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EMF at Civil Vessels and Harbour Areas

ELECTROMAGNETIC FIELDS AT CIVIL VESSELS AND HARBOUR AREAS.

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10/24/2007

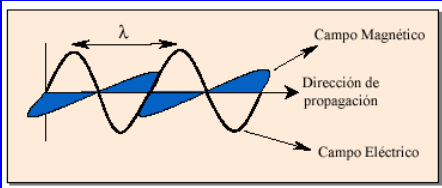
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1



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- Electromagnetic Fields cannot be detected by human senses. We cannot smell them. We cannot see them. We cannot hear them. We cannot taste them. We cannot touch them. Nevertheless, Electromagnetic Fields exist and cannot be overlooked.

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- In the last edition of this Congress, held in November 2002 in Bilbao, we presented a paper in order to make the maritime scientific community aware that there were several aspects of civil vessels that there had not been studied in any form and that some of normalized experiment should be started to promote the identification of all types of EMF levels the we can find onboard.

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- Today we present the “Electromagnetic Fields at Civil Vessels and Harbour Areas. Creation of a Data File”project, financed by the Spanish Ministry of Civil Works (Ministerio de Fomento), Transport Secretariate with an amount of 70,000.00 Euros, as appeared in BOE nr 56, 6th March 2003 call for proposal and its results were published in the nr 306 BOE, 23th December of the same year.

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- With the 70,000.00 Euros we have acquired a broadband measurement system covering from 3 Hz to 40 GHz of PMM firm, a narrowband measurement system covering from 100 kHz to 3 GHz of Rohde & Swartz firm, two notebook computers for control the mentioned sets and for data manage purposes and two VHF-UHF walky-talkies with continuous reception from 100 kHz to 1,3 GHz range in a secondary channel.

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- Within the broadband measurement system we have included two isotropic probes for radiofrequency electric fields and one VLF probe for electric and magnetic fields with espectral analysis capability in order to measure as at the deck as at the auxiliar generator rooms of all types of vessel

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- July 2004, course of EMF measurement techniques.
- Research Group members
- to measure the radiations generated by the Radiostation and Radionavigation simulators of the CASEM and the derived results are presented as an approximation of the possible values reached on board a ship or inside a Vessel Traffic Station

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- Searching...
 - 1) **Controlled Environments** - where personnel are aware of the potential danger of RF exposure concurrently with employment, or exposure which may occur due to incidental transient passage through an area, and;
 - 2) **Uncontrolled Environments** - A lower maximum level where there is no expectation that higher levels should be encountered, such as living quarters.

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- Frequency range of time-varying EMF (up to 300 GHz). Static magnetic fields are covered in the ICNIRP guidelines issued in 1994.
- Basic restrictions: Restrictions on exposure to time-varying electric, magnetic, and electromagnetic fields that are based directly on established health effects are termed "basic restrictions".
- Reference levels: These levels are provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded.

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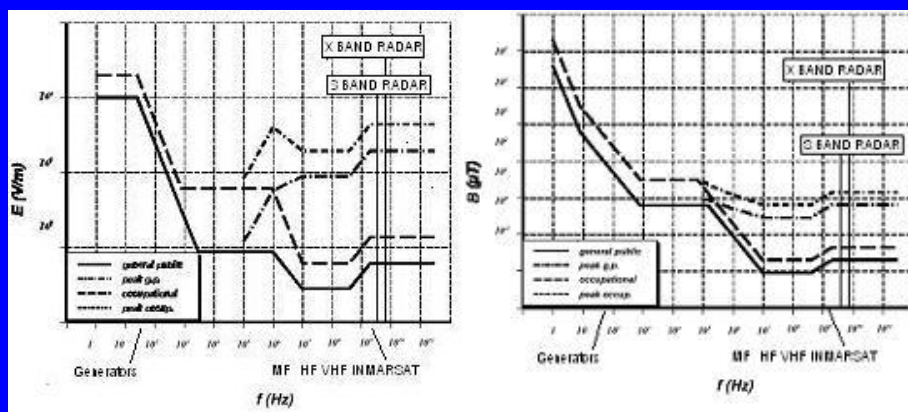
- Today we all have our mobile telephone and computers have a Wireless modem card integrated with its mother board which emits at the same frequency that the kitchen microwave ovens. But, in the general public opinion, only the mobile telephony repeaters are harmful, no body speaks about the sets that are nearest of the operators or users, as in the vessel case.

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INFORMATION IS SAFETY.

- An important aspect is to be sure that all shipboard personnel is well informed about potential radiation hazards, and to enforce exposure limits. Warning signs must be posted, and danger zones must be clearly marked by circles painted around all transmitting antennas that pose a threat to safety




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- The next step involves a detailed electromagnetic mapping of surface ship topsides through specialized radiation level environmental survey. Unsuspected sources of hazardous radiation may be detected as part of the survey.
- The final step requires implementation of specific methods to reduce the potential for creation of hazardous conditions.

