

P25, Trunking, & MARCS, Oh My

APCO who?

P25 why?

P25 what?

APCO

- Association of Public Safety Communications Officials
- Around since 1935
- Promote development of PS communications technologies
- Represent its members before regulatory and policy making entities (lobby)

Project 25

Projects 20 – 24 not entirely successful?

- Various digital protocols (VSELP)
- Vendor specific
- Not interoperable
- Reduced competitive landscape

Project 25

US Congress directed the FCC in 1988 to solicit recommendations

APCO Project 25 committee

Establish common digital radio standards (TIA-102)

Ensure interoperability

Spectrum efficiency

Alphabet soup of agencies

TIA, NITA, DOD, NASTD, NCS, NSA, POKY, GMBY

Project 25

Common Air Interface (CAI)

Specifies the type and content of signals transmitted by compliant radios

Phase 1

IMBE codec vocoder

12.5 FDMA radio channel

C4FM modulation (4 level FSK)

CQPSK (LSM) modulation for simulcast

4800 Baud

2 Bits per symbol

4400 bits voice payload

2800 bits FEC

2400 bits signaling

9600 bps throughput

P25 Phase 1: Full-rate vocoder (7200 bps)

Voice 4400 bps	FEC 2800 bps	Signaling 2400 bps	= 9600 bps
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Project 25

Common Air Interface (CAI)

Specifies the type and content of signals transmitted by compliant radios

Phase 2

AMBE+2 codec vocoder

12.5 TDMA radio channel

H-DQPSK Harmonized Differential Quadrature Phase Shift Keying (linear)

H-CPM Harmonized Continuous Phase Modulation (non-linear)

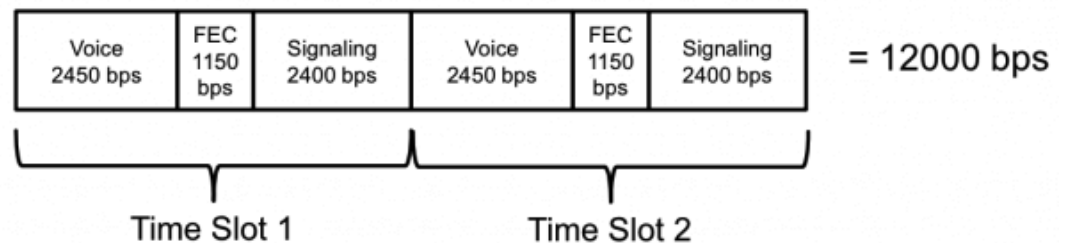
2450 bits voice payload/TS

1150 bits FEC/TS

2400 bits signaling/TS

12000 bps throughput both TS

P25 Phase 2: Half-rate vocoder (3600 bps)



