Understanding the California 510 Fire Code

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California 510 Fire Code

Review of the California 510 code, its relevance to ERRCS DAS and BDA Systems

Along with a review of some of the other related codes
(i.e. FCC, NEC, NFPA, and AHJ modifications)

Regarding this 510 Presentation

Training **follows** the code book, it is **NOT word-for-word**

All "Notes" and "Boldings" are Chris Herrington's interpretation

The codes are available to you at the start of this presentation for you to follow along or/and review at a later date.

Please feel free to ask question as we move along
Or contact me later

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Why The 510 and ERRCS?

Emergency
Responder
Radio
Communication
System

911 showed the country a couple of issues that Emergency responders have

- Interoperability between departments—Maybe LTE will solve?
- Availability Everywhere. **The 510 Attempts to solve this one**

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Key

ERRCS = Emergency Responder (Police and primarily Fire), Radio (as in two-way radios) Communication System (Note it is a **System,** not unrelated Components) which include:

BDA = Bi-Directional (Two way) Amplifier/Amplification

DAS = Distributed (as in more than one) Antenna System. This is the cable and antennas that Distribute **and** collect the signal

Donor Antenna = Antenna on Rooftop pointing at ERRCS Transceiver tower/location(s)

Transceiver Antenna/Tower = The AHJ signal source, sometimes called the Donor **Site** (as opposed to the Donor Antenna which points to the Donor site)

AHJ = **A**uthority **H**aving **J**urisdiction. **Anyone** that has the authority to **require**, **approve**, or **deny** any part of the ERRCS. Also anyone that provides the information on 510.4.2.2. In this document it is also used where the code states “Fire Code Official”, etc.

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ERRCS Transceiver Tower/location

Often called the Transmitter site (though actually a transceiver as it is two-way), Service Site, or the Donor Site (as opposed to the Donor Antenna which is pointed to the Donor Site).

Some Jurisdictions have **up to three** different Transceiver Sites/frequency bands that need to be repeated!

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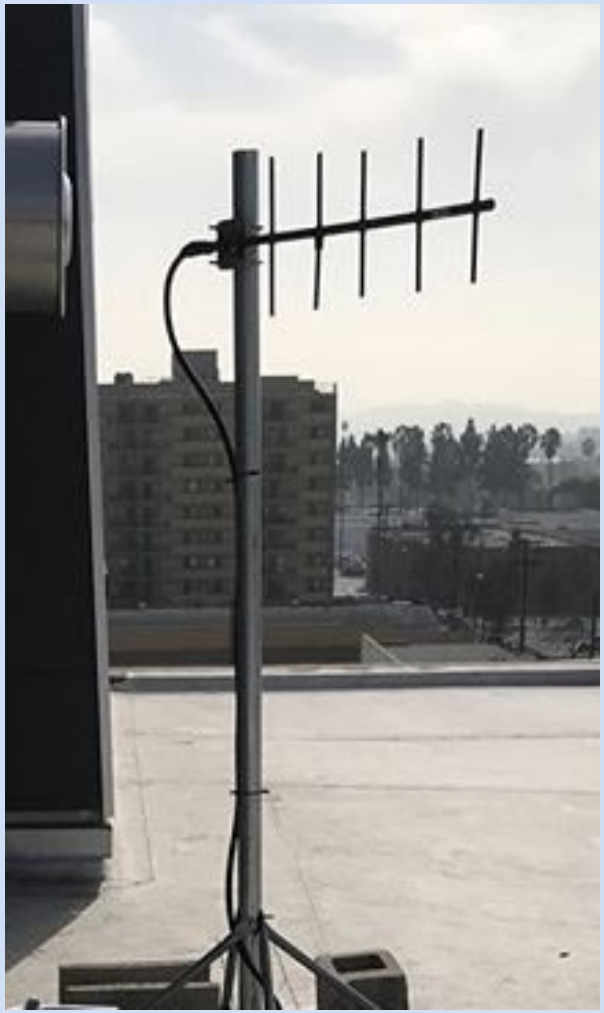
Donor Antenna



The Donor Antenna points to one or several transceiver towers, or there can be several Donor Antennas for this purpose.

The Donor Antenna is then connected to the **BDA----through a 2 hour fire rated pathway!**

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BDA / Bi-Directional Amplifier

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Battery Backup

A 12, 24, or 72 hour Battery Backup is required for all systems, depending on Jurisdiction (**510 requires 24 Hours**)

