

# Military EMC standards

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- MIL STD 461 D/E/F/G
- MIL STD 188-125 PCI, SE, CW : EMP 방호설비 시험검사
- MIL STD 220C : 군용 필터 공인시험



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# 1. 현용 미군 EMP/EMC 관련 규격

Reference	Title
MIL-STD-188-124	Grounding, Bonding and Shielding for Common Long Haul/Tactical Communications Systems Including Ground Based Communication-Electronics Facilities and Equipments
MIL-STD-188-125-1	High-Altitude Electromagnetic Pulse (HEMP) Protection For Ground-Based C4I Facilities Performing Critical, Time-Urgent Missions - Part 1 - Fixed Facilities
MIL-STD-188-125-2	High-Altitude Electromagnetic Pulse (HEMP) Protection For Ground-Based C4I Facilities Performing Critical, Time-Urgent Missions - Part 2 - Transportable Systems
MIL-STD-331C	Environmental and Performance Tests for Fuze and Fuze Components
MIL-STD-449D	Measurement of Radio Frequency Spectrum Characteristics
MIL-STD-461F	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-464A	Electromagnetic Environmental Effects – Requirements for Systems
MIL-STD-704F	Aircraft electric Power Characteristics
MIL-STD-1310H	Shipboard Bonding, Grounding, and other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety
MIL-STD-1377	Measurement of effectiveness of cable, connector, and weapons enclosure shielding and filters in precluding Hazards of electromagnetic radiation to ordnance
DOD-STD-1399-70-1	Interface Standard for Shipboard Systems – Section 070 – Part 1 – DC Magnetic Field Environment
MIL-STD-1399-300B	Interface Standard for Shipboard Systems – Section 300 - Electric Power, Alternating Current
MIL-STD-1541A	Electromagnetic Compatibility Requirements for Space Systems
MIL-STD-1542B	Electromagnetic Compatibility and Grounding Requirements for Space System Facilities
MIL-STD-1576	Electroexplosive Subsystem Safety Requirements and Test Methods for Space Systems
MIL-STD-1605A	Procedures for Conducting a Shipboard Electromagnetic Interference (EMI) Survey (Surface Ship)
MIL-STD-2169B	High Altitude Electromagnetic Pulse (HEMP) Environment.

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## 2. 현용 미군 Handbook & Test procedure

Reference	Title
MIL-HDBK-235B	Electromagnetic (Radiated) Environment Considerations for Design and Procurement of Electrical and Electronic Equipment, Subsystems and systems
MIL-HDBK-237D	Electromagnetic Environmental Effects and Spectrum Supportability Guidance for the Acquisition Process
MIL-HDBK-240	Hazards of Electromagnetic Radiation to Ordnance (HERO) Test Guide
MIL-HDBK-274	Electrical Grounding for Aircraft safety
MIL-HDBK-419A	Grounding, Bonding and Shielding for Electronic Equipments and Facilities, Volume 1 of 2 Basic Theory
MIL-HDBK-423	High-Altitude Electromagnetic Pulse (HEMP) Protection for Fixed and Transportable Ground-Based C4 1 Facilities – Volume 1 – Fixed Facilities
MIL-HDBK-454B	General Guidelines for Electronic Equipment
MIL-HDBK-83575	General Handbook for Space Vehicle Wiring Harness Design and Testing
MIL-HDBK-83578	Criteria for Explosive Systems and Devices used on Space Vehicles

