Department of Homeland Security

Federal Emergency Management Agency

DEMONSTRATION REPORT AND RBDS PRODUCT SPECIFICATION

For

Integrated Public Alert and Warning System (IPAWS) Radio Broadcast Data System (RBDS) Study

HSFEMW-09-F-0538

September 29, 2010

Prepared For:

The Federal Emergency Management Agency
National Continuity Programs
500 C. Street, SW, Room 529
Washington, DC 20472

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DEMONSTRATION REPORT AND RBDS PRODUCT SPECIFICATION FOR INTEGRATED PUBLIC ALERT AND WARNING SYSTEM (IPAWS) RADIO BROADCAST DATA SYSTEM (RBDS) STUDY

1.0 INTRODUCTION

Northrop Grumman Corporation (NGC) has prepared this *Demonstration Report and RBDS Product Specification* to support the Performance Work Statement (PWS), under Contract Number GS23F0058K, Order Number HSFEMW-09-F-0538, and Requisition W456782Y. Under this contract, NGC assists the National Continuity Programs (NCP), Federal Emergency Management Agency (hereinafter referred to as FEMA) of the Department of Homeland Security (DHS) to support development of the Integrated Public Alert and Warning System (IPAWS) through the demonstration of Radio Broadcast Data System (RBDS) technical capabilities.

This *report* complies with the requirements outlined in the Statement of Work (SOW), and addresses a period of performance that began on September 30, 2009, and concludes on September 29, 2010.

1.1 EXECUTIVE SUMMARY

FEMA serves as the White House's Executive Agent for nationwide systems including the National-level Emergency Alert System (EAS). In FEMA's role as Program Manager for DHS IPAWS, FEMA is charged with managing large complex systems involving multiple layers of coordination at the local, state, and federal levels to improve the nation's alert and warning capabilities. IPAWS and other contingency programs are designed to provide Americans with critical and timely hazard alerts and warning information that saves lives and property during emergencies and natural disasters.

RBDS technologies have already been employed to distribute digital alert messages through FM radio stations. To improve the speed and penetration of Federal, State, and Local emergency alerts and warnings, FEMA is evaluating this innovative method to increase the efficiency and effectiveness of the alerts and warnings distribution infrastructure. This study validates the usefulness of existing RBDS technologies to deliver notification to individuals during emergencies.

The objectives for this study are detailed here from the contractual statement of work and include:

- Validating the benefits of an RBDS. (refer to Section 2.3)
- Understanding the RBDS capability and how it may integrate into IPAWS. (refer to Section 3.1)
- Testing and assessing the quality of the RBDS. (refer to Section 2.3)

- Identifying the plan for a potential implementation. (refer to section 3.3)

By meeting these objectives, the IPAWS Program Management Office will validate the usefulness of the existing RBDS technologies in delivering notifications to individuals during emergencies.

1.1.1 Context of RBDS Study

RBDS technologies are currently in use by many FM broadcast stations, providing services in addition to their main broadcast content. These services utilize subsidiary carriers, frequencies which are combined with and broadcast with their normal audio programming. The most commonly encountered subcarrier is the 57 kHz RBDS signal, which often conveys the station call letters, slogan, and/or artist and title information displayed by many FM receivers. The North American RBDS standard was introduced in 1993 and was based in part upon the pre-existing European Radio Data Standard (RDS).

This study capitalized on the existing RBDS installations by requesting information and data from the current RBDS vendors to create a RBDS Market Survey[1]. The results of the Market Survey along with the objectives of the study refined the scenarios that were demonstrated. Three scenarios were created that mirrored two of the three critical scenarios in the IPAWS Test and Evaluation Master Plan (TEMP). The third scenario was a Campus Security Incident which replaced the IPAWS TEMP terrorist attack critical scenario one.

Three vendor systems were chosen for the study and their equipment was deployed for a three month operational period. During this operational period, the systems were used by the emergency managers for real-world notifications as well as specific witnessed scenario demonstrations. Vendors involved in this study implemented RBDS technology to solve two different problem sets. Two vendor systems solve alerting the public in an enterprise environment. Their receivers are wall receivers installed in locations where a large population is expected, much like an enhanced fire alarm system. In this report we refer to these as Enterprise style systems. One vendor system focuses on personal alerting. While this vendor also has wall units located in public places similarly to the Enterprise style system, their focus is on desktop/mobile receivers that are designed to be mobile and carried by a single user. In this report we refer to these as Personal style systems.

Feedback on the systems (refer to Section 2.3) was received from the “users” of the systems including the Emergency Managers who originated the notifications, the FM Broadcasters who provided the broadcast infrastructure, and the public alert recipients who received the alert notifications. This feedback, as well as technical data collected during the demonstration period, was analyzed to evaluate the benefits and test the quality of RBDS technology against FEMA’s Key Performance Parameters (KPPs) and Additional Performance Factors (APFs). Based on the analysis, strengths and areas for improvement were identified for each KPP and APF.

Analysis of the current but not finalized IPAWS architecture was performed to determine if and how the RBDS technology may become one of the system-of-systems. The analysis provided recommendations and considerations for the necessary changes and standards to allow for RBDS technology insertion into IPAWS (refer to section 3.1).

[1] Market Survey for Integrated Public Alert and Warning System (IPAWS) Radio Broadcast Data System (RBDS) Study, December 14, 2009

The following sections detail the major strengths and areas for improvement for RBDS technology identified as a result of the study and provide a product specification for RBDS technology which describes how it may integrate with the IPAWS architecture, along with a plan for potential implementation.

1.1.2 Major Strengths and Areas for Improvement

Local and State Emergency managers are relying on Enterprise and Personal style RBDS technology to provide the necessary emergency alerting communications to millions across several states and enterprises. Through demonstrations, responses to real-world events, and analysis conducted during this study, this technology has proven to be a viable technology for public alerting and warning. Evaluation of RBDS technology against FEMA's KPPs and APFs (Table 1) validates its effectiveness as a mechanism for public alert and warning. While the following paragraphs summarize the KPPs and APFs results, full details can be found in Sections 2.3.2 and 2.3.3.

Table 1. KPPs/APFs Strengths and Areas for Improvement

Activity Identifier	Strengths	Areas for Improvement
Resilient **KPP.1**	Backup transmitters, backup generators, overlapping FM coverage, and remote origination reduce likelihood of loss of alerting capability and increase likelihood of rapid restoration of capability	Expanded monitoring of FM RBDS signal to more rapidly identify and respond to outages
Secure **KPP.2**	Secure portal logins, viewable target groups based upon privileges, 128-bit encryption from FM tower to receiver	None identified
Language-Targeted **KPP.3**	Minority language alerts sent and received, ADA recipients received and understood alerts	Timely, accurate translation of alert messages, character set availability at receivers, enhanced use of symbology
Geo-Targeted **KPP.4**	Stationary receivers are easily programmed for current location	Mobile receivers cannot automatically receive alerts based upon actual current location
Availability **KPP.5**	Observed availability >99% during 3 month demonstration period, successful performance in response to real-world events	Eliminate single points of failure such as satellite transmission
Interoperability **KPP.6**	Demonstrated Common Alerting Protocol (CAP) initiated alerts and automatic imminent threat weather alerts	Cross-vendor reception of alerts
Simplicity **APF.1.1**	Alert Origination is streamlined. Receivers are simple to operate	None identified
Understandable **APF.1.2**	>92% of recipients in all, English as a Second Language (ESL), and Americans with Disabilities Act (ADA) communities understood message, >70% of recipients in all, ESL, and ADA communities identified correct action, messages up to 240 characters allow for more information to be conveyed	None identified
Economical **APF.1.3**	Minimal use of the existing allocated spectrum, low financial burden for broadcaster	None identified
Relationships **APF.1.4**	Originator satisfaction with vendors, broadcaster support for vendors, current RBDS options developed to support customer needs	None identified

Activity Identifier	Strengths	Areas for Improvement
Standards **APF.1.5**	CAP Initiated Alerts, no degradation to broadcaster's signal, product conformance to RBDS standard	None identified
Local Laws **APF.1.6**	No Federal Communications Commission (FCC) license required, meets National Fire Protection Association (NFPA) 72 In-Building Mass Notification System Requirements	None identified
Distribution **APF.2.1**	One-to-Many distribution allows expansion of target population without loss of distribution speed, successful targeting of ESL and ADA communities, message delivery in minutes provides timely alerting to imminent threats	None identified
Coverage **APF.2.2**	Understandable messages delivered over wide area	None identified
Addressability **APF.2.3**	Alert origination to groups, group selection at the receivers	None identified
Geo-Targeting **APF.2.4**	Weather alerts automatically targeted to specified areas	None identified
Environment **APF.3.1**	Successful outdoor reception while mobile, including on water	Indoor signal quality may be limited by structural and environmental factors
Maintainability **APF.4.1**	Low maintenance for broadcasters, originators, and receivers	None identified
Lifecycle **APF.4.2**	No costs per subscriber, no costs per alert issued, minimal hardware replacement	None identified
Power **APF.4.3**	Mobile receivers battery-powered for months, stationary receivers battery-powered days to months	None identified

RBDS technology is resilient because multiple broadcasters providing overlapping FM coverage and individual broadcaster backup transmitters and generators ensure rapid recovery from an all-hazard event. Resilience can be enhanced by expansion of the demonstrated FM RBDS signal monitoring capability since this will allow signal outages to be more rapidly identified and targeted for restoration.

RBDS technology is secured at the origination point and in the broadcasted signal to prevent the unauthorized dissemination of emergency alerts. Secure logins with assigned privileges prevent originators from issuing emergency alerts to jurisdictions outside of their authority, and 128-bit encryption is applied to the transmitted message to prevent unauthorized alerts from activating the RBDS receivers.

Minority languages were supported by the RBDS technology during the demonstrations. The technology is challenging for Alert Originators to create an accurate translation of the alert messages within a timely manner, and for alert receivers to have the necessary character sets to display the received messages. A technology enhancement would include the use of symbology to represent the emergency and the action to be taken.

Geographical targeting was successfully demonstrated by the RBDS technology with a granularity of buildings and floors for the Enterprise Style systems and a granularity of specific individuals, specific work locations, and specific counties for the Personal style systems. The technology works exceptionally well for stationary receivers. Mobile receivers could be manually configured to activate based upon geographical targeting and activated when these geographically targeted messages were issued. A technology enhancement to the mobile receiver would allow emergency alerts to be received automatically based upon the current geographical location of the receiver.

The RBDS technology demonstrated an availability that was greater than 99% for the operational period. Single points of failure were detected, however, including a single broadcaster providing coverage to targeted recipients and a single distribution path from the RBDS systems to the broadcast tower. Eliminating these single points of failure would increase the availability of the system to deliver time critical emergency alerts.

The RBDS technology recognizes the importance of interoperability for the origination of messages. CAP v1.1 messages were successfully consumed by the RBDS technology, which initiated the generation of an understandable emergency alert message to the alert recipients. The technology would benefit from the development of a common transmission protocol that would allow cross-vendor reception of emergency alert messages.

RBDS vendors have a strong relationship with their served user community. They have developed systems to meet the needs of their served community and have built their systems to be easy to use, economical to broadcasters, and compliant with standards and local laws.

The RBDS technology is able to deliver messages in a one-to-many relationship across a large geographic area within minutes with no known network limitations. Because of this capability, the alert recipient population can grow with no effect on the overall dissemination time to alert recipients.

The RBDS technology was observed and demonstrated operating under a variety of conditions: while stationary, while mobile, while using backup power, and in environments including outdoors, on the water, and indoors. Signal quality was reduced in some areas due to structural and environmental factors. Mobile receivers demonstrated the ability to operate on battery power for over two months.

The RBDS technology has minimal lifecycle costs. Alert originators incurred no per message fees and alert recipients incurred no subscription or registration fees for the service.

Additional observations (Section 2.3.4) related to the RBDS technology were made during the study which were not directly related to the evaluation against the KPPs and APFs. For instance, a Consumer Electronics Association (CEA) Technology and Standards Working Group R5WG16 has been preparing a document titled “Best Practices for Implementing Common Alerting Protocol (CAP) based Alerts for Consumer Electronic Devices”, which is identifying ways to extend RBDS technology to more consumer devices while maintaining conformance to CAP. Another observation details the activities of two RBDS vendors, where one vendor is testing the ability of receivers to operate on another vendor’s RBDS signal. This activity is directed toward improving cross-vendor interoperability.

1.1.3 RBDS PRODUCT SPECIFICATION SUMMARY

The RBDS Product Specification (Section 3.0) consists of three main areas of discussion: possible RBDS technology insertion into the IPAWS architecture (Section 3.1), proposed functional requirements for the use of RBDS as a public alert and warning system (Section 3.2), and a potential high-level implementation plan for the insertion of RBDS into IPAWS (Section 3.3). Each of these areas is summarized in the following paragraphs.

The main role of RBDS within the current IPAWS architecture is as a message disseminator for State and Local Unique alerting systems (Figure 1). The state and local emergency managers create alerts for their jurisdictions as well as receive messages from multiple external governmental sources and forward the messages on through their RBDS system.

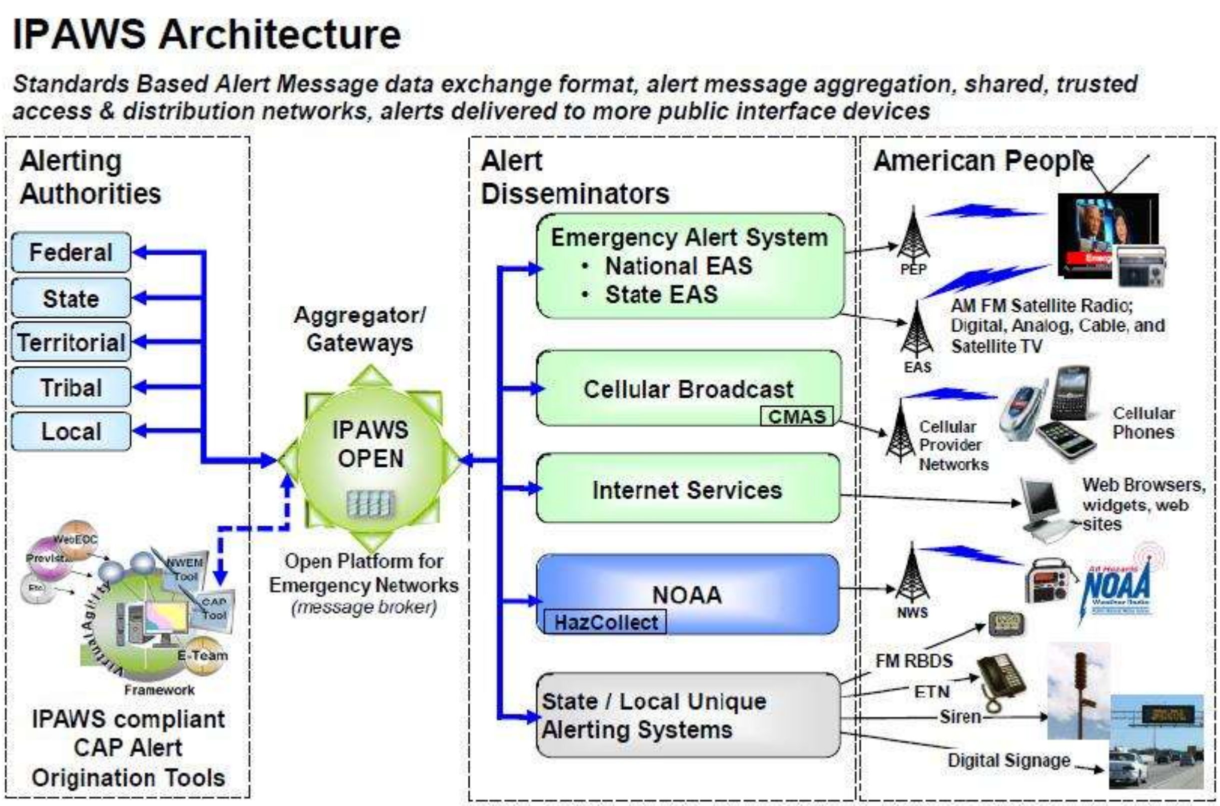

FIGURE 1. FEMA IPAWS ARCHITECTURE

A secondary role of RBDS that is in use today is the dissemination of National Oceanic and Atmospheric Administration (NOAA) weather alerts without passing through state or local unique alerting systems. One particular RBDS system currently has the capability to monitor NOAA via the internet for weather alerts and, based upon the geo-targeted information within the weather alert, transmit the alert via satellite to the FM Broadcasters with the vendor's installed RBDS equipment servicing the targeted area. In this way users can use the RBDS receiver much like they use weather radio for receipt of emergency weather alerts. This provides imminent threat weather alerts through RBDS to areas with a RBDS footprint, even where local emergency management is not currently using RBDS as an alert disseminator. As indicated in the figure, in the future these weather alerts may be initiated through the IPAWS architecture and disseminated through multiple alert dissemination paths including RBDS.

Three areas were identified which would further advance RBDS insertion into the national IPAWS architecture. Enabling cellular phones as RBDS receivers (Section 3.1.1) will provide a single platform with multiple alerting mechanisms, increasing the likelihood that an emerging alert is received at the platform. Inclusion of RBDS into cellular handsets can be an effective hedge against issues in receiving cellular transmissions, including network congestion during emergency periods and reduction in cellular network coverage due to vulnerabilities of cell towers.

Improving RBDS message dissemination (Section 3.1.2) was a second area considered to advance RBDS into the national IPAWS architecture. The RBDS Study has demonstrated the use and effectiveness of RBDS technology at the state emergency manager, local emergency manager, and enterprise emergency manager level. As the FM Broadcaster coverage is virtually ubiquitous, it can provide the capability for individuals to receive FM signals almost anywhere in the country at home, in the car, or even walking around using portable devices. The FCC already considers broadcasters as a major partner during emergencies at the national level. This relationship could be leveraged to implement RBDS as a path for emergency messages with all of the broadcasters currently supporting and planning to support EAS transmissions.

The third area considered to advance RBDS into the national IPAWS architecture would originate CAP messages in RBDS (Section 3.1.3). This would enable integration of generated alerts with the IPAWS aggregator and transmission through multiple message disseminators in the IPAWS architecture. This will allow the emergency managers to leverage the alert disseminators available through the IPAWS architecture and provide their stakeholders additional paths by which they may receive emergency messages.

An RBDS system consists of an end-to-end system used for the delivery and receipt of message data via the RBDS channel of an FM Radio Broadcaster. The message data is used to transmit emergency information prior to, during, and following emergency incidents. Functional requirements are proposed as a basis for a system to be considered an end-to-end RBDS system. These proposed functional requirements are intended to be used as guidance on the capability of an ideal RBDS system. These requirements may be used as a starting point for discussion and creation of more detailed specifications. Over 30 proposed functional requirements (Section 3.2) were defined, including requirements related to the origination, transmission, and receipt of alert and warning messages.

If the RBDS technology were to be incorporated more fully into the IPAWS architecture, a potential implementation plan (Section 3.3) could include the following activities:

- mandate cellular carriers to activate FM/RBDS chips where they currently exist in their cell phones and mobile devices
- commission a Special Interest Group (SIG) to create a technical standard for RBDS receivers that would foster interoperability across RBDS vendors

- develop and implement a campaign to make the public more aware of the RBDS technology and how to gain access to this form of public notification
- evaluate the interaction between the RBDS subcarrier and the main audio channel particularly throughout the entire EAS activation from the tones through broadcast of the message, and develop guidance for the installation of RBDS in broadcaster facilities so that the RBDS subcarrier will continue to be transmitted during EAS activations
- develop an RBDS infrastructure deployment plan to install the necessary equipment at FM Broadcasters within the "Top 100 Metro Areas"
- update policy/rules/standards as necessary to mandate CMAS cellular broadcast to integrate with RBDS on a single mobile device
- mandate cellular carriers to work with their mobile device manufacturers to install the FM/RBDS chip into all of their new models
- encourage consumer electronics manufacturers to install the FM/RBDS chip into their products, thus extending the number of potential RBDS receivers
- initiate the development and adoption of a standard set of Emergency Alert symbols which would be representative of a wide range of possible emergency situations and actions to be taken

In conclusion, this study has validated the benefits of RBDS technology and has demonstrated that it warrants consideration for the dissemination of national, state, and local public alerts and warnings. Origination of alerts and warnings within the RBDS systems, as well as ownership and maintenance of these systems, is expected to continue as a local and state function as it is currently. The demonstration and associated analysis and assessment have shown that the RBDS technology has major strengths that support this mission as well as areas for improvement. The RBDS technology can currently function as an alert disseminator within the IPAWS architecture.

2.0 Demonstration - After Action Report (AAR)

The following sub-headings include all of the details about this demonstration including how the demonstration was planned, how the demonstration details were designed, and how the demonstration results were analyzed.

2.1 Section 1 of AAR: Demonstration Overview

The following sections provide a high-level overview of the demonstration including the basic high-level details along with information on the planning team and the demonstrating participants and organizations.

2.1.1 Demonstration Details

Demonstration Name

IPAWS RBDS Study (RBDSS)

Type of Exercise

Operations-Based Demonstration, incorporating elements of both Drills and Full-Scale Exercises.

Demonstration Start Date

March 8, 2010

Demonstration End Date

June 7, 2010

Duration

Three months operational period for ad-hoc, everyday emergency alerts and several Demonstration Days.

Scenario / Demonstration Day / Location

1. Campus Security Incident
    a. 25 March 2010 – County of Oktibbeha, MS, Mississippi State University (MSU), Starkville MS
    b. 13 April 2010 – Carnegie Mellon University (CMU), Pittsburgh PA
    c. 4 May 2010 – Gallaudet University (GAL), Washington DC
2. Regional Pandemic
    a. 8 April 2010 & 12 May 2010 – Mississippi Counties of Hancock, Harrison, Jackson, County of Mobile Alabama, Pearl MS, NGC Ingalls Shipyard
3. Localized Natural Disaster
    a. 16 March 2010 – Missouri Western State University (MWSU), St. Joseph MO
    b. 6 May 2010 – Shelby County, TN
    c. 19 May 2010 – American University (AU), Howard University (HU), Georgetown University (GU), and George Washington University (GW), Washington DC

Sponsor

U.S. Department of Homeland Security (DHS) / Federal Emergency Management Agency (FEMA)

Program

Integrated Public Alert and Warning System (IPAWS) Radio Broadcast Data System (RBDS) Study

Mission

Protection and Response

Capabilities

IPAWS Key Performance Parameters

RBDSS Additional Performance Factors

2.1.2 Demonstration Planning Team

The RBDSS Demonstration Planning Team consisted of Northrop Grumman Corporation (NGC), Mississippi State University Social Science Research Center (MSU SSRC), Global Security Systems (GSS), Alertus Technologies (Alertus), and Metis Secure Solutions (Metis). While NGC was responsible for the overall demonstration planning, oversight, and conduct of the demonstration, NGC depended on and utilized the expertise of the other Demonstration Planning Team Members.

The NGC Demonstration Planning Team consisted of:

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NGC was responsible for the overall demonstration oversight. NGC ensured that planning efforts were coordinated among all of the team members. Specifically, NGC supported the following functions:

- Coordinated and integrated the efforts of the team members and venues to create a coherent demonstration design that met the policy and strategic-level objectives of the contract.
- Provided guidance to all team members.
- Reviewed and approved team member products and demonstration documentation, including the scenarios and related products, the Master Scenario Events List (MSEL), Survey Instruments and Training.
- Adjudicated conflicts or discrepancies among team members regarding their work products.
- Provided periodic updates on the progress of demonstration design and development to government officials.

- Ensured a shared awareness of ongoing demonstration design and development efforts among demonstration planners.

2.1.3 Participants and Organizations

Numerous state, local, and private sector organizations participated in RBDSS. A full list of participating organizations can be found in Annex G of this report. Table 2 provides participant totals by demonstration role/position. These numbers reflect the minimum number of participants. Given the dispersed nature of this demonstration, it is estimated that significant numbers of personnel at various locations became engaged in the demonstration without officially registering as a participant.

Table 2. Participant Totals by Role

Scenario	Location	Alert Originators	FM Broadcasters	Alert Receivers
Campus Security Incident	CMU	2	1	26
	MSU	1	3	27
	GAL	1	*1	25
Regional Pandemic	MS/AL	5	19	471
Localized Natural Disaster	TN	1	4	34
	MWSU	1	1	80
	AU / HU / GU / GW	1	*0	28
	TOTALS	12	29 (*same broadcaster)	691

2.2 Section 2 of AAR: Demonstration Design Summary

The design of the RBDSS demonstration is detailed in the following sections and includes the purpose and design of the demonstration, demonstration capabilities and objectives, scenario definitions, and the methodology for evaluating the demonstration.

2.2.1 Demonstration Purpose and Design

The purpose of the demonstration was to assess the RBDS technology core capabilities and objectives demonstrated in a no-fault, operations-based exercise. The Homeland Security Exercise and Evaluation Program (HSEEP) methodology guided the design, conduct, and evaluation of the demonstration. During the planning, conduct, and evaluation phases, RBDSS also capitalized on the existing and emerging relationships among the state, local, and private sector agencies and organizations. The findings from this demonstration may be used to validate that RBDS is a viable technology for public alert and warning, to validate that RBDS is compatible with the IPAWS solution, and to plan for a potential implementation.

The demonstration design completed the following major functions:

- Identify scenarios using the IPAWS TEMP and installed base.
- Develop the Master Scenario Events List (MSEL) to execute the selected scenario.
- Analyze the required capabilities to determine the data to be collected.
- Develop the survey instruments to capture the required data.
- Identify and coordinate with specific survey participants.

2.2.2 Demonstration Capabilities and Objectives

The RBDSS was based on demonstrating a set of core capabilities that served as the guiding framework for the demonstration. All aspects of the demonstration were designed so that there would be sufficient data collected that could be analyzed and evaluated against the objectives of the study and the core capabilities.

Capabilities-based planning allows for planning teams to develop objectives and observe outcomes through a framework of specific action items. The capabilities listed below form the foundation for the organization of all objectives and observations in this demonstration. Additionally, each capability is linked to several corresponding activities and tasks to provide additional detail.

The following list depicts the RBDSS core capabilities and related activities:

- IPAWS Key Performance Parameters (KPPs)
  - **Resilient**: system able to recover from an all-hazard event and resume operations.
  - **Secure**: authenticated delivery of coordinated messages through as many communications pathways as practicable.
  - **Language-Targeted**: adaptable distribution of content for those without an understanding of the English language or for those with disabilities.
  - **Geo-Targeted**: adaptable distribution of content on the basis of geographic location and risk.
  - **Availability**: system is operable and committable before, during, and after any

all-hazards scenario.
  - **Interoperability**: common protocols, standards, and coordinated procedures at all levels of government, and public and private stakeholders.
- RBDSS Additional Performance Factors (APFs)
  - **Simplicity**: ease of use for the user population.
  - **Understandable**: messages are understandable by the user groups including multi-lingual and special needs populations.
  - **Economical**: low financial burden for broadcasters and no degradation of signal.
  - **Relationships**: assessment of vendor's ongoing relationships with the broadcasters and emergency managers.
  - **Standards**: compliance with applicable FEMA standards and compatibility with other RBDS products.
  - **Local Laws**: compliance of installed systems with local laws and building codes.
  - **Distribution**: flexible distribution to targeted populations including special needs, multi-lingual, and other defined demographics.
  - **Coverage**: distribution to targeted towers where coverage extends to known limits of FM signal penetration.
  - **Addressability**: flexible distribution to multiple targeted addresses and defined grids.
  - **Geo-targeting**: targeting of Emergency Operations Center (EOC) and NOAA messages to the assigned area.
  - **Environment**: end user devices operate in a variety of environments from indoors to outdoors, mobile, and on the water.
  - **Maintainability**: maintenance requirements for the emergency manager, broadcaster, and end user.
  - **Lifecycle**: costs of equipment and software over time for the emergency manager, broadcaster, and end user.
  - **Power**: operational time while on battery backup power.

2.2.3 SCENARIO SUMMARIES

The RBDS technology demonstration was designed to elicit feedback on the use of RBDS during a three month operational period for real-world alert notifications as well as for three distinct scenarios. A designated "Demonstration Day" was scheduled for each scenario at each scenario location for a total of seven Demonstration Days (Figure 2). These Demonstration Days allowed for controlled tests and Government Independent Verification and Validation (IV&V) participation at each location while not placing too large a test burden on each individual location. The dates chosen for the individual Demonstration Days were based upon the availability of demonstration participants, for example, avoiding spring break and exam periods in the respective academic calendars.

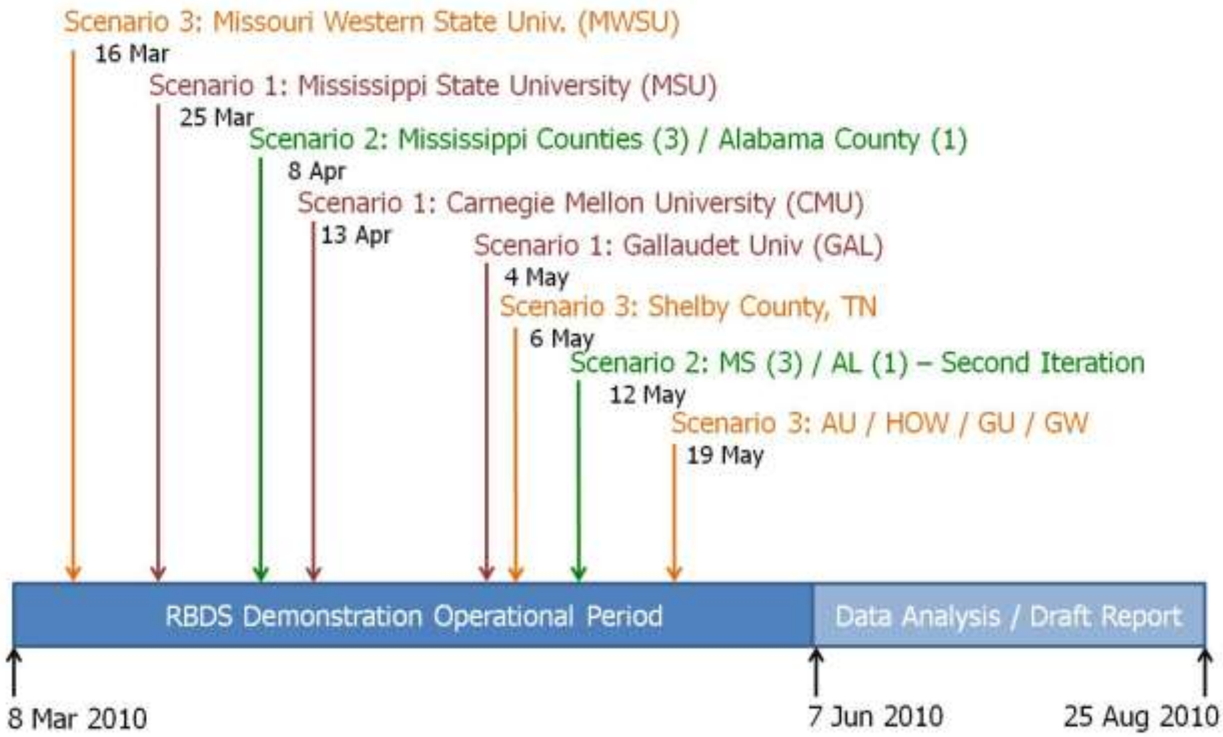


FIGURE 2. RBDS DEMONSTRATION OPERATIONAL PERIOD

The first scenario encompasses a small geographic area comprising a building or a series of buildings as would be relevant during a Campus Security Incident. The second scenario involves alert dissemination across several local jurisdictions as would occur during a regional event such as a Regional Pandemic. The third scenario involves a localized geographic area as would be relevant during a localized weather alert or natural disaster.

The alerts issued during the scenario Demonstration Days were determined in advance and were similar within a particular scenario. Most of the alerts during the Demonstration Day were generated locally and issued by alert originators using their individual vendor portal. This allowed for better control of the test demonstration. During the Demonstration Day activities, at least one CAP formatted message was processed by the participating vendor system. In addition, the majority of the alerts generated outside of the Demonstration Day activities were CAP weather alerts.

The text of each alert was generated so that there was a clear indication that it was a test alert and not a real-world event, which was a requirement of the local emergency managers participating in the demonstration. Each alert had some action to be taken and, upon the completion of the Demonstration Day, demonstration participants submitted user feedback based upon their participation.

Each alert message was issued twice at the AlertFM and Metis Secure Solutions scenario locations: the first time in English followed by the second alert containing the alert message translated to Spanish. On any given receiver, the message was received only once, either in English or Spanish based upon the receiver configured for the targeted group assignment. To aid data collection and analysis, each alert message contained a unique “System Test” number. The system test number was composed of three parts which indicated the scenario, vendor, and the message in the series.

The CAP version 1.1 messages were created within the FEMA Disaster Management Interoperability Services (DMIS) tools. NGC accessed the DMIS tool, created the alerts as described within the MSEL, and posted the alerts to the "DMIS Interoperability COG". The vendors' systems accessed the "DMIS Interoperability COG" at the time determined in the MSEL and downloaded the CAP alert into their respective systems for processing and generation of alerts to their respective alert receivers. After posting the alert, NGC viewed the list of "DMIS Interoperability COG" alerts from the AlertFM portal, then selected and saved the NGC created alerts into Extensible Markup Language (XML) files (Figure 47). The XML files were made available to the vendors as a back-up in case access to the DMIS Collaborative Operational Groups (COGs) was not available during the required timeframe within the scenario.

A total of 691 receivers (Annex G, Table 14) was allocated and distributed across the three scenarios. Of this allocation, 62 were allocated to the special needs (deaf, hard of hearing, blind) population, and 34 were allocated to individuals who view English as their second language. Several types of receivers were allocated including, 219 wall units, 462 desk/mobile units, and 10 cell phones configured for RBDS reception.

The receivers were distributed by the vendors to the alert originators. The alert originators were trained by their vendors on the use of the vendor portal software as well as how to distribute the receivers and train the alert recipients (Figure 3). Individual alert recipient training was deemed not necessary by the vendors Alertus Technologies and Metis Secure Solutions for their respective receivers.

Alert Originator Instructions
for ALERT FM Receiver Distribution and Participant Surveying

1. Distribute ALERT FM receivers based on the “Alert Receiver Distribution” spreadsheet.
2. Document participant Name, Phone number, Email address, and Address. PLEASE DO NOT DISTRIBUTE RECEIVERS WITHOUT COLLECTING INDIVIDUAL CONTACT INFORMATION.
3. Document participants preferred method of contact for participant survey. The Social Science Research Center (SSRC) at Mississippi State University (MSU) will conduct individual surveys of each participant based on the preferred contact method of each person. The available choices for participating in the survey are the following:

   A. Web-based survey in which notification and link to fill out survey is delivered to participant in the form of an e-mail (internet access required)
   B. Telephone call to the participant after message testing
   C. Hardcopy version of survey distributed by e-mail to participants and returned to SSRC by mail:

      Social Science Research Center
      Mississippi State University

      1 Research Blvd., Suite 103
      Starkville, MS 39759

   D. Hardcopy version of survey distributed by alert originators, collected by alert originators once completed and returned to GSS/Alert FM. GSS/Alert FM will forward collected surveys to SSRC.
   E. Face-to-Face or telephone assisted interview (these options should only be used in the case of a special needs person)

4. Place emphasis on finding Special Needs participants (legally blind, hard of hearing)

FIGURE 3. GSS ALERT ORIGINATOR INSTRUCTIONS

Additional scenario details of each Demonstration Day including the text of the alerts along with the receiver distribution plan can be found in Annex F and Annex G.

2.2.3.1 Scenario 1: Campus Security Incident

Scenario 1 simulated an incident on a college campus in which alert and warning messages were distributed to the user community including specific English as a Second Language (ESL) and special needs community participants. Installations used to exercise this scenario were Carnegie-Mellon University (CMU) using the Metis Secure Solutions system, Gallaudet University using the Alertus Technologies system, and Mississippi State University using the Global Security System's (GSS) AlertFM system. Each installation was to follow the same scenario including the text of the alerts. To support this scenario, each vendor provided a user base of at least 25 receivers and related system equipment. Receivers were distributed by the campus emergency managers in accordance with the receiver distribution plan (Annex G) developed by the MSU Social Science Research Center (SSRC).

This scenario involved a series of four alert messages in English with the corresponding alert re-issued in Spanish for the CMU and MSU locations. The first alert in the series was to be issued through each vendor's portal to all demonstration alert receiver participants indicating the start of the test of the Campus Alerting System. Those that received the alert were directed to document their location, time, and the system test number. The second alert in the series indicated a continuation of the test and was a CAP formatted alert that was to be received by each vendor's system and forwarded on to all demonstration alert receiver participants, who were again directed to document their location, time, and the system test number. The third alert in the series was to be issued via the vendor's portal to a specific, pre-defined subset of receivers located within the same geographic area, namely, a specific building or buildings on campus. Those that received the limited geographically distributed third alert were again directed to document their location, time, and the system test number. The fourth and final alert was to be issued via the vendor's portal to all alert receiver participants. This final alert was the "all clear"; recipients were directed to document their location, time, system test number and to complete the user survey provided by MSU SSRC.

One addition to this scenario occurred at the CMU location. An additional alert originator was added to the scenario, which allowed Allegheny County Emergency Services to originate an alert message that was received only by the CMU Environmental Health and Safety Office (EH&S). Upon receiving this alert, the CMU EH&S Office continued the scenario as previously described.

2.2.3.2 Scenario 2: Regional Pandemic

Scenario 2 simulated a regional health pandemic along the Gulf Coast. This scenario was designed to align with Critical System Scenario 2 from the IPAWS Test and Evaluation Master Plan (TEMP). The scenario was to be initiated by the Mississippi Emergency Management Agency (MEMA), who were to be operating from a mobile location within Jackson County MS using the GSS AlertFM system. In this scenario, MEMA was to inform County Emergency Operations Centers (EOCs) in the Mississippi counties of Hancock, Harrison, and Jackson, as well as the Alabama county of Mobile, of a pandemic health scare with an alert message. These County EOCs were then to distribute a message from their AlertFM portals through the broadcaster nodes to the receivers distributed around the region. Northrop Grumman Ingalls Shipbuilding in Pascagoula, MS was also to participate in this scenario as an alert recipient for 30 receivers. MEMA was to complete the scenario by sending an alert message to all of the respective receivers in the scenario, thus illustrating that a message can be sent to recipients across a region from the state EOC.

To support this scenario, GSS provided a user base of 471 AlertFM receivers and related system equipment. In addition, special needs accessories for 20 users were provided for this scenario. The receiver distribution plan (Annex G) for this scenario was developed by MSU SSRC in cooperation with the county emergency management agencies and the state sponsors.

This scenario involved a series of five alert messages. The first alert message was to be sent from MEMA and received by the county EOCs located in the Mississippi counties of Hancock, Harrison, and Jackson, as well as the Alabama county of Mobile. Each EOC was then to issue the second alert message in both English and Spanish through the AlertFM portal to all the demonstration alert receivers within the respective EOC's county indicating the start of the Regional Health Alerting System Test. Those that received the alert were directed to document their location, time, and the system test number. The third alert in the series indicated a continuation of the test and was a CAP formatted alert that was to be initiated by each participating county EOC AlertFM system to all demonstration alert receiver participants. Those that received the third alert were again directed to document their location, time, and the system test number. The fourth alert in the series was to be issued from the Jackson County EOC via the AlertFM portal to the NGC Ingalls Shipbuilding facility, a specific geographic area within Jackson County MS. Those that received the limited geographically distributed fourth alert were again directed to document their location, time, and the system test number. The fifth and final "all clear" alert was to be issued by MEMA via the AlertFM portal to all the alert receiver participants indicating the completion of the system test of the Regional Health Alerting system. Those that received the final alert were directed to document their location, time, and system test number, and to complete the user survey provided by MSU SSRC.

2.2.3.3 Scenario 3: Localized Natural Disaster

Scenario 3 simulated a localized tornado natural disaster, leveraging RBDS installations in the Memphis area of Shelby County, TN using the GSS AlertFM system, and at Missouri Western State University (MWSU) and the four Washington DC campuses of American University (AU), Howard University (HU), Georgetown University (GU), and George Washington University (GW) using the Alertus Technologies System. This scenario was designed to align with Critical System Scenario 3 from the IPAWS TEMP. In this scenario, the Shelby County, TN portal, the MWSU portal, and the AU portal were used to distribute alert messages over the networked FM stations informing recipients of a tornado warning.

To support this scenario, each vendor provided at least 25 new receivers and related system equipment which were distributed by the AU, HU, GU, and GW campus emergency managers and Shelby County Office of Preparedness emergency managers in accordance with the receiver distribution plan (Annex G) developed by the MSU SSRC. The existing installed base of over 80 receivers at the MWSU location was also used for this scenario.

This scenario involved a series of four alert messages in English with the corresponding alert re-issued in Spanish at the Shelby County location. The first alert in the series was to be issued through each vendor's portal to all demonstration alert receiver participants indicating the start of the test of the Local Weather Alerting System. Those that received the alert were directed to document their location, time, and the system test number. The second alert in the series indicated a continuation of the test and was a CAP formatted alert that was to be received by each vendor's system and forwarded on to all demonstration alert receiver participants. Those that received the second alert were again directed to document their location, time, and the system test number. The third alert in the series was to be issued via the vendor's portal to a specific, pre-defined subset of receivers located within the same geographic area, namely, a specific building on campus or a predefined set of individuals at the Shelby County demonstration. Those that received the limited geographically distributed third alert were again directed to document their location, time, and the system test number. The fourth and final "all clear" alert was to be issued via the vendor's portal to all alert receiver participants. Those that received the final alert were directed to document their location, time, and system test number and to complete the user survey provided by MSU SSRC.

2.2.4 Demonstration Evaluation Methodology

This section will describe the process and mechanisms for collecting data from the various study participants including the Alert Originators, FM Radio Broadcasters, Alert Recipients, and Consumer Electronic Manufacturers.

2.2.4.1 Data Collection

The data collection for this study took several forms and was collected from many sources. Operational technical data was collected from each vendor system, and surveys were completed by several differing communities. The following sections provide the details for each form of data that was collected.

2.2.4.1.1 Surveys

Several surveys were created and presented to various communities to capture differing forms of data. The surveys collected data spanning the entire process of RBDS emergency alerting, from alert origination, through the FM Broadcaster infrastructure, to the alert recipient, and finally, to the manufacturers for future RBDS technologies. The survey data was collected and analyzed by the MSU SSRC. The results of the data collection and analysis can be found in section 2.3 of this document.

The following sub-sections provide the details for each survey that was used during the demonstration period.

2.2.4.1.1.1 Alert Recipient Scenario Demonstration Day

The Alert Recipient Scenario Demonstration Day survey (Annex E, Figure 34 and Figure 35) was developed to solicit feedback from those participants who were the final recipient of the emergency alert. The survey collected information regarding the number of messages that they received as part of the Demonstration Day scenario. For each message that they received, the survey collected the system test identifier, the time of message receipt, their personal location when received, and whether each message was understandable. Additional questions pertained to their alert receiver, emergency alerting, and personal demographics.

The survey was completed by the alert recipients in one of three ways: electronically through a web interface, by hand on a hard copy of the survey, and by an interview. The interview was administered either face-to-face or telephonically. The alert recipients either were personally assigned a receiver or received the alert from a public alert receiver that was part of the demonstration. The following defines the process for each group.

Personally Assigned Receiver Survey Data Collection Process

Personally assigned receivers were implemented in two ways. At CMU and MWSU, dedicated observers were assigned to receivers that were placed in public locations. These dedicated observers completed hard copy versions of the Alert Recipient Scenario Demonstration Day survey and provided the surveys to passers-by for completion as well. These hard copy surveys were collected by the demonstration team at the completion of the Demonstration Day activities. A Supplemental Technical Data Collection at MWSU survey (Annex E, Figure 44) was also completed by the dedicated observers at MWSU, which provided information related to audibility, visibility, and text-to-speech understandability for each receiver.

For Mississippi/Alabama Counties, Shelby County TN, and AU/HU/GU/GW demonstrations, receivers were assigned to individual registered users. One day prior to the start of every Demonstration Day, an email was sent to every registered alert receiver user that was participating for the given Demonstration Day. The email (Annex E, Table 13, Ref ID #1) was a reminder of their upcoming Demonstration Day and detailed their individual responsibilities for the demonstration.

Immediately following the last message of the Demonstration Day scenario, an email (Annex E, Table 13, Ref ID #2) was sent to every registered alert receiver user for that scenario and location. A reminder email (Annex E, Table 13, Ref ID #3) was sent three days later to those that had not completed the survey based upon the initial email request. One week following the previous reminder email, one last email (Annex E, Table 13, Ref ID #4) was sent to those that had not yet completed the survey, one last time asking for their user feedback.

FIGURE 4. SSRC DATA COLLECTION LAB

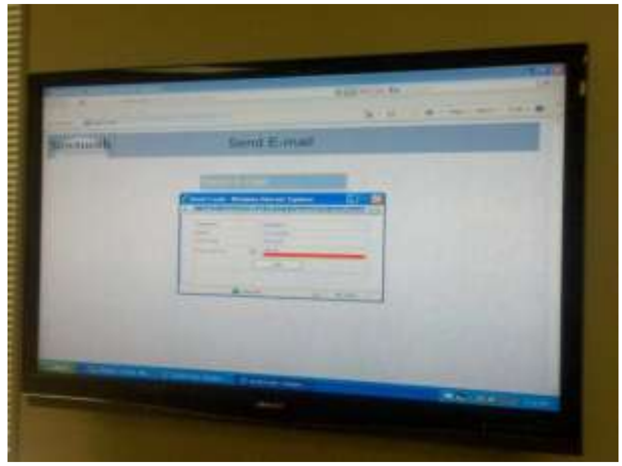


FIGURE 5. SSRC EMAIL SOLICITATION TOOL

For those who requested to be contacted by telephone rather than by email, the survey feedback protocol was similar. All calls were originated by the SSRC and no return calls were requested. The first call attempt was made immediately (as soon as possible) following the dissemination of the last message of the Demonstration Day scenario. When a participant could not be reached, a second follow-up call was attempted later in the day. A third follow-up call was attempted the next business day. When a participant had not been reached by the third call, a fourth and final follow-up call was attempted two business days following the scenario demonstration date. The fourth and final call was placed during afternoon business hours. SSRC callers left voice messages (Annex E, Table 13, Ref ID #5) when prompted with details on when SSRC would attempt to contact the participant again.

<u>Public Receiver Survey Data Collection Process</u>

The receivers at the Gallaudet University location were public receivers for which dedicated observers were not available. At this location, we solicited user feedback in multiple ways. Surveys were completed via a web-based interface or via a hard-copy survey which was then faxed to MSU SSRC or placed in an envelope next to an Alert Beacon™ or in a drop-box in the Public Safety Department office.

To encourage participation, a campus-wide email was sent daily for the one week prior to the demonstration announcing the test. The email on the Demonstration Day included instructions (Figure 6) and web link for the completion of the survey. Envelopes were placed next to each receiver which contained blank surveys, and a drop-box was placed in the Public Safety Department office for additional hard-copy survey collections.

FEMA tests Gallaudet's emergency notification beacons

Date and Time:
4 May 2010 - 4 May 2010
9:30 AM - 10:30 AM

Description:
Gallaudet is participating in a test of the emergency alert devices present in many of our public spaces and some classrooms on campus, called the "Alertus" emergency notification beacons. Here is a picture of one of the devices. There are about 40 of these devices located in common spaces in buildings at the University and the Clerc Center. You may have noticed one of these devices before.

In the case of an emergency, targeted text messages can be sent to all or some of the beacons with specific instructions on safety. The devices also have flashing light capability to attract people to read the messages.

The Federal Emergency Management Agency (FEMA), as part of its Integrated Public Alert and Warning System (IPAWS) project, wants to know about the effectiveness of the nation's emergency alert systems, including Gallaudet's system. The Alertus system is classified as a radio broadcast data system. (For more information about FEMA and IPAWS, go here: http://www.fema.gov/emergency/ipaws/systemenhancements.shtm).

Therefore, the Northrop Grumman Corporation, in partnership with the Social Science Research Center at Mississippi State University, has been contracted by FEMA to conduct a test of the Gallaudet Alertus beacons.

When the test is underway, the beacon lights will flash and a text message will be displayed. If you are in close proximity to one of the beacons when this happens, the text messages will then instruct you on what to do next. Basically, you'll be asked to complete a survey about your experience. The surveys will be immediately available near the beacons in paper format and can be completed on the spot. The surveys are also available online at this website: ***Edited***. The online survey will be activated once the emergency notification system test is underway.

If you have any questions or feedback about the survey, the test, or the beacons, please contact ***Edited ***.

FIGURE 6. GALLAUDET'S DEMONSTRATION NOTIFICATION

2.2.4.1.1.2 Alert Originators

The Alert Originators six page survey (Annex E, Figure 36 through Figure 41) was developed to solicit feedback from those who originated the alerts at all of the locations throughout the three month demonstration period. The survey collected information regarding their jurisdictional demographics, ability to target the ESL recipients, ease and ability to target on a geographical and functional basis, and the effectiveness, reliability, and maintainability of the system.

The survey was emailed to all of the alert originators two weeks prior to the end of the demonstration period asking, for a response within a week. The completed surveys were emailed, hand-delivered, and mailed back to MSU for data collection and analysis. A reminder email was sent three and five days following the requested return date to those who had not returned a completed survey.

2.2.4.1.1.3 FM Broadcasters

The FM Radio Broadcasters one page survey (Annex E, Figure 45) was developed to solicit feedback from the FM Radio Broadcasters who participated in the demonstration as well as broadcaster organizations that represent member FM Radio Broadcasters. The survey collected information regarding station transmitter availability, reliability, backup capability, and the installed RBDS technology. The RBDS technology questions inquired about maintenance requirements, reliability, and signal quality.

The survey was emailed to all of the FM Radio Broadcasters who participated in the demonstration as well as the National Association of Broadcasters (NAB) and National Alliance of State Broadcasters Association (NASBA) one month into the demonstration operational period. Responses were requested to be completed within a week and emailed back to MSU SSRC for data collection and analysis. A reminder email was sent two weeks and three weeks following the requested return date to those that had not returned a completed survey.

2.2.4.1.1.4 Non-Scenario Alerts Recipient

The Non-Scenario Alert Recipient survey (Annex E, Figure 42 and Figure 43) was developed to solicit feedback from those participants that were the final recipient of the emergency alert. The survey collected information regarding their experience and use of the system throughout the demonstration operational period. The survey also collected information regarding the alert recipient's opinion on specific aspects of the alerting device for real-world events.

The survey was administered at the end of the Demonstration Operational period and was completed by the alert recipients entirely through a web interface.

2.2.4.1.1.5 Consumer Electronics

The Consumer Electronics survey (Annex E, Figure 46) was developed to solicit feedback from members of the Consumer Electronics Association (CEA). The survey collected information regarding consumer electronic products containing public alerting and warning capabilities including FM RBDS, including a potential price per chip range that would be feasible for implementing FM RBDS in consumer electronics products.

2.2.4.1.2 Vendor Technical Data

The vendors were to collect operational data throughout the demonstration operational period. One vendor planned to record data related to each alert issued through their alert origination portals, recording data for every weather alert that is automatically generated and recording alerts that are received by their FM Monitoring station.

A second vendor planned to record every RBDS packet that is received by every receiver participating in the demonstration, along with the quality of the received signal. Data related to the availability and status of the individual receivers was planned to be recorded.

The final vendor planned to record the availability and status of the individual receivers, quality of the received signal, and time to activation for all alerting methods that the receiver uses.

2.2.4.2 IPAWS CAP Compliance Assessment

NGC has worked with the IPAWS Conformance Assessment Office managed by Eastern Kentucky University (EKU) to have the vendors participating in this study assessed for CAP v1.2 compliance. Due to the late approval of the CAP v1.2 standard by the Organization for the Advancement of Structured Information Standards (OASIS), the conformance assessment by EKU for our vendors was not completed prior to the publication of this report. However, all three vendors have submitted their products to the IPAWS Compliance Assessment Office for conformance testing, as well as demonstrated the ability to process CAP v1.1 messages during the individual Demonstration Days.

2.2.4.3 Analysis Process

The data collected during this study by survey, observations, and vendor technical data was analyzed for relevance to the success criteria of the KPPs (Table 3) and APFs (Table 4). The Data Collection and Analysis column in each table below indicates the source of the data that is expected to contribute to observations related to each KPP and APF. The identified observations related to each KPP and APF were characterized as either a strength or an area for improvement

TABLE 3. KPPS AND DEFINED SUCCESS CRITERIA

Activity Identifier	IPAWS KPP	Data Collection and Analysis	Success Criteria
Resilient **KPP.1**	System able to recover from an all-hazard event and resume operations.	AlertFM Monitoring System FM footprint overlay shows where a loss of one FM station is not a problem for the receivers Broadcaster Survey Form, Questions 1 thru 3, and 6 Alertus has system monitoring capability when connected with Ethernet Metis has system monitoring capability when connected via their Mesh network RBDS system can be used to recover from the loss of a local EOC, as demonstrated in Scenario 2 with MEMA sending alerts to all of the Scenario 2 receivers instead of the local EOC	Analysis shows system is operational when there is a loss of an FM broadcaster. Demonstration shows that alert origination can be geographically dispersed.

