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MILITARY STANDARD

ELECTROMAGNETIC EMISSION AND SUSCEPTIBILITY REQUIREMENTS FOR THE CONTROL OF ELECTROMAGNETIC INTERFERENCE

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1. THE FOLLOWING PAGES CONSTITUTE PART 2 OF MIL-STD-461C FOR AIR FORCE ACQUISITIONS:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
2-i through 2-iv	15 October 1987	2-i through 2-iv	4 August 1986
2-1 through 2-24	15 October 1987	2-1 through 2-24	4 August 1986
2-25 through 2-32	15 October 1987		

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Preparing activity:
Air Force - 11

Project No. EMCS-F122

Review activities:
Air Force - 13, 14, 15, 17, 18, 19, 70, 71, 80, 82, 84, 90, 99

AMSC N/A

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1. SCOPE

This part of MIL-STD-461 supplements Part 1 of the standard by defining emission and susceptibility requirements and limits for equipment and subsystems intended for use aboard aircraft (class A1), including associated non-shipboard ground support equipment and for class A3 equipment and subsystems procured for the Air Force.

1.1 Determining requirements

1.1.1 Air Force and Navy procurements. Table 2-I defines categories of class A1 equipment and subsystems. Table 2-II shall be used to determine the requirements applicable for equipment and subsystems procured for Air Force or Navy use. The table also denotes the paragraphs where in the requirements and limits are defined. A "Y" entry in the table means the requirement is applicable, and the limit shall be met using the procedures in MIL-STD-462 or the approved EMI Test Plan. A "Y_L" entry means the applicability of the requirement is limited and is specified in the appropriate corresponding paragraph. The limit shall be met using the procedures in MIL-STD-462 or the approved EMI Test Plan. A "T" entry means that the applicability of the requirement must be determined on a case-by-case basis and, if the requirement is to be imposed, it must so specified in the appropriate procurement document. When required, the limit shall be met using the procedures in MIL-STD-462 or the approved EMI Test Plan. Absence of an entry means the requirement is not applicable.

TABLE 2-I. Categories of class A1 equipment and subsystems.
(For Air Force and Navy use)

Category	Description
A1a	Air launched missiles
A1b	Equipment installed on aircraft (internal or external to airframe)
A1c	Aerospace ground equipment required for the checkout and launch of the aircraft, including electronic test and support equipment
A1d	Trainers and simulators
A1e	Portable medical equipment used for aeromedical airlift
A1f	Aerospace ground equipment used away from the flightline, such as engine test stands and hydraulic test fixtures
A1g	Jet engine accessories
A1h	Class A3 equipment procured for Air Force use

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TABLE 2-II. Emission and susceptibility requirements for class A1 equipment and subsystems (For Air Force and Navy Use).

Requirement	Categories of class A1 equipment and subsystems								Applicable	
	A1a	A1b	A1c	A1d	A1e	A1f	A1g	A1h	Paragraph	Limit Curve
CE01		Y_L					Y_L		2	2-1
CE03	Y	Y	Y	Y	Y	Y	Y	Y	3	2-2, 2-3
CE06	Y_L	Y_L	Y_L					Y_L	4	
CE07	Y	Y	Y	Y	T			Y	5	
CS01	Y	Y	T	Y	T		Y	Y	6	2-4
CS02	Y	Y	Y	Y	T	T	Y	Y	7	
CS03	Y_L	Y_L	Y_L					Y_L	8	
CS04	Y_L	Y_L	Y_L			Y_L		Y_L	9	2-5
CS05	Y_L	Y_L	Y_L			Y_L		Y_L	10	
CS06	Y	Y	Y	Y	Y		Y	Y	11	2-6
CS07		Y_L	Y_L					Y_L	12	
CS09		Y_L							13	2-7
CS10	T	T	T	T	T	T	T		14	2-8
CS11	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L		15	2-9
CS12	Y	Y					Y		16	2-15, 2-16
CS13	Y	Y					Y		17	2-17, 2-18
RE01		Y_L							18	2-10
RE02	Y	Y	Y	Y	Y	Y	Y	Y	19	2-11, 2-12
RE03	T	T	T					T	20	
RS01	T	Y_L							21	2-13
RS02	Y	Y	Y	Y	Y	T	Y	Y	22	2-6
RS03	Y	Y	Y	Y	Y	T	Y	Y	23	
RS05	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L		24	2-14
RS06	Y	Y					Y		25	

1/ SEE SAE AIR 1423 AND 1425 FOR ADDITIONAL GUIDANCE ON TAILORING.

2/ CATEGORY A1c AND A1f EQUIPMENT PROCURED FOR NAVY SHIPBOARD USE SHALL MEET THE APPLICABLE CLASS A4 REQUIREMENTS IN PART 5 OF THIS STANDARD.

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1.1.2 Army procurements. Table 2-III shall be used to determine the specific requirements for class A1 equipment and subsystems procured for Army use. The table also denotes the paragraphs wherein the requirements and limits are defined. A "Y" entry in the table means the requirement is applicable, and the limit shall be met using the procedures in MIL-STD-462 or the approved EMI test plan. A Y entry means the applicability of the requirement is limited and is specified in the appropriate corresponding paragraphs. When applicable the limit shall be met using the procedures in MIL-STD-462 or the approved EMI test plan. A "T" entry means that the applicability must be determined on a case-by-case basis and, if the requirement is to be imposed, it must be specified in the appropriate procurement document. When required, the limit shall be met using the procedures in MIL-STD-462 or the approved EMI Test Plan. Absence of an entry means the requirement is not applicable. For procurements of subsystems, such as radar, EW, surveillance, navigation, and the like, comprised of individual equipment listed in table 2-III, the applicable emission and susceptibility requirements for the subsystem shall be tailored by the procuring activity based on the requirements of the individual equipment.

2. CE01 (limited applicability)

2.1 CE01 applicability. This requirement is applicable for equipment and subsystems installed on aircraft having an anti-submarine warfare (ASW) capability and for Navy equipment and subsystems intended for use on aircraft and having Very Low Frequency (VLF) subsystems and equipment. When required, CE01 is applicable only for narrowband emissions between 30 Hz and 15 kilohertz (kHz) on alernating current (AC) and direct current (DC) leads, which obtain power from other sources or provide power to other equipment or subsystems; grounds or neutrals, which are not grounded internally to the subsystem or equipment being measured; and, for Army and Navy procurements, interconnecting control leads which provide AC and DC power from or to the test sample. The requirement is not applicable for interconnecting signal leads such as clock, IF, audio, firing, digital, RF, and the like, unless otherwise specified by the Command or agency concerned.

2.2 CE01 limits

2.2.1 AC, DC, and interconnecting control leads. Electromagnetic emissions shall not appear on AC, DC, and, where required, interconnecting control leads in excess of the values as shown on figure 2-1. The limits shall be met when measured with an effective bandwidth not exceeding the primary power frequency plus 20% of the power frequency for AC power leads or 75 Hz for DC power leads.

2.2.2 Interconnecting signal leads. If compliance with this requirement is required for signal leads, limits shall developed on a case-by-case basis considering the intentional transmission, its specified power level, necessary information bandwith, and pulse rise time. Such limits must be approved by the Command or agency concerned.

TABLE 2-III. EMISSION AND SUSCEPTIBILITY REQUIREMENTS FOR CLASS A1 EQUIPMENT AND SUBSYSTEMS (FOR ARMY USE).

Requirement / Specific Equipment/Subsystem	Receivers	Transmitters	Antenna Multicouplers	Amplifier, Tuned, RF	Amplifier, Untuned, RF	Intercom/Interphone	Modem	Repeater	Amplifier, Power/Audio	Modulators	Multiplexers	Laser Devices	IR Devices	Transponders	Beacons	Power Supplies	Sensors/Antennas	Inertial Guidance	Teletypewriters	Recorders	Visual Displays	Digital Equipment	Data Annotation	Camera Data	Telephone SWBD	Servo/Synchro	Test Equipment	Time/Frequency STDS	Ultrasonic Devices	Telephones	Trainers/Simulators	Commercial Eq.	All Others Not Listed Herein	Applicable Paragraph
CE01	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				2
CE03	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	3
CE06	Y	Y												Y	Y																	Y	Y	4
CE07	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			5
CS01	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	Y_L	6
CS02	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	7
CS03	T			T										T																				8
CS04	T			T										T																				9
CS05	T			T										T																				10
CS06	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11
CS07	T																																	12
RE02	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	15
RE03		Y												Y	Y																	Y	Y	16
RS01																	T	T																17
RS02						T			T							T	T	T	T	T		T			T	T				T				18
RS03	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19

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3. CE03

3.1 CE03 applicability. This requirement is applicable for the following types of leads: AC and DC leads, which obtain power from other sources or provide power to other equipment, distribution panels, or subsystems; ground or neutrals, which are not grounded internally to the subsystem or equipment being measured; and, for Army and Navy procurements, interconnecting control leads which provide AC and DC power from or to the test sample. The requirement is not applicable for interconnecting signal leads such as a clock, IF, audio, firing, digital, radio frequency (RF), and the like, unless otherwise specified by the Command or agency concerned. For Army procurements, the requirement is applicable using the Line Impedance Stabilization Network, as described in MIL-STD-462.

3.2 CE03 limits

3.2.1 AC, DC, and interconnecting control leads. Electromagnetic emissions shall not appear on AC, DC, and, where required, interconnecting control leads in excess of the values shown on figures 2-2 and 2-3 for narrowband and broadband emissions, respectively. For Navy and Air Force procurements, conducted switching spike emissions (including ON/OFF switching) on AC and DC power leads shall meet the requirements of CE07.

3.2.2 Interconnecting signal leads. If compliance with this requirement is required for signal leads, limits shall be developed on a case-by-case basis considering the intentional transmission, its specified power level, necessary information bandwidth, and pulse rise time. Such limits must be approved by the Command or agency concerned.

4. CE06 (limited applicability)

4.1 CE06 applicability. This requirement is applicable for those equipment and subsystems with antenna leads or those designed to be connected to antennas. The transmitter (key-down mode), harmonic, and spurious emission portions of this requirement are not applicable for equipment and subsystems procured solely for Army use, when any of the following conditions exist: (a) transmitter power exceeds 5 kilowatts (kW) average, (b) the fundamental frequency of the test sample exceeds 1.24 gigahertz (GHz), (c) the test sample's antenna is an integral part of the transmitter and cannot be replaced by suitable dummy load, or (d) for equipment and subsystems with waveguide transmission lines and operating below 1.24 GHz. For cases (a) through (d) use RE03. The frequency range of this requirement is dependent on the operating frequency of the test sample (see MIL-STD-462). The transmitter (key-down) portion of this requirement is not applicable within either the test sample's necessary bandwidth or ±5 percent of the fundamental frequency.

4.2 CE06 limits. Conducted emissions in excess of the values given 4.2.1 through 4.2.3 shall not appear at the test sample's antenna terminals.

4.2.1 Receivers

a. Narrowband emissions: 34 decibels above 1 microvolt (dBμ V)

b. Broadband emissions: 40 dBμ V/megahertz (MHz)

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4.2.2 Transmitters (key-up and standby)

a. Narrowband emissions: 34 dBμ V

b. Broadband emissions: 40 dBμ V/MHz

4.2.3 Transmitters (key-down mode). Harmonics, except the second and third, and all other spurious emissions shall have peak powers 80 decibels (dB) down from the power at the fundamental. The second and third harmonics shall be suppressed by: 50 + 10 log P (where P = peak power, in watts, at the fundamental) or 80 dB, whichever requires less suppression.

5. CE07

5.1 CE07 applicability. This requirement is applicable for Air Force and Navy procurements for the following types of leads: AC and DC leads which obtain power from or provide power to other equipment or subsystems.