Reference	Title	Associated with
DI-EMCS-80199C	Electromagnetic Interference Control Procedures (EMICP)	MIL-STD-461F
DI-EMCS-80200C	Electromagnetic Interference Test Report (EMITR)	MIL-STD-461F
DI-EMCS-80201C	Electromagnetic Interference Test Procedures (EMITP)	MIL-STD-461F
DI-EMCS-81295A	Electromagnetic Effects Verification Procedures (EMEVP)	Engineering/manufacturing development phase - any
DI-EMCS-81528	Electromagnetic Compatibility Program Procedures	Demo of life cycle EMC compliance - any
DI-EMCS-81540A	Electromagnetic Environmental Effects (E3) Integration and Analysis Report (E31AR)	MIL-STD-464A
DI-EMCS-81541A	Electromagnetic Environmental Effects (E3) Verification Procedures (E3VP)	MIL-STD-464A
DI-EMCS-81542A	Electromagnetic Environmental Effects (E3) Verification Report (E3VR)	MIL-STD-464A
DI-EMCS-81777	Electromagnetic Interference Survey (EMIS) Test Report	MIL-STD-1605A
DI-EMCS-81782	Electromagnetic Interference Survey (EMIS) Test Procedures	MIL-STD-1605A
TOP-1-2-511	Electromagnetic Environmental Effects System Testing	MIL-STD-464A
TOP 1-2-622	Vertical Electromagnetic Pulse (VEMP) Testing	MIL-STD-464A and MIL-STD-2169B

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### 3. MIL STD 461 변천사

MIL-STD-461A, 1967			MIL-STD-461B/C, 1980/1986			MIL-STD-461D, 1993			MIL-STD-461E, 1999		MIL-STD-461F, 2007		MIL-STD-461G, 2015.12	
Test	Description	Frequency	Test	Description	Frequency	Test	Description	Frequency	Test	Description	Test	Description	Test	Description
CE01	Power Leads	30 Hz-20 kHz	CE01	Power/Signal Leads	30 Hz-15kHz	CE101	Power Leads	30 Hz-10kHz	CE101	Power Leads	CE101	30 Hz-10kHz, Power lead	CE101	30 Hz-10kHz, Power lead
CE02	Control/Signal Leads	30 Hz-20 kHz	CE02	N/A										
CE03	Power Leads	20 kHz-50 MHz	CE03	Power/Signal Leads	15 kHz-50 MHz	CE102	Power Leads	10 kHz-10 MHz	CE102	Power Leads	CE102	10 kHz-10 MHz, Power lead	CE102	10 kHz-18 GHz, Power lead
CE04	Control/Signal Leads	20 kHz-50 MHz	CE04	N/A										
CE05	Inverse Filter Method	30 Hz-50MHz	CE05	N/A										
CE06	Antenna Terminal	10 kHz-10GHz	CE06	Antenna Terminal	10 kHz-26 GHz	CE106	Antenna Terminal	10 kHz-40 GHz	CE106	Antenna Terminal	CE106	Antenna Terminal	CE106	Antenna Terminal
CE07	N/A		CE07	Power Leads	Spikes /시간축									
C501	Power Leads	20 Hz-50 kHz	C501	Power Leads	30 Hz-50 kHz	CS101	Power Leads	30 Hz-50kHz	C5101	Power Leads	C5101	Power Leads	C5101	Power Leads
C502	Power Leads	50 kHz-400 MHz	C502	Power Leads	50 kHz-400MHz									
C503	Inter-modulation	15 kHz-10 GHz	C503	Inter-modulation	15 kHz-10 GHz	CS103	Antenna Port-Inter Mod.	15 kHz-10 GHz	C5103	Antenna Port-Inter-M	C5103	Antenna Port-Inter-M	C5103	Antenna Port-Inter-M
