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To: EDGES Group

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Subject: Test of absolute accuracy of N5222A VNA

The Agilent N5222A VNA was calibrated using the Maury 804831 open, Maury 8047 short and Anritsu OSLK50 load. Values for the short delay (16.684 ps) and the delay (14.49 ps) and C0, C1, C2, C3 for the open were entered into the N5222A. the Anritsu load was used because its measured resistance was  $50.00 \pm 0.01 \Omega$ , whereas the Maury load was  $50.2 \Omega$ . The error in the Maury load would require another step to correct (see memo 93). The resistance of 2 attenuators were carefully measured using a Fluke 8845A precision multimeter with female port open. The S11 of these attenuators was then measured at 150 MHz. The following results were obtained:

atten. Nominal (dB)	resistance $\Omega$	calculated S11 (dB)	measured (dB)
7	$74.31 \pm 0.01$	$-14.174 \pm 0.003$	-14.180
6	$85.68 \pm 0.01$	$-11.602 \pm 0.003$	-11.605

These 2 tests provide some confidence that the high quality N5222A can provide an accuracy of 0.01 dB for S11 ~ 15dB. The measurements of the resistance was made by connecting the ohmmeter clip lead to a SMA male connector. The ohm meter the measured the attenuator following by the Maury short whose value ( $\sim 0.08 \Omega$ ) included the lead resistance was subtracted. Also a check was made for contact potentials by reversing the lead polarity. It was noted that both attenuators had a temperature coefficient of  $-0.002 \Omega / ^\circ C$ . It was noted that while measurements with the VNA were highly repeatable and not dependent on the tightness of the connection the resistance measurements were more subject to the connection and were only reliably repeatable at the 0.01  $\Omega$  level.

Some measurements were also made with the Agilent FieldFox VNA but were found to drift rapidly with initial agreement with the N5222A at the 0.01 to 0.02 dB level.