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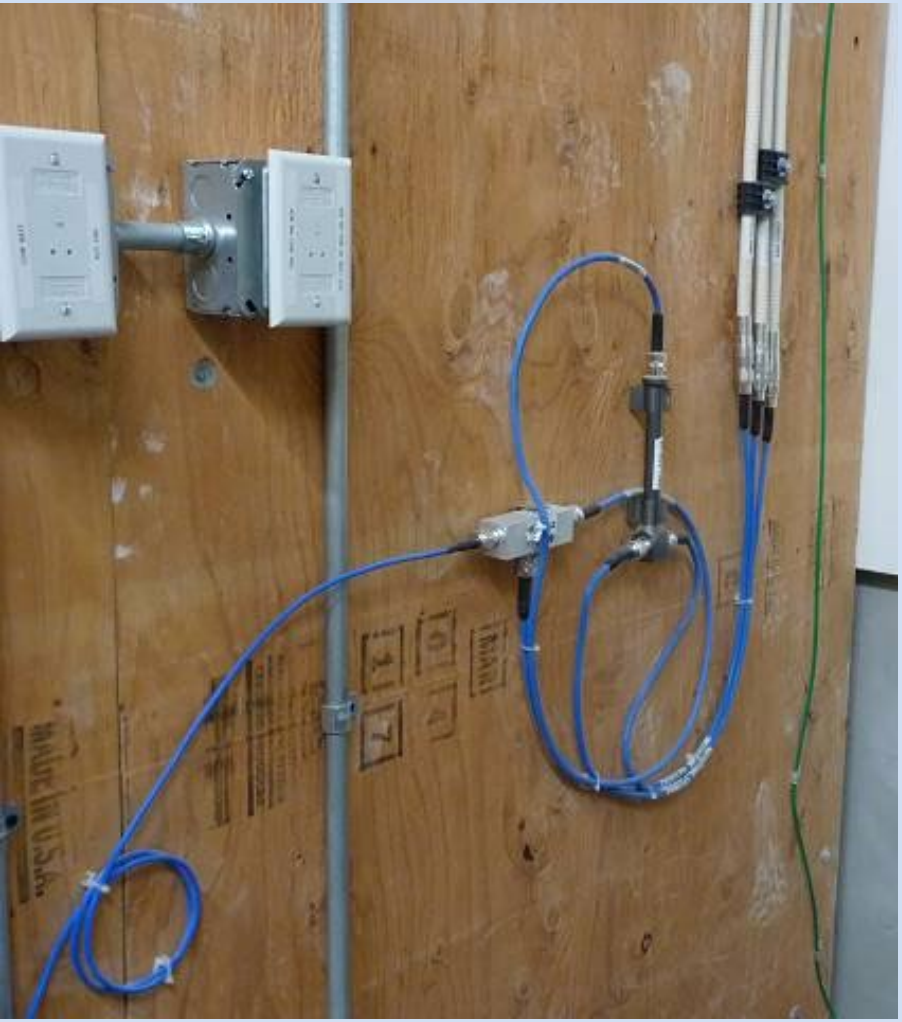
DAS / Distributed Antenna System



Above: couplers and cables going to feed antennas in the building

Above: **Antenna** mounted in Garage

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Other Codes

NFPA 70: National Electric Code (AKA NEC)

NFPA 72: Fire Alarm and Signaling

NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

Common Sense: Though this is clarified in the NEC as: installed in a "**workman like manner":**

General Neatness: NEC 800.24: States that "Communications circuits and equipment shall be installed in a neat and workmanlike manner" **Also covered in the CEC 110.12**

And many other codes referenced by these codes, including:

- IEEE/ANSI
- Bicsi
- Other NFPA code books

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The Rules and Changes

In California the **primary rule** regarding the need for, and the installation of, an “Augmented” ERRCS (i.e. BDA/DAS system) is the **California Fire Code**, **section 510**

Cities and County Jurisdictions have their own **modifications**:

- **When** a BDA/DAS system is **required**
  (i.e. Building size minimums & types that are **excluded)**
- Battery Backup **time**
- **Codes** the equipment must be certified under (UL, and others)
- **Frequencies**

Not always easy to get, but important to follow

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Modifications regarding signaling the local responders

Often added is **how the local fire department is to be notified** in the event of a ERRCS failure. It can a **Dial-up modem**, or **Alarm Panel Connection**, and report:

- System Component Fail
- Donor Antenna Fail
- Amplifier Fail
- Power Fail
- Backup Power fail
- low Battery (typically 70%)
- And/or others depending on AHJ

Note: The above are from **NFPA 1221 9.6.13.2**

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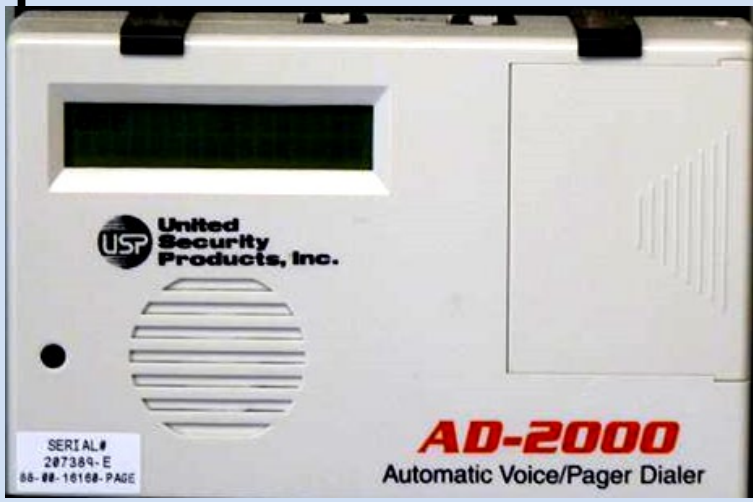
Some Jurisdictions require:

- If required Dial-up Modems are part of the ERRCS and must be in a **NEMA-4 Enclosure**



- **EPO** (Emergency Power Off) switch: shuts down both the BDA **and** the Battery Backup

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Some Jurisdictions require: (Cont)

New building that **shade or otherwise diminishes** the signal strength at another building: you must provide remedies (i.e. BDA/DAS) in the affected buildings.

Extensive paperwork that should be posted at the BDA location and given to the building owner and AHJ at the completion of the project.

See the following pages for this Paperwork to be Posted.

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Placarding /Labeling Required

***510.3) Building Permit** for the installation of the ERRCS*
Must be Posted at the BDA site before <u>construction begins</u>

510.4.2.4.4) (all) Equipment shall have **FCC certification <u>prior</u>** to installation.

Note, this must be Clearly Labeled (see 510.5.1)

Also in 510 (not required to be posted, but would save a lot of time):

510.5.2) Minimum Qualifications of Personnel (Designer and lead installation Personnel) **<u>shall</u>** include **BOTH** of the following.

1) A valid FCC GROL
2) Certification of in-building System

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Placarding /Labeling Required

510.5.3 6) All test measurements shall be kept on file with the building owner.

Note: It is suggested that a copy be also posted at the BDA, along with the Manuals, etc.

510.6.1) “inspected and tested annually”

Note: The placard/label should also contain the approvals for the original testing and the annual testing per the AHJ.

