

**CAB Information Paper:
Increasing FM Frequency Availability
Through the Use of Co-Sited Second-Adjacent FM Channels**

Report Summary

Under its current rules, Industry Canada does not approve the use of 2nd-adjacent FM assignments (i.e. those separated by 400 kHz) within the same market. A few exceptions have been made where the incumbent station voluntarily accepts the presence of a new local 2nd-adjacent interferer. The Department has previously received representations suggesting that it should require incumbent stations to accept co-sited 2nd-adjacent assignments, as a means of increasing the number of assignments in markets where the FM band is saturated. However, this concept was rejected by the B-TAC and has not been incorporated within Industry Canada's rules so far. The technical practicability of this concept was discussed recently by the CRTC, as part of its 31 March 2009 public hearings pertaining to applications for new Ottawa-Gatineau FM stations.

This report examines whether co-sited 2nd-adjacent assignments would produce significant benefits and concludes that:

- (a) It is not realistic at this time to expect that relaxed rules for 2nd-adjacent protections would present a significant number of new opportunities, either for new FM programming services or AM-to-FM flips.*
- (b) Frequencies that might be liberated by such a rule-change would probably have limited coverage potential and would also suffer significant interference limitations from existing stations.*
- (c) The stations that are at most risk of suffering increased interference from new same-market 2nd-adjacent operations would be existing licensees that currently enjoy interference-free service over wide areas.*
- (d) Stations that accept the presence of co-sited 2nd-adjacent operations may compromise their ability to make future technical changes, including the implementation of hybrid HD Radio™ services.*
- (e) Regardless of any commitment by a new 2nd adjacent station to change parameters or shut down should interference occur, in reality it is often impractical to enforce this.*
- (f) As this issue has been reviewed recently by the Broadcast Technical Advisory Committee (BTAC), and it was concluded that the current practice of allowing only voluntary exceptions should continue, the 2nd-adjacent spacing rules should not be modified.*
- (g) Applicants for special-case approvals, involving voluntary acceptance by 2nd-adjacent incumbents, should be obliged to demonstrate the technical and financial capability to undertake all necessary interference mitigation measures.*

1. Introduction

One of the main challenges facing those applying for new FM licences is the lack of suitable frequencies in many markets. In more remote areas, it is often possible to use a vacant allotment from the FM Plan or else engineer a “drop-in” frequency that can be added to the Plan, while still observing all the current FM allotment rules. Generally, this is not possible in the larger radio markets, especially those close to the US border, because all the conventional channels are already in use. In addition to those who are seeking licences for altogether new programming services, the frequency shortage affects many existing AM licensees that would like to convert their operations to the FM band.

In recent years, some additional channels have been added by relaxing rules that appeared to be too restrictive. For example, Industry Canada modified its rules to allow stations on 3rd-adjacent frequencies (i.e. 600 kHz spacing) to operate in the same market. Unfortunately, this has resulted in several recent cases where incumbent stations suffered increased interference when the 3rd-adjacent newcomer commenced operations. This did not occur when the new 3rd-adjacent operations were co-sited with the incumbent station(s) but rather when the newcomer’s transmitter was situated somewhere between the incumbent’s site and its 0.5 mV/m protected contour. As a result, the Department has made some adjustments to add certain additional restrictions on same-market 3rd-adjacent operations.

Under its current rules, the Department does not approve the use of 2nd-adjacent FM assignments (i.e. those separated by 400 kHz) within the same market. A few exceptions have been made where the incumbent station voluntarily accepts the presence of a new 2nd-adjacent interferer. Recently, the Department has been receiving representations suggesting that it should require incumbent stations to accept 2nd-adjacent assignments, so long as they are co-sited and operate at parameters that will not create any interference to their operations. Proponents of this technique believe that this will make it easier to add new stations in markets where all FM drop-in frequency possibilities have been exhausted. As well, some existing licensees have expressed interest in exploring this technique as a means of providing additional FM frequencies for AM-to-FM flips.

This issue was raised in the context of the 31 March 2009 CRTC public hearing, where it was suggested by some applicants that it would be possible to accept a new Ottawa-Gatineau FM assignment on 94.5 MHz, co-sited with CIMF-FM on 94.9 MHz. In the view of several engineers testifying at the hearing, an effective service could be implemented on 94.5 MHz without causing undue interference to CIMF-FM.

