NDB 'OFFSETS' DE-MYSTIFIED

By Brian Keyte.

NDB offsets, and how to listen for them, puzzled me for quite a while and I think they can be a bit mysterious for many of our newer members - so here's a basic explanation.

Try these tests on your receiver. It is important to choose daytime for them to avoid lots of confusing extra signals.

Let's take things a step at a time -

1. Select the receiver's **AM setting**, and quite a wide filter if you have a choice. Have the AGC switched 'on', and/or reduce the RF gain to avoid overloading the receiver. Choose one of your semi-local NDBs (not a local 'blockbuster') - say about 80 km or 50 miles away - and in an otherwise quiet part of the band. Tune slowly, listening to the Morse identification. Notice that it is spread across quite a range of frequency settings and heard with the one modulating audio frequency note which we call the NDB's 'offset', almost certainly one of the two common frequencies, 400Hz or 1,020Hz. (Listeners in France may have to search for a less local NDB to hear this).

> This way of logging NDBs is OK - you can probably hear quite a few of them - but it is certainly not the best method of hearing more distant ones! Notice that the centre (carrier) frequency - as quoted in a list of NDBs - is quite difficult to estimate. You could easily be 1 kHz or so in error. If you have a half-musical 'ear', you would also know whether the beacon's 'offset' is nominally 400 Hz or 1020 Hz, but there is a bit more to it than that.

2. Now switch your receiver to the **CW setting** (not LSB or USB - yet), still using a fairly wide filter, if any, and keeping the AGC switched 'on', or with the RF gain reduced. If you have a 'BFO' control, make sure that it is 'off', or set to 0 or is in the centre position.

Again, tune SLOWLY across the same NDB. This time try to IGNORE the Morse ident. signal! You should hear a beat note which falls in frequency as you turn the tuning knob. When it becomes so low in frequency that you can only ***just*** hear it, note down the receiver's frequency reading. Continuing to tune, the note will re-appear at a very low frequency 'on the other side' - again note down the frequency reading when you can only ***just*** hear it. Finally it will rise until it is too high pitched for you to hear - or is being filtered out by your receiver.

> What have we gained by this step? Well, we have measured the carrier frequency fairly accurately - it is the halfway point (average) of your two frequency readings and you will probably find that it is very close to the advertised frequency for that NDB.

3. Now, if your receiver allows, it's time to switch from CW to **USB** (upper sideband), still keeping the other receiver settings. Start with the 'dial' frequency set right on the nominal frequency of the same NDB. You should hear just the Morse, probably at 400 Hz or 1020 Hz, but this time you are using the receiver to generate a beat note with the NDB signal's upper sideband, or upper offset as we often call it. Now tune **slowly** higher in frequency. This time ignore any continuous carriers and concentrate on the Morse beat note. It will start to fall in frequency until it becomes so low that you can only ***just*** hear it - note down that 'dial' reading. Continue to tune slowly HF - the Morse will probably come back, but will soon weaken because the USB setting is trying to pass only signals that are higher in frequency than the 'dial' setting.

4. Switch from USB to **LSB** (all other settings unchanged). Now, listening from 2 kHz or so away on the HF side, you will hear the carrier note as well as the Morse - both are lower in frequency than the 'dial' setting. Tuning **slowly** lower in frequency, the carrier beat note falls steadily (no surprise!). Listen **very carefully** to the falling Morse note - i.e. the beat note with the upper offset. When that note gets so low in frequency that you can only ***just*** hear it, note the 'dial' reading again. But this time the Morse has NOT disappeared. Why is that? It is because you can also hear a high pitched beat note coming from the lower offset (except for most NDBs in Canada). Continuing to tune slowly LF, the carrier's continuous beat note disappears leaving only the Morse ident from the lower offset.

