

# ATSC 3.0 and Wireless Emergency Alerting – a Great Match

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**Abstract** – When disasters strike, it is imperative that lines of communication remain open so that the public can receive important and potentially lifesaving updates from authorized authorities. For television and radio broadcasters this information has been provided by Emergency Alert System (EAS) announcements and through newscasts and weather alerts. Wireless Emergency Alerts (WEA) were developed to deliver similar announcements to the public via cellular networks if they are within the targeted area. But what happens if cellular service is compromised due to disaster? In 2017 the Federal Communications adopted a new, voluntary television broadcast standard developed by the Advanced Television Systems Committee (ATSC), a standard development organization. The new standard, ATSC 3.0 (also known as NEXTGEN TV), is built on a robust over-the-air broadcast platform and utilizes an Internet Protocol core.<sup>1</sup> Could ATSC 3.0 be a solution during widespread outages to deliver critical messages to mobile devices? This paper explores this issue and will describe a tested solution.

## Background

Wireless Emergency Alerts provide critical information to the public directly to mobile devices. They were created as a result of “The Warning, Alert and Response Network (WARN) Act” in 2008. WEAs were launched in 2012.<sup>2</sup>

The Department of Homeland Security defines Wireless Emergency Alerts as “*short emergency alerts authorities can send to any WEA-enabled mobile device in a locally targeted area. Alerting Authorities who are authorized to send WEAs include state, local, tribal, and territorial public safety officials, the National Weather Service, the National Center for Missing and Exploited Children and the President of the United States.*”<sup>3</sup>

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<sup>1</sup> <https://www.atsc.org/nextgen-tv/>

<sup>2</sup> <https://www.fcc.gov/consumers/guides/wireless-emergency-alerts-wea>

<sup>3</sup> <https://www.fcc.gov/consumers/guides/wireless-emergency-alerts-wea#:~:text=Not%20all%20wireless%20service%20providers,all%2C%20of%20their%20service%20areas.>

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WEAs are part of an alerting ecosystem that utilizes the Integrated Public Alert and Warning System (IPAWS)<sup>4</sup> for delivery of emergency messages. IPAWS acts as the aggregator and connector of messages from various authorities to broadcasters, cellular providers, National Oceanic and Atmospheric Administration (NOAA) weather radio transmitters, and other methods of delivery to the public. All use the Common Alerting Protocol (CAP)<sup>5</sup> to deliver messages in a well-defined manner.

In North Carolina four authorities are authorized to generate emergency messages into IPAWS for delivery to the public. Those authorities are the National Weather Service, the North Carolina State Highway Patrol, the North Carolina Center for Missing Persons, and North Carolina Emergency Management, a division of the North Carolina Department of Public Safety.

While many cellular providers have the ability to send these Wireless Emergency Alerts, not all do. Furthermore, because mobile device users may opt “in” or “out” of these messages, this critical information is not always able to be relayed to the public in a consistent manner.

