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TRACKING MOTOROLA SYSTEMS

The most common trunked radio systems in use by public safety agencies in the United States are those manufactured by Motorola. This month we'll briefly review the different systems and go into more detail with each one in the coming months.

Broadly speaking, there are four main types of Motorola systems. They are Type I, Type II, Type I/II hybrids, and ASTRO. With the exception of ASTRO, voice transmissions in these systems are analog, meaning you can hear them on a regular scanner.

Motorola Type I

Type I is a first generation trunking system that operates only in the 800 MHz range. You may also run across the phrase "Privacy Plus," which started out in life as a Motorola marketing term for a Type I system.

Type I systems are somewhat more confusing to a beginning listener because of the way talk groups are assigned. As you may recall from previous columns, conventional (non-trunked) two-way radio creates talk groups by assigning a different radio frequency to each group of users. In trunked radio systems, a small set of radio frequencies is shared among a number of groups, with each group having their own "talk group" identifier. In a public safety system, for example, a city may have the police department in one talk group, the fire department in another talk group, and the streets and sanitation department in a third talk group. These talk groups are distinguished by digital codes that the radios transmit and receive.

Fleets and Subfleets

Type I systems are organized into a hierarchy of fleets, subfleets, and users. Each fleet is made up of several subfleets, and each subfleet in turn is made up of individual radio identifiers. A fleet is usually a group of subfleets that all work for the same organization, like a police or fire department. Each of those subfleets is made up of individual users who have the same kind of job and don't usually need to talk to other subfleets. Within a police department fleet, for instance, you may have patrol, detective, and traffic subfleets, and each of those subfleets will be made up of individual officers.

Each Type I system has a fixed number of fleets, subfleets, and radio identifiers. Some users may need many fleets with just a few subfleets and numerous individual radios, while others may require just one fleet with many subfleets and a handful of individual radios. Type I system designers must plan for growth in the beginning, since the number of identifiers any fleet or subfleet can support is limited and the selections are not easily changed once a system is running.

Radio Addressing

Radios in any trunked system have a digital "address" that uniquely identifies them and are held in a part of the radio called a "code plug." Addresses are part of what mobile radios and repeaters transmit, and what trunk-tracking scanners decode.

Address information in a Type I system is broken up into eight blocks, numbered zero through

seven. Each block is assigned a "size code" that determines how many fleets, subfleets, and individual radio identifiers can be supported in that block. For instance, a block with a size code of S-2 can support, at most, 16 fleets, 8 subfleets per fleet, and 64 individual radio identifiers per subfleet. Size codes S-12, S-13, and S-14 are special in that they take up more than one block. S-12 uses two blocks, S-13 uses four blocks, and S-14 takes up all eight blocks.

MAXIMUM VALUES FOR TYPE I SYSTEMS

Motorola Size Code	Uniden Size Code	Fleets	Subfleets	IDs
A	S-0	(used with Type II systems)		
B	S-1	128	4	16
C	S-2	16	8	64
D	S-3	8	8	128
E	S-4	1	16	512
F	S-5	64	4	32
G	S-6	32	8	32
H	S-7	32	4	64
I	S-8	16	4	128
J	S-9	8	4	256
K	S-10	4	8	256
L	S-11	2	16	256
M	S-12	1	16	256
N	S-13	1	16	1024
O	S-14	1	16	2048
Q	S-15	1	16	4096

A "fleet map" is the size code for all eight blocks. The combination of block, fleet, subfleet, and radio identifier is a Type I address that uniquely identifies a radio.

Scanning Chicago's O'Hare Airport

The Command Center at O'Hare International Airport in Chicago uses a Type I trunking system for a variety of ground operations, including security, fire, and parking. They are assigned seven radio frequencies: 856.7625 MHz, 857.7625 MHz, 858.7625 MHz, 859.7125 MHz, 859.7625 MHz, 860.7125 MHz, and 860.7625 MHz.

Trunk-tracking scanners come with a number of preprogrammed fleet maps. For O'Hare, the fleet map that seems to work well is E1P4, which looks like this:

BLOCK SIZE CODE

0	S-12
1	-
2	S-4
3	S-4
4	S-4

5	S-4	
6	S-4	
7	S-4	

Blocks 0 and 1 are used by S-12, which supports one fleet with sixteen subfleets and 1024 unique radio identifiers. Assignments of each subfleet, as reported by listeners, is as follows:

FLEET	SUBFLEET	ASSIGNMENT
000	01	Dispatch
000	02	Trades
000	03	Electrical
000	04	HR
000	05	Construction
000	06	Parking
000	07	Ground Transportation
000	08	F 100
000	09	Police
000	11	Fire
000	12	Operations
000	13	Security
000	14	Emergency
000	15	Aircraft Rescue and Fire Fighting
000	16	Accident Control

Motorola Type II

Type II systems are the second generation of Motorola trunking technology, which they sell under the trademark "SmartNet." These systems operate in the 800 MHz, 900 MHz, VHF, and UHF bands and provide emergency signaling, enhanced security, remote monitoring, and more flexible grouping options. Type II systems can have, at most, 28 radio channels and 4000 talk groups, but the most significant difference to a radio listener is the change in how radios are addressed.

