SWITCHING SYSTEMS MANAGEMENT

NO. 1 ELECTRONIC SWITCHING SYSTEM

SERVICE RESULTS

DIAL TONE SPEED

1. GENERAL

1.01 This section describes Dial Tone Speed (DTS) operations and the uses of test results. Because this is an important service and engineering item, the network administrator should be knowledgable about the DTS test program and the uses of data obtained from it.

1.02 Whenever this section is reissued the reason for reissue will be listed in this paragraph.

1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

DESCRIPTION OF OPERATION

1.04 With the No. 1 Electronic Switching System (ESS), it is possible to conduct DTS tests and measurements without:

(1) Using extra hardware

(2) Assigning customer line circuits to this function

(3) Interference or interruption to the normal service of the customer.

1.05 The purpose of the DTS test is to measure, by means of system-originated test calls, the grade of dial tone service that customers receive: that is, the interval of time between receiver off-hook and the receipt of dial tone. Dial tone delay is one of the measures of central office performance. The number of dial tone delays, among other items, is one of the criteria used in determining the need for line load control (LLC). When LLC is enabled, the results of DTS tests are used by the program as the criterion for determining when to start denying originating service to some nonessential lines.

1.06 This test is performed under program control. When in operation, the program originates DTS test on working lines by first entering a simulated service request into a buffer where the central control or signal processor line scanning program can load it into the line service request hopper. The program next proceeds to go through the routine of establishing a dial tone connection (in memory) up to the point of final closure of the dial tone path to the customer digit receiver, then dropping the attempt. This simulated test for dial tone does not interfere with normal service. Tests are initiated at four-second intervals, 225 test calls are made during the quarter-hour and printed on the teletypewriter (TTY) TC15 message and a total of 900 test calls are made during the hour and printed on the TTY H schedule. The program goes into translations to determine whether the line for which the bid for dial tone was made is marked as a TOUCH-TONE® line. If so, it will be scored as a TOUCH-TONE DTS test; otherwise, it will be scored as a dial-pulse DTS test. Manual

and unequipped lines or lines unable to originate are not tested.

1.07 The program generates the line equipment number (LEN) of the line to be tested via the following scheme (Fig. 1). The first test will involve LEN 00 00 0000. Upon completion of the DTS test a new LEN is generated by the program. This new LEN will be one line switch frame (LSF) and one level higher than the current line. If the LEN generated by the program is busy, a new LEN is generated. The new LEN will be one level higher than the busy LEN. Next, the program checks to see if the LEN generated is within the range of LENs assigned to the switching network and also determines from translations if the line is acceptable for testing. If the line link network (LLN) of the LEN is less than or equal to the highest LLN and if the LSF of the LEN is less than or equal to the highest LSF for this particular network, the LEN is in the range of acceptable LENs. If the LEN is an assigned line and not a master control console (MCC) line, a manual line, or a line which is denied service, it is acceptable for DTS test (see Fig. 1). If the LEN to be tested is not acceptable rangewise or translationwise, the program generates a new LEN, also checking it for acceptability. If the LEN is unassigned, the program will immediately move to next designated test LEN. If the LEN is busy, the program will select a new LEN one level higher in the same switch. If all the levels have been exhausted, it will move to the next switch. If all the switches have been exhausted, it will move to next concentrator, etc.

1.08 For CTX-4 and later generic programs, the nominal length of the DTS test is 11 seconds. The system checks at the end of 3 seconds, and if the attempt to complete the connection to a customer digit receiver (CDR) has not been successful, the test time is extended another 8 seconds. This does not affect the next DTS test that is initiated 4 seconds after the start of the previous test. If LLC has been activated (either manually or automatically) and three successive checks indicate that dial tone delays are exceeding 3 seconds, the system will start to deny originating service to some nonessential lines. If the system is in the automatic LLC mode and three successive 11-second checks fail, the system automatically enables LLC. Once enabled, LLC uses the 3-second dial tone delay as the criterion for denying originating service to some nonessential lines. Detailed information

on LLC can be found in Dial Facilities Management Practices (DFMP), Division H, Section 6d(1), Line Load Control.

1.09 For all generic programs, the program records the number of tests performed and the number of failures encountered regardless of how DTS tests have been enabled. This information is printed out by the system as part of the quarter-hour (TC15) printout. The office counts for DTS tests and delays should also be assigned to the block H traffic measurement schedule. Further details are covered in the Translation Guide (TG-1A) and DFMP, Division H, Section 6i(2), Traffic Measurements—Hourly and Section 6i(5), Traffic Measurements—Quarter-Hourly.

1.10 For a summary of dial tone speed measurement and operation, refer to Fig. 2.

2. IMPLEMENTING DIAL TONE SPEED TESTS

2.01 For CTX-4 and later generic programs, the DTS test program is normally always in effect. However, manual control is provided by a series of TTY requests which can turn the DTS test on or off if circumstances are serious enough to warrant the need. No other system or automatic controls are provided.

> *Caution: DTS test should not be turned off except during extraordinary circumstances; ie, during installation procedures or growth periods when DTS test might interfere with certain installation or growth activities.*

If DTS test is turned off, a traffic overload and control status (TØC01 or TØC02) message is immediately printed out at the network administration and maintenance TTYs.

2.02 For CTX-4 and later generic programs, the DTS test program is controlled by typing in the appropriate message on either the local or remote maintenance TTYs. This is explained in the following paragraphs.

2.03 *To turn off DTS test,* the following message is typed:

DT-INH-.

> *Caution: If LLC is in effect, typing in the above message inhibits LLC.*

(1) If LLC is *on,* a major alarm is sounded, a bell is rung on the network administration TTY, and a TØC01 message is printed out on the maintenance and network administration TTYs.

(2) If LLC is *off,* a TØC02 message is printed out on the maintenance and network administration TTYs.

> *Note 1:* Turning off the DTS test will not stop the quarter-hour printout (TC15). This is independent of DTS test and can be turned on or off by schedule using the LS-QUARTER TTY input message.

