

# F1102 Extended Frequency Range

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- AT0225
  
- Rev 01: 2015-05-20 Added Noise Figure

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# Introduction

- Customer is interested in the F1102 mixer but would like to use it in the Band 31 (452 to 457 MHz) and high IF frequency (348 – 368 MHz). The LO is injection on the high side.
- The customer is curious about what parameters might change.



# Testing

- Testing was only done at +25 C.
- Only the Low Current mode was used.
- Three configurations were tested.



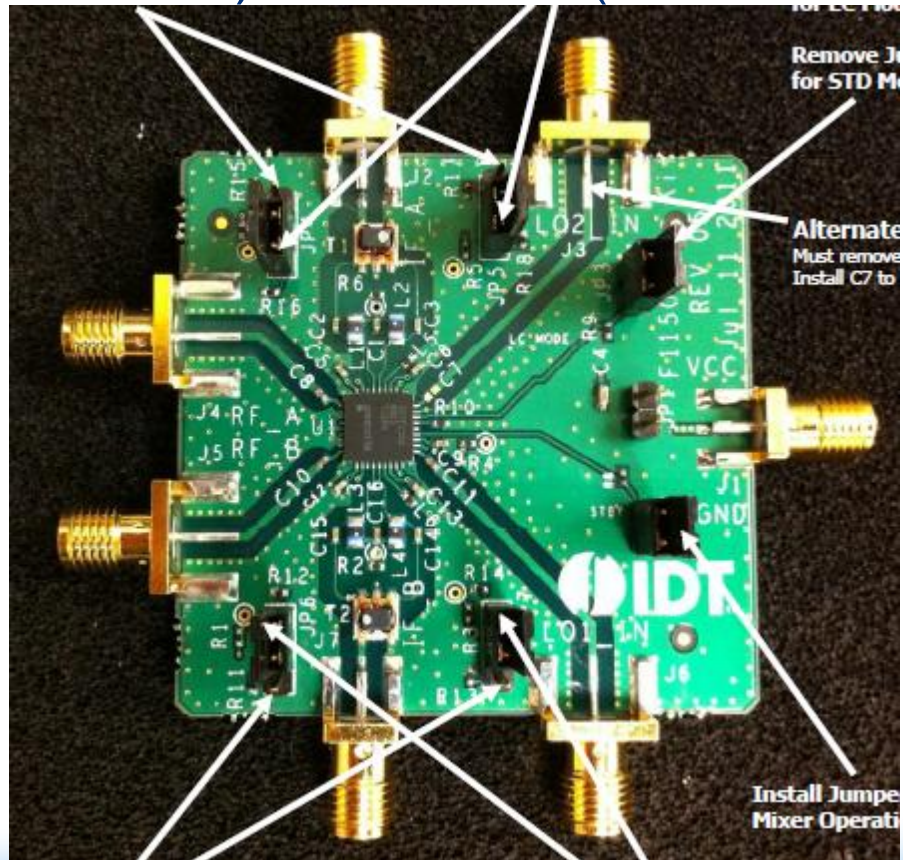
# Configuration - Standard

## ➤ Standard Configuration (STD)

- This is the evaluation board configuration for high frequency RF operation (900 MHz) and low IF (200 MHz).

## ➤ Key Components

- RF Path
  - ✓  $C8=C10 = 150 \text{ pF}$
- LO Path
  - ✓  $C11 = 150 \text{ pF}$
- IF Path
  - ✓  $T1=T2 = \text{TC4-1TG2+}$   
(0.5-300 MHz)



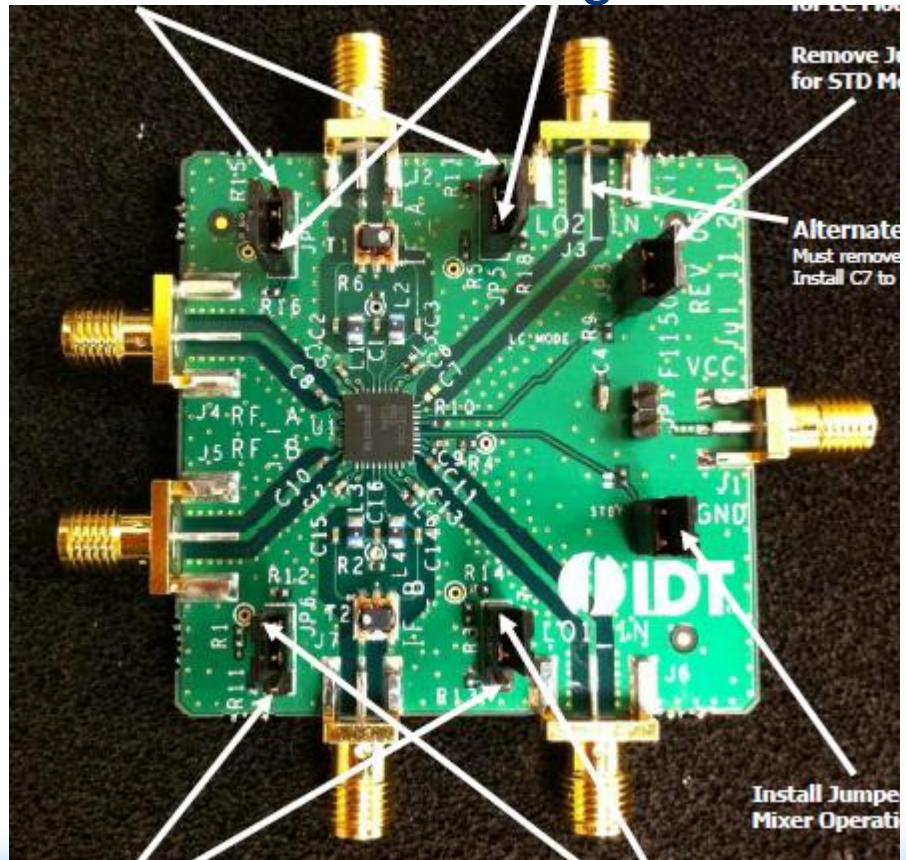
# Configuration – RF Paths Tuned

## ➤ RF Tune

- The evaluation board was modified for operation at 454 MHz which is similar to the 400 MHz configuration in the datasheet.

