



BROWARD COUNTY BOARD OF RULES AND APPEALS

1 N. University Drive, Suite 3500B, Plantation, FL 33324

P: 954-765-4500 | F: 954-765-4504 broward.org/CodeAppeals

To: Members of the Committee to Address Uniform Procedures for Installation of
Bi-Directional Amplifiers (BDA)

D. Rice, P.E.	B. Bowers	M. Bray	K. Brown	J. DeZayas	T. DiBernardo
R. Dinello	J. Franklin	K. Grams	B. Higdon	W. Keys	H. Melamed
J. Preston	M. Sheehan	R. Taylor	A. Zackria		

From: Bryan Parks, Chief Fire Code Compliance Officer
Ken Castronovo, Chief Electrical Code Compliance Officer

Date: September 17, 2019

Subj: BDA Committee to Discuss Agenda Items

The Chairman of the BDA Committee, Mr. Dave Rice, P.E., has called for a meeting of the BDA Committee on September 17, 2019 at 1:30pm at the Plantation Fire Station, 550 NW 65th Avenue, Plantation, FL 33317. The latest issues concerning Bi-Directional Amplifiers will be discussed.

Chairman Welcoming Remarks

New Member(s):

Roll Call

Acceptance of July 29, 2019 Meeting Minutes

Item 1: Staff Opinion Dated August 2, 2019

Structural Plan Revision and Inspections

Item 2: Discuss "Guidelines Draft Rev. 1"

Item 3: Discuss "Sample Drawings Draft Rev. 1"

Item 4: Questions and Answers on Guidelines Draft Rev. 1

Item 5: New Products Listed to UL 2524 Standards

Item 6: Report on Safer Building Coalition Event on September 12, 2019

Item 7: Importance of a Good Plan Review

Engineer of Record

Item 8: Training

Q&A at the end of each BDA Meeting:

- A. Questions submitted prior to meeting coaxial cable plenum rated
- B. Turn on a BDA System
- C. Lightning Protection (NFPA 1221-9.6.3) Grounding
- D. Pathway Survivability

Item 9: General Discussion

Schedule Next Meeting

Adjournment

Sunshine Law Reminder: Advisory Board members cannot communicate with each other on a possible committee or Board topic outside of a public meeting, per State statute.



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MEETING OF THE COMMITTEE TO ADDRESS UNIFORM PROCEDURES FOR INSTALLATION OF BI-DIRECTIONAL AMPLIFIERS

**Minutes
July 29, 2019**

Call to order:

Chair David Rice, P.E. called a published meeting of the Broward County Board of Rules and Appeals Committee to Address Uniform Procedures for Installation of Bi-Directional Amplifiers to order at 1:37pm.

The roll was called, and the following members were present:

Present:

Bruce Bowers

Kevin Grams

Mike Sheehan

Mickey Bray

Brad Higdon

Abbas Zackria

Robert "Bob" Dinello

John Preston

Jonathan Franklin

David Rice, P.E.

Staff: Bryan Parks, Chief Fire Code Compliance Officer
Kenneth Castronovo, Chief Electrical Code Compliance Officer

Chair David Rice, P.E., shared a statement that was sent to him via email by Mr. William Redmond, Broward County Building Code Services Division. Mr. Redmond was concerned that he was misinterpreted at the April 25, 2019 BDA Committee Meeting. His email clarified that he would like the minutes to be corrected to state that foreign equipment is not permitted in the elevators and there are exceptions for sprinkler plates, heating and cooling. Rather than how it is currently worded: "Foreign equipment in the elevators is permitted. There are exceptions for sprinkler plates, heating and cooling."

A MOTION WAS MADE BY MR. BRAY AND SECONDED BY MR. ZACKRIA TO APPROVE THE MODIFICATIONS FOR THE APRIL 25, 2019 COMMITTEE TO ADDRESS UNIFORM PROCEDURES FOR INSTALLATION OF BI-DIRECTIONAL AMPLIFIERS MEETING MINUTES. THE MOTION PASSED BY UNANIMOUS VOTE.

Chair Rice explained that since there were so many agenda items with a limited amount of time, at this BDA Meeting the committee members would go through the agenda without input from the audience.

Item 1: Discuss UL 60950 and UL 2524

Chair Rice said that the goal is to establish uniform standards throughout the Broward County municipalities. He added that by utilizing the guidelines, there should be a lowered cost by minimizing complications and/or delays on the job, which will lessen the chance of re-inspections being required. Chair Rice also mentioned that the guidelines have been modeled after the Broward Sherriff's Office – Fire Rescue's checklist. He asked for the members of the public to share their comments and questions with him and to pay close attention to the grounding details. Because Florida is the lightning capital, this aspect of the plans is integral.

Mr. Kenneth Castronovo, Broward County Board of Rules and Appeals, explained that when the Formal Interpretation expired on April 19, 2019, the BDA Committee requested the adoption of UL 2524. Using UL 2524, UL 60950 and a field evacuation was acceptable. After that process was approved, the committee decided to take it further to advance the standards.

Chair Rice clarified that the BDA Committee falls under both, the Florida Building Code and the Florida Fire Prevention Code. Since there is nothing in either code explicitly requiring that the UL 2524, the only thing that could make it mandatory is a code change. The state of Florida is currently under the 2013 National Electric Code (NEC) – NFPA 72. The code won't be changed until 2020, moving the state to the 2016 NEC. Making the state's code updated, yet outdated.

NO MOTION.

Item 2: Discuss the Compatibility List

The issues associated with third-party inspections were discussed. Chair Rice shared that because many building departments are not very familiar with BDA systems, it can become more problematic when the different components of the system are not all UL listed. The departments rely heavily on the results of the third-party inspections. Chair Rice developed a product compatibility list. It is modeled after the manufacturers' compatibility lists for fire alarm systems.

Chair Rice presented the form at the Electrical Chiefs Meeting, where it was well received. He moved on to sharing the compatibility list with Advanced RF Technologies, Inc., Honeywell, Comba and Westell Technologies, Inc. Chair Rice's goal is to have the forms filled out by the system's integrator listing the system's components, part numbers and listing numbers (if applicable). He said that these forms have the potential to eliminate third-party inspections and could generate savings of \$2,000 - \$10,000 on a job.

NO MOTION.

Item 3: Discuss having a Plan Review Meeting

Chair Rice shared that one system integrator was interested in having a plan review meeting. He added that Broward County does not currently have a system in place for situations like these and there is a lack of funding for them.

NO MOTION.

Item 4: Discuss the proposed draft edition of the “Guidelines”

Chair Rice communicated his intentions for the “Broward County Two-Way Radio Communications Enhancement Systems (BC RCES) Guidelines.” He asked for everyone in the room to use their copies to identify the flaws of the current draft.

He also noted that a Broward County BDA system should only be turned on after ORCAT has given their approval.

Chair Rice asked the public if anyone had more than 10 years of experience designing RF systems or more than 10 years of designing radio systems. He added that because these types of systems have only been in use for a short amount of time, it can be difficult to find people with adequate experience.

Chair Rice explained that the owner, contractor, licensed electrical contractor or licensed fire alarm contractor are permitted to hire a systems integrator; but the owner cannot hire a systems integrator if that systems integrator is not a contractor.

Mr. Abbas Zackria, WZA Architects, noted that in a BDA system installation, a BDA engineer is required, not a standard Mechanical, Electrical or Plumbing (MEP) engineer.

It is not permitted to have anything in the elevator shaft without a variance from the elevator inspector.

A member of the public asked for clarification about signal usage when testing the system.

Mr. Gray answered, by explaining that closed loop line sweeps are permitted. Anything that is being radiated into an antenna inside or outside of the building is not permitted without an FCC-granted license. It has the potential to create interference and affect every frequency user in the area.

Chair Rice added that both the BDA manufacturer and the engineer are responsible for a BDA system’s compatibility.

NO MOTION.

Item 5: Discuss the proposed draft edition of the “Sample Drawings”

Chair Rice clarified that he, not the Broward County Board of Rules and Appeals, provided the agenda’s sample drawing. The sample drawing was provided to articulate how plans should be presented.

He also added that he would like the members of the public to contact him with questions and comments about the sample drawings. As well as the contacting him to share information about pricing across the industry.

NO MOTION.

Item 6: Discuss Re-inspections: Should the Engineer of Record be required to attend?

Chair Rice asked if anyone in the room was an engineer. A few people raised their hands. He selected one of the women from the class. She confirmed that she is a registered State Florida engineer and went on to share some of the details about her job and the process of how she communicates with the inspectors about her projects' plans.

NO MOTION.

Item 7: Discuss how many BDA systems have been installed in Broward County and how many next will be installed next year?

Chair Rice shared that the Federal Communications Commission (FCC) has a feature on their website which allows visitors to research registrations. He announced that, roughly, Broward County had 24 BDA systems installed in 2014; 6 BDA systems installed in 2015; 60 BDA systems installed in 2016; 46 BDA systems installed in 2017; 93 BDA systems installed in 2018; and 30 BDA systems were installed as of June 2019.

NO MOTION.

Item 8: Discuss the future of the BDA Committee

Chair Rice expressed that the BDA Committee has been very reactive. He would like to change the approach and become more proactive.

Chair Rice said that he would like the BDA Committee to have a mission statement. He requested assistance for creating the committee's mission.

Chair Rice mentioned that first responder safety is the top priority; he is also interested in providing education to ensure that Items 1-9 are taken care of.

Mr. Gray added that he would like to include the residents as a priority. He explained that the residents have a need for safety and the first responders are the tools that are used to get residents the help that they need, when they need it. If the first responders cannot communicate, the residents cannot be helped.

Chair Rice stated that he would like to reduce the system cost through education. As an engineer, he always gets complaints about pricing when he designs projects. He reiterated that by passing your first inspection, the reinspection costs will be eliminated. Failed inspections cost money for the property owner and everyone else on the job site.

Chair Rice also shared his long-term goals. First, to minimize government. He plans to do that by ultimately eliminating the BDA Committee. Second, to provide education to all of the professionals involved in the BDA

system installation process (designers, engineers, installers, integrators, electricians and permitting employees).

NO MOTION.

Item 9: Discuss General Items

Mr. John Preston, Oakland Park Fire Rescue, asked the members of the public if they had documents or input that they would like to present to the committee members. Several people raised their hand. After that response, Mr. Preston suggested that the next meeting be a community/industry input and engagement meeting. This will allow the members of the public to share their comments, concerns and questions with the members of the BDA Committee.

The discussion of pathway survivability began. There was confusion about who is responsible for making sure that the pathway survivability is accurate. Chair Rice said that the Structural Inspector is the person who is responsible.

A member of the public asked for an approved vendor list for third-party inspections. Chair Rice suggested that she look online for Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratories (NRTL).

Mr. Keith Jewett, City of Fort Lauderdale, mentioned that the City of Fort Lauderdale has begun to require coverage in all buildings.

NO MOTION.

Adjournment

Having no further business to go before the Committee, the meeting adjourned at 3:28pm.

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Item 1:

Staff Opinion Dated August 2, 2019

Structural Plan Revision and Inspections



BROWARD COUNTY BOARD OF RULES AND APPEALS

ONE NORTH UNIVERSITY DRIVE
SUITE 3500-B
PLANTATION, FLORIDA 33324

PHONE: 954-765-4500
FAX: 954-765-4504

www.broward.org/codeappeal

2019 Voting Members

Chair

Mr. Daniel Lavrich,
P.E., S.I., SECB, F.ASCE, F.SEI
Structural Engineer

Vice-Chair

Mr. Stephen E. Bailey, P.E.
Electrical Engineer
Mr. Jeffrey Lucas, FM, CFI, CFEI
Fire Service Professional
Mr. John Famularo,
Roofing Contractor
Mrs. Shalanda Giles Nelson,
General Contractor
Mr. Daniel Rourke
Master Plumber
Mr. Gregg D'Attila,
Mechanical Contractor
Mr. Ron Burr
Swimming Pool Contractor
Mr. John Sims,
Master Electrician
Mr. Dennis A. Ulmer
Consumer Advocate
Mr. Abbas H. Zackria, CSI
Architect
Mr. Robert A. Kamm, P.E.
Mechanical Engineer

Vacant

Representative Disabled Community

2019 Alternate Board Members

Mr. Jeff Falkanger
Architect
Mr. Steven Feller, P.E.
Mechanical Engineer
Mr. Alberto Fernandez,
General Contractor
Mr. Robert Taylor
Fire Service
Mr. Gary Elzweig, P.E., F.ASCE
Structural Engineer
Mr. David Rice, P.E.
Electrical Engineer
Mr. James Terry,
Master Plumber
Mr. David Tringo,
Master Electrician
Mr. William Flett,
Roofing Contractor

Board Attorney

Charles M. Kramer, Esq.

Board Administrative Director

James DiPietro

—ESTABLISHED 1971—

Subject: Staff Opinion Concerning Structural Plan Review and Inspections for BDA Projects.

Date: August 2, 2019

To: BDA Committee, Broward County Electrical Inspectors, Fire Inspectors and ORCAT

From: Kenneth Castronovo, Chief Electrical Code Compliance Officer
Bryan Parks, Chief Fire Code Compliance Officer
Michael Guerasio, Chief Structural Code Compliance Officer

At the last Bi-Directional Amplifier Committee meeting on July 29th, 2019 there were questions from the BDA Committee as to who should inspect the fire rating construction of pathway survivability requirements, fire rated rooms for cable connections and fire penetrations for BDA installations. The staff was asked to provide their opinion.

Staff Opinion: Staff believes that the construction elements of all risers, BDA cable connection rooms, pathway survivability raceways and fire rated wall penetrations shall be reviewed, and field inspected by the structural department for every BDA installation. These requirements are found in NFPA 72 section 24.3.6.8.3 for Riser Installations, NFPA 72 section 24.3.6.8.4 for BDA Cable Connections, FBC 714.2 for Fire Assembly Detail, FBC 714.3.1 for Through Penetrations, FBC 1023.5 for Penetrations in Stairwells and NFPA 70, section 820.26 for Spread of Fire or Products of Combustion.

Respectfully,

Kenneth Castronovo, CECCO

Bryan Parks, CFCCO

Michael Guerasio, CBCCO

Item 2:

Discuss “Guidelines Draft Rev. 1”

Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

For Review and Approval by the

BDA Committee
2019

Draft Edition

DRAFT EDITION
2019-09-17 Rev 1

Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

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2019-09-17 Rev 1

Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

Part 1. Overview

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1.1 Purpose

A “Two-Way Radio Communications Enhancement System” (RCES) gives fire departments and law enforcement a reliable in-building communication system without detrimentally impacting the surrounding community’s Public Radio Communication Systems.

The purpose of these guidelines is to provide the designers, manufacturers, installers, inspectors, and FCC License Holders the tools to properly design, permit, install, and inspect a fully functional in-building communication enhancement system that meets the state and local codes for Broward County, Florida.

These are guidelines only and are not intended to be code items.

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1.2 Background

Each municipality has a public emergency Two-Way Radio Communications System for use by the fire department and law enforcement. These two-way radio systems generally work in open spaces without problems. However, these two-way radio systems do not always work inside buildings. Most buildings now require a signal repeater system located in the building to amplify the radio signal to allow the two-way radio system to work. These systems are known as “Two-Way Radio Communications Enhancement Systems (RCES)” or “Bi-Directional Amplifier Systems” (BDA).

When these systems are not properly designed, installed, and inspected, then major communication problems can occur inside and outside of the building. One faulty system may take down the radio communication system in a large part of a municipality. This faulty system would prohibit the fire department and law enforcement from communicating through their two-way radio system.

In 2015, BDA Systems installed in high rise buildings in the cities of Aventura and Hallandale Beach caused significant interference with the Broward County’s Public Safety Radio System. The Hallandale Beach System was improperly adjusted after the inspections were completed. Once the problems were identified, the building systems were immediately taken off-line, repaired, and re-inspected. Broward County then asked Broward County Board of Rules and Appeals (BORA) to investigate the problems associated with the faulty installation and to review the existing codes and procedures to attempt to prevent this problem from occurring again.

BORA started up a temporary committee to address these problems. The committee found the following:

1. The state and local codes, Florida Building Codes (FBC), Florida Fire Prevention Code (FFPC), and NFPA 72, if followed, were sufficient and did not require any changes.
2. The problem was a procedural one. All three (3) codes required that the installation shall be permitted and the AHJ’s be notified. A new code section was added to the Florida Building Code (FBC), Broward County Edition, Chapter 1. This new section 118 set forth procedures requiring AHJ notification, among other requirements.

The temporary committee was made a permanent committee in 2018 to address ongoing Two-Way Radio Communications Enhancement Systems problems. The technology is moving at a faster pace than the codes are able to address.

1.3 Codes and Requirements for Broward County

As of January 1, 2018, the following codes have been in effect:

Florida Statute (FS)633.202(1)

Adopts the FFPC

Florida Statute (FS)633.202(18)

This statute pertains to high-rise buildings.

Florida Building Code (FBC), Broward County Edition, Chapter 1, Sixth Edition (2017)

Section 118 Two-Way Radio Communication Enhanced Public Safety Signal
Booster Systems

Florida Fire Prevention Code (FFPC) Sixth Edition (2017)

NFPA 1 Fire Code (2015)

Section 1.4 Equivalencies
Section 2.2 Referenced Publications
NFPA 70, NFPA 72, NFPA 780, (NFPA 1221 Not enforceable)
Section 11.10 Two-Way Radio Communications Enhancement System
when required by AHJ

NFPA 70 (NEC) (2014)

Section 90.7
Article 100 Definitions
Section 110.2 Approval (UL, etc.)
Section 100.2(B) Approval (UL, etc.)

NFPA 72 (Fire Alarm) (2013)

Chapter 10 Fundamentals
Section 12.4 Pathway Survivability
Section 14.4.10 In-Building Emergency Radio Communication System
Section 24.3.6 Pathway Survivability
Section 24.5.2 Two-Way Radio Communications Enhancement Systems
Annex A14.4.10.3 DAQ
Annex A14.4.10.5 DAQ

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1.3 Codes and Requirements for Broward County (cont.)

Codes and Standards Available:

NO.	Description	Issue Date								
		2013	2014	2015	2016	2017	2018	2019	2020	2021
NFPA 70	Electric		FL			*				
NFPA 72	Fire Alarm	FL			*			*		
NFPA 780	Lightning Protection Systems		#			*				
NFPA 1221	Em Service Comm System				*			*		
UL 2524	2-way EM Comm						*			
FL – Adopted by Florida <u># - Adopted by Florida for hospitals, nursing homes, schools only</u> * - Code Now Available, but not adopted by Florida										
State of Florida is up to six (6) years behind in adopting codes.										

Other Codes and Standards Available, but not adopted by Florida:

NO.	Description	Issue Date								
		2013	2014	2015	2016	2017	2018	2019	2020	2021
IFC	International Fire Code IFC/ICC			*			*			
IEEE 1692	Institute of Electric and Electronic Engineers Guide for the Protection of Communication Installations from Lightning Effects 2011									
Motorola R56	Standards and Guidelines 2015 For Communications Sites Chapter 4 Exterior Grounding Chapter 5 Interior Grounding Chapter 7 Surge Protection Devices Chapter 9 Equipment Installation 9.9.8 RF Cabling									
ANSI/TIA	569, 607 Pathways, Grounding									

Other Guidelines:

City of Fort Lauderdale	Communications	BDA Guidelines 2019
Broward County	RESC	BDA Guidelines 2019

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1.3 Codes and Requirements for Broward County (cont.)

Optional Codes and Dates

The State of Florida, through the FFPC (2017), Chapter 1, Section 1.4, allows the Two-Way Radio Communications Enhancement System Engineer of Record to design the system with present or newer codes, if acceptable by the AHJ, as shown below:

The design engineer shall select one of the following three options:

NFPA 72 (2013)

NFPA 72 (2016) and NFPA 1221 (2016)

NFPA 72 (2019) and NFPA 1221 (2019)

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1.3 Codes and Requirements for Broward County (cont.)

Code Comparison

The State of Florida has adopted NFPA (2013). The Engineer of Record (EOR) may select to design the system using NFPA 72 (2016), NFPA 1221 (2016), or NFPA 72 (2019), NFPA 1221 (2019).

Main differences between codes and dates:

	NFPA 72 (2013)	NFPA 72 (2016), NFPA 1221 (2016)
1	Feeder and riser cables are routed through an enclosure rated for 2 hours. (NFPA 72-24)	Feeder and riser cables are routed through an enclosure that matches the building's fire rating. (NFPA 1221-9.6)
2	The antenna <u>shall be protected by</u> a Lightning Protection System if a Lightning Protection System is existing. The system shall comply with NFPA 780.	The antenna <u>shall be protected by</u> a Lightning Protection System if a Lightning Protection System is existing. A new Lightning Protection System shall be installed if one does not exist. The system shall comply with NFPA 780. (NFPA 1221-9.6.3)

	NFPA 72 (2013)	NFPA 72 (2019), NFPA 1221 (2019)
1	Feeder and riser cables shall be routed through an enclosure rated for 2 hours. (NFPA 72-24)	Backbone cables shall be routed through an enclosure that matches the building's fire rating. (NFPA 1221-9.6)
2	Feeder cables are cables from the donor antenna to the BDA. Riser cables are cables from the BDA to the antenna distribution cables. (NFPA 72-1224)	Feeder and riser cables are now called backbone cables. Cables from the BDA to the distribution antenna are called antenna distribution cables. (NFPA 1221-9.6)
3	A Pathway Survivability of Level 1 allows antenna distribution cables to be installed in metal raceways instead of in a 2-hour-fire rated enclosure. (NFPA 72-24)	The Pathway Survivability has been removed. Antenna distribution cables are not required to be in an enclosure that is fire-rated. Antenna distribution cables are not required to be in conduit. (NFPA 1221-9.6)
4	The antenna <u>shall be protected by</u> a Lightning Protection System if a Lightning Protection System is existing. The system shall comply with NFPA 780.	The antenna <u>shall be protected by</u> a Lightning Protection System if a Lightning Protection System is existing. A new Lightning Protection System shall be installed if one does not exist. The system shall comply with NFPA 780. (NFPA 1221-9.6.3)

1.4 Authorities Having Jurisdiction (AHJ)

The AHJ is defined as: “An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation or a procedure”.

In Broward County, Florida, the AHJ’s are as follows for the installation of Two-Way Radio Communications Enhancing Systems:

Local Municipalities (City or County)

1. Chief Electrical Inspector
NFPA 70
2. Fire Official
NFPA 72
3. Broward County Elevator Inspection
FBC-30, FS 399, FAC 61C-5, ASME A17-1
4. FCC License Holder
 - A. Broward County (RESC)
 - B. Fort Lauderdale
 - C. Coral Springs (RESC)
 - D. Plantation (RESC)
 - E. Hollywood (RESC)
5. Building Inspector

Note: Work shall not start on any project until a permit has been issued and signed by each of the five (5) AHJ’s:

Electrical, Fire, Elevator, FCC License Holder, Building

The system shall not be energized (including testing) until written authorization is obtained by each of the four (4) AHJ’s:

Electrical, Fire, FCC License Holder, Building

A certificate of completion, or occupancy shall not be issued until the permit work is completed and signed off by each of the four (4) AHJ’s:

Electrical, Fire, FCC License Holder, Building

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1.5 Design

The Two-Way Radio Communications Enhancement System shall be designed by a Professional Engineer, licensed in the State of Florida. The Professional Engineer shall follow the Florida Statutes and the Florida Administration code requirements for the system engineering process.

The FBC, Broward County Edition, Section 118 requires that the Professional Engineer have training and experience in Electrical Engineering.

Heat wave map drawings shall be prepared by the Professional Engineer or a designer under the direct supervision of the Professional Engineer in accordance with FS and FAC requirements. Heat wave map drawings shall be prepared by a designer certified by the heat wave map software company. The drawings shall include the designer's name and the name of the heat wave map software company.

The professional Engineer shall show on the drawings all applicable codes with corresponding dates:

The Professional Engineer should be available for Plan Review and re-inspections.

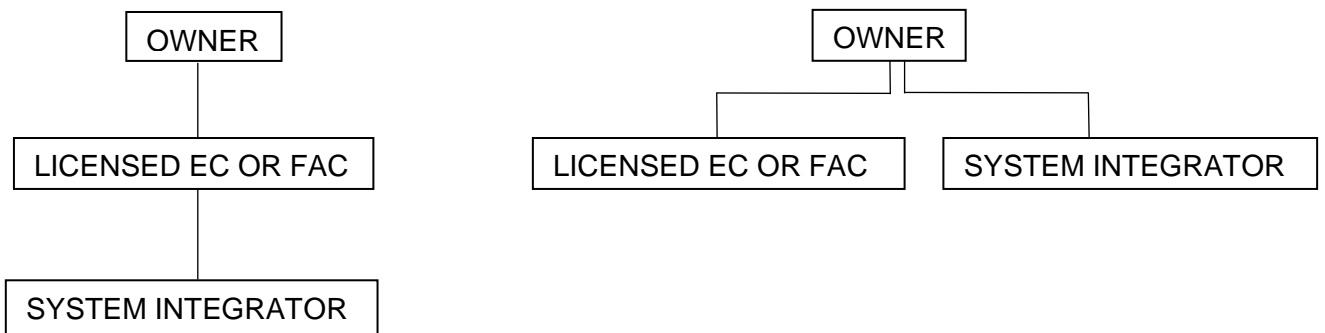
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1.6 Installation

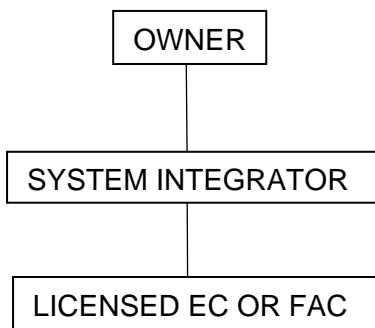
The installation shall be completed by a qualified Electrical Contractor or Fire Alarm Contractor. The contracting shall be in compliance with the State of Florida Electrical Contractor's Licensing Board (ECLB).

Only a licensed Electrical Contractor, Fire Alarm Contractor, or ESCS Contractor (pending) can contract to install a system. A systems integrator, which is not a licensed EC or FC, cannot contract for the installation. (FAC 61G6)

Allowed



Not Allowed



Note: Never energize the system for any reason without first passing the FCC AHJ's Initial Inspection.

