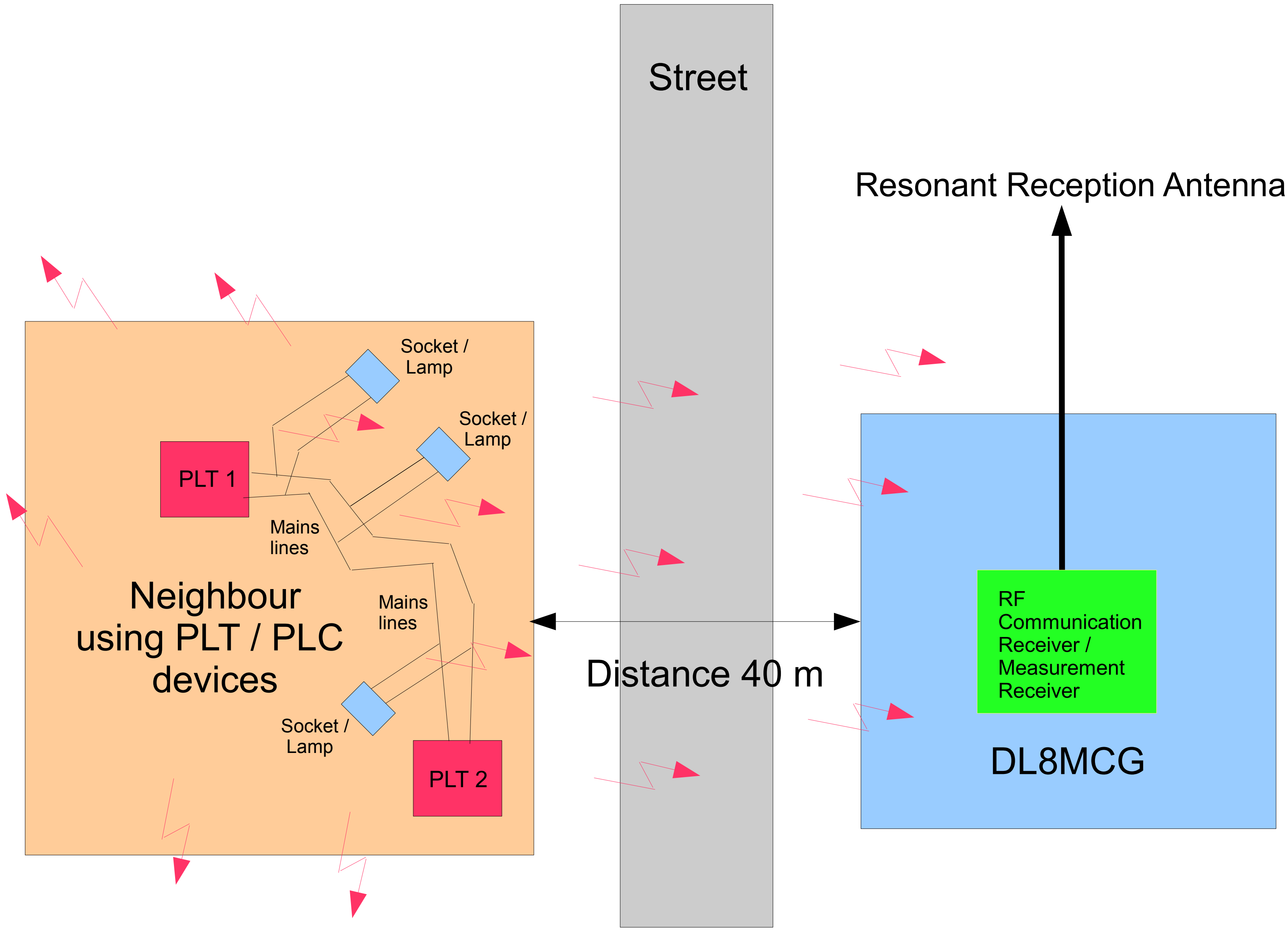
Measurements of radiated disturbances from a pair of PLT / PLC modems



DL8MCG,
Sept. 2012

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PLT/PLC producer claim their products to be system compliant with EN 55022.

