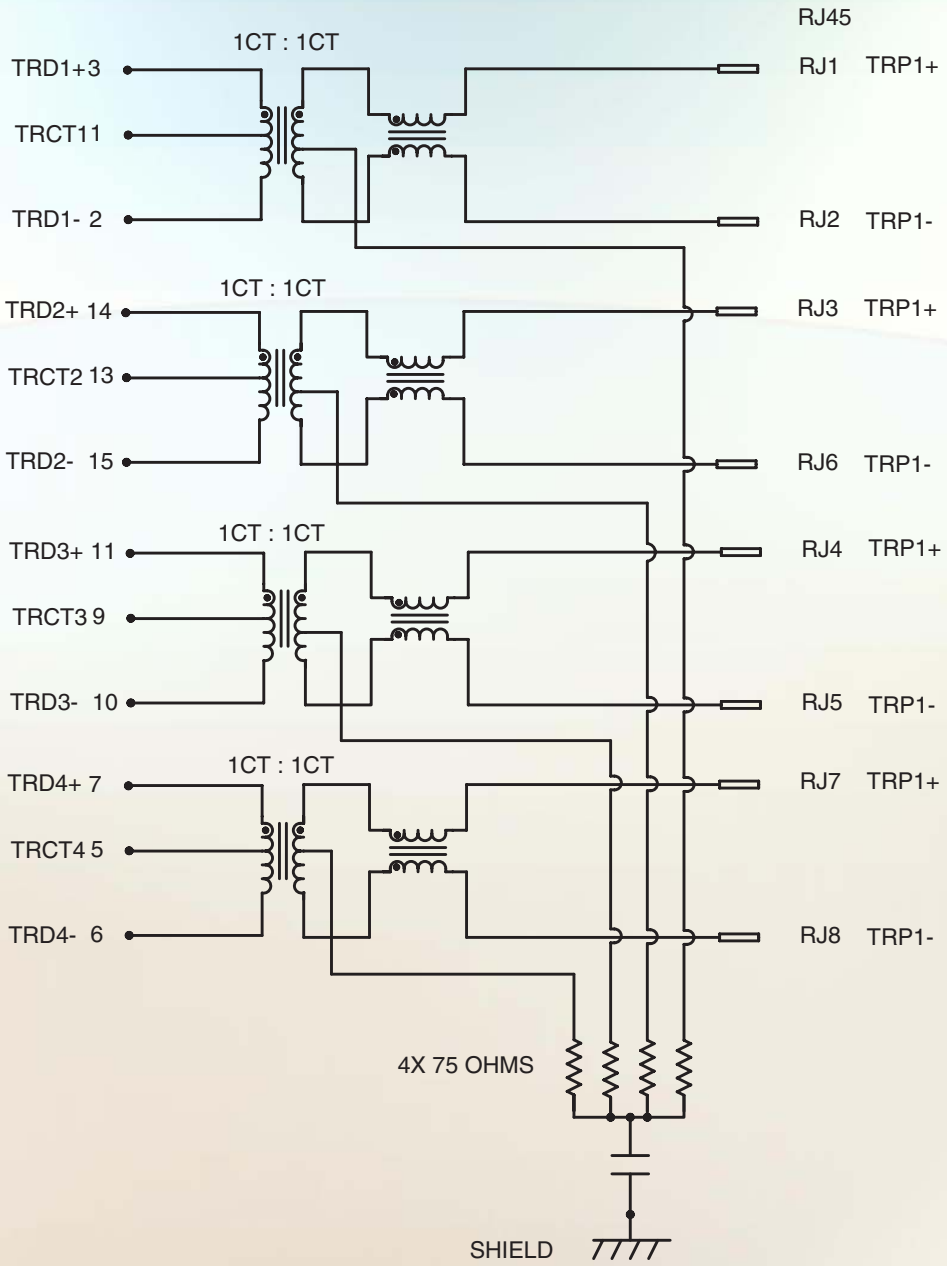
Magnetics for 10GBase-T

Brian Buckmeier
Principal Design Engineer
Bel Stewart Connector
August 22, 2005

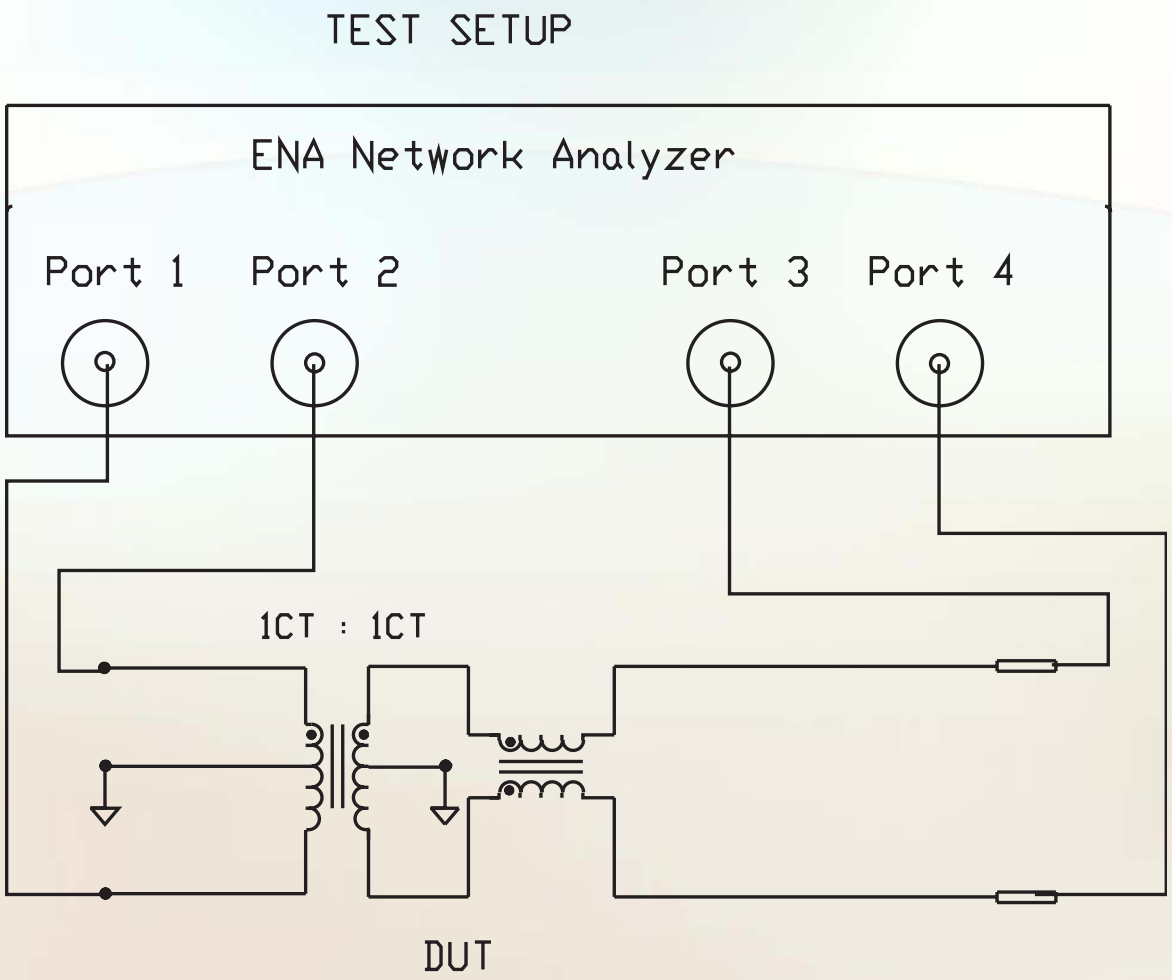
Objective

- Backward compatibility
  - Meet 350 µH OCL with bias, 0° to 70° C
  - Insertion loss 3 dB ~ 500 MHz
  - Return loss ~ 5 dB @ 500 MHz
  - Crosstalk ~ 35 dB @ 500 MHz, all pairs
  - Common to common ~ 40 dB to 1 GHz
  - Differential to common ~ 40 dB to 1 GHz
- Magnetics include common mode choke
  - Test results include Cat 6 connector and plug

Circuit


RJ45
1CT : 1CT
TRD1+3
TRCT11
TRD1- 2
RJ1 TRP1+
RJ2 TRP1-
1CT : 1CT
TRD2+ 14
TRCT2 13
TRD2- 15
RJ3 TRP1+
RJ6 TRP1-
1CT : 1CT
TRD3+ 11
TRCT3 9
TRD3- 10
RJ4 TRP1+
RJ5 TRP1-
1CT : 1CT
TRD4+ 7
TRCT4 5
TRD4- 6
RJ7 TRP1+
RJ8 TRP1-
4X 75 OHMS
SHIELD

