

# TitanSDR

## HF Multichannel SDR Receiver

### Parallel Demodulation, Recording and Analysis of HF Emissions

#### Main Features

- Direct conversion Front-End architecture
- 9 kHz to 32 MHz frequency coverage
- 16 frequency preselectors
- High front-end linearity
- One to four parallel Wideband channels (312.5 KHz to 2.1875 MHz wide)
- Up to 40 parallel Narrowband channels
- Modes: SSB, AM, NBFM, CW, eSSB, FSK, IQ
- High frequency resolution Panoramic Spectrum (305 Hz RBW)
- Wideband and Narrowband spectrum and waterfall (with custom palette)
- Record-and-replay of Wideband channels
- Scheduler of recording activities
- Software frequency calibration
- Squelched-controlled recording
- Tight integration with Krypto500 decoder by Comint Consulting
- Support for Hoka Electronic software decoders

#### Overview

TitanSDR is a Software Defined Radio receiver, allowing up to 40 NB (Narrowband) channels. It is operated by a commercial PC (Personal Computer), through USB 2.0 interfacing. Acquisition bandwidth can be split into up to 4 WB (Wideband) channels. WB and NB channels are provided with spectrum and waterfall plots and can be recorded and replayed. Interface to software decoders is through VAC (Virtual Audio Cable) or LAN Ethernet (customizable on request).



#### Applications

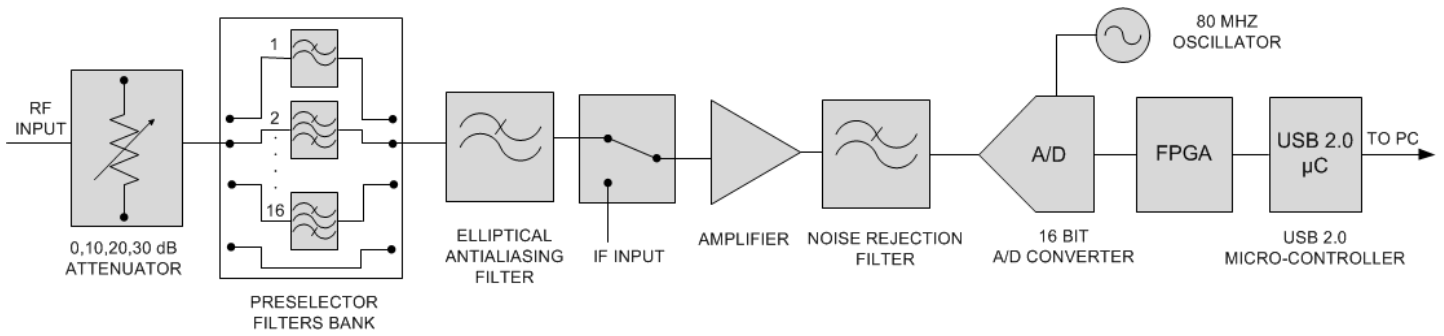
TitanSDR is an effective tool for surveillance and monitoring of the radio spectrum and can be usefully employed in the following areas:

- Homeland security and foreign intelligence (SIGINT and COMINT)
- Military communications
- Environmental protection (from electromagnetic pollution)
- Detection of interfering or illegal electromagnetic emissions (by national radio frequency agencies)

#### Advantages

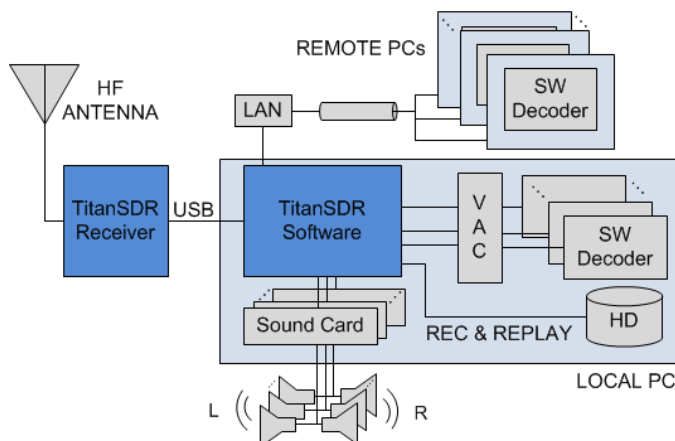
Until recently multiple monitoring of radio channels required a distinct receiver for each channel and a multicoupler (to split the antenna signal among receivers), resulting in costly systems with significant dimensions, weight and power consumption. Instead by just connecting TitanSDR to an HF aerial, dozens of radio channels can be listened to (by PC sound cards), recorded (as .wav files) or streamed to software decoders (for decoding of digital formats) in parallel. TitanSDR is ideal to equip monitoring centers and for monitoring missions in which logistics is a critical element, thanking to its compactness.