## State, Territorial, Tribal, Local - Level

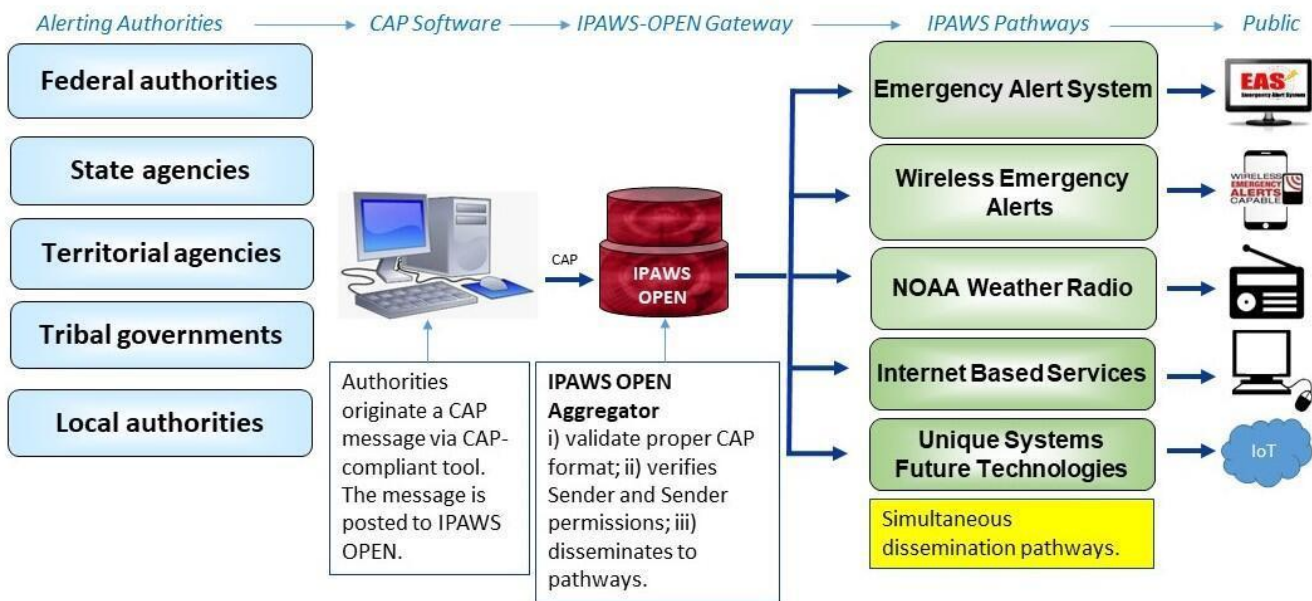


FIGURE 1: FEMA/IPAWS INFOGRAPHIC<sup>6</sup>

Utilizing existing infrastructure, America’s public television stations established a nationwide broadcast data backbone network for WEA. This network was initiated by Congress via the “WARN” Act and funded by the Department of Commerce’s NTIA<sup>7</sup> to provide a backup dissemination method of Wireless Emergency Alerts (WEAs) should IPAWS connection to cellular providers ever be interrupted.<sup>8</sup> PBS

<sup>4</sup> <https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system>

<sup>5</sup> [https://www.fema.gov/fact-sheet/common-alerting-protocol-cap-implementation#:~:text=The%20Common%20Alerting%20Protocol%20\(CAP,Structured%20Information%20Standards%20\(OASIS\).](https://www.fema.gov/fact-sheet/common-alerting-protocol-cap-implementation#:~:text=The%20Common%20Alerting%20Protocol%20(CAP,Structured%20Information%20Standards%20(OASIS).)

<sup>6</sup> [https://www.fema.gov/sites/default/files/2020-11/fema\\_ipaws-infographic\\_photo\\_11-17-2020.jpg](https://www.fema.gov/sites/default/files/2020-11/fema_ipaws-infographic_photo_11-17-2020.jpg)

<sup>7</sup> <https://www.pbs.org/about/about-pbs/contact-information/warn/>

<sup>8</sup> <https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/public/wireless-emergency-alerts>

North Carolina, along with all other Public Broadcasting System television stations participate in this effort to ensure uninterrupted distribution of geo-targeted WEA messages to participating cellular providers. It should be noted that this service does not directly connect to consumer mobile devices.

## What is PBS WARN?

- PBS uses its nationwide broadcast infrastructure to provide an alternate path for WEAs to reach mobile carriers.
- Every PBS station participates (FCC required)
- **Each of your transmitters broadcast 9,000 alerts last year!**

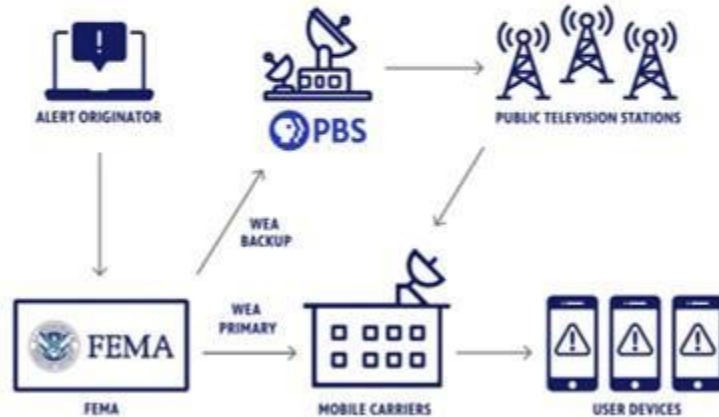


FIGURE 2: PBS WARN SYSTEM

## WEA Failures

Wildfires, earthquakes, severe weather events, and other types of disasters can all have debilitating effects on cellular communications. And, with the very recent nationwide outage of a major cellular provider, non-natural disaster events can cause significant disruptions.