PLT/PLC modems pump in high symmetric energy in a highly unsymmetric mains lines system.

Due to the high unsymmetry of the mains line system the RF energy is converted to an unsymmetric current. This unsymmetric current is further transformed to radiated energy and causes severe disturbance at RF receivers in the area of approx. 300 m to 500 m radius distance.

When doing laboratory measurements according to EN 55022 these measurements are done on highly symmetric and terminated (!) mains line laboratory networks, as defined in the norm. Therefore just a very small amount of the high symmetric energy, that is pumped in, is converted to unwanted asymmetric current.
And by doing so the EN 55022 test is passed! The PLT/PLC producer is happy.
BUT: → EN 55022 laboratory measurements still don´t represent reality!! In real live a huge amount of the pumped in symmetric energy is radiated, due to a lot of symmetry disturbing stub lines (mains line outlet sockets, lamps, switches) and non constant line impedances.
Every RF expert is aware of that fact. Has someone told the electrician that he instead of a simple 50 Hz wire construction had to install a highly symmetric Radio Frequency - Net that needs to incorporate a symmetric to unsymmetric attenuation of more than 50 dB up to Radio - Frequencies of 30 MHz ? No! Probably he never has heard about things like RF and symmetry and radiation. What he builds is and remains a 50 Hz net that can not be used for transportation of RF signals.

PLT producer fear that more and more RF experts come on the table and explain how badly PLT technology behaves within real world. So they decided to quickly knit their own norm for high power injection to legalize their RF pollution work as soon as possible. prEN50561 already has been denied one time by the commission as the majority of commission members still are honorable people who feel responsible to maintain a clean radio spectrum.

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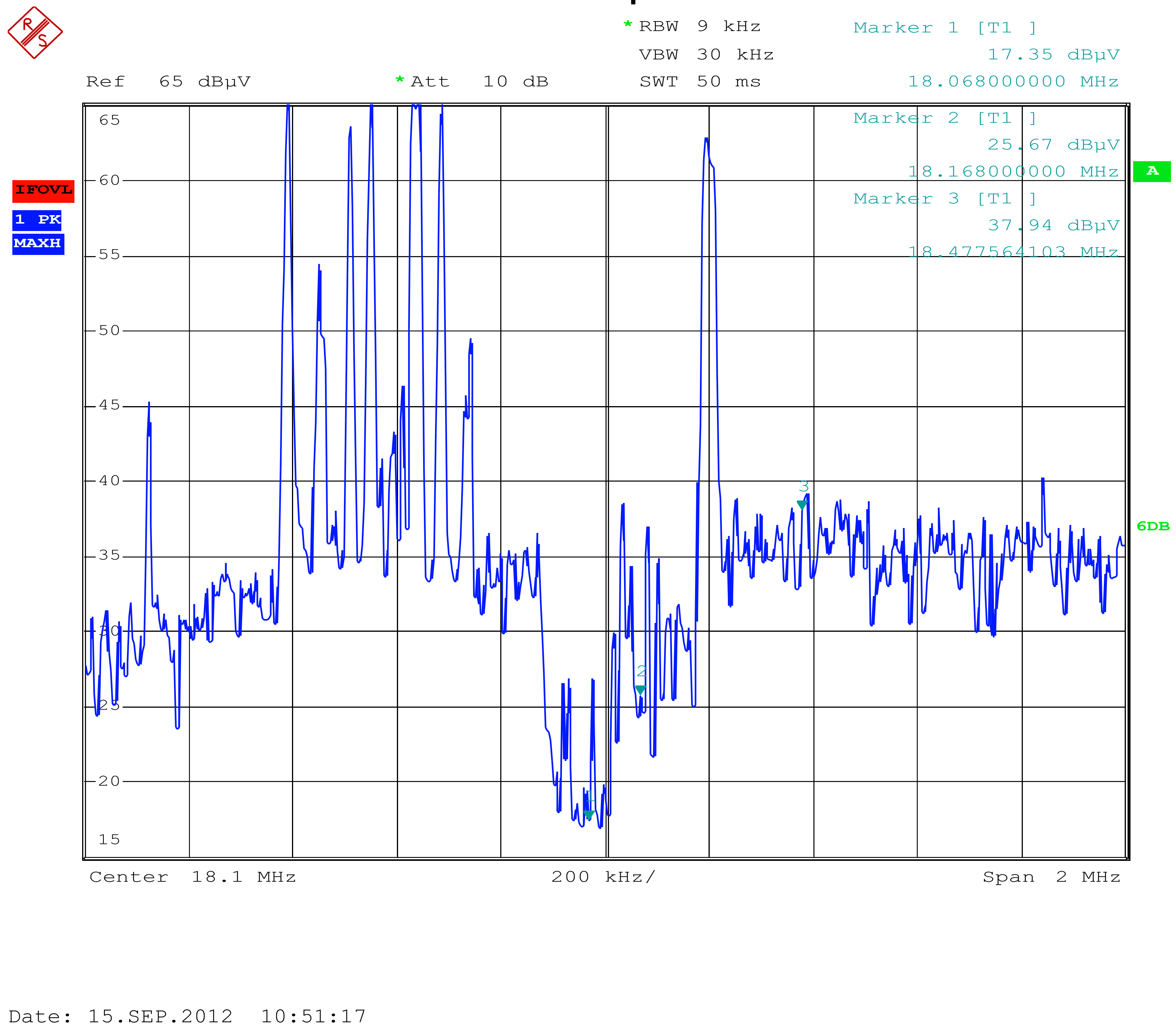

