NIST Public Safety Broadband Network RFC Response

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Hypres, Inc. has developed a sophisticated capability, Smart Carrier Aggregation (SCA), to allow LTE networks operating on non-contiguous channels to transmit through a common power amplifier and share PA bandwidth. A problem encountered in PA provisioning is that capacity must be provided to accommodate peak power levels, with the result that the unit is not fully utilized in the time intervals between peaks. This leads to low PA efficiencies and base stations larger than necessary.

Hypres SCA capability permits multiple channels, utilizing non-adjacent frequency allocations, to be aggregated into a combined PA exciter signal, enabling them to all transmit without introducing interference in adjacent channels. The SCA algorithm combines channels such that the peaks do not add coherently, hence eliminating additive peaks by distributing individual peaks throughout the combined signal. The result is a combined signal that is distortion-free, preserves the individual waveforms, and delivers waveforms through the transmit chain with higher efficiency and lower peak to average power ratio (PAPR) than with arbitrary combining. This in turn provides in an increase in PA utilization for a given peak power capacity.

When implemented, the Public Safety Broadband Network will provide greatly improved digital communication links for the Public Safety community. Although the intent is to provide a dedicated network, it is inevitable that some organizations will not have equipment installed immediately when deployment starts. As a result, spectrum in some locations will be underutilized.

There are some locations, however, where provisioning will occur toward the end of the deployment cycle. In many such areas, commercial networks will be operating that could, if properly licensed, transmit on the dedicated Public Safety channels. Hypres SCA capability provides an opportunity to use existing commercial physical plant of those networks to enable activation of Public Safety channels using existing RF equipment prior to installation of dedicated facilities.

The NIST Request for Comment identifies a number of desired capabilities. Suggested applications of Hypres SCA are indicated for specific RFC feature set descriptions below (*in italics)*.

To ensure affordability/commercial alignment:

- *Compatibility with Commercial Infrastructure: The utilization of a variety of commercial services when public safety is in areas not covered by the public safety broadband network.*

While major metropolitan areas will have dedicated public safety infrastructure for their broadband networks, suburban and rural jurisdictions wishing to implement local broadband systems will be able to initiate deployment using commercial networks.

Use of commercial LTE standards will enable PS radio equipment to operate in conjunction with commercial users. Use of Hypres SCA will enable aggregation of carriers on a single PA. Under emergency conditions, when available spectrum may be inadequate, incremental capacity can be provided by accessing additional channels.

- *Network sharing: The shared use of infrastructure between commercial and public safety users.*

Hypres SCA capability will enable commercial base stations to transmit on full-time PS-licensed channels without need to install dedicated transmitters.

Operating with either shared or dedicated back-haul, PS transmissions utilize existing PA capacity for their traffic on their own dedicated channels. SCA operates after the physical layer. This means that dedicated channels can be individually uniquely encrypted before they are presented to the SCA software allowing multiple carrier operations in a sector over common transmit equipment that are independent and secure from each other. As no commercial traffic can access this spectrum, issues of prioritization during emergency incidents do not arise.

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