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Product Note No 11A

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4 to 26.5 GHz Coaxial Programmable Tuner Model 2604

The coaxial programmable tuners, model 2604 operate from 4 to 26.5 GHz using precision 3.5mm connectors. Different versions operate from 2 to 30 GHz in different bands [1].
They are using a rugged chassis with two 1.8° stepper motors and a precisely machined aluminum slabline with a cutoff frequency beyond 30 GHz (figure 1). A single slotted and polished Berrylium Copper RF slug is permanently fixed on the teflon stabilized vertical axis and ensures minimum loss and high phase tuning stability.
The RF slug is moved in, out and along the slabline to generate controllable Γ and phase. The probe's horizontal play during vertical movement is less than ±1µm in total. The slug is sliding on the walls of the slabline for perfect ground contact and negligible microphonics (sensitivity of the RF parameters to mechanical vibrations).
The 2604 tuners are fully compatible with the IBM®-PC based CCMT control and measurement software for Calibration, Noise and Load Pull measurements. Obtainable VSWR exceeds 10:1, and reaches up to 15:1 in most parts of the band (figures 2,4). The 2604 tuners are also available at modified frequency bands (2.5 to 24 GHz or 6 to 30 GHz [1]) and represent a wide band 50Ω load at the lower frequencies keeping this way most devices from spurious oscillations.

2604 Tuner Characteristics

Frequency Range [1]	4 - 26.5 GHz using a single RF slug
VSWR min	1.15:1
VSWR max	10:1 (15:1)
Insertion Loss	0.6 dB max @ VSWR min
RF resetability	45 dB min
Calibration	181 or 361 impedances per frequency (figure 2).
Tuning Resolution	0.14°/step @ 26.5 GHz
Max Tunable points	>3,300,000 @ 26.5 GHz
Mechanical - Accuracy	±1 step
Step Size	Vertical 1.5µm, Horizontal 2.95µm
RF Connectors	GPC-3.5 mm
Overall Size	7.8 x 6 x 5 inches
Weight	4.3 kg
Power Handling	20 W CW (connector limitation)
Operation	Automatic - Manual - Mouse Tuning for test fixture or 'on wafer' setups.

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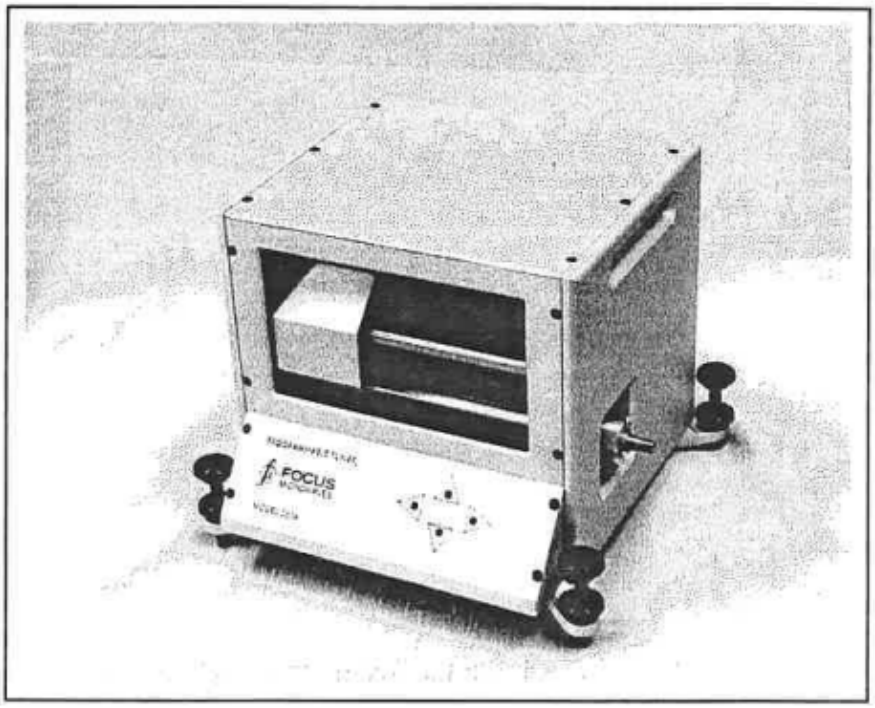

