# ANDROMEDA



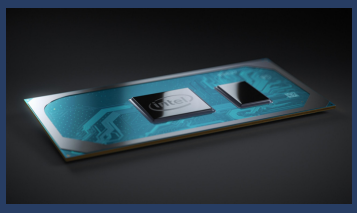
ANDROMEDA integrates all of the elements of an HF software defined radio. The PC, display, DSP and RF elements are all integrated into a single unit giving true standalone operation. The front panel is fully integrated to the THETIS software providing leading edge DSP with “conventional radio” usability.

The front panel features a high resolution VFO encoder, six dual encoders for a range of settings and 29 pushbuttons. All the encoders and pushbuttons are programmable allowing the user to re-allocate them to other functions from a menu within THETIS.

A 7” touchscreen display is provided for the THETIS PC display. A configurable “softkey” menu button bar at the bottom of the screen can be used to make most of the user settings needed to operate THETIS; others are accessed through setup menus. A set of pushbuttons below the touchscreen can be used to operate the “softkey” buttons, or could be user reprogrammed to other functions.

## CUTTING EDGE FEATURES:

ANDROMEDA incorporates a high spec Intel i7 NUC PC running the Window 10 operating system. THETIS runs on the NUC; other radio programs can also be run on it for functions such as logging, FT8 encoding & decoding and more. Wi-Fi is available as standard; an external Ethernet port and display can be connected to a rear panel USB3 hub if needed. ANDROMEDA truly can be a complete radio in one box.

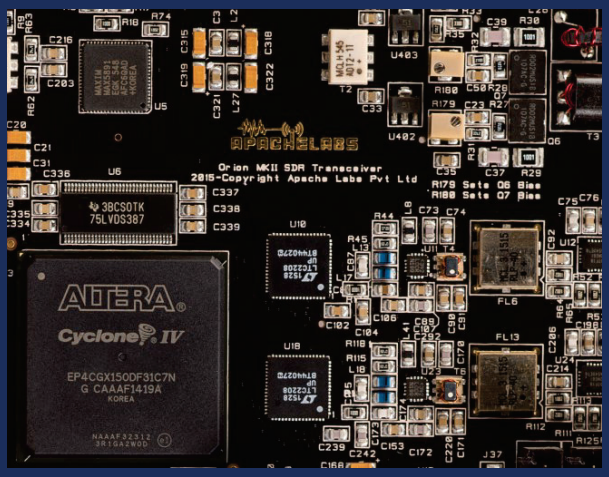


Windows 10

An automatic Antenna Tuning Unit will be available as a user upgrade. This is integrated into THETIS and the tuner status is shown on the display. Settings are stored for each of 3 antennas at 10KHz steps across the HF band. Tuning is fully integrate into the radio’s TUNE function.

**Noise Mitigation:** The new Spectral Noise Blanker uses a priori knowledge of speech and noise, specifically, statistical models of speech and noise, to produce superior signal-to-noise ratios and vibrant sound.

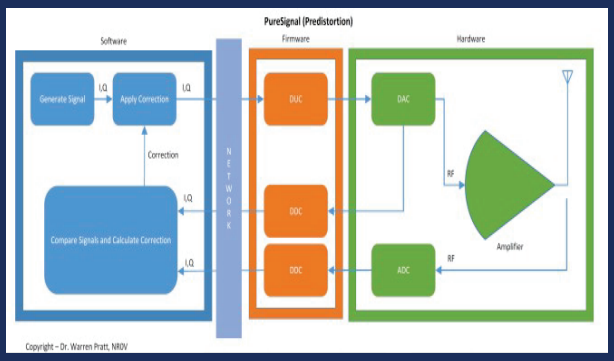
**Minimized Latency:** Filtering contributes most of the latency in SDR processing. There are two reasons: (1) large sets of samples, "buffers," are normally collected before executing the filter so that efficient FFT algorithms can be used, and (2) sharp "brick-wall" linear-phase filters inherently have a long latency , no matter ho w implemented. Both these issues have been addressed and conquered in Andromeda. Small "buffers," requiring little collection time, can now be used even with very sharp "brick-wall" filters. In addition, the option of using very low-latency "minimum-phase" filters is provided. In almost all situations, laboratory and on-air testing have demonstrated no discernible difference in performance between linear-phase and minimum-phase filters. With filters as sharp as you desire, sub-20ms receive latencies are now available, comparable to the best of conventional DSP radios and much better than competing SDRs!




