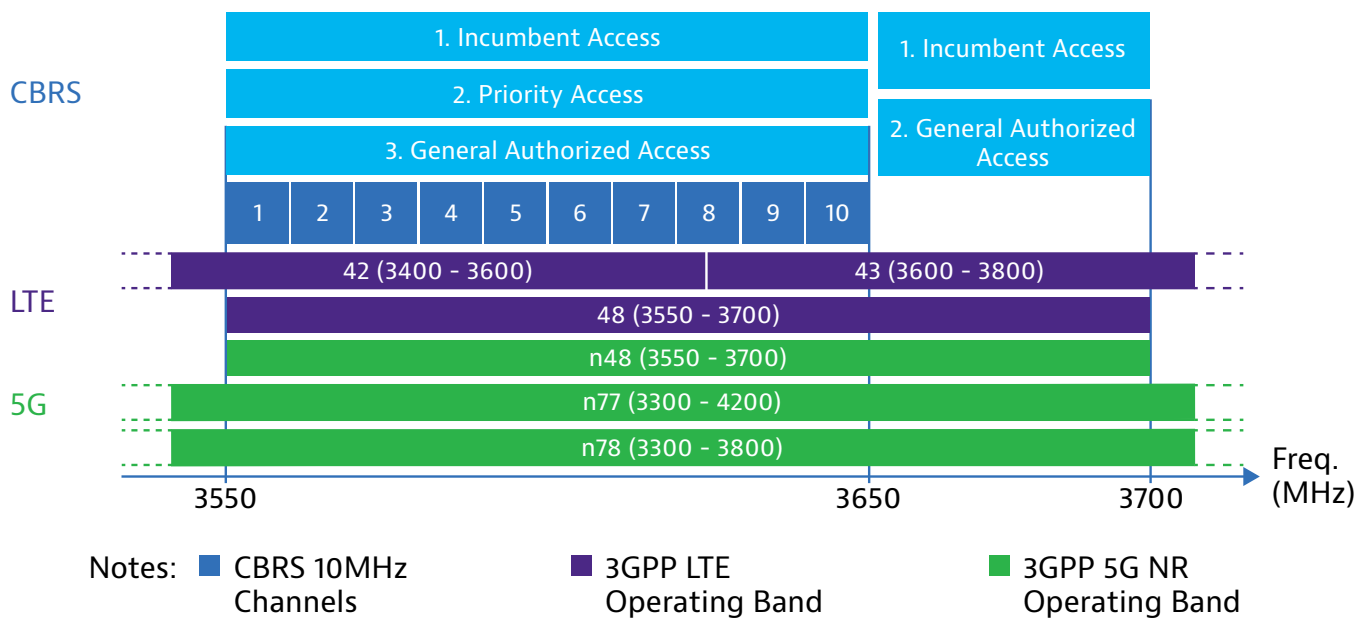


# VIAVI

## CellAdvisor 5G

### Mobile Services in CBRS

The Citizens Broadband Radio Services (CBRS) band at 3.5GHz was used by the United States government (department of defense), fixed satellite systems and wireless Internet service providers; however, for several years, the spectrum was only partially utilized. As a result, the FCC created a spectrum sharing approach to allow federal and non-federal operators to use this spectrum, providing an additional 150MHz, available in multiple 10MHz channels, to mobile operators and general users for in-door and out-door mobile services.



The CBRS spectrum sharing is managed by a tier-layer license access framework coordinated by a Spectrum Access System (SAS) which manages spectrum access to different licensed users based on its authorization priority, and according to their location and time requested.

