

PLCモデムの電力(PSD)測定法

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第6回PLC作業班資料

国立天文台

PLCモデム単体でのPSD測定法

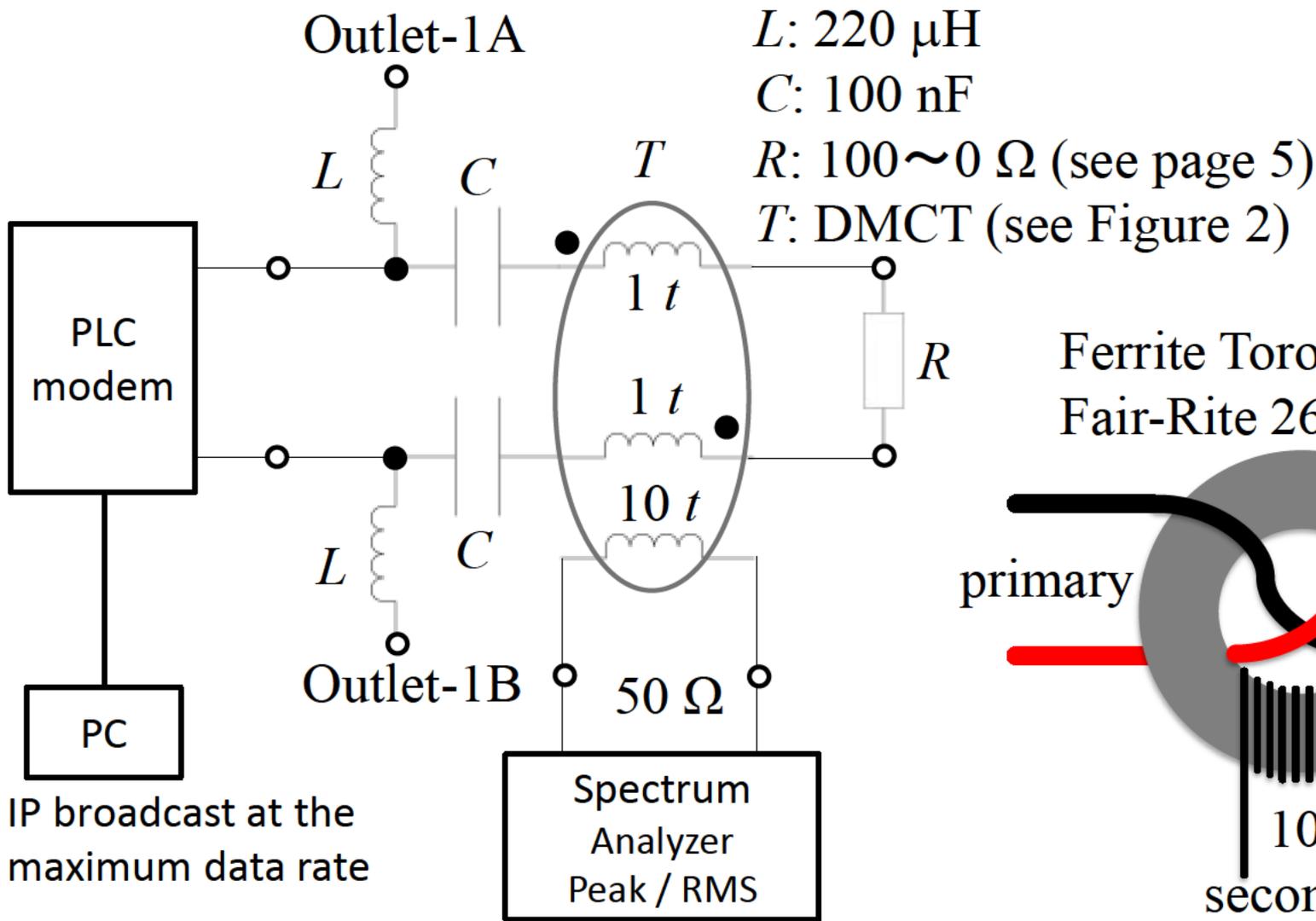


Figure 1: PSD measurement method for single PLC modem

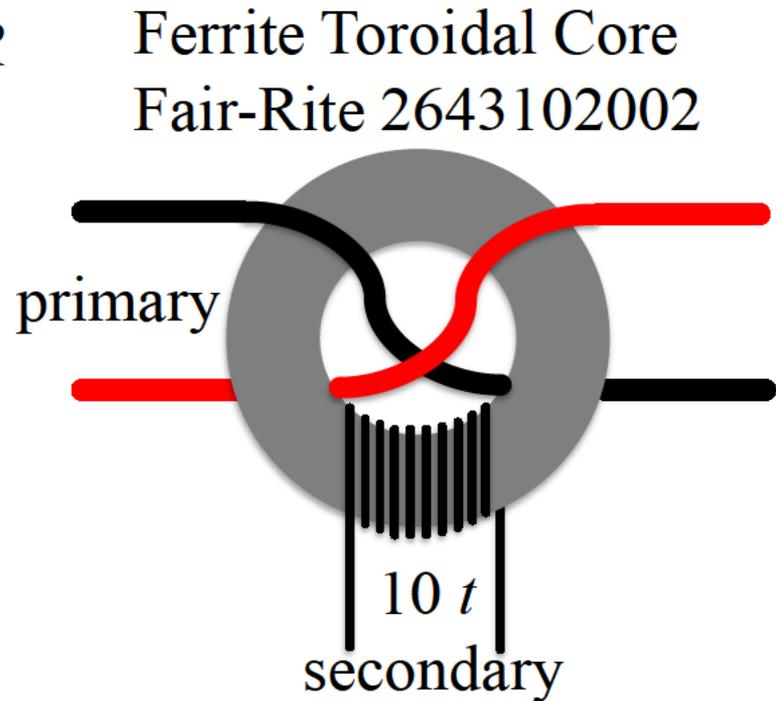
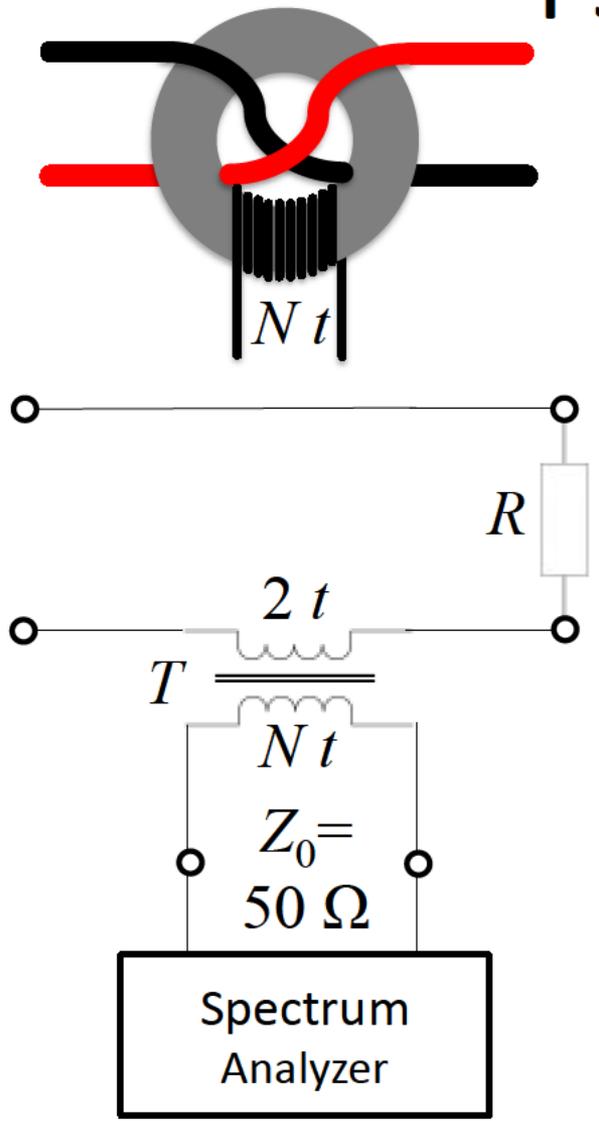


Figure 2: Differential-Mode Current Transformer

差動モード電流トランス(DMCT)による PSD測定法の原理



Primary

Effective Load Impedance

$$R_e = R + r, \quad r = (2/N)^2 Z_0$$

Power $P = i^2 R_e$

Secondary

Current $i_m = i/N^2$

Power $P_m = i_m^2 Z_0$

Ratio $k = P/P_m = 1 + N^2 R/4Z_0$

$P[\text{dBm}] = P_m[\text{dBm}] + 10 \log_{10} k$

$N=10, Z_0=50$ $R_e=R+2$ $k=1+R/2$
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Figure 4: PSD Measurement by Differential-Mode Current Transformer

