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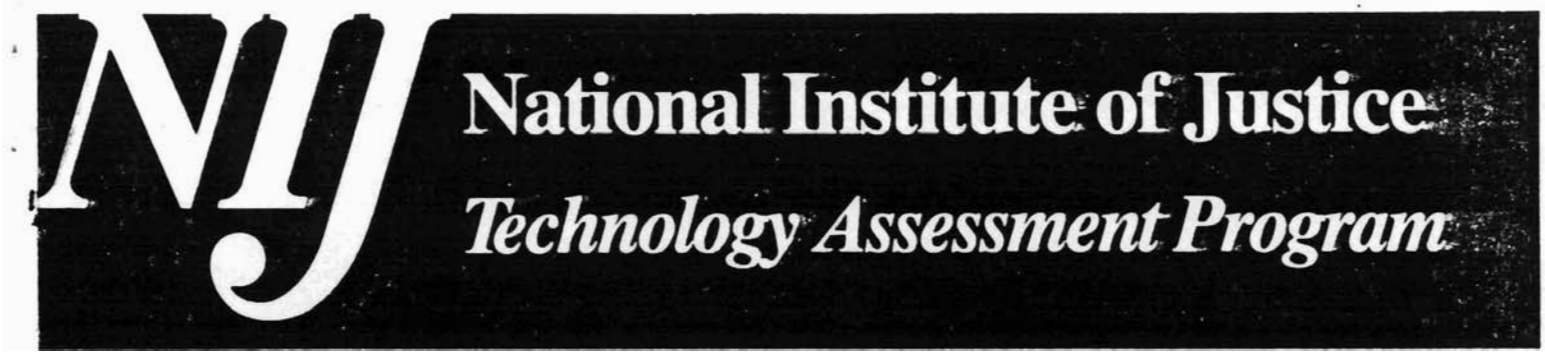

Telephone Dialers with Taped Voice Messages

NIJ Standard-0322.00

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James K. Stewart, Director
National Institute of Justice

Technology Assessment Program

NIJ Standard for Telephone Dialers with Taped Voice Messages

NIJ Standard-0322.00

A Voluntary National Standard Promulgated by the National Institute of Justice

October 1984

U.S. Department of Justice
National Institute of Justice

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National Institute of Justice

James K. Stewart, Director

ACKNOWLEDGMENTS

This standard was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the direction of Lawrence K. Eliason, Chief of LESL and Daniel E. Frank, Manager, Security Systems Program. Suggestions and editorial contributions were made by Jacob J. Diamond, former Chief of LESL. Technical research was performed by Raymond L. Falge and Paul H. Krupenie. The preparation of this standard was sponsored by the National Institute of Justice, Lester D. Shubin, Standards Program Manager. The standard has been reviewed and approved by the Technology Assessment Program Advisory Council (TAPAC) and adopted by the International Association of Chiefs of Police (IACP) as an IACP standard.

FOREWORD

This document, NIJ Standard-0322.00, Telephone Dialers with Taped Voice Messages, is an equipment standard developed by the Law Enforcement Standards Laboratory of the National Bureau of Standards. It is produced as part of the Technology Assessment Program of the National Institute of Justice. A brief description of the program appears on the inside front cover.

This standard is a technical document that specifies performance and other requirements equipment should meet to satisfy the needs of criminal justice agencies for high quality service. Purchasers can use the test methods described in this standard themselves to determine whether a particular piece of equipment meets the essential requirements, or they may have the tests conducted on their behalf by a qualified testing laboratory. Procurement officials may also refer to this standard in their purchasing documents and require that equipment offered for purchase meet the requirements. Compliance with the requirements of the standard may be attested to by an independent laboratory or guaranteed by the vendor.

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Before citing this or any other NIJ standard in a contract document, users should verify that the most recent edition of the standard is used. Write to: Chief, Law Enforcement Standards Laboratory, National Bureau of Standards, Washington, DC 20234.

Lester D. Shubin
Program Manager for Standards
National Institute of Justice

NIJ STANDARD FOR TELEPHONE DIALERS WITH TAPED VOICE MESSAGES

CONTENTS

NIJ STANDARD FOR TELEPHONE DIALERS WITH TAPED VOICE MESSAGES

1. PURPOSE AND SCOPE

This standard establishes performance requirements and test methods for evaluating dialers that dial one or more specified telephone numbers and transmit one or more taped voice messages in response to an actuation. These devices transmit an alarm signal [the voice message(s)] through the ordinary switched telephone network to a telephone answering service or private phone. Emphasis in this standard is on characteristics affecting the ability of the devices to perform their tasks reliably and on factors that affect false alarm susceptibility.

Dialers that have received FCC approval may be connected directly to the telephone network [1,2][1]; otherwise, a registered protective circuit must be used [3]. In conformance with existing state or local ordinances, prior permission may be required, in writing, from those whose telephone numbers are to be dialed, before such numbers may be programmed into the dialer.

2. CLASSIFICATION

This standard does not classify dialers by type. The dialers covered by this standard operate on (nominally) 115-V ac power (with a battery as an optional standby power supply), and transmit taped voice messages. The dialers may come as modules, as units that stand alone in their own cabinets intended to be connected to an intrusion alarm control unit, or as elements to be incorporated into an intrusion alarm control unit. This standard does not distinguish among any of these forms and only defines tests for the dialer portion of any composite system. The control unit portion of any composite system must satisfy its own standard, NIJ Standard-0321.00 [4]. Several options may be available with each dialer.

