Een praktische invulling van een op risico's gebaseerde EMC aanpak

Jan-Kees van der Ven

de Nederlandse EMC-ESD Vereniging
EMC-ESD Event 2019

NH Conference Centre Koningshof
Veldhoven

woensdag 20 november

Index

RH MARINE

EMC-ESD Event 2019

Introduction & context

Safer Autonomous Systems

NEDERLANDSE EMC-ESD VERENIGING

NEC

IEC

EMC-ESD Event 2019

Risk based EMC???

Vrijdag 08 november 2019 | Het laatste nieuws het eerst op NU.nl

Wat is er aan de hand?

Volgens Red Bull (en Mercedes) zou Ferrari een trucje hanteren waardoor de 'fuelflow-meter' - een instrument dat de hoeveelheid benzine die de motor gebruikt meet - soms niet alles registreert. Deze meter zou het eigenlijk moeten aangeven dat een motor meer dan de toegestane 100 kilo brandstof per uur gebruikt. Vermoedelijk doet Ferrari dit door er een kabel met hoge spanning van het hybride systeem langs te leggen, waardoor de meter wordt verstoord. Als dit trucje succesvol is, kan Ferrari dus op momenten die ertoe doen (dus met name in de kwalificatie) meer brandstof gebruiken dan is toegestaan, waardoor de motor krachtiger wordt.

https://www.nu.nl/formule-1/6008605/analyse-wat-is-er-aan-de-hand-met-de-motor-van-ferrari.html

