Rebanding: Do I Need a New Railroad Scanner?

by Dan Rapak

The buzz in the communications industry these days is "rebanding." The communications industry touches our lives more and more every day. Everything from cell phones to wireless Internet to digital television to two-way radio revolves around radio communications of some form or another. This includes railroad communications and eventually, the scanners that many of us use to monitor railroad voice communications may have to change.

What is "Rebanding" and Why are We Doing This?

There are tons of new electronic gadgets available for people today. Use of the things above plus 3G and 4G smart phones, iPads, Kindles and other toys continues to grow. Each of these devices use radio signals to get their data or to allow you to talk to Grandma. The problem is, there is only so much radio spectrum to go around. As a matter of physics, there are a limited number of frequencies (or channels) available for everyone to use and we're beginning to run out. To address this, the Federal Communications Commission (the FCC) has taken steps to squeeze more channels out of the available radio spectrum.

In the "old days" state-of-the-art radio equipment wasn't as precise or as stable as things are today. A railroad radio that was supposed to operate on 160.980 MHz would drift around a little. It might really operate on 160.978 or 160.982. To make matters worse, radios would drift as the temperature changed or as the voltage in the locomotive varied or as the battery in the hand-carried radio drained down. Radio wasn't an exact science. That's just the way things were in the days of vacuum tubes and even into the days of transistors. To allow for this, the FCC spaced radio channels a good distance apart to keep people from interfering with one another. If your radio drifted a little, no problem. You didn't drift into the next guy's channel.

Another factor was filtering and how sharply a radio could tune to a given channel. If I want to communicate on 160.980 and someone else wanted to communicate on 160.985 it wouldn't work. The radios of the day couldn't tell the difference. Our conversations would overlap and interfere with each other. Think of it like office cubicles. If people in adjacent cubicles are carrying on conversations, you hear each other. The only way to avoid the problem is to keep the cubicles farther apart. In radio, this means spacing channels farther apart and that meant eating up more of the available radio spectrum.

Today things are different. Modern digital circuitry and manufacturing techniques make radios much more stable. That radio on 160.980 isn't going to drift as much. It's going to stay pretty darned close to 160.980. Plus, the filtering is much better. Instead of office cubicles we now have separate offices with real walls. You heard the guy in the next cubicle, but you don't hear the guy in an adjacent office. Your conversations no longer overlap and interfere.

As a result, the FCC has decided to redistribute or "reband" the channels within the radio spectrum. Radio channels are moving closer together and the channels themselves are being made narrower. This will allow us to squeeze more channels into less space and add much needed capacity. This is being done across the board. Every radio service from police, fire and EMS to taxicabs and radio dispatched pizza delivery trucks are being affected.

In the case of railroad communications, the number of channels available for the railroads to use will double. Basically there will be a new channel squeezed in between each of the existing channels and all of the channels – including the existing channels – will be half the width or less. See Table 1 below.

What does this mean for existing scanners?
Initially, we won't notice much difference. Even after the rebanding is completed, if the railroads aren't having any interference problems now there's no real reason to change to the new (additional) channels. You might see some changes in larger cities that are served by several railroads where interference is an issue, but road channels will likely change very little.

What you will notice is that the volume level of your scanner will go down and the background noise will increase as railroads convert from the old, wide channels to the new, narrower ones. Like most two-way radio systems, railroads use frequency modulation or FM. With FM, the frequency of the carrier wave changes in accordance with the audio. The louder the audio, the further the carrier changes its frequency. In rebanding, the channel widths are being cut in half. That means that the carrier can't swing its frequency as far. Your old scanner is still looking for the carrier to swing the width of the old, wide channel. Instead, the carrier will only be swinging half that much. Since your scanner only sees half the swing, it will only produce half the volume. The bottom line: you have to crank up the volume a bit more than you currently do.

Another thing you may notice is more background noise when you turn that volume up. Again, your scanner is looking at the old, wide channel while the railroad is only using half of it. The unused part is filled with static. That static will mix with the voice and add some "hiss" to the communications.