Figure 1: CCMT model 2604 (4 to 26.5 GHz)

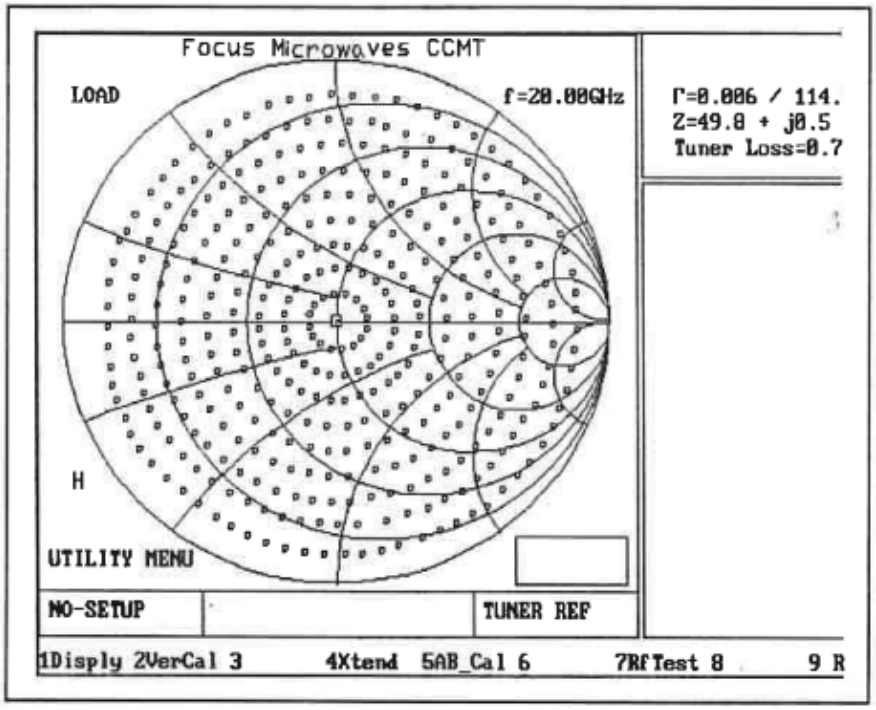

Figure 2: 2604 High Density Calibration (20 GHz , VSWR max≈15:1)

