

Proposed Content Outlines
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Proposed Content Outlines		Level I	Level II	Level III	Design
A	Defining the Project Scope				
1	Understand requirements and obtain authorization to proceed from the FCC licensee			x	
2	Review and interpret project specifications		x		x
3	Review and interpret project drawings (Level II) Review and interpret project drawings and site survey report (Design)		x		x
4	Understand and comply with project schedule		x		
5	Understand requirements and obtain authorization to proceed from the AHJ			x	
B	Evaluating RF Signal Strength and Quality				
1	Determine and obtain test equipment			x	
2	Identify sources of potential RF interference (Level III) Understand potential RF interference (Design)			x	x
3	Consider all field observations in design				x
4	Measure RF signal strength and quality (Level II) Interpret RF signal strength and quality results (Design)		x		x
5	Grade and document RF signal strength and quality test results			x	
6	Troubleshoot issues that impact RF performance		x		
C	System Design and Layout (Level III) Designing the System (Design)				
1	Provide parameters for system design applications (Level III) Enter parameters into system design application (Design)			x	x
2	Validate selected system equipment (BDA and non-BDA solutions) (Level III) Select system equipment (Design)			x	x
3	Plan headend (e.g., physical layout, structural and architectural construction considerations) (Level III) Plan headend (e.g., equipment selection, cabling) (Design)			x	x
4	Review and finalize system layout (Level III) Determine system layout (Design)			x	x
5	Validate bill of materials (BOM) (Level III) Create bill of materials (BOM) (Design)			x	x
6	Execute permit process (Level III) Generate submittal package (Design)			x	x
D	Performing Rough Installation Activities				
1	Read and follow RF system installation documentation	x			
2	Install cable (e.g., support, firestopping, grounding)	x			

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Proposed Content Outlines			Level I	Level II	Level III	Design
	3	Terminate cable	x			
	4	Test cable		x		
	5	Install passive equipment	x			
	6	Validate passive equipment installation		x		
	7	Verify electrical and grounding requirements		x		
E	Performing Finish and Trim Out Installation Activities					
	1	Install donor antenna	x			
	2	Validate electrical and grounding installation		x		
	3	Install active equipment	x			
	4	Install dedicated annunciator	x			
	5	Interface with fire alarm system		x		
	6	Install battery backup (BBU)	x			
F	Performing Commission, Acceptance Test, and Maintenance Activities					
	1	Adjust headend and remote amplification equipment		x		
	2	Test system alarms		x		
	3	Test battery backup (BBU)		x		
	4	Complete acceptance process			x	

Specialized Knowledge
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Specialized Knowledge	
Basic construction knowledge	Knowledge cable/fiber optic preparation and termination tools
Knowledge of active and passive sources of RF interference	Knowledge of AHJ requirements for approval
Knowledge of AHJ requirements for approval (e.g., firestopping)	Knowledge of AHJ test requirements for approval (e.g., approval for live voice testing, RF frequencies, radio communication protocols)
Knowledge of AHJ testing requirements	Knowledge of antenna placement
Knowledge of available equipment	Knowledge of basic electrical theory
Knowledge of basic RF system components	Knowledge of battery enclosure requirements
Knowledge of building construction	Knowledge of building construction documents
Knowledge of building materials that impact RF propagation	Knowledge of cable/fiber optic run characteristics
Knowledge of cable/fiber optic support solutions	Knowledge of cable/fiber optic termination techniques
Knowledge of cable/fiber optics characteristics (e.g., bend radius)	Knowledge of closeout documentation components
Knowledge of correct donor sites and frequencies	Knowledge of date coding
Knowledge of delivered audio quality (DAQ) scale	Knowledge of donor antenna azimuth and power
Knowledge of donor source azimuth	Knowledge of electrical requirements
Knowledge of equipment calibration process	Knowledge of equipment grounding requirements
Knowledge of equipment lead time	Knowledge of equipment mounting requirements
Knowledge of equipment power requirements	Knowledge of federal, state, and local requirements
Knowledge of fiber optic principles and their application	Knowledge of fire alarm integration
Knowledge of floor plan characteristics	Knowledge of frequency that will be tested
Knowledge of how construction building materials, furniture, fixtures and equipment (FFE) affect RF propagation	Knowledge of how surrounding buildings, other outside sources, and the system being installed can affect RF propagation and/or cause interference
Knowledge of infrastructure construction	Knowledge of isolation testing
Knowledge of job site safety requirements	Knowledge of jurisdictional frequencies
Knowledge of levels of survivability	Knowledge of lightning protection requirements