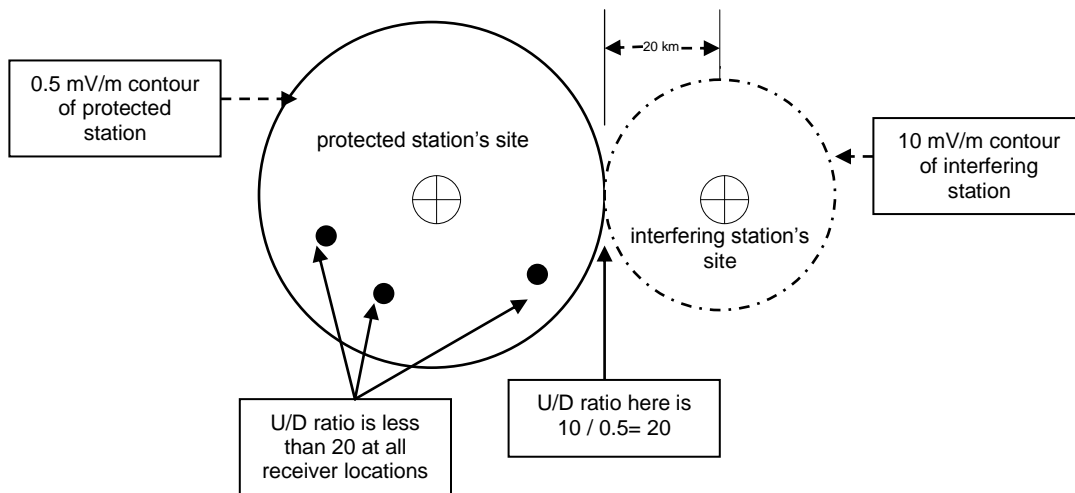
2. Technical methods of protecting against 2nd-adjacent interference

Industry Canada’s current FM technical rules (BPR-3), require broadcasters operating on 2nd-adjacent channels to protect each other’s service area through adequate geographical spacing as well as the choice of operating parameters¹. Each new station must be designed so that its signal strength cannot exceed that of any 2nd-adjacent station by more than a pre-determined amount, known as the Undesired-to-Desired (U/D) signal ratio, anywhere within the protected service area of an incumbent station. The protected service area for most stations is defined by its 0.5 mV/m contour, as depicted on its “official” coverage map.

¹ Ref: Industry Canada; *Broadcasting Procedures and Rules- Part 3 – Issue 5*; Section C-1.3; January 2009.

This requires siting of the new interfering transmitter outside the protected service areas of any related incumbent stations. Operating parameters are then adjusted to ensure that, at the 0.5 mV/m contour of each protected station, the incoming 2nd-adjacent station will produce an interfering signal that does not exceed 10 mV/m². For example, a new full-power Class B FM station on say 100.1 MHz must be located approximately 20 km outside the protected service area of any Class C1 stations operating on the two 2nd-adjacent frequencies, 99.7 MHz and 100.5 MHz. This is depicted visually in Figure 1.

Figure 1



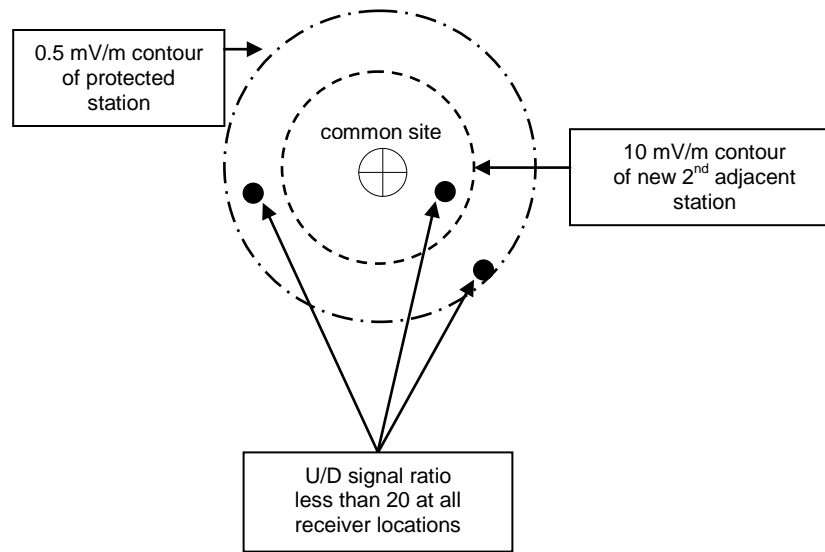
If an incoming broadcaster complies with this procedure, its application will be considered technically acceptable by the Department, even if an incumbent broadcaster believes that interference may result.

In studies leading up to the release of the current issue of BPR-3, the Broadcast Technical Advisory Committee (BTAC) addressed the matter of utilizing an alternative approach. (i.e.) co-locating stations that have 2nd-adjacent frequency relationships. The theory behind this concept says that when stations are located at exactly the same site, the strength of the interfering station will always be constant with respect to the desired station because the radio signal path to any given receiver will always be identical for both stations. So long as the basic U/D ratio required by a typical receiver is always observed, interference-free reception for both stations should be possible at all locations within the required service area(s). This concept is illustrated in Figure 2.

