

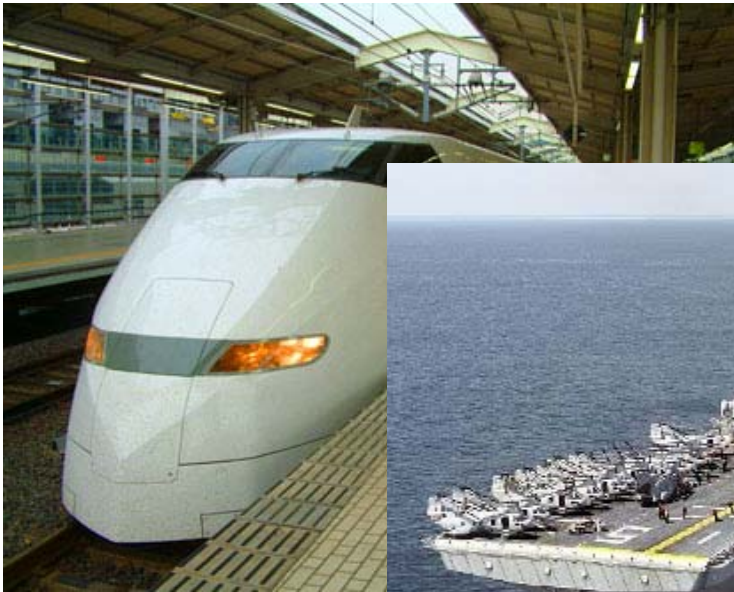
A Simple Summary of Several Electromagnetic Environments: “What’s really out there?”

Doug Kramer
NCEE Labs

Adrian Matoi
Transilvania University of
Brasov

What is the “environment”?

- Typically when people think of TC-3 activities and EME, they think of:



What is the “environment”?

- The REAL harsh environments



But what does that environment look like?

- Data from 2 countries, multiple locations presented.

Ambient from 4 U.S. locations

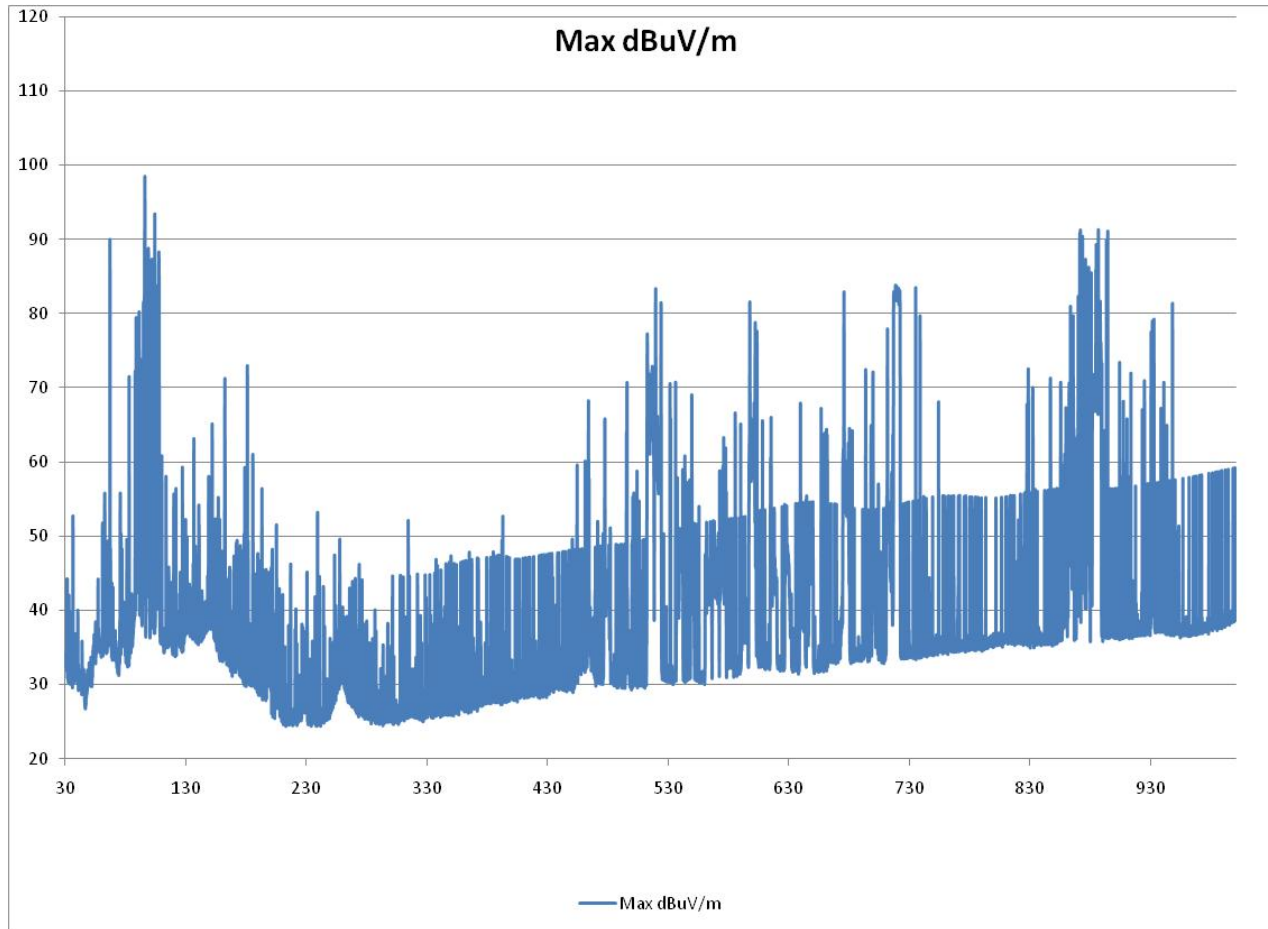
- Ft Collins, CO
- E. Moline, IL
- Lincoln, NE
- Wichita, KS



