THE CHALLENGE OF THE SPECTRUM REPACK

39 months to install over 1,000 Full power TV transmitters

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Make ideas real

AGENDA

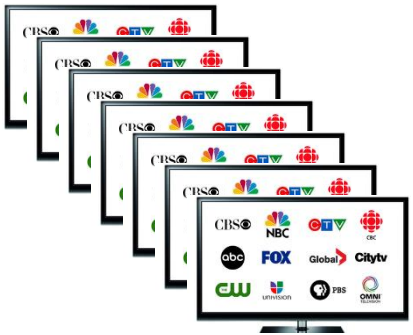
- What is Repack
- Where are we?
- Change in technology from IOT to Solid State
- Repack Challenges
- Thinking ATSC 3.0

WHAT IS TV SPECTRUM “REPACK”

► FCC’s Definition of “Repacking”

Source: https://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions/primer-broadcasters

“Repacking involves reorganizing television stations in the broadcast television bands so that stations that remain on the air after the incentive auction occupy a smaller portion of the UHF band, thereby freeing up a portion of that band for new wireless services uses.”



Repack

REIMBURSEMENT UPGRADE

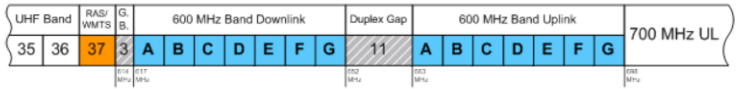
- FCC allocated $1.75B repack fund to pay for the relocation costs

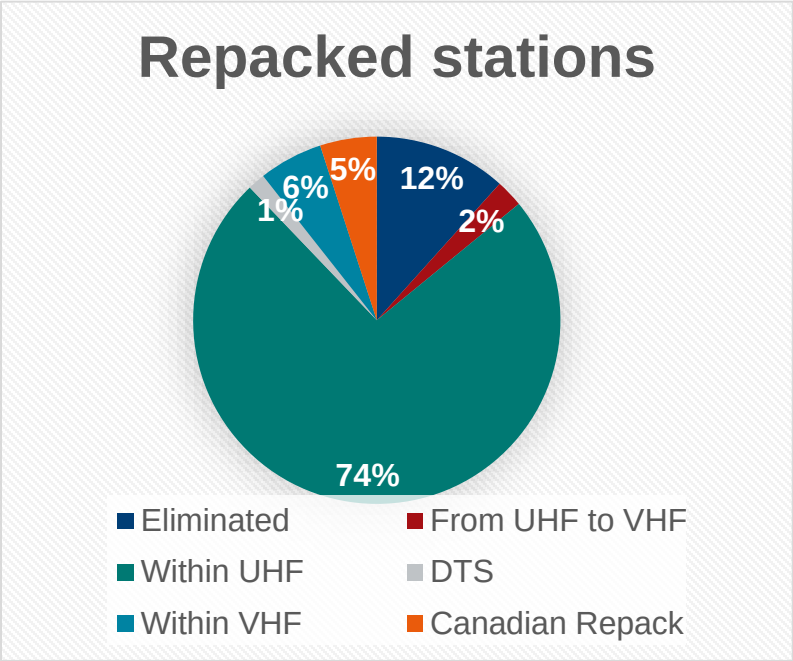
- Commercial stations: up to 80% of estimated costs
- Noncommercial stations: up to 90% of estimated costs

- Upgrades not covered
  - IOT vs Solid state
  - H-Pol to E-Pol
  - Transmission headroom limited
  - Stations indirectly impacted (FM and Canada)

