

Exposure To Electromagnetic Field (EMF)

IEEE LEBANON COMMUNICATIONS WORKSHOP 2009 (IEEE LCW')



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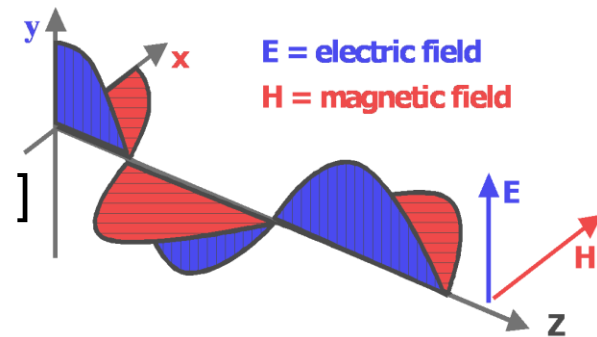
Electromagnetic Fields:

Intentional emitters use electromagnetic fields for signal transmission.

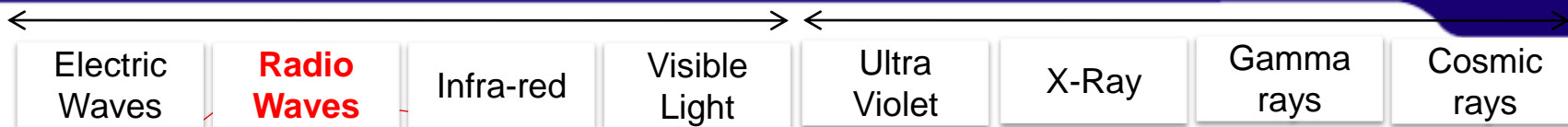
They produce EMF that may exceed the safety limits in some regions depending on the operating power, frequency, gain, orientation and directivity of the transmitting antenna

Electromagnetic fields can be sub-divided into two components:

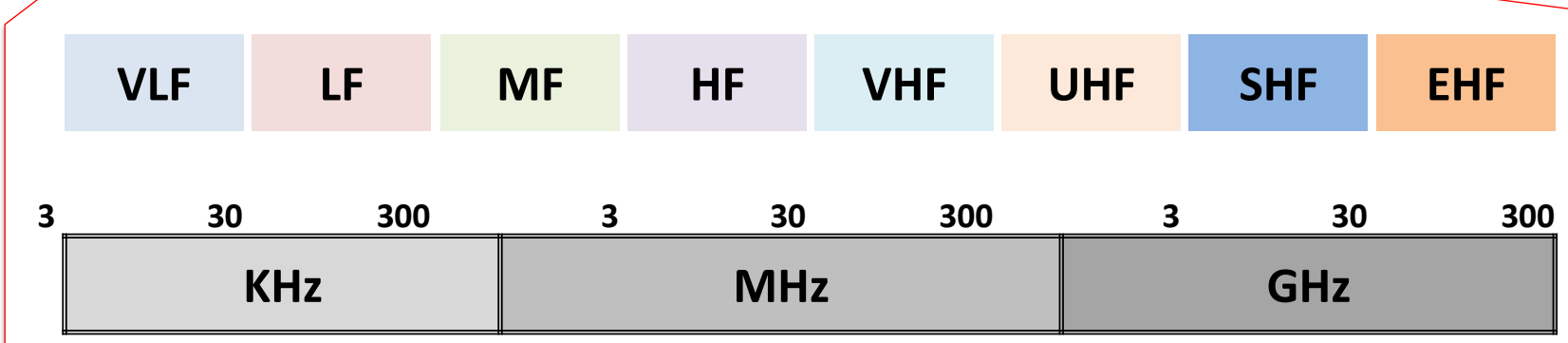
- Electric field E [measured in Volts per meter or V/m]
- Magnetic field H [measured in Amperes per meter or A/m]



