TRAFFIC MEASUREMENTS
NETWORK ADMINISTRATION
REMOTE SWITCHING SYSTEM

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1. GENERAL

1.01 The Remote Switching System (RSS) is designed to function as part of a host Electronic Switching System (ESS) office for either pair gain, or Community Dial Office (CDO) applications. In each instance, RSS terminals will have appearance as part of the ESS host line network and as such, RSS calls (originations and terminations) will use an extensive portion of ESS host line-processing software. Thus, it is advisable from a traffic measurement standpoint to view the RSS as an integral part of the host ESS. Initial RSS applications will be with No. 1 ESS as the host. The data processing capability of the No. 1 ESS provides for the collection, summarization, and storing of traffic data in counters contained in temporary call store memory. This section describes that portion of the ESS that is utilized in conjunction with providing traffic measurements for RSS.

1.02 Whenever this section is reissued, this paragraph will contain the reason(s) for reissue.

1.03 References in this section to methods, planning, data requirements, and equipment quantities are based on AT&T Company recommendations.

1.04 Recommendations for changes, additions, and/or deletions to this section should be forwarded as specified in Section 000-010-015.

1.05 Traffic data are collected and analyzed to:

- Indicate the level of customer service provided
- Engineer and forecast equipment and trunks
- Administer equipment for efficient utilization
- Guide in instituting special procedures during overload conditions
- Serve as a basis for division of revenue or other special studies.

1.06 Part 2 of this section describes the type of counts, the method of accumulating and

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storing the counts in call store and the output schedules available.

1.07 Part 3 of this section provides a listing of the traffic measurements available for the RSS.

2. EQUIPMENT ARRANGEMENTS

DATA COLLECTION

A. Basic Type of Traffic Measurements

2.01 Traffic measurements are of three basic types: peg count, overflow, and usage.

2.02 ***Peg count*** is a cumulative count of the number of times a specified event occurs during a given time interval. In some cases, the event may be defined as an attempt to take some action, not necessarily a successful attempt.

2.03 ***Overflow*** is a cumulative count, during a given time interval, of the number of call attempts which failed to seize a member of a specified group of facilities because no idle member was available. An overflow scoring in No. 1 ESS does not always imply that a call has been lost, rather it sometimes indicates that a call has been delayed; eg, placed in a queue where it is held until the desired circuit becomes available.

2.04 ***Usage*** is a measure of the total amount of time the members of a group of facilities are busy during a given interval. Usage is obtained by examining a specified group at regular intervals and accumulating the number found in a busy state at each scan over a fixed period of time. The accumulation period and scan rate normally used are one hour and one hundred seconds, respectively. This results in the accumulated total being readable directly as hourly CCS (hundred-call seconds). Increased measurement accuracy on facilities having a holding time of ten seconds or less can be achieved by using a 10-second scan rate. The readings from a 10-second scan rate are converted to hourly CCS by dividing the readings by ten. ***Total usage*** is the total load measured on a group of facilities, whether the load is customer generated or due to a maintenance busy condition. ***Traffic usage*** is the generated load excluding maintenance busy usage. Usage obtained by fast scan (10-second rate) in ESS contains traffic usage only. Since service circuits are generally on fast scan, the usage collected is normally traffic usage. For No. 1 ESS usage obtained for trunk groups, which are normally on a 100-second scan basis, is total usage. In either case, maintenance usage can be obtained separately on a 100-second scan basis.

B. Traffic Register Description

2.05 The ESS does not use traffic register hardware common to electromechanical dial systems, but uses the memory storage and call processing software of the system.

2.06 The traffic measurement programs are contained in the generic program. Under control of the main program, the routines of the traffic measurements program accumulate traffic data in the form of peg, usage, and overflow counts. A separate traffic register consisting of one or more counters is required for each item measured. Specific registers can be read when a teletype (TTY) printout is requested, or when the traffic data are automatically printed at the assigned time.

2.07 The standard registers are the office counts, network counts, etc, which are provided on a one-per-control-group basis. Registers for office counts are provided by the generic program. The associated holding registers for printouts of the H and C schedule must be assigned by the network administrator. See the TG-1A for more detailed information.

2.08 The variable registers or counters include all items in H or C schedule that are not constant, eg, trunk groups, service circuit groups, multiline hunt groups, etc.

2.09 The traffic registers, whether standard or variable, are identified by a 3-digit code, called a Type Measurement Code (TMC). The TMC describes the type of measurement being made. A TMC must be assigned to every register, including those reserved for future use.

2.10 The TMC for RSS is 112. For further information on other TMCs, consult the TG-1A, Division 3, Section 4.

2.11 Traffic registers within a TMC are further identified by an equipment, group, or office

count number (EGO). The EGOs for RSS are listed in Tables A and B.

