TitanSDR-HF
TitanSDR-VLF
TitanSDR-AB

Multichannel SDR Receivers

Data Sheet

TitanSDR-HF (Versions 1.0 and 2.0):

- Frequency coverage: 100 kHz to 32 MHz
- 16 frequency preselectors
- Acquisition bandwidth: 2.18 MHz (max) and 9.66 MHz for Version 1.0 and 2.0 respectively
- Up to 4 WB channels for Version 1.0
- Up to 40 and 100 Narrowband channels for Version 1.0 and 2.0 respectively

TitanSDR-VLF:

- Frequency coverage: 3 kHz to 2 MHz (by a single WB channel)
- Up to 40 Narrowband channels

TitanSDR-AB (Air Band):

- Frequency coverage: 118 - 137 MHz
- WB channel: 19 MHz
- Up to 100 Narrowband channels

Common features:

- Modes: SSB, AM, NBFM, CW, eSSB, FSK, IQ
- Wideband and Narrowband spectrum and waterfall (with custom color palette)
- Record-and-replay of Wideband channels
- Scheduler of recording activities
- Squelched-controlled recording
- Third party decoders: tight integration with Krypto500 (by Comint Consulting) and CODE300-32 (by Hoka Electronic)
- *Spectrum Explorer* (SE) of Wideband recordings (software option)
- *Energy Detection* (ED) to monitor lists of frequencies (software option)

Overview

The TitanSDRs are Software Defined Radio receivers. They are operated by a commercial PC (Personal Computer), through USB 2.0 interfacing. Interface to third party software decoders is through VAC (Virtual Audio Cable) or LAN Ethernet.

Acquisition bandwidth of TitanSDR-HF Ver. 1 can be split into up to 4 WB (Wideband) channels, whilst TitanSDR-HF Ver.2, TitanSDR-VLF and TitanSDR-AB feature a single WB channel. WB and NB channels can be recorded and WB recordings can be played back.

Applications

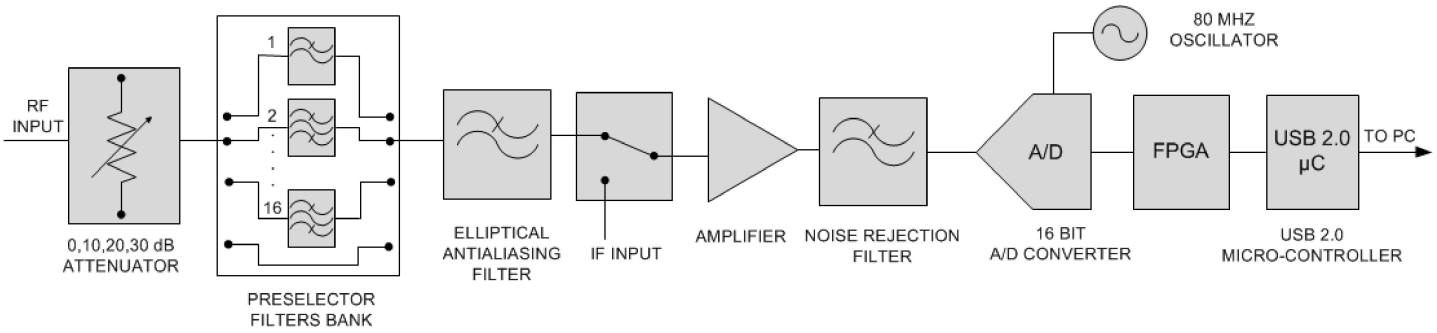
The TitanSDRs are effective tools for surveillance and monitoring of the radio spectrum and can be usefully employed in the following areas:

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

Advantages

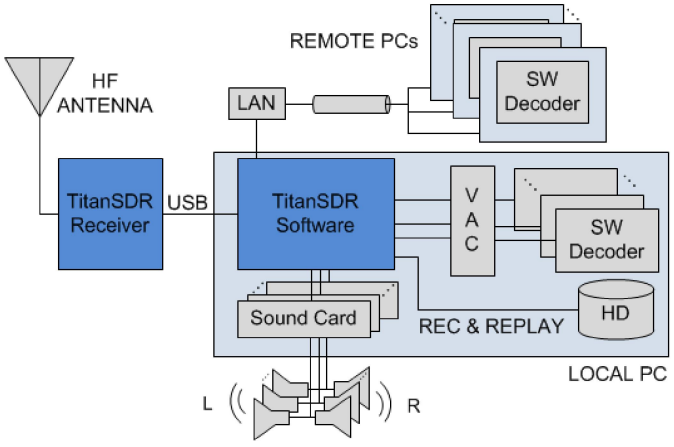
Until recently multiple monitoring of radio channels required a distinct receiver for each channel and a multicoupler (to split the antenna signal among receivers), resulting in costly systems with significant dimensions, weight and power consumption. Instead by just connecting each TitanSDR to an aerial, 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. The TitanSDRs are ideal to equip monitoring centers and for monitoring missions in which logistics is a critical element, thanking to their compactness.

Receiver Block Diagram

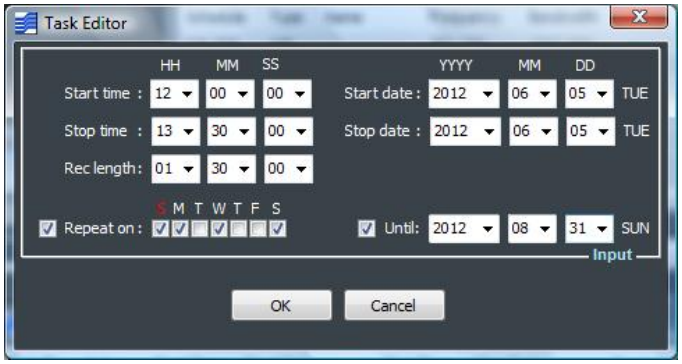


Basic Software Features

In *Receiver mode* the PC software application is fed by the receiver via USB 2.0 streaming. Front-End controls allow to set the receiver input (RF or IF), the attenuation to RF input and the preselection filter for TitanSDR-HF. After allocating a WB channel (possible bandwidths are from 312.5 KHz to 2.18 MHz for TitanSDR-HF Ver.1, 9.66 MHz for TitanSDR-HF Ver.2 and 19 MHz for TitanSDR-AB), it can be tuned by mouse dragging the corresponding shaded area over the *Panoramic Scope* (see next page, upper screenshot). NB channels can be allocated within any WB channel on the *Wideband Scope* (down left side window of software application GUI) and are represented by shaded areas of the same color of their WB channel. By clicking on a NB channel shaded area, its RF 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 and zooming. Custom color palettes can be set for NB and WB waterfall plots. Figure below illustrates how NB and WB channels outputs can be sourced from the PC software.



In particular, the demodulated output of any NB channel can be listened to by PC loudspeakers, recorded (at customizable sampling rate) on local HD as a wav file (also possibly under squelch control) and addressed to external third party software decoders, by VAC or LAN. Also the spectrum of demodulated audio can be displayed as an alternative to RF spectrum. 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).