> *Note 2:* In offices with CTX-4 generic programs prior to Issue 2A, an emergency action phase 4 or higher zeros all traffic registers. This action includes, DTS test results and the traffic map. Also, DTS test is automatically turned on with system initalization.

2.04 *To turn on DTS test,* the following message is typed.

DT-ALLØW-.

(1) If LLC is *on,* a major alarm is sounded, a bell on the network administration TTY rings, and a TØC01 message is printed out on the maintenance and network admistration TTYs.

(2) If LLC is *off,* the typing of this message results in the printing out of a TØC02 message on the maintenance and network administration TTYs.

3. TC15 TRAFFIC AND OVERLOAD STATUS PRINTOUT

3.01 This message is printed out at quarter-hour intervals. Following is the data given in the message pertaining to DTS test.

(a) *Dial Pulse Test:* The number of test calls that were initiated during the last clock quarter-hour on lines whose translations specified dial pulse. Normally, it should equal 225 minus TOUCH-TONE tests.

(b) *TOUCH-TONE Test:* The number of test calls that were initiated during the last clock quarter-hour on lines whose translations indicated TOUCH-TONE. Normally, it should equal 225 minus dial pulse tests.

(c) *Dial Pulse Delay:* The number of dial pulse tests [out of the total dial pulse tests made in (a) above] for which a 3-second delay was measured or for which the line selected for the test was denied dial tone. Dial tone may have been delayed by the initiation of LLC.

(d) *TOUCH-TONE Delay:* The number of TOUCH-TONE tests [out of the total made in (b) above] for which a 3-second delay was measured or for which the line selected for the test was denied dial tone. Dial tone may have been delayed by the initiation of LLC.

(e) *Extended Dial Tone Delay (only for CTX-4 and later generic programs):* The total number of DTS tests [out of the total made in (a) and (b) above] for which an 11-second delay was measured or for which the line selected was denied dial tone. Dial tone may have been temporarily denied by the initiation of LLC.

3.02 The TC15 format may vary throughout different generic programs. However, the appropriate DTS counts are a fixed part of this printout. For a complete explanation of the TC15, refer to DFMP, Division H, Section 6i(5), Data Administration Quarter-Hour Measurements.

TRAFFIC SCHEDULE RESULTS

3.03 The 3-second DTS test and delays are printed out as part of the block H traffic measurement if specified on the ESS 1400 Form.

3.04 The measurements pertaining to DTS test on the hourly printout are the same as those found on the TC15 printout. See 3.01 and 3.02 of this section.

4. DIAL TONE SPEED MEASUREMENT—DAYS

DAYS TO BE INCLUDED

4.01 Valid DTS data for five business days each week (generally Monday through Friday) should be included in the DTS component of the

dial line index. In some locations, Saturday may be one of the busy days. Saturday may be used in place of a normal business day provided it is consistently one of the five high days.

4.02 All business days of the month are to be reported and included in the dial line index, regardless of the service conditions. Such conditions may exist due to civil disturbances, curfews, storms, floods, impaired dial facilities, Western Electric installation activities, etc.

DAYS TO BE EXCLUDED

4.03 The days to be excluded are those whenever the DTS program fails to function properly during the busy hour; for example, whenever the call store memory is temporarily erased.

4.04 Holidays celebrated on a nationwide basis, in general, do not carry traffic representative of the average business day and may be excluded from the dial line index. For example, Christmas Eve evening data is highly unrepresentative and would not be included. Special days proclaimed as a holiday may be excluded only if they are observed as a holiday on a nationwide basis. Some holidays (such as Lincoln's Birthday, Veterans Day, Columbus Day, and Good Friday) may well be equal to or greater than a representative business day. If one of these holidays falls on a weekday or is celebrated on a Monday or Friday, these days may be included in the dial line index, if locally desired. Refer to Traffic Service Observing Practices Division F, Section 2B for more information.

5. DIAL TONE SPEED BUSY HOUR SELECTION

5.01 Dial tone delay data must be measured during the actual busy hour to measure dial service quality accurately. The network administration group must determine that the busy hour has been correctly established. They must also be alert for shifts in the busy hour due to changes in calling characteristics.

5.02 For purposes of computing the DTS component, the *busy hour* is defined as that time-consistent hour having the greatest average business day percentage dial tone delay over 3 seconds. The busy hour may start on the hour, half-hour, or quarter-hour (10 am to 11 am, 10:30 am to 11:30 am, or 9:45 am to 10:45 am, etc).

5.03 Each year, prior to the busy season period, the busy hour is selected from DTS data obtained during the previous busy season period. The busy hour selected from these data is retained for the duration of the current busy season period. An exception to this would be if the results show another time-consistent clock hour that has an average business day percentage of dial tone delay over 3 seconds which exceeds the designated busy hour results. It must be exceeded by at least 0.5 percent for each of two consecutive service observing months. If this occurs, the hour with the higher percentage of dial tone delay over 3 seconds is designated as the new busy hour commencing no later than the second month; it is generally retained for the remainder of that busy season period.

Example:

	DIAL TONE DELAY OVER 3 SECONDS	
	DECEMBER	JANUARY
9 am to 10 am (previously designated BH)	1.1%	2.0%
7:30 pm to 8:30 pm	1.6%	2.7%
Difference	0.5%	0.7%

(Starting in January, report 7:30 pm to 8:30 pm)

(a) Whenever the busy hour is not readily apparent or a shift in busy hour is expected, data for the 2 or 3 busiest or pertinent hours should be accumulated each day during the current busy season to accurately forecast the hour to be used for the next busy season. A study of half hours for one or two representative weeks should be made to determine these 2 or 3 hours. Ordinarily the study would be made early in the busy season period.

(1) When a pronounced busy hour is indicated and data are accumulated for a single hour, a second study is made during a later month when traffic loads normally are higher. If at that time several hours are close, studies need to be continued for a longer period, as in the preceding paragraph.

(b) A record should be made by the following notations on Form E-4372 (Fig. 3) when a service observing busy hour is changed:

(1) Show the clock period and service results for the previously designated busy hour.

(2) Indicate dates of verification studies.

(c) It is highly important that official DTS measurement results not be shifted to a new hour without appropriate *validated* data.

