

# **146-147MHz**

## **A New Frontier for Amateur Innovation**

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**RSGB VHF Manager**

**Oct 2014**



# Ofcom Announcement 10<sup>th</sup> Oct

As it is not our expectation that all the available spectrum to be required by alternative uses immediately we will make available additional spectrum on a temporary basis for Amateur Radio between 146 – 147 MHz, adjacent to the existing Amateur Radio allocation at 144 - 146 MHz.

Access to spectrum will be authorised under a Notice of Variation, time-limited to 12 months and available to Full Licence holders only.

From 31st October 2014: 146 – 147 MHz available by a Notice of Variation to holders of Full Amateur Radio licences. This will be available through the Radio Society of Great Britain (RSGB) website.



1913

## *The Founding idea*

***“The freedom to  
experiment in radio  
communication”***



Advancing Amateur Radio



# What is Amateur Radio?

*“Ham radio has and must be primarily about innovation. Once a technology is mature, it's no longer properly in the ambit of ham radio. We can use mature technologies to accomplish our other goals, but we must never become complacent, satisfied that the solutions we have today are "good enough" for our purposes”.*

**Jeff Davis KE9V**



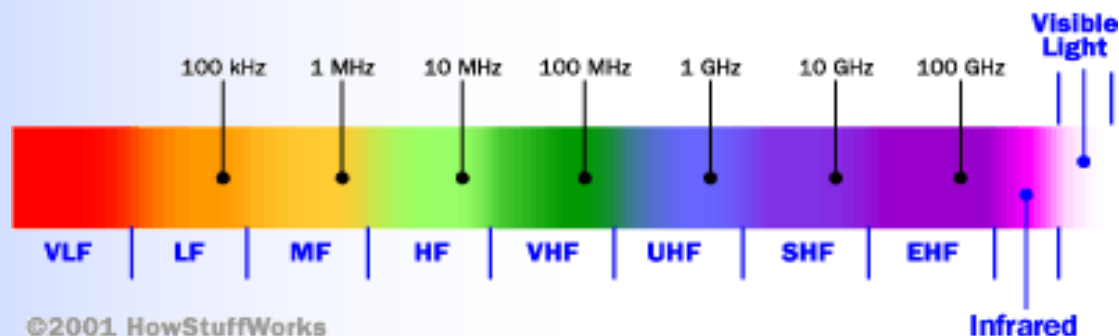
# Convincing people of the value of amateur radio

- Government & Regulators
  - A world where spectrum is considered to have value - £££
  - Limited interest in radio science
- ‘Value Statements’ for amateur radio
  - Value of training young people
  - Value of novel spectrum usage
  - Value of new technologies; SDR etc



# Winning Spectrum

— *without spectrum amateur radio is just electronics*



1925	80-40-20m
1930	10m
1947	160,80,40,20,15,10,2m, 70cm, 23cm
1979	30-17-12m
1986	6m
2002	60m
2004	40m extn
2013	600m
2014	2m extn 146-147MHz





## Looking To The Future





# Consultation Question

March 2014

*Q4. Do you agree with the proposal to make some spectrum not currently assigned to other applications available on a temporary for Amateur Radio use with these restrictions?*





# Sixty consultation inputs published on Ofcom website

- Yes. I believe this 'clear' amateur spectrum presents a marvelous opportunity for amateur technological developments that would be very hard to achieve elsewhere in the amateur allocations.
- Yes. This would provide an opportunity for experimentation with innovative digital communications projects (perhaps based on the Raspberry Pi) to help build the UK's future advanced technology base. and (b) the Notice of Variations were available to ALL three classes of UK Amateur Radio Licence (Foundation, Intermediate and Full).
- **Thanks to all of those that responded to Ofcom**
  - **(except one!)**



# NoV VARIATION FOR THE PURPOSE OF USING 146 MHz TO 147 MHz

Lower band limit <sup>1</sup>	Upper band limit	Maximum transmit power (effective radiated power)	Maximum antenna height above ground level
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146.000 MHz	147.000 MHz <sup>2</sup>	25 Watts	20 metres
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## Notes

<sup>1</sup> These band limits are absolute limits and not centre frequencies.

