

Increasing Interoperability of Ground Station Infrastructure through Digitiation and Virtualization

For almost 4 decades, WORK Microwave is at the forefront in developing advanced satellite communication (SATCOM) solutions. Providing a wide range of products in analogue RF and digital signal processing, the company has a broad understanding of the challenges related to the virtualization and digitalization of the SATCOM ground infrastructure. In recent years that expertise has also been extended to the field of optical communication. WORK Microwave is a long-standing active contributor to standards in satellite and space communication. Across the industry the company is recognized for its work in standardization bodies such as DVB, CCSDS, and DIFI. As a member of the DIFI Board of Directors, WORK Microwave can leverage that experience to facilitate the digital transformation of satellite and space communication.

Key motivation

More flexibility of application-specific connectivity protocols, waveforms or channel management

Improved interoperability of more H/W and S/W products through standardization (DIFI)

Use of SaaS in combination with COTS H/W (e.g. in local data centres)

Reduce H/W CAPEX (e.g. replacing L-Band infrastructure incl. H/W Modems)

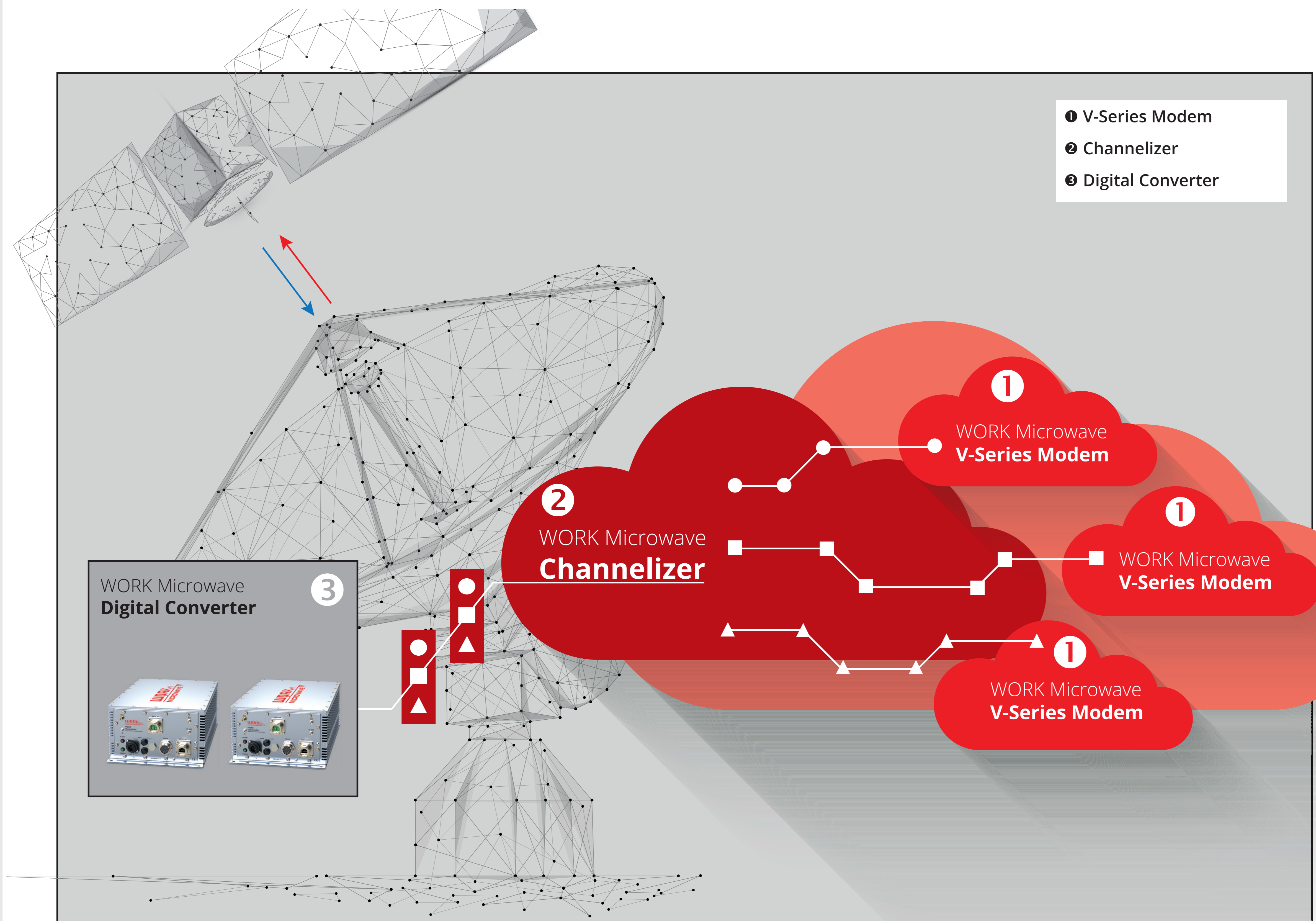
Flexible software-defined satellites require compatible ground segment technologies