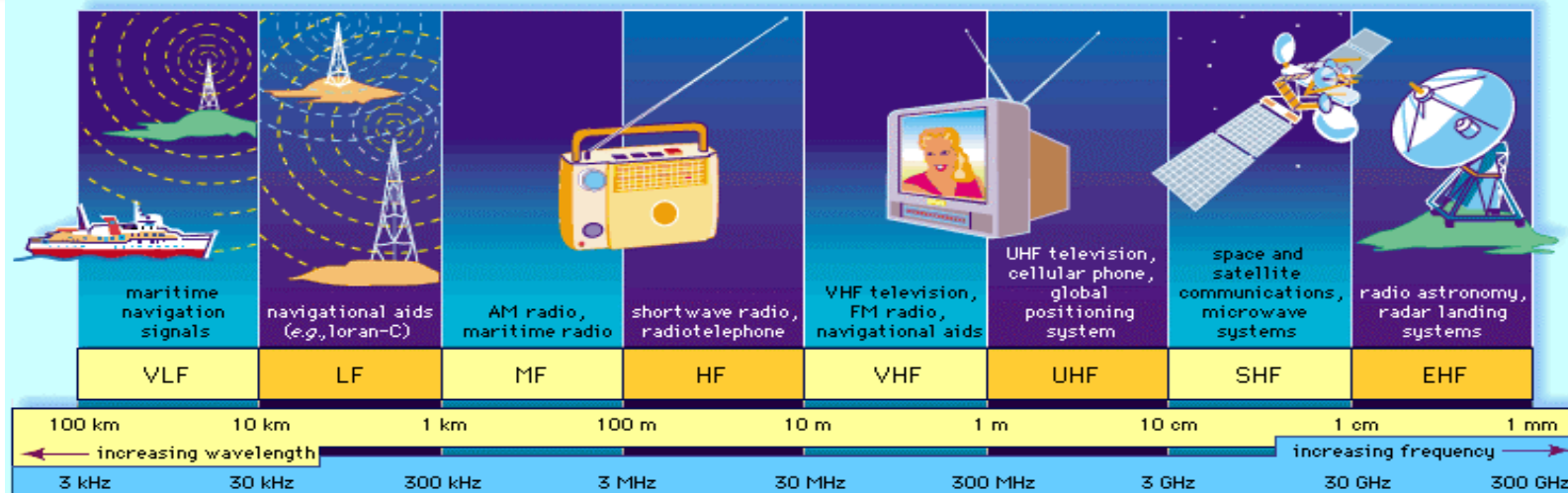
Radio Spectrum



Radio Spectrum



Mostly Valued



“TRA is responsible to set standards and technical requirements applicable to all Telecom Equipment in order to prevent any harm to telecom networks and hazards to public health or safety”

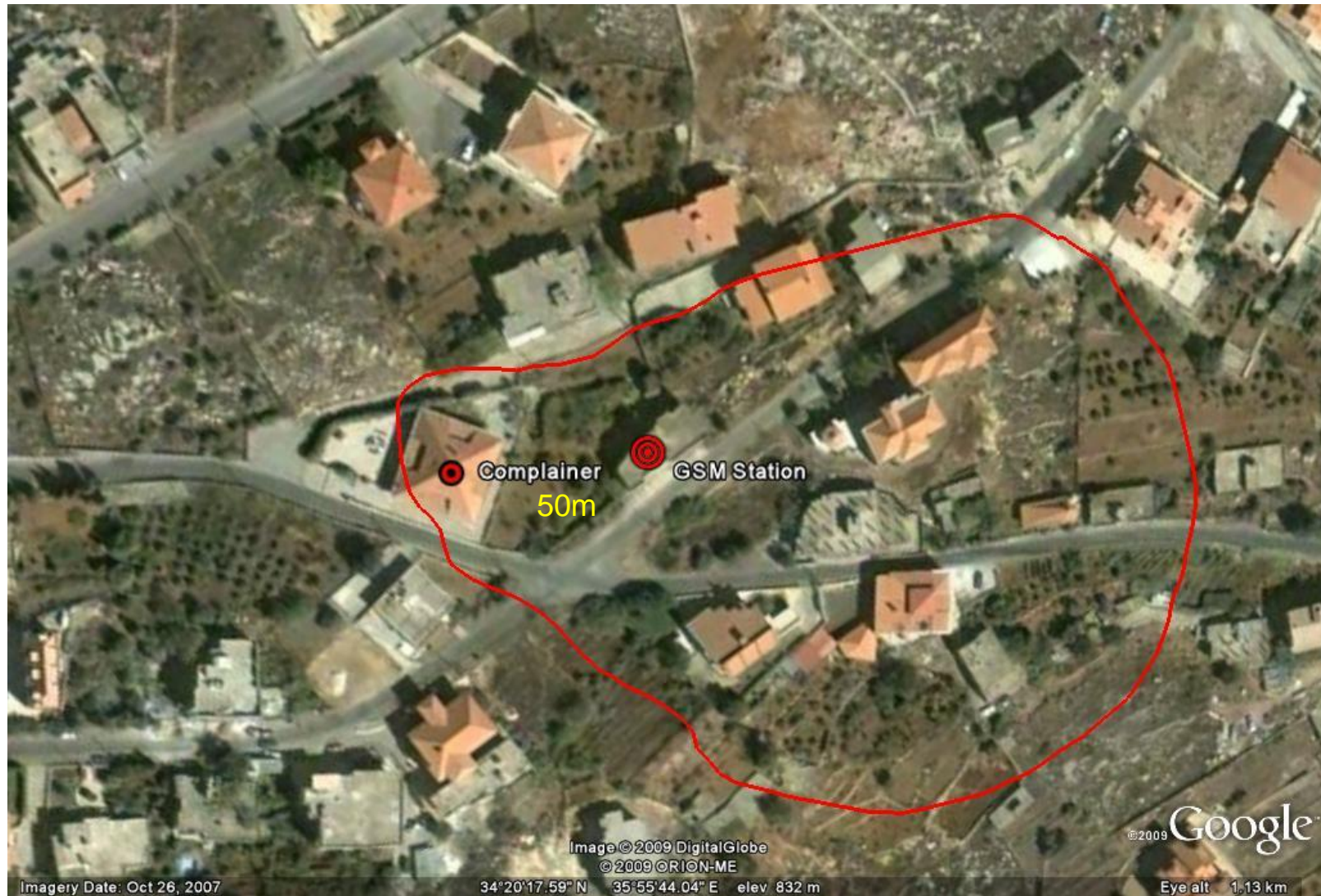
- ❑ TRA drafted EMF regulation to protect the public and workers from adverse health effects arising from EMF exposure and to establish limits on human exposure to EMF in the frequency range 3 kHz to 300 GHz
- ❑ TRA issued Import and Type Approval certificates for “Radio Telecom & Terminal Equipment (RTTE)” that should be comply with the guidelines and limits set in TRA’s **“Human EMF exposure limit regulation”**
- ❑ TRA is following the recommendations of the “International Commission of Non-Ionizing Radiation Protection” (ICNIRP) adopted by WHO and ITU

