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TEST SPECIFICATION: TIA-968-A, "Connection of Terminal Equipment to the Telephone Network"

ENGINEERING TEST REPORT NO. 34031-02

FCC COMPLIANCE TESTS FOR THE

EL25 ENTRY SYSREM

FOR: Chamberlain Manufacturing
Elmhurst, Illinois

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ENGINEERING TEST REPORT NO. 34031-02

Table of Contents

Section		Page No.
I.	INTRODUCTION	(1)
II.	LABORATORY IDENTIFICATION	(1)
III.	DESCRIPTION OF TEST ITEM AS IT PERTAINS TO COMPLIANCE TESTING	(1)
	(1) Physical Description	(1)
	(2) Operational Test Modes	(2)
IV.	APPLICABLE TEST REQUIREMENTS	(2)
V.	ORDER OF TESTING	(3)
VI.	SUMMARY OF TEST RESULTS	(4)
VII.	RINGER EQUIVALENCE NUMBER	(4)
VIII.	EQUIPMENT LIST	(5)
IX.	SPECIFIC TESTS	(6)
	(1) ENVIRONMENTAL SIMULATION	(6)
	A. Mechanical Shock	(6)
	B. Type A Surge Test	(6)
	B1. Metallic Voltage Surge	(6)
	B2. Longitudinal Voltage Surges on Telephone Lines	(7)
	C. Type B Surge Test	(8)
	C1. Metallic Voltage Surge	(8)
	C2. Longitudinal Voltage Surges on Telephone Lines	(9)
	D. Longitudinal Voltage Surge	(10)
	(2) LEAKAGE CURRENT LIMITATIONS	(11)
	(3) HAZARDOUS VOLTAGE LIMITATIONS	(12)
	(4) SIGNAL POWER LIMITATIONS	(12)
	A. Voice Band Metallic Signal Power Measurements	(12)
	A.1) Limitations on Internal Signal Sources not intended for Network Control Signaling	(12)
	A.2) On Internal Signal Sources Primarily Intended for Network Control Signaling	(14)
	B. Signal Power in the 3995-4005 Hz Frequency Band	(14)
	C. Longitudinal Voltage in the	(15)

100 to 4000 Hz Freq. Band
D. Voltage in the 4 kHz to 6 MHz Frequency Band (16)
D.1) Metallic Voltages (16)
D.2) Longitudinal Voltages (17)

(5) LONGITUDINAL BALANCE LIMITATIONS (18)
A. Balance Measurements (18)

(6) ON-HOOK IMPEDANCE LIMITATIONS (19)
A. Limitations on Individual Equipment Intended for Operation of Loop-Start Telephone Facilities (19)
A.1) On-hook DC Resistance Measurements (19)
A.2) On-hook AC Impedance Limitations (21)
A.3) Ringer Equivalence Definition (22)

(7) BILLING PROTECTION (23)
A. Voice and Data Equipment On-Hook Sig. Requirements (23)
B. Voice and Data Equipment Loop Current Measurements (24)
C. Signaling Interference (24)

(8) HEARING AID COMPATIBILITY (25)

(9) ADDITIONAL LIMITATIONS (25)

APPENDIX A - FIRE HAZARD SAFETY EVALUATION (26)

ENGINEERING TEST REPORT NO. 34031-02

I. INTRODUCTION:

This exhibit presents the results and analysis to show that the following listed equipment complies with the TIA-968-A "Conditions for Registration".

TEST ITEM: Model No.: EL25
Description: Entry System with MODEM

SUBMITTED FOR TESTING BY: Chamberlain Manufacturing
Elmhurst, Illinois

II. LABORATORY IDENTIFICATION: The compliance tests were performed by Elite Electronic Engineering, Inc. at their laboratory in Downers Grove, Illinois.

III. DESCRIPTION OF TEST ITEM AS IT PERTAINS TO COMPLIANCE TESTING:

(1) PHYSICAL DESCRIPTION

(a) General: The EL25 is used as a remote entry system. The MODEM is used to contact an occupant.

(b) Exposed Conductive Surfaces: None, metal case

(c) Type Dialing: Tone

(d) Automatic Redial Limitations: N/A

(e) Power Requirements: 12VAC from transformer

(f) Normal Usage: Not normally customer carried

(g) Surge Protection: Surge arrester, tip to ring

(h) Terminal for through transmission: None

(i) Terminal for non-registered equipment: None

(j) Standard Jack used for connection to network: RJ11

(2) OPERATIONAL TEST MODES:

The following operational modes were used for the tests.

TEST MODES	ACHIEVED BY
(a) On-Hook	Place EUT on-hook
(b) Off-Hook, data	Place EUT off-hook, send data
(c) Off-hook, dial	Place EUT off-hook, send dtmf

For test purposes, the EUT case was placed on a copper ground plane. The EUT was connected to the loop simulator with the 2-wire telephone cord (RJ-11) equipped with EUT.

IV. APPLICABLE TEST REQUIREMENTS FOR TEST ITEM:

Section — Title

4.2 ENVIRONMENTAL SIMULATION

Tests Required
A. Shock
A.1) No test required
B. Type A Surge Test
B.1) Metallic Voltage Surge
B.2) Longitudinal Voltage Surge
C. Type B Surge Test
C.1) Metallic Voltage Surge
C.2) Longitudinal Voltage Surge
D. Longitudinal Voltage Surge on AC Power Line

4.3 LEAKAGE CURRENT LIMITATIONS

Tests Required
A. Leakage Current Measurements

4.4 HAZARDOUS VOLTAGE LIMITATIONS

Tests Required
A. No testing required

4.5 SIGNAL POWER LIMITATIONS

Tests Required
A. Voice Band Metallic Signal Power Measurements
A.1) On Internal Signal Sources not Intended for Network Control Signaling
A.2) On Internal Signal Sources Intended for Network Control Signaling
B. Signal Power in the 3995-4005 Hz Frequency Band
C. Longitudinal Voltage in the 100 to 4000 Hz Freq. Band
D. Voltage in the 4 kHz to 6 MHz Frequency Band

4.6 TRANSVERSE BALANCE LIMITATIONS

Tests Required
A. Balance Measurements

4.7 ON-HOOK IMPEDANCE LIMITATIONS

Tests Required
A. Limitations on Individual Equipment Intended for Operation of Loop-Start Telephone Facilities
A.1) On-hook DC Resistance Measurements
A.2) On-hook AC Ring Impedance and DC Ring Current Draw Measurements
A.3) Ringer Equivalence Definition

4.8 BILLING PROTECTION

Tests Required
A. Voice and Data Equipment On-Hook Sig. Requirements
B. Voice and Data Equipment Loop Current Measurements
C. Signaling Interference Measurements

V. ORDER OF TESTING:

The electrical evaluation tests, which include all tests except the environmental simulation tests, were performed twice. The item was tested once before any of the environmental tests were performed. These results are listed under "Before" in the results.

After the initial electrical tests were completed, the EUT was subjected to the environmental simulation tests (surge testing). The electrical evaluation testing was repeated a second time to determine the effect of these environmental stresses. These results are listed under "After" in the results.

VI. SUMMARY OF TEST RESULTS:

The EUT was tested to the requirements listed in Section IV. The specific results to each test are presented with the section describing that specific test.

The EUT complies with the "Conditions for Registration" as listed

in the report. The item met the criteria both before and after the environmental tests.

VII. RINGER EQUIVALENCE NUMBER:

Ringing Type	Ringer Equivalence Number (REN)
Class B	0.8

The calculation for the REN can be found in Section 6. The ringer equivalence number was unchanged by the modification.

VIII. EQUIPMENT LIST:

Equipment used for these tests is listed in Elite TP-FCC68 20 Mar 98.

IX. SPECIFIC TESTS:

(1) ENVIRONMENTAL SIMULATION (4.2)

The registered terminal equipment shall comply with all the criteria contained in the rules and regulations under "Conditions for Registration", both prior to and after the application of each of the mechanical and electrical stresses specified in this section, not withstanding that certain of these stresses may result in partial or total destruction of the equipment.

A. MECHANICAL SHOCK TEST (4.2.1):

PURPOSE: This test simulates the shock conditions that the EUT might encounter during normal use.

REQUIREMENT: The applicable drop test was chosen from the following according to the unpackaged weight and its normal usage:

Table III - Unpackaged Shock Test Requirements

a) Hand-Held Items Normally used at Head Height
   Test - 18 random drops from a height of 1.5 meters.

b) Normally Customer Carried Equipment
   Test - 6 random drops from a height of 30"

c) No requirements for other equipment.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The EUT is not normally customer carried. According to Table III, no drop test is required.

ANALYSIS AND EVALUATION: No drop tests were required.

B. TYPE A SURGE TEST (4.2.2):

B.1 TYPE A METALLIC VOLTAGE SURGE:

PURPOSE: This test simulates the effect of severe lightning surges conducted to the equipment via the telephone lines.

REQUIREMENT: One positive and one negative 800 volt peak surge, having a maximum risetime of 10 microseconds and a minimum decay time to half crest of 560 microseconds, shall be applied between the tip and ring of the EUT. The EUT shall be operated in any operational state which can affect compliance with the requirements of Part 68.

TEST PROCEDURES: Elite TP-FCC68 20 Mar 98. The EUT was subjected to required surges, one positive and one negative surge, for each of the following operational states.

(a) on-hook

(b) off-hook

Test modes described in Section III(3).

TEST RESULTS: The EUT was subjected to the required metallic voltage surges according to the schedule below.

Operational State	Surge Voltage	Polarity	Applied to
(a) on-hook (b) off-hook	800 800	+/- +/-	Tip to Ring Tip to Ring

ANALYSIS AND EVALUATION: The construction of the EUT was adequate to withstand the surges.

B.2) TYPE A LONGITUDINAL VOLTAGE SURGES ON THE TELEPHONE LINES (4.2.2):

PURPOSE: This test simulates the effects of severe lightning induced voltage surges conducted to the equipment through the Earth Ground.

REQUIREMENTS: One positive and one negative 1500 volt peak surge, having a maximum risetime of 10 microseconds and a minimum decay time to half crest of 160 microseconds, shall be applied separately between the tip and ring (tied together) and earth ground. The EUT shall be operated in any operational state which can affect compliance with the requirements of Part 68.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. One set of surges was applied with the EUT operating under each of the following operational states.

(a) On-hook

(b) Off-hook

Test modes described in Section III(3).

TEST RESULTS: The EUT was subjected to the required longitudinal voltage surges according to the schedule that follows. The surge voltage was applied from the telephone lines to ground.