Ground station operators can deploy on-orbit and ground-based capabilities more effectively

Digitized ground infrastructure allows for improved support of 5G/6G networks

Industries using cloud technology can focus on core competencies

Cost and complexity reduction through new market entries



Virtual Ground Station (VGS)

WORK Microwave End-to-End Architecture represents a significant leap forward in the satellite communication industry, empowering operators to maximize efficiency, reduce costs, and adapt to the dynamic demands of modern satellite missions. Modular design consisting of three functional blocks offering an end-to-end virtualization of ground station infrastructure

All WORK Microwave VGS units can be commanded through a standard Network Management System (NMS) via SNMP and RESTful API interface. This enables centralized operations of a world-wide system and guarantees maximum network operator flexibility to integrate WORK Microwave's VGS into their existing NMS systems.

Virtualized Software Modem (V-Series)

The software based Modem can be operated on a cloud-based infrastructure either locally or entirely dislocated from the satellite ground station.

Key Parameters

- Compliance with DVB-S/S2/S2X & CCSDS 131.x / 231.0
- Symbol rates up to 500 Msps
- Data rates up to 6 Gbps
- CCM, VCM and ACM operation
- Supports time slicing (Annex-M ETSI EN 302 307-1)
- GSE / MPE en-/decapsulation
- Supports data record & replay
- Processes digitized IQ samples to decoded BBFRAMEs and Transfer Frames (with IP en-/decapsulation)
- Runs on CPU/FPGA accelerated hardware platforms via established virtualization technologies

- Modular design enables future expansion of waveforms, waveform extensions, and custom data processing

Channelizer (full version)

The Channelizer unit is most efficiently operated locally in a data center at the satellite ground station to optimize data connectivity demands to the (De-)Digitizer units.

