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## **TIA-855 Automatic Stutter Dialtone Detection FAQ List**

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## 1. Introduction

This document contains answers to frequently asked questions regarding the TIA-855 standard, and provides answers for ambiguous requirements or statements in the TIA-855 standard. The information contained herein is the opinion of AST Technology Labs. AST Technology Labs was a major contributor for the development of the TIA-855 standard. AST's president, James Bress was the chairman of the TIA-TR-41.3.2 working group which wrote the standard that was published in July, 2001.

## 2. Background

The TIA-855 standards for Automatic Stutter Dialtone (SDT) CPE includes requirements for the following purpose:

1. To establish performance criteria for network interoperability to improve the probability of the SDT CPE functioning properly in most CPE installations.
2. Provide a method whereby SDT CPE can determine if the telephone line the CPE is connected to has reliable VMWI service. If the VMWI is deemed to be reliable, SDT Checking is disabled. This allows the SDT CPE to perform the task it was designed for, which is to provide a visual Voicemail indicator where VMWI service is not present, or is unreliable due to loop transmission issues.
3. To clarify rules established by the FCC Part-68 SDT CPE waiver (now part of TIA-968 (ACTA)). These clarifications include:
  - a. Defining a method for multiple SDT CPE device synchronization. Synchronization is required by the TIA-968 rules but there is no method provided.
  - b. Defining rules to determine if a ring signal is considered an "unanswered call".
  - c. Determining if an Off-Hook condition is a "call" or caused by some other Off-Hook event (such as another SDT CPE performing a SDT Check).

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### 3. FAQ List

#### 3.1 *Stutter Dialtone Cadence Tolerances*

TIA-855 includes the following text in a table defining the Stutter Dialtone cadence detection tolerances in section 4.2 (SDT Signaling Parameters):

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Cadence (SDT): 90 ms on/off to 160 ms on/off, with a +/- 10% tolerance on each interval

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There are also Notes below the SDT parameter table. The ambiguity is in defining what the 10% tolerance is applied to.

#### CLARIFICATIONS

Add the following Note after the SDT parameters table

#### NOTE:

The On/Off period for the SDT signal is nominally equal (i.e., On duration = Off duration). The 10% tolerance applies to the On/Off durations such that the +/- 10% tolerance is calculated starting with On duration = Off duration. For example the following tolerances may be applied to a nominal cadence of 100 ms On/Off:

- 90 ms ON / 90 ms OFF
- 90 ms ON / 110 ms OFF
- 110 ms ON / 90 ms OFF
- 110 ms ON / 110 ms OFF

90 ms is the absolute minimum signal duration, and 160 ms is the absolute maximum signal duration, required to be detected, therefore the +/- 10% tolerance required for detection does not extend below 90 ms or above 160 ms.

### **3.2 Definition of In-Use Event**

TIA-855 includes the following text defining an In-Use Event in section 4.7.1 (In-Use Event):

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An In-Use Event occurs if the line goes In-Use, then dial tone starts and lasts for more than 2.5 seconds.

An In-Use Event also occurs if the line is In-Use for more than 5.0 seconds.

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There are no tolerances given for the 2.5 second timer or the 5 second timer.

#### **CLARIFICATIONS**

The In-Use Event trigger should be defined as:

- An In-Use Event occurs if the line goes In-Use, then dial tone starts and lasts for more than 2.5 seconds (+/- 0.1 seconds).
- An In-Use Event also occurs if the line is In-Use for more than 5.0 seconds (+/- 0.2 seconds).

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### 3.3 **Definition of An Unanswered Ring Event**

TIA-855 includes the following text in section 4.7.2.1 (Unanswered Ring Event Timing):

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An Unanswered Ring Event occurs when power ringing exists for at least 150 ms followed by a continuous Line Idle condition for a period of at least 4 seconds starting 6 seconds after the end of the power ringing signal.

