
15 Timing advance and absolute delay

15.1 Definition and applicability

Timing advance (TA) is a time offset in bits as sent to the MS by the BS. The MS shall advance its transmissions to the BS by the timing advance relative to 3 timeslots behind transmissions received from the BS.

The absolute delay is the delay between a common burst reference point within the received and the transmitted RF burst.

NOTE: For normal or dummy bursts, the common burst reference point is defined to be the transition from bit 13 to bit 14 of the midamble. For an access burst it is defined to be the transition from bit 48 to bit 49 of the burst.

Equivalently the delay can be referenced to the modulator input vs. the demodulator output or to the differential encoder input vs. the differential decoder output, provided the measured delay is corrected for the additional delays in the signal path.

The requirement and this test apply to all types of GSM 400, GSM 900 and DCS 1 800 MS.

15.2 Conformance requirement

- 1) The random access burst transmission, measured at the MS antenna, shall use a TA of 0, and therefore be 3 timeslots behind the transmissions received from the BTS, with an absolute tolerance of +/- 1 bit period.

GSM 05.10, 6.4; GSM 05.10, 6.6.

- 2) The normal burst transmission, measured at the MS antenna, shall be 3 timeslots - TA behind the transmissions received from the BTS, with an absolute tolerance of +/- 1 bit period.

GSM 05.10, 6.4.

- 3) When the MS receives a new value of TA on the SACCH, it shall implement the new value of TA at the first TDMA frame belonging to the next reporting period, after the SACCH frame containing the new TA value.

GSM 05.10, 6.5.

- 4) The MS shall signal the used TA to the BS, in the L1 header of the uplink SACCH message.

GSM 05.10, 6.4, GSM 04.04, 7.2.

15.3 Test purpose

- 1) To verify that the MS uses a TA value of 0 for the access burst.
- 2) To verify that the MS meets the absolute receive/transmit delay requirement for the access burst.
- 3) To verify that the MS meets the absolute receive/transmit delay requirement for normal bursts.
- 4) To verify that the MS implements a new timing advance value as signalled on the SACCH as in the requirement.
- 5) To verify that the MS sends the TA used on the uplink SACCH as in the requirement.

15.4 Method of test

15.4.1 Initial conditions

The SS sends "MAXRETRANS = 7" and "TX-INTEGGER = 3" on the BCCH.

The MS is brought into MM state "idle, updated".

15.4.2 Procedure

- a) The SS pages the MS after 10 s.
- b) The SS does not respond to the first 7 CHANNEL REQUEST messages from the MS. The SS responds to the 8th CHANNEL REQUEST from the MS on the RACH by sending an IMMEDIATE ASSIGNMENT message, with TA set to 0.
- c) The SS continues to set up a call according to the generic call set up procedure.
- d) The SS signals the TA values 10, 20, 30, 40, 50, 60, 63, and one random value other than these values to the MS in consecutive SACCH blocks.

For GSM 400 MS, the SS signals the TA values 35, 70, 105, 140, 175, 210, 219, and one random value other than these values to the MS in consecutive SACCH blocks.

The SS determines the TA value set in the L1 header on the uplink SACCH for each timing advance.

The SS measures the absolute delay for all bursts.

15.5 Test requirement

The measured receive/transmit delay for each burst shall equal the following nominal values with an absolute tolerance of +/- 1 bit period:

access bursts: 3 timeslots (= 45/26 ms)

normal bursts: 3 timeslots (= 45/26 ms) minus the last TA value received from the SS.

The MS shall use the new timing advance at the first TDMA frame belonging to the next reporting period after the SACCH frame containing the new TA value.

The TA field in the uplink SACCH L1 header shall contain to the most recently ordered TA value.

15.6 GPRS Timing advance and absolute delay

15.6.1 Definition and applicability

Timing advance (TA) is a time offset in bits as sent to the MS by the BS. The MS shall advance its transmissions to the BS by the timing advance relative to 3 timeslots behind transmissions received from the BS.

The absolute delay is the delay between a common burst reference point within the received and the transmitted RF burst.

The timing advance procedure is used to derive the correct value for timing advance that the MS has to use for the uplink transmission of radio blocks.

The timing advance procedure comprises two parts:

- initial timing advance estimation;
- continuous timing advance update.

NOTE: For normal or dummy bursts, the common burst reference point is defined to be the transition from bit 13 to bit 14 of the midamble. For an access burst it is defined to be the transition from bit 48 to bit 49 of the burst.

Equivalently the delay can be referenced to the modulator input vs. the demodulator output or to the differential encoder input vs. the differential decoder output, provided the measured delay is corrected for the additional delays in the signal path.

