Integrated 2T2R TDD and FDD RadioVerse Transceiver with Dual Observation Paths

FEATURES

- 2 differential transmitters
- 2 differential receivers
- 2 differential observation receivers
- LO tunable range: 450 MHz to 7125 MHz
- RF range: 350 MHz to 7225 MHz[1]
- Maximum transmitter large-signal bandwidth: 200 MHz
- Maximum transmitter synthesis bandwidth: 450 MHz
- Maximum receiver signal bandwidth: 200 MHz
- Maximum observation receiver signal bandwidth: 450 MHz
- Fully integrated fractional-N RF synthesizer
- Fully integrated clock synthesizer
- Dual external LO inputs supporting operation up to 6 GHz
- JESD204B and JESD204C digital interface: up to 16.5 Gbps
- TDD and FDD operation
- Simplifying thermal and power consumption challenges
  - 4.82 W power consumption for the TDD mode, enabled use case with 200 MHz iBW/OBW[2]

APPLICATIONS

- Software defined radios
- Portable instrumentation
- Military communications
- General-purpose radios
- Wireless infrastructure
- TDD and FDD applications

GENERAL DESCRIPTION

The ADRV9032R is a highly integrated, RF agile transceiver offering two transmitters, two observation receivers for monitoring transmitter channels, two receivers, integrated local oscillator (LO) and clock synthesizers, and digital-signal processing functions to provide a complete transceiver solution. The device provides the high radio performance and low-power consumption demanded by cellular infrastructure applications, software-defined radios, portable instruments, and military communications.

The receiver and transmitter signal paths use a zero-IF (ZIF) architecture that provides wide bandwidth with dynamic range suitable for non-contiguous multicarrier applications. The ZIF architecture has the benefits of low power and RF and bandwidth agility. The lack of aliases and out-of-band images eliminates anti-aliasing and image filters, reducing system size and cost, and making band independent solutions possible.

The device also includes two wide-bandwidth observation path receiver sub-systems for monitoring transmitter outputs. The complete transceiver subsystem includes automatic and manual attenuation control, DC offset correction, quadrature error correction (QEC), and digital filtering. General-purpose inputs and outputs (GPIOs) that provide an array of digital control options are also integrated.

The transceiver includes four fully integrated phase-locked loops (PLLs). A single PLL provides high performance, low-power fractional-N RF LO synthesis supporting single and multiband time division duplex (TDD) and frequency division duplex (FDD) operation with large-signal bandwidth up to 200 MHz. An additional PLL provides a second RF LO in order to support multiband applications with spacing greater than 200 MHz, or to enable unique transmitter and receiver LO frequencies for frequency planning flexibility. A multichip synchronization mechanism synchronizes the phases of all local oscillators and clocks between multiple chips. All voltage-controlled oscillators (VCOs) and loop filter components are integrated and can be adjusted through the serial-peripheral interface (SPI).

External LO paths are supported on the ADRV9032RBBPZ-2T1 model to provide an option for improved phase noise performance, which meets the more restrictive performance requirements demanded by some radar and instrumentation applications.

The serial-data interface consists of eight serializer lanes and eight deserializer lanes. The interface supports both the JESD204B and JESD204C standards, and it operates at data rates up to 16.5 Gbps. Both fixed and floating-point data formats are supported. The floating-point format allows internal automatic gain control (AGC) to be transparent to the baseband processor.

The ADRV9032R is powered directly from the 0.8 V, 1.0 V, and 1.8 V regulators and is controlled by a standard SPI serial port. Comprehensive power-down modes are included to minimize power consumption in normal use. The device is packaged in a 506-ball ball grid array, thermally enhanced [BGA_ED].

[1] The relationship between the LO and RF ranges can be expressed as: RF range = LO tuning range ± (large-signal bandwidth/2).

[2] Power consumption values shown are for a typical use case. Power consumption depends heavily on the device configuration (use case). Please refer to the power analysis tab in the EVAL-ADRV903X evaluation software (ACE) to estimate the power consumption for the specified use case.

DOCUMENT FEEDBACK
TECHNICAL SUPPORT
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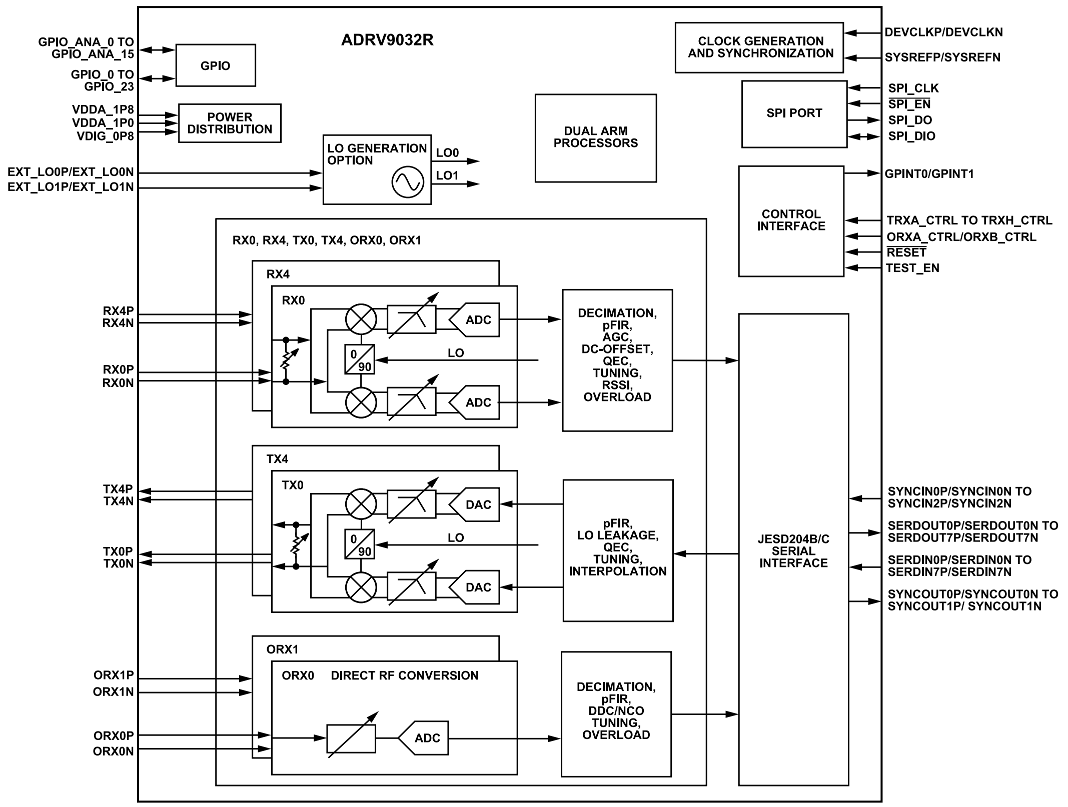
1/2025—Revision 0: Initial Version

FUNCTIONAL BLOCK DIAGRAM



NOTES
1. VDDA_1P8 REPRESENTS VVCO0_1P8, VVCO1_1P8, VANA0_1P8, VANA1_1P8, VSYS_1P8, VCONV0_1P8, VCONV1_1P8, VCONV2_1P8, VCONV3_1P8, VORX0_1P8, VORX1_1P8, VIF_1P8, VSERVCO_1P8, VCLKVCO_1P8, VTX0_1P8, AND VTX1_1P8.
2. VDDA_1P0 REPRESENTS VRXLO0_1P0, VTXLO0_1P0, VLO0_1P0, VLO1_1P0, VTXLO1_1P0, VRXLO1_1P0, VBB0_1P0, VBB1_1P0, VCONV0_1P0, VCONV1_1P0, VCONV2_1P0, VCONV3_1P0, VSCLK0_1P0, VSCLK1_1P0, VORX0_1P0, VORX1_1P0, VCLKSYN_1P0, VCLKGEN_1P0, VSERSYN_1P0, VSYN0_1P0, VSYN1_1P0, VDEV_1P0, VSER_1P0, AND VDES_1P0.

Figure 1. Functional Block Diagram

SPECIFICATIONS

Table 1 shows electrical characteristics at ambient temperature range. All RF specifications are based on measurements that include printed circuit board (PCB) and matching circuit losses, unless otherwise noted.

Table 1. Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
TRANSMITTERS (Tx)						
Center Frequency		450		7125	MHz	
Large-Signal Bandwidth				200	MHz	
Synthesis Bandwidth				450	MHz	
Input Data Rate		61.44		491.52	MSPS	Supported data rates: 61.44 MSPS, 122.88 MSPS, 184.32 MSPS, 245.76 MSPS, 368.64 MSPS and 491.52 MSPS
Full-Scale Output Power	P_{OUT}					Continuous wave (CW) output power at 0 dBFS, 0 dB Tx attenuation, 1 MHz tone
450 MHz			5.5		dBm	
900 MHz			5		dBm	
1800 MHz			4.5		dBm	
2600 MHz			4.5		dBm	
3500 MHz			3.5		dBm	
4500 MHz			2.5		dBm	
5600 MHz			2		dBm	
6300 MHz			2		dBm	
7100 MHz			2		dBm	
Flicker Noise						
1 kHz Offset from LO			−137		dBFS/Hz	
P_{OUT} Temperature Slope			−30		mdB/°C	Valid over full power control range
Power Control Range			32		dB	Signal-to-noise ratio (SNR) maintained for 0 to 20 dB RF attenuation
Power Control Resolution			0.05		dB	
Attenuation Accuracy			0.1		dB	Valid over full power control range for any 4 dB step
			±0.04		dB	Monotonic
Phase Change vs. RF Attenuation			3		Degrees	Uncorrected, valid over full power control range, LO = 3500 MHz
RF Delay Variation With Temperature			1.2		ps/°C	Valid over full power control range
Peak-to-Peak Gain Deviation						Includes compensation by programmable finite impulse response (FIR) filter; measured with 800 MHz synthesis bandwidth use case
200 MHz RF Bandwidth			0.2		dB	
400 MHz RF Bandwidth			0.4		dB	
Peak-to-Peak Gain Deviation Narrow Band						
20 MHz RF Bandwidth			0.1		dB	Any 20 MHz bandwidth span within the large-signal bandwidth; includes compensation by programmable FIR filter

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Deviation from Linear Phase						Measured with 800 MHz synthesis bandwidth use case
100 MHz RF Bandwidth			±1		Degrees	
450 MHz RF Bandwidth			±5		Degrees	
Error Vector Magnitude	EVM					PLL optimized for integrated noise measured using long-term evolution (LTE) 20 MHz signal; PLL loop filter bandwidth (LFBW) approximately 500 kHz
450 MHz			0.1		%	
900 MHz			0.1		%	
1800 MHz			0.12		%	
2600 MHz			0.26		%	
3500 MHz			0.38		%	
4500 MHz			0.28		%	
5600 MHz			0.52		%	
6300 MHz			0.7		%	
7100 MHz			0.9		%	
Adjacent Channel Leakage Ratio (ACLR) (LTE)						20 MHz LTE at −12 dBFS
450 MHz			−67		dBc	
900 MHz			−67		dBc	
1800 MHz			−67		dBc	
2600 MHz			−67		dBc	
3500 MHz			−65		dBc	
4500 MHz			−62		dBc	
5600 MHz			−60		dBc	
6300 MHz			−57		dBc	
7100 MHz			−57		dBc	
In-Band Noise Floor						In-band noise falls dB for dB with attenuation until limited by the thermal noise floor
0 dB Attenuation			−157		dBFS/Hz	
20 dB Attenuation			−154		dBFS/Hz	
Out-of-Band Noise Floor			−158		dBFS/Hz	0 dB attenuation 3 × synthesis bandwidth/2 offset
Interpolation Images						
Large-Signal Bandwidth			−70		dBc	
Synthesis Bandwidth			−55		dBc	
Second- and Third-Order In-Band Harmonic Distortion	HD2/HD3					−12 dBFS CW signal Harmonic distortion (HD) product falling inside the large-signal bandwidth; 30 MHz baseband frequency
450 MHz			−75		dBc	
900 MHz			−75		dBc	
1800 MHz			−75		dBc	
2600 MHz			−70		dBc	
3500 MHz			−70		dBc	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
4500 MHz			−70		dBc	
5600 MHz			−67		dBc	
6300 MHz			−65		dBc	
7100 MHz			−65		dBc	
Second- and Third-Order Out-of-Band Harmonic Distortion	HD2/HD3					−12 dBFS CW signal; HD product falling outside the large-signal bandwidth
450 MHz			−70		dBc	
900 MHz			−70		dBc	
1800 MHz			−70		dBc	
2600 MHz			−65		dBc	
3500 MHz			−65		dBc	
4500 MHz			−65		dBc	
5600 MHz			−63		dBc	
6300 MHz			−60		dBc	
7100 MHz			−60		dBc	
Third-Order Intermodulation Products	IM3					Two −15 dBFS carriers within the large-signal bandwidth
450 MHz			−70		dBc	
900 MHz			−70		dBc	
1800 MHz			−70		dBc	
2600 MHz			−65		dBc	
3500 MHz			−65		dBc	
4500 MHz			−65		dBc	
5600 MHz			−64		dBc	
6300 MHz			−62		dBc	
7100 MHz			−60		dBc	
Image Rejection						
Within Large-Signal bandwidth						Quadrature error correction (QEC) active; up to 20 dB of attenuation
LO < 5000 MHz			65		dBc	
5000 MHz ≤ LO ≤ 6300 MHz			60		dBc	
LO > 6300 MHz			55		dBc	
Beyond Large-Signal Bandwidth			40		dBc	Assumes that distortion power density is 25 dB below desired power density
Output Impedance	Z_{OUT}		100		Ω	Differential – nominal
Maximum Output Load Voltage Standing Wave Ratio (VSWR)				3		Maximum value to ensure adequate calibration
Output Return Loss			10		dB	
LO Leakage Power						LO leakage (LOL) correction active
Carrier Offset from LO						
450 MHz			−84		dBFS	
900 MHz			−84		dBFS	
1800 MHz			−84		dBFS	
2600 MHz			−84		dBFS	
3500 MHz			−84		dBFS	
4500 MHz			−82		dBFS	
5600 MHz			−82		dBFS	
6300 MHz			−82		dBFS	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
7100 MHz			−82		dBFS	
Carrier on LO						
450 MHz			−71		dBFS	
900 MHz			−71		dBFS	
1800 MHz			−71		dBFS	
2600 MHz			−71		dBFS	
3500 MHz			−71		dBFS	
4500 MHz			−71		dBFS	
5600 MHz			−71		dBFS	
6300 MHz			−71		dBFS	
7100 MHz			−71		dBFS	
RECEIVERS (Rx)						
Center Frequency		450		7125	MHz	
Signal Bandwidth				200	MHz	
Output Data Rate		61.44		491.52	MSPS	Supported data rates: 61.44 MSPS, 122.88 MSPS, 184.32 MSPS, 245.76 MSPS, 368.64 MSPS and 491.52 MSPS
Full-Scale Input Power	P_{FS}					CW input power that produces 0 dBFS; 0 dB Rx attenuation
450 MHz			−11.5		dBm	
900 MHz			−11.5		dBm	
1800 MHz			−10.7		dBm	
2600 MHz			−10.4		dBm	
3500 MHz			−9.9		dBm	
4500 MHz			−9.7		dBm	
5600 MHz			−9.5		dBm	
6300 MHz			−9.5		dBm	
7100 MHz			−9		dBm	
Attenuation Control						
Gain Range			32		dB	
Analog Gain-Step Size			0.5		dB	Attenuator steps from 0 dB to 6 dB
			1		dB	Attenuator steps from 6 dB to 32 dB
Residual Gain-Step Error			0.1		dB	Attenuator steps from 0 dB to 20 dB
			0.2		dB	Attenuator steps from 20 dB to 32 dB
Gain-Temperature Slope						
LO < 5000 MHz			−3		mdB/°C	
LO > 5000 MHz			−4		mdB/°C	
Phase Change vs. Rx Gain						Uncorrected, valid over full gain-control range
450 MHz			2		Degrees	
900 MHz			3		Degrees	
1800 MHz			6		Degrees	
2600 MHz			9		Degrees	
3500 MHz			12		Degrees	
4500 MHz			16		Degrees	
5600 MHz			19		Degrees	
6300 MHz			22		Degrees	
7100 MHz			25		Degrees	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
RF Delay Variation with Temperature			1		ps/°C	Valid over full gain-control range
Peak-to-Peak Gain Deviation						Over signal bandwidth, includes compensation by programmable FIR filter
200 MHz RF Bandwidth			1		dB	
Rx Decimation Image Rejection		80			dB	Due to digital filters
Rx Alias Band Rejection			70		dB	Rejection of signals within the analog-to-digital converter (ADC) alias band
Input Impedance	Z_{IN}		100		Ω	Differential
Maximum Source VSWR				3		
Input Port Return Loss			10		dB	
Rx Input LO Leakage at Maximum Gain						Leakage decreased dB for dB with attenuation for first 12 dB, over full attenuation range
450 MHz			−68		dBm	
900 MHz			−70		dBm	
1800 MHz			−65		dBm	
2600 MHz			−65		dBm	
3500 MHz			−65		dBm	
4500 MHz			−65		dBm	
5600 MHz			−65		dBm	
6300 MHz			−65		dBm	
7100 MHz			−60		dBm	
Image Rejection			−75		dBc	QEC active up to −1 dBFS
Noise Spectral Density	N_0					Offset = 40 MHz, spot
450 MHz			−151.7		dBFS/Hz	
900 MHz			−151.5		dBFS/Hz	
1800 MHz			−151.5		dBFS/Hz	
2600 MHz			−151.1		dBFS/Hz	
3500 MHz			−150.5		dBFS/Hz	
4500 MHz			−150.7		dBFS/Hz	
5600 MHz			−150.3		dBFS/Hz	
6300 MHz			−149.7		dBFS/Hz	
7100 MHz			−149.5		dBFS/Hz	
Noise Figure	NF					0 dB attenuation
450 MHz			10.2		dB	
900 MHz			10.5		dB	
1800 MHz			11.8		dB	
2600 MHz			12.5		dB	
3500 MHz			13.5		dB	
4500 MHz			13.8		dB	
5600 MHz			14		dB	
6300 MHz			14.5		dB	
7100 MHz			15		dB	
Noise Figure Ripple			1		dB	Peak-to-peak deviation in noise figure over large-signal bandwidth
Second-Order Harmonic Distortion	HD2		−76		dBc	HD2 products occurring anywhere in-band, −3.5 dBFS CW signal

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Third-Order Harmonic Distortion	HD3					HD3 products occurring anywhere in-band
LO ≤ 600 MHz			−72		dBc	−3.5 dBFS CW signal
600 MHz < LO < 1200 MHz			−72		dBc	−2.5 dBFS CW signal
LO ≥ 1200 MHz			−70		dBc	−1 dBFS CW signal
Fourth-Order Harmonic Distortion	HD4		−90		dBc	HD4 products occurring anywhere in-band, −1 dBFS CW signal
Fifth-Order Harmonic Distortion	HD5		−80		dBc	HD5 products occurring anywhere in-band, −3.5 dBFS CW signal
Second-Order Intermodulation Products	IM2					
450 MHz			−80		dBc	Two CW tones at −9.5 dBFS, 200 MHz signal bandwidth
900 MHz			−80		dBc	Two CW tones at −8.5 dBFS, 400 MHz signal bandwidth
1800 MHz			−80		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
2600 MHz			−80		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
3500 MHz			−80		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
4500 MHz			−80		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
5600 MHz			−80		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
6300 MHz			−78		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
7100 MHz			−78		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
Third-Order Intermodulation Products	IM3					IM products band edge
450 MHz			−70		dBc	Two CW tones at −9.5 dBFS, 200 MHz signal bandwidth
900 MHz			−66		dBc	Two CW tones at −8.5 dBFS, 400 MHz signal bandwidth
1800 MHz			−60		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
2600 MHz			−61		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
3500 MHz			−61		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
4500 MHz			−61		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
5600 MHz			−61		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
6300 MHz			−60		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
7100 MHz			−60		dBc	Two CW tones at −7 dBFS, 600 MHz signal bandwidth
Rx Band Spurs Referenced to RF Input at Maximum Gain			−95		dBm	No more than one spur at this level per 10 MHz of Rx bandwidth; excludes converter clock spurs; no input signal applied; non-IoT

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
OBSERVATION RECEIVER (ORx)						ORx digital datapath contains a −6 dB scaling due to the removal of the ADC image, therefore, a full-scale signal at the output of the ADC appears as a −6 dBFS signal at the digital datapath output, and ADI recommends adding this 6 dB back into the 2.14 (16-bit resolution) or 2.10 (12-bit resolution) data output (all values in the data sheet assume that this compensation has occurred)
Center of Input Frequency Range		450		7125	MHz	
Signal Bandwidth				450	MHz	
Output Data Rate		61.44		491.52	MSPS	Supported data rates: 61.44 MSPS, 122.88 MSPS, 184.32 MSPS, 245.76 MSPS, 368.64 MSPS and 491.52 MSPS
Maximum ORx Input Power				16	dBm	Specified at the pin; peak power for modulated signals with peak-to-average ratio (PAR) ≥ 7 dB; for CW, it is reduced to 10 dBm
Full-Scale Input Power	P_{FS}					CW input power that produces 0 dBFS; 0 dB ORx attenuation; no external attenuator
450 MHz			5.5		dBm	
900 MHz			5.4		dBm	
1800 MHz			5.3		dBm	
2600 MHz			6.1		dBm	
3500 MHz			7.5		dBm	
4500 MHz			7.5		dBm	
5600 MHz			9		dBm	
6300 MHz			10		dBm	
7100 MHz			11		dBm	
Gain Range			16		dB	Limited by maximum input power of 16 dBm at device under test (DUT) input pins; ORx attenuation ≤ 12 dB recommended to achieve linearity performance
Gain Step			1		dB	
Peak-to-Peak Gain Deviation						Within signal bandwidth, includes compensation by programmable FIR filter; flatness is dependent on the external match and external match is not de-embedded
200 MHz RF Bandwidth			0.4		dB	
400 MHz RF Bandwidth			0.6		dB	
Peak-to-Peak Gain Deviation Narrow Band						
20 MHz RF Bandwidth			0.1		dB	Any 20 MHz bandwidth span within the large-signal bandwidth, includes compensation by programmable FIR filter
Deviation from Linear Phase			±2		Degrees	800 MHz RF bandwidth

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Input Impedance	Z_{IN}		100		Ω	Differential
Input Source VSWR				3		
Input Port Return Loss			10		dB	
Third-Order Intermodulation Product	IM3					Two tones, each at −13 dBFS; ORx attenuation ≤ 12 dB recommended to achieve performance
LO < 5000 MHz			−70		dBc	
LO > 5000 MHz			−65		dBc	
Second-Order Harmonic Distortion	HD2					0 dB ORx attenuation; ORx attenuation ≤ 12 dB recommended to achieve performance
LO < 5000 MHz						
−1 dBFS			−51		dBc	
−10 dBFS			−60		dBc	
LO > 5000 MHz						
−1 dBFS			−46		dBc	
−10 dBFS			−55		dBc	
Third-Order Harmonic Distortion	HD3					0 dB ORx attenuation; ORx attenuation ≤ 12 dB recommended to achieve performance
LO < 5000 MHz						
−1 dBFS			−52		dBc	
−10 dBFS			−70		dBc	
LO > 5000 MHz						
−1 dBFS			−47		dBc	
−10 dBFS			−65		dBc	
Spurious-Free Dynamic Range	SFDR		−65		dBFS	Within signal bandwidth; −10 dBFS input; nonintermodulation related spurs; does not include harmonic distortion; limited by CW spur at N (where N is any integer number) × $f_S/4$
			−70		dBFS	Within signal bandwidth; −10 dBFS input; nonintermodulation related spurs; does not include harmonic distortion; does not include $f_S/4$ spur; limited by clock spurs at $f_{IN} \pm f_S/4$
			−75		dBFS	−10 dBFS input, not including clock spurs at $f_{IN} \pm f_S/4$
Noise Spectral Density	N_0					0 dB ORx attenuation; tone power −20 dBFS or lower
2949.12 MHz Sampling Frequency			−144		dBFS/Hz	
3932.16 MHz Sampling Frequency			−145		dBFS/Hz	
5898.24 MHz Sampling Frequency			−147		dBFS/Hz	
7864.32 MHz Sampling Frequency			−148		dBFS/Hz	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
CHANNEL TO CHANNEL ISOLATION						
Tx to Tx Isolation						
450 MHz			73		dB	
900 MHz			73		dB	
1800 MHz			73		dB	
2600 MHz			69		dB	
3500 MHz			67		dB	
4500 MHz			66		dB	
5600 MHz			65		dB	
6300 MHz			65		dB	
7100 MHz			63		dB	
Tx to Rx Isolation						
450 MHz			70		dB	
900 MHz			70		dB	
1800 MHz			70		dB	
2600 MHz			65		dB	
3500 MHz			63		dB	
4500 MHz			61		dB	
5600 MHz			60		dB	
6300 MHz			60		dB	
7100 MHz			60		dB	
Tx to ORx Isolation						
450 MHz			75		dB	
900 MHz			75		dB	
1800 MHz			75		dB	
2600 MHz			74		dB	
3500 MHz			70		dB	
4500 MHz			67		dB	
5600 MHz			65		dB	
6300 MHz			65		dB	
7100 MHz			65		dB	
Rx to Rx Isolation						
450 MHz			75		dB	
900 MHz			75		dB	
1800 MHz			75		dB	
2600 MHz			75		dB	
3500 MHz			63		dB	
4500 MHz			62		dB	
5600 MHz			60		dB	
6300 MHz			60		dB	
7100 MHz			60		dB	
Rx to ORx Isolation						
450 MHz			75		dB	
900 MHz			75		dB	
1800 MHz			75		dB	
2600 MHz			75		dB	
3500 MHz			75		dB	
4500 MHz			70		dB	
5600 MHz			70		dB	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
6300 MHz			70		dB	
7100 MHz			70		dB	
ORx to ORx Isolation						
450 MHz			75		dB	
900 MHz			75		dB	
1800 MHz			75		dB	
2600 MHz			75		dB	
3500 MHz			75		dB	
4500 MHz			75		dB	
5600 MHz			75		dB	
6300 MHz			75		dB	
7100 MHz			75		dB	
LO SYNTHESIZER						
LO Spectral Purity			−80		dBc	TDD mode, not including integer boundary spurs
Integrated Phase Noise, Wide Band						Integrated from 1 kHz to 50 MHz; PLL bandwidth optimized for integrated phase noise; PLL LFBW approximately 500 kHz
450 MHz			0.017		°RMS	
900 MHz			0.03		°RMS	
1800 MHz			0.07		°RMS	
2600 MHz			0.15		°RMS	
3500 MHz			0.22		°RMS	
4500 MHz			0.16		°RMS	
5600 MHz			0.23		°RMS	
6300 MHz			0.33		°RMS	
7100 MHz			0.46		°RMS	
Integrated Phase Noise, Narrow Band						Integrated from 1 kHz to 50 MHz; PLL optimized to minimize phase noise at offsets > 200 kHz; PLL LFBW approximately 70 kHz
450 MHz			0.058		°RMS	
900 MHz			0.13		°RMS	
1800 MHz			0.26		°RMS	
2600 MHz			0.56		°RMS	
3500 MHz			1.2		°RMS	
4500 MHz			0.74		°RMS	
5600 MHz			1.25		°RMS	
6300 MHz			1.92		°RMS	
7100 MHz			2.67		°RMS	
Spot Phase Noise, Wide Band						PLL bandwidth optimized for integrated phase noise; PLL LFBW approximately 500 kHz
450 MHz						
100 kHz Offset			−133		dBc/Hz	
1 MHz Offset			−145.9		dBc/Hz	
10 MHz Offset			−158.8		dBc/Hz	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
900 MHz						
100 kHz Offset			−127		dBc/Hz	
1 MHz Offset			−139		dBc/Hz	
10 MHz Offset			−160		dBc/Hz	
1800 MHz						
100 kHz Offset			−119		dBc/Hz	
1 MHz Offset			−132		dBc/Hz	
10 MHz Offset			−156		dBc/Hz	
2600 MHz						
100 kHz Offset			−113		dBc/Hz	
1 MHz Offset			−125		dBc/Hz	
10 MHz Offset			−150		dBc/Hz	
3500 MHz						
100 kHz Offset			−110		dBc/Hz	
1 MHz Offset			−120		dBc/Hz	
10 MHz Offset			−148		dBc/Hz	
4500 MHz						
100 kHz Offset			−113		dBc/Hz	
1 MHz Offset			−122		dBc/Hz	
10 MHz Offset			−149		dBc/Hz	
5600 MHz						
100 kHz Offset			−110		dBc/Hz	
1 MHz Offset			−119		dBc/Hz	
10 MHz Offset			−146		dBc/Hz	
6300 MHz						
100 kHz Offset			−108		dBc/Hz	
1 MHz Offset			−117		dBc/Hz	
10 MHz Offset			−144		dBc/Hz	
7100 MHz						
100 kHz Offset			−105		dBc/Hz	
1 MHz Offset			−114		dBc/Hz	
10 MHz Offset			−142		dBc/Hz	
Spot Phase Noise, Narrow Band						PLL optimized to minimize phase noise at offsets > 200 kHz; PLL LFBW approximately 70 kHz; numbers met for DEVCLK ≥ 122.88 MHz
450 MHz						
100 kHz Offset			−121		dBc/Hz	
200 kHz Offset			−131		dBc/Hz	
250 kHz Offset			−135		dBc/Hz	
400 kHz Offset			−141		dBc/Hz	
600 kHz Offset			−146		dBc/Hz	
1 MHz Offset			−151		dBc/Hz	
1.2 MHz Offset			−152		dBc/Hz	
1.8 MHz Offset			−155		dBc/Hz	
6 MHz Offset			−159		dBc/Hz	
10 MHz Offset			−159		dBc/Hz	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
900 MHz						
100 kHz Offset			−114		dBc/Hz	
200 kHz Offset			−125		dBc/Hz	
250 kHz Offset			−128		dBc/Hz	
400 kHz Offset			−134		dBc/Hz	
600 kHz Offset			−139		dBc/Hz	
1 MHz Offset			−144		dBc/Hz	
1.2 MHz Offset			−146		dBc/Hz	
1.8 MHz Offset			−150		dBc/Hz	
6 MHz Offset			−158		dBc/Hz	
10 MHz Offset			−160		dBc/Hz	
1800 MHz						
100 kHz Offset			−109		dBc/Hz	
200 kHz Offset			−118		dBc/Hz	
250 kHz Offset			−121		dBc/Hz	
400 kHz Offset			−127		dBc/Hz	
600 kHz Offset			−132		dBc/Hz	
1 MHz Offset			−138		dBc/Hz	
1.2 MHz Offset			−140		dBc/Hz	
1.8 MHz Offset			−144		dBc/Hz	
6 MHz Offset			−154		dBc/Hz	
10 MHz Offset			−156		dBc/Hz	
2600 MHz						
100 kHz Offset			−100		dBc/Hz	
1 MHz Offset			−130		dBc/Hz	
10 MHz Offset			−150		dBc/Hz	
3500 MHz						
100 kHz Offset			−90		dBc/Hz	
1 MHz Offset			−123		dBc/Hz	
10 MHz Offset			−148		dBc/Hz	
4500 MHz						
100 kHz Offset			−95		dBc/Hz	
1 MHz Offset			−128		dBc/Hz	
10 MHz Offset			−150		dBc/Hz	
5600 MHz						
100 kHz Offset			−92		dBc/Hz	
1 MHz Offset			−124		dBc/Hz	
10 MHz Offset			−146		dBc/Hz	
6300 MHz						
100 kHz Offset			−88		dBc/Hz	
1 MHz Offset			−121		dBc/Hz	
10 MHz Offset			−144		dBc/Hz	
7100 MHz						
100 kHz Offset			−84		dBc/Hz	
1 MHz Offset			−117		dBc/Hz	
10 MHz Offset			−142		dBc/Hz	
EXTERNAL LO INPUT						
Input Frequency		3.55		12	GHz	
Input Signal Power						Specified at the pin

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
		−3		+6	dBm	3.55 GHz to 8 GHz
		0		6	dBm	8 GHz to 12 GHz
Allowable Input Signal Differential Phase Imbalance		−15		+15	Degrees	To ensure adequate quadrature error correction
Allowable Input Signal Differential Amplitude Imbalance				1.5	dB	
Input Signal Duty Cycle Error				2.5	%	
Input Impedance			100		Ω	Off-chip AC coupling is required
Input Port Return Loss			10		dB	
Supported LO Divider Ratio						Frequency division ratio of external LO to mixer, only powers of 2 supported; Tx LO range between 3.00 GHz and 3.55 GHz is not currently supported when using the external LO input for the Tx LO source
Tx: LO ≤ 3.00 GHz		4		32		
Tx: LO ≥ 3.55 GHz		2		2		
Rx		2		32		
External LO Path Phase Noise						
Referred to 2 GHz						
800 kHz			−150		dBc/Hz	
3 MHz			−153		dBc/Hz	
10 MHz			−156		dBc/Hz	
CLOCK SYNTHESIZER						
Integrated Phase Noise, Wide Band						1 kHz to 100 MHz; PLL bandwidth optimized for low jitter (491.52 MHz f_{PFD})
2949.12 MHz Sample Clock			0.15		°RMS	
3932.16 MHz Sample Clock			0.165		°RMS	
Integrated Phase Noise, Narrow Band						1 kHz to 100 MHz;PLL bandwidth optimized for low phase noise at > 800 kHz
2949.12 MHz Sample Clock			0.77		°RMS	
3932.16 MHz Sample Clock			0.86		°RMS	
Spot Phase Noise, Wide Band						1 kHz to 100 MHz; PLL bandwidth optimized for low jitter (491.52 MHz f_{PFD})
2949.12 MHz Sample Clock						
100 kHz Offset			−112		dBc/Hz	
1 MHz Offset			−123.5		dBc/Hz	
10 MHz Offset			−149.5		dBc/Hz	
3932.16 MHz Sample Clock						
100 kHz Offset			−110.5		dBc/Hz	
1 MHz Offset			−124.5		dBc/Hz	
10 MHz Offset			−149.5		dBc/Hz	
Spot Phase Noise, Narrow Band						1 kHz to 100 MHz; PLL bandwidth optimized for low phase noise at > 800 kHz
2949.12 MHz Sample Clock						
100 kHz Offset			−96		dBc/Hz	

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
800 kHz Offset			−125		dBc/Hz	
1 MHz Offset			−127.5		dBc/Hz	
3 MHz Offset			−140		dBc/Hz	
10 MHz Offset			−150		dBc/Hz	
3932.16 MHz Sample Clock						
100 kHz Offset			−97		dBc/Hz	
800 kHz Offset			−125		dBc/Hz	
1 MHz Offset			−127.5		dBc/Hz	
3 MHz Offset			−139		dBc/Hz	
10 MHz Offset			−149		dBc/Hz	
REFERENCE CLOCK (DEVCLK_IN SIGNAL)						
Frequency Range		61.44		491.52	MHz	
Slew Rate (Differential)		1			V/ns	Using ±100 mV differential window
Signal Level (Differential)		0.35		1.9	V p-p	AC-coupled; Common-mode voltage internally supplied; for best spurious performance and to meet the specified PLL performance parameters, use a 1.9 V p-p input clock
Input Impedance			100		Ω	Needs external AC-coupling
SYSTEM REFERENCE INPUTS (SYSREF+, SYSREF−)						
Logic Compliance			Low-voltage differential signaling (LVDS)			Alternative signal formats, such as low-voltage positive emitter coupled logic (LVPECL), can be supported through the use of external components, as long as they adhere to the specification and maximum pin voltage limits
Differential Input Voltage	V_{OD}	0.225	0.7	0.9	V p-p	DC-coupled LVDS
Input Common-Mode Voltage	V_{OC}	1.075		1.375	V	Common mode supplied by LVDS driver
Input Resistance (Differential)			48		kΩ	
Input Capacitance (Differential)			1		pF	
Input Offset Range		30		220	mV	Programmable input offset used to prevent SYSREF toggling if LVDS driver has been turned off
Device Clock to SYSREF Setup Time		320			ps	Align SYSREF rising edges to falling edges of DEVCLK at their inputs
Device Clock to SYSREF Hold Time		180			ps	Align SYSREF rising edges to falling edges of DEVCLK at their inputs
DIGITAL SPECIFICATIONS (CMOS)						
Logic Inputs						
Input Voltage						
High Level		VIF × 0.65		VIF + 0.18	V	Power supply specification in Table 2
Low Level		−0.30		VIF × 0.35	V	
Input Current						
High Level		−10		10	μA	
Low Level		−10		10	μA	
Logic Outputs						

SPECIFICATIONS

Table 1. Specifications (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
Output Voltage						
High Level		VIF − 0.45			V	
Low Level				0.45	V	
Drive Capability			10		mA	
DIGITAL SPECIFICATIONS (LVDS)						
Logic Inputs						
Input Voltage Range		825		1675	mV	Each differential input in the pair
Input Differential Voltage Threshold		−100		+100	mV	
Receiver Differential Input Impedance			100		Ω	Internal termination enabled
Logic Outputs						
Output Voltage						
High				1375	mV	
Low		1025			mV	
Differential			225		mV	
Offset			1200		mV	
DIGITAL SPECIFICATIONS (GPIO_ANA)						
Logic Inputs						
Input Voltage						
High Level		VDDA_1P8 × 0.65		VDDA_1P8 + 0.18	V	Power supply specification in Table 2
Low Level		−0.30		VDDA_1P8 × 0.35	V	
Input Current						
High Level		−10		+10	µA	
Low Level		−10		+10	µA	
Logic Outputs						
Output Voltage						
High Level		(VDDA_1P8 × 0.95) – 0.45			V	2 mA drive current at default drive strength
		(VDDA_1P8 × 0.95) – 0.11			V	0.5 mA drive current at default drive strength
		VDDA_1P8 × 0.95			V	<20 µA drive current at default drive strength
Low Level				0.45	V	
Drive Capability			2		mA	

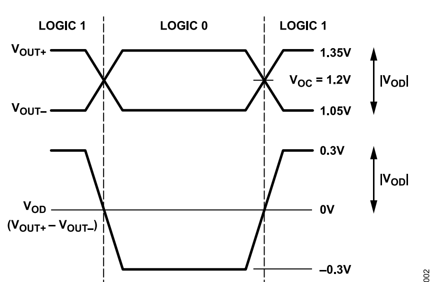


Figure 2. LVDS Input Levels for SYSREF

SPECIFICATIONS

POWER SUPPLY SPECIFICATIONS

Table 2. Power Supply Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
SUPPLY CHARACTERISTICS						
VDIG_0P8 Supply		0.76	0.8	0.84	V	±5%
VDDA_1P0 Supply		0.975	1	1.025	V	±2.5%
VDDA_1P8 Supply		1.71	1.8	1.89	V	±5%
VIF Supply		1.71	1.8	1.89	V	±5%

DIGITAL INTERFACE AND TIMING SPECIFICATIONS

Table 3. Digital Interface and Timing Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
SERIAL-PERIPHERAL INTERFACE (SPI) TIMING						
Write SPI_CLK Period	t_{CP}	20			ns	
SPI_CLK High Pulse Width	t_{MP}	5			ns	
SPI_EN Setup to First SPI_CLK Rising Edge	t_{SC}	4			ns	
Last SPI_CLK Falling Edge to SPI_EN Hold	t_{HC}	0			ns	
SPI_DIO Data Input Setup to SPI_CLK	t_S	4			ns	
SPI_DIO Data Input Hold to SPI_CLK	t_H	0			ns	
SPI_CLK Falling Edge to Output Data Delay	t_{CO}	3.5		8	ns	3- or 4-wire mode
Bus Turnaround Time After Baseband Processor Drives Last Address Bit	t_{HZM}	$t_{CO\ MINIMUM}$		$t_{CO\ MAXIMUM}$	ns	3-wire mode
Bus Turnaround Time After Transceiver Drives Last Data Bit (Must be in Terms of Baseband Processor)	t_{HZS}	$t_{CO\ MINIMUM}$		$t_{CO\ MAXIMUM}$	ns	3-wire mode
JESD204B/C DATA OUTPUT TIMING						
Unit Interval	UI	61.7		407	ps	
Data Rate per Channel, Nonreturn to Zero (NRZ)						
JESD204B		2457.6		16500	Mbps	
JESD204C		2027.52		16500	Mbps	
Rise Time	t_R	17	26		ps	20% to 80% in 100 Ω load
Fall Time	t_F	17	26		ps	20% to 80% in 100 Ω load
Output Common-Mode Voltage	V_{CM}	0		1.8	V	AC-coupled
Differential Output Voltage	V_{DIFF}	360	466	1000	mV ppd	
Short-Circuit Current	I_{DSHORT}	−100		+100	mA	
Differential Termination Impedance	Z_{RDIFF}	80	100	120	Ω	
JESD204B/C DATA INPUT TIMING						
Unit Interval	UI	61.7		407	ps	
Data Rate per Channel, NRZ						
JESD204B		2457.6		16500	Mbps	
JESD204C		2027.52		16500	Mbps	
Input Common-Mode Voltage	V_{CM}	0.05		1.65	V	AC-coupled
Differential Input Voltage	V_{DIFF}	125		1000	mV ppd	
Differential Termination Impedance	Z_{RDIFF}	80	106	120	Ω	

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Table 4. Absolute Maximum Ratings

Parameter	Rating
VDDA_1P8 to VSSA	−0.2 V to +1.98 V
VDIG_0P8 to VSSD, VSSA	−0.2 V to +1.05 V
VDDA_1P0 to VSSA	−0.2 V to see Table 10
VIF Referenced Logic Inputs and Outputs to VSSD	−0.3 V to VIF + 0.3 V
JESD204B/C Logic Outputs to VSSA	−0.2 V to +1.1 V
JESD204B/C Logic Inputs to VSSA	−0.2 V to +1.1 V
Input Current to Any Pin Except Supplies	±10 mA
Maximum Input Power into Rx Ports	See Table 9 for limits vs. survival time
Maximum Input Power into ORx Port	20 dBm[1]
Junction Temperature Range	−40°C to +110°C[2]
Storage Temperature Range	−65°C to +150°C

1 This is for modulated signals with PAR ≥ 7 dB and ORx attenuation ≥ 6 dB. For lower attenuation, the maximum rating decreases dB to dB. For CW, it is 14 dBm for all ORx attenuations.

2 Operation up to 125°C is supported, but specification compliance is only guaranteed up to 110°C. Operation above 110°C can impact device operating lifetime. To avoid a reduction in operating lifetime by operating above 110°C, the device must operate at a temperature below 110°C for a period. Use the following equation to calculate lifetime: Lifetime = $(\Sigma(time_T \times AF_T) \times 10)$, where: $time_T$ refers to time spent at discrete temperatures on Table 6 in terms of duty cycle, and AF_T are acceleration factors taken from Table 5. Note that the maximum lifetime is 10 years.

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.

Table 5. Acceleration Factors for High Temperature Operation

Operating Junction Temperature (°C)	Acceleration Factor (AF)
125	3.32
120	2.25
115	1.51
110	1
105	0.89
100	0.79
95	0.70
90	0.62
85	0.56
80	0.48

The following example shows how the equation and the acceleration factor values are used to understand whether operating lifetime is degraded or not. An example scenario is shown in Table 6 which indicates the time that the device spends on a certain junction temperature with a duty cycle.

Table 6. Example Scenario to Estimate Impact of Accelerating Factor on Lifetime

Operating Junction Temperature (°C)	Duty Cycle
125	0.05 (5%)
120	0.1 (10%)
95	0.4 (40%)
90	0.45 (45%)

With values from Table 5 and Table 6, the condition for operating lifetime of 10 years is satisfied and there is no degradation:

$$20 - (((0.05 \times 3.32) + (0.1 \times 2.25) + (0.4 \times 0.70) + (0.45 \times 0.62)) \times 10) = 10.5$$

To the extent that the customer operates the hardware under the condition T_J > 110°C, the customer represents and warrants that they first consult with an Analog Devices field representative. To support any failure analysis made by Analog Devices, the customer further warrants that it provides relevant historical logs reasonably requested by Analog Devices. In the absence of relevant historical logs being made available by the customer, Analog Devices determines, at its sole discretion by analyzing various technical indicators, whether or not the customer has operated the device within guidance, see Table 4 for reference.

Analog Devices represents and warrants that performance of its hardware products meets the provided specifications only to the extent that the customer has operated the device (see Table 4) and in accordance with Analog Devices' standard warranty. If the customer operates the hardware beyond the lifetime determined (see Table 4) Analog Devices does not warrant that the hardware operates as expected, operates without malfunction, damage, or failure, or performs in a manner consistent with its provided specifications. In such circumstances, Analog Devices further assumes no liability for the operation of the hardware.

REFLOW PROFILE

The transceiver reflow profile is in accordance with the JEDEC JESD20 criteria for Pb-free devices. The maximum reflow temperature is 260°C.

THERMAL RESISTANCE

Thermal performance is directly linked to PCB design and operating environment. Careful attention to PCB thermal design is required.

Thermal resistance values specified in Table 7 are calculated based on JEDEC specs (unless specified otherwise) and must be used in compliance with JESD51-12.

Using enhanced heat removal (such as PCB, heat sink, and airflow) techniques improve thermal resistance values.

θ_{JA} is the natural convection, junction to ambient thermal resistance measured in a one cubic foot sealed enclosure, θ_{JC_TOP} is the junction to case, top thermal resistance, θ_{JB} is the junction to board

ABSOLUTE MAXIMUM RATINGS

thermal resistance, Ψ_{JT} is the junction to top of the package thermal resistance, and Ψ_{JB} is the junction to the board thermal resistance.

Table 7. Thermal Resistance

Package Type	θ_{JA}	θ_{JC_TOP}	θ_{JB}	Ψ_{JT}	Ψ_{JB}	Unit
BP-506-1	11.61	1.12	3.15	0.83	2.72	°C/W

ELECTROSTATIC DISCHARGE (ESD) RATINGS

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

Human body model (HBM) per ANSI/ESDA/JEDEC JS-001.
Charged device model (CDM) per ANSI/ESDA/JEDEC JS-002.

ESD Ratings for the ADRV9032R

Table 8. ADRV9032R, 506-Ball CSP_BGA

ESD Model	Withstand Threshold (V)	Class
HBM	±1000	1B
CDM	±175[1]	C0B

[1] All pins except transmitter channel pins and EXT LO pins rated at ±250 V CDM classification test level (Class C1).

Table 9. Maximum Input Power into Receiver Ports vs. Lifetime

RF Port Input Power (Continuous Wave Signal)	Lifetime	
	ATTEN = 32 dB	ATTEN = 0 dB
7 dBm	>10 years	>10 years
10 dBm	>10 years	>10 years
20 dBm	>10 years	70 hours
21 dBm	>10 years	24 hours
24 dBm	>10 years	24 hours

Table 10. VDDA_1P0 Voltage vs. Duty Cycle to Maintain 10-Year Lifetime

VDDA_1P0 (V)	Required Duty Cycle to Maintain 10-Year Lifetime (%)
1	100.0
1.01	100.0
1.02	100.0
1.03	100.0
1.04	100.0
1.05	98.8
1.06	66.5
1.07	45.0
1.08	30.5
1.09	20.7
1.1	14.2
1.11	9.7
1.12	6.7
1.13	4.6
1.14	3.2
1.15	2.2
1.16	1.5

Table 10. VDDA_1P0 Voltage vs. Duty Cycle to Maintain 10-Year Lifetime (Continued)

VDDA_1P0 (V)	Required Duty Cycle to Maintain 10-Year Lifetime (%)
1.17	1.1
1.18	0.8
1.19	0.5
1.2	0.4

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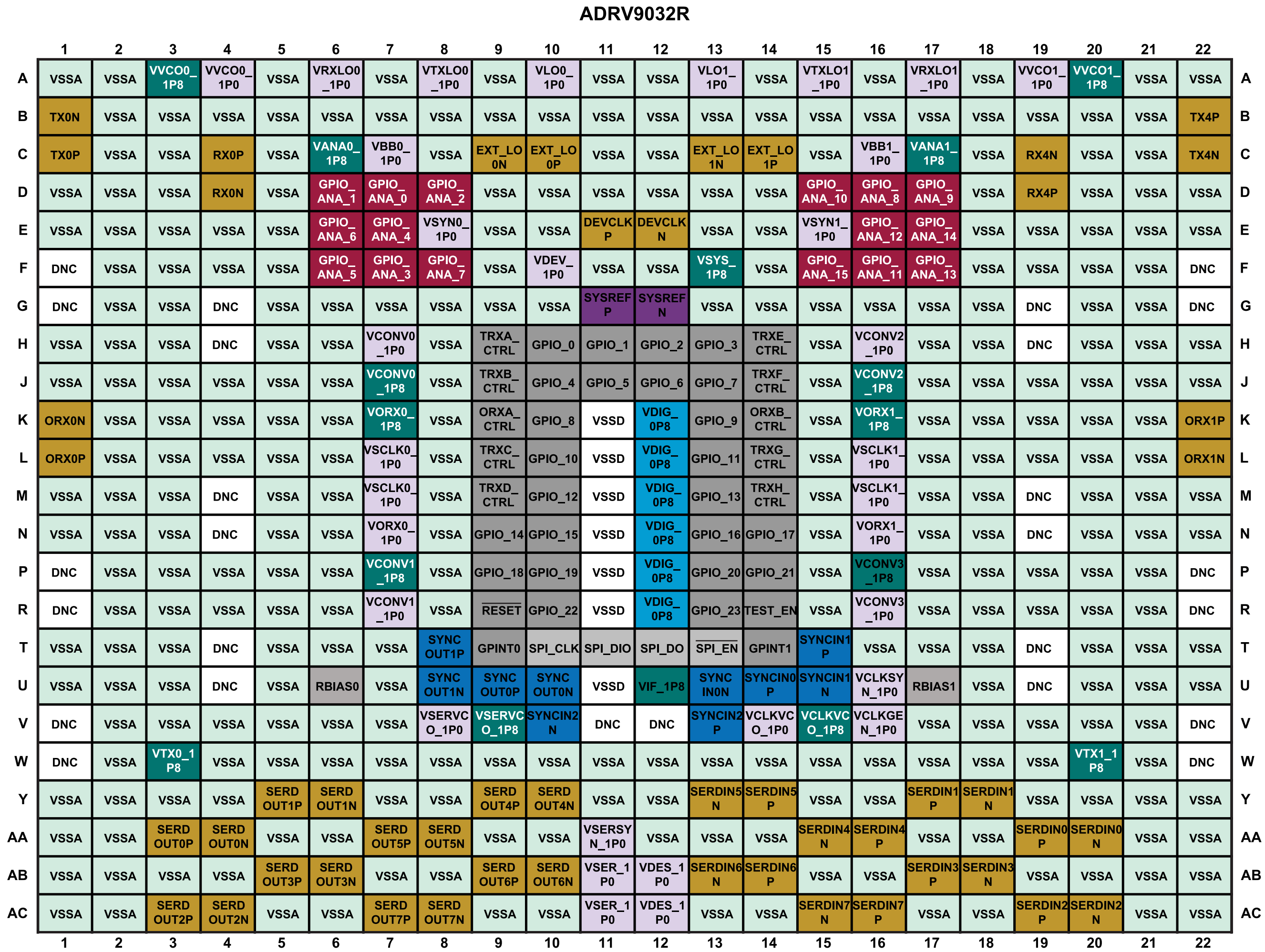
ESD CAUTION

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



NOTES
1. DNC = DO NOT CONNECT. DO NOT CONNECT TO THIS PIN.

Figure 3. Pin Configuration

Table 11. Pin Function Descriptions

Pin No.	Mnemonic	Type[1]	Description
A1, A2, A5, A7, A9, A11, A12, A14, A16, A18, A21, A22, B2 to B21, C2, C3, C5, C8, C11, C12, C15, C18, C20, C21, D1 to D3, D5, D9 to D14, D18, D20 to D22, E1 to E5, E9, E10, E13, E14, E18 to E22, F2 to F5, F9, F11, F12, F14, F18 to F21, G2, G3, G5 to G10, G13 to G18, G20, G21, H1 to H3, H5, H6, H8, H15, H17, H18, H20 to H22, J1 to J6, J8, J15, J17 to J22, K2 to K6, K8, K15, K17 to K21, L2 to L6, L17 to L21, M1 to M3, M5, M6, M17, M18, M20 to M22, N1 to N3, N5, N6, N8, N15, N17, N18, N20 to N22, P2 to P6, P8, P15, P17 to P21, R2 to R6, R8, R15, R17 to R21, T1 to T3, T5 to T7, T16 to T18, T20 to T22, U1 to U3, U5, U7, U18, U20 to U22, V2 to V7, V17 to V21, W2, W4 to W19, W21, Y1 to Y4, Y7, Y8, Y11, Y12, Y15, Y16, Y19	VSSA	I	Analog Grounds.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

Table 11. Pin Function Descriptions (Continued)

Pin No.	Mnemonic	Type[1]	Description
to Y22, AA1, AA2, AA5, AA6, AA9, AA10, AA12 to AA14, AA17, AA18, AA21, AA22, AB1 to AB4, AB7, AB8, AB15, AB16, AB19 to AB22, AC1, AC2, AC5, AC6, AC9, AC10, AC13, AC14, AC17, AC18, AC21, AC22			
L8, M8	VSSA	I	Analog Grounds, Return Pins for VSCLK0_1P0. Connect decoupling capacitor between L7 and L8 and M7 and M8.
L15, M15	VSSA	I	Analog Grounds, Return Pins for VSCLK1_1P0. Connect decoupling capacitor between L16 and L15 and M16 and M15.
A3	VVCO0_1P8	I	1.8 V Supply Voltage. Requires local bypass to ground.
A4	VVCO0_1P0	O	1.0 V Internal Low-Dropout (LDO) Output. Connect a 4.7 µF ceramic capacitor from the A4 pin to VSSA.
A6	VRXLO0_1P0	I	1.0 V Supply Voltage.
A8	VTXLO0_1P0	I	1.0 V Supply Voltage.
A10	VLO0_1P0	I	1.0 V Supply Voltage.
A13	VLO1_1P0	I	1.0 V Supply Voltage.
A15	VTXLO1_1P0	I	1.0 V Supply Voltage.
A17	VRXLO1_1P0	I	1.0 V Supply Voltage.
A19	VVCO1_1P0	O	1.0 V Internal LDO Output. Connect a 4.7 µF ceramic capacitor from the A19 pin to VSSA.
A20	VVCO1_1P8	I	1.8 V Supply Voltage. Requires local bypass to ground.
B1, C1	TX0N, TX0P	O	Differential Outputs for Transmitter Channel 0. Do not connect if unused.
B22, C22	TX4P, TX4N	O	Differential Outputs for Transmitter Channel 4. Do not connect if unused.
C4, D4	RX0P, RX0N	I	Differential Inputs for Receiver Channel 0. Do not connect if unused.
C6	VANA0_1P8	I	1.8 V Supply Voltage.
C7	VBB0_1P0	I	1.0 V Supply Voltage.
C9, C10	EXT_LO0N, EXT_LO0P	I	Differential External LO Input 0. Do not connect if unused.
C13, C14	EXT_LO1N, EXT_LO1P	I	Differential External LO Input 1. Do not connect if unused.
C16	VBB1_1P0	I	1.0 V Supply Voltage.
C17	VANA1_1P8	I	1.8 V Supply Voltage.
C19, D19	RX4N, RX4P	I	Differential Inputs for Receiver Channel 4. Do not connect if unused.
D6 to D8, D15 to D17, E6, E7, E16, E17, F6 to F8, F15 to F17	GPIO_ANA_1, GPIO_ANA_0, GPIO_ANA_2, GPIO_ANA_10, GPIO_ANA_8, GPIO_ANA_9, GPIO_ANA_6, GPIO_ANA_4, GPIO_ANA_12, GPIO_ANA_14, GPIO_ANA_5, GPIO_ANA_3, GPIO_ANA_7, GPIO_ANA_15, GPIO_ANA_11, GPIO_ANA_13	I/O	General-Purpose Inputs and Outputs Referenced to 1.8 V. If unused, these pins can be connected to VSSA with a 10 kΩ resistor or configured as outputs, driven low, and left disconnected.
E8	VSYN0_1P0	I	1.0 V Supply Voltage.
E11, E12	DEVCLKP, DEVCLKN	I	Device Clock Differential Inputs.
E15	VSYN1_1P0	I	1.0 V Supply Voltage.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

Table 11. Pin Function Descriptions (Continued)

Pin No.	Mnemonic	Type[1]	Description
F1, F22, G1, G4, G19, G22, H4, H19, M4, M19, N4, N19, P1, P22, R1, R22, T4, T19, U4, U19, V1, V11, V12, V22, W1, W22	DNC	N/A	Do Not Connect. Do not connect to the DNC pins.
F10	VDEV_1P0	I	1.0 V Supply Voltage.
F13	VSYS_1P8	I	1.8 V Supply Voltage.
G11, G12	SYSREFP, SYSREFN	I	LVDS System Reference Clock Inputs for the Serializer/Deserializer (SERDES) Interface.
H7	VCONV0_1P0	I	1.0 V Supply Voltage.
H9, H14, J9, J14, L9, L14, M9, M14	TRXA_CTRL, TRXE_CTRL, TRXB_CTRL, TRXF_CTRL, TRXC_CTRL, TRXG_CTRL, TRXD_CTRL, TRXH_CTRL	I	Radio Control Pins.
H10 to H13, J10 to J13, K10, K13, L10, L13, M10, M13, N9, N10, N13, N14, P9, P10, P13, P14, R10, R13	GPIO_0 to GPIO_23	I/O	General-Purpose Digital Inputs and Outputs. See Figure 3 to match the pin location to the GPIO_x signal name. If unused, these pins can be connected to VSSD with a 10 kΩ resistor or configured as outputs, driven low, and left disconnected.
H16	VCONV2_1P0	I	1.0 V Supply Voltage.
J7	VCONV0_1P8	I	1.8 V Supply Voltage.
J16	VCONV2_1P8	I	1.8 V Supply Voltage.
K1, L1	ORX0N, ORX0P	I	Differential Inputs for Observation Receiver Channel 0. Do not connect if unused.
K7	VORX0_1P8	I	1.8 V Supply Voltage.
K9, K14	ORXA_CTRL, ORXB_CTRL	I	ORx Control Pins.
K11, L11, M11, N11, P11, R11, U11	VSSD	I	Digital Grounds.
K12, L12, M12, N12, P12, R12	VDIG_0P8	I	0.8 V Supply Voltages.
K16	VORX1_1P8	I	1.8 V Supply Voltage.
K22, L22	ORX1P, ORX1N	I	Differential Inputs for Observation Receiver Channel 1. Do not connect if unused.
L7, M7	VSCLK0_1P0	I	1.0 V Supply Voltages.
L16, M16	VSCLK1_1P0	I	1.0 V Supply Voltages.
N7	VORX0_1P0	I	1.0 V Supply Voltage.
N16	VORX1_1P0	I	1.0 V Supply Voltage.
P7	VCONV1_1P8	I	1.8 V Supply Voltage.
P16	VCONV3_1P8	I	1.8 V Supply Voltage.
R7	VCONV1_1P0	I	1.0 V Supply Voltage.
R9	$\overline{\text{RESET}}$	I	Active-Low Chip Reset.
R14	TEST_EN	I	Test Input Used for Joint Test Action Group (JTAG) Boundary Scan. Pull high to enable boundary scan. Connect to VSSA if unused.
R16	VCONV3_1P0	I	1.0 V Supply Voltage.
T8, U8	SYNCOUT1P, SYNCOUT1N	O	LVDS Sync Signal Output 1. Do not connect if unused.
T9, T14	GPINT0, GPINT1	O	General-Purpose Interrupt Pins.
T10	SPI_CLK	I	SPI Clock.
T11	SPI_DIO	I/O	SPI Data In and Out.
T12	SPI_DO	O	SPI Data Out.
T13	$\overline{\text{SPI\_EN}}$	I	Active-Low SPI Enable.
T15, U15	SYNCIN1P, SYNCIN1N	I	LVDS Sync Signal Input 1. Connect to VSSA if unused.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

Table 11. Pin Function Descriptions (Continued)

Pin No.	Mnemonic	Type[1]	Description
U6, U17	RBIAS0, RBIAS1	I	Bias Resistor Connections. Pin U6 and Pin U17 generate an internal current based on an external 0.1% resistor. Connect a 4.99 kΩ resistor between each pin and analog ground (VSSA).
U9, U10	SYNCOUT0P, SYNCOUT0N	O	LVDS Sync Signal Output 0. Do not connect if unused.
U12	VIF_1P8	I	1.8 V Supply Voltage.
U13, U14	SYNCIN0N, SYNCIN0P	I	LVDS Sync Signal Input 0. Connect to VSSA if unused.
U16	VCLKSYN_1P0	I	1.0 V Supply Voltage.
V8	VSERVCO_1P0	O	1.0 V Internal LDO Output. Connect a 4.7 µF ceramic capacitor from V8 to VSSA.
V9	VSERVCO_1P8	I	1.8 V Supply Voltage.
V10, V13	SYNCIN2N, SYNCIN2P	I	LVDS Sync Signal Input 2. Connect to VSSA if unused.
V14	VCLKVCO_1P0	O	1.0 V Internal LDO Output. Connect a 4.7 µF ceramic capacitor from V14 to VSSA.
V15	VCLKVCO_1P8	I	1.8 V Supply Voltage.
V16	VCLKGEN_1P0	I	1.0 V Supply Voltage.
W3	VTX0_1P8	I	1.8 V Supply Voltage.
W20	VTX1_1P8	I	1.8 V Supply Voltage.
Y5, Y6	SERDOUT1P, SERDOUT1N	O	SERDES Differential Output 1. Do not connect if unused.
Y9, Y10	SERDOUT4P, SERDOUT4N	O	SERDES Differential Output 4. Do not connect if unused.
Y13, Y14	SERDIN5N, SERDIN5P	I	SERDES Differential Input 5. Do not connect if unused.
Y17, Y18	SERDIN1P, SERDIN1N	I	SERDES Differential Input 1. Do not connect if unused.
AA3, AA4	SERDOUT0P, SERDOUT0N	O	SERDES Differential Output 0. Do not connect if unused.
AA7, AA8	SERDOUT5P, SERDOUT5N	O	SERDES Differential Output 5. Do not connect if unused.
AA11	VSERSYN_1P0	I	1.0 V Supply Voltage.
AA15, AA16	SERDIN4N, SERDIN4P	I	SERDES Differential Input 4. Do not connect if unused.
AA19, AA20	SERDIN0P, SERDIN0N	I	SERDES Differential Input 0. Do not connect if unused.
AB5, AB6	SERDOUT3P, SERDOUT3N	O	SERDES Differential Output 3. Do not connect if unused.
AB9, AB10	SERDOUT6P, SERDOUT6N	O	SERDES Differential Output 6. Do not connect if unused.
AB11, AC11	VSER_1P0	I	1.0 V Supply Voltages.
AB12, AC12	VDES_1P0	I	1.0 V Supply Voltages.
AB13, AB14	SERDIN6N, SERDIN6P	I	SERDES Differential Input 6. Do not connect if unused.
AB17, AB18	SERDIN3P, SERDIN3N	I	SERDES Differential Input 3. Do not connect if unused.
AC3, AC4	SERDOUT2P, SERDOUT2N	O	SERDES Differential Output 2. Do not connect if unused.
AC7, AC8	SERDOUT7P, SERDOUT7N	O	SERDES Differential Output 7. Do not connect if unused.
AC15, AC16	SERDIN7N, SERDIN7P	I	SERDES Differential Input 7. Do not connect if unused.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

Table 11. Pin Function Descriptions (Continued)

Pin No.	Mnemonic	Type[1]	Description
AC19, AC20	SERDIN2P, SERDIN2N	I	SERDES Differential Input 2. Do not connect if unused.

[1] I is input, O is output, I/O is input and output, and N/A means not applicable.

TYPICAL PERFORMANCE CHARACTERISTICS

450 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 450 MHz, unless otherwise noted.

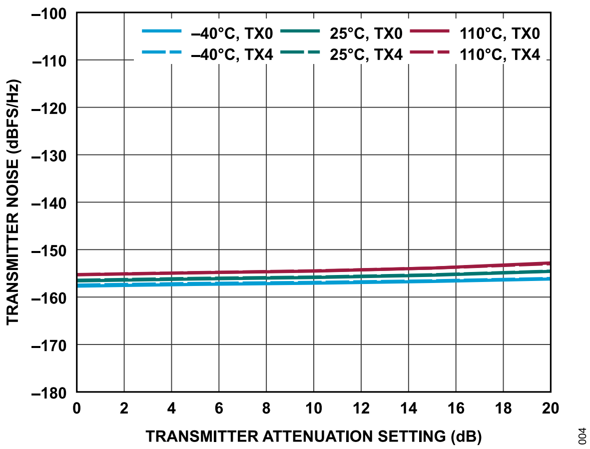


Figure 4. Transmitter Noise vs. Transmitter Attenuation Setting, 50 MHz Offset

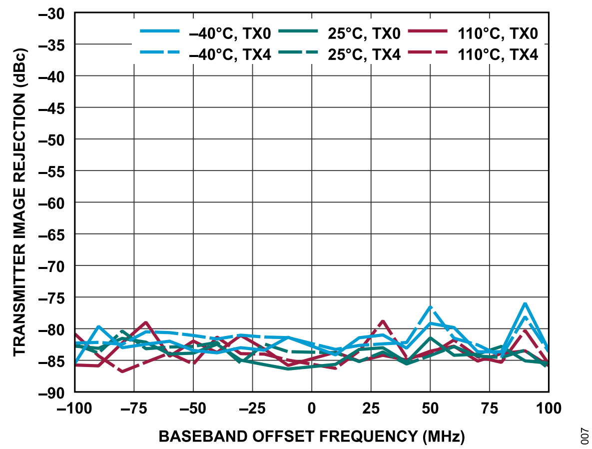


Figure 7. Transmitter Image Rejection vs. Baseband Offset Frequency, −12 dBFS CW Signal

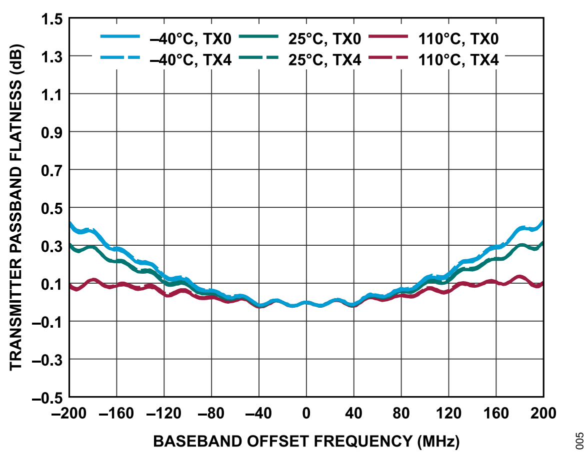


Figure 5. Transmitter Passband Flatness vs. Baseband Offset Frequency

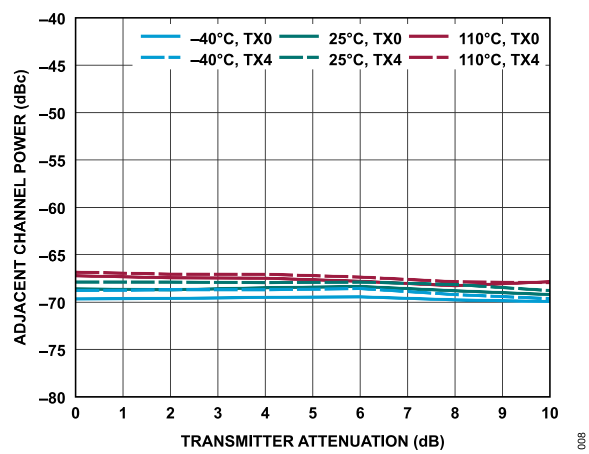


Figure 8. Adjacent Channel Power vs. Transmitter Attenuation, 190 MHz Offset, 20 MHz LTE, PAR = 12 dB

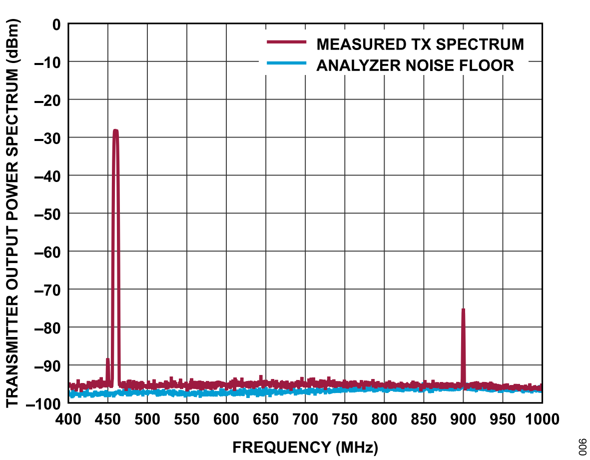


Figure 6. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

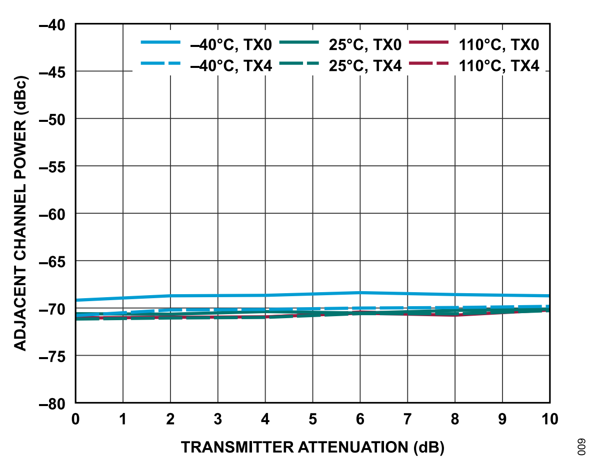


Figure 9. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

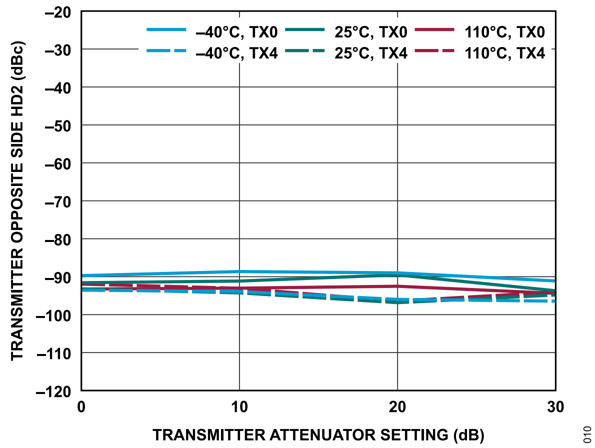


Figure 10. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 10 MHz Offset, −12 dBFS CW Signal

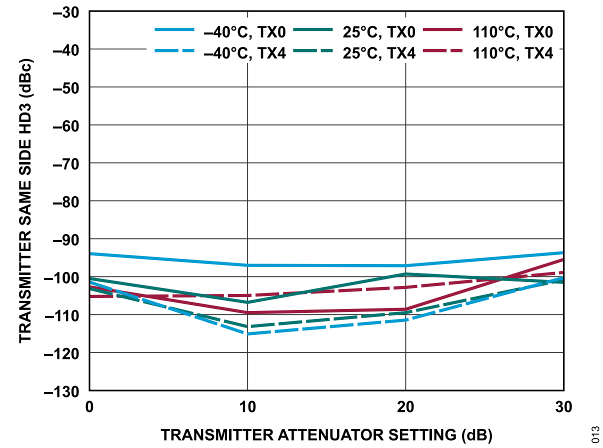


Figure 13. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 10 MHz Offset, −12 dBFS CW Signal

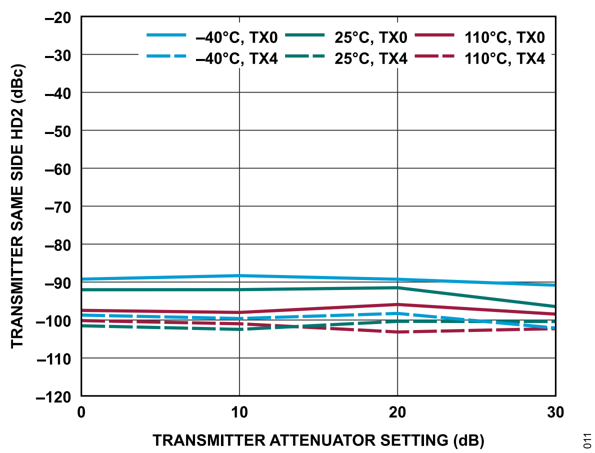


Figure 11. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 10 MHz Offset, −12 dBFS CW Signal

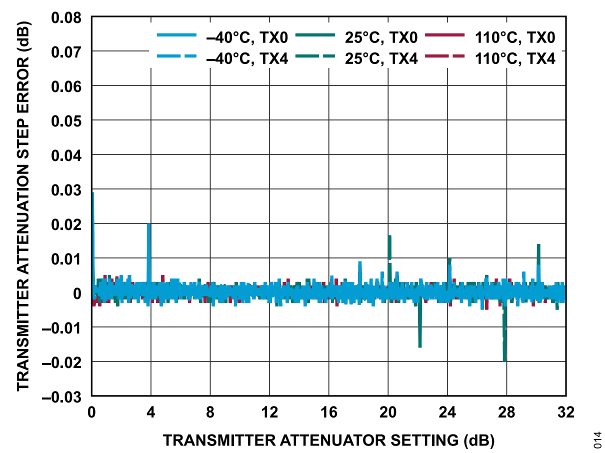


Figure 14. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 10 MHz Offset, −12 dBFS CW Signal

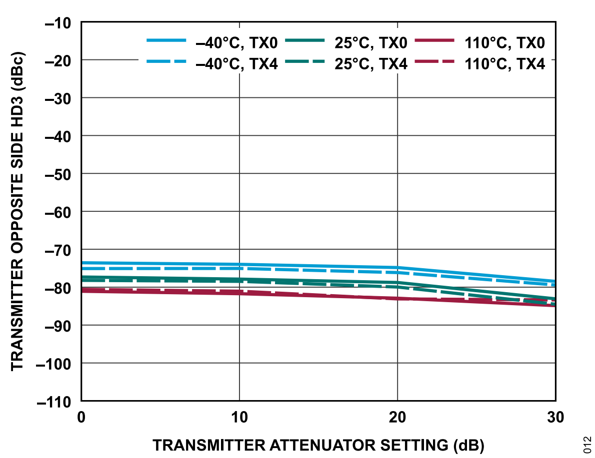


Figure 12. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 10 MHz Offset, −12 dBFS CW Signal

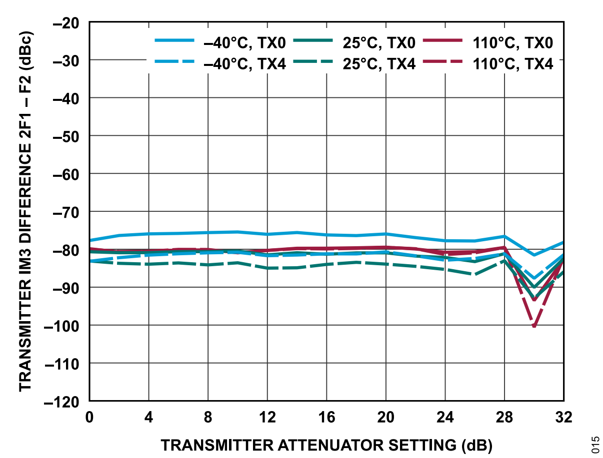


Figure 15. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 80 MHz Offset, F2 = 85 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

