RVP7 V19 Release Notes

These notes cover changes made to the RVP7 code since release V18 of 25 March 2000. If you are upgrading from an earlier release, please read those notes also. Most of the bug repairs and new features in this release are related to new DAFC (Digital AFC) uplink features, and better support at high PRFs up to 20KHz.

Bug Repairs

1. A memory allocation error was repaired that would cause the RVP7 to crash in time series mode whenever a) the RVP7 was configured for dual simultaneous receivers, and b) the product of the sample size with the bin count was greater than 4500.

2. Additional PRF checks have been added to insure that there is sufficient time for the uplink serial data stream to be properly transmitted. Operation at the maximum PRF of 20KHz now requires that the FIR impulse response length be less than 2.8 μsec.

3. Additional checks have been added to insure that the bits in each uplink serial transmission are internally consistent, i.e., that changing AFC levels can not produce a single transmission that contains some bits from the old level and some from the new.

   Important: This repair does not require any hardware change as long as you plan to operate at PRFs below 10KHz. For operation up to 20KHz you must install the new RVP7-3-U73 chip, which SIGMET will supply at no cost to any customer who actually needs it. The RVP7 will detect which version of U73 is installed and impose the appropriate PRF bounds.

4. A bug was repaired in the detection of the burst pulse signal level that could cause the AFC tracking loop not to switch off immediately upon loss of the burst pulse, e.g., at the instant that the transmitter is turned off (not terribly serious). This bug was introduced in Rev.15.

5. Additional PRF checks have been added to the **Pr** plotting command to insure that the IF data are always sampled properly. Plots having 20 μsec and 50 μsec data spans starting from range zero will now be PRF-limited to approximately 6.8Khz and 3.1KHz. The PRF bound will be further reduced as the start range of the plot is increased; an effect which conceivably could limit the PRF at any plot span.

New Features

1. The amount of time series data that can be acquired in each processed ray has been increased. The product of the sample size with the bin count can now be as large as 15000, rather than the previous limit of 9000.

2. The new RVP7/DAFC Digital AFC Module is now available, and is fully supported by this code release. Please see Section 2.4 of the *RVP7 User's Manual* for a complete write-up of this new board and its functions.

3. The **Ps** filter design and plotting command now displays the power loss (calibration error) that results when the given filter is applied to the given transmit burst waveform. This allows you to correct for the difference between what a broad-band power meter measures as the overall transmit power, and what the RVP7 narrow-band receiver will detect within its passband. The filter loss is a subtle quantity that depends on the combined characteristics of both the transmit waveform and the receiver matched filter.

   The filter loss is zero if the burst waveform consists of a pure sinusoid at the designated intermediate frequency. It is also very near zero as long as all of the burst energy is contained within the passband of the RVP7's filter. The filter loss will increase as the bandwidth of the burst waveform increases and begins to spill out of that passband. Typical losses for a well-matched filter are in the 0.5–1.8dB range, depending on the FIR length and other design criteria.

   If your radar calibration was performed using CW waveforms, then the reported filter loss should either be added to the receiver calibration losses, or subtracted from the effective transmit power; the net result being that dBZ_0 will increase slightly.

4. The RVP7's implementation of AFC has been generalized so that there is no longer any difference between configuring an analog loop and a digital loop. The AFC loop parameters themselves are unchanged, but there is a new model for how the AFC information is made available to the outside world. Many new types of interfaces and protocols have thus become possible. AFC output now follows these three steps:

   - The internal feedback loop still uses a conceptual [–100%,+100%] range of values. However, this range may now be mapped into an arbitrary numeric span for eventual output. For example, choosing the span from –32768 to +32767 would result in 16-bit AFC just like before, and 0 to 999 might be appropriate for 3-digit BCD; but any other span could also be selected from the full 32-bit integer range.

   - Next, an encoding format is chosen for the specified numeric span. The result of the encoding step is another 32-bit pattern which represents the above numeric value. SIGMET will make an effort to include in the list of supported formats all custom encodings that our customers encounter from their vendors.

     Available formats include straight binary, BCD, and mixed-radix formats that might be required by a specialized piece of equipment. The "8B4D" format encodes the low four decimal digits as four BCD digits, and the remaining upper bits in binary. For example, 659999 base-10 would encode into 0x00419999 Hex.

   - Finally, an output protocol is selected for the bits that comprise the encoded span of values. The bits may be written to the eight RVP7/Main backpanel RS232 outputs (the former digital AFC bits), or sent on the uplink as a value to be received by the RVP7/IFD (the former analog AFC voltage). But the newest option is for the bits to be sent on the uplink and received by the RVP7/DAFC board, which supports arbitrary remapping of its output pins.

To summarize: the internal AFC feedback level is first mapped into an arbitrary numeric span, then encoded using a choice of formats, and finally mapped into an arbitrary set of pins for digital output. We are hopeful that this degree of flexibility will allow easy hookup to virtually any STALO synthesizer that one might encounter.