In September 2007, the Federal Communications Committee (FCC) established the Disaster Information Reporting System (DIRS) in response to communication failures caused by Hurricane Katrina. DIRS enables communications providers, including broadcasters and cellular providers, a means of self-reporting the status of their systems during and after these events.<sup>9</sup>

One of the deadliest wildfires that caused massive disruptions of cellular communications was the Paradise, California “Camp Fire” in November 2018<sup>10</sup> which resulted in over 80 fatalities and caused an estimated \$422B in damage. Cellular coverage was quickly and greatly compromised and thousands of users never received critical WEA messages.<sup>11</sup>

<sup>9</sup> <https://www.fcc.gov/general/disaster-information-reporting-system-dirs-0>

<sup>10</sup> <https://www.fire.ca.gov/our-impact/remembers-the-camp-fire#:~:text=It%20covered%20an%20area%20of,about%2095%25%20of%20their%20structures>

<sup>11</sup> Government Technology, Industry Insider, Tribune News Service, San Jose Mercury News, 12/16/2018 - <https://insider.govtech.com/california/news/camp-fire-aftermath-technology-the-thing-i-trust-most-failed.html>

The 2023 wildfire in Maui, Hawaii, is another heartbreaking example of how natural disasters can disrupt cellular service and prevent the public from accessing WEAs and other critical lifelines to emergency services.<sup>12</sup> Within a few days, all cellular service was lost in 6 cities in Maui due to the fires.

Mass cellular outages are not just caused by wildfires; severe weather events can cause significant failures as well. In North Carolina, the most recent, widespread disaster was Hurricane Florence in September 2018. This storm ravaged the coasts of North and South Carolina, caused 26 storm-related fatalities and over \$24B in damages.<sup>13</sup>

During Hurricane Florence, 49 North Carolina counties representing a total population of over 5.8 million<sup>14</sup> reported that 1063 cellular communication sites failed out of a total of approximately 5800, or 18.4 %. It took several days to reduce the number of failed sites to under 5%.<sup>15</sup> Television broadcasters were not immune to the effects of Hurricane Florence, and some suffered outages. PBS North Carolina, with emergency power systems designed to respond to such conditions, stayed fully operational during the entirety of the storm and its aftermath. With fewer towers to “defend” and strict design, construction and maintenance efforts, tall broadcast towers are a beacon of information during difficult times.

In response to the 2023 Maui wildfires and the failure of the WEA messaging system due to cellular infrastructure loss, the FCC issued a request: “FCC Seeks Partners to Test WEA Delivery Without Cell Towers.”<sup>16</sup> PBS North Carolina and business partners Device Solutions Inc, and Digital Alert Systems, responded to this request showing the capabilities of ATSC 3.0, also known as “NEXTGEN TV,” to deliver WEA messages to mobile and other consumer devices via robust television broadcast.<sup>17</sup> This paper delves into the proposed solution.

## **ATSC 3.0 Solution for delivering Wireless Emergency Alerts**

ATSC 3.0 is the next generation of terrestrial television broadcasting. Developed by the Advanced Television System Committee,<sup>18</sup> it offers a wide range of improvements for the delivery of over-the-air broadcasts to a large area via “High Power/High Tower” transmission. It is being deployed across the United States, as well as South Korea and Jamaica. Other countries are also considering its adoption.

ATSC 3.0, with its Internet Protocol backbone, allows for the provision of not only television broadcast streams but also data streams in a robust, efficient manner. PBS North Carolina has launched two ATSC 3.0 broadcast facilities and is planning to transition the rest of the network in the next five years.

This technology is the basis for PBS North Carolina’s effort to develop a notification system that replaces existing analog voice paging technology with a digital paging system, thereby reducing the

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<sup>12</sup> <https://docs.fcc.gov/public/attachments/DOC-396351A1.pdf>

<sup>13</sup> Allen, Jennifer, CoastalReview.org, 09/22/2020, - <https://coastalreview.org/2020/09/florences-financial-toll-clearer-two-years-on/#:~:text=Damage%20losses%20in%20North%20Carolina,surge%20flooding%20totalled%20%2422%20billion>

<sup>14</sup> <https://www.osbm.nc.gov/facts-figures/population-demographics/state-demographer/county-population-estimates/certified-county-population-estimates>