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1.7 Permitting

Record drawings, signed and sealed by a qualified Professional Engineer, shall be submitted to each AHJ for plan review and approval. The drawings shall be approved by all AHJ's prior to the start of any work.

Refer to the applicable Code Compliance Plan Review Checklist for the requirements of each AHJ.

1.8 Inspections

The contractor shall coordinate all inspections as required by the AHJ's.

Note: Never energize the system for any reason without first passing the FCC AHJ initial inspection.

Refer to the applicable Code Compliance Inspection Checklist for the requirements of each AHJ.

1.9 Final Acceptance

A Certificate of Occupancy or a Certificate of Completion for a building shall not be given until the Two-Way Radio Communications Enhancement System is approved by the Authority Having Jurisdiction. (Electric, Fire, Elevator, FCC License Holder, and Building)

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Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

Part 2A. Recommended Checklists for NFPA 72 (2013)

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2019-09-17 Rev 1

2A.1.1 NFPA 72 (2013) Plan Review - Fire

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Scope of Work
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering.
The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. The AHJ may require that the Engineer of Record shall provide evidence of experience and training in Electrical Engineering. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FBC 714, FBC 1023.5)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Firewall penetration details, etc. (NFPA 1-12.7.5.1 2015)
- 10. Not Used
- 11. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 12. Provide an information binder stored next to the BDA. Information shall include:
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 13. Pathway survivability level shall be 1, 2, or 3. For Level 1, all coaxial cables shall be in metal raceways. (NFPA 72-12.4)
- 14. The feeder and riser coaxial cables shall be rated as plenum cable. (NFPA 72-24.3.6.8.1.1)
- 15. Riser and donor antenna coaxial cables shall be routed through a 2-hour-rated enclosure. (NFPA 72-24.3.6.8.3)
- 16. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 90% in general building areas. (NFPA 72-24.5.2.2)
- 17. Signal strength inbound shall be a minimum of -95 dBm. (NFPA 72-24.5.2.3.1)
Signal strength outbound shall be a minimum of -95 dBm. (NFPA 72-24.5.2.3.2)
Note: a signal strength of less than -90 dBm as shown on the plans has a high probability of failing the final inspection of DAQ 3.0 minimum.
See NFPA 72-14.4.10.3 Test Procedures; Recommend -90 dBm.
- 18. Isolation shall be a minimum of 15 dBm above the signal booster gain under all operating conditions. (NFPA 72-24.5.2.3.3)
Note: NFPA 1221 (2016) requires a minimum of 20 dBm. Any lower value may result in the probability of failing the final inspection.

2A.1.1 NFPA 72 (2013) Plan Review - Fire (cont.)

- 19. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies used by the AHJ. (NFPA 72-24.5.2.4)
- 20. Frequency changes. System shall be capable of upgrading. (NFPA 72-24.5.2.4.2)
- 21. System Components: Components shall be approved and compatible with the local Public Safety Radio System. (NFPA 72-24.5.2.5.1) (NFPA-1.1.4)
- 22. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 72-24.5.2.5.2) (NFPA 1-1.4)
- 23. Power supplies shall have at least two independent sources. (NFPA 72-24.5.5)
- 24. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72-10.6.5. (NFPA 72-24.5.5.1)
- 25. The secondary power source shall consist of one of the following (NFPA 72-24.5.2.5.5.2):
 - (1) Battery with at least 12 hours of operation at 100% per NFPA 72-10.6.10
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100% per NFPA 10.6.11.3.
- 26. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 72-24.5.2.6.1):
 - (1) Integrity of the circuit monitoring signal booster(s) and power supply(ies) shall comply with NFPA 72-24.10.6.9 and NFPA 72-12.6.
 - (2) System and signal booster supervisory signals shall include the following:
 - (a) Antenna malfunction
 - (b) Signal booster failure
 - (c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted.
 - (3) Power supply signals shall include the following for each signal booster:
 - (a) Loss of normal AC power
 - (b) Failure of battery charger
- 27. Dedicated Panel (annunciator panel) shall show (NFPA 72-24.5.2.6.2):
 - (1) Normal AC power
 - (2) Signal booster trouble
 - (3) Loss of normal AC power
 - (4) Failure of battery charger
 - (5) Low battery capacity
 - (6) Donor Antenna Malfunction
(NFPA 1221 9.6.13.2)(2016)
- 28. Technical Criteria (NFPA 72-24.5.2.7)
 - (1) Frequencies required
 - (2) Location of effective radiated power (ERP) of the FCC AHJ radio site
 - (3) Maximum propagation delay less than 30 micro-seconds
 - (4) List of specifically approved components
 - (5) Other support technical information (Battery calculations)
- 29. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room." (NFPA 72-24.5.4) (ASME A17.1)

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

2A.1.2 NFPA 72 (2013) Plan Review - Electrical

Plans shall include the following information:

- 1. Building owner and address
- 2. Copy of the contract with the owner or GC (FAC 61G6)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering.
The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (FBC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15; NFPA 70-820-26)
- 10. Grounding and mounting details for antenna, mast, surge protection, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)
- 11. Antenna NFPA 780 protection (if existing). (FAC 61G15) (NFPA 780)
- 12. Identify the panel and circuit breaker; show panel location on plan (NFPA 72)
- 13. Show circuit breaker lock. (NFPA 72)
- 14. Show how the system components are wired to power (120V). (NFPA 70-110.2(B))
- 15. Circuit shall have an isolated ground, if required by the manufacturer. (NFPA 70)
- 16. Listing and labeling requirements (NFPA 70-110.2)
- 17. Identify minimum conduit sizes and minimum conduit 90-degree bend radiuses. (NFPA 70-110.3)
- 18. System equipment shall be installed in an air-conditioned and mechanically ventilated room where the manufacturer's installation document requires a temperature limitation and/or ventilation. (NFPA 70-110.3)

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2A.1.3 NFPA 72 (2013) Plan Review - Elevator

Plans shall include the following information:

A variance shall be obtained from the Broward County Elevator Inspection Services Section at Permitting prior to any work inside an elevator shaft or elevator machine room. The variance shall be to install one or more antenna(s) in the elevator shaft(s). (ASME A17.1)

Note: The elevator code does not allow the elevator shaft to be used for coaxial cable risers.
(ASME A17.1.2.8.1)

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2A.1.4 NFPA 72 (2013) Plan Review - FCC License Holder

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Copy of the contract with the owner or GC (FBC 118.1.5)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering. The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61g15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. Propagation (heat) map drawings shall include the following (FBC 118.2.1.4):
 - Indoor Prediction Legend
 - Pictogram Legend
 - Calculations Legend
 - Number of Channels
 - Predictive propagation on floor plans
 - Name of certified designer and company
 - Materials Legend
 - Cables Legend
 - Frequencies
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15)
- 10. Manufacturer's specifications for equipment; include equipment temperature limits. Provide and air-conditioned space as required. (FAC 61G15)
- 11. Grounding and mounting details for antenna, mast, surge protector, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)(recommend Motorola R56, IEEE 1692, TIA 569, TIA 607)
- 12. Notes on plans shall state (FBC 118.4.2.2):

“The system shall never be energized for testing or operation until written, or on site, approval is obtained from the FCC License Holder.”
- 13. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 14. Pathway survivability level shall be 1, 2, or 3. Level 1: All coaxial cables shall be in metal conduit. (NFPA 72-12.4)
- 15. Radio coverage shall be a minimum of 99% in critical areas and 95% in general building areas. (NFPA 72-24.5.2.2)
- 16. Signal strength inbound shall be a minimum of -95 dBm. Signal strength outbound shall be a minimum of -95 dBm. (NFPA 72-24.5.2.3)

Note: a signal strength of less than -90 dBm as shown on the plans (or DAQ 3.4 minimum) has a high probability of failing the final inspection of DAQ 3.0 minimum. See NFPA 72-14.4.10.3 Test Procedures; Recommend -90 dBm.
- 17. Isolation shall be a minimum of 15 dBm above the signal booster gain under all operating conditions. (NFPA 72-24.5.2.3.3)

Note: NFPA 1221 (2016) requires a minimum of 20 dBm. Any lower value may result in the probability of failing the final inspection.
- 18. System radio frequencies: system shall be capable of transmitting all public safety radio frequencies used by the FCC AHJ. (NFPA 72-24.5.2.4)

2A.1.4 NFPA 72 (2013) Plan Review - FCC License Holder (cont.)

- 19. Frequency changes. System shall be capable of upgrading. (NFPA 72-24.5.2.4.2)
- 20. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 72-24.5.2.5)
Show the propagation delay.
Signal Boosters shall have FCC Certification. Power supplies shall have at least two independent supplies. Battery shall provide twelve (12) hour minimum operational run time. (Provide a battery calculation at 100%)
- 21. System Monitoring: (NFPA 72-24.5.2.6.1) The fire alarm system shall monitor the following items as a minimum:
 - (1) Integrity of the circuit monitoring signal booster(s) and power supply(ies) shall comply with NFPA 72-24.10.6.9 and NFPA 72-12.6.
 - (2) System and signal booster supervisory signals shall include the following:
 - (a) Antenna malfunction
 - (b) Signal booster failure
 - (c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted.
 - (3) Power supply signals shall include the following for each signal booster:
 - (a) Loss of normal AC power
 - (b) Failure of battery charger
- 22. Dedicated Panel (annunciator panel) (NFPA 72-24.5.2.6.2)
 - (1) Normal AC power
 - (2) Signal booster trouble
 - (3) Loss of normal AC power
 - (4) Failure of battery charger
 - (5) Low battery capacity
 - (6) Donor Antenna Malfunction (NFPA 1221 9.6.13.2)(2016)
- 23. Technical Criteria (NFPA 72-24.5.2.7)
 - (1) Frequencies required
 - (2) Location of effective radiated power (ERP) of the FCC AHJ radio site
 - (3) Maximum propagation delay (30 microseconds)
 - (4) List of specifically approved components
 - (5) Other support technical information
- 24. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room. (NFPA 72-24.5.4) (ASME A17.1)
- 25. Antenna mast shall be installed per FBC, Broward County Edition, HVHZ Sections.
- 26. Other industry standards include Motorola R56, IEEE 1692, TIA 569, and TIA 607.

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2A.1.5 NFPA 72 (2013) Plan Review – Building (Structural)

- 1. Antenna mast structural installation detail (FBC 107.3.5.A.8)
- 2. Floor plans showing fire-rated enclosure for cables and BDA room (FBC 107.3.5.A.4)
- 3. Riser plan showing fire-rated enclosure for cable enclosures and BDA room (FBC 107.3.5.A.4)
- 4. Details, including firewall penetration (FAC 61G15)(FBC 1023.5)(NFPA 70-820.26)

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2A.2.1 NFPA 72 (2013) Inspection - Fire

Final Inspection

Property Information

Property Name: _____ Permit #: _____ Inspection Date: _____

Property Address: _____

Contact Information:

BDA Equipment Provider: _____

BDA Licensed Contractor: _____

Fire Alarm Licensed Contractor: _____

Fire Alarm Monitoring Company: _____

Engineer of Record: _____

- 1. The latest approved record drawings, operation manuals, and maintenance manuals are on the site.
- 2. The following representatives are on the site for the inspection:
 - Fire Inspector
 - Broward County RESL (ORCAT)
 - Ft. Lauderdale TelCom
 - Electrical Inspector
 - BDA equipment provider (systems integrator)
 - BDA Licensed Contractor
 - Fire Alarm Licensed Contractor
 - Engineer of Record, only for re-inspections
 - Building Owner Representative
- 3. Fire Rated Enclosure openings and penetrations are properly sealed. (NFPA 1-12.7.5.1)
- 4. The installation complies with the pathway of survivability level as shown on the approved record drawings.
- 5. The system components match the approved record drawings for manufacturer and part numbers. (NFPA 72-24.5.2.5.1) (NFPA-1.1.4)
- 6. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 7. Provide an information binder stored next to the BDA. Information shall include (NFPA 72-14.6.1.1) (FBC 118):
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map, final measured readings after commissioning
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval, and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 8. Pathway survivability level shall be 1, 2, or 3. For Level 1, all coaxial cables shall be in metal raceways. (NFPA 72-12.4)
- 9. The feeder and riser coaxial cables shall be rated as plenum cables. (NFPA 72-24.3.6.8.1.1)
- 10. Riser and donor antenna coaxial cables shall be routed through a 2-hour-rated enclosure. (NFPA 72-24.3.6.8.3)

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2A.2.1 NFPA 72 (2013) Inspection - Fire (cont.)

- 11. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 90% in general building areas. (NFPA 72-24.5.2.2)
- 12. Signal strength inbound shall be a minimum of -95 dBm. (NFPA 72-24.5.2.3.1)
Signal strength outbound shall be a minimum of -95 dBm. (NFPA 72-24.5.2.3.2)
- 13. Isolation shall be a minimum of 15 dBm above the signal booster gain under all operating conditions. (NFPA 72-24.5.2.3.3)
- 14. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies used by the FCC AHJ. (NFPA 72-24.5.2.4)
- 15. Frequency changes. System shall be capable of upgrading. (NFPA 72-24.5.2.4.2)
- 16. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 72-24.5.2.5.1) (NFPA-1.1.4)
- 17. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 72-24.5.2.5.2) (NFPA 1-1.4)
- 18. Power supplies shall have at least two independent sources. (NFPA 72-24.5.5)
- 19. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72-10.6.5. (NFPA 72-24.5.5.1)
- 20. The secondary power source shall consist of one of the following (NFPA 72-24.5.5.2):
 - (1) Battery with at least 12 hours of operation at 100% per NFPA 72-10.6.10
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100% per NFPA 10.6.11.3.
- 21. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 72-24.5.2.6.1):
 - (1) Integrity of the circuit monitoring signal booster(s) and power supply(ies) shall comply with NFPA 72-24.10.6.9 and NFPA 72-12.6 (Auto-notification within 3 minutes 20 seconds).
 - (2) System and signal booster supervisory signals shall include the following:
 - (a) Antenna malfunction
 - (b) Signal booster failure
 - (c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted.
 - (3) Power supply signals shall include the following for each signal booster:
 - (a) Loss of normal AC power
 - (b) Failure of battery charger
- 22. Dedicated Panel (annunciator panel) shall show (Auto-notification within 3 minutes, 20 seconds) (NFPA 72-24.5.2.6.2):
 - (1) Normal AC power
 - (2) Signal booster trouble
 - (3) Loss of normal AC power
 - (4) Failure of battery charger
 - (5) Low battery capacity

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2A.2.1 NFPA 72 (2013) Inspection - Fire (cont.)

- 23. Signage is provided to locate the BDA.
Fire Department signal booster permit number, service provider, and contact telephone numbers are shown. (FBC 118.2.1.8) (NFPA 72-10.18.3.2)
- 24. Completed NFPA documentation specific to this system is provided. [NFPA 72-7.8.2; figure 7.8.2(a) and (b)]
- 25. Documentation is provided showing that a maintenance and service agreement has been entered into between the property owner and the provider of the BDA System. (NFPA 72-14.4.10.1; NFPA 72-14.4.10.6; NFPA 72-14.6.1.1)
- 26. DAQ, Delivered Audio Quality, for the system is a minimum of DAQ 3.0. Include all floors, critical areas, elevator cabs, and general building areas.

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

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2A.2.2 NFPA 72 (2013) Inspection - Electrical

- 1. **Rough Electrical Inspection** (FBC BC (2017)-1.110.8.5)
 - Conduits
 - Coaxial Cables
 - Panels, BDA, BBU, etc. shall be grounded.
 - Antenna and mast
 - Grounding, Lightning Protection System (if installed)
 - Lead-in surge protection
 - Power connection to the BDA
 - Fire-rating of all conduit enclosures

- 2. **Final Inspection**
 - All electrical components are in place.

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2A.2.3 NFPA 72 (2013) Inspection - Elevator

1. Rough System Inspection

- Conduit and cable installed in elevator shafts.

2. Final Inspection

- Antenna(s) installed in the elevator shaft.

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2A.2.4 NFPA 72 (2013) Inspection - FCC License Holder

1. Initial Inspection

- 1. The system shall never be energized for testing or operation until written, or onsite approval is obtained from the FCC License Holder.
(FBC BC 1.118.4.2.2)
- 2. Prior to the initial inspection, a letter from the Engineer of Record stating that the installation is complete and ready to be energized for testing shall be received by the FCC License Holder. The system settings and pictures of the installed major components shall also be provided to the FCC License Holder.
(FBC BC – 1.118.4.2.1)

The following components shall be included in the letter and pictures:

- (1) BDA with information
Permit Number; Serviced by _____; Telephone _____
 - (2) Enclosures with battery charger and batteries installed, wired with a label showing the battery installation date.
 - (3) The Dedicated annunciator shall be wired. The system shall be constructed and programmed to the FACP and the annunciator.
 - (4) BDA and FACP rooms shall be fire rated. Doors shall also be fire rated.
 - (5) All equipment shall be properly grounded.
 - (6) Antenna mast shall be grounded and connected to the NFPA 780 Lightning Protection System (if installed).
 - (7) Antenna shall have surge protection installed and wired.
 - (8) Antenna(s), if installed in the elevator shaft, shall have the approval of the Elevator Inspector. Provide a copy of the variance.
 - (9) Junction boxes connected to the riser coaxial cables to the horizontal cables shall be installed and wired.
 - (10) All electrical rough inspections shall be completed.
- 3. The contractor shall coordinate the inspection with all responsible parties.
The following shall be present at a minimum:
 - Owners representative
 - Electrical Contractor
 - Fire Alarm Contractor
 - BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
 - FCC AHJ
 - 4. The Initial Inspection shall include the following:
 - (1) The System shall be energized for the first time.
 - (2) Items B (1) through B (10) shall be inspected for compliance.
 - (3) Acceptable dB levels shall be recorded. Include stairwells and elevator cab.
 - (4) Check the noise floor of the BDA transmitter. The noise floor shall be -100 dB to -105 dB or less than a 5 dB increase in the noise floor.
 - (5) System Engineer of Record shall attend all re-inspections.

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2A.2.4 NFPA 72 (2013) Inspection - FCC License Holder (cont.)

Final Inspection

This Inspection is a joint effort between the Fire Official and the FCC License Holder. Prior to the final inspection, the contractor shall provide to the Fire Official and to the FCC License Holder the following documentation showing that the building is ready for the final inspection.

After passing the initial inspection, the contractor shall submit to the FCC License Holder a Post Heat Map Study, with the actual measured signal strengths, to show that all areas are covered per the code. A letter from the Engineer of Record shall state that the System is completed, fully operational, and ready for the final inspection.

The contractor shall coordinate the inspection with all responsible parties. The following shall be present at a minimum:

- Owners representative
- Electrical Contractor
- Fire Alarm Contractor
- BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
- System Engineer of Record, only for re-inspections
- Electrical AHJ
- Fire Official AHJ
- FCC AHJ

Final Inspection:

- (1) Building Radio Coverage Inspection
 - 99% in critical areas
 - 95% in common areas
 - DAQ 3.0 or better
- (2) All dB levels are acceptable
- (3) Remote annunciator shall be functional.
- (4) Connection to the fire alarm shall be functional.
- (5) Owner shall provide proof of a signed service agreement with the BDA vendor.

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2A.2.5 NFPA 72 (2013) Inspection – Building (Structural)

□ 1. Rough Electrical Inspection

- 1. Antenna Mast Installation (FBC 110.3.A.7)(2017)
- 2. Inspection for all fire-rated enclosures for Cables and BDA room. (FBC 110.3.A.7.d and .e)(2017)

□ 2.Final Inspection

- 1. Antenna Mast Installation (FBC 110.3.A.7)(2017)
- 2. Inspection for all fire-rated enclosures for Cables and BDA room. (FBC 110.3.A.7.d and .e)(2017)
- 3. Inspection of all sealed openings in the fire-rated enclosure. (FBC 110.3.A.7.e) (Fire Stopping)

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Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

Part 2B. Recommended Checklists for NFPA 72 (2016), NFPA 1221 (2016)

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2B.1.1 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - Fire

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Written sequence of operation
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering.
The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. The AHJ may require that the Engineer of Record shall provide evidence of experience and training in Electrical Engineering. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FBC 714, FBC 1023.5)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Firewall penetration details, etc. (NFPA 1-12.7.5.1)
- 10. Manufacturer's specifications for equipment (FAC 61G15)
- 11. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 12. Provide an information binder stored next to the BDA. Information shall include:
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 13. Pathway survivability level shall be 1, 2, or 3. For Level 1, all coaxial cables shall be in metal raceways. (NFPA 1221-5.10)
- 14. The feeder and riser coaxial cables shall be rated as plenum cable. (NFPA 1221-9.6.2.1.1)
- 15. Riser and donor antenna coaxial cables shall be routed through an enclosure matching the building's fire rating. (NFPA 1221-9.6.2.1.3)
- 16. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 95% in general building areas. (NFPA 1221-9.6.7)
- 17. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 18. Donor antenna isolation shall be a minimum of 20 dBm above the inside antennas. (NFPA 1221-9.6.9)
- 19. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221-9.6.10.1)
- 20. Frequency changes. System shall be capable of upgrading. (NFPA 1221-9.6.10.2)

2B.1.1 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - Fire (cont.)

- 21. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.11) (NFPA-1.1.4)
- 22. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 1221-9.6.11.2) (NFPA 1-1.4)
- 23. Power supplies shall have at least two independent sources. (NFPA 1221-9.6.12)
- 24. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72. (NFPA 1221-9.6.12.1)
- 25. The secondary power source shall consist of one of the following (NFPA 1221-9.6.12.2):
 - (1) Battery with at least 12 hours of operation at 100%
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100%.
- 26. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) System component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 27. Dedicated Panel (annunciator panel) shall show (NFPA 1221-9.6.13.2):
 - (1a) Normal AC power
 - (1b) Loss of normal power
 - (1c) Battery charger failure
 - (1d) Low battery capacity
 - (1e) Donor antenna malfunction
 - (1f) Active RF emitting device malfunction
 - (1g) System component malfunction
 - (2) Communication link between the FACP and the BDA shall be monitored for integrity.
- 28. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room. (ASME A17.1)
- 30. Systems shall have a Lightning Protection System that complies with NFPA 780. (NFPA 1221-9.6.3)

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

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2B.1.2 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - Electrical

Plans shall include the following information:

- 1. Building owner and address
- 2. Copy of the contract with the owner or GC (FAC 61G6)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering.
The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (FBC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15) (NFPA 70 820-26)
- 10. Grounding and mounting details for antenna, mast, surge protection, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)
- 11. Antenna NFPA 780 protection, if existing. If not existing, add system. (FAC 61G15) (NFPA 780)
- 12. Identify the panel and circuit breaker; show panel location on plan. (NFPA 72)
- 13. Show circuit breaker lock. (NFPA 72)
- 14. Show how the system components are wired to power (120V). (NFPA 70-110.2(B))
- 15. Circuit shall have an isolated ground, if required by the manufacturer. (NFPA 70)
- 16. Listing and labeling requirements (NFPA 70-110.2)
- 17. Identify minimum conduit sizes and minimum conduit 90-degree bend radiuses. (NFPA 70-110.3)
- 18. System equipment shall be installed in an air-conditioned and mechanically ventilated room where the manufacturer's installation document requires a temperature limitation and/or ventilation. (NFPA 70-110.3)

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2B.1.3 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - Elevator

Plans shall include the following information:

A variance shall be obtained from the Broward County Elevator Inspection Services Section at Permitting prior to any work inside an elevator shaft or elevator machine room. The variance shall be to install an antenna in the elevator shaft(s) (ASME A17.1).

Note: The elevator code does not allow the elevator shaft to be used for coaxial cable risers.
(ASME A17.1.2.8.1)

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2B.1.4 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - FCC License Holder

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Copy of the contract with the owner or GC (FBC 118.1.5)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering. The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2)).
- 4. Applicable codes and edition dates (61g15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15)
- 10. Manufacturer's specifications for equipment; include equipment temperature limits. Provide and air-conditioned space as required. (FAC 61G15)
- 11. Grounding and mounting details for antenna, mast, surge protector, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)(recommend Motorola R56, IEEE 1692, TIA 569, TIA 607)
- 12. Notes on plans shall state (FBC 118.4.2.2):
"The system shall never be energized for testing or operation until written, or on site, approval is obtained from the FCC License Holder."
- 13. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 14. Pathway survivability level shall be 1, 2, or 3. Level 1: All coaxial cables shall be in metal conduit. (NFPA 1221-5.10)
- 15. Radio coverage shall be a minimum of 99% in critical areas and 95% in general building areas. (NFPA 1221-9.6.7)
- 16. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 17. Isolation shall be a minimum of 20 dBm above the signal booster gain under all operating conditions. (NFPA 1221-9.6.9))
- 18. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221.9.6.10.1)
- 19. Frequency changes. System shall be capable of upgrading. (NFPA 1221-9.6.10.2)
- 20. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.11.1)
Show the propagation delay.
Signal Boosters shall have FCC Certification. Power supplies shall have at least two independent supplies. Battery shall provide twelve (12) hour minimum. (Provide a battery calculation at 100%)

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2B.1.4 NFPA 72 (2016), NFPA 1221 (2016) Plan Review - FCC License Holder (cont.)

- 21. System Monitoring: The fire alarm system shall monitor the following items as a minimum:
(NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) System component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 23. Dedicated Panel (annunciator panel) (NFPA 1221-9.6.13.2):
 - (1a) Normal AC power
 - (1b) Loss of normal power
 - (1c) Battery charger failure
 - (1d) Low battery capacity
 - (1e) Donor antenna malfunction
 - (1f) Active RF emitting device malfunction
 - (1g) System component malfunction
 - (2) Communication link between the FACP and the BDA shall be monitored for integrity.
- 24. Technical Criteria (NFPA 1221-9.6.14)
 - (1) Frequencies required
 - (2) Location of effective radiated power (ERP)
 - (3) Maximum propagation delay (30 microseconds)
 - (4) List of specifically approved components
 - (5) Other support technical information
- 25. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room. (ASME A17.1)
- 26. Antenna mast shall be installed per FBC, Broward County Edition, HVHZ Sections.
- 27. Other industry standards include Motorola R56, IEEE 1692, TIA 569, and TIA 607..