Operational State	Surge Voltage	Polarity	Applied to
(a) On-hook	1500	+/-	Tip/ring to ground

(a) On-hook	1500	+/-	Tip to ground
(a) On-hook	1500	+/-	Ring to ground
(b) Off-hook	1500	+/-	Tip/ring to ground
(b) Off-hook	1500	+/-	Tip to ground
(b) Off-hook	1500	+/-	Ring to ground

ANALYSIS AND EVALUATION: The EUT was not damaged due to the surge.

C. TYPE B SURGE TEST (4.2.3):

C.1 TYPE B METALLIC VOLTAGE SURGE:

PURPOSE: This test simulates the effect of nominal lightning surges conducted to the equipment via the telephone lines.

REQUIREMENT: One positive and one negative 1000 volt peak surge, having the specified waveforms, shall be applied between the tip and ring of the EUT. The EUT shall be operated in any operational state which can affect compliance with the requirements of Part 68.

TEST PROCEDURES: Elite TP-FCC68 20 Mar 98. The EUT was subjected to required surges, one positive and one negative surge, for each of the following operational states.

(a) on-hook

(b) off-hook

Test modes described in Section III(3).

TEST RESULTS: The EUT was subjected to the required metallic voltage surges according to the schedule below.

Operational State	Surge Voltage	Polarity	Applied to
(a) on-hook	1000	+/-	Tip to Ring
(b) off-hook	1000	+/-	Tip to Ring

ANALYSIS AND EVALUATION: The EUT was not damaged due to the surge. It continued to operate as normal.

C.2) TYPE B LONGITUDINAL VOLTAGE SURGES ON THE TELEPHONE LINES (4.2.3):

PURPOSE: This test simulates the effects of nominal lightning induced voltage surges conducted to the equipment through the Earth Ground.

REQUIREMENTS: One positive and one negative 1500 volt peak surge, having the specified waveforms, shall be applied separately between the tip and ring (tied together) and earth ground. The EUT shall be operated in any operational state which can affect compliance with the requirements of Part 68.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. One set of surges was applied with the EUT operating under each of the following operational states.

(a) On-hook

(b) Off-hook

Test modes described in Section III(3).

TEST RESULTS: The EUT was subjected to the required longitudinal voltage surges according to the schedule that follows. The surge voltage was applied from the telephone lines to ground.

Operational State	Surge Voltage	Polarity	Applied to
(a) On-hook	1500	+/-	Tip/ring to ground
(a) On-hook	1500	+/-	Tip to ground
(a) On-hook	1500	+/-	Ring to ground

(b) Off-hook	1500	+/-	Tip/ring to ground
(b) Off-hook	1500	+/-	Tip to ground
(b) Off-hook	1500	+/-	Ring to ground

ANALYSIS AND EVALUATION: The EUT was not damaged due to the surge.

D. LONGITUDINAL VOLTAGE SURGE ON THE AC POWER LINE (4.2.4):

PURPOSE: This test simulates the effect of lightning induced voltage surges conducted to the equipment through the AC power lines.

REQUIREMENT: Six 2500 volt peak surges, three positive and three negative, and having a 2 microsecond maximum risetime to crest and a 10 microsecond minimum decay time to half crest shall be applied between the phase and the neutral terminals of the AC powerline.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The wall transformer unit of the EUT was subjected to the six required surges on the AC power connections.

No. of Surges	Surge Voltage	Polarity	Applied to
3	2500	+/-	Phase to Neutral

ANALYSIS AND EVALUATION: The power surge did not affect the EUT. The wall mounted power supply was not damaged by the surge.

(2) LEAKAGE CURRENT LIMITATIONS (4.3):

PURPOSE: This test verifies the electrical isolation.

REQUIREMENT: The leakage current shall not exceed 10 milliamperes when a voltage source is connected to the combinations listed in Table 68.304.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. It was determined that

this equipment has the following connection points:

(1) Telephone connections (tip and ring)
(2) Case ground
(3) AC power to FACP

Test Data:

Voltage Source Applied Between	Voltage Applied 60Hz, VAC RMS	Maximum Peak Current (mA)		Limit
		Before	After	
(1) and (2) On-hook	1000	0.4	0.4	10
(2) and (3)	1500	0.4	0.4	10

ANALYSIS AND EVALUATION: The leakage current was below the limit. The telephone input is isolated from ground.

(3) HAZARDOUS VOLTAGE LIMITATIONS (4.4):

PURPOSE: This test is to assure that no hazardous voltage will appear on the telephone lines.

REQUIREMENT: The open circuit voltage on the telephone connections shall not exceed 70 volts peak for more than one second.

A voltage source is non-hazardous if:

i) AC voltage is less than 42.4 volts peak
ii) DC voltage is less than 80 volts
iii) Combined AC and DC voltages are less than 42.4 volts peak when the absolute value of the DC component is less than 21.2 volts and less than (28.8 + 0.64 x VDC) when the absolute value of the DC component is between 21.2 and 80 volts.

Leads to, or any conducting path to the telephone connections, shall be reasonably physically separated and restrained from and neither be routed in the same cable bundle nor use the same connector as leads or metallic paths connecting hazardous power connections.

ANALYSIS AND EVALUATION: No testing is required since the EUT

does not contain hazardous voltages.

(4) SIGNAL POWER LIMITATIONS (4.5):

A. VOICE BAND METALLIC SIGNAL POWER (4.5.2)

A.1 LIMITATIONS ON INTERNAL SIGNAL SOURCES NOT INTENDED FOR NETWORK CONTROL SIGNALING (4.5.2.1)

PURPOSE: This test measures the level of the voice band (200 to 4000Hz) metallic signal power at the terminals of the EUT which is produced by internal signal sources, other than live voice signals, that is not intended for network control.

REQUIREMENT: The maximum voice band metallic signal power, other than live voice signals, delivered to the loop simulator circuit shall not exceed -9 dB with respect to one milliwatt when averaged over any 3 second interval.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The voice band metallic signal power was measured with the EUT operating in the following states:

(b) Off-Hook,data

Test modes are described in Section III (3).

TEST RESULTS: The maximum voice band signal power was observed to be less than -9 dB with respect to 1 milliwatt for all operational states checked.

Test Data - Voice Band Signal Power, Other than Live Voice, Not Intended for Network Controlling

Operational State	Voiceband Signal Power (dBm)		
	Before Env. Test	After Env. Test	Rule Limit

Off-Hook, idle	-71	-71	-9
Off-Hook, data	-36	-36	-9

ANALYSIS AND EVALUATION: This device does not generate excessive signals in the voiceband.

A.2 LIMITATIONS ON INTERNAL SIGNAL SOURCES PRIMARILY INTENDED FOR NETWORK CONTROL SIGNALING, CONTAINED IN VOICE AND DATA EQUIPMENT (4.5.2.2):

PURPOSE: This test measures the level of the voice band (200 to 4000Hz) metallic signal power at the terminals of the EUT which is produced by internal signal sources that are primarily intended for network control.

REQUIREMENT: The maximum voice band metallic signal power delivered to the loop simulator circuit shall not exceed -0 dB with respect to one milliwatt when averaged over any 3 second interval.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The voice band metallic signal power was measured with the EUT operating in the following states:

(c) Off-Hook, dial

Test modes are described in Section III (3).

TEST RESULTS: The maximum voice band signal power was observed to be less than 0 dB with respect to 1 milliwatt for all operational states checked.

Test Data - Voice Band Signal Power Measurements of Internal Signals Primarily Intended for Network Control Signaling

Operational State	Voiceband Signal Power (dBm)		

	Before Env. Test	After Env. Test	Rule Limit
Off-Hook, dial	-15	-15	0

ANALYSIS AND EVALUATION: This device does not generate any excessive network control signals in the voiceband.

B. SIGNAL POWER IN THE 3995 TO 4005 HZ FREQUENCY BAND (4.5.3)

PURPOSE: This test measures the metallic signal power in the 3995 to 4005 Hz frequency band produced by internal signal sources not intended for network control signaling.

REQUIREMENT: The maximum voiceband metallic signal power in the 3995 to 4005 Hz frequency band delivered to the loop simulator circuit shall be 18 dB below the maximum permitted power as specified for the 200 to 4000 Hz band when averaged over any 3 second interval.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The voice band metallic signal power was measured with the EUT operating in the following states:

(b) Off-Hook

Test modes are described in Section III (3).

TEST RESULTS: The maximum voice band signal power was observed to be less than -27 dB with respect to 1 milliwatt for all operational states checked.

Test Data - Voice Band Signal Power in the 3995 to 4005 Hz Band, Not Intended for Network Controlling

Operational State	Voiceband Signal Power (dBm)		
	Before Env. Test	After Env. Test	Rule Limit
Off-Hook, idle	-110	-110	-27

Off-Hook, Data	-101	-101	-27

ANALYSIS AND EVALUATION: There was no excessive signal power in the 3995 to 4005 Hz frequency band.

C. LONGITUDINAL VOLTAGE IN THE 100 Hz to 4000 Hz FREQUENCY BAND (4.5.4)

PURPOSE: This test measures the level of the longitudinal voltage in the 100 Hz to 4000 Hz frequency band at the terminals of the EUT which is produced by internal signal sources, other than live voice signals, that is not intended for network control.

REQUIREMENT: The maximum weighted longitudinal termination shall not exceed -30 dBV (RMS voltage) when averaged over 100 milliseconds.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The longitudinal voltage level was measured with the EUT operating in the following states:

(b) Off-Hook

Test modes are described in Section III (3).

TEST RESULTS: The maximum longitudinal voltage level observed was less than -30 dBV for all operational states checked.

Test Data - Weighted Longitudinal Voltage Level for Signal not Intended for Network Controlling

Operational State	Weighted Longitudinal Voltage Level (dBV)		
	Before Env. Test	After Env. Test	Rule Limit
Off-Hook, idle	-97	-97	-30
Off-Hook, data	-93	-93	-30

ANALYSIS AND EVALUATION: The longitudinal voltage in the 100 Hz to 4 kHz band was less than the limit in all operational states tested.

D. VOLTAGE IN THE 4 kHz TO 6 MHz FREQUENCY RANGE

D.1) METALLIC VOLTAGE IN THE 4 kHz TO 6 MHz FREQUENCY RANGE:

PURPOSE: This test measures the metallic voltage level over the frequency range from 4 kHz to 6 MHz at the terminals of the EUT which is produced by internal signal sources, other than live voice signals, that is not intended for network controlling.

