Application Note

Medical Device EMC Compliance

IEC 60601-1-2 Essentials

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Applicable Standards: IEC 60601-1-2 Ed. 4.1, IEC 61000 Series

1. Introduction

Medical electrical equipment must operate reliably in the complex electromagnetic environment of healthcare facilities while not interfering with other medical devices or critical systems. IEC 60601-1-2, the collateral standard for electromagnetic compatibility within the IEC 60601 series, establishes requirements and test methods to ensure medical devices maintain basic safety and essential performance under electromagnetic stress.

This application note provides comprehensive guidance on EMC compliance for medical devices, focusing on IEC 60601-1-2 Edition 4.1 requirements. Understanding these requirements is essential for device manufacturers to achieve regulatory approval, ensure patient safety, and prevent device malfunctions due to electromagnetic interference.

1.1 Evolution of IEC 60601-1-2

IEC 60601-1-2 has evolved significantly since its first edition in 1993. Edition 4, published in 2014, introduced major changes including risk-based testing, environment-specific immunity levels, and enhanced requirements for wireless medical devices. Edition 4.1, published in 2020, provides clarifications and addresses large equipment testing, proximity field immunity, and updated normative references.

Edition	Year	Key Changes
Edition 1	1993	Initial EMC requirements
Edition 2	2001	Expanded frequency ranges
Edition 3	2007	Life-supporting classification
Edition 4	2014	Risk-based approach, environment classification
Edition 4.1	2020	Proximity field immunity, large equipment guidance

2. Risk Management and EMC

Edition 4 fundamentally changed the approach to medical device EMC by integrating electromagnetic disturbances into the overall risk management process per ISO 14971. Manufacturers must identify basic safety and essential performance characteristics, assess risks from electromagnetic phenomena, and establish appropriate immunity test criteria.

2.1 Basic Safety and Essential Performance

Basic safety refers to freedom from unacceptable risk directly caused by physical hazards when medical electrical equipment is used under normal and single fault conditions. Essential performance refers to performance necessary to achieve freedom from unacceptable risk. These concepts form the foundation for EMC acceptance criteria.

Determining Essential Performance:

1. Identify intended use and reasonably foreseeable misuse
2. Analyze which performance characteristics affect patient safety
3. Document essential performance in technical specifications
4. Define acceptance criteria for EMC testing based on essential performance
5. Consider all operational modes and configurations

2.2 Environment Classification

IEC 60601-1-2 defines two electromagnetic environments with different immunity test levels. The manufacturer must determine the intended environment and test accordingly. This classification significantly impacts immunity test severity.

Professional Healthcare Environment:

Hospitals, clinics, dental offices, and dedicated healthcare facilities. Higher immunity levels required (typically 3-10 V/m for radiated RF immunity). Assumes professionally maintained equipment and controlled electromagnetic environment.

Home Healthcare Environment:

Residential settings, nursing homes, commercial buildings, and vehicles. Higher immunity levels required (typically 3-10 V/m for radiated RF immunity, same as professional). Assumes less controlled environment with consumer electronics, cordless phones, and wireless networks present.

3. Emissions Testing Requirements

Medical devices must comply with emissions limits to prevent interference with other devices and systems. IEC 60601-1-2 references **CISPR 11** for emissions testing, with specific requirements for Group 1 and Group 2 equipment, and Class A and Class B limits.

3.1 Conducted Emissions

Conducted emissions testing measures RF voltage on AC mains power supply leads in the frequency range **150 kHz to 30 MHz**. Testing uses a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) with measurements taken using quasi-peak and average detectors.

Test Parameters:

- **Frequency range:** 150 kHz - 30 MHz
- **Measurement types:** Quasi-peak and average detection per CISPR 16-1-1
- **Class B limits** typically required for home healthcare devices
- **Group 1 classification** for most medical devices (no intentional RF generation)
- **Test voltage:** Rated AC supply voltage during all operational modes

Recommended Com-Power Equipment for Conducted Emissions:

Line Impedance Stabilization Networks (LISNs):

- **LI-150C LISN** - 150 kHz to 30 MHz, ideal for CISPR 11 conducted emissions testing
- **LI-1100 LISN** - 100A rating, compliant with CISPR 16-1-2 and ANSI C63.4
- **Three-Phase LISNs** - Available in 16A to 100A current ratings for three-phase medical equipment
- **LI-325C LISN** - Multi-standard compliance including CISPR 25 and CISPR 16-1-2

