



Douglas County Sheriff's Office Radio Shop

POLICY: ERCES
Implementation Guidelines

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The Douglas County Sheriff's Office Radio Shop (DCSORS) is responsible for the operation and maintenance of the Colorado DTRS 700MHz & 800MHz (CODTRS) Project 25 (P25) trunked radio system within Douglas County. As the FCC license custodian, DCSORS issues authorization for all radio transmitters communicating through this system in accordance with FCC regulation CFR 47 Part 90. This includes all in-building Emergency Responder Communications Enhancement Systems (*ERCES*, aka BDA systems).

The ERCES technical design, implementation, operation, and maintenance will abide by the specifications supplied by DCSORS herein. The intent of this document is to assist the building owner and/or owner's agent inclusive of owner's designated ERCES design/installation contractor (hereafter and collectively referred to as *Owner*) in securing approval for construction, verification of operation and ultimately approval for continuing operation of the ERCES.

National Fire Protection Association (NFPA), locally adopted and/or amended International Fire Code (IFC), and local City ordinances (collectively and hereafter, *Fire Code*) define building Owner's responsibilities for the design, installation, and maintenance of ERCES if in-building radio coverage is inadequate to support reliable public safety two-way radio communications via the CODTRS.

ERCES permitting may be required by the Authority Having Jurisdiction (AHJ) or building department; any permitting work shall be coordinated through the AHJ. It is the responsibility of the Owner to execute all steps in proper order and secure all permissions and permits prior to ERCES construction or activation. Failure to do so may result in delays, penalties or denial of approval to operate a given ERCES.

The system shall not be left in a powered-on state, with donor antenna connected, except for testing during regular business hours, until final inspection has been completed, and final approval has been issued by DCSORS.

This document is effective for all ERCES initial submittals or projects received on or after August 1st, 2025. All AHJs operating within Douglas County have reviewed this document and agreed to its content.

All radio-related email correspondence regarding ERCES matters should be directed to ERCES@dcsheriff.net. Any discrepancies between Fire Code and this document shall be addressed with AHJ and DCSORS.

Regards,
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Important Notes:

1. DCSORS has standardized on the use of PCTEL SeeHawk tools for ERCES-related testing and reporting. This document will refer to the following:
 - SeeHawk® Touch & IBflex scanner for RF coverage testing and reporting (hereafter *IBflex*);
 - SeeHawk® Monitor for RF spectrum monitoring at Donor Sites and RF uplink testing (hereafter *Monitor*);
 - SeeHawk® Central for cloud-based standardized RF coverage test setup/profiles, workflow automation, and related shared ERCES report documentation repository (hereafter *Central*).
2. This document references the Safer Building Coalition’s *Complete ERCES Handbook*, first edition, by Alan Perdue, Mike Brownson, and John S. Foley, originally published 2023. (hereafter *SBC Handbook*).
3. There will be a cost to the Owner for use of *Central*. There is no cost to the AHJ for use of *Central*.



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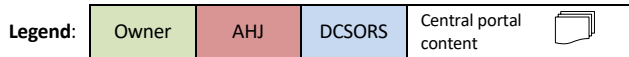
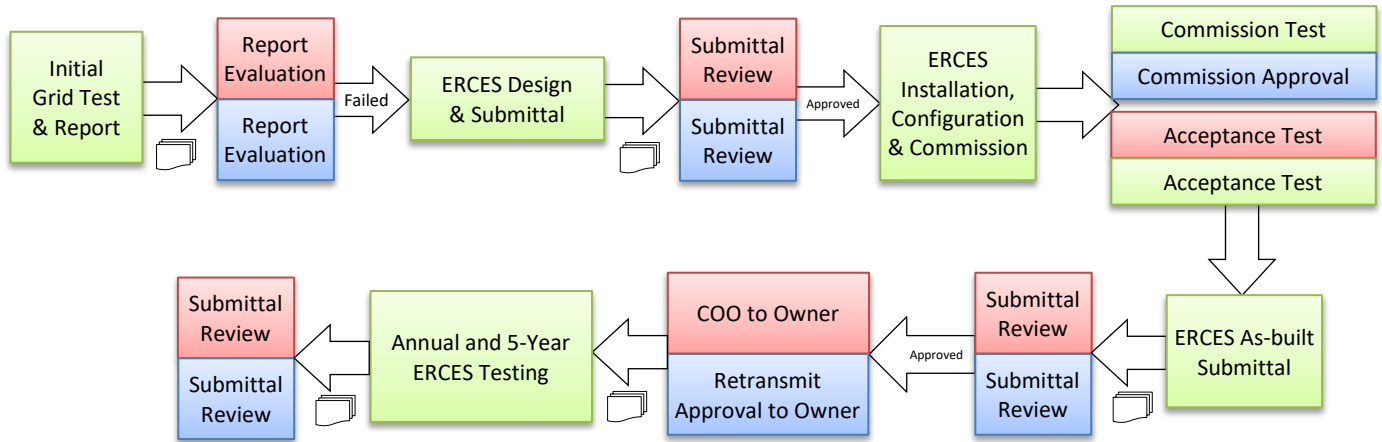
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Definitions

AHJ	Authority Having Jurisdiction	ERCES	Emergency Responder Communications Enhancement System. Also referred to as BDA system, RES, ERRCS, Booster System.
AGC	Auto Gain Control. BDA adjustment to protect the BDA from excessive RF input power, both UL & DL.	FACP	Fire Alarm Control Panel
ALC	Auto Level Control. BDA adjustment that controls maximum RF composite power, both UL & DL.	(F)BER	(Frame) Bit Error Rate
Band 14	Specific frequencies in the 700MHz range dedicated to FirstNet operation	FCC	Federal Communications Commission
BBU	Battery Back-Up Unit	GROL	FCC General Radio Operator License
BDA	Bi-Directional Amplifier. The active electronic element in an ERCES; aka signal booster.	IBWAVE	In-building radio system planning software
CO DTRS	Colorado Digital Trunk Radio System	LOS	Line of Sight
CLASS A BDA	A signal booster designed to retransmit channelized RF signals within a narrow frequency band (<75KHz)	LBR	Link Budget Report
CLASS B BDA	A signal booster designed to retransmit any RF signals within a frequency band wider than 75kHz	NEAR & FAR FIELD	Near: the physical location within each building floor with the strongest DL signal. Far: the physical location within each building floor with the weakest DL signal.
CW	Constant Wave, RF signal tone near the desired RF channel used for testing ERCES operation.	NICET	National Institute for Certification in Engineering Technologies
DAQ	Delivered Audio Quality. A measure of audio quality over a transmission medium.	NFPA	National Fire Prevention Association
DAS	Distributed Antenna System. Passive portion of ERCES consisting of coaxial cable, passive RF power dividing devices, and antennas within the facility; fed by the BDA.	RANPLAN	In-building radio system planning software
DCSO	Douglas County Sheriff's Office	RF	Radio Frequency
DCSORS	Douglas County Sheriff's Office Radio Shop or their designated representative.	SCIF	Sensitive Compartmented Information Facility. Secure building area that suppresses sensitive data leakage, including RF signals, across its boundary.
DL	Downlink. The RF signal from tower-based Donor Site to portable radio.	SERVICE ANTENNA	Indoor antenna withing the DAS; aka DAS antenna.
DONOR ANTENNA	Primary building-top outdoor antenna providing the RF link between the BDA and the donor site	SINR	Signal to Interference + Noise Ratio reference value
DONOR SITE	DCSORS radio repeater site serving the ERCES.	UL	Uplink. The RF signal path from the portable radio to the Donor Site.
EPO	Emergency Power Off. Method to disable the power to the BDA.	Unique Site ID	A building-unique identification number used to track the ERCES project
ERFPO	Emergency RF Power Off. Method to disable the RF UL & DL within the BDA.	UPS	Uninterruptable Power Supply