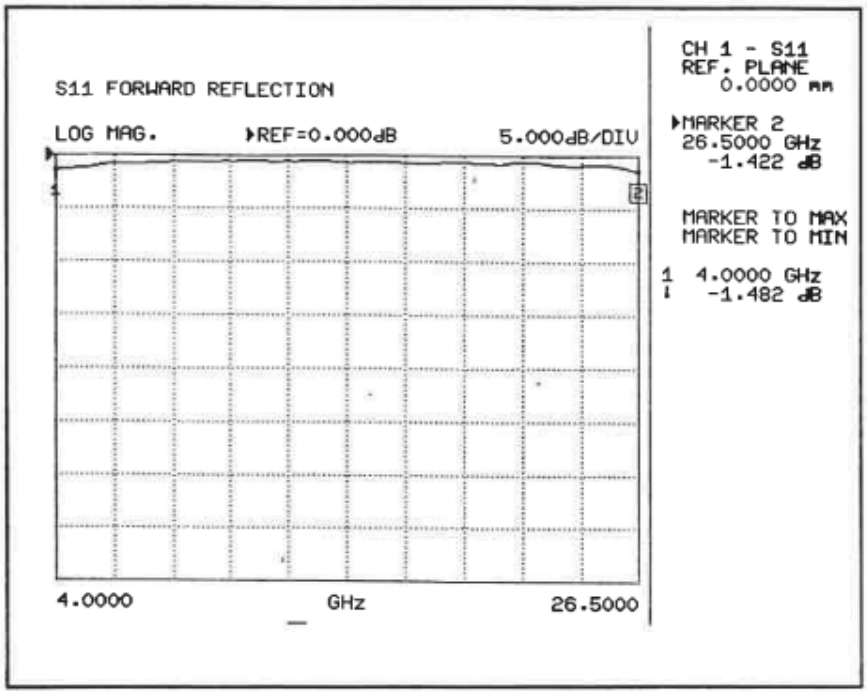

Figure 3: CCMT-2604 Frequency Response (Maximum Reflection)

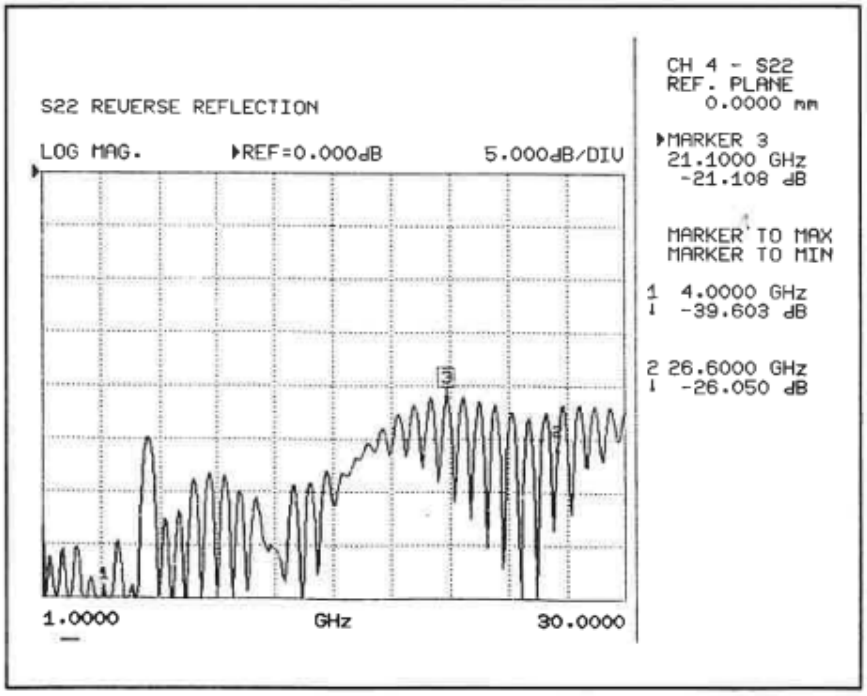

Figure 4: CCMT-2604 Frequency Response (Residual Reflection)

RF-Resetability over 10 Cycles (0.001->60dB, 0.0001->80dB)