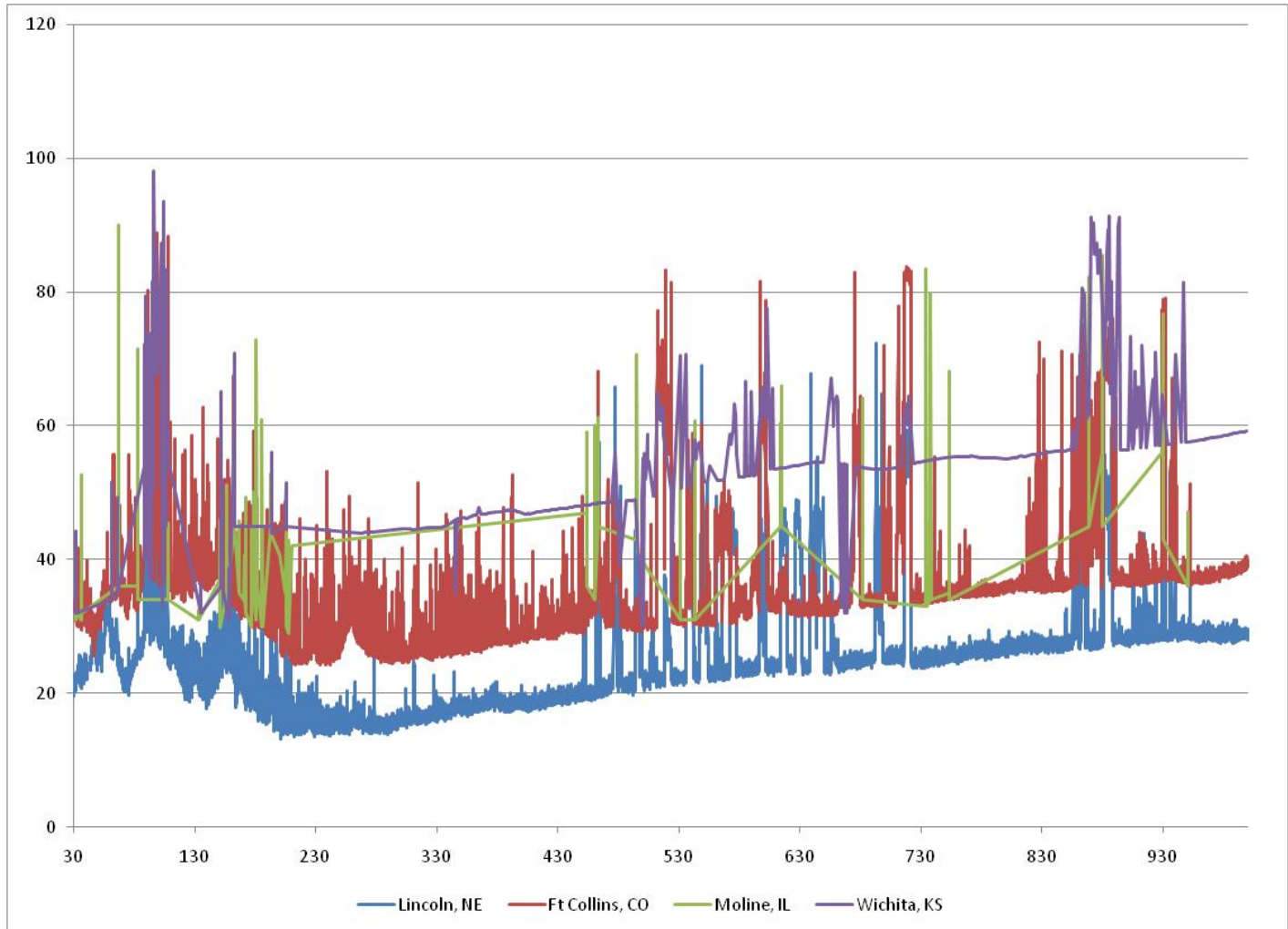
Measurements in the U.S. were made as background scans from in-situ measurements.