## Receiver Block Diagram

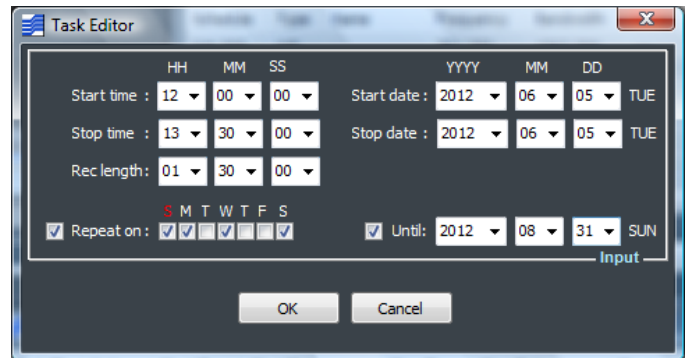


## Software Features

In *Receiver mode* (as opposite of *Player mode*), software input is from the receiver via USB 2.0. Front-End controls allow to set the receiver input (HF or IF), the attenuation to HF input and the preselection filter (if required). After allocating a WB channel (possible bandwidth ranges from 312.5 KHz to 2.1875 MHz), it can be tuned by mouse dragging of the corresponding shaded area over the *Panoramic Scope* (see next page, upper screenshot). NB channels are allocated on the *Wideband Scope* (down left side window) and are represented by shaded areas of the same color of their WB channel. By clicking on a NB channel shaded area, its spectrum appears on the *Narrowband Scope* (down right side window) where mode can be set, as well as channel bandwidth (by editing or mouse dragging its cut-off filter frequencies). All spectrum scopes allow averaging, zooming and choosing among several data windowing alternatives. Custom palettes can be set for NB and WB waterfall plots. Figure below illustrates how outputs of TitanSDR software may be possibly employed.