REPACK RESULTS

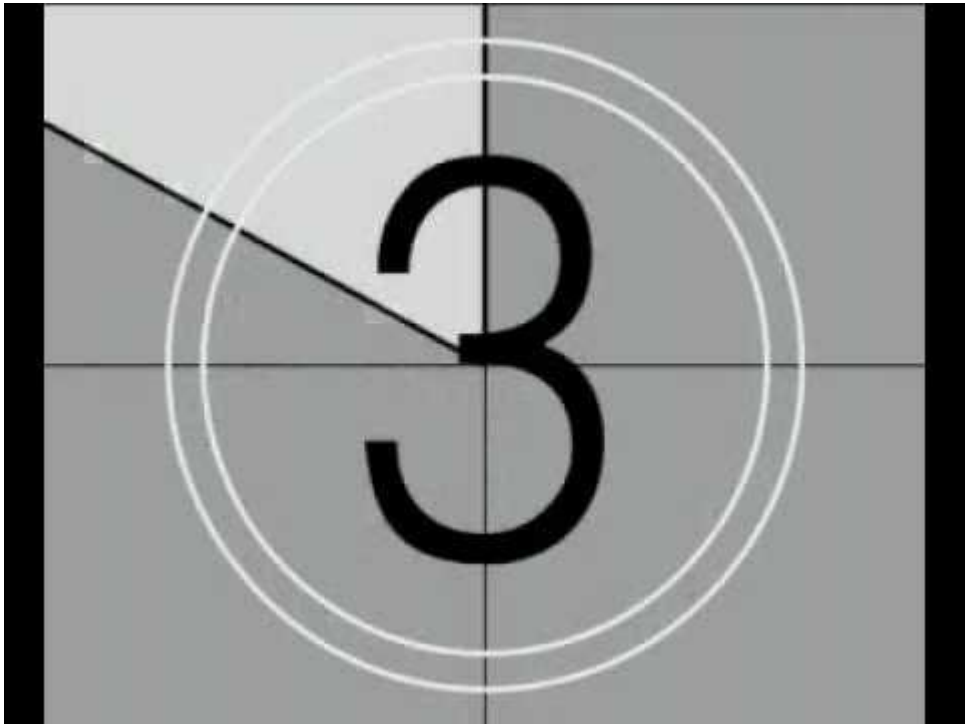
- Spectrum cleared during auction 84 MHz (prev. CH 38 – 51)
- Total Repacked station: over 1,000
- **Only 39 months!!!**



