

# ACCURATELY MEASURE YOUR UWB DEVICE'S TIME OF FLIGHT

The R&S®CMP200 radio communication tester together with the R&S®CM-Z300A time of flight kit provides an accurate setup for time of flight measurements – in validation, calibration and certification.



Rohde & Schwarz test solution for accurate UWB device testing.

## Your task: accurate time of flight measurements

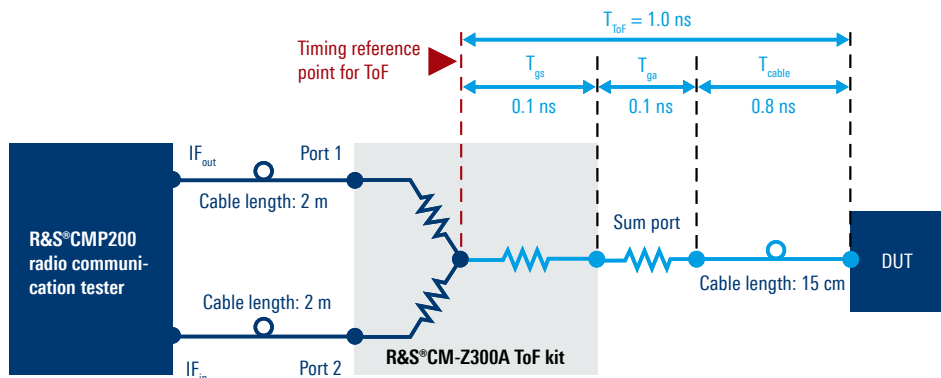
Secure ranging is a key feature for several ultrawideband (UWB) applications. Therefore, accurate time of flight (ToF) measurements are required for the validation of UWB devices and chipsets, antenna calibration, as well as physical layer certification as defined by the FiRa consortium.

## Rohde & Schwarz solution for UWB time of flight

Rohde & Schwarz provides a test solution for accurate time of flight measurements that is easy to set up. The R&S®CM-Z300A UWB ToF measurement kit together with the R&S®CMP200 radio communication tester enables typical time of flight measurements to be performed without the need for additional calibration and path delay measurements.

The time of flight measurement kit consists of an RF power splitter/combiner, a selection of attenuators, a pair of cables to connect to the R&S®CMP200 and a short cable (15 cm) to connect to the antenna port of the device under test (DUT), as illustrated in the figure below.

## Test setup for ToF measurements as required for e.g. FiRa physical layer certification



## Components of the R&S®CM-Z300A UWB time of flight measurement kit

- ▶ Power splitter/combiner
- ▶ 6 dB attenuator
- ▶ 10 dB attenuator
- ▶ 20 dB attenuator
- ▶ 30 dB attenuator
- ▶ RF cable set, 2 m

Depending on the specific needs, it is possible to add or change components in the setup such as different cables. In this case, it is highly recommended to validate the delay characteristics of the setup using a vector network analyzer (VNA) and to change the configuration parameter in the UWB test suite accordingly.

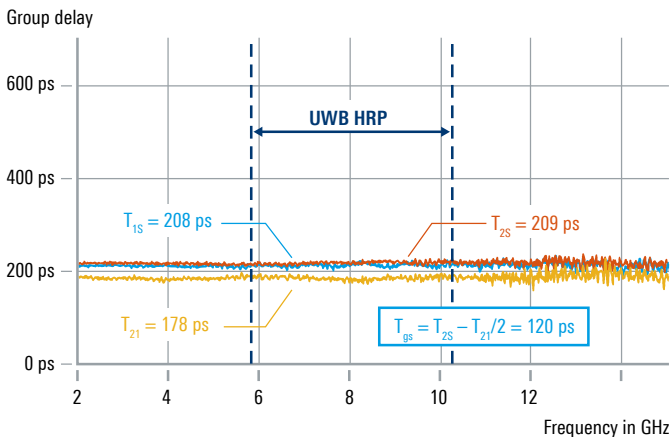
### Configuration of the test setup in just a few steps

For the setup, the configuration port 1 of the splitter/combiner is connected to the TX port 1 ( $IF_{out}$ ) of the R&S®CMP200 using a long RF cable. Port 2 of the splitter/combiner is connected to the RX port 1 ( $IF_{in}$ ) of the R&S®CMP200 using the other long cable. Finally, the sum port S of the splitter/combiner is connected to the antenna port of the device under test using the short RF cable.

The RF coupling from RX to TX acts as a timing reference for the ToF measurements. The length of the cables between the splitter and the R&S®CMP200 is therefore uncritical.

As depicted in the example below, the expected time of flight for a configuration including an attenuator of e.g. 10 dB would be exactly 1 ns, which corresponds to a measured distance in the air of 30 cm.

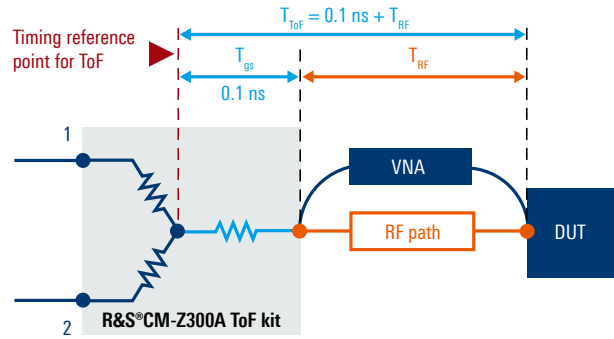
### Group delay of the splitter/combiner



Rohde & Schwarz GmbH & Co. KG  
www.rohde-schwarz.com

Rohde & Schwarz training  
www.training.rohde-schwarz.com  
Rohde & Schwarz customer support  
www.rohde-schwarz.com/support

### RF path delay measurement in a customized setup



If the measurement setup requires longer cables, or the measurements should be performed via RF switches to several antenna ports, or in case of over-the-air test setups, the RF path delay needs to be determined with a multiport network analyzer.

In this case, perform the following steps:

1. Assemble the R&S®CM-Z300A with all other RF cables and network devices (splitters, combiners, circulators) that will be used with the DUT to interface with the R&S®CMP200.
2. Connect the two ends of this RF network – the DUT terminated end and the R&S®CMP200 terminated end at the sum port S of the splitter/combiner – to the two ports on a multiport RF network analyzer such as the R&S®ZNB vector network analyzer.
3. Measure the RF path delay of the RF network, for example at the UWB channel of interest e.g. on channel 5: 6489.6 MHz.
4. Update the path delay property of the test\_config.ini file with the value measured in step 3 plus the 0.1 ns from the kit ( $T_{gs}$ ), in microseconds.

### ToF measurement made easy

The R&S®CMP200 combined with the R&S®CM-Z300A ToF kit enables accurate time of flight measurements with an easy to handle test setup.

### See also

[www.rohde-schwarz.com/UWB](http://www.rohde-schwarz.com/UWB)

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG  
Trade names are trademarks of the owners  
PD 5216.3889.92 | Version 01.00 | July 2022 (ch)  
Accurately measure your UWB device's time of flight  
Data without tolerance limits is not binding | Subject to change  
© 2022 Rohde & Schwarz GmbH & Co. KG | 81671 Munich, Germany