5.2 CE07 limits. Conducted switching spikes of less than 50 microseconds in duration shall not exceed the following, as applicable:

a. AC leads: ±50 percent of nominal rms voltage.

b. DC leads: +50 percent, -150 percent of nominal line voltage.

Conducted switching spikes equal to or greater than 50 microseconds in duration shall meet the transient requirements of MIL-STD-704. Spike duration is the time interval between the 50% amplitude point on the transient leading edge and the 50% amplitude point on the transient trailing edge; high frequency ringing superimposed on the pulse leading or trailing edges should be ignored.

6. CS01 (limited applicability)

6.1 CS01 applicability. This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem. This requirement is not applicable within ±5 percent of the power frequency(ies). For Navy procurements, this requirement may be deleted for AC leads, with the approval of the command or agency concerned, if no circuit within the equipment or system is more sensitive than 100 millivolts (mV). For equipment and subsystems procured solely for Army use, this requirement is applicable for DC leads only.

6.2 CS01 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to electromagnetic energy injected onto its power leads equal to the values on figure 2-4. The requirement is also met when the power source specified in CS01 of MIL-STD-462, adjusted to dissipate 50 watts in a 0.5 ohm load, cannot develop the required voltage at the test sample power input terminals, and the test sample is not susceptible to the output of the signal source.

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7. CS02

7.1 CS02 applicability. This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem.

7.2 CS02 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to 1-volt from a 50 ohm source. The test signal shall be applied directly to the equipment input terminals, not through the test sample's power line cord. The requirement is also met when a 1-watt source of 50 ohms impedance cannot develop the required voltage at the test sample power input terminals, and the test sample is not susceptible to the output of the signal source.

8. CS03 (limited applicability)

8.1 CS03 applicability. This requirement is applicable to receiving equipment and subsystems, such as receivers, RF amplifiers, transceivers, and the like. The applicable frequency range of this requirement is dependent on the operating frequency of the test sample as specified in MIL-STD-462.

8.2 CS03 limits. The test sample shall not exhibit any intermodulation products from two signals, beyond those permitted in the individual equipment or subsystem specification, when:

a. Signal generator #1 is set 66 dB above the level required to obtain the standard reference output, as specified in MIL-STD-462; except that when f_1 is in the frequency range of either 200 to 400 MHz or 2 to 25 MHz, the generator output shall be 80 dB above the reference level, but the output of signal generator #1 shall not exceed 10 dBm.

b. Signal generator #2 is set 66 dB above the level required to obtain the standard references output, as specified in MIL-STD-462, but the generator output level shall not exceed a power level of 10 dBm.

9. CS04 (limited applicability)

9.1 CS04 applicability. This requirement is applicable to receiving equipment and subsystems, such as receivers, RF amplifiers, transceivers, and the like. The applicable frequency range of this requirement is dependent on the operating frequency of the test sample, as specified in MIL-STD-462.

9.2 CS04 limits. The test sample shall not exhibit any undesired response when subjected to the test signal shown on figure 2-5.

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10. CS05 (limited applicability)

10.1 CS05 applicability. This requirement is applicable to receiving equipment and subsystems such as receivers, RF amplifiers, transceivers, and the like. The applicable frequency range of this requirement is dependent on the operating frequency of the test sample, as specified in MIL-STD-462.

10.2 CS05 limits. The test sample shall not exhibit, due to cross modulation, any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystems specification, when subjected to the following from signal generator #2: a signal 66 dB above the level required to obtain the standard reference output, as specified in MIL-STD-462, but not to exceed a power output level of 10 dBm.

11. CS06

11.1 CS06 applicability. This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem.

11.2 CS06 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when the test spikes having the waveform shown on figure 2-6 are applied to the AC and DC power input leads for a period of not less than 1 minute at each phase position, and for a total test period not exceeding 15 minutes in duration (in lieu of the values in MIL-STD-462). The values of $E_{(\ )}$ and $t_{(\ )}$ are given below. Each spike shall be superimposed on the powerline voltage waveform.

a. Spike #1 (All Services) E_1 = 200 Volts; t_1 = 10 microseconds 20%

b. Spike #2 (Air Force and Navy) E_2 = 200 Volts; t_2 = 0.15 microseconds 20%

12. CS07 (limited applicability)

12.1 CS07 applicability. This requirement is applicable for receiving equipments and subsystems which utilize squelch circuits.

12.2 CS07 limits

12.2.1 Requirement 1. Squelch circuits shall not open when the output of a 50-ohm impedance impulse generator, set at 90 dBμV/MHz, is applied and matched to the input terminals of the test sample.

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12.2.2 Requirement 2. The squelch circuit shall not open when two signals are applied at the input of the test sample. One signal shall be an unmodulated RF signal at the receiver tuned frequency, whose amplitude is two-thirds of the RF voltage used to adjust the squelch threshold. The second signal shall be an impulse signal of 50 $dB_{\mu}V/MHz$.

13. CS09 (limited applicability)

13.1 CS09 applicability. This requirement is applicable to Navy equipment and subsystems that have an operating frequency range of 100 kHz or less and an operating sensitivity of 1μV or less, such as 0.5μV.

13.2 CS09 limits. The test sample shall not exhibit any malfunction, degradation of performance or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification when subjected to the levels shown on figure 2-7 across the applicable test points.

14. CS10 (limited applicability)

14.1 CS10 applicability. This electromagnetic pulse (EMP) requirement is applicable to Navy equipment and subsystem interface pins and terminals of power leads, control leads, signal leads, and grounds and neutrals which are not grounded internally to the equipment or subsystem. Applications of requirement are to be determined on a case-by-case basis. It should be noted that if the equipment is to be installed in an intentionally unhardened aircraft, the equipment will not be adequately protected against the specified EMP.

14.2 CS10 limit. The test sample shall not exhibit any permanent malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances and recovery times indicated in the individual equipment or subsystem specification, after being subjected to a test signal having either the waveform and common mode current level shown on figure 2-8, as determined in accordance with MIL-STD-462.

15. CS11 (limited applicability)

15.1 CS11 applicability. This EMP requirement is applicable to Navy equipment and subsystems having interconnecting or intraconnecting control, signal, or power cables. This requirement is not applicable for equipment intended solely for use on non-metallic aircraft, unless otherwise specified by the procuring activity. It should be noted that if the requirement is to be installed in an intentionally unhardened aircraft, the equipment will not be adequately protected against the specified electromagnetic pulse (EMP). Actual cable types, sizes and configurations subjected to the specified RS05 levels are exempt from meeting this requirement.

15.2 CS11 limit. The test sample shall not exhibit any permanent malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances and recovery times indicated in the equipment or subsystem specification, after being subjected to a test signal having the waveform shown in figure 2-9 and having a maximum bulk common mode cable current of 10 amps, as determined in accordance with MIL-STD-462.

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16. CS12

16.1 CS12 applicability. This requirement is applicable to equipment and subsystems procured for Air Force use.

16.2 CS12 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances allowed by the individual equipment or subsystems specification, when the current waveform of figure 2-15 is induced at 10 kHz, 100 kHz, 1 MHz, 10 MHz, and 100 MHz in each interconnecting and power cable at the peak current level specified on figure 2-16. Additional test frequencies(particularily between 1 and 50 MHz) shall apply when required by system design considerations or when required by the procuring activity. When a 1500 volt level is reached between any pin and its lowest impedance return the requirement of this test shall be considered to be met.

17. CS13

17.1 CS13 applicability. This requirement is applicable to equipment and subsystem procured for Air Force use.

17.2 CS13 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances allowed by the individual equipment or subsystem specification, when a pulse signal is applied to each single wire or multiple wire unit (twisted pair, triax, etc.) of the interconnecting and power leads. The pulse signal shall produce the current and voltage waveform of figure 2-17 at the levels shown on figure 2-18 when applied to calibration loops. Test frequencies shall be 10 kHz, 100 kHz, 1 MHz, 10 MHz and 100 MHz. Additional test frequencies (particularily between 1 MHz and 50 MHz) shall when required by system design considerations or when required by the procuring activity.

18. RE01 (limited applicability)

18.1 RE01 applicability. This requirement is applicable only for equipments and subsystems installed in aircraft having an ASW capability and for Navy equipment and subsystems intended for use on aircraft having Very Low Frequency (VLF) equipment and subsystems. When required, RE01 is applicable for radiated emissions from equipments and subsystems, cables (including control, pulse, intermediate frequency (IF), power antennas transmission lines) and interconnecting wiring of the test sample. The requirement applies at the fundamental frequencies and all spurious emissions, including harmonics, but does not apply for radiation from antennas.

18.2 RE01 limit. Magnetic field emissions shall not be radiated in excess of the levels shown on figure 2-10.

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19. RE02

19.1 RE02 applicability. This requirement is applicable for radiated emissions from equipments and subsystems, cables (including control, pulse IF, power and antennas transmission lines) and interconnecting wiring of the test sample; for narrowband, it applies at the fundamental frequencies, and all spurious emissions including harmonics, but does not apply for radiation from antennas. This requirement is applicable for broadband emissions from 14 kHz to 1 GHz and for narrowband emissions from 14 kHz to 10 GHz.

19.2 RE02 limits. E-field emissions shall not be radiated in excess of those given in 19.2.1 and 19.2.2. Above 30 MHz, the limits shall be met for both horizontally and vertically polarized waves.

19.2.1 Narrowband electric field emissions. Narrowband E-field emissions shall not be radiated in excess of the applicable limit curve shown on figure 2-11 at the required test distance, as specified in MIL-STD-462.

19.2.2 Broadband electric field emissions. Broadband E-field emissions from all equipments and subsystems, including radiated switching transients resulting from (1) automatic cycling of electronic or electrical switching circuitry, (2) actuation of push-to-talk mechanisms (that is keying of transmitters), or (3) manual switching shall not be radiated in excess of the applicable limit curve shown on figure 2-12 at the required test distances, as specified in MIL-STD-462.

20. RE03 (limited applicability

20.1 RE03 applicability. This requirement is applicable for transmitting equipments and subsystems with antenna leads or those designed to be connected to antennas. The frequency range of this requirement is dependent on the operating frequency of the test sample (see MIL-STD-462). The requirement is not applicable within either the test sample's necessary bandwidth or 5 percent of the fundamental frequency.

20.1.1 Army procurements. This requirement is applicable for transmitting equipments and subsystems procured solely for Army use when any of the following conditions exist: (a) transmitter power exceeds 5 kW average; (b) the fundamental frequency of the test sample exceeds 1.24 GHz; (c) the test sample's antenna is an integral part of the transmitter and cannot be replaced by a suitable dummy load; or (d) for equipments and subsystems with waveguide transmission lines and operating below 1.24 GHz.

20.1.2 Air Force and Navy procurements. This requirement is applicable, with the approval of the procuring activity, when the transmitter spurious emissions and harmonics cannot be determined using the procedures in CE06.

20.2 RE03 limit. Harmonics, except the second and third, and all other spurious emissions shall have peak powers 80 dB down from the power at the fundamental. The second and third harmonics shall be suppressed by: 50 + 10 log P (where P = peak power, in watts, at the fundamental) or 80 dB whichever requires less suppression.

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21. RS01 (limited applicability)

21.1 RS01 applicability. This requirement is applicable only for equipments and subsystems installed in aircraft having an ASW capability, and for Navy equipment and subsystems intended for use on aircraft having Very Low Frequency (VLF) equipment and subsystems. When required, RS01 is applicable to equipments and subsystems, and their associated cabling and connectors.

21.2 RS01 limit. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to magnetic fields equal to the levels shown on figure 2-13.

