**THETIS 2.6.4 RELEASE NOTES 8 APRIL 2019**

There are many changes in this major update of Thetis.

* VAC1 startup problem fixed.
* VAC2 resampler problem fixed.
* Option to use VAC2 on split.
* Speedier TX-RX and RX-TX transitions on phone (improves latency by at least 10ms).
* New default database values (DATABASE RESET HIGHLY RECOMMENDED—see below for more information).
* Substantially improved QSK features and performance. FULL QSK is now possible on the 7000DLE, 8000DLE, and 200D hardware. (REQUIRES Protocol 2 firmware—see below for more information).
* Substantially improved VOX/DEXP features and performance (see below for more information).

**New Default Database Values**

The default values in earlier versions of Thetis were based on those in PowerSDR mRX PS, which have not been updated in a very long time. These defaults were based on much older, much less advanced versions of software and hardware. As such, they were long overdue for updating themselves.

Starting with this version of Thetis, there is a completely new set of default values that should help new users be more immediately productive and enjoy a better, "out of the box" user experience.

PERFORMING A DATABASE RESET WITH THIS VERSION IS HIGHLY RECOMMENDED.

Because of the large number of changes associated with both the new default values and the new VOX/DEXP functionality, it is strongly recommended that with Thetis 2.6.3 users start with a totally reset database and manually rebuild their settings. To prepare for this consider the following actions:

* Make screenshots of important or complex settings, for instance amplifier calibration values.
* Use Setup > Transmit > Export Current Profile to export important and/or complex transmit profiles.
* Use Setup > CAT > Configure MIDI > Manage Mappings > Export Mappings to export MIDI settings.

For each transmit profile exported it can be imported using Settings > Import Database. It will require a separate import cycle for each profile. You will most likely want to re-save each profile to pick up the additional VOX/DEXP elements that will now comprise a part of the transmit profile. WARNING: transmit profiles also modify the settings in Setup > DSP > Options. If may want to review those settings after importing a transmit profile. Recommended settings are a Filter Type of “Low Latency”, Filter Size of 4096, and Filter Window BH-7.

MIDI settings can be imported using the “Import Mappings” function that was adjacent to the “Export Mappings” function referred to above.

**New QSK Capability on CW**

This version of Thetis supports operating QSK in CW modes, and REQUIRES Protocol 2 firmware as follows:

* ANAN-7000 (all versions) or ANAN-8000: Protocol 2 firmware version 1.7 or later.
* ANAN-200D: Protocol 2 version 1.6 or later.

A new button labeled QSK appears in the CW sub-panel of the main console when operating in CW modes (CWU or CWL). If the Protocol 2 firmware version currently loaded in your radio is older than that required (see above), the QSK button is disabled. With QSK (sometimes called “full break-in”) enabled, receiver audio can be heard between CW elements (dots and dashes). This enables monitoring activity while transmitting. It's very useful when working a split-frequency or simplex DX pileup, operating in a contest, or any time the ability to hear what's going on while sending is desired.

Clicking the QSK button to activate the QSK features causes several settings to take effect that enable optimal QSK operation. These include:

* AGC is set to Custom mode (more on this later)
* PTT is disabled (it's handled in the firmware on CW when QSK is engaged)
* Semi break-in mode is enabled, and its delay is set to zero (0).
* Since Thetis MOX is not active in QSK (necessary for quick response), there is no transmit spectral displays and NO TRANSMIT METERING. Simply turning off QSK will resume the display and metering of normal transmit behavior, either with PTT or semi-break-in.

When the QSK button is clicked to disable QSK (or when changing to a non-CW mode, including when this happens as a result of clicking a band button), everything is set back to the way it was before QSK was enabled.

While operating QSK, the sidetone level becomes tied to the monitor level, which can be set in the Setup > Transmit, monitor sub-panel, with the control labeled "TX AF". Since it is a separate control from the receiver audio, the sidetone can be adjusted to be louder or softer than the receive audio according to preference. The setting remains in effect until QSK is disabled, at which time it returns to its previous value. TX AF levels will then switch back and forth between the QSK and non-QSK setting depending on the state of the QSK button.

