Media Information
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Cutting-edge „Virtual Ground Station®“

Holzkirchen, Germany - WORK Microwave, one of the leading manufacturers of advanced satellite communications equipment, presents its cutting-edge developments of a **Virtual Ground Station® (VGS)**. The state-of-the-art VGS architecture is based on a modular design consisting of three functional blocks offering an end-to-end virtualization of ground station infrastructure: conversion of received RF signals in all possible frequency bands into a digitized signal according to DIFI or other digital signal standards, separation of individual digitized channels, and cloud-based wideband signal processing by a virtualized software modem.

WORK Microwave's End-to-End Virtual Ground Station 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.

VGS provides unparalleled scalability, allowing operators to easily expand and adapt their ground station capabilities to meet evolving mission requirements, enabling at the same time efficient and centralized control of satellite communication networks and the utilization of a world-wide cloud infrastructure.

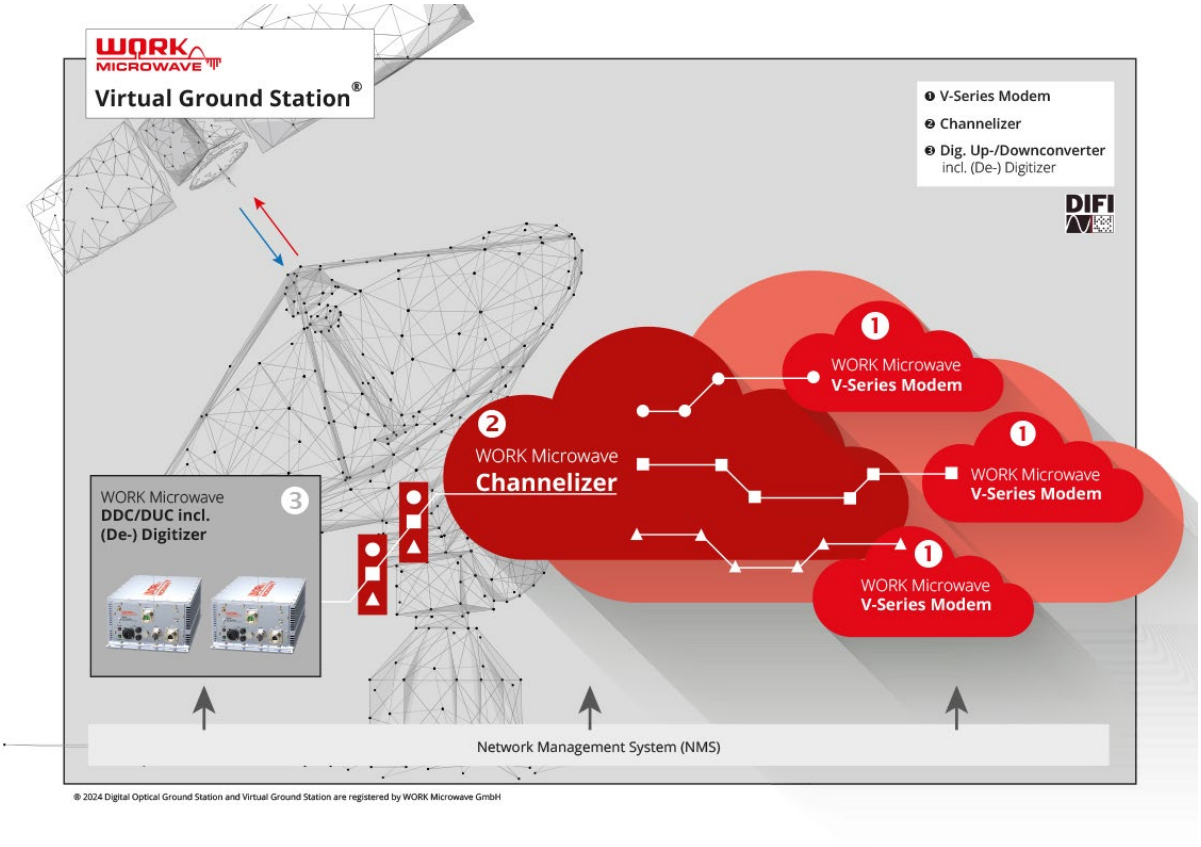
Technical concept and building blocks

Digital Converter with integrated Digitizer functionality
On the receive side of the system, the antenna Rx signals from S to V-Band are down-converted and digitized into a digital IF signal (DIFI) or other digital standards by WORK Microwave's Digital Downconverter (DDC). On the uplink side, the inverse process is carried out by the Digital Upconverter (DUC). DDC and DUC can be made available as stand-alone units or in a single IP 65 outdoor unit for both up- and downlink depending on mission needs with up to 3.5 GHz bandwidth.

Channelizer
The Channelizer plays a key role in the overall management of the data streams and the economic operation of the global network system. It helps to minimize the IP bandwidth needs of the virtualized system by extracting the actually required bandwidth from the digitized RF signal prior to sending it to the cloud-based modem on the receive side, and by effectively combining channels on the uplink path. While the most economic way of realizing this functionality is a software solution operating on a satellite ground station based indoor hub infrastructure, it can also incorporated inside the Digital Converter if required.

Virtualized Software Modem
The software based V-Series Modem can be operated on a cloud-based infrastructure either locally or entirely dislocated from the satellite ground station. It exchanges the user-relevant data channels and supports both DVB-S2X as well as CCSDS waveforms.
The modulated and waveform-related data is exchanged with a Digital Up-/Down-Converter through digital IF (DIFI) or other digital standards via IP networks.

VGS operations
All WORK Microwave VGS units can be commanded through a standard network management system 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.