C504	Undesired Signal Rejection	15 kHz-10 GHz	C504	Undesired Sig Rejection	30 kHz-20 GHz	CS104	Antenna Port Rejection	30 Hz-20 GHz	C5104	Antenna Port-Rejection	C5104	Antenna Port-Rejection	C5104	Antenna Port-Rejection
C505	Cross Modulation	15 kHz-10 GHz	C505	Cross Modulation	30 kHz-20 GHz	CS105	Antenna Port-Cross Mod.	30 Hz-20 GHz	C5105	Antenna Port-Cross M	C5105	Antenna Port-Cross M	C5105	Antenna Port-Cross M
C506	Spikes, Power Leads		C506	Spikes, Power Leads			삭제			C5106	Spikes, Power Leads 추가			삭제
C507	Squelch Circuits		C507	Squelch Circuits										
C508	Undesired Sig. Reject.	30 Hz-10 GHz	C508	N/A										
	N/A		C509	Structure CM Current	60 Hz-100 kHz	CS109	Structure CM Current	60 Hz-100 kHz	C5109	60 Hz-100 kHz	C5109	60 Hz-100 kHz	C5109	60 Hz-100 kHz
	N/A		C510	Damped Sinusoidal Transients	10 kHz-100 MHz									
						CS114	Bulk Cable Injection	10 kHz-400 MHz	C5114	Bulk Cable Injection	C5114	Bulk Cable Injection	C5114	Bulk Cable Injection, probe 위치
						CS115	Bulk Cable Injection	반복 Impulse	C5115	반복 Impulse	C5115	반복 Impulse	C5115	반복 Impulse
						CS116	Damped sinusoidal Transients Cables, Power	10 kHz-100 MHz	C5116	Damped sinusoidal Transients Cables, Power	C5116	Damped sinusoidal Transients Cables, Power Leads	C5116	Damped sinusoidal Transients Cables, Power Leads
													C5117	Multiple stroke and burst lightning 추가
													C5118	ESD 추가, Contact +/- 5kV Air +/- 15kV
RE01	Magnetic Field	30 Hz-50 kHz	RE01	Magnetic Field	30 Hz- 50 kHz	RE101	Magnetic Field	30 Hz-100 kHz	RE101	Magnetic Field	RE101	30 Hz-100 kHz	RE101	30 Hz-100 kHz
RE02	Electric Field	14 kHz-10 GHz	RE02	Electric Field	14 kHz-10 GHz	RE102	Electric Field	10 kHz-18 GHz	RE102	Electric Field	RE102	10 kHz-18 GHz	RE102	10 kHz-18 GHz
RE03	Spurious & Harmonic	10 kHz-40 GHz	RE03	Spurious & Harmonic	10 kHz-40 GHz	RE103	Antenna Spurious & Harmonics	10 kHz-40 GHz	RE103	Antenna Spurious & Harmonics	RE103	10 kHz-40 GHz	RE103	10 kHz-40 GHz
RE04	Magnetic Field	20 Hz-15 kHz	RE04	N/A										
RE05	Vehicle & Engine	150 kHz-1 GHz	RE05	N/A										
RE06	Overhead Power lines	14 kHz-1 GHz	RE06	N/A										
R501	Magnetic Field	30 Hz-30 kHz	R501	Magnetic Field,	30 Hz-50 kHz	RS101	Magnetic Field,	30 Hz-100 kHz	R5101	Magnetic Field	RS101	MF, 30 Hz-50 kHz	R5101	MF, 30 Hz-50 kHz
R502	Magnetic Induction	Power line & Spike	R502	Equipment & Cables	Power line & Spike		삭제							
R503	Electric Field	14 kHz-10 GHz	R503	Electric Field,	14 kHz- 40 GHz	RS103	Electric Field	10 kHz-40 GHz	R5103	Electric Field, 2 MHz-40 GHz	RS103	Electric Field, 2 MHz-40 GHz	R5103	Electric Field, width-area 변경 2 MHz-40 GHz
R504	Parallel Line Fields	14 kHz-30 MHz	R504	N/A										
R505	N/A		R505	EMP	50kV/m	RS105	EMP, 50kV/m	Transients	R5105	EMP, 50kV/m	RS105	EMP, 50kV/m	R5105	EMP, 50kV/m

