# DATA SYSTEMS—"DATAPHONE®" SERVICE AND OTHER DATA SERVICE ON THE DIRECT DISTANCE DIALING NETWORK TEST LIMITS FOR SUBSCRIBER, FOREIGN EXCHANGE, PBX, AND WATS LINES

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## 1. GENERAL

1.01 This section describes the transmission test requirements on subscriber, remote exchange (RX), foreign exchange (FX), PBX, and wide area telecommunications service (WATS) lines used to access the switched telecommunications network (DDD) for data transmission. Information in this section applies equally to both DATAPHONE service and other data service with customer-provided equipment (CPE) unless otherwise specified.

1.02 This section is reissued for the following reasons:

- To revise the maintenance tables
- To update references.

Since this reissue makes major revisions to the content and organization of the section, change arrows have been omitted.

1.03 The tests described in this section are made between the dial tone office and the data set location unless otherwise specified. Maximum use should be made of test signal sources such as milliwatt source, quiet termination, and 107-type test line or similar type test line, when available, to avoid the need for a second craft employee at the serving office during testing.

*Note:* Test requirements are frequently specified at 1000 Hz and 2800 Hz. However, in actual testing, the signal must be offset by +4 Hz to avoid quantizing problems in T-Carrier Systems.

## 2. CLASSES OF ACCESS LINES

2.01 Two classes of access lines are defined for data use: Lines terminated in voice jacks and lines terminated in data jacks. These jacks are used to connect both TELCO data sets and CPE. The customer may have either of the types of access lines. At installation, both are treated the same as any other business line regardlesss of bit rate or modem ownership (see Table A). That is, only a normal business line test is required. However, insertion loss is measured as part of the data jack installation. In case of problems at installation or a customer trouble report, the parameters given in Table B are measured and supported. The parameters listed in Tables A through E are given in the suggested order they should be checked during installation and maintenance activities.

2.02 Voice jacks are used to connect data sets with a fixed output level not exceeding -9 dBm. Data jacks are used for data sets with either -4 dBm or programmable output levels.

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## 3. TYPES OF ACCESS LINES

### Local Loop

**3.01** The local loop is the facility from the customer premises to the main frame of the normal serving central office. Local loops are normally 2-wire facilities, and data transmission limits for them are given in Table C.

### FX Lines

**3.02** A FX line provides service between the customer premises and a remote central office in an area other than the central office which normally would serve that customer location. Data service on FX lines is supported only up to 200 miles from the dial tone office. Data transmission limits are given in Table D.

### *WATS Lines*

**3.03** Wide area telecommunications service (WATS) lines may be direct (local central office is the dial tone office) or remote (local central office is not the dial tone office). Direct WATS lines have the same transmission objectives as a local loop. Remote WATS limits are given in Table E.

### *Data Service Through a PBX*

**3.04** Data stations may be located on stations behind PBXs. These may be on- or off-premises stations. The wiring and cabling from the on-premises station to the PBX, in addition to an average trunk to the serving central office, are considered as equivalent to a local loop in meeting the data test requirements. This applies only to TELCO PBXs. When CPE PBXs are involved, data requirements only apply to the trunk interface with the PBX. Data trasmission limits are given in Table C.

**3.05** Meeting the local loop limits for an off-premises station may not be possible. Therefore, support for off-premises stations is limited to an on-premise station serving the same TELCO PBX. In this application, the limits that apply are given in Table D. Performance from an off-premises station to another station on the network is not specified or supported.

**3.06** Note that when treatment is applied to one PBX trunk, all trunks must meet the same criteria. Centrex on customer premises is the same as PBX. Central office (CO) centrex lines are treated the same as local loops.

### Remote Exchange (RX) Lines

**3.07** Remote exchange (RX) lines are those lines when, for telephone company reasons, it becomes necessary to provide service from a distant central office because the nearest central office is not suitable for data transmission. RX lines are supported the same as remote WATS lines. Data transmission limits for RX lines are given in Table E.