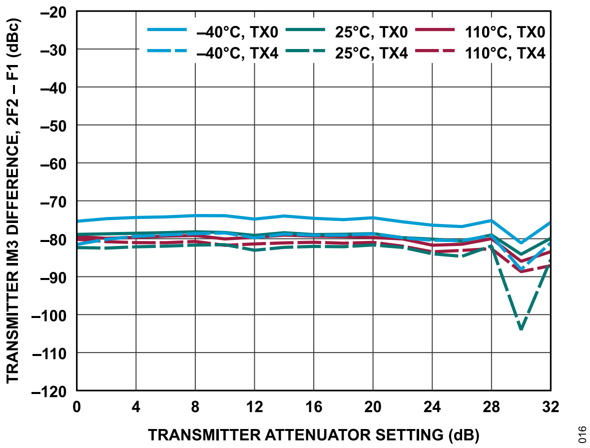


Figure 16. Transmitter IM3, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 80 MHz Offset, F2 = 85 MHz Offset

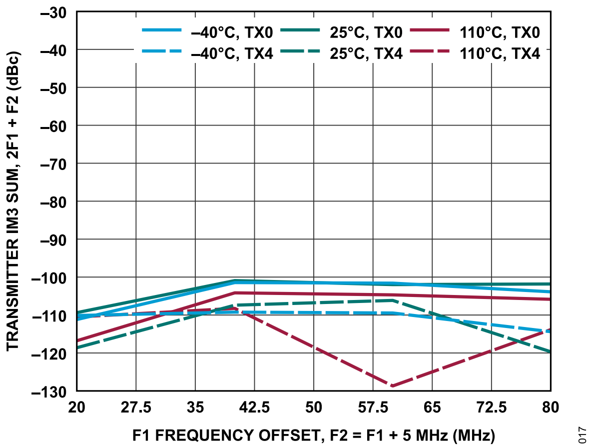


Figure 17. Transmitter IM3 Sum, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 + 5 MHz, Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone

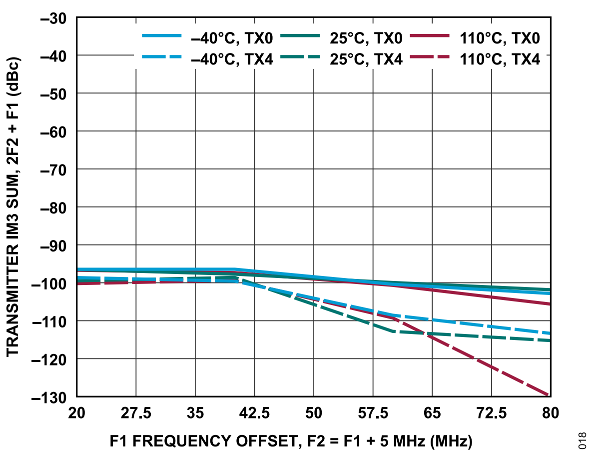


Figure 18. Transmitter IM3 Sum, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 + 5 MHz, Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone

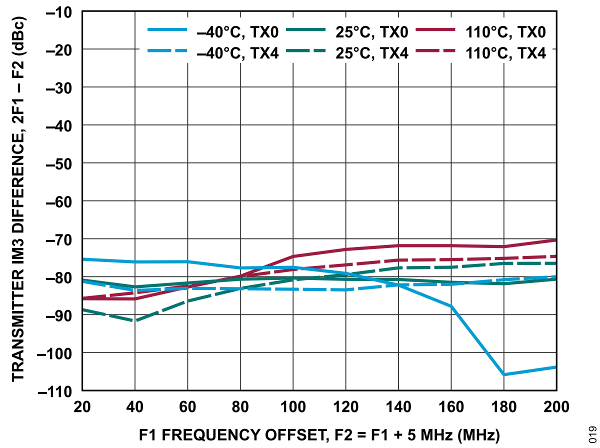


Figure 19. Transmitter IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 + 5 MHz, Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone

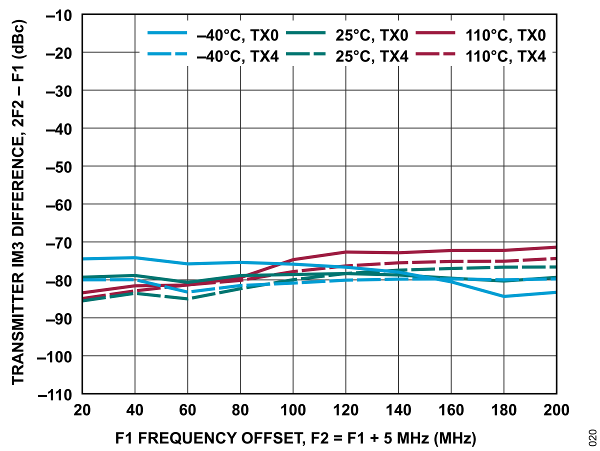


Figure 20. Transmitter IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 + 5 MHz, Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone

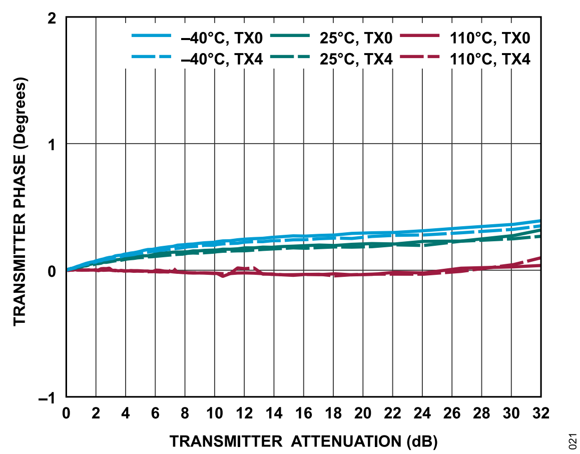


Figure 21. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

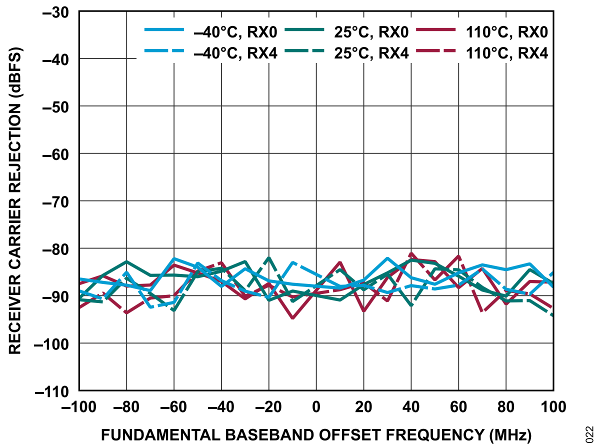


Figure 22. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

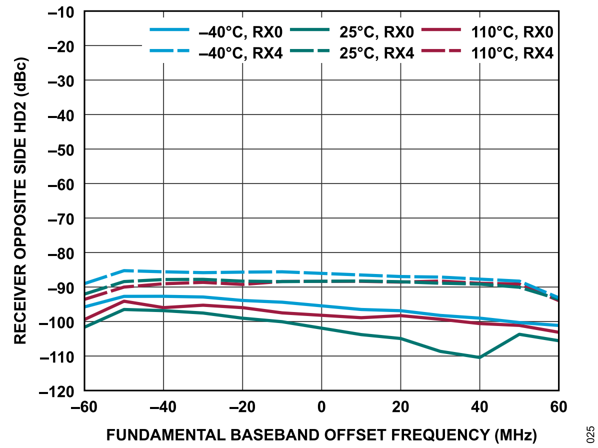


Figure 25. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

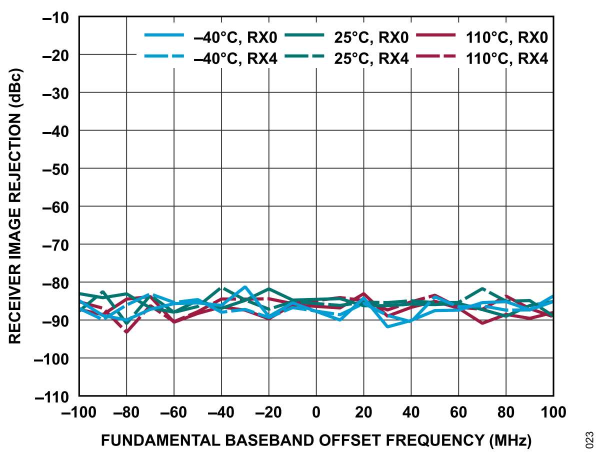


Figure 23. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

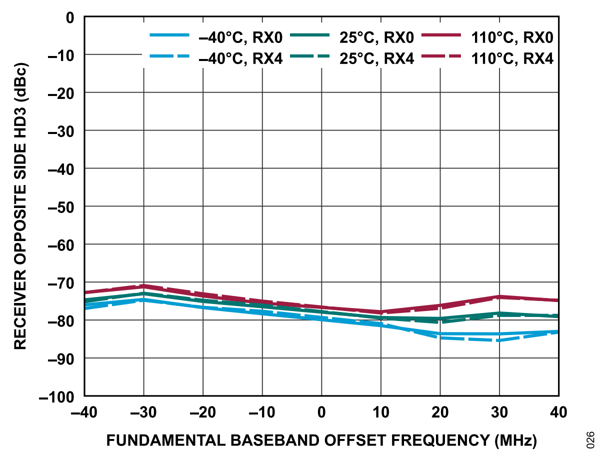


Figure 26. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

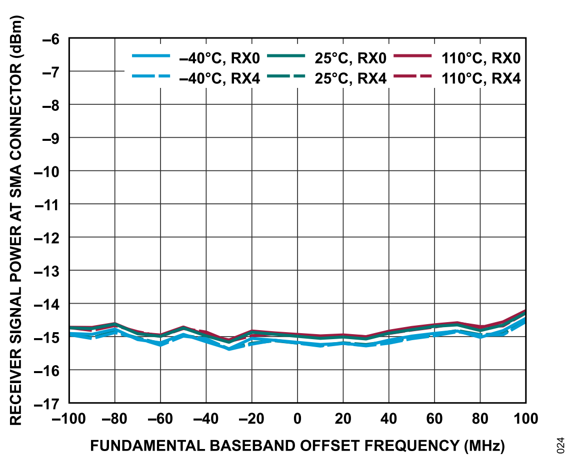


Figure 24. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −3.5 dBFs input Signal (Match Not De−Embedded)

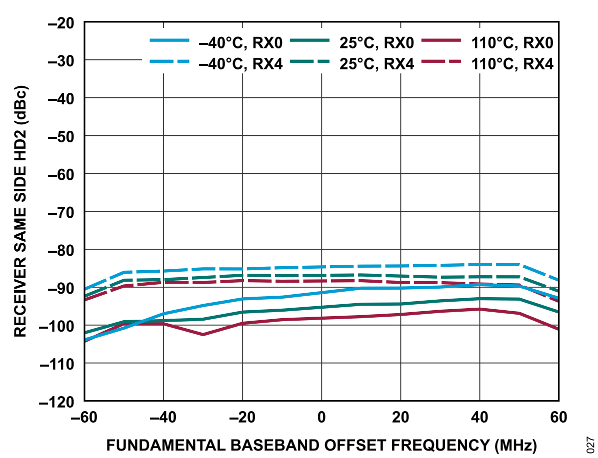


Figure 27. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

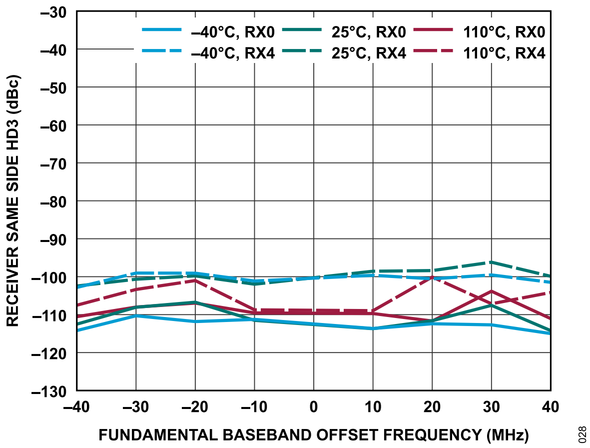


Figure 28. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −3.5 dBFS Input Signal

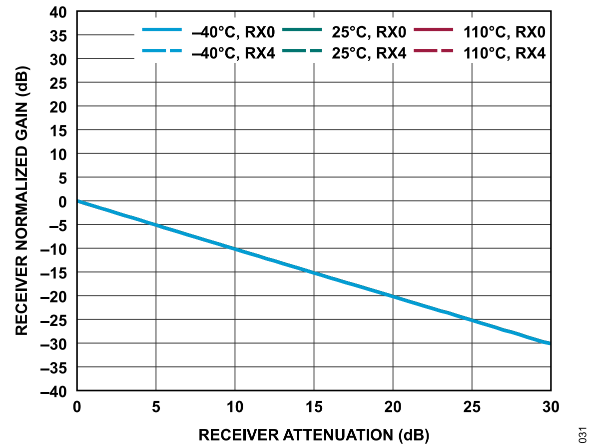


Figure 31. Receiver Normalized Gain vs. Receiver Attenuation, 20 MHz Offset, −3.5 dBFS Input Signal

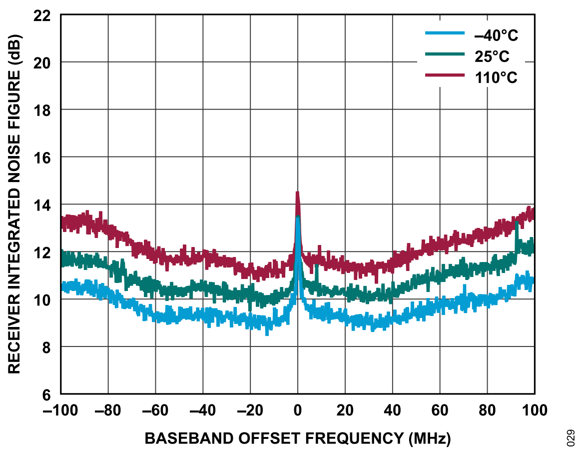


Figure 29. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 245.76 MSPS Sample Rate

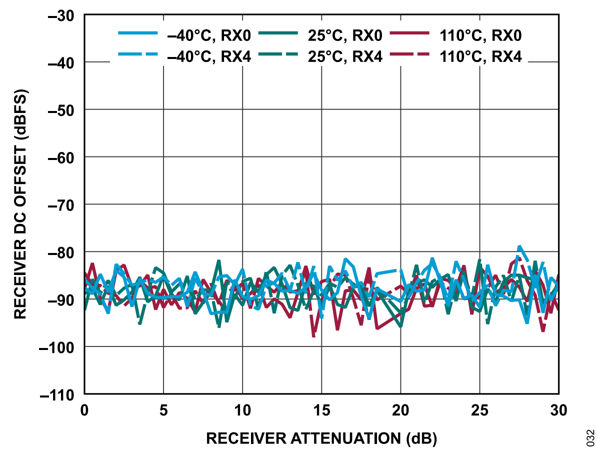


Figure 32. Receiver DC Offset vs. Receiver Attenuation, 20 MHz Offset, −3.5 dBFS Input Signal

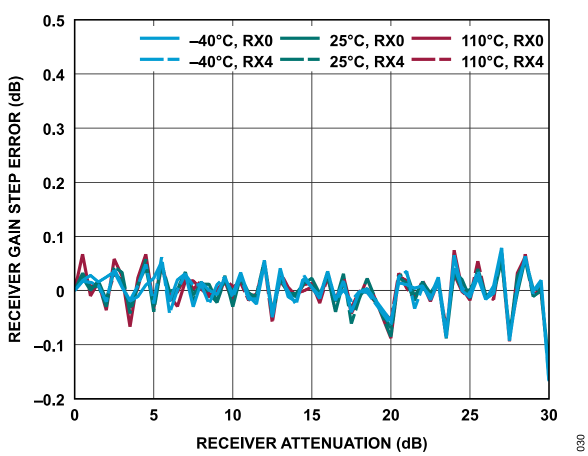


Figure 30. Receiver Gain Step Error vs. Reciever Attenuation, 20 MHz Offset, −3.5 dBFS Input Signal

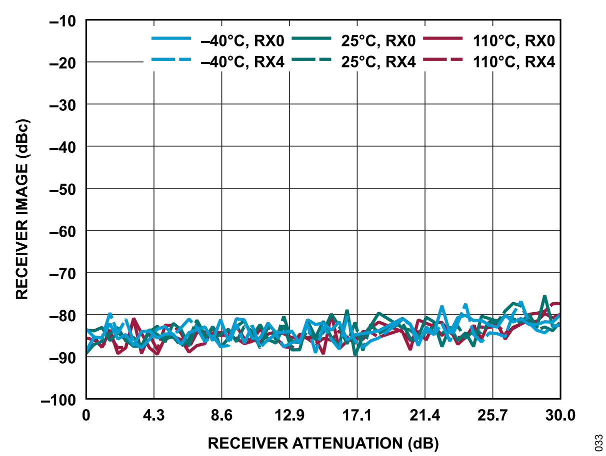


Figure 33. Receiver Image vs. Receiver Attenuation, 20 MHz Offset, −3.5 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

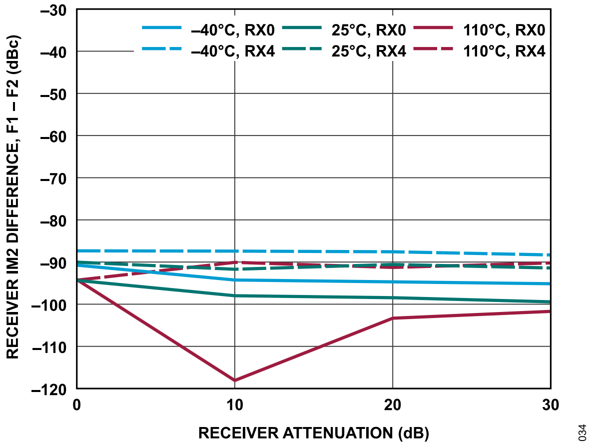


Figure 34. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 51 MHz Offset, F2 = F1 − 2 MHz Offset

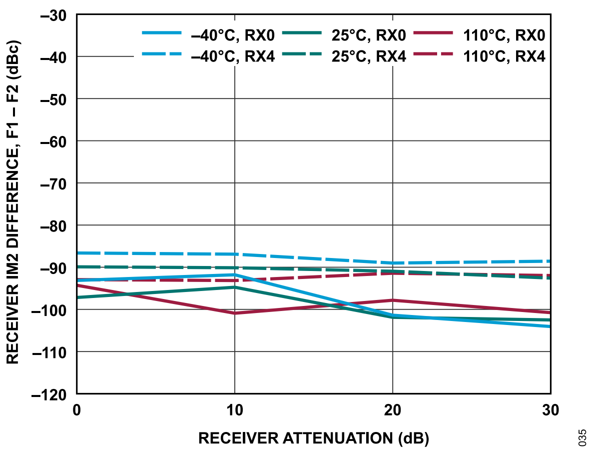


Figure 35. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 92 MHz Offset, F2 = 2 MHz Offset

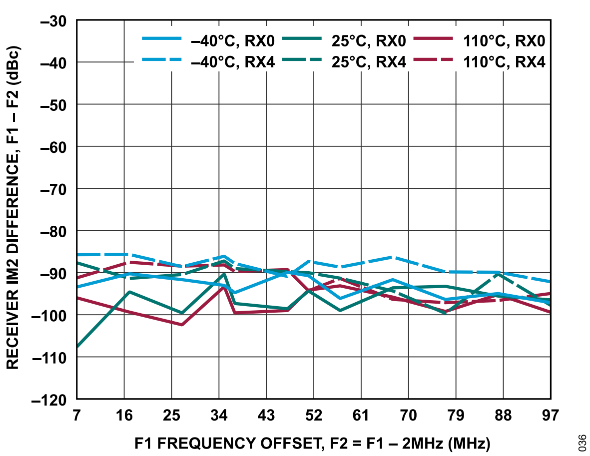


Figure 36. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

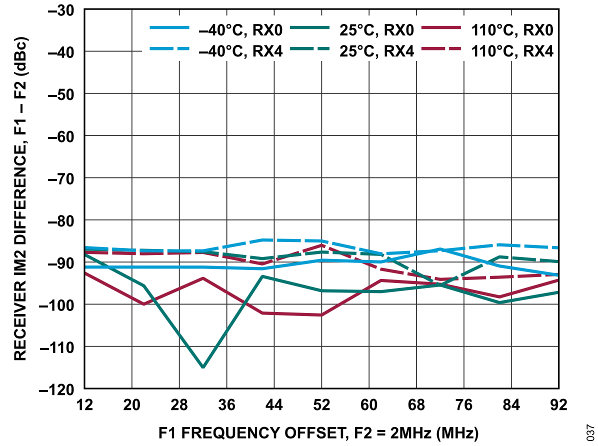


Figure 37. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

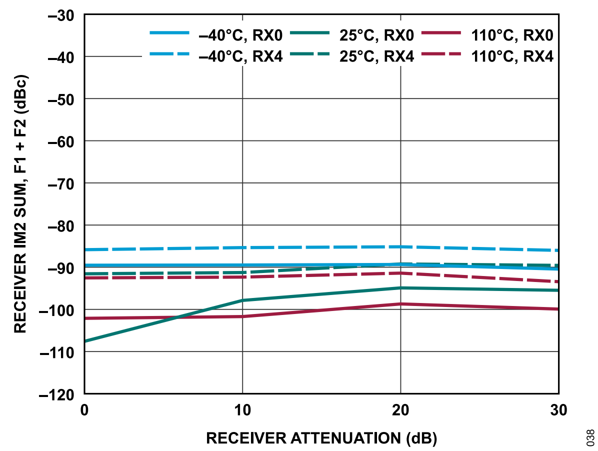


Figure 38. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 51 MHz Offset, F2 = F1 − 2 MHz Offset

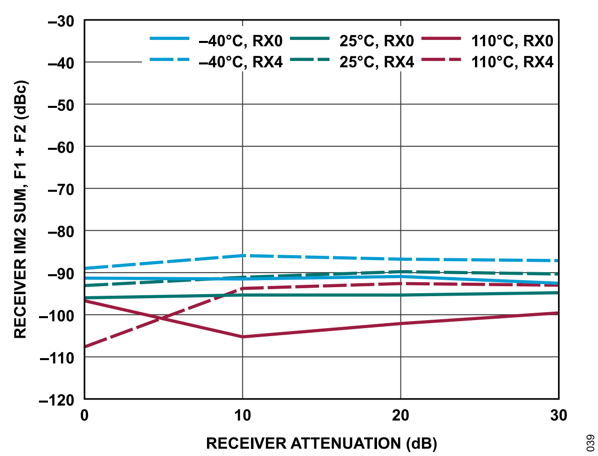


Figure 39. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 92 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

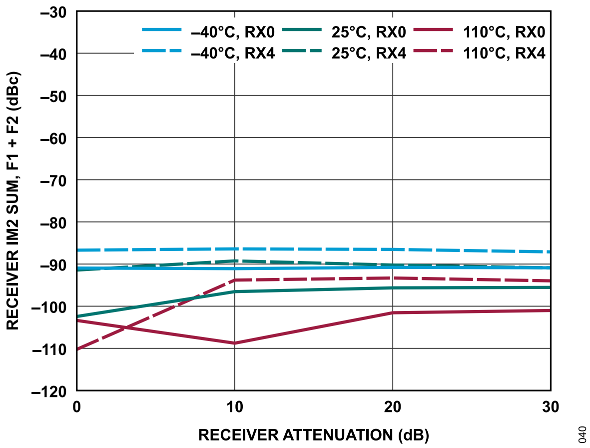


Figure 40. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 102 MHz Offset, F2 = 2 MHz Offset

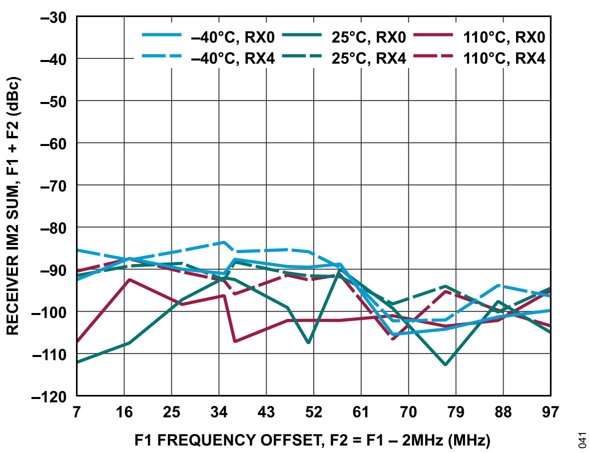


Figure 41. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

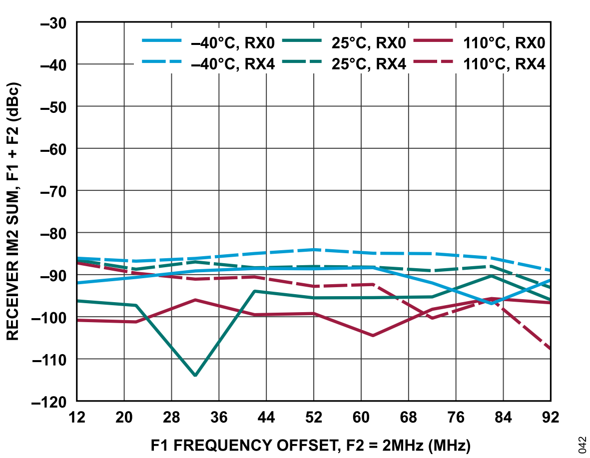


Figure 42. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

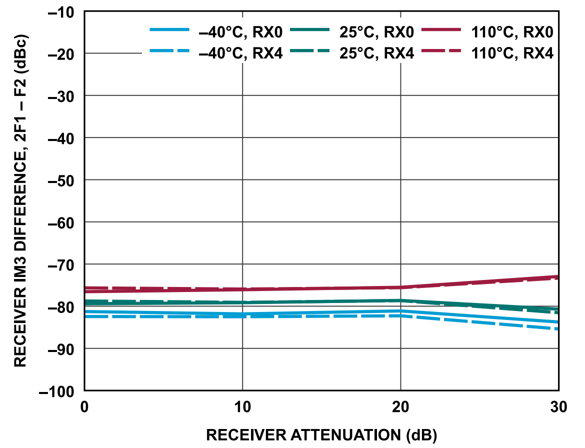


Figure 43. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 97 MHz Offset, F2 = F1 − 2 MHz Offset

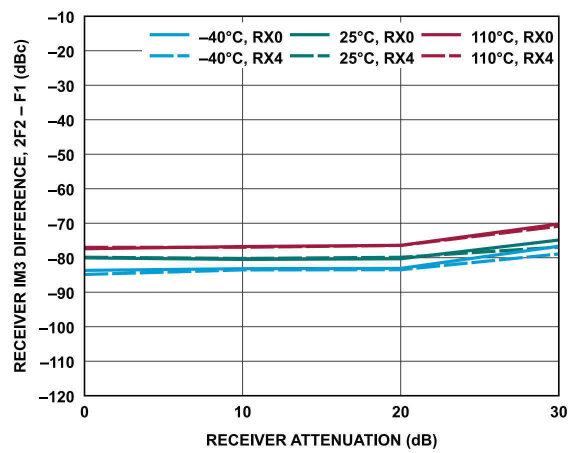


Figure 44. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 97 MHz Offset, F2 = F1 − 2 MHz Offset

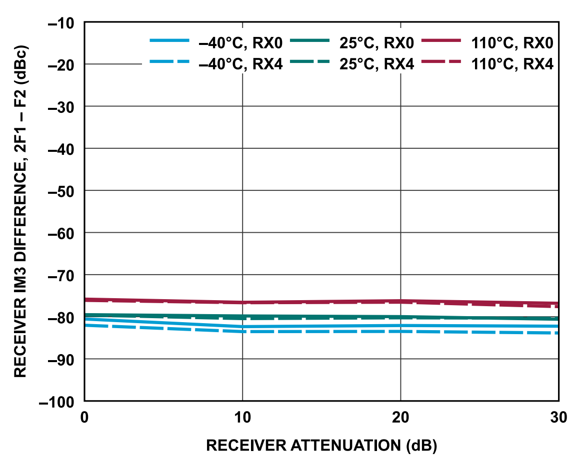


Figure 45. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

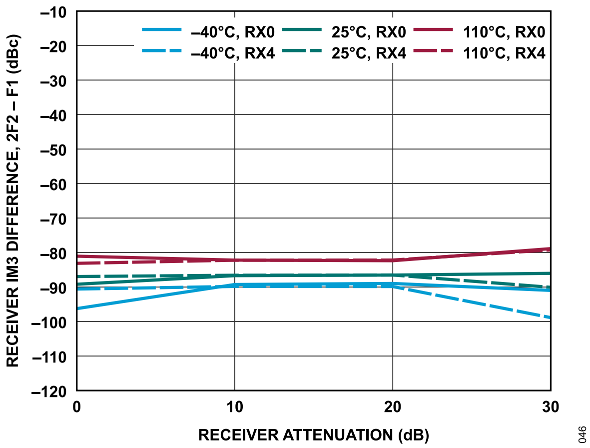


Figure 46. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

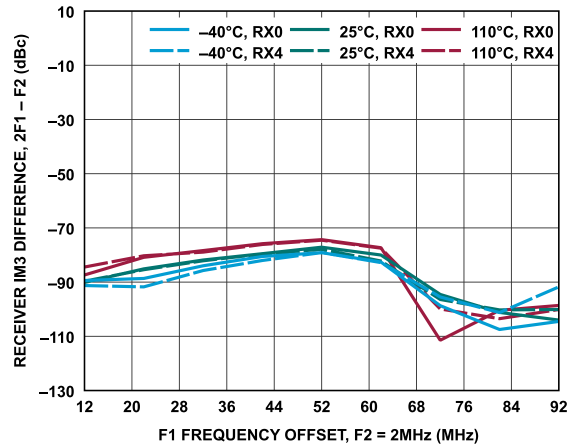


Figure 49. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

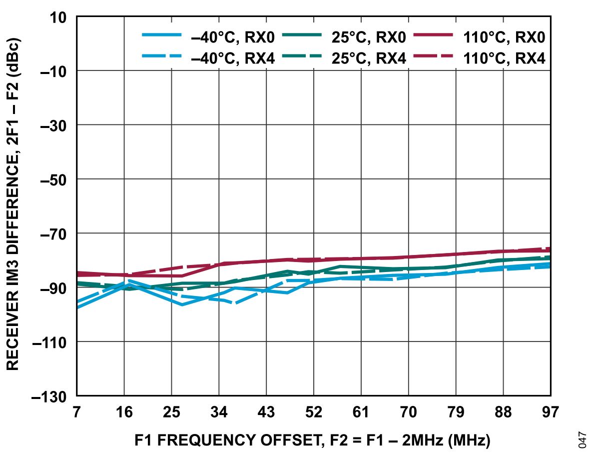


Figure 47. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

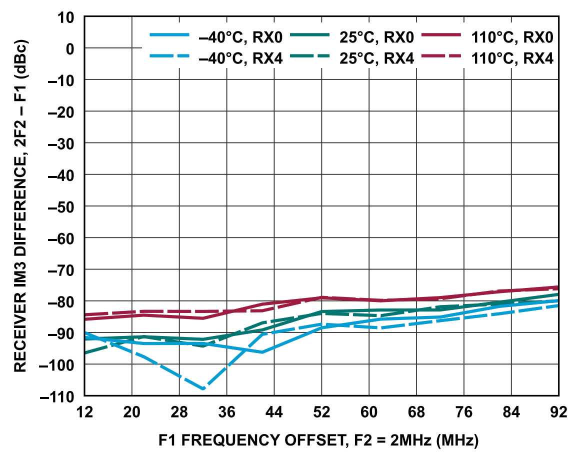


Figure 50. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

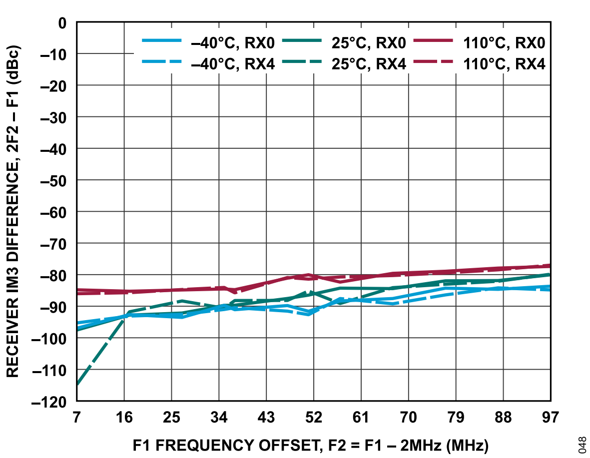


Figure 48. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

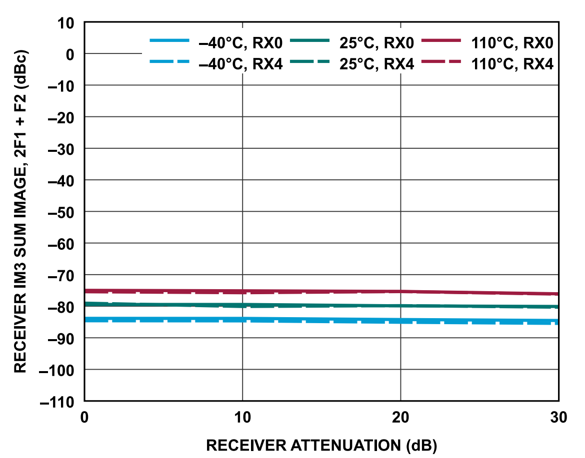


Figure 51. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 35 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

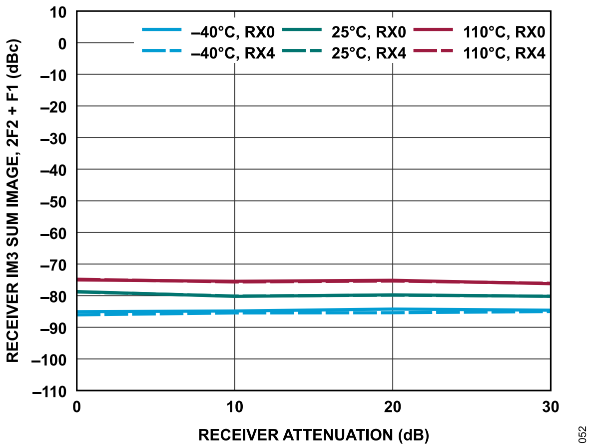


Figure 52. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 35 MHz Offset, F2 = F1 − 2 MHz Offset

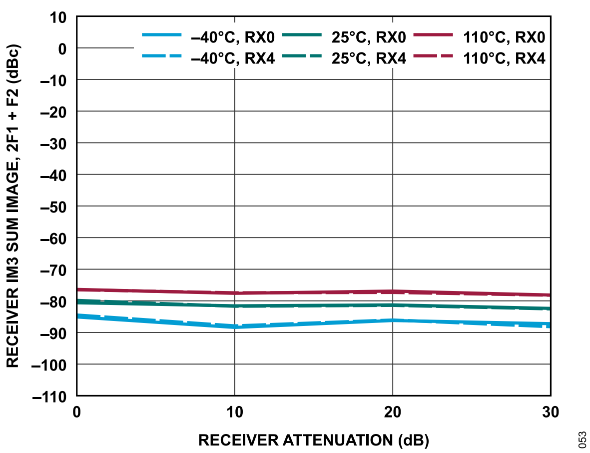


Figure 53. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

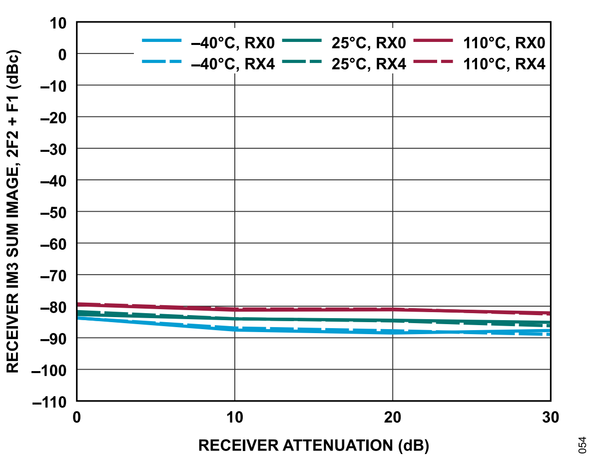


Figure 54. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −9.5 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

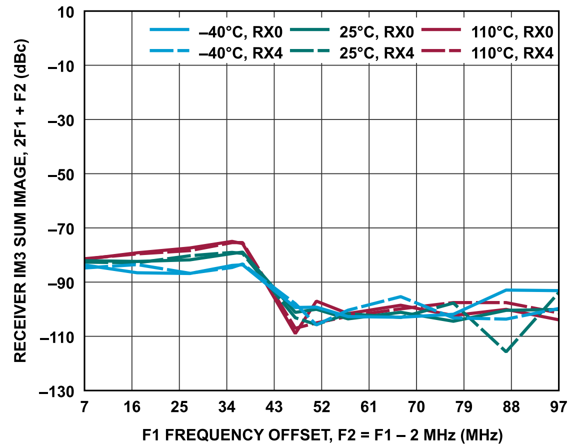


Figure 55. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

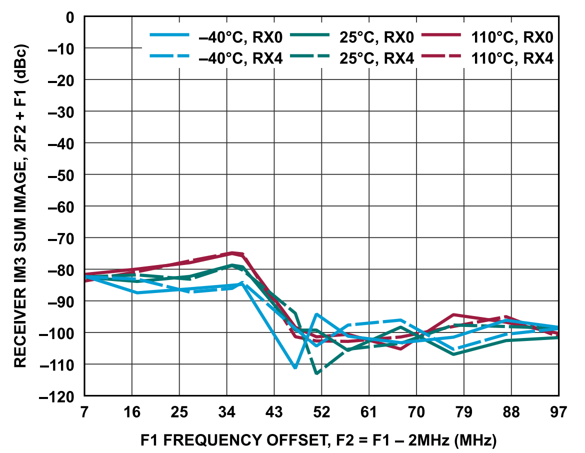


Figure 56. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

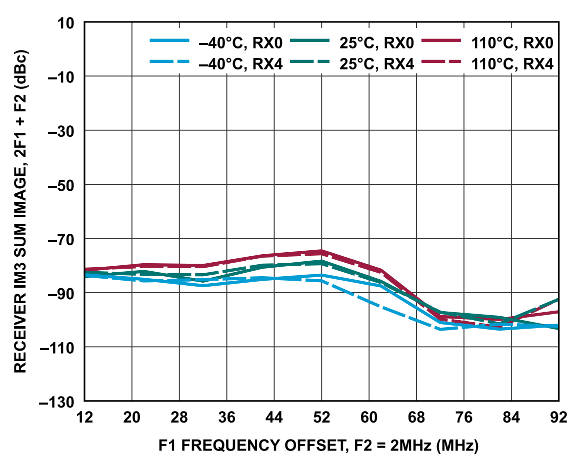


Figure 57. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

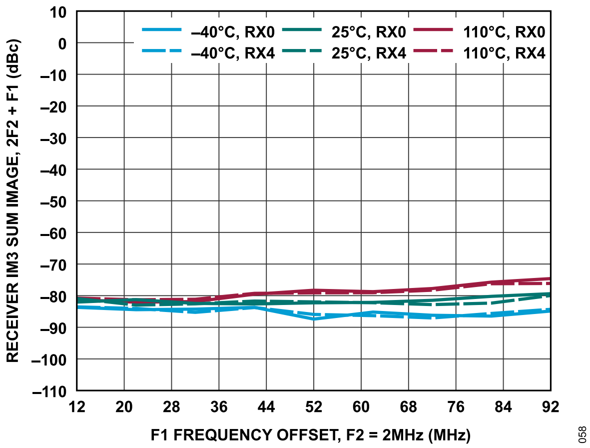


Figure 58. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −9.5 dBFS Signal Level per Tone

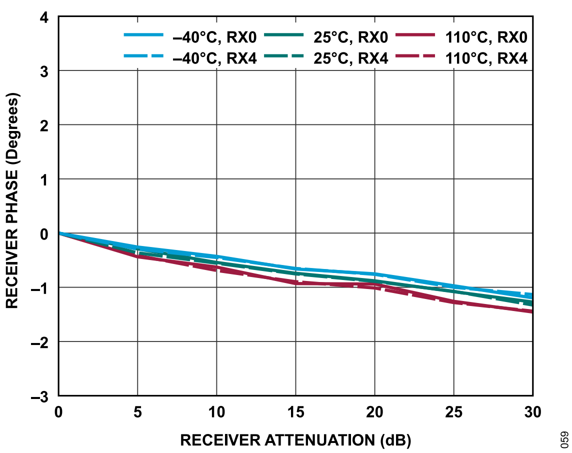


Figure 59. Receiver Phase vs. Receiver Attenuation

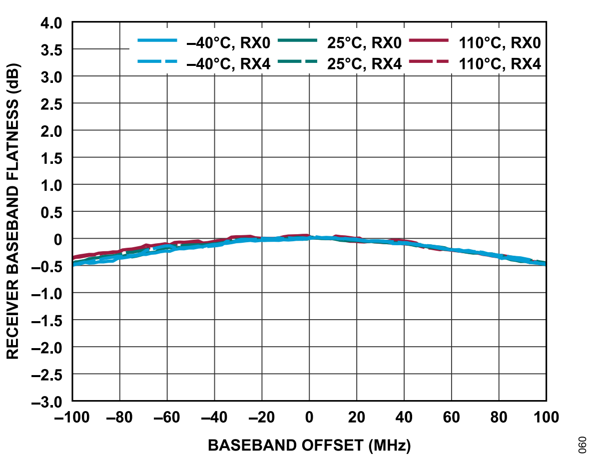


Figure 60. Receiver Baseband Flatness vs. Baseband Offset

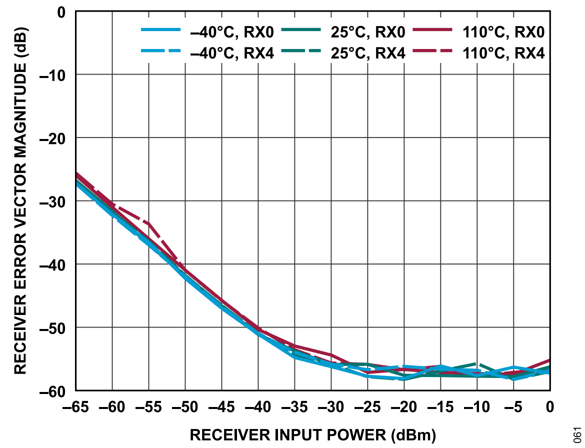


Figure 61. Receiver Error Vector Magnitude vs. Receiver Input Power, 20 MHz LTE, TDD Mode, AGC Enabled

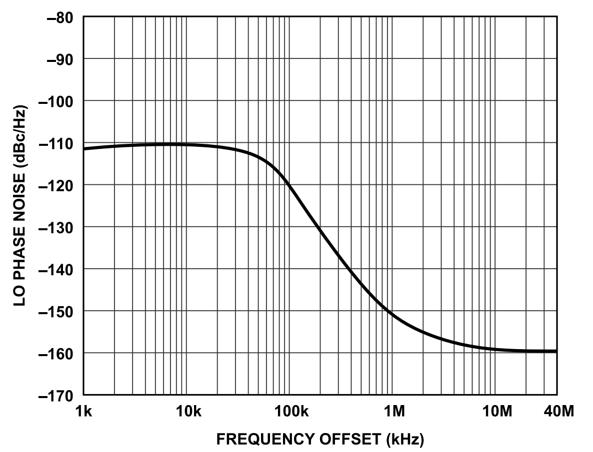


Figure 62. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

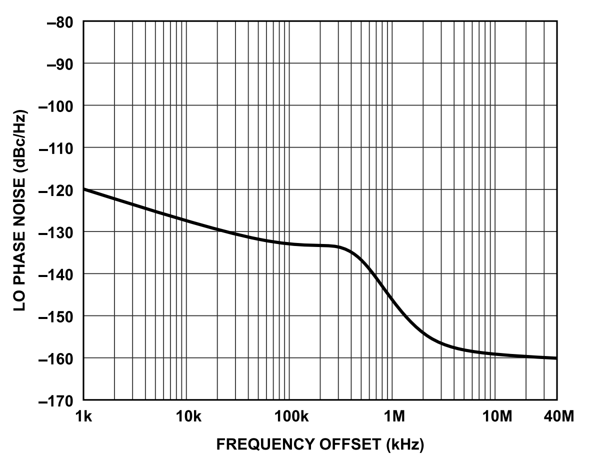


Figure 63. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

TYPICAL PERFORMANCE CHARACTERISTICS

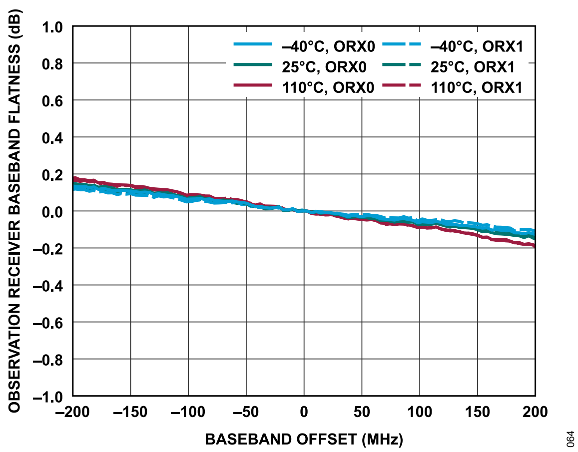


Figure 64. Observation Receiver Baseband Flatness vs. Baseband Offset

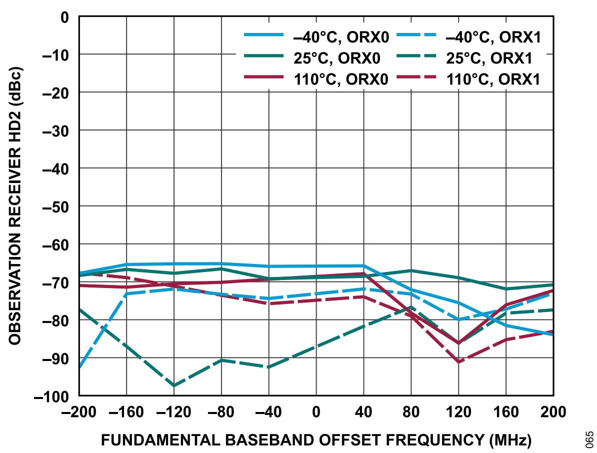


Figure 65. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

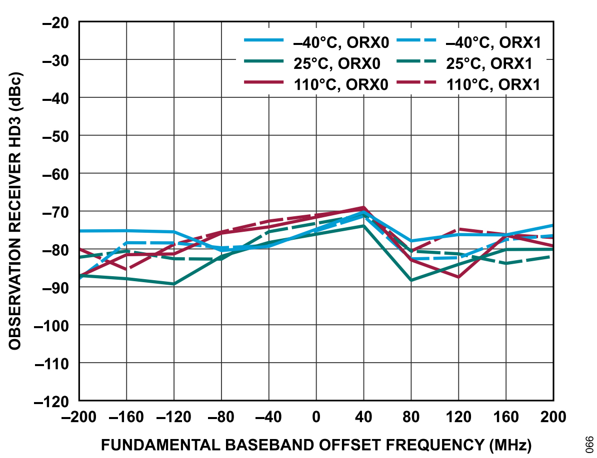


Figure 66. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

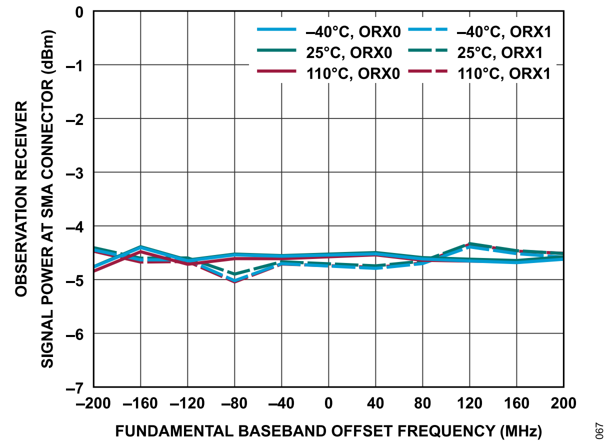


Figure 67. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De−Embedded)

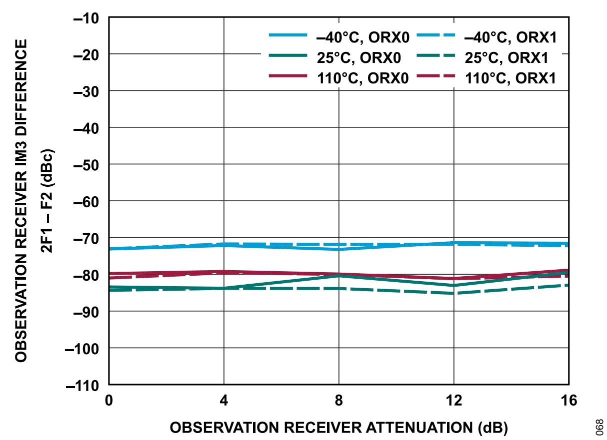


Figure 68. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 482 MHz, F2 = 452 MHz

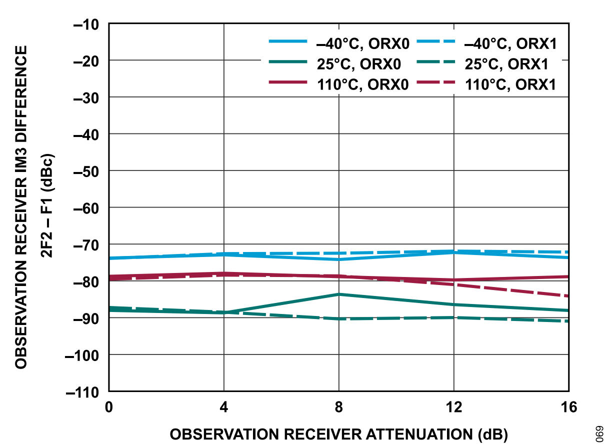


Figure 69. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 482 MHz, F2 = 452 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

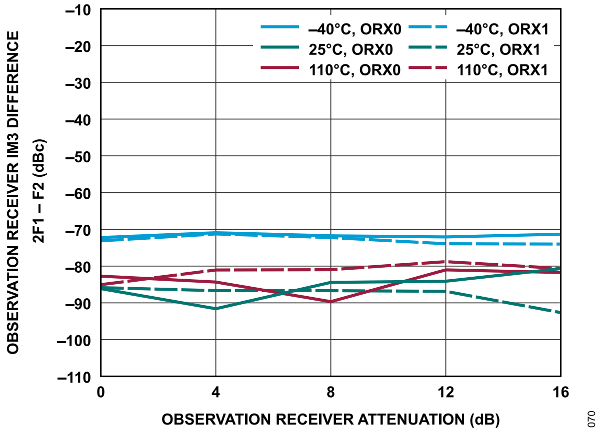


Figure 70. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 542 MHz, F2 = 452 MHz

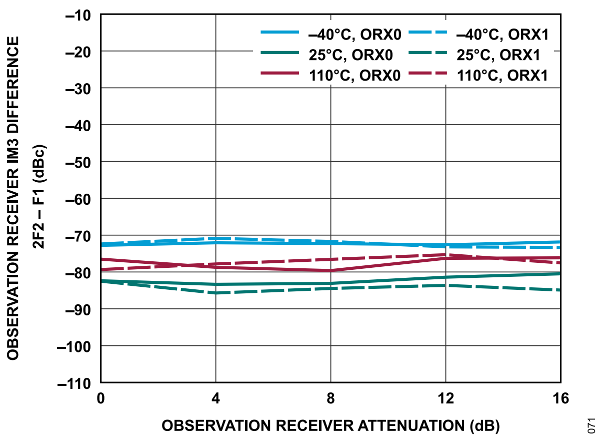


Figure 71. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 542 MHz, F2 = 452 MHz

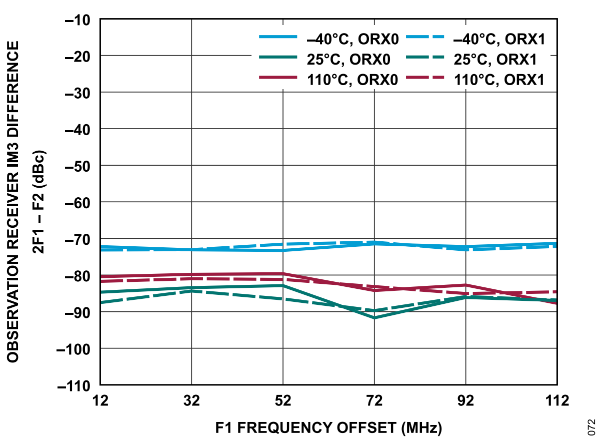


Figure 72. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 452 MHz

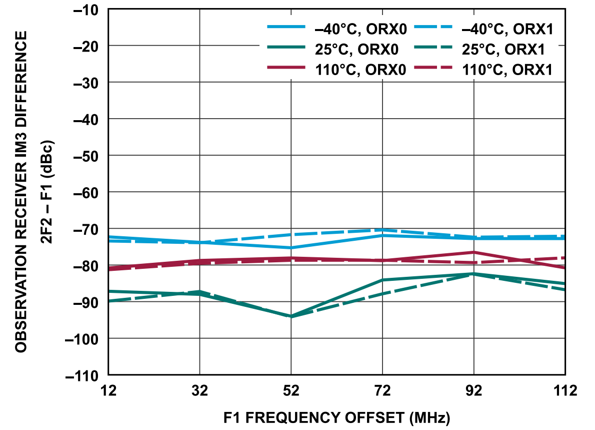


Figure 73. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 452 MHz

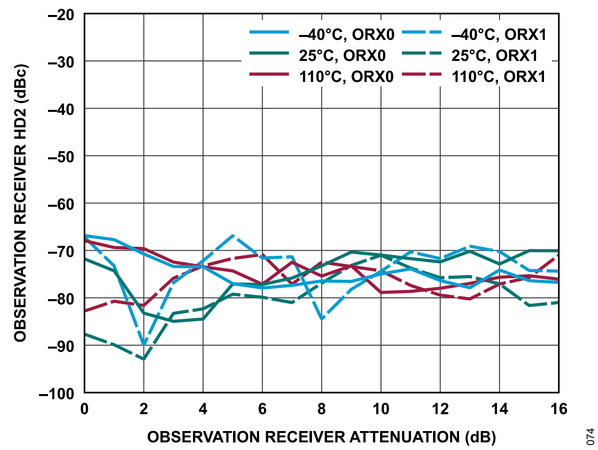


Figure 74. Observation Receiver HD2 vs. Observation Receiver Attenuation, −40 MHz Offset, −10 dBFS Input Signal

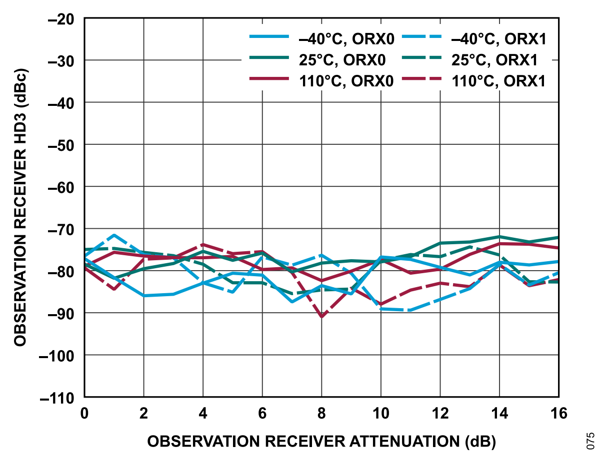


Figure 75. Observation Receiver HD3 vs. Observation Receiver Attenuation, −40 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

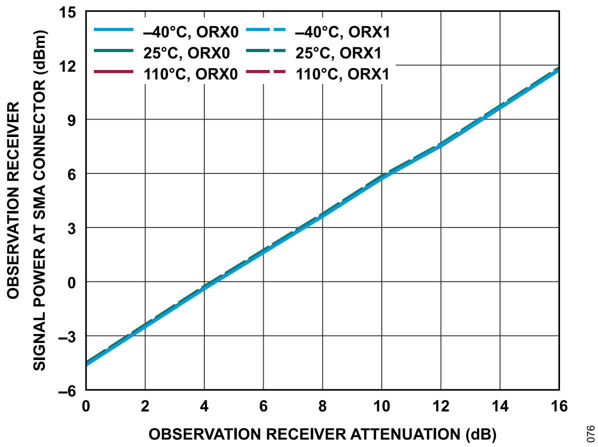


Figure 76. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, −40 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

900 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 900 MHz, unless otherwise noted.

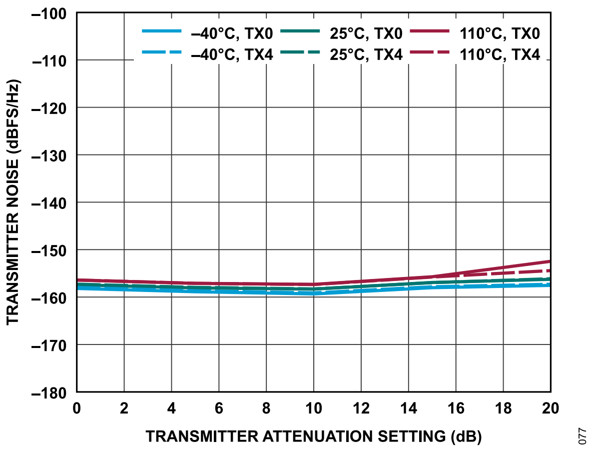


Figure 77. Transmitter Noise vs. Transmitter Attenuation Setting, 100 MHz Offset

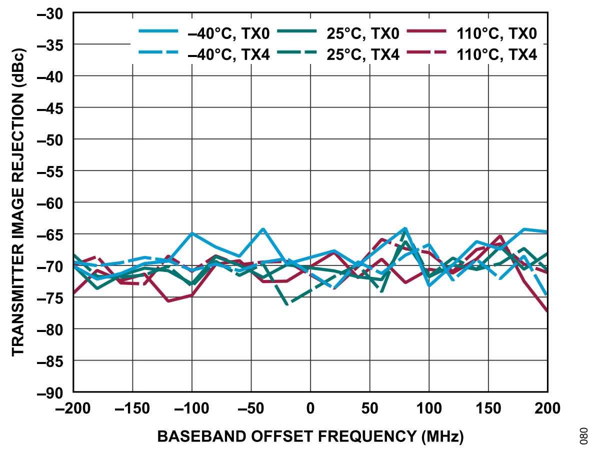


Figure 80. Transmitter Image Rejection vs. Baseband Offset Frequency, −12 dBFS CW Signal

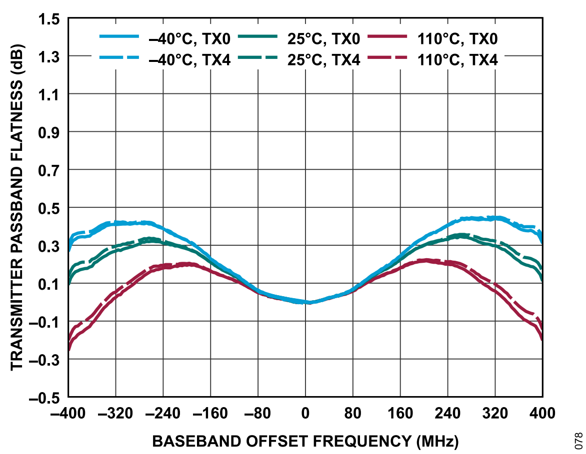


Figure 78. Transmitter Passband Flatness vs. Baseband Offset Frequency

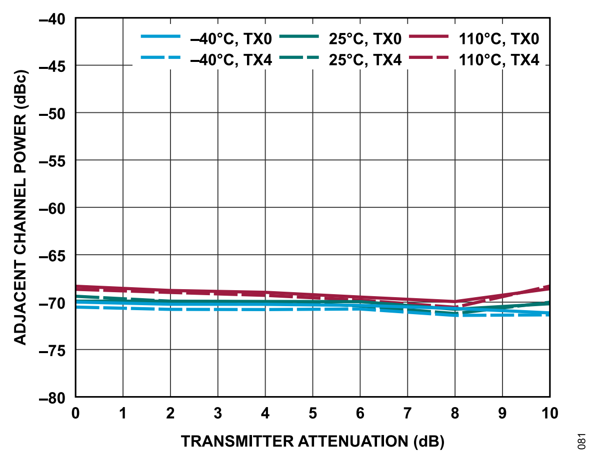


Figure 81. Adjacent Channel Power vs. Transmitter Attenuation, 190 MHz Offset, 20 MHz LTE, PAR = 12 dB

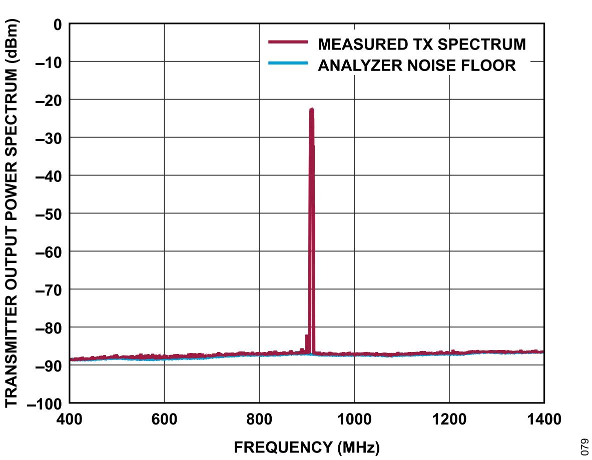


Figure 79. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

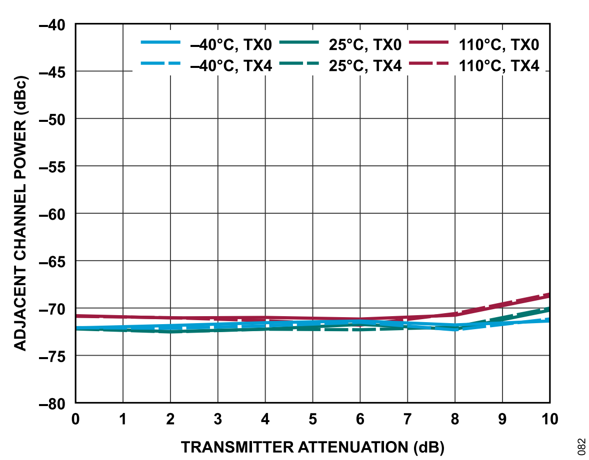


Figure 82. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

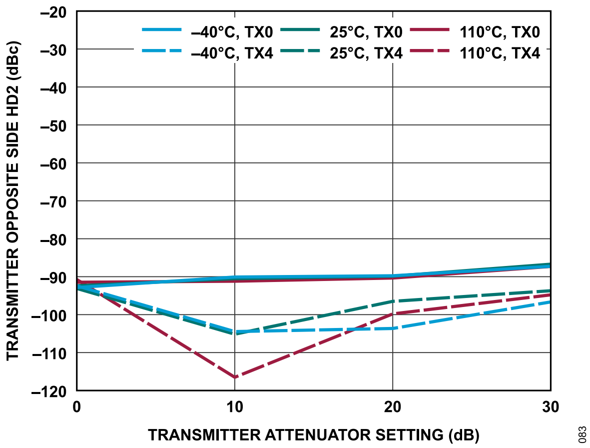


Figure 83. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

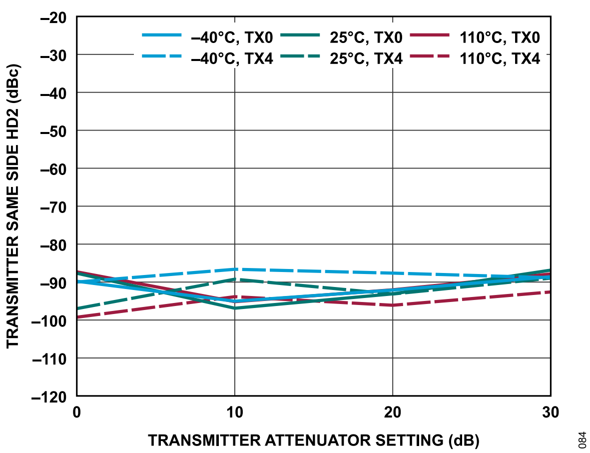


Figure 84. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

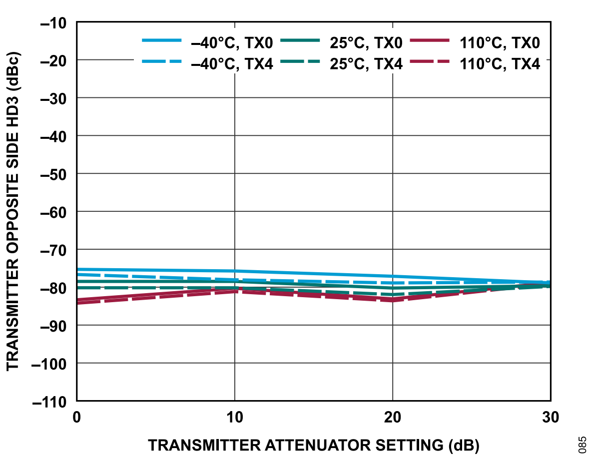


Figure 85. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

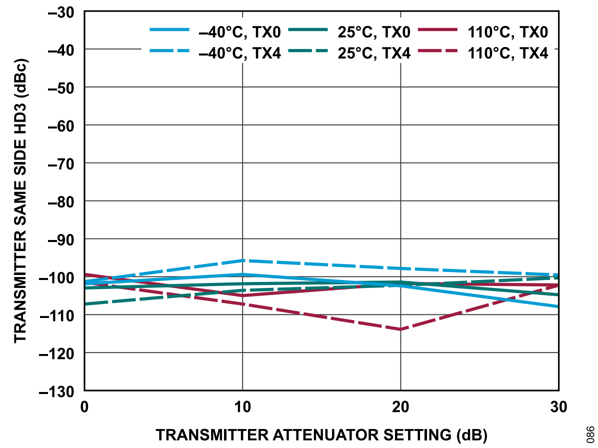


Figure 86. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

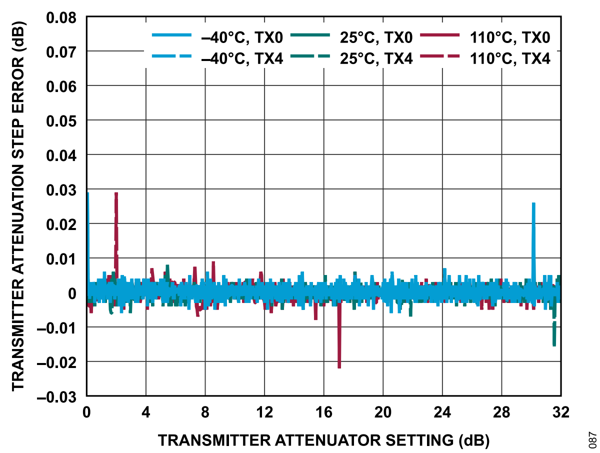


Figure 87. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

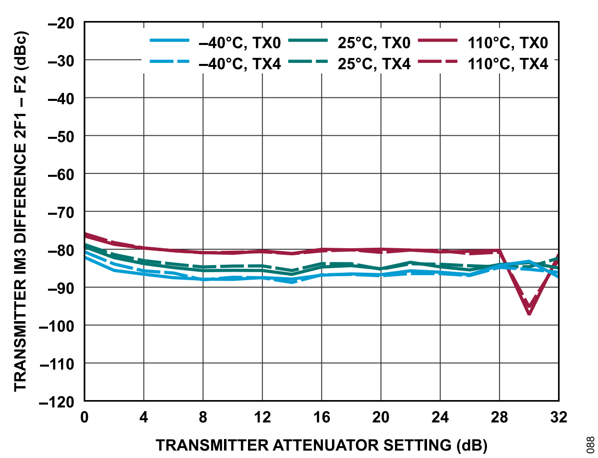


Figure 88. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 105 MHz Offset, F2 = 100 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

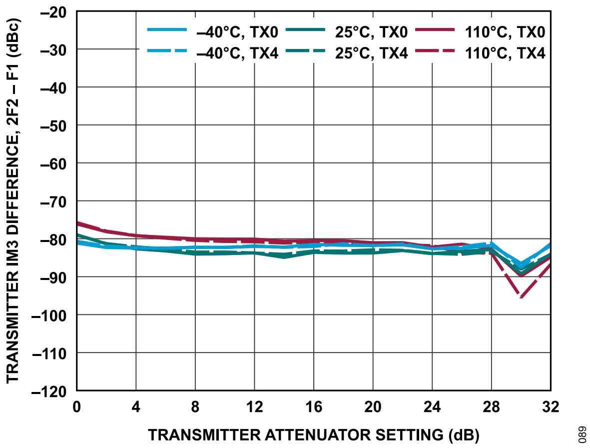


Figure 89. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 105 MHz Offset, F2 = 100 MHz Offset

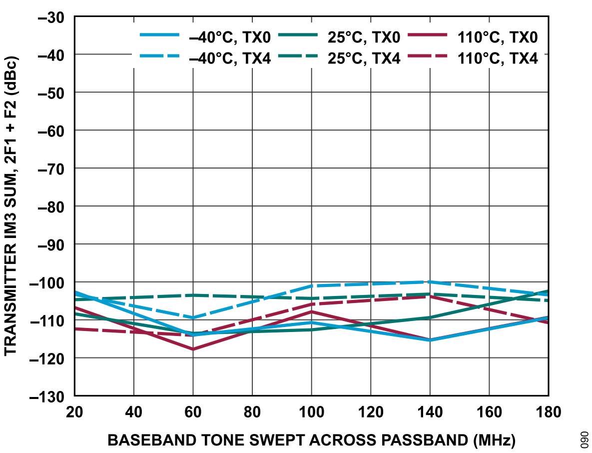


Figure 90. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

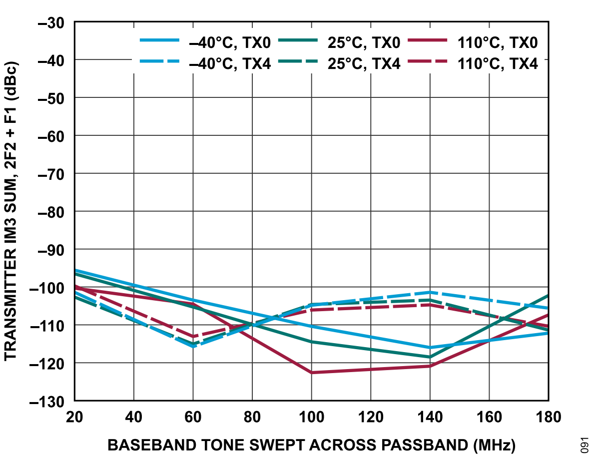


Figure 91. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

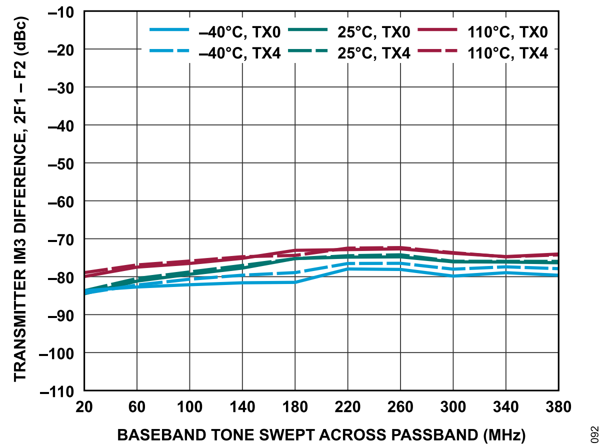


Figure 92. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

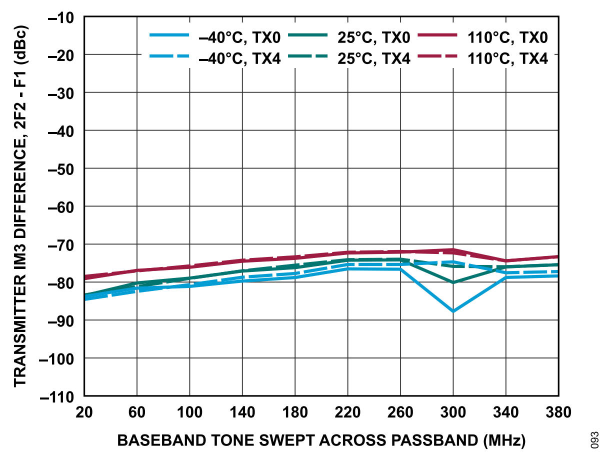


Figure 93. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

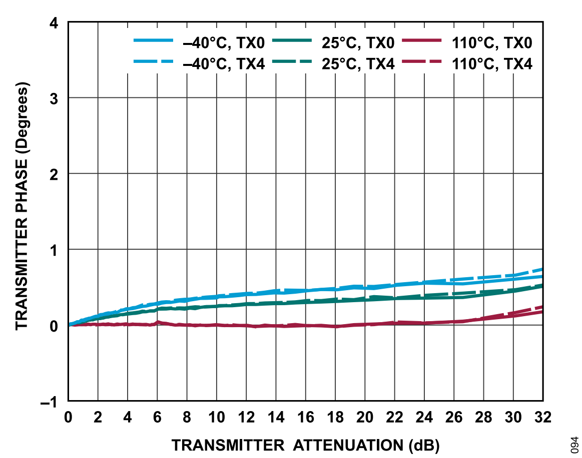


Figure 94. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

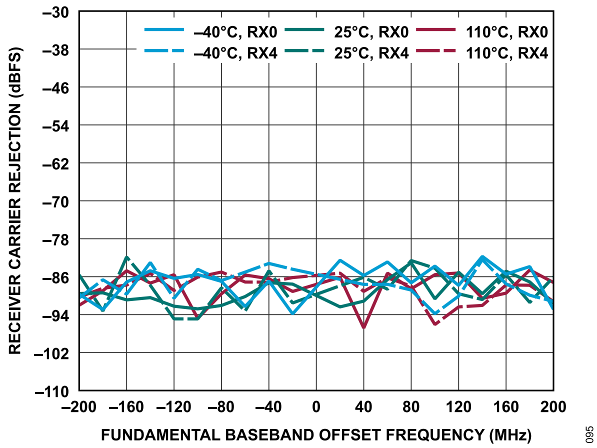


Figure 95. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

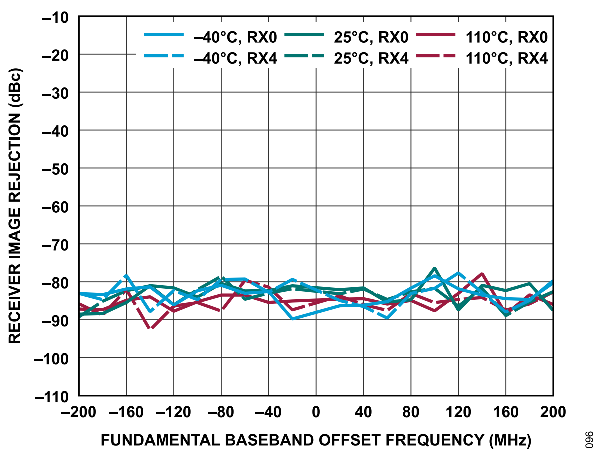


Figure 96. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

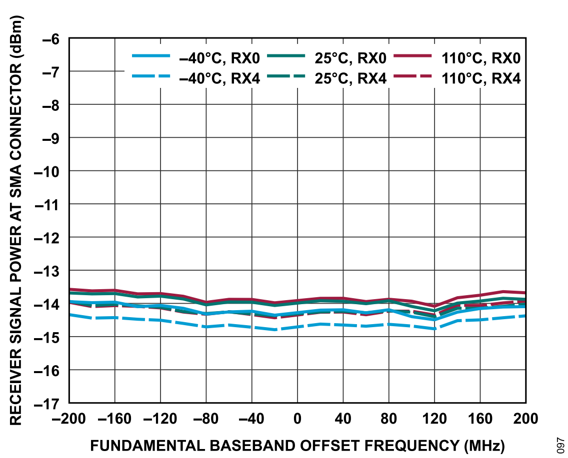


Figure 97. Receiver Signal Power at SMA Connector vs. Baseband Offset Frequency, −2.5 dBFs input Signal (Match Not De−Embedded)

