Allied Radio Matrix for Emergency Response (ARMER) Standards, Protocols, Procedures

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Standard Title	ARMER Aircraft Radio	
	Installations and Operations	
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1. Purpose or Objective

The purpose of this standard is to set a policy regarding aircraft subscriber radio installation, programming, and operation on the ARMER system.

2. Technical Background

Due to the elevated altitude of operation, aircraft radios have a greater coverage footprint. This allows a radio operated in the air to talk into sites as far away as 150 to 200 miles, while mobile radios operated in vehicles on the ground typically have ranges limited to 30 to 40 miles. Radios in aircraft operating with the ARMER system function slightly different than radios on the ground.

Due to the interference potential from the larger coverage footprint of aircraft operated radios, the Federal Communications Commission (FCC) rules for operation of these radios limits the output power to help reduce interference, as frequency reuse is applicable in the ARMER system.

The ARMER sites transmit a list of adjacent control channels to subscribers registered to the site. This list is limited to 16 adjacent control channels. The aircraft radio could stay affiliated with a site and never be aware of a closer site's control channel.

There are a limited number of radios available for permanent aircraft mounting. The aircraft instrument panel has limited space, and a limited number of aircraft avionics manufactures are available for panel mounted ARMER radio installs.

Installation of aircraft mounted radios is governed by the FAA, and permanent installations must be performed by FAA certified personnel.

Flight tests of aircraft radios on the ARMER system were conducted by State Patrol aircraft and the Minnesota Department of Transportation (MnDOT) technical staff using various BER thresholds, output power, and in-line attenuators in the antenna feed line. These tests

were conducted with the aircraft flying across multiple sites and making a number of landings along the flight test route.

The best, overall aircraft operation was observed with use of a radio set for 2.5 watts into an antenna without an inline attenuator with a radio BER threshold setting of 2.5% and the radio set to no site preferences. These settings apply for both aircraft installed ARMER radios using remote mounted mobile radios and Technisonic-type aircraft control panel mounted avionics packages using internal portable radios.

3. Operational Context

Subscribers that acquire a large coverage footprint due to high altitude operations need to take the following into consideration:

- Potential interference due to frequency reuse throughout the ARMER system. This
 could cause interference to other ARMER system users. This interference could
 appear as an interruption, loss of communications, or as tailgating to other
 talkgroup transmissions on other sites.
- Aircraft radios will potentially cling to distant sights and outfly the adjacent control
 channel list of the site that the radio is affiliated to. This could cause short losses of
 the ARMER system while radios search for new sites. This loss could be as long as
 five to ten minutes while the radios searches all 800 MHz frequencies looking for a
 control channel.
- Loss of ARMER site affiliation during aircraft descent.

4. Recommended Protocol/Standard

All permanently aircraft installed ARMER radios shall comply with the FCC power output limitation of 1 watt ERP. This output is achieved by limiting the radio power to its minimum setting of 2 to 3 watts, which is reduced to 1 watt ERP through antenna feed line loss and use of a unity gain antenna.

Permanently mounted aircraft ARMER radios should be programmed with a BER threshold of 2.5%.

Permanently mounted aircraft ARMER should be programmed for no site preference.

For aircrews that are assigned portable radios, these portable radios should be programmed with 2.5 or 2.9% BER threshold and no site preferences.

Procedures for landing zone areas where communications with ground personnel are conducted on the ARMER system should be in compliance with State Standard 3.16.2.

In addition to the training requirement of State Standard 1.11.4, training for users of aircraft ARMER radios shall include a description of the issues surrounding airborne operation of ARMER radios:

- Site selection issues, especially the issue that could arise in descent and the loss of site affiliation
- Issues of potential interference to ARMER users due to system frequency reuse
- Personnel using portable radios in a limited capacity (observers, guests, etc.) and the potential for slower site switching, potential Federal Aviation Administration (FAA) and FCC rule violation, and interference

5. Recommended Procedure

- Installation and programming, as outlined in section 4 of this standard.
- Operation of Aircraft landing zone coordination, as described in State Standard 3.16.2
- In-flight transmissions should be as brief as possible, due to the potential interference as outlined in section 3 of this standard.

6. Management

The System Administrators of regions where ARMER equipped aircraft are based will be responsible for the oversight and compliance of this standard. Due to the potential of interference issues to expand beyond a specific region, MnDOT personnel should also be notified if any interference is detected and is believed to have been originated by an ARMER equipped aircraft.