PSDの負荷インピーダンス依存性

PLC modem DM: Open Voltage E , Source Impedance R_s (unknown)

DM Load Impedance: R_e

Power: $P = R_e E^2 / (R_s + R_e)^2 = (E^2 / 4R_s) (2 / (x^{1/2} + 1/x^{1/2}))^2$, $x = R_e / R_s$

Maximum Power: $P_{\max} = E^2 / 4R_s$ ($x=1$)

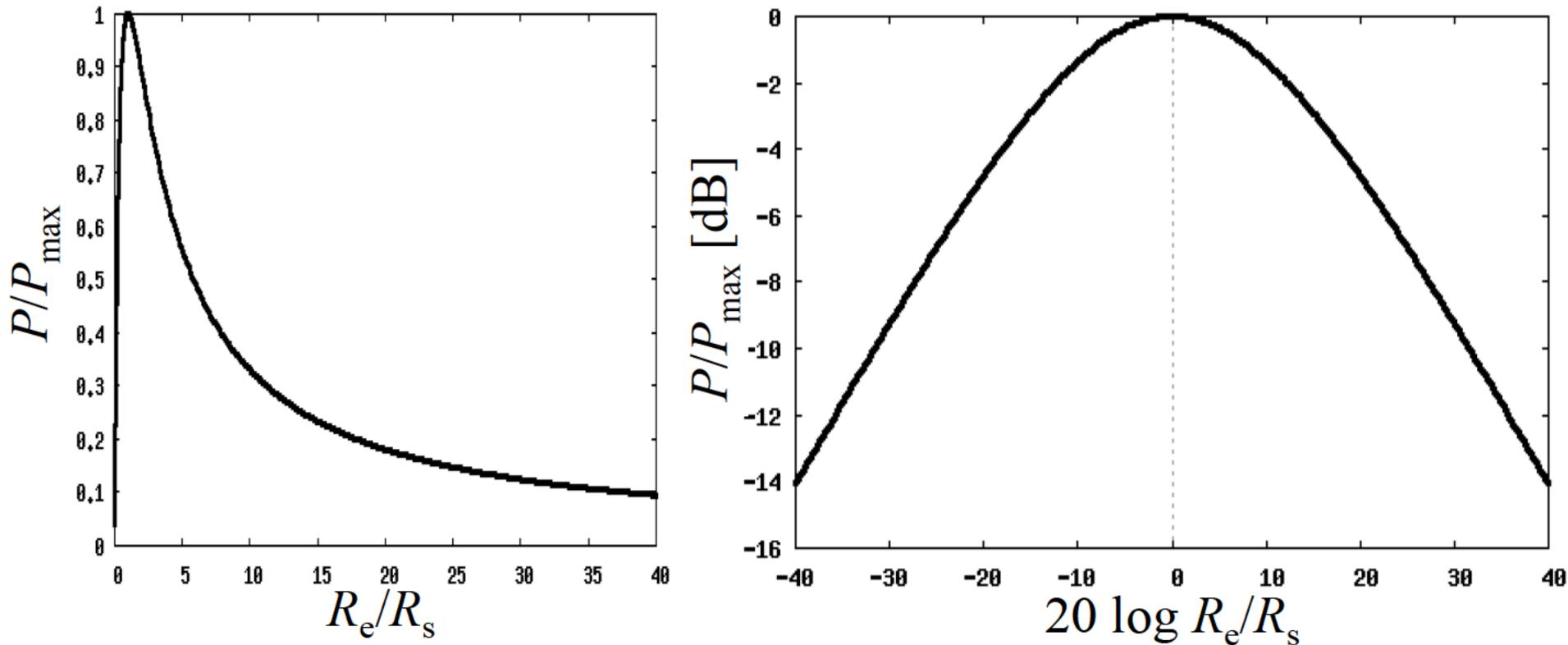


Figure 5: PSD dependence on load impedance

R_s as low as 1 Ω is reported.

$R_e = R + 2$, $R = 0, 1.0, 2.2, 4.7, 10, 22, 47, 100$ (E3 series, minimum req.)