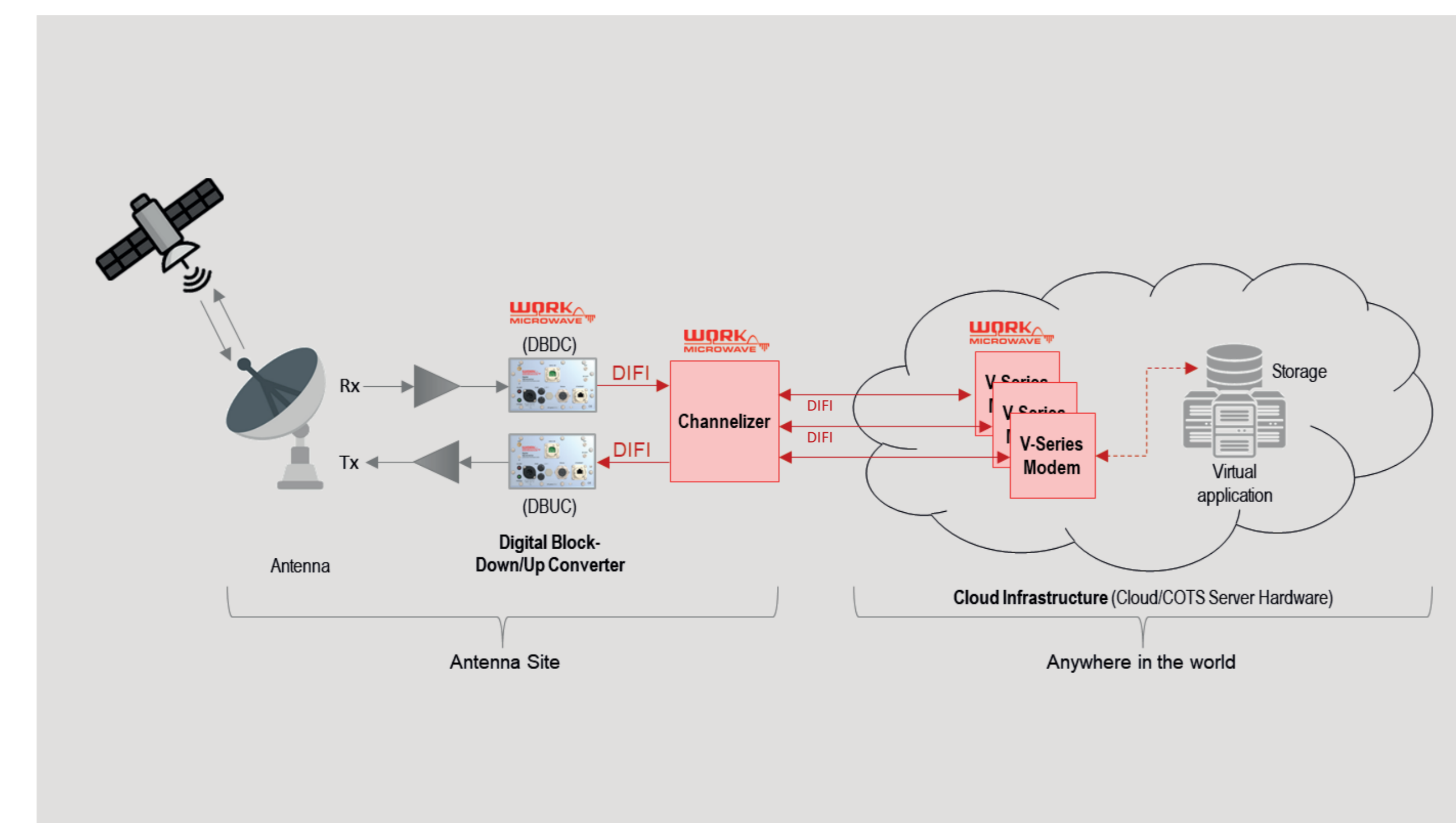
Digital Converter with Channelizer "light" option

The Digital Converter integrates a DIFI Digitizer and a RF Converter frontend in a single unit.

Key Parameters

- Instantaneous BW per Channel > 1500 MHz
- IF Frequency (standalone DeDigitizer): 950 – 2450 MHz
- SFDR > 60 dBc
- Tx: Noise Spectral Density < -133 dBm/Hz
- Optional Channelizer light (depends on combination of amount and bandwidth of DIFI-substreams)
- OIP3 > 20 dBm
- DAC resolution: up to 12 Bits
- Tx: Aggregated Output Power: -30 ... 0 dBm (0.1 dB steps)
- Rx: Aggregated Output Power: -40 ... -20 dBm (0.1 dB steps)
- QSFP28 (100 GbE) Ethernet
- Dual Channel architecture: 2x Tx or 2x Rx or 1x Rx/1x Tx
- 10 MHz and pps sync
- Wide operational temperature range: -30° to +60° C
- Web GUI , SNMPv3, RESTful API for remote control and automation purpose