The requirement and this test apply to all types of GSM 400, GSM 900 and DCS 1 800 MS supporting GPRS.

15.6.2 Conformance requirement

- 1) The random access burst transmission, measured at the MS antenna, shall use a TA of 0, and therefore be 3 timeslots behind the transmissions received from the BTS, with an absolute tolerance of +/- 1 bit period.

GSM 05.10, 6.4; GSM 05.10, 6.6.

- 2) The normal burst transmission, measured at the MS antenna, shall be 3 timeslots - TA behind the transmissions received from the BTS, with an absolute tolerance of +/- 1 bit period. In case of a multislot configuration, the MS shall use a common timebase for transmission of all channels. In this case, the MS may optionally use a timeslot length of 157 bit periods on timeslots TN = 0 and 4, and 156 bit periods on timeslots with TN = 1, 2, 3, 5, 6 and 7, rather than 156,25 bit periods on all timeslots. In case of a packet switched multislot configuration the common timebase shall be derived from all timeslots monitored by the MS. In this case, the MS may assume that the BTS uses a timeslot length of 156,25 bit periods on all timeslots

GSM 05.10, 6.4.

- 3) For an MS in Packet transfer mode, except MS class A in dedicated mode:

Within the packet resource assignments (see GSM 04.08 and GSM 04.60) for uplink or downlink messages the MS gets the Timing Advance Index (TAI). The MS shall send access bursts on the subchannel defined by the TAI on the PTCCH using TA=0.

GSM 05.10 6.5.2

- 4) For an MS in Packet transfer mode, except MS class A in dedicated mode:

When the MS receives the updated value of TA from the BTS on the downlink PTCCH, it shall always use the last received TA value for the uplink transmission.

GSM 05.10 6.5.2

- 5) For an MS in Packet transfer mode, except MS class A in dedicated mode:

Upon initiation of the continuous timing advance procedure the MS shall disregard the TA values on PTCCH until it has sent its first access burst on PTCCH.

GSM 05.10 6.5.2

- 6) For an MS in Packet transfer mode, except MS class A in dedicated mode:

The network may request the MS to send 4 access bursts to calculate a new TA value. For this purpose the network sets the system information element CONTROL_ACK_TYPE to indicate that the MS is to respond with a PACKET_CONTROL_ACKNOWLEDGEMENT consisting of 4 access bursts (see GSM 04.60), and sends a PACKET_POLLING_REQUEST to the MS. In this case, the MS shall transmit 4 consecutive access bursts on the assigned resources.

GSM 05.10 6.5.2

- 7) For an MS in Packet transfer mode, except MS class A in dedicated mode:

If the MS receives a resource assignment or power control/timing advance message (see GSM 04.60), the MS shall use the included TA value until it receives a new value on PTCCH.

GSM 05.10 6.5.2

- 8) For an MS in Packet transfer mode, except MS class A in dedicated mode:

If the MS receive a packet resource assignment (see GSM 04.08 and GSM 04.60) indicating to the MS that it can only start the uplink transmission on PDTCH after the timing advance is obtained by the continuous update procedure, the MS shall start the packet transfer after the TA value is received on the PTCCH.

GSM 05.10 6.5.2

- 9) For an MS in Packet transfer mode, except MS class A in dedicated mode:

If the MS receives a packet resource assignment (see GSM 04.08 and GSM 04.60) indicating that a default timing advance shall be used, the MS shall not use the continuous timing advance procedure.

GSM 05.10 6.5.2

- 10) For an MS in Packet transfer mode, except MS class A in dedicated mode:

When the MS receives a new or updated TA value on the downlink PTCCH or downlink PACCH, the MS shall be ready to transmit using the new TA value within 40 ms of the end of the last timeslot of the message block containing the new TA value.

GSM 05.10, 6.9

NOTE: A MS class A in dedicated mode has to follow the procedures described in GSM 05.10 subclause 6.5.1.