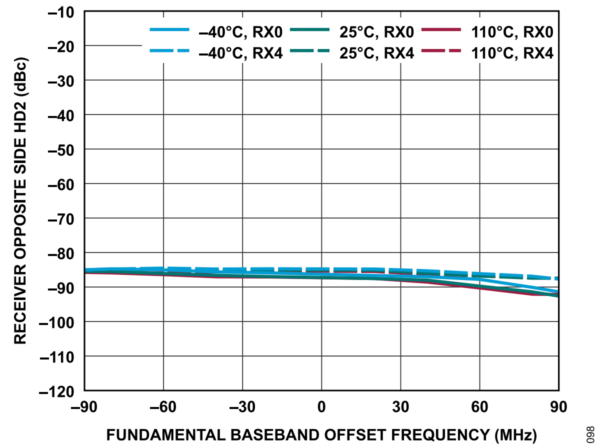


Figure 98. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

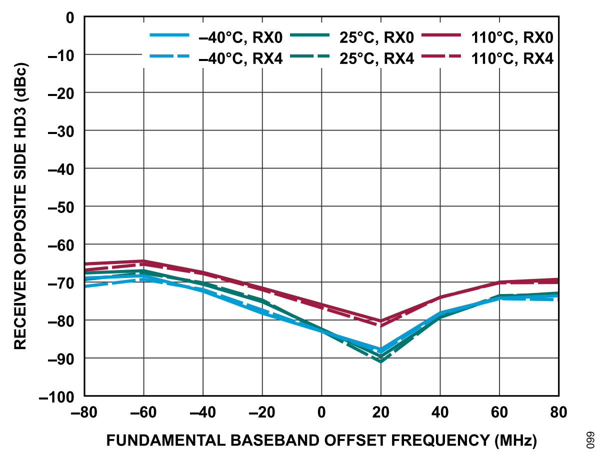


Figure 99. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

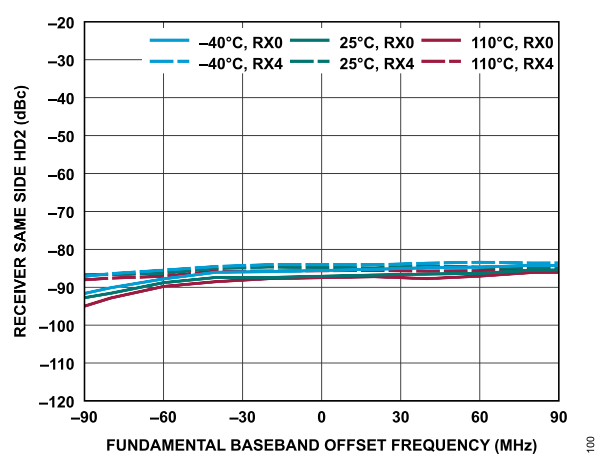


Figure 100. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

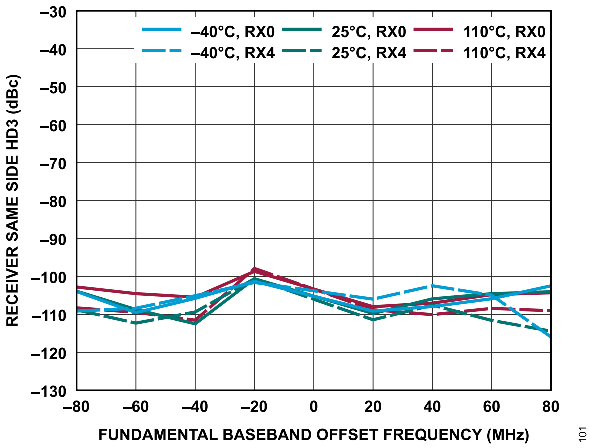


Figure 101. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −2.5 dBFS Input Signal

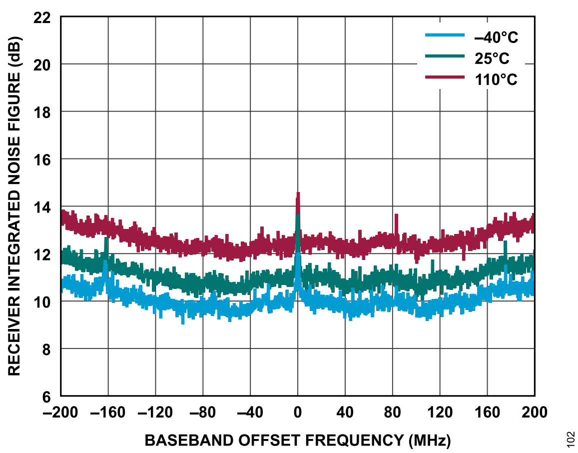


Figure 102. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

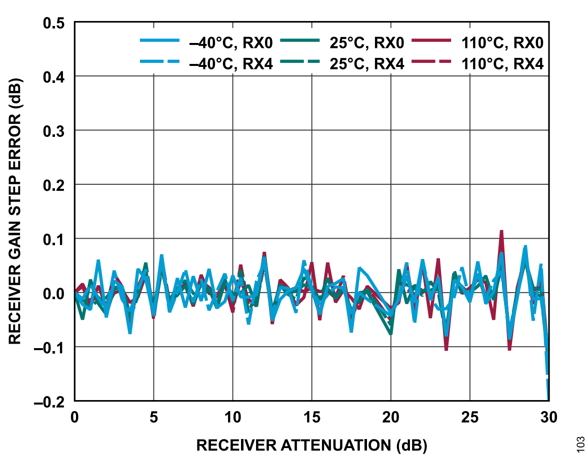


Figure 103. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −2.5 dBFS Input Signal

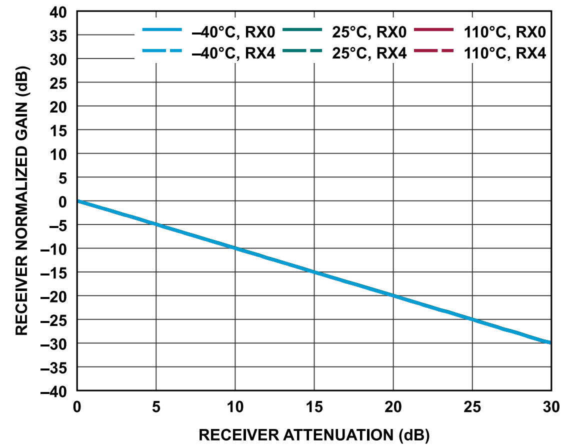


Figure 104. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −2.5 dBFS Input Signal

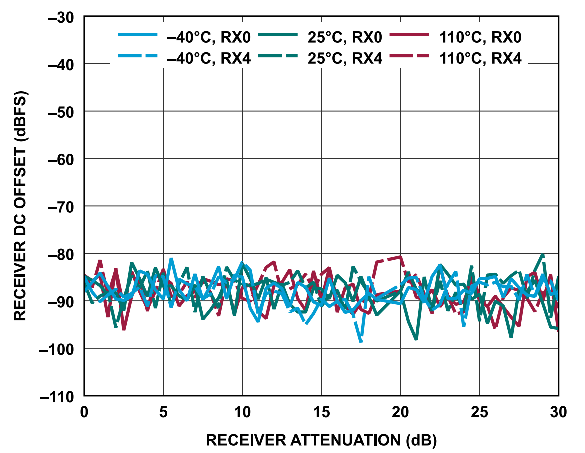


Figure 105. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −2.5 dBFS Input Signal

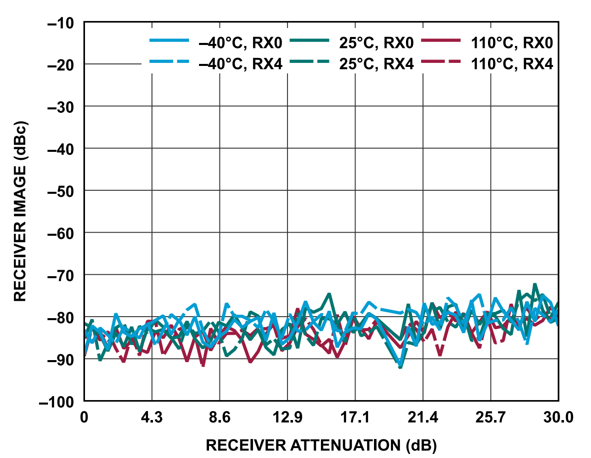


Figure 106. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −2.5 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

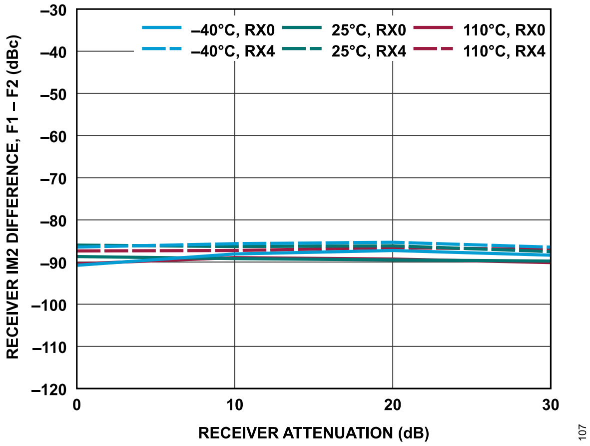


Figure 107. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F1 − 2 MHz Offset

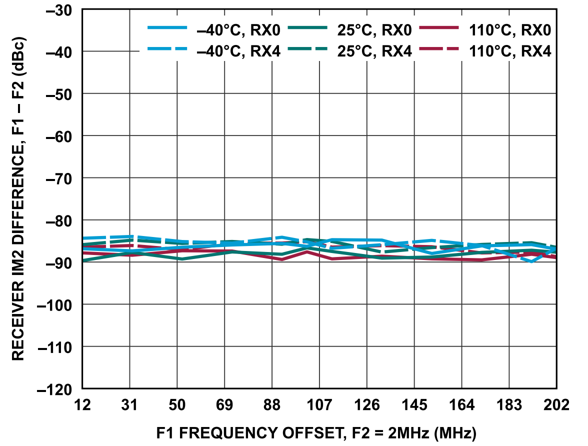


Figure 110. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

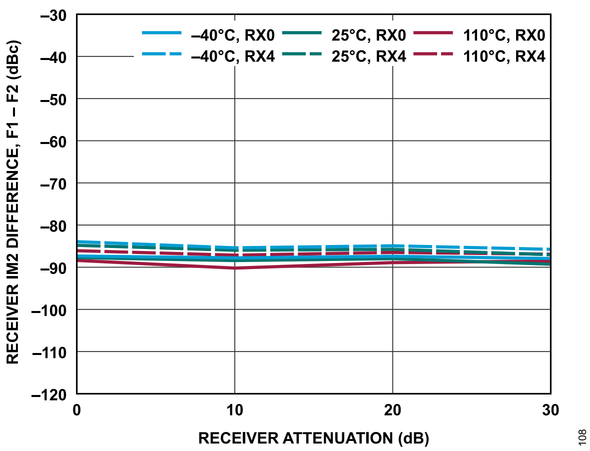


Figure 108. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

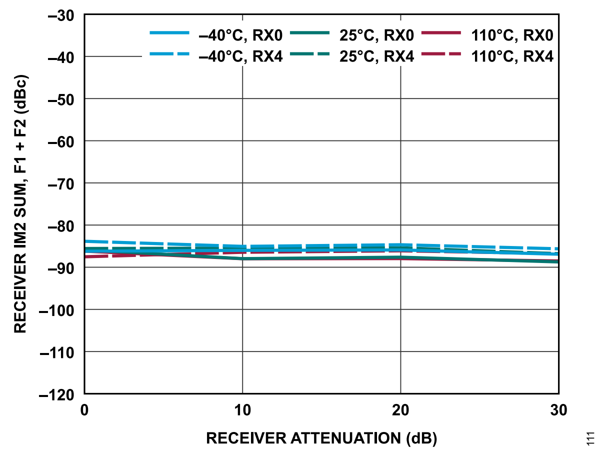


Figure 111. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F1 − 2 MHz Offset

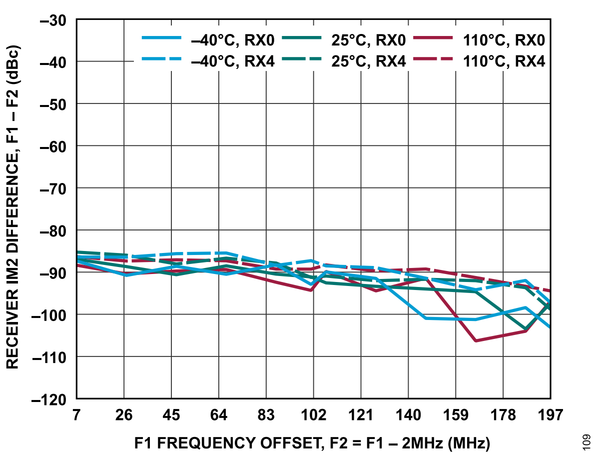


Figure 109. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

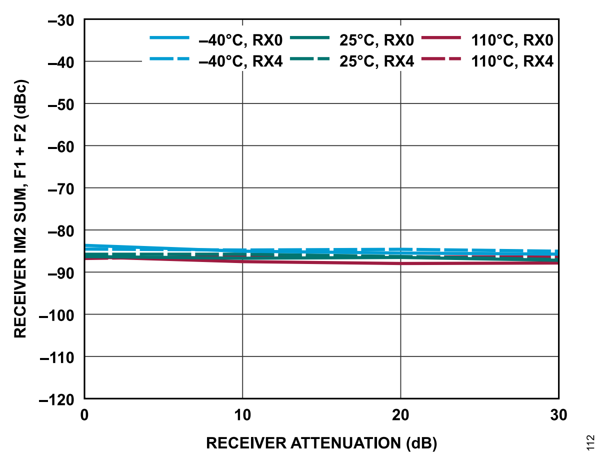


Figure 112. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 87 MHz Offset, F2 = 85 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

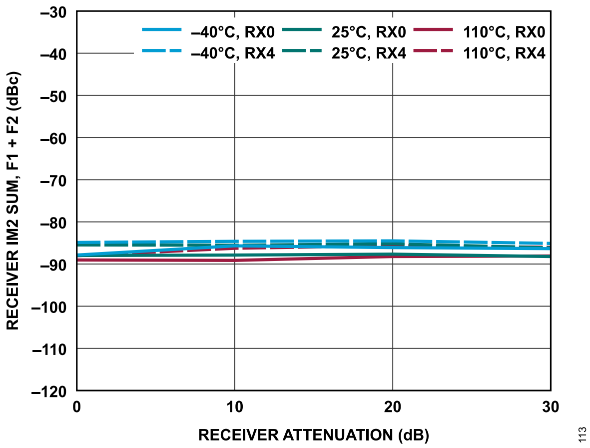


Figure 113. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

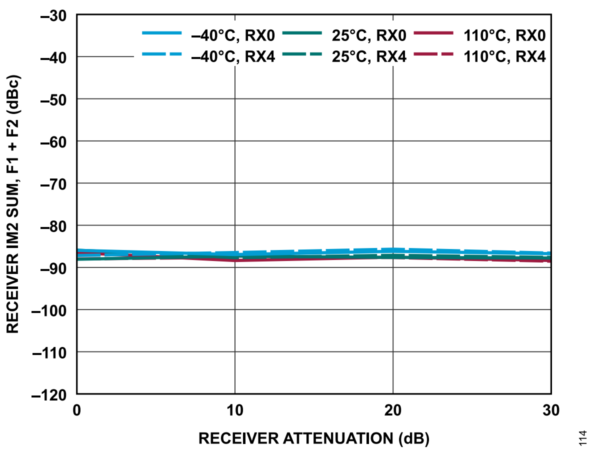


Figure 114. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 202 MHz Offset, F2 = 2 MHz Offset

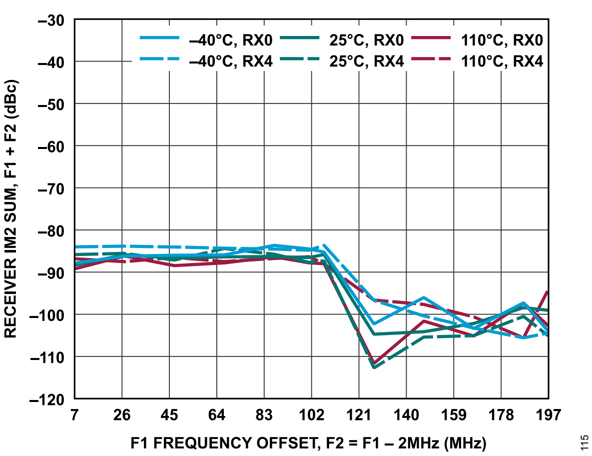


Figure 115. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

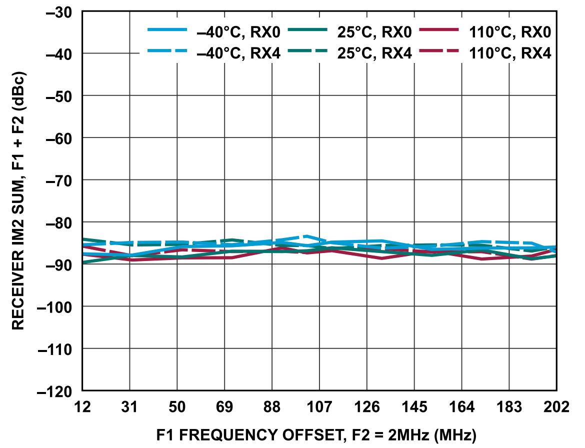


Figure 116. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

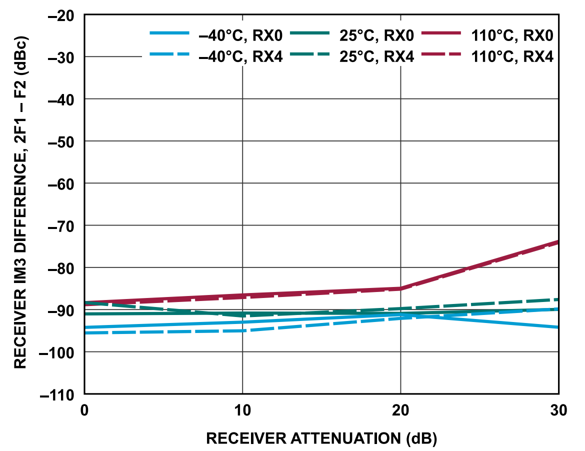


Figure 117. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F1 − 2 MHz Offset

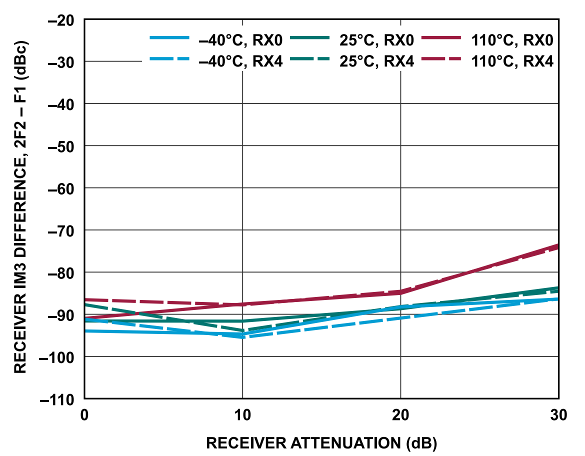


Figure 118. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F2 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

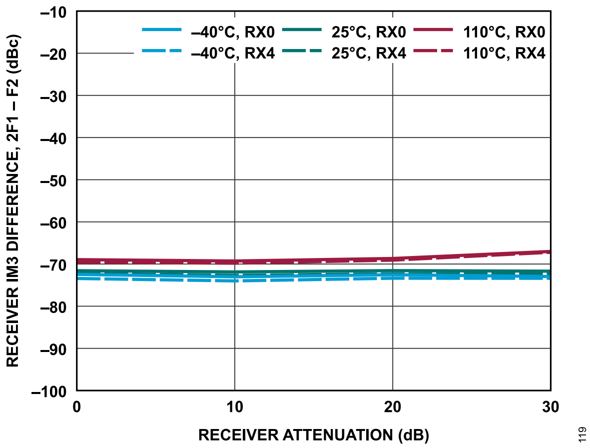


Figure 119. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 197 MHz Offset, F2 = F1 − 2 MHz Offset

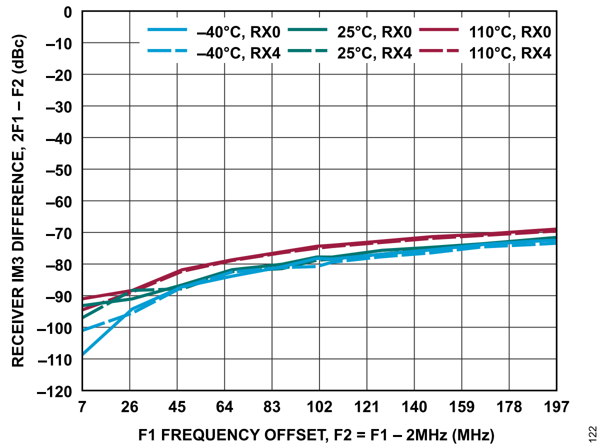


Figure 122. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

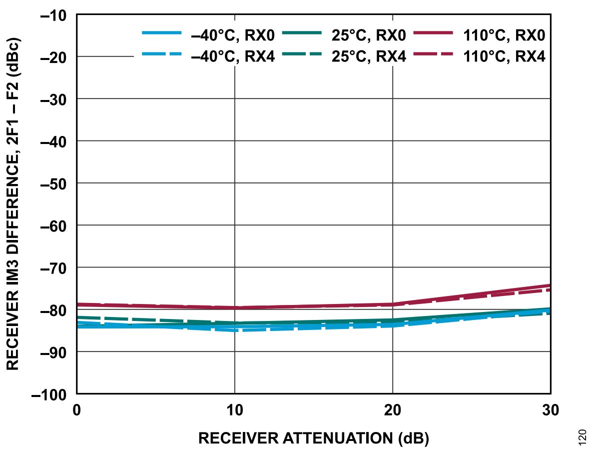


Figure 120. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

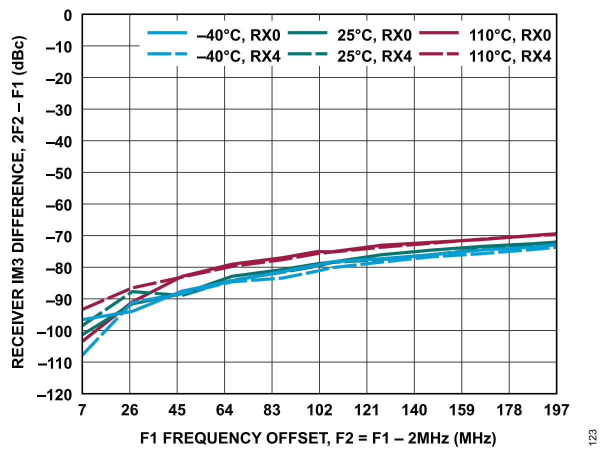


Figure 123. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

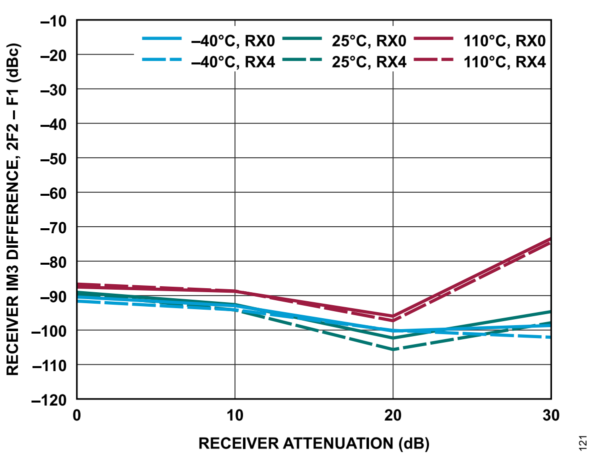


Figure 121. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

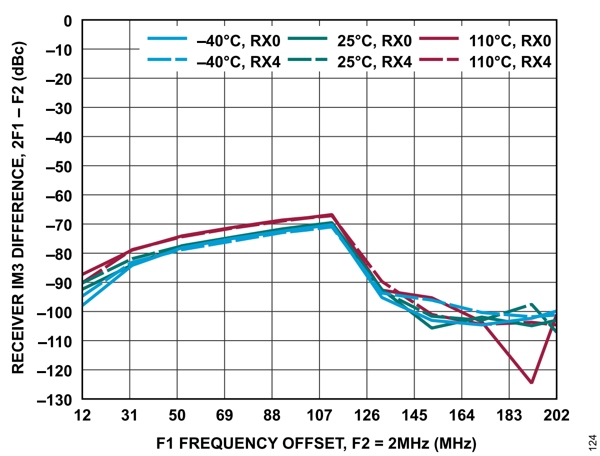


Figure 124. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

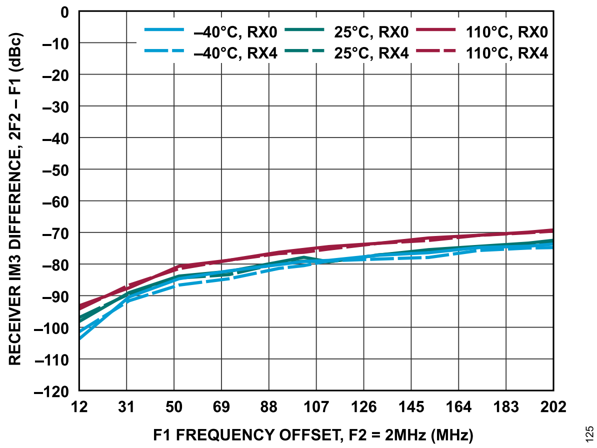


Figure 125. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

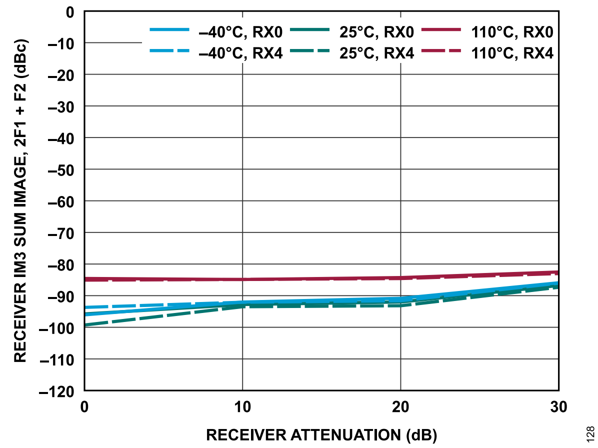


Figure 128. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

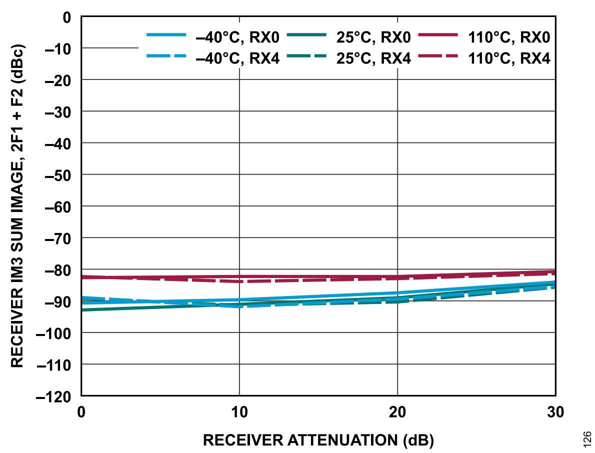


Figure 126. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F1 − 2 MHz Offset

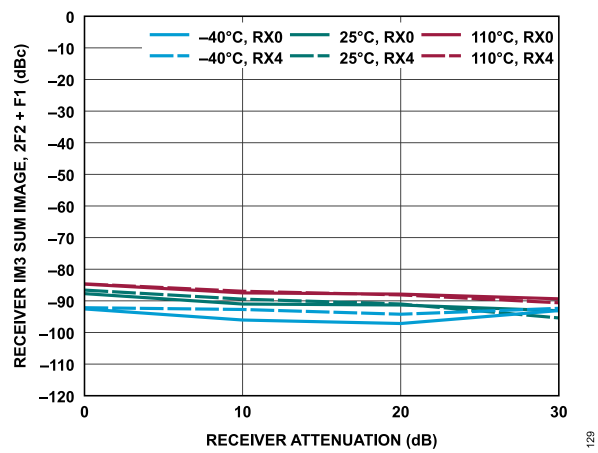


Figure 129. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

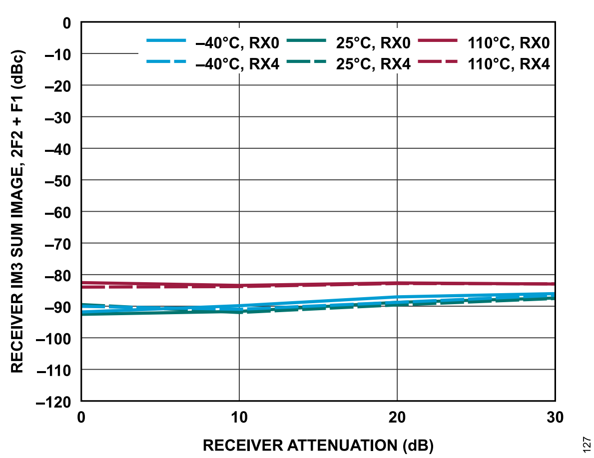


Figure 127. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −8.5 dBFS Signal Level per Tone, F1 = 27 MHz Offset, F2 = F1 − 2 MHz Offset

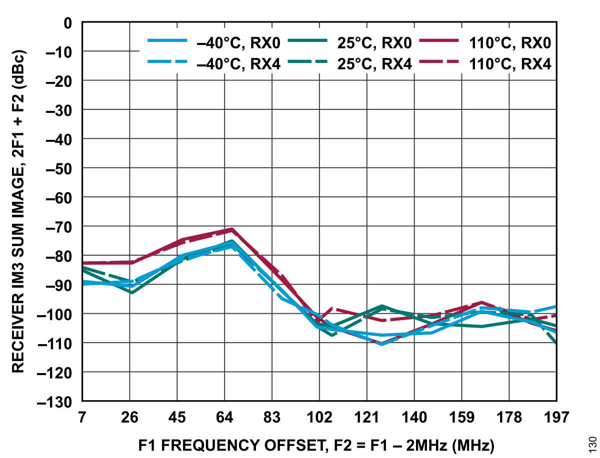


Figure 130. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

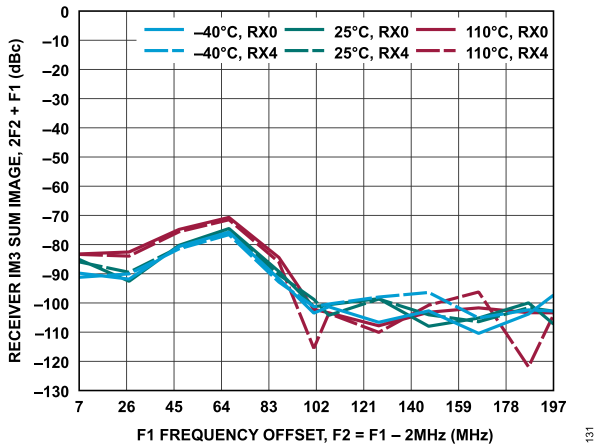


Figure 131. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

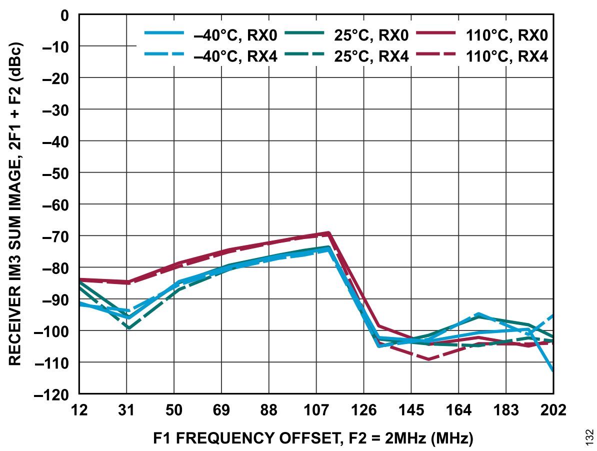


Figure 132. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

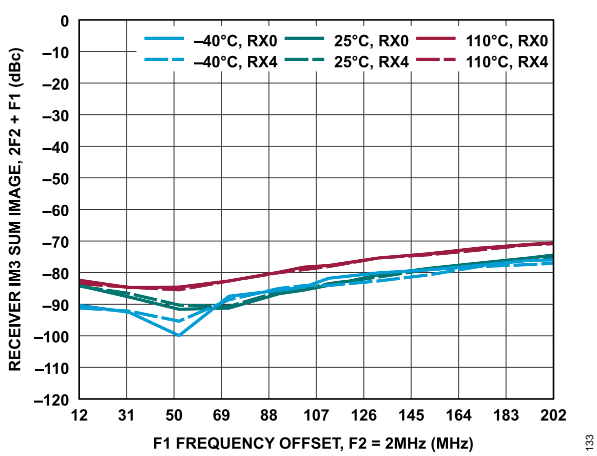


Figure 133. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −8.5 dBFS Signal Level per Tone

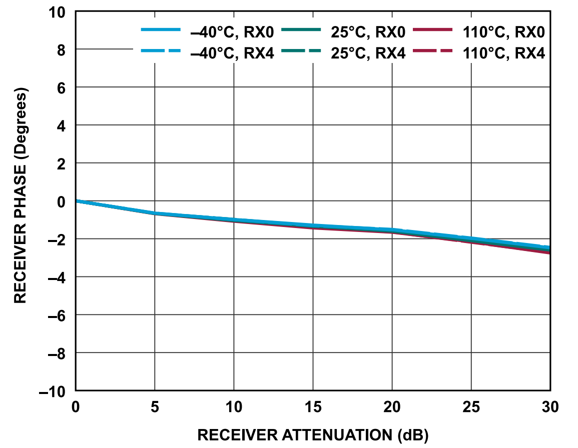


Figure 134. Receiver Phase vs. Receiver Attenuation

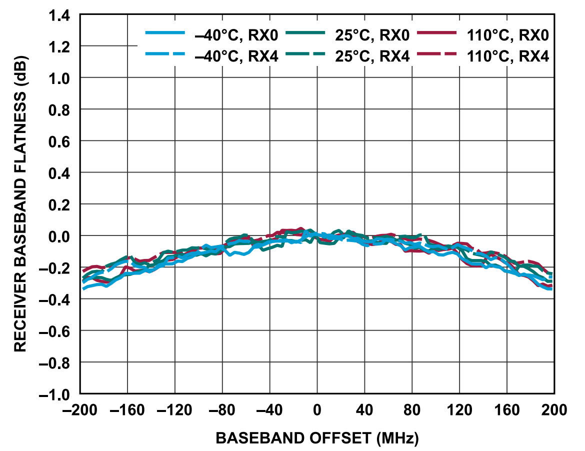


Figure 135. Receiver Baseband Flatness vs. Baseband Offset

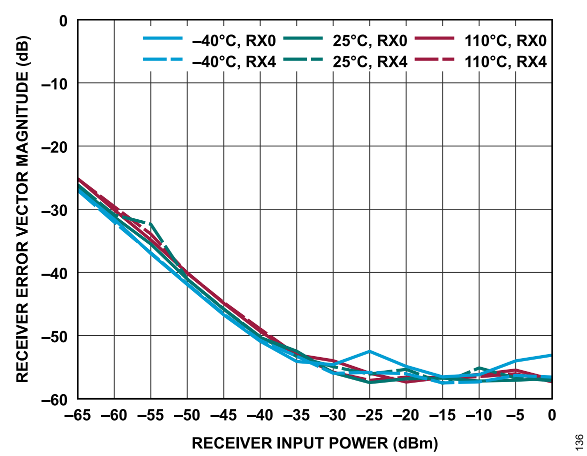


Figure 136. Receiver Error Vector Magnitude vs. Receiver Input Power, 20 MHz LTE, TDD Mode, AGC Enabled

TYPICAL PERFORMANCE CHARACTERISTICS

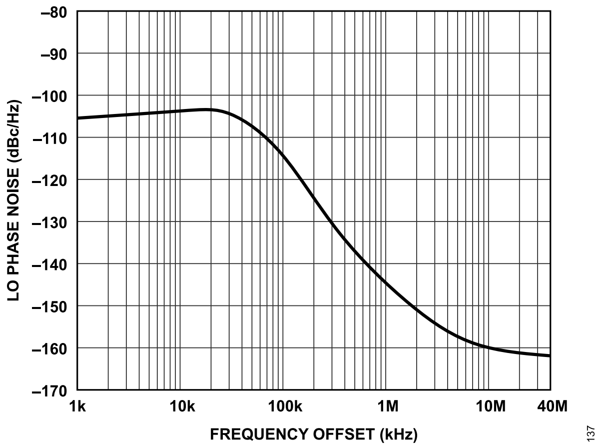


Figure 137. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

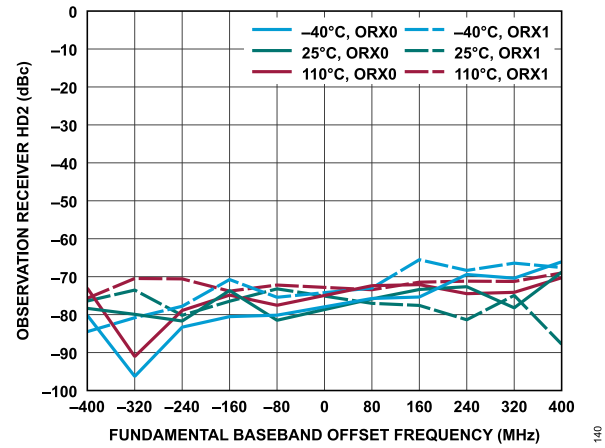


Figure 140. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

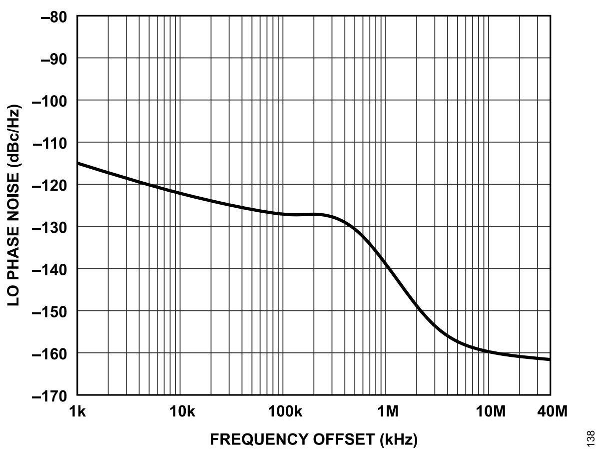


Figure 138. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

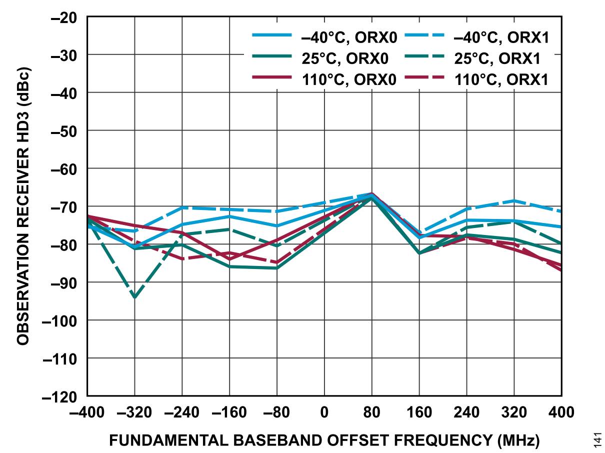


Figure 141. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

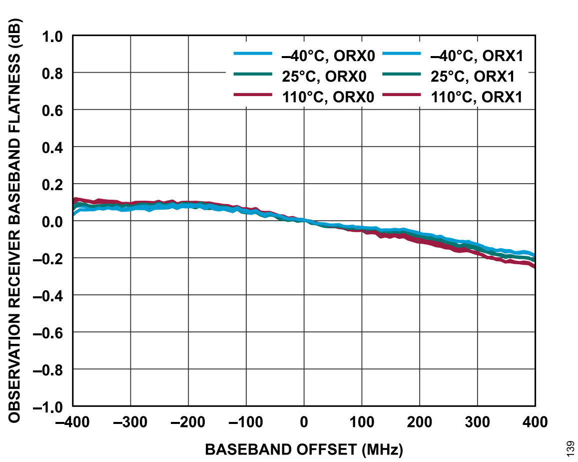


Figure 139. Observation Receiver Baseband Flatness vs. Baseband Offset

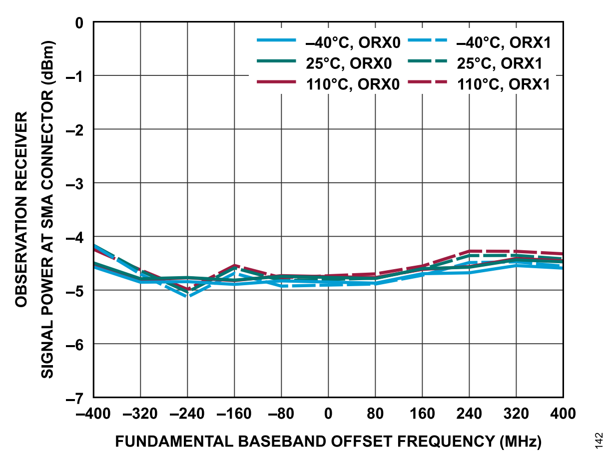


Figure 142. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De−Embedded)

TYPICAL PERFORMANCE CHARACTERISTICS

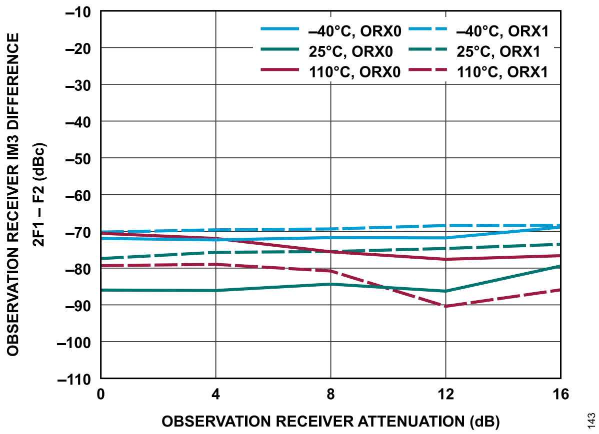


Figure 143. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 902 MHz, F2 = 912 MHz

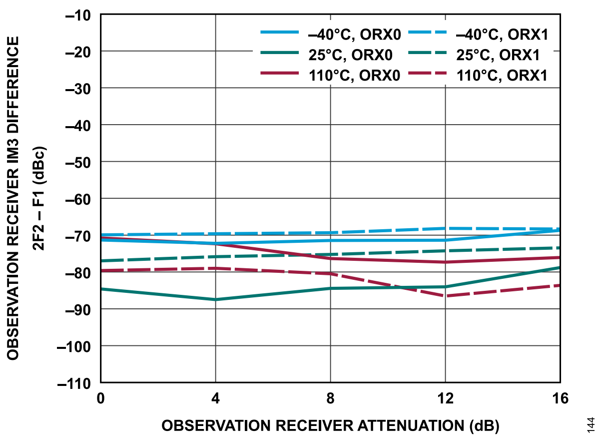


Figure 144. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 902 MHz, F2 = 912 MHz

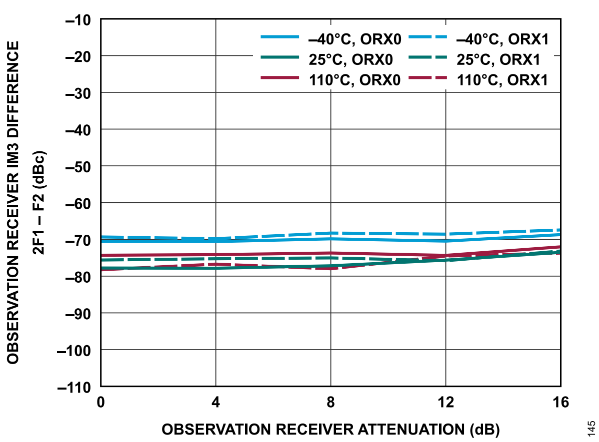


Figure 145. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 902 MHz, F2 = 1112 MHz

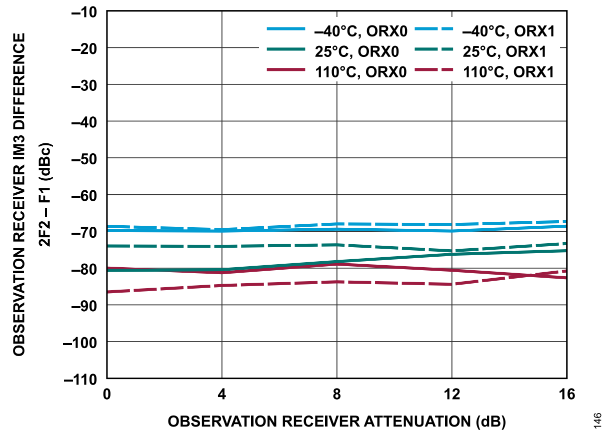


Figure 146. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 902 MHz, F2 = 1112 MHz

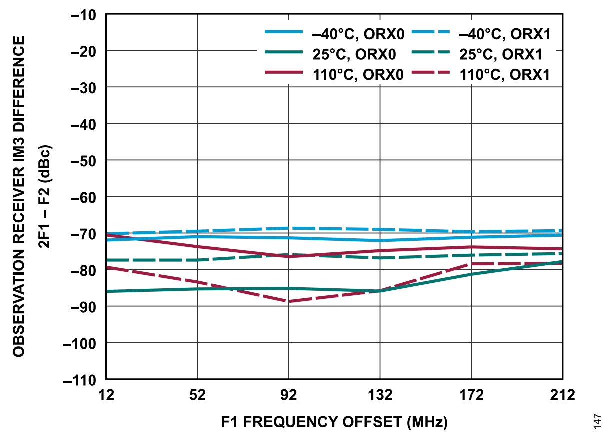


Figure 147. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 902 MHz

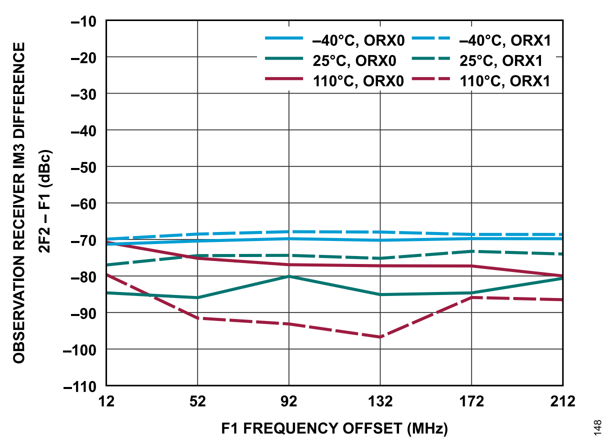


Figure 148. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 902 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

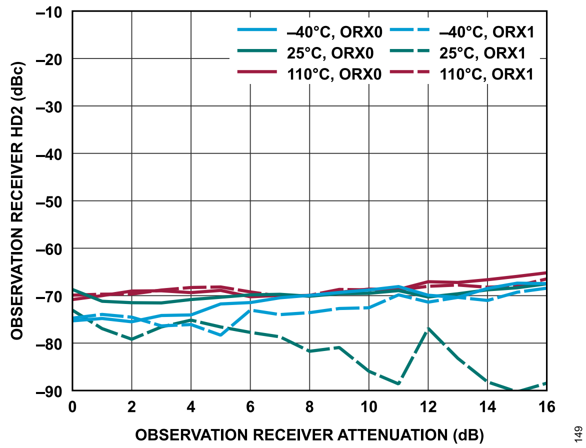


Figure 149. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

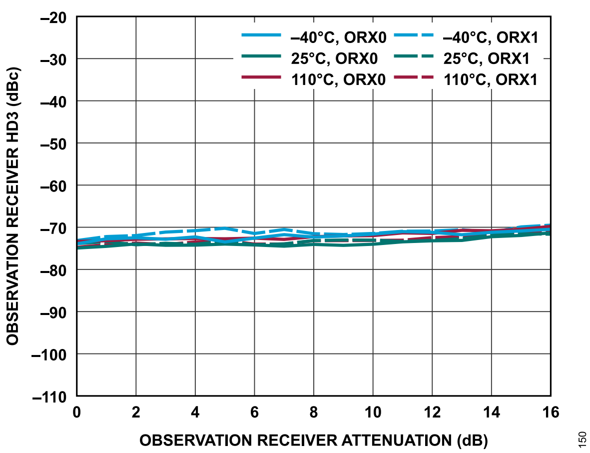


Figure 150. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

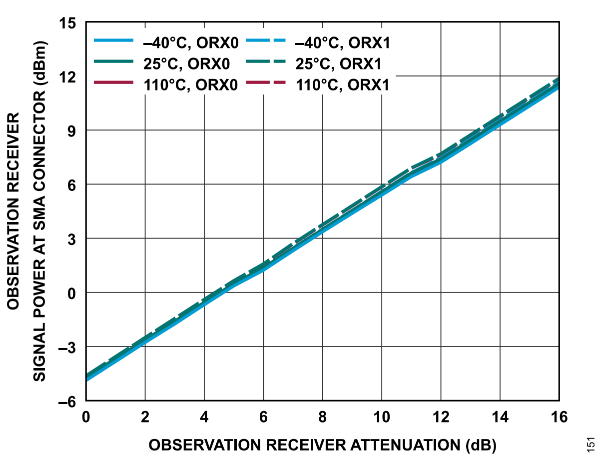


Figure 151. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

1800 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 1800 MHz, unless otherwise noted.

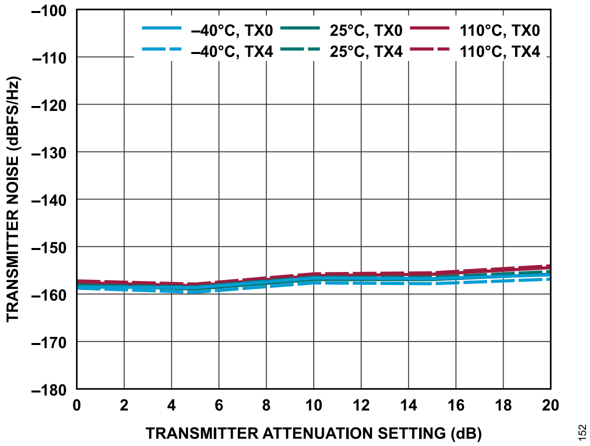


Figure 152. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

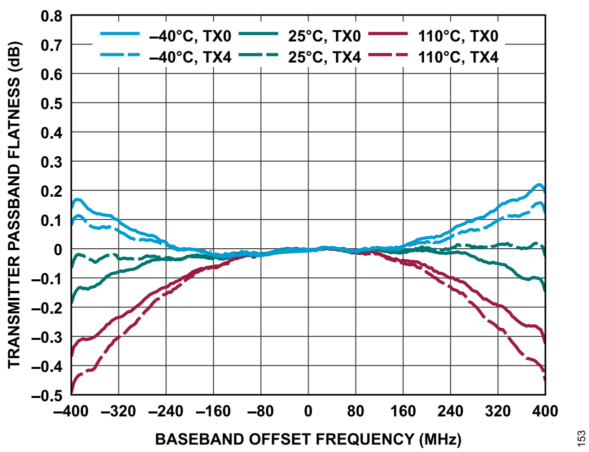


Figure 153. Transmitter Passband Flatness vs. Baseband Offset Frequency

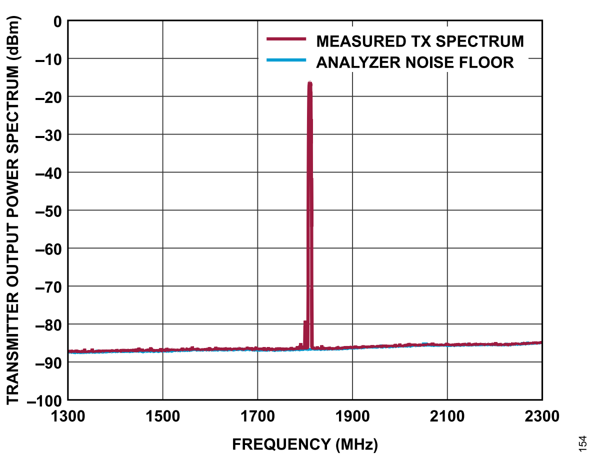


Figure 154. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

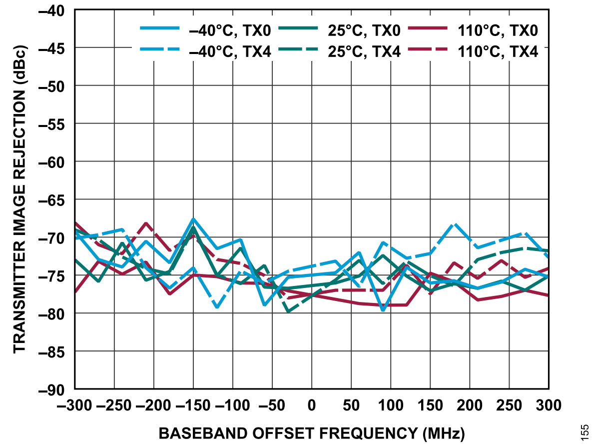


Figure 155. Transmitter Image Rejection vs. Baseband Offset Frequency, −6 dBFS CW Signal

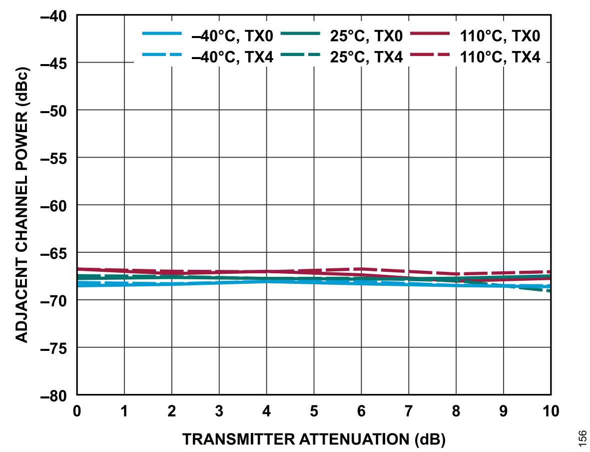


Figure 156. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

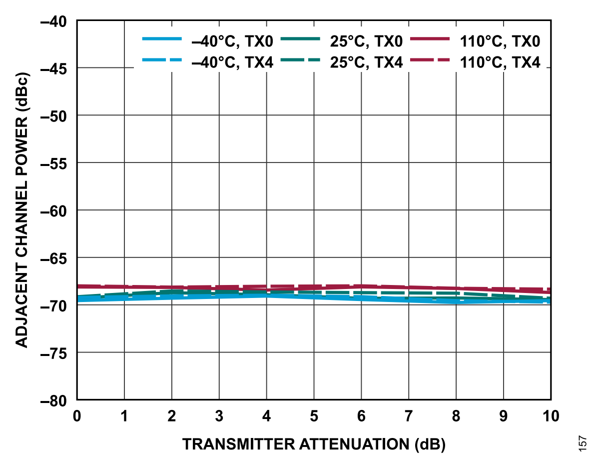


Figure 157. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

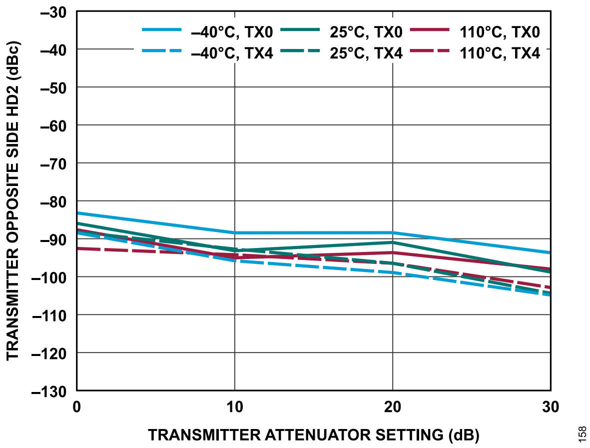


Figure 158. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

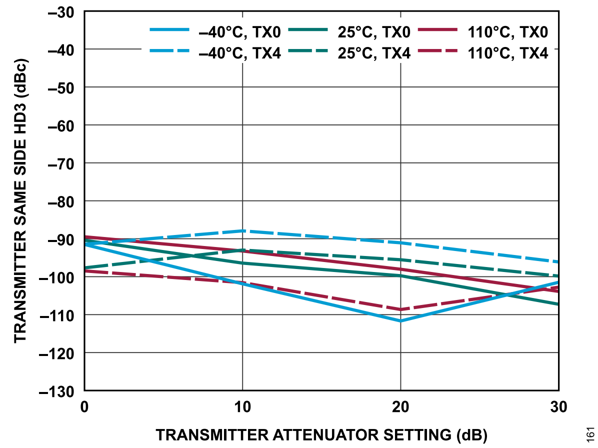


Figure 161. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

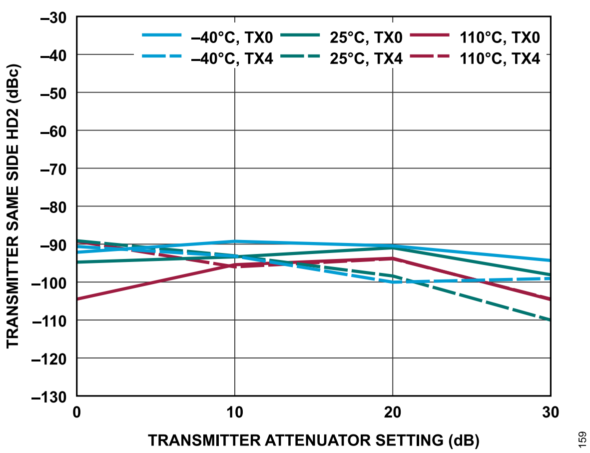


Figure 159. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

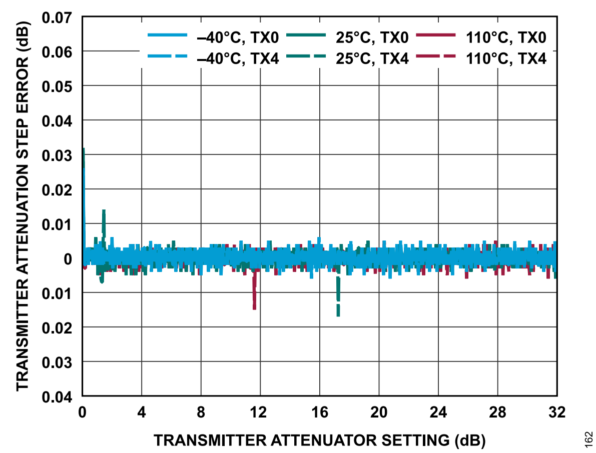


Figure 162. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

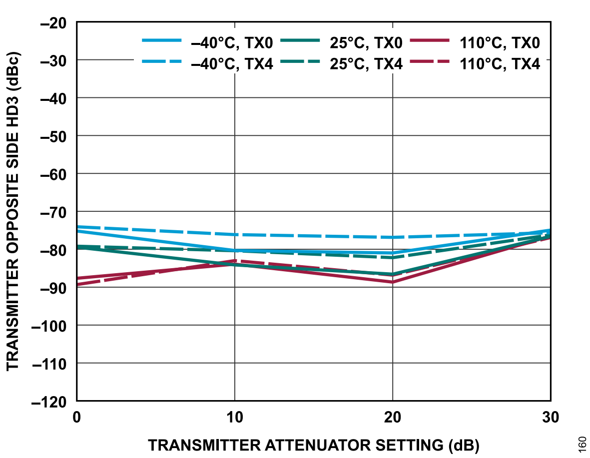


Figure 160. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

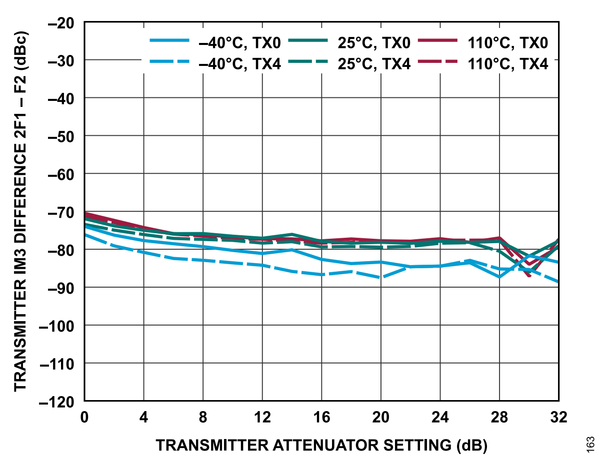


Figure 163. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

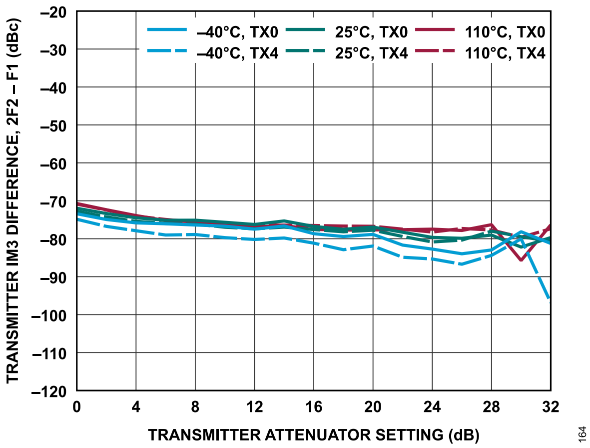


Figure 164. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

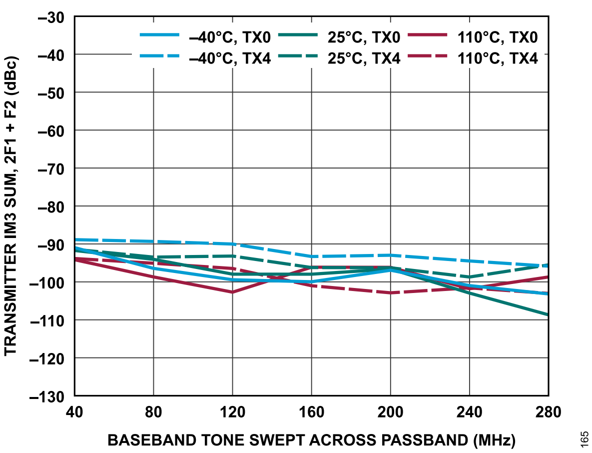


Figure 165. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

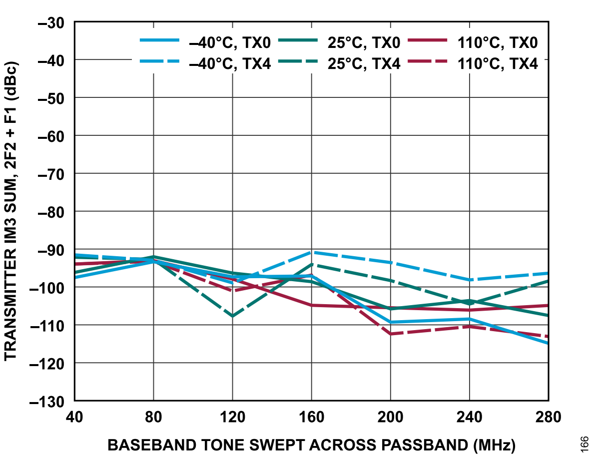


Figure 166. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

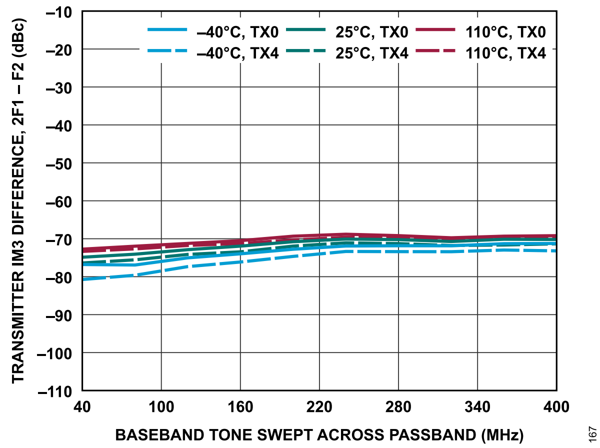


Figure 167. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

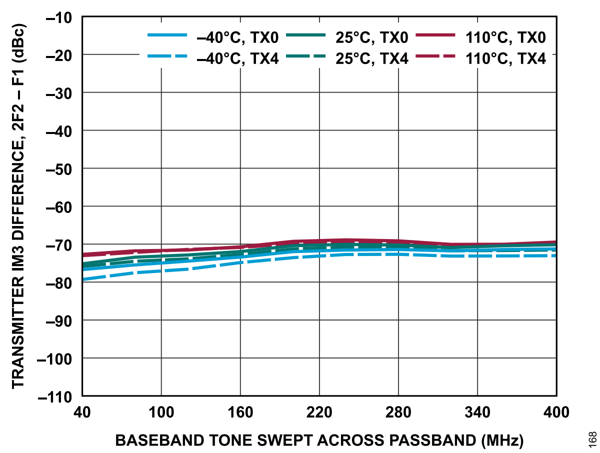


Figure 168. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

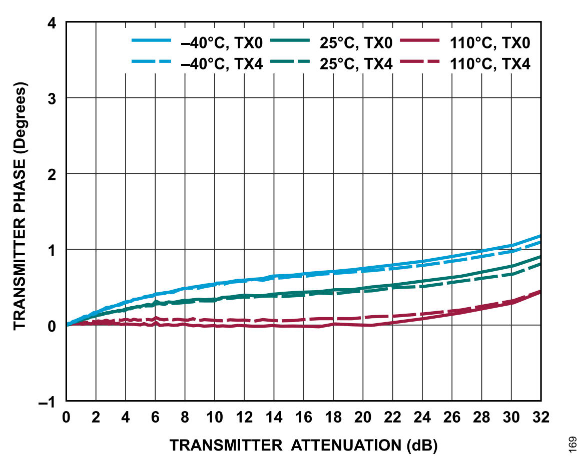


Figure 169. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

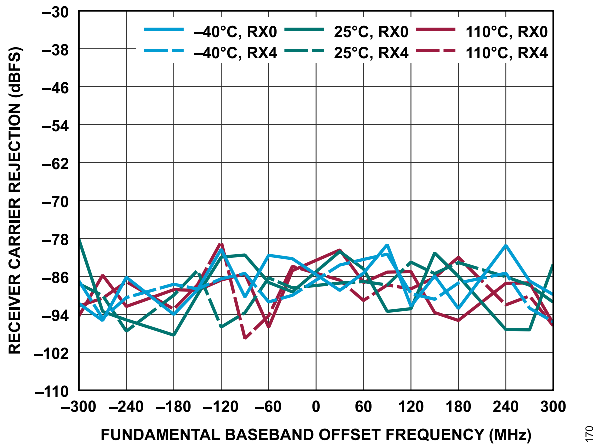


Figure 170. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

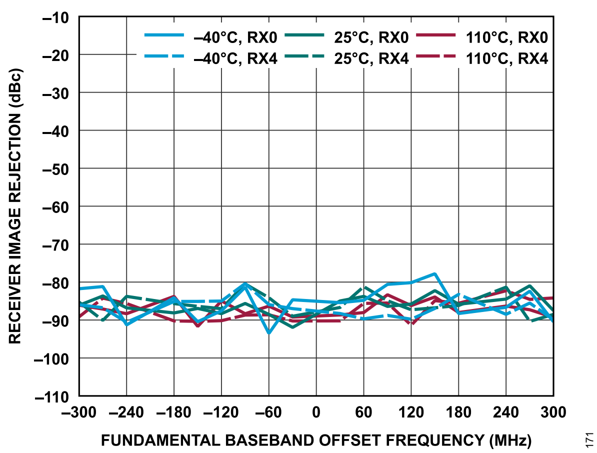


Figure 171. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

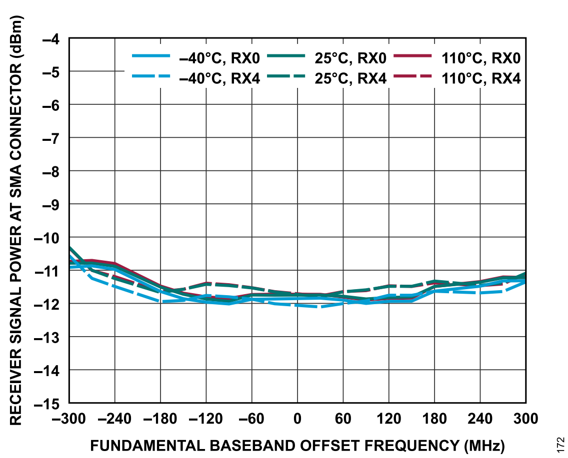


Figure 172. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

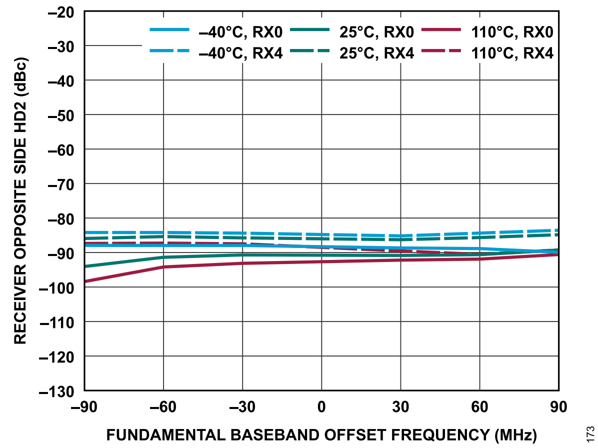


Figure 173. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

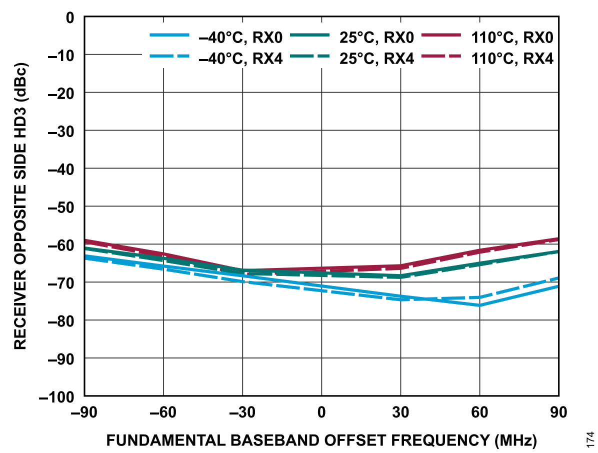


Figure 174. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

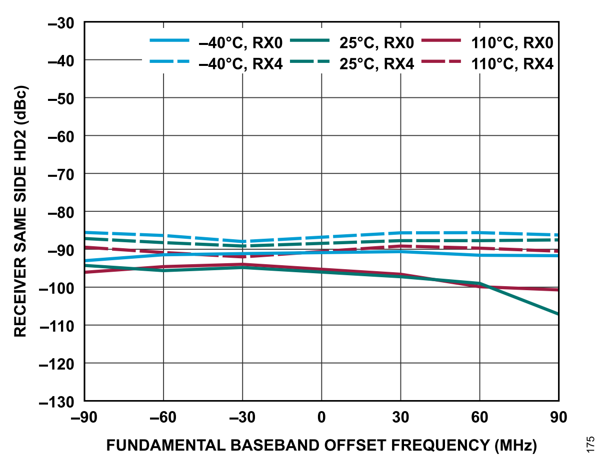


Figure 175. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

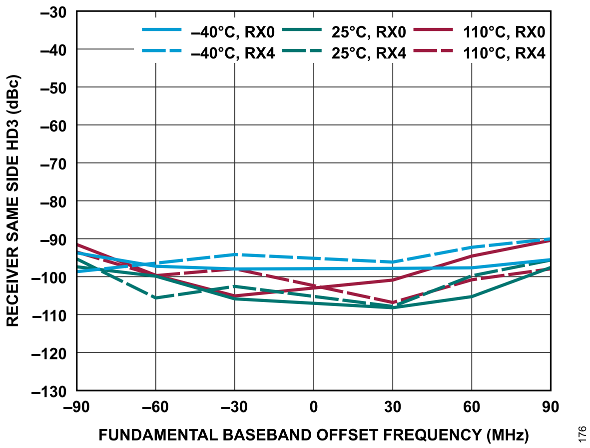


Figure 176. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

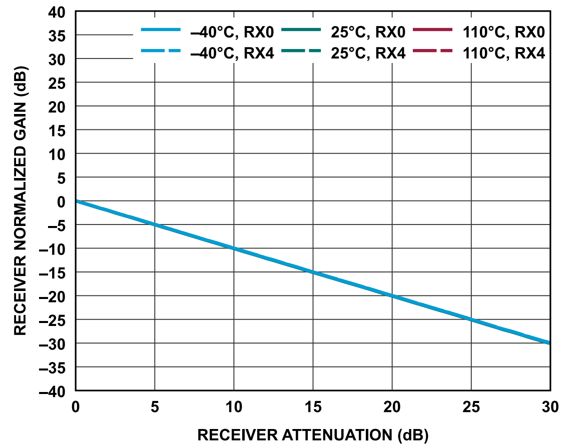


Figure 179. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

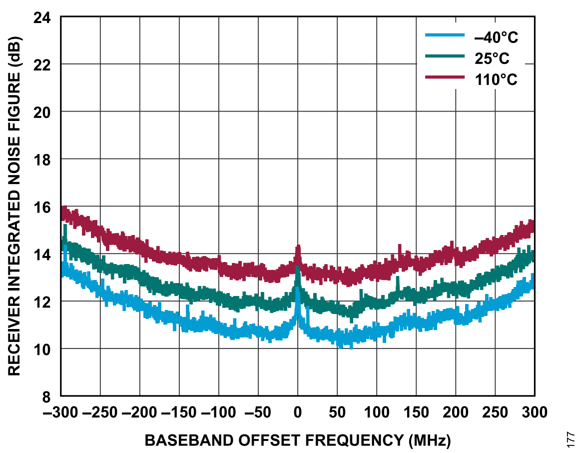


Figure 177. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

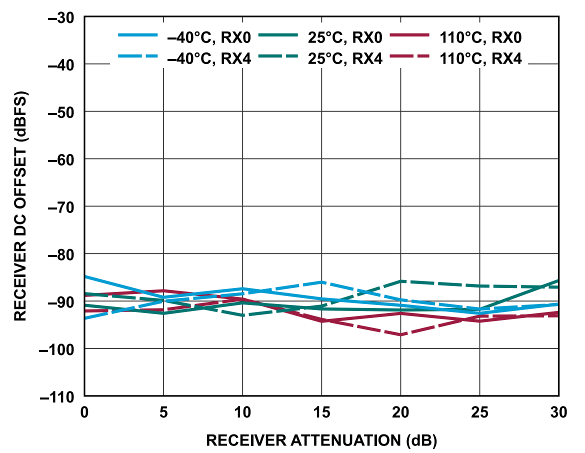


Figure 180. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

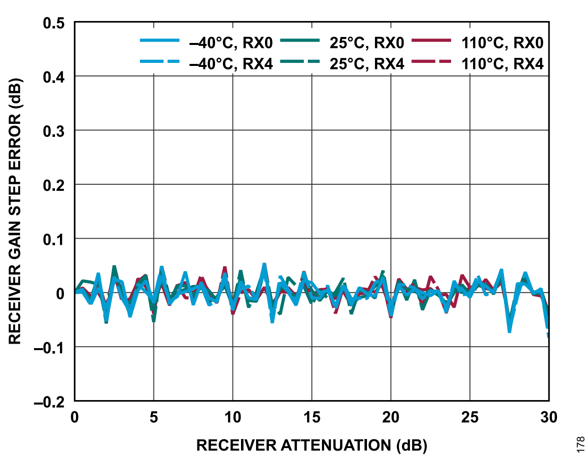


Figure 178. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

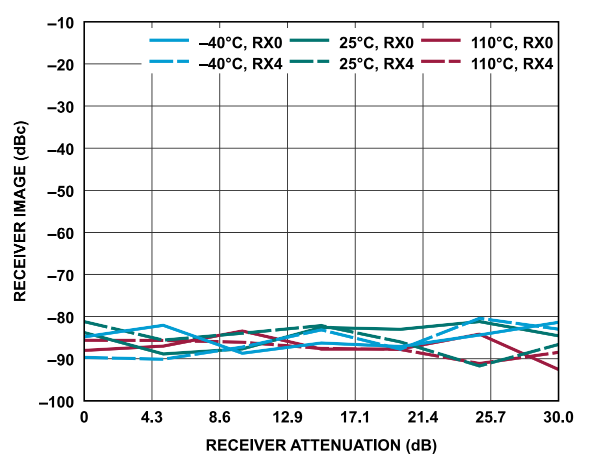


Figure 181. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

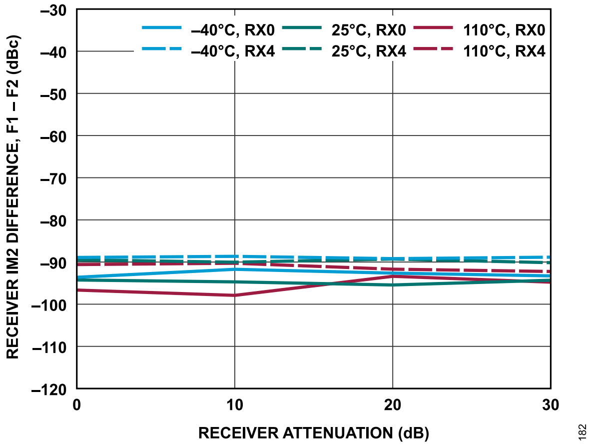


Figure 182. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

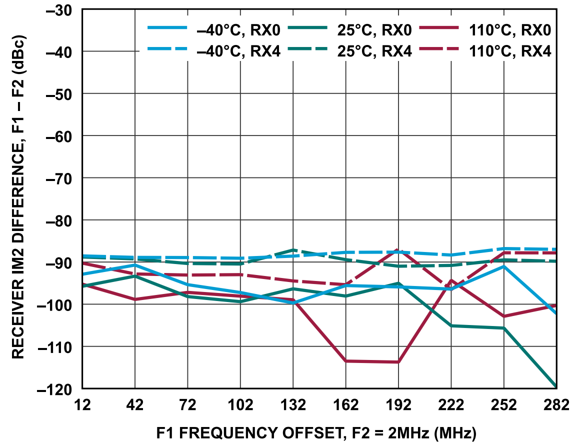


Figure 185. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

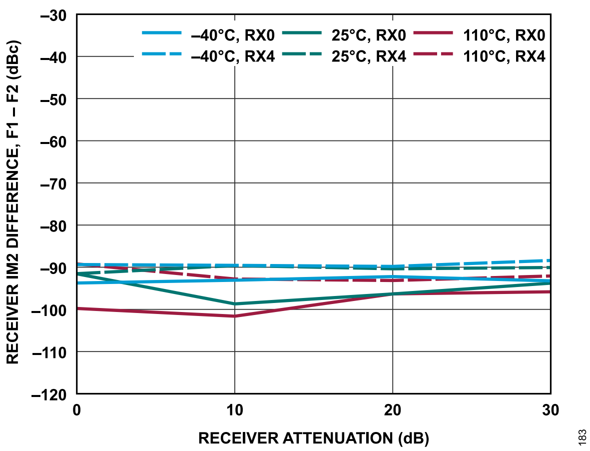


Figure 183. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

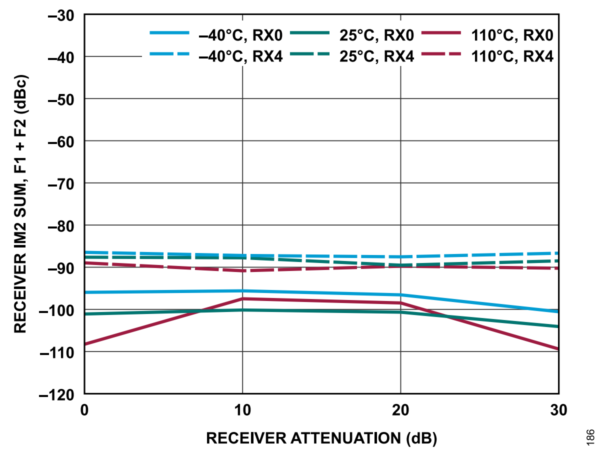


Figure 186. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

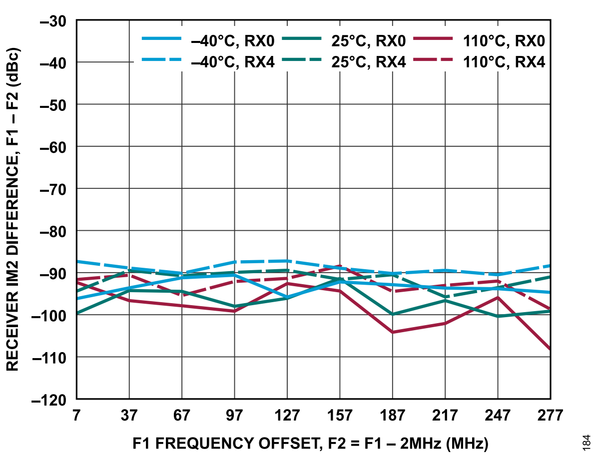


Figure 184. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

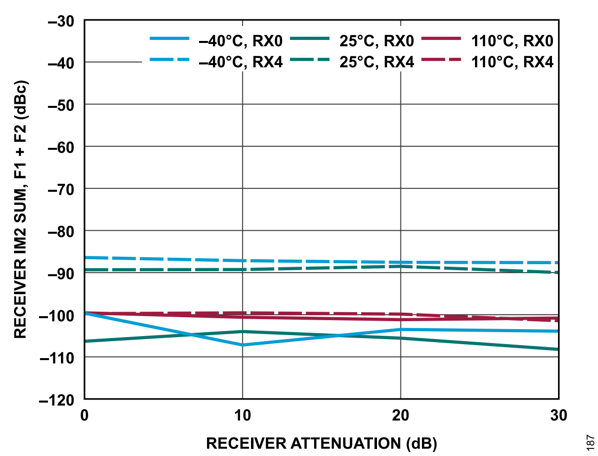


Figure 187. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

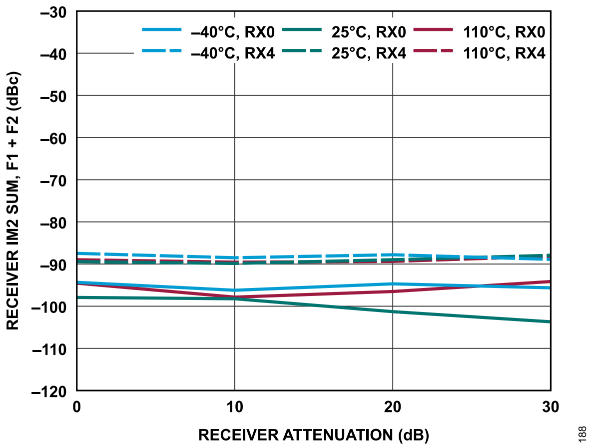


Figure 188. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

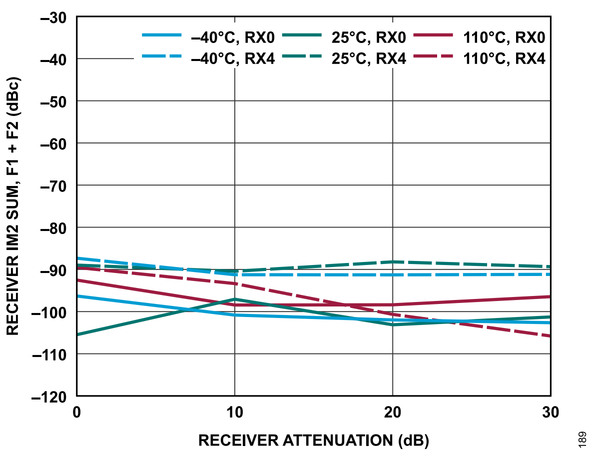


Figure 189. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 282 MHz Offset, F2 = 2 MHz Offset