ERCES Process Flow



Notes:

- This flow may differ slightly for each AHJ. Example: some AHJs may review initial Grid Tests only if the building fails the test.
- A more detailed process framework can be found in *SBC Handbook*, pages 154-157.
- Owner should expect this process to take between 45 and 120 days. Owner should consider this project timeline when developing their construction schedule.



Step 1: Initial (Baseline) Radio Coverage Testing and Reporting Process

Weak or non-existent in-building 2-way radio coverage for first responders can be devastating during times of an emergency. As a matter of Fire Code compliance, after substantial construction completion and prior to Certificate of Occupancy, Owners of new or substantially remodeled buildings must perform an in-building public safety radio coverage test to evaluate if ERCES is needed to enhance the RF signal level within the building.

Owner Submits Coverage Test Request Form to DCSORS	DCSORS form (see https://apps.dcssoapps.com/erces/)
DCSORS Provides Owner with Test Parameter Details	<ul style="list-style-type: none"> • A list of required public safety radio frequencies and donor site(s) to be evaluated during the tests. • Test parameters: <ul style="list-style-type: none"> ○ Follow grid size as dictated by Fire Code. Minimum of twelve (12) samples per grid. ○ Test all floors of facility. ○ A signal level resulting in SINR greater than 20 dB and FER less than 2.0% (provides a safety margin to achieve a 3.0 DAQ score) across 95% of non-critical areas and 99% of critical areas. • Instructions and credentials to be used for transferring test results and associated documents directly to <i>Central</i> workspace. <p>Note: Owner may dictate a smaller grid size than is specified in Fire Code. Note: To conduct the RF coverage tests, DCSORS will provide the <i>Central</i> workspace name which includes the radio frequencies and threshold criteria for pass/fail. Note: DCSORS may provide IBflex loaner test equipment, given a security deposit, to an Owner provides proof of certification for IBflex RF scanner test equipment. DCSORS may loan copies of reference materials contained in this document. Note: A table of SINR (SINAD) to DAQ equivalence can be found in the TIA TSB-88-B document.</p>
Owner Performs RF Coverage Test	<ul style="list-style-type: none"> • Perform initial RF DL grid coverage test. • If Owner believes ERCES will be required, then: <ul style="list-style-type: none"> ○ At all locations being considered for the Donor antenna location on the roof, measure and document over-air Donor Site DL control channel power level, SINR level, and FBER. This will educate a decision if the signal is good enough to amplify and to educate best Donor Site selection. • Upload test results to the <i>Central</i> workspace. <p>Note: AHJ may require permit for this coverage grid test.</p>
Coverage Test Evaluation	<ul style="list-style-type: none"> • DCSORS will validate the grid test results to ensure compliance with test parameters. • AHJ will evaluate the grid test results to determine if the building requires ERCES. • AHJ will communicate ERCES requirement decision to Owner. • Owner shall upload AHJ-provided reviewed documents to <i>Central</i>.



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☞ If ERCES is required for the building, continue to **Step 2: ERCES Application and Approval Process**.

Step 2: ERCES Application and Approval Process

AHJs and other first responders desire reliable in-building 2-way radio communications in times of emergency. Once an ERCES's need is determined, it is the AHJ's responsibility to enforce the Fire Code that dictates ERCES design, permitting, construction, acceptance testing, and on-going maintenance & testing.

Owners desire a structured and well-communicated process & requirements for the ERCES design/build to ensure compliance with Fire Code and to simplify their workflows.

Assuming ERCES is required, as a matter of Fire Code compliance, owners of new or substantially remodeled buildings must complete the design, construction, compliance testing, and annual testing of the ERCES.

Owner Performs ERCES Design	<ul style="list-style-type: none"> See APPENDIX on <i>ERCES Design & Operating Requirements</i>
Owner Submits ERCES Design Package for Permitting	<ul style="list-style-type: none"> See APPENDIX on <i>Common Submittal Requirements</i> See APPENDIX on <i>Minimum Design Submittal Requirements</i> Submittals shall be uploaded to <i>Central</i> workspace for approval. <p>Note: AHJ may require plan submittal to an additional portal.</p>
AHJ and DCSORS Design Review	<ul style="list-style-type: none"> AHJ will review the submittal to determine acceptability per Fire Code and notate any required modification or correction. DCSORS will review the submittal to determine acceptability for operation within the CODTRS and notate any required modification or correction. Once accepted by AHJ and DCSORS: <ul style="list-style-type: none"> AHJ will provide Owner with a design approval documentation. DCSORS will send a <i>Letter of Authorization for Provisional Retransmission</i> which shall include a Unique Site ID. Construction may not commence until Owner's receipt of both AHJ and DCSORS approval documentation. <p>Note: Additional permits may be required by the AHJ for each project.</p>
Owner Performs ERCES Construction	<ul style="list-style-type: none"> See APPENDIX on <i>ERCES Installation Requirements</i>
ERCES Acceptance Test and Documentation	<ul style="list-style-type: none"> See APPENDIX on <i>ERCES Acceptance Testing & Final Approval</i>



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Owner Submits As-built Package	<ul style="list-style-type: none"> • See APPENDIX on <i>Common Submittal Requirements</i> • See APPENDIX on <i>Minimum As-built Submittal Requirements</i> • Submittal shall be uploaded to <i>Central</i> workspace for approval.
AHJ and DCSORS Review Final Approval	<ul style="list-style-type: none"> • See APPENDIX on <i>ERCES Acceptance Testing & Final Approval</i>
Owner Stores ERCES Documents	<ul style="list-style-type: none"> • Owner shall maintain As-built Submittal and Approval letters at the project site for future reference by AHJ and/or DCSORS.
Owner Performs Annual ERCES Testing	<ul style="list-style-type: none"> • See APPENDIX on <i>Annual ERCES Testing</i>.



