NATO STANDARD

AECP-02/MECP-02

NATO NAVAL RADIO AND RADAR RADIATION HAZARDS MANUAL

Edition D Version 1

AUGUST 2015

NORTH ATLANTIC TREATY ORGANIZATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

20 August 2015

1. The enclosed Allied/Multinational Electromagnetic Compatibility Publication AECP-02/MECP-02, Edition D, Version 1 – NATO NAVAL RADIO AND RADAR RADIATION HAZARDS MANUAL, which has been approved by the nations in the Military Committee Maritime Standardization Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 1380.

2. AECP-02/MECP-02, Edition D, Version 1 is effective upon receipt and supersedes AECP-02, Edition C, which shall be destroyed in accordance with the local procedure for the destruction of documents.

4. This publication shall be handled in accordance with C-M(2002)60.

Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
GENERAL	ESP
GENERAL	ROU
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

ESP	Implementation of the STANAG 1380 (Edition 5), up to 40 Ghz.
ROU	The necessary parameters for establishing the TRAD and SRAD codes (the values for the safety distances, the TRAD values for the all non-comms and comms transmitters from the naval platforms and navy helicopters) are not determined. In present, the values for Permissible Exposure Level/PEL at the electromagnetic radiations for each category of material (fuels, ammunitions and inflammable materials) are not established.

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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PART 0 - BACKGROUND

0.1. RELATED DOCUMENTS

The documents which have to be taken into reference for the use of the present publication are:

STANAG 1397	RADHAZ CLASSIFICATION OF MUNITIONS AND WEAPON SYSTEMS EMBODYING ELECTRO-EXPLOSIVE DEVICES
STANAG 1379	NATO RADHAZ WARNING SIGN
STANAG 2345	EVALUATION AND CONTROL OF PERSONNEL EXPOSURE TO RADIO-FREQUENCY FIELD 3 kHz to 300 GHz
STANAG 4699	LOW POWER CERTIFICATION PROCESS
STANAG 4370	ENVIRONMENTAL TESTING
OP 3565	for USA
BRd 2924	for GBR
GAM DRAM 02	for FRA
DIN VDE 0848	for DEU

0.2. AIM

The aim of this publication is to give information regarding procedures to be taken to avoid the hazards that can arise when:

- Personnel;
- Munitions and weapon systems embodying electro-explosive devices (EED);
- Fuels and flammable materiel;
- Safety critical electronic systems (SCES),

are exposed to electromagnetic radiation (EMR) in radio and radar frequency environments during NATO Naval operations. Methods by which these hazards can be avoided are described, or referenced, for those with responsibilities for directing such operations.

The publication is divided in two parts:

- **PART 1: RECOMMENDATIONS TO ENSURE RADHAZ SAFETY.**

  This part contains the information, which describes the procedures by which these hazards may be avoided.

- **PART 2: PRACTICAL OPERATIONAL GUIDANCE AND PROCEDURES.**

  This part takes the detailed recommendations given in PART 1 - and summarises them in a form suitable for use by operational units, giving examples for the implementation of the procedures where appropriate.

0.3. SCOPE

The scope of the publication is restricted to consideration of the possible hazards that are related to the use of radio and radar frequency transmitters up to 45 GHz.

It is not intended to cover electromagnetic vulnerability (EMV), electromagnetic interference (EMI) and hazards from the effects of electrostatic discharge, lightning, nuclear electromagnetic pulse and lasers. Those aspects are covered respectively by:

- AECTP 250 leaflet 253, leaflet 254 and leaflet 256;
- AECTP 500 leaflet 508, where tests procedures are described.

0.4. ACRONYMS

The following acronyms are used in AECP-02.

A/m	Amps per meter
CW	Continuous Waveform
EED	Electro Explosive Device
EIRP	Effective Isotropic Radiated Power
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMR	Electromagnetic Radiation
EMV	Electromagnetic Vulnerability
HERO	Hazards of Electromagnetic Radiation to Ordnance
PEL	Permissible Exposure Level
PRAD	Personnel RADHAZ Designator
RADHAZ	Radio & radar radiation hazards
RADHAZ FR	RADHAZ frequency range
RD	Reference Distance
RL	Reference Level
RR	Reference Ratio
RRO	RADHAZ Responsible Officer
SAR	Specific Absorption Rate
SCES	Safety Critical Electronic Systems
SD	Safety Distance
SRAD	Susceptibility RADHAZ Designator
SSD	Safe Separation Distance
TRAD	Transmitter RADHAZ Designator
W/m^2	Watt per meter Square

PART 1 - RECOMMENDATIONS TO ENSURE RADHAZ SAFETY

1.1. DEFINITIONS

The following definitions are used for the purpose of this Publication only:

TERM (ACRONYM)	DEFINITION
AVERAGE POWER DENSITY	The power of EMR per unit cross sectional area normal to the direction of propagation expressed at a given point W/m²and averaged on a given period.
DUMMY LOAD	A device for absorbing the power output of an EMR source.
EFFECTIVE ISOTROPIC RADIATED POWER (EIRP)	The product of the average power (P) and the gain (G) of an EMR source. If the source is isotropic and emits in all directions, the average flux power density (S) at an arbitrary distance (d) depends on the average output power (P) of the source: $S = \frac{P}{4\pi d^2}$ When directional antennas are used, power density depends on the gain of the antenna G according the expression: $S = \frac{PG}{4\pi d^2}$ where G is defined as the gain over the ideal isotropic antenna and the product PG is called the EIRP.
ELECTRIC FIELD STRENGTH	The magnitude of the electric field vector of the EMR at a given point expressed V/m.
ELECTRO-EXPLOSIVE DEVICE (EED)	An explosive or pyrotechnic component that initiates an explosive, burning, electrical or mechanical train and is activated by the application of electrical energy.
ELECTROMAGNETIC COMPATIBILITY (EMC)	The capability of electrical and electronic systems, equipment and devices to operate in their intended electromagnetic environment within a defined margin of safety, and at design levels of performance without suffering or causing unacceptable degradation as a result of EMI. See also EMV.
ELECTROMAGNETIC INTERFERENCE (EMI)	Any electromagnetic disturbance, whether intentional or not, which interrupts, obstructs or otherwise degrades or limits the effective performance of electronic or electrical equipment.

ELECTROMAGNETIC VULNERABILITY (EMV)	The characteristics of a system that cause it to suffer degradation in performance of or inability to perform its specified task as a result of EMI. See also EMC.
EMR	Electromagnetic Radiation
FAR FIELD ➢ **FRAUNHOFER REGION**	The region far from an antenna, compared to the size of the antenna and the wavelength of the radiation, where the power decreases with the square of the distance from the source. In this region, the radiation has the properties of a plane wave.
FIELD STRENGTH	A general term that usually means the magnitude of the electric field vector, commonly expressed in V/m, but may also mean the magnitude of the magnetic field vector, commonly expressed in A/m.
HERO SAFE ORDNANCE	Ordnance items containing electrically initiated devices proven by test and/or analysis to be immune to adverse affects and can be exposed safely to EME levels as high as those specified in Table A-1 index 7 or as defined in accordance with each nations.
HERO SUSCEPTIBLE ORDNANCE	Ordnance items that have known susceptibilities (shown by test and/or analysis) and will have a designated RADHAZ code index between 1 and 6, depending on the degree of susceptibility or as defined in accordance with each nations.
HERO UNSAFE ORDNANCE	Ordnance items that have not been classified as either **HERO SAFE** or **HERO SUSCEPTIBLE** as a result of a test and/or analysis. Additionally, any ordnance item containing electrically initiated devices (including those previously classified as **HERO SAFE** or **HERO SUSCEPTIBLE** ordnance) that has its internal wiring exposed; when tests are being conducted on that item that result in additional electrical connections to the item; when electrically initiated devices having exposed wire leads are present and handled or loaded in any but the tested condition; when the item is being assembled or disassembled; or when such ordnance items are damaged causing exposure of internal wiring or components or destroying engineered HERO protective devices or as defined in accordance with nations.
MAGNETIC FIELD STRENGTH	The magnitude of the magnetic field vector of the EMR at a given point expressed in A/m.
MATERIEL	Term used in this agreement to designate weapon systems, munitions or any stores embodying EED and/or SCES.
NEAR FIELD	The electromagnetic field that exists relatively near the EMR source, where field strengths (the electric field E and magnetic field H) do not decrease in inverse proportion to the distance from the source. The near field region further is subdivided into the reactive near field region, which is closest to the antenna and contains most or nearly all of the

	stored energy associated with the field of the antenna and the radiating near field region, where the radiation field predominates over the reactive field and is complex in structure.
OVEREXPOSURE	Any irradiation of personnel that exceeds the limits defined by National Standards or those given in STANAG 2345 (see ANNEX C).
PERMISSIBLE EXPOSURE LEVEL (PEL)	EMR that materiel or personnel can withstand without RADHAZ risk.
PERSONNEL RADHAZ DESIGNATOR (PRAD)	The designator which is assigned to each helicopter, vertical/short takeoff and landing (VSTOL) aircraft and aircraft to describe the RADHAZ area for personnel due to its transmitters. The PRAD will consist of a series of letters/number combinations that define the area surrounding the aircraft at which the reference level (RL) of 100 W/m^2 occurs, as follows (see ANNEX E): PRAD takes the following format: Ft(a) - Rr(b) - Sb(c) - Pt(d) - Bt(e) - Tp(g) **a.** The capital and small letters represent the sides of aircraft where a hazard exists. Front: Ft | Rear: Rr | Starboard: Sb | Port: Pt | Bottom: Bt | Top: Tp **b**. The small letters between brackets represent the radius (in meter) of the semi-circle defining the zones where the power density falls below the RL of 100 W/m² in accordance with Annex E. For frequencies in which the PEL for personnel is less than 100 W/m^2, the hazardous area will be greater than the PRAD radius. The actual SD must be calculated.
PLATFORM	A mobile or fixed installation such as ship, aircraft, shore station, etc. A platform can be a potential source of RADHAZ due to its transmitters, referred to as "platform type T" (T as in "Transmitter"). A platform also can be an installation on which personnel, materiel and systems can be exposed to RADHAZ, referred to as "platform type S" (S as in “Susceptible”).
PLATFORM SUSCEPTIBILITY RADHAZ DESIGNATOR (SRAD) CODE	The code of a platform and which is based upon the most susceptible materiel on that platform within each particular RADHAZ frequency range (RADHAZ FR). The Platform SRAD Code is made up of the lowest index value of the materiel SRAD of the platform within each particular RADHAZ FR. It takes the same format as the SRAD of the materiel. Rp | Tp | Up | Vp | WAp | WBp | YAp | YBp | Zp
PLATFORM TRANSMITTER RADHAZ	The code which describes the level of emissions from a type T platform and which is based upon the TRAD of the transmitters of this platform within each particular RADHAZ frequency range (RADHAZ FR). The

