

Photonic Signal Transport on Aerospace Platforms: Is Analog Signaling Ever Useful?

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Abstract—For photonic signal transport in multi-GHz, waveform-sensitive RF transport applications, it will be shown that digital-over-fiber fundamentally enables superior SNR performance versus analog-over-fiber. However, for SWaP-constrained systems, the latter can provide a viable solution with minimal SNR penalty.

Keywords—*photonics, digital-over-fiber, analog-over-fiber, radio-over-fiber, optics, aerospace, defense.*

I. INTRODUCTION

In many aerospace and defense RF applications, it is desirable to physically separate the spectrum processing

considerations will be omitted. Additionally, only the RF receive chain will be considered, as the RF transmit chain analysis reaches similar conclusions via the same treatment in reverse-order.

II. DIGITAL RADIO-OVER-FIBER PERFORMANCE

In the DRoF link architecture, the ADC is co-located with the RF antenna at the sensor edge, and a digital optical link is implemented between the ADC and the platform's central processing resources. In this architectural implementation, the immediate digitization of the spectrum without preceding active analog components (and hence noise and distortion