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Must have/post documents

510.5.1) Amplification systems capable of operating on frequencies licensed to any public safety agency by the **FCC shall not** be installed without **prior coordination** and **approval** of the AHJ.

Per FCC 90.219

B 1 (i) Express Consent: Non-licensees (i.e. not the AHJ) seeking to operate signal boosters **must obtain** the **express consent** of the **licensee**(s) (i.e. AHJ) of the frequencies for which the device is intended to amplify. The **consent must be maintained** in a **recordable format** that can be **presented to an FCC** representative or other relevant licensee investigating interference.

Note: This Must be Posted at the BDA

B 5 Class B signal booster installations **must be registered** in the FCC signal booster database that can be accessed at the following URL: www.fcc.gov/signal-boosters/registration.

Note, if required: This Must be Posted at the BDA site

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Other Items to be located at the BDA

Manuals: for all the equipment

Design: including expected loss/signal levels to the DAS antennas

Instructions: for Emergency Shut off of BDA and the Battery Backup

Approval to operate (signed off Building Permit or other) after acceptance by the AHJ:

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Placarding / Label Examples

510.3
Building
Permit
(or in Binder)

510.5.1 AHJ
Approval prior
to installation

(*If Class B*)
FCC Class B
Signal Booster
Registration

510.6.1
Initial & Annual
AHJ inspection
sticker / label w/
date.

Wall Mounted
Or per AHJ, placed in BDA Manual. Class B Registration **is** required to be posted on the wall, as are all similar FCC documents

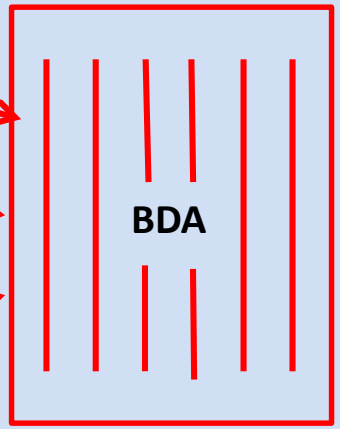
First 3 to be in place before any testing, and the last one should be obtained & posted before placing BDA in operation

BDA labels

FCC
Compliance
label

UL Label?

NEMA 4
Certified label
(Also on Battery
Backup / UPS)



BDA Site Operation Manual

Binder / folder with:
BDA & UPS manual
Building Permit (or on wall)
Class of Amplifier (A or B)
Frequencies amplified by BDA
Installer W/GROL #
System Design w/designer info

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Approvals and code notes

Most Codes say Approved, Listed, etc. This applies to Grounds, Clamps, cables, and the big stuff. **All parts need to be labeled!**

LA City (for example) has in their code that **All BDA electronics** (the BDA and Battery Backup) **must** be **UL Tested**.

Please note that this does **NOT** mean tested to **UL Standards by another company.**

Though there are International codes that are "mostly equal" (i.e. ETL), the LA City specifically states that the BDA must be UL Tested and will not accept International or "Tested to UL Standards" by other organizations other than UL (Underwriters Laboratories).

There are differences between UL and International Standards, and it is well within LA City's rights to have this requirement. However it **was not** well **documented**.

NOW YOU KNOW! Check, Check, **Check!**

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Approvals and code notes
other gotchas from 510 and other Codes

1) Dedicated power (**i.e. NO Plugs**) is required:
- Must be **hard wired** in conduit back to the **Circuit breaker**
- **Primary Power** Junction box **must be labeled** with the Circuit Breaker Panel ID, location, and Circuit Breaker number.
- **Conduit between System Components** (i.e. Battery Backup, BDA, EPO, etc.)
- All **Conduit** must meet the **NEMA-4** rating requirement for a System

2) If an **EPO** is not installed then there must be a **clear label** on **how to quickly shut off** the BDA and Battery Backup in an emergency.

If time or interest allows we will review these and other Code violations at the end

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The 510 Code

By the Numbers

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510.1 New Buildings

New Buildings: shall have approved coverage

This is also taken to mean any building construction (old or new), including Tenant Improvements, **when a permit is applied for**.

Except:

1) Where an **approved Wired System** is Permitted

2) **Radio Coverage is NOT needed?** (See AHJ, but often residential, and smaller buildings, without underground parking or basements)

3) Where ERRCS could have a **negative impact** (AHJ will decide)

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510.2 Existing Buildings

Existing Buildings shall have an ERRCS as required in Chapter 11*

1) when existing **wired system fails--**and **can not** be fixed

2) **on a schedule** set up by adopting AHJ

Note: Chapter 11 is at end of your handouts, it reiterates 510.2

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510.3 Permit Required

A construction Permit is required for New and modification of ERRCS

Note: As you shall see there is a lot of paperwork required for ERRCS

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510.4 New Systems Must comply with the following

Note, this applies to new buildings without ERRCS
Otherwise an ERRCS is required
with slightly different rules

510.4.1) Building will have acceptable signal Strength when **95% of areas** on each floor have acceptable signal strength per 510.4.1.1 and .2

510.4.1.1) Minimum signal strength of -95dBm
Note: assumed to be across a 0 dBi antenna, *typical of what First Responder have on their radios*

510.4.1.2) Minimum signal strength of **-95 dBm** to be received at the **Agency's radio system**.

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510.4.2 System Design

Designed as follows:

510.4.2.1) Buildings that can **not** support the minimum signal requirements **shall** be equipped with a **DAS and BDA** system with FCC Certified BDA or other systems approved by AHJ to achieve required coverage.