Marker 3 shows the level of the radiated PLT – spectrum, received by antenna

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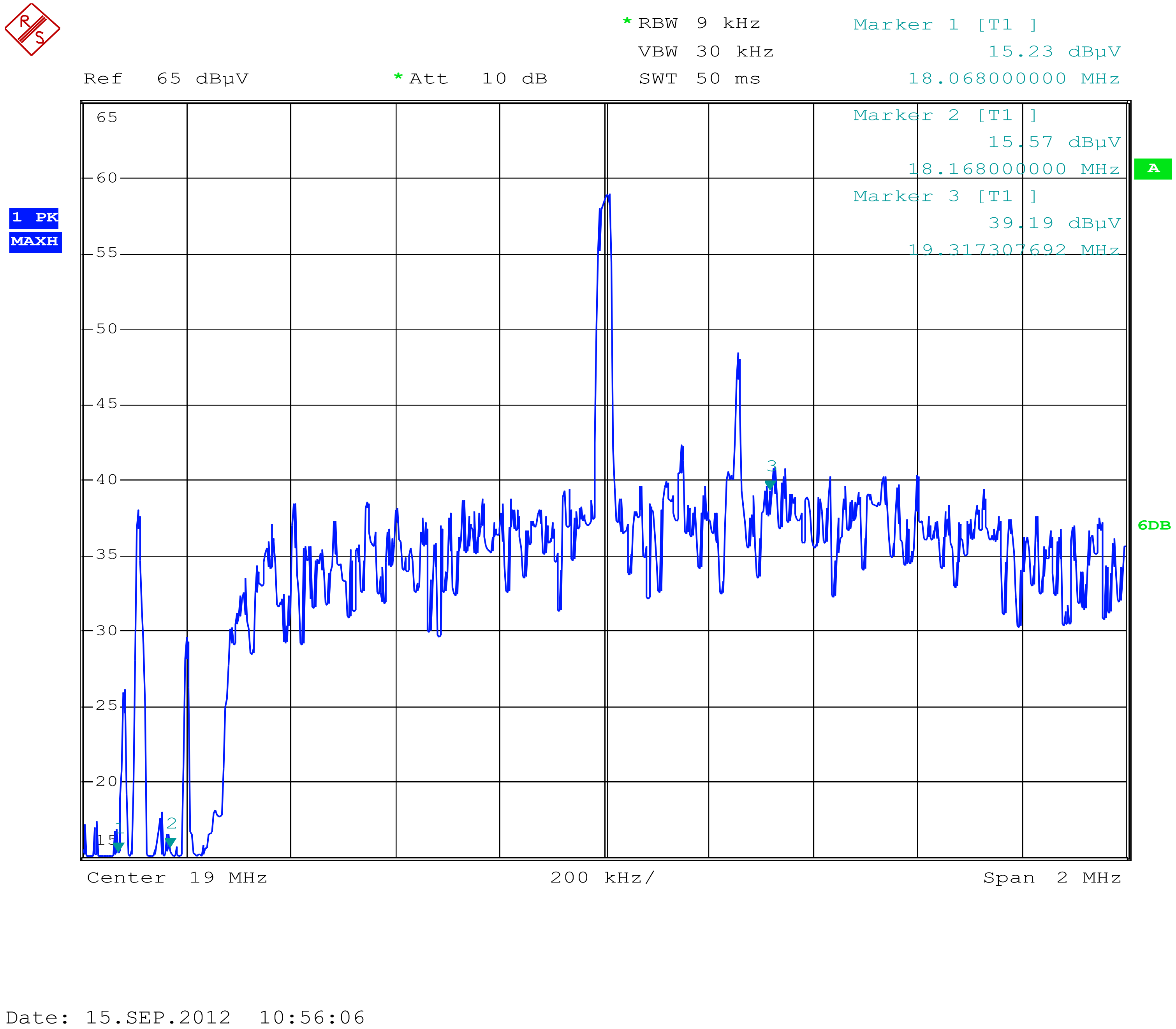

