May 17, 2010

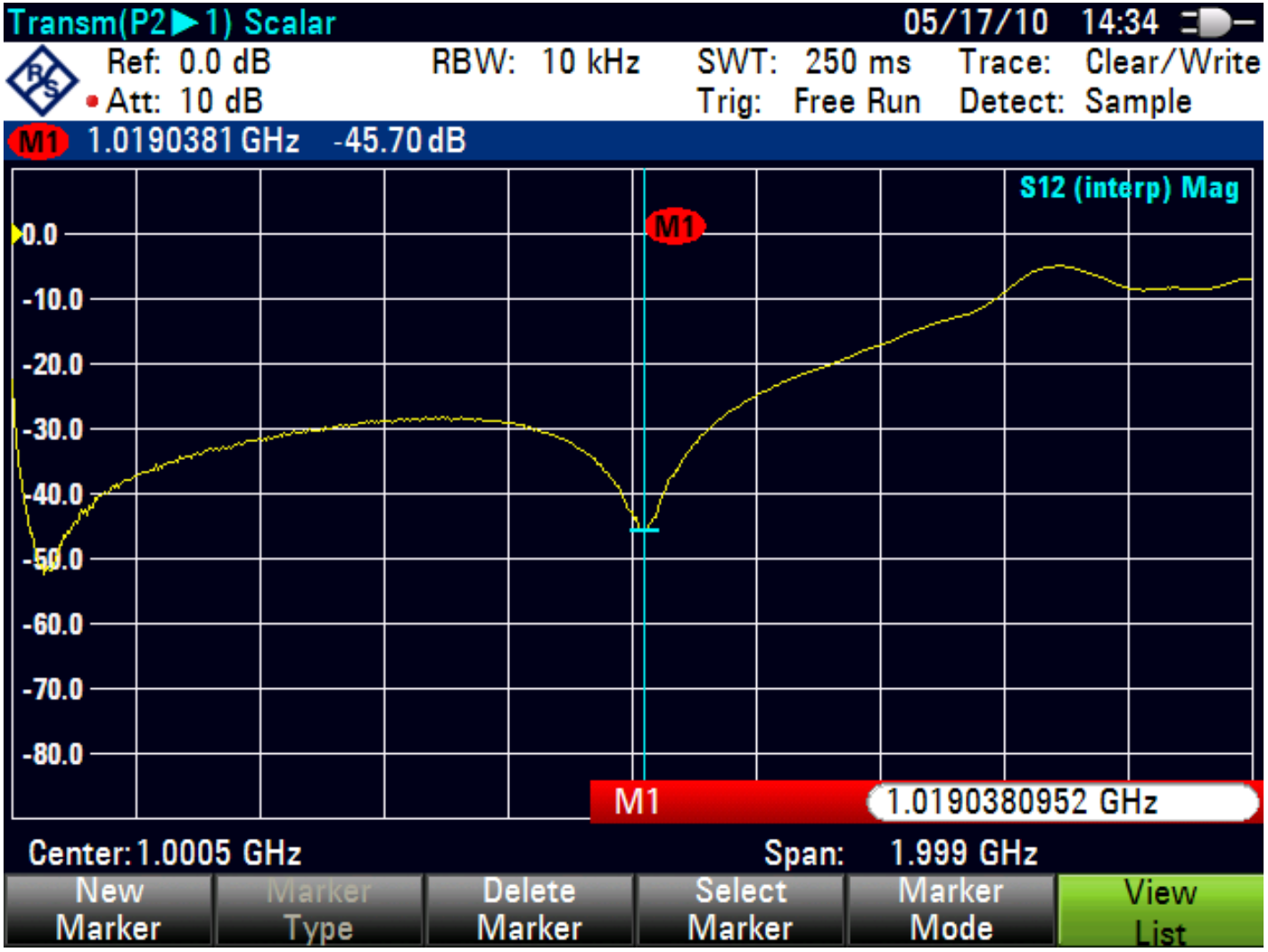
Introduction

The following waveforms measure port-to-port 'isolation' values between output ports on a standard 1 GHz 2-way splitter compared with a DC-9 directional coupler, with an intent in assessing whether DC-9's offer additional isolation in combining networks, as has often been suggested. All measurements were taken with a Rohde & Schwarz FSH818 Spectrum analyzer & tracking generator, with test lead and adaptor losses 'normalized' to the 0 dB reference line, therefore the *loss values* shown on the diagrams are the precise (accuracy better than .1 dB) insertion loss and/or isolation values. The horizontal (frequency) axis is from 0 to 2 GHz.

