADIO
COMPATIBLE
KD-X310BT
Digital Media
Receiver
Built-in
Bluetooth®
2 Phones
Full-Time
Connection
WORKS WITH
PANDORA
iHeartRADIO
USB 1A for iPod/iPhone etc.
Digital Processing Tuner
MP3/WMA/WAV/FLAC
Low-Pass Filter

Open Automotive Alliance

- Announced on 1/6/14
- "…committed to bringing the Android platform to cars starting in 2014"
- Developing a new Android platform feature to allow the car to be a connected Android device

Audi

GM

Google

HONDA
The Power of Dreams

HYUNDAI
MOTOR GROUP

NVIDIA.

http://www.openautoalliance.net

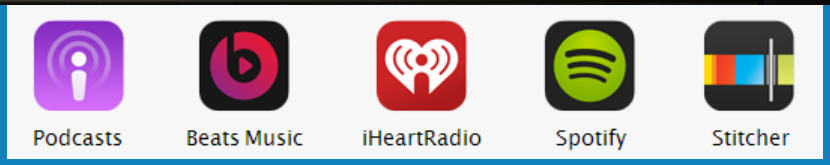
Apple CarPlay

- March 6, 2014 – Apple announces rollout of “CarPlay”
- New iPhone interface for cars, available on iPhone 5 models

http://www.apple.com/ios/carplay/

Apple CarPlay

- iRadio and other streaming apps supported



Broadband-equipped cars

- 2015 Audi A3 - $16 a month
  - Using AT&T
  - $100 for 5 gigabytes for 6 months
  - $500 for 30 gigabytes for 30 months (typical lease term)
- GM announcing similar plans soon

Automotive Dashboard - summary

- More car manufacturers are developing built-in Internet radio options
- Apple CarPlay and Android Open Automotive Alliance may accelerate this trend
- HD Radio penetration is encouraging and vital
- Broadcasters need to support enhanced content to stay competitive in the auto

FCC EAS Nationwide Test NPRM

FCC EAS Nationwide Test NPRM

- Released June 26, 2014.
- Focuses on 4 Issues re National Periodic Tests
  - Propose to establish a national location code for EAS alerts issued by the President;
  - Proposes to establish a code and amend the rules national EAS test code for future nationwide tests;
  - Require EAS Participants to file national test result data electronically; and
  - Require EAS Participants to meet minimal standards to ensure that EAS alerts are accessible to all members of the public, including those with disabilities
- Compliance date: Six months after final rule adoption

FCC EAS Nationwide Test NPRM

- National Location Code
  - FCC proposes All zeros 000000 (PSSCCC)
- National EAS Test Code
  - NPT
  - Like regular test Or like EAN

FCC EAS Nationwide Test NPRM

- EAS Test Reporting System (ETRS)
  - Post test data reporting
  - Mandated
  - Participants would be required to update the station info in ETRS annually
  - Some integrate data with info from State EAS plans

FCC EAS Nationwide Test NPRM

- Visual Crawl and Audio Accessibility
  - Institute Caption Type Quality requirements
  - Crawl Speed
  - Completeness
  - Placement
  - How can FCC Improve EAS audio & Visual elements of an alert.

FCC EAS Nationwide Test NPRM

- Report and Order expected by year's end
  - Expect adoption of all zero FIPS code & NPT
  - Reporting form… Maybe
  - Further Notice on Quality

Other TV Stuff

- Accessibility
  - Talking Crawls
  - Caption quality
- BAS DoD channel sharing
- 3.6 GHz sharing (CBS)

TV INCENTIVE AUCTION

The U.S. National Broadband Plan

- FCC authored in 2010 after a 10-month public process
- Provides recommendations on how to encourage deployment and adoption of fixed and mobile broadband
- Identifies goal of making **500 MHz** available for broadband within 10 years (300 MHz within 5 years)
  - One of the key ideas was that incumbents could be moved off of more desirable spectrum if given proper incentives
  - Specifically recommended world's first spectrum "incentive auction" to repurpose broadcast TV spectrum