120kHz RBW

Max Ambient



Data from individual locations



Romanian Measurement system/characteristics



Rohde&Schwarz TS-EMF

- Frequency Domain: 80 MHz – 3 GHz
- Sensibility: 1 mV/m
- Dynamic measurement range: 1 mV/m - 100 V/m
- Peak and average detectors

Location / Settings

Brasov:

Zone A – Astra Braşov,

Zone B – Bartolomeu

Brasov,

Zone C – Gară Braşov,

Zone D – Rectorat Braşov

Bucharest:

Grozavesti Bridge/

Bucharest

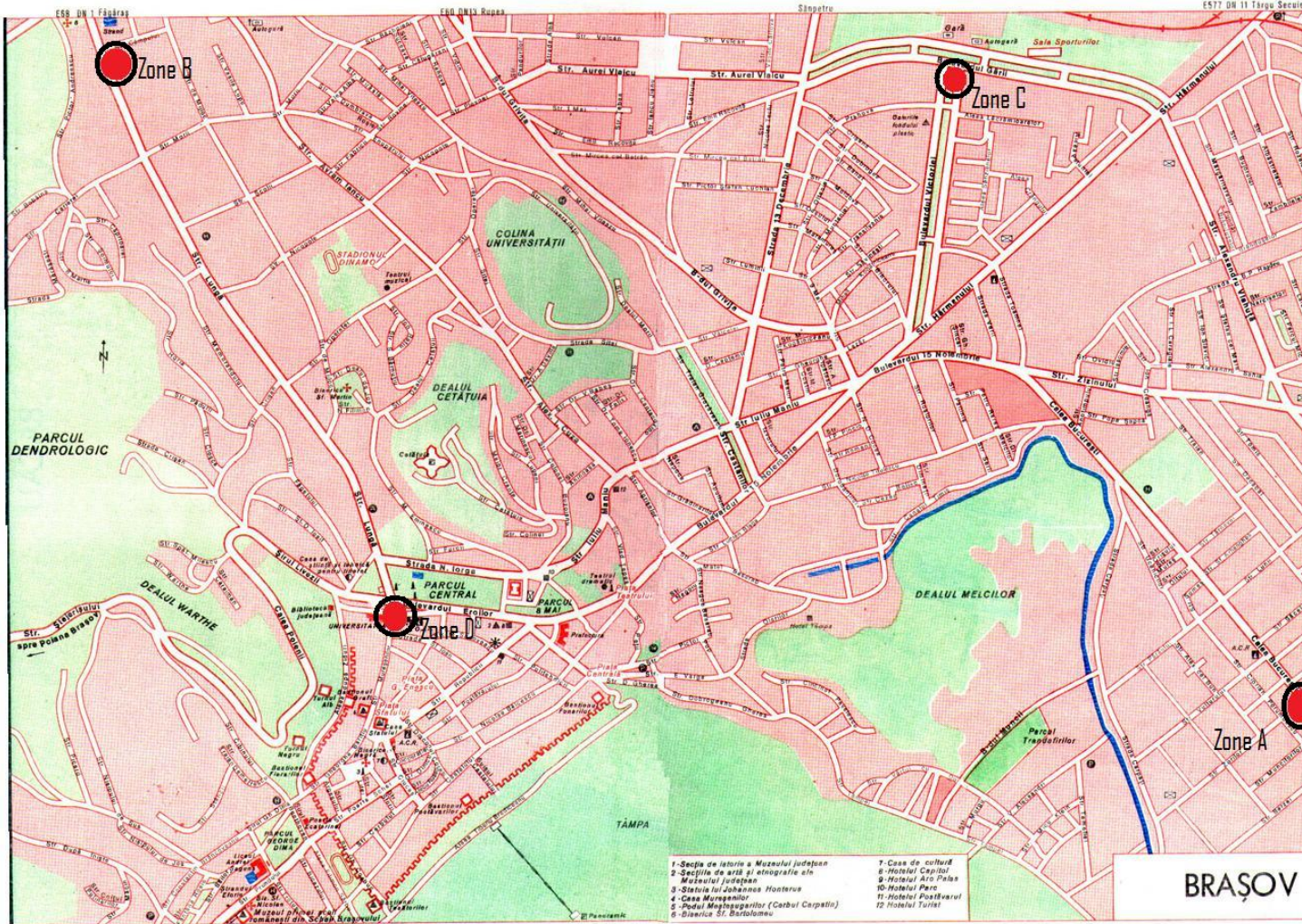
Press House/ Bucharest

Unirii Square/ Bucharest

Victoriei Square/ Bucharest

- Frequency domain: 80 MHz – 3 GHz;
- Resolution bandwidth: 200 kHz;
- Frequency step: 1 MHz;
- Dwell time: 250 ms;
- Threshold: + 5 dB distance from noise level (obtained through calibration);
- Height of the antenna : 1,5 m from the ground plane

Brasov points



Zone A –
Astra Braşov,

Zone B –
Bartolomeu Braşov,

Zone C –
Gară Braşov,

Zone D –
Rectorat Braşov

What has been measured ?