Electric Field Limit per Service

Service	Frequency range (MHz)	ICNIRP electric field limit V/m
FM	87 - 108	28
VHF	174 - 230	28
UHF	470 - 862] 29.80 – 40.36 [
GSM 900	935 - 960] 42.04 – 42.60 [
GSM 1800	1710 - 1785] 56.85 – 58.09 [
UMTS	2210 - 2170	61
MBWA	2300 - 2400	61
Wimax 802.16e (MBWA)	2500- 2690	61
Wimax 802.16d (FBWA)	3400 - 3600	61

Electric Field Exposure limits

Case Study-Lebanese Village



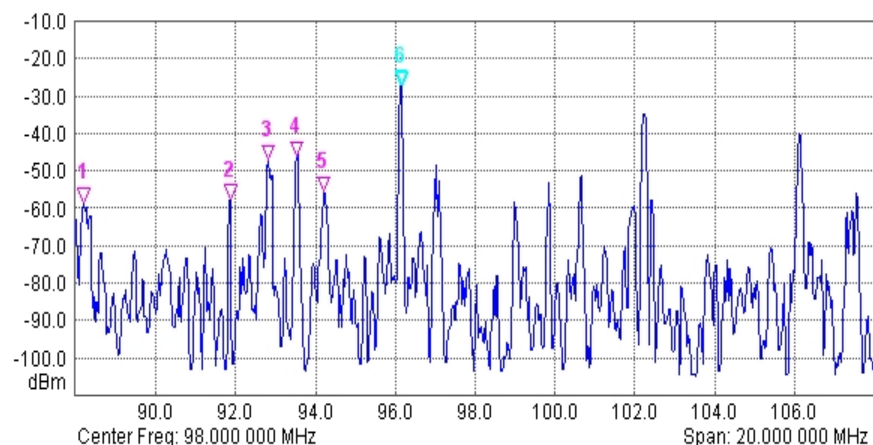
Case Study-Lebanese Village



Measurements Results on Spectrum Analyzer

Spectrum Analyzer Data
mizyara-fm (10/15/2009 9:22:09 AM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input type="checkbox"/>	<input type="checkbox"/>	88.181 8 MHz	-58.50 dBm	--	--
2	<input type="checkbox"/>	<input type="checkbox"/>	91.854 5 MHz	-57.62 dBm	--	--
3	<input type="checkbox"/>	<input type="checkbox"/>	92.800 0 MHz	-46.98 dBm	--	--
4	<input type="checkbox"/>	<input type="checkbox"/>	93.527 3 MHz	-45.95 dBm	--	--
5	<input type="checkbox"/>	<input type="checkbox"/>	94.218 2 MHz	-55.42 dBm	--	--
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	96.145 5 MHz	-27.13 dBm	--	--

