Title:	Signal Boosters	SOP No:	ITS-RADIO-018
Revision:	1.0	Effective Date:	October 29, 2014
Owner:	Manager - Radio Services	Department:	IT Solutions

Signal Boosters

1 Purpose

Implement an engagement procedure with specific guidelines for CFW P25 radio system customers to request approval to procure, install and operate signal boosters.

2 Scope

This policy applies to internal and external agencies that utilize the CFW P25 radio network for primary communications and require enhanced radio communications in specific use cases that may be achieved by the installation of signal boosters. Signal boosters are also commonly referred to as bidirectional amplifiers or signal amplifiers.

External agencies that are not FCC license holders must obtain documented consent by the City of Fort Worth if their signal booster operates on the P25 radio network. This stipulation is a requirement of the FCC Report and Order referenced in section 3.

3 References

FCC 13-21A1 Report and Order
https://apps.fcc.gov/edocs_public/attachmatch/FCC-13-21A1.pdf

4 Conditions for Exemption

Exceptions to the policy must be approved by the Senior Manager over Radio Services.

5 Justification

Public safety entities that operate private land mobile radio (PLMR) and public safety radio services provide mission critical and emergency response radio communications services to their customers. Because Part 90 channels are interleaved, PLMR licenses are sometimes not adjacent and create unique design and interference considerations. As such, the FCC has defined a specific class of industrial signal boosters with regulatory considerations as defined in the Report and Order referenced in section 3.

It is critical that signal boosters installed for improved or additional radio coverage in specific facilities meet FCC and industry standard specifications for optimal performance and functionality. Signal boosters must not introduce interference or introduce adverse coverage effects to the CFW P25 radio system. Therefore, a policy is necessary to enforce their implementation and ongoing performance.

6 Signal Boosters Implementation Procedures

The FCC Report and Order 13-21A1 establishes rules applicable to new and existing signal boosters, which are effective March 1, 2014.

The goal of the regulatory framework is to ensure signal boosters do not degrade the performance of Public Safety wireless networks and are designed to mitigate interference. Key points are summarized below, but are not all inclusive. Agencies operating and/or requesting signal boosters must comply with the FCC Report and Order referenced in section 3 and applicable FCC Part 90 rules in their entirety.

- Signal boosters installed for Public Safety entities are considered industrial as defined by FCC part 90 rules and are authorized on a secondary non-interference basis only. They require installation by licensees or qualified installers.
- As documented in section 6.1, non-licensees must obtain documented consent of the licensee namely the City of Fort Worth prior to procuring, installing or operating signal boosters. This requirement is also applicable to existing signal boosters. Thus, a need to establish a coordinated process for signal booster implementation between the CFW and non-license holders is necessary.
- Agencies requesting signal boosters must provide an engineering analysis of the noise floor, emission limits and interference potential of the equipment. Additional requirements are documented in section 6.2.
- Existing signal booster operators will be handled by the CFW on a case-by-case basis to fulfill written consent and regulatory requirements.
- Industrial Class A narrowband signal boosters are permitted in both fixed and mobile environments provided they do not introduce interference to other licensed services.
- Industrial Class B wideband signal boosters are authorized only in fixed deployments for specific applications. Mobile deployments of Class B wideband signal boosters are not permitted by the FCC.

6.1 Signal Boosters Acquisition Process

Agencies that are non-licensees and desire to procure a signal booster to amplify signals on the CFW P25 radio network must comply with the procedure outlined in Figure 1. First, the individual entities ILA with the City of Fort Worth must include provisions for signal boosters.

The process is initiated once a written justification is provided by the requesting agency to the City of Fort Worth Radio System Manager indicating the need, application and installation specifics of the device. All relevant information such as make, model, manufacturer and specifications should be included. Additionally, the agency must provide a professional engineering analysis specifically documenting the noise floor, potential interference, and coverage impact and emission limits of the potential signal booster. The requesting agency's ILA with the CFW must include signal booster services.

The City of Fort Worth will review the agency's provided justification and engineering analysis. If necessary, the appropriate CFW staff will contact the agency for site visits, additional communication or supplementary information. The signal booster request will either be approved in writing via letter, email or other record or denied with a documented reason for refusal. Written approval is the City's consent for the external agency to move forward with procurement, installation and testing of the signal booster per FCC Report and Order requirements referenced in section 3. If the signal booster request is refused, the external agency may resubmit an alternative proposal and/or provide any additional information requested by the City of Fort Worth.

Approved signal boosters can be procured and installed in accordance with the approved proposal. Once activated, a post-installation engineering analysis is necessary to validate that final performance specifications meet those designated in the original approved proposal. Final signal booster test results must be resubmitted to the CFW Radio Manager for review. If any discrepancies or issues are a concern the City will work with the external agency to resolve them. If the problem cannot be fixed, the CFW may deem it necessary to revoke its approval of the signal booster.