## ➤ Key Components

- RF Path
  - ✓  $C8=C10 = 18 \text{ pF}$
  - ✓ Added Shunt  $3.0 \text{ pF}$
- LO Path
  - ✓  $C11 = 6.8 \text{ pF}$
- IF Path
  - ✓  $T1=T2 = \text{TC4-1TG2+}$   
(0.5-300 MHz)





# Configuration – Transformer Changed

## ➤ RF Tune & HF Xfmr

- Since the IF is above 300 MHz the IF transformer was change to a broader part,

## ➤ Key Components

### • RF Path

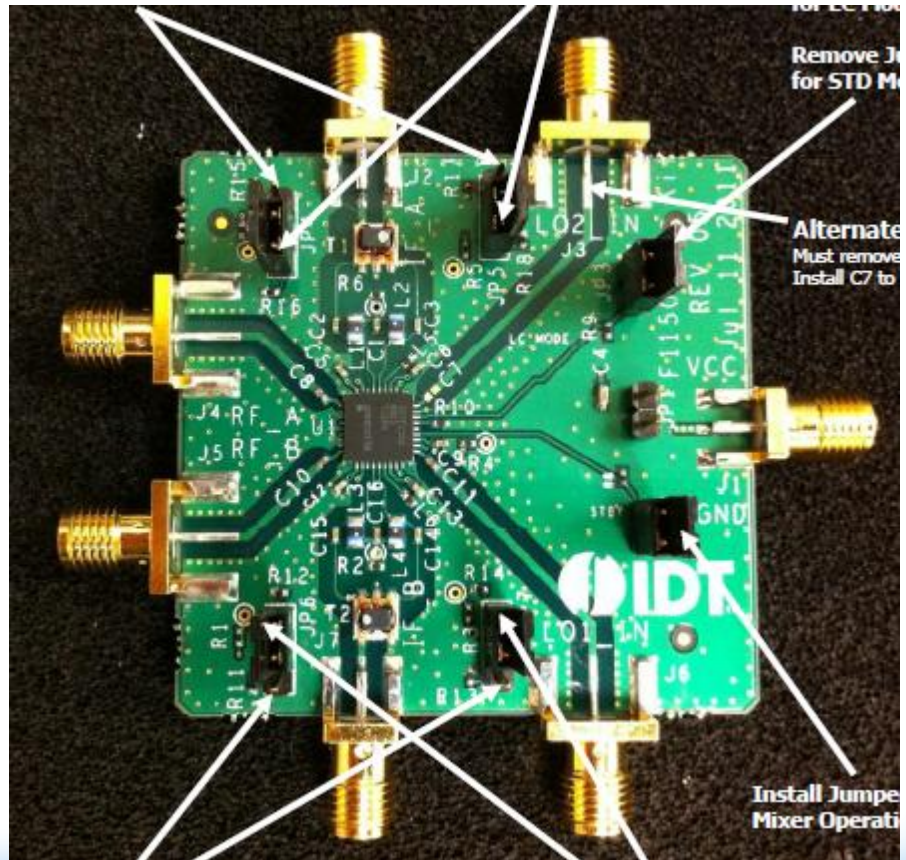
- ✓  $C8=C10 = 18 \text{ pF}$
- ✓ Added Shunt  $3.0 \text{ pF}$