Note: there can be other requirements too, imposed by the AHJ

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510.4.2.2 Technical Requirements

AHJs have their work too

Finally something for the AHJs

•The Fire Code Official (i.e. AHJ, Fire Department, Radio department, and other Agencies having authority) **shall maintain a document** providing the **specific technical** information and requirements for the ERRCS. It shall contain, but **not be limited** to:

1. Various frequencies required
2. Location of Radio sites
3. Effective Radiated Power (ERP) (**Note:** at the Transceiver Antenna(s))
4. Supporting Technical documentation

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Chris' Comments about 510.4.2.2

Supporting documentation should include:

- Contacts for:
  - Questions and radio assistance (where needed)
  - Fire Marshalls / Fire Protection officer
  - Building inspector (pertaining to ERRCS if not above)
  - Fire alarm reporting
- Rules and regulations that differ from the 510 code
- How **510.4.2.4, (**Electronic Monitoring) is to be accomplished
- Web sites with updated information for all of the above

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510.4.2.3 Standby Power:

Not less than 24 hours Per 510

Except: Some jurisdictions are only requiring 12 hours, and some may require more than 24 hours—Check, Check, **Check!**

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510.4.2.4 Signal Booster Requirements

1) ERRCS (i.e. SYSTEM) **shall** be contained in **NEMA-4** Type Waterproof Cabinet

2) Battery Systems used for the emergency power **shall** be contained in **NEMA-4** Type Waterproof Cabinet

Note 1: NEMA-4 is a USA Standard, and not a Canadian or International standard. Cabinets meeting other than NEMA-4 standards **MAY** or **MAY NOT** be approved by the AHJ

Check with your AHJ before installing **non-approved/listed** equipment and **get it in writing** if they approve other than NEMA-4. A **Costly Mistake!**

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510.4.2.4 Signal Booster Requirements Notes

Note 2: the Battery backup, BDA **and interconnecting cables** (power, data, etc.) are all part of the **SYSTEM**.

Also, as you move into bigger buildings you will have **Fiber Optic units** which must also be enclosed in a NEMA-4 enclosures, as well as all the interconnecting cables.

Check with your AHJ if you plan on taking short-cuts on this!

510.4.2.4 Signal Booster Requirements Continued

3) The signal booster system and battery system:

- **shall** be electronically **supervised** and **monitored** by a supervisory service,

OR

- **when approved** by the **AHJ**, **shall** sound an **audible signal** at a constantly attended location (**Note:** Possibly a Prison?)

Note: Check, Check, **Check** with the AHJ or the local ordinance regarding this, as there are several ways the AHJ will want this accomplished. Mistakes here may not be that costly in materials, but **could be extremely time consuming to fix**.

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510.4.2.4 Testing Cont

4) Equipment **shall** have **FCC certification prior** to installation

Note: As you will see later on, it also must be **designed, installed** and **tested** by **FCC licensed** personnel

5) The ERRCS shall be **capable** of **modification** or expansion if required

Note: per 510.6.2 (coming up) this **cost shall be borne by the Building Owner** if changes are required, or **possibly the installer or designer** if they are **not aware of current requirements** when Designing and Building the System.

510.5 Installation Requirements

510.5.1) Approval prior to installation. Amplification Systems (ERRCS) capable of operating on frequencies licensed to ANY public safety agency by the FCC **shall not be installed without** prior coordination and a**pproval of the AHJ**.

Note: This means **all BDAs** will have **prior** approval (from the AHJ or by building permit—**in writing**)

Class B amplifiers will **ALSO** have prior coordination by filing for a **Class B** Signal Booster Registration **BEFORE** installation and before asking for testing or approval sign-off. These **should be posted** at the BDA location **before testing**.

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510.5.2 Minimum Qualifications

Minimum Qualifications of Personnel *(Designer and lead installation Personnel) shall include* ***BOTH*** *of the following:*

1) **A valid FCC GROL**

2)

- Certification of in-building System training issued by a Nationally recognized organization or school

OR

- The manufacturer of the equipment being installed

Note: APCO Technician Certificate ***<u>usually</u>*** (**check AHJ**) is acceptable for #2

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510.5.3 Acceptance test procedure

Where an ERRCS is required: and upon completion of installation, the building owner shall have the radio system tested to verify that two-way coverage on each floor of the building is not less than **90%***.

***Note: Reduced from 95%** as required in a building **without a repeater** system.

The test procedure shall be conducted as follows:

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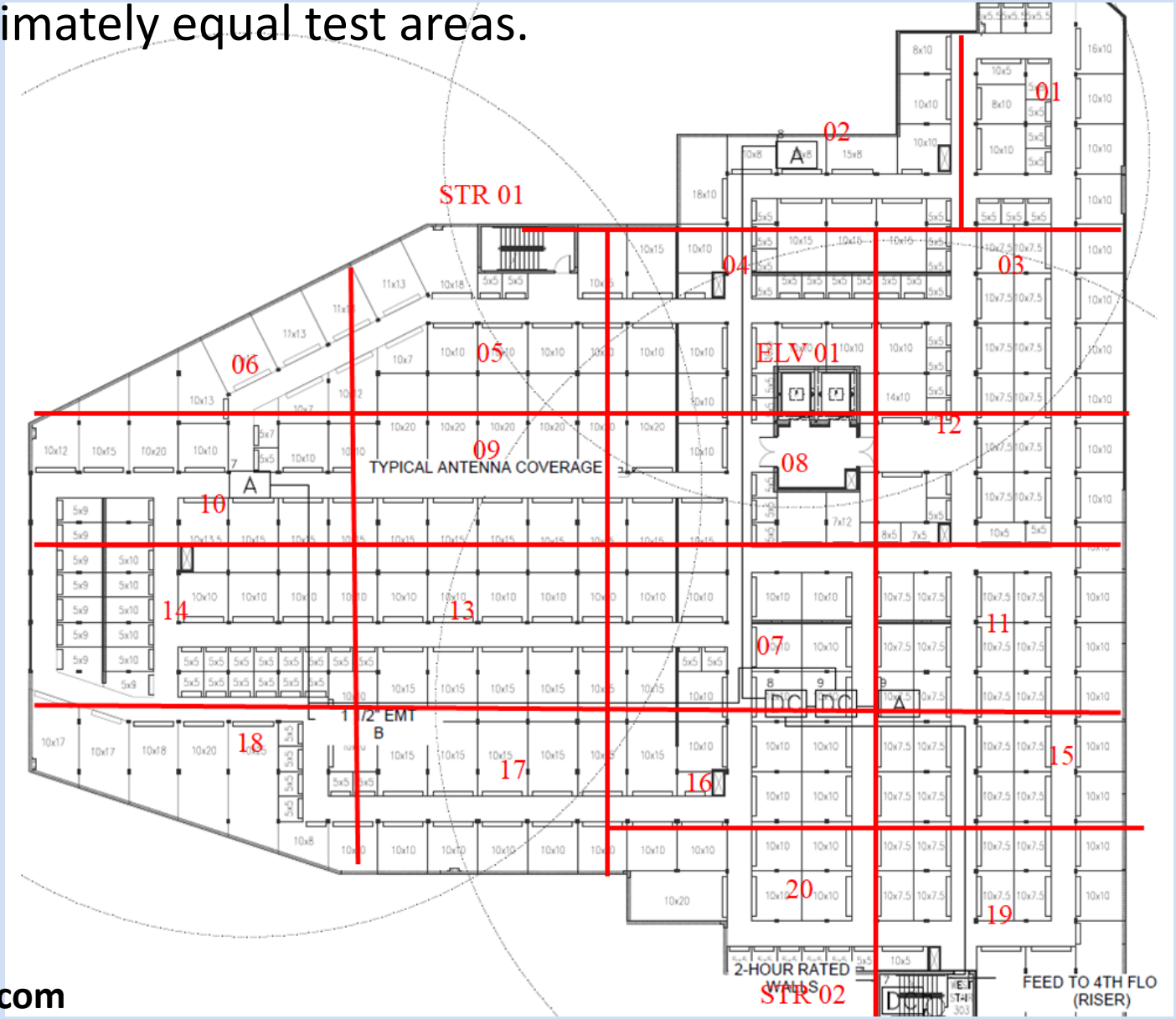
510.5.3 Acceptance test procedure

1) Each floor of the building shall be divided into a grid of **20** approximately equal test areas.



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NFPA 1221 9.6.7.4 Required

NOT part of 510 but still needed at 99% Pass

Note: AHJs usually require testing the following "**Special**" areas in additions to the standard grid test:

a. Roof-top
b. Perimeter of the building (4 sides)
c. Lobby/Main Entry
d. Fire Control Room(s)
e. Electrical Room(s)
f. All (each floor)
    1. Exits
    2. Stairwells
    3. Elevator lobbies
    4. and other designated areas

Best to do this and not need it than not do it and need it.
Check with the AHJ if deciding not to perform these tests!

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510.5.3 Testing Continued

2) The test shall be conducted using a **calibrated** portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.

Note: It is common, and **usually preferabl**e, to use alternate signal reading devices such as **Spectrum Analyzers** and other Accurate (i.e. calibrated and verifiable) signal reading instruments capable of **recording** actual signal levels. (this is called for later)

Often an AHJ may require **performing a DAQ test** using their radios.

Always perform testing per the AHJ!!

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510.5.3 Testing Continued

3) **Failure** of **not more** than two nonadjacent test areas **shall not** result in failure of the test.

Note: OK, read this 3 times quick and tell me what it means????

Here it is: **90%** of 20 locations is **18 locations**. Therefore only two locations can fail and still meet the 90% requirement. **However** the two locations that fail **can NOT** be adjacent.

Note: "**Special**" Areas require 99% passing per 1221

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510.5.3 Testing Cont

4) If three of the test areas fail the test the floor shall be permitted to be divided into **40 equal** test areas.

Failure of not more than **four nonadjacent** test areas shall not result in failure of the test.

If the system **fails the 40-area** test, the **ERRCS shall be altered** to meet the 90-percent coverage requirement.

Note: i.e. Fix the repeater system if it fails

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510.5.3 Testing Cont

5) Test locations approximately **in the center** of each test area, with the radio enabled to **verify two-way*** communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, **that location shall represent** the **entire test area**. Failure in the selected test location shall be considered failure of that test area. **Additional test locations shall NOT** be **permitted**.

Note: NO Cherry Picking test locations! Pick a location in each grid and test it. **Do not wander** around a grid area looking for the **"sweet spot"**. This should be a random test of the 20 or 40 grid areas, not standing by the DAS antenna, etc. to get a passing signal.

Remember: all testing should be **repeatable** by anyone that performs a similar test.

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510.5.3 Testing Note

***Note:* "Verify two-way communications"** in 5 above. Generally the return path to the Transceiver/Donor Tower **is calculated** based on the received signal levels and the levels received and amplified at the BDA based on Minimum and Maximum possible signal levels of a standard Fire or Police radio roaming the building.

The return path is usually measured only to the BDA, and calculated from there to the Transceiver/donor tower. This has been nearly universally accepted by every AHJ. However **do confirm** with the local **AHJ** before performing this procedure and show your work (i.e. calculations) if using this method. **There are exceptions!!**

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510.5.3 Testing Cont.

6) The **gain values of all amplifiers shall be measured** and the test measurement results **shall** be **kept on file with the building owner** so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

Note: A copy should be kept in a safe place by the building owner, and I suggest that a copy also be located with the other manuals and documents posted at the BDA

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510.5.3 Testing Cont.

