

F1102 Low IF Frequency and Lower DC Power Consumption

- April 23, 2014
- Task AT0053

Michael J. Virostko
Principal Product Application Engineer



The Analog and Digital Company™

Agenda

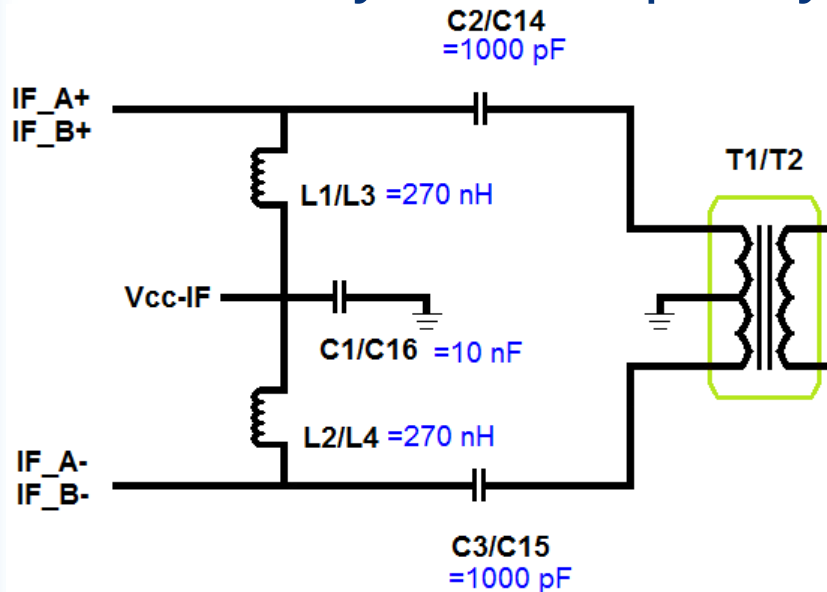
- Purpose
- Circuit Modifications
- Characterization
- Conclusion

Purpose

- Customer's application requires a lower DC power consumption of the F1102 Dual Downconverting Mixer.
- Customer also requires that the output IF response work from 25 – 100 MHz.
- We will investigate various bias conditions by varying the bias resistors and then perform a full characterization for one part.

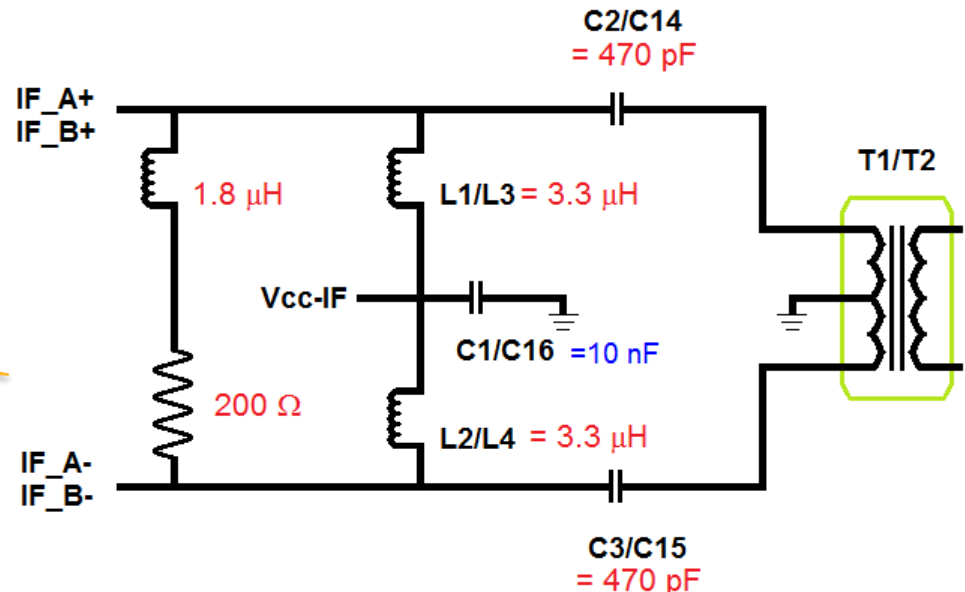
Circuit Modifications

- IDT's evaluation board (F1150 EV Kit Rev 5) has IF Circuitry for a frequency range of 50 to 300 MHz.



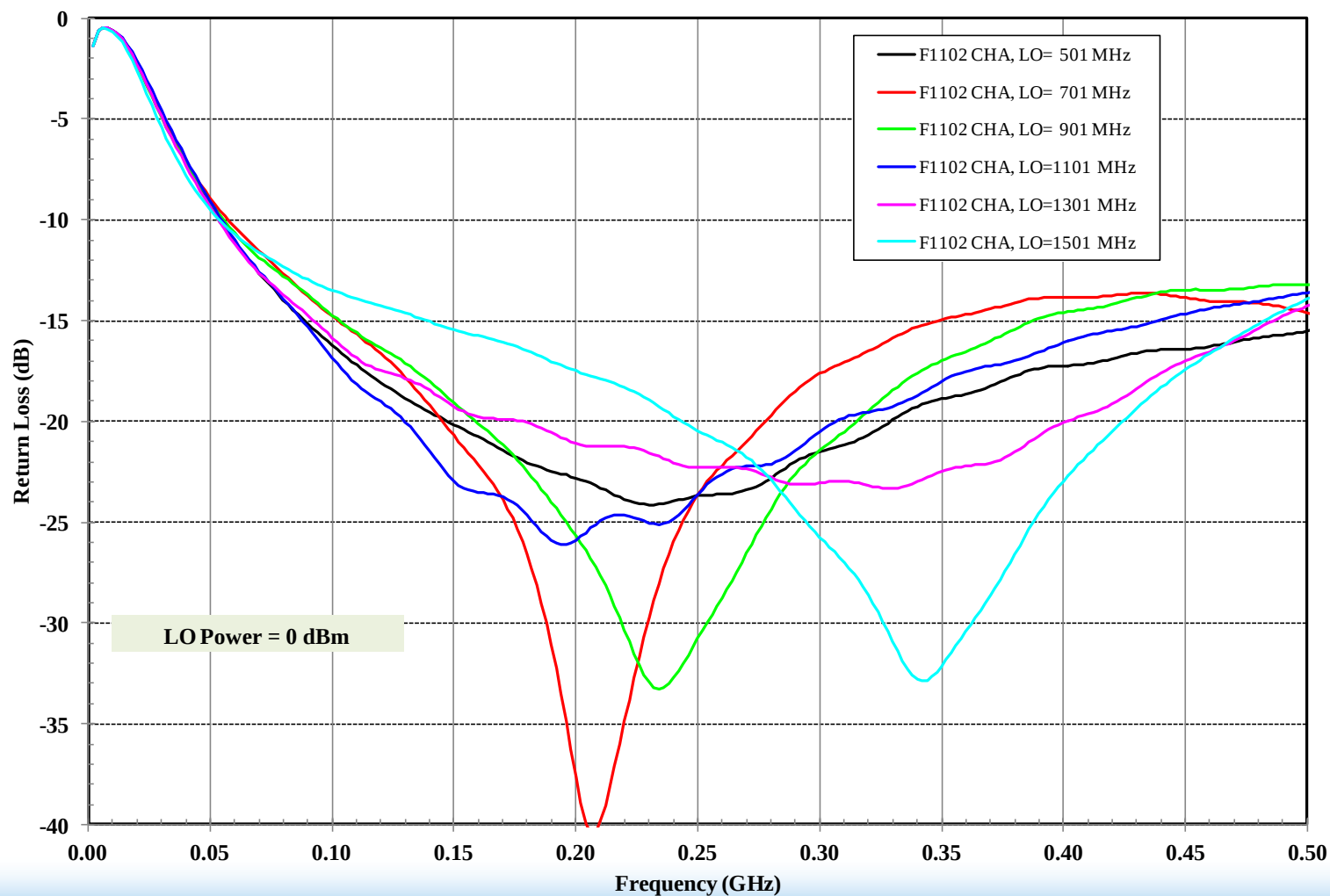
**Standard Evaluation
Board IF Circuitry**

**Modified IF Circuitry
for 10 MHz Operation**



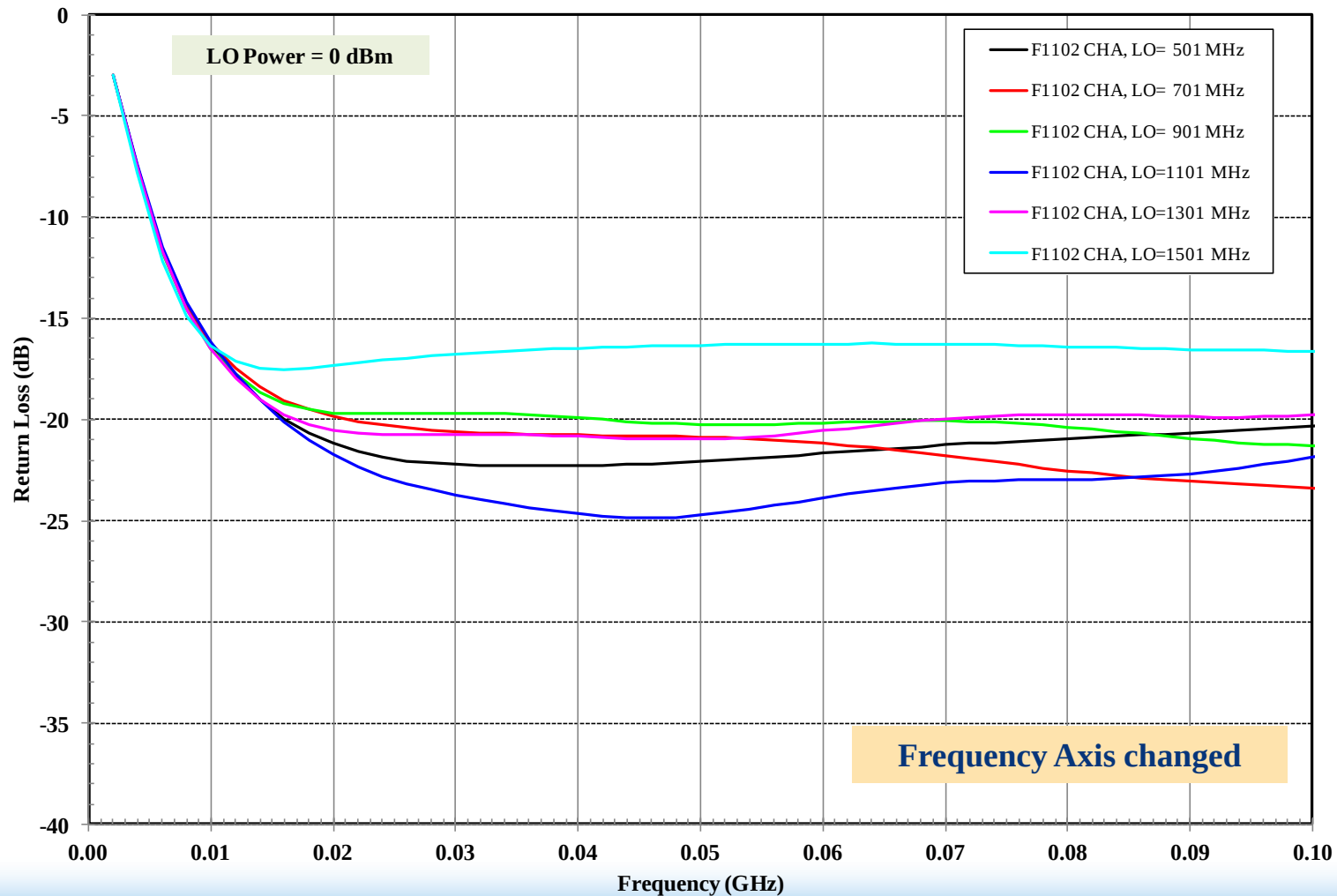
Characterization – IF Return Loss - Standard

