LSATx

## SDR PLATFORM ALLOWING DIRECT SAMPLING AND SYNTHESIS FROM IF TO X-BAND

CelestiAntwerp
Celestia Technologies Group Company

LSATx

The LSATx is a Software Defined Radio (SDR) platform that allows direct sampling and direct synthesis from 70 MHz up to X-band. It is a digital front end for use as part of low, medium and geostationary earth orbit (LEO/MEO/GEO) satellite ground stations. Unlike legacy frequency converters, no analog conversion is performed before sampling or after the digital-to-analog conversion. Instead, LSATx relies on latest generation of analog-to-digital converters (ADC), digital-to-analog converters (DAC) and tracking-and-hold amplifiers (THA), with wide RF bandwidth and high sampling rates. It converts RF input signals coming from an Antenna RF section into Ethernet frames that will be injected in a 10 Gigabit Ethernet (GbE) link towards a baseband modem. On the transmitting side, it performs direct synthesis of an RF signal from digital samples received over an 10 GbE link from the baseband modem.
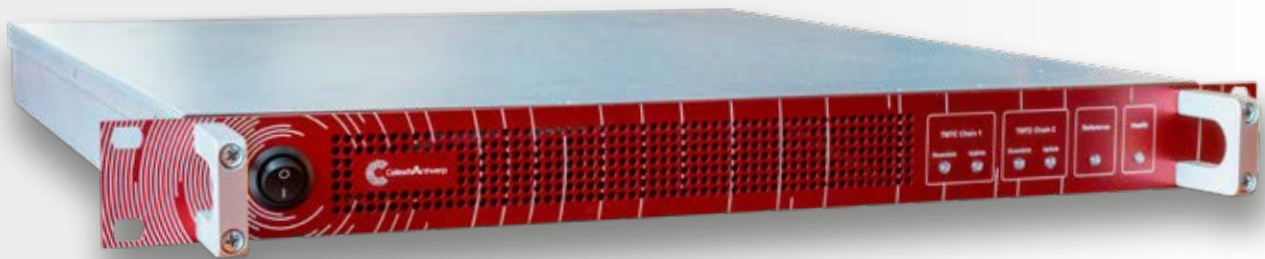
MAIN FUNCTIONALITY

RX PART	TX PART
RF signal amplification and conditioning	RF signal synthesis, amplification and conditioning
Filtering of images, spurious, harmonics and out of band signals	Filtering of images, spurious, harmonics and out of band signals
Analog to digital conversion	Digital to analog conversion
Digital frequency conversion	Digital frequency conversion
Digital downsampling	Digital upsampling
Digital equalisation to compensate for RF impairments	Digital pre-equalisation to compensate for RF impairments
Signal compression to match the 10 GbE bandwidth	Signal decompression from the 10 GbE stream
RF over IP formatting	RF over IP formatting
Supported bands: 65 MHz – 8.4 GHz	Supported bands: 65 MHz – 7.235 GHz
Bandwidth: up to 500 MHz	Bandwidth: up to 500 MHz

APPLICATIONS

▶ An efficient and cost-effective alternative to legacy frequency converters
▶ An open, lightweight SDR platform for small, micro, nano-sats proprietary implementation
▶ Generic sampling board for RF signal analysis

KEY BENEFITS

▶ More cost-effective solution compared to a solution including frequency converters
▶ Greater flexibility for spares or maintenance
▶ Simplifies ground station architectures
▶ Easy to install on any site
▶ Next generation processing and functionality

DIRECT SAMPLER

▶ LSATx allows direct sampling of signals with a sampling rate of between 1 Msps and 500 Msps
▶ Typical frequencies and bandwidth needs:

Frequency	Bandwidth
IF: 65 – 75 MHz	10 MHz
L-band: 950 – 2250 MHz	350 MHz
S-band: 2200 – 2300 MHz	100 MHz
C-band: 3700 - 4200 MHz	50 MHz
X-band: 8000 - 8400 MHz	400 MHz