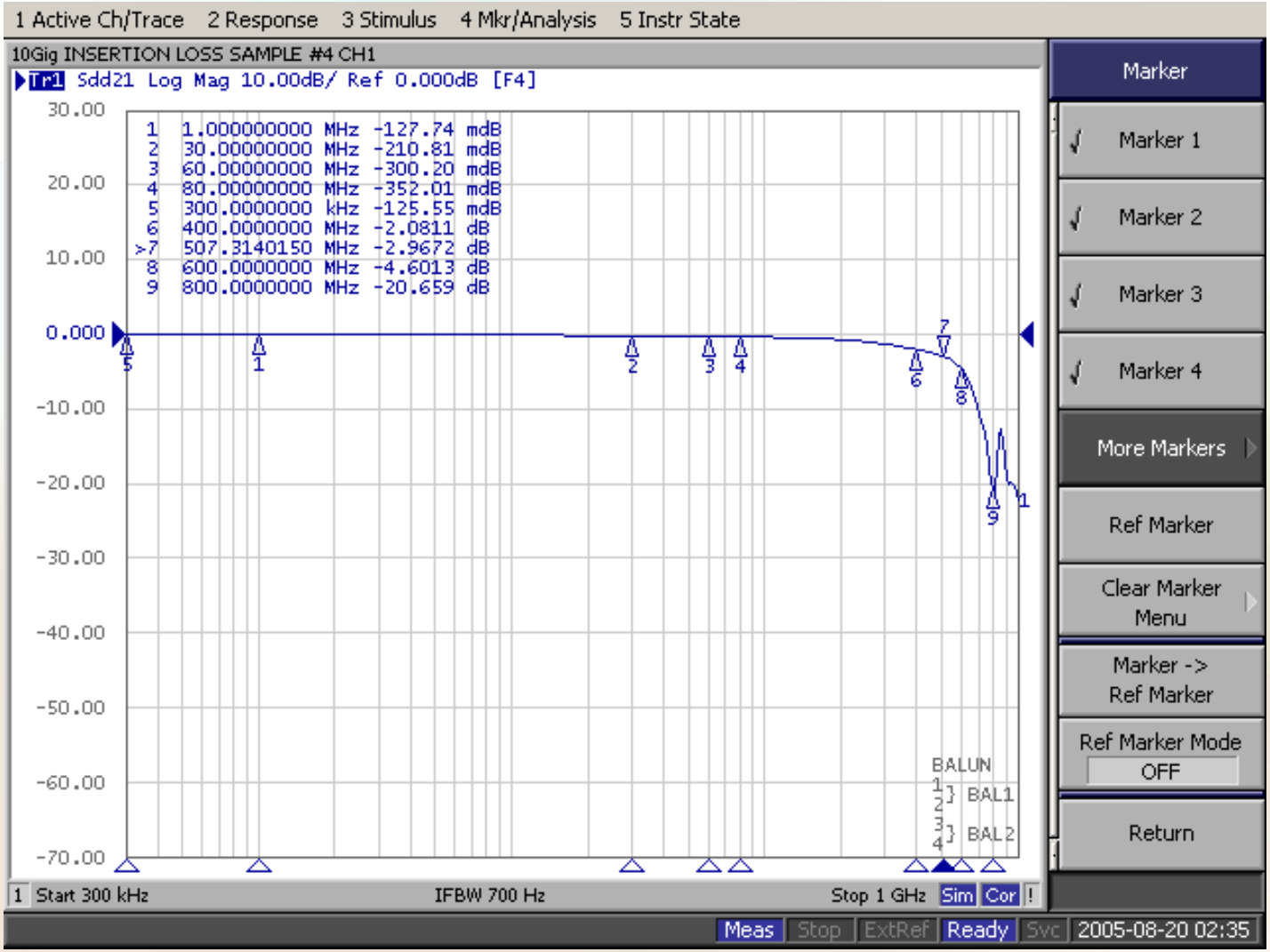
Test Setup


TEST SETUP
ENA Network Analyzer
Port 1
Port 2
Port 3
Port 4
1CT : 1CT
DUT

Insertion Loss

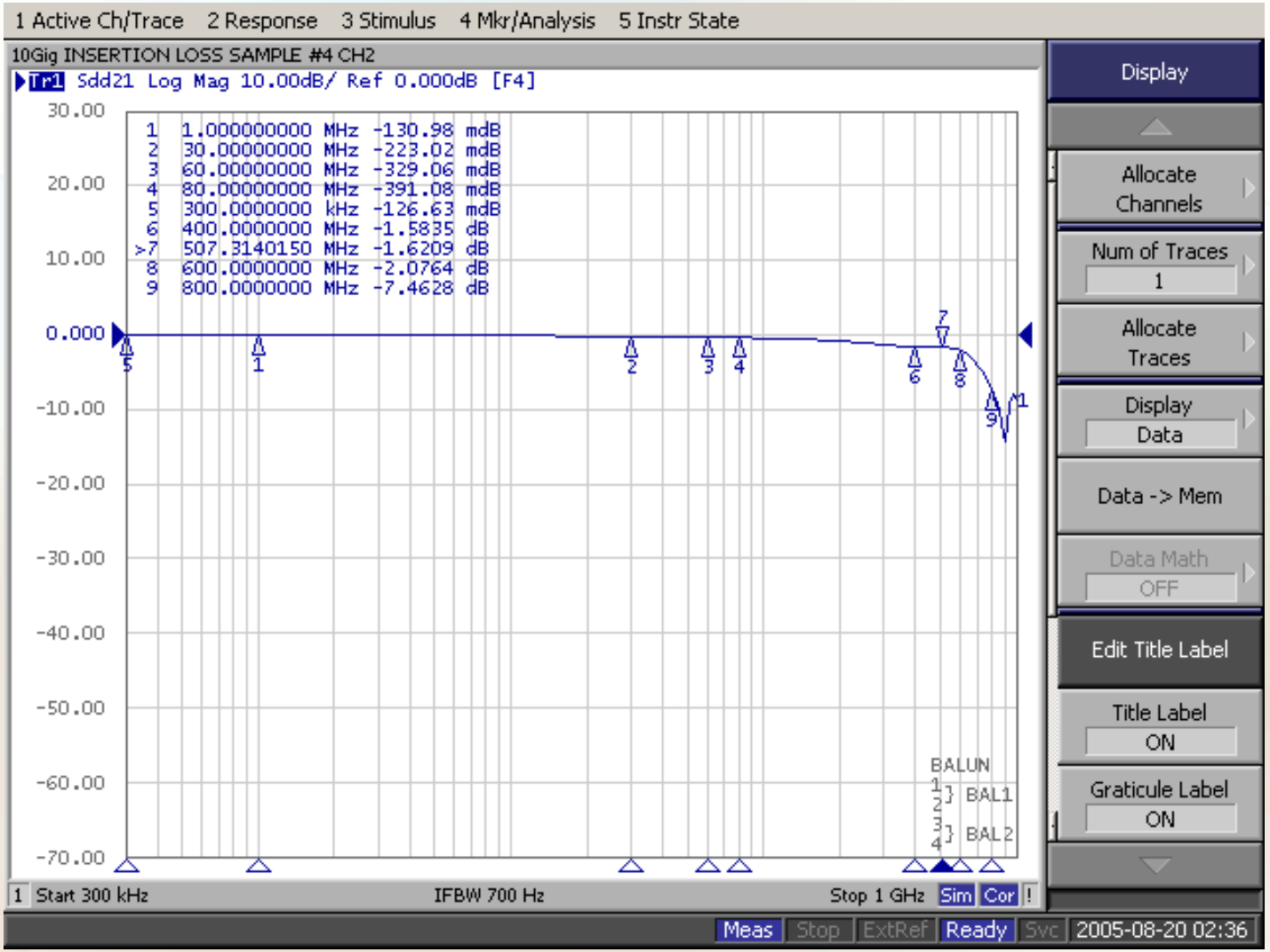
- CH 1 = Pairs 1, 2

(All data typical)