APPENDIX A: ERCES Design & Operating Requirements

Owner is fully responsible for the 700/800MHz ERCES design and Fire Code. Any discrepancies between code, amendments, and this document shall be addressed with DCSORS and AHJ.

Aspect	Requirement
Radio Tx Powers	<ul style="list-style-type: none"> ERCES designs may assume a portable Effective Radiated Power (ERP) level of +34dBm. ERCES designs may assume a Donor Site ERP level of +53dBm (200 Watts).
BDA Operating Frequencies	<ul style="list-style-type: none"> Must be operational on both 800MHz and 700MHz Public Safety bands. Operate on all assigned DCSORS 800MHz and 700MHz frequencies and sites assigned during initial submittal. Intentional retransmission of any frequencies other than those assigned by DCSORS must have approval from the license custodian of those frequencies. FirstNet 700MHz channels shall be filtered out. Commercial wireless services (i.e., cellular communication carriers) shall not utilize any portion of the ERCES unless with explicit DCSORS approval.
BDA FCC Class	<ul style="list-style-type: none"> Class A. Required without exception. <ul style="list-style-type: none"> Capable of 30 channels in the 700 MHz band and 30 channels in the 800 MHz public safety band. Each filter must exhibit channel delay of less than 20 μs. <p>Note: Only Class A will be allowed. Although more expensive than Class B BDAs, the RF performance, RF noise rejection, and better dynamic gain range of a channel-filtered BDA substantially benefit the Donor Site and overall radio network.</p>
Single BDA	<ul style="list-style-type: none"> Campus buildings shall not utilize multiple discrete BDAs (each with their own Donor Antenna) but rather a single fiber optic-based BDA consisting of a single donor antenna, a primary BDA, and fiber-optic-connected remote BDA units. <p>Note: Campus Buildings are those owned and/or managed by the same Owner and within proximity to each other, such as an apartment complex or multi-building healthcare complex.</p>
BDA RF Controls	<ul style="list-style-type: none"> The BDA must be capable of independent gain adjustment and uplink squelch operation for each band. The BDA shall include anti-oscillation circuitry with the following functionality: auto-reset the BDA for the first three oscillation events detected within 24 hours; auto-disable BDA RF transmissions upon the 4th oscillation event detected within that same 24-hour period. <ul style="list-style-type: none"> If not supported by BDA, then BDA must support manual reset. ERCES shall be designed with adequate isolation to preclude BDA oscillations that impair / degrade the donor public safety 700 / 800 MHz systems. The BDA shall include Automatic Gain Control (AGC) circuitry on the uplink. The ERCES shall be designed and tested to ensure that noise and spurious emissions do not degrade the performance of the Donor Site or any other FCC licensed system.



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<p>System Gain and RF Power - Downlink</p>	<ul style="list-style-type: none"> ● BDA DL: <ul style="list-style-type: none"> ○ ERCES shall be designed to minimize gain required to achieve required signal strength in all areas. Ideally, a properly designed and balanced BDA system will have control channel signal strength of -50dBm to -95dBm throughout the building structure. ○ ERCES coverage shall be designed for worst-case scenario, i.e. include all components which materially affect signal strength with doors, windows, and other components in their normally open/closed position. ○ Service antenna placement and downlink gains shall be designed to prevent RF leakage outside the building and to avoid downlink levels higher than -95dBm at or near the building interior perimeter.
<p>System Gain and RF Power - Uplink</p>	<ul style="list-style-type: none"> ● BDA UL: <ul style="list-style-type: none"> ○ Operating gain is not to exceed +65dB without prior approval from DCSORS. ○ Transmissions are not to exceed +27dBm at BDA donor port and not to exceed +37dBm ERP in compliance with FCC regulations. ○ Transmissions are to reach the assigned Donor Site(s) at per-channel levels between -100dBm and -80dBm. ○ Reduce the gain to comply with the maximum allowed BDA Noise per FCC Part 90.219(d)(6) regulation; the ERP of noise within the bandpass should not exceed -43 dBm in 10 kHz measurement bandwidth. ○ Calculated noise power within a 10kHz bandwidth as received at the Donor Site shall be no greater than -145dBm.
<p>Service (DAS) Antennas</p>	<ul style="list-style-type: none"> ● Designed to operate through the 700 and 800 MHz public safety bands. ● Shall be assigned unique alpha-numeric identifiers which shall be shown in all line drawings, documentation and floor plans. <ul style="list-style-type: none"> ○ Example identifier: ANTn-Fm. Where n is the antenna number on that floor and m is the floor number; the 8th antenna on floor 3 would be "ANT8-F3". This is simply an example and should not be interpreted as the only allowable nomenclature. ● To balance the UL power into the BDA, service antennas shall be located to minimize the range of UL power into the BDA's DAS port from the in-building portable radio, varying by no more than: <ul style="list-style-type: none"> ○ 50dB for Class A BDA. ● To balance the DL power out of the BDA, service antennas shall be located such that the difference in DL power out of all antennas are within 6dB.
<p>Donor Antenna</p>	<ul style="list-style-type: none"> ● Designed to operate only through the 700 and 800MHz public safety bands. ● Maximum horizontal beamwidth of 48 degrees except when approved by DCSORS. ● Antenna placement should be at or very near the building edge, facing the Donor Site (not overshooting the rooftop) to maximize indoor-outdoor isolation and thus minimize the potential for oscillation. ● Must be one of the following directional designs: <ul style="list-style-type: none"> ○ Outdoor-rated enclosed panel ○ Welded construction Yagi ○ Other antenna type upon written approval from DCSORS