The maximum permissible U/D ratio applicable to either siting model has been determined through empirical testing, in labs and in the field, of various makes and models of consumer FM receivers. It has been found that the required U/D ratio varies considerably with the type of receiver being used. For example, automobile radios are almost always able to accommodate higher 2nd-adjacent interfering signal levels than are portable, table and clock radios. However, it has also been found that the ability of all types of FM receivers to reject interference from 2nd-adjacent interferers decreases as the signal strength of the desired signal increases. In other words, when receivers are operated in areas where strong local signals exist, they can tolerate less interference than when they are located in fringe service areas.

² Thus providing a U/D signal ratio no greater than 20 at the outer limit of the desired station's protected contour.

Figure 2



The two factors outlined above conspire to complicate the development of transmitter siting rules for 2nd-adjacent FM stations. A single U/D figure for determination of 2nd-adjacent protections is desirable, so that the rules do not become overly complicated to administer. But this means that interference-free reception can only be guaranteed for most (but not all) receiver types and models in current use. Moreover, the selected ratio is only valid for a specific range of desired signal strengths.

This raises troubling questions where it is proposed that a new co-sited assignment should be made in an area where a powerful 2nd-adjacent incumbent station already exists. The strong signals from the incumbent may already be “saturating” the front-end circuitry of many cheap, broad-band FM receivers, making them quite prone to additional interference effects. Although the incumbent station may not be affected much by the lower-powered newcomer, the operator of the new station will usually be disappointed to find that its signal is impaired by the incumbent’s signal inside the “core” market where it hopes to earn its revenues.

3. Specific technical considerations relating to co-sited 2nd-adjacent stations

A number of other practical realities come into play when co-sited 2nd-adjacent assignments are being considered:

- **Opportunities for effective new assignments would be very limited:**

Although co-sited 2nd-adjacent stations are supposed to work in theory, it would be difficult in practice to retrofit the existing Canadian FM frequency allocation scheme to accommodate such a concept at this late date. This is because the original FM Allotment Plan was designed on the basis that stations in the same market can be assigned frequencies that are no closer than 800 kHz apart (i.e. 4th-adjacent assignments). Many such situations exist, especially in the larger markets where these 4th-adjacent allotments are already assigned to powerful stations. While a 2nd-adjacent slot between two 4th-adjacent stations may exist in such cases, any assignments using this channel would be

subjected to strong signals from both incumbents, creating a situation of “bracketed” interference for the newcomer.

- **Operating parameters for the new station would likely be quite limited:**

In many 2nd-adjacent situations, the reality is that the frequency is already assigned to another station in an immediately-adjacent radio market, sometimes in a US border community. For example, 99.1 MHz and 99.9 MHz are assigned to CBLA-FM and CKFM-FM respectively in Toronto. The middle frequency, 99.5 MHz, is assigned to WDCX-FM Buffalo. Therefore, any use of this frequency in Toronto would be quite limited, since it would need to protect the co-channel Buffalo station’s coverage anywhere on US soil, and this may mean that its coverage in Canada would be quite limited.

- **Co-channel interference limitations can be severe:**

In the above situation, the adjacent-market co-channel station will often be operating with substantial parameters. This would produce a strong interfering signal within the normal protected service contour (0.5 mV/m) of the incoming station. Because it would be co-channel interference, it would be impossible to overcome, except where it might be obstructed by buildings or terrain. In the Toronto example described above, WDCX-FM operates from a site that is only 123 km from the CN Tower, with an ERP of 110 kW and an antenna HAAT of 290 metres toward Toronto. Its 99.5 MHz signal in Toronto is substantial and would produce significant interference to any new service operating on that frequency in the GTA.

- **Common antennas generally cannot be used:**

Co-siting is usually most cost-effective for broadcasters when an existing antenna can be shared. But it is not practical for the incoming station to share an antenna with a 2nd-adjacent station because the very close frequency spacing would require combining filters of exceptionally large physical size. Therefore, in almost all cases, a separate antenna would be required for the incoming station. An existing second antenna at the same site might be used, so long as any stations already using that antenna are at least 4th-adjacent to the incoming station. Otherwise, an altogether new antenna would be required, which may be difficult to accommodate unless the tower has vacant space and can tolerate the extra weight and wind loading that would occur. Moreover, adding a new antenna can affect a transmitter site’s continued compliance with the maximum RF energy limits mandated in *Safety Code 6*.