22. RS02

22.1 RS02 applicability. This requirement is applicable to equipment and systems as indicated in 22.1.1 and 22.1.2.

22.1.1 Part I - spikes. This portion of RS02 is applicable for all Department of Defense (DoD) activities.

22.1.2 Part II - power frequency. This requirement is applicable for equipments and subsystems procured for Air Force and Navy use.

22.2 RS02 limits

22.2.1 Part I - spikes. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to the test spikes having the waveform shown on figure 2-6. The values of $E_{(\ )}$ and $t_{(\ )}$ are given below:

a. Spike #1 (All Services) — E_1 = 200 Volts; t_1 = 10 microseconds ±20%

b. Spike #2 (Air Force and Navy) — E_2 = 200 Volts; t_2 = 0.15 microseconds ±20%

22.2.2 Part II - power frequency. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when 20 amperes are applied to the test wire at the power frequency(ies) of the test sample.

23. RS03

23.1 RS03 applicability. This requirement is applicable for all equipment and subsystem between 14 kHz and 10 GHz. Above 10 GHz, this requirement applies only at all intentionally generated frequencies of known intentional emitters on the aircraft, and for Navy procurements, the aircraft's host ship. For Air Force procurements, this requirement is not applicable above 10 GHz, unless otherwise required by the procuring activity.

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23.2 RS03 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when subjected to the radiated electric fields (E) specified herein. Above 30 MHz, the requirement shall be met for both horizontally and vertically polarized waves; circurlarly polarized waves are also acceptable. Appropriate consideration shall be given to the operational radiated electromagnetic environment from both friendly and hostile emitters which an equipment or subsystem may encounter during its life cycle. Applicable portions of MIL-HDBK-235 shall be used to determine the anticipated environment. As a minimum, the following levels apply. If levels substantially higher than those given herein are specified, modifications to the procedure in MIL-STD-462 may be required or desirable. Such modifications are to be described in the EMI Test Plan.

Frequency Range	E-Field (Volts/Meter (V/m))
14 kHz to 2 MHz	20, except that for Army procurements the level is 1 V/m
2 to 10 GHz	20
Above 10 GHz	20

23.2.1 Air Force and Navy equipments and subsystems installed in non-metallic aircraft, non-metallic structures on metallic aircraft or externally mounted on metallic aircraft. Such equipments shall not malfunction when subjected to a radiated E-field of 200 V/m over the required frequency range.

23.2.2 Air Force flight critical equipment and subsystems. Equipment and subsystems which are flight critical shall not malfunction when subjected to a radiated E-field of 200 V/m from 14 kHz to 10 GHz.

24. RS05 (limited applicability)

24.1 RS05 applicability). This requirement is intended for Navy equipment and subsystems and is applicable whenf both of the following conditions exist: (a) operation of the equipment or subsystem is essential for safety or the success of a mission and (b) the equipment or subsystem is installed on a non-metallic structure on a metallic aircraft or externally mounted on on a metallic aircraft. This requirement is not applicable for equipment intended solely for use on non-metallic aircraft, unless otherwise required by the procuring activity. Cables that can not be tested in accordance with MIL-STD-462 shall meet the requirements of CS11, and cables subjected to the specified CS11 levels are exempt from meeting this requirement.

24.2 RS05 limit. The test sample shall not exhibit any permanent malfunction degradation of performance, or deviation from specified indications,beyond the tolerances and recovery times indicated in the individual equipment or subsystems specification, after being subjected to a test signal having thewaveform and amplitude shown on figure 2-14.

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25. RS06

25.1 RS06 applicability. This requirement is applicable to equipment and subsystems procured for Air Force use.

25.2 RS06 limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances allowed by the individual equipment or subsystem specification while being subjected to a radiated eletromagnetic field generated by fast switching pulses from a relay coil. The peak-to-peak transient voltage across the relay coil shall be a minimum of 600 volts.

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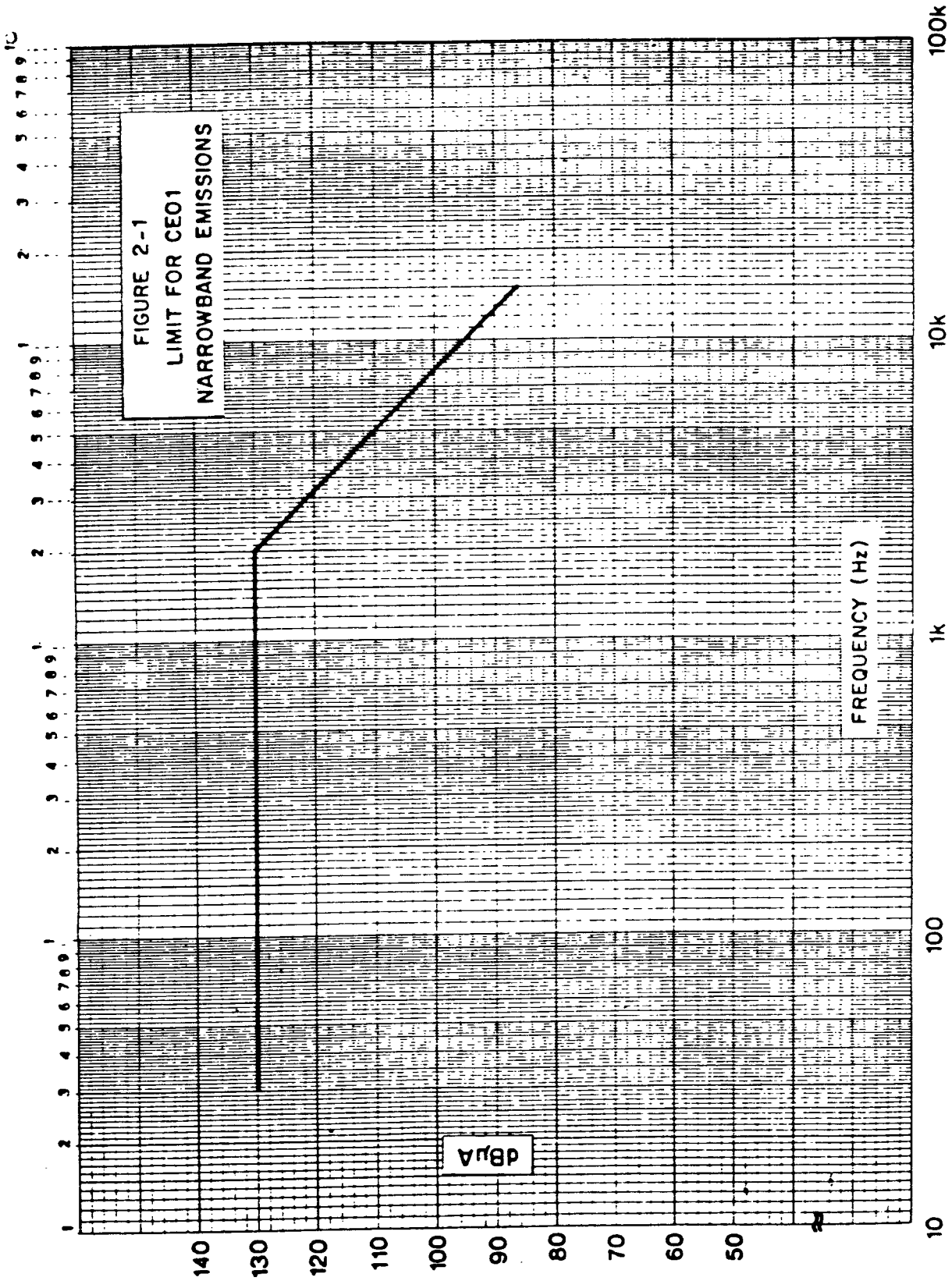

FIGURE 2-1. LIMIT FOR CE01 NARROWBAND EMISSIONS

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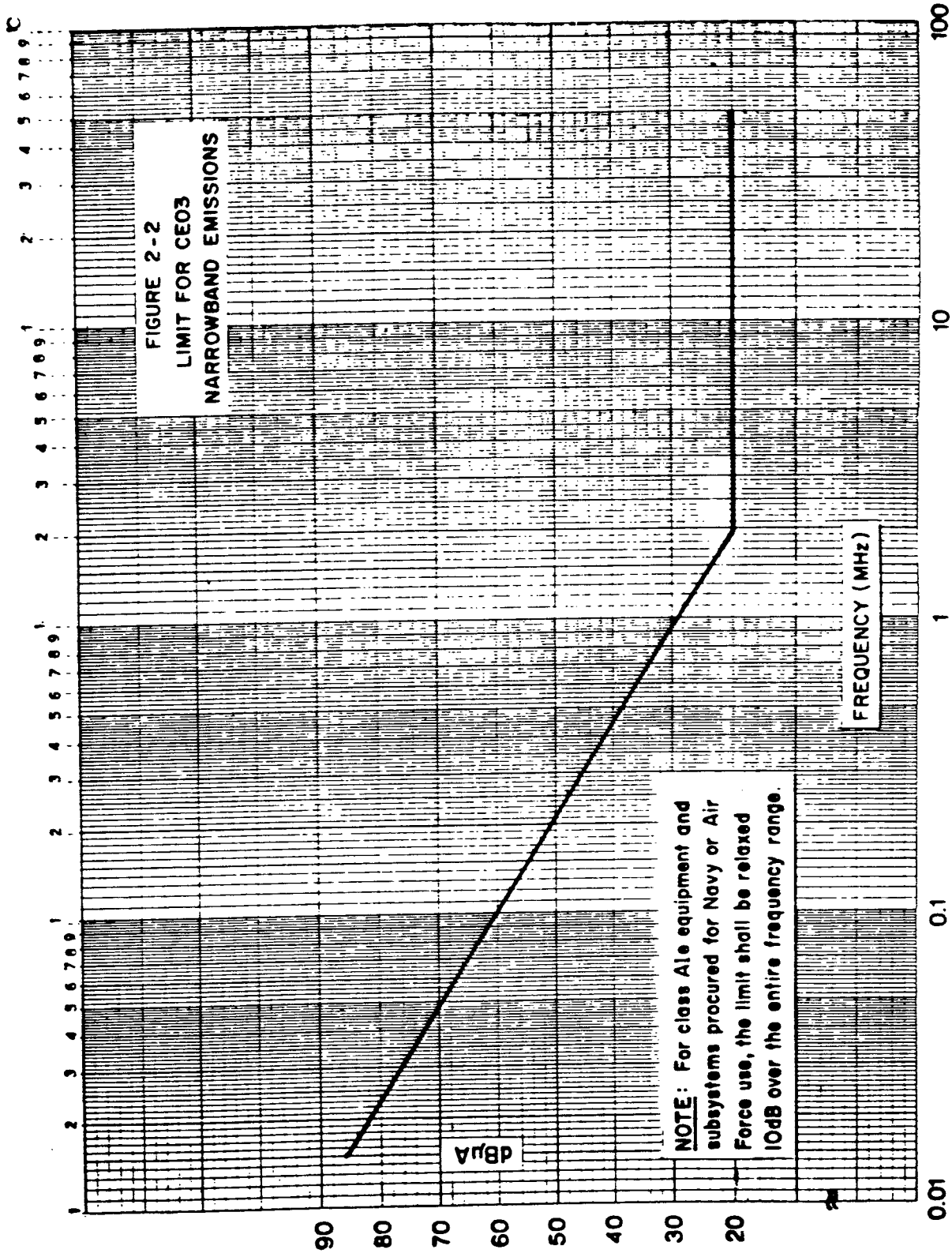