(1) Recognition should be given to maintenance outages, abnormal equipment operating conditions affecting service results; to area transfers, new tariff offerings, or other factors affecting traffic characteristics; and to pertinent customer trouble reports.

(2) When the hour of highest dial tone delay does not substantially coincide with the hour of maximum hundred call seconds (CCS) usage for that type of equipment, the reason(s) should be investigated and documented.

(d) The selection of the service observing busy hour by the network administration group should be coordinated with the engineering and network maintenance forces.

6. METHOD OF OBTAINING DAILY WEIGHTED PERCENTAGE DIAL TONE SPEED FOR AN ENTITY

6.01 The weighting factors developed each month for computing the daily weighted DTS results are based on originating calls taken during the busy hour for two to five days each month. If practical, these weighting factors may be used for weighting the current service observing month's DTS results; however, the factors may be used for weighting the dial tone speed results in the month immediately following the study. Once it has been determined how the factors are to be applied (current service observing month or the first month following), the procedure should remain consistent. Factors shall not be used, in any case, for computing DTS results beyond the first month following the current service observing month.

6.02 Separate DTS results are to be obtained by the type of customer digit receiver, and results are weighted daily. If an office is 100

percent TOUCH-TONE or dial pulse, weighting is not required.

    (a) *Weighting Factors:* The weight assigned to dial pulse and TOUCH-TONE service is based on the total receiver peg count. It is the percentage of each type of the total receiver peg count of the entity being weighted.

    (b) Refer to Fig. 4 for an example of a dial pulse and TOUCH-TONE receiver, weighted percent dial tone speed, calculation.

7. COMPUTING DIAL TONE SPEED RESULTS AT ENTITY LEVEL

7.01 *For 22 Business Days Measured in Observing Month:*

    Step 1: Separately, for each business day measured, read the entity weighted busy hour percentage dial tone delay over 3 seconds directly into the Dial Tone Speed—BH Index Table (Fig. 5) to determine the dial tone speed index points earned for each day. Express the result to two decimal places.

    Step 2: Total the daily index points earned (as obtained in Step 1) for the 22 days measured. Express the result to one decimal place. The sum of the daily points earned is to be used in computing the entity dial line index.

7.02 *For 15 through 21, 23, or 24 Business Days Measured in Observing Month:* The Dial Tone Speed Index Table is based on daily points obtainable for a 22-business-day month. This means that if DTS results are available for 15 through 21 days, the points obtainable for the month will be something less than the points allocated to the DTS component. Conversely, if 23 or 24 days are measured, the points obtainable would exceed the points allotted. In these cases, a DTS adjustment factor is applied to the sum of the daily points earned for the measured days to increase (or decrease) the total points earned to the equivalent of the maximum monthly points possible.

    Step 1: Determine the sum of the daily points earned for the number of days measured, reported to two decimal places.

    Step 2: Multiple the sum of the total points earned by the appropriate DTS adjustment factor. Express the result as a percentage, rounded to one decimal place.

    Note: The earned points reported should never exceed the maximum points allocated to the DTS component.

7.03 *For Less Than 15 Days Measured in Observing Month:* If less than 15 days are measured in any month, the DTS component is to be omitted from the dial line index, and official dial line results.

7.04 *Dial Tone Speed Component Index:* The dial tone speed component index is obtained by dividing the total points earned for the month by the maximum points available and multiplying the result by 100.

8. PREPARATION OF FORM E-4372—BUSY HOUR DIAL TONE SPEED

A. General

8.01 Form E-4372, *Busy Hour Dial Tone Speed,* is provided for computing daily busy hour DTS results for an entity (Fig. 3). For local reproduction purposes, a full size form is provided on an unnumbered page at the end of this section.

8.02 The preparation of Form E-4372 will generally be the responsibility of the network administration group. A duplicate copy shall be forwarded to the service observing group.

8.03 The term *item* as used in the subsequent instructions refers to the column number, or block number, of the corresponding item on the *Busy Hour Tone Speed* Form E-4372. Only items which relate to the No. 1 ESS will be discussed herein.

B. Instructions for Use of Form E-4372

8.04 *Items — Top of Form E-4372:* Space has been provided for entering the following information.

    (a) *Report Month:* Enter the service observing month and year for which the DTS data is reported.

(b) *Page — of —:* Enter the page number and the total number of pages for the office.

(c) *Entity:* Identify the entity for which DTS data is reported.

(d) *Type of Central Office Equipment:* Enter the type of dial central office equipment provided for entity. For No. 1 ESS, the term DTS test program will suffice.

8.05 *Item 1 — Date Business Days:* Enter the date of each business day. Days on which DTS measurements are to be included in the dial line index are covered in 4.01 and 4.02; days to be excluded are covered in 4.03 and 4.04.

8.06 *Items 2 through 9:* Form E-4372 is designed for entering DTS data for a single entity. The form provides for reporting a maximum of four separately measured classes of service. However, for the No. 1 ESS, only two types of service (dial pulse and TOUCH-TONE) are available.

(a) *Class and Type:* Space is provided for identifying each measured class and type.

(b) *Time:* Enter the DTS busy hour for each type, whether the selected busy hour is the same or a different hour for each type. Rules for determining the DTS busy hour for each type of dial central office equipment are outlined in Part 5.

(c) *Factor:* Enter the weighting factor for each type as determined in item 24.

8.07 *Items 2 and 6 — Number of Tests:* Enter the number of DTS tests obtained during the DTS busy hour separately for each type. This is the number of registrations recorded on the test register of the traffic schedule.

8.08 *Items 3 and 7 — Number Over 3 Seconds:*

(a) Enter for each day the number of delays registered during the DTS busy hour separately for each type. This is the number of registrations recorded on the delay registers of the traffic schedule.

(b) Enter the code NA (not available) in this item whenever DTS delay registrations are not available.

8.09 *Items 4 and 8 — Percentage Over 3 Seconds:* Separately for each type, calculate the delay registrations percentage of the total number of tests made during the DTS busy hour (item 3 divided by item 2; and item 7 divided by item 6). Multiply the quotient by 100 and express the result to one decimal place.