1 – WORK Microwave Virtualized V-Series Modem

WORK Microwave's V-series software based modems are fully compliant with DIFI or other digital standards to receive / transmit digitized RF signals from / to the corresponding DDC / DUC Digital Converters. Modem (VX), Transmitter (VT) and Receiver (VR) models are offered following operator needs.

The main features and advantages of V-series modems are:

- Virtualized software modems with capabilities of WORK Microwave's A-Series modems, transmitters and receivers
- Compliance with DVB-S2/S2X, CCSDS and ECSS standards
- Symbol rates from 16 ksps up to1 Gsps (TX) uplink, 500 Msps downlink
- Data rates up to 6 Gbps uplink, 3 Gbps downlink
- CCM, VCM and ACM operation
- Time Slicing (Annex-M ETSI EN 302 307-1)
- Full processing chain from digitized IQ samples to decoded BBFRAMEs / transfer frames and corresponding decapsulation over IP
- Web GUI, SNMP, RESTful API for remote control and automation purposes
- Support DIFI standard and other digital standards
- Modular design allows future expansion of additional waveforms, waveform extensions and customized data processing deviating from standards
- Replaces dedicated hardware modems, brings flexibility in terms of "Modem as a Service" business model for multi-operational efficiency
- Brings future-proven solutions for operators without replacement of hardware, by implementing new features and options (Multistream, multichannel, higher symbol rates, new waveforms, …)

- Designed for local data center and cloud deployment, as per customer preference
- Running on CPU and/or FPGA accelerated consumer hardware platforms
- Offers huge degree of scalability and redundancy and thereby a high level of QoS (Quality of Service) to operators

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2 - Channelizer

The Channelizer (and De-Channelizer) is a software-based key management unit for an efficient operation of the Virtual Ground Station. It allows the operator to optimize network resources by extracting only those data streams, which are to be sent to the modem or which need to be efficiently combined to be converted to analog RF and sent to the satellite. It thus ensures efficient usage of IP links for cloud connectivity and optimized RF bandwidth usage for satellite transmission.

The main features and advantages of Channelizer units are:
De-Channelizer (Uplink):

- Offers a highly scalable channel capacity
- Accepts digital IF signals (DIFI 1.2 or others) at different sampling rates and bandwidths from 1 MHz to 1 GHz
- Digital IF signals are up-sampled to unified sampling rate and digitally filtered
- IF signals are frequency shifted (according to required channel spacing) and combined to a unified digital IF signal
- The unified digital IF signal (DIFI 1.2 or other) is sent to digital Upconverter (DUC)
- Web GUI, SNMPv3, RESTful API for remote control and automation purposes

Channelizer (Downlink):

- Offers a highly scalable channel capacity
- Accepts digital IF signal (full bandwidth) from digital Downconverter (DDC) or digitizer
- Filters and splits signal for all individual channels
- Individual decimation to required sampling rate
- Individual digital IF (DIFI 1.2) signals are forwarded to individual sink (e.g. digital modem)
- Web GUI, SNMPv3, RESTful API for remote control and automation purposes

The Channelizer unit is most efficiently operated locally in a data center at the satellite ground station to optimize data connectivity demands to the Digitizer / De-Digitizer units. If preferred, it can also be integrated into WORK Microwave's Digital Converters (DUC/DDC).

3&4 – Digital Converters incl. Digitizer

The **Digital Downconverter (DDC)** receives RF-signals from the antenna's LNA and converts them to a digital IF signal. It combines WORK Microwave's proven frequency downconverter technology with a brand new wideband digitizer platform with DIFI-based or other digital standard output. The digital baseband signals are transported as IP packets to the Channelizer unit.

The **Digital Upconverter (DUC)** receives digital baseband signals as IP packets in DIFI or other digital standard from the Channelizer unit and converts them to RF signals. It combines WORK Microwave's proven frequency upconverter technology with a brand new wideband De-Digitizer platform. At the output, the RF signals are sent to the HPA for amplification.

The main features and advantages of the units are:

- World-leading RFconverter technology (direct S/C/X/Ku/DBS/Ka/Q/V-band ports are possible). This feature makes the units very compact and eliminates additional need for separate frequency converters, redundancy switches, additional RF connection points and signal attenuations. RF-front-ends make use of WORK Microwave Frequency Converter platforms and can be easily adapted to specific customer requirements.
- DUC and DDC functionality can be integrated into a single housing (option)
- (De-)Digitizer functionality can be integrated with Converter and Digitizer function (option)
- Bandwidth up to 5 GHz
- Outdoor design IP65 supporting mounting in the antenna hub or to the outdoor antenna structure. This feature eliminates a need for a large RF shelter near the antenna and saves significant space in terms of system integration.
- High operational temperature range: -30° to +60° C
- Web GUI, SNMPv3, RESTful API for remote control and automation purpose
- Fiber optical interface to either Channelizer or Virtual ModemHigh reliability ensuring outstanding QoS (Quality of Service)

About WORK Microwave (www.work-microwave.com**)**
Headquartered in Holzkirchen (near Munich), Germany, and comprised of four product lines — Satellite Communication, Navigation Simulators, Defence Electronics, and Sensors & Measurement — WORK Microwave leverages over 35 years of experience to anticipate market needs and apply an innovative and creative approach to the development of its technologies while maintaining the highest standards for quality, reliability, and performance.

WORK Microwave's Satellite Communication division develops and manufactures high-performance, advanced satellite communications equipment for earth observation and science missions, NGEO constellations, IP networks, government communication, direct-to-home broadcast, teleport management, and many more applications.

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