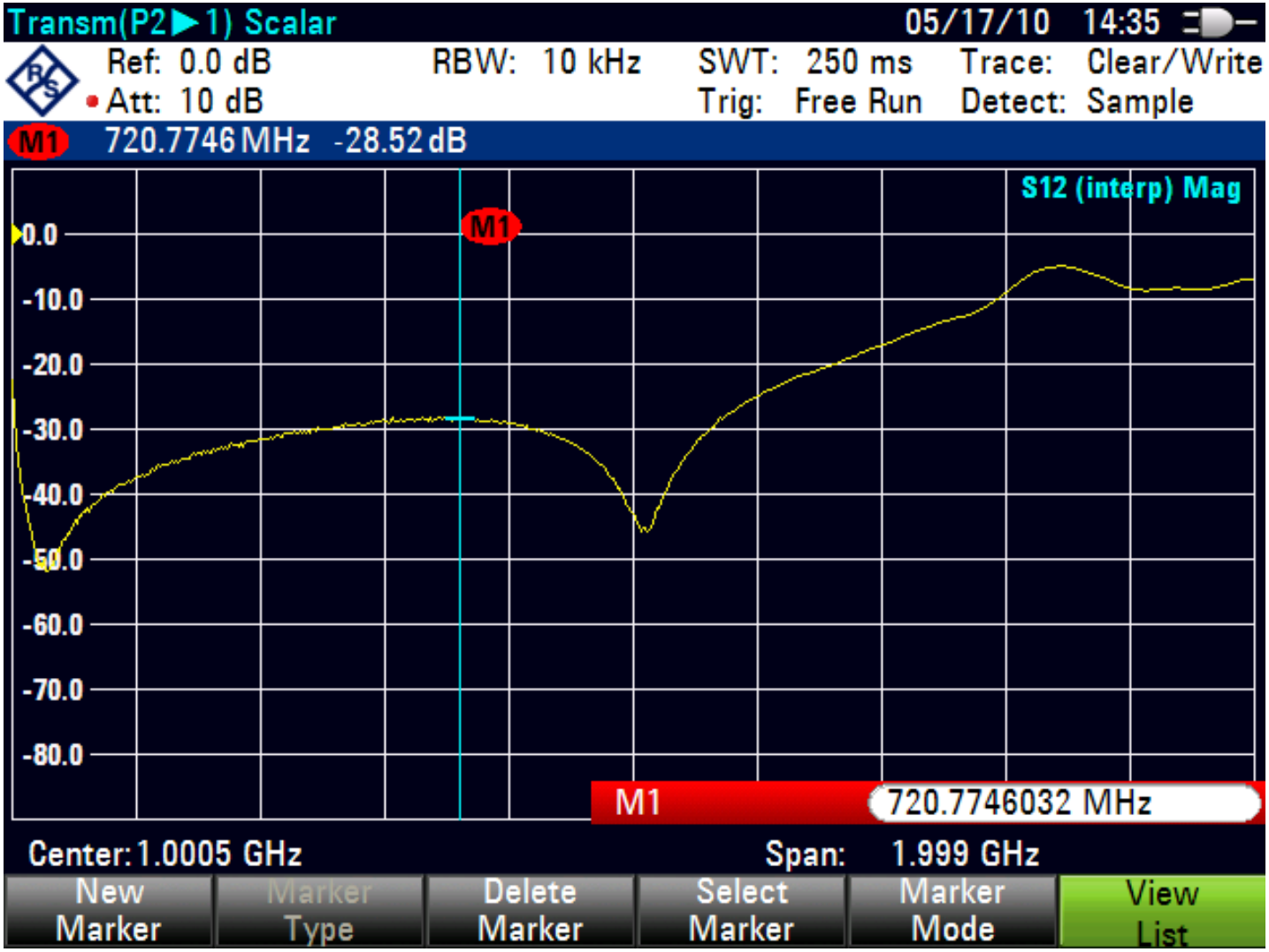
Conclusion

After a review of the measurements in this document, one can summarize as follows.

