



ANSI/CAN/UL 2524:2024

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

STANDARD FOR SAFETY

Emergency Responder Communication Enhancement Systems

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SCC FOREWORD

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UL Standard for Safety for Emergency Responder Communication Enhancement Systems, ANSI/CAN/UL 2524

Third Edition, Dated March 22, 2024

Summary of Topics

This new Third Edition of ANSI/CAN/UL 2524 dated March 22, 2024 includes the following changes in requirements:

- ***Correction to Polarity Reversal Test; [46.1](#)***
- ***Revised standard title to "Emergency Responder Communication Enhancement System"; [1.1](#), [1.3](#), [6.2](#), [6.10](#), [33.2](#), [36.1.1](#) – [36.1.3](#), [36.1.5](#) and [54.12](#)***
- ***Updated references to Model Building and Installation Codes; [1.2](#), Section [5](#) and [53.1.1](#)***
- ***Optical fiber technology and relaxation of enclosure requirements for equipment intended for indoor use/dry locations; [9.1.1](#)***
- ***Clarification of on-premises visual and labeled indications; [6.30](#), [36.1.3](#); [36.1.6](#); [34.2](#) and [34.3](#)***
- ***Update of Annex [A](#) – Standards for Components***
- ***Addition of requirements for products intended to be installed outdoors; Section [49](#), Section [51](#), and [53.1.22](#)***
- ***Corrections to Section [28.3](#)***
- ***Clarification of maximum propagation delay; [34.4](#)***

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated September 29, 2023 and December 20, 2023.

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MARCH 22, 2024



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ANSI/CAN/UL 2524:2024

Standard for Emergency Responder Communication Enhancement Systems

First Edition – October, 2018
Second Edition – January, 2019

Third Edition

March 22, 2024

This ANSI/CAN/UL Safety Standard consists of the Third Edition.

The most recent designation of ANSI/UL 2524 as an American National Standard (ANSI) occurred on March 22, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on March 22, 2024.

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Preface

This is the Second Edition of the ANSI/CAN/UL 2524, Standard for Emergency Responder Communication Enhancement Systems.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 2524 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

Annex [A](#), identified as informative, is for information purposes only.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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This Edition of the Standard has been formally approved by the Technical Committee (TC) on Emergency Responder Communication Enhancement Systems, TC 2524.

This list represents the TC 2524 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

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Patrick Adamo	Firecom Inc	Producer	USA
Chad Brown	Peterborough Fire Services	AHJ	Ontario
Mike Brownson	Westell Technologies INC	Producer	USA
Adam Carroll	Hartland Deerfield Fire Authority	AHJ	USA
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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

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INTRODUCTION

1 Scope

1.1 These requirements cover products (e.g. repeater, transmitter, receiver, signal booster components, remote annunciators and operational consoles, power supply, and battery charging system components) used for emergency responder communication enhancement systems installed in a location to improve wireless communication at that location.

1.2 In the United States – These requirements cover products to be employed in accordance with the following Model Building and Installation Codes:

- a) Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, NFPA 1221;
- b) Standard for Emergency Services Communications, NFPA 1225;
- c) National Electrical Code, NFPA 70;
- d) Fire Code NFPA 1;
- e) Life Safety Code, NFPA 101;
- f) International Fire Code
- g) Building Construction and Safety Code, NFPA 5000.

1.3 The products covered by this standard are intended to be used in combination with other products and devices to form an emergency responder communication enhancement system. An installation document(s) provided with the product describes the various products needed to form an emergency responder communication enhancement system and their intended use and installation.

1.4 These requirements address the safety, reliability and operational requirements prior to installation.

1.5 These requirements do not include determination of compliance with national regulations addressing electromagnetic radiation and use of radio frequencies. Should products covered by these requirements be required to comply with national regulations, a report of verification from the manufacturer is required as evidence of such compliance.

2 Components

2.1 Except as indicated in [2.2](#), a component of a product covered by this standard shall comply with the requirements for that component. See Annex [A](#) for a list of standards covering components used in the products covered by this standard.

2.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Normative References

5.1 The following standards are referenced in this standard, and portions of these referenced standards may be essential for compliance.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D396, *Standard Specification for Fuel Oils*

ASTM E11, *Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves*

ASTM E230/E230M, *Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

CSA C22.1, *Canadian Electrical Code, Part I, Safety Standard for Electrical Installations*

CSA C22.2 No. 0.15-01, *Adhesive Labels*

CSA C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 65, *Wire Connectors*

CSA C22.2 No. 88, *Splicing Wire and Cable Connectors*

CSA C22.2 No. 94.1, *Enclosures for Electrical Equipment, Non-Environmental Considerations*

CSA C22.2 No. 94.2, *Enclosures for Electrical Equipment, Environmental Considerations*

CSA C22.2 No. 158, *Terminal Blocks*

CSA C22.2 No. 223, *Power Supplies with Extra-Low-Voltage Class 2 Outputs*

CSA C22.2 No. 60065, *Audio, Video, and Similar Electronic Apparatus-Safety Requirements*

CSA C22.2 No. 60950-1, *Information Technology Equipment*

CSA C22.2 No. 62368-1, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*

IEEE C62.41, *Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits*

IEC 60417-1, *Graphical Symbols for Use on Equipment – Part 1: Overview and Application*

International Fire Code

NFPA 1, *Fire Code*

NFPA 70, *National Electrical Code*

NFPA 72, *National Fire Alarm and Signaling Code*

NFPA 101, *Life Safety Code*

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*

NFPA 1225, *Standard for Emergency Services Communications*

6 Glossary

6.1 ACKNOWLEDGE – Action taken to confirm that a message or signal has been received, such as pressing a button.

6.2 ACTIVE RADIO FREQUENCY EMITTING DEVICE – A powered device that emits a radio frequency signal as part of an emergency responder communication enhancement system.