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The following ambiguities are found:

1. No tolerance is given for the 150 ms of ring detection.
2. There is no definition of "continuous line idle". A minimum line in-use duration to be detected must be defined to establish when the line is no longer considered to be in a "continuous" Line Idle state during the 4 second time window which starts 6 seconds after the end of the ring signal.
3. There appears to be a "loop hole" in the TIA-855 rules whereby the line could be in the In-Use state for 5 seconds after the ring, but is in the Idle state before the start of the 4 second window. In this case it could be determined that 2 SDT Checks should be triggered: one for the 5 second Line In-Use Event, and a second SDT Check for the Unanswered Ring Event. This clearly does not meet the intent of the original FCC waiver rule which reads:

**the device makes an off-hook stutter dial tone check after an unanswered call no more than once**

The purpose for not using the 6 seconds after the ring to determine if a ring signal was an answered call is due to the reality that some switching equipment may have a low DC level associated with power ringing that may stay low for as long as 6 seconds after the end of the ring signal.

#### CLARIFICATIONS

The text from 4.7.2.1 in TIA-855 should read as:

- A time interval T-Idle is used to denote the 4 second time interval starting 6 seconds after the end of a ring signal.
- An Unanswered Ring Event occurs when power ringing exists for at least 150 ms (+0 / - 50 ms) followed by a continuous Line Idle condition during T-Idle.

The following clarifying requirements are made to accurately define a "continuous Line Idle" condition.

- The line shall be considered to be in a continuous Line Idle state if there is <450 ms of a Line In-Use condition during T-Idle.
  - The line may be considered to be in a continuous Line Idle state, or considered to be not in a continuous Line Idle state if there is >=450 ms to <=900 ms of a Line In-Use condition during T-Idle.
  - The line shall be considered to be not in a continuous Line Idle state if there is >900 ms of a Line In-Use condition during T-Idle.
-

- SDT Checks shall not be triggered for both a Line In-Use Event and an Unanswered Ring Event if the Line In-Use Event occurs during the first 6 seconds after the end of a ring signal and an Unanswered Ring Event is triggered for the same ring signal. In this case, only the Unanswered Ring Event shall trigger an Automatic SDT Check.

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### 3.4 Automatic SDT Check Interactions

The TIA-855 standard includes the following text in section 4.8.1 (Interaction of Automatic SDT Checks):

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The rules for handling Automatic SDT Check interactions are as follows:

1. If Automatic SDT Checks are pending for both an In-Use Event and an Unanswered Ring Event and the Automatic SDT Checks are scheduled to occur within 10 seconds of each other, then the earlier pending Automatic SDT Check shall be canceled. This will reduce the number of automatic SDT checks.
2. If an Automatic SDT Check is pending, and the Event that caused the Automatic SDT Check to be pending (In-Use or Unanswered Ring Event) occurs again, the Automatic SDT Check shall be canceled. The later Event shall trigger a new pending Automatic SDT Check. This will reduce the number of automatic SDT checks.
3. If an SDT check is pending due to a prior Unanswered Ring Event, and an In-Use Event occurs less than 10 seconds before the pending Automatic SDT Check is to occur, the pending Automatic SDT Check shall be canceled. This will reduce the number of automatic SDT checks.

Note: The In-Use Event will trigger a pending SDT Check.

4. If Power Ringing occurs less than 10 seconds before a pending Automatic SDT Check is to occur, the pending Automatic SDT Check shall be canceled. This will minimize the possibility that an automatic SDT check will answer an incoming call.

Note 1: If the Power Ringing causes an In-Use Event (i.e., an answered call), the In-Use Event will trigger a pending SDT Check.

Note 2: If the Power Ringing becomes an Unanswered Ring Event, the Unanswered Ring Event will trigger a SDT Check if the indicator is off.

5. In no case shall the CPE initiate an Automatic SDT Check less than 5 seconds after the line has been In-Use. This will eliminate the possibility of an automatic SDT check from interfering with call disconnect timing.

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There are several timers defined without a tolerance given. These rules are re-written below with clarification of timer tolerances and other ambiguities resolved. Many ambiguities occurred by making use of terms such as "10 seconds before the pending SDT Check is to occur". Because there is a time window (T1 and T2) when SDT Checks may occur it is not practical to verify these parameters. The interaction rules have been re-written below to make the rules more testable and keep the spirit of each rule intact.