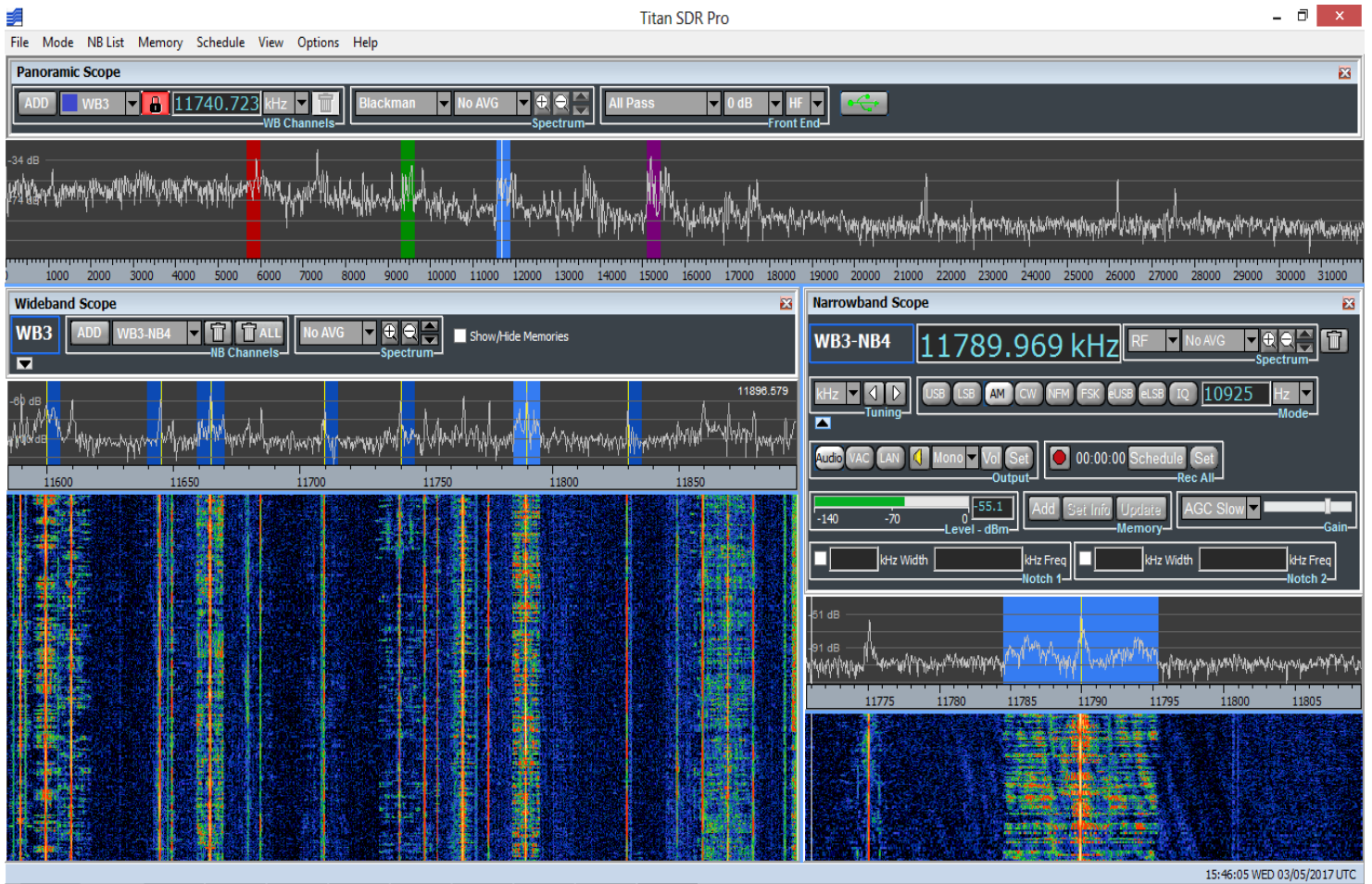
In particular NB channels demodulated output can be listened to (by PC loudspeakers), recorded (at customizable sampling rate) on local HD (wav files) and sent to external third party software decoders, by VAC or LAN. NB channel recording can be squelch controlled. Furthermore its spectrum can be displayed (instead of RF spectrum), as well as its waterfall plot. WB channels can be recorded and resulting archive files (proprietary format) can be played-back in *Player mode*. Recording of each NB and WB channel can even be scheduled through the *Task Editor* window (screenshot below).



All allocated NB channels are listed in the *NB Channels List* (see next page, lower screenshot), reporting their status and allowing to recall their controls by simply clicking on their rows.

## DSP approach

Innovative pre-processing (based on filters banks) was implemented on FPGA, instead of conventional DDC (Digital Down Conversion), allowing for flexible partitioning of the acquisition bandwidth into WB channels and permitting tens of NB channels with reduced impact on CPU, even during replay of WB channels.



TitanSDR Software: *Panoramic Scope* (top), *Wideband Scope* (down left side) and *Narrowband Scope* (down right side)

The screenshot shows the "NB Channels List" dialog box, which contains a table listing various narrowband channels. The table has the following columns: Name, Frequency, Bandwidth, Mode, Audio, Wav Rec, VAC, VAC Output, LAN, and Memory.

Name	Frequency	Bandwidth	Mode	Audio	Wav Rec	VAC	VAC Output	LAN	Memory
<input type="checkbox"/> WB1-NB1	980.897	10.000	IQ	---	On	---	---	---	Mem001
<input type="checkbox"/> WB1-NB2	1106.940	10.000	NFM	---	Off	---	---	---	---
<input type="checkbox"/> WB2-NB1	15435.052	10.000	AM	LEFT	Off	---	---	RIGHT	Mem004
<input type="checkbox"/> WB2-NB2	15499.490	0.500	CW	---	On	---	---	---	Mem003
<input type="checkbox"/> WB3-NB1	9655.657	2.500	LSB	---	Off	Line 2 (Virtua...	RIGHT	---	---
<input checked="" type="checkbox"/> WB3-NB2	9680.004	10.000	AM	---	Off	---	---	---	---
<input type="checkbox"/> WB3-NB3	9555.052	0.500	CW	---	Off	---	---	LEFT	---
<input type="checkbox"/> WB3-NB4	9605.886	2.500	LSB	---	On	Line 2 (Virtua...	LEFT	---	---
<input type="checkbox"/> WB3-NB5	9724.569	10.000	eSSB-U	---	Off	---	---	---	---
<input type="checkbox"/> WB3-NB6	9800.089	10.000	eSSB-L	---	Off	---	---	---	Mem002
<input type="checkbox"/> WB3-NB7	9629.859	2.000	FSK	RIGHT	On	Line 1 (Virtua...	RIGHT	---	---

An "OK" button is located at the bottom center of the dialog box.