DESIGNATOR (TRAD) CODE	platform TRAD code takes the same format as the susceptibility RADHAZ designator (SRAD): Rq | Tq | Uq | Vq | WAq | WBq | YAq | YBq | Zq The letters R, T, U, V, WA, WB, YA, YB and Z represent RADHAZ FR of the platform transmitters and q is the highest index value within the RADHAZ FR of interest.
POWER DENSITY	The power of EMR per unit cross sectional area, normal to the direction of propagation, expressed at a given point in W/m². For electromagnetic plane waves the power density (S) is related to the electric field intensity (E)by the following equation: $S = \frac{E^2}{Z_0}$. Where: E = The electric field (V/m) S = The power density (W/m^2) Z_0 = The intrinsic impedance of free space (120 π)
RADIO & RADAR RADIATION HAZARDS RADHAZ	The risk of inadvertent ignition of EED and flammables, injury to personnel or malfunction/failure of SCES resulting from exposure to EMR environment in the frequency range 10 kHz-300 GHz. For the purpose of this publication, the term RADHAZ covers only the EMR effects in the frequency range 150 kHz-45 GHz.
RADHAZ FREQUENCY RANGE (RADHAZ FR)	The frequency ranges R, T, U, V, WA, WB, YA, YB, Z, defined in ANNEX A, which are to be used for the radio & radar radiation hazards (RADHAZ) procedures applying to materiel with EED.
RADHAZ RESPONSIBLE OFFICER RRO	The officer made responsible for ensuring the procedures described in this publication are carried out.
RADHAZ UNSAFE MATERIEL	A materiel with a SRAD susceptibility index which is equal to 0 in any of the radiation hazard frequency range (RADHAZ FR) of interest. A materiel which has not been tested from a RADHAZ standpoint or which is in an unsafe coupling configuration (not yet tested) has to be considered as a RADHAZ unsafe materiel. In this case, all the SRAD indexes are equal to zero.
REFERENCE DISTANCE (RD)	The distance where the RL is reached for a given transmitter. For a platform, the RD is the maximum of the RD corresponding to each transmitter of that platform. The RL is used for preventing overexposure to personnel, not for materiel.

REFERENCE LEVEL (RL)	The exposure level corresponding to an average power density equal to 100 W/m² used to determine the RD for each source of EMR. This level is used as a reference to calculate the SD for personnel when platforms which are approaching each other belong to Nations having different standards and then different PEL for personnel. The PEL which can be used to determine the SD to be maintained between personnel and sources of EMR are taken from National Standards or from ANNEX C of this Publication as applicable.
REFERENCE RATIO (RR)	The ratio between the RL and the PEL for personnel. RR are dependent upon the personnel PEL used by each Nation.
SAFETY CRITICAL ELECTRONIC SYSTEMS (SCES)	The electronic systems in which a failure or malfunction may cause a direct hazard to personnel and/or loss of materiel.
SAFETY DISTANCE (SD)	The minimum distance at which the PEL for a materiel or personnel is not exceeded.
SIMPLIFIED SRAD	The SRAD of a materiel which has the same value "p" for all the numerical indexes representing the RADHAZ susceptibility of this materiel for each RADHAZ frequency range (FR). This materiel is said to have a simplified SRAD called (p): SRAD = (p)
SUSCEPTIBILITY RADHAZ DESIGNATOR (SRAD)	The code which describes the RADHAZ susceptibility of a materiel in terms of its maximum PEL for each RADHAZ frequency range (RADHAZ FR). SRAD takes the following format: Rp Tp Up Vp WAp WBp YAp YBp Zp The letters R, T, U, V, WA, WB, YA, YB and Z represent the RADHAZ FR defined in Table-A1 of Annex A and the suffix letter p is a numerical index representing the RADHAZ susceptibility of the materiel for each RADHAZ FR. This allocated index corresponds to a PEL for the materiel. For the classification method described in Annex A, there are eight susceptibility indexes, from 0 to 7, to describe the RADHAZ susceptibility of a materiel. If materiel has not yet been tested to know its RADHAZ susceptibility, or when there is an uncertainty about its susceptibility, the SRAD code of this materiel is: R_0 T_0 U_0 V_0 WA_0 WB_0 YA_0 YB_0 Z_0
TRANSMITTER RADHAZ DESIGNATOR (TRAD)	The code which describes the level of emission of a transmitter in terms of the maximum EMR environment it is capable of generating. TRAD takes the following format: F q

	where: ➢ F is a letter representing the RADHAZ frequency range (RADHAZ FR) of the transmitter, ➢ q is a numerical index representing the strength or EMR environment provided by the transmitter in terms of EIRP as indicated in 0. Some transmitters may cover more than one RADHAZ FR. In this case, those transmitters have to be coded with several TRADs.
WEAPON(S) SYSTEM	A combination of one or more weapons with all related equipment, services, personnel and means of delivery and deployment (if applicable) required for self sufficiency.

1.2. PROCEDURES TO ENSURE RADHAZ SAFETY

1.2.1. PURPOSE

This paragraph describes the procedures to apply between two platforms in order to ensure RADHAZ safety for:

a. Personnel.

b. Weapon systems and munitions embodying EED.

c. SCES.

d. Fuels and flammable materiel.

1.2.2. PROTECTION PROCEDURES FOR PERSONNEL

1.2.2.1. INTRODUCTION

Among the hazards to take into account when personnel are exposed to radio and radar frequency radiation, the two most significant are:

a. **Thermal effects:** the radiated energy is directly absorbed in tissues of exposed personnel in the form of heat. In general, protection is achieved by restricting access to antennas or by maintaining a minimum safe distance from such antennas, together with general precautions, as indicated in paragraph 1.2.2.3.

b. **Shock/burn effects:** a shock or burn may be experienced by personnel when touching a structure exposed to EMR.

1.2.2.2. BASIC PROTECTION PROCEDURES

Personnel shall not be exposed to electromagnetic environment levels exceeding the PEL of the National Standards or those given in ANNEX C. Therefore, the RRO of each platform has to be aware of:

- The reference distance (RD) from its own platform where this level is obtained.
- The ratio between the reference level (RL) and PEL for personnel of its own platform or approaching platforms of other Nations, called the RR.

a. The SD1 to ensure the safety of personnel on a platform 2 (considered as a type S platform), when facing the transmitters of a platform 1 (considered as a type T platform), is obtained by using the following relationship:

$$(SD1) = (RD1)\ x \sqrt{\frac{(RL)}{(PEL2)}}$$

or

$$(SD1) = (RD1)\, x \sqrt{(RR2)}$$

where:

RL: is the reference level equal to 100 W/m²;

RD1: is the reference distance corresponding to the platform 1;

RR2: is the reference ratio [ratio between (RL) and (PEL2)] for the platform 2;

PEL2: is the permissible exposure level (expressed in W/m²) for personnel of the platform 2.

Reciprocally the safety distance (SD2) to ensure the safety of the personnel of the platform 1 (considered as a type S platform) facing the transmitters of the platform 2 (considered as a type T platform) is obtained by using the following relationship:

$$(SD2) = (RD2)\ x\ \sqrt{\frac{(RL)}{(PEL1)}} \quad = (RD2)\ x\ \sqrt{(RR1)}$$

b. The SD to ensure the protection of personnel of both platforms (considered as type T platform for each other) is the maximum value of either distance (SD1) and (SD2).

c. To facilitate the determination of personnel safety distances, the RRO of each platform should have a record of the RD and the corresponding RR of the significant transmitters of their own platform.

d. When the SD for personnel cannot be maintained, the power output of the subject transmitter has to be reduced, or inhibited.

To calculate power reduction that is required for a given platform, use the following relationship:

$$P_2 = P_1\, x\, [\frac{(D)}{(SD)}]^2$$

where:

SD safety distance for personnel;

D is the actual distance between the two platforms;

P_2 is the new power level required for the chosen platform;

P_1 is the normal power level for this platform.

e. It is the responsibility of the RRO of a platform wishing to close within 50 meters of another platform, to advise the RRO of the other platform of his intention to transmit on RADHAZ frequency ranges R & T so that precautions to avoid a risk of burn/shock hazard may be instigated.

f. It is the responsibility of the RRO of a platform wishing to close within 5000 meters of another platform, to advise the RRO of the other platform of his intention to transmit on RADHAZ frequency ranges V to Z so that precautions can be taken to avoid a risk of overexposure to personnel from radar emissions. The following procedure have to be applied:

- Calculation of the personnel safe distance is to be carried out in accordance with the basic protection procedures detailed in a to d above,

The following precautions could be taken, for example, by:

- Ceasing transmission on this RADHAZ FR,
- Reducing transmitter power or use of sector blanking.

g. When the minimum horizontal separation distance between an aerial and a metallic structure or object which may give rise to a burn/shock hazard cannot be observed, several precautions are to be taken. For example use:

- Rubber or PVC gloves when handling spans, falls, etc., or when handling hooks.
- Equipment to cordon off the area.
- Insulation materials for stays and slings.

h. The specific safety precautions associated with the landing and taking off of aircraft, vertical/short takeoff and landing (VSTOL), and helicopters are described in ANNEX E and ANNEX F. In essence, the hazard arising from the helicopter or aircraft transmitters is described as the SD at which the PEL is exceeded in volumetric terms; i.e.:

Front	**Ft**	Rear	**Rr**	Starboard	**Sb**	Port	**Pt**	Bottom	**Bt**	Top	**Tp**

with each suffixed by the appropriate RD.

The SD must be calculated based on the RD and PEL of the personnel involved.

If personnel are likely to be exposed within those safety distances during aircraft or helicopter operations, then the subject transmitter(s) should be inhibited before permission is given to conduct such operations.

See ANNEX F for specific safety precautions.

1.2.2.3. ADDITIONAL PRECAUTIONS

In addition to the basic protection procedures, the following additional measures are recommended:

a. All unnecessary exposures to radio & radar frequency radiation should be avoided.

b. Personnel at risk should be briefed about the hazards and control measures being taken to protect them.

c. During maintenance of transmitters, where personnel and materiel may be exposed to radio and radar frequency radiation, transmitters shall be connected to a dummy load.

d. In case of suspected or actual overexposure, the occurrence must be investigated and appropriate measures taken. Specific guidelines are provided in individual Nation's documentation or in ANNEX C of this Publication.

1.2.3. PROCEDURES TO ENSURE RADHAZ SAFETY FOR MUNITIONS AND WEAPON SYSTEMS EMBODYING EED

1.2.3.1. CONCEPT

The concept of the procedures and methods presented covers the following configurations:

a. Any ship capable of receiving any aircraft.

b. Aircraft fly-by of ships.

c. Ships in company.

d. Aircraft in company.

e. Naval aircraft landing on and taking off from shore stations.

f. Naval and air operation in the port and in the territorial waters.

1.2.3.2. BASIC PRINCIPLE

The basic principle is that of matching alpha-numeric codes (designators) representing the electromagnetic susceptibility of sensitive materiel and the electromagnetic output produced by radio & radar frequency transmitters. To manage the Naval RADHAZ situations, this concept leads to platforms with two different codes according to whether that platform is considered as a type S platform (platform SRAD code) or as a type T platform (platform TRAD code). The definition of each of these codes is given in paragraph 1.1. It should then be recognized that any particular platform could have both SRAD & TRAD codes.