Specialized Knowledge
Certified In-Building Emergency Responder Communication Enhancement
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Specialized Knowledge	
Knowledge of local and municipality requirements	Knowledge of local code standards
Knowledge of local codes and regulations	Knowledge of manufacturer's configuration requirements
Knowledge of manufacturer's equipment	Knowledge of manufacturer's equipment power requirements
Knowledge of manufacturer's equipment reporting	Knowledge of mounting applications
Knowledge of national codes and regulations	Knowledge of national codes and standards
Knowledge of national electrical code requirements	Knowledge of near/far effect
Knowledge of noise floor effect on LMR systems in uplink and downlink	Knowledge of passive equipment characteristics
Knowledge of RF applications	Knowledge of RF filter requirements
Knowledge of RF principles	Knowledge of RF propagation principles
Knowledge of RF terminology	Knowledge of signal source location
Knowledge of sweep test equipment	Knowledge of system design
Knowledge of system design parameters	Knowledge of system equipment
Knowledge of system requirements and project specifications	Knowledge of the application and deployment of optical communications in IB-ERCES systems
Knowledge of the license holder requirements	Knowledge of the licensee's requirements
Knowledge of transmit-receive isolation principles	Knowledge of types and formats of floorplans
Knowledge of where to obtain licensee information	Knowledge of who is the licensee
Understanding of construction timelines	

Skills and Abilities
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Skills and Abilities	
Ability to adjust system layout	Ability to assemble closeout documentation package according to AHJ requirements
Ability to calculate link budget	Ability to comply with job site safety requirements
Ability to conduct full RF analysis of the building and how to enhance ERRC coverage	Ability to conduct RF signal strength and quality tests
Ability to configure active equipment according to system design	Ability to confirm design aligns with the donor site and frequencies
Ability to determine appropriate equipment for application	Ability to determine directional measurements (e.g., compass, gps)
Ability to determine if equipment meets required audibility	Ability to determine pass-fail
Ability to document modifications for final as-built drawings	Ability to evaluate continuous wave (CW) test results against design
Ability to evaluate equipment	Ability to evaluate manufacturer's equipment for compliance with RF principles and local codes and regulations
Ability to evaluate manufacturer's installation manual	Ability to evaluate quality (e.g., detail and clarity) of floor plans
Ability to evaluate surrounding building structures	Ability to grade RF measurements based on code
Ability to identify cable/fiber optic termination requirements	Ability to identify components of a system
Ability to identify distance to fault (DTF)	Ability to identify the necessary authorities
Ability to identify voltage standing wave ratio (VSWR) sweep	Ability to install active equipment according to system design
Ability to install lightning protection equipment	Ability to install passive equipment according to system design
Ability to interpret codes, regulations, and specifications	Ability to interpret DAQ scale
Ability to interpret design documents	Ability to interpret how various codes and standards work together
Ability to interpret site survey results	Ability to interpret system design
Ability to interpret test results	Ability to keep accurate records (e.g., test results)
Ability to layout equipment (e.g., spacing)	Ability to measure transmit-receive isolation
Ability to operate handheld radio	Ability to operate RF evaluation equipment
Ability to operate test equipment	Ability to perform a continuous wave (CW) test
Ability to perform BTU calculations	Ability to perform coverage needs analysis
Ability to perform link budget analysis	Ability to perform power calculations
Ability to perform propagation analysis	Ability to read design drawings