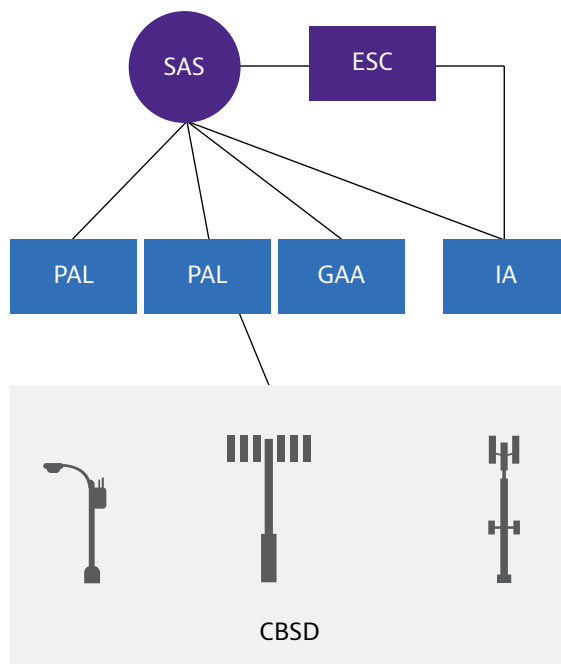
An important aspect of the spectrum sharing management is the ability to dynamically re-allocate spectrum for federal use. This function is performed by the Environmental Sensing Capability (ESC) which can be an element of the SAS.

The tier users include the following:

Priority	Tier User Access	License Description
1	Incumbent Access (IA)	Authorized federal users and fixed satellite service earth stations with protection from PAL or GAA interference
2	Priority Access License (PAL)	Licensed users by county with 10MHz channels, having up to 7 PAL license and up to 4 for carrier aggregation; with protection from GAA interference
3	General Authorized Access (GAA)	Licensed-by-rule to permit open and flexible access for potential users; with no protection of interference

The main functions of SAS are the following:

- Determine and provide to CBRS devices (CBSD) permissible channels at their location
- Communicate with the environmental sensing capability (ESC) to obtain information about federal incumbent users and instruct other CBRS devices to move to another frequency or cease transmissions
- Ensure CBRS devices to operate in the geographic areas and within the maximum power levels to protect federal Incumbent Users from harmful interference
- Protect PAL from interference caused by other PAL users or from GAA users



SAS Architecture

## CellAdvisor 5G CBRS Signal Analysis

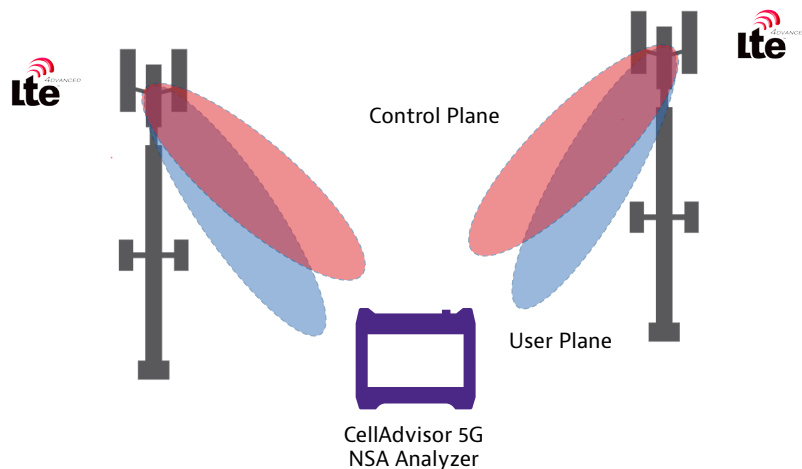
CellAdvisor™ 5G provides RF engineers and cell technicians the ability to quickly identify service performance issues and effectively isolate the source of the problem. For example, CBRS service quality degradation can be attributed to temporary blockage due to interference, not proper radio configuration, or possible impairments in the LTE anchor when CBRS is deployed as supplemental downlink channels.