2.1 Option I—Line Checking

The dialer has circuitry to automatically check the telephone line for selected usability conditions. If the telephone line is unusable, a local alarm is activated.

2.2 Option II—Tamper Protection

The dialer is supplied in a key-locked cabinet with a tamper switch that activates the dialer if unauthorized entry to the cabinet is attempted.

2.3 Option III—Test Speaker

The dialer contains a speaker which can be used to check the content and quality of a previously taped message.

2.4 Option IV—Extension Phone Disconnect

The dialer has the capability to deactivate all extension phones connected to the telephone line intended for alarm message transmittal.

[1] Numbers in brackets refer to references in appendix A.

3. DEFINITIONS

3.1 Alarm Signal

A signal produced by a control unit indicating the existence of an alarm state.

3.2 Alarm State

The condition of a sensor of an intrusion alarm system that causes a control unit in the secure state to transmit an alarm signal.

3.3 Break Interval

An on-hook (open circuit) signal of approximately 40-ms duration, as part of a dialing pulse train.

3.4 Chatter

The rapid (undesirable) repeated switching of a dialing pulse train.

3.5 Control Unit

A device, usually electronic, that provides the interface between the alarm system and the human operator and produces an alarm signal when its programmed response indicates an alarm state.

3.6 Decibel (dB)

A unit denoting the logarithmic ratio of two powers, defined as $n = 10 \log_{10} P/P_{ref}$; n is in decibels, P is a power level, and P_{ref} is a reference power level. Under conditions where the ratios of voltages are used instead of the corresponding power ratios, $n = 20 \log_{10} V/V_{ref}$ is the formula to use.

3.7 Decibel with 1-mW Reference (dBm)

A unit expressing power level in decibels, above or below a reference level of 1 mW.

3.8 Dialing Pulses

A series of interruptions of the current flow in the customer's loop in the telephone switching network. This pulse train registers at the telephone switching equipment as digits of the telephone number dialed.

3.9 Distortion

An undesired change in waveform.

3.10 Flutter (and Wow)

Distortion caused by nonuniform tape motion during recording or playback. This type of distortion is recognized as aural pitch variations when the tape motion cycles in the range of 0.1 to 6 variations per second (defined as wow) and as a roughening of the tones when the tape motion cycles more rapidly than 6 variations per second (defined as flutter). For the purposes of this standard nonuniform tape motion in the range of 0.1 to 250 variations per second will be called flutter without the requirement to separate the flutter and wow components.

3.11 Frequency Response

The variation of signal amplitude as a function of frequency.

3.12 Harmonic Distortion

Distortion characterized by the appearance in the output signal of harmonics of the input frequency when the input wave is a single sinusoid.

3.13 Line Checking

The capability of a dialer, or add-on component to a dialer, to detect an open or shorted telephone line. Immediately following such a detection, the dialer may alert the user (by means of a light, or other signal), or produce a local audible alarm, when the system is placed into its alarm state.

3.14 Make-Interval

An off-hook (closed circuit) signal of approximately 60-ms duration, as part of a dialing pulse train.

3.15 Off-Hook Signal

A signal by the dialer to the telephone line, equivalent to a model 500-type telephone with the cradle button up (line voltage becomes 6 V).

3.16 On-Hook Signal

A signal by the dialer to the telephone line represented by an open circuit. This is equivalent to a model 500-type telephone with the cradle button down (line voltage becomes 48 V).

3.17 Programmer

A device used for programming message tapes.

3.18 Programming

The act of recording the control commands and the voice message(s) on the tape to be used by the dialer.

3.19 Secure State

The condition of an alarm system in which all sensors and control units are ready to respond to an intrusion.

3.20 Sound Pressure Level (SPL)

The logarithmic ratio expressed in decibels of a sound pressure, P, to a reference pressure, P_{ref}, of 20 μPa.

$$SPL = 20 \log_{10} P/P_{ref}.$$

3.21 Talking Battery

The dc voltage supplied by the telephone company central office to the customer's loop for the operation of the carbon transmitter in the handset of a telephone and to enable the distinguishing of dialing pulses.

3.22 Tamper Switch

A switch that initiates an alarm signal if an attempt is made to gain access to the interior of a protected piece of equipment. This switch is usually activated by an attempt to remove the cover of the equipment.

3.23 Test Tapes

Test tapes are a series of tape recordings used for test and evaluation of the dialer characteristics. The test tapes for the purposes of this standard are described in section 5.2.3. These six recordings may be supplied by the dialer manufacturer or they may be created by the test laboratory according to the instructions in section 5.2.4.

3.24 Weighted Peak Flutter

Flutter indicated by the weighted peak flutter measuring equipment specified in IEEE STD 193-1971 [5].

4. REQUIREMENTS

4.1 Acceptance Criteria

A dialer that transmits taped voice messages satisfies the requirements of this standard if all sample specimens (see sec. 5.1) pass all of the tests required by this standard.

4.2 User Information

The following information items shall be among the data supplied to the user by the manufacturer or distributor:

(a) Full installation and operation instructions (for all modes of operation), instructions for setting the phone number(s) to be called, minor troubleshooting and routine testing, a recommended maintenance schedule, and any installation restrictions.
(b) Options included (sec. 2).
(c) Signal characteristics necessary to activate the dialer.
(d) Standby power requirements, including the identification of usable battery types, the maximum period of standby power operation, and the minimum time required to fully recharge a completely discharged battery if the equipment includes an integral battery charging unit.
(e) Instructions for making test tapes, if such tapes are not provided by the manufacturer or distributor.
(f) Length of play of the tape to be used with the dialer, how many messages (channels) are available, and the allowable length (minimum/maximum) of each message.
(g) Description of tamper protection and/or other optional features (see sec. 2).
(h) Instructions to be followed by the user in order to comply with the rules of the FCC concerning connection of terminal equipment to the telephone network.
(i) Programmer and instructions for its use and operation if prepared tapes are not provided.
(j) Nominal operating voltages.
(k) Certification of compliance with this standard.

