



INSTRUCTION MANUAL

LOOP SENSOR

ANTENNA

MODEL ELS-11

20 Hz - 100 kHz

INSTRUCTION MANUAL

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20 Hz - 100 kHz

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MODEL ELS-11

SERIAL NO: N/A

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WARRANTY

This Model ELS-11 Loop Sensor Antenna is warranted for a period of 12 months (USA only) from date of shipment against defective materials and workmanship. This warranty is limited to the repair of or replacement of defective parts and is void if unauthorized repair or modification is attempted. Repairs for damage due to misuse or abnormal operating conditions will be performed at the factory and will be billed at our commercial hourly rates. Our estimate will be provided before the work is started.

DESCRIPTION AND USE ELECTRO-METRICS MODEL ELS-11 LOOP SENSOR ANTENNA

1.0 Introduction

The ELS-11 Loop Sensor Antenna uses passive circuits to transform magnetic field components from 20 Hz to 100 kHz to an equivalent open circuit two-terminal voltage on an EMI Analyzer. Use of the Conversion Factor Chart will yield the strength of the magnetic induction field referenced to a uniform field. The loop is electrostatically shielded and therefore sensitive only to the magnetic component (B-Field) of the electromagnetic fields.

The ELS-11 comprises a loop sensor, boom, and positioning probe which are constructed of a non-metallic (except for conductors) material and thus do not influence the magnetic field measurement.

2.0 Applications

The ELS-11 is designed, constructed, and tested in exact accordance with the requirements of MIL-STD-461A. The Loop Sensor Antenna fully meets the magnetic field radiated emission test requirement, REO1, for MIL-STD-461A, MIL-STD-461B, MIL-STD-461C, and RE101 for MIL-STD-461D.

The ELS-11 may be used with EMI Analyzers having input impedances greater than 50 Ω . Calibration into 10 k Ω or greater impedance as stated in MIL-STD-461A is provided, as well as the standard 50 Ω and 600 Ω calibration.

3.0 Specifications

3.1 Electrical

Frequency Range (calibrated): 20 Hz-100 kHz.

- 1) Refer to Figure 1 for 50 Ω /600 Ω Conversion Factor Chart. Actual measured Antenna Factors.
- 2) Refer to Figure 2 for 10 k Ω Conversion Factor Chart. Typical Antenna Factor data.

Conversion Factor: As per MIL-STD-461A, Figure 1B.

Output Connector: BNC.

3.2 Mechanical

Boom Length: 49.75 cm (19.59").
50 cm from coil center.

Probe Tip Length:	60 mm (2.36") 7 cm from coil center.
Loop Sensor Diameter:	146 mm (5.75").
Weight:	795 g (1.75 lbs).

4.0 Theory Of Operation

The ELS-11 Loop Sensor Antenna uses passive circuits to transform magnetic field components from 20 Hz to 100 kHz to an equivalent open circuit two-terminal voltage on an EMI Analyzer. Use of the Conversion Factor Chart (Figure 1) will yield the strength of the magnetic induction field referenced to a uniform field.

The effective height or conversion factor for the ELS-11 Loop Sensor Antenna is governed by the equation:

$$E = 2\pi f N A B \times 10^{-16}$$

Where:

A = the area of the loop in cm².

N = the number of turns in the loop.

f = the frequency in Hz.

B = the magnetic flux density in pT.

E = the open circuit induced voltage.

The ELS-11 has the following design parameters:

- a. Mean diameter of the coil: 13.3 cm,
- b. Number of turns: 36,
- c. Type of wire: 7-41 Litz.

The loop is electrostatically shielded and therefore sensitive only to the magnetic component (B-Field) of the electromagnetic fields. The conversion factors shown in the Conversion Factor Chart (Figure 1) were obtained by placing the antenna within a Reuben coil system which generates a uniform known magnetic field with a variation of less than 1%. This allows magnetic field measurements taken with the ELS-11 to be referenced to a uniform field.

If the ELS-11 is used to measure a non-uniform field, the antenna will integrate the energy in its effective area and produce an open circuit voltage. This voltage, when referenced to the conversion chart, will yield the equivalent uniform magnetic field.