EMI Receivers and Spectrum Analyzers:

- **Com-Power Spectrum Analyzers** - Full compliance and pre-compliance options with quasi-peak and average detectors

Transient Protection:

- **LIT-153A Transient Limiter** - 150 kHz-30 MHz, 10 dB insertion loss, protects spectrum analyzer input from voltage spikes

Current Monitoring Probes (for diagnostic measurements):

- **CLCE-332 Current Probe** - 9 kHz-300 MHz, 32 mm aperture, CISPR compliant
- **CLCE-438 Current Probe** - 9 kHz-400 MHz, 38 mm aperture for larger cables

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3.2 Radiated Emissions

Radiated emissions testing measures electromagnetic field strength at specified distances in the frequency range **30 MHz to 6 GHz**. Testing is performed in a semi-anechoic chamber or Open Area Test Site (OATS) with the device operating in all normal modes.

Test Requirements:

- **Frequency range:** 30 MHz - 6 GHz
- **Test distance:** 3 meters (can be 10m for large equipment)
- **Antenna polarizations:** Horizontal and vertical
- **Measurement types:** Quasi-peak (30-1000 MHz), peak (>1000 MHz)
- **Wireless devices:** Intentional transmissions exempted, spurious emissions must comply

Recommended Com-Power Equipment for Radiated Emissions:

Broadband Antennas (Com-Power Antenna Product Line):

- **Biconical Antennas** - 30-200 MHz coverage, ideal for lower frequency medical device emissions
- **AC-220 CombiLog Antenna** - 20 MHz to 2 GHz receiving range, reduces test time by 30%
- **ACL-6000 CombiLog Antenna** - 30 MHz to 6 GHz receiving, covers entire CISPR 11 radiated emissions frequency range
- **Log-Periodic Antennas** - 200 MHz to 2 GHz for mid-range frequencies
- **Horn Antennas** - 1-18 GHz for higher frequency emissions (wireless medical devices)
- **Active Horn Antennas** - Built-in preamplifiers for improved sensitivity above 1 GHz

EMI Receivers and Measurement Equipment:

- **Com-Power EMI Receivers** - Quasi-peak and peak detection for CISPR 11 compliance
- **Preamplifiers** - Low noise figure for measuring low-level emissions

Reference Signal Sources:

- **CGO-520 Comb Generator** - Broadband EMC reference signal source for system verification

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4. Immunity Testing Requirements

Immunity testing verifies that medical devices maintain **basic safety and essential performance** when subjected to electromagnetic disturbances. IEC 60601-1-2 specifies eight immunity tests addressing different electromagnetic phenomena and coupling mechanisms.

4.1 Electrostatic Discharge (ESD) - IEC 61000-4-2

ESD testing simulates human body discharges that occur during normal device handling and operation. Testing includes both contact discharge (direct application to conductive surfaces) and air discharge (discharge to insulated surfaces and air gaps).

Test Levels:

- **Contact discharge:** ±8 kV (typical for both environments)
- **Air discharge:** ±15 kV (typical for both environments)
- **Test points:** All user-accessible surfaces and connectors
- **Discharge rate:** Minimum 10 discharges per point, both polarities

Recommended Com-Power Equipment for ESD Testing:

Note: Com-Power focuses primarily on conducted and radiated EMC testing equipment. For ESD testing per IEC 61000-4-2, we recommend contacting Com-Power at www.com-power.com for:

- ESD generator recommendations from partner manufacturers
- Complete ESD test setup consultation
- ESD coupling planes and test fixtures

Alternative: Major ESD simulator manufacturers include EM Test, Teseq, and Haefely. Com-Power can provide guidance on compatible test setups.

4.2 Radiated RF Immunity - IEC 61000-4-3

This test simulates electromagnetic fields from radio transmitters, mobile phones, and wireless communication equipment. The device is exposed to amplitude-modulated RF fields while monitoring for malfunction or performance degradation.