F1102 Standard Evaluation Board
IF Port Return Loss



Characterization – IF Return Loss – 10 MHz

F1102 IF Return Loss
Low Frequency IF components



Characterization – Measurement Parameters

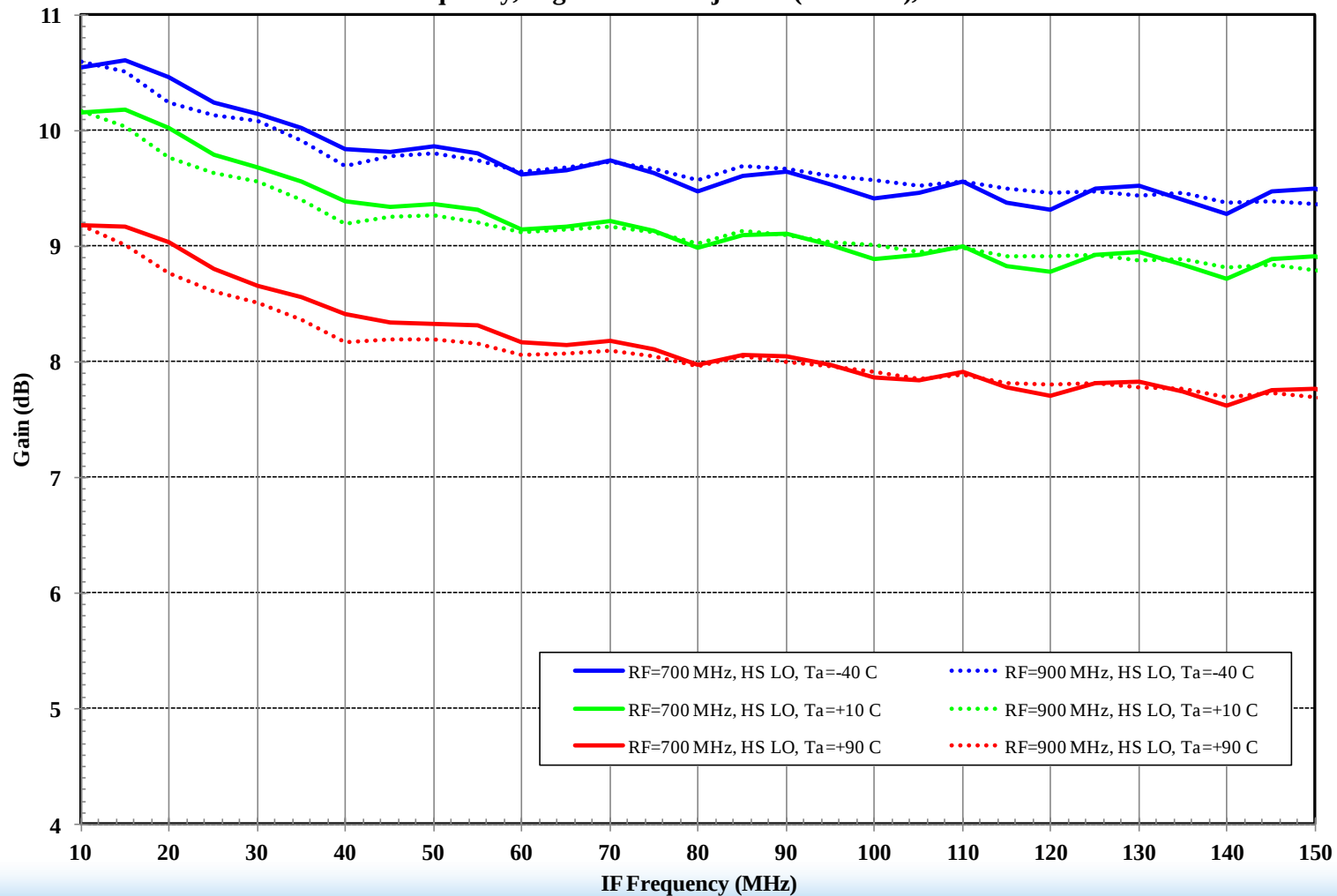
- Data is collected at the end of the evaluation board
 - No loss correction is done
- Low Current mode was used for all measurements. The resistors used are:
 - IF_BiasA = IF_BiasB = 62 ohms
 - LO1_Adj_Bias = 180 ohms
 - LO2_Adj_Bias = 4100 ohms
 - Different from the standard low current mode
- RF frequency was 700 and 900 MHz
- LO swept for both high and low side injection
- IF swept

Characterization – Measurement Parameters

- The Voltage applied to the IF circuit (V_{cc-IF}) was changed from 5.0 to 3.3 V.
- V_{cc-IF} must be turned on before V_{cc} .
- The current variation is in the 10's of μA . The nominal current is 104.4 mA for either applied voltage.
- DC Power is calculated for the entire device (both Channels).
- RF data was only collected on Channel A.

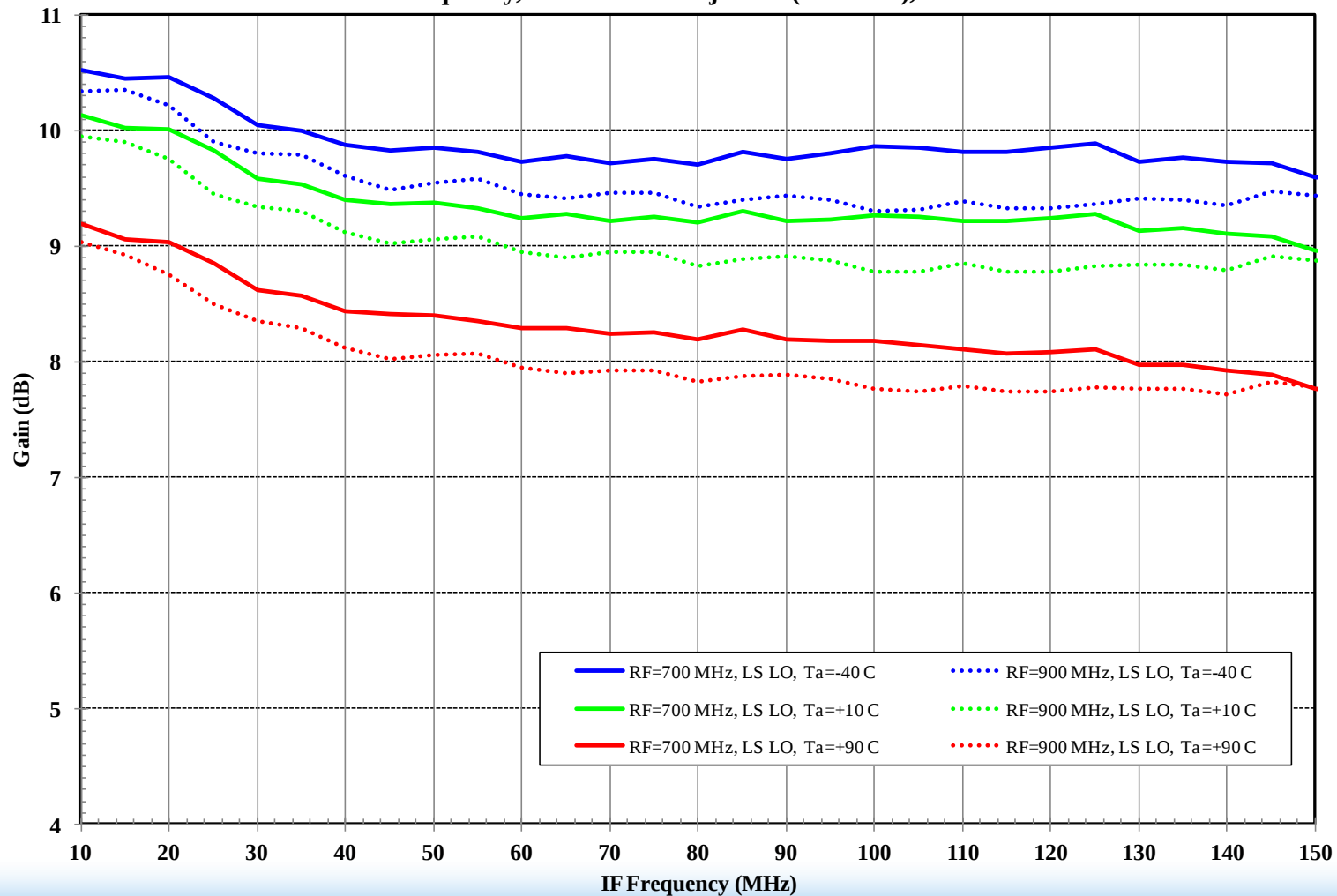
Characterization – Gain, High Side LO

F1102 RF to IF Dual Downconverting Mixer
Low Frequency IF Circuitry, $V_{cc-IF} = +3.3\text{ V}$, $V_{cc} = +5.0\text{ V}$
RF Fixed Frequency, High Side LO Injection ($RF < LO$), $IF = LO - RF$



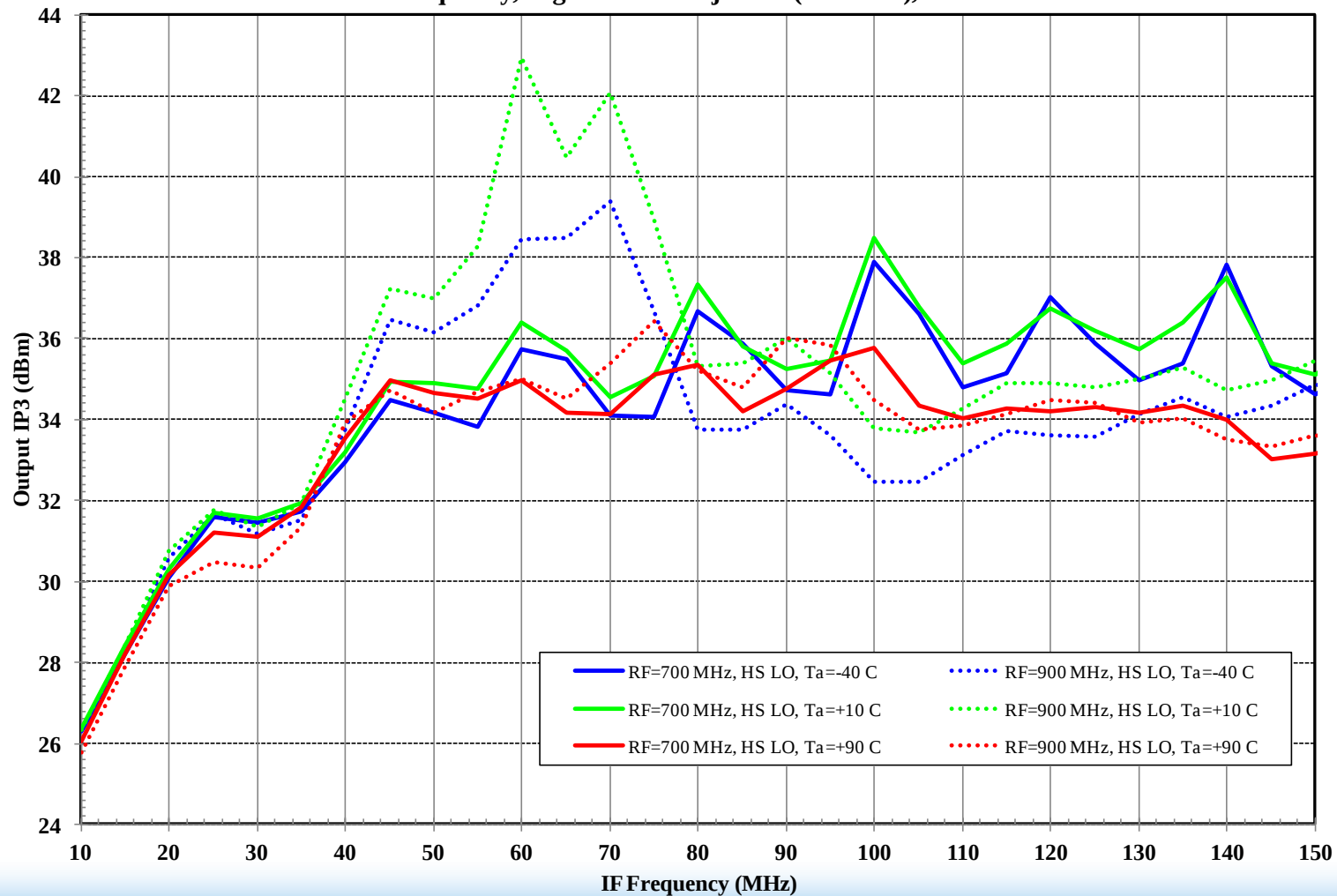
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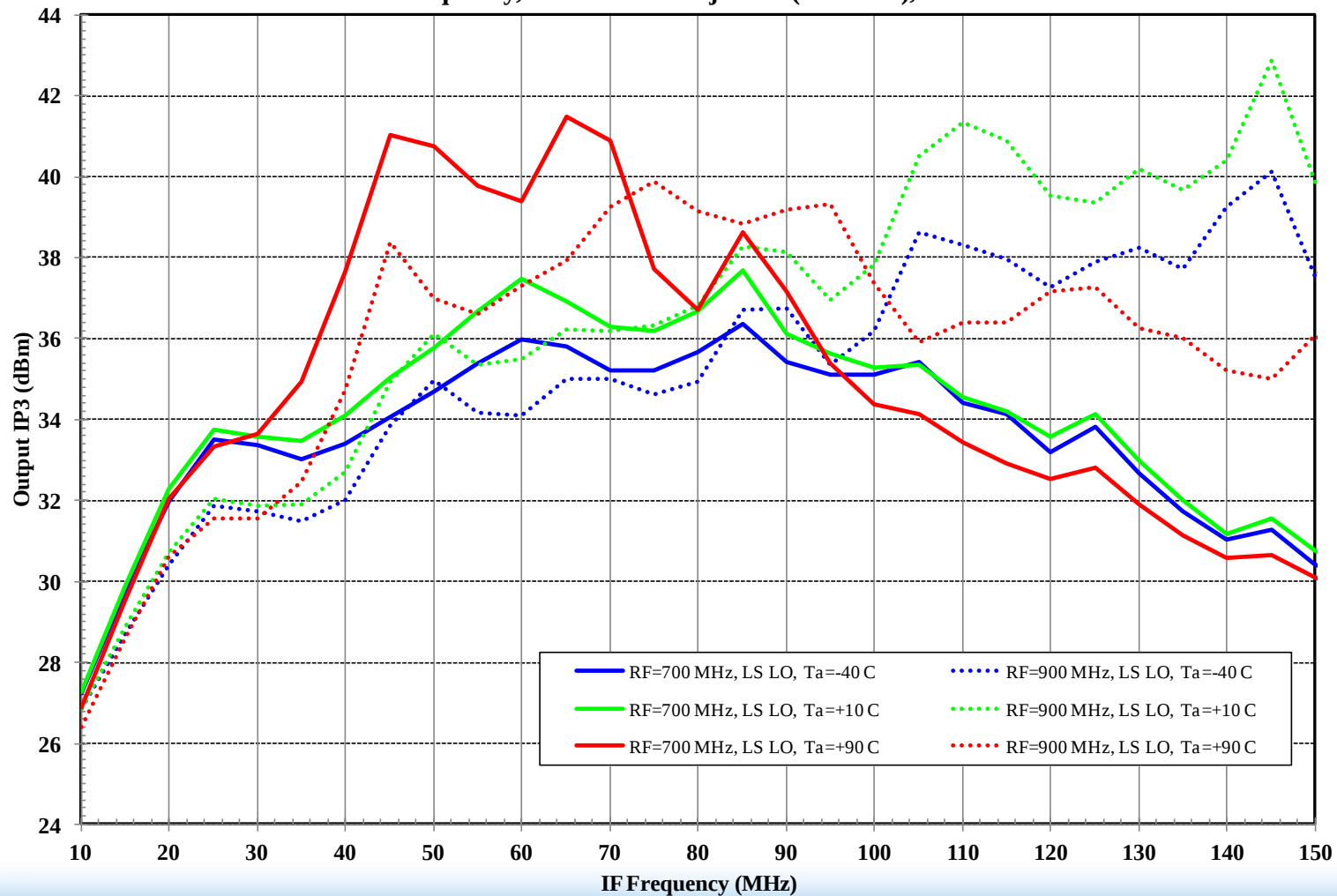
Characterization – OIP3, High Side LO