<sup>2</sup> In Scotland or anywhere within 40km of the border between England and Scotland or within 40 km of the Scottish coast, the upper band limit is 146.93750 MHz.



# Geographic Restrictions

Areas in which use is not authorised (for illustrative purposes only)

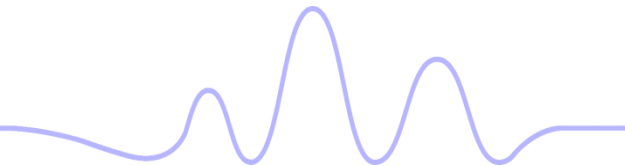


**a) The Variation authorises the use of the Station in the Authorised Band only in the United Kingdom, as may further be qualified elsewhere in the Variation.**

**(b) The Variation does not authorise the use of the Station in the Authorised Band on the high seas or in any other country or territory or anywhere in the Isle of Man or Guernsey or Jersey or, in each case, in their territorial seas.**



**What could amateur  
radio do with 1MHz  
of virgin  
spectrum?...**



# A Few Possibilities

- Digital voice
  - Some relief in congested areas
  - Room to experiment with new techniques
- Digital Amateur Television
  - Narrowband DVB-S
  - Other bearer technologies
- New data modes
  - Up to 500 kHz bandwidth
  - Possibly with voice, video and data