Test Parameters:

- **Frequency range:** 80 MHz - 2.7 GHz
- **Field strength:** 3-10 V/m depending on environment and risk assessment
- **Modulation:** 1 kHz sine wave, 80% amplitude modulation
- **Frequency step:** 1% of test frequency
- **Dwell time:** Time necessary to evaluate basic safety and essential performance

Recommended Com-Power Equipment for Radiated RF Immunity:

RF Power Amplifiers (Com-Power Amplifier Product Line):

- **ACS-230-25W RF Amplifier** - 150 kHz-230 MHz, 25W output
  - Suitable for 3 V/m test levels in typical chamber setups
  - High gain (43 dB ±2), AM/FM/pulse modulation compatible
- **ACS-230-50W RF Amplifier** - 150 kHz-230 MHz, 50W output
  - Suitable for 10 V/m test levels or larger chambers
  - 47 dB gain, automatic safety shutoff
- **ACS-250-100W RF Amplifier** - 150 kHz-250 MHz, 100W output
  - High-power solution for demanding test requirements
  - LCD display with real-time power monitoring

Note: For frequencies above 250 MHz up to 2.7 GHz, contact Com-Power for additional amplifier recommendations.

Transmitting Antennas:

- **Biconical Antennas** - 80-200 MHz transmitting
- **AC-220 CombiLog Antenna** - 80 MHz-2 GHz transmitting, 500W power handling
  - Covers most of IEC 61000-4-3 frequency range with single antenna
- **ACL-6000 CombiLog Antenna** - 80 MHz-6 GHz transmitting
  - Complete coverage including extended frequency ranges
- **Log-Periodic Antennas** - 200 MHz-2 GHz for mid-band testing
- **Horn Antennas** - 1-6 GHz for higher frequencies

Field Monitoring Equipment:

- **Isotropic Field Probes** - Contact Com-Power for field strength monitoring solutions
- **Directional Couplers** - For forward/reverse power monitoring

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4.3 Proximity Fields - IEC 61000-4-39

Edition 4.1 introduced proximity field immunity testing to address interference from wireless devices in very close proximity (typically <1 meter). This tests RFID readers, NFC devices, and wireless charging systems that may be used near medical equipment.

Common Test Frequencies:

- **385 MHz:** RFID systems
- **450 MHz:** Mobile communications
- **710, 745, 780, 810, 870, 930 MHz:** Cellular bands
- **1720, 1845, 1970, 2450 MHz:** Cellular and Wi-Fi
- **5240, 5500, 5785 MHz:** Wi-Fi 5 GHz bands

Recommended Com-Power Equipment for Proximity Field Testing:

RF Signal Generation:

- **Com-Power RF Amplifiers** - Various power levels for proximity field generation
- **Antenna Systems:** Contact Com-Power for proximity field test antenna recommendations

For 5 GHz Wi-Fi Testing:

- Contact Com-Power for specialized high-frequency amplifiers and antenna solutions up to 6 GHz

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4.4 Electrical Fast Transients (EFT) - IEC 61000-4-4

EFT testing simulates transient disturbances from switching inductive loads such as relays, contactors, and motors. Fast repetitive bursts of pulses are applied to power supply and signal cables.

Test Levels:

- **AC/DC power ports:** ±2 kV (typical)
- **Signal/control cables >3m:** ±1 kV
- **Pulse rise time:** 5 ns, duration: 50 ns
- **Test duration:** Minimum 1 minute per polarity

Recommended Com-Power Equipment for EFT Testing:

Note: EFT/Burst testing requires specialized pulse generators. Com-Power specializes in RF conducted and radiated testing. For EFT test equipment, contact Com-Power at www.com-power.com for:

- EFT/Burst generator recommendations
- Coupling/decoupling network (CDN) solutions for medical device signal lines
- Complete EFT test system consultation

Com-Power CDN Products:

- **Coupling/Decoupling Networks (CDNs)** - Various configurations available for signal line testing

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4.5 Surge Immunity - IEC 61000-4-5

Surge testing simulates overvoltages from lightning strikes and switching transients on external power lines. Testing applies high-energy pulses with specific rise times and energy content.

Test Levels:

- **Line-to-line:** ±0.5 kV to ±1 kV
- **Line-to-earth:** ±0.5 kV to ±2 kV
- **Rise time:** 1.2 µs, duration: 50 µs (1.2/50 µs combination wave)
- **Test:** Minimum 5 positive and 5 negative surges per coupling mode

Recommended Com-Power Equipment for Surge Testing:

Note: Surge testing requires specialized high-voltage pulse generators. Com-Power focuses on RF EMC testing equipment. For surge test equipment, contact Com-Power at www.com-power.com for:

- **Surge Generator Recommendations** from partner manufacturers
- CDN solutions for surge coupling to medical device ports
- Complete surge test system consultation

