

To: T10 Technical Committee  
 From: Mahbubul Bari ([bari@vitesse.com](mailto:bari@vitesse.com))  
 Subject: SAS-2 Return Loss Measurement Methodology

Revision History

R0: Initial posting  
 R1: Modified Annex B  
 R2: Applied amplitude from the network analyzer

Related Documents

<http://www.t10.org/ftp/t10/document.07/07-063r2.pdf>  
<http://www.t10.org/ftp/t10/document.07/07-007r2.pdf>  
<http://www.t10.org/ftp/t10/drafts/sas2/sas2r08.pdf>

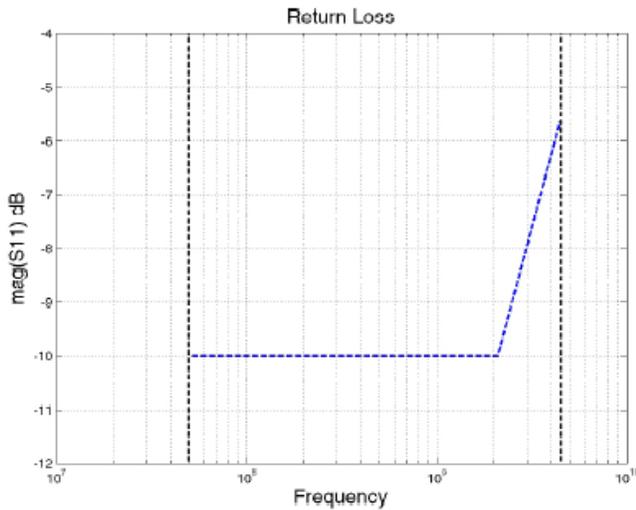
Overview

Return loss measurement methodology:

- Identify the condition of the Transmitter during the test
- Identify the applied amplitude of the network analyzer
- S-parameter measurements and conversion

Discussion and Proposal

- 1) Identify the condition of the Transmitter during return loss measurement:  
 The transmitter under test should be configured to continuously transmit D24.3 pattern. The pattern is a non-compliant repeating bit stream.
- 2) Identify the applied amplitude of the network analyzer:



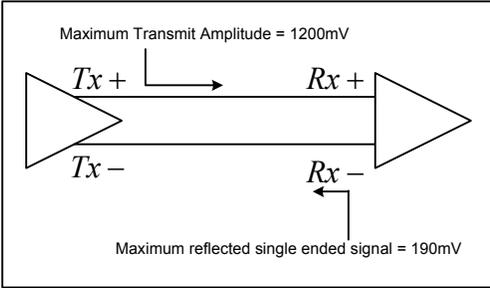
for  $50 \text{ MHz} < f < 6.0 \text{ GHz}$

$$SCC22 = SDD22$$

$$= \max \left\{ -10, -7.9 + 13.3 * \text{Log}_{10} \left( \frac{f}{3.0 \text{ G}} \right) \right\}$$

Figure xyx Receiver Differential and Common Mode Return Loss

Maximum Transmit amplitude is 1200mV.  
Receiver return loss specified at -10dB.  
Network Analyzer Amplitude should be limited to 190mV.



3) SAS2r08 - Section B.9 in Annex B describes S-parameter measurements. Clarification should be added to section B.9.3 on transmitter and receiver connection related to the S-parameter measurements. Will also include the derivation information.

VNA ports are all single-ended; the differential and common-mode properties for differential ports are calculated internal to the VNA or may mathematically derived. If using a TDNA, consult the details for the specific instrument. Four analyzer ports are required to measure the properties of two differential ports.

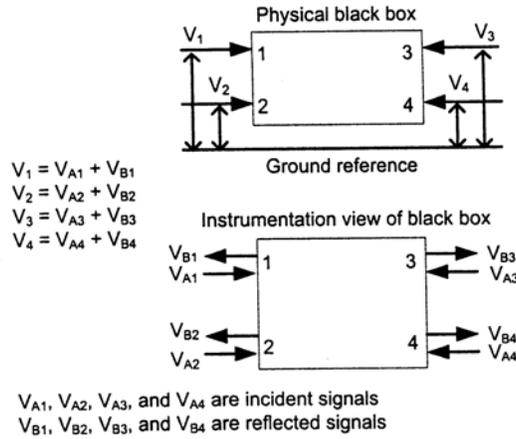


Figure B.13 — Four single-ended port or two differential port element

Figure B.14 shows the set of S-parameters for a single-ended system and for a differential system.

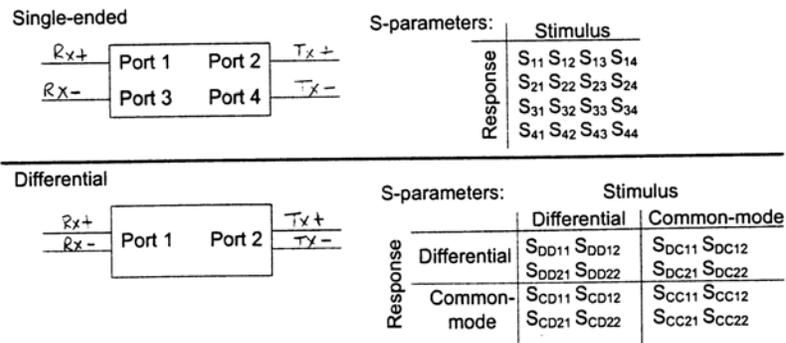


Figure B.14 — S-parameters for single-ended and differential systems

$$S_{mm} = \frac{1}{2} \begin{bmatrix} \text{SDD11} & S_{12} - S_{14} - S_{32} + S_{34} & \text{SDC11} & S_{12} + S_{14} - S_{32} - S_{34} \\ S_{21} - S_{23} - S_{41} + S_{43} & S_{22} - S_{24} - S_{42} + S_{44} & S_{21} + S_{23} - S_{41} - S_{43} & S_{22} + S_{24} - S_{42} - S_{44} \\ \text{SCD11} & S_{12} - S_{14} + S_{32} - S_{34} & \text{SCC11} & S_{12} + S_{14} + S_{32} + S_{34} \\ S_{21} - S_{23} + S_{41} - S_{43} & S_{22} - S_{24} + S_{42} - S_{44} & S_{21} + S_{23} + S_{41} + S_{43} & S_{22} + S_{24} + S_{42} + S_{44} \end{bmatrix}$$