(a) Enter the code NA in this item whenever a code NA has been entered under *No Tests* and/or *No. Over 3 Seconds* for a particular type.

(b) Line Designated *Total:* Total the percentage figures separately for each type for the month.

(c) Line Designated *Average:* Divide the *Total* as determined in (b) by the number of days used in arriving at the total.

8.10 *Items 5 and 9 — Weighted Percentage Over 3 Seconds:* Enter for each day the weighted percentage DTS over 3 seconds for each type. Multiply the *% Over 3 Seconds* in items 4 and 8 by the corresponding weighting factors. Express the result to one decimal place.

(a) Enter the code NA in this item whenever the code NA has been entered in the item *% Over 3 Seconds* for a particular type.

(b) Enter the code NA in this item whenever a check mark (✔) has been entered in item 19.

8.11 *Item 18 — Number of Tests — Total Class Busy Hours:*

(a) Enter for each day the total number of DTS tests. This is the sum of entries recorded in items 2 and 6.

(b) Enter the code NA in item 18 whenever DTS results are not available for one (or more) type, as indicated by the code NA in any of items 2 through 9.

8.12 *Item 20 — Daily Weighted Percentage Over 3 Seconds — Total Class Busy Hours:*

(a) Enter for each day, the daily weighted percentage DTS for the entire entity. Report the result to one decimal place. This is the sum of entries recorded in items 5 and 9.

(b) Enter the code NA in item 20 whenever a check mark (✔) has been entered in item 19.

8.13 *Item 21 — Accumulated Weighted Percentage Over 3 Seconds — Total Class Busy Hours:* For each day, enter the accumulated weighted percentage DTS over 3 seconds. Add the *Daily Wtd. % Over 3 Seconds* in item 20 to the previous day's accumulated weighted percentage over 3 seconds.

(a) Line Designated *Total:* Enter the same figures as shown for the last day reported in item 21.

(b) Line Designated *Average:* Divide the *Total* as determined in (a) by the number of days used in arriving at the total.

8.14 *Items 22 and 23 — Points Earned — Total Class Busy Hours:* Items 22 and 23 are used for entering *daily* and *accumulated daily* index points earned for the DTS component of the dial line index. These items are used for ESS, crossbar and panel entities, and the TOUCH-TONE portion of step-by-step entities partially equipped with common equipment.

(a) *Item 22 — Points Earned — Daily:* For each measured day, read the *Daily WTD. % Over 3 Seconds* in item 20 directly in the *Performance* column of the "Dial Tone Speed — BH" table (labeled Crossbar — ESS — Panel SXS TT) of the Dial Line Index Table (Fig. 5). Enter the corresponding points earned in item 22. Report the result to two decimal places.

(b) *Item 23 — Points Earned — Cumulative:* For each measured day, enter the accumulated DTS index points earned. Add the *daily points earned* in item 22 to the previous day's accumulated DTS points earned. Express the result to two decimal places.

(1) Line Designated *Total:* Enter the accumulated index points earned for all days reported in the total month. This is the same figure as shown for the last day, reported in item 23. Report the result to two decimal places. Enter the code NA whenever less than 15 days are measured in the observing month.

8.15 *Item 24 — Weighting Factors:* Weighting factors are used to weight DTS results for an entity having more than one type. Compute a weighting factor for each *type* separately measured for an entity.

(a) *Type:* Identify each separately measured *type* in the entity. These should correspond with the headings shown in the *type* at the top of the form.

(b) *Average Type Busy Hour Peg Count:* Enter the average type of busy hour peg count (DP-TT, DP) registrations corresponding to the type entered in (a). These counts should be based on studies taken for at least two to five business days each month in the class busy hour. Enter the total number of *average registrations* for the entity on the line designated *Total.*

(c) *Factor:* Compute the weighting factor for each type. Divide the *registrations* of each type by the total of the class busy hour registrations for the entity. Report the weighting factor to three decimal places. The sum of the weighting factory must always equal 1.000.

8.16 *Item 26 — Adjustment Factor — Total Month:* Enter the *Adjustment Factor* corresponding to the total number of days that DTS data are reported and indexed for the total service observing month. This factor is obtained from the Dial Line Index Table.

8.17 *Item 27 — Total Adjusted Index Points Earned — Total Month:* Multiply the *Points Earned Cumulative* in item 23, line designated *Total* by the conversion factor in item 26. Enter the result in item 27, reported to one decimal place.

8.18 *Item 28 — Component Index — Total Month:* Divide the *Total Adjusted Index Points Earned* reported in item 27 by

the maximum DTS points attainable. Express the result as a whole number.

> *Note:* Round the component index to the next higher number whenever the fraction is 0.5 or larger. For example, 97.49 is to be reported 97; 97.50 is to be reported 98.

8.19 *Item 29 Weakspot (✔) — Total Month:*
Enter a check mark (✔) in item 29 whenever the DTS component index for the entity, as reported in item 28, is 89 or lower.

8.20 *Item 31 — Notes:* Space is provided at the bottom of the form for entering a written explanation of any pertinent service item or unusual occurrence.

9. USE OF DIAL TONE SPEED TEST RESULTS

MONITOR SERVICE RESULTS

9.01 The DTS test is one of the service indicators by which the network administrator may determine the grade of service the customer is receiving. It also acts as an indicator as to how well the office is functioning during an overload. Close analysis of the traffic schedules with DTS will enable the network administrator to closely monitor dial tone service results.

OVERLOAD INDICATOR

9.02 Dial tone overloads are defined from two points: an equipment overload and a network overload. An equipment overload occurs when the usage of the customer dial pulse receiver exceeds engineered capacity or designed capacity. A network overload occurs when the load is so heavy that service deteriorates in the form of excessive dial tone delays and/or matching loss. Since service is a major concern, a network administrator analyzes the hour in which the customer is receiving the poorest service.

9.03 The DTS test acts as an indicator as to how well the office is functioning during an overload. Close analysis of the TC15 reports will enable the network administrator to closely track dial tone service results. Figure 5 shows how changes in load can affect dial tone delay.