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- **TEST PROPOSAL.**
- The purpose of the test is to determine that permissible levels of radiation exposure are not exceeded in normally occupable areas near the EMF sources.
- We can identify three types of antennas [7]:
 - Fixed and vertical polarized antennas, as the MF/HF and VHF transmitting antennas.
 - Rotating antennas, as the X and S bands radar antennas.
 - Focus antennas, as Inmarsat A, B, M, Mini-M.

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- **Test procedures:**

Two researchers groups were formed. One of them at the CASEM Radiostation and the other at the CASEM aerial field. Both groups were linked via the VUHF walky-talkies in order to synchronize the measures.



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15



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- The Radiostation operators emit with the Skanti TRP 8250 MF/HF or the Sait D73 VHF transceivers once at a time and during fifteen to twenty-five seconds continuous cycles at its different powers. The tests were made with different modulation modes



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- The two classifications of EMR exposure on ship are: continuous and intermittent [7].



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- A continuous exposure EM radiation environment is one in which an individual may experience a constant level of radiation exposure.
- This is typical of the MF/HF and VHF transmitting antennas and waveguide energy leaks.



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- The Intermittent exposure is an EMR situation in which an individual may be exposed to varying levels of radiation, as the Radar EMR or ARQ radioteletype cases.



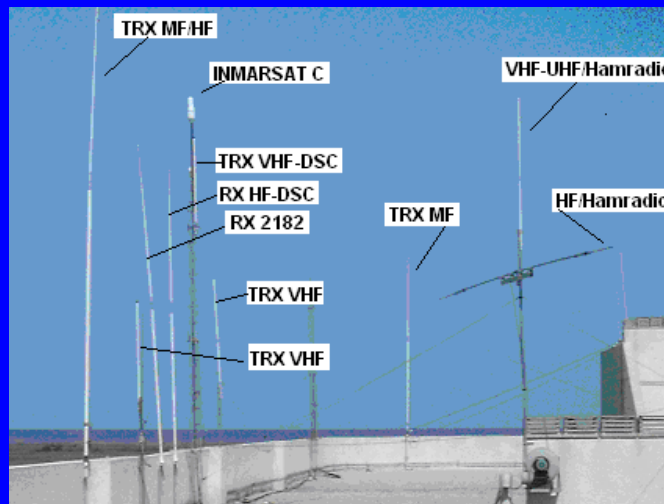
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19



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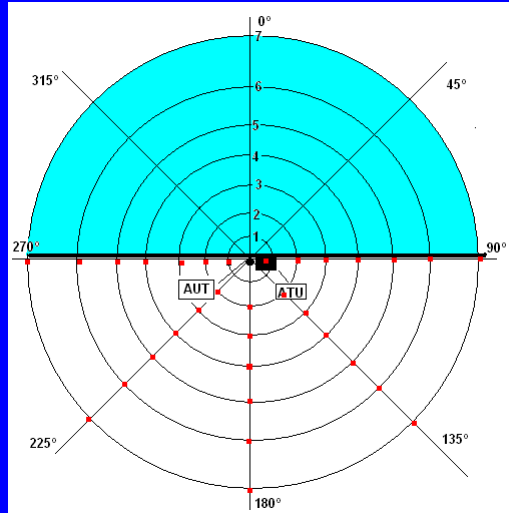
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- In the CASEM aerial field we use one 15 seconds measure each metre from one to 7 metre distances and we made 5 beams 45° bearing stepped.