<sup>15</sup> <https://www.fcc.gov/florence>

<sup>16</sup> <https://www.fcc.gov/document/fcc-seeks-partners-test-wea-delivery-without-cell-towers>

<sup>17</sup> <https://www.pbsnc.org/bento-api/filer-file-download/339031/>

<sup>18</sup> <https://www.atsc.org/nextgen-tv/>

time required to deliver information to and dispatch first responders. Work on this effort is available at the PBSNC.org/NextGen-TV webpage.<sup>19</sup>

## NEXTGEN TV // PBS NC NEXTGEN TV Deployments

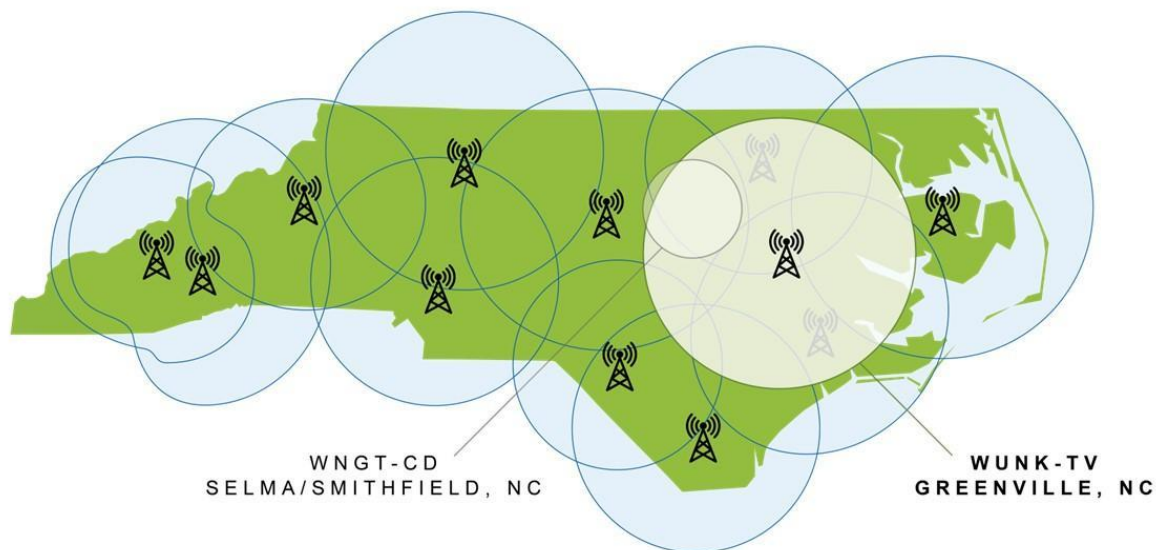


FIGURE 3: PBS WARN SYSTEM

PBS North Carolina believes that the technology developed for the paging effort could easily be adapted to deliver WEA's. Through a Department of Homeland Security (DHS) Small Business Innovation Research (SBIR) Phase II grant (PIID: 70RSAT21C0000018) titled "Emergency Digital Pager over Public Television (eDPPT)," Device Solutions (together with partners PBS North Carolina and Triveni Digital) successfully demonstrated ATSC 3.0's emergency alert and public safety datacasting capability by using standard protocols to develop and optimize a public safety digital paging prototype system operating over public television ATSC 3.0 transmissions.

Through this work, we demonstrated that ATSC 3.0 broadcasts are a reliable transmission means to deliver emergency dispatch information over a large area with superior coverage, penetration, and reduced latency.

For additional information on the eDPPT project, refer to the White Paper "ATSC 3.0 as a Use Case for Public Safety Communications – Development Milestones."<sup>20</sup> A video overview of the project is available at <https://youtu.be/pBM4ATF3xfQ>.<sup>21</sup>

See diagram below.