9.04 The abrupt up swing in dial tone delay is an inherent property of the No. 1 ESS. Central control (CC), while processing calls, checks

to see if the line service request hopper is full. If so, the following strategy is followed:

(1) Hopper is full, scanning is stopped.

(2) CC unloads the hopper by setting up dial tone paths.

(3) When the hopper is emptied to an acceptable level, scanning is resumed.

9.05 The increase in dial tone delay may occur as CC unloads the hopper. If the hopper is not full, each line is scanned five times per second. As the load increases, scanning may be reduced to four or less times per second without dial tone delay. As the load increases to the point where line scans are drastically reduced, there will not be any dial tone delays if CC can establish a dial tone path within 2.9 seconds. However, a slight increase in load will cause a further reduction in the line scan rate causing the dial tone path to be established in 3 seconds or more. This results in DTS failures during this period of time. That is why in Fig. 6, the dial tone delay curve makes such an abrupt up swing once the delay for dial tone reaches 3 seconds.

IMBALANCE INDICATOR

9.06 Other factors that affect DTS are line load balance, customer digit receiver (CDR) balance, trunk balance, and class of service balance. Network imbalance can cause DTS delays that may require corrective action.

9.07 For load balance correction techniques, refer to DFMP, Division H, Section 6g, Load Balance.

CRITERIA FOR PROGRAM TO START LINE LOAD CONTROL

9.08 When the LLC program is enabled, the regular DTS test results act as one of the factors which determine if the LLC program either denies or restores service to nonessential groups. More detailed information on LLC is found in DFMP, Division H, Section 6d(1), Line Load Control and Section 6m, Abnormal Traffic/Load Conditions.

10. DIAL TONE SPEED SERVICE OBJECTIVES

10.01 Dial tone speed service is a measure of the number of 3 second dial tone delays

compared to the number of tests performed. It is expressed in a percentage. For example: Nine delays in 900 tests equals one percent delay. (Percentage of dial tone delay equals delays multiplied by 100 and divided by the number of tests.)

10.02 Provision of equipment is based on load criteria, as well as meeting service objectives. The objectives are as follows:

- Average busy season—1.5 percent

- Average ten high days—8.0 percent

- High day—20.0 percent

10.03 For equipment provisioning purposes, the measurement periods are defined as follows:

(a) *Average Busy Season:* The three months (not necessarily consecutive) having the highest average time—consistent (same hour) busy hour load.

(b) *Average Ten High Days:* The ten days (not confined to the busy season) having the highest time—consistent (same hour) busy hour load.

(c) *High Day:* Refers to the highest day of the ten high days.

A. **NORMAL SEQUENCE:** NEXT LEN TO BE TESTED IS ONE LSF AND ONE LEVEL HIGHER THAN THE LAST LEN TESTED

EXAMPLE:

ORDER OF STEPPING	EQUIPMENT	TEST NUMBER								
		1	2	3	4	5	6	7	8	9
3	LINE LINK NETWORK	00	00	00	00	00	00	00	00	01
1	LINE SWITCH FRAME	0	1	2	3	0	1	2	3	0
5	BAY	0	0	0	0	0	0	0	0	0
4	CONCENTRATOR	0	0	0	0	0	0	0	0	0
2	SWITCH	0	0	0	0	1	1	1	1	2
1	LEVEL	00	01	02	03	00	01	02	03	00

B. **ENCOUNTERING AN UNASSIGNED LINE OR DENIED ORIGINATING LINE.**

IMMEDIATELY MOVE TO NEXT DESIGNATED TEST LEN FOR TEST (TOTAL NUMBER OF TESTS WILL NOT BE AFFECTED)

C. **ENCOUNTERING A BUSY LINE**

(1) MOVE TO NEXT LEVEL IN SAME SWITCH

(2) EXHAUST LEVELS—MOVE TO NEXT SWITCH

(3) EXHAUST SWITCH — MOVE TO NEXT CONCENTRATOR

(4) ANYTIME IT HITS AN UNASSIGNED LINE — ADVANCE AS IN "B."
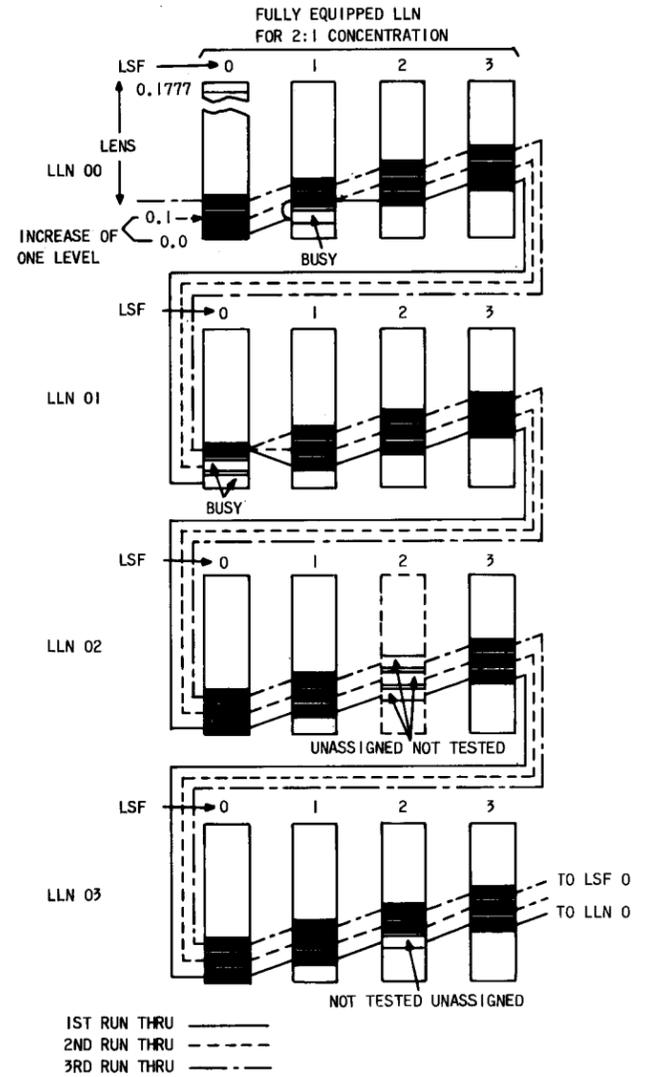
Fig. 1—Dial Tone Speed Testing Sequence (1.07)

Type: Constant holding time (3 second test plus 1 second pause or 1 test every 4 seconds).