While your current scanner will continue to tune the existing channels just fine (albeit at a reduced volume level) it may or may not be able to tune the newer, "sandwiched in between" channels. This depends entirely on the particular make and model of scanner you own. If your radio tunes only in steps of 5 kHz or greater you won't be able to tune the new channels directly. If it can tune in smaller steps you'll probably be okay. Table 2 at the end of this article lists all the AAR Channels after rebanding. Try to tune the new channels (AAR 107 and up) on your scanner. Again, there probably won't be a ton of activity on the new "in-between channels" for some time so this isn't really a show stopper.

What about new scanners?
Newer model scanners are already designed with these changes in mind. The exact nomenclature used to refer to channel width varies from one manufacturer to another. I have a Uniden / Bearcat that has a mode called "WFM" or Wide FM for your local FM radio stations, "FM" for the current day channels and "NFM" or narrow FM for the new, rebanded channels. The literature for the new radio should specifically state that it accommodates the new, narrow, rebanded channels.

What about digital?
You may have heard that the new rebanding means railroads will convert to digital. Digital is not compatible with currently available scanners. Conversion to digital is now an option for the railroads to use, but it is NOT yet a requirement. It probably WILL be a requirement within the next ten years, but it is not a requirement just yet. With all of the existing infrastructure that's out there plus the fact that locomotives must operate in interchange service between various railroads it is reasonable to expect the railroads to remain analog for several more years. However, looking toward the future, the railroads are beginning to experiment with digital radios. The American Association of Railroads (the AAR) is recommending that all new radios purchased be capable of digital operation. That way, when the FCC mandates a conversion to digital, the changeover will

simply involve the flip of a switch. The fly in the digital ointment as far as scanner users are concerned involves the type of digital radios the railroads are experimenting with.

Just as analog radio has AM and FM (and a few lesser known modulation methods) digital radio also has several modulations methods available, each with its own advantages and disadvantages. This is why a Verizon digital cell phone isn't compatible with Sprint's cell phone network. Without a dual mode phone, you can't roam with a Verizon phone on Sprint and vice versa. Think of one as AM and the other as FM. They can't talk to one another even if they're on the same channel.

To date, most digital two-way radio systems – those used by first responders, etc. – use a digital system called APCO P25. So far, this is the only digital system built into the modern scanners available today. However, P25 isn't the only digital system out there. Another system that is beginning to hit its stride is called NXDN and this is the system chosen by the AAR as the digital standard for railroad radios. As of this writing there are no scanners that are capable of receiving NXDN radio signals. So, we'll just have to wait and see what scanner manufacturers come up with.

What about scrambling?

Scrambling (or encryption) involves altering the signal so that it can't be received by the general public. Some law enforcement agencies encrypt their communications to prevent the bad guys from listening in. Of course this prevents you and me from listening in as well. While it's possible to crack the code of some scrambling methods, in the United States it is illegal to do so. So even if you have a hack that will let you listen in on scrambled police calls, you could go to jail if you're caught.

That said, it's important to understand that digital radio DOES NOT necessarily mean encrypted radio! Digital is just another method of impressing sound on a radio wave. Just as we've had AM and FM as analog modulation for years, now we have various forms of digital modulation. And just as some analog radio transmissions are encrypted and some are "in the clear" we also have digital radio transmissions that are encrypted and some that are in the clear.

While there have been rumors that railroads would encrypt their signals when they convert to digital, I've read nothing on the AAR website or elsewhere that indicates this is true. Unless you are really paranoid about homeland security issues, there would be little reason for railroads to encrypt. In any event, this is something railroad enthusiasts have no control over so there's no point in worrying about it. If the railroads decide to encrypt their signals, no scanner sold in the US will be able to receive the communications.

When is this all going to happen?

It pretty much already has happened. The AAR set a date of July 1, 2010 as the date by which all locomotives should be voluntarily converted to narrow band transmissions. A complete list of changeover dates were posted on the AAR web site. Most of the major railroads have completed their changeovers. At some of the smaller regional railroads and short lines, this may still be a work in progress. There also seem to be a number of talking defect detectors here and there that have not yet been switched over and thus sound much louder than the rest of the communications.