Project 25

NAC: Network Access Code

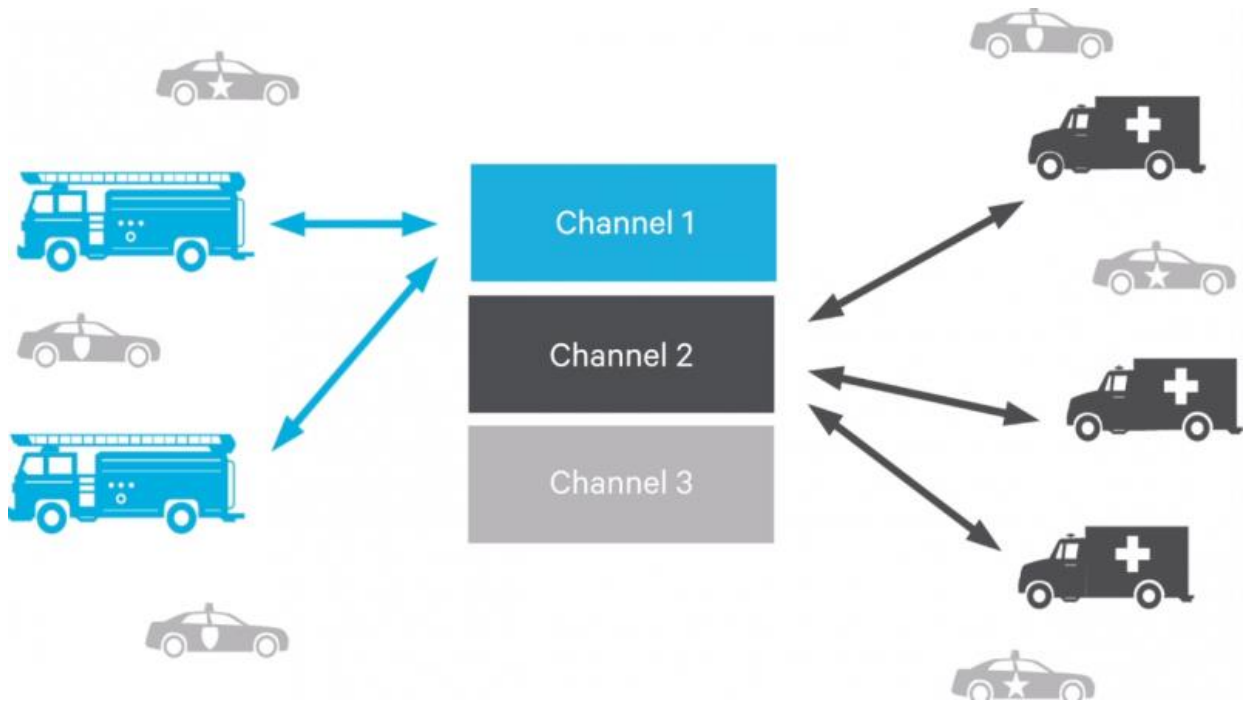
Three digit hex code (12 bit) prefixes every packet of data, including those carrying voice.

- \$293 Default NAC
- \$F7E Decode all
- \$F7F
Repeater will allow all incoming decoded signals and the repeater transmitter will retransmit the received NAC

Trunking – The basics

Conventional System

The radios are manually switched to the correct channel.



Trunking – The basics

Trunking System

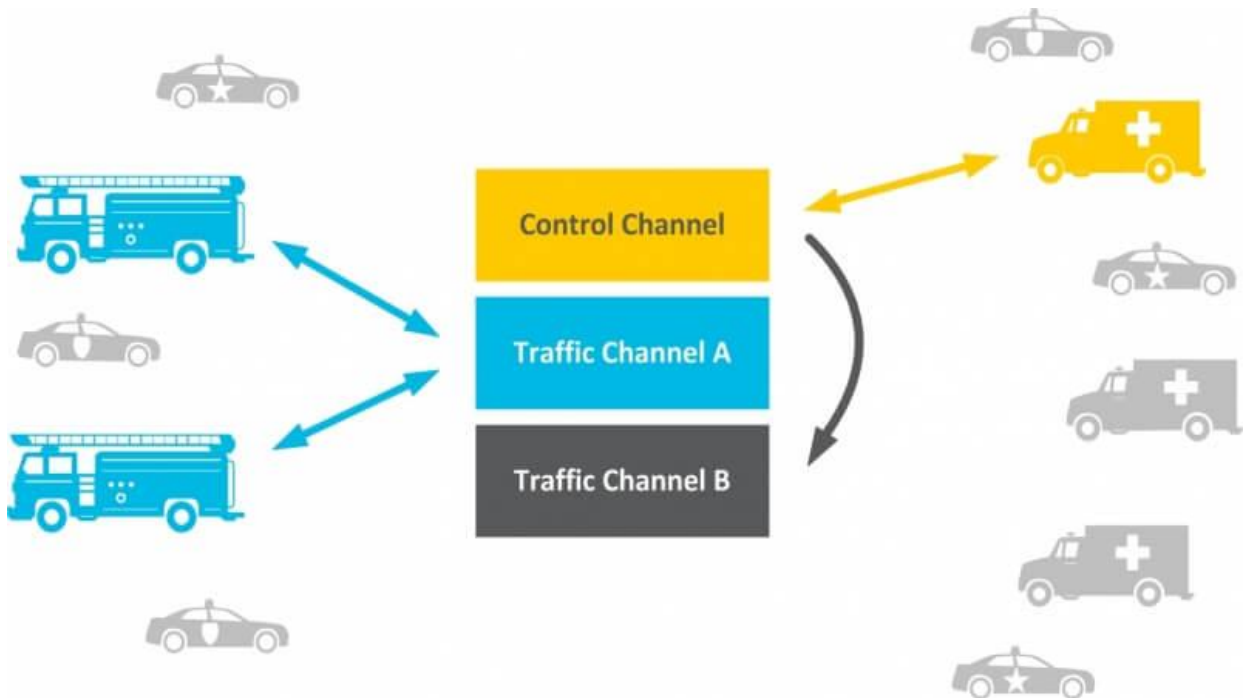
A pool of repeaters available for voice and data calls, (traffic channels), an additional repeater acts as a control channel.