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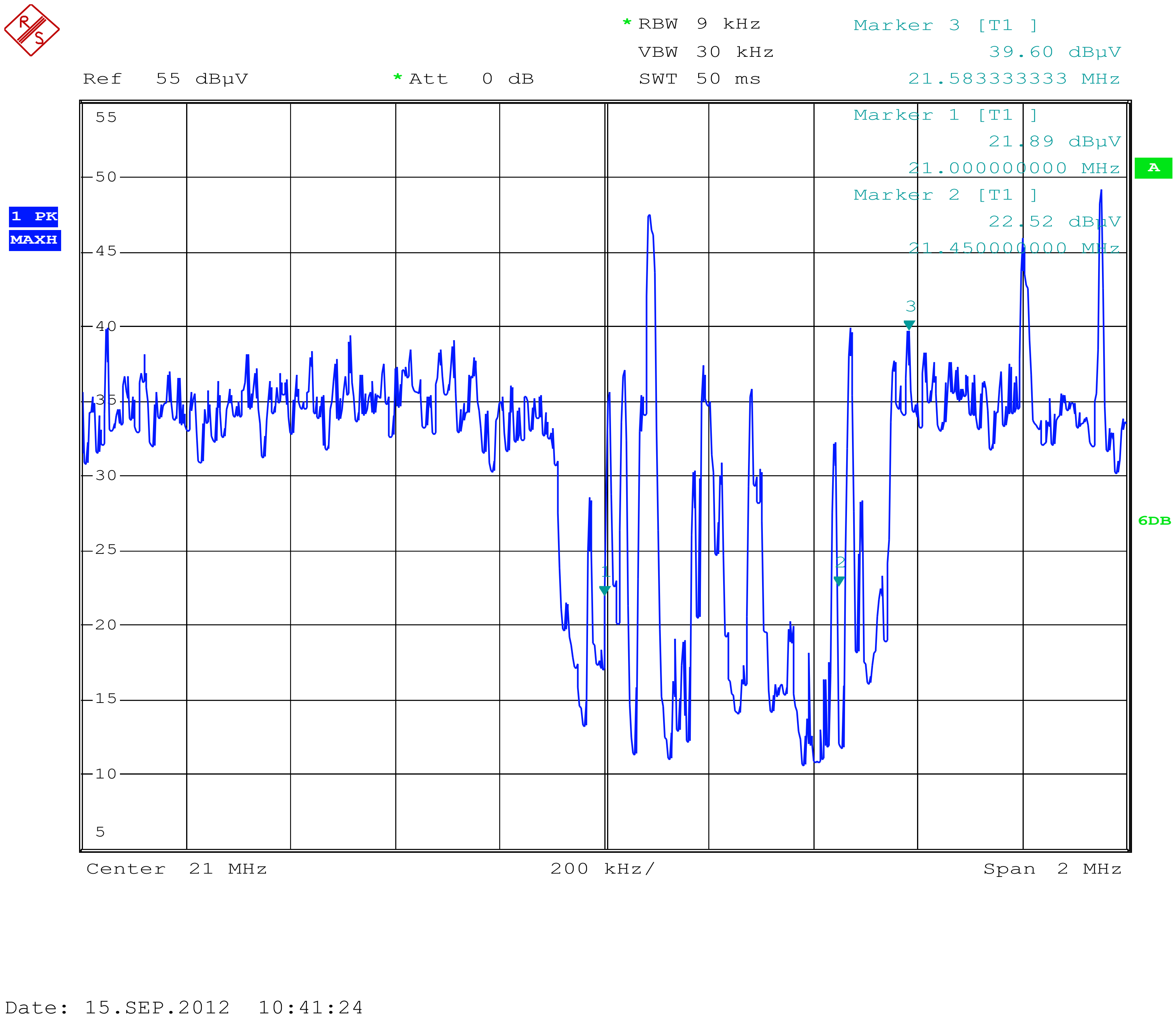

