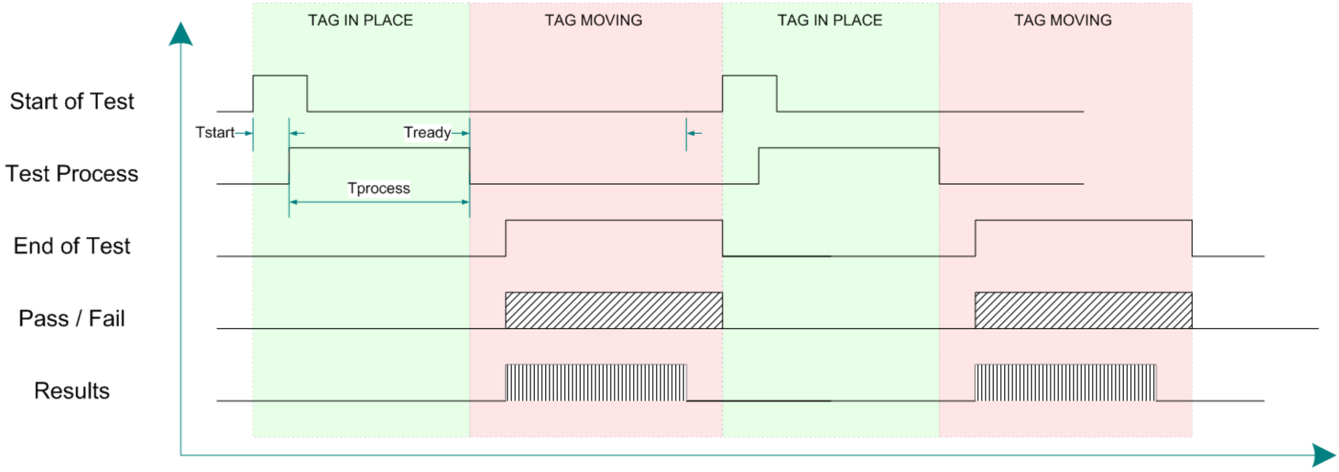
RTS200 Test speed discussion

The diagram shows the RTS200 implementation of the test cycle.



The times involved are described as follows.

- **Tstart** The time it takes for the RTS200 to start the test. From the instant when the tag is in place (and the corresponding signal is generated by the machine), to the starting of the air interface communication implementation by the RTS200.
- **Tprocess** The time it takes the RTS100 to perform all the pre-defined tests.
- **Tready** From the end of the test to the instant when the RTS200 can accept a new Trigger (start) from the machine. During this period, the RTS200 is sending the result information through the communication channel to the host, and signaling the status to the machine through the hardware interface.

The process has been divided in two states:

TAG IN PLACE

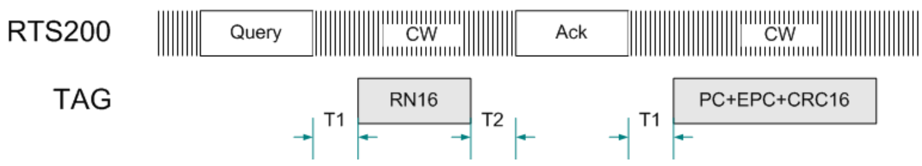
The machine flags the start of the test by rising the SOT (Start of Test) signal. This is a digital input to the RTS200, so the delay (Tstart), is practically negligible, as it is related to microprocessor cycle times. The constraint to apply in this case is that the time available for the test (Tstart + Tprocessing), corresponds to the time the tag is still on the test site. Depending on the test process (see discussion on test modes below in this section), it is possible to perform during this time, one or more RTS-TAG communication cycles. If the tag answers the first time, only one cycle will be needed. Otherwise, additional cycles will take place, up to the value indicated by the NTRIES parameter.