Additional Medical Device EMC Testing Equipment from Com-Power

Complete Conducted Immunity Test Systems

Conducted Immunity System (CIS) Series:

While primarily designed for IEC 61000-4-6 (conducted RF immunity), these systems can support various medical device immunity testing requirements:

- **CIS-25 System**
  - 25W RF amplifier (150 kHz-230 MHz)
  - Includes CDN, directional coupler, adapters, cables
  - Optional CSAT automation software
- **CIS-50 System**
  - 50W RF amplifier for higher test levels
  - Complete turnkey solution
  - Suitable for more demanding medical device testing
- **CIS-100 System**
  - 100W RF amplifier (150 kHz-250 MHz)
  - Maximum power for challenging test scenarios
  - Comprehensive system for full compliance lab

Bulk Current Injection (BCI) Equipment

For testing immunity of medical device cables to RF interference:

Current Injection Probes:

- **CLCI-100 BCI Probe** - 10 kHz-100 MHz, 40 mm aperture
- **CLCI-400 BCI Probe** - 10 kHz-400 MHz, extended frequency range

Current Monitoring Probes:

- **CLCE-332** - For monitoring injection current levels
- **CLCE-438** - Larger aperture for bundle testing
- **Calibration Fixtures** - FCLCE-332 for accurate probe calibration

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Medical Device Testing Facility Setup

Essential Equipment Checklist

For CISPR 11 Conducted Emissions (3.1):

- ✓ LISNs appropriate for device power requirements
- ✓ EMI receiver with quasi-peak and average detectors
- ✓ Transient limiters for instrument protection
- ✓ Shielded test enclosure
- ✓ Calibrated test cables

For CISPR 11 Radiated Emissions (3.2):

- ✓ Semi-anechoic chamber or OATS
- ✓ Broadband antenna set (30 MHz-6 GHz)
- ✓ EMI receiver with appropriate detectors

- ✓ Turntable and mast for device positioning
- ✓ Preamplifiers for low-level measurements

For IEC 61000-4-3 Radiated RF Immunity (4.2):

- ✓ Shielded anechoic chamber
- ✓ RF power amplifiers (80 MHz-2.7 GHz minimum)
- ✓ Transmitting antennas
- ✓ Signal generator with AM modulation
- ✓ Isotropic field probe
- ✓ Test automation software (recommended)

For Conducted Immunity Testing:

- ✓ CDNs for various port types
- ✓ RF amplifiers for injection
- ✓ Current injection/monitoring probes
- ✓ Signal generators

Com-Power Advantages for Medical Device Testing

Quality and Compliance

- **3-Year Warranty** on all Com-Power products
- **NIST-Traceable Calibration** included with every unit
- **Optional ISO 17025 Certification** for regulated medical device testing
- **Full compliance** with CISPR, IEC, and international EMC standards

Technical Support

- **Expert Engineering Support** for test setup and troubleshooting
- **15+ Years Industry Experience** in EMC test equipment
- **Custom Solutions** available for specialized medical device testing
- **Application Notes** and technical documentation

Product Benefits

- **Air-Core Inductors** in LISNs prevent saturation and ensure measurement accuracy
- **Individual Calibration** of all equipment with comprehensive data
- **Modular Systems** allow staged implementation of test capabilities
- **Software Automation** available for efficiency in production testing

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Planning Your Medical Device EMC Test Lab

Staged Implementation Approach

Phase 1: Pre-Compliance Testing (Recommended Starting Point)

- LISNs for conducted emissions
- Basic spectrum analyzer
- Antenna set for radiated emissions
- Shielded room or basic RF enclosure

Phase 2: Conducted Immunity

- Conducted immunity test system
- CDNs for signal lines
- Current injection probes

Phase 3: Radiated Immunity

- RF power amplifiers
- Transmitting antennas
- Anechoic chamber (if not already available)
- Field monitoring equipment

Phase 4: Full Compliance Lab

- Full-compliance EMI receivers
- Complete antenna range up to 18 GHz
- ESD, EFT, Surge generators
- Automation software
- Chamber upgrades

Testing Services and Consultation

For medical device manufacturers who need:

- **Equipment recommendations** specific to their device type
- **Custom test solutions** for unique medical device configurations
- **Training** on EMC testing procedures
- **Calibration services** for existing equipment
- **Complete turnkey lab solutions**

Contact Com-Power:

- **Website:** www.com-power.com
- **Product Categories:** Navigate to specific equipment types
- **Request Quote:** Available online for all products
- **Technical Support:** Contact forms and phone support available

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Key Standards Reference

Primary Standards for Medical Devices:

- **IEC 60601-1-2** - Medical electrical equipment EMC standard

- **CISPR 11** - ISM equipment emissions (referenced by IEC 60601-1-2)
- **IEC 61000-4-2** - ESD immunity testing
- **IEC 61000-4-3** - Radiated RF immunity testing
- **IEC 61000-4-4** - EFT/Burst immunity testing
- **IEC 61000-4-5** - Surge immunity testing
- **IEC 61000-4-6** - Conducted RF immunity testing
- **IEC 61000-4-39** - Proximity field immunity testing
- **CISPR 16-1-1** - EMI receiver specifications
- **CISPR 16-1-2** - LISN specifications

Classification System:

CISPR 11 Groups:

- **Group 1:** Equipment with no intentional RF generation (most medical devices)
- **Group 2:** ISM equipment that intentionally generates/uses RF energy

CISPR 11 Classes:

- **Class A:** Industrial/commercial locations
- **Class B:** Residential locations (more stringent limits)

Compliance Testing Best Practices

Pre-Compliance Testing

1. Start with **conducted emissions** - easiest and most cost-effective
2. Use **Com-Power pre-compliance equipment** for in-house testing
3. Identify issues early in development cycle
4. Iterate design improvements before formal compliance testing

Formal Compliance Testing

1. Select accredited test lab familiar with medical devices
2. Ensure all test equipment is calibrated and compliant
3. Document all test configurations and results
4. Plan for potential re-testing if modifications needed

Equipment Selection Tips

1. **Consider future needs** - modular systems allow expansion
2. **Verify frequency coverage** - ensure equipment covers all required ranges
3. **Check power ratings** - especially for immunity testing amplifiers
4. **Automation capability** - saves time in production testing
5. **Support and calibration** - factor in ongoing costs

Additional Resources

Com-Power Product Categories

- **Complete LISN Product Line** - All power configurations
- **RF Power Amplifiers** - 25W to 100W+ options
- **Antenna Systems** - 9 kHz to 40 GHz
- **Current Probes** - Injection and monitoring
- **Spectrum Analyzers** - Pre-compliance and compliance
- **Immunity Test Systems** - Complete turnkey solutions
- **CDNs and Accessories** - Wide variety available

Application Notes and Guides

Visit www.com-power.com for:

- Technical application notes
- Product comparison guides
- Setup and configuration manuals
- Calibration procedures
- Standards compliance documentation

Document Notes

This updated guide integrates Com-Power Corporation's EMC test equipment solutions for IEC 60601-1-2 medical device testing. Com-Power provides high-quality test equipment specifically designed for:

- **CISPR 11 emissions testing** (conducted and radiated)
- **IEC 61000-4-3 radiated RF immunity** (80 MHz - 6+ GHz)
- **Conducted immunity testing** (IEC 61000-4-6)
- **Pre-compliance and full compliance** testing requirements

Equipment Coverage Summary:

Test Requirement	Com-Power Solutions	Product Links
Conducted Emissions CE	LISNs, EMI Receivers, Current Probes	LISNs
Radiated Emissions RE	Antennas, EMI Receivers, Preamplifiers	Antennas
Radiated RF Immunity	RF Amplifiers, Antennas, Field Probes	Amplifiers
Conducted RF Immunity	CIS Systems, CDNs, BCI Probes	Immunity Systems
Proximity Fields	RF Amplifiers, Signal Generation	Amplifiers

For specialized equipment needs (ESD, EFT, Surge generators), Com-Power can provide recommendations and consultation services.

All Com-Power products feature:

- Individual NIST-traceable calibration
- 3-year manufacturer warranty
- Comprehensive technical documentation
- Worldwide technical support

- ISO 17025 calibration options

For quotes, technical questions, or custom medical device testing solutions:

Visit www.com-power.com or contact Com-Power's sales and engineering teams directly.

Com-Power Corporation - *Your trusted partner for medical device EMC testing equipment for over 15 years.*

5. Design Guidelines and Best Practices

Achieving EMC compliance requires proactive design from initial concept. This section provides practical guidance on design techniques that enhance electromagnetic compatibility while maintaining medical device functionality and safety.