### • LO Path

- ✓  $C11 = 6.8 \text{ pF}$

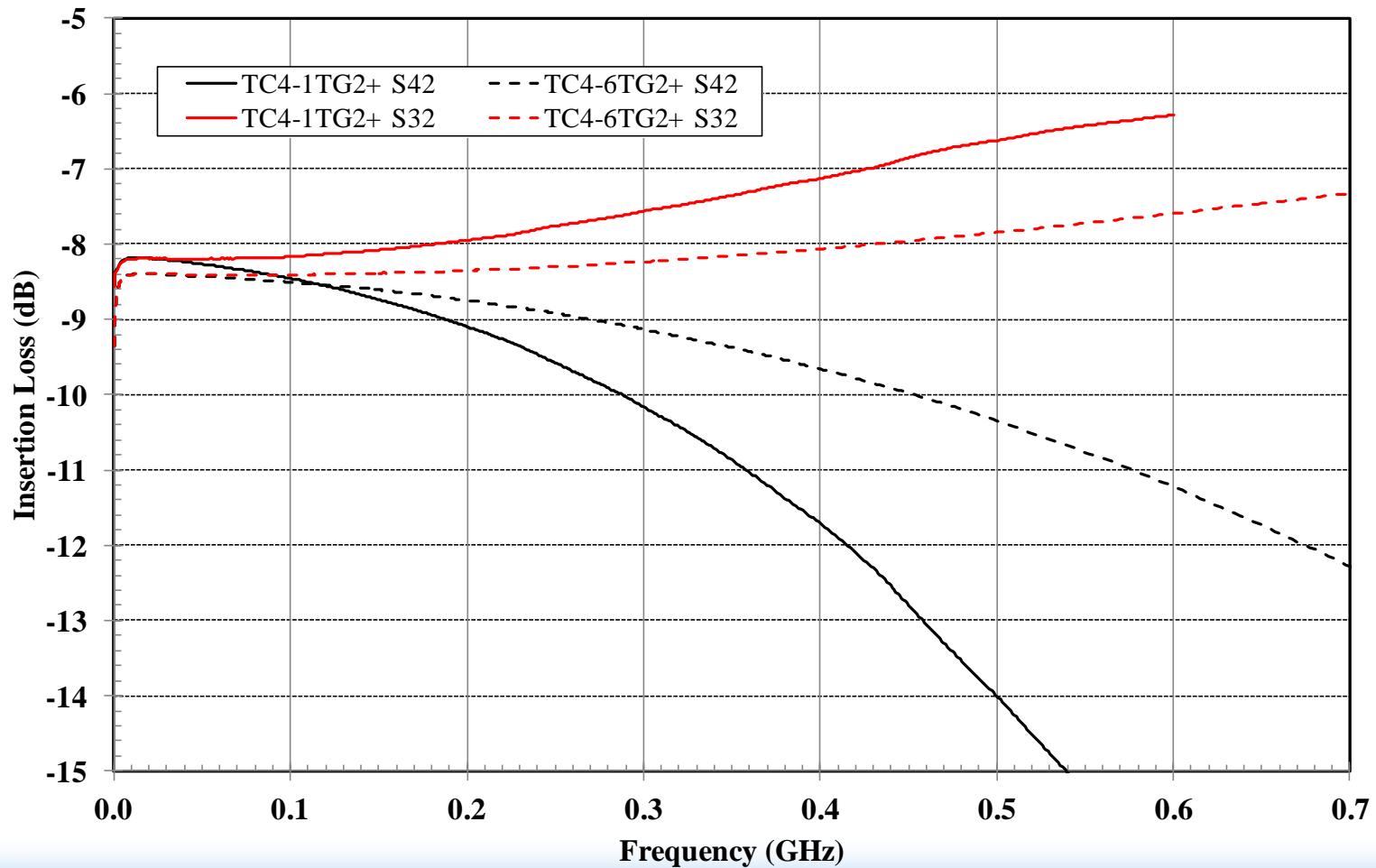
### • IF Path

- ✓  $T1=T2 = \text{TC4-6TG2+}$   
(1.5-600 MHz)



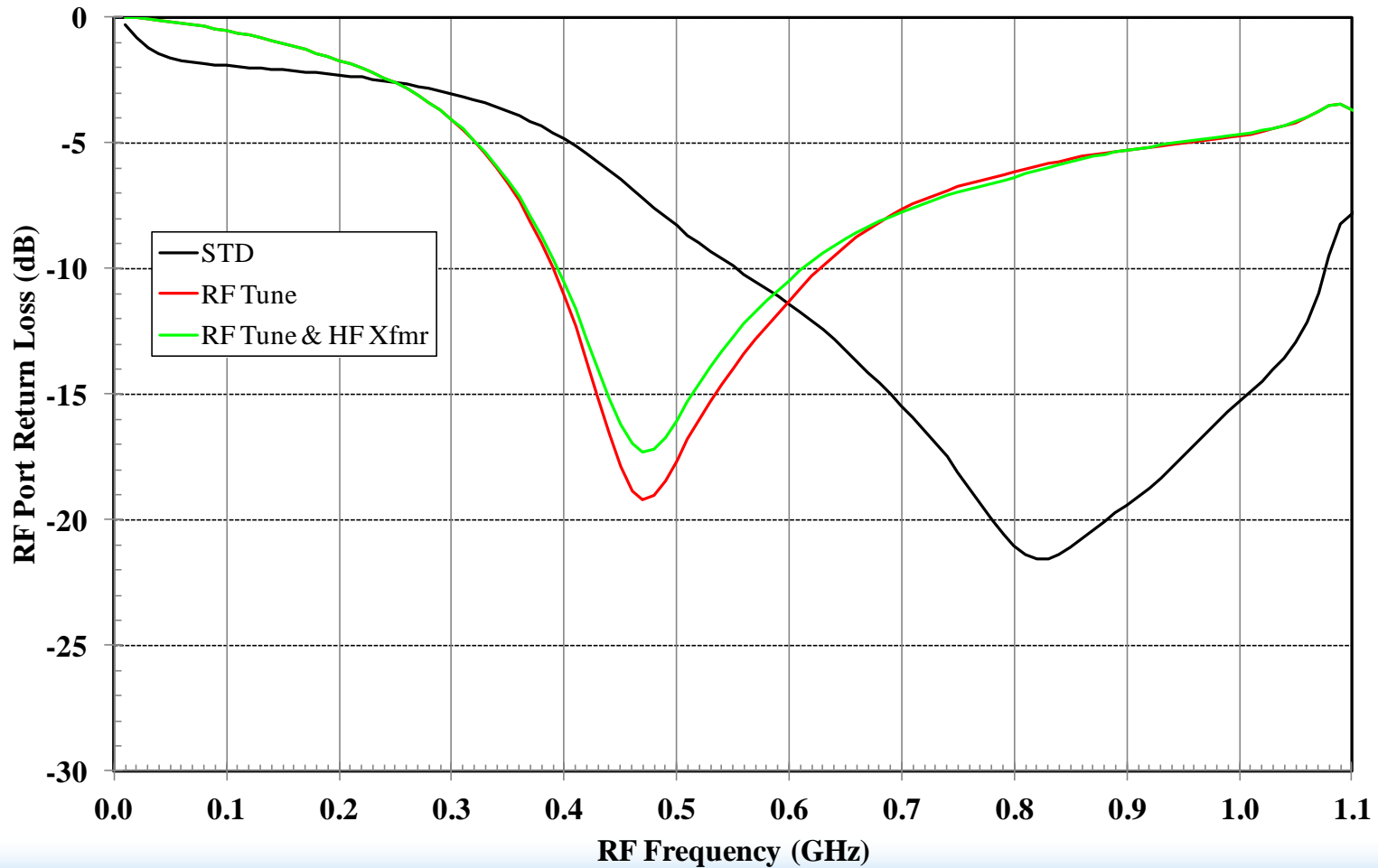
# Mini-Circuits Transformers comparison

Comparison of Mini-Circuits 4:1 transformers  
Measurements made as a 4-port device by Mini-Circuits