2.12 To record the measurements in call store memory, four types of counters are used:

- Accumulators
- Up-down counters
- Holding registers
- Totaling registers.

The accumulators and up-down counters reside in the constant, or "compool," area of call store for standard measurements and in the head cell area of call store for variable registers. Holding and totaling registers are assigned to a specific area of call store, eg, H and C schedule.

2.13 Each of the aforementioned counters are described as follows:

(a) ***Accumulators*** are used on all items for which peg, overflow, and usage counts are maintained. Each time a given event occurs (or for overflow, each time a given event fails) one score is added to the corresponding accumulator. For usage counts, the contents of an up-down counter are added to the corresponding accumulator after each periodic scan.

(b) ***Up-down Counters*** are provided for most groups of items for which ***usage*** is measured. Such items are trunks, service circuits, nonequipment registers, etc. Each time the item is busied, one is added to the up-down counter corresponding to its group. When the item is idled, one is subtracted from the up-down counter corresponding to its group. In other words, the contents of the up-down counter associated with any group of items should equal the number of busy items in that group. It should be observed that the up-down counter contents ***cannot be zeroed automatically*** by the system at the end of a given time period.

Note: If the up-down counter contents were zeroed, it would no longer reflect the number of busy items in the group, unless all items are idle by chance; thus an error in the up-down count could go undetected for a long time.

(c) ***Holding registers*** are provided for all item counts assigned to a collection schedule. A collection period may be a 15-minute period, an hour, a day, or a week. At collection time, the contents of specified accumulators are moved to corresponding holding registers, and the accumulators are reset to zero to be ready for a new collection period. The counts are subsequently printed out from the holding registers if requested on the printout schedule.

(d) ***Totaling registers*** are provided for all item counts assigned to more than one collection schedule; eg, four quarter-hour totals are added in an hourly totaling register to obtain both quarter-hour counts and hour counts.

2.14 These counters are used in four basic patterns or combinations to record traffic measurements for a particular traffic register.

2.15 The following describes a typical sequence of operation:

(a) Add one to the accumulator each time a certain event occurs (or each time a certain event fails to occur in the case of overflow).

(b) When requested, transfer the contents of the accumulator to an associated holding register.

(c) Reset accumulator to zero.

(d) When requested, print contents of the holding register. (Must be printed or transmitted prior to the next request for transfer of the data from the accumulator or the contents of the holding register will be replaced with new data.)

C. Data Collection and Printing Routines

2.16 The traffic measurement program contains a routine corresponding to each collect and print routine on the traffic map. The traffic map is a timetable matrix used to specify the day, hour, and quarter-hour in which a particular routine is to begin or end. The TG-1A, Division 3, Section 4-a and Section 231-061-040 contain a general description of the processes involved with the collection and printing of traffic data.

2.17 Traffic measurements are recorded on the following schedules:

(a) Quarter-Hour Output Schedules

- Fixed Quarter-Hour (TC15)
- Signal Processor Quarter-Hour (SP15) (available with CTX-7 and later generics)
- Selected Quarter-Hour (DA15)
- Network Management Quarter-Hour (NM10, NM11, NM12, and NM24)
- HILO Quarter-Hour (HL15)
- RSS Quarter-Hour (TRFRSS Q)

(b) Hourly Schedules

- Busy Hour (H-Schedule)
- Continuous (C-Schedule)
- Special Studies (S-Schedules)

(c) Daily Schedules

- 24-hour (TC24A, TC24B, TC24C, and TC24Z)
- RSS Daily Schedule (TRFRSS D)
- Division of Revenue Traffic Schedule (TDR01)

(d) Weekly Schedule (W-Schedule)

(e) Connected Trunks Per Group Schedule (CT/G Schedule)

DATA COLLECTION OUTPUT SCHEDULES

A. General

2.18 Traffic measurements are recorded in various output schedules. Output schedules TC15, TC24A, and weekly, have their counts assigned by the generic program. The Network Administration group is required to assign counts to all other schedules. When initial translations are prepared, the network administrator is responsible for assigning traffic registers to all measured traffic items. Thereafter, administration of register assignments is performed by the network administrator. The data on the output schedules are printed on a teletypewriter which is capable of producing both a "hardcopy" printout and a punched paper tape. The data from the output schedules may be transmitted to Engineering and Administration Data Acquisition System (EADAS) for subsequent processing by the Central Office Equipment Report (COER). Offices not having EADAS require a manual input of the data to COER.

B. Teletypewriter

2.19 The teletypewriter is used as the primary means of communications between Network Administration and/or Network Management personnel and the No. 1 ESS. Only one teletype channel was available to the Network Administration group (dial service channel) prior to CTX-7 generic program. With CTX-7, an additional channel has been made available to the Network Administration group (supplementary dial service channel).

2.20 The dial service teletype channel is used to input a timetable which controls the collecting and printing of the measurement schedules. It can also be used for activating and deactivating special counts.