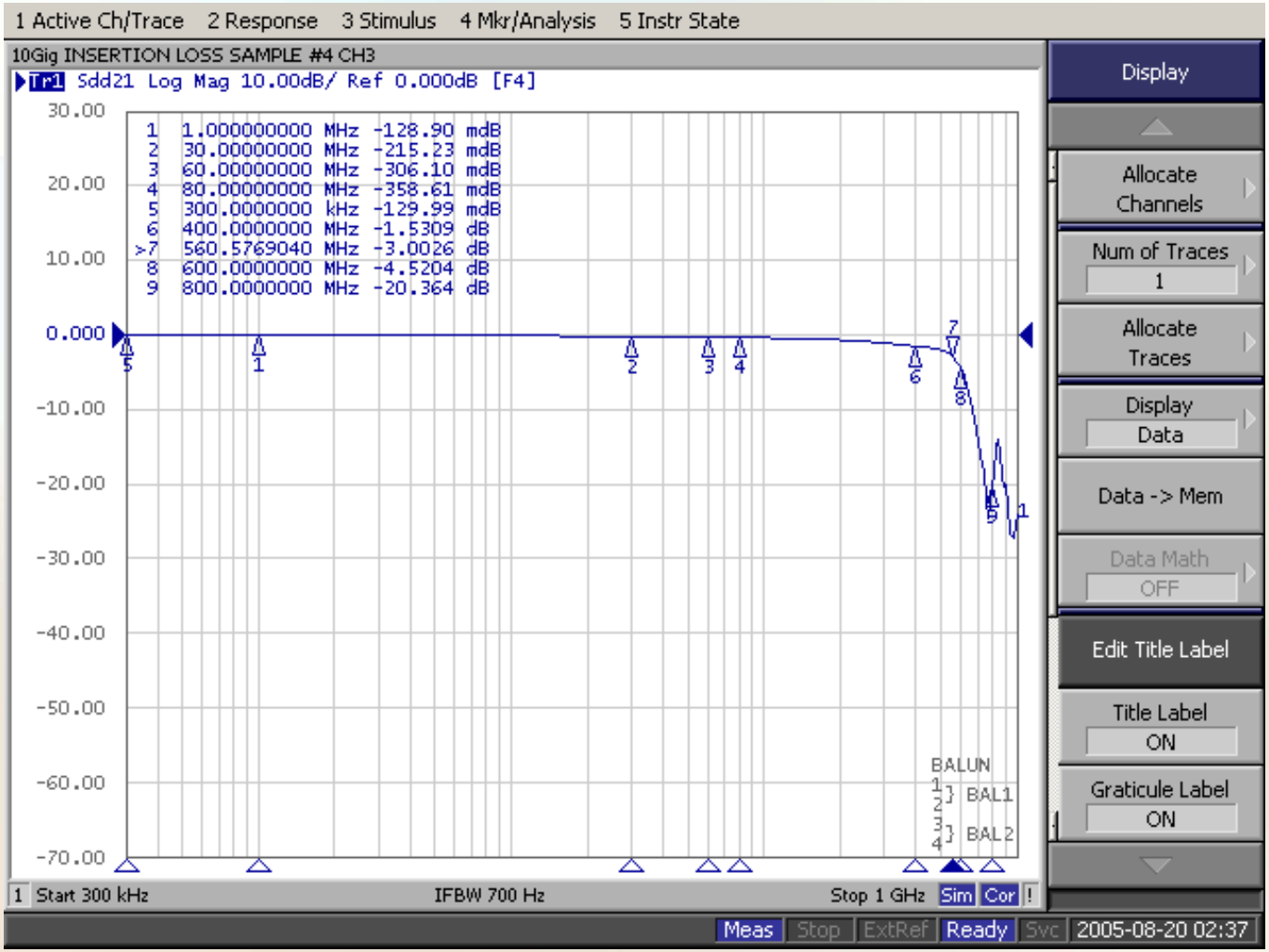
Insertion Loss

- CH 2 = Pairs 3, 6



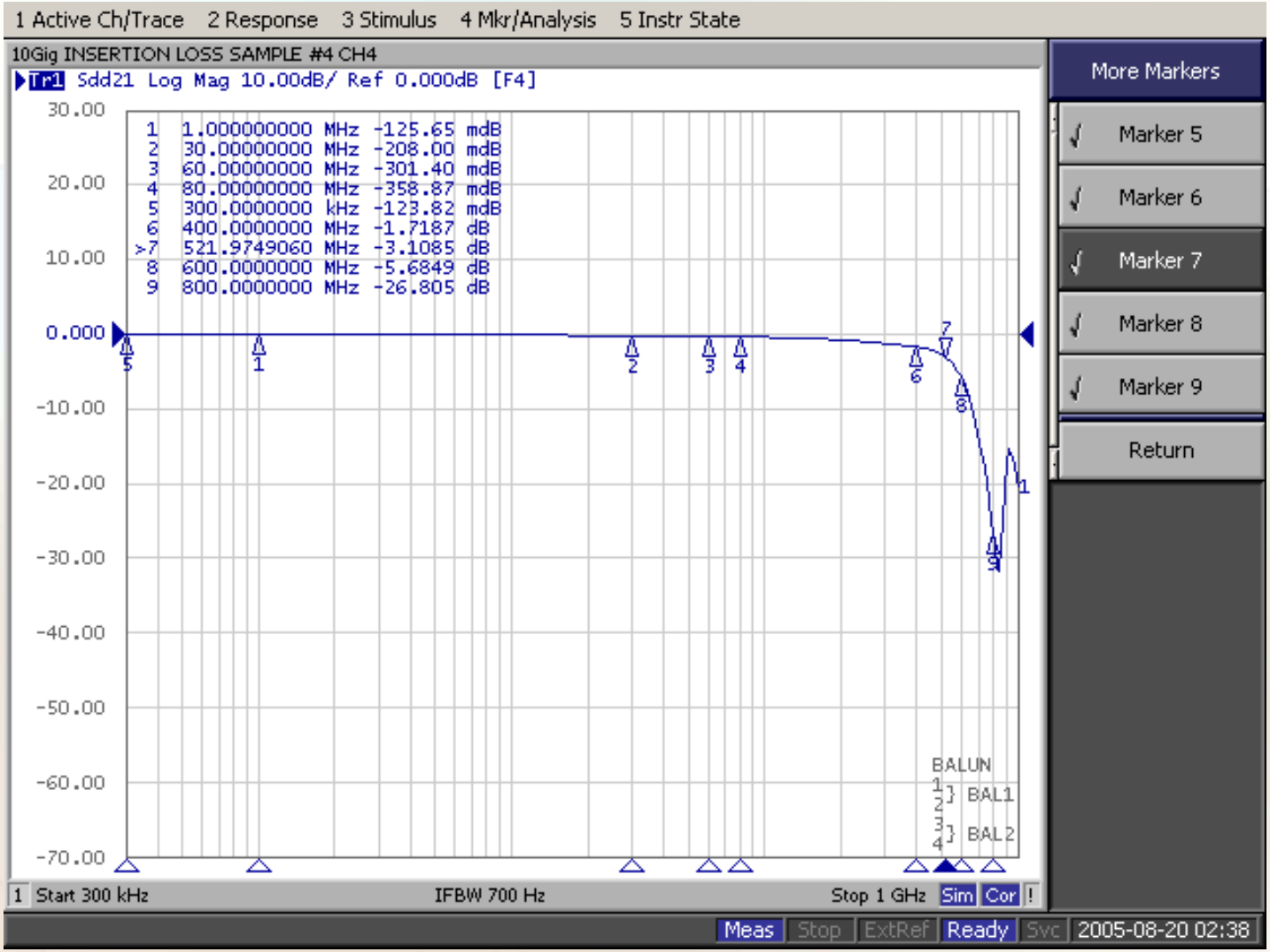
Insertion Loss

- CH 3 = Pairs 4, 5



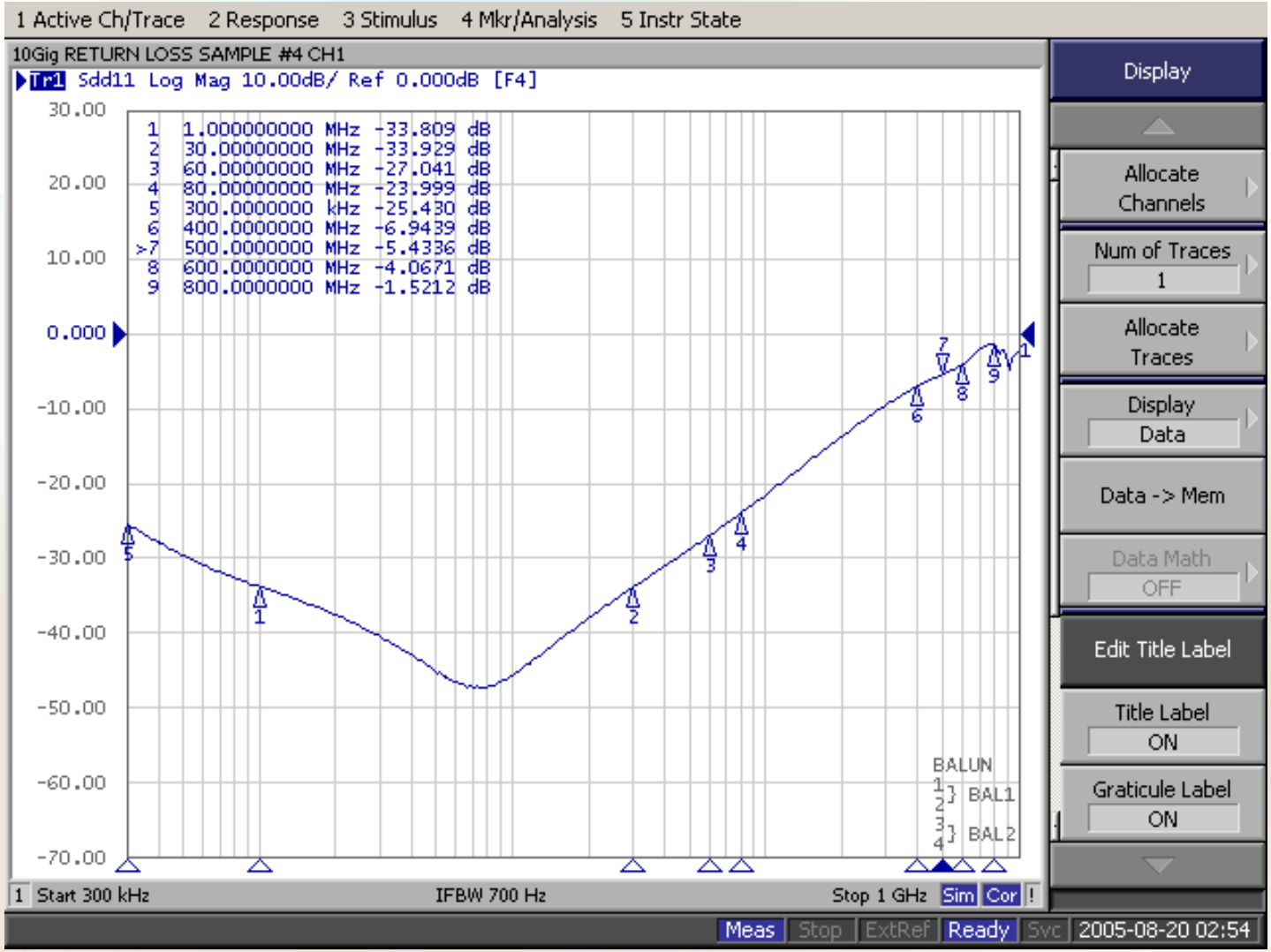
Insertion Loss

- CH 4 = Pairs 7, 8



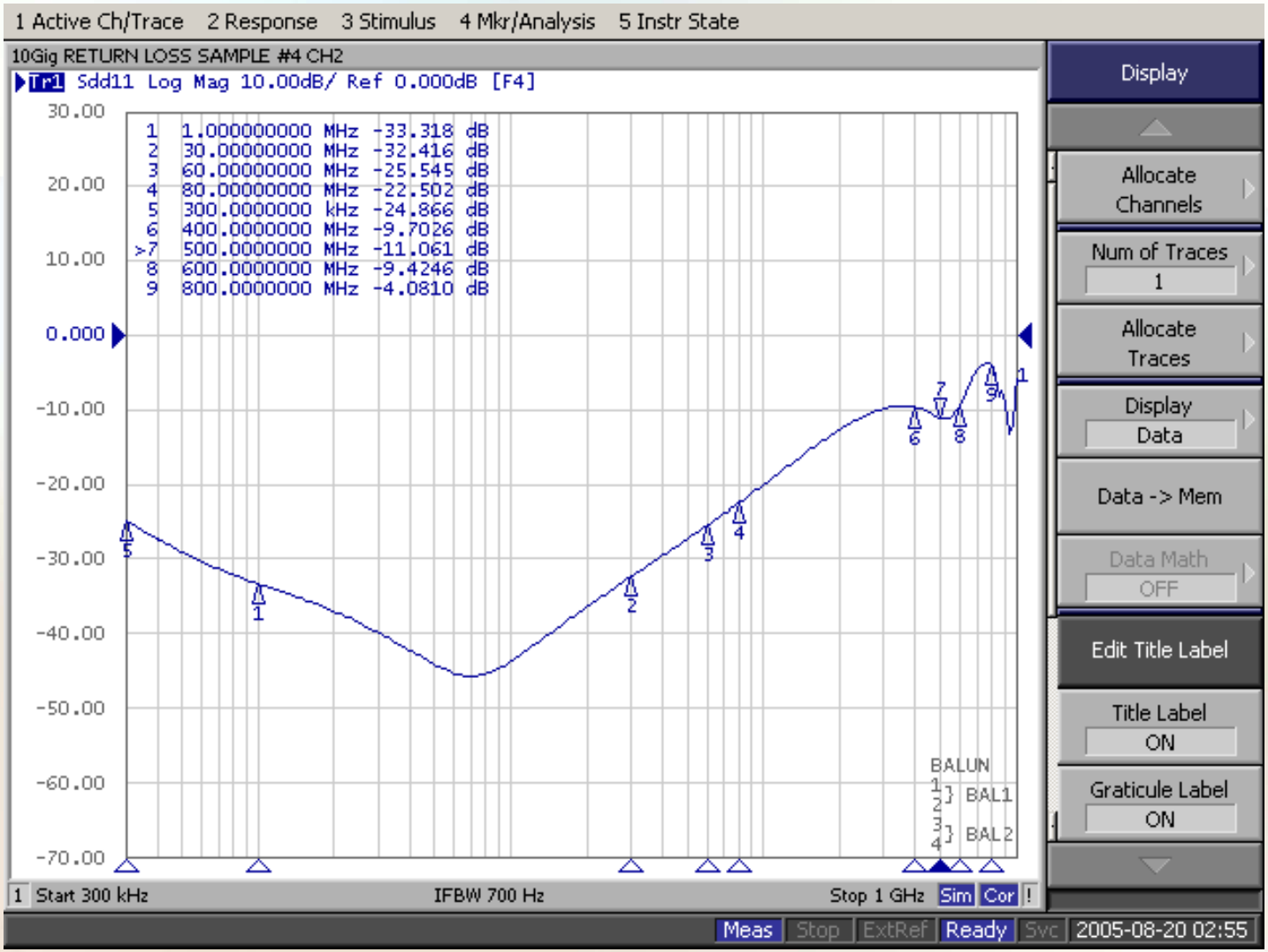