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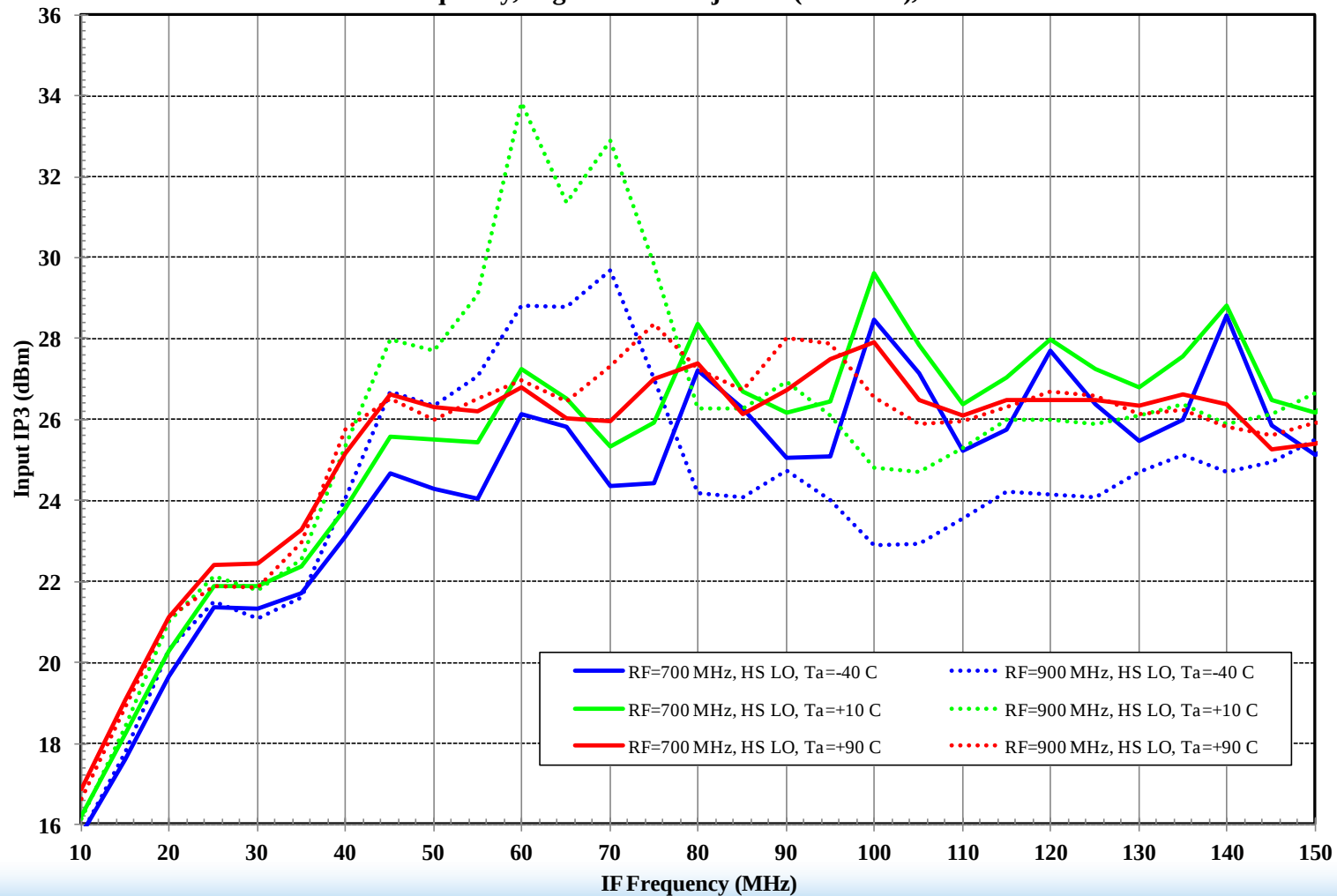
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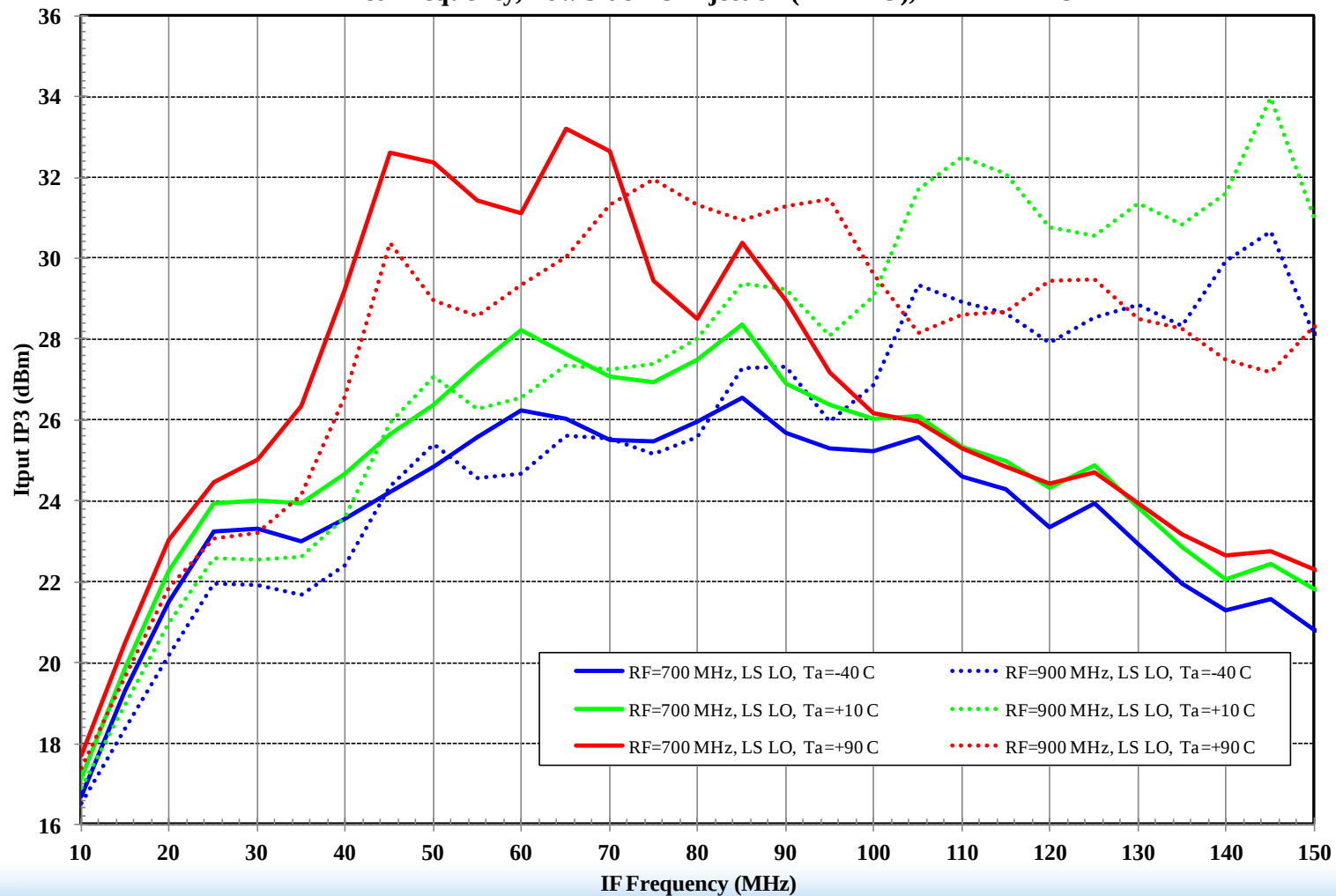
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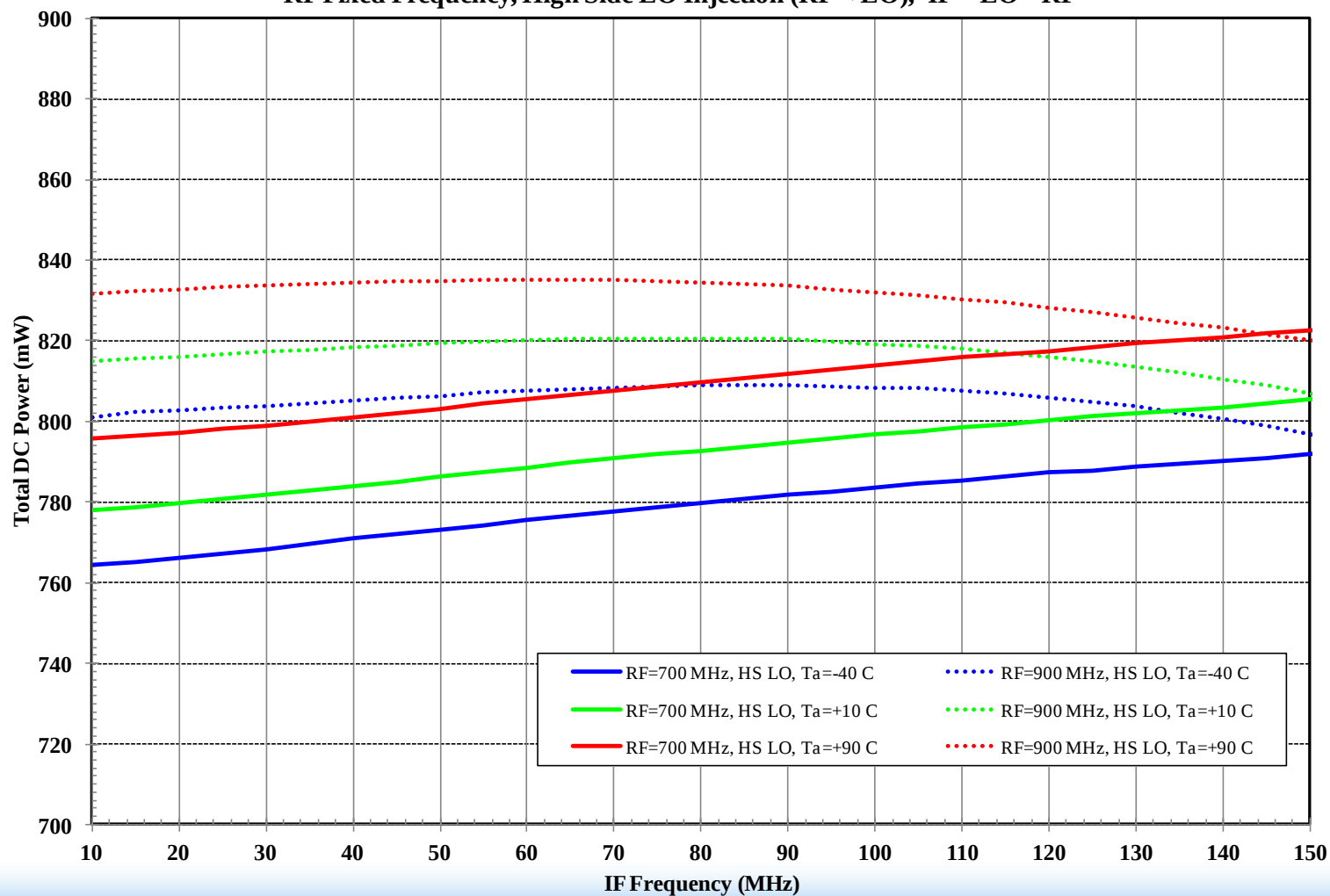
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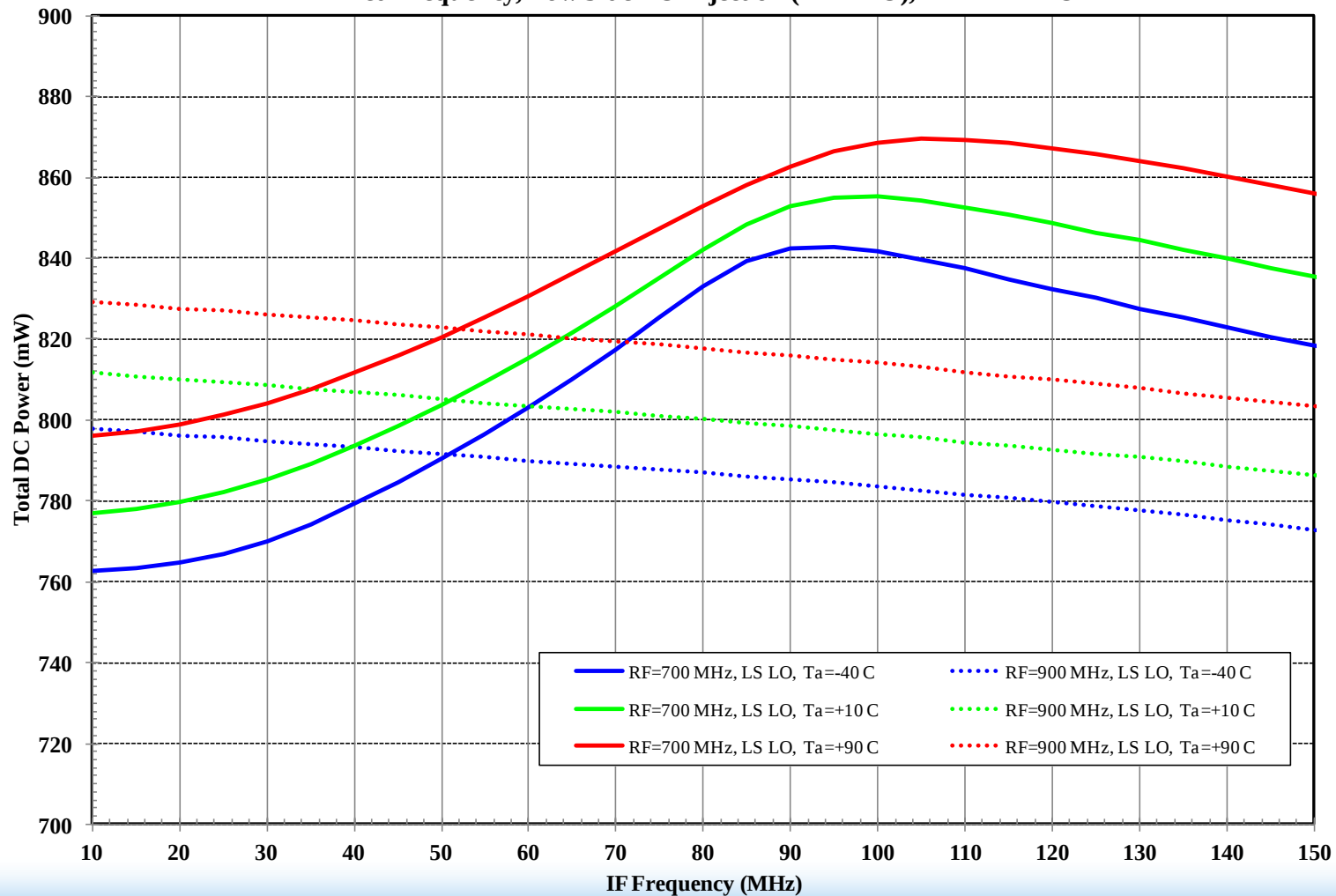
Characterization – DC Power, High Side LO