# RF Port Return Loss

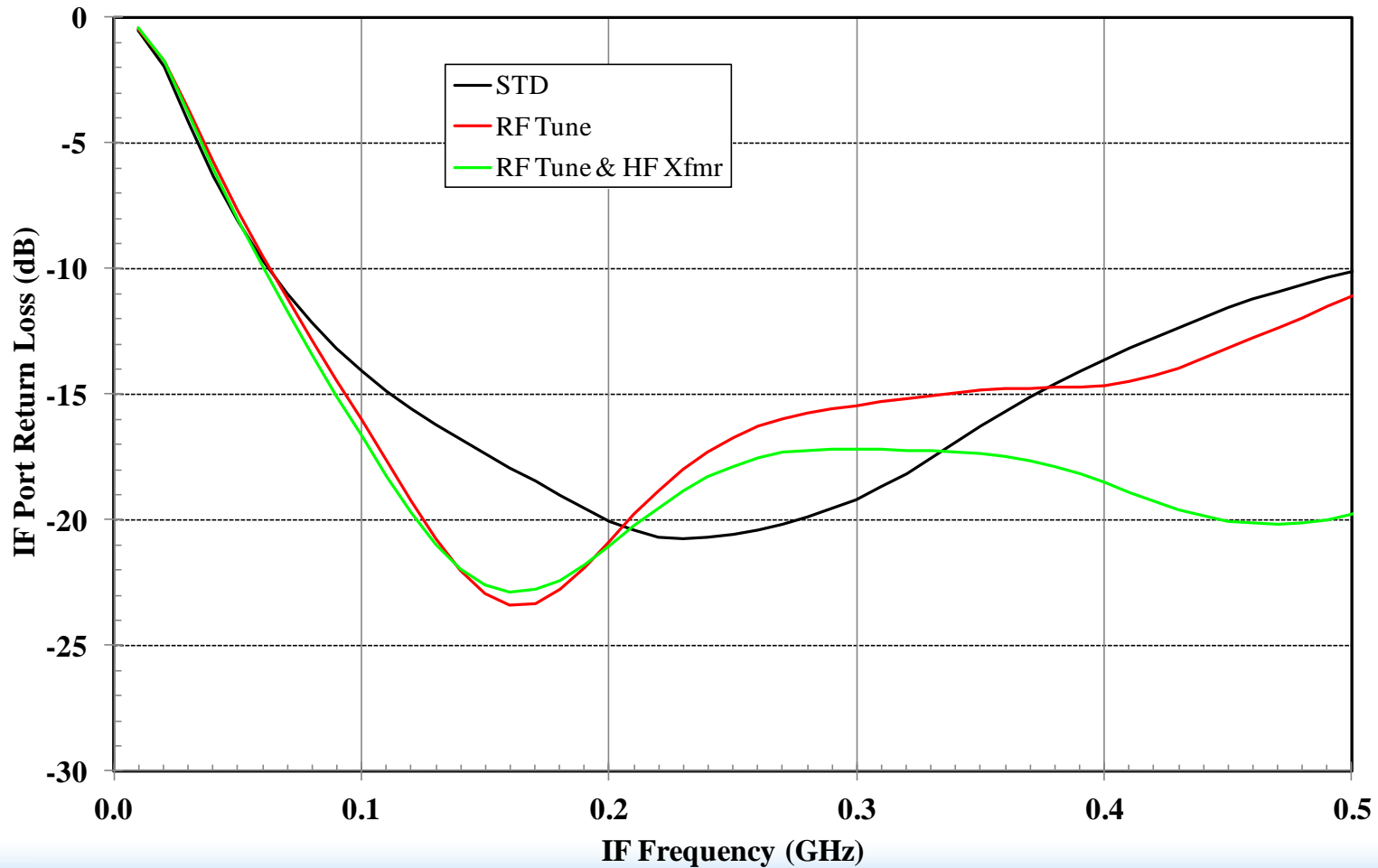
**F1102**  
**LO=1.105 GHz, 0 dBm, +25 C**  
**Data is measured at the evaluation Board**