# Narrower Bandwidth DATV

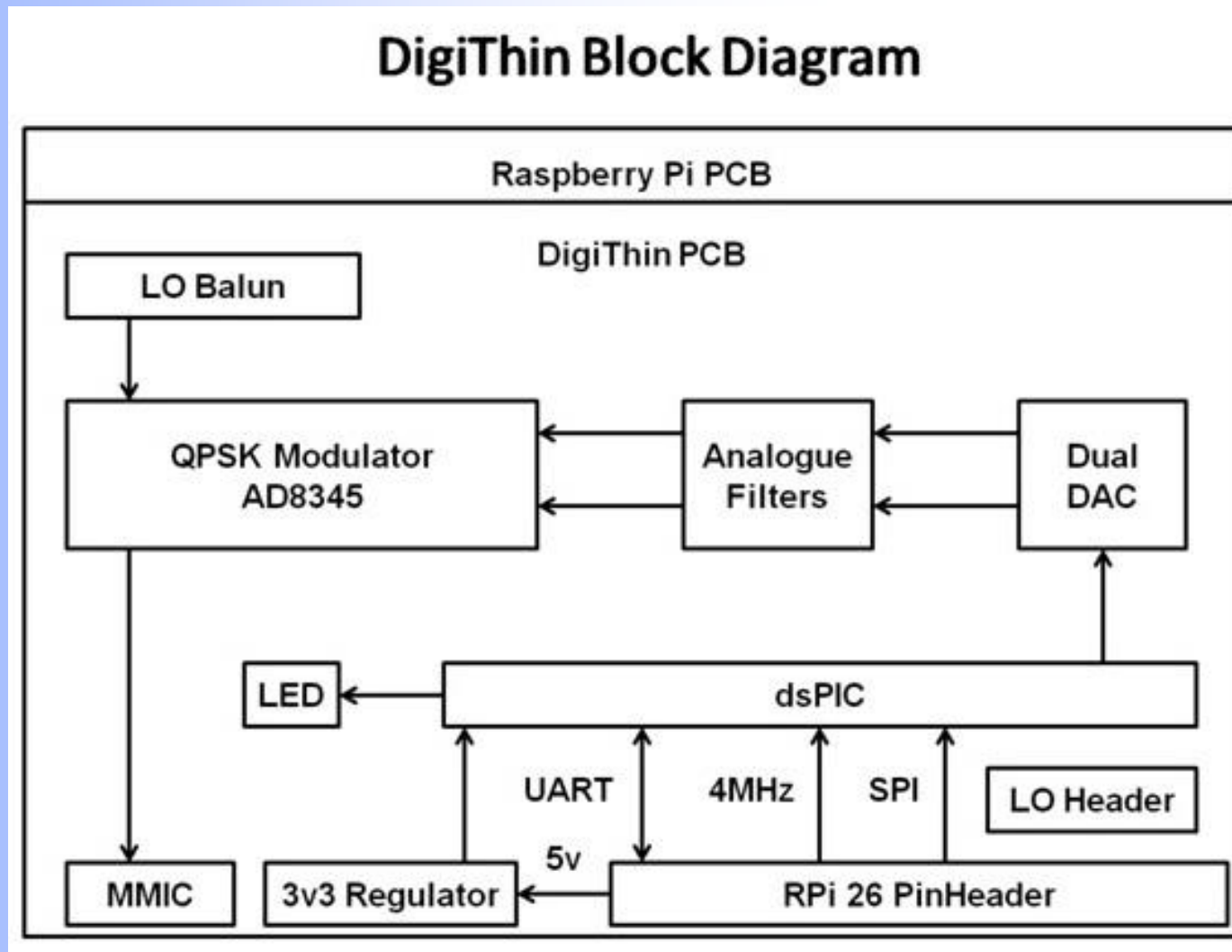
Data from F6DZP & W6HHC

DVB-S (QPSK) with H.264					
Symbol-Rate	H.264 Video	Audio	Resolution	(Video Capture) Frames per Sec	FEC
250 KS/sec	300 Kbps	32 Kbps (MPEG1)	352x288 (SD)	18 or 20 fps	7/8
125 KS/sec	110 Kbps	32 Kbps (MPEG1)	320x240 (SD)	12 or 15 fps	7/8
400 KS/sec (HD test-1)	360 Kbps	192 Kbps (AC3)	1920x1080 (HD)	3 fps??	7/8
125 KS/sec (HD test-2)	110 Kbps	32 Kbps (MPEG1)	1920x1080 (HD)	1 fps	7/8