6.3 ADVERSE CONDITION – Any condition occurring in a circuit or communication path that interferes with the proper signaling or interpretation of status-change signals or both. Conditions include radio frequency interference.

6.4 AIR-HANDLING SPACE – Space used for environmental air-handling purposes other than ducts or plenums. The space over a hung ceiling used for environmental air-handling is an example.

6.5 ANNUNCIATOR – A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location.

6.6 AVERAGE VALUE – The sum of all instantaneous values of current (or voltage), averaged over one-half of an alternating cycle.

6.7 BATTERY CHARGER – A product intended to deliver sufficient current to maintain storage batteries in their fully-charged condition while the batteries are not connected to a load.

6.8 DAQ (Delivered Audio Quality) – A measure of speech intelligibility of Land Mobile Radio.

6.9 DISCHARGED BATTERY – A standby battery discharged as described in [37.2](#).

6.10 DONOR ANTENNA – Antennas used with the emergency responder communication enhancement systems that provide the connection between it and the wide area communications system of interest.

6.11 END-OF-LINE DEVICE – A device installed at the end of a circuit for the purpose of monitoring the circuit for fault conditions.

- 6.12 EXTERNAL CIRCUITS – Circuits or wiring leaving the product.
- 6.13 FAULT – An open, ground, or short-circuit condition on any line extending from a product.
- 6.14 FIELD WIRING – Conductors to be installed in the field to connect a product to source(s) of supply, devices, other products, and loads.
- 6.15 FIXED EQUIPMENT – Any equipment product that is intended to be permanently connected electrically to the wiring system.
- 6.16 GROUNDED CONDUCTOR – A conductor employed to connect the intentionally grounded circuit of a wiring system to a grounding electrode.
- 6.17 GROUND FAULT – A circuit impedance to ground sufficient to result in the annunciation of a trouble condition.
- 6.18 GROUNDING CONDUCTOR – A conductor employed to connect non-current-carrying parts of equipment, raceways, and enclosure to a grounding electrode at the service which is, in turn, connected to earth ground or to some conducting body which serves in place of earth ground.
- 6.19 OPEN FAULT – A circuit impedance increase sufficient to prevent normal operation.
- 6.20 OPERATOR – Individual(s) responsible to access and operate the product and/or system, but does not have access to portions of the product required for servicing and maintenance.
- 6.21 OPERATOR INTERFACE – Providing controls for manually operating the product/system or interrogating the system for faults.
- 6.22 PASSIVE RF COMPONENT – Any device that RF passes through that does not have an active electronic component that requires external power. This includes antennas, splitters, couplers, coaxial cable and connectors. Passive components cannot amplify RF signals.
- 6.23 PATH (PATHWAY) – Any conductor, optic fiber, radio carrier, or other means for transmitting information between two or more units and/or locations.
- 6.24 POWER SUPPLY – A source of electrical operating power including the circuits and terminations connecting it to the dependent product/system components.
- 6.25 POWER SUPPLY-BATTERY CHARGER – A power supply that serves the dual function of providing operating power and charging storage batteries. The power supply is usually permanently connected to storage batteries, and the power supply-battery combination is intended to provide all of the electrical operating power required by the equipment to which the combination is connected, when the equipment is operating in its intended manner.
- 6.26 REPEATER – A device for receiving and re-transmitting two-way communication signals.
- 6.27 RESET – A control function that attempts to return a system or device to its normal state.
- 6.28 RISK OF ELECTRIC SHOCK – A risk of electric shock is determined to exist at any part if:
- a) The potential between the part and earth ground or any other accessible part is more than 42.4 V peak, and

b) The continuous current flow through a 1500 W resistor connected across the potential exceeds 0.5 mA.

6.29 RISK OF FIRE – A risk of fire is considered to exist at any two points in a circuit where:

a) The open circuit voltage is more than 42.4 V peak and the energy available to the circuit under any condition of load including short circuit, results in a current of 8 A or more after 1 min of operation; or

b) A power of more than 15 W can be delivered into an external resistor connected between the two points.

6.30 SIGNAL SOURCE MALFUNCTION — An abnormal condition resulting in the loss of the RF signal from the public safety radio communications system to the ERCES. Examples include the disconnection of the antenna coax, a short in the coax, a damaged coax, a misdirected donor antenna, donor antenna malfunction, damage to fiber optic cable (if the source of the signal is a fiber optic cable between the sites), and oscillation detection.