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1. If Automatic SDT Checks are pending for both an In-Use Event and an Unanswered Ring Event, in no case shall two SDT Checks start within 10 seconds (+/- 1 second) of each other. It is permissible for the CPE to perform only one SDT Check if T1 starts between 27 seconds (+/- 2 seconds) before the start of T2, to 12 seconds (+/- 2 seconds) after the end of T2. This will reduce the number of automatic SDT checks.
2. If an Automatic SDT Check is pending, and the Event that caused the Automatic SDT Check to be pending (In-Use or Unanswered Ring Event) occurs again, the Automatic SDT Check shall be canceled. The later Event shall trigger a new pending Automatic SDT Check. This will reduce the number of automatic SDT checks.
3. If an Automatic SDT check is pending due to a prior Unanswered Ring Event, and an In-Use Event is triggered before the pending SDT Check occurs, the SDT Check pending for the Unanswered Ring Event shall not start less than 10 seconds (+/- 1 second) after the line returns to the Idle state. This will reduce the number of automatic SDT checks.

Note: The In-Use Event will trigger a pending SDT Check.

4. If an Automatic SDT check is pending due to a prior In-Use Event, and Power Ringing (minimum duration 150 ms (+0 ms / -50 ms)) ends before the pending SDT Check occurs, the SDT Check pending for the In-Use Event shall not start less than 10 seconds (+/- 1 second) after the end of the Power Ringing signal. This will minimize the possibility that an automatic SDT check will answer an incoming call.

Note 1: If the Power Ringing causes an In-Use Event (i.e., an answered call), the In-Use Event will trigger a pending SDT Check.

Note 2: If the Power Ringing becomes an Unanswered Ring Event, the Unanswered Ring Event will trigger a SDT Check if the indicator is off.

5. In no case shall the CPE initiate an Automatic SDT Check less than 5 seconds after a Line In-Use condition which shall be detected by the CPE as follows:
  - A Line In-Use state of <450 ms shall be ignored (not detected).
  - A Line In-Use state of >=450 ms to <=900 ms may, or may not be detected.
  - A Line In-Use state of >900 ms shall be detected.This will eliminate the possibility of an automatic SDT check from interfering with call disconnect timing.

### **3.5 Automatic SDT Check Timing Parameters**

The TIA-855 standard includes the following text in section 4.9.1 (Automatic SDT Check Timing Parameters):

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- The CPE shall go Off-Hook at time  $T_0$  after verifying that the line was not In-Use at time  $T_0 - 100$  ms.
- 

There is no tolerance on the 100 ms timer.

#### **CLARIFICATIONS**

- The CPE shall go Off-Hook at time  $T_0$  after verifying that the line was not In-Use at time  $T_0 - 100$  ms (+/- 10 ms).

### 3.6 Automatic SDT Detector Immunity to Noise

The TIA-855 standard includes the following table in section 4.9.3 (Automatic SDT Detector Immunity to Noise):

Noise Frequency (f)	SNR (per tone)	Maximum Noise Level
$f \leq 60$ Hz	-18 dB	+6 dBm
$60 \text{ Hz} < f \leq 120$ Hz	-6 dB	-4 dBm
$120 \text{ Hz} < f \leq 200$ Hz	0 dB	-10 dBm
$200 \text{ Hz} < f \leq 3200$ Hz	+25 dB	-35 dBm
$3200 \text{ Hz} < f$	+6dB	-16 dBm

These noise levels and SNRs were copied from TIA-777. TIA-777 is currently being re-written (to become TIA-777-A) with many technical changes. It was discovered during the TIA-777-A technical development meetings that the maximum Off-Hook noise levels used for TIA-777 were in error due to a copy of the parameters from a previous standard for On-Hook caller-ID, TIA-716. The SNRs selected for TIA-855 were purposely chosen to be higher than the TIA-777 specifications as a compromise due to the greater difficulty to design a product to detect 350 Hz but have a step roll-off to 200 Hz. It is suggested to maintain the continuity between standards that the SDT Maximum Noise Level requirements be changed to those documented in TIA-777-A-Draft, but the original SNR values agreed for TIA-855 remain as they currently exist. This would change the Noise Immunity table as follows:

Noise Frequency (f) Range	Minimum SNR	Maximum Single Frequency Noise Level
$f \leq 40$ Hz	-18 dB	-14 dBm <sub>600</sub>
$40 \text{ Hz} < f \leq 60$ Hz	-18 dB	-25 dBm <sub>600</sub>
$60 \text{ Hz} < f \leq 80$ Hz	-6 dB	-25 dBm <sub>600</sub>
$80 \text{ Hz} < f \leq 120$ Hz	-6 dB	-29 dBm <sub>600</sub>
$120 \text{ Hz} < f \leq 180$ Hz	0 dB	-29 dBm <sub>600</sub>
$180 \text{ Hz} < f \leq 200$ Hz	0 dB	-32 dBm <sub>600</sub>
$200 \text{ Hz} < f \leq 3200$ Hz	+25 dB	-37 dBm <sub>600</sub>
$f > 3200$ Hz	+6 dB	-18 dBm <sub>600</sub>

### **3.7 Automatic SDT Check Synchronization**

The TIA-855 standard includes the following text in section 4.10 (Automatic SDT Check Synchronization):

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- The line going In-Use shall be qualified as an Automatic SDT Check if the line is In-Use for less than 4.1 seconds and DT or SDT is present on the line for the last 0.8 to 1.2 seconds before the line returned to idle. If the line returns to the Idle state less than 0.8 seconds, or more than 1.2 seconds, after the start of dial tone the event shall not be qualified as an Automatic SDT Check.
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There is no tolerance given for the 0.8 second and 1.2 second timers. The following clarification is made:

- The line going In-Use shall be qualified as an Automatic SDT Check if the line is In-Use for less than 4.1 seconds and DT or SDT is present on the line for the last 0.8 seconds (+0.0 / - 0.1 seconds) to 1.2 seconds (+0.1 / -0.0 seconds) before the line returns to idle. If the line returns to the Idle state less than 0.8 seconds (+0.0 / -0.1 seconds), or more than 1.2 seconds (+0.1 / -0.0 seconds), after the start of dial tone, the event shall not be qualified as an Automatic SDT Check.

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### 3.8 Call Event Definition for Timing the VMWI 30 Second Rule

The TIA-855 standard includes the following text in section 4.11 (Interaction With VMWI):

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1. CPE shall always accept a valid VMWI message. If a valid VMWI message is received during the time period between an Automatic SDT triggering event (Unanswered Ring or Off-Hook Event) and an Automatic SDT Check, then the pending Automatic SDT Check shall be cancelled.
2. If a valid VMWI message is received more than 30 seconds after any call event the VMWI service is deemed to be Reliable. In this case the Automatic SDT Checking feature shall be disabled. (No Automatic or Non-Automatic SDT Checks shall be performed.).

**Note:** It is expected that the Digital Loop Carrier will enter the power down mode within 15 seconds, therefore the 30 second interval should cover current network conditions.

3. Power Reset shall re-enable the Automatic SDT Checking feature if it has been disabled.
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In 2. above, the statement "...30 seconds after a call event..." is used. This could easily be confused with the SDT Check Trigger Events defined in the standard. TIA-855 explains that the reason behind needing to define "reliable VMWI" is the fact that Digital Loop Carrier (DLC) equipment may only pass VMWI-FSK signaling from the switch to the CPE after signaling has occurred on the line and a DLC channel is open for a brief time but long enough for a VMWI-FSK signal to pass through. The intention is that if a signal that could open a DLC channel from switch to CPE occurs less than 30 seconds before receiving a VMWI-FSK message, then that VMWI message is not considered reliable. If one VMWI message is received that is reliable (per the 30 second rule) then the SDT Checking shall be disabled.

The following ambiguities are found:

1. Defining the "call event" that should be required for the CPE to detect to time the duration from the end of a "call event" to the start of receiving the VMWI-FSK message.
2. There is no tolerance provided for timing the 30 seconds after a "call event".