Skills and Abilities
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Skills and Abilities	
Ability to recognize potential sources of RF interference	Ability to simulate alarm conditions
Ability to test alarm system integration	Ability to test annunciator
Ability to test battery back up	Ability to translate site survey results into design documentation
Ability to use fiber optic testing equipment	Ability to utilize electrical voltage meter
Ability to validate antenna alignment	Communication skills
Drafting/drawing skills	Familiarity with architecture and employment of radio used within jurisdiction
Project management skills	Salesmanship
Skill in sweep testing	

Tools, Equipment, and Resources
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Tools, Equipment, and Resources	
American Red Cross AED First Aid Participant's Manual	Business software (e.g., calculator, spreadsheet)
Cable/fiber optic preparation tools	Construction Management Jumpstart
Directional measurement tools (e.g., compass, gps)	Distributed Antenna Systems
Electrical voltage meter	Engineering, Drawing, and Design
Equipment manufacturer's specifications	Equipment manufacturer's websites
FCC Public Notice DA 19-1255	FCC Title 47 Part 20
FCC Title 47 Part 90	Hand tools (e.g., drill, screwdriver, socket set, saw, pliers)
IEC 62037-1:2012	IFC
In-building design system software	In-Building Radio Enhancement Systems for Public Safety Technical Report 11-480
Indoor Radio Planning: A Practical Guide	Local codes and regulations
Local municipal radio shops	Manufacturer's certification
Manufacturer's installation instructions	Manufacturer's instructions
NFPA 1	NFPA 70
NFPA 72	NFPA 170
NFPA 1221	NPSTC Best Practices for In-Building Communications
NPSTC LMR 101	NTIA Technical Report TR-11-480
Open-short-load test device	OSHA 29 CFR 1910
OSHA 29 CFR 1926	Practical Radio Frequency Test and Measurement: A Technician's Handbook
Project Management Body of Knowledge	Project management references
Public safety handheld radio	radioreference.com
RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)	RF modeling software (e.g., iBwave, Ranplan)
RF software	saferbuildingscoalition.com
Signal generator	Sweep test equipment
TIA-568.1-D	TIA-569-D
TIA-606-B	TIA-607-C
Torque wrench	UL 2524
Voice Radio Communications Guide for the Fire Service	

Acronyms
Certified In-Building Emergency Responder Communication Enhancement
System Professional (IB-ERCES)

Acronym	Description
AHJ	authority having jurisdiction
BBU	battery backup
BDA	bi-directional amplifier
BOM	bill of materials
CW	continuous wave
DAS	distributed antenna system
FCC	Federal Communications Commission
FFE	furniture, fixtures, and equipment
IBC	International Building Code
IFC	International Fire Code
LMR	Land Mobile Radio
NEC	National Electrical Code
NFPA	National Fire Protection Association
NPSTC	National Public Safety Telecommunications Council
NTIA	National Telecommunications and Information Administration
OSHA	Occupational Safety and Health Administration
RF	radio frequency
UL	Underwriter's Laboratories
VSWR	voltage standing wave ratio

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
A	Defining the Project Scope			
	1 Understand requirements and obtain authorization to proceed from the FCC licensee <i>(Level III)</i>			
		<ul style="list-style-type: none"> • Knowledge of RF terminology • Knowledge of the licensee's requirements • Knowledge of where to obtain licensee information • Knowledge of who is the licensee 	<ul style="list-style-type: none"> • Communication skills 	<ul style="list-style-type: none"> • FCC Public Notice DA 19-1255 • FCC Title 47 Part 20 • FCC Title 47 Part 90 • Local municipal radio shops • radioreference.com • saferbuildingscoalition.com
	2 Review and interpret project specifications <i>(Level II & Design)</i>			
		<ul style="list-style-type: none"> • Basic construction knowledge • Knowledge of RF applications 		<ul style="list-style-type: none"> • Construction Management Jumpstart • Engineering, Drawing, and Design • FCC Title 47 Part 20 • FCC Title 47 Part 90 • In-Building Radio Enhancement Systems for Public