Lines Used in Test: Any customer *assigned line* (allowed to originate a call) in memory which is *idle* (on hook) at time of test.

Sequence of Lines Tested: Random under machine control. (See dial tone speed testing sequence chart Fig. 1.)

Operation:

(1) Every four seconds a simulated bid for dial tone is initiated.

(2) The request is entered in the line service request hopper with a flag indicating a test call.

(3) Central control operates just as if the test call were a customer bid for dial tone, up to the point of link closure. When closure is possible but not executed a second flag is set.

(4) Three seconds after beginning a test the central control looks for the second flag. The test register is scored and the delay register may or may not be scored depending upon the presence of the second flag.

(5) If at the beginning of the test the line service request hopper is full, it is scored as a delay automatically. A second test is not initiated until after 4 seconds have elapsed. This means that the customer, under full hopper conditions, receives comparable or better dial tone speed service than indicated by the dial tone speed test results.

Note: If line load control is in effect and a denied line is selected as a dial tone speed test line, the delay register will automatically be scored. However for the purposes of administering the line load control program, the report will be recorded in accordance with the actual outcome of the test.

Fig. 2—Dial Tone Speed Measurement and Operation (1.10)

DP

TT

Form E–4372 (5–73)
Printed in U.S.A.

REPORT MONTH_____ 19____   **BUSY HOUR DIAL TONE SPEED**   PAGE_____ OF_____

ENTITY_____ TYPE OF C.O. EQUIPMENT_____ TYPE OF DTS EQUIPMENT _____

CLASS AND TYPE	TIME		FACTOR		TIME		FACTOR		TIME		FACTOR		TIME		FACTOR		TOTAL CLASS BUSY HOURS						ESS
DATE BUS. DAYS	NO. TESTS	NO. OVER 3"	% OVER 3"	WTD % OVER 3"	NO. TESTS	NO. OVER 3"	% OVER 3"	WTD % OVER 3"	NO. TESTS	NO. OVER 3"	% OVER 3"	WTD % OVER 3"	NO. TESTS	NO. OVER 3"	% OVER 3"	WTD % OVER 3"	NO. TESTS	UNUS-ABLE DAYS (√)	DAILY WTD % OVER 3"	ACCUM. WTD % OVER 3"	ESS–CROSSBAR PANEL–SXS TT POINTS EARNED		NO. BLOCKED DT BH
																					DAILY	CUM.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	30
TOT.																							
AVG.																							

WEIGHTING FACTORS		24
CLASS	AVG. CLASS BH PEG COUNT	FACTOR
DP		X X
TT		X X
TOTAL		1.000

CALCULATED DIAL TONE SPEED TESTS [25] [31]

NO. EXPECTED TESTS:_____

ALLOWABLE DEVIATION:

MAX:_____ MIN:_____

NOTES:

TOTAL MONTH

ADJUSTMENT FACTOR	[26]
TOTAL ADJ INDEX POINTS EARNED	[27]
COMPONENT INDEX	[28]
WEAKSPOT (√)	[29]

IF MORE THAN ONE PAGE IS USED SHOW TOTALS ON THE LAST PAGE

Fig. 3—Example of Form E-4372, Busy Hour Dial
Tone Speed (5.03, 8.01)

(1) Determine the weighting factors as follows:

TYPE OF RECEIVER	RECEIVER BUSY HOUR		PERCENTAGE OF TOTAL (SHOWN AS FACTOR)
	TIME	PEG COUNT	
DP	10:30 am — 11:20 am	3592	0.573
TT	10:30 am — 11:30 am	2674	0.427
Total		6266	1.000

(2) Calculate the weighted percentage DTS
by the type of receiver as follows:

TYPE OF RECEIVER	NO. OF STUDIES (RECEIVER BUSY HOUR)	(1) PERCENTAGE OF DTS OVER 3 SECONDS (RECEIVER BUSY HOUR)	(2) FACTOR	(1X2) WEIGHTED % DTS
DP	726	1.3	0.573	0.74
TT	532	0.9	0.427	0.38
Total	1258		1.000	1.10

Fig. 4—Weighted Percentage Dial Tone Speed Calculation (6.02)