RH MARINE

EMC-ESD Event 2019

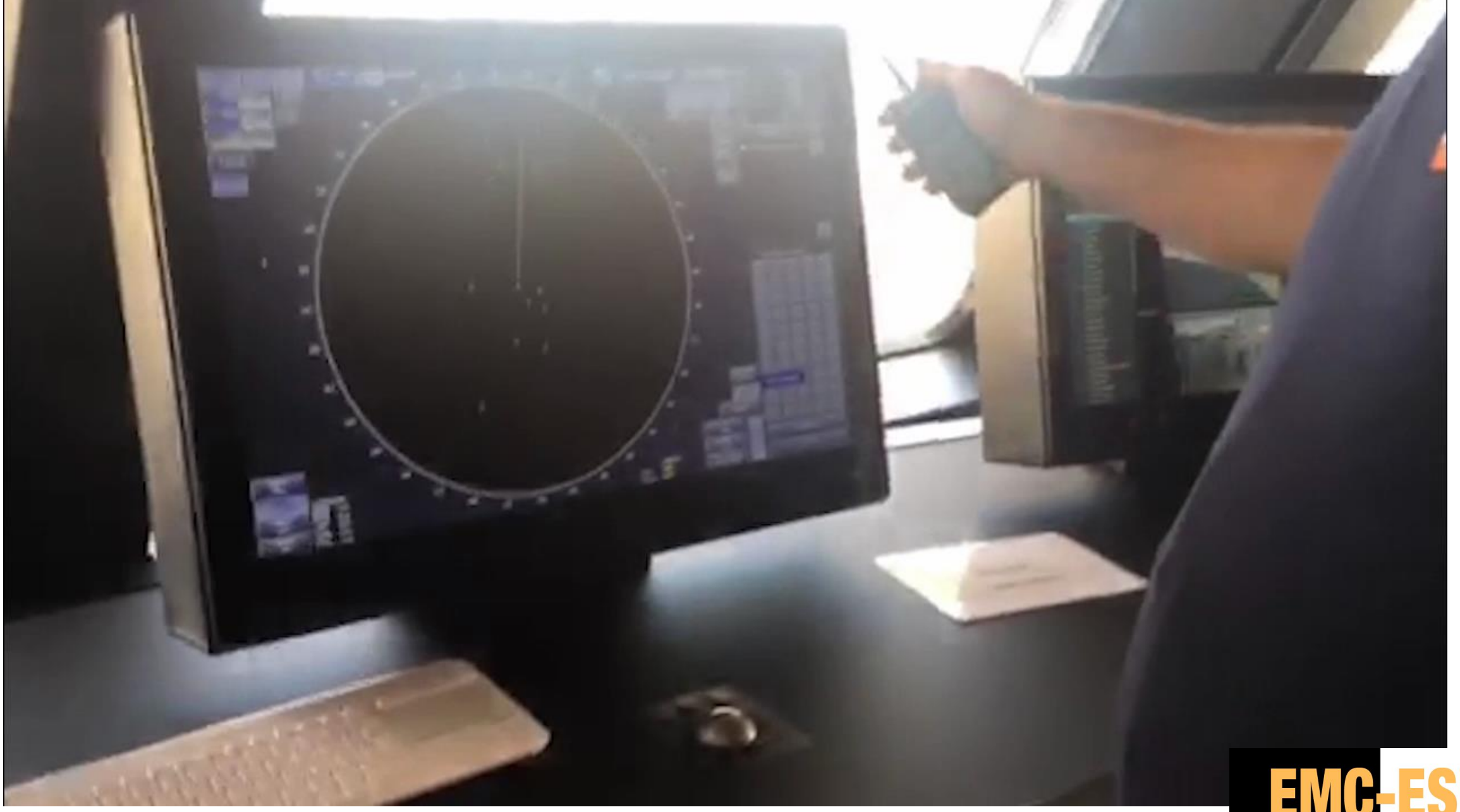
EMC directive

- **DIRECTIVE 2004/108/EU**
  - The word “Risk” is not mentioned
- **DIRECTIVE 2014/30/EU**
  - The word “Risk” is mentioned 18 times and the following requirement is added:

> 3. **Technical documentation**
>
> The manufacturer shall establish the technical documentation. The documentation shall make it possible to assess the apparatus conformity to the relevant requirements, and shall include an adequate analysis and assessment of the risk(s).

RH MARINE

EMC-ESD Event 2019



EMC Risk assessment

1. Study the EM environment
2. Define measures to mitigate the risks

	Victim:	EMCON	Propulsion converter	VHF transmitter	VHF receiver	Distribution transformer	LED lighting bridge
Disturbance source	Lightning		1	1,2	1,2		1
	Skyline		1	1	1		
	Propulsion conv.	1,3		3	1,3	4	3
	VHF transmitter		1				1,3
	Mobile radio						
	Distr. transformer						

Best Practices
1) Metal hull, EMC MCT's
2) Surge arrestors
3) Screened cables
4) Harmonic suppression

