RVP7 V09 Release Notes

These notes cover changes made to the RVP7 code since release V08 of 22 June 1998. If you are upgrading from an earlier release, please read those notes also.

Bug Repairs

1. The *RVP7 User's Manual* was confusing in its definition of the FIR filter bandwidth. Both the code and the manual have been improved (See New Feature #3.).

New Features

1. Transmitter phase modulation is now available from the RVP7. The eight RS422 phase control outputs will be driven with a random sequence of codes that are chosen from the set of codes enabled by the "**Mz**" command. The phase control sequence will be output only when the RVP7 is in one of its random phase processing modes (time series or parameter).

2. The RVP7 can now perform pulse-to-pulse amplitude correction of the digital (I,Q) data stream based on the amplitude of the Burst/COHO input. The technique computes a (real valued) correction factor at each pulse by dividing the mean amplitude of the burst by the instantaneous amplitude of the burst. The (I,Q) data for that pulse are then multiplied by this scale factor to obtain corrected time series. The amplitude correction is applied after the Linearized Saturation Headroom correction.

   The mean burst amplitude is computed by an exponential average whose *(1/e)* time constant is selected as a number of pulses. A short time constant will settle faster, but will not be as thorough in removing amplitude variations (since the mean itself will be varying). Longer time constants do a better job, but will require a second or two before valid data is available when the transmitter is first turned on. The default value of 70 will give excellent results in almost all cases.

   Whenever the RVP7 enters a new internal processing mode (time series, FFT, PPP, etc.), the burst power estimator is reinitialized from the level of the first pulse encountered, and an additional pipeline delay is introduced to allow the estimator to completely settle. Thus, valid corrected data are produced even when the RVP7 is alternating rapidly between different data acquisition tasks, e.g., in a multi-function ASCOPE display. The additional pipeline delay will not affect the high-speed performance when the RVP7 runs continuously in any single mode.

   For amplitude correction to be applied, the instantaneous Burst/COHO signal level must exceed the minimum valid burst power specified in the "**Mb**" section. If that level is not met, e.g., if the transmitter is turned off, then no correction is performed. Thus, the amplitude correction feature conveniently "gets out of the way" when receiver-only tests are being performed.

   The maximum correction that will ever be applied is $\pm$5dB. If the burst power in a given pulse is more than 5dB above the mean, or less than 5dB below it, then the correction is

clamped at those limits. The power variation of a typical transmitter will easily be contained within this interval (it is typically less than 0.3dB).

Instantaneous amplitude correction is a unique feature of the RVP7 digital receiver. Bench tests with a signal generator reveal that an amplitude modulated waveform having 2.0dB of pulse-to-pulse variation is reduced to less than 0.02dB RMS of (I,Q) variation after applying the amplitude correction.

3. The filter design parameters in the "**Ps**" command now list the actual 3dB bandwidth of the FIR filter, along with the cutoff frequency of the ideal lowpass prototype. Previously, only the ideal bandwidth was shown, which required that the user make a guess as to how the constraints imposed by the impulse response length would modify the ideal value. The actual 3dB bandwidth will be:

   - Larger than the ideal bandwidth if that bandwidth is narrow and the FIR length is too short to realize that degree of frequency discrimination. In these cases it may be reasonable to increase the filter length.
   - Smaller than the ideal bandwidth if the FIR length easily resolves the frequency band. This is because of the interaction within the filter's transition band of the ideal filter and the particular design window being used. For example, for a Hamming window and sufficiently long filter length, the ideal bandwidth is an approximation of the 6dB (not 3dB) attenuation point. Hence, the 3dB width is narrower than the ideal prototype width.

   Two examples of the new information line from the "**Ps**" command are:

```
Navg:3,  FIR:1.33 usec ( 48 Taps),  BW:1.000(0.503) MHz,  DC–Gain:ZERO
Navg:3,  FIR:2.92 usec (105 Taps),  BW:0.629(0.821) MHz,  DC–Gain:ZERO
```

   In each line the first bandwidth (BW) value is the actual 3dB bandwidth of the filter. This is what you would measure with a signal generator that sweeps through the filter's passband. The parenthesized BW value is the cutoff frequency of the ideal prototype. In the first example, the prototype is much narrower than the actual filter because the 1.33 μsec impulse response is incapable of resolving the 0.503 MHz ideal bandwidth. In the second example, there are plenty of filter taps to work with and the 3dB width is narrower than the prototype because of the edge effects of the (Hamming) window.

Setup Changes

1. An additional setup question has been added to the "**M***" section to permit the LOG conversion slope to be viewed, changed, and locked at its present value. The RVP7 uses the LOG slope only for the purpose of converting internal calibrated power levels into the older style [0–256] LOG units when the latter are needed for output. This new question allows the RVP7 to work properly with old versions of ZAUTO that would try to change the slope midway through the calibration process. By manually locking the RVP7's LOG slope at some reasonable value (we recommend 0.480 dB/#), the reload attempted by an old ZAUTO will be ignored, and the calibration steps can be completed successfully.

2. The command to produce a complete listing of all RVP7 setup parameters is now ”??” rather than ”M”. This was changed because the single ”M” was too likely to be typed by mistake. Note that the single ”?” command still produces the short help command list.

3. New setup questions have been added to support transmitter phase modulation (See New Feature #1.). The transition time of the phase lines (relative to the other triggers) is chosen by a new question in the ”**Mt<n>**” section. The state of the phase lines when idle, i.e., not producing a random sequence, is chosen by a new question in the “**Mz**” section.

4. The following questions have been added to the “Mp” section to configure amplitude correction (See New Feature #2.).

```
Apply amplitude correction based on Burst/COHO: YES
  Time constant of mean amplitude estimator: 70 pulses
```