2.21 The CTX-7 and later generic programs are arranged to transmit a tape perforate character to the teletypes which permits a punched paper tape to be made of selected traffic schedules. A tape perforator deactivation character is transmitted after a schedule has been completed.

3. TRAFFIC REGISTER COUNTS

3.01 The traffic registers in No. 1 ESS are considered in two groups, standard and variable, as previously defined. The group of standard registers is provided in every office as standard blocks of words, and they are included in the office constant and compool area of the generic program. Their associated accumulating and/or holding registers for H, C, DA15, and S printouts must be provided by the network switching engineer and will require two call store words per item with CTX-7 and later generic programs. For offices equipped with generic programs prior to CTX-7, either one or two words, dependent upon the item, will be required. The memory engineering for these registers is achieved by utilizing Central Office Equipment Engineering System-Mechanized Ordering (COEES-MO).

3.02 A listing of the various counts available in No. 1 ESS, and the schedules with which they are generally associated, or available for the S-schedules, is shown in Section 231-061-605. As new features are added, changes are continuously being made to the measurement programs. Descriptions of the various register counts and a discussion of administrative requirements may be found in the TG-1A Div. 3, Section 4 and in Section 231-070-505.

3.03 The following is a list of the traffic measurements required to manage, maintain, engineer, and account for the RSS. For clarity, assume the following definitions:

- Channel Interface (CHI)—the carrier link between the ESS and the RSS for voice, supervision, and signaling.
- Trunk—any incoming or outgoing trunk to the ESS (this does not include the channel interface circuits between the ESS and the RSS).
- RSS-ESS—a call originating on the RSS which requires the channel interface as part of the talking path.
- ESS-RSS—a call terminating on the RSS which requires the channel interface as part of the talking path.

3.04 The RSS feature is available in No. 1 ESS with the 1E6 generic. If the RSS feature package (9FRSS) is not loaded, the counts described here will have no meaning and the TMC should not be used.

A. Measurements Per ESS

3.05 These measurements are reported during the host ESS busy hour. They include the total for all RSSs on the host ESS. The host ESS will take these measurements. A listing of these counts with their respective TMCs and EGOs are shown in Table A.

(a) ***RSS Control Equipment Measurements:*** There are various pieces of engineerable memory in the host ESS that serve all the RSSs. The following measurements are to be taken on these memory areas:

- Remote order buffer queue peg count. This measurement counts each time a request for a remote order buffer is put on queue
- Remote order buffer usage. This count measures each remote order buffer found busy during a 10-second usage count.
- RSS call register peg count. This count is pegged each time a RSS call register is seized by a client program.
- RSS call register usage. This count is pegged for each RSS call register found busy during a 10-second usage count.
- RSS call register overflow. This measurement counts each time a request for a RSS call register cannot be filled because none are available.

Since RSS calls will use more real time than ESS calls, it is necessary to have these measurements to accurately determine ESS processor capacity.

B. Measurements Per RSS

3.06 These measurements are reported for each RSS on the host ESS on an hourly basis. It should be noted that RSS is engineered via extreme value engineering. Therefore, the data to be processed will be peak values only. Except for the stand-alone measurements, all these measurements are taken by the host ESS. The stand-alone option comes into effect if the data link between the host and the RSS fails. The stand-alone option will allow IAO calls to be completed within the RSS. (See Table B.)

(a) ***RSS Office Peg Count:***

- Total originating call attempts from the RSS. This measurement counts originations where one or more digits have been dialed.
- Total RSS IAO call attempts. Counter is incremented after digit translation.
- Total ESS-RSS call attempts. Counter is incremented after digit translation.

- Total RSS-ESS call attempts. Counter is incremented after digit translation.

(b) ***Channel Interface Measurements:*** These measurements are to be taken on the channel interface group between the host ESS and each RSS.

- Peg count
- Overflow peg count (all channels busy)
- Usage (excludes maintenance usage)
- Maintenance usage

(c) ***RSS Network Usage Measurements:*** These measurements are to be taken on the network entirely within the RSS. At present, this network can grow to a maximum of two modules.

- Individual A-link group CCS (optional on a per-concentrator basis)
- Total A-link CCS
- Intermodule junctor CCS
- Intramodule 0 junctor CCS
- Intramodule 1 junctor CCS

(d) ***Service Evaluation Measurements:*** In order to ensure that RSS customers are not experiencing unacceptable dial tone delay, dial tone speed tests must be peformed. In RSS, acutal calls are checked rather than simulated calls as in other systems. A per-call host response time is made. The timing begins when the line is scanned off-hook. Timing ends when the RSS path memory is cut through to the selected channel. A computation of the average host response time (average delay) is made and reported on the H and D schedules. A count of all calls where the response time (delay) is over 3 seconds is also kept. This latter measurement is provided on the host quarter-hour RSS traffic schedule as well as the H and D schedules. The following service evaluation measurements are related to ineffective attempts. Ineffective attempts classify call failures by phase rather than by type. For each call phase in which RSS equipment participates, the various call failure counts are kept.