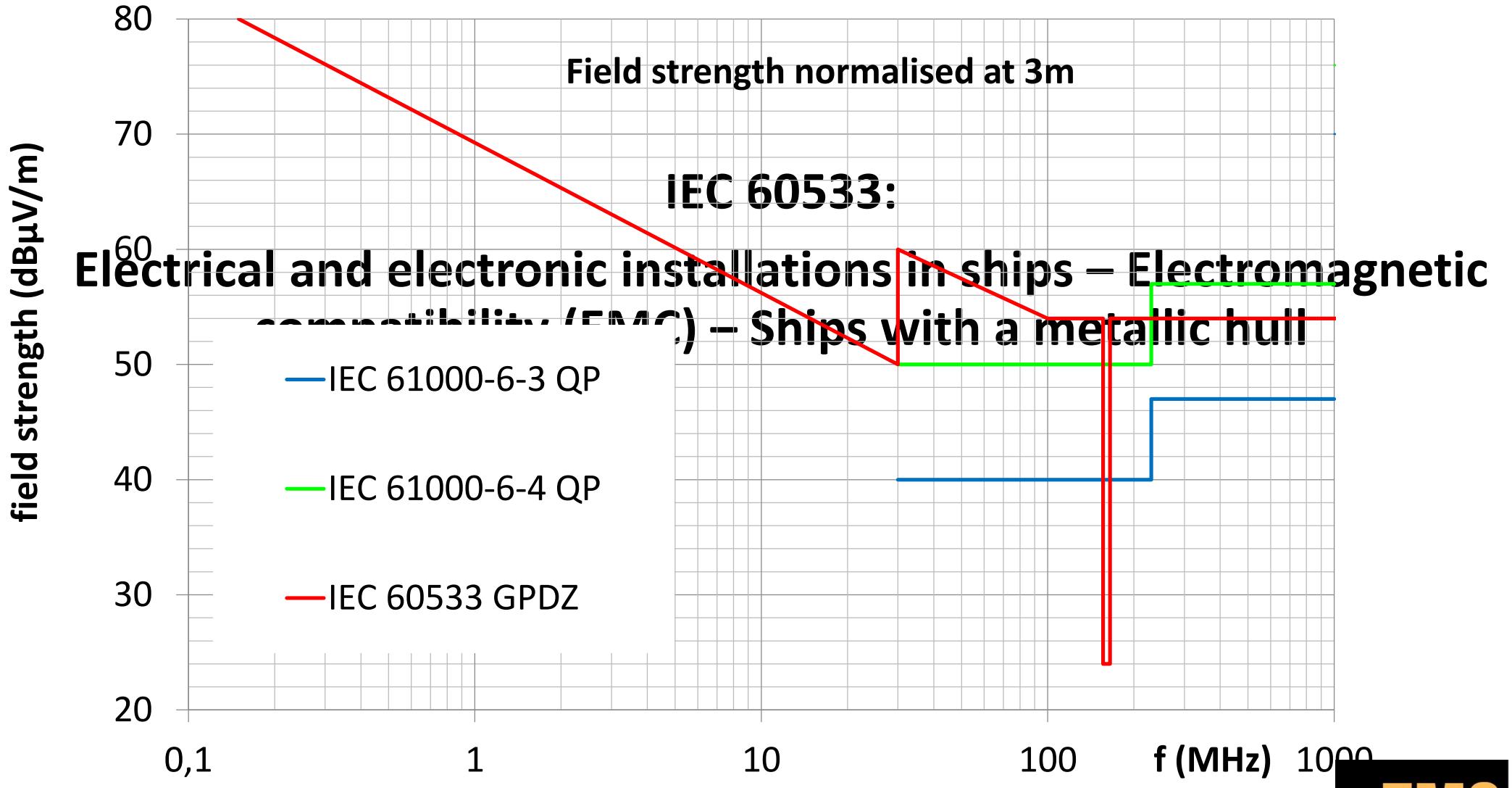
RH MARINE

EMC-ESD Event 2019

Dealing with risks

1. Requirement
2. Is this requirement realistic considering the situation
3. Define mitigation measures
4. Evaluate the effectivity of the mitigation measures

Example 1: VHF requirements



IEC 60533:

Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull

RH MARINE

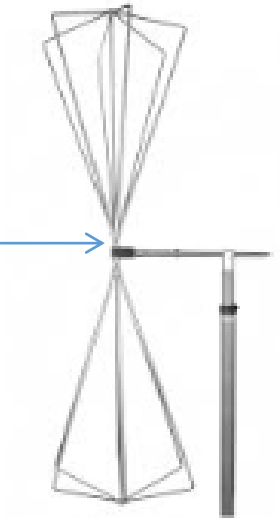
EMC-ESD Event 2019

Rational VHF requirements

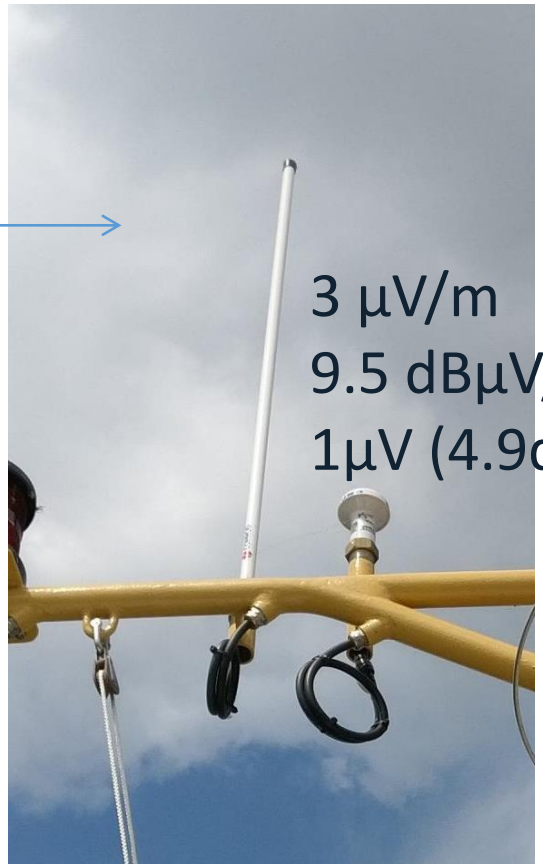
65 pW EIRP QP in 9 kHz

15 meter

3 meter



24 dBµV/m
15 µV/m



3 µV/m
9.5 dBµV/m
1µV (4.9dBi)