TitanSDR Software: screenshot of *NB Channels List*

## Technical Data

<b>Frequency Range</b>	9 kHz – 32 MHz
<b>Noise Figure</b>	<b>9 KHz - 1.5 MHz:</b> NF = 15.25dB <b>1.5 MHz – 32 MHz:</b> NF = 14.2dB
<b>Preselectors (16)</b>	<b>Low Pass:</b> 0-1.54 MHz <b>Band Pass (1.44-32 MHz):</b> 1.44-2.07, 1.88-2.7, 2.4-3.46, 2.96-4.26, 3.56-5.12, 4.22-6.08, 4.88-7.03, 5.53-7.96, 6.46-9.31, 7.81-11.24, 9.74-14.03, 12.53-18.05, 16.55-23.17, 21.67-28.17, 26.67-32
<b>Attenuation</b>	0dB, 10dB, 20dB, 30dB
<b>Clipping</b>	-8dBm (@ 0dB Attenuation)
<b>Wideband Channels</b>	<b>Maximum Number of Channels:</b> 4 <b>Bandwidths (kHz):</b> 312.5, 625, 937.5, 1250, 1562.5, 1875, 2187.5 <b>Maximum Total Bandwidth (kHz):</b> 2187.5, 1875, 1562.5 and 1250 for 1, 2, 3 and 4 Wideband Channels, respectively
<b>Narrowband Channels</b>	40 independently tunable within Wideband Channels
<b>Spectrum Scopes Refresh Rate</b>	19 Hz
<b>Panoramic Scope</b>	0 Hz ÷ 32 or 40 MHz, 305 Hz RBW
<b>Wideband Scope</b>	312.5 ÷ 2187.5 kHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable palette)
<b>Narrowband Scope</b>	<b>RF:</b> 39.06 kHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable palette) <b>Audio:</b> 5512.5 ÷ 22050 Hz, RBW 5.4 ÷ 21.5 Hz (Spectrum & Waterfall with customizable palette)
<b>Modes</b>	USB, LSB, AM, NBFM, CW, eUSB, eLSB, FSK, IQ
<b>Selectivity</b>	100 dB (Stop Band Attenuation)
<b>Sensitivity</b>	-116 dBm (0.34 µV) SSB at S+N/N=10dB, 15MHz, 2.4 kHz BW

<b>Tuning Accuracy</b>	+/- 0.5 ppm (worst case prior to software calibration procedure)
<b>Recording</b>	Wideband Channels: - Simultaneous recording of all channels (proprietary file format) Narrowband Channels: - Simultaneous recording of all channels (.wav files) - Squelch controlled recording - Selectable sampling rate (8000, 11025, 16000, 22050, 24000, 44100 48000 sps) <b>Scheduler function:</b> recording at programmable time intervals (also day-time periodic tasks with selectable days of week)
<b>Demodulated audio to SW decoders</b>	By <b>VAC</b> (Virtual Audio Cable) By <b>LAN</b> to <i>Krypto500</i> and to <i>Hoka Electronic</i> software decoders
<b>Support for SW developers</b>	LAN Ethernet control of TitanSDR software application through ad hoc TCP commands set
<b>Memories</b>	Saving allowed for NB channel frequency, bandwidth, mode, entry time, entry date, callsign, ITU code, station and user description
<b>A/D Conversion</b>	16 bit, 80 Msps
<b>Image Rejection</b>	90 dB typ.
<b>IIP3</b>	>37 dBm
<b>SFDR</b>	>108 dB
<b>Alias Rejection</b>	115 dB
<b>Antenna Input</b>	50 Ohm BNC
<b>IF input</b>	50 Ohm SMA - Bandwidth: 0.1 ÷ 32MHz
<b>PC Operating System</b>	Windows 7/Vista/XP
<b>PC Interface</b>	USB 2.0
<b>Operating Temperature</b>	0° - 40° (°Celsius)
<b>Supply Voltage</b>	6VDC +/-1V
<b>Supply Current</b>	2.5Amp
<b>Dimensions</b>	243mm x 52mm x 145mm (WxHxL)

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