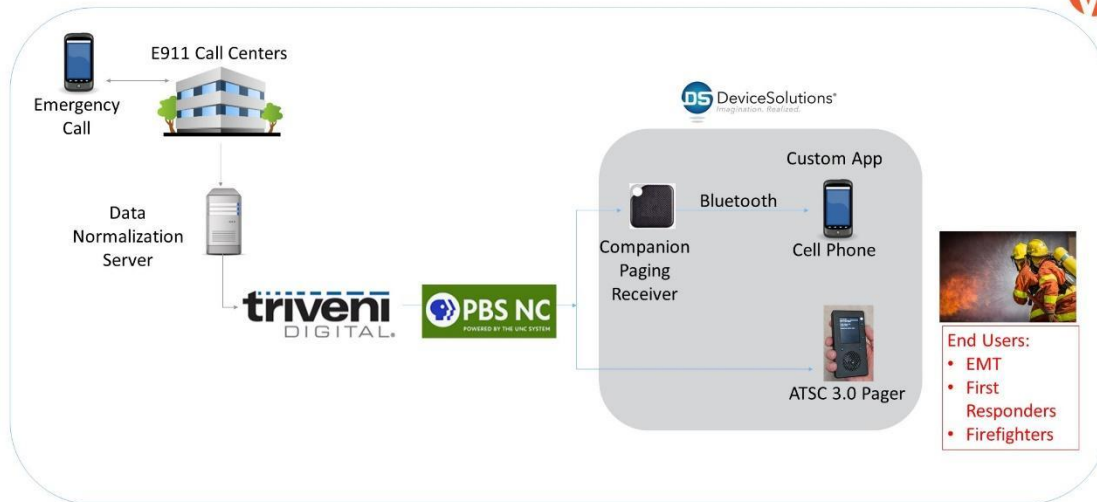
<sup>19</sup> <https://www.pbsnc.org/nextgen-tv/>

<sup>20</sup> [https://bento.pbs.org/prod/filer\\_public/pbsnc-redesign-phase-1/services/next-gen-tv/c7722a68ff\\_2022-BEIT-Conference-Proceedings-Paper-PBS-North-Carolina.pdf](https://bento.pbs.org/prod/filer_public/pbsnc-redesign-phase-1/services/next-gen-tv/c7722a68ff_2022-BEIT-Conference-Proceedings-Paper-PBS-North-Carolina.pdf)

<sup>21</sup> PBS North Carolina. (2023, March 8). NEXTGEN TV and PBS North Carolina: Improving emergency services response time [Video]. YouTube. <https://www.youtube.com/watch?v=pBM4ATF3xfQ>



## An End-to-End Solution with ATSC 3.0



*Emergency Digital Paging over ATSC 3.0 Eco-System*

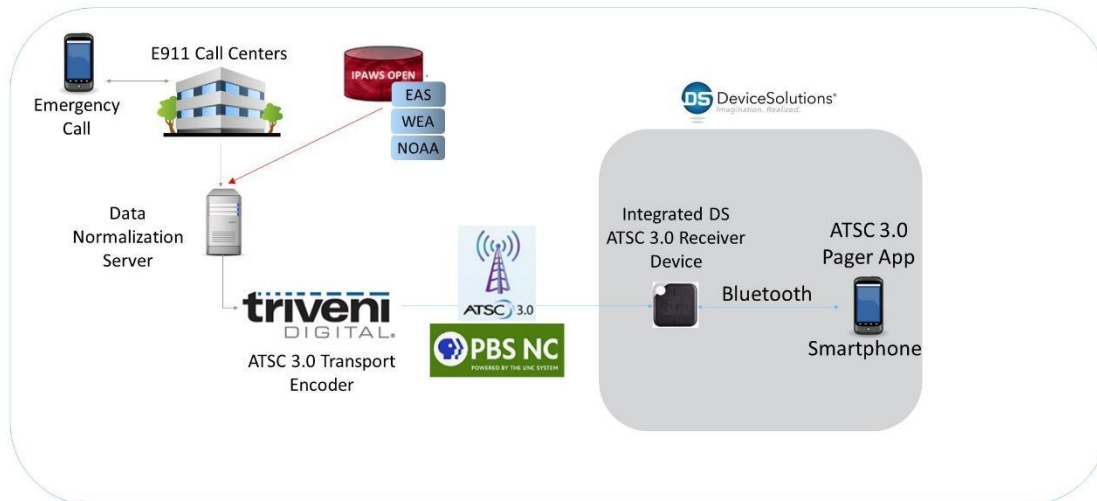
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<http://www.device-solutions.com/>



FIGURE 4: DIGITAL PAGING OVER ATSC 3.0

The system architecture deployed in the prototype deliverable is extendible to support the input of WEA / EAS / IPAWS Open managed messaging. The diagram below shows the WEA messages as an input to the ATSC 3.0 data path.