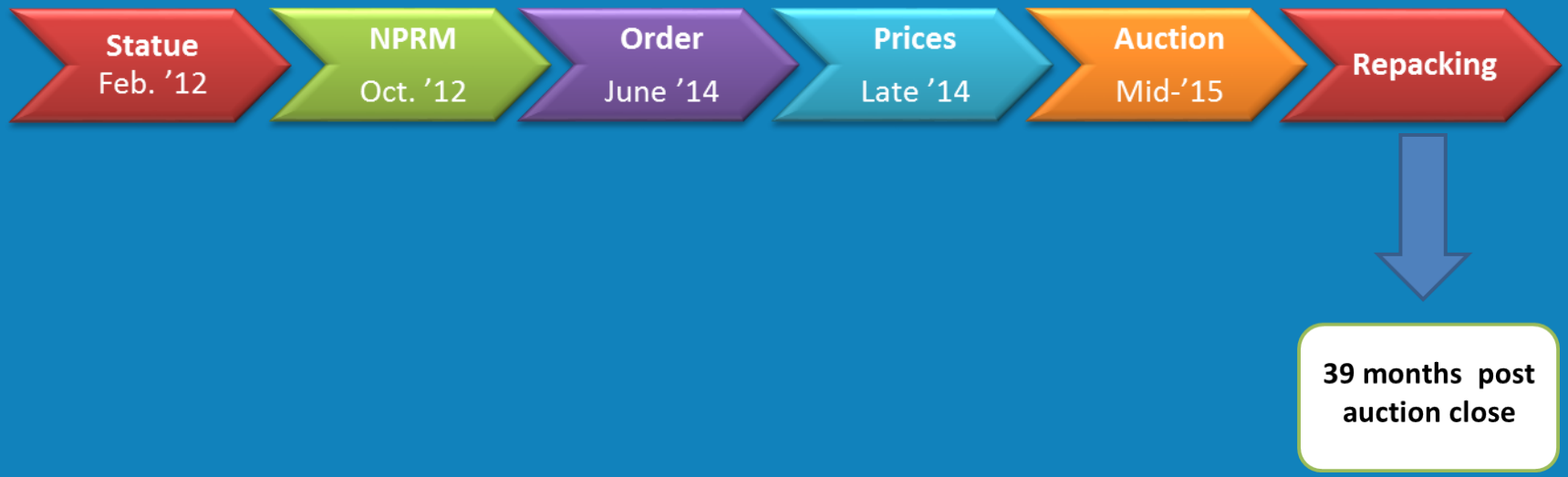
Incentive Auction Authorization

- To conduct an incentive auction, the FCC needed specific authorization from the U.S. Congress
- In 2012, Congress passed into law the “Spectrum Act,” which allows the FCC to share proceeds from a forward (mobile) auction with incumbent broadcast licensees that volunteer to relinquish some/all of their spectrum
  - The Spectrum Act also permits the FCC to increase the amount of spectrum reclaimed by “repacking” broadcasters
- No predetermined amount of spectrum to be recovered