Activity Identifier	IPAWS KPP	Data Collection and Analysis	Success Criteria
Secure **KPP.2**	Authenticated delivery of coordinated messages through as many communications pathways as practicable.	Vendor's messages are encrypted to the devices. Security related technical notes from vendors	The vendors meet National Institute of Standards and Technology (NIST) Lo/Hi/Hi level standards[2] for confidentiality, integrity, and availability.
Language-Targeted **KPP.3**	Adaptable distribution and content for those without an understanding of the English language or for those with disabilities.	Alert Originator Survey Form, Questions 5 thru 9. Alert Receiver Survey Form, Questions 3d, 5, 10W AlertFM demonstration includes English and Spanish messages initiated at the portal and received at the receivers. Also, various ADA equipment will be attached to receivers for ADA notifications (bed shakers, strobes) Alertus Units include audible sirens as well as flashing LED pattern Metis units include audible sirens, flashing LED pattern, and text to speech. Several units will be targeted specifically with Spanish	Messages are successfully received and understood in a language other than English.
Geo-Targeted **KPP.4**	Adaptable distribution and content on the basis of geographic location and risk.	Messages will be geographically targeted based on receiver codes. Survey responses will demonstrate success of targeting Alert Originator Survey Form, Questions 10 thru 13 and 15 Alert Receiver Survey Form, Questions 3a, 3c, 5, 11W, 10H	Alerts are received based upon targeted jurisdiction even in overlapping FM footprint in neighboring counties.
Availability **KPP.5**	System is operable and committable before, during and after any all-hazards scenario.	Alert Originator Survey Form, Questions 16 thru 26	Systems are operationally available 99% of the time to send messages during the Demonstration Period outside of normally scheduled maintenance.

[2] FIPS PUB 199, Standards for Security Categorization of Federal Information and Information Systems, Feb 2004

Activity Identifier	IPAWS KPP	Data Collection and Analysis	Success Criteria
Interoperability **KPP.6**	Common protocols, standards, and coordinated procedures at all levels of government, and public and private stakeholders.	Alert Originator Survey Form, Question 28 Alert Receiver Survey Form, Questions 3a All scenarios have a CAP generated message from DMIS. Include the EKU conformance testing results	CAP formatted messages are received by the vendors which generate understandable message to the receivers.

TABLE 4. APFS AND DEFINED SUCCESS CRITERIA

Activity Identifier Grouped by Attribute	APF Description	Where Data is Collected	Success Criteria
User Adoption and Acceptance			
Simplicity **APF.1.1**	Ease of use	Alert Receiver Survey Form, Questions 6, 7, 8, 16 Alert Originator Survey Form Questions 5, 12, and 31	95% of alert receiver responses find the receivers easy or somewhat easy to use. 95% of alert originators responses find it easy or somewhat easy to issue alerts.
Understandable **APF.1.2**	Understandable messages	Alert Receiver Survey Form, Questions 3d, 4, 5, 14, 15	95% of alert receiver responses were understandable at the receiver with additional break down based upon ADA and ESL.
Economical **APF.1.3**	Low burden for broadcasters	Broadcast Survey Form, Questions 6a thru 6e	Minimal routine maintenance of equipment required. No degradation of audio signal is identified.
Relationships **APF.1.4**	Contractor's relationships with key stakeholders such as broadcasters and emergency managers	Broadcast Survey Form, Questions 5, thru 7 Alert Originator Survey Form, Question 29	Vendors have supported broadcasters and originators requirements.
Standards **APF.1.5**	Compliance with applicable standards and compatibility with other RBDS products	Broadcast Survey Form, Question 6e Alert Originator Survey Form, Question 28 EKU response	Receipt of CAP messages generates an alert that is understandable at the alert receiver and faithfully reflects CAP message content.
Local Laws **APF.1.6**	Compliance with local laws and building codes	Alert Originator Survey Form, Question 30	Installation of equipment requires no special permits or building modifications.
Distribution Efficiency and Flexibility			
Distribution **APF.2.1**	Population Reach	Alert Receiver Form, Questions 3c, 5, 6, 7, 8, 9, 11W, 12, 14, 15, 16	95% of alert receiver responses for ADA and ESL were from targeted messages, verifiable by system test number.

Activity Identifier Grouped by Attribute	APF Description	Where Data is Collected	Success Criteria
Coverage **APF.2.2**	Coverage area	From Scenario 2 Alert Receiver Form, Questions 3a, 3c, 5, 11W as well as AlertFM Monitoring System Vendors' system (historical) logs for operational period to validate with NOAA alerts	Understandable alerts are received at furthest points of known FM signal penetration.
Addressability **APF.2.3**	Addressability	Alert Originator Survey Form, Questions 12 thru 15 and 27 Alert Receiver Form, Questions 3a, 3c, 5, 11W. All AlertFM scenarios demonstrate multiple addressability targeting given the group codes for county, test, ESL test, MEMA test, and MEMA ESL	95% of alert receiver responses indicate receipt of alerts for which they are registered. 95% of alert originators find it easy to address their alerts and that there is enough granularity in addressing to meet their needs.
Geo-Targeting **APF.2.4**	Message geo-targeting	Alert Receiver Form, Questions 3a, 3c, 5, 11W Vendors' system (historical) logs for operational period to validate with NOAA alerts along with the AlertFM Monitoring system	Messages are received only by the specific target audience selected by the originator.
Range of Operating Environments			
Environment **APF.3.1**	Ability for end user devices to operate in a variety of environments such as indoors, outdoors, mobile, and on the water	Alert Receiver Form, Questions 3c, 11W, 10H Alert Receiver Non-Scenario Form, Question 8Hc Receiver distribution by intended location	Demonstration shows that alerts can be received while mobile, indoors, and outdoors.
Logistics and Life Cycle Management			
Maintainability **APF.4.1**	Maintainability	Broadcast Survey Form, Questions 6a thru 6e Alert Originator Survey Form, Question 18 Alert Receiver Non-Scenario Survey Form, Questions 8Ha and 8He	95% of routine maintenance is easily performed without assistance of vendor.
Lifecycle Costs **APF.4.2**	Lifecycle costs of equipment and software	Alert Receiver Form, Questions 6, 7, 8, 9, 10H, 11H Broadcast Survey Form, Questions 6 and 7 Alert Originator Survey Form, Questions 16, 19 Alert Receiver Non-Scenario Form, Question 8Hb	95% of alert originators indicate that the lifecycle costs are reasonable.

Activity Identifier Grouped by Attribute	APF Description	Where Data is Collected	Success Criteria
Power **APF.4.3**	Battery life	Information from vendors on battery life based on any testing that they have done or product spec Observation on battery life under different operational conditions (operating modes, inside/outside, other) Alert Receiver Non-Scenario Survey Form Question 8Ha	Battery life is greater than 95% of average power outages.

2.3 SECTION 3 OF AAR: ANALYSIS OF RESULTS

The following sections provide the results of this study. First, the results of each Demonstration Day are summarized. Then, the results of the analysis from the demonstration are detailed to provide the strengths and areas for improvement for each KPP and APF. Following these sections are additional observations and comments that are not directly related to the Demonstration Days or KPPs and APFs already discussed. These sections are then combined into an overall conclusion regarding the validation of the RBDS technology.

The vendors involved in this study implemented RBDS technology to solve two different problem sets. The vendors Metis Secure Solutions and Alertus Technologies have implemented their solutions to alert the public in an enterprise environment. Their receivers are wall receivers installed in locations where a large population is expected, much like an enhanced fire alarm system. In this report we refer to these as Enterprise style systems. The vendor GSS/AlertFM has implemented a solution for personal alerting. While GSS also has wall units located in public places similar to the Enterprise style system, their focus is on desktop/mobile receivers that are designed to be mobile and carried by a single user. In this report we refer to these as Personal style systems. This consideration is important when evaluating the KPPs and APFs, since one style system may perform differently against the KPPs and APFs from the other.

2.3.1 DEMONSTRATION DAY AND REAL-WORLD INCIDENT SUMMARIES

The following sections provide details of each of the Demonstration Day activities and significant real-world usage of the systems in chronological order.

2.3.1.1 16 Mar – MWSU Demonstration Day

FIGURE 7. MWSU DEMONSTRATION DAY PICTURES

The MWSU installation consisted of an installation base of 84 Alertus Alert Beacons™, although 4 of these units were off-line due to spring break maintenance. The installed Alertus beacons are activated both by FM RBDS and by Ethernet for planned redundancy. Ethernet activation is achieved by the Alert Beacons™ performing a "heart beat" check-in with the main system server on a 23 second periodic basis. During this check-in, active alerts are retrieved by the beacons and the beacon also reports the time at which any complete FM RBDS alert has been received. The activating method for each beacon is based upon whichever method determines there is an alert to process. Even if both methods recognize the alert, the beacon will activate only once for each unique alert.

The RBDS Study Demonstration Day activities were integrated into the annual MWSU Griffon Alert Test. The Griffon Alert system comprises a suite of emergency notification tools (http://www.missouriwestern.edu/griffonalert) including the Alert Beacons™, Short Message Service (SMS) text messages, Emails, Voice Messaging, Outdoor Public Address Speakers, and MWSU Television Interrupts. The full suite of notification tools was activated in the first in a series of five activations. Tests two thru five activated only the Alert Beacons™ at 15 minute intervals according to the script defined in the MSEL (Annex F).

Before the tests started, 33 MWSU staff and student volunteer observers were given a pre-brief of their responsibilities, provided blank survey forms, and assigned to observe all of the Alert

Beacons™ on the MWSU campus. The pre-brief described the observer responsibilities for completing the user feedback survey (Annex E, Figure 34 and Figure 35), collecting user feedback from others that are passing by the activated beacons, and completing the supplemental data collection survey (Annex E, Figure 44). Overall, 44 user feedback surveys and 148 additional supplemental data collection surveys were collected; the results were combined with the results from the other Demonstration Day activities.

Back-end system data provided additional technical data collection including the alert initiation time, text of alert message, and the FM RBDS and Ethernet activation time for each Alert Beacon™ connected via the Ethernet.

Alert Origination occurred from two places. The messages originated as part of the Griffon Alert Test were initiated from the Campus Public Safety office. The remaining activations of the beacons were performed by a member of the MWSU Information Technology (IT) staff using a laptop with wireless internet connectivity. The laptop was located within the lobby of Murphy Hall.

2.3.1.2 25 Mar – MSU Demonstration Day

FIGURE 8. MSU DEMONSTRATION DAY PICTURES

The MSU installation consisted of a total of 27 AlertFM receivers that were distributed to assigned individuals throughout the campus. The receivers were a mixture of 20 desktop units, 5 wall units, and 2 cell phones. Activation of the receivers occurred through one of three FM Broadcast stations, all of whose FM signal footprints encompassed the MSU campus. The FM broadcaster was automatically selected by each receiver based on the strength of signal at a given location. Additional receivers which were configured to receive both the English and Spanish alerts were provided to the NGC representatives to aid in the observation of the demonstration.

Prior to the start of the first activation, a pre-brief was presented by Mr. Jim Britt, Director of Oktibbeha County Emergency Management Agency (EMA). Mr. Britt discussed the history of public alerting within the Oktibbeha County and their current use of the AlertFM system. Also in attendance at this pre-brief were Ms. Kristen Campanella, the Deputy Directory Oktibbeha County EMA; Mr. Jim Jones, MSU Crisis Action Team member; and representatives of AlertFM.

The demonstration consisted of a total of four tests. Each test consisted of two activations, one in English and one in Spanish, for a total of eight alert activations (Figure 8). The MSEL (Annex F) contains the timing and alert text for each activation. Shortly following the last activation, an email was sent from the MSU SSRC to all of the registered alert recipients for this demonstration requesting their completion of a user feedback survey (Annex E, Figure 34 and Figure 35). 16 user feedback surveys were collected with the initial request and an additional 2 surveys were completed following the first reminder. The second and last reminder email brought in 4 additional user survey completions, for a total of 22 user survey completions for this Demonstration Day.

Alert Origination for this demonstration was performed by Ms. Campanella. She was located at the MSU SSRC facilities and used a laptop that was connected to the alert origination portal via a wireless internet connection. Mr. Britt indicated that alert origination would occur normally at the offices of the Oktibbeha County Emergency Management Agency, although he has used his Blackberry device to initiate alerts when necessary.

2.3.1.3 08 Apr – MS / AL Demonstration Day

The receivers were a mixture of personal desktop units, wall units, and cell phones that were distributed across the Mississippi Counties of Jackson, Harrison, and Hancock and the Alabama County of Mobile (Annex G). Activation of the receivers was to occur through one of several FM Broadcast stations (Annex G), all of whose FM signal footprints encompassed the respective counties. The FM broadcaster was automatically selected by each receiver based on the strength of signal at a given location. Additional receivers which were configured to receive both the English and Spanish alerts were provided to the DHS/FEMA and NGC representatives to aid in the observation of the demonstration.

Prior to the start of the first activation, a pre-brief was presented at the Jackson County EOC by Mr. Donald Langham, Directory of Jackson County Emergency Management Agency. Mr. Langham discussed emergency response in the county, the current use and value of RBDS in communicating information during emergencies, and activities that occurred during the emergency response to Hurricane Katrina. Also in attendance at this pre-brief were representatives from FEMA, Ms. Susan Perkins from Mississippi Emergency Management Agency (MEMA), and representatives from NGC and GSS/AlertFM.

Ms. Perkins initiated the exercise by activating an alert that was targeted for the four participating county EOCs. The Hancock County EOC was the only county to receive the alert. A second attempt was initiated with similar results. Mobile County EOC and Jackson County initiated their alerts as scripted and in accordance with the established timeline, which resulted in no alerts being received by any of the receivers. At this point, the demonstration was paused to allow representatives from GSS/AlertFM time to investigate. Their investigation revealed that no alerts were getting to their designated receivers for any of their tests and no workaround was available. The demonstration was terminated with no further alert origination attempts to allow Jackson County attendees to travel to Hancock County EOC for a brief from Brian Adams, Hancock County EMA Director.

GSS representatives continued their root cause analysis for the failure and determined that their Satellite Provider had hardware issues that prevented the transmission of the alert to the individual FM broadcasters. The Satellite Provider provided a confidential report[3] detailing the technical failure that was forwarded to representatives from FEMA IPAWS.

[3] April 8th Service Disruption Summary from GSS Satellite provider

2.3.1.4 12 Apr to 15 Apr – NAB Show, Las Vegas NV

FIGURE 9. IPAWS BOOTH IN NAB SHOW

The FEMA IPAWS Office indicated that they were showcasing their Disaster Management Open (DM-Open) tools at the National Association of Broadcasters (NAB) Show in Las Vegas, Nevada. They requested support to show the complete end-to-end process (Figure 10) from CAP alert origination to CAP alert notification with receivers alarming and displaying the alerts. Two of the study's vendor partners, GSS/AlertFM and Alertus Technologies, as well as a third RBDS vendor, ViaRadio, were able to support the request.

GSS provided a CAP-based aggregation software tool, AlertFM RBDS Encoder, RF exciter, transmitter with antenna, and AlertFM personal and wall FM RBDS receivers for receipt of the alerts. Alertus installed onto a FEMA laptop the Alertus Server Software which was configured to poll the DM-Open, retrieve the data, and transmit the emergency notifications to the Alert Beacons™ and other Alertus facility notification end-points including Text-to-Speech Voice Annunciators, Digital Signage Override, and Alertus Desktop computer alerting.

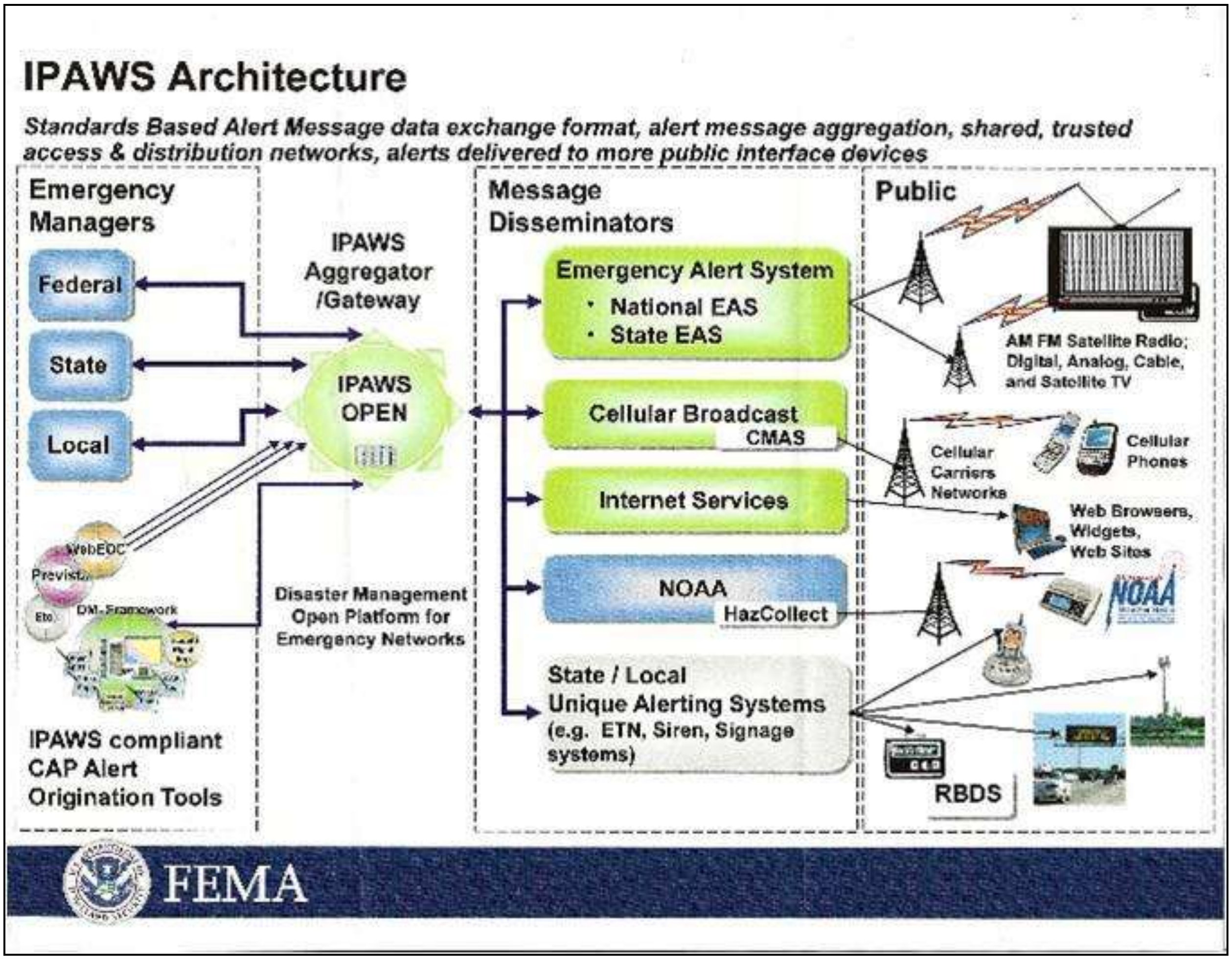


FIGURE 10. FEMA IPAWS ARCHITECTURE DETAILED IN NAB HANDOUTS

The IPAWS demonstration included several CAP producers, which are dispatch interfaces used to compose and post CAP messages. These systems published data to the DM-Open Interoperability Collaborative Operational Group (COG). The second half of the demo consisted of a few CAP consumers, including the AlertFM and Alertus Facility Notification System, which received data from the COG and communicated it publicly.

During the event, FEMA personnel dispatched messages corresponding to one of three pre-determined scenarios. The scenarios were executed both on the half-hour and when requested by interested personnel. Dissemination devices in addition to the RBDS devices included Emergency Alert System (EAS) devices from multiple vendors, NOAA Radio for both weather and non-weather messages, and several software applications used by EOCs such as Next 360 and E-Team.

2.3.1.5 13 Apr – CMU Demonstration Day

FIGURE 11. CMU DEMONSTRATION DAY PICTURES

The CMU installation consisted of a total of 26 Metis Secure Solutions (Metis) wall-mounted receivers that were distributed to 5 buildings located on and near the CMU campus. Individuals were assigned to observe the receivers during the demonstration and to solicit additional feedback from users that were in the vicinity of the receivers during the demonstration.

Activation of the receivers occurred through one FM Broadcast station whose FM signal footprint encompassed the entire CMU campus and surrounding area. For this demonstration, the strobes were activated and the voice and sirens were activated at low volume. When a particular receiver was activated for a test, the receiver would first display English on the display and the voice alert was in English. The receiver was then activated with Spanish on the display and the voice in Spanish. Finally, the receiver was activated with a Korean voice and the display indicated English. Korean was not available on the display because the Korean character set was not installed on the device.

Prior to the start of the first activation, a pre-brief was presented by Madelyn Miller, CMU Environmental Health & Safety (EH&S). Ms. Miller discussed the history of public alerting within CMU and their current use of the Metis system. Also in attendance at this pre-brief were representatives of Metis, MSU SSRC, and NGC.

The demonstration consisted of a total of four tests. Each test consisted of three activations, one in English, one in Spanish, and a third in Korean Voice for a total of 12 alert activations (Figure 8). The MSEL (Annex F) contains the timing and alert text that was transmitted for each activation. User survey forms (Annex E, Figure 34 and Figure 35) requesting feedback on the system were distributed by personnel that were assigned to observe the receivers to those in the vicinity of the receiver during the test. 98 hard copy survey forms were collected during this Demonstration Day event and are included in the overall results.

Alert Origination for this demonstration was performed by the Allegheny County Office of Emergency Management for the initial message, which activated the receiver in Ms. Miller's office. The remaining alerts were issued by Ms. Miller from her office located in the CMU EH&S offices. She used the Metis internet portal to create and initiate the alert messages. Ms. Miller timed the message from when she hit "send" of the alert until the receiver in her office alarmed with the times ranging from 4.5 – 11 seconds.

Following the final message of the demonstration, the hardcopy surveys were collected from the observers assigned to the receivers and all personnel returned to the CMU EH&S office for a final debrief. One anomaly was noted. The receivers that were geo-targeted as part of the third series of alerts did not activate the voice on the final all clear message while the display displayed the receipt of the final all-clear message. Upon post-demonstration analysis, Metis determined that this anomaly was due to an improperly defined alert preset configuration.

2.3.1.6 23 - 25 April – Southeast Tornadoes Real-World Incident

Numerous large super cell tornadoes moved through Mississippi producing rain, large hail, damaging winds and tornadoes beginning April 23, 2010. The Governor of Mississippi declared a State of Emergency for 16 counties with an activation of National Guard personnel (MS EMA, and FEMA Region IV)[4].

The GSS/AlertFM product conveyed several alerts on behalf of the state and county emergency management administrators throughout the state of Mississippi, as can be seen in Figure 12 for Decatur County MS, and in Figure 13, which provides a general view of the types of alert messages issued.

Additionally, the Jones County MS EMA on 27 April 2010[5], while discussing the potential for another wave of storms on a similar scale as the 24 April 2010 storms, showed confidence in the ability of the system by indicating that AlertFM receivers were available for the broadcasted severe weather alerts.

[4]DHS/FEMA Situation Report dated Monday, April 26, 2010

[5] Potential severe weather threat looms, 27 April 2010

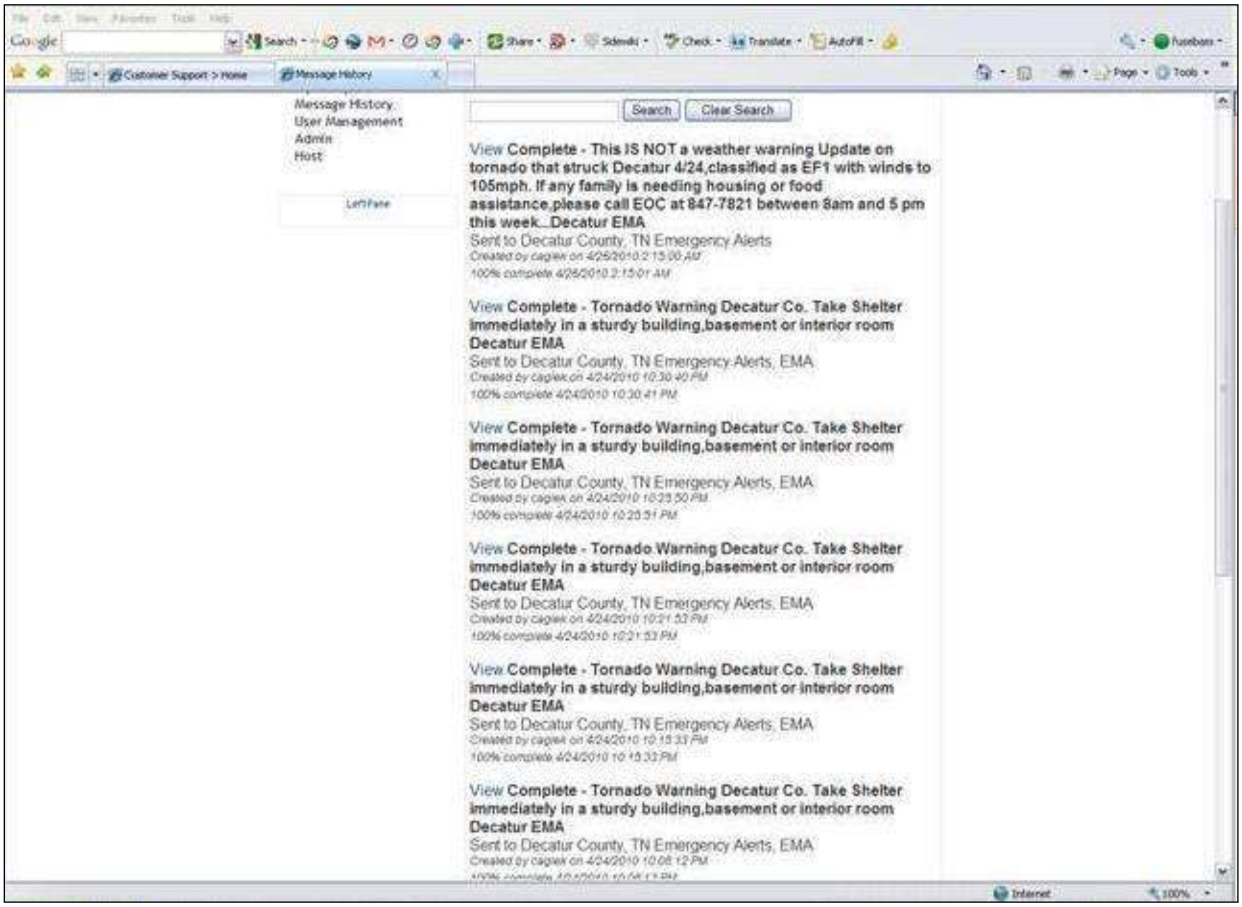


FIGURE 12. DECATUR COUNTY REAL-WORLD EXAMPLES

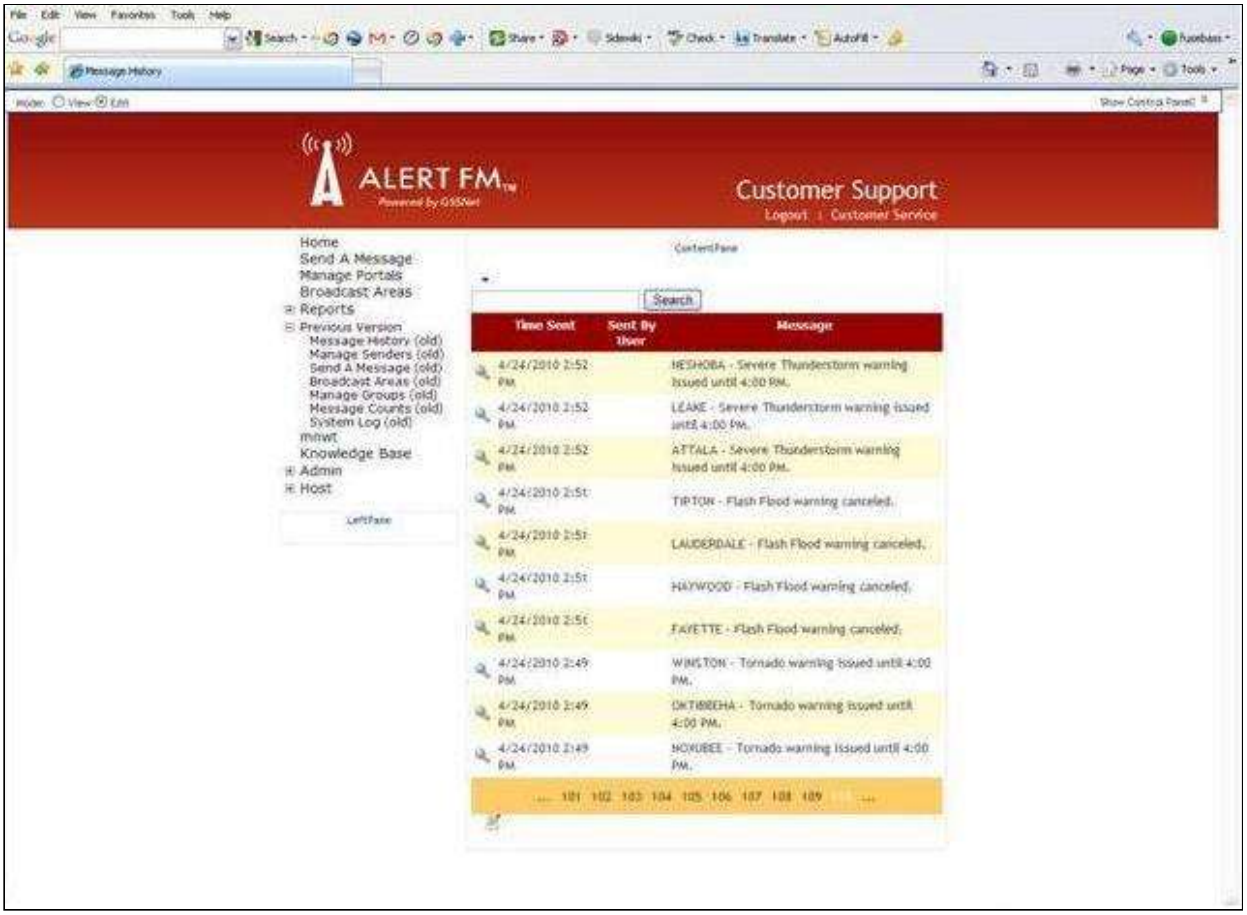


FIGURE 13. MISSISSIPPI REAL-WORLD EXAMPLES

2.3.1.7 30 April - 8 May –Tennessee Severe Storms, tornadoes, flooding

FIGURE 14. SHELBY COUNTY TN REAL-WORLD TORNADO

FIGURE 15. SHELBY COUNTY TN REAL-WORLD FLASH FLOOD

Shelby County TN experienced severe weather that started on 30 April with flooding that continued through 8 May. The AlertFM system (Figure 14 and Figure 15) was one of the public alerting systems used throughout this time period by the Shelby County Emergency Management Agency. The alerts that are pictured on the wall units are just a few of the last 30 received alerts that were stored on the device when the RBDS Study team arrived for the Demonstration Day on 6 May.

2.3.1.8 04 May – Gallaudet University Demonstration Day

FIGURE 16. GALLAUDET DEMONSTRATION DAY PICTURES

Two types of Alertus systems were involved with the Demonstration Day, the existing installed Alertus beacons activated only via their Ethernet connection and 23 Alertus beacons with FM RBDS activation capabilities. The FM RBDS capable beacons were placed around the campus prior to the start of the Demonstration Day tests with a mixture of these beacons on continuous and battery power. There are no differences with the displaying of the alerts via either alerting mechanism to the alert recipient. Ethernet activation is achieved by the Alert Beacons^{TM} performing a "heart beat" check-in with the main system server on a 23 second periodic basis. During this check-in, active alerts are retrieved by the beacons.

Prior to the start of the tests, a short pre-brief was given by Ms. Fabienne Collson, Manager, Communications, Gallaudet Department of Public Safety. She discussed the history of public alerting at Gallaudet University including the use of the Alertus system. She indicated that the system was just used for a real-world event the day prior to this Demonstration Day. Following the pre-brief, representatives from DHS/FEMA and NGC split into two groups. One group departed for the I. King Jordan Student Academic Center to observe the reaction to the beacons, and the second group stayed in the Public Safety Department to witness the alert origination. Following the alert origination of the first test, the second group departed to Carlin Hall for the second test, and subsequently departed to the Plaza Dining Hall to observe the reaction to the beacons for the remaining tests. Both groups returned to the Department of Public Safety following the final test for a debrief of the series of four alerts.

There were four tests completed. Each alert in the MSEL (Annex F) was issued twice, once for the FM RBDS beacons and once for the Ethernet connected beacons. This dual activation was an artificiality of the system installation and was performed so that there would be a better chance of collecting user feedback from the system activations. The Dining Hall was the targeted facility for the third test in the series.

The observed response of those in the vicinity of the beacons was limited at best. Although the observed reaction was limited, 13 surveys were collected. 9 surveys were completed by hand and placed into the adjacent envelopes, 3 surveys were completed online, and 1 was faxed to MSU SSRC. The lack of acknowledgment of the alerting units by those nearby may have been a result of an over-announcement of the demonstration by the campus administration. The test was announced (Figure 6) daily for a week prior to the demonstration by a campus-wide email.

2.3.1.9 06 May – Shelby County TN Demonstration Day

FIGURE 17. SHELBY COUNTY TN DEMONSTRATION DAY PICTURES

Due to the ongoing flooding[6] following the severe storms that began on 30 April within Shelby County TN, the original design for this scenario was adjusted to accommodate the real-world events. The EMA agreed to continue with the test but were unable to provide EOC personnel to generate the alerts. They agreed and gave permission for AlertFM representatives to access their AlertFM portal to generate the alerts on their behalf. Since the EOC was at full activation, they provided a conference room from which to initiate the alerts and to have receivers activate due to this origination.

A total of 34 AlertFM receivers were distributed to assigned individuals throughout the county. The receivers comprised 27 desktop units, 5 wall units, and 2 cell phones. Activation of the receivers occurred through one of four FM Broadcast stations, all of whose FM signal footprints encompassed Shelby County TN. The FM broadcaster was automatically selected by each receiver based on the strength of signal at a given location. Additional receivers which were configured to receive both the English and Spanish alerts were provided to the DHS/FEMA and NGC representatives to aid in the observation of the demonstration.

Prior to the start of the first activation, Mr. Mike Brazzell, Shelby County Office of Preparedness, discussed public alerting within Shelby County and their current use of the AlertFM system given their ongoing real-world events. Following the tests, Mr. Bob Nations, Shelby County Office of Preparedness Director, discussed briefly public alerting within Shelby County.

The demonstration consisted of a total of four tests. Each test consisted of two activations, one in English and one in Spanish, for a total of eight alert activations (Figure 8). The MSEL (Annex F) contains the timing and alert text for each activation. Shortly following the last activation, an email was sent from the MSU SSRC to all of the registered alert recipients for this demonstration requesting their completion of a user feedback survey (Annex E, Figure 34 and Figure 35). A total of 24 user surveys were completed for this Demonstration Day.

An additional element on display at this location was the AlertFM Monitoring Station. This system allows for a visual representation of available AlertFM services across installed FM Broadcasters.

[6] DHS/FEMA Disaster Declaration #1909, Tennessee Severe Storms, Tornadoes, Straight-line Winds, and Flooding

2.3.1.10 12 May – MS / AL Second Iteration Demonstration Day

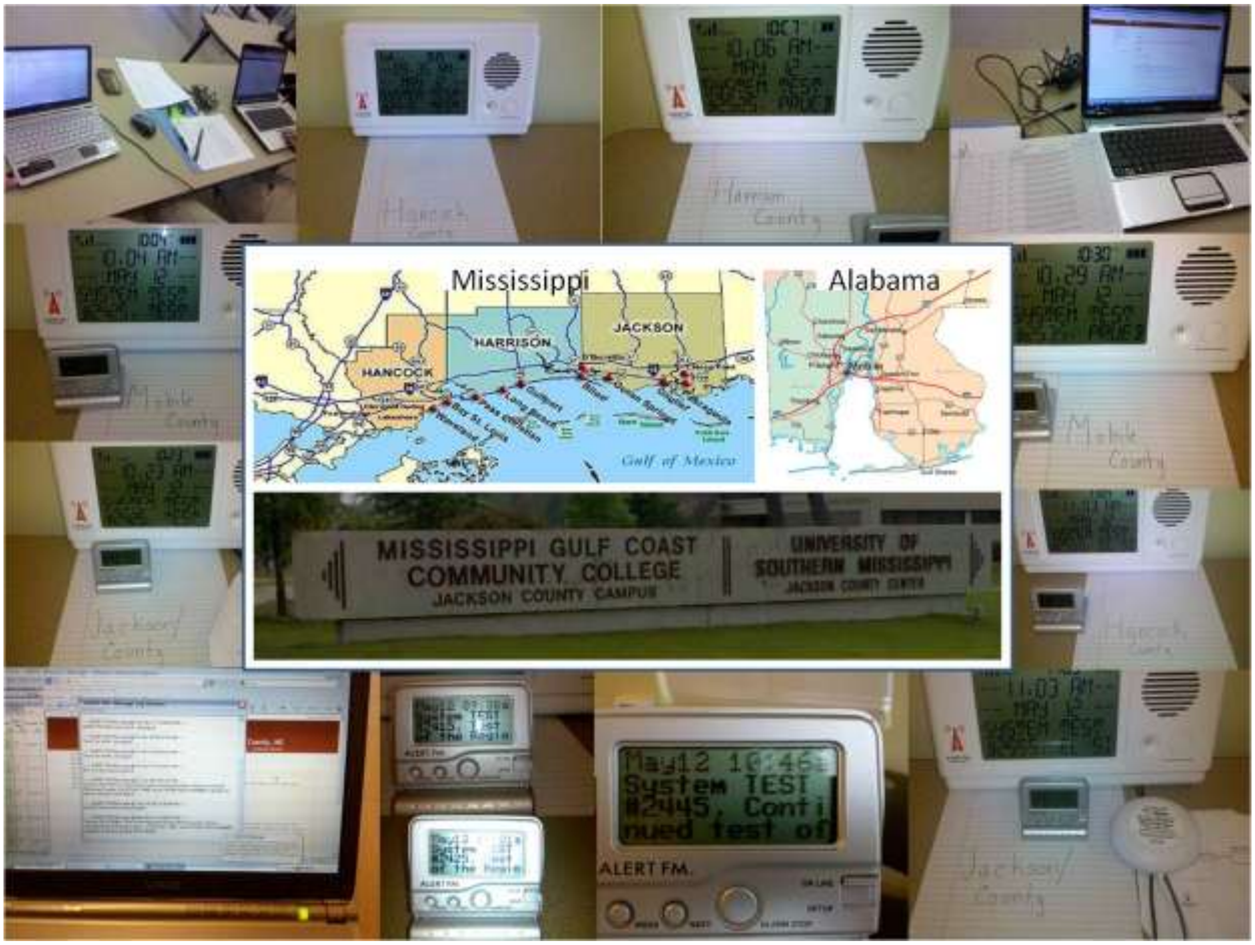


FIGURE 18. MS / AL SECOND ITERATION DEMONSTRATION DAY PICTURES

Due to the ongoing Oil Platform Explosion and Spill of National Significance[7] in the Gulf Coast, the original design for this scenario was adjusted to accommodate the real-world event. The EMAs of the four participating counties all agreed to continue with the test but were unable to provide EOC resources for hosting the test or personnel to generate the alerts. They also all agreed and gave permission for AlertFM representatives to access their AlertFM portals to generate the alerts on their behalf.

AlertFM secured a conference room at the Mississippi Gulf Coast Community College located in Gautier MS to host the alert origination. Within the conference room, four tables were set up representing the four counties participating. On each table, a wall receiver and a desktop receiver were programmed to receive the alerts for that particular represented county. Two additional receivers were programmed to receive the NGC Ingalls Shipyard targeted alerts. Two laptops with wireless capabilities were used to log into the AlertFM portals for the four counties and MEMA. The MSEL (Annex F) was followed although all of the alert activations occurred from within the conference room through the appropriate AlertFM portal.

[7] DHS/FEMA National Situation Report: Updated Friday April 30, 2010

Overall, 471 receivers were given to the four county EMAs and MEMA for distribution prior to the Demonstration Day. The receivers that were distributed comprised 415 desktop units, 50 wall units, and 6 cell phones. Additional receivers which were configured to receive both the English and Spanish alerts were provided to the DHS/FEMA and NGC representatives to aid in the observation of the demonstration.

The demonstration consisted of a series of five tests. The first test simulated MEMA activating an alert to the four participating county EOCs. The four tables of receivers all alarmed at the same instant. According to the MSEL timeline, the second test in the series consisted of each EOC sending an English alert followed by a Spanish alert. In our setup, the order of messages was first all of the English alerts starting with Hancock County, followed by Harrison, Jackson, and finally Mobile County. The same order was followed for the Spanish alerts to each of the four counties. The third test in the series followed the same order as the second test with each county receiving an English alert followed by a Spanish alert.

The fourth test in the series consisted of a targeted message from the Jackson County EMA to the NGC Ingalls Shipbuilding facilities. NGC Ingalls had a total of 30 receivers distributed at their facilities for the demonstration. In addition, two desktop receivers were programmed to receive the NGC Ingalls alerts within our alert origination conference room. The fifth and final test simulated MEMA issuing the demonstration complete message to all the participating receivers in the four counties and across Mississippi for the MEMA distributed receivers.

There were some elements on display at this location that were not seen at previous demonstrations, such as a Universal Serial Bus (USB) receiver that was plugged into an origination laptop. Each alert was displayed in a pop-up on the laptop screen. Also, a bed shaker was plugged into the desktop unit designated for Jackson County. The bed shaker vibrated when the Jackson County receiver received an alert.

2.3.1.11 19 May – AU / HU / GU / GW Demonstration Day

FIGURE 19. AU / HU / GU / GW DEMONSTRATION DAY PICTURES

This Demonstration Day was added to the schedule during the planning as a way to be sure to collect additional user feedback from alert recipients of the Alertus systems. 28 Alertus beacons were installed across the campuses of American University (AU), Georgetown University (GU), Howard University (HU), and George Washington University (GW) (Annex G). The majority of the receivers were installed at AU and these receivers were a mixture of FM RBDS activation only and dual activation by FM RBDS and Ethernet. Prior to the start of the tests, NGC and Alertus personnel met with Mr. Adam Cooper, AU Department of Public Safety. We discussed the beacon configuration and other alerting mechanisms that are being used on the AU campus.

Following the discussion, representatives from NGC and Alertus split into two groups. One group departed for Bender Arena to observe the reaction to the beacons, and the second group stayed in the Public Safety Department to witness the alert origination. Following the final alert, all personnel returned to the Department of Public Safety for a short debrief of the demonstration.

Four tests were completed as defined in the MSEL (Annex F). Three buildings on the AU campus were identified for the targeted third alert: Bender Arena, Mary Gradon, and Asbury. Immediately following the final alert, MSU SSRC sent the email to the registered participants requesting their time to complete the online survey.

2.3.2 KEY PERFORMANCE PARAMETERS (KPPS)

In this section, the analysis of the data is summarized into observations for each KPP. For each observation cited, the observation analysis is presented with a list of the referencing data and a list of recommendations. Each KPP observation is determined to be either a "Strength" or an "Area for Improvement" with the highlights summarized in Table 5.

TABLE 5. ACHIEVEMENT OF KPP ACTIVITIES

Activity Identifier	Strengths	Areas for Improvement
Resilient **KPP.1**	Backup transmitters, backup generators, overlapping FM coverage, and remote origination reduce likelihood of loss of alerting capability and increase likelihood of rapid restoration of capability	Expanded monitoring of FM RBDS signal to more rapidly identify and respond to outages
Secure **KPP.2**	Secure portal logins, viewable target groups based upon privileges, 128-bit encryption from FM tower to receiver	None identified
Language-Targeted **KPP.3**	Minority language alerts sent and received, ADA recipients received and understood alerts	Timely, accurate translation of alert messages, character set availability at receivers, enhanced use of symbology
Geo-Targeted **KPP.4**	Stationary receivers are easily programmed for current location	Mobile receivers cannot automatically receive alerts based upon actual current location
Availability **KPP.5**	Observed availability >99% during 3 month demonstration period, successful performance in response to real-world events	Eliminate single points of failure such as satellite transmission
Interoperability **KPP.6**	Demonstrated CAP initiated alerts and automatic imminent threat weather alerts	Cross-vendor reception of alerts

2.3.2.1 Resilient (KPP.1)

A resilient RBDS system is able to recover from an all-hazard event and resume operations. Resiliency is measured against whether the RBDS system is operational when there is a loss of an FM broadcaster and whether the system can continue to function with the loss of the alert origination facility.

2.3.2.1.1 Resilient Observation 1: Strength, FM Broadcaster Facilities

FM Broadcasters are prepared to operate and be on the air when normal utility power is not available or when they experience a loss of their main transmitter.

References:

a. FM Broadcaster Survey (Annex E, Figure 45), questions 1 – 3 and 6

Analysis:

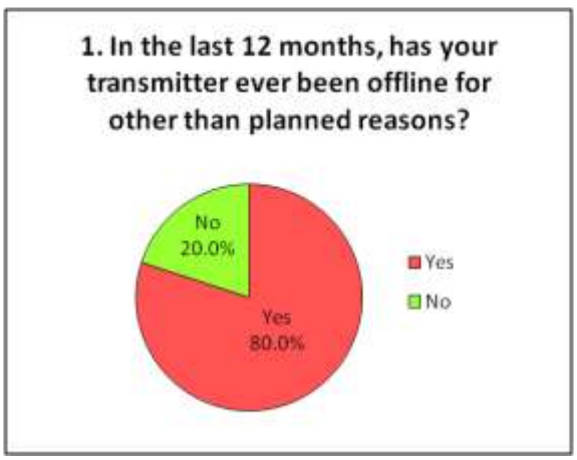
Multiple survey questions were asked of the broadcaster to determine their level of preparedness for a loss of transmission capability due to loss of utility power or their main transmitter. The results from each of those survey questions are discussed in the following paragraphs.

Question 1 of the FM Broadcaster Survey asked the broadcasters about the operational state of their transmitter over the last 12 months. Respondents could select one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	16	57.1%
No	4	14.3%
Don't Know	0	0.0%
Decline	8	28.6%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 8 (28.6%) of the respondents declined to answer the question. While this was a valid response to the question, these responses provide no insight into the "Transmitter Offline" that was being measured. Chart 1 represents the respondents who provided a definitive response as well as answered the follow-up question of how long the transmitter was offline.

80% of the respondents indicated that their transmitter was unexpectedly offline within the last 12 months. Of those transmitters that were offline, 75% were reported as being offline for 1 hour or less.



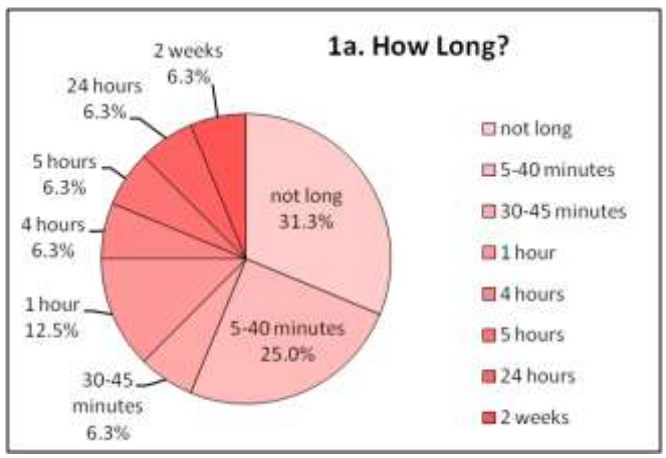


CHART 1 FM BROADCASTER SURVEY (1) TRANSMITTER OFFLINE?

Question 2 of the FM Broadcaster Survey asked the broadcasters about whether they have a standby or back-up transmitter. Respondents could select one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	24	85.7%
No	4	14.3%
Don't Know	0	0.0%
Decline	0	0.0%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that all of the respondents provided a definitive answer to the question of whether a standby or back-up transmitter was available. Chart 2 represents the respondents who provided a definitive response as well as answered a follow-up question concerning the transmission power of the standby transmitter.

85.7% of the respondents indicated that they have a standby transmitter. Of those standby transmitters, 69.6% were reported as having the same transmission power as their primary transmitter.

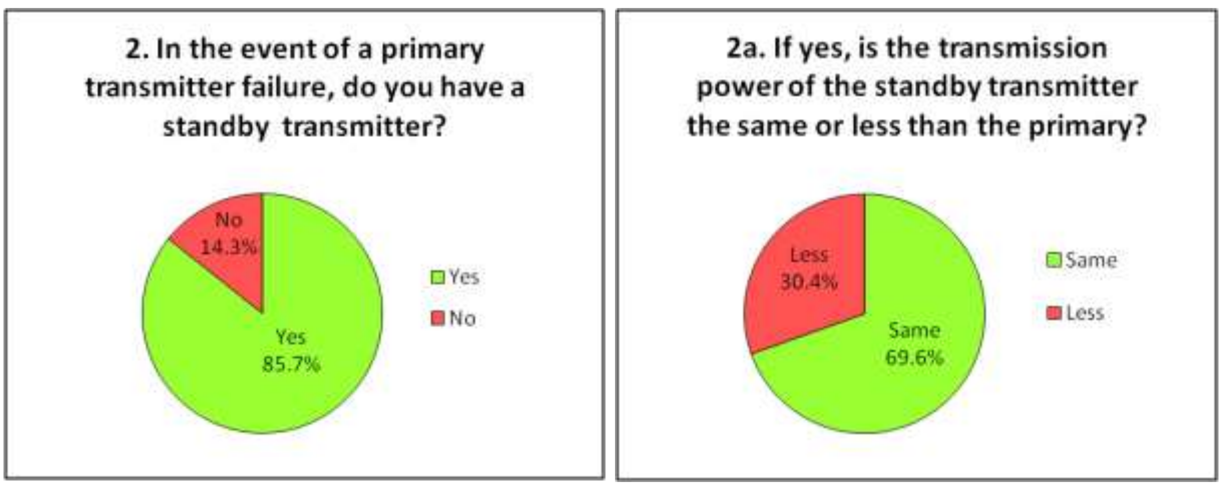


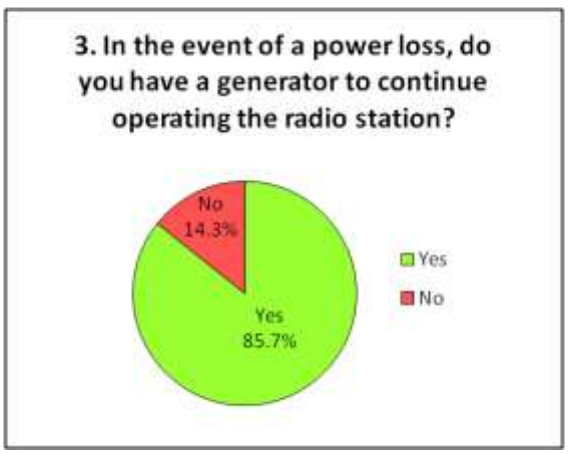
CHART 2. FM BROADCASTER SURVEY (2) STANDBY TRANSMITTER?

Question 3 of the FM Broadcaster Survey asked the broadcasters about their ability to operate when utility electrical power is unavailable. Respondents could select one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	24	85.7%
No	4	14.3%
Don't Know	0	0.0%
Decline	0	0.0%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that all of the respondents provided a definitive answer to the question of backup power generation. Chart 3 represents the respondents who provided a definitive response as well as answered the follow-up question of how long they were able to operate on backup power before running out of fuel.

85.7% of the respondents indicated that they have the ability to generate electrical power in the event of a loss of utility electrical power. Of those with electrical power generation ability, 83.3% indicated that they have enough fuel to operate on generated electrical power for at least three days.



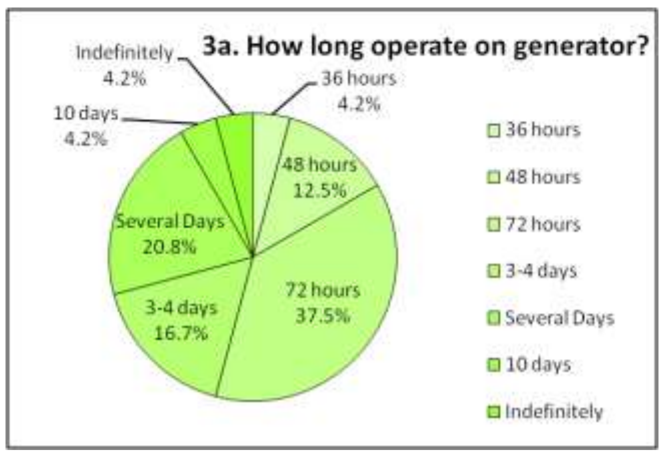


CHART 3. FM BROADCASTER SURVEY (3) BACKUP POWER GENERATION?

Question 6 of the FM Broadcaster Survey asked the broadcasters a series of questions about RBDS technology including whether they have RBDS installed, for how long, RBDS failure rates, and the availability of RBDS technology on standby transmitters.

Initially, respondents indicated the existence of RBDS technology by selecting one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	27	96.4%
No	1	3.6%
Don’t Know	0	0.0%
Decline	0	0.0%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that all of the respondents provided a definitive answer to the question of RBDS technology installed. Chart 4 represents the respondents who provided a definitive response as well as answered the follow-up questions of how long the RBDS technology was installed, RBDS failure rates, and whether RBDS technology is installed on the standby transmitter.

96.4% of the respondents indicated that they currently have RBDS technology installed in their station and 51.9% of the installations have been installed for 2 years or more. Additionally, 68.0% indicated that RBDS technology was installed on their standby transmitter.

The RBDS equipment failure rates were provided by the broadcasters, with 85.2% of the responses indicating that there have been zero equipment failures. 14.8% of the responses reported that failures occurred at an average rate of twice a year.

