La REF realiza un estudio del impacto que la aplicación de la norma NB30 puede tener tanto en la radioafición como en la radiodifusión.

HF Receivers desensitisation from wideband noise spurious in HF bands (1.8 to 30 MHZ)

Impact of spurious radiations at the limits of NB30 recommendations on the reception of HF signals with amateur radio antennas and with broadcast receivers

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- *Réseau des Emetteurs Français* -

Noise received from wideband spurious radiations in amateurs HF bands

- Amateur radio antennas can be close to PLC lines or equipment
  - They may have large dimensions (5m to 40m or even more…)
  - They can be high over the ground level (10m to 25m and sometimes more…)
  - Their gain may vary from –3 dBi to +10 dBi (2.1 dBi for λ/2 dipole antenne)
- Table showing how HF amateurs communications can be disturbed on their receive path by radiated spurious at the limit of NB30 recs (dipole antenna) :

	Loss	**NB30 limits in dBµV/m**		Spurious	Man /Industr	Average	Rx Sensit.
Frequency	3m=>10m	at 3m	at 10m	Noise	Degradation	Noise floor	Degradation
(MHz)	(dB)	9 kHz Bw	2,5 kHz Bw	(dBm)	(dB)	(dBm)	(dB)
3,5	8	35,2	21,6	-64,4	27	-103	38,6
7	7,5	32,6	19,5	-72,5	20	-110	37,5
14	7,8	29,9	16,5	-81,5	13	-117	35,5
29	8,5	27,1	13,0	-91,3	6	-124	32,7

- Achieving an «acceptable» degradation of about 1 dB instead of these 33 dB to 39 dB would require antennas installed at more than 100 m to 1 Km from any PLC line or device

HF short wave Broadcast reception degradation

- More listeners over the world than many national FM broadcasting
- High quality digital transmission promoting their application in a very near future
- SW broadcast frequencies in use at up to about 22 MHz
  - > 10dB degradation of Rx noise floor from « industrial » man made noise
- Usual antennas have less efficiency than radio amateur antennas :
  - From –10dBi (5m to 10m wires) to –30 dBi (whips on portable set)
  - Often in house installations too close to PLC devices
- Since « industrial » noise is receivable, degradation is the same than for amateur radio communications
  - At least up to 10 MHz with whips and on the whole HF range with wires
- Portable receivers with integrated antennas may be in use at less than 5m from PLC indoor devices
  - High desensitisation also expected by 10 dB to 30 dB
  - Also verified by measurements and field test

HF bands sensitivity to spurious radiations

- Already noticeable over the industrial "man made noise"
  - Mainly narrow band radiations from all kind of oscillators
  - PC time bases, DC power supplies etc...
  - Possible escaping from narrow band spurious by change of frequency
  - Usual limits based on about – 50 dBm (10 nanowatts) radiated power
- Wideband radiated spurious limits identical to narrow band's one
  - Average power radiation to be multiplied by bandwidth ratio :
    - *3000 From 9 kHz to 27 MHz meaning 1/30 milliwatts wideband spurious*
    - *Not far from short range low power devices' transmission !*
  - Impossible escaping from such wideband radiations
- Harmonics and intermodulations effects may be perceived at higher frequencies
  - No limits specified up to now (NB30 ?)
  - High gain antennas connected to base stations receivers
  - May results in quality of service degradation

How can a radio-communication community, aware of such risks, accept a step by step performances' degradation from unwanted and unuseful radiations ?

Appendix

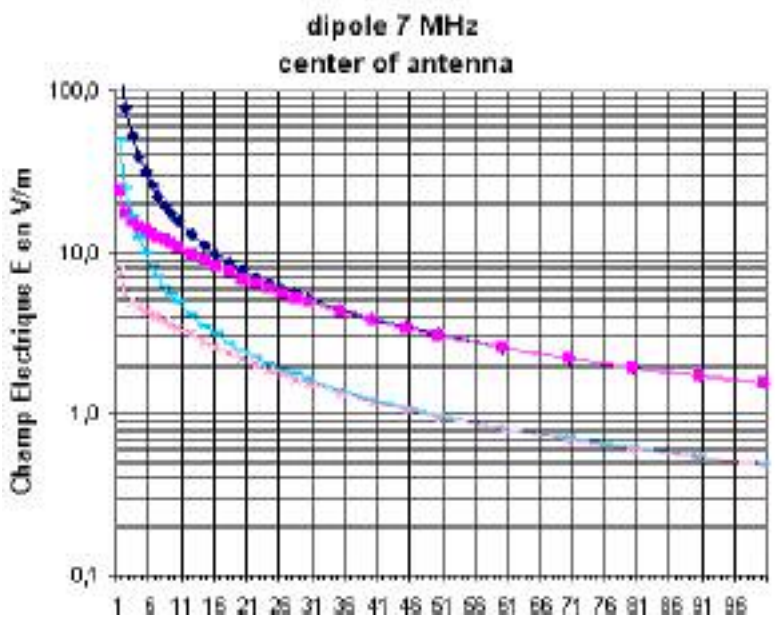
Technical hypothesis for electrical field strength conversion into receiver desensitisation