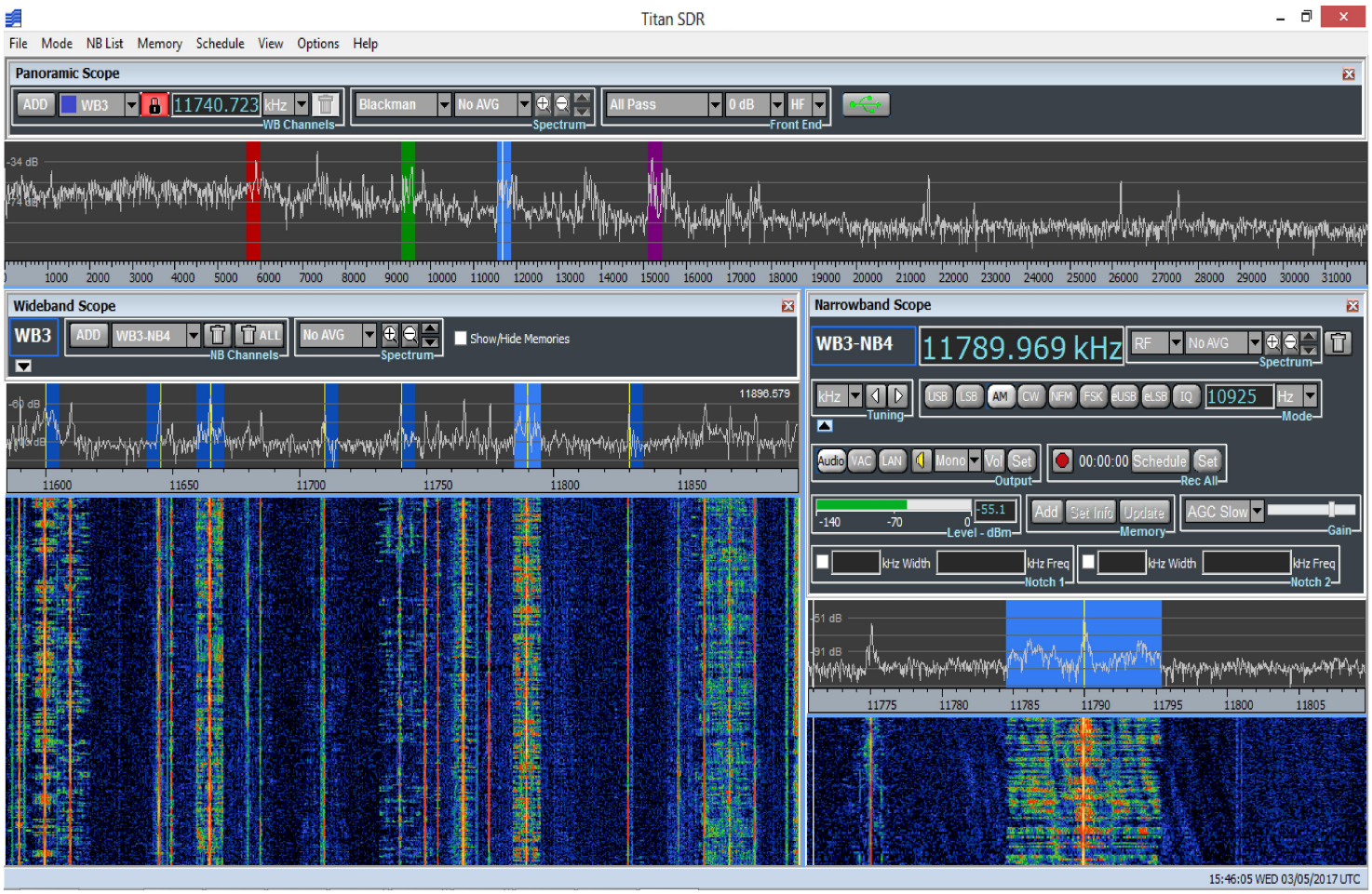


All allocated NB channels are listed in the *NB Channels List* (see next page, lower screenshot), reporting their status and allowing to recall their controls by simply clicking on their rows.

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 off line replay of WB recordings.

