

### Frequency Stability of Digital Repeaters

Axell Wireless legacy channel selective repeaters take the wanted signal, mixed with a local oscillator down to an IF frequency where the filtering is carried out and then is mixed back to the original frequency with the same local oscillator. If you do the calculations on this process any drift of the local oscillator cancels out and the output always equals the input frequency. Local oscillator drift has the effect of moving the filter centre frequency with respect to the signal so in an extreme case it could result in sideband cutting or even tuning to the next channel but still the output = input.

In a digital repeater exactly the same thing happens with the up/down converter because the conversion process to IF is the same. In the case of a digital repeater the filtering is not based on fixed crystal resonator elements but sampling and calculation based on the same reference oscillator that drives the synthesisers. The effect is the same, the exact filter frequency moves but again the drift cancels and we always have output = input.

There is one more thing to consider, a digital repeater is capable of being programmed for frequency translation but usually it isn't. This would only be done in very rare cases where the licensing administration allows it. Usually it involves a fixed offset (but it need not be), e.g. Output = Input +4MHz. A frequency translating repeater is easy to recognise as in the GUI there will be separate frequency selection boxes for input and output frequency of each channel. In this case the cancellation of reference oscillator error is slightly imperfect and a small residual offset is introduced. The offset is in error by the PPM error of the reference, e.g. the 10MHz reference has an error of +1ppm. A non-frequency shifting repeater with a channel centre frequency of 400MHz moves by 1ppm now becoming centred at 400Hz high, in a frequency shifting repeater (say for argument up by 4MHz) the input channel centred at 400MHz still moves high by 400Hz but now the intended 4MHz shift increases by 4Hz.