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<p>RF Power Splitters</p>	<ul style="list-style-type: none"> • Power dividers (splitters, couplers, tappers) must be rated for maximum possible system power. • Shall be assigned unique alpha-numeric identifiers which shall be shown in all line drawings, documentation and floor plans. <ul style="list-style-type: none"> ○ Example identifier: <i>val_SPTn-Fm</i>. Where <i>val</i> is the coupler value; <i>n</i> is the divider number on that floor and <i>m</i> is the floor number; the 5th coupler on floor 2 is a 10dB coupler and would be "10dB_SPT5-F2". This is simply an example and should not be interpreted as the only allowable nomenclature.
<p>Coaxial and Fiber Optic Cabling</p>	<ul style="list-style-type: none"> • Feed line segments, fiber optic cables, and signal jumpers more than 6 feet installed by the Owner shall be assigned unique alpha-numeric identifiers which shall be shown in line drawings, documents and floor plans. <ul style="list-style-type: none"> ○ Example identifier: <i>CBLn</i>. Where <i>n</i> is the unique cable segment number across the whole ERCES; the 14th cable segment would be "CBL14". This is simply an example and should not be interpreted as the only allowable nomenclature.
<p>BDA RF EPO Controls</p>	<p>There are two options to allow DCSORS to disable the BDA radio transmission at times when the ERCES is causing harmful interference to Donor Site(s).</p> <ol style="list-style-type: none"> 1. A BDA Emergency RF Power Off switch (ERFPO) on the exterior of the building. <ul style="list-style-type: none"> ○ AHJ's access to this ERFPO box is optional based on AHJ desire. ○ Accessible by DCSORS ○ Shall be placed within a Knox Box near the building's existing Fire Department entrance Knox Box. ○ The Knox Box shall be: Labelled as "BDA Power". Knox Box physical keying to be coordinated with AHJ and DCSORS. 2. Remote network-accessible BDA control system (preferred) <ul style="list-style-type: none"> ○ ERRCS Response Linq (https://responselinq.com) connection in compliance with 47 CFR Part 90.219 (b) maintaining a 50 Mbps or faster Ethernet connection within 18 inches of BDA/ERCES with a Dynamic Host Configuration Protocol (DHCP)-assigned IP address to connect to the ERRCS Response Linq (https://responselinq.com). <ul style="list-style-type: none"> ▪ Any other remote-control OEM/solution may be utilized once functional equivalency is proven to DCSORS. ○ Owner shall implement and maintain this service for the life of the BDA unless an ERFPO is installed and operational. <p>Note: State or other government buildings may be exempt at the discretion of DCSORS.</p>



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<p>BDA/BBU to FACP Alarm Signaling</p>	<p>Unless Fire Code states otherwise or Response Linq or other remote-control solution (see above) has been implemented, all the following alarm signals shall be monitored at the building's FACP. Alarms a, b, c and d, in addition to standard notifications, shall have DCSORS added to the alarm notification list as a mandatory phone call to DCSORS voicemail system.</p> <ol style="list-style-type: none"> a. Donor antenna disconnection b. Donor antenna malfunction c. Active RF emitting device malfunction d. System component malfunction e. AC Input Normal f. Loss of Normal AC Power g. Loss of Battery Capacity h. Battery Charger Failure <p>Note: DCSORS has an existing process in place to automatically forward voicemail messages to the on-call DCSORS technician.</p>
<p>Programming and Error Log Access</p>	<ul style="list-style-type: none"> • The system shall support programming (local and remote units) via Ethernet connection for the purpose of programming and error log review; web browser-based interface preferred.
<p>ERCES Signage</p>	<ul style="list-style-type: none"> • If unspecified by Fire Code, signage shall be placed on / in the building: <ul style="list-style-type: none"> ○ At the building entrance, Knox Box location, or other location(s) as designated by AHJ: "This Building Contains a Public Safety Radio Enhancement System" ○ Upon or near the door of the room housing the BDA unit: "Public Safety BDA". ○ Upon or adjacent to the Donor antenna mount: "ERCES Antenna – Movement or repositioning of this antenna is prohibited without approval from the Fire Code Official".



APPENDIX B: Common Submittal Requirements

The use of a standardized format and content in all submittals will reduce the potential for delays caused by repeated resubmittals. To that end, the following common requirements for standardized submittals have been established.

Aspect	Requirement
Submittal Package: General	<ul style="list-style-type: none"> • All pages shall contain: <ul style="list-style-type: none"> ○ Project name, drawing set revision, page identifier & page description • Floor plans, exterior elevations and area drawings shall contain: <ul style="list-style-type: none"> ○ Legend ○ Scale via graduated ruler ○ Compass orientation
Format and Filenames	<ul style="list-style-type: none"> • Page size: As required by AHJ. All pages must be of the same dimension. • All submittals shall be submitted in PDF form. • Filenames shall contain the project name and date of filing; revision number may also be included in file name. • File resolution must provide clear images and text. • Every effort should be made to maintain the individual file sizes below 100MB. • Supporting source files (document, spreadsheet, RF heatmaps, etc.) may be submitted to assist in review but must be accompanied by its PDF representation format.
Document Uploading	<ul style="list-style-type: none"> • In addition to the normal and usual building permit process as dictated by applicable building department, the submittals described here shall be submitted to DCSORS for approval. <p>Note: See Appendix on <i>Central ERCES Communication Hub</i>.</p>



APPENDIX C: Minimum Design Submittal Requirements

The use of a standardized format and content in all submittals will greatly reduce the potential for delays caused by repeated resubmittals. To that end, the following minimum requirements for standardized submittals have been established.

Prior to construction of ERCES, the AHJ and DCSORS must review and approve the design. Construction of ERCES systems requires the contractor to obtain appropriate permits from the local authority(ies).

ERCES design submittals shall be formatted as described below and include the following information.

Aspect	Requirement
Submittal Package: Cover Sheet (project information)	<ul style="list-style-type: none"> • Project Name and Street Address • Vicinity map showing property location • Building description, including: <ul style="list-style-type: none"> ○ Usage ○ Construction type ○ Number of floors above and below grade ○ Proposed square footage • Scope of work for ERCES project • Project stakeholders: <ul style="list-style-type: none"> ○ Property Owner contact information ○ Contractor's contact information ○ AHJ organization name • Proposed start and finish dates of project <ul style="list-style-type: none"> ○ If project has multiple phases or future growth, provide intended connection to existing or future elements. • Document index (table of contents) • Submittal check list with acknowledgement List of applicable Fire Code, amendments, policies