- **Separate antennas may have dissimilar radiation characteristics:**

When separate antennas are used, they seldom have absolutely identical radiation characteristics; moreover, they will be operating at different heights above ground. These factors can cause the “constant” U/D ratio that should exist for co-sited stations, as shown in Figure 2, to vary from one receiver location to the next. If these differences are severe enough, they can create realistic interference zones that, in theory, are not supposed to occur. Such variations are very hard to predict in advance, since they are partly produced as a result of signal reflections from the ground, the supporting tower and other

structures on the site. Perhaps the largest factor that may create dramatically different radiation characteristics is the number of bays of the antenna system. An incumbent high power station may use an eight, ten, or twelve bay antenna system for the combined purposes of antenna gain and power handling capacity, while a new 2nd adjacent station would likely choose an antenna system with fewer bays because of the lower power, lower cost, smaller aperture and lower tower loading.

- **Future technical change options may be limited:**

Once 2nd-adjacent stations commence operating in the same market, they will forever be “joined at the hip”, as it were. Technical changes to the operating parameters of stations in such a relationship would have to be carefully co-ordinated. Future site changes for only one of the related stations could be particularly problematic.

- **2nd-adjacent assignments may preclude future IBOC operations:**

The hybrid HD Radio™ IBOC digital radio system was developed to function in the US FM broadcasting environment, which does not permit co-sited stations to operate less than 800 kHz apart (i.e. 4th-adjacent). Tests conducted by the National Radio Systems Committee (NRSC) on the interference effects on home and portable analog FM receivers of 2nd-adjacent hybrid HD Radio carriers, show that FM analog signals can be degraded if a much stronger station located only 2 channels away begins to transmit IBOC signals³. This suggests that an incoming station that is 2nd-adjacent to an incumbent may be in a position to object to the latter’s subsequent deployment of a hybrid HD Radio service⁴.

- **Enforcement of commitments may be difficult:**

Although a new 2nd-adjacent station may commit to resolving complaints about interference to incumbents, it may be difficult to enforce operating parameter changes or station shut-downs should interference to incumbents occur after investments are made and the new station has been built. This is especially the case with smaller operations that would be providing desirable new community, ethnic or minority-language services in the market. It is always assumed by the regulators that a technical solution to signal impairment or interference will somehow be found; meanwhile, the affected station suffers the consequence of audience loss.

Therefore, for a number of valid reasons it is not realistic to expect that relaxation of the current Industry Canada 2nd-adjacent rules would liberate many new FM frequencies that could be used effectively without producing an impact on incumbent stations. In many major centres, there might only be one or two candidate frequencies that could even be considered. Some markets may not be able to take advantage of this technique at all.

³ See: (NRSC) DAB Subcommittee; *Evaluation Of The Ibiqity Digital Corporation IBOC System*; Part 1 – FM IBOC Report from the Evaluation Working Group; (November 29, 2001).

⁴ Industry Canada’s proposed procedure for the implementation of IBOC services says that if an HD Radio broadcasting operation causes harmful interference to another station, the (digital) broadcaster is to take “immediate remedial action”.

4. Current Industry Canada Position

After much discussion, and following consideration of the factors mentioned previously, the BTAC advised the Department, prior to releasing Issue 5 of BPR-3, that the current rule requiring the siting of new 2nd-adjacent interfering stations outside the service area of incumbent stations should be retained.

However, it was agreed that the current practice of allowing voluntary exceptions to this rule should continue, when both the incumbent and the incoming station agree in advance to accept any mutual interference and/or resolve interference complaints. In most cases, agreements will be possible where:

- common ownership or business relationships have been established between the affected broadcasters; or,
- the incumbent broadcaster already operates a transmitter on another frequency that carries identical programming and has service contours that overlap the infringed area.

Given this, the Department does not appear inclined to force incumbent stations to accept new local drop-in assignments that are 2nd-adjacent to their existing operations.

5. Conclusions

Considering all of the above:

- (a) It is not realistic at this time to expect that relaxed rules for 2nd-adjacent protections would present a significant number of new opportunities, either for new FM programming services or AM-to-FM flips.
- (b) Frequencies that might be liberated by such a rule-change would probably have limited coverage potential and would also suffer significant interference limitations from existing stations.
- (c) The stations that are at most risk of suffering increased interference from new same-market 2nd-adjacent operations would be existing licensees that currently enjoy interference-free service over wide areas.
- (d) Stations that accept the presence of co-sited 2nd-adjacent operations may compromise their ability to make future technical changes, including the implementation of hybrid HD Radio™ services.
- (e) Regardless of any commitment by a new 2nd adjacent station to change parameters or shut down should interference occur, in reality it may be difficult to enforce this.
- (f) As this issue has been reviewed recently by the Broadcast Technical Advisory Committee (BTAC), and it was concluded that the current practice of allowing only voluntary exceptions should continue, the 2nd-adjacent spacing rules should not be modified.

- (g) Applicants for special-case approvals, involving voluntary acceptance by 2nd-adjacent incumbents, should be obliged to demonstrate the technical and financial capability to undertake all necessary interference mitigation measures.

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