DIAL LINE INDEX TABLE

Comp. Index	Equipment Irregularities				NC or Reorder				Dial Tone Speed – BH				Incoming Match. Loss – BH		Comp. Index
	Crossbar ESS		Step-by-Step Panel		Crossbar ESS		Step-by-Step Panel		Crossbar – ESS Panel – SxS (TT)		Step-by-Step Dial Pulse		Crossbar ESS		
	Perf.	Points	Perf.	Points	Perf.	Points	Perf.	Points	Perf.	Points	Perf.	Points	Perf.	Points	
100	.0	25.0	.0	30.0	.0– .2	25.0	.0– .3	35.0	.0–1.1	1.59	.0– 1.2	35.0	.0– 1.7	15.0	100
99	.1	24.8	.1	29.7	.3– .4	24.8	.4– .5	34.7	1.2–1.4	1.57	1.3– 1.4	34.7	1.8– 1.9	14.9	99
98	.2	24.5	.2	29.4	.5– .6	24.5	.6	34.3	1.5–1.6	1.56	1.5– 1.6	34.3	2.0– 2.1	14.7	98
97	.3	24.3	.3	29.1	.7	24.3	.7	34.0	1.7–1.8	1.54	1.7	34.0	2.2	14.6	97
96	.4	24.0	.4	28.8	.8	24.0	.8	33.6	1.9–2.0	1.53	1.8	33.6	2.3	14.4	96
95	.5	23.8	.5	28.5	.9	23.8	.9	33.3	2.1	1.51	1.9	33.3	2.4	14.3	95
94	.6	23.5	.6	28.2	1.0	23.5	1.0	32.9	2.2	1.49	2.0	32.9	2.5	14.1	94
93	.7	23.3	.7	27.9	–	–	–	–	2.3	1.48	2.1	32.6	2.6	14.0	93
92	–	–	–	–	1.1	23.0	1.1	32.2	2.4	1.46	2.2	32.2	2.7	13.8	92
91	.8	22.8	.8	27.3	–	–	–	–	2.5	1.45	–	–	–	–	91
90	.9	22.5	.9	27.0	1.2	22.5	1.2	31.5	2.6	1.43	2.3	31.5	2.8	13.5	90
88	1.0	22.0	1.0	26.4	1.3	22.0	1.3	30.8	2.7–3.0	1.40	2.4– 2.5	30.8	2.9– 3.0	13.2	88
85	1.1	21.3	1.1	25.5	1.4	21.3	1.4	29.8	3.1–3.4	1.35	2.6– 2.7	29.8	3.1– 3.2	12.8	85
82	1.2	20.5	1.2	24.6	1.5–1.6	20.5	1.5–1.6	28.7	3.5–3.8	1.30	2.8– 2.9	28.7	3.3– 3.4	12.3	82
78	1.3	19.5	1.3	23.4	1.7	19.5	1.7	27.3	3.9–4.2	1.24	3.0– 3.2	27.3	3.5– 3.6	11.7	78
74	1.4	18.5	1.4	22.2	1.8	18.5	1.8	25.9	4.3–4.7	1.18	3.3– 3.6	25.9	3.7– 3.8	11.1	74
70	1.5	17.5	1.5	21.0	1.9	17.5	1.9	24.5	4.8–5.2	1.11	3.7– 4.0	24.5	3.9– 4.0	10.5	70
65	1.6	16.3	1.6	19.5	2.0	16.3	2.0	22.8	5.3–5.7	1.03	4.1– 4.5	22.8	4.1– 4.2	9.8	65
60	1.7	15.0	1.7	18.0	2.1	15.0	2.1	21.0	5.8–6.2	.95	4.6– 5.0	21.0	4.3– 4.5	9.0	60
55	1.8	13.8	1.8	16.5	2.2	13.8	2.2	19.3	6.3–6.8	.87	5.1– 6.0	19.3	4.6– 5.0	8.3	55
50	1.9	12.5	1.9	15.0	2.3–2.4	12.5	2.3–2.4	17.5	6.9–7.5	.80	6.1– 7.0	17.5	5.1– 6.0	7.5	50
40	2.0	10.0	2.0	12.0	2.5–2.6	10.0	2.5–2.6	14.0	7.6–8.4	.64	7.1– 9.0	14.0	6.1– 7.0	6.0	40
30	2.1–2.2	7.5	2.1–2.2	9.0	2.7–2.8	7.5	2.7–2.8	10.5	8.5–9.4	.48	9.1–12.0	10.5	7.1– 8.0	4.5	30
20	2.3–2.4	5.5	2.3–2.4	6.0	2.9–3.3	5.5	2.9–3.2	7.0	9.5–10.5	.32	12.1–16.0	7.0	8.1–10.0	3.0	20
10	2.5–3.4	2.5	2.5–3.4	3.0	3.4–4.1	2.5	3.3–4.1	3.5	10.6–15.0	.16	16.1–20.0	3.5	10.1–12.0	1.5	10
0	Over 3.4	0.0	Over 3.4	0.0	Over 4.1	0.0	Over 4.1	0.0	Over 15.0	.00	Over 20.0	0.0	Over 12.0	0.0	0

Index Conversion Factors

Max. Points Possible For Items Indexed	Conversion Factor
85	1.176
65	1.538
50	2.000

Dial Tone Speed-C.I.
Crossbar-ESS-Panel

To determine the Dial Tone Speed component index for the month, divide the points earned by 35.0 and multiply by 100.

Crossbar-ESS-Panel-SXS TT
DTS Adjustment Factors

24 DA.-	.917	19 DA.-	1.158
23 DA.-	.957	18 DA.-	1.222
22 DA.-	1.000	17 DA.-	1.294
21 DA.-	1.048	16 DA.-	1.375
20 DA.-	1.100	15 DA.-	1.467

Fig. 5—Dial Line Index Table (7.01, 8.14)

DIAL TONE DELAY

HIGH

For a wide change in load virtualy no
change in measured dial tone delay.