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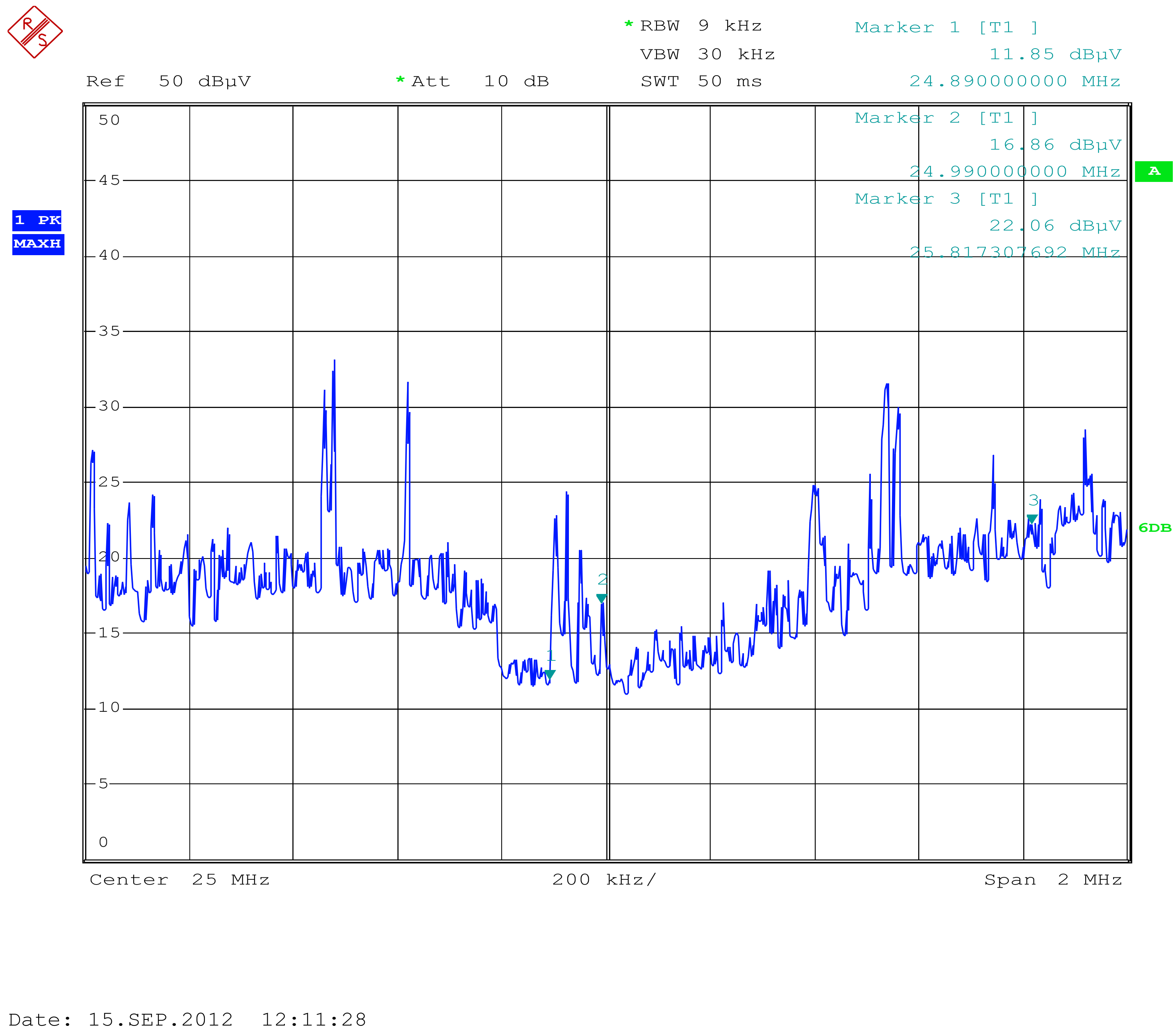

