

Qs & A's on the Conversion of Railway Radio Communication to Narrowband Technology.

Introduction

In the past two decades, the use and demand for telecommunications in North America has experienced unprecedented growth. Because of this growth, wireless communication has faced some physical limitations. There are an absolute number of frequencies physically available in the radio spectrum.

Government regulatory bodies managing the use of the wireless spectrum are faced with burgeoning demand for radio frequencies from various users. Industry Canada and the US Federal Communications Commission (FCC) approved a rule making the conversion to narrowband mandatory for certain portions of the radio spectrum. This conversion is essentially a process of splitting each traditional wideband channel into two or more narrowband channels, as technology now allows voice to be carried on “narrower” channels without degradation.

In the US, radio suppliers will be forbidden to manufacture wideband only equipment after January 1st, 2011. The railway radio networks will need to be converted to narrowband by January 1st, 2013. In Canada, although the railway's 160.17-161.58 MHz VHF band is exempted from this process (unlike in the U.S.), it is in our industry's best interest to convert to a narrow band channel plan in a timely manner in order to:

- Address spectrum shortage in urban areas
- Harmonize with the U.S.
- Avoid a radio equipment shortage after 2011 and,
- Allow a smooth migration to more spectrum efficient technologies

As the entity responsible for managing the railway radio spectrum in Canada, the RAC firmly believes that the conversion from wideband to narrowband technology is a necessary exercise towards efficient spectrum management in the railway band.

Although not every Canadian railway will need to convert to narrowband in the short or medium term, the RAC considers that it is the responsibility for each passenger, short line, commuter and class 1 railway to ensure interoperability of their communication system with those of their commercial partners. Interoperability is at the core of railroad safety according to Transport Canada requirements.

The following Q&A is designed to address general concerns about the transition to narrowband. More specific or technical questions should be directed to:

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1. Question - What is radio spectrum?

Answer – Radio spectrum consist of electromagnetic frequencies used for communications; it includes frequencies used for radio, radar, cellular phones and television. The Canadian Railroad VHF Spectrum consists of 1.41 MHz of spectrum between 160.1700 and 161.5800 MHz. The federal government regulates the use of the radio spectrum while the Railway Association of Canada (RAC) manages the railway radio spectrum.

2. Question - What is a radio channel?

Answer – A radio channel is the bandwidth allocated in the radio spectrum to transmit one voice channel. Currently, a radio channel is 30 or 25 kHz wide. Railway radio spectrum is currently divided into 30 KHz wide channels.

3. Question – What is narrowband technology?

Answer - Narrowband technology allows the reduction by half of the bandwidth allocated to a radio channel, from 25 or 30 kHz to 12.5 or 15 kHz.

4. Question – Why would someone reduce its bandwidth?

Answer – Technology now allows voice to be carried on narrowband channels without degradation. In the case of railways, the conversions to narrowband transmission will double the number of channels available within the same amount of radio spectrum. The same exercise was performed in 1960, when radio channels went from 60 to 30 kHz!

5. Question – Are Canadian railways required by law to switch to narrowband?

Answer - The federal government does not mandate narrowbanding for Canadian railways. However, the RAC is responsible for the efficient use of its radio spectrum and the conversion to narrowband to replace a 50 year old technology is an expected and normal step toward efficiency and this is why the RAC strongly recommends that its members adopt narrow band technology in a timely matter.

6. How about the U.S.?

Answer- Narrowbanding is mandatory in the U.S.; most radio spectrum users south of the border below 512 MHz, including railways, will need to switch to narrowband operations by January 1st, 2013.

7. Question – If it's not mandatory in Canada, why would I have to spend money and switch to narrowband?

Answer – there are 3 cases where conversion to narrow band transition in the short to mid term is necessary:

- If you interchange with U.S. railways, you will need to be interoperable with your partners and therefore convert your system to narrowband.

- Both Canadian Class 1 railways will eventually convert to narrowband; if you need to do business with them, you will also need to convert.
- Finally, if you operate in the Vancouver, Montreal, Southern Ontario or the Winnipeg area, you might be asked to switch to narrowband by the RAC to address spectrum shortage and interference problems and to be compliant with the new AAR/RAC frequency plan.