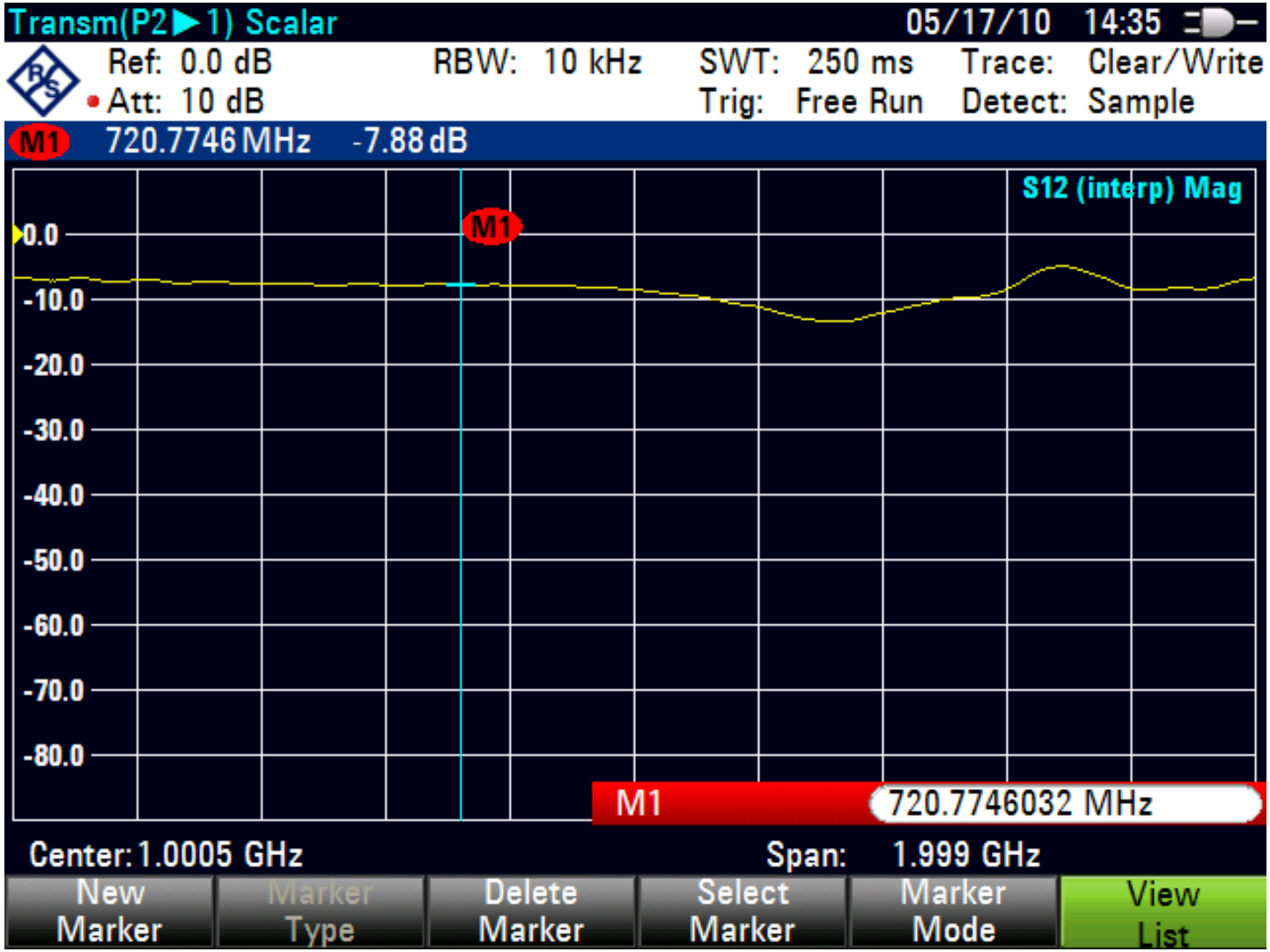
- At certain frequencies, the DC-9 does appear to offer superior isolation as compared to a 2W splitter. For example, the best-case isolation at any frequency (0 to 1 GHz) for the DC-9 was 53.7 dB, as compared to 45.7 dB for the 2W. On average, however, the isolation values are comparable to each other when viewed over the entire 0 to 1 GHz bandwidth.
- What is far more important, as can be seen through waveform examination, is whether proper splitter/coupler port (75 ohm) impedance is maintained. Since a splitter or coupler, by itself, does not have a 75 ohm impedance; this reinforces why **distributed padding** is vitally important in FDM (combiner) networks, where small pad values, evenly distributed throughout the combining circuitry, 'force' a good 75 ohm match on the input and output of all passive components and thus keep isolation values as high as possible.