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2B.1.5 NFPA 72 (2016), NFPA 1221 (2016) Plan Review – Building (Structural)

- 1. Antenna mast structural installation detail (FBC 107.3.5.A.8)
- 2. Floor plans showing fire-rated enclosure for cables and BDA room (FBC 107.3.5.A.4)
- 3. Riser plan showing fire-rated enclosure for cable enclosures and BDA room (FBC 107.3.5.A.4)
- 4. Details, including firewall penetration (FAC 61G15)(FBC 1023.5)(NFPA 70-820.26)

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2B.2.1 NFPA 72 (2016), NFPA 1221 (2016) Inspection - Fire

Final Inspection

Property Information

Property Name: _____ Permit #: _____ Inspection Date: _____

Property Address: _____

Contact Information:

BDA Equipment Provider: _____

BDA Licensed Contractor: _____

Fire Alarm Licensed Contractor: _____

Fire Alarm Monitoring Company: _____

Engineer of Record: _____

- 1. The latest approved record drawings, operation manuals, and maintenance manuals are on the site.
- 2. The following representatives are on the site for the inspection:
 - Fire Inspector
 - Broward County RESL(ORCAT)
 - Ft. Lauderdale TelCom
 - Electrical Inspector
 - BDA equipment provider (systems integrator)
 - BDA Licensed Contractor
 - Fire Alarm Licensed Contractor
 - Engineer of Record, only for re-inspections
 - Building Owner Representative
- 3. Fire Rated Enclosure openings and penetrations are properly sealed. (NFPA-1-12.7.5.1)
- 4. The installation complies with the pathway of survivability as shown on the approved record drawings.
Note: A level 1 pathway requires coaxial cables installed in metal raceways. (NFPA 1221-5.10)
- 5. The system components match the approved record drawings for manufacturer and part numbers.
(NFPA 1221-9.6.11.1) (NFPA-1.1.4)
- 6. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 7. Provide an information binder stored next to the BDA. Information shall include:
(NFPA 72-14.6.1.1) (FBC 118)
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 8. Pathway survivability level shall be 1, 2, or 3. For Level 1, all coaxial cables shall be in metal raceways.
(NFPA 1221-5.10)
- 9. The feeder and riser coaxial cables shall be rated as plenum cables. (NFPA 1221-9.6.2.1.1.1)
- 10. Riser coaxial cables shall be through an enclosure matching the building's fire rating.
(NFPA 1221-9.6.2.1.3)

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2B.2.1 NFPA 72 (2016), NFPA 1221 (2016) Inspection - Fire (cont.)

- 11. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 95% in general building areas. (NFPA 1221-9.3.1.2.1)
- 12. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 13. Isolation shall be a minimum of 20 dBm above the signal booster gain under all operating conditions. (NFPA 1221-9.6.9)
- 14. System radio frequencies: system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221-9.6.10.1)
- 15. Frequency changes: System shall be capable of upgrading. (NFPA 1221-9.6.10.2)
- 16. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.11)
- 17. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 1221-9.6.11.2) (NFPA 1-1.4)
- 18. Power supplies shall have at least two independent sources. (NFPA 1221-9.6.12)
- 19. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72. (NFPA 1221-9.6.12.1)
- 20. The secondary power source shall consist of one of the following (NFPA 1221-9.6.12.2):
 - (1) Battery with at least 12 hours of operation at 100%
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100%
- 21. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) System component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 22. Dedicated Panel (annunciator panel) shall show (Auto-notification within 3 minutes, 20 seconds) (NFPA 1221-9.6.13.2):
 - (1a) Normal AC power
 - (1b) Loss of normal power
 - (1c) Battery charger failure
 - (1d) Low battery capacity
 - (1e) Donor antenna malfunction
 - (1f) Active RF emitting device malfunction
 - (1g) System component malfunction
 - (2) Communication link between the FACP and the BDA shall be monitored for integrity.

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2B.2.1 NFPA 72 (2016), NFPA 1221 (2016) Inspection - Fire (cont.)

- 23. Signage is provided to locate the BDA.
Fire Department signal booster permit number, service provider, and contact telephone numbers are shown. (FBC 118.2.1.8) (NFPA 72-10.18.3.2)
- 24. Completed NFPA documentation specific to this system is provided. [NFPA 72-7.8.2; figure 7.8.2(a) and (b)]
- 25. Documentation is provided showing that a maintenance and service agreement has been entered into between the property owner and the provider of the BDA System. (NFPA 72-14.4.10.1; NFPA 72-14.4.10.6; NFPA 72-14.6.1.1)
- 26. DAQ, Delivered Audio Quality, for the system is a minimum of DAQ 3.0. Include all floors, critical areas, elevator cabs, and general building areas. (NFPA 1221-9.6.7.3)
- 27. Where required by the manufacturer, the power receptacle shall be an isolated ground type receptacle and shall be connected to an isolated ground. (NFPA 1221-5.8.2)
- 28. Systems shall have a Lightning Protection System that complies with NFPA 780. (NFPA 1221-9.6.3)

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

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2B.2.2 NFPA 72 (2016), NFPA 1221 (2016) Inspection - Electrical

- 1. **Rough Electrical Inspection** (FBC BC (2017)-1.110.8.5)
 - Conduits
 - Coaxial Cables
 - Panels, BDA, BBU, etc. shall be grounded.
 - Antenna and mast
 - Grounding, Lightning Protection System (if installed)
 - Lead-in surge protection
 - Power connection to the BDA
 - Fire-rating of all conduit enclosures

- 2. **Final Inspection**
 - All electrical components are in place.

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2B.2.3 NFPA 72 (2016), NFPA 1221 (2016) Inspection - Elevator

1. Rough System Inspection

- Conduit and cable installed in elevator shafts.

2. Final Inspection

- Antenna(s) installed in the elevator shaft.

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2B.2.4 NFPA 72 (2016), NFPA 1221 (2016) Inspection - FCC License Holder

1. Initial Inspection

- 1. The system shall never be energized for testing or operation until written, or onsite approval is obtained from the FCC License Holder.
(FBC BC 1.118.4.2.2)
- 2. Prior to the initial inspection, a letter from the Engineer of Record stating that the installation is complete and ready to be energized for testing shall be received by the FCC License Holder. The system settings and pictures of the installed major components shall also be provided to the FCC License Holder.
(FBC BC – 1.118.4.2.1)

The following components shall be included in the letter and pictures:

- (1) BDA with information
Permit Number; Serviced by _____; Telephone _____
 - (2) Enclosures with battery charger and batteries installed, wired with a label showing the battery installation date.
 - (3) The Dedicated annunciator shall be wired. The system shall be constructed and programmed to the FACP and the annunciator.
 - (4) BDA and FACP rooms shall be fire rated. Doors shall also be fire rated.
 - (5) All equipment shall be properly grounded.
 - (6) Antenna mast shall be grounded and connected to the NFPA 780 Lightning Protection System (if installed).
 - (7) Antenna shall have surge protection installed and wired.
 - (8) Antenna(s), if installed in the elevator shaft, shall have the approval of the Elevator Inspector.
 - (9) Junction boxes connected to the riser coaxial cables to the horizontal cables shall be installed and wired.
 - (10) All electrical rough inspections shall be completed.
- 3. The contractor shall coordinate the inspection with all responsible parties.
The following shall be present at a minimum:
 - Owners representative
 - Electrical Contractor
 - Fire Alarm Contractor
 - BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
 - System Engineer of Record
 - Electrical AHJ
 - Fire Official AHJ
 - FCC AHJ
 - 4. The Initial Inspection shall include the following:
 - (1) The System shall be energized for the first time.
 - (2) Items B (1) through B (10) shall be inspected for compliance.
 - (3) Acceptable dB levels shall be recorded.
 - (4) Check the noise floor of the BDA transmitter. The noise floor shall be -100 dB to -105 dB or less than a 5 dB increase in the noise floor.
 - (5) System Engineer of Record shall attend all re-inspections.

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2B.2.4 NFPA 72 (2016), NFPA 1221 (2016) Inspection - FCC License Holder (cont.)

2. Final Inspection

This Inspection is a joint effort between the Fire Official and the FCC License Holder. Prior to the final inspection, the contractor shall provide to the Fire Official and to the FCC License Holder the following documentation showing that the building is ready for the final inspection.

After passing the initial inspection, the contractor shall submit to the FCC License Holder a Post Heat Map Study to show that all areas are covered per the code. A letter from the Engineer of Record shall state that the System is completed, fully operational, and ready for the final inspection.

The contractor shall coordinate the inspection with all responsible parties. The following shall be present at a minimum:

- Owners representative
- Electrical Contractor
- Fire Alarm Contractor
- BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
- System Engineer of Record, only for re-inspections
- Electrical AHJ
- Fire Official AHJ
- FCC AHJ

Final Inspection:

- (1) Building Radio Coverage Inspection
 - 99% in critical areas
 - 95% in common areas
 - DAQ 3.0 or better
- (2) All dB levels are acceptable.
- (3) Remote annunciator shall be functional.
- (4) Connection to the fire alarm shall be functional.
- (5) Owner shall provide proof of a signed service agreement with the BDA vendor.

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2B.2.5 NFPA 72 (2016), NFPA 1221 (2016) Inspection-Building (Structural)

- 1. Antenna Mast Installation (FBC 110.3.A.7)(2017)
- 2. Inspection for all fire-rated enclosures for Cables and BDA room. (FBC 110.3.A.7.d and .e)(2017)

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Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

Part 2C. Recommended Checklists for NFPA 72 (2019), NFPA 1221 (2019)

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2C.1.1 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - Fire

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Written sequence of operation
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering. The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. The AHJ may require that the Engineer of Record shall provide evidence of experience and training in Electrical Engineering. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FBC 714, FBC 1023.5)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Firewall penetration details, etc. (NFPA 1-12.7.5.1)
- 10. Manufacturer's specifications for equipment (FAC 61G15)
- 11. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 12. Provide an information binder stored next to the BDA. Information shall include:
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 13. Pathway survivability level has been removed.
- 14. Backbone and antenna distribution cables shall be rated as plenum cables. (NFPA 1221-9.6.2.1)
- 15. Backbone cables shall be routed through an enclosure matching the building's fire rating. (NFPA 1221-9.6.2.3)
- 16. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 95% in general building areas. (NFPA 1221-9.6.7)
- 17. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 18. Donor antenna isolation shall be a minimum of 20 dBm above the inside antennas. (NFPA 1221-9.6.9)
- 19. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221-9.6.10.1)
- 20. Frequency changes. System shall be capable of upgrading. (NFPA 1221-9.6.10.2)

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2C.1.1 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - Fire (cont.)

- 21. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.11) (NFPA-1.1.4)
- 22. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 1221-9.6.11.2) (NFPA 1-1.4)
- 23. Power supplies shall have at least two independent sources. (NFPA 1221-9.6.12)
- 24. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72. (NFPA 1221-9.6.12.1)
- 25. The secondary power source shall consist of one of the following (NFPA 1221-9.6.12.2):
 - (1) Battery with at least 12 hours of operation at 100%
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100%
- 26. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) Active system component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 27. Dedicated Panel (annunciator panel) shall show (NFPA 1221-9.6.13.2):
 - (1) Normal AC power
 - (2) Loss of normal power
 - (3) Battery charger failure
 - (4) Low battery capacity
 - (5) Donor antenna malfunction
 - (6) Active RF emitting device malfunction
 - (7) System component malfunction
 - (8) Communication link between the FACP and the BDA shall be monitored for integrity.
- 28. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room. (ASME A17.1)
- 29. Systems shall have a Lightning Protection System that complies with NFPA 780. (NFPA 1221-9.6.3)

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

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2C.1.2 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - Electrical

Plans shall include the following information:

- 1. Building owner and address
- 2. Copy of the contract with the owner or GC (FAC 61G6)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering. The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (FBC 118.1.4), (61G15-30.003(2))
- 4. Applicable codes and edition dates (61G15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15) (NFPA 70-820.26)
- 10. Grounding and mounting details for antenna, mast, surge protection, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)
- 11. Antenna NFPA 780 protection, if existing. If not existing, add system.(NFPA 780)
- 12. Identify the panel and circuit breaker; show panel location on plan. (NFPA 72)
- 13. Show circuit breaker lock. (NFPA 72)
- 14. Show how the system components are wired to power (120V). (NFPA 70-110.2(B))
- 15. Circuit shall have an isolated ground, if required by the manufacturer. (NFPA 70)
- 16. Listing and labeling requirements (NFPA 70-110.2)
- 17. Identify minimum conduit sizes and minimum conduit 90-degree bend radiuses. (NFPA 70-110.3)
- 18. System equipment shall be installed in an air-conditioned and mechanically ventilated room where the manufacturer's installation document requires a temperature limitation and/or ventilation. (NFPA 70-110.3)

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2C.1.3 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - Elevator

Plans shall include the following information:

A variance shall be obtained from the Broward County Elevator Inspection Services Section at Permitting prior to any work inside an elevator shaft or elevator machine room. The variance shall be to install an antenna in the elevator shaft(s) (ASME A17.1).

Note: The elevator code does not allow the elevator shaft to be used for coaxial cable risers.
(ASME A17.1.2.8.1)

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2C.1.4 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - FCC License Holder

Plans shall include the following information:

- 1. Building owner and address (FAC 61G6)
- 2. Copy of the contract with the owner or GC (FBC 118.1.5)
- 3. Signature and seal of the Engineer of Record with experience and training in electrical engineering. The name, PE number, business name, CA number, address, and contact information shall be shown on the plans. (NFPA 72-10.5) (FAC 118.1.4) (61G15-30.003(2))
- 4. Applicable codes and edition dates (61g15-30.003(1b))
- 5. Building description showing building construction, building occupancy, total square footage, number of floors, total height of building (FAC 61G15)
- 6. Floor plans showing device locations, fire-rated enclosures, conduit runs, and propagation modeling, etc. (FBC 118.2.1.4)
- 7. Riser plans for systems (FAC 61G15)
- 8. Specifications with manufacturer's parts numbers (FAC 61G15)
- 9. Details, including firewall penetration, etc. (FAC 61G15)
- 10. Manufacturer's specifications for equipment; include equipment temperature limits. Provide and air-conditioned space as required. (FAC 61G15)
- 11. Grounding and mounting details for antenna, mast, surge protector, BDA, power supply, battery enclosure, etc. (FAC 61G15)(NFPA 70)(recommend Motorola R56, IEEE 1692, TIA 569, TIA 607)
- 12. Notes on plans shall state (FBC 118.4.2.2):
"The system shall never be energized for testing or operation until written, or on site, approval is obtained from the FCC License Holder."
- 13. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 14. Pathway survivability level has been removed. Backbone cables shall be routed through an enclosure matching the building fire rating. (NFPA 1221-9.6.2.3) Backbone and antenna distribution cables shall be rated as plenum cables. (NFPA 1221-9.6.2.1)
- 15. Radio coverage shall be a minimum of 99% in critical areas and 95% in general building areas. (NFPA 1221-9.6.7)
- 16. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 17. Isolation shall be a minimum of 20 dBm above the signal booster gain under all operating conditions. (NFPA 1221-9.6.9)
- 18. System radio frequencies; system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221-9.6.10.1)
- 19. Frequency changes. System shall be capable of upgrading. (NFPA 1221-9.6.10.2)
- 20. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.1)
Show the propagation delay.
Signal Boosters shall have FCC Certification. Power supplies shall have at least two independent supplies. Battery shall provide twelve (12) hour minimum. (Provide a battery calculation at 100%)

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2C.1.4 NFPA 72 (2019), NFPA 1221 (2019) Plan Review - FCC License Holder (cont.)

- 21. System Monitoring: The fire alarm system shall monitor the following items as a minimum: (NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) Active system component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 22. Dedicated Panel (annunciator panel) (NFPA 1221-9.6.13.2):
 - (1) Normal AC power
 - (2) Loss of normal power
 - (3) Battery charger failure
 - (4) Low battery capacity
 - (5) Donor antenna malfunction
 - (6) Active RF emitting device malfunction
 - (7) System component malfunction
 - (8) Communication link between the FACP and the BDA shall be monitored for integrity.
- 23. Technical Criteria (NFPA 1221-9.6.14)
 - (1) Frequencies required
 - (2) Location of effective radiated power (ERP)
 - (3) Maximum propagation delay (30 microseconds)
 - (4) List of specifically approved components
 - (5) Other support technical information
- 24. When an elevator(s) is(are) present in the building, an antenna is typically required to be mounted in the elevator shaft(s) to get coverage inside the elevator car(s). A note on the plan shall be provided: "Contractor shall obtain written approval from the elevator inspector prior to any work inside an elevator shaft or machine room. (ASME A17.1)
- 25. Antenna mast shall be installed per FBC, Broward County Edition, HVHZ Sections.
- 26. Other industry standards include Motorola R56, IEEE 1692, TIA 569, and TIA 607.

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2C.1.5 NFPA 72 (2019), NFPA 1221 (2019) Plan Review – Building (Structural)

- 1. Antenna mast structural installation detail (FBC 107.3.5.A.8)
- 2. Floor plans showing fire-rated enclosure for cables and BDA room (FBC 107.3.5.A.4)
- 3. Riser plan showing fire-rated enclosure for cable enclosures and BDA room (FBC 107.3.5.A.4)
- 4. Details, including firewall penetration (FAC 61G15)(FBC 1023.5)(NFPA 70-820.26)

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2C.2.1 NFPA 72 (2019), NFPA 1221 (2019) Inspection - Fire

Final Inspection

Property Information

Property Name: _____ Permit #: _____ Inspection Date: _____

Property Address: _____

Contact Information:

BDA Equipment Provider: _____

BDA Licensed Contractor: _____

Fire Alarm Licensed Contractor: _____

Fire Alarm Monitoring Company: _____

Engineer of Record: _____

- 1. The latest approved record drawings, operation manuals, and maintenance manuals are on the site.
- 2. The following representatives are on the site for the inspection:
 - Fire Inspector
 - Broward County RESL (ORCAT)
 - Ft. Lauderdale TelCom
 - Electrical Inspector
 - BDA equipment provider (systems integrator)
 - BDA Licensed Contractor
 - Fire Alarm Licensed Contractor
 - Engineer of Record, only for re-inspection
 - Building Owner Representative
- 3. Fire Rated Enclosure openings and penetrations are properly sealed (NFPA 1-12.7.5.1).
- 4. The installation complies with the pathway of survivability as shown on the approved record drawings.
Note: A level 1 pathway requires coaxial cables installed in metal raceways. (NFPA 1221-5.10)
- 5. The system components match the approved record drawings for manufacturer and part numbers.
(NFPA 1221-9.6.11.1) (NFPA-1.1.4)
- 6. The BDA enclosure shall be painted red and a sign shall show permit number, vendor name and telephone number. (FBC 118.2.1.8)
- 7. Provide an information binder stored next to the BDA. Information shall include:
(NFPA 72-14.6.1.1) (FBC 118)
 - (1) As-built drawings
 - (2) Manufacturer's data sheets and specs
 - (3) Heat map
 - (4) Final signal strength measurement (dB)
 - (5) Maintenance contract
 - (6) Broward County Regional Emergency Services and Communications (RESC) approval and elevator variance letter, if applicable.
 - (7) Maintenance Repair Log
- 8. Pathway survivability level has been removed.
- 9. The backbone and antenna distribution cables shall be rated as plenum cables. (NFPA 1221-9.6.2.1.)
- 10. Backbone cables shall be routed through an enclosure matching the building's fire rating.
(NFPA 1221-9.6.2.3)

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2C.2.1 NFPA 72 (2019), NFPA 1221 (2019) Inspection - Fire (cont.)

- 11. Radio coverage shall be a minimum of 99% in critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ and 95% in general building areas. (NFPA 1221-9.3.1.2.1)
- 12. Signal strength inbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.1)
Signal strength outbound shall be a minimum of DAQ 3.0. (NFPA 1221-9.6.8.2)
- 13. Isolation shall be a minimum of 20 dBm above the signal booster gain under all operating conditions. (NFPA 1221-9.6.9)
- 14. System radio frequencies: system shall be capable of transmitting all public safety radio frequencies. (NFPA 1221-9.6.10.1)
- 15. Frequency changes: System shall be capable of upgrading. (NFPA 1221-9.6.10.2)
- 16. System Components: Components shall be approved and compatible with the Public Safety Radio System. (NFPA 1221-9.6.11)
- 17. All repeaters, transmitter receptacles, signal booster components and battery system components shall be in a NEMA 4, 4X enclosure. (NFPA 1221-9.6.11.2.1) Where the battery system components are listed to the UL 2524 Standard, a NEMA 3R enclosure is permitted. (NFPA 1221-9.6.11.2.2)
- 18. Power supplies shall have at least two independent sources. (NFPA 1221-9.6.12)
- 19. The primary power source shall be supplied from a dedicated circuit and shall comply with NFPA 72. (NFPA 1221-9.6.12.1)
- 20. The secondary power source shall consist of one of the following (NFPA 1221-9.6.12.2):
 - (1) Battery with at least 12 hours of operation at 100%
 - (2) Life Safety generator with at least 12 hours of operation at 100% and a battery with at least 2 hours of operation at 100%
- 21. System Monitoring: The fire alarm system shall monitor the following items as a minimum (NFPA 1221-9.6.13.1):
 - (1) Monitoring for integrity of the system shall comply with NFPA 72-10
 - (2a) Donor antenna malfunction
 - (2b) Active RF emitting device failure
 - (2c) Low battery capacity indicator
 - (2d) System component failure
 - (3a) Loss of normal AC power
 - (3b) Failure of battery charger
 - (4) Communication link between the FACP and the BDA shall be monitored for integrity.
- 22. Dedicated Panel (annunciator panel) shall show (Auto-notification within 3 minutes, 20 seconds) (NFPA 1221-9.6.13.2):
 - (1) Normal AC power
 - (2) Loss of normal power
 - (3) Battery charger failure
 - (4) Low battery capacity
 - (5) Donor antenna malfunction
 - (6) Active RF emitting device malfunction
 - (7) System component malfunction
 - (8) Communication link between the FACP and the BDA shall be monitored for integrity.

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2C.2.1 NFPA 72 (2019), NFPA 1221 (2019) Inspection - Fire (cont.)

- 23. Signage is provided to locate the BDA.
Fire Department signal booster permit number, service provider, and contact telephone numbers are shown. (FBC 118.2.1.8) (NFPA 72-10.18.3.2)
- 24. Completed NFPA documentation specific to this system is provided. [NFPA 72-7.8.2; figure 7.8.2(a) and (b)]
- 25. Documentation is provided showing that a maintenance and service agreement has been entered into between the property owner and the provider of the BDA System. (NFPA 72-14.4.10.1; NFPA 72-14.4.10.6; NFPA 72-14.6.1.1)
- 26. DAQ, Delivered Audio Quality, for the system is a minimum of DAQ 3.0. Include all floors, critical areas, elevator cabs, and general building areas. (NFPA 1221-9.6.7.3)
- 27. Where required by the manufacturer, the power receptacle shall be an isolated ground type receptacle and shall be connected to an isolated ground. (NFPA 1221-5.8.2)
- 28. Systems shall have a Lightning Protection System that complies with NFPA 780. (NFPA 1221-9.6.3)

Note: This checklist is a minimum checklist. Coordinate with the local Fire AHJ for additional checklist items.

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2C.2.2 NFPA 72 (2019), NFPA 1221 (2019) Inspection - Electrical

- 1. **Rough Electrical Inspection** (FBC BC (2017)-1.110.8.5)
 - Conduits
 - Coaxial Cables
 - Panels, BDA, BBU, etc. shall be grounded
 - Antenna and mast
 - Grounding, Lightning Protection System (if installed)
 - Lead-in surge protection
 - Power connection to the BDA
 - Fire-rating of all conduit enclosures

- 2. **Final Inspection**
 - All electrical components are in place.

Note: This checklist is a minimum checklist. Coordinate with the local Electrical AHJ for additional checklist items.

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2C.2.3 NFPA 72 (2019), NFPA 1221 (2019) Inspection - Elevator

1. Rough System Inspection

- Conduit and cable installed in elevator shafts.

2. Final Inspection

- Antenna(s) installed in the elevator shaft.

Note: This checklist is a minimum checklist. Coordinate with the local Elevator AHJ for additional checklist items.

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2C.2.4 NFPA 72 (2019), NFPA 1221 (2019) Inspection - FCC License Holder

1. Initial Inspection

- 1. The system shall never be energized for testing or operation until written, or onsite approval is obtained from the FCC License Holder.
(FBC BC 1.118.4.2.2)
- 2. Prior to the initial inspection, a letter from the Engineer of Record stating that the installation is complete and ready to be energized for testing shall be received by the FCC License Holder. The system settings and pictures of the installed major components shall also be provided to the FCC License Holder.
(FBC BC – 1.118.4.2.1)

The following components shall be included in the letter and pictures:

- (1) BDA with information
Permit Number; Serviced by _____; Telephone _____
 - (2) Enclosures with battery charger and batteries installed, wired with a label showing the battery installation date.
 - (3) The Dedicated annunciator shall be wired. The system shall be constructed and programmed to the FACP and the annunciator.
 - (4) BDA and FACP rooms shall be fire rated. Doors shall also be fire rated.
 - (5) All equipment shall be properly grounded.
 - (6) Antenna mast shall be grounded and connected to the NFPA 780 Lightning Protection System (if installed).
 - (7) Antenna shall have surge protection installed and wired.
 - (8) Antenna(s), if installed in the elevator shaft, shall have the approval of the Elevator Inspector.
 - (9) Junction boxes connected to the riser coaxial cables to the horizontal cables shall be installed and wired.
 - (10) All electrical rough inspections shall be completed.
- 3. The contractor shall coordinate the inspection with all responsible parties.
The following shall be present at a minimum:
 - Owners representative
 - Electrical Contractor
 - Fire Alarm Contractor
 - BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
 - System Engineer of Record
 - Electrical AHJ
 - Fire Official AHJ
 - FCC AHJ
 - 4. The Initial Inspection shall include the following:
 - (1) The System shall be energized for the first time
 - (2) Items B(1) through B(10) shall be inspected for compliance
 - (3) Acceptable dB levels shall be recorded
 - (4) Check the noise floor of the BDA transmitter. The noise floor shall be -100 dB to -105 dB or less than a 5 dB increase in the noise floor.
 - (5) System Engineer of Record shall attend all re-inspections.

