

**Performance Levels and Methods of Measurement of Magnetic and
Electric Field Strength from Electric Vehicles, Broadband,
9 kHz To 30 MHz****Foreword**

This part of SAE J551 was initially included as an appendix to the historical broadband radiated noise test. It was published separately in June 1995, and is now in use in the industry as the standard method for electromagnetic emission testing of electric vehicles. As with all SAE standards, users are invited to comment on this document to the EMR Standards Committee.

1. Scope

The test procedures and performance levels in this SAE Recommended Practice cover the measurement of magnetic and electric field strengths over the frequency range 9 kHz to 30 MHz and conducted emissions over the frequency range of 450 kHz to 30 MHz¹.

Conducted emission measurements in this document are applicable only to battery-charging systems which utilize a switching frequency above 9 KHz, are mounted on the vehicle, and whose power is transferred by metallic conductors. Conducted emission requirements apply only during charging of the batteries from AC power lines.

Conducted and radiated emissions measurements of battery-charging systems that use an induction power coupling device are not covered by this document.

The measurement of electromagnetic disturbances for frequencies from 30 MHz to 1000 MHz and narrowband electromagnetic disturbances for frequencies from 150 KHz to 30 MHz are covered in SAE J551-2.

¹ The levels and methods for the conducted emissions test are based on CFR Title 47 Part 15 Subpart B - Unintentional Radiators. CISPR 22, the IEC document comparable to CFR Title 47 Part 15 Subpart B, has a broader frequency range, different measuring requirements and limits.

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2. References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents indicated as follows. Members of IEC and ISO maintain registers of currently valid International Standards.

2.1 Applicable Publications

The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J551-1—Performance Levels and Methods of Measurement of Electromagnetic Compatibility of Vehicles and Devices (60 Hz to 18 GHz)

SAE J551-2—Test Limits and Methods of Measurement of Radio Disturbance Characteristics of Vehicles, Motorboats, and Spark-Ignited Engine-Driven Devices, Broadband, 30 to 1000 MHz

2.1.2 CISPR PUBLICATIONS

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

CISPR 16-1—CISPR Specification for radio disturbance measuring apparatus and measurement methods; Part 1: Radio disturbance and immunity measuring apparatus

CISPR 22—Information Technology Equipment—Radio Disturbance Characteristics—Limits and Methods of Measurement

2.1.3 ANSI PUBLICATIONS

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, or from IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331.

ANSI C63.4—American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz

ANSI C63.12—American National Standard for Electromagnetic Compatibility Limits— Recommended Practice

2.1.4 UNITED STATES GOVERNMENT OFFICE OF THE FEDERAL REGISTER PUBLICATIONS

Available from US Government Printing Office, P.O. Box 371954, Pittsburgh, PA 15250-7954.

Code of Federal Regulations Title 47—Telecommunications; Part 15—Radio Frequency Devices

2.2 Related Publication

The following publication is provided for information purposes only and is not a required part of this document.

2.2.1 IEEE PUBLICATION

Available from IEEE, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

IEEE Std. 291—IEEE Standard Methods for Measuring Electromagnetic Field Strength of Sinusoidal Continuous Waves, 30 Hz to 30 GHz

3. Definitions

For general definitions see SAE J551-1.

4. Limits of Disturbance

4.1 Radiated Emissions

The recommended performance level for electric field strength is given in Figure 1 and for magnetic field strength in Figure 2. A derivation that re-establishes these limits from the original electric vehicle limits, based on a change of measurement distance, is included in Appendix A.

TABLE 1—ELECTRIC FIELD EMISSION LIMITS

Frequency	Level dB(μ V/m/KHz)
9 KHz to 4.77 MHz	$99.9 - 20\log_{10}(\text{Freq(MHz)}/.009)$
4.77 MHz to 15.92 MHz	$154.4 - 40\log_{10}(\text{Freq(MHz)}/.009)$
15.92 MHz to 20 MHz	$89.4 - 20\log_{10}(\text{Freq(MHz)}/.009)$
20 MHz to 30 MHz	22.5

TABLE 2—MAGNETIC FIELD EMISSION LIMITS

Frequency	Level dB(μ A/m/KHz)
9 KHz to 4.77 MHz	$48.4 - 20\log_{10}(\text{Freq(MHz)}/.009)$
4.77 MHz to 15.92 MHz	$102.9 - 40\log_{10}(\text{Freq(MHz)}/.009)$
15.92 MHz to 20 MHz	$37.9 - 20\log_{10}\text{Freq(MHz)}/.009)$
20 MHz to 30 MHz	-29.0