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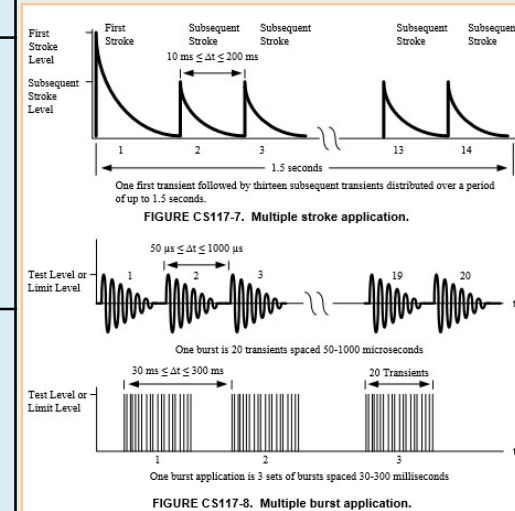
## 4. MIL STD 461F /G시험 항목별 에너지량

Test	Description	Lowest Emission or Highest Susceptibility	MIL STD 461 E/F/G
CE101	Conducted Emissions, Power Leads, 30 Hz to 10 kHz	76 dB $\mu$ A	-
CE102	Conducted Emissions, Power Leads, 10 kHz to 10 MHz	60 dB $\mu$ V	-
CE106	Conducted Emissions, Antenna Terminal, 10 kHz to 40 GHz	34 dB $\mu$ V	-
CS101	Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz	136 dB $\mu$ V	Applicability added for surface ships; setup modifications suggested.
CS103	Conducted Susceptibility, Antenna Port, Intermodulation, 15 kHz to 10 GHz	Per procurement specification	-
CS104	Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals, 30 Hz to 20 GHz	Per procurement specification	-
CS105	Conducted Susceptibility, Antenna Port, Cross-Modulation, 30 Hz to 20 GHz	Per procurement specification	-
CS106	Conducted Susceptibility, Transients, Power Leads	400 V peak	MIL STD 461 G에서 삭제
CS109	Conducted Susceptibility, Structure Current, 60 Hz to 100 kHz	120 dB $\mu$ A	-
CS114	Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz	109 dB $\mu$ A	Adds common mode test for some applications.
CS115	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	5A x 30 ns	-
CS116	Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz	10 A peak	Testing with power off is deleted; procedure allows reduction of calibrated test signal if necessary.
CS117	Lightning, cable & power based on RTCA DO-160 Sec.22	2000A for external	MIL STD 461G에서 추가
CS118	ESD, IEC 61000-4-2	Con +/-8kV, air +/-15kV	MIL STD 461G에서 추가
RE101	Radiated Emissions, Magnetic Field, 30 Hz to 100 kHz	76 dBpT @ 7 cm	Test procedure is modified to allow separations > 7cm where non-compliances are noted.
RE102	Radiated Emissions, Electric Field, 10 kHz to 18 GHz	24 dB $\mu$ V/m @ 1m	Applicability and frequency ranges modified. Rod antenna methods modified.
RE103	Radiated Emissions, Antenna Spurious and Harmonic Outputs, 10 kHz to 40 GHz	-80 dBc, far field	Minor test procedure changes.
RS101	Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz	180 dBpT	Scan rate is reduced.
RS103	Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz	200 V/m	Sensor placement clarified; radiating antenna distance limited to $\geq$ 1m.
RS105	Radiated Susceptibility, Transient Electromagnetic Field	50 kV/m peak	-

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# 5. MIL STD 461 G 추가, CS117 multiple stroke and burst lightning