TAG MOVING

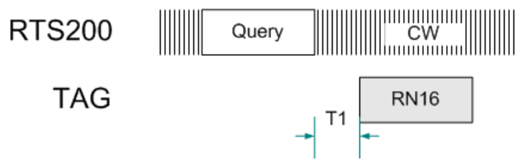
While the tag is moving (so the next tag reaches the test site), the RTS200 sends its information to the machine and the host: EOT (End of Test) signal, PASS/FAIL signal, and result information as a serial stream of data to be sent to the host.

The implementation of the GEN2 protocol has been carefully designed to minimize the communication cycle time. Two test modes have been defined:

Test Mode A: ID reading



Test Mode B: Max speed

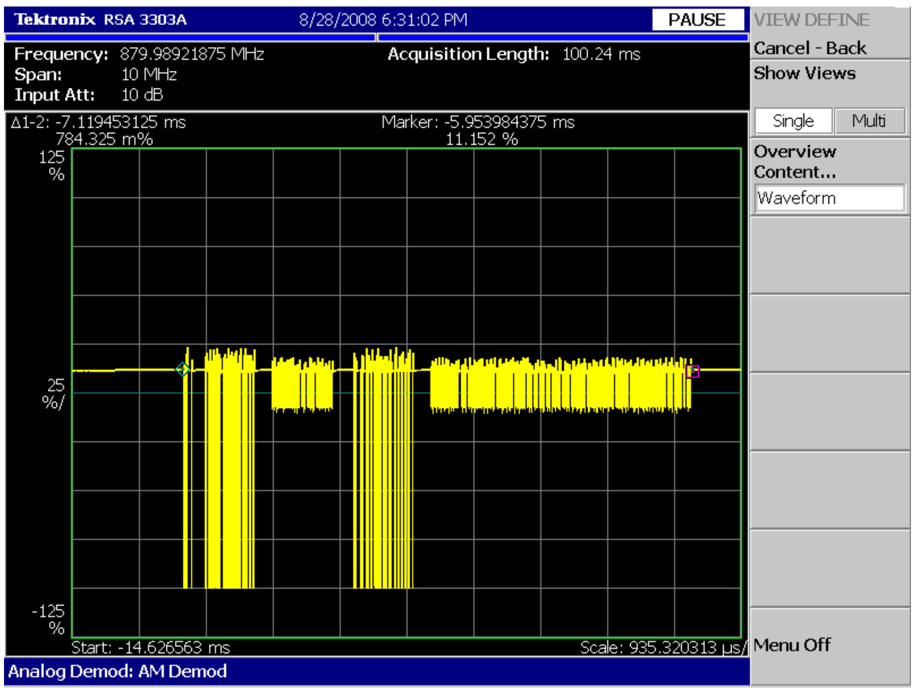


The test mode A implements the minimum set of commands from the RTS200 to the Tag, **to get its ID code, the EPC**.