Return Loss

- CH 1



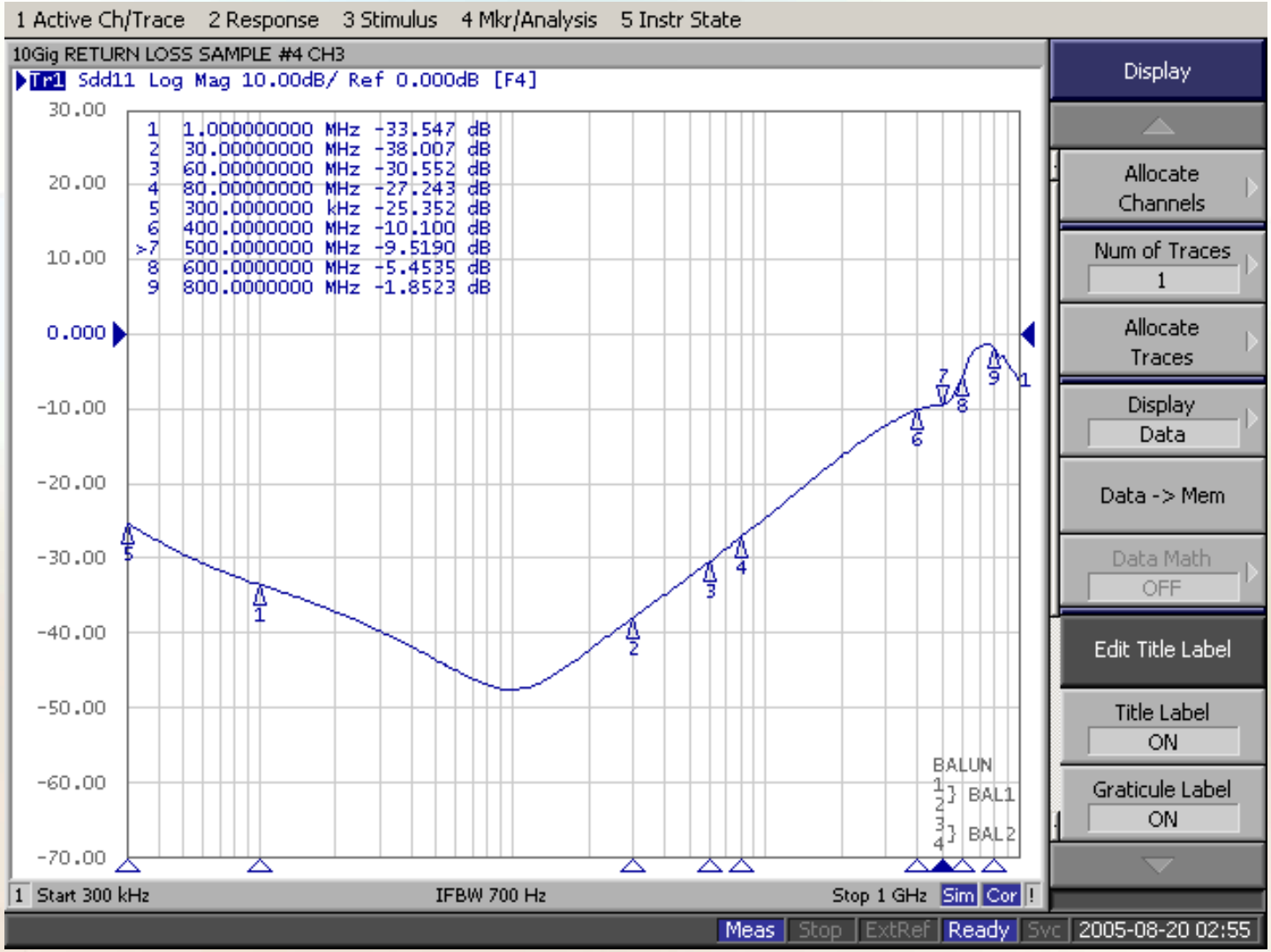
Return Loss

- CH 2



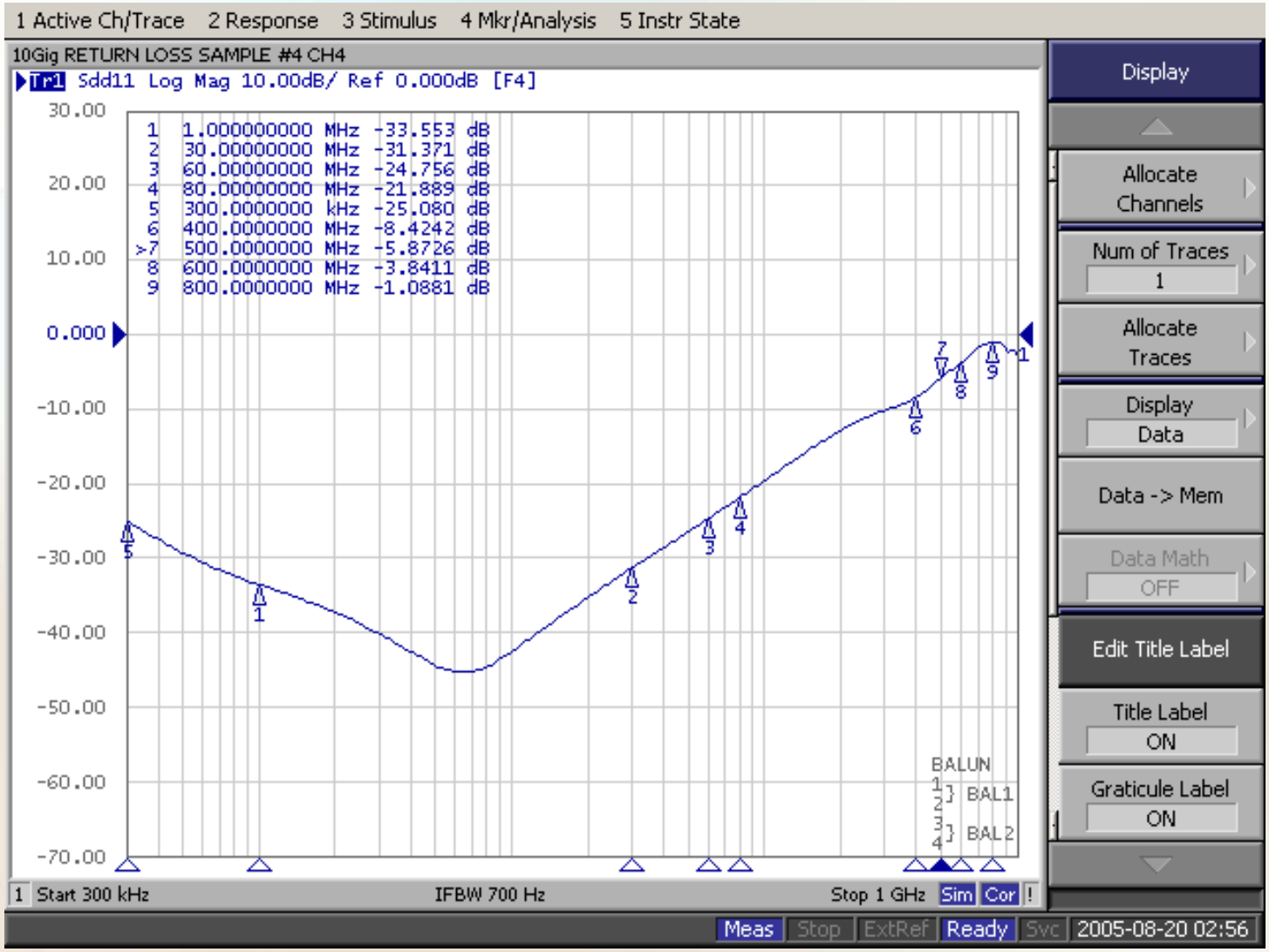
Return Loss

- CH 3



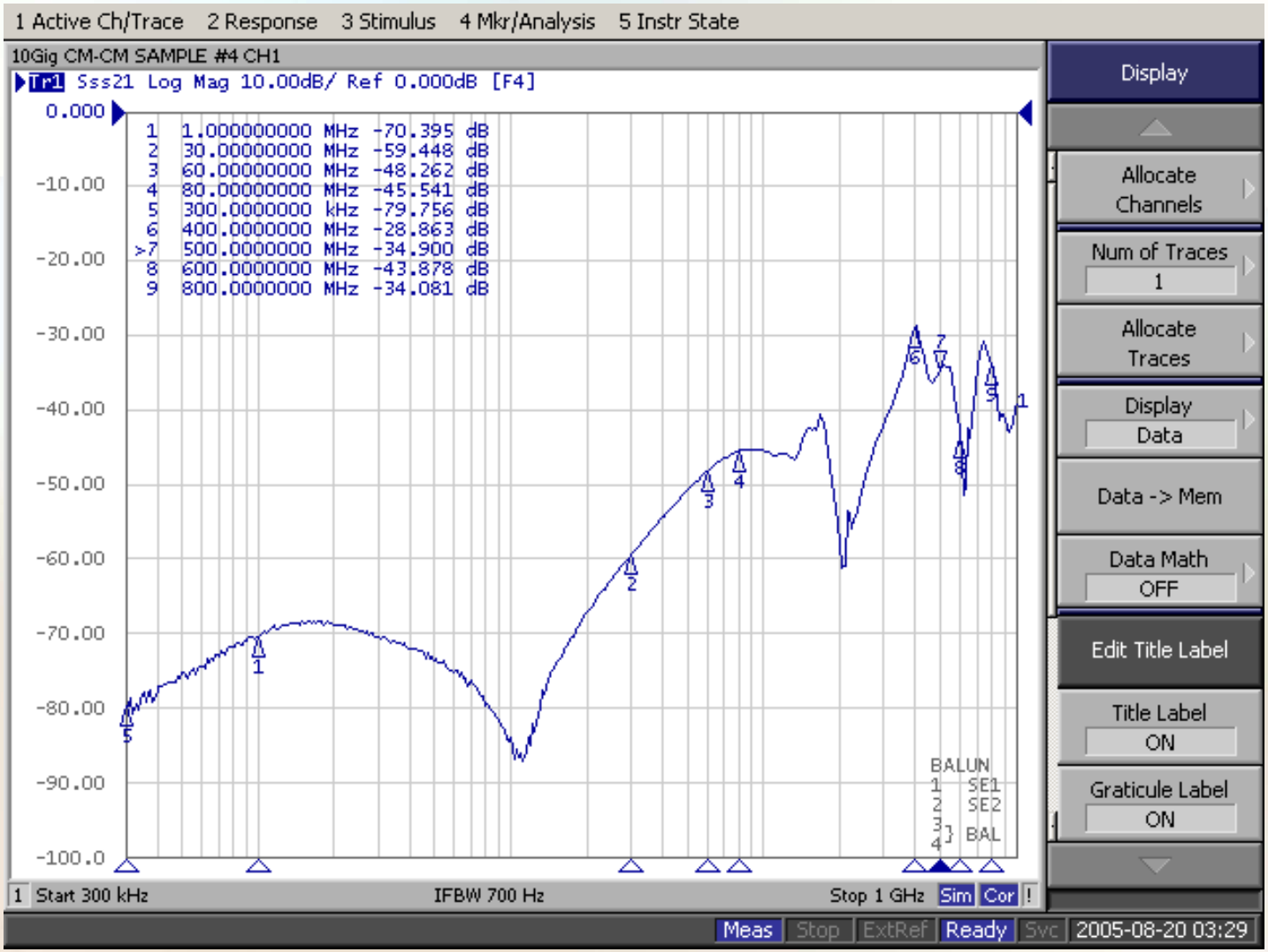
Return Loss

- CH 4



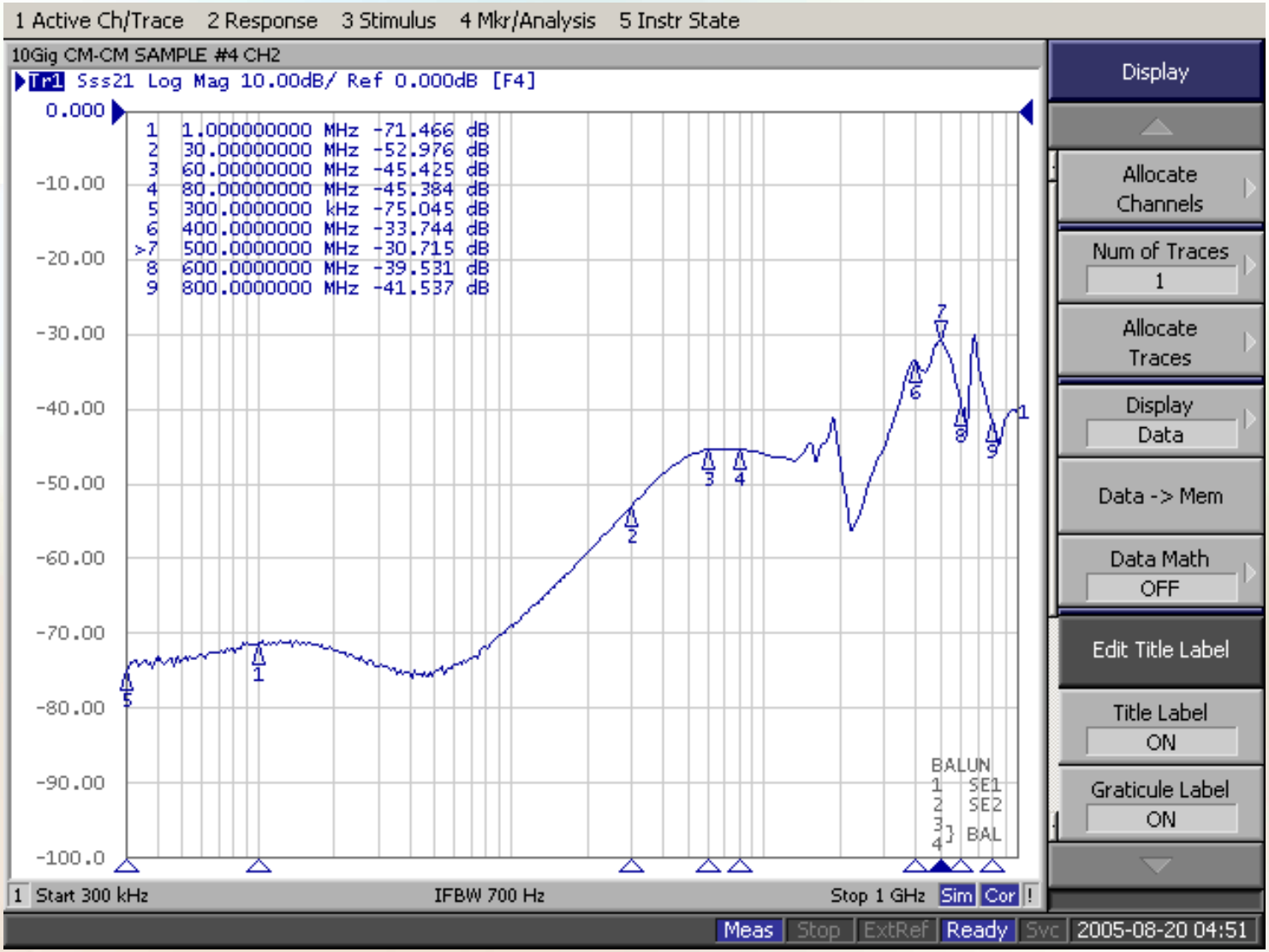
Common Mode to Common Mode Attenuation

