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INTERNATIONAL 5ESS® SWITCHING EQUIPMENT MESH EARTHING BUILDING CIRCUIT

TABLE OF CONTENTS PAGE

SECTION I - GENERAL DESCRIPTION . . 1

1. PURPOSE OF CIRCUIT. 1

2. DEFINITIONS 1

3. APPLICATIONS. 2

SECTION II - DETAILED DESCRIPTION . 2

1. EQUIPMENT RACK EARTHING 2

2. MESH EARTHING 2

3. BATTERY SUPPLY. 3

4. CBN CONNECTION. 3

5. SHIELDED CABLES 3

SECTION III - REFERENCE DATA. . . . 3

1. WORKING LIMITS. 3

2. TESTING REQUIREMENTS. 3

3. REFERENCES. 4

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The Mesh Earthing Building Circuit bonds the various earthing conductors within a telecommunication center to accomplish [1]:

- safety from electrical hazards,
- reliable signal reference, and
- satisfactory EMC performance.

Involved are the 5ESS® Switch shielded cabinet structure, earthing conductors, cable shields, AC electrical power protective earths, battery plant conductors, and conductive building structure components that are intended to be at the earth potential.

2. DEFINITIONS [1]

2.01 Earth is the conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero. Note that the word "earth" (European) is synonymous with the word "ground" (North American) when applied to electrical circuits.

2.02 The Bonding Ring Conductor (BRC) is a ring conductor along the inside perimeter of the building. A basic element of the Common Bonding Network (CBN).

2.03 The Common Bonding Network (CBN) is the principal means for effectively bonding and earthing inside a telecommunication building. It is the set of metallic components that are intentionally or incidentally interconnected to form the principal bonding network in a building, and include: structural steel or reinforcing rods, metallic plumbing, AC power conduit, Protective Earth (PE) conductors, cable racks, bonding conductors, and the BRC. The CBN always has a mesh topology and is connected to the earthing network.

2.04 The Earth Electrode is a conductive part or group of conductive parts in intimate contact with and providing an electrical connection with earth.

2.05 The Main Earthing Terminal (MET) is a terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors and conductors for functional earthing, if any, to the means of earthing.

2.06 The System Reference Potential Plane (SRPP) is a conductive solid plane, as an ideal goal in potential equalizing, that is approached in practice by the mesh network formed by the array of copper bars connecting all the equipment racks.

3. APPLICATIONS

3.01 The Mesh Earthing Building Circuit does not apply to all 5ESS® Switch installations. It is used only with the version of the switch designed to comply with European requirements for ElectroMagnetic Compatibility (EMC) and mesh earthing. It cannot be used on any installation that employs the single-point method of system grounding. The concept of interconnecting the earthing structure and the (+) conductors of the 48V supply at multiple points is a violation of the single-point ground concept.

SECTION II - DETAILED DESCRIPTION

1. EQUIPMENT RACK EARTHING

1.01 Within each equipment rack, the following conductive elements are all electrically connected together:

- -48V RTN conductors,
- line and trunk circuitry,
- framework,
- digital circuit grounds,
- cable shields, and
- AC protective conductor.

Located at the top of each rack is the low-impedance copper bar structure called the System Reference Potential Plane (SRPP), which bonds together the equipment racks and the -48VRTN conductors.

2. MESH EARTHING

2.01 The SRPP is the "mesh," which is an array of rectangles formed by copper bars having a 3mm x 20mm cross-section. These components are part of the overhead cable rack assembly and cable rack coupling kit. Each rectangle has an area of one square meter or less. Because of its low impedance, the SRPP forms an equipotential plane keeping all the equipment racks at one potential during transient current surges.

3. BATTERY SUPPLY

3.01 The feeder power lines, -48V and -48VRTN, between the battery and the Power Control and Distribution Frame (PCDF) supply the current required to power the 5ESS® Switch. The minimum size of these feeder cables is controlled by two factors. One is the allowable current capacity rating of the conductors, and the other is the maximum allowed voltage drop between the battery and the PCDF. The method of determining the feeder cable size for the 5ESS® Switch is documented in drawing SD-5D005-01, "5ESS® Switching Equipment DC Power Distribution Circuit."

3.02 The -48V feeder cables carries 100% of the battery current. However, the return current is split between the -48VRTN feeder cables and the building earthing system. Since the building earthing system will be very low impedance, it will carry a large portion of the return current. Bonding conductors BC-A, BC-B, BC-C, BC-D, and BC-E, as defined in SD-5D515-01, sheet A2, must be large enough so that the -48VRTN current will never exceed their allowable current capacity ratings. This must be true under the following conditions:

A. maximum possible current drain by the equipment at full growth, and

B. over-current in the case of a fault between the negative power conductor and any part of the mesh earth bonding network.

The same consideration must also be given to any other conductor in the Mesh Earthing Building Circuit that carries the -48VRTN current.

4. CBN CONNECTION

4.01 Refer to SD-5D515-01, sheet B2. Conductors BC-C make the connection between the CBN and the SRPP. Spacing these conductors equally around the perimeter of the SRPP minimizes any potential differences between the CBN and the SRPP. Increasing the number of BC-C connections will lower the earthing impedance of the total earthing structure.

5. SHIELDED CABLES

5.01 All shielded cables that exit from the equipment rack/cabinet have their shields connected to an earth conductor (frame ground) at both ends.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 The number of BC-C connections between the SRPP and the CBN will be determined by the size of the switch, the building layout, and the local standards of the customer.

1.02 For example, The Netherlands PTT requires the spacing between the BC-C bonding conductors to be five meters or less. [2]

1.03 The size of bonding conductor BC-E, Digital Distribution Frame (DDF) to SRPP, will be determined by the customer. For example, The Netherlands PTT requires BC-E be seventy square millimeters or larger. This minimum size assures that any -48VRTN DC currents that may flow in the shielded cables (DDF to Equipment Rack) will have an extremely low magnitude and will not be significant.

2. TESTING REQUIREMENTS

2.01 Refer to SD-5D515-01, sheets A2 and B2, for bonding conductor definitions and locations. After initial operation, bonding conductors BC-A, BC-B, BC-C, BC-D, and BC-E, and other parts of the Mesh Earthing Building Circuit that carry -48VRTN

battery current must be checked with a DC current probe. The measurements must be modified by a correction factor to compensate for maximum equipment growth. Corrected measurements must be compared to the allowable current capacity rating of the conductors. Further derating of the conductors may be required for over-current that will occur in case of a fault between the negative power conductor and the mesh bonding network.

3. REFERENCES

1. ETSI DRAFT DE/EE 2002, dated Jan. 27, 1991: "Earthing and Bonding of Telecommunication Equipment in Telecommunication Centres."

2. The Netherlands PTT Telecom specification TF-572-08-F, dated 900202, issue 3 "Specification of Requirements for: Combined ISDN/PSTN Telecommunication Exchanges."

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