

SECTION 27 60 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

PART 1 – GENERAL

1.1 SUMMARY. This section includes requirements for furnishing and installing a complete Emergency Responder Radio Coverage System (ERRCS), including requirement and frequency verification, benchmark surveying, building modeling, design, documentation, commissioning, and maintenance & inspections in accordance with applicable local, state, and federal requirements.

1.2 RELATED SECTIONS.

- Division 01 – General Requirements
- Division 26 – Electrical
- Division 28 – Fire Detection and Alarm

1.3 REFERENCED STANDARDS.

- 2022 Connecticut State Fire Safety Code (CSFSC)
- NFPA 72, NFPA 1221, NFPA 1225
- 2021 International Fire Code, Section 510
- FCC Part 90
- UL 2524 and UL 2196
- ANSI/TIA-222, ANSI/TIA/EIA Building Telecom Cabling Standards
- Connecticut Telecommunications System (CTS) Unit Technical Advisory Bulletin: Interim Emergency Responder Radio Coverage (Feb 2023)

1.4 APPLICABILITY AND EXCEPTIONS. In-building ERRCS coverage shall be provided in all new buildings, as required by Section 1.3 referenced standards and the Authority Having Jurisdiction (AHJ). Emergency responder communication coverage within the building shall be based on the existing coverage levels of the public safety communication system utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communications system.

Exceptions:

- a) Where a wired emergency communication system is approved to be installed or maintained instead of an approved radio coverage system
- b) Where radio coverage is determined unnecessary by the AHJ.
- c) Where ERRCS components may adversely affect facility operation and AHJ permits automatically activated emergency responder radio coverage systems.
- d) Where emergency responder radio communication coverage measured at the exterior of the building is insufficient to provide reliable communications as per referenced standards

Waiver of Applicability: Buildings with adequate signal coverage or applying for exclusion may request a waiver by submitting a benchmark signal survey to EOR, CTS, and AHJ. Coverage will be verified by EOR and the AHJ with CTS Engineer/and or designee. Waivers must be renewed every 5 years or following construction changes. At any time it is determined by EOR, the AHJ or CTS that radio coverage does not accommodate requirements of referenced standards, the waiver shall be revoked

1.5 MINIMUM QUALIFICATIONS OF PERSONNEL. All ERRCS design and installation shall be performed under the supervision of personnel holding the following current certifications:

- FCC General Radiotelephone Operators License (GROL)
- iBwave Public Safety Certification
- NICET In-Building Public Safety Communications – Design (IB-PSC Design)
- NICET IB-PSC Level II (Minimum)
- PCTEL Public Safety Certification (signal receiver-based testing)
- Manufacturers certification from the manufacturer of ERRCS equipment to be integrated

1.6 SUBMITTALS. Prior to installation, submit a complete ERRCS submittal package to EOR, CTS, and AHJ for review. Submittal shall include the following:

- PDF format record of project information documents (Size 8.5" x 11")
 - Site address and building name
 - Written record of AHJ correspondence and frequency/requirements verification including but not limited to verified systems and frequencies, donor site locations and parameters.

- Name and certifications for design and integration personnel
- PDF format design plans (Size Arch D 24" x 36")
 - Dimensionally scaled floor plans (Inclusive of scale)
 - Dimensionally scaled RF propagation output maps for all in-building floor plans (inclusive of scale)
 - One-line riser diagram and DAS architecture
 - Donor antenna locations and corresponding site names and parameters
 - Interior DAS antennas (with antenna labels) and coverage zones
 - Head-end location and room number
 - Remote unit locations (if applicable)
 - Cable Pathways
 - 2-hour rated backbone pathways
 - Notation of standby or emergency generator power circuit feeding ER-RCS, including documentation attesting connected emergency power is sufficient to support necessary operation of ERRCS, and relevant test documentation
- PDF format test and modeling report (Size 11" x 17")
 - Proposed test plan
 - Record of valid signal receiver or spectrum analyzer calibration documentation
 - Benchmark signal survey evaluation report
- PDF format calculations and system specifications (Size 8.5" x 11")
 - Bill of Materials with equipment model numbers and specifications. If pages contain multiple PIDs, highlight the PIDs intended for use
 - BDA features and configuration documentation
 - Link Budget Calculations
 - Battery Backup Calculations
 - Technical data sheets with FCC and UL 2524 certifications
 - If other DAS are present, intermodulation studies demonstrating that capabilities present in proposed equipment will protect the ERRCS from adjacent interference