- CH 1



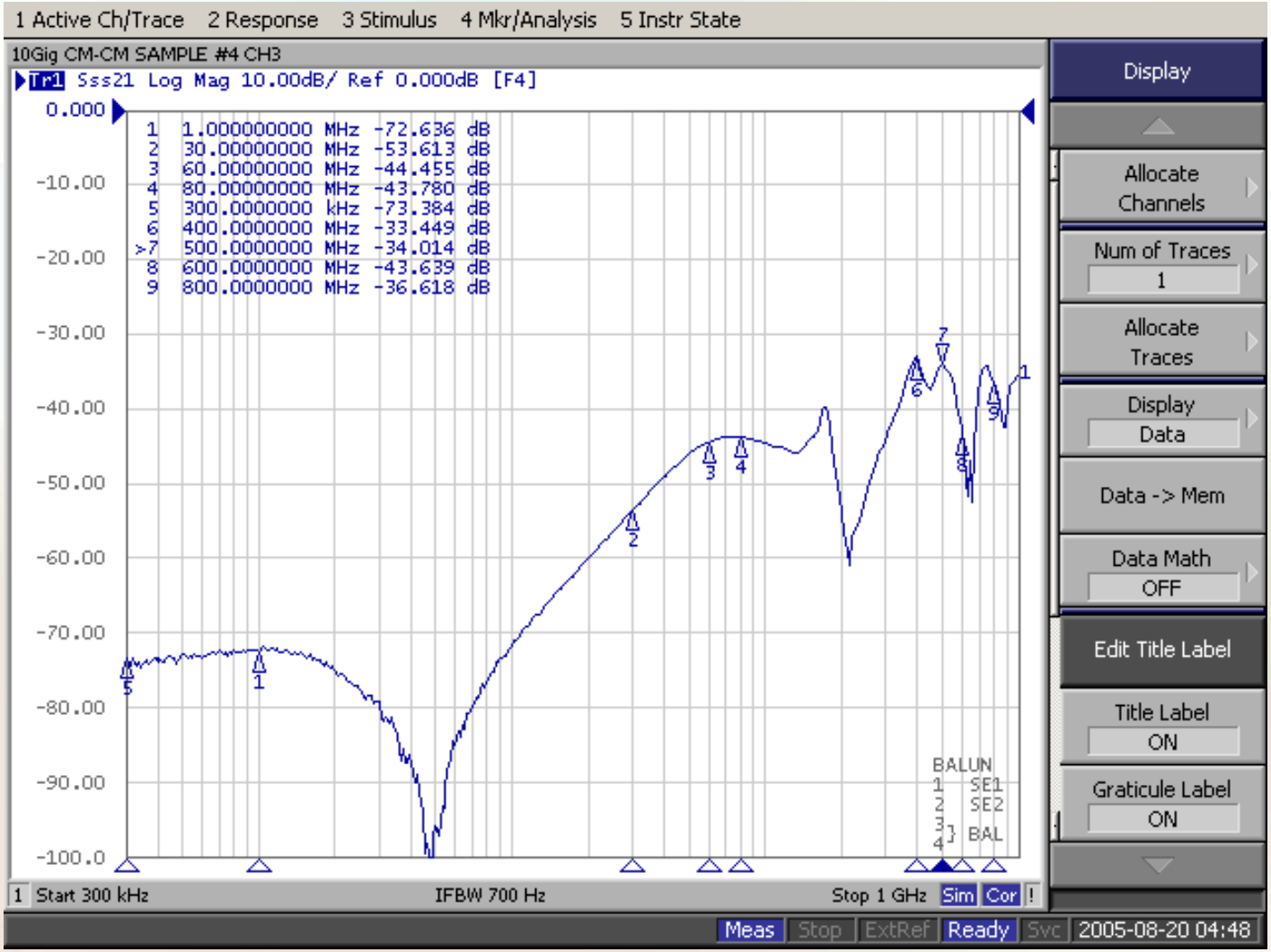
Common Mode to Common Mode Attenuation

- CH 2



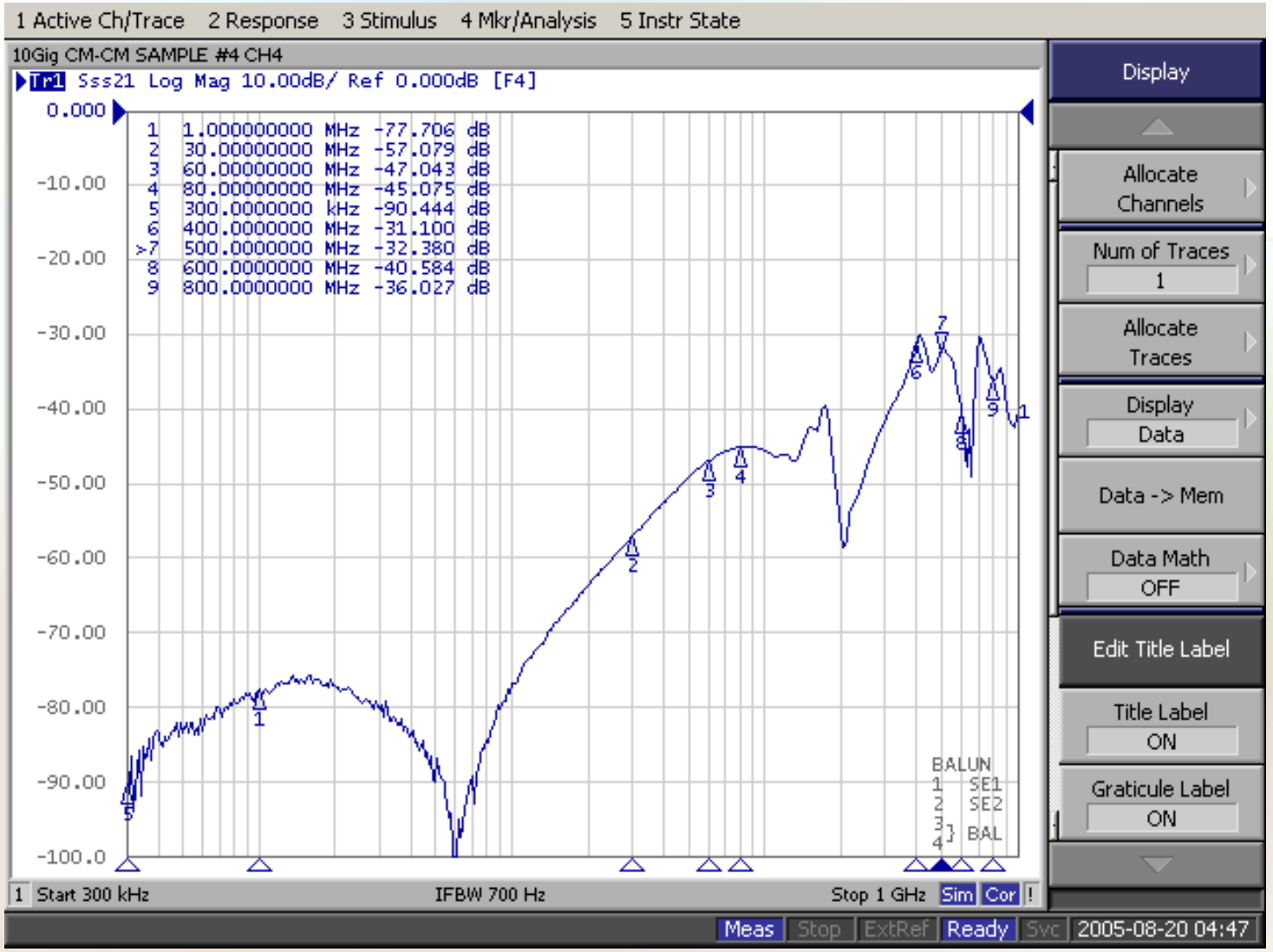
Common Mode to Common Mode Attenuation

- CH 3



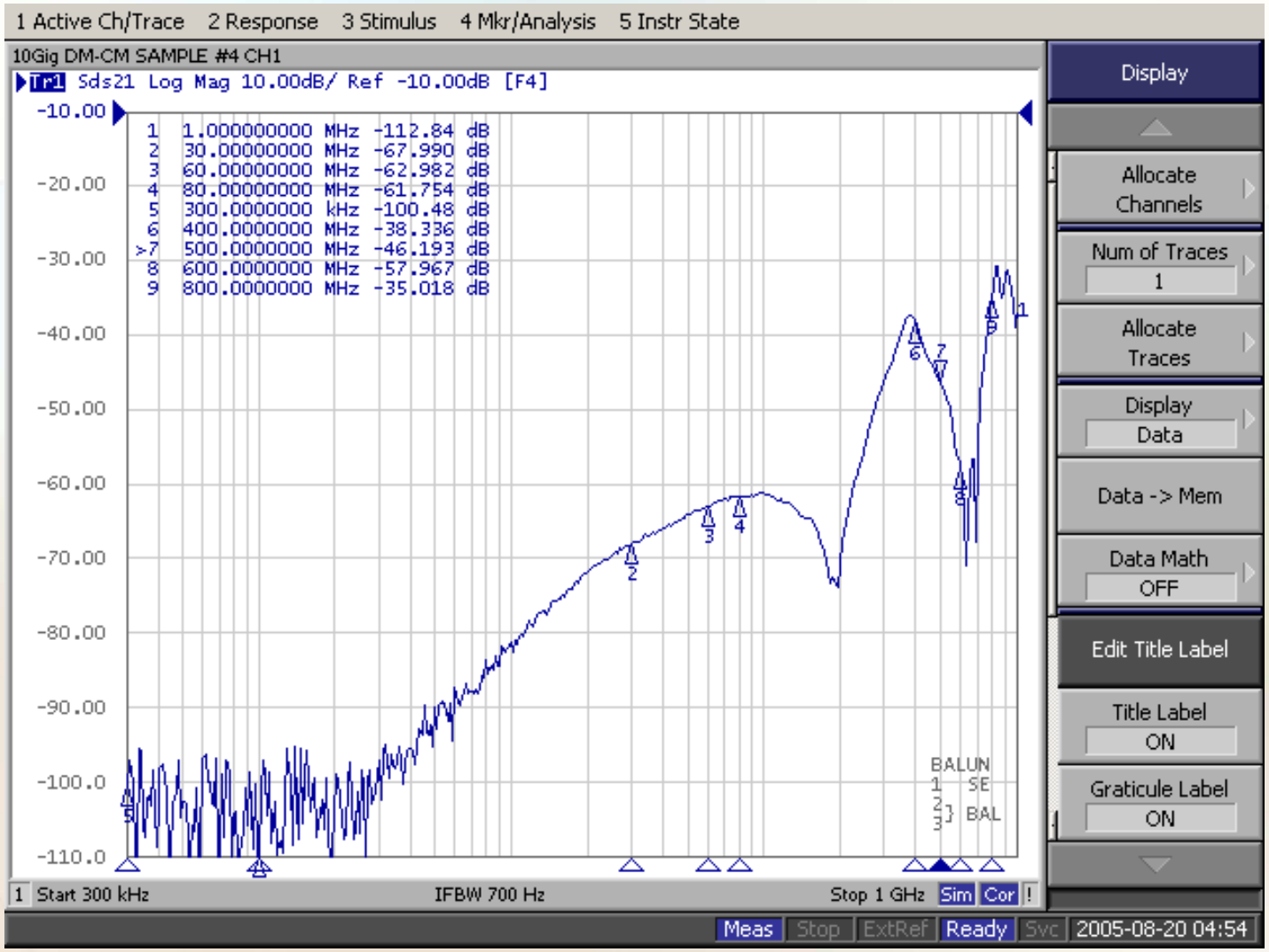
Common Mode to Common Mode Attenuation

- CH 4



