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81 GHz to 86 GHz E-Band I/Q Downconverter

Data Sheet **HMC7587**

FEATURES

Conversion gain: 10 dB typical
Image rejection: 30 dBc typical
Noise figure: 6 dB typical
Input power for 1 dB compression (P1dB): −10 dBm typical
Input third-order intercept (IP3): −2 dBm typical
Input second-order intercept (IP2): 25 dBm typical
6× LO leakage at RFIN: −40 dBm typical
Radio frequency (RF) return loss: 10 dB typical
Local oscillator (LO) return loss: 20 dB typical
Die size: 3.599 mm × 2.199 mm × 0.05 mm

APPLICATIONS

E-band communication systems
High capacity wireless backhauls
Test and measurement

GENERAL DESCRIPTION

The HMC7587 is an integrated, E-band gallium arsenide (GaAs), monolithic microwave integrated circuit (MMIC), in-phase/quadrature (I/Q) downconverter chip that operates from 81 GHz to 86 GHz. The HMC7587 provides a small signal conversion gain of 10 dB with 30 dBc of image rejection across the frequency band. The device uses a low noise amplifier followed by an image rejection mixer that is driven by a 6× multiplier.

The image rejection mixer eliminates the need for a filter following the low noise amplifier. Differential I and Q mixer outputs are provided for direct conversion applications. Alternatively, the outputs can be combined using an external 90° hybrid and two external 180° hybrids to allow for single-sideband applications. All data includes the effect of a 3 mil wide ribbon wedge bond on the RF port, and a 1 mil gold wire wedge bond on the intermediate frequency (IF) ports.

FUNCTIONAL BLOCK DIAGRAM

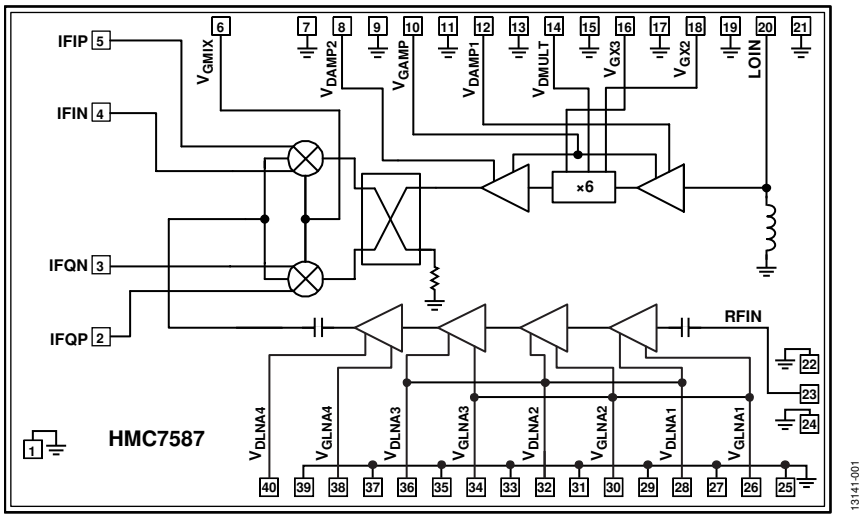

Figure 1.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700

Technical Support www.analog.com

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COMPARABLE PARTS

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DOCUMENTATION

Data Sheet

- HMC7587: 81 GHz to 86 GHz E-Band I/Q Downconverter Data Sheet

DESIGN RESOURCES

- HMC7587 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all HMC7587 EngineerZone Discussions.

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DOCUMENT FEEDBACK

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REVISION HISTORY

3/16—Revision A: Initial Version

SPECIFICATIONS

T_A = 25°C, IF = 500 MHz, V_{GMIX} = −1 V, V_{DAMPx} = 4 V, V_{DMULT} = 1.5 V, voltage on the V_{DLNAx} pins (V_{DLNA}) = 3 V, LO = 2 dBm, upper sideband selected. Measurements performed as a downconverter with external 90° and 180° hybrids at the IF ports, unless otherwise noted.

Table 1.

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
OPERATING CONDITIONS					
RF Frequency Range		81		86	GHz
LO Frequency Range		11.83		14.33	GHz
IF Frequency Range		0		10	GHz
LO Drive Range		2		8	dBm
PERFORMANCE					
Conversion Gain		8	10		dB
Image Rejection		20	30		dBc
Input Third-Order Intercept (IP3)			−2		dBm
Input Second-Order Intercept (IP2)			25		dBm
Input Power for 1 dB Compression (P1dB)			−10		dBm
6× LO Leakage at RF Input (RFIN)			−40		dBm
1× LO Leakage at IF Output (IFOUT)			−50		dBm
Amplitude Balance[1]			−0.5		dB
Phase Balance[1]			±4		Degrees
Noise Figure			6		dB
RF Return Loss	LO = 2 dBm at 12 GHz		10		dB
LO Return Loss			20		dB
IF Return Loss[1]			25		dB
POWER SUPPLY					
Supply Current					
I_{DAMP}[2]			175		mA
I_{DMULT}[3]	Under LO drive		80		mA
I_{DLNA}[4]			50		mA

[1] These measurements were performed without external hybrids at the IF ports.
[2] Adjust V_{GAMP} between −2 V and 0 V to achieve the total quiescent current, $I_{DAMP} = I_{DAMP1} + I_{DAMP2}$ = 175 mA.
[3] Adjust V_{GX2} and V_{GX3} between −2 V and 0 V to the achieve the quiescent current, I_{DMULT} = 1 mA to 2 mA. See the Applications Information section for more information.
[4] Adjust V_{GLNAx} between −2 V and 0 V to achieve the quiescent current, $I_{DLNA1} + I_{DLNA2} + I_{DLNA3} + I_{DLNA4}$ = 50 mA.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Drain Bias Voltage	
V_{DAMP1}, V_{DAMP2}	4.5 V
V_{DMULT}	3 V
V_{DLNA1}, V_{DLNA2}, V_{DLNA3}, V_{DLNA4}	4.5 V
Gate Bias Voltage	
V_{GAMP}	−3 V to 0 V
V_{GX2}, V_{GX3}	−3 V to 0 V
V_{GLNA1}, V_{GLNA2}, V_{GLNA3}, V_{GLNA4}	−3 V to 0 V
V_{GMIX}	−3 V to 0 V
LO Input Power	10 dBm
Maximum Junction Temperature (to Maintain 1 Million Hours Mean Time to Failure (MTTF))	175°C
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−55°C to +85°C

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

THERMAL RESISTANCE

Table 3. Thermal Resistance

Package Type	θ_{JC}[1]	Unit
40-Pad Bare Die [CHIP]	61.7	°C/W

[1] Based on ABLEBOND® 84-1LMIT as die attach epoxy with thermal conductivity of 3.6 W/mK.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

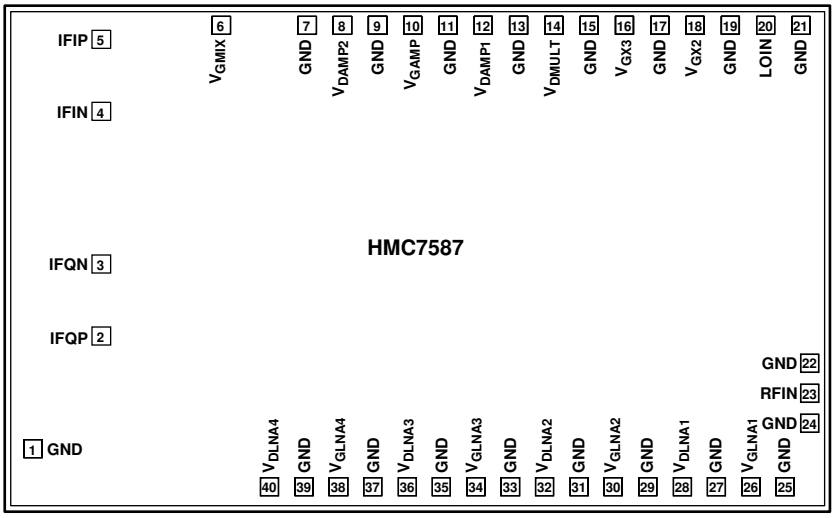

Figure 2. Pad Configuration

Table 4. Pad Function Descriptions

Pad No.	Mnemonic	Description
1, 7, 9, 11, 13, 15, 17, 19, 21, 22, 24, 25, 27, 29, 31, 33, 35, 37, 39	GND	Ground Connect (See Figure 3).
2, 3	IFQP, IFQN	Positive and Negative IF Q Inputs. These pads are dc-coupled. When operation to dc is not required, block these pads externally using a series capacitor with a value chosen to pass the necessary frequency range. For operation to dc, these pads must not source or sink more than 3 mA of current or die malfunction and possible die failure may result (see Figure 4).
4, 5	IFIN, IFIP	Negative and Positive IF I Inputs. These pads are dc-coupled. When operation to dc is not required, block these pads externally using a series capacitor with a value chosen to pass the necessary frequency range. For operation to dc, these pads must not source or sink more than 3 mA of current or die malfunction and possible die failure may result (see Figure 4).
6	V_{GMIX}	Gate Voltage for the FET Mixer (See Figure 5). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
8, 12	V_{DAMP2}, V_{DAMP1}	Power Supply Voltage for the First and the Second Stage LO Amplifier (See Figure 5). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
10	V_{GAMP}	Gate Voltage for the First and the Second Stage LO Amplifier (See Figure 5). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
14	V_{DMULT}	Power Supply Voltage for the LO Multiplier (See Figure 5). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
16, 18	V_{GX3}, V_{GX2}	Gate Voltage for the LO Multiplier (See Figure 5). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
20	LOIN	Local Oscillator Input. This pad is dc-coupled and matched to 50 Ω (see Figure 6).
23	RFIN	RF Input. This pad is ac-coupled and matched to 50 Ω (see Figure 7).
26, 30, 34, 38	V_{GLNA1}, V_{GLNA2}, V_{GLNA3}, V_{GLNA4}	Gate Voltage for the Low Noise Amplifier (See Figure 8). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
28, 32, 36, 40	V_{DLNA1}, V_{DLNA2}, V_{DLNA3}, V_{DLNA4}	Power Supply Voltage for the Low Noise Amplifier (See Figure 8). External bypass capacitors of 120 pF, 0.01 µF, and 4.7 µF are recommended (see Figure 211).
Die Bottom	GND	Ground. The die bottom must be connected to RF/dc ground (see Figure 3).

INTERFACE SCHEMATICS

Figure 3. GND Interface

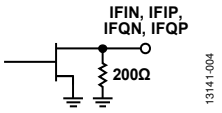

Figure 4. IFIN, IFIP, IFQN, and IFQP Interface

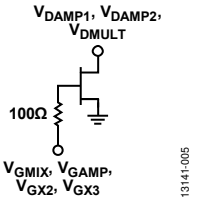

Figure 5. V_{GMIX}, V_{DAMP1}, V_{DAMP2}, V_{DMULT}, V_{GAMP}, V_{GX2}, and V_{GX3} Interface

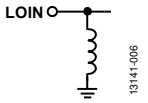

Figure 6. LOIN Interface

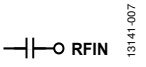

Figure 7. RFIN Interface

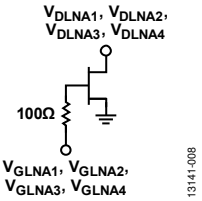

Figure 8. V_{DLNA1}, V_{DLNA2}, V_{DLNA3}, V_{DLNA4}, V_{GLNA1}, V_{GLNA2}, V_{GLNA3}, and V_{GLNA4} Interface

TYPICAL PERFORMANCE CHARACTERISTICS

UPPER SIDEBAND SELECTED, IF = 500 MHz

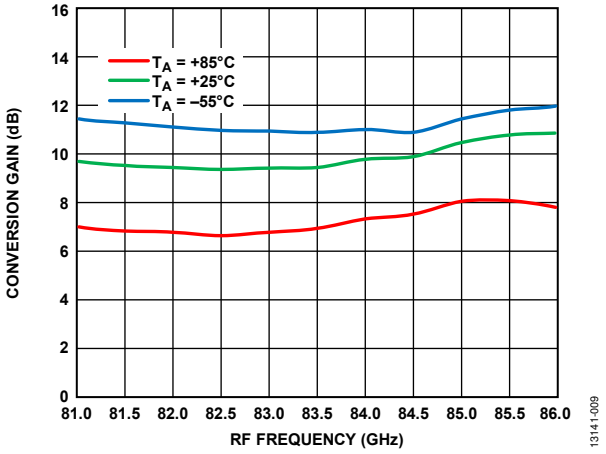

Figure 9. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, Voltage on the V_{DLNAx} Pins (V_{DLNA}) = 4 V