# IF Port Return Loss

**F1102**  
**LO=1.105 GHz, 0 dBm, +25 C**  
**Data is measured at the evaluation Board**

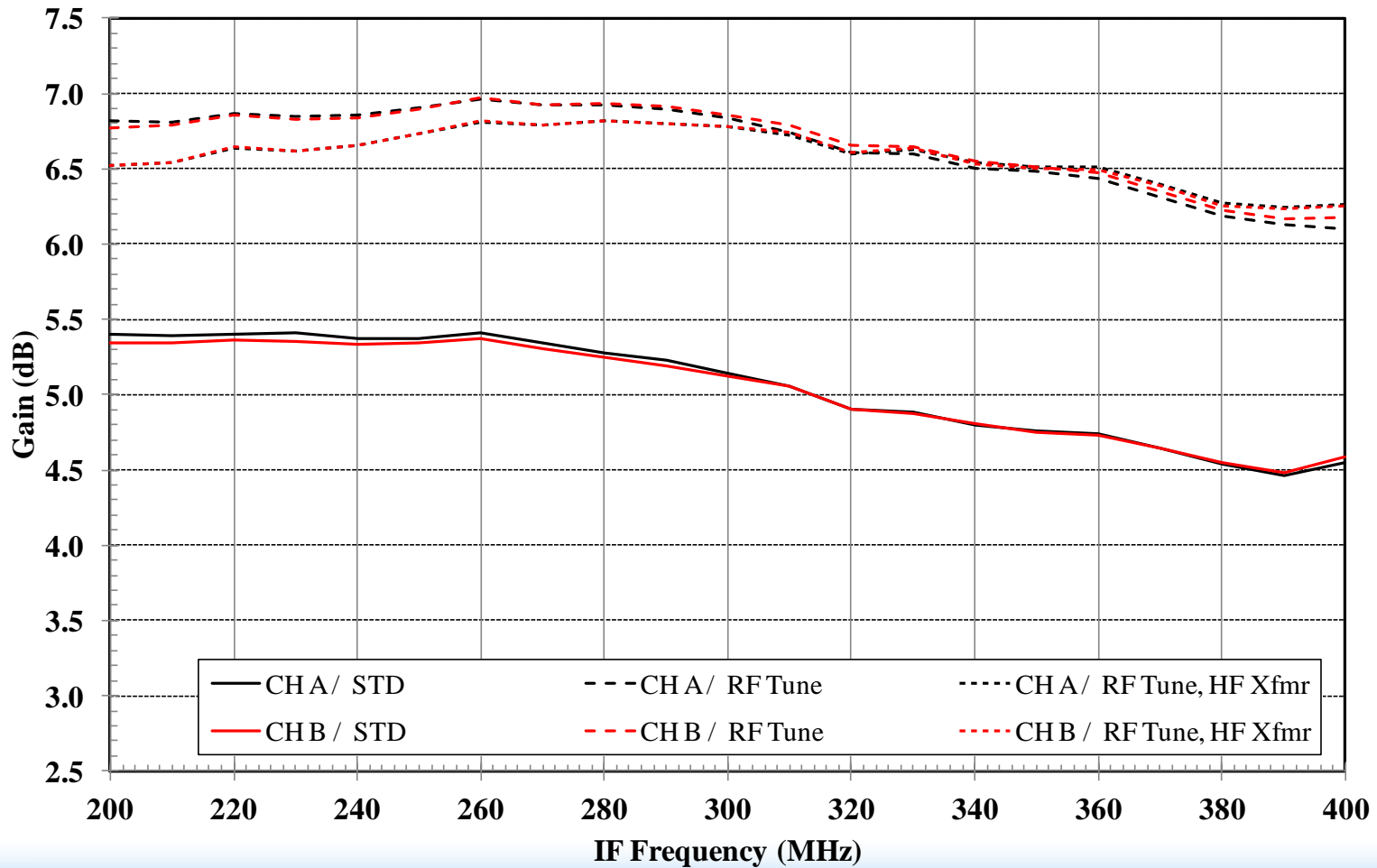


# Gain, LC Mode

F1102

RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board

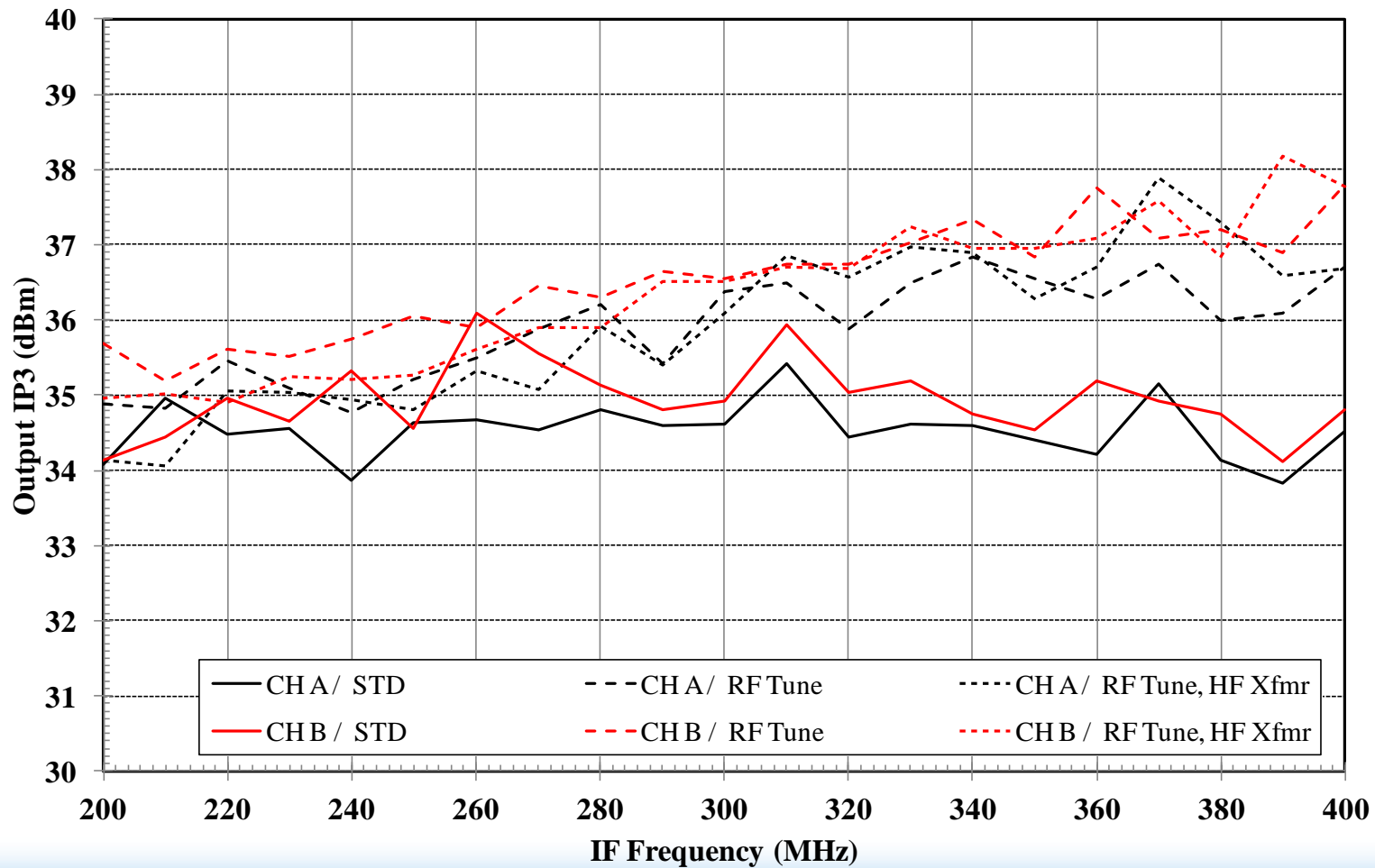


# OIP3, LC Mode

F1102

RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board

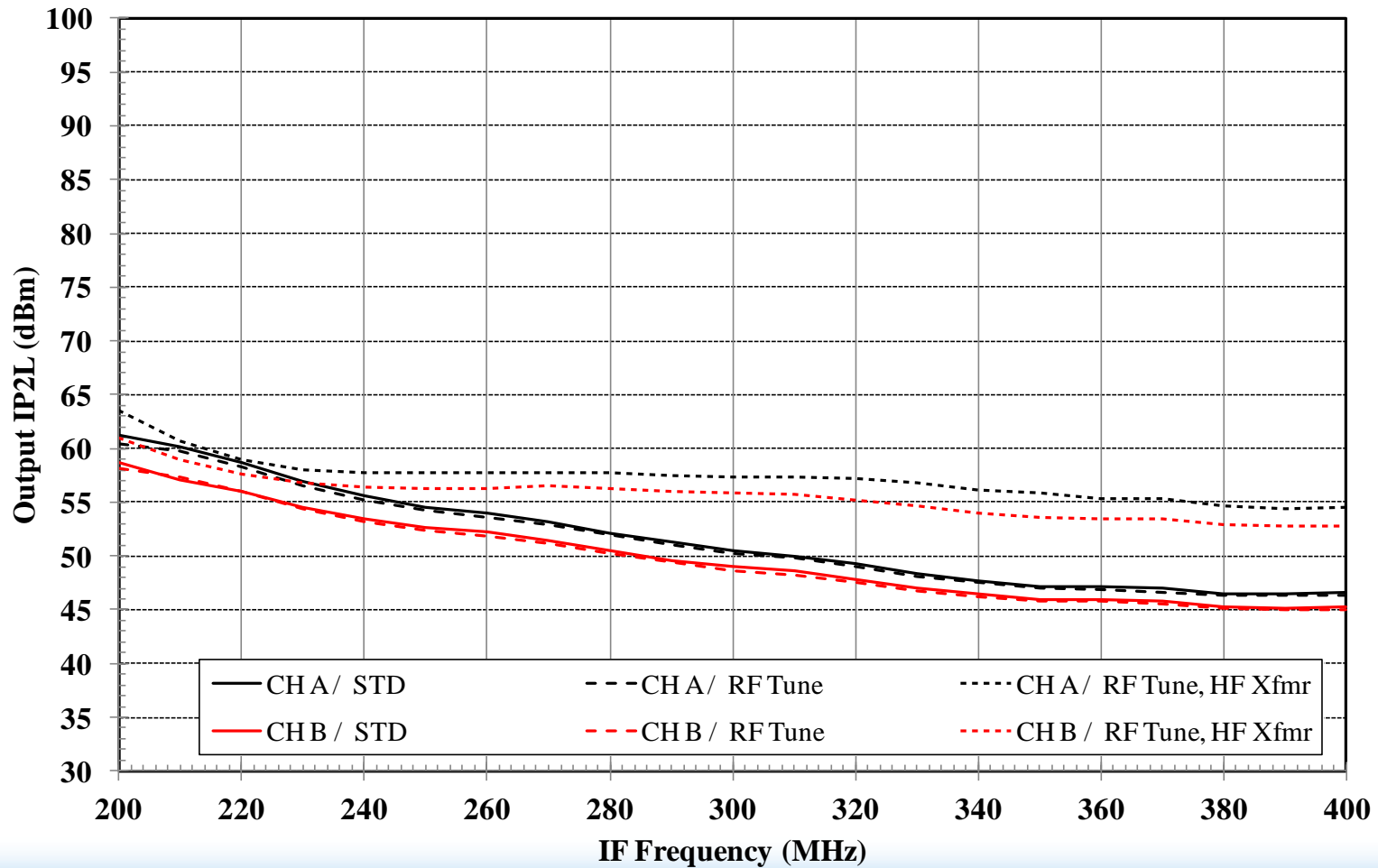


# OIP2, LC Mode

F1102

RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board

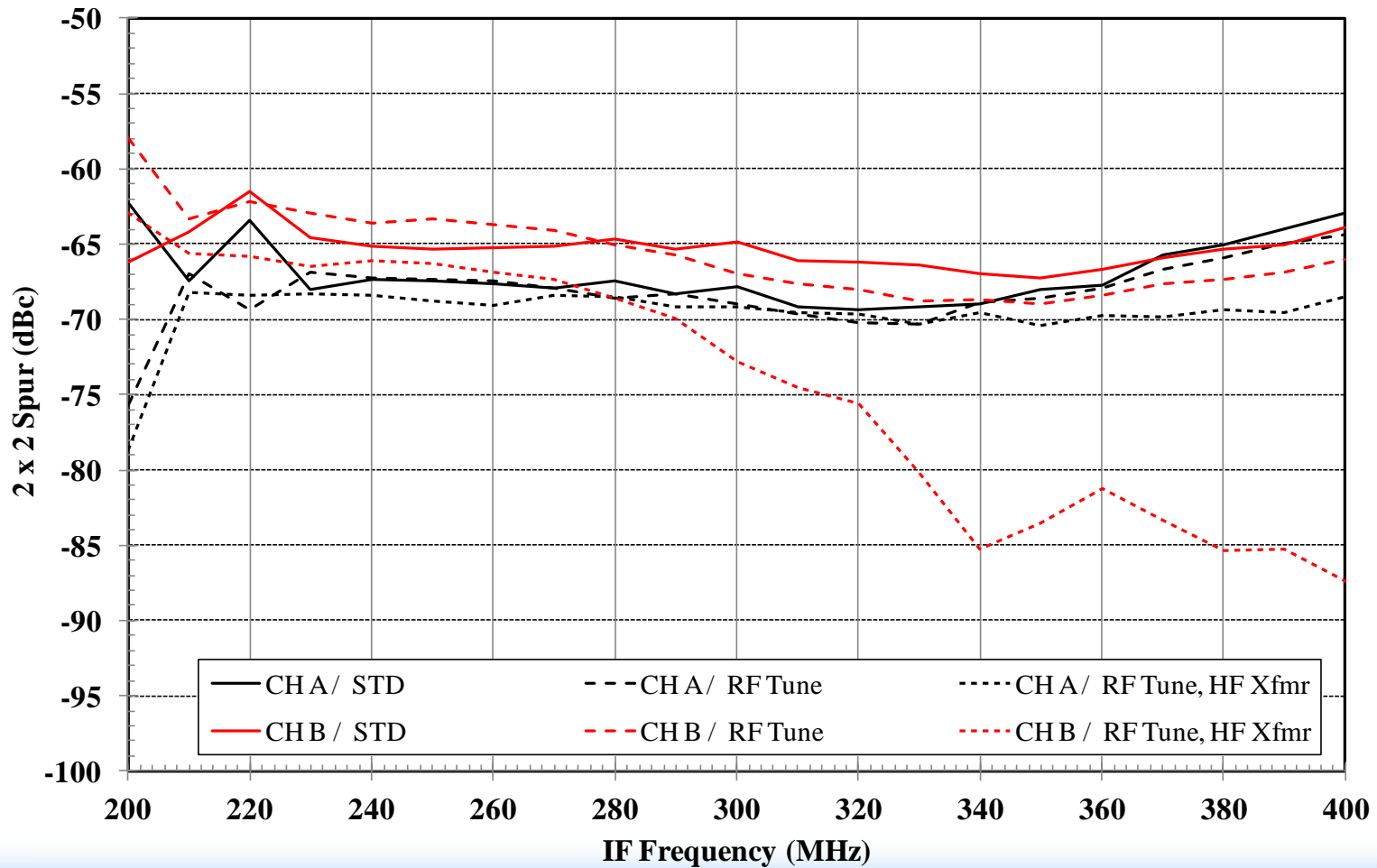


# 2x2 Spur, LC Mode

F1102

RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board

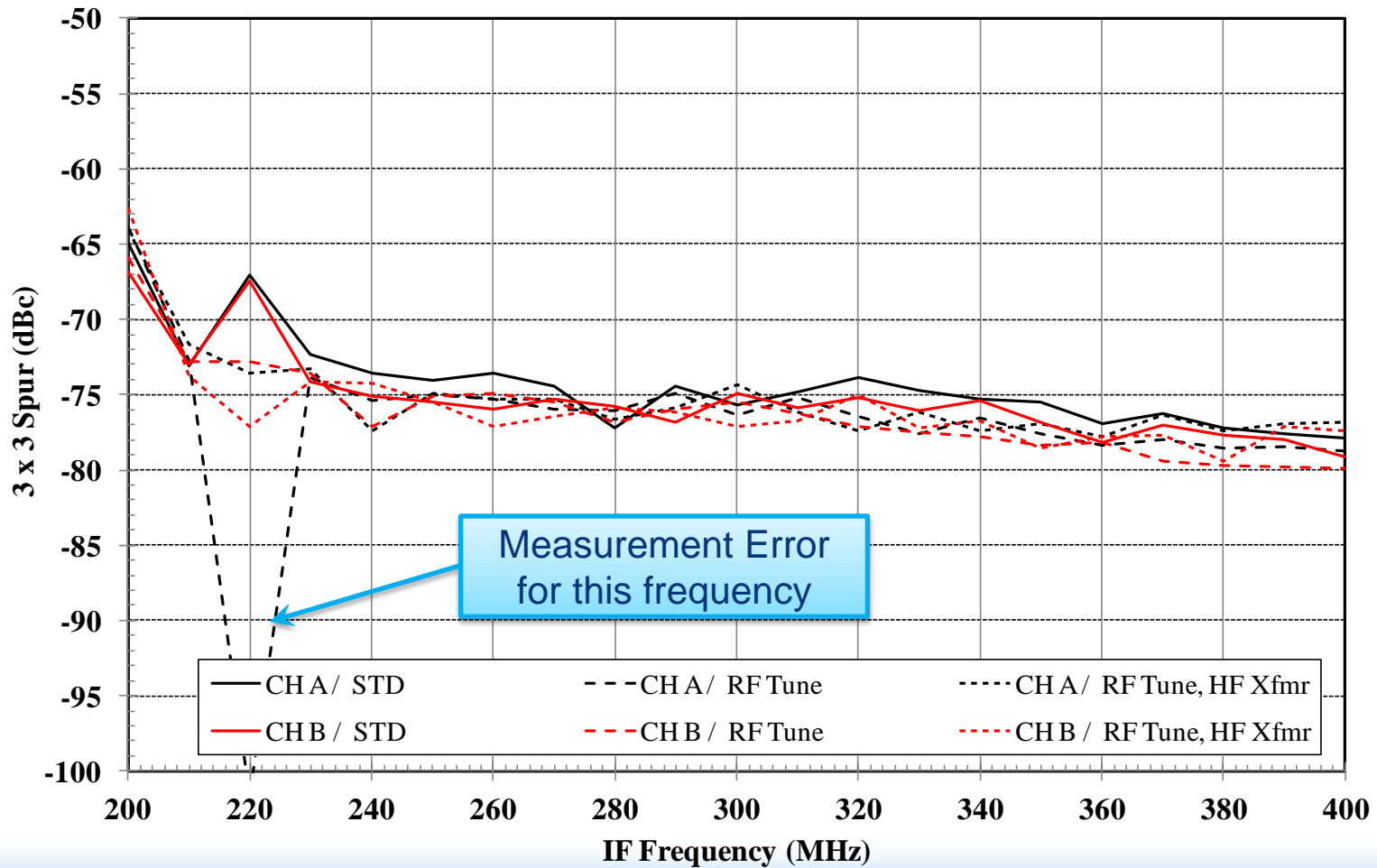


# 3x3 Spur, LC Mode

F1102

RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board



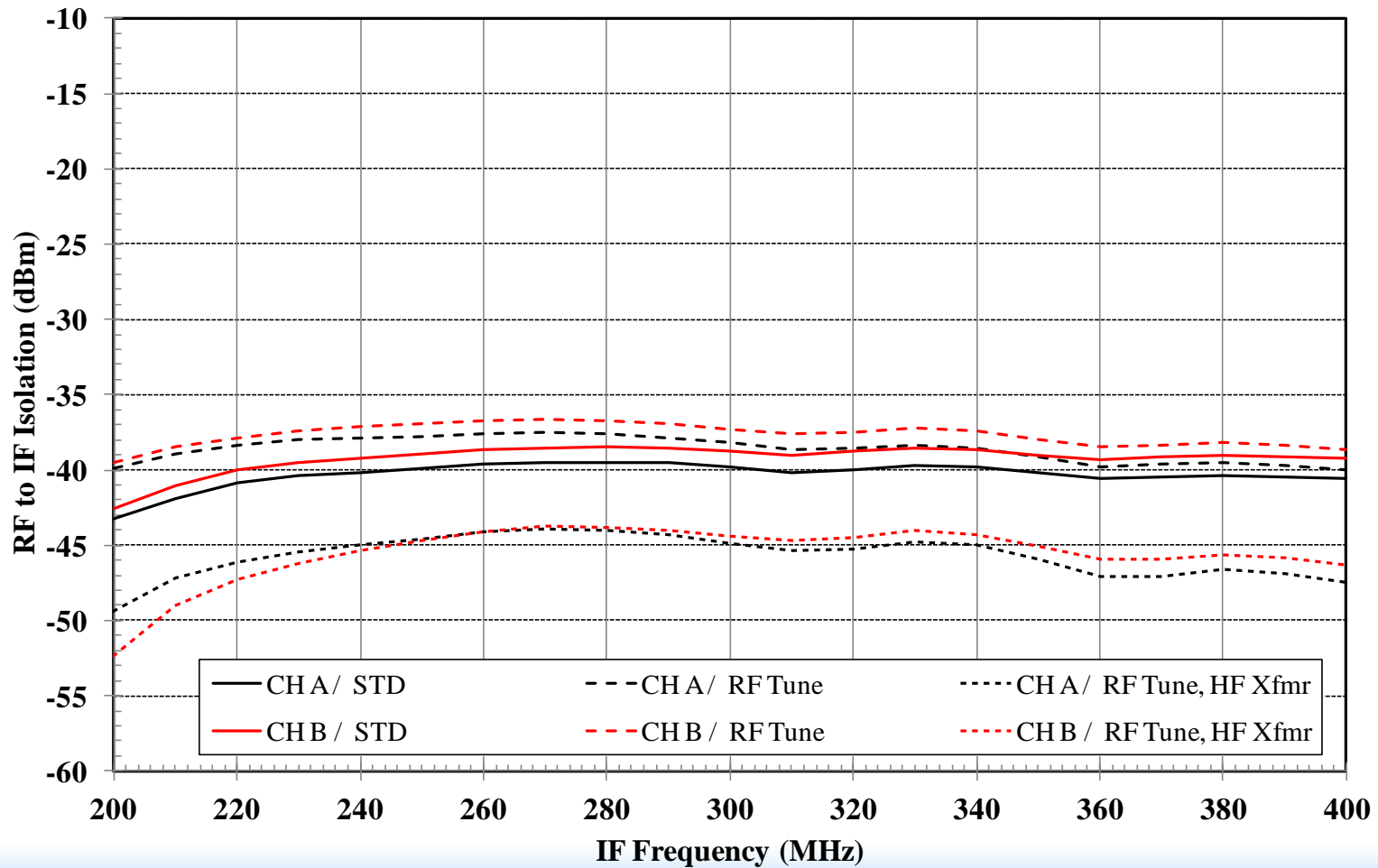


# RF to IF Isolation, LC Mode

F1102