RH MARINE
EMC-ESD Event 2019

Observations

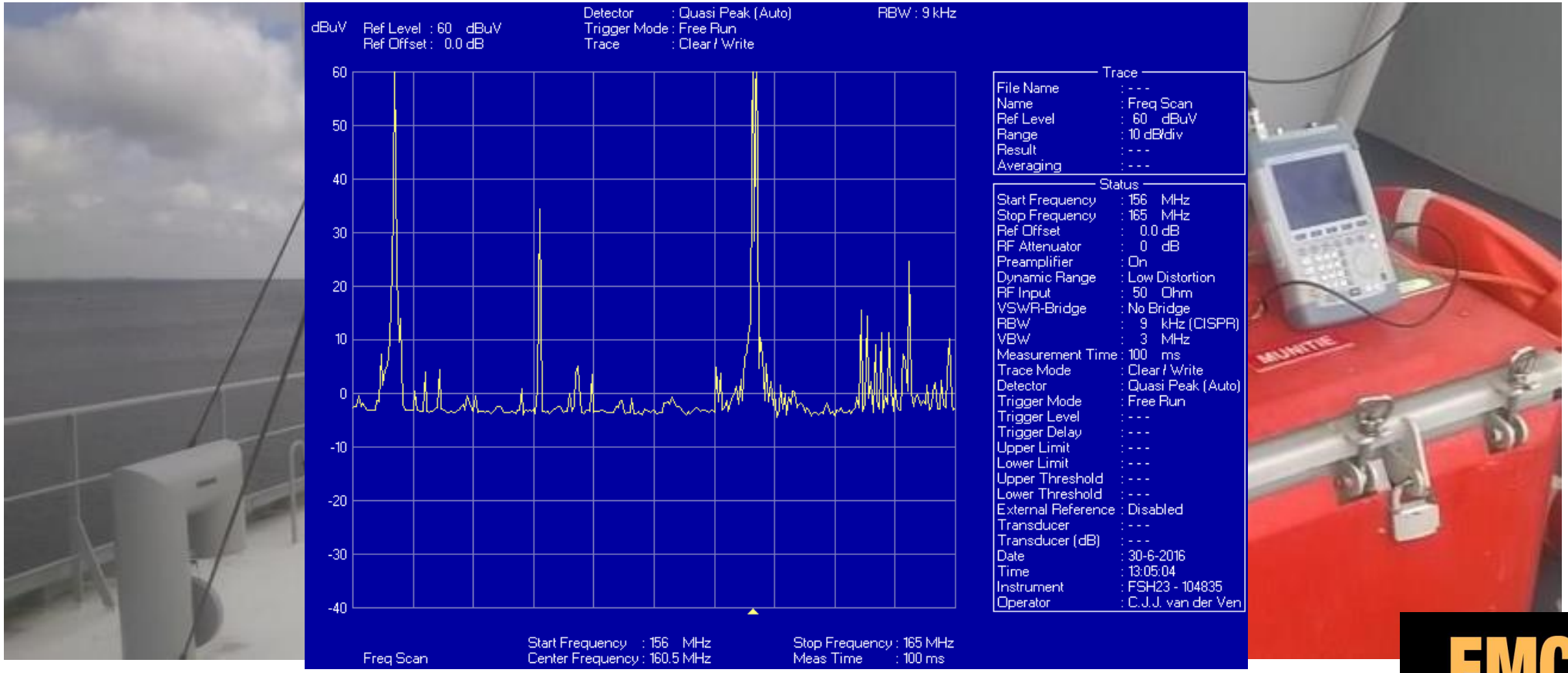
- Navigation lights were compliant
- Disturbances stop when lights are switched off
- Aerials are placed at 10 to 50 cm from navigation lights;

