EMC Levels in Near Site Areas

With more significance being placed on EMC field strength levels around Transmitting Stations, a brief outline of the problems and some suggested solutions are presented.

The field strength levels are related to antenna gain, Effective Radiated Power, and height above the ground. The level of 1 V/m is difficult to achieve for low gain, high power antennas which are not positioned very high on masts.

To work out field strength at a point in space the following formula is used

$$E = \frac{0.22 \sqrt{W}}{d} \qquad \underline{1} \text{ (from CCIR report 566)}$$

Where E = Field Strength in V/m

W = ERP in kW

d = distance in km

The distance along the ground for the field strength can be calculated using Pythagoras, assuming one already knows the height of the antenna.

The remaining calculation to work out the actual field strength at a point on the ground is to factor the level calculated in equation 1 by the VRP level of the proposed antenna. The VRP shows the relative field strengths of the antenna at angles below the horizontal, and this can be directly translated to distance using tan Ø, where Ø is the angle below horizontal for the radiation pattern.

Having ascertained the field strengths at points along the ground including the VRP proportioning, it can be seen whether at certain points the ideal level of 1V/m is exceeded.

The figures produced remain theoretical, and in practice local variation and ground reflections can affect the values significantly. There can be no guarantee for absolute levels.

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SOLUTIONS TO EMC PROBLEMS

There may be several reasons for the high field strength, some of which can be more easily adjusted than others.

i) Height of antenna: if the antenna is relatively near the ground, improvement can be made by raising the mean height. Due to other users and existing structure integrity this is usually the least feasible of the variables to adjust.

ii) Antenna Gain: for small aperture (low gain) antennas the main beam is broad and sidelobes are difficult to suppress, thus if the aperture of the antenna is increased the main beam will narrow, and side lobes can be controlled using amplitude and/or phasing techniques. This is only possible if the aperture is available and the structure has sufficient loading capacity.

iii) Power Levels: the option is available to reduce the transmitter power, but this has to be weighed up against loss of coverage. There may be a balance to be struck between increased antenna aperture and reduced transmitter power. Financial as well as technical considerations come into play here.

There is a further problem which arises from trying to define field levels in close proximity to the site, and this is that the field is no longer in the ‘Far-Field’ mode. The relationship that generally defines the minimum distance from the antenna where the radiation operates in the more predictable far-field region is.

$$\frac{2\,D^2}{\lambda}$$

where D = Aperture in m of the antenna
λ = Wavelength

It can be seen that for a 11m aperture antenna, operating at 600MHz, the far-field region only becomes applicable at distances greater than 484m.

Therefore closer than this to the antenna and near field techniques come into play. It is then very difficult to be predict with any certainty the field levels in the near region.

Aperture	**100Mhz**	**175Mhz**	**230MHz**	**470MHz**	**600MHz**	**700MHz**	**860MHz**
5m	17m	29m	38m	78m	100m	117m	143m
9m	54m	95m	124m	254m	324m	378m	464m
12m	96m	168m	221m	451m	576m	672m	826m
17m	193m	337m	443m	906m	1,156m	1,349m	1,657m
21m	294m	515m	676m				
24m	384m	672m	883m				
30m	600m						