Software application GUI of TitanSDR-HF

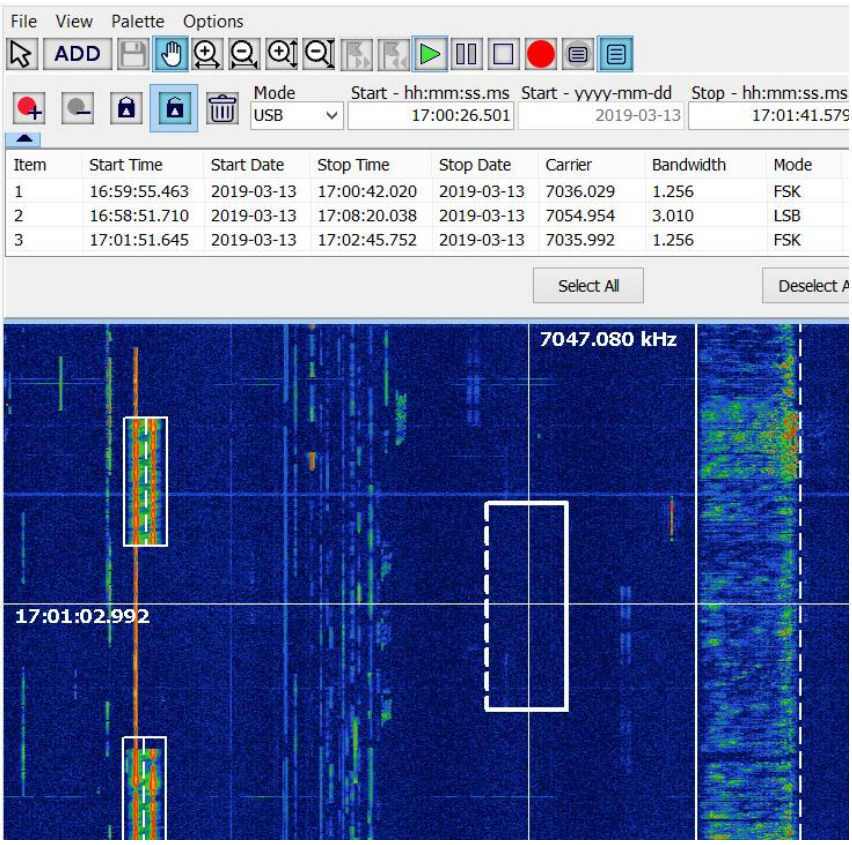


Software application GUI: *Panoramic Scope* (top), *Wideband Scope* (down left side) and *Narrowband Scope* (down right side)

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

Software application GUI: screenshot of *NB Channels List*

Spectrum Explorer (SE) - Off-line .wav files extraction from WB recordings



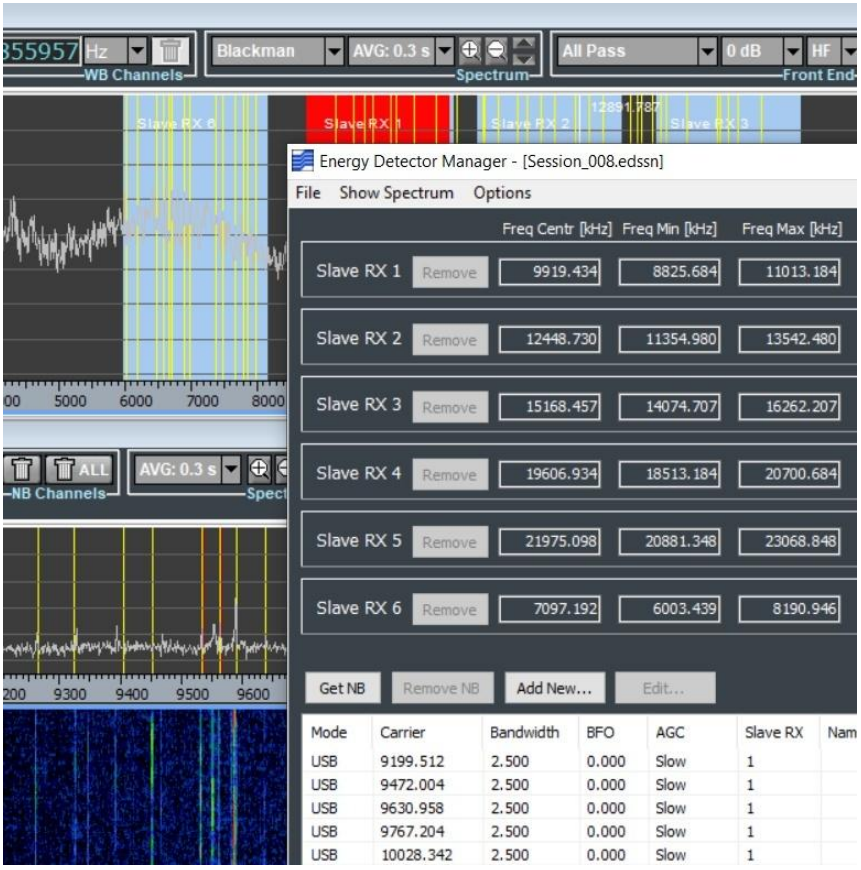
The *Spectrum Explorer* (SE) functionality (available as a software option for the TitanSDRs) allows to explore any WB recording, by representing it as time-frequency power map, based on a selectable color palette (frequency increases from left to right and time increases from top to bottom). Exploration in time and frequency is done by mouse dragging and zooming in/out the map. Transmissions can be identified graphically as vertical stripes and, after enclosing them into rectangles, they can be demodulated (based on any NB channel mode), listened to and extracted as WAV files, all within few mouse clicks. A list of transmissions is populated with all added rectangles.