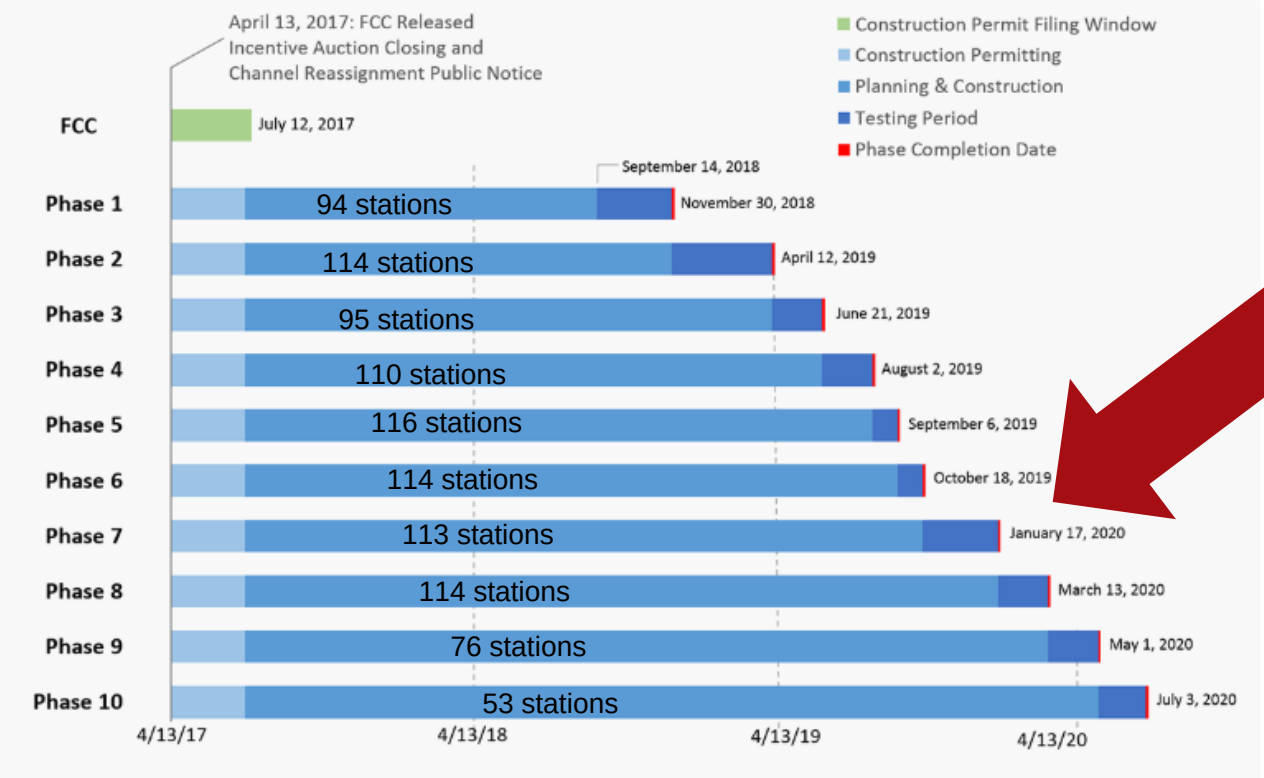


- TV services from CH 2 to CH 6, CH 7 to 13 and CH 14 to CH 36 (up to 608 MHz)
- Wireless spectrum channelized into 5 MHz pairs

REPACK TIMELINE



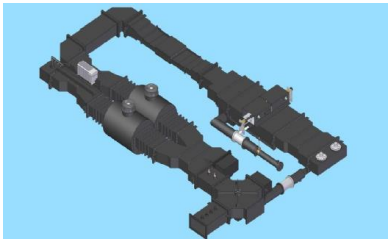
TRANSITION SCHEDULE



WHAT'S CHANGING

Yesterday

Transmitters



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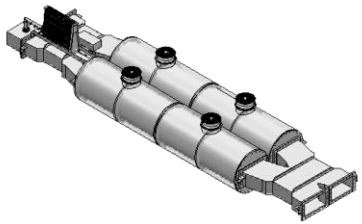


Combiner

T/L and Antenna

Size?
Wind Load?
Weight?
Gain?

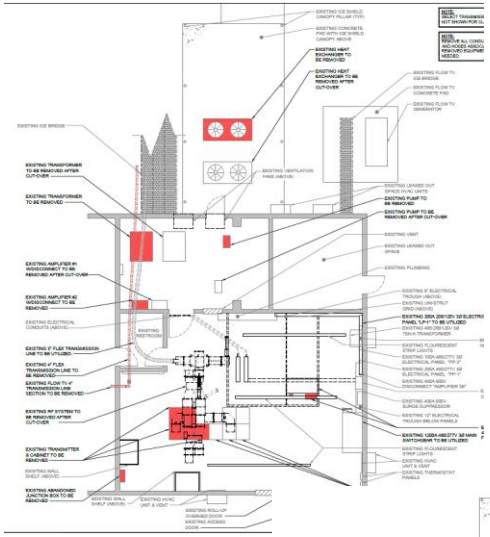
TODAY

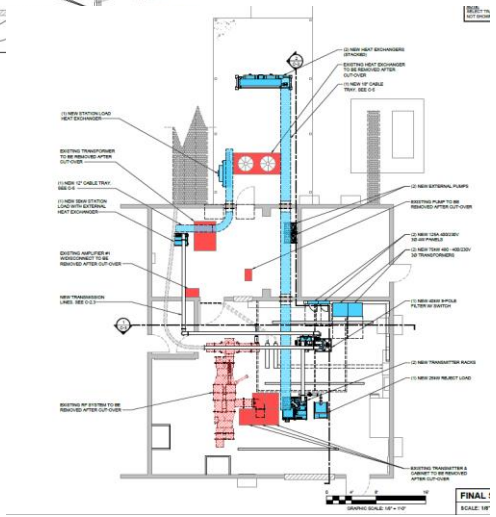
TRANSMITTERS HAVE CHANGED

- IOT technology replaced by Solid State
  - High efficiency up to 43%
  - Lower maintenance cost
  - No single point of failure
- Several manufacturers are not around anymore
- Old transmitter were not frequency agile
- Lack of support for older models
- Higher power density per cabinet

