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MICROWAVE
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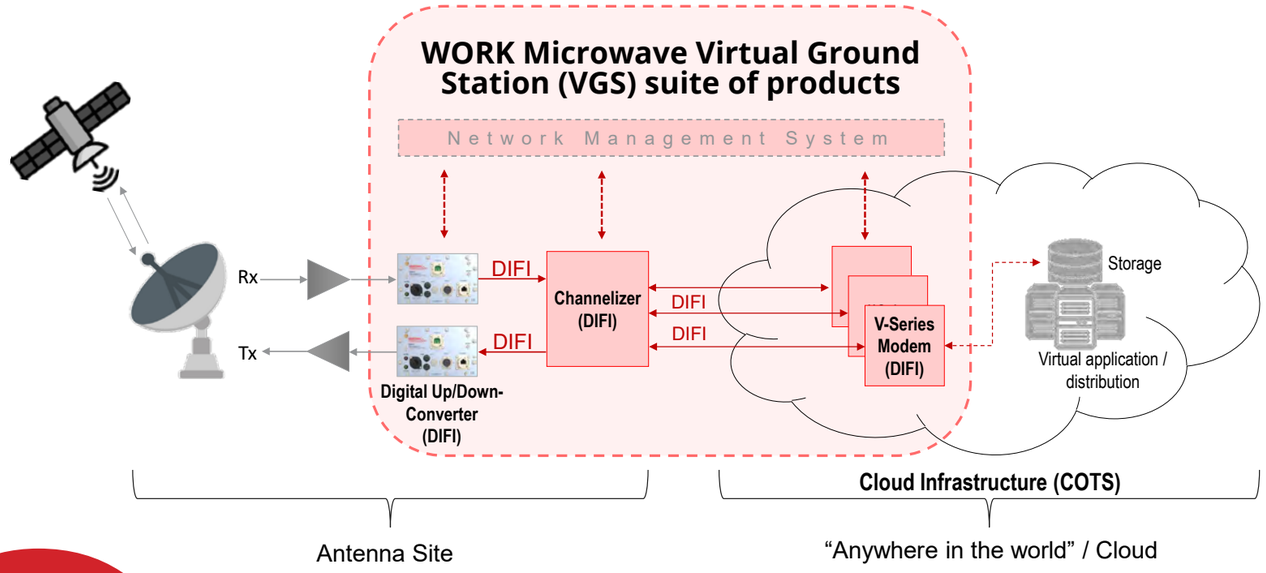
Virtual Ground
Station Solutions
DIFI
Board Member

Virtual Ground Station (VGS)

WORK Microwave's Virtual Ground Station (VGS) suite of software-defined and DIFI products offers an End-to-End Architecture of variable scope which can be adapted to specific customer needs. Offering unrivaled flexibility in ground segment architecture and operation, it 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.

All 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 either integrate WORK Microwave's VGS into their existing NMS systems, or decide for a fully integrated VGS system incl. NMS provided by WORK Microwave.

WORK Microwave's VGS solution offers a modular design architecture consisting of four functional blocks which enables customers to virtualize their ground stations according to their individual needs with limited scope for certain functionalities only, up to an end-to-end implementation: Virtualized Modem, Channelizer, Digital Up-/Downconverter with DIFI connectivity, and a Network Management System.



Ground

Key Motivations

Flexibility: benefit from software-defined solutions in space and ground system architectures, incl. site divergence, channel management, application-specific connectivity protocols or waveform evolutions

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

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

CAPEX savings e.g. by replacing L-Band infrastructure incl. H/W Modems

Improved support of 5G/6G networks through virtualized ground infrastructure

Virtualized Software Modem (V-Series)
The software based Modem can be operated on a cloud-based infrastructure either locally or remote from the satellite ground station. It offers the full spectrum of DVB waveforms, CCSDS standards and wideband capability up to 500 Msps.

Virtualized Modem key parameter:
- 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
- Time slicing (Annex-M ETSI EN 302 307-1)
- GSE / MPE en-/decapsulation
- Data record & replay
- Processes digitized IQ samples to decoded BBFRAMEs and Transfer Frames (with IP en-/decapsulation)
- Runs on COTS accelerated hardware platforms via established virtualization technologies
- Modular design enables future expansion of waveforms, waveform extensions, and custom data processing
- Web GUI, SNMPv3, RESTful API for remote control and automation

Channelizer
The Channelizer is an essential element in the virtualized architecture which manages the traffic of individual DIFI data streams between a typical large bandwith Up-/Down-Converter and individual DIFI data channels directed from/to the virtualized Modems. Depending on the use case, the combining of various DIFI input streams in the uplink case or the separation of a digitized large bandwith DIFI data stream into various channels in the downlink case can become a challenging task requiring substantial signal processing capability. WORK Microwave's Channelizer technology builds on COTS hardware modules, either operated locally in a teleport data center or remotely in a cloud, depending on terrestrial bandwith capabilities and constraints. The modular design of WORK Microwave's Channelizer allows channelization and de-channelization of almost unlimited bandwidth by simply adding additional modules. For limited channel/bandwith requirements, a "light" version of the Channelizer can be integrated into the DIFI Up-/Down-Converter to further simplify and optimize system architecture.

Channelizer key parameter (per module, higher number of channels and bandwidth can be covered by combining several modules):
- Aggregate Bandwidth: 1.5 GHz per module
- Number of channels: 16 per module
- Channel granularity: 1 MHz
- Interface: DIFI1.2 (including flow control) on 100 GbE
- Bit depth 4 … 12 (16 bit on request)
- Web GUI, SNMPv3, RESTful API for remote control and automation

Channelizer light (integrated into Digital Converter) parameter:
- Aggregate Bandwidth: 1 GHz
- Number of channels: up to 4 channels with equal bandwidth
- Interface: DIFI1.2 (including flow control) on 100 GbE

Digital DIFI Up-/Down-Converter with Channelizer "light" option
The Digital Converter integrates a DIFI Digitizer and a RF Converter frontend in a single unit. It combines WORK Microwave's proven RF technology and state-of-the-art signal processing technologies.

Digital Converter key parameter:
- Multi-Channel architecture for Tx and Rx available
- Instantaneous BW per Channel > 1500 MHz
- RF Frontend Frequency: up to V-Band (52.4 GHz)
- IF Frequency (standalone Digitizer): 950 – 2450 MHz
- SFDR > 60 dBc
- Tx: Aggregated Output Power: -30 … 0 dBm (0.1 dB steps)
- Rx: Input Power: -40 … -10 dBm (0.1 dB steps)
- DAC / ADC resolution: up to 12 Bits
- Optional: fully integrated "Channelizer light" (depending on combination of number and bandwidth of DIFI-substreams)
- Hybrid solution with simultaneous RF- and DIFI-interface available
- QSFP28 (100 GbE) Ethernet
- 10 MHz and PPS sync
- Wide operational temperature range: -30° to +60° C
- Web GUI , SNMPv3, RESTful API for remote control and automation.

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