4.3 Test Tape Requirement

The manufacturer or distributor may elect to supply the test tapes required by the tests in this standard. If supplied, the tapes shall conform to the tape descriptions contained in section 5.2.3. If the test tapes are not supplied with the dialer, the testing laboratory shall prepare them in conformance with section 5.2.3 using the instructions contained in section 5.2.4.

4.4 Electronic Requirements

4.4.1 Frequency Response Requirement

When tested in accordance with section 5.4.1, the device shall satisfy the following criteria. On playback of test tape A, over the frequency range from 500 to 3200 Hz, the difference between the maximum and minimum response shall not exceed 15 dB. The existence of not more than two notches having widths between the -3 dB points of less than 10 percent of their center frequency in the frequency response curve shall not be considered a violation of this requirement.

4.4.2 Operating Level (Sound Pressure) Requirement

When tested in accordance with section 5.4.1, using test tape B (the 1000 Hz sine wave reference level), the output across the 600-Ω resistor in figure 1 shall be not less than -8 dBm.

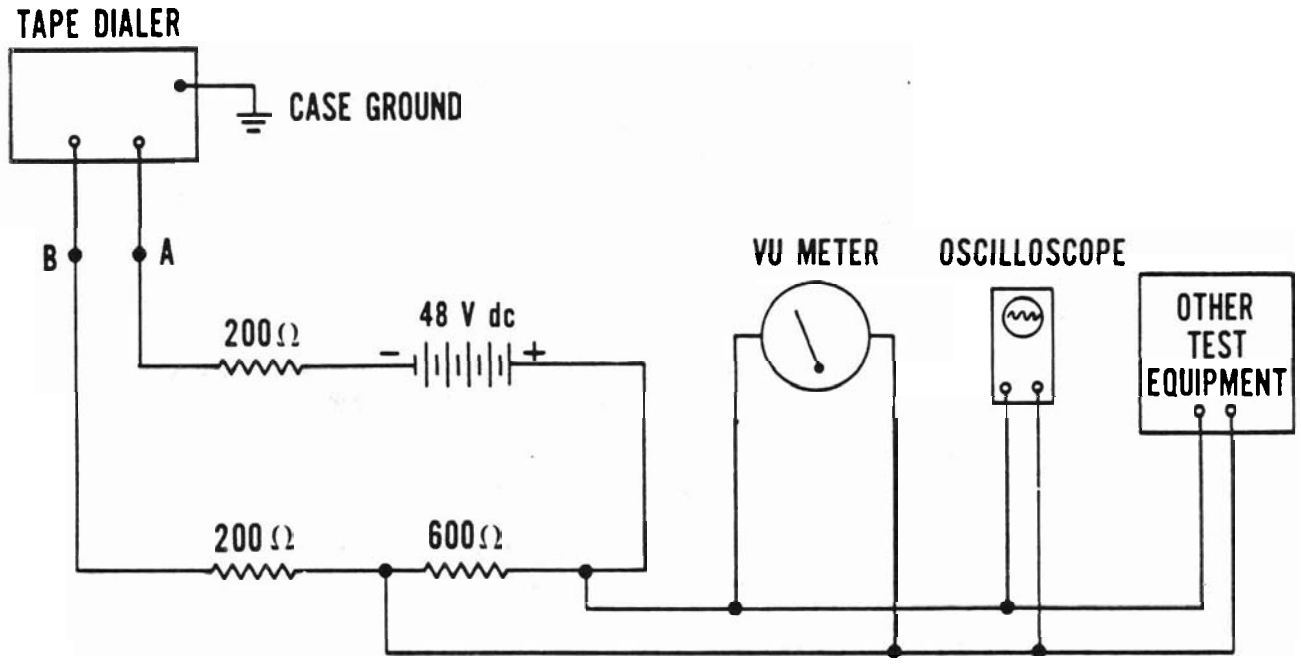

FIGURE 1. *Test equipment connection to dialer's telephone terminals.*

4.4.3 Harmonic Distortion Requirement

When tested in accordance with section 5.4.2, with an output power level in the range -8 to -2 dBm, the harmonic distortion shall not exceed 5 percent of the signal (rms).

4.4.4 Signal-to-Noise Ratio Requirement

When tested in accordance with section 5.4.3, the signal-to-noise ratio shall be not less than 30 dB (with the gain set, if possible, so that the reference signal of section 4.4.2 gives -3 dBm).

4.5 Tape Speed Requirement

When tested in accordance with section 5.5, the playback frequency of the recorded tone on test tape D shall be 2±0.200 kHz.

4.6 Flutter Requirement

When reproducing a constant frequency near 2 kHz (test tape D) and tested in accordance with section 5.5, the weighted peak flutter [5] content of the output signal shall not exceed 3 percent.

4.7 Dial Pulse Requirements

4.7.1 Pulse Time Interval Requirement

When tested in accordance with section 5.6, the combined time intervals for a break interval and its preceding or following make interval shall lie in the range 91 to 125 ms. In addition, the ratio of the break interval to either of the combined time intervals shall be not less than 0.58 or more than 0.64, in conformity with telephone company regulations [6].