6.31 SOFTWARE – Programs, instructions, procedures, data, and the like that are executed by a central processing unit of a product and which influences the functional performance of that product. For the purpose of this standard, software is one of two types:

a) EXECUTIVE SOFTWARE – Control and supervisory program which manages the execution of all other programs and directly or indirectly causes the required functions of the product to be performed.

b) SITE-SPECIFIC SOFTWARE – Program that is separate from, but controlled by, the executive software which allows inputs, outputs, and system configuration to be selectively defined to meet the needs of a specific installation.

c) DEVICE SPECIFIC FIRMWARE – Firmware that is accessed via a connection and modified via a graphical user interface.

6.32 STANDBY POWER SOURCE – Provides power when the primary power source fails.

6.33 STORAGE BATTERY – Any battery which, by design or construction, is intended to be recharged. The storage battery is intended to provide a secondary source of operating power in response to failure of the primary source of operating power.

6.34 SUPERVISORY SIGNAL – A signal indicating the need of action in connection with the supervision of watchmen, sprinkler and other extinguishing systems or equipment, or with the maintenance features of other protective systems.

6.35 SUPPLEMENTARY – Refers to equipment or operations not required by this standard.

6.36 SUPPLEMENTARY DEVICE – A device intended to be connected to a supplementary device circuit.

6.37 SUPPLEMENTARY-DEVICE CIRCUIT – A circuit provided by a product for controlling a device, the operation of which is supplementary to the primary initiating and indicating devices of the control unit.

6.38 TROUBLE SIGNAL – A visual or audible signal indicating a fault condition of any nature, such as a circuit break or ground or other trouble condition occurring in the device or wiring associated with a protective signaling system.

6.39 USER – An individual who operates or services the product.

6.40 WIRE-TO-WIRE FAULT – A wire-to-wire (short circuit) fault is determined to be a resistance of 0.1 Ohm or less across the circuit.

7 Information Required for Assessment

7.1 The following documentation may be required to determine compliance:

- a) Schematic diagrams of all circuits.
- b) Where the product uses software, the software revision level.
- c) Marking to be applied to the product as required in Markings, Section [53](#).
- d) Installation wiring diagram/instructions as required in Installation Wiring Diagram/Instructions, Section [54](#).

7.2 Samples representative of all manufactured components utilized in the system may be required to determine compliance.

CONSTRUCTION

8 General

8.1 A product shall use materials that have been determined to comply with the requirements for the particular use, as indicated by the performance requirements of this standard.

8.2 Metals, when required to meet the requirements of this standard, shall not be used in such combination as to cause galvanic action that will increase the risk of fire, electric shock, injury to persons, or impair the operation of a product associated with the safety of life and/or property protection.

8.3 Where breakage or deterioration of a part such as an enclosure, a frame, a guard, or the like can result in a risk of injury to persons, the part shall be constructed to meet the demand or expected loading conditions.

8.4 The requirement in [8.3](#) applies also to those positions of a part adjacent to a moving part identified to involve a risk of injury to persons.

8.5 Electrical equipment with nonmetallic enclosures and other non-metallic discrete objects, intended to be installed in air-handling spaces shall additionally comply with the requirements in:

- a) United States, The Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, UL 2043, or
- b) Canada, Fire Test for Heat and Visible Smoke Release for Discrete Products, ULC-S142.

8.6 Products that currently meet all the requirements of one of the standards indicated below need only be evaluated to the following sections with respect to the construction requirements: [9.1](#), [9.2](#), [9.3](#), [12.5](#), [14.1.1](#), [14.2.1.1](#), [14.2.2.1](#), [14.2.5](#), [15.1.2](#) – [15.1.5](#), [15.3](#), [15.6](#), [17.4](#), [22](#), and [26.1](#).

a) In the United States

- 1) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, or

2) Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1, or

3) Standard for Audio, Video, and Similar Electronic Apparatus-Safety Requirements, UL 60065.

b) In Canada

1) CSA C22.2 No. 60950-1, Information Technology Equipment, or

2) CSA C22.2 No. 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, or

3) CSA C22.2 No. 62368-1, Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements.

9 Enclosures

9.1 General

9.1.1 All repeater, transmitter, receiver, signal booster components, optical-to-RF converters, RF-to-optical converters, external filters, and battery system components shall be contained in enclosures that comply with the requirements for a Type 4 or 4X enclosure covered by the standards indicated below:

a) In the United States

1) Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50 and

2) Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E.

b) In Canada

1) CSA C22.2 No. 94.1, Enclosures for Electrical Equipment, Non-Environmental Considerations, and

2) CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations.

Exception No. 1: Rechargeable standby batteries are permitted to be contained in enclosures that comply with the requirements for a Type 3R specified in the following standards:

a) In the United States

1) *Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50 and*

2) *Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E.*

b) In Canada

1) *CSA C22.2 No. 94.1, Enclosures for Electrical Equipment, Non-Environmental Considerations, and*

2) *CSA C22.2 No. 94.2, Enclosures for Electrical Equipment, Environmental Considerations.*