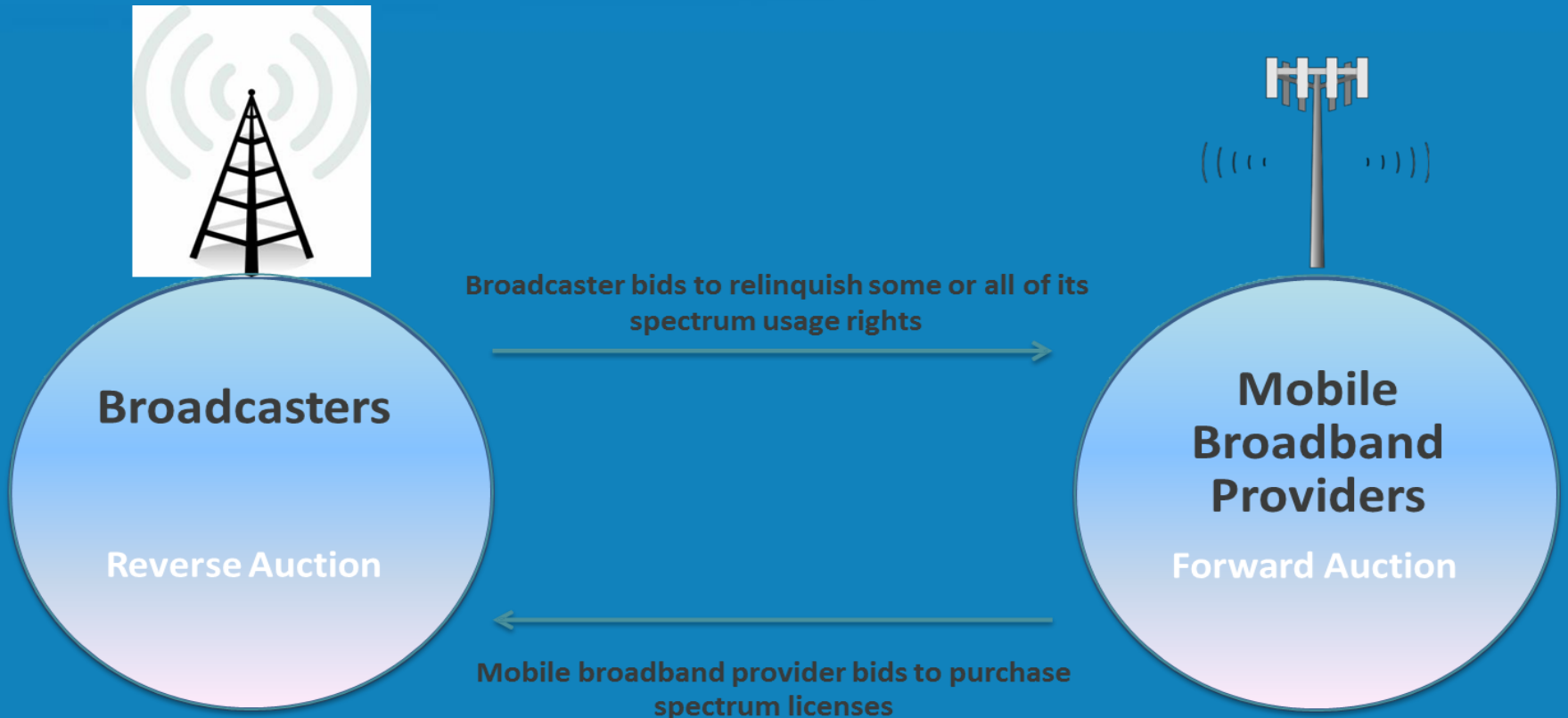
Incentive Auction: Key Elements

- The auction must be voluntary; no broadcaster can be coerced into participation by any means
- The FCC must make "all reasonable efforts" to preserve the coverage area and population served of each licensee
  - Although FCC not required to "replicate" those areas in all cases
- Congress instructed the FCC to establish a fund of $1.75 billion to reimburse repacked broadcasters for expenses related to their relocation