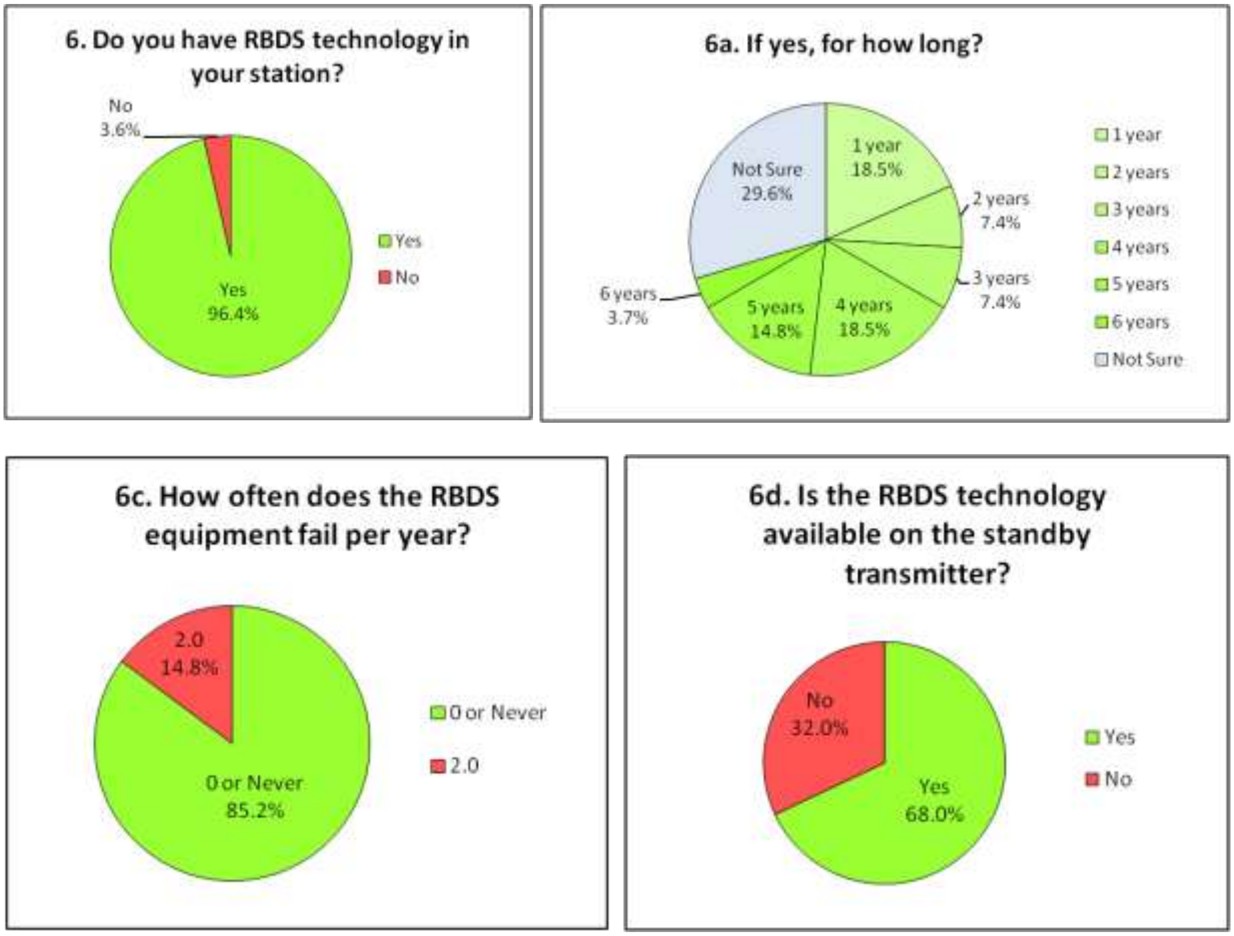


CHART 4. FM BROADCASTER SURVEY (6) RBDS TECHNOLOGY?

Overall, this observation is a strength since the broadcaster survey responses indicate that they are prepared to operate in conditions where they lose utility electrical power or their main transmitter and that RBDS equipment has few equipment failures. The broadcasters' preparedness is further enhanced by their relationship with federal agencies such as the Public Safety and Homeland Security Bureau of the FCC[8]. The FCC provides the Disaster Information Reporting System (DIRS), which is a systematic and automated process for communications providers to report the status of their infrastructures during a disaster. While participation in DIRS is voluntary for the broadcaster, FEMA and the FCC emergency response personnel (ESF-2) supporting restoration efforts use DIRS reports to coordinate needed assistance (e.g., fuel, generators, etc.) for the nearly 800 broadcasters who are now enrolled[9].

Recommendations:

a. Maintain the FM Broadcasters level of preparedness
b. Install RBDS technology onto the remaining standby transmitters

[8] FCC Disaster Support For Broadcasters, Public Safety and Homeland Security Bureau
[9] FCC Encourage Television and Radio Broadcasters to Enroll in DIRS, August 6, 2010, DA 10-1459

2.3.2.1.2 Resilient Observation 2: Strength, FM Overlapping Coverage

Multiple FM broadcasters with overlapping signal coverage provides multiple levels of redundancy so that messages can continue to be transmitted even with the loss of a single broadcaster.

References:

a. 12 May – MS / AL Second Iteration Demonstration Day
b. Figure 20. FM Station Footprint for AlertFM (MS, AL, TN, LA)

Analysis:

It is important prior to and following a disaster that the message can get out to the public. If more sources are transmitting the signal, there is a greater likelihood that the signal will be received. Overlapping FM coverage provides redundant message paths to the public, increasing probability of reception and resiliency when a transmitter is damaged. RBDS receivers use a "roaming" capability that automatically scans for the strongest signal when a signal is lost.

Figure 20 shows the current signal coverage or "footprint" of RBDS coverage for the state of Mississippi and parts of Tennessee, Louisiana, and Alabama. This figure includes only the stations that have RBDS Alerting capability. Almost the entire state of Mississippi has coverage from at least one FM Broadcaster, with most areas in the footprint of multiple FM stations. An area of significant overlapping coverage is along the Gulf Coast, which has a high probability for significant hurricane events.

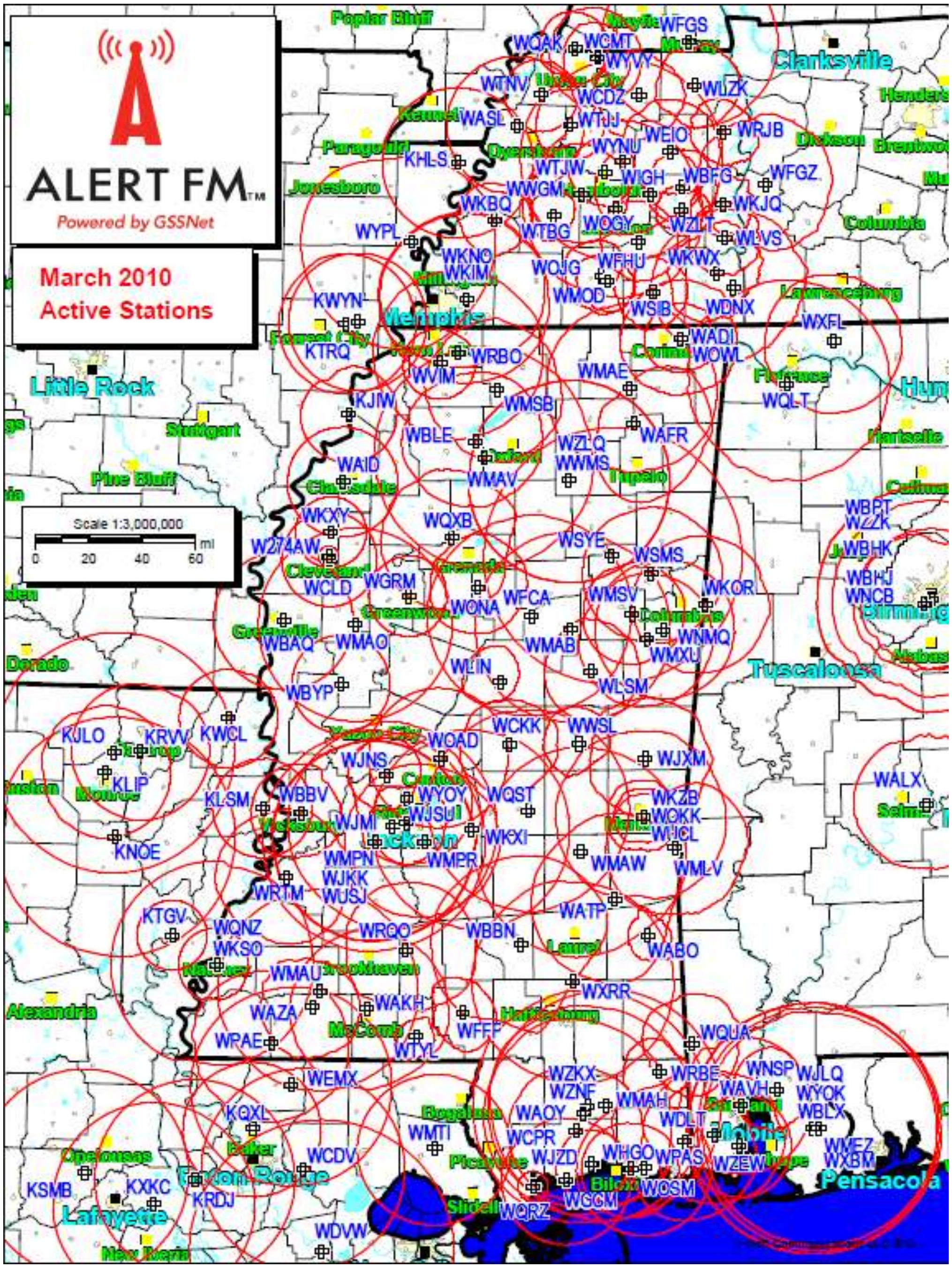


FIGURE 20. FM STATION FOOTPRINT FOR ALERTFM (MS, AL, TN, LA)

This observation demonstrates the strength of overlapping FM coverage for public alerting and warning purposes that was demonstrated in the state of Mississippi and along the Mississippi Gulf Coast.

Recommendations:

a. The Enterprise style systems should expand the installation of RBDS encoders to additional FM Broadcasters to gain the benefit of overlapping FM coverage.

2.3.2.1.3 Resilient Observation 3: Strength, Remote Alert Origination

The origination of alerts is not constrained by specific software, location, or devices.

References:

a. 16 Mar – MWSU Demonstration Day
b. 25 Mar – MSU Demonstration Day
c. 12 May – MS / AL Second Iteration Demonstration Day
d. 19 May – AU / HU / GU / GW Demonstration Day

Analysis:

Remote origination was observed during four of the Demonstration Days with two of the participating RBDS systems. At the MWSU demonstration, alerts were activated from within their Campus Public Safety office and remotely on campus while using a laptop with wireless internet connectivity (Section 2.3.1.1).

During the MSU demonstration, all of the alerts were activated using a laptop with wireless internet connectivity from a conference room located within the MSU SSRC. The conference room used for the demonstration is at a remote location away from the offices of the Oktibbeha County Emergency Agency (Section 2.3.1.2). While it was not demonstrated, Mr. Britt, Director of Oktibbeha County Emergency Management Agency, indicated he routinely used his Blackberry mobile device to initiate the alerts. Figure 21 is an example of an available mobile device origination screen.

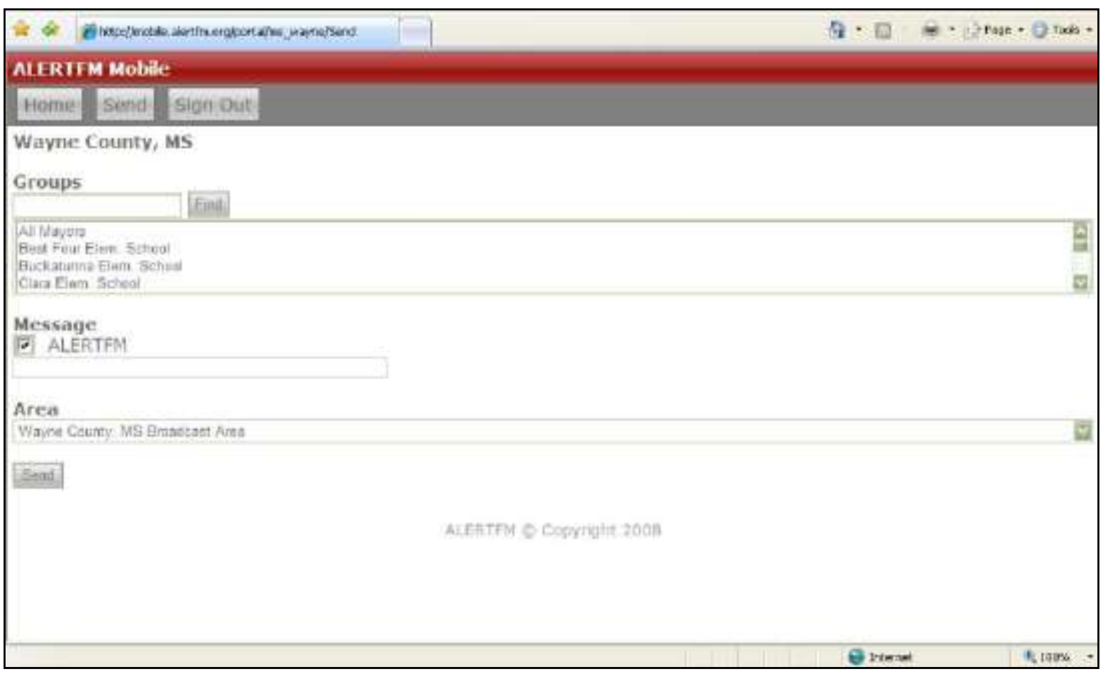


FIGURE 21. EXAMPLE OF ALERT ORIGINATION ON A MOBILE DEVICE

The Scenario 2 demonstration was designed to demonstrate remote origination (Section 2.2.3.2). This scenario demonstrated the ability for MEMA, a state agency, to alert county EOCs at three MS counties and one AL county. It also demonstrated the ability of MEMA to assume the alerting authority within the four participating counties by generating an alert directly to all of the participants within each of the four counties, as may be needed following a widespread catastrophic event. During the MS/AL demonstration, all of the MEMA and the four county EOCs alerts were activated using two laptops with wireless internet connectivity from a conference room located on the campus of Mississippi Gulf Coast Community College in Gautier MS. (Section 2.3.1.10)

The demonstration held across the campuses of AU/HOW/GU/GW provided a similar cross-jurisdictional remote origination (Section 2.3.1.11). This Demonstration Day together with the MS/AL scenario demonstrated that the technology has the capability to allow higher level authorities to assume alerting duties. This observation can be especially important following a catastrophic event when the local alerting authority is unable to provide notifications to their jurisdictions.

This observation demonstrates the strength of remote alert origination by allowing remote devices to initiate local alerts and by allowing higher jurisdictional authorities to assume local jurisdictional alert origination authority and duties.

Recommendations:

a. Provide additional remote origination paths, such as through the use of a telephone connection, to be able to create, select, and send alerts.
b. Develop capabilities to allow for easier assumption of alert origination by higher levels of jurisdictional authorities.

2.3.2.1.4 Resilient Observation 4: Area for Improvement, FM RBDS Signal Monitoring

Monitoring of FM RBDS signal availability for a geographically dispersed system needs to be expanded and become more robust before it can provide a worthwhile situational awareness to the alert originators.

References:

a. Annex G: Participant Distribution
b. 16 Mar – MWSU Demonstration Day
c. 13 Apr – CMU Demonstration Day
d. 06 May – Shelby County TN Demonstration Day
e. 12 May – MS / AL Second Iteration Demonstration Day

Analysis:

The RBDS alerting path is a one-way flow of alerts. Once alerts are "sent", there is no viable way to know whether the alert has made it to the receivers. The three RBDS vendors that were part of this study demonstrated three different solutions to overcome this deficiency.

Two of the vendors implemented a return data path to the originator via Ethernet or RF to the originating RBDS systems, allowing for signal status and other information to be returned, analyzed, and displayed. In the Enterprise style systems at MWSU and CMU, this data was displayed and observed during the Demonstration Days. These implementations were successful in displaying receiver status to the originator. However, there are drawbacks to these implementations. Some of the receivers are installed in locations where it is infeasible to connect the receivers to Ethernet. The RF solution is limited by geographic distance, making it an infeasible solution to monitor the entire FM footprint.

The GSS Personal style system used an FM Monitoring station that was strategically located in the demonstration areas. These stations were enhanced receivers that had the ability to receive the FM RBDS signal and alerts and to transmit this data via the internet to the central data center for their systems. The reported data was then displayable per location on maps (Figure 22, Figure 23) that were available to the originators. However, the placement of the FM Monitoring Stations was not within the range of all of the FM broadcasters that were participating in the given scenario and locations, so the approach could not verify that signals from all FM broadcasters were received.

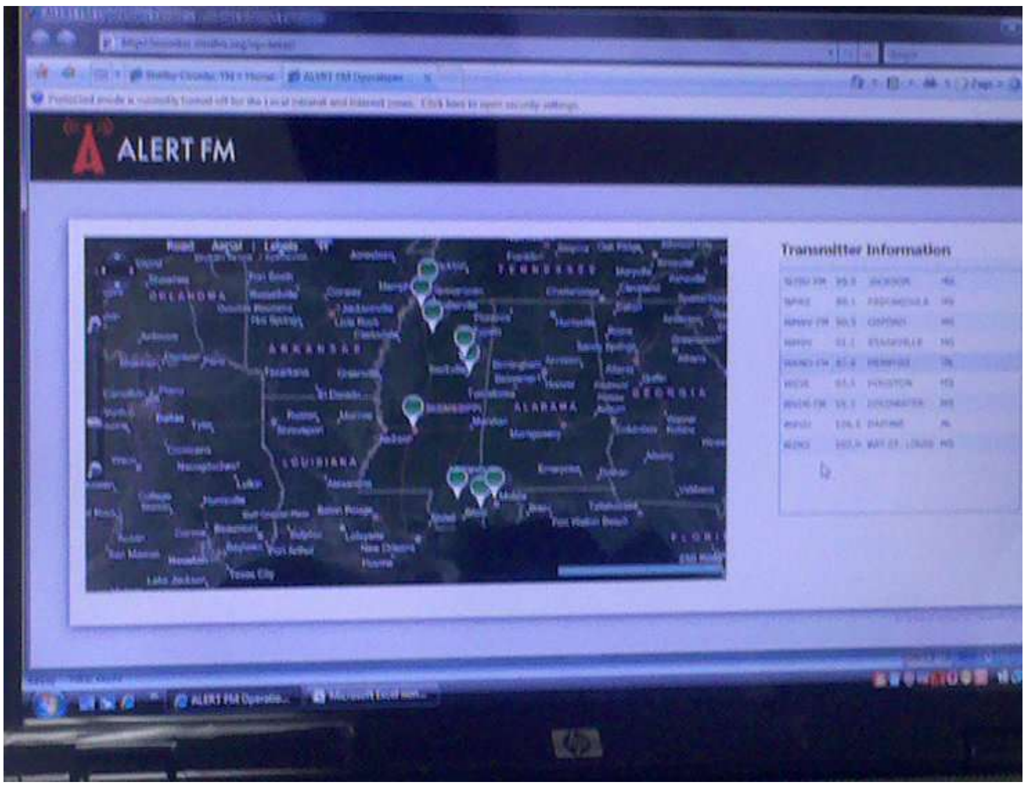


FIGURE 22. FM BROADCASTER MONITORING MAP

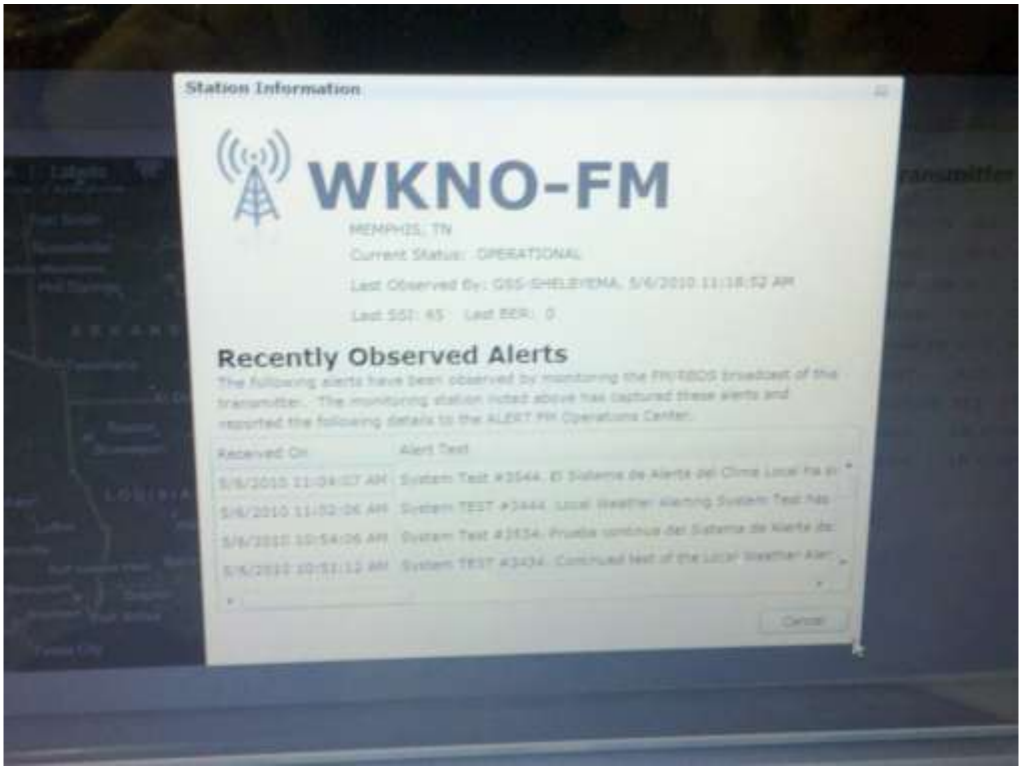


FIGURE 23. FM BROADCASTER DETAILED STATUS

While monitoring of the FM RBDS signal was successfully demonstrated, improvements could be made for Personal style systems operating over geographically dispersed regions. The capability to monitor every broadcaster that is distributing RBDS alerts needs to be expanded so that the alert originators can determine that their message is reaching the targeted areas.

Recommendations:

a. Expand to cover entire installed base
b. Expand to cover every FM RBDS installed broadcaster
c. Add the ability to monitor the entire distribution path (i.e. Satellite)

2.3.2.2 Secure (KPP.2)

A secure RBDS system provides authenticated delivery of coordinated messages throughout their entire delivery process from origination, through the broadcaster, and from the tower to the end receiver.

2.3.2.2.1 Secure Observation 1: Strength: Origination Portal

Access to the origination portals is via a username/password authentication over an https connection. Available alerting groups are assigned for each individual authenticated user.

References:

a. FIPS PUB 199, Standards for Security Categorization of Federal Information and Information Systems[10]
b. Alert Originator Survey (Annex E, Figure 36 through Figure 41), question 16
c. 16 Mar – MWSU Demonstration Day
d. 25 Mar – MSU Demonstration Day
e. 13 Apr – CMU Demonstration Day
f. 04 May – Gallaudet University Demonstration Day
g. 06 May – Shelby County TN Demonstration Day
h. 12 May – MS / AL Second Iteration Demonstration Day
i. 19 May – AU / HU / GU / GW Demonstration Day
a. GSS Technical Data Response, 15 February 2010
b. Alertus Technical Data Response, 6 January 2010
j. Metis Technical Data Response, 24 February 2010

Analysis:

The RBDS systems need to conform to NIST Standards for Federal Information and Information Systems as defined in Federal Information Processing Standards (FIPS) Publication (PUB) 199 (Table 6). In the following paragraphs, the RBDS alert origination and encrypted message dissemination strategies will be analyzed against the three security objectives in the table to demonstrate how the systems are secured to meet the potential impact criteria of Confidentiality (Low), Integrity (High), and Availability (High).

TABLE 6. NIST POTENTIAL IMPACT DEFINITIONS FOR SECURITY OBJECTIVES

	POTENTIAL IMPACT		
Security Objective	LOW	MODERATE	HIGH
Confidentiality Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information. [44 U.S.C., SEC. 3542]	The unauthorized disclosure of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized disclosure of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized disclosure of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.
Integrity Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity. [44 U.S.C., SEC. 3542]	The unauthorized modification or destruction of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized modification or destruction of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized modification or destruction of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.

[10] FIPS PUB 199, Standards for Security Categorization of Federal Information and Information Systems, Feb 2004

Availability Ensuring timely and reliable access to and use of information. [44 U.S.C., SEC. 3542]	The disruption of access to or use of information or an information system could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The disruption of access to or use of information or an information system could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The disruption of access to or use of information or an information system could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.

The two most vulnerable points within an RBDS system are at the point of origination of the alert and the transmission of the alert from the tower to the receiver. Confidentiality and Integrity are both addressed by the RBDS systems through authenticated logins.

An RBDS system is considered to have a Low impact assessment for Confidentiality. There is very little if any data that is stored within the portal where accidental disclosure would have more than a limited adverse effect on the operation. The primary data that is stored are the alerts that were meant for public consumption. During their Demonstration Days each vendor demonstrated authenticated and password protected logins via a Hypertext Transfer Protocol (HTTPS) and Secure Sockets Layer (SSL) connection. Additional privileges are assigned based upon the individually assigned user login. Groups are used to add another level of confidentiality for alerts to be targeted to specific groups vs. the public at large.

An RBDS system is considered to have a High impact assessment for Integrity. Modification of the public message could have catastrophic results to the alerted public if the modified message places the public into further and imminent danger. Protection of a broadcasted message is implemented through 128-bit encryption and is discussed further in Section 2.3.2.2.2.

An RBDS system is considered to have a High impact assessment for Availability. The public may experience catastrophic consequences and be placed in harm if not alerted in a timely and reliable fashion. Resiliency and Availability are discussed in Sections 2.3.2.1 and 2.3.2.5 respectively. It has been demonstrated that RBDS systems have been available to deliver alerts before, during, and following real-world events.

Review of the operational period technical data reveals a particular county's level of trust in the RBDS system meeting the Confidentiality (Low), Integrity (High), and Availability (High) security objectives. This county used the RBDS system to transmit dispatch information that is sensitive and on a "need-to-know" basis from their 911 dispatch center to their local Law Enforcement and Fire and Rescue departments.

This observation is a demonstrated and analyzed strength. The RBDS systems protect against unauthorized alert origination and receipt of unauthorized messages from the broadcast tower.

Recommendations:

a. Maintain

2.3.2.2.2 Secure Observation 2: Strength: Tower to Receiver

The data transmitted from the FM tower to the receivers is encrypted to a 128-bit level, preventing rogue transmitters from issuing false alerts.

References:

a. GSS Technical Data Response, 15 February 2010
b. Alertus Technical Data Response, 6 January 2010
c. Metis Technical Data Response, 24 February 2010
d. GSS Operational Period Technical Data, 1 July 2010

Analysis:

Each vendor participating in the study provided data on their system's security implementations. All implement 128-bit encryption of the proprietary payload that is sent using the RBDS data protocol from the FM tower to the receivers. Symmetric key technology such as Advanced Encryption Standard [11](AES) is employed for encryption. The details provided were limited due to the proprietary and confidential methods employed by the vendors.

Additional protection features employed include a system preventing "play-back" alerts by not allowing the same encrypted message to be valid for alerting at the receiver. One system utilizes a "primary identifier" (service) and a programmable identifier (group) addressing scheme. The groups are defined in the secure portal and up to 30 groups are entered into the receiver. Likewise, services are defined that provide a level of "need to know" targeting and up to 30 groups are entered into the receiver. The service code that is displayed in the receiver is encoded so that the actual service code cannot be determined, preventing the compromise of the "need to know" service on a lost or misplaced receiver. The "need to know" groups and services can also be reprogrammed from the Emergency Management Agency when a receiver is compromised.

Additional protection against a compromised FM broadcast RBDS signal is accomplished by providing the delivery of the alert to the broadcast tower by satellite. This eliminates the more vulnerable internet connection as a source for rogue message injection into the system.

Review of the operational period technical data reveals a particular county's level of trust in the system's security. This county used the RBDS system to transmit dispatch information that is sensitive and on a "need-to-know" basis from their 911 center to their local Law Enforcement and Fire and Rescue departments.

This observation is an analyzed strength when the technical responses are reviewed and combined with discussions between DHS/FEMA, NGC, and RBDS vendor representatives.

Recommendations:

a. Maintain

[11] Advanced Encryption Standards (AES), Federal Information Processing Standards (FIPS) Publication 197, November 2001

2.3.2.3 Language-Targeted (KPP.3)

An RBDS system needs to be able to support minority languages as well as the majority languages through adaptable distribution of content for those without an understanding of the English language or for those with disabilities. There are several observations discussed in the following sections that indicate both strengths and areas for improvements.

2.3.2.3.1 Language-Targeted Observation 1: Strength: Minority Language Alerts

It was observed that alerts could be sent in Spanish, a minority language, and successfully received and understood by those who are fluent in Spanish and who consider English as a secondary language.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 3d for messages 1-5 and questions 5 and 10W
b. Annex F: Master Scenario Events List (MSEL)
c. Annex G: Participant Distribution
d. 25 Mar – MSU Demonstration Day
e. 13 Apr – CMU Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. 12 May – MS / AL Second Iteration Demonstration Day

Analysis:

Review of the text of the alerts sent during the Demonstration Days within the MSEL (Annex F) found that Spanish alerts were sent as part of four Demonstration Days. All of the receivers at CMU were public wall units and each unit received text alerts in both English and Spanish. The Personal style receivers at MSU, Shelby County and the MS / AL Gulf Coast were assigned specific group addressable codes designated for the receipt of the Spanish alerts. The receivers were then assigned to individuals fluent in Spanish for the demonstration. Additionally, the system at CMU had audio files generated for the test alerts in English, Spanish, and Korean. These audio files were then loaded onto the receivers prior to the demonstration.

DHS / FEMA and NGC representatives witnessed the receipt of Spanish alerts at the Shelby County Demonstration and the MS / AL Gulf Coast Demonstration. NGC representatives also witnessed the receipt of Spanish alerts at MSU and the receipt of Spanish alerts at CMU and heard the English, Spanish, and Korean audio.

Question 3d of the Alert Recipient Scenario Survey asked the alert recipients about their "understandability" of the received alert message for each alert message that was received. Review of the survey responses by ESL participants revealed that 41 alerts were reported as being received by ESL participants with an "understandability" of 92.7% (Section 2.3.3.2 provides a complete analysis of "understandability").

Valid Response	ESL Frequency	Percent of ESL Responses
Yes	38	92.7%
No	3	7.3%
Total	41	100.0%

This observation is a demonstrated strength when the results from the ESL participants are combined with the DHS/FEMA and NGC witnessed observations which demonstrated the delivery of a minority messages to an alerting receiver.

Recommendations:

a. Maintain

2.3.2.3.2 Language-Targeted Observation 2: Strength: ADA Support

It was observed that RBDS receivers could alert and inform those in the community who are deaf, hard-of-hearing, and blind.

References:

a. NFPA72, National Fire Alarm and Signaling Code[12]
b. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 3d for messages 1-5 and questions 5 and 10W
c. Annex F: Master Scenario Events List (MSEL)
d. Annex G: Participant Distribution
e. 16 Mar – MWSU Demonstration Day
f. 25 Mar – MSU Demonstration Day
g. 13 Apr – CMU Demonstration Day
h. 04 May – Gallaudet University Demonstration Day
i. 06 May – Shelby County TN Demonstration Day
j. 12 May – MS / AL Second Iteration Demonstration Day
k. 19 May – AU / HU / GU / GW Demonstration Day

Analysis:

The ADA community addressed in this study included the deaf, hard-of-hearing, and the blind, each having unique challenges that have to be overcome by the alerting equipment. The blind were alerted by audible sirens that are part of every receiver, and they received the content of the message by audio that was either pre-recorded or generated by text-to-speech (TTS) embedded in the receiver or an attached speaker. The deaf and hard-of-hearing were alerted by flashing LEDs and strobe lights, and they viewed the LCD display of the receiver to retrieve the content of the message.

The NFPA 72 2010 Handbook, which is the National Fire Alarm and Signaling Code owned by the National Fire Protection Association (NFPA), provides specific instructions on in-building notifications to be ADA compliant. Alertus receivers are specifically highlighted.

[12] NFPA72, National Fire Alarm and Signaling Code, 2010

Chapter 24 on Emergency Communications Systems describes the use of Alertus beacons in an effective in-building alerting solution to address the special needs of the ADA community.

Review of the seven Demonstration Days found the vendors' RBDS systems implemented in different configurations to address their localized ADA needs. Additionally, ADA specific equipment such as a "bed shaker" attachment was demonstrated for DHS / FEMA and NGC observers at the 12 May – MS / AL Second Iteration Demonstration Day.

Question 3d of the Alert Recipient Scenario Survey asked the alert recipients about their "understandability" of the received alert message for each alert message that was received. ADA participants indicated that 43 alerts were reported as being received, with an "understandability" of 79.1% (Section 2.3.3.2 provides a complete analysis of "understandability").

Valid Response	ADA Frequency	Percent of ADA Responses
Yes	34	79.1%
No	1	2.3%
Don't Know	6	14.0%
Decline	2	4.7%
Total	43	100.0%

Question 10w of the Alert Recipient Scenario Survey asked all of the alert recipients whether the receiver "attracted the attention" of others in the vicinity. Recipients could select one of four valid responses: two responses provided a definitive "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know".

Valid Response	Frequency	Percent of Responses
Yes	100	69.9%
No	26	18.2%
Don't Know	14	9.8%
Decline	3	2.1%
Total	143	100.0%

For the 143 alert messages received and survey responses collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 3 (2.1%) of the responses were "Decline". While this was a valid response to the question, it provides no insight into the "Ability to Attract" that was being measured. Chart 5 represents the respondents' opinion on "Ability to Attract" of each of the received alert messages by calculating the percentage of responses for the three charted responses where an opinion was provided. 18.6% of the responses indicated that the receivers did not attract the attention of others in the area. A contributing factor for the 18 of the 26 "No" answers was the lower volume setting used for the receivers during the CMU demonstration.

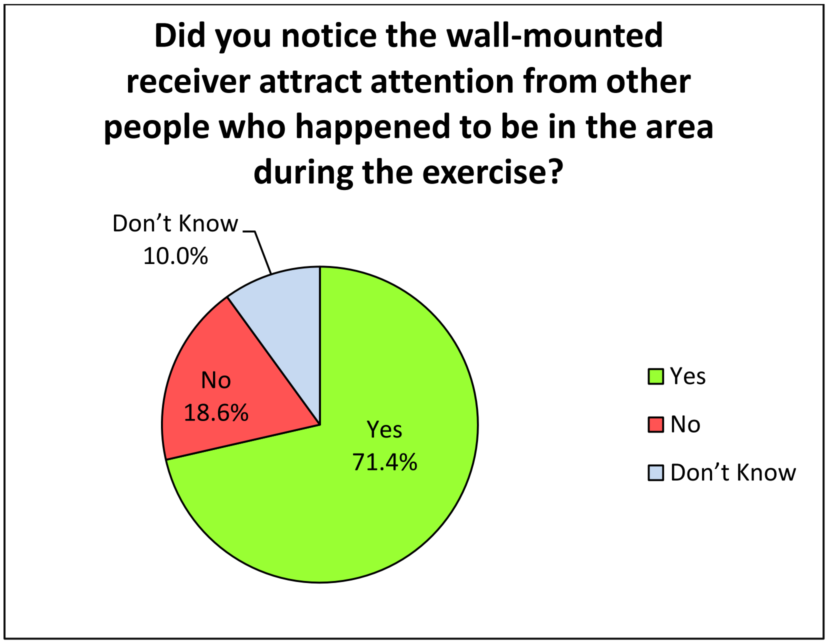


CHART 5. ALERT RECIPIENT SCENARIO SURVEY (10W) NOTICE RECEIVER?

This observation is a demonstrated strength when the results from the ADA participants are combined with the DHS/FEMA and NGC witnessed observations at the seven Demonstration Days and the NFPA72 Code recommending Alertus, an RBDS system.

Recommendations:

a. Add vibration capabilities to Personal style receivers.
b. Add crescendo volume control to all receivers to prevent startling the recipient on initial activation.
c. Add volume control to all receivers for the control of the top volume levels and muting of Personal style receivers when vibration is available.
d. Integrate additional ADA compliant attachments such as Text-to-Braille.

2.3.2.3.3 Language-Targeted Observation 3: Area for Improvement: Origination Translation

Alerts which maintained the same "message" that was trying to be communicated were difficult to create in languages other than English.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. 25 Mar – MSU Demonstration Day
c. 08 Apr – MS / AL Demonstration Day
d. 13 Apr – CMU Demonstration Day
e. 06 May – Shelby County TN Demonstration Day
f. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions 5-7

Analysis:

Alerting in a language other than English was a challenge for the Demonstration Days. As the MSEL was being developed (Section 2.2.3), the English alerts were translated to Spanish and reviewed by those who were fluent in Spanish. It was discovered that translation between languages is not an exact science, as each reviewer presented a different result. The few responses from the Alert Originator Survey indicate a full range from easy to difficult for the ability of the originators to translate alerts into Spanish if needed.

During the Demonstration Day briefings and discussions, the demographics of the local jurisdiction were discussed, and it was found that there were potential alert recipients using many languages other than English. Where possible, these jurisdictions are able to create "canned" messages for "common" situations in a few of the minority languages in advance of an incident. However, timely translations of unique messages during an incident were considered a challenge. There are software tools available that will translate text between various languages, but this technology may not provide sufficiently accurate translations for this application.

For instance, there is a large Korean speaking population on the campus of CMU. To include this community in the demonstration, prior to the Demonstration Day a Korean interpreter read the English text of the alert and spoke the alert in Korean, which was recorded. The recorded audio was "pushed" to each receiver in the demonstration and was activated during the demonstration along with the alert displayed in English. This activity was completed well in advance of the Demonstration Day activity and could not be completed in a timely manner during an incident.

This observation is an area for improvement. Alert originators cannot reliably create alerts for minority languages when time is critical for issuing the alert.

Recommendations:

a. Alert Originators should develop as many "canned" messages in the minority languages as they need prior to incidents.
b. RBDS vendors should include access to automated translation tools in their alert origination portals.

2.3.2.3.4 Language-Targeted Observation 4: Area for Improvement: Receiver Limitations

Receivers displayed the text of alerts in at most two languages which prevented the communication of the alert to those that cannot read the languages displayed.

References:

a. 25 Mar – MSU Demonstration Day
b. 13 Apr – CMU Demonstration Day
c. 06 May – Shelby County TN Demonstration Day
d. 12 May – MS / AL Second Iteration Demonstration Day

Analysis:

Spanish was transmitted and received in several of the Demonstration Days as an alternative to English. At the CMU demonstration, alert recipients additionally heard the test alerts spoken in Korean from the receivers while the display showed the alert in English, which caused an observed level of confusion.

The alerts displayed on the receivers were limited by the character set chosen for the receiver's display and the language in which the alerts were sent. This presents a problem of understanding the message for those who are unable to read the displayed language. These alert recipients may see the flashing lights and hear the sirens, but that is all the information that is being communicated. This is especially a problem for receivers that are located in public areas as most of the Enterprise style receivers were. The Personal style receivers that received the Spanish alerts were distributed to those who read Spanish, so this level of confusion was not as apparent. However, the controls on these receivers were in English.

Textual display of several different languages on the receivers is an area of improvement based upon this observation. Displaying symbols that represent the threats as well as the suggested action along with the alert text will give the recipient who cannot read the displayed language an opportunity to understand the alert. The Canadian Association for Public Alerting and Notification (CAPAN) has devised an experimental symbology service that includes symbology associated with CAP-Canadian Profile (CAP-CP) events. The symbology was drawn from a new Canadian symbology development effort[13].

Recommendations:

a. Increase the number of installed language character sets in the receivers.
b. Define an emergency symbols character set similar to "wing dings" that represent the most common imminent threats and most common actions. At the receiver, common symbols can then be displayed for those that cannot read the text.

2.3.2.4 Geo-Targeted (KPP.4)

An RBDS system needs to be able to accurately target emergency alerts to geographically defined areas so those who are located within the defined geographic area can be properly informed. Observations discussed in the following sections indicate both strengths and areas for improvement.

2.3.2.4.1 Geo-Targeted Observation 1: Strength: Stationary Receivers

Permanent wall mounted receivers and mobile receivers used at a stationary location such as on a desk were manually programmed for geographic parameters such as zip-code and county group codes. These stationary receivers were able to receive geo-targeted alerts for their respective geographic location.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. Annex G: Participant Distribution

[13] Briefing on "CAP Implementation in Canada' by Doug Allport, July 21, 2010

c. 16 Mar – MWSU Demonstration Day
d. 25 Mar – MSU Demonstration Day
e. 13 Apr – CMU Demonstration Day
f. 04 May – Gallaudet University Demonstration Day
g. 06 May – Shelby County TN Demonstration Day
h. 12 May – MS / AL Second Iteration Demonstration Day
i. 19 May – AU / HU / GU / GW Demonstration Day
j. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3 for messages 1-5
k. Alertus Operational Period Technical Data Analysis, 22 July 2010

Analysis:

All of the mobile receivers that were used in the demonstrations were assigned geographic groups (Annex G). The permanently installed units were grouped within the origination portals based upon select buildings. As part of each Demonstration Day, a specific test was performed where an alert was issued only to a specific geo-targeted location based upon the groupings. Analysis of the MSEL provided the specific System Test Number that was geo-targeted. Responses to the Alert Recipient Scenario Survey were reviewed for the reported locations and times of the specific geo-targeted alerts, which were compared against the expected location and actual alert time. The following table shows the number of alerts that were received at the expected geo-targeted location.

Demonstration Day Location	Geo-Target Location	System Test #	Frequency in Survey
MWSU	Murphy Hall	3634	3
MSU	Mitchell Memorial Library	1434 1534	5 1
CMU	University Center, Metis Offices	1834 1934	21 1
Gallaudet	Dining Hall	1634	1
Shelby	Specific Individuals	3434 3534	3 0
MS / AL	NGC Ingalls	2445	1
AU / HU / GU / GW	Bender Arena, Mary Gradon Center, Asbury Building	1634	1 1 0

System test #3534 could not be verified since there were no survey responses that reported that test. The Asbury building on the campus of AU was not verifiable by the survey responses, but the receipt of the alert was verified through analysis of the Alertus Operational Period Technical Data. Additionally, each of the geo-targeted locations was observed by NGC representatives at each of the Demonstration Days.

This observation is a demonstrated and analyzed strength for stationary receivers when the geographic configuration parameters are well known.

Recommendations:

a. Add location determination capabilities to the receiver to allow for automatic configuration for geo-targeted alerts

2.3.2.4.2 Geo-Targeted Observation 2: Area for Improvement: Mobile Receivers

Receivers that have no normal stationary location are considered mobile receivers and cannot automatically be programmed to receive alerts based upon the current location of the receiver.

References:

a. 25 Mar – MSU Demonstration Day
b. 06 May – Shelby County TN Demonstration Day
c. 12 May – MS / AL Second Iteration Demonstration Day
d. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 16

Analysis:

Mobile receivers were demonstrated and observed as part of three Demonstration Days. The receivers that were demonstrated were group based and allowed for manual programming of geographic groups such as zip code or county group code.

For instance, a receiver that was distributed for use in Mobile County AL had multiple groups programmed into the device prior to distribution, including the Mobile County Emergency Management group code. This receiver would activate for alerts targeted to the Mobile County group code when the receiver was receiving an FM signal from a broadcaster whose signal footprint includes Mobile County regardless of the receiver's current location. This was observed during the 12 May MS / AL Demonstration (2.3.1.10) where the receivers were physically located within Jackson County but activated for the counties of Hancock, Harrison, and Mobile.

A respondent to the Alert Receiver Scenario Survey asked, "*Will this alarm work any where else other than Shelby county? Let's say that I am traveling going to Georgia, will this alert me of any weather alert in the area I am traveling? If so, it would be a good thing.*" As of today, this will not automatically work. When a mobile receiver leaves an area for which it has been manually programmed, the receiver will no longer receive alerts since there is no automatic programming of the receiver based upon its current location.

However, the mobile receivers do automatically scan for an FM signal when a signal is lost while moving from one location to another. This allows the user of a mobile receiver to automatically maintain contact with an FM broadcaster for receipt of timely emergency alerts while moving about a large geographic area.

For mobile receivers, this observation is an area for improvement. An effective mobile receiver will automatically be configured to receive alerts for the receiver's current location, which should be determined to at least the county level.

Recommendations:

a. Add location determination capabilities such as Global Positioning System (GPS) or triangulation of FM signals to the receiver to allow for automatic reception for geo-targeted alerts while operating mobile.

2.3.2.5 Availability (KPP.5)

An RBDS system needs to be operationally available to send alerts before, during, and after an all-hazard alert. Availability needs to be considered throughout the entire process of originating, broadcasting, and receiving alerts. The following observations describe the availability of the RBDS systems to deliver alerts during the demonstration operational period.

2.3.2.5.1 Availability Observation 1: Strength: RBDS Operational More than 99% of the Demonstration Period

The RBDS systems were available and used for the dissemination of alerts for greater than 99% of the demonstration operational period.

References:

a. Metis Operational Period Technical Data Analysis, 22 July 2010
b. GSS Operational Period Message Count Data, 3 August 2010
c. Alertus Operational Period Technical Data Analysis, 22 July 2010

Analysis:

The Metis system recorded several categories of data for each of their receivers during the demonstration operational period, including the minimum (Min) and maximum (Max) Signal to Noise ratio (SNR). Chart 27 shows the raw SNR data, where higher is better, captured in four hour segments for one unit throughout the demonstration operational period.

The Metis units continuously logged RBDS data in 4 hour increments beginning on 8 March 2010 and ending on 7 June 2010. The following categories of data were logged:

- Time and date
- Good RBDS packets
- Dropped RBDS packets
- Signal to Noise ratio (SNR) minimum and maximum
- Alerts received over RBDS
- Alerts received over mesh network

Availability of the Metis system was measurable in four areas:

- <u>Communication to the broadcaster tower</u>: no problems encountered in the required internet connection to the RBDS encoder
- <u>Broadcaster up time</u>: 1 instance of RBDS equipment failure and one instance of transmitter failure caused by severe weather
- <u>Device up time</u>: no device failures were detected
- <u>Device reception</u>: requires minimum SNR greater than 10 to alert. Devices that did not meet the minimum requirement were moved to achieve better signal reception.

TABLE 7. METIS RBDS DATA PACKETS RECEIVED

Data field	Total	%
# of RBDS packets logged	* 2,060,133,032	100.00
% of good packets		96.80
% of good packets when SNR >10		99.84
** total consists of 11.3 RBDS broadcasts data packets per second for the 26 units installed at this location during the operational period.*		

Table 7 provides a summary of the data packets that were received by the Metis system and shows availability of 96.8% throughout the entire demonstration period based solely on the receipt of good data packets. At least one device was moved one month into the demonstration due to SNR not being optimal. The percentages of good packets are lower for the entire period due to the one unit operating for one month at a lower SNR. Metis employs multiple techniques to recover data, even if the data quality is 95%, including using multiple transmissions and various CRC techniques. Metis estimates correct alerting can occur 99.9% of the time or better.

The AlertFM system recorded 20,028 messages that were sent by all of their installations during the entire Demonstration Operational period as seen in Chart 6. Of the 20,028 messages, 986 were sent by the locations that participated in the demonstrations, with 540 of those generated with the alert originator portal and 446 of those automatically generated weather messages. The only known time the system was not operational during the operational period was on 8 April when a Satellite Provider experienced hardware issues preventing the dissemination of alerts to the broadcast towers (Section 2.3.1.3). Considering the known down time, this system was operational 99.63% of the time during the 91 day demonstration operational period.

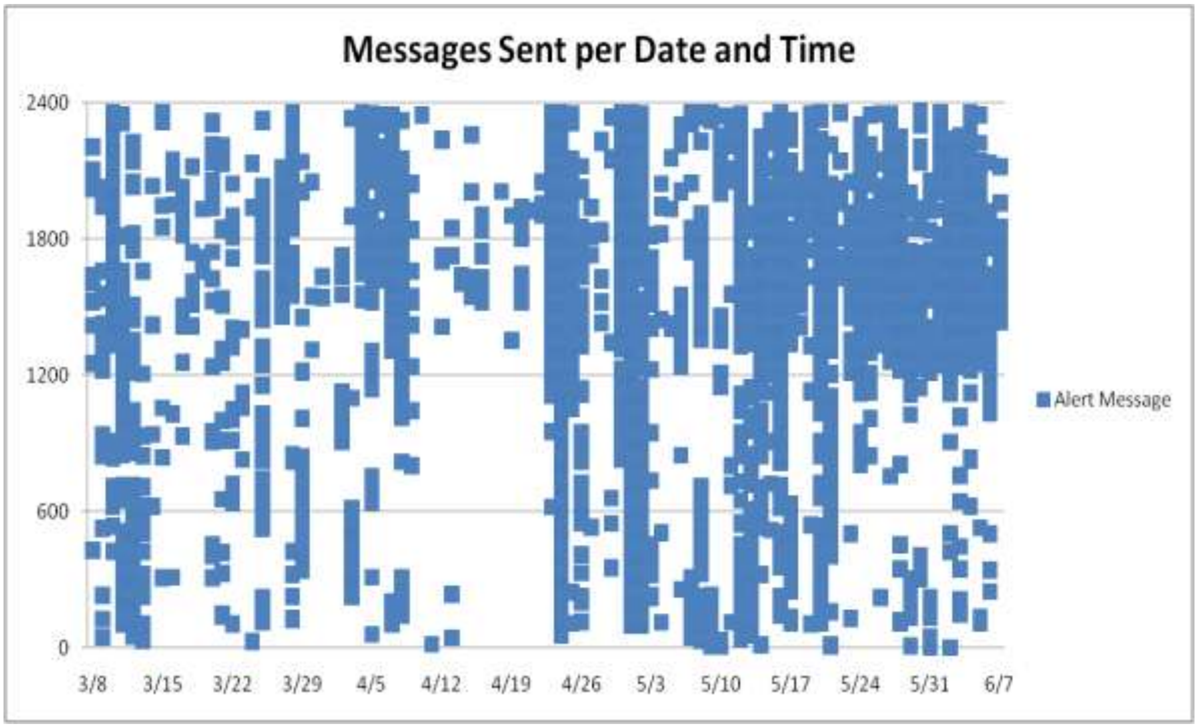


CHART 6. ALERTFM – DEMONSTRATION OPERATIONAL PERIOD, 20,028 MESSAGES

Interestingly, the alerts associated with the Tornado Outbreaks on 24 April (Section 2.3.1.6) and the severe flooding in Tennessee (Section 2.3.1.7) that occurred starting on 30 April are easily seen in Chart 6. Also easily visible are the afternoon severe weather events that occurred from mid-May through the end of the demonstration period.

The Alertus System transmits low priority commands such as configuration data commands during system idle time. These transmissions are controlled by a scheduler on a priority basis at a rate that is typically one command every three to four minutes. The FM-enabled Alert Beacon™ maintains the elapsed time since the last valid command was received over the air, which is then reported to the server during the Alert Beacon™'s periodic "check in" via a network connection. The "Time since last FM Command" is one of several indicators that can be used to detect system abnormalities. Therefore, the presence (or absence) and frequency of these FM reception monitoring notifications can serve as a metric for system availability. If all of the units in the Enterprise style system have not received a command within a specified time, this would be an indication of a communication problem between the server and the RBDS encoder or a problem with the RBDS subcarrier. A failure of this type which is detected would result in a system-wide error with an email notification sent to designated individuals in the Enterprise.

Based upon Alertus's independent networking monitoring of the RBDS transmissions, a network accessibility report for the Demonstration Operational period at MWSU was created and is shown in Figure 24. This report shows that the transmission equipment was unreachable on 8 occasions for a total of just over 18 hours. Five of these occurrences lasted long enough to affect server communications and resulted in a system monitoring warning email to be issued. Considering the known down time, this system was operational 99.18% of the time during the Demonstration Operational period.