Energy Detection (ED) - Real-time .wav files production for listed frequencies

The *Energy Detection* (ED) functionality, available as a software option, allows to monitor lists of frequencies by automatically:

- allocating NB channels in real time on those frequencies that get used
- recording the demodulated output of allocated NB channels as .wav files.

The ED functionality for TitanSDR-HF can monitor frequencies which fall in a spectrum interval of 2.18 MHz for Ver.1, 9.66 MHz for Ver.2 and 19 MHz for TitanSDR-AB, whilst it can monitor frequencies in the 3kHz-2MHz band for the VLF version. Multiple receivers can be added to the same detection session (to allow frequency coverage extension and/or antenna diversity) and their controlling PCs are managed via LAN by the same *Energy Detector Manager* window.



TitanSDR-HF Ver. 1 - Technical Data

Frequency Range	100 kHz – 32 MHz
Noise Figure	< 16 dB
Preselectors (16)	***Low Pass:*** 0-1.54 MHz ***Band Pass*** *(1.44-32 MHz)**:*** 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
Attenuation	0dB, 10dB, 20dB, 30dB
Clipping	-8dBm (@ 0dB Attenuation)
Wideband Channels	***Maximum Number of Channels:*** 4 ***Bandwidths*** *(kHz)**:*** 312.5, 625, 937.5, 1250, 1562.5, 1875, 2187.5 ***Maximum Total Bandwidth*** *(kHz)**:*** 2187.5 , 1875, 1562.5 and 1250 for 1, 2, 3 and 4 Wideband Channels, respectively
Narrowband Channels	40 independently tunable within Wideband Channels
Spectrum Scopes Refresh Rate	19 Hz
Panoramic Scope	0 Hz ÷32 or 40 MHz, 305 Hz RBW
Wideband Scope	312.5 ÷ 2187.5 kHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable palette)
Narrowband Scope	***RF:*** 39.06 kHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable color palette) ***Audio:*** 5512.5 ÷22050 Hz , RBW 5.4 ÷ 21.5 Hz (Spectrum & Waterfall with customizable palette)
Modes	SSB, AM, NBFM, CW, eSSB, FSK, IQ
Selectivity	100 dB (Stop Band Attenuation)
Sensitivity	-116 dBm (0.34 µV) SSB at S+N/N=10dB, 15MHz, 2.4 kHz BW
Tuning Accuracy	+/- 0.5 ppm (worst case prior to software calibration procedure)