1.2.3.3. PROCEDURE

The procedure is to compare the SRAD of one platform to the TRAD of another platform for each RADHAZ FR. SRAD and TRAD codes are explained in ANNEX A and ANNEX B.

a. If the TRAD numerical index is a number lower than or equal to the SRAD numerical index, then no precautions are necessary.

b. If the TRAD numerical index is a number higher than the SRAD numerical index, for the same RADHAZ FR, then precautions have to be taken, for example, by performing the following:

- Ceasing transmission on this RADHAZ FR.
- Reducing transmitter power or use of sector blanking.
- Maintaining a minimum safety distance between the platforms. The SD can be obtained using Table G-1 in ANNEX G. When a minimum SD occurs in more than one frequency range, then the largest minimum SD figure represents the worst case.
- Jettisoning, if possible, the susceptible materiel.

c. If the SRAD is unknown, the value of SRAD = 0 shall be assumed. When the above procedures are not practicable, in port or in territorial sea, refer to ANNEX D.

1.2.3.4. EXAMPLES OF THE APPLICATION OF THE ABOVE PROCEDURE

Some examples of the application of the above procedure are given in ANNEX H. The different RADHAZ codes developed by each Nation may be tabled with the suggested formats in ANNEX I.

1.2.3.5. GENERAL PRECAUTIONS & PROCEDURES

In addition to the basic protection procedures described above, the following general measures are recommended:

a. In ports, local constraints should be followed. Local authorities should be contacted before any radio or radar transmission in order to prevent transmissions during munitions loading or transportation operations in the harbour.

b. Prohibit all radio and radar transmissions by the aircraft involved in the loading or unloading of munitions. If other aircraft or vehicles in the loading area are capable of radiating hazardous radio and radar frequency fields, ensure that these sources do not transmit. If maintenance requires operation of equipment which may radiate hazardous fields in the loading/down loading area, the equipment must be connected to a dummy load.

c. Maintain a minimum separation distance of at least 3 meters or National minimum requirements between a fixed shipboard transmitting antennas and munitions or an aircraft structure (wings, fuselage or helicopter blades).

d. Plan munitions operations so that there is a minimum of exposure of the munitions to EMR during handling and loading operations.

e. Do not allow electrical contacts, electrodes (primers) or contact pins to touch any object capable of conducting electromagnetic energy during handling and loading operations. Objects capable of conducting electromagnetic energy include aircraft structures, bomb rack breeches, tools, other cartridges and cartridge actuated devices.

f. Make no electrical connections to air-launched munitions before the ammunition is racked to the aircraft unless such procedures are specifically authorized in the check list or loading manual. Electrical connections to munitions are the most likely paths for electromagnetic energy to enter. (Racking munitions to the aircraft first and tightening "sway braces" before making electrical connection reduces the amount of electromagnetic energy which can be induced into the internal circuitry.)

g. Transport all munitions in completely enclosed metal containers whenever possible (especially those items which have exposed wiring attached).

h. Cover all open electrical connectors on the ammunition with the non-shorting caps or by alternative means to prevent the pins of these connectors from accidentally being touched. The caps should be removed just prior to connector mating and reinstalled promptly after connector removing.

i. Do not expose internal wiring and firing circuits by assembling or disassembling munitions in an electromagnetic environment.

j. Exercise precautions for use of low power system (e.g. portable devices, mobiles, wireless systems, WIFI, and amateur band transmitters). The low power system is defined as those that radiated at five (5) watts or less EIRP. The HERO SSD can be obtained using table G-2 and G-3 in ANNEX G.

1.2.4. PROCEDURES TO ENSURE RADHAZ SAFETY FOR SCES OF AIRCRAFT

For these systems, the same principles as for weapons and munitions apply, except that one of the precautions ("jettison") defined in paragraph 1.2.3, is impossible.

1.2.5. PROCEDURES TO ENSURE RADHAZ SAFETY FOR FUELS & FLAMMABLES

1.2.5.1. BASIC PROCEDURES FOR FUELS & FLAMMABLE MATERIEL

General instructions regarding the control of transmission to avoid hazards to fuel and flammable materiel are summarized as follows:

a. Only flammables with flash points > 60° C may be exposed. Others must be in shielded closed containers when there is a possibility of being exposed to EMR.

b. In port and in territorial sea, refer to ANNEX D.

1.2.5.2. PROCEDURES FOR FLAMMABLES WITH FLASH POINT < 60°C

To avoid causing a hazard during fuelling operations on vessels in close company, the following more detailed procedures should be observed for flammable materiel with a flash point below or equal to 60 °C when they are exposed to EMR during fuelling, defueling and handling operations and ship-to-ship replenishments. These procedures apply also when there is any leakage of flammable materiel (including those with flash point <60°C) from a damaged container.

a. Radar & Satellite Communications (SATCOM)

Radar main beams and radiations from other directional aerials of own or other ship must not illuminate fuelling points, fuelling rigs, aircraft, vehicles or craft being fuelled, defueled or replenished within 300 meters for radars of average power greater than 500 Watts and within 100 meters at lower powers.

b. Radio Communication (Omnidirectional)

DISTANCE OF FUELLING POINT	MEASURES
D < 15 meters	Fuelling rig or nearest point of aircraft platform being fuelled or replenished. No transmissions at all from own or other ship are authorized.
15 meters < D < 30 meters	Transmissions are allowed from own and other ship up to 250 Watts per transmitter.
D > 30 meters	No restriction.

c. Low Power wireless devices

Examples: mobile phones; RFID; WIFI; portable devices; etc…

For transmitters operating at a frequency at, or between, 30.0 MHz and 10.0 GHz and with an output power $\leq$ 1 Watt, transmissions are permitted for distances larger than 1 meter but not permitted within 1 meter of the fuelling point.

For all other transmitters operating at a transmit frequency below 30.0 MHz, or higher than 10.0 GHz, or with an output power > 1Watt, then the procedures of paragraph 1.2.5.2 (a) & (b) shall apply.

d. Dummy Loads

Transmitters connected to a dummy load do not cause RADHAZ risks and are not restricted by the above procedures.

PART 2 - PRACTICAL OPERATIONAL GUIDANCE AND PROCEDURES

2.1. BACKGROUND

2.1.1. INTRODUCTION

Radio & radar radiation from platforms present a potential hazard to personnel, flammables (e.g. fuels) and materiel, e.g.: weapon systems; munitions or any stores embodying electro-explosive devices (EED) and/or safety critical electronic systems (SCES). The Commanding Officer of a platform has to apply the following general operational guidance and procedures to ensure safety when engaged in operations with platforms of other Nations.

The areas where level of radiations may constitute hazards to personnel, flammables and materiel, should be clearly indicated by a warning sign as defined in Stanag 1379.

This part takes the detailed recommendations given in PART 1 - and summarises them in a form suitable for use by operational units giving examples for the implementation of the procedures where appropriate.

The Commanding Officer should appoint a RADHAZ Responsible Officer (RRO) to ensure these procedures are properly observed.

2.1.2. SCOPE

This guide applies to the control of the hazards to susceptible materiel, personnel and flammables during operations:

a. On high seas when distances between platforms are less than 5000 meters[1].

b. In territorial waters and in port.

Later, in paragraph 2.7, advice is provided regarding how to implement the procedures in a simplified manner with examples.

2.2. GENERAL GUIDANCE & PROCEDURES FOR PERSONNEL

The Commanding Officer of each platform will appoint a RADHAZ Responsible Officer (RRO) who will be responsible for all radio and radar radiation hazards (RADHAZ) issues (personnel, materiel and fuel). The Commanding Officer also is ultimately responsible for ensuring that personnel are not subjected to levels greater than National permissible exposure levels (PEL) or those of STANAG 2345.

National engineering authorities will establish safety distances (SD) for all their platform transmitters. It is the responsibility of every transmitting platform to ensure that personnel are not illuminated within these SD.

In addition to the basic protection procedures above, the following additional measures are recommended:

a. All unnecessary exposures to radio and radar frequency radiation should be avoided.

b. Personnel at risk should be briefed about the hazards and measures being taken to protect them.

[1] No restrictions apply when distances between platforms are greater than 5000 meters.

c. During maintenance of transmitters, where personnel and materiel may be exposed to radio and radar frequency radiation, transmitters shall be connected to a dummy load.

d. In case of suspected or actual overexposure, the occurrence must be investigated and appropriate measures taken as given in individual Nation's documentation or in ANNEX C.

2.3. GENERAL GUIDANCE & PROCEDURES FOR SUSCEPTIBLE MATERIEL

2.3.1. BASIC PRINCIPLES

The principle involves the use of alpha-numeric codes e.g.:

R2	T5	U3	V1	WA6	WB6	YA1	YB1	Z0

to represent the susceptibility of materiel and the radiated power of the radio frequency transmitters. The alpha characters in the codes represent the RADHAZ frequency range (RADHAZ FR); see Table A-1.

The numerical index represents:

- The degree of susceptibility of the materiel in the case of the susceptibility RADHAZ designator (SRAD) code; the lower the number, the greater the degree of susceptibility
- The degree of radiated power (TRAD)

2.3.1.1. Hero categories

Ordnance categorized as **HERO SAFE ORDNANCE** are items containing electrically initiated devices proven by test and/or analysis to be immune to adverse affects and can be exposed safely to EME levels as high as those specified in Table A-1 index 7. Ordnance items categorized as **HERO SUSCEPTIBLE ORDNANCE** are items that have known susceptibilities (shown by test and/or analysis) and will have a designated RADHAZ code index between 1 and 6, depending on the degree of susceptibility. And finally, ordnance categorized as **HERO UNSAFE ORDNANCE** (i.e., RADAHZ code index 0) are items that have not been classified as either **HERO SAFE** or **HERO SUSCEPTIBLE** as a result of a test and/or analysis. Additionally, any ordnance item containing electrically initiated devices (including those previously classified as **HERO SAFE** or **HERO SUSCEPTIBLE** ordnance) that has its internal wiring exposed; when tests are being conducted on that item that result in additional electrical connections to the item; when electrically initiated devices having exposed wire leads are present and handled or loaded in any but the tested condition; when the item is being assembled or disassembled; or when such ordnance items are damaged causing exposure of internal wiring or components or destroying engineered HERO protective devices is considered **HERO UNSAFE ORDNANCE**.

2.3.1.2. The effective isotropic radiated power (EIRP) of a transmitter in the case of the transmitter RADHAZ designator (TRAD) code; the higher the number is, the greater the EIRP is.

Both SRAD & TRAD codes are to be supplied to their fleet assets by the appropriate individual Nation's engineering authority.

2.3.2. PROCEDURE

A platform about to introduce or expose susceptible materiel to another platform will provide its SRAD code prior to closing within 5000 meters. The receiving platform will ensure that the materiel is not overexposed by its emitter's EIRP.