Reported by IMO IMO sub-committee on navigation, communications and search and rescue NCSR 3/INF.14 23 December 2015

RH MARINE

EMC-ESD Event 2019

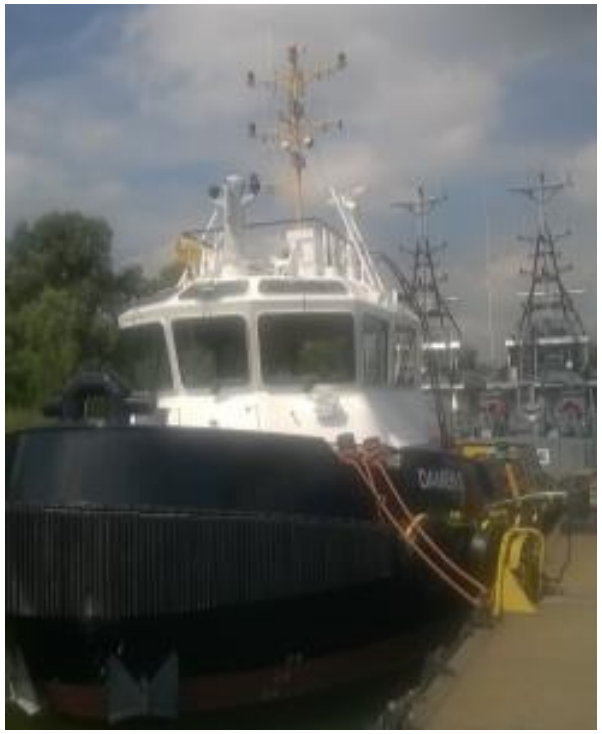
Practical approach



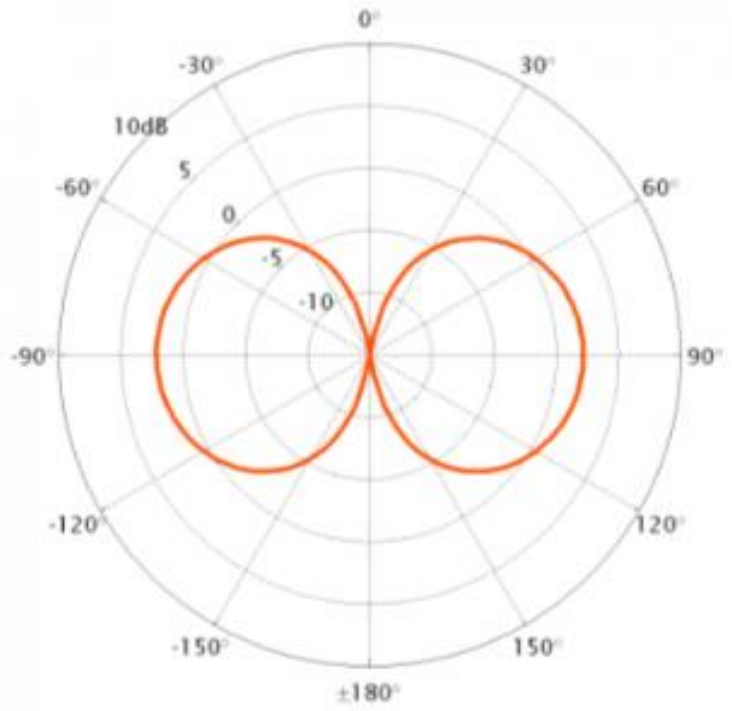
RH MARINE

EMC-ESD Event 2019