5.0 Operating Procedure

5.1 Setup

- a. Connect a coaxial cable between the BNC connector of the ELS-11 and the RF Input connector of the EMI Analyzer.
- b. Position the antenna with the tip of the positioning probe against the unit under test. The antenna is now ready for use.

5.1.1 MIL-STD-462 Probe Positioning Requirements

MIL-STD-462 for radiated emission test requirement RE01 requires that the mean diameter of the antenna be placed 7 cm from the face of the test sample.

For the ELS-11:

The tip of the positioning probe is exactly 7 cm from the mean diameter of the sensor loop.

5.1.2 MIL-STD-462D Probe Positioning Requirements

MIL-STD-462D for radiated emission test requirement RE101 requires that the mean diameter of the antenna be placed 7 cm and 50 cm from the face of the test sample, with radiated emission measurements taken at each distance.

For the ELS-11:

The tip of the positioning probe is exactly 7 cm from the mean diameter of the sensor loop.

The tip of the antenna boom is exactly 50 cm from the mean diameter of the sensor loop.

5.2 Measurement Technique

With the Model ELS-11 Loop Sensor Antenna, connected to the EMI Analyzer as described above, tune the EMI Analyzer to the frequency of interest. Read the two-terminal voltage indicated by the EMI Analyzer for the particular signal of interest.

To convert the resulting two-terminal reading to the appropriate magnetic field strength in dB(pT) when using the ELS-11 simply add the "conversion factor in dB(pT/ μ V)" at the frequency of interest from the Conversion Factors Chart for an input impedance of either 50 Ω /600 Ω or 10 k Ω .

The ELS-11 may be used with receivers having input impedances greater than 50 Ω . Calibration into 10 k Ω or greater impedance as stated in MIL-STD-461A is provided, as well as the standard 50 Ω calibration. Figure 1 is the Conversion Factors Chart for an input impedance of 50 Ω or 600 Ω , while Figure 2 is the Conversion Factors Chart for an input impedance of 10 k Ω .

EXAMPLE:

SIGNAL AMPLITUDE INDICATION.....+10 dB(μ V)
 Two-terminal voltage indication is thus.....+10 dB(μ V)
 Conversion factor from graph.....+50 dB(pT/ μ V)
 Magnetic Field intercepted by antenna is.....+60 dB(pT)

5.3 MIL-STD-461 RE01 Specification Limits

The specification limits for the magnetic field radiated emission test requirement RE01 of MIL-STD-461A, MIL-STD-461B, MIL-STD-461C, and RE-101 of MIL-STD-461D are shown in Figures 3, 4, 5, 6, and 7 respectively.

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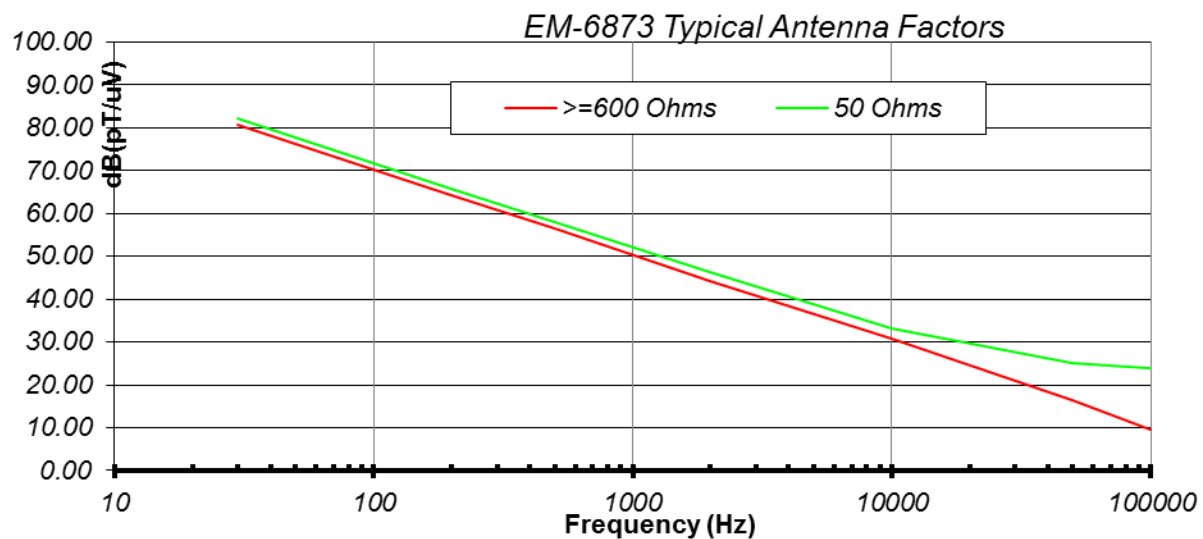
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FIGURE 1
CONVERSION FACTORS CHART, 50Ω AND 600Ω IMPEDANCE
(ACTUAL CALIBRATION DATA)

