NB-IoT NTN Device Acceptance

Protocol, RF and functional test solutions



Ensure chipset and devices comply to 3GPP and Satellite Network Operator certification test

Non-Terrestrial Networks (NTN) offer wireless connectivity through satellite and satellite constellations and can be used standalone or as a complement to traditional Terrestrial Networks (TN). The latter is an interesting use case for commercial communications based on 5G as it permits extending the coverage to the complete globe without access restrictions in remote areas and oceans which have been out of reach so far. Besides global coverage another advantage is a greater resilience to natural disasters and network damages in conflict areas, which ensure access to wireless communication to emergency services.

The use of satellite networks is facilitated by the evolution of the satellite technology with lower cost of operation now. There are different types of satellite networks depending on the orbit altitude and latitude.

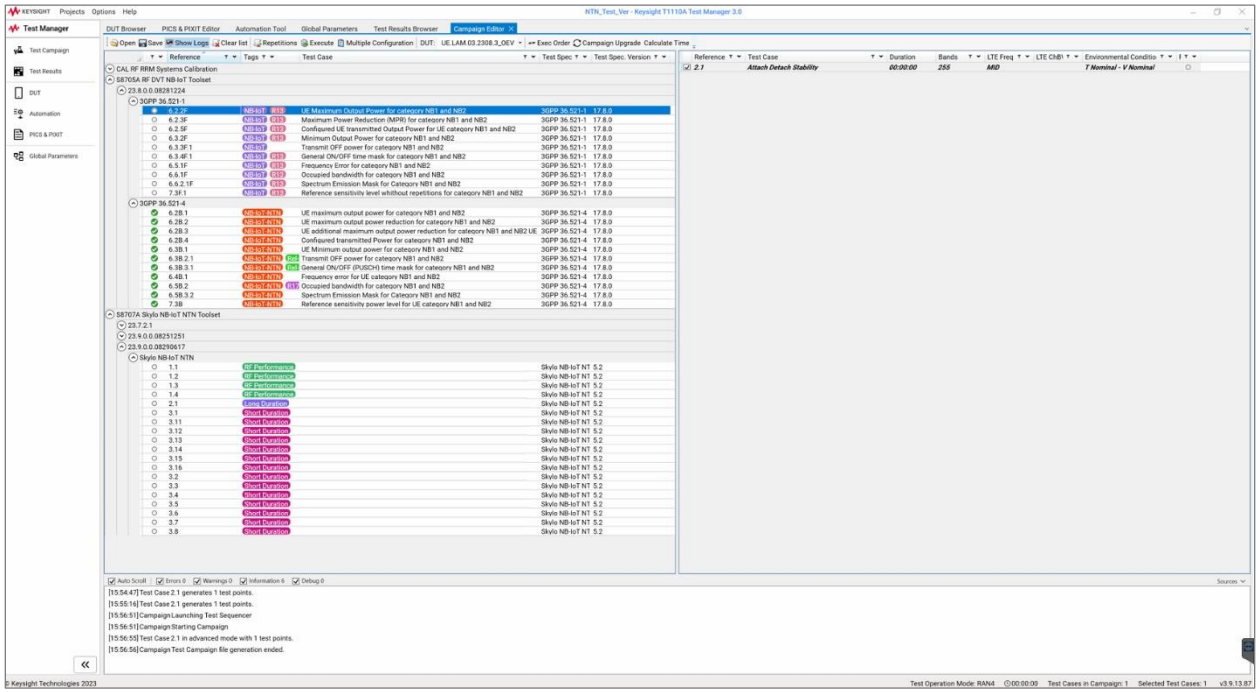
- Geostationary or GEO, with satellites located approx. 36000 km altitude and appearing nearly stationary to a ground observer and have same orbital period as the earth. The orbit is in the plane of the equator, with 0º degrees inclination. GEO with its high orbital altitude has a long delay in the communication to ground, although such delay is fix and therefore easier to compensate. These satellites are relatively expensive and have few available orbits.
- Geosynchronous or GSO, is a special case of GEO with a variable inclination e.g., orbital tilt relative to the equator. GSO have more orbit opportunities and therefore can be used by a greater number of satellite operators. Delay and also frequency shift due to doppler effect vary during the orbit and devices must be designed to do the proper compensation to ensure coverage.
- Non-Geosynchronous or NGSO, consist of low flying satellites with orbit time less than 24h, often referred as LEO for Low Earth Orbit. The advantage is fast and lower cost deployment at the expense of offering only discontinuous coverage and requiring more precise compensation of the delay and doppler by the devices.

As with other features, to ensure NTN meets the service providers and user expectations, global specifications and test specifications are needed as well as certification programs which can prove compliance of devices. With the evolution of 5G NR different device form factors can be subject to testing from mobile phones to wearables, and IoT sensors and actuators.

3GPP Release 17 already supports NTN. The work is about to finalize for 3GPP test specifications for Protocol and RF/RRM test cases with priority first in NB-IoT NTN followed by NR NTN. Additionally, some Satellite Network Operators have their own certification programs. It is the case of Skylo who is supporting 3GPP Release 17 standards and working on specific supplementary test to ensure good performance of the devices on their network.