For a single break pulse, the break interval shall be not less than 53 ms or more than 80 ms. The time interval between the final pulse (break to make) of a given digit and the beginning of the first pulse of the next digit (interdigital interval) shall be not less than 600 ms or more than 3 s [6].

4.7.2 Chatter, Spurious Breaks, and Spurious Make Requirement

When tested in accordance with section 5.7, the duration of pulse chatter shall not exceed 3 ms after the initial make-to-break or break-to-make transition of any pulse. Spurious breaks shall not occur in the time interval starting 100 ms before the first make-to-break transition and ending 100 ms after the last break-to-make transition of any pulse train that represents a digit. The duration of spurious breaks shall not exceed 1 ms; the separation between spurious breaks shall be at least 100 ms. The duration of spurious makes during the break interval shall not exceed 10 μs [6].

4.8 Dialing Impedance Requirement

When tested in accordance with section 5.8, the resistance of the device during the make state, as measured at its telephone terminals, shall be not more than 300 Ω and during the break state, the resistance shall exceed 150 kΩ [7].

4.9 Test Tape Dialing and Voice Message Requirement

When tested in accordance with section 5.9, the dialer shall correctly dial the programmed telephone number(s) and transmit one or more voice messages that are intelligible.

4.10 Telephone Line Control Requirement

The dialer shall be able to disconnect an incoming call and seize the telephone line for its own use when tested in accordance with section 5.10.

4.11 Line Checking (Option I) Requirement

If this option is provided, the dialer shall have a contact closure or other suitable means of actuating a local annunciator in the event that the dialer detects an unusable telephone circuit. As a minimum, the dialer shall check the telephone circuit for being shorted or open.

4.12 Tamper Protection (Option II) Requirement

If the dialer is in an enclosure, the dialer shall signal an alarm if an attempt is made to gain access to the dialer while it is in the secure state. When tested in accordance with section 5.12, the tamper switch shall not cause the system to signal an alarm until the cover or cover screw, whichever actuates the tamper switch, has moved at least 1.5 mm (0.06 in) and shall signal an alarm before the cover has moved a sufficient distance to permit a direct line of sight to electrical circuits or adjustment controls.

4.13 Test Speaker (Option III) Requirement

If this option is provided, the dialer shall not signal an alarm when the test speaker is actuated. The speaker and any associated circuitry shall be of sufficient quality that when tested in accordance with section 5.13 a tape that meets the requirements of section 4.9 shall be heard intelligibly through the test speaker.

4.14 Extension Phone Disconnect (Option IV) Requirement

If this option is provided, the dialer shall be able to disconnect an outgoing call and seize the telephone line for its own use when tested in accordance with section 5.14.

4.15 Stability Requirement

When tested for supply voltage variations, operation on standby power, mechanical shock, temperature, and humidity (sec. 5.15), the unit shall continue to operate correctly (sec. 4.9) and it shall not falsely actuate.

4.16 Electromagnetic Susceptibility Requirement

When subjected to radiated electromagnetic fields, conducted interference, and simulated lightning voltage surges on the telephone lines in accordance with section 5.16, the dialer shall meet the requirements of section 4.9 and shall not falsely actuate.

5. TEST METHODS

5.1 Sampling

Three dialers shall be selected at random for testing. Units with seriously damaged packaging or other obvious damage that would normally result in the units being returned should be excluded from tests.

5.2 Test Conditions

5.2.1 Test Environment

Unless otherwise specified, all tests shall be performed with the dialer operated at its specified normal operating voltage and in a typical laboratory ambient environment. In all cases, the dialer shall be allowed to warm up for a minimum of 5 min after being turned on, or as specified by the manufacturer, before any tests are performed.

5.2.2 Test Setup

The test equipment shall be connected to the dialer terminals through a loading circuit shown in figure 1. The signals are measured across the 600±6-Ω resistor. The 48±5-V talking battery is connected, with the polarity indicated, in series with the loop resistance of the telephone lines which is simulated by a nominal 200-Ω resistor in each side of the circuit. During the tests the positive side of the talking battery may be grounded, or it may be allowed to float, depending on the characteristics of the test instruments. The polarity of the connections to the dialer shall be in accordance with the manufacturer's directions. If there is a terminal for grounding the dialer, then the terminal shall be grounded; if not, then the dialer case shall be grounded.

5.2.3 Test Tape Content Description

Test Tape A—A recording of an audio frequency sweep spanning the range from 500 to 3200 Hz. Duration of the sweep is at least 1 min.

Test Tape B—A recording of a reference frequency of 1 kHz, accurate to ±0.1 percent, having a duration of 2 min.

Test Tape C—A recording of room noise as specified in section 5.2.4 from an open microphone, having a duration of 2 min.

Test Tape D—A recording of a constant frequency of 2 kHz, accurate to ±0.1 percent, having a duration of 2 min.

Test Tape E—A recording of a succession of programmed dialing pulses of the dial digit "one" lasting 1 min, followed by a succession of programmed dialing pulses of the dial digit "zero" also lasting 1 min.

Test Tape F—A recording of dialing pulses that will dial a test phone, and also contains a voice message to be transmitted after the test phone number has been reached.

5.2.4 Test Tape Preparation

If the tape programmer has provision for adjusting the recording level, adjust it according to the manufacturer's instructions. If the recording level is fixed, proceed to make the test tapes without adjustment. Consult the manufacturer if difficulty is encountered.