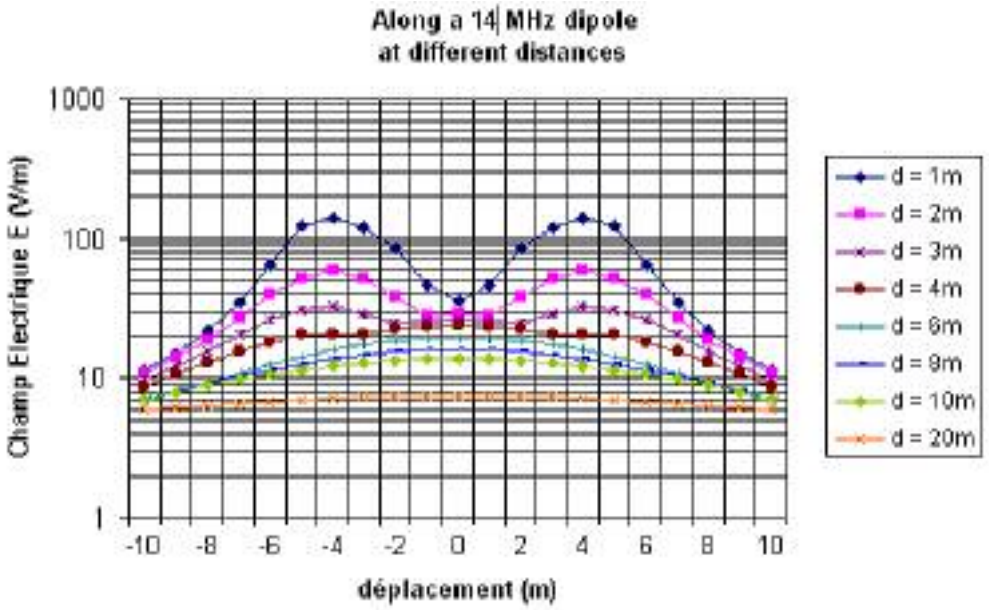
Field strength reception in HF bands

- Conversion of dBµV/m into dBm with an isotropic antenna :
  - From Prec (in Watts) = $(\lambda^2/4\pi)(E^2/120\pi)$ λ= wavelength in m, **E in V/m**
  - With λ = 300/F, Prec = $(300/4\pi)^2(E^2/30)(1/F^2)$ in watts with **F in MHz**
  - Converted to Prec in dBm and E in dBµV/m : **Prec = E - 20log(F) - 77.2**
- Isotropic antenna gain (Gi) in the appropriate direction to be added
- Usual radio amateurs antennas may have Gi from –3dBi to 10 dBi
- Noise floor estimation with usual radio transceivers
  - Based on a noise figure Nf = 10 dB and SSB receiver bandwidth Bw = 2.5 KHz
  - Nr(dBm) = -174+Nf+10*log(Bw) = -174+10+34 = -130 dBm
  - Additional « human / industrial noise » added in urban / suburban environment :
    - *6 dB to 30 dB degradation depending on HF frequency band and time*
- Minimum usable S/N in SSB is about 10dB (Peak with compressed audio)
  - -120 dBm in quiet conditions and -114 dBm to -90 dBm effectively
- Digital transmissions may have narrower bandwidth (divided by 10) and accept lower S/N (7 dB) for more than 80% decoding :
  - 13 dB improvement => -127 dBm to -103 dBm

Path losses in far field and near field conditions

- Far field propagation conditions applicable with less than 1 dB errors at Tx to Rx distance greater than 0.5 wavelength ($\lambda/2$= 150/F with F in MHz)
  - For 10m distance far field & free space rules applicable above 15 MHz
  - Field strength measurement at 3m distance (0.3λ at 30 MHz) follow near field rules
- Near field conditions below this limit with high variations along the antenna
  - At 10m distance +/- 2 dB at 3.5 MHz, +/- 1 dB at 7 MHz & +/-0.5 dB at 14 MHz
  - Average loss from **3m to 10m** distance increased by < 20*Log(10/3) (i.e10.5 dB)
    - = ***7.5 dB to 8.5 dB*** *depending on frequency from 3.5 to 30 MHz*





Note : Curves are plotted for 800 watts and 80watts average EIRP in near filed and far field conditions (free space) with NEC simulation software

Desensitisation from spurious reception at 10m from a power line

- NB30 limits conversion (K) from 3m to 10m distance in 2.5 KHz bandwidth
  - - K (loss in dB) depending on frequency band & -10*log(9/2.5) = 5.6 dB
- Conversion E (dBµV/m) into Prec (dBm) by a dipole antenna (Gi = 2.1 dB) looking like spurious noise added to natural noise floor :

	Loss	NB30 limits in dBµV/m		Spurious	Man /Industr	Average	Rx Sensit.
Frequency	3m=>10m	at 3m	at 10m	Noise	Degradation	Noise floor	Degradation
(MHz)	(dB)	9 kHz Bw	2,5 kHz Bw	(dBm)	(dB)	(dBm)	(dB)
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- In order to make spurious acceptable (1dB max desensitisation) at this distance an additional 40 dB attenuation should be appropriate.
- Spurious radiated at the NB30 limits could be perceived up to 100 times this reference distance (= 1 Km) in free space conditions…
  - very high antennas => 20*Log(distance ratio) = 40 dB
- Or at least 10 times (100m) for low antennas close to ground
  - i.e mobiles => 40*Log (distance ratio) = 40 dB
- Field measurement campaigns have verified these hypothesis...