Test No	Test Description / Applicability	Internal Equipment Limits <sup>1/</sup>	External Equipment limits <sup>1/</sup>
1	Multiple Stroke – Waveforms 1 and 2. Applicable to all aircraft.	Initial Stroke $V_L = 300$ volts (WF #2) $I_T = 600$ amps(WF #1) $I_L = 60$ amps <sup>2/</sup> Subsequent Strokes $V_L = 150$ volts (WF #2) $I_T = 150$ amps(WF #1) $I_L = 30$ amps <sup>2/</sup>	Initial Stroke $V_L = 750$ volts (WF #2) $I_T = 1500$ amps(WF #1) $I_L = 150$ amps <sup>2/</sup> Subsequent Strokes $V_L = 375$ volts (WF #2) $I_T = 375$ amps(WF #1) $I_L = 75$ amps <sup>2/</sup>
2	Multiple Stroke – Waveform 3, (apply at both 1 and 10 MHz) Applicable to all aircraft.	Initial Stroke $V_T = 600$ volts (WF #3) $I_L = 120$ amps(WF #3) $I_T = 12$ amps <sup>2/</sup> Subsequent Strokes $V_T = 300$ volts (WF #3) $I_L = 60$ amps(WF #3) $I_T = 12$ amps <sup>2/</sup>	Initial Stroke $V_T = 1500$ volts (WF #3) $I_L = 300$ amps(WF #3) $I_T = 60$ amps <sup>2/</sup> Subsequent Strokes $V_T = 750$ volts (WF #3) $I_L = 150$ amps(WF #3) $I_T = 30$ amps <sup>2/</sup>
3	Multiple Stroke – Waveform 4 and 5, (apply at both 1 and 10 MHz) Applicable to aircraft with composite skin/structure. Not applicable to an all-metal skin/structure aircraft.	Initial Stroke $V_L = 300$ volts (WF #4) $I_T = 1000$ amps(WF #5) $I_L = 300$ amps <sup>2/</sup> Subsequent Strokes $V_L = 75$ volts (WF #2) $I_T = 300$ amps(WF #1) $I_L = 150$ amps <sup>2/</sup>	Initial Stroke $V_L = 750$ volts (WF #4) $I_T = 2000$ amps(WF #5) $I_L = 750$ amps <sup>2/</sup> Subsequent Strokes $V_L = 187.5$ volts (WF #2) $I_T = 400$ amps(WF #1) $I_L = 375$ amps <sup>2/</sup>
4	Multiple Burst – Waveform 3, (apply at both 1 and 10 MHz) Applicable to all aircraft	$V_T = 360$ volts (WF #3) $I_L = 6$ amps(WF #3) $f = 1$ MHz, 10MHz	$V_T = 900$ volts (WF #3) $I_L = 15$ amps(WF #3) $f = 1$ MHz, 10MHz
5	Multiple Burst – Waveform 6. Applicable to low impedance bundles only	$V_T = 600$ volts (WF #6) $I_L = 30$ amps(WF #6)	$V_T = 1500$ volts (WF #6) $I_L = 75$ amps(WF #6)



## 6. US military EMC & 환경 시험 요구, RTCA DO-160G

Environmental Requirements	
Section 4.0	Temperature and Altitude
Section 5.0	Temperature Variation
Section 6.0	Humidity
Section 7.0	Operational Shocks and Crash Safety
Section 8.0	Vibration
Section 9.0	Explosion Proofness
Section 10.0	Waterproofness
Section 11.0	Fluids Susceptibility
Section 12.0	Sand and Dust
Section 13.0	Fungus Resistance
Section 14.0	Salt Spray
Section 24.0	Icing
Section 26.0	Fire, Flammability

EMC Requirements	
Section 15.0	Magnetic Effect
Section 16.0	Power Input
Section 17.0	Voltage Spike
Section 18.0	Audio Frequency Conducted Susceptibility – Power Inputs
Section 19.0	Induced Signal Susceptibility
Section 20.0	Radio Frequency Susceptibility (Radiated and Conducted)
Section 21.0	Emission of Radio Frequency Energy
Section 22.0	Lightning Induced Transient Susceptibility
Section 23.0	Lightning Direct Effects
Section 25.0	Electrostatic Discharge

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## 7. MIL STD 464A / C System level EMC 요구 규격 요약



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Clause	Parameter	Lowest Emission or Highest Susceptibility
5.2	Intra-system EMC (see also MIL-STD-461F clause 4.2.3)	Self-compatibility
5.2.1	Hull-generated intermodulation interference (IMI)	Not detectable by onboard receivers
5.2.2	Shipboard internal electromagnetic environment (EME).	50 V/m
5.2.3	Multipaction, space applications, equipment and subsystems	No effect
5.3	External RF electromagnetic environment (EME) Flight deck, ships Weather deck, ships Main beam of transmitter, ships Space and launch vehicle systems Ground systems Army rotary wing aircraft Fixed wing aircraft, excluding shipboard	2030 V/m peak, 200 V/m average 2030 V/m peak, 200 V/m average 27460 V/m peak, 2620 V/m average 200 V/m peak, 200 V/m average 2500 V/m peak, 50 V/m average 27460 V/m peak, 3120 V/m average 7200 V/m peak, 1050 V/m average
5.4	Lightning Severe stroke Near strike	200kA strike, 100 kA restrike 2.2 x 10 <sup>9</sup> A/m/s @ 10m
5.5	Electromagnetic pulse (EMP) per MIL-STD-2169B	classified
5.6	Subsystems and equipment EMI	Per MIL-STD-461F
5.6.1	Non-developmental items (NDI) and commercial items	System operational performance requirements shall be met.
5.6.2	Shipboard DC magnetic field environment.	See MIL-STD-1399, Section 070
5.7	Electrostatic charge control. Vertical lift and in-flight refueling. Precipitation static (p-static) control Ordnance subsystems.	300 kV discharge Meet operational requirements 25 kV discharge
5.8	Electromagnetic radiation hazards (EMRADHAZ) Hazards of electromagnetic radiation to personnel (HERP). Hazards of electromagnetic radiation to fuel (HERF) Hazards of electromagnetic radiation to ordnance (HERO).	See DoDI 6055.11 No inadvertent ignition 27460 V/m peak, 2620 V/m average
5.10.3	Mechanical interfaces – DC bonding levels	2.5 – 15 mΩ
5.11.1	Aircraft grounding jacks – resistance between the mating plug and the system ground reference.	≤ 1 Ω
5.13	Emissions control (EMCON)	≤ 105 dBm/m <sup>2</sup> @ 1 km, 500 kHz – 40 GHz

