TCOMM911 IN-BUILDING ERCES DESIGN APPROVAL PROCESS

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Definitions

AGC - Automatic Gain Control.

AHJ - Authority Having Jurisdiction.

BDA – Bi-Directional Amplifier receives, amplifies, and broadcasts radio signal back and forth from a radio site allowing re-transmission using a DAS inside a building.

DAQ - Delivered Audio Quality.

DAS – Distributed Antenna System are the antennas located throughout a building that connect to a BDA allowing two-way communication using an external radio network.

dB: A method for specifying the ratio of two signals, which is equal to 10 times the log of the ratio of the power of the two signals.

dBd: Power ratio in decibels of a signal compared to a reference dipole (defined as 2.15 dBi).

dBi: Power ratio in decibels of a signal compared to an isotropic radiator.

dBm: Power ratio in decibels of the measured power referenced to one milliwatt.

DL – Downlink is the link from the radio system to the end user.

ERCES – Emergency Radio Communication Enhancement System, also referred to as BDA/DAS, or DAS.

ERP - Effective Radiated Power.

FCC Class A - A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75kHz.

FCC GROL - General Radiotelephone Operator License.

P25 Phase 2 - A suite of standards focusing on interoperable radio communications. Phase 2 is time-division multiple access (TDMA).

TCERN – Thurston County Emergency Radio Network - The new P25 digital radio network for first responders.

TCOMM911 – Thurston 911 Communications - The agency that owns and operates the TCERN system infrastructure and 911 emergency dispatch center.

TCOMM911 Radio Systems Department – The radio department is responsible for the system performance of TCERN.

TDI - Time Domain Interference.

UL - Uplink is the link between the end user and the radio system.

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Design Approval Process

1.1. Purpose

Thurston 911 Communication (TCOMM911) has instituted design review and approval for in-building ERCES (Emergency Radio Communication Enhancement Systems, also referred to as BDA/DAS or DAS) operating within Thurston County to:

- Better integrate radio operator approval with fire AHJ approval processes.
- Verify adherence to TCOMM911 technical criteria and the uplink validation process. See the appendix for links to supplemental documentation.
- Reduce risk to property developers and ERCES vendors when commissioning ERCES.

1.2. Limitation of Authority

Successful completion of the TCOMM911 design approval process does not preclude or guarantee approval by the local fire code authority, building authority, or any other authority having jurisdiction.

1.3. Request to TCOMM911 for a New ERCES and Donor Site

When a vendor is engaged with a property owner/developer to install a new ERCES in Thurston County the Vendor must submit a request to TCOMM911 to have a donor site identified for the new installation. All requests are made via email to RadioHelpDesk@tcomm911.org. The following information must be provided in the request:

- Civic Address for the property
- Property Owner Contact information
    - Name
    - Address
    - Phone Number
    - Email
- Installer/Vendor Contact Information
    - Name
    - Address
    - Phone Number
    - Email
- Lat/Long of the donor antenna location
- Height above ground for the donor antenna

When the request is received, TCOMM will:

- Create a record for the property.
- Identify an appropriate donor site and advise the vendor including azimuth information for the donor antenna.

Any changes to the donor antenna location must be highlighted in the design submission document. If during the installation process a clear path to the donor site is unavailable, vendors must immediately contact TCOMM911 to request an alternate donor site.

1.4. TCOMM911 ERCES Design Submittal Process

ERCES design submittals (refer to section 0) are submitted to TCOMM911 via email to RadioHelpDesk@tcomm911.org.

Upon receipt, TCOMM911 will:

- Review the submittal for conformance to this document as well as the most current TCOMM911 technical criteria document available @ https://tcomm911.org/in-building-erces-resources/.
- Document the review using the TCOMM ERCES Design Approval Checklist.
- Report status and send a copy of the TCOMM ERCES Design Approval Checklist to the submitter.
- Deficiencies, if any, will be documented in the checklist. Requests for modification of design documentation will be made via email to the submitter.
- Approval of design documentation will be communicated via a signed checklist sent by email to the submitter.