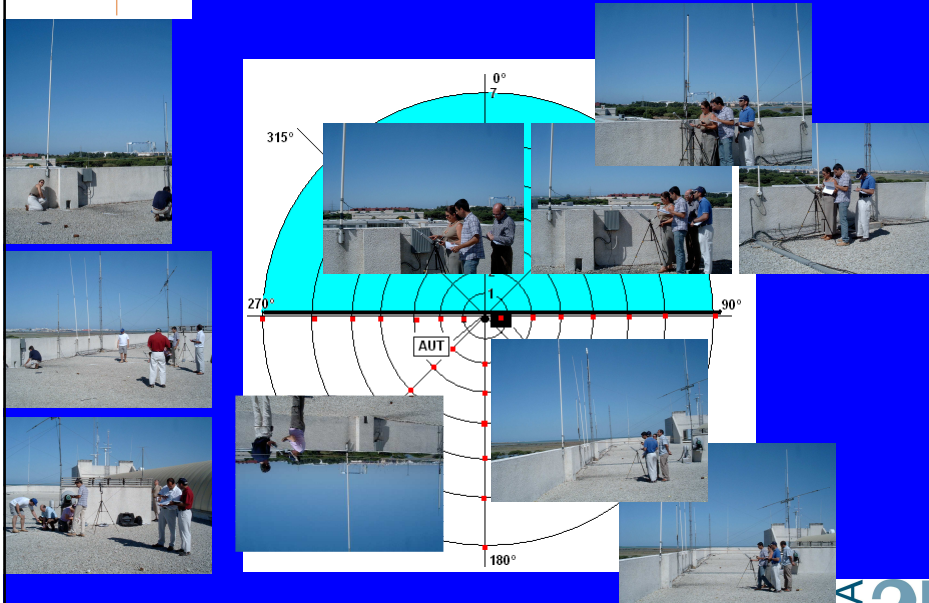
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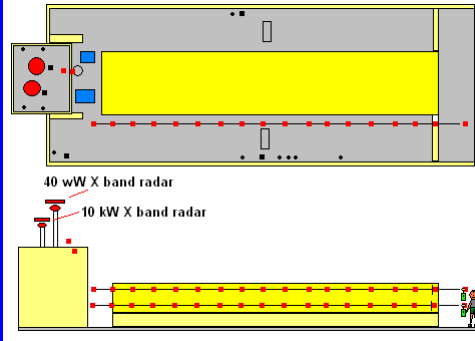
22





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- The X Band Radars tests were made in only one right line of 60 metres long with these results (Figures 4 to 6). The measures was captured each 5 metres at one and two metres high over the roof. Values are Maximum.



The diagram shows a top-down view of a 60m long testing area with a yellow highlighted section. Below it, a side view shows a 40 kW X band radar and a 10 kW X band radar positioned to measure a yellow cylindrical object. A person is shown standing next to the object for scale.

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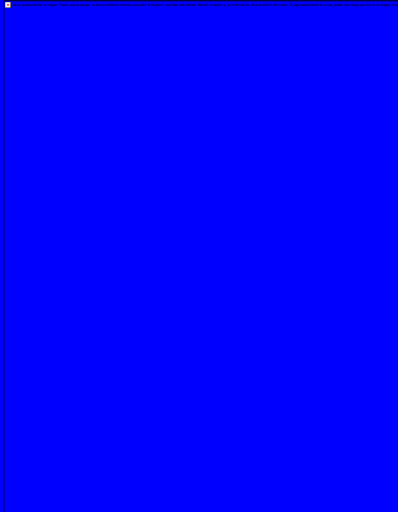
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- Inside the CASEM Radiostation we use one 15 seconds measure each metre from one to 5 metres distances and we made 3 beams 45° bearing stepped.



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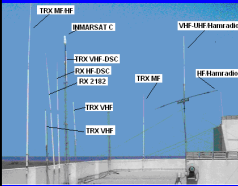
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| Transceiver | Power (W) | Modulation Mode | EU Reconven Dation Reference Levels | E Field (V/m) 1 m. distance | E Field (V/m) 2 m. distance | E Field (V/m) 3 m. distance | E Field (V/m) 4 m. distance | E Field (V/m) 5m. distance | Max V/m | |
|------------------------------|--------------------|-------------------------------------|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|---------|-------|
| MF/HF TRX (2 MHz Band) | 1/4 (60 W) | 3K00R3EJN 100HR0NJN | 43.5 V/m | 47.5 | 21.89 | 13.26 | 8.43 | 5.23 | 72 | |
| | | | | 7.32 | 2.82 | 1.4 | 0.99 | 0.63 | 12.4 | |
| MF/HF TRX (2 MHz Band) | 1/2 (125 W) | 3K00R3EJN 100HR0NJN | | 142.9 | 73.77 | 39.07 | 19.91 | 12.36 | 199 | |
| | | | | 22.81 | 9.92 | 4.88 | 2.51 | 1.53 | 41 | |
| MF/HF TRX (2 MHz Band) | Full (250 W) | 3K00R3EJN 100HR3EJN | | 251.7 | 140.3 | 84.42 | 33.29 | 17.6 | 340 | |
| | | | | 56.84 | 24.12 | 11.85 | 5.56 | 3.51 | 72.1 | |
| MF/HF TRX (8 MHz Band) | 1/4 (60 W) | 2K70J3EJN 3K00R3EJN 100HR0NJN | | 10,1 V/m | 5.454 | 2.868 | 2.632 | 2.404 | 1.978 | 6.07 |
| | | | | | 23.64 | 4.23 | 2.328 | 2.308 | 2.218 | 36.71 |
| MF/HF TRX (8 MHz Band) | 1/2 (125 W) | 2K70J3EJN 3K00R3EJN 100HR0NJN | | | 12.27 | 8.446 | 7.228 | 6.918 | 5.87 | 16.4 |
| | | | | | 15.50 | 8.634 | 7.528 | 7.46 | 7.824 | 108.8 |
| MF/HF TRX (8 MHz Band) | Full (250 W) | 2K70J3EJN 3K00R3EJN 100HR0NJN | | | 2.132 | 1.496 | 1.208 | 1.154 | 0.946 | 12.36 |
| | | | | | 28.33 | 17.45 | 14.77 | 13.21 | 10.83 | 55.55 |
| MF/HF TRX (8 MHz Band) | Full (250 W) | 3K00R3EJN 100HR0NJN | 27.78 | | 16.81 | 13.52 | 12.26 | 10.74 | 222.5 | |
| | | | 5.14 | | 3.198 | 3.038 | 2.902 | 2.392 | 7.62 | |