## Wireless Emergency Alerts (WEA) over ATSC 3.0



*Public Safety Datacasting Use Cases Over ATSC 3.0*

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FIGURE 5: WEA OVER ATSC 3.0 BASIC SYSTEM DIAGRAM

Wireless Emergency Alerts, aggregated by the Digital Alert Systems DASDEC emergency message platform are sent to the ATSC 3.0 broadcast infrastructure (Transport Encoder) for reception by ATSC 3.0 receivers – either standalone, mobile devices, set-top boxes or integrated with another device (e.g., smartphone) to take advantage of native smartphone applications (e.g., positioning, uplink data) to augment the WEA data (e.g., images, maps, evacuation routes, etc.).

## » IPAWS OPEN / WEA support (Examples)

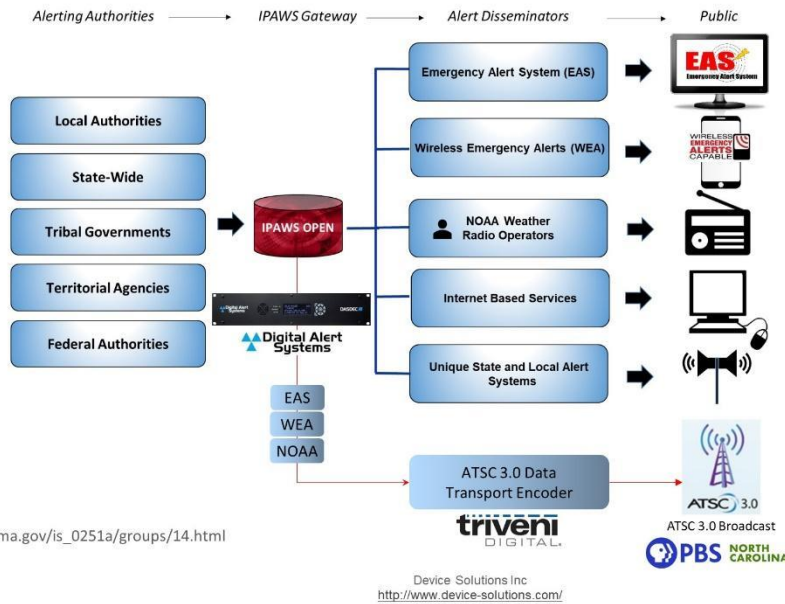


FIGURE 6: WEA OVER ATSC 3.0 SYSTEM DIAGRAM

## Additional Capabilities for Enhanced WEA Preparedness Over ATSC 3.0

The ATSC 3.0 broadcast could augment the WEA message with additional information provided by authorized authorities to be received and displayed on the mobile device. PBS North Carolina, working in concert with North Carolina Emergency Management, is exploring the use of existing, enhanced mapping data to provide the public instructions for safe evacuation routes and the location of critical resources. Utilizing the mobile devices internal GPS capability the location of the mobile user would be overlaid on top of the mapping information sent in parallel with the WEA data. PBS North Carolina anticipates many states and municipalities have similar mapping information.

## Conclusion

Building on the successful delivery of the DHS Phase II eDPPT working prototype solution for the first responder paging effort over ATSC 3.0, PBS North Carolina, in partnership with Device Solutions Inc, Triveni Digital, and Digital Alert Systems, we believe WEA alerts can be successfully delivered to cellular devices over an ATSC 3.0 transmission via a portable, companion ATSC 3.0 receiver device via wireless connectivity. The ATSC 3.0 receivers can be low-cost, low-power consumption and suitable for integration into NOAA weather radios, smart speakers, automobile infotainment systems and other devices.

During the emergency paging field trials, propagation models for analyzing ATSC 3.0 coverage were generated for three ATSC 3.0 transmitters and coverage maps incorporating transmitter data from the three targeted geographic locations were developed. This data was used to model and estimate coverage areas, identify areas with coverage impediments, and establish drive routes. The live testing results show good correlation with the field measurements and predict excellent ATSC 3.0 coverage for public safety. For example, the PBS North Carolina ATSC 3.0 WUNK broadcast tower covering much of the eastern coast performed well beyond the expected modeling.

Consumers are better served by WEA alerts being available at low cost (device and infrastructure), on more devices, and with more reliable up-time, and improved coverage and penetration.

PBS North Carolina, the North Carolina Department of Public Safety and business partners Device Solutions Inc, Triveni Digital, and Digital Alert Systems, utilizing ATSC 3.0 broadcast technology, offer a potential solution for this vexing problem.

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