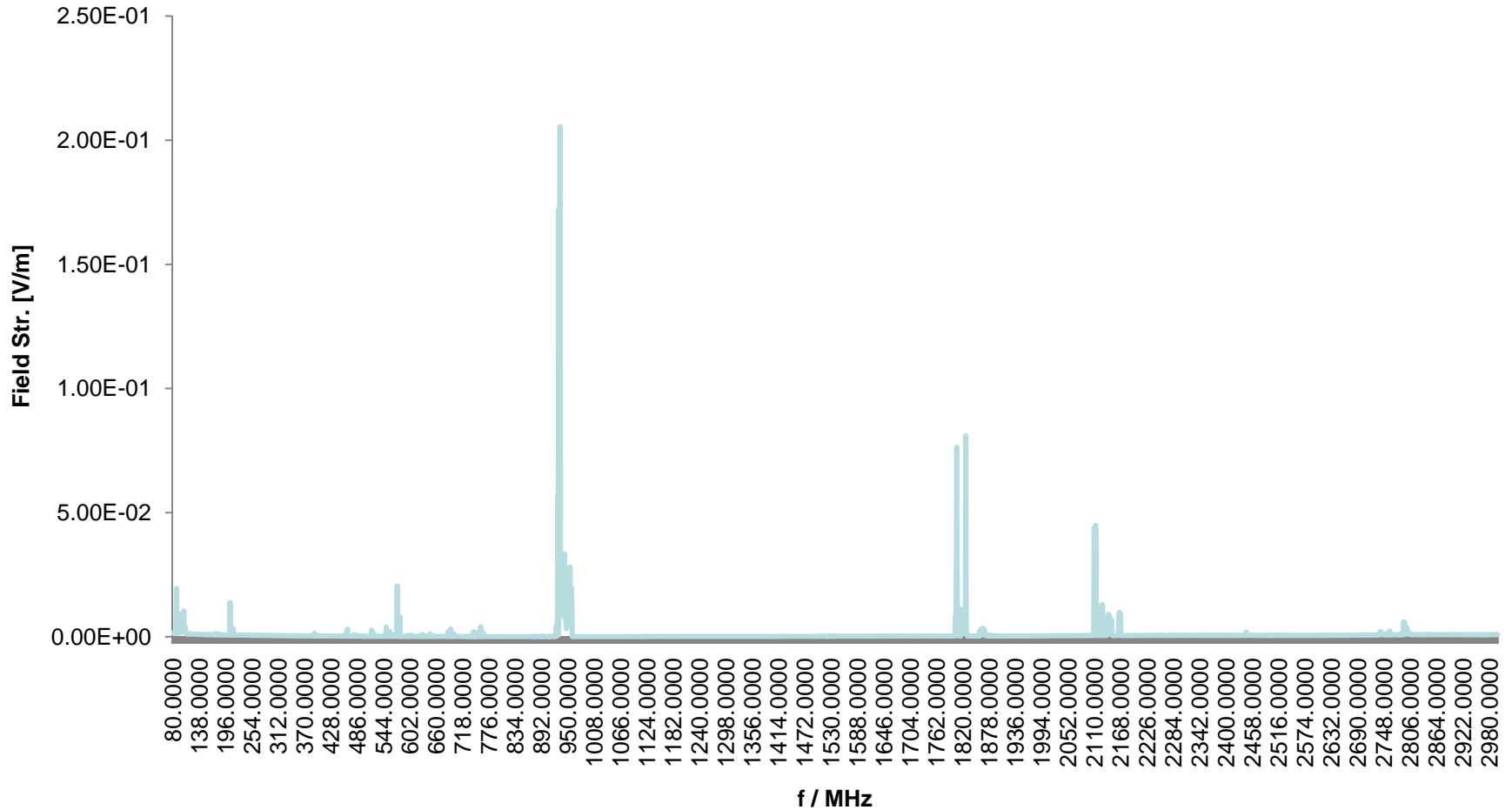
- **Specific Energy Absorption (SA)** [J/kg]
- **Specific Energy Absorption Rate (SAR)** [W/kg]
- **Electric field strength** [V/m]
- **Magnetic field strength** [A/m]
- **Magnetic flux density** [T]