TRANSITION SCENARIO 1

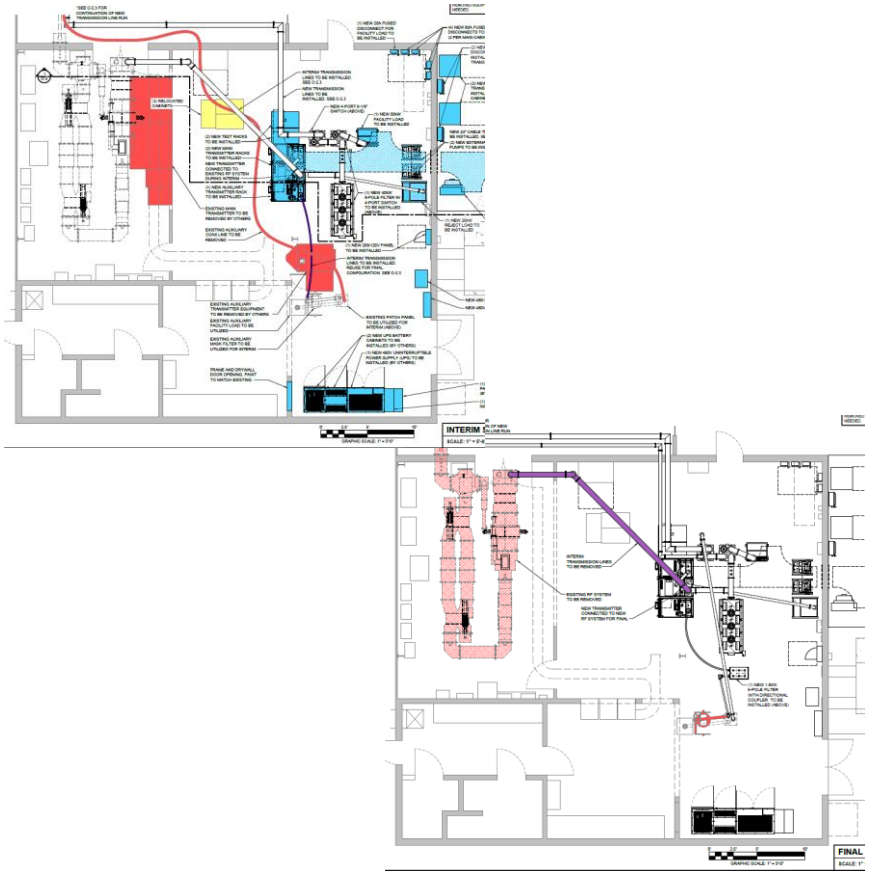
- Install Aux Antenna for existing channel
- Transition current CH to Aux Antenna
- Remove former Main CH Antenna
- Install new Antenna
- Install new Transmitter and RF system
- Test phase
- Commence operation at Full power on new CH
- Remove old Transmitter
  - If possible, retune as backup





TRANSITION SCENARIO 2

- Install Aux Antenna for new channel
- Install new Transmitter
- Install new RF system
- Transition to new channel
- Remove legacy main channel Antenna
- Install new main channel Antenna
- Commence operation at full power
- Remove old Transmitter
  - If possible, retune as backup



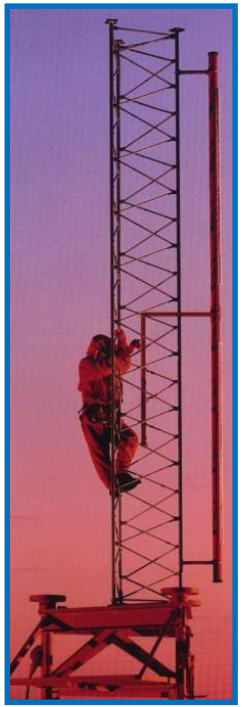
A WORLD FULL OF UNKNOWNS: WHAT IF…

- Share a tower
- Stacked tower top antennas
- Share a Combiner
- Operate on a shared antenna and transmission line
- FM stations on shared tower with TV
- An increased number of CH 14 scenarios
  - Larger Real Estate required
  - Longer install time

- Weather
- Family / personal emergency
- …

IMPACT ON INDUSTRY PROFESSIONALS

- Broadcast industry has not seen a demand and a volume like this before at this pace
- Not enough qualified people available with this timeline.
  - Broadcasters still demand for the highest quality
- Professionals scarcity include:
  - Consulting engineers
  - Structural analysis
  - Transmitter installers
  - Tower crews



MEETING DEADLINES BUT…

- Filing Special Temporary Authorization
- Going into the aux at reduced power
- Return trip will be required to complete installation and go full power
- Filed for Single extension up to 180 days when Unable to construct on time