Trunking – The basics

Trunking System

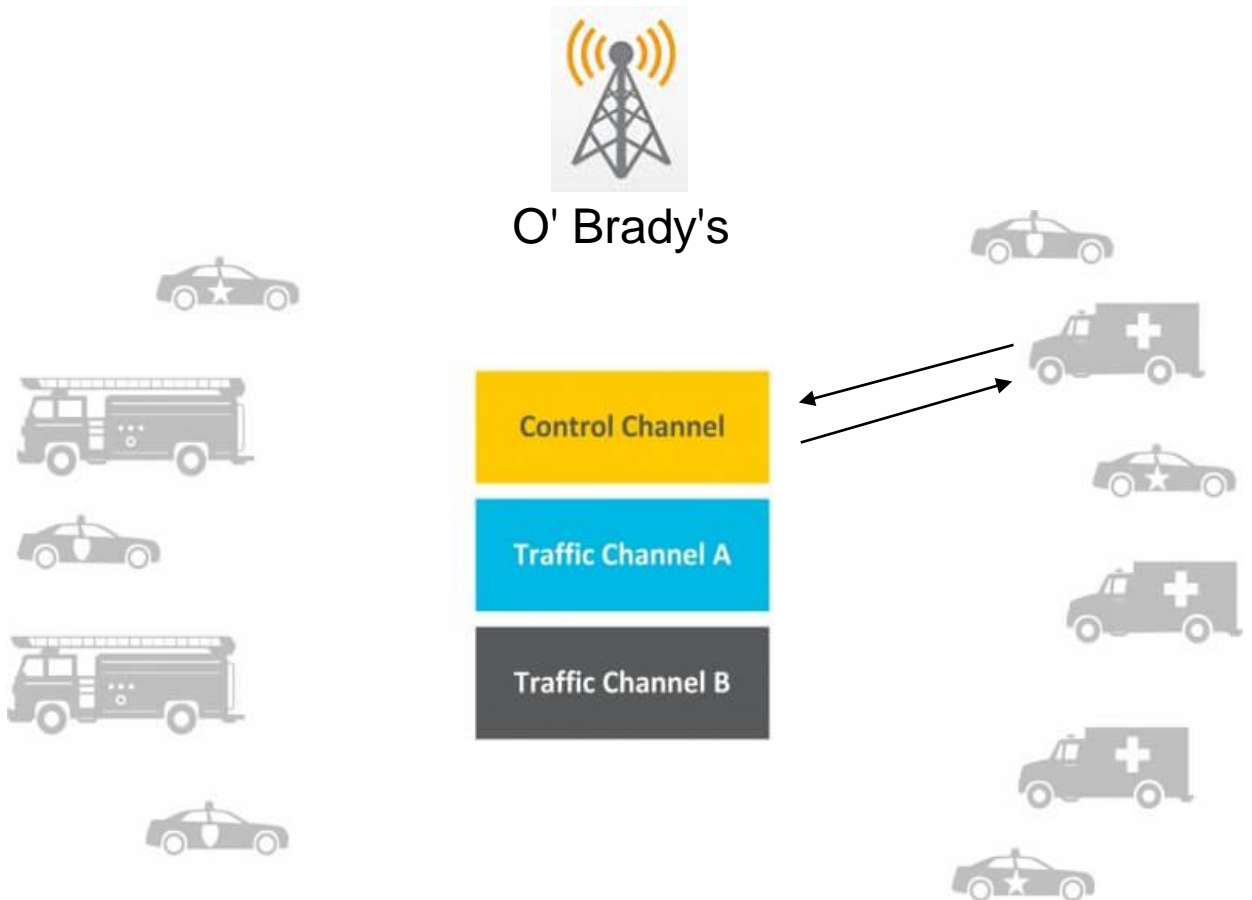
The control channel is used by the system to communicate with the mobile and portable radios, allowing them to request and be allocated a traffic channel from the pool of available repeaters.