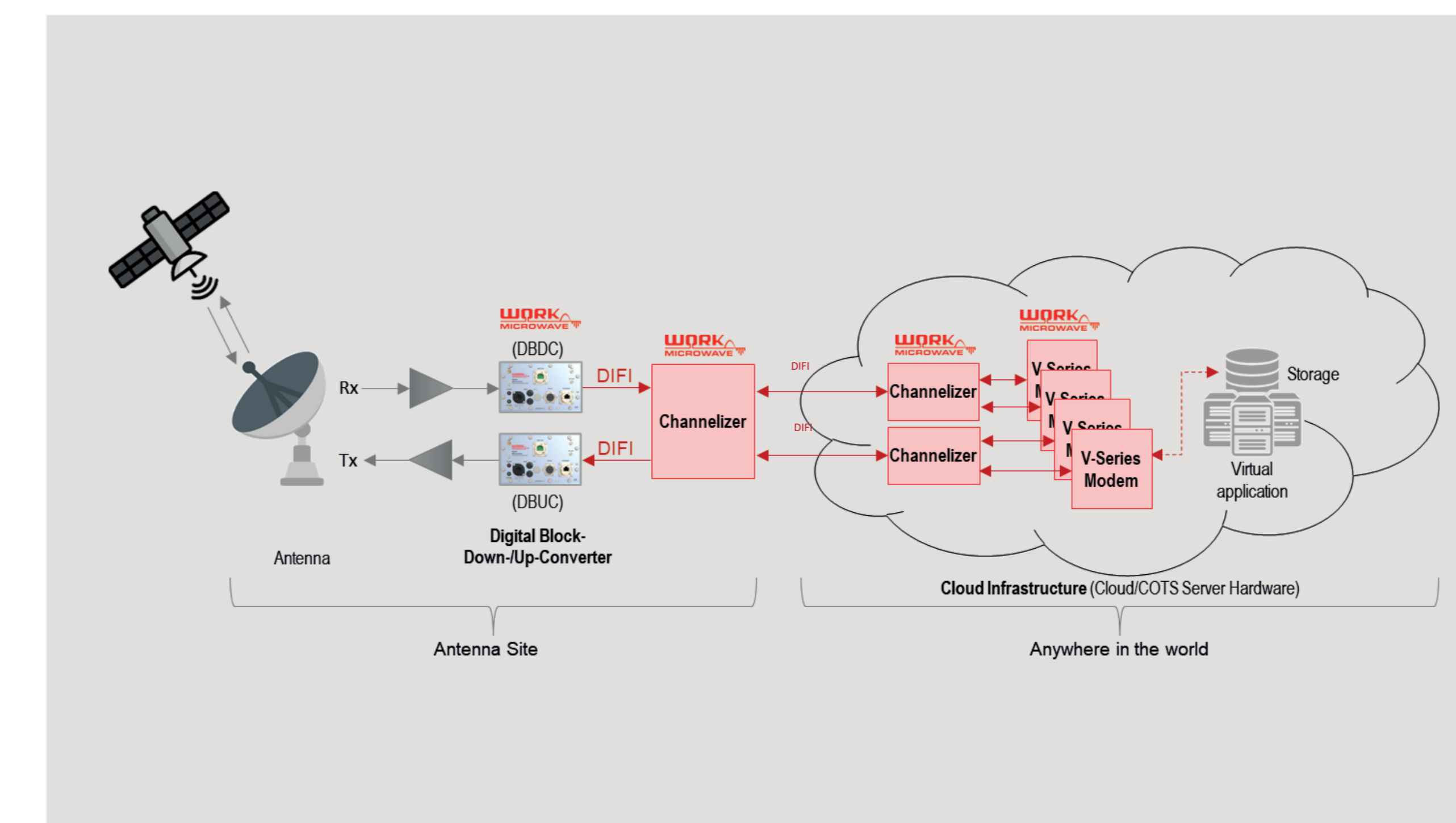
"Backend": Channel separation/aggregation remotely or cloud-based



