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### ***Product Note 24***

## **Setup Configurations for Very Low Impedance Tuning**

Standard CCMT and MTS tuners can tune accurately to reflection factors between 0.82 and 0.85. This corresponds to VSWR of 10:1 to 12.5:1 and permits to measure safely transistors with internal resistances  $Z_{in}$  of 4 to 5  $\Omega$ . Tuners with option -HR (High Reflection [1]) can tune to VSWR of 20:1 ( $\Gamma=0.904$ ,  $Z_{in}=2.5 \Omega$ ). To measure transistors with lower internal resistance we recommend to use transforming networks [2]. The main reasons for this are the accuracy and reproducibility of the tuners as well as the accuracy of calibration and measurement of the network analyzers [2].

### **Setup Recommendations**

DUT Resistance	Required VSWR	Corresponding $\Gamma$	Recommended Solution
5 $\Omega$	>10:1	0.818	Standard CCMT/MTS
2.5 $\Omega$	>20:1	0.906	CCMT/MTS -HR option
1 $\Omega$	>50:1	0.961	CCMT/MTS + one 20 $\Omega$ $\lambda/4$ Transformer
0.5 $\Omega$	>100:1	0.980	" " "
0.2 $\Omega$	>250:1	0.992	CCMT/MTS -HR + one 10 $\Omega$ $\lambda/4$ Transformer
0.1 $\Omega$	>500:1	0.996	" " "

Single section transformers reduce instantaneous band-width to about 15%. At medium and high frequencies ( $f > 4$ GHz) multi-sectional transformers can be designed and manufactured covering bandwidth such as 6 to 18 GHz or 10 to 40 GHz.

[1] "RF tuner with Very High VSWR, model MTS-308-HR", Product Note 17, Focus Microwaves, August 1994.

[2] "Load Pull Measurements on Very Low Impedance Transistors", Appl. Note 6, Focus Microwaves, November 1993.

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