Trunking – The basics

Registration & Affiliation

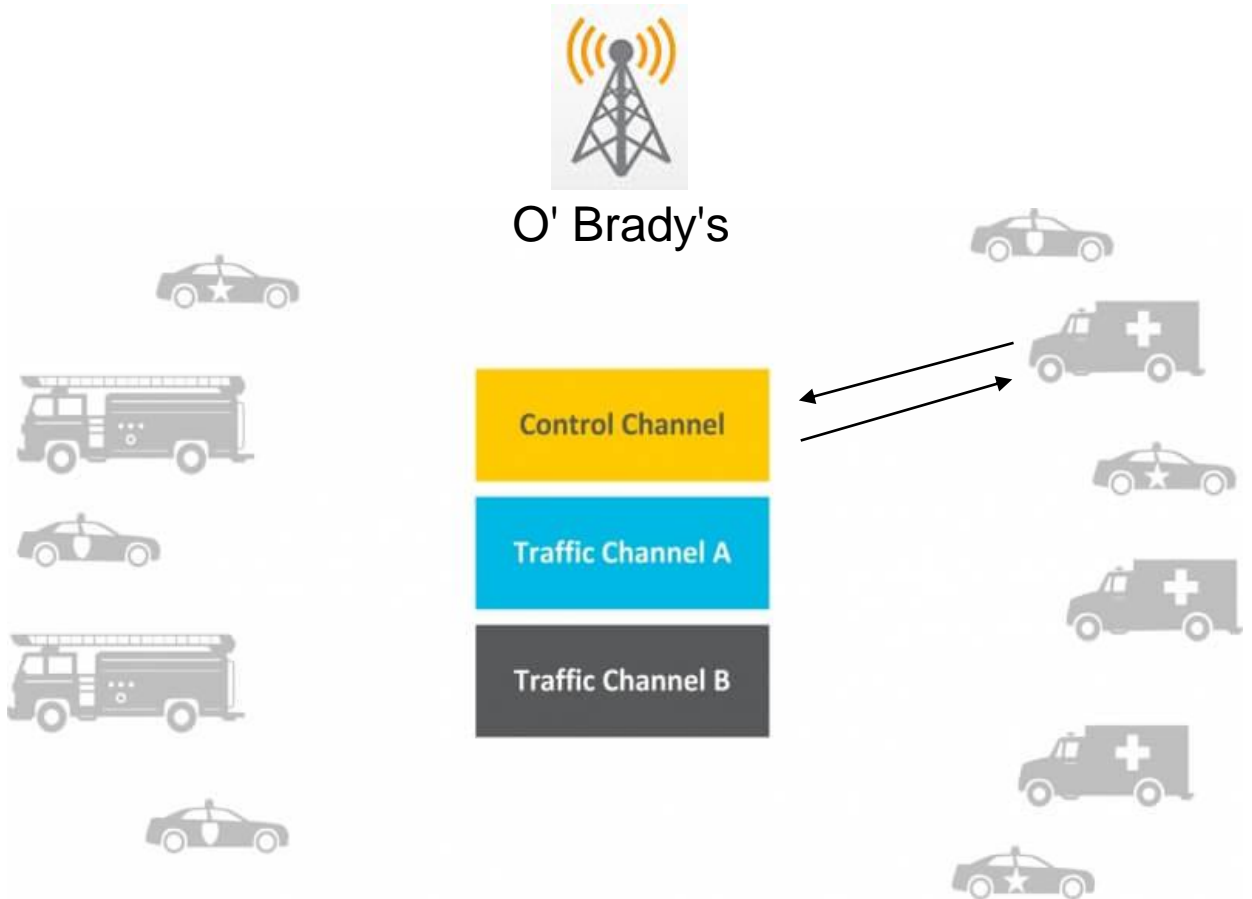
- Find system
- Register
- Affiliate TG
- Ack & direct S.U.



