

Update on amateur activities during the past 12 months in the 146-147 and 70.5-71.5 MHz experimental spectrum

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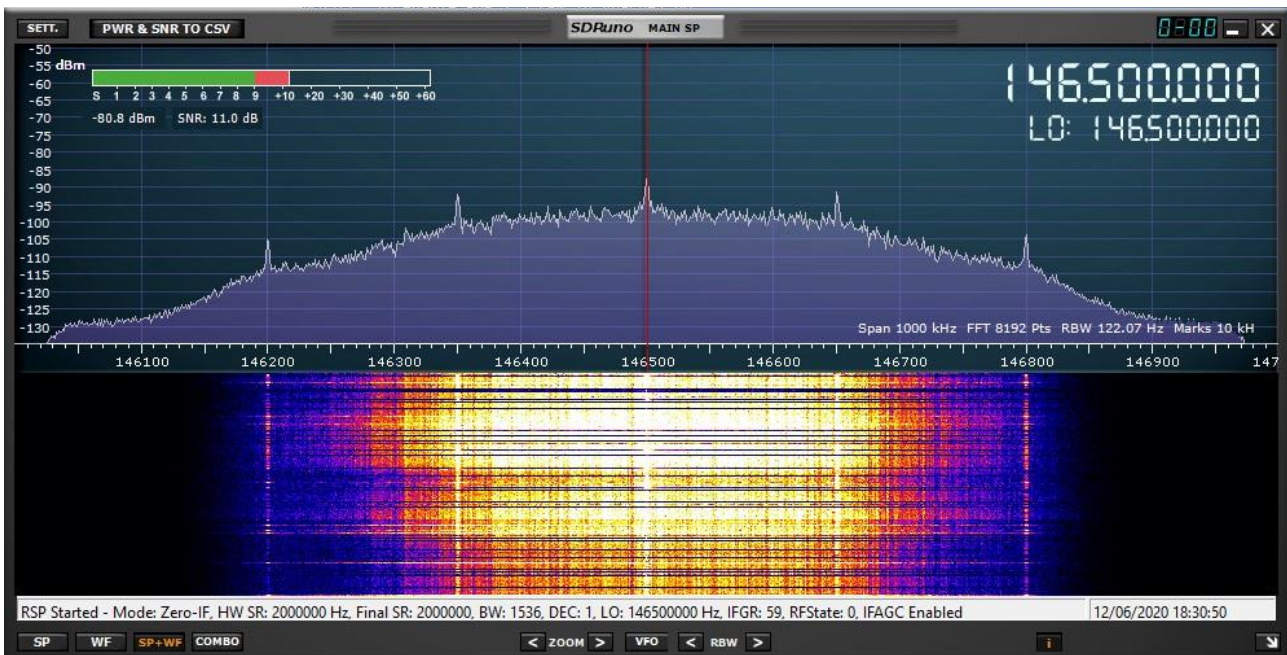
Progress in the last year:

The most significant developments in the last year have been in the area of medium-speed 100-500Kbps data transmission. Around a dozen amateurs have built experimental systems at 146MHz using a protocol scheme known as New Packet Radio (NPR). This protocol involves layering TCP/IP over TDMA which then sits over 4GFSK modulation.

The full specification of New Packet Radio is published here:

https://cdn.hackaday.io/files/1640927020512128/NPR_specification_v2.0.pdf

Currently, amateur transmitters use commercial off-the-shelf modem chips which do not use any bandwidth tailoring techniques. Therefore, with spectral regrowth the occupied bandwidth, -50dBc currently is almost twice the data rate. The screenshot below shows the spectral occupancy of a 470Kbps data rate transmission at 146MHz.



Most amateur experiments are conducted at a slightly lower rate of 360Kbps which is contained, -50dBc in around 600kHz. With 25W EIRP typical fixed station ranges are 10-20Km from amateur suburban locations. Initial bench testing indicates that the spectrum -50dBc, with a 330Kbps usable data rate, can be contained within 600kHz. In the longer term it is hoped to reduce the bandwidth by better coding and control of spectral-regrowth as has been done with Reduced-Bandwidth, Digital Amateur Television (RB-DATV).



The ability to communicate at several hundred Kbps has opened to a new range of applications to amateur radio at VHF. One amateur is serving some of the pages of his own web site across a short link at 146Mhz at his home. This link shows this demonstration: <http://npr.m0ahn.co.uk:82/>

Fixed to mobile operation of 360Kbps TCP/IP data has been demonstrated at ranges up to 5Km. Packet retry built into TCP-IP smoothing out errors due to signal flutter although at a cost of increased latency. The success in this area has now prompted a number of amateur groups to look at how this technology can be used to support emergency communications.

To date, experiments have been in the 146MHz band using 4GFSK modulation. The New Packet Radio TDMA scheme should work equally well over other modulation schemes therefore work is underway to access the suitability of other modulation schemes which could result in similar tests being possible in the 70.5-71.5MHz experimental spectrum.

The majority of the 244 NoVs issued in the past year have been to those involved in Reduced Bandwidth Digital Amateur Television (RB-DATV) where there has been considerable activity, consolidating previous technical innovations. Most work has been with rates of 128-333KSymbols/second with many amateurs having regular fixed station to fixed station contacts. Covid19 restrictions have limited portable operation from hilltop sites although a number of 50-150km two-way exchanges of RB-DATV images on 71MHz and 146MHz have been reported.

Looking Forward:

Now that significant progress has been made with medium rate, 360Kbps, data communications it is expected that following months will result in many more amateurs being involved in testing a wide range of applications over TCP-IP over VHF radio. The potential applications of Internet based technologies over VHF radio are only limited by the time available and amateur imagination.

Although first prototype modems use TDMA framing over 4GMSK modulation, other commercial chipsets including LoRa, are being investigated.

For both DATV and data the possibility of using a moderate bandwidth, ~500KHz OFDM modulation scheme is still being investigated. If successful this should provide much better immunity to fading and multipath than the currently used modulation schemes.

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