Incentive Auction Timeline



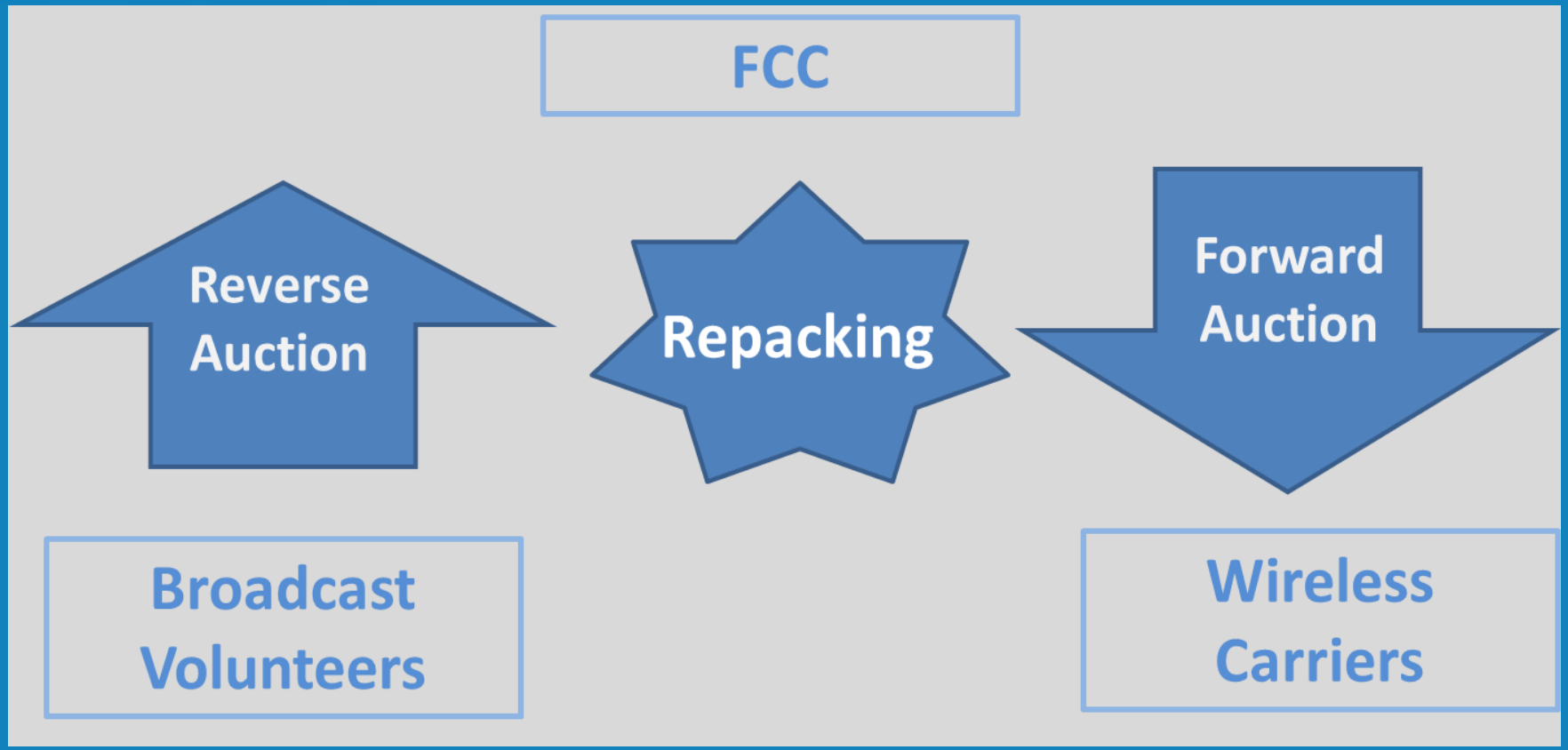
How the Incentive Auction Works



Broadcaster Participation Options

- **Go Off Air:** Bid to relinquish license, receive payment, and go off the air
- **Channel Share:** Bid to relinquish current channel, receive payment, and share a channel with another broadcaster
- **U-to-V:** Bid to relinquish a UHF channel, receive payment, and move to either a high VHF (7 to 13) or low VHF (2 to 6) channel
- **High-V to Low-V:** Bid to relinquish a high VHF channel, receive payment, and move to a low VHF channel

Incentive Auction Process



Reverse Auction

- Prior to the auction, the FCC will provide opening bid prices to broadcasters for each bid option
  - Each station price is designed to reflect "objective" factors, such as location and interference potential
- Stations indicate whether willing to participate at that price
- Prices offered to each station are then adjusted downward in subsequent bidding rounds
- Bidders may drop out at any point and be repacked in same band
- Prices continues to drop until no excess supply of bidding stations to achieve the spectrum target (*i.e.*, bidding ends)

Forward Auction

- The FCC takes the volunteered spectrum, along with what it can yield by repacking, and sets a new band plan
- Wireless carriers (and spectrum speculators) will bid
  - Major bidders likely AT&T, Verizon, DISH, Sprint, and T-Mobile
- Prices start low and then are adjusted upwards in subsequent bidding rounds
- New wireless band plan is in 5 MHz increments (converted from 6 MHz broadcast channels)

When Does the Auction Conclude?

Average price for forward auction licenses exceeds $X per MHz-pop (set by the Commission before auction)

OR

Aggregate bids for forward auction licenses exceeds the same $X per MHz-pop times the number of wireless MHz-pops for the specified clearing benchmark, T MHz (set by the Commission before auction)

AND

The aggregate bids for forward auction licenses are sufficient to meet statutory minimum plus any residual amount for FirstNet (the public safety broadband network)

Broadcaster Repacking Overview

- Non-participating broadcast stations, or those that do not have bids accepted, will continue to operate following the auction
- FCC will repack full power and Class A TV stations that remain on the air so they occupy a smaller portion of the UHF band and enable the reallocation of contiguous nationwide spectrum for the forward auction
- We expect approximately 1,000 stations will be repacked
- Repacked stations will have up to 39 months from the effective date of the repack to vacate their old channel
- $1.75b TV Broadcaster Relocation Fund

Broadcaster Ongoing Concerns

- FCC's new coverage area program makes unlawful changes in coverage areas and people that stations currently serve
- No guarantee of full reimbursement for repacking expenses
- No certain international coordination prior to the auction
- Wireless microphone use jeopardized (more later)
- Not protecting "fill-in" translators
- 39-months and off the air (no exceptions)
- FCC repacking methodology is still a mystery