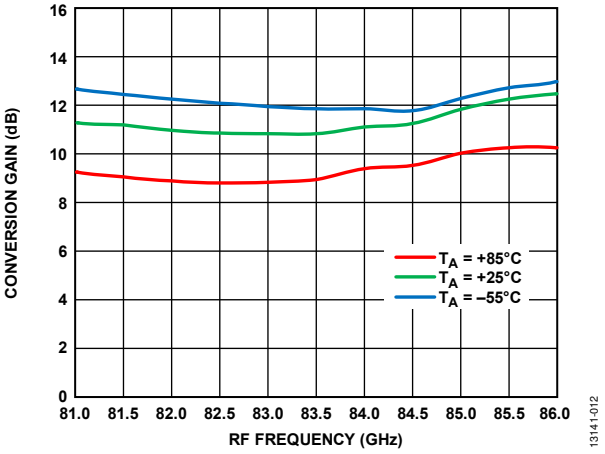

Figure 12. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

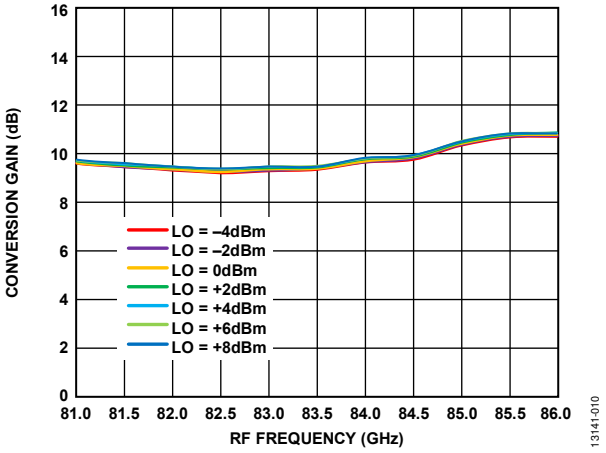

Figure 10. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 500 MHz, V_{DLNA} = 4 V

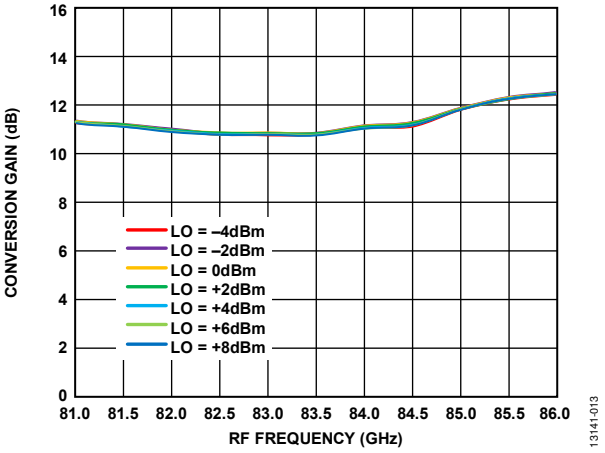

Figure 13. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 500 MHz, V_{DLNA} = 3 V

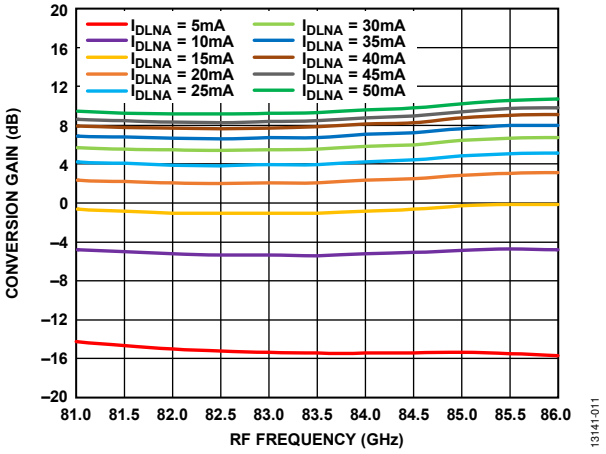

Figure 11. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

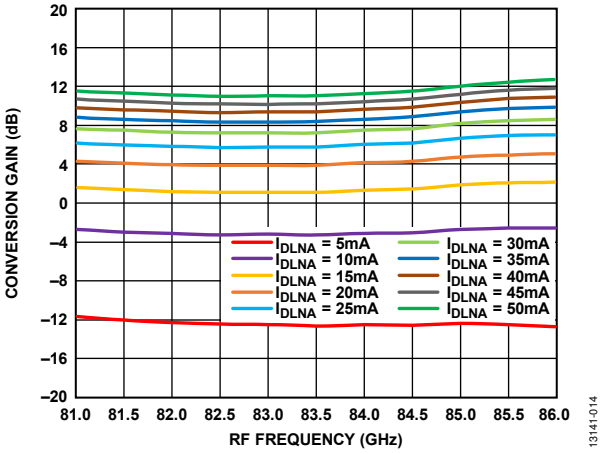

Figure 14. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

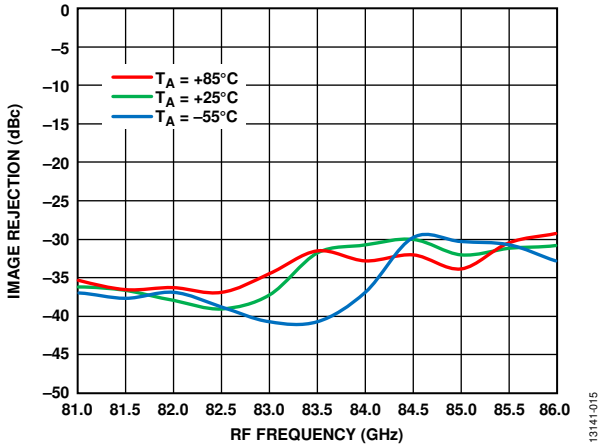

Figure 15. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

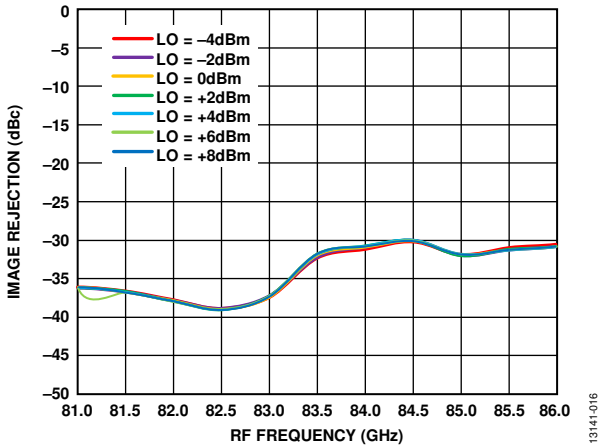

Figure 16. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 500 MHz, V_{DLNA} = 4 V

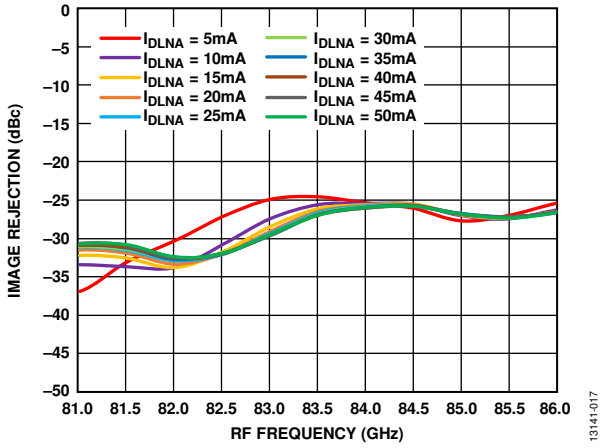

Figure 17. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

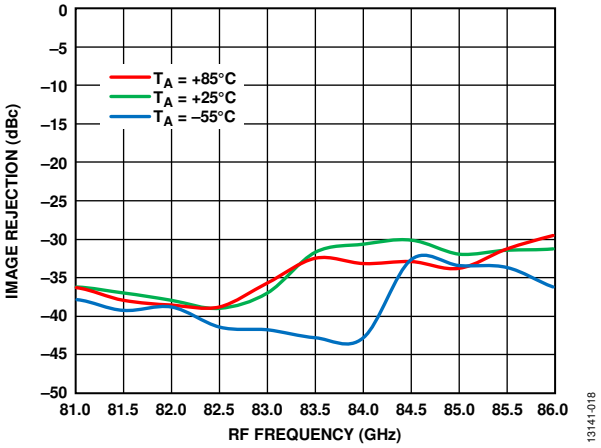

Figure 18. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

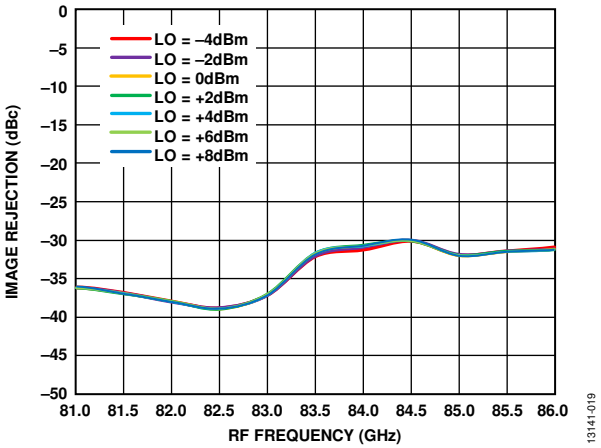

Figure 19. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 500 MHz, V_{DLNA} = 3 V

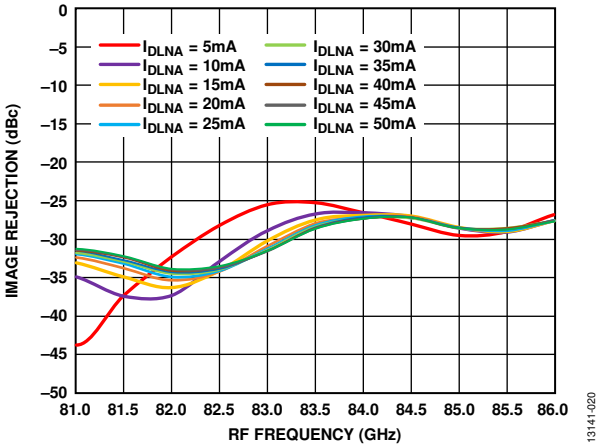

Figure 20. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

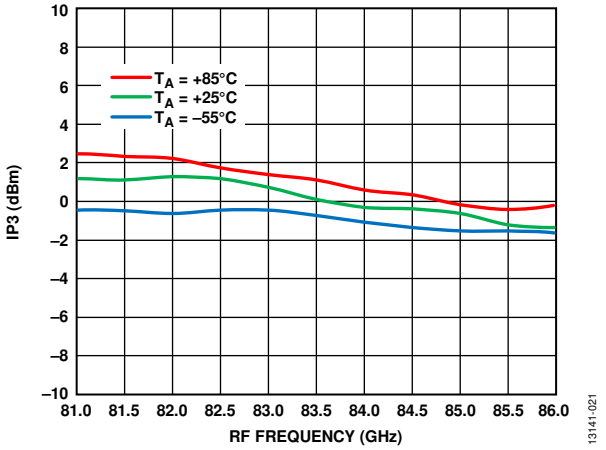

Figure 21. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

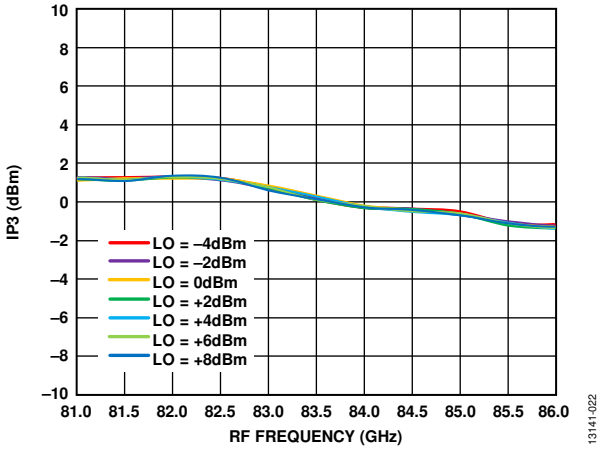

Figure 22. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 500 MHz, V_{DLNA} = 4 V

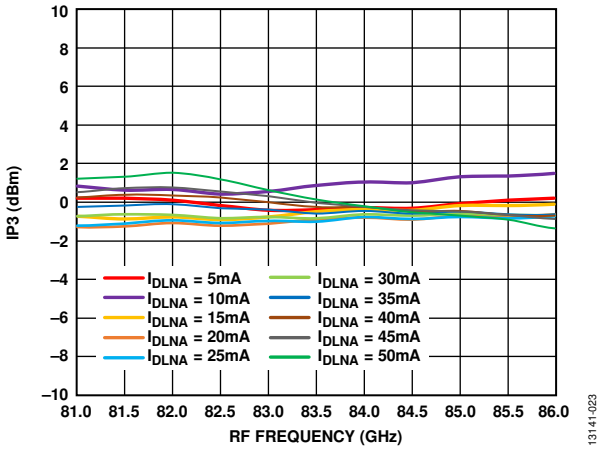

Figure 23. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

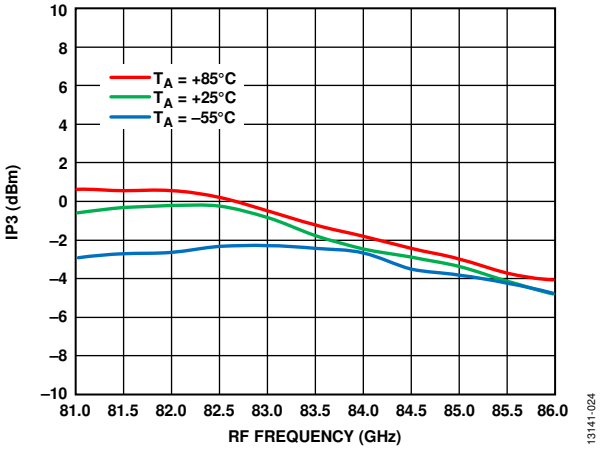

Figure 24. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

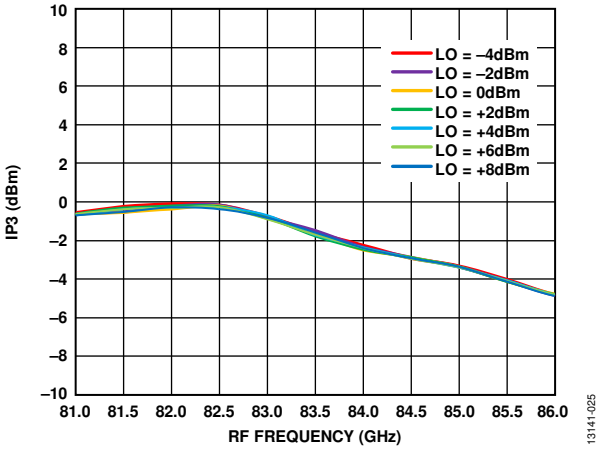

Figure 25. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 500 MHz, V_{DLNA} = 3 V