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
				Safety Technical Report 11-480 • Voice Radio Communications Guide for the Fire Service
3	Review and interpret project drawings (Level II) Review and interpret project drawings and site survey report (Design)			
		<ul style="list-style-type: none"> • Basic construction knowledge • Knowledge of floor plan characteristics • Knowledge of RF applications • Knowledge of types and formats of floorplans 	<ul style="list-style-type: none"> • Ability to evaluate quality (e.g., detail and clarity) of floor plans 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • NFPA 70 • NFPA 72 • NFPA 170 • NFPA 1221 • UL 2524
4	Understand and comply with project schedule (Level II)			
		<ul style="list-style-type: none"> • Knowledge of equipment lead time • Knowledge of local and municipality requirements • Knowledge of RF applications • Understanding of construction timelines 	<ul style="list-style-type: none"> • Communication skills • Project management skills • Salesmanship 	<ul style="list-style-type: none"> • RF modeling software (e.g., iBwave, Ranplan) • Project management references • Project Management Body of Knowledge
5	Understand requirements and obtain authorization to proceed from the AHJ (Level III)			

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
		<ul style="list-style-type: none"> Knowledge of federal, state, and local requirements 	<ul style="list-style-type: none"> Ability to identify necessary authorities Ability to interpret how various codes and standards work together 	<ul style="list-style-type: none"> FCC Title 47 Part 20 FCC Title 47 Part 90 IFC NFPA 1 NFPA 70 NFPA 72 NFPA 1221
B	Evaluating RF Signal Strength and Quality			
	1 Determine and obtain test equipment (Level II)			
		<ul style="list-style-type: none"> Knowledge of AHJ testing requirements Knowledge of available equipment Knowledge of frequency that will be tested 	<ul style="list-style-type: none"> Ability to determine if equipment meets required audibility Ability to evaluate equipment Ability to evaluate manufacturer's installation manual 	<ul style="list-style-type: none"> Equipment manufacturer's websites FCC Title 47 Part 20 FCC Title 47 Part 90 NPSTC LMR 101 NPSTC Best Practices for In-Building Communications
	2 Identify sources of potential RF interference (Level III) Understand potential RF interference (Design)			

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> • Knowledge of active and passive sources of RF interference • Knowledge of how construction building materials, furniture, fixtures and equipment (FFE) affect RF propagation • Knowledge of how surrounding buildings, other outside sources, and the system being installed can affect RF propagation and/or cause interference • Knowledge of noise floor effect on LMR systems in uplink and downlink • Knowledge of RF propagation principles 	<ul style="list-style-type: none"> • Ability to evaluate surrounding building structures • Ability to operate RF evaluation equipment • Ability to recognize potential sources of RF interference 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • NPSTC Best Practices for In-Building Communications • NPSTC LMR 101 • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)
3	Consider all field observations in design <i>(Design)</i>		
	<ul style="list-style-type: none"> • Knowledge of infrastructure construction 	<ul style="list-style-type: none"> • Familiarity with architecture and employment of radio used within jurisdiction 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • NPSTC Best Practices for In-Building Communications • NPSTC LMR 101 • TIA-568.1-D • TIA-569-D • TIA-607-D