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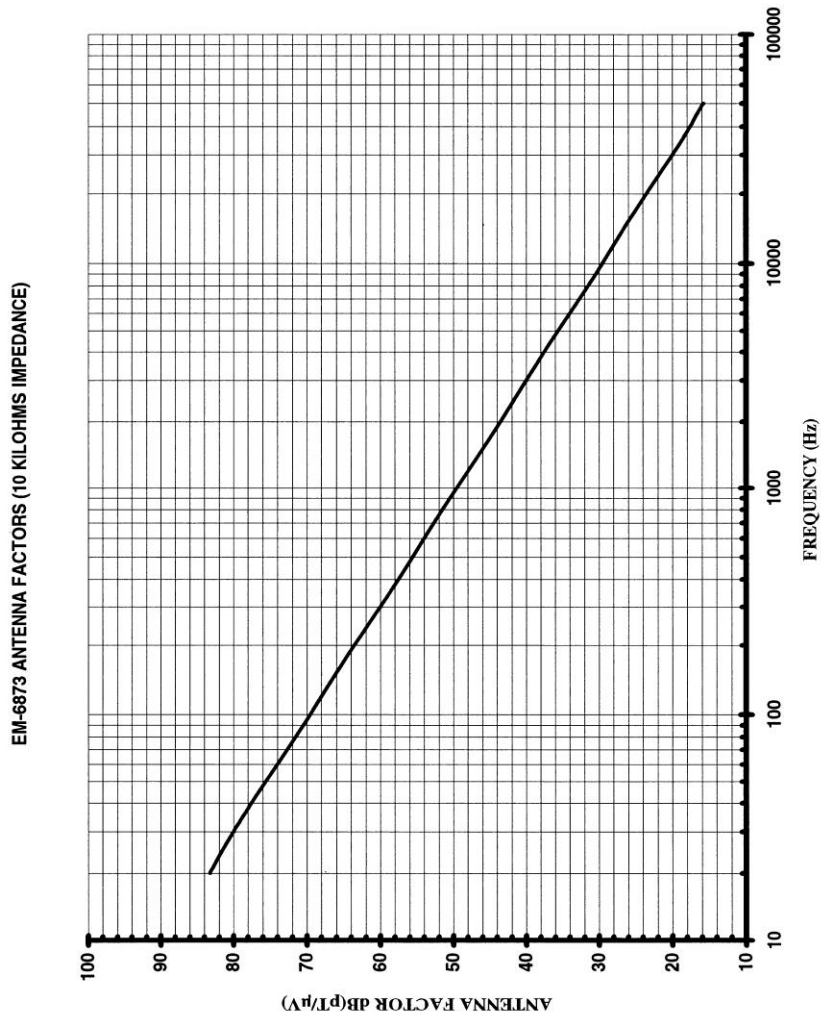


FIGURE 2
CONVERSION FACTORS CHART, 10 kΩ IMPEDANCE
(TYPICAL)