The procedure is to compare the TRAD code to the SRAD code for each RADHAZ FR:

a. If the TRAD numerical index is a number lower than or equal to the SRAD numerical index, then no precautions are necessary. Subject to maintaining a minimum separation distance of 3 meters between the transmitting antenna and the susceptible materiel.

b. If the TRAD numerical index is a number higher than the SRAD numerical index for the same RADHAZ FR, then the following precautions must be taken, either by:

(1) Reducing transmitter power or by using sector blanking.

(2) Ceasing transmission on this RADHAZ FR.

(3) Maintaining a minimum safety distance (SD) which is obtained using TABLE G-1in ANNEX G. When a minimum SD occurs in more than one FR, then the largest minimum SD figure represents the worst case.

(4) Jettisoning the susceptible materiel if possible.

c. When the numerical index for an SRAD code is not given, then an index value of 0 is to be used (worst case). This can be given as: SRAD (0).

2.3.3. USE OF SAFETY DISTANCES TABLE

a. When TRAD and SRAD codes have been allocated to transmitters, materiel, ships, aircraft and shore stations, respectively, the SD between these platforms and susceptible materiel are obtained from Table G-1 where the seven vertical columns on the left side refer to the SRAD and the two horizontal lines on the upper right side refer to the TRAD.

The procedure to determine the SD is explained by the following example:

b. Take a materiel with an SRAD code of U1 and a transmitter with a TRAD code of U5. Identify the SRAD index of 1 in the left hand U column and read across to the column for TRAD of numerical index 5; the SD is 40 meters.

2.4. GENERAL GUIDANCE & PROCEDURES FOR FUELS & FLAMMABLES

2.4.1. BASIC PROCEDURES FOR FUELS & FLAMMABLE MATERIALS

See 1.2.5.1

2.4.2. SPECIFIC PROCEDURES FOR FLAMMABLES WITH FLASH POINT < 60° C

See 1.2.5.2

a. Radar & Satellite Communications (SATCOM)

See 1.2.5.2.a

b. Radio Communication (Omnidirectional)

See 1.2.5.2.b

c. Low Power wireless devices

See 1.2.5.2.c

d. Dummy Loads

See 1.2.5.2.d

2.5. SPECIFIC RESTRICTIONS

2.5.1. RADIO & RADAR EMISSIONS IN THE TERRITORIAL WATERS & PORTS

It is the responsibility of the Commanding Officer of a platform to maintain the appropriate safety distance (SD) as described in paragraph 2.2 to ensure that no other platform or installation in the territorial waters or ashore is irradiated at power density levels greater than those permissible to ensure the safety of the personnel.

2.5.2. EXPOSURE OF MATERIEL & FLAMMABLES IN TERRITORIAL WATERS & PORTS

It is the responsibility of Commanding Officers to maintain a minimum SD of 5000 meters between platforms. If closing within this distance, the procedures given above are to be used. Fuels and flammables with a flashpoint < 60° C have then to be in shielded, closed containers (see paragraph 2.5.1).

2.6. GENERAL ADDITIONAL PRECAUTIONS AND PROCEDURES

See 1.2.3.5

2.7. GUIDANCE TO SIMPLIFY THE IMPLEMENTATION OF OPERATIONAL PROCEDURES

2.7.1. GUIDANCE FOR MATERIEL

a. Each platform will have received the susceptibility RADHAZ designator (SRAD) codes for its own materiel from the National engineering authority. These codes may be placed in a table (see Table 1/3).

TABLE 1/3

MATERIEL	SRAD								
EFCS	R4	T5	U3	V4	WA4	WB4	YA6	YB6	Z4
1000 lb Bomb	R6	T4	U2	V5	WA2	WB2	YA6	YB6	Z4
Surface missile MM07	R6	T5	U4	V4	WA5	WB5	YA6	YB6	Z4
Overall SRAD	R4	T4	U2	V4	WA2	WB2	YA6	YB6	Z4

b. Each platform will have received the transmitter RADHAZ designator (TRAD) codes of its own transmitters (Tr_x) from the National engineering authority. The TRAD of each transmitter of the platform can be placed in a table (see Table 2/3).

TABLE 2/3

		RADHAZ FREQUENCY RANGES								
		R	**T**	**U**	**V**	**WA**	**WB**	**YA**	**YB**	**Z**
TRANSMITTERS	**Tr_1**	-	2	1	-	-	-	-	-	-
	Tr_2	-	1	4	-	1	1			-
	Tr_3	-	-	2	-	1	1	-	-	-
	Tr_4	-	-	-	-	3	3	-	-	-
	Tr_5	-	-	-	-	2	2	3	3	-
	Tr_6	-	-	-	-	-	-	4	4	0
	Tr_7	-	-	-	-	-	-			3
	Overall	-	**T2**	**U4**	**-**	**WA3**	**WB3**	**YA4**	**YB4**	**Z3**

The overall TRAD of the platform is determined by taking the highest index for each radio & radar radiation hazards frequency range (RADHAZ FR).

TRAD	-	T2	U4	-	WA3	WB3	YA4	YB4	Z3
SRAD	R4	T4	U2	V4	WA2	WB2	YA6	YB6	Z4
Action	None	None	Yes	None	Yes	Yes	None	None	None

The TRAD for the emitter in RADHAZ FR "U", “WA” and “WB” must be reduced to 2 or less, or other action is necessary.

c. When two platforms close, and the TRAD cannot be reduced or sectored, safety distances (SD) may be determined using Table 3/3. The appropriate distance between the emitter and materiel will ensure the materiel is not overexposed. The distances are taken from Table G-1. This table can be prepared in advance with the knowledge of the TRAD for the particular platform and allows for the reception of materiel with any SRAD numerical index.

Table 3/3

		RADHAZ FREQUENCY RANGES								
		R	**T2**	**U4**	**V**	**WA3**	**WB3**	**YA4**	**YB4**	**Z3**
SRAD INDEX	**7**									
	6									
	5									
	4									
	3									
	2			10						
	1		10	20						
	0		40	110						

	No transmitter in this RFR.
	Represents a minimum safe distance of **3 meters**.
	Distance in meters

2.7.2. GUIDANCE FOR PERSONNEL

Each National engineering authority will provide an SD for each of its significant transmitters; the distance represents the point at which the permissible exposure level (PEL) is reached.

Transmitters of the Platform	Safety Distance for Personnel (meters)
Tr1	
Tr2	
Tr3	
TrN, ...	

ANNEX A SRAD ALLOCATION PROCEDURE

1. SUSCEPTIBILITY OF MATERIEL

The susceptibility of materiel to the EMR environment is described with maximum PEL materiel can accept without RADHAZ risk. Table A-1 gives the RADHAZ susceptibility indexes corresponding to different PEL for each RADHAZ FR. This table contains susceptibility levels expressed as average values obtained from electromagnetic evaluations. These values take into account the effects of the modulation of CW transmissions and the pulse effects of radar transmissions.

2. SRAD

The SRAD of a materiel is made up of the RADHAZ FR and susceptibility indexes defined in Table A-1. To determine the SRAD, the maximum PEL of the considered materiel has to be placed, for each RADHAZ FR, with regard to the exposure levels given in this table. When the maximum exposure level of this materiel is comprised between two levels of the table, the lower index has to be chosen.

3. EXAMPLE

Example A-1: A materiel with the following maximum PEL:

PEL =	8	V/m	from	150	kHz	to	600 kHz	(R band)
PEL =	15	V/m	from	600	kHz	to	32 MHz	(T band)
PEL =	9	V/m	from	32	MHz	to	150 MHz	(U band)
PEL =	7	W/m^2	from	150	MHz	to	790 MHz	(V band)
PEL =	9	W/m^2	from	790	MHz	to	2,7 GHz	(WA band)
PEL =	9	W/m^2	from	2.7	GHz	to	4,5 GHz	(WB band)
PEL =	2500	W/m^2	from	4,5	GHz	to	8,5 GHz	(YA band)
PEL =	2500	W/m^2	from	8,5	GHz	to	18 GHz	(YB band)
PEL =	10000	W/m^2	from	18	GHz	to	45 GHz	(Z band)

Has the following SRAD**:**

R1	T2	U1	V3	WA0	WB0	YA5	YB5	Z7

When using Table A-1, it can be noted that PEL of a materiel are always higher than or equal to susceptibility levels corresponding to SRAD indexes**. Table A-1 is used to develop the SRAD code for an ordnance item in terms of its susceptible frequency band/s and susceptibility index which is related to a maximum field**

strength or power density exposure level. Table A-1 below has been modified to allow further refinement of specific guidance for the frequencies in the W and Y bands. The W band covers the frequency range from 790 MHz to 4.5 GHz and was broken into 2 sub-bands (WA) 790 MHz – 2.7 GHz and (WB) 2.7 – 4.5 GHz. The Y band covers the frequency range from 4.5 – 18 GHz and was also broken into 2 sub-bands (YA) 4.5 – 8.5 GHz and (YB) 8.5 – 18 GHz. If required the SRAD codes can be developed using the entire W and Y bands or the sub-bands. The benefit to splitting the W and Y bands into smaller bands is that a single emitter which operated in a narrow frequency range will not drive the code for the entire band. The use of W and Y sub-bands are optional; however, using the new sub-bands will potentially reduce the emission control restrictions placed on emitter systems and or ordnance items. As a result it should minimize the impact to the NATO operations and improve mission success.

TABLE A-1

Susceptibility Index	FIELD INTENSITY (V/m)			POWER DENSITY (W/m^2)					
	R	T	U	V	WA	WB	YA	YB	Z
	150 kHz	600 kHz	32 MHz	150 MHz	790 MHz	2.7 GHz	4.5 GHz	8.5 GHz	18 GHz
	600 kHz	32 MHz	150 MHz	790 MHz	2.7 GHz	4.5 GHz	8.5 GHz	18 GHz	45 GHz
7	200	300	200	400	1500	10000	8000	10000	800
6	200		150	200	1250	4000	4000	4000	600
5	100			26	1000				500
4	60			10	400				
3	20			1	200				
2	10			0.26	100				
1	6	3		0.1	10		40		50
0	2	0.5		0.05	1		10		

ANNEX B TRAD ALLOCATION PROCEDURE

1. The **TRAD** allocated to a transmitter has the following format:

F q

where:

- F is a letter representing the RADHAZ FR range of the transmitter (the RADHAZ FR is defined in Table A-1 of ANNEX A).
- q is a numerical index representing the strength of the EMR environment provided by the transmitter in terms of EIRP. The index j can be deduced from Chart B-1.

2. This chart divides the EIRP domain (Average Power x Antenna Gain) into different areas, noted from 1 to 19, with the Average Power (Watts) on the X axis and the Antenna Gain (dBi) on the Y axis.

The index j which has to be allocated to the TRAD of a given transmitter corresponds to the serial number of the particular area in which the point representing the power (X) and the antenna gain (Y) of that transmitter fall.