Less processing resources required at antenna site

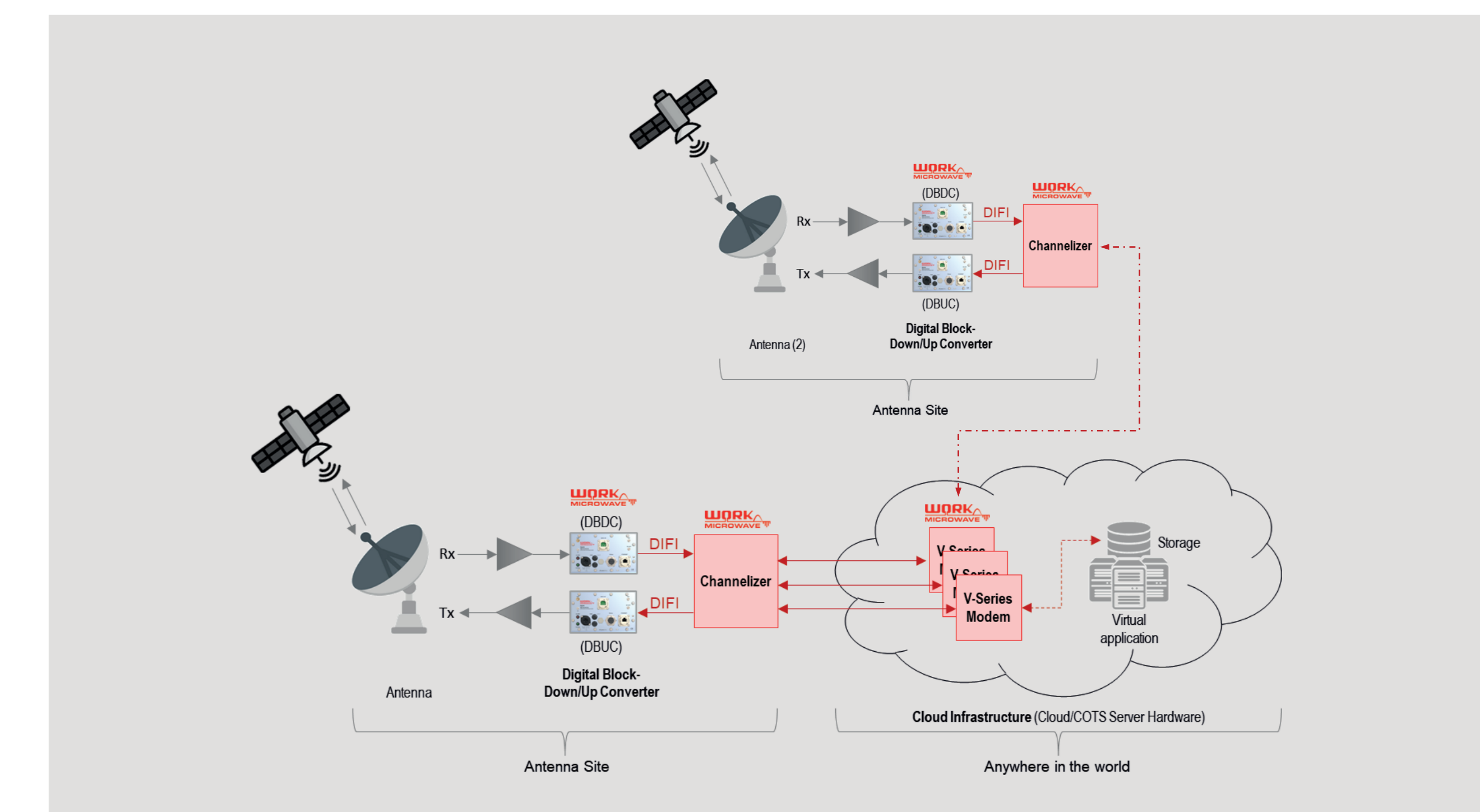
- Solution of interest for users handling small bandwidths, but e.g. require antenna site diversity
- Channelizer realized in S/W

"Hybrid Approach": Channel management in 2 stages - Frontend & Backend/Cloud



- Significantly reduces traffic volume per channel into the cloud
- Only moderate Frontend processing power needed
- Frontend Channelizer can be integrated into Converter (compact solution)
- Solution combines max. flexibility and data management efficiency

"Multiple Frontend": On-Site Channel Management



- Channel management at respective antenna site
- High degree of channel management flexibility
- Complex Channelizer at each antenna site (H/W effort, computational power)