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
4	Measure RF signal strength and quality (Level II) Interpret RF signal strength and quality results (Design)	<ul style="list-style-type: none"> • Knowledge of AHJ test requirements for approval (e.g., approval for live voice testing, RF frequencies, radio communication protocols) • Knowledge of delivered audio quality (DAQ) scale • Knowledge of local code standards • Knowledge of national codes and standards • Knowledge of RF applications • Knowledge of signal source location 	<ul style="list-style-type: none"> • Ability to interpret DAQ scale • Ability to operate handheld radio • Ability to operate RF evaluation equipment 	<ul style="list-style-type: none"> • Distributed Antenna Systems • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • Indoor Radio Planning: A Practical Guide • NFPA 72 • NFPA 1221 • NTIA Technical Report TR-11-480 • Practical Radio Frequency Test and Measurement: A Technician's Handbook • Public safety handheld radio • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
5	Grade and document RF signal strength and quality test results <i>(Level III)</i>			
		<ul style="list-style-type: none"> • Knowledge of AHJ test requirements for approval (e.g., approval for live voice testing, RF frequencies, radio communication protocols) • Knowledge of delivered audio quality (DAQ) scale • Knowledge of local code standards • Knowledge of national codes and standards • Knowledge of RF applications 	<ul style="list-style-type: none"> • Ability to conduct full RF analysis of the building and how to enhance ERRC coverage • Ability to determine pass-fail • Ability to grade RF measurements based on code • Ability to interpret DAQ scale • Ability to operate RF evaluation equipment 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • NFPA 72 • NFPA 1221 • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver) • RF software
6	Troubleshoot issues that impact RF performance <i>(Level II)</i>			
		<ul style="list-style-type: none"> • Knowledge of building materials that impact RF propagation • Knowledge of RF principles 	<ul style="list-style-type: none"> • Ability to interpret test results • Ability to operate test equipment 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • NPSTC Best Practices for In-Building Communications • NPSTC LMR 101
C	System Design and Layout (Level III) Designing the System (Design)			
1	Provide parameters for system design applications (Level III) Enter parameters into system design application (Design)			

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> • Knowledge of AHJ test requirements for approval (e.g., approval for live voice testing, RF frequencies, radio communication protocols) • Knowledge of correct donor sites and frequencies • Knowledge of delivered audio quality (DAQ) scale • Knowledge of donor antenna azimuth and power • Knowledge of license holder requirements • Knowledge of local code standards • Knowledge of national codes and standards • Knowledge of RF applications • Knowledge of signal source location 	<ul style="list-style-type: none"> • Ability to calculate link budget • Ability to confirm design aligns the with donor site and frequencies • Ability to interpret codes, regulations, and specifications • Ability to interpret site survey results • Ability to translate site survey results into design documentation 	<ul style="list-style-type: none"> • Business software (e.g., calculator, spreadsheet) • Equipment manufacturer's specifications • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • In-building design system software • Local codes and regulations • NFPA 72 • NFPA 1221
2	Validate selected system equipment (BDA and non-BDA solutions) (Level III) Select system equipment (Design)		

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
		<ul style="list-style-type: none"> • Knowledge of local codes and regulations • Knowledge of RF principles • Knowledge of system equipment • Knowledge of system requirements and project specifications 	<ul style="list-style-type: none"> • Ability to determine appropriate equipment for application • Ability to evaluate manufacturer's equipment for compliance with RF principles and local codes and regulations 	<ul style="list-style-type: none"> • Equipment manufacturer's specifications • FCC Public Notice DA 19-1255 • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • NFPA 72 • NFPA 1221
3	Plan headend (e.g., physical layout, structural and architectural construction considerations) (Level III) Plan headend (e.g., equipment selection, cabling) (Design)			
		<ul style="list-style-type: none"> • Knowledge of building construction documents • Knowledge of equipment power requirements • Knowledge of levels of survivability • Knowledge of local codes and regulations • Knowledge of RF principles 	<ul style="list-style-type: none"> • Ability to layout equipment (e.g., spacing) • Ability to perform BTU calculations • Ability to perform power calculations 	<ul style="list-style-type: none"> • IFC • NFPA 70 • NFPA 72 • NFPA 1221 • FCC Title 47 Part 20 • FCC Title 47 Part 90 • Equipment manufacturer's specifications
4	Review and finalize system layout (Level III) Determine system layout (Design)			