Elucidation



- Steel super structure
- EMC feed-throughs
- Directivity antenna



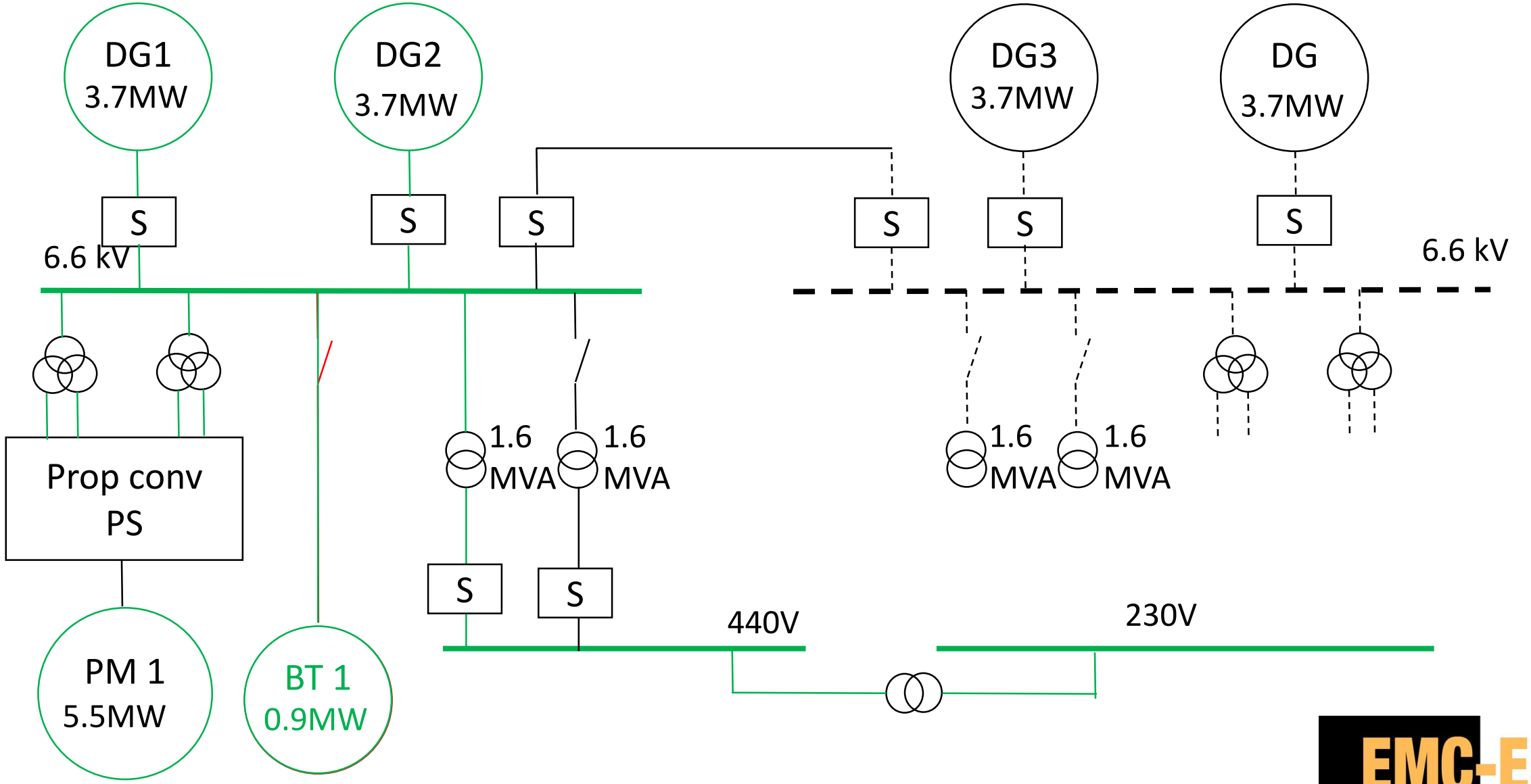
Specification from SCAN antenna: http://www.scan-antenna.com/product/vhf0hd-0-db VHF0HD 0 dB Heavy-duty end-fed full 1/2 λ dipole marine antenna

