INFORMATION FOR AGENCIES JOINING TACN

The Tennessee Advanced Communications Network (TACN) is a P-25 statewide 700/800 MHz system
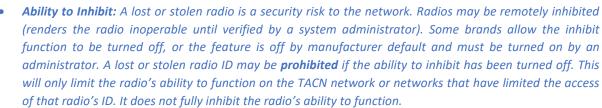
TACN MINIMUM REQUIREMENTS & RECOMMENDED BEST PRACTICES

Requirements for Devices on System:

- **Project 25 Phase II (TDMA) compliant:** *more information found here:* https://www.cisa.gov/safecom/project-25
- **Hardware System Key is required for all radios coming onto TACN**
- **Ability to Inhibit:** *A lost or stolen radio is a security risk to the network. Radios may be remotely inhibited (renders the radio inoperable until verified by a system administrator). Some brands allow the inhibit function to be turned off, or the feature is off by manufacturer default and must be turned on by an administrator. A lost or stolen radio ID may be* **prohibited** *if the ability to inhibit has been turned off. This will only limit the radio's ability to function on the TACN network or networks that have limited the access of that radio's ID. It does not fully inhibit the radio's ability to function.*

Recommendations and Best Practices:

- **TACN recommends partner agencies have clear policy for immediately reporting lost or stolen radios and that TACN administration is also notified as soon as the agency is notified by one of their end users.**
- **Encryption is optional,** *however, if used, ADP/ARC4 and DES algorithms will only be used for backwards compatibility and interoperability with legacy equipment and only when required. AES-256 is the recommended best practice (some Federal grants may require it: see more info here:* https://www.dhs.gov/science-and-technology/approved-grant-eligible-equipment*)*
- **Multi-key encryption:** *if using encryption- best practice indicates use of multi-key to avoid limiting interoperability with other agencies*

APPROVED VENDOR DEVICES, P-25 CAP TESTING, AND GRANTS ELIGIBILITY

TACN defers to the approved vendor devices list meeting P-25 Standards as defined by the Project 25 Compliance Assessment Program (P25 CAP), a partnership of the U.S. Department of Homeland Security's Science and Technology Directorate (DHS S&T) and SAFECOM. DHS-recognized laboratories provide P25 CAP testing for compliance to P25 CAP standards. The DHS S&T's "Approved (Grant-Eligible) Equipment" is the definitive list of products that meet the requirements and are allowable for purchase by FEMA and other federal entities.

Information on the P25 CAP program can be found here: https://www.dhs.gov/science-and-technology/p25-cap

Federal grants *have specific requirements for interoperability and encryption. Information on Federal grant-approved radio brand/devices can also be found here:* https://www.dhs.gov/science-and-technology/approved-grant-eligible-equipment

The TACN system is built around a Motorola core, therefore Motorola devices will have optimal performance while some of the proprietary features or functionality in other brands may not be fully compatible or do not operate as intended unless operating on a same-brand network core.

TACN cannot guarantee end users' radio device performance, therefore it is imperative to verify compatibility and system features of different brands will work as expected over a Motorola network core, before purchasing such radios or equipment intended to join the TACN network.

Department of
Safety &
Homeland Security

Capacity is the radio system's ability to support multiple conversations simultaneously. Several factors influence system capacity, including the number of "channels" or talk paths available at each tower site, the radio system protocol used (FDMA, TDMA, or DCA), and overall system design. Other external variables may include end users' peak talk times, number of end users affiliated to sites at a given time, and number of system-wide talk groups affiliated to sites.

TDMA or time division multiple access involves splitting talk time between two users, in milliseconds. This allows two conversations to take place seemingly simultaneously, on a single channel, effectively boosting the capacity of the radio channel.

FDMA or frequency division multiple access, entails dividing conversations by frequency. Only one conversation takes place at a time on the channel because the conversation is occurring on a specifically allocated part of the spectrum (that frequency assigned to the end user for that talk group at that moment). It is less efficient since only one talk group can utilize it at a time.

DCA or dynamic channel assignment, assigns end users based on demand and availability, enhancing overall system capacity by responding dynamically to varying usage scenarios, based on real-time demand and network conditions. This maximizes available capacity, making the system even more efficient. TACN has converted all sites to DCA; however, the system still must accommodate the least capable device on the system when it affiliates to a site (reverts to FDMA).

Sufficient capacity is at or below 30% utilization, depending on number of users during normal daily operations. The system more easily handles radio traffic during emergencies, spikes in activity, or other high-volume events.

Network congestion may occur when a tower site is consistently using around 60% of the available capacity during normal daily operations. Peak times, spikes in usage, or high-volume events may result in end users getting a "system busy" tone (sounds like a bonk), or channel not available (the number of end users and talk groups affiliating to the site in that moment is exceeding the system's available capacity).

The standard minimum number of channels at any tower site is 6 (often referred to as a 6-pack), while some sites have 12 or more. Each channel is housed in a server (sometimes referred to as a blade), inserted into a rack at the tower site equipment shelter.

A 6-channel site can support 10 conversations on 10 different talk groups simultaneously if they are all TDMA (one channel is always reserved for the control channel, which steers users to the available channels). When adding a new agency onto the system, it is necessary to assess the impact the agency's talk groups will have on the overall capacity at the tower site or sites to which the agency will affiliate. The assessment is an estimate, based on current radio traffic trends, number of existing talk groups already affiliated to the site, and additional talk groups to be added.