CellAdvisor 5G

Mobile operators have different strategies to effectively utilize CBRS without impacting user experience even though it is based on shared resources (spectrum). A viable alternative is to deploy LTE or 5G carriers in CBRS as supplemental downlink (SDL) channels, increasing the network capacity and therefore bandwidth to mobile users. This SDL approach in CBRS follows the same guideline of non-standalone (NSA), where the user equipment (UE) establish dual connectivity:

1. LTE and/or 5G carriers in a licensed band as an anchor carrier responsible for the control plane and user plane (data)
2. LTE and/or 5G carriers in CBRS band transmitting downlink data (user plane)



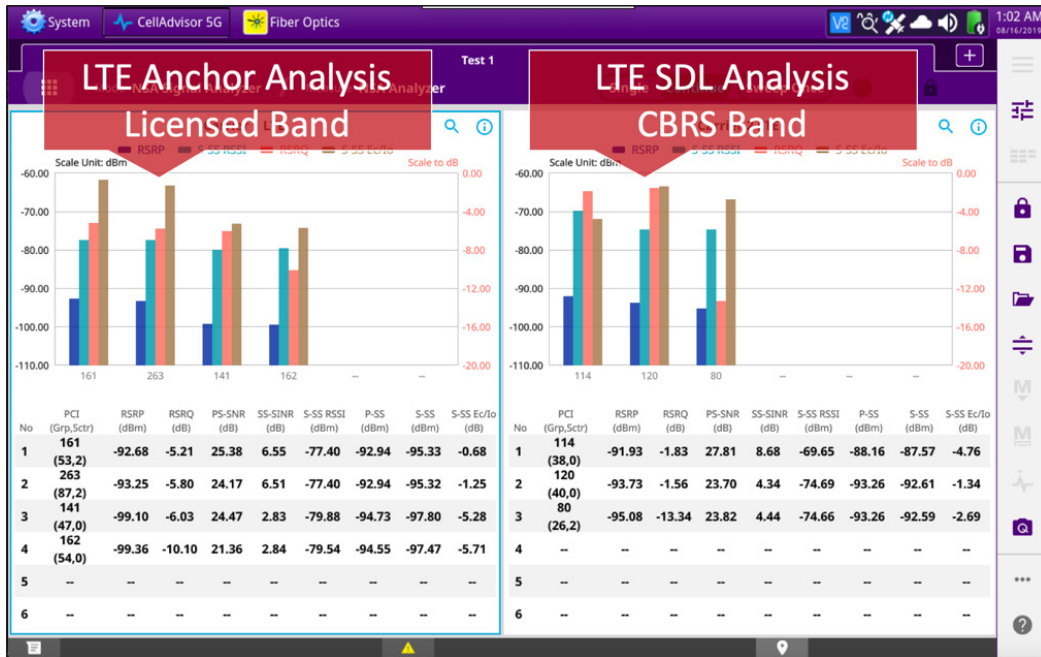
CellAdvisor 5G NSA Analyzer option mode offers the following concurrent 5G and LTE measurements:

- NSA Analyzer performs 5G beam analysis and LTE reference signal power and dominance.
- NSA Scanner performs channel power and signal quality measurements for 5G and LTE carriers.
- NSA Route Map perform concurrent coverage maps of 5G and LTE carriers in real-time.