Notes:

a. In the particular case of radio communication transmitters with multiple wires or whip antennas on board a ship, an assumption has been made that antenna Gain = 3 dB when the exact value is not known.

b. In the particular case where the EIRP product falls on a line of Chart B-1, the lower TRAD index has to be used**.**

Example B-1

A radar transmitter has the following characteristics:

Average Power:	500 W
Antenna Gain:	16.5 dB
Frequency:	5000 MHz

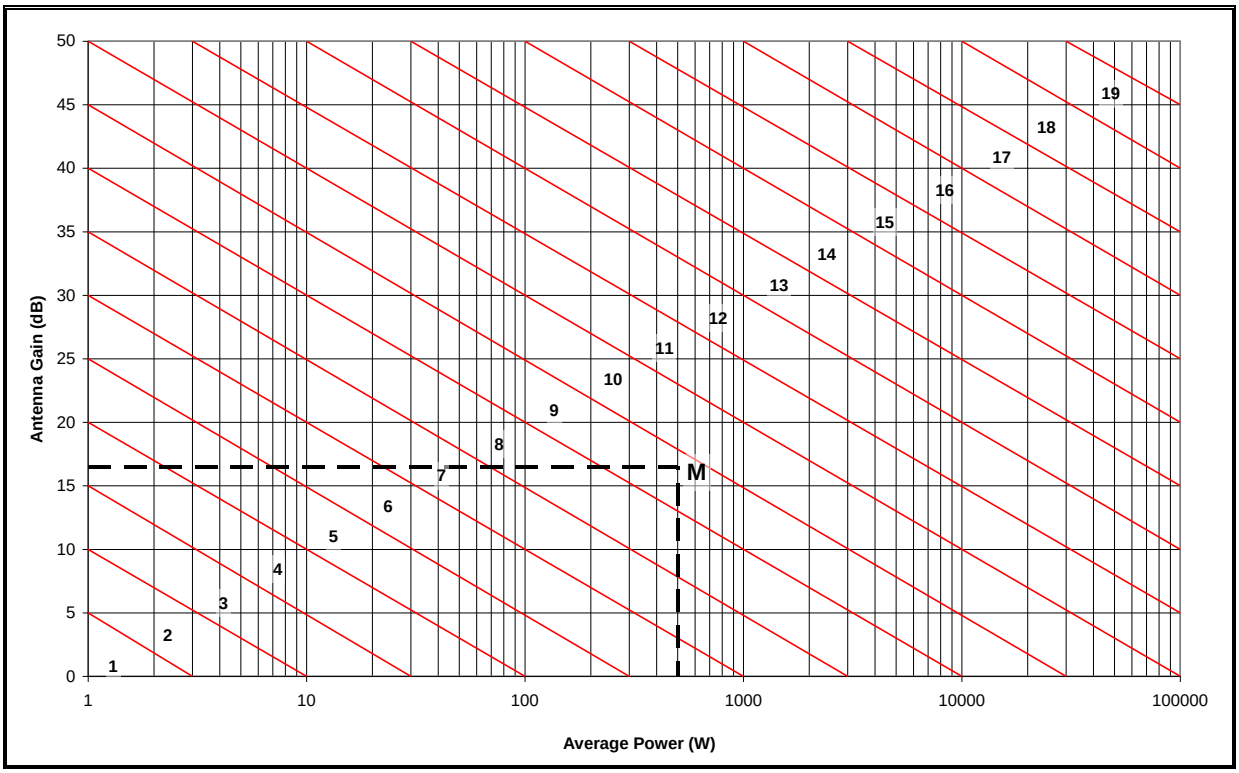
The RADHAZ FR corresponding to the frequency 5000 MHz is represented by the letter YA.

The point M shown on Chart B-1 (P = 500 W, G = 16.5 dB) is in the area 9. The j index allocated to the TRAD is 9.

The TRAD of that transmitter is:

YA9

CHART B-1



3. When there are several transmitters on the same ship, the TRAD code of that ship is obtained taking into account only the transmitter giving the highest index j within each RADHAZ FR (see **example H-1,** in ANNEX **H**).

ANNEX C LIMITATIONS OF EXPOSURE & CONTROL MEASURES FOR PERSONNEL

1. FOREWORD

a. All unnecessary radiation exposure should be avoided.

b. Personnel at risk should be briefed about the hazards and the control measures being taken to protect them.

2. LIMITATION OF EXPOSURE FOR PERSONNEL

C-2.1. GENERAL

The EMR protection standards are based primarily on the SAR, expressed in W/kg; i.e., the thermal effect when personnel are exposed to EMR. The standards take account of the frequency dependency of SAR and give appropriate advice on the plane wave field intensity and power flux densities which are likely to give rise to the SAR basic restriction.

C-2.2. BASIC PROTECTION GUIDELINES

Personnel shall not be exposed to electromagnetic environment levels exceeding the PEL of the National Standards or those given by STANAG 2345. In the absence of any agreement or appropriate National Standard, STANAG 2345 should be used.

C-2.3. IN WARTIME

In time of war there may be situations where, in the interests of ship's safety or fighting efficiency, Commanding Officers may be required to send persons into areas where the electromagnetic environment exceeds the PEL. Guidance is therefore offered on the effects of such an action.

In all cases, the following restrictions should be applied:

- Personnel should only be placed in hazardous situations if essential for the ship's safety, fighting efficiency or to save life.
- Time spent in the hazard area is to be kept to a minimum.
- Personnel so exposed should be warned that they may feel parts of their body being heated, which is acceptable, but that they should leave the area if they feel faint or ill.

The following guidance on the effects of overexposure is offered:

a. Continuous exposure to average power densities between 100 & 1000 W/m².

Fit personnel on the upper deck of a ship underway should not experience any untoward effect at the time, although at power densities above 500 W/m² the risk of subsequently developing cataracts may be increased. On stationary ships in the tropics, personnel might succumb to the effects of generalized overheating in less than an hour, particularly at power densities approaching 1000 W/m².

b. Continuous exposure to average power densities between 1000 & 2000 W/m².

No ill effects should be felt for 10 minutes (sooner if the temperature is high and the ship is stationary). Thereafter, overheating leading to heat stroke may be rapid.

c. Continuous exposure to average power densities in excess of 2000 W/m².

At these levels, severe overheating will result and no useful work can be done.

3. ACTION TO BE TAKEN IN CASE OF SUSPECTED OVEREXPOSURE OF PERSONNEL (INCIDENT)

In case of a suspected overexposure, the procedures of STANAG 2345 should be applied.

ANNEX D OPERATIONAL GUIDANCE AND PROCEDURES IN PORT AND TERRITORIAL WATERS

The following operational guidance and procedures may be applied to ensure the safety of materiel and personnel by the Commanding Officer of a platform in port and territorial waters, and in such situations where there are more than three platforms in company and where procedures defined in paragraph 1.2 are not considered practicable to apply.

1. EXPOSURE OF WEAPONS AND FLAMMABLE MATERIEL

RADHAZ control in ports and the territorial waters (e.g., at shore installations, oil installations at sea and aboard ships and aircraft crossing over the area) requires the acceptance of restrictions in radio & radar transmissions and/or the curtailment of operations involving weapons with SRAD indexes lower than or equal to 5 for the RADHAZ frequency ranges (RADHAZ FR) R, T, U, V, WA, WB, YA, YB and lower than or equal to 3 for the FR Z as indicated below:

R5	T5	U5	V5	WA5	WB5	YA5	YB5	Z3

For flammable materiel, only those with flash points > 60 °C are allowed to be exposed. Others must be in shielded closed containers.

2. EXPOSURE OF PERSONNEL

It is the responsibility of the Commanding Officer of a platform to ensure that no other platform or installation in the territorial waters or ashore is irradiated at a level more than the limit levels defined by National Standards or those given in ANNEX C.

Note: In the procedures detailed below, the term ‘aircraft’ is used for helicopter, aircraft and vertical/short takeoff and landing (VSTOL) aircraft.

a. Aircraft of NATO Naval Forces can be represented by rectangular boxes as shown on the drawing below, with sides identified by the following code:

Ft: Front
Rr: Rear
Sb: Starboard
Pt: Port
Bt: Bottom
Tp: Top

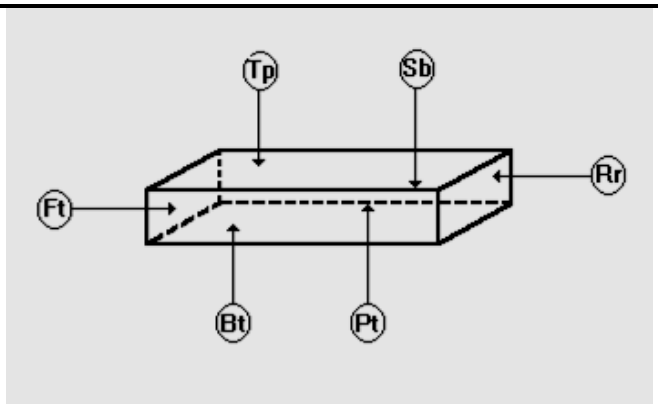


FIGURE D-1: REPRESENTATION OF NATO NAVAL FORCES AIRCRAFT

b. Aircraft transmitters concerned with hazards to personnel assessment are those with an average effective power greater than 10 W and a frequency greater than 150 kHz.

c. The reference distance (RD) associated with each transmitter shall be defined by taking into account the coarse modelling of its antenna diagram with a semi-circle centred on a side of aircraft at the antenna location (as defined in Figure E-1 above) where the power density is less than the reference level (RL) of 100 W/m².

d. For radar transmitters, the distance where the RL of 100 W/m^2 is reached shall be determined for the operational mode of the radar (i.e. scanning, rotating tracking, etc). From this information, the safety distance (SD) may be calculated as shown in paragraph 1.2.

e. A PRAD shall be assigned to each helicopter/VSTOL aircraft engaging in operations with ships of NATO forces. The PRAD will consist of a series of letter/number combinations that define the RL surrounding the aircraft as follows:

Ft(a) - Rr(b) - Sb(c) - Pt(d) - Bt(e) - Tp(g)

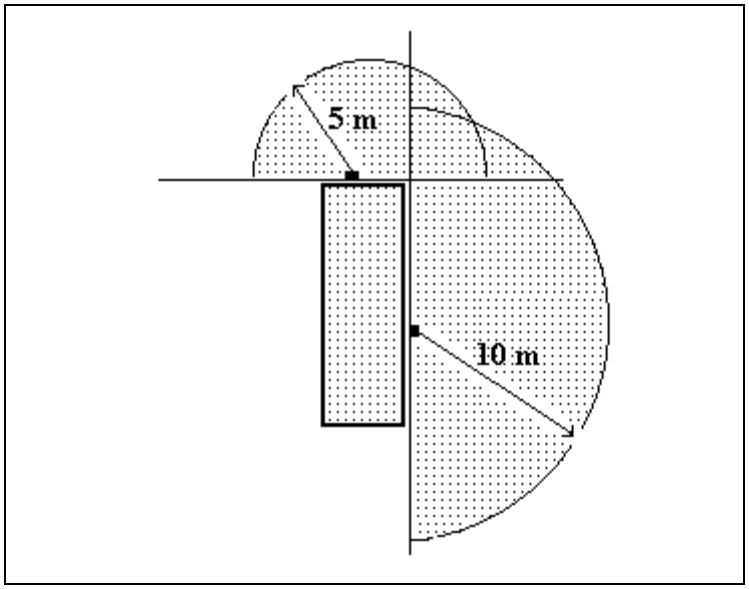
where:

(1) Capital letters and small letters represent the sides of aircraft where a hazard may exist.