In addition, there are other incentives to switch to narrowband:

- Equipment shortage: Equipment manufacturers in the U.S. (where most of them are) will be forbidden to distribute wide-band (i.e. 30 KHz) equipment after January 1st, 2011;
- Radio channels shortages and interference problems in urban areas: more channels will mean less crowded, more secure radio channels
- Interoperable communications between railways is one of the key elements of safe transportation.

8. Question – I deal a lot with the U.S. railways. When do I need to be narrowband compatible?

Answer- If you go to the U.S., then your locomotive radio will have to be NB compliant by Jan 1, 2013. If U.S. locomotives travel on your lines, your network will also need to be NB compatible by Jan 1, 2013. Also, note that the AAR's Safety & Operations Management Committee (SOMC) recently set July 1, 2010, as the date locomotives operated at interchange or in run-through service must be equipped with radios capable of transmitting narrow band. You might want to check with your U.S. partner if this will affect you.

9. Question – I deal a lot with the class 1 railways. When do I need to be narrowband compatible?

Answer- Class 1 railways will convert to narrow band over the next few years. If you need to operate on Class 1 railways in Canada, check with them to know when the trunk will be converted to NB communications. Class 1 railways were asked to provide as much notice as possible to their short line and passenger partners before converting to narrow band and to provide a quarterly status report reflecting the progress of their conversion.

10. Question – I operate in a “congested area” (Vancouver, Montreal, Southern Ontario or Winnipeg). When do I need to be narrowband compatible?

In order to comply with the new frequency plan, you will eventually be asked by the RAC, within a reasonable timeframe, to convert your system.

11. Question – Does that mean that if I don't meet the above condition, I don't need to switch to narrowband?

Answer - Base and mobile stations that are located in non-congested centers and are involved in domestic operations only (i.e. mainly short-lines), are not required to convert to narrowband channels in the immediate future. However, since wide-band equipment will not be distributed after January 1st, 2011, it is strongly recommended that railways replace their radios with narrowband or dual-band radios as the equipment wears out: wideband only equipment will

become harder to source and support. They might also need to switch frequencies in order to accommodate the new frequency plan developed by the AAR and the RAC.

12. Question – Are narrowband and wide band radios compatible?

Answer – So called dual band radios can operate in both modes and are pretty common. Outside of that, even if a narrowband transmission can be decoded by a wide band receiver and vice versa, the quality of communications can be affected to the point that it becomes unsafe for railway operations.

13. Question – So we have to buy new radios to operate narrowband?

Answer – It depends. Most radios purchased in the last 10-15 years are already narrowband capable. They only need to be re-tuned. Most locomotive radios are not, however; they will eventually need to be replaced. Note that narrowband equipment is currently deployed and easily available on the market.

14. Question – Overall, what are the cost elements associated with the conversion to narrow band?

Answer –

- The purchase of new radio equipment.
- The labor for installing this equipment.
- The labor for re-tuning existing ancillary equipment such as filters, duplexers, antennas (if applicable).

You may also take advantage and replace some older cables and antennas with more performing equipment while on site. Interference analysis, frequency selection and licensing are parts of RAC's responsibilities and will not be charged to its members.

15. Question – Will narrowbanding reduce my coverage or the quality of my communications?

Answer – No. Actually, the replacement of old, corroded equipment might improve your radio coverage.

16. Question – Will this affect annual radio license fees paid by the RAC to Industry Canada?

Answer – No. License fees will not be affected.

17. Question – What is all the fuss about so called “very narrowband”?

Answer – Very narrowband is a technology that allows for an even more efficient use of spectrum by reducing the size of a voice channel to 6.25 kHz, using digital modulation techniques. Although the NXDN standard was recently adopted by both the AAR and the RAC as the digital standard for very narrowband, this promising technology is NOT mandated by U.S. or Canadian regulators or associations in the railway band. However, very narrowband may eventually be used in the short term by railways in very congested areas.

18. Question – How will the transition occur?

Answer - This is a huge undertaking, especially for larger railways interchanging with the U.S. To address this issue, the RAC's Wireless Communication Committee (WCC) is coordinating its efforts with the AAR in order to ensure a smooth transition. To find out how this transition might affect your railways, or to take part in WCC activities, please contact your WCC representative or the RAC Manager, Radio Spectrum. Literature on this topic is also available in the RAC's web site at www.redeployment.railcan.ca