REQUIREMENT: The maximum metallic voltage shall not exceed the values given in Figure 4D. An 8 kHz bandwidth shall be used for center frequencies 8 kHz to 266 kHz and the voltage shall be averaged over 100 milliseconds. For the 270 kHz to 6 MHz band, a broadband measurement shall be made using a 2 usec average.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The metallic voltage level was measured with the EUT operating in the following states:

(b) Off-Hook

Test modes are described in Section III (3).

TEST RESULTS: The out of band metallic voltages were within the required limit.

The following metallic voltage levels were observed:

Test Data - Metallic Voltage Levels

Freq. Band (kHz)	Term. Impedance (ohm)	Metallic Voltage (dBV)		
		Before Env. Test	After Env. Test	Rule Limit
Operational State: Off-Hook, idle				
8-266 270-6000	300/135 135	p101 -54	p102 -54	See Data -15
Operational State: Off-Hook, data				
8-266 270-6000	300/135 135	p103 -54	p104 -54	See Data -15

ANALYSIS AND EVALUATION: This EUT does not produce excessive metallic signals in the frequency range from 4 kHz to 6 MHz.

D.2) LONGITUDINAL VOLTAGE IN THE 4 kHz TO 6 MHz FREQUENCY RANGE:

PURPOSE: This test measures the longitudinal voltage level over the frequency range from 4 kHz to 6 MHz at the terminals of the EUT which is produced by internal signal sources, other than live voice signal, that is not intended for network controlling.

REQUIREMENT: The maximum longitudinal voltage shall not exceed the values given in Figure 4D. For center frequencies from 8 kHz up to 266 kHz an 8 kHz bandwidth shall be used and the voltage shall be averaged over 100 milliseconds. From 270 kHz to 6 MHz, a broadband measurement shall be made using a 2 μsec average.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98. The longitudinal voltage level was measured with the EUT operating in the following states:

(b) Off-Hook

Test modes are described in Section III (3).

TEST RESULTS: The maximum longitudinal voltage level observed are listed below:

Test Data - Longitudinal Voltage Levels

Freq. Band (kHz)	Term. Impedance (ohm)	Longitudinal Voltage (dBuV)		
		Before Env. Test	After Env. Test	Rule Limit
Operational State: Off-Hook, idle				
8-266 270-6000	500/90 90	p105 -54	p106 -54	See Data -30
Operational State: Off-Hook, data				
8-266 270-6000	500/90 90	p107 -54	p107 -54	See Data -30

ANALYSIS AND EVALUATION: The device and its tip and ring connections are isolated from ground. The longitudinal voltage signals from 4 kHz to 6 MHz were below the specification limit.

(5) TRANSVERSE BALANCE LIMITATIONS (4.6):

PURPOSE: This test measures the metallic-to-longitudinal balance coefficient, or BALANCE.

REQUIREMENTS: BALANCE is expressed as:

$$\text{BALANCE} = 20 \log (eM/eL)$$

where eL is the longitudinal voltage produced across a 500 ohm longitudinal termination and eM is the metallic voltage across the tip and ring of the input port when a voltage, between 200 and 4000 Hz in frequency, is applied from a balanced 600 ohm metallic source.

The minimum balance requirement is:

Frequency Range (Hz)	Minimum Balance (dB)	Operational State
200 to 1000	60	On-hook
1000 to 4000	40	On-hook
200 to 4000	40	Off-hook

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The longitudinal balance was measured and found to be greater than the minimum requirement for the on-hook state.

Test Data: See Data page 108 through 111.

ANALYSIS AND EVALUATION: The Balance was greater than the minimum required level. The telephone lines are isolated from any ground connections.

(6) ON-HOOK IMPEDANCE LIMITATIONS (4.7):

A. LIMITATIONS ON INDIVIDUAL EQUIPMENT INTENDED FOR OPERATION OF LOOP-START TELEPHONE FACILITIES:

A1) ON-HOOK DC RESISTANCE LIMITATIONS:

PURPOSE: This test measures the On-Hook DC resistance.

REQUIREMENT: The DC on-hook resistance shall exceed 5 megohms for DC voltages less than 100 VDC, and exceed 30 kilohms for DC voltages from 100 VDC to 200 VDC when measured between tip and ring conductors, and between each tip and ring conductor and earth ground.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The DC resistance is greater than the rule limit before and after the environmental simulation.

Test Data:

<u>DC On-Hook Resistance (Megohms) Between Tip and Ring Conductors</u>

Applied Voltage	Minimum Limit	Before Env. Test	After Env. Test
1	5	12	12
10	5	12	12
20	5	12	12
50	5	12	12
100	5	12	12
200	0.03	12	12
-1	5	12	12
-10	5	12	12
-20	5	12	12
-50	5	12	12
-100	5	12	12
-200	0.03	12	12

DC On-Hook Resistance (Megohms) Between Tip Conductors and Ground

Applied Voltage	Minimum Limit	Before Env. Test	After Env. Test
1	5	>1000	>1000
10	5	>1000	>1000
20	5	>1000	>1000
50	5	>1000	>1000
100	5	>1000	>1000
200	0.03	>1000	>1000
-1	5	>1000	>1000
-10	5	>1000	>1000
-20	5	>1000	>1000
-50	5	>1000	>1000
-100	5	>1000	>1000
-200	0.03	>1000	>1000

DC On-Hook Resistance (Megohms) Between Ring Conductors and Ground

Applied Voltage	Minimum Limit	Before Env. Test	After Env. Test
1	5	>1000	>1000
10	5	>1000	>1000
20	5	>1000	>1000
50	5	>1000	>1000
100	5	>1000	>1000
200	0.03	>1000	>1000
-1	5	>1000	>1000
-10	5	>1000	>1000
-20	5	>1000	>1000
-50	5	>1000	>1000
-100	5	>1000	>1000
-200	0.03	>1000	>1000

ANALYSIS AND EVALUATION: When the device is on-hook, the DC resistance is above the minimum requirements.

A2) ON-HOOK AC IMPEDANCE LIMITATIONS:

PURPOSE: This test measures the on-hook AC impedance and the DC current during the application of simulated ring voltages. The impedance is measured between tip and ring conductors, and between

each tip and ring conductor and earth ground.

REQUIREMENTS: During the application of a simulated ring signal, the AC on-hook impedance between the tip and ring shall be greater than the value shown in Table V below, and less than 40 kilohms. The DC current shall not exceed 3 milliamperes. The impedance between tip and ring conductors, and ground shall be greater than 100 kilohms.

Table V - On-hook AC Impedance Limitations

Ringing Type	Range of Compatible Ringing Frequencies	Simulated Ringing Voltage Superimposed on 52.5 VDC	Impedance Limitation
A	20 ±3	40 to 130	1400
	30 ±3	40 to 130	1000
B	15.3 to 68	40 to 150	1600

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The AC impedance was within the minimum and maximum requirements. There was no DC current during the ring.

Test Data:

AC IMPEDANCE: TIP TO RING

Freq (Hz)	Ring Voltage VRMS AC	AC Impedance (kΩ)				DC Current (mA)		
		Min Limit	Before Env.	After Env.	Max Limit	Before Env.	After Env.	Limit
15.3	40	1.0	40	57	25	0.0	0.0	3
	100	2.5	29	40	63	0.0	0.0	3
	150	3.8	27	16	93	0.0	0.0	3
20	40	1.0	33	57	25	0.0	0.0	3
	100	2.5	22	37	63	0.0	0.0	3
	130	3.3	22	39	81	0.0	0.0	3
30	40	1.0	36	50	25	0.0	0.0	3
	100	2.5	15	34	63	0.0	0.0	3
	130	3.3	16	33	81	0.0	0.0	3
68	40	1.0	20	50	25	0.0	0.0	3
	100	2.5	10	33	63	0.0	0.0	3
	150	3.8	10	21	93	0.0	0.0	3

AC IMPEDANCE: TO GROUND

Freq (Hz)	Ring Voltage VRMS AC	AC Impedance (kΩ)					
		Tip to Ground			Ring to Ground		
		Before Env.	After Env.	Min Limit	Before Env.	After Env.	Min Limit
15.3	150	15000	15000	100	15000	15000	100
20	130	13000	13000	100	13000	13000	100
30	130	4333	4333	100	4333	4333	100
68	150	3000	3000	100	3000	3000	100

ANALYSIS AND EVALUATION: The AC impedance meet the requirements.

A3) RINGER EQUIVALENCE DEFINITION

PURPOSE: In this section, the ringer equivalence numbers were calculated for the EUT for the appropriate ringer type using the data obtained from the on-hook AC impedance measurements.

REQUIREMENTS: The Ringer Equivalence is five times the minimum AC impedance limitation divided by the minimum measured AC impedance.

TEST PROCEDURES: Elite TP-FCC68 20 Mar 98. The ringer equivalence was calculated using the data from the on-hook AC impedance measurements. The largest values for each Ringing Type was selected for the Ringer Equivalence Number (REN).

TEST RESULTS: Five times the minimum AC impedance limitation divided by the minimum measured AC impedance.

Class A	@ 20 Hz	5 X 1400/22000 = 0.3
	@ 30 Hz	5 X 1000/15000 = 0.3
Class B	@ 15.3 Hz	5 X 1600/27000 = 0.3
	@ 68 Hz	5 X 1600/10000 = 0.8

Ringing Type	Ringer Equivalence Number (REN)
Class A	0.3
Class B	0.8

ANALYSIS AND EVALUATION: The ringer equivalence of the EUT was less than five which should allow the device to operate with the network.

(7) BILLING PROTECTION (4.8):

A. VOICE AND DATA EQUIPMENT ON-HOOK SIGNAL REQUIREMENTS (4.8.2):

PURPOSE: This test measures the isolation between the EUT and the telephone network when the EUT is on-hook.

REQUIREMENTS: The on-hook signal level over the frequency range from 200 Hz to 4000 Hz shall not exceed -55 dB with respect to one milliwatt when measured across a 600 ohm termination.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The on-hook signal level was found to be below the

minimum required level before and after the environmental simulation tests.

Test Data - On-Hook Signal Level

Operational State	On-Hook Signal Level (dBm)		
	Before	After	Max. Limit
On-Hook	-100	-100	-55

B. VOICE AND DATA EQUIPMENT LOOP CURRENT REQUIREMENTS

PURPOSE: This test measures the off-hook loop current draw for the EUT.

REQUIREMENT: The loop current shall be as great as the current obtained with a 200 ohm resistance connected across the tip and ring, or not decrease more than 25 percent from its maximum during the first 5 second interval that the equipment goes to the normal off-hook state.