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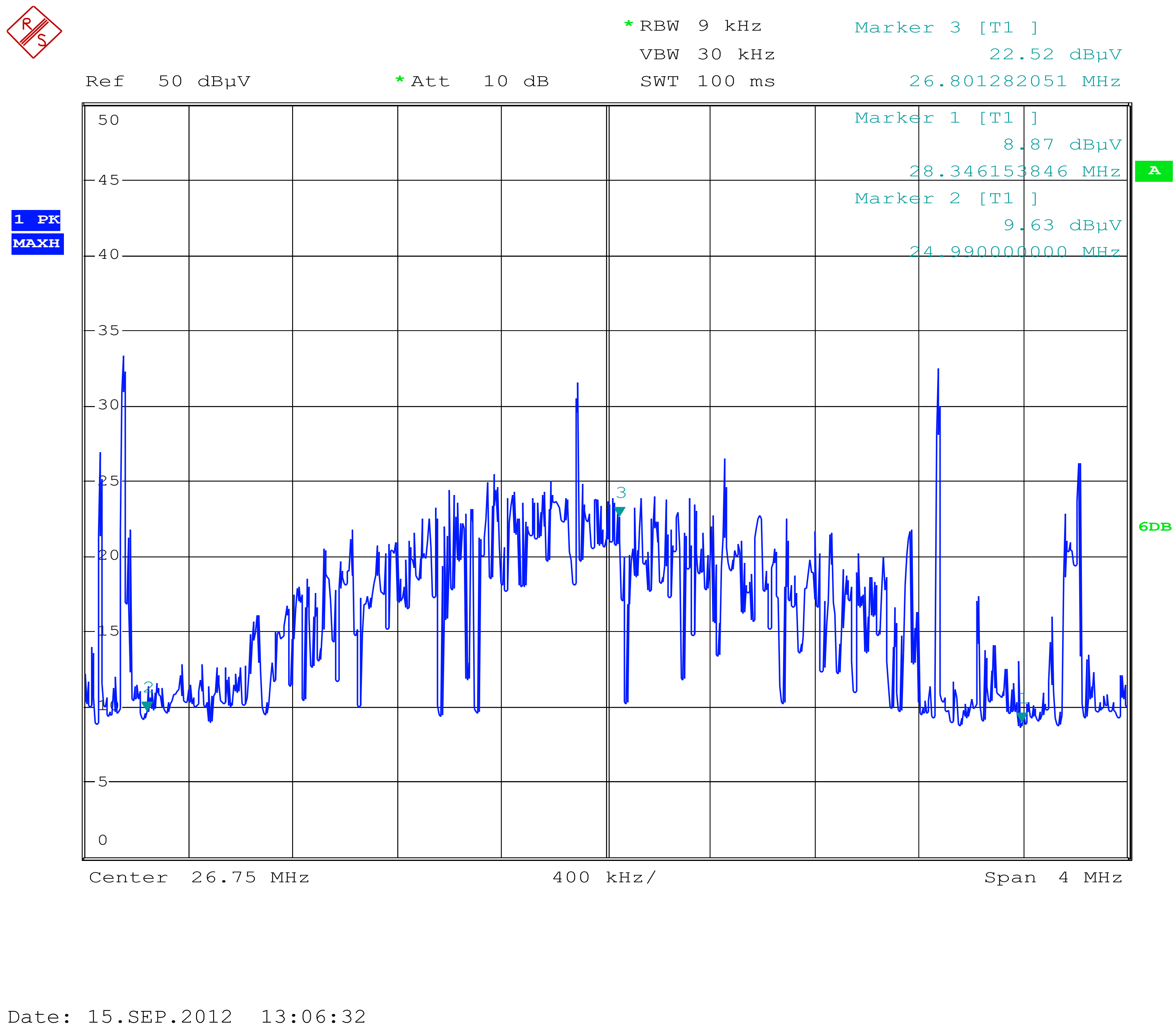