Summary:
The bottom line of rebanding is this:

- ✓ New channels have been added, but will probably not see wide spread use in the immediate future.
- ✓ Your present scanner will continue to receive the current channels, though you will have to turn up the volume control a bit more than usual and you may notice a bit more background hiss.
- ✓ Your current scanner may or may not be able to tune the new channels that have been added. It depends entirely on the particular model of scanner you own.
- ✓ If your scanner can't tune the new channels, don't sweat it. Initially, activity on the new channels should be minimal.

If the railroads convert to digital:

1. We will all have to buy new scanners as there are no scanners manufactured today that can receive the NXDN digital format that the railroads are looking at.
2. We will have to wait to make that purchase until someone manufactures a scanner that can receive the NXDN format since none exist today (January 2013.)

The bottom line: Hang onto your current scanner for the time being. It should continue to serve you in monitoring railroad communications for some time to come. If you're thinking of buying a new scanner, you might want to hold off until scanners with NXDN capability are available.

Table 1 - Comparison of Old Channels to New, Narrow Channels

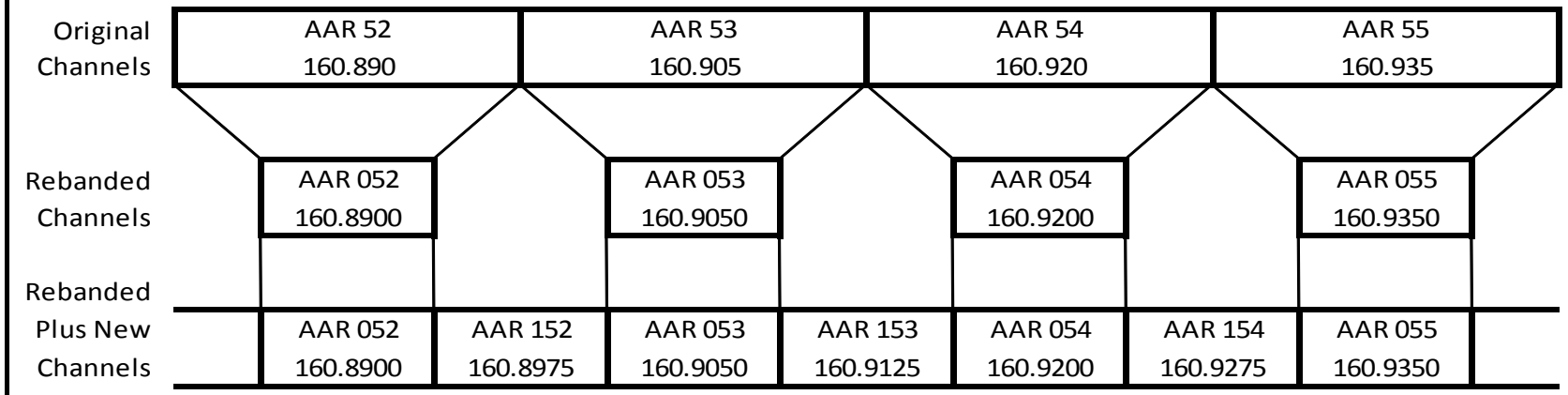

Table 2 - AAR Channel Assignments After Re-Banding

Note that the original, old channels numbers are retained but with the addition of a leading zero to indicate they are narrow band. Old AAR 45 becomes new AAR 045.