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<p>Submittal Package: Cover Sheet (technical information)</p>	<ul style="list-style-type: none"> • Applicable public safety radio system name & radio band <ul style="list-style-type: none"> ○ List of all frequencies to be amplified by system. ○ BDA Class: Class A. • Donor Site Signal Path(s) <ul style="list-style-type: none"> ○ Area map showing donor site location and path to designated donor site. Show both topographical (elevation) and aerial views. • ERCES designer qualifications to include: <ul style="list-style-type: none"> ○ Full name of ERCES designer. (required) ○ FCC GROL copy with license holder's signature. (required) ○ Manufacturer training certification for system designer software e.g. iBwave, RANPlan etc. (required) ○ Manufacturer training certification for proposed BDA product. (required) ○ Nationally recognized training certification, eg, NICET or ETA. appropriate level for system design. This certification is currently desired but will be required starting January 1, 2026. • ERCES installation staff qualifications to include: <ul style="list-style-type: none"> ○ Full name of lead installer ○ FCC GROL copy with license holder's signature. (required) ○ Manufacturer training certification for proposed BDA product. (required) ○ Nationally recognized training certification, e.g., NICET or ETA. appropriate level for system installation. This certification is currently desired but will be required starting January 1, 2026.
<p>Submittal Package: Calculations</p>	<ul style="list-style-type: none"> • Battery Backup run time calculations based on equipment to be installed. Provide in tabular format listing requirements for each powered device and capacity provided by proposed BBU. • RF Link Budget calculations on per-channel basis: <ul style="list-style-type: none"> ○ UL Signal Far-field: RF power link budget calculation from far-field indoor portable radio, through ERCES to donor antenna, over air to Donor Site. ○ UL Signal Near-field: RF power link budget calculation from near-field indoor portable radio, through ERCES to donor antenna, over air to Donor Site. ○ UL Noise: RF noise power budget calculation from service port antenna to Donor Site, as measured in a 10kHz bandwidth. ○ DL Signal: RF link budget calculation from rooftop Donor antenna, through ERCES to indoor portable radio at near field and far field. DL power at rooftop antenna should be based on measured value discovered in <i>Step 1: Initial Radio Coverage Testing and Reporting Process</i>. • RF power calculations table for each service antenna: <ul style="list-style-type: none"> ○ DL power through to each service antenna output. <p>Note: RF composite power (effect of combining multiple channels) should be considered when making proper BDA selection to ensure ample DL and UL RF power is available to support the maximum number of RF channels.</p>



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<p>Submittal Package: One-line Drawing</p>	<ul style="list-style-type: none"> • System schematic of proposed ERCES showing unique identifier of: <ul style="list-style-type: none"> ○ Active devices ○ Antennas ○ RF power dividers (splitters, couplers, etc.) ○ Coaxial cable segments ○ Fiber optics layout, and interconnect (if applicable) ○ Show cable lengths of all segments ○ Show UL and DL RF power computations at BDA ports and all antennas ○ Show BDA UL & DL gains • Tabular list of unique identifiers for all components and major cable segments.
<p>Submittal Package: Layout Plan Drawings</p>	<ul style="list-style-type: none"> • Floor plans and equipment layout for all levels, even those not covered by ERCES, showing unique identifier of: <ul style="list-style-type: none"> ○ Active devices ○ Antennas <ul style="list-style-type: none"> ○ Service antennas ○ Donor antenna location, pointing azimuth and elevation ○ RF power dividers (splitters, couplers, etc.) ○ Coaxial cable routes ○ Fiber optics layout, and interconnect (if applicable). ○ Show UL and DL RF power computations at BDA ports and all antennas
<p>Submittal Package: RF coverage heatmaps</p>	<ul style="list-style-type: none"> • Floor plans showing computer model-generated (iBwave or RANplan) RF coverage heatmap for all building levels where the ERCES intends to enhance RF coverage: <ul style="list-style-type: none"> ○ Each heatmap is to be a gradient with varying color for each 10dB range between -45dBm and -105dBm (wider ranges are acceptable). ○ Include legend on each page defining color scheme for projections. Strongest signal level should be magenta/red. Levels below -105dBm shall be colored dark blue. <p>Note: Heatmap colors should be reasonably opaque such that the submittal reviewers can read room numbers or other building area identifiers through the heatmap.</p>
<p>Submittal Package: Installation details</p>	<ul style="list-style-type: none"> • For Donor antenna: <ul style="list-style-type: none"> ○ Surge protector shown installed indoors or outdoors and mounted as close to 24-inches of building entry point where possible. ○ Mounting structures shown grounded to the master building ground bus. ○ Feed line shown bonded to building ground using a coaxial ground kit. The ground kit shall be attached to the coax at the point of transition from vertical to horizontal routing or at the point of entry to the building or grounded metallic conduit. • For BDA and BBU: <ul style="list-style-type: none"> ○ Rack- or wall mount elevations including attachment method ○ Typical electrical, ground, alarm, and remote annunciator (if applicable) cabling details



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<p>Submittal Package: ERCES Materials</p>	<ul style="list-style-type: none">• List of materials for all active and passive components excluding small hardware:<ul style="list-style-type: none">○ Manufacturer & full model number○ Manufacturer's description○ Quantities for each line item• Manufacturers' cutsheets / datasheets:<ul style="list-style-type: none">○ Active components with FCC ID# (type acceptancy approval for active devices)○ Antennas○ RF power dividers (splitters, couplers, taps, etc.)○ Coaxial cable○ Coaxial connectors○ Fiber cable & fiber connections (if applicable)○ Enclosures to be provided by contractor <p>Note: For datasheets with multiple part numbers, applicable part number shall be highlighted.</p> <p>Note: Campus buildings shall not utilize multiple discrete BDAs (each with their own Donor Antenna) but rather a single fiber optic-based BDA comprised of a single Donor Antenna, primary BDA, and fiber-optic connected remote BDA units.</p>
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APPENDIX D: ERCES Installation Requirements

DCSORS requires adherence to the following requirements as prerequisites to granting a *Letter of Authorization for Retransmission* and operation of ERCES supporting CODTRS within Douglas County.

Fire Code and Electrical Code standards also apply; additional requirements may be made by the AHJ.

Aspect	Requirement
Adherence to Design	<ul style="list-style-type: none"> • Construction per Design Submittal, above.
Labelling	<ul style="list-style-type: none"> • All labels shall be moisture proof and indelible, easily readable and appropriately fixed to the device. • BDA, BBU, and ancillary enclosures must have visible identification showing: <ul style="list-style-type: none"> ○ Unique Site ID (BDA only). ○ Power distribution panel ID and circuit branch/breaker ID. ○ Contact information of ERCES installer. ○ Contact information for building representative with access to ERCES components and records. • Power distribution panel breaker must have label showing "ERCES BDA" or "ERCES BBU", as applicable. • Service antennas shall be labelled with their unique alpha-numeric identifier per the design submittal; label shall be visible from below the antenna. • RF power dividers (splitters, couplers, taps, etc.) shall be labelled with their unique alpha-numeric identifier per the design submittal. • Except for short jumpers, coaxial cable segments shall be labeled with their unique identifier per the design submittal and within 18-inches of each end of the segment.
On-site Documentation	<ul style="list-style-type: none"> • System documentation to be located with main BDA. If stored externally to equipment, Owner must provide appropriate metallic or rigid plastic document holder to be placed near BDA. • Must contain: <ul style="list-style-type: none"> ○ The final ERCES submittal documents. ○ Final ERCES acceptance report. ○ Copy of the DCSORS <i>Letter of Authorization for Retransmission</i> ○ Subsequent annual ERCES test reports.



