

11 Beacons

11.1 IARU REGION 1 VHF / UHF BEACONS A GUIDE TO GOOD PRACTICE

Beacon transmitters have long been used to indicate the presence of VHF openings and have contributed significantly to our knowledge of propagation. As the numbers of beacons is increasing rapidly and the amount of spectrum available for them is under pressure it is important that beacon builders are aware of the technical parameters required, the reasons for them and the procedure to be followed to obtain an agreed frequency.

Beacon - A station in the Amateur Service or Amateur-Satellite Service that autonomously transmits in a defined format, which may include repetitive data or information, for the study of propagation, determination of frequency or bearing or for other experimental purposes including construction."

It is not intended that this document should specify the exact purpose of any individual beacon, its power level or the number of beacons in any country, as this should be agreed within the national society concerned. It is also not intended to be applied rigorously to experimental beacons or beacons with a special purpose. It should however apply to the vast majority of VHF/UHF/Microwave beacons for propagation monitoring purposes, as designated by the beacon sections of the bandplans.

11.1.1 CO-ORDINATION PROCEDURE

The existing requirement for co-ordination of regional beacons will be retained. For non-coordinated beacons the beacon proposal should be agreed with the national society (with consultation with neighbouring societies where appropriate) and a provisional frequency chosen.

If the beacon has an ERP of greater than 10W then the frequency should be submitted to the IARU Region 1 VHF beacon co-ordinator to check for potential interference problems. Societies should provide regular and frequent updates to the IARU R1 Beacon coordinator. Beacons or changes to beacons which are not notified to the coordinator forfeit their arbitration rights in any coordination dispute.

11.1.2 Local Beacons:

In the microwave bands, local beacons, which should be 10W ERP max, may preferably be placed in the x.750-x.800MHz range of the relevant narrowband segment, adjacent to, but outside of the exclusive propagation beacon segments. In this range, the lower powers will permit greater frequency reuse. This permits traditional propagation beacon frequencies to be used more efficiently and minimise cases of local/mutual interference. National societies should inform the IARU R1 Beacon coordinator of such local beacons and national bandplan use.

11.1.3 TRANSMISSION MODE

Amplitude or Frequency shift keying (A1A or F1A) may be used according to the scheme below. The beacon radiates on its nominal frequency during the period where no information is transmitted. It then moves to "space", 250/400Hz below and then keys back to nominal ("mark") while transmitting its information. In this way the transmission sounds like A1A in a SSB receiver set to receive USB.

11.1.4 FREQUENCY SPACING

All coordinated and notified beacons should operate within the beacon segment of the band plan and be on a frequency which is in accordance to the table below. In bands above 1.3GHz, half the frequency spacing defined below be used as an offset in frequency coordination disputes (Vienna 2007).

Band	50 MHz	70 MHz	145 MHz	435 MHz	1.3 GHz	2,4 to 10GHz	24 to 47 GHz
Frequency ppm	4	2.8	1.4	1.0	0.8	TBA	TBA
Tolerance Hz	200	200	200	400	1000		
Spacing between beacons - kHz	1	1	1	1	2-3kHz	5kHz	10kHz
F1A Frequency shift - Hz	250	250	400	400	400	400	400
Frequency at "space" - Hz	nominal - 250	nominal - 250	nominal - 400	nominal - 400	nominal - 400	nominal -400	nominal -400

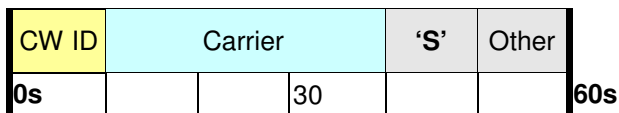
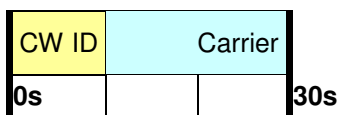
TBA = To Be Agreed at a future conference

11.1.5 BEACON MESSAGE

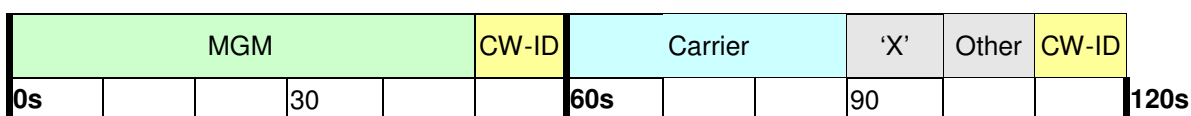
As beacons are often heard at very low signal levels, together with spurious signals, it is important the message is simple, unambiguous and repeated frequently. It is also necessary to have a period without information ("carrier") for frequency checking purposes and signal strength measurement; and also to make it easy to distinguish the frequency when using F1A.

1. For a coordinated beacon, the only essential information in the beacon message is the callsign. The locator or other information is not essential
2. The callsign should be sent in plain CW at least once per minute, not exceeding 60 characters per minute
3. Beacons should include a period of plain carrier of approximately 20-30s, sufficient for frequency checking purposes.
4. For mixed mode beacons, the MGM mode should start on the even minute, whilst the odd minute includes the plain carrier period. Effort should be made to ensure good timing accuracy of the even/odd minutes.
5. It may be helpful to indicate a forthcoming change of mode by a short CW symbol (such as an 'S' or 'X')
6. For beacons that are MGM only (which should only be exceptions to the other recommendations) then the message should be MGM at the start, followed by the CW ID within a minute period.