FIGURE 2-2. LIMIT FOR CE03 NARROWBAND EMISSIONS

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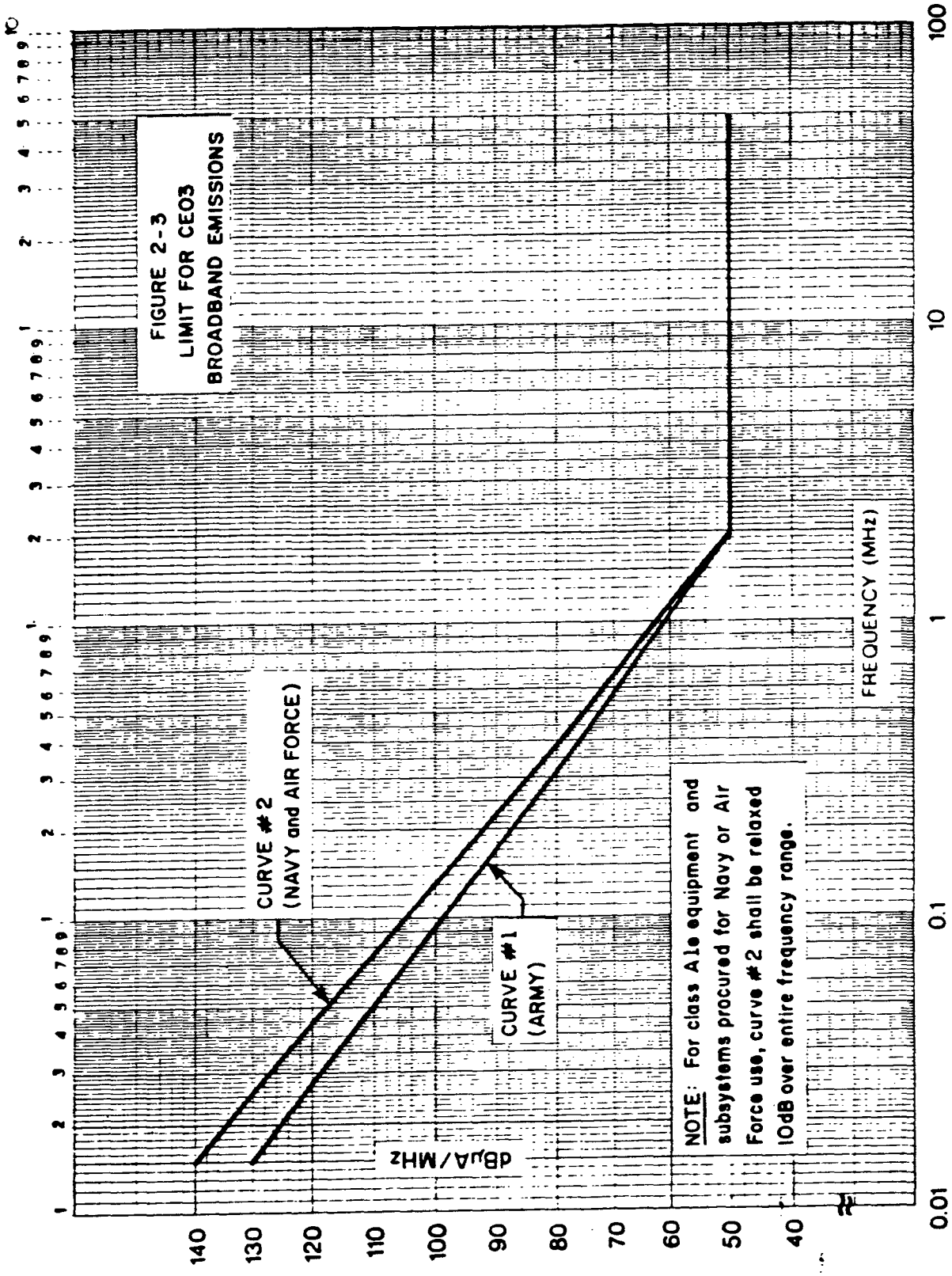

FIGURE 2-3. LIMIT FOR CE03 BROADBAND EMISSIONS

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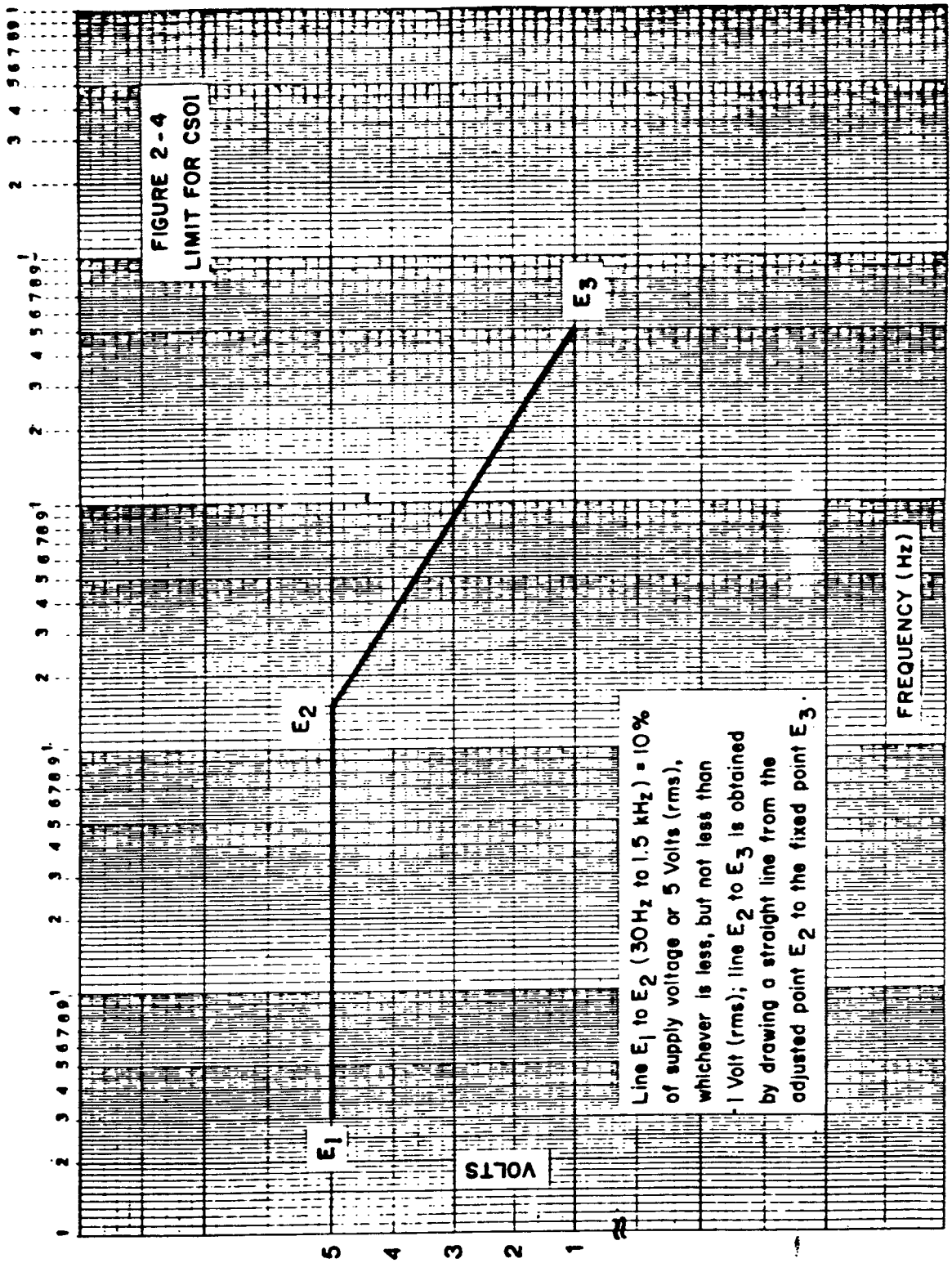

FIGURE 2-4. LIMIT FOR CS01

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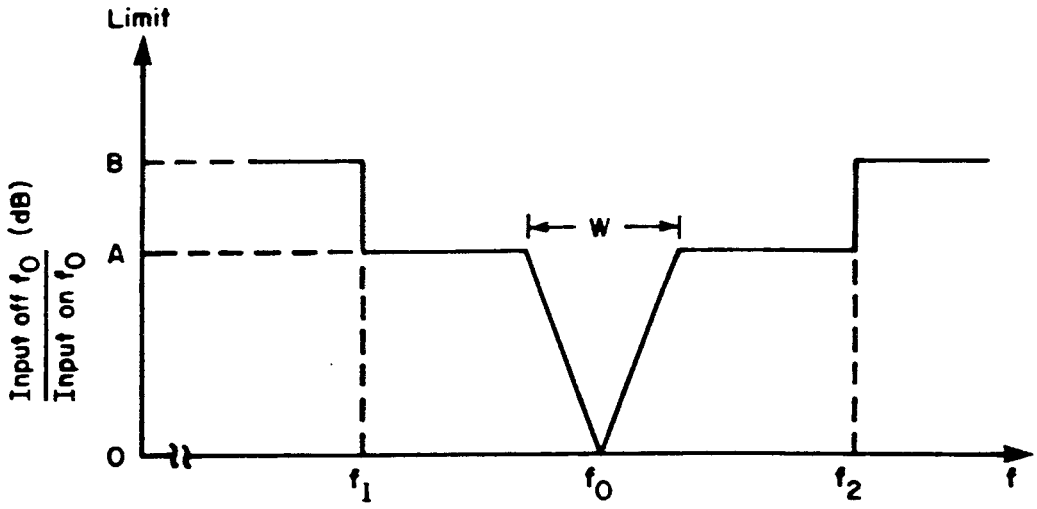

f_0 = Receiver tuned frequency or band center for amplifiers.

f_1 = Lowest tunable frequency of receiver band in use or the lowest frequency of amplifier passband.

f_2 = Highest tunable frequency of receiver band in use or the highest frequency of amplifier passband.

W = Bandwidth between the 80 dB points of the receiver selectivity curve as defined in the test sample's technical requirements or the control plan.

Limits:

1. The limit at A is 80 dB above the input level required to produce the standard reference output. (This limit shall not be used for amplifiers)
2. The limit at B shall be set as follows:
   a. Receivers: 0 dBm applied directly to the receiver input terminals.
   b. Amplifiers: The limit shall be as specified in the test sample's technical requirement or control plan. If no limit is defined in the above documents, the 0 dBm value shall be used.

FIGURE 2-5. LIMIT FOR CSO4

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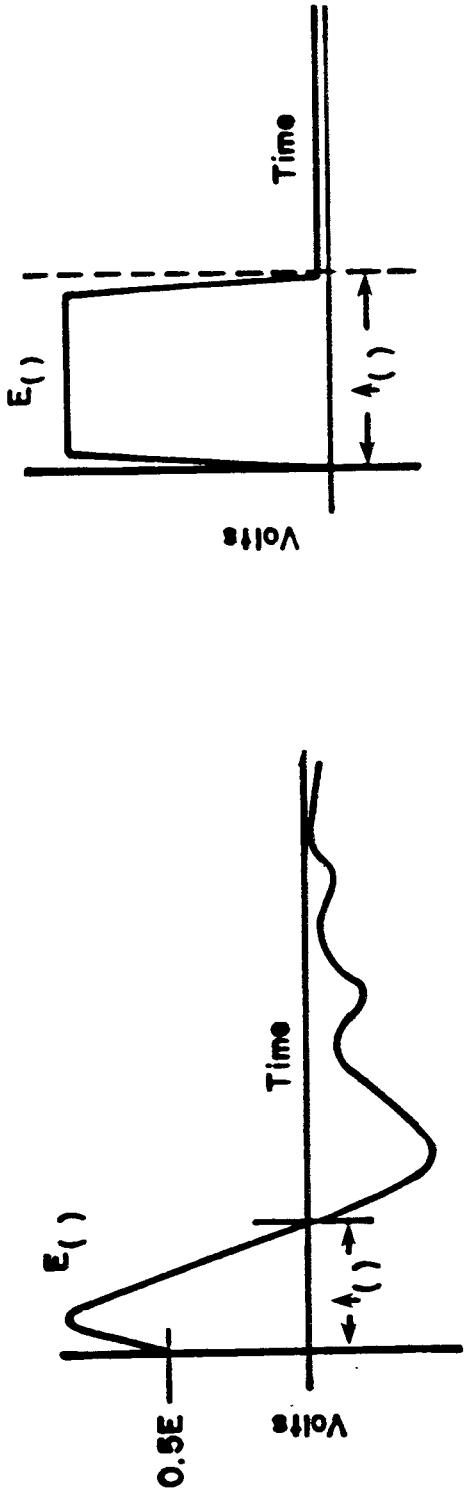

NOTE: The test sample shall be subjected to the spike(s) with the waveform shown and with the specified voltage (s) and pulsewidth(s).