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2C.2.4 NFPA 72 (2019), NFPA 1221 (2019) Inspection - FCC License Holder (cont.)

Final Inspection

This Inspection is a joint effort between the Fire Official and the FCC License Holder. Prior to the final inspection, the contractor shall provide to the Fire Official and to the FCC License Holder the following documentation showing that the building is ready for the final inspection.

After passing the initial inspection, the contractor shall submit to the FCC License Holder a Post Heat Map Study to show that all areas are covered per the code. A letter from the Engineer of Record shall state that the System is completed, fully operational, and ready for the final inspection.

The contractor shall coordinate the inspection with all responsible parties. The following shall be present at a minimum:

- Owners representative
- Electrical Contractor
- Fire Alarm Contractor
- BDA Vendor representative with analyzer and computer to gain access to the BDA program to check levels and settings.
- System Engineer of Record, only for re-inspections.
- Electrical AHJ
- Fire Official AHJ
- FCC AHJ

Final Inspection:

- (1) Building Radio Coverage Inspection
 - 99% in critical areas
 - 95% in common areas
 - DAQ 3.0 or better
- (2) All dB levels are acceptable.
- (3) Remote annunciator shall be functional.
- (4) Connection to the fire alarm shall be functional.
- (5) Owner shall provide proof of a signed service agreement with the BDA vendor.

Note: This checklist is a minimum checklist. Coordinate with the local FCC License Holder AHJ for additional checklist items.

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2C.2.5 NFPA 72 (2019), NFPA 1221 (2019) Inspection -Building (Structural)

- 1. Antenna Mast Installation (FBC 110.3.A.7)(2017)
- 2. Inspection for all fire-rated enclosures for Cables and BDA room. (FBC 110.3.A.7.d and .e)(2017)

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Broward County
Two-Way Radio Communications Enhancement Systems
BC RCES Guidelines

Part 3. Additional Information Attachments

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Additional Information Attachments

This attachment is for informational and guidance purposes only. Attachments include code requirements and also include good engineering practices. These engineering practices may include items that go beyond the minimum code standards.

These attachments shall be updated and expanded in the future to reflect current technologies and standards.

The interpretation of any code item shall be completed by the specific Authority Having Jurisdiction (AHJ).

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Additional Information Attachments (cont.)

3.1 Applicable Codes and Edition Dates

- A) The Florida Fire Prevention Code had adopted NFPA 72, 2013.
- B) The Florida Fire Prevention Code does allow the Florida Engineer of Record to select a later NFPA code for a specific project (FPPC (2017) 1, 4 Equivalencies...).
- C) The Florida Engineer of Record may select one of the following sets of codes:
 - NFPA 72 (2013)
 - or
 - NFPA 72 (2016) and NFPA 1221 (2016)
 - or
 - NFPA 72 (2019) and NFPA 1221 (2019)
- D) This selection shall be identified on the system drawings for permit and shall be approved by the Fire AHJ.

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Additional Information Attachments (cont.)

3.2 FCC License Holder Additional Requirements

The FCC License Holder has additional requirements beyond state and local codes. Those requirements are from industry standards:

IEEE 1692 (2011) Guide for the Protection of Communication Installations from Lightning Effects

TIA/ANSI/EIA 569-C (2012) Telecommunications Pathways and Spaces

TIA/ANSI/EIA 607-B (2011) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

Motorola R56 Standards and Guidelines for Communication Sites

Refer to the following FCC License Holder requirements:

Broward County RESC Communications Requirements dated 2019

City of Fort Lauderdale Communications Requirements dated 2019

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Additional Information Attachments (cont.)

3.3 UL Standards and NRTL's

A. Equipment with UL Standards:

The conductors and equipment required or permitted by this code shall be acceptable only if approved (NFPA 70-110.2 approval),

Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling (NFPA 70-110.3(B)) manufacturers installation instructions.

Definition of approved: Acceptable to the Authority Having Jurisdiction (AHJ), (NFPA 70-100).

- Listed equipment
- Evaluation by the AHJ
- Field evaluation as per NFPA 790, 791

Listing Standards:

- UL 60950 For BDA's/Repeaters
- UL 2524 For RCES equipment, BDA's/Repeaters, transmitters, Signal Booster components, Remote Annunciators, Power Supply, Battery Charging System components
- UL 924 Power Supply
- UL 1778 Uninterruptable Power Supply

B. Standards and Nationally Recognized Testing Laboratories (NRTL):

List of companies that are recognized by OSHA to test equipment (NRTL'S):

- | | | | |
|-----|-----|-----|------|
| UL | MET | ARL | SGS |
| ETL | TUV | CSA | ETC. |

UL sets the standards for testing products:

- UL 60950
- UL 2524

NRTL'S test the products for compliance:

- Listed: A product that is safe for use
- Labeled: A product that is field evaluated by a third-party testing laboratory per NFPA 790, 791.
(This may be accepted by the AHJ as an alternate to a listed product.)

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Additional Information Attachments (cont.)

3.4 Product Capability

Equipment without UL Standards:

There are many components of an RCES that do not fall into a category having a UL Standard. In these cases, the AHJ should use NFPA 1-1.4 Equivalencies, Alternatives, and Modifications to enable the usage of these components in an RCES.

See the attached product compatibility forms.

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3.4 Two-Way Radio Communications Enhancement Systems
Product Compatibility
Draft Edition 2019-06-14

Item	Manufacturer	Product Name	Part Number	UL Standard	NRTL Listing
BDA/Repeater				60950 2524	
Power Supply					
Charger					
Battery/Enclosure					
Remote Annunciator					
Surge Protection					
Donor Antenna				N/A	-
In-Building Antenna				N/A	-
Couplers				N/A	-
Connectors				N/A	-
Splitters				N/A	-
Ground Kit				NA	-
Mast				NA	-
Outside Cable					
Plenum Cable					

The above items are compatible for use with the BDA. This form shall be filled out by the BDA manufacturer.

BDA Mfgr. _____ Address _____ City/State _____ Rep Name _____ Title _____ Date _____	Florida Engineer of Record: _____ Name _____ PE # _____ Company _____ CA # _____ Date
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Two-Way Radio Communications Enhancement Systems Product Compatibility

Item	Manufacturer	Product Name	Part Number	UL Standard	NRTL Listing
BDA/Repeater	BDA Corp.	Repeater	BDA-XXX	60950 2524	UL/ETL
Power Supply UPS	UPS Corp.	UPS	Incl BDA-XXX		
Charger	C Corp.	Charger	Incl BDA-XXX		
Battery/Enclosure	B/E Corp.	Battery Backup	BDA-XXX		
Remote Annunciator	RA Corp.	Annunciator			
Surge Protection	Polyphaser	Surge Protector		NA	
Donor Antenna	Sinclair	800/700 MHZ	SY407-SF2SNM	NA	-
In-Building Antenna	Galtronics	700/800 MHZ	PEAR-S5379	NA	-
Couplers	Micro Lab	2-Way	D2-85FN	NA	-
Connectors	RFS	N-Male	NM-LCF12-D01	NA	-
Splitters	Micro Lab	Power Splitter Fixed Ratio	DN-XXFN	NA	-
Ground Kit	CI Wireless.com	1/2" Ground Kit Tinned	SCGK12	NA	-
Mast				NA	-
Outside Cable	RFS	1/2" UV Cable	ICA12-50J		ETL
Plenum Cable	RFS Commscope	1/2" Plenum Cable 1/2" Plenum Cable	LCF12-50JPL HL4- 50A		ETL ETL
Busbar	CI Wireless	Tinned Copper Busbar	GB212-NH	NA	

The above items are compatible for use with the BDA. This form shall be filled out by the BDA manufacturer.

BDA Mfgr. BDA Corp
 Address Any Street
 City/State Any Town, Any State
 Rep Name _____
 Title _____
 Date _____

Florida Engineer of Record:
 Name _____
 PE # _____
 Company _____
 CA # _____
 Date _____

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Additional Information Attachments (cont.)

3.5 Battery Enclosures

The battery enclosure type is determined by the NFPA code and issue date. The following codes apply:

1. NFPA 72.24.5.2.5.2 (2013)
The battery enclosure shall be a NEMA 4, 4X type.
2. NFPA 1221-9.6.11.2 (2016)
The battery shall be stored in a NEMA 4, 4X type enclosure.
3. NFPA 1221-9.6.11.2.2 (2019)
The battery shall be stored in a NEMA 4, 4X type enclosure.
NFPA 1221-9.6.11.2.2
Batteries that require ventilation shall be stored in a NEMA 3R type enclosure.

All rechargeable batteries manufactured today, including “sealed” batteries, require ventilation. The 2019 Code addresses this issue and requires a NEMA 3R type enclosure.

When a project is permitted under NFPA 72 (2013) or NFPA 1221 (2016), approval from the Fire AHJ is required to use the NEMA 3R type enclosure. The Fire AHJ may approve the NEMA 3R type enclosure based on NFPA 1-1.4, Equivalencies, Alternatives, and Modifications.

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Additional Information Attachments (cont.)

3.6 Drawing Set Numbering Option

Drawing numbers for plans should be set up in a logical sequence. Care should be taken to select the first and second letters to minimize confusion in reviewing drawings.

The following are typical drawing letters:

A:	Architectural
C:	Civil
E:	Electrical
F, FP:	Fire Protection
FA:	Fire Alarm
I:	Interior
M:	Mechanical
P:	Plumbing
Q:	Equipment
T:	Telecommunications

FC should be used for Fire RCES Drawings.

<u>Drawing Number</u>	<u>Description</u>
FC	Fire Communication Drawing Set
FC-1.XX	Title Sheet, Drawing Index, Property Information, Project Team, Applicable Codes with Edition Dates, Scope of Work, Specific Requirements, Legend, Notes, Specifications
FC-2.XX	Floor Plans with Fire Rating of Walls, Equipment Locations, Conduit Runs
FC-3.XX	Conduit Riser, Details
FC-4.XX	Propagation Plan, System Riser Diagrams, Equipment Lists, Link Budgets, Etc.
FC-5.XX	Product Compatibility List Manufacturer's Specs for Equipment

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Additional Information Attachments (cont.)

3.7 Conditioned Space for Equipment

Equipment shall be installed in a space that does not exceed the temperature limitations as indicated in the manufacturer's specifications and requirements (NFPA 70-110.3(B)).

The system also has a battery backup system. These systems require mechanical ventilation for operation.

Most, if not all, RCES systems are installed in an air-conditioned space to meet the temperature requirements in the State of Florida.

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Additional Information Attachments (cont.)

3.8 Lightning Protection

NFPA 72 (2013); NFPA 1221.9.6.3 (2016, 2019)

- A) Systems, with the exception of hospitals, nursing homes, or schools, installed under NFPA 72 (2013) are not required to have a lightning protection system that complies with NFPA 780. NFPA 72 (2013).

However, if the building has a Lightning Protection System that complies with NFPA 780, then the new RCES shall be protected the Lightning Protection System and shall comply with NFPA 780.

- B) Systems installed under NFPA 1221 (2016, 2019) shall have lightning protection that complies with NFPA 780. (NFPA 1221.9.6.3)
- 1) This section of NFPA 1221 clearly states that the Two-Way Radio Communications Enhancement shall be protected by an NFPA 780 Compliant Lightning Protection System.
 - 2) In buildings where there is an NFPA 780 Compliant Lightning Protection System, the antenna shall be protected by the NFPA 780 Compliant Lightning Protection System and the system shall be re-certified by the Lightning Protection System installer to meet the requirements of NFPA 780.
 - 3) In buildings where there is no NFPA compliant Lightning Protection System, a new NFPA 780 Lightning Protection System shall be installed. The antenna shall be protected by the new NFPA 780 Compliant Lightning Protection System. The entire system shall be certified by the Lightning Protection System installer. (The cost of a new NFPA 780 Compliant Lightning Protection System could be in excess of \$10,000.00 for a 10,000 SF building)

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Additional Information Attachments (cont.)

3.9 Coaxial Cables, Conduits, and Pull Boxes

The Manufacturer’s minimum bend radius for repeated bends shall be used for all coaxial cables installed in conduits (NFPA 70-110.3B).

The drawing shall specify the conduit sizes and the minimum bend radius of all coaxial cables.

Coaxial cables can be easily damaged during the installation. It is recommended that oversized conduits with large radius bends be used to protect the cables during the installation process.

A standard 90-degree elbow for a 2” EMT has a bend radius of 9-1/2”. Some cable spec sheet requires a 10” radius for 1/2” cable with repeated bends. A bend radius of 9-1/2” does not meet the manufacturer’s requirements.

Notes:

1. Riser and donor antenna conduits are recommended to be a minimum of 2” with large 24” radius bends for all riser and donor antenna coaxial cables.
2. Conduits are recommended to be a minimum of 1-1/2” with large 24” radius bends for all feeder coaxial cables (metal raceways).
3. Junction or pull boxes are recommended to be a minimum of 16” x 16” x 4”.
4. The AHJ may require sweep testing at any time. Small conduits, long runs, small junction boxes, or multiple bends could be strong indicators that there might be problems with the installation. Resolutions of these problems are an expensive process and may cause delays on the project.

	90° Elbow Bend Radius	90° Large Elbow Bend Radius
EMT		
1-1/4”	7.25”	24”
1-1/2”	8.25”	24”
2”	9.5”	24”
Coaxial Cable Plenum Rated 1/2”	Minimum Bend Radius, Repeated Bends	Tensile Strength
RFS 1CA 12-50 JPL	10”	250 lbs.
Trilogy APC 012 J50-RD	5”	275 lbs.
Comscope AL4 RPV-50	5”	175 lbs.

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2019-09-17

Additional Information Attachments (cont.)

3.9 Coaxial Cables, Conduits, and Pull Boxes (cont.)

The Motorola R56 Standard and the Telecommunications Industry Association Standard, TIA/ANSI-569-C, recommends the following guidelines:

9.8.2.1 Length

No section of conduit shall be longer than 100ft. between pull points.

9.8.2.1 Bends

No section of conduit shall contain more than two 90° bends, or equivalent, between pull points.

9.8.2.3 Pull Tension

The pull tension of the cable being installed shall not be exceeded.

9.8.2.4 Pull Boxes

9.8.3.2 Pull Strings

Pull strings shall be placed in installed conduit.

9.9.4 Pathway Fill Factor (Conduits)

For future pathways, the maximum pathway fill shall be 40%.

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Additional Information Attachments (cont.)

3.10 Coaxial Cables, Plenum Rated

All coaxial cables shall be plenum rated.

(NFPA 72-24.3.6.8.1.1) (2013)

(NFPA 1221-9.6.2.1.1.1) (2016)

(NFPA 1221-9.6.2.1) (2019)

To understand this requirement, the NFPA 72 Handbook shall be referenced.

24.5 Two-Way, In-Building Emergency Communications Systems

Two-Way communications service within a building provides a reliable method for fire-fighters and other emergency response personnel to communicate with each other during the course of an emergency. The code recognizes two means: two-way telephones and two-way, in-building radio communications enhancement systems.

24.3.6.8 Two-way radio communications enhancement systems shall comply with 24.3.6.8.1 through 24.3.6.8.4

24.3.6.8.1 Where a two-way radio communications enhancement system is used in lieu of a two-way in-building wired emergency communications system, it shall have a pathway survivability of Level 1, Level 2, or Level 3.

24.3.6.8.1.1 The feeder and riser coaxial cables shall be rated as plenum cables

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Additional Information Attachments (cont.)

3.11 Cables, Pathway Survivability

NFPA 72 (2013)

- Level 1 Feeder cables in conduit

- Riser cables in a 2-hour fire-rated enclosure
 (Donor antenna to BDA cables are riser cables)

- Level 2,3 All cables in a 2-hour fire-rated enclosure

NFPA 72 (2016), NFPA 1221 (2016)

- Level 1 Feeder cables in conduits

- Riser cables in a fire-rated enclosure to match building fire rating
 (Donor antenna to BDA cables are riser cables)

- Level 2,3 All cables in a fire-rated enclosure to match building fire rating

NFPA 72 (2019), NFPA 1221 (2019)

Pathway Survivability removed

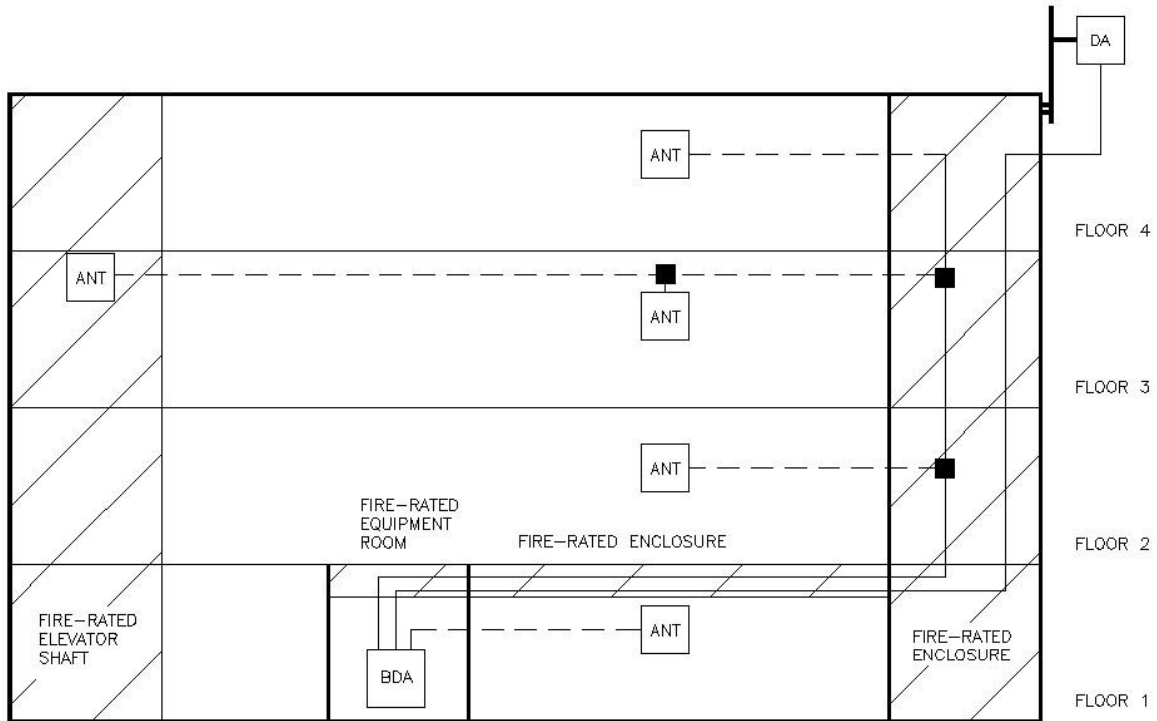
- | | |
|--|---|
| Antenna Distribution Cables:
(Feeder cable) | Not in conduit
Not in a fire-rated enclosure |
| Backbone Cables:
Donor antenna to BDA cables
BDA to riser shaft cables
Riser cables | Fire-rated enclosure to match building |

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Additional Information Attachments (cont.)

3.12 Cables, Typical Details

NFPA 72 (2013)



Notes and Legend

Fire-rated enclosures shall have a 2-hour fire-rating

Pathway survivability Levels 1, 2, or 3

All cables shall be plenum rated.

Riser cables (solid):

In a fire-rated enclosure

(Backbone cables)

Feeder cables (dashed)

Level 1: In a fire-rated enclosure or in metal raceways

(Antenna Distribution cables)

Level 2,3: In a fire-rated enclosure

Provide fire stop where cables penetrate fire-rated walls.



Donor Antenna



Distribution Antenna



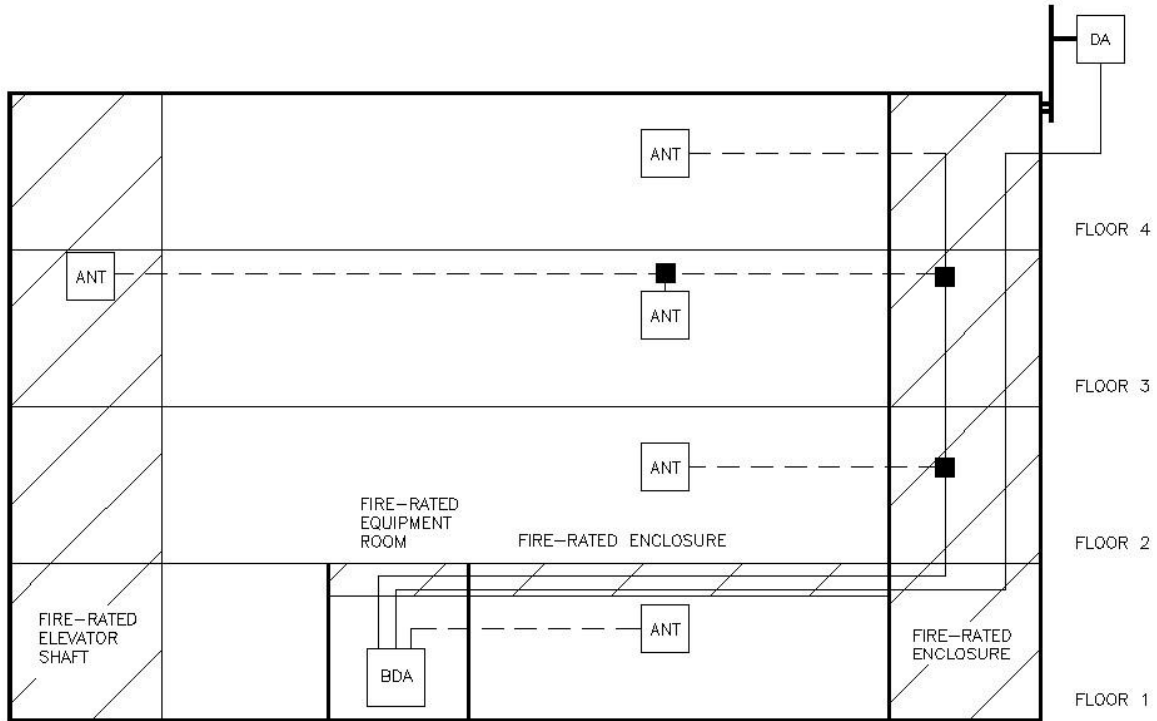
Bi-directional amplifier, Public Safety repeater

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Additional Information Attachments (cont.)

3.13 Cables, Typical Details

NFPA 72 (2016), NFPA 1221 (2016)



Notes and Legend

Fire-rated enclosures shall match the building's fire-rating.

Pathway survivability Levels 1, 2, or 3

All cables shall be plenum rated.

Riser cables (solid):

In a fire-rated enclosure

(Backbone cables)

Feeder cables (dashed)

Level 1: In a fire-rated enclosure or in metal raceways

(Antenna Distribution cables)

Level 2,3: In a fire-rated enclosure

Provide fire stop where cables penetrate fire-rated walls.



Donor Antenna



Distribution Antenna



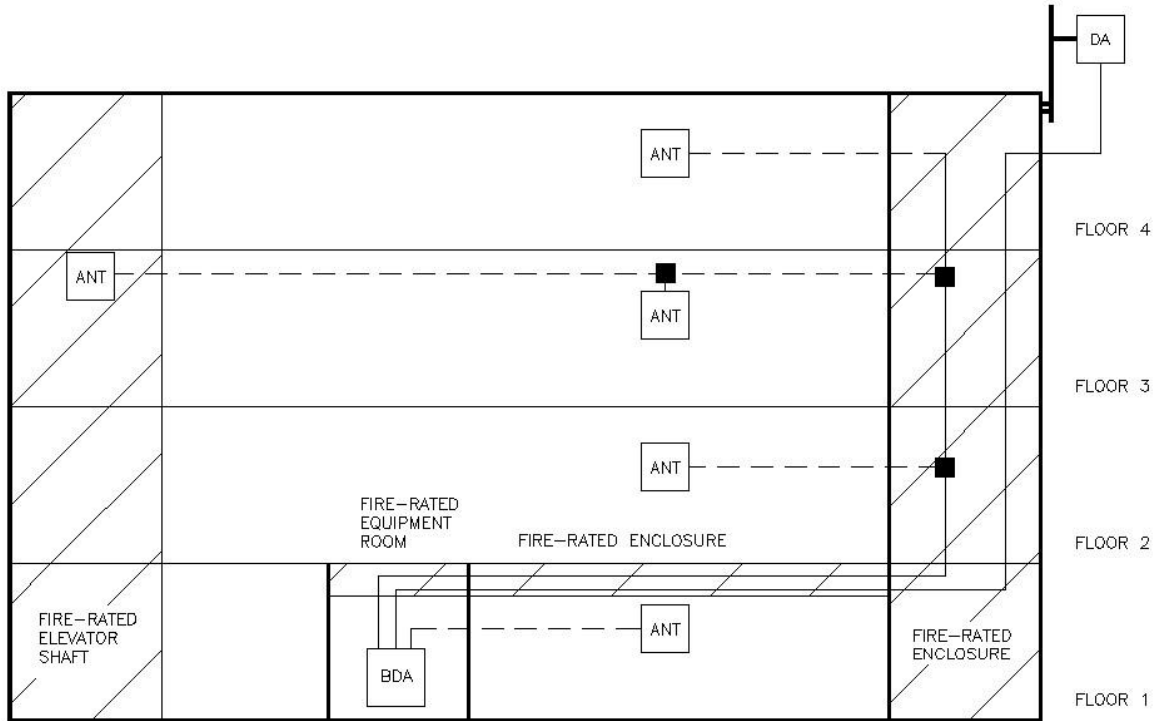
Bi-directional amplifier, Public Safety repeater

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Additional Information Attachments (cont.)

3.14 Cables, Typical Details

NFPA 72 (2019), NFPA 1221 (2019)



Notes and Legend

Fire-rated enclosures shall match the building's fire-rating

There is no pathway survivability.

All cables shall be plenum rated.

Backbone cables (solid):

In a fire-rated enclosure

(Riser cables)

Antenna Distribution Cables (dashed):

A fire-rated enclosure is not required.

(Feeder cables)

Metal raceways are not required.

Provide fire stop where cables penetrate fire-rated walls.



Donor Antenna



Distribution Antenna



Bi-directional amplifier, Public Safety repeater

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Additional Information Attachments (cont.)