Test tape A is prepared as follows. Connect the audio sweep oscillator through an amplifier to a speaker. Aim the speaker toward a large room or in a direction that will minimize echoes. Align a sound

level meter coaxially with respect to the speaker. Sweep the oscillator at a uniform rate through the frequency range 500 to 3200 Hz and record on the x-y recorder the sound pressure level (as determined by the sound level meter) as a function of frequency. Select as a reference that frequency between 900 and 1000 Hz which produces the greatest sound pressure level. Adjust the amplifier gain so that this reference level is between 80 and 90 dB on the sound level meter. Replace the sound level meter by the programmer microphone and record the audio output of the speaker while the audio oscillator is uniformly swept from 500 to 3200 Hz once in a time period greater than 1 min.

Test tape B is prepared as follows. Without changing the basic setup or the adjustments for making test tape A, set the audio oscillator to a frequency of 1 kHz $\pm$1 Hz. Record this tone for 2 min.

Test tape C requires that the noise be at least 40 dB below the sound level used in recording the reference frequency of test tape B. Using the sound level meter measure the sound level in the test area. If the sound level in the room is at least 40 dB below the 80 to 90-dB reference level used for test tapes A and B, proceed. If the room noise is not at least 40 dB below the reference level, the room noise (background noise) will have to be lowered until it meets the 40-dB requirement. Record 2 min of room noise.

To prepare test tape D, set the audio oscillator to 2 kHz $\pm$2 Hz and record 2 min of this tone at the basic setup adjustments.

Using the instructions provided by the manufacturer for programming the telephone number to be called, prepare test tape E by repeatedly dialing the digit "one" for 1 min followed by repeatedly dialing the digit "zero" for 1 min.

Test tape F is prepared by following the manufacturer's instructions for creating a taped alarm message including a telephone number to be dialed.

5.3 Test Equipment

5.3.1 Amplifier and Speaker

The amplifier and speaker together shall have a response flat to within 0.5 dB over the frequency range 500 to 3200 Hz as measured by the sound level meter (sec. 5.3.8).

5.3.2 Audio Spectrum Analyzer

The Audio Spectrum Analyzer shall be capable of displaying the frequency of the input signal over the range 500 to 3200 Hz with an accuracy of not less than 10 percent of the indicated frequency and the amplitude of that signal on either a linear or logarithmic scale (logarithmic scale preferred) with an accuracy of $\pm$1 dB.

5.3.3 Audio Sweep Oscillator

The audio sweep oscillator shall be linear in frequency to within 1 percent over the frequency range 500 to 3200 Hz.

5.3.4 Distortion Analyzer

When used over the frequency range of 500 to 3200 Hz, and at a distortion reading of 5 percent, the distortion analyzer shall measure the total harmonic distortion with an uncertainty of less than $\pm$10 percent of the reading.

5.3.5 Frequency Counter

The counter shall be digital and capable of determining frequencies between 100 Hz and 4 kHz to within $\pm$2 Hz and provide at least four digits of information.

5.3.6 Flutter (and Wow) Meter

The flutter (and wow) meter shall conform to IEEE Std 193-1971 [5].

5.3.7 Lightning Surge Test Circuit

A circuit (fig. 2) designed to generate a pulse having a rise time of 10$\pm$2 μs and a decay time (to one half peak) of 1.6$\pm$0.2 ms.