Recording	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) ***Scheduler function:*** recording at programmable time intervals (also day-time periodic tasks with selectable days of week)
Demodulated audio to SW decoders	By **VAC** (Virtual Audio Cable) By **LAN** to *Krypto500* (by Comint Consulting) and *CODE300-32* (by Hoka Electronic) software decoders
Support for SW developers	LAN Ethernet control of software application through ad hoc TCP commands set
Memories	Saving allowed for NB channel frequency, bandwidth, mode, entry time, entry date, callsign, ITU code, station and user description
A/D Conversion	16 bit, 80 Msps
Image Rejection	90 dB typ.
IIP3	>37 dBm
SFDR	>108 dB
Alias Rejection	115 dB
Antenna Input	50 Ohm BNC
IF input	50 Ohm SMA - Bandwidth: 0.1÷ 32MHz
PC Operating System	Windows 7/Windows 10
PC Interface	USB 2.0
Operating Temperature	0° - 40° (°Celsius)
Supply Voltage	6VDC +/-1V
Supply Current	2.5Amp
Dimensions	243mm x 52mm x 145mm (WxHxL)
SW options	- SE (Spectrum Explorer) of WB recordings - ED (Energy Detection) of listed frequencies

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TitanSDR-HF Ver. 2 - Technical Data

Frequency Range	100 kHz – 32 MHz
Noise Figure	< 16 dB
Preselectors (16)	***Low Pass:*** 0-1.54 MHz ***Band Pass*** *(1.44-32 MHz)**:*** 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
Attenuation	0dB, 10dB, 20dB, 30dB
Clipping	-8dBm (@ 0dB Attenuation)
Wideband Channel	Bandwidth *(MHz)**:*** 9.66
Narrowband Channels	100 independently tunable within the Wideband Channel
Spectrum Scopes Refresh Rate	25 Hz
Panoramic Scope	0 Hz ÷32 or 40 MHz, 203.4 Hz min RBW
Wideband Scope	9.66 MHz, min RBW 25.4 Hz (Spectrum & Waterfall with customizable palette)
Narrowband Scope	***RF:*** 39.06 kHz, min RBW 25.4 Hz (Spectrum &Waterfall with customizable color palette) ***Audio:*** 5512.5 ÷22050 Hz , RBW 5.4 ÷ 21.5 Hz (Spectrum & Waterfall with customizable palette)
Modes	SSB, AM, NBFM, CW, eSSB, FSK, IQ
Selectivity	100 dB (Stop Band Attenuation)
Sensitivity	-116 dBm (0.34 µV) SSB at S+N/N=10dB, 15MHz, 2.4 kHz BW
Tuning Accuracy	+/- 0.5 ppm (worst case prior to software calibration procedure)

Recording	Wideband Channel: recording bandwidth of 9.66 MHz (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) ***Scheduler function:*** recording at programmable time intervals (also day-time periodic tasks with selectable days of week)
Demodulated audio to SW decoders	By **VAC** (Virtual Audio Cable) By **LAN** to *Krypto500* (by Comint Consulting) and *CODE300-32* (by Hoka Electronic) software decoders
Support for SW developers	LAN Ethernet control of software application through ad hoc TCP commands set
Memories	Saving allowed for NB channel frequency, bandwidth, mode, entry time, entry date, callsign, ITU code, station and user description
A/D Conversion	16 bit, 80 Msps
Image Rejection	90 dB typ.
IIP3	>37 dBm
SFDR	>108 dB
Alias Rejection	115 dB
Antenna Input	50 Ohm BNC
IF input	50 Ohm SMA - Bandwidth: 0.1÷ 32MHz
PC Operating System	Windows 7/Windows 10
PC Interface	USB 2.0
Operating Temperature	0° - 40° (°Celsius)
Supply Voltage	6VDC +/-1V
Supply Current	2.5Amp
Dimensions	243mm x 52mm x 145mm (WxHxL)
SW options	- SE (Spectrum Explorer) of WB recordings - ED (Energy Detection) of listed frequencies

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TitanSDR-VLF - Technical Data

