FreeDV plus Video for RADE?

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Introduction

Is it time for a new version of FreeDV+ compatible with the new RADE FreeDV mode?

The most recent version of FreeDV+ is compatible with the 1600 and 700D FreeDV modes. But these modes are rarely used these days, with the advent of the RADE (RADio autoEncoder) mode. RADE is a much-improved mode, offering superior voice quality. RADE requires slightly more bandwidth than the older modes, 1500 Hz vs. 1200 Hz. RADE (V1) is described at:

https://github.com/drowe67/radae/blob/main/doc/rade_intro_waveform.pdf

Figure 3 and related text describes the RADE spectrum. The spectrum for FreeDV+, using the 1600 and 700D FreeDV modes, is described at:

https://www.qsl.net/wa6nut/sig.html

This document you're reading discusses the issues involved in adapting FreeDV+ for the RADE FreeDV mode.

Modifications Required

The FreeDV+ webpage shows the FreeDV+ spectrum for the 1600 and 700D modes of FreeDV. Note that the FreeDV signal is sandwiched between the FreeDV+ chrominance subcarriers (below) and the FreeDV+ luminance subcarriers (above). The composite FreeDV+ signal occupies baseband frequencies from 375 Hz and 3487.5 Hz. This transmit audio frequency range must be accommodated by the SSB transceiver used (this range is beyond the capability of most SSB transceivers).

To accommodate the RADE V1 signal, a baseband frequency range of 262.5 Hz to 3600 Hz is required (reducing the lower end by 112.5 Hz, increasing the upper end by 112.5 Hz).

Details of the modification are as follows:

Move FreeDV+ chroma subcarriers down by 112.5 Hz (3 37.5 Hz “bins”):

FROM: 375 Hz (B10) – 825 Hz (B22)
TO: 262.5 Hz (B7) – 712.5 Hz (B19)

Move FreeDV+ luminance subcarriers up by 112.5 Hz (3 37.5 Hz “bins”):

FROM: 2175 Hz (B58) – 3487.5 Hz (B93)
TO: 2287.5 Hz (B61) – 3600 Hz (B96)

Is this Modification Practical?

The original version of FreeDV+ was a “stretch”, requiring a transmit audio frequency range beyond the capability of most SSB transceivers (and the corresponding receive audio frequency range as well). To further limit the compatibility of FreeDV+ with available SSB transceivers using RADE seems unwise, especially as long as FreeDV 1600 and 700D modes remain available in the FreeDV software.

Conclusion

Since the FreeDV 1600 and 700D modes remain available in the FreeDV software, no changes will be made to accommodate the RADE mode. Accommodating the RADE mode would also require modification of the SSB transceiver to increase its bandwidth (see Appendix). The downside of keeping the present version of FreeDV+ will be that the voice component of the FreeDV+ signal will not be copied by other stations unless they switch to the 1600 or 700D mode.

Appendix

SSB Transceivers

Procedures for adjusting older SSB HF transceivers for extended bandwidth are at:

https://www.nu9n.com/transmitter_settings.html

Note that the procedures extend the bandwidth upper end higher in frequency (for the FreeDV+ luminance subcarriers). But it is also important to extend the bandwidth lower end lower in frequency (for the FreeDV+ chroma subcarriers). And extending the lower end too low could degrade the carrier suppression for the SSB signal.

Hardware modifications may also be used to extend bandwidth. See the Voodoo Labs website at:

https://www.voodoo-labs.com

and the eSSB Audio Forum at:

https://www.wz5q.net/talkvoodoo/index.php

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