#### CLARIFICATIONS

A call event is defined as the following:

1. Reception of at least 150 ms (+0 ms / -50 ms) of Power Ringing.
2. A Line In-Use state with duration detected by the CPE as follows:
  - A Line In-Use state of <450 ms shall be ignored (not detected).
  - A Line In-Use state of >=450 ms to <=900 ms may, or may not be detected.
  - A Line In-Use state of >900 ms shall be detected.

The 30 second timer is defined as:

1. Change "30 seconds" to 30 seconds (+/- 2 seconds)
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### **3.9 SDT Check After Unanswered Ring Event With The Indicator On**

The TIA-855 standard states the CPE shall not perform an SDT Check after an Unanswered Ring Event if the indicator is On. This requirement was made to meet the FCC-Waiver / ACTA rule stating the same requirement as:

*the device performs no off-hook stutter dial tone check after an unanswered incoming call if the visual message indicator is already lit*

The TIA-855 standard establishes two triggers that may cause a CPE to perform an SDT Check:

- A Line In-Use Event
- An Unanswered Ring Event

The CPE is required to maintain separate trigger timers for each event. Therefore it is possible to have a pending SDT Check set for both an In-Use Event trigger and an Unanswered Ring Event trigger at the same time. The following two scenarios are possible:

1. When an Unanswered Ring Event occurs the indicator is On but due to a SDT Check triggered by an In-Use Event that occurs before the SDT Check triggered by the Unanswered Ring Event, the indicator is Off at the time the SDT Check for the Unanswered Ring Event would occur.
2. When an Unanswered Ring Event occurs the indicator is Off but due to a SDT Check triggered by an In-Use Event that occurs before the SDT Check triggered by the Unanswered Ring Event, the indicator is On at the time the SDT Check for the Unanswered Ring Event would occur.

In the case of 1., or 2. above, where the indicator status changes between an Unanswered Ring Event trigger and the SDT Check associated with that trigger, it is assumed that either performing and SDT Check, or not performing and SDT Check, meets the requirements of the TIA-855 standard and the ACTA SDT Rules.

### **3.10 SDT and DT Detection For Secondary SDT Check**

The TIA-855 standard states the CPE shall detect a Secondary SDT Check (detects SDT or DT during a SDT Check performed by a parallel CPE). There is no explicit mention of the SDT / DT minimum signal level detection threshold but it is implied that the minimum detection threshold should be the same as for a regular SDT Check (-36 dBm). This minimum Secondary SDT Check signal threshold should be tested separately.

### **3.11 *Inter-working With Legacy (non-TIA-855) SDT CPE***

The TIA-855 standard does not directly address issues related to inter-working with legacy (non-TIA-855 compliant) SDT CPE. The following scenario may create a situation which can cause the CPE to fail to perform a SDT Check:

1. A SDT Check trigger event occurs (Line In-Use or Unanswered Ring Event).
2. The CPE waits for its designed time to perform the SDT Check during the valid SDT Check window (15 to 30 sec. after a Line In-Use Event or 340 to 380 sec. after an Unanswered Ring Event).
3. While the CPE is waiting to perform a SDT Check during the valid SDT Check window for the previous triggering event, the line goes In-Use. It is possible that a legacy (non-TIA-855 compliant) CPE generated the Line In-Use which did not conform to the TIA-855 timing requirements.

AST suggests to use the following rules to inter-work with a legacy SDT CPE connected on the same line:

1. TIA-855 states to measure the timing of the Line In-Use and also detect SDT or DT during the Line In-Use. If the Line In-Use is from 0.8 sec. to 1.2 sec., the CPE should consider this to be a valid SDT Check and accept the detected SDT or DT signal (this is called a "Secondary SDT Check" as defined by TIA-855).
2. TIA-855 does not say what to do if the Line In-Use timing does not meet the 0.8 sec. to 1.2 sec. requirement for a Secondary SDT Check. In this case, AST suggests the CPE should wait 5 sec. after the line goes back to idle (On-Hook) and an SDT Check should be performed if it is still during the valid window for an SDT Check for the previous trigger.
3. Following these rules will allow the CPE to inter-work better with legacy non-TIA-855 compliant CPE connected on the same telephone line.