$$E = \frac{k \cdot Q}{d^2}$$

$$SAR = \int_{sample} \frac{\sigma \cdot |E|^2}{2\rho} \cdot dV$$

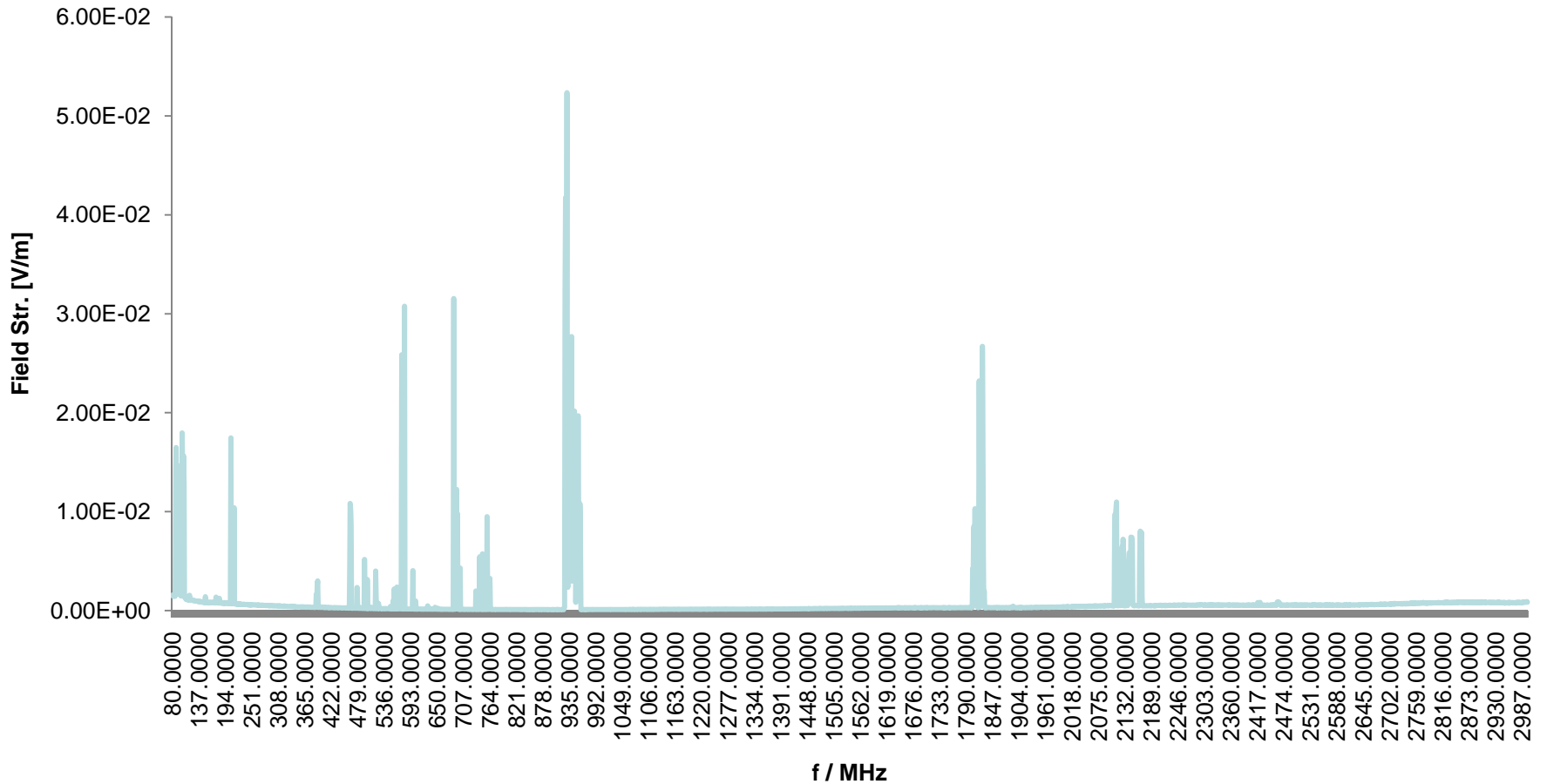
Results I - Brasov

Astra/Brasov, 4.07.2008, 16.00 (Peak values)