# NSA Analysis

## LTE Anchor and LTE CBRS

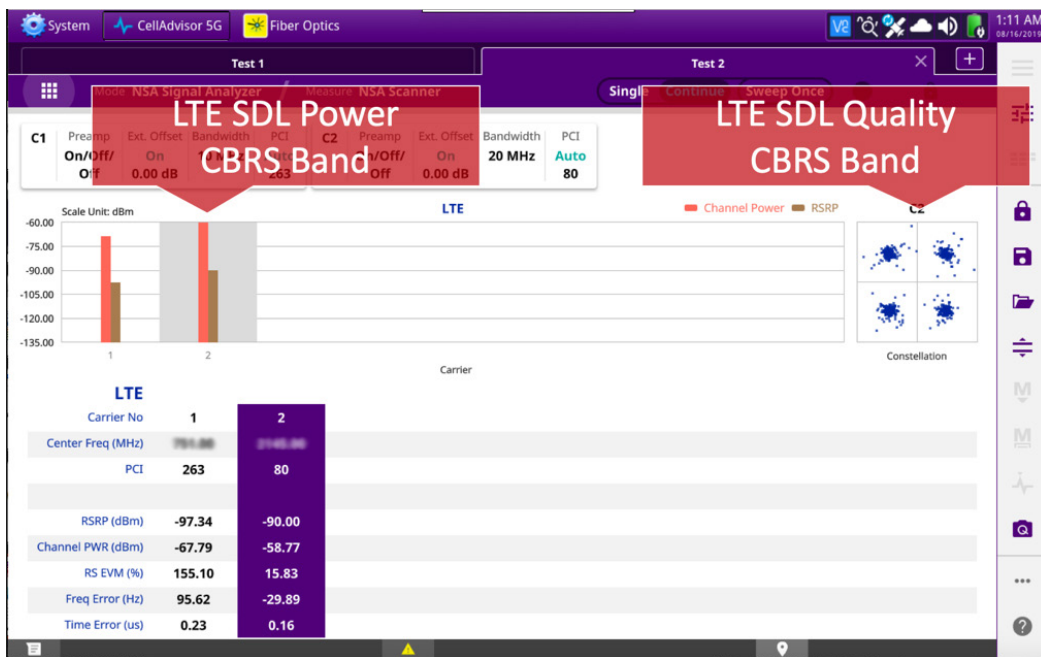
- LTE anchor (licensed band) signal analysis, indicating the power and signal dominance
- LTE supplemental downlink (CBRS band) signal analysis, indicating the power and signal dominance



# NSA Scanner

## LTE Anchor and LTE CBRS

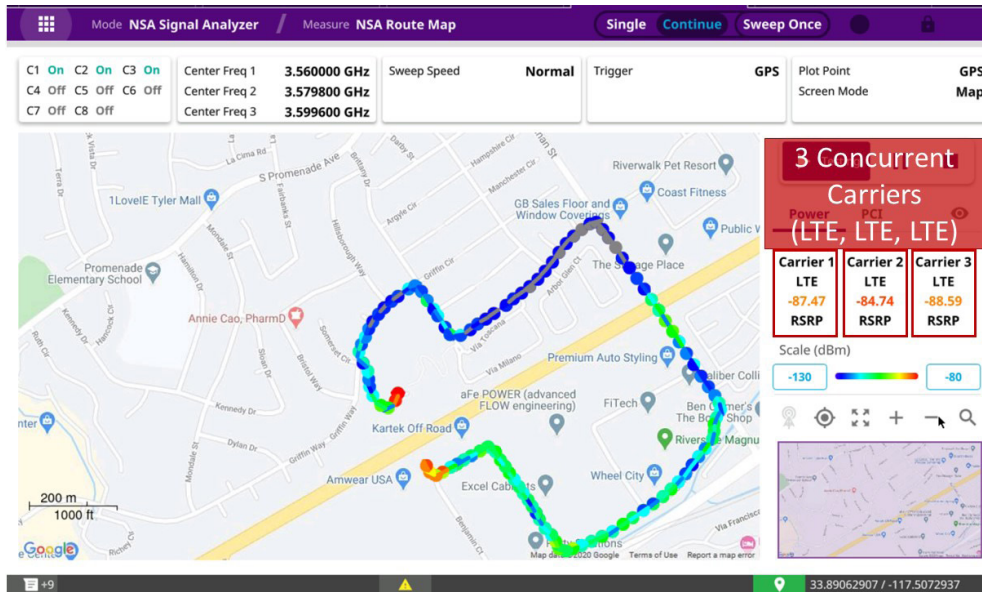
- Multi-carrier scanning of up to eight LTE carriers, of any band and any bandwidth
- Performs concurrent channel power and signal quality of LTE carriers including LTE anchor and LTE DSL (CBRS)