7) As part of the installation **a spectrum analyzer** or other suitable test equipment **shall be utilized** to **ensure spurious oscillations** are not being generated. This **test shall** be conducted **at the time of installation and subsequent annual inspections.**

Note 1: It is not enough to check for the desired signals, but you must also look for undesired performance as well. Spectrum Analysis testing is best for this. **Save all tests!**

Note 2: You also (Per the FCC license you have been granted to use) need to ensure your **signal does not leak outside the building significantly**, or **cause loopback**. There are other areas of the NFPA, particularly the 1221, that deal with the many intricacies of testing an ERRCS as well as the complete FCC requirements

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510.5.4 FCC Compliance

The emergency responder radio coverage system installation and components shall also **comply with all applicable federal regulations** including, but not limited to, FCC 47 CFR Part 90.219

Note: see end notes of your **510 handout** for all of Part 90.219

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510.6 Maintenance

510.6) Maintenance. ERRCS shall be **maintained operational at all times** per Sections 510.6.1 through 510.6.3.

510.6.1) Testing and proof of compliance. The **ERRCS** shall be inspected and tested **annually** or where **structural changes** occur including additions or remodels that could materially change the original field performance tests.

Note: Generally anytime a **building permit** is pulled for any work for a building, including tenant improvements, it is considered a **structural change**

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510.6.1 Testing shall consist of the following:
Note: this is for Annual and Maintenance tests

1**) Full Grid test** as described in Section **510.5.3**.
2**) BDA tested** to verify that the **gain is the same as accepted**
3) **Backup batteries and power supplies shall be tested under load** of a period of **1 hour** to verify that they will properly operate during an actual power outage. If the battery exhibits symptoms of failure the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.

Note: This actual Battery testing is **NOT required by the 510** at the **initial installation**. However the designer should have designed (and shown their work) that a Battery Backup system would run 24 hours per the 510 code, or as needed by the AHJ. The testing is required for all annual inspections. **Some AHJs do require** this testing with the original installation—Check, Check, **Check!!**

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510.6.1 Testing Cont.

4) Other **active components shall be checked** to verify operation within the **manufacturer's specifications**.

5) At the conclusion of the testing, **a report**, which shall verify compliance with Section 510.5.3, **shall be submitted to the AHJ**.

Note 1: This submission to the AHJ was also done with the initial testing in order to get the ERRCS approved, though not so clearly stated

Note 2: A copy of this report should also be given to the Building Owner and posted at the BDA.

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510.6.2 Additional frequencies

510.6.2) The **building owner** shall **modify or expand** the emergency responder radio coverage system at **his or her expense** in the **event frequency changes** are required by the FCC or additional frequencies are made available by the FCC. **Prior approval** of a public safety radio coverage system on previous frequencies **does not exempt this section**.

510.6.3) Field testing. Agency personnel shall have the **right to enter** onto the property at any reasonable time to conduct field testing.

Note: This applies to AHJ Officials, not contractors

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The End of 510

Questions?

But Wait, there is more

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Other Good and Bad Code Violations

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Rooftop Antenna

316.4 (CFC) Obstructions on roofs. Wires, cables, ropes, antennas, or other suspended obstructions installed on the roof of a building having a roof slope of less than 30 degrees (0.52 rad) shall not create an obstruction that is less than 7 feet (2133 mm) high above the surface of the roof.

Note: This is so that emergency crews walking on the roof in obstructed conditions do not hit their head or poke out an eye with an antenna or supporting structures. If Antenna is over an area that can not be walked upon, then this rule probably does not apply, however it is up to the AHJ

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EPO / Emergency Power Off

Requirements vary between jurisdictions on the requirements of the BDA room. The EPO (**Emergency Power Off)** is understood by some jurisdictions to be required by **NEC 645.10-11 & / or 480.6**. It is a good idea for several reasons.

1) It cuts the power off to both the UPS and the BDA simultaneously in the event of an electrical event (fire, electrocution, etc.)
2) In the event that the BDA causes unwanted radio interference it is an easy way for emergency personnel unfamiliar with the radio to shut it down and stop the interference.

Check with your AHJ before deciding on weather or not to install an EPO. I have yet to find a jurisdiction that is opposed to an EPO.

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Antenna Grounding

NEC 800.93 Grounding. The antenna, mount, Cable all need to be properly grounded—before it enters the building! Many NEC codes refer to this.

810.20 Antenna Discharge Units – Receiving Stations.
(A) Where Required. Each Conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit

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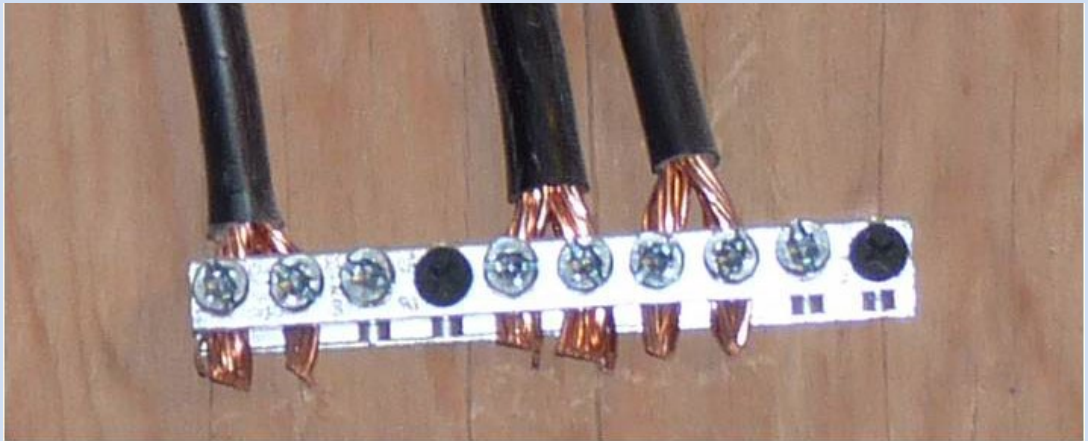
Grounding

Grounding: There are many codes (many in **NEC 647.6 & 810.21**) in the NEC that pertain to Grounding. However most important of these is that all parts in a grounding system are “Listed” or “Approved”.

Even the smallest ground connections will have UL or similar markings on them. It is **NOT** approved to have a ground lug so small that strands of wire need to be trimmed in order to use them.