3.15 Engineer of Record

1) State of Florida

Florida Statute FS 471 Engineering
Florida Administrative Code FAC 61G15
Degree in Engineering from an accredited university
Pass the Fundamentals of Engineering Exam
Pass the Professional Engineering Exam
5 years' experience as an engineer under a PE

PE designates Professional Engineer.

Florida does not designate a specific discipline. For example: A civil engineer may design roads, bridges, nuclear power plants, and BDA systems. The State of Florida only states that the engineer shall be qualified. The engineer is qualified until proven differently.

FAC Chapter 61G15-30(4) states:

“Engineering Documents: Engineering documents are designs, plans, specifications, drawings, prints, reports, or similar instruments of service in connection with engineering services or creative work that have been prepared and issued by the professional engineer or under his responsible supervision, direction, or control.”

The engineer cannot sign work designed by others unless the engineer was involved during the design process. The engineer cannot sign and seal plans prepared by others with only a quick review. The engineer shall fully understand the signed and sealed drawings.

Engineers typically sign and seal drawings prepared by designers, CADD operators, software specialists, and others who are under the Engineer's responsible supervision.

2) Florida Building Code (FBC)(2017), Broward County Edition, Section 118.1.4 Design

A sealed submittal from an engineer, with training and experience in Electrical Engineering, shall also be required.

As a minimum, this requires a BSEE (Bachelor's Degree in Electrical Engineering). Additional training is also required as Continuing Education. Experience should include at least five (5) years direct experience in Electrical Engineering.

3) NFPA 72 (2013)

Section 10.5.1.4: The system designer shall provide evidence of their qualifications and/or certifications when required by the Authority Having Jurisdiction (AHJ).

Additional Information Attachments (cont.)

3.16 Elevator Cabs

Elevator cabs are used by first responders on a daily basis. NFPA 72-25.5.2.2.1 does not include the elevator cab as a critical area. The elevator cab is included in the general building area. General building areas shall be provided with 90% floor area radio coverage.

This is interpreted as follows:

Each elevator cab shall have a minimum of 90% floor area radio coverage. Sufficient DAS antennas shall be provided in the elevator lobbies and/or in the elevator shafts. Antennas installed in the elevator shafts require a variance from the AHJ.

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Additional Information Attachments (cont.)

3.17 Signal Strength (Design vs. Code)

NFPA 24.5.2.3 requires a minimum signal strength of -96 dBm and a minimum of 15 dB above the signal booster gain.

The only way to pass a final inspection with these values is that a system shall be designed with a -90 dBm and a minimum of 20 dB above the signal booster gain.

NFPA 1221-9.3.1.2.2 (2016) requires a minimum DAQ of 3.0. However, the annex A9.3.1.2.2 recommends that the system be designed for DAQ of 3.4.

The design value shall always be more stringent than the code value.

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Additional Information Attachments (cont.)

3.18 Reserved

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Item 3:

Discuss “Sample Drawings Draft Rev. 1”

TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM SAMPLE OFFICE BUILDING BROWARD COUNTY, FLORIDA

INFORMATION PURPOSES
NOT FOR PERMITTING OR CONSTRUCTION

<p>PROPERTY INFORMATION</p> <p>ADDRESS 1730nw 33rd ST. POMPANO BEACH, FL 33064</p> <p>BROWARD COUNTY PROPERTY ID# 4842 2240 0010</p> <p>SITE COORDINATES 26.270583 DEG -80.147414 DEG (FROM GOOGLE MAPS)</p> <p>OWNER XYZ CORP, INC. 12327 WILES RD. CORAL SPRINGS, FL 33076</p> <p>TOTAL AREA: _____ SQ.FT. NUMBER OF FLOORS: _____ FLOORS</p>	<p>SYSTEM INTEGRATOR</p> <p>BDA INTEGRATION, INC. FCC# 123456789</p> <hr/> <p>SYSTEM INSTALLER</p> <p>BDA CONTRACTOR, INC. EC# 123456</p>
--	---

SCOPE OF WORK

FURNISH AND INSTALL A COMPLETE OPERATIONAL TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM.

THE SYSTEM SHALL BE IN COMPLIANCE WITH THE APPLICABLE CODES AND STANDARDS AND WITH THE APPLICABLE FCC LICENSE HOLDER REQUIREMENTS.

TIE INTO THE FIRE ALARM SYSTEM.

INDEX OF DRAWINGS	
DRAWING	TITLE
FC-1.1	TITLE SHEET, DRAWING INDEX, INFORMATION
FC-1.2	SPECS, LEGEND, ETC.
FC-1.3A	AHJ NOTES NFPA 72 (2013)
FC-1.3B	AHJ NOTES NFPA 72 (2016) NFPA 1221 (2016)
FC-1.3C	AHJ NOTES NFPA 72 (2019) NFPA 1221 (2019)
FC-2.1	FIRST FLOOR PLAN
FC-2.2	SECOND FLOOR PLAN
FC-3.1	CONDUIT RISER DIAGRAM
FC-3.2	ANTENNA AND GROUNDING DETAIL
FC-4.1	FIRST FLOOR PROPAGATION PLAN
FC-4.2	SECOND FLOOR PROPAGATION PLAN
FC-4.3	SYSTEM RISER DIAGRAM
FC-5.1	PRODUCT COMPATIBILITY LIST
FC-5.2	MANUFACTURER'S SUBMITTAL SHEET 1
FC-5.3	MANUFACTURER'S SUBMITTAL SHEET 2
FC-5.4	MANUFACTURER'S SUBMITTAL SHEET 3

NFPA 72 (2013) THIS PROJECT

CODE REQUIREMENTS:

- FIRE RATED ENCLOSURES SHALL BE 2-HOUR.
- TIE INTO EXISTING LIGHTNING PROTECTION SYSTEM, IF INSTALLED.

PATHWAY SURVIABILITY SHALL BE A LEVEL 1 FOR DISTRIBUTION:

- COAXIAL CABLES FROM THE DONOR ANTENNA TO THE BDA SHALL BE IN A FIRE-RATED ENCLOSURE.
- COAXIAL CABLES AS RISER CABLES SHALL BE IN A FIRE-RATED ENCLOSURE.
- DISTRIBUTION COAXIAL CABLES FROM THE BDA TO THE DISTRIBUTION ANTENNAS SHALL BE IN A METAL RACEWAY.

OTHER STANDARDS AND REQUIREMENTS

- FCC LICENSE HOLDERS
 - BROWARD COUNTY REGIONAL EMERGENCY SERVICES AND COMMUNICATIONS 2019 REQUIREMENTS
 - CITY OF FORT LAUDERDALE TELECOMMUNICATIONS SECTION 2019 REQUIREMENTS
- FREQUENCIES
 - 800 MHZ
 - 700 MHZ P25
- PATHWAY SURVIABILITY IS A LEVEL 1 (NFPA 12.4) BUILDING SPRINKLERED

OPTIONAL CODE SELECTION BY THE ENGINEER

NFPA 72 (2016), NFPA 1221 (2016)

CODE REQUIREMENTS:

- FIRE RATED ENCLOSURES SHALL MATCH THE BUILDING'S FIRE-RATING.
- TIE INTO EXISTING LIGHTNING PROTECTION SYSTEM, IF INSTALLED.
- TIE INTO A NEW LIGHTNING PROTECTION SYSTEM IF ONE DOES NOT EXIST.

PATHWAY SURVIABILITY SHALL BE A LEVEL 1 FOR DISTRIBUTION:

- COAXIAL CABLES FROM THE DONOR ANTENNA TO THE BDA SHALL BE IN A FIRE-RATED ENCLOSURE.
- COAXIAL CABLES AS RISER CABLES SHALL BE IN A FIRE-RATED ENCLOSURE.
- DISTRIBUTION COAXIAL CABLES FROM THE BDA TO THE DISTRIBUTION ANTENNAS SHALL BE IN A METAL RACEWAY.



THE DOCUMENT IS FOR TEACHING PURPOSES ONLY AND IS FOR A SAMPLE OFFICE BUILDING, NOT A SPECIFIC BUILDING.

THE DOCUMENT INCLUDES COMPLIANCE WITH THE REQUIRED STATE AND LOCAL CODES, AS WELL AS GOOD ENGINEERING PRACTICES.

THE DOCUMENT IS PRELIMINARY AND IS NOT IN THE FINAL FORM. THE DOCUMENT MAY BE REVISED AT ANY TIME TO RESOLVE ANY ISSUES.

DO NOT COPY OR REPRODUCE WITHOUT PRIOR WRITTEN AUTHORIZATION.

NFPA 72 (2019), NFPA 1221 (2019)

CODE REQUIREMENTS:

- FIRE RATED ENCLOSURES SHALL MATCH THE BUILDING'S FIRE-RATING.
- TIE INTO EXISTING LIGHTNING PROTECTION SYSTEM, IF INSTALLED.
- TIE INTO A NEW LIGHTNING PROTECTION SYSTEM IF ONE DOES NOT EXIST.

PATHWAY SURVIABILITY HAS BEEN REMOVED.

- BACKBONE COAXIAL CABLES SHALL BE INSTALLED IN A FIRE-RATED ENCLOSURE.
- DISTRIBUTION COAXIAL CABLES DO NOT HAVE TO BE IN A FIRE-RATED ENCLOSURE AND DO NOT HAVE TO BE INSTALLED IN CONDUIT.

OTHER APPLICABLE STANDARDS

IEEE 1692 (2011) GUIDE FOR THE PROTECTION OF COMMUNICATION INSTALLATIONS FROM LIGHTNING EFFECTS

TIA/ANSI/EIA 569-C (2012) TELECOMMUNICATIONS PATHWAYS AND SPACES

TIA/ANSI/EIA 607-B (2011) GENERIC TELECOMMUNICATIONS BONDING AND GROUNDING (EARTHING) FOR CUSTOMER PREMISES

MOTOROLA R56 STANDARDS AND GUIDELINES FOR COMMUNICATION SITES

DRAFT EDITION

Rev 1 2019-09-17

DRAFT EDITION
2019-09-17

THIS DRAWING HAS NOT BEEN APPROVED BY ANY AHJ.

TITLE SHEET, DRAWING INDEX, INFORMATION

SCALE: NTS

RC ENGINEERING INC 5532 NW 106th DRIVE CORAL SPRINGS, FL 33076 (954)757-7900 CA4755	COORD DUR 2019-09-17	REVISIONS 2019-07-20 MAR DUR NTS	JOB NO. 19005
PROJECT TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM SAMPLE OFFICE BUILDING BROWARD COUNTY, FLORIDA			
TITLE TITLE SHEET, DRAWING INDEX, INFORMATION			
SEAL			
DATE David L. Rice, P.E. Electrical Engineer State of Florida PE 34343			
SHEET FC-1.1			

GENERAL SPECIFICATIONS FBC, SIXTH EDITION (2017)

THE CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS, TAXES, AND OTHER FEES AS REQUIRED FOR A COMPLETE JOB. THE COMPLETE INSTALLATION SHALL BE IN ACCORDANCE WITH STATE AND LOCAL AUTHORITIES HAVING JURISDICTION, FBC SIXTH EDITION, FFPC SIXTH EDITION, NFPA 70 (NEC) 2014, AND NFPA 72 (SEE DRAWING FC-1.1).

THE CONTRACT DOCUMENTS INDICATE THE EXTENT AND GENERAL ARRANGEMENT OF EQUIPMENT AND WIRING. ALL ITEMS NOT SPECIFICALLY MENTIONED IN THE DOCUMENTATION BUT WHICH ARE OBVIOUSLY NECESSARY TO MAKE A COMPLETE WORKING INSTALLATION SHALL BE INCLUDED. THE WORK SHALL BE OF FIRST CLASS QUALITY.

THE CONTRACTOR SHALL PROVIDE A GUARANTEE AGAINST DEFECTIVE WORKMANSHIP, MATERIALS, OR EQUIPMENT FOR A MINIMUM OF ONE (1) YEAR FROM THE DATE OF ACCEPTANCE.

THE CONTRACTOR SHALL VISIT THE PROJECT. IF ANY DEPARTURES FROM THE CONTRACT DOCUMENTS ARE DEEMED NECESSARY BY THE CONTRACTOR, DETAIL OF SUCH DEPARTURES AND REASONS THEREFORE SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS MUST BE DONE AS SOON AS POSSIBLE AND WITHIN TEN (10) DAYS AFTER AWARD OF CONTRACT. NO SUCH DEPARTURES SHALL BE MADE WITHOUT WRITTEN APPROVAL OF THE ENGINEER.

THE CONTRACTOR SHALL VERIFY ALL EQUIPMENT AND SIZES. COORDINATE THESE REQUIREMENTS AND SIZES WITH THE OTHER TRADES AND THE OWNER'S REPRESENTATIVE BEFORE PLACING ORDERS.

THE CONTRACTOR SHALL PROVIDE ALL CUTTING AND PATCHING, ETC. FOR A COMPLETE JOB. ALL MATERIALS SHALL BE NEW, SHALL BEAR THE LABEL OF THE UNDERWRITER'S LABORATORIES OR APPROVED EQUIVALENT, SHALL BE APPROVED BY THE LOCAL CODE ENFORCING AUTHORITIES, AND SHALL BE OF COMMERCIAL GRADE.

ALL CIRCUIT BREAKERS SHALL BE FULL SIZE; NO TANDEM TYPE CIRCUIT BREAKERS. PROVIDE AN ACCURATE PANEL SCHEDULE ON THE INSIDE OF EACH PANEL DOOR.

ALL GUTTER AND WIREWAY SIZES SHALL COMPLY WITH NEC ARTICLE 376.22 AND TABLES 312.6(A) & (B).

ELECTRICAL EQUIPMENT EXPOSED TO THE WEATHER SHALL BE WEATHERPROOF.

PENETRATION OF ALL PIPES AND CONDUITS THROUGH FIRE RATED PARTITIONS SHALL BE IN COMPLIANCE WITH UL ASSEMBLY. PROVIDE 3M FIRE BARRIER CP-25 N/S FIRESTOP CAULKING FOR CONDUITS UP TO 4" IN TWO (2) HOUR (MAX) RATED FIRE PARTITIONS.

THE ROOM WITH THE BDA EQUIPMENT SHALL BE FIRE-RATED. THE ROOM SHALL ALSO BE AIR-CONDITIONED WITH MECHANICAL VENTILATION AT ALL TIMES, AS REQUIRED BY THE MANUFACTURER'S INSTALLATION GUIDELINES.

SHOP DRAWINGS SHALL BE PROVIDED AND SHALL INCLUDE, BUT NOT BE LIMITED TO, BDA'S, REPEATERS, POWER SUPPLIES, BATTERIES, ENCLOSURES, REMOTE ANNUNCIATORS, SURGE PROTECTORS, PASSIVE DEVICES, AND COAXIAL CABLES.

1. PROVIDE A DETAILED LIST OF ANY DEVIATION BETWEEN EACH SPECIFIED ITEM AND THE ITEM SUBMITTED FOR REVIEW. THIS LIST SHALL BE HIGHLIGHTED SUCH THAT ALL DEVIATIONS ARE OBVIOUS AND CLEAR, AND INCLUDE INFORMATION ON DIMENSIONS, FINISH, MATERIAL, ETC.
2. PROVIDE SCALED SHOP DRAWINGS SHOWING THE FIT OF ALL ITEMS WHERE THE DIMENSIONS OF THE SUBMITTED ITEMS ARE DIFFERENT FROM THE SPECIFIED ITEMS.
3. PROVIDE COST SAVINGS INFORMATION TO OWNER, WHERE ANY DEVIATIONS ARE IDENTIFIED IN THE DETAILED LIST ABOVE.

ELECTRICAL LEGEND

	120V - 20A DUPLEX RECEPTACLE - 18" AFF OR AS NOTED (C-CEILING MOUNTED) (A-AUTOMATIC CONTROL)
	CONDUIT RUN, CONCEAL AS POSSIBLE
	ELECTRICAL DISTRIBUTION PANEL
EC	ELECTRICAL CONTRACTOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
WP	WEATHERPROOF
WR	WEATHER-RESISTANT
	BI-DIRECTIONAL AMPLIFIER/REPEATER
	ANNUNCIATOR
	BATTERY WITH ENCLOSURE
	UNINTERRUPTIBLE POWER SUPPLY
	DONOR ANTENNA △ 1
	DISTRIBUTION ANTENNA
	SPLITTER
	JUNCTION BOX
	SURGE PROTECTION DEVICE (WP) △ 1
	FIRE ALARM CONTROL PANEL
	FIRE ALARM ANNUNCIATOR

DRAFT EDITION
 Rev 1 2019-09-17

DRAFT EDITION
 2019-09-17
 THIS DRAWING HAS NOT BEEN APPROVED BY ANY AHJ.

SPECS, LEGEND, ETC.

SCALE: NTS

RC ENGINEERING INC
 5532 NW 106th DRIVE
 CORAL SPRINGS, FL 33076
 (954)757-7900
 CA4755

REVISIONS
 △ 2019-09-17 DLR COORD

Date: 2019-07-20	Drawn: MAR	Checked: DLR	Scale: NTS	JOB NO. 19005
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PROJECT
 TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
 OFFICE BUILDING
 BROWARD COUNTY, FLORIDA

TITLE
 SPECS, LEGEND,
 ETC.

SEAL

DATE
 David L. Rice, P.E.
 Electrical Engineer
 State of Florida
 PE 34343

SHEET
 FC-1.2

FIRE AHJ NOTES

- 1. THE BDA ENCLOSURE SHALL BE PAINTED FIRE-ENGINE RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
2. PROVIDE AN INFORMATION BINDER STORED NEXT TO THE BDA. INFORMATION SHALL INCLUDE:
(1) AS-BUILT DRAWINGS
(2) MANUFACTURER'S DATA SHEETS AND SPECS
(3) PRE-INSTALLATION READINGS (HEAT MAP)
(4) FINAL SIGNAL STRENGTH MEASUREMENT
(5) MAINTENANCE CONTRACT
(6) BROWARD COUNTY REGIONAL EMERGENCY SERVICES AND COMMUNICATIONS (RESC) APPROVAL
(7) MAINTENANCE REPAIR LOG
3. PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. FOR LEVEL 1, ALL COAXIAL CABLES SHALL BE IN METAL RACEWAYS. (NFPA 72-12.4)
4. THE FEEDER AND RISER COAXIAL CABLES SHALL BE RATED AS PLENUM CABLE. (NFPA 72-24.3.6.8.1.1)
5. RISER COAXIAL CABLES SHALL BE ROUTED THROUGH A 2-HOUR-RATED ENCLOSURE. (NFPA 72-24.3.6.8.3)(NFPA 72-24.3.6.8.4)
6. RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS, SUCH AS THE FIRE COMMAND CENTER(S), THE FIRE PUMP ROOM(S), EXIT STAIRS, EXIT PASSAGEWAYS, ELEVATOR LOBBIES, STANDPIPE CABINETS, SPRINKLER SECTIONAL VALVE LOCATIONS, AND OTHER AREAS DEEMED CRITICAL BY THE AHJ AND 90% IN GENERAL BUILDING AREAS. (NFPA 72-24.5.2.2)
7. SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
8. SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
9. NOTE: A SIGNAL STRENGTH OF LESS THAN -90 DBM AS SHOWN ON THE PLANS HAS A HIGH PROBABILITY OF FAILING THE FINAL INSPECTION OF DAQ 3.0 MINIMUM. SEE NFPA 72-14.4.10.3 TEST PROCEDURES; RECOMMEND -90 DBM.
10. ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 72-24.5.2.3.3) (NFPA 1221-9.6.9 (2016))
11. NOTE: NFPA 1221 (2016) REQUIRES A MINIMUM OF 20 DBM. ANY LOWER VALUE MAY RESULT IN THE PROBABILITY OF FAILING THE FINAL INSPECTION.
12. SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE AHJ. (NFPA 72-24.5.2.4)
13. FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 72-24.5.2.4.2)
14. SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE LOCAL PUBLIC SAFETY RADIO SYSTEM. (NFPA 72-24.5.2.5.1) (NFPA-1.1.4)
15. ALL REPEATERS, TRANSMITTER RECEPTACLES, SIGNAL BOOSTER COMPONENTS AND BATTERY SYSTEM COMPONENTS SHALL BE IN A NEMA 4, 4X ENCLOSURE. (NFPA 72-24.5.2.5.2) (NFPA 1-1.4)
16. POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SOURCES. (NFPA 72-24.5.5)
17. THE PRIMARY POWER SOURCE SHALL BE SUPPLIED FROM A DEDICATED CIRCUIT AND SHALL COMPLY WITH NFPA 72-10.6.5. (NFPA 72-24.5.5.1)
18. THE SECONDARY POWER SOURCE SHALL CONSIST OF ONE OF THE FOLLOWING (NFPA 72-24.5.5.2):
(1) BATTERY WITH AT LEAST 12 HOURS OF OPERATION AT 100% PER NFPA 72-10.6.10
(2) LIFE SAFETY GENERATOR WITH AT LEAST 12 HOURS OF OPERATION AT 100% AND A BATTERY WITH AT LEAST 2 HOURS OF OPERATION AT 100% PER NFPA 10.6.11.3.
19. SYSTEM MONITORING: THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM (NFPA 72-24.5.2.6.1):
(1) INTEGRITY OF THE CIRCUIT MONITORING SIGNAL BOOSTER(S) AND POWER SUPPLY(IES) SHALL COMPLY WITH NFPA 72-24.10.6.9 AND NFPA 72-12.6.
(2) SYSTEM AND SIGNAL BOOSTER SUPERVISORY SIGNALS SHALL INCLUDE THE FOLLOWING:
(a) ANTENNA MALFUNCTION
(b) SIGNAL BOOSTER FAILURE
(c) LOW-BATTERY CAPACITY INDICATION WHEN 70 PERCENT OF THE 12-HOUR OPERATING CAPACITY HAS BEEN DEPLETED.
(3) POWER SUPPLY SIGNALS SHALL INCLUDE THE FOLLOWING FOR EACH SIGNAL BOOSTER:
(a) LOSS OF NORMAL AC POWER
(b) FAILURE OF BATTERY CHARGER
20. DEDICATED PANEL (ANNUNCIATOR PANEL) SHALL SHOW (NFPA 72-24.5.2.6.2):
(1) NORMAL AC POWER
(2) SIGNAL BOOSTER TROUBLE
(3) LOSS OF NORMAL AC POWER
(4) FAILURE OF BATTERY CHARGER
(5) LOW BATTERY CAPACITY
(6) DONOR ANTENNA MALFUNCTION
21. TECHNICAL CRITERIA (NFPA 72-24.5.2.7)
(1) FREQUENCIES REQUIRED
(2) LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
(3) MAXIMUM PROPAGATION DELAY LESS THAN 30 MICRO-SECONDS
(4) LIST OF SPECIFICALLY APPROVED COMPONENTS
(5) OTHER SUPPORT TECHNICAL INFORMATION
22. A NOTE ON THE PLAN SHALL BE PROVIDED:
"CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM." (NFPA 72-24.5.4) (ASME A17.1)

ELECTRICAL AHJ NOTES

- 1. ALL CIRCUIT BREAKERS SHALL BE FULL SIZE; NO TANDEM TYPE CIRCUIT BREAKERS. PROVIDE AN ACCURATE PANEL SCHEDULE ON THE INSIDE OF EACH PANEL DOOR.
2. PROVIDE LOCKABLE CIRCUIT BREAKER FOR ALL SYSTEM CIRCUITS.
3. ALL WIRING SHALL BE COPPER. THE MINIMUM SIZE SHALL BE #12 AWG, EXCEPT AS NOTED. THE INSULATION SHALL BE THHN, THWN. ALL WIRING SHALL BE IN CONDUIT.
4. ALL GUTTER AND WIREWAY SIZES SHALL COMPLY WITH NEC ARTICLE 376.22 AND TABLES 312.6(A) & (B).
5. ELECTRICAL EQUIPMENT EXPOSED TO THE WEATHER SHALL BE WEATHERPROOF.
6. ALL EMPTY CONDUITS SHALL HAVE NYLON PULL CORDS AND SHALL BE IDENTIFIED AT EACH END. ALL CONDUITS THROUGH THE ROOF SHALL PENETRATE THE ROOF USING PROPER, APPROVED FLASHING.
7. PENETRATION OF ALL PIPES AND CONDUITS THROUGH FIRE RATED PARTITIONS SHALL BE IN COMPLIANCE WITH UL ASSEMBLY. PROVIDE 3M FIRE BARRIER CP-25 N/S FIRESTOP CAULKING FOR CONDUITS UP TO 4" IN TWO (2) HOUR (MAX) RATED FIRE PARTITIONS.

EMPTY CONDUITS AND JUNCTION BOXES

DONOR ANTENNA CABLES AND RISER CABLES SHALL BE IN A MINIMUM OF 2" CONDUITS IN A FIRE-RATED ENCLOSURE OR BELOW THE FIRST FLOOR SLAB.
FEEDER CABLES SHALL BE A MINIMUM OF 1-1/2" EMT (METAL RACEWAY) FOR PATHWAY SURVIVAL LEVEL 1.
METAL RACEWAYS FROM UPS TO 120V POWER PANEL SHALL BE 3/4" MINIMUM.
METAL RACEWAYS FROM BDA TO FIRE ALARM CONTROL PANEL 1" MINIMUM.
A MAXIMUM OF TWO (2) 90° BENDS ARE ALLOWED BETWEEN JUNCTION/PULL BOXES.
A MAXIMUM OF 100 FEET IS ALLOWED BETWEEN JUNCTION/PULL BOXES.
JUNCTION PULL/BOXES SHALL BE A MINIMUM OF 18"x18"x6".
ALL CONDUITS PENETRATING A FIRE-RATED ENCLOSURE SHALL BE FIRE-STOPPED.
JUNCTION BOXES FOR CONDUITS LEAVING A FIRE-RATED ENCLOSURE SHALL BE LOCATED IN THE FIRE-RATED ENCLOSURE.

ELEVATOR AHJ NOTES

FOR ANY DAS ANTENNAS INSTALLED IN AN ELEVATOR SHAFT, A VARIANCE SHALL BE OBTAINED FROM THE BROWARD COUNTY BUILDING CODE SERVICES DIVISION, CHIEF ELEVATOR INSPECTOR, PRIOR TO THE START OF ANY WORK INSIDE AN ELEVATOR SHAFT OR ELEVATOR MACHINE ROOM.
THIS VARIANCE MAY TAKE SIX TO EIGHT WEEKS TO OBTAIN. WORK SHALL NOT START UNTIL THE VARIANCE IS OBTAINED. ALL WORK INSIDE THE ELEVATOR SHAFT SHALL BE COORDINATED WITH THE ELEVATOR INSPECTOR.
SEE FC-2.2 FOR ADDITIONAL INFORMATION.