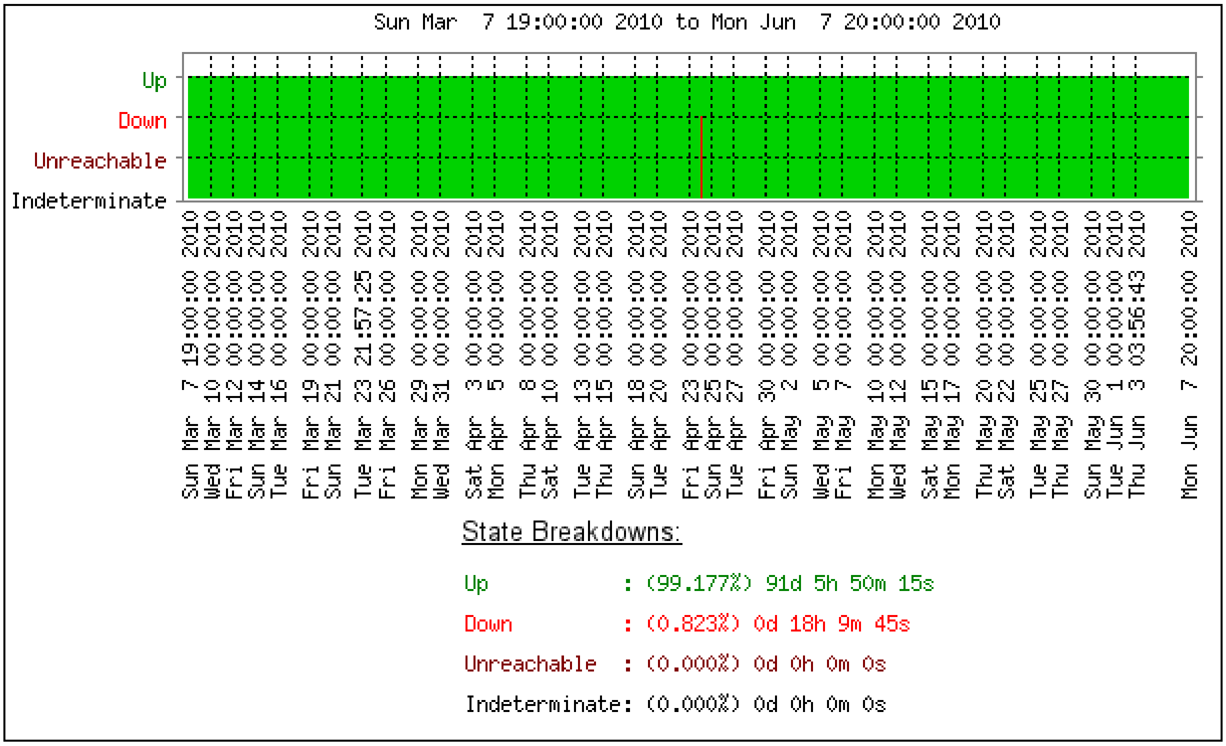


Figure 24. Network Availability of RBDS Equipment Used in MWSU Test

This observation is a demonstrated strength based upon the availability of the three RBDS systems being greater than 99% for the Demonstration Operational period.

Recommendations:

a. Implement recommendations found in Section 2.3.2.5.3 that provide redundant communication paths to the broadcast tower.

2.3.2.5.2 Availability Observation 2: Strength: Before/During/After Real-World Event

A wide range of severe weather alerts were successfully issued and received before, during, and following real-world incidents.

References:

a. 23 - 25 April – Southeast Tornadoes Real-World Incident
b. 30 April - 8 May –Tennessee Severe Storms, tornadoes, flooding
c. 06 May – Shelby County TN Demonstration Day
d. GSS Operational Period Technical Data, 1 July 2010
e. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), question 15

Analysis:

Analysis of the GSS Operational period shows that the system was available and was used in Shelby County TN to issue 64 weather messages starting at 4/30/10 23:57 with a Severe Thunderstorm Warning. This event lasted several days due to the flash flooding and additional severe storms that occurred following the initial severe storm (Section 2.3.1.7). The last of the 64 weather messages was issued at 5/2/10 4:21.

The availability and use of the system was confirmed by FEMA and NGC representatives who were present for the Shelby County Demonstration Day on 06 May (Section 2.3.1.9).

Reviewing the comments provided in the Alert Recipient Real-World Survey indicates that the receivers were alarming for these messages. For instance, one respondent indicated *"I am in Memphis and at one time during the past spring, We had Flash Flood Warnings, Thunderstorm Warnings and tornado warnings going off nonstop. I thought the thing was going to explode."*. This is an indication that many if not all the alerts were received.

Oktibbeha County used their RBDS system to issue 163 dispatches by the 911 center of their local Law Enforcement and Fire and Rescue departments throughout the entire demonstration operational period. Additionally, weather alerts were issued, including for the tornadoes that passed through Mississippi in late April. An Alert Recipient Real-World Survey respondent commented *"Before the school year was out, we had an emergency situation where Tornado's were coming through Mississippi. I worked in a residence hall on campus and instructed my resident adviser's to have students take cover in the first floor hall way as a result of Alert FM. We received all of the alerts from this device prior to sirens going off on campus or other campus announcements going out."* In this event, 21 weather alerts were sent by Oktibbeha County, with the first alert being sent at 4/24/10 11:57 and ending at 4/24/10 16:04.

This observation is a demonstrated strength based upon the trust Oktibbeha County places in the availability of the system to be used by their 911 centers for dispatch.

Recommendations:

a. Maintain

2.3.2.5.3 Availability Observation 3: Area for Improvement: Single point of failure

An RBDS system should not fail to transmit an alert due to any single point of failure.

References:

a. 08 Apr – MS / AL Demonstration Day
b. Metis Operational Period Technical Data Analysis, 22 July 2010
c. Annex G: Participant Distribution

Analysis:

Operational RBDS systems need to be available to deliver critical imminent threat messages when the time is required. To achieve this level of availability, redundancy needs to be built into all parts of the system, including multiple avenues for originating the alert (Section 2.3.2.1.3), redundant paths to the broadcaster, redundant broadcaster capabilities (Section 2.3.2.1.1), and redundant signal coverage for the targeted areas (Section 2.3.2.1.2).

In one instance, messages are transmitted to a broadcast tower through a satellite. The satellite provider experienced a short anomaly which prevented the message from reaching the broadcast tower. This single point of failure ultimately prevented the test alerts from being transmitted.

Metis indicated that there were two instances of failure at their broadcaster. In one instance the RBDS experienced an unknown anomaly, and in another instance the transmitter experienced a failure due to severe weather. At this location, there was only one broadcaster indicated as providing RBDS alert transmission for Metis (Annex G). It is unknown whether the broadcaster resorted to backup RBDS and transmitter equipment during these failures. If not, complete loss of this single broadcaster is a single point of failure for the served area.

This observation is a demonstrated area for improvement. All nodal points in the path from origination to transmission and ultimately to receipt of the message should have redundancy built-in, and there should be notification of failures in the path.

Recommendations:

a. Implement Monitoring of Satellite Data path.
b. Design alternative data path to the Broadcasters.
c. Verify Satellite Provider has implemented full mitigation plan

2.3.2.6 Interoperability (KPP.6)

RBDS systems need to conform to common protocols, standards, and coordinated procedures at all levels of government and among public and private stakeholders. The overarching standard for public alerting is the Common Alerting Protocol or CAP. The following observations discuss RBDS implementation and use of CAP protocols with their systems.

2.3.2.6.1 Interoperability Observation 1: Strength: CAP-Initiated Alerts

CAP formatted messages were observed as being received by the RBDS systems, forwarded to the appropriate receivers, and successfully received at the receivers.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. 12 Apr to 15 Apr – NAB Show, Las Vegas NV
c. 25 Mar – MSU Demonstration Day
d. 13 Apr – CMU Demonstration Day
e. 04 May – Gallaudet University Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. 12 May – MS / AL Second Iteration Demonstration Day
h. 19 May – AU / HU / GU / GW Demonstration Day
i. 23 - 25 April – Southeast Tornadoes Real-World Incident
j. 30 April - 8 May –Tennessee Severe Storms, tornadoes, flooding

k. Alert Originator Survey (Annex E, Figure 36 through Figure 41), question 28
l. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3

Analysis:

During the Demonstration Operational Period for this study, CAP version 1.1 was the latest OASIS approved version. An update to CAP v1.2 was under review by OASIS, with conformance testing at Eastern Kentucky University (EKU) prepared to begin once approved. OASIS approved CAP v1.2 several months later than expected on 01 July 2010. This delay in approval has delayed the conformance testing of this study's participating RBDS vendors, thus the conformance test results are not part of this report.

CAP v1.1 message receipt and alert generation were demonstrated three ways during the operational period: during the Demonstration Days, during real-world usage of the systems, and in support of the DHS/FEMA IPAWS office at the NAB show.

To initiate CAP messages for the demonstrations, NGC created alerts through the DMIS-Open tool and posted the alerts to the DMIS-Interoperability COG prior to the Demonstration Day. At the time defined in the MSEL during the demonstration, the RBDS portals accessed the DMIS Interoperability COG, downloaded the CAP v1.1 formatted alert, and generated the RBDS alert to their receivers. Review of the MSEL indicates that the 10 System Test numbers as shown in the table were CAP messages initiated through this process. Review of the survey responses indicate a total of 174 instances of these System Tests alerts were received, as shown in the following table.

System Test # of CAP Message	Frequency
1424	13
1524	2
1624	7
1824	58
1924	5
2425	21
2525	1
3424	11
3524	3
3624	53
Total	174

Several instances of real-world uses of the RBDS systems that occurred from late April through early May were the origination of alerts from National Weather Service (NWS) CAP v1.1 formatted messages. DHS/FEMA and NGC representatives observed these messages stored on the receivers when they arrived for the 06 May Demonstration in Shelby County TN.

At the 12 Apr to 15 Apr – NAB Show, Las Vegas NV, DHS/FEMA IPAWS personnel observed the activation of RBDS receivers based upon CAP alerts. The RBDS participation helped showcase the IPAWS CAP message aggregator with a complete end-to-end demonstration of CAP v1.1 messages.

Interoperability as defined by the support of consuming CAP messages and generating alerts to RBDS was successful. This strength was observed during controlled demonstrations as well as observed following real-world incidents.

Recommendations:

a. RBDS Vendors to be verified as CAP v1.2 compliant
b. Implement additional rules based processing to allow for a finer granularity of the automatic dissemination of CAP messages

2.3.2.6.2 Interoperability Observation 2: Area for Improvement: Tower to Receiver

Receivers from one vendor cannot easily be used to receive alerts transmitted from another vendor.

References:

a. GSS Technical Data Response, 15 February 2010
b. Alertus Technical Data Response, 6 January 2010
c. Metis Technical Data Response, 24 February 2010
d. RBDS Cross Vendor Platform Activities Technical Notes, 5 August, 2010

Analysis:

Review of the discussions and materials provided by the vendors participating in this study indicates that each vendor has implemented a proprietary protocol on top of the standard RBDS transmission. Included in each proprietary protocol are each vendor's security features as well as their group addressing schemes. This is much the same paradigm as cell phones that work only with specific carriers.

For instance, suppose a local county emergency management agency has deployed a Personal style RBDS system from Vendor "A". Also within the same area, suppose a local university has deployed an Enterprise style RBDS system from Vendor "B". Because of the proprietary protocols, the alert recipient would need to purchase two separate receivers to be able to receive alerts from both alerting organizations.

While the protocols are proprietary, the equipment that accesses the RBDS subcarrier can still function regardless of the vendor transmitting the alert. There is one instance where cross-vendor platform activities are being explored. In this instance, one vendor (B) is modifying their software on the receiver to conform with another vendor's (A) broadcast tower to the receiver communication protocol. This would then allow Vendor B's receivers to be operational in an area where Vendor A's signal is being broadcast. This conformance has the added benefit that Vendor A's receivers can be configured to be activated by Vendor B's origination portal.

Ideally, it would be advantageous for users of Personal style mobile receivers to be able to travel across jurisdictions locally, regionally, and nationally, and be able to be alerted in these areas without having to purchase alerting equipment that is specific to that area. This can be accomplished by having a standard protocol used by the RBDS vendors for encryption and delivery of the emergency alerts.

Recommendations:

a. Define and implement a common protocol to be used as part of the Standard RBDS protocol for delivery of emergency alerts regardless of receiver hardware.

2.3.3 Additional Performance Factors (APFs)

In this section, the analysis of the data is summarized into observations for each APF. For each observation cited, the observation analysis is presented with a list of the referencing data and a list of recommendations. Each observation is determined to be either a "Strength" or an "Area for Improvement", with the highlights summarized in Table 8.

TABLE 8. ACHIEVEMENT OF APF ACTIVITIES

Activity Identifier	Strengths	Areas for Improvement
Simplicity **APF.1.1**	Alert Origination is streamlined. Receivers are simple to operate	None identified
Understandable **APF.1.2**	>92% of recipients in all, ESL, and ADA communities understood message, >70% of recipients in all, ESL, and ADA communities identified correct action, messages up to 240 characters allow for more information to be conveyed	None identified
Economical **APF.1.3**	Minimal use of the existing allocated spectrum, low financial burden for broadcaster	None identified
Relationships **APF.1.4**	Originator satisfaction with vendors, broadcaster support for vendors, current RBDS options developed to support customer needs	None identified
Standards **APF.1.5**	CAP Initiated Alerts, no degradation to broadcaster's signal, product conformance to RBDS standard	None identified
Local Laws **APF.1.6**	No FCC license required, meets NFPA72 In-Building Mass Notification System Requirements	None identified
Distribution **APF.2.1**	One-to-Many distribution allows expansion of target population without loss of distribution speed, successful targeting of ESL and ADA communities, message delivery in minutes provides timely alerting to imminent threats	None identified
Coverage **APF.2.2**	Understandable messages delivered over wide area	None identified
Addressability **APF.2.3**	Alert origination to groups, group selection at the receivers	None identified
Geo-Targeting **APF.2.4**	Weather alerts automatically targeted to specified areas	None identified
Environment **APF.3.1**	Successful outdoor reception while mobile, including on water	Indoor signal quality may be limited by structural and environmental factors
Maintainability **APF.4.1**	Low maintenance for broadcasters, originators, and receivers	None identified
Lifecycle **APF.4.2**	No costs per subscriber, no costs per alert issued, minimal hardware replacement	None identified
Power **APF.4.3**	Mobile receivers battery-powered for months, stationary receivers battery-powered days to months	None identified

2.3.3.1 Simplicity (APF.1.1)

An RBDS system achieves simplicity when Alert Originators and Alert Recipients believe their part of the system is easy to use.

2.3.3.1.1 Simplicity Observation 1: Strength: Alert Origination

Alert originators indicate that emergency alert notifications are easy to generate and issue to their alert recipients.

References:

a. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions 5,7,12,31,32
b. 16 Mar – MWSU Demonstration Day
c. 25 Mar – MSU Demonstration Day
d. 13 Apr – CMU Demonstration Day
e. 04 May – Gallaudet University Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. 12 May – MS / AL Second Iteration Demonstration Day
h. 19 May – AU / HU / GU / GW Demonstration Day

Analysis:

During the Demonstration Day briefings and discussions, the RBDS systems were discussed. The general observation was that alerts were easy to generate. All of the systems have the ability to create canned or template alerts in advance, which were used by all of the originators. Custom alerts were simple to create and send as well.

The Alert Originator Survey included several questions regarding simplicity of the RBDS system for the generation of alerts. There are not enough responses to provide a sufficient level of statistical analysis, but the received responses tend to support the Demonstration Day observations and discussions with the Alert Originators, with two respondents providing the comments, *"Great System"* and *"The Alert FM system is very user friendly and makes it easy to send messages"*.

Alert Originators need to get their time critical information to their intended recipients and cannot be hindered by the origination process. The RBDS systems that were demonstrated provide a simple process for the generation of alerts, which makes this observation an observed strength.

Recommendations:

a. Maintain

2.3.3.1.2 Simplicity Observation 2: Strength: Alert Recipients

Alert recipients indicate that the receivers were easy to use, convenient, and effective for emergency alert notifications.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 6-8
b. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), question 6d

Analysis:

Alert recipients were asked multiple survey questions to determine their opinion on the receiver's ease of use, convenience, and effectiveness. The results from each of those survey questions are discussed, beginning with ease of use.

Question 6 of the Alert Recipient Scenario Survey asked alert recipients about their ease of use of the receivers. Recipients could select one of seven valid responses: five responses provided a range from “Very Easy” to “Very Difficult”, and two responses provided the ability to indicate either they did not want to answer the question, “Decline”, or did not understand the question being asked, “Don’t Know”.

Valid Response	Frequency	Percent of Valid Responses
Very Easy	98	40.2%
Somewhat Easy	56	23.0%
Neither easy nor difficult	21	8.6%
Somewhat Difficult	52	2.0%
Very Difficult	2	0.8%
Don’t Know	54	22.1%
Decline	8	3.3%
Total	244	100.0%

For 244 surveys collected, respondents selected 1 of the 7 valid responses. Analysis of the valid responses determined that 62 (25.4%) of the responses were either “Don’t Know” or “Decline”. While these were valid responses to the question, they provide no insight into the “Ease of Use” that was being measured. Additionally, 48 of the 54 “Don’t Know” responses were associated with Enterprise style systems, which had “Nothing” to operate as deemed by the vendors. Chart 7 represents the respondents’ opinion on “Ease of Use” of the receivers by calculating the percentage of responses for the five charted responses where an opinion was provided. 3.8% of the respondents provided a negative opinion by considering the device as “Somewhat difficult” or “Very Difficult” to use.

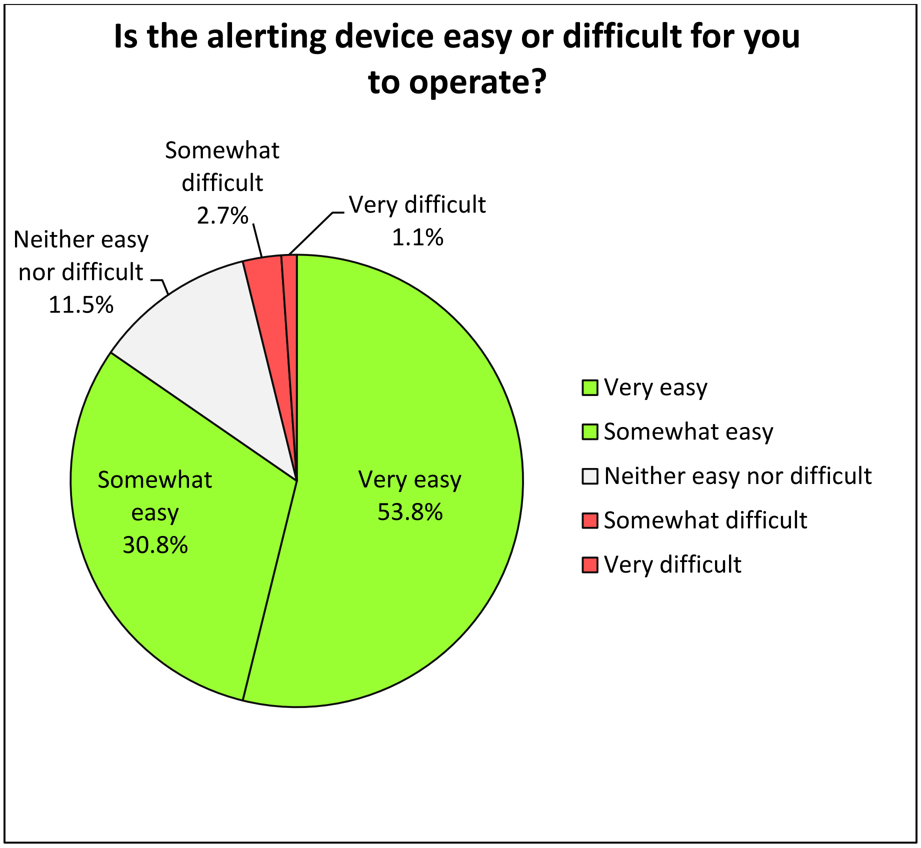


CHART 7. ALERT RECIPIENT SCENARIO SURVEY (6) EASY TO OPERATE?

Similarly, Question 6d of the Alert Recipient Real-World Events Survey asked the alert recipients about their ease of use of the receivers. Recipients could select one of 11 valid responses: ten responses provided a range from "10 – Most Favorable" to "1 – Least Favorable", and 1 response provided the ability to indicate they "Did not use device" or did not understand the question being asked.

Analysis of 42 valid responses determined that 38 (90.5%) of the responses were favorable towards "Ease of Use" by responding with a "6" or higher. Chart 8 represents the respondents' opinion on "Ease of Use" from the end of demonstration operational period Alert Recipient Real-World Events Survey.

Valid Response	Frequency
10 – Most Favorable	19
9	9
8	4
7	3
6	3
5	2
4	1
3	0
2	0
1 – Least Favorable	1
Don't Know	0
Total	42

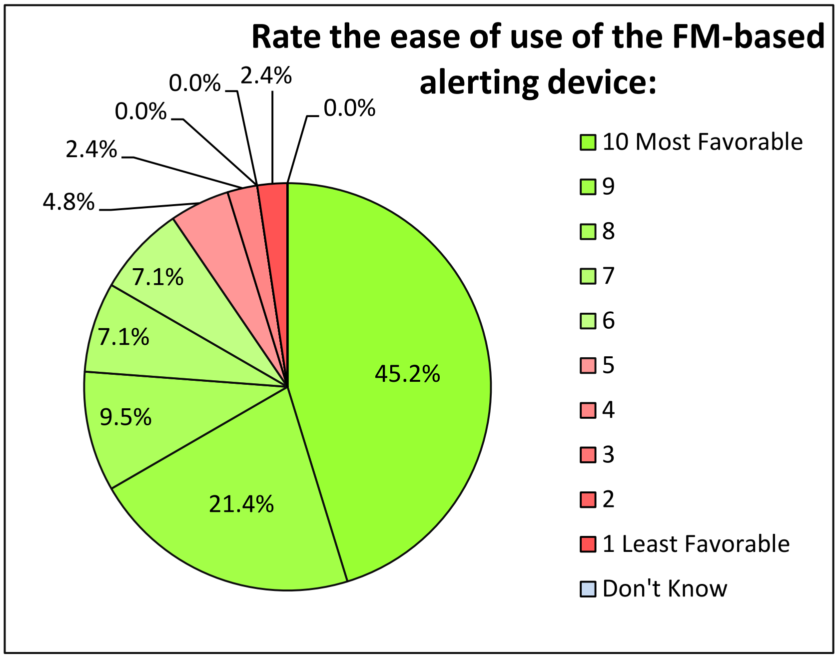


CHART 8. ALERT RECIPIENT REAL-WORLD EVENTS SURVEY (6D) EASE OF USE?

Convenience of the receivers was determined by Question 7 of the Alert Recipient Scenario Survey. Recipients could select one of seven valid responses: five responses provided a range from "Very convenient" to "Very inconvenient", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know".

Valid Response	Frequency	Percent of Valid Responses
Very convenient	93	38.3%
Somewhat convenient	51	21.0%
Neither convenient nor inconvenient	25	10.3%
Somewhat inconvenient	11	4.5%
Very inconvenient	3	1.2%
Don't Know	51	21.0%
Decline	9	3.7%
Total	243	100%

For 243 surveys collected, respondents selected 1 of the 7 valid responses. Analysis of the valid responses determined that 60 (24.7%) of the responses were either "Don't Know" or "Decline". While these were valid responses to the question, they provide no insight into the "Convenience" that was being measured. Additionally, 45 of the 51 "Don't Know" responses were associated with Enterprise style systems. All of the receivers of an Enterprise style system are permanently mounted in public areas, which is in contrast to the definition of "convenient" as easily accessible. Chart 9 represents the respondents' opinion on "Convenience" of the receivers by calculating the percentage of responses for the five charted responses where an opinion was provided. 7.6% of the respondents provided a negative opinion by considering the device as "Inconvenient" or "Very inconvenient" to use.

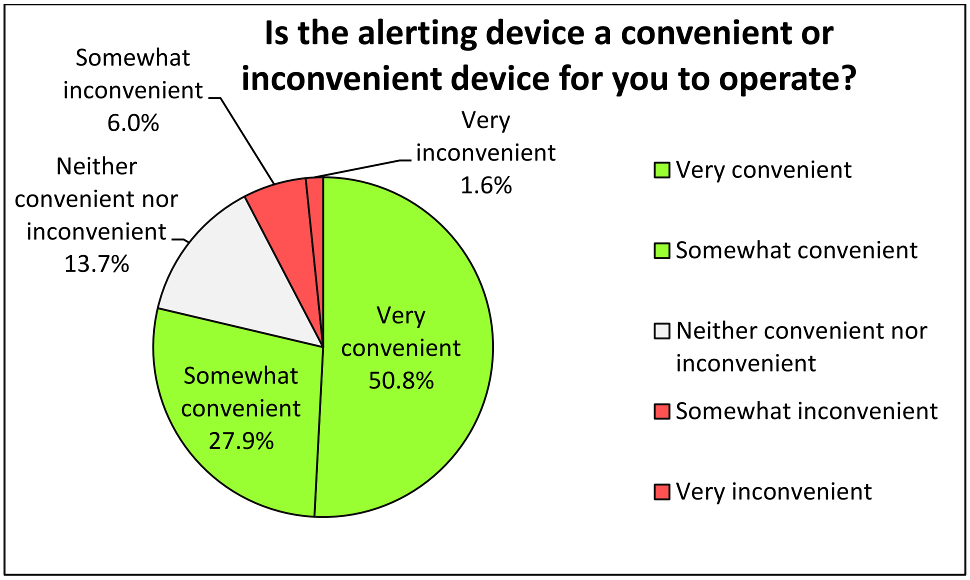


CHART 9. ALERT RECIPIENT SCENARIO SURVEY (7) CONVENIENT TO OPERATE?

The perceived effectiveness of the receivers was determined by analyzing the responses to Question 8 of the Alert Recipient Scenario Survey. Recipients could select one of seven valid responses: five responses provided a range from "Very effective" to "Very ineffective", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or were unable to provide an opinion on the question that was being asked, "Don't Know".

Valid Response	Frequency	Percent of Valid Responses
Very effective	98	39.7%
Somewhat effective	85	34.4%
Neither effective nor ineffective	10	4.0%
Somewhat ineffective	10	4.0%
Very ineffective	9	3.6%
Don't Know	30	12.1%
Decline	5	2.0%
Total	247	100%

For 247 surveys collected, respondents selected 1 of the 7 valid responses. Analysis of the valid responses determined that 5 (2.0%) of the responses were "Decline". While this was a valid response to the question, they provide no insight into the "Effectiveness" that was being measured. Chart 10 represents the respondents' opinion on "effectiveness" of the receivers by calculating the percentage of responses for the five charted responses where an opinion was provided. 7.8% of the respondents provided a negative opinion by considering the device as "Ineffective" or "Very ineffective" to use.

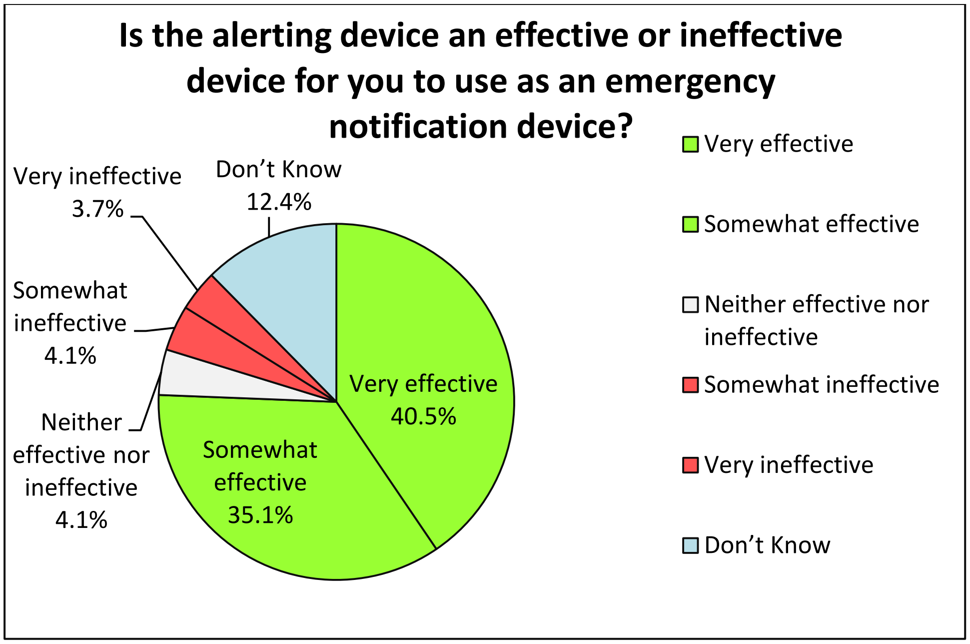


CHART 10. ALERT RECIPIENT SCENARIO SURVEY (8) EFFECTIVE DEVICE?

Overall, the survey provided minimal negative responses, which suggests that the vast majority of respondents feel that the receivers are easy to use, convenient, and are effective as an emergency notification device. However, improvements can be made to user's guides that are provided with the Personal style receivers and by better labeling of the controls on all styles of the alert receivers.

Recommendations:

a. Improve User's Guide for Personal style receivers.
b. Improve labels on the receivers.

2.3.3.2 Understandable (APF.1.2)

An understandable RBDS system provides readable and actionable messages to the Alert Recipients in a format or language that they can understand.

2.3.3.2.1 Understandable Observation 1: Strength: Alert Recipients Understood

The alert recipients, including ESL and ADA communities, were able to understand and respond to the action within the test alert message.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3d for messages 1-5 and questions 4 & 5

b. Annex D: Participant Feedback Summary, Alert Recipient Scenario Survey Demographics

Analysis:

Alert recipients were asked multiple survey questions to determine their opinion on the "understandability" and the "action to take" of the alert message at the receiver. The results of each question were considered for the whole population as well as with respect to two sub-communities (Annex D), those who consider English as a Second Language (ESL) and those who are deaf/hard-of-hearing or legally blind (ADA). The results from each of those survey questions are discussed beginning with "understandability".

Question 3d of the Alert Recipient Scenario Survey asked the alert recipients about their "understandability" of the received alert message for each alert message that was received. Recipients could select one of four valid responses: two responses provided a definitive "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know".

Valid Response	Frequency	Percent of Valid Responses	ESL Frequency	Percent of ESL Responses	ADA Frequency	Percent of ADA Responses
Yes	518	90.6%	38	92.7%	34	79.1%
No	35	6.1%	3	7.3%	1	2.3%
Don't Know	14	2.4%			6	14.0%
Decline	5	0.9%			2	4.7%
Total	572	100.0%	41	100.0%	43	100.0%

For 572 alert messages received and survey responses collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 19 (3.3%) of the responses were either "Don't Know" or "Decline". While these were valid responses to the question, they provide no insight into the "Understandability" that was being measured. Chart 11 represents the respondents' opinion on "Understandability" of each of the received alert messages by calculating the percentage of responses for the two charted responses where an opinion was provided. 6.3% of all of the alert messages were not understood, as well as 7.3% of the ESL and 2.9% of the ADA received alert messages.

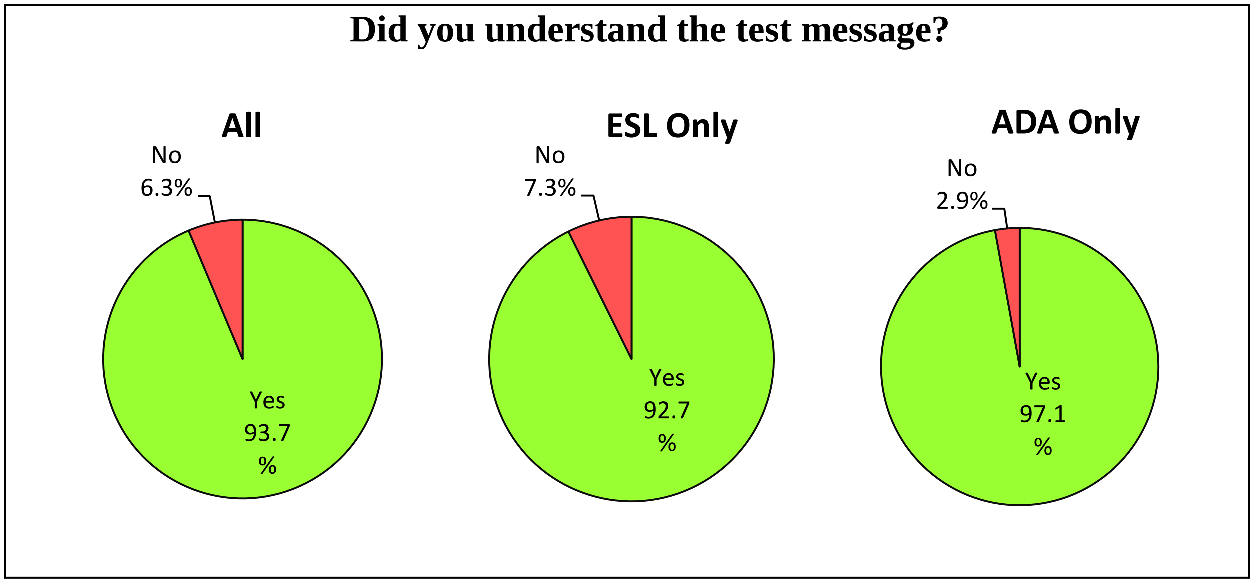


CHART 11. ALERT RECIPIENT SCENARIO SURVEY (3D) UNDERSTAND THE MESSAGE?

Question 4 of the Alert Recipient Scenario Survey asked the survey respondent "What action did the alert message indicate to take?". Recipients could select one of seven valid responses: five responses provided definitive answers, "Tell Others", "Find Shelter", "Document", "No Action", "Did not Understand", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know".

Valid Response	Frequency	Percent of Valid Responses	ESL Frequency	Percent of ESL Responses	ADA Frequency	Percent of ADA Responses
Tell others about the alert message	1	0.4%	0	0.0%	1	5.0%
Document location, time of day, and a system test number.	189	79.1%	16	94.1%	14	70.0%
Find Shelter	0	0.0%	0	0.0%	0	0.0%
The message did not inform me of any actions I should take	29	12.1%	1	5.9%	3	15.0%
I did not understand the test alert message	3	1.3%	0	0.0%	0	0.0%
Don't Know	17	7.1%	0	0.0%	2	10.0%
Decline	0	0.0%	0	0.0%	0	0.0%
Total	239	100.0%	17	100.0%	20	100.0%

Every test alert message indicated the same action to take, namely, to “Document location, time of day, and a system test number”. This correct response was indicated on 79.1% of the responses.

For 239 surveys collected, respondents selected 1 of the 7 valid responses. Analysis of the valid responses determined that 17 (7.1%) of the responses were either “Don’t Know” or “Decline”. While these were valid responses to the question, they provide no insight into the “Action to take” that was being measured, possibly because “Document” was not recognized as an action. Chart 12 represents the respondents’ opinion on “Action to take” by calculating the percentage of responses for the five charted responses where an opinion was provided. 1.3% of the respondents indicated they did not understand the message and 0.4% of the respondents took the wrong action of telling others. Zero of the ESL respondents took the wrong action and zero of ESL respondents misunderstood the message. One of the ADA respondents selected the wrong action of telling others, and zero of the ADA respondents misunderstood the messages.

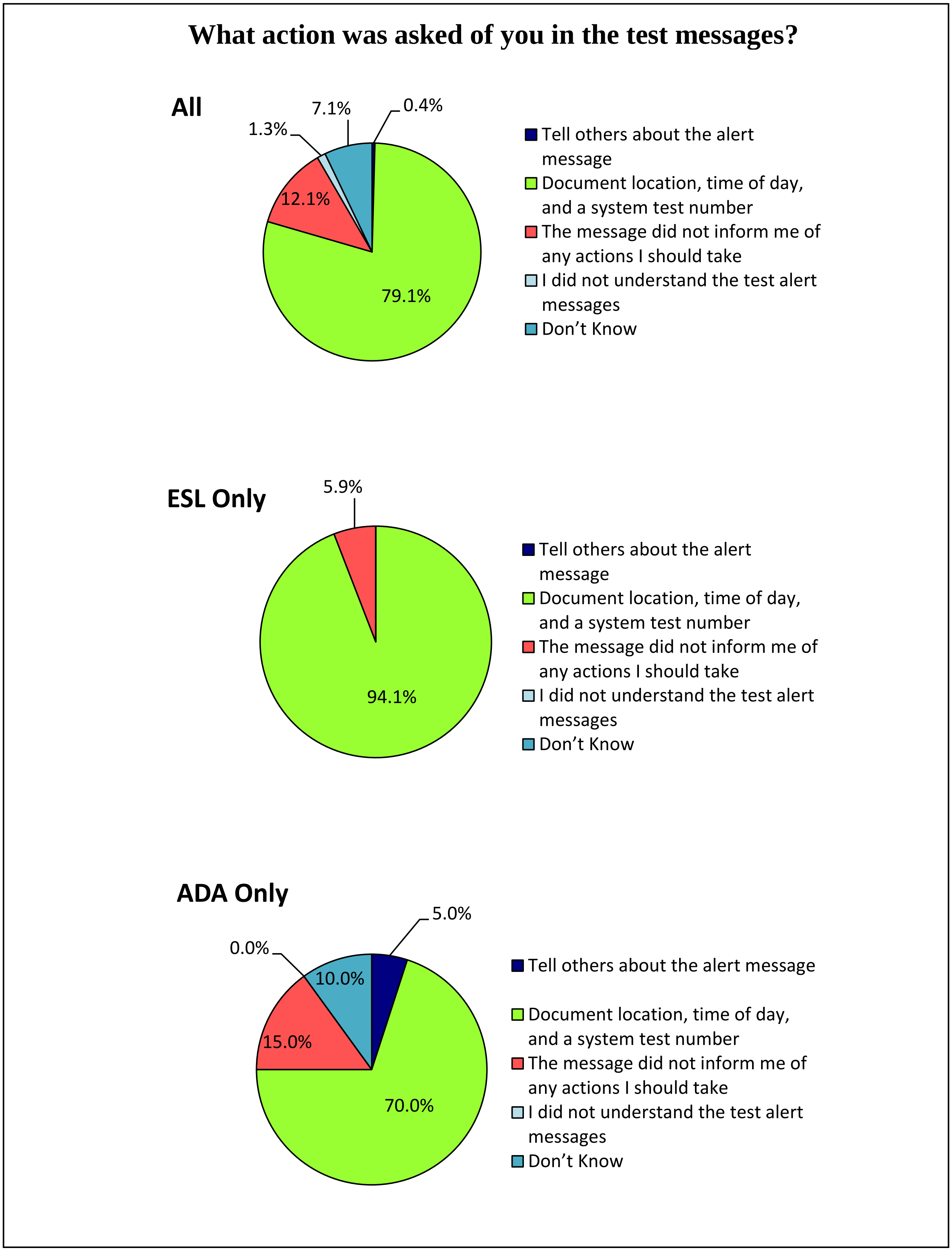


CHART 12. ALERT RECIPIENT SCENARIO SURVEY (4) WHAT ACTION TO TAKE?

Overall, the survey provided minimal negative responses, which suggests that the vast majority of respondents understood the messages and knew what action to take. However, improvements can be made. Longer messages are easier to comprehend and understand.

Recommendations:

a. Maintain

2.3.3.2.2 Understandable Observation 2: Strength: Message Length

The RBDS protocol allows for alert messages greater than 200 characters, which enhances the ability to provide understandable messages and actions to take.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. 12 May – MS / AL Second Iteration Demonstration Day
c. AlertFM Receiver User Guide[14]
d. FEMA / FCC announce CMAS standards[15]

Analysis:

Review of the text of the alerts sent during the Demonstration Days within the MSEL (Annex F) found that longest messages were demonstrated in the 12 May 2010 Scenario 2 along the Gulf Coast in Mississippi and Alabama.

System Alert #2555 on 12 May was a message in Spanish with a total length of 225 characters. The full text is found in the text box below. Figure 25 indicates the last "page" of the entire alert that was received on an AlertFM receiver.

> System Test #2555. El Sistema de Alerta de Salud Regional ha sido completado. Documente los tres puntos siguientes: LUGAR, TIEMPO, y NUMERO DE PRUEBA DEL SISTEMA y complete y devuelva los formularios. PRUEBA del sistema #2555
>
> (This was the full text of alert)

FIGURE 25. ALERT 2555, 225 CHARACTERS

System Alert #2455 on 12 May was a message in English with a total length of 206 characters. The full text is found in the text box below. Figure 26 indicates the last "page" of the entire alert that was received on an AlertFM receiver.

[14] Alert FM Receiver User Guide
[15] FEMA And The FCC Announce Adoption Of Standards For Wireless Carriers To Receive And Deliver Emergency Alerts Via Mobile Devices

System TEST #2455. Regional Health Alerting System Test has completed. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER and complete and return Feedback forms. System TEST #2455

(This was the full text of alert)

FIGURE 26. ALERT 2455, 206 CHARACTERS

Longer messages allow the alert originators to convey more information, including actions that are to be taken to obtain additional information related to the message. While 225 character messages were demonstrated, AlertFM indicates their systems are capable of 240 character messages, which is 2.6 times greater than the 90 character length of the in-development IPAWS CMAS implementation. The additional characters allow more information to be conveyed, such as internet web addresses where additional information regarding the alert can be viewed.

Recommendations:

a. Allow for special hyperlink type characters so that web addresses can be passed as part of the message which interacts with smart phone technology.

2.3.3.3 Economical (APF.1.3)

An RBDS system is economical when the financial burden on the broadcaster is low, no new spectrum needs to be allocated or licensing is required, and minimal use of the subcarrier spectrum is required for the delivery of emergency messages.

2.3.3.3.1 Economical Observation 1: Strength: No New Spectrum Allocation Needed

FCC indicates that systems such as RBDS emergency alerting systems require no new spectrum allocation or rules to operate, but operate within the existing FM spectrum allocation.

References:

a. FCC Radio Subcarriers SCAs Subsidiary Communications Authority[16]
b. FCC Rules Concerning Use of Subsidiary Communications Authorizations[17]

[16] FCC Radio Subcarriers SCAs Subsidiary Communications Authority
[17] FCC Amendment of Parts 2 and 73 of the Commission's Rules Concerning Use of Subsidiary Communications Authorizations

Analysis:

Analysis of the FCC discussion on Radio Subcarriers reveals that subcarriers are transmitted on a separate channel along with the main audio signal over an existing broadcast frequency. Subcarrier use is considered secondary to transmissions of the main audio signal, thus it follows the licensing and spectrum requirements of the main audio signal.

> *"A **subcarrier**, known also as **Subsidiary Communications Authority** or **SCA**, is a separate audio or data channel which is transmitted along with the main audio signal over a broadcast station. These subcarrier channels are not receivable with a regular radio; special receivers are required. ... A broadcast station may transmit more than one subcarrier signal."* [16]

Additionally, the FCC ruling on the Amendment of Parts 2 and 73 of the Commission's Rules clearly states that no new spectrum allocations are needed to perform non-broadcast related uses of FM subchannels. The following comments are excerpts of paragraph 15 of this ruling.

> *"15. In changing our rules to authorize non-broadcast related uses of FM subchannels, we are particularly impressed with the potential for additional communication services without the need for additional allocations of valuable spectrum. Although the intelligence carried on a subchannel is not necessarily related to the main channel, the subchannel itself is part and parcel of the bandwidth each FM station is authorized to use." ... "However, we found that substantial portions for the spectrum available for subchannels were unused."... "Using spectrum that was originally allocated to the FM service, licensees may provide additional communications service, without materially affecting the provision of their main channel."*[17]

This observation is an analyzed strength for RBDS emergency alerting systems since as stated by the FCC, these systems require no new spectrum allocation.

Recommendations:

a. Maintain

2.3.3.3.2 Economical Observation 2: Strength: Minimal Spectrum Used

RBDS Vendors require minimal use of the FM Broadcaster's subcarrier spectrum for the delivery of their messages.

References:

a. NRSC-4-A US RBDS Standard, April 2005[18]
b. GSS Operational Period Technical Data, 1 July 2010

Analysis:

Analysis of the RBDS standard reveals that Type 9 Group data packets, which are used for Emergency Warning Systems or Open Data Applications (ODA), are transmitted very infrequently unless an emergency occurs or when test transmissions are required.

---

[18] National Radio Systems Committee, NRSC-4-A, US RBDS Standard, April 2005

One vendor issued 986 messages during the entire Demonstration Operational Period across all of their participating locations, which equals an average of one message issued every 131.4 minutes. In addition, these messages were not issued to every location, so only those broadcasters receiving a given message were affected, further reducing the rate. Table 9 shows the average rate in messages per minute at which the broadcasters providing a signal for each given location were required to distribute the messages.

TABLE 9. BROADCASTER EMERGENCY MESSAGE DISTRIBUTION RATE

Location	Portal Messages	Automatic Weather Messages	Total Messages	Message Rate (Messages Per Minute)
Oktibbeha County	163	64	227	.0018
Hancock County MS	28	29	57	.0004
Harrison County MS	16	34	50	.0004
Jackson County MS	35	29	64	.0004
MEMA	193	0	193	.0015
Mobile County AL	90	155	245	.0019
Shelby County TN	15	135	150	.0012
Total	540	446	986	.0075

While the average rate throughout the entire demonstration operational period is low, even during times of emergency notifications the rate of messages would still be considered low, although higher than the average rate. For example, an average distribution of 245 messages across 24 hours would be a rate of .1701 messages per minute.

This observation is an analyzed strength because of the low rate at which messages are transmitted and because these messages cause no interruption to the main audio signal.

Recommendations:

a. Maintain

2.3.3.3.3 Economical Observation 3: Strength: Low Broadcaster Financial Burden

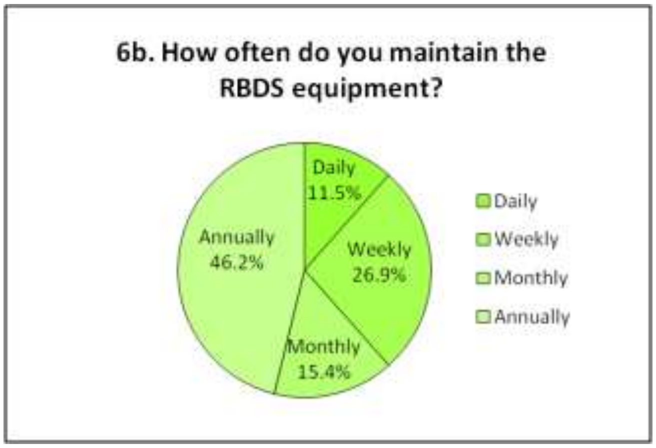
Broadcasters incur a low financial burden for the operation of the RBDS subchannel in providing emergency alerts.

References:

a. FM Broadcaster Survey (Annex E, Figure 45), question 6

Analysis:

The bottom line financially for broadcasters is their ability to stay operational and on-the-air. Additional, recurring costs such as RBDS maintenance may add to the broadcasters' financial burden. Chart 13 shows that broadcasters indicated that maintenance on the RBDS equipment was performed at long operational intervals and there were few reported RBDS equipment failures; these responses suggest minimal financial burden for operating RBDS. Additionally, no financial costs are incurred for FCC RBDS specific licenses since the broadcaster requires no license to use the RBDS subchannel of their main audio channel. (Refer to Sections 2.3.2.1.1, 2.3.3.12.1 and 2.3.3.6.1 for the complete discussion on Resiliency, Maintenance, and Licensing.)



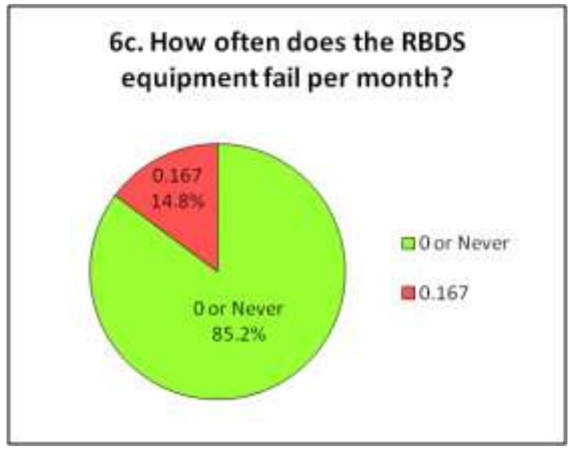


CHART 13. BROADCASTER'S BURDEN OF RBDS EQUIPMENT?

Many broadcasters are finding ways to use the RBDS equipment to increase revenues. The RBDS protocol allows for differing types of data packets to be transmitted, and broadcasters are using the data type that normally displays their station's call sign to display advertiser's text while broadcasting their commercial on the main audio channel.

This observation is an analyzed strength. RBDS systems offer a low financial burden to broadcasters, providing a valuable community service without interrupting their main audio channel.

Recommendations:

a. Maintain

2.3.3.4 Relationships (APF.1.4)

This APF details the RBDS vendor's relationship with key stakeholders including broadcasters and the emergency managers who are the alert originators.

2.3.3.4.1 Relationships Observation 1: Strength: Vendors worked well with Alert Originators

Alert originators expressed satisfaction with their vendor's product and working relationships.

References:

a. 16 Mar – MWSU Demonstration Day
b. 25 Mar – MSU Demonstration Day
c. 08 Apr – MS / AL Demonstration Day
d. 13 Apr – CMU Demonstration Day
e. 04 May – Gallaudet University Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. Alert Originator Survey (Annex E, Figure 36 through Figure 41), question 29
h. Metis Case Study, CMU Mellon Institute[19]

Analysis:

At most of the Demonstration Days, DHS/FEMA and NGC representatives participated in briefings and discussions prior to, during, and following the demonstration with the local alert originators, who are directly responsible for managing their emergency management organization. The comments expressed were all positive for the product and the vendor's responsiveness to meet their needs.

Comments indicated that many of the unique features among the vendors were implemented to meet the respective originators' direct needs and requests. For example, Metis developed a wireless mesh network to extend the receiver's alerting capability to areas of poor FM reception, areas within buildings where existing technology could not provide a viable solution. The alert originator said, *"If it works here, it will work anywhere."*

Question 29 of the Alert Originator Survey supported the Demonstration Day observations. This question asked the originators whether their vendor was responsive to their needs; the responses are displayed in Chart 14.

[19] Metis Case Study, CMU Mellon Institute, March 2009

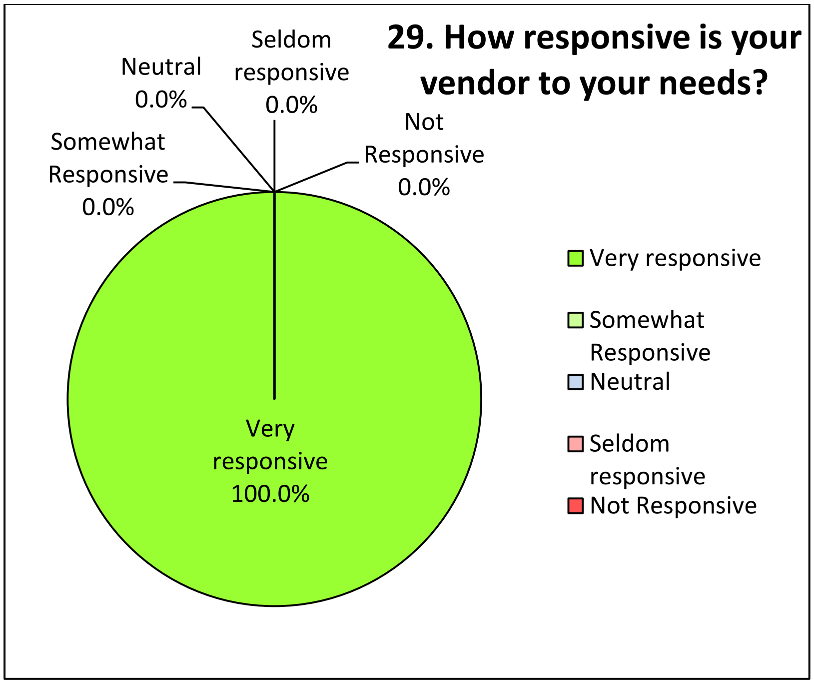


CHART 14. ALERT ORIGINATOR SURVEY (29) RESPONSIVE VENDOR?

This observation is a strength as observed during the Demonstration Day briefings and from the enhanced features that vendors incorporated into their systems at stakeholder request.

Recommendations:

a. Maintain

2.3.3.4.2 Relationships Observation 2: Strength: Vendors worked well with Broadcasters

Broadcasters are supportive of the vendors and extending the RBDS technology for emergency alerting.

References:

a. FM Broadcaster Survey (Annex E, Figure 45), questions 5 – 8

Analysis:

Broadcasters were asked multiple survey questions to determine their support of the vendors and the vendor's effort to extend RBDS technology for emergency alerting. The results from each of those survey questions are discussed in the following paragraphs.

Question 5 of the FM Broadcaster Survey asked the broadcasters whether they support extending the capability of the national EAS through the development of an FM radio based alert and warning system. Respondents could select one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	22	78.6%
No	5	17.8%
Don’t Know	1	3.6%
Decline	0	0.0%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 1 (3.6%) of the respondents was unable to answer the question. While this was a valid response to the question, it provides no insight into the “Broadcaster Vendor Support” that was being measured. Chart 15 represents the respondents who provided a definitive response, which shows that 81.5% support the vendors and the development of an FM radio based alert and warning system. This is further confirmed by a comment on Question 8 of the FM Broadcaster Survey which says *“you have our support”*.

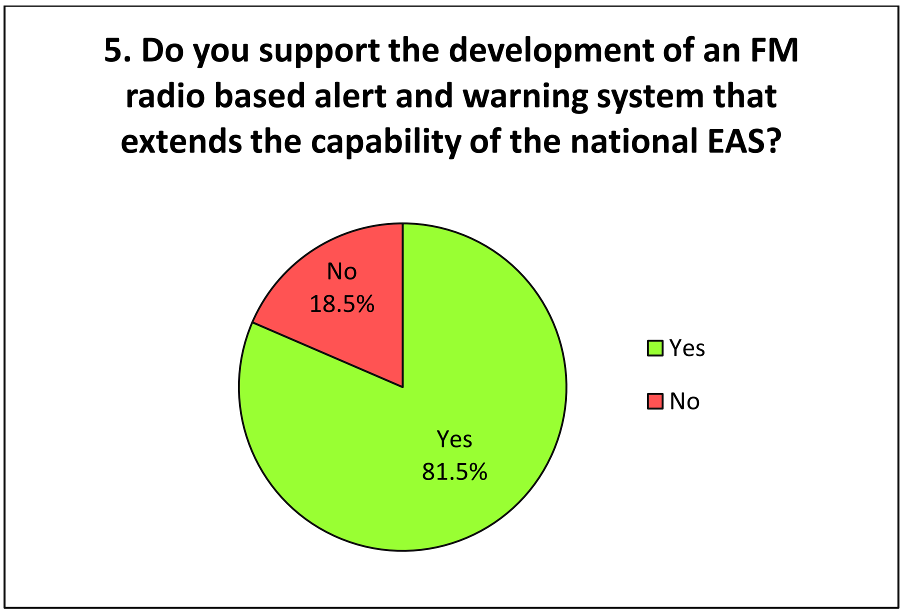


CHART 15. FM BROADCASTER SURVEY (5)
SUPPORT EXTENDING EAS WITH RBDS?