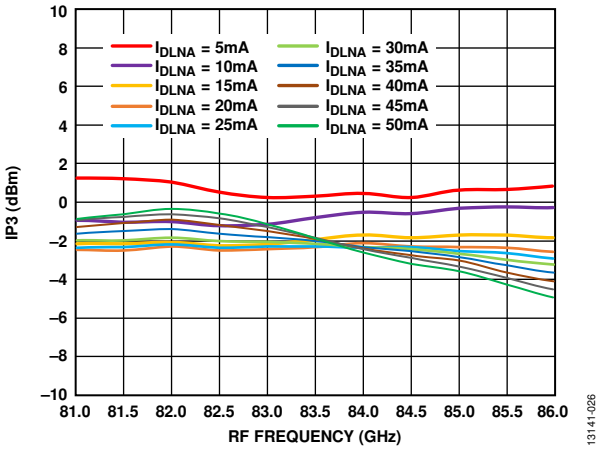

Figure 26. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

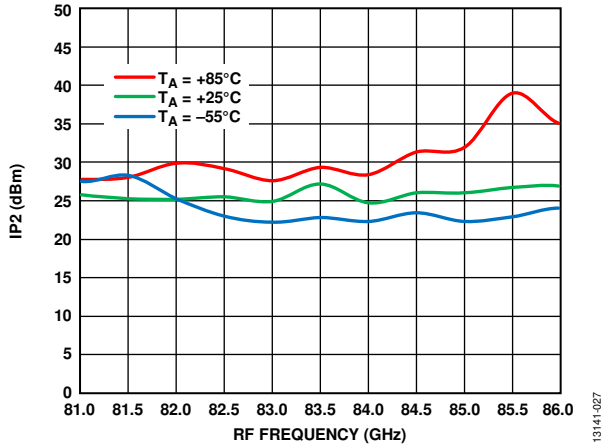

Figure 27. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

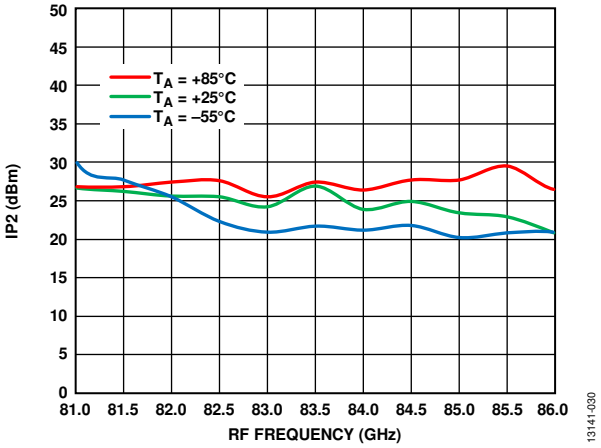

Figure 30. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

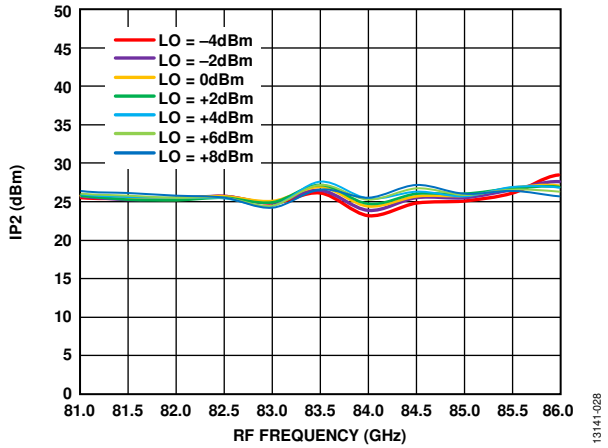

Figure 28. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 500 MHz, V_{DLNA} = 4 V

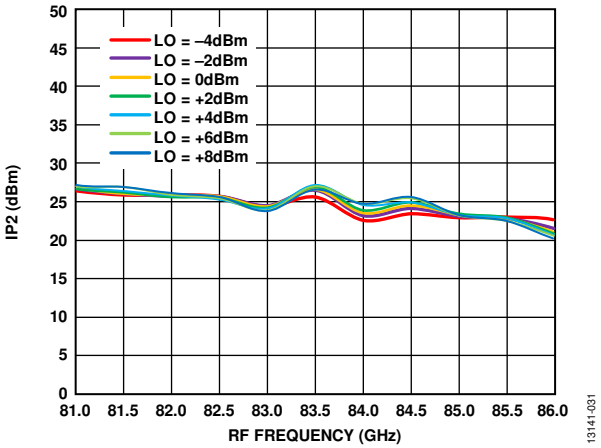

Figure 31. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 500 MHz, V_{DLNA} = 3 V

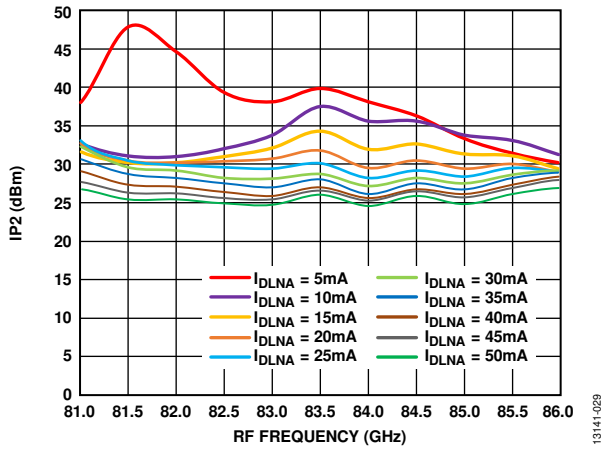

Figure 29. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

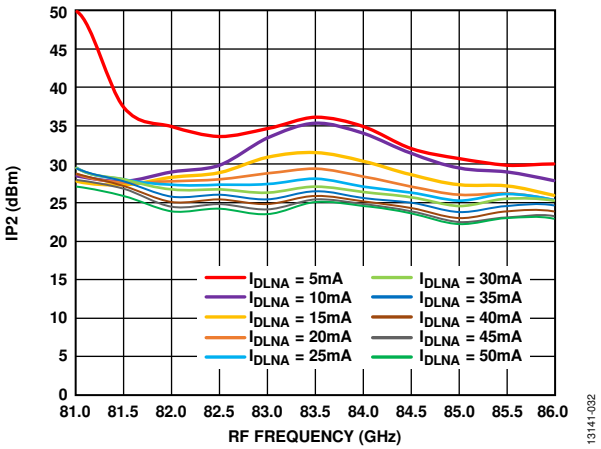

Figure 32. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

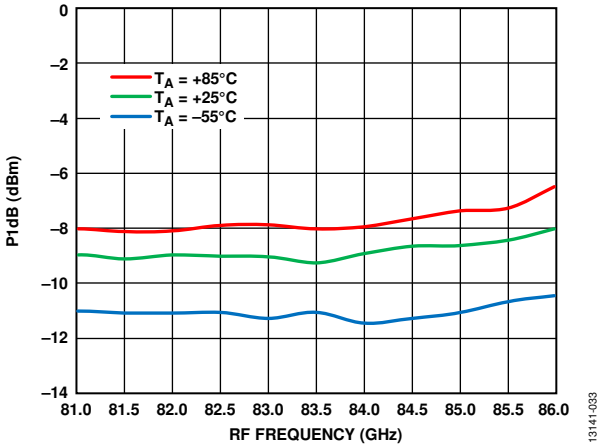

Figure 33. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

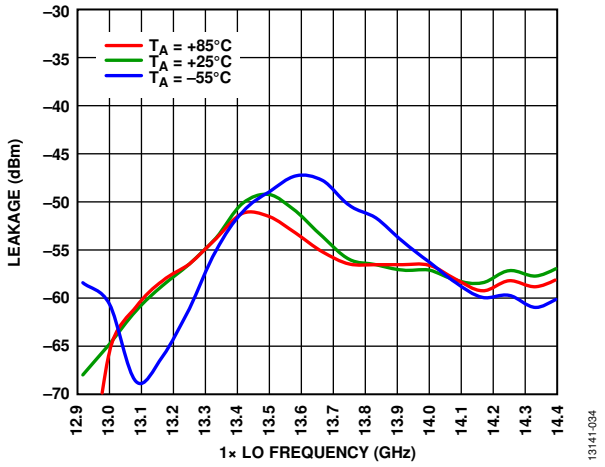

Figure 34. 1× LO Leakage at IFOUT vs. 1× LO Frequency at Various Temperatures, LO = 2 dBm, V_{DLNA} = 3 V

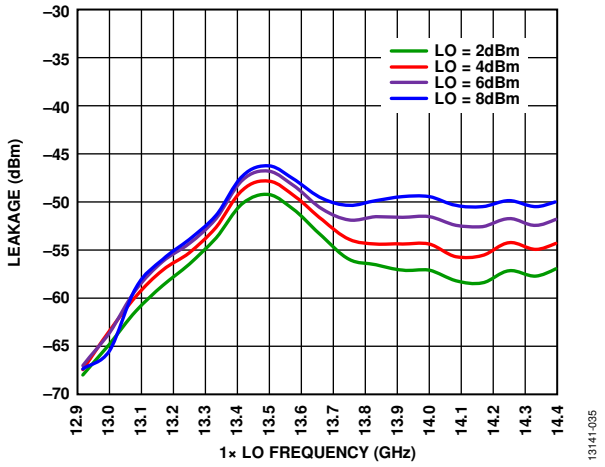

Figure 35. 1× LO Leakage at IFOUT vs. 1× LO Frequency at Various LO Powers, V_{DLNA} = 3 V

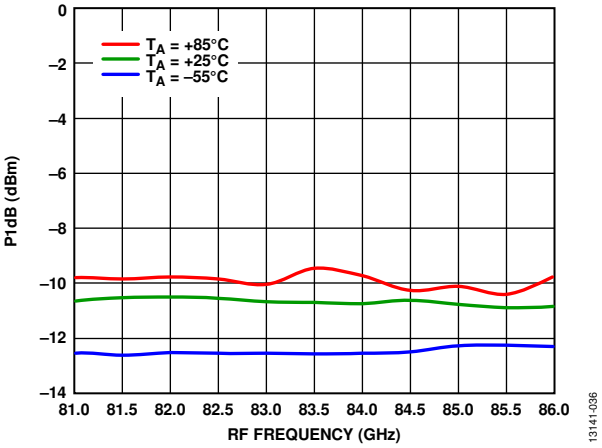

Figure 36. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

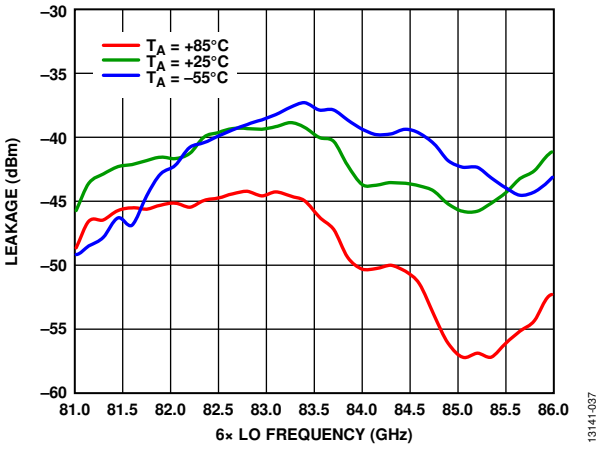

Figure 37. 6× LO Leakage at RFIN vs. 6× LO Frequency at Various Temperatures, LO = 2 dBm, V_{DLNA} = 3 V

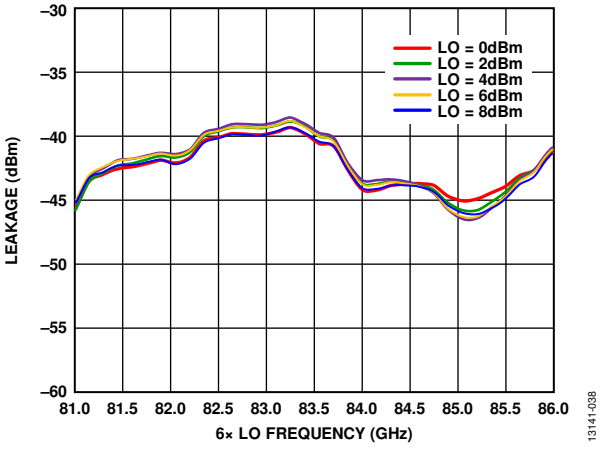

Figure 38. 6× LO Leakage at RFIN vs. 6× LO Frequency at Various LO Powers, V_{DLNA} = 3 V