New Auction Related FCC Items

- Public Notice on Draft TV Broadcaster Relocation Fund Reimbursement Form.
- NPRM on the long term future for spectrum usage by wireless microphones.
- NPRM on Part 15 rules for operation of white space devices in the television bands.
- Report & Order on Inter-Service Interference
- NPRM LPTV Digital transition

Relocation Fund Reimbursement Form PN

- Will be implemented in conjunction with a Catalog of Eligible Expenses.
- A final version of the catalog will be released prior to the incentive auction.
- Eligible broadcasters must file estimate of costs for the transition no later than three months following release of the Channel Reassignment Public Notice
- The FCC will provide an initial allocation to broadcasters based on that estimate (up to 80% for commercial stations and up to 90% for non-commercial stations)

Relocation Fund Reimbursement Form PN

- An updated Reimbursement Form along with cost documentation for actual costs is to be submitted when seeking reimbursement against the allocation
- A final Reimbursement Form showing total expenses must be submitted prior to the end of the three year reimbursement period as specified in the Spectrum Act
- Form will be filled out and submitted electronically

Wireless Mic NPRM

- Following the incentive auction, there will be fewer frequencies in the UHF band available for wireless microphone operation
- Asks for specific information on wireless mic uses and needs
- The FCC proposes to adopt the European Telecommunications Standards Institute (ETSI) emission masks, which have more stringent out-of-band emission control than the FCC rules
- Seeks comment on specifying separate emission masks for analog and digital microphones, or whether a single mask is sufficient

Wireless Mic NPRM

- Requests comment on impact of raising the power for VHF mics from 50 mW to 250 MW
- Proposes to allow wireless mics to operate closer to a co-channel TV station than currently permitted, including inside the DTV contour
- What steps should be taken to facilitate a smooth transition for wireless mics out of the 600 MHz band
- Proposes prohibiting the manufacturing or marketing of wireless microphone devices intended for use in the repurposed 600 MHz band with an effective date of 18 months after the release of the Channel Assignment Public Notice

Wireless Mic NPRM

- Based on current rules for wireless microphone operation in the 944-952 MHz band, proposes to make unused portions of the 941-944 MHz and the 952-960 MHz band available for licensed wireless microphone operations on a secondary basis
- Explores use of various other frequency bands and proposes wireless microphone operations in the BAS/CARS 7 GHz band for entities eligible to hold BAS or CARS licenses

White Space Devices NPRM

- Eliminate the prohibition on the use of channels 3 and 4 by fixed white space devices
- Eliminate the prohibition on personal/portable device operation on channels 14-20
- Seeks comment on whether personal/portable device operation should be permitted below channel 14
- Allow fixed devices to operate adjacent to occupied TV channels (within their contours) at a maximum operating power of 40 mW EIRP and seek comment on a higher maximum power than 40 mW

Inter-Service Interference

- Regards Interference Between Broadcast TV & Wireless in the 600 MHz Band
- Rejected adoption of an aggregate interference limit for TV stations.
- Reaffirmed that its one-half percent limit on new interference will be applied on a pairwise station-to-station
- Adopted additional measures of channel optimization procedures and special post-assignment modification processes cases where a station is predicted to receive aggregate new interference in excess of one percent

Inter-Service Interference

- Adopted a methodology for predicting inter-service interference, for use during the incentive auction, proposed by the Commission in Jan 2014 PN.
- Seeks comment on:
  - proposed rules to govern interference between broadcast television and wireless broadband service in the 600 MHz band following the incentive auction.
  - A proposes a new OET Bulletin No. 74 which specifies use of the Longley-Rice methodology for predicting interference to broadcast TV from mobile broadband services.

LPTV Digital Transition

- Regards the end of analog LPTV
- Proposes to postpone the current September 2015 deadline
- Seeks comment on whether a new deadline should be established now, or before the incentive auction or after the incentive auction is complete
- Seeks comment on channel sharing
- Proposes eliminating the requirement for manufacturers include analog tuners in future TV receivers.

Repacking Alignment with ATSC 3.0

- Ideal scenario would be to match up the incentive auction and a transition to a new standard
- However, FCC has made it clear it will not slow down the auction process to accommodate a standards change
  - Despite the fact the auction does not have to occur until 2022
- The result could be **two** transitions back-to-back; an auction repack and then a standards change
- This approach would be bad for consumers and more expensive for broadcasters**.**

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Questions?

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