Also all Ground Bus Bars (ANY device used to consolidate grounds from more than one source) must be connected using “two-hole lugs”. This later is covered by **NEC 800.24**, which refers to ANSI, etc. It is **ANSI 607-C 7.2.3 and 7.3.3** which covers the two-hole lug issue.



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Electrical Outlets

The electrical outlet that feeds the Battery System (i.e. feeding the entire BDA system) must have a **dedicated** power receptacle for the BDA system alone, and must be labeled to the Circuit Breaker (which must also be labeled).

This is covered by **NEC 708.10** and others. **Section C of 708.10** also covers the installation of conduit on all electrical cables in feeding the Battery and BDA systems.

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Notes on Vertical Riser and Horizontal Distribution cables

Level 3: 2 hour; In conduit and cement or other with Sprinkler
Level 2: Conduit and Sprinkler
Level 1: Conduit
Level 0: no protection
See NFPA 72, Chapter 24 for details
Typical.....2hr riser if building is rated....if building is only 1 hr rated....riser would be de-rated.
Horizontals.....Level 2 survivability for most new installs.
Level 3 in new high-rises.
Level 1 and Level 0: **perhaps** be allowed in existing building - special approval from fire marshal.

Check the plans and the Doors

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Cable between BDA and Donor Antenna

If Approved for a cable path stairwells are great for a 2 hour cable rating.

HOWEVER, we have found that there are contractors out there who place 1 or 1.5 hour doors in a 2 hour rated area. It is easy to check!!

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Cable Penetrations (for all locations)

Cable Penetration into/out of the room: This is very tricky and often wrong! Here is advice from **Andrew Tobias**, owner of Unique Fire Stop.

Regarding **"Approved Methods"** in the code book: This means: Tested and "rated' for the application. Ratings from the test are recorded in time. F ratings – T ratings – L ratings. An Inspector will require an independent facility like UL or ETL to test and rate systems. **No homemade systems allowed……**

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Cable Penetrations cont. Andrew Tobias

Per the NEC 300.21: YOU "MUST RESTORE THE HOURLY RATING OF THE FIREWALL". If you penetrate it with an **"approved"** system matching or exceeding the rating of the barrier then **you must show** the applicable UL listing so the AHJ can verify compliance.

Regarding placing just intumescent Fire Putty or caulk around a cable through a fire penetration:
Have the installation company provide the applicable UL **listing** for the application at hand. No test – no listing - no approval if you are not compliant.

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Cable Penetrations Cont. Andrew Tobias

If the installer presents a tested system for the **rating and situation**, then they would be OK. However if they have a 4” hole with a single cable could they just goop in a few tubes of the caulk and be good to go? I THINK NOT! Their selected listing will tell the details….. You must always inspect to the letter of the listing…

Most caulk (or putty) “sleeveless” **listings** involve small openings (1/2” or smaller).

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Cable Penetrations Cont. Andrew Tobias

Using intumescent putty or caulk by itself: The putty won't work without the vessel (i.e. Sleeves (listed conduit), or other containing pathway, etc.) because the is nothing to contain, control and direct the intumescent expansion during a fire. It will simply dislodge itself, **failing any test…..**

Sleeves won't work without putty as a "vessel of containment" to contain, control and direct the expansion of the intumescent during a fire and choke off the spread of fire and smoke..

AHJ is the last person to look at these new installs!

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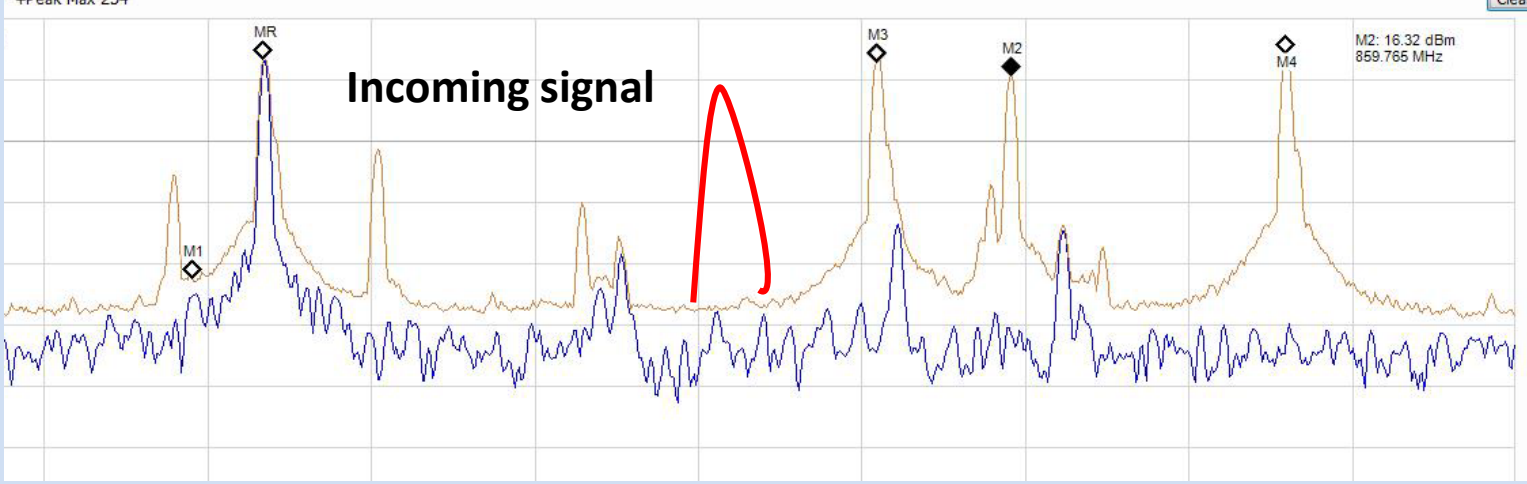
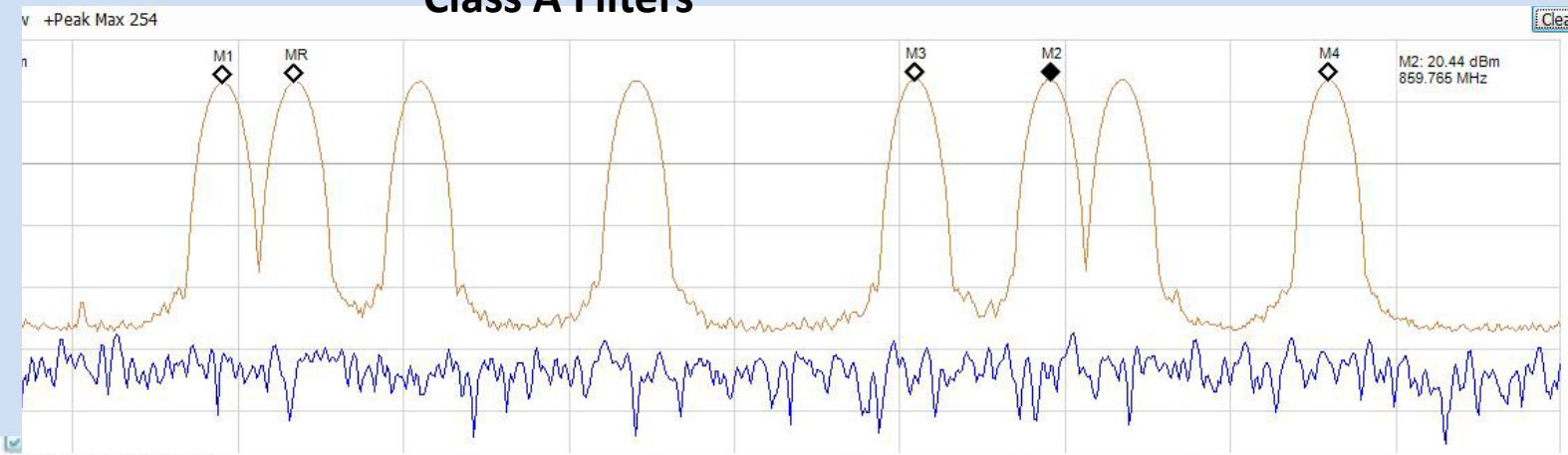
Class A and B