## 4. INSTALLATION TESTS

**4.01** Normal business line tests are required at installation except for those tests required in the data jacks installation procedures and any tests associated with TELCO data sets. However, designed services, such as FX and WATS, require other transmission tests. These tests are shown in Table A under the column headings of FX and remote WATS.

**4.02** If problems are encountered which indicate a possible transmission impairment, tests in Table B should be used to isolate the cause. If the investigations show that insertion loss (voice jack) or slope (data jack) limits cannot be met, the matter should be referred to the circuit provision bureau (CPB) for action on an expedited basis.

**4.03** Results of installation tests, when performed, should be recorded on the circuit layout record card (CLRC) or other record forms as "bench marks" during maintenance testing.

**4.04** During trouble investigation, additional measurements may be needed to verify the transmission parameters given in Tables C, D, and E.

## 5. TEST LIMITS

**5.01** Tables A and B list the installation and maintenance tests respectively, that should be performed depending on the type access line. Tables C, D and E give the data transmission limits for installation and maintenance tests.

TABLE A

INSTALLATION TESTS

| PARAMETER | LOCAL LOOP LOCAL WATS (NOTE 1) | FX | REMOTE WATS AND RX |
|---|---|---|---|
| Insertion Loss | X* | X | X |
| Impulse Noise | | X | X |
| C - Notched Noise | | X | X |

*Note 1:* Measurement of all parameters may be necessary if problems are encountered. See paragraph 2.01.

* Required for installation of data jack.

TABLE B

MAINTENANCE TESTS

| PARAMETER | LOCAL LOOP | | FX, REMOTE WATS AND RX |
|---|---|---|---|
| | VJ | DJ | |
| Insertion Loss | X | X | X |
| C-Notched Noise | X | X | X |
| Impulse Noise | X | X | X |
| Phase Jitter | | | X |
| Gain Slope | | X | X |
| P/AR | | X | X |
| Intermodulation Distortion | | | X |
| Gain Hits | | | X |
| Phase Hits | | | X |
| Dropouts | | | X |
| Frequency Shift | | | X |
| Envelope Delay Distortion* | | X | X |

*If P/AR limit is met, it should not be necessary to perform the envelope delay distortion test.

VJ — Voice Jack

DJ — Data Jack

TABLE C

LOCAL LOOP LIMITS (NOTE 1)

| PARAMETER | LIMIT | |
|---|---|---|
| | VOICE JACK | DATA JACK |
| 1004-Hz Insertion Loss | 10 dB Maximum | 8.5 dB Maximum |
| C-Notched Noise | 49 dBrnC0 | 49 dBrnC0 Maximum |
| Impulse Noise at 59 dBrnC0 | 15 counts in 15 minutes Maximum | 15 counts in 15 minutes Maximum |
| Attenuation Distortion (slope) 504-2804 Hz referenced to 1004 Hz | Not Specified | —1 to 3 dB Maximum |
| P/AR | Not Specified | 90 Minimum |
| Transmitted Data Power (at serving CO) | —12 dBm Maximum | —12 dBm Maximum |
| Envelope Delay Distortion* | Not Specified | 100 Microseconds (1004 to 2804 Hz) |

*P/AR measurement can usually be substituted for this parameter.

*Note 1:* —If Limits are not met, refer to Sections 314-205-300 or 668-010-300 for corrective measures.

## 6. REFERENCES

**6.01** Bell System Practices covering the various equipment associated with data service are as follows:

| SECTION | TITLE |
|---|---|
| 103-611-101 | J94003C Noise Measuring Set |
| 103-611-102 | J94003CR Noise Measuring Set |
| 103-620-101 | 6H and 6HR Impulse Counters (J94006H and J94006HR) Description, Operation, and Maintenance |
| 103-626-100 | 6F and 6FR Voiceband Noise Measuring Sets (J94006F and J94006FR) Description, Operation, and Maintenance |
| 311-100-500 | Circuit Order and Trunk Order Transmission Tests—PBX Central Office Trunks, Off-Premises Station Lines and Tie Trunks Having Access to the Direct Distance Dialing Network |
| 311-100-501 | 1000 Hz and Noise Measurements—PBX Central Office Trunks, Off-Premises Station Lines and Tie Trunks Having Access to the Direct Distance Dialing Network |
| 314-205-300 | Data Systems—DATAPHONE Service and Other Data Services on the Direct Distance Dialing Network—Overall Maintenance Procedures |
| 314-205-500 | Data Systems—DATAPHONE Service and Other Data Services on the Direct Distance Dialing Network, Overall Data Transmission Test Requirements |