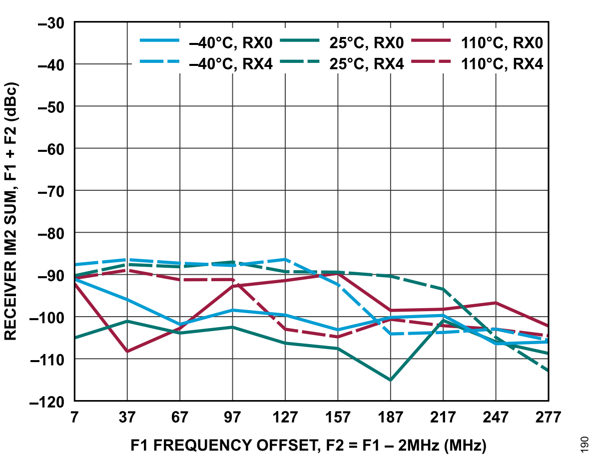


Figure 190. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

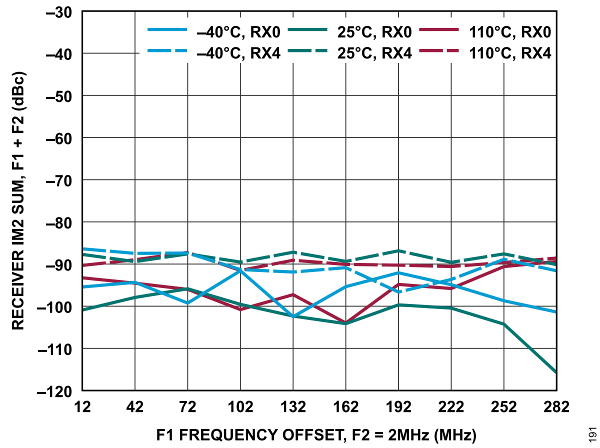


Figure 191. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

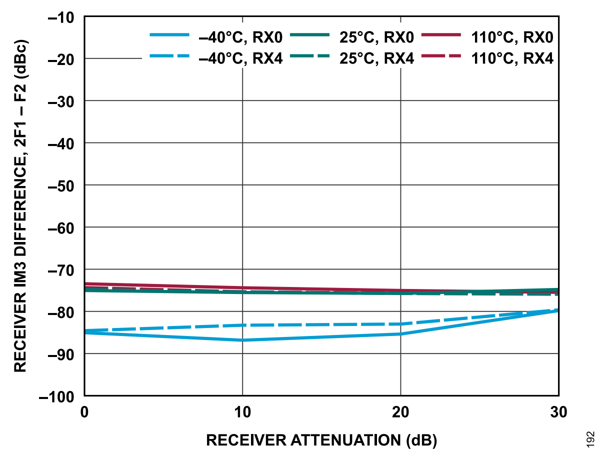


Figure 192. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

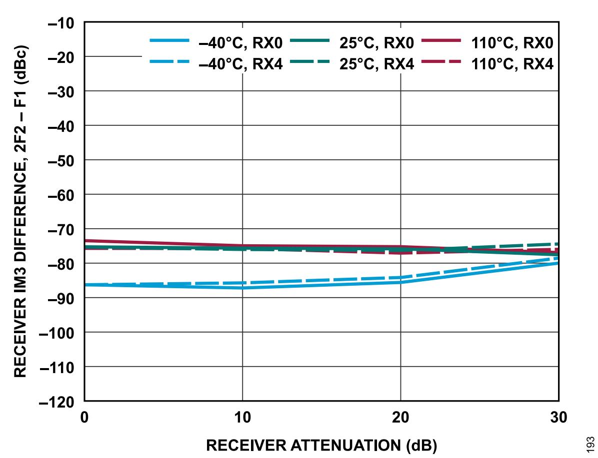


Figure 193. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

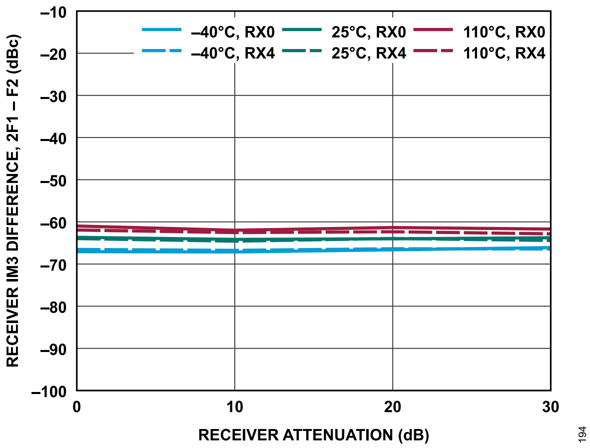


Figure 194. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

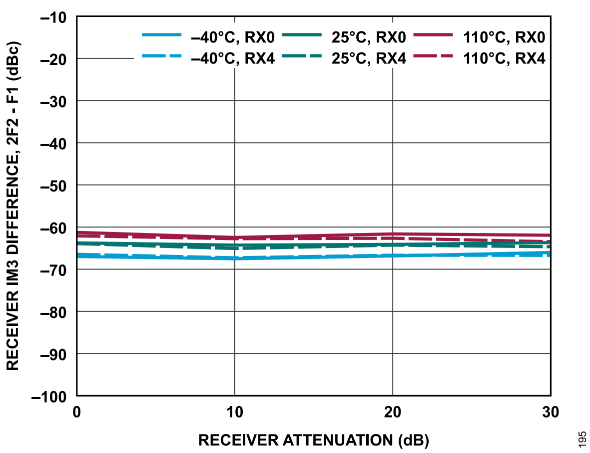


Figure 195. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

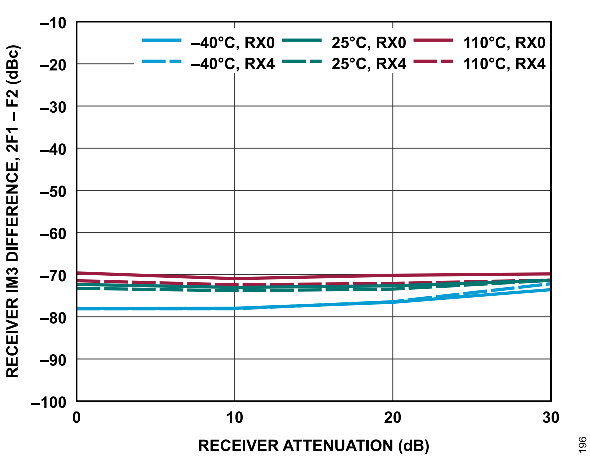


Figure 196. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

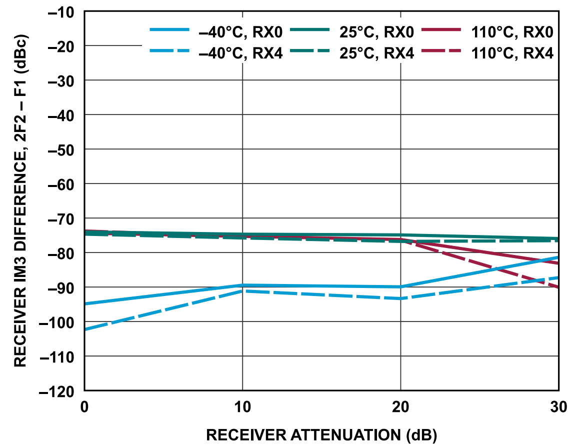


Figure 197. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

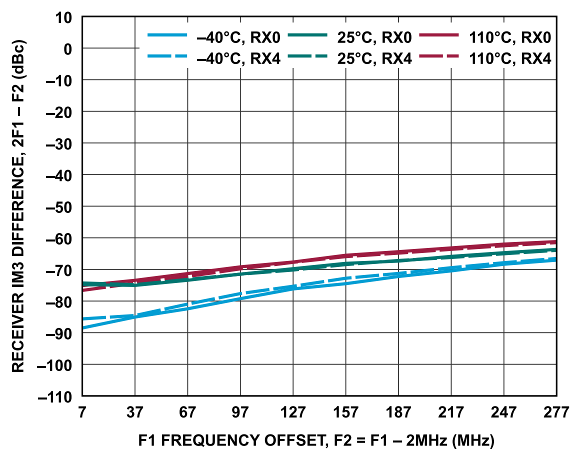


Figure 198. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

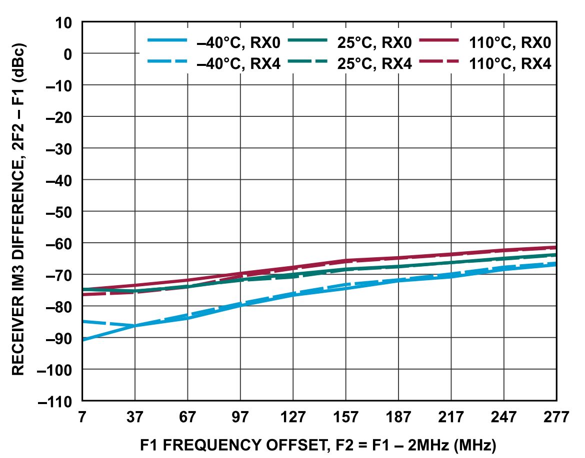


Figure 199. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

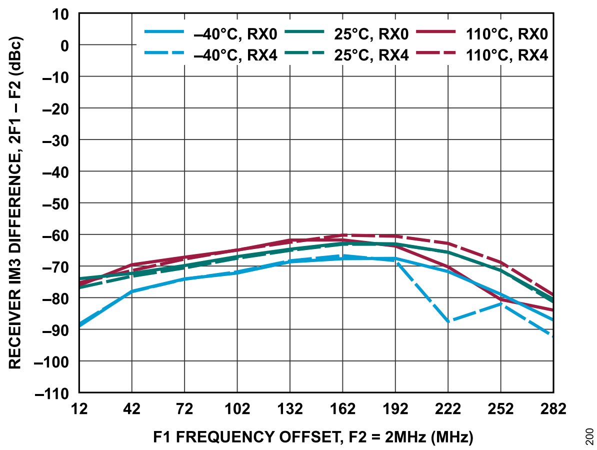


Figure 200. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

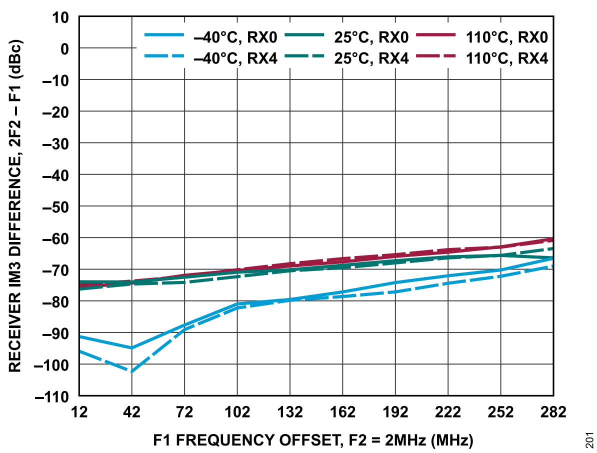


Figure 201. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

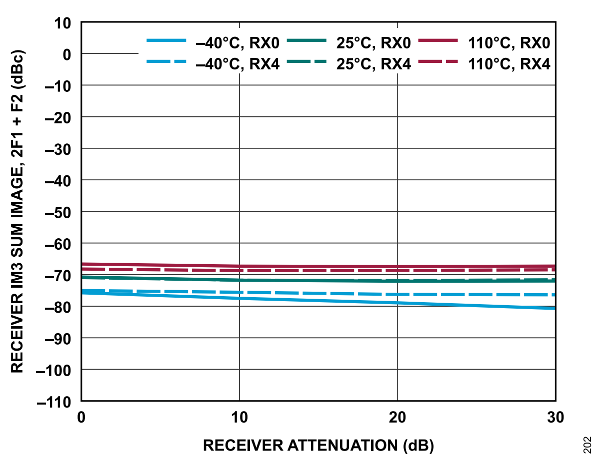


Figure 202. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

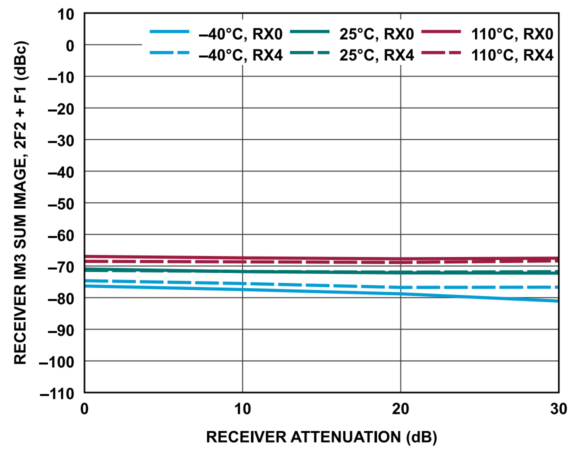


Figure 203. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

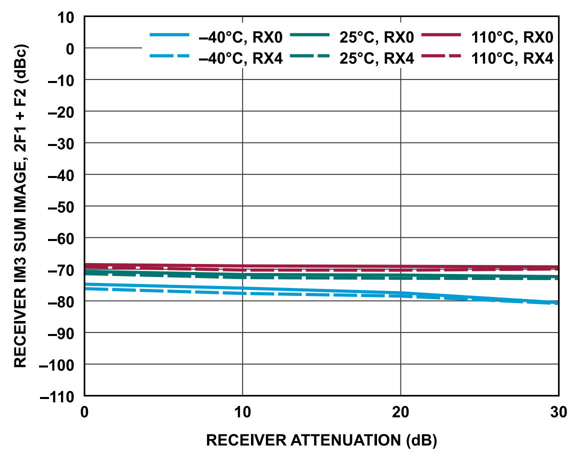


Figure 204. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

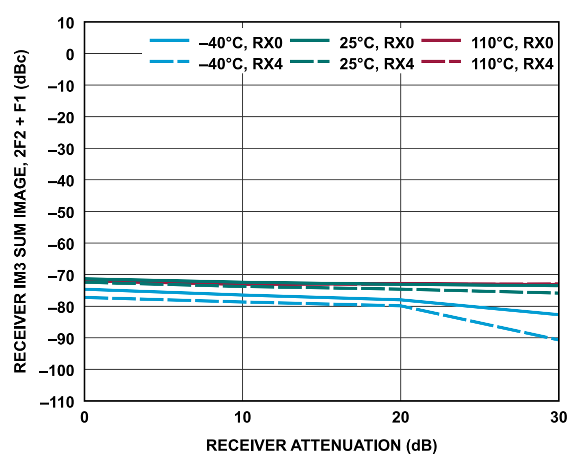


Figure 205. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

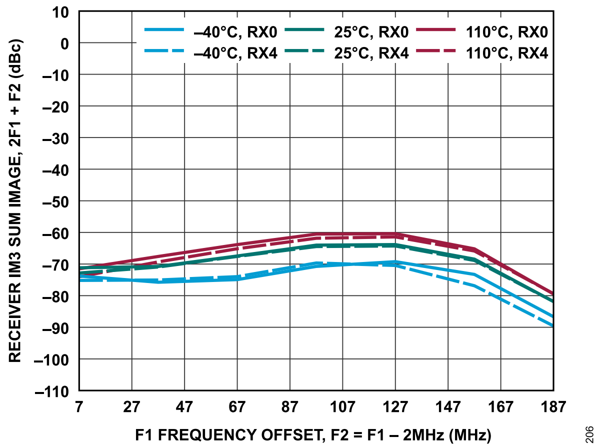


Figure 206. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

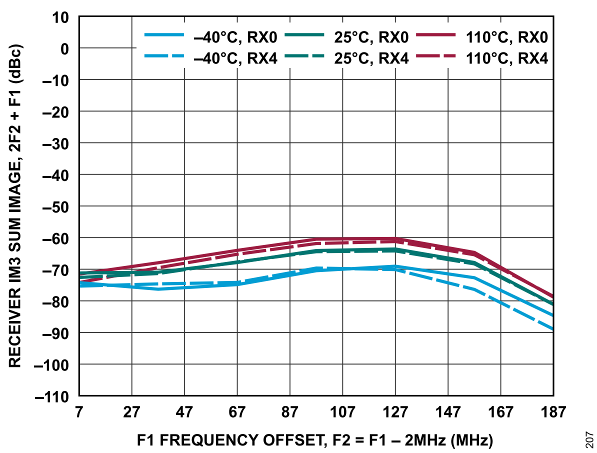


Figure 207. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

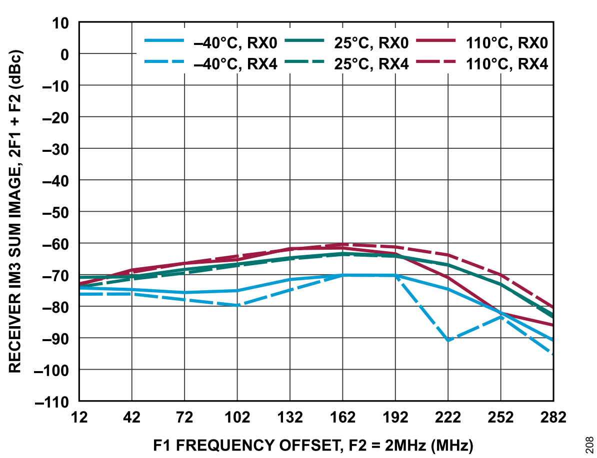


Figure 208. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

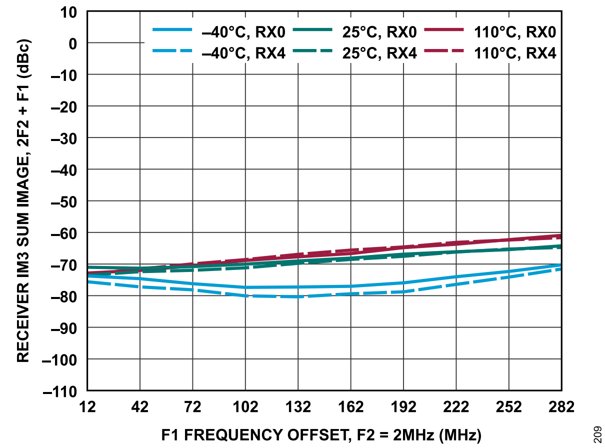


Figure 209. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

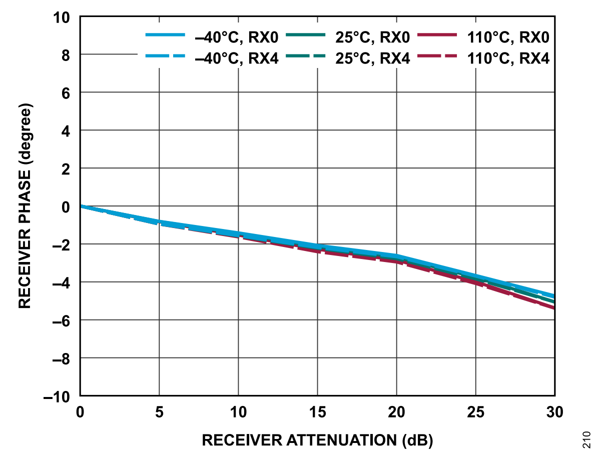


Figure 210. Receiver Phase vs. Receiver Attenuation

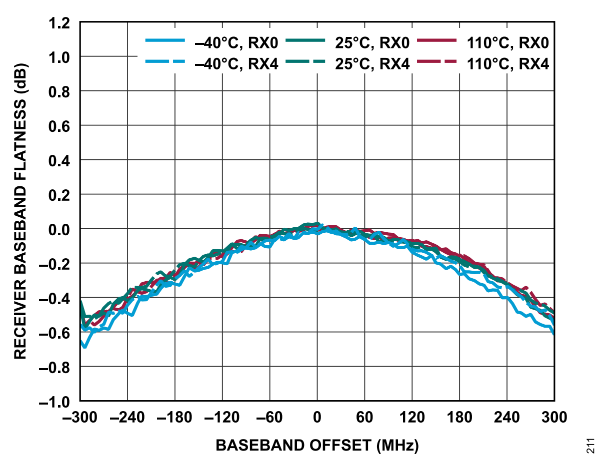


Figure 211. Receiver Baseband Flatness vs. Baseband Offset

TYPICAL PERFORMANCE CHARACTERISTICS

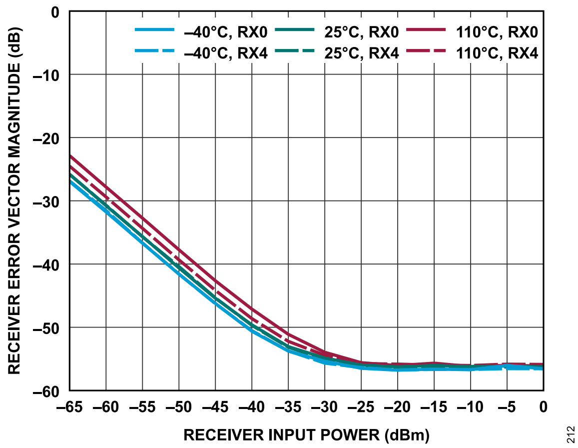


Figure 212. Receiver Error Vector Magnitude vs. Receiver Input Power, 10 MHz Offset, 20 MHz LTE, TDD Mode, AGC Enabled

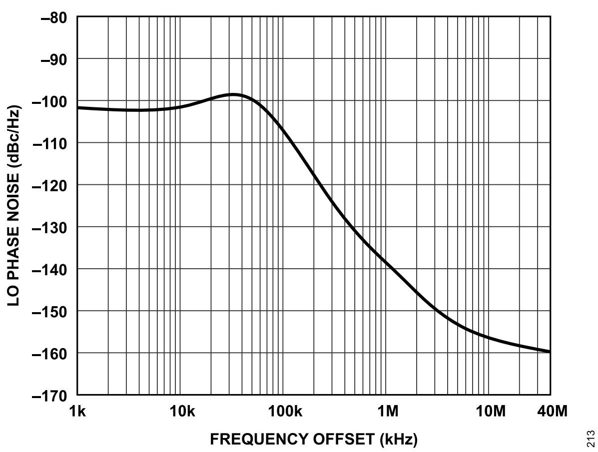


Figure 213. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

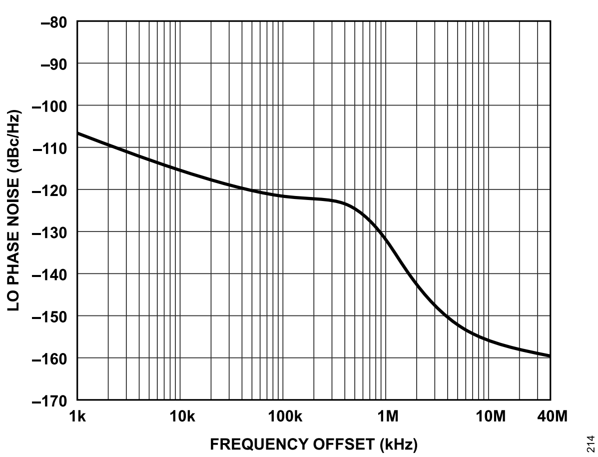


Figure 214. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

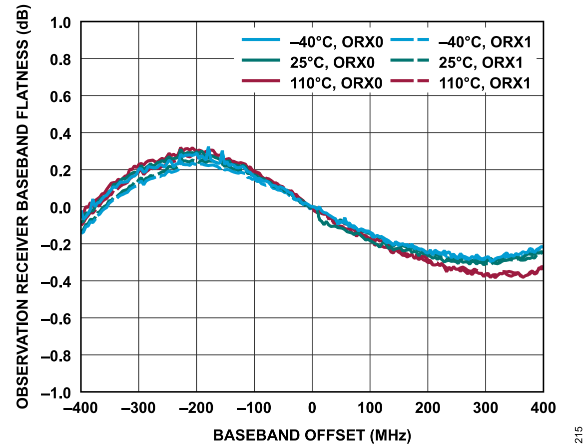


Figure 215. Observation Receiver Baseband Flatness vs. Baseband Offset

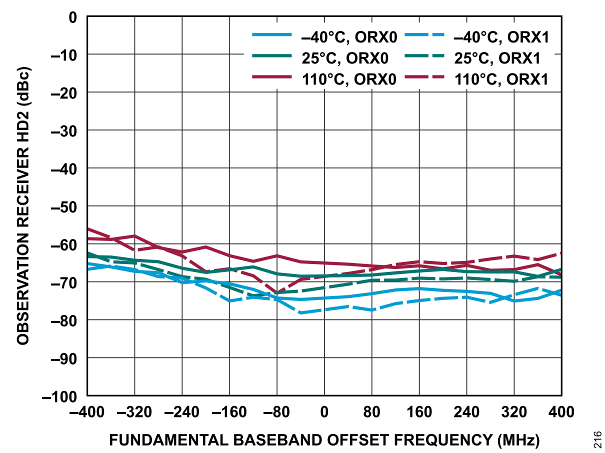


Figure 216. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

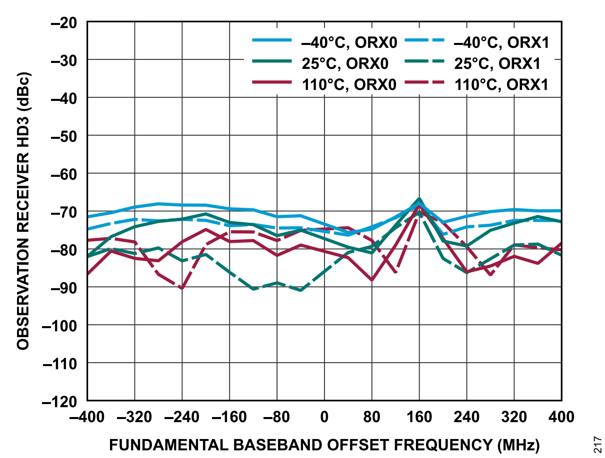


Figure 217. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

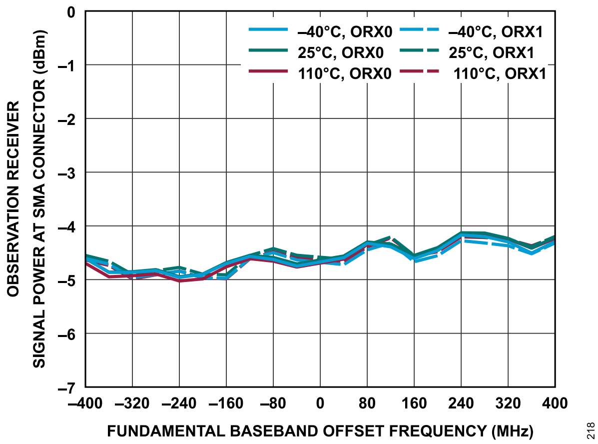


Figure 218. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

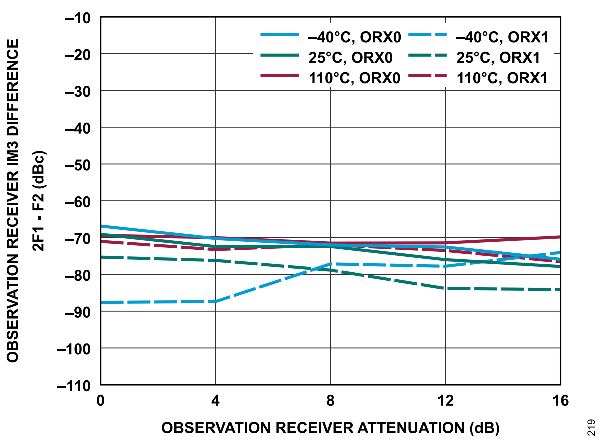


Figure 219. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 1802 MHz, F2 = 1812 MHz

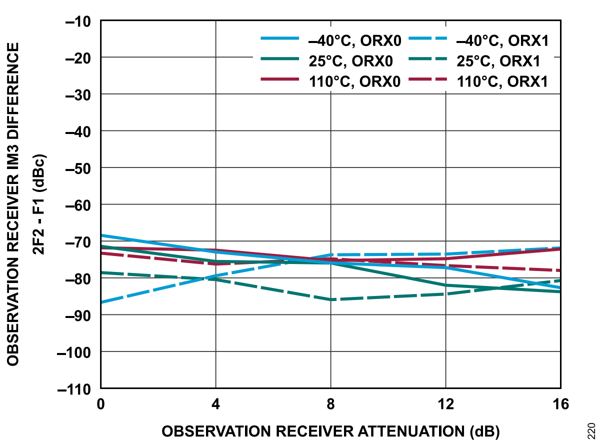


Figure 220. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 1802 MHz, F2 = 1812 MHz

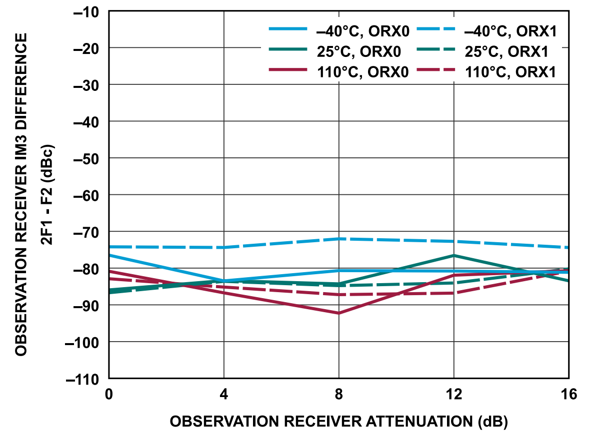


Figure 221. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 1802 MHz, F2 = 2012 MHz

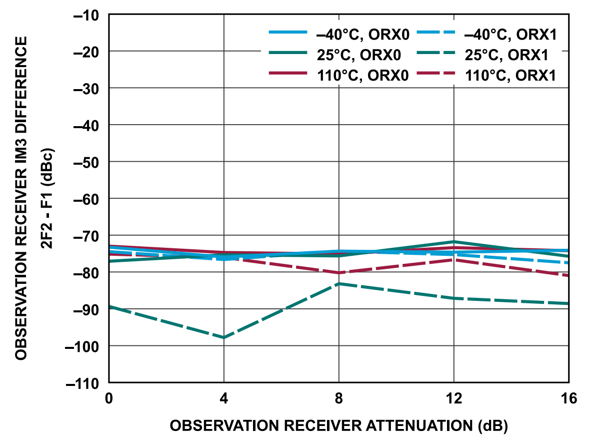


Figure 222. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 1802 MHz, F2 = 2012 MHz

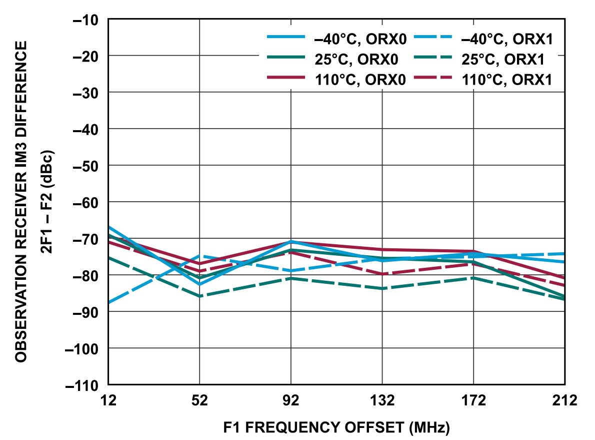


Figure 223. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 1802 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

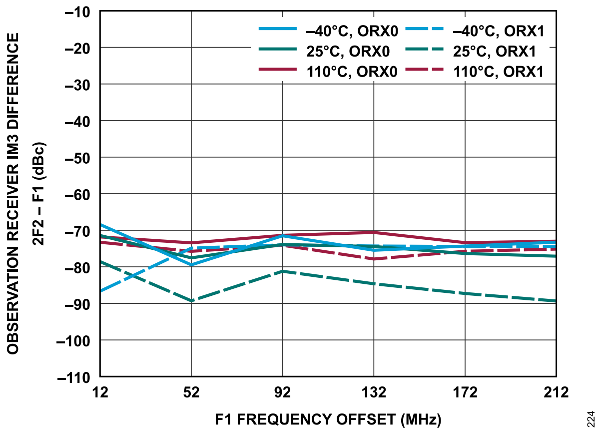


Figure 224. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 1802 MHz

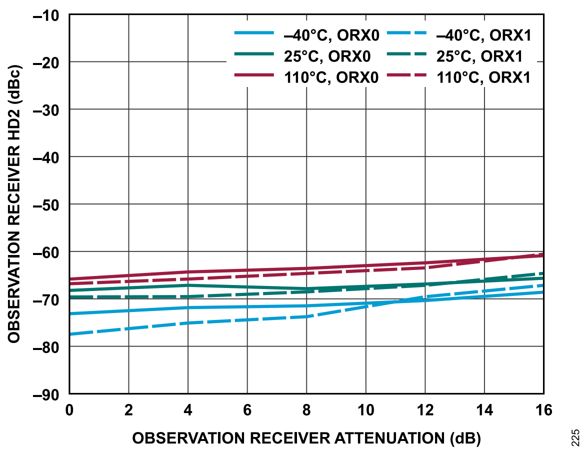


Figure 225. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

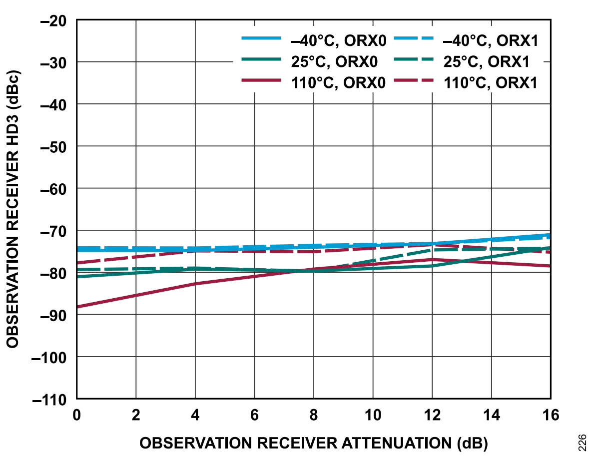


Figure 226. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

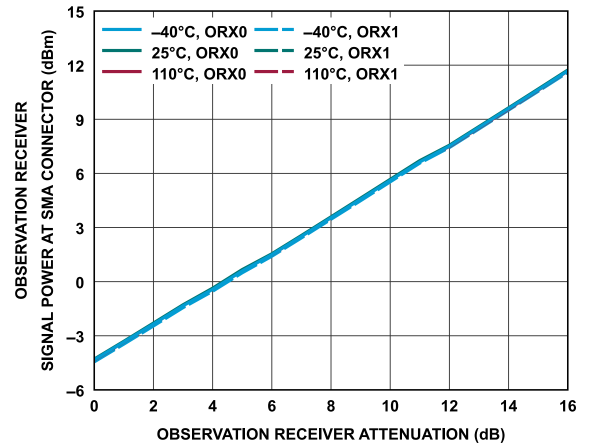


Figure 227. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

2600 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 2600 MHz, unless otherwise noted.

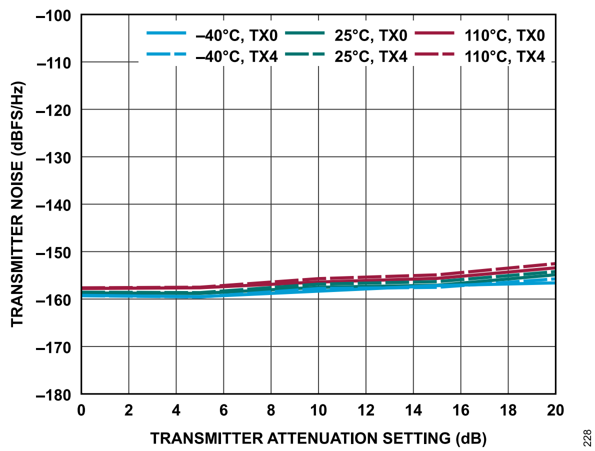


Figure 228. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

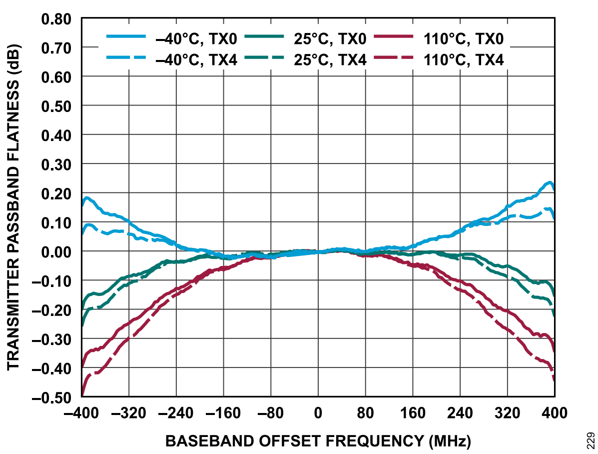


Figure 229. Transmitter Passband Flatness vs. Baseband Offset Frequency

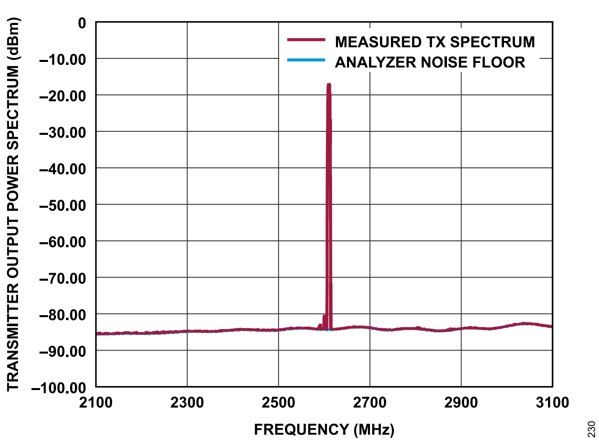


Figure 230. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

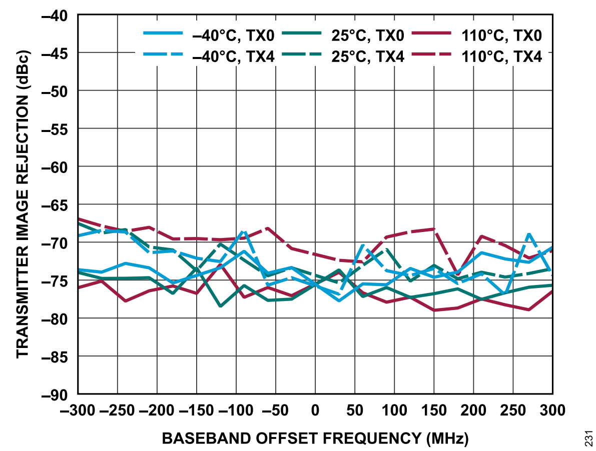


Figure 231. Transmitter Image Rejection vs. Baseband Offset Frequency, −6 dBFS CW Signal

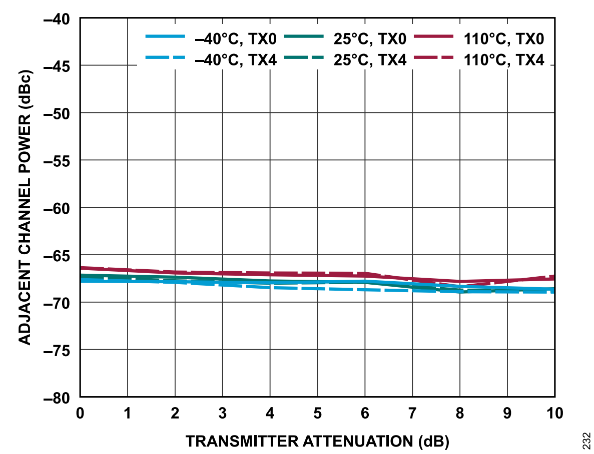


Figure 232. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

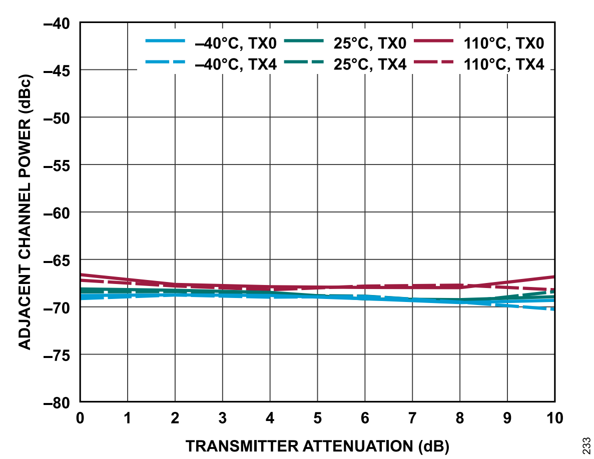


Figure 233. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

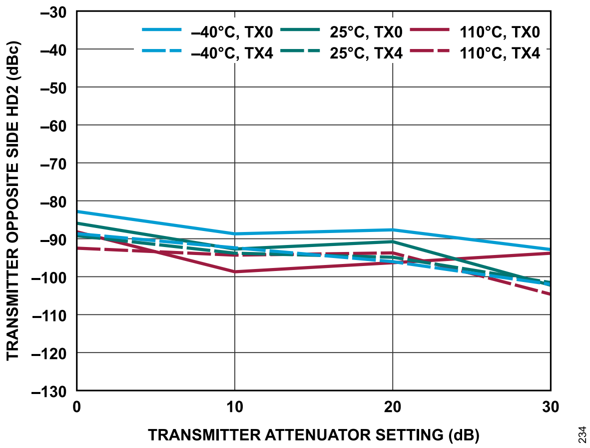


Figure 234. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

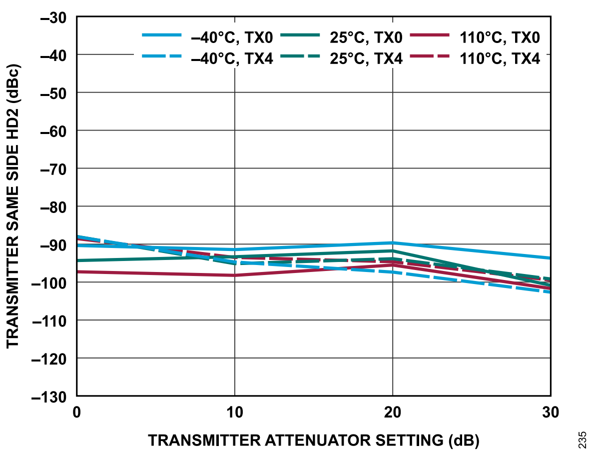


Figure 235. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

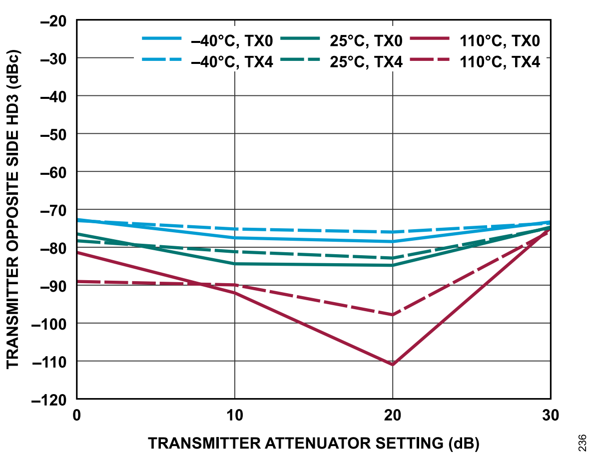


Figure 236. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

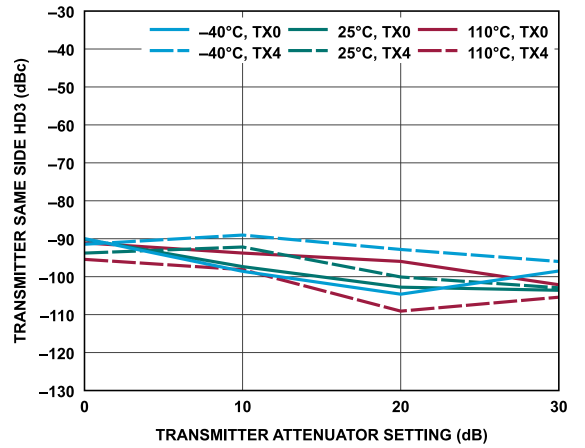


Figure 237. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

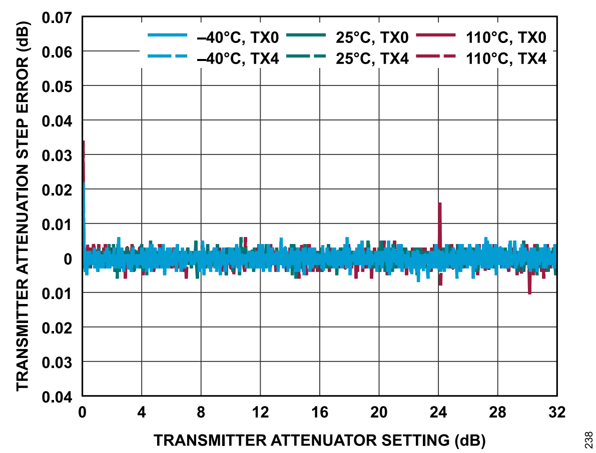


Figure 238. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

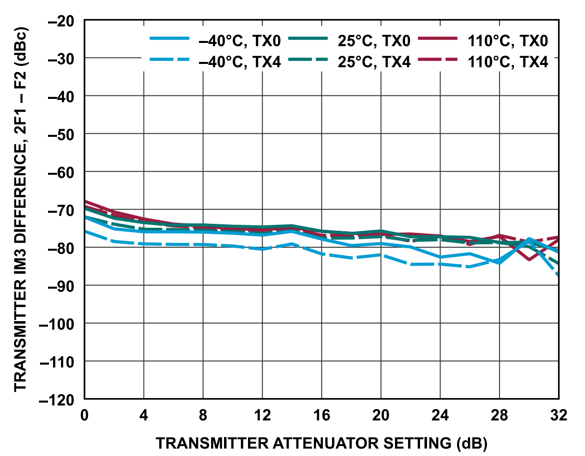


Figure 239. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

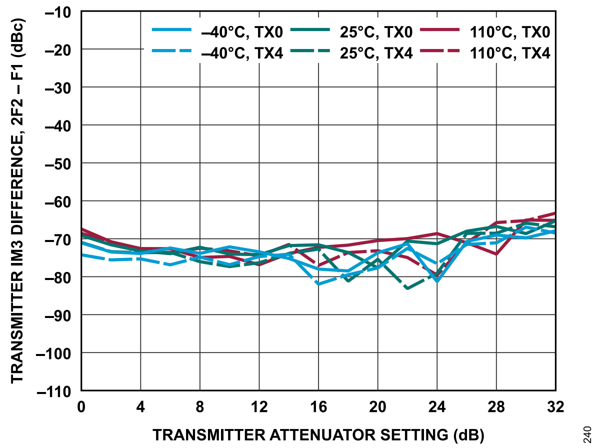


Figure 240. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

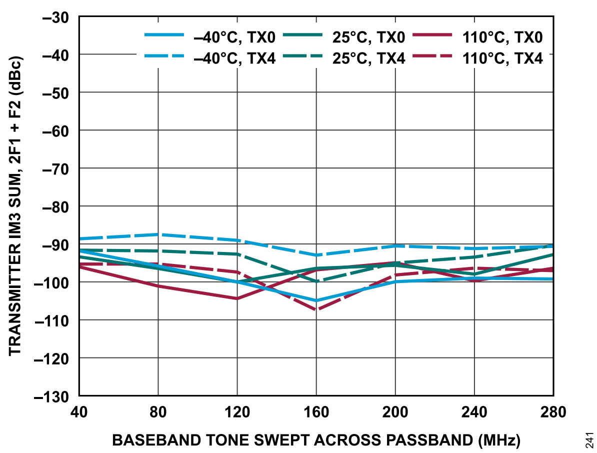


Figure 241. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

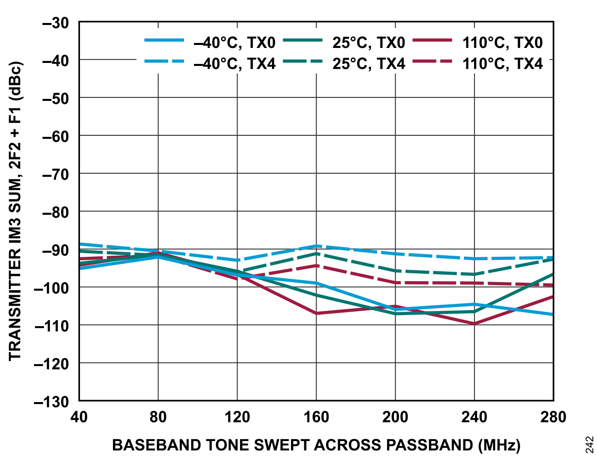


Figure 242. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

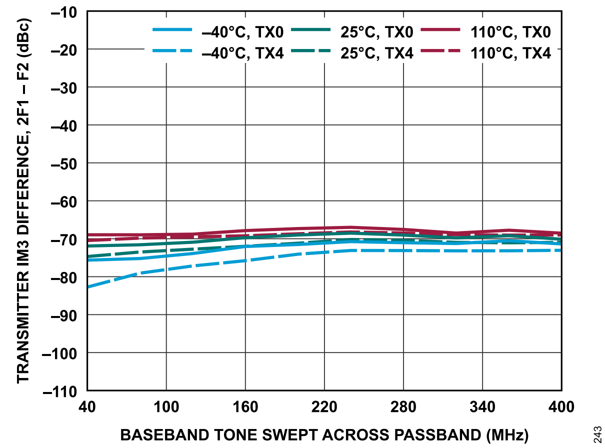


Figure 243. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

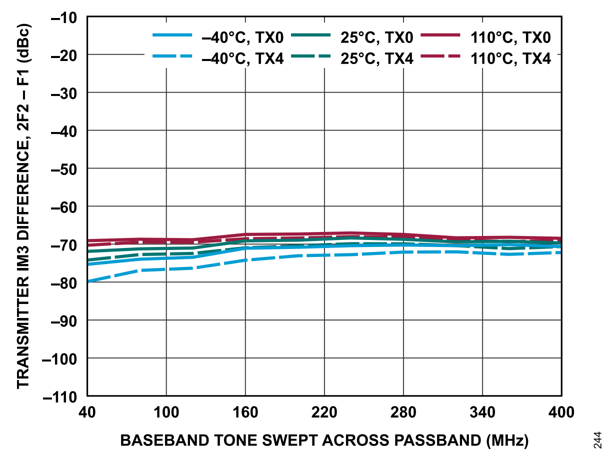


Figure 244. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

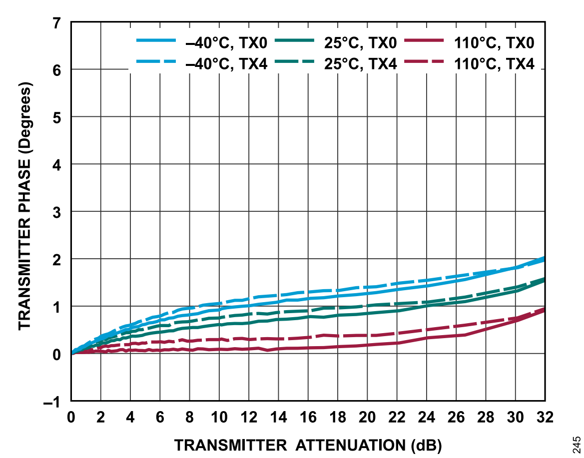


Figure 245. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

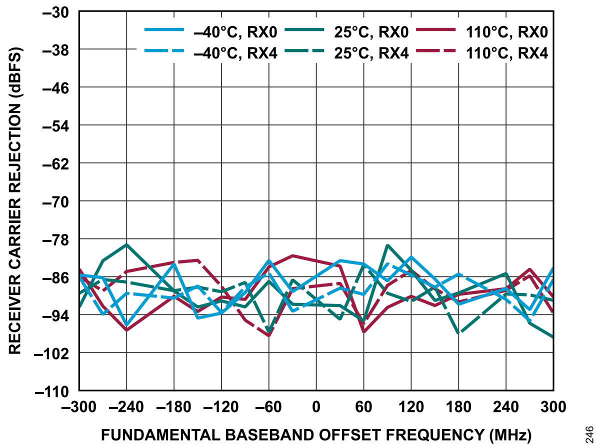


Figure 246. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

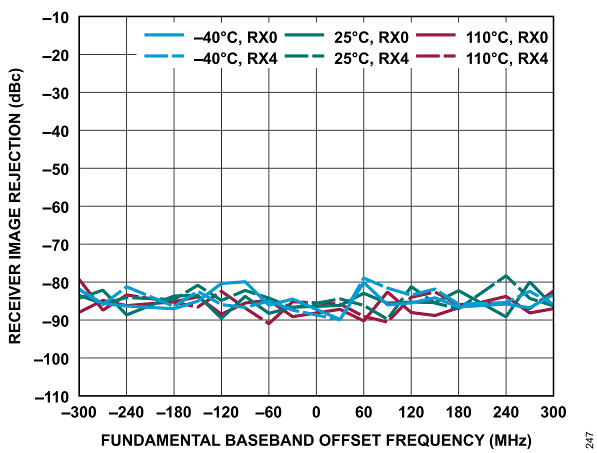


Figure 247. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

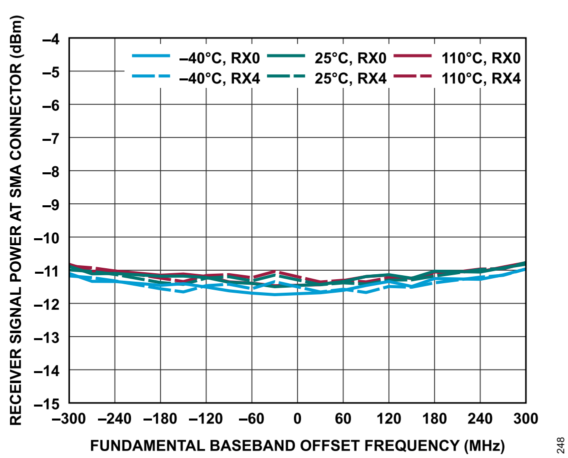


Figure 248. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

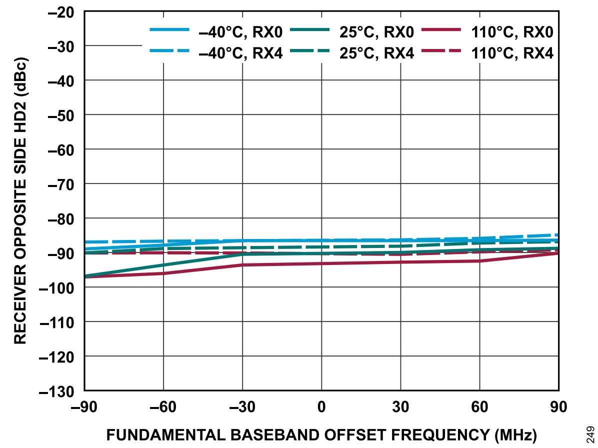


Figure 249. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

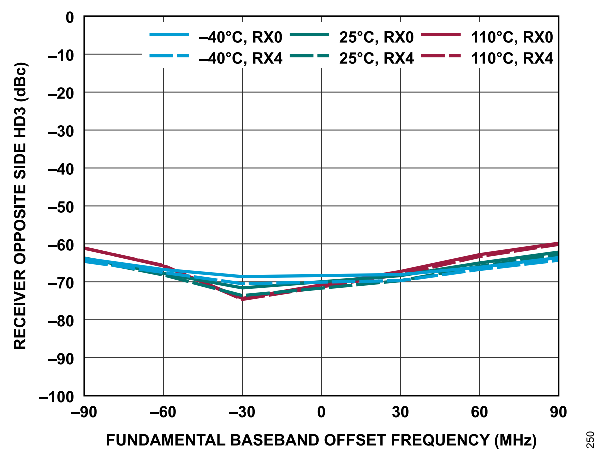


Figure 250. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

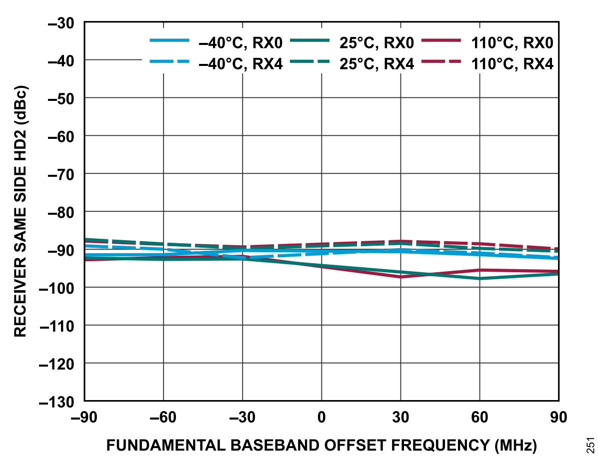


Figure 251. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

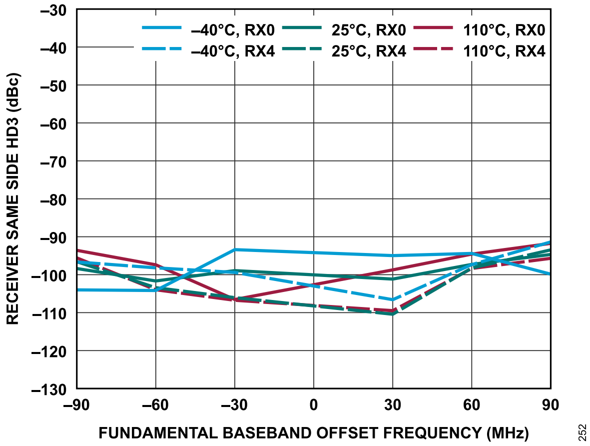


Figure 252. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

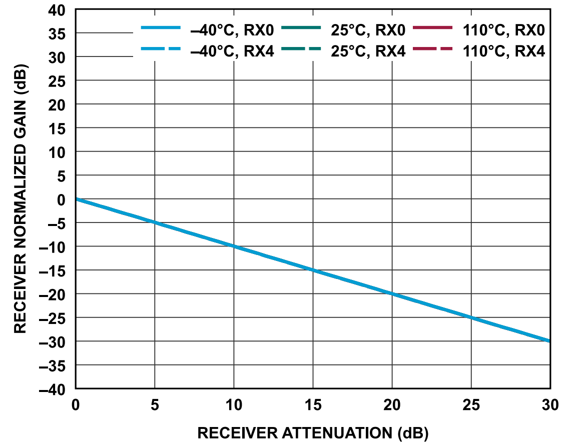


Figure 255. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

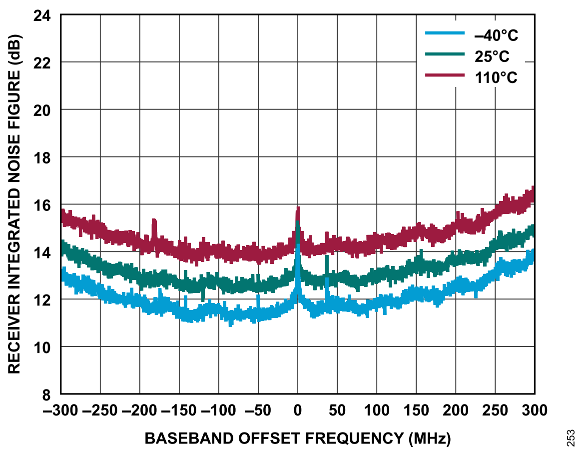


Figure 253. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

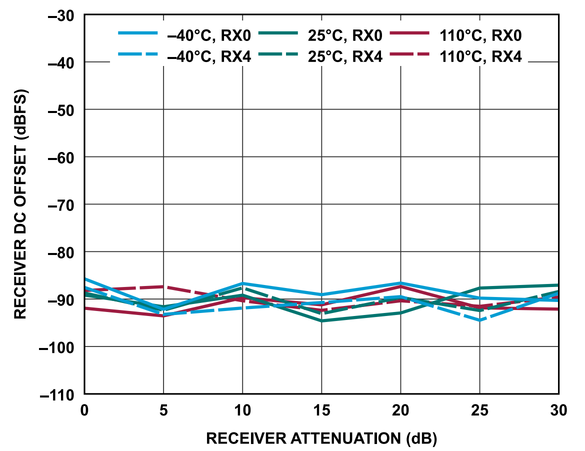


Figure 256. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

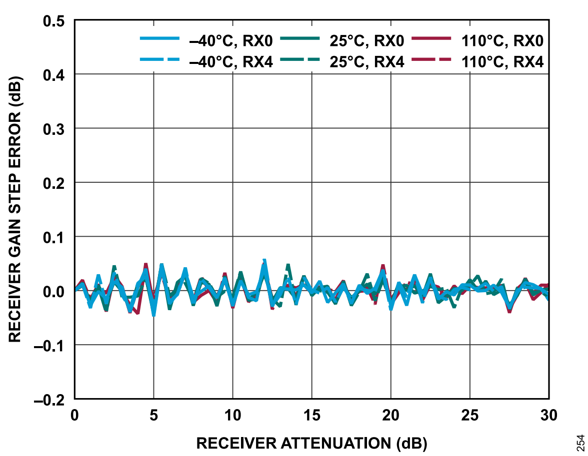


Figure 254. Receiver Gain Step Error vs. Attenuation, 30 MHz Offset, −1 dBFS Input Signal

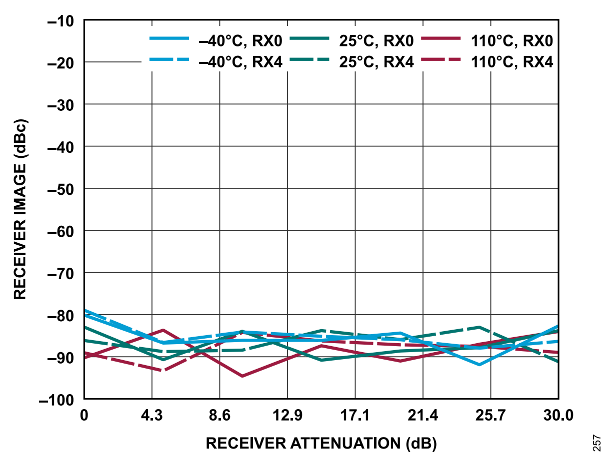


Figure 257. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

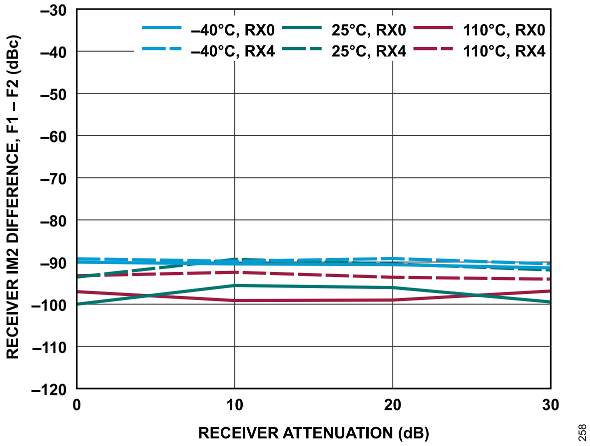


Figure 258. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

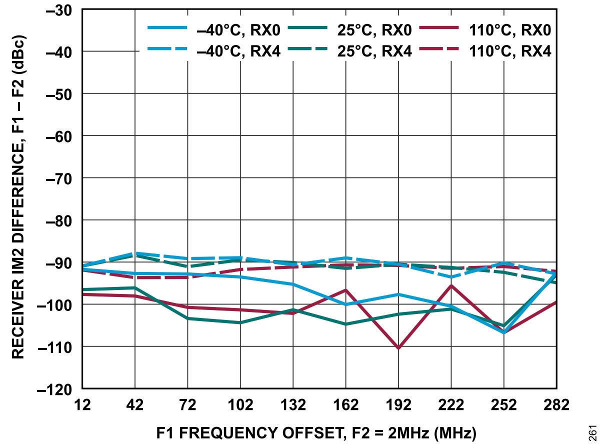


Figure 261. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

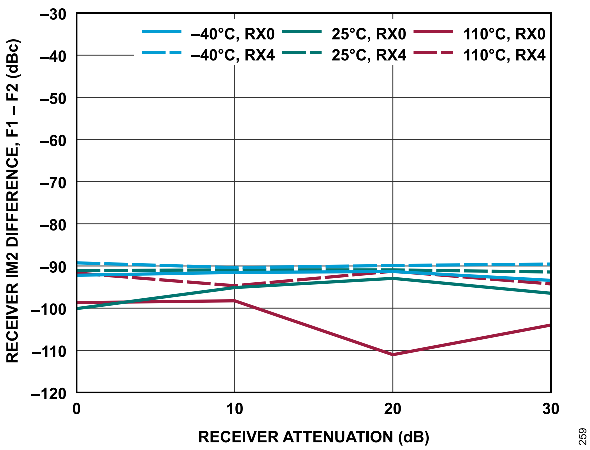


Figure 259. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

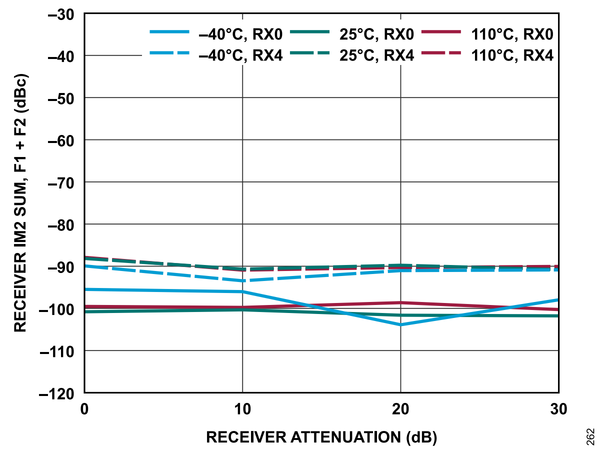


Figure 262. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

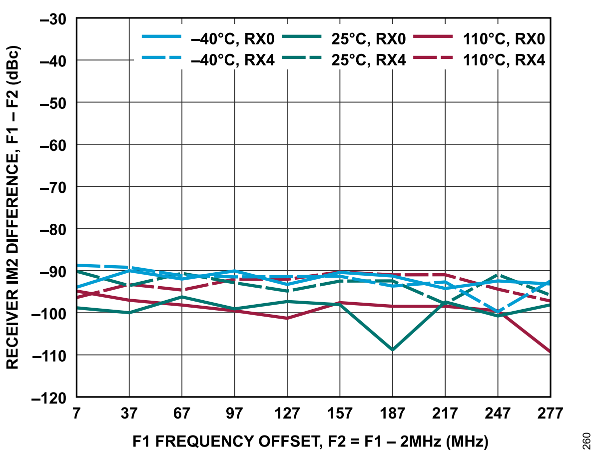


Figure 260. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

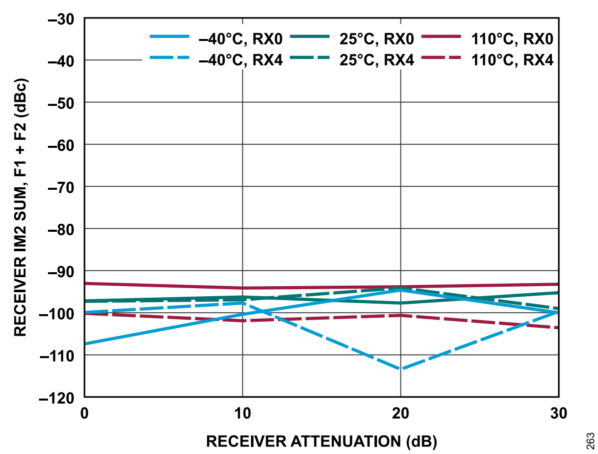


Figure 263. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

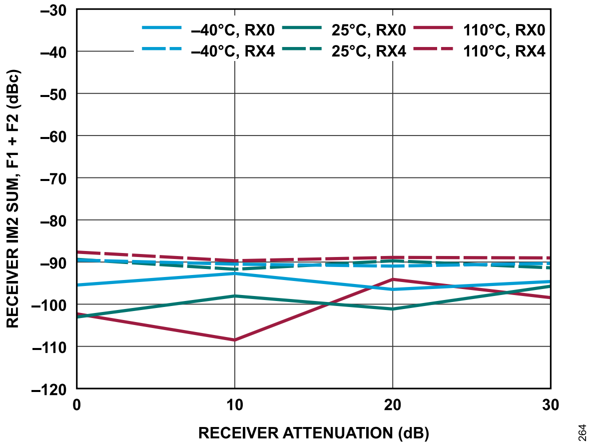


Figure 264. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

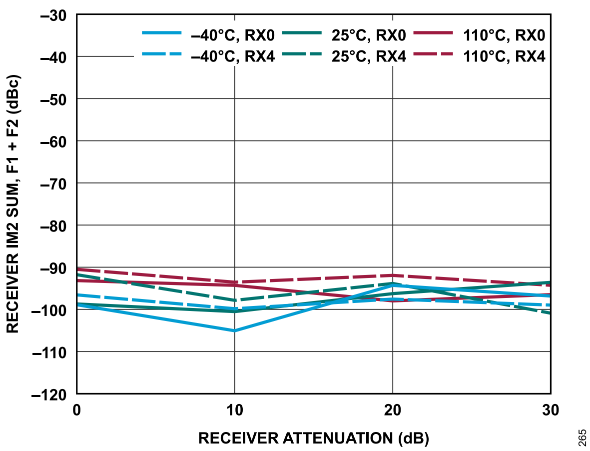


Figure 265. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 282 MHz Offset, F2 = 2 MHz Offset