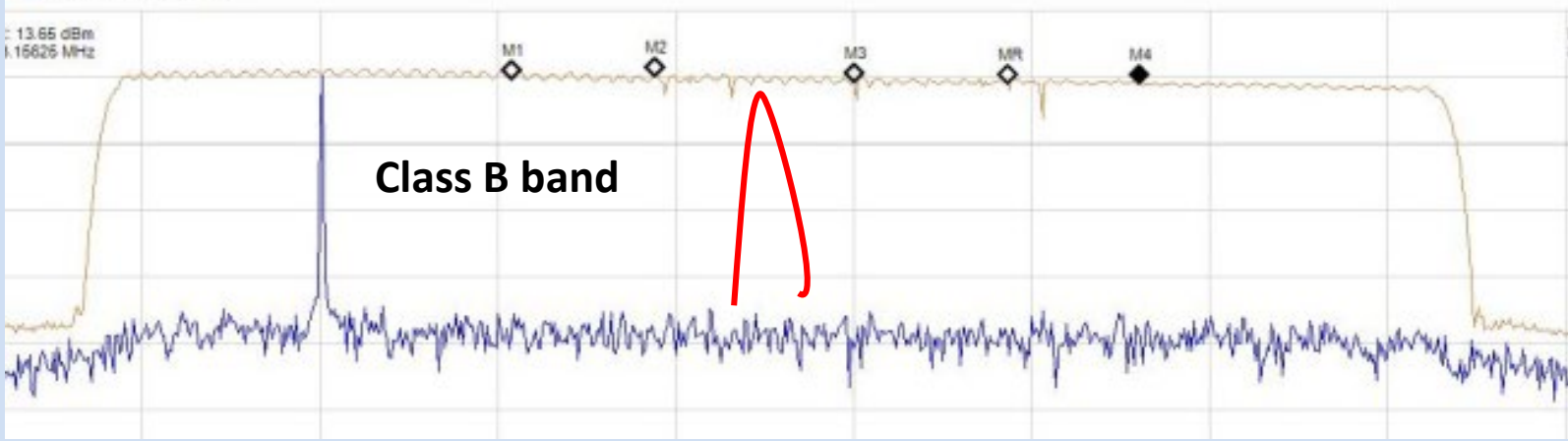
Class A amplifiers will not amplify unauthorized channels

Class B Amplifiers amplify everything between end points, even unauthorized Channels



Class A Filters





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Chris' notes about Class A Vs B

Class A is "supposed to be" one designated Amplifier/amplification per channel. This allows each Amplified Channel (assuming AGC is working/available) to always operate at the Ideal signal levels in both directions

However, the 75KHz channel allocated for this is sometimes shared between two 25 or 12.5 KHz Channels, which is technically legal, but not (IMHO) the intent of these amplifier.

These amplifiers typically have a limited number of Channels they can handle, so often several BDAs will be required to handle all of the channels in some systems properly.

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Chris' notes about Class A Vs B

Class B Repeats all the desired, and undesired (***other systems***) channels, which is why a Class B must be registered with the FCC (as well as the local Jurisdiction, as does the Class A above).

Class B will Change the power/amplification of individual Channels based on the aggregate power of all the Channels in use: therefore if many radios are transmitting on many carriers at the same time across the BDA all the Carriers will be lowered in power from the optimum. Not common but it CAN happen, especially when there is an emergency and many users are in the building at once.

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Thank you

- **Chris Herrington**, PMP, RCDD/OSP & WD Specialist
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