Question 7 of the FM Broadcaster Survey asked the broadcasters whether they believed that the addition of an FM radio based alert and warning system adds to the relevance of their FM radio station. Respondents could select one of four valid responses, which provided a range from “Great Extent” to “Not at all”, with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Great extent	12	42.9%
Somewhat	11	39.3%
Very little	0	0.0%
Not at all	5	17.9%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 82.1% of the respondents provided a favorable response as seen in Chart 16.

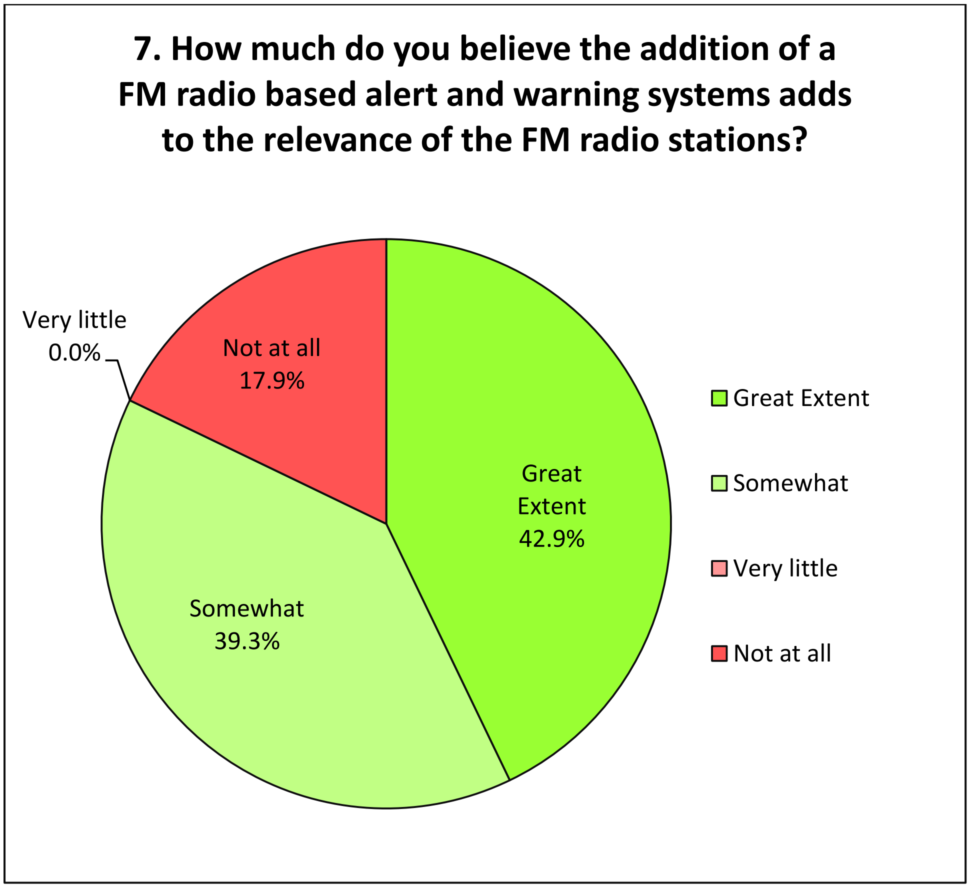


CHART 16. FM BROADCASTER SURVEY (7) RELEVANCE OF FM RBDS ALERTS?

This observation is an analyzed strength due to the large percentage of broadcasters that support the vendors in extending the EAS through FM based alerting and the relevance that these alerting systems add to their FM radio stations.

Recommendations:

a. Increase broadcaster awareness of the capabilities of the emergency alert and warning systems through FM RBDS and how it would benefit the broadcasters.

2.3.3.5 Standards (APF.1.5)

This APF is to assess the compliance of RBDS systems with applicable standards and the compatibility between RBDS products. The overarching standard for the initiation of alerts is CAP.

2.3.3.5.1 Standards Observation 1: Strength: CAP Initiated Alerts

CAP-initiated alerts were observed as being received by the RBDS systems, forwarded to the receivers, and successfully understood by the alert recipient.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. 25 Mar – MSU Demonstration Day
c. 13 Apr – CMU Demonstration Day
d. 04 May – Gallaudet University Demonstration Day
e. 06 May – Shelby County TN Demonstration Day
f. 12 May – MS / AL Second Iteration Demonstration Day
g. 19 May – AU / HU / GU / GW Demonstration Day
h. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3d for messages 1-5

Analysis:

To initiate CAP messages for the demonstrations, NGC created alerts through the DMIS-Open tool and posted the alerts to the DMIS-Interoperability COG prior to the Demonstration Day. At the time defined in the MSEL during the demonstration, the RBDS portals accessed the DMIS Interoperability COG, downloaded the CAP v1.1 formatted alert, and generated the RBDS alert to their receivers. Review of the MSEL indicates the 10 system test numbers as shown in the table which were CAP messages initiated through this process. Review of the survey responses indicates a total of 174 instances of these System Test alerts having been received (Section 2.3.2.6.1).

Question 3d of the Alert Recipient Scenario Survey asked the alert recipients about their “understandability” of the received alert message for each alert message that was received. Recipients could select one of four valid responses: two responses provided a definitive “Yes” or “No”, and two responses provided the ability to indicate either they did not want to answer the question, “Decline”, or did not understand the question being asked, “Don’t Know”. The following table indicates the frequency of responses for the 10 CAP test messages issued during the Demonstration Days.

System Test #	Yes	No	Don't Know	Decline/ Missing	Frequency
1424	12	1			13
1524	2				2
1624	4	2	1		7
1824	53	3		2	58
1924	2	2		1	5
2425	20		1		21
2525	1				1
3424	11				11
3524	3				3
3624	49			4	53
Total	157	8	2	7	174

For 174 CAP alert messages received and survey responses collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 9 (5.2%) of the responses were either "Don't Know" or "Decline". While these were valid responses to the question, they provide no insight into the "Understandability" that was being measured. Chart 17 represents the respondents' opinion on "Understandability" of each of the received CAP alert messages by calculating the percentage of responses for the two charted responses where an opinion was provided. 95.2% of all of the CAP alert messages were understood by the Alert Recipient.

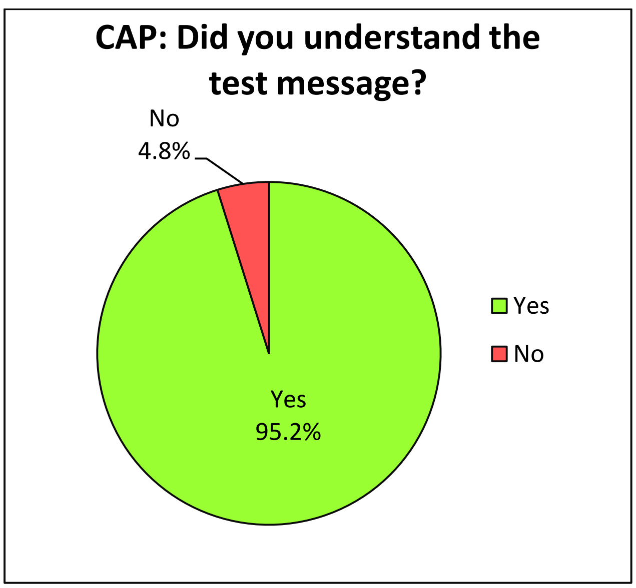


CHART 17. ALERT RECIPIENT SCENARIO SURVEY (3D) UNDERSTAND THE CAP MESSAGE?

This observation demonstrated that a standard CAP message can be ingested into an RBDS system and the alert is ultimately understood by the Alert Recipient.

Recommendations:

a. RBDS Vendors to be verified as CAP v1.2 compliant

2.3.3.5.2 Standards Observation 2: Strength: Compatibility with Broadcaster

RBDS vendors work well with sharing the RBDS subcarrier with the broadcaster's RBDS message content with no degradation of the main audio signal.

References:

a. FM Broadcaster Survey (Annex E, Figure 45), question 6e

Analysis:

Question 6e of the FM Broadcaster Survey asked the broadcasters whether their installed RBDS technology degraded their main audio signal by either a loss of power or fidelity. Respondents could select one of four valid responses: two responses provided a definitive answer of a "Yes" or "No", and two responses provided the ability to indicate either they did not want to answer the question, "Decline", or did not know whether the RBDS technology had an effect on the main audio signal. The frequency of responses is indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	0	0.0%
No	19	70.4%
Don't Know	8	29.6%
Decline	0	0.0%
Total	27	100.0%

For 27 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 0% of the respondents reported a degradation of signal due to the RBDS technology, while 70.4% of the respondents indicated that that there was no degradation of signal. 29.6% of the respondents did not know whether there was degradation to their main signal. Chart 18 represents the respondents who provided a definitive response or responded "Don't Know" to the question.

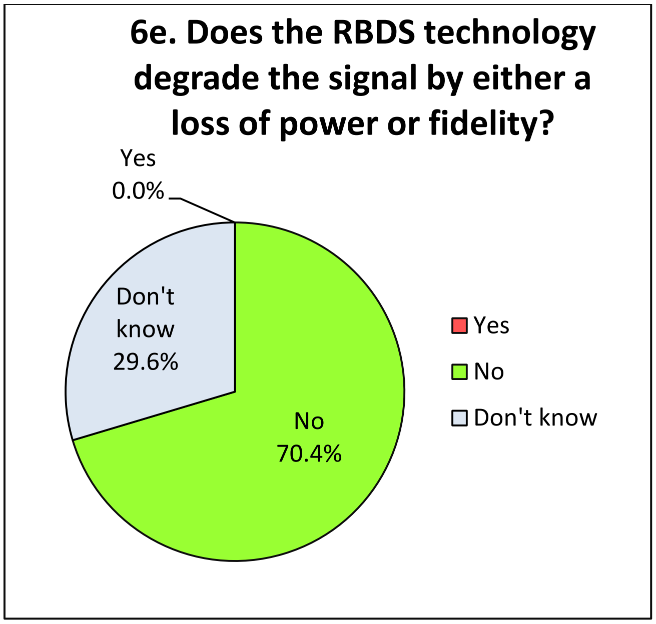


CHART 18. FM BROADCASTER SURVEY (6E) DEGRADE SIGNAL?

This observation demonstrates that RBDS compatibility with other broadcaster requirements is a strength due to no known degradation of the main audio signal.

Recommendations:

a. Maintain

2.3.3.5.3 Standards Observation 3: Strength: RBDS Conformance

The transmission from the broadcast tower to the receivers conforms to the RBDS standard.

References:

a. NRSC-4-A US RBDS Standard, April 2005[20]
b. Metis Operational Period Technical Data Analysis, 22 July 2010
c. RBDS Cross Vendor Platform Activities Technical Notes, 5 August, 2010

Analysis:

The Metis units continuously logged over 2 billion RBDS data packets in 4 hour increments beginning on 8 March 2010 and ending on 7 June 2010. A total of 338 alert messages were sent to the 26 units, which accounted for only a small fraction of the 2 billion data packets received. Due to the units' receiving a standard RBDS data packet, the units were able to filter out the data packets that were not destined for the Metis receivers.

Conformance to the RBDS standard is also demonstrable by two vendors who are exploring cross-vendor platform activities. In this instance, one vendor is exploring the activation of their receivers through the use of another vendor's RBDS signal. No hardware modifications are required since both vendors' hardware is compliant with the RBDS standard, although

[20] National Radio Systems Committee, NRSC-4-A, US RBDS Standard, April 2005

software modifications to the firmware are required due to the differing receiver communication protocols that are transmitted using the RBDS standard.

This observation is a strength since all of the vendors' receivers follow the RBDS standard, which means that no hardware modifications will be required as receiver communication standards are enhanced.

Recommendations:

a. Maintain

2.3.3.6 Local Laws (APF.1.6)

An operational RBDS should not require any new licenses to operate or require special architectural modifications for installations, and it should comply with all local, state, and federal laws.

2.3.3.6.1 Local Laws Observation 1: Strength: No FCC license required

RBDS alerts can be issued without the need for any additional FCC licenses.

References:

a. FCC Radio Subcarriers SCAs Subsidiary Communications Authority[21]
b. FCC 47 CFR Section 73.293, Use of FM multiplex subcarriers [22]

Analysis:

Analysis of the FCC Code of Federal Regulations (CFR) reveals that there is no licensing requirement for the RBDS subcarrier operations. Subcarrier use is considered secondary to transmissions of the main audio signal, thus it follows the licensing requirements of the main audio signal.

> *"A **subcarrier**, known also as **Subsidiary Communications Authority** or **SCA**, is a separate audio or data channel which is transmitted along with the main audio signal over a broadcast station. These subcarrier channels are not receivable with a regular radio; special receivers are required. ... A broadcast station may transmit more than one subcarrier signal. Licensing of subcarrier operations ended in 1983 when the service was deregulated."*[21]

Additionally, FCC 47 CFR section 73.293 explicitly indicates the no licensing requirement for all subcarriers.

> ***§ 73.293 Use of FM multiplex subcarriers.***
> *Licensees of FM broadcast stations may transmit, without further authorization, subcarrier communication services in accordance with the provisions of §§ 73.319 and 73.322.*
> *[51 FR 17028, May 8, 1986]*[22]

[21] FCC Radio Subcarriers SCAs Subsidiary Communications Authority
[22] FCC 47 CFR Section 73.293, Use of FM multiplex subcarriers

This observation is an analyzed strength for RBDS emergency alerting systems since no special licensing applications need to be completed prior to starting operations.

Recommendations:

a. Maintain

2.3.3.6.2 Local Laws Observation 2: Strength: NFPA72 In-Building Mass Notification System

Enterprise style RBDS receivers conform to the National Fire Protection Association (NFPA) 72 National Fire Alarm Signaling Codes.

References:

a. NFPA72, National Fire Alarm and Signaling Code[23]
b. Alert Originator Survey (Annex E, Figure 36 through Figure 41), question 30

Analysis:

Local jurisdictions require structures to be in compliance with building and fire related codes that rely on many of the NPFA codes including NFPA 72, National Fire Alarm and Signaling Code. NFPA 72 was updated in 2009 to include Chapter 24, Emergency Communications Systems (ECS). The print edition of the NFPA 72, 2010 National Fire Alarm and Signaling Handbook specifically highlights an RBDS receiver from a vendor that participated in this study in Figure 24.9. This handbook highlights the ability of Enterprise style RBDS receivers in meeting the new NFPA 72 code.

Question 30 of the Alert Originator Survey asked the originator whether any laws or constraints were applicable to the installation of the FM-based Alert system. The few responses to the question are available in Chart 19.

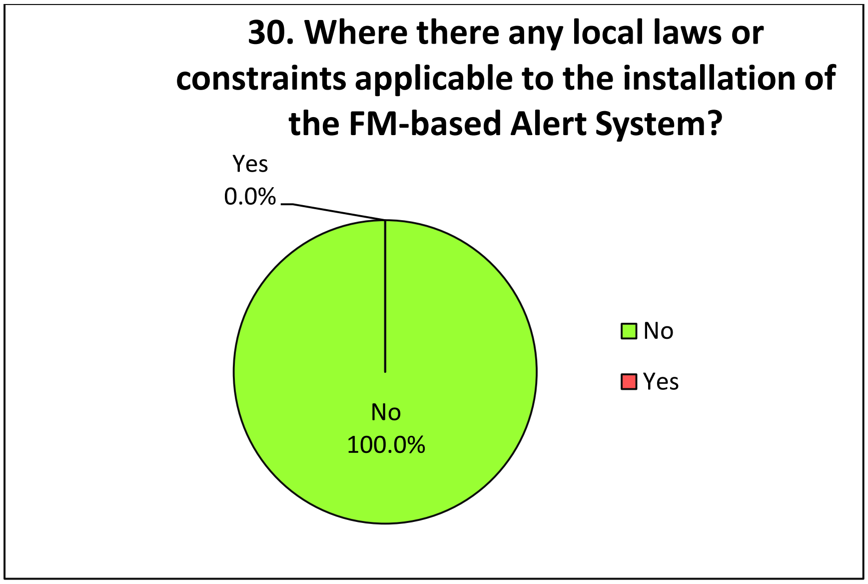


CHART 19. ALERT ORIGINATOR SURVEY (30) LOCAL LAWS?

[23] NFPA72, National Fire Alarm and Signaling Code, 2010

This observation is a strength since, as demonstrated by the Enterprise style RBDS systems, evolving building and fire codes are easily met with no or minimal installation modifications.

Recommendations:

a. Maintain

2.3.3.6.3 Local Laws Observation 3: Strength: No Liability for Broadcaster

FCC ruling indicated that there was no liability to broadcasters for carrying the FM RBDS alert signal.

References:

a. FCC Meeting Notes – January 2009[24]

Analysis:

A broadcast group in Missouri provides the FM signal for an RBDS emergency alert system (GSS' AlertFM system) covering a four county area near a nuclear power facility. This broadcast group wanted confirmation from the FCC that there was no liability to the broadcaster for carrying the FM RBDS alert signal.

A meeting was held at the FCC Headquarters in January, 2009 to discuss the liability question. Attendees included two members of the FCC Enforcement Bureau and a member of the FCC Public Safety and Homeland Security Bureau.

The following three items were determined in the meeting (from the FCC Meeting Notes):

- *None of the Emergency Alert Service, rule 47 CFR, Part 11 apply to a FM subcarrier data service (such as Alert FM) except for the broadcast hoax rule*
- *To violate the broadcast hoax rule you have to broadcast a falsified message or audio with intent or knowledge*
- *EAS rules don't apply to alert service such as Alert FM since there are no tones and the broadcasters don't initiate*

This observation is a strength since it removes the broadcaster's liability on the alert messages that are transmitted by their infrastructure, removing an obstacle to the broadcaster's willingness to implement RBDS.

Recommendations:

a. None

2.3.3.7 Distribution (APF.2.1)

It is important for time sensitive, imminent threat emergency alerts to reach their intended recipients in a timely fashion. The following observations discuss the population reach, to include members of the ADA and ESL communities, and the timeliness of the delivery of messages to all of the alert recipient communities.

[24] FCC Meeting Notes, January 2009

2.3.3.7.1 Distribution Observation 1: Strength: ADA/ESL Received Targeted Messages

Alert Recipients who are part of the ADA or ESL communities can be specifically targeted for alerts by Alert Originators.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 3 for messages 1-5, and questions 5 and 16
b. Annex F: Master Scenario Events List (MSEL)
c. Annex G: Participant Distribution
d. 25 Mar – MSU Demonstration Day
e. 13 Apr – CMU Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. 12 May – MS / AL Second Iteration Demonstration Day
h. 19 May – AU / HU / GU / GW Demonstration Day

Analysis:

Review of the alert receiver distribution (Annex G) found that members of the ADA and ESL communities were assigned to observe specific receivers for five of the Demonstration Days. In two of these five demonstrations, the specific receivers observed were public units, part of an Enterprise style RBDS system.

Review of the text of the alerts sent during the Demonstration Days within the MSEL (Annex F) found the test numbers for the targeted Spanish alerts. Section 2.3.2.3 provides a full discussion concerning the strength of language targeted alerts. Review of the Alert Recipient Scenario Survey responses provides the following list of System Test Numbers that were received by the ADA or ESL communities.

System Test #	ADA Frequency
1414	1
1424	1
1444	1
1614	1
1624	4
1644	3
1814	3
1824	5
1834	1
1844	3
2425	1
3614	4
3624	3
3634	3
3644	3
Total	37

System Test #	ESL Frequency
1514	2
1524	1
1544	1
1814	5
1824	8
1834	3
1844	4
1914	2
1924	3
1934	1
3514	4
3524	3
3534	1
3544	1
Total	39

Analyzing the received System Test Numbers reported in the Alert Recipient Scenario Survey responses against the MSEL shows that targeted messages were received by each of the targeted communities at most of the demonstrations. In addition, NGC observers witnessed the targeted messages at all of the Demonstration Days where survey responses were not provided.

This observation is an analyzed and demonstrated strength. ADA and ESL communities were successfully targeted by Alert Originators as analyzed in the survey responses and demonstrated during the Demonstration Day activities.

Recommendations:

a. Maintain

2.3.3.7.2 Distribution Observation 2: Strength: One-to-Many

The RBDS vendors' architectures leverage the one to many distribution relationships inherent to an FM broadcaster.

References:

a. Market Survey for IPAWS RBDS Study, December 14, 2009[25]

Analysis:

Analysis of the participating vendors' system architectures reveals that the benefit of the broadcasters' one-to-many relationship is maintained for delivery of the emergency alert

[25] Market Survey for Integrated Public Alert and Warning System (IPAWS) Radio Broadcast Data System (RBDS) Study, December 14, 2009

messages. The vendors leverage this relationship to aid the speed and distribution of messages. Receivers can be added to and removed from the system without the need for alert recipients registering their unit, although the Alert Recipients may need to contact Alert Originators to obtain special group codes to configure their receivers for specially targeted messages.

For alerting redundancy and a better opportunity of delivery, the Enterprise style systems have enhanced this one-to-many relationship to be a several-to-many relationship. The Enterprise style systems issue the same message several times to allow the receivers an opportunity to overcome any momentary loss of signal. This increases the likelihood that the emergency message is received by the intended alert recipient.

This observation is an analyzed strength. The inherent nature of an FM RBDS broadcast is a one-to many-relationship that allows for all receivers to receive a message at the same time from a single broadcaster.

Recommendations:

a. Personal style RBDS systems should enhance their delivery to a several-to-many relationship to increase the likelihood of message delivery.

2.3.3.7.3 Distribution Observation 3: Strength: Speed of Delivery

Demonstration Day messages were delivered to alert recipients in under a minute on average.

References:

a. Annex F: Master Scenario Events List (MSEL)
b. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3 for messages 1-5
c. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), question 15
d. 16 Mar – MWSU Demonstration Day
e. 25 Mar – MSU Demonstration Day
f. 13 Apr – CMU Demonstration Day
g. 04 May – Gallaudet University Demonstration Day
h. 06 May – Shelby County TN Demonstration Day
i. 12 May – MS / AL Second Iteration Demonstration Day
j. 19 May – AU / HU / GU / GW Demonstration Day
k. Alertus Operational Period Technical Data Analysis, 22 July 2010

Analysis:

Question 3 of the Alert Recipient Scenario Survey asked the Alert Recipients to record the message's System Test Number, location, and message receipt time. Comparing message receipt time in the survey responses to the time the messages were sent as documented in the MSEL reveals the overall average time to deliver a message across all the Demonstration Days was 42 seconds.

Table 10 shows the calculated averages for each scenario location, which were calculated by System Style and for all locations. The average at each location was calculated by determining the difference between receipt and activation of every message in the survey responses for which there was a valid time and System Test Number. In many cases, the difference was zero (0) since the activation and receipt times both had a granularity of "minutes".

Another factor that may have affected the delivery times is that the clocks used by the alert recipients were not necessarily synchronized to the sender's clock. The average delivery time in the table is close to the Northrop Grumman observations at each of the Demonstration Day locations. The longer delivery time for the Personal vs. Enterprise style system was expected. The Enterprise style systems delivered their message directly to one broadcaster, whereas the Personal style systems required delivery to multiple broadcasters via a satellite data path, which added to the overall delivery time.

TABLE 10. AVERAGE DELIVERY TIME FROM DEMONSTRATION DAY SURVEY RESPONSES

System Style	Location	# of Messages		Average Delivery Time (hh:mm:ss)	
Personal	MSU	51		00:01:09	
	Shelby	46		00:00:46	
	MS/AL	53		00:02:16	
	Subtotals		150		00:01:26
Enterprise	MWSU	106		00:00:00	
	CMU	179		00:00:10	
	GAL	14		00:00:39	
	AU/HOW/GU/GW	52		00:01:50	
	Subtotals		351		00:00:23
	Total		501		00:00:42

The CMU average time is supported by the Alert Originator who timed how long it took for her receiver to activate after she pushed the "send" button. She indicated during the post-demonstration brief that her receiver activated within a range of 4.5 to 11 seconds for the series of messages that she activated.

The systems that are installed at MWSU and AU have receivers activated through one of two methods, RBDS (FM) or Ethernet (IP). The alert recipient cannot distinguish between the two methods of activation. However, the receivers recorded their activation via both methods and the following table summarizes the activation time per method.

Location	Activation #	# of FM and IP Receivers	Average Activation Time FM (seconds)	Average Activation Time IP (seconds)
MWSU	1	49	35.43	19.82
MWSU	2	49	43.93	18.10
MWSU	3	4	26.00	24.75
MWSU	4	49	25.57	22.42
AU/HU/GU/GW	1	7	22.25	16.50
AU/HU/GU/GW	2	7	24.75	12.60
AU/HU/GU/GW	3	1	21.00	9.00
AU/HU/GU/GW	4	7	22.50	10.00

Review of the system recorded activation times supports the average activation time for MWSU that is found in Table 10. The system activation times for the AU/HU/GU/GW location do not support the survey responses. Analysis of the survey data could not isolate the discrepancy, but the observations by Northrop Grumman representatives support the system time activations.

Review of the comments provided in the Alert Recipient Real-World Survey provides the following observation: *"We had an emergency situation where Tornado's were coming through Mississippi. I worked in a residence hall on campus and instructed my resident adviser's to have students take cover in the first floor hall way as a result of Alert FM. We received all of the alerts from this device prior to sirens going off on campus or other campus announcements going out."*

This observation is a demonstrated and observed strength. Messages were distributed to the alert recipients with an average time of receipt of 42 seconds for the Demonstration Day test messages.

Recommendations:

a. Maintain

2.3.3.8 Coverage (APF.2.2)

An RBDS system provides understandable messages at a long radial distance from an FM broadcast tower.

2.3.3.8.1 Coverage Observation 1: Strength: Understandable to a Wide Area

Understandable messages were received several miles from the broadcast tower providing a wide coverage area for the FM signal.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3 for messages 1-5
b. FCC FM Radio Database Query[26]
c. GSS Operational Period Technical Data, 1 July 2010

[26] FCC FM Radio Database Query, Service Contour Maps for Call Sign search

d. GSS Technical Data Response, 09 August 2010
e. 16 Mar – MWSU Demonstration Day
f. 25 Mar – MSU Demonstration Day
g. 13 Apr – CMU Demonstration Day
h. 04 May – Gallaudet University Demonstration Day
i. 06 May – Shelby County TN Demonstration Day
j. 12 May – MS / AL Second Iteration Demonstration Day
k. 19 May – AU / HU / GU / GW Demonstration Day

Analysis:

Analysis was performed on the available data to determine the approximate distance a message was received from the broadcast tower. When the location where the message was received was within range of more than one broadcast tower and the "locked on" broadcaster was unknown, the distance to the closest broadcast tower was calculated.

The FCC's Service Contour Maps for each of the analyzed broadcasters were used to determine the location of the broadcast tower and whether the received location was within the FM signal footprint of the broadcast tower. The maps display the 60 dBu service contour for the FM broadcaster, which is the area that is generally protected from interference caused by other stations under the present FCC rules. In most cases, FM signal can be received at locations well beyond the location of the mapped contour. Table 11 shows the approximate distance between known received locations and the broadcast tower.

TABLE 11. DISTANCE UNDERSTANBLE MESSAGE RECEIVED FROM BROADCAST TOWER

Scenario (Location)	FM Broadcaster	Distance Between	Additional Verification Methods
MS / AL Gulf Coast (Cuevas Town Rd, Kiln, MS)	WMAH (Figure 29)	~28 miles	FM Monitoring Station #6
(Convent Ave, Pascagoula, MS)	WPAS	~22 miles	FM Monitoring Station #7
Shelby County (Channel Ave, Memphis TN)	WKIM (Figure 28)	~16 miles	Survey Response 3414 3424 3444
(Avery Ave, Memphis TN)	WKNO	~7 miles	FM Monitoring Station #1 (Figure 23)
CMU (Oakmont PA) (Campus)	WDUQ (Figure 27)	~13 miles ~3.2 miles	Survey Response 1814 1824 1834 1844

Scenario (Location)	FM Broadcaster	Distance Between	Additional Verification Methods
MWSU Campus	KKJO	~14.4 miles	
Gallaudet Campus	WAMU	~5.6 miles	
AU / HU / GW / GU Campuses	WAMU	AU ~0.5 miles HU ~ 4.0 miles GW ~ 3.6 miles GU ~2.2 miles	
MSU (E Harrington St, Houston, MS)	WSYE	~12 miles	FM Monitoring Station #5
(MSU Campus)	WMSV	~2.8 miles	

Question 3 of the Alert Recipient Scenario Survey asked the alert recipients where they were located when the message was received and their "understandability" of the received alert message. Section 2.3.3.2 provides a complete discussion on "understandability" of the received messages.

For the campus scenarios, the received locations reported on the survey responses were locations on campus with one exception. One survey response for the CMU Demonstration Day indicated receipt of four understandable messages at an off-campus location in Oakmont PA, which is several miles farther from the broadcast tower than the CMU campus. Figure 27 displays the locations of the received messages on the contour map in relation to the broadcast tower.

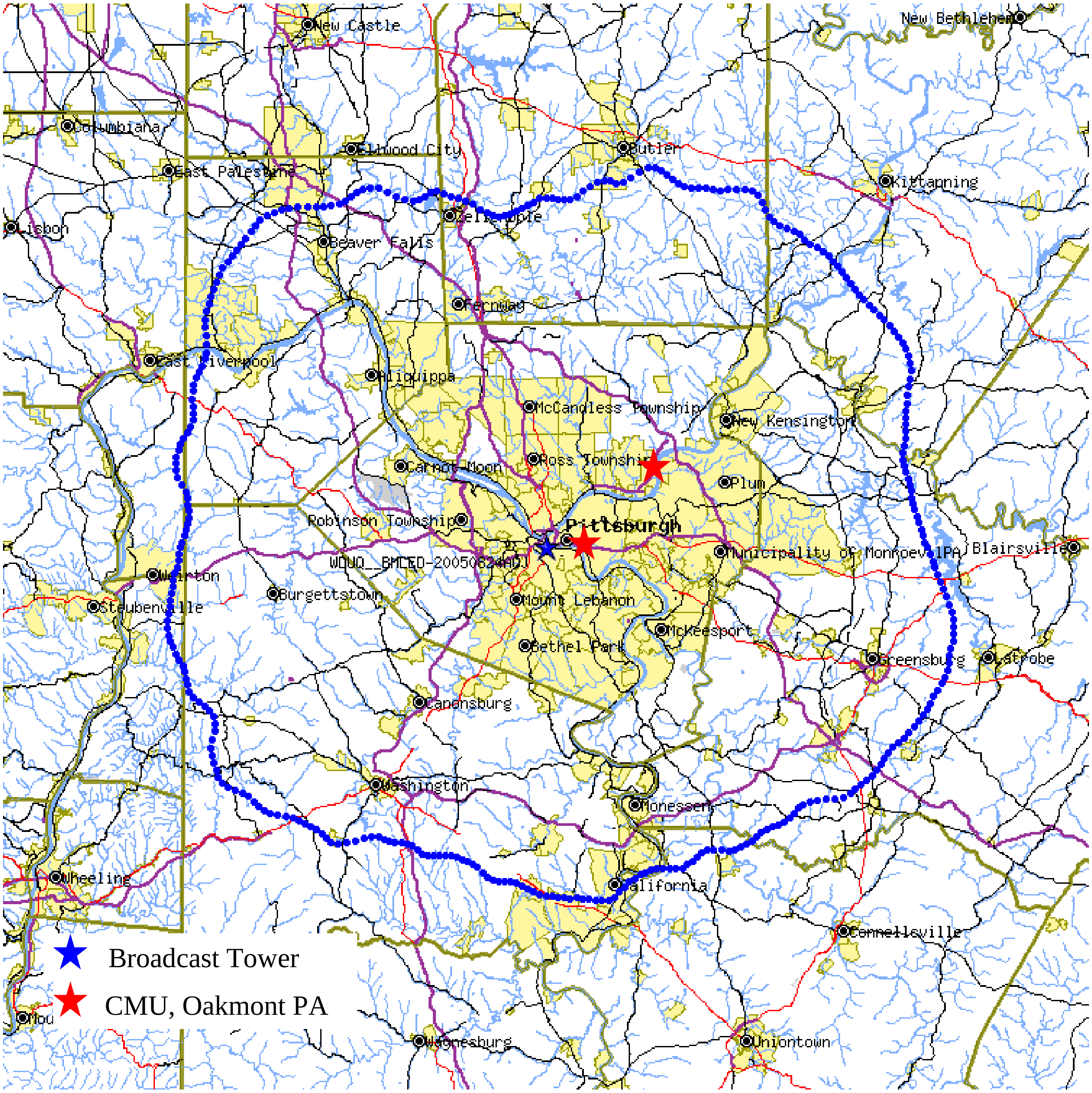


FIGURE 27. WDUQ SERVICE CONTOUR MAP - CMU, OAKMONT PA

The received location reported on the survey responses for the Shelby County Demonstration Day indicated the receipt of three understandable messages at the farthest known distance from a broadcast tower for this scenario and location. Figure 28 displays the location of the received messages on the contour map in relation to the broadcast tower.

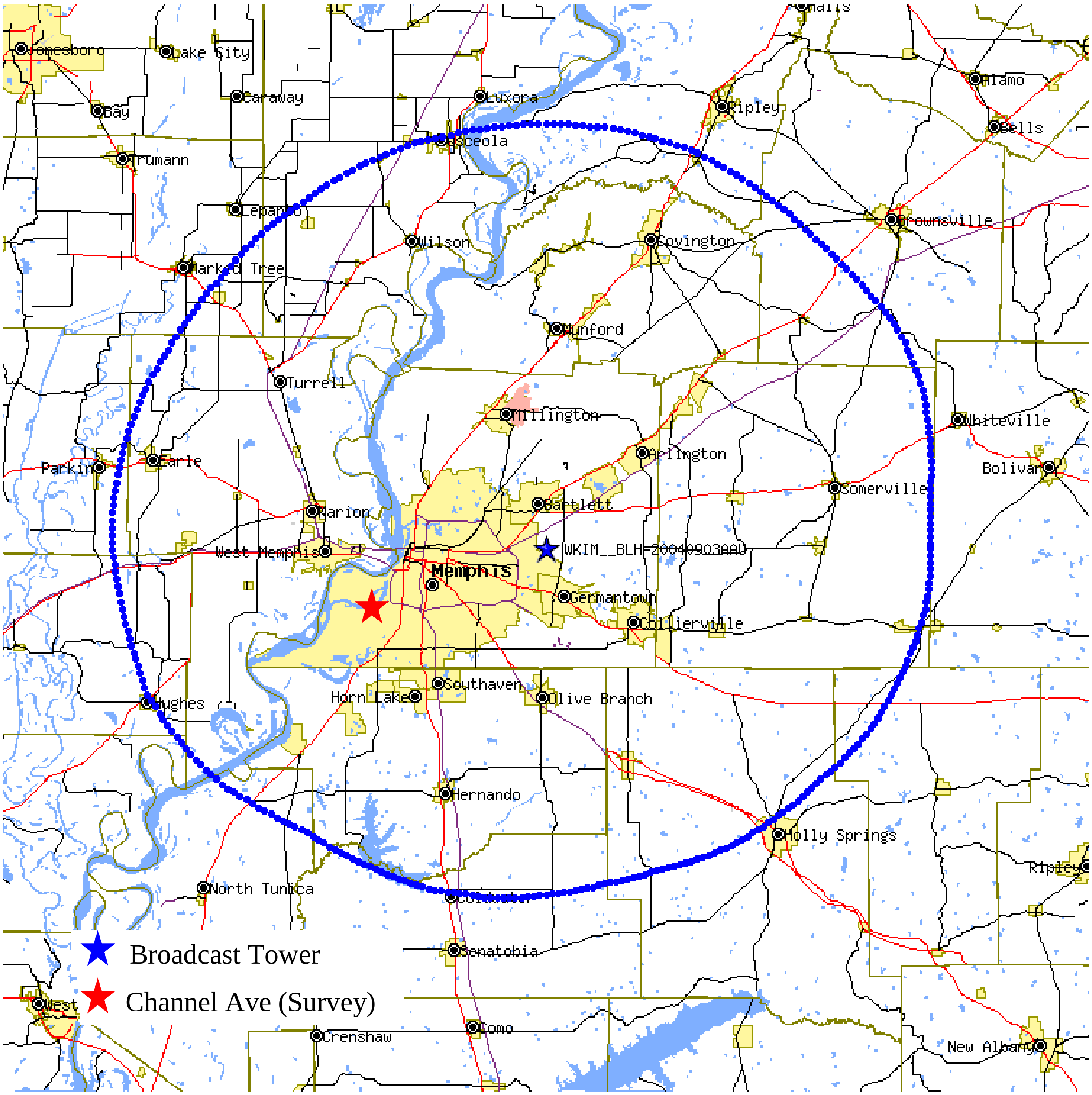


FIGURE 28. WKIM SERVICE CONTOUR MAP - SHELBY COUNTY

One vendor provided a monitoring capability of several broadcast towers and recorded the received messages (Section 2.3.2.1.4). Figure 22 and Figure 23 show the locations of the broadcast towers that were being monitored and the recorded messages for a particular broadcaster. Figure 29 displays the location of the FM Monitoring Station #6 on the contour map in relation to the broadcast tower. This monitoring station recorded the receipt of 32 messages during the Demonstration Operational period.

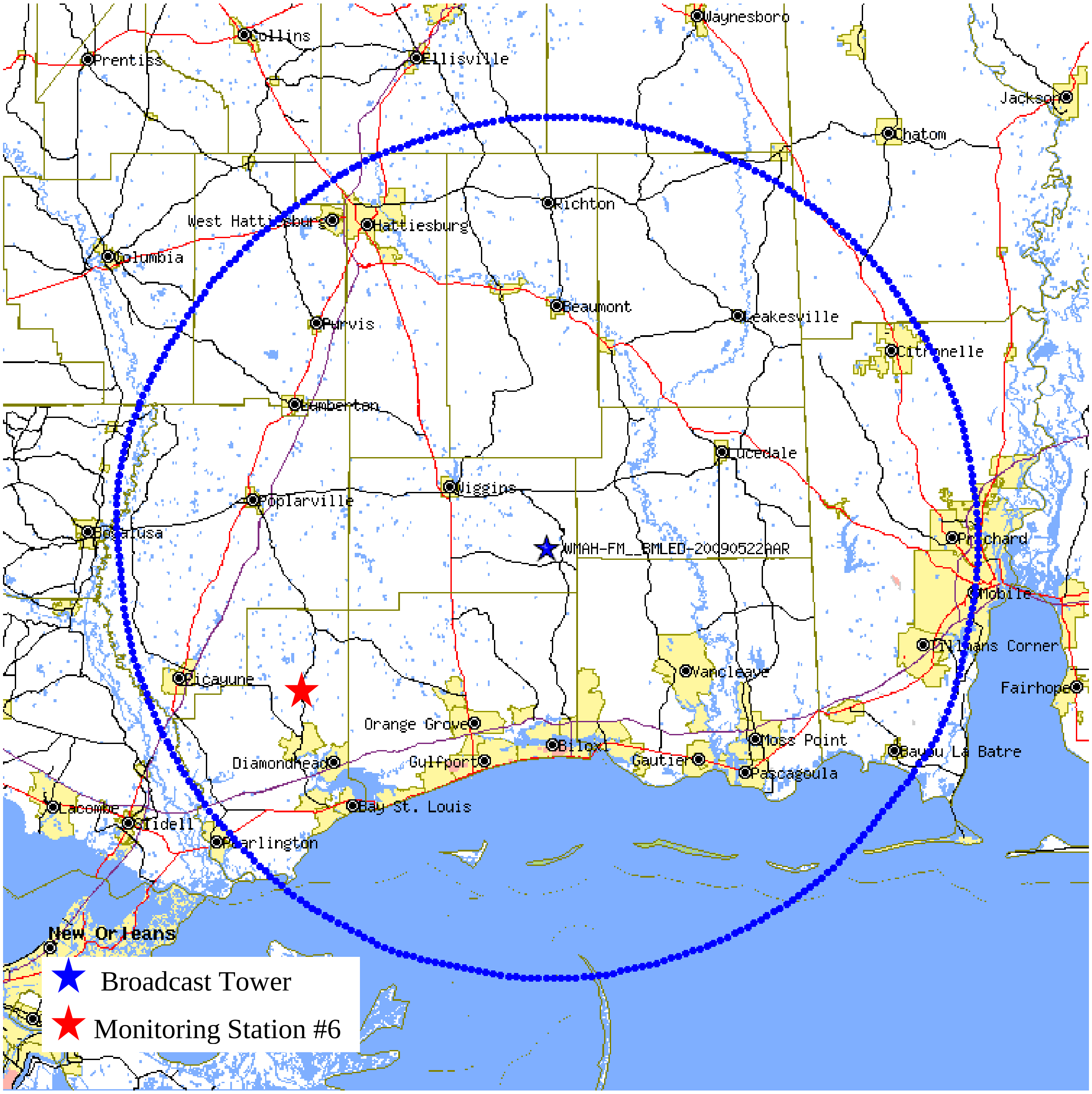


FIGURE 29. WMAH SERVICE CONTOUR MAP - MS / AL GULF COAST

This observation is a demonstrated strength based upon the receipt of understandable messages at several miles radius from the broadcast tower.

Recommendations:

a. Maintain

2.3.3.9 Addressability (APF.2.3)

An RBDS system needs to allow alert originators to define "groups" of alert recipients at a level of granularity that meets their needs, and the alert recipients need the capability to receive the messages for the groups that they are registered.

2.3.3.9.1 Addressability Observation 1: Strength: Origination to Groups

Alert Originators have the ability to target their message to receivers for both geographical and function based groups.

References:

a. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions 10, 12-15, and 27
b. Annex F: Master Scenario Events List (MSEL)
c. Annex G: Participant Distribution
d. 16 Mar – MWSU Demonstration Day
e. 25 Mar – MSU Demonstration Day
f. 13 Apr – CMU Demonstration Day
g. 04 May – Gallaudet University Demonstration Day
h. 06 May – Shelby County TN Demonstration Day
i. 12 May – MS / AL Second Iteration Demonstration Day
j. 19 May – AU / HU / GU / GW Demonstration Day
k. GSS Operational Period Technical Data, 1 July 2010

Analysis:

Discussions and observations during the Demonstration Days reveal that there are no limits to the organization of groups for the sending of messages. Alert Originators of Enterprise style systems typically created geographical groups based upon the locations of deployed receivers. Locations were organized hierarchically in the RBDS systems, i.e., a specific receiver could be targeted, or all of the receivers on a floor, or all of the receivers in a building, or all of the receivers in a cluster of buildings, or all of the receivers on a campus. Functional grouping was not as common within the Enterprise style systems, but no restrictions were found that would prevent the creation of functional groups.

Alert Originators of Personal style systems created both geographical and functional based groups. They created geographical groups for their local county and areas within the county such as a Neighborhood and University. Functional groups were created for schools, nursing homes, hospitals, law enforcement, and fire and rescue departments. No restrictions were found that would prevent the creation of functional groups or geographical groups for Personal style systems.

Review of the MSEL found that at all of the demonstrations, a specific geographic area was successfully targeted for messages (Section 2.3.2.4). Observations at the Demonstration Days validated the ability of Alert Originators to target geographical areas such as the state, county, and NGC Ingalls Shipyard at demonstrations involving the Personal style RBDS systems and specific buildings and floors at demonstrations involving the Enterprise style RBDS systems.

Question 27 of the Alert Originator Survey supported the Demonstration Day observations. This question asked the originators whether the RBDS system was effective in alerting the desired population in the event of an emergency; the responses are displayed in Chart 20.

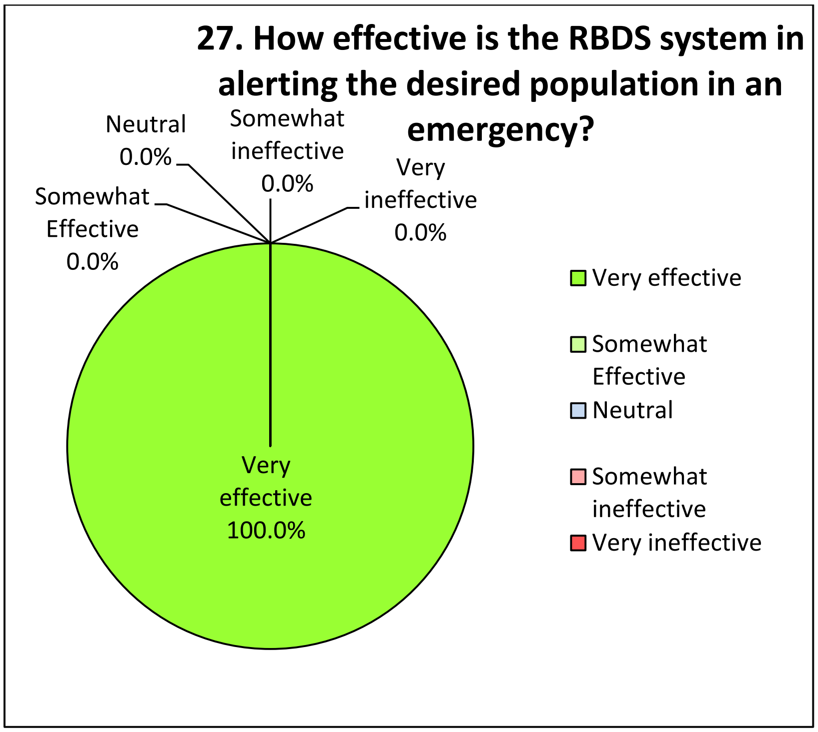


CHART 20. ALERT ORIGINATOR SURVEY (27) EFFECTIVE TARGETING?

Analysis of the messages sent by a particular county during the demonstration operational period reveals that 150 messages were successfully sent to their local Law Enforcement and Fire Rescue Department functional groups.

This observation is a demonstrated and analyzed strength. The demonstrations showed that Alert Originators can address messages to both geographical and functional groups of alert recipients and that there are no limits to defining the functional or group addresses.

Recommendations:

a. Maintain

2.3.3.9.2 Addressability Observation 2: Strength: Group Selection at the Receiver

Alert Recipients have the ability to configure their Personal style receivers for both geographical and function based groups.

References:

a. Annex G: Participant Distribution
b. 25 Mar – MSU Demonstration Day
c. 06 May – Shelby County TN Demonstration Day
d. 12 May – MS / AL Second Iteration Demonstration Day
e. GSS Operational Period Technical Data, 1 July 2010
f. AlertFM Receiver Product Specification[27]

Analysis:

The ability for alert recipients to configure addressability at the receiver is dependent upon the style of the RBDS system. Enterprise style systems have receivers that are permanently installed within the enterprise and are configured for addressability at the receiver by the Alert Originators. Personal style systems have receivers that are customizable by the Alert Recipient who can select groups and services for which they are authorized and would like to receive messages. The following paragraphs discuss addressability for Personal style stationary and mobile receivers.

Review of the alert receiver distribution (Annex G) found that at three of the Demonstration Days, Personal style receivers were allocated to multiple groups and services. The groups and services included groups for the state, county, NGC Ingalls Shipyard, county weather, and county Spanish group.

Observations at the three demonstrations validated that the Personal style receivers were able to be configured for multiple groups and services. One of the receivers that NGC used and observed at all three of the demonstrations has the capability for 30 groups and 30 services. It was configured for the demonstrations with 20 groups, 2 services, and 1 zip-code, which allowed the receiver to receive the correctly addressed messages at each of the demonstrations.

Analysis of the messages sent by a particular county during the demonstration operational period reveals that they had created multiple functional groups to represent their local Law Enforcement and Fire and Rescue Departments. Alert Originators also discussed during the Demonstration Days their intent to create functional groups for their schools based upon their alert receiver distribution.

This observation is a demonstrated and analyzed strength. The demonstrations showed that the Personal style receivers can be configured for multiple groups and services, and those messages could be targeted specifically to these geographical and functional groups.

[27] AlertFM Receiver Product Specification

Recommendations:

a. Allow for further granularity in groups and services requested, such as allowing alert recipients to choose not to receive weather warnings updates or cancels.

2.3.3.10 Geo-Targeting (APF.2.4)

An RBDS system needs to be able to accurately and automatically target emergency alerts to geographically defined areas so those that are located within the defined geographic area can be properly informed.

2.3.3.10.1 Geo-Targeting Observation 1: Strength: Automatic Weather Alerts

Weather alerts were automatically targeted to the broadcasters whose signal "covers" the specified targeted area and these alerts were received by the intended Alert Recipients.

References:

a. GSS Operational Period Technical Data, 1 July 2010
b. AlertFM, Find Groups In Your Area Tool[28]
c. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43) questions 8Hd
d. FCC FM Radio Database Query[29]

Analysis:

Review of the GSS Operational Period Technical Data reveals that 446 weather alerts were automatically generated and targeted to one of six counties that participated in the demonstration. Analysis of the data shows two versions of the GSS messaging scheme that are in use. An older addressing scheme is used in Alabama where any alert targeted to an area within Alabama is sent to every broadcast tower whose contour maps overlay any part of Mobile. Every weather alert targeted to Mobile County AL is sent to every GSS broadcaster in Alabama, as well as to seven GSS broadcasters in Mississippi whose contour maps overlay part of Alabama.

A newer addressing scheme is used in Mississippi which allows for messages to be sent only to those broadcasters whose contour map overlays part of the targeted area. The expected group code for the targeted area was determined by entering a zip code into the AlertFM product support website, which returns a listing of hexadecimal groups. These group codes were transmitted through the broadcasters regardless of the addressing scheme that was in place. Regardless of the addressing scheme, the group code that was transmitted through the broadcasters was the expected weather group code associated with the targeted county.

Additionally, the text in every message was compared against the targeted group code to ensure that the automatic geo-targeting was correct. Analysis showed that the text within the messages matched the expected targeted group. The following table indicates the number of geo-targeted messages that were sent and the targeted county.

[28] AlertFM, Find Groups In Your Area, Customer Support Tool
[29] FCC FM Radio Database Query, Service Contour Maps for Call Sign search

# of Automatic Weather Messages	Geo-Targeted County	Group Code (Hex)	Broadcaster Domain
135	Shelby, TN	247157 (3C575)	co.shelby.tn.us
64	Oktibbeha, MS	228105 (37B09)	co.oktibbeha.ms.us
29	Hancock, MS	228045 (37ACD)	co.hancock.ms.us
34	Harrison, MS	228047 (37ACF)	co.harrison.ms.us
29	Jackson, MS	228059 (37ADB)	co.jackson.ms.us
15 20 20 20 20 20 20 20	Mobile, AL	201097 (31139)	al.us wjxm.ms.us wmbc.ms.us wmlv.ms.us wmxu.ms.us wowl.ms.us wsms.ms.us wsye.ms.us
Total = 446			

Question 8Hd of the Alert Recipient Real-World Events Survey asked the alert recipients whether they received messages for areas other than where they were located at the time the message was received. Respondents could select one of three valid responses: two responses provided a definitive answer regarding receipt of an unexpected message, and one response provided the ability to indicate they did not know the answer to the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	6	12.8%
No	34	72.3%
Don't Know	7	14.9%
Total	47	100.0%

For 47 surveys collected, respondents selected 1 of the 3 valid responses. Chart 21 represents the respondents who provided a definitive response to the survey question. 72.3% of the respondents indicated that they did not receive any unexpected messages, 14.9% did not know or were unsure about receipt of unexpected messages, and 12.8% responded that they did receive unexpected messages.

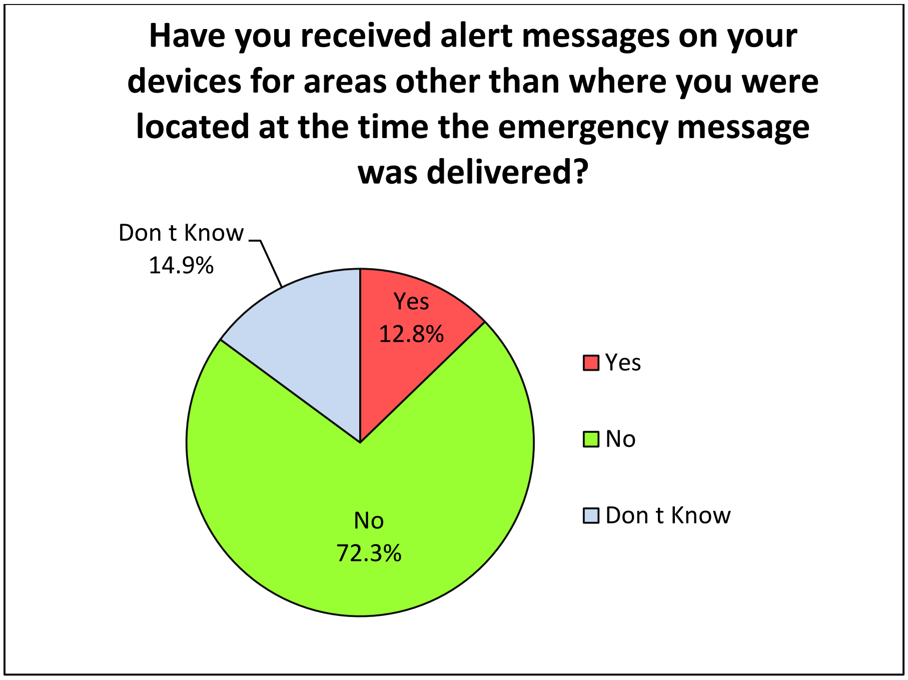


CHART 21. ALERT RECIPIENT REAL-WORLD EVENTS SURVEY (8HD) UNEXPECTED ALERT?