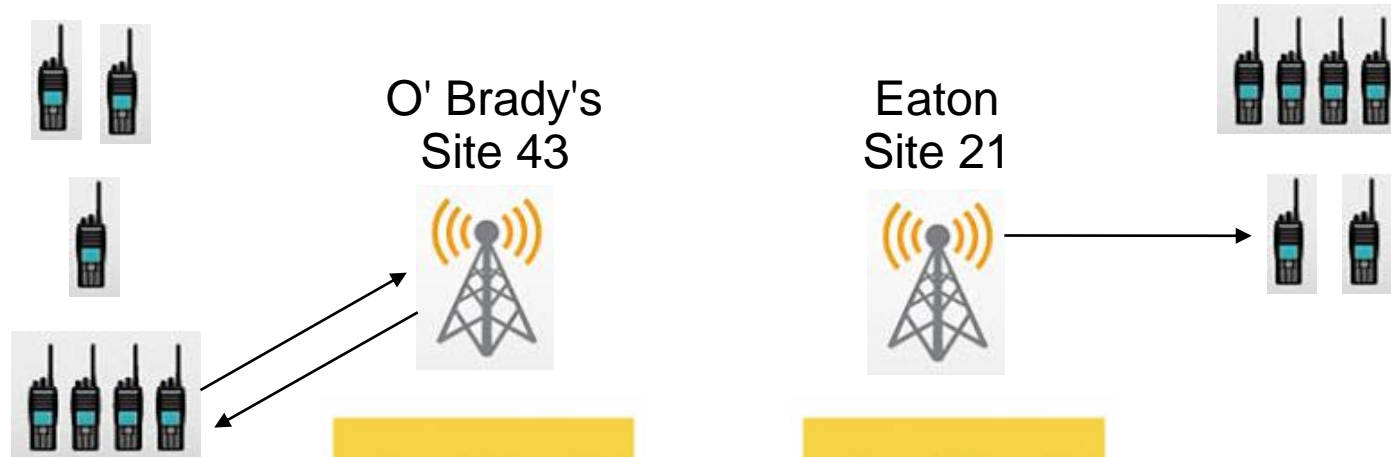
Trunking – The basics

Mobility Register

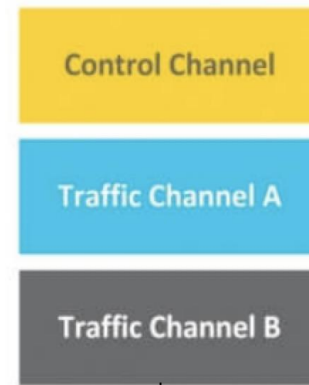
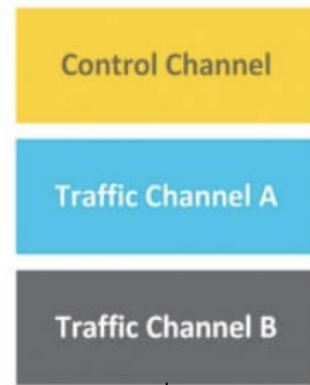
SubUnit ID	TG
2590019	TechSrv
4103	WadsEMS
4110	WadsPD
2135	WadsFD
2553	WadsEMS
4101	BarbrPD
13123	WadsEMS



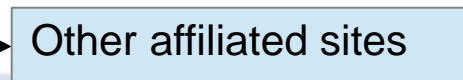
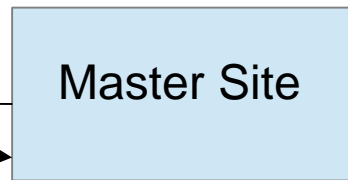
Trunking – Multi Site