APPENDIX E: Minimum As-built Submittal Requirements

Aspect	Requirement
Owner Completes On-line DCSORS ERCES As-built Form	The DCSORS form (see https://apps.dcoapps.com/erces/) will request: <ul style="list-style-type: none"> • Project Name • Site Address • Unique Site ID number (see Design Submittal). • BDA location within building: Floor & Room number. • Make, model number, and serial number(s) of all active components: BDA, BBU, remote units • BDA actual configuration <ul style="list-style-type: none"> ○ Class A ○ Number of filters and bandwidth(s) used in 700/800MHz ○ FCC Site Registration Number. • Contact available 24/7 to provide access to all on-site equipment, (building owner/manager) <ul style="list-style-type: none"> ○ Name, address, telephone number, email address • Installation Contractor contact <ul style="list-style-type: none"> ○ Name, address, telephone number, email address
Submittal Package: As-Built Digital Images	Digital images of system installation: <ul style="list-style-type: none"> • Active components • AC power service disconnect(s) • Antennas: donor and service. • LOS path from donor antenna to donor site. • Passive coupling devices: taps, couplers, power dividers, etc. • Coaxial cable and related sweep test screenshots • Fiber cable, if used & fiber connections, if used • Enclosures provided by contractor, if used • BDA signage • BDA gain and filter settings screenshot • Screenshot or value of BDA UL noise level at Donor port with 10kHz resolution bandwidth and at as-built UL gain setting <p>Note: Components' labels must be readable in the image.</p>
Submittal Package: Final As-Built	Full Design Submittal (see above) with: <ul style="list-style-type: none"> • Any changes or variances red-lined and noted • RF calculations based on actual values
Submittal Package: Acceptance Test Report	See Appendix on <i>ERCES Acceptance Testing</i> .



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APPENDIX F: ERCES Acceptance Testing & Final Approval

Per Fire Code, for buildings containing ERCES, it is the Owner's responsibility to:

- Perform ERCES acceptance testing
 - After ERCES installation and before building occupancy.
 - In cooperation and coordination with AHJ and DCSORS; and
 - Include acceptance test report with ERCES As-built Package Submittal.
- Keep on file for inspection by AHJ and DCSORS
 - Annual ERCES test report.
 - Letter(s) of Authorization for Retransmission.

Aspect	Requirement
Owner Coordinates Testing	<ul style="list-style-type: none"> • Test date and time to be coordinated in advance with both the AHJ and DCSORS. • The test and report must be completed by one of the following: <ul style="list-style-type: none"> ○ DCSORS at additional cost to Owner. ○ PCTel-certified vendor with approval of DCSORS. Vendor shall use a currently calibrated IBflex test set and DCSORS-provided portable radio. <p>Note: AHJ may desire to attend radio walk testing; consult with AHJ. Note: DCSORS may provide IBflex loaner test equipment and portable radio unit, given a security deposit, to an Owner who shows IBflex RF scanner test equipment proof of certification. DCSORS may loan copies of reference materials contained in this document.</p>
Owner Sets and Records BDA Settings	<ul style="list-style-type: none"> • Set and document BDA UL & DL gains to minimize RF noise and still meet UL & DL signal level requirements. • Set and document BDA RF filter ranges per band for both UL and DL. <p>Note: BDA amplifiers should still be disabled at this point and until DCSORS approves provisional retransmission. Note: See <i>APPENDIX: ERCES Design & Operating Requirements</i>.</p>



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<p>Owner Performs RF DL Tests</p>	<p>Note: Before performing any UL tests or any tests where the BDA will be transmitted within actual licensed radio channels, notify DCSORS that the BDA will be enabled and that it will begin transmitting.</p> <ul style="list-style-type: none"> • Donor Signal Verification: At Donor antenna location, measure and document DL control channel signal level and SINR level. <ul style="list-style-type: none"> ○ Reference: <i>SBC Handbook</i>, Donor Signal Verification Test, section 22.9.1, page 418 • Antenna Verification with Live Signal Test: verify DL signal is being transmitted throughout the DAS at expected levels. <ul style="list-style-type: none"> ○ Note and remediate any passive DAS issues. ○ Reference: <i>SBC Handbook</i>, section 22.9.2, page 419 • Antenna Isolation: Using CW, DL and UL test and document Donor-to-services antenna isolation of 20dB or greater than BDA's maximum gain setting, unless otherwise approved by DCSORS. <ul style="list-style-type: none"> ○ Reference: <i>SBC Handbook</i>, Isolation Test, section 22.8.2, page 416 • Exterior RF Leakage Test: Measure DL signal outside of building compared to Donor Site's signal level. <ul style="list-style-type: none"> ○ At ground level and at 3 feet from the building perimeter at four sample locations, one sample per building side, signal level from the ERCES shall not be less than 15dB below the Donor signal. ○ Reference: <i>SBC Handbook</i>, Exterior RF Leakage, section 22.9.3, page 420. <p>Note: Some tests will require the use of a calibrated RF signal generator. The CW generator should be set to a 12.5kHz channel width at a center frequency near, but not within the public safety radio band, i.e., guardband.</p> <p>Note: DCSORS believes RF signal injection within the guardband is reasonable and acceptable because: a) the frequency is near the actual operating frequency of the radio system; b) the RF noise floor will be at its lowest; c) there will be no active radio traffic confusing the measurements; and d) the short-term RF signal injection cannot affect actual real-time radio traffic.</p>
<p>Owner Performs RF UL Tests</p>	<p>Note: Before performing any UL tests or any tests where the BDA will be transmitted within actual licensed radio channels, notify DCSORS that the BDA will be enabled and that it will begin transmitting.</p> <ul style="list-style-type: none"> • Uplink Noise and Channel Power Test <ul style="list-style-type: none"> ○ Coordinating with DCSORS, with BDA powered on but no radio operating, record UL channel power and SINR level at Donor Site's Monitor. • Near / Far Test per Floor: one in the near-field and one in the far-field, measure and record signal level and SINR level from the far radio at <i>Monitor</i> while the near-field radio is on. <ul style="list-style-type: none"> ○ Reference: <i>SBC Handbook</i>, Two-radio Near-Far, section 22.13.2 pages 431 <p>Note: Some of these tests will require the use of a calibrated RF signal generator. The CW generator should be set to a 12.5kHz channel width at a center frequency near, but not within the public safety radio band, i.e., guardband.</p>