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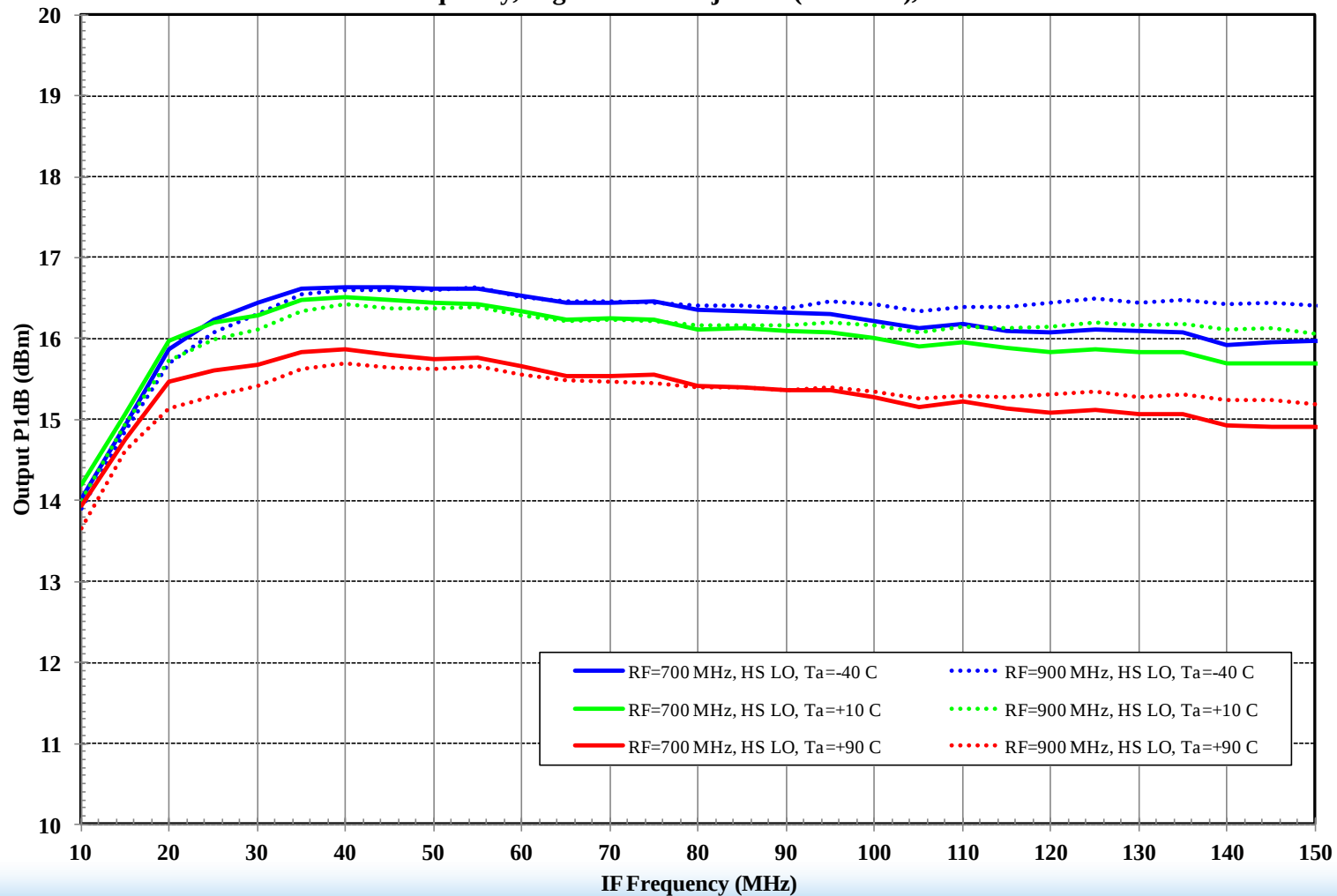
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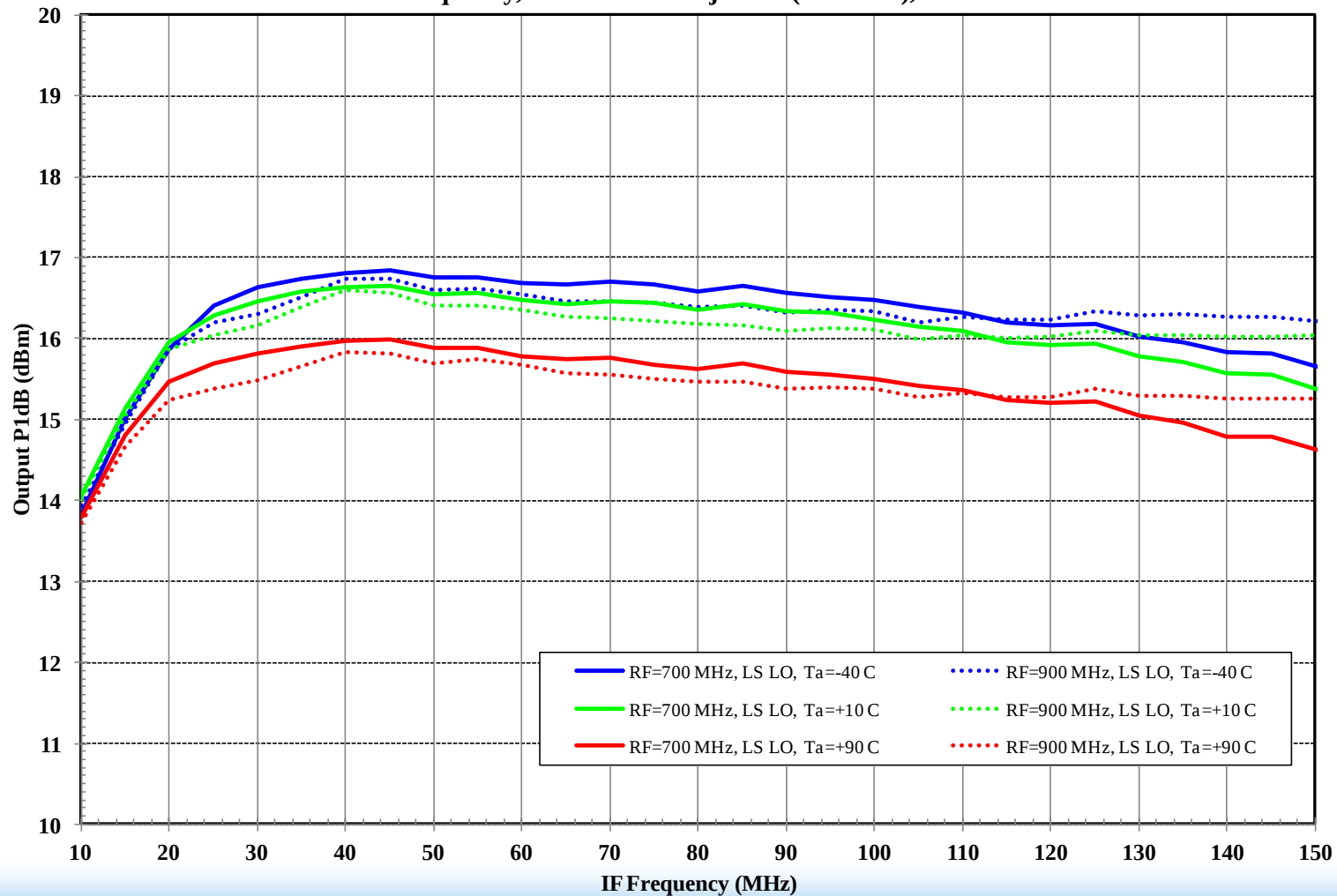
Characterization – OP1dB, High Side LO