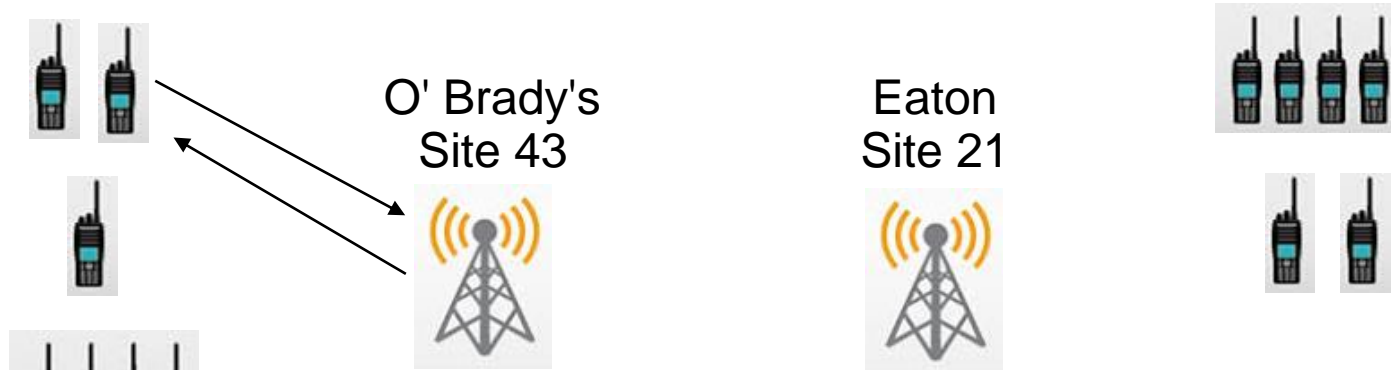
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4101	WadsPD
4103	WadsPD
2353	WadsPD
13123	WadsPD



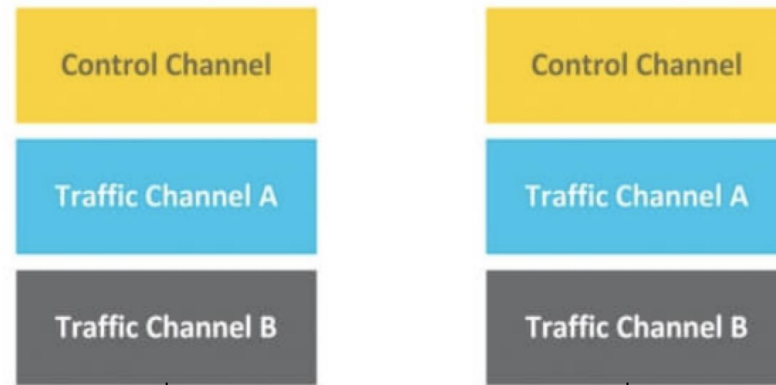
SubUnit ID	TG
1292	EatonFD
1358	EatonFD
340012	EatonFD
102939	EatonFD
10751	WadsPD
2353	WadsPD