TEST PROCEDURE: Elite TP-FCC68 20 Mar 98.

TEST RESULTS: The DC off-hook current draw was slightly below the current obtained with 200 ohms connected tip to ring for the current levels checked. Therefore, the percentage change was measured. The EUT complies with the loop current requirements.

Test Data - DC Off-Hook Current

Loop Current With 200 ohms (mA)	Loop Current With EUT Before	Loop Current With EUT After	Percent Change During 1st 5 Sec. Before	Percent Change During 1st 5 Sec. After
20	18.5	18.5	0	0
40	39.0	39.0	0	0
60	60.7	60.7	0	0
80	81.8	81.8	0	0

(8) HEARING AID COMPATIBILITY:

ANALYSIS AND EVALUATION: No tests were required since the EUT does not have any earphones that will be used by the hearing impaired.

(9) ADDITIONAL LIMITATION (68.318):

ANALYSIS AND EVALUATION: No tests were required since this device is not equipped for digital services.

The automatic re-dialing limits do not apply since the EUT does not re-dial.

APPENDIX A: FIRE HAZARD SAFETY FEATURE EVALUATION

EQUIPMENT UNDER TEST: EL25

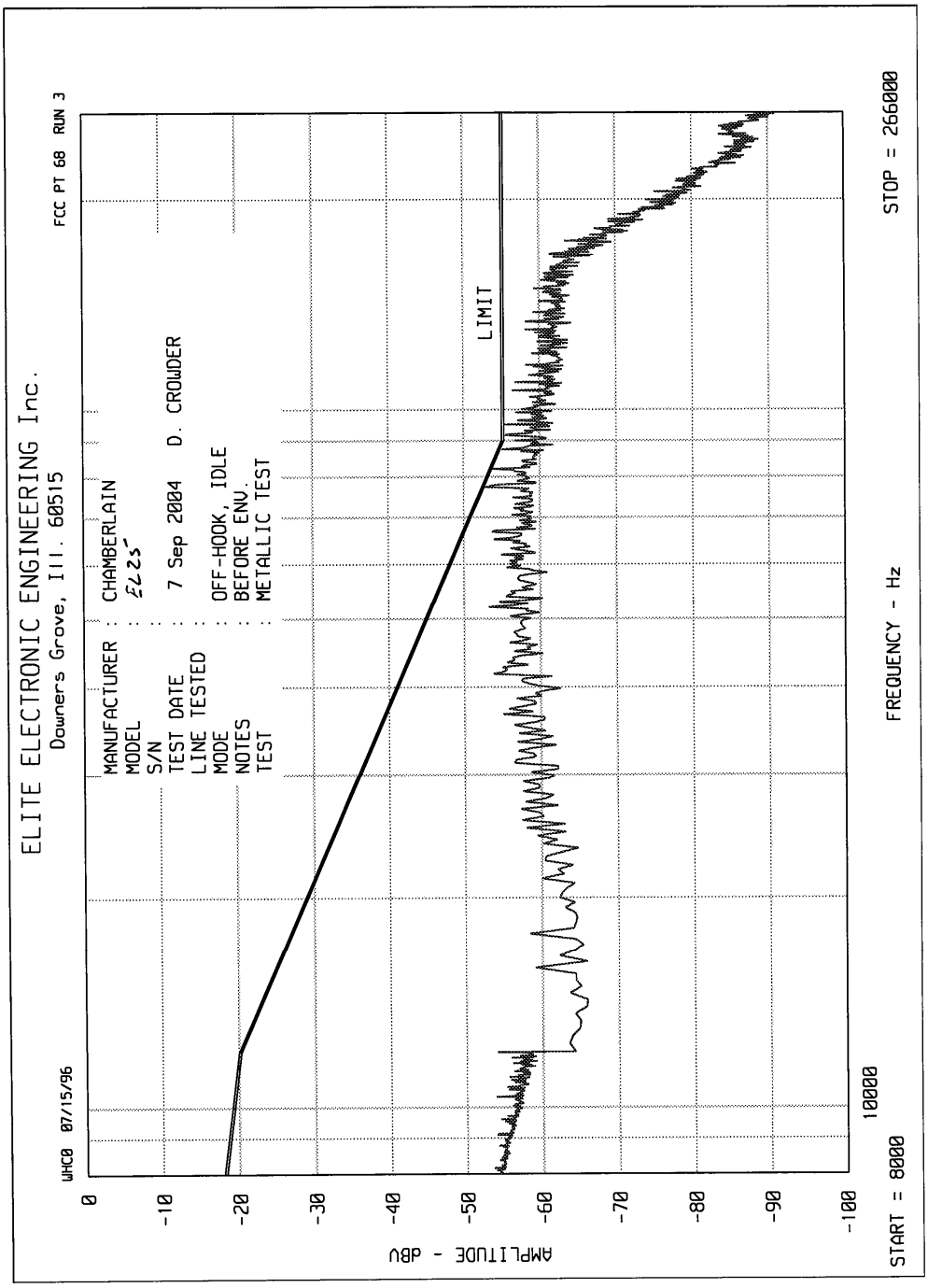
MANUFACTURER: Chamberlain Manufacturing
Elmhurst, Illinois

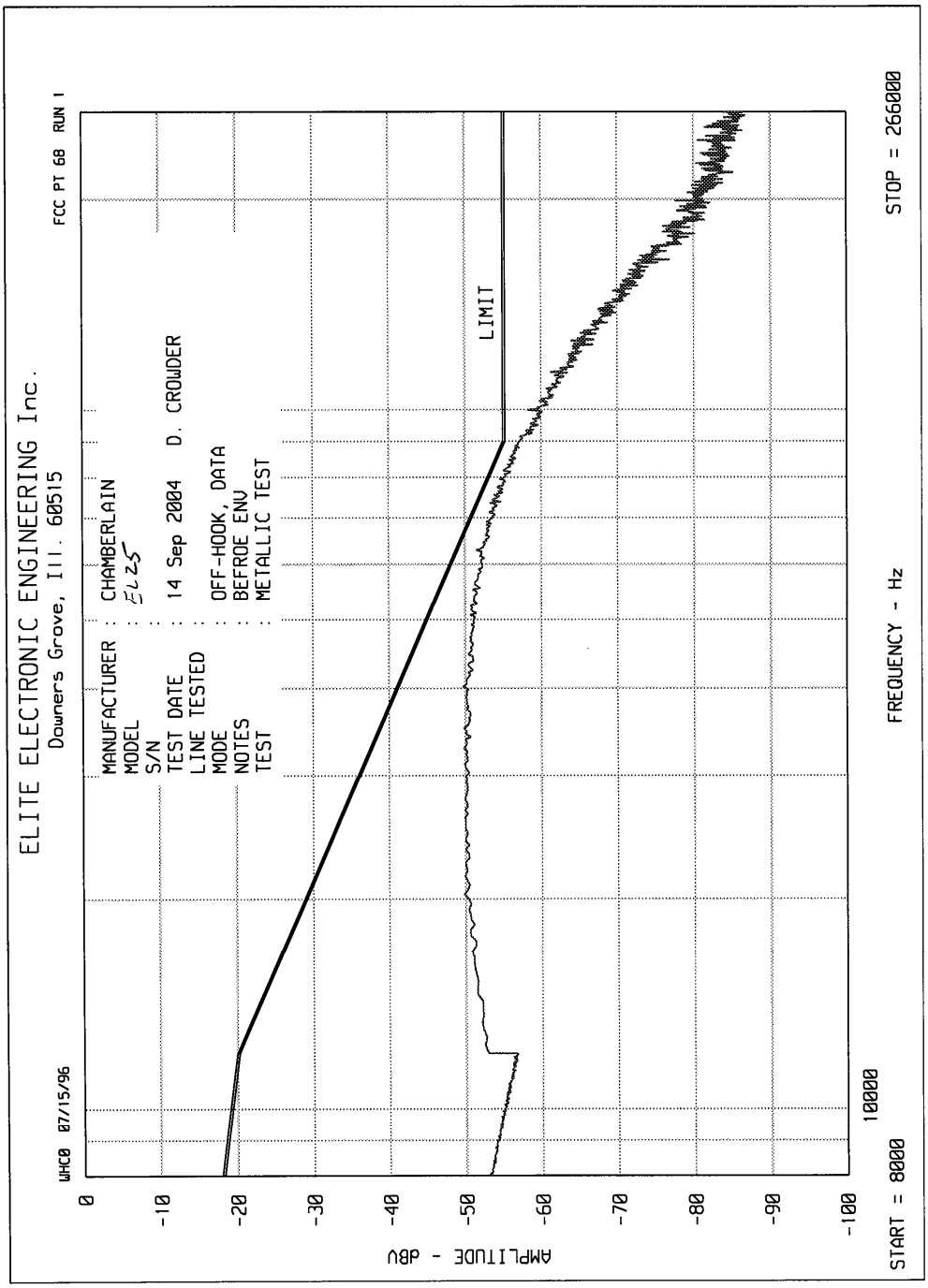
The EL25 is designed with several safety features to guard against fire hazard.