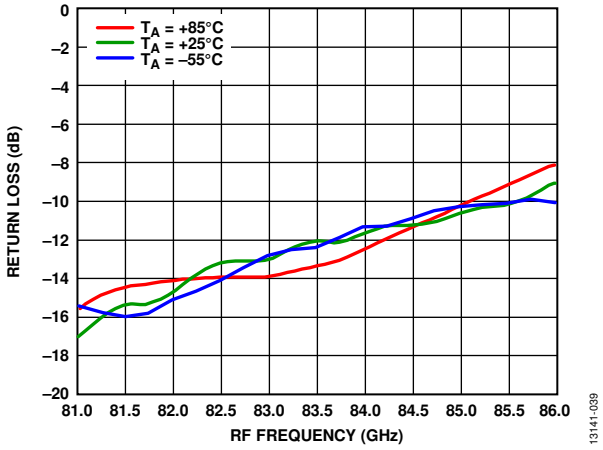

Figure 39. RF Return Loss vs. RF Frequency at Various Temperatures, LO = 2 dBm, LO = 12 GHz, V_{DLNA} = 4 V

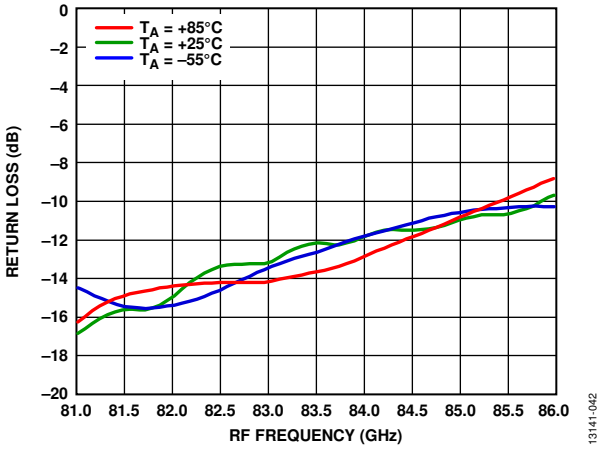

Figure 42. RF Return Loss vs. RF Frequency at Various Temperatures, LO = 2 dBm, LO = 12 GHz, V_{DLNA} = 3 V

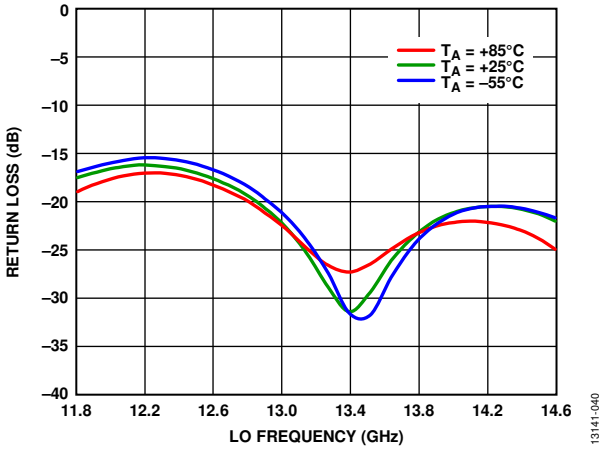

Figure 40. LO Return Loss vs. LO Frequency at Various Temperatures, LO = 2 dBm, V_{DLNA} = 3 V

