TV Spectrum Incentive Auction

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Incentive Auction Description

• IA has separate “reverse” and “forward” auctions
  • Reverse auction – Recover spectrum from TV service
    • Full power and Class A stations volunteer relinquish spectrum in auction with decreasing prices
    • FCC established opening round prices
  • Forward auction – Distribute recovered spectrum to wireless carriers
    • Carriers bid for spectrum in auction with increasing prices
    • Spectrum offered in 5 MHz pairs in PEAs (Partial Economic Areas)
  • Spectrum clearing (recovery) target set based on TV stations participating
Incentive Auction Description

• Forward auction - Sale of 5x5 spectrum blocks in “PEAs” (“Partial Economic Areas”)
  • 416 PEAs
  • Derived from Bureau of Economic Analysis’s “Economic Areas”
  • Economic Areas – One or more economic nodes and surrounding counties
  • So PEAs are county based; also closely fit many wireless providers existing footprints
Incentive Auction Process

• Forward and reverse auctions conducted in series of “stages”
  • Each stage consists of a reverse auction and a forward auction
    • Rounds of bidding in each stage
    • Reverse auction stage ends when all stations have dropped out, been bought, or are not needed
    • Forward auction stage ends when bidding stops
  • At end of each stage the proceeds of the auction are checked against the “final stage rule” – must cover auction costs and meet competitive price level standard
  • IA ends when “final stage rule” is satisfied
Incentive Auction Process

• Prior to first stage an initial “clearing target” is determined (how much spectrum to recover)

• In any subsequent stages, clearing target is lowered and less spectrum is available for the forward auction

Notes:

• Stations could offer to: 1) go off-the-air (relinquish channel/channel share), 2) move to high VHF, or 3) move to low VHF

• FCC wants to minimize number of stations: 1) bought and 2) relocated to new channels (minimize auction costs)
Incentive Auction Status

• Auction Began March 29
  • No information on how many or which stations are participating

• Initial clearing target set at 126 MHz (21 channels)

• Stage 1 reverse auction bidding to begin May 31, 2016

• May be multiple stages

• Expect auction to conclude late summer/early fall
Low Power Stations

• LPTV/TV translators, including digital replacement translators (DRTs), will not be included in repacking
  • Secondary
  • Not entitled to protection from primary services under current rules
  • Would unduly constrain repacking flexibility
• Provisions for mitigating effects of the incentive auction on LPTV/TV translators
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Repacking/Transition Plan

• Incentive auction will be “completed” when the FCC issues a Public Notice announcing that the reverse and forward auction, respectively, have ended

• Post-auction - Remaining full power and Class A stations will be repacked into reduced TV spectrum using repacking optimization software
  • Relocate as few stations as possible
  • Minimize re-build costs
  • Preserve existing service areas
Repacking/Transition Plan

• Full power and Class A stations must cease operation on 600 MHz Band channels no later than 39 months from date of Channel Reassignment PN (i.e., end of the Post-Auction Transition Period)

• Concerns about time allowed for the transition and funds available for relocating TV stations remaining on the air

• Likely will be adjustments in the transition plan as needed once the auction is completed
Transition Plan
LPTV/TV Translator 600 MHz Provisions

- LPTV/TV translator stations may continue on 600 MHz channels until notified by wireless licensees
  - Wireless licensee must notify low power TV of intent to commence operations where interference likely
  - Notification not less than 120 days in advance of the wireless operational commencement date
- LPTV/TV translator stations on channels in guard bands (including the duplex gap) must cease operations on those channels
  - No later than end of the 39-month post-auction transition period; earlier if receive notification letter from a wireless licensee
Transition Plan
LPTV/TV Translator Provisions - IA R&O

• Special filing window for displaced LPTV/TV translators, including DRTs, to select a new channel
  • After relocating primary stations have submitted CP applications and had an opportunity to request alternate channels or expanded facilities

• Stations with MX displacement applications to be allowed to reach a settlement or an engineering solution

• Priority for displaced DRTs where MX displacement applications cannot be resolved
Transition Plan

LPTV/TV Translator Provisions – Third R&O/Fourth FNPRM
Dkt. 03-185, FCC 15-175

• DTV transition deadline for analog stations extended to 12 months after 39-month Post-Auction Transition Period

• Will allow channel sharing between LPTV and TV translator stations outside the auction context

• Will use IA repacking optimization software to assist displaced LPTV/TV translators in finding new channels
  • Channels to be identified by MB not less than 60 days prior to post-auction LPTV /TV translator displacement window
  • Stations to pick channel assignments; may be different from channels identified by MB
Transition Plan
LPTV/TV Translator Provisions – Third R&O/Fourth FNPRM

• Requirement for analog tuners in new TV receivers to end August 31, 2017
• Will try to streamline international coordination process to avoid delays in displacement application process
• Established a “digital-to-digital replacement translator” service (DTDRT) for full power television stations
• Proposed to allow channel sharing between primary and secondary stations
• Requested comment on issues re:
  • Term length of agreements, MVPD carriage (same rights as if not sharing), Reimbursement, and Notice
TV Spectrum Update

Questions?