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## 8. MIL STD 1541A 기타 EMC 관련 규격



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Section	Test	Limit
5.2.5	Lightning protection	200 kA peak
5.2.6	Outer surface resistivity of ESD control Grounded semiconductive coating over insulating material Painted surface over grounded semiconductive material-over dielectric Volume resistivity of a coating( t, cm) over a grounded metal conductor	$\leq 10^8 \Omega/\text{square}$ $\leq 4.6 \times 10^7 \Omega/\text{square}$ $(2.5/t) \times 10^{10} \Omega\text{-cm}$
5.2.10	Electrical power quality Voltage ripple Spikes Surges Load switching and load faults Power subsystem faults – surge amplitude Vehicle power output ground isolation	$\leq 500 \text{ mV peak-to-peak}$ $< 3 \text{ times nominal load, } < 0.14 \times 10^{-3} \text{ V-s}$ Return to steady-state in 5 ms (+) and 100 ms (-) Remain within 65% to 130% of nominal Remain within 0% to 175% of nominal $\geq 1 \text{ M}\Omega$

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## 9. NATO / MIL STD/ DEF STAN EMC 시험 항목의 상관성

Reference	Description	Test Derived from
NCE01	Conducted Emissions, Power Leads, 30 Hz to 10 kHz	MIL-STD-461F
NCE02	Conducted Emissions, Power Leads, 10 kHz to 10 MHz	MIL-STD-461F
NCE03	Conducted Emissions, Antenna Terminal, 10 kHz to 40 GHz	MIL-STD-461F
NCE04	Conducted Emissions, Exported Transients on Power Leads	Def Stan 59-411
NCE05	Conducted Emissions, Power, Control & Signal Leads, 30 Hz to 150 MHz	Def Stan 59-411
NCS01	Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz	MIL-STD-461F
NCS02	Conducted Susceptibility, Control & Signal Leads, 20 Hz to 50 kHz	Def Stan 59-411
NCS03	Conducted Susceptibility, Antenna Port, Intermodulation, 15 kHz to 10 GHz	MIL-STD-461F
NCS04	Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals, 30 Hz to 20 GHz	MIL-STD-461F
NCS05	Conducted Susceptibility, Antenna Port, Cross Modulation, 30 Hz to 20 GHz	MIL-STD-461F
NCS06	Conducted Susceptibility, Structure Current, 60 Hz to 100 kHz	MIL-STD-461F
NCS07	Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz	MIL-STD-461F
NCS08	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	MIL-STD-461F
NCS09	Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz	MIL-STD-461F
NCS10	Conducted Susceptibility, Imported Lightning Transient (Aircraft/Weapons)	Def Stan 59-411
NCS11	Conducted Susceptibility, Imported Low Frequency on Power Leads (Ships)	Def Stan 59-411
NCS12	Conducted Susceptibility, Electrostatic Discharge <span style="color: red;">MIL STD 461G CS118</span>	Def Stan 59-411
NCS13	Conducted Susceptibility, Transient Power Leads	MIL-STD-461F
NRE01	Radiated Emissions, Magnetic Field, 30 Hz to 100 kHz	MIL-STD-461F
NRE02	Radiated Emissions, Electric Field, 10 kHz to 18 GHz	MIL-STD-461F
NRE03	Radiated Emissions, Antenna Spurious and Harmonic Outputs, 10 kHz to 40 GHz	MIL-STD-461F
NRS01	Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz	MIL-STD-461F
NRS02	Radiated Susceptibility, Electric Field, 50 kHz to 40 GHz	MIL-STD-461F / Def Stan 59-411
NRS03	Radiated Susceptibility, Transient Electromagnetic Field	MIL-STD-461F
NRS04	Radiated Susceptibility, Magnetic Field, (DC)	Def Stan 59-411