Andromeda includes two phase synchronous front ADCs to enable Diversity reception and other advanced applications, the transmit chain is designed keeping in mind PureSignal (Predistortion).

Andromeda provides protection against high SWR, there are onboard sensors to detect Voltage, Current and chassis temperature.

## PURESIGNAL PREDISTORTION




There is no truly Linear RF amplifier, the non-linearity in an amplifier shows up as Inter Modular distortion within and outside the transmitted bandwidth, there are challenges to reducing IMD which are not trivial, hence, most manufacturers either do not quote IMD values in their specifications or use an inefficient Class A option at much lower than rated power output to slightly reduce IMD.

Andromeda has been built from scratch keeping in mind PureSignal (Predistortion), it achieves an astounding -66dB IMD (below PEP) on 20M at full 100W output, this is at least 25 to 30dB or approximately a 1000 times lower distortion than a “Class A” capable flagship transceiver.

An ultra-rugged LDMOS driver and a rugged MOSFET amplifier completely


Redesigned for adaptive Predistortion achieves excellent IMD figures, no other brand Transceiver can match Andromeda Transmit IMD.

Andromeda uses the universally accepted 13.8v DC supply standard for the internal PC and the Radio, hence, making it extremely adaptable to field use.

## Monoblock SDR:

Andromeda combines a modern & Powerful Intel i5/i7 Windows 10 PC with a high Performance 100W HF & 6M SDR Radio.
Data Logging, FT8 and other Digital Modes can be run without the need for an external PC as required with other radios.

## WITH APPROPRIATE SOFTWARE AND ANTENNAS OUR SDRS CAN BE USED FOR :

- Phil Harman, VK6PH's VNA Application
- Alex, VE3NEA's VNA Application
- If a linux “dual boot” environment is configured, John Melton’s Pihpsdr and linhpsdr applications could be used.
  The PC can also execute other radio related applications. These may include logging functions, data mode encoding and decoding such as FT8, PSK31 or more.
- Spatial diversity operations to mitigate/reduce signal fading compared with single antenna operations

## Developers

**Phil Harman, VK6PH**
*Hardware Design, Ethernet Protocol for the OpenHPSDR/ANAN SDRs, FPGA code, KISS Console, VNA Software.*

**Doug Wigley, W5WC**
*OpenHPSDR PowerSDR developer and Custodian.*

**Dr. Warren Pratt, NR0V**
*WDSP DSP Engine, PureSignal (Predistortion Algorithm), Minimized Latency Filtering, Noise mitigation Algorithms.*

**Kjell Karlsen, LA2NI**
*Andromeda Front Panel Design,*
*RF Driver Amplifier and other Hardware inputs.*

**Laurence Barker, G8NJJ**
*Andromeda concept design, Arduino sketches for front panel and ATU, THETIS changes for touchscreen display*