BUILDING AHJ NOTES

- 1. THE ANTENNA MAST SHALL BE INSTALLED ON THE ROOF PER THE MINIMUM REQUIREMENTS OF THE HVHZ SECTIONS OF THE FLORIDA BUILDING CODE, BROWARD COUNTY AMENDMENT, SIXTH EDITION.
2. THE DONOR ANTENNA TO THE BDA CABLE SHALL BE IN A FIRE-RATED ENCLOSURE.
3. THE RISER CABLES SHALL BE IN A FIRE-RATED ENCLOSURE.
4. THE BDA SHALL BE INSTALLED IN A FIRE-RATED ROOM.
5. APPROVED FIREWALL PENETRATIONS SHALL BE PROVIDED.

FCC LICENSE HOLDER AHJ NOTES

- 1. SEE THE ANTENNA AND SURGE PROTECTOR DETAIL ON DRAWING FC-5.1 (FAC 61G15)
2. THE SYSTEM SHALL NEVER BE ENERGIZED FOR TESTING OR OPERATION UNTIL WRITTEN, OR ON SITE, APPROVAL IS OBTAINED FROM THE FCC LICENSE HOLDER. (FBC 118.4.2.2)
3. THE BDA ENCLOSURE SHALL BE PAINTED RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
4. PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. LEVEL 1: ALL COAXIAL CABLES SHALL BE IN METAL CONDUIT. (NFPA 72-12.4)
5. RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS AND 95% IN GENERAL BUILDING AREAS. (NFPA 72-24.5.2.2)
6. SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
7. SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
8. NOTE: A SIGNAL STRENGTH OF LESS THAN -90 DBM AS SHOWN ON THE PLANS HAS A HIGH PROBABILITY OF FAILING THE FINAL INSPECTION OF DAQ 3.0 MINIMUM. SEE NFPA 72-14.4.10.3 TEST PROCEDURES; RECOMMEND -90 DBM.
9. ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 72-24.5.2.3.3)
10. NOTE: NFPA 1221 (2016) REQUIRES A MINIMUM OF 20 DBM. ANY LOWER VALUE MAY RESULT IN THE PROBABILITY OF FAILING THE FINAL INSPECTION.
11. SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE FCC AHJ. (NFPA 72-24.5.2.4)
12. FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 72-24.5.2.4.2)
13. SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE PUBLIC SAFETY RADIO SYSTEM. (NFPA 72-24.5.2.5)
14. SHOW THE PROPAGATION DELAY.
15. SIGNAL BOOSTERS SHALL HAVE FCC CERTIFICATION. POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SUPPLIES. BATTERY SHALL PROVIDE TWELVE (12) HOUR MINIMUM OPERATIONAL RUN TIME.
16. SYSTEM MONITORING: (NFPA 72-24.5.2.6.1) THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM:
(1) INTEGRITY OF THE CIRCUIT MONITORING SIGNAL BOOSTER(S) AND POWER SUPPLY(IES) SHALL COMPLY WITH NFPA 72-24.10.6.9 AND NFPA 72-12.6.
(2) SYSTEM AND SIGNAL BOOSTER SUPERVISORY SIGNALS SHALL INCLUDE THE FOLLOWING:
(a) ANTENNA MALFUNCTION
(b) SIGNAL BOOSTER FAILURE
(c) LOW-BATTERY CAPACITY INDICATION WHEN 70 PERCENT OF THE 12-HOUR OPERATING CAPACITY HAS BEEN DEPLETED.
(3) POWER SUPPLY SIGNALS SHALL INCLUDE THE FOLLOWING FOR EACH SIGNAL BOOSTER:
(a) LOSS OF NORMAL AC POWER
(b) FAILURE OF BATTERY CHARGER
17. DEDICATED PANEL (ANNUNCIATOR PANEL) (NFPA 72-24.5.2.6.2)
(1) NORMAL AC POWER
(2) SIGNAL BOOSTER TROUBLE
(3) LOSS OF NORMAL AC POWER
(4) FAILURE OF BATTERY CHARGER
(5) LOW BATTERY CAPACITY
(6) DONOR ANTENNA MALFUNCTION
18. TECHNICAL CRITERIA (NFPA 72-24.5.2.7)
(1) FREQUENCIES REQUIRED
(2) LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
(3) MAXIMUM PROPAGATION DELAY (30 MICROSECONDS)
(4) LIST OF SPECIFICALLY APPROVED COMPONENTS
(5) OTHER SUPPORT TECHNICAL INFORMATION
19. WHEN AN ELEVATOR(S) IS(ARE) PRESENT IN THE BUILDING, AN ANTENNA IS TYPICALLY REQUIRED TO BE MOUNTED IN THE ELEVATOR SHAFT(S) TO GET COVERAGE INSIDE THE ELEVATOR CAR(S). A NOTE ON THE PLAN SHALL BE PROVIDED: "CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM. (NFPA 72-24.5.4) (ASME A17.1)
20. OTHER INDUSTRY STANDARDS INCLUDE IEEE 1692, TIA/ANSI/EIA 569-C, TIA/ANSI/EIA 607-B, MOTOROLA R56.

DRAFT EDITION
Rev 1 2019-09-17

DRAFT EDITION
2019-09-17
THIS DRAWING HAS NOT BEEN APPROVED BY ANY AHJ.
THIS DRAWING IS FOR NFPA 72 (2013) ONLY

AHJ NOTES

SCALE: NTS

RC ENGINEERING INC
5532 NW 106th DRIVE
CORAL SPRINGS, FL 33076
(954)757-7900
CA4755

REVISIONS
Date: 2019-07-20
Drawn: MAR
Checked: DLR
Scale: NTS
JOB NO. 19005

2019-09-17 DLR COORD

TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
OFFICE BUILDING
BROWARD COUNTY, FLORIDA

TITLE
AHJ NOTES

SEAL

DATE
David L. Rice, P.E.
Electrical Engineer
State of Florida
PE 34343

SHEET
FC-1.3A

FIRE AHJ NOTES

- THE BDA ENCLOSURE SHALL BE PAINTED FIRE-ENGINE RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
- PROVIDE AN INFORMATION BINDER STORED NEXT TO THE BDA. INFORMATION SHALL INCLUDE:
 - AS-BUILT DRAWINGS
 - MANUFACTURER'S DATA SHEETS AND SPECS
 - PRE-INSTALLATION READINGS (HEAT MAP)
 - FINAL SIGNAL STRENGTH MEASUREMENT
 - MAINTENANCE CONTRACT
 - BROWARD COUNTY REGIONAL EMERGENCY SERVICES AND COMMUNICATIONS (RESC) APPROVAL
 - MAINTENANCE REPAIR LOG
- PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. FOR LEVEL 1, ALL COAXIAL CABLES SHALL BE IN METAL RACEWAYS. (NFPA 72-12.4)
- THE FEEDER AND RISER COAXIAL CABLES SHALL BE RATED AS PLENUM CABLE. (NFPA 1221-9.6.2.1.1)
- RISER COAXIAL CABLES SHALL BE ROUTED THROUGH AN ENCLOSURE THAT MATCHES THE BUILDING'S FIRE-RATING (NFPA 1221-9.6.2.1.3)
- RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS, SUCH AS THE FIRE COMMAND CENTER(S), THE FIRE PUMP ROOM(S), EXIT STAIRS, EXIT PASSAGEWAYS, ELEVATOR LOBBIES, STANDPIPE CABINETS, SPRINKLER SECTIONAL VALVE LOCATIONS, AND OTHER AREAS DEEMED CRITICAL BY THE AHJ AND 90% IN GENERAL BUILDING AREAS. (NFPA 1221-9.6.7)
- SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.1)
SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.2)
- ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 1221-9.6.9)
- SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE AHJ. (NFPA 1221-9.6.10.1)
- FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 1221-9.6.10.2)
- SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE LOCAL PUBLIC SAFETY RADIO SYSTEM. (NFPA 1221-9.6.11) (NFPA-1.1.4)
- ALL REPEATERS, TRANSMITTER RECEPTACLES, SIGNAL BOOSTER COMPONENTS AND BATTERY SYSTEM COMPONENTS SHALL BE IN A NEMA 4, 4X ENCLOSURE. (NFPA 1221-9.6.11.2) (NFPA 1-1.4)
- POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SOURCES. (NFPA 1221-9.6.12)
- THE PRIMARY POWER SOURCE SHALL BE SUPPLIED FROM A DEDICATED CIRCUIT AND SHALL COMPLY WITH NFPA 72. (NFPA 1221-9.6.12.1.)
- THE SECONDARY POWER SOURCE SHALL CONSIST OF ONE OF THE FOLLOWING (NFPA 1221-9.6.12.2):
 - BATTERY WITH AT LEAST 12 HOURS OF OPERATION AT 100% PER NFPA 72-10.6.10
 - LIFE SAFETY GENERATOR WITH AT LEAST 12 HOURS OF OPERATION AT 100% AND A BATTERY WITH AT LEAST 2 HOURS OF OPERATION AT 100% PER NFPA 10.6.11.3.
- SYSTEM MONITORING: THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM (NFPA 1221-9.6.13.1):
 - MONITORING FOR INTEGRITY OF THE SYSTEM SHALL COMPLY WITH NFPA 72-10.
 - (a) DONOR ANTENNA MALFUNCTION
 - (b) ACTIVE RF EMITTING DEVICE FAILURE
 - (c) LOW BATTERY CAPACITY INDICATOR
 - (d) SYSTEM COMPONENT FAILURE
 - (a) LOSS OF NORMAL AC POWER
 - (b) FAILURE OF BATTERY CHARGER
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- DEDICATED PANEL (ANNUNCIATOR PANEL) SHALL SHOW (NFPA 1221-9.6.13.2):
 - (a) NORMAL AC POWER
 - (b) LOSS O NORMAL POWER
 - (c) BATTERY CHARGER FAILURE
 - (d) LOW BATTERY CAPACITY
 - (e) DONOR ANTENNA MALFUNCTION
 - (f) ACTIVE RF EMITTING DEVICE FAILURE
 - (g) SYSTEM COMPONENT MALFUNCTION
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- TECHNICAL CRITERIA (NFPA 1221-9.6.14)
 - FREQUENCIES REQUIRED
 - LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
 - MAXIMUM PROPAGATION DELAY LESS THAN 30 MICRO-SECONDS
 - LIST OF SPECIFICALLY APPROVED COMPONENTS
 - OTHER SUPPORT TECHNICAL INFORMATION
- A NOTE ON THE PLAN SHALL BE PROVIDED: "CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM." (ASME A17.1)

ELECTRICAL AHJ NOTES

- ALL CIRCUIT BREAKERS SHALL BE FULL SIZE; NO TANDEM TYPE CIRCUIT BREAKERS. PROVIDE AN ACCURATE PANEL SCHEDULE ON THE INSIDE OF EACH PANEL DOOR.
- PROVIDE LOCKABLE CIRCUIT BREAKER FOR ALL SYSTEM CIRCUITS.
- ALL WIRING SHALL BE COPPER. THE MINIMUM SIZE SHALL BE #12 AWG, EXCEPT AS NOTED. THE INSULATION SHALL BE THHN, THWN. ALL WIRING SHALL BE IN CONDUIT.
- ALL GUTTER AND WIREWAY SIZES SHALL COMPLY WITH NEC ARTICLE 376.22 AND TABLES 312.6(A) & (B).
- ELECTRICAL EQUIPMENT EXPOSED TO THE WEATHER SHALL BE WEATHERPROOF.
- ALL EMPTY CONDUITS SHALL HAVE NYLON PULL CORDS AND SHALL BE IDENTIFIED AT EACH END. ALL CONDUITS THROUGH THE ROOF SHALL PENETRATE THE ROOF USING PROPER, APPROVED FLASHING.
- PENETRATION OF ALL PIPES AND CONDUITS THROUGH FIRE RATED PARTITIONS SHALL BE IN COMPLIANCE WITH UL ASSEMBLY. PROVIDE 3M FIRE BARRIER CP-25 N/S FIRESTOP CAULKING FOR CONDUITS UP TO 4" IN TWO (2) HOUR (MAX) RATED FIRE PARTITIONS.

EMPTY CONDUITS AND JUNCTION BOXES

DONOR ANTENNA CABLES AND RISER CABLES SHALL BE IN A MINIMUM OF 2" CONDUITS IN A FIRE-RATED ENCLOSURE OR BELOW THE FIRST FLOOR...

FEEDER CABLES SHALL BE A MINIMUM OF 1-1/2" EMT (METAL RACEWAY) FOR PATHWAY SURVIVAL LEVEL 1.

METAL RACEWAYS FROM UPS TO 120V POWER PANEL SHALL BE 3/4" MINIMUM.

METAL RACEWAYS FROM BDA TO FIRE ALARM CONTROL PANEL 1" MINIMUM.

A MAXIMUM OF TWO (2) 90° BENDS ARE ALLOWED BETWEEN JUNCTION/PULL BOXES.

A MAXIMUM OF 100 FEET IS ALLOWED BETWEEN JUNCTION/PULL BOXES.

JUNCTION PULL/BOXES SHALL BE A MINIMUM OF 18"x18"x6".

ALL CONDUITS PENETRATING A FIRE-RATED ENCLOSURE SHALL BE FIRE-STOPPED.

JUNCTION BOXES FOR CONDUITS LEAVING A FIRE-RATED ENCLOSURE SHALL BE LOCATED IN THE FIRE-RATED ENCLOSURE.

ELEVATOR AHJ NOTES

FOR ANY DAS ANTENNAS INSTALLED IN AN ELEVATOR SHAFT, A VARIANCE SHALL BE OBTAINED FROM THE BROWARD COUNTY BUILDING CODE SERVICES DIVISION, CHIEF ELEVATOR INSPECTOR, PRIOR TO THE START OF ANY WORK INSIDE AN ELEVATOR SHAFT OR ELEVATOR MACHINE ROOM.

THIS VARIANCE MAY TAKE SIX TO EIGHT WEEKS TO OBTAIN. WORK SHALL NOT START UNTIL THE VARIANCE IS OBTAINED. ALL WORK INSIDE THE ELEVATOR SHAFT SHALL BE COORDINATED WITH THE ELEVATOR INSPECTOR.

SEE FC-2.2 FOR ADDITIONAL INFORMATION.

BUILDING AHJ NOTES

- THE ANTENNA MAST SHALL BE INSTALLED ON THE ROOF PER THE MINIMUM REQUIREMENTS OF THE HVHZ SECTIONS OF THE FLORIDA BUILDING CODE, BROWARD COUNTY AMENDMENT, SIXTH EDITION.
- THE DONOR ANTENNA TO THE BDA CABLE SHALL BE IN A FIRE-RATED ENCLOSURE.
- THE RISER CABLES SHALL BE IN A FIRE-RATED ENCLOSURE.
- THE BDA SHALL BE INSTALLED IN A FIRE-RATED ROOM.
- APPROVED FIREWALL PENETRATIONS SHALL BE PROVIDED.

FCC LICENSE HOLDER AHJ NOTES

- SEE THE ANTENNA AND SURGE PROTECTOR DETAIL ON DRAWING FC-5.1 (FAC 61G15)
- THE SYSTEM SHALL NEVER BE ENERGIZED FOR TESTING OR OPERATION UNTIL WRITTEN, OR ON SITE, APPROVAL IS OBTAINED FROM THE FCC LICENSE HOLDER. (FBC 118.4.2.2)
- THE BDA ENCLOSURE SHALL BE PAINTED RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
- PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. LEVEL 1: ALL COAXIAL CABLES SHALL BE IN METAL CONDUIT. (NFPA 72-12.4)
- RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS AND 95% IN GENERAL BUILDING AREAS. (NFPA 1221-9.6.7)
- SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.1.2)
- ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 1221-9.6.9)
- SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE FCC AHJ. (NFPA 1221-9.6.10.1)
- FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 1221-9.6.10.2)
- SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE PUBLIC SAFETY RADIO SYSTEM. (NFPA 1221-9.6.11)
SHOW THE PROPAGATION DELAY.
SIGNAL BOOSTERS SHALL HAVE FCC CERTIFICATION. POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SUPPLIES. BATTERY SHALL PROVIDE TWELVE (12) HOUR MINIMUM OPERATIONAL RUN TIME.
- SYSTEM MONITORING: (NFPA 1221-9.6.13.1) THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM:
 - MONITORING FOR INTEGRITY OF THE SYSTEM SHALL COMPLY WITH NFPA 72-10.
 - (a) DONOR ANTENNA MALFUNCTION
 - (b) ACTIVE RF EMITTING DEVICE FAILURE
 - (c) LOW BATTERY CAPACITY INDICATOR
 - (d) SYSTEM COMPONENT FAILURE
 - (a) LOSS OF NORMAL AC POWER
 - (b) FAILURE OF BATTERY CHARGER
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- DEDICATED PANEL (ANNUNCIATOR PANEL) (NFPA 1221-9.6.13.2)
 - (a) NORMAL AC POWER
 - (b) LOSS O NORMAL POWER
 - (c) BATTERY CHARGER FAILURE
 - (d) LOW BATTERY CAPACITY
 - (e) DONOR ANTENNA MALFUNCTION
 - (f) ACTIVE RF EMITTING DEVICE FAILURE
 - (g) SYSTEM COMPONENT MALFUNCTION
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- TECHNICAL CRITERIA (NFPA 1221-9.6.14)
 - FREQUENCIES REQUIRED
 - LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
 - MAXIMUM PROPAGATION DELAY (30 MICROSECONDS)
 - LIST OF SPECIFICALLY APPROVED COMPONENTS
 - OTHER SUPPORT TECHNICAL INFORMATION
- WHEN AN ELEVATOR(S) IS(ARE) PRESENT IN THE BUILDING, AN ANTENNA IS TYPICALLY REQUIRED TO BE MOUNTED IN THE ELEVATOR SHAFT(S) TO GET COVERAGE INSIDE THE ELEVATOR CAR(S). A NOTE ON THE PLAN SHALL BE PROVIDED: "CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM. (ASME A17.1)
- OTHER INDUSTRY STANDARDS INCLUDE IEEE 1692, TIA/ANSI/EIA 569-C, TIA/ANSI/EIA 607-B, MOTOROLA R56.

SYSTEMS SHALL HAVE LIGHTNING PROTECTION THAT COMPLIES WITH NFPA 780. (NFPA 1221-9.6.3)

DRAFT EDITION
Rev 1 2019-09-17

DRAFT EDITION
2019-09-17

THIS DRAWING HAS NOT BEEN APPROVED BY ANY AHJ.

THIS DRAWING IS FOR NFPA 72 (2016), NFPA 1221 (2016) ONLY

AHJ NOTES
SCALE: NTS

RC ENGINEERING INC
5532 NW 106th DRIVE
CORAL SPRINGS, FL 33076
(954)757-7900
CA4755

REVISIONS
Date: 2019-07-20
Drawn: MAR
Checked: DLR
Scale: NTS
JOB NO. 19005

PROJECT
TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
OFFICE BUILDING
BROWARD COUNTY, FLORIDA

TITLE
AHJ NOTES

SEAL

DATE
David L. Rice, P.E.
Electrical Engineer
State of Florida
PE 34343

SHEET
FC-1.3B

FIRE AHJ NOTES

- THE BDA ENCLOSURE SHALL BE PAINTED FIRE-ENGINE RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
- PROVIDE AN INFORMATION BINDER STORED NEXT TO THE BDA. INFORMATION SHALL INCLUDE:
 - AS-BUILT DRAWINGS
 - MANUFACTURER'S DATA SHEETS AND SPECS
 - PRE-INSTALLATION READINGS (HEAT MAP)
 - FINAL SIGNAL STRENGTH MEASUREMENT
 - MAINTENANCE CONTRACT
 - BROWARD COUNTY REGIONAL EMERGENCY SERVICES AND COMMUNICATIONS (RESC) APPROVAL
 - MAINTENANCE REPAIR LOG
- PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. FOR LEVEL 1, ALL COAXIAL CABLES SHALL BE IN METAL RACEWAYS. (NFPA 1221-9.6.2.3)
- THE BACKBONE AND ANTENNA DISTRIBUTION COAXIAL CABLES SHALL BE RATED AS PLENUM CABLE. (NFPA 1221-9.6.2.1.)
- RISER COAXIAL CABLES SHALL BE ROUTED THROUGH AN ENCLOSURE THAT MATCHES THE BUILDING'S FIRE-RATING (NFPA 1221-9.6.2.3)
- RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS, SUCH AS THE FIRE COMMAND CENTER(S), THE FIRE PUMP ROOM(S), EXIT STAIRS, EXIT PASSAGEWAYS, ELEVATOR LOBBIES, STANDPIPE CABINETS, SPRINKLER SECTIONAL VALVE LOCATIONS, AND OTHER AREAS DEEMED CRITICAL BY THE AHJ AND 90% IN GENERAL BUILDING AREAS. (NFPA 1221-9.6.7)
- SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.1)
SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.2)
- ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 1221-9.6.9)
- SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE AHJ. (NFPA 1221-9.6.10)
- FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 1221-9.6.10.2)
- SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE LOCAL PUBLIC SAFETY RADIO SYSTEM. (NFPA 1221-9.6.11.2) (NFPA-1.1.4)
- ALL REPEATERS, TRANSMITTER RECEPTACLES, SIGNAL BOOSTER COMPONENTS AND BATTERY SYSTEM COMPONENTS SHALL BE IN A NEMA 4, 4X, OR 3R ENCLOSURE. (NFPA 1221-9.6.11.2.2) (NFPA 1-1.4)
- POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SOURCES. (NFPA 1221-9.6.12)
- THE PRIMARY POWER SOURCE SHALL BE SUPPLIED FROM A DEDICATED CIRCUIT AND SHALL COMPLY WITH NFPA 72. (NFPA 1221-9.6.12.1.)
- THE SECONDARY POWER SOURCE SHALL CONSIST OF ONE OF THE FOLLOWING (NFPA 1221-9.6.12.2):
 - BATTERY WITH AT LEAST 12 HOURS OF OPERATION AT 100% PER NFPA 72-10.6.10
 - LIFE SAFETY GENERATOR WITH AT LEAST 12 HOURS OF OPERATION AT 100% AND A BATTERY WITH AT LEAST 2 HOURS OF OPERATION AT 100% PER NFPA 10.6.11.3.
- SYSTEM MONITORING: THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM (NFPA 1221-9.6.13.1):
 - MONITORING FOR INTEGRITY OF THE SYSTEM SHALL COMPLY WITH NFPA 72-10.
 - (a) DONOR ANTENNA MALFUNCTION
 - (b) ACTIVE RF EMITTING DEVICE FAILURE
 - (c) LOW BATTERY CAPACITY INDICATOR
 - (d) ACTIVE SYSTEM COMPONENT FAILURE
 - (a) LOSS OF NORMAL AC POWER
 - (b) FAILURE OF BATTERY CHARGER
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- DEDICATED PANEL (ANNUNCIATOR PANEL) SHALL SHOW (NFPA 1221-9.6.13.2):
 - NORMAL AC POWER
 - LOSS O NORMAL POWER
 - BATTERY CHARGER FAILURE
 - LOW BATTERY CAPACITY
 - DONOR ANTENNA MALFUNCTION
 - ACTIVE RF EMITTING DEVICE FAILURE
 - SYSTEM COMPONENT MALFUNCTION
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- TECHNICAL CRITERIA (NFPA 1221-9.6.14)
 - FREQUENCIES REQUIRED
 - LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
 - MAXIMUM PROPAGATION DELAY LESS THAN 30 MICRO-SECONDS
 - LIST OF SPECIFICALLY APPROVED COMPONENTS
 - OTHER SUPPORT TECHNICAL INFORMATION
- A NOTE ON THE PLAN SHALL BE PROVIDED: "CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM." (ASME A17.1)

ELECTRICAL AHJ NOTES

- ALL CIRCUIT BREAKERS SHALL BE FULL SIZE; NO TANDEM TYPE CIRCUIT BREAKERS. PROVIDE AN ACCURATE PANEL SCHEDULE ON THE INSIDE OF EACH PANEL DOOR.
- PROVIDE LOCKABLE CIRCUIT BREAKER FOR ALL SYSTEM CIRCUITS.
- ALL WIRING SHALL BE COPPER. THE MINIMUM SIZE SHALL BE #12 AWG, EXCEPT AS NOTED. THE INSULATION SHALL BE THHN, THWN. ALL WIRING SHALL BE IN CONDUIT.
- ALL GUTTER AND WIREWAY SIZES SHALL COMPLY WITH NEC ARTICLE 376.22 AND TABLES 312.6(A) & (B).
- ELECTRICAL EQUIPMENT EXPOSED TO THE WEATHER SHALL BE WEATHERPROOF.
- ALL EMPTY CONDUITS SHALL HAVE NYLON PULL CORDS AND SHALL BE IDENTIFIED AT EACH END. ALL CONDUITS THROUGH THE ROOF SHALL PENETRATE THE ROOF USING PROPER, APPROVED FLASHING.
- PENETRATION OF ALL PIPES AND CONDUITS THROUGH FIRE RATED PARTITIONS SHALL BE IN COMPLIANCE WITH UL ASSEMBLY. PROVIDE 3M FIRE BARRIER CP-25 N/S FIRESTOP CAULKING FOR CONDUITS UP TO 4" IN TWO (2) HOUR (MAX) RATED FIRE PARTITIONS.

EMPTY CONDUITS AND JUNCTION BOXES

DONOR ANTENNA CABLES AND RISER CABLES SHALL BE IN A MINIMUM OF 2" CONDUITS IN A FIRE-RATED ENCLOSURE OR BELOW THE FIRST FLOOR...

FEEDER CABLES SHALL BE A MINIMUM OF 1-1/2" EMT (METAL RACEWAY) FOR PATHWAY SURVIVAL LEVEL 1.

METAL RACEWAYS FROM UPS TO 120V POWER PANEL SHALL BE 3/4" MINIMUM.