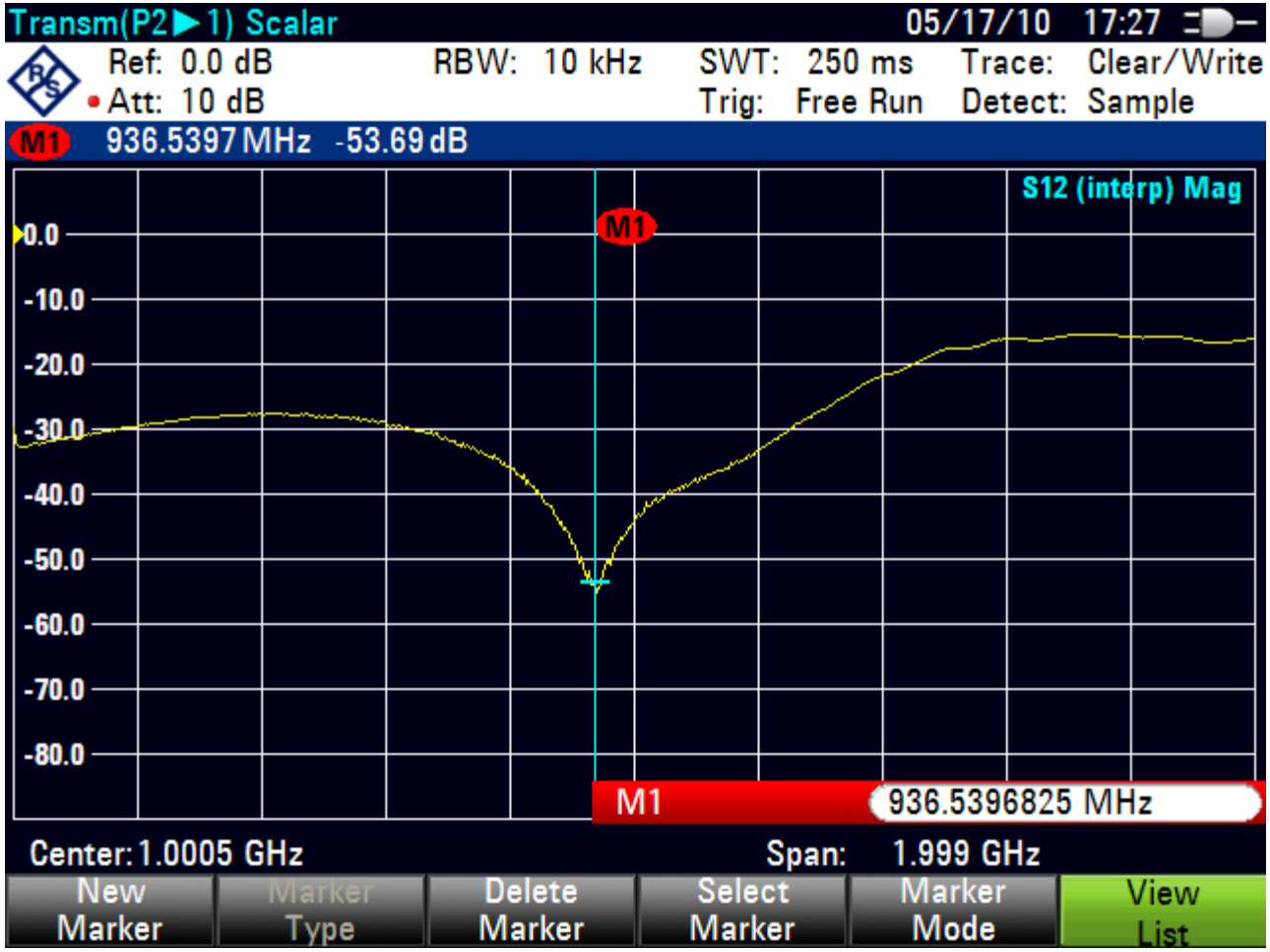
2W splitter output port-to-port isolation with the input port properly terminated. Isolation at 1 GHz is 45.7 dB.