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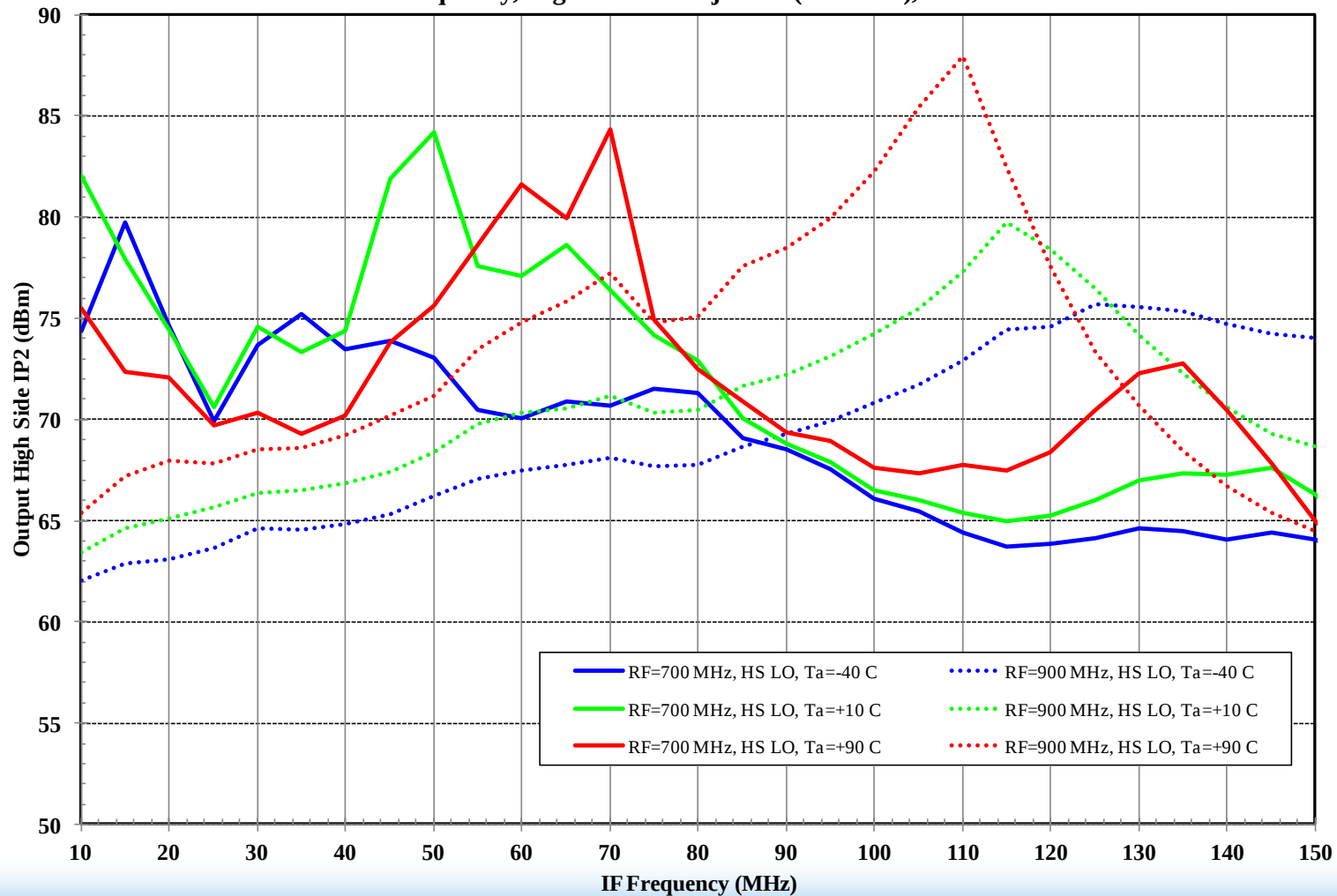
Characterization – OP1dB, Low Side LO

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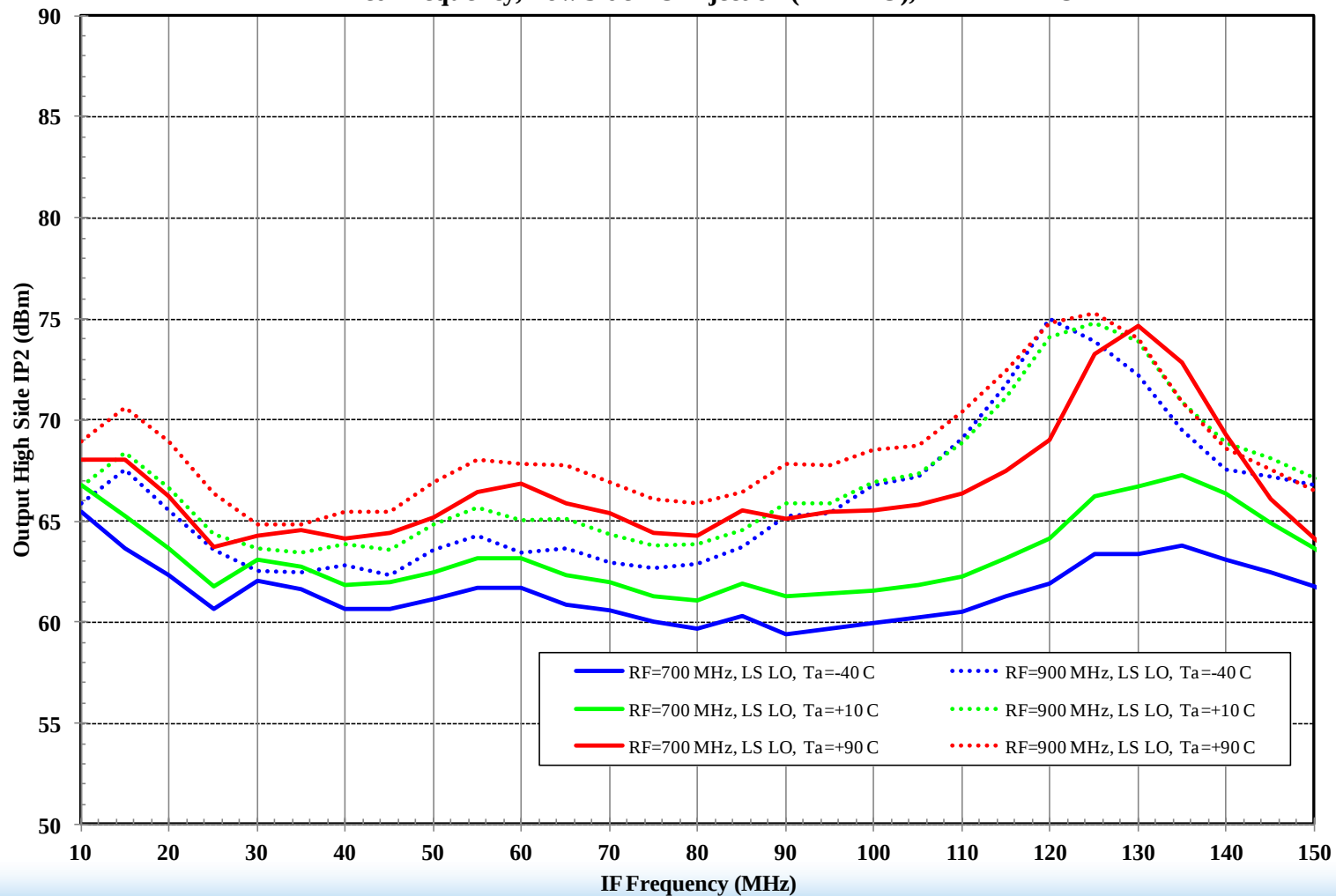
Characterization – OIP2, High Side LO

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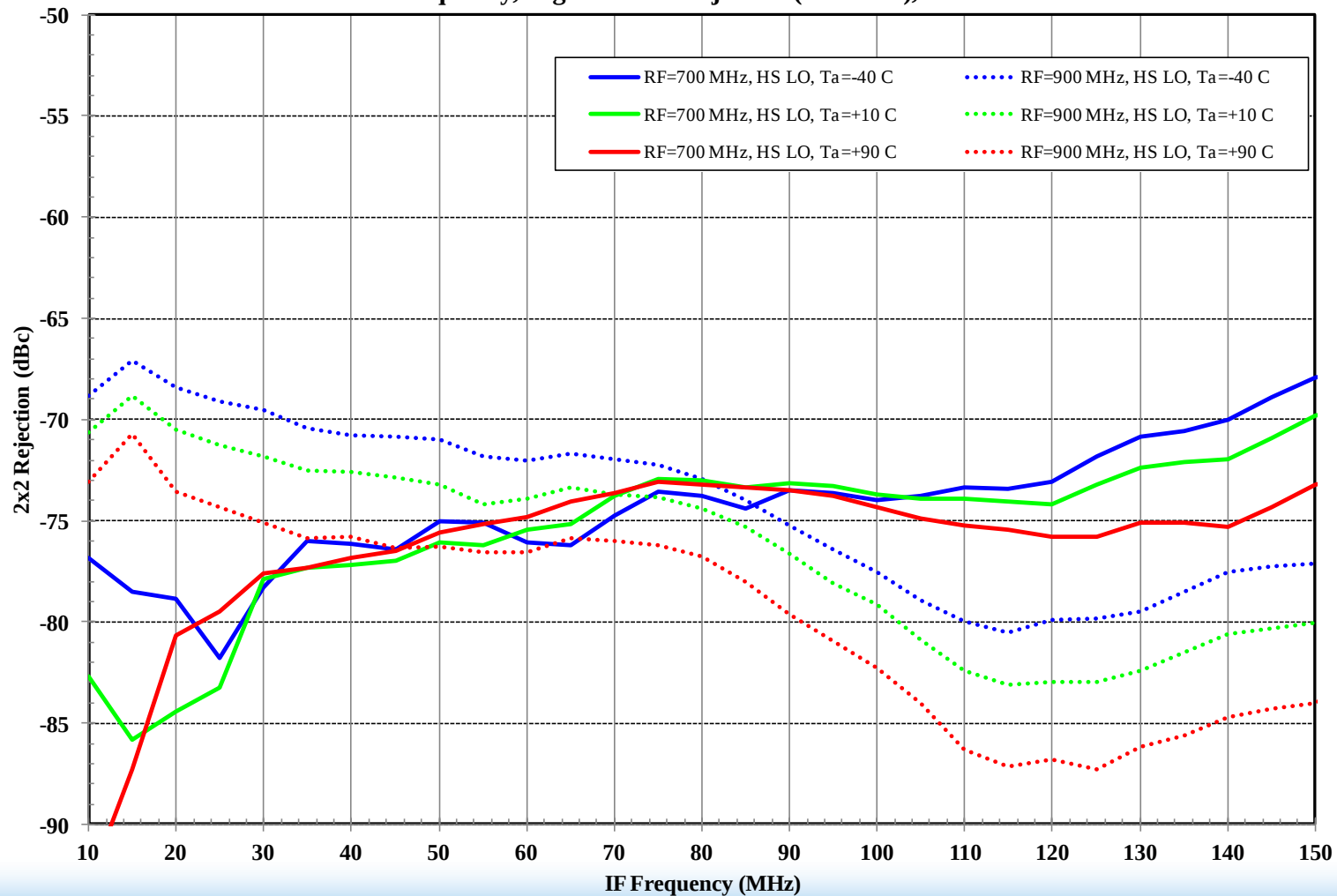
Characterization – OIP2, Low Side LO