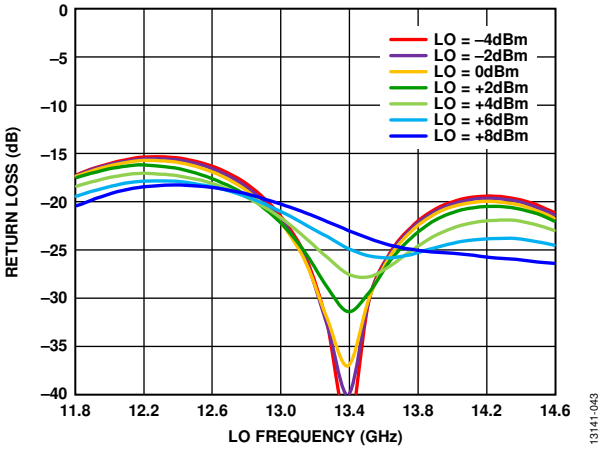

Figure 43. LO Return Loss vs. LO Frequency at Various LO Powers, V_{DLNA} = 3 V

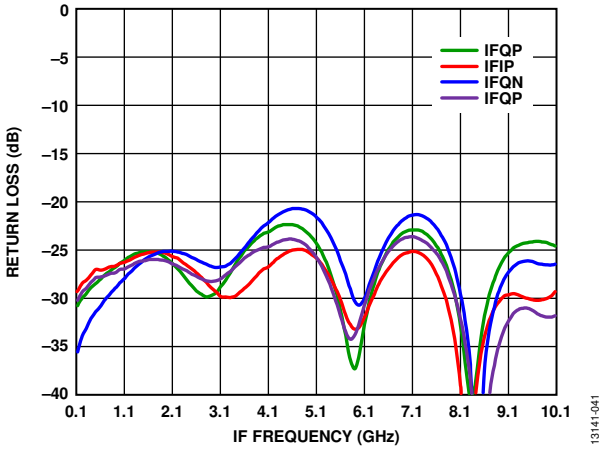

Figure 41. IF Return Loss vs. IF Frequency, LO = 2 dBm at 12 GHz, V_{DLNA} = 3 V

UPPER SIDEBAND SELECTED, IF = 1000 MHz

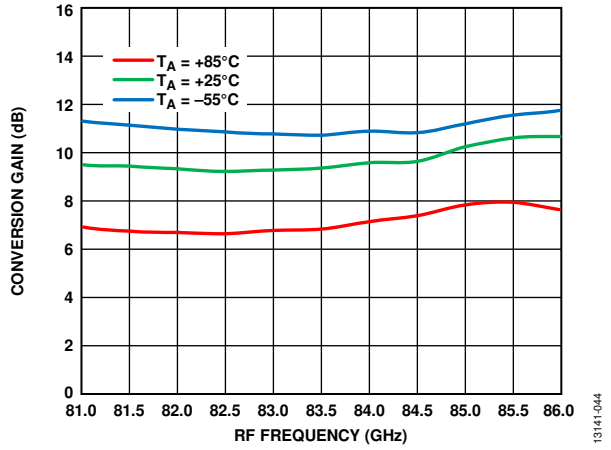

Figure 44. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

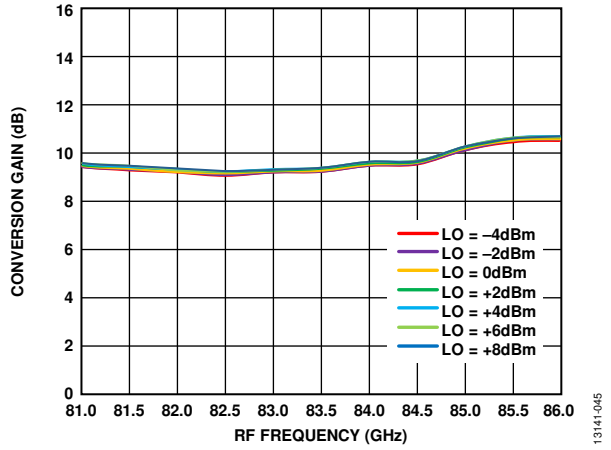

Figure 45. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

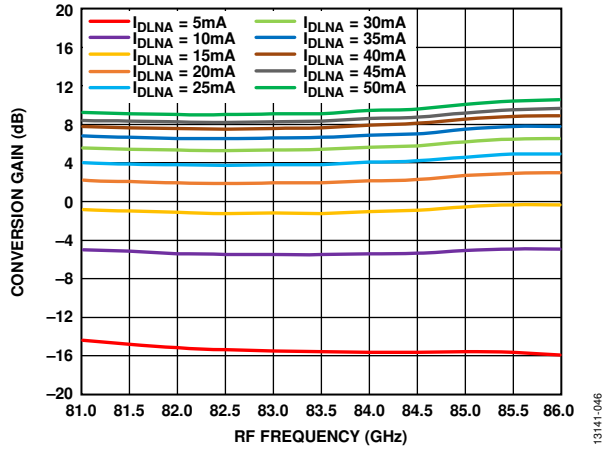

Figure 46. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

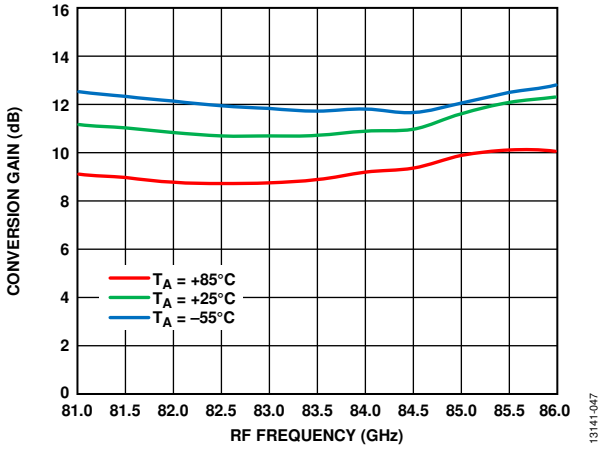

Figure 47. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

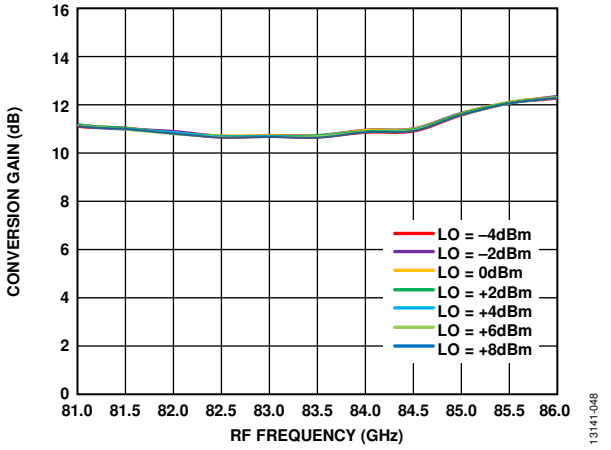

Figure 48. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

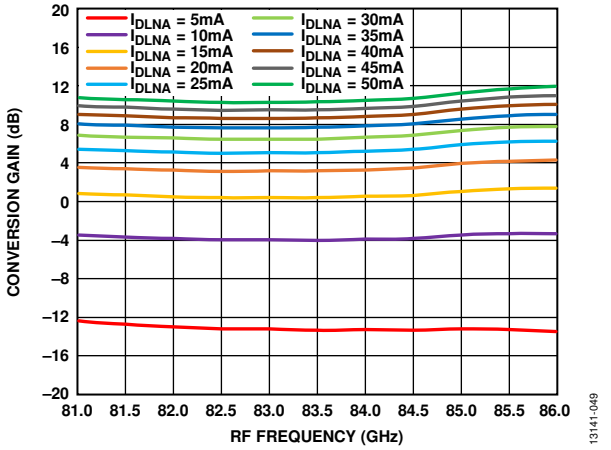

Figure 49. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

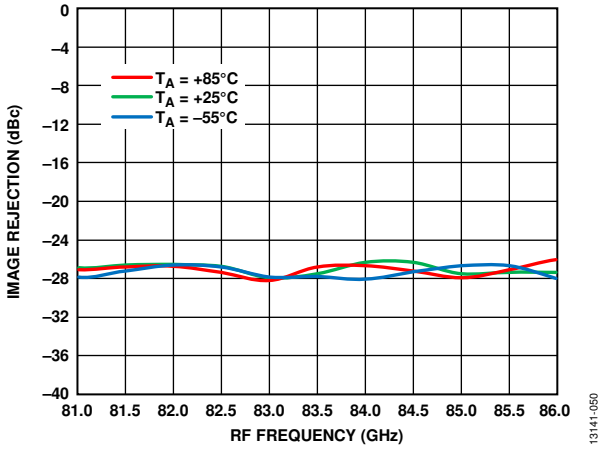

Figure 50. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

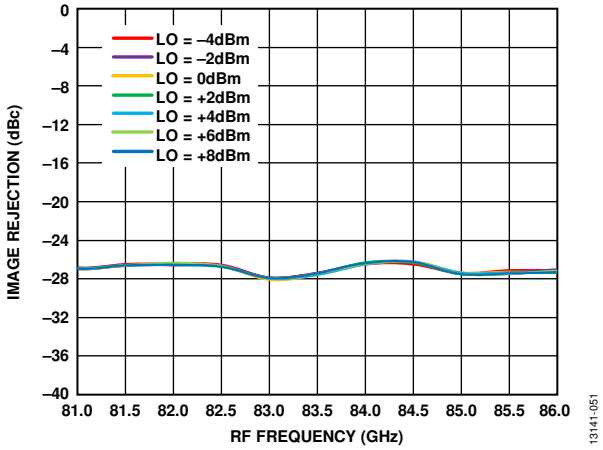

Figure 51. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

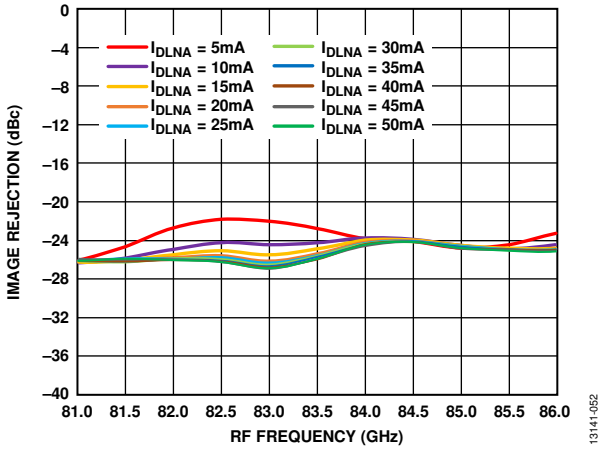

Figure 52. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

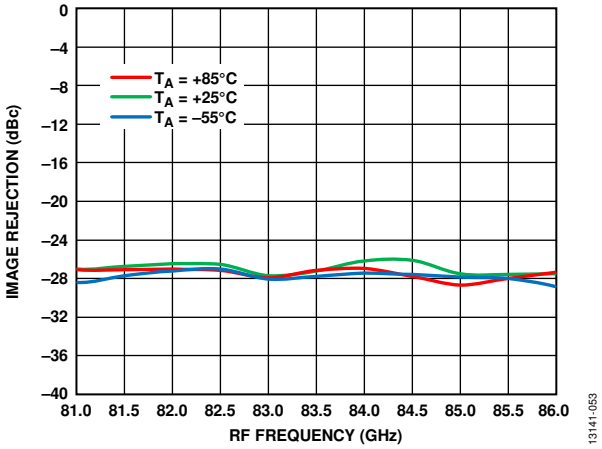

Figure 53. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

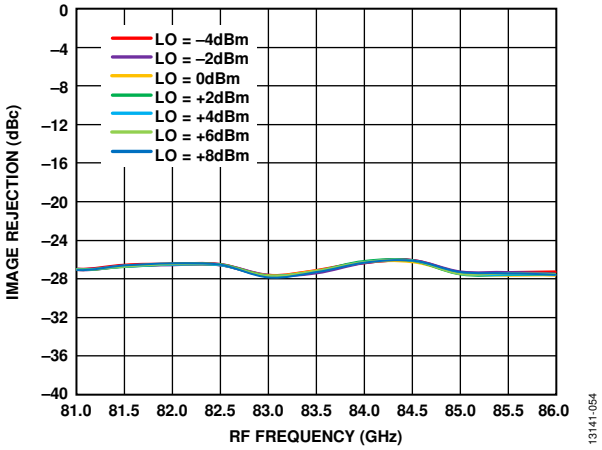

Figure 54. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

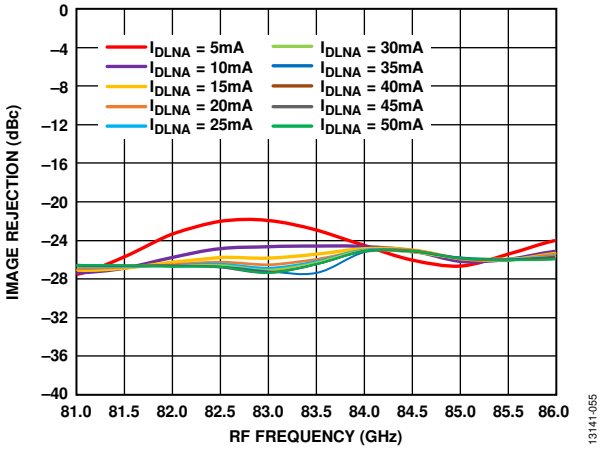

Figure 55. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

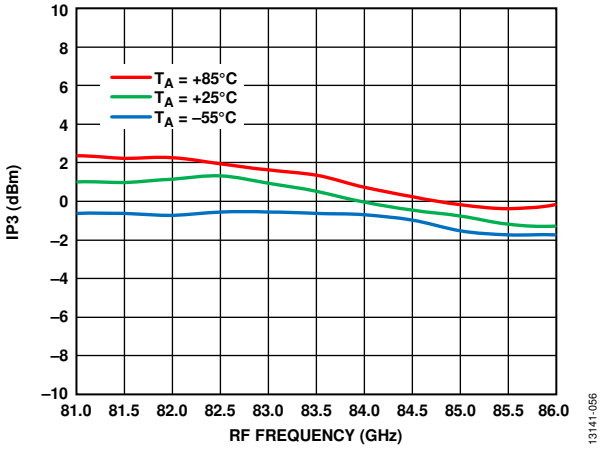

Figure 56. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

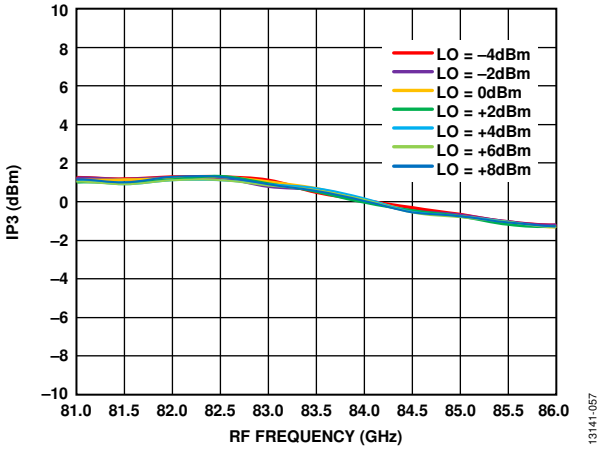

Figure 57. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

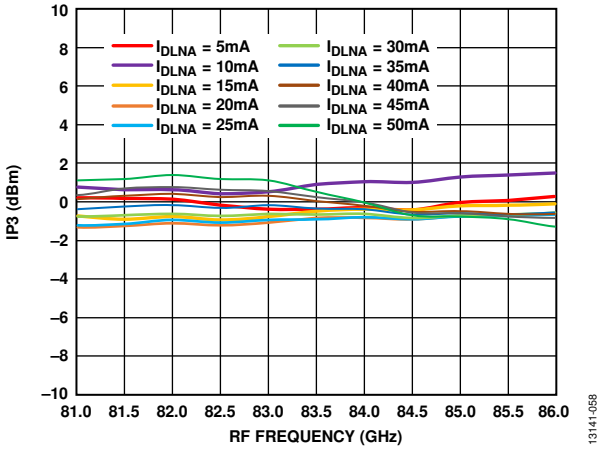

Figure 58. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

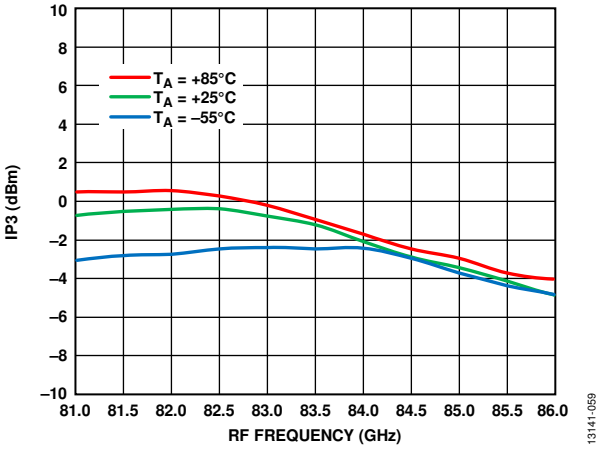

Figure 59. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

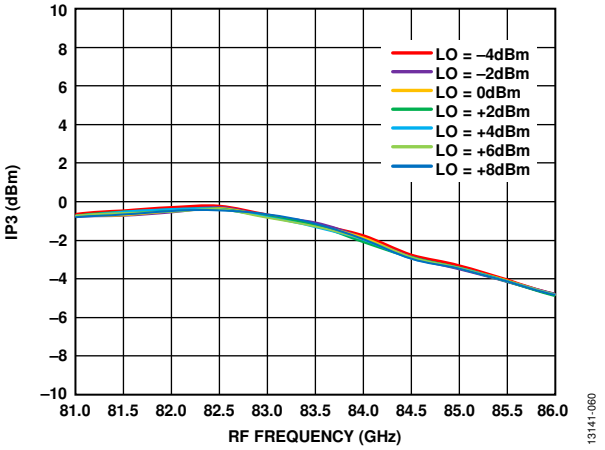

Figure 60. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

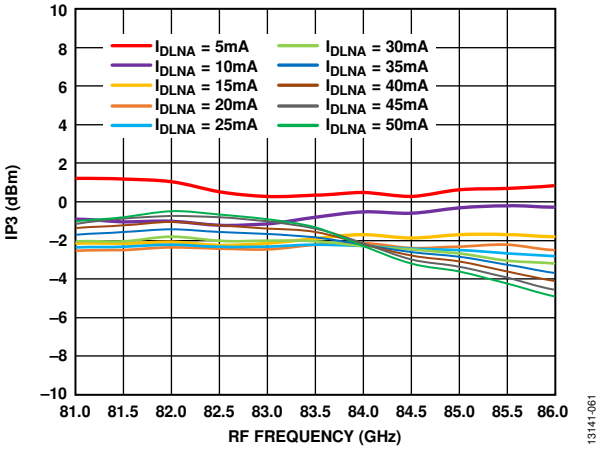

Figure 61. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

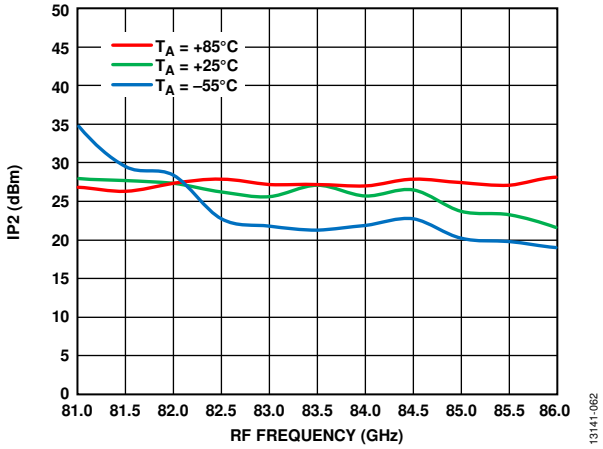