**Abhishek Prakash**
*Orion MKII and overall Hardware design.*

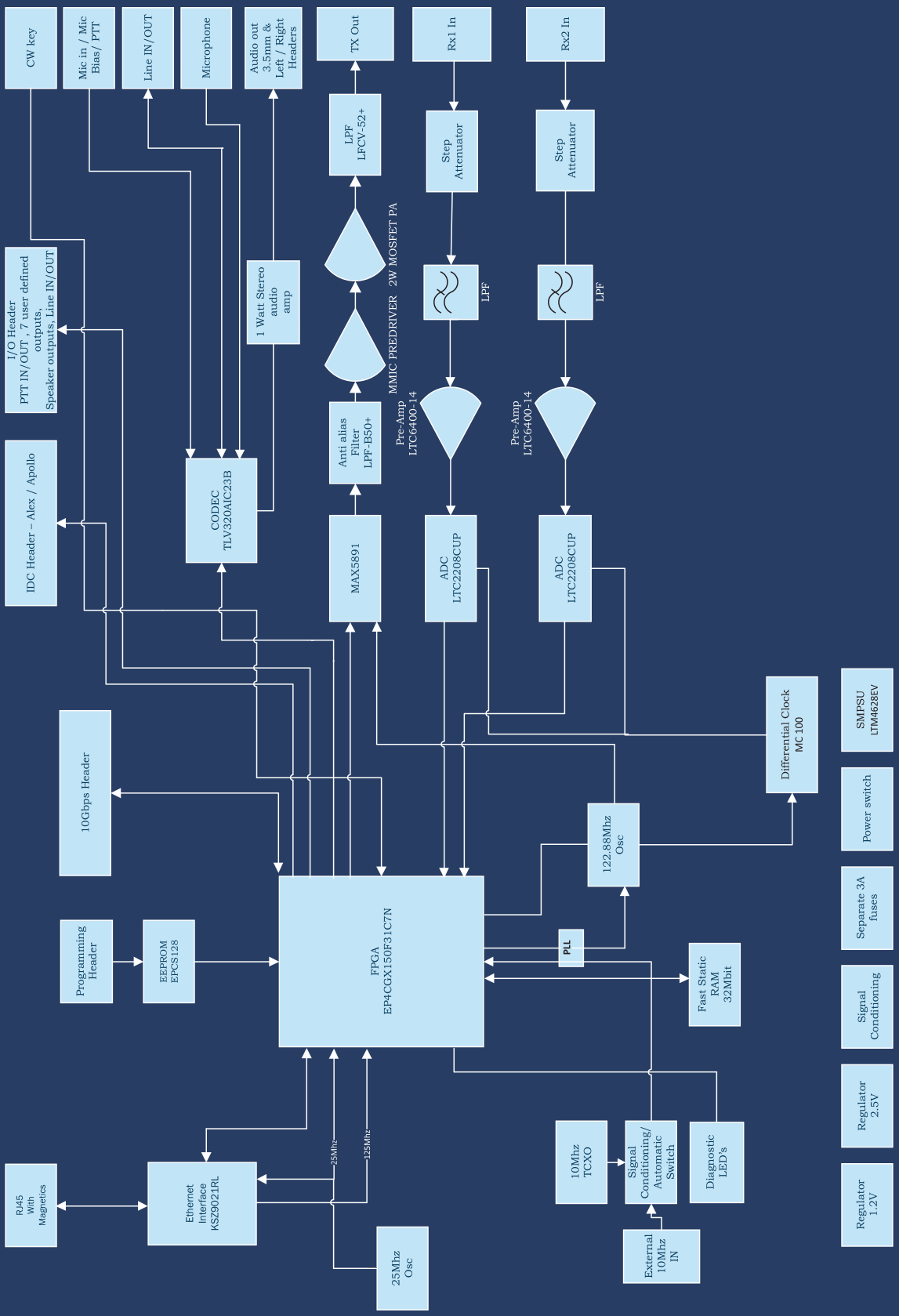
**Dr. Joe Martin, K5S0**
*Orion MKII FPGA code, Diversity and Radio Astronomy code.*