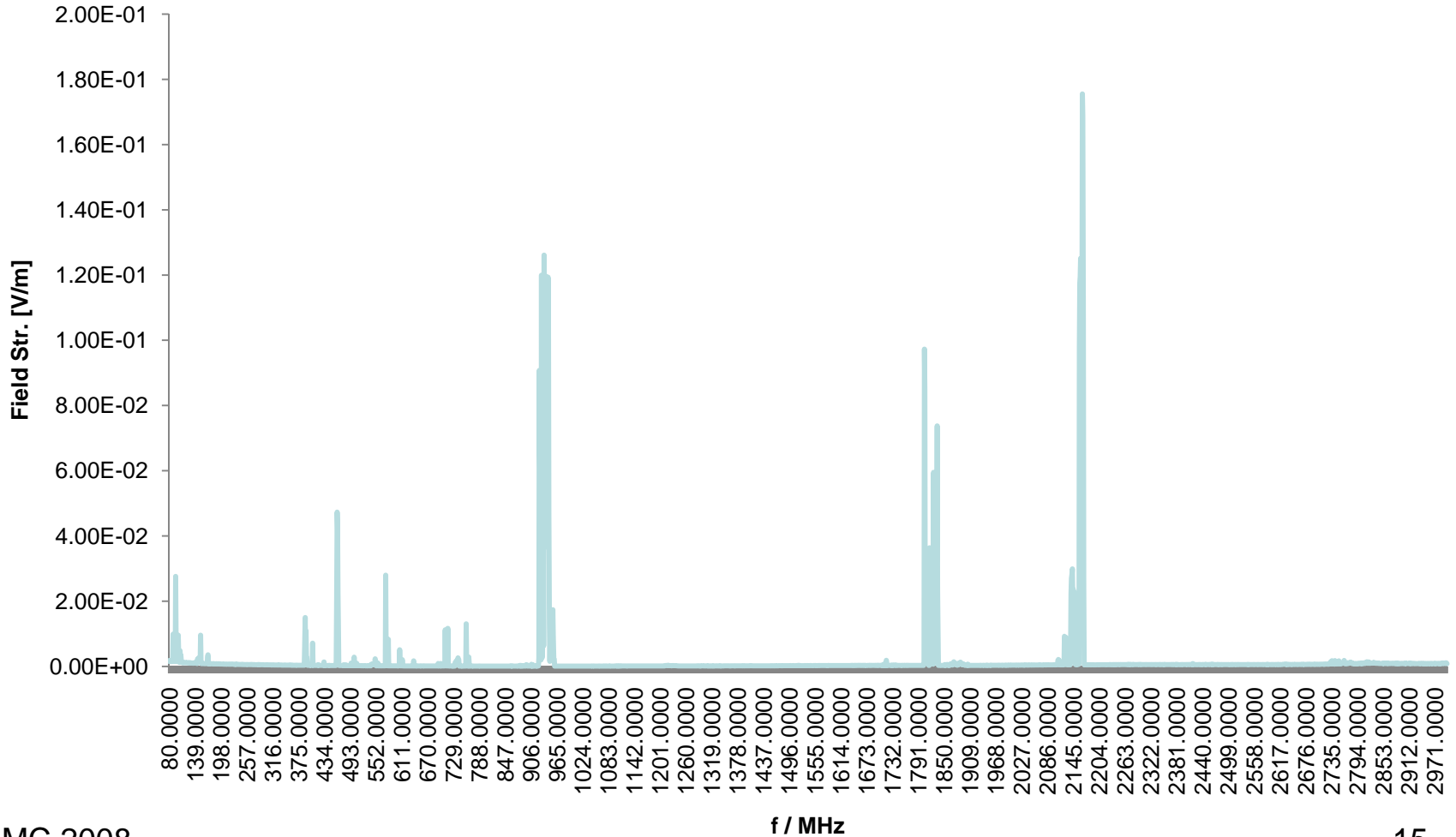
Results II - Brasov

Bartolomeu/Brasov, 5.07.2008, 09.00 (Peak Values)



Results III - Bucharest

Unirii Square/Bucharest, 16.07.2008, 08.00 am (Peak Values)



Results IV - Bucharest

Victoriei Square/Bucharest, 16.07.2008, 9.30 am (Peak Values)