KEYSIGHT

Test NTN Device Acceptance Today!

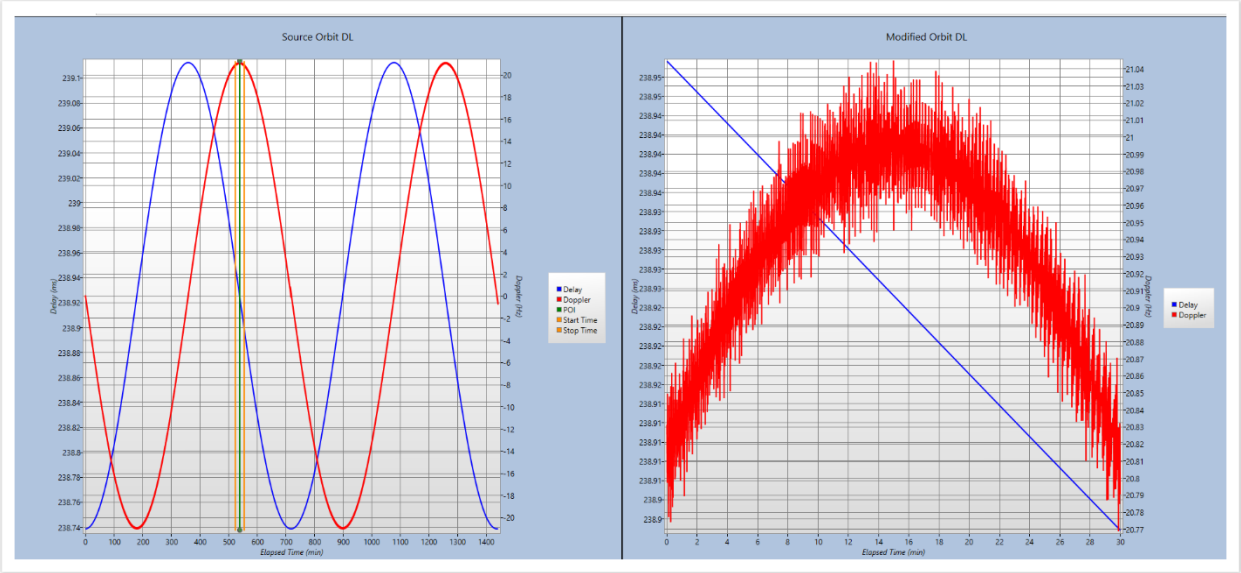


Keysight Device Acceptance Solutions support NTN Conformance and Carrier acceptance requirements.

- 3GPP Protocol Test Cases based on 36.523-1
- 3GPP Transmitter and Receive Test Cases based on 36.521-4
- 3GPP Demodulation Performance Test Cases based on 36.521-4
- 3GPP Radio Resource Management (RRM) Test Cases based on 36.521-3
- Skylo's NB NTN Certification test cases (Sep'23 release)

Toolset is same as for other R15, R16 and R17 test cases ensuring short learning time to configure sample, prepare test case, execute, and check results.

There are however specific values of interest for the NTN test cases which are unique for this type of test and depend on the distance to satellite and orbitational mode; doppler, delay and path loss. In the conformance and carrier acceptance test the values are configured by the test tool and customer can do specific changes as desired. The RF RRM Conformance toolset could use orbit model created with Keysight Orbit Emulation tool which allow users create their own orbit or use existing orbit models from real samples. For NB-IoT NTN the orbits are emulated by the UXM 5G platform (no external hardware required).

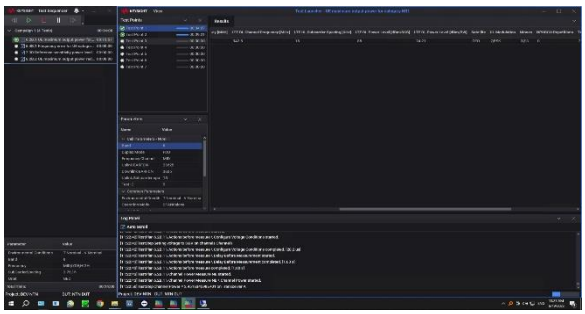


Graph on left shows 24h GEO orbit model. Graph on the right shows detail in between yellow markers for 30 min test in which maximum doppler is reached and maximum rate of the delay occurs.

RF RRM Toolset uses underneath Keysight S8711A Test Application Toolset, measurements and protocol exchanges can be seen during test case execution. In DVT mode, test case execution can be paused from Sequencer application, then without losing the connection user can access Test Application software to review and/or modify the signaling configuration or capture logs from UE for debugging. The tool allows resuming the execution anytime to complete the test point and test case.

Keysight knows 5G

Keysight's solutions were first to market for 5G NR test providing a wealth of experience. Continuing enhancements provide test solutions for NTN and other advancements such as R16 UL Coverage, Mobility and Power Saving enhancements.





For more information

- Keysight RF RRM Video Demo (min 8th)
- Keysight Device Test Solutions
- Keysight UXM 5G Wireless Test Platform
- Keysight Skylo press release
- Satellite Mission Assurance Brochure
- Keysight NTN Portfolio landing page

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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