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
		<ul style="list-style-type: none"> • Knowledge of active and passive sources of RF interference • Knowledge of antenna placement • Knowledge of cable/fiber optic run characteristics • Knowledge of fiber optic principles and their application • Knowledge of how construction building materials, furniture, fixtures and equipment (FFE) affect RF propagation • Knowledge of levels of survivability • Knowledge of local codes and regulations • Knowledge of near/far effect • Knowledge of passive equipment characteristics • Knowledge of the application and deployment of optical communications in IB-ERCES systems 	<ul style="list-style-type: none"> • Ability to adjust system layout • Ability to document modifications for final as-built drawings • Ability to perform coverage needs analysis • Ability to perform link budget analysis • Ability to perform propagation analysis • Ability to use fiber optic testing equipment • Drafting/drawing skills 	<ul style="list-style-type: none"> • Business software (e.g., calculator, spreadsheet) • Equipment manufacturer's specifications • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • NFPA 70 • NFPA 72 • NFPA 1221 • RF modeling software (e.g., iBwave, Ranplan)
5	Validate bill of materials (BOM) (Level III) Create bill of materials (BOM) (Design)			
		<ul style="list-style-type: none"> • Knowledge of basic RF system components • Knowledge of national codes and regulations 	<ul style="list-style-type: none"> • Ability to read design drawings • Ability to identify components of a system 	<ul style="list-style-type: none"> • Business software (e.g., calculator, spreadsheet)

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
				<ul style="list-style-type: none"> Distributed Antenna Systems IFC Indoor Radio Planning: A Practical Guide NFPA 70 NFPA 72 NFPA 1221
6	Execute permit process (Level III) Generate submittal package (Design)			
		<ul style="list-style-type: none"> Knowledge of AHJ requirements for approval Knowledge of national codes and standards 	<ul style="list-style-type: none"> Ability to interpret codes, regulations, and specifications 	<ul style="list-style-type: none"> Business software (e.g., calculator, spreadsheet) Distributed Antenna Systems FCC Title 47 Part 20 FCC Title 47 Part 90 IFC Indoor Radio Planning: A Practical Guide NFPA 70 NFPA 72 NFPA 1221
D	Performing Rough Installation Activities			

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
1	Read and follow RF system installation documentation <i>(Level I)</i>	<ul style="list-style-type: none"> • Knowledge of AHJ requirements for approval • Knowledge of building construction • Knowledge of local codes and regulations • Knowledge of manufacturer's equipment • Knowledge of national codes and regulations 	<ul style="list-style-type: none"> • Ability to interpret design documents 	<ul style="list-style-type: none"> • Equipment manufacturer's specifications • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • NFPA 70 • NFPA 72 • NFPA 1221
2	Install cable (e.g., support, fire stopping, grounding) <i>(Level I)</i>	<ul style="list-style-type: none"> • Knowledge of AHJ requirements for approval (e.g., firestopping) • Knowledge of cable/fiber optic characteristics (e.g., bend radius) • Knowledge of cable/fiber optic support solutions • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of national codes and regulations 	<ul style="list-style-type: none"> • Ability to comply with job site safety requirements 	<ul style="list-style-type: none"> • NFPA 70 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers)
3	Terminate cable <i>(Level I)</i>			

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> • Knowledge cable/fiber optic preparation and termination tools • Knowledge of cable/fiber optic termination techniques • Knowledge of job site safety requirements • Knowledge of manufacturer's equipment 	<ul style="list-style-type: none"> • Ability to identify cable/fiber optic termination requirements 	<ul style="list-style-type: none"> • Equipment manufacturer's specifications • Cable/fiber optic preparation tools • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • American Red Cross AED First Aid Participant's Manual • TIA-606-B • Indoor Radio Planning: A Practical Guide
4	Test cable <i>(Level II)</i>		
	<ul style="list-style-type: none"> • Knowledge of equipment calibration process • Knowledge of job site safety requirements • Knowledge of RF principles • Knowledge of sweep test equipment 	<ul style="list-style-type: none"> • Ability to identify distance to fault (DTF) • Ability to identify voltage standing wave ratio (VSWR) sweep • Ability to keep accurate records (e.g., test results) • Skill in sweep testing 	<ul style="list-style-type: none"> • American Red Cross AED First Aid Participant's Manual • Distributed Antenna Systems • IEC 62037-1:2012