# NSA Route Map

## LTE Anchor and LTE CBRS

- Creates a multi-carrier LTE route map for up to 3 carriers in realtime
- NSA route map measurement data can also be exported for post-processing



## CellAdvisor 5G CBRS Interference

Mobile networks are subject to service impairments due to external or internal interference signals that collide with radio signals (downlink) or mobile signals (uplink), where uplink interference is more critical because the communication from mobile devices is transmitted at a significantly lower power level than radios and typically external interference sources are in closer proximity to mobile users.

### Interference Analysis Overview

Interference analysis is performed with a series of measurement techniques including:



RFoCPRI interference analysis characterizing interference signals (RF) through CPRI links, obtaining an accurate and reliable visibility of the uplink spectrum, since the RF path and components are derived from the actual radio. This interference characterization will be the basis for locating the area and source of interference.



Interference location with the VIAVI InterferenceAdvisor™, automatically locating the area where the interference is generated by performing a drive test and taking into consideration the characteristics of the interferer.



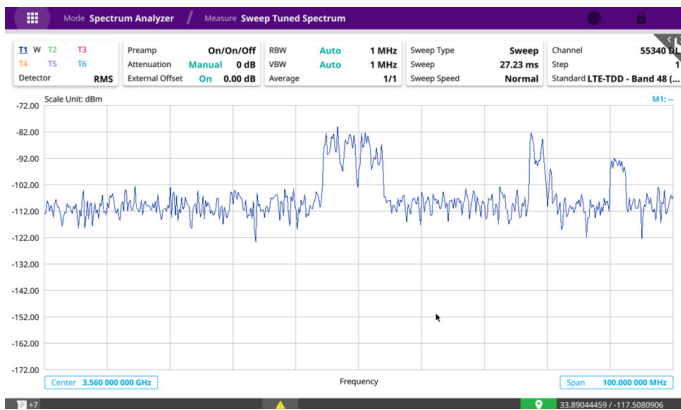
Interference source, with the VIAVI AntennaAdvisor™, locating the device that is generating the interference signal performing directional over-the-air measurements.

## Interference Analysis in CBRS

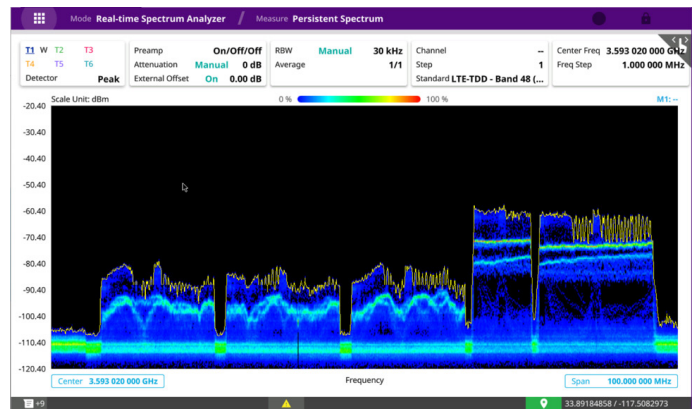
Interference analysis in CBRS band (3.5GHz) has the additional complexity that carriers are transmitted in time division duplex (TDD) mode where the uplink and downlink signals are transmitted over the same frequency channel but at different timeslots.

Technology	Mode	Band	Frequency Range (MHz)
LTE	TDD	42	3400 to 3600
LTE	TDD	43	3600 to 3800
LTE	TDD	48	3550 to 3700
5G	TDD	n48	3550 to 3700
5G	TDD	n77	3300 to 4200
5G	TDD	n78	3300 to 3800

VIAVI CellAdvisor 5G real-time persistence spectrum is an effective analysis approach for TDD signals because it displays the signal power level on different color schemes based on the amount of time (persistence) the signal is present at a specific power level, resulting in a proper representation of time variation signals such as TDD carriers that transmit uplink and downlink signals in different timeslots.