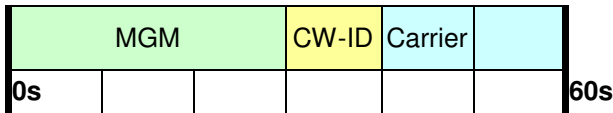
Examples of these (with approximate message lengths) are illustrated below:- Simple 30 & 60 second Messages



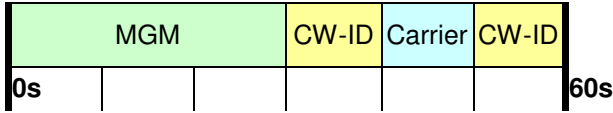
MGM Mixed Mode (these are examples and can be change to suit the MGM mode deployed – Varna 2014)



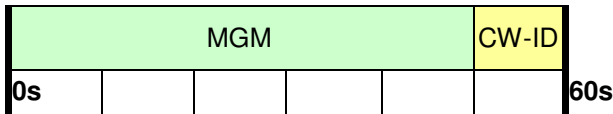
MGM Mixed Mode



MGM Mixed Mode



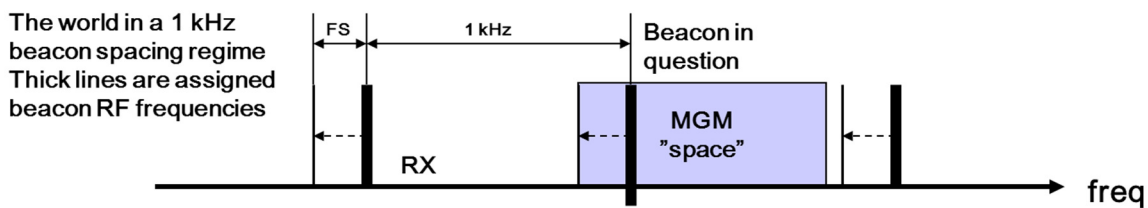
MGM



11.1.6 OPERATION

- Operation should be 24 hour continuous.
- If beacons change parameters during the transmission this must be reflected in the message transmitted.
- IARU Region-1 encourages best practice for both timing/frequency accuracy and phase noise to enhance general performance for the benefit of all.
- That development of new modes optimised for beacons are encouraged, which may either enhance DX reception or permit more efficient equipment (and thus lower electricity costs) to enhance sustainability
- That National Societies and IARU-R1 coordinators be kept updated on such developments.

11.1.7 BEACONS SPECTRUM



Should MGM be implemented on a beacon, a standard 1kHz tuning offset should be adopted as per the example in the diagram.

In any given frequency band, the specific MGM selection should have regard to the beacon frequency spacing and MGM bandwidth

11.1.8 STATUS

It is important that the operational parameters and the status of each beacon are widely known. The information should be sent to the IARU Region 1 VHF beacon coordinator via the local beacon coordinator or spectrum manager at least once per annum or when the operational parameters are changed to ensure that the IARU Region 1 beacon list is up to date.

11.2 TRANSATLANTIC BEACON PROJECT

At the IARU Region 1 Conference in Tel Aviv 1996 a proposal from URE for a coordinated project whereby beacons at the (North-)West-coast of European countries would be installed in order to test the possibilities of 145 MHz propagation over the Atlantic Ocean, resulted in a recommendation, unanimously accepted by the Conference :

To help investigate VHF transatlantic propagation, Member Societies are encouraged to participate in an IARU Region 1 co-ordinated programme to establish "Conjugate Beacons" in the 145 MHz band. (These would be similar to the conjugate beacons in the HF bands, emitting sequential signals which are repeated.)

To help manage this project, a co-ordinator is required.
The tasks of this Beacon Project Co-ordinator will be:

1. To make contact with the IARU Region 1 and Region 2 VHF/UHF Beacon Co-ordinators and to make contact with societies/amateurs in Region 1 and Region 2 who are interested in participating in this programme.
2. To consult with technical experts with the aim of establishing the technical specifications of the beacons.
3. To liaise and co-ordinate between groups building beacons and also those build listening equipment.
4. To collect the results of the experiments and to report them to IARU Region 1.

This action of IARU Region 1 should be communicated to IARU Region 2 with the request that they consider similar action.

11.3 Synchronised 50 MHz Beacon Project (Varna 2014)

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 50MHz 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 1kHz 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’

Member Societies are invited to participate in the pilot programme for the SBP. The paper VA14_C5_14 will be used as an implementation guide and an initial pilot scheme demonstration. The societies are invited to consider the best locations for SBP (e.g. an existing site or new strategic site). Region 2 and Region 3 will be informed of progress should they wish to start implementing their own beacon multiplexes.

In addition, opportunities for a 50 MHz space-borne receiver should also be sought for monitoring both standard beacons and the SBP. This will enable assessments of propagation, band usage; support for further research; and support potential future frequency allocation requests

11.4 IARU REGION 1 VHF AND MICROWAVE BEACON LIST

This list of VHF/UHF Beacons is compiled for IARU Region 1 by G0RDI, and it builds upon the valuable work contributed by G3UUT. Many thanks to the VHF/UHF/ Microwave managers of radio societies across Region 1, beacon keepers, beacon coordinators and VHF/UHF DXers too numerous to mention.

The main Region 2 & 3 6m beacons are included in the list in italics for completeness. Thanks to G3USF, the IARU HF beacon coordinator for these. All inputs are welcome and should be sent to the address below.

You are free to use information from this beacon list but please acknowledge IARU Region 1 and G0RDI.

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The list is also posted on the RSGB web site at

<http://data.dcc.rsgb.org>