**John Melton, G0ORX**
*Developer of the PiHPSDR, Android, QTHPSDR and GHPSDR Applications.*

**Adam Farson, AB4OJ/VA7OJ**
*Detailed Hardware Testing and Analysis.*

**Richard Koch, N1GP**
*Firmware Development.*

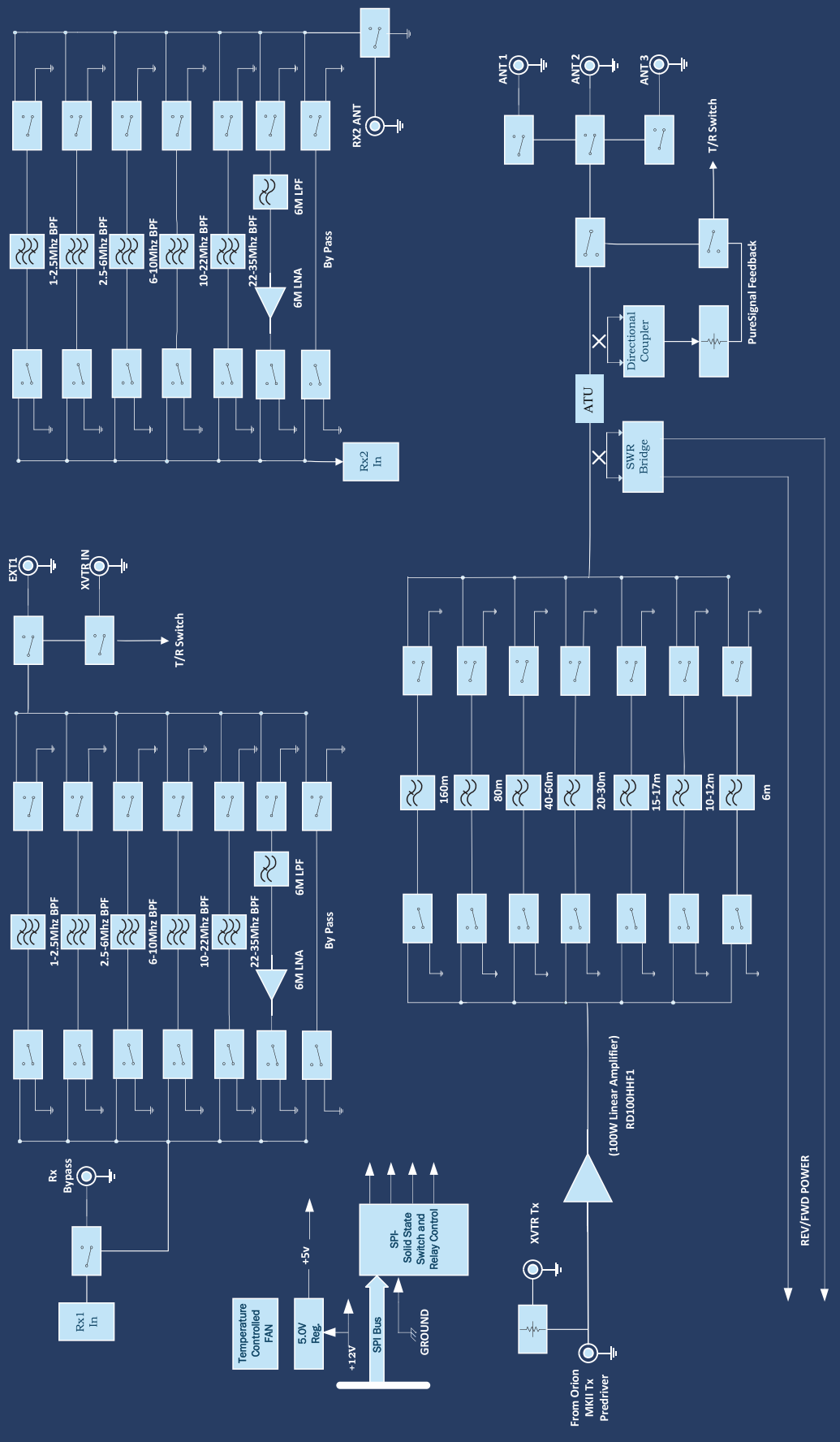

*Back Panel IOs*




# ANDROMEDA MKII SDR CARD



*Based on the work of the OpenHPSDR Community*




## ANDROMEDA AMP & FILTERS


*Based on the work of the OpenHPSDR Community*

# SPECIFICATIONS & HIGHLIGHTS

## GENERAL SPECIFICATIONS:

- Architecture: Direct Sampling DDC/DUC Transceiver
- Interface: Mono-Block Inbuilt PC
- Phase Noise (Clock): -149dB @ 10Khz
- TCXO Stability (Typical): /- .1 PPM
- Modes: CW, SSB, NFM, AM, Digital
- Antenna Ports: 3 - BNC 50 ohm Software Configurable Ports, 2 - BNC ADC1 receive only
  antenna ports, 1 – BNC Transverter receive only port, 1 - BNC for ADC2
- Frequency Resolution: 1 Hz

## ELECTRICAL SPECIFICATIONS:

- 13.8v DC @ 25A, 4A Rx/25A Tx (13.8v 30A Supply recommended)

## MECHANICAL SPECIFICATIONS:

- 6 Kg (approx. Weight)
- Dimensions: 355MM (L) x 130MM (H) x 300MM (W) (Not including extrusions)