> Now we have made big progress - in steps 3. and 4. we have listened to the ident from each offset in turn at audio frequencies of our choosing and without interference from the carrier. We have also measured the actual frequency of the upper offset fairly accurately - it is the average of your last two readings. The upper offset could be quoted on your log as the difference between the carrier frequency (as published, or as you measured it in step 2) and the upper offset frequency. You will probably find that it comes out close to either 400 Hz or 1020 Hz. You could measure the lower offset frequency using the LSB and USB settings in a similar way.
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> In practice we usually only aim to identify the offsets as being a nominal 400 or 1020 - any error is seldom more than about 20 Hz, so normal tuning should find the signal and there is usually no need to measure and quote either the offsets or the carrier with greater accuracy. However, if you have a good measure of the frequency of one or both offsets you can deduce the likely carrier frequency - very useful for the first few reports of an UNID (unidentified beacon).

5. Finally, switch to a fairly **narrow filter**, say 300 Hz or so, if you have one. Tuning through a signal now becomes much more comfortable, as most of the unwanted QRM is cut out. For 400 Hz offset beacons, you will probably now ONLY hear the beacon's upper sideband (offset), OR the carrier, OR the lower sideband (offset), at any time. This makes it easier to listen to the Morse from one of the offsets without interference from the carrier or from carriers of other NDBs. Even without a narrow filter, you should be able to identify far more NDBs than when using the AM setting, as in step 1.

For me, the best reception is usually when the receiver's frequency setting gives a low frequency beat note for the ident - around 180 Hz, say. That means that there are places on the 'dial' that are good for hearing idents and others where usually nothing is well heard.

FOUR 'DIAL' SETTINGS per NDB!

Taking the 1020 Hz offset NDBs first, if **345 kHz** is the carrier frequency, the offsets will be at about 345 kHz +/- 1020 Hz (1.02 kHz) - i.e. at about 343.98 and 346.02 You could listen for either of these offsets, and for each one of them you could use either the receiver's LSB or USB setting - four quite different frequency settings.

To keep it simple, and to avoid confusing myself (!) I nearly always use the LSB receiver setting, and I mostly listen for the upper offset. To hear that well, I would set the 'dial' reading to about 346.02 kHz + 180 Hz - i.e. 346.20 kHz. So for me, nnn.20 kHz is a good setting to listen for most of the 1020 offset beacons.

Similarly, for a 400 Hz NDB on 345 kHz, the offsets (sidebands) are on 344.60 and 345.40, so my preferred setting is about 345.58, or nnn.58 kHz more generally. Sometimes, due to interference, etc., the lower offset may be easier to hear, needing a frequency setting of around nnn.78 (still using LSB) - or about nnn.16 for the 1020 NDBs. (I'll leave you to work out the other two settings if you use USB).

FRANCE and CANADA

Things are much simpler for most of the NDBs in France, and often for some in countries with a French connection. There is just a carrier, which is itself keyed on and off to send the Morse ident. So there are no sidebands to hear and we quote the offset as 0 (zero). For these there are only two good 'dial' settings - for me they are nnn.00 kHz +/- 180 Hz. That's nnn.18 if using LSB, nnn.82 for USB (much the same as the nnn settings for the 1020 NDBs). Most Canadian NDBs, and occasional ones elsewhere, have a normal continuous carrier, but only have an upper offset (usually 400 Hz). So there are only two good 'dial' settings for them, too!

NDBs on nnn.50 kHz

There is another little complication. A few NDBs, especially in Europe, have their carriers on half-kHz frequencies - like 345.50 kHz. Their offsets, and the receiver settings to hear them, are therefore at another series of points on the 'dial', also 0.5 kHz away from 'normal'.

Conclusion

If you have persevered through this, I hope you have found it helpful.

It is not so easy to put these ideas across in words - there is really nothing like lots of actual listening to become familiar with the best ways of 'driving' your receiver and to discover how to dig out those more difficult DX signals.

I am sure you will find that it is an excellent way of spending many happy hours - good listening!