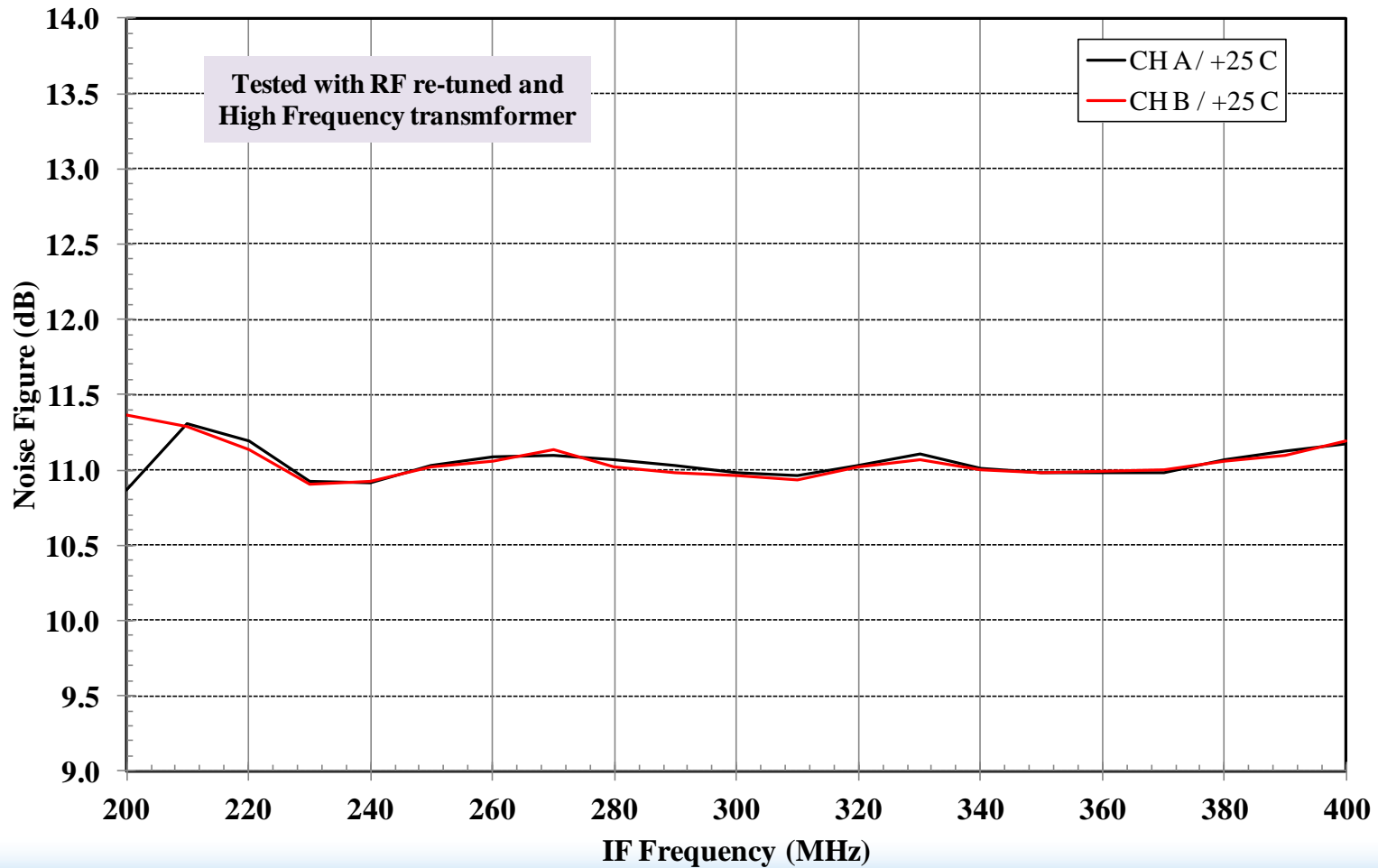
RF = 454 MHz, -10 dBm, High Side LO (LO = RF + IF), 0 dBm, +25 C

Data is measured at the evaluation Board



# Noise Figure, LC Mode

**F1102 Noise Figure**  
**RF = 454 MHz, High Side LO (LO = RF + IF), 0 dBm, +25 C**  
**Data is measured at the evaluation Board**



# Comments

- The gain is only 6.5 dB (datasheet has a typical gain of 8 dB), but the RF tuning helped to increase the gain from the standard configuration.
- The Output IP3 is approximately 37 dBm which is typical for the low current mode.
- The 3x3 Spur is approximately -75 dBc which is similar to the datasheet.
- The RF to IF isolation is about -45 dBm which better than the datasheet of -26 dBm.
- The noise figure is slightly worse, 11 dB versus 9.5 dB.
- *The measured data has board losses that has not be de-embedded which at most will be 0.5 dB.*