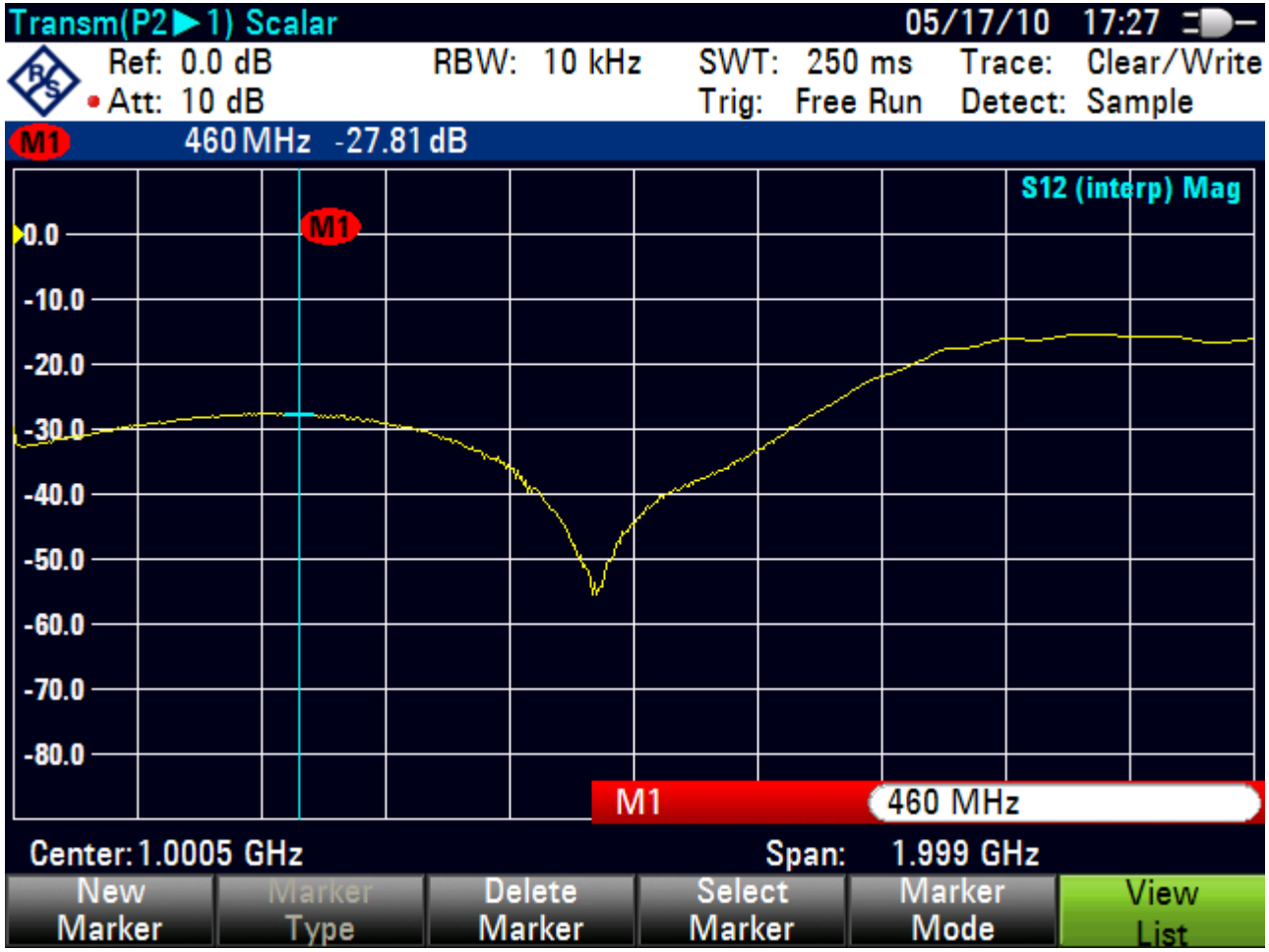
2W splitter output port-to-port isolation with the input port properly terminated.
The worst-case isolation from 0 to 1 GHz is 28.5 dB at 720 MHz.