5.1 PCB Layout for Medical Devices

Critical Design Principles:

- Implement solid ground planes on inner layers
- Separate analog signal processing from digital circuits
- Route patient-connected circuits with enhanced isolation and filtration
- Use differential signaling for noise-sensitive measurements
- Implement guard traces around high-impedance inputs
- Place decoupling capacitors immediately adjacent to IC power pins

5.2 Power Supply and Distribution

Medical device power supplies must provide clean, stable power while minimizing conducted emissions. Proper filtering and voltage regulation are essential for both EMC compliance and patient safety.

Power System Recommendations:

- Implement multi-stage input filtering (common-mode and differential-mode)
- Use medical-grade power supplies with enhanced isolation
- Provide separate power domains for patient-connected circuits
- Add voltage transient protection (TVS diodes, varistors)
- Design for worst-case supply voltage variations per IEC 60601-1

5.3 Cable and Connector Design

Cables and connectors are major pathways for electromagnetic interference. Medical devices with patient connections, external sensors, or communication interfaces require careful cable design and proper shielding.

Cable Design Guidelines:

- Use shielded cables for all patient-connected circuits
- Implement 360-degree shield termination at connectors
- Add common-mode chokes on communication interfaces
- Filter signal lines at equipment entry/exit points
- Use medical-grade connectors with proper contact resistance

6. Wireless Medical Devices

Wireless connectivity in medical devices introduces unique EMC challenges. IEC 60601-1-2 includes specific provisions for devices with intentional RF transmitters including Wi-Fi, Bluetooth, cellular, and proprietary wireless protocols.

6.1 Exemptions and Additional Requirements

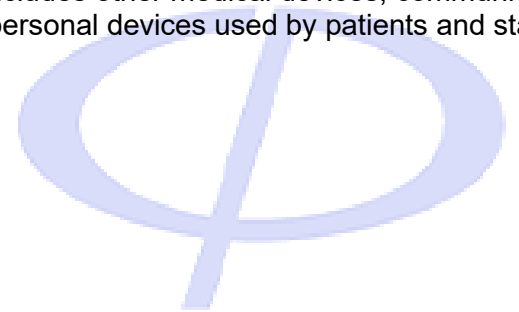
Intentional transmissions from compliant radio modules are exempted from radiated emission limits. However, all other emissions including spurious emissions, harmonics, and unintentional radiations from the device must comply with limits. The wireless functionality must be tested during immunity testing.

Wireless Device Testing:

- Verify radio compliance to regional requirements (FCC, CE, etc.)
- Test radiated emissions with radio transmitting (exclude fundamental)
- Perform immunity testing with radio both active and inactive
- Validate wireless performance under electromagnetic stress
- Document wireless-specific risk mitigation in risk management file

6.2 Coexistence Considerations

Medical devices with wireless connectivity must coexist with other wireless devices in healthcare facilities. This includes other medical devices, communication systems, patient monitoring networks, and personal devices used by patients and staff.



7. Conclusion

EMC compliance for medical devices requires comprehensive understanding of IEC 60601-1-2, integration with risk management processes, and proactive design practices. The standard's evolution toward risk-based testing and environment-specific requirements reflects the increasing complexity of modern medical devices and their electromagnetic environment.

Key Success Factors:

6. Integrate EMC into risk management from initial design
7. Clearly define basic safety and essential performance
8. Select appropriate environmental classification and test levels
9. Conduct pre-compliance testing during development
10. Work with accredited EMC test laboratories
11. Maintain comprehensive EMC documentation

8. References

Primary Standards:

12. IEC 60601-1-2:2014+AMD1:2020, Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances - Requirements and tests
13. IEC 60601-1:2005+AMD1:2012+AMD2:2020, Medical electrical equipment - Part 1: General requirements for basic safety and essential performance
14. ISO 14971:2019, Medical devices - Application of risk management to medical devices
15. CISPR 11:2015+AMD1:2016, Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

Immunity Test Standards:

16. IEC 61000-4-2: Electrostatic discharge immunity test
17. IEC 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test
18. IEC 61000-4-4: Electrical fast transient/burst immunity test
19. IEC 61000-4-5: Surge immunity test
20. IEC 61000-4-6: Immunity to conducted disturbances
21. IEC 61000-4-39: Radiated fields in close proximity from RF wireless communications equipment

For medical device EMC test equipment and compliance support,
contact Com-Power Corporation
www.com-power.com