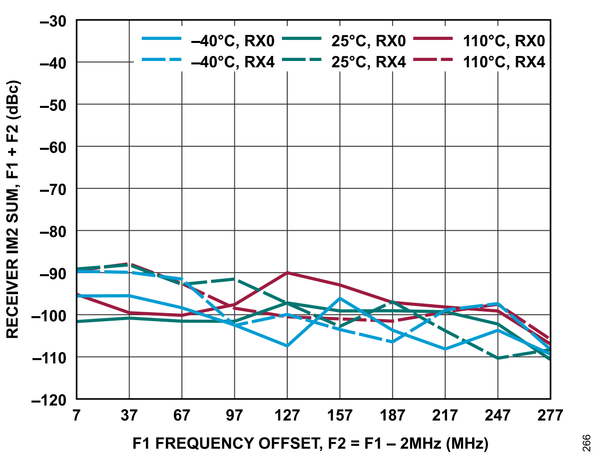


Figure 266. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

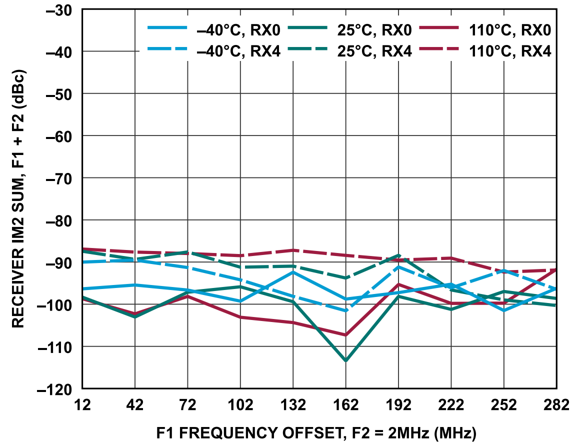


Figure 267. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

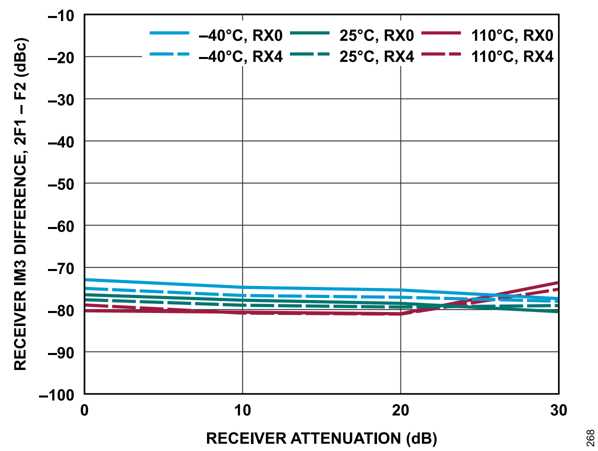


Figure 268. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

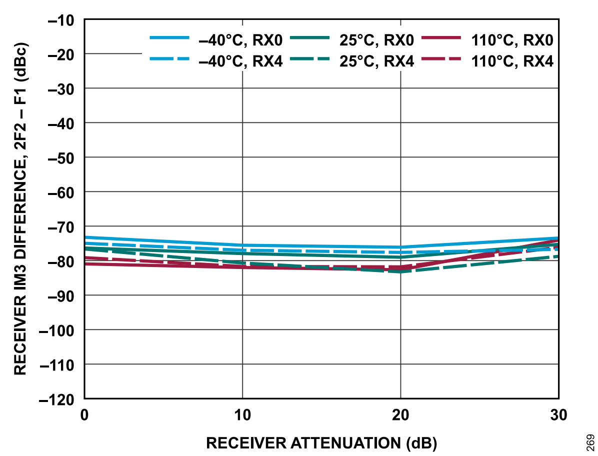


Figure 269. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

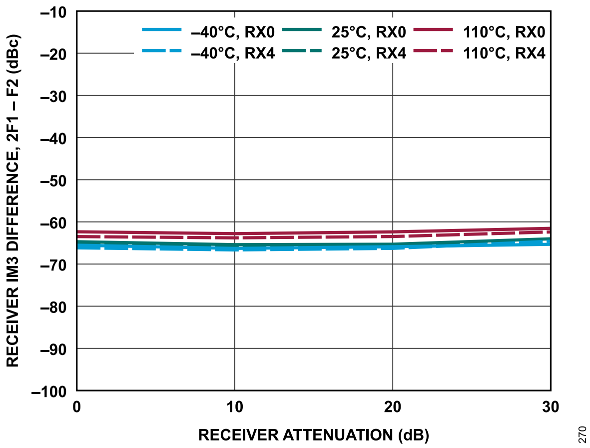


Figure 270. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

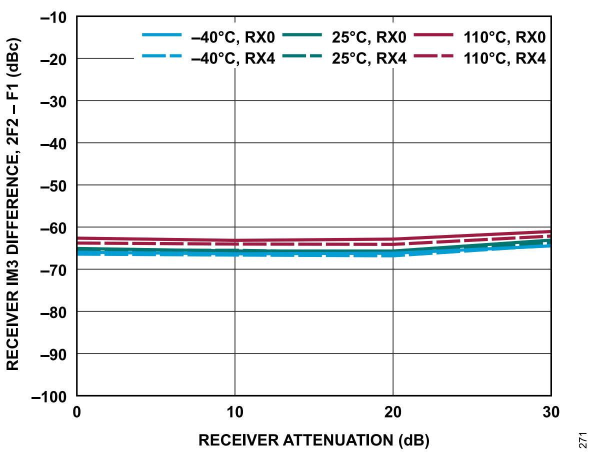


Figure 271. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

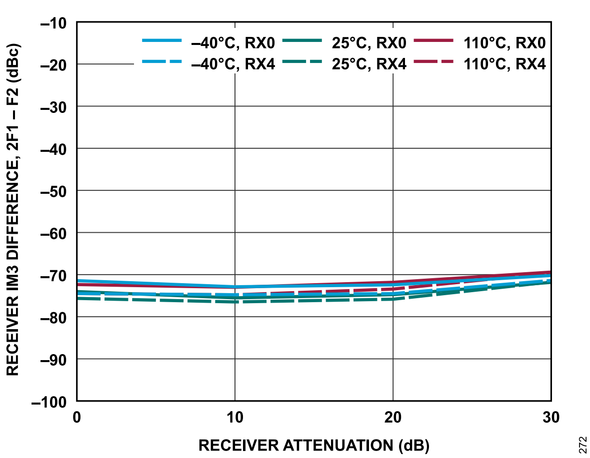


Figure 272. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

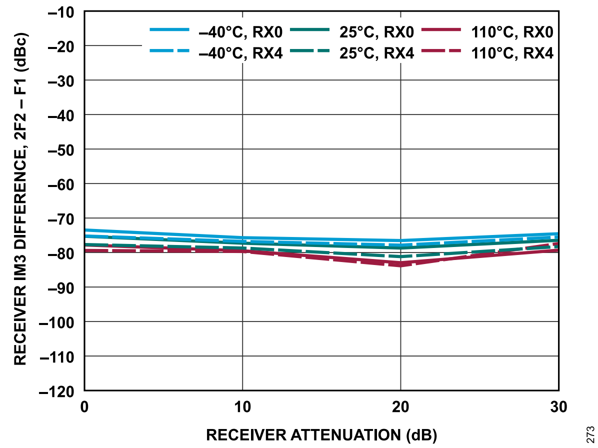


Figure 273. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

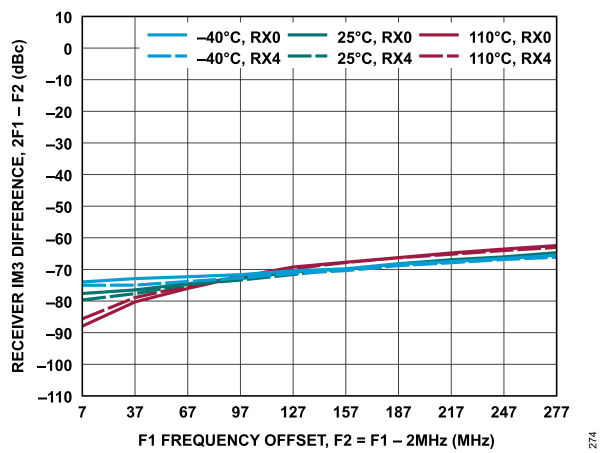


Figure 274. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

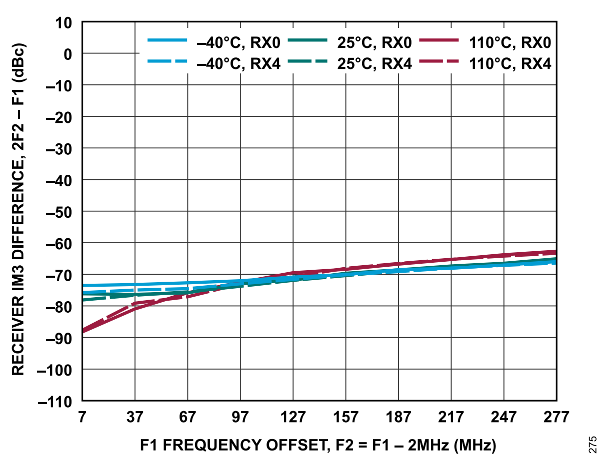


Figure 275. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

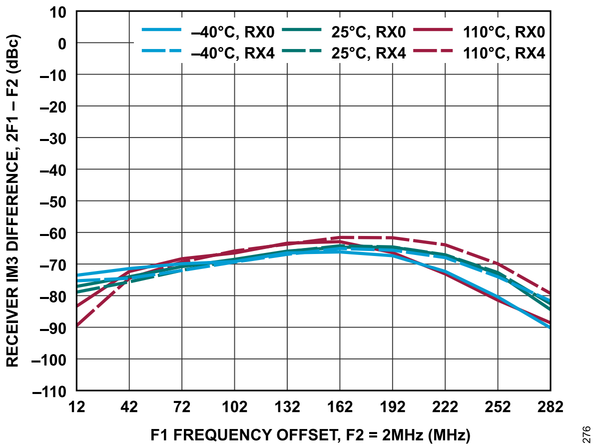


Figure 276. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

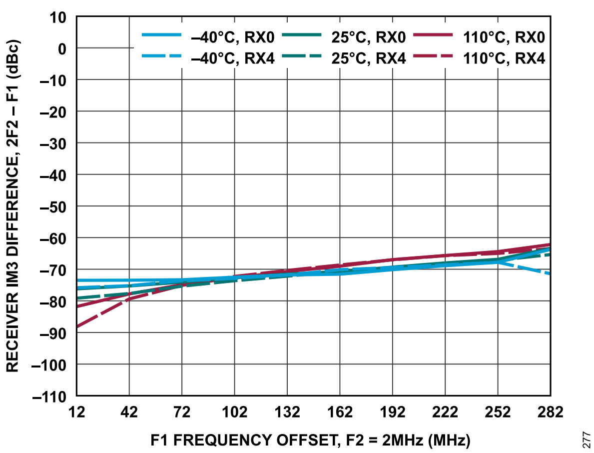


Figure 277. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

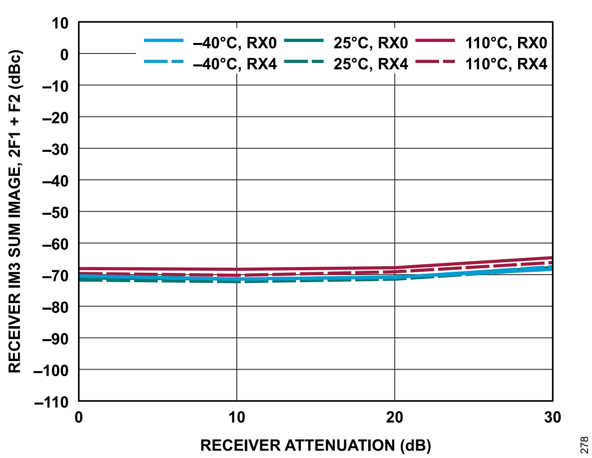


Figure 278. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

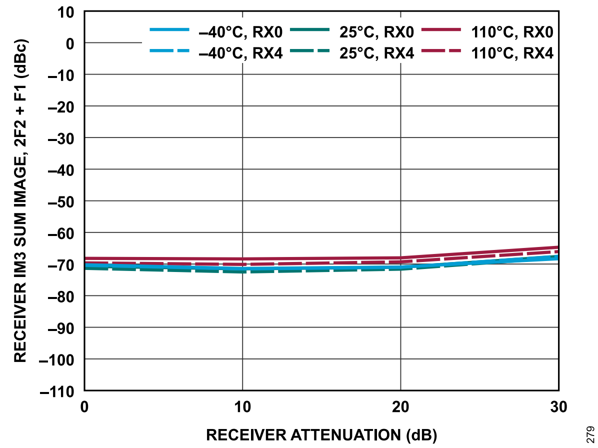


Figure 279. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

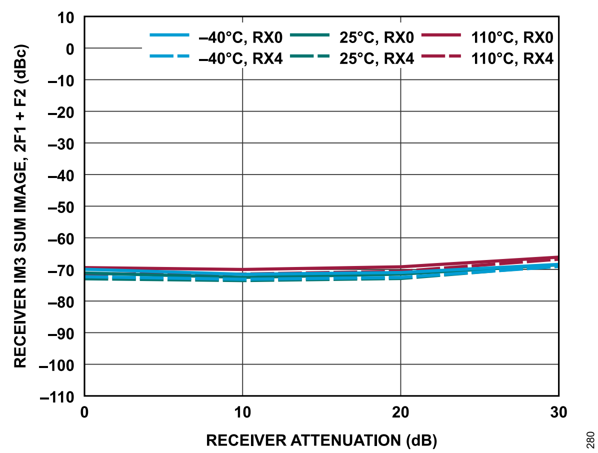


Figure 280. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

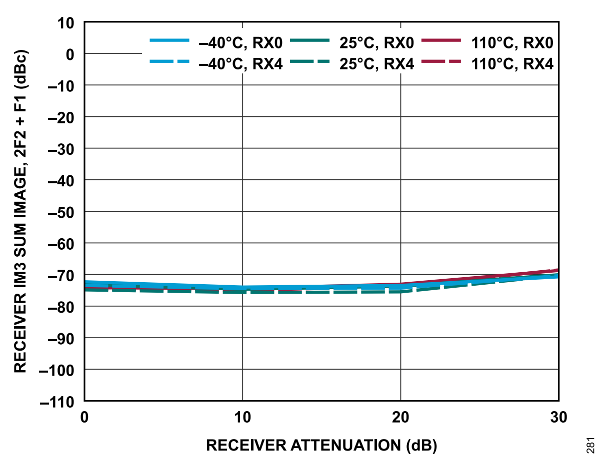


Figure 281. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

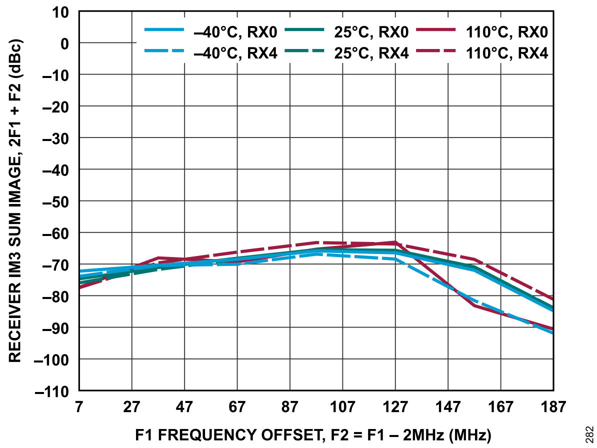


Figure 282. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

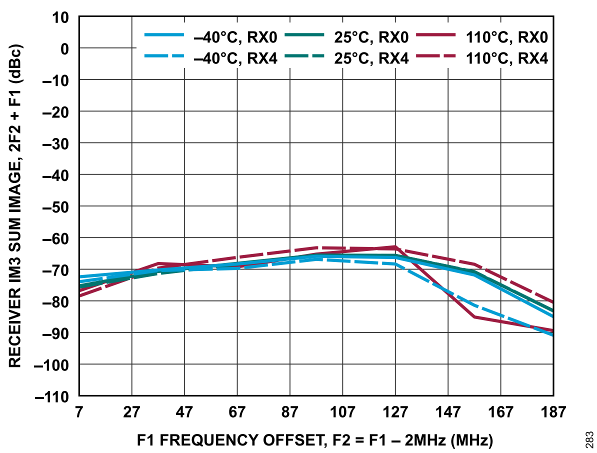


Figure 283. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

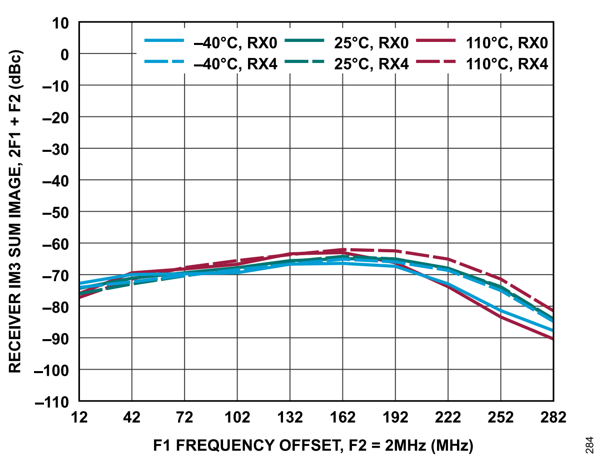


Figure 284. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

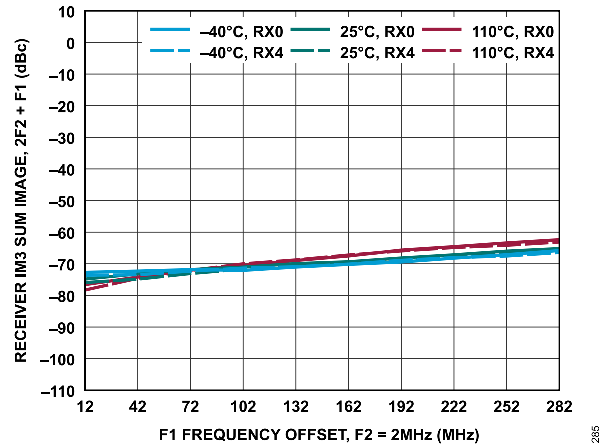


Figure 285. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

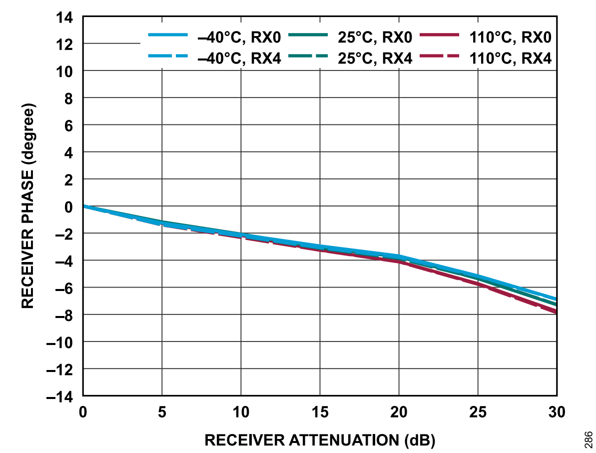


Figure 286. Receiver Phase vs. Receiver Attenuation

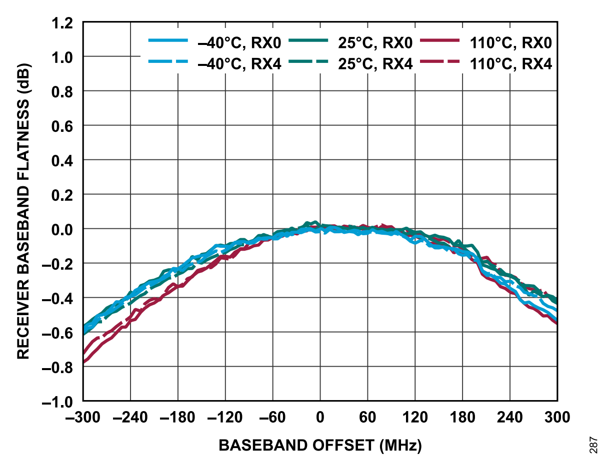


Figure 287. Receiver Baseband Flatness vs. Baseband Offset

TYPICAL PERFORMANCE CHARACTERISTICS

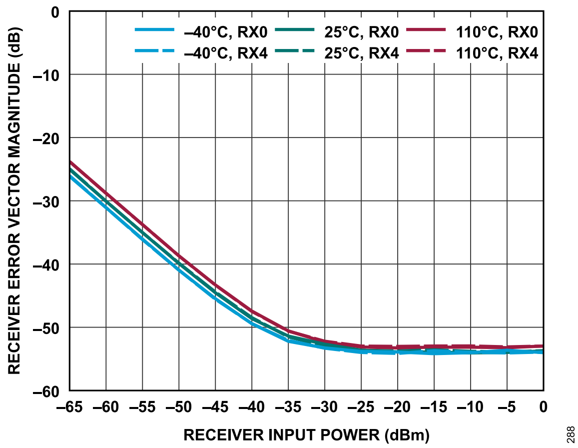


Figure 288. Receiver Error Vector Magnitude vs. Receiver Input Power, 10 MHz Offset, 20 MHz LTE, TDD Mode, AGC Enabled

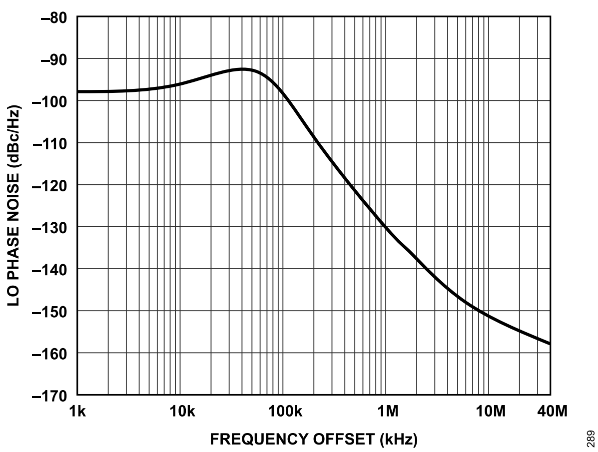


Figure 289. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

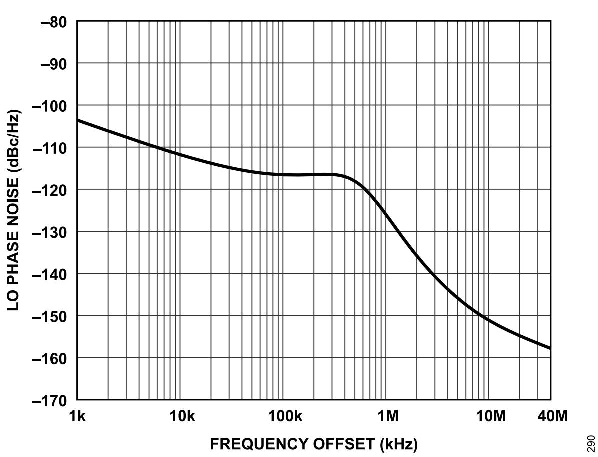


Figure 290. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

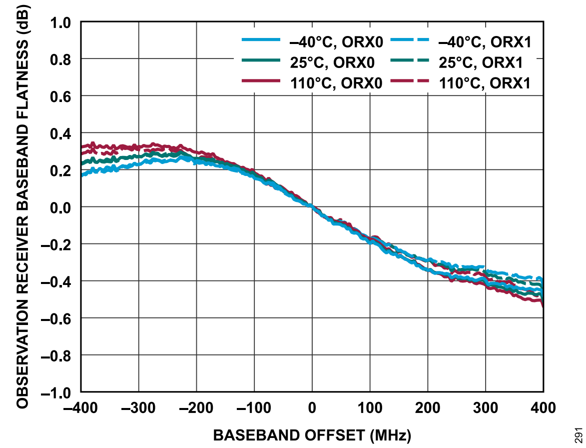


Figure 291. Observation Receiver Baseband Flatness vs. Baseband Offset

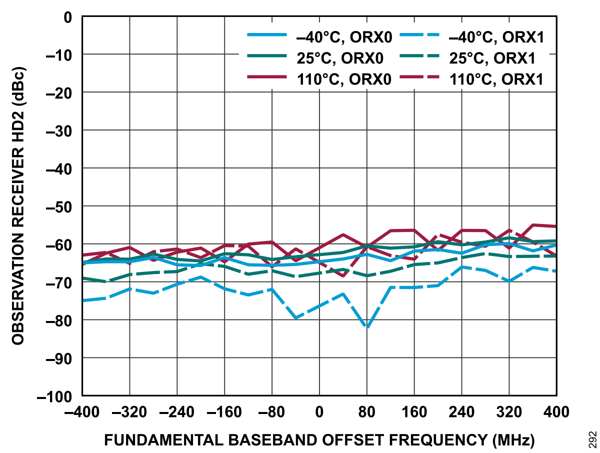


Figure 292. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

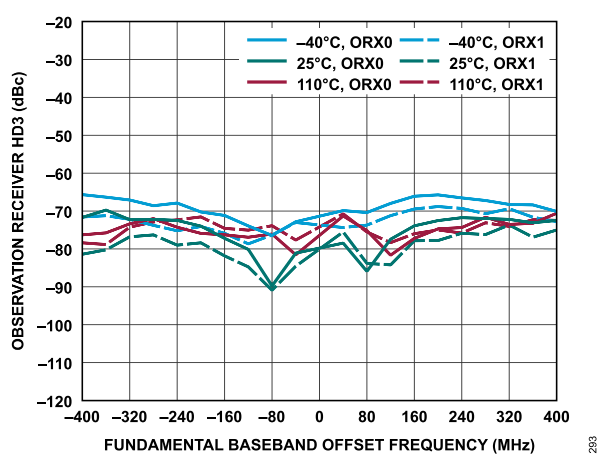


Figure 293. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

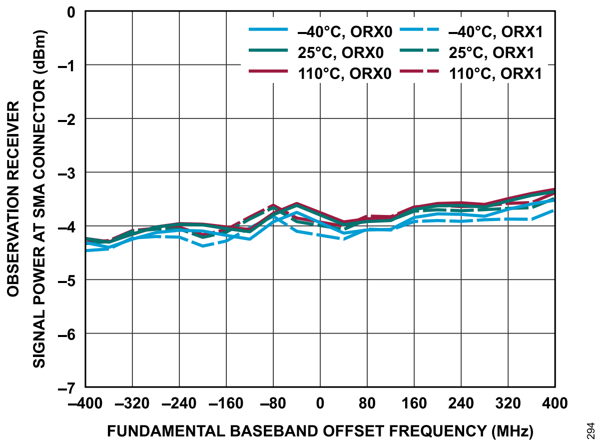


Figure 294. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

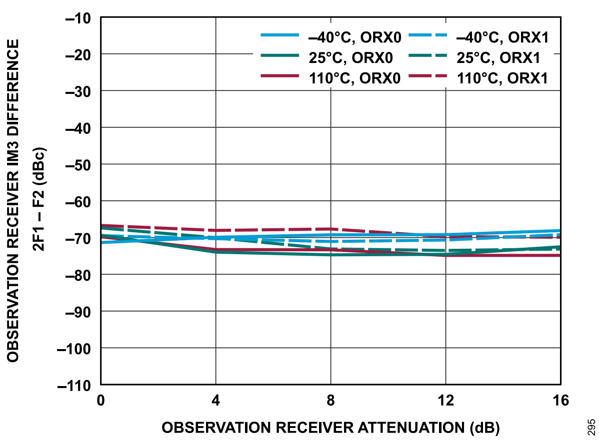


Figure 295. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 2602 MHz, F2 = 2612 MHz

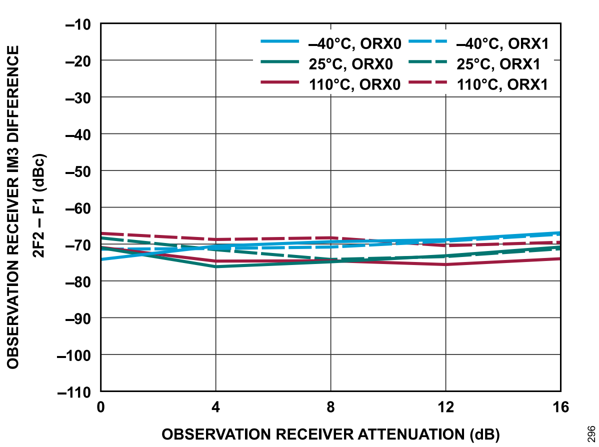


Figure 296. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 2602 MHz, F2 = 2612 MHz

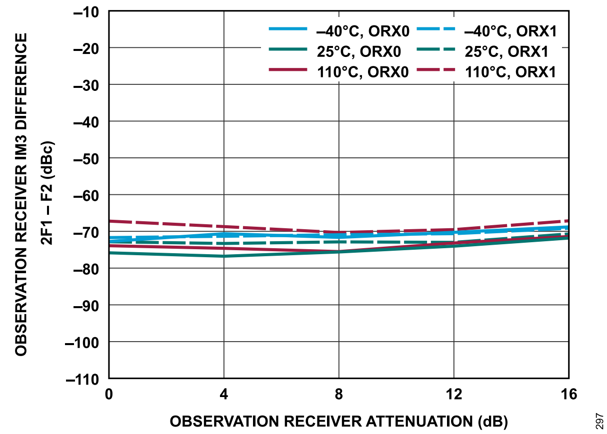


Figure 297. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 2602 MHz, F2 = 2812 MHz

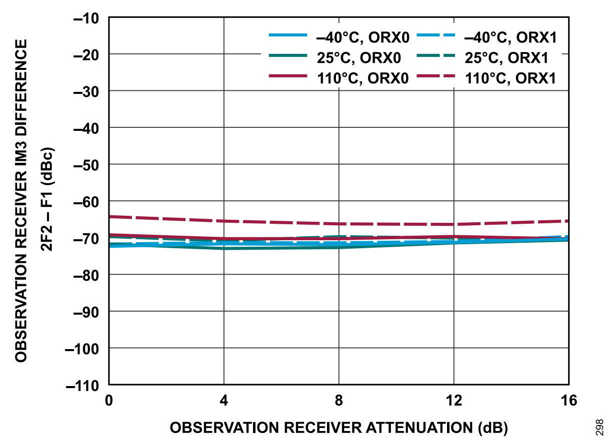


Figure 298. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 2602 MHz, F2 = 2812 MHz

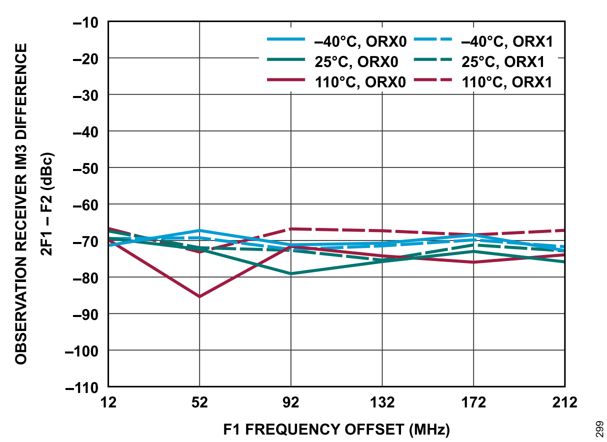


Figure 299. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 2602 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

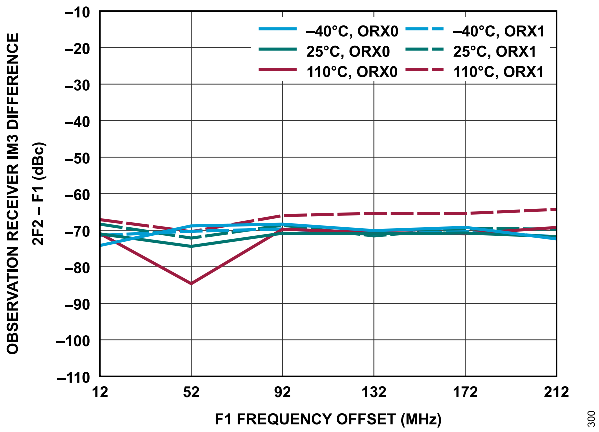


Figure 300. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 2602 MHz

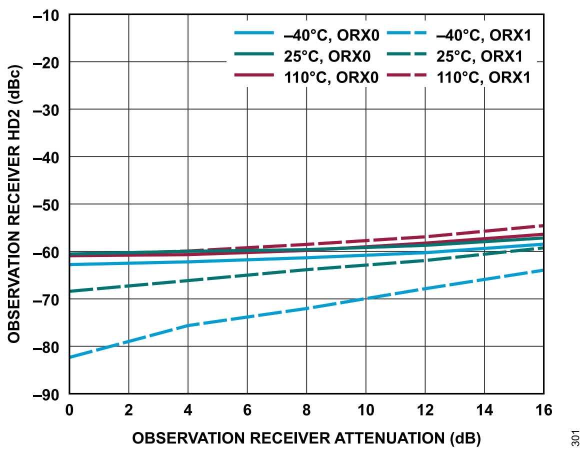


Figure 301. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

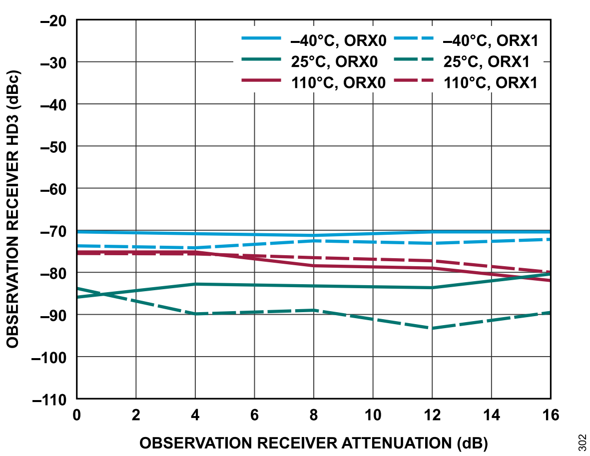


Figure 302. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

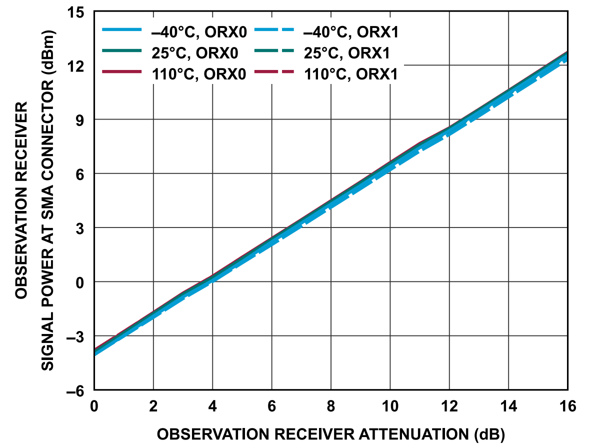


Figure 303. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

3500 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 3500 MHz, unless otherwise noted.

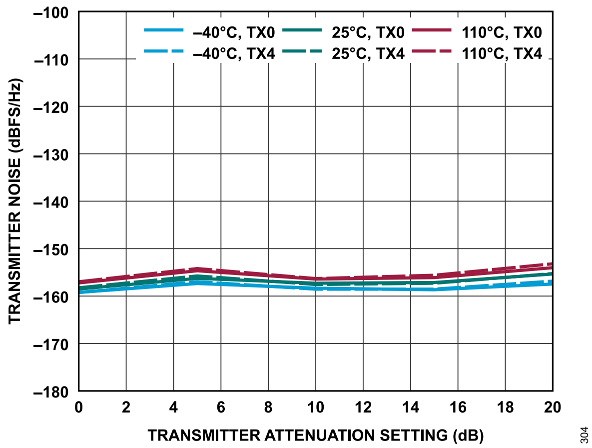


Figure 304. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

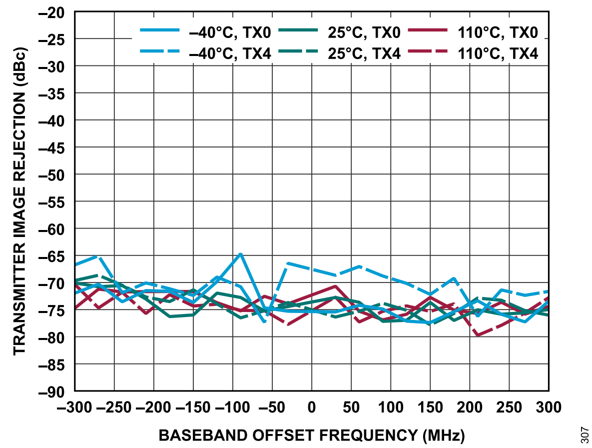


Figure 307. Transmitter Image Rejection vs. Baseband Offset Frequency, −6 dBFS CW Signal

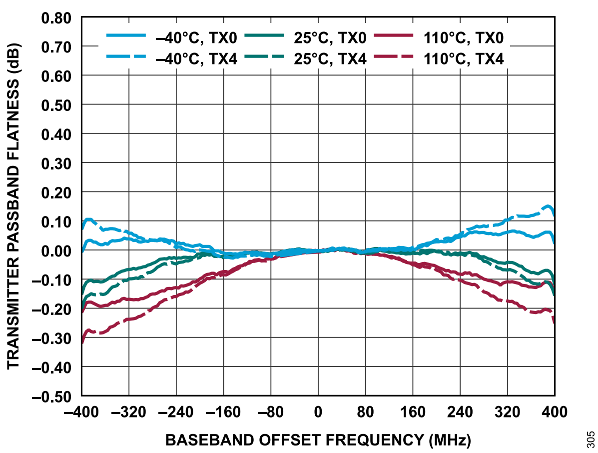


Figure 305. Transmitter Passband Flatness vs. Baseband Offset Frequency

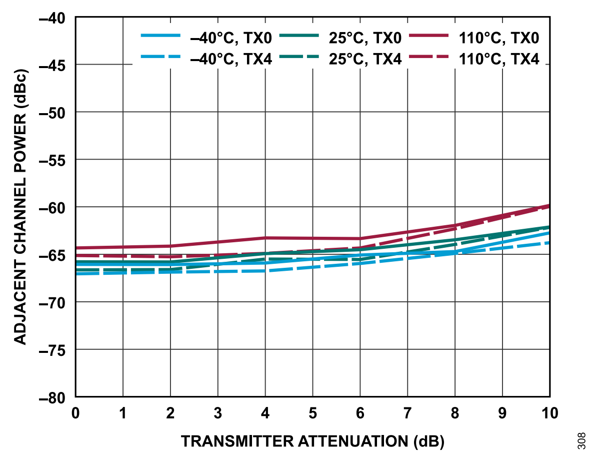


Figure 308. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

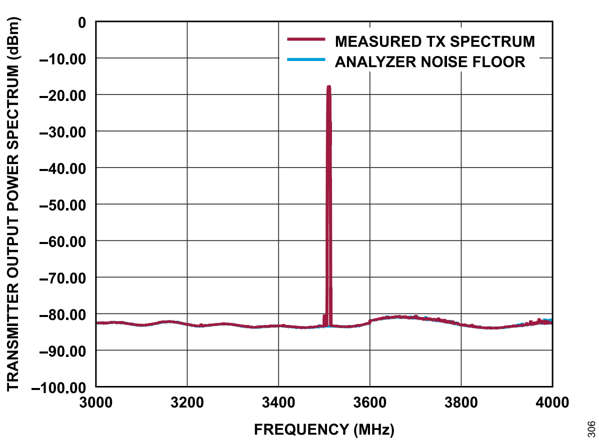


Figure 306. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

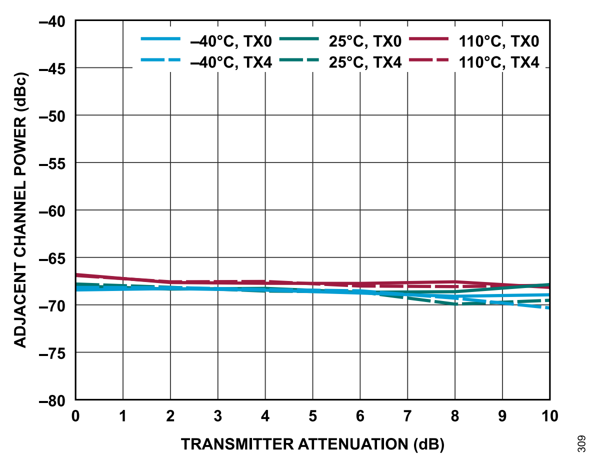


Figure 309. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

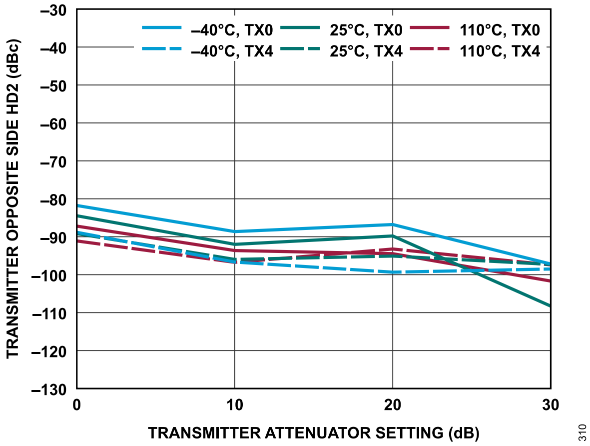


Figure 310. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

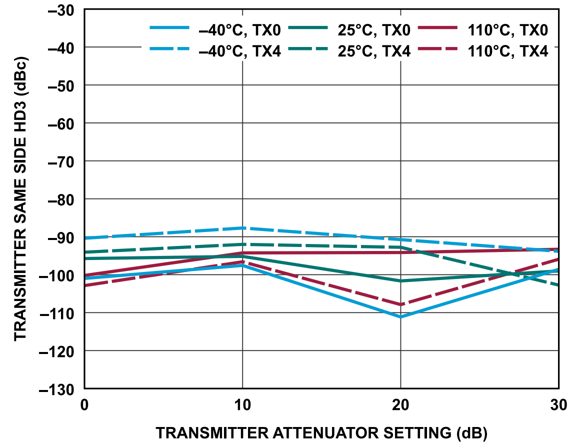


Figure 313. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

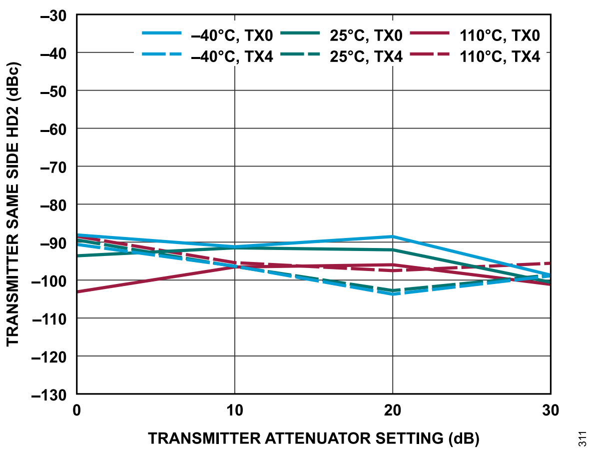


Figure 311. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

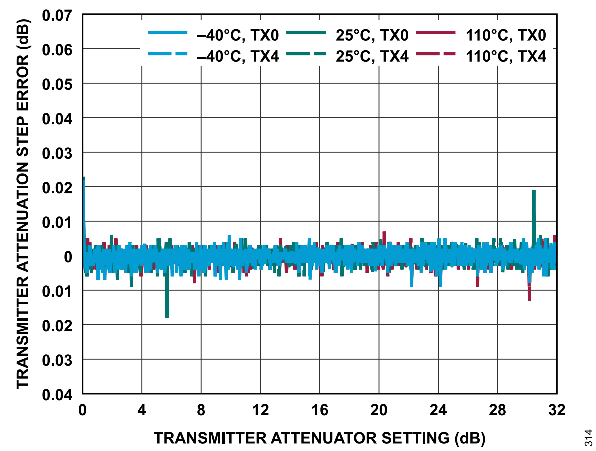


Figure 314. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

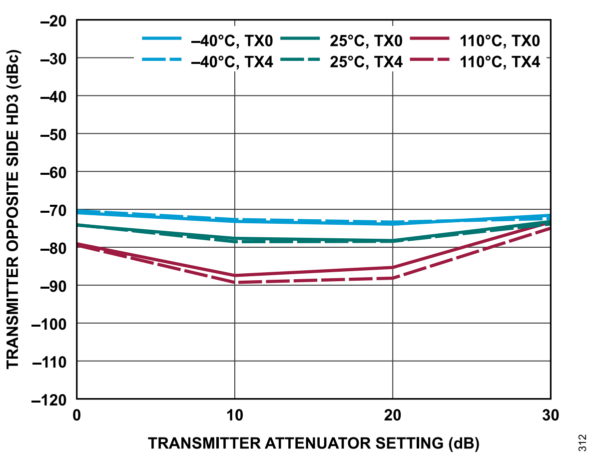


Figure 312. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

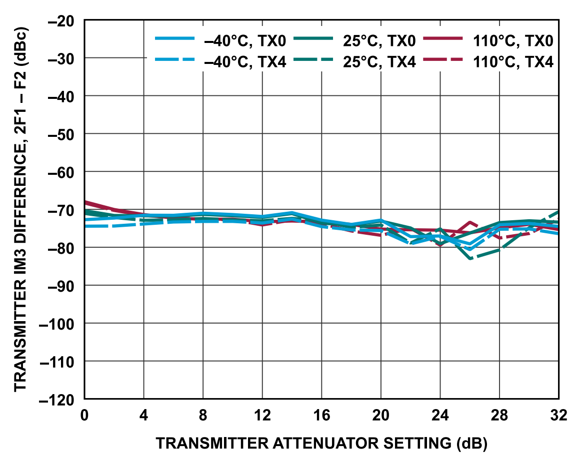


Figure 315. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

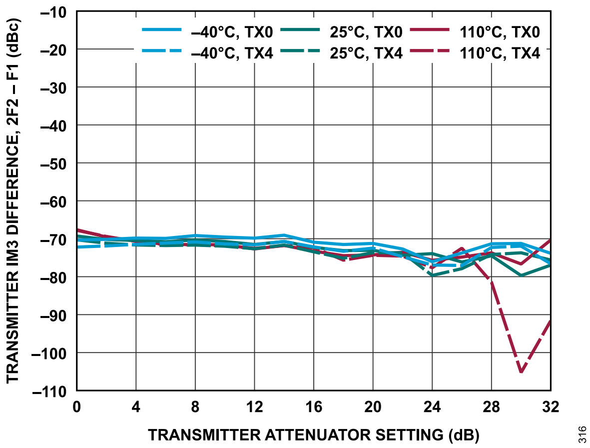


Figure 316. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

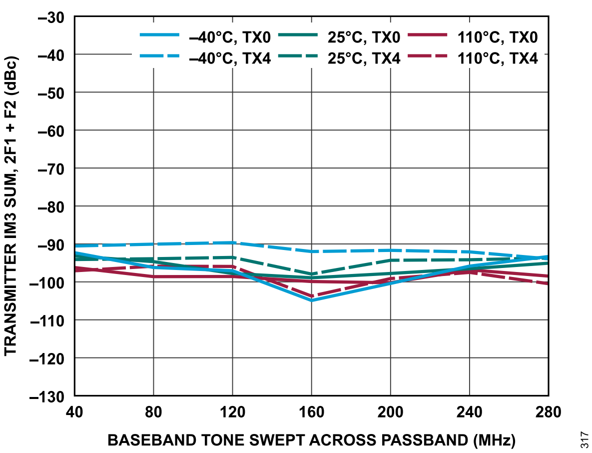


Figure 317. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

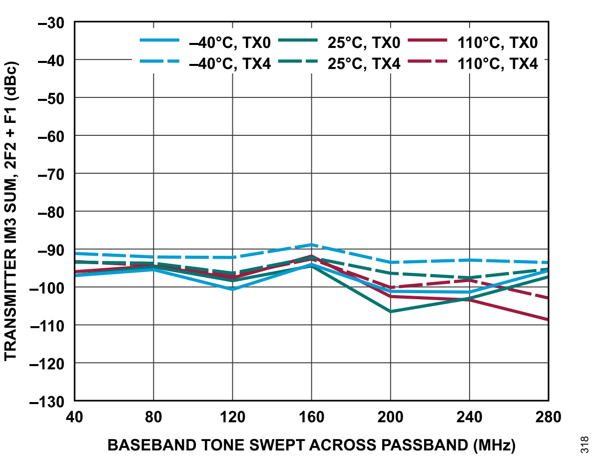


Figure 318. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

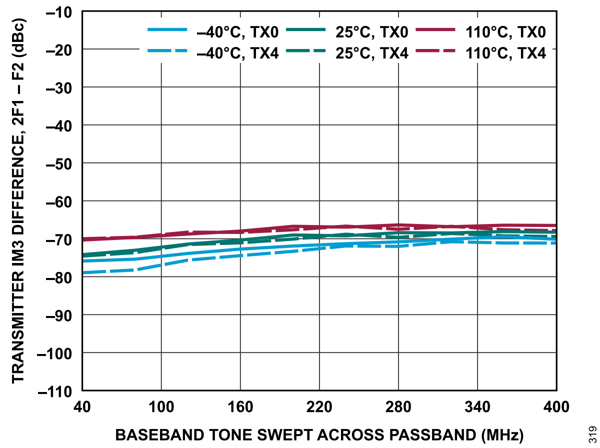


Figure 319. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

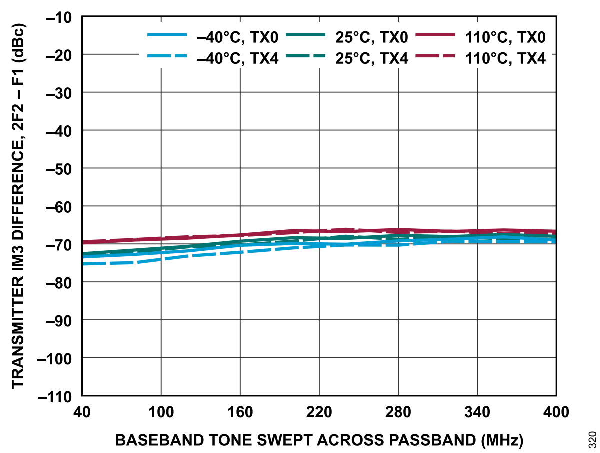


Figure 320. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

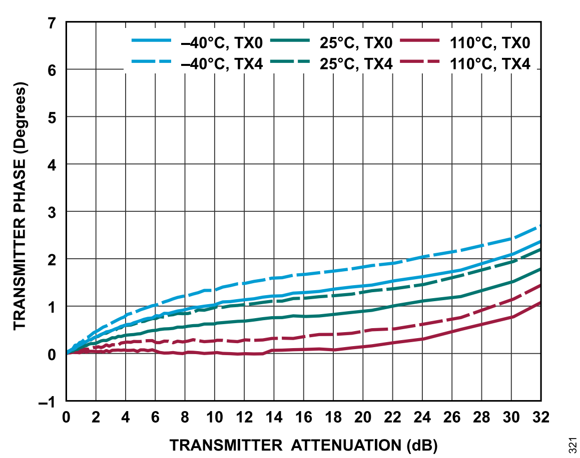


Figure 321. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

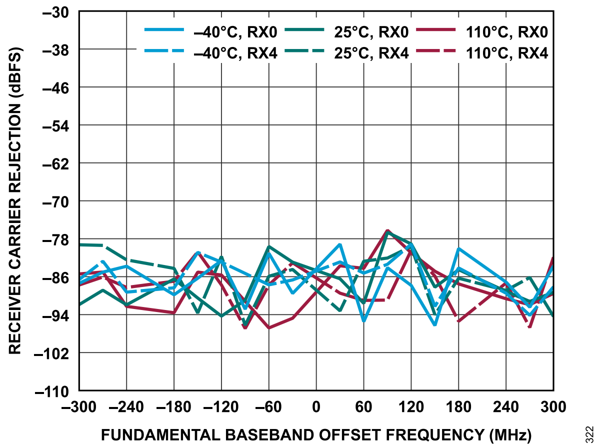


Figure 322. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

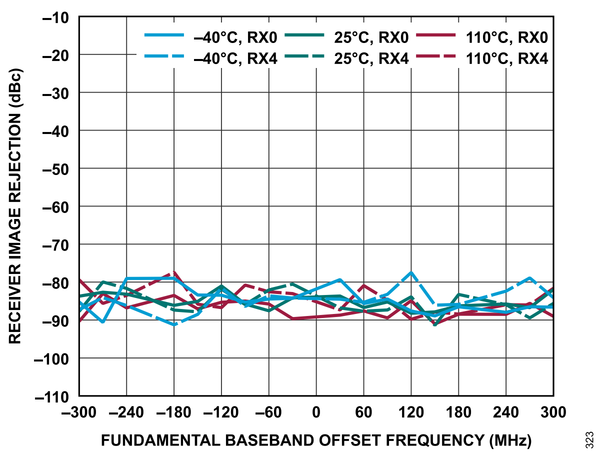


Figure 323. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

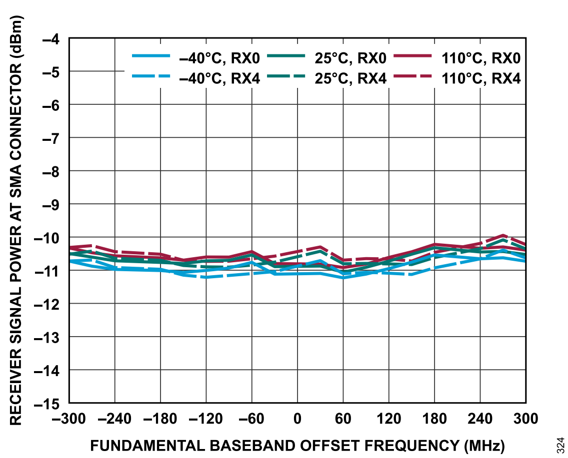


Figure 324. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

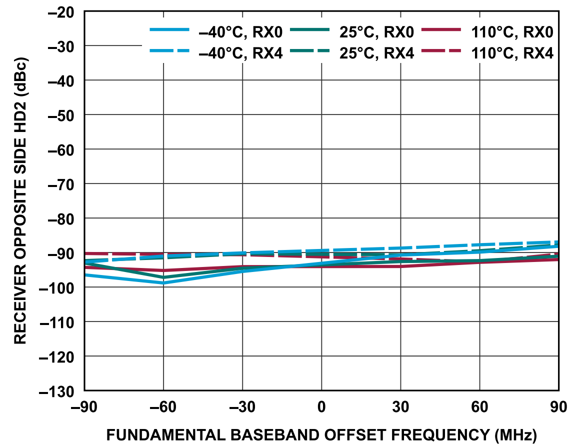


Figure 325. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

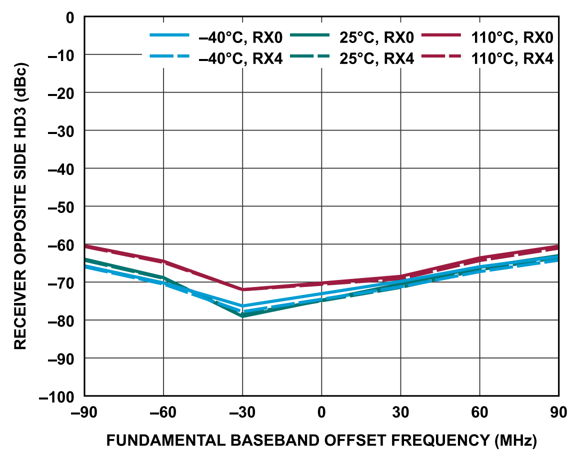


Figure 326. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

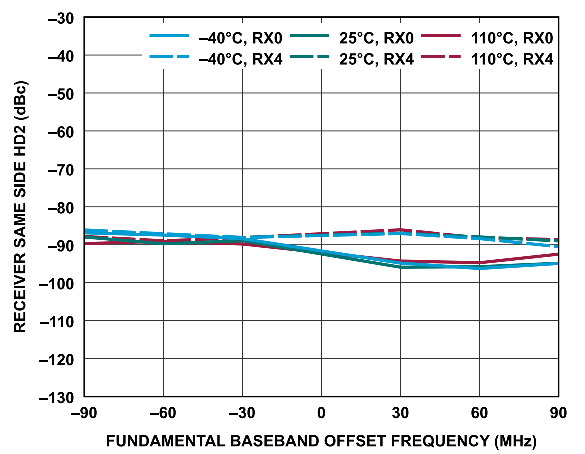


Figure 327. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

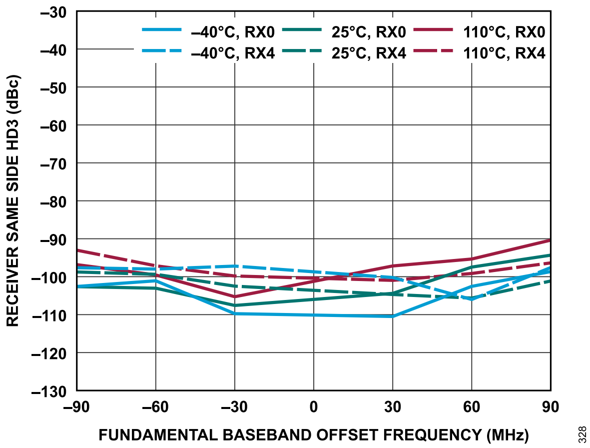


Figure 328. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

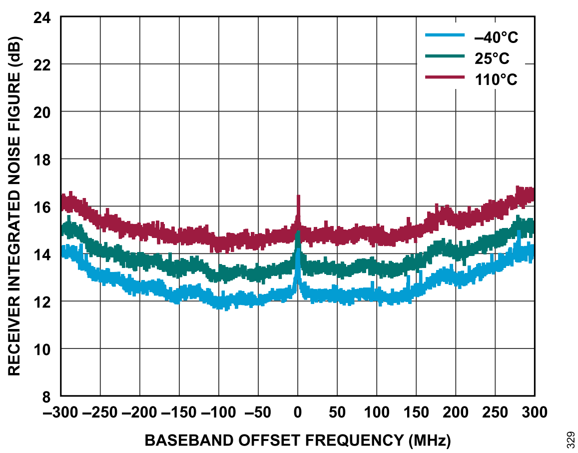


Figure 329. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

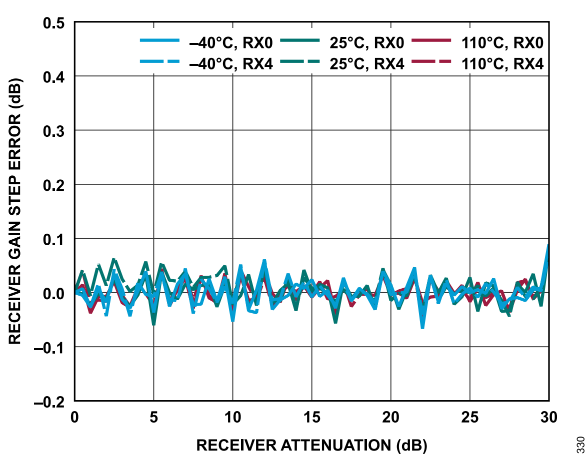


Figure 330. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

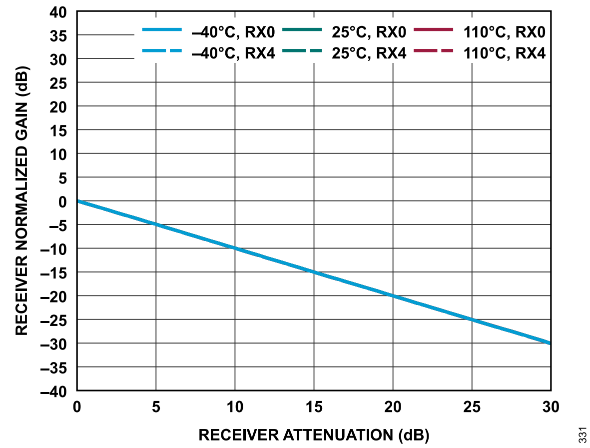


Figure 331. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

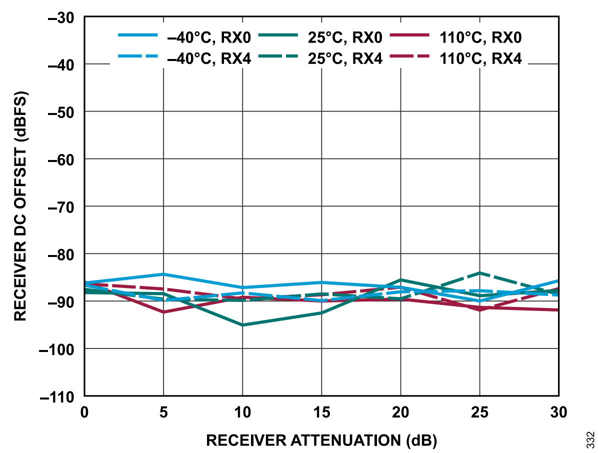


Figure 332. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

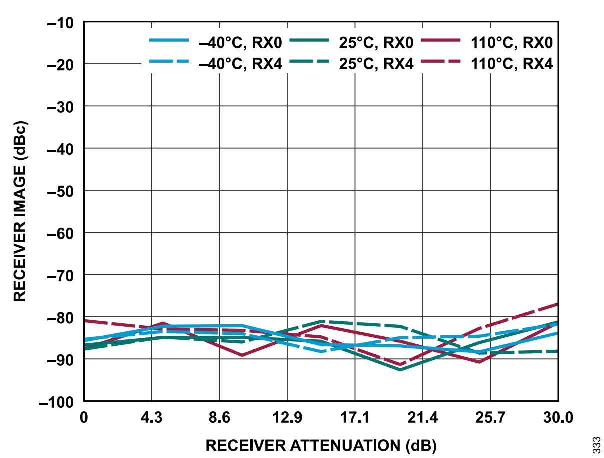


Figure 333. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

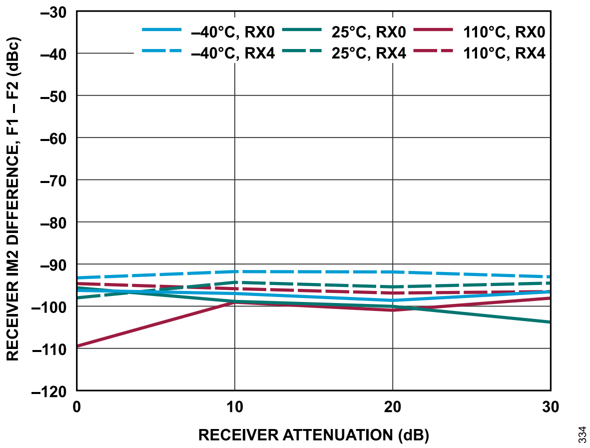


Figure 334. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

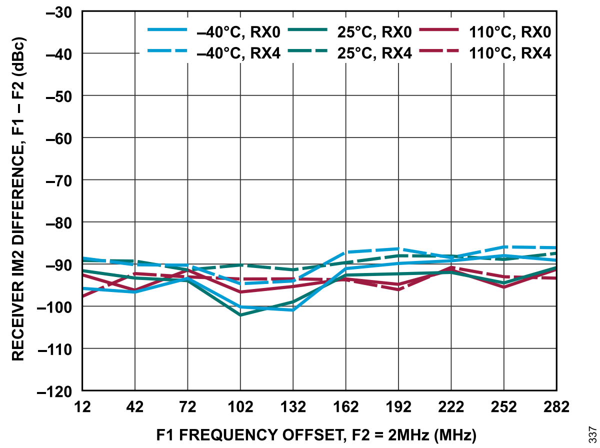


Figure 337. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

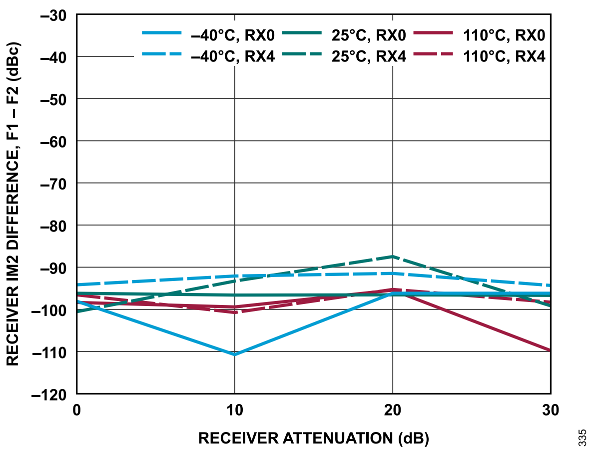


Figure 335. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

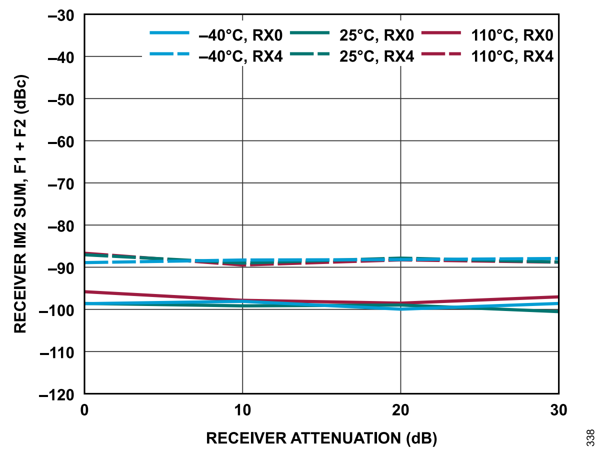


Figure 338. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

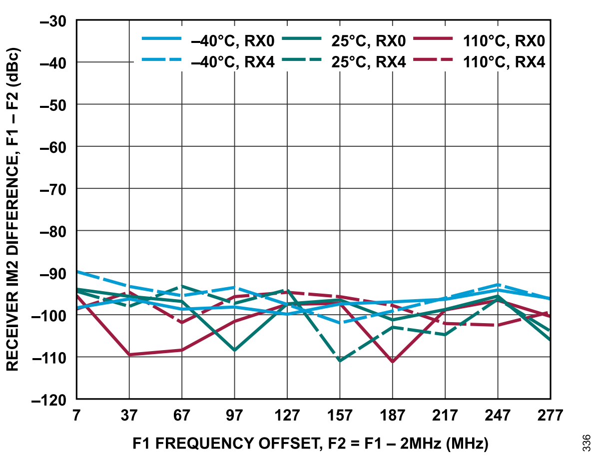


Figure 336. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

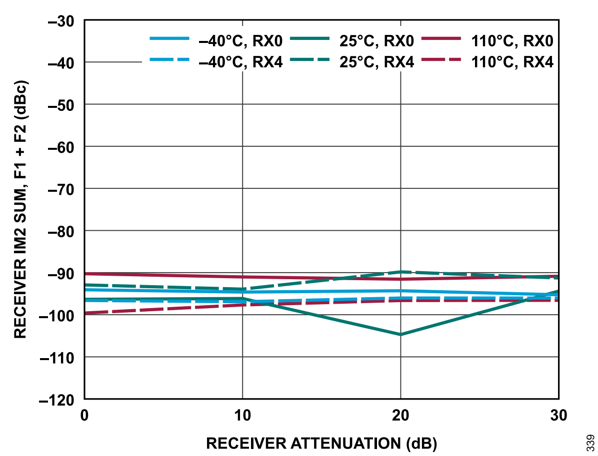


Figure 339. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

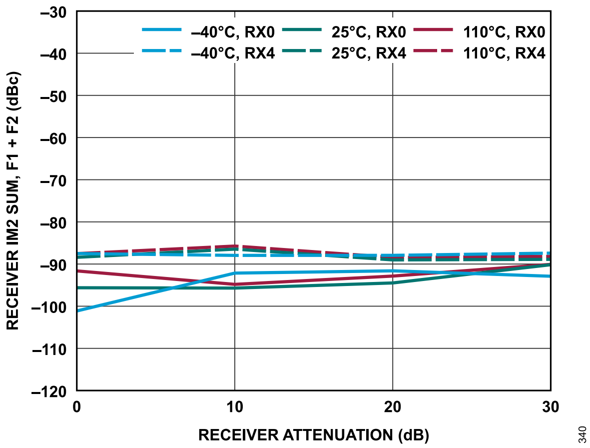


Figure 340. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

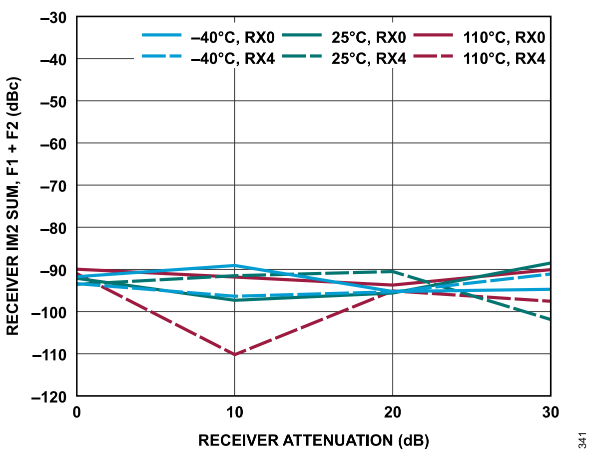


Figure 341. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 282 MHz Offset, F2 = 2 MHz Offset