1.5. Design Changes After Approval

Reapproval is required for any design changes materially impacting RF propagation or system performance. Resubmittals should be made as a new request by email to RadioHelpDesk@tcomm911.org. A copy of the previously granted approval must be included. Examples of changes requiring reapproval include but are not limited to:

- Substitution of active (powered) ERCES components.
- Relocation of the donor antenna.
- Orientation of the donor antenna to a different donor site.
- Relocation of a ERCES service antenna more than 10 feet.

- Link budget adjustment due to changes in directional couplers, splitters, tappers, or the addition or removal of more than 50' of coaxial cable.

1.6. Next Steps Following Design Approval

Following receipt of design approval, ERCES vendors will:

- Install ERCES.
- Obtain signatures from property owner/developer on rebroadcast agreement.
- Obtain test radios from TCOMM911.
- Perform and submit the Uplink Validation checklist.
- Schedule Uplink Validation with TCOMM911 technical staff.
- Demonstrate Uplink Validation performance.

Note that design approval from TCOMM911 is not a substitute for building permits that me be required.

Upon satisfactory completion, TCOMM911 will execute a rebroadcast agreement with the property owner.

Design Submittal Requirements

2.1. Transmittals

Transmittals will be submitted via the service portal and must include a point of contact for response to this request.

Documents must be submitted in a flattened (non-editable) PDF format using a secure cloud storage service such as Box, OneDrive, DropBox, Google Drive, etc.

Submittals must include the following:

- ERCES designer qualifications (NICET In-Building Public Safety Communications (IB-PSC) Certified).
- ERCES construction floor plans.
- ERCES donor antenna information (make, model, RF parameters, etc.).
- ERCES one-line diagram.
- ERCES equipment list.
- ERCES equipment cut sheets for each component.

- ERCES performance calculations.
- ERCES coverage predictions using industry recognized software like iBwave.
- A fully executed TCOMM911 Rebroadcast agreement.

All documentation must comply with the following requirements:

- Documents should follow ASME or ISO standards and must be of sufficient quality and free of extraneous markings to be legible.
- Color is permitted but documents must be legible in grayscale.

Transmittal Details

2.2. ERCES Designer Qualifications

In addition to the FCC GROL and a certificate issued by the manufacturer of the equipment being installed, TCOMM911 highly recommends that ERCES designers have a NICET In-Building Public Safety Communications (IB-PSC) Certification.

Pass/Fail Criteria:

- Proof of certification must be included.

2.3. ERCES Construction Floor Plans

All drawings:

- Must match the same orientation.
- Documentation must follow ASME or ISO drafting standards and be legible to distinguish items. Hand drawn floor plans will not be accepted.
- Must show the location with unique labels of each cable, splitter, coupler, tapper, antenna, BDA, fiber-fed remote, and donor antenna.

Pass/Fail Criteria:

- Drawings must conform to requirements.

2.4. ERCES Donor Antenna Information

TCOMM911 will specify the donor site to be used. If, for any reason, there are questions regarding donor site selection, please contact TCOMM911 at RadioHelpDesk@tcomm911.org.

ERCES donor information must be submitted as one of the construction floor plans, conforming to the requirements in 2.3. When considering a ERCES and radio coverage, please consider the following from the TCOMM911 technical criteria:

ERCES donor information shall include the following:

- Google Earth elevation profile between building location and specified donor site (TCOMM911 retains the right to require use of an alternate donor site).
- Straight-line distance to the donor site.
- Google Earth 1/4 mile surroundings view with donor azimuth indicated.
- Indication on roof floor plan of proposed donor location.

Pass/Fail Criteria:

- All items must be present.
- Donor line of sight shall be unobstructed, or explanation shall be provided as to why obstructed line of sight is the best choice.

2.5. ERCES One-Line Diagram

ERCES one-line diagram(s) must be submitted as one of the construction floor plans, conforming to the requirements in 2.3.

ERCES one-line diagram(s) must show interconnection of all system components displayed on a building elevation.

Pass/Fail Criteria

- All items must be present.

2.6. ERCES Equipment List

ERCES equipment list shall include the following components if present:

- BDA.
- Fiber head-end.
- Fiber-fed remote.
- Fiber jumpers and connectors.
- Coaxial cable.
- Donor antenna.

- ERCES/Service antennas.
- Lightning arrestor.
- Splitters/Couplers/Tappers.
- External filters.