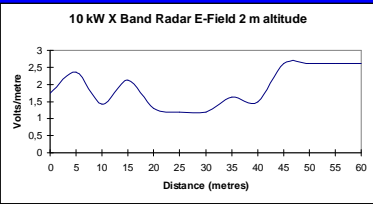
Table nr.1 Near Field E-Field Levels at CASEM Aerial Field.

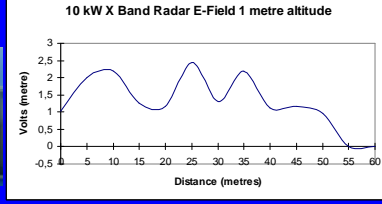
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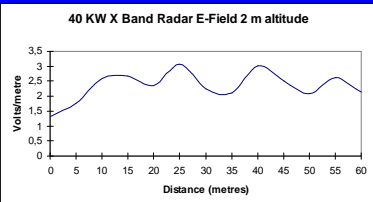
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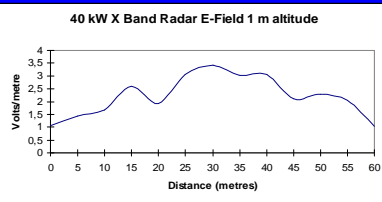
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Far-field measurements for two X band Radars

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| Transceiver | Power (W) | Modulation Mode | EU Recommendation Reference Levels | E Field (V/m) 1 m. distance | E Field (V/m) 2 m. distance | E Field (V/m) 3 m. distance | E Field (V/m) 4 m. distance | E Field (V/m) 5m. distance | Notes |
|------------------------|--------------|------------------------|------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-------|
| MF/HF TRX (2 MHz Band) | 1/4 (60 W) | 3K00R3EJN 100HR3NJN | 43.5 V/m | 1.47 | 1.65 | 2.43 | 3.34 | 1.67 | 1 |
| | 1/2 (125 W) | 3K00R3EJN 100HR3NJN | | 0.20 | 0.00 | 0.40 | 0.52 | 0.58 | |
| | Full (250 W) | 3K00R3EJN 100HR3NJN | | 5.26 | 6.41 | 6.35 | 9.66 | 7.07 | |
| MF/HF TRX (2 MHz Band) | Full (250 W) | 3K00R3EJN 100HR3NJN | 28 V/m | 11.60 | 16.51 | 14.36 | 16.60 | 8.97 | |
| | 1 W | 16K0F3EJN | | 0 | 0.6 | 0 | 0 | 0 | |
| | 25 W | 16K0F3EJN | | 0.36 | 0.40 | 0.27 | 0.14 | 0.09 | |
| VHF TRX | 1 W | 16K0F3EJN | 28 V/m | 3.3 | 1.88 | 1.47 | 1.47 | 0.83 | 2 |
| VHF W-T | 1 W | 16K0F3EJN | | 10.71 | 6.88 | 4.17 | 3.37 | 3.01 | 2 |
| VHF W-T | 5 W | 16K0F3EJN | | | | | | | |

Table nr.2 Near Field E-Field Levels inside CASEM Radiostation.

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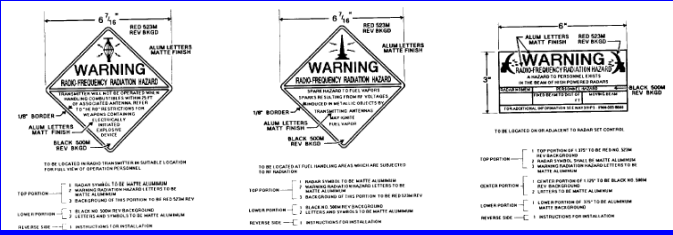


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Conclusions.

- The areas near the antennas must be restricted to the personnel if the Electric or Magnetic Fields are greater than the Reference Levels in the Aerial Field of the CASEM.



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- **Aknowledgement.**

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and ...

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- IZAR de Construcciones Navales (División Armas y Sistemas-FABA),
- Bureau Veritas España

for the support letters in order to financing the project named: Electromagnetics Fields at Civil Vessels and Harbour Areas. Data File creation”.

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