



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:

In the last year communication tests of some of the newer medium bandwidth, <500kHz modes have been constrained by the Covid lockdowns and limits on the number of people able to get together to set up experimental radio links.

Throughout this period though, there have been numerous RB-DATV (Reduced Bandwidth Digital Amateur Television) contacts between fixed amateur locations at 146 and 71MHz using previously developed technology.

The UK amateur television community has also recently developed circuit boards enabling the use of DVB-T based OFDM technology with H265 video encoding to be used in bandwidths as low as 333 kHz. This has enabled contacts on 71 and 146 MHz to be made over paths not previously possible, due to multipath, with single carrier DVB-S. It is planned to carry out mobile transmission tests using narrow-band DVB-T where it is hoped this will prove significantly more robust than DVB-S in this challenging environment.

On the data communications side the use of New Packet Radio which is a 250-500Kbps TCP/IP, half-duplex, TDMA over 4GFSK, has been limited to small groups of experimenters located within 15km of each other. Other work in the medium bandwidth, <500kHz data has included testing several of the commercially available LoRa chipsets that are capable of operation below 400MHz. A number of tests at 146.5MHz, between amateurs using commercial modules employing the Semtech SX1276 chips have attempted. Early results were somewhat disappointing due to difficulties in achieving the specified +20dBm chipset output at 146.5MHz and the complexity of adding narrow-bandwidth transmitter power amplifiers and receiver preamplifiers.

Looking Forward:

The experimental work using commercial chipsets, Gaussian-FSK and LoRa at VHF has identified that without tailoring of the modulating waveform, the spectral usage will be in the order of twice the main modulated bandwidth. There are significant issues with controlling spectral regrowth when such waveforms are amplified. Whilst this spectral usage might well be acceptable for Low Power Device communications in the various ISM bands it will not be acceptable where medium bandwidth, <500kHz data communications needs to be used adjacent to conventional narrow bandwidth voice and data allocations. All of the experiments to date have been carried out using commercial chipsets which appear to be the limiting factor. However, the developments of modulation tailoring in the amateur television and narrow bandwidth data communications areas have indicated that Software Defined Radio (SDR) transceivers are almost certainly the route forward. In the last couple of years, a set of OFDM software



modules have been made available as part of the open source GNU Radio initiative. Details of the GNU Radio OFDM software are available here: https://wiki.gnuradio.org/index.php/Main_Page.

Commercial and academic work has concentrated on using these software modules at 900, 1800 & 2400MHz as 4G and 5G testbeds over expensive (£1K-£10K+) USRP hardware (https://en.wikipedia.org/wiki/Universal_Software_Radio_Peripheral)

A small group of amateurs are now investigating whether the GNU Radio OFDM modules can be used in conjunction with the far cheaper (~£150) HackRF SDR transceivers - <https://greatscottgadgets.com/hackrf/one/>

This work will involve modification of some of the GNU Radio modules but hopefully will enable the use of medium bandwidth, <500kHz, data over OFDM two-way communications in the 71 and 146MHz bands.

An increasing number of amateur operators around the world, including Europe, South Africa and Australia are now equipped with RB-DATV DVB-T equipment supplied by the BATC (British Amateur Television Club), originally developed for use at 146 and 71MHz, and it is hoped that the coming year will see an increase in narrow band DVB-T video contacts facilitated by this UK amateur innovation.

Although the number of digital experimenters is relatively small, over 300 146MHz NoVs have been issued in the last 12 months. It is hoped that the resulting innovation with VHF spectrum justifies further temporary access to experimental spectra at 146 and 71MHz.

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