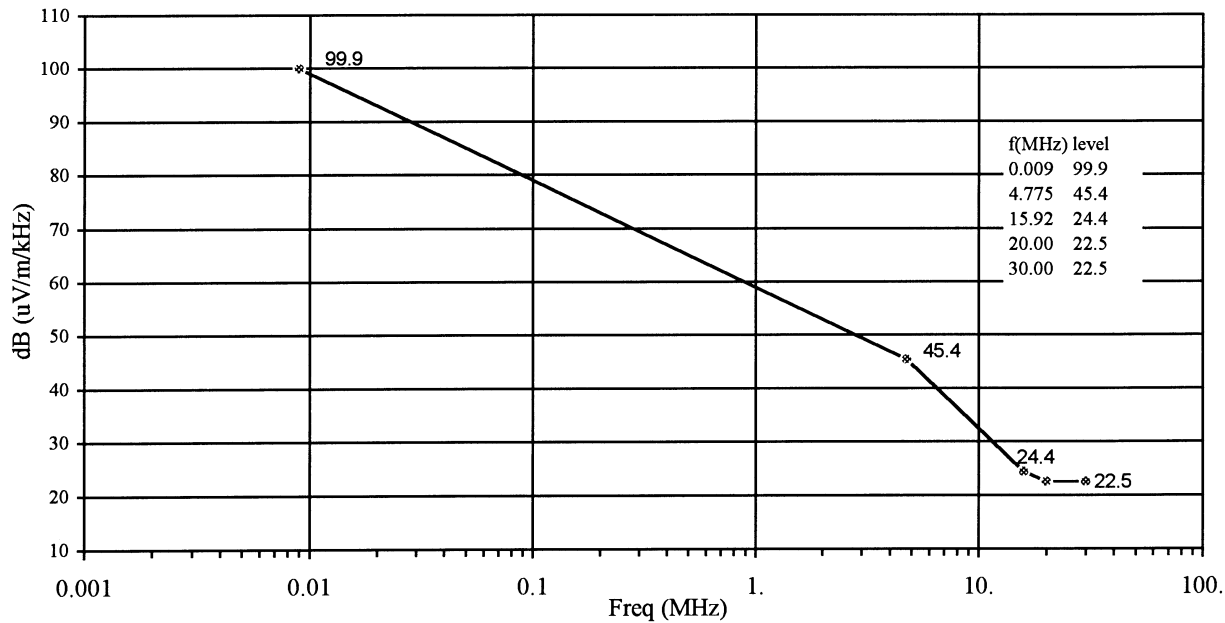


FIGURE 1—RECOMMENDED PERFORMANCE LEVEL FOR NORMALIZED PEAK
IMPULSE ELECTRIC FIELD STRENGTH

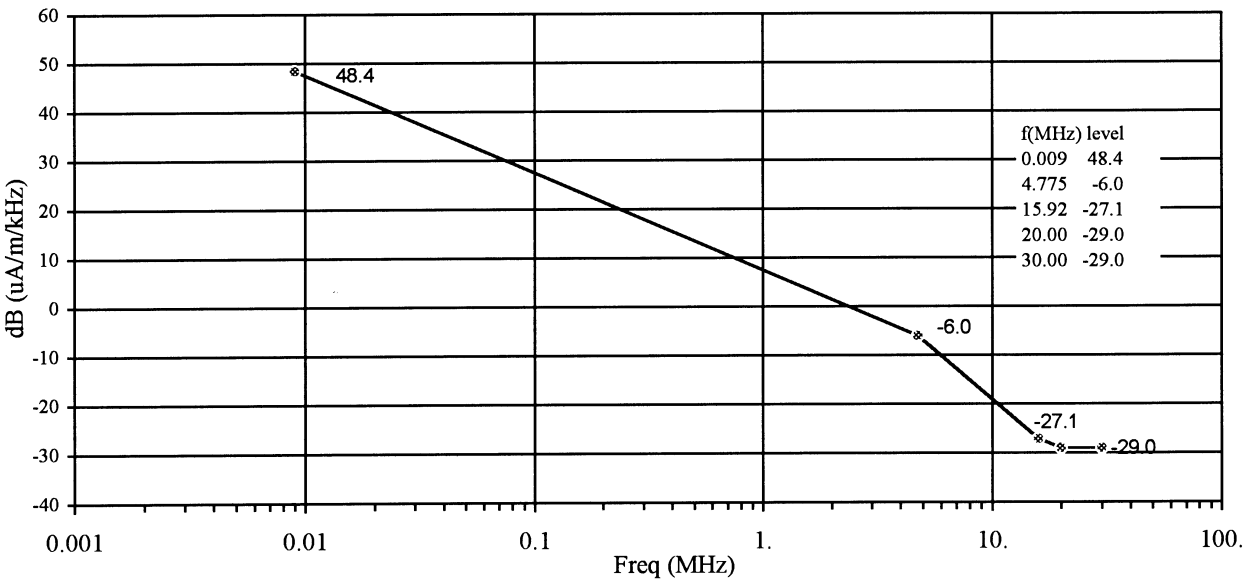


FIGURE 2—RECOMMENDED PERFORMANCE LEVEL FOR NORMALIZED PEAK
IMPULSE MAGNETIC FIELD STRENGTH