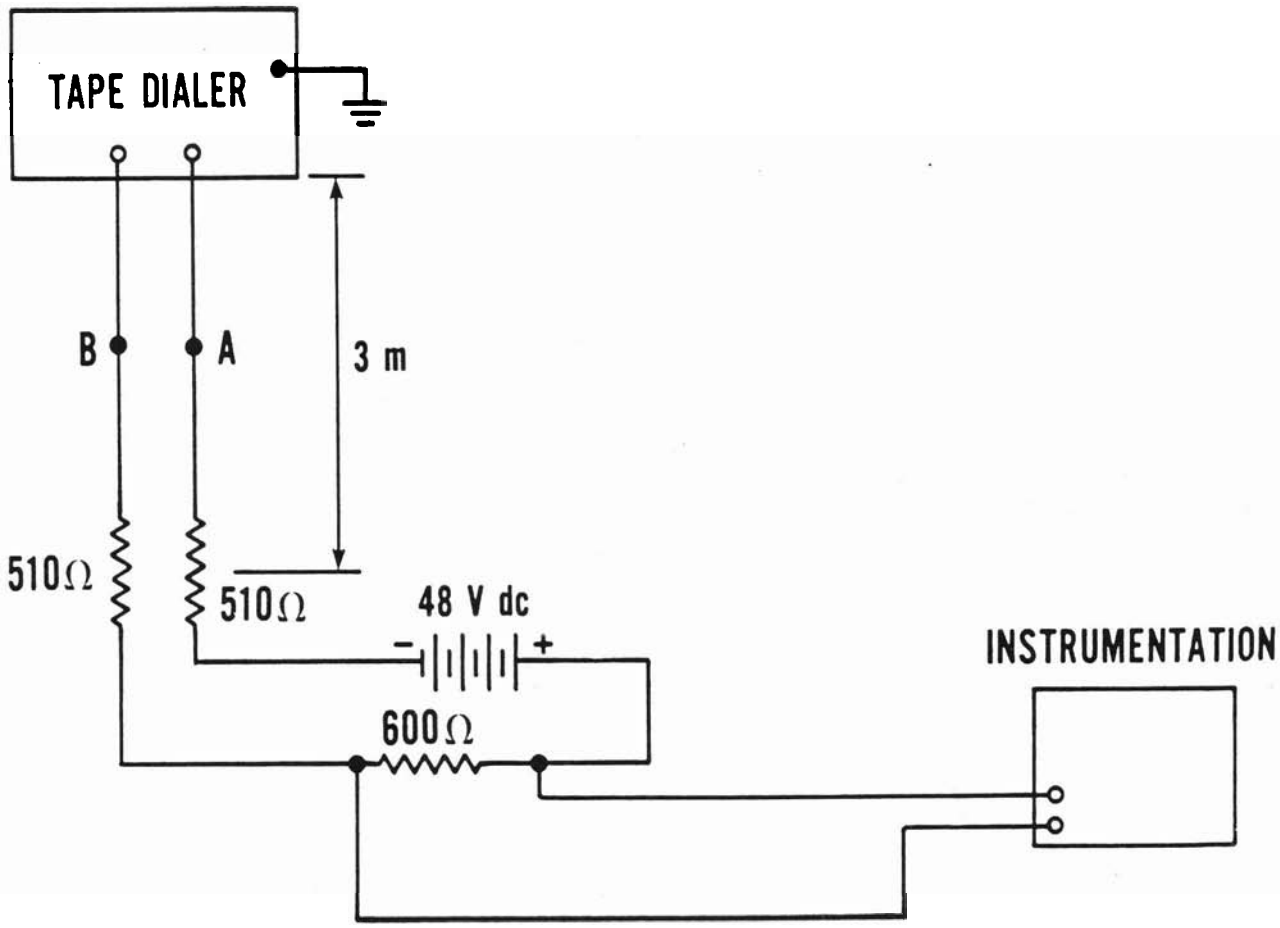

FIGURE 2. *Test circuit setup for conducted and radiated EMI tests.*

5.3.8 Sound Level Meter

The sound level meter shall conform to ANSI Standard S1.4-1971 [8].

5.3.9 VU Meter

The VU meter is an ac voltmeter with scale in decibels, designed to measure the relative volume of sound. The VU meter shall conform to ANSI Standard C16.5-1954 (R1961) [9].

5.3.10 X-Y Recorder

The X-Y recorder shall be accurate to 1 percent of full scale in each of the X and Y coordinates.

5.3.11 Environmental Test Chamber

The environmental test chamber(s) shall be of a size sufficient to accommodate the dialer and any associated enclosure and be capable of maintaining any temperature in the range 0 to 50 °C (32 to 122 °F) within ±2 °C (±3.6 °F). A recorder shall continuously record the temperature during the tests with an accuracy of ±1 °C (±1.8 °F).

The humidity test chamber(s) shall be capable of maintaining humidity in the range from 20 percent to at least 90 percent relative humidity within ±2 percentage points over the entire range of relative humidity at 30±5 °C (86±9 °F). A recorder shall continuously record the relative humidity and temperature during the test with an uncertainty of less than 1 percent.

5.3.12 High-Voltage Power Supply

The high-voltage power supply for the lightning surge test shall be capable of charging the 3.3-μF capacitor to 600-V dc in 10 s or less.

5.3.13 Oscilloscope and Camera

The oscilloscope shall have a high impedance differential input amplifier or plug-in amplifier with a bandwidth from dc to at least 1 MHz. Input resistance shall be 1 MΩ or higher while input capacitance shall be 50 pF or less. The common-mode rejection ratio shall be at least 500:1 for ac or dc signals. The oscilloscope shall have the capability of measuring test signals over a range of 1 mV to 100 V. A data recording camera compatible with the oscilloscope shall be used.

5.4 Electronic Tests

5.4.1 Frequency Response Test; Operating (Sound Pressure) Output Level Test

Play test tape A. Using the Audio Spectrum Analyzer determine the dialer's output signal level as a function of output frequency. From the record presented by the Audio Spectrum Analyzer determine the difference between the maximum and minimum response in dB units. Also, monitor the dialer output signal level with a VU meter. Correct for constant sound pressure level (i.e., subtract from the output signal value the output value at the reference frequency).

Play test tape B. Use the VU meter to measure the output signal from the dialer.

5.4.2 Harmonic Distortion Test

Connect a distortion analyzer or a spectrum analyzer to the dialer output terminals in parallel with the audio frequency voltmeter (as in fig. 1). Play test tape B and determine the harmonic distortion (up to at least the fourth harmonic) in the dialer output signal. Use of the talking battery is required. Repeat this test for each channel if more than one channel is provided. Measure distortion in this manner with the dialer operating from its internal standby power when this option is provided, as well as from the ac power line. Note: Harmonic distortion is defined as:

$$\frac{\sqrt{[V_{2f}^2+V_{3f}^2+---+V_{nf}^2]}}{V_f}$$

where V_f is the voltage of the fundamental frequency, and V_n's are the voltages of the nth harmonics.

5.4.3 Signal-to-Noise Ratio Test

Play test tapes B (signal) and C (noise). Determine the signal-to-noise ratio by using the VU meter across the 600-Ω resistor of figure 1 and taking the ratio of the two outputs.

5.5 Tape Speed and Flutter Tests

Play test tape D on the dialer operating at its nominal voltage. Using the frequency counter, measure the frequency of the output tone, and with the flutter (and wow) meter [5], measure the weighted peak flutter. (Disregard peaks that occur at a rate of less than one every 3 s.)