(2) Small letters between brackets represent the extent (in meter) of the semi-circles defining the RD.

Example D-1

Ft 5 - Sb 10 is the PRAD of an aircraft corresponding with the drawing below. The RD in the front of the aircraft is 5 meters to the 100 W/m^2 level, and on the starboard side the distance is 10 meters to the RL. The SD is calculated based on this information and the PEL for the personnel in the frequency band of the transmitters.



f. When an aircraft is considered safe from a RADHAZ point of view, its PRAD is said to be equal to 0.

ANNEX E GENERAL PRECAUTIONS & SPECIAL PROCEDURES TO ENSURE SAFETY OF PERSONNEL WHEN IRRADIATED BY AIRCRAFT TRANSMITTERS

1. SPECIAL PROCEDURES FOR LANDING AND TAKING OFF

a. The ship must be advised of the PRAD of the aircraft. When the designator is known, action is to be taken to ensure that personnel are outside the areas covered by the different calculated SD as defined in ANNEX D.

b. When the procedure defined in a. leads to restrictions, the transmitter which causes radiation hazards has to be switched off or directed in a safe direction. If these measures are not possible, action is to be taken to ensure that personnel are not exposed to levels exceeding National Standards when they exist or PEL defined in ANNEX C.

2. SPECIAL PROCEDURES FOR AIRCRAFT ON THE DECK

The procedures below must be used when more than one aircraft is on the deck.

a. Transmissions from an aircraft on a flight deck shall not be permitted unless authorized. When authorized, the aircraft shall be oriented with the transmitter antenna on a bearing that radiates to the open sea and avoids personnel and also ships in close company.

b. Transmissions in the hangar are prohibited, unless specifically authorized.

c. Rotation or scanning of an energized radar antenna shall not be carried out in congested areas unless specifically authorized.

d. Whenever possible, radar transmissions are to be limited in an area by the use of suitable EMR absorption material in the form of flat screens or covers for the radome or aerial.

3. GENERAL PRECAUTIONS TO CONTROL TRANSMISSIONS FROM ALL SOURCES ON DECK

The following precautions shall be taken to ensure that personnel are not exposed to power density levels exceeding PEL of National Standards when they exist or those defined in ANNEX C.

a. Maintenance personnel are to ensure that aircraft do not transmit without verification that personnel are clear of the SD as defined above.

b. Personnel shall not look directly into the beam of radars: guidance should be sought from qualified personnel for locating the beam for each antenna installation.

c. Visual inspection of feed horns, open ends of waveguides or any source emitting electromagnetic energy shall not be made unless the equipment is secured for the purpose of such an inspection.

d. Dummy loads shall be employed, where possible, during testing or system checks, rather than radiating the energy into the surroundings.

e. High power radar beams shall not be directed toward personnel working areas.

f. Personnel shall observe "RADHAZ" warning signs or other devices which point out the existence of microwave (i.e. frequencies between 300 MHz and 300GHz) radiation hazards in a specific location or area.

ANNEX F OPERATIONAL PROCEDURE & GUIDANCE FOR TWO APPROACHING PLATFORMS

The procedure defined in this Annex is an example of the procedures to be used to cover all the different platform configurations as defined in paragraph 1.2.

1. As a part of pre-flight procedures, the aircraft pilots will have a record of the platform SRAD code (1) for the weapon/stores configuration for the specific mission, established using the SRAD allocation procedure defined at ANNEX A. Upon approaching a foreign ship, the pilot has to pass his SRAD code during his request for permission to close.

2. Ships participating in NATO operations shall establish their TRAD code using the procedure defined in 0.

3. To receive an aircraft and to ensure its safe recovery, the ship compares SRAD and TRAD. The ship's crew place SRAD and TRAD in a table with the SRAD on the first line and TRAD on the second line:

a. When the indexes of TRAD are lower than or equal to those of SRAD, the minimum distance to observe between the aircraft and the transmitters is 3 meters. In all other cases, the ship determines the minimum distance between the aircraft and the transmitters for each radio and radar radiation hazards frequency range (RADHAZ FR), consulting Table G-1 of ANNEX G and places these distances on the third line of the table as shown in the examples below:

Example F-1									
SRAD (1)	**R3**	**T4**	**U2**	**V5**	**WA5**	**WB5**	**YA2**	**YB2**	**Z4**
TRAD	R1	T2	U2	V4	(2)	(2)	YA13	Y13	Z4
Safety distances in meters	3	3	3	3	(2)	(2)	50	50	3

Example F-2									
SRAD (1)	**R2**	**T0**	**U2**	**V4**	**WA3**	**WB3**	**YA5**	**YB5**	**Z4**
TRAD	(2)	T2	U3	V8	WA3	WB3	YA16	Y16	(2)
Safety distances in meters	(2)	40	3	10	3	3	90	90	(2)

Notes	
(1)	The SRAD code of each materiel has to be determined by each Nation.
(2)	No transmitter in this RADHAZ FR.

b. If the SD derived is greater than the distance between any of the transmitting antennas and the landing area, suitable steps are to be taken by the ship to switch off the transmitter in the RADHAZ FR of concern, or, if that is not possible, to reduce power output (thereby decreasing minimum safe distances) or sector scan,

where applicable, to eliminate EMR in the landing areas. In the event that maintenance of the calculated safety distances impacts recovery of the aircraft, all transmitters creating the RADHAZ condition are to be switched off, or permission to land denied.

4. A procedural flow chart (FigureF1) is given below to outline the different steps of the procedure. An example of how to use the procedure is given in ANNEX I.

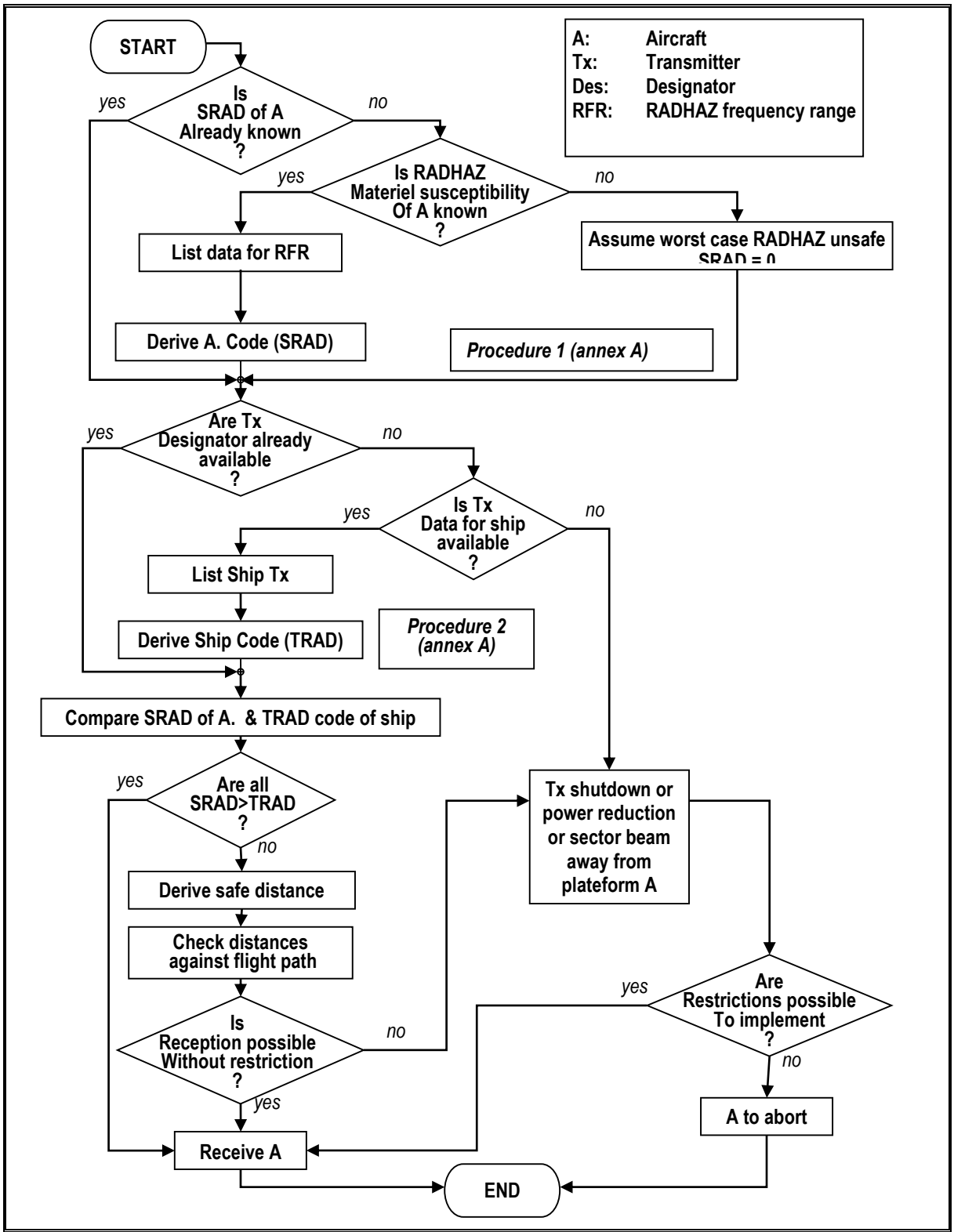


FIGURE F-1 - PROCEDURAL FLOW CHART

ANNEX G SAFETY DISTANCES (SD) AND HERO SAFE DISTANCE TABLES

1. The SD between transmitters (characterized by TRAD) and susceptible components (characterized by SRAD) are obtained from Table G-1.

2. The procedure to determine the SD is explained by the following example. Take a materiel with an SRAD code of U1 and a transmitter with a TRAD code of U5. Identify the SRAD index of 1 in the left hand U column and read across to the column for a TRAD of numerical index 5; the SD is 40 Meters.