Thank you!
White Spaces

• Unlicensed devices will continue to operate in TV spectrum
  • Rules for operation loosened somewhat
  • Two channels for wireless mics around channel 37 eliminated
  • Allowed on channel 37
• Vacant channel proceeding to ensure at least one channel available everywhere for white space devices
• Unlicensed devices to be allowed on 600 MHz frequencies
  • Duplex gap and guard bands
• Rules for licensed/unlicensed wireless mics in 600 MHz band
• NPRM proposing to require geolocation in fixed devices/eliminate professional installer option
Repacking
Auction Process

• At start of reverse auction (stage 1, round one)
  • Feasibility of assigning each non-participating and active bidding station a channel in its pre-auction band checked
  • Non-participating stations with one or more feasible channels will be provisionally assigned a channel in TV band
  • Non-participating stations with no feasible channel in TV band may be assigned channel in 600 MHz band or bought, depending on whether market variation limit exceeded (no dynamic pricing)
Repacking
Final TV Channel Assignment Plan

- At the end of the auction, the channels for TV stations will be optimized in a “Final TV Channel Assignment Plan”

- Optimization objectives:
  - Preserve coverage area and population served
  - Minimize ISIX with 600 MHz wireless operations
  - Avoid significant viewer losses due to terrain losses
  - Maximize number of stations assigned to their pre-auction channel
  - Minimize channel assignments that would result in new aggregate interference to any individual station over one percent
  - Avoid reassignments with high anticipated relocation costs
Vacant Channel Proceeding

- FCC wants at least one UHF channel available for unlicensed devices and wireless mics everywhere
- Proposed that Class A, LPTV, TV translator, and BAS applicants must show proposed facilities would not eliminate the last available vacant UHF channel for white space devices and wireless mics in an area
- Requested comment on whether to require vacant channel demonstrations for full power applications
- Specific channel to be preserved would vary depending on the area
- Where duplex gap is impaired, would designate second vacant channel in UHF TV band
- Would apply to applications after the 39-month transition period
Vacant Channel Proceeding

• Applicant to perform technical study showing white space devices and wireless mics in same area as proposed facility could access at least one channel
  • Study to be included with application
  • Use white space databases
• Vacant channel availability to be determined using same criteria as that for determining channels that white space devices and wireless mics can use
• Impact on LPTV/TV translators/BAS expected low as repacking simulations show areas with the vast majority of population nationwide would have at least two vacant channels available
Inter-service Interference

Four Interference Cases

- With both fixed & mobile and broadcast services in the band, several potential interference scenarios exist
- Cases 3 & 4 prohibited by statute, Cases 1 & 2 impact forward auction revenue by encumbering markets near DTV operations
Inter-service Interference
TV on Wireless Uplink Frequencies – 2\textsuperscript{nd} R&O

- **Case 1 – TV to wireless base stations**
  - Divide wireless license areas (PEAs) into 2 x 2 km grid cells
  - Predict field strength from TV stations in grid cells in PEAs
  - IX to wireless base stations in grid cells that exceed IX threshold (red cells) or are inside the TV service contour

- **Case 4 – Wireless handsets to TV**
  - Divide wireless license areas into 2 x 2 km grid cells
  - IX to TV from handsets in cells within and up to 5 km co-channel or 0.5 km adjacent channel outside the TV service contour (red/pink cells)
Inter-service Interference
Market Variation/2\textsuperscript{nd} R&O and FNPRM

- Need to avoid interference between TV and wireless services in the 600 MHz band
- During the forward auction, wireless bidders need to know if spectrum blocks are impaired by ISIX
  - Amount of impairment will vary by location and block
  - Two categories of impairments: 0-15\% and >15\%-50\%
  - Blocks with >50\% impairment will not be sold
- After the auction, wireless licensees need to:
  - Protect TV from new interference
  - Assess whether a continuing LPTV/TV translator station would interfere with their operations
Inter-service Interference
TV on Wireless Downlinks – 2\textsuperscript{nd} R&O

