



S5048 VECTOR NETWORK ANALYZER
REFLECTION COEFFICIENT ERRORS AND DRIFT

ADDITIONAL ANALYSIS

(Upon customer request)

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Measurement Report
 Supplementary information
 Reflection coefficient errors and drift by using S5048 vector network analyzer

Instrument specification:

Table 1

Effective system data	Value [dB]	Value [lin]
Directivity E_d	46	0.005
Source match E_s	40	0.010
Reflection tracking E_r	0.10	1.012

Applies over the temperature range of $(23 \pm 5) ^\circ\text{C}$ after 40 minutes of warming-up, with less than $1 ^\circ\text{C}$ deviation from the full one-port calibration temperature, using suitable calibration kit, at output power of -5 dBm. Receiver noise floor and trace noise parameters have a little impact on reflection measurement accuracy.

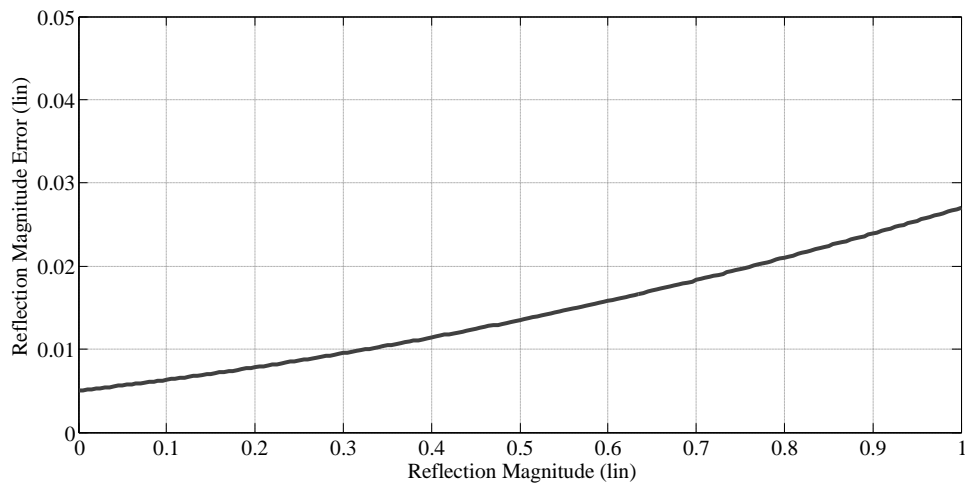
Systematic errors of the reflection magnitude in dB or linear scale (dimensionless) can be calculated by formulas below:

$$\Delta S_{11} [\text{dB}] = -20 \cdot \log[1 - (10^{-E_d/20} + (1 - 10^{-E_r/20}) \cdot 10^{-S_{11}/20} + 10^{-E_s/20} \cdot 10^{-S_{11}/10}) / 10^{-S_{11}/20}] \quad (1)$$

$$\Delta S_{11} [\text{lin}] = E_d + (E_r - 1) \cdot S_{11} + E_s \cdot S_{11}^2 \quad (\text{all parameters in lin scale}) \quad (2)$$

$$\Delta S_{11} [\text{lin}] = 0.005 + 0.012 \cdot S_{11} + 0.010 \cdot S_{11}^2$$

S_{11} – measured reflection magnitude value from 0 to 1, dimensionless



Drift of the parameters over temperature range from 18 °C to 32 °C. Here is considered that the system calibration was performed at 18 °C, and measurement was conducted at 32 °C, without recalibration.

Table 2

System data drift	Value [dB]	Value [lin]
Directivity E_d		
up to 2 GHz	45	0.006
above 2 to 4.8 GHz	37	0.014
Source match E_s		
up to 2 GHz	45	0.006
above 2 to 4.8 GHz	50	0.003
Reflection tracking E_r		
up to 2 GHz	0.05	1.006
above 2 to 4.8 GHz	0.20	1.023

$$\Delta S_{11.total} [lin] = \Delta S_{11.spec} [lin] + \Delta S_{11.drift} [lin] \text{ (all parameters in lin scale)}$$

where $\Delta S_{11.total}$ – total measurement error;

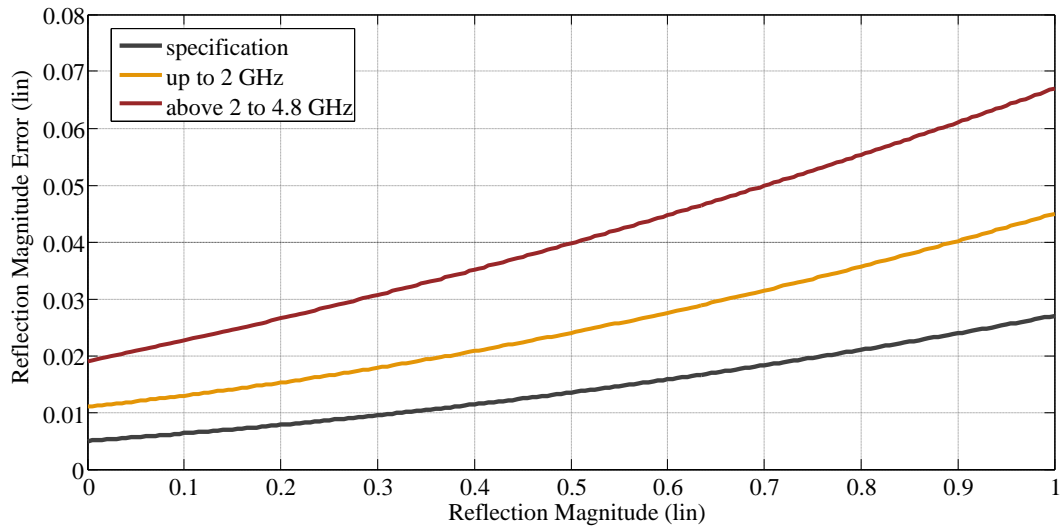
$\Delta S_{11.spec}$ – error in accordance with the specification (formula 2, Table 1);