Frequency Range	3 kHz – 2 MHz
Noise Figure	< 16 dB for frequency >10kHz
Attenuation	0dB, 10dB, 20dB, 30dB
Narrowband Channels	40 independently tunable
Spectrum Scopes Refresh Rate	19 Hz
Wideband Scope	0-2 MHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable palette)
Narrowband Scope	***RF:*** 39.06 kHz, min RBW 19.07 Hz (Spectrum & Waterfall with customizable color palette) ***Audio:*** 5512.5 ÷22050 Hz , RBW 5.4 ÷ 21.5 Hz (Spectrum & Waterfall with customizable palette)
Modes	CW, FSK, SSB, eSSB, IQ
Selectivity	100 dB (Stop Band Attenuation)
Tuning Accuracy	+/- 0.5 ppm (worst case prior to software calibration procedure)
Recording	Wideband recording: - 0-300 kHz band recording (for off line replay) Narrowband recordings: - Simultaneous recording of all narrowband channels (.wav files) - Squelch controlled recording - Selectable sampling rate (8000, 11025, 16000, 22050, 24000, 44100 48000 sps) ***Scheduler function:*** recording at programmable time intervals (also day-time periodic tasks with selectable days of week)
Demodulated audio to SW decoders	By **VAC** (Virtual Audio Cable) By **LAN** to *Krypto500* (by Comint Consulting) and *CODE300-32* (by Hoka Electronic) software decoders
Memories	Saving allowed for NB channel frequency, bandwidth, mode, entry time, entry date, callsign, ITU code, station and user description
A/D Conversion	16 bit, 80 Msps
Image Rejection	90 dB typ.

SFDR	>108 dB
Alias Rejection	115 dB
Antenna Input	50 Ohm BNC
PC Operating System	Windows 7/Windows 10
PC Interface	USB 2.0
Operating Temperature	0° - 40° (°Celsius)
Supply Voltage	6VDC +/-1V
Supply Current	2.5Amp
Dimensions	243mm x 52mm x 145mm (WxHxL)
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TitanSDR-AB - Technical Data

Frequency Range	118 MHz - 137 MHz
Noise Figure	< 16 dB
Attenuation	0dB, 10dB, 20dB, 30dB
Clipping	-10dBm (@ 0dB Attenuation)
Wideband Channel	Bandwidth***:*** 19MHz
Narrowband Channels	100 independently tunable within the Wideband Channel
Spectrum Scopes Refresh Rate	31 Hz
Panoramic Scope	118 ÷137 MHz, 254.25 Hz min RBW
Wideband Scope	19 MHz, min RBW 31.8 Hz (Spectrum & Waterfall with customizable palette)
Narrowband Scope	***RF:*** 48.82 kHz, min RBW 31.8 Hz (Spectrum &Waterfall with customizable color palette) ***Audio:*** 5512.5 ÷22050 Hz , RBW 5.4 ÷ 21.5 Hz (Spectrum & Waterfall with customizable palette)
Modes	SSB, AM, NBFM, CW, eSSB, FSK, IQ
Selectivity	100 dB (Stop Band Attenuation)
Tuning Accuracy	+/- 0.5 ppm (worst case prior to software calibration procedure)
Recording	Wideband Channel: recording bandwidth of 10.5 MHz (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) ***Scheduler function:*** recording at programmable time intervals (also day-time periodic tasks with selectable days of week)
Demodulated audio to SW decoders	By **VAC** (Virtual Audio Cable) By **LAN** to *Krypto500* (by Comint Consulting) and *CODE300-32* (by Hoka Electronic) software decoders

Support for SW developers	LAN Ethernet control of software application through ad hoc TCP commands set
Memories	Saving allowed for NB channel frequency, bandwidth, mode, entry time, entry date, callsign, ITU code, station and user description
A/D Conversion	16 bit, 100 Msps
Image Rejection	90 dB typ.
SFDR	>108 dB
Alias Rejection	115 dB
Antenna Input	50 Ohm BNC
PC Operating System	Windows 7/Windows 10
PC Interface	USB 2.0
Operating Temperature	0° - 40° (°Celsius)
Supply Voltage	6VDC +/-1V
Supply Current	2.5Amp
Dimensions	243mm x 52mm x 145mm (WxHxL)
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