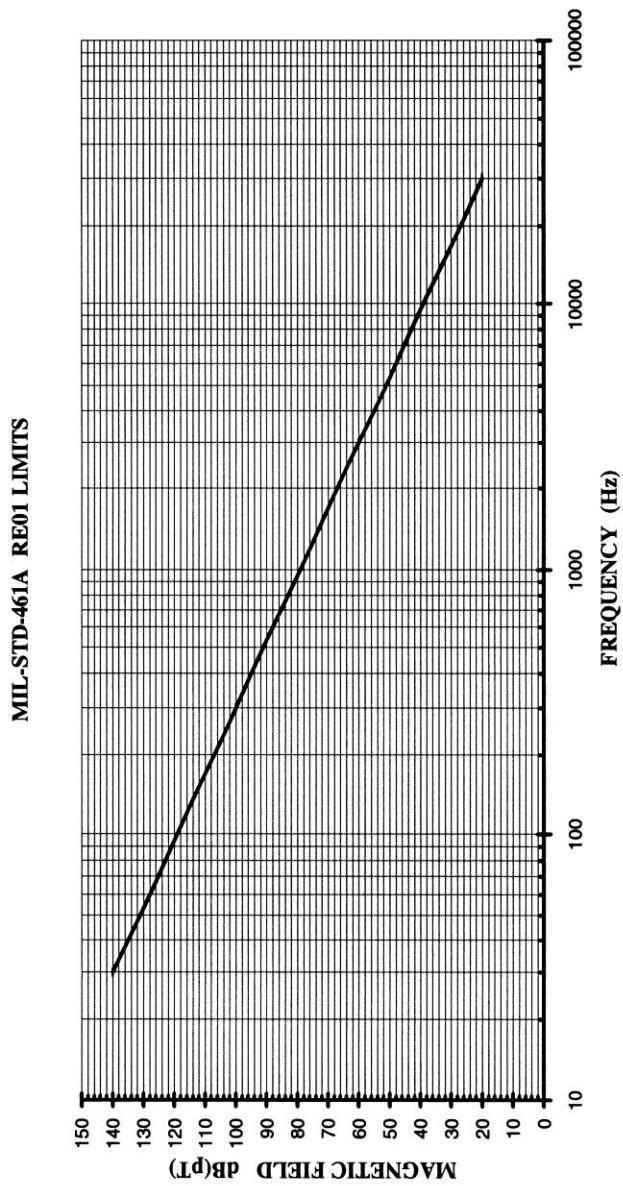


FIGURE 3
MIL-STD-461A RE01 LIMITS

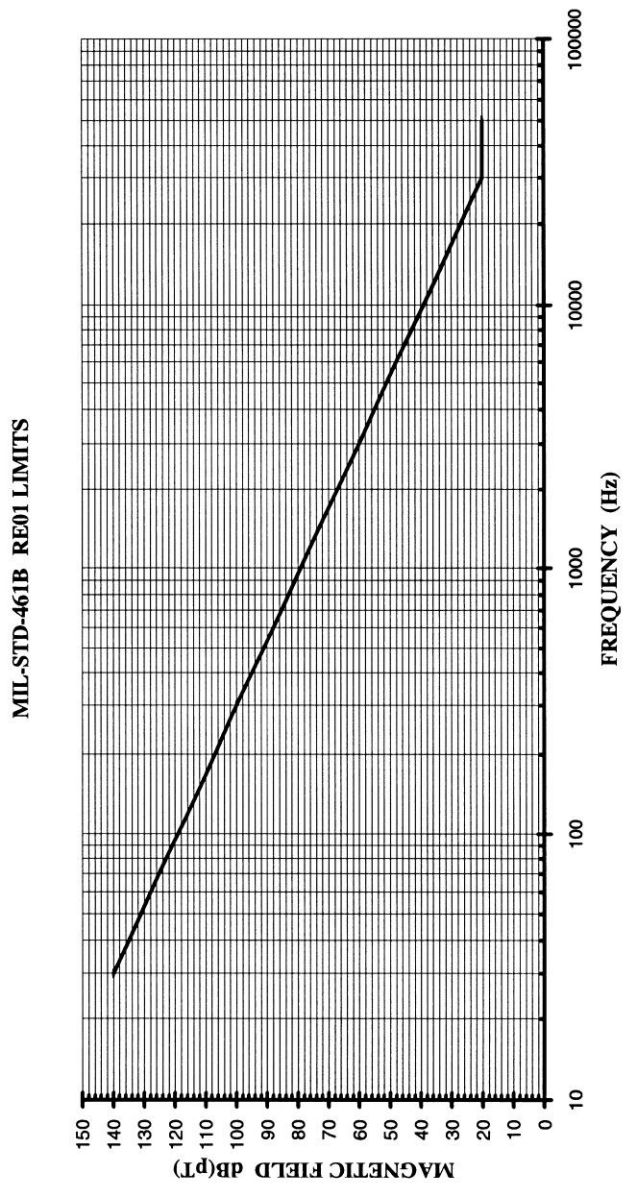


FIGURE 4