Any changes to building construction that occur following initial submittal shall be incorporated into revised submittal documentation, reflective of any manufacturers specifications sheets for any equipment changes not originally submitted. Any system relevant changes as the result of construction shall be revised and re-submitted for review.

Submittals must be addressed to: EOR, CTS, local AHJ

SECTION 1A – PERFORMANCE REQUIREMENTS

1A.1 LINK BUDGET ASSUMPTIONS.

- Talk-out link budgets shall assume a 3W portable radio worn at the hip.
- Vehicle-accessible areas (e.g., tunnels, parking garages) shall be designed for both 3W portables and 35W mobile radios.
- Talk-out and Talk-in link budgets must be balanced and clearly shown in submittals.

1A.2 COVERAGE CRITERIA.

- Minimum downlink RSSI: -95 dBm
- Minimum downlink SINR: 18 dB
- Maximum downlink FBER: 2.6%
- Minimum downlink DAQ: 3.4
- Building is compliant if:
 - 95% of all areas on each floor meet compliant signal thresholds
 - 99% of critical areas (e.g. emergency and standby power rooms, elevator lobbies, areas of refuge, exit stairs and exit passage ways, elevator machine rooms, and all other critical areas as determined by AHJ) meet compliant signal thresholds
- Talk-out DAQ must be minimum 3.4
- Talk-in must meet minimum of above noise floor of
 - -95 dBm, or
 - 18 dB, whichever is more stringent

1A.3 DONOR SITE IMPACT CONTROL.

- ERRCS transmissions must not exceed -55 dBm received at communications site.
- Received signal at host site receiver must be equal to the noise floor plus 18 dB when transmitted from the edge of the cell (lowest received signal in the targeted area)
- The signal level received at the input of ERRCS and transmitted by a user device (portable or mobile) shall be at least 5dB below the max operating power of the BDA and at least 10dB lower than the max damaging threshold of the BDA, in particular when transmitted in close proximity of a DAS antenna

1A.4 LINK BUDGET REQUIREMENTS.

- Vendor shall estimate link budgets incorporating:
 - DAS losses, donor antenna, couplers, splitters, cable, as well as gains of active components, applicable to both uplink and downlink estimates

1A.5 SIMULTANEOUS TRAFFIC MANAGEMENT.

- System shall be able to successfully operate to the voice quality standards in the presence of multiple simultaneous public safety radio transmissions
- Downlink propagation outputs must simulate realistic simultaneous channel usage

1A.6 INTERFERENCE MANAGEMENT.

- The ERRCS shall be able to withstand and maintain compliance with voice quality requirements with any other licensed public safety system
- Vendor shall optimize gain to prevent excessive impact on donor site

1A.7 OTHER RADIO SYSTEMS.

- Vendor in collaboration with building owner shall document all other radio systems located in the building or intended to be installed in the building, including but not limited to two-way radio systems, cellular distributed antenna systems
- If risk of adjacent interference exists, awarded vendor shall provide document and provide impact study as applicable

1A.8 ISOLATION REQUIREMENTS.

- Minimum BDA-to-Donor Isolation shall be 20 dB greater than system gain

1A.9 BACKUP POWER REQUIREMENTS.

- ERRCS shall have secondary power:
 - Independent battery power shall be for a minimum of 24 hours
 - Battery system shall automatically charge in presence of external power input
 - Where generator standby or emergency backup exists, ERRCS shall be connected to building standby or emergency power circuits

1A.10 SYSTEM MONITORING AND CONTROL.