TABLE G-1 - SAFETY DISTANCES (meters)

SRAD									TRAD R, T, U,V, WA, WB, YA, YB, Z																
R	T	U	V	WA	WB	YA	YB	Z	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
							7		3	3	3	3	3	3	3	3	3	3	3	3	10	10	20	30	50	90	160
					7				3	3	3	3	3	3	3	3	3	3	3	3	10	10	20	30	50	90	160
						7			3	3	3	3	3	3	3	3	3	3	3	10	10	10	20	40	60	100	180
						6			3	3	3	3	3	3	3	3	3	3	3	10	10	20	30	50	80	150	250
				7					3	3	3	3	3	3	3	3	3	3	10	10	20	30	40	80	130	240	400
				6					3	3	3	3	3	3	3	3	3	3	10	10	20	30	50	80	140	260	440
				5					3	3	3	3	3	3	3	3	3	3	10	10	20	30	50	90	160	290	490
								7	3	3	3	3	3	3	3	3	3	10	10	10	20	40	60	100	180	320	550
								6	3	3	3	3	3	3	3	3	3	10	10	20	20	40	70	120	200	370	640
								5	3	3	3	3	3	3	3	3	3	10	10	20	30	40	70	130	220	400	700
			7	4					3	3	3	3	3	3	3	3	3	10	10	20	30	50	80	150	250	450	780
	7								3	3	3	3	3	3	3	3	10	10	10	20	40	60	100	190	320	580	1000
			6	3					3	3	3	3	3	3	3	3	10	10	20	20	40	70	110	200	350	640	1100
7/6	6	7		2					3	3	3	3	3	3	3	3	10	10	20	30	50	90	160	290	490	900	1600
		6				1	1	1	3	3	3	3	3	3	3	10	10	20	30	50	80	150	250	450	780	1500	2500
5									3	3	3	3	3	3	10	10	10	20	30	60	100	180	300	550	950	1800	3000
4				1		0	0		3	3	3	3	3	3	10	10	20	30	50	100	160	290	500	920	1600	2900	>5000
3				0					3	3	3	3	10	10	20	30	50	90	150	280	480	870	1500	2800	4800	>5000	>5000
2									3	3	10	10	10	20	40	60	100	180	300	550	950	1800	3000	>5000	>5000	>5000	>5000
1			1						3	3	10	10	20	30	60	90	160	290	490	900	1600	2900	4900	>5000	>5000	>5000	>5000
			0						3	10	10	20	30	40	80	130	230	400	700	1300	2200	4000	>5000	>5000	>5000	>5000	>5000
	1								10	10	20	20	40	60	110	190	330	580	1000	1900	3200	>5000	>5000	>5000	>5000	>5000	>5000
0									10	10	20	30	50	90	160	280	490	870	1500	2800	4800	>5000	>5000	>5000	>5000	>5000	>5000
	0								20	40	70	110	200	350	620	1100	2000	3500	>5000	>5000	>5000	>5000	>5000	>5000	>5000	>5000	>5000

TABLE G-2

Equations for computing Safe Field Strength/distance for HERO UNSAFE ordnance (5 Watts or less EIRP)

Frequency Ranges (MHz)	Equations
$0.01 \leq f < 2.0$	$D = 5.5 f \sqrt{P_t G_t}$ meters $D = 18 f \sqrt{P_t G_t}$ feet
$2.0 \leq f < 80.0$	$D = 10.95 \sqrt{P_t G_t}$ meters $D = 36 \sqrt{P_t G_t}$ feet
$80.0 \leq f < 100000.0$	$D = 876 f^{-1} \sqrt{P_t G_t}$ meters $D = 2873 f^{-1} \sqrt{P_t G_t}$ feet

Where:

D	is the distance in the units designated
P_t	is the average power output of the transmitter in watts
G_t	is the numerical (far-field) gain ratio (not the dB value) of the transmitting antenna, derived as follows: $G_t = 1x10^{G/10}$ where G = gain in dBi,
f	is the transmitting frequency in Megahertz (MHz)

Notes:

1. The information above represents “worst-case” conditions for the Safe Separation Distance required.
2. Equations are provided with the proper numerical multipliers to yield distances in either meters or feet.
3. In cases where the computed separation distance is less than 3 meters (10 feet), refer to Table G-3for guidance.

TABLE G-3

Supplementary Calculations for Computed Safe distance < 10 Feet (3 meters) for HERO SAFE, HERO SUSCEPTIBLE, and HERO UNSAFE ORDNANCE with Low Power System (5 Watts or less EIRP).

MINIMUM SEPARATION DISTANCE (FT)	HERO CLASSIFICATION		
	SAFE	SUSCEPTIBLE	UNSAFE/UNRELIABLE
≥ 10	General HERO Requirements	Use Calculated Distance (see Note 2)	Use Calculated Distance (see Note 2)
5	0.5 < EIRP ≤ 5 Watts All Frequencies	EIRP ≤ 0.5 Watts Frequencies ≥ 100 MHz	0.025 < EIRP ≤ 0.1 Watts 200 MHz ≤ Freq < 1 GHz
1	0.1 < EIRP ≤ 0.5 Watts All Frequencies	0.025 < EIRP ≤ 0.1 W Frequencies ≥ 200 MHz	0.025 < EIRP ≤ 0.1 Watts Frequencies ≥ 1 GHz
0 (see Note 1)	EIRP ≤ 0.1 W All Frequencies	EIRP ≤ 0.025 W All Frequencies	EIRP ≤ 0.025 W Frequencies ≥ 100 MHz
All ORDNANCE			
Maintain 1.5 meters (5 feet) from rigid waveguide routed through magazines.			
HERO SAFE ORDNANCE			
Maintain 1.5 meters (5 feet) from the vertical projection of a lowered deck edge antenna with the transmitter operating at an average EIRP of 1000 watts or less, provided all loading procedures have been completed Maintain a minimum separation of 15 meters (50 feet) from any transmitting antenna during vertical replenishment (VERTREP) operations.			

$EIRP = P_t \times G_t$

Where:

EIRP is the effective isotropic radiated power in watts.

P_t is the average power output of the transmitter in watts.

G_t is the numerical (far-field) gain ration (not the dB value) of the transmitting antenna, derived as follows:

$Gt = 1 \times 10^{G/10}$ where

G = gain in dBi

Example: If the antenna far-field gain is 2.1 dBi, the far-field gain ratio is

$1 \times 10^{2.1/10} = 1 \times 10^{0.21} = 1.62$

Note (1): A zero Safe Separation Distance means transmitter can be placed against the sensitive device but with no part of the antenna touching it.

Note (2): Use calculated Safe Separation Distance per Table G-2

SYSTEM PARAMETERS	MINIMUM SEPARATION DISTANCE (FEET/METERS)
EIRP ≤ 0.025 watts Frequencies ≥ 100 MHz	0/0 Note: a zero Safe Separation Distance means transmitter can be placed against the sensitive device but with no part of the antenna touching it.
0.025 < EIRP ≤ 0.1 watts Frequencies ≥ 1 GHz	1/0.3
0.025 < EIRP ≤ 0.1 watts 200 MHz ≤ Freq < 1 GHz	5/1.5
All other combinations of EIRP and Frequency	Use calculated Safe Separation Distance per Table G-2

$EIRP = P_t \times G_t$

Where:

EIRP is the effective isotropic radiated power in watts.

P_t is the average power output of the transmitter in watts.

G_t is the numerical (far-field) gain ratio (not the dB value) of the transmitting antenna, derived as follows:

$G_t = 1 \times 10^{G/10}$ where G = gain in dBi

Example: If the antenna far-field gain is 2.1 dBi, the far-field gain ratio is

$$1 \times 10^{2.1/10} = 1 \times 10^{0.21} = 1.62$$

ANNEX H PRACTICAL EXAMPLES FOR APPLICATION OF THE PROCEDURES DEFINED IN PARAGRAPH 1.2

EXAMPLE H-1: A HELICOPTER APPROACHING A SHIP

1. Helicopter "H" has the following equipment (including one safety critical electronic flight control system which has to be considered as a safety critical electronic system (SCES))

a. Electronic flight control system (EFCS).

b. 1000 lbs bomb.

c. Surface missile MM07.

The PEL by this equipment for each RADHAZ FR are given on Table H-1 below. The levels for R, T and U ranges are expressed in V/m and the levels for V, WA, WB, YA, YB & Z ranges are expressed in W/m^2.

TABLE H-1 - PEL FOR A HELICOPTER APPROACHING A SHIP

	V/m			W/m^2					
MATERIEL	**R**	**T**	**U**	**V**	**WA**	**WB**	**YA**	**YB**	**Z**
EFCS	**85**	**120**	**56**	**15**	**400**	**400**	**8200**	**8200**	**500**
1000 lb Bomb	**320**	**90**	**15**	**75**	**150**	**150**	**5000**	**5000**	**1000**
Surface Missile MM07	**400**	**100**	**75**	**12**	**1500**	**1500**	**1000**	**1000**	**450**

The SRAD of each piece of equipment can be obtained from Table A-1 of ANNEX A.

MATERIEL	**SRAD**								
EFCS	R4	T5	U3	V4	WA4	WB4	YA7	YB7	Z5
1000 lb Bomb	R7	T4	U2	V5	WA2	WB2	YA6	YB6	Z7
Surface Missile MM07	R7	T5	U4	V4	WA7	WB5	YA5	YB5	Z4

2. The SRAD code of the helicopter is then made up from the worst case, i.e. the lowest index, for each RADHAZ FR.

R4 T4 U2 V4 WA2 WB2 YA5 YB5 Z4

3. This helicopter approaches a ship which has the following transmitters:

a. R & V RADHAZ FR: no transmitter.

b. T RADHAZ FR: 1000 W communication transmitter Tr1 associated to a whip antenna, the gain of which is unknown (1).

c. U RADHAZ FR: 200 W communication transmitter Tr2 with 14 dB antenna gain.

d. WA RADHAZ FR: three transmitters:

transmitter Tr3 with P = 1200 W and	G = 30dB
transmitter Tr4 with P = 500 W and	G = 40dB
transmitter Tr5 with P = 200 W and	G = 36dB

e. WB RADHAZ FR: no transmitter.

f. YA RADHAZ FR: no transmitter.

g. YB RADHAZ FR: transmitter Tr6 with P = 10 W & G = 15 dB.

h. Z RADHAZ FR: transmitter Tr7 with P = 10 W & G = 10 dB.

The TRAD of each transmitter can be determined by the procedure defined in 0.

		RADHAZ FREQUENCY RANGES								
		R	**T**	**U**	**V**	**WA**	**WB**	**YA**	**YB**	**Z**
TRANSMITTERS	**Tr1**	-	7	-	-	-	-	-	-	-
	Tr2	-	-	8	-	-	-	-	-	-
	Tr3	-	-	-	-	13	-	-	-	-
	Tr4	-	-	-	-	14	-	-	-	-
	Tr5	-	-	-	-	12	-	-	-	-
	Tr6	-	-	-	-	-	-	-	5	-
	Tr7	-	-	-	-	-		-	-	4

The TRAD of the ship can be deduced from **Chart B-1** taking the highest index for each RADHAZ FR:

-	**T7**	**U8**	**-**	**WA14**	**-**	**-**	**YB5**	**Z4**

Note (1): According to paragraph 2 (Note a.) of 0**,** the gain is assumed to be equal to 3 dB.

