N3 CARRIER TELEPHONE SYSTEM

OVERALL SYSTEM

CHANNEL PHASE JITTER MEASUREMENT

This section provides a procedure for measuring the phase jitter performance of N3 carrier facilities engineered to transmission objectives presently in force. Phase jitter requirements are given for message, data, and special services channels for single link N3 systems and for multilink or tandem N3 systems. In either case, measurements should be made on a customer-to-customer basis (where practicable) to determine overall requirements. However, where sectionalization may be necessary, the requirements of a single link of the tandem system is equivalent to the requirements of a single link N3 system. The more critical phase jitter requirements for N3 carrier links in voice bandwidth private line data circuits are given in Section 314-410-500.

This section affects the Equipment Test List.

The effects of excessive phase jitter are most frequently noticed on analog data transmission services in N3 systems sharing the same cable sheath with K-carrier systems; however, excessive phase jitter has been encountered in other situations. The maximum allowable phase jitter limits specified in this section apply both to N3 systems and N3-L systems. Where there is an N3-L junction, the phase jitter requirements are given in Table A for the N3 link. (See Section 362-921-300, Table C for junction and terminal configurations.) The phase jitter requirements also apply to noncompandored channels equipped with voice-frequency amplifiers.

The mechanism for unsatisfactory phase jitter performance is related to the design of existing J99300AS frequency correction units (FCUs) where cable crosstalk coupling may be present at frequencies near the frequency correction carrier. There are two types of FCUs (J99300AE, Section 362-907-100, and J99300AS, Section 362-907-101) used in N3 carrier systems and they are not directly interchangeable. The older J99300AE FCU (manufacture discontinued), while more vulnerable to noise, is much less susceptible to phase jitter. A circuit modification has been made on the J99300AS FCU (List B) that improves the stability of the phase-locked loop within the FCU and thereby improves the phase jitter performance.

The phase jitter tests of this section can be performed on all N3 carrier systems. Should a channel in a system using the older J99300AE FCU fail to meet the requirements, the problem may not be related to the FCU and should be referred to the Transmission Engineering Department. However, should a channel in a system using an unmodified J99300AS FCU fail to meet the requirements, replacement with a modified (List B) FCU will improve the phase jitter performance. If the modified unit does not provide a significant improvement in phase jitter performance, refer the problem to the Transmission Engineering Department.

Phase jitter measurements should be made on an out-of-service basis on individual N3 channels when phase jitter trouble is suspected on the message or data network or on a private line. The channel should be completely aligned and the noise measurement tests of Section 362-900-506 should be successfully performed before the phase jitter test is made. The Transmission Engineering Department should be consulted in situations where channel or facility selection may be necessary to meet the more critical requirements of some private line applications.

APPARATUS:

1—Hekimian Labs Model 56 Jitter Meter, or equivalent [Hekimian Labs Models 48 or 44 Jitter Meter or TTI 1200 Phase Jitter Test Set (use only with SELECT switch in P-P FLT IN)]

1—J94021A Transmission Measuring Set (21A TMS), or equivalent

1—3P17 Cord

1—3P6 Cord

STEP	PROCEDURE

A. Measurement of Phase Jitter

Note 1: The phase jitter test of Steps 1 through 11 may be performed on single link N3 systems end to end, tandem N3 systems end to end, and a single link of a tandem N3 system.

Note 2: If phase jitter measurements are performed on N3 systems with J99300AE FCUs and the requirements are not met, refer the problem to the Transmission Engineering Departments.

1 Remove the channel from service.

2 At the transmitting terminal, connect the 21A TMS to a convenient 115V 60-Hz outlet.

3 Turn the 115V 60-Hz power switch to the ON position and allow the set to warm up.

4 Turn the FREQ MULT switch to the x100 position and the associated FREQ scale to 10.2 for a 1020-Hz test tone.

5 Adjust the 10-dB step and the continuously variable OSC OUTPUT controls to the white or −dBm settings of −30 and −2, respectively (3 dB below data level at −16 TLP).

6 Use the 3P17 cord to patch from the OSC OUT 600-ohm jacks on the meter panel of the TMS to the MOD IN or VF IN jacks of the circuit to be tested in the jack field or patch bay.

7 At the receiving terminal, remove the Model 56 jitter meter or equivalent from its case, plug the attached power cord to the meter, and then plug the other end of the cord to a convenient 115V 60-Hz outlet. Turn the power on and allow the meter to warm up.

8 Set the input DIAL selector to the 600Ω position.

9 Set the function selector switch to its highest degree P-P JITTER range.

10 Plug one end of the 3P6 cord into the jitter jack on the meter panel and the other end to the DEM OUT or VF OUT jacks in the jack field or patch bay.