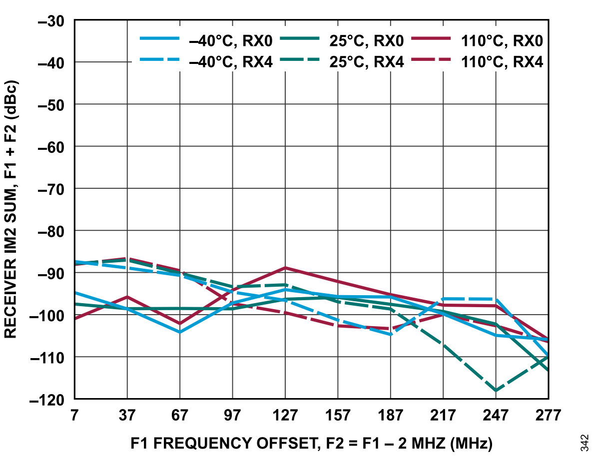


Figure 342. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

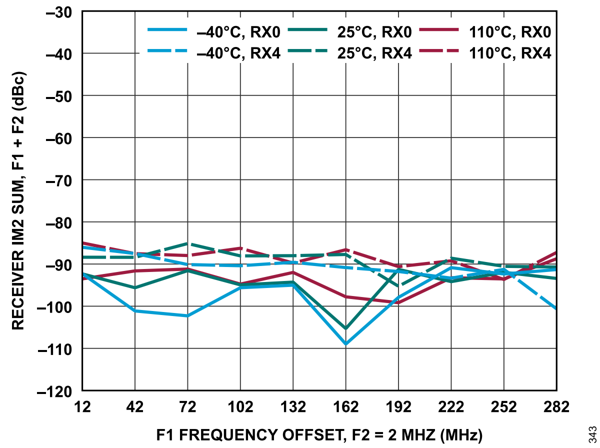


Figure 343. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

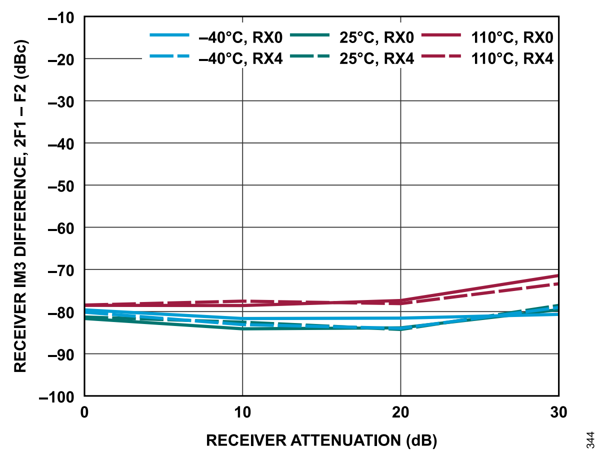


Figure 344. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

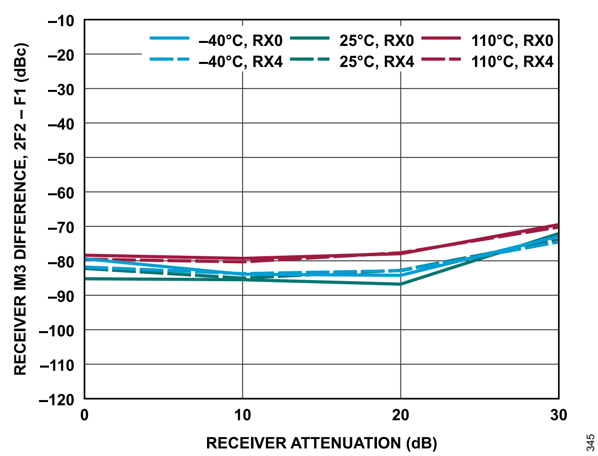


Figure 345. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

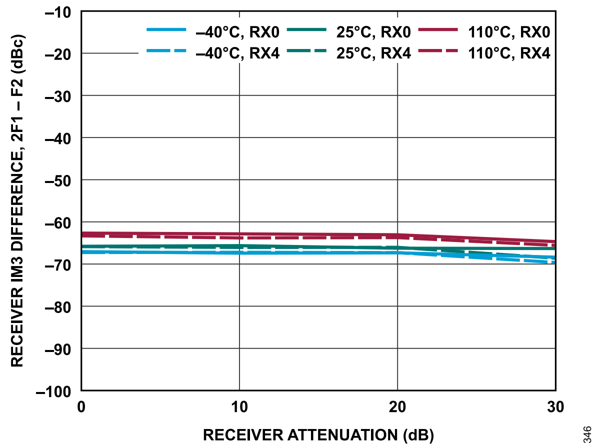


Figure 346. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

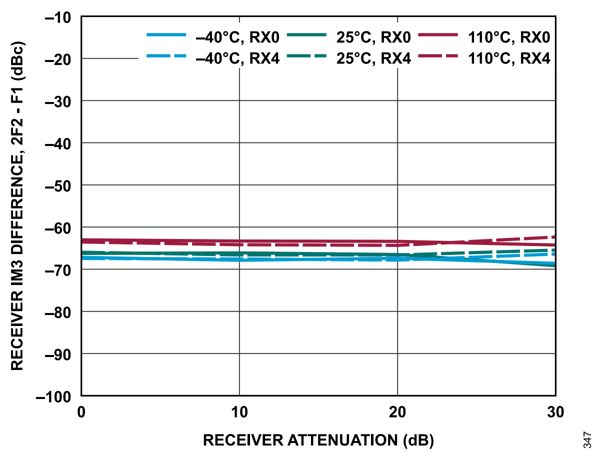


Figure 347. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

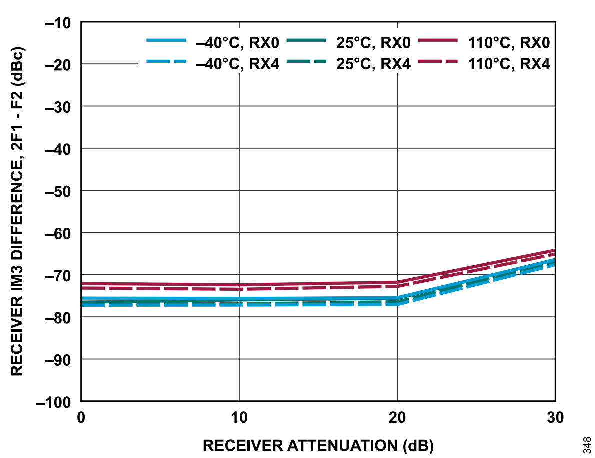


Figure 348. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

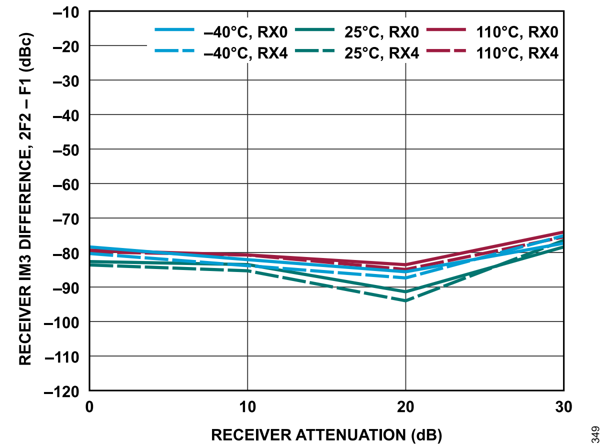


Figure 349. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

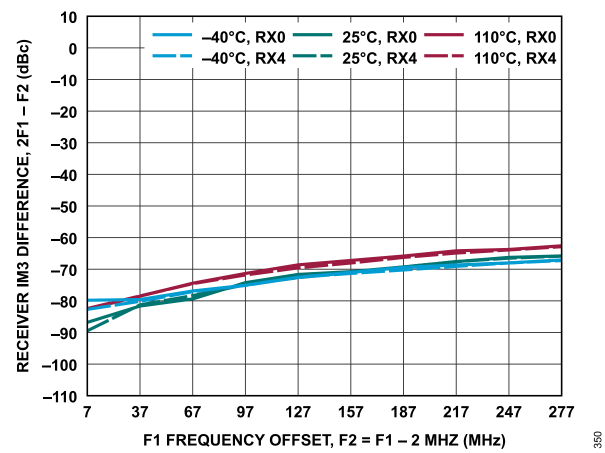


Figure 350. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

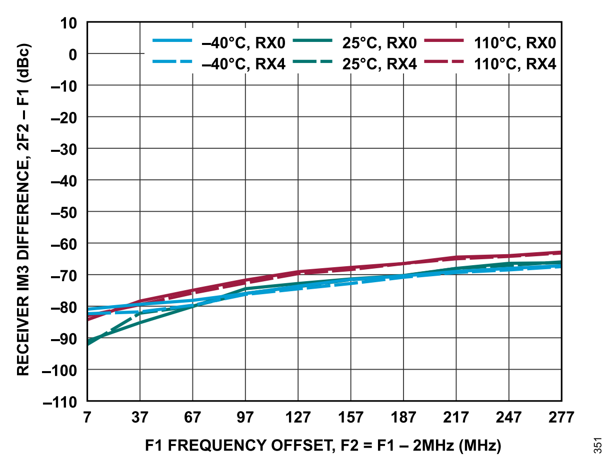


Figure 351. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

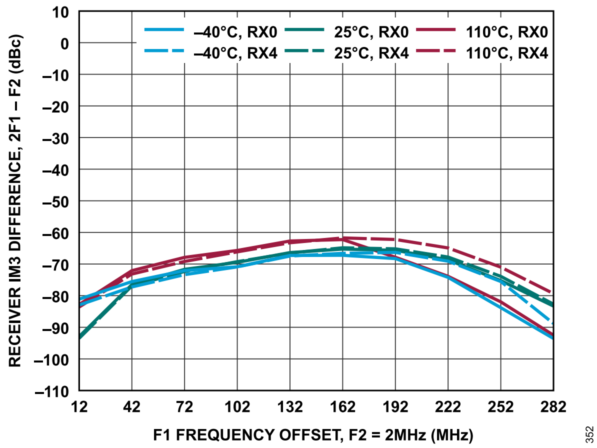


Figure 352. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

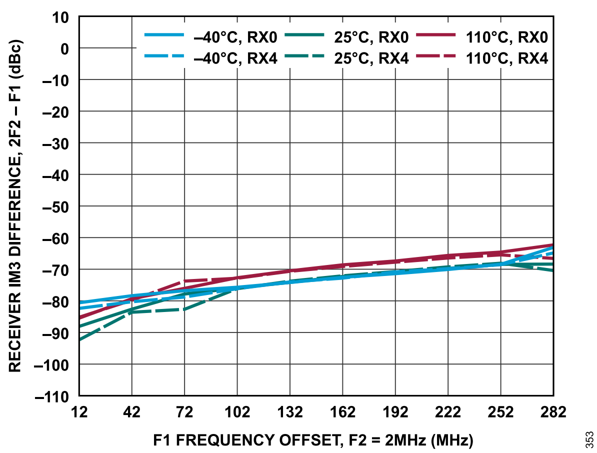


Figure 353. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

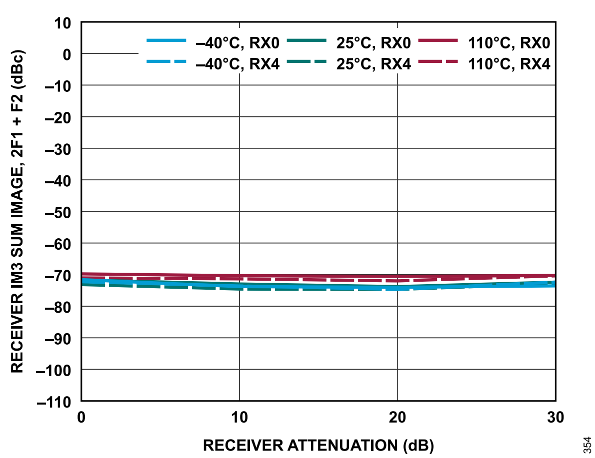


Figure 354. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

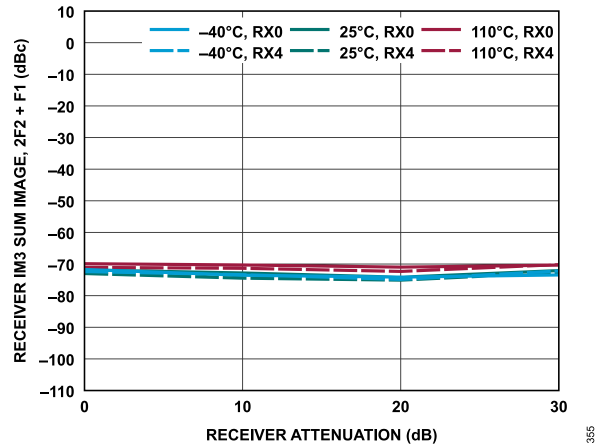


Figure 355. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

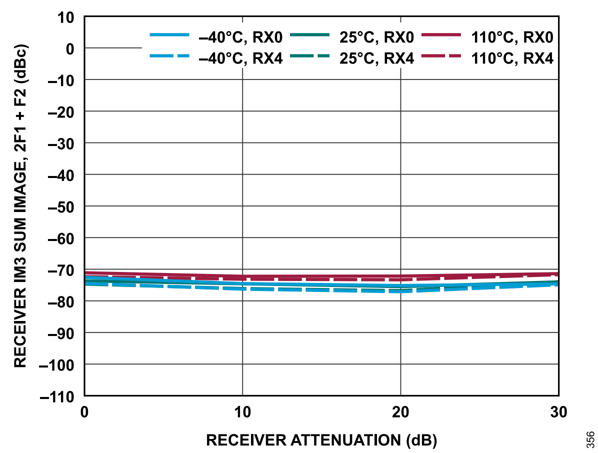


Figure 356. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

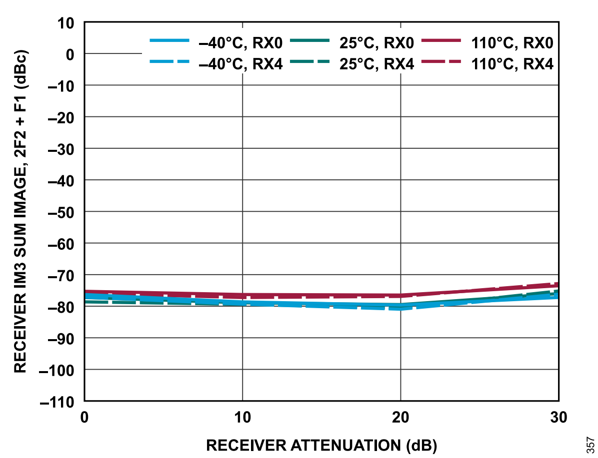


Figure 357. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

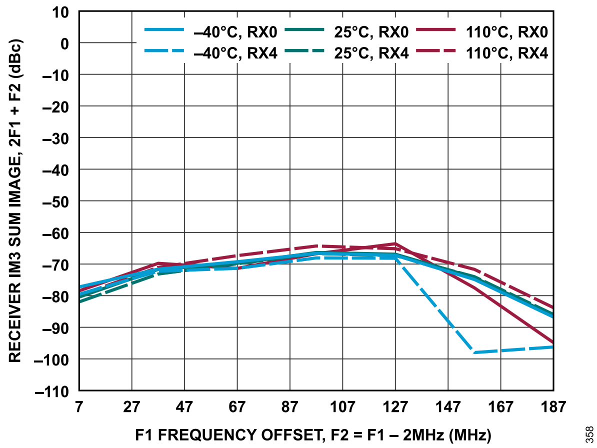


Figure 358. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

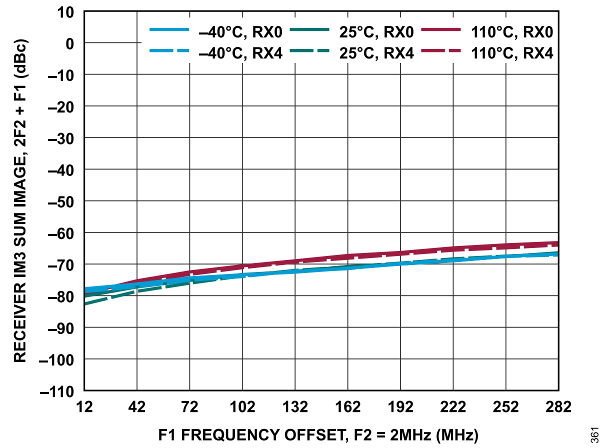


Figure 361. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

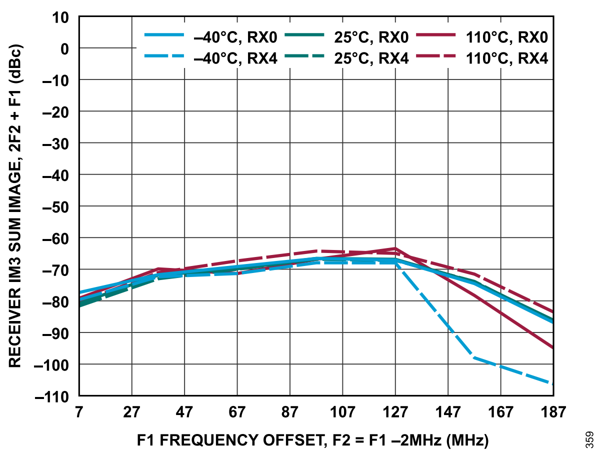


Figure 359. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

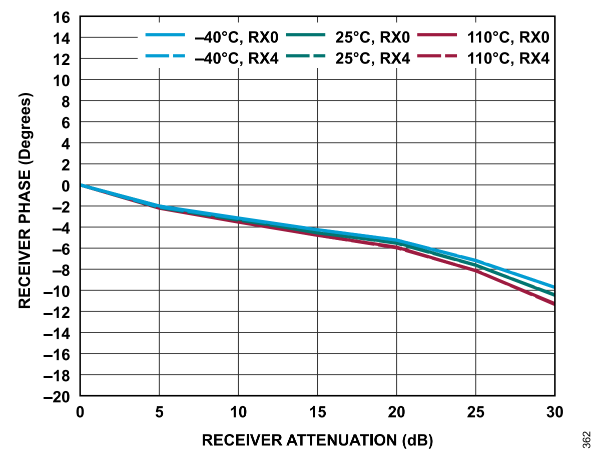


Figure 362. Receiver Phase vs. Receiver Attenuation

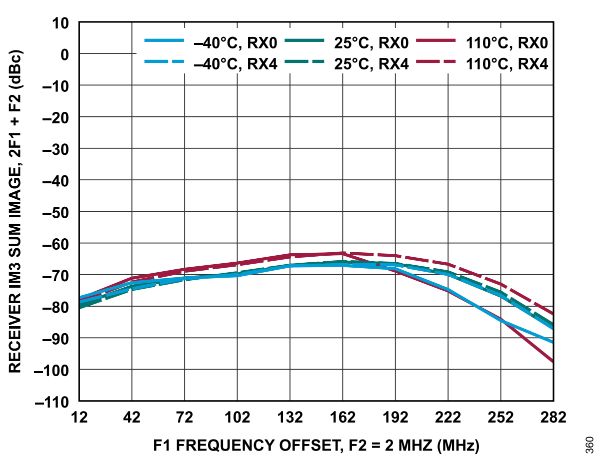


Figure 360. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

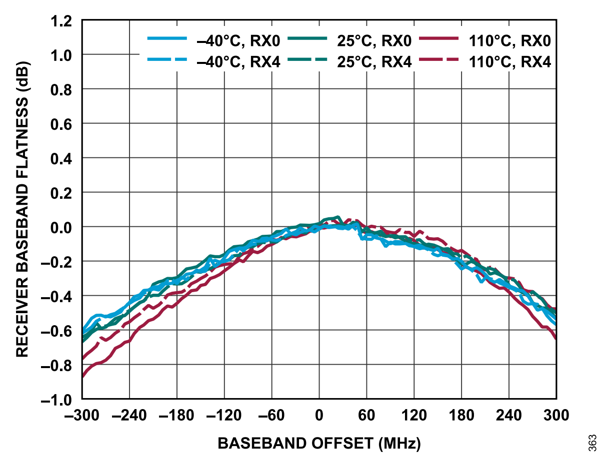


Figure 363. Receiver Baseband Flatness vs. Baseband Offset

TYPICAL PERFORMANCE CHARACTERISTICS

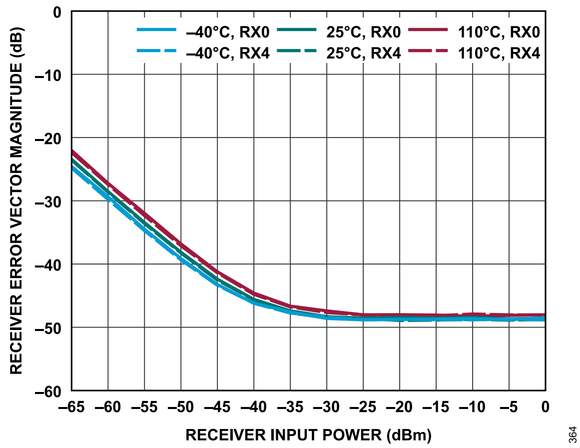


Figure 364. Receiver Error Vector Magnitude vs. Receiver Input Power, 10 MHz Offset, 20 MHz LTE, TDD Mode, AGC Enabled

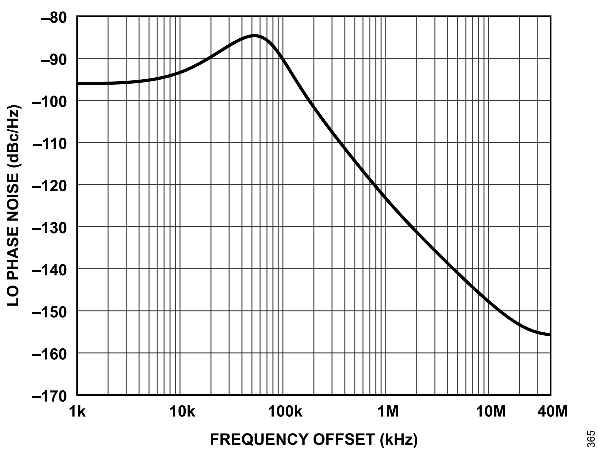


Figure 365. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

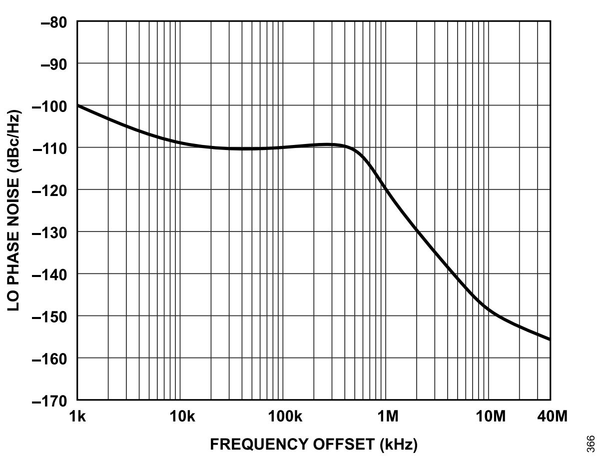


Figure 366. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

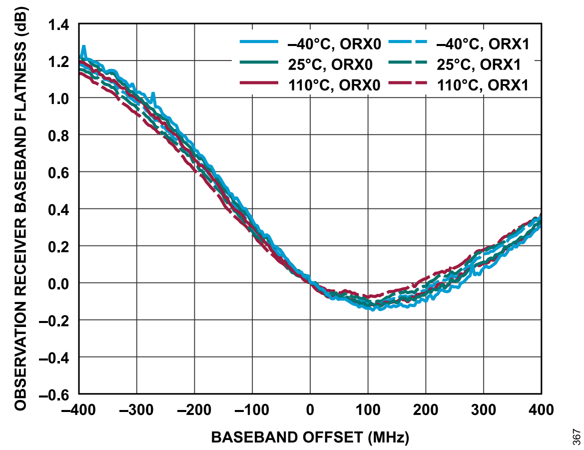


Figure 367. Observation Receiver Baseband Flatness vs. Baseband Offset

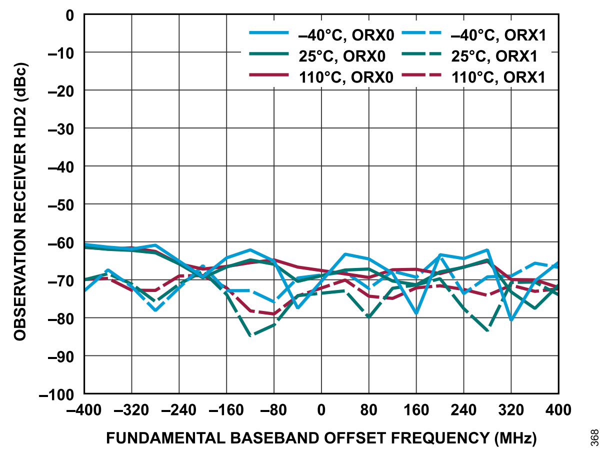


Figure 368. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

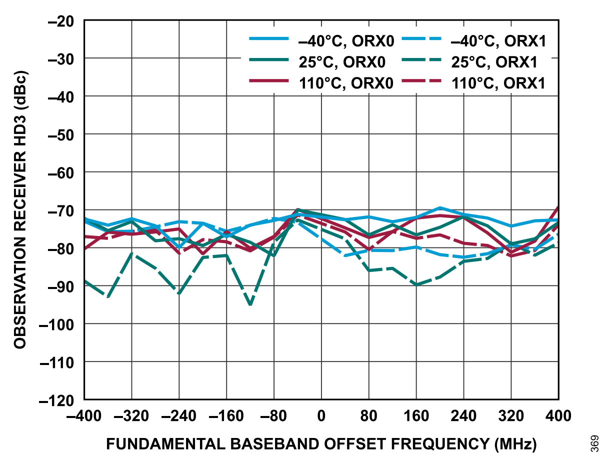


Figure 369. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

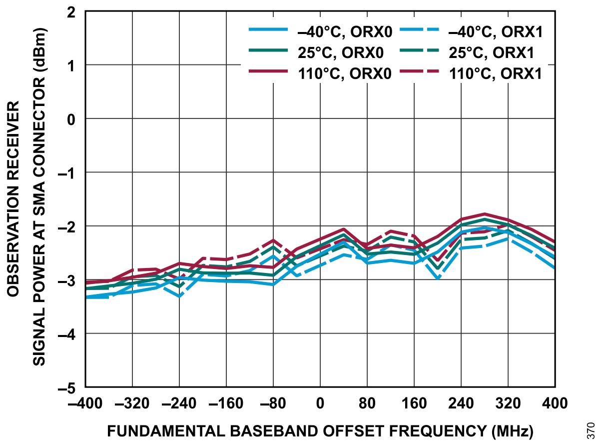


Figure 370. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

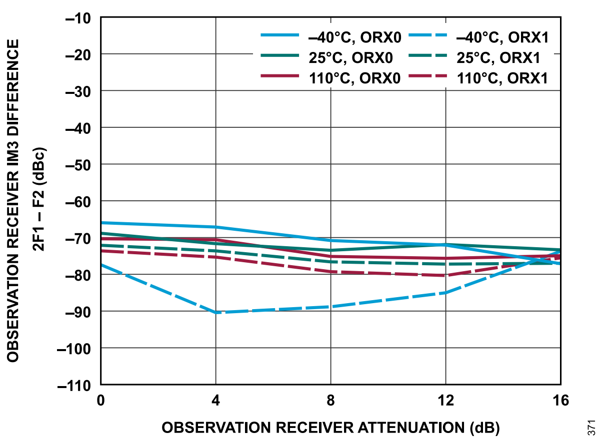


Figure 371. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 3502 MHz, F2 = 3512 MHz

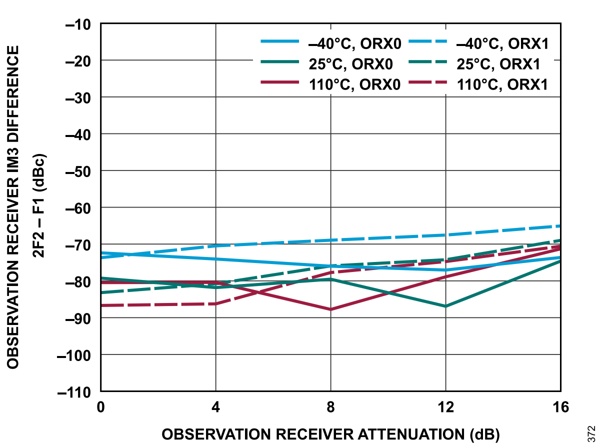


Figure 372. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 3502 MHz, F2 = 3512 MHz

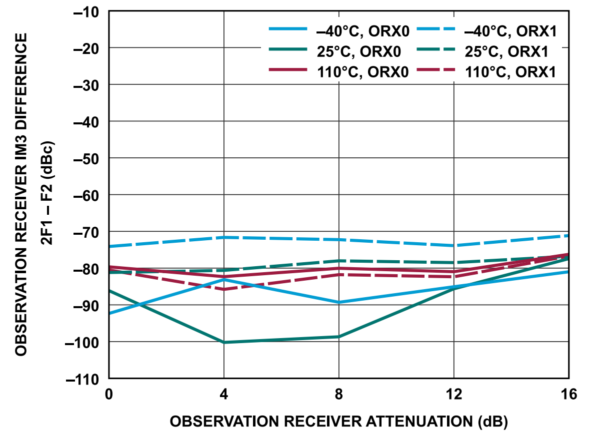


Figure 373. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 3502 MHz, F2 = 3712 MHz

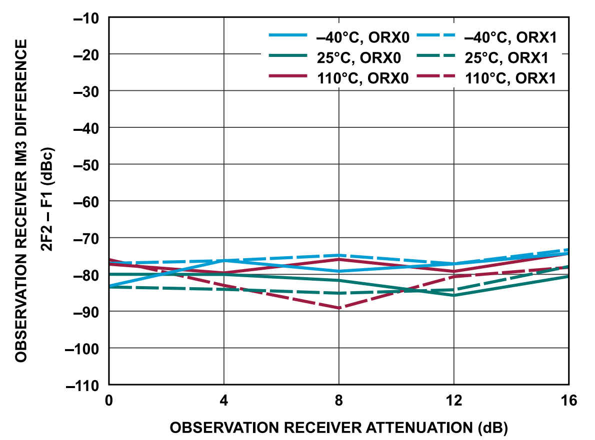


Figure 374. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 3502 MHz, F2 = 3712 MHz

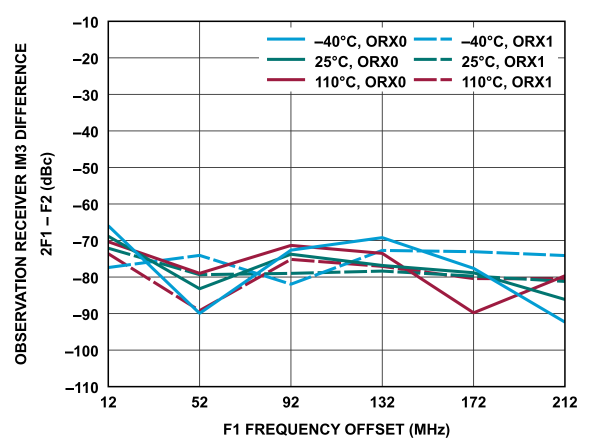


Figure 375. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 3502 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

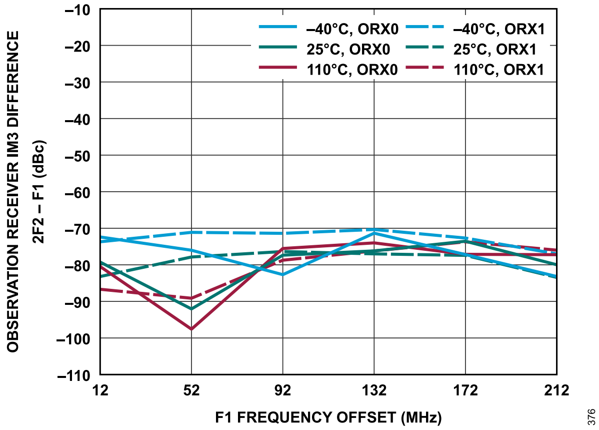


Figure 376. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 3502 MHz

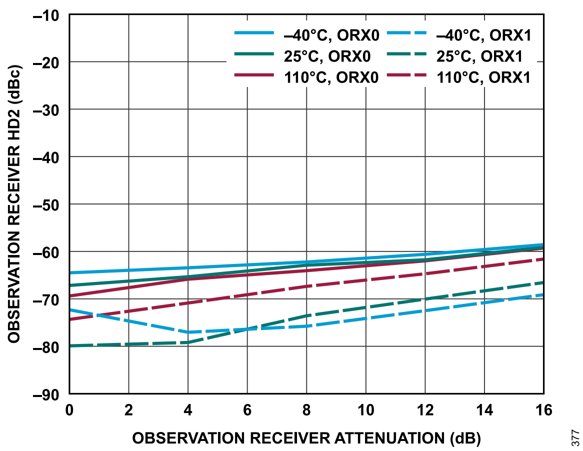


Figure 377. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

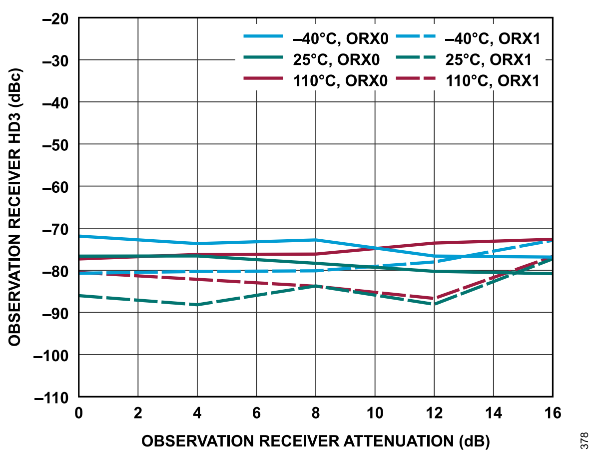


Figure 378. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

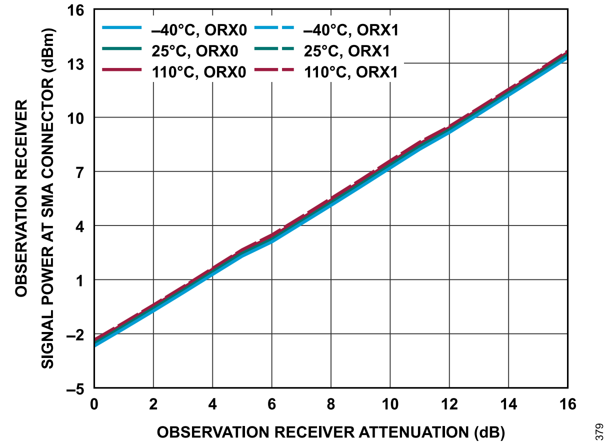


Figure 379. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

4500 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 4500 MHz, unless otherwise noted.

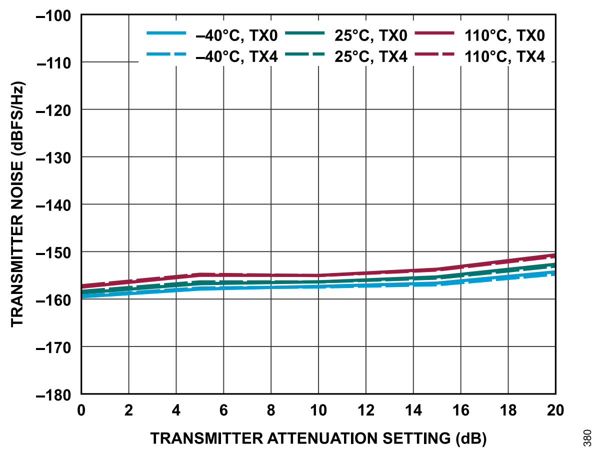


Figure 380. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

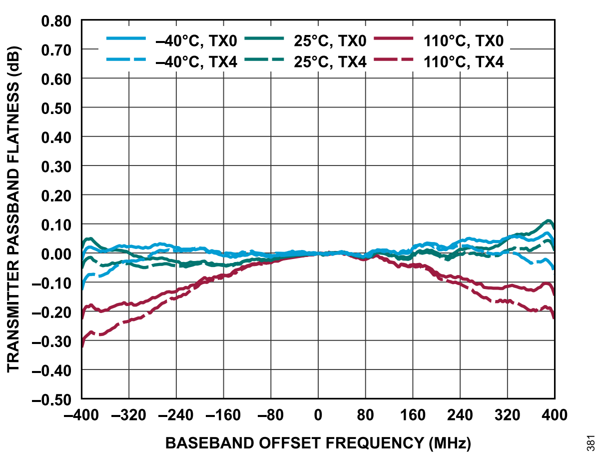


Figure 381. Transmitter Passband Flatness vs. Baseband Offset Frequency

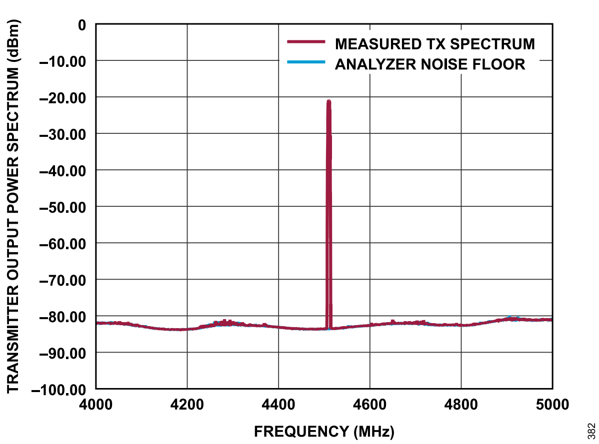


Figure 382. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −10 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

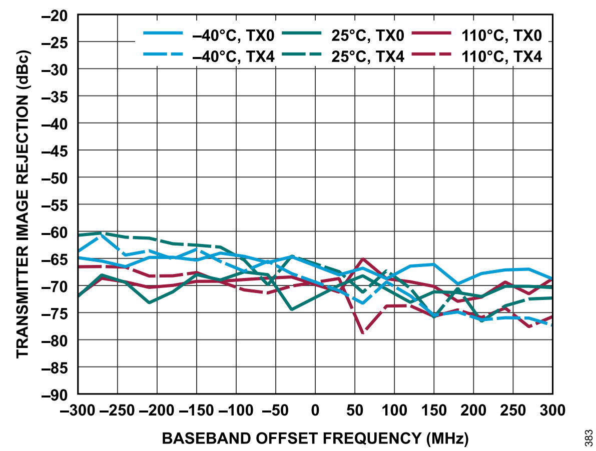


Figure 383. Transmitter Image Rejection vs. Baseband Offset Frequency, −6 dBFS CW Signal

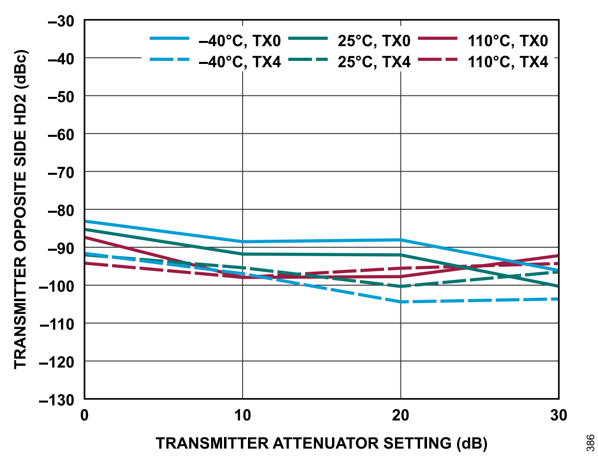


Figure 384. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

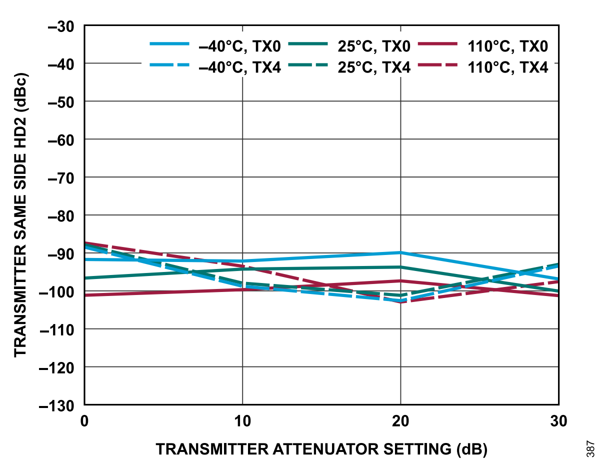


Figure 385. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

TYPICAL PERFORMANCE CHARACTERISTICS

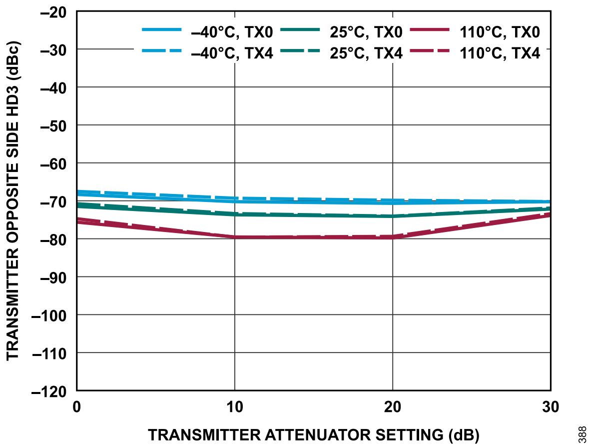


Figure 386. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

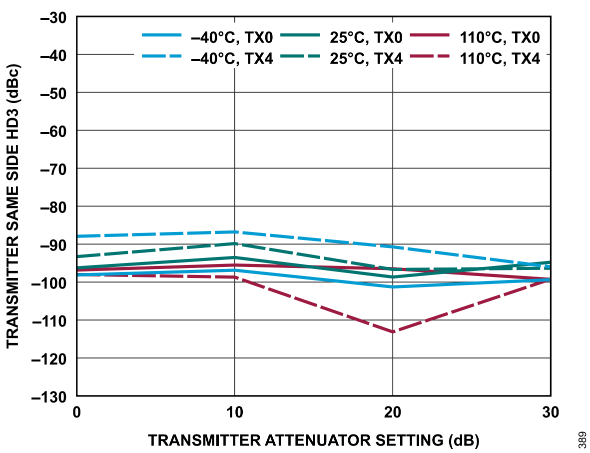


Figure 387. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

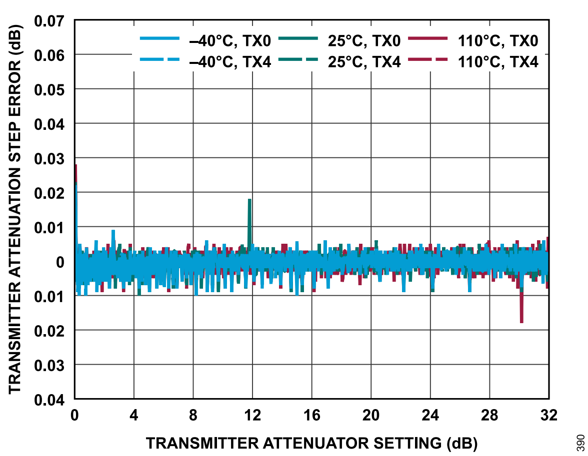


Figure 388. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

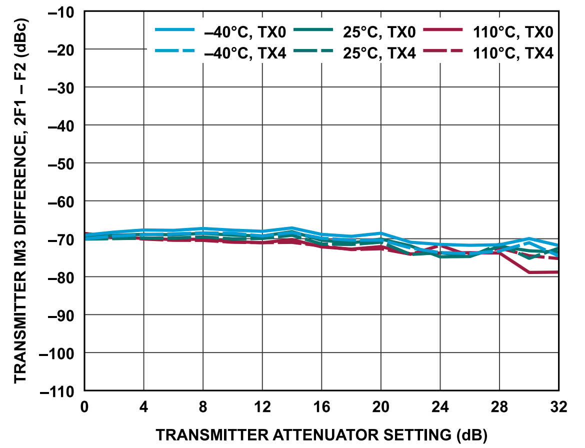


Figure 389. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

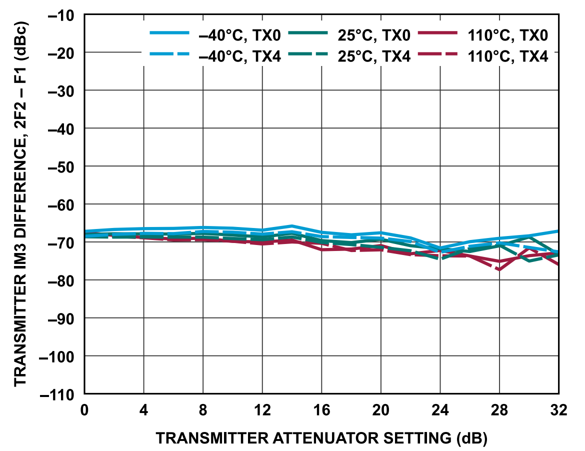


Figure 390. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

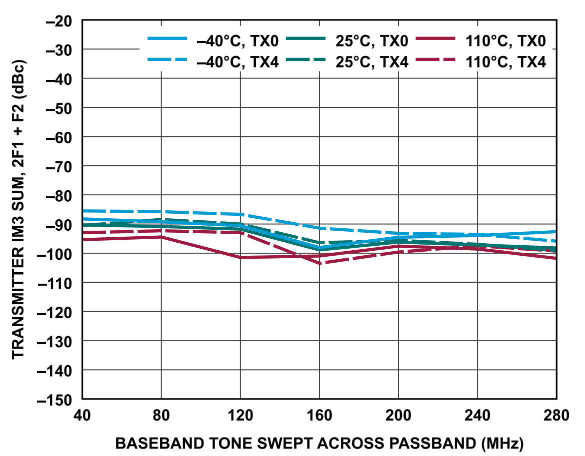


Figure 391. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

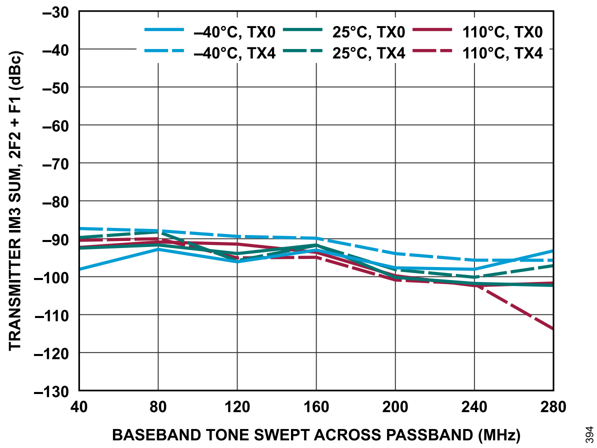


Figure 392. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

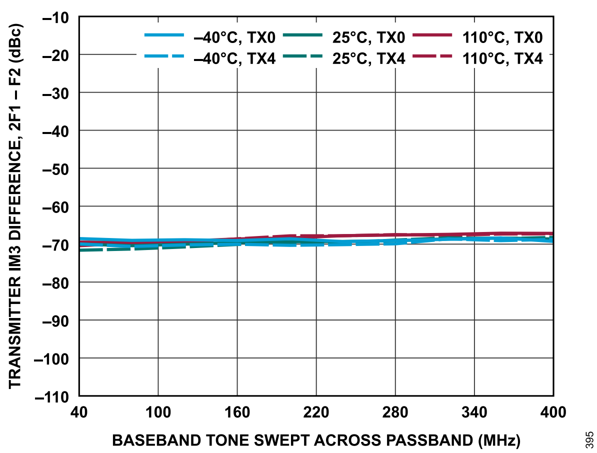


Figure 393. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

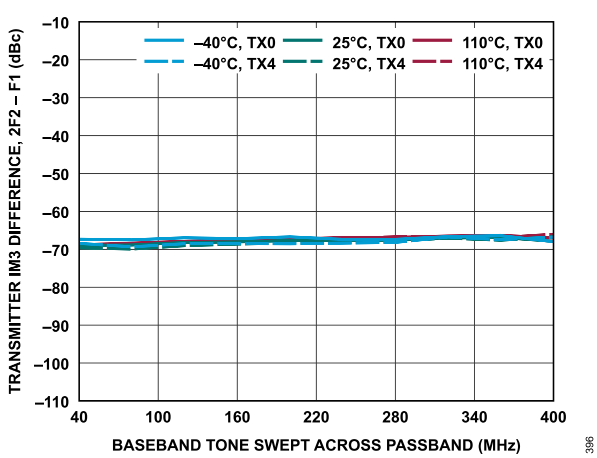


Figure 394. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

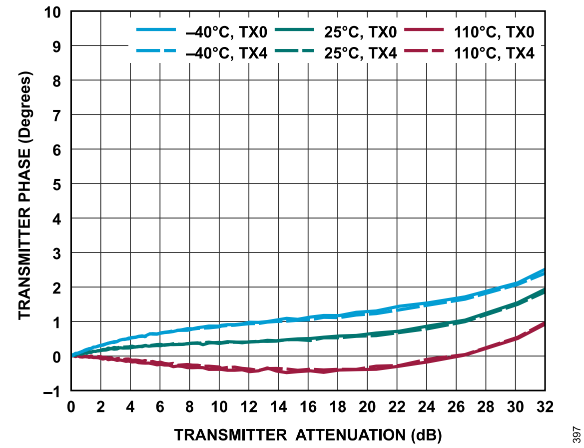


Figure 395. Transmitter Phase vs. Transmitter Attenuation

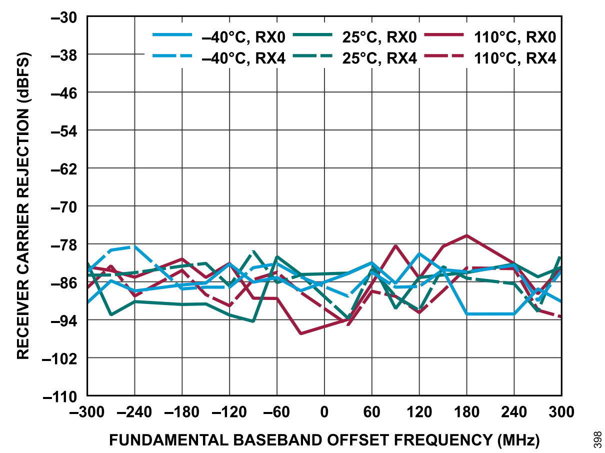


Figure 396. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

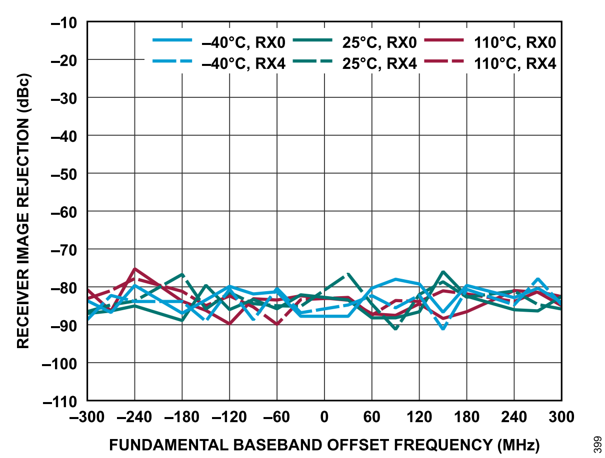


Figure 397. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

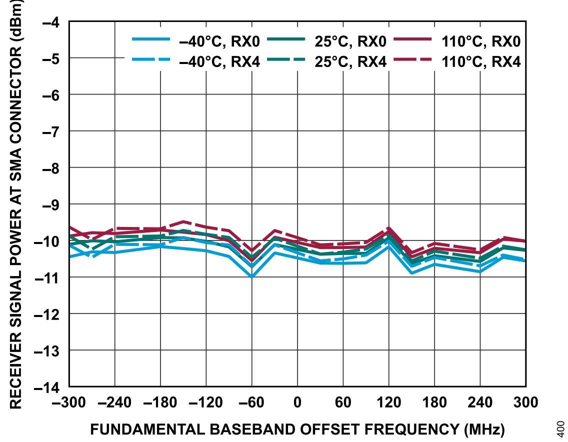


Figure 398. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

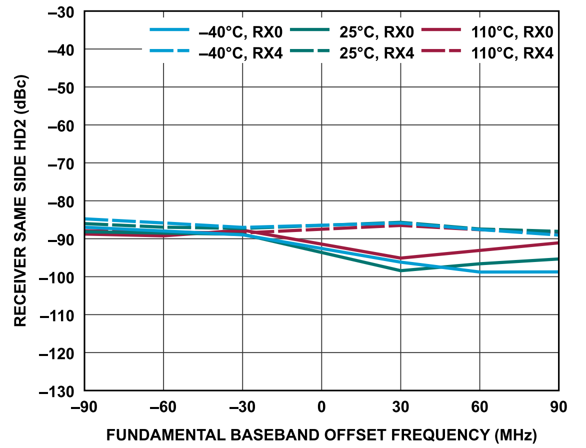


Figure 401. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

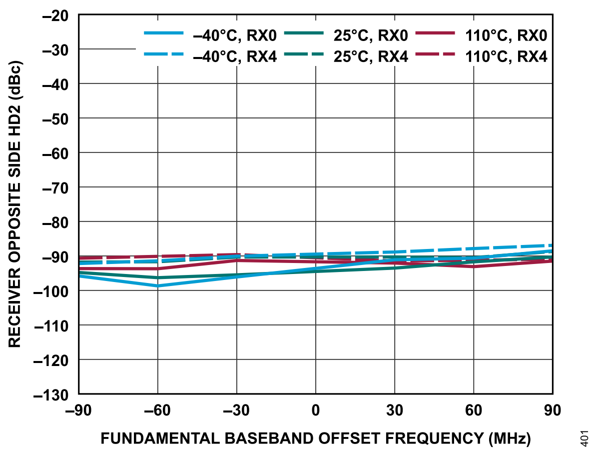


Figure 399. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

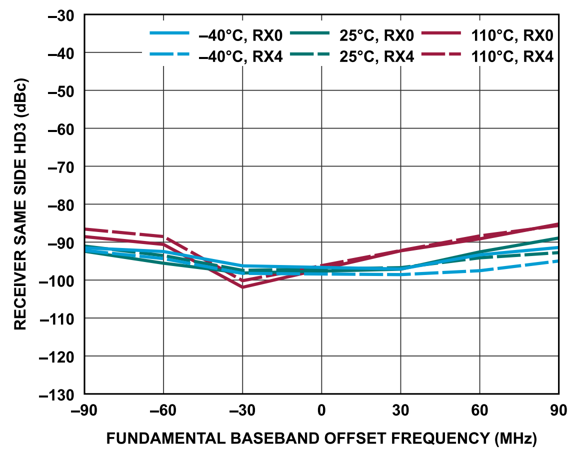


Figure 402. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

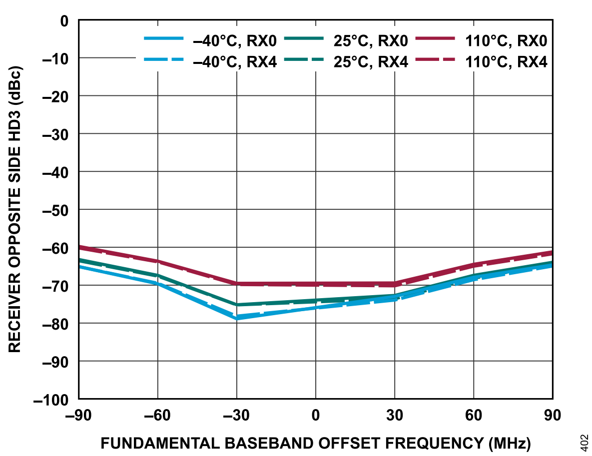


Figure 400. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

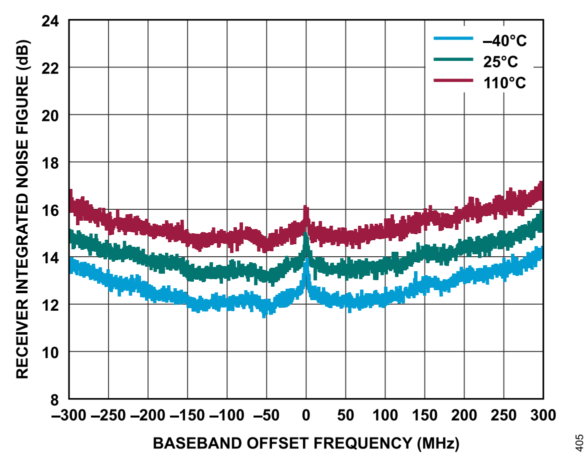


Figure 403. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

TYPICAL PERFORMANCE CHARACTERISTICS

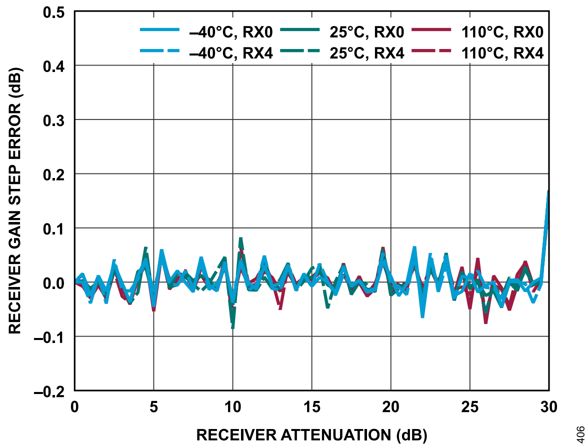


Figure 404. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

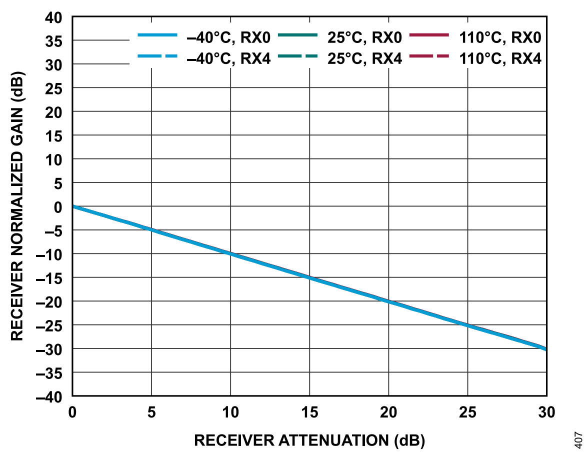


Figure 405. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

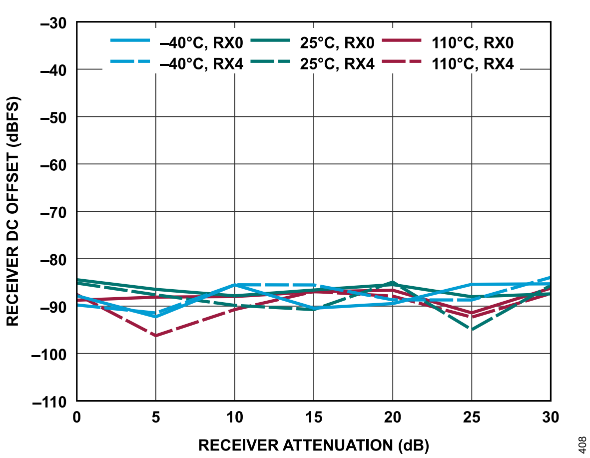


Figure 406. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

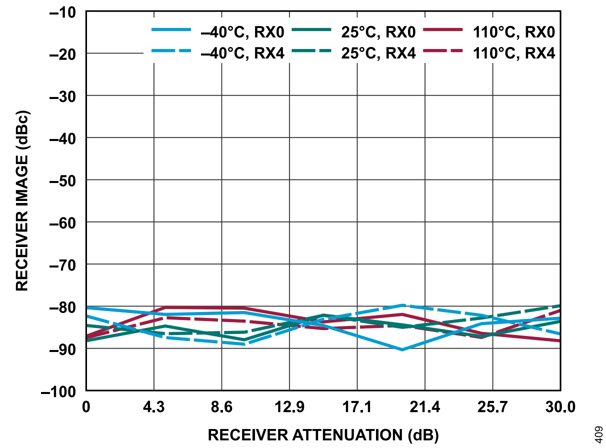


Figure 407. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

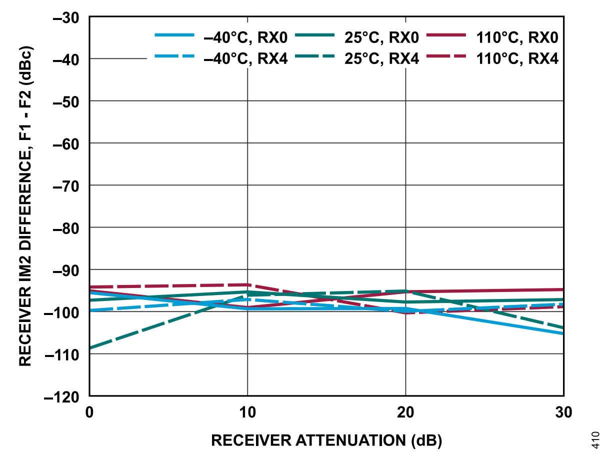


Figure 408. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

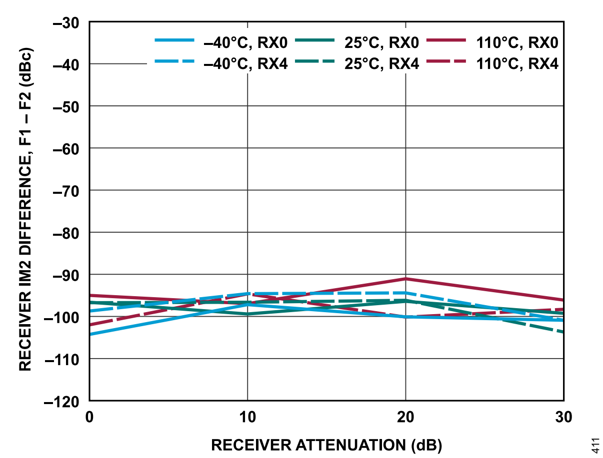


Figure 409. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

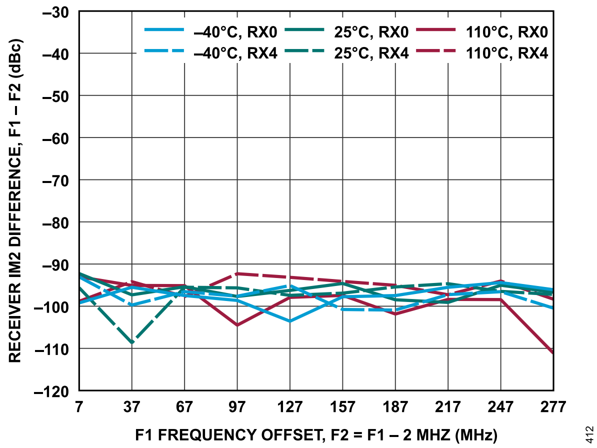


Figure 410. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

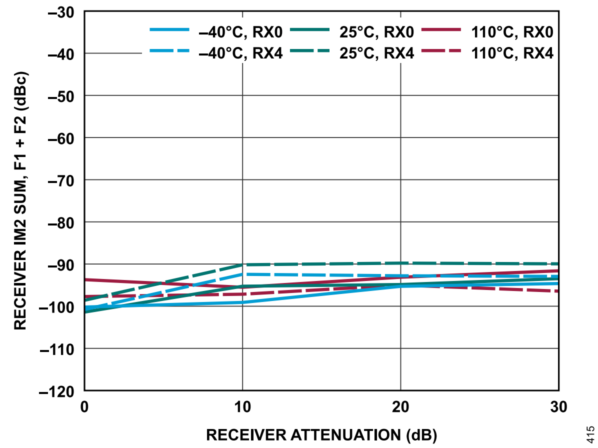


Figure 413. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

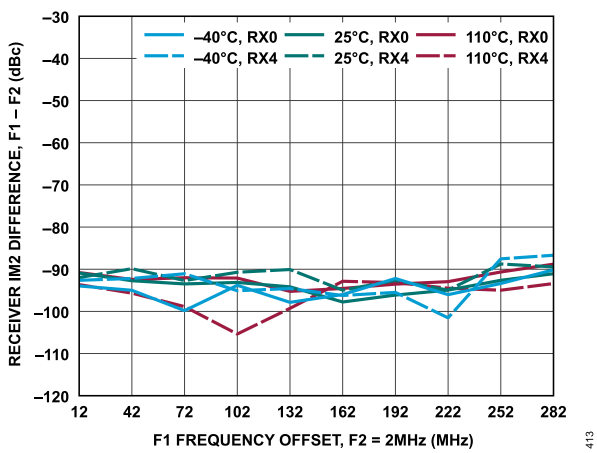


Figure 411. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

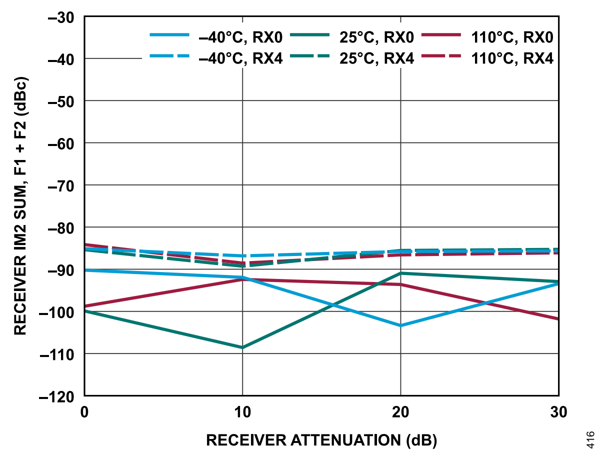


Figure 414. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

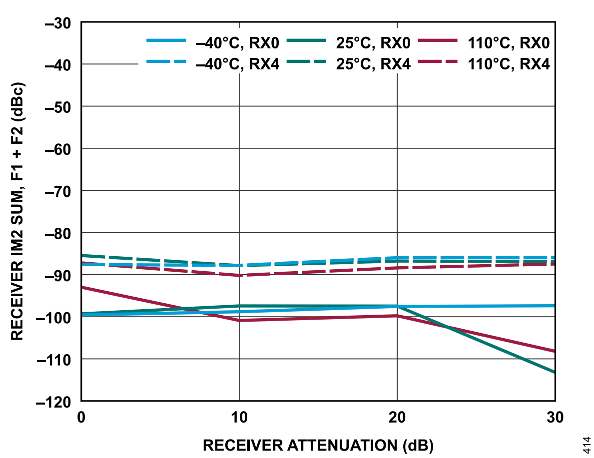


Figure 412. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

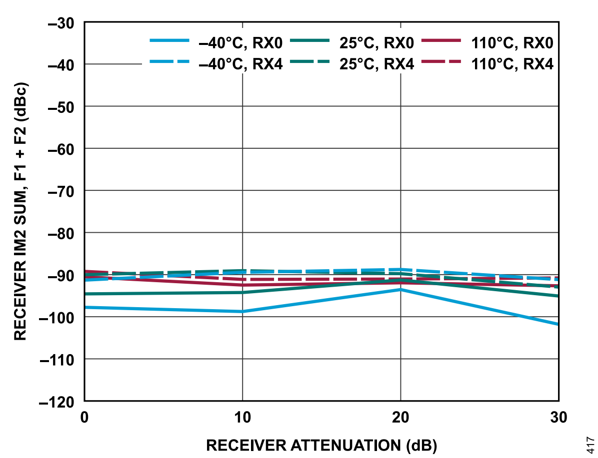


Figure 415. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 282 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

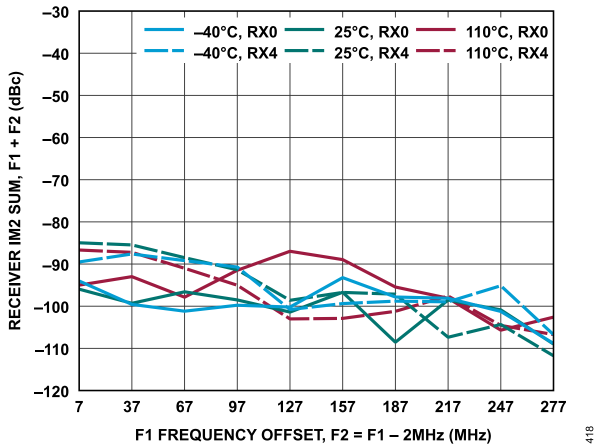


Figure 416. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

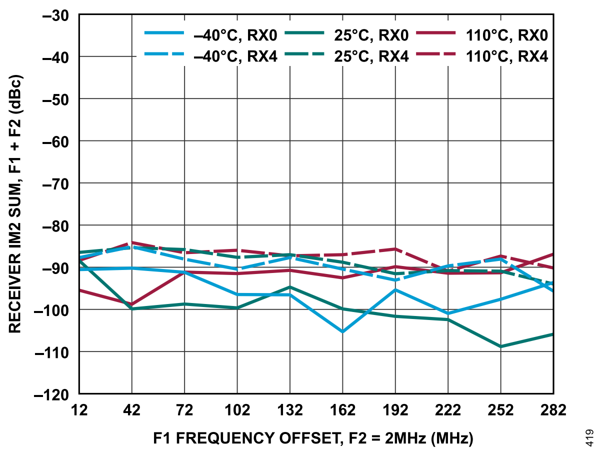


Figure 417. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

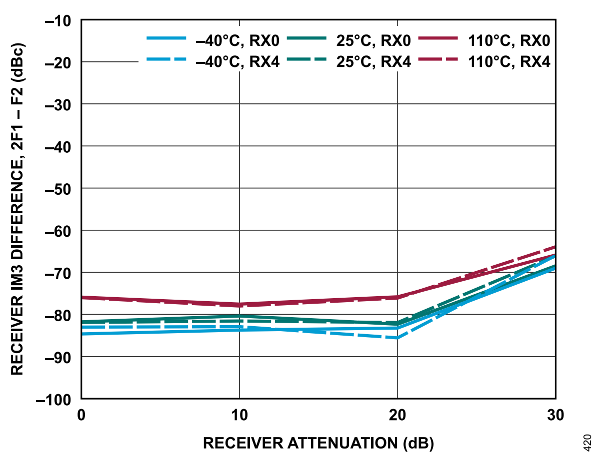


Figure 418. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

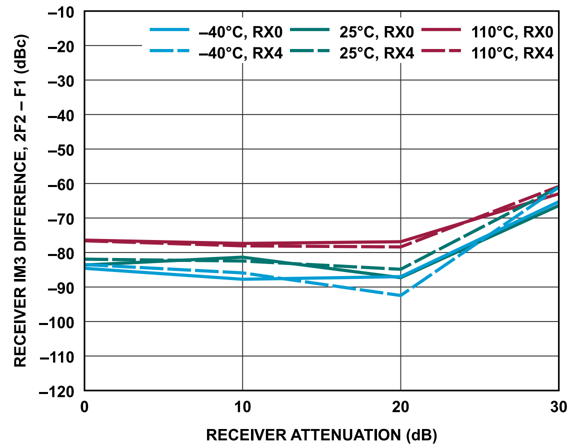


Figure 419. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

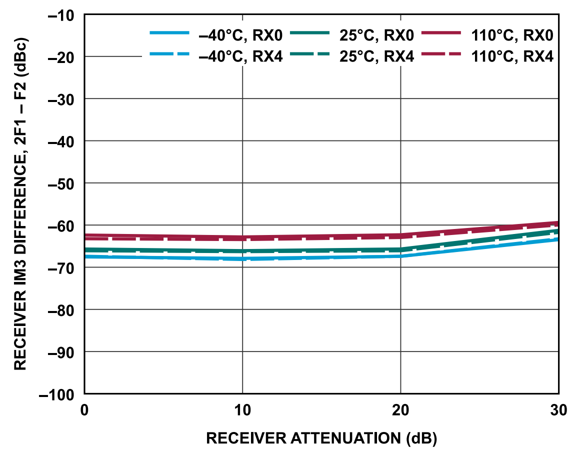


Figure 420. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

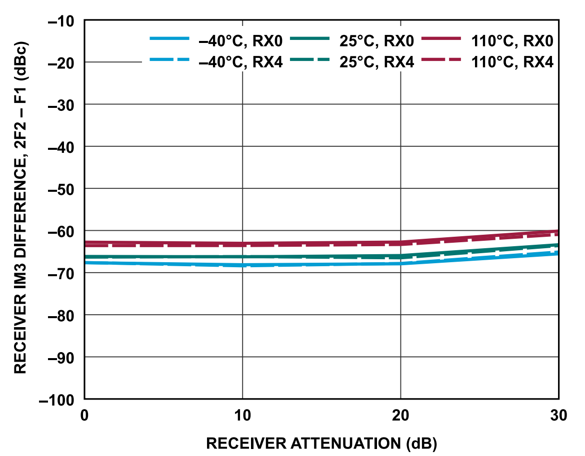


Figure 421. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

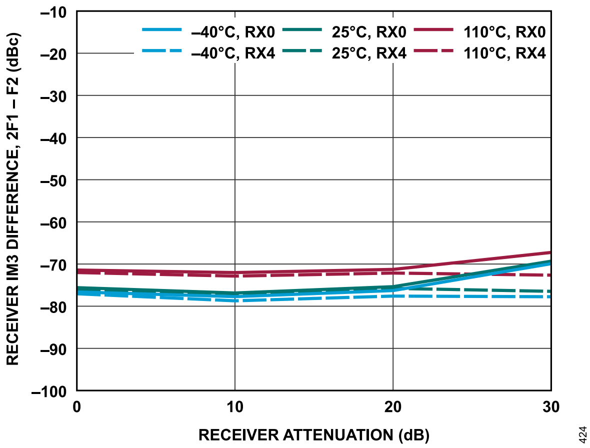


Figure 422. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

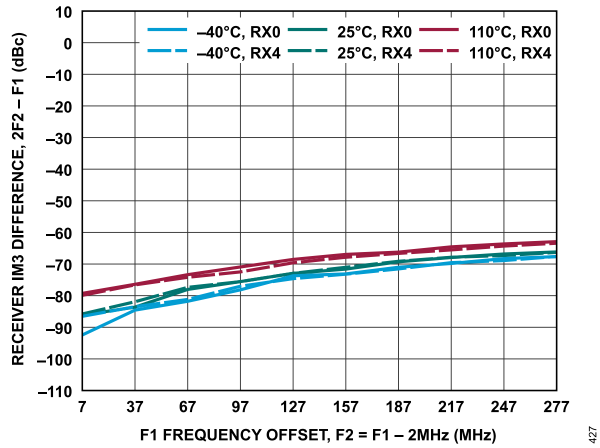


Figure 425. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

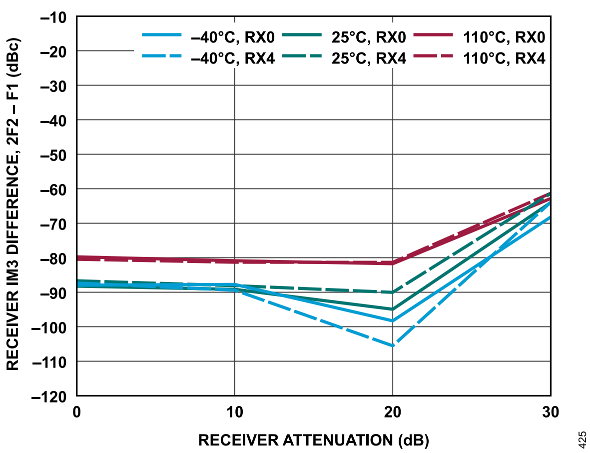


Figure 423. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

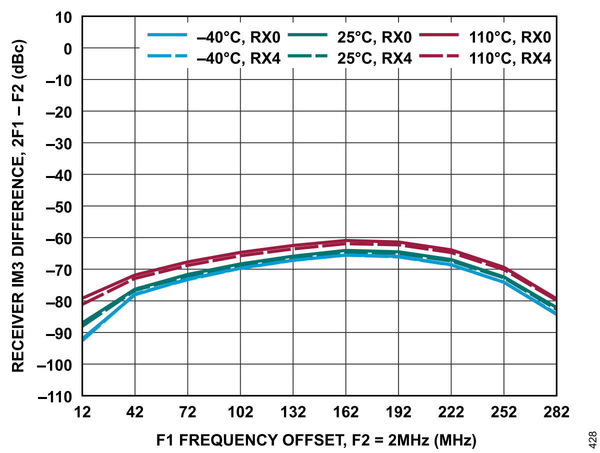


Figure 426. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

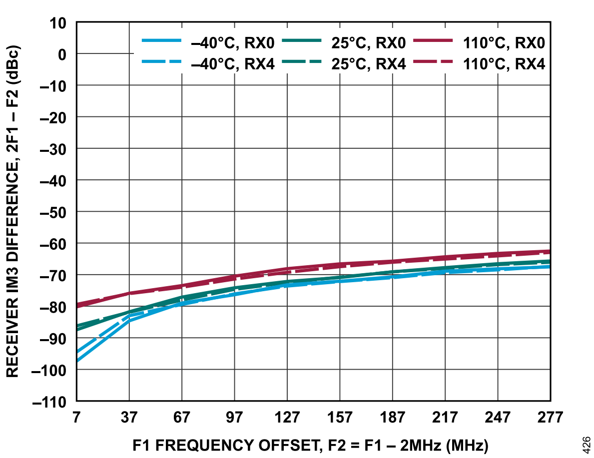


Figure 424. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

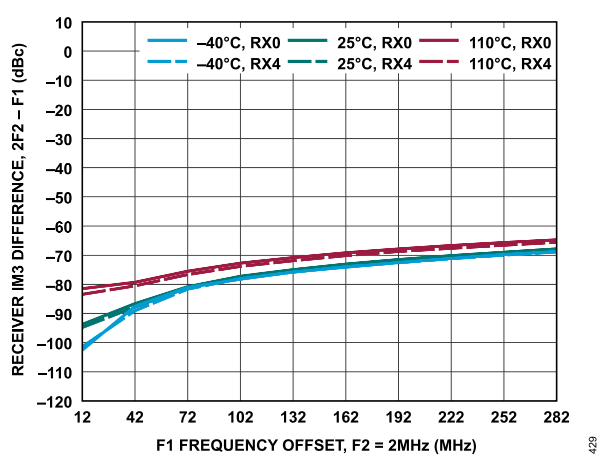


Figure 427. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

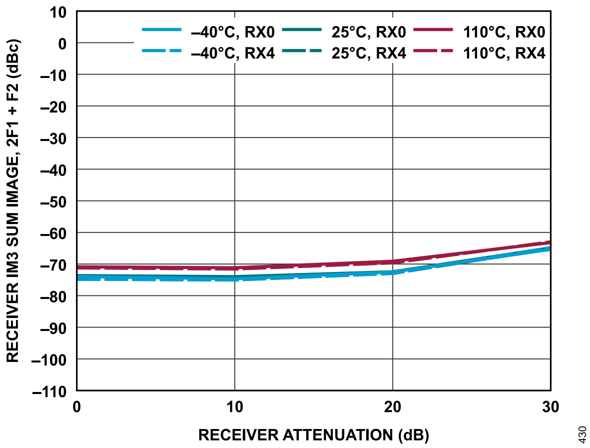


Figure 428. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

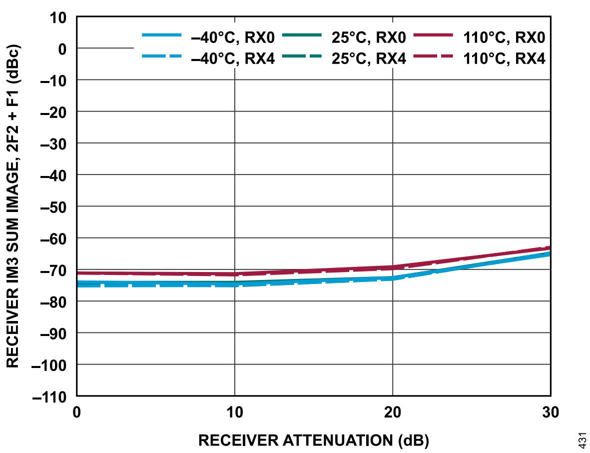


Figure 429. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

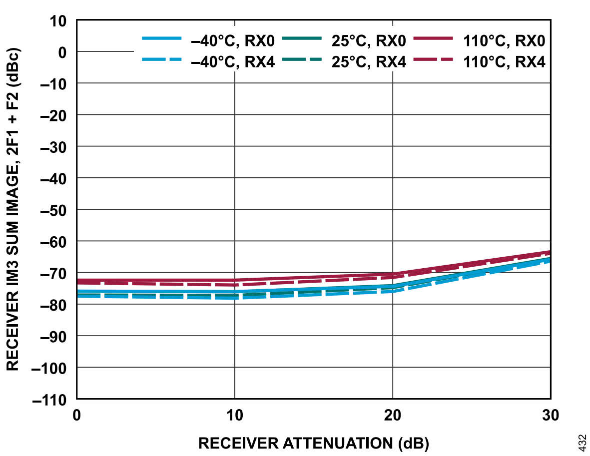


Figure 430. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

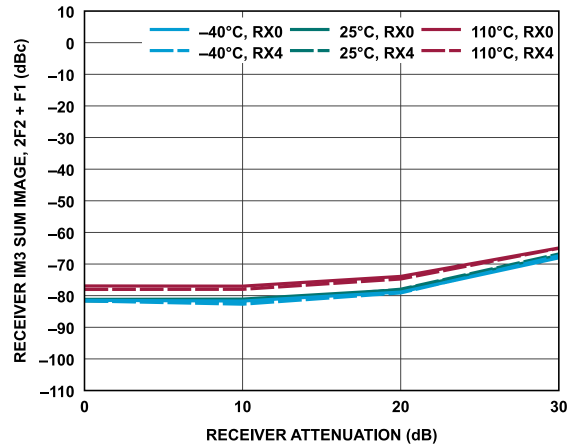


Figure 431. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 42 MHz Offset, F2 = 2 MHz Offset