CellAdvisor 5G – Swept Tuned Spectrum TDD Carriers



CellAdvisor 5G – Real-time Persistence Spectrum TDD Carriers

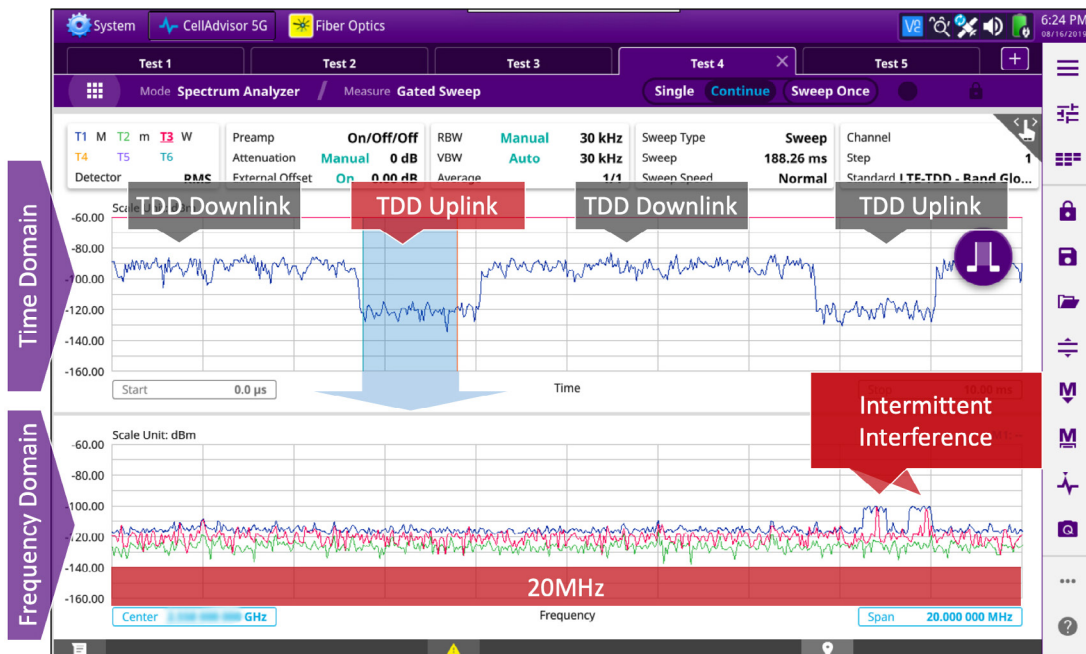
Interference analysis of TDD carriers is difficult to conduct over the air because it requires setting the measurement time only for uplink timeslots.



CellAdvisor 5G – Spectrum Analysis TDD Carrier with Intermittent Interference

Therefore, a unique measurement method is required to properly perform over-the-air interference analysis for TDD signals to effectively locate the interference area and the device that is generating the interference.

CellAdvisor 5G is capable of performing gated-sweep spectrum measurements with which spectrum measurements are performed only at uplink timeslots allowing for an effective interference analysis of TDD carriers in CBRS band.



CellAdvisor 5G – Gated Sweep Spectrum

CellAdvisor 5G is the first field-portable test solution available to enable RF engineers to test, identify and resolve both 5G and LTE/LTE-A radio access issues with a single, easy-to-use solution.

## Ordering Information

Part Number	Description
CA5000-S043	CellAdvisor 5G NSA Analyzer (Requires 5G Signal Analysis option CA5000-S041)
CA5000-S015	CellAdvisor 5G Gated-sweep spectrum analysis

For more information, visit our [CellAdvisor 5G](#) page.

### References:

[1]. [FCC 3.5 GHz Band Overview](#)

[2]. Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band (WINNF-TS-0112 Version V1.9.1)

[3]. [Federated Wireless](#)



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