TABLE D

FX LIMITS

| PARAMETER | LIMIT |
|---|---|
| S/N Ratio | 27 dB Minimum |
| C-Notched Noise | 50 dBrnC0 Maximum |
| Impulse Noise | $\leq$ 10 in 15 minutes at 71 dBrnC0 |
| Phase Jitter, (20-30 Hz) | 8° P-P Maximum |
| Phase Jitter, (4-300 Hz)<br>Phase Jitter, (4-20 Hz) | 12° P-P Maximum<br>8° P-P Maximum |
| Slope | -1 to 8 dB Maximum, 404-2804 Hz referenced to 1004 Hz |
| P/AR | 70 Minimum |
| Intermodulation Distortion<br>2nd Order<br>3rd Order | <br>28 dB Minimum<br>35 dB Minimum |
| Gain Hits | $\leq$ 6 in 15 minutes $\geq$ 3 dB |
| Phase Hits | $\leq$ 6 in 15 minutes $\geq$ 20° |
| Dropouts | 1 in 30 minutes $\geq$ 12 dB |
| Frequency Shift | ±3 Hz Maximum |
| Envelope Delay Distortion | 1000 Microseconds 900-2500 Hz |

| | | | |
|---|---|---|---|
| 314-205-503 | Data Systems—DATAPHONE Service and Other Data Services on the Direct Distance Dialing Network—Minimum Acceptable Performance (MAP) Criteria | 330-300-501 | Completion Tests of Exchange-Area Cables Apparatus, Records, and Forms |
| | | 330-300-502 | Completion Tests of Exchange-Area Cables Preparation |
| 314-410-500 | Voice Bandwidth Private Line Data Circuits, Tests and Requirements | 330-300-503 | Completion Tests of Exchange-Area Cables Testing |
| 330-300-500 | Completion Tests of Exchange-Area Cables Introduction | 330-300-504 | Completion Tests of Exchange-Area Cables Analysis and Reports |

TABLE E

REMOTE WATS AND RX LINES

| PARAMETER | LIMIT |
|---|---|
| S/N Ratio | 29 dB Minimum |
| C-Notched Noise | 48 dBrnC0 Maximum |
| Impulse Noise | $\leq$ 5 in 15 minutes at 71 dBrnC0 |
| Phase Jitter (20-300 Hz) | 2° P-P Maximum |
| Phase Jitter (4-300 Hz)<br>Phase Jitter (4-20 Hz) | 3° P-P Maximum<br>2° P-P Maximum |
| Slope | −1 to 4.5 dB 404-2804 Hz referenced to 1004 Hz |
| P/AR | 85 minimum |
| Intermodulation Distortion<br>2nd Order<br>3 rd Order | <br>33 dB Minimum<br>39 dB Minimum |
| Gain Hits | $\leq$ 2 in 15 minutes $\geq$ 3 dB |
| Phase hits | $\leq$ 2 in 15 minutes $\geq$ 20° |
| Dropouts | 1 in 30 minutes $\geq$ 12 dB |
| Frequency Shift | ±2 Hz Maximum |
| Envelope Delay Distortion | 400 Microseconds 900-2500 Hz |

| | | |
|---|---|---|
| 590-101-103 | Jacks for Registered Data Equipment—Single and Multiline Installations | on the Direct Distance Dialing Network, Data Test Center, Trouble Analysis Procedure |
| 668-010-300 | Data Systems—DATAPHONE Service and other Data Services | |