

Transpositional Modulation (TM) unlocks new revenue opportunities by adding additional capacity on existing spectrum holdings. Public and private wireless carriers and satellite providers can benefit from TM's ability to access new applications and markets. TM increases the capacity of existing wireless networks by adding a new fourth 'bit-carrier' to Amplitude Modulation (AM), Frequency Modulation (FM), Pulse Modulation (PM) and their advanced surrogate schemes of QAM, nPSK, OFDM and others. TM creates non-interfering side channels to a parent channel; increasing capacity by as much as 50% in complex modulations and even more in basic modulations. These new side channels can be treated as Network Slices to provision new high margin services over existing infrastructure. As high bandwidth sensor and imaging systems become deployed into Advanced Manufacturing, Smart Transportation and Precision Agriculture systems, TM's ability to create Network Slices (see to support always-on monitoring and management applications can generate new revenue for wireless service providers. Additionally, service providers can provision features such as Zero Trust security within a TM-based Network Slices to ensure only authenticated and authorized systems can connect to mission critical systems.

New Revenue Modeling

Advanced Manufacturing (Critical Infrastructure)

Advanced Manufacturing systems are being incorporated into a number of industries to improve production yields. A core aspect of Advanced Manufacturing is to stream sensor and imaging systems data from assembly lines and robotic systems to machine learning based monitoring and management systems. Unfortunately, many private wireless networks are unable to support the bandwidth requirements of these new advanced manufacturing systems.

TM-based Network Slices provides a cost-effective strategy of leveraging existing spectrum and infrastructure to partition high-priority traffic increasing up-time and drive more profits. Additionally, the incorporation of Zero Trust security to Network Slices protects mission critical systems from cyberattacks.

Example: Ensuring secure communications for SCADA control systems is critical to ensure non-stop operations. Isolation of SCADA data flows using TM-based Network Slices is a cost effective & efficient solution to creating a mission critical network. The obfuscation properties of TM-based Network Slice can hide critical data flows to prevent cyber intrusion.



Smart Transportation (5G Overlay)

Smart Transportation systems require safe and secure communications systems to support real time traffic management as well as monitoring of emerging autonomous vehicles. The wide coverage area combined with the challenge of supporting mobile high-definition video can strain existing wireless networks.

TM-based Network Slices can be used to create a dedicated Smart Transportation network that aggregates the capacity of terrestrial and satellite networks. As air, rail and vehicle infrastructure systems are becoming more automated and interdependent, service providers will have the opportunity to create new revenue streams to monitor and manage these physically distributed systems.



Example: New intelligent traffic congestion solutions utilize high resolution video surveillance to feed cloud-based AI systems to manage traffic. Unfortunately, utilizing commercial 5G networks is too expensive for bandwidth heavy streaming video. Additionally new requirements to monitor autonomous vehicles will further strain networks. TM-based Network Slices can be added to commercial 5G networks without impacting existing services. Thus, Roadside Compute Units (RSU) and autonomous vehicles can be connected at a lower cost.



Precision Agriculture (Satellite + Unlicensed)

Precision Agriculture systems utilize a combination of water, temperature and crop sensors to reduce spoilage while lowering the cost of operations. Environmental sensors, autonomous air & ground robotic platforms, and spectral imaging cameras are foundation technologies to enable Precision Agriculture. Unfortunately, high bandwidth wireless services are often unavailable or too expensive in rural areas.

TM's ability to provision Network Slices over terrestrial and satellite networks in remote areas is a key enabler to Precision Agriculture systems. Large scale agricultural operations can now improve efficiency, productivity, quality, profitability and sustainability of agricultural production by utilizing data to make key decisions.

Example: Satellite communications have traditionally been viewed as too expensive for high bandwidth rural communications. TM-based Network Slices can be added to existing bent pipe satellites with no reconfiguration of space-based systems. Connected vehicles and ground sensors can be connected to space networks transparently via WiFi/CBRS gateways.