METAL RACEWAYS FROM BDA TO FIRE ALARM CONTROL PANEL 1" MINIMUM.

A MAXIMUM OF TWO (2) 90° BENDS ARE ALLOWED BETWEEN JUNCTION/PULL BOXES.

A MAXIMUM OF 100 FEET IS ALLOWED BETWEEN JUNCTION/PULL BOXES.

JUNCTION PULL/BOXES SHALL BE A MINIMUM OF 18"x18"x6".

ALL CONDUITS PENETRATING A FIRE-RATED ENCLOSURE SHALL BE FIRE-STOPPED.

JUNCTION BOXES FOR CONDUITS LEAVING A FIRE-RATED ENCLOSURE SHALL BE LOCATED IN THE FIRE-RATED ENCLOSURE.

ELEVATOR AHJ NOTES

FOR ANY DAS ANTENNAS INSTALLED IN AN ELEVATOR SHAFT, A VARIANCE SHALL BE OBTAINED FROM THE BROWARD COUNTY BUILDING CODE SERVICES DIVISION, CHIEF ELEVATOR INSPECTOR, PRIOR TO THE START OF ANY WORK INSIDE AN ELEVATOR SHAFT OR ELEVATOR MACHINE ROOM.

THIS VARIANCE MAY TAKE SIX TO EIGHT WEEKS TO OBTAIN. WORK SHALL NOT START UNTIL THE VARIANCE IS OBTAINED. ALL WORK INSIDE THE ELEVATOR SHAFT SHALL BE COORDINATED WITH THE ELEVATOR INSPECTOR.

SEE FC-2.2 FOR ADDITIONAL INFORMATION.

BUILDING AHJ NOTES

- THE ANTENNA MAST SHALL BE INSTALLED ON THE ROOF PER THE MINIMUM REQUIREMENTS OF THE HVHZ SECTIONS OF THE FLORIDA BUILDING CODE, BROWARD COUNTY AMENDMENT, SIXTH EDITION.
- BACKBONE CABLES SHALL BE IN A FIRE-RATED ENCLOSURE.
- THE BDA SHALL BE INSTALLED IN A FIRE-RATED ROOM.
- APPROVED FIREWALL PENETRATIONS SHALL BE PROVIDED.

FCC LICENSE HOLDER AHJ NOTES

- SEE THE ANTENNA AND SURGE PROTECTOR DETAIL ON DRAWING FC-5.1 (FAC 61G15)
- THE SYSTEM SHALL NEVER BE ENERGIZED FOR TESTING OR OPERATION UNTIL WRITTEN, OR ON SITE, APPROVAL IS OBTAINED FROM THE FCC LICENSE HOLDER. (FBC 118.4.2.2)
- THE BDA ENCLOSURE SHALL BE PAINTED RED AND A SIGN SHALL SHOW PERMIT NUMBER, VENDOR NAME AND TELEPHONE NUMBER. (FBC 118.2.1.8)
- PATHWAY SURVIVABILITY LEVEL SHALL BE 1, 2, OR 3. LEVEL 1: ALL COAXIAL CABLES SHALL BE IN METAL CONDUIT. (NFPA 72-12.4)
- RADIO COVERAGE SHALL BE A MINIMUM OF 99% IN CRITICAL AREAS AND 95% IN GENERAL BUILDING AREAS. (NFPA 1221-9.6.7)
- SIGNAL STRENGTH INBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4)
SIGNAL STRENGTH OUTBOUND SHALL BE A MINIMUM OF -90 DBM. (DAQ 3.4) (NFPA 1221-9.6.8.1.2)
- ISOLATION SHALL BE A MINIMUM OF 20 DBM ABOVE THE SIGNAL BOOSTER GAIN UNDER ALL OPERATING CONDITIONS. (NFPA 1221-9.6.9)
- SYSTEM RADIO FREQUENCIES; SYSTEM SHALL BE CAPABLE OF TRANSMITTING ALL PUBLIC SAFETY RADIO FREQUENCIES USED BY THE FCC AHJ. (NFPA 1221-9.6.10)
- FREQUENCY CHANGES. SYSTEM SHALL BE CAPABLE OF UPGRADING. (NFPA 1221-9.6.10.2)
- SYSTEM COMPONENTS: COMPONENTS SHALL BE APPROVED AND COMPATIBLE WITH THE PUBLIC SAFETY RADIO SYSTEM. (NFPA 1221-9.6.11.2)
SHOW THE PROPAGATION DELAY.
SIGNAL BOOSTERS SHALL HAVE FCC CERTIFICATION. POWER SUPPLIES SHALL HAVE AT LEAST TWO INDEPENDENT SUPPLIES. BATTERY SHALL PROVIDE TWELVE (12) HOUR MINIMUM OPERATIONAL RUN TIME.
- SYSTEM MONITORING: (NFPA 1221-9.6.13.1) THE FIRE ALARM SYSTEM SHALL MONITOR THE FOLLOWING ITEMS AS A MINIMUM:
 - MONITORING FOR INTEGRITY OF THE SYSTEM SHALL COMPLY WITH NFPA 72-10.
 - (a) DONOR ANTENNA MALFUNCTION
 - (b) ACTIVE RF EMITTING DEVICE FAILURE
 - (c) LOW BATTERY CAPACITY INDICATOR
 - (d) SYSTEM COMPONENT FAILURE
 - (a) LOSS OF NORMAL AC POWER
 - (b) FAILURE OF BATTERY CHARGER
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- DEDICATED PANEL (ANNUNCIATOR PANEL) (NFPA 1221-9.6.13.2)
 - (a) NORMAL AC POWER
 - (b) LOSS O NORMAL POWER
 - (c) BATTERY CHARGER FAILURE
 - (d) LOW BATTERY CAPACITY
 - (e) DONOR ANTENNA MALFUNCTION
 - (f) ACTIVE RF EMITTING DEVICE FAILURE
 - (g) SYSTEM COMPONENT MALFUNCTION
 - COMMUNICATION LINK BETWEEN THE FACP AND THE BDA SHALL BE MONITORED FOR INTEGRITY.
- TECHNICAL CRITERIA (NFPA 1221-9.6.14)
 - FREQUENCIES REQUIRED
 - LOCATION OF EFFECTIVE RADIATED POWER (ERP) OF THE FCC AHJ RADIO SITE
 - MAXIMUM PROPAGATION DELAY (30 MICROSECONDS)
 - LIST OF SPECIFICALLY APPROVED COMPONENTS
 - OTHER SUPPORT TECHNICAL INFORMATION
- WHEN AN ELEVATOR(S) IS(ARE) PRESENT IN THE BUILDING, AN ANTENNA IS TYPICALLY REQUIRED TO BE MOUNTED IN THE ELEVATOR SHAFT(S) TO GET COVERAGE INSIDE THE ELEVATOR CAR(S). A NOTE ON THE PLAN SHALL BE PROVIDED: "CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE ELEVATOR INSPECTOR PRIOR TO ANY WORK INSIDE AN ELEVATOR SHAFT OR MACHINE ROOM. (ASME A17.1)
- OTHER INDUSTRY STANDARDS INCLUDE IEEE 1692, TIA/ANSI/EIA 569-C, TIA/ANSI/EIA 607-B, MOTOROLA R56.

SYSTEMS SHALL HAVE LIGHTNING PROTECTION THAT COMPLIES WITH NFPA 780. (NFPA 1221-9.6.3)

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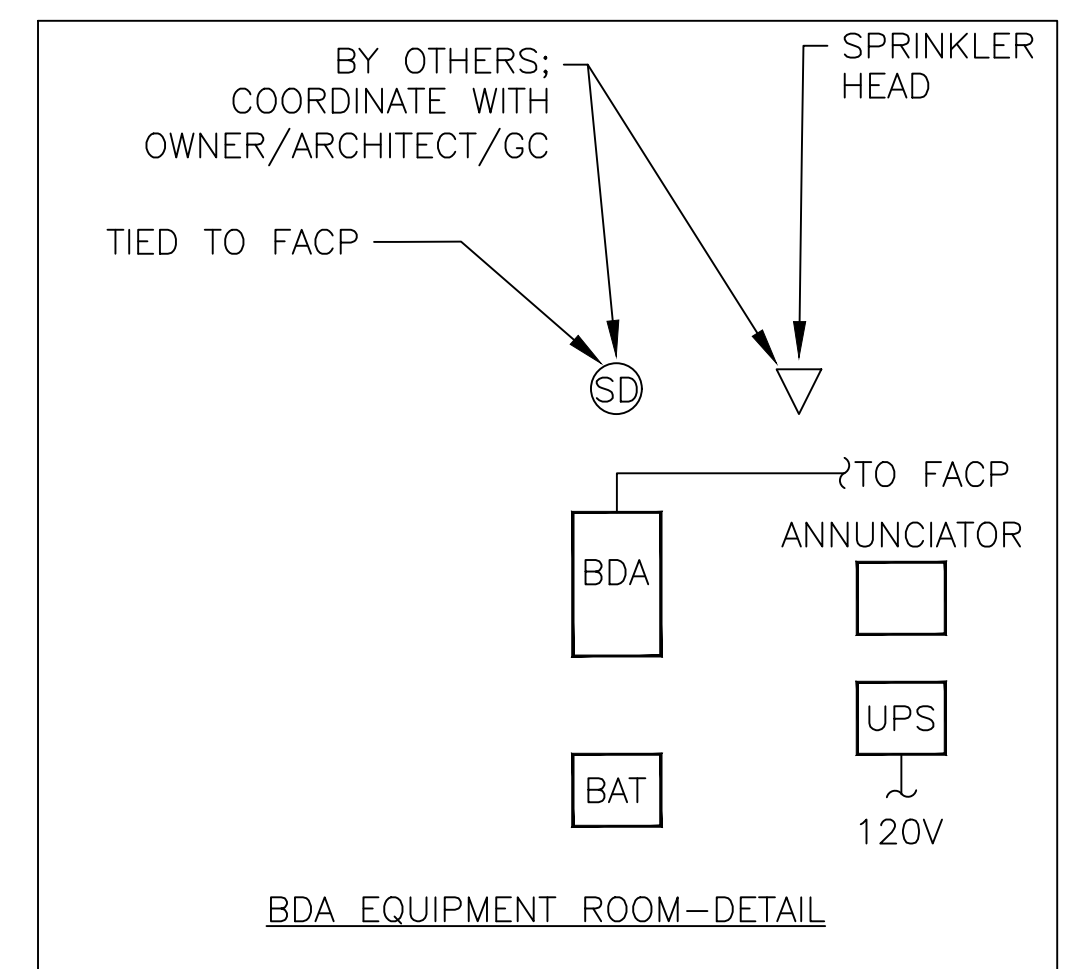
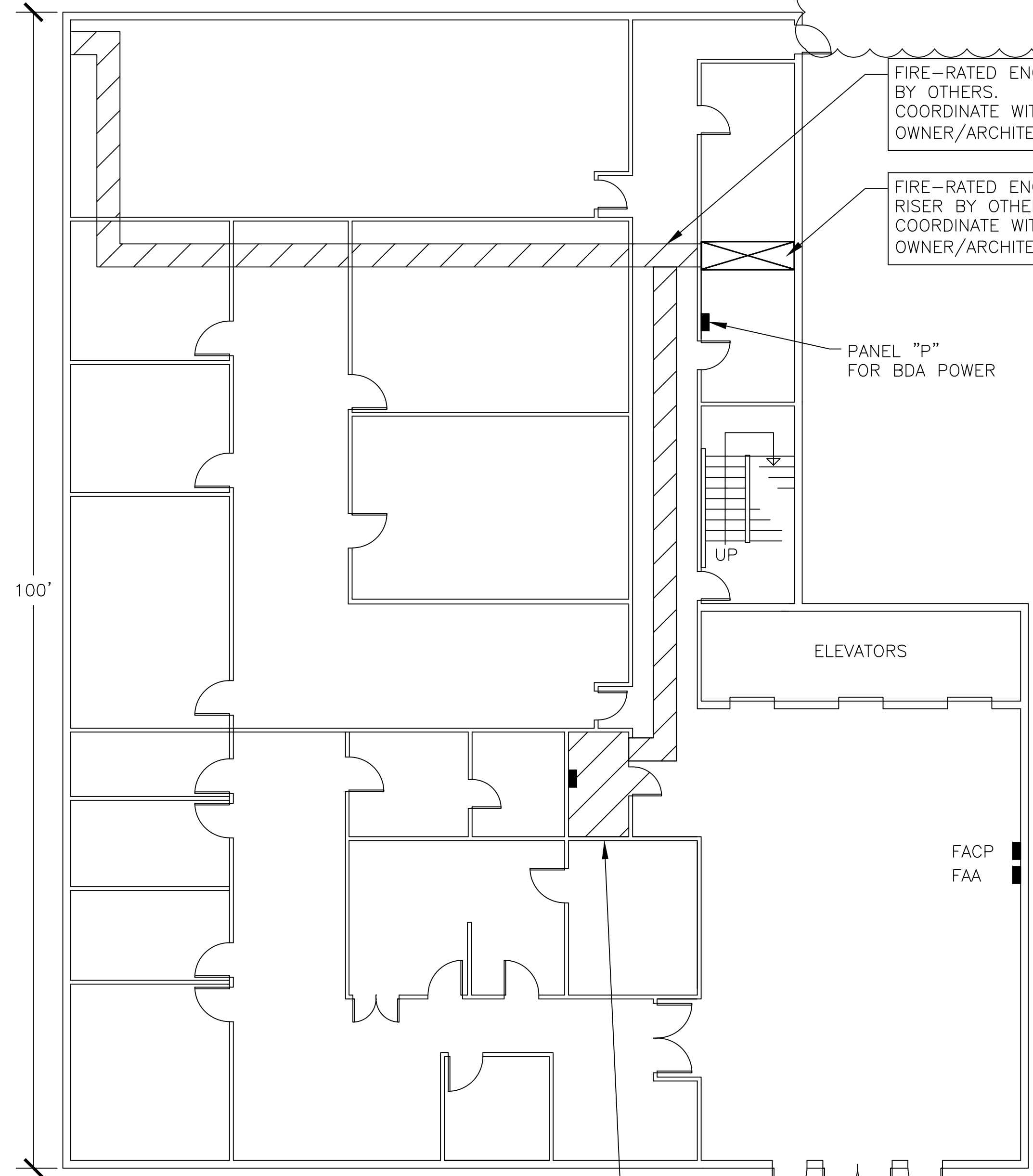
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THIS DRAWING IS FOR NFPA 72 (2019), NFPA 1221 (2019) ONLY

AHJ NOTES
SCALE: NTS

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REVISIONS Date: 2019-07-20 Drawn: MAR Checked: DLR Scale: NTS JOB NO. 19005
COORD 2019-09-17 DLR
PROJECT TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM OFFICE BUILDING BROWARD COUNTY, FLORIDA
TITLE AHJ NOTES
SEAL
DATE David L. Rice, P.E. Electrical Engineer State of Florida PE 34343
SHEET FC-1.3C

BATTERY CALCULATION NFPA 72-5.2.5.5.2 EQUIPMENT POWER CONSUMPTION AT 100%: _____ WATTS. EQUIPMENT AMP DRAW AT 100%: _____ AMPS. HOURS OF OPERATION AT 100%: 12 HOURS. BATTERY VOLTAGE: _____ VOLTS. AMPS x HOURS x 1.2 = _____ AH MINIMUM BATTERY SIZE	FIRE STOP DETAIL FIRE WRAP DETAIL
SEE THE ARCHITECTURAL DRAWINGS FOR DETAILS OF ALL FIRE-RATED ENCLOSURES.	



TIE THE BDA TO THE FACP FOR THE REQUIRED ALARMS.
 WIRE THE UPS TO A 120V PANEL WITH A 20A, 1P, LOCKABLE CB. PANEL SHALL BE ON THE EMERGENCY GENERATOR, IF AVAILABLE.
 PROVIDE A LOCKABLE SWITCH OR TWIST LOCK RECEPTACLE (UNDER A COVER) NEXT TO THE UPS.

BDA EQUIPMENT ROOM, FIRE-RATED, A/C, AND MECHANICAL VENTILATION BY OTHERS. COORDINATE WITH OWNER/ARCHITECT/GC.

FLOOR TO FLOOR 12'-0"
 CEILINGS 9'-0"
 WINDOWS (EGLASS) 4'-0" TO 8'-0" AROUND PERIMETER

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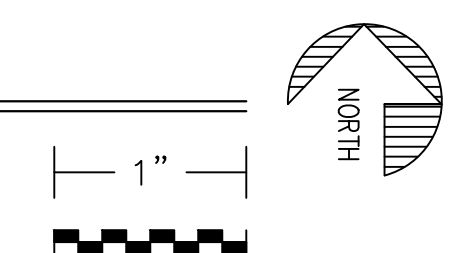
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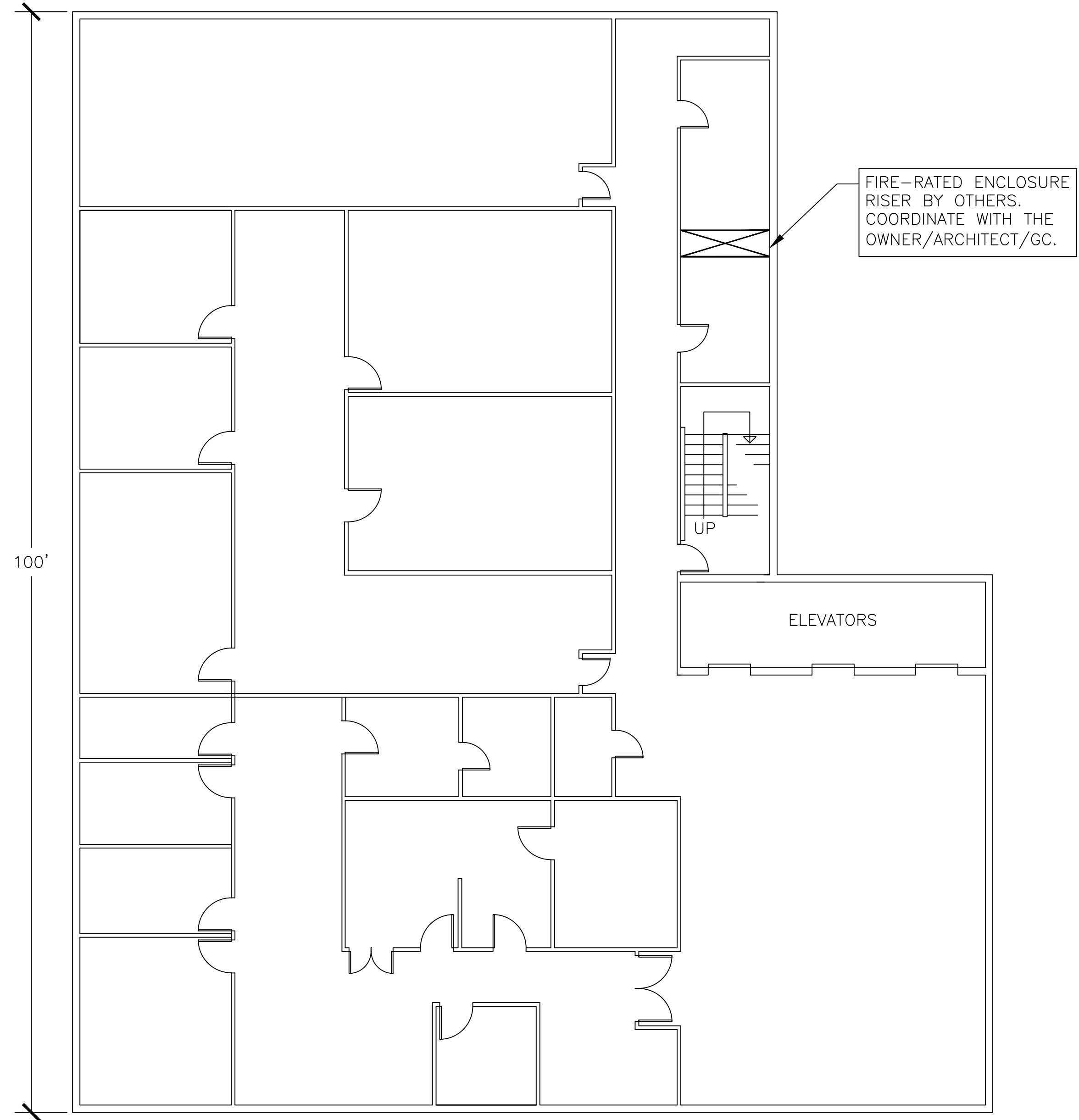
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FIRST FLOOR PLAN

SCALE: 1/8" = 1'-0"



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SEE THE ARCHITECTURAL DRAWINGS FOR DETAILS OF ALL FIRE-RATED ENCLOSURES.

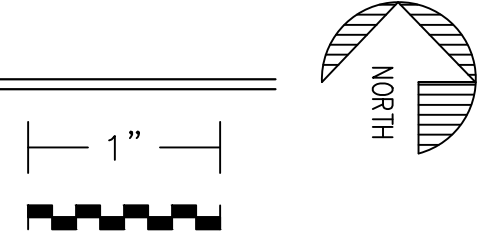
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SECOND FLOOR PLAN

SCALE: 1/8" = 1'-0"



RC ENGINEERING INC
 5532 NW 106th DRIVE
 CORAL SPRINGS, FL 33076
 (954)757-7900
 CA4755

REVISIONS
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Date: 2019-07-20
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 JOB NO. 19005

PROJECT
 TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
 OFFICE BUILDING
 BROWARD COUNTY, FLORIDA

TITLE
 SECOND FLOOR PLAN

SEAL

DATE
 David L. Rice, P.E.
 Electrical Engineer
 State of Florida
 PE 34343

SHEET
 FC-2.2
 of sheets

FIRE STOP DETAIL
GYPSUM

3M, HILTI, OR EQUIVALENT

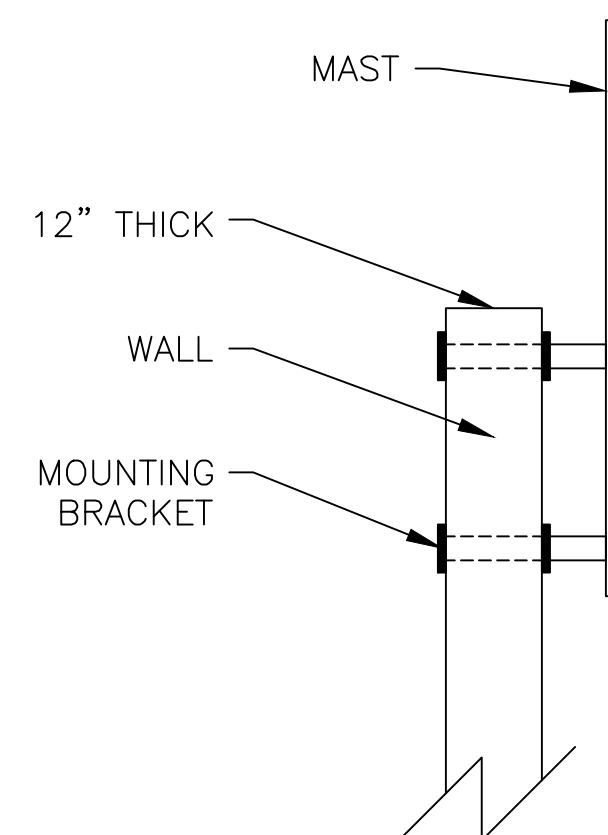
MANUFACTURER'S FIRE STOP DETAIL

FIRE STOP DETAIL
CONCRETE

3M, HILTI, OR EQUIVALENT

MANUFACTURER'S FIRE STOP DETAIL

ANTENNA MAST INSTALLATION DETAIL



MOUNTING NOTE:
PROVIDE SHOP DRAWINGS FOR REVIEW BY THE ENGINEER OF RECORD
(4 COPIES MINIMUM).

SHOP DRAWINGS SHALL BE SIGNED AND SEALED BY A FLORIDA REGISTERED
PROFESSIONAL ENGINEER.

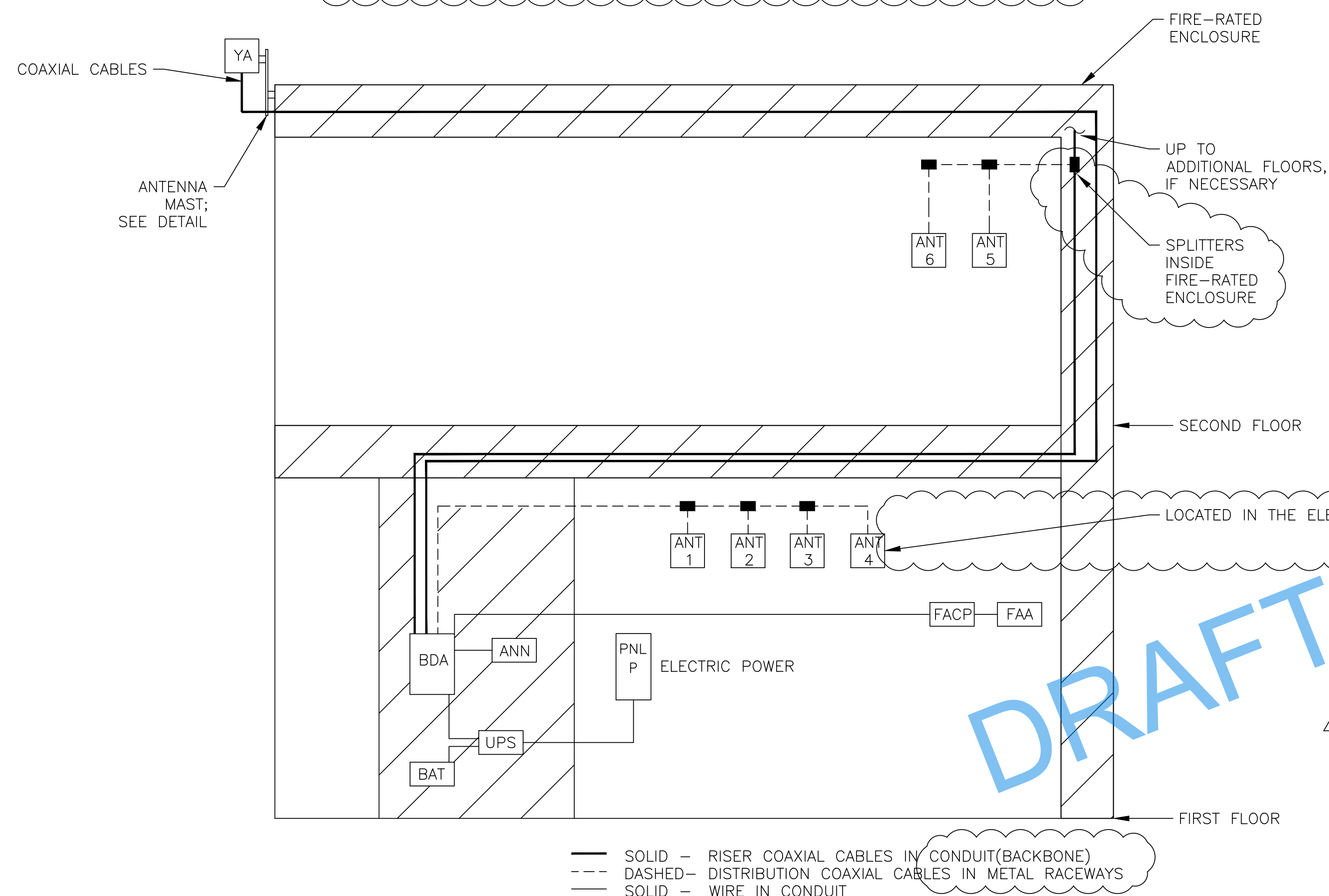
SHOP DRAWINGS SHALL INCLUDE THE COMPLETE ASSEMBLY, INCLUDING
MAST, ANTENNA, MOUNTING HARDWARE, AND BUILDING CONSTRUCTION.