MIL-STD-461B RE01 LIMITS

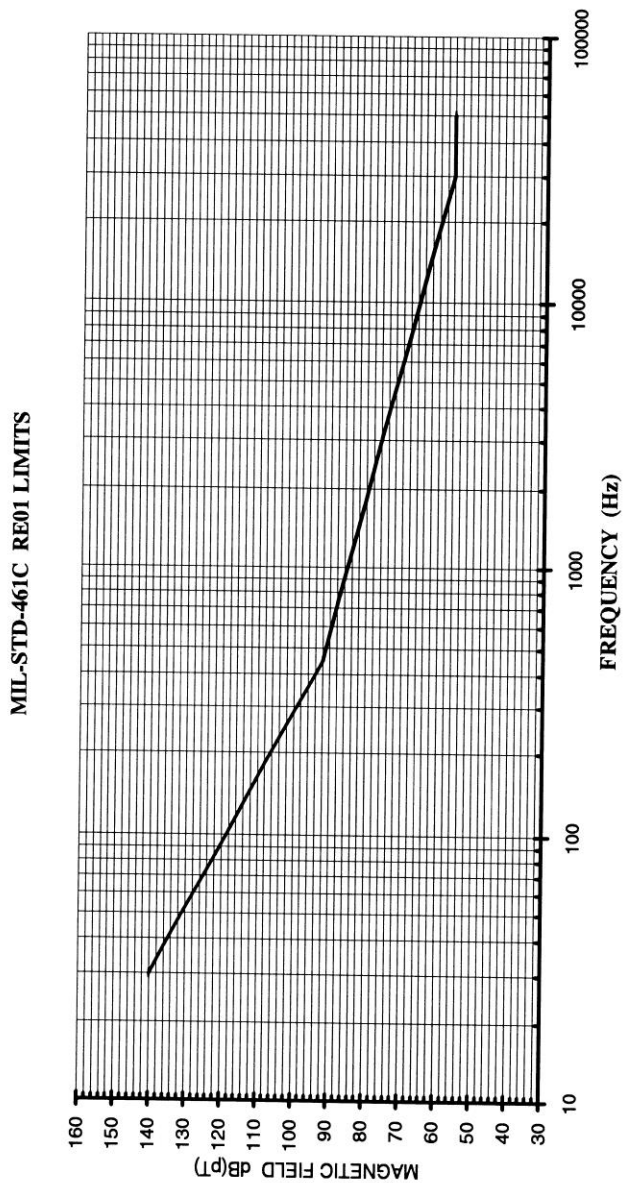


FIGURE 5

MIL-STD-461C RE01 LIMITS

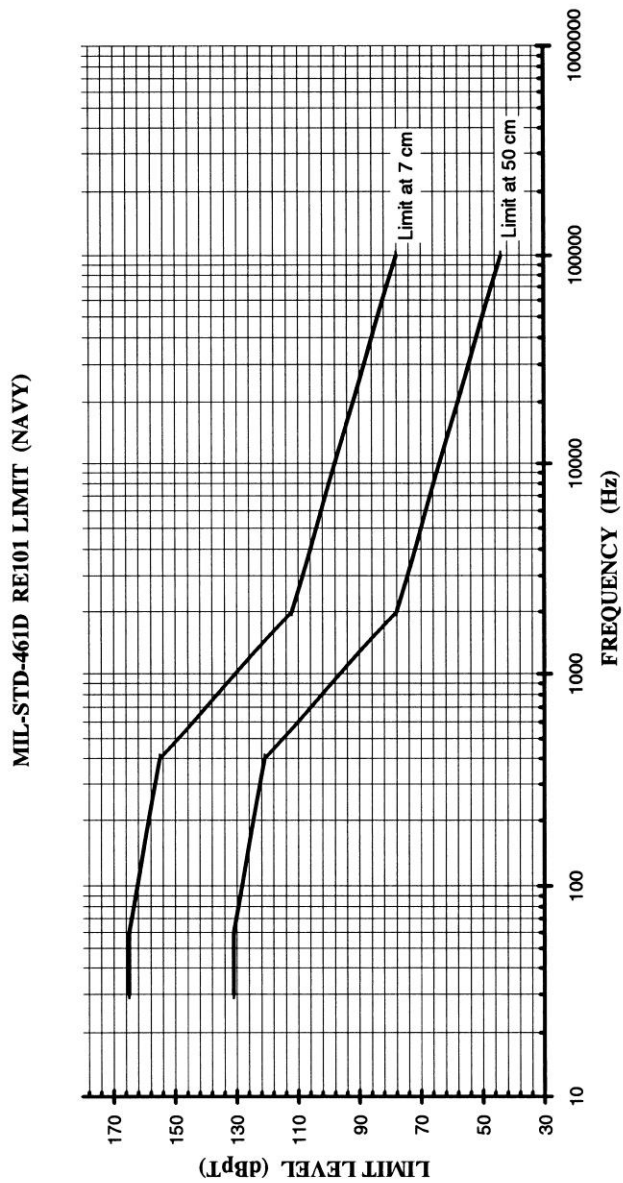