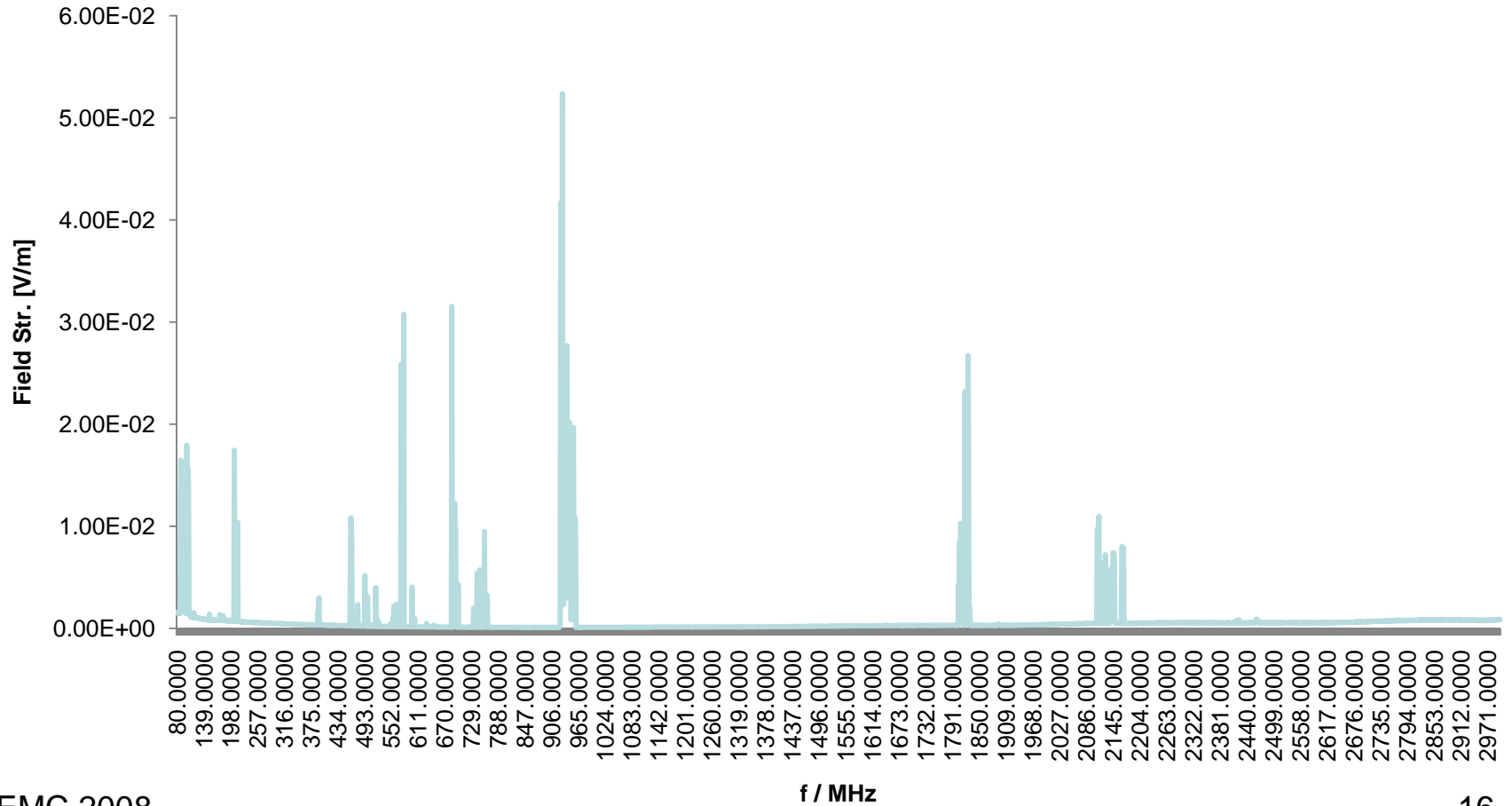


Table of Data – Brasov

Frequency domain	Zone	$E_{v,max}$ [mV/m]			$E_{v,med}$ [mV/m]
		Hour 9,00	Hour 12,00	Hour 16,00	Average
80-110 MHz	Zone A (1)	17.4	19.6	19.4	18.8
	Zone B (2)	18	17.9	49.8	28.5
	Zone C (3)	30.1	29.7	31.1	30.3
	Zone D (4)	153	145	171	156.3
200-230 MHz	Zone A (5)	18.1	14.2	13.8	15.3
	Zone B (6)	17.5	91.8	88.9	66.1
	Zone C (7)	4.45	5.24	7.56	5.75
	Zone D (8)	220	294	231	248
550-580 MHz	Zone A (9)	5.27	11	20.5	12.2
	Zone B (10)	30.8	163	121	105
	Zone C (11)	39.1	44.1	40.1	41.1
	Zone D (12)	169	92.3	65.6	109
920-970 MHz	Zone A (13)	283	253	205	247
	Zone B (14)	52.4	93.2	67.2	70.9
	Zone C (15)	400	282	310	330.6
	Zone D (16)	258	311	325	298
1800-1840 MHz	Zone A (17)	107	99	81	95.6
	Zone B (18)	26.7	16.3	29.9	24.3
	Zone C (19)	123	121	159	134.3
	Zone D (20)	278	201	259	246
2110-2180 MHz	Zone A (21)	40.7	45.9	44.9	43.8
	Zone B (22)	11	4.93	13.5	9.8
	Zone C (23)	35.3	27.9	29.6	30.9
	Zone D (24)	45.1	53.4	87.8	62.1