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
			<ul style="list-style-type: none"> • Indoor Radio Planning: A Practical Guide • Open-short-load test device • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • Practical Radio Frequency Test and Measurement: A Technician's Handbook • Sweep test equipment
5	Install passive equipment <i>(Level I)</i>		
	<ul style="list-style-type: none"> • Knowledge of job site safety requirements • Knowledge of manufacturer's equipment • Knowledge of RF filter requirements • Knowledge of system design parameters 	<ul style="list-style-type: none"> • Ability to install passive equipment according to system design • Ability to interpret system design 	<ul style="list-style-type: none"> • American Red Cross AED First Aid Participant's Manual • Distributed Antenna Systems • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • Indoor Radio Planning: A Practical Guide

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
			<ul style="list-style-type: none"> • Manufacturer's installation instructions • NFPA 70 • NFPA 72 • NFPA 1221 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • Torque wrench
6	Validate passive equipment installation <i>(Level II)</i>		
	<ul style="list-style-type: none"> • Knowledge of isolation testing • Knowledge of RF principles • Knowledge of transmit-receive isolation principles 	<ul style="list-style-type: none"> • Ability to evaluate continuous wave (CW) test results against design • Ability to interpret system design • Ability to measure transmit-receive isolation • Ability to perform a continuous wave (CW) test 	<ul style="list-style-type: none"> • American Red Cross AED First Aid Participant's Manual • Distributed Antenna Systems • FCC Title 47 Part 20 • FCC Title 47 Part 90 • IFC • Indoor Radio Planning: A Practical Guide • NFPA 70 • NFPA 72 • NFPA 1221 • OSHA 29 CFR 1910

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
				<ul style="list-style-type: none"> • OSHA 29 CFR 1926 • Practical Radio Frequency Test and Measurement: A Technician's Handbook • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver) • Signal generator • TIA-606-B
7	Verify electrical and grounding requirements <i>(Level II)</i>			
		<ul style="list-style-type: none"> • Knowledge of electrical requirements • Knowledge of equipment grounding requirements • Knowledge of manufacturer's equipment power requirements • Knowledge of national electrical code requirements 	<ul style="list-style-type: none"> • Ability to interpret design documents 	<ul style="list-style-type: none"> • Manufacturer's installation instructions • NFPA 70 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926
E	Performing Finish and Trim Out Installation Activities			
1	Install donor antenna <i>(Level I)</i>			
		<ul style="list-style-type: none"> • Knowledge of donor source azimuth • Knowledge of job site safety requirements 	<ul style="list-style-type: none"> • Ability to determine directional measurements (e.g., compass, GPS) • Ability to install lightning protection equipment 	<ul style="list-style-type: none"> • Directional measurement tools (e.g., compass, GPS)

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> Knowledge of lightning protection requirements Knowledge of local codes and regulations Knowledge of mounting applications Knowledge of RF principles 	<ul style="list-style-type: none"> Ability to interpret design documents Ability to operate RF evaluation equipment Ability to validate antenna alignment 	<ul style="list-style-type: none"> FCC Title 47 Part 20 FCC Title 47 Part 90 Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) Manufacturer's installation instructions NFPA 70 OSHA 29 CFR 1910 OSHA 29 CFR 1926 RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)
2	Validate electrical and grounding installation <i>(Level II)</i>		
	<ul style="list-style-type: none"> Knowledge of electrical requirements Knowledge of equipment grounding requirements Knowledge of manufacturer's equipment power requirements Knowledge of national electrical code requirements 	<ul style="list-style-type: none"> Ability to interpret design documents Ability to utilize electrical voltage meter 	<ul style="list-style-type: none"> Electrical voltage meter Manufacturer's installation instructions NFPA 70 OSHA 29 CFR 1910 OSHA 29 CFR 1926

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
3	Install active equipment <i>(Level I)</i>	<ul style="list-style-type: none"> • Knowledge of electrical requirements • Knowledge of equipment mounting requirements • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of RF principles 	<ul style="list-style-type: none"> • Ability to install active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • Manufacturer's installation instructions • NFPA 70 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • Torque wrench
4	Install dedicated annunciator <i>(Level I)</i>	<ul style="list-style-type: none"> • Knowledge of equipment mounting requirements • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of national codes and standards 	<ul style="list-style-type: none"> • Ability to install active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's installation instructions • NFPA 70 • NFPA 1221 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926