▶ SFDR (Spurious Free Dynamic Range) better than -60 dBc
▶ Gain flatness ≤ 1 dBpp
▶ Noise figure ≤ 12 dB
▶ Input level: between -100 dBm and -20 dBm
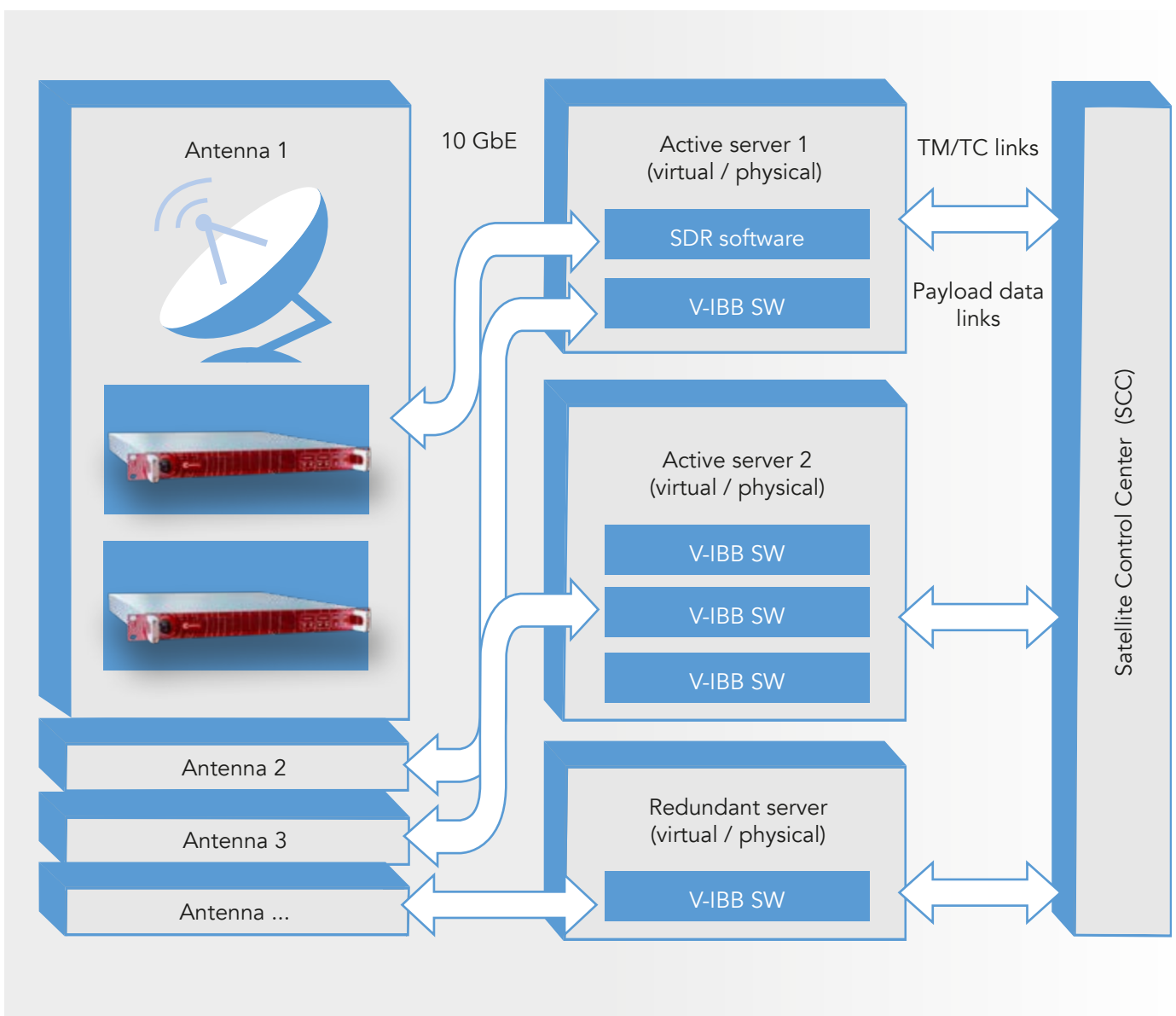
DIRECT SYNTHESIS

