SERVICE NOTE

Supersedes: None

EXTENDING HP 8512A, 8514A TEST SET FREQUENCY COVERAGE

The HP 8512A R/T and the 8514A S-Parameter Test Sets for the HP 8510 Network Analyzer are specified to operate from 500 MHz to 18 GHz. But what about using these test sets below 500 MHz and above 18 GHz?

The HP 8512A test set will work fine for transmission measurements all the way down to 45 MHz, since the signal path for the test channel is directly applied to the frequency converter. This is already specified in the data sheet. However, when using the HP 8512A in reflection and the HP 8514A in both reflection and transmission, the signal path for the test channel goes through internal couplers in the test sets. The coupling factor of these couplers rolls off at about 6 dB per octave below about 1.8 GHz, but directivity and port match remain good.

This has the effect of reducing the dynamic range and signal-to-noise ratio (raising the noise floor) in the test channel as frequency decreases. The reduction is about 30 dB at 45 MHz. Since the test-channel signal level is lower, dynamic accuracy will also suffer. A lower signal-to-noise ratio results in reduced accuracy when measuring high return loss (small reflection coefficient) devices or high insertion loss devices (HP 8514A only). A notable example is that when using time domain lowpass to measure such devices, the vertical trace level (derived from the performance of the device at low frequencies) will have much more noise with these test sets as compared to the HP 8513A and 8515A 45-MHz to 26.5-GHz test sets. Averaging can reduce this noise or "trace bounce."

The effects of the coupler rolloff were judged to be small to about 500 MHz, and so the HP 8512A (reflection only) and 8514A test sets are hard-specified to these frequencies. These test sets are quite usable down to 45 MHz as long as you are aware of their capabilities.

Since the frequency response of the HP 8512A (reflection) and HP 8514A test sets rolls off quickly, measurements will benefit by using a source with excellent source frequency accuracy and residual FM. The HP 8341A Synthesized Sweeper operated in stepped mode is highly recommended.

None of the HP 8510 test sets can be reliably operated below 45 MHz. The reason is that the analyzer can lock up to the second harmonic of the 20-MHz IF rather than to the RF test signal.

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Now let's turn our attention to performance above 18 GHz. The HP 8512A and 8514A test sets may be operated to 20 GHz. However, there is a connector bead resonance in 7mm connectors just above 18 GHz which can affect magnitude measurements by several tenths of a dB in magnitude and several degrees in phase. Above 19.2 GHz, the 7mm transmission line geometry supports a higher order mode, which affects measurement accuracy in an unpredictable fashion.

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