SHOP DRAWINGS SHALL BE FOR WORST CASE CONDITIONS.

ALL ASSOCIATED COSTS FOR THE TOTAL INSTALLATION INCLUDING SHOP
DRAWINGS AND DESIGN FEES SHALL BE INCLUDED IN THE CONTRACT.

SHOP DRAWINGS SHALL STATE THAT THE COMPLETE ASSEMBLY INSTALLATION
COMPLIES WITH THE MINIMUM REQUIREMENTS OF THE HVHZ SECTIONS OF
THE FLORIDA BUILDING CODE, BROWARD COUNTY AMENDMENTS, SIXTH
EDITION (2017).

SEE THE ARCHITECTURAL
DRAWINGS FOR DETAILS OF
ALL FIRE-RATED ENCLOSURES.



— SOLID — RISER COAXIAL CABLES IN CONDUIT(BACKBONE)
- - - DASHED— DISTRIBUTION COAXIAL CABLES IN METAL RACEWAYS
— SOLID — WIRE IN CONDUIT

CONDUIT RISER DIAGRAM

SCALE: NTS

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PROJECT
TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
OFFICE BUILDING
BROWARD COUNTY, FLORIDA

TITLE
CONDUIT RISER
DIAGRAM

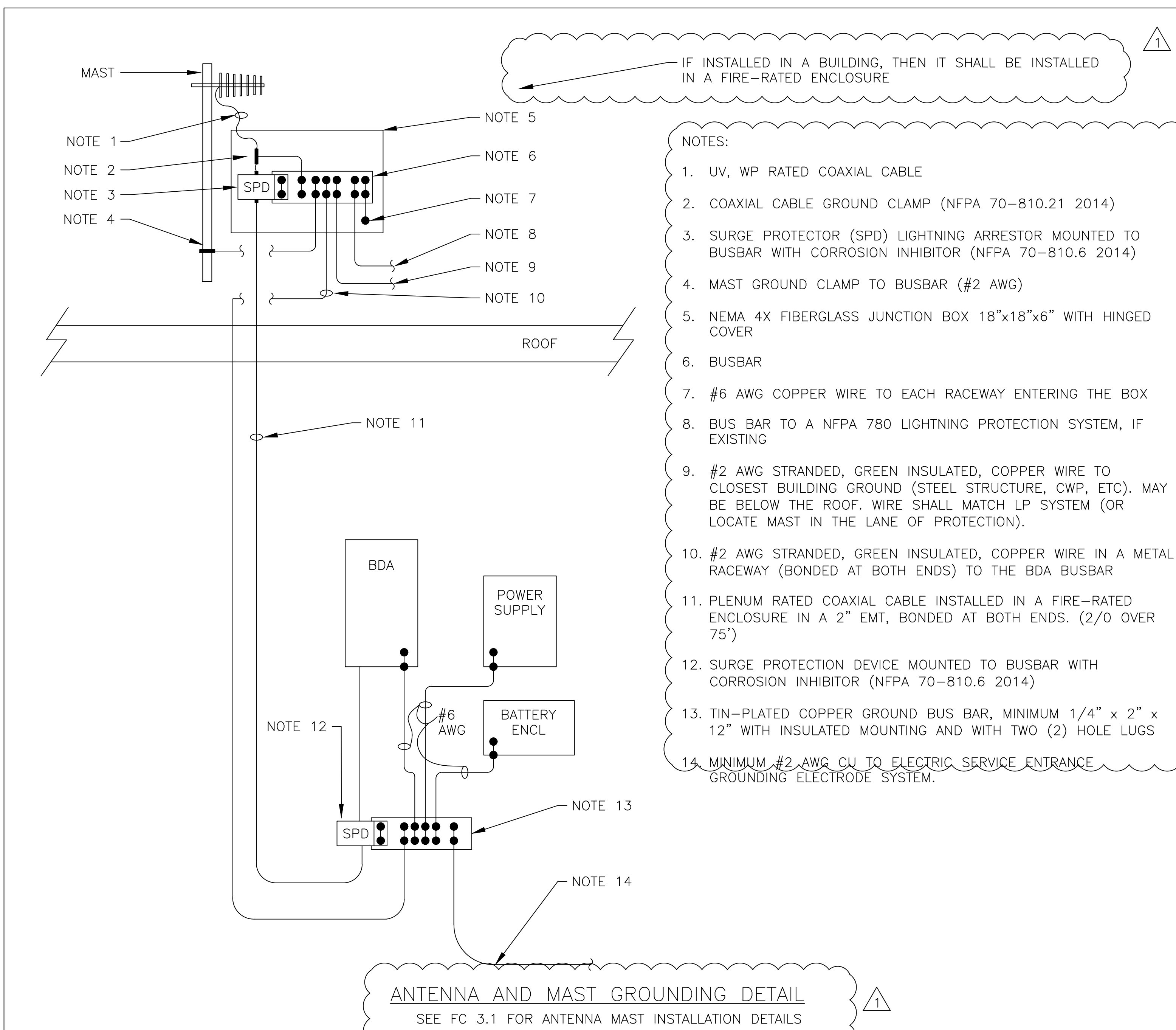
SEAL

DATE
David L. Rice, P.E.
Electrical Engineer
State of Florida
PE 34343

SHEET
FC-3.1

MISCELLANEOUS NOTES:

- INSTALLATION SHALL BE IN COMPLIANCE WITH:
 - NFPA 70-810 (2014)
 - IEEE STD 1692 (2011)
 - TIA/ANSI/EIA 569-C (2012)
 - TIA/ANSI/EIA 607-B (2011)
 - MOTOROLA R-56
- ANTENNA MAST SHALL BE 12" ABOVE ANTENNA.
- ANTENNA MAST SHALL BE SIZED TO COMPLY WITH THE STRUCTURAL DETAIL REQUIREMENTS.
- BUSBAR SHALL BE LISTED, A MINIMUM OF 1/4" x 2" x 12", TIN-RATED COPPER, WITH STAINLESS STEEL BRACKETS, FIBERGLASS INSULATION, TWO-HOLE LUGS, IRREVERSIBLE CRIMP CONNECTORS.
- ALL MECHANICAL CONNECTIONS SHALL BE COATED WITH A LISTED CONDUCTIVE ANTI-OXIDANT COMPOUND.
- ALL CONDUCTORS SHALL BE:
 - PROTECTED FROM PHYSICAL DAMAGE
 - SECURELY FASTENED (36")
 - RUN IN AS STRAIGHT A LINE AS PRACTICAL
 - A MINIMUM BEND RADIUS OF 8"
 - A MAXIMUM OF 90°
 - BENT AND CURVED TOWARD THE GROUNDING ELECTRICAL SYSTEM (NO 'U' BENDS)
 - AS SHORT AS POSSIBLE
- SURGE SUPPRESSORS SHALL BE COMPATIBLE WITH THE ANTENNA AND BDA.
- NFPA 70-110.3B INSTALLATION AND USE LISTED OR LABELED EQUIPMENT SHALL BE INSTALLED AND USED IN ACCORDANCE WITH ALL INSTRUCTIONS INCLUDED IN THE LISTING OR LABELING.



ANTENNA AND MAST GROUNDING DETAIL
SEE FC 3.1 FOR ANTENNA MAST INSTALLATION DETAILS

- NOTES:
- UV, WP RATED COAXIAL CABLE
 - COAXIAL CABLE GROUND CLAMP (NFPA 70-810.21 2014)
 - SURGE PROTECTOR (SPD) LIGHTNING ARRESTOR MOUNTED TO BUSBAR WITH CORROSION INHIBITOR (NFPA 70-810.6 2014)
 - MAST GROUND CLAMP TO BUSBAR (#2 AWG)
 - NEMA 4X FIBERGLASS JUNCTION BOX 18"x18"x6" WITH HINGED COVER
 - BUSBAR
 - #6 AWG COPPER WIRE TO EACH RACEWAY ENTERING THE BOX
 - BUS BAR TO A NFPA 780 LIGHTNING PROTECTION SYSTEM, IF EXISTING
 - #2 AWG STRANDED, GREEN INSULATED, COPPER WIRE TO CLOSEST BUILDING GROUND (STEEL STRUCTURE, CWP, ETC). MAY BE BELOW THE ROOF. WIRE SHALL MATCH LP SYSTEM (OR LOCATE MAST IN THE LANE OF PROTECTION).
 - #2 AWG STRANDED, GREEN INSULATED, COPPER WIRE IN A METAL RACEWAY (BONDED AT BOTH ENDS) TO THE BDA BUSBAR
 - PLENUM RATED COAXIAL CABLE INSTALLED IN A FIRE-RATED ENCLOSURE IN A 2" EMT, BONDED AT BOTH ENDS. (2/0 OVER 75')
 - SURGE PROTECTION DEVICE MOUNTED TO BUSBAR WITH CORROSION INHIBITOR (NFPA 70-810.6 2014)
 - TIN-PLATED COPPER GROUND BUS BAR, MINIMUM 1/4" x 2" x 12" WITH INSULATED MOUNTING AND WITH TWO (2) HOLE LUGS
 - MINIMUM #2 AWG CU TO ELECTRIC SERVICE ENTRANCE GROUNDING ELECTRODE SYSTEM.

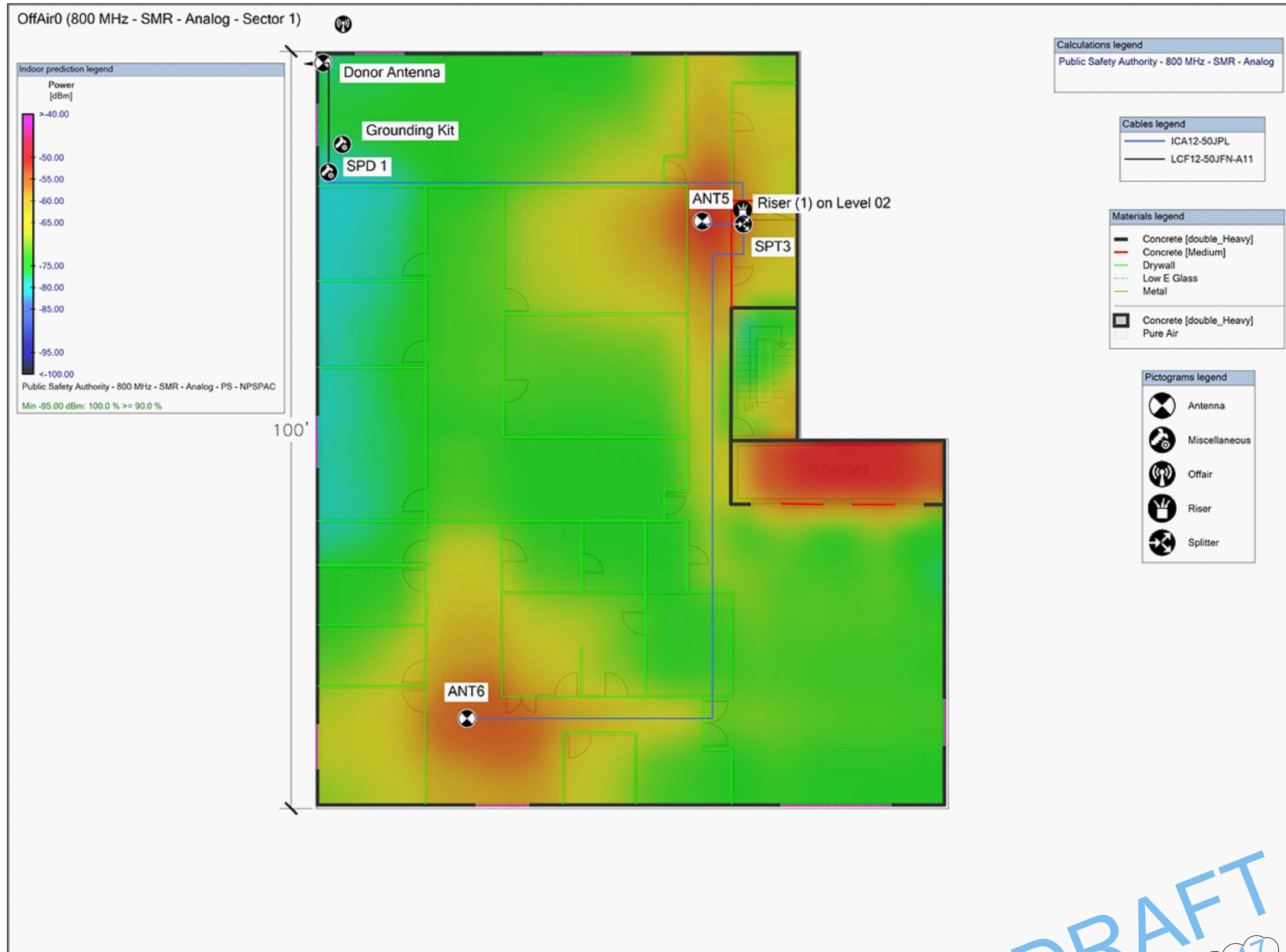
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ANTENNA AND GROUNDING DETAILS
SCALE: NTS

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REVISIONS	COORD
Date: 2019-07-20	2019-09-17 DLR
Drawn: MAR	Checked: DLR
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PROJECT TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM OFFICE BUILDING BROWARD COUNTY, FLORIDA	
TITLE ANTENNA AND GROUNDING DETAILS	
SEAL	
DATE David L. Rice, P.E. Electrical Engineer State of Florida PE 34343	
SHEET FC-3.2	



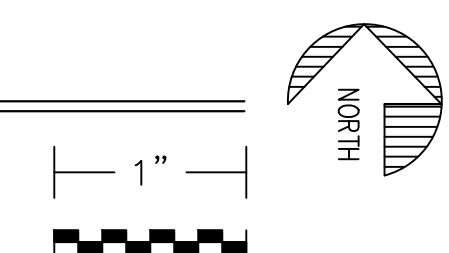
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SECOND FLOOR PROPAGATION PLAN

SCALE: 1/8" = 1'-0"



RC ENGINEERING INC
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 CORAL SPRINGS, FL 33076
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 CA4755

REVISIONS
 DATE: 2019-07-20
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PROJECT
 TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
 OFFICE BUILDING
 BROWARD COUNTY, FLORIDA

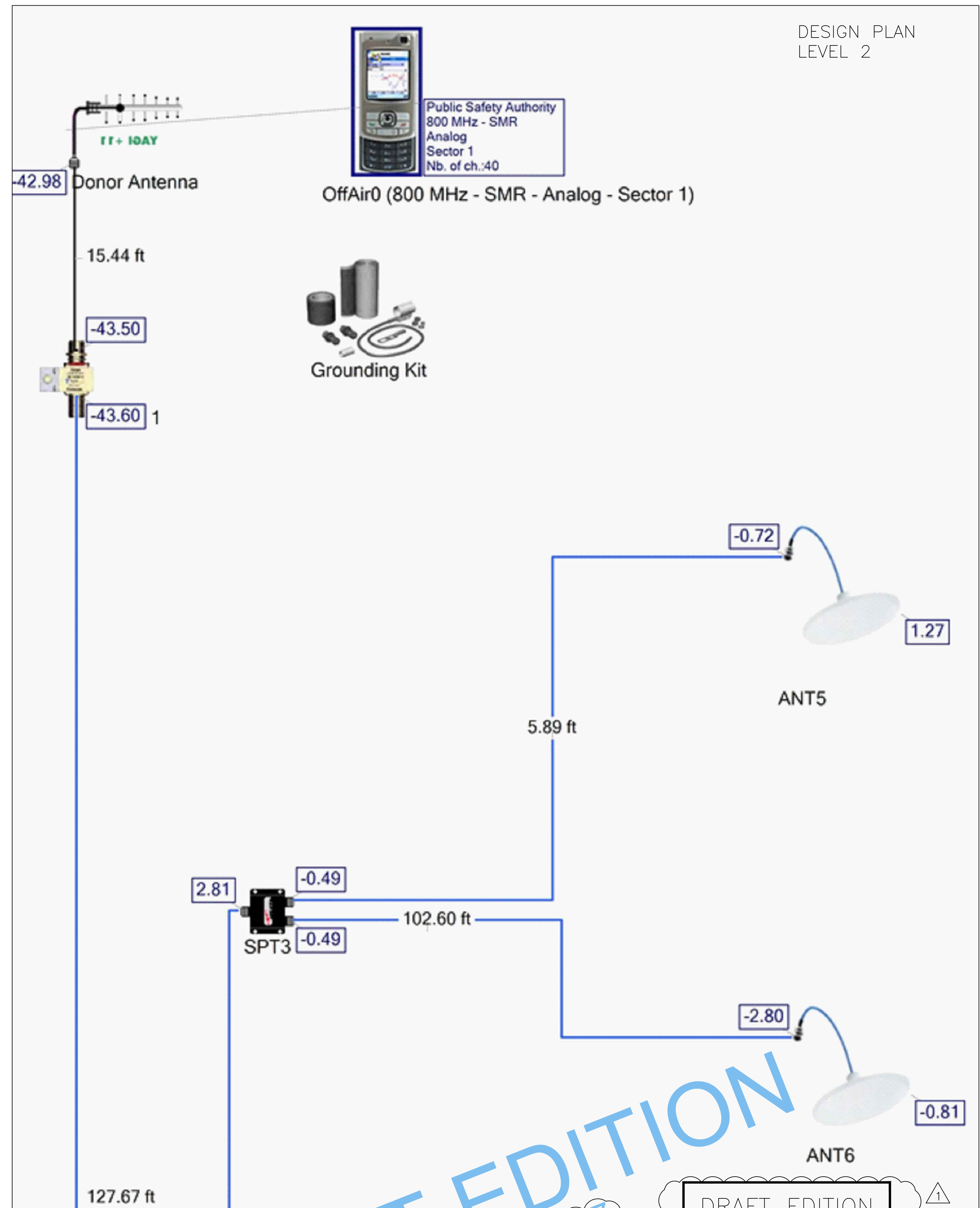
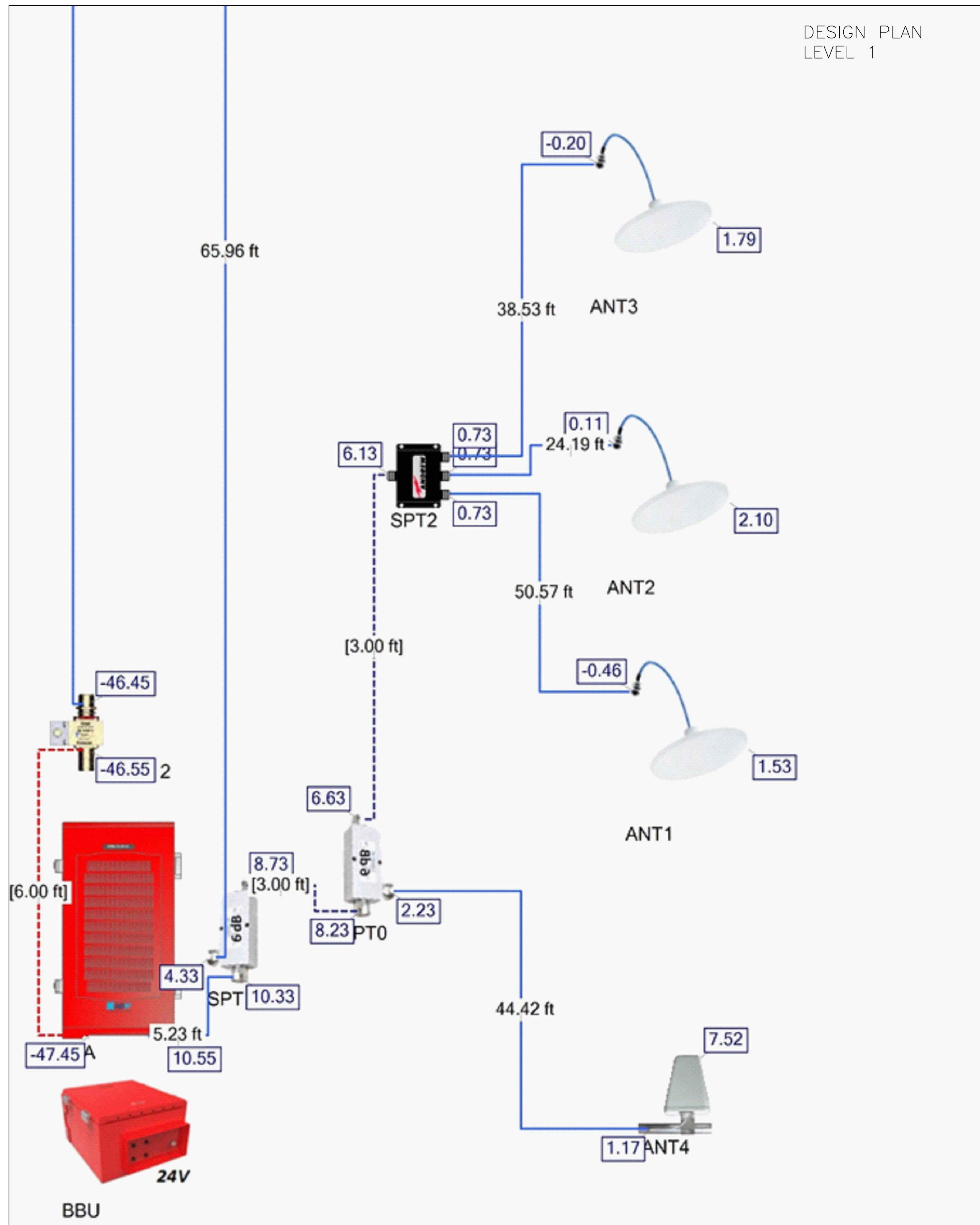
TITLE
 SECOND FLOOR
 PROPAGATION PLAN

SEAL

DATE
 David L. Rice, P.E.
 Electrical Engineer
 State of Florida
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SHEET
 FC-4.2

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DESIGN PLAN
 SCALE: NTS

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REVISIONS <table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>DESCRIPTION</th> </tr> <tr> <td>1</td> <td>2019-09-17</td> <td>DLR COORD</td> </tr> </table>	NO.	DATE	DESCRIPTION	1	2019-09-17	DLR COORD
NO.	DATE	DESCRIPTION				
1	2019-09-17	DLR COORD				
PROJECT TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM OFFICE BUILDING BROWARD COUNTY, FLORIDA						
TITLE DESIGN PLAN						
SEAL						
DATE David L. Rice, P.E. Electrical Engineer State of Florida PE 34343						
SHEET FC-4.3 of sheets						

BDA

MANUFACTURER'S
SPEC SHEET

POWER SUPPLY

MANUFACTURER'S
SPEC SHEET

BATTERY AND ENCLOSURE

MANUFACTURER'S
SPEC SHEET

ANNUNCIATOR

MANUFACTURER'S
SPEC SHEET

NOTES:

1. ALL SPECS, NOTES, DESCRIPTIONS, ETC. SHALL BE PRINTED ON AN 11x17 DRAWING.
2. THIS DRAWING IS FOR INFORMATION PROVIDED BY THE PRODUCT MANUFACTURER. THE ENGINEER OF RECORD IS NOT RESPONSIBLE FOR THE MANUFACTURER'S CONTENT AS PER FAC-61G15.30.003(3)

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MANUFACTURER'S SUBMITTAL SHEET 1

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CA4755

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Date:	2019-07-20
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TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM

PROJECT

TITLE

MANUFACTURER'S
SUBMITTAL SHEET 1

SEAL

DATE
David L. Rice, P.E.
Electrical Engineer
State of Florida
PE 34343

SHEET

FC-5.2

of sheets

DAS ANTENNA

DAS ANTENNA

COUPLER

COUPLER RFS

PLENUM CABLE

OUTSIDE CABLE

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1 2019-09-17 DLR COORD

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PROJECT
TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
OFFICE BUILDING
BROWARD COUNTY, FLORIDA

TITLE
MANUFACTURER'S
SUBMITTAL SHEET 2

SEAL

DATE
David L. Rice, P.E.
Electrical Engineer
State of Florida
PE 34343

SHEET
FC-5.3

MANUFACTURER'S SUBMITTAL SHEET 2

SCALE: NTS

SPD POLYPHASER

SPD TIMES MICROWAVE

SPLITTERS

DONOR ANTENNA SINCLAIR

DONOR ANTENNA SINCLAIR

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MANUFACTURER'S SUBMITTAL SHEET 3

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PROJECT
TWO-WAY RADIO COMMUNICATIONS ENHANCEMENT SYSTEM
OFFICE BUILDING
BROWARD COUNTY, FLORIDA

TITLE
MANUFACTURER'S
SUBMITTAL SHEET 1

SEAL

DATE
David L. Rice, P.E.
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State of Florida
PE 34343

SHEET
FC-5.4