FIGURE 2-6. ACCEPTABLE WAVESHAPES FOR CS06 AND RS02

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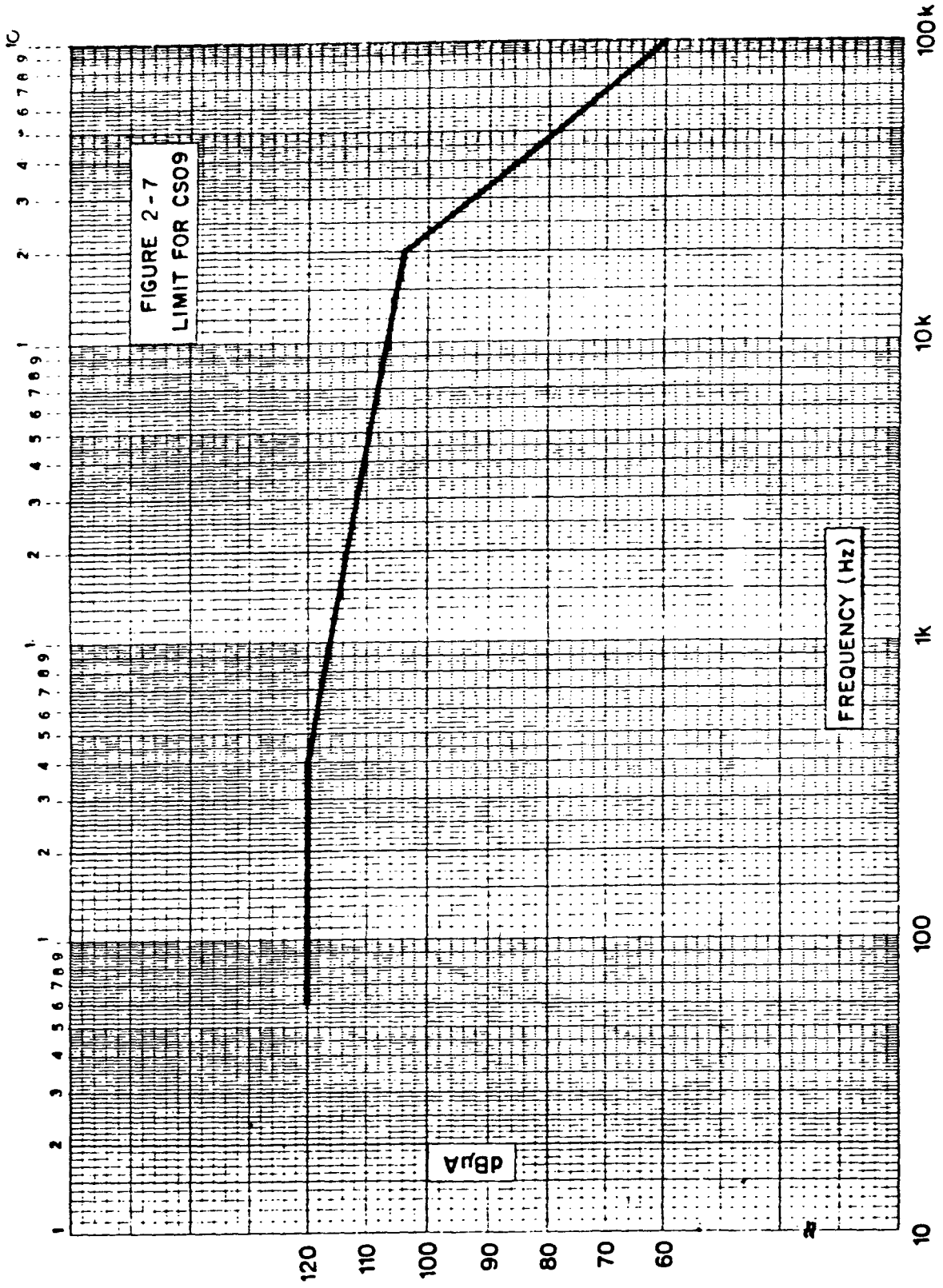

FIGURE 2-7. LIMIT FOR CS09

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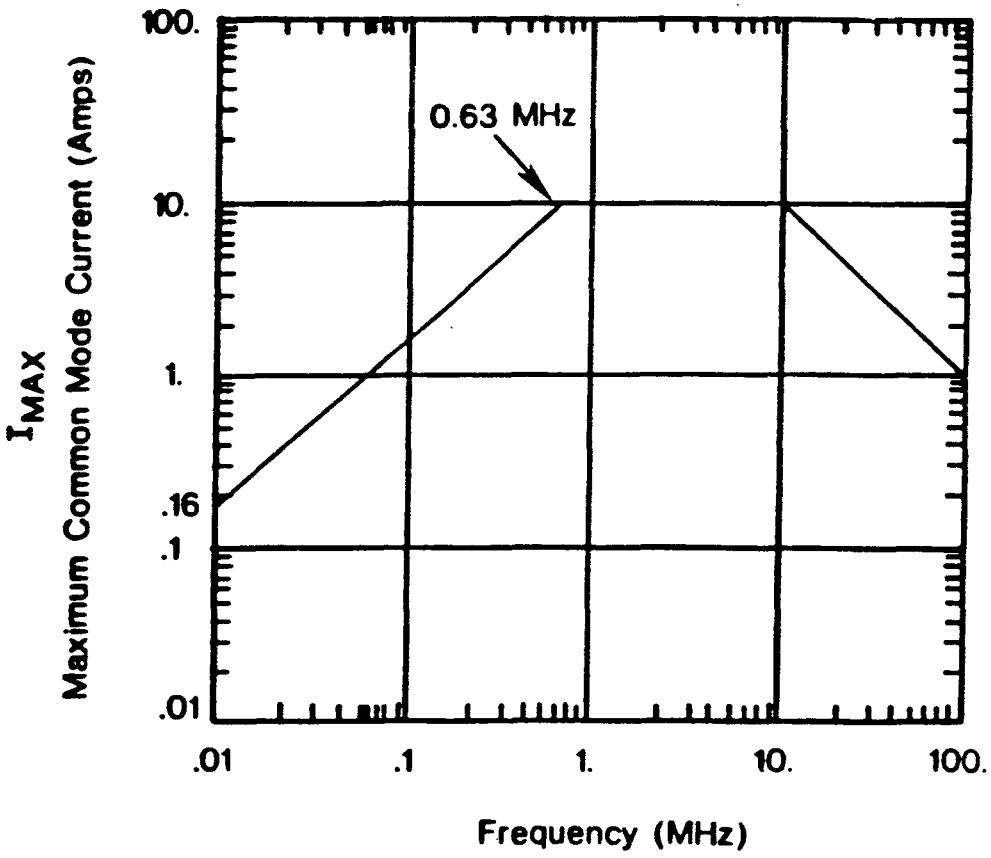

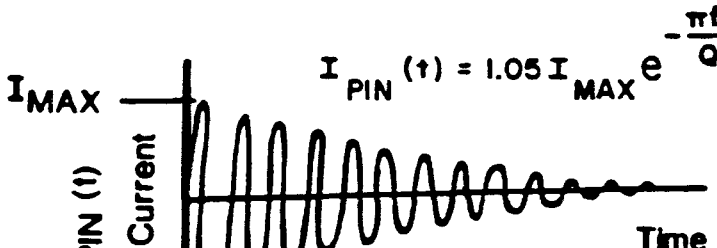

$$I_{PIN}(t) = 1.05\, I_{MAX}\, e^{-\frac{\pi f t}{Q}}\, SIN(2\pi f t)$$

where,

I_{PIN} (t) = common mode pin current in amps

f = frequency, hertz

t = time, seconds

Q = decay factor

FIGURE 2-8. LIMIT FOR CS10

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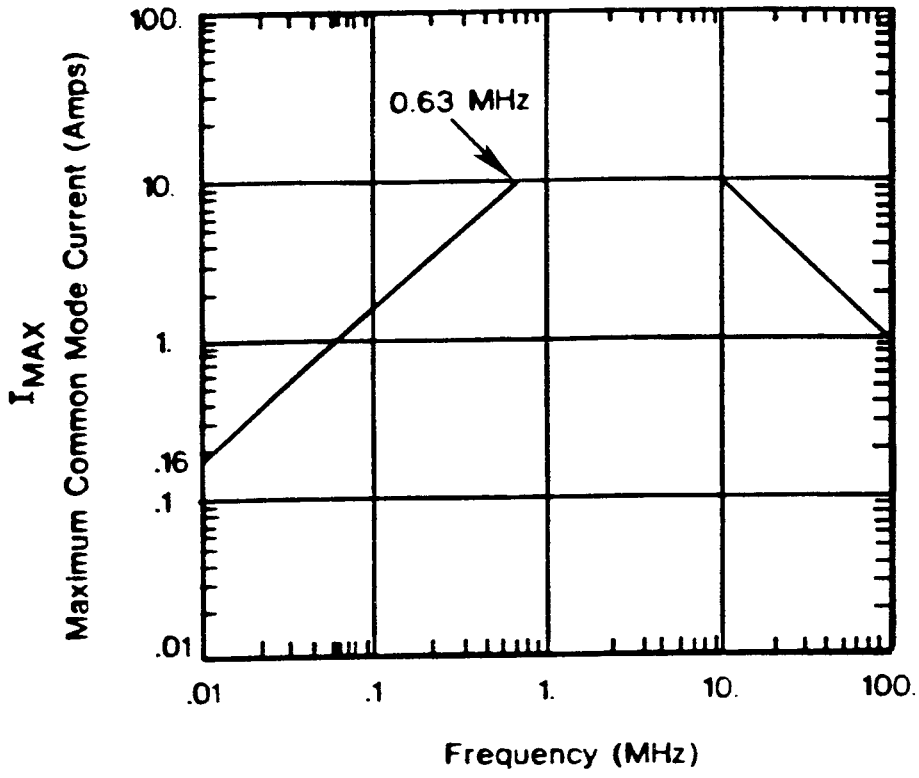
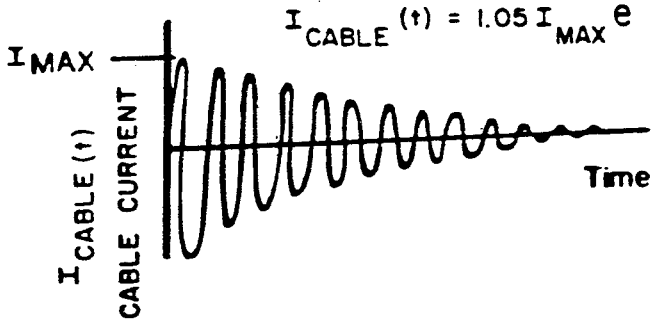


$$I_{CABLE}(t) = 1.05\, I_{MAX}\, e^{-\frac{\pi f t}{Q}}\, \mathrm{SIN}(2\pi f t)$$