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Measurements of radiated disturbances from a pair of PLT / PLC modems

Calculation of the field strength of the received PLT/PLC signal:

Field strength at a distance of r $E = \frac{1}{r}\sqrt{\frac{P}{4\pi}Z_0}$ and Free space propagation attenuation $a = \left[\frac{\lambda}{4\pi r}\right]^2$ → Field strength calculated from reception power $E = \frac{1}{\lambda}\sqrt{P_{RX}4\pi Z_0}$

```
% Calculation of the E-field strength from the measured reception voltage
f = 21.7e6          % reception frequency
UmeasdBuV = 40      % measured reception voltage in dBuV
Gant = 0;           % Gain of antenna over dipol
Gpreamp = 0;        % Gain Preamp
Gkabel = -0.5       % Cable loss
Gdipolisotrop = 2.15;   % Gain dipol to isotropic radiotor
R = 50                  % nominal Impedance

UmeasuV = (10^(UmeasdBuV/20))*1e-6 % linear voltage
PmeasW = UmeasuV^2 / R             % Power in W
PmeasmW = PmeasW*1000              % Power in mW
PmeasdBm = 10*log10(PmeasmW)       % Power in dBm

PrxdBm = PmeasdBm - Gkabel - Gpreamp - Gant - Gdipolisotrop  % reception power at the antenna

c = 3e8;            % speed of light
Zo = 377;           % free wave propagation resistance

P = (10^(PrxdBm/10)) / (1000);        % reception power in W (linear)
E = 1/(c/f) * sqrt(P * 4 * pi * Zo);  % reception field strength at the isotropic radiator (linear)
EdBuVm = 20 * log10( E * 1e6 )        % reception field strength (logarithmic)

Result : EdBuVm = 35.3 dBuV/m
```

This calculation shows that the received PLT/PLC field strength is very strong and will severely disturb broadcasting station signals. The distance from PLT/PLC interferer to the reciever is in this case 40 m. The situation certainly would be even more severe with a shorter distance between interferer and receiver. The worst interference situation will be when the interferer and the radio listener are in the same residential unit.

DL8MCG,
Oct. 2012