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Executive Summary

Traditionally, at least in the IARU Region 1, Low-VHF beacons have used CW and more latterly PI4 as identification methodology.

A number of Irish amateurs are experimenting with other ident modes such as the very-widely used FT8. A popular mode such as this would likely encourage increased beacon monitoring and reporting as this mode is often already in use on the amateur's PC.

It is proposed that Region 1 low-VHF beacons consider expanding their use of idents to include more widely used modes such as FT8 and others as appropriate.

It is also proposed that these narrow-band modes are positioned in the lower portion of the bands with other (wider) MGM bands at the higher portion of the bands.

Introduction

In Ireland, ComReg, the Irish telecommunications regulator has allocated additional low-VHF spectrum to the amateur service on a national secondary basis at 30 to 49 MHz, 50 to 70.125 MHz and 70.45MHz to 70.5 MHz. All modes of transmission including machine generated (MGM) emissions may be utilised. This means that the 6m (50-52 MHz) and 4m (69.9-70.5MHz) IARU band plans can be fully implemented in Ireland.

The grant of the additional low-VHF spectrum comes as a result of IRTS input to recent consultation processes. The new frequency bands are listed among the bands available generally to Irish radio amateur licensees in Annex 1 of a recently revised (2018) version of the Irish amateur station licence Guidelines document ComReg 09/45 R4 which is available on the ComReg.ie website.

Currently there is no regional or international allocation to the amateur service circa 40 MHz in any of the three ITU Regions. However, in propagation study terms the absence of reliable continuous and identifiable signals in these frequency bands causes problems and means that the progress of a propagation event starting in the HF range and identified using beacons at 28 MHz cannot be reliably tracked as it progresses towards 50 MHz and onwards towards 70 MHz. Nor can general experimentation take place with amateurs in countries which have a national frequency allocation, similar to Ireland.

In the 1990s a CEPT spectrum investigation raised this issue as a result of input to the consultation process. They believed that beacons could be located at appropriate geographical sites, chosen in order to minimise the possibility of interference to other radio services. Particular reference was made to the ISM frequency band 40.66 – 40.70 MHz, centred on 40.68 MHz.

Now would be an appropriate time to address the optimum characteristics for low-VHF beacons to provide the radio amateur community with the necessary information to improve efficient and effective radiocommunications between amateur stations.

Ireland has two beacons on 40 MHz and one each on 50 MHz, 60MHz, 70MHz and 144 MHz.

Frequency allocation for low-VHF beacons

Traditionally, beacons were at the bottom of the band. This facilitated recognition of a rising maximum useable frequency (MUF). The 2011 IARU Region-1 General Conference in Sun City agreed to a new Synchronised Beacon Project (SBP) as part of its revisions to the 50 MHz band plan. This required the existing beacons to migrate by August 2014 to 50.4 - 50.5 MHz in order to leave space for the new system at the bottom of the 50MHz band. As agreed at the Vienna Interim meeting in 2013, the basic parameters for beacons in the SBP are 1 kHz frequency spacing, 1 minute CW/MGM and a 4 minute repeat period. At the 2014 IARU Region-1 General Conference in Varna 2014, the migration of Region-1 50 MHz beacons was reviewed and noted as progressing (with good propagation reports), but not yet achieved completely.

The deadline for migration of the remainder was extended to 31 December 2015, noting that the default for QSY is usually + 400 kHz unless a specific request is sent to the IARU Region 1 beacon coordinator. Furthermore it was also agreed that the coordination of new beacons below 50.4 MHz shall no longer be possible, except for the members of the Synchronised Beacon Project (SBP). The Synchronised beacons will now use – ‘once every 5 minute’ slots, instead of ‘once every 4 minutes’.

Several objections to the enforced move were raised by 6m operators and organisations such as the UKSMG but these were ignored. Some beacons such as the CT 6m beacons have still not moved years after the deadline as this does not seem to have raised any issues. A move to modes such as FT8 would allow all the beacons to move back down the band subject to GPS locked TX and strict frequency coordination if the individual beacon keepers so choose.

There may be an argument that there is a benefit of having beacons in the upper extremes of the bands BELOW Your band of choice - a key argument for the 40 MHz and 60 MHz beacons for users of 6m and 4m.

Should it therefore be proposed that beacons should be positioned at BOTH end of bands for this reason, but with position-related mode restrictions? The beacons in the lower end of the band should observe best practice for space-saving and minimising interference, and also be geared towards very weak signal reception - thereby giving the best chances of hints of an opening. Beacons at the top end of a band should use less economic modes, like the traditional CW, PI4 etc., given there

is far more available space there.

The hidden meaning in this would be, a ban on 'wide' modes in lower portions of bands, and a very small allocation (3 kHz would be fine) for smart e.g. sequenced or interleaved or scheduled 'narrow' modes, while the under-used upper ends of bands would permit all manner of MGM in the much larger available space.

Identification Modes

Here are some observations regarding PI4 vs. FT8:

FT8 Advantages:

- * popular mode for QSOs
- * widespread acceptance
- * ongoing development
- * decodes as low as -24db
- * up to 20 signals per 1 KHz
- * 'weak signal' design
- * includes quality (SNR, Timing, Drift) data
- * software for almost all hardware
- * strong association with gratification from use for DX
- * good results with very modest stations
- * 'internet' reporting of decodes (reverse beacon use for casual ops)

FT8 Disadvantages:

- * ongoing development - risk of forced-upgrade if developer changes his mind on something
- * requires a computer & software to decode
- * steep learning curve for non-computer savvy ops
- * does not include CW Ident in standard configuration
- * use of mode has perceived negative effect on phone & CW use

PI4 Advantages:

- * sequenced TX - any of 5 1 minute slots can be defined
- * extra identifying quality from 'timeslot'
- * 'weak signal' design
- * decodes as low as -22.2db
- * includes quality (SNR, Timing, Drift) data
- * includes CW ID ident
- * 'internet' reporting of decodes (good for beacon keepers)
- * readily available low-cost hardware

PI4 Disadvantages:

- * requires a computer & software to decode
- * steep learning curve for non-computer savvy ops
- * wide bandwidth required (>1khz)

- * limited available software, restricted to Microsoft Windows only (?)
- * mode specific to beacons - not in use for QSOs

Advantages of FT8 over PI4:

- * 15 second modulus for FT8, 1 minute for PI4.
- * very small bandwidth required (50 Hz) for FT8, 1 kHz for PI4.
- * larger operating user base for FT8 (see: PSK reporter website)
- * FT8 software compatible with all major hardware platforms, inc. Mobile Phones.
- * possible to allocate a max of 1200 'slots' in 3 kHz every 5mins with FT8, but only 15 with PI4.

Advantages of PI4 over FT8:

- * beacon specific mode with distinctive tonal quality, FT8 can be mistaken for many other modes.
- * supported by "QRP Labs" beacon rig, FT8 is not.
- * CW ident as standard, FT8 does not issue CW as a default.

Conclusion regarding modes

FT8 appears a 'best practice' choice for sequenced (slotted) beacons, as it appears to demonstrate better use of available resources, for equal or improved results over PI4.

Conclusions

There would seem to be benefits for a very small allocation (e.g., 3 kHz) for smart e.g., sequenced or interleaved or scheduled 'narrow' modes, while the under-used upper ends of bands would permit all manner of MGM in the much larger available space.

Recommendation

It is proposed that Region 1 low-VHF beacons consider expanding their use of idents to include more widely used modes such as FT8 and other narrow-band modes at the lower ends of the bands with other MGM modes at the higher portion of the bands.