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Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
5	Interface with fire alarm system <i>(Level II)</i>	<ul style="list-style-type: none"> • Knowledge of fire alarm integration • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of national codes and standards 	<ul style="list-style-type: none"> • Ability to install active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's installation instructions • NFPA 70 • NFPA 72 • NFPA 1221 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926
6	Install battery backup (BBU) <i>(Level I)</i>	<ul style="list-style-type: none"> • Knowledge of battery enclosure requirements • Knowledge of date coding • Knowledge of electrical requirements • Knowledge of equipment mounting requirements • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of national codes and standards 	<ul style="list-style-type: none"> • Ability to install active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's installation instructions • NFPA 70 • NFPA 72 • NFPA 1221 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926

Updated DACUM Chart for Certified In-Building Emergency Responder Communication Enhancement System Professional (IB-ERCES)

Duties, Tasks, and Steps		Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
F	Performing Commission, Acceptance Test, and Maintenance Activities			
	1 Adjust headend and remote amplification equipment <i>(Level II)</i>			
		<ul style="list-style-type: none"> • Knowledge of electrical requirements • Knowledge of job site safety requirements • Knowledge of jurisdictional frequencies • Knowledge of manufacturer's configuration requirements • Knowledge of RF principles 	<ul style="list-style-type: none"> • Ability to configure active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • FCC Title 47 Part 20 • FCC Title 47 Part 90 • Manufacturer's certification • Manufacturer's installation instructions • NFPA 70 • NPSTC Best Practices for In-Building Communications • NPSTC LMR 101 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926 • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)
	2 Test system alarms <i>(Level II)</i>			

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> • Knowledge of basic electrical theory • Knowledge of fire alarm integration • Knowledge of local codes and regulations • Knowledge of manufacturer's equipment reporting • Knowledge of national codes and standards 	<ul style="list-style-type: none"> • Ability to simulate alarm conditions • Ability to utilize electrical voltage meter 	<ul style="list-style-type: none"> • Electrical voltage meter • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's instructions • NFPA 70 • NFPA 72 • NFPA 1221
3	Test battery backup (BBU) <i>(Level II)</i>		
	<ul style="list-style-type: none"> • Knowledge of battery enclosure requirements • Knowledge of date coding • Knowledge of electrical requirements • Knowledge of equipment mounting requirements • Knowledge of job site safety requirements • Knowledge of local codes and regulations • Knowledge of national codes and standards 	<ul style="list-style-type: none"> • Ability to install active equipment according to system design • Ability to interpret design documents 	<ul style="list-style-type: none"> • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's installation instructions • NFPA 70 • NFPA 72 • NFPA 1221 • OSHA 29 CFR 1910 • OSHA 29 CFR 1926
4	Complete acceptance process <i>(Level IV)</i>		

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Duties, Tasks, and Steps	Knowledge	Skills, Abilities, and Attributes	Tools, Equipment and Resources
	<ul style="list-style-type: none"> • Knowledge of AHJ test requirements for approval (e.g., approval for live voice testing, RF frequencies, radio communication protocols) • Knowledge of closeout documentation components • Knowledge of fire alarm integration • Knowledge of local codes and regulations • Knowledge of national codes and standards • Knowledge of RF principles • Knowledge of system design 	<ul style="list-style-type: none"> • Ability to assemble closeout documentation package according to AHJ requirements • Ability to conduct RF signal strength and quality tests • Ability to configure active equipment according to system design • Ability to test alarm system integration • Ability to test annunciator • Ability to test battery back up • Communication skills 	<ul style="list-style-type: none"> • Electrical voltage meter • Hand tools (e.g., drill, screwdriver, socket set, saw, pliers) • IFC • Manufacturer's instructions • NFPA 70 • NFPA 72 • NFPA 1221 • RF evaluation equipment (e.g., spectrum analyzer, directional antenna, scanning receiver)