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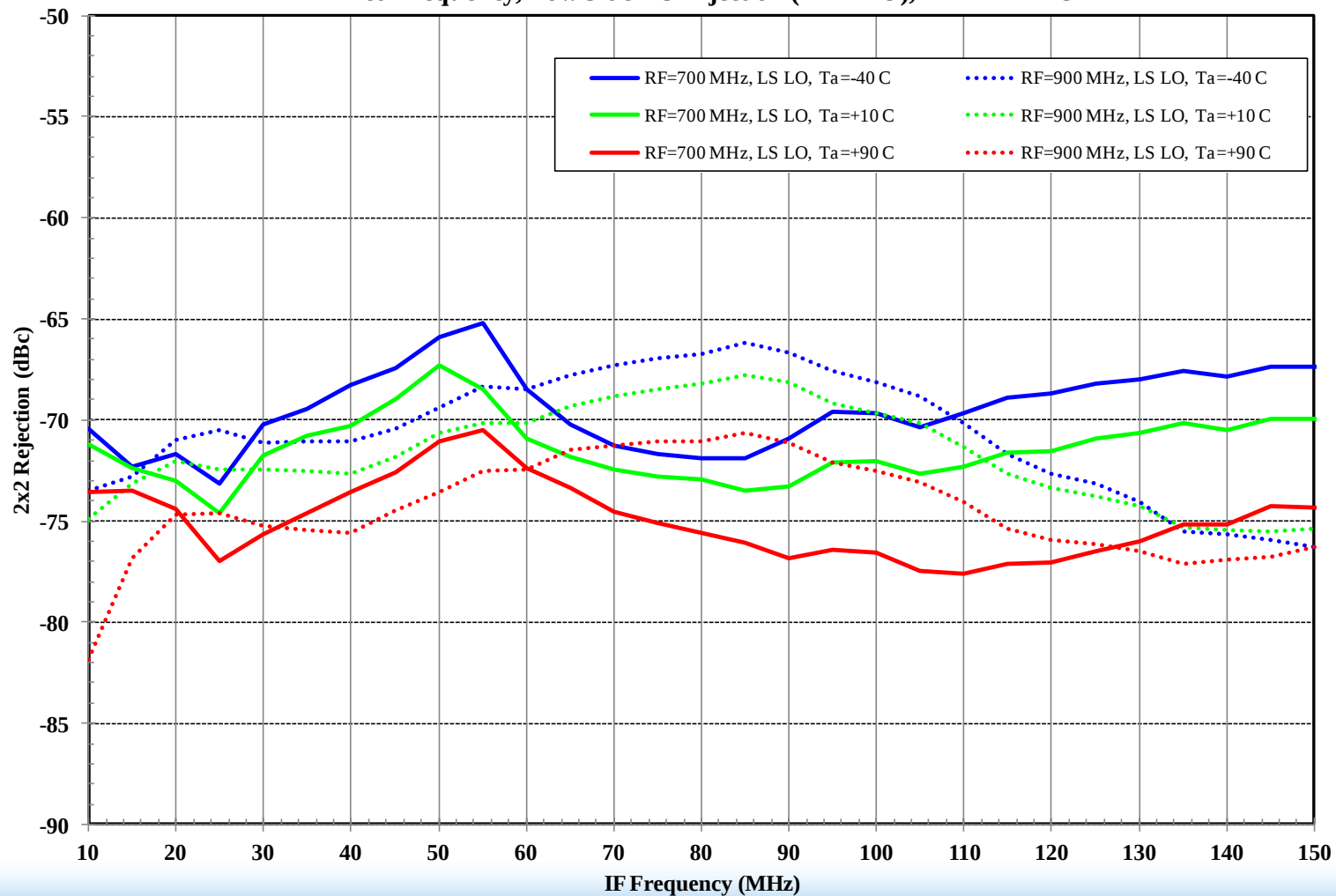
Characterization – 2x2 Rejection, High Side LO

F1102 RF to IF Dual Downconverting Mixer
Low Frequency IF Circuitry, $V_{cc-IF} = +3.3\text{ V}$, $V_{cc} = +5.0\text{ V}$
RF Fixed Frequency, High Side LO Injection ($RF < LO$), $IF = LO - RF$



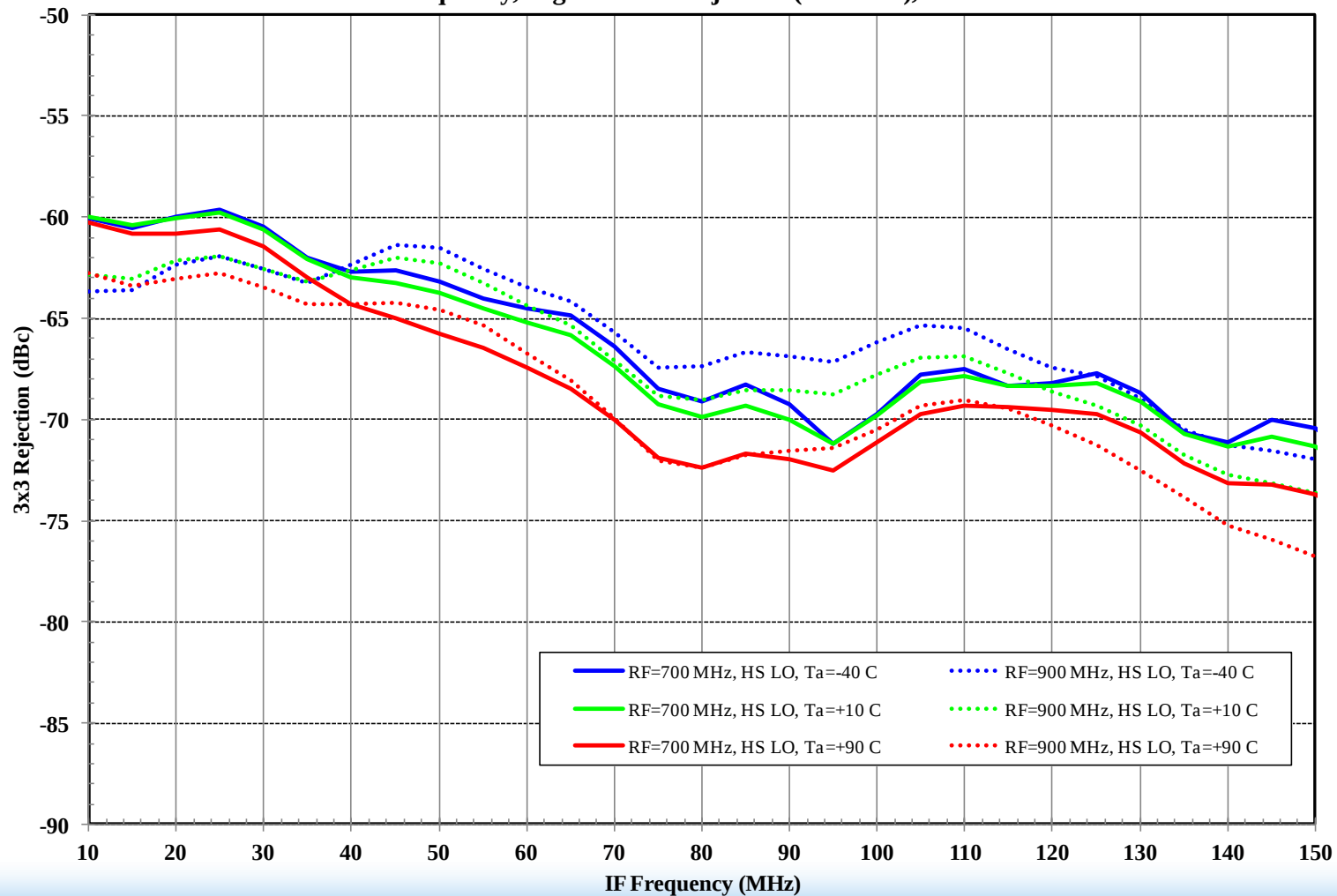
Characterization – 2x2 Rejection, Low Side LO

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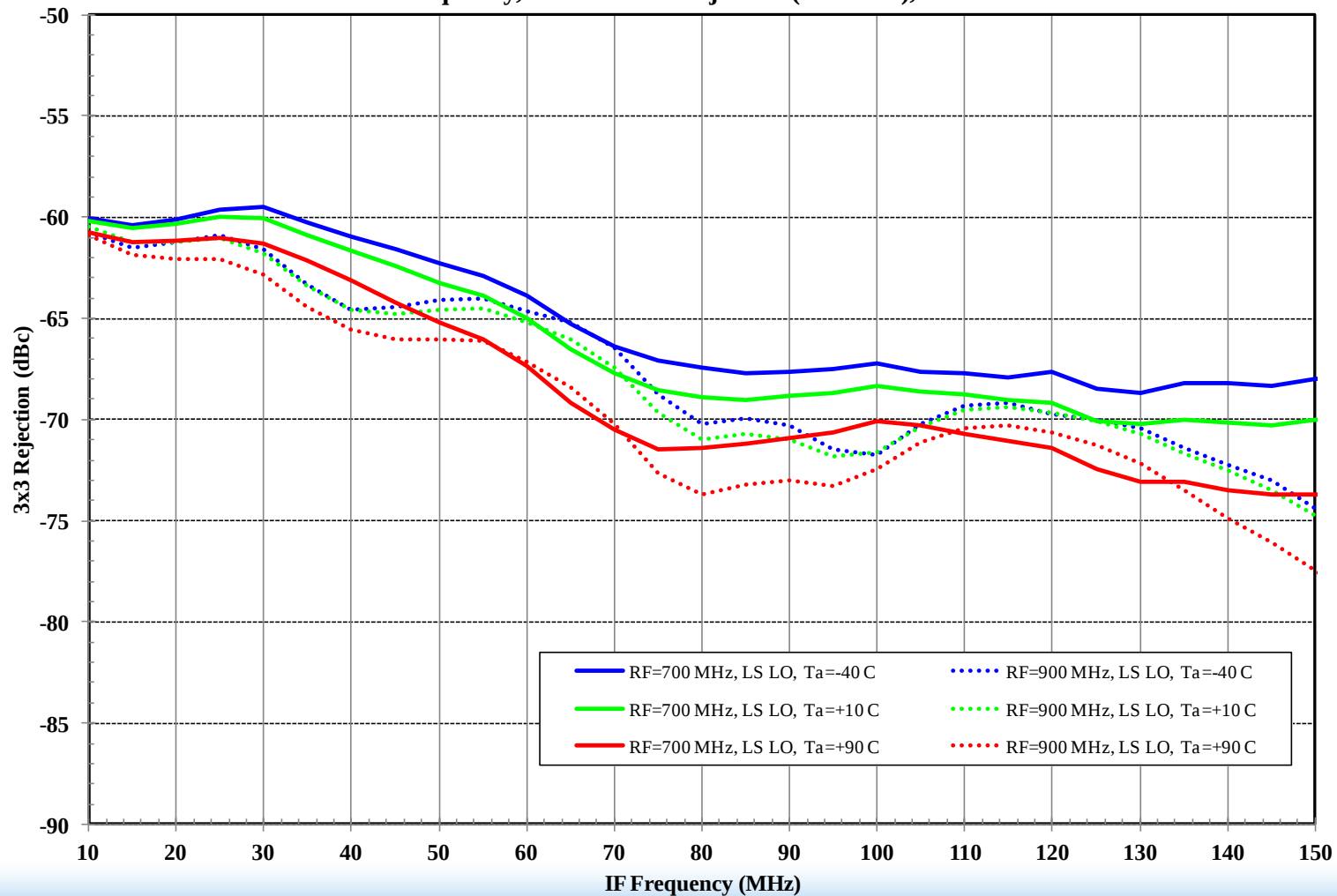
Characterization – 3x3 Rejection, High Side LO

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Low Frequency IF Circuitry, $V_{cc-IF} = +3.3\text{ V}$, $V_{cc} = +5.0\text{ V}$
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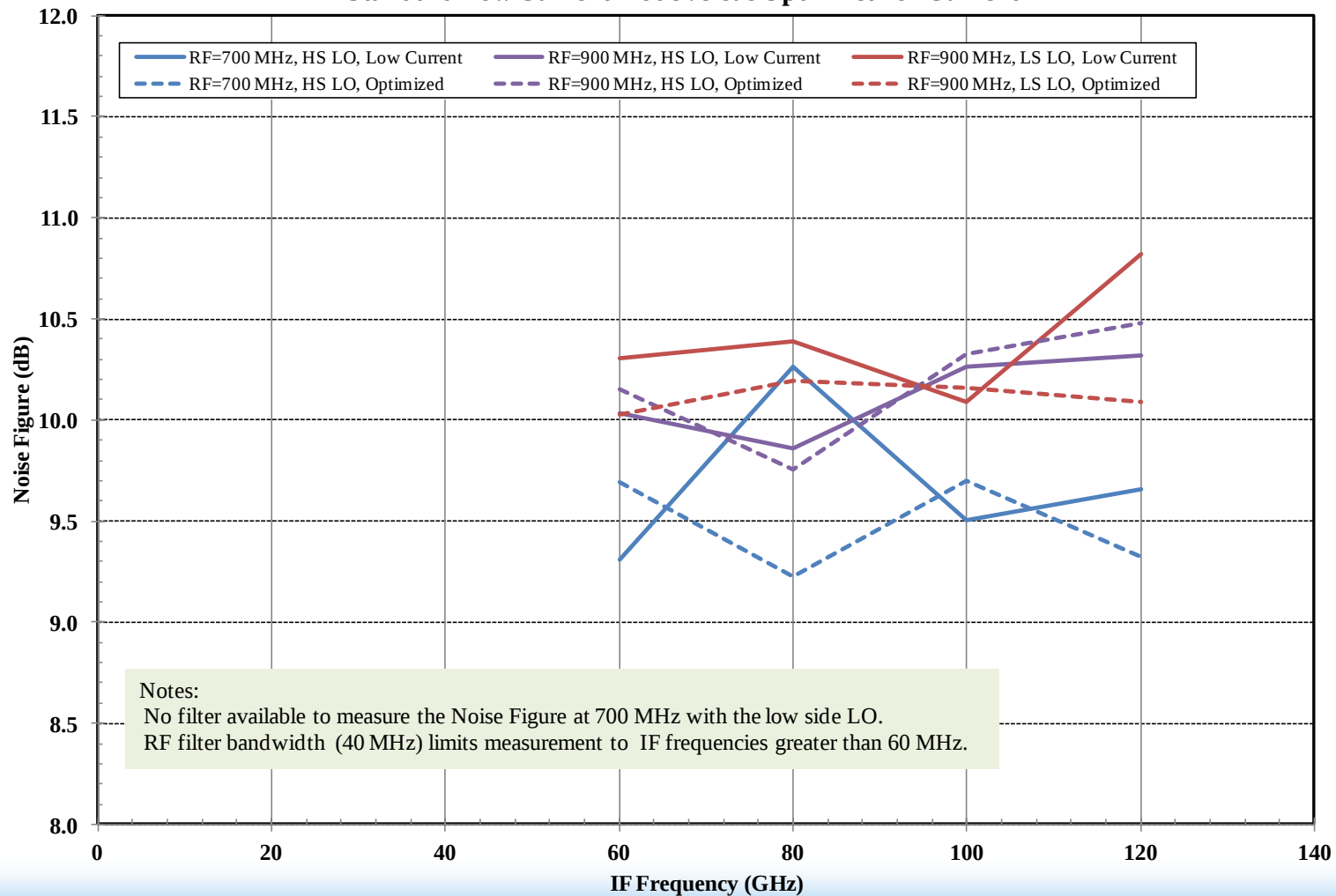
Characterization – 3x3 Rejection, Low Side LO