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<p>Owner Performs Non-Radio Tests</p>	<ul style="list-style-type: none"> • ERCES Alarm Tests: <ul style="list-style-type: none"> ○ Coordinating with DCSORS, with BDA powered on but no radio operating, confirm DCSORS receipt of all required FACP Supervisory alarms as per <i>BDA/BBU to FACP Alarm Signaling in APPENDIX: ERCES Design & Operating Requirements</i>. • Perform BBU load test and other tests per Fire Code.
<p>Owner Uploads Test Results</p>	<ul style="list-style-type: none"> • Upload test results to the <i>Central</i> workspace.
<p>DCSO Validates ERCES Tests</p>	<ul style="list-style-type: none"> • Owner will coordinate with DCSORS to provide them with BDA administrator login credentials. • On site, DCSORS will validate BDA settings, UL test results, and sample final grid test results, if necessary.
<p>Owner Performs Final Grid Tests</p>	<ul style="list-style-type: none"> • Performs RF Coverage Test per <i>Step 1: Pre-ERCES Signal Coverage Testing and Reporting Process</i>.
<p>Owner Submits As-built Package</p>	<ul style="list-style-type: none"> • See APPENDICES on <i>Common Submittal Requirements</i> and <i>Minimum As-built Submittal Requirements</i>. • Submittal shall be uploaded to <i>Central</i> workspace for approval.
<p>AHJ and DCSORS Final Approval & Notices</p>	<ul style="list-style-type: none"> • AHJ will review the submittal to determine acceptability per Fire Code and any requirements for modification or correction. • DCSORS will review the submittal to determine acceptability for operation within the CODTRS and any requirements for modification or correction. • Once accepted by AHJ and DCSORS: <ul style="list-style-type: none"> ○ AHJ will provide Owner with a final approval document. ○ DCSORS will send a final <i>Letter of Authorization for Retransmission</i> which shall include Unique Site ID. This approval is valid for one year from grant date and must be renewed by receipt of a compliant annual inspection from DCSORS. ○ Owner will upload letters of approval to the <i>Central</i> workspace.
<p>Owner Registers BDA with FCC</p>	<ul style="list-style-type: none"> • Register the Class A BDA with the FCC at https://signalboosters.fcc.gov/signal-boosters/.



APPENDIX G: Annual ERCES Testing

Per Fire Code, Owner shall perform annual inspection and testing of ERCES systems.

Aspect	Requirement
Owner Coordinates Testing	<ul style="list-style-type: none"> • Test date and time to be coordinated in advance with both the AHJ and DCSORS. • The ERCES test and report must be completed by one of the following: <ul style="list-style-type: none"> ○ DCSORS at additional cost to Owner. ○ PCTel-certified vendor with approval of DCSORS. Vendor shall use a currently calibrated PCTel ibFlex test set and DCSORS-provided portable radio. <p>Note: DCSORS may provide IBflex loaner test equipment and portable radio units, given a security deposit, to an Owner who shows IBflex RF scanner test equipment proof of certification. DCSORS may loan copies of reference materials contained in this document.</p>
Report Format	<ul style="list-style-type: none"> • Cover page showing <ul style="list-style-type: none"> ○ Site name, address, and Site ID ○ Date(s) of inspection ○ Owner name address, phone number and email address ○ Testing company name and address. ○ Testing an individual's name, address, phone number and email address. <ul style="list-style-type: none"> ○ FCC GROL number ○ BDA manufacturer's certification ○ Nationally recognized training certification, eg, NICET, ETA, etc. appropriate level for ERCES testing. ○ Test equipment make, model, software version, date of last calibration ○ Applicable Fire Code • Test results pages
Owner Performs the Tests	<ul style="list-style-type: none"> • Test per <i>Owner Performs the Tests</i> section in <i>APPENDIX: ERCES Acceptance Testing & Final Approval</i> • Perform DL power and DAQ (SINR) test under each service antenna. <ul style="list-style-type: none"> ○ Compare test results to original acceptance grid test results; note any service antenna that differs by greater than 3dB SINR. • Perform visual inspection of visible passive components and note any unusual or needing repair. Non-visible passive components only need to be inspected upon discovery of abnormal signal measurements. • Observe and record BDA configuration for UL & DL gains, center channels, transmit power, passbands and RF filters. <ul style="list-style-type: none"> ○ Compare results to original results; note any differences. • Upload test results to the <i>Central</i> workspace and submit to AHJ per AHJ requirements. <p>Note: For Annual testing, perform grid tests as instructed by Fire Code.</p>



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Acceptance	<ul style="list-style-type: none">● AHJ and DCSORS will evaluate the test results to determine compliance.<ul style="list-style-type: none">○ Owner will address any deficiencies.● Once accepted by AHJ and DCSORS:<ul style="list-style-type: none">○ DCSO will send a final <i>Letter of Authorization for Retransmission</i> which shall include Unique Site ID. This approval is valid for one year from grant date and must be renewed by receipt of a compliant annual inspection from DCSORS.
Owner Keep Record	<ul style="list-style-type: none">● Update on-site documentation records with DCSORS letters of approval per Fire Code and FCC Title 47 Part 90.219. <p>Note: Failure to maintain documentation on site may result in enforcement action(s) including DCSORS disabling ERCES and FCC fines.</p>



APPENDIX H: Five-Year ERCES Testing

It is possible that the future tower-based public safety radio system may be modified to such a point that the ERCES is no longer needed within the building. Every five years after the ERCES has been installed and approved, the following ERCES testing shall be performed and test results report uploaded to *Central*.