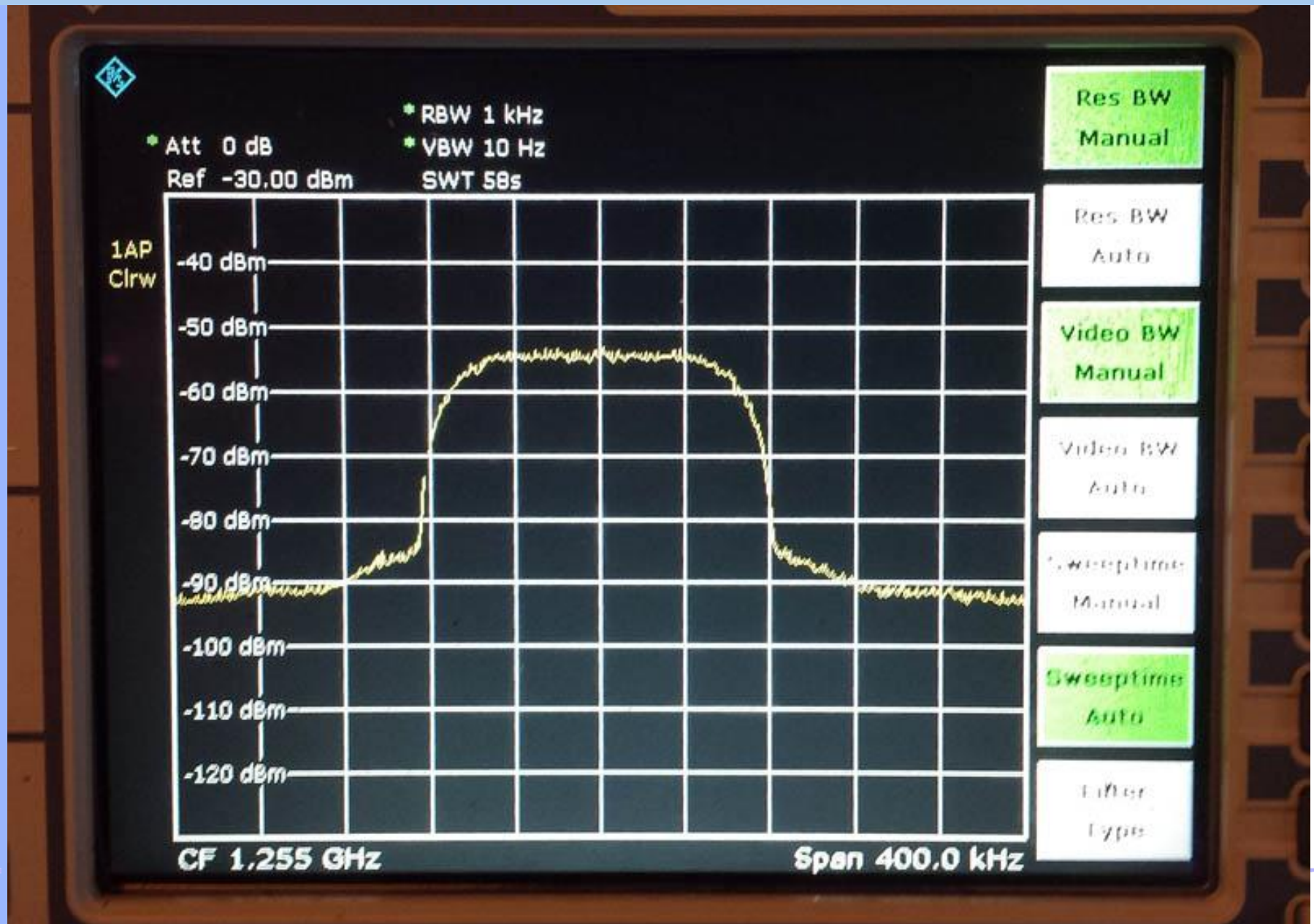




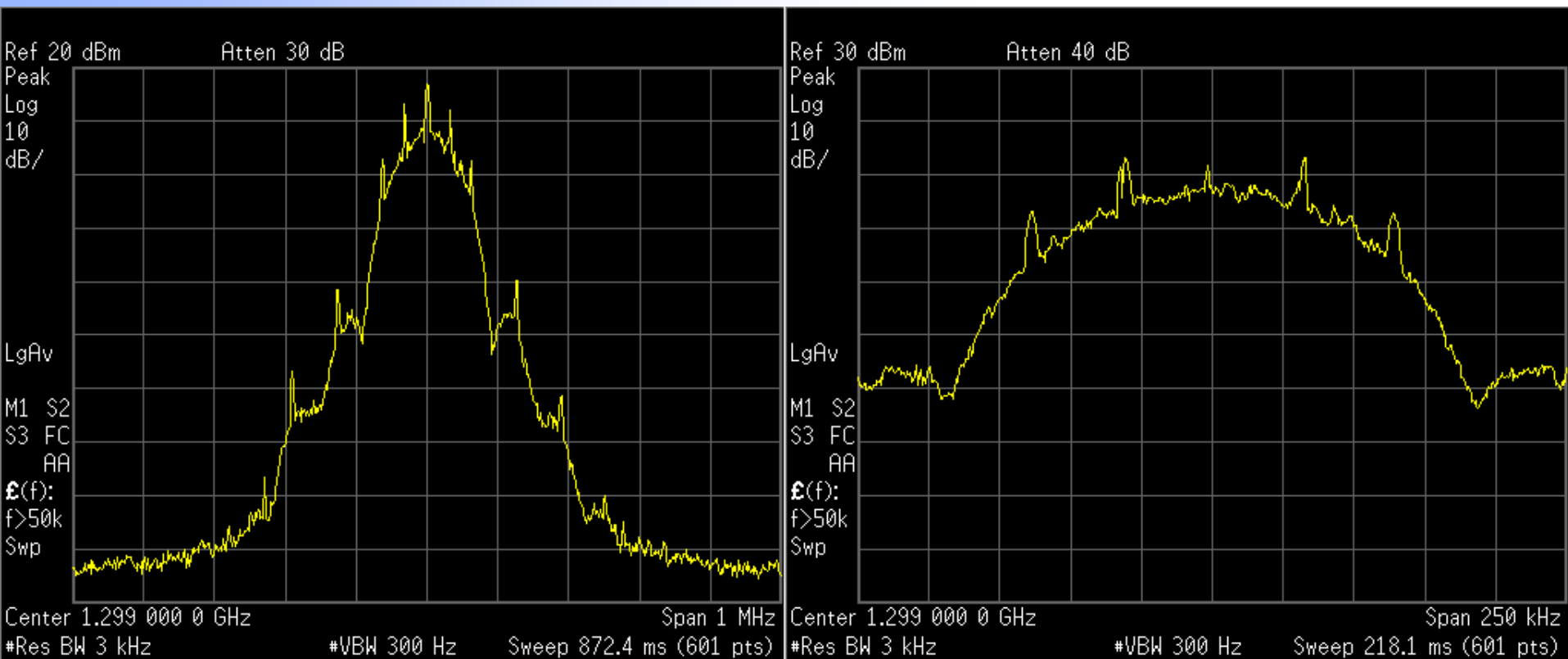
# DigiLite and DigiThin



# DVB-S 125KS/s Symbol Rate



# 128kbps D-Star ("DD" mode)

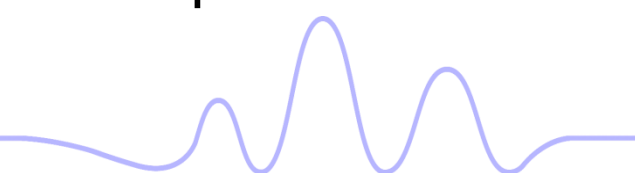


~ 400KHz wide at -60dB points !!