- Case 2 – TV to Wireless Handsets
  - Divide all wireless license areas into 2 x 2 km grid cells
  - Predict field strength from TV stations in all grid cells
  - Interference to handsets in grid cells outside TV contour that exceed interference threshold (pink cells) or are inside the TV service contour (red cells)
Inter-service Interference
Wireless on TV Channels - Case 3 (Pre-Auction)

Harford County, Maryland

Base stations spaced every 10 km

Grid points where D/U falls below threshold

Since some sample points in Harford County cause interference inside TV protected contour, entire county is flagged as potentially impaired
Inter-service Interference
TV on Wireless Downlinks – 2nd R&O (Pre-Auction)

Case 3: Wireless Base Stations to TV

- Location and configuration of 600 MHz base stations not known
- To determine where wireless licensees may interfere with TV, hypothetical base station transmitters are placed on a grid spaced every 10 kilometers within 500 kilometers of any TV Station
- Calculate the D/U ratio for each of these base stations at every 2 x 2 kilometer grid point inside each TV station’s contour
- If hypothetical base station(s) cause IX to TV inside the TV station’s contour, the county containing that transmitter point is flagged (portion of county affecting TV to trigger flag not yet decided)
- Also, a county is flagged if its boundary is within 5 kilometers of a TV station’s contour
Inter-service Interference
TV on Wireless Downlinks - FNPRM (Post-Auction)

• Case 3 – Wireless Base Stations to TV (proposals)
  – Use actual base station locations
  – 0% threshold for harmful interference from wireless to TV
  – Prohibit wireless base stations from operating within the contour of a co-channel or adjacent-channel TV station
  – Prohibit wireless user equipment from operating within 5 km of a co-channel contour or within 0.5 km of an adjacent-channel contour
  – New OET Bulletin No. 74 methodology to predict interference from wireless to TV
  – Require wireless licensees to eliminate actual interference to TV stations if it occurs
IA R&O - Repacking
Definitions

- **Coverage area** –
  - Full power – service area (area within noise-limited F(50,90) contour where signal strength is predicted to exceed noise-limited service level
  - Class A - area within protected contour
  - Existing contour to be replicated as closely as possible (same geographic area)

- **Population served** –
  - Persons within coverage area at locations where signal is not subject to interference
Declaratory Ruling - Repacking
Interference Protection

• Coverage area –
  • Unpopulated areas and areas where a station’s signal cannot be received due to existing interference will not be protected from new interference

• Population served –
  • Existing viewers to be protected
  • No channel assignments will be allowed that would reduce a station’s existing population served by more than a de minimis (0.5 percent) amount
Inter-service Interference
Proposed OET Bulletin No. 74

- Post-auction methodology for wireless licensees to protect TV stations from inter-service interference
  - Terrain-dependent interference analysis for all wireless sites within the specified culling distance corresponding to the ERP and HAAT of each site
  - Site-specific information, including geographic location, ERP/HAAT, and antenna patterns
    - Antenna patterns can be all omni, if desired
  - Aggregate interference power from wireless base stations
  - D/U ratios according to spectral overlap as specified in ISIX Methodology
Auction Actions and Schedule
Major Adopted Actions

Proposals:
• Unlicensed Operations NPRM – September 2014
  • Unlicensed Devices and Unlicensed Wireless Mics
• Wireless Mic NPRM – September 2014
• Third FNPRM – October 2014
  • LPTV and TV Translators
• Public Notice Requesting Comments on Bidding Procedures – December 2014
• Public Notice on Commencing Operations (New Wireless) – March 2015
Auction Actions and Schedule

Upcoming Actions (All Final Decisions)

- Incentive Auction MO&O
  - Will address Petitions for Reconsideration of R&O
- Bidding Procedures Public Notice
- Third R&O on ISIX
- MO&O on Aggregate IX Cap and ISIX
- R&O on LPTV and TV Translators
- R&O on Unlicensed Operations
- R&O on Wireless Mics

May Be 2 Parts Possibly Together
Incentive Auction R&O

- Incentive Auction Report and Order – May 2014
  - Reorganized UHF Band
    - 600 MHz Band Plan
  - Repacking
  - Unlicensed Operation
- Auction Process
  - Reverse Auction
  - Forward Auction
- Post-Auction Transition
  - TV Stations/Reimbursement for TV Stations and MVPDs
  - Other Services and Unlicensed Operations
    - LPTV and TV Translator Stations, TV Fixed BAS, Unlicensed TV White Space, LPAS and Unlicensed Wireless Mics