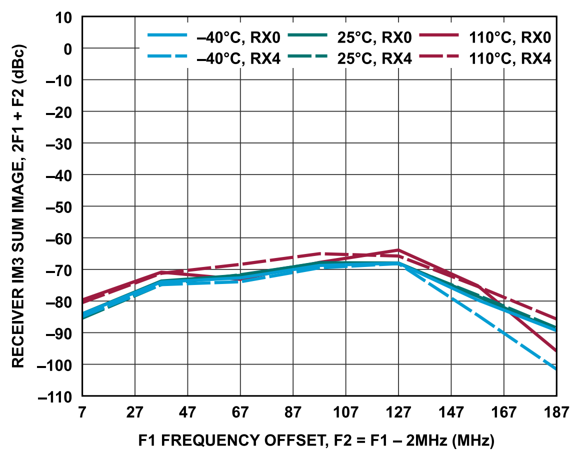


Figure 432. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

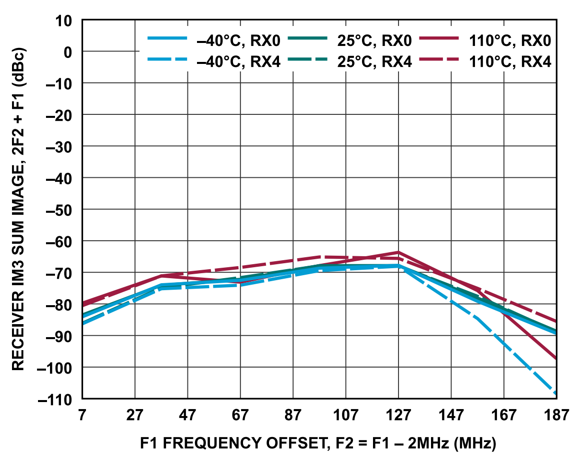


Figure 433. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

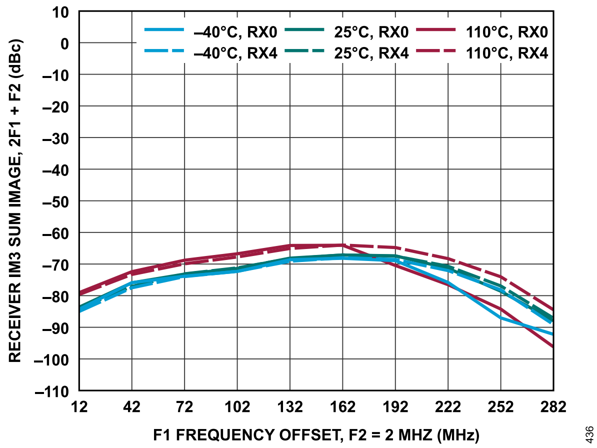


Figure 434. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

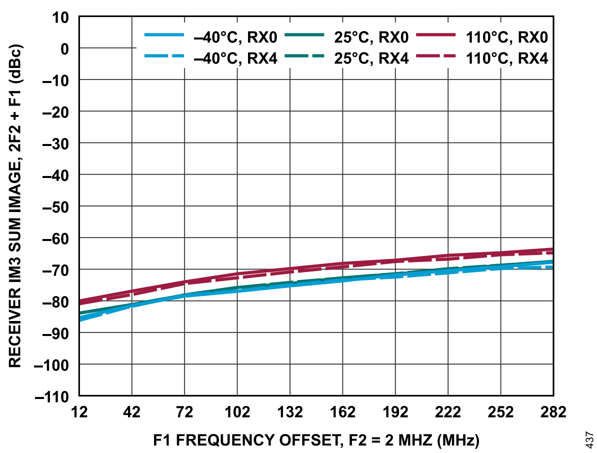


Figure 435. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

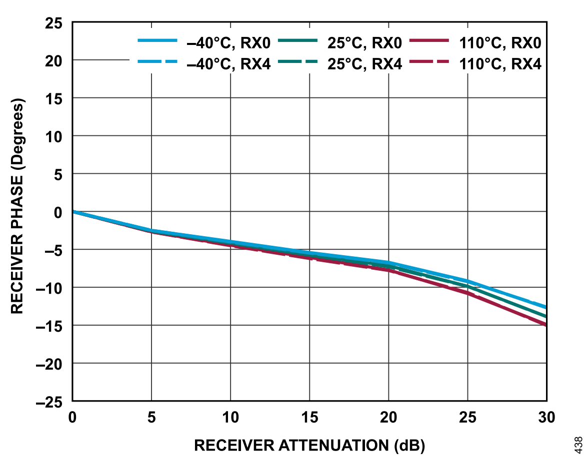


Figure 436. Receiver Phase vs. Receiver Attenuation

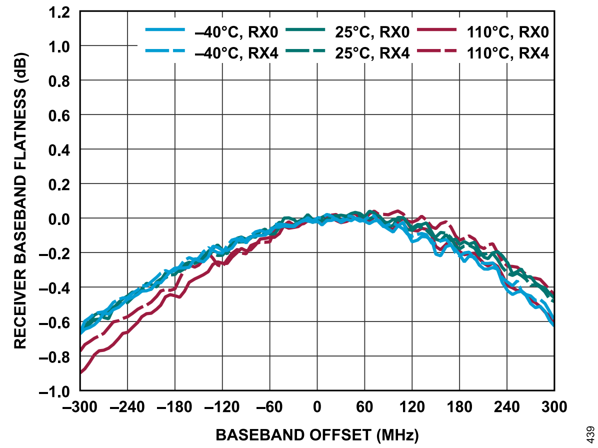


Figure 437. Receiver Baseband Flatness vs. Baseband Offset

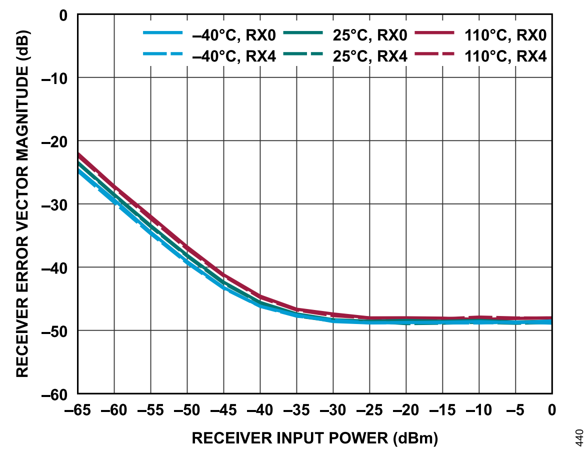


Figure 438. Receiver Error Vector Magnitude vs. Receiver Input Power, 10 MHz Offset, 20 MHz LTE, TDD Mode, AGC Enabled

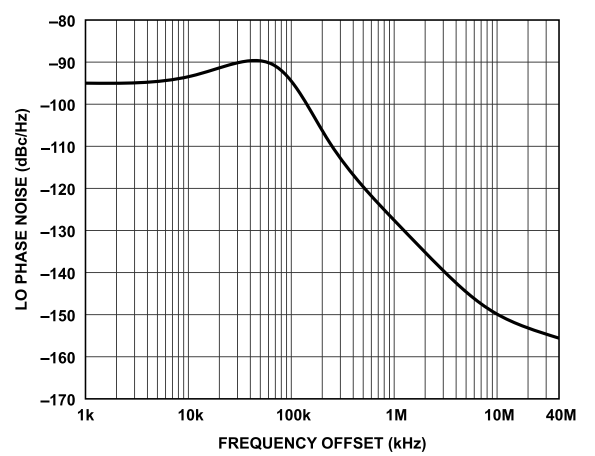


Figure 439. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

TYPICAL PERFORMANCE CHARACTERISTICS

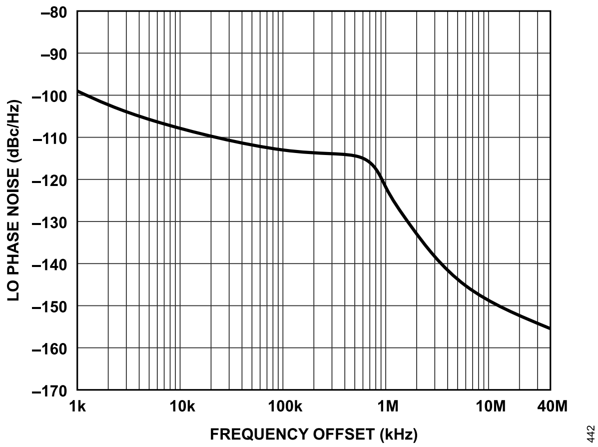


Figure 440. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

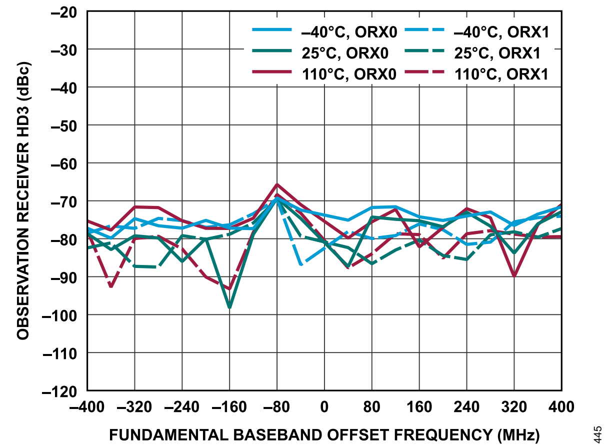


Figure 443. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

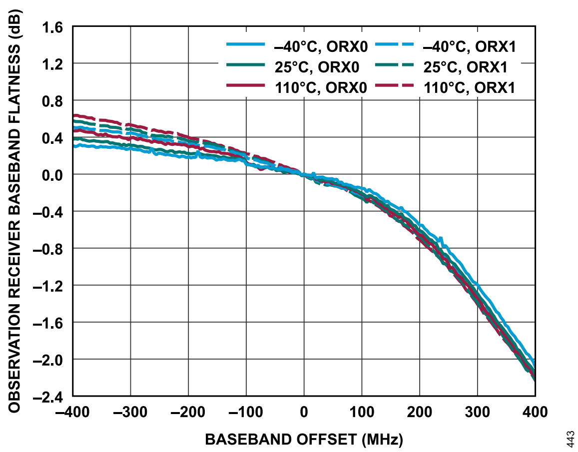


Figure 441. Observation Receiver Baseband Flatness vs. Baseband Offset

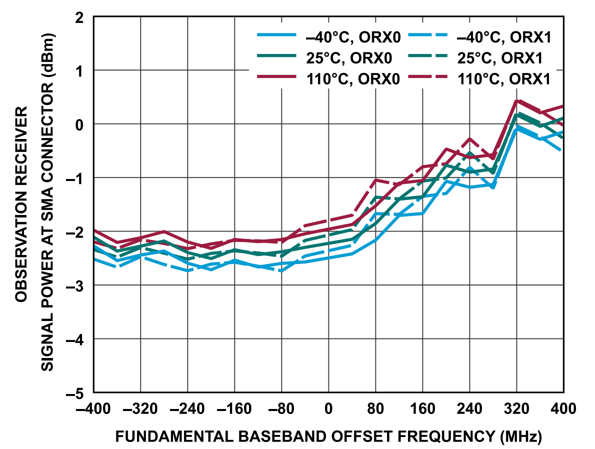


Figure 444. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

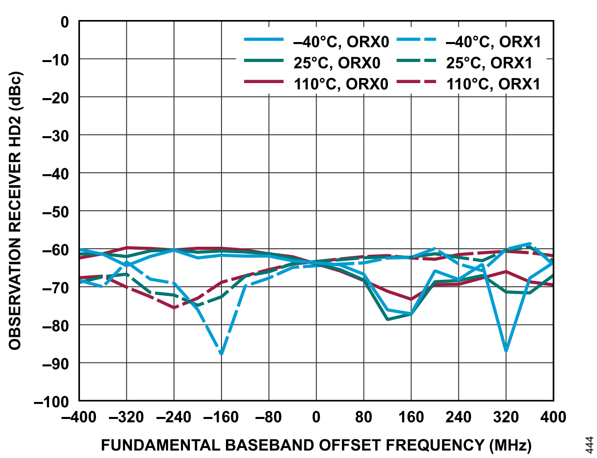


Figure 442. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

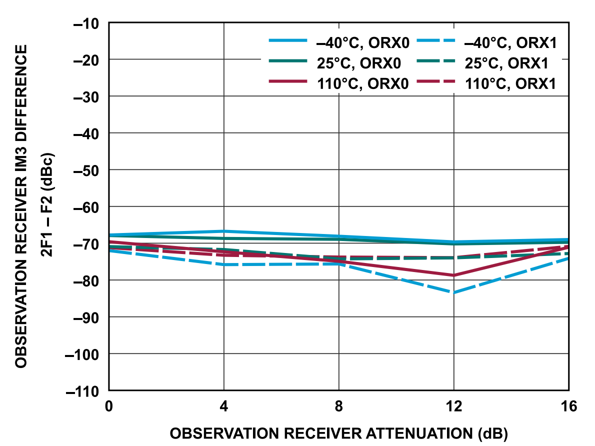


Figure 445. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 4502 MHz, F2 = 4512 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

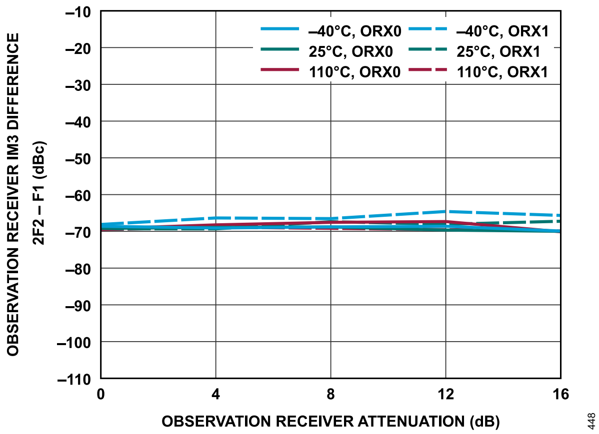


Figure 446. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 4502 MHz, F2 = 4512 MHz

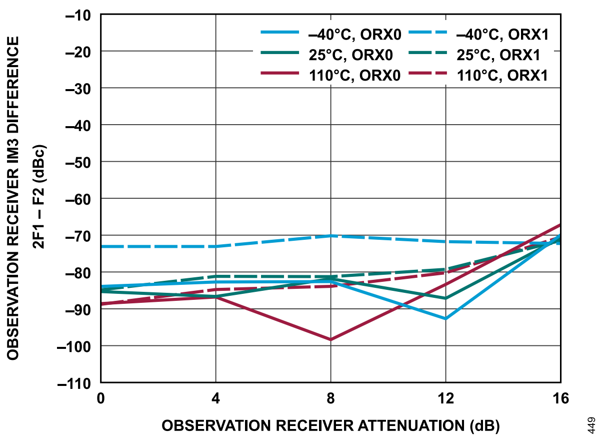


Figure 447. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 4502 MHz, F2 = 4712 MHz

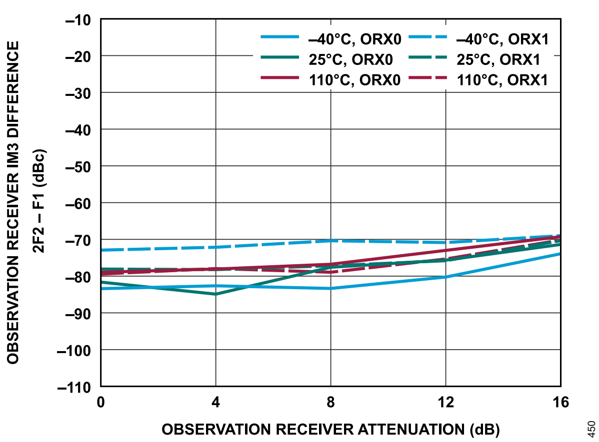


Figure 448. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 4502 MHz, F2 = 4712 MHz

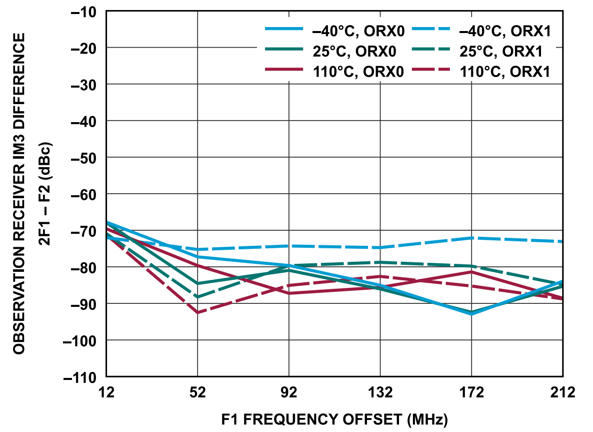


Figure 449. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 4502 MHz

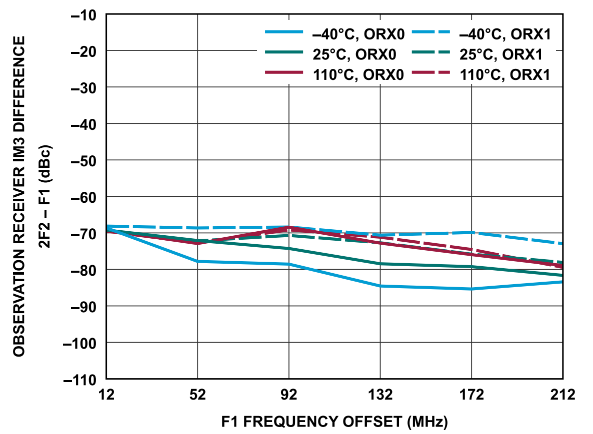


Figure 450. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 4502 MHz

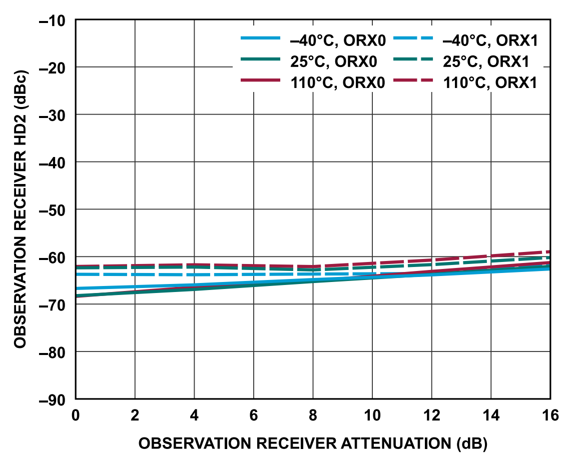


Figure 451. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

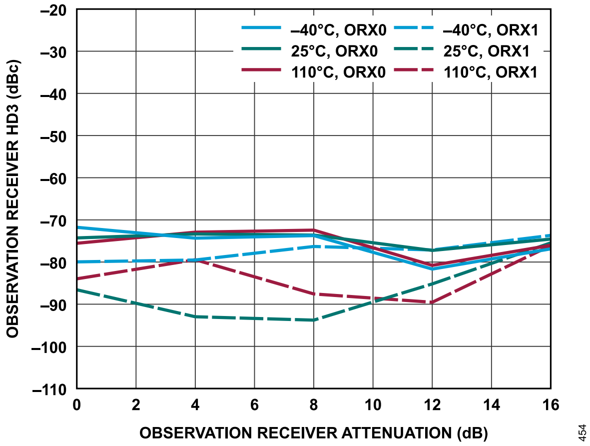


Figure 452. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

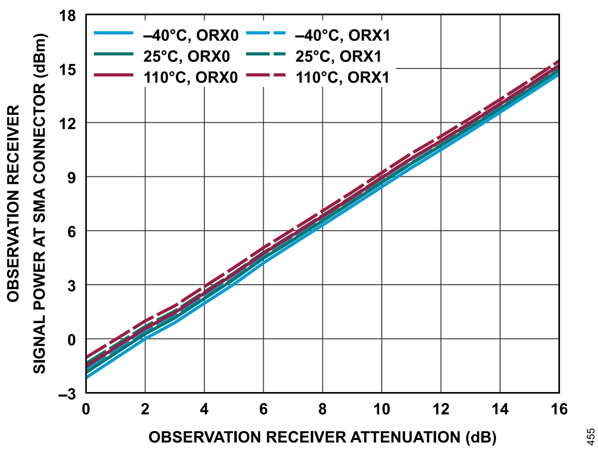


Figure 453. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

5600 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 5600 MHz, unless otherwise noted.

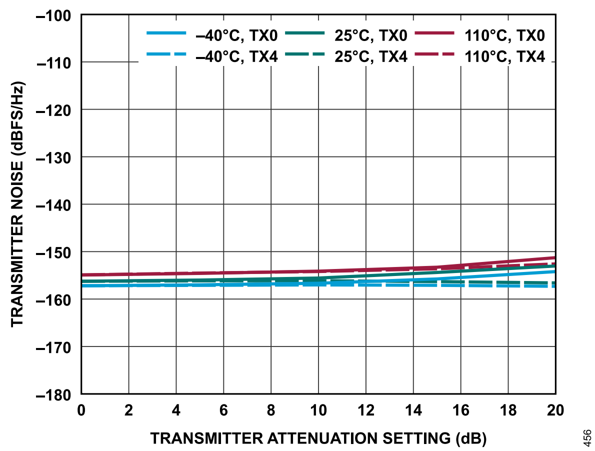


Figure 454. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

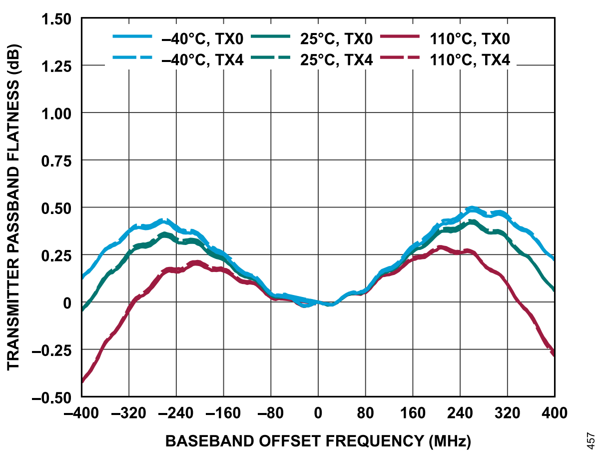


Figure 455. Transmitter Passband Flatness vs. Baseband Offset Frequency

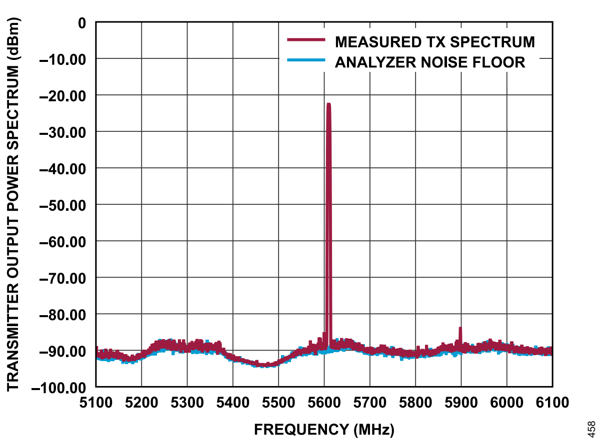


Figure 456. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −6 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

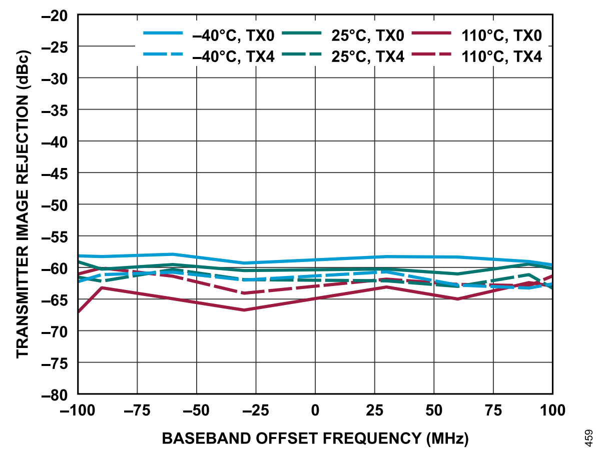


Figure 457. Transmitter Image Rejection vs. Baseband Offset Frequency, −12 dBFS CW Signal

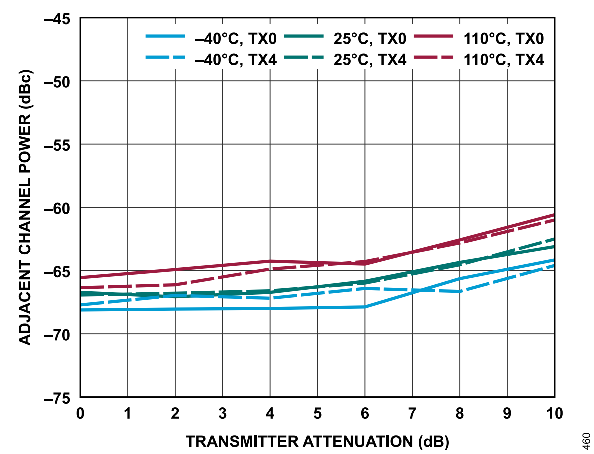


Figure 458. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

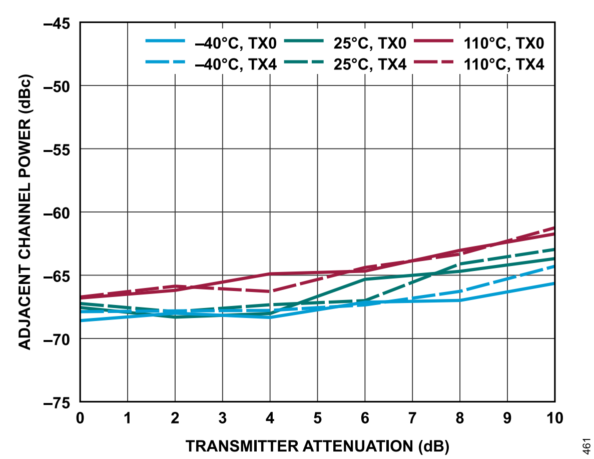


Figure 459. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

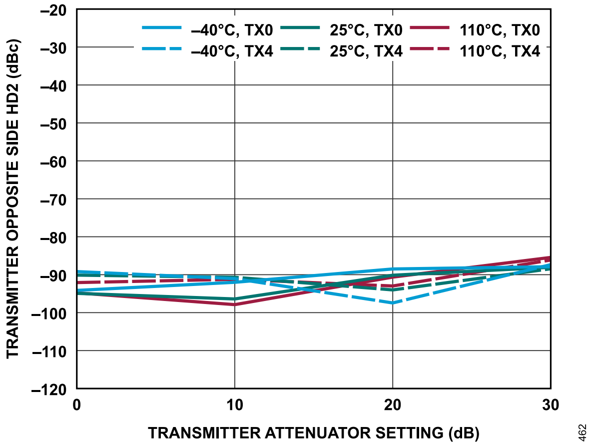


Figure 460. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

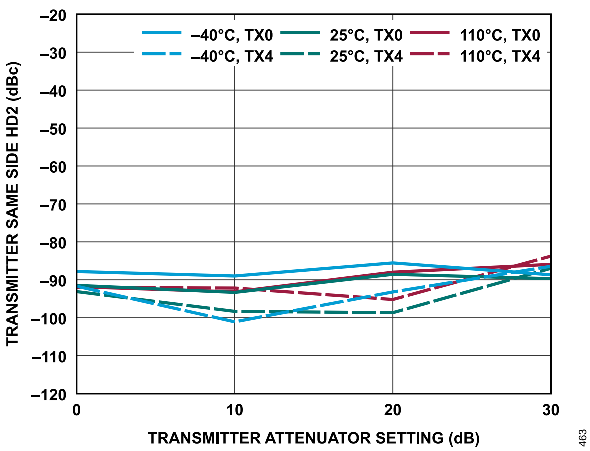


Figure 461. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

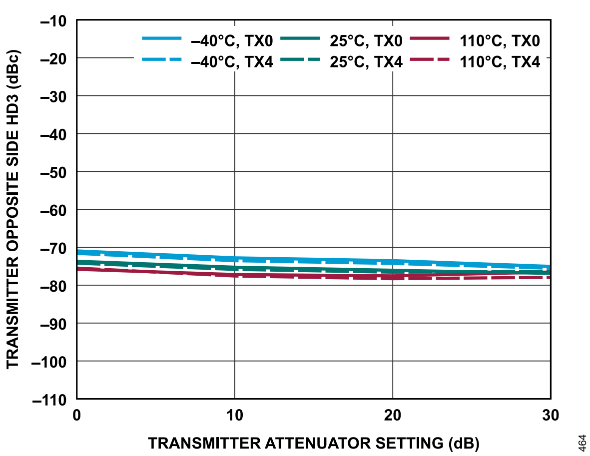


Figure 462. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

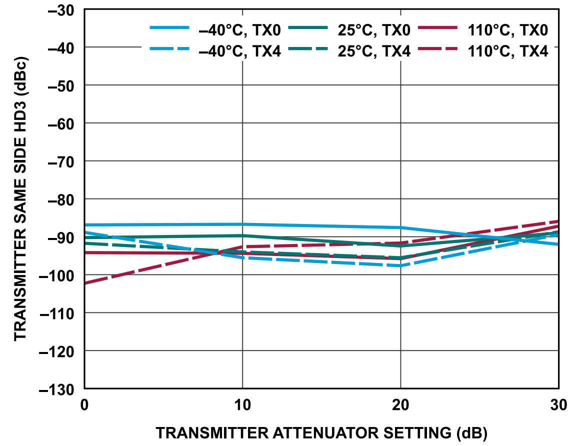


Figure 463. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

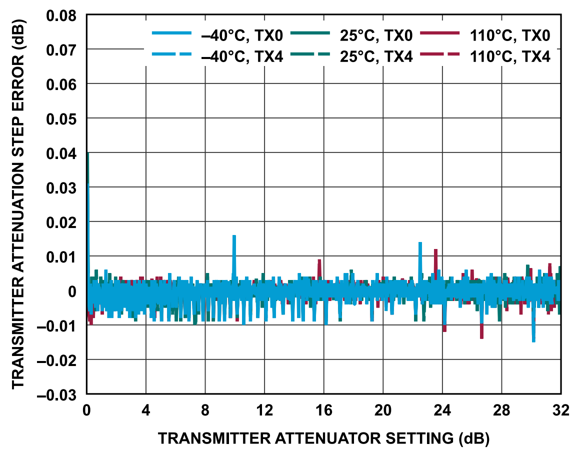


Figure 464. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

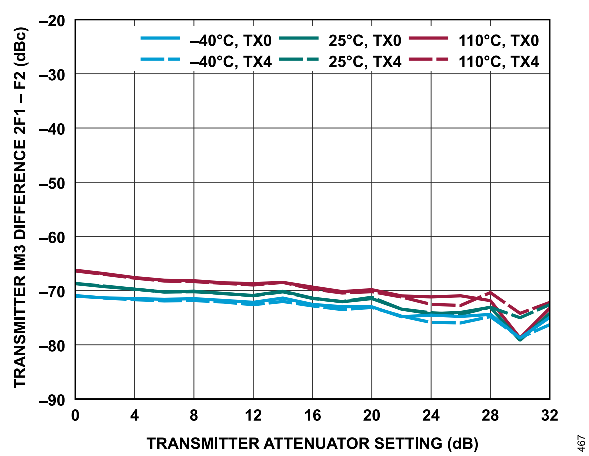


Figure 465. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

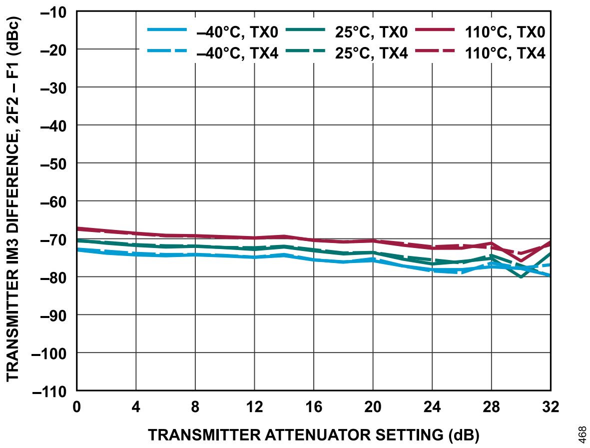


Figure 466. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

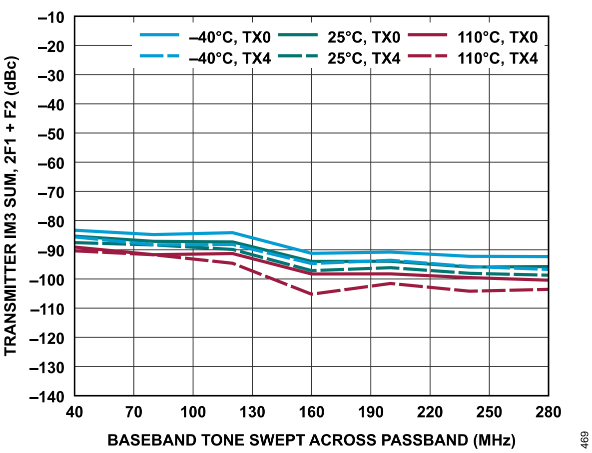


Figure 467. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

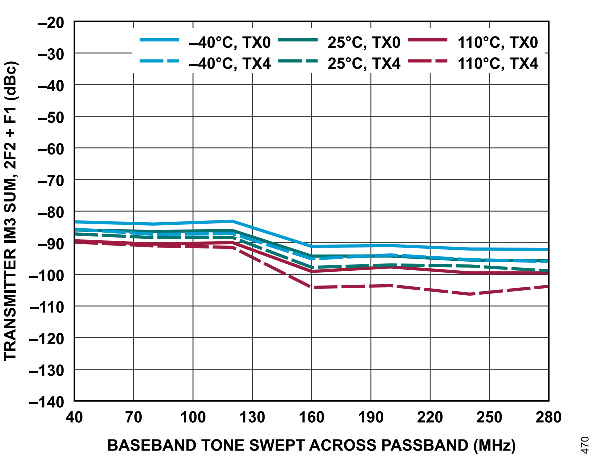


Figure 468. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

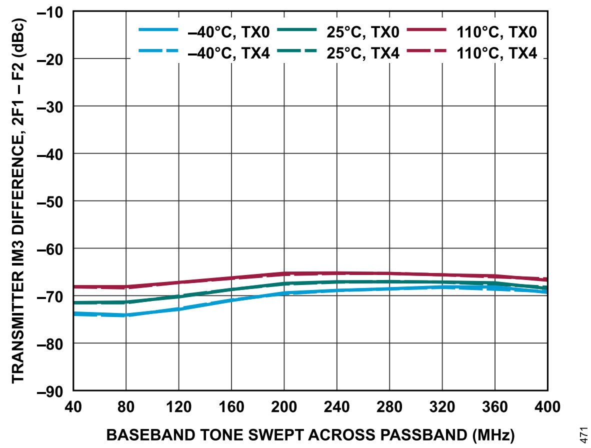


Figure 469. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

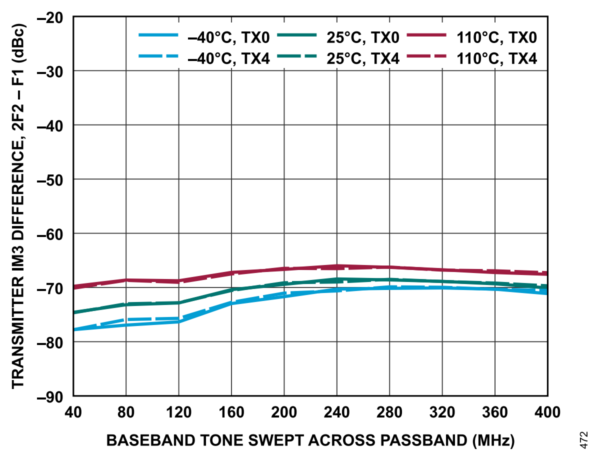


Figure 470. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

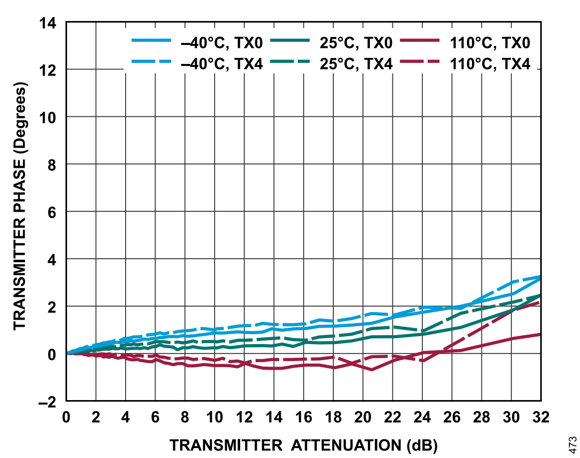


Figure 471. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

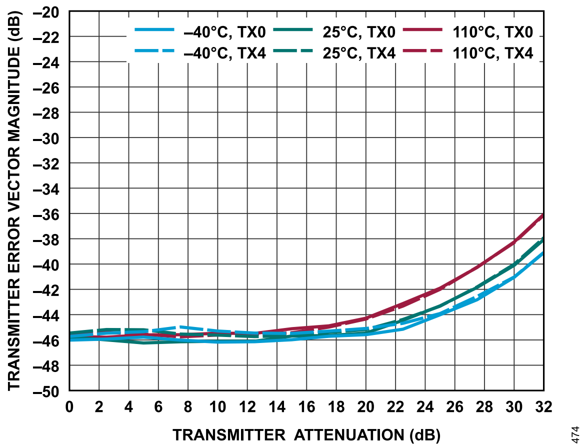


Figure 472. Transmitter Error Vector Magnitude vs. Transmitter Attenuation, 20 MHz LTE, PAR = 12 dB

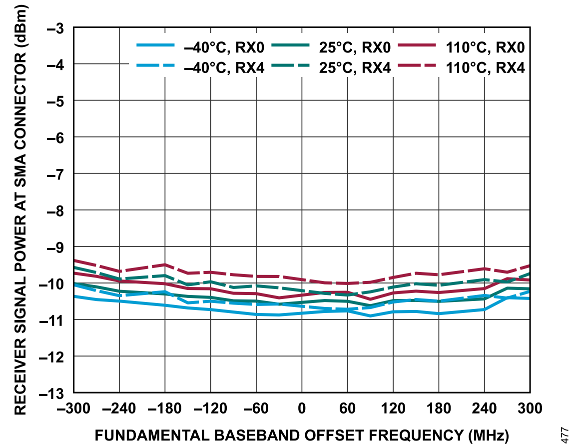


Figure 475. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

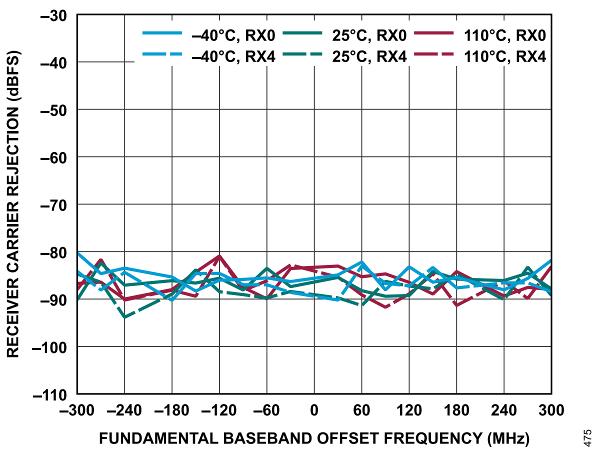


Figure 473. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

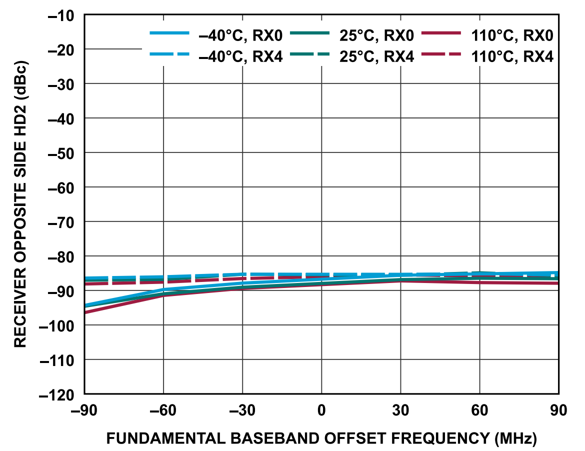


Figure 476. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

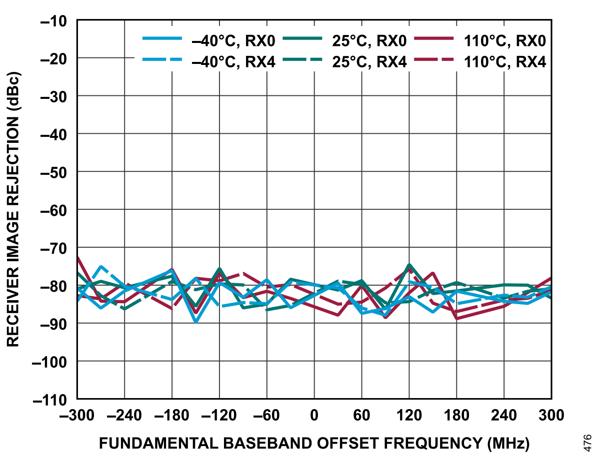


Figure 474. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

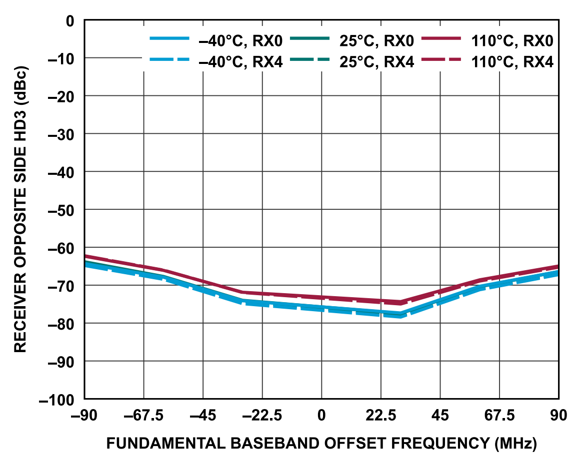


Figure 477. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

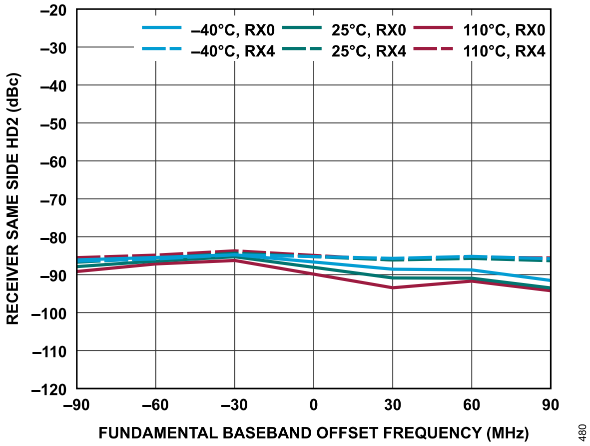


Figure 478. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

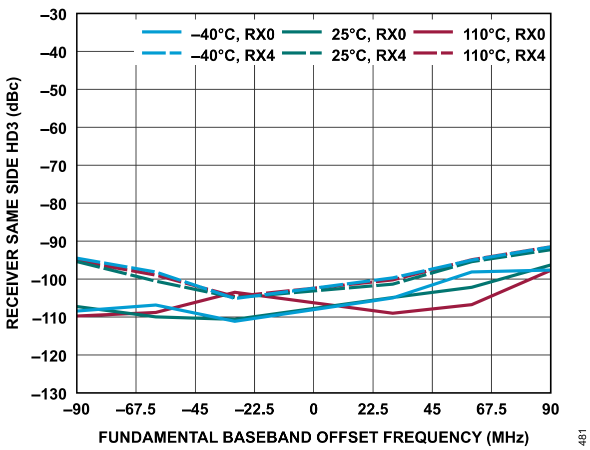


Figure 479. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

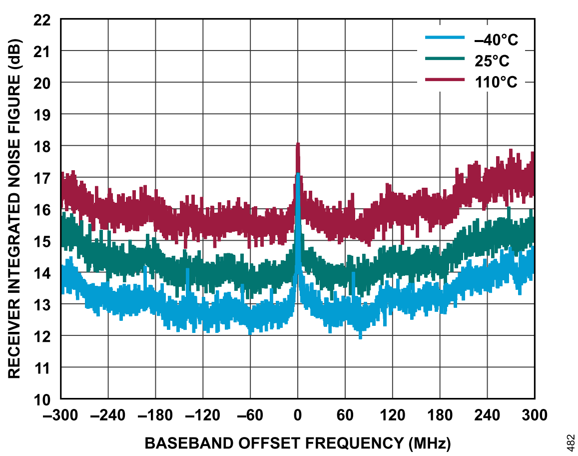


Figure 480. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

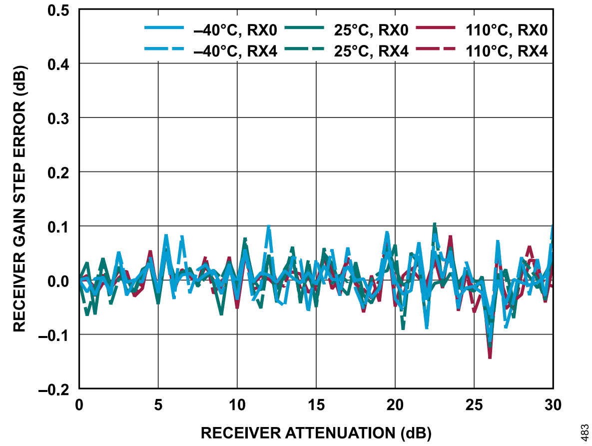


Figure 481. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal (Measured Using High Band Gain Table)

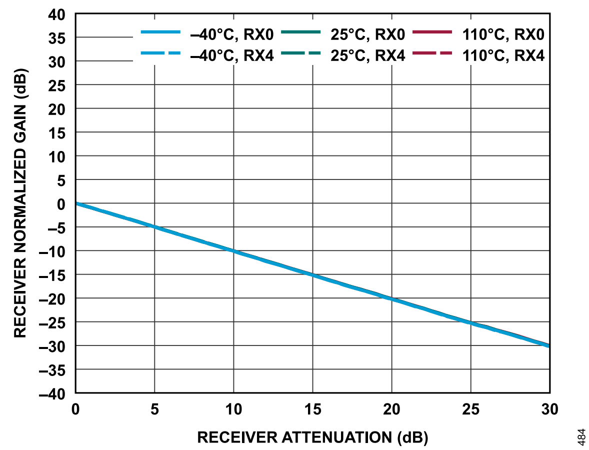


Figure 482. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

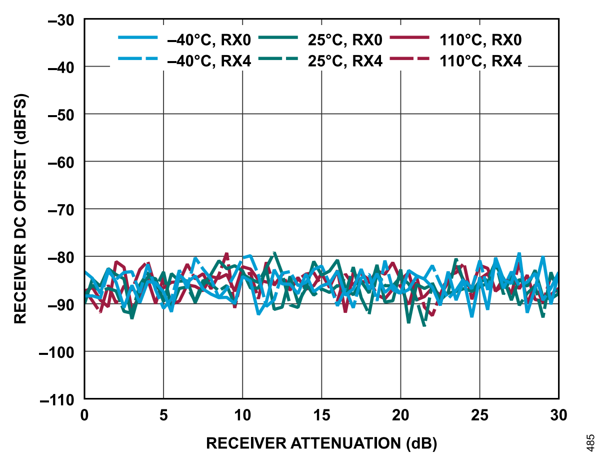


Figure 483. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

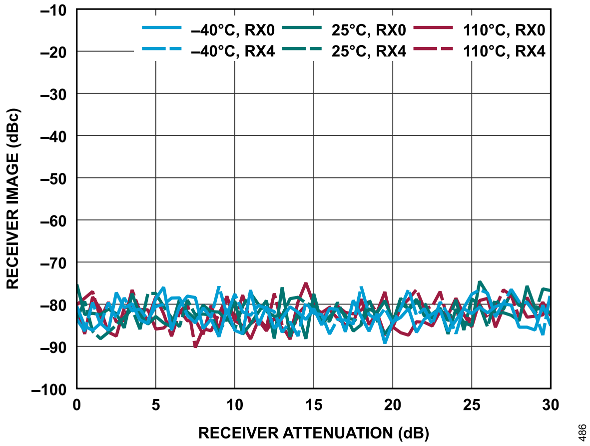


Figure 484. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

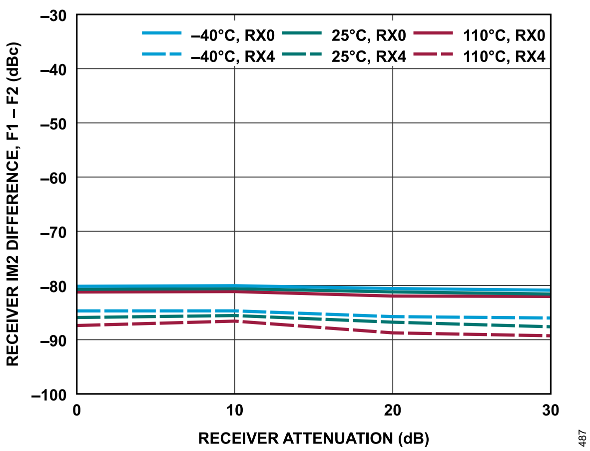


Figure 485. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

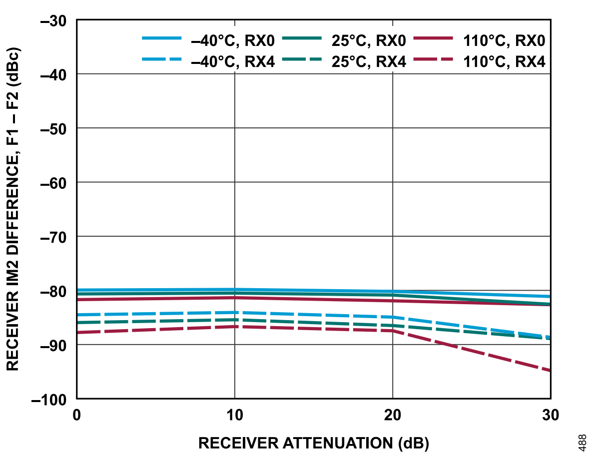


Figure 486. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

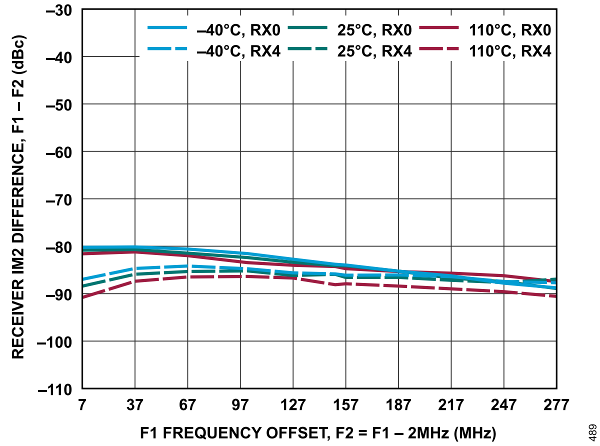


Figure 487. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

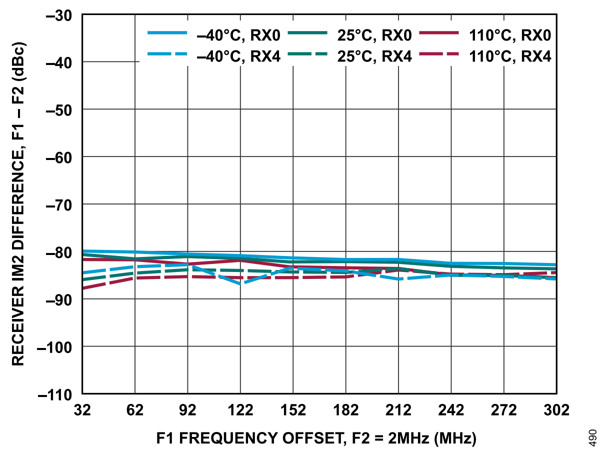


Figure 488. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

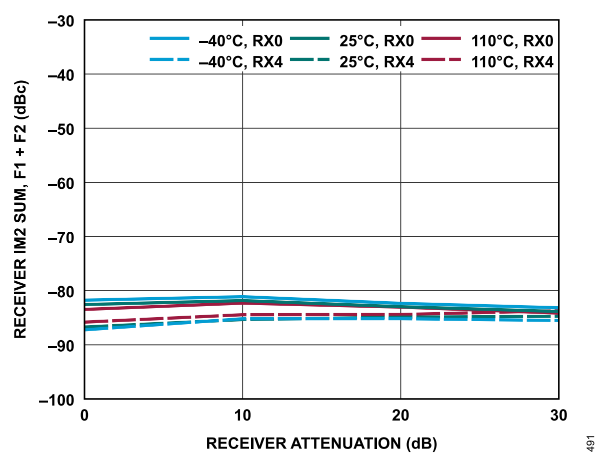


Figure 489. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

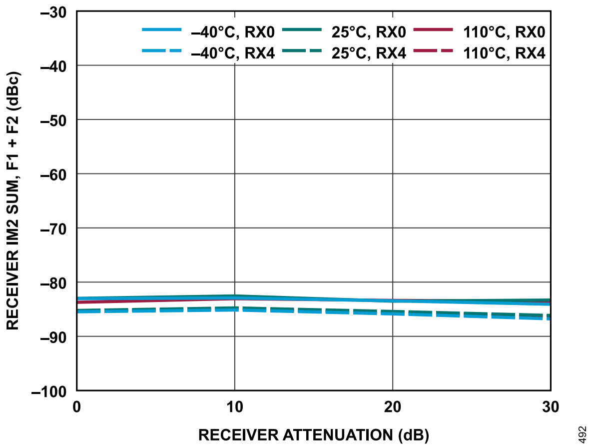


Figure 490. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

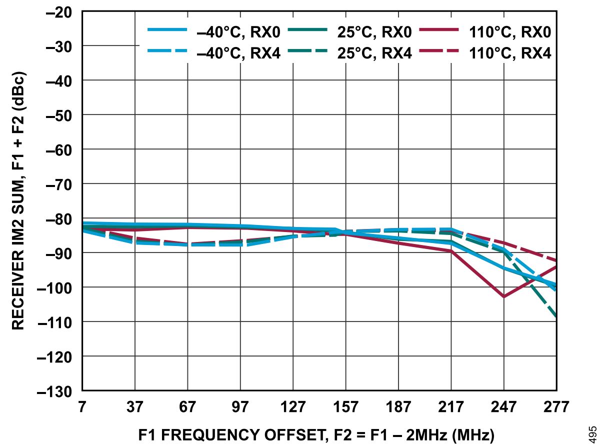


Figure 493. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

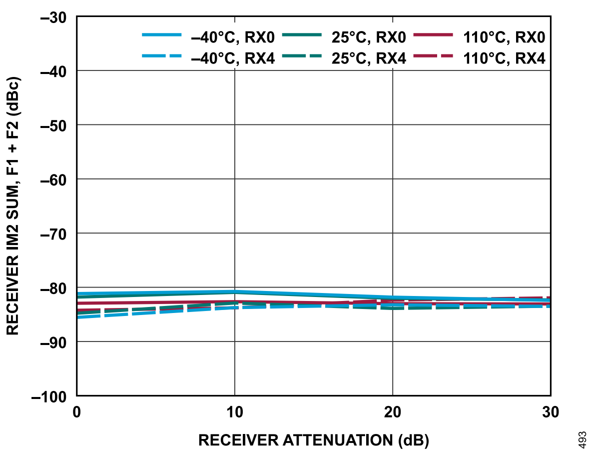


Figure 491. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

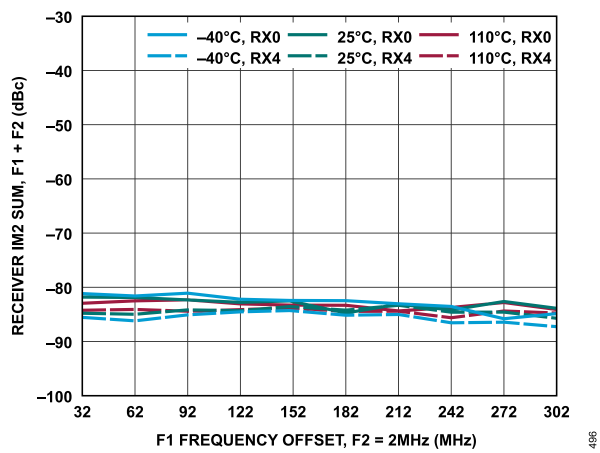


Figure 494. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

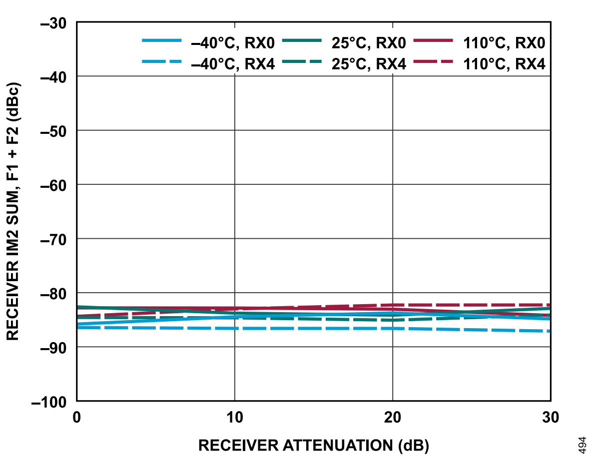


Figure 492. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 272 MHz Offset, F2 = 2 MHz Offset

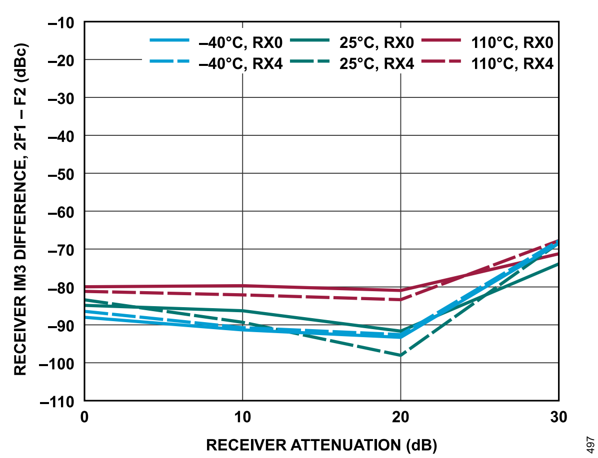


Figure 495. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

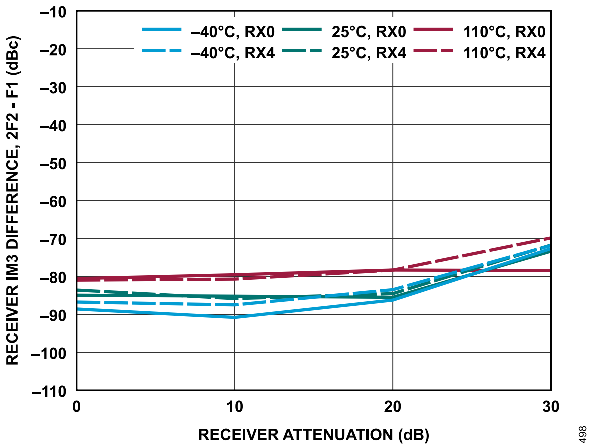


Figure 496. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

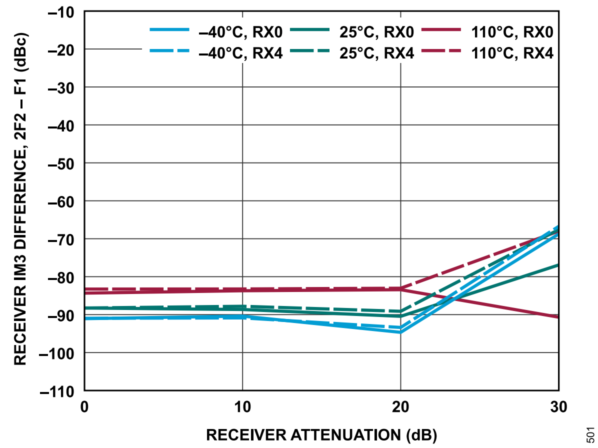


Figure 499. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

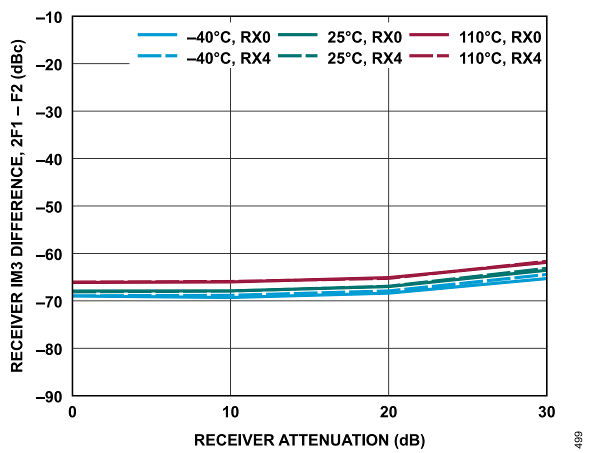


Figure 497. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = 275 MHz Offset

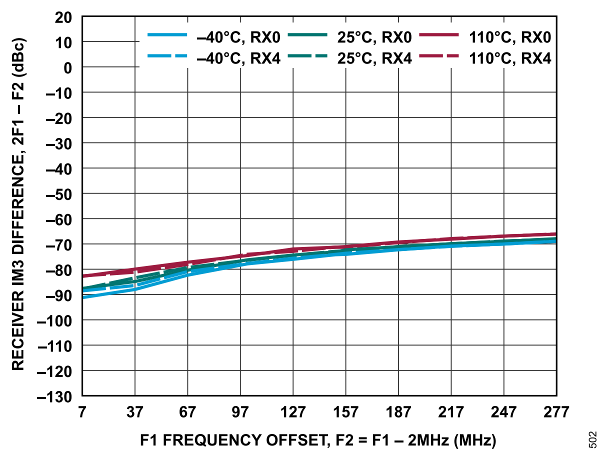


Figure 500. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

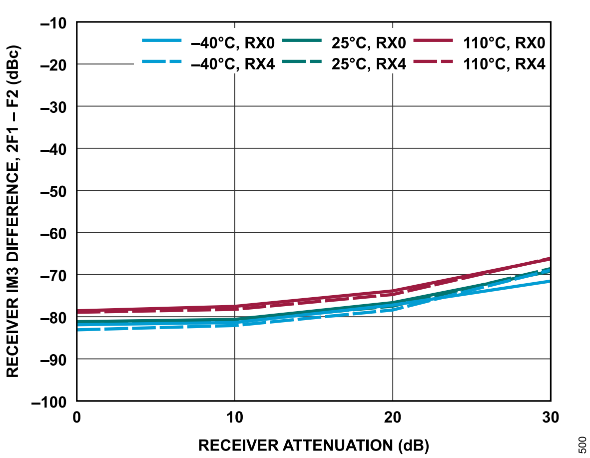


Figure 498. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

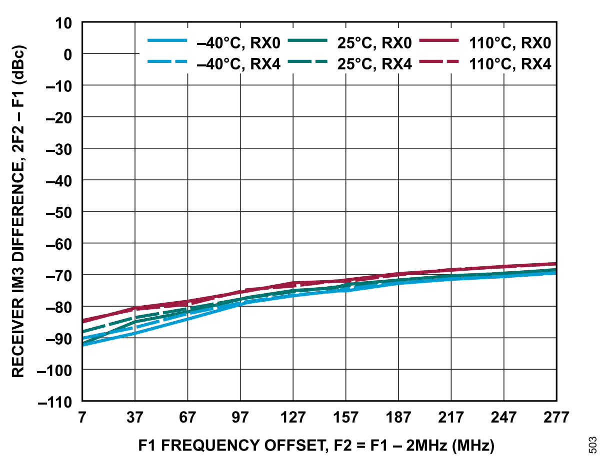


Figure 501. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

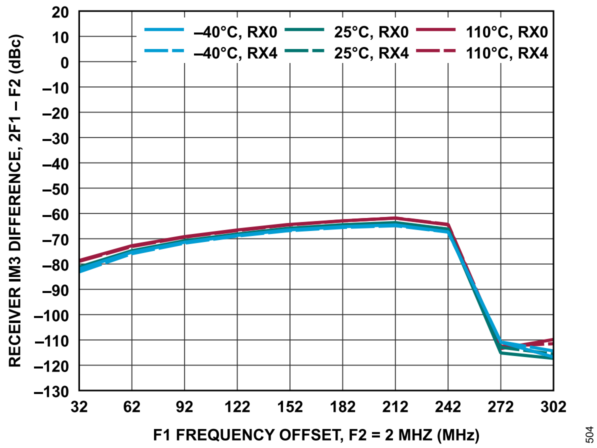


Figure 502. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

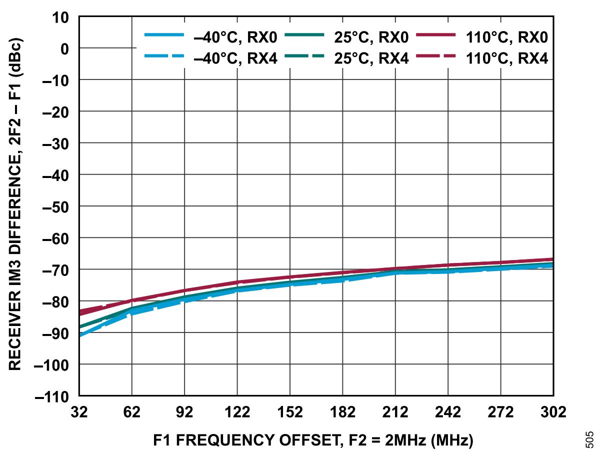


Figure 503. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

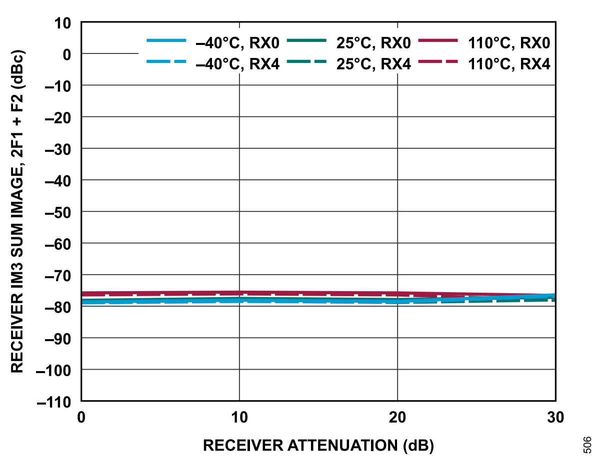


Figure 504. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

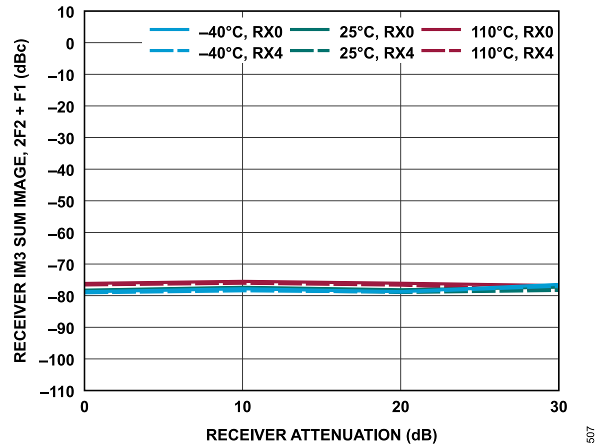


Figure 505. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

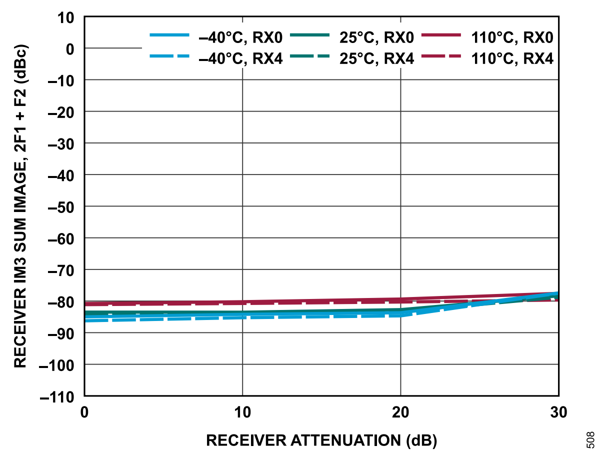


Figure 506. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

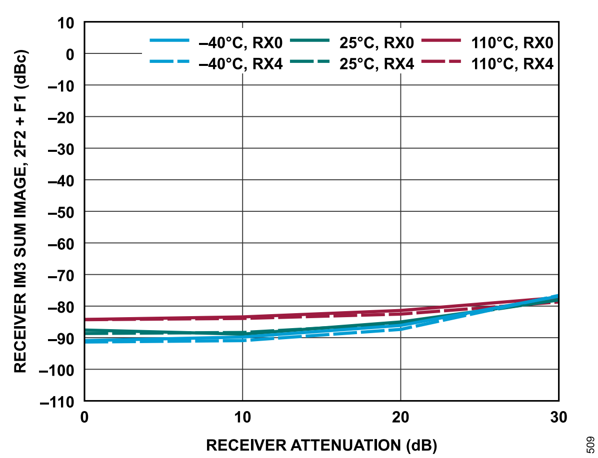


Figure 507. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

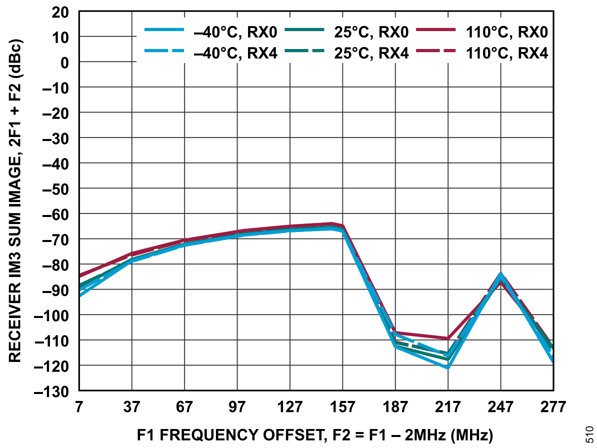


Figure 508. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

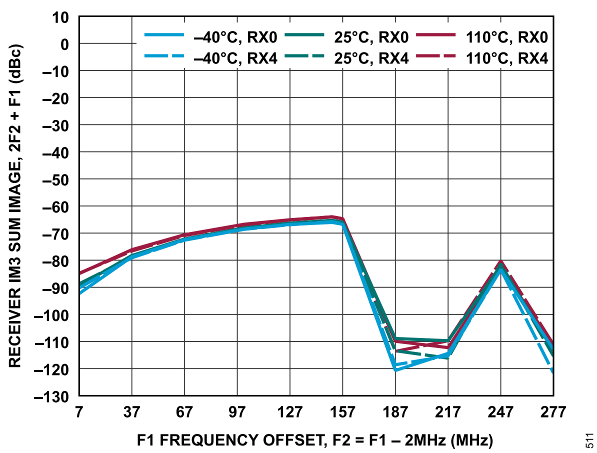


Figure 509. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

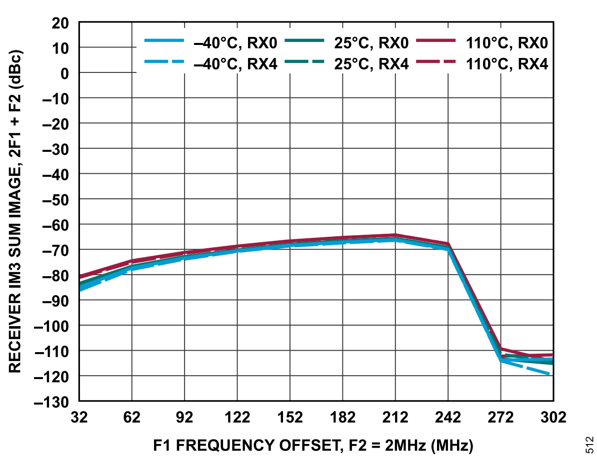


Figure 510. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

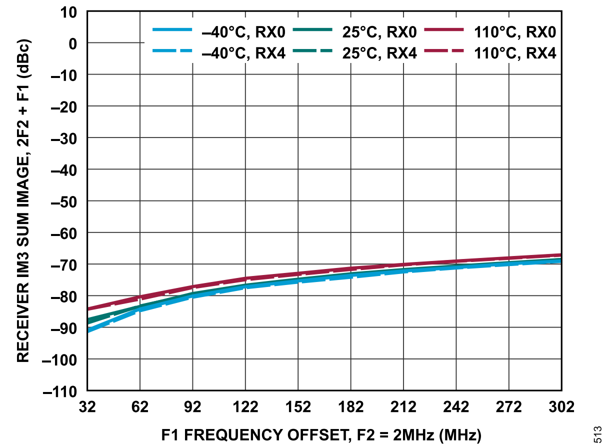


Figure 511. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

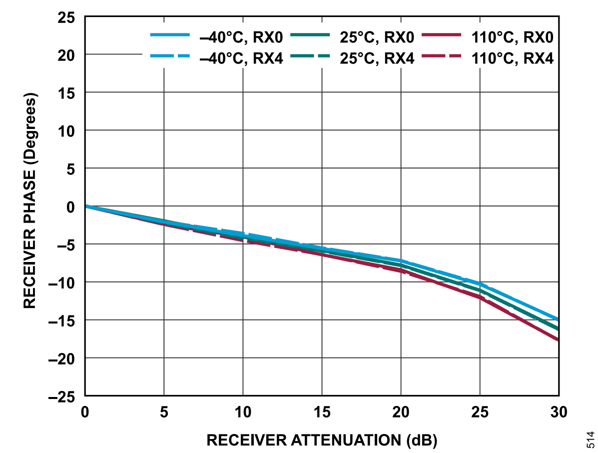


Figure 512. Receiver Phase vs. Receiver Attenuation

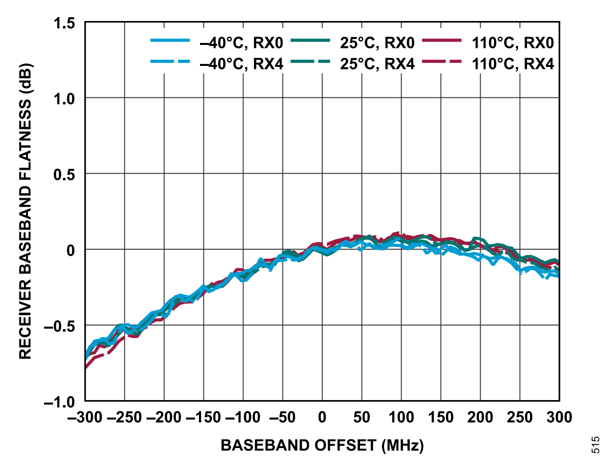


Figure 513. Receiver Baseband Flatness vs. Baseband Offset

TYPICAL PERFORMANCE CHARACTERISTICS

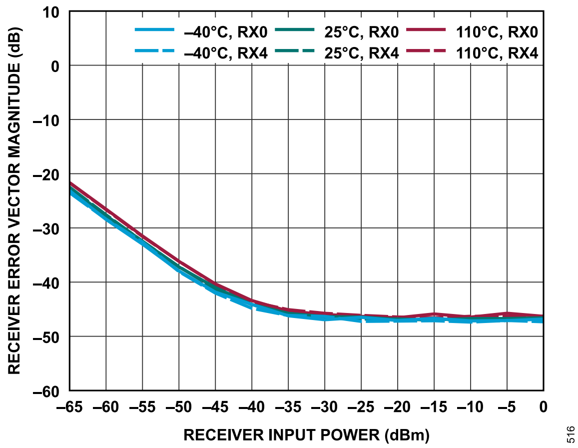


Figure 514. Receiver Error Vector Magnitude vs. Receiver Input Power, 20 MHz LTE, TDD Mode, AGC Enabled