FIGURE 6

MIL-STD-461D RE101 LIMITS-NAVY

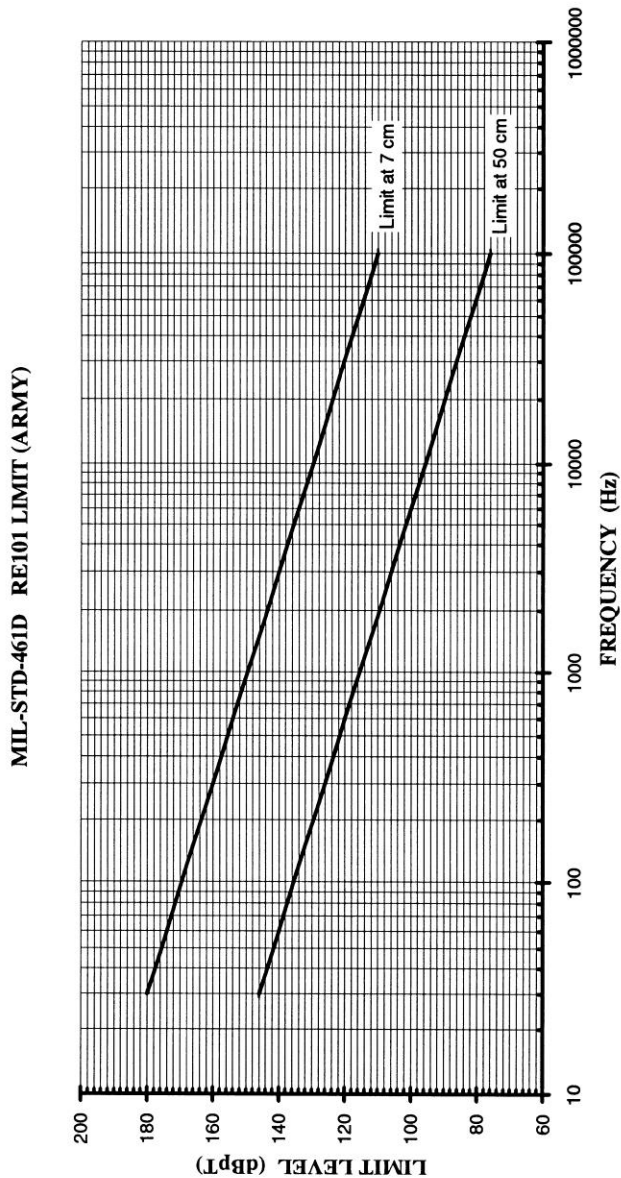


FIGURE 7

MIL-STD-461D RE101 LIMITS-ARMY