15.6.3 Test purpose

- 1) To verify that the MS uses a TA value of 0 for the access burst.
- 2) To verify that the MS meets the absolute receive/transmit delay requirement for the access burst.
- 3) To verify that the MS meets the absolute receive/transmit delay requirement for normal bursts.
- 4) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, when it receives an updated value of TA from the BTS on the downlink PTCCH, uses the last received TA value for the uplink transmission, respecting conformance requirement 10.
- 5) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, upon initiation of the continuous timing advance procedure shall disregard the TA values on PTCCH until it has sent its first access burst on PTCCH.
- 6) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, if it receives a packet polling message as defined in conformance requirement 6, sends 4 access bursts on a network assigned uplink resource.
- 7) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, if it receives a resource assignment or power control/timing advance message (see GSM 04.60), uses the included TA value until it receives a new value on PTCCH.
- 8) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, if it receives a packet resource assignment (see GSM 04.08 and GSM 04.60) indicating to the MS that it can only start the uplink transmission on PDTCH after the timing advance is obtained by the continuous update procedure, it starts the packet transfer after the TA value is received on the PTCCH respecting conformance requirement 10.
- 9) To verify that an MS in Packet transfer mode, except for a GPRS Class A MS in dedicated mode, if it receives a packet resource assignment (see GSM 04.08 and GSM 04.60) indicating that a default timing advance shall be used, does not use the continuous timing advance procedure.

15.6.4 Method of test

15.6.4.1 Initial conditions

The SS sets the Packet System Information 1 parameter CONTROL_ACK_TYPE to "0".

The MS is brought into packet idle mode.

15.6.4.2 Procedure

- a) The SS pages MS on the PPCH. The SS measures the receive/transmit delay for each burst.
- b) The MS is brought into packet transfer mode. The SS transmits a packet resource assignment to the MS with a valid TAI. The SS transmits a TA value on the PTCCH for this TAI which is not 0 nor 1. The SS measures the receive/transmit delay for each burst.

- c) The SS transmits a number of different TA values on the PTCCH for the TAI assigned to the MS. The SS also changes the TA values on the PTCCH for the other TAI in such a way that there is no correlation between TA values. The SS measures the receive/transmit delay for each burst.
- d) The SS transmits a new TA value, different by more than 1 from the previously transmitted one, in such a way that the MS can only correctly receive the last (4th) occurrence of the new TA value. The SS measures the receive/transmit delay for each burst.
- e) The MS is made to send a Packet Channel Request. The SS responds with a Packet Queuing Notification. After 10 s the SS sends a Packet Polling, addressing the MS with its Temporary Queuing Identity. The SS measures the receive/transmit delay for each burst.

NOTE: The 10 s is an arbitrary value.

- f) The SS sends a Packet Uplink Assignment to the MS with valid TIMING_ADVANCE_INDEX, TIMING_ADVANCE_TIMESLOT_NUMBER, and TIMING_ADVANCE_VALUE. As part of the subsequent continuous timing advance update procedure, the SS sends a timing advance value on the downlink PTCCH for the MS, that is different from the TIMING_ADVANCE_VALUE in the Packet Uplink Assignment. The SS measures the receive/transmit delay for each burst.
- g) The SS sends a Packet Uplink Assignment to the MS with valid TIMING_ADVANCE_INDEX and TIMING_ADVANCE_TIMESLOT_NUMBER corresponding to the PTCCH, and with the TIMING_ADVANCE_VALUE field not present. The SS allocates uplink resources to the MS in such a way that the allocated uplink resources occur before the uplink PTCCH allocated to the MS. The SS measures the receive/transmit delay for each burst.
- h) The SS sends a Packet Uplink Assignment to the MS with TIMING_ADVANCE_VALUE set to a value different from the last one ordered on the PTCCH, and the TIMING_ADVANCE_INDEX and TIMING_ADVANCE_TIMESLOT_NUMBER fields not present. The SS continues to transmit TA values on the PTCCH. These shall be different from the TA value TIMING_ADVANCE_VALUE in the Packet Uplink Assignment. The SS measures the receive/transmit delay for each burst.

15.6.5 Test requirement

The measured receive/transmit delay for each burst shall equal the following nominal values with an absolute tolerance of +/- 1 bit period.

access bursts: 3 timeslots (= 45/26 ms)

normal bursts: 3 timeslots (= 45/26 ms) minus the last TA value received from the SS.

In step a) the MS shall transmit an access burst on the PRACH.

In step b) the MS shall send access bursts on the PTCCH on the subchannel defined by the TAI with TA = 0.

In step c) the MS shall use the updated TA values.

In step d) the MS shall use the updated TA value.

In step e) the MS shall transmit 4 access bursts.

In step f) the MS shall use the TIMING_ADVANCE_VALUE in the Packet Uplink Assignment first, and change to the Timing Advance value transmitted on the downlink PTCCH in response to the sending of an access burst on the uplink PTCCH.

After step h) the MS shall not transmit on the allocated resources before it received a Timing Advance value on the downlink PTCCH in response to the sending of an access burst on the uplink PTCCH.

In step h) the last TA value received from the SS is the TIMING_ADVANCE_VALUE in the Packet Uplink Assignment.