- Even when Spectrum is clear, Repack might not be over yet for Broadcasters

PREPARING FOR ATSC 3.0

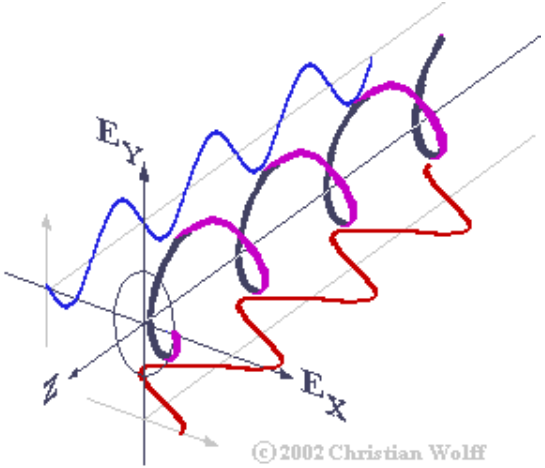
- Plan, Plan, Plan

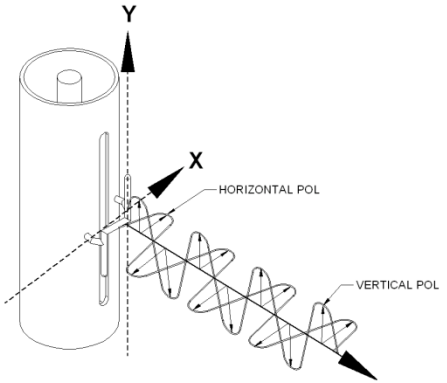
- Broadcasters are serious about adopting ATSC 3.0 and are taking steps NOW

- New Physical layer (OFDM) with unlimited potential
  - Boost your coverage
  - Target new audience (Mobile, Smartphone, Tablet)
- New Business models
- Improve public service capability (AWARN)

ATSC 3.0 ANTENNA CONSIDERATION

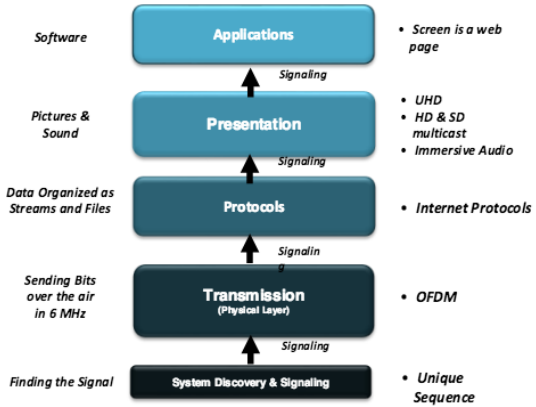
- Add V-Pol for Mobile reception
  - Aka Elliptical, Circular
- Single Frequency Network (SFN) Topology

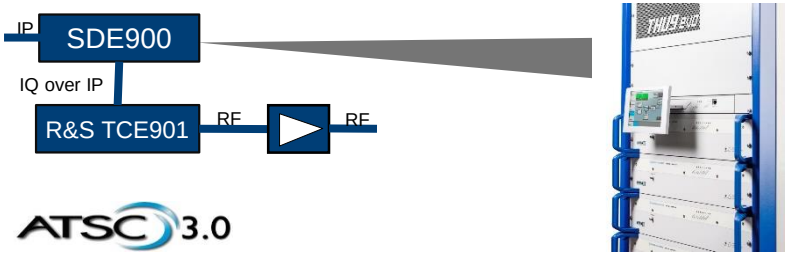




ATSC 3.0 TRANSMITTER CONSIDERATIONS

- If adding V-Pol to the Antenna, will the transmitter have sufficient TPO?
- Adding 30% V-Pol can increase Transmitter TPO requirement over 40%
- ATSC 3.0 is OFDM, higher PAPR, this will reflect in different Transmitter Nominal power
- You are doing the big project now, why do it twice?





CONCLUSION

- Repack is currently clearing up spectrum for Phase 7
- Phase 10 will conclude in June 2020
- Technology has come a long way in the last 10 years bringing benefits to Broadcasters
- Limited qualified resources available are making difficult to stay on track
- ATSC 3.0 is around the corner…

…and the Industry is excited about it