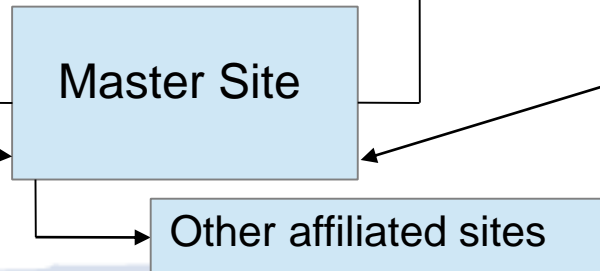
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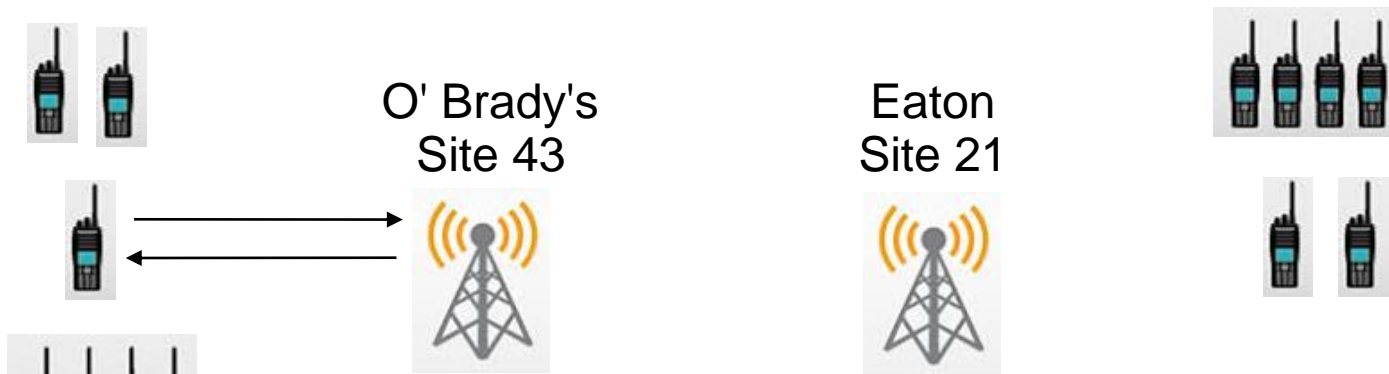
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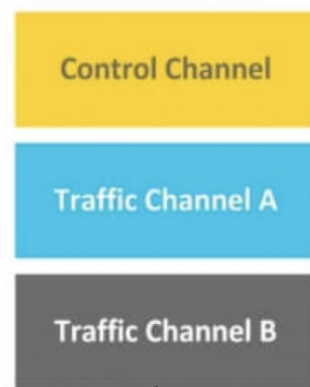
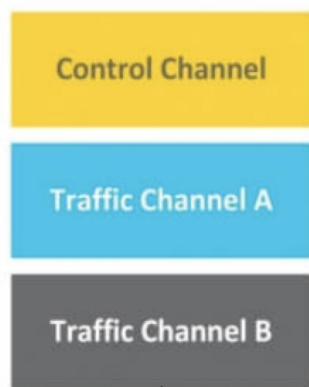
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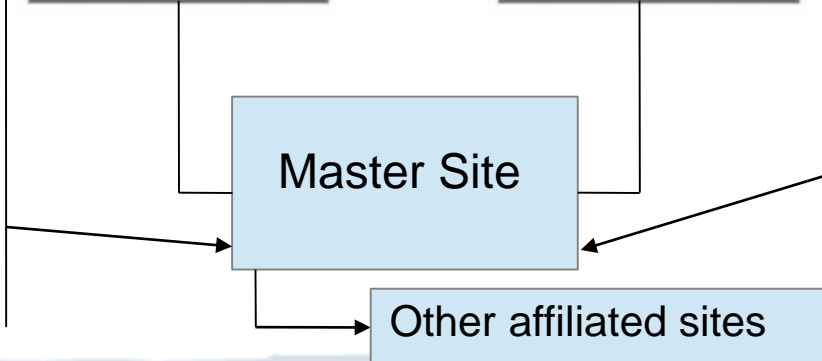
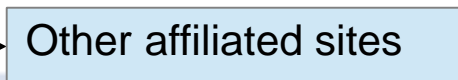
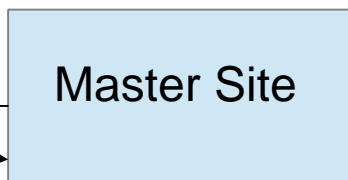
Trunking – Multi Site



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2135	WadsEMS
4110	WadsEMS
4101	WadsPD
4103	WadsPD
2353	WadsPD
13123	WadsPD



SubUnit ID	TG
1292	EatonFD
1358	EatonFD
340012	EatonFD
102939	EatonFD
10751	WadsPD
1701	WadsPD



Trunking – Multi Site Scan

EatonFD active

Eaton
Site 21



Unit 2353 Scan List

EatonFD

WadsPD

WadsEMS

Control Channel

Traffic Channel A

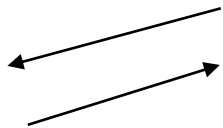
Traffic Channel B

SubUnit ID	TG
1292	EatonFD
1358	EatonFD
340012	EatonFD
102939	EatonFD
10751	WadsPD
2353	WadsPD

Trunking – Multi Site Scan

WadsPD active

Eaton
Site 21



Unit 2353 Scan List

EatonFD
WadsPD
WadsEMS

Control Channel

Traffic Channel A

Traffic Channel B

SubUnit ID	TG
1292	EatonFD
1358	EatonFD
340012	EatonFD
102939	EatonFD
10751	WadsPD
2353	WadsPD



Affiliated on WadsPD

Trunking – Multi Site

WadEMS active at O' Brady's site

Eaton
Site 21



Unit 2353 Scan List

EatonFD

WadsPD

WadsEMS

Control Channel

Traffic Channel A

Traffic Channel B

SubUnit ID	TG
1292	EatonFD
1358	EatonFD
340012	EatonFD
102939	EatonFD
10751	WadsPD
2353	WadsPD

No units are affiliated to WadsEMS on the Eaton site.

Nothing heard on WadsEMS.

← Affiliated on WadsPD