

Does One Bad Packet Spoil the Whole Stream?

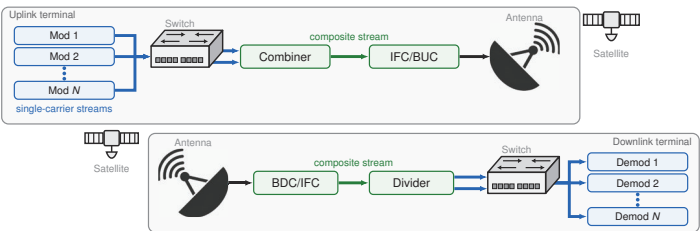
DIFI Stream Impairments and Real-Time Stream Monitoring



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Streams: ■ single carrier ■ composite

A The Digitized Ground Segment



DIFI signal transport replaces analog IF in both directions. Damage from packet impairments on a single-carrier stream is limited to one carrier, but for a composite stream all component streams are impacted.

B Example Packet Impairments

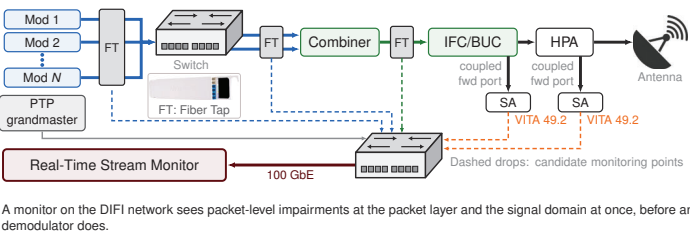
#	Impairment and mechanism	Symptoms
1	Dropped packets congestion, buffer overflow, link errors	Bit errors at the distant end
2	Reordered or duplicated packets	Bit errors due to sudden SATCOM frame misalignment
3	Context versus data bit-depth mismatch	Possible loss of link
4	Context sample-rate or bandwidth mismatch	Carriers misaligned in frequency
5	Missing or stale context packets	DIFI sinks cannot interpret data they receive
6	I/Q clipping	Spectral regrowth, raised noise floor
7	Effective-bits loss from unused dynamic range	Weaker carriers sink towards the quantization noise floor. Degraded E_s/N_0 at distant end.
8	Poor gap fill for missing packets: splatter versus mute	Splatter across the band, or a spectrum hole. Likely bit errors at distant end unless very short packets are used.
9	Power alignment error The analog signal level does not match the Context Reference Level.	Transmit power mismatch
10	Frequency alignment error The analog carrier doesn't match the Context Reference Frequency + offset. Mechanisms include stale context, unflagged spectral inversion, or modulator freq offset.	Carrier arrives off frequency
11	Timestamp-to-arrival error arrival at a reference point disagrees with the DIFI timestamp	Alignment errors time/phase. Possible impacts on TDMA or beamforming.

Packet impairments on the downlink path have similar effects. For single-carrier streams, the impact is localized to that carrier. For composite streams, it is spread across all component carriers.

C Example Signal Impairments

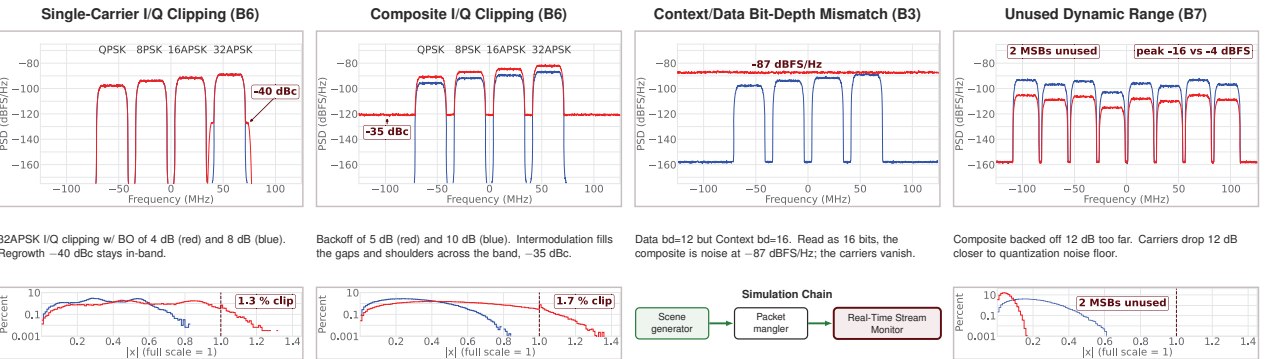
#	Impairment and source	Tap Observation
1	Transmit-chain delay error	Signal arrival at DIFI Reference Point doesn't agree with DIFI Stream Time Stamp
2	High-power amplifier (HPA) compression	Spectral regrowth
3	Oscillator leakage and spurs	Discrete spectral lines absent from the composite stream
4	Image-rejection failure	Image out of spec
5	Gain drift or dropouts	Analog power changing over time, or momentary loss of the band while the composite stream is steady

D Monitor Taps

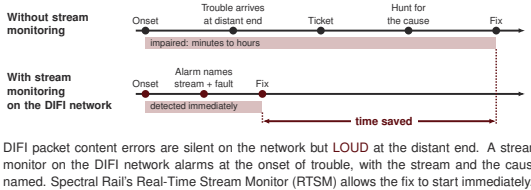


A monitor on the DIFI network sees packet-level impairments at the packet layer and the signal domain at once, before any demodulator does.

G Simulated Impairments



E Time to Visibility



F Take-Aways

- 1. A stream monitor on the DIFI network is the operator's earliest visibility.
- 2. The demo is focused on the uplink path. The downlink can be monitored with the same equipment.
- 3. Reliability of DIFI transport is enhanced by real-time stream monitoring.
- 4. The technology to perform real-time stream monitoring is available today.