- System must include NMS (Network Management System) for:
 - Alarm detection (inclusive of both ERRCS head-end and remote units as applicable)
 - Monitoring via local and remote access
 - Configuration
 - Control of active components
- Alarms interfacing with building Fire Alarm Control System shall include the following:
 - AC Power Status
 - Loss of AC Power
 - Battery Capacity Low
 - Battery Charger Fail
 - RF Emitting Device Malfunction
 - System Component Fail
 - Donor Antenna Malfunction
 - Donor Antenna Disconnection

PART 2 – PRODUCTS

2.1 GENERAL.

- All components shall be listed for public safety use and comply with UL 2524
- All active RF-emitting equipment must be FCC Part 90 certified for public safety use
- The ERRCS shall be a Class A BDA system certified by the FCC and compatible and fully operational with both P25 Phase 1 and P25 Phase 2
- The ERRCS shall have capability to be shut down from the Fire Control Center via a key switch, push button, or equivalent
- No active components shall be shared between the ERRCS and other in-building wireless systems
- The ERRCS shall provide squelch capability for uplink
- The ERRCS shall support 7/800 MHz bands and accommodate at minimum:

- 800 MHz CTS Trunked System (Stamford Subsystem):
- Stamford Fire Department Systems (as required)
- All other verified responding department systems as applicable
- It is the responsibility of the awarded contractor to verify in writing all site applicable frequency requirements

2.2 BASIS OF DESIGN. The system shall be based on the following components (Westell or approved equal):

- Dual Band 700/800 MHz Class A BDA – (Westell CS40 Series or Approved Equal)
- Remote Optical Radio (Westell CS40 Series or Approved Equal)
- Optical Master Unit (Westell CS40 Series or Approved Equal)
- DAS Remote Annunciator (Westell CS40 Series or Approved Equal)
- Donor Antenna: Yagi Directional (Westell CS03-003-430 or Approved Equal)
- Indoor Antennas: Omni-directional (Westell CS03-019-429 Approved Equal)

2.3 BACKUP POWER SYSTEM.

- Battery Backup Units (Westell CS19 series or Approved Equal) shall provide minimum 24 hours runtime.
- Power Source: Dedicated 120V, 20A circuit from life safety panel and standby or emergency backup generator circuits as applicable

2.4 COAXIAL CABLE SYSTEM.

- Indoor Plenum Coax: 1/2" 50 Ohm, low PIM rating
- Outdoor Rated Coax: 1/2" 50 Ohm, low PIM rating
- Jumpers: N-Type (4.3-10 for connection to Westell CS40 Series ports)
- Connectors: N-Type, low PIM rating (4.3-10 for connection to Westell CS40 Series ports)
- Lightning Protection: Westell CS60 Series or Approved Equal

2.5 FIBER OPTIC SYSTEM.

- 12-strand single-mode plenum-rated fiber cabling
- SC/APC pigtailed
- SC/APC compatible fiber patch panels
- Protective dust covers

2.6 SPLITTERS AND TAPPERS.

- 2-Way Power Splitters: Westell CS04 Series or Approved Equal
- Power Tappers: Westell CS05 Series or Approved Equal

2.7 GROUNDING AND BONDING.

- Use UL-listed grounding kits for all outdoor cable runs.
- Install equipment ground bar and connect to building grounding electrode system.

2.8 ENCLOSURES .

- All Active ERRCS equipment shall be contained in NEMA-4 Cabinets

2.9 LABELING AND SIGNAGE.

- Clearly label and tag all cabling and equipment with function and port designations.
- Post signage at the Head-End BDA panel, indicating in bright yellow lettering the assigned BDA number, AC breaker number, and CTS contact number information.

SECTION 2A – BASIS OF DESIGN SYSTEM MANUFACTURER, TESTING, AND INTEGRATION VENDORS

2A.1 SYSTEM MANUFACTURER – BASIS OF DESIGN. The following equipment manufacturers are approved as basis of design and compatible with project requirements.