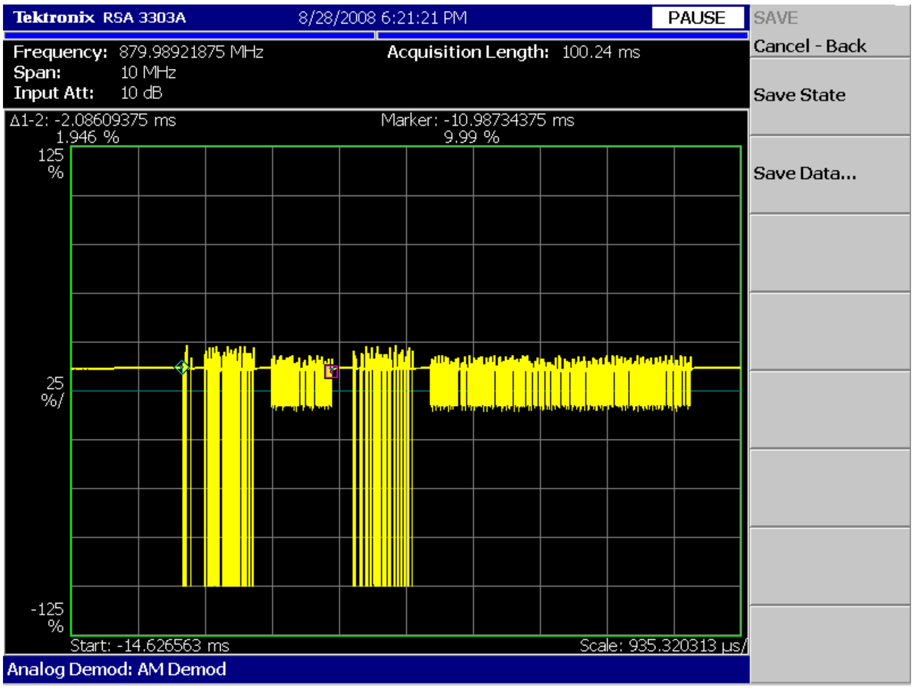
The test mode B is even simpler. The first command (Query) is sent to the tag. The tag answers by sending back a random number (RN16). The verification is based on the checking of the RN16 reception. As there is not any redundancy check in this transmission, the checking is based on the received signal level, and the bit timing.

This is the fastest protocol implementation that gives an indication of the tag being answering or not. So, if the EPC code is not needed, this is, from our point of view, the best option if fast processing speed is required.

Some figures are indicative. The image shows the test mode A implementation with the RTS200.



The markers shows that the mode A implementation takes 7.12ms. Below the same image can be seen with the markers in the mode B part of the protocol:



In this case, the test takes just 2.08ms, just 30% of the original test time. It is possible to perform near 500 measurements per second in the mode B, and only 140 in mode A (in fact these values will not be met, as there will be some extra guard times to be kept between commands).

The RTS200 can perform either a mode A test (normal reading test), or a mode B test (called Fast Mode in the software), and this is user configurable.

OTHER FACTORS AFFECTING PROCESSIN SPEED

In most cases, the limitation will come from the **time available for the test**, that is, the TAG IN PLACE time. The fact that the tag is moving throughout all the process has to be considered at high speeds. For instance, let´s consider a tag moving in front of the antenna at 10m/s. If we consider that the optimal position for the tag-tester communication is around 1cm, the tag is only in place during just 1ms, which is not enough for a reliable test.

Another important limiting factor would be the **trigger innacuracies**. The trigger position has to be carefully adjusted so the RTS can start with the tests as soon as the tag enters the reading zone. Any innacuracy will result in wasting of time that should be available for the tests. But, having in mind that the reading zone depends on many factors (environment, type of tags, tag-antenna distance), it can not be determined with precission, and so some innacuracies are inherent to the system operation.

The **test configuration** might affect the reading speed too. For instance, if the test frequency makes the tag reading not reliable. The tag is usually optimized for the operation at a certain frequency (868MHz, 915MHz, or both in some cases). But when the tag enters the test site, all the environment affects the tag operation, and usually, the best performance is not obtained at the design frequency. In other cases, the field distribution in the test site at a certain frequency (again as a consequence of the environment, metallic elements, reflections of RF signal, multipath, …) is very bad for a particular inlay geometry. In this case, the chip does not receive enough energy, and does not answer, so the reading is not reliable. To avoid these problems, the RTS200 makes it possible to adjust the test frequency to non-standard values. Verification of the tag performance at different frequencies for a particular test site is required if the testing process has to be optimized for speed.

Finally it is also important to mention the **shielding effectiveness** as a limiting factor. The test speed relies on the fact that only one tag will answer at a time. If there are two different tags answering because the one outside the testing zone is not properly shielded, it will generate collisions in the air interface protocol, and as a consequence test errors and additional reading cycles that will degrade test speed and reliability.

Improving all these factors will have a positive impact on testing speed, but, from our experience, we consider that a certain percentage of reduction for the maximum theoretical test speed has to be applied in real production environments.