There is no data available that will allow for a complete analysis of those that received unexpected messages; there are however, two plausible explanations. The first is that the mixed addressing scheme caused the mobile receivers that were programmed for Mobile County to receive the message while anywhere in Alabama or within the signal range of one of the seven Mississippi broadcasters that provides a signal to Alabama.

A second explanation would be the area for improvement discussed in Section 2.3.2.4.2, which discusses how a mobile receiver cannot determine its location and will receive a message when the group code in the signal matches the group code in the mobile receiver. Additionally, the Mississippi and Alabama Gulf Coast has several FM broadcasters providing overlapping coverage (Figure 20) to more than one county. When operating mobile within these areas without automatic location configuration on the device, there is a possibility that unexpected messages will be received.

This observation is a demonstrated strength because the messages are automatically configured for the correct geo-targeted group, are delivered to broadcast towers that provide signal to the geo-targeted area, and are received at locations within the geo-targeted area.

Recommendations:

a. Enhance mobile receivers to automatically configure based upon current geographic location.
b. Ensure that a consistent addressing scheme is in place throughout the installed operational areas.

2.3.3.11 Environment (APF.3.1)

Alert recipients should be able to receive messages in a variety of environments such as indoors, outdoors, mobile, and on the water. Operation in each of those environments was demonstrated and the following sections detail the observations.

2.3.3.11.1 Environment Observation 1: Strength: Outdoor Reception

Receivers successfully alarmed outdoors while mobile, including on the water.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 3 for messages 1-5
b. 25 Mar – MSU Demonstration Day
c. 06 May – Shelby County TN Demonstration Day
d. 12 May – MS / AL Second Iteration Demonstration Day
e. GSS report on Florida State University (FSU) evaluation, Fall of 2009[30]

Analysis:

Mobile receivers were demonstrated and observed operating on battery power while outdoors, including on the water. This demonstrated the ability of mobile receivers to operate for an extended time on battery power (Section 2.3.3.14) and automatically scan and lock onto the strongest FM signal (Section 2.3.2.4). This observation has been demonstrated through two different methods.

Question 3c of the Alert Recipient Scenario Survey asked the alert recipients about their location when they received the test messages. Two respondents, one from the MSU demonstration and one from the Shelby County demonstration, gave a clear indication that they received a message while operating mobile and outdoors. One respondent received the alert while *"Riding on a Golf Cart to the Football Stadium"*. The second respondent received the alert while *"I was walking from one building to another at work"*. Additionally, NGC and MSU representatives observed the operation and activation of the mobile receivers while walking outdoors on the campus of MSU.

One vendor provided data from a three month evaluation of their system by a boat rental facility on the campus of Florida State University (FSU). Analysis of the data found that three battery powered mobile receivers were placed within the rental boats and were used by the rental office to provide information to the boats on the water. A sampling of the alerts includes: *"FSU Rez Message: Kayak 1, Return to Rez Marina"*, *"FSU Rez Message: Canoe 1, return to marina"*, and *"FSU Rez Msg: Put that jacket on!"*. The report indicated that 66 messages were sent. Of those 66 messages, 13 were considered as "Not Applicable" or "Not Verifiable" due to message addressing and severe weather message that consumed the message history on the receivers. 89% of the remaining 53 messages were successfully received.

[30] GSS report on Florida State University (FSU) evaluation, Fall of 2009

This observation is a demonstrated strength when the results of the Demonstration Day activities are combined with the demonstrated observations of the prior system evaluation.

Recommendations:

a. Provide notification when the signal has been lost by the mobile receiver through a low tone audible signal.

2.3.3.11.2 Environment Observation 2: Area for Improvement: Indoor Reception

The successful activation of stationary and mobile receivers located within structures was dependent upon the quality of the FM signal that was received.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 3 for messages 1-5 and question 16
b. 16 Mar – MWSU Demonstration Day
c. 25 Mar – MSU Demonstration Day
d. 13 Apr – CMU Demonstration Day
e. 04 May – Gallaudet University Demonstration Day
f. 06 May – Shelby County TN Demonstration Day
g. 12 May – MS / AL Second Iteration Demonstration Day
h. 19 May – AU / HU / GU / GW Demonstration Day
i. Metis Operational Period Technical Data Analysis, 22 July 2010

Analysis:

All of the Demonstration Days were observed by NGC representatives, and several of the Demonstration Days were observed by DHS/FEMA representatives and MSU representatives. Stationary, indoor receivers including both permanently attached and mobile receivers were observed activating as required with one exception during the MSU Demonstration Day.

At the MSU demonstration, NGC and MSU representatives observed the operation and activation of the stationary receivers in a conference room located within the MSU SSRC facilities (Section 2.3.1.2). On the conference room tables were more than five stationary receivers operating on battery power. The initial alert activated all but one of these receivers, which had experienced a momentary loss of FM signal.

Question 3c of the Alert Recipient Scenario Survey asked the alert recipients about their location when they received the test messages. Many of the respondents indicated that the receiver was used in a stationary fashion such as sitting on their desk. Question 16 of the Alert Recipient Scenario Survey allowed the alert recipients to provide additional comments. Review of the comments indicates that signal reception was an issue, as seen in the following sampling:

> *"I did not have reception in my office in the place that I put it originally. Once I moved the alarm and checked the reception, it worked fine."*

"This would be a great desktop device, but did not always keep signal as I went through my building yesterday."

"The No Service note never went away. I walked around my work area several feet each direction and it never changed"

"My Alert FM device did not work, due to the fact that I could not get service at my desk."

"We were given the alert device however it is not operational. It is plugged up but we have no service registered on the screen."

"I could never get reception on this device indoors unless I was right on the window. I sit about 15 feet away from a 100 ft long bank of windows."

Based upon the comments and observations, stationary receivers work well when they are properly positioned.

The Enterprise style receivers have added differing forms of alerting redundancy including Ethernet and a proprietary mesh network to overcome momentary or complete loss of an FM signal. The Enterprise style systems also repeatedly issued the alert to allow for lost packets due to low quality of signal. For example, Chart 22 provided by Metis shows the raw data for any dropped packets vs. the minimum signal to noise ratio. The signal to noise ratio improves as the number of dropped packets goes to zero, showing the importance of a good signal.

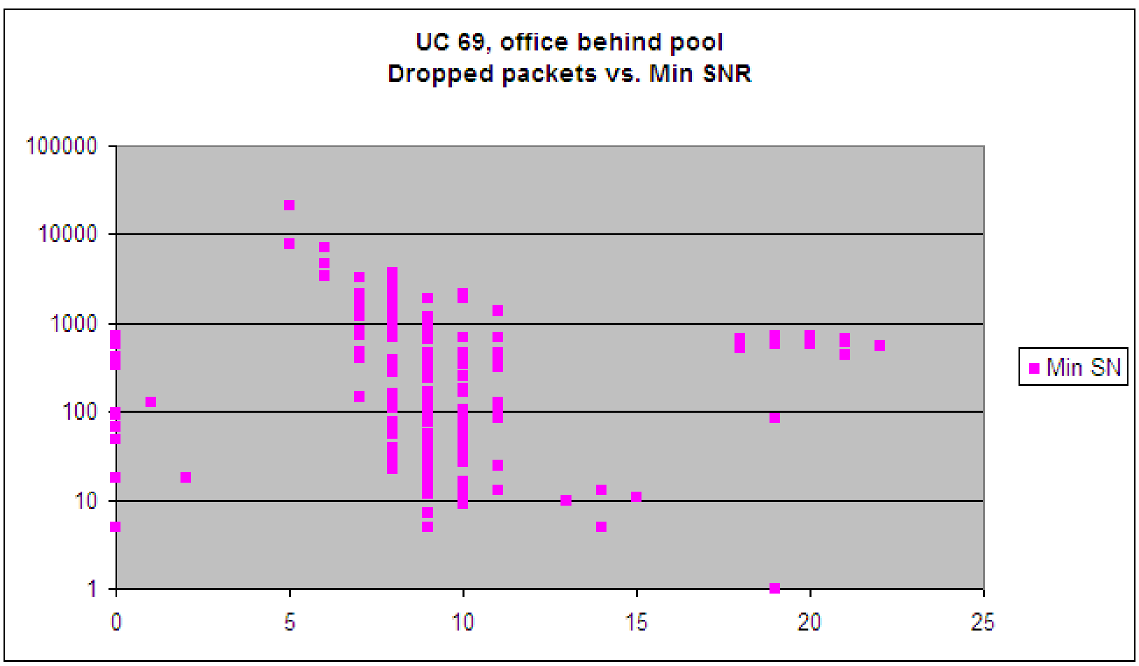


CHART 22. METIS DROPPED PACKETS VS. MIN SNR

Although receipt of messages while located within structures was successfully demonstrated and observed, improvements could be made to increase the ability of the receivers to receive an FM signal. One suggestion is to provide a detachable external antenna for the mobile receivers that are used in a stationary position to increase the ability for these receivers to maintain receipt of the FM signal.

Recommendations:

a. Provide antenna accessory for mobile receivers used in a stationary fashion to increase the likelihood of signal receipt.
b. Issue alert multiple times to allow for missed packets or a momentary loss of signal.

2.3.3.12 Maintainability (APF.4.1)

A maintainable RBDS system requires a low burden in resources and time for the originators, broadcasters, and the alert recipients. Maintenance should be easily performed with minimal vendor support. The following observations will describe the maintainability for each of these three groups.

2.3.3.12.1 Maintainability Observation 1: Strength: Low Maintenance for Broadcasters

Broadcasters perform maintenance of the RBDS equipment less often than normal network maintenance.

References:

a. FM Broadcaster Survey (Annex E, Figure 45), questions 4, 6, and 8

Analysis:

Broadcasters were asked multiple survey questions to determine their level of maintenance of their network and the RBDS technology. The results from each of those survey questions are discussed in the following paragraphs.

Question 4 of the FM Broadcaster Survey asked the broadcasters whether they regularly perform maintenance of their network. Respondents could select one of four valid responses: two responses provided a definitive answer of a “Yes” or “No”, and two responses provided the ability to indicate either they did not want to answer the question, “Decline”, or did not understand the question being asked, “Don’t Know”, with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Yes	26	92.9%
No	1	3.6%
Don’t Know	1	3.6%
Decline	0	0.0%
Total	28	100.0%

For 28 surveys collected, respondents selected 1 of the 4 valid responses. Analysis of the valid responses determined that 1 (3.6%) of the respondents was unable to answer the question. While this was a valid response to the question, it provided no insight into the "Broadcaster Maintainability" that was being measured. Chart 23 represents the respondents who provided a definitive response as well as answered the follow-up question requesting the frequency of network maintenance.

96.3% of the respondents indicated that they regularly perform maintenance of their FM radio network. Of the 26 respondents that perform maintenance, 88.5% indicated that the maintenance was performed at least weekly.

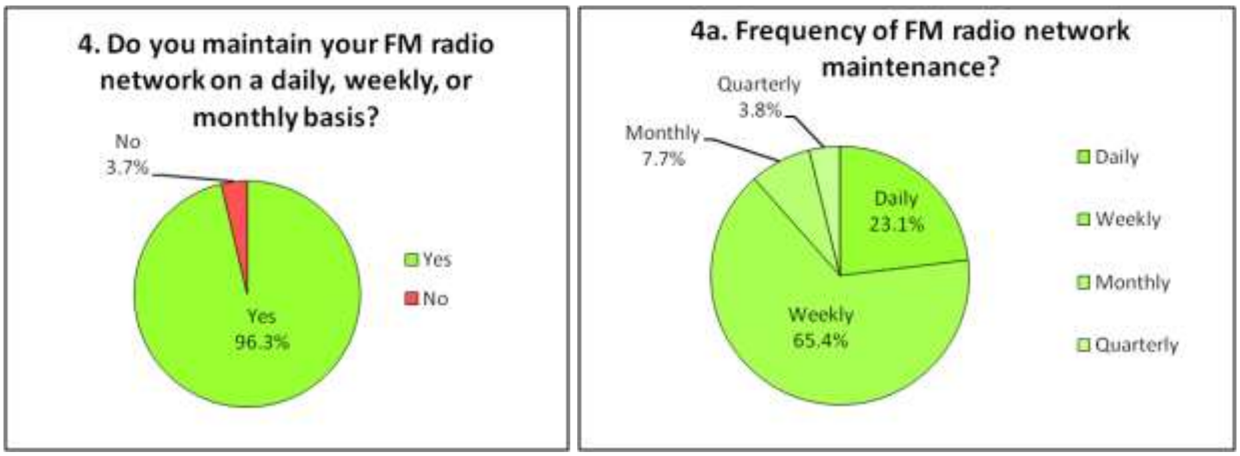


CHART 23.FM BROADCASTER SURVEY (4) FM RADIO NETWORK MAINTENANCE

Sub-questions to question 6 of the FM Broadcaster Survey asked the broadcasters about the rate at which they perform maintenance of their RBDS equipment and whether vendor support is required to perform the maintenance.

Chart 24 represents the respondents who provided a rate of RBDS equipment maintenance and the need for vendor support to perform the maintenance. 26 responses were provided for the RBDS maintenance rate, with 46.2% indicating maintenance was performed only on an annual basis and 78.6% of 14 respondents to question 6c indicating that vendor support was not required to perform RBDS maintenance.

While broadcasters require vendor support for RBDS maintenance, the percentage shown in the chart may actually be less when one considers that 13 of the 27 respondents that have RBDS equipment declined to provide a response. Also, one broadcaster provided the comment *"Alert FM uses our RBDS signal and maintains it."* which may have been included in the "Yes" responses.

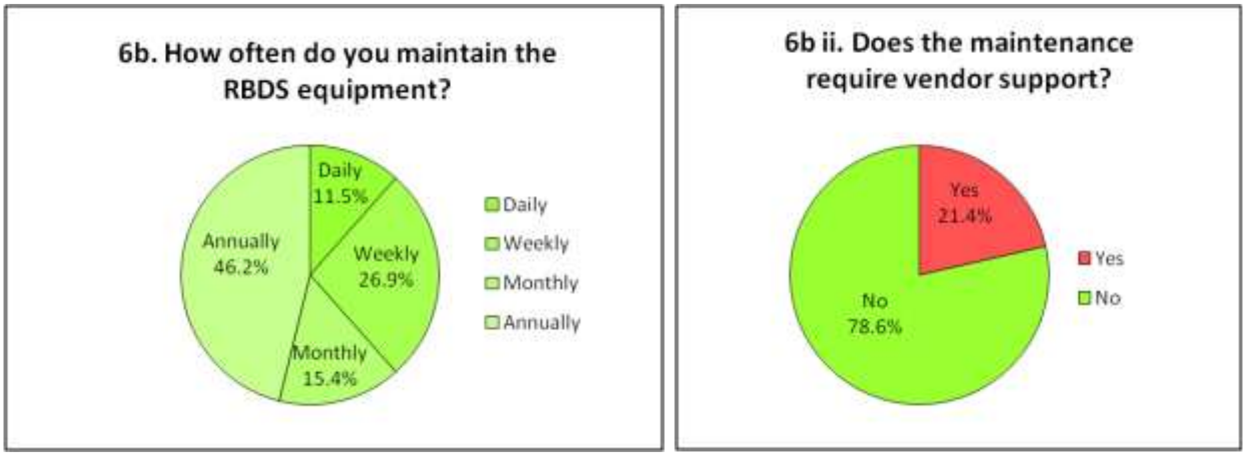


CHART 24. FM BROADCASTER SURVEY (6) RBDS MAINTENANCE

This observation is a strength as the broadcaster survey responses indicate. The rate at which the RBDS equipment is maintained is less than the FM network as seen in following table.

Rate Comparison	Network Maintenance	RBDS Maintenance
Daily	23.1%	11.5%
Weekly	65.4%	26.9%
Monthly	7.7%	15.4%
Quarterly	3.8%	
Annually		46.2%

Less time is required for maintenance of the RBDS technology than for normal network maintenance, and low failure rates of RBDS equipment as discussed in Section 2.3.2.1.1 (Resilient) indicates a low burden for the broadcaster.

Recommendations:

a. Maintain

2.3.3.12.2 Maintainability Observation 2: Strength: Low Maintenance for Originators

Alert Originators need to perform very few tasks to maintain the operational state of the RBDS system.

References:

a. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions 17 – 20
b. 16 Mar – MWSU Demonstration Day
c. 13 Apr – CMU Demonstration Day
d. 04 May – Gallaudet University Demonstration Day
e. 19 May – AU / HU / GU / GW Demonstration Day
f. Alertus Technical Data Response, 6 January 2010
g. Metis Technical Data Response, 24 February 2010

Analysis:

The level of maintenance required of the Alert Originators is dependent upon the style, Enterprise or Personal, of the installed RBDS system. While Enterprise style systems require the Alert Originators to maintain the individual receivers, tools inherent to the system automatically provide the operational status of the individual receivers. These tools were observed at several of the Demonstration Days.

Several questions were asked on the Alert Originator Survey regarding maintenance and recurring costs associated with their RBDS system. While there are not enough responses to provide a statistical analysis, the responses tend to support the general observation that Alert Originators need to do little to maintain the system.

Sending test alerts was the most common task performed by the Alert Originators to verify the operational status of the system. The Enterprise style systems have an added ability to issue silent test alerts, with the networked receivers reporting operational status back to the alert originator. Alert Originators for the Personal style system generally keep a receiver in the area where they originate the majority of their messages as a way to confirm the alert has been issued. Some Alert Originators reported they issued audible test messages at regular intervals at a rate that ranged from Bi-Annual to Semi-Annual, while others reported they issued test messages on an irregular schedule.

This observation is an observed strength. Observations showed that very little Alert Originator maintenance was required and that there were several tools available to inform the Alert Originators of failures in the Enterprise style system.

Recommendations:

a. Maintain

2.3.3.12.3 Maintainability Observation 3: Strength: Low Maintenance for Alert Recipients

Minimal maintenance of receivers was observed, namely, replacement of the battery and repositioning for better signal reception.

References:

a. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43) questions 8Ha and 8He
b. Metis Operational Period Technical Data Analysis, 22 July 2010
c. 13 Apr – CMU Demonstration Day

Analysis:

Alert recipients were asked multiple survey questions to determine their level of maintenance of their RBDS technology. In addition, a technical analysis of the vendor data recorded during the demonstration operational period was performed. The results from each of those survey questions and the technical data analysis are discussed in the following paragraphs.

Question 8Ha of the Alert Recipient Real-World Events Survey asked the alert recipients about the rate at which they replaced their device's battery. Respondents could select one of five valid responses: four responses provided a definitive answer to the replacement of their device's batteries and one response provided the ability to indicate they did not know the answer to the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
Never replaced battery (device IS operational)	9	19.1%
Never replaced battery (device NOT operational)	2	4.3%
Replaced the batteries	7	14.9%
Keep device plugged into A/C outlet	27	57.4%
Don't Know	2	4.3%
Total	47	100%

For 47 surveys collected, respondents selected 1 of the 5 valid responses. Analysis of the valid responses determined that 29 (61.7%) of the respondents' devices operated on A/C power or the respondents were unaware of their power use. While these were valid responses to the question, they provide no insight into the "Replacement of Battery" maintenance that was being measured. Chart 25 represents the respondents who provided a definitive response to the survey question. 50.0% of the respondents indicated that they never had to replace the batteries and their devices were operational. Batteries were replaced 1 time in 38.9% of the responses to keep the devices operational, while 11.1% of the devices were not operational and the batteries were never replaced.

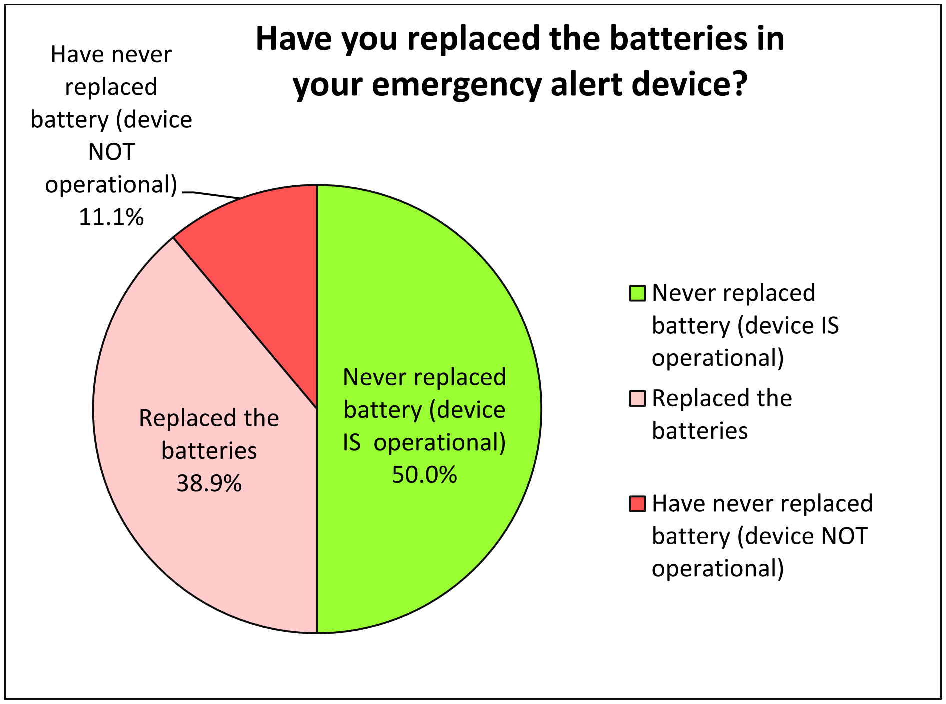


CHART 25. ALERT RECIPIENT REAL-WORLD EVENTS SURVEY (8HA) REPLACED BATTERY?

Question 8He of the Alert Recipient Real-World Events Survey asked the alert recipients about the device's needing repair and the timeliness of the needed repairs. Respondents could select one of five valid responses: three responses provided a definitive answer of "No repair required", "Yes", or "No", and two responses provided the ability to indicate either they did not want to answer the question, "No Comment", or did not understand the question being asked, "Don't Know", with the frequency of responses indicated in the following table.

Valid Response	Frequency	Percent of Valid Responses
No repair required	39	83.0%
Yes	2	4.3%
No	4	8.5%
Don't Know	1	2.1%
No Comment	1	2.1%
Total	47	100%

For 47 surveys collected, respondents selected 1 of the 5 valid responses. Analysis of the valid responses determined that 2 (4.2%) of the respondents either did not know whether the device required repair or provided no response. While these were valid responses to the question, they provide no insight into the "Device needs Repair and Timeliness of Repair" maintenance that was being measured. Chart 26 represents the respondents who provided a definitive response to the survey question. 86.7% of the respondents indicated that their device required no repairs.

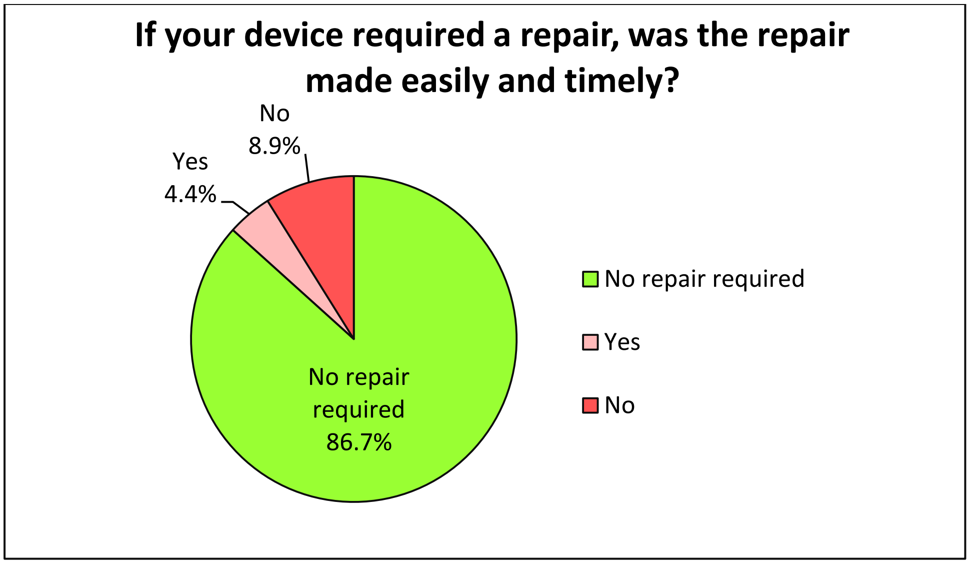


CHART 26. ALERT RECIPIENT REAL-WORLD EVENTS SURVEY (8HE) REPAIR NEEDED?

The Metis system recorded several categories of data for each of their receivers during the demonstration operational period, including the minimum (Min) and maximum (Max) Signal to Noise ratio (SNR). Chart 27 shows the raw SNR data, where higher is better, captured in four hour segments for one unit throughout the demonstration operational period.

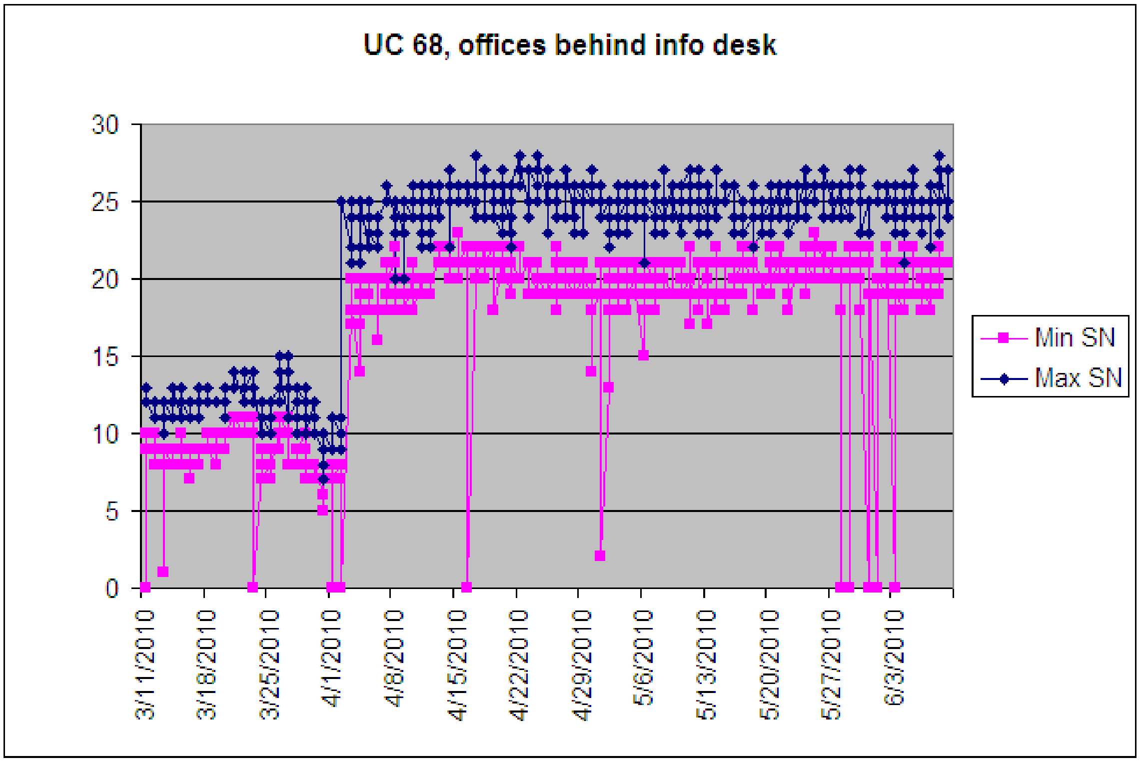


CHART 27. METIS RECORDED MIN/MAX SNR FOR A DEVICE

Metis's early analysis of this data indicated the Min and Max SNR for a particular unit was not optimal. On 2 April 2010, Metis performed maintenance on this unit by physically moving the unit from one side of the office to the other. This move can be seen in Chart 27 by the jump in Min and Max SNR. The move of the device was unable to correct all instances of low or zero SNR. One single reading of zero (0) around 16 April 2010 was caused by a single burst of local interference. Zero SNR levels indicated between 28 May 2010 and 3 June 2010 were found to be caused by their local broadcast station experiencing equipment failures.

This observation demonstrates that minimal device maintenance is required by the alert recipient other than replacement of batteries and moving a device so that it achieves a better signal.

Recommendations:

a. Perform further analysis on the repairs needed to the devices with the intent to improve the manufacture of the device.
b. Make improvements to the repair process for the alert recipients because more than half of the needed repairs were not easy or timely.

2.3.3.13 Lifecycle (APF.4.2)

An RBDS system will have reasonable recurring costs for the origination equipment, receivers, and the system software.

2.3.3.13.1 Lifecycle Observation 1: Strength: No Costs per Subscriber

Personal style receivers do not require registration and are not required to pay for a subscription service to receive emergency alerts.

References:

a. AlertFM Receiver Product Specification[31]
b. Alert Originator Survey (Annex E, Figure 36 through Figure 41), question 19

Analysis:

Analysis of the system architecture and product materials for the Personal style systems reveals that the only costs incurred by an alert recipient are those associated with the initial purchase and periodic battery replacement. There are no required registration fees and no recurring subscription fees. The receivers work in much the same way as a typical FM radio, where the radio is purchased and tuned to a station to receive the signal. For an RBDS system, the signal received is a data signal that at times receives emergency messages.

Enterprise style systems differ from the Personal style systems in that the receivers are owned and managed by the Alert Originators and are often networked into the system. Because of the additional features inherent in an Enterprise style system, the vendors' business models do not preclude there being a recurring cost for the receivers, but the

[31] AlertFM Receiver Product Specification

responses to question 19 of the Alert Originator Survey suggests that no recurring costs are required for the systems.

This observation is an analyzed strength for Alert Recipients who operate Personal style receivers that require no subscription or per message received costs.

Recommendations:

a. Maintain

2.3.3.13.2 Lifecycle Observation 2: Strength: No costs per Alert Issued

Alert Originators do not incur costs for issuing messages.

References:

a. AlertFM Literature, Government Benefits [32]
b. Alertus Product Literature [33]
c. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions

Analysis:

Analysis of the product materials for both the Personal and Enterprise style systems reveals that there are no usage costs incurred by an Alert Originator to initiate the emergency alert. This is supported by the responses to question 19 of the Alert Originator Survey, which suggests that no recurring costs are required for the systems.

This is an important consideration for Alert Originators who operate on a fixed and limited budget. Financial costs should not be a part of the decision making process on whether an emergency message is issued.

This observation is an analyzed strength because no usage fees or recurring costs are incurred by the Alert Originator for issuing emergency alerts.

Recommendations:

a. Maintain

2.3.3.13.3 Lifecycle Observation 3: Strength: Minimal Hardware Replacement

Minimal recurring costs are required for the maintenance of the hardware associated with the RBDS system.

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), questions 10H and 11H
b. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), questions 8Ha, 8Hb, 8He
c. FM Broadcaster Survey (Annex E, Figure 45), questions 6 and 7
d. Alert Originator Survey (Annex E, Figure 36 through Figure 41), questions 16 and 19

[32] AlertFM Literature, Government Benefits
[33] Alertus Product Literature

Analysis:

Recurring hardware costs to operate an RBDS system are minimal for Alert Originators, broadcasters, and alert recipients. The primary lifecycle costs are attributable to providing maintenance of the system, which includes testing of the system, repair or replacement of hardware, and battery replacement.

While Section 2.3.2.1.1, Section 2.3.3.12.1, Section 2.3.3.6.1 and Section 2.3.3.14 provide a complete discussion on Resilience, Maintenance, Licensing, and Power respectively, the following paragraphs provide a short summary of those sections to understand the impact to lifecycle costs.

Broadcasters reported a maintenance cycle of the RBDS equipment that was less frequent than what was needed to maintain their main audio signal. 85.2 % of the broadcasters reported zero (0) failures of their RBDS equipment. A few of the broadcasters reported failures of their RBDS equipment at an average rate of 0.167 times a month.

Several questions were asked on the Alert Originator Survey regarding maintenance and recurring costs associated with the RBDS system. Although there are not enough responses to provide a statistical analysis, the responses tend to support the general observation that there are minimal recurring costs. Of those originators that knew, several indicated that their average monthly cost for maintaining their RBDS emergency alert system was $0. Some originators indicated that they regularly issued test messages at a rate ranging from Bi-Annual to Semi-Annual, while others reported they issued test messages on an irregular schedule.

The recurring maintenance required on the receivers is the replacement of backup batteries. Receivers can fail, and replacement of the receiver may be an alternative to repair based upon replacement purchase price. Question 11H of the Alert Recipient Scenario Survey and question 8Hb of the Alert Recipient Real-World Survey asked the alert recipients the maximum acceptable purchase price for a personal emergency alert device. Respondents could select one of eight valid responses: six responses provided a range from “$0” to “Over $100”, and two responses provided the ability to indicate either they did not want to answer the question, “Decline”, or did not know what an acceptable purchase price would be, “Don’t Know”, with the frequency of responses indicated in the following table.

Valid Response	Scenario Survey Frequency	Percent of Valid Responses	Real-World Scenario Frequency	Percent of Valid Responses
$0	4	3.2%	0	0.0%
$1 to $10	14	11.1%	9	19.1%
$11 to $25	46	36.5%	18	38.3%
$26 to $50	26	20.6%	12	25.5%
$51 to $100	6	4.8%	3	6.4%
Over $100	6	4.8%	0	0.0%
Don't Know	21	16.7%	4	8.5%
Decline	3	2.4%	1	2.1%
Total	126	100.0%	47	100.0%

For 173 surveys collected, respondents selected 1 of the 8 valid responses. Analysis of the valid responses determined that 4 (2.3%) of the respondents declined to answer the question. While these were a valid response to the question, they provide no insight into the "Maximum Acceptable Purchase Price" that was being measured. Chart 28 represents the respondents' opinion on the "Maximum Acceptable Purchase Price" of the receivers by calculating the percentage of responses combined from both surveys for the seven charted responses where an opinion was provided. 69.2% of the respondents believe that a maximum purchase price of $25 would be acceptable, 31.4% of the respondents believe that $50 is an acceptable maximum purchase price, and 13.6% of the respondents believe that $10 is an acceptable maximum purchase price.

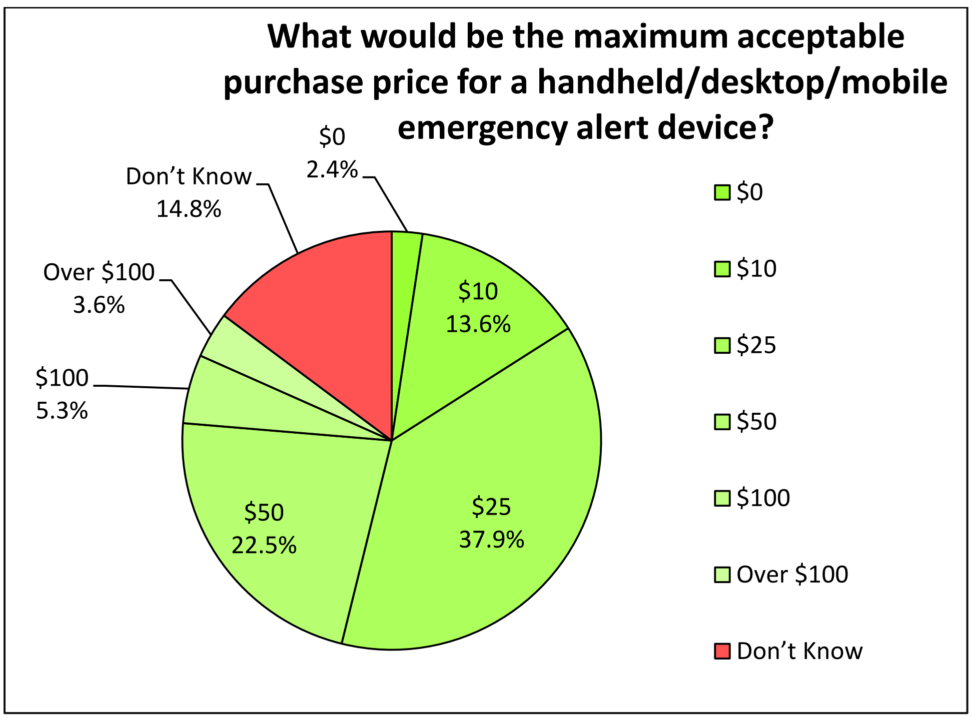


CHART 28. MAXIMUM ACCEPTABLE PURCHASE PRICE?

This observation is a strength. Alert Originators incur little or no recurring costs for the RBDS system, the failure rate for broadcasters' RBDS equipment is minimal, and alert recipients have few recurring costs.

Recommendations:

a. Maintain

2.3.3.14 Power (APF.4.3)

An effective receiver in an RBDS system can operate for extended periods without the need for standard utility power so that timely alerts can be received even during periods when standard utility power is not available. The Alert Recipient Scenario Survey (Chart 29) indicates that both plugged-in and battery powered receivers were used throughout the seven Demonstration Days. The plugged-in units were regarded as stationary and the battery powered were regarded as mobile. The distribution of responses roughly mirrors the distribution between Personal and Enterprise style systems (Annex D). Personal style systems generally operate on battery power, since they are carried by individuals. Enterprise style systems typically are plugged into facility power.

Valid Response	Frequency	Percent of Valid Responses
Battery	42	32.1%
Plugged into wall with AC adapter	69	52.7%
Don't Know	20	15.3%
Decline	0	0.0%
Total	131	100%

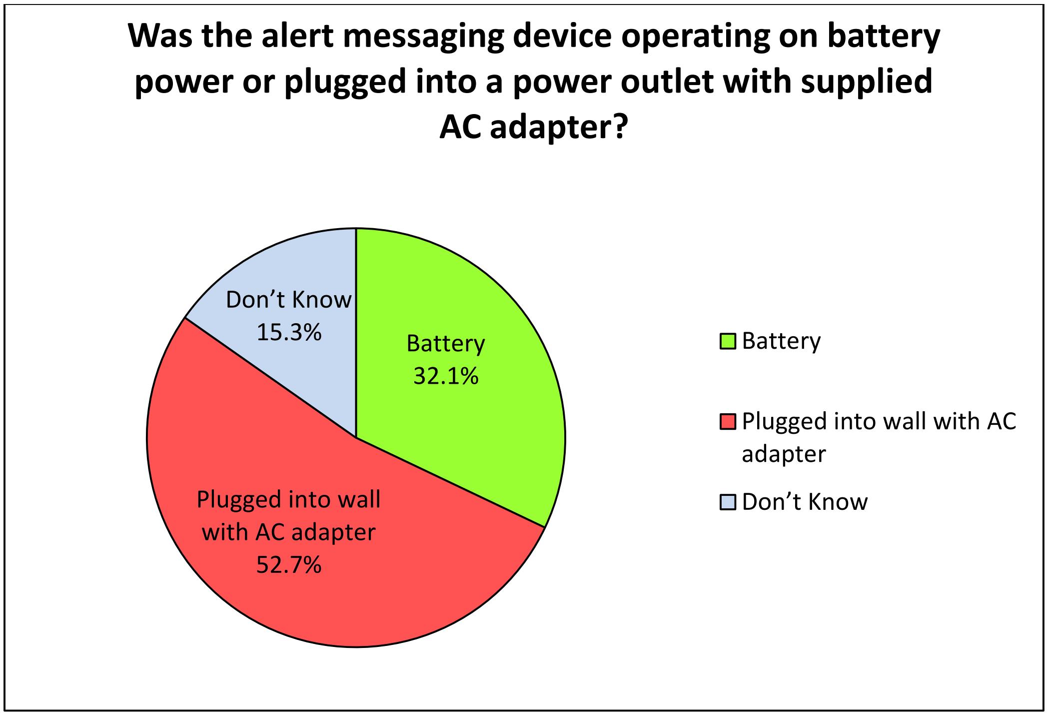


CHART 29. ALERT RECIPIENT SCENARIO SURVEY (10H) OPERATE ON BATTERY?

The following observations provide analysis of mobile and stationary receivers.

2.3.3.14.1 Power Observation 1: Strength: Mobile Receivers Battery Powered for Months

Mobile receivers operated on battery power for extended periods without the need for new batteries.

References:

a. 25 Mar – MSU Demonstration Day
b. 08 Apr – MS / AL Demonstration Day
c. 23 - 25 April – Southeast Tornadoes Real-World Incident
d. 30 April - 8 May –Tennessee Severe Storms, tornadoes, flooding
e. 06 May – Shelby County TN Demonstration Day
f. 12 May – MS / AL Second Iteration Demonstration Day
g. AlertFM Receiver Product Specification[34]
h. GSS report on Florida State University (FSU) evaluation, Fall of 2009 [35]
i. NGC RBDS Study Team Observance

Analysis:

Mobile receivers for this discussion are units that are operational and receive alerts while not connected to A/C power. One of the three participating vendors in this study has developed a

[34] AlertFM Receiver Product Specification
[35] GSS Report on Florida State University (FSU) Evaluation

mobile receiver capable of operating on a single "AA" battery for two months. This specification has been validated through two different methods.

The AlertFM system was evaluated over a three month period in the fall of 2009. During this time, no batteries were replaced in the receivers, which continued to receive alerts throughout the three month evaluation period.

NGC was given two receivers to use throughout the study. One of these receivers was used in a mobile fashion with no A/C power connection. This unit stayed powered and operational for over two months while in a locked or signal scan state. The scan state would search for a signal and, when not finding a signal, go to sleep for a short duration and try again. This unit was off and on battery power from 08 March 8 till 12 May and continuously on battery power from 17 May till the battery expired on 18 July.

For this study, three locations (MSU, MS/AL, Shelby County, TN) used the Personal style mobile receivers. At each location, the receivers were distributed at least several days in advance of the Demonstration Days. In no cases were there requests for new batteries from the alert receiver participants and the receivers remained operational. Also, these receivers remained operational during real-world events when utility power was unavailable.

This observation is a strength as demonstrated by the mobile receivers providing full operational capability of alerting during extended absence of utility A/C power.

Recommendations:

a. Maintain

2.3.3.14.2 Power Observation 2: Strength: Stationary Receivers Battery Powered Days to Months

Stationary receivers have the capacity to operate on battery power for extended periods without the need for new batteries.

References:

a. 04 May – Gallaudet University Demonstration Day
b. 06 May – Shelby County TN Demonstration Day
c. 12 May – MS / AL Second Iteration Demonstration Day
d. AlertFM Wall Receiver Product Specification[36]
e. Small Business Computing Article dated August 27, 2008

Analysis:

Stationary receivers for this discussion are units that are operational and receive alerts while connected to A/C power or are considered permanently installed such as hanging on a wall. Stationary receivers were a part of every demonstration location and Demonstration Day.

Two of the participating vendors' wall receivers have rechargeable batteries as part of their normal installation. These receivers have the ability to operate for up to 24 hours on backup

[36] AlertFM Wall Receiver Product Specification

battery power and then recharge to full backup capacity when utility power is restored. The third vendor participating in the study deploys their wall units with a lithium backup battery that has the capability of providing backup power for five years as documented in their product specification.

Stationary wall receivers operating on battery power were demonstrated during three of the Demonstration Days. At Gallaudet University (GAL) on 4 May (Section 2.3.1.8), several wall units operating on rechargeable batteries were placed throughout the campus several hours prior to the demonstration event. These units received all of the expected alerts during the demonstration and were operational on battery power when collected several hours following the demonstration.

The Demonstration Day events at Shelby County TN on 6 May (Section 2.3.1.9) and the Gulf Coast on 12 May (Section 2.3.1.10) included the use of AlertFM wall units operating on battery power. In both cases, the units were on battery power for several hours and all successfully received their expected alerts.

Operation when connected to normal utility power is expected, but post-incident alerting when utility power is unavailable is also critical. Figures from the Electric Power Research Institute (EPRI)[37] reported in a Small Business Computing article show that within the U.S., the average power company customer loses power for 214 minutes every year. This observation is a strength as all of the vendors that participated in the study by demonstration provide a battery backup capability for their systems that exceeds the average power loss time frame.

Recommendations:

a. Upgrade RBDS system such that the receivers shall have the capability to receive messages for at least three days[38] following the loss of normal utility provided power.

[37] Small Business Computing Article, dated August 27, 2008

[38] FEMA Ready.Gov, preparedness recommendation for sufficient supplies to last for at least three days.

2.3.4 Additional Observations

The following sections provide additional observations, discussions, and comments that were uncovered during the study which cannot be attributed to any individual Demonstration Day, KPP, or APF.

Table 12. Summary of Additional Observations

Observation	Highlights
CEA Standards Committee	Letter of Support for FM RBDS Chips into Consumer Electronics
Cross-Vendor Platform Activities	Vendors testing the ability of receivers to operate on another vendor's RBDS signal
Alternative Receivers	FM chip installed in a Prototype Chumby Internet Device
Alert Fatigue	Alert recipients disable device when no options are available to recipient to configure device when experiencing alert fatigue
BP Gulf Oil Cleanup	20 units distributed to contractors on land and in boats for weather alerts and other needed communications
Alerting Methods	Methods by which currently notified and top three ways to be notified during a future emergency
Alert Recipient Opinions on RBDS Alerting	Opinions on effectiveness, reliability, accuracy of information, taking action, quickest notification method, and recommend RBDS to family

2.3.4.1 CEA Standards Committee

References:

a. CEA Working Group R6WG16 letter of support, 20 July 2010[39]
b. Best Practices for Implementing CAP based Alerts for Consumer Electronic Devices, CEA R6WG16 Draft[40]

Discussion:

NGC received a letter from the Consumer Electronics Association Working Group R6WG16, signed by Ms. Megan Hayes, CEA Senior Manager, Technology Standards, which described its role and support of CAP based alert and warning systems. Figure 30 contains excerpts from the letter.

[39] CEA Working Group R6WG16 letter of support for CAP based alert and warning systems, 20 July 2010
[40] Best Practices for Implementing Common Alerting Protocol (CAP) based Alerts for Consumer Electronic Devices, Consumer Electronics Association, CEA R6WG16 Draft

> The working group is preparing a document which provides recommended practices, independent of delivery method, for CAP-encoded data usage, among various consumer electronics devices that process CAP-encoded data. The document includes guidelines for filtering and device response. The document does not address the usage of CAP-encoded data that is converted by the delivering source into its regular ('native') format, as it may be perceived by the devices as regular format content. This bulletin focuses on the device behavior associated with the receipt and processing of the alert messages on compliant devices.
>
> The alert information that reaches the end device ("receiver") depends on the technology or field it serves. However, alert information rendering and presentation to the user are further defined by the capabilities of the specific receiver. In order to allow the users to quickly and clearly understand the alert information that their receiver provides, it is desired to create similar user experience across technologies and devices.
> The working group has developed a document Draft CEA-CEB25, Best Practices for Implementing Common Alerting Protocol (CAP) based Alerts for Consumer Electronics Devices.
>
> The goal is to accelerate the adoption and development of CAP based devices in the consumer marketplace with common behavior and features to provide life-saving messages for the citizens of the United States.

FIGURE 30. EXCERPTS FROM CEA LETTER OF SUPPORT

2.3.4.2 Cross-Vendor Platform Activities

References:

a. RBDS Cross Vendor Platform Activities Technical Notes, 5 August, 2010

Discussion:

NGC was made aware of the activities of Global Security Systems (GSS) and Alertus Technologies to allow for conformance to cross-platform communication protocols.

Alertus Technologies is in the process of offering its Alert Beacon™ receivers with full compatibility on GSS's RBDS network. This will allow both the Alert Beacons™ and the AlertFM receivers to receive RBDS messages transmitted by the FM radio stations equipped with GSS RBDS encoders.

From a hardware perspective, the products of Alertus Technologies and GSS/AlertFM were designed with full compatibility to the RBDS standard. By finalizing software modifications to accomplish communication protocol conformance, Alert Beacons™ will be capable of receiving alerts over the GSS RBDS radio network.

2.3.4.3 Alternative Receivers

References:

a. GSS Technical Notes, 27 July 2010

Discussion:

GSS is experimenting with alternative consumer electronic devices that have FM chips installed and decode AlertFM signals. Figure 31 shows a prototype Chumby[41] One

[41] Chumby Internet Device (www.chumby.com)

application which utilizes the Chumby's onboard Quintic QN8005 FM with RDS decoder to consume the AlertFM data broadcast by a local FM station.

FIGURE 31. ALERTFM PROTOTYPE CHUMBY ONE DEVICE

2.3.4.4 Alert Fatigue

References:

a. Alert Recipient Scenario Survey (Annex E, Figure 34 and Figure 35), question 16
b. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), question 15
c. GSS Operational Period Technical Data, 1 July 2010

Discussion:

Review of the comments provided with the Alert Recipient Scenario Survey and the Alert Recipient Real-World Survey revealed that several respondents experienced alert fatigue. The following are a few of the comments provided:

"The FM alert system is beneficial, but I also found it very irritating. I could not figure out how to silence it if I didn't want to receive messages even during an emergency. It changes the update constantly from tornado watch to warning to no watch or warning; this is similar to what it does in a thunderstorm. There didn't seem to be any way to turn it off if I wanted to."

"The system needs options related to which type of warnings can and cannot be received. It needs to be programmable or it will not be used because it is annoying in an area with many different weather issues. I am in Memphis and at one time during the past spring,

We had Flash Flood Warnings, Thunderstorm Warnings and tornado warnings going off nonstop. I thought the thing was going to explode. Where I live, the only warning that concerns me is the Tornado warnings. It should be my choice."

"We also received numerous messages during a recent wx event. Please use as sparingly as possible (I don't really need watch cancellations). Too many alarms at late hours cause spousal irritation."

Analysis of the weather alerts found in the GSS Operational Technical data supports the Alert Fatigue experienced by the respondents through the numerous "Cancels" and "Updates" weather alerts. A few examples are in the following table.

Message Content	Date / Time
SHELBY - Severe Thunderstorm warning issued until 12:45 AM.	3/10/10 23:56
SHELBY - Severe Thunderstorm warning continues until 2:00 AM	3/11/10 1:08
SHELBY - Flash Flood warning issued until 4:30 AM.	3/11/10 1:22
SHELBY - Severe Thunderstorm warning canceled. *(cancel 34 minutes before expiring, generates alert)*	3/11/10 1:26
SHELBY - Flash Flood warning canceled. *(cancel, generates alert)*	3/11/10 2:16
SHELBY - Flash Flood warning canceled. *(second cancel 16 minutes before expiring, generates alert)*	3/11/10 4:14
SHELBY - Severe Thunderstorm warning issued until 4:00 PM.	3/25/10 15:13
SHELBY - Severe Thunderstorm warning continues until 4:00 PM *(update 27 minutes before expiring, generates alert)*	3/25/10 15:33
SHELBY - Severe Thunderstorm warning canceled. *(cancel 6 minutes before expiring, generates alert)*	3/25/10 15:54

Alert Fatigue can be reduced in two ways: by reducing the number of alerts issued and by providing the alert recipient the ability to configure their receiver to receive only the alerts that they are interested in. If no controls are put into place, Alert Fatigue will eventually cause the alert recipient to take the only action available, which is to disable the device. There was one reported instance where a user was so tired of the alerts that he destroyed the device rather than remove the battery. All alerting technology would benefit by reducing the alert fatigue experienced by their alert recipients.

2.3.4.5 BP Gulf Oil Cleanup

References:

a. GSS Technical Notes, 2 August 2010

Discussion:
GSS uncovered a unique use of the RBDS system by organizations involved in the BP oil spill cleanup in the Gulf of Mexico during the summer of 2010.

The Harrison County Mississippi Emergency Management Agency distributed 20 AlertFM receivers to contractors involved in the cleanup whose duty locations were on land and on boats performing oil skimming and other related activities.

The main purpose of the receivers was to alert the workers of severe weather, but Harrison County EMA personnel have the ability to communicate any type of message to the workers. Mr. Bruce Wilkerson of Harrison County EMA indicated that the feedback from the workers has been positive and that the units are working properly. Bruce also indicated that Ziploc baggies were used to "waterproof" the receivers that were distributed to the boats.

2.3.4.6 Alerting Methods

References:

a. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), questions 3 and 9

Discussion:
Question 3 of the Alert Recipient Real-World Events Survey asked the alert recipients to identify all of the alerting mechanisms that they used to keep themselves informed. The 65 survey respondents were asked to select all that applied from 14 valid responses. Chart 30 displays the 258 selections that were made by the 65 survey respondents. Colors are used to highlight response groupings from the most used to the least used.

