# Informative: Reference Applications

## White Space device radio operation

Either the network operator or device operator using spectrum sensing to identify primary or other secondary users of particular channels. Spectrum sensing would either built into the radio devices or in standalone sensing units.

The standard allows a “CR Mode” of operation that would make it suitable for use in radio systems to complement Geolocation Databases (such as a WSDB).

## National spectrum regulation

National radio regulators would use a system comprising spectrum sensing devices to feed into a national spectrum utilization database for assignment management and planning purposes, and generating historical records for compliance monitoring and enforcement.

Devices deployed in various scenarios:

* Fixed devices at key locations and high sites
* Mobile devices on vehicles that travel widely and can create a sample set of spectrum utilization through snapshots at time or location intervals
* Devices either at fixed locations or periodically moved to create location-based spectrum utilization datasets
* Nationally deployed in a swarm of a given device density to create real-time national spectrum utilization maps and for validation of Spectrum Geolocation databases.

When spectrum monitoring is used for automated spectrum usage enforcement, data from a spectrum monitoring system has a critical role in the six basic steps for spectrum enforcement:

1. detecting, 2. identifying and classifying, 3. locating, 4. reporting, 5. mitigating, 6. remediating interference.

It is important to note that each of these six steps may, in general, require a different data type to be collected and stored; ranging from amplitude only information to raw IQ samples. It is possible for the sensing network to process spectrum data at the edge and only report the result of the processing, where conceivably a sensor or set of sensors can identify and locate an emitter without sending the raw spectrum measurements.

For example, the sensing network might report and store only the location information along with the signal classification information. This standard has been made flexible enough to define and enable both the collection of the various data types, along with associated meta-data, as well as the reporting and collection of the results of data analysis performed at the edge.

Spectrum management systems work to accomplish agency missions in geographic area(s) with limited and often shrinking frequency assignments. Monitoring can support spectrum managers in being more efficient by providing real-time and historical information about the RF environment on-base and at-boundary. Further, monitoring information can be used to mitigate and protect government wireless assets from intentional and unintentional interference.

## Research programs

Scientists using sensitive radio frequency systems (e.g. radio-telescopes) struggle with RF interference. SCOS devices can let them identify RFI and the location of their sources.

## Law enforcement and public order

Law enforcement and other authorities are increasingly dealing with problems stemming from radio-controlled or radio-connected systems.

**Illegal drone use:**  These include people flying radio-controlled unmanned aerial vehicles (drones) in prohibited places. SCOS systems can be used to detect characteristic transmissions of drone operation in areas such as in the airfield flight traffic area.

**Detecting jamming devices:** A problem area for security staff and law enforcement is the use of radio jammers to interfere with remote control devices like vehicle keyless entry systems or radio links for alarm systems. SCOS devices can be used to identify and locate jamming systems.

**Detecting unauthorized mobile phone use:** Controlled and high security areas such as prisons will frequently prohibit the use of cellular phones in certain areas, but may not jam operating frequencies because of other regulations. Identifying and locating transmissions allows direct action to be taken on equipment users.

## Network Operator Applications

Radio planning for fixed radio deployment.

Spectrum forensics for identifying sources of interference.