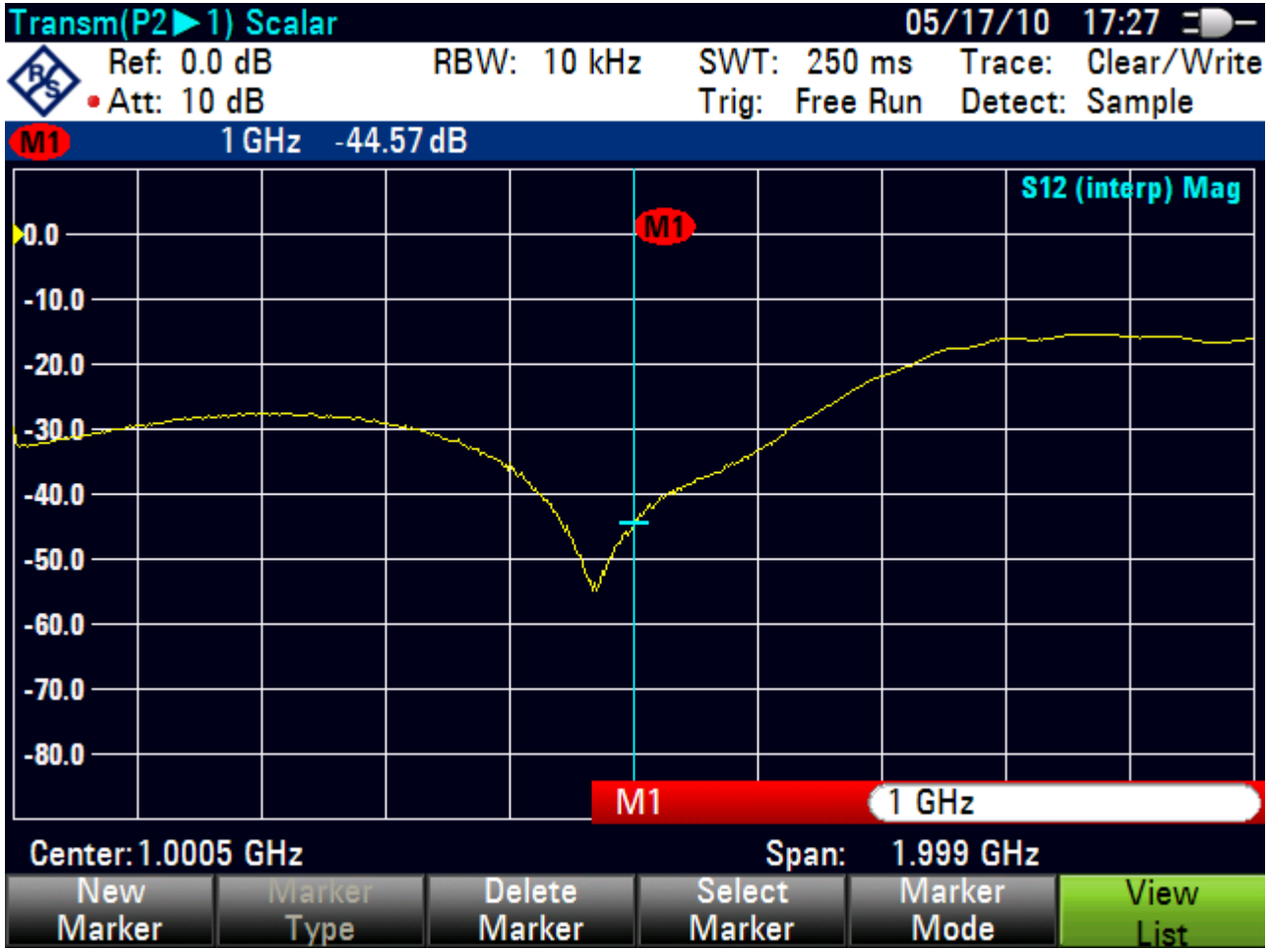
This final waveform shows the effect on **2W splitter** port-to-port isolation when the input port has a poor impedance match. The isolation value at 720 MHz is now only 7.88 dB, as compared to 28.5 dB, where the input has a good 75 ohm match.