5. The serial 16-bit uplink data word now has several different interpretations according to how the RVP7 has been configured, and whether Bit #22 of the uplink stream is set or clear. The evolution of these different formats has been in response to new features being added to the RVP7/IFD, and the production of the RVP7/DAFC Digital AFC Module. Please see Section 2.51 of the *RVP7 User's Manual* for a description of the complete set of uplink formats.

i **Note 1: The RVP7 will continue to support all of the uplink formats that have existed in the past. The new protocols have been implemented in such a way as to assure backward compatibility with old uplink receiving hardware.**

i **Note 2: If you plan on using the RVP7/DAFC board along with RVP7/IFD clock locking at the same time, then you will need to install an IFD–4–U6 upgrade chip in your RVP7/IFD. At the moment, we know of no customers that actually use this configuration.**

6. It is now possible to reassign the waveforms that are driven onto the six user trigger (TRIG1–6) BNC outputs on the backpanel of the RVP7. This makes it easier to adapt the external cabling of the RVP7 so as to make better use of the available BNC connectors and related 15V drivers. You may substitute either of the two polarization control lines or the four pulsewidth control lines in place of any of the six normal triggers. See also Setup Change #5.

7. The RVP7's internal trigger interrupt handler now runs as a multiplexed co-routine in support of Bug Repair #3. Much less CPU time is used, especially at PRFs above 5KHz, and many more options for future uplink support are now possible. However, fewer independent burst pulses are processed each second compared to before, and you may notice a little more uncertainty in the 1KHz digit of the Burst frequency estimator that is shown in the **Pb** and **Ps** plots. This almost certainly will not pose any real problem; but if it does, you may want to retune (increase) some of the settling time parameters in the **Mb** section.

Setup Changes

1. The **Ps** command now reports filter loss (See New Feature #3.) in its continuously printed status line as follows:

```
Freq:29.997 MHz,  Pwr:–6.8 dBm(–5.5*us), Loss:1.2db,  AFC:–18.39%
```

The filter loss is a positive number in deciBels, and is only displayed if the overall burst power exceeds the minimum valid burst threshold set in the **Mb** command. Clearly, it would not be possible to compute the filter loss when the burst waveform is missing.

2. The **Ps** command can now produce a numerical printout of the frequency response of the FIR filter (in addition to already being able to print the filter coefficients). Use the new "*****" command which will display the spectrum in deciBels at 500 equally spaced points.

3. The additional number in square brackets that is printed to the right of the **Ps** command's AFC level now shows the encoded bit pattern which corresponds to that level. This will only appear when the RVP7 deduces that a special digital format is being used, i.e., when the backpanel phase-out lines have been configured for AFC, or when any of the following are not true: a) the low and high numeric AFC span is –32768 to +32767, b) the uplink is enabled, c) the uplink format is binary, and d) pinmap protocol is OFF. Binary format is printed in base-10, BCD format is printed in Hex, and 8B4D format is printed with the low 16-bits (four BCD digits) in Hex and the upper bits in base-10.

4. There are several new AFC questions in the **Mb** setup section that control how AFC is made available to the outside world. See the full description under New Feature #4.

```
AFC span– [–100%,+100%] maps into [ –32768 , 32767 ]
AFC format– 0:Bin, 1:BCD, 2:8B4D: 0,  ActLow: NO
AFC uplink protocol– 0:Off, 1:Normal, 2:PinMap : 2
  PinMap Table (Type '31' for GND, '30' for +5)
  ---------------------------------------------
  Pin01:00   Pin02:01   Pin03:02   Pin04:03   Pin05:04
  Pin06:05   Pin07:06   Pin08:07   Pin09:08   Pin10:09
  Pin11:10   Pin12:11   Pin13:12   Pin14:13   Pin15:14
  Pin16:15   Pin17:16   Pin18:17   Pin19:18   Pin20:19
  Pin21:20   Pin22:21   Pin23:22   Pin24:23   Pin25:24
  FAULT status pin (0:None): 0,  ActLow: NO
```

5. Six new questions have been added to the **Mt** (general trigger setup) section that allow you to reassign the waveforms being driven onto the six user trigger BNC outputs:

```
Trigger #1 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 0
Trigger #2 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 0
Trigger #3 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 0
Trigger #4 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 1
Trigger #5 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 0
Trigger #6 – 0:Normal, 1–2:Pol0–1, 3–6:PW0–3 : 4
```

   In the example above, triggers #1, #2, #3, and #5 are all driven with their normal waveforms. However trigger #4 will have a copy of the POLAR0 polarization control line, and trigger #6 will have a copy of the PWBW1 pulsewidth control line. Neither POLAR0 nor PWBW1 themselves are changed by these assignments.

   Whenever any of the six user trigger lines is reassigned from its normal setting, the plot of that trigger within the **Pb** command will show a hashed line across the screen. This is a graphical reminder that that trigger has been replaced by some other waveform.

6. Removed the extra Carriage-Return / Line-Feed that preceded typing the setup banner the first time that the setup menus were entered after bootup.

7. The *Current Noise Level* and *Powerup Noise Level* questions in the **Mt<n>** setup section now will only show information for the primary and secondary receive channels when a dual-receiver configuration has indeed been selected. Previously, the secondary channel levels would be printed even for a single-receiver system.