



URSI AP-RASC,  
SYDNEY, AUSTRALIA,  
17 – 22 AUGUST 2025

## Exogenous radiofrequency electromagnetic exposure of outdoor workers who are managing touristic boat journeys

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## INTRODUCTION

As for many **outdoor occupations**, touristic boat (TB) workers are exposed to **RF EMF** from a variety of **exogenous sources**:

- Radio and TV terrestrial broadcasts
- Wi-Fi & WiMAX
- Public mobile communication systems
  - Downlink (DL) signals from base stations
  - Uplink (UL) signals from terminals (phones, tablets) for voice and video/data



## INTRODUCTION

Their **outdoor activities** take place in two main microenvironments:

- at the **pier** before and after the journey
- on the **boat** (outdoor on an open upper deck) during the journey

This study is a survey of an outdoor public environment with a specific physical structure and composition of RF EMF sources.



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## RF MEASUREMENT METHODOLOGY (FREQUENCY AND TIME PATTERNS)

### Narda SRM 6000

Preview Spectral analysis



Warszawa Harbour, Vistula River, Poland



### EME SPY selective RF-data loggers (121, 200, Evolution)

- RMS isotropic E-field (0.1 - 5.5 GHz)
- Frequency bands coverage based on the preview spectrum analysis
- 4 to 10 sec sampling rate
- EME SPY located in investigator's backpack
- Investigator located near workers serving passengers (ticketing, food, safety, security, cleaning, information)
- Recordings acquired at pier and at upper outdoor deck of TB
- On-going data collection (2018-2025) at: Baltic coast and Vistula River, Poland; Malaga harbour, Spain; Tokyo harbour, Japan; Lakes in Poland and Japan

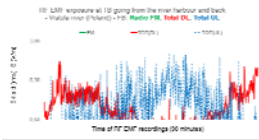


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**RESULTS – example of RF exposure during a Vistula river touristic boat journey near small old city/ touristic destination (Poland’2023)**



TB journey (river going along the coast) covered by recordings at the upper open deck of TB [Start and Stop: in the same small harbour]



- Exposure components:
- **TOT(DL)** – RMS values covering all downlink signals emitted by BTSS,
  - **TOT(UL)** – RMS values covering all uplink signals emitted by passenger terminals
  - **Radio FM** – RMS values covering all FM radio signals (not recorded for this case)

**RESULTS – example of RF exposure during a touristic boat journey over the large Baltic coast harbour near the large city (Poland’2023)**



TB journey (sea going) covered by recordings at the upper open deck of TB [Start: in the large harbour - across the bay - Stop: at the small harbour]



- Exposure components:
- **TOT(DL)** – RMS values covering all downlink signals emitted by BTSS,
  - **TOT(UL)** – RMS values covering all uplink signals emitted by passenger terminals
  - **Radio FM** – RMS values covering all FM radio signals

**SUMMARY**



- ❑ RF exposure of TB workers on an open upper deck is compliant with international safety guidelines but may exceed 3 V/m
- ❑ **Mobile DL** exposures dominate when the TB is in the harbour
- ❑ **Mobile UL** exposures from passenger terminals dominate when TB is going away from the harbour or approaching coast/harbour
- ❑ **RTV broadcasting** exposures may dominate in the harbour or near by at the open sea/river
- ❑ Unlike the passengers, TB workers are exposed to such RF exposure patterns every *workday* which may be a consideration for designing epidemiological studies

**Thank you very much for your attention**

**See you in Kraków!**



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**ACKNOWLEDGEMENTS:**  
 Results of "Governmental Programme for Improvement of Safety and Working Conditions", supported in Poland by the Ministry of Family, Labour and Social Policy (Poland); agreement no. UM-1/DPP/10/2023/02, task no.: 3.ZS.14., and the National Centre for Research and Development (Poland); agreement no. DW/PN/WP/W/2023; task no.: III.PN.13. (Programme's main co-ordinator: CIOP-PIB).  
 This work received also kind help in data collecting from Dr Sachiko Yamaguchi-Sekino from the National Institute of Information Technology, Japan.