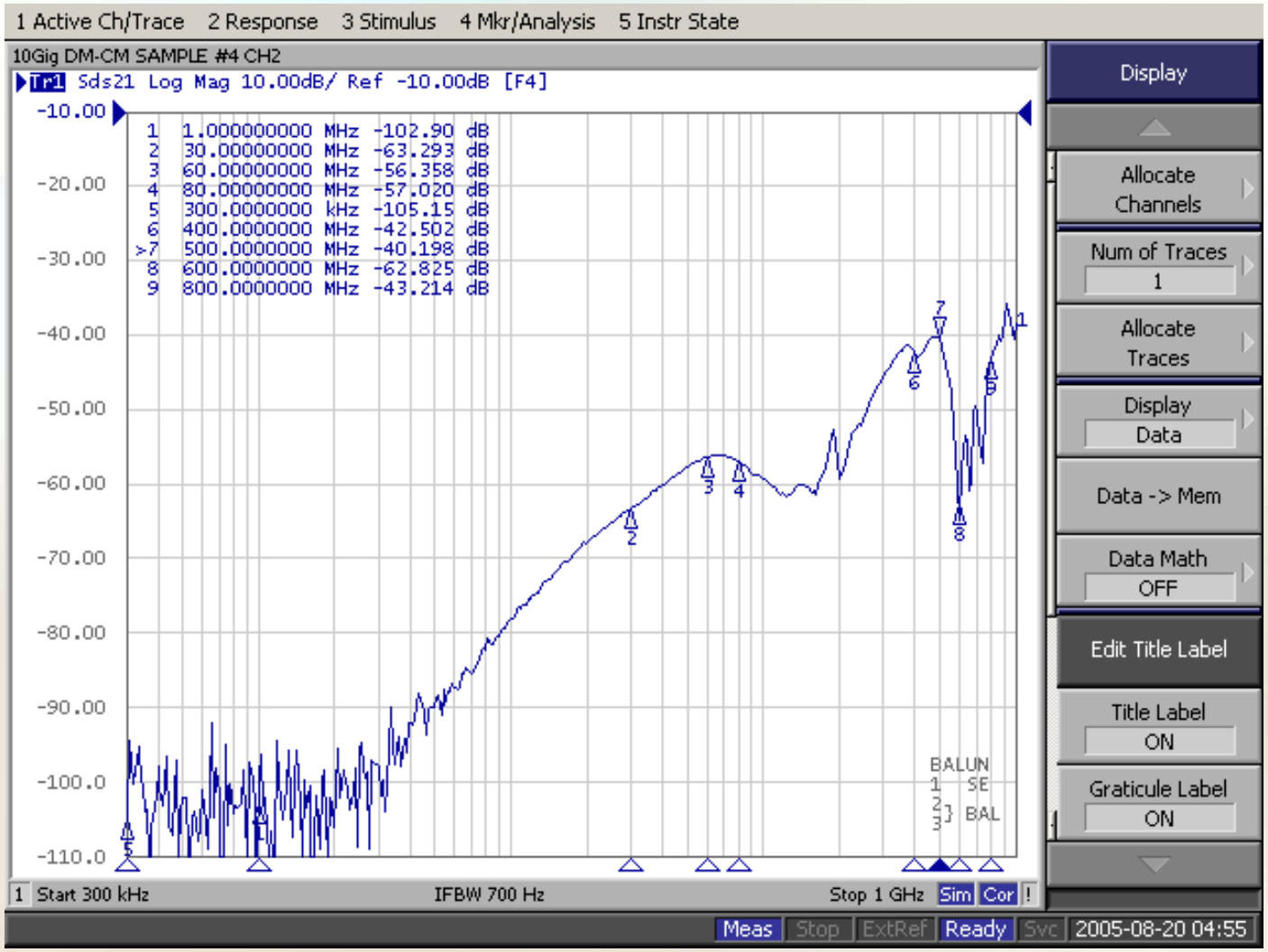
Differential Mode to Common Mode Attenuation

- CH 1



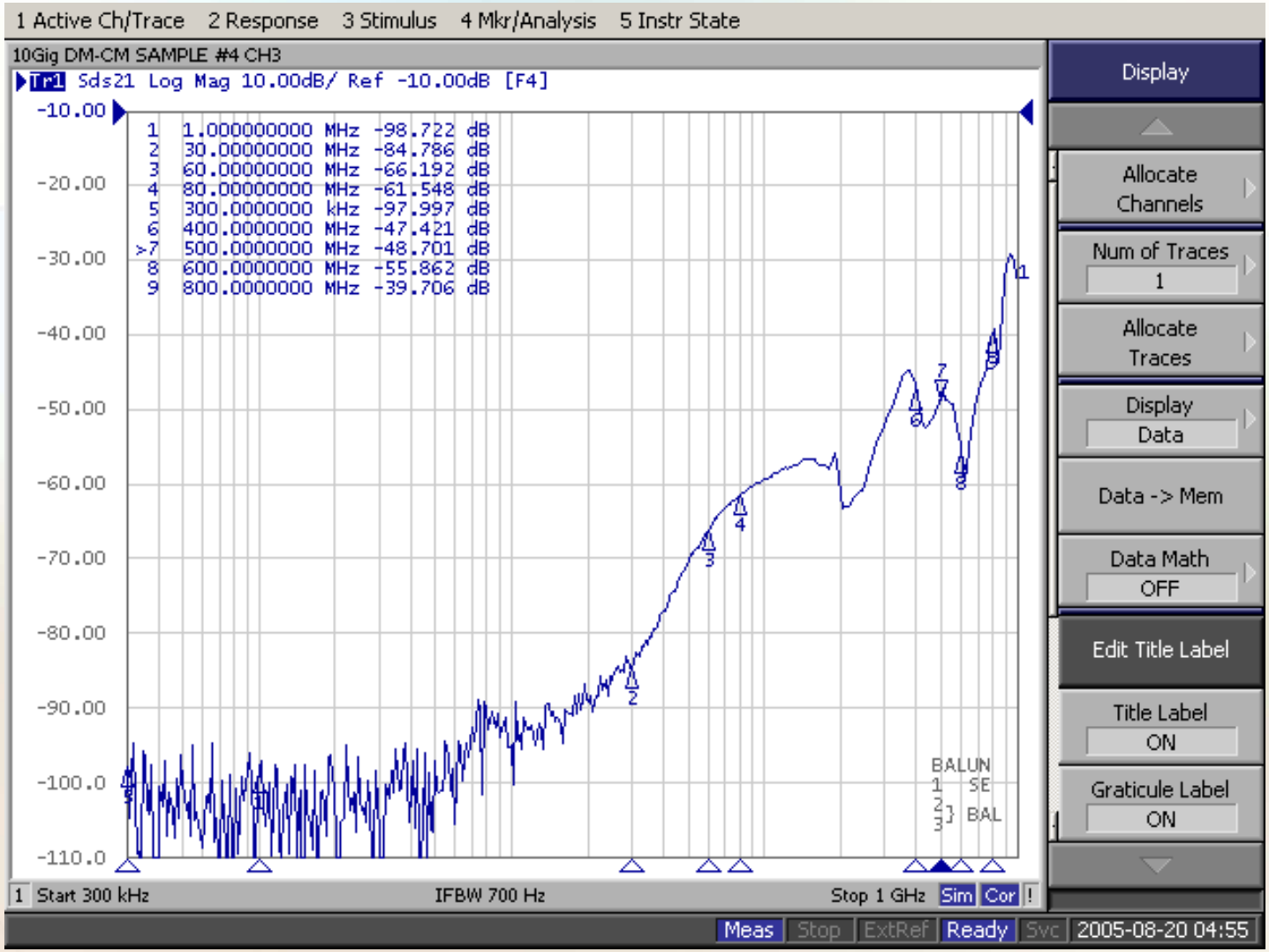
Differential Mode to Common Mode Attenuation

- CH 2



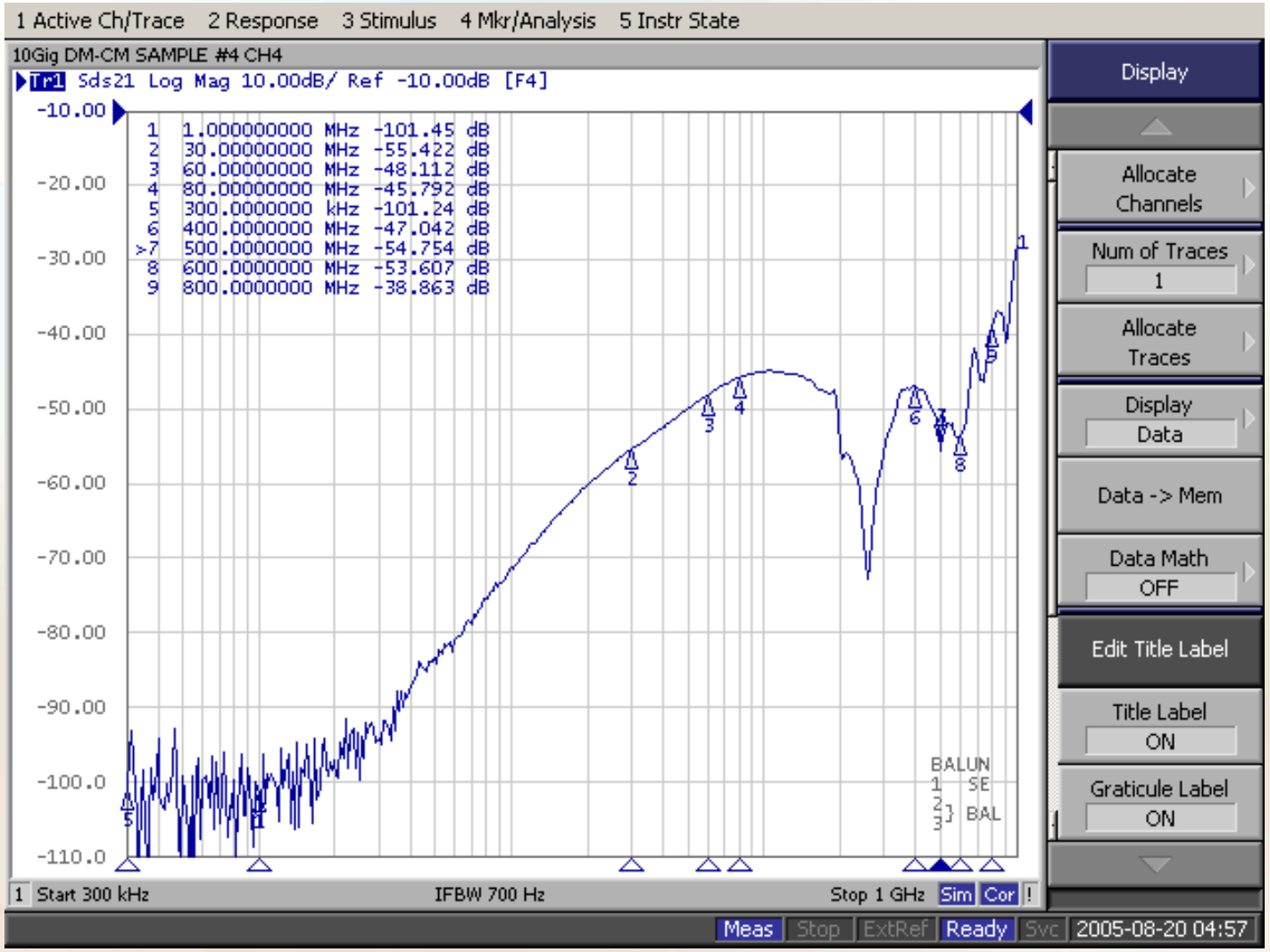
Differential Mode to Common Mode Attenuation