Original AAR Channel Assignmments				Additional AAR Channel Assignments			
Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel
159.8100	AAR 002	160.8600	AAR 050			160.8675	AAR 150
159.9300	AAR 003	160.8750	AAR 051			160.8825	AAR 151
160.0500	AAR 004	160.8900	AAR 052			160.8975	AAR 152
160.1850	AAR 005	160.9050	AAR 053			160.9125	AAR 153
160.2000	AAR 006	160.9200	AAR 054			160.9275	AAR 154
160.2150	AAR 007	160.9350	AAR 055	160.2225	AAR 107	160.9425	AAR 155
160.2300	AAR 008	160.9500	AAR 056	160.2375	AAR 108	160.9575	AAR 156
160.2450	AAR 009	160.9650	AAR 057	160.2525	AAR 109	160.9725	AAR 157
160.2600	AAR 010	160.9800	AAR 058	160.2675	AAR 110	160.9875	AAR 158
160.2750	AAR 011	160.9950	AAR 059	160.2825	AAR 111	161.0025	AAR 159
160.2900	AAR 012	161.0100	AAR 060	160.2975	AAR 112	161.0175	AAR 160
160.3050	AAR 013	161.0250	AAR 061	160.3125	AAR 113	161.0325	AAR 161
160.3200	AAR 014	161.0400	AAR 062	160.3275	AAR 114	161.0475	AAR 162
160.3350	AAR 015	161.0550	AAR 063	160.3425	AAR 115	161.0625	AAR 163
160.3500	AAR 016	161.0700	AAR 064	160.3575	AAR 116	161.0775	AAR 164
160.3650	AAR 017	161.0850	AAR 065	160.3725	AAR 117	161.0925	AAR 165
160.3800	AAR 018	161.1000	AAR 066	160.3875	AAR 118	161.1075	AAR 166
160.3950	AAR 019	161.1150	AAR 067	160.4025	AAR 119	161.1225	AAR 167
160.4100	AAR 020	161.1300	AAR 068	160.4175	AAR 120	161.1375	AAR 168
160.4250	AAR 021	161.1450	AAR 069	160.4325	AAR 121	161.1525	AAR 169
160.4400	AAR 022	161.1600	AAR 070	160.4475	AAR 122	161.1675	AAR 170
160.4550	AAR 023	161.1750	AAR 071	160.4625	AAR 123	161.1825	AAR 171
160.4700	AAR 024	161.1900	AAR 072	160.4775	AAR 124	161.1975	AAR 172
160.4850	AAR 025	161.2050	AAR 073	160.4925	AAR 125	161.2125	AAR 173
160.5000	AAR 026	161.2200	AAR 074	160.5075	AAR 126	161.2275	AAR 174
160.5150	AAR 027	161.2350	AAR 075	160.5225	AAR 127	161.2425	AAR 175
160.5300	AAR 028	161.2500	AAR 076	160.5375	AAR 128	161.2575	AAR 176
160.5450	AAR 029	161.2650	AAR 077	160.5525	AAR 129	161.2725	AAR 177
160.5600	AAR 030	161.2800	AAR 078	160.5675	AAR 130	161.2875	AAR 178
160.5750	AAR 031	161.2950	AAR 079	160.5825	AAR 131	161.3025	AAR 179
160.5900	AAR 032	161.3100	AAR 080	160.5975	AAR 132	161.3175	AAR 180
160.6050	AAR 033	161.3250	AAR 081	160.6125	AAR 133	161.3325	AAR 181
160.6200	AAR 034	161.3400	AAR 082	160.6275	AAR 134	161.3475	AAR 182
160.6350	AAR 035	161.3550	AAR 083	160.6425	AAR 135	161.3625	AAR 183
160.6500	AAR 036	161.3700	AAR 084	160.6575	AAR 136	161.3775	AAR 184
160.6650	AAR 037	161.3850	AAR 085	160.6725	AAR 137	161.3925	AAR 185
160.6800	AAR 038	161.4000	AAR 086	160.6875	AAR 138	161.4075	AAR 186
160.6950	AAR 039	161.4150	AAR 087	160.7025	AAR 139	161.4225	AAR 187
160.7100	AAR 040	161.4300	AAR 088	160.7175	AAR 140	161.4375	AAR 188
160.7250	AAR 041	161.4450	AAR 089	160.7325	AAR 141	161.4525	AAR 189
160.7400	AAR 042	161.4600	AAR 090	160.7475	AAR 142	161.4675	AAR 190
160.7550	AAR 043	161.4750	AAR 091	160.7625	AAR 143	161.4825	AAR 191
160.7700	AAR 044	161.4900	AAR 092	160.7775	AAR 144	161.4975	AAR 192
160.7850	AAR 045	161.5050	AAR 093	160.7925	AAR 145	161.5125	AAR 193
160.8000	AAR 046	161.5200	AAR 094	160.8075	AAR 146	161.5275	AAR 194
160.8150	AAR 047	161.5350	AAR 095	160.8225	AAR 147	161.5425	AAR 195
160.8300	AAR 048	161.5500	AAR 096	160.8375	AAR 148	161.5575	AAR 196
160.8450	AAR 049	161.5650	AAR 097	160.8525	AAR 149	161.5725	AAR 197