With QSK on your own signal is heard in the receiver while transmitting. When operating with a single VFO (i.e. not split) the tone heard is identical to the CW pitch setting, since that determines the transmitter offset in CW when in tranceive mode. Depending on the sidetone volume, it may be possible to distinguish between the two tones due to a slight time difference between them. If the transmit frequency is moved slightly away from its transceiver offset, either by changing RIT/XIT or tuning the transmitter off frequency a bit using split mode, both tones will be clearly heard at different frequencies.

You will want to experiment with the Custom-mode AGC settings to tailor QSK behavior to your liking. This is done by activating QSK, then going into Settings > DSP > AGC/ALC. The AGC settings are on the left. The following settings are a good starting place:

* Slope 5, Max Gain 100, Decay 1, Hang 12.

Additional QSK Operating Notes:

1. Although semi-break-in can be manually enabled with a delay of 0 without QSK, this results in something less than true QSK. It will work but nothing will be audible between CW elements unless sending very slowly. The new QSK mode makes use of the AGC Custom mode setting and increases the AGC hang threshold to a high enough value so that AGC hang doesn't blank out the receiver between CW elements.
2. The key-down delay (Setup > General > Options) is now limited to permit a setting no shorter than 7ms to ensure a clean CW signal. Setting it lower than this would cause key clicks to be transmitted due to keying the CW signal before the relays have fully engaged. This is not healthy for the relays, and other operators on the band will not appreciate the resulting key clicks that are produced, which may extend up and down the band for 10s of KHz. Some external amplifiers may also need a longer delay, although this setting should work with most. Check your amplifier’s manual and timing requirements before using its QSK capability. In the other direction, increasing key-down delay longer than about 10ms reduces the time available to hear signals between CW elements, defeating the purpose of QSK. Likewise, key-up delays longer than a few ms is unnecessary and you likely will find that the minimum of 1ms works fine.
3. When in QSK, the usual cycling of the MOX function in Thetis doesn't occur. As a result, checking for band boundaries doesn't happen and will not prevent you from transmitting out of band. Use caution! Prevention may come in the next release.

**New Thetis VOX/DEXP Functionality**

Up until now the VOX gate and the downward expander/noise gate (DEXP) have been two different audio processing stages. They were largely redundant and not very adjustable. In particular the VOX was rather unsophisticated and not well disposed to natural sounding voice. With the advent of the new, high performance audio processing facilities in PowerSDR 3.4.1 and then in Thetis, this was the final remaining area for improvement in the audio processing chain for phone operations. The primary goal for this change was to provide studio quality noise gating and downward expansion, and thereby obtain smoother, more reliable operation and much more natural sounding voice quality on the air. To that end there are a lot more adjustments available, a delay line to avoid first syllable cut-off, and a couple of features designed to eliminate VOX activation due to background noises. These adjustments can be left at the default setting, all set to minimum numbers with DEXP turned off for an old-fashioned, hard-edged VOX, or adjusted to obtain the performance desired. *Used properly, and with judicious adjustment, people may not even realize you are using VOX!*

**Location in the signal processing chain:**

* Mic input: the VOX/DEXP block is located after Mic Boost and before Mic Gain and all other audio processing.
* Line input: the VOX/DEXP block is located before Mic Gain and all other audio processing.
* VAC input: the VOX/DEXP block is located after VAC Gain and before all other audio processing.
* Anti-VOX taps receiver audio after RX1 AF and RX2 AF controls, but before Master AF or VAC RX Gain.

**User interface changes:**

* Both the VOX and DEXP threshold control are now combined into a single slider widget that provides audio level metering indications against the selected threshold.
* The DEXP slider widget is no longer required.
* VOX and DEXP controls are now located together in Setup > DSP > VOX/DE.

**Modes of operation:**

* VOX OFF, DEXP OFF—no PTT action, no gating or downward expansion.
* VOX ON, DEXP OFF—PTT action, all gating functions operating except for Expander Ratio (Exp. Ratio), which is effectively set to infinity (a pure gate, no downward expansion).
* VOX OFF, DEXP ON—no PTT action, all gating and expander functions operating.
* VOX ON, DEXP ON—PTT action, all gating and expander functions operating.

**Basic gate adjustments:**

* VOX threshold is adjusted with the slider control on the main console user interface in the same manner as previous versions of Thetis. Approximately 15 to 20 dB above normal background noise levels is a good starting point (not including receiver audio; see “Anti-VOX” below).