Tower sites and talk group activity/use is evaluated regularly to ensure adequate capacity on the system. When a partner agency begins to operate consistently at or above 60% capacity for daily operations, a recommendation may be made that they add capacity to the system.

FLEETMAPPING & TALK GROUPS

*The **fleetmap** is how talk groups are arranged and assigned in the end user's portable radio for programming. Each zone holds 16 talk groups. The first zone is usually programmed with the user's home agency or primary talk group (main dispatch), and then further arranged according to use (tactical, operational, mutual response, events, mutual aids, talk-arounds, etc.). All agencies who join TACN are given both Mutual Aid talk groups as well as Statewide Interoperability talk groups or TGs.*

The agency's zones can be named according to preference for their own TGs. For example, Primary, Home, Alpha, Zone 1, etc. Other state and national interoperability zones follow standard nomenclature and order within the zone. The following is a sampling of fleetmap zones, local, State Parks, the Statewide Interops, and nationwide VHF.

Coffee County	State Parks	Statewide IO	VHF Nationwide IO
COFFEE CNTY SO	**HENRY HORTON SP**	**TN INTEROP**	**VHF INTEROP**
Coffee SO	Henry Horton	TN CALL	VCALL10
SO TAC 2	Hen Htn TACN	TN IO 1	VTAC11
Coffee Net	Marshall SD1	TN IO 2	VTAC12
LE MA 1	Marshall SD2	TN IO 3	VTAC13
LE MA 13	D7Disp 1	TN IO 4	VTAC14
Manchester PD	D7 Disp 2	TN IO 5	VTNMA
Manchester FD	TDEC Statewide	TN IO 6	VTNMAD
County FD/RS	Parks TAC	TN IO 7	VTNTAC
Coffee EMA	TDEC	TN IO 8	VLAW31
Coffee EMS	TSP 1	TN IO 9	VLAW32
THP Statewide	TSP 2	TN IO 10	VLAW33
TN CALL	Law Mut Aid 16	TN IO 11	VTAC34
MNCSTR PD TAC2	Law Mut Aid 17	TN IO 12	VTAC35
Coffee SO TAC1	Law Mut Aid 18	TN IO 13	VTAC36
Coffee SIU 2		TN IO 14	VTAC37
		TN IO 15	VTAC38

User fees are not currently levied for agencies joining TACN. The State's goal is to foster interoperability between state and local agencies by requiring statewide interoperability and mutual aid talk groups for radios on the system.

When agencies express intent to join TACN for daily operations, the TACN team will assess their talk group request and utilize a matrix to calculate the appropriate number of talk groups given to the agency for daily use on the system. The matrix takes into consideration existing system capacity for the tower sites to which the agency will affiliate, as well as the other State users already on the site/s, any resources or existing infrastructure the joining agency is providing or sharing, and any historical/current usage data the joining agency is able to provide.

Department of
Safety &
Homeland Security

TALK GROUP PRIORITY

Talk group priority is standardized across the system, with types of end users grouped together and prioritized uniformly. Public safety primary dispatch TGs have the highest priority, followed by secondary public safety TGs, then public works, public transportation, schools, and other non-public safety last. Priorities are assigned 1-10; however, priority 1 is always reserved for emergency button activation.

Understanding how talk groups are prioritized on the system in coordination with proper talk group management during an incident or event can mitigate network congestion issues during peak talk times.

Example: grouping strike teams performing similar assignments onto one tactical talk group rather than separate talk groups for each team (conserves talk group capacity), or moving an emergency utility response onto a mutual aid to gain higher priority in the system during the response (provides the utility with equal access as Law, Fire, and EMS while on assignment to the incident/event).

Priority 1	Emergency button activation
Priority 2-3	Primary Dispatch TGs for public safety responders (Law, Fire, EMS, & Electric)
Priority 4-7	Secondary public safety TGs (TAC's, Events, Special Units, Incident talk groups and TACN Mutual Aids)
Priority 8-10	Public Works, Public Transportation, Schools, non-public safety TGs

NETWORK DYNAMIC SYSTEM RESILLIENCY (DSR)

TACN operates four redundant cores to provide dynamic system resiliency. The network cores are redundant and geographically diverse and designed to switch automatically and seamlessly in the event a core site goes down, which is a very rare occurrence.

Triggering events *that may impact the system at a regional or site-specific level are planned or emergency maintenance and weather-related incidents: high winds or tornados, lightning strikes, and snow/ice. A tower site is not often damaged by these weather events; however, loss of commercial power is always closely monitored. All sites are equipped with UPS battery back-ups and emergency generators with an on-site fuel source. Continued operation of the site is then dependent on the number of hours of remaining fuel or restoration of commercial power, either of which may be impacted by external factors such as on-going weather conditions, ingress/egress to the site for refueling, availability of resources, and restoration priority efforts by the commercial power provider.*

Site trunking: if a tower site loses connectivity with the network core, it is operating in "site trunking" which means it is no longer a "repeated" site. The users affiliated to that site will still be able to talk to one another, but their radio traffic will not be repeated beyond that tower. This means radio traffic will not reach others monitoring the same talk group who are affiliated to another tower, and towers in site trunking cannot relay traffic to a dispatch center unless that center is also affiliated to the tower that is in site trunking.

Notifications to partners: If necessary, as a planned event for maintenance or repair, agencies affiliated to affected site/s will be notified well before a site is taken off-line. This is part of the Method of Procedure (MOP) under the maintenance plan. For emergency repairs or service impact to a site, notifications are made as soon as possible to partner agencies who may be impacted by degradation of service.