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Low Frequency IF Circuitry, $V_{cc-IF} = +3.3\text{ V}$, $V_{cc} = +5.0\text{ V}$
RF Fixed Frequency, Low Side LO Injection ($RF > LO$), $IF = RF - LO$



Characterization – Comparison of Noise Figure, +25 C

F1102 RF to IF Dual Downconverting Mixer
Low Frequency IF Circuitry, RF Fixed Frequency, +25 C
Standard Low Current Mode versus Optimized for Current

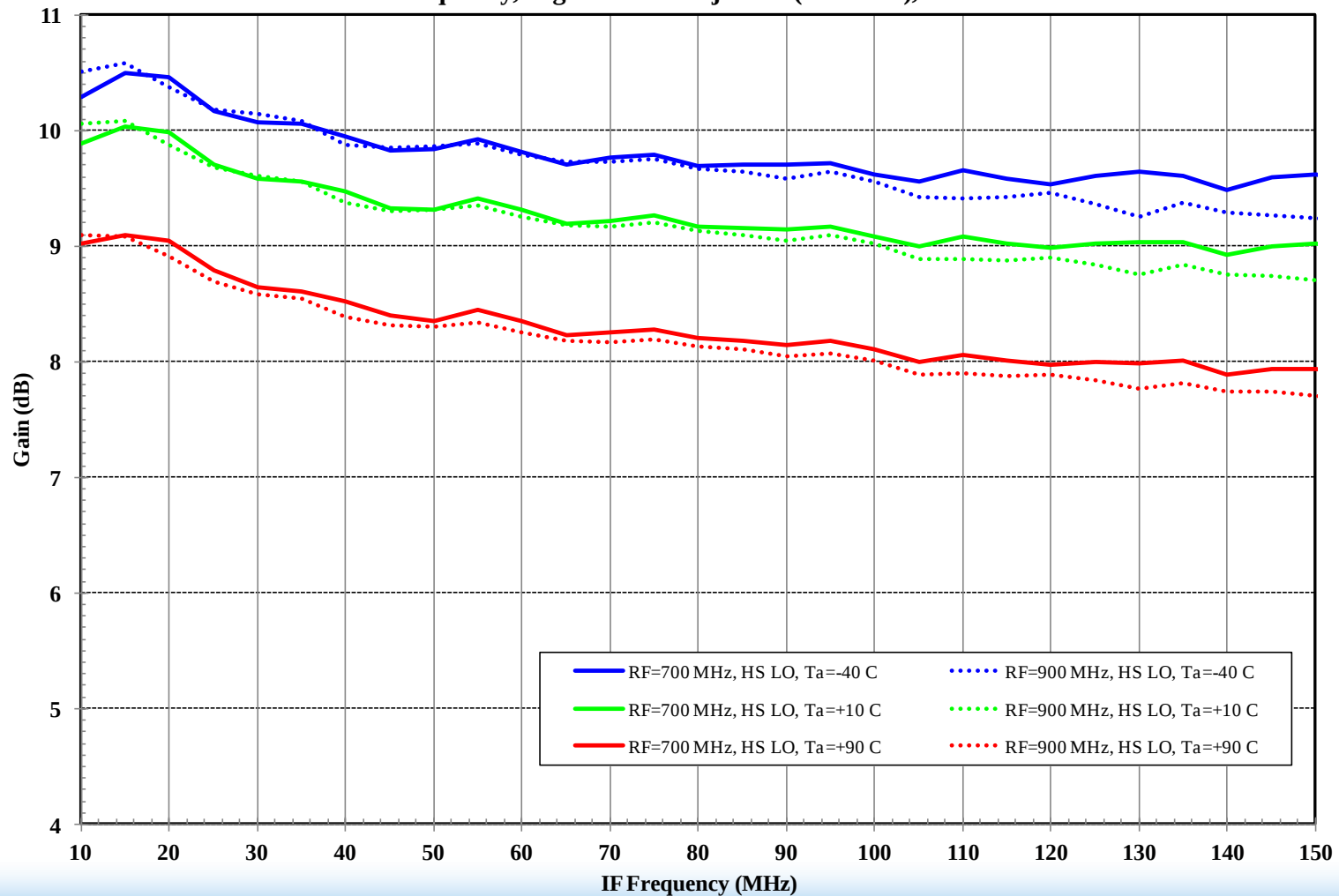


Characterization – Standard Measurement Parameters

- Standard Low Current mode was used for all measurements. The resistors used are:
 - IF_BiasA = IF_BiasB = 62 ohms
 - LO1_Adj_Bias = 180 ohms
 - LO2_Adj_Bias = 1900 ohms
- Everything else is the same.
- Selected Data is being presented

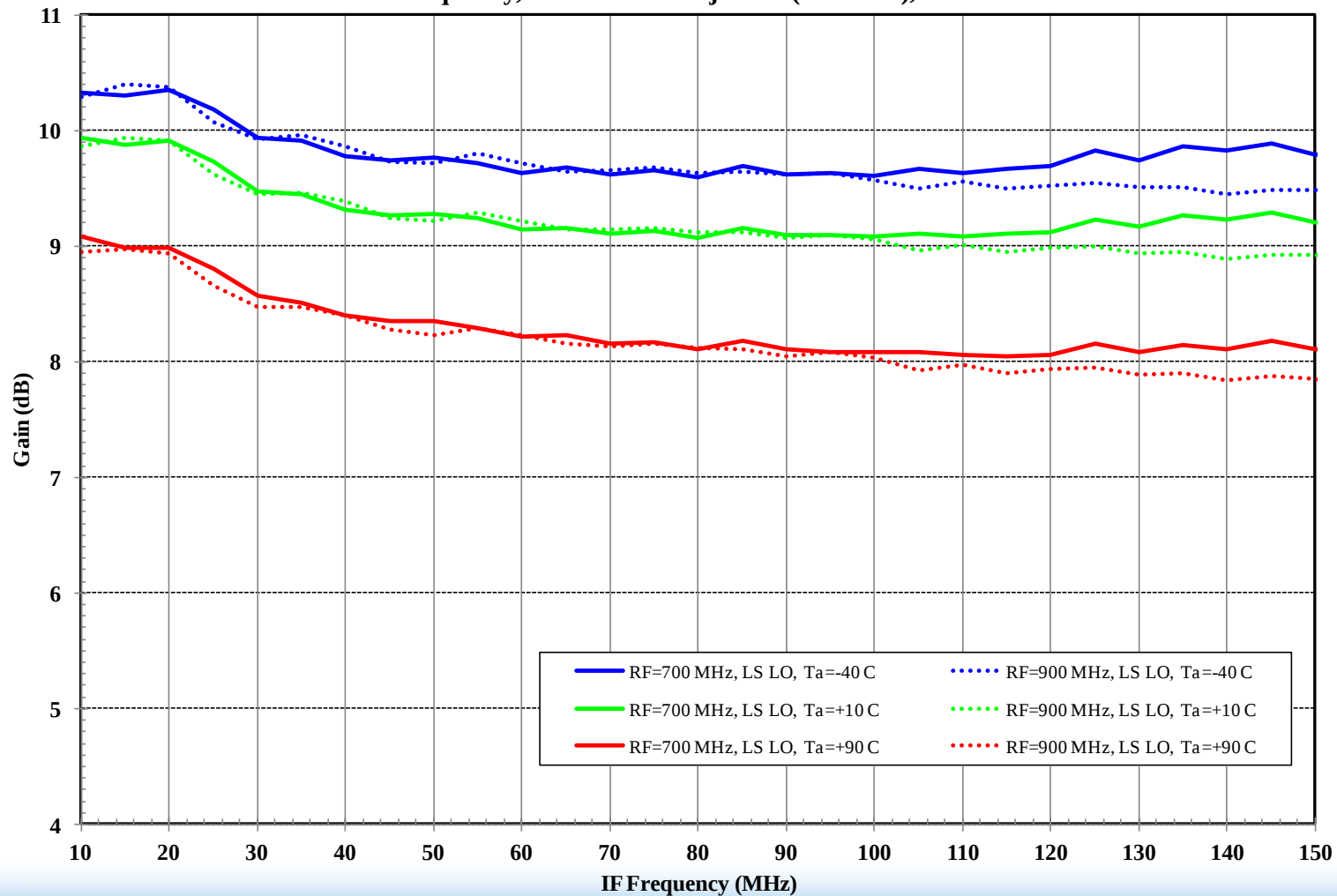
Characterization – LC Gain, High Side LO