## RECEIVER SPECIFICATIONS:

- Receiver Architecture: Direct Down Conversion
- Dual 16 bit Phase Synchronous ADCs
- Independent filter banks for each ADC
- 6M LNAs
- Frequency Coverage: 9Khz to 60Mhz
- Attenuator: 1-30dB step attenuator
- Reciprocal Mixing Dynamic Range (RMDR): 116dB @ 2Khz offset
- Receiver Phase noise: -149dB @ 10Khz
- Image rejection: 90dB
- Hardware support for 7 independent receivers assignable to either ADC

## TRANSMITTER SPECIFICATIONS:

- Transmitter Architecture: Direct Up Conversion
- DAC Resolution: 16 bit
- RF Output Power: 100W SSB, CW, FM, RTTY, Digital; 1-30W AM
- IMD3 typically -68dB below PEP @ 100W output on 20M
- Harmonics: Typically better than -43dBc on HF and -60dBc on 6M
- Carrier and Opposite Sideband Suppression: Better than -80dBc
- Transverter IF Output: 0db to 15dB

## ADDITIONAL IO CONNECTIONS:

- RCA - Line In, PTT In, PTT Out, 2 – DIG inputs
- DB9F - 7 Software Configurable Open Collector Outputs
- SMA – XVTR output, 10Mhz Reference Input
- 3.25mm Barrel Mic, CW Key, Headphones and two 6.25mm Speaker Outputs, SDR RJ-45
- PC- USB 2.0 , USB 3.0, USB-C, Audio Barrel (PC), Wi-Fi SMA

## ATU:

To be determined, The ATU will be available as an add-on product at a later date.

## TWO PHASE SYNCHRONOUS ADCs

ANDROMEDA includes phase synchronous ADC's to enable Diversity reception and other advanced applications. The Transmit chain is designed keeping in mind the unique "PureSignal" Linearization and predistortion.

## NOISE BLANKERS:

The PowerSDR provides a choice of two Wideband Noise Blankers in addition to the new Spectral Noise Blanker by Warren NR0V.
The two Wideband Noise Blankers are:

- A pre-emptive Blanker which effectively slews it's output to zero before an impulse arrives, and then slews back to full amplitude after the impulse passes.
- An Interpolating Noise Blanker which is also pre-emptive, but has modes such as Linear interpolation of the signal during the impulse. Wideband Noise Blankers, while they are the best choice in some situations, have a well-known issue that they may become ineffective in the presence of strong adjacent signals, for example during a busy contest. The Spectral Noise Blanker cleverly overcomes this deficiency by using Linear Predictive Coding (LPC). LPC provides the capability to predict a sequence of samples by analyzing the spectral content of the samples before and after the sequence. By comparing the predictions with the measured samples, impulses are detected and blanked or reduced. The LPC is again used to predict what the signal waveform should be during the incident pulse and thereby replace the corrupt samples with clean signals.

## FRONT PANEL:

- High resolution 480ppr VFO encoder
- 6 dual encoders. The functions for each are fully programmable
- 29 pushbuttons. The functions for each are programmable
- 7" 1024x600 touchscreen display
- Menu bar with 8 "softkey" menu buttons
- Configuration form to allow all encoders, pushbuttons and menu buttons to be re-assigned

## MINIMIZED LATENCY:

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## PURESIGNAL PRE-DISTORTION:

There is no truly Linear RF amplifier. The Non-linearity in an amplifier shows up as Intermodulation Distortion (IMD) within and outside the transmitted bandwidth. There are many challenges to reduce IMD, hence, most manufacturers of Amateur Radio Equipment do not specify their IMD, or use inefficient Class-A options that lower IMD at the expense of power. Andromeda was designed with the unique PureSignal Linearization (Pre- Distortion) to achieve an astounding -68dBm IMD on 20M at full 100W output. This achievement in design is an improvement of at least 25 to 30dB or approximately 1000 times lower distortion than conventional "Class-A" capable flagship transceivers.



APACHE LABS
3 Pershing Way, Point Cook, VIC, 3030. Australia
Tel: +61 459 618 933,
Email: support@apache-labs.com,
www.apache-labs.com