$\Delta S_{11.drift}$ – drift error caused by temperature changing (formula 2, Table 2).

$$\Delta S_{11.total} [lin] = 0.011 + 0.018 \cdot S_{11} + 0.016 \cdot S_{11}^2 \text{ in frequency range up to 2 GHz}$$

$$\Delta S_{11.total} [lin] = 0.019 + 0.035 \cdot S_{11} + 0.013 \cdot S_{11}^2 \text{ in frequency range above 2 to 4.8 GHz}$$

over temperature range from 18 °C to 32 °C



Drift of the parameters over temperature range from 18 °C to 23 °C (within 5 °C). Here is considered that the system calibration was performed at 23 °C, and measurement was conducted at 18 °C, without recalibration.

Table 3

System data drift	Value [dB]	Value [lin]
Directivity E_d		
up to 2 GHz	55	0.002
above 2 to 4.8 GHz	45	0.006
Source match E_s		
up to 2 GHz	50	0.003
above 2 to 4.8 GHz	50	0.003
Reflection tracking E_r		
up to 2 GHz	0.02	1.002
above 2 to 4.8 GHz	0.08	1.010

$$\Delta S_{11.total} [lin] = \Delta S_{11.spec} [lin] + \Delta S_{11.drift} [lin] \text{ (all parameters in lin scale)}$$

where $\Delta S_{11.total}$ – total measurement error;

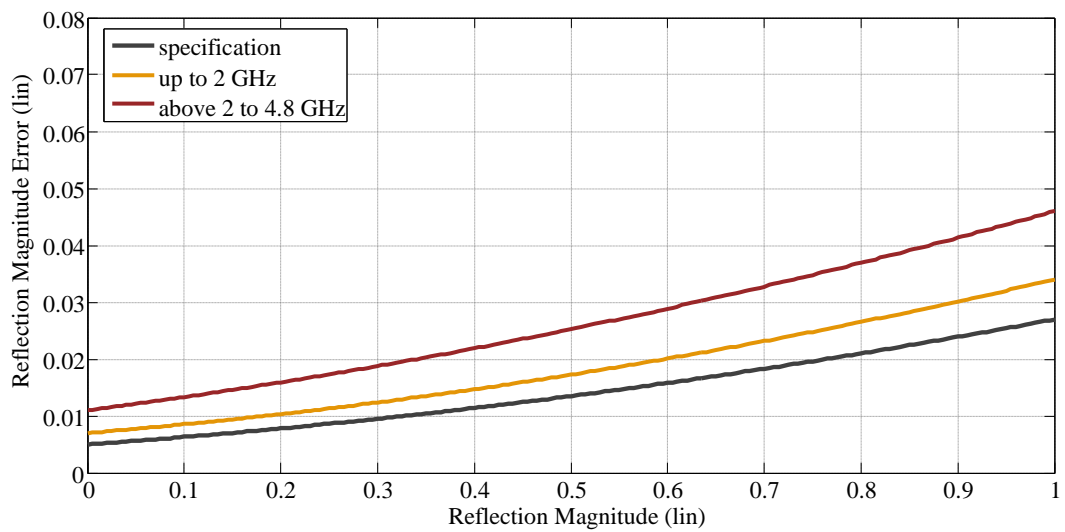
$\Delta S_{11.spec}$ – error in accordance with the specification (formula 2, Table 1);

$\Delta S_{11.drift}$ – drift error caused by temperature changing (formula 2, Table 3).

$$\Delta S_{11.total} [lin] = 0.007 + 0.014 \cdot S_{11} + 0.013 \cdot S_{11}^2 \text{ in frequency range up to 2 GHz}$$

$$\Delta S_{11.total} [lin] = 0.011 + 0.022 \cdot S_{11} + 0.013 \cdot S_{11}^2 \text{ in frequency range above 2 to 4.8 GHz}$$

over temperature range from 18 °C to 23 °C (within 5 °C)



Summary data for entire frequency range.

Table 4

System data drift	Typical value [dB/degree]	Typical value [lin/degree]
Directivity E_d	60	0.001
Source match E_s	65	0.0006
Reflection tracking E_r	0.02	1.002

$$\Delta S_{11,drift} [lin] = 0.001 + 0.002 \cdot S_{11} + 0.0006 \cdot S_{11}^2$$

Drift of the reflection magnitude measurement per every 1 °C