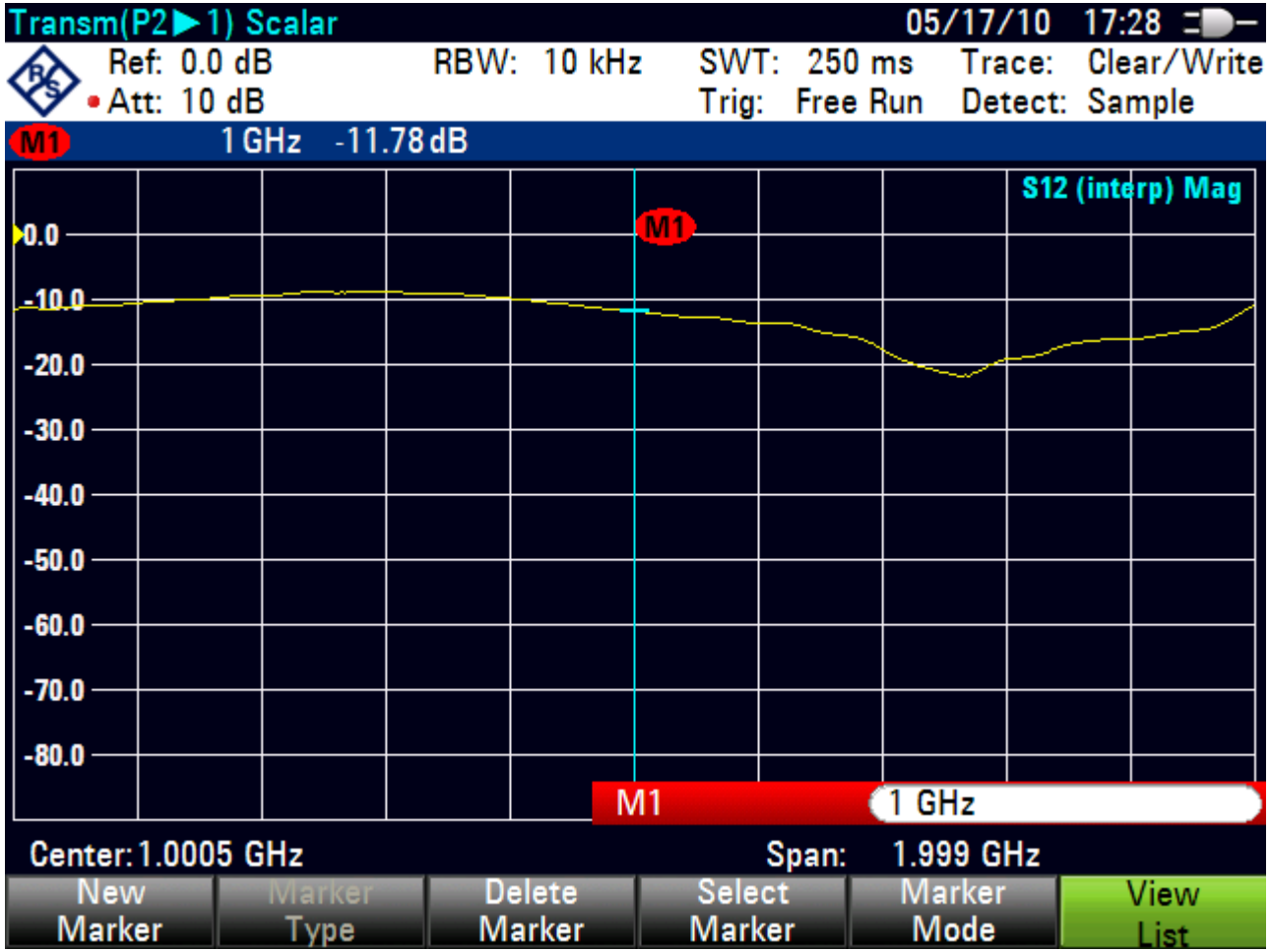
DC-9 isolation is now measured from the 'tap' to the 'output' port (TG signal injection at tap leg), with the input port terminated. The best-case isolation value is a whopping 53.7 dB, measured at approx. 936.5 Mhz.