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# 10. 독일 BV.VG 시험 항목과 MIL STD 461G와 상관성

MIL STD 461G <sup>2)</sup>	BV 3012 <sup>1)</sup> 독일해군	VG 95373 독일군	NATO STANAG 4437 NAV.
CE 101, 전원선, 30Hz-20kHz	LA01G, LA02G, -30Hz -30Mz/100MHz	LA 01G, 30Hz-10kHz/100MHz	NCE 01, 전원선, 30Hz-50MHZ, ac/dc 전원선
CE 102, 전원선, 10kHz-10MHz		LA02G, 10k-300MHz	NCE 02, 전원선, 30Hz-50MHz, control and signal leads
CS 101, 전원선, 30Hz-150kHz	LF01, 30Hz-50kHz LF02: 3Vrms 전원단자	LF01G,30Hz-50kHz, 유도성 결합	NCS 01, 30Hz-100MHz ac/dc 전원선
		LF02G, 50k-400MHz, 용량성 결합	NCS 02, 30kHz-100MHz 제어 및 신호선
CS 106(F), Transient us 펄스	LF 03G : 10us pulse, 동작전압 2배, 5Ω양단 최대 100V까지 LF 04G : nano second pulse	LF03G : us pulse, 인덕터 직렬/병렬 결합 LF 04G : nano second pulse	NCS 03, Spark, ac/dc 전원선
CS114, BCI , 10kHz-200MHz	LF02G, 10k-400MHz	LF02G, 10k-400MHz	NCS 07 BCI 반복 임펄스 주입시험
	LF 06G : 150kHz-400MHz	LF 06G : 150kHz-400MHz	
RE 101, 30Hz-100kHz	SA 01G : 30Hz-200kHz	SA 01G : 30Hz-200kHz, 50mm 측정거리	NRE 01, 30Hz-50kHz, Magnetic field
RE 102, E-field, 10kHz-18GHz	SA 02G : 10kHz-30MHz SA04/05 : 30MHz- 30GHz	SA 02G : 10kHz-30MHz, 1m측정거리 SA04/05 :30MHz- 30GHz	NRE 02, E-field, 10kHz-18GHz, E field
RS 101, 30Hz- 100kHz	SF01G :30Hz-150kHz, MF SF 02G, 10kHz-400MHz	SF01G/SF01G :30Hz-150kHz, MF, 0.3mm 굵기, 반경 12cm, 10turns 코일로 인가 SF 02G/SF 02G 10kHz-400MHz, 시료/전선 3턴 휘감아 인가 주입	NRS 01, 10kH-30MHz MF
RS 103, E-field, 2MHz-18GHz	SF02G : 30Hz-3MHz SF 03G : 3MHz-30MHz SF04G : 30MHz- 18GHz	SF02G : 30Hz-3MHz, 50mm 거리 SF 03G : 3MHz-30MHz, 시료에 3 Turn감아 SF04G : 30MHz- 18GHz, 1m 거리	NRS 02, E-field, 10kHz-40GHz

주1) 독일 해군 규격 특징: 함선탑재장비의 금속 메탈 함체 채택, 5mm이하 환기창, 배선 50mm-300mm 간격 본딩 등 요구 있음.

주2) 위 MIL STD461F 규격의 시험항목은 MIL STD 461F Table V legend "Applicable" 를 기준으로 비교.

주3) xA : Emission 규격이고, xF : Susceptibility 규격임

**본 자료의 저작권은 한국기술연구소에 있으므로 허락 없이 무단 사용을 금합니다.**