

High-Performance Digital RF For Resilient Satellite Ground Infrastructure

Digitizing — and generating — the complete 100 MHz to 8.5 GHz spectrum at the antenna and distributing it over IP: the basis for a ground segment that survives site loss, fade and equipment failure.

M. Mettendorff • C. Daniel

DEV Systemtechnik GmbH • Grüner Weg 4A • D-61169 Friedberg • Germany

info@dev-systemtechnik.com

+49 6031 6975 100

dev-systemtechnik.com

The whole spectrum, not a slice. INFINIT is the only platform that digitizes *and* generates the complete spectrum up to 8.5 GHz and shares it over IP — 8.5 GHz combined instantaneous bandwidth on each of TX and RX, more than 2 GHz per channel, software defined.

Background

Satellite ground stations still distribute RF as analog extended L-band, 850 to 2,450 MHz, through a cascade of amplifiers, switches, matrices and splitters to the modem racks.

Analog signals degrade over copper, so the ground station has to sit next to the antenna, with all the limits that brings.

Co-location constraint

A site under fade, fault or threat takes its processing capacity with it.

Topology fixed in hardware

Routing lives in matrices and cable. Re-planning a mission means re-patching a rack.

Single points of failure

One trunk, one matrix, one amplifier chain — each can remove an antenna from service.

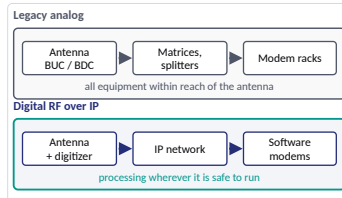


Fig. 1 — The same signal chain before and after digitization.

What resilience requires

Site diversity itself is not new. DEV builds redundant analog gateways today, and RF over Fiber carries them 200 to 300 km. That distance is the ceiling — and it is what digitization removes. Once the signal is on IP, three things change.

Separation without a distance limit

Antenna sites and processing can sit in different regions, reached over ordinary network infrastructure.

Processing assigned on demand

Modem and DSP resources follow the mission, not the antenna, and run wherever it is safe to run them.

SIGINT and countermeasures

Signal processing in the digital domain opens AI-assisted signal intelligence and active countermeasures against interference and jamming — capability an analog chain cannot provide.

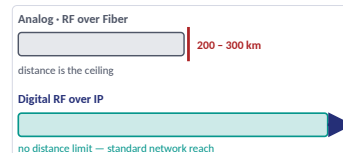


Fig. 2 — What digitization changes: site separation stops being an RF problem.

Resilience in operation

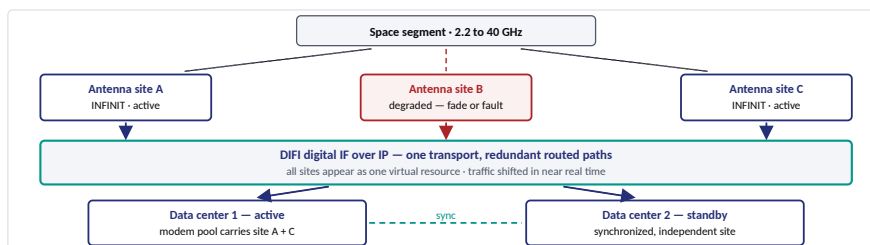


Fig. 5 — A degraded site is bypassed in the network, not in the rack. Antenna sites, transport paths and processing locations are independently redundant; the mission sees one continuous resource. The dashed red path marks the degraded site.

Methods

INFINIT digitizes at the antenna by direct RF sampling across the whole front end, packetizes to DIFI 1.3 (IEEE-ISTO Std 4900-2021) and carries the result over standard IP.

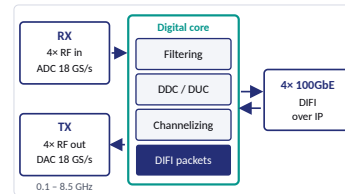


Fig. 3 — INFINIT building blocks: direct RF sampling and waveform generation across the full front end.

Digital spectrum multicasting

The digitized spectrum is carried as sub-bands in separate IP multicast groups. Each modem joins only the groups it processes, so the traffic reaching the modem farm falls by up to a factor of 100 — a modem that would otherwise need a 100GbE feed can subscribe at 1GbE.

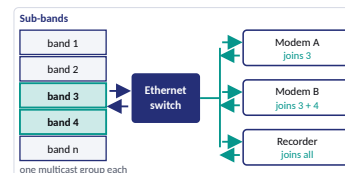


Fig. 4 — Spectrum multicasting: each consumer subscribes only to the sub-bands it needs.

Results

INFINIT Digital RF Platform — key figures:

RF FRONT END	100 MHz to 8,500 MHz
CHANNELS	4x TX / 4x RX
SAMPLING RATE	18 GS/s
RESOLUTION	up to 18 bit / sample
DIRECT RF	up to 8.5 GHz, TX and RX
INST. BW	> 2 GHz per channel, software defined
COMBINED BW	8.5 GHz, each TX and RX
CONVERSION	programmable ADC / DAC
PROCESSING	configurable digital up / down conversion
AGILITY	frequency hopping support
ETHERNET	up to 4x 100GbE
MGMT	SNMP, RESTful API, web interface
PROTOCOL	DIFI 1.3, IEEE-ISTO Std 4900-2021

What this delivers

Sites decoupled from processing

Processing runs in the data center that is available, not the one next to the dish.

Wideband situational awareness

Real-time analysis up to 8.5 GHz, waterfall and carrier analysis — for gateway operations, monitoring and radar.

Waveform generation, software defined

Ultra-wideband waveforms generated directly at RF, with frequency hopping.

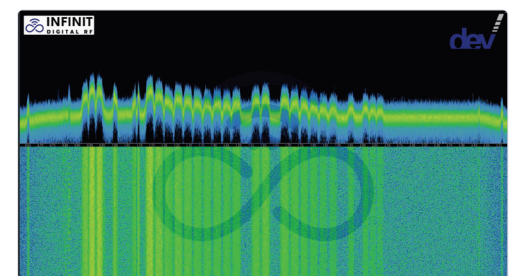


Fig. 6 — Real-time spectrum and waterfall, 600 to 2,600 MHz, sampled and transported over 100GbE.

Conclusions

Resilience becomes a network property

Once the signal is digital at the antenna, redundancy is a question of routing and of where processing runs — site diversity, path diversity and hot standby instead of fixed cabling.

Full-spectrum capability

The complete 100 MHz to 8.5 GHz range, digitized and generated at 18 GS/s with 8.5 GHz combined instantaneous bandwidth per direction — monitoring, hopping waveforms and gateway traffic from one platform.

Bandwidth spent where it is needed

Digital spectrum multicasting lets each modem subscribe to its sub-bands only, cutting the feed to a modem by up to a factor of 100 and letting commodity switching do part of the channelizing.

Talk to us at MILCOM 2026

Scan for the white paper "Digital Satellite Ground Segment" • dev-systemtechnik.com • info@dev-systemtechnik.com • +49 6031 6975 100