Type II radios use two different types of addresses, a radio identifier and one or more talkgroup codes. Every radio in the trunked system has assigned to it a unique, individual identifier. Every talkgroup also has a unique identifier, designated by a hexadecimal code.

A radio may be added to a talk group by simply adding the corresponding hexadecimal code to the radio. Because radio identifiers are separate from talkgroups, there is no need to reprogram every radio in the system and no limit to the number of radios that can participate in a talkgroup.

Scanning Disneyland

Disneyland amusement park in Anaheim, California, is reported to use a Type II system for security and park operations. I've gotten one report that they use five frequencies in the 800 MHz band, namely 861.5125 MHz, 862.5125 MHz, 863.5125 MHz, 864.5125 MHz and

865.5125 MHz, but the more likely frequencies are 938.3875 MHz, 938.4000 MHz, 938.4375 MHz, 938.4500 MHz, 938.4625 MHz, 938.4750 MHz, 938.4875 MHz, and 938.5000 MHz. The Anaheim Police Department is supposed to have a patch into the system as well. Can anyone confirm the proper frequencies and talkgroups?

Type II systems may also be linked together to form a "SmartZone" (another Motorola marketing term). As many as 48 sites can be interconnected using microwave or landline links to provide communications over a wide area. Mobile radios transmit to the nearest site but can participate in a talkgroup with other radios operating through other sites.

Motorola Type I/II Hybrid

A hybrid system contains a mixture of Type I and Type II radios. It is often used by an organization that is transitioning to a Type II system but wants to keep using their old Type I equipment.

Hybrid systems can be confusing to trunk-tracking scanner listeners, since the received signal may contain both talkgroups and fleet/subfleet addresses.

Scanning Arlington, Texas

The city of Arlington, Texas uses a hybrid system on the following eight radio frequencies: 856.4875 MHz, 856.7125 MHz, 857.4875 MHz, 857.7125 MHz, 858.4875 MHz, 858.7125 MHz, 859.4875 MHz, 859.7125 MHz, 860.4875 MHz, and 860.7125 MHz.

The appropriate fleet map for Arlington looks like:

BLOCK	SIZE CODE
0	S-4
1	S-11
2	S-12
3	-
4	S-11
5	S-0
6	S-0
7	S-0

The fire department uses Type I fleet addresses beginning with 100 and the police use Type I fleet addresses beginning with 200. Other services use fleets 000 and 101. The University of Texas at Arlington shares the system and uses several talkgroups with Type II addressing.

Motorola ASTRO

ASTRO is a Motorola trademark for their line of digital voice radios. An ASTRO system is similar in concept to a Type II system except that a user's voice is transmitted in digital rather than analog form. This means that scanners on the market today cannot decode the voice portion of the conversation.

ASTRO is Motorola's answer to APCO Project 25. The Association of Public Safety Communications Officials (APCO) began Project 25 to produce a set of technical standards for

land mobile radios. These radios are designed meet the needs of public safety users and allow maximum interoperability between different jurisdictions, including local, state, and federal government agencies. These standards are open and available to the public, although the complete printed set of documents is rather expensive (more than $2500). The most annoying part of the standard as far as scanner listeners are concerned is the digital voice transmissions. Look for more information on that subject in a future column.

Large municipalities, such as Cleveland and San Diego County, California are the main customers for ASTRO. Several statewide systems are also in operation, including Florida, Massachusetts and Michigan.

One of the more recent conversions to ASTRO is the city of Baltimore, Maryland. Their $65 million system came on-line last November with 28 channels and nine simulcast sites. More than 5,000 mobile and portable radios are using the 800 MHz system.

Last July the city of Philadelphia signed a $51 million contract for two 15-channel ASTRO systems linked via SmartZone. More than 6,000 radios are expected to operate over their system.

That's all for this month. I welcome your comments, questions, frequency lists and talkgroup information via electronic mail at dan@decodesystems.com. You can also check my website at www.decodesystems.com for more information on wireless communication. Until next time, happy monitoring!

Comments to Dan Veeneman

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