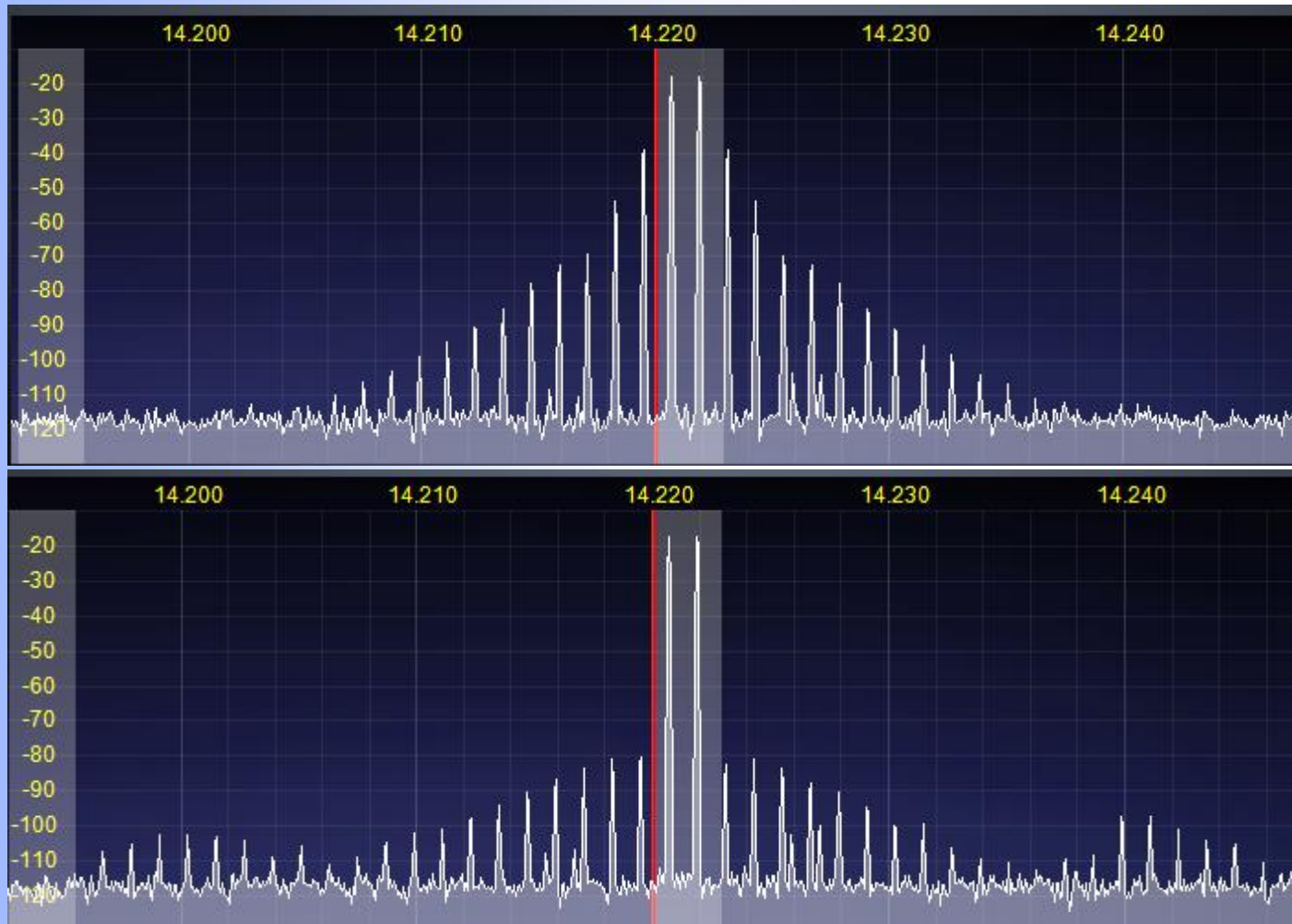


# ***Spectral Compatibility & Wider Bandwidth Modes***

- Users of wider bandwidth modes will need to enforce tighter spectral control that has been acceptable on microwaves
- 'Rules of Thumb' for 60dB bandwidth are not good enough where the band edges are concerned!
  - These are absolute!
  - Even 'local' spreading outside the band is unacceptable
- There are narrow band services on both sides and there will be narrowband digital users within 146-147MHz
  - We are considering a band-plan with narrowband digital channels at the top and bottom on the new band
- Transmitters may require better filtering than is practiced today on higher frequencies



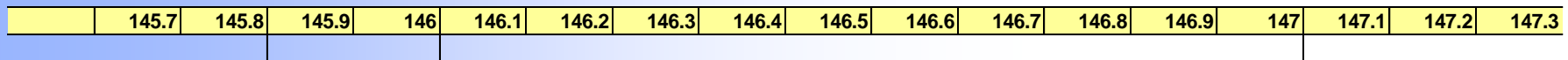
# *Software Defined Pre-Distortion*



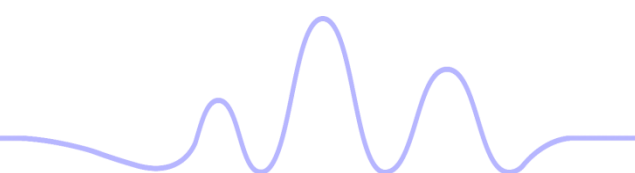
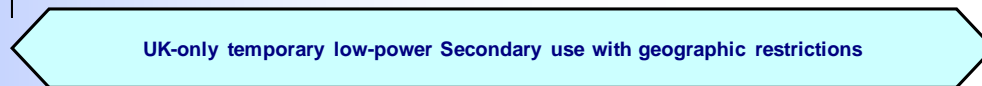
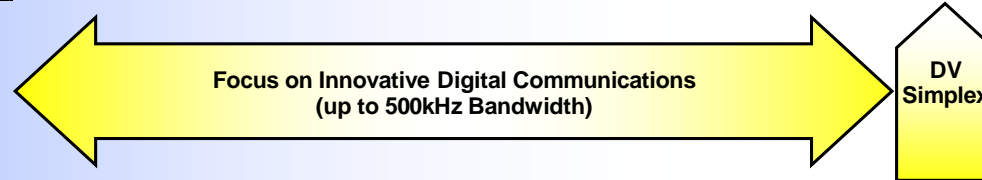
# 146 – 147 MHz Bandplan!

► A few draft thoughts!

Moderate (<500KHz) bandwidth  
TV and data



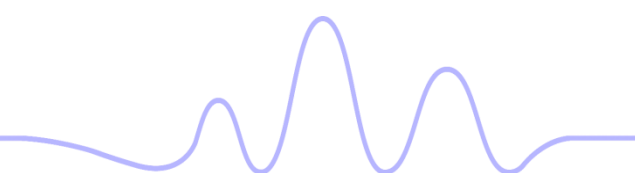
Amateur Satellite





# New Ways of Amateur Communications

- The number of young people joining amateur radio is in steep decline
- Perhaps traditional voice/Morse communication has lost its appeal
- One in three children has their own tablet computer
- Imagine what apps could sit over simple tablet (USB) to tablet radio communications!



# ***What do you think?***



# Thank you

Working for the future of Amateur Radio