5.6 Dial Pulse Timing Test

Connect the equipment as shown in figure 1; then play test tape E on the dialer. Use the oscilloscope and an associated data recording camera to obtain a record of the dialing pulses. Set the oscilloscope sweep rate at 50 ms/cm to obtain at least four (make-to-break and break-to-make) transitions of the "zero" pulses on the oscilloscope screen. Take at least four photographs of the "zero" pulses and four photographs of the "one" pulses. From the photographs measure the duration of the make and break intervals and the interdigital spacing.

5.7 Chatter Test

By means of an oscilloscope (as in sec. 5.6), examine the dialing pulses of test tape E for any spurious makes or breaks. Take at least four photographs of the pulse trace; examine these for spurious breaks or makes and if any are observed, determine their duration and separations. The oscilloscope trace intensity and sweep rate will need adjusting to insure that any short-duration chatter has not been missed.

5.8 Dialing Impedance Test

With the dialer in the secure state, use an ohmmeter to measure the open-contact (break) impedance as seen at the telephone terminals of the dialer. Activate the dialer in accordance with the manufacturer's instructions, and measure the closed-contact (make) impedance at the same terminals. During these measurements the dialer should not be connected to any other apparatus.

5.9 Test Tape Dialing and Voice Message Test

Connect the dialer to the telephone lines in accordance with the manufacturer's instructions. Activate the dialer and play test tape F. Determine whether the dialer has correctly dialed the programmed number (7 to 11 digits) and transmitted an intelligible voice message. Repeat this four times for each channel.

5.10 Telephone Line Control Test

Connect the dialer to the telephone lines in accordance with the manufacturer's instructions. From a telephone not on the same line, place a call to the telephone number associated with the line the dialer uses. While the phone is ringing, activate the dialer and play test tape F. Verify that the requirements of sections 4.9 and 4.10 are met.

5.11 Line Checking (Option I) Test

Connect the dialer to the test circuit of figure 1. Monitor the local annunciator actuating circuit. Short the dialer terminals from "A" to "B." Activate the dialer. Note the status of the local annunciator actuating circuit. Remove the short. Repeat the above test but open the circuit first at "A" and then at "B" as separate tests.

5.12 Tamper Protection (Option II) Test

If the enclosure has a hinged cover, swing it open until the tamper switch is first actuated, and measure the displacement of the cover opposite the hinge. If the unit has a nonhinged cover, lift one side until the tamper switch first actuates, and measure the displacement of that side of the cover. Repeat this for each of the other three sides. If an unhinged cover cannot be lifted one side at a time, then lift or move it uniformly until the tamper switch first actuates, and measure the movement of the cover. If the device has a tamper switch actuated by the motion of a cover screw, retract the screw until the tamper switch is actuated, and measure the displacement of the screw.

In each case, examine the unit while the cover is lifted to the position just sufficient to actuate the tamper switch, and determine if there is a direct line of sight to any internal adjustment control or electrical circuitry.

5.13 Test Speaker (Option III) Test

With the dialer in its test mode, actuate the dialer and play tape F. Monitor the telephone terminals to determine if an alarm signal is transmitted and listen to the test speaker to check for conformance with section 4.13.

5.14 Extension Phone Disconnect (Option IV) Test

Connect the dialer to the telephone lines in accordance with the manufacturer's instructions. From a telephone on the same line (an extension phone), place a call. While the call is in progress, activate the dialer and play test tape F. Verify that the requirements of sections 4.9 and 4.14 are met.

5.15 Stability Tests

Set up the dialer according to section 5.2.2. Use a work bench for mounting the equipment unless instructed otherwise in each test.

5.15.1 High-Voltage Test

Connect the dialer to a variable voltage power supply. Adjust the power supply for a voltage of 110 ± 1 percent of the nominal operating voltage and perform the test of section 5.9.

5.15.2 Low-Voltage Test

Adjust the variable voltage power supply for a voltage of 85±1 percent of the nominal operating voltage and perform the test of section 5.9.

5.15.3 Standby Power Operation

Disconnect the dialer from the power line and permit it to operate from its fully charged standby power supply. After 1 min, reconnect it to the power line and again observe whether there are any transmitted alarms. Repeat the test two additional times. Disconnect the dialer from the power line and allow it to operate continuously from the standby power supply for the period of time specified by the manufacturer (sec. 4.2). Upon completion of the required operating period, perform the test of section 5.9. Allow the batteries to discharge to a level where the dialer will not operate. Reconnect the dialer to the power line voltage and again perform the test of section 5.9. Allow it to operate continuously for the period of time specified by the manufacturer to fully recharge the batteries. Then repeat the initial standby power operation test.

5.15.4 Shock Test

Disconnect the dialer from the power line voltage and standby power and place the unit on a bench with a horizontal solid wooden top at least 4-cm (1-5/8 in) thick or on a floor having at least the same rigidity as the work bench top. Using one edge of the unit as a pivot, lift the opposite edge until it forms an angle of 45° with the bench top, or the lifted edge has been raised 10 cm (4 in) above the horizontal surface, or the lifted edge is just below the point of perfect balance, whichever condition occurs first. Then let the unit drop back freely to the flat surface. Repeat, using other practical edges of the same horizontal side as the pivot edges for a total of four drops.

Repeat the entire procedure with the unit resting on other sides until it has been dropped a total of four times on each side on which the unit could be practically placed during servicing. Reconnect power and then test in accordance with section 5.9.

5.15.5 High-Temperature Test

Place the dialer in an environmental chamber at a temperature of 50±2 °C (122±3.6 °F). Allow it to remain at that temperature for a minimum of 4 h, and then while at that test temperature, perform the test in accordance with section 5.9. The instrumentation shall be located outside the environmental chamber. The dialer shall be arranged so that the reset switch can be actuated from outside of the chamber.