Figure 62. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

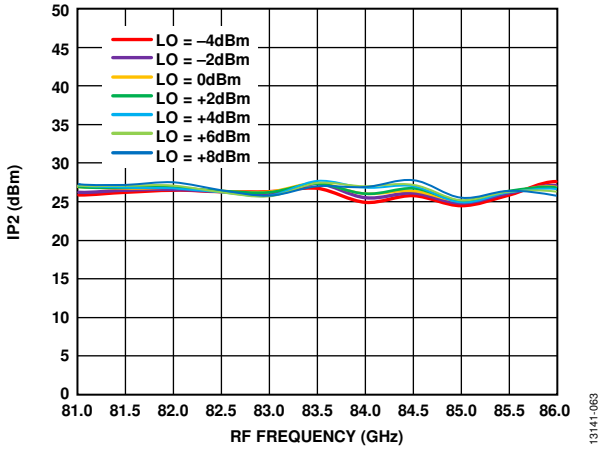

Figure 63. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

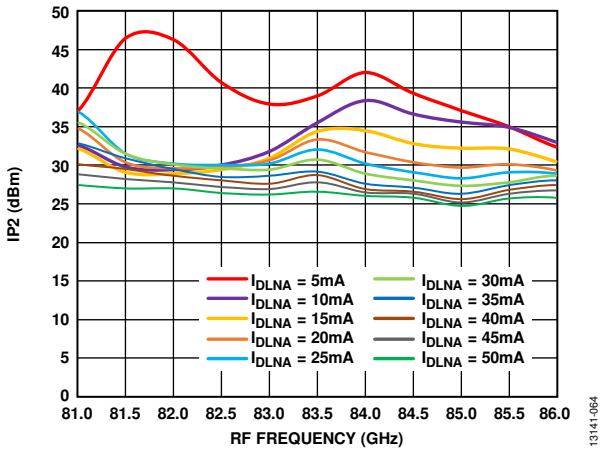

Figure 64. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

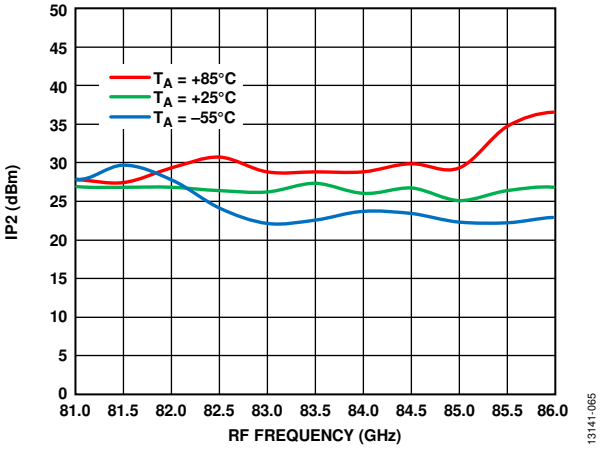

Figure 65. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

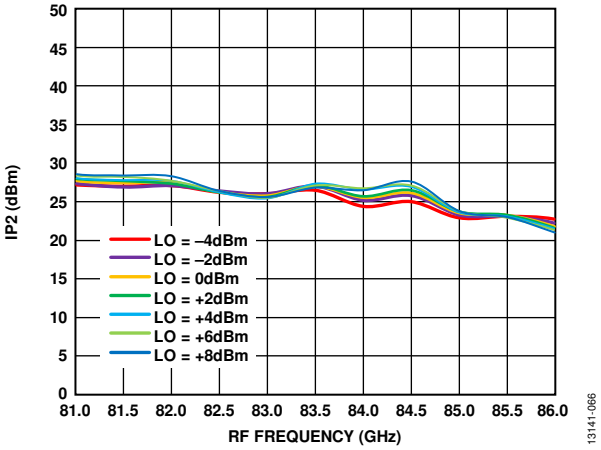

Figure 66. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

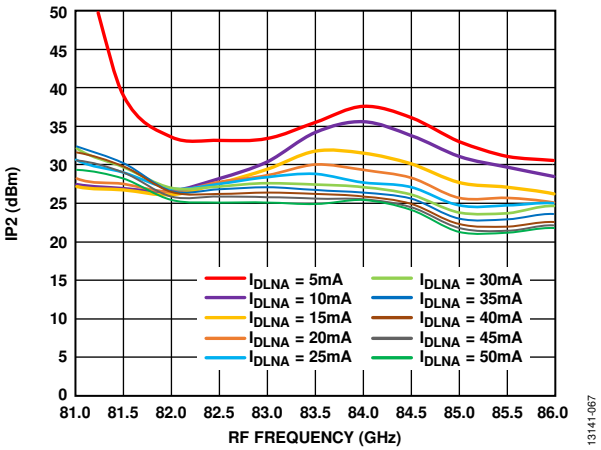

Figure 67. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

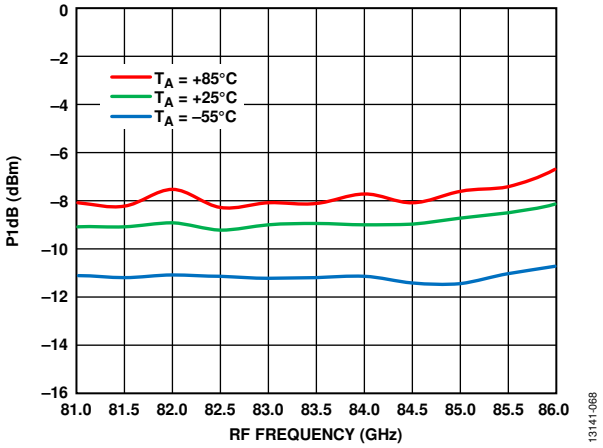

Figure 68. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

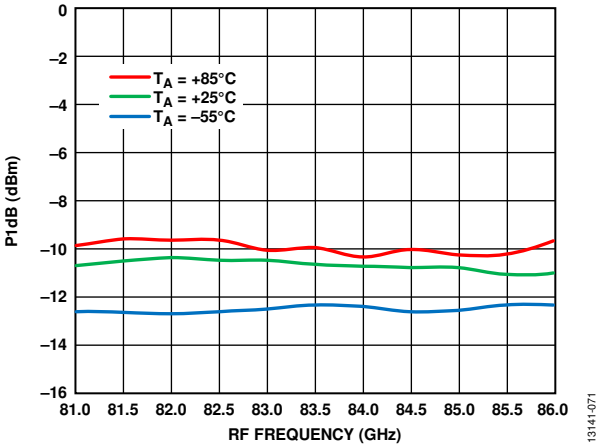

Figure 69. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

UPPER SIDEBAND SELECTED, IF = 2000 MHz

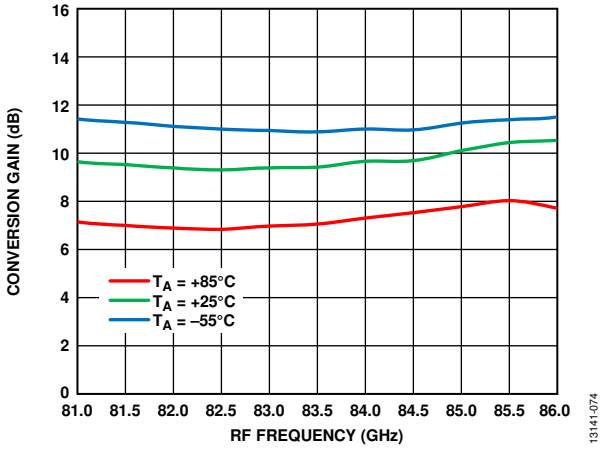

Figure 70. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

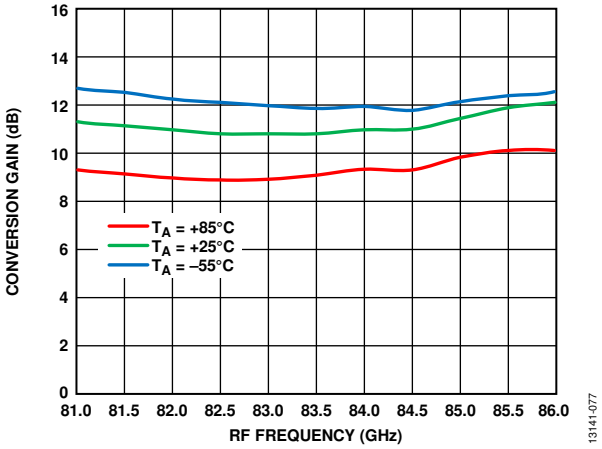

Figure 73. Conversion Gain vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

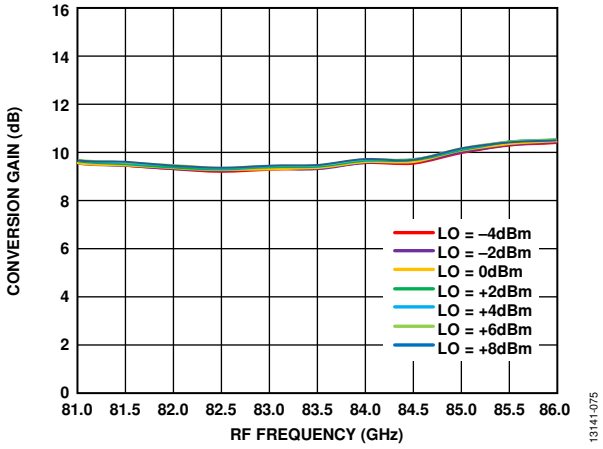

Figure 71. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

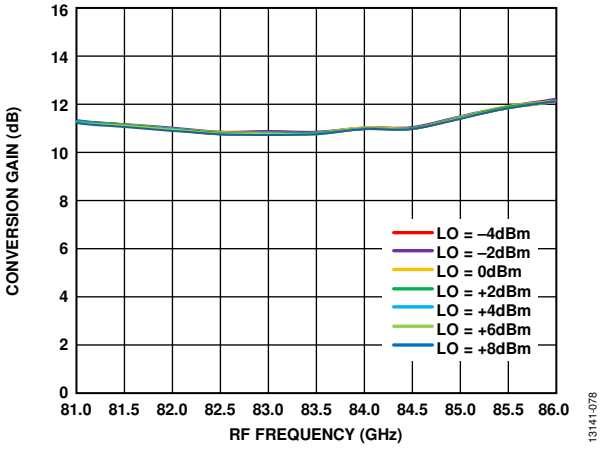

Figure 74. Conversion Gain vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

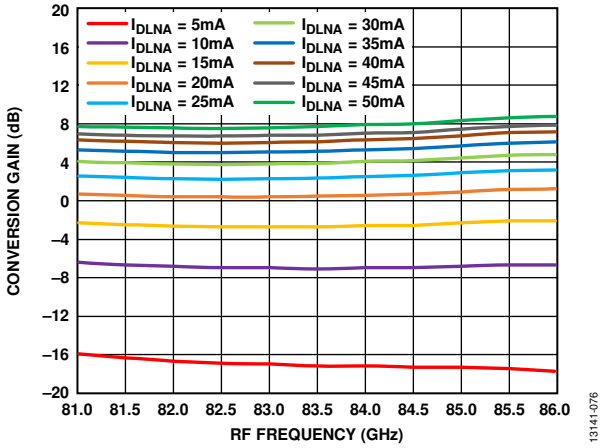

Figure 72. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

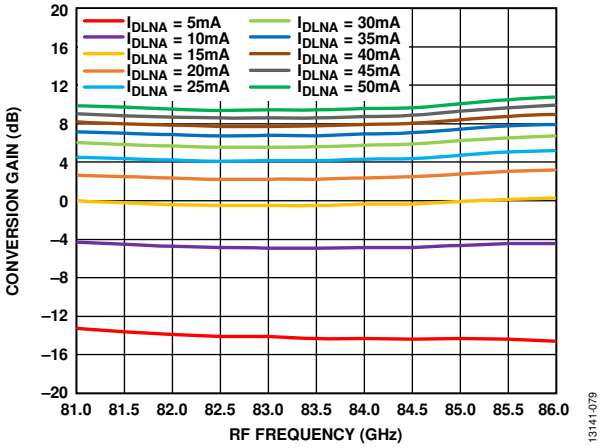

Figure 75. Conversion Gain vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

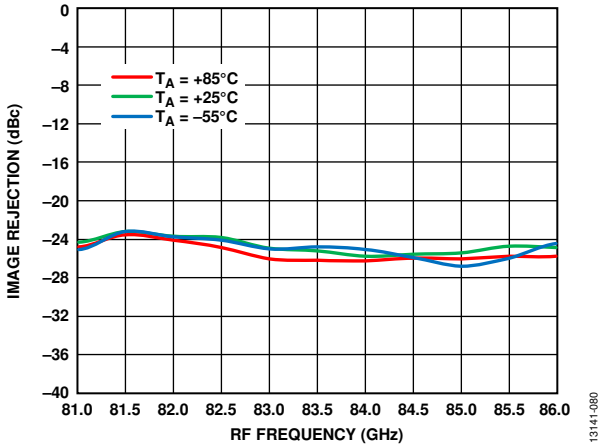

Figure 76. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

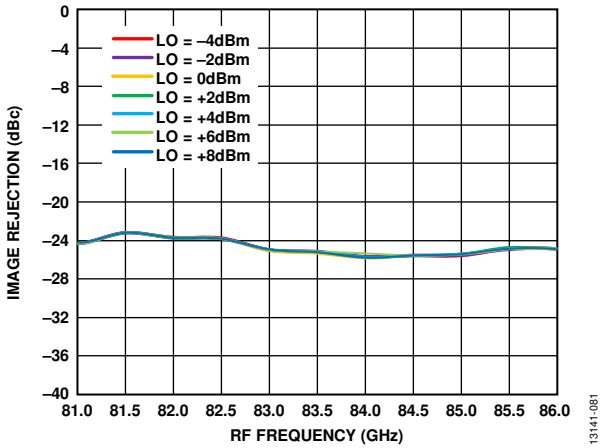

Figure 77. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

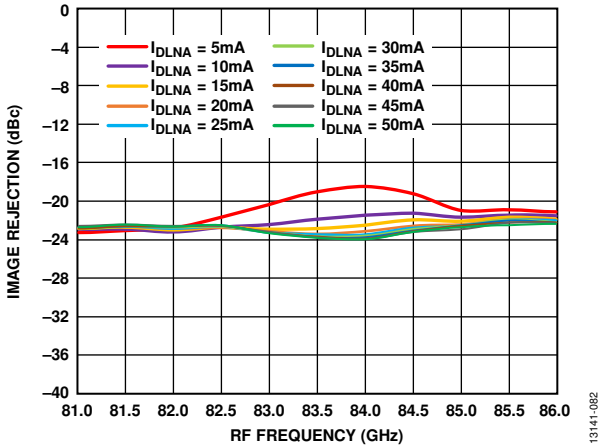

Figure 78. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

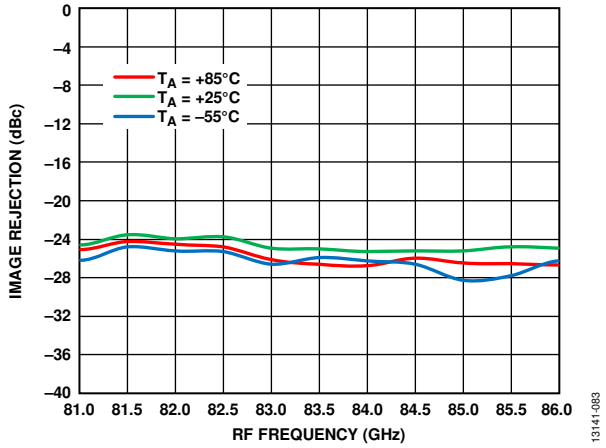

Figure 79. Image Rejection vs. RF Frequency at Various Temperatures, RFIN = −20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

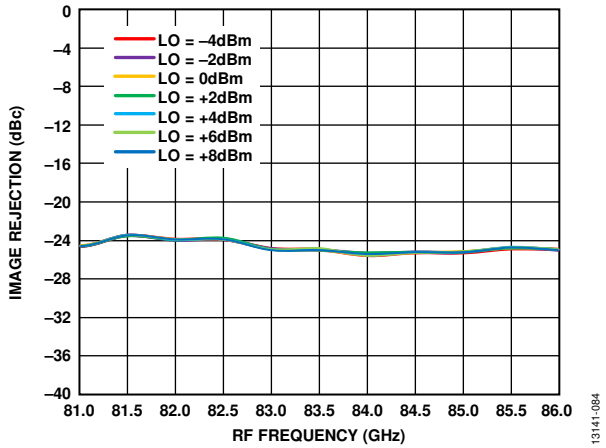

Figure 80. Image Rejection vs. RF Frequency at Various LO Powers, RFIN = −20 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