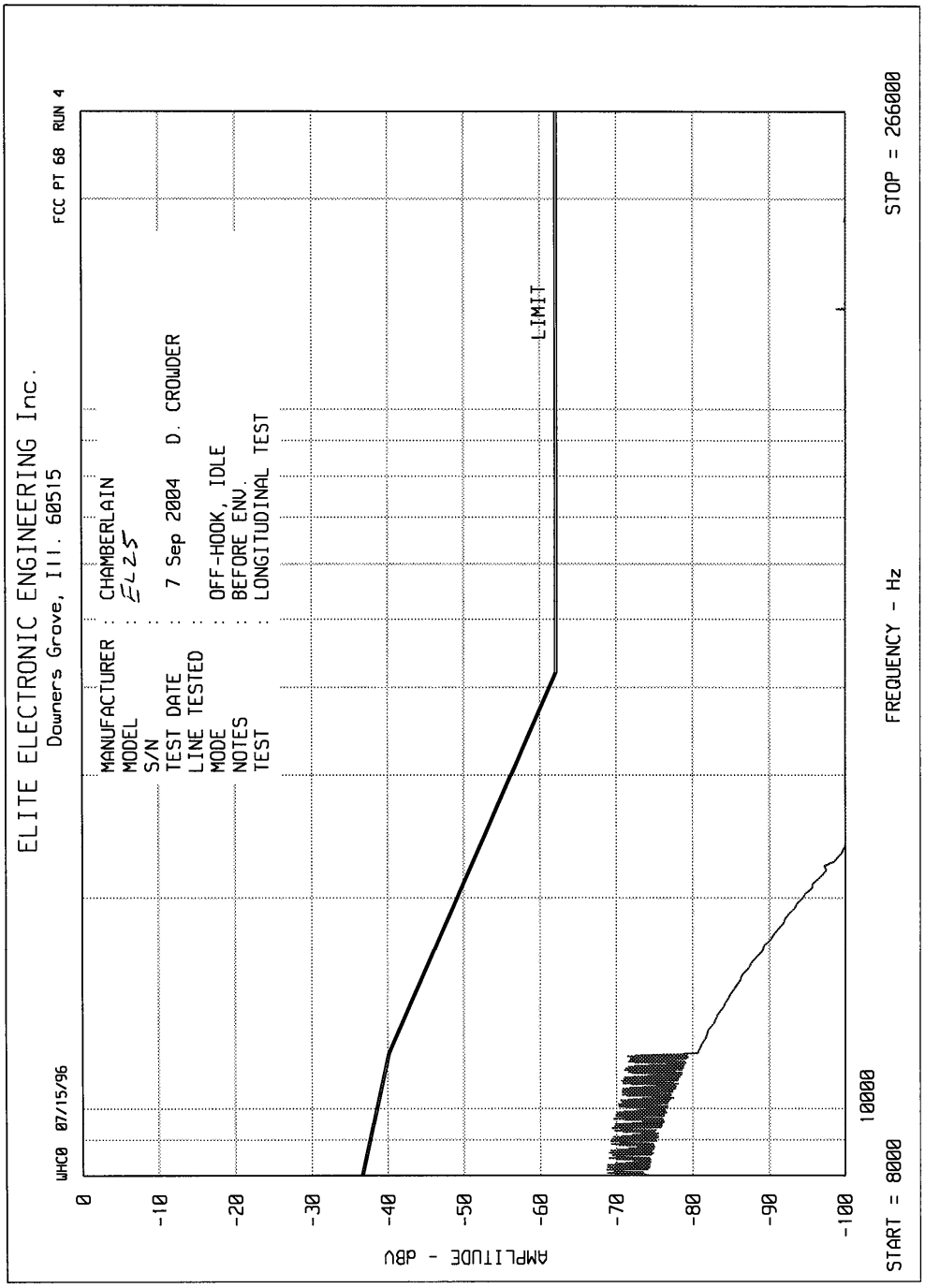
a) This EUT has a varistor from tip to ring for secondary surge suppression across the telephone interface.

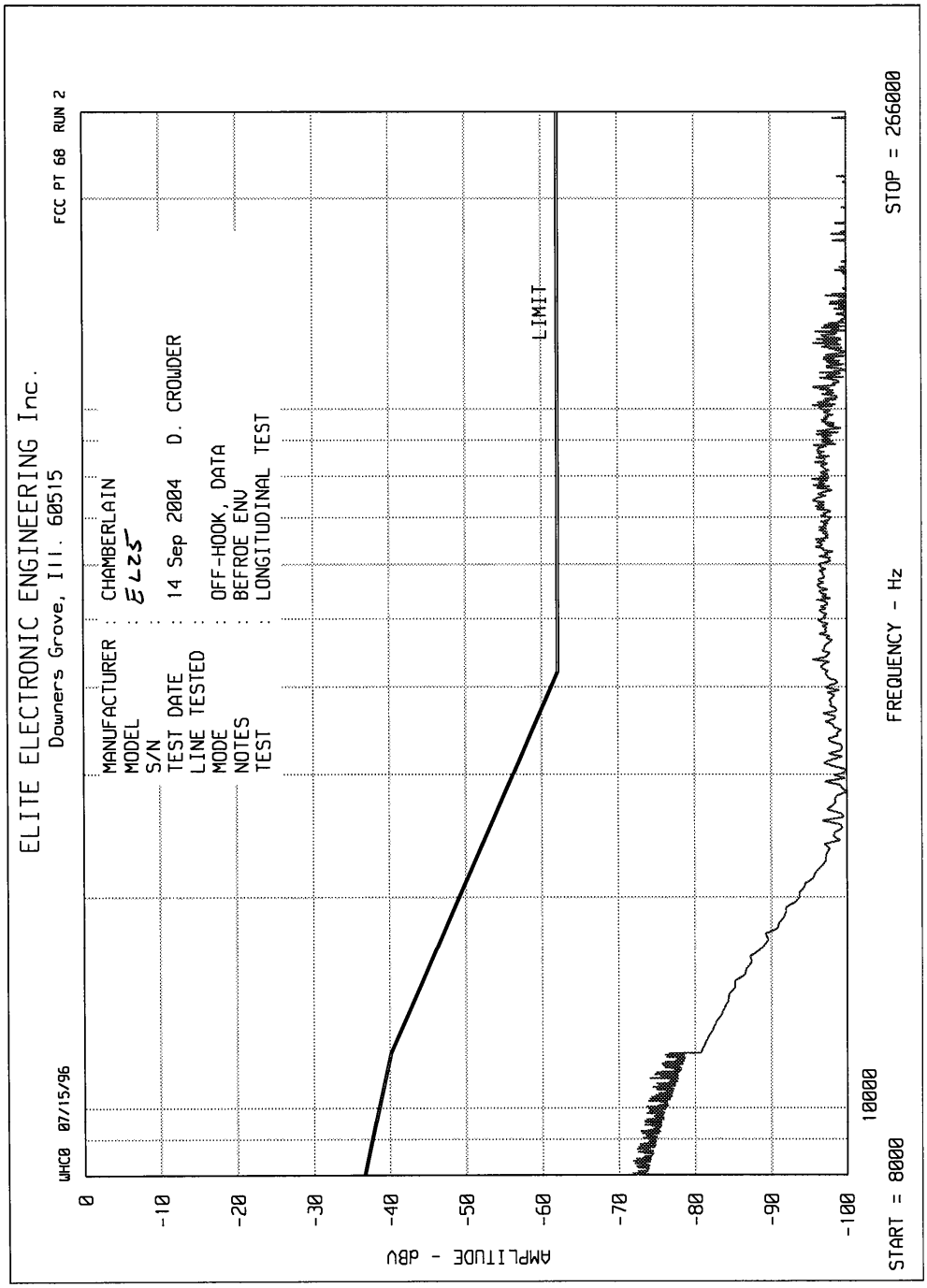
b) The telephone input is fused to prevent excessive currents on the telephone input from causing fires.

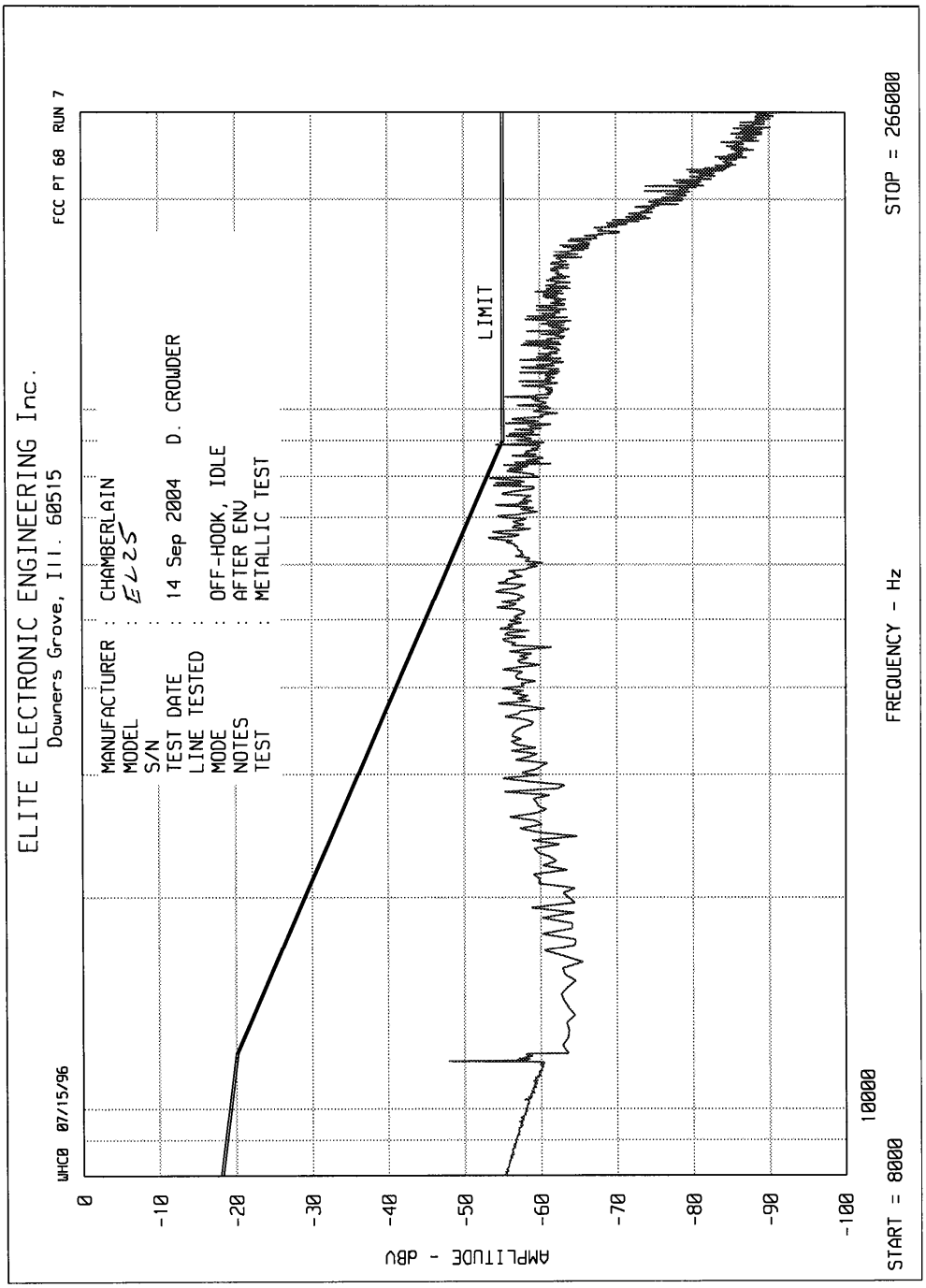
The EL25 should not present a fire hazard. It should provide safe operation in the event of surges on the phone lines.

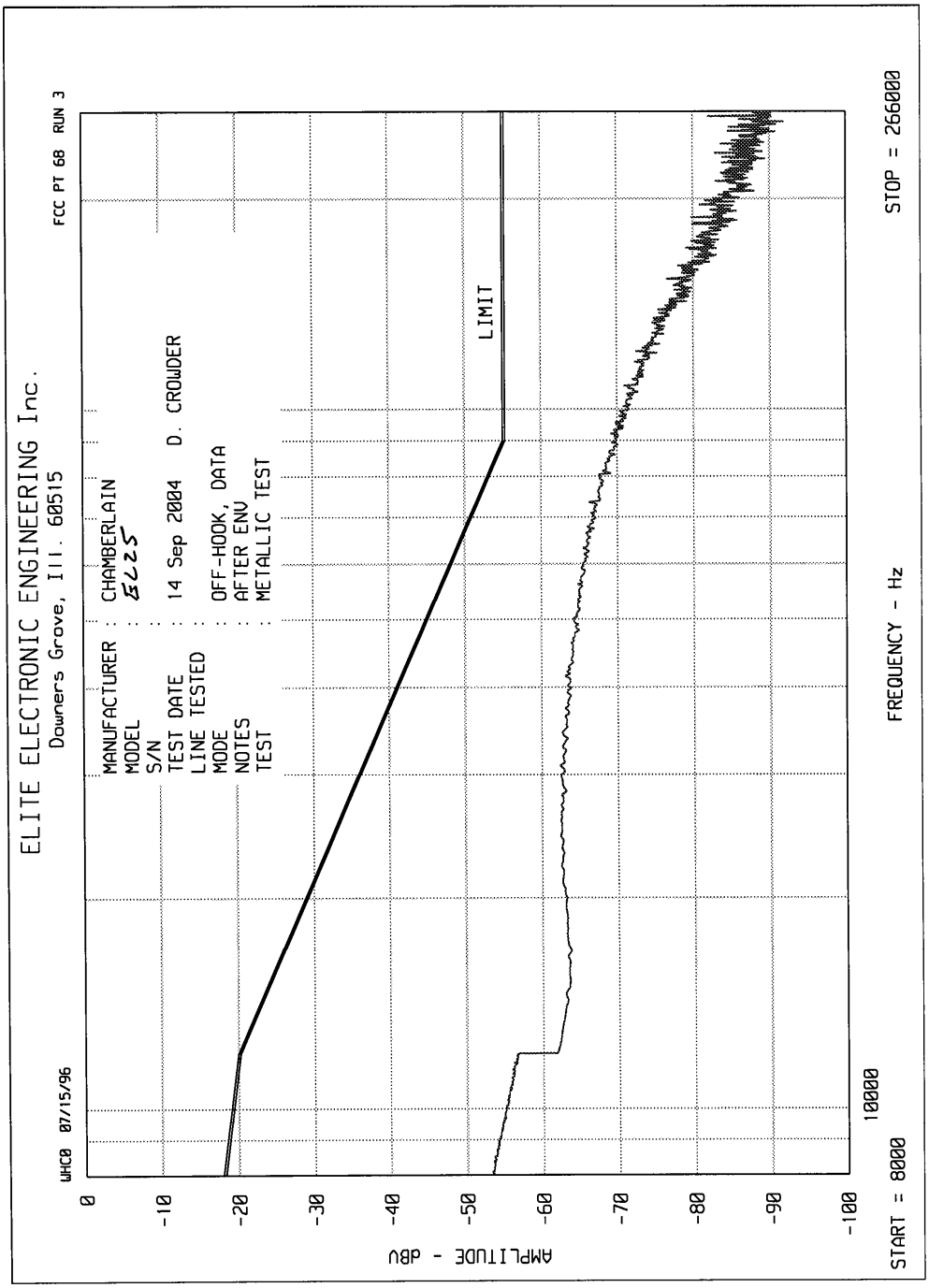

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 3
WHC0 07/15/96
MANUFACTURER : CHAMBERLAIN
MODEL : 2225
S/N :
TEST DATE : 7 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, IDLE
NOTES : BEFORE ENV.
TEST : METALLIC TEST
LIMIT
AMPLITUDE - dBU
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000

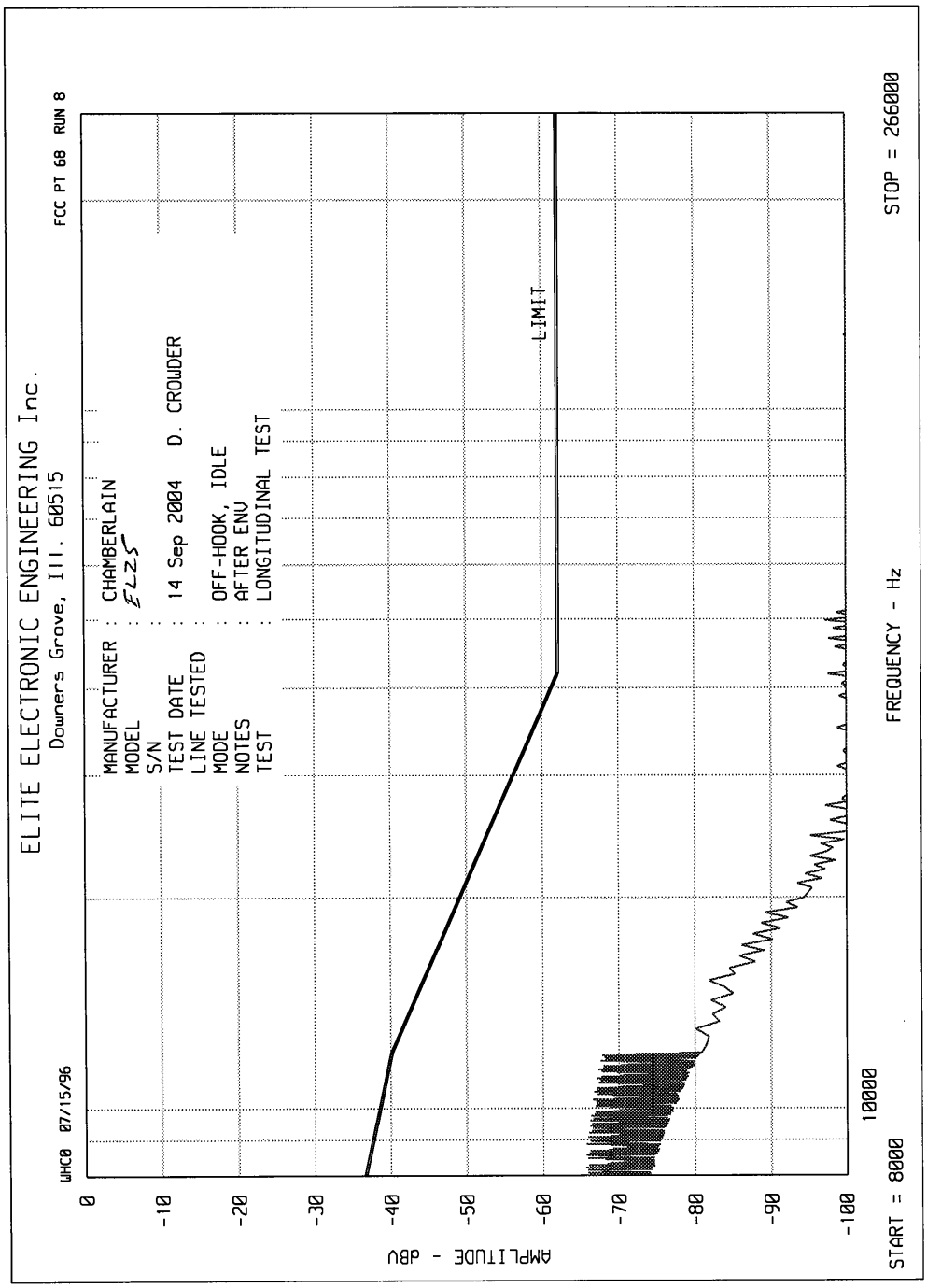

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 1
MANUFACTURER : CHAMBERLAIN
MODEL : 2125
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED : OFF-HOOK, DATA
MODE : BEFROE ENV
NOTES : METALLIC TEST
TEST : METALLIC TEST
LIMIT
WHC0 07/15/96
AMPLITUDE - dBu
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000

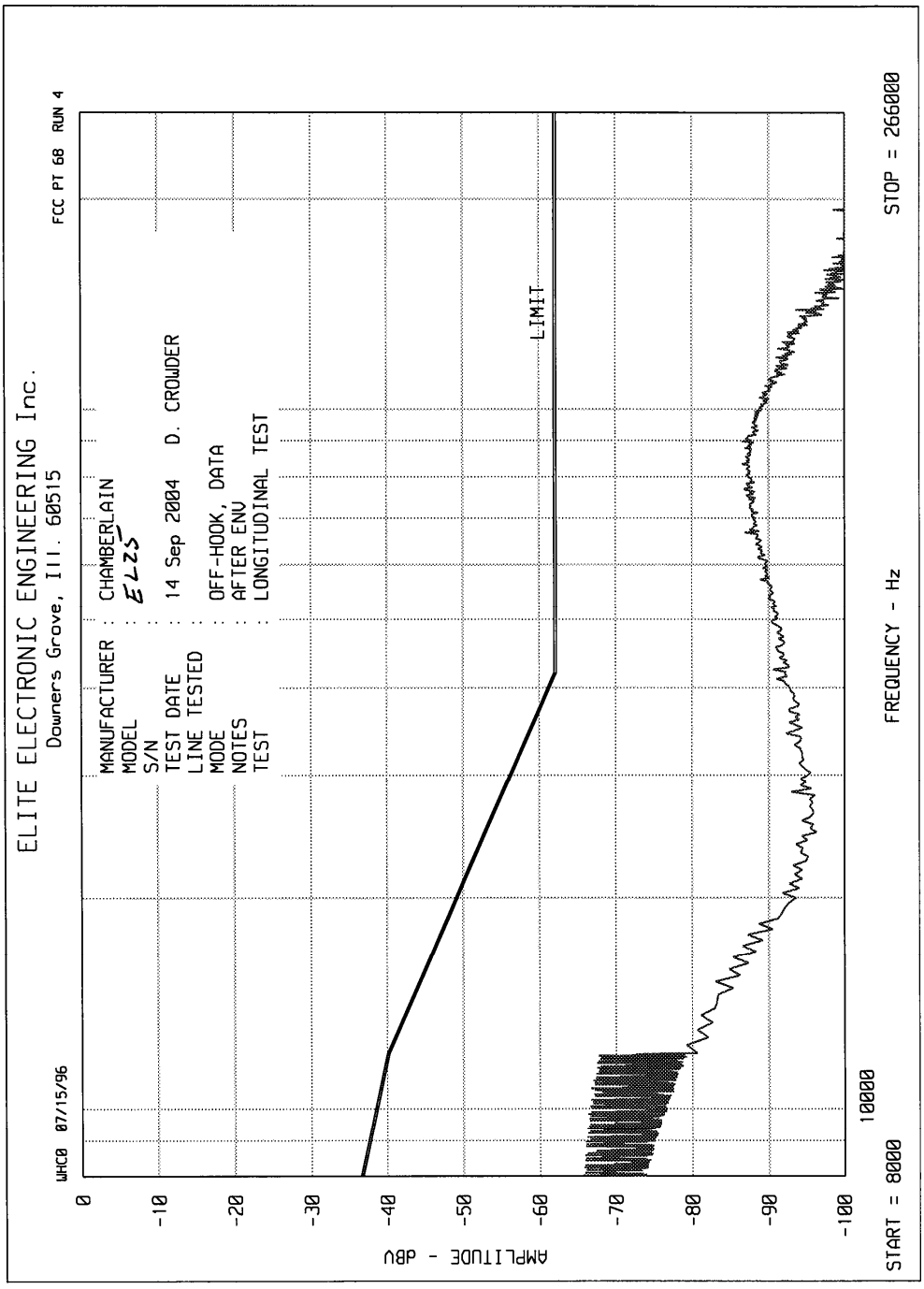

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 4
WHC0 07/15/96
MANUFACTURER : CHAMBERLAIN
MODEL : 2225
S/N :
TEST DATE : 7 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, IDLE
NOTES : BEFORE ENV.
TEST : LONGITUDINAL TEST
LIMIT
AMPLITUDE - dBu
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000

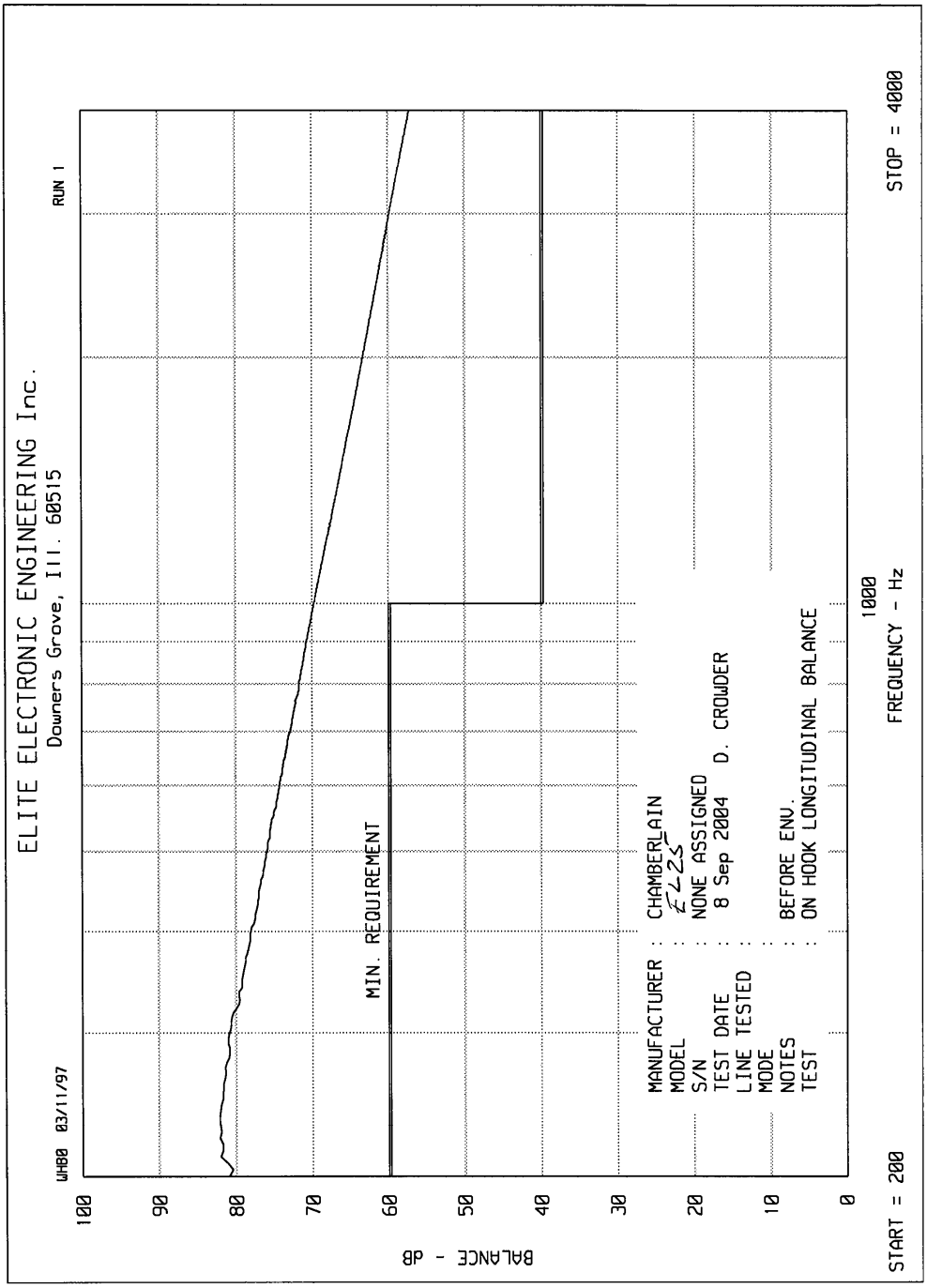

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WHC0 07/15/96
FCC PT 68 RUN 2
MANUFACTURER : CHAMBERLAIN
MODEL : EL25
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, DATA
NOTES : BEFROE ENV
TEST : LONGITUDINAL TEST
LIMIT
AMPLITUDE - dBV
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
10000
START = 8000
FREQUENCY - Hz
STOP = 266000

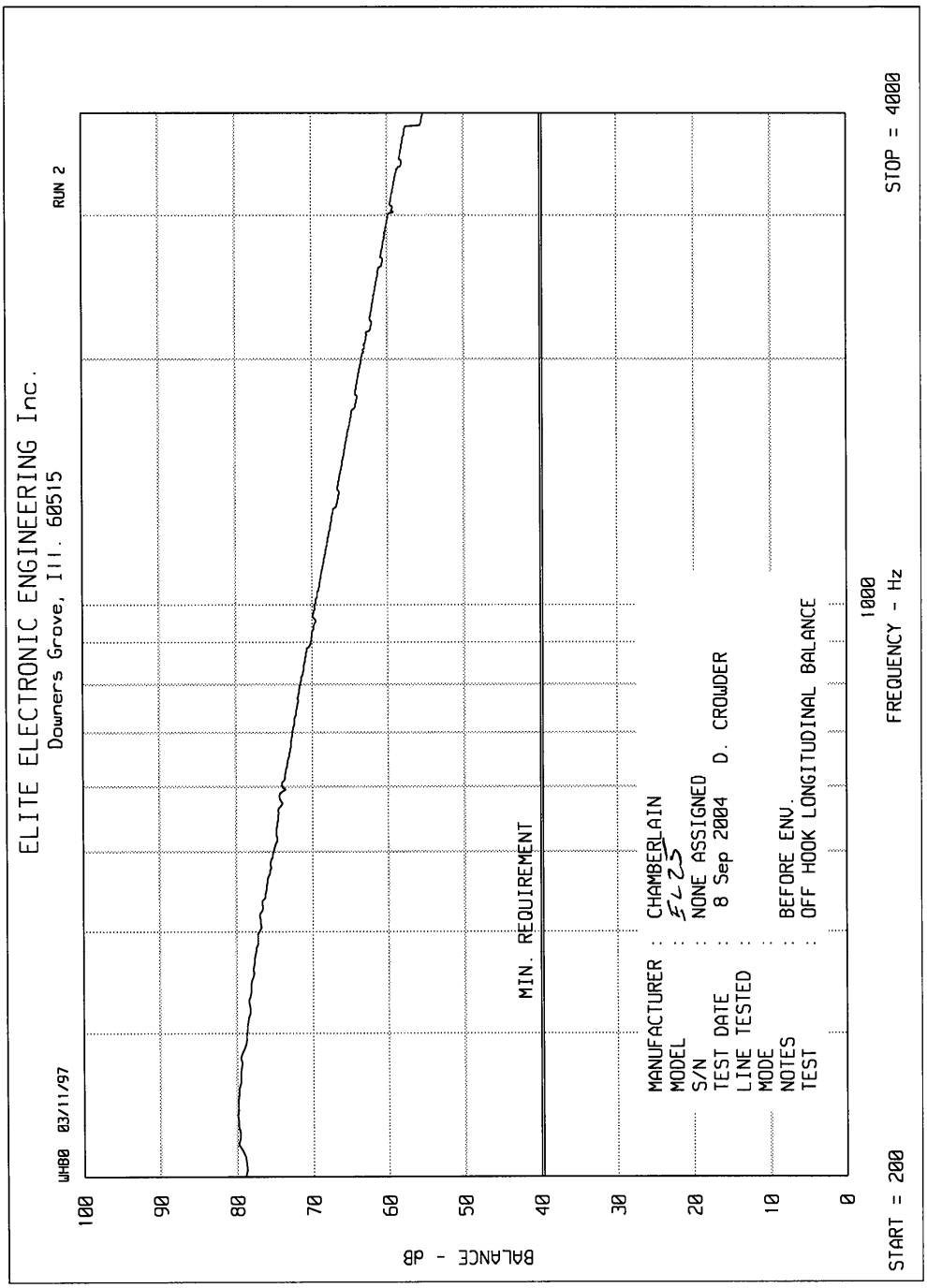

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WHC0 07/15/96
FCC PT 68 RUN 7
MANUFACTURER : CHAMBERLAIN
MODEL : EL25
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, IDLE
NOTES : AFTER ENV
TEST : METALLIC TEST
LIMIT
AMPLITUDE - dBV
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
10000
START = 8000
FREQUENCY - Hz
STOP = 266000

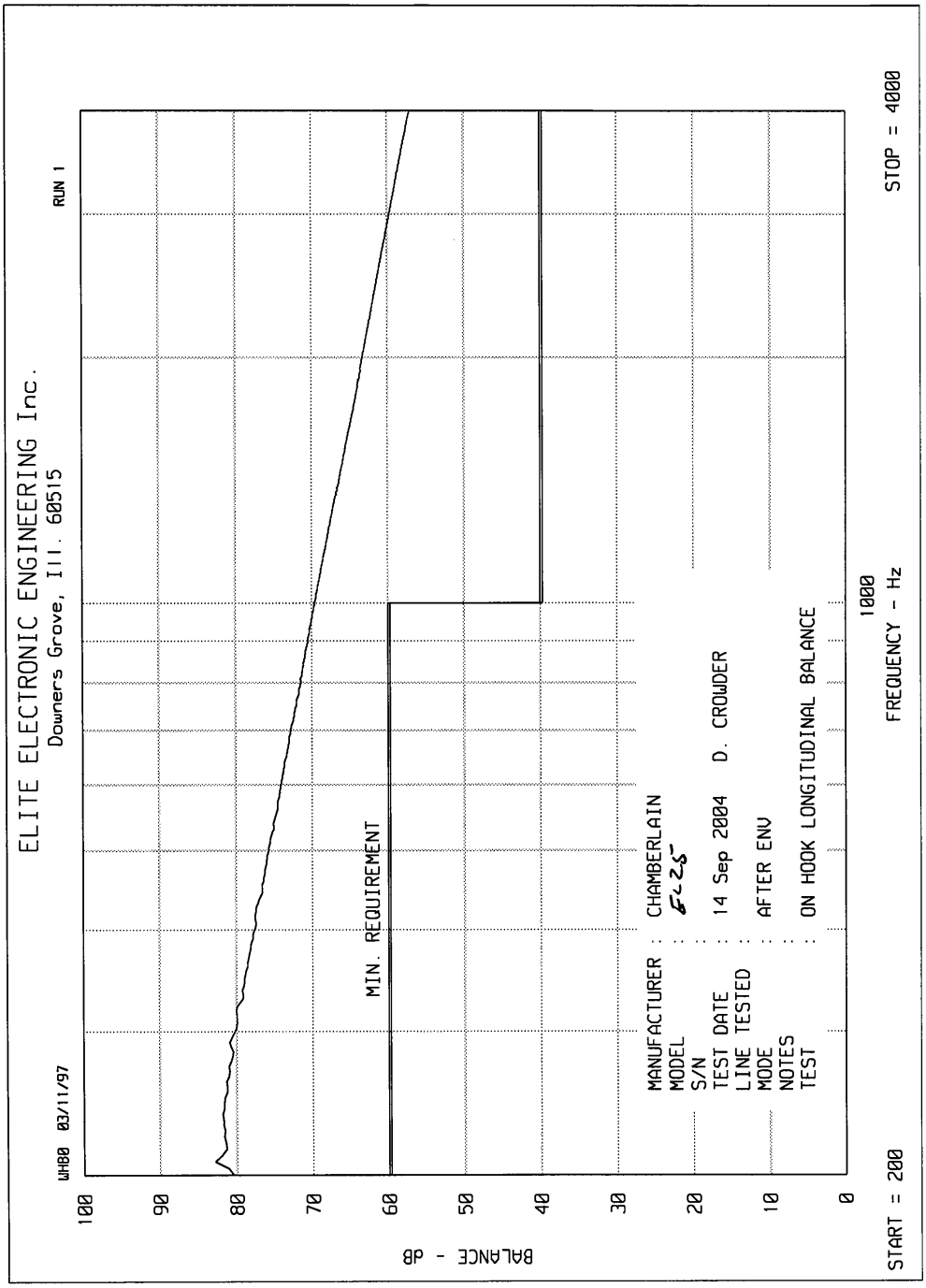

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 3
MANUFACTURER : CHAMBERLAIN
MODEL :
S/N : 8225
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, DATA
NOTES : AFTER ENV
TEST : METALLIC TEST
LIMIT
WHC0 07/15/96
AMPLITUDE - dBV
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000

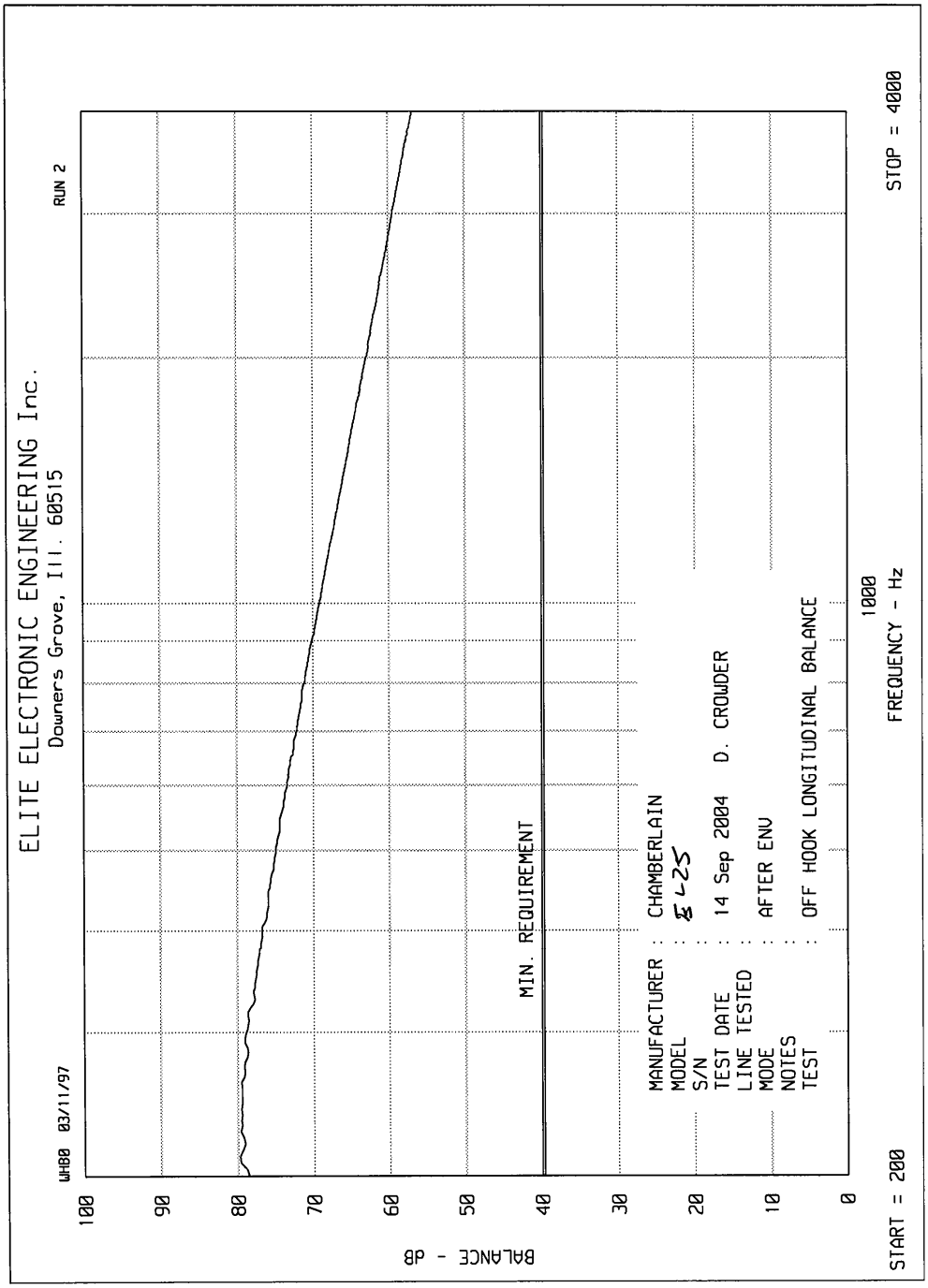

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 8
MANUFACTURER : CHAMBERLAIN
MODEL :
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED :
MODE : OFF-HOOK, IDLE
NOTES : AFTER ENV
TEST : LONGITUDINAL TEST
LIMIT
WHC0 07/15/96
AMPLITUDE - dBV
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
FCC PT 68 RUN 4
WHC0 07/15/96
MANUFACTURER : CHAMBERLAIN
MODEL : ELZS
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED : OFF-HOOK, DATA
MODE : AFTER ENV
NOTES : LONGITUDINAL TEST
TEST :
LIMIT
AMPLITUDE - dBV
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
START = 8000
10000
FREQUENCY - Hz
STOP = 266000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
RUN 1
WH80 03/11/97
BALANCE - dB
100
90
80
70
60
50
40
30
20
10
0
MIN. REQUIREMENT
MANUFACTURER : CHAMBERLAIN
MODEL : 2225
S/N : NONE ASSIGNED
TEST DATE : 8 Sep 2004 D. CROWDER
LINE TESTED :
MODE :
NOTES : BEFORE ENV.
TEST : ON HOOK LONGITUDINAL BALANCE
START = 200
1000
FREQUENCY - Hz
STOP = 4000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WHBB 03/11/97
RUN 2
BALANCE - dB
100
90
80
70
60
50
40
30
20
10
0
MIN. REQUIREMENT
MANUFACTURER : CHAMBERLAIN
MODEL : EL23
S/N : NONE ASSIGNED
TEST DATE : 8 Sep 2004 D. CROWDER
LINE TESTED :
MODE :
NOTES : BEFORE ENV.
TEST : OFF HOOK LONGITUDINAL BALANCE
START = 200
1000
FREQUENCY - Hz
STOP = 4000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WH80 03/11/97
RUN 1
MIN. REQUIREMENT
MANUFACTURER : CHAMBERLAIN
MODEL : 625
S/N :
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED : AFTER ENV
MODE :
NOTES : ON HOOK LONGITUDINAL BALANCE
TEST :
BALANCE - dB
100
90
80
70
60
50
40
30
20
10
0
START = 200
1000
FREQUENCY - Hz
STOP = 4000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
RUN 2
WHBB 03/11/97
BALANCE - dB
100
90
80
70
60
50
40
30
20
10
0
MIN. REQUIREMENT
MANUFACTURER : CHAMBERLAIN
MODEL :
S/N : 8125
TEST DATE : 14 Sep 2004 D. CROWDER
LINE TESTED : AFTER ENV
MODE :
NOTES :
TEST : OFF HOOK LONGITUDINAL BALANCE
START = 200
1000
FREQUENCY - Hz
STOP = 4000