Analysis - Brasov

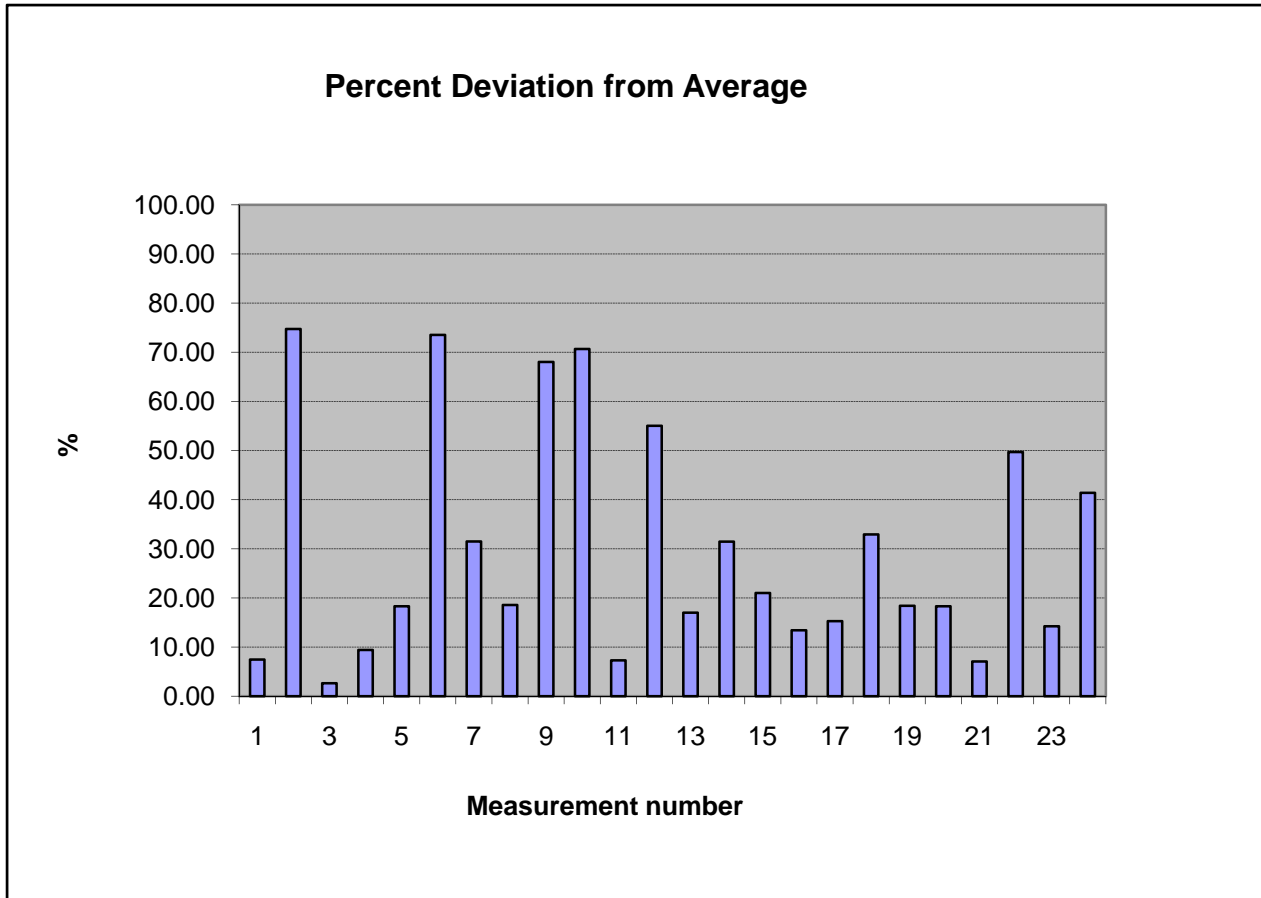


Table of Data- Bucharest

Frequency domain	$E_{v,max}$ [mV/m]			
	Zone A	Zone B	Zone C	Zone D
80-110 MHz	101	114	27.6	582
200-230 MHz	-	-	-	-
550-580 MHz	11.9	10.4	28	12.2
920-970 MHz	100	80.8	126	52.5
1800-1840 MHz	97.6	64.2	97.3	170
2110-2180 MHz	12.6	26.4	176	30.7

What/who produces EM Fields?

- ✓ 80 MHz - 110 MHz, FM radio transceivers;
- ✓ 200 MHz – 230 MHz, fixed and mobile telecommunication equipment or VHF TV transceivers;
- ✓ 550 MHz – 580 MHz, UHF TV transceivers;
- ✓ 920 MHz – 970 MHz, mobile telecommunication equipment;
- ✓ 1800 MHz – 1840 MHz, mobile telecommunication equipment;
- ✓ 2110 MHz - 2180 MHz, radio/astronomy equipment
- ✓ 2400 MHz -2483,5 ISM band

Conclusions

- ✓ Electric field strength varies with time – traceability is an open subject
- ✓ Characteristics of EM sources are not the only factors that determine the parameters of electromagnetic environment
- ✓ There needs to be a better awareness of the Electromagnetic environment in which consumer/commercial products are used and operated
- ✓ The complexity of the environment requires further research and work