

LTE-Advanced Carrier Aggregation Analysis

Using CellAdvisor™ for time alignment error verification

LTE-Advanced (LTE-A) supports higher downlink data throughput by aggregating up to five LTE carriers, or component carriers, for a single mobile user session. A key factor to successfully achieving higher-rate data service in carrier aggregation is the synchronization of different carriers. 3GPP has defined a set of guidelines for different methods of aggregating component carriers in the same or different frequency bands.

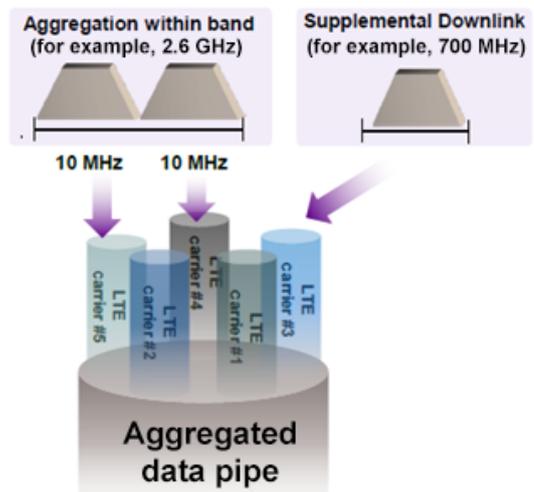
Carrier Aggregation

Many major mobile operators have launched 3-band LTE-A service to support 300 MHz downlink data throughput by combining three LTE carriers. Each service provider occupies 40 MHz bandwidth to support 3-band LTE-A.

CA Band	E-UTRA Operating Bands	Frequency Band	Mobile Operator
CA_1-3-5	1	2100 MHz	A
	3	1800 MHz	
	5	850 MHz	
CA_1-3-8	1	2100 MHz	B
	3	1800 MHz	
	8	900 MHz	
CA_1-5-7	1	2100 MHz	C
	5	850 MHz	
	7	2600 MHz	

Source: ETSI TS 136 141 V11.3.0 (2013-02)

To implement this, service providers need a portable solution that measures the synchronization conformance, or time-alignment error (TAE), of aggregated component carriers to ensure the throughput required for their LTE-A network.



The Standard: 3GPP TS 36 141 V11.3.0

Time Alignment Error

- For MIMO (antenna 1 and antenna 2), each carrier frequency should exhibit a TAE not greater than 90 ns. For intra-band carrier aggregation, with or without MIMO, TAE shall not exceed 155 ns.
- For intra-band non-contiguous carrier aggregation, with or without MIMO, TAE shall not exceed 285 ns.
- For inter-band carrier aggregation, with or without MIMO, TAE shall not exceed 285 ns.



CellAdvisor

Viavi CellAdvisor analyzers perform LTE-A analysis with concurrent measurements for up to five LTE component carriers, indicating the power and modulation quality measuring error vector magnitude (EVM) of all the control channels for each component carrier.

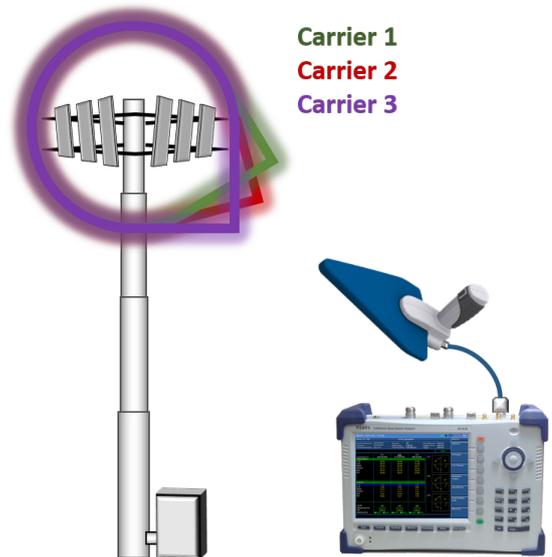
Subframe #: 0	CC1 2650.00 MHz	CC2 2115.00 MHz	CC3 889.00 MHz
Power (dBm)			
P-SS	-54.93	-49.40	-51.03
S-SS	-54.97	-49.44	-51.08
PBCH	-57.23	-52.49	-46.77
PCFICH	-56.37	-52.32	-46.88
RS0	-57.97	-55.18	-55.94
RS1	-63.83	-56.27	-47.60
EVM (%)			
P-SS	5.14	8.63	5.90
S-SS	3.59	9.06	5.84
PBCH	14.47	17.60	3.25
PCFICH	16.17	18.13	3.34
RS0	5.33	12.59	3.58
RS1	10.43	9.41	1.75

In addition, CellAdvisor performs TAE measurements between the different component carriers, indicating the cell-id, frequency error, and antenna under test.

Cell ID	253	253	253
Frequency Error	-40.60 Hz	-38.23 Hz	-14.66 Hz
TAE	-0.00 ns	12.90 ns	9.50 ns
Antenna Port	ANT0 ANT1	ANT0 ANT1	ANT0 ANT1

CellAdvisor LTE-A analysis can be conducted during commissioning on a direct connection to the radio or over-the-air under the following test conditions:

- Direct line of sight to the radio
- Channel power >-70 dBm
- Expected RS EVM <20%

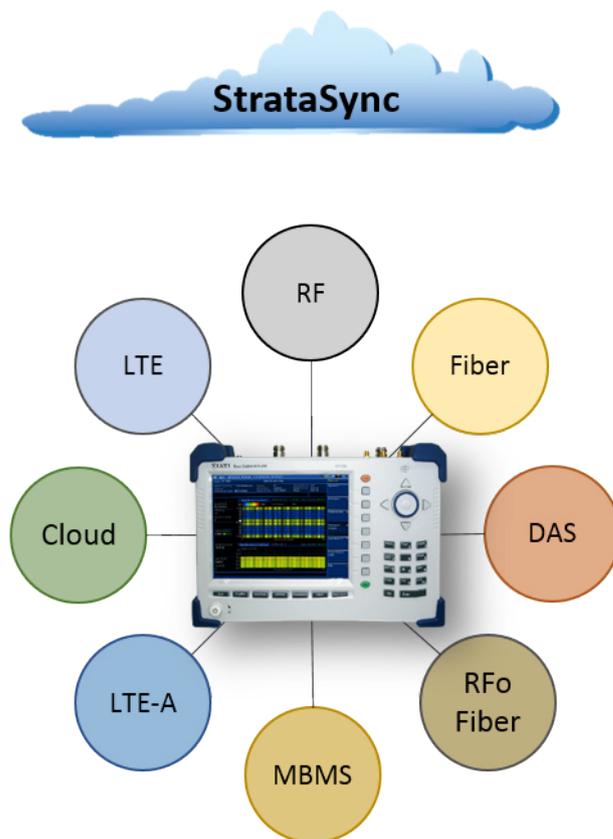


CellAdvisor displaying LTE-A carrier aggregation

Summary

LTE-A enables the use of multiple carriers in the same or different frequency bands with the same or different channel bandwidths. For proper operation, these carriers must exhibit a small time alignment error between them; CellAdvisor verifies this requirement, ensuring proper performance.

CellAdvisor supports all wireless technologies—GSM/GPRS/EDGE, CDMA/EV-DO, WCDMA/HSPDA, LTE-FDD/LTE-TDD—and offers advanced capabilities for LTE-MBMS, LTE-A, fiber inspection, cloud services, RFoCPRI™, and RFoBSA. It is the most advanced and complete portable test solution for installing and maintaining cell sites.





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