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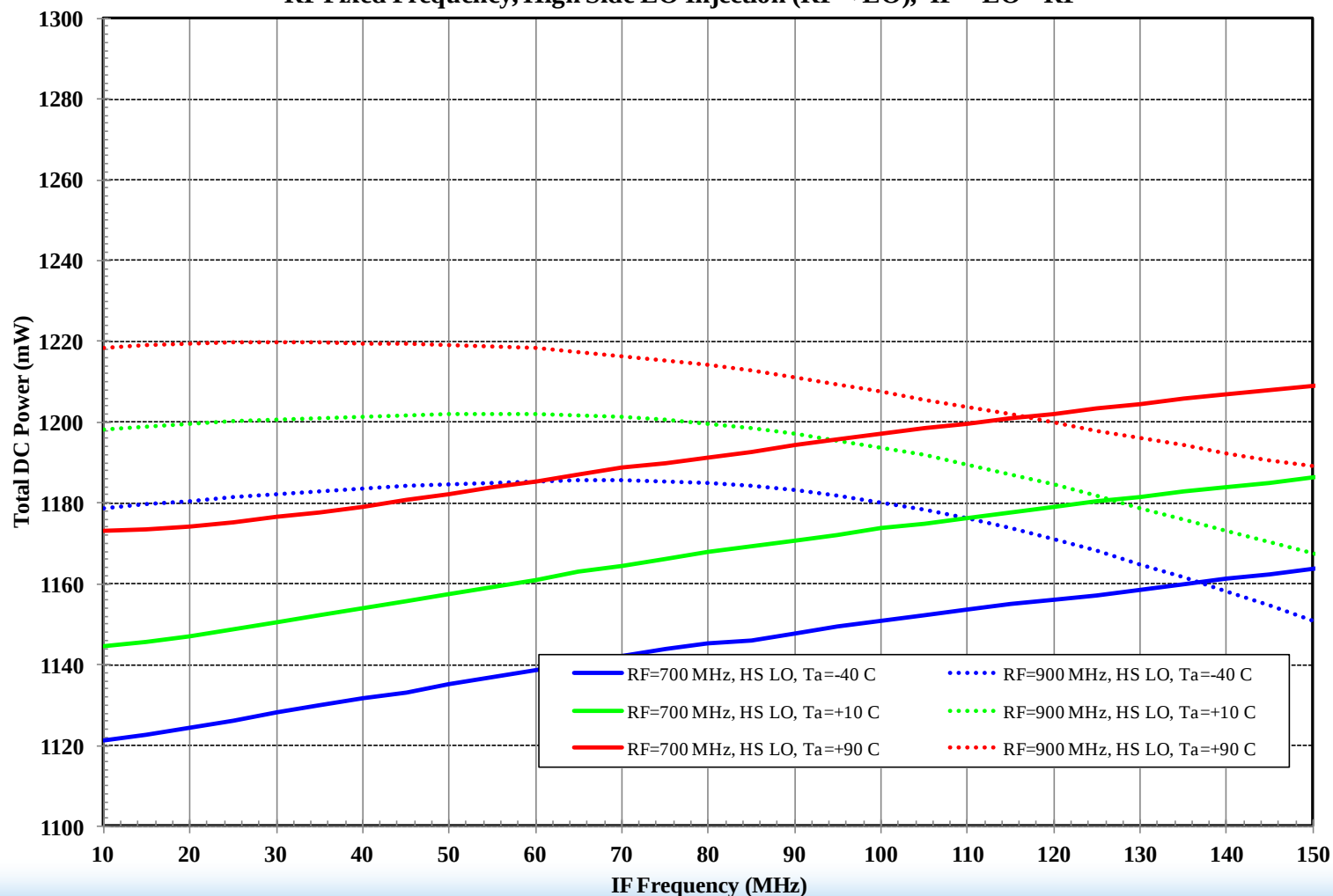
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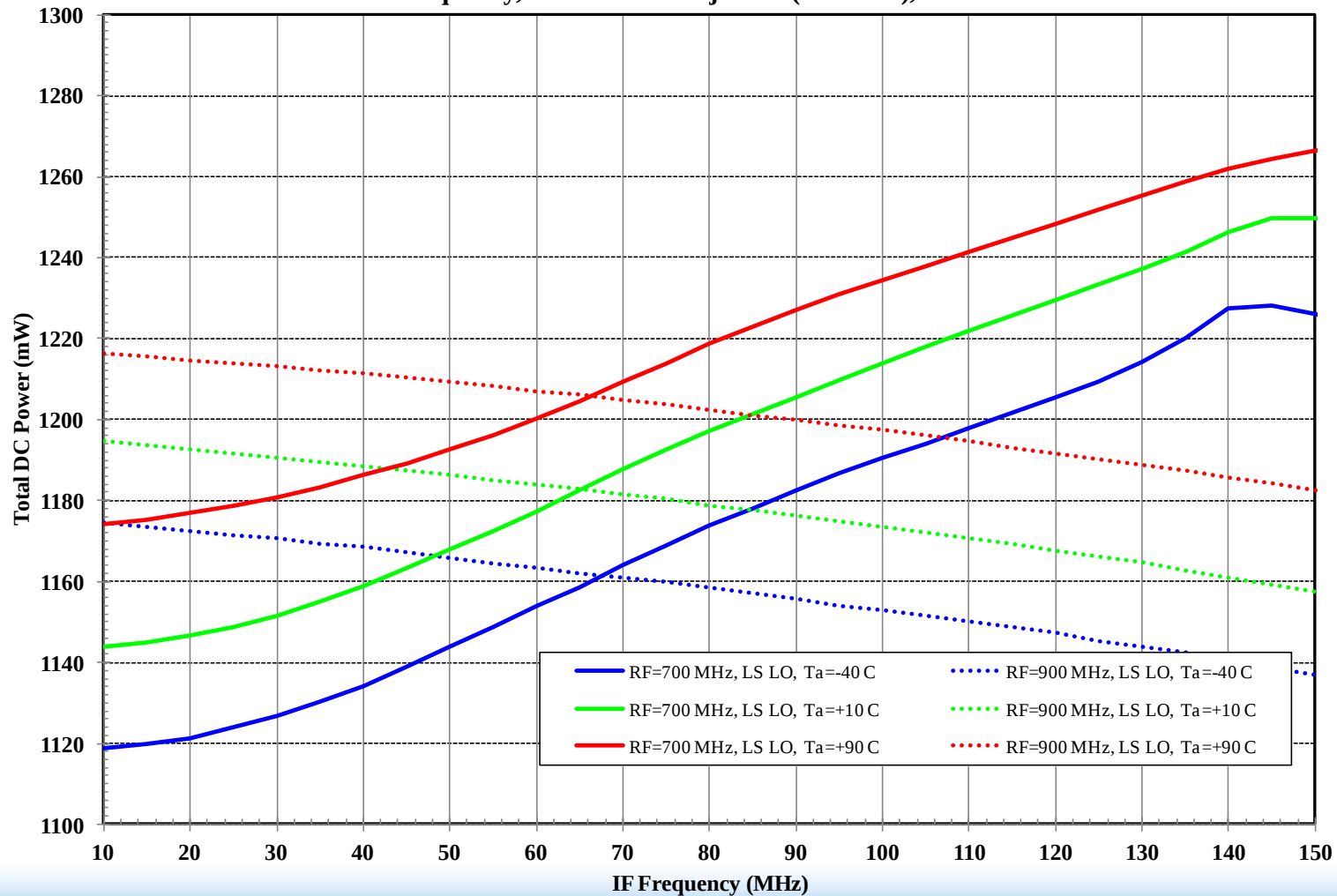
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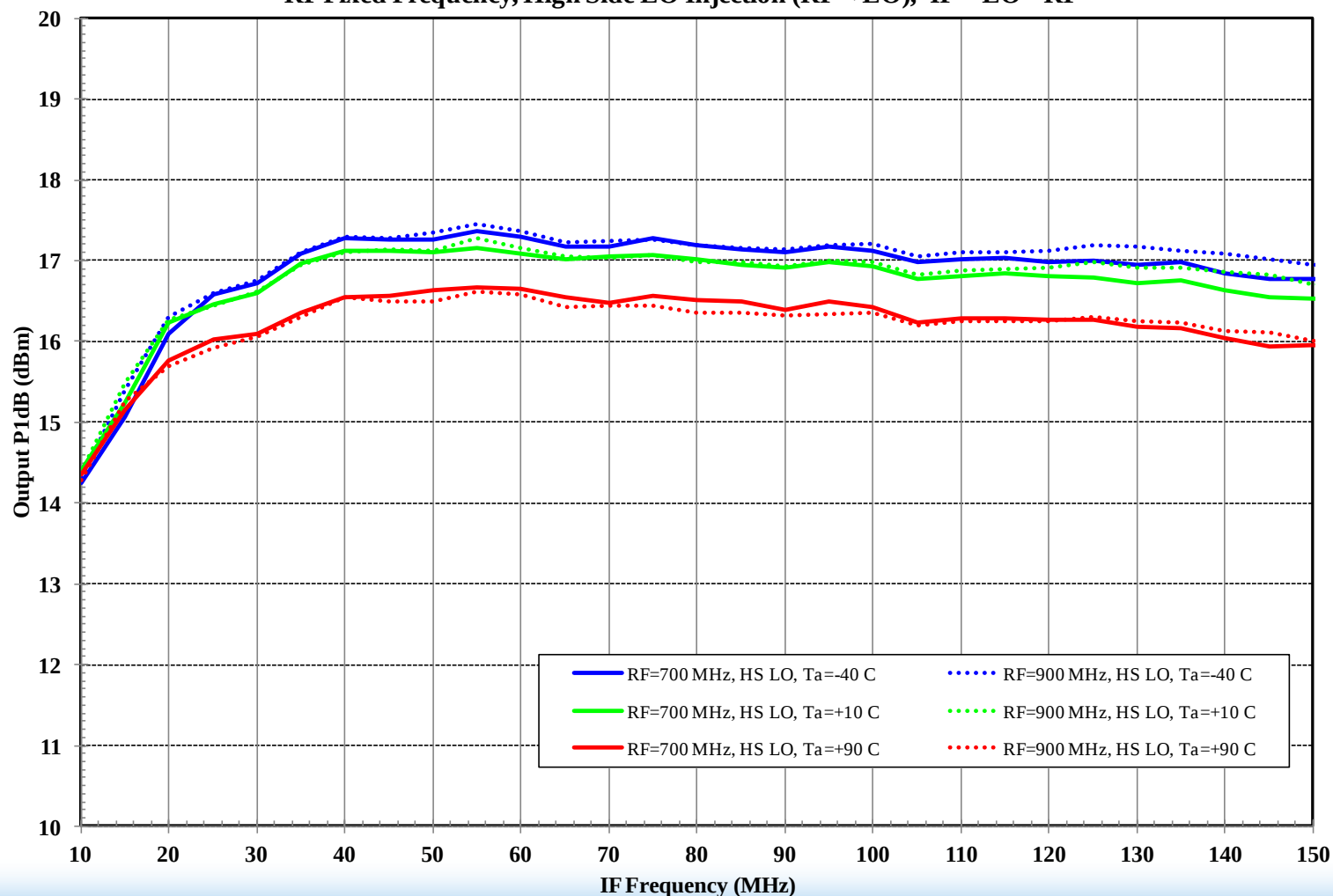
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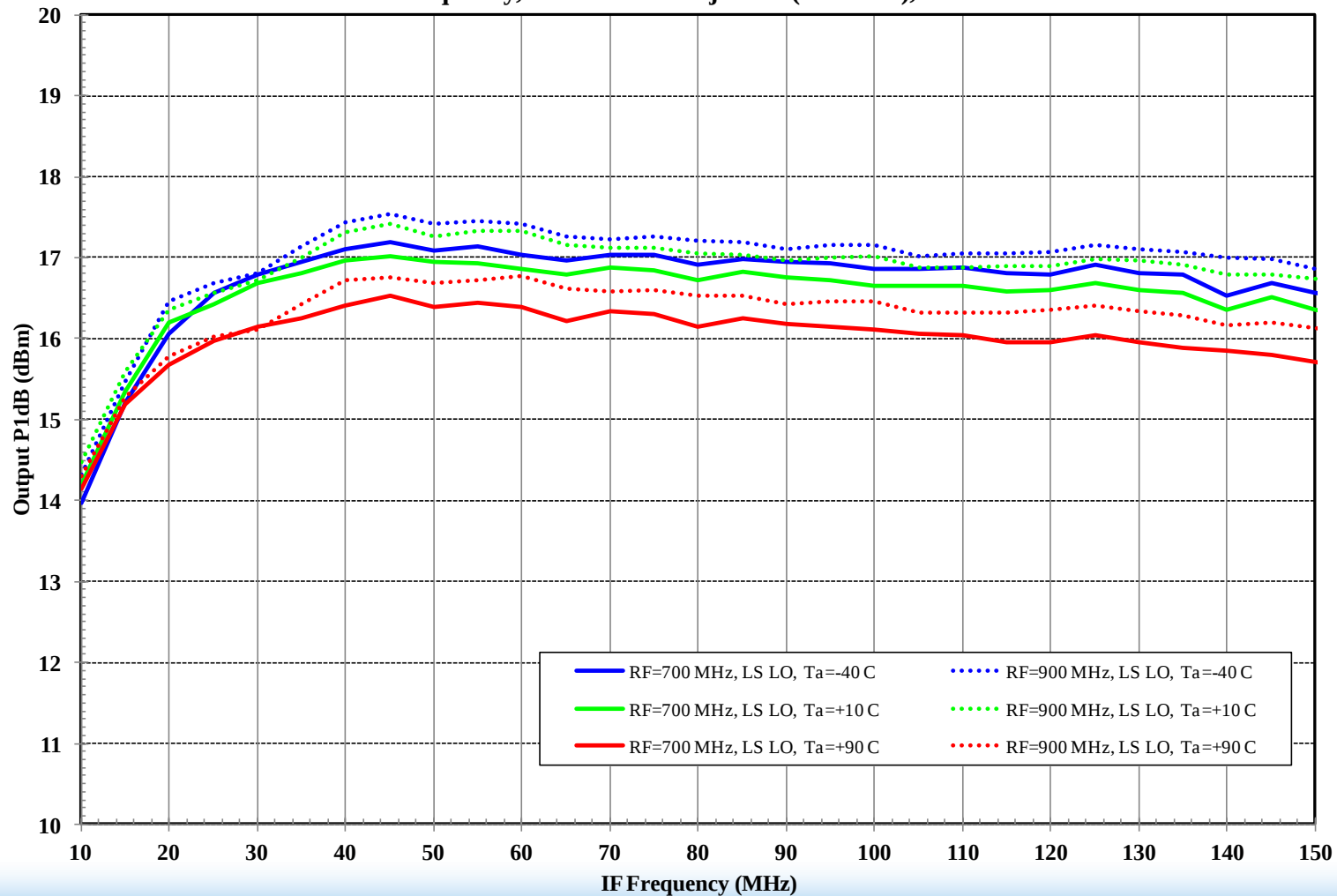
Characterization – LC OP1dB, High Side LO

F1102 RF to IF Dual Downconverting Mixer
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Characterization – LC OP1dB, LO Side LO

F1102 RF to IF Dual Downconverting Mixer
Low Frequency IF Circuitry, $V_{cc-IF}=V_{cc} = +5.0\text{ V}$
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Conclusion

- Less than 0.5 dB difference in gain.
 - DC Power has been reduced by 32 %
(1280 mW to 880 mW).
 - Less than 1 dB loss in Output P1dB.
 - No significant difference for IP3.
 - No significant difference in the Noise Figure.
-
- ***DC Power can be reduced with very little RF performance difference.***