- **Westell Technologies**
Representative:
Email:
Phone:

2A.2 TESTING, DESIGN, AND INTEGRATION CONSULTANTS – BASIS OF DESIGN. The following vendors are listed as the basis of design for system testing, design, and integration.

- **CASCODE**
Representative:
Email: info@cascode.co
Phone:

- Representative:
Email:
Phone:

PART 3 – EXECUTION

3.0 FREQUENCY AND DONOR SITE VERIFICATION.

- Verify all public safety frequency requirements with the AHJ and CTS Unit
- Submit a formal request for:
 - Uplink/Downlink frequencies
 - Donor site locations and parameters

3.1 EXAMINATION.

- Verify that building conditions support ERRCs integration
- Confirm exterior donor signal levels
- Participate in pre-integration walkthroughs with CTS and AHJ

3.1A BENCHMARK SIGNAL SURVEY.

- Perform grid-based benchmark testing on each floor
- Measure:
 - RSSI, SINR, DAQ, FBER
- Highlight pass/fail zones and submit to EOR, CTS, AHJ for review
- All measurements must be conducted using:
 - Calibrated PCTEL IBflex Scanner (or approved equal)
 - Calibrated Spectrum analyzer

3.1B IBWAVE BUILDING PROPAGATION MODELING.

- Develop an RF propagation model using iBwave Public Safety or Approved Equal
- Modeling inputs shall include:
 - Floor-by-floor architectural data
 - Material attenuation properties
 - Benchmark test data
- Output the following for inclusion in construction set:
 - Heatmaps showing predicted final building state coverages
 - System output calculations

3.2 INSTALLATION.

- Install components per approved design
- Ensure head-end and remote equipment is located in secure space and grounded to suitable building ground in accordance with all manufacturer specifications and referenced codes
- No active components shall be shared between the ERRCS and other in-building wireless systems
- Apply UL 2196 compliant fire-rated cable methods
- Use rubber mat sled for rooftop protection
- Weatherproofing kits required for all rooftop terminations
- Rooftop donor antenna, mount, and coaxial cabling shall be grounded and bonded on the roof to suitable building ground
- Lightning surge arrestors shall be installed at rooftop penetration and grounded and bonded to suitable building ground

3.3 SYSTEM MONITORING AND ALARMING.

- ERRCS alarms shall interface with building Fire Alarm Control System

3.4 ACCEPTANCE TESTING.

- Submit test request to EOR, CTS, and AHJ upon system integration completion
- Conduct RF survey walk-through for system performance validation on all floors
- Vendor shall certify passing criteria per applicable standards and references

During acceptance testing, the maximum adjacent gid areas permissible for failure is (2), even if all other criteria outline in 1A.2 Coverage Criteria section are satisfied

3.5 CLOSEOUT DOCUMENTATION.

- Deliver complete binder of:
 - System record drawings
 - As-built iBwave model and output report
 - Final RF survey report
 - Updated Link budget calculations
 - Alarm and supervision point documentation
 - As-built plan documentation and Excel spreadsheet noting category and location of all equipment labeling

3.6 FCC REGISTRATION AND CONSENT.

- No final system operation shall occur until EOR, CTS, and AHJ grant consent in writing and record of FCC registration and FCC FRN is provided.

3.7 ANNUAL TESTING.

- All active ERRCS components including but not limited to BDA, power supply, and battery systems shall be inspected a minimum of once every (12) months

3.8 FIVE-YEAR RE-CERTIFICATION.

RF Survey consistent with acceptance testing procedure outlined in Section 3.4 shall be conducted every (5) years to ensure ERRCS continues to provide required level of coverage

3.9 MODIFICATIONS.

- Modification of existing ERRCS requires prior approval by CTS and AHJ
- Modification shall not degrade coverage at any time
- An application shall be submitted to CTS and AHJ including a description of work to be performed and drawing reflecting intended modification
- An RF survey must be completed and submitted to CTS and AHJ following modification