where,

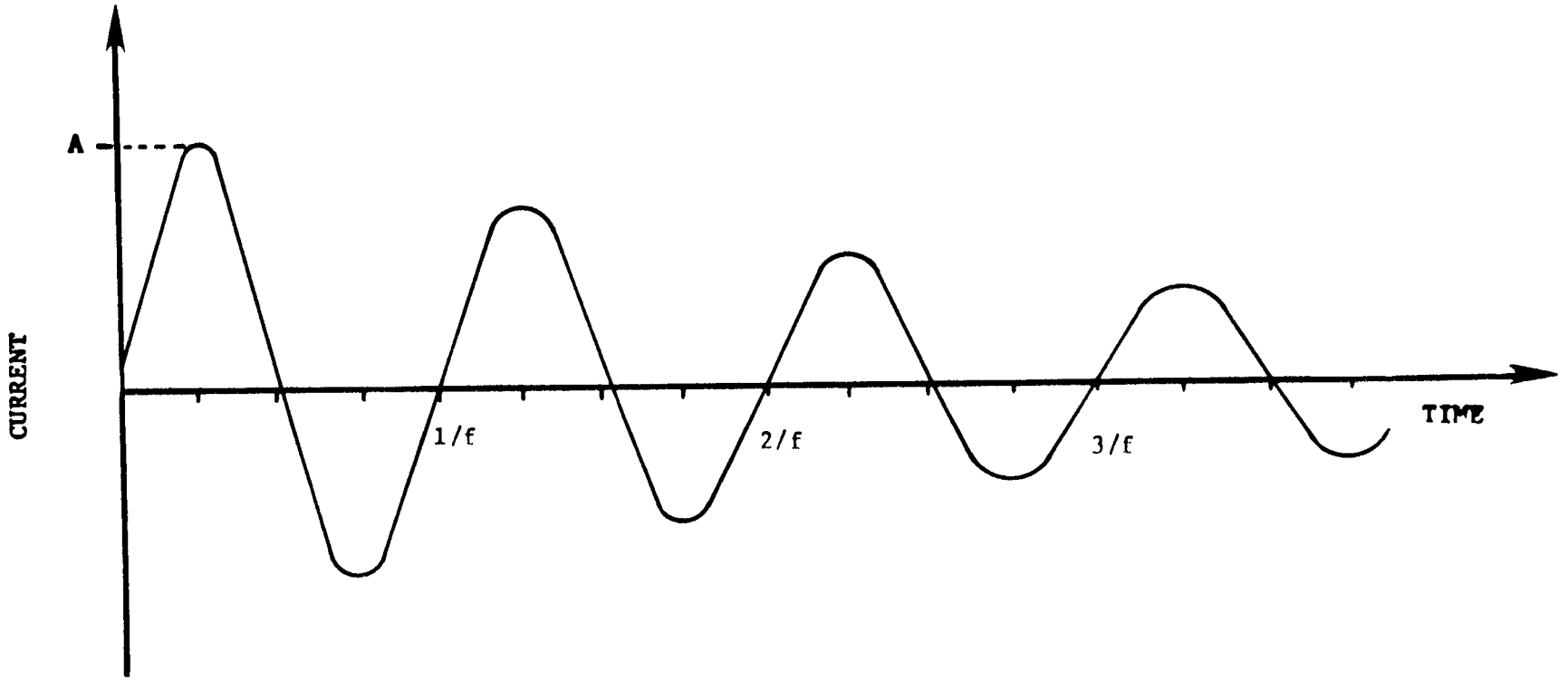
$I_{CABLE}(t)$ = common mode cable current in amps

f = frequency, hertz

t = time, seconds

Q = decay factor

FIGURE 2-9. LIMIT FOR CS11



NOTES: 1/ Waveform equation normalized: $e^{-(\pi ft)/Q} \sin 2\pi ft$ where:

f= test frequency (Hz)
t= time (sec)
Q= 20±5 quality factor

2/ "A" is the peak current level shown in Figure 2-16.

FIGURE 2-15. Waveform for CS12.

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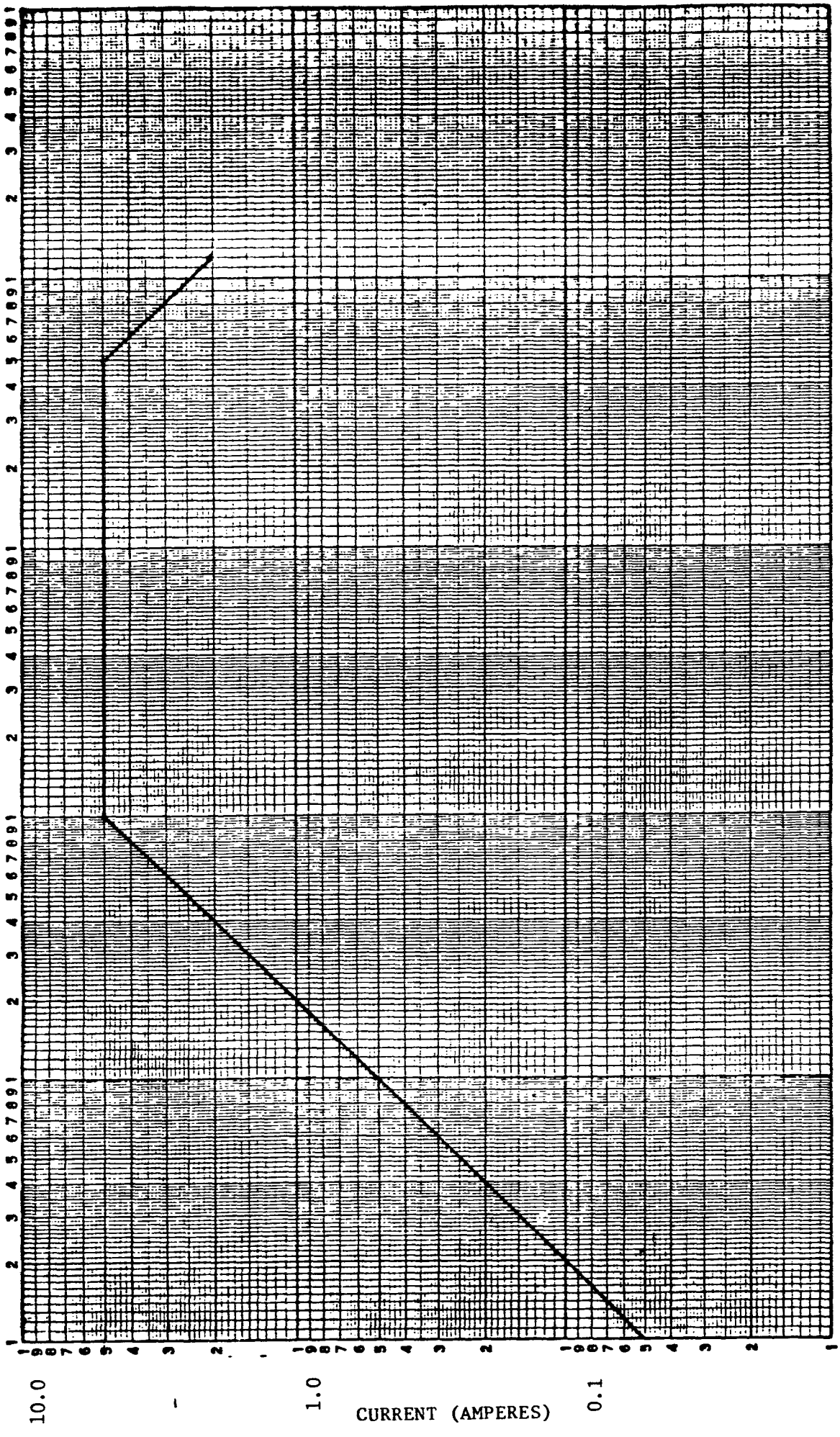
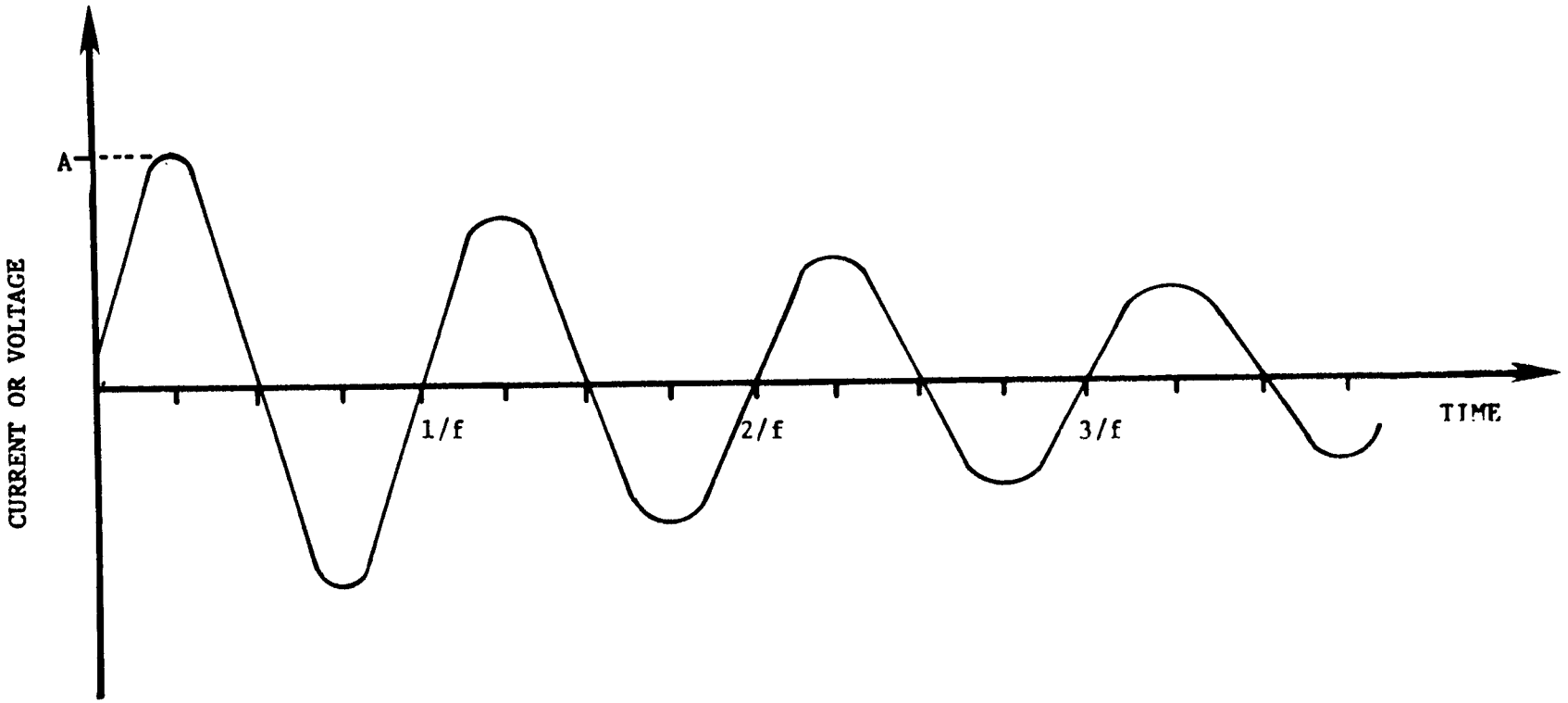


FIGURE 2-16. Limit for CS12.



NOTES: 1/ Waveform equation normalized: $e^{-(\pi ft)/Q} \sin 2\pi ft$ where:

f= test frequency (Hz)
t= time (sec)
Q= 20±5 quality factor

2/ "A" is the peak current or voltage level shown in Figure 2-18.