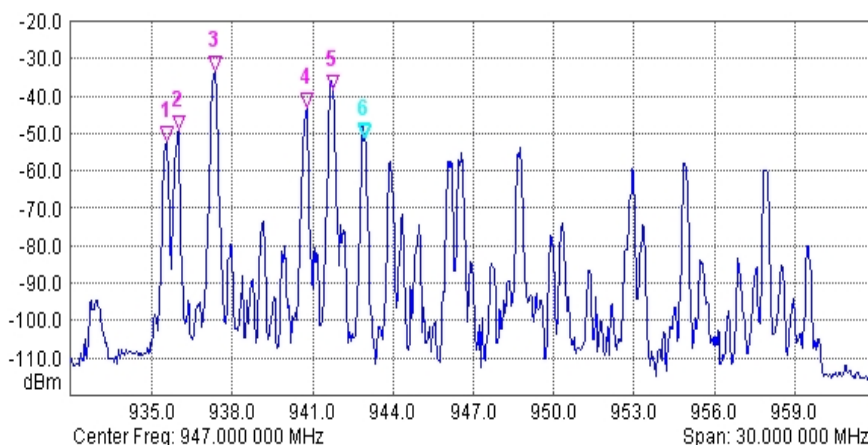
Measurement Parameters

Trace Mode	Max Hold	Frequency Span	20.000 MHz
Reference Level Offset	0.0 dB	Reference Level	-10.000 dBm
Input Attenuation	0.0 dB	Scale	10.0 dB/div
RBW	10.0 kHz	Serial Number	813045
VBW	1.0 kHz	Base Ver.	V1.88
Detection	Sample	App Ver.	V1.89
Center Frequency	98.000 MHz	Date	10/15/2009 9:22:09 AM
Start Frequency	88.000 MHz	Device Name	
Stop Frequency	108.000 MHz		

FM Levels

Spectrum Analyzer Data
mizyara-h-v (10/15/2009 9:05:12 AM)

Spectrum Analyzer



Mkr	Ref	Delta	Ref Freq	Ref Amp	Delta Freq	Delta Amp
1	<input type="checkbox"/>	<input type="checkbox"/>	935.545 5 MHz	-52.02 dBm	--	--
2	<input type="checkbox"/>	<input type="checkbox"/>	935.981 8 MHz	-48.98 dBm	--	--
3	<input type="checkbox"/>	<input type="checkbox"/>	937.345 5 MHz	-33.28 dBm	--	--
4	<input type="checkbox"/>	<input type="checkbox"/>	940.781 8 MHz	-42.95 dBm	--	--
5	<input type="checkbox"/>	<input type="checkbox"/>	941.763 6 MHz	-38.21 dBm	--	--
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	942.963 6 MHz	-51.18 dBm	--	--