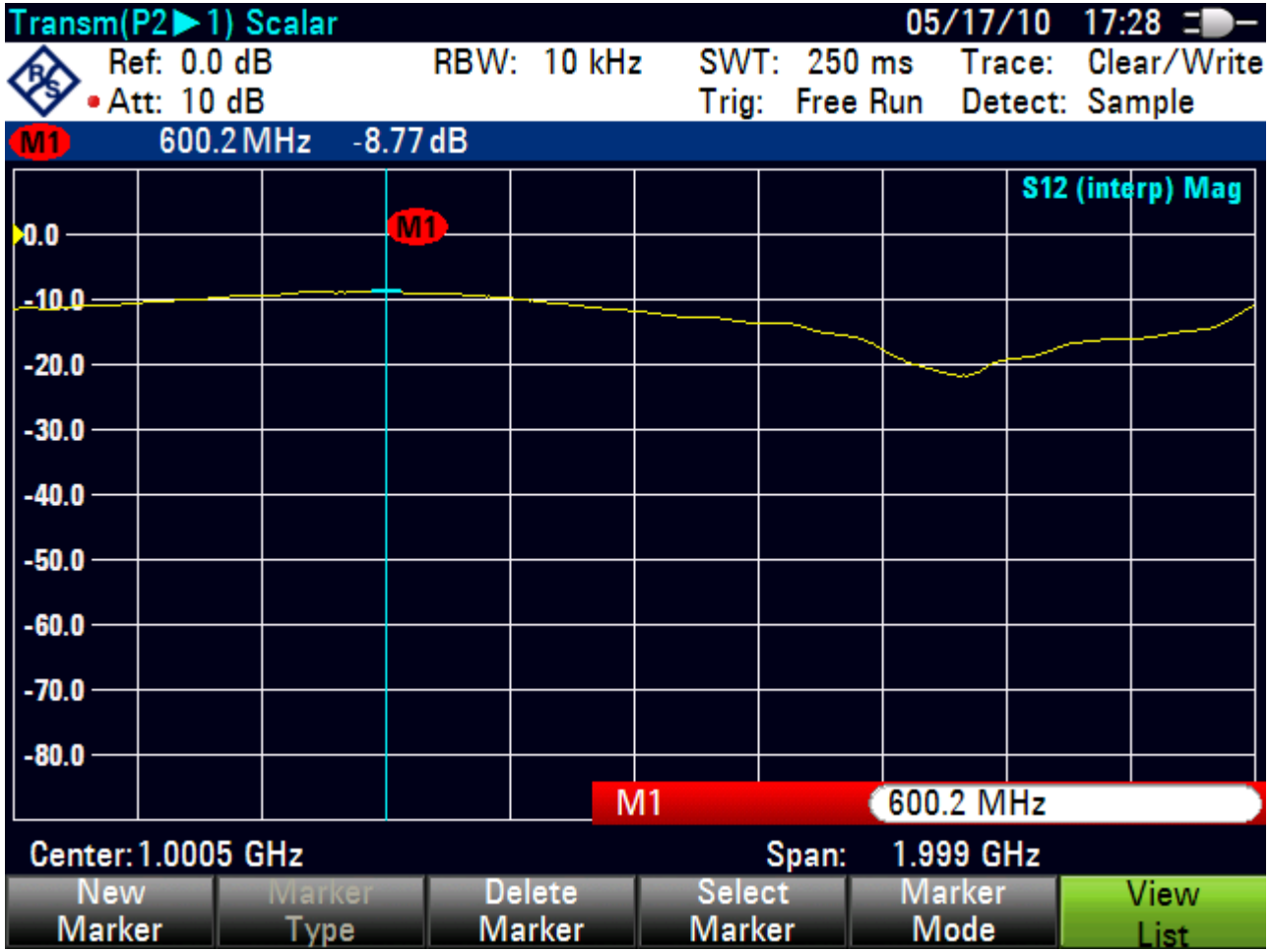
DC-9 isolation is now measured from the 'tap' to the 'output' port (signal injection at tap leg), with the input port terminated. The worst-case isolation value is 27.8 dB, measured at 460 Mhz. *This is 25.9 dB worse than the isolation at 936 MHz!*



DC-9 isolation 'Tap port' to 'output port' isolation at 1 GHz is 44.6 dB.



DC-9 isolation is now measured from the 'tap' to the 'output' port (signal injection at tap leg), with a **poor impedance** match on the input port. The isolation at 1 GHz is only 11.8 dB.



DC-9 isolation is now measured from the 'tap' to the 'output' port (signal injection at tap leg), with a **poor impedance** match on the input port. The isolation value at 600 MHz is only 8.8 dB.

Comparison Summary

Type	Best Case Isolation	Worst Case Isolation (proper Z maintained)
2Way	45.7 dB	28.5 dB
DC-9	53.7 dB	27.8 dB