FIGURE 2-17. Waveform for CS13.

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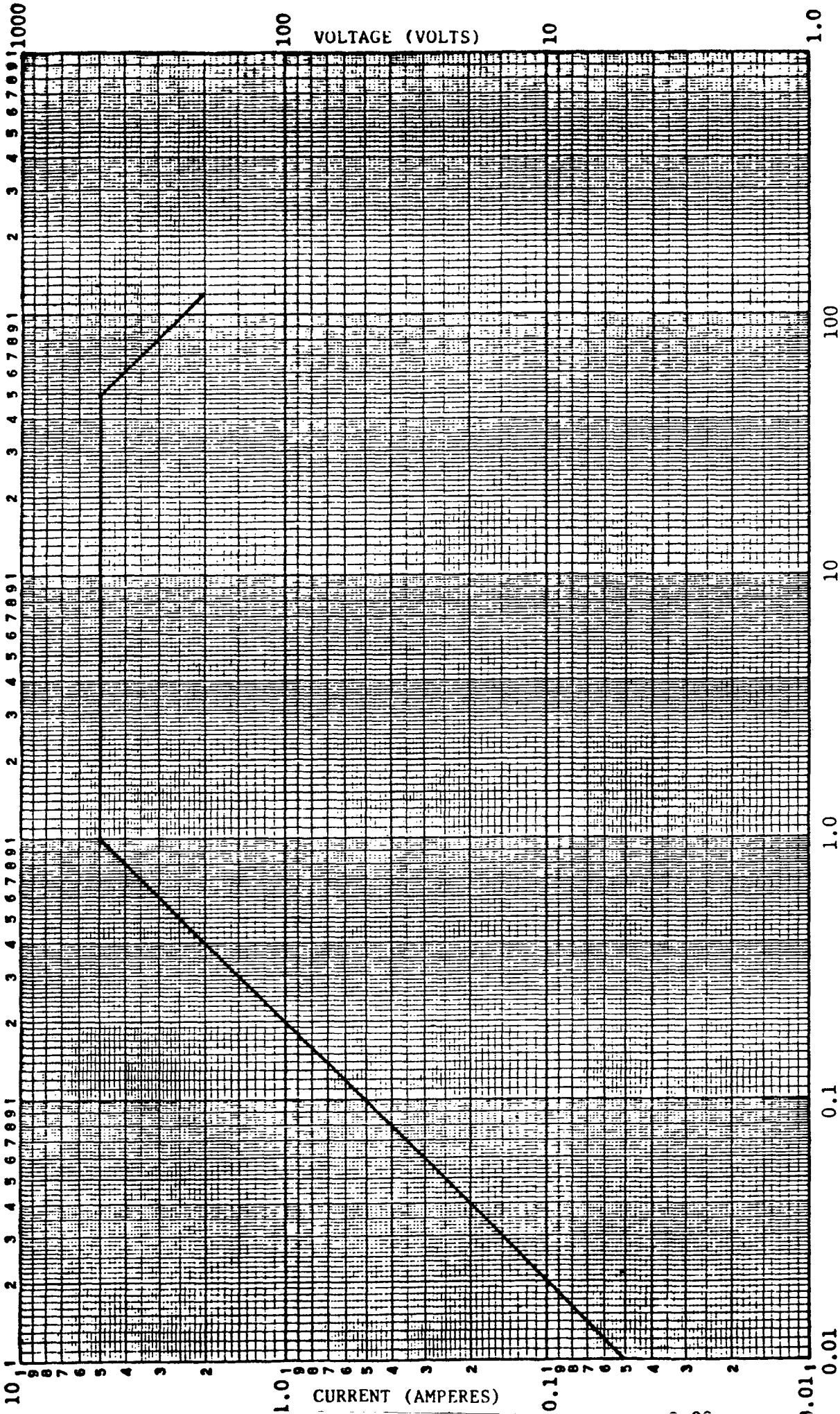

FIGURE 2-18. Limit for CS13.

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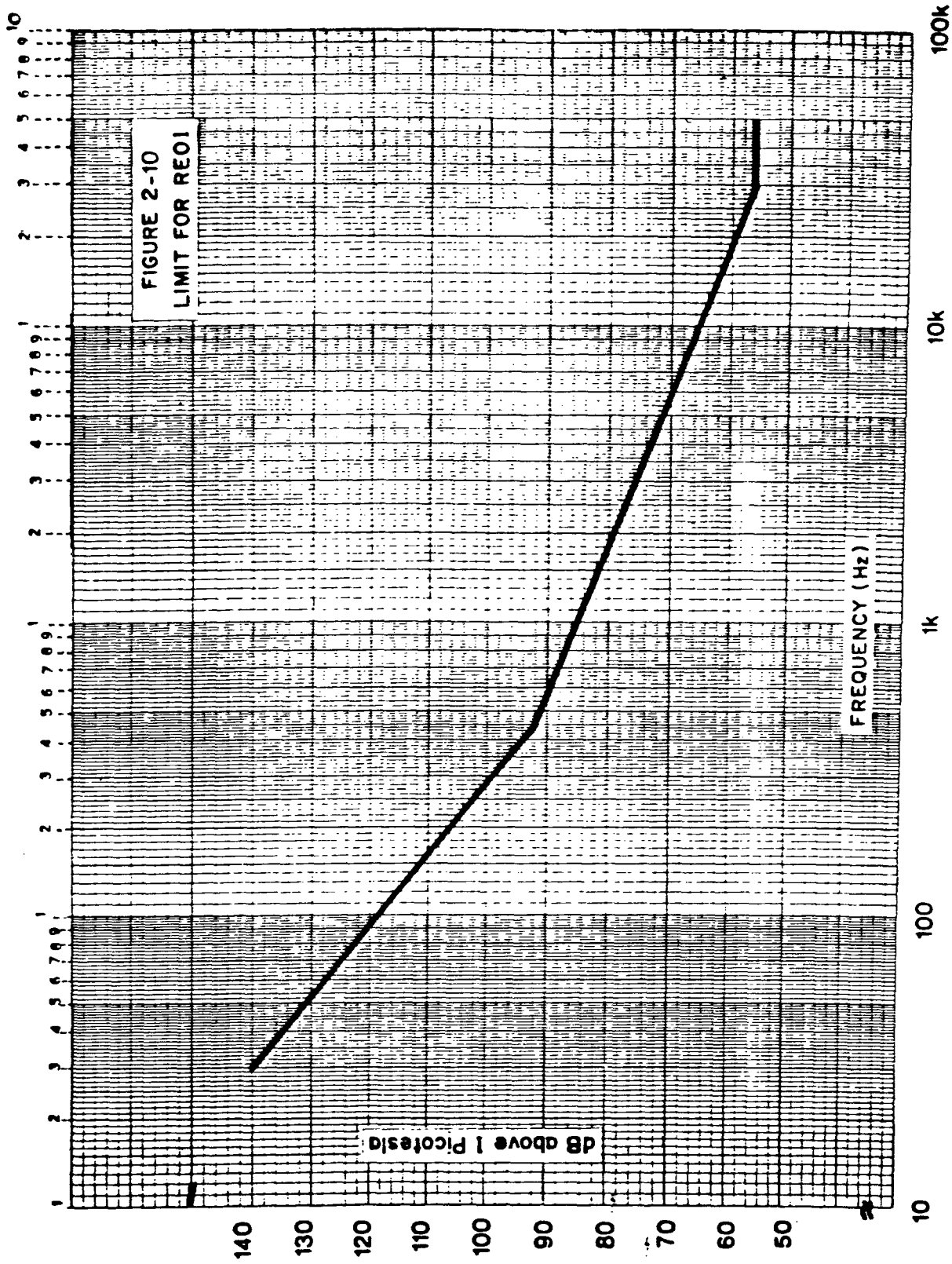

FIGURE 2-10. LIMIT FOR REO1

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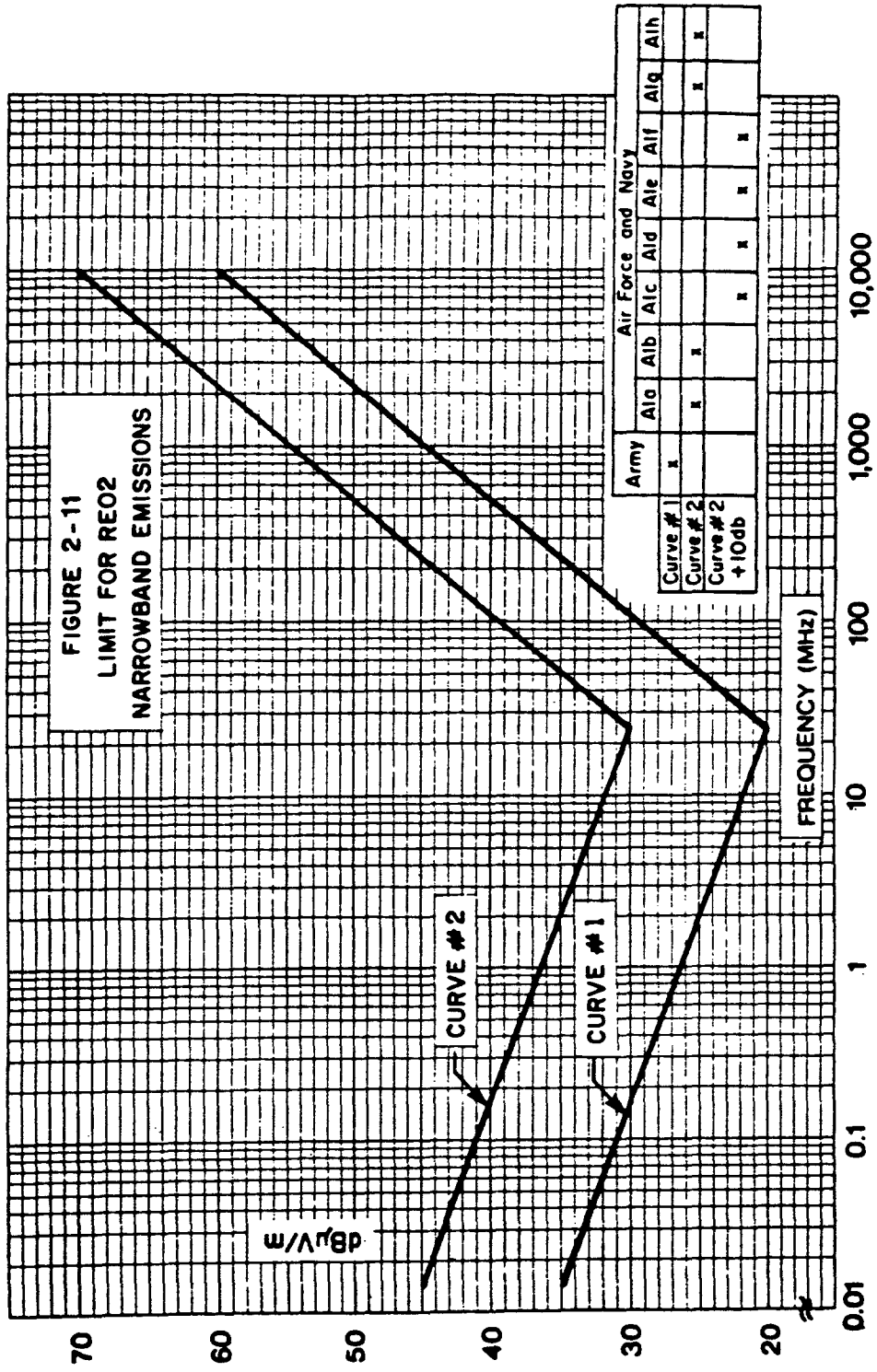

