HAMChallenge 2023

SPB144

A **S**pecial **B**eacon **P**roject on **144** MHz

Application for Challenge #2

by

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Abstract

For many decades radio amateurs are fascinated by the large variety of propagation modes in the 144 MHz band. From tropospheric ducting to different kinds of ionospheric reflections and combinations out of it so much is possible. The invention of digital modes and software defined radio equipment led to contacts, we only could dream about in the past.

Experiences with a Synchronized Beacon Project in the 50 MHz band led to the idea to introduce a Special Beacon Project in the 144 MHz band to explore propagation modes on special paths with setups of beacons using digital modes and a net of automated receivers, monitoring 24/7 and uploading any receptions of interest to public available servers in the internet. This opens the potential for systematic analysis and citizen science.

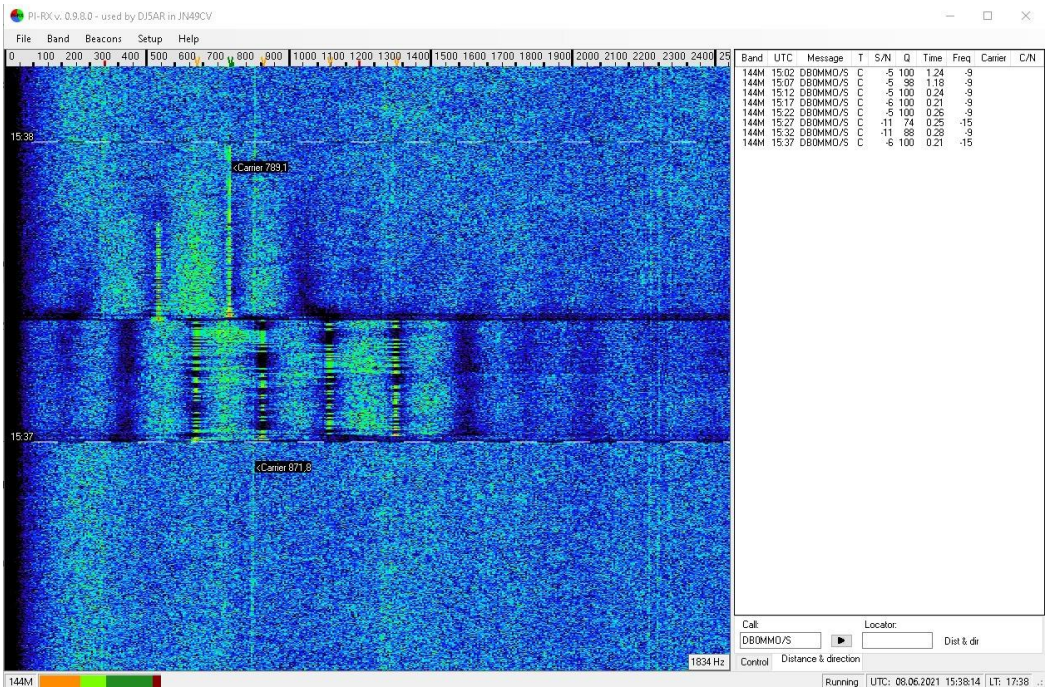
Automated beacon monitoring

Times have changed a lot in the last decades and today we have digital modes, allowing signals to be decoded deep in the noise by computers. New propagation opportunities have been discovered, as from mid Europe to the Cape Verdes.

Many are running receivers on popular calling frequencies, uploading reports about received stations on servers in the internet. There are websites, displaying, what has been received in maps, like the popular www.pskreporter.info. It is out of question, that such websites provide a good overview about conditions and activity. The problem is, there are no systematics behind. It depends on, who is running a receiver and who is transmitting at a certain time, just by coincidence.

More efficient would be a system of transmitters and corresponding receivers 24/7 on air. We already have a system of transmitters, the beacons. Some are already using machine decodable modes like PI4. So, we should have a focus on the receiver side. There is a software to decode PI4 and it writes details about all reception periods to a log file. This information could be prompt forwarded to a database on a dedicated server and be made accessible for all interested people, to do further analysis on it. It could result in propagation maps, displaying the paths between transmitters and receivers in relation to the standard signal strength. This standard signal strength can easily be determined by the average value.

How to setup a receiver? It should be cheap and simple, like a SDR stick with LNA on a Raspberry Pi. There is no need to lock the SDR to a reference, as all beacons operating in PI4 are GPS-locked. the receiver can be initialized by scanning the band for a PI4 beacon. In case of reception, the frequency offset can be determined and corrected. It should be connected to the Internet or the Hamnet, to set the internal clock and forward the received data to the dedicated server. It´s obvious to run the receiver 24/7. The system should monitor a beacon frequency for just a single transmission period of usually one minute and tune to the next beacon then. All kind of locations are of interest. The more data can be collected, the more valuable is the full data set.



Example: Transmission period of DB0MMO

(Part of the Synchronized Beacon Project on 50 MHz)

At present this is no real project, just a conception. All radio amateurs interested in propagation studies or data processing, are asked for contributions.

There are some main subjects to be discussed:

- Hardware setup
- Software to control the SDR
- Software to decode digital modes
- Collection and distribution of data

Special Beacons on 144 MHz

The 50 MHz band is often called the magic band, as it offers a wide range of propagation modes. For a more systematic investigation on these modes, a synchronized beacon project (SBP) has been established. Suitable beacon hardware is available and can be adopted to the 144 MHz band. Most of the propagation modes, the 6 m band is famous for, are available on the 2 m band as well. It is obvious to have something similar on this band as well. As there is just a minor chance of intercontinental propagation in east-west direction, no separate frequency ranges for the three IARU regions are needed. Just a 10 kHz wide slot would be sufficient. To respect the possibility of an east-west propagation, like transatlantic, the more western beacons in an IARU region could occupy the lower frequencies within in the available channels and the more eastern ones the upper channels.

Where to allocate this required 10 kHz sub band? The existing beacon band already is packed with beacons. In the 50 MHz band it is allocated at the lower end of the band. This insists, to have the same on 2 m. In the band plan 144.000 MHz to 144.025 MHz is allocated for satellite downlink. In respect of the doppler effect the transmitters in space must keep a certain distance to the lower edge of the 2 m band. A coexistence of a synchronized beacon system and satellite downlinks is conceivable, as beacons must be qualified, to become part of the project. So many of them will be in remote locations and there will be quite a distance between them. In case all timeslots and channels are allocated to different beacons, each beacon will transmit for one minute every five minutes only, occupying just a 1 kHz channel.

We are aware, that this part of the band is allocated in the US by the FCC for CW use only. But it doesn´t restrict the reception of digital signals. In case, stations from IARU region 2 will join the project, it can be discussed, to allocate a further sub band anywhere else within 144.1 to 148 MHz.

Who we are

Mathias, DH4FAJ and Andreas, DJ5AR are experienced VHF, UHF and SHF operators for decades now and still curious about propagation phenomena and modes in these bands.

Beside many other activities in amateur radio Mathias is the VHF/UHF/SHF Beacon Coordinator in IARU Region 1 and Andreas is one of his team members.

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