- CH 3



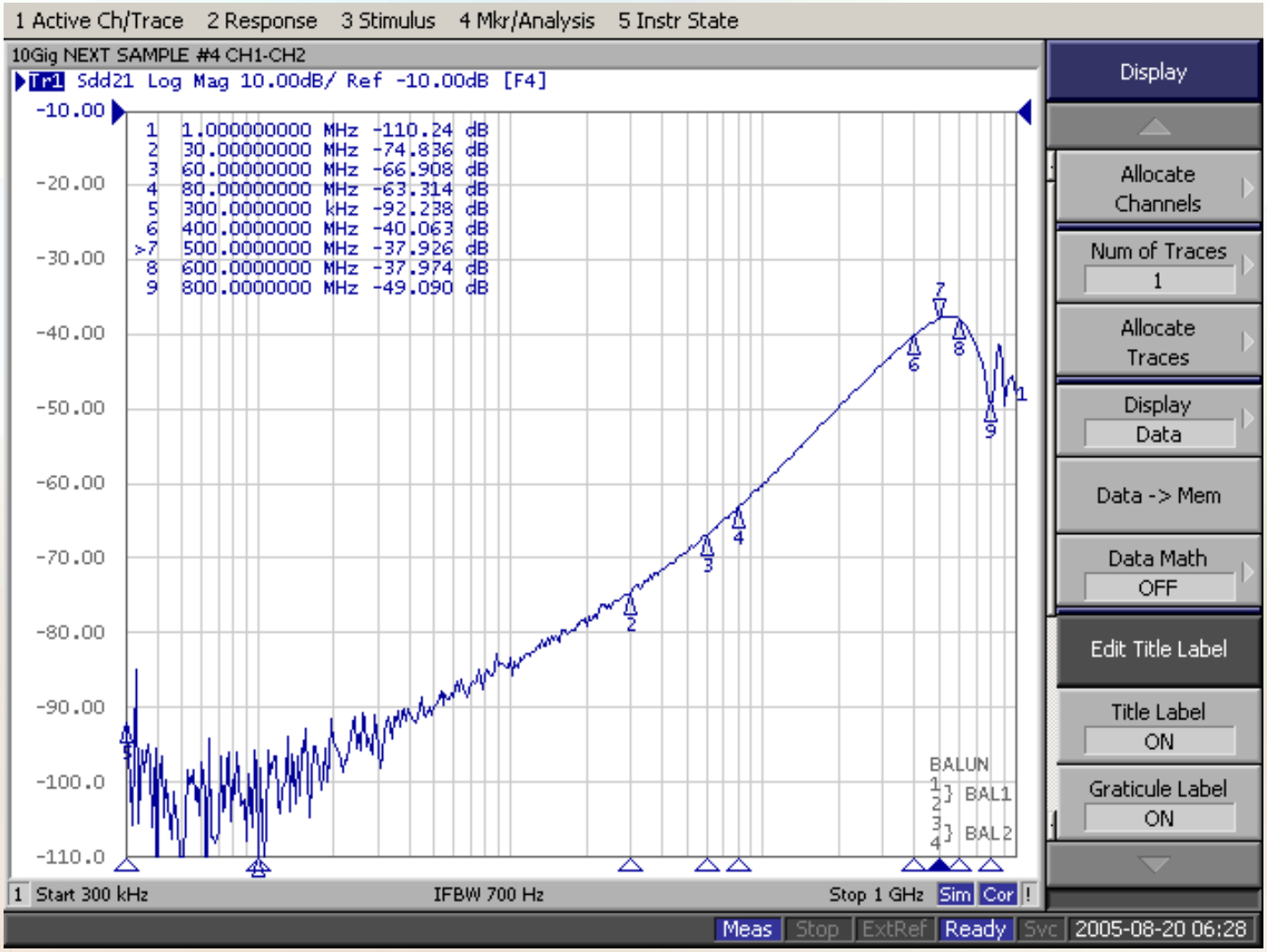
Differential Mode to Common Mode Attenuation