FIGURE 2-11. LIMIT FOR REO2 NARROWBAND EMISSIONS

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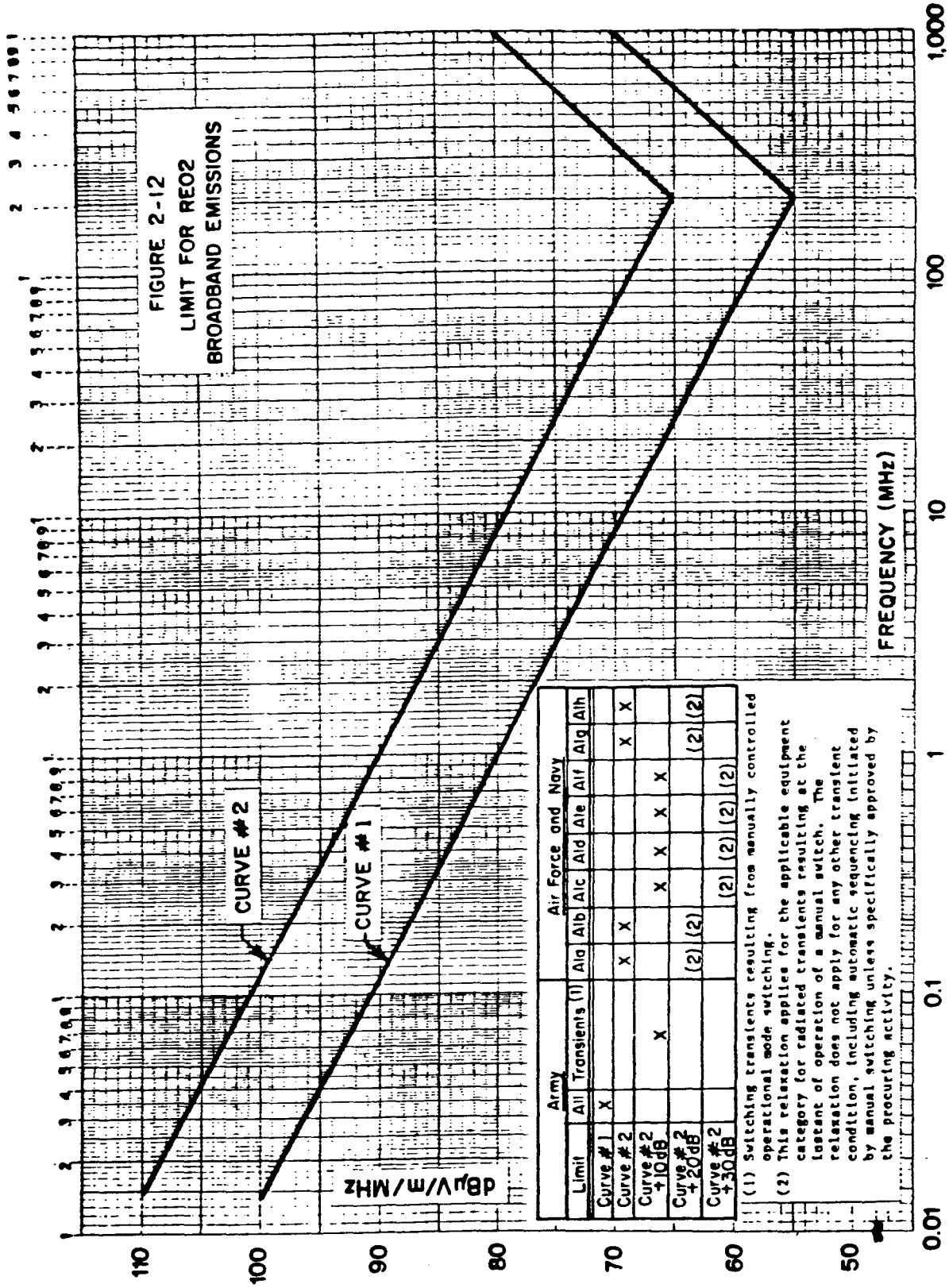

FIGURE 2-12. LIMIT FOR RE02 BROADBAND EMISSIONS

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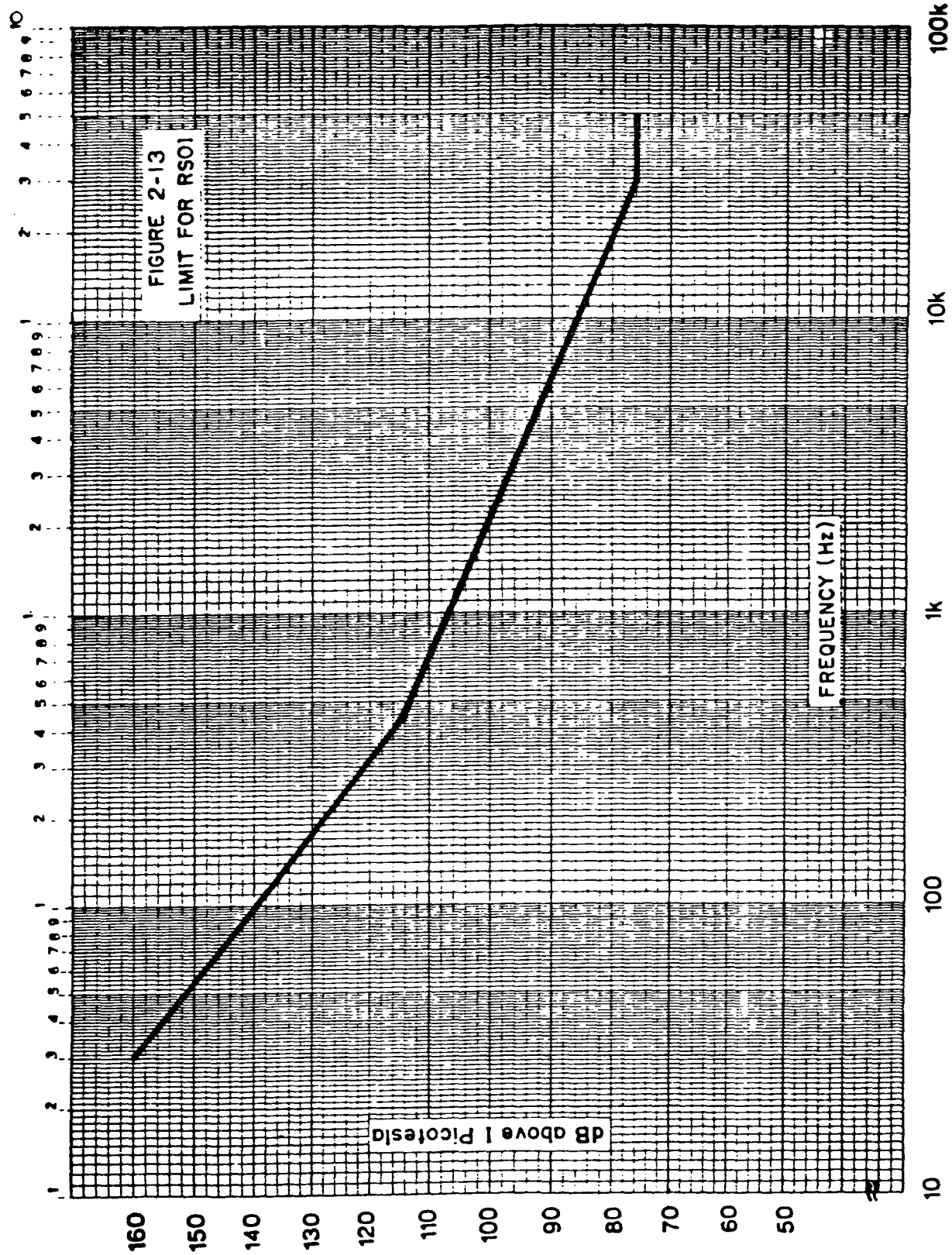

FIGURE 2-13. LIMIT FOR RSO1

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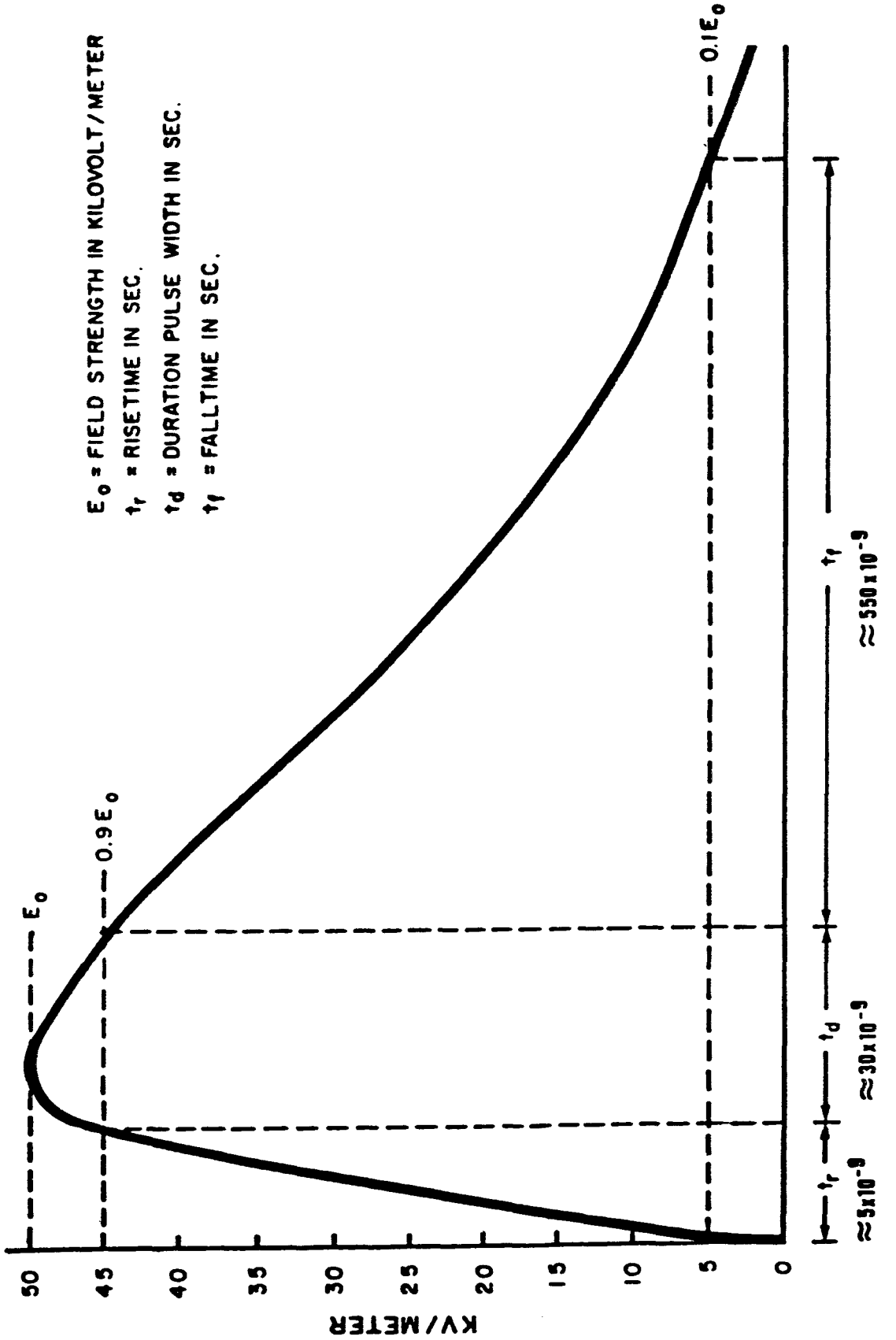

FIGURE 2-14. LIMIT FOR RS05