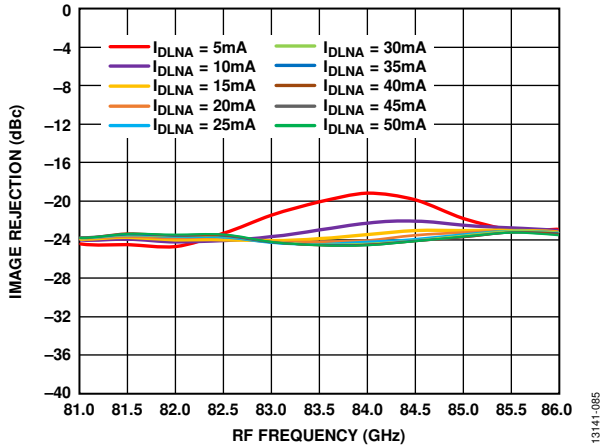

Figure 81. Image Rejection vs. RF Frequency at Various I_{DLNA} Values, RFIN = −20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

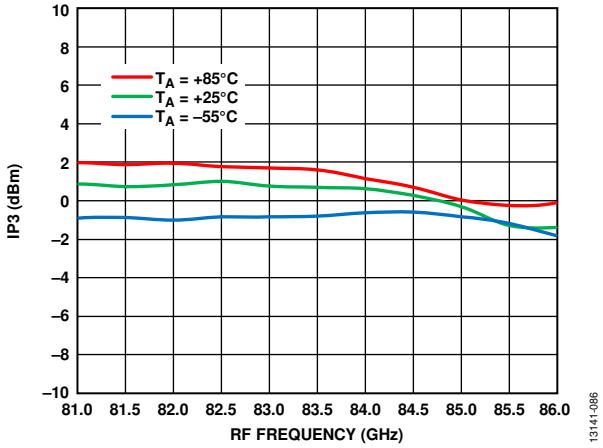

Figure 82. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

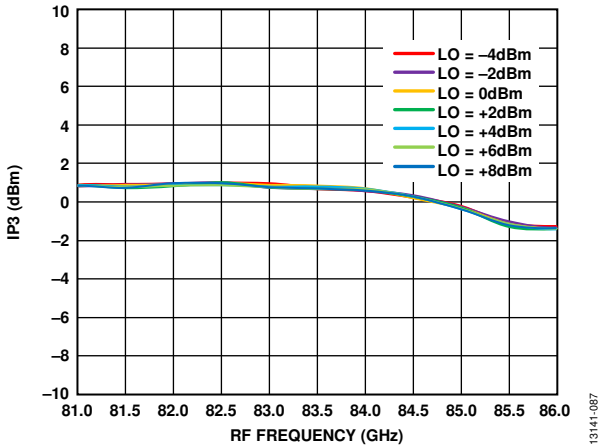

Figure 83. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

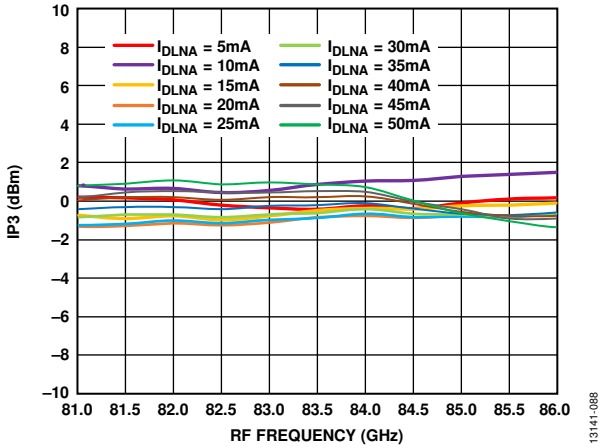

Figure 84. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

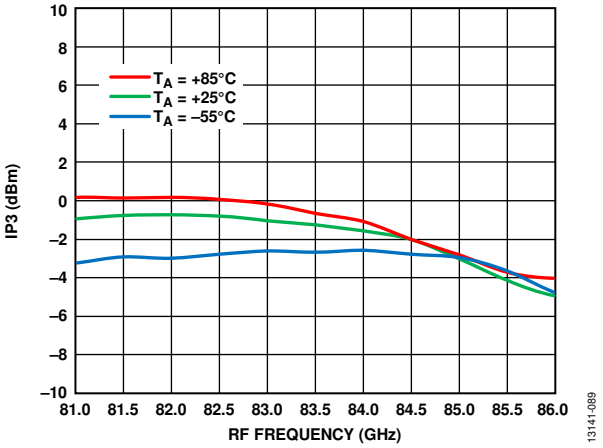

Figure 85. Input IP3 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

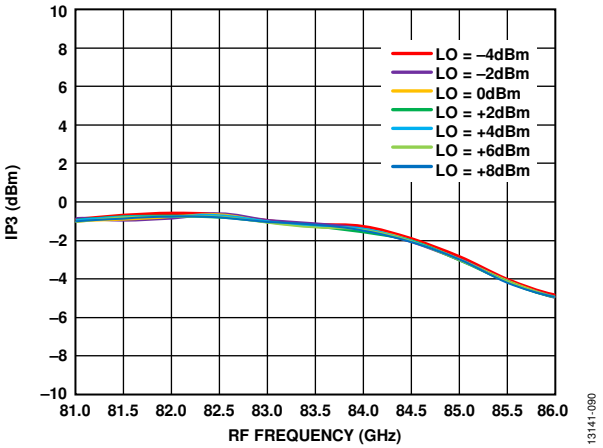

Figure 86. Input IP3 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

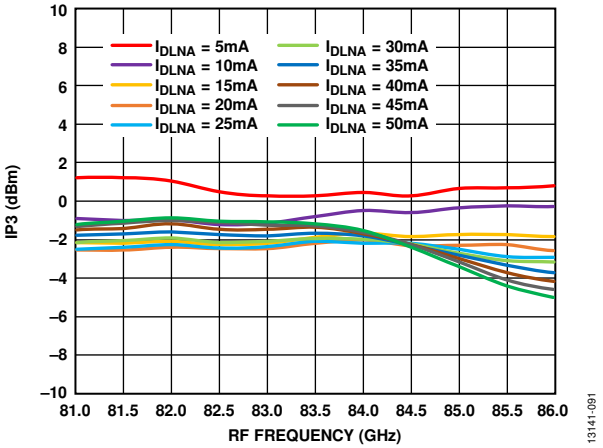

Figure 87. Input IP3 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

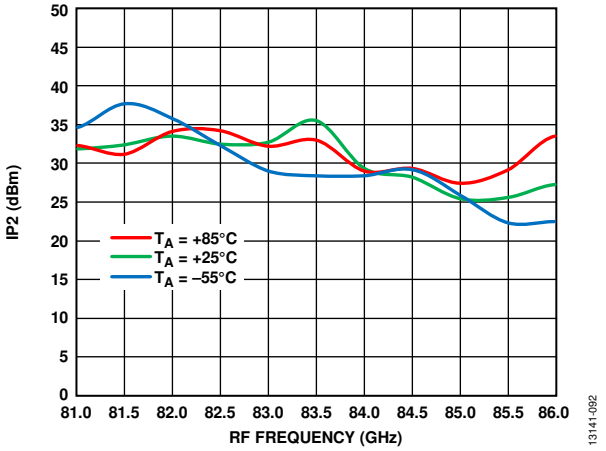

Figure 88. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

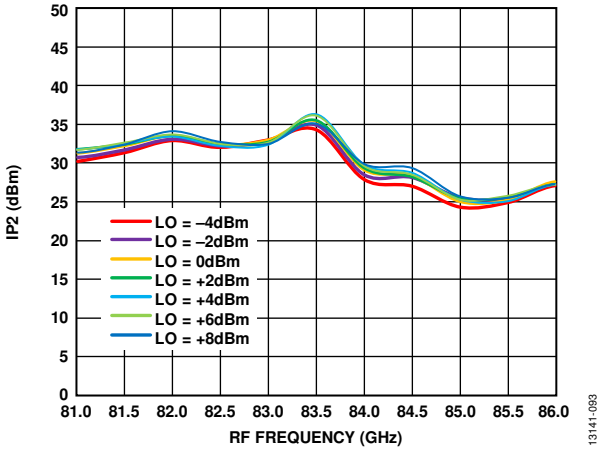

Figure 89. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

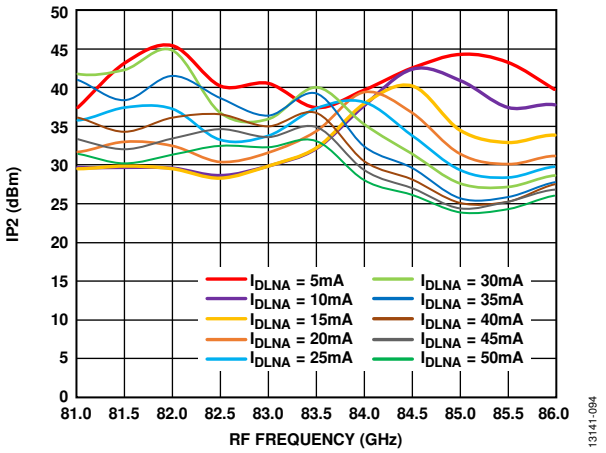

Figure 90. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

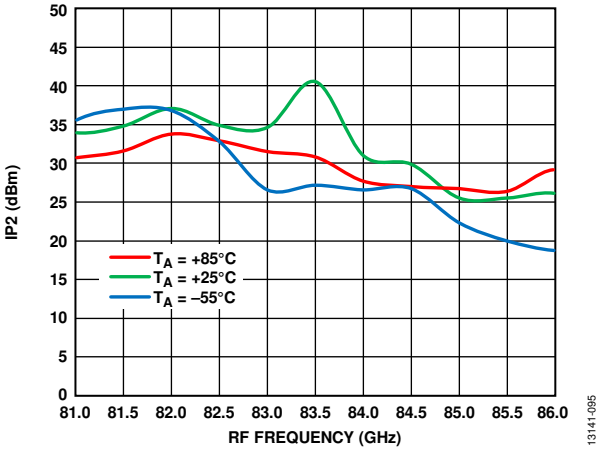

Figure 91. Input IP2 vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

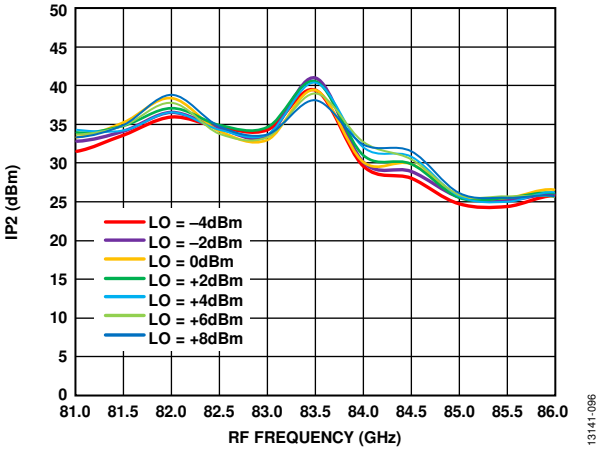

Figure 92. Input IP2 vs. RF Frequency at Various LO Powers, RFIN = –20 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

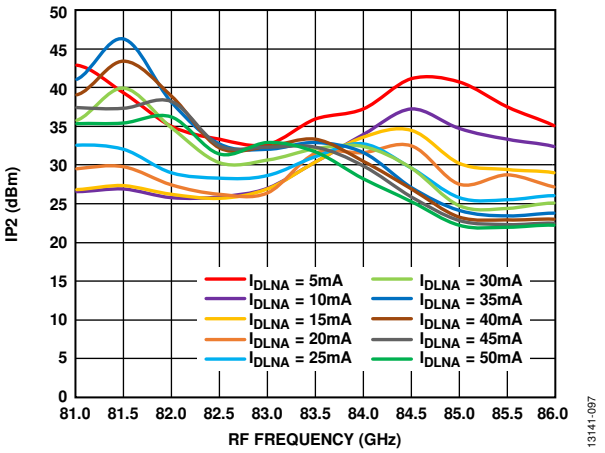

Figure 93. Input IP2 vs. RF Frequency at Various I_{DLNA} Values, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