- CH 4



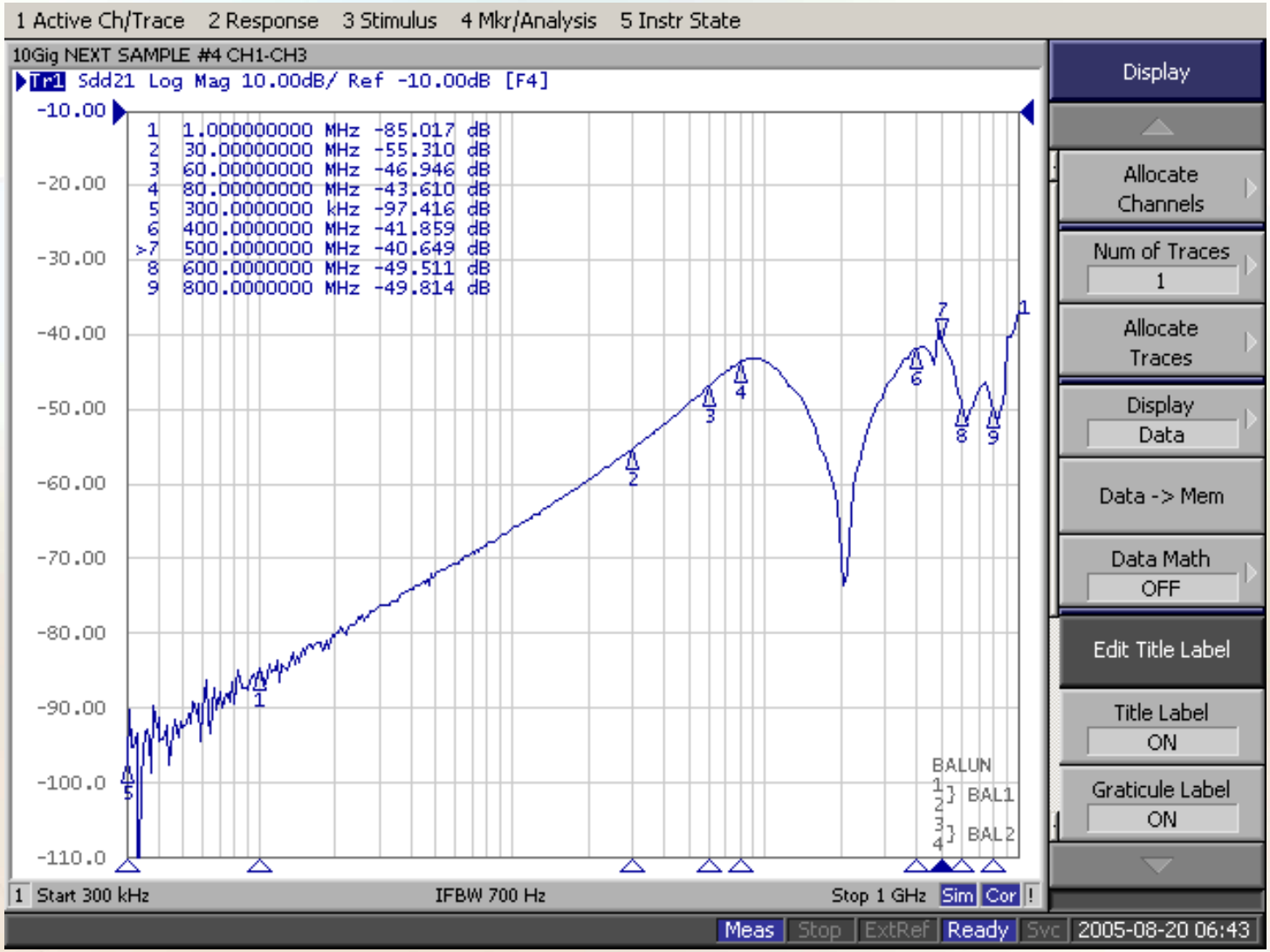
Near End Crosstalk

- CH 1 – CH 2



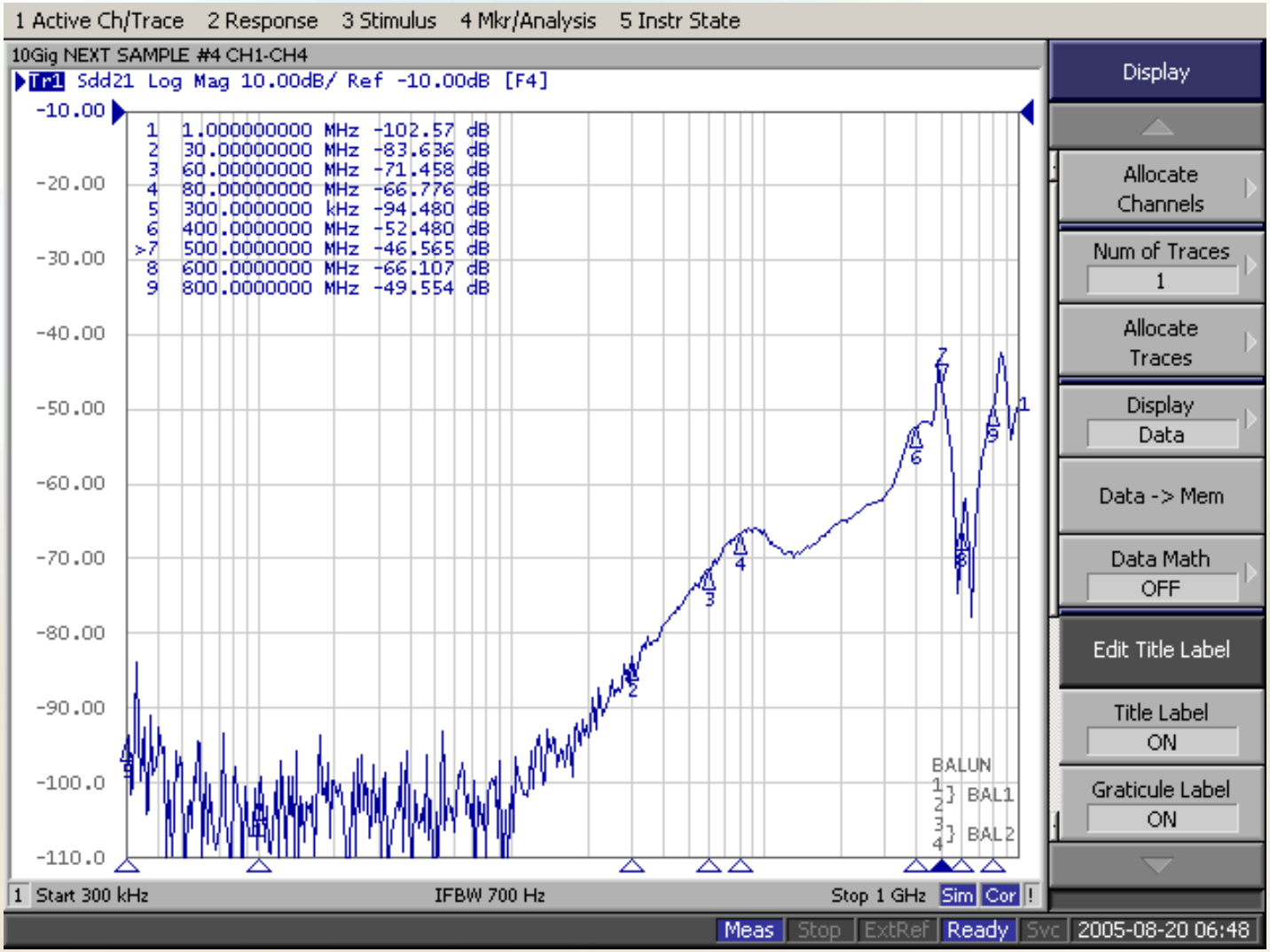
Near End Crosstalk

- CH 1 – CH 3



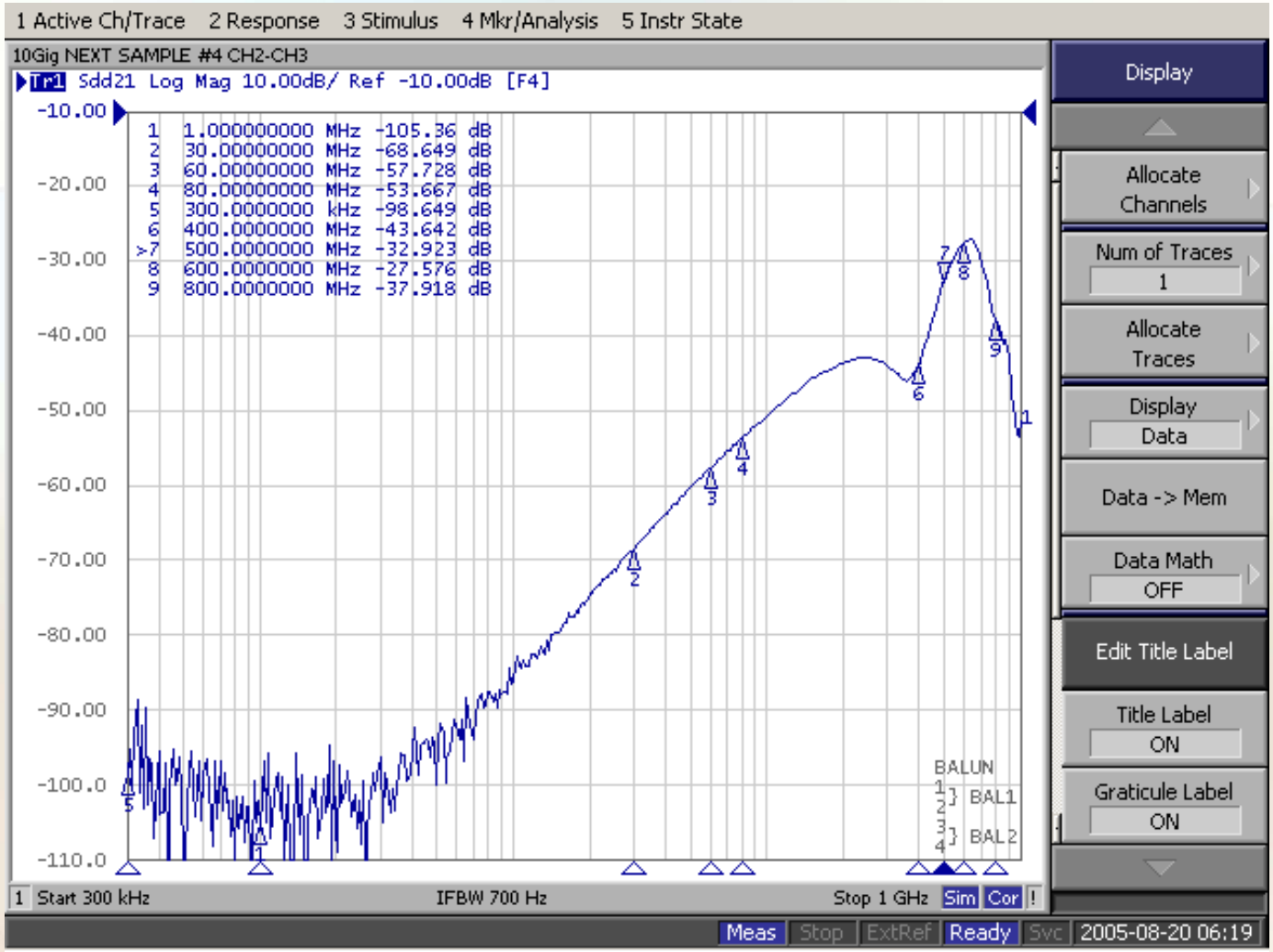
Near End Crosstalk

- CH 1 – CH 4



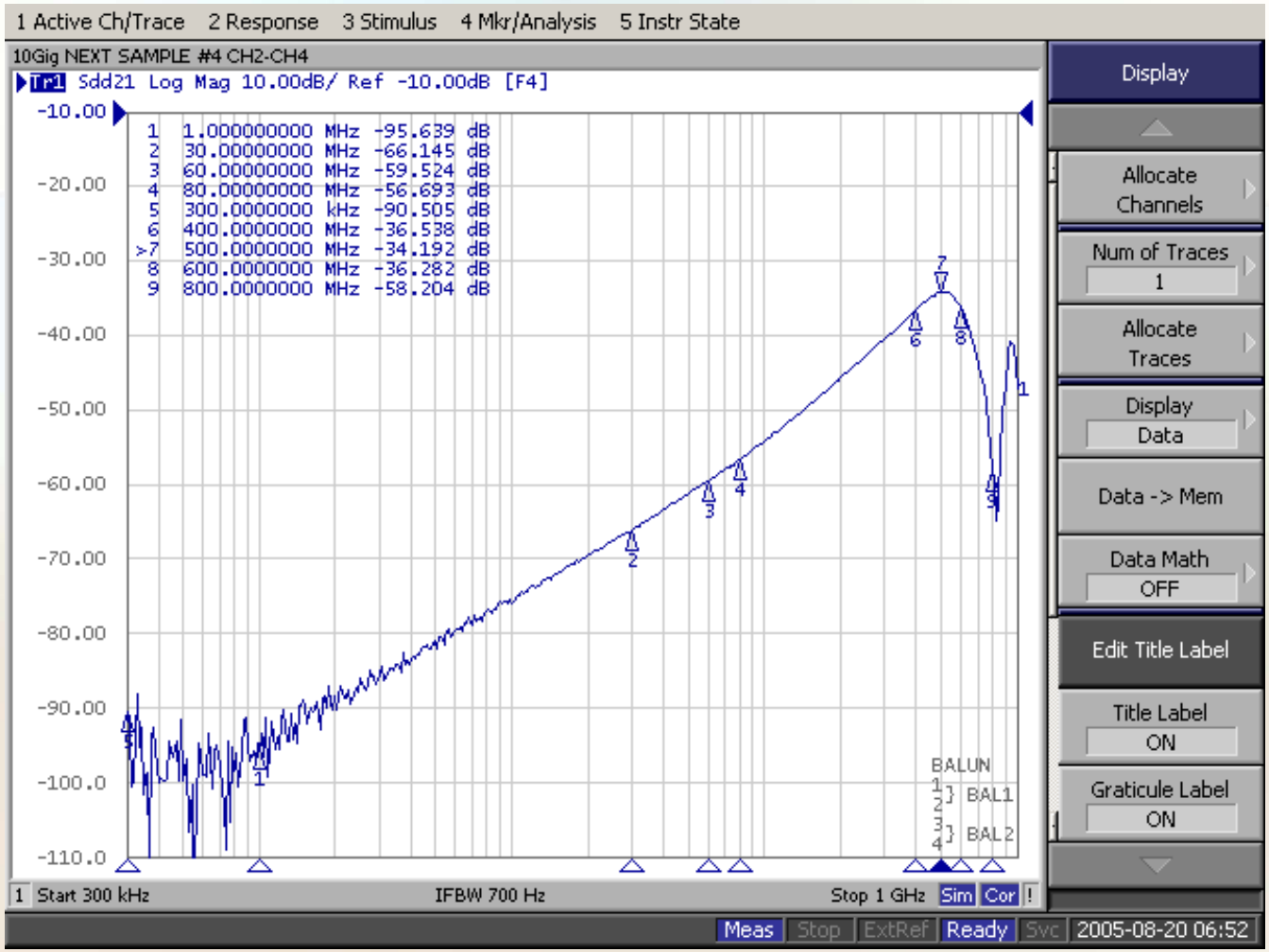
Near End Crosstalk

- CH 2 – CH 3



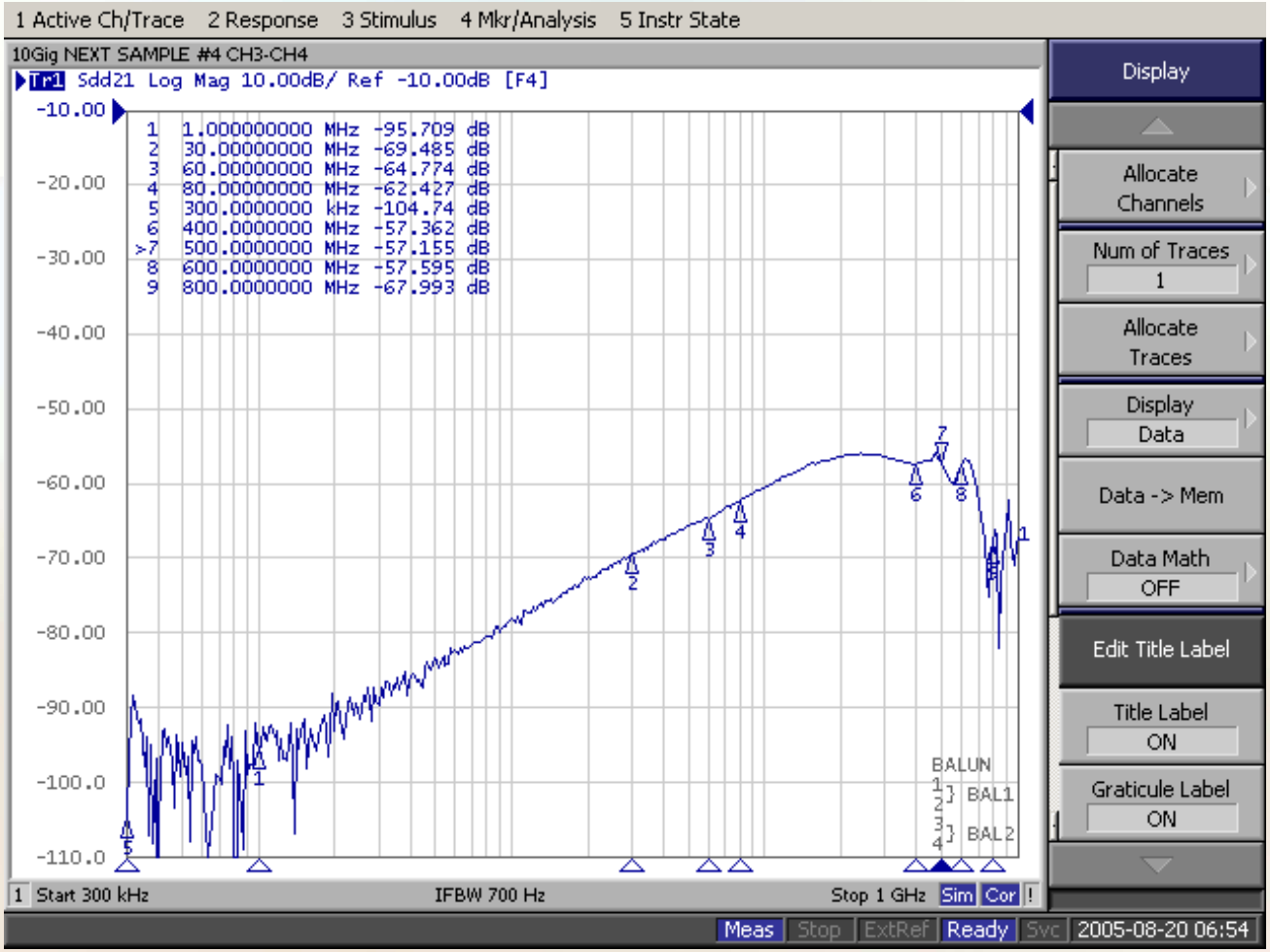
Near End Crosstalk

- CH 2 – CH 4



Near End Crosstalk

- CH 3 – CH 4



Summary

- Can meet 3 dB bandwidth to 500 MHz
- Return loss will be PHY and layout dependent
- Can achieve ~ 30 dB of near end crosstalk up to 500 MHz
- Improving common to common and differential to common mode conversion performance, more is always better