

FM band expanders - further information

The frequency range agreed internationally for FM broadcasting includes 88-108 MHz and is used in virtually all countries including New Zealand. Japan, in an exception to normal international usage, uses the frequency range 76-90 MHz which is lower and narrower than the international range. Used cars imported from Japan are usually fitted with a Japanese specification car radio which, without modification, only receives New Zealand broadcasts at 90 MHz or below. A common and inexpensive solution has been to fit a "band expander" in the aerial lead to allow more stations to be received.

Until recently, most FM broadcasting in New Zealand was on frequencies between 89 and 100 MHz. Frequencies between 100 and 108 MHz are now being used and this use will increase in future, providing more services for radio listeners. Users of band expanders are likely to experience increasingly degraded or wholly unsatisfactory reception as more radio services are implemented in New Zealand.

These guidance notes provide technical information about "band expanders" at a more detailed level than the Ministry's brochure entitled "[FM Reception Problems? Solutions for poor radio reception in Japanese import cars](#)" or phone free: 0508 RSM INFO (0508 776 463). Overseas callers please call +64-3-962 2603. Information on band expanders is also available on the Internet.

The Ministry makes no warranty about the accuracy of the information contained in this document or any other information provided by it with respect to band expanders.

Purpose

The Ministry of Economic Development does not consider band expanders when planning and engineering FM broadcasting bands. Band expanders are an ad hoc solution to reception problems faced by owners of Japanese import cars fitted with car radios which are not suitable for use in New Zealand. The different models of band expanders, and their performance characteristics, mean that there would be a significant reduction in the number of radio stations able to be licensed if band expanders were to be taken into account.

The Ministry does not endorse or encourage the use of band expanders. The most practicable long term solution to allow full reception of the FM band is to replace the car radio with a model designed for the FM band used in New Zealand.

The limitations of band expanders are primarily an issue for consumers to consider when purchasing. This document is intended to assist vehicle importers, retailers and consumers to understand the limitations of band expanders and how these occur. Retailers and installers of band expanders are advised to consider any obligations that may arise at law, including under the Sale of Goods Act 1908, the Fair Trading Act 1986 and the Consumer Guarantees Act 1993.

It should be noted that degradation of reception through use of a band expander is not "interference" in terms of the Radiocommunications Act as the degradation occurs within the particular equipment which is unsuited for New Zealand conditions.

What do band expanders do?

Band expanders "shift" FM radio signals used in New Zealand to the frequency range used in Japan. The degree of success of this technique depends on the particular frequencies in use in the area and the amount of "shift" used by the particular band expander. Because the New Zealand band is wider than the Japanese domestic band (20 MHz c.f. 14 MHz), the overall band is "shifted" in two parts with the intention of "overlapping" one part to fall in between stations in the other part of the band. The tuning dial on the radio still shows the Japanese frequency range, irrespective of the transmitted frequency of the stations actually being heard.

Limitations of band expanders

All band expanders have limitations depending upon the design, the stations to be received and the quality of reception desired. The following is based on the Ministry's assessment of information on band expanders currently available to it. Other limitations may come to light once more stations commence broadcasting above 100 MHz.

Frequency shift

Frequency planning in New Zealand is based on use of the international FM band, along with other recognised parameters of transmission and reception. Main stations in any area are typically (but not always) separated by 0.8 MHz, with translator or in-fill stations separated by 0.4 MHz.

Most band expanders use either a 10 or 12 MHz "shift" to alter the received frequencies to suit the car radio. As such they are designed to produce both a 10 MHz and 20 MHz shift simultaneously (or 12 and 24 MHz) in order to cover the international band. Other models have 14, 16 or even 18 MHz shifts or are user switchable.

Because band expanders cannot properly convert all frequencies and keep the stations separated on the dial, users may notice two problems when turning to various stations:

- Double-up of stations separated by the same frequency difference as the band expander shift frequency.

In this case the listener cannot hear a station clearly. For example, a band expander with a 12 MHz shift may mix signals for stations 12 MHz apart (such as 92.1 MHz and 104.1 MHz) so that the associated radio produces a mixed signal when tuned to receive either of the frequencies, or the receiver may switch between signals seemingly at random as signal strengths vary.

It should be noted that where a regular pattern of stations separated by 0.8 MHz is used, there will be several pairs of stations exactly 12 MHz apart because 12 MHz is exactly divisible by 0.8 MHz. Where in-fill coverage with 0.4 MHz separation is used, both 12 MHz and 10 MHz expanders may give degraded reception. The Table (below) shows which frequencies may be affected in this way, by relating them to the frequency shift of the associated band expander.

- Blank-spots on the tuning range.

These may occur at multiples of the oscillator frequency (shift frequency) of the band expander. For example, a band expander with a 10 MHz shift will give "blank-spots" when trying to receive stations at 90 MHz and at 100 MHz. Stations near those frequencies cannot be received by the associated radio.

Overload due to high signal levels

Band expanders may weaken signal selectivity and result in "overload" in areas of high signal strength. In such cases, performance might be improved by:

- Reducing the length of the car radio antenna.

Experiment with the length to get the best result for the particular radio set up in the geographic area the car is operated in.

- Installing a 10 to 20dB attenuator in the antenna lead to the band expander.

A higher value attenuator may be needed in some cases to allow satisfactory reception of the wanted station. The appropriate value of attenuator needs to be found by trial and error. Be aware that attenuation will also affect AM reception. Values above 25 dB generally reduce the sensitivity too much.

A combination of these options may be required, and are likely to work best if the band expander has been installed directly on the antenna input to the radio and the attenuator is installed directly on the antenna input to the band expander. These solutions may not work if the band expander has been installed some distance from the car radio, such as the rear of the vehicle. Both solutions are likely to lower the performance when receiving weaker FM stations and the performance on all AM stations.

Degraded reception due to Radiotelephone signals

Radio signals from NZ radio communication services in the band that would normally be directly tuned by the Japanese radio (i.e. in the 76 - 88 MHz band) are likely to affect reception by passing directly through the band expander. This is likely to occur when in close proximity to radiotelephone services and may occur intermittently. Some expanders may have adequate filtering, but if radiotelephone interference is a problem, then fitting a suitable "Radiotelephone Blocking Filter" before the band expander may help. Again, this needs to be as near as possible to the radio for maximum effect.

Frequency usage in New Zealand

With the increasing use of stations in the upper FM bands all band expander shift frequencies are likely to cause reception degradation to some services.

Most main centres in New Zealand already have some stations with an exact 12 MHz separation. Use of band expanders with this shift is likely to cause problems in these areas for reception of existing as well as new stations. In some areas, stations are separated by 10 MHz, resulting in a likelihood of reception degradation if a 10 MHz band expander is used.

The following [table](#) shows the potential shift conflicts for each transmit frequency for 10, 12, 14 and 16 MHz band expanders, which you can check against current and future allocations. Online access to the register of radio frequencies is available at [Spectrum Online](#), which shows all current licences (tip: search for spectrum licences between 88 and 108 MHz in your district).

EMC Compliance

The Ministry has undertaken laboratory testing of some band expanders currently offered for sale in New Zealand. Preliminary tests suggest that some may not conform to New Zealand electromagnetic compatibility ([EMC standards](#)) due to excessive unintentional radiation, which may cause interference. The sale or use of non-conforming equipment may result in compliance action by the Ministry in accordance with the Radiocommunications Regulations.

[Table: Potential band expander conflicts](#)