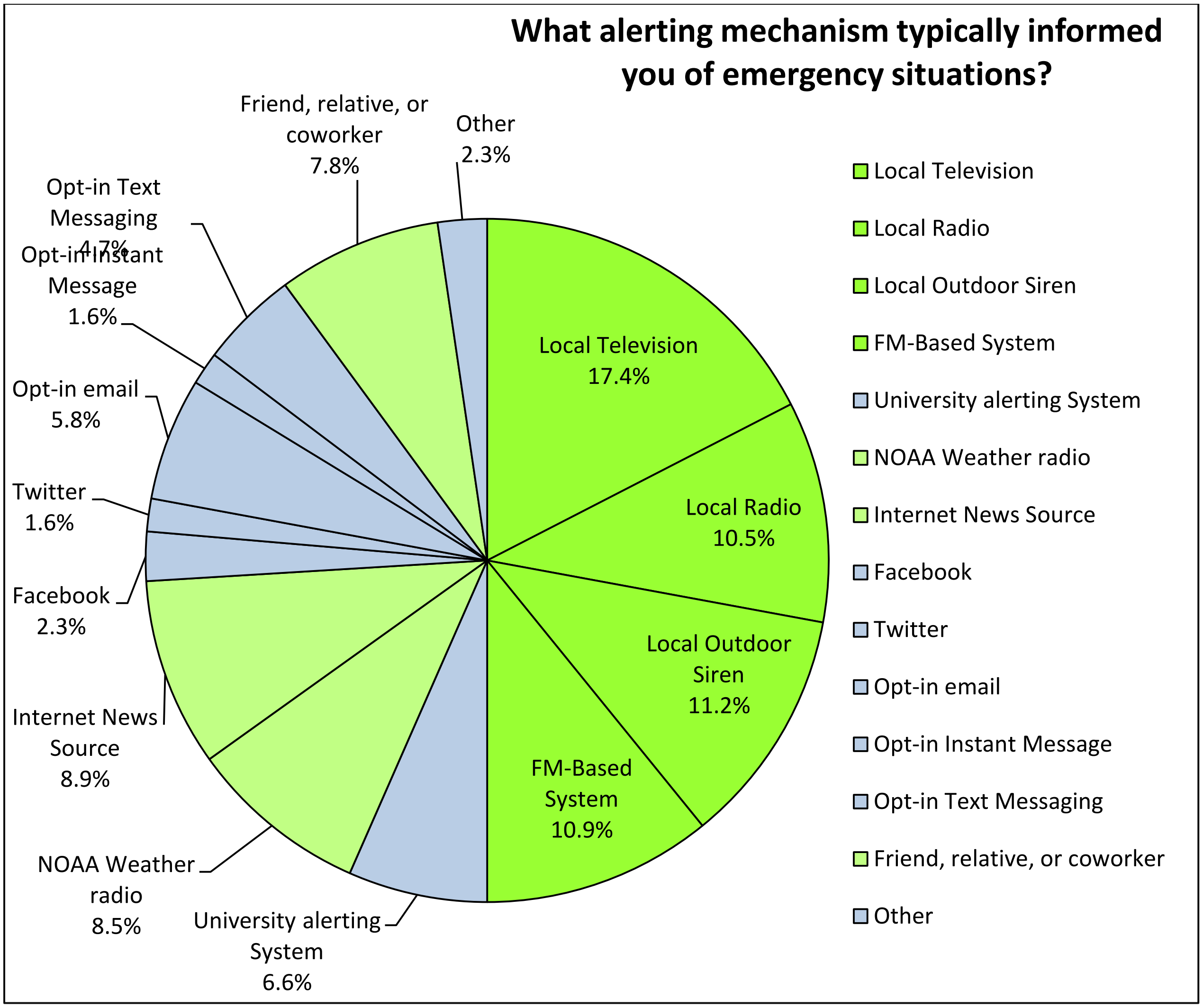


CHART 30. WHAT ALERTING MECHANISM TYPICALLY INFORMED YOU?

Question 9 of the Alert Recipient Real-World Events Survey asked the alert recipients through which alerting mechanisms they would like to be informed in the future of emergency alert notifications. The 65 survey respondents were asked to select the three that applied best from 14 valid responses. Chart 31 displays the 182 selections that were made by the 65 survey respondents. Colors are used to highlight response groupings from the most preferred to the least preferred.

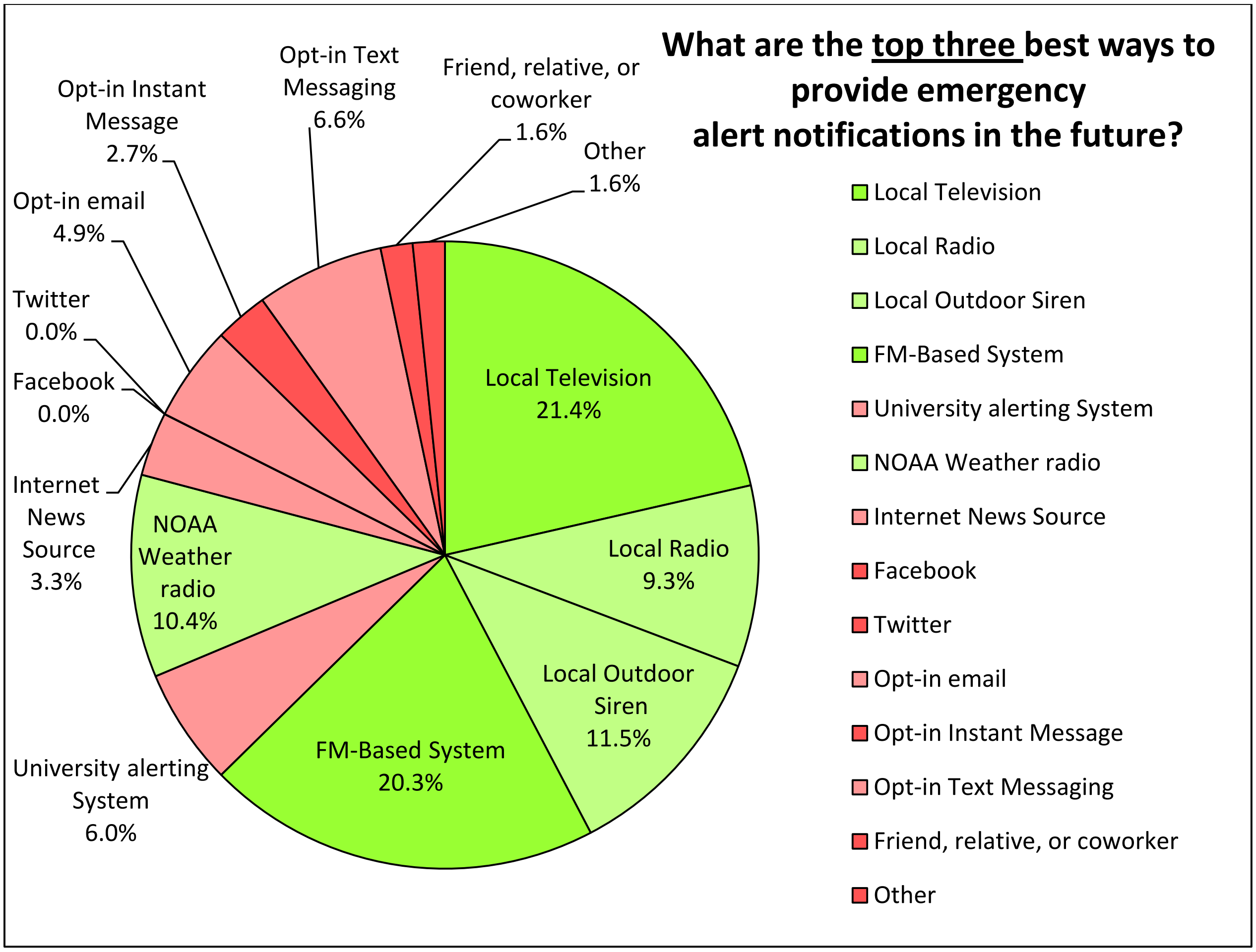


CHART 31. TOP 3 WAYS TO PROVIDE FUTURE EMERGENCY ALERT NOTIFICATIONS?

2.3.4.7 Alert Recipient Opinions on RBDS Alerting

References:

a. Alert Recipient Real-World Survey (Annex E, Figure 42 and Figure 43), questions 6a–6c and 7a–7c

Discussion:

Question 6a – 6c of the Alert Recipient Real-World Events Survey asked the alert recipients to provide their opinions on a 10 point scale with 10 being the most favorable and 1 being the least favorable. Chart 32 displays the 42 responses to the three questions requesting an opinion on the effectiveness, reliability, and accuracy of information from the FM based alerting device.

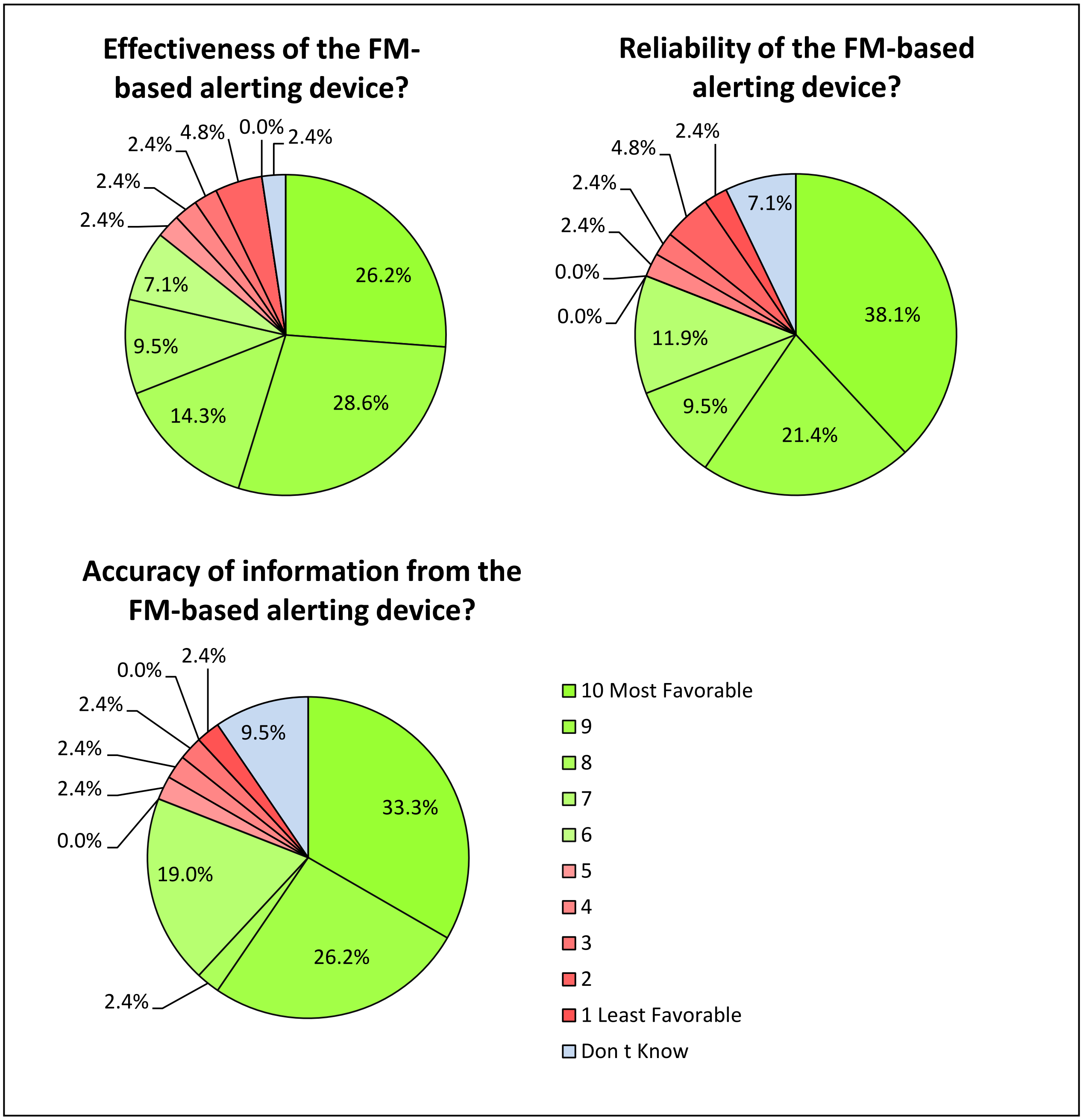


CHART 32. RBDS EFFECTIVENESS, RELIABILITY, ACCURACY OF INFORMATION?

Question 7a – 7c of the Alert Recipient Real-World Events Survey asked the alert recipients to provide their opinions on a 10 point scale with 10 corresponding to “strongly agree” and 1 corresponding to “strongly disagree”. Chart 33 displays the 61 responses to the three questions requesting an opinion on whether the FM based alerting device would prompt the recipient to take protective action, was the quickest notification method, and would be recommended to family and friends.

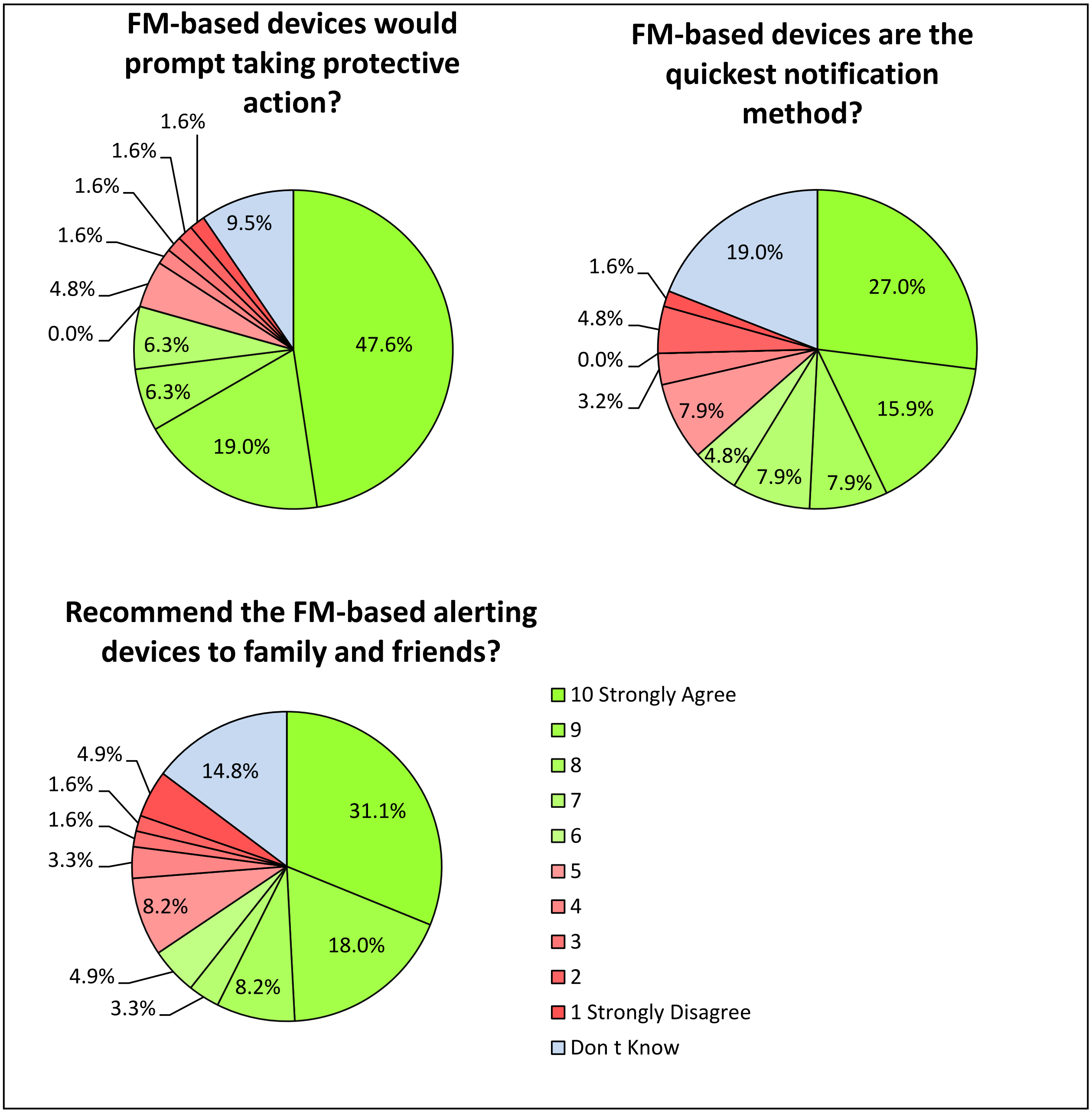


CHART 33. TAKE ACTION, QUICKEST, AND RECOMMEND TO FAMILY?

2.4 SECTION 4 OF AAR: CONCLUSION

Local and State Emergency managers are relying on Enterprise and Personal style RBDS technology to provide the necessary emergency alerting communications to millions across several states and enterprises. Through demonstrations, responses to real-world events, and analysis conducted during this study, this technology has proven to be a viable technology for public alerting and warning. Evaluation of RBDS technology against FEMA's KPPs and APFs validates its effectiveness as a mechanism for public alert and warning.

RBDS technology is resilient because multiple broadcasters providing overlapping FM coverage and individual broadcaster backup transmitters and generators ensure rapid recovery from an all-hazard event. Resilience can be enhanced by expansion of the demonstrated FM RBDS signal monitoring capability since this will allow signal outages to be more rapidly identified and targeted for restoration.

RBDS technology is secured at the origination point and in the broadcasted signal to prevent the unauthorized dissemination of emergency alerts. Secure logins with assigned privileges prevent originators from issuing emergency alerts to jurisdictions outside of their authority, and 128-bit encryption is applied to the transmitted message to prevent unauthorized alerts from activating the RBDS receivers.

Minority languages were supported by the RBDS technology during the demonstrations. The technology is challenging for Alert Originators to create an accurate translation of the alert messages within a timely manner, and for alert receivers to have the necessary character sets to display the received messages. A technology enhancement would include the use of symbology to represent the emergency and the action to be taken.

Geographical targeting was successfully demonstrated by the RBDS technology with a granularity of buildings and floors for the Enterprise Style systems and a granularity of specific individuals, specific work locations, and specific counties for the Personal style systems. The technology works exceptionally well for stationary receivers. Mobile receivers could be manually configured to activate based upon geographical targeting and activated when these geographically targeted messages were issued. A technology enhancement to the mobile receiver would allow emergency alerts to be received automatically based upon the current geographical location of the receiver.

The RBDS technology demonstrated an availability that was greater than 99% for the operational period. Single points of failure were detected, however, including a single broadcaster providing coverage to targeted recipients and a single distribution path from the RBDS systems to the broadcast tower. Eliminating these single points of failure would increase the availability of the system to deliver time critical emergency alerts.

The RBDS technology recognizes the importance of interoperability for the origination of messages. CAP v1.1 messages were successfully consumed by the RBDS technology, which initiated the generation of an understandable emergency alert message to the alert recipients. The technology would benefit from the development of a common transmission protocol that would allow cross-vendor reception of emergency alert messages.

RBDS vendors have a strong relationship with their served user community. They have developed systems to meet the needs of their served community and have built their systems to be easy to use, economical to broadcasters, and compliant with standards and local laws.

The RBDS technology is able to deliver messages in a one-to-many relationship across a large geographic area within minutes with no known network limitations. Because of this capability, the alert recipient population can grow with no effect on the overall dissemination time to alert recipients.

The RBDS technology was observed and demonstrated operating under a variety of conditions: while stationary, while mobile, while using backup power, and in environments including outdoors, on the water, and indoors. Signal quality was reduced in some areas due to structural and environmental factors. Mobile receivers demonstrated the ability to operate on battery power for over two months.

The RBDS technology has minimal lifecycle costs. Alert originators incurred no per message fees and alert recipients incurred no subscription or registration fees for the service.

In conclusion, this study has validated the benefits of RBDS technology and has demonstrated that it warrants consideration for the dissemination of national, state, and local public alerts and warnings. Origination of alerts and warnings within the RBDS systems, as well as ownership and maintenance of these systems, is expected to continue as a local and state function as it is currently. The demonstration and associated analysis and assessment have shown that the RBDS technology has major strengths that support this mission as well as areas for improvement. The RBDS technology can currently function as an alert disseminator within the IPAWS architecture.

3.0 RBDS PRODUCT SPECIFICATION

The following sections define at a high level the product specification for the use of RBDS as a delivery mechanism for public alerts and warnings. Three main areas of discussion include the possible RBDS technology insertion into the IPAWS architecture, proposed functional requirements for the use of RBDS as a public alert and warning system, and a potential high-level implementation plan for the insertion of RBDS into IPAWS. Each of these areas is summarized in the following paragraphs.

3.1 RBDS TECHNOLOGY INSERTION INTO IPAWS ARCHITECTURE

The main role of RBDS within the current IPAWS architecture, as represented in Figure 1, is as a message disseminator for State and Local Unique alerting systems. The state and local emergency managers create alerts for their jurisdictions as well as receive messages from multiple external governmental sources and forward the messages on through their RBDS system.

A secondary role of RBDS that is in use today but is not represented in Figure 1 is the dissemination of NOAA weather alerts without passing through state or local unique alerting systems. One particular RBDS system currently has the capability to monitor NOAA via the internet for weather alerts and, based upon the geo-targeted information within the weather alert, transmit the alert via satellite to the FM Broadcasters with the vendor's installed RBDS equipment servicing the targeted area. In this way users can use the RBDS receiver much like they use weather radio for receipt of emergency weather alerts. This provides imminent threat weather alerts through RBDS to areas with a RBDS footprint, even where local emergency management is not currently using RBDS as an alert disseminator. As indicated in the figure, in the future these weather alerts may be initiated through the IPAWS architecture and disseminated through multiple alert dissemination paths including RBDS.

The following sections discuss areas to further advance RBDS insertion into the national IPAWS architecture. These areas include the following:

- Enable cellular phones as RBDS receivers
- Improve RBDS message dissemination
- Originate CAP messages in RBDS to enable integration of generated alerts with the IPAWS aggregator and transmission through multiple message disseminators in the IPAWS architecture

3.1.1 ENABLE CELLULAR PHONES AS RBDS RECEIVERS

The IPAWS architecture inclusion of cellular[42] broadcast as a dissemination mechanism reflects the important role that wireless technologies play in consumers' lives today. Inclusion of RBDS into cellular handsets will provide a single platform with multiple alerting mechanisms, increasing the likelihood that an emerging alert is received at the platform. This is analogous to how the Enterprise style RBDS systems from this demonstration have provided redundant delivery mechanisms (i.e., Ethernet and RF) to their alert devices. Inclusion of RBDS into

[42] FEMA And The FCC Announce Adoption Of Standards For Wireless Carriers To Receive And Deliver Emergency Alerts Via Mobile Devices

cellular handsets can be an effective hedge against issues in receiving cellular transmissions, including network congestion during emergency periods and reduction in cellular network coverage due to vulnerabilities of cell towers.

60 members of Congress requested DHS Secretary Napolitano and FCC Chairman Genachowski explore the potential benefits of including FM radio tuners in mobile telephone handsets[43]. On July 22, 2010, Mr. Whit Adamson, President of the Tennessee Association of Broadcasters, in his Hearing testimony[44] before the U.S. Senate Appropriations Subcommittee on Energy and Water Development, reiterated radio's desire to have cell phone makers put an FM radio chip into their devices for emergency alerting.

Many of today's cell phones already have the FM/RBDS chip installed. In his testimony, Mr. Adamson states that "there are currently over 800 million handsets in Europe with readily accessible radio service", although the numbers in the United States are much smaller. In a 2009 study, the NAB identified17 cell phones offered by AT&T, Verizon, and T-Mobile which had a built-in FM radio, and 17 unlocked GSM cell phones with a built-in FM radio that may be compatible with the GSM systems of AT&T and T-Mobile[45].

Several of the 2010 "Smart" phones have the Broadcom BCM4329[46] FM/RBDS chip installed including the iPhone 3g[47], iPhone 4g[48], iPad[49], HTC Incredible[50], HTC Evo[51], and the Nexus One[52]. Applications (Figure 32) could be made available for these "Smart" phones to access the RBDS alerts for a given area. For instance, if the FM/RBDS chipset were accessible on the new iPhone 4[53], the 1.7 million of these mobile devices bought in three days would have access to RBDS emergency alerts that may be provided within their area, although multiple applications would need to be used to receive each of the vendors' proprietary RBDS protocol transmissions.

The FM chips available now are sensitive enough to receive FM radio signals without relying on an external headset antenna[54]. Coupled with tuning and battery-saving software provided by such applications as Radiolicious and AlertFM, the tuner "wakes" and "goes to sleep" through a station-synchronization technique developed over 20 years. The same battery-preserving software is used in GPS receivers, NOAA weather data receivers, alert receivers, smoke detectors, and other consumer devices.

[43] Congressional Request to explore benefits of FM radio tuners in mobile devices, September 8, 2009
[44] Testimony of Whit Adamson, President, Tennessee Association of Broadcasters, Hearing before the U.S. Senate Appropriations Subcommittee on Energy and Water Development, July 22, 2010
[45] NAB Cell phones with FM radio, 19 March, 2009
[46] Broadcom BCM4329 Datasheet
[47] iPhone 3g Broadcom Chip Notes
[48] iPhone 4g Teardown Notes
[49] iPad has same Broadcom BCM4329 FM Tx/Rx radio capabilities as iPhone , iPod touch
[50] HTC Incredible Teardown Notes
[51] HTC Evo 4G Teardown Notes
[52] Nexus One Technical Notes
[53] iPhone 4 Sales Top 1.7 Million, June 28, 2010
[54] FM Radio and Data-Capable Cell phones Increase Listener Base, Radio Ink. April 6, 2009

FIGURE 32. IPHONE APP FOR ALERTFM

Redundant alerting mechanisms are especially important following a geographically large disaster. FM broadcasters have a larger footprint and more redundant backup transmitters and power than individual cellular towers, so an RBDS system may more reliably provide critical information immediately following a disaster than a cellular system.

3.1.2 MESSAGE DISSEMINATION

The RBDS Study has demonstrated the use and effectiveness of RBDS technology at the state emergency manager, local emergency manager, and enterprise emergency manager level. Both the Demonstration Day data and the real-world operational use of the technology indicate that emergency messages generated in an RBDS and transmitted to geo-targeted fixed and mobile RBDS receivers can be used by the public for prompt response to evolving conditions. The systems have been used operationally for real-world emergencies including severe thunderstorms, flooding, and tornados. Integration with the IPAWS architecture was demonstrated through the ability to download and process CAP-based messages from the DM-Open server, which is evolving into the IPAWS OPEN aggregator/gateway component of the IPAWS architecture. This interface was essentially human-in-the-loop, with the state, local, or emergency manager using the RBDS message portal to access messages available for dissemination which were downloaded from the DM-Open server. The emergency manager was then able to select messages for dissemination using RBDS. Automated capabilities were also demonstrated, for example, at the NAB demonstration, where messages were automatically downloaded from the DM-Open server and transmitted over RBDS. Future capabilities could allow selective transmission of downloaded messages based, for example, on the source COG on the DM-Open Server and/or specific values of CAP message fields.

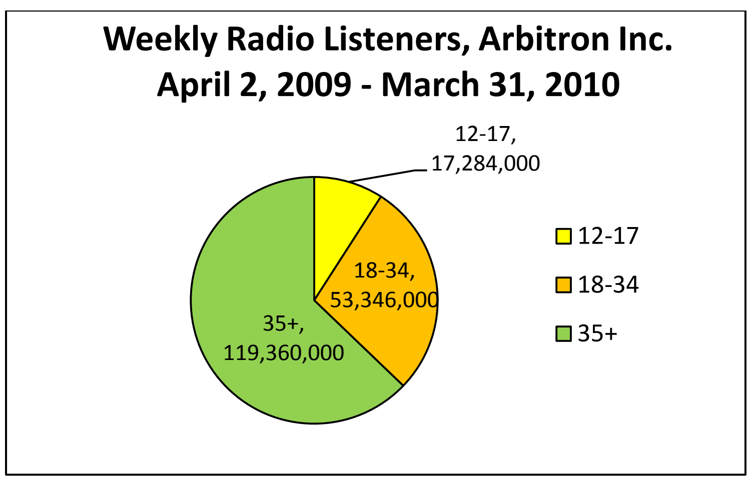
As illustrated in Figure 33, FM Broadcaster coverage is virtually ubiquitous, and it can provide the capability for individuals to receive FM signals almost anywhere in the country, at home, in the car, or even walking around using portable devices.

FIGURE 33. FM BROADCAST COVERAGE

On June 21, 2010, Arbitron Inc. reported in its June 2010[55] RADAR® (Radio's All Dimension Audience Research) radio network audience ratings (RADAR 105) that during each week of the survey period more than 189 million persons aged 12+ heard one or more network radio commercials that were aired on the 51 radio networks reached. The following table and chart illustrate the distribution among the key demographic groups.

Percent of Persons Aged		Persons
73.8%	12+	189,990,000
74.3%	18+	172,706,000
73.7%	35+	119,360,000
76.5%	18-49	103,336,000
76.9%	25-54	97,489,000

Full details can be found at: http://arbitron.mediaroom.com/index.php?s=43&item=695



The FCC already considers Broadcasters as a major partner during emergencies at the national level. This relationship could be leveraged to implement RBDS as a path for emergency messages with all of the broadcasters currently and planning to support EAS transmissions. This will require the installation of RBDS encoders at an expanded number of broadcasters. Current

[55] Arbitron Inc, June 2010 Radio Network Ratings Network

RBDS vendors have a relatively localized footprint for their installed encoders, based on the areas where RBDS technology is in use by state, local, and enterprise emergency managers. Widespread installation is limited primarily to the southern states, augmented by selected university and other local broadcasters in the mid-Atlantic region. Widening the footprint of the installed encoder base will allow RBDS to leverage the full impact of FM radio coverage in disseminating emergency messages to the American public wherever they are located in the United States.

3.1.3 RBDS CAP Alert Origination

As previously discussed, RBDS technology is principally being used as a mechanism for communicating emergency messages between state, local, and enterprise emergency managers and between these managers and specific groups including first responders and the public at large. It is typically one of several systems that are used for emergency communications. The IPAWS architecture could enhance the reliability of messages being received by providing additional message dissemination mechanisms. This could be accomplished by enhancing CAP alert origination capabilities within the installed state, local, and enterprise RBDS systems so that these messages could be uploaded into the IPAWS OPEN Aggregator/Gateway. This will allow the emergency managers to leverage the alert disseminators available through the IPAWS architecture and provide their stakeholders additional paths by which they may receive emergency messages.

3.2 RBDS Product Functional Specifications

An RBDS system is an end-to-end system used for the delivery and receipt of message data via the RBDS channel of an FM Radio Broadcaster. It comprises an origination capability, a transmission capability, and a reception and notification capability, where notification includes visual and audio components. The message data is used to transmit emergency information prior to, during, and following emergency incidents.

The proposed functional requirements were formulated initially by NGC based upon observation of the three participating systems, discussions with the alert originators, and survey responses. These initial requirements were then made available to the three participating vendors for comments and suggestions. The initial requirements were then revised based upon the team members' review and comments. The final proposed functional requirements are intended to be used as guidance on the capability of an ideal RBDS system. These requirements may be used as a starting point for discussion and creation of more detailed specifications.

The proposed functional requirements are:

1. An RBDS origination portal shall provide secure logins to prevent the unauthorized issuance of alerts through the RBDS system.
2. An RBDS origination portal shall provide privileges to the users based upon the secure logins to prevent unauthorized issuance such as cross-jurisdictional issuance of alerts through the RBDS system.
3. An RBDS origination portal shall provide a mechanism to ensure non-repudiation of alerts that are originated.
4. An RBDS system shall be able to target alerts to areas no larger than the targeted county, although smaller areas within a county may be targeted.
5. An RBDS system shall use mechanisms such as multiple transmissions of the message, check sums and CRC protocols to validate data packet reception and reduce errors.
6. An RBDS system shall be able to generate a CAP message.
7. An RBDS system shall be able to transmit a CAP message to the IPAWS aggregator.
8. An RBDS system shall be able to receive a CAP message from the IPAWS aggregator.
9. An RBDS system shall be able to store pre-planned messages for later transmittal.
10. An RBDS system shall be able to generate non-CAP messages.
11. An RBDS system shall be able to transmit messages to targeted groups.
12. An RBDS system shall provide secure transmission from the FM Broadcast tower to the RBDS receiver to prevent unauthorized activation of the RBDS receivers.
13. An RBDS system shall be able to transmit RBDS messages for at least three days following the loss of normal utility provided power or main transmitter.
14. An RBDS receiver shall have one or more means to deliver the message content to the alert recipient such as a visual display, audible speech, or TTY (Braille).

15. An RBDS receiver with a visual display shall provide an indication to distinguish between types of alerts such as advisories, watches, warnings, imminent threats, AMBER, and presidential. Such indications shall comply with national standards for emergency notification codes such as NFPA 72.
16. An RBDS receiver shall provide an attention getter such as a sirens, lights, and/or vibration.
17. RBDS receivers shall provide for the ability to attach accessories which may include but are not limited to bed shakers, speakers, text-to-speech modules, and strobes.
18. RBDS receivers shall have the ability to receive and activate on presidential alerts.
19. An RBDS Personal style system shall not impose any per message expense to the alert recipient to receive the messages.
20. RBDS Personal style receivers shall be configurable at the receiver to exclude receipt of imminent threats and AMBER alerts.
21. RBDS receivers shall be configurable to specify the latitude-longitude location of the receiver and may be configurable to specify additional location information such as building identification, floor identification, room identification, street addresses, and other local or regional nomenclature.
22. An RBDS receiver shall have the capability to receive messages following the loss of normal utility provided power for a period consistent with the risk profile of the organization and all additional applicable industry standards such as NFPA 72.
23. An RBDS receiver shall detect and suppress the presentation of an identical alert that is received through multiple alerting paths.
24. An RBDS receiver shall automatically tune to an RBDS signal.
25. An RBDS receiver shall be able to detect and display the current FM signal strength and an indication of being locked onto an emergency alerting RBDS signal.
26. An RBDS receiver shall be able to notify the user of no signal being received for an extended period.
27. An RBDS receiver shall be equipped with at least one connector to accommodate the addition of external antennas to enhance FM reception.
28. An RBDS receiver shall have the ability to detect and display the current battery life.
29. An RBDS receiver shall be able to provide an indication of low battery life.
30. A message on an RBDS receiver shall be viewable in the dark without external light sources.
31. An RBDS receiver shall have the ability for volume control so that initial activation does not startle the recipient.

3.3 POTENTIAL IMPLEMENTATION PLAN FOR RBDS INSERTION INTO IPAWS

If the potential RBDS technology insertion into the IPAWS architecture as defined in Section 3.1 were to be implemented, a series of steps would need to be completed. The steps below are listed in a recommended order of execution (i.e., 1, 2, 3…) as indicated by their number in the list. Steps to be executed first will quickly capitalize on the RBDS alerting infrastructure that is currently in place and provide enhanced alert and warning capability using RBDS technology. Subsequent steps either depend on previous steps or will require more time to complete. Steps that can be executed in parallel are indicated by letters (i.e., 1a, 1b …). Additionally, each step indicates the proposed leading organization along with potential supporting organizations.

1a. Policy/Rule updates to mandate cellular carriers to provide the OS/firmware updates that would allow RBDS software application access on the cell phones and mobile devices that already have an FM/RBDS chip installed. (Owned by FCC/FEMA, supported by carriers and mobile phone manufactures).

    Reason: This would allow development of "apps" to provide immediate access by mobile devices already being carried within established RBDS alerting areas.

1b. Commission a Special Interest Group (SIG) consisting of representatives from FCC, PMO IPAWS, NAB, CEA, and manufacturers of RBDS transmitters and receivers to create a technical standard for RBDS receivers that would foster interoperability across RBDS vendors. This group would complete a scope of work similar to that of CEA-2009A, which created the technical standard for Public Alert receivers, i.e., weather radios. (Owned by CEA/FEMA, supported by consumer electronics manufacturers)

    Reason: Facilitate interoperability of RBDS signal reception across RBDS vendors.

2. Develop and implement a campaign to make the public more aware of the technology and how to gain access to this form of public notification. The campaign should be delivered by the carriers as well as the state and local emergency management agencies where RBDS alerting is available. (Owned by FEMA, supported by carriers and emergency management agencies)

   Reason: The public needs to know about as many sources of emergency information as possible. Public outreach is more effective than word-of-mouth and is consistent with FEMA's and other emergency managers' mission to ensure that the public is informed during an emergency.

3. Evaluate the interaction between the RBDS subcarrier and the main audio channel particularly throughout the entire EAS activation from the tones through broadcast of the message, and develop guidance for the installation of RBDS in broadcaster facilities so that the RBDS subcarrier will be transmitted during all main audio channel transmissions, including during EAS activations. (Owned by FEMA, supported by RBDS Alerting Vendors and Broadcast Associations)

   Reason: It is desirable for RBDS to be transmitting complementary information during an EAS transmission on the main audio channel.

4. Develop an RBDS infrastructure deployment plan to install the necessary equipment at FM Broadcasters within the "Top 100 Metro Areas" according to Arbitron. The FM Broadcasters within the areas selected would be those that currently receive EAS

notifications as these broadcasters have already shown their cooperation towards emergency alerting and are generally more resilient. The deployment plan should include installation guidelines and the funding source for the equipment, software, and labor to install the equipment and software. Broadcasters receiving such funding should be required to provide non-exclusive access to multiple RBDS system vendors. (Owned by FEMA, supported by RBDS Alerting Vendors and Broadcast Associations).

Reason: Deploying initially to the Top 100 Metro area would extend the population footprint by over 166 million citizens over the age of 12 or almost 80% of the total US population using this[56] metric.

5a. Policy/rules/standards updates as necessary to mandate CMAS cellular broadcast to integrate with RBDS on a single mobile device (Owned by FCC/FEMA, supported by carriers and mobile phone manufacturers).

Reason: A single mobile device should alert only once regardless of which notification method (RBDS, CMAS) reaches the device so as to not over-alert the individual with the same alert.

5b. Policy/Rule updates to mandate cellular carriers to work with their mobile device manufacturers to install the FM/RBDS chip into all of their new models. (Owned by FCC/FEMA, supported by carriers and mobile phone manufactures).

Reason: By extending RBDS alerting receivers into cell phones and related devices, users will have a single platform for receiving messages related to imminent threats via multiple channels. This will increase convenience to the user as well as increasing the likelihood of receiving the message.

6. Encourage consumer electronics manufacturers to install the FM/RBDS chip into their products (e.g. home security systems, Chumby device, overhead signage) thus extending the number of potential RBDS receivers. (Owned by FCC/FEMA, supported by consumer electronics manufacturers and associations[57])

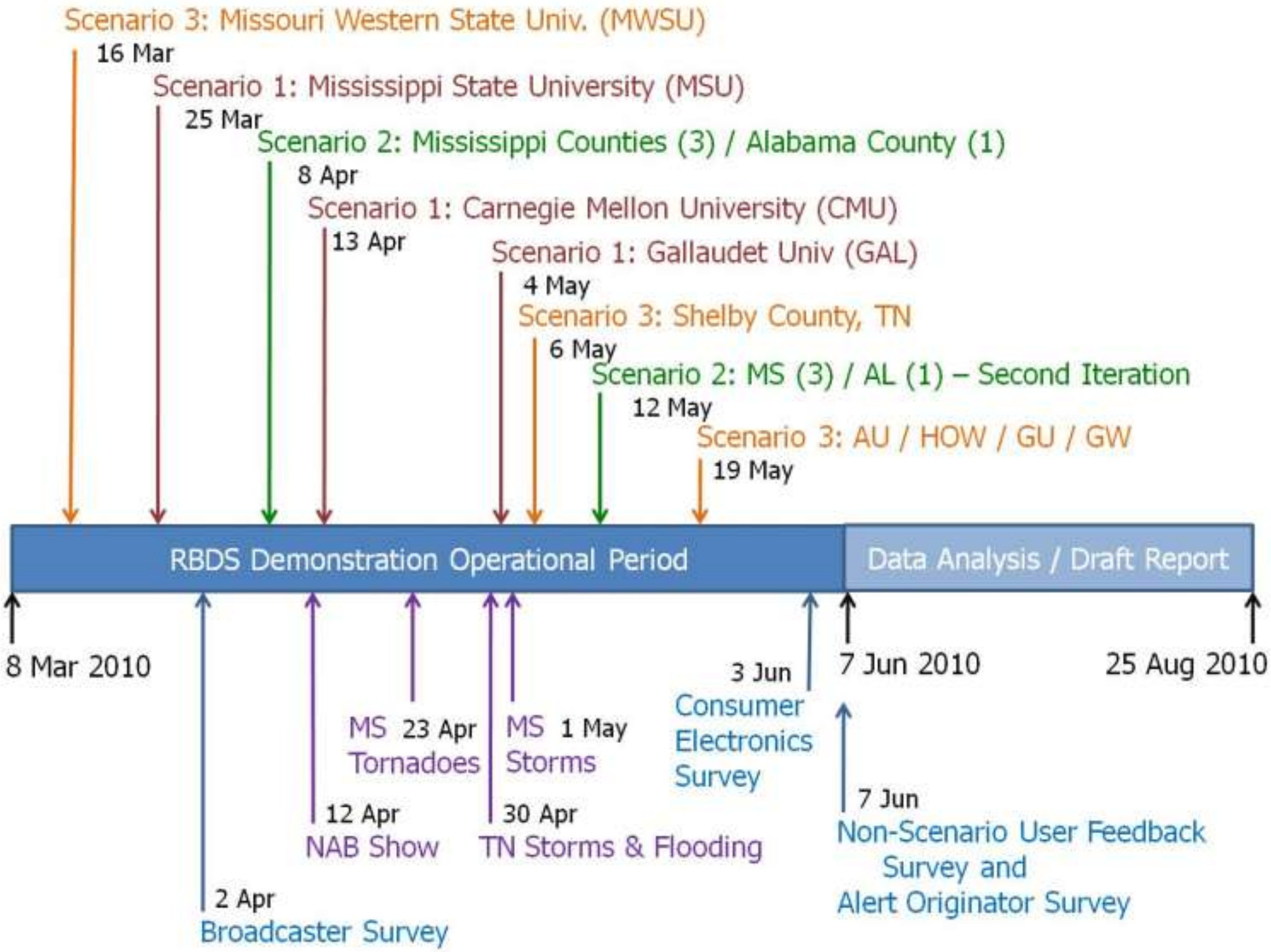
Reason: By extending RBDS alerting receivers into many everyday products, the public will have many more opportunities to be informed of imminent threats.

7. Initiate the development and adoption of a standard set of Emergency Alert symbols. The symbols would be representative of a wide range of possible emergency situations and actions to be taken. (Owned by FEMA, supported by consumer electronics manufacturers)

Reason: By creating a standard set of symbols representing various emergency situations and actions to be taken, you increase the ability of communicating with individuals that are not fluent in the language for which the alert is being presented.

[56] NAB and GSS Support Expansion of FM Radio in Cell Phones Joint Statement, March 2010
[57] CEA Working Group R6WG16 letter of support for CAP based alert and warning systems, 20 July 2010

ANNEX A: TIMELINE OF KEY DEMONSTRATION EVENTS



ANNEX B: ACRONYMS AND ABBREVIATIONS

AAR	After Action Report
ADA	Americans with Disabilities Act
AES	Advanced Encryption Standard
Alertus	Alertus Technologies
APF	Additional Performance Factors
AU	American University
CAP	Common Alerting Protocol
CAP-CP	Common Alerting Protocol Canadian Profile
CAPAN	Canadian Association for Public Alerting and Notification
CEA	Consumer Electronics Association
CFR	FCC Code of Federal Regulation
CMAS	Commercial Mobile Alert Service
CMU	Carnegie-Mellon University
COG	Collaborative Operational Group
COTR	Contracting Officer Technical Representative
DHS	Department of Homeland Security
DIRS	FCC Disaster Information Reporting System
DMIS	Disaster Management Interoperability Services
EAS	Emergency Alert System
EH&S	Environmental Health & Safety
EKU	Easter Kentucky University
EMA	Emergency Management Agency
EOC	Emergency Operations Center
ESF	Emergency Support Function
ESL	English as a Second Language
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FIPS	Federal Information Processing Standards
FM	Frequency Modulation
FSU	Florida State University
GAL	Gallaudet University

GPS	Global Positioning System
GSS	Global Security Systems
GU	Georgetown University
GW	George Washington University
HSEEP	Homeland Security Exercise and Evaluation Program
HTTPS	Hypertext Transfer Protocol Secure
HU	Howard University
IPAWS	Integrated Public Alert and Warning System
IT	Information Technology
IV&V	Independent Verification and Validation
KPP	Key Performance Parameter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MEMA	Mississippi Emergency Management Agency
Metis	Metis Secure Solutions
MSEL	Master Scenario Events List
MSU	Mississippi State University
MWSU	Missouri Western State University
NAB	National Association of Broadcasters
NASBA	National Alliance of State Broadcasters Associations
NCP	National Continuity Programs
NFPA	National Fire Protection Association
NGC	Northrop Grumman Corporation
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OASIS	Organization for the Advancement of Structured Information Standards
ODA	Open Data Application
PUB	Publication
PWS	Performance Work Statement
RBDS	Radio Broadcast Data System
RBDSS	IPAWS RBDS Study

RDS	Radio Data System
SIG	Special Interest Group
SMS	Short Message Service
SNR	Signal to Noise Ratio
SOW	Statement of Work
SSL	Secure Sockets Layer
SSRC	Social Science Research Center
TEMP	Test and Evaluation Master Plan
TTS	Text-to-Speech
USB	Universal Serial Bus
WARN	Warning, Alert and Response Network
XML	Extensible Markup Language

ANNEX C: LIST OF REFERENCES

1,[25] Market Survey for Integrated Public Alert and Warning System (IPAWS) Radio Broadcast Data System (RBDS) Study, December 14, 2009.

2,[10] FIPS PUB 199, Standards for Security Categorization of Federal Information and Information Systems, Feb 2004 (http://csrc.nist.gov/publications/fips/fips199/FIPS-PUB-199-final.pdf)

3 April 8th Service Disruption Summary, GSS Satellite provider, copy provided to IPAWS Project Office on May 7, 2010

4 DHS/FEMA Situation Report, dated Monday, April 26, 2010 (www.fema.gov/emergency/reports/2010/nat042610.shtm)

5 Potential severe weather threat looms, 27 April 2010, (leadercall.com/local/x1687726092/Potential-severe-weather-threat-looms-for-weekend)

6 DHS/FEMA Disaster Declaration #1909, Tennessee Severe Storms, Tornadoes, Straight-line Winds, and Flooding (http://www.fema.gov/news/event.fema?id=12789)

7 DHS/FEMA National Situation Report: Updated Friday April 30, 2010 (http://www.fema.gov/emergency/reports/2010/nat043010.shtm)

8 FCC Disaster Support For Broadcasters, Public Safety and Homeland Security Bureau (http://www.fcc.gov/pshs/broadcastersupport.html)

9 FCC Encourage Television and Radio Broadcasters to Enroll in DIRS, August 6, 2010, DA 10-1459 (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-10-1459A1.pdf)

[10] (See reference [2])

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[21] (See reference [16])

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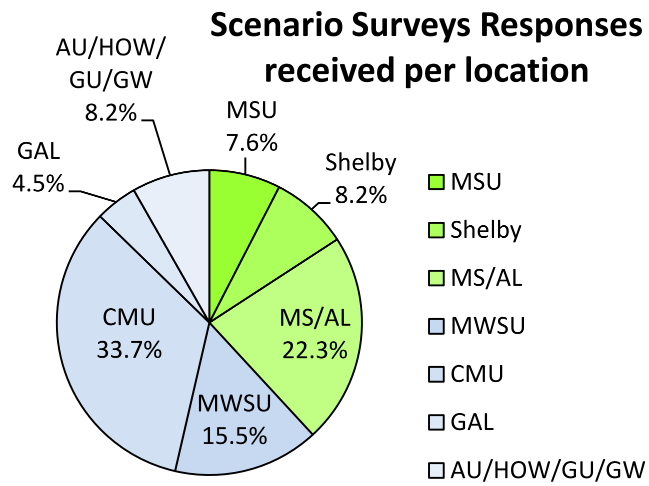
ANNEX D: PARTICIPANT FEEDBACK SUMMARY

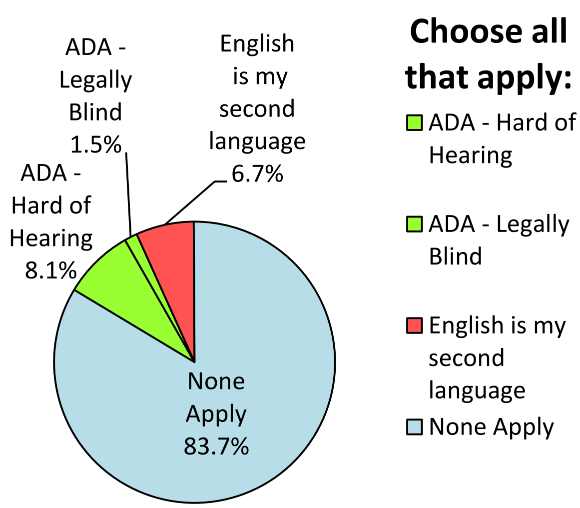
This annex summarizes all of the feedback received from the participants.