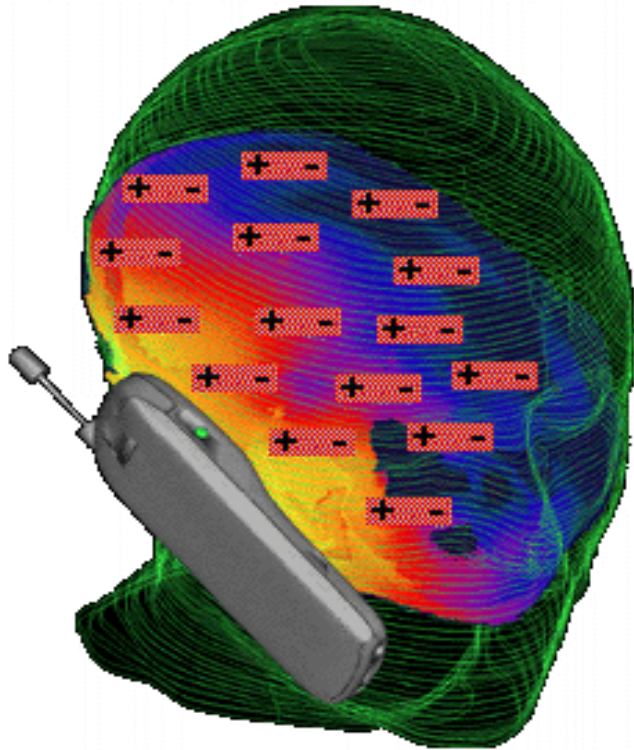
Measurement Parameters

Trace Mode	Max Hold	Frequency Span	30.000 MHz
Reference Level Offset	10.0 dB	Reference Level	-20.000 dBm
Input Attenuation	0.0 dB	Scale	10.0 dB/div
RBW	10.0 kHz	Serial Number	813045
VBW	1.0 kHz	Base Ver.	V1.88
Detection	Sample	App Ver.	V1.89
Center Frequency	947.000 MHz	Date	10/15/2009 9:05:12 AM
Start Frequency	932.000 MHz	Device Name	
Stop Frequency	962.000 MHz		

GSM Levels

Case Study-Results

ARFCN #	dBm	E (v/m)	x^2	FM Ch#	dBm	E (v/m)	y^2
1	-33	0.12	0.0144	1	-27	0.025	0.00063
2	-38	0.065	0.0042	2	-35	0.01	0.0001
3	-43	0.035	0.0012	3	-41	0.005	2.5E-05
4	-49	0.017	0.0003	4	-46	0.0045	2E-05
5	-51	0.015	0.0002	5	-47	0.004	1.6E-05
6	-52	0.015	0.0002	6	-49	0.0038	1.4E-05
7	-56	0.008	6E-05	7	-51	0.0035	1.2E-05
8	-57	0.007	5E-05	8	-53	0.003	9E-06
9	-57	0.007	5E-05	9	-55	0.001	1E-06
10	-58	0.007	5E-05	10	-56	0.0009	8.1E-07
11	-59	0.006	4E-05	11	-58	0.00075	5.6E-07
12	-59	0.006	4E-05	12	-58	0.00075	5.6E-07
13	-60	0.005	3E-05	13	-58	0.00075	5.6E-07
		Total	0.0209	14	-58	0.00075	5.6E-07
				15	-59	0.00065	4.2E-07
$E_{\text{resultant}} = \sqrt{\sum_1^n E_n^2}$						Total	0.00083
						EGSM resultant	0.1446 v/m
						EFM resultant	0.02875 v/m
	ICNIRP limit	42	290 Less		ICNIRP limit	28	974 Less



A max level of 0 dBm was measured during call set-up, which is equivalent to 6 v/m, compared to ICNIRP level (42 v/m)

Non-Compliant Sites



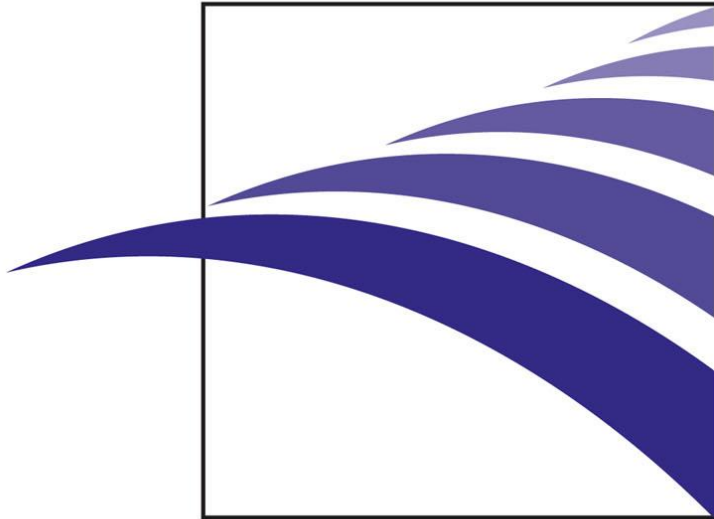
FM & TV stations broadcasting in front of residential Buildings



Bad Connector out from FM transmitter

- TRA has issued the "**Human EMF Exposure Limit Regulation**" draft for consultation on October 28, 2009 (www.tra.gov.lb), deadline on 11 December 09
- TRA can receive EMF complaints through its website or via hotline 1739 established jointly with MoET (Ministry of Economy and Trade)
- TRA will continue to follow up the latest studies undertaken by regulators and international organizations related to the effect of EMF on health

Thank You



الجمهورية اللبنانية
الهيئة المنظمة للاتصالات



Republic of Lebanon
Telecommunications
Regulatory Authority