LOW

INCREASING LOAD

DIAL TONE DELAY

At a point where dial tone delay
measurements begin to appear,
a small change in load can produce
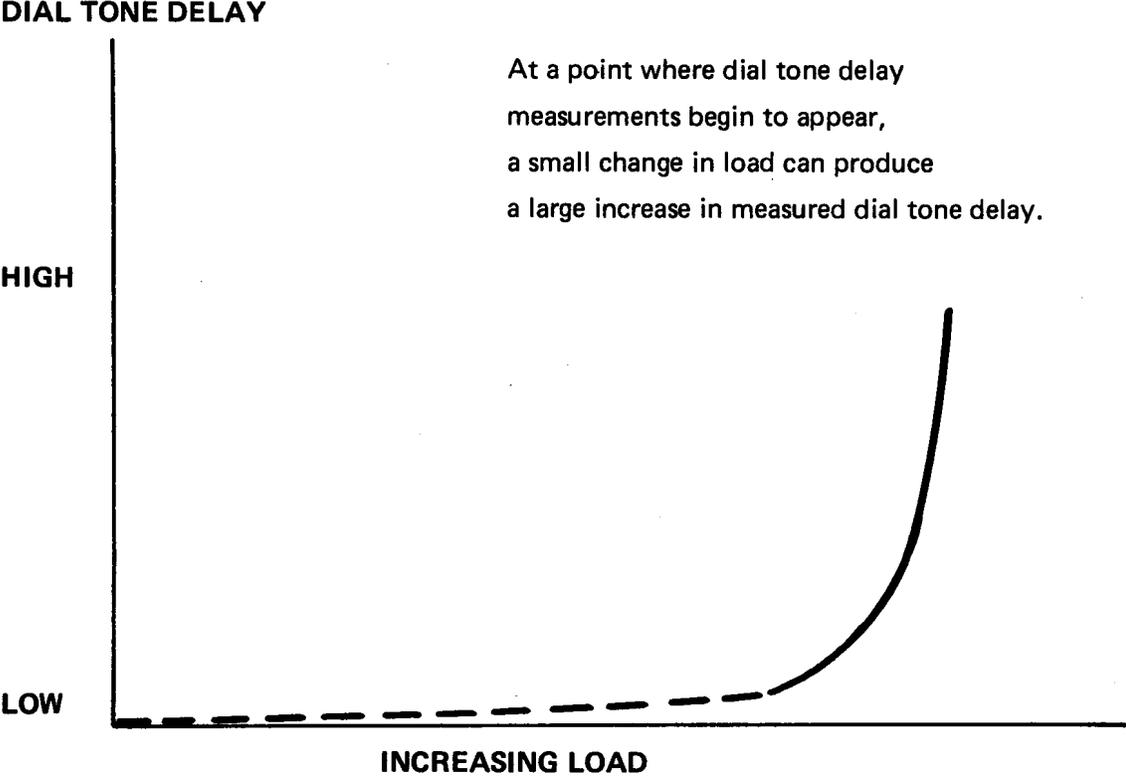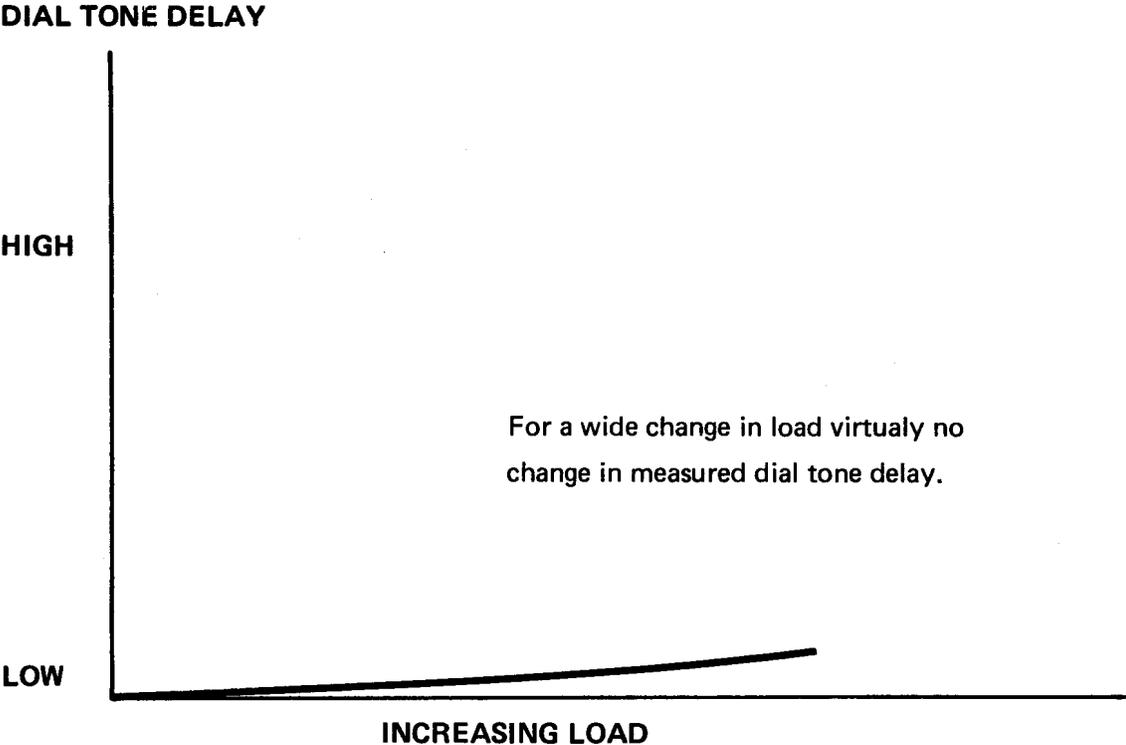a large increase in measured dial tone delay.

HIGH

LOW

INCREASING LOAD

Fig. 6—Dial Tone Speed Versus Load (9.05)

REPORT MONTH_____ 19_____   **BUSY HOUR DIAL TONE SPEED**   PAGE_____ OF_____

ENTITY_____ TYPE OF C.O. EQUIPMENT_____ TYPE OF DTS EQUIPMENT _____

CLASS AND TYPE	TIME		FACTOR		TIME		FACTOR		TIME		FACTOR		TIME		FACTOR		TOTAL CLASS BUSY HOURS						ESS
																	NO. TESTS	UNUS-ABLE DAYS (√)	DAILY WTD % OVER 3''	ACCUM. WTD % OVER 3''	ESS—CROSSBAR PANEL·SXS TT POINTS EARNED		NO. BLOCKED DT BH
DATE BUS. DAYS	NO. TESTS	NO. OVER 3''	% OVER 3''	WTD % OVER 3''	NO. TESTS	NO. OVER 3''	% OVER 3''	WTD % OVER 3''	NO. TESTS	NO. OVER 3''	% OVER 3''	WTD % OVER 3''	NO. TESTS	NO. OVER 3''	% OVER 3''	WTD % OVER 3''					DAILY	CUM.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	30
TOT.																							
AVG.																							

WEIGHTING FACTORS		24
CLASS	AVG. CLASS BH PEG COUNT	FACTOR
TOTAL		1.000

CALCULATED DIAL TONE SPEED TESTS [25] [31]

NO. EXPECTED TESTS:_____

ALLOWABLE DEVIATION:

MAX:_____ MIN:_____

NOTES·

T O T A L M O N T H	ADJUSTMENT FACTOR	26	
	TOTAL ADJ. INDEX POINTS EARNED	27	
	COMPONENT INDEX	28	
	WEAKSPOT (√)	29	

IF MORE THAN ONE PAGE IS USED SHOW TOTALS ON THE LAST PAGE