The remaining controls are found in Setup > DSP > VOX/DE:

* Attack time—after being triggered open the gate gain increases from fully closed to fully open in this amount of time. This adjustment can help soften the start of audio for a more natural sounding result, it is typically kept short for radio applications. 2 ms is a good starting point.
* Hold time—after being triggered closed the gate gain will stay fully open for this amount of time. This is most closely analogous to the old VOX hold time. If re-triggered open this timer resets. Adjust as desired, typical values range around 250ms, which is also a good starting point.
* Release time—after the hold time expires the gate gain decreases from fully open to fully closed in this amount of time. With VOX enabled, PTT releases after this time expires. It can be made longer for a more natural sound, especially when not using VOX, or made shorter for contest or VOX work. Typical values range from 10ms to 250ms. 100ms is a good starting point.
* Det. (detector) Tau—the amount of time the input audio must be over threshold before the gate is triggered open and, with VOX activated, PTT asserted. Making this longer can help filter out extraneous background noises from triggering the gate, such as typing on a keyboard, but it does increase gate latency. 10-20ms is a good starting point.
* Anti-VOX—this feature raises the VOX threshold in real time in concert with receiver audio levels in order to prevent receiver audio emanating from speakers from tripping the VOX threshold. Anti-VOX is not required when using headphones, of course. Note: this is not “noise cancellation”, only an adjustment based on sound level.
* Anti-VOX Gain—this is the gain factor used to cause VOX threshold adjustments in concert with receiver audio volume emanating from the radio speaker(s). This value can be positive or negative. Set the value as low as possible but high enough to prevent receiver audio from triggering VOX. It generally helps to set it very low, say -40dB, then work up from there. For average listening levels and RX1 AF or RX2 AF set to 100, a value of -20dB is typical. If the VOX threshold is set using a quiet room (fans and other equipment, but no receiver audio), adjustment in this manner should still allow triggering VOX even when receiver audio is active, e.g. when trying to break into a DX pile-up.
* Anti-VOX Tau—this sets the time constant of the low pass filter applied to the Anti-VOX gain algorithm. Smaller numbers make Anti-VOX more responsive to receiver audio at the expense of making the Anti-VOX gain setting more sensitive (aka “touchy”). 20ms is a good starting place.
* Use VAC Audio—when not checked, Anti-VOX will use both RX1 and RX2 audio (nominally for people using speakers attached to radio hardware). When checked, Anti-VOX will use the audio present on active VAC outputs (nominally for users who are fully “virtualized” i.e. remoted from the hardware).

**Advanced gate adjustments:**

* Side-channel Trigger Filter—when enabled, the actual audio used by the gate trigger detector will be filtered by the combination of the low and high cut filter adjustments. This does NOT affect the audio passed through the gate and sent out over the air, which remains unfiltered. Along with the Det. Tau adjustment, the side-channel filter can be extremely helpful in eliminating false triggers caused by keyboarding, bumping or moving the microphone around, cats jumping on the desk, etc. Adjust this to match up with the dominant frequencies of your voice. A low cut of 500Hz and a high cut of 1500Hz is a good starting point.
* Audio look-ahead—this adjusts a delay line such that the VOX/gate trigger decision can be made on a first syllable but that first syllable will not be lost because the gate acts on the audio coming out of the delay line. For best results this setting should be greater than the sum of the Det. Tau setting AND the RF Delay setting (in Setup > General > Options) PLUS 10ms. Used properly, people may not even realize you are using VOX. The downside is that there is some latency so it may not be the optimum choice for contesting or the like. Proper adjustment depends on how quickly you speak, but a good starting place is 60ms.
* Hyst. (hysteresis) Ratio—to prevent rapid triggering/un-triggering of the gate this is the difference between the threshold for triggering the gate open or closed. 2dB is a good starting point.

**Expander adjustment:**

* Exp. Ratio—this is the only expander adjustment, and this is the slope of the audio gain line from the gate threshold to fully closed. For a hard, "pure" gate, this can be made equal to 30dB. A more typical value would be 10dB which results in a 10:1 slope (fairly steep). For those who prefer a softer, more gradual transition (usually those who are not using VOX, maybe someone who just wants to suppress background fan noise), this can be made very gradual. For example a value of 3dB will provide a 2:1 gain slope.