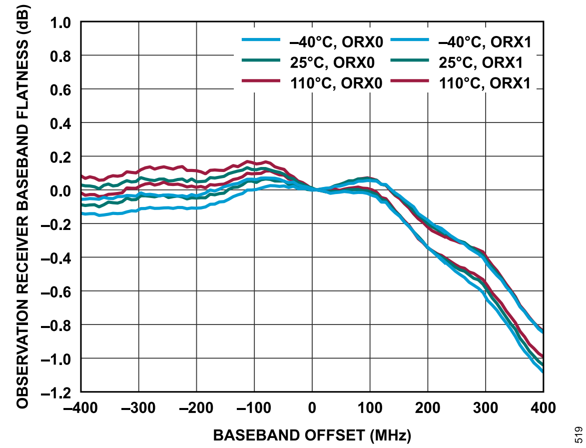


Figure 517. Observation Receiver Baseband Flatness vs. Baseband Offset

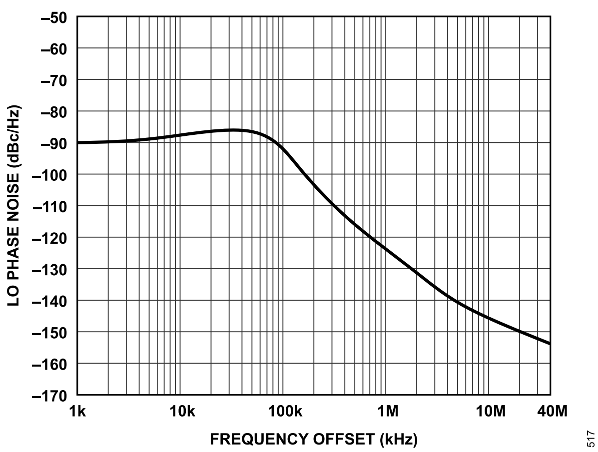


Figure 515. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

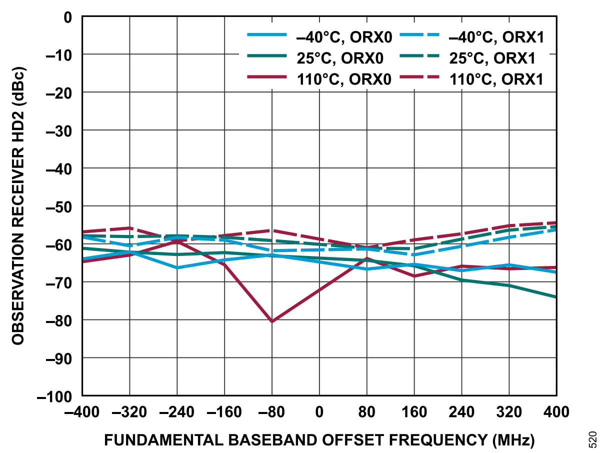


Figure 518. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

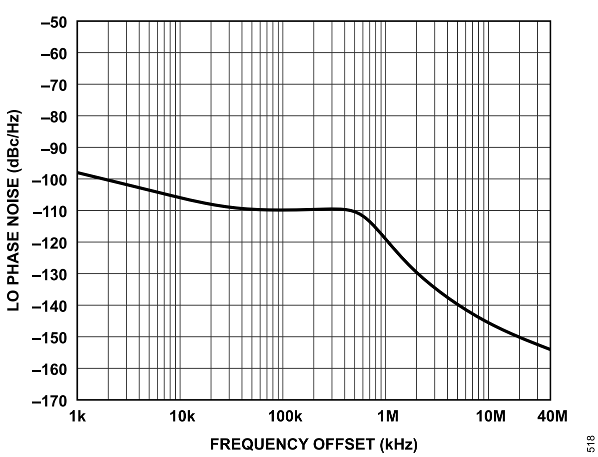


Figure 516. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

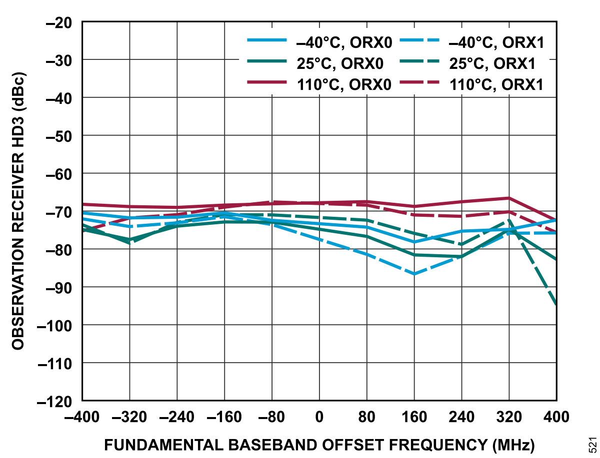


Figure 519. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

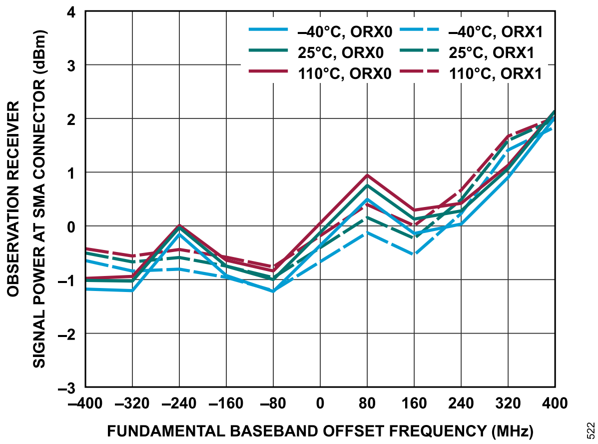


Figure 520. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

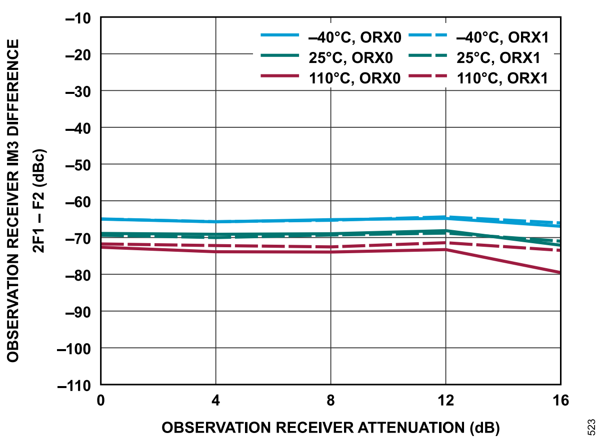


Figure 521. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 5602 MHz, F2 = 5612 MHz

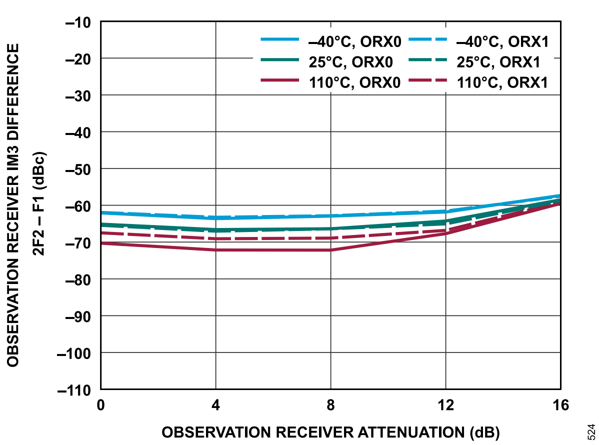


Figure 522. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 5602 MHz, F2 = 5612 MHz

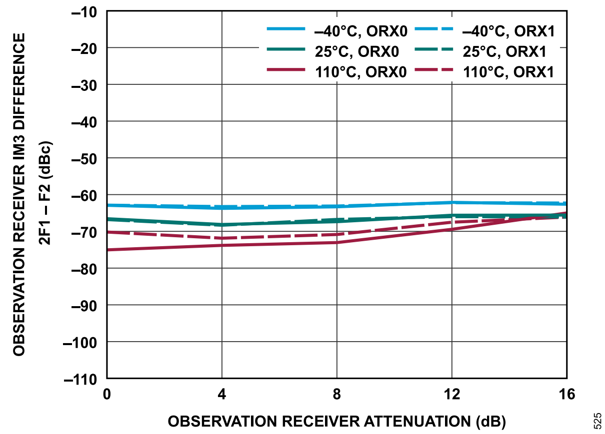


Figure 523. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 5602 MHz, F2 = 5612 MHz

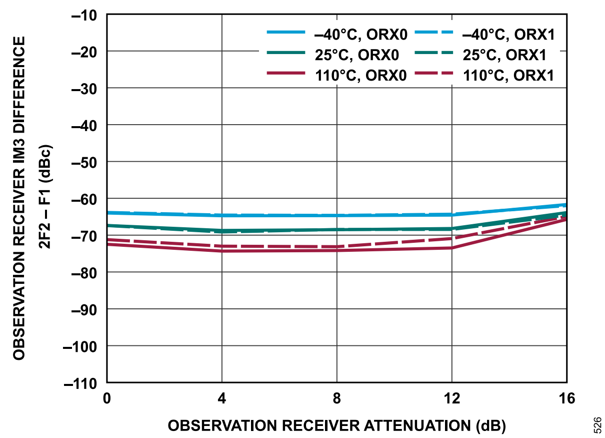


Figure 524. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 5602 MHz, F2 = 5612 MHz

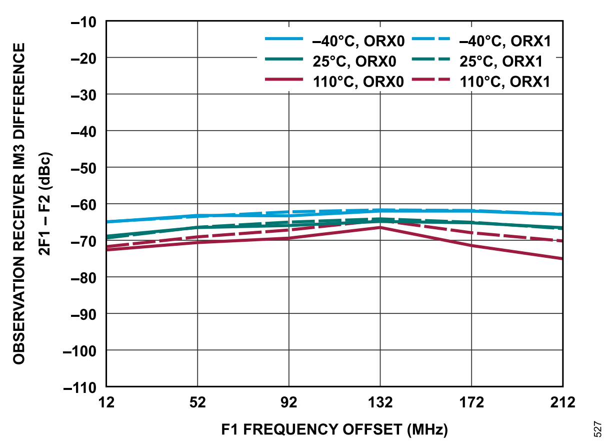


Figure 525. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 5602 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

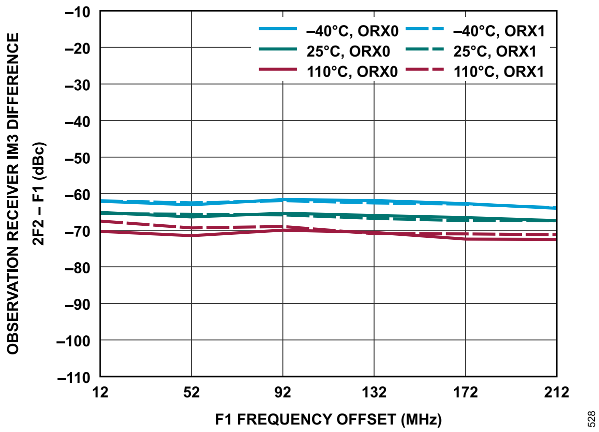


Figure 526. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 5602 MHz

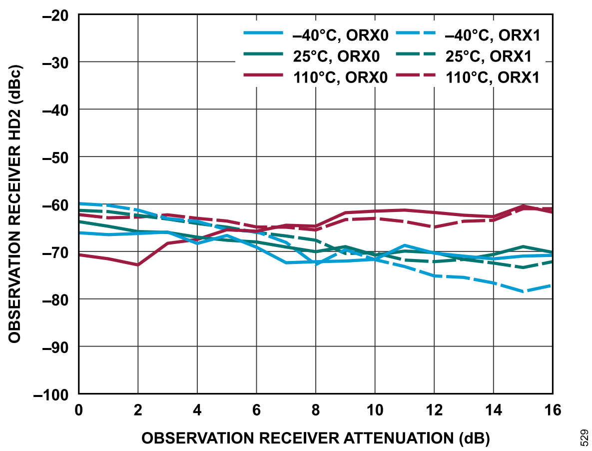


Figure 527. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

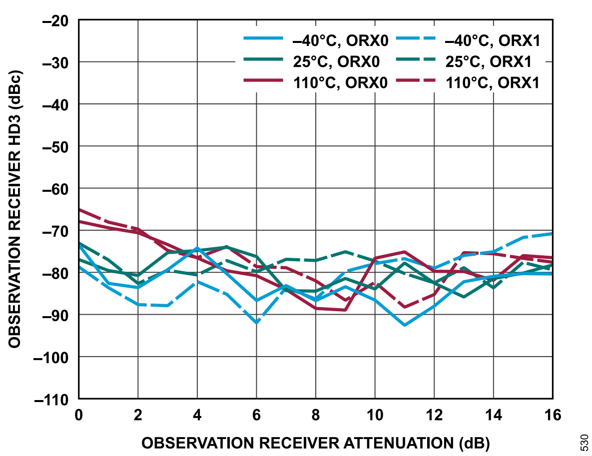


Figure 528. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

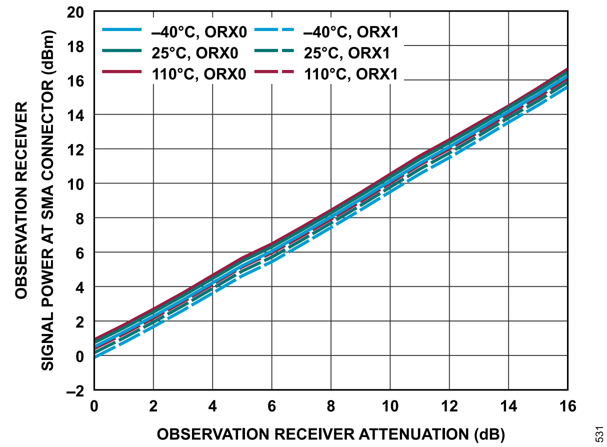


Figure 529. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

6300 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 6300 MHz, unless otherwise noted.

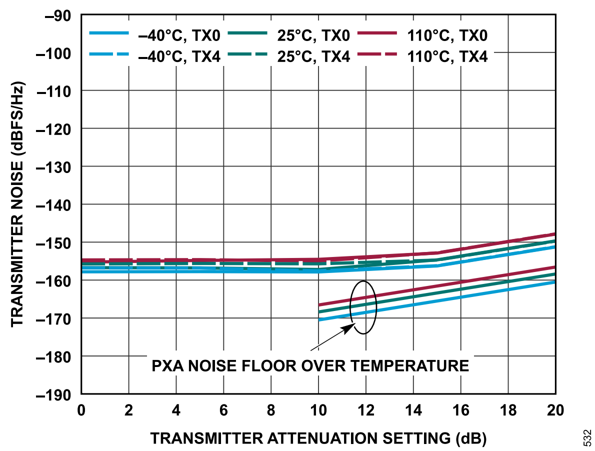


Figure 530. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

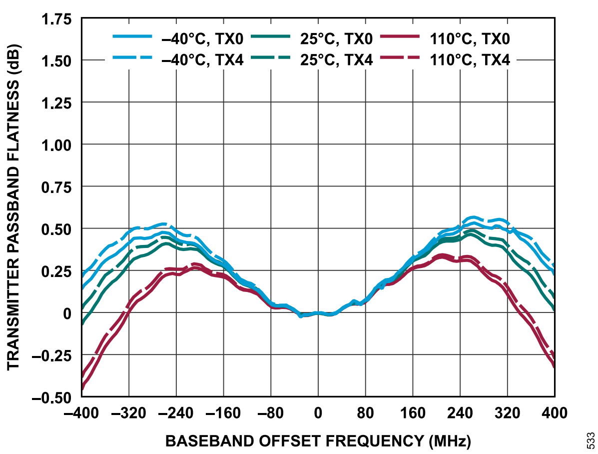


Figure 531. Transmitter Passband Flatness vs. Baseband Offset Frequency

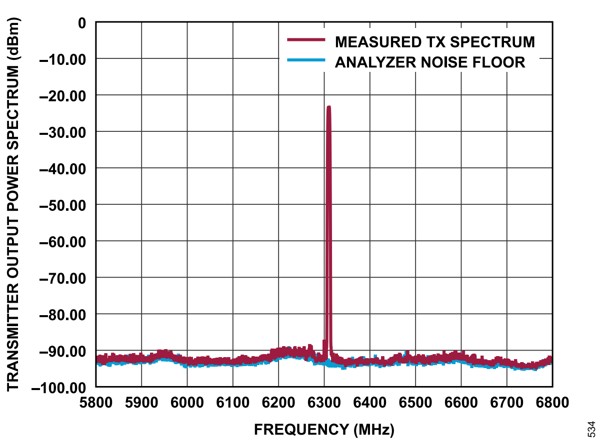


Figure 532. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −6 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

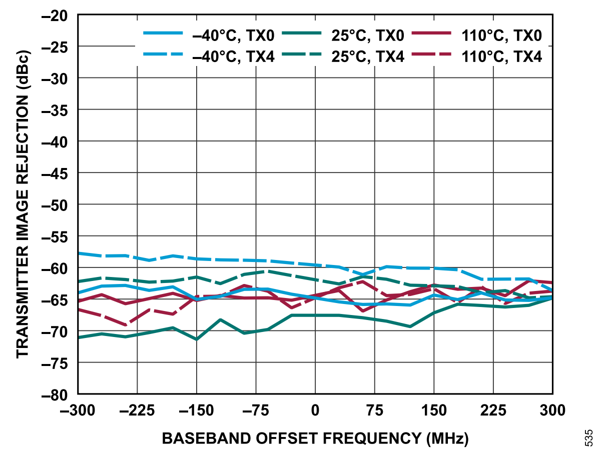


Figure 533. Transmitter Image Rejection vs. Baseband Offset Frequency, −12 dBFS CW Signal

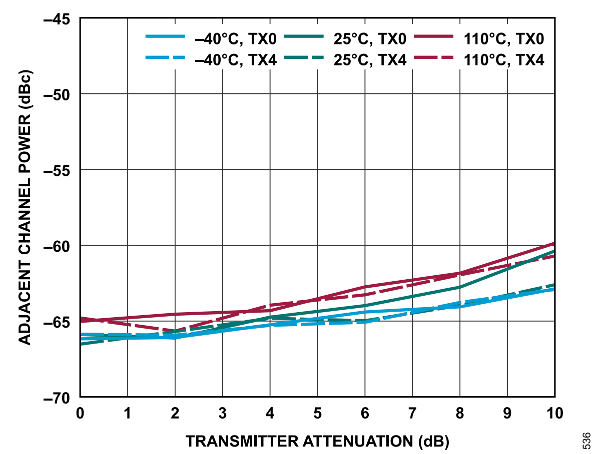


Figure 534. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

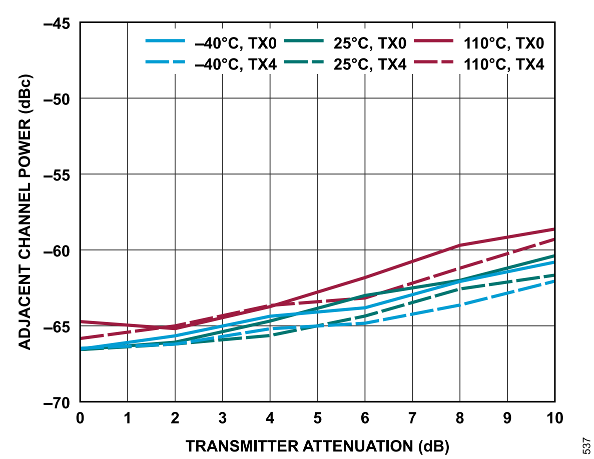


Figure 535. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

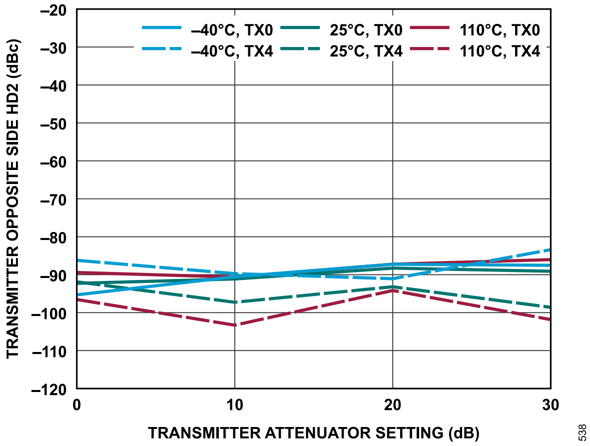


Figure 536. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

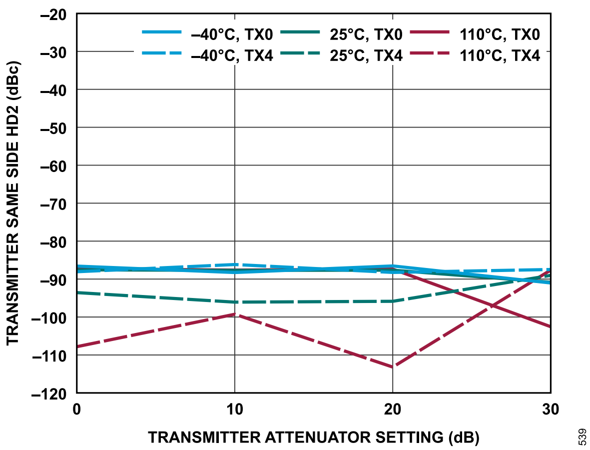


Figure 537. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

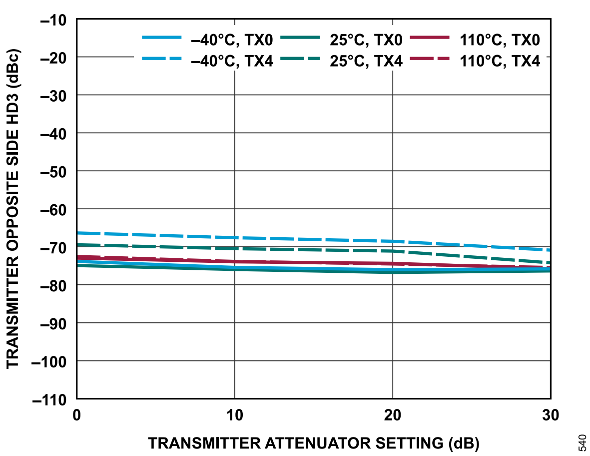


Figure 538. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

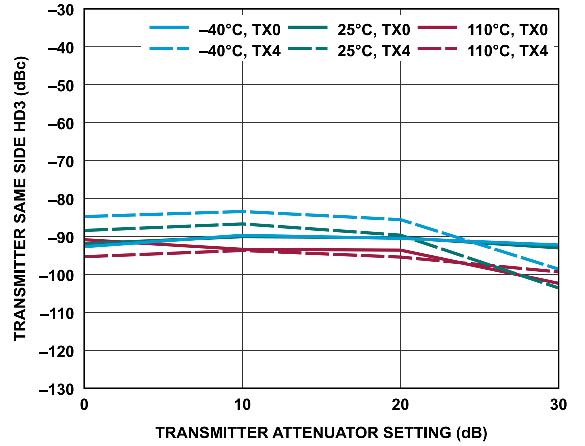


Figure 539. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

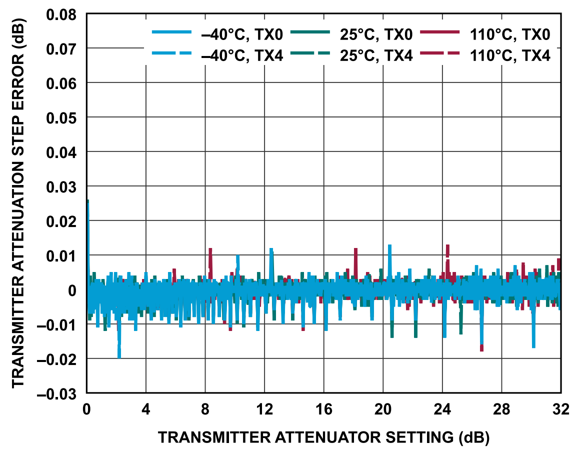


Figure 540. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

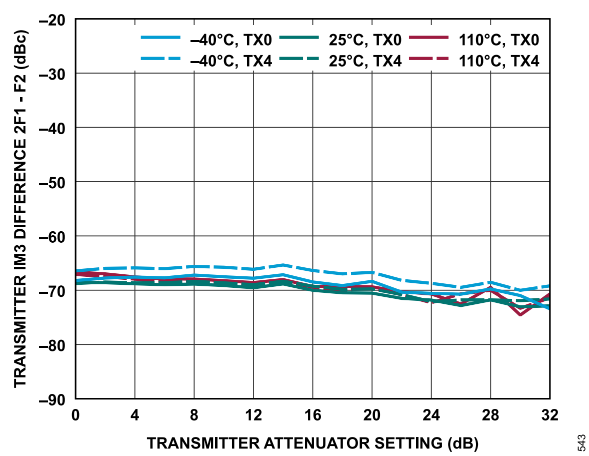


Figure 541. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

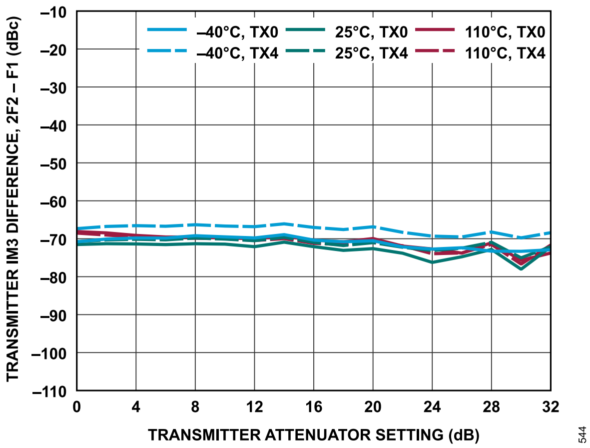


Figure 542. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

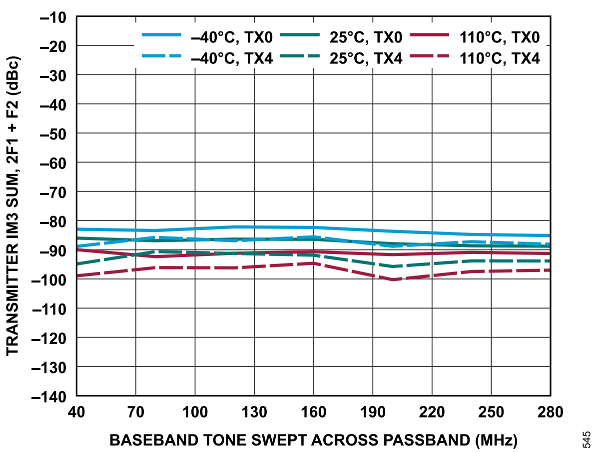


Figure 543. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

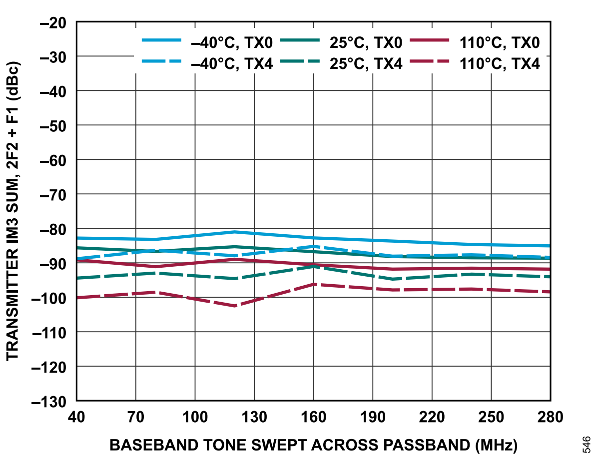


Figure 544. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

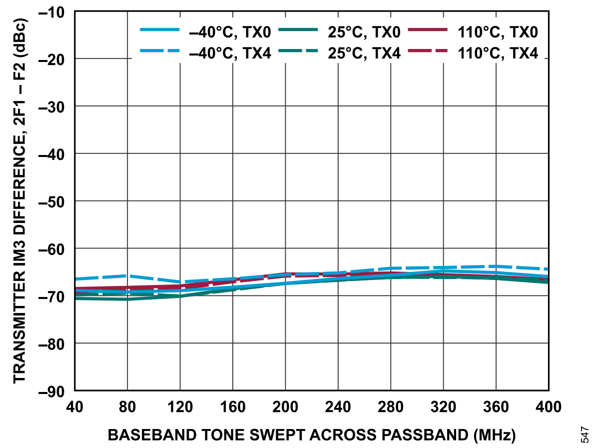


Figure 545. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

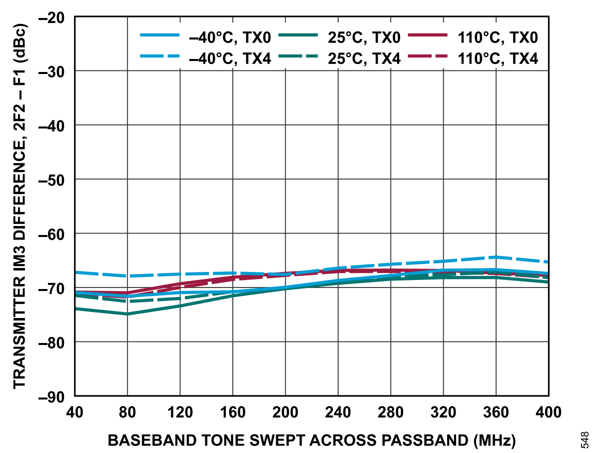


Figure 546. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

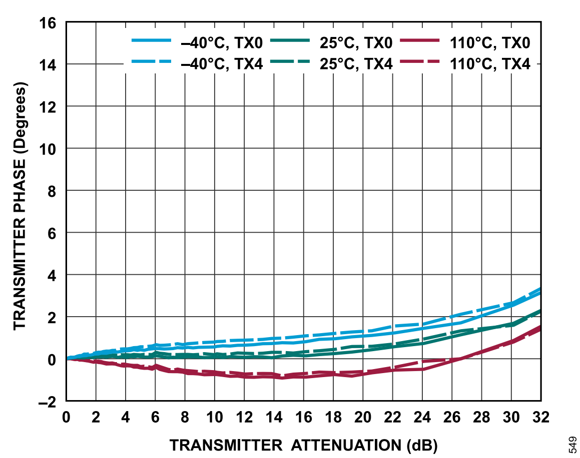


Figure 547. Transmitter Phase vs. Transmitter Attenuation

TYPICAL PERFORMANCE CHARACTERISTICS

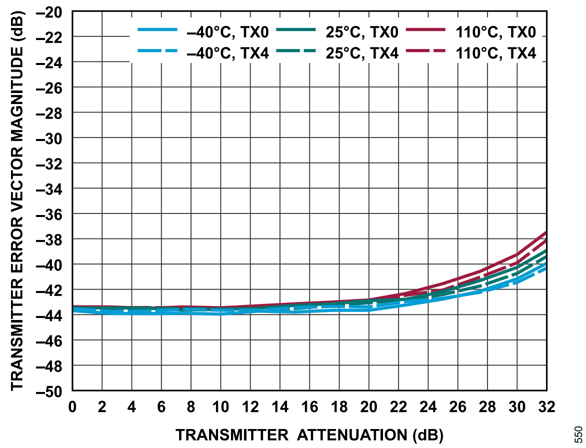


Figure 548. Transmitter Error Vector Magnitude vs. Transmitter Attenuation, 20 MHz LTE, PAR = 12 dB

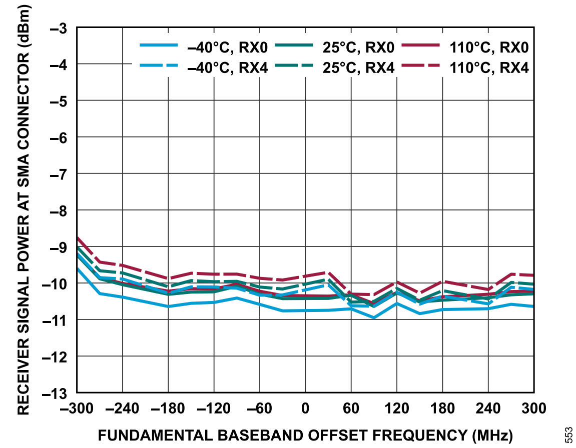


Figure 551. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs Input Signal (Match Not De-Embedded)

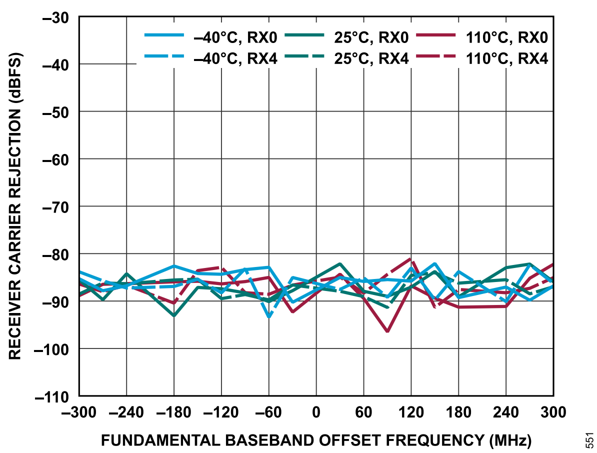


Figure 549. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

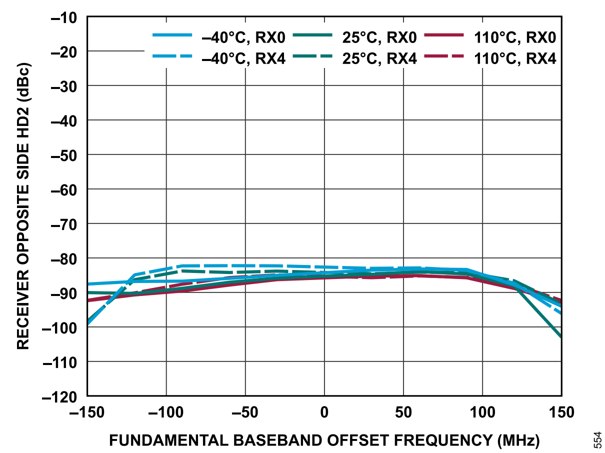


Figure 552. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

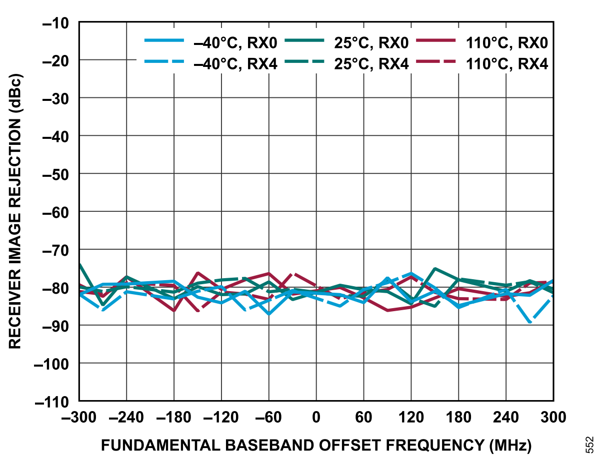


Figure 550. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

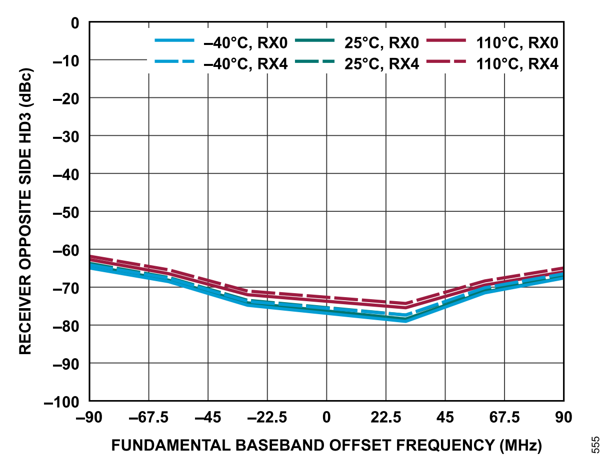


Figure 553. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

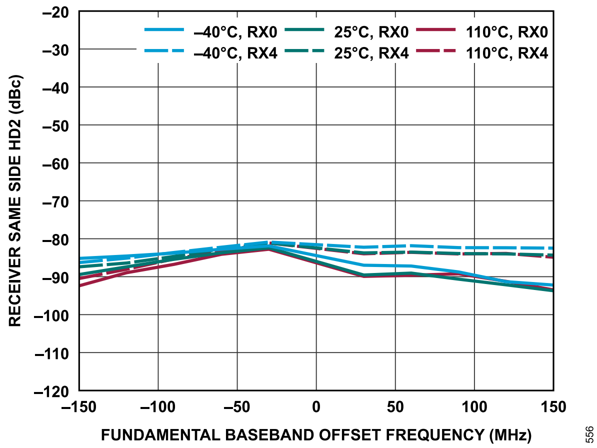


Figure 554. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

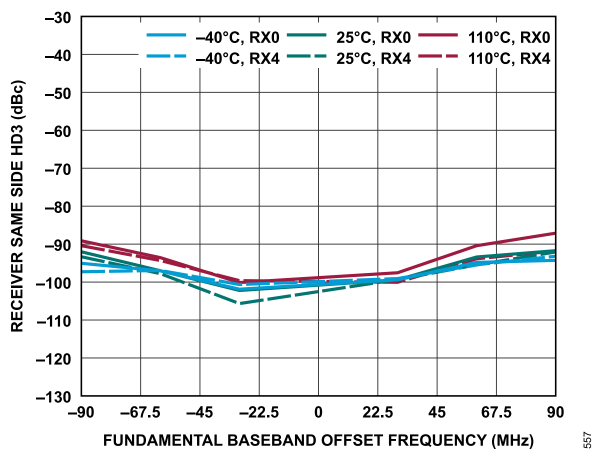


Figure 555. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

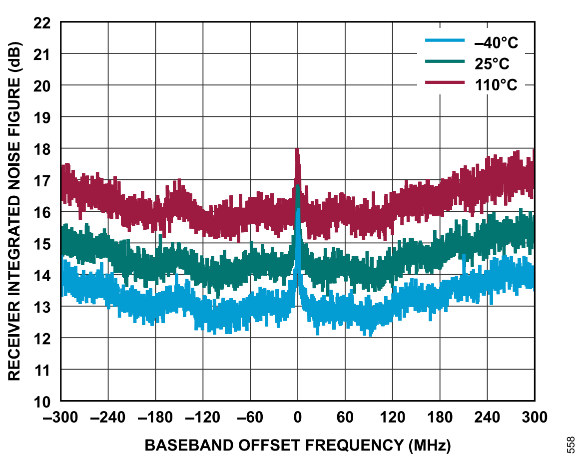


Figure 556. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

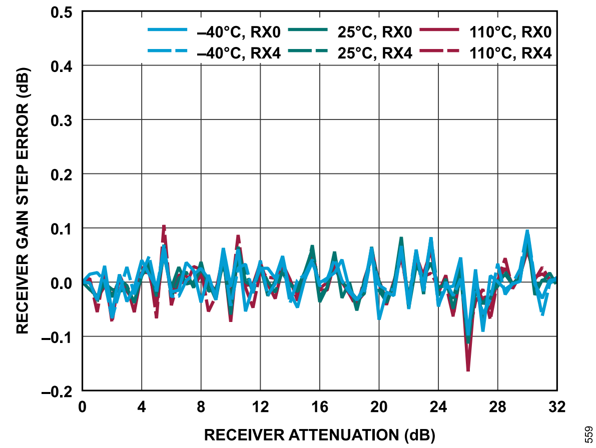


Figure 557. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal (Measured Using High Band Gain Table)

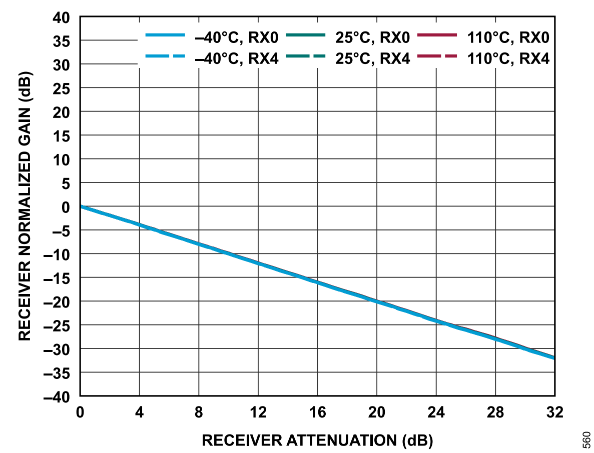


Figure 558. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

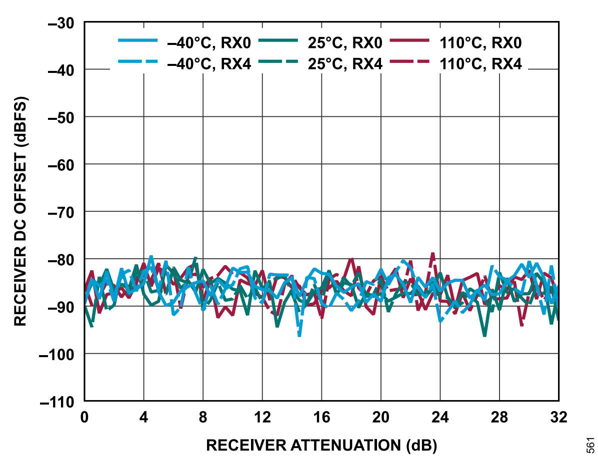


Figure 559. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

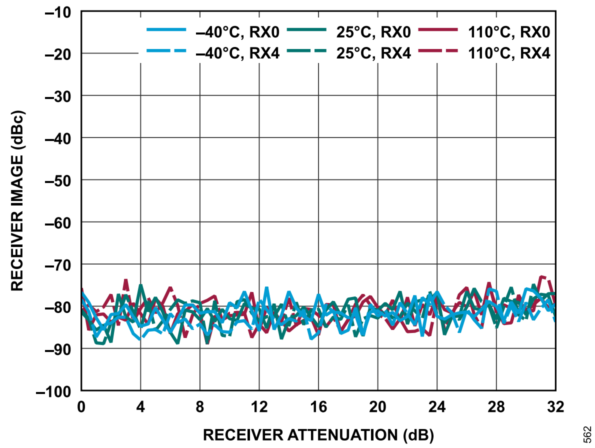


Figure 560. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

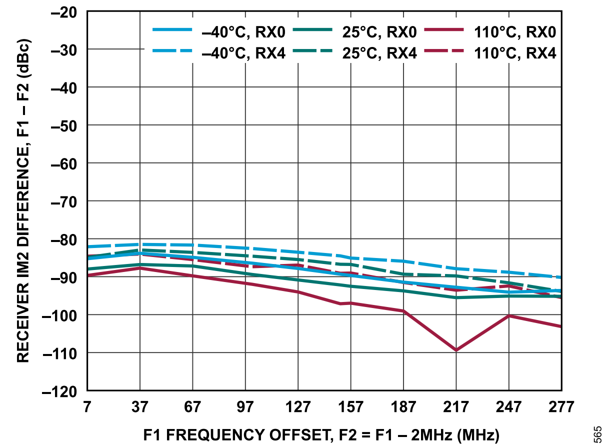


Figure 563. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

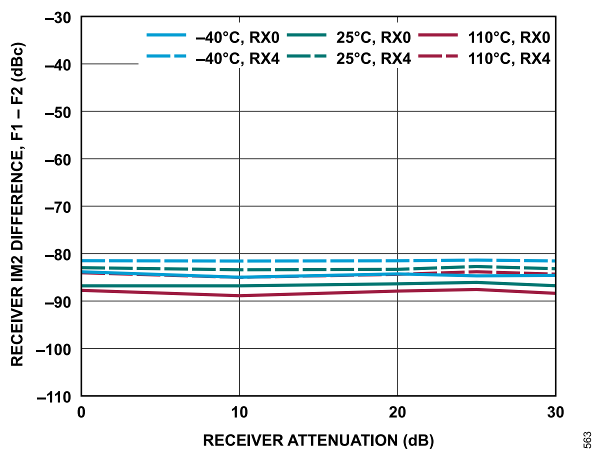


Figure 561. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

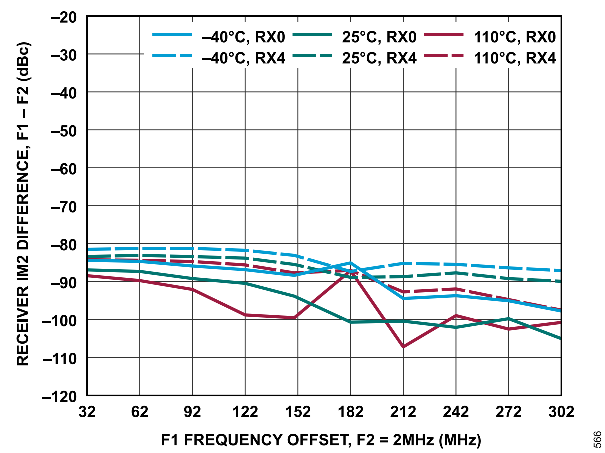


Figure 564. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

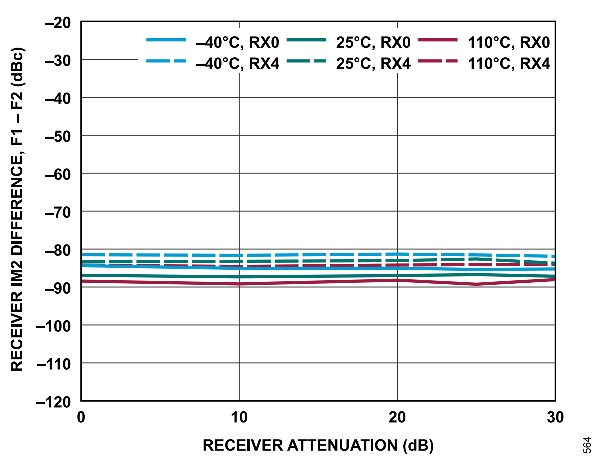


Figure 562. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

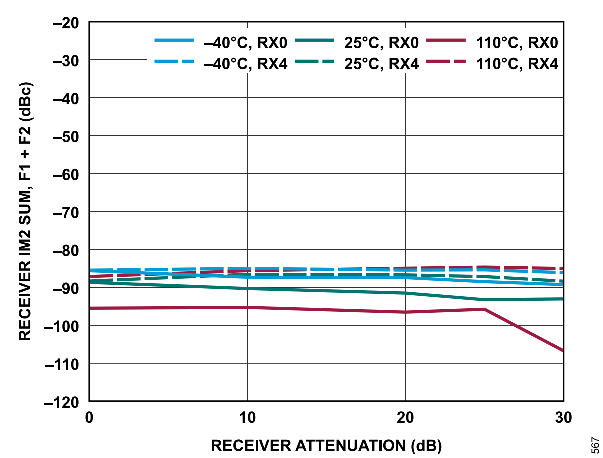


Figure 565. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

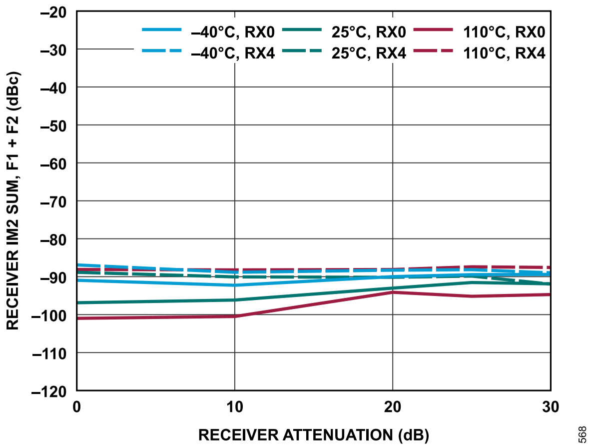


Figure 566. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

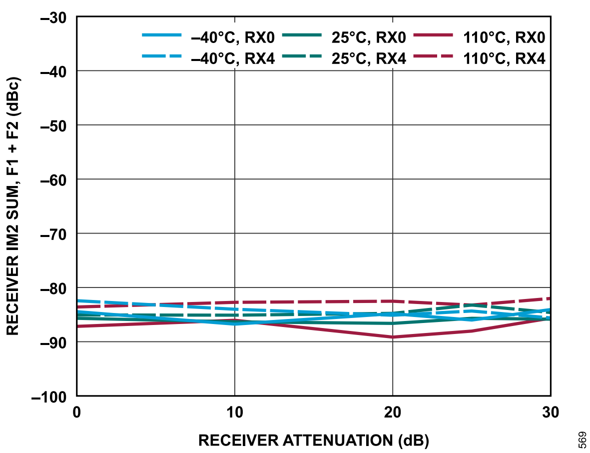


Figure 567. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

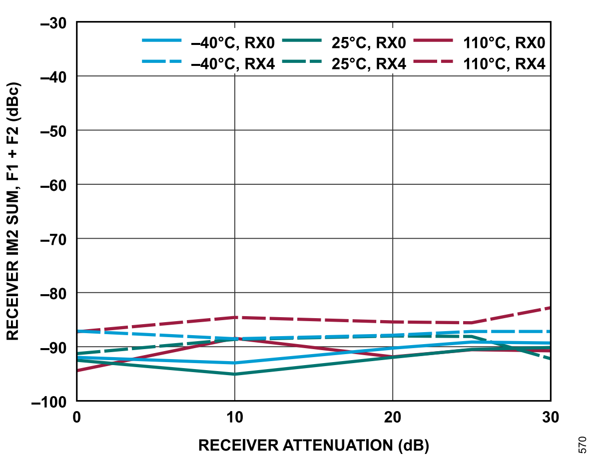


Figure 568. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 272 MHz Offset, F2 = 2 MHz Offset

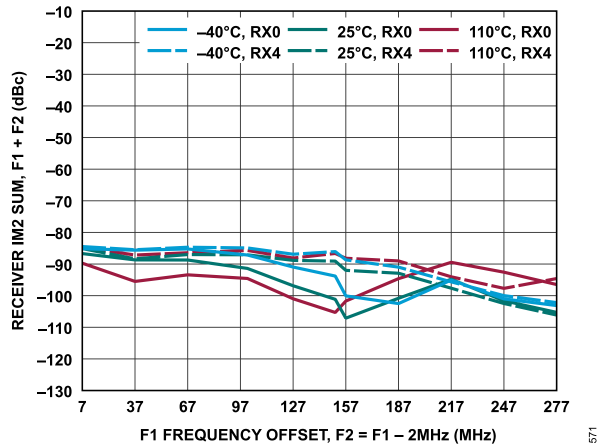


Figure 569. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

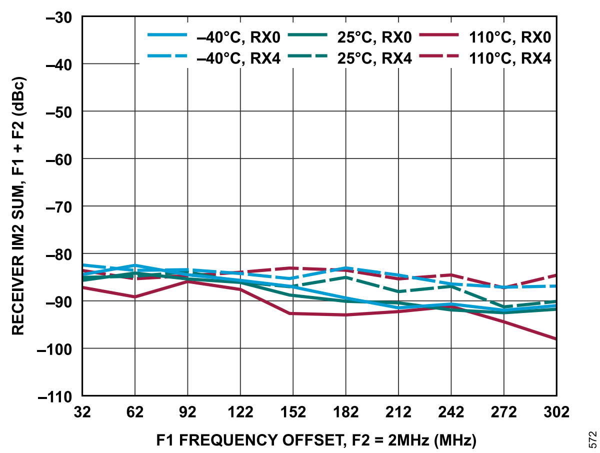


Figure 570. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

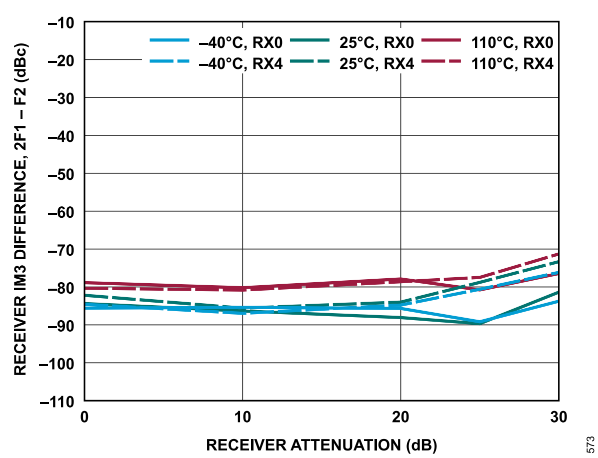


Figure 571. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

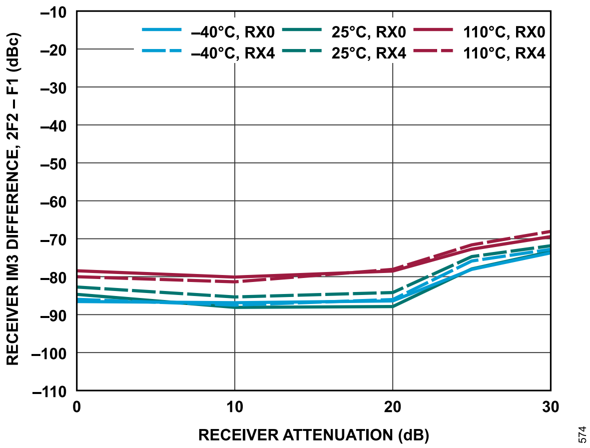


Figure 572. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

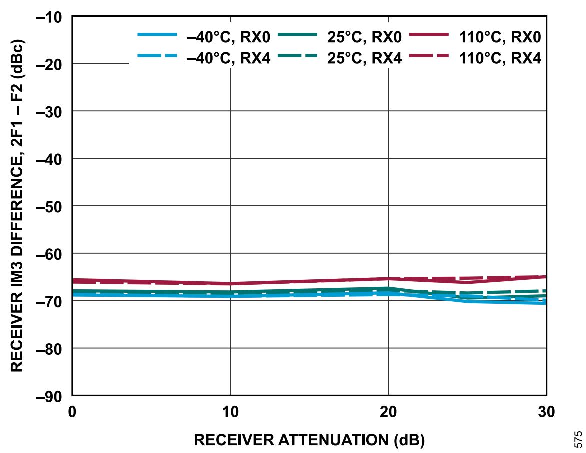


Figure 573. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = 275 MHz Offset

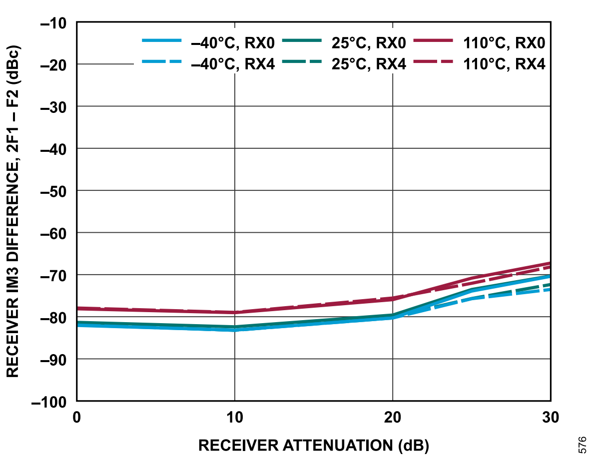


Figure 574. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

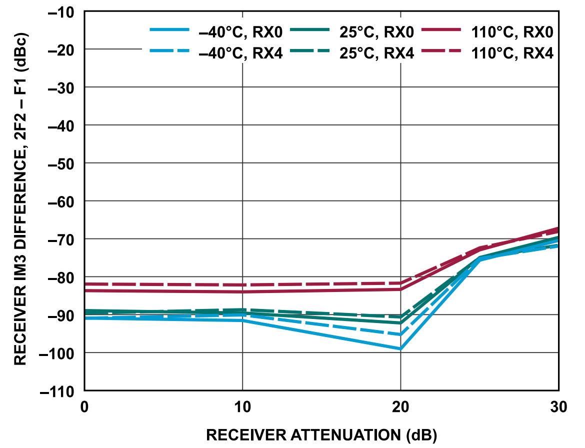


Figure 575. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

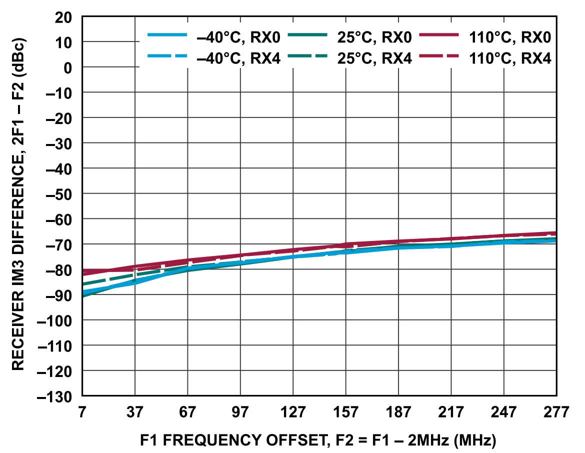


Figure 576. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

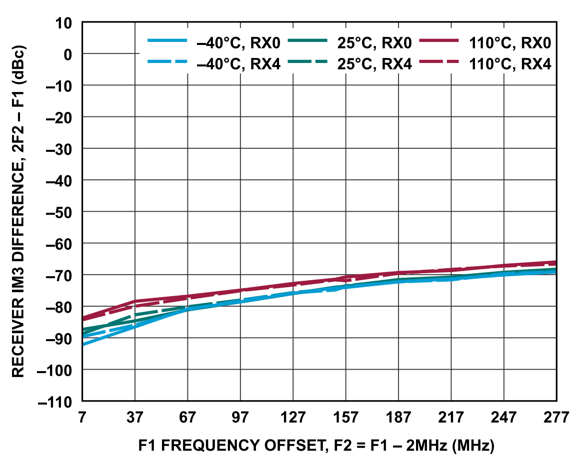


Figure 577. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

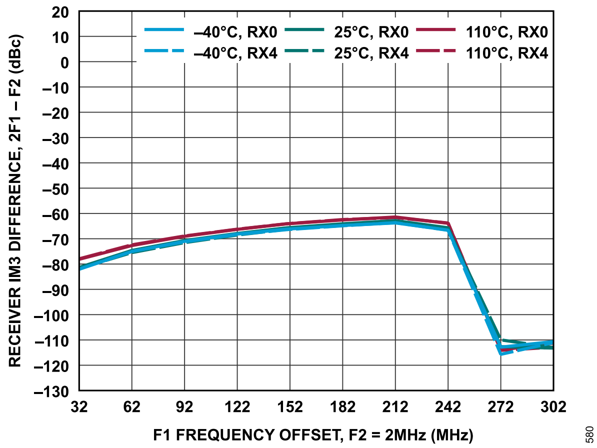


Figure 578. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

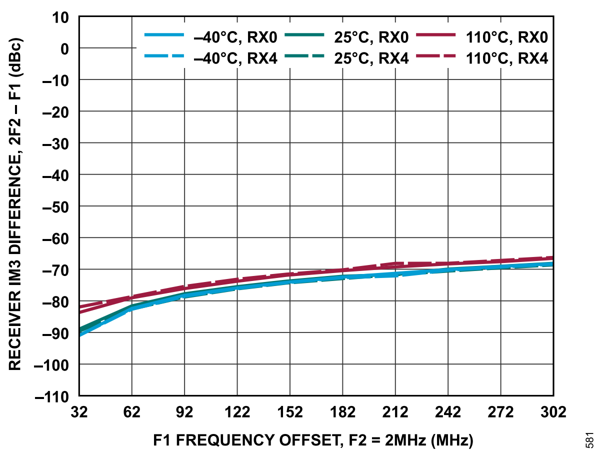


Figure 579. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

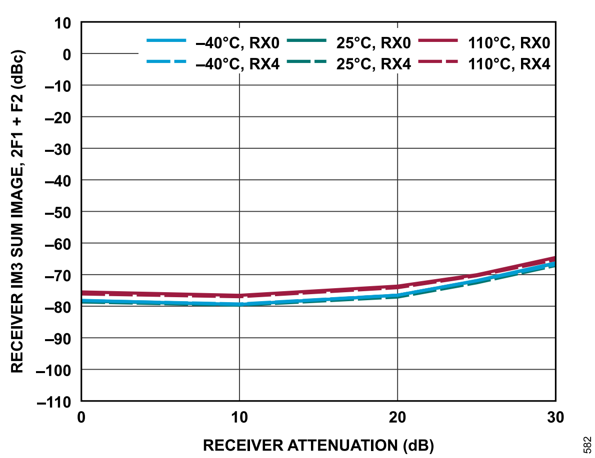


Figure 580. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

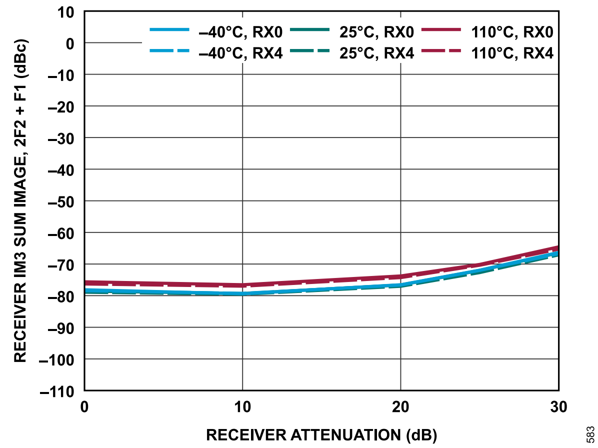


Figure 581. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

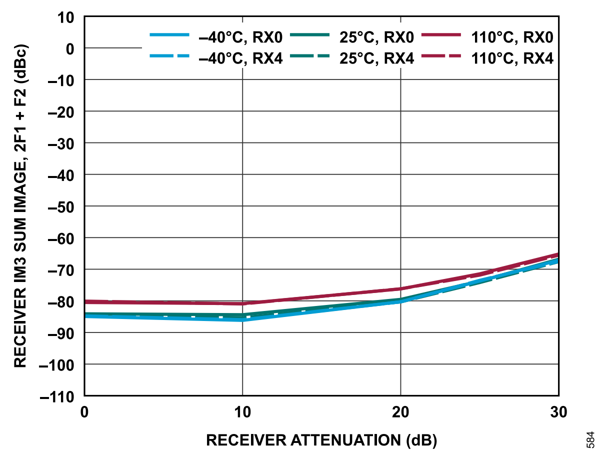


Figure 582. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

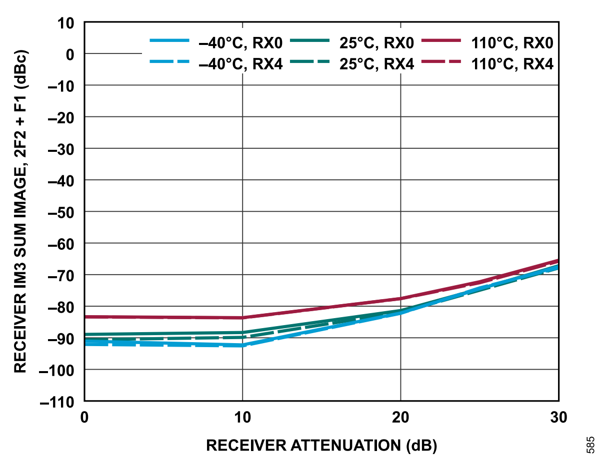


Figure 583. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

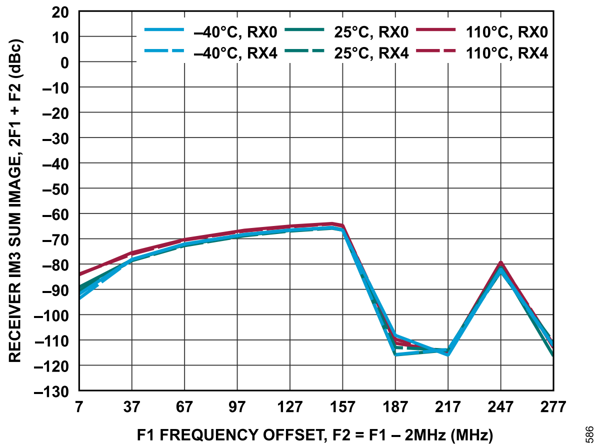


Figure 584. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

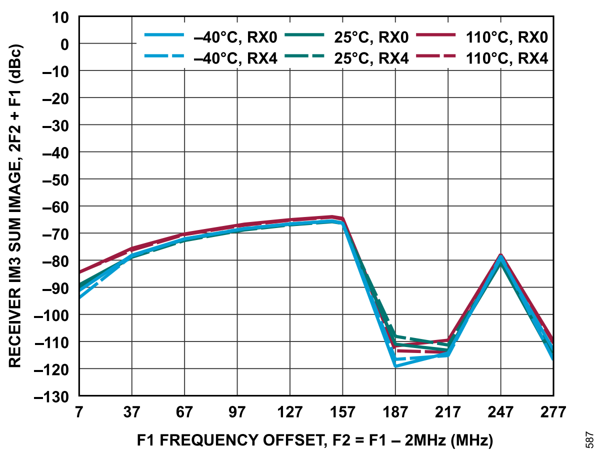


Figure 585. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

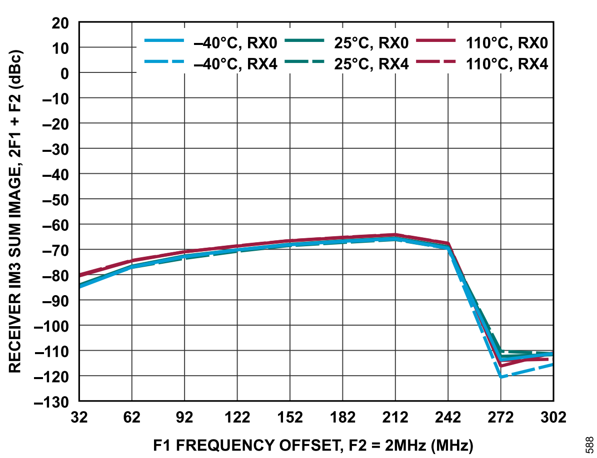


Figure 586. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

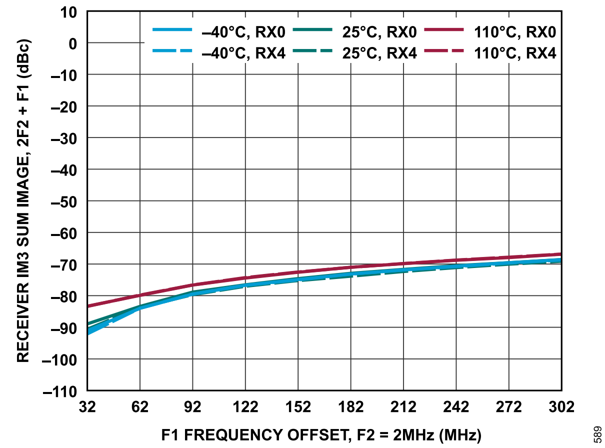


Figure 587. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

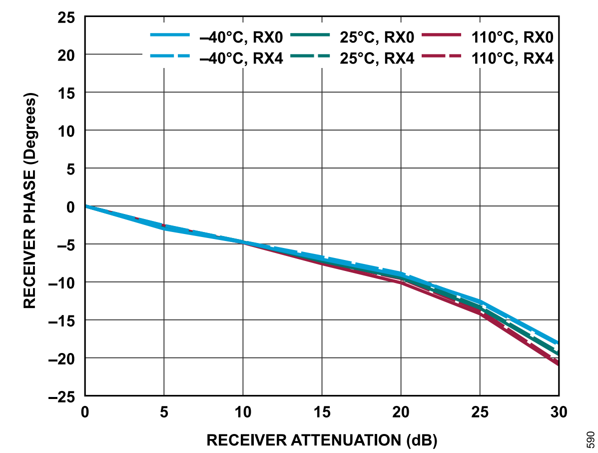


Figure 588. Receiver Phase vs. Receiver Attenuation

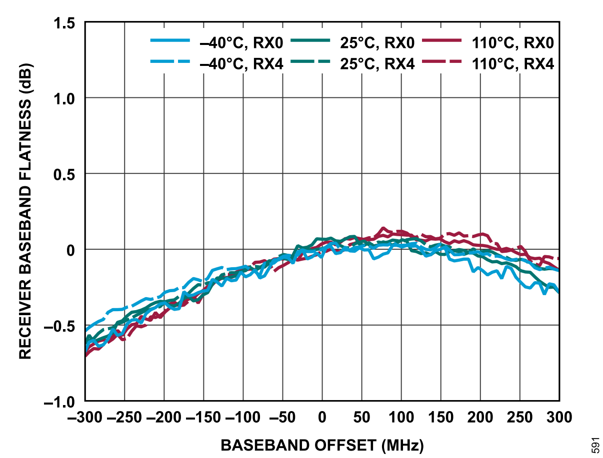


Figure 589. Receiver Baseband Flatness vs. Baseband Offset

TYPICAL PERFORMANCE CHARACTERISTICS

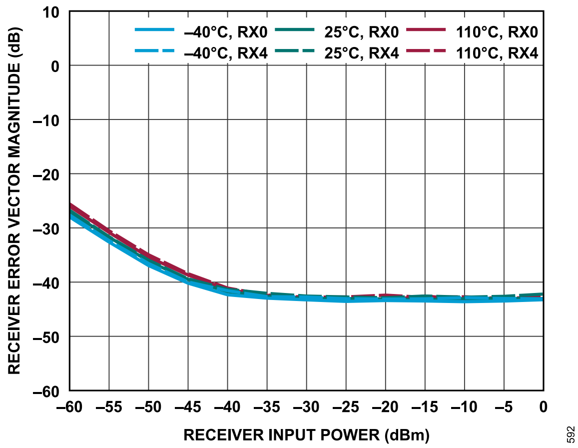


Figure 590. Receiver Error Vector Magnitude vs. Receiver Input Power, 20 MHz LTE, TDD Mode, AGC Enabled

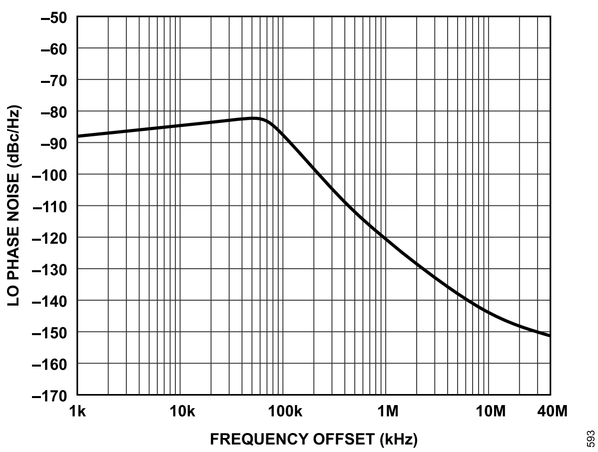


Figure 591. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

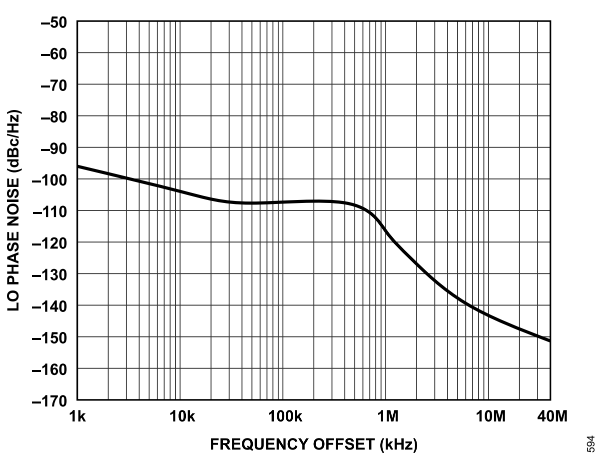


Figure 592. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

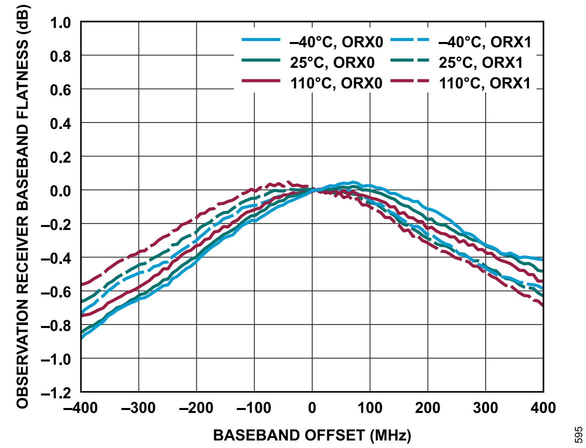


Figure 593. Observation Receiver Baseband Flatness vs. Baseband Offset

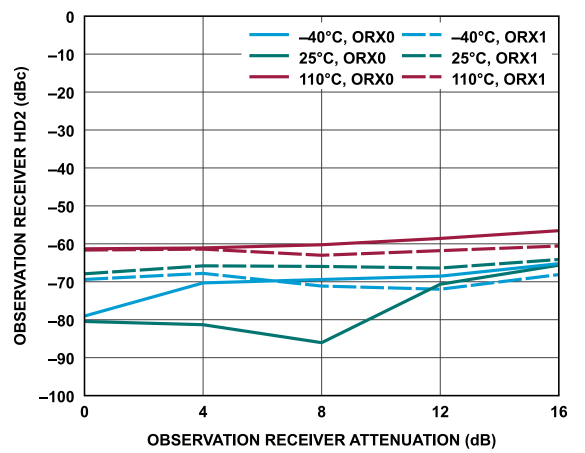


Figure 594. Observation Receiver HD2 vs. Observation Receiver Attenuation, −10 dBFS Input Signal

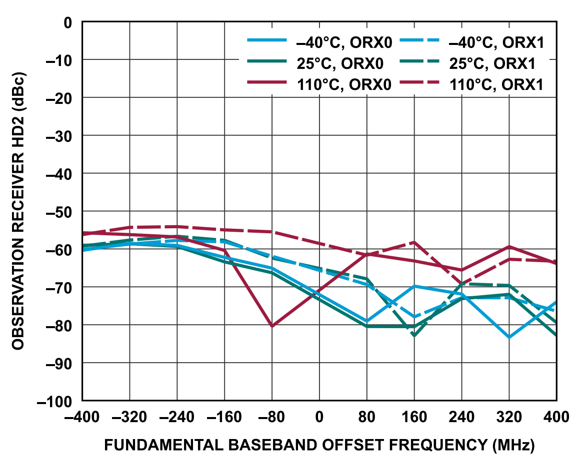


Figure 595. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

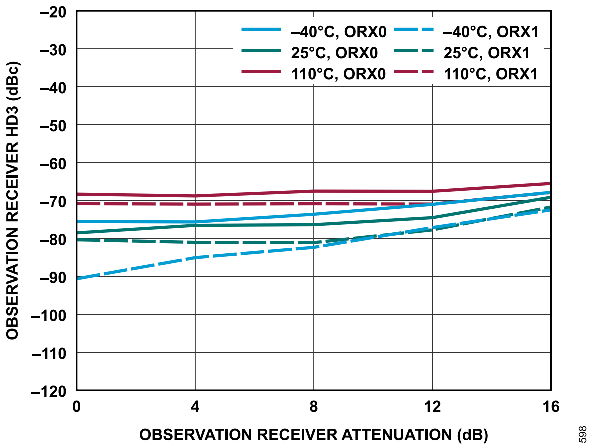


Figure 596. Observation Receiver HD3 vs. Observation Receiver Attenuation, −10 dBFS Input Signal

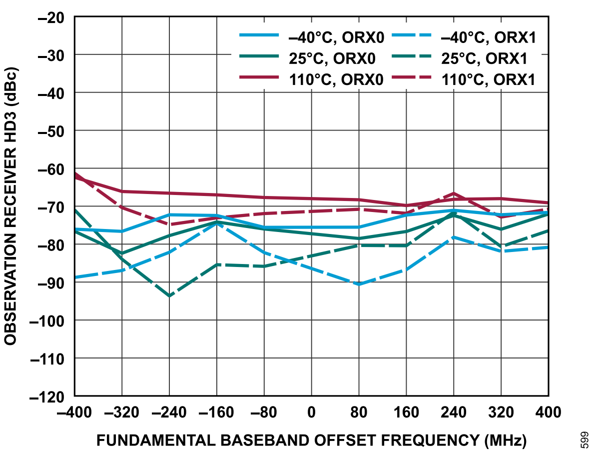


Figure 597. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