▶ Typical frequencies and bandwidth needs:

Frequency	Bandwidth
IF: 65 – 75 MHz	10 MHz
L-band: 950 – 2250 MHz	350 MHz
S-band: 2025 – 2120 MHz	95 MHz
C-band: 5925 – 6425 MHz	50 MHz
X-band: 7145 – 7235 MHz	90 MHz

▶ Group delay ≤ 1 ns peak to peak
▶ Maximum noise spectral density (NSD) ≤ 140 dBFs/Hz
▶ Frequency stability + 5 x 10^{-9} per day
▶ Spurious:
  • Signal related ≤ -65 dBc
  • Signal independent ≤ -85 dBm
  • IMD (two tone intermodulation) ≤ -50 dBc
▶ Output level: between -40 dBm and 0 dBm

ENVIRONMENTAL & POWER

▶ Operating temperature: + 10 °C to + 40 °C
▶ Storage temperature: - 20 °C to + 60 °C
▶ Relative humidity: 10 % to 90 % non condensing
▶ Power supply: 90 - 265 V, 47 - 63 Hz
▶ The equipment is CE compliant and tested according to CB scheme

INTERFACES

▶ Sampler input (SMA-F)
▶ Direct synthesis output (SMA-F)
▶ SMA-F for 10 / 100 MHz external frequency reference (SMA-F)
▶ External sampling clock (SMA-F)
▶ Alarm output and interlock (DB-9 on indoor version, MIL-C-26482 style for outdoor)
▶ Power supply (IEC 60320 on indoor version, Amphenol C16-1 outdoors)
▶ 10 GbE interface to transmit/receive samples to external modulator, running RFoIP
▶ 1000Base-T interface for Monitoring and Control

PHYSICAL DIMENSIONS

▶ The LSATx is 1 U high, 19"rack-mount equipment
▶ Dimensions (WxHxD): 43.7 x 4.4 x 47 cm
▶ Weight: 5 kg max

RELATED PRODUCTS

▶ VIBB TT&C modem

THE LSATX CAN BE USED IN DIFFERENT FREQUENCY BANDS MAKING IT SUITABLE FOR THE FOLLOWING APPLICATIONS :

950 - 2250 MHz	L

- ▶ Satellite navigation (Galileo and Beidou)
- ▶ Mobile phone telecommunication over satellite (Iridium, Inmarsat, Ligado Networks, Thuraya)
- ▶ Aircraft surveillance (ADS-B)
- ▶ Amateur satellite (L-Band by AMSAT)
- ▶ Digital Audio Broadcasting (IBOC Solution DAB Solution, WorldSpace satellite radio)
- ▶ Digital Video Broadcasting (DVB-H, DVB-SH, DVB-T2)
- ▶ Digital Multimedia Broadcasting (T-DMB)
- ▶ SmallSat and CubeSat
- ▶ As intermediate frequency for Ku-band and Ka-band satellites

3700 - 6425 MHz	C

- ▶ Communication satellites
- ▶ TV and broadcast satellites
- ▶ IoT (Internet of Things)

2025 - 2300 MHz	S

- ▶ Telemetry and Telecommand of satellites
- ▶ Weather satellites (payload data)
- ▶ Mobile TV and satellite radio
- ▶ Payload data download for Micro Sat and Small Sat
- ▶ IoT (Internet of Things)

7145 - 8400 MHz	X

- ▶ Payload data reception of earth observation-, scientific- and SAR satellites
- ▶ Communication satellites
- ▶ Maritime Vessel Traffic Control

65 - 75 MHz	IF

- ▶ Intermediate frequency for all other bands

Celestia Antwerp BV
Address: Roderveldlaan 1 (bus 3)
         2600 Berchem
         Belgium
Email: info@celestia-antwerp.be
Phone: +32 (0) 3 303 94 50 (general)
          +32 (0) 3 303 94 52 (sales)
Website: www.celestia-antwerp.be

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