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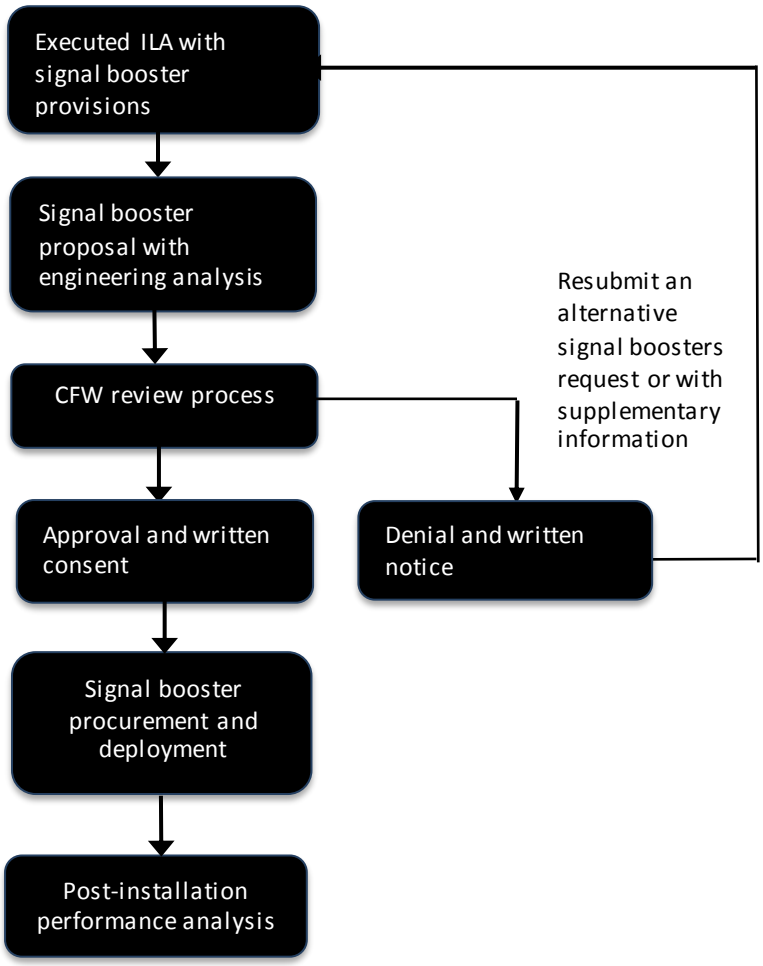

Figure 1: Signal Boosters Acquisition Process

External agencies that are non-licensees and operating existing signal boosters Existing signal booster operators will be handled by the CFW on a case-by-case basis to fulfill written consent and regulatory requirements.

Existing signal boosters that are suspected of malfunctioning and/or causing interference issues impacting communications on the CFW radio system must be investigated by the signal booster operator. The signal booster operator is responsible for further engineering analysis, mitigation and all associated costs. The City will withdraw its consent for operation if detrimental impact to primary licensed operations is evident.

6.2 Signal Boosters Implementation Guidelines

The guidelines below provide general signal boosters specifications for external agencies. However please note that all requirements outlined in the FCC Report and Order referenced in section 3 must be fulfilled.

- FCC Part 90, specifically 90.219 designates regulatory requirements for public safety industrial signal boosters. Signal boosters should be limited to confined areas such as large facilities or other structures where the resulting amplified signal would remain contained.
- Per the FCC Report and Order, public safety entities may procure industrial signal boosters without additional licensing requirements if the deployment does not extend service area boundary per 90.219. These signal boosters will only amplify the specific licensed channels.
- Effective March 1, 2014 Industrial signal boosters must be appropriately labeled by the manufacturer indicating the requirement for written licensee consent also identifying it as a Class A or B device. This requirement is indicated in the FCC Report and Order referenced in section 3.
- Industrial signal boosters must be Class A narrowband for fixed or mobile applications or Class B wideband for fixed implementations only.
- Class B implementations should be restricted for use cases where multiple licensees require enhanced communications. In this scenario, external antennas should be utilized and the amplified signal contained within confined areas. Additionally, by November 1, 2014, Class B signal boosters must be registered with the FCC. Registration must include the operating range of the Class B signal booster, physical location and point of contact. Registration will allow licensees experiencing interference to identify the source and point of contact. Class B signal booster operators may not amplify any service bands without express license or licensee consent or commercial service bands.
- Industrial signal boosters must be designed with customized frequencies, antenna systems and power output specific to the requesting agency's application and subscribers serviced. Additionally, noise floor and interference specifications must be included as part of the engineering design. The CFW also recommends a spectrum analysis.
- Industrial signal boosters can only be deployed by license holders, or by expressed consent of license holders. Therefore, all requesting external agencies operating on the CFW for primary radio communications must comply with 6.1.
- Class A and Class B signal boosters authorized by 90.219 are limited to 5-Watts ERP transmitting power to limit potential for interference. Class A devices passband per channel must be no larger than 75 kHz. However, RF exposure compliance of power limits is still applicable. Signal booster operators may not amplify service bands where they do not have a license or licensee consent.

- The FCC R&O referenced in section 3 also requires all Industrial signal boosters both Class A and B to suppress spurious emissions so they don't exceed -13dBm within any 100kHz measurement bandwidth. The noise figure of the signal boosters must be limited so it does not exceed 9dB in either direction.
- The FCC has established engineering best practices for signal booster installations whose compliance is that in a 10kHz measurement bandwidth the ERP of intermodulation products should not exceed -20dBm and the ERP of noise within the signal booster passband should not exceed -43dBm. Also, the noise of spectrum more than 1MHz outside of the signal booster passband should not exceed -70dBm.

Version Control

Version	Date	Description	Author
1.0	10/29/2014	Original version	Abinta Khan