RH MARINE

EMC-ESD Event 2019

Example 2: Power supply variations

A power supply variation verification test



RH MARINE

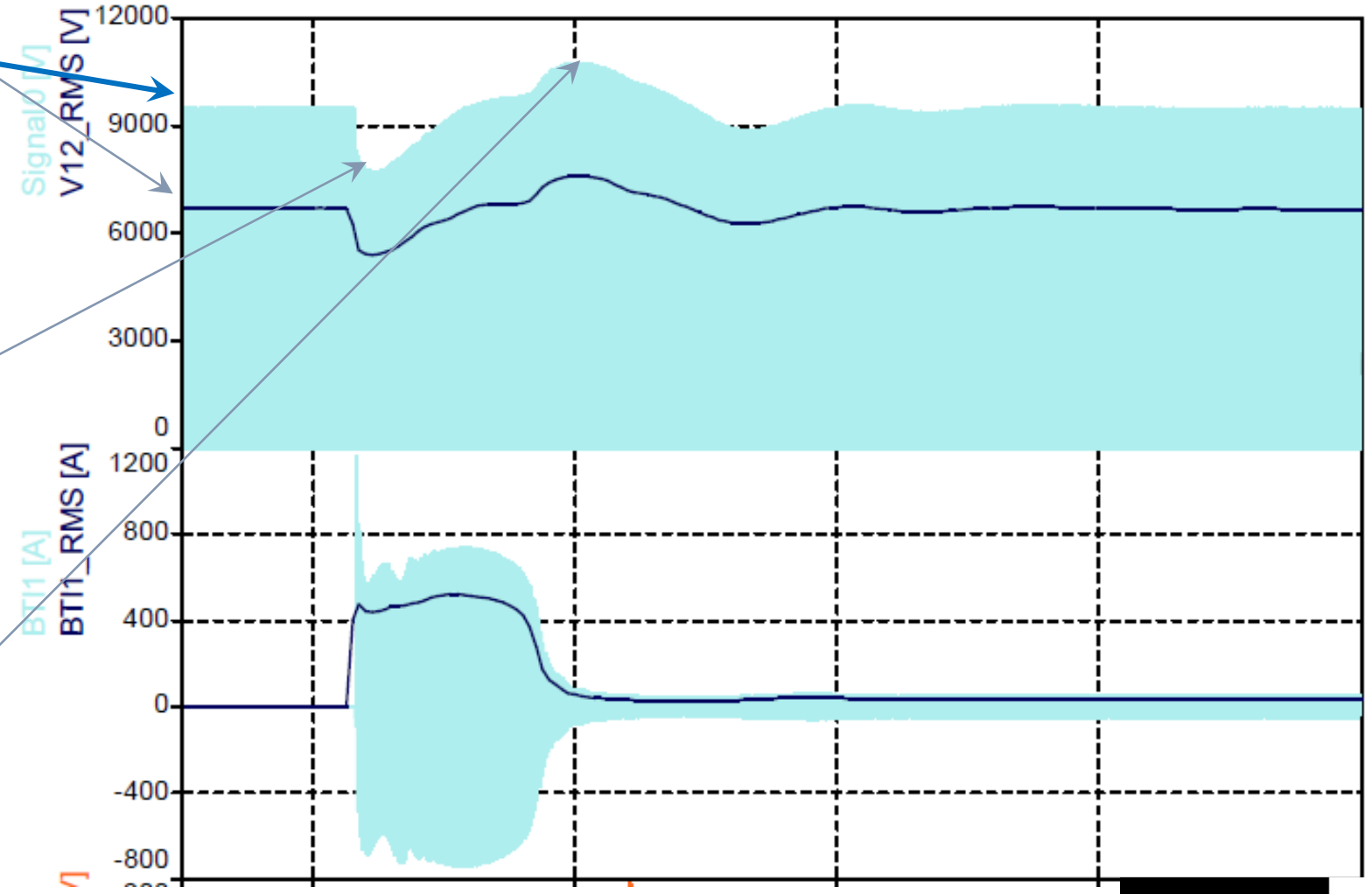
EMC-ESD Event 2019

Voltage fluctuations caused by load step

Nom. voltage:
6.6 kV * SQRT2
= 9.3 kV

Min. voltage =
9.3 kV – 1.8kV =
7.6 kV → -19%

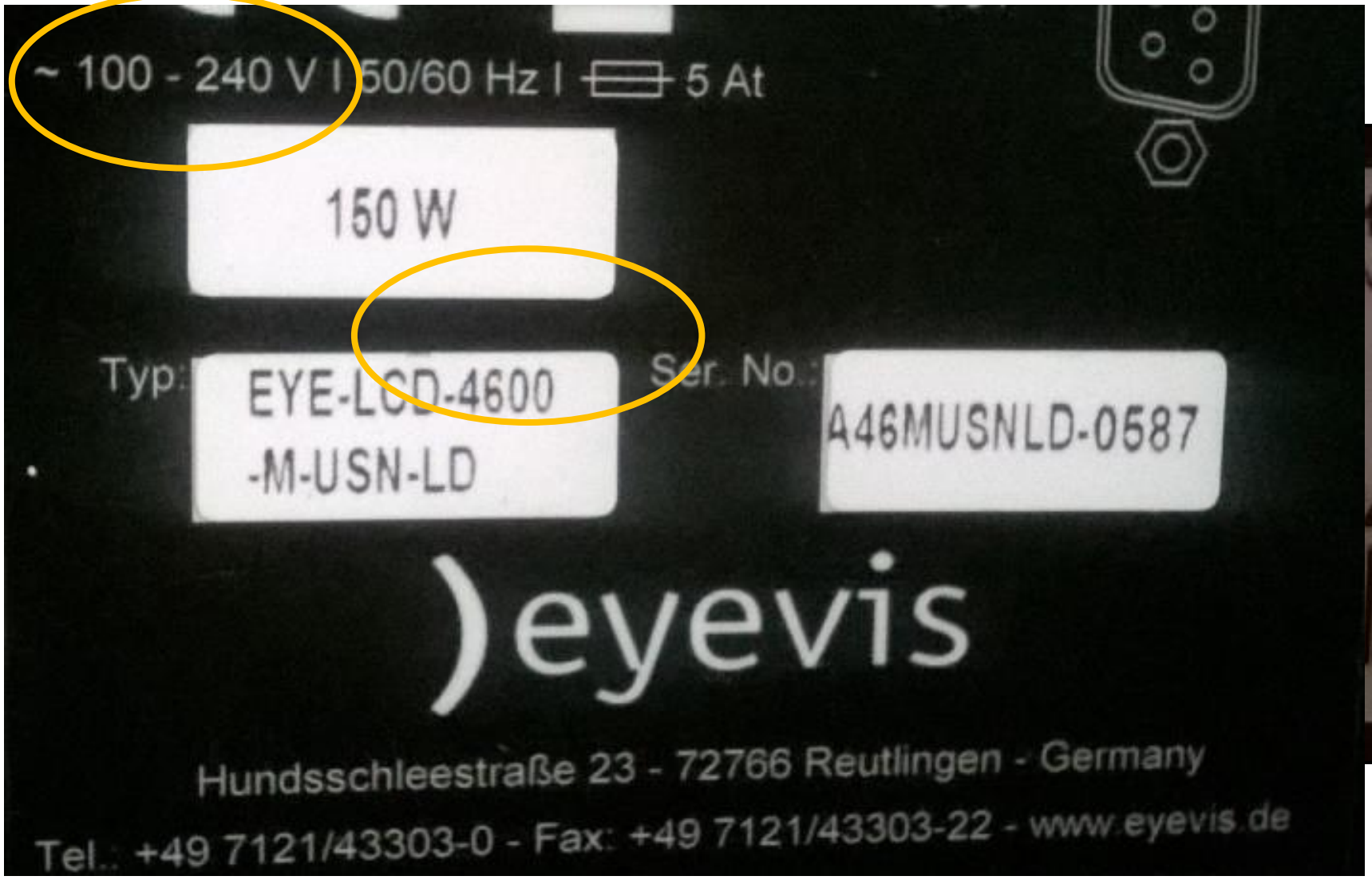
Max. voltage =
9.3 kV + 1.2kV =
10.5 kV → +13%



RH MARINE

EMC-ESD Event 2019

Fluctuations in low voltage



To summarize

- Risk based is a necessity
  - Equipment is used in different environments
  - Power and control is more and more integrated
- Way to proceed
  1. Assess the intended environment
  2. Verify the threats
  3. Define measures
  4. Validate effectiveness of measures

Thank you for your attention