STEP	PROCEDURE

11 Read and record the PHASE meter reading.

If this measurement is being made on a single link N3 system end to end or one link of a tandem N3 system, proceed to Part B, Step 12.

If this measurement is being made on a tandem N3 system (two links) end to end, proceed to Part B, Step 14.

B. Evaluation of Phase Jitter

12 Compare the phase jitter level recorded in Step 11 for the system length given in Table A.

Requirement: Recorded measurement should not exceed the maximum permissible level.

13 If the requirement of Step 12 is not met, replace the J99300AS FCU at the receive terminal with a modified J99300AS FCU and repeat the phase jitter test of Steps 1 through 12 (see Note 2).

Caution: The channel group (12 channels) must be removed from service if the FCU is to be replaced.

If the requirement of Step 12 is met, disconnect all test equipment and restore the channel to service.

Tandem N3 System (Two Links) End to End

14 Use Table A to find the maximum permissible phase jitter for each link length. Using Table B, read vertically for link 1 and horizontally for link 2 at the values of phase jitter obtained from Table A. The point of intersection of these values in Table B is the maximum permissible phase jitter for the end-to-end tandem N3 system.

Example: Assume the length of link 1 to be 20 miles and the length of link 2 to be 70 miles. From Table A the requirement for each link is 5 and 6 degrees peak to peak, respectively. Using Table B, the end-to-end requirement obtained (the point of intersection of 5 and 6) is 9 degrees peak to peak.

15 Compare the end-to-end tandem N3 system phase jitter level recorded in Step 11 with the value found in Step 14.

Requirement: Recorded phase jitter level should not exceed the maximum permissible level.

16 If the requirement of Step 15 is not met, proceed with Step 17 (see Note 2 of Test A).

If the requirement of Step 15 is not met on an N3-L system, refer the problem to the Transmission Engineering Department.

If the requirement is met, disconnect all test equipment and restore the channel to service.

Note: The phase jitter evaluations of Steps 17 through 24 are made on tandem N3 systems (two links), one link at a time, to locate faulty N3 carrier link or links.

STEP	PROCEDURE
17	Make phase jitter measurements on link 1 of the tandem system by performing the phase jitter test of Steps 1 through 12. Record this value of PHASE meter reading.
18	If the requirement of Step 12 is not met, replace the J99300AS FCU at the receiving terminal of the link with a modified J99300AS FCU and repeat Steps 1 through 12. ***Caution: The channel group (12 channels) must be removed from service if the FCU is to be replaced.***
19	Make phase jitter measurements on link 2 of the tandem system by performing the phase jitter test of Steps 1 through 12. Record this value of PHASE meter reading.
20	If the requirement of Step 12 is not met, replace the J99300AS FCU at the receiving terminal of the link with a modified J99300AS FCU and repeat the phase jitter test of Steps 1 through 12. ***Caution: The channel group (12 channels) must be removed from service if the FCU is to be replaced.***
21	Use Table A to find the maximum permissible phase jitter for each link length and combine the results per Table B by reading vertically for link 1 and horizontally for link 2 at the values of phase jitter obtained from Table A. The point of intersection of these values is the maximum permissible phase jitter for the system. Record this value.
22	Use the values obtained in Steps 17 and 19 to find the actual or theoretical system phase jitter level by combining the results in Table B and taking their point of intersection. Record this value.
23	Compare recorded values of Steps 21 and 22. ***Requirement:*** Actual or theoretical phase jitter value should not exceed the maximum permissible value recorded in Step 21.
24	Disconnect the test equipment and restore the channel to service.

TABLE A

N3 SYSTEM – MAXIMUM PHASE JITTER

LINK LENGTH IN MILES	DEGREES PEAK TO PEAK
0 to 50	5.0
51 to 100	6.0
101 to 200	8.0

TABLE B

N3 SYSTEMS – PHASE JITTER FOR TANDEM ARRANGEMENTS

		LINK 1, PHASE JITTER IN DEGREES PEAK TO PEAK									
		1	2	3	4	5	6	7	8	9	10
LINK 2,	1	2	3	4	4	5	6	7	8	9	10
PHASE	2	3	3	4	5	6	7	8	9	10	11
JITTER IN	3	4	4	5	6	7	8	9	10	11	12
DEGREES	4	4	5	6	7	8	8	9	10	11	12
PEAK TO	5	5	6	7	8	8	9	10	11	12	13
PEAK	6	6	7	8	8	9	10	11	12	13	14
	7	7	8	9	9	10	11	12	13	13	14
	8	8	9	10	10	11	12	13	13	14	15
	9	9	10	11	11	12	13	13	14	15	16
	10	10	11	12	12	13	14	14	15	16	17