4. To determine the safety distances, the ship has to place the SRAD and the TRAD on the table shown below.

For each column, a safety distance can be deduced from Table G-1 of ANNEX G.

a. Columns R & V: no transmitters; therefore, NOT APPLICABLE, (no RADHAZ Safety distance required).

b. Column T: the SD is 5 meters.

c. Column U: the SD is 55 meters.

d. Column W: the SD is 87 meters.

e. Column Y and Z: the index of TRAD is lower or equal to the SRAD; therefore, the SD is 3 meters.

RADHAZ FR	**R**	**T**	**U**	**V**	**WA**	**WB**	**YA**	**YB**	**Z**
SRAD	R4	T4	U2	V4	WA2	-	YA5	YB5	Z4
TRAD	-	T7	U8	-	WA14	-	-	YB5	Z4
d (in meters)	-	10	60	-	90	-	-	3	3

EXAMPLE H-2: A SHIP RECEIVING A HELICOPTER

1. A GBR helicopter, with a typical weapon configuration, requires permission to be received by a FRA frigate, on its aft flight deck.

The helicopter's SRAD is:	R5	T3	U4	V4	WA2	WB2	YA2	YB2	Z4
The helicopter's TRAD is:	-	T6	U4	V4	-	-	YA11	-	-
The helicopter's personnel RADHAZ designator (PRAD) is Ft 4.									
The frigate's SRAD is:	R6	T6	U2	V6	WA5	WB5	YA5	YB5	Z0
The frigate's TRAD is:	-	T7	U6	V6	WA12	-	YA13	-	-

2. The helicopter's pilot communicates his PRAD, SRAD & TRAD codes to the receiving vessel before closing within 5000 meters.

3. The frigate's RADHAZ Responsible Officer (RRO**)** compares the helicopter SRAD and TRAD codes with the frigate's codes respectively, using matrix Table G-1 of ANNEX G. The minimum SD obtained are indicated below:

Helicopter SRAD	R5	T3	U4	V4	WA2	WB2	YA2	YB2	Z4
Frigate TRAD	-	T7	U6	V6	WA12	-	YA13	-	-
Minimum safe distance (in meters)	-	20	3	3	30	-	50	-	-
Frigate SRAD	R6	T6	U2	V6	WA5	WB5	YA5	YB5	Z0
Helicopter TRAD	-	T6	U4	V4	-	-	YA11	-	-
Minimum safe distance (in meters)	-	3	10	3	-	-	10	-	-

4. From the matrices, it is seen that:

a. The worst case minimum safety distance (SD) between the frigate transmitters and the helicopter's susceptible materiel is 50 meters.

b. The helicopter transmitters do not put the frigate's susceptible materiel at risk.

c. To ensure the safety of personnel of the frigate with regard to the helicopter transmitters, the PRAD of the helicopter has to be considered. If the PEL for personnel of the frigate is different from 100 W/m², then the distance is determined by the formula given in paragraph 1.2.2. If the PEL for personnel of the frigate is 100 W/m^2, then the SD is 4 meters.

If the PRAD of Ft (4) were in the "U" and/or "V" RFR, then the PEL using STANAG 2345 is 10 W/m^2, and the SD (from paragraph 1.2.2) would be:

$$SD = 4\text{m} \times \sqrt{\frac{100\,\text{W/m}^2}{10\,\text{W/m}^2}} = \quad 4\text{m} \times \sqrt{10} \quad = \quad 4\text{m} \times 3.16 \quad = \quad 12.6\ \text{m}$$

5. The frigate's RRO makes the decision that the helicopter may be received safely on the aft flight deck by either ceasing transmission in RADHAZ FR: T, WA, YA, or, if this is not operationally acceptable, reducing the hazard by performing the following:

a. Ceasing transmission (RADHAZ FR T) from the aft high frequency (HF) whip antenna, which is within 15 meters of the flight deck.

b. Ensuring, when possible, that the frigate's missile tracking and guidance radar and satellite communications (SATCOM) are not on a bearing which would hazard the helicopter on its final approach. This will delete the requirement of the YA band distance of 50 meters.

c. Cater for the hazard arising from the frigate's surveillance radar (RADHAZ FR WA), by instructing the helicopter to approach not closer than 30 meters while alongside, and to make its final approach not higher than e.g. 10 meters above the flight deck in the final 10 meters if it fits in the landing procedures.

d. On landing, the frigate's RRO will ensure personnel are removed at a distance 12.6 meters as indicated by the SD calculation until the helicopter transmission is ceased.

e. On landing, the helicopter is positioned such that its weapon(s) are on a safe bearing.

EXAMPLE H-3: AIRCRAFT CARRIER RECEIVING AN AIRCRAFT OF ANOTHER NATION

1. A GBR VSTOL aircraft, with a typical weapon configuration, requires permission to land on a USA aircraft carrier.

The aircraft's SRAD is:	R5	T3	U4	V4	WA2	YA5	Z4
The aircraft's TRAD is:	(1)	T6	U4	V4	(1)	YA12	(1)
The carrier's SRAD is:	R5	T5	U2	V5	WA3	YA5	Z0
The carrier's TRAD is:	R1	T8	U6	V7	WA13	YA15 (2)	(1)

Notes

(1) No transmitter in this RADHAZ FR.

(2) This is determined by the worst case TRAD for the position of aircraft spotted on the flight deck.

2. The aircraft pilot communicates his SRAD & TRAD codes to the carriers before closing within 5000 meters.

3. As in example H-2, the carrier's RRO arranges the comparison of the aircraft SRAD & TRAD codes with the carrier TRAD and SRAD codes and the derivation of safe distances, using matrix Table G-1 of ANNEX G.

Aircraft SRAD	R5	T3	U4	V4	WA2	YA5	Z4
Carrier TRAD	R1	T8	U6	V7	WA13	YA15	-
Minimum safe distance (in meters)	3	30	3	10	50	50	-
Carrier SRAD	R5	T5	U2	V5	WA3	YA5	Z0
Aircraft TRAD	-	T6	U4	V4	-	YA12	-
Minimum safe distance (in meters)	-	3	10	3	-	10	-

4. The carrier's RRO makes the decision that the aircraft may land safely on the flight deck, providing that the aircraft, in its approach, does not approach the island closer than 50 meters, in the main beam of WA and YA bands transmitters. Lower value can be calculated if the aircraft remains far below the main beam of transmitters.

5. Once landed, the aircraft is moved to an appropriate parking location, at least 30 meters from the nearest high powered HF antenna.

ANNEX I SUGGESTED FORMATS & EXAMPLES FOR RADHAZ CODES

This annex gives some suggested formats and examples to collect data and to table the different radio and radar radiation hazards (RADHAZ) codes defined herein.

1. SRAD CODES

For:

a. Weapons and munitions containing EED in isolation.

b. Aircraft with weapons and munitions loaded. More than one SRAD code will be listed, depending upon the aircraft weapon/ammunition payload.

2. TRAD CODES

For:

a. Ships, more than one TRAD code for a vessel may be given if within a class, variations are recognized and given operational combinations of transmitting equipment also are recognized.

b. Ship's individual major transmitting equipment.

c. Aircraft.

d. Naval shore station.

3. PRAD CODES

For aircraft.

4. EXAMPLES OF TABLES

ALLOCATION OF SRAD CODES

TABLE I-1: WEAPONS & MUNITIONS IN ISOLATION (EXAMPLE)

	R	T	U	V	WA	WB	YA	YB	Z
Missile MMY	3	2	4	4	5	4	6	5	4
Missile AMR	3	2	5	6	5	4	6	5	4

TABLE I-2: AIRCRAFT WEAPONS & MUNITIONS LOADED & SCES (EXAMPLE)

	R	T	U	V	WA	WB	YA	YB	Z
Helicopter & Weapon configuration 1	3	4	5	5	6	5	4	2	4
Helicopter & Weapon configuration 2	5	5	5	6	5	5	3	5	3
Helicopter & Weapon configuration 3	2	5	6	6	2	3	3	5	3

I-4.1.

I-4.2.

I-4.3.

I-4.4. ALLOCATION OF TRAD CODES

I-4.5. TRAD FOR INDIVIDUAL TRANSMITTERS (EXAMPLE)

DRBV60	Y9
NRBP25	W3
DRV35	W8
DRBV24	Y10
ERBM19	T6
ERGJ3	R9

I-4.6. TRAD FOR SHIPS (EXAMPLE)

SHIP	R	T	U	V	WA	WB	YA	YB	Z
Transmitting Equipment	12	15	16	16	12	11	12	12	12
without Missile Tracking Radar & SATCOM or Sector Blanking	10	12	9	4	6	7	9	9	4
without Main HF & Tracking Radar/SATCOM Sector Blanking	8	9	5	8	3	3	3	2	2

A-1.1. TRAD FOR SHIP'S INDIVIDUAL MAJOR TRANSMITTING EQUIPMENT (EXAMPLE)

	R	T	U	V	WA	WB	YA	YB	Z
USA ANSQ 12	3	10	2						
USA ANSQ 25	5	4	5	6					
USA SQZ 33				9	15	15	6	6	3
GBR GLK 33					3	3	15	15	

I-4.7. TRAD FOR NAVAL SHORE STATIONS (EXAMPLE)

	R	T	U	V	WA	WB	YA	YB	Z
GBR RNAS HERON	5	6	5	5	5	5	3	3	1
FROYU PLACE	2	4	6	2	4	4	3	3	4
BARBADES	5	5	6	5	6	6	5	5	4

A-1.2. ALLOCATION OF PRAD CODES (EXAMPLE)

Helicopter DGH	PRAD = Bt 7*
Helicopter AS21	PRAD = Ft 7*, Bt 5*, Sb 10*
Helicopter NJH	PRAD = Rr 4*, Pt 5*, Sb 4*

Note (*): The numerical values are RD, not SD.

ALLOCATION OF REFERENCE DISTANCES (RD)

REFERENCE DISTANCES (in Meters) FOR SHIP'S TRANSMITTERS

	R	T	U	V	WA	WB	YA	YB	Z
TR01	(1)	(1)	(1)	15	(1)	(1)	(1)	(1)	(1)
TR02	(1)	(1)	(1)	(1)	130	(1)	(1)	(1)	(1)
HK33	(1)	(1)	(1)	90	(1)	50	(1)	(1)	(1)
DR24	(1)	(1)	25	25	(1)	(1)	(1)	(1)	(1)
KU05	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	20

Note (1): This transmitter does not work in this FR.

REFERENCE DISTANCES FOR SHIPS

	R	T	U	V	WA	WB	YA	YB	Z
SHIP AH01	(1)	10	20	80	(1)	(1)	50	50	(1)
SHIP XT10	4	10	(1)	26	130	130	(1)	(1)	10
SHIP VGB1	6	20	(1)	90	52	52	75	75	(1)
SHIP SSDF	(1)	15	25	25	75	75	(1)	(1)	12
SHIP PIY6T	(1)	9	5	(1)	50	50	(1)	(1)	20

Note (1): No transmitter works in this FR on that ship.

AECP-02/MECP-02(D)(1)