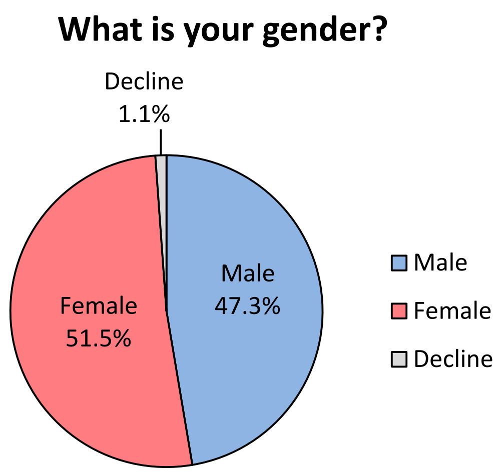
Alert Recipient Scenario Survey Demographics

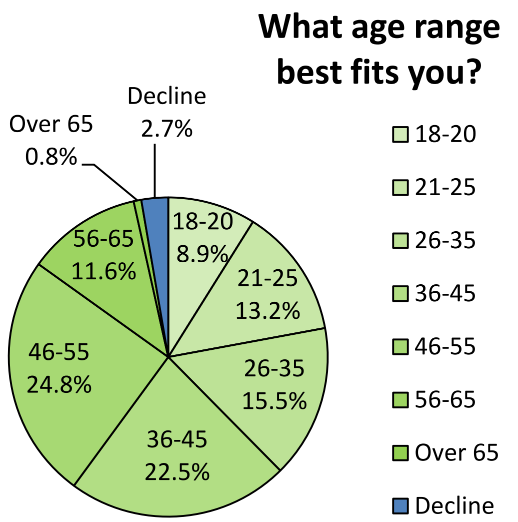
System Style	Location	# Surveys Collected	
Personal	MSU	22	
	Shelby	24	
	MS/AL	65	
	Subtotals		111
Enterprise	MWSU	45	
	CMU	98	
	GAL	13	
	AU/HOW/GU/GW	24	
	Subtotals		180
	Total		291

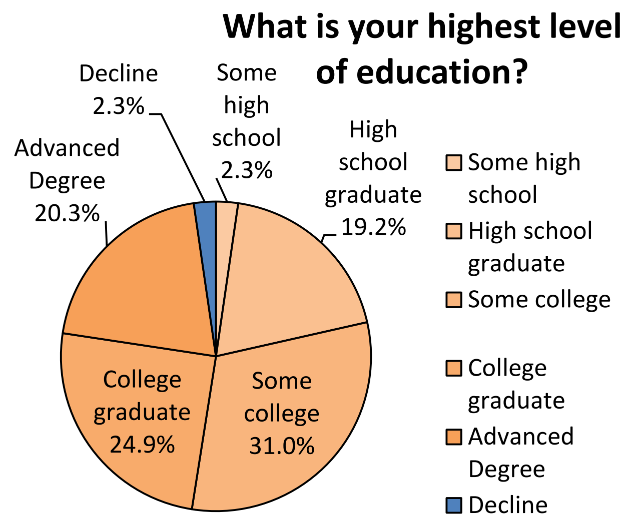


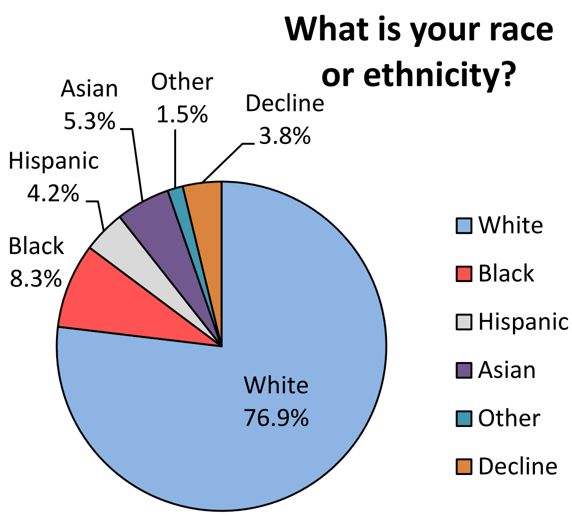
Demographics of Scenario Survey Participants across all locations





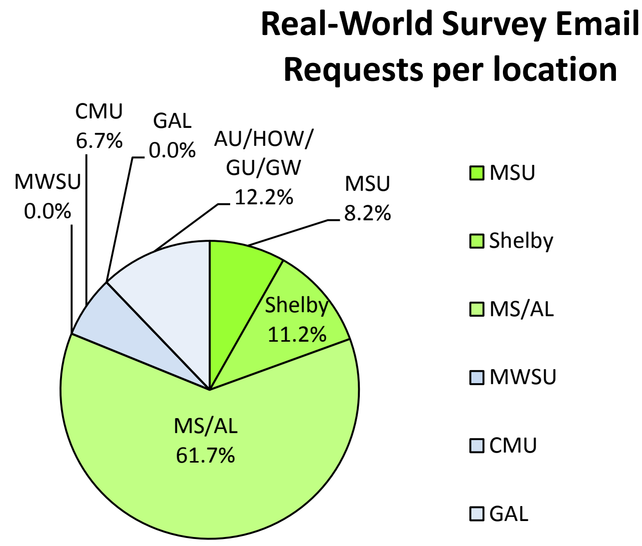

What age range best fits you?
18-20 8.9%
21-25 13.2%
26-35 15.5%
36-45 22.5%
46-55 24.8%
56-65 11.6%
Over 65 0.8%
Decline 2.7%
18-20
21-25
26-35
36-45
46-55
56-65
Over 65
Decline


What is your highest level of education?
Decline 2.3%
Some high school 2.3%
High school graduate 19.2%
Some college 31.0%
College graduate 24.9%
Advanced Degree 20.3%
Some high school
High school graduate
Some college
College graduate
Advanced Degree
Decline


What is your race or ethnicity?
Asian 5.3%
Other 1.5%
Decline 3.8%
Hispanic 4.2%
Black 8.3%
White 76.9%
White
Black
Hispanic
Asian
Other
Decline

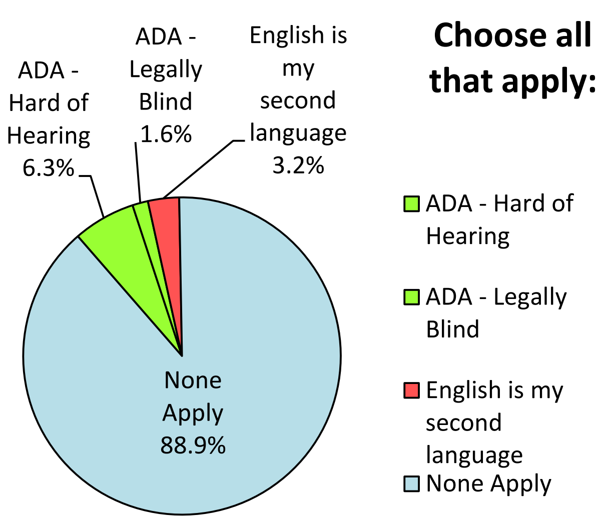
Alert Recipient Real-World Events Survey

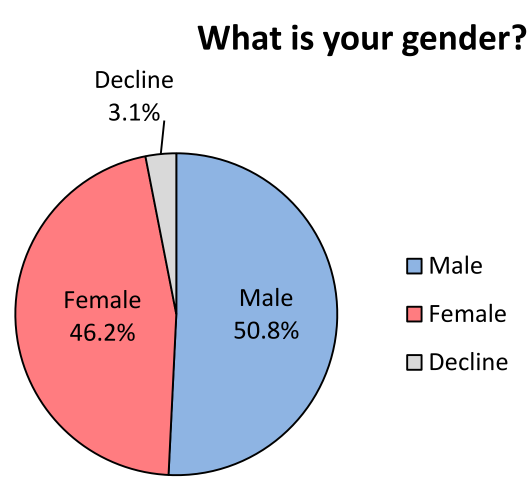
System Style	Location	# Survey Email Requests	
Personal	MSU	27	
	Shelby	37	
	MS/AL	203	
	Subtotals		267
Enterprise	MWSU	0	
	CMU	22	
	GAL	0	
	AU/HOW/GU/GW	40	
	Subtotals		62
	Total		329

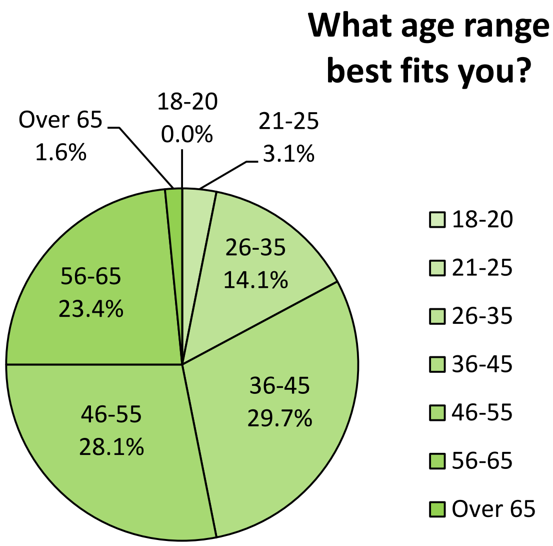


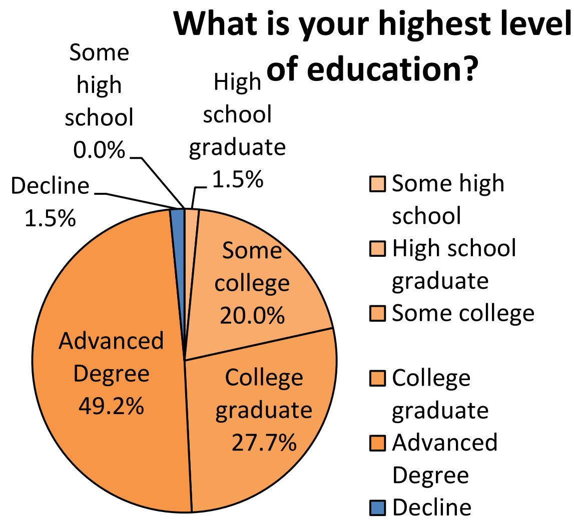
# of Collected Responses	% of Email Requests
65	19.8%

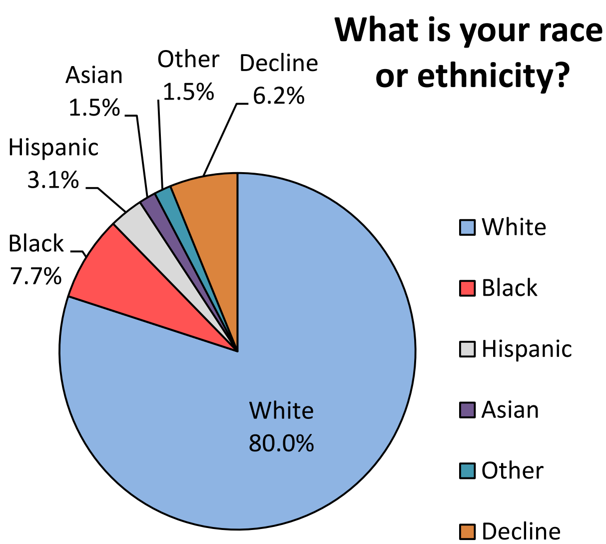
Demographics of Real-World Events Survey Participants across all locations



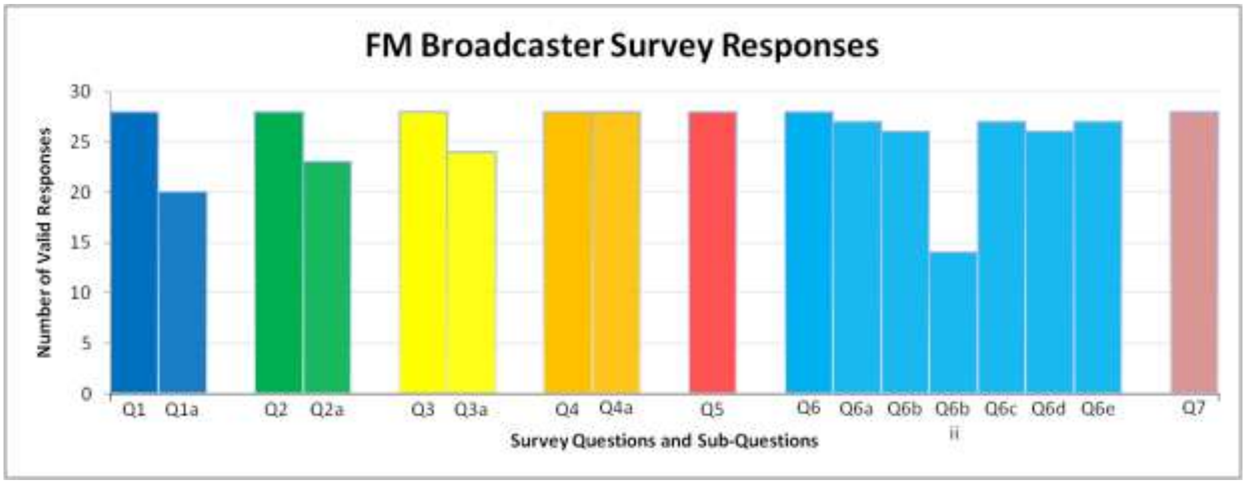



What age range best fits you?
Over 65 1.6%
18-20 0.0%
21-25 3.1%
26-35 14.1%
36-45 29.7%
46-55 28.1%
56-65 23.4%
18-20
21-25
26-35
36-45
46-55
56-65
Over 65

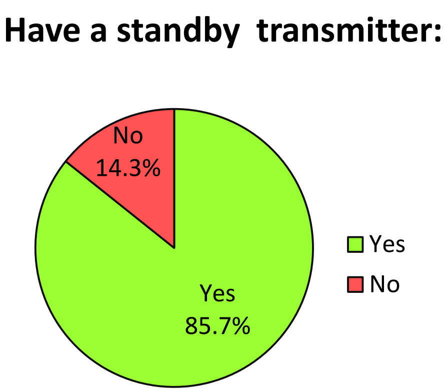

What is your highest level of education?
Some high school 0.0%
High school graduate 1.5%
Decline 1.5%
Some college 20.0%
College graduate 27.7%
Advanced Degree 49.2%
Some high school
High school graduate
Some college
College graduate
Advanced Degree
Decline

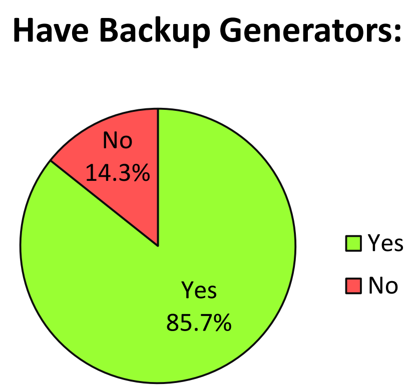

What is your race or ethnicity?
Asian 1.5%
Other 1.5%
Decline 6.2%
Hispanic 3.1%
Black 7.7%
White 80.0%
White
Black
Hispanic
Asian
Other
Decline

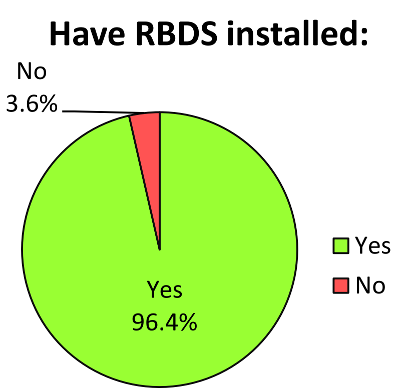
FM Broadcasters Survey

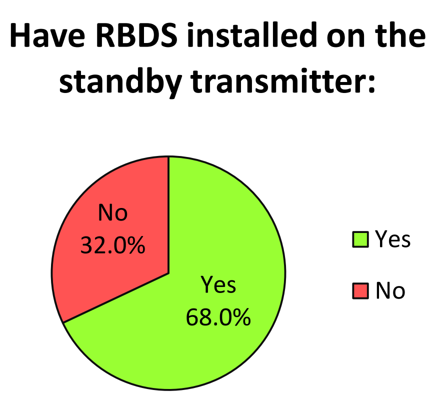


Demographics of the FM Broadcasters Surveyed









Alert Originator Survey

Due to the limited number of responses, no further demographic information can be displayed to maintain the anonymous results.

# of Collected Responses	% of Email Requests
6	50.0%

Consumer Electronics Manufacturers Survey

This survey was sent to the Consumer Electronics Association Technology and Standards membership. Due to the limited number of responses, no further demographic information can be displayed to maintain the anonymous results.

# of Collected Responses
2

ANNEX E: SURVEY INSTRUMENTS

(Contact Information has been removed from the survey forms)

The two page survey form used for collection of Alert Receivers' feedback can be found in Figure 34 and Figure 35. The only difference in survey forms between Scenario 1, 2, and 3 is the description indicating the scenario type. Table 13 includes the email text that was sent to the Alert Receivers preparing them for the demonstration and requesting their user feedback following the demonstration.

The six page survey form used for collection of Alert Originators' feedback can be found in Figure 36 through Figure 41.

The survey form used for collection of Non-Scenario Alert Recipients' feedback can be found in Figure 42 and Figure 43.

The survey form used for collection of supplemental technical data at MWSU can be found in Figure 44.

The survey form used for collection of FM Radio Broadcasters' feedback can be found in Figure 45.

The survey form used for collection of Consumer Electronic Manufacturers' feedback can be found in Figure 46.

Emergency Alerting System Evaluation
Campus Security Incident

Name: ______________________ (Please Print)

The Social Science Research Center (SSRC) at Mississippi State University (MSU) thanks you for participating in this emergency alert system questionnaire! The following questions focus on recent "test" alerts conducted in your area. These alert system tests were intended to simulate an actual emergency alert in the case of a campus security incident.

The information gathered from this questionnaire will be used to evaluate the emergency alerting system's use in your area and the effectiveness of the radio broadcast data system technology in distributing emergency alerts nationally. Your answers and personal information are held in strict confidence by the SSRC. Any reports generated from this information will contain only generalized data. This questionnaire is completely voluntary and you may decline to answer any question or stop at any time. Again, thank you for your participation in this research.

Please ☑ the box with your answers and/or fill in the appropriate response to the questions.

1. Before today, did you know you would be participating in the evaluation?
   - ❒ Yes
   - ❒ No (Skip to Question 3a)
   - ❒ Don't know
   - ❒ Decline

2. Did circumstance (i.e. meeting, appointment, etc.) prevent you from participating in the exercise?
   - ❒ Yes, and that circumstance was __________ (Skip to Question 5)
   - ❒ No
   - ❒ Don't know
   - ❒ Decline

		1st MESSAGE	2nd MESSAGE	3rd MESSAGE	4th MESSAGE	5th MESSAGE
	Answer (3a – 3d) for EACH message received.	❒ Did NOT receive a 1st message	❒ Did NOT receive a 2nd message	❒ Did NOT receive a 3rd message	❒ Did NOT receive a 4th message	❒ Did NOT receive a 5th message
3a	What was the "System TEST Number" received in the TEST message? (ie. System TEST #1299)	System Test # ☐☐☐☐ ❒ Don't know ❒ Decline	System Test # ☐☐☐☐ ❒ Don't know ❒ Decline	System Test # ☐☐☐☐ ❒ Don't know ❒ Decline	System Test # ☐☐☐☐ ❒ Don't know ❒ Decline	System Test # ☐☐☐☐ ❒ Don't know ❒ Decline
3b	What time did you receive the TEST message? (use message time stamp if available)	AM / PM ☐☐:☐☐ ❒ Don't know ❒ Decline	AM / PM ☐☐:☐☐ ❒ Don't know ❒ Decline	AM / PM ☐☐:☐☐ ❒ Don't know ❒ Decline	AM / PM ☐☐:☐☐ ❒ Don't know ❒ Decline	AM / PM ☐☐:☐☐ ❒ Don't know ❒ Decline
3c	Where were you located when you received the TEST message?	Location: ______ ❒ Don't know ❒ Decline	Location: ______ ❒ Don't know ❒ Decline	Location: ______ ❒ Don't know ❒ Decline	Location: ______ ❒ Don't know ❒ Decline	Location: ______ ❒ Don't know ❒ Decline
3d	Did you understand the TEST message?	❒ Yes ❒ No ❒ Don't know ❒ Decline	❒ Yes ❒ No ❒ Don't know ❒ Decline	❒ Yes ❒ No ❒ Don't know ❒ Decline	❒ Yes ❒ No ❒ Don't know ❒ Decline	❒ Yes ❒ No ❒ Don't know ❒ Decline

4. What action was asked of you in each of the test messages?
   - ❒ Tell others about the alert message
   - ❒ Document location, time of day, and a system test number
   - ❒ Find Shelter
   - ❒ The message did not inform me of any actions I should take
   - ❒ I did not understand the test alert messages
   - ❒ Don't know
   - ❒ Decline

5. Choose all that apply to you:
   - ❒ Hard of hearing
   - ❒ Legally Blind
   - ❒ English is my secondary language
   - ❒ None of these apply to me
   - ❒ Decline

Page 1 of 2

(continued on back of page)

FIGURE 34. ALERT RECEIVER USER SURVEY FORM (PAGE 1 OF 2)

6. Is the alerting device easy or difficult for you to operate?
- ❒ Very easy
- ❒ Somewhat easy
- ❒ Neither easy nor difficult
- ❒ Somewhat difficult
- ❒ Very difficult
- ❒ Don't know
- ❒ Decline

7. Is the alerting device a convenient or inconvenient device for you to operate?
- ❒ Very convenient
- ❒ Somewhat convenient
- ❒ Neither convenient nor inconvenient
- ❒ Somewhat inconvenient
- ❒ Very inconvenient
- ❒ Don't know
- ❒ Decline

8. Is the alerting device an effective or ineffective device for you to use as an emergency notification device?
- ❒ Very effective
- ❒ Somewhat effective
- ❒ Neither effective or ineffective
- ❒ Somewhat ineffective
- ❒ Very ineffective
- ❒ Don't know
- ❒ Decline

9. Do you think you would use this device and follow message instructions in the event of an actual emergency alert message?
- ❒ Definitely would use this device
- ❒ Probably would use this device
- ❒ Undecided
- ❒ Probably would NOT use this device
- ❒ Definitely would NOT use this device
- ❒ Don't know
- ❒ Decline

If you received the system test message on a wall mount device please answer questions 10W & 11W. If you received the system test message on a handheld/desktop/mobile device please answer questions 10H & 11H.

Wall Mounted Device

10W. Did you notice the wall-mounted receiver attract attention from other people who happened to be in the area during the exercise?
- ❒ Yes
- ❒ No
- ❒ Don't know
- ❒ Decline

11W. What is the name of the building or structure that houses the wall unit from which you received the test messages?

Name of Building: ______________________

What Floor of Building? __________

What is closest room number? __________
- ❒ Don't know
- ❒ Decline

Handheld/Desktop/Mobile Device

10H. Was the alert messaging device operating on battery power or plugged into a power outlet with supplied AC adapter?
- ❒ Battery
- ❒ Plugged into wall with AC adapter
- ❒ Don't know
- ❒ Decline

11H. In your opinion what would be an acceptable purchase price amount for the handheld/desktop/mobile emergency alert device?
- ❒ $0
- ❒ $1 to $10
- ❒ $11 to $25
- ❒ $26 to $50
- ❒ $50 to $100
- ❒ Over $100
- ❒ Don't know
- ❒ Decline

12. What is your gender?
- ❒ Male
- ❒ Female
- ❒ Decline

13. What is your Race?
- ❒ White
- ❒ Black
- ❒ Hispanic
- ❒ Asian
- ❒ Other
- ❒ Decline

14. What age range best fits you?
- ❒ 18 – 20
- ❒ 21 – 25
- ❒ 26 – 35
- ❒ 36 – 45
- ❒ 46 – 55
- ❒ 56 – 65
- ❒ Over 65
- ❒ Decline

15. What is your highest level of education?
- ❒ Some HS
- ❒ HS Graduate
- ❒ Some College
- ❒ College Graduate
- ❒ Advanced Degree
- ❒ Decline

16. Additional Comments? ______________________

____

____

Research conducted by: SSRC, Mississippi State University

Project managed by: Northrop Grumman

If you have any questions about this survey, please contact the SSRC –

Page 2 of 2

FIGURE 35. ALERT RECEIVER USER SURVEY FORM (PAGE 2 OF 2)

TABLE 13. EMAIL AND PHONE TEXT FOR SCENARIO SURVEY COLLECTION

Ref ID	Purpose	Format	Text
#1	Pre-Scenario Reminder (One day prior to the scenario)	Email	Good (morning, afternoon, evening) from the Social Science Research Center at Mississippi State University. We thank you for your participation in this important voluntary research involving the validation of FM Alerting Systems as an integral part of the Federal integrated public alerting and warning system. These systems are aimed at alerting the public of impending emergencies in a timely and effective manner. Upon agreeing to be a participant of the study, you have chosen to receive a link to a web-based version of the survey instrument via electronic mail. We appreciate your willingness to participate in this research and would like to remind you that the scenario test will take place tomorrow, (insert date and time), after which a link to a web-based survey will be sent to this email address. We hope that you will take the time to fill out the survey. If by chance you have received this notice in error, please accept our apologies and reply back to the sender so that we can remove you from future communications. If you have any questions or concerns please contact Mr. David Parrish at ***EDITED*** or Mr. Dallas Breen at ***EDITED***. Again, thank you!

Ref ID	Purpose	Format	Text
#2	Post-Scenario Feedback Request (immediately following scenario)	Email	Good (morning, afternoon, evening) from the Social Science Research Center at Mississippi State University. We appreciate your willingness to participate in today's demonstration and would like to inform you that the test has ended. We now ask for your cooperation to complete the important web-based survey that can be found at "LINK". The surveys responses are an important part of the research involving the validation of this FM Alerting system. If by chance, you were unavailable during part of or the entire demonstration, we would still ask that you complete the survey. We again would again like to thank you for your participation in this important research which will help to guide the Federal public alerting and warning systems. If you have received this notice in error, please accept our apologies and reply back so that we can remove you from future communications. If you have any questions or concerns, please contact Mr. David Parrish at ***EDITED*** or Mr. Dallas Breen at ***EDITED***. Again, thank you! "LINK to Survey" – "along with any additional survey completing instructions"

Ref ID	Purpose	Format	Text
#3	Feedback Reminder #1 (three days following scenario)	Email	Good (morning, afternoon, evening) from the Social Science Research Center at Mississippi State University. We appreciate your willingness to participate in the demonstration of the FM Alerting System that occurred a few days ago. We originally contacted you at the end of the test asking for you to complete a survey. We understand that you may have been distracted or unavailable at the time of our initial request so we hope that you are still willing to assist us by taking a few minutes now to complete the web-based survey. The surveys responses are an important part of the research involving the validation of this FM Alerting system. If by chance, you were unavailable during part of or the entire demonstration, we would still ask that you complete the survey. We again would again like to thank you for your participation in this important research which will help to guide the Federal public alerting and warning systems. If by chance you have received this notice in error or if you have completed the survey previously, please accept our apologies and reply back so that we can remove you from future communications. If you have any questions or concerns please contact Mr. David Parrish at ***EDITED*** or Mr. Dallas Breen at ***EDITED***. Again, thank you! "LINK to Survey" – "along with any additional survey completing instructions"

Ref ID	Purpose	Format	Text
#4	Feedback Reminder #2 (seven days following previous reminder)	Email	Good (morning, afternoon, evening) from the Social Science Research Center at Mississippi State University. We appreciate your willingness to participate in the demonstration of the FM Alerting System that occurred a week ago. We originally contacted you at the end of the test and a few days following asking for you to complete the survey. We understand that you may have been distracted or unavailable at the time of our requests so we hope that you are still willing to assist us by taking a few minutes now to complete the web-based survey. The surveys responses are an important part of the research involving the validation of this FM Alerting system. If by chance, you were unavailable during part of or the entire demonstration, we would still ask that you complete the survey. We again would again like to thank you for your participation in this important research which will help to guide the Federal public alerting and warning systems. If by chance you have received this notice in error or if you have completed the survey previously, please disregard this message and accept our apologies. If you have any questions or concerns please contact Mr. David Parrish at ***EDITED*** or Mr. Dallas Breen at ***EDITED***. Again, thank you! "LINK to Survey" – "along with any additional survey completing instructions"
#5	Feedback Request Phone Message	Phone	"Hello. This is [caller's name] at the Social Science Research Center at Mississippi State University. I am calling with regard to your request to be contacted by phone for participation in an emergency alert research questionnaire. Your feedback from your recent experiences using emergency alert technology is very important to this research effort. We will attempt to call you again on [specify day of week, date, and approximate time]. Thank you in advance for participating in this important research. Have a wonderful day!"

Alert Originators Survey

Name: ______________________________

DEMOGRAPHICS

1) What FM-based Alert System is installed (i.e.Who is the vendor)?

____

2) What jurisdiction/campus does your system alert (e.g. Harrison County or Mississippi State University Campus)?

____

3) How long has the FM-based Alert System been installed and operational?

____

4) How long have you used the FM-based Alert System to generate alerts?

____

TARGETING

LINGUISTICAL

5) During the test scenario did you have any difficulty generating messages in Spanish?
   - ❒ I had no difficulty generating Spanish messages
   - ❒ I had little difficulty generating Spanish messages
   - ❒ I had difficulty generating Spanish messages
   - ❒ I was unable to generate Spanish messages
   - ❒ I was not asked to generate Spanish messages
   - ❒ No comment

6) Are messages automatically translated into Spanish at the portal?
   - ❒ Yes
   - ❒ No
   - ❒ No comment

7) If there were any actual emergency message that needed to be sent out in Spanish how easy/difficult would it be for you to generate the Spanish message?
   - ❒ Very easy
   - ❒ Somewhat easy
   - ❒ Neither easy nor difficult
   - ❒ Somewhat difficult
   - ❒ Very difficult
   - ❒ No comment

FIGURE 36. ALERT ORIGINATORS SURVEY (PAGE 1 OF 6)

8) Please list the languages you anticipate targeting during an emergency situation? (not including English)

______________, ______________, ______________, ______________, ______________

9) Explain how are you able to target various languages? ______________________________

____

____

GEOGRAPHICAL

10) What geographic areas have you defined as target areas (check all that apply)?
- ❒ County
- ❒ City
- ❒ Street
- ❒ Building
- ❒ Floor
- ❒ Postal Code
- ❒ Neighborhood
- ❒ Others ______________, ______________, ______________, ______________
- ❒ No comment

11) How much of your jurisdiction/campus is covered by a FM radio signal capable of transmitting alert messages?
- ❒ All of my jurisdiction/campus is covered by usable radio signal coverage
- ❒ Most of my jurisdiction/campus is covered by usable radio signal coverage
- ❒ Some of my jurisdiction/campus is covered by usable radio signal coverage
- ❒ Very little of my jurisdiction/campus is covered by usable radio signal coverage
- ❒ None of my jurisdiction/campus is covered by usable radio signal coverage
- ❒ No comment

CATEGORICAL

12) How much difficulty have you had generating alerts directed at your target audience?
- ❒ No difficulties at all
- ❒ Some difficulty
- ❒ Much difficulty
- ❒ Unable to generate alerts directed at target audience
- ❒ No comment

13) Are you able to target alerts based on function (group affiliation, schools, hospitals, fire & rescue personnel, etc) rather than geography?
- ❒ Yes
- ❒ No
- ❒ Do not understand
- ❒ No Comment

FIGURE 37. ALERT ORIGINATORS SURVEY (PAGE 2 OF 6)

14) Do you target any special needs populations such as the physically or mentally handicapped, senior citizens, etc? If so, please list.
- ❒ Yes, ____________________, ______________________, ______________________
- ❒ No
- ❒ Do not understand
- ❒ No comment

15) How do you target these special needs populations within your target area? ______________

____

____

RELIABILITY

16) Has the FM-based Alert System been unavailable at any time since installed?
- ❒ Yes, Why?____
- ❒ No
- ❒ No comment

17) Are you able to determine whether the FM-based Alert System is ready and available to deliver a message?
- ❒ Yes, How? ____
- ❒ No
- ❒ Not Sure
- ❒ No Comment

18) What activities are periodically performed to maintain the operational readiness of the FM-based Alert System; indicate which activities require vendor support?

____

____

____

19) What is the average monthly cost of maintaining the FM-based Alert System?

$_____________ per month

20) How often are test messages sent out of the FM-based Alert System?
- ❒ Annually
- ❒ Quarterly
- ❒ Monthly
- ❒ Bi-weekly
- ❒ Weekly
- ❒ Daily
- ❒ Other: ______________________________
- ❒ No comment

FIGURE 38. ALERT ORIGINATORS SURVEY (PAGE 3 OF 6)

21) Does the FM-based Alert System have the ability to deliver alerts under a power outage condition?
- ❒ Yes
- ❒ No
- ❒ Don't know
- ❒ No Comment

22) Has the FM-based Alert System delivered alerts under a power outage condition?
- ❒ Yes
- ❒ No
- ❒ No Comment

23) List any other unusual condition where the FM-based Alert System has the ability to deliver alerts:

____

____

____

24) Are you aware of any additional FM-based Alert Systems IN USE in your area? If so please list.
- ❒ Yes, ____________, ____________, ____________
- ❒ No
- ❒ No Comment

25) IF you answered YES to the previous question, do the other FM-based Alert Systems interfere with your operation of the current FM-based Alert System?
- ❒ Yes, Which one? ____________ Why? ____________
- ❒ No
- ❒ No Comment

26) Does ANY other equipment you use as an alert originator interfere with your operation of the current FM-based Alert System? If so please list and explain why below.
- ❒ Yes, ____________, ____________, ____________
- ❒ No
- ❒ No Comment

Explain (if necessary): ________________________________

____

____

____

____

____

____

FIGURE 39. ALERT ORIGINATORS SURVEY (PAGE 4 OF 6)

EFFECTIVENESS

27) How effective or ineffective is the tested RBDS in alerting the desired populations in the event of an emergency?
- ❒ Very effective
- ❒ Somewhat effective
- ❒ Neutral
- ❒ Somewhat ineffective
- ❒ Very ineffective
- ❒ No comment

28) Do you have an outside source such as NOAA, FEMA, etc. which automatically generates alerts for your FM-based alert system? If so, please list.
- ❒ Yes, ___________________, ______________________, ______________________
- ❒ No
- ❒ Don't know
- ❒ No Comment

29) How responsive is your vendor to your needs?
- ❒ Very responsive
- ❒ Somewhat responsive
- ❒ Neutral
- ❒ Seldom responsive
- ❒ Not responsive at all
- ❒ No comment

30) Were there any local laws or constraints applicable to the installation of the FM-based Alert System? If so, please explain below.
- ❒ Yes
- ❒ No
- ❒ No comment

Explain (if necessary): ____

____

____

31) What do you find difficult with this FM-based Alerting System? ______________________

____

____

32) Additional Comments? ____

____

____

____

FIGURE 40. ALERT ORIGINATORS SURVEY (PAGE 5 OF 6)

SURVEY QUESTIONS

If you have any questions or comments about this survey please contact

SURVEY RETURN

Upon completion, the surveys please choose one of the following three options for returning the surveys to Mississippi State University:

1. Electronically scan the survey document and email as an attachment (MS Word or Adobe PDF preferred) to
2. Fax to SSRC/MSU (attention:
3. Mail via USPS, UPS, FedEx or other carrier to

   Social Science Research Center
   Mississippi State University
   1 Research Boulevard, Suite 103
   Starkville, MS 39759.

FIGURE 41. ALERT ORIGINATORS SURVEY (PAGE 6 OF 6)

Emergency Alerting System Evaluation
"Real World" Experiences

Name: ____________________
(Please Print)

The Social Science Research Center (SSRC) thanks you for participating in this emergency alert system questionnaire! Even if you did not participate in the recent test demonstrations we ask that you complete this survey concerning your "real world" experiences with FM-based alerting technology during the past few months. The following questions focus on the effectiveness of the FM-based alerting systems (Alert FM™, Alertus, MetisSecure).

The information gathered from this questionnaire will be used to evaluate the emergency alerting system's "real world" application in the area. Your answers and personal information are held in strict confidence by the SSRC. Any reports generated from this information will contain generalized data. This questionnaire is completely voluntary and you may decline to answer any question or stop at any time. Again, thank you for your participation.

Please ☑ the box with your answers and/or fill in the appropriate response to the questions.

1. Did you receive any "real world" emergency alerts from any FM-based alerting device within the past few months?
   - ❒ Yes
   - ❒ No
   - ❒ Don't know

2. Did you stop using the FM-based emergency alerting device intentionally or unintentionally within the past few months?
   - ❒ Yes, Intentionally. Why? ____________________
   - ❒ Yes, UNintentionally. Why? ____________________
   - ❒ No, I continue to rely on the device for emergency alert notices

3. What alerting mechanisms typically informed you of emergency situations? **(select all that apply)**
   - ❒ Local television announcement
   - ❒ Local radio announcement
   - ❒ Local outdoor siren
   - ❒ FM-based emergency alert system (Alert FM™, Alertus, MetisSecure)
   - ❒ University alerting system
   - ❒ NOAA weather radio
   - ❒ Internet news source
   - ❒ Facebook
   - ❒ Twitter
   - ❒ Opt-in e-mail alert service
   - ❒ Opt-in instant messaging alert service
   - ❒ Opt-in text messaging alert service on cell phone
   - ❒ Friend, relative or coworker
   - ❒ Other: ____________________
   - ❒ I was not aware of any emergency during last few months

4. Were you typically in proximity to an FM-based alerting device during emergency situations such as severe weather?
   ❒ Yes ❒ No ❒ Don't know

5. Did any of the FM-based emergency alert messages you received contain conflicting information as compared to other emergency alert sources?
   ❒ Yes ❒ No ❒ Don't know

6.	Rate the following questions on a 10 point scale with 10 being the *highest or most favorable* rating and 1 being the *lowest or least favorable* rating.	Did not use device	←←← Low					High →→→				
			1	2	3	4	5	6	7	8	9	10
6a	How would you rate the overall **effectiveness** of the FM-based alerting device?	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6b	How would you rate the **reliability** of the FM-based alerting device?	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6c	How would you rate the **accuracy of information** from the FM-based alerting device?	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6d	How would you rate the **ease of use** of the FM-based alerting device?	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

7.	Rate the following comments on a 10 point scale with 10 corresponding to *strongly agree* and 1 to *strongly disagree*.	Did not use device	←← Disagree					Agree →→				
			1	2	3	4	5	6	7	8	9	10
7a	I believe messages from the FM-based device would result in my taking a course of action to protect myself from harm.	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
7b	I believe FM-based devices are the quickest means of notifying the public in the event of a emergency situation.	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
7c	I would recommend the use of FM-based alerting devices to my friends and family.	❒	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Continued on Back

Page 1 of 2

Figure 42. Non-Scenario Alert Recipient (Page 1 of 2)

If you received "real world" alert messages on a handheld/desktop/mobile device please answer questions 8H a-e. If you received "real world" alert messages on a wall mount device please answer questions 8W a-b.

Handheld/Desktop/Mobile Device

8H a. How many times have you replace the batteries in the emergency alert device?
- ❒ I keep the device plugged into A/C outlet
- ❒ I never replaced the battery (device **IS** and has been operational)
- ❒ I never replaced the battery (device **NOT** currently operational)
- ❒ I have replaced the batteries _________ time(s)
- ❒ Don't know

8H b. In your opinion what would be an acceptable purchase price amount for the handheld/desktop/mobile emergency alert device?
- ❒ $0 ❒ $11 to $25 ❒ $50 to $100 ❒ Don't know
- ❒ $1 to $10 ❒ $26 to $50 ❒ Over $100

8H c. Which of the following **BEST** describes the environment in which the device is located a majority of the time?
- ❒ In my pocket or purse ❒ Inside a vehicle ❒ Other: _____________
- ❒ Desk at office or work ❒ Outside
- ❒ Inside my home ❒ On a body of water

8H d. Have you received alert messages on your devices for areas other than where you were located at the time the emergency message was delivered?
- ❒ Yes ❒ No ❒ Don't know

8H e. If your device required a repair, was the repair made easily and timely?
- ❒ Yes ❒ No ❒ No repair required ❒ Don't know

Wall Mounted Device

8W a. If you noticed emergency alerts from an FM-based alerting device during the last few months did you typically proceed to the device to read the notification?
- ❒ Yes
- ❒ No
- ❒ Don't know

8W b. Did you also notice the wall-mounted receiver attract attention from other people who happened to be in proximity of the device during the last few months?
- ❒ Yes
- ❒ No
- ❒ Don't know

9. What are the **BEST** ways in the future to provide you emergency alert notifications, such as during a tornado or other emergency situation in your area? **(please make up to 3 choices but no more than 3)**
- ❒ Local television announcement
- ❒ Local radio announcement
- ❒ Local outdoor siren
- ❒ FM-based emergency alert system (Alert FM™, Alertus, MetisSecure)
- ❒ University alerting system
- ❒ NOAA weather radio
- ❒ Internet news source
- ❒ Facebook
- ❒ Twitter
- ❒ Opt-in e-mail alert service
- ❒ Opt-in instant messaging alert service
- ❒ Opt-in text messaging alert service on cell phone
- ❒ Friend, relative or coworker
- ❒ Other: ______________________________
- ❒ Don't know

10. Choose all that apply to you:
- ❒ Deaf / Hard of hearing
- ❒ Legally Blind
- ❒ English is my secondary language
- ❒ None of these apply to me

11. What is your gender?
- ❒ Male
- ❒ Female

12. What is your Race?
- ❒ White
- ❒ Black
- ❒ Hispanic
- ❒ Asian
- ❒ Other

13. What age range best fits you?
- ❒ 18 – 20 ❒ 46 – 55
- ❒ 21 – 25 ❒ 56 – 65
- ❒ 26 – 35 ❒ Over 65
- ❒ 36 – 45

14. What is your highest level of education?
- ❒ Some HS ❒ College Graduate
- ❒ HS Graduate ❒ Advanced Degree
- ❒ Some College

15. Additional Comments? ______________________

Research conducted by: SSRC, Mississippi State University

Project managed by: Northrop Grumman

If you have any questions about this survey, please contact the SSRC

Page 2 of 2

FIGURE 43. NON-SCENARIO ALERT RECIPIENT (PAGE 2 OF 2)

FEMA Supplemental Data Collection at MWSU

Indicate observation/activation time (to ensure consistency with technical reporting):

Describe the location and nature of the building including construction:

Visibility of Flashing Strobes: What is the approximate distance of attention?

Audibility of Siren: What is the approximate amplification distance that the audible tones can be heard? How many walls does it pass through, or how many rooms away can it be heard?

Audibility of Text-To-Speech: What is the approximate distance that the text-to-speech can be heard? What is the distance in which it is intelligible?

How would you rate the text-to-speech intelligibility quality? If in any location quality is low, please describe the space location and/or take a photo; specifically describe floor and ceiling materials.

Does the siren interfere in any way with the text-to-speech?

FIGURE 44. SUPPLEMENTAL TECHNICAL DATA COLLECTION AT MWSU

FM Radio Based Alerting Broadcast System Evaluation

Radio Station Call Letters: ________ (Please Print)

The Social Science Research Center (SSRC) at Mississippi State University (MSU) thanks you for participating in this FM radio based emergency alert system questionnaire! The following questions focus on your FM station capabilities and coverage area.

The information gathered from this questionnaire will be used to evaluate the FM radio-based emergency alerting system's use in your area and the effectiveness of the radio broadcast data system technology in distributing emergency alerts nationally. Your answers and radio station information are held in strict confidence by the SSRC. Any reports generated from this information will contain only generalized data. This questionnaire is completely voluntary and you may decline to answer any question or stop at any time. Again, thank you for your participation in this research.

Please ☑ the box with your answers and/or fill in the appropriate response to the questions.

1. In the last 12 months, has your transmitter ever been offline for other than unplanned reasons?
   - ☐ Yes, How long? ________
   - ☐ No
   - ☐ Don't know
   - ☐ Decline

2. In the event of a primary transmitter failure, do you have a standby transmitter?
   ☐ Yes ☐ No ☐ Don't know ☐ Decline

   a. If yes, is the transmission power of the standby transmitter the same or less than the primary transmitter?
   ☐ Same ☐ Less ☐ Don't know ☐ Decline

3. In the event of a power loss, do you have a generator to continue operating the radio station? If yes, how long can you operate (regardless if primary or standby transmitter configuration) before you run out of fuel?
   - ☐ Yes, How long? ________
   - ☐ No
   - ☐ Don't know
   - ☐ Decline

4. Do you maintain your FM radio network on a daily, weekly or monthly basis?
   - ☐ Yes
   - ☐ No
   - ☐ Don't know
   - ☐ Decline

   a. If yes, how often and what activities do you perform in maintaining your FM radio network?
   ____
   ____

5. Do you support the development of an FM radio based alert and warning system that extends the capability of the national EAS?
   - ☐ Yes
   - ☐ No, Why? ________
   - ☐ Don't know
   - ☐ Decline

6. Do you have RBDS technology in your station?
   ☐ Yes ☐ No ☐ Don't know ☐ Decline

   If yes, please answer questions a – e.

   a. For how long? ________ years

   b. Do you maintain your RBDS equipment on a daily, weekly, monthly, or annual basis?
   ☐ Yes ☐ No ☐ Don't know ☐ Decline

      i. If yes, how often and what activities do you perform in maintaining your RBDS equipment?
      ____
      ____

      ii. If yes, does the maintenance require vendor support?
      ☐ Yes ☐ No ☐ Don't know ☐ Decline

   c. On average, how often does your RBDS equipment fail?
   ________ times/month ________ times/year

   d. Is the RBDS technology available on the standby transmitter?
   ☐ Yes ☐ No ☐ Don't know ☐ Decline

   e. Does the RBDS technology degrade the signal by either a loss of power or fidelity?
   ☐ Yes ☐ No ☐ Don't know ☐ Decline

7. How much do you believe the addition of a FM radio based alert and warning system adds to the relevance of the FM radio station?
   - ☐ Great extent
   - ☐ Somewhat
   - ☐ Very Little
   - ☐ Not at all

8. Additional Comments? ________
____
____
____

If you have any questions about this survey, please contact the SSRC –

FIGURE 45. FM RADIO BROADCASTER SURVEY

FM Radio-Based Alerting
Consumer Electronics Evaluation

Company Name: ______________________
(Please Print)

The Social Science Research Center (SSRC) at Mississippi State University (MSU) thanks you for participating in this FM radio based emergency alert system questionnaire! The following questions focus on your consumer oriented alert and warning product market research.

The information gathered from this questionnaire will be used to evaluate the FM radio-based emergency alerting system's implementation across your product area and the use of radio broadcast data system technology in distributing emergency alerts nationally via consumer electronics products. Your answers and company information are held in strict confidence by the SSRC. Any reports generated from this information will contain only generalized data. This questionnaire is completely voluntary and you may decline to answer any question or stop at any time. Again, thank you for your participation!

Please ☑ the box with your answers and/or fill in the appropriate response to the questions.

1. Currently, does your company develop and sell consumer electronics products which provide alert and warning capabilities?
❒ Yes, How long? ___________
❒ No
❒ Don't know
❒ Decline

2. FEMA has implemented a program to deploy a nationwide public alert and warning system for Federal, State and Local jurisdictions. In response, would your company implement FM Radio Based Alerting during the next five years?

❒ Yes ❒ No ❒ Already Have It ❒ Don't know ❒ Decline

3. Do you currently have FM Radio capability in your products?

❒ Yes ❒ No ❒ Don't know ❒ Decline

If yes, please answer questions a – c.

a. For how long? __________ years
b. Which type of functional product platforms?
____
____
c. Do you plan to continue to develop products with FM radio capability?
❒ Yes ❒ No ❒ Don't know ❒ Decline

4. Do you have RBDS technology in your products?

❒ Yes ❒ No ❒ Don't know ❒ Decline

If yes, please answer questions a – c.

a. For how long? __________ years
b. Which type of functional product platforms?
____
____
c. Do you plan to continue to develop products using the RBDS technology?
❒ Yes ❒ No ❒ Don't know ❒ Decline

5. What factors are you evaluating to determine if you will implement alert and warning capability across your product lines? ______________________________
____
____

6. FM radio chips are available with an embedded antenna on a single chip, eliminating the need for using headsets as antennas. Would this configuration be a factor in your product design and approach?
❒ Yes
❒ No
❒ Don't know
❒ Decline

a. If yes, what price point would the radio chip need to be offered to meet your economic model?
❒ $0.50 or less
❒ $0.51 - $0.75
❒ $0.76 - $1.00
❒ $1.01 - $1.50
❒ Other: $________
❒ Don't Know
❒ Decline

7. Do you support the development of an FM radio based alert and warning system that extends the capability of the national EAS?
❒ Yes
❒ No, Why? ______________________
❒ Don't know
❒ Decline

8. How much do you believe the addition of a FM radio based alert and warning system adds to the relevance of your consumer based products?
❒ Great extent
❒ Somewhat
❒ Very Little
❒ Not at all
❒ Don't Know
❒ Decline

9. Additional Comments? ______________________
____
____
____

If you have any questions about this survey, please contact the SSRC -

FIGURE 46. FM RADIO-BASED ALERTING CONSUMER ELECTRONICS EVALUATION

ANNEX F: MASTER SCENARIO EVENTS LIST (MSEL)

Refer to the file "RBDSS_MSEL_Master.xlsx" for the complete details of every Demonstration Day. The following summarizes the MSEL:

Scenario 1

Approximate Time	Alert Message	Description	Expected Action
1000 EDT	System TEST #1614. Test of the Campus Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #1614	A test of the Campus Alerting system. Direct the alert recipients to record their location, time of day, and the system test number and await further instructions.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1020 EDT	System TEST #1624. Continued test of the Campus Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #1624	Continued test of the Campus Alerting System with a CAP message. Alert recipients are to record their location, time, and the system test number and await further instructions.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1030 EDT	System TEST #1634. Continued test of the Campus Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. System TEST #1634	Continued test of the Campus Alerting System targeted to a limited population. Alert recipients are to record their location, time, and the system test number and await further instructions.	Only the geo-target specific receivers are to be alarmed with the detailed information.
1045 EDT	System TEST #1644. Campus Alert Test has completed. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER and complete and return Feedback forms. System TEST #1644	Campus Alert test has been completed. Alert recipients are to record their location, time, and the system test number and then complete and return the user feedback forms.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.

Scenario 2

Approximate Time	Alert Message	Description	Expected Action
0930 CDT	System TEST #2415. Test of the Regional Health Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Initiate System Test #2425. System TEST #2415	A test of the Regional Health Alerting system. Direct the alert recipients to record their location, time of day, and then initiate System Test #2425.	Receivers in the EOCs of Hancock County, Harrison County, Jackson County, and Mobile County are alarmed.
1000 CDT	System TEST #2425. Test of the Regional Health Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #2425	A test of the Regional Health Alerting system with a CAP message. Direct the alert recipients to record their location, time of day, and the system test number and await further instructions.	All receivers in [Hancock, Harrison, Jackson, Mobile] County are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1020 CDT	System TEST #2435. Continued test of the Regional Health Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #2435	Continued test of the Regional Health Alerting System. Alert recipients are to record their location, time, and the system test number and await further instructions.	All receivers in [Hancock, Harrison, Jackson, Mobile] County are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1045 CDT	System TEST #2445. Continued test of the Regional Health Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #2445	Continued test of the Regional Health Alerting System targeted to a limited population. Alert recipients are to record their location, time, and the system test number and await further instructions.	Only the geo-target specific receivers being NGC Ingalls Shipbuilding are to be alarmed with the detailed information.
1100 CDT	System TEST #2455. Regional Health Alerting System Test has completed. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER and complete and return Feedback forms. System TEST #2455	MEMA initiates the alert indicating that the Regional Health Alert test has been completed. Alert recipients are to record their location, time, and the system test number and then complete and return the user feedback forms.	All receivers in [Hancock, Harrison, Jackson, Mobile] County MS EMA, Harrison County MS EMA, Jackson County MS EMA, Mobile County AL EMA participating in the demonstration are alerted.

Scenario 3

Approximate Time	Alert Message	Description	Expected Action
1000 CDT	System TEST #3614. Test of the Local Weather Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #3614	A test of the Local Weather Alerting system. Direct the alert recipients to record their location, time of day, and the system test number and await further instructions.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1020 CDT	System TEST #3624. Continued test of the Local Weather Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #3624	Continued test of the Local Weather Alerting System with a CAP message. Alert recipients are to record their location, time, and the system test number and await further instructions.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.
1030 CDT	System TEST #3634. Continued test of the Local Weather Alerting System. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER. Updates to follow. System TEST #3634	Continued test of the Local Weather Alerting System targeted to a limited population. Alert recipients are to record their location, time, and the system test number and await further instructions.	Only the geo-target specific receivers are to be alarmed with the detailed information.
1045 CDT	System TEST #3644. Local Weather Alerting System Test has completed. Please document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER and complete and return Feedback forms. System TEST #3644	Local Weather Alert test has been completed. Alert recipients are to record their location, time, and the system test number and then complete and return the user feedback forms.	All receivers in demonstration are alarmed with all sirens, strobes with alert message indicating the alert and actions to take.

```xml
<?xml version="1.0" encoding="utf-16"?>
<alert xmlns:x="urn:oasis:names:tc:emergency:cap:1.2">
    <identifier>DM8221625288781061120</identifier>
    <sender>DMIS_Interoperability_COG</sender>
    <sent>2010-03-22T17:18:55.0000000-05:00</sent>
    <status>Exercise</status>
    <msgType>Alert</msgType>
    <source>Northrop Grumman Controller</source>
    <scope>Public</scope>
    <restriction />
    <addresses />
    <code />
    <note />
    <references />
    <incidents />
    <info>
        <language>en-US</language>
        <category>Safety</category>
        <event>RBDS Study: Scenario 1 MSU</event>
        <responseType>Prepare</responseType>
        <urgency>Expected</urgency>
        <severity>Minor</severity>
        <certainty>Likely</certainty>
        <audience />
        <effective />
        <onset />
        <expires />
        <senderName>Northrop Grumman Controller</senderName>
        <headline>RBDS Study: Scenario 1 MSU</headline>
        <description>System TEST #1424. Continued test of the Campus Alerting System. Please
         document the following 3 items: LOCATION, TIME, and SYSTEM TEST NUMBER.
         Updates to follow. System TEST #1424</description>
        <instruction />
        <contact />
    </info>
</alert>
```


FIGURE 47. SCENARIO 1 CAP MESSAGED USED AT MSU IN XML FORMAT

ANNEX G: PARTICIPANT DISTRIBUTION

The following summarizes the list of participants:

Alert Originators

- Scenario 1:
  - Carnegie Mellon Environmental Health and Safety Office
  - Allegheny County PA Emergency Services
  - Oktibbeha County, MS Emergency Management Agency
  - Gallaudet University Department of Public Safety
- Scenario 2:
  - Mississippi Emergency Management Agency
  - Hancock County, MS Emergency Management Agency
  - Harrison County, MS Emergency Management Agency
  - Jackson County, MS Emergency Management Agency
  - Mobile County, AL Emergency Management Agency
- Scenario 3:
  - Shelby County, TN Emergency Management Agency
  - Missouri Western State University Public Safety Department
  - American University Public Safety Department

FM Radio Broadcasters

- Scenario 1:
  - WDUQ (90.5)
  - WAMU (88.5)
  - WMSV (91.1)
  - WSYE (93.3)
  - WMAB (89.9)
- Scenario 2:
  - WMTI (106.1)
  - WCPR (97.9)
  - WAOY (91.7)
  - WZKX (107.9)
  - WXNF (95.3)
  - WGCM (102.3)
  - WMAH (90.3)
  - WOSM (103.1)
  - WQUA (102.1)
  - WPAS (89.1)
  - WHGO (105.9)
  - WZEW (92.1)
  - WAVH (106.5)
  - WDLT (98.3)

    - WJLQ (100.7)
    - WYOK (104.1)
    - WBLX (92.9)
    - WMEZ (94.1)
    - WXBM (102.7)
- Scenario 3:
    - KKJO (105.5)
    - WAMU (88.5)
    - WVIM (95.3)
    - WRBO (103.5)
    - WKIM (98.9)
    - WKNO (91.1)

Alert Receivers

- Scenario 1:
    - Carnegie Mellon University students and faculty
    - Gallaudet University students and faculty
    - Mississippi State University Crisis Action Team
    - Mississippi State University Residence Hall Directors
- Scenario 2:
    - Residents of the Mississippi Counties of Hancock, Harrison, and Jackson
    - Residents of the Alabama County of Mobile
    - Northrop Grumman Corporation Ingalls Shipbuilding, MS
- Scenario 3:
    - Residents of Shelby County, TN
    - Missouri Western State University students and faculty
    - American University students and faculty
    - Howard University students and faculty
    - George Washington University students and faculty
    - Georgetown University students and faculty

Table 14 (found on the next page) contains the participant summary worksheet from the work product file "Alert Receiver Distribution.xls", which indicates the number of receivers allocated per scenario and location.

TABLE 14. PARTICIPANT SUMMARY FROM ALERT_RECEIVER_DISTRIBUTION.XLS

Participant Summary

Scenario 1

	Location	# of FM stations	# of Rcvrs	# Desk Rcvrs	# Wall Rcvrs	# Cell Phone Rcvrs	# ADA Rcvrs	# ESL Rcvrs
Metis	CMU	1	26	0	26	0	7	4
Alertus	GAL	1	25	0	25	0	25	0
AlertFM	MSU	3	27	20	5	2	5	5
	Sub-Totals	5	78	20	56	2	37	9

Scenario 2

	Location	# of FM stations	# of Rcvrs	# Desk Rcvrs	# Wall Rcvrs	# Cell Phone Rcvrs	# ADA Rcvrs	# ESL Rcvrs
AlertFM	Pearl, MS	19	17	10	5	2	0	0
AlertFM	Hancock County, MS	0	106	95	10	1	5	5
AlertFM	Harrison County, MS	0	106	95	10	1	5	5
AlertFM	Jackson County, MS	0	136	120	15	1	5	5
AlertFM	Mobile County, AL	0	106	95	10	1	5	5
	Sub-Totals	19	471	415	50	6	20	20

Scenario 3

	Location	# of FM stations	# of Rcvrs	# Desk Rcvrs	# Wall Rcvrs	# Cell Phone Rcvrs	# ADA Rcvrs	# ESL Rcvrs
Alertus	MWSU	1	80	0	80	0	0	0
Alertus	AU/HOW/GU/GW	0	28	0	28	0	0	0
AlertFM	Shelby County, TN	4	34	27	5	2	5	5
	Sub-Totals	5	142	27	113	2	5	5

Total FM Broadcasters	29			
		462 Desk	62	Total ADA Receivers
		219 Wall	34	Total ESL Receivers
		10 Phone		
	691	691 Total Receivers		