RSS Originating Phase

- Blocked dial tone peg count. This measurement is pegged each time the host ESS drops an origination due to blockage in the RSS network, in the channels, or in the host network.

RSS Terminating Phase

- Terminating call failure peg count. This count will be incremented each time a call fails to terminate because of problems with the called party's line or with the Universal Service Circuit (USC), for example: low line resistance, no ring current, power cross failure.

RSS Connecting Phase

- Call failure due to no bus/USC peg count. This count will be incremented each time a call fails due to no metallic bus or no USC.
- Call failure due to no channel interface peg count. This count will be incremented whenever a call fails due to no channel interface.
- IAO matching loss peg count. This counter will be pegged whenever there is a failure to find a path in the RSS network between two RSS lines. This count will include those instances where a RSS call was switched back to the ESS network for a service circuit, (eg, 3-port conference circuit, etc), and was later unable to revert to a talking path in RSS. These calls will not be failures since the connection will remain stable in the ESS network until one party hangs up.
- Terminating first failure to match peg count. This count is incremented on the first failure to find a path through the RSS network for terminating calls.
- Terminating final failure to match peg count. The terminating failure to match covers the RSS talking path of an inter-RSS call. If a call fails to match on the first attempt, a new channel interface is chosen. If the

call fails to match on the second (final) attempt, the call is failed. Thus it is necessary to measure first and final failure to match.

- Reswitch up attempts. This count is incremented each time an attempt is made to reswitch an intra-RSS call from an RSS network connection to a host network connection.

- Reswitch up failure peg count. Every time an RSS IAO call attempts to reswitch back to the ESS network for a service circuit, (eg, 3-port conference circuit, etc), the reswitch up attempt counter is pegged. Every time this ESS connection is unable to be completed due to no circuit, no channel interface, no RSS network path, no ESS network path, etc, the reswitch up failure counter is pegged.

Call Failure due to RSS

- This count is the sum of the following four registers:

  (1) Terminating failure peg count

  (2) Call failure due to no bus/USC

  (3) Call failure due to no channel

  (4) Terminating final failure to match.

Intra-RSS Usage

- This division of revenue count will be calculated internally by subtracting channel usage from junctor usage.

TABLE A

RSS TRAFFIC MEASUREMENTS PER ESS

ESS TRAFFIC SCHEDULE		NO. 1 ESS	
		TMC	EGO
H	-Remote Order Buffer Queue Peg Count	05	453
H	-Remote Order Buffer Usage	05	454
H	-RSS Call Register Peg Count	05	455
H	-RSS Call Register Usage	05	456
H	-RSS Call Register Overflow	05	457

TABLE B

TRAFFIC MEASUREMENTS PER RSS

ESS TRAFFIC SCHEDULE		NO. 1 ESS	
		TMC	EGO†
H, D	Total Originating Calls from the RSS	112	64
H, D	Total RSS IAO Call Attempts		96
H, D	Total ESS—RSS Call Attempts		128
H, D	Total RSS—ESS Call Attempts		160
H, D	Channel Interface Peg Count	112	864
H, D	Channel Interface Overflow Peg Count		896
H, D	Channel Interface Usage		832
H, D	Channel Interface Maintenance Usage		928
D	Individual Concentrator A-Link CCS	Optional	
D	Total A-Link CCS	112	32
D	Intermodule Junctor CCS		192
D	Intramodule 0 Junctor CCS		224
D	Intramodule 1 Junctor CCS		256
H, D	Average Dial Tone Delay	112	288
H, D	% Calls with Delay over Three Seconds Greater than Three Seconds (DP and TT)		320
D	Blocked Dial Tone Peg Count		352
D	Terminating Call Failure Peg Count		384
D	Call Failure Due to No Bus or No Universal Service Circuit Peg Count		416
D	Call Failure Due to No Channel Interface Peg Count		448
D	IAO Matching Loss Peg Count		544
D	Terminating First Failure to Match Peg Count		576
D	Terminating Final Failure to Match Peg Count		608
D	Reswitch Up Attempts		480
D	Reswitch Up Failures Peg Count		512
H	Call Failure Due to RSS		960
*	Total Originating Call Attempts		
*	Total RSS IAO Attempted Calls		
*	Total RSS IAO Completed Calls		
H	RSS IAO Line-to-Line Usage	112	1056

*The stand-alone measurements will not be part of an ESS traffic schedule. Rather these measurements would be printed on the traffic teletypewriter when the RSS comes out of the stand-alone mode.

† EGO number equals the EGO plus the RSS number. Valid RSS numbers are from 1 to 31.