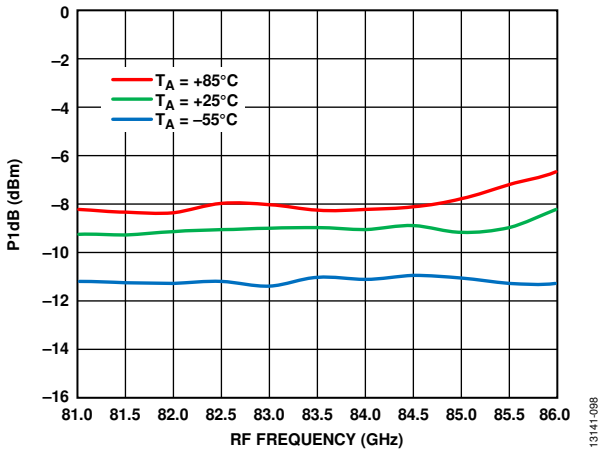

Figure 94. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

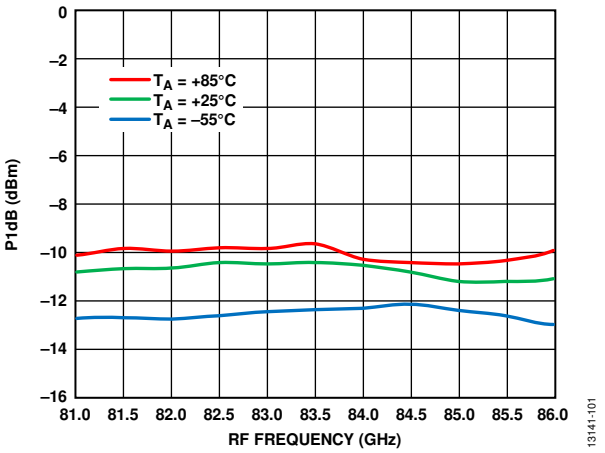

Figure 95. Input P1dB vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

NOISE FIGURE PERFORMANCE WITH UPPER SIDEBAND SELECTED

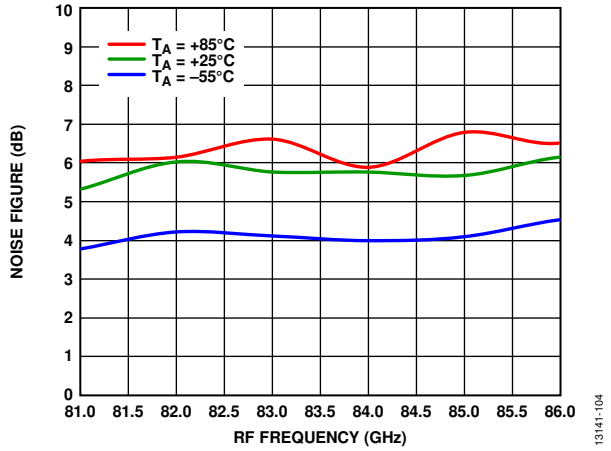

Figure 96. Noise Figure vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

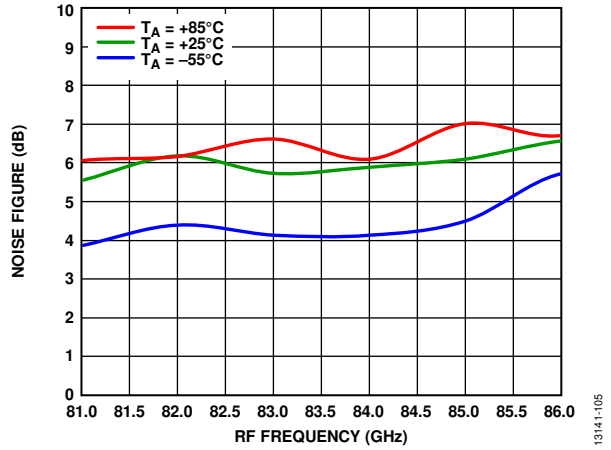

Figure 97. Noise Figure vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

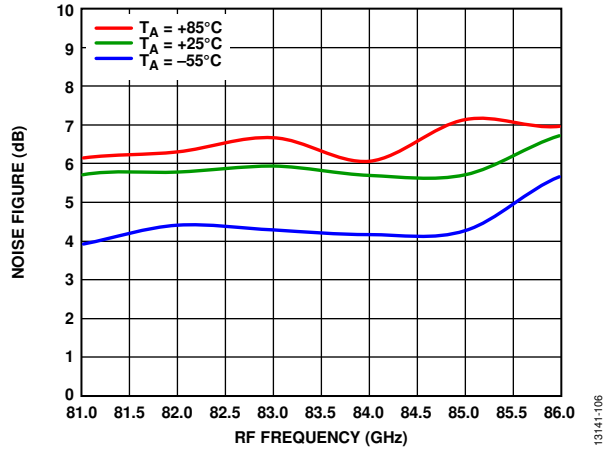

Figure 98. Noise Figure vs. RF Frequency at Various Temperatures, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V

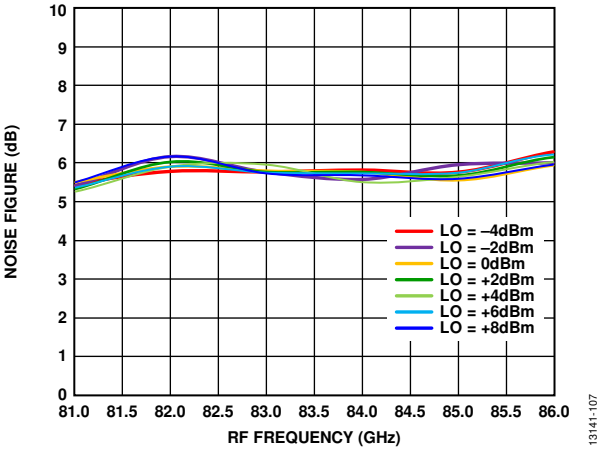

Figure 99. Noise Figure vs. RF Frequency at Various LO Powers, IF = 500 MHz, V_{DLNA} = 3 V

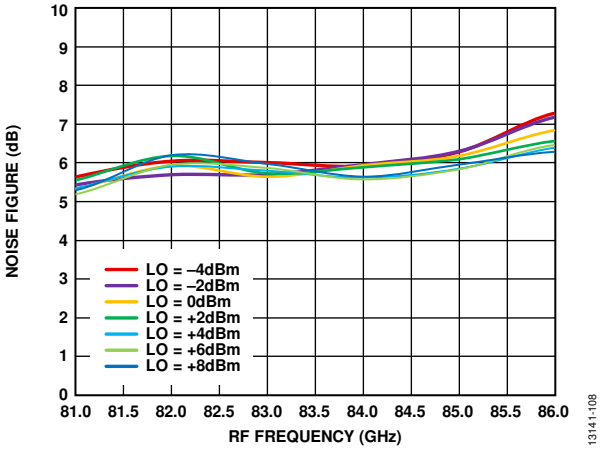

Figure 100. Noise Figure vs. RF Frequency at Various LO Powers, IF = 1000 MHz, V_{DLNA} = 3 V

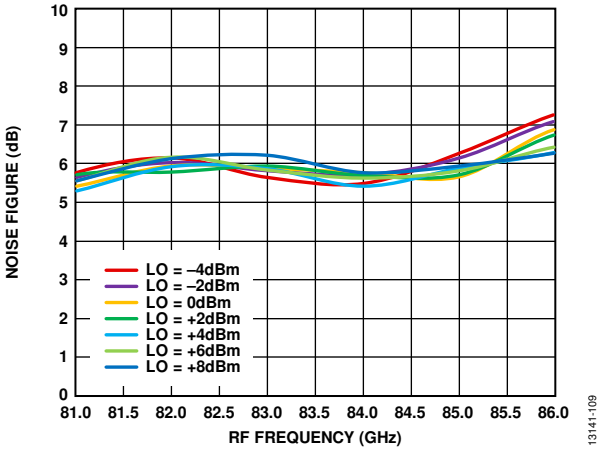

Figure 101. Noise Figure vs. RF Frequency at Various LO Powers, IF = 2000 MHz, V_{DLNA} = 3 V

AMPLITUDE BALANCE PERFORMANCE WITH UPPER SIDEBAND SELECTED

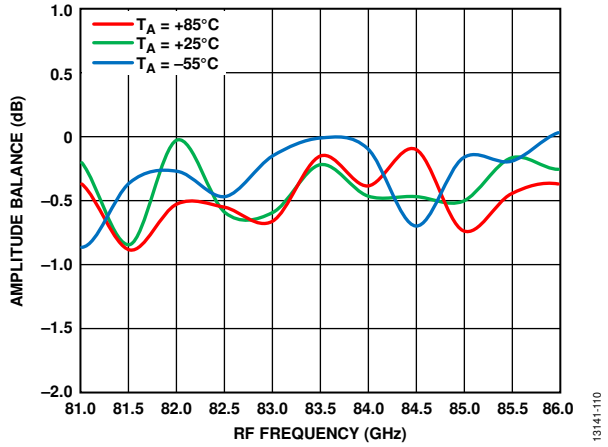

Figure 102. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 4 V

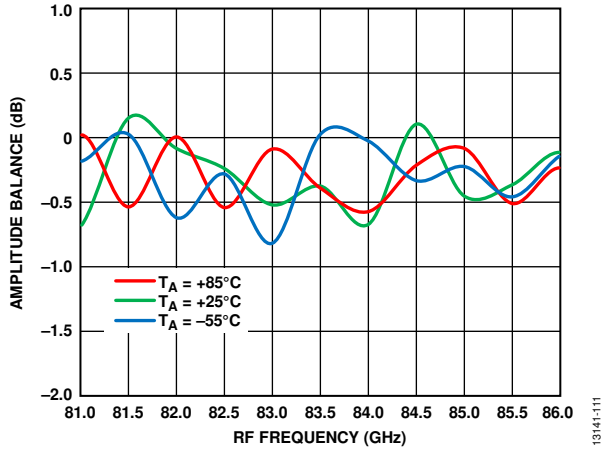

Figure 103. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 4 V

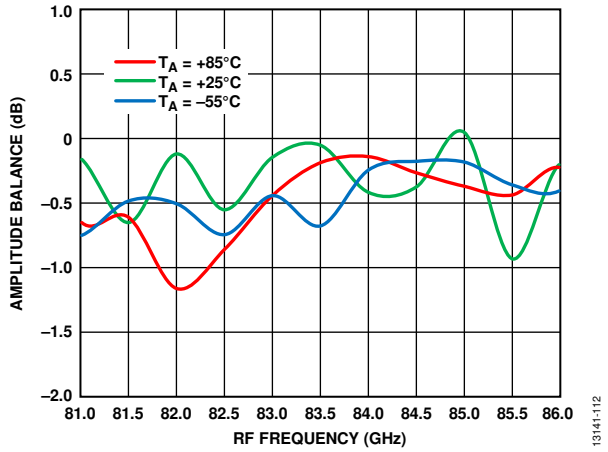

Figure 104. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 4 V

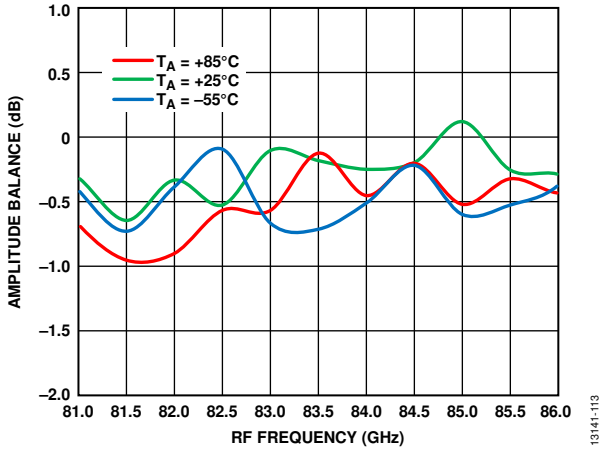

Figure 105. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 500 MHz, V_{DLNA} = 3 V

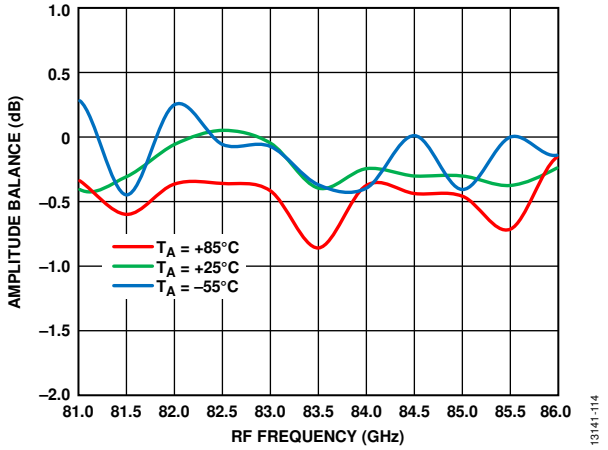

Figure 106. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 1000 MHz, V_{DLNA} = 3 V

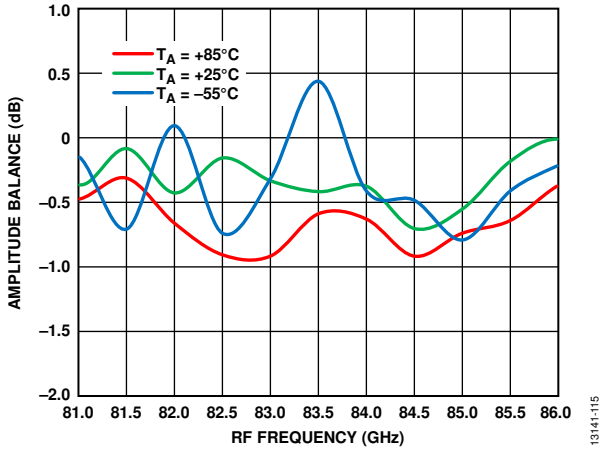

Figure 107. Amplitude Balance vs. RF Frequency at Various Temperatures, RFIN = –20 dBm, LO = 2 dBm, IF = 2000 MHz, V_{DLNA} = 3 V