TUNER 109, Frequency = 26.000 GHz

Point	δ|S11|	δφ11°	δ|S12|	δφ12°	δ|S21|	δφ21°	δ|S22|	δφ22°
1:	0.0000,	0.02	-0.0001,	0.00	-0.0001,	-0.00	0.0001,	0.22
2:	-0.0000,	-0.19	-0.0000,	-0.01	-0.0001,	0.00	-0.0000,	0.18
3:	0.0000,	-0.18	0.0000,	-0.01	0.0001,	0.00	-0.0001,	0.16
4:	0.0002,	-0.19	-0.0001,	-0.00	-0.0000,	-0.01	0.0001,	0.14
5:	-0.0000,	-0.18	-0.0001,	0.01	0.0000,	-0.00	-0.0001,	0.15
6:	0.0003,	-0.15	-0.0000,	-0.00	0.0001,	-0.00	-0.0000,	0.14
7:	-0.0000,	-0.14	-0.0000,	0.01	0.0002,	0.00	-0.0001,	0.16
8:	0.0002,	-0.16	0.0001,	0.01	0.0000,	0.01	-0.0000,	0.18
9:	-0.0001,	-0.17	-0.0000,	-0.01	0.0002,	0.01	-0.0003,	0.16
10:	-0.0001,	-0.17	0.0001,	-0.01	0.0000,	-0.01	-0.0002,	0.15
11:	-0.0000,	-0.14	0.0000,	-0.00	0.0001,	-0.01	-0.0000,	0.13
12:	0.0003,	-0.20	-0.0007,	-0.02	-0.0006,	-0.01	0.0000,	0.18
13:	0.0000,	-0.16	0.0003,	0.00	0.0001,	-0.01	-0.0003,	0.14
14:	-0.0002,	-0.17	0.0012,	-0.04	0.0012,	-0.02	-0.0002,	0.14
15:	-0.0006,	-0.24	-0.0002,	-0.00	-0.0001,	0.01	-0.0001,	0.26
16:	0.0000,	-0.21	-0.0006,	0.02	-0.0002,	0.02	0.0000,	0.20
17:	0.0006,	-0.20	-0.0010,	0.03	-0.0010,	0.01	0.0005,	0.25
18:	0.0002,	-0.22	0.0003,	-0.04	-0.0001,	-0.01	0.0003,	0.21
19:	0.0003,	-0.28	-0.0008,	0.00	-0.0007,	-0.03	0.0002,	0.25
20:	-0.0004,	-0.22	0.0019,	-0.05	0.0018,	-0.05	-0.0007,	0.14
21:	-0.0002,	-0.17	0.0007,	0.00	0.0007,	-0.02	-0.0002,	0.10
STD.DEV=	0.0002,	0.19	0.0006,	0.02	0.0006,	0.02	0.0002,	0.18

Figure 5: CCMT-2604 RF tuning resetability measured at 10 runs over the same set of Impedances at 26 GHz.

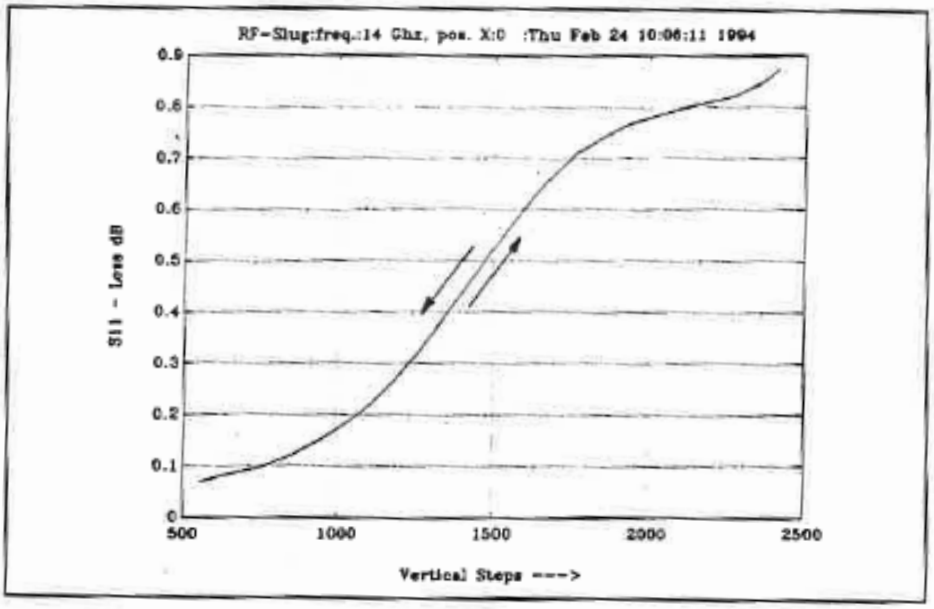

Figure 6: Hysteresis of S11 as a function of Vertical Position. Frequency = 14 GHz.