Aspect	Requirement
Owner Coordinates Testing and Report Format	<ul style="list-style-type: none"> Follow <i>APPENDIX: Annual ERCES Testing</i>
Owner Performs the Tests	<ul style="list-style-type: none"> Follow <i>APPENDIX: Annual ERCES Testing</i> Test and record results per <i>Owner Performs the Tests</i> section in <i>APPENDIX: ERCES Acceptance Testing & Final Approval</i> With the BDA powered ON, perform RF coverage grid test per <i>Step 1: Pre-ERCES Signal Coverage Testing and Reporting Process</i>. With the BDA powered OFF, perform RF coverage grid test per <i>Step 1: Pre-ERCES Signal Coverage Testing and Reporting Process</i>. <ul style="list-style-type: none"> Make special note if the grid tests pass signal level, SINR, and BER acceptance criteria with the BDA off.
Acceptance	<ul style="list-style-type: none"> AHJ will evaluate the test results to determine acceptance. AHJ will communicate ERCES acceptance decision to the Owner via communications from the <i>Central</i> workspace for the project. Once accepted by AHJ and DCSORS: <ul style="list-style-type: none"> AHJ will provide Owner with a letter of approval. DCSO will send a final <i>Letter of Authorization for Retransmission</i> which shall include Unique Site ID. This approval is valid for one year from grant date and must be renewed by receipt of a compliant annual inspection from DCSORS.
Owner Keep Record	<ul style="list-style-type: none"> Update on-site documentation records with DCSORS letters of approval per Fire Code and FCC Title 47 Part 90.219. <p>Note: Failure to maintain documentation on site may result in enforcement action(s) including DCSORS disabling ERCES and FCC fines.</p>



APPENDIX I: Central ERCES Communication Hub

DCSORS has adopted SeeHawk™ Central from PCTEL. The use of Central will result in:

- Consistent radio coverage test results and ERCES-related design, build, approval, certification, and inspection processes across the county.
- Centrally controlled radio coverage test configurations and a repository with access controls.
- Coordinated scheduling of Owners ERCES UL testing.
- Security knowing Owners / contractors cannot manipulate coverage test results.

The software tool allows:

- AHJs sharing of ERCES-related requirements to Owners in common location.
- DCSORS sharing of CODTRS-related requirements to Owners in common location.
- Standardization of PCTEL ibFlex RF coverage test equipment configuration specific to the CODTRS.
 - Review and approval of BDA commissioning tests
- Uploading and storage of public safety radio coverage assessment (pre-ERCES) test result reports by Owner on a per-building basis – viewable by AHJ and DCSORS.
- Uploading and storage of ERCES submittals - reviewable by AHJs and DCSORS.
- Uploading and storage of ERCES radio coverage test result reports by Owner on a per-building basis – reviewable by AHJ and DCSORS.
- Storage of public safety radio retransmission agreements.
- Mapping and tracking of buildings within the county and the respective ERCES status, including annual testing results.

For AHJs: access to Central can be requested here: <https://www.pctel.com/shc-ahj-request/>

For Owners: Responsible for uploading ERCES-related documents like test results and submittals into Central.

1. Obtain login credentials from PCTel. Annual license fees may apply.
2. Login to PCTEL Central: <https://seehawkcentral.pctel.com/#/login> Access the platform using your credentials.
3. Navigate to the upload area of the Workspace: Locate the "Upload Files" option, which might be within your profile settings, a project dashboard, or a dedicated file management section.
4. Select files: Browse your computer to locate the desired files you want to upload.
5. Initiate upload: Click the "Upload" button to start the file transfer process.
6. Important considerations:
 - a. File formats: Check if PCTEL Central has any limitations on supported file types.
 - b. File size limits: Be aware of any maximum file size restrictions for uploads.
 - c. Progress monitoring: Most platforms display a progress bar to track the upload status.



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APPENDIX J: Retransmission Authorization Delegation (sample)

The intent of this section is to provide sample verbiage for a potential agreement between the CO DTRS radio license holder (State of Colorado) and the local radio shop personnel responsible for enforcement of ERCES policy. The agreement will provide process simplification and allow the local radio shop to provide radio retransmission authorizations to Owners implementing ERCES. This is purely a starting point for a potential agreement.

Sample agreement language

The undersigned, as the 800MHz public safety band FCC licensee and operator of the CO DTRS, agrees to delegate both *Authorizations for Provisional Retransmission* and annual *Authorizations for Retransmission*, specifically within the scope of in-building ERCES operating YE (Public Safety/Special Emergency and Public Safety, National Plan, 806-817/851-862MHz, Trunked) FCC Radio Service, and specifically within the respective geographic coverage area(s) for which the delegate is responsible for enforcing this ERCES policy.

This delegation may be rescinded by the licensee at any time and for any reason.

Note: This verbiage does not apply to DCSORS, which is the FCC licensee within Douglas County.



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APPENDIX K: Stakeholder Contact List

Organization Name	Title & Contact	Phone & Email	Responsibility	Permit required	Annual Testing Coordinated	Specific Requirements	Fire code reference (URL)
Aurora Fire Rescue				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N	Eg, on-site during final inspection/radio test?	Aurora Colorado
Castle Rock Fire Rescue	Kevin Sullivan	KSullivan@crgov.com;		Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://www.crgov.com/3453/Castle-Rock-Fire-and-Rescue
Colorado Division of Fire Prevention and Control				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://dfpc.colorado.gov
Elizabeth Fire Rescue				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://elizabethfpd.colorado.gov/
Franktown Fire Protection District	Ryan Potton	rpotton@franktownfire.org		Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		http://franktownfire.org/
Jackson 105 Fire Protection District				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://www.jackson105.org/
Larkspur Fire Protection District	Chad Campagnola	ccampagnola@larkspurfire.org		Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://www.larkspurfire.org/
Monument Fire District				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://www.monumentfire.org/
Rattlesnake Fire Protection District				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://rfdpd.colorado.gov/
South Metro Fire Rescue	Aaron Miller, Plan Reviewer	720.989.2246 aaron.miller@southmetro.org	ERCES Plan Review	Initial coverage test: N Construction: Y Annual Testing: N	No		https://www.southmetro.org/
Town of Parker Building Division	Randy Capra	rcapra@parkerco.gov		Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		https://www.parkerco.gov/114/Building-Division



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Organization Name	Title & Contact	Phone & Email	Responsibility	Permit required	Annual Testing Coordinated	Specific Requirements	Fire code reference (URL)
West Douglas County Fire Protection District				Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N		West Douglas County Fire
West Metro Fire Rescue	Steve Kabelis	skabelis@westmetrofire.org		Initial coverage test: Y/N Construction: Y/N Annual Testing: Y/N	Y/N	Steve reviews all the designs for the life safety / fire marshals and used to be system manager for the Lakewood portion of the MARC radio system.	https://www.westmetrofire.org/
DCSORS	Jeff Vaughn, Radio System Supervisor	Office: (303) 660-7506 Radio Shop: (303) 814-7013 jvaughn@dcsheriff.net radioshop@dcsheriff.net		N/A	Yes		