For each component in the equipment list, provide:

- Manufacturer.
- Model number.
- Options or Licenses as appropriate.
- Quantity.
- Unit (if length of cable).

Pass/Fail Criteria

- All items must be present.

2.7. ERCES Equipment Cut Sheets

Manufacturer information sheets shall be provided for each item on the ERCES equipment list. Any effort to minimize sales literature and only provide RF transmission equipment specifications is appreciated.

Conformance to the TCERN ERCES Technical Criteria (see appendix) will be demonstrated through the equipment cut sheets. Mark up documents with boxes or arrows to describe how these are met.

Pass/Fail Criteria:

- All items must be present.

2.8. Downlink Performance Calculations

Provide the following table:

Est. DL Output		Add green columns, subtract red columns			
Donor ERP	FSPL	Donor ant. gain (in dBd)	Cable + ins. loss to BDA donor port	BDA DL gain	DL PPCH output

Use DL power per channel output for your coverage prediction mapping

Pass/Fail Criteria:

- All items must be present
- DL PPCH must be used to generate coverage prediction mapping

2.9. Uplink Performance Calculations

DAS link budgeting and propagation modeling should be configured for signal level at hip height (3 ft) and with 15dB of body loss.

Provide the following table for the 3 lowest transmission locations served by different antennas, and 1 highest transmission while measuring with a resolution bandwidth of 10 kHz:

Lowest UL Receive		**Add green columns, subtract red columns**						
Antenna ID	Portable ERP	Body loss + loss from portable to ant.	Cable + ins. loss to BDA DAS port	BDA UL gain	Donor insertion loss	Donor ant. gain (in dBd)	Loss to donor (include RX delta)	Expected receive at site

Highest UL Receive		**Add green columns, subtract red columns**						
Antenna ID	Portable ERP	Body loss + loss from portable to ant.	Cable + ins. loss to BDA DAS port	BDA UL gain	Donor insertion loss	Donor ant. gain (in dBd)	Loss to donor (include RX delta)	Expected receive at site

Indicate on coverage predictions the expected 3 lowest uplink transmission power locations and 1 highest power location.

Provide a statement of how the combination of BDA channelized AGC and dynamic receive range at the broadcast site between -75dBm and -100dBm will satisfy best- and worst-case transmissions.

Pass/Fail Criteria:

- All items must be present
  - Calculations table
  - Arrows or clouds on coverage predictions identifying the highest and lowest UL locations
  - Statement of means to achieve signal between -75dBm and -100dBm at donor site
- Dynamic range of uplink transmissions, accounting for AGC, must arrive at donor site within-75dBm and -100dBm.
- Max ERP must be ≤ +37dBm per channel

2.10. ERCES Coverage Predictions

- Conforming to the requirements in 2.3, provide coverage predictions using industry standard tools like iBwave for each floor and area receiving ERCES coverage on individual floorplans.
- Provide a legend for the prediction color code, including the percent of floor area receiving at least the indicated level of signal.
- Any portion of the building where coverage is planned to be provided by either through-floor signal or macro coverage must be clouded and noted. Through-floor coverage notation must also describe the material composition of the floor and the expected attenuation.

Pass/Fail Criteria:

- All items must be present.
- Minimum downlink signal strength of -95dBm in 95% of coverage area, and 99% of critical areas.

TCOMM911 Rebroadcast Agreement

Attach a completed rebroadcast agreement signed and dated by the property owner.

Pass/Fail Criteria:

- Completed rebroadcast agreement submitted.

References

TCOMM911 In-Building ERCES Technical Criteria available at https://tcomm911.org/in-building-ERCES-resources/

FCC 90.219
https://www.law.cornell.edu/cfr/text/47/90.219

NFPA 1221
https://www.nfpa.org/codes-and-standards/nfpa-1221-standard-development/1221

TIA Project 25
http://standards.tiaonline.org/standards/technology/project_25/index.cfm

TSB-88.1-E
https://global.ihs.com/doc_detail.cfm?document_name=TIA%20TSB%2D88%2E1&item_s_key=00504960

WAC 51-54A-0510 – Emergency Responder Communication Coverage
https://app.leg.wa.gov/wac/default.aspx?cite=51-54A-0510#:~:text=The%20building%20shall%20be%20considered,building%20meet%20the%20signal%20strength