5.15.6 Low-Temperature Test

Place the dialer in an environmental chamber at a temperature of 0±2 °C (32±3.6 °F). Allow it to remain at that temperature for a minimum of 4 h, and then while at that test temperature, perform the test in accordance with section 5.9. The instrumentation shall be located outside the environmental chamber. The dialer shall be arranged so that the reset switch can be actuated from outside the chamber.

5.15.7 High-Humidity Test

Place the dialer in an environmental chamber at a relative humidity of 85±2 percent and at a temperature of 30±5 °C (86±9 °F). Allow it to remain at that humidity for 24 h, and while at the test humidity, perform the test in accordance with section 5.9. The instrumentation shall be located outside the environmental chamber. The dialer shall be arranged so that the reset switch can be actuated from outside of the chamber.

5.16 Electromagnetic Susceptibility Tests

The radiated electromagnetic susceptibility test shall be performed in a shielded room (EMI test chamber). The conducted electromagnetic susceptibility and lightning surge tests may be performed without an EMI chamber, however, the test site should be located away from sensitive instruments. The conducted radio frequency signals and voltage spikes on the power lines can interfere with the operation of such instruments.

5.16.1 Conducted Electromagnetic Susceptibility Tests

Connect the dialer as shown in figure 2. Observe whether the dialer activates during the performance of the tests.

Subject the dialer to power line conducted interference in accordance with test methods CS01, CS02, and CS06 of MIL-STD-462, [10]. Maintain a test level of 1- to 3-V rms, either manually or automatically, over the entire frequency test range.

Determine the level of susceptibility of the unit for each frequency at which the unit falsely actuates. Manually tune to the frequency at which the unit indicated an alarm, and raise the signal level from the lowest output level until the unit actuates. The threshold susceptibility level is that signal level for which the dialer will not actuate for a 10-percent reduction in the signal level from the level that does cause an actuation.

Repeat test CS02 on the transmission lines (points "A" and "B" of fig. 2) leading into the dialer.

5.16.2 Radiated Electromagnetic Susceptibility Test

Connect the dialer as shown in figure 2. The instrumentation and line resistors shall be located outside of the EMI test chamber during testing. Arrange the dialer so that the reset switch can be actuated from outside of the chamber.

Subject the dialer to radiation in accordance with test method RS03 of MIL-STD-462 [10]. Use an electric field of 1 V/m for frequencies in the range from 14 kHz to 2 MHz and 3 V/m for frequencies in the range from 2 MHz to 12 GHz.

Determine the susceptibility of the unit for each frequency or frequency band at which the unit actuates. The susceptibility level is that signal level for which the dialer will not actuate for a 10 percent reduction in signal level from the level that does cause an actuation.

5.16.3 Lightning Surge Test

Connect the lightning surge test circuit to the oscilloscope, with the output of the circuit terminated in a 600-Ω resistor as shown in figure 3. Operate the circuit and examine the pulse shape. If necessary, change the values of the nominal 33-Ω resistor and 0.1-μF capacitor to get a 600±30-V pulse with a rise time of 10±2 μs and a decay time to one-half maximum of 1.6±0.2 ms.

Connect the dialer as shown in figure 1. Remove the 600-Ω terminating resistor and connect the lightning simulation test circuit across transmission lines at points A and B. Apply five test surges of each polarity to the dialer, with at least a 15-s interval between surges to insure that the 3.3-μF capacitor in the pulse circuit is fully charged. Repeat the test with the lightning surge simulator circuit connected between ground and, respectively, points A and B with the 600-Ω terminating resistor connected across the output of the pulse circuit. Record any alarm actuations. Finally, perform the test tape dialing and voice message test of section 5.9, once for each channel.

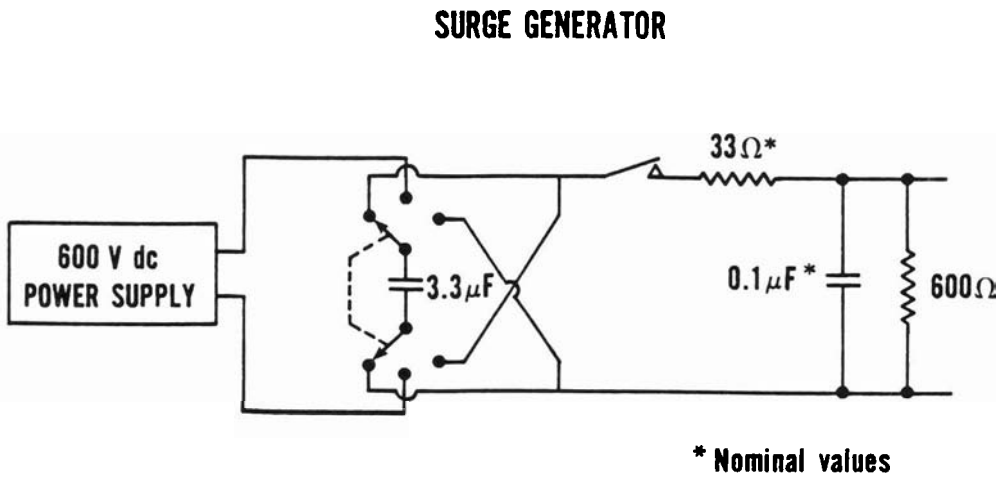

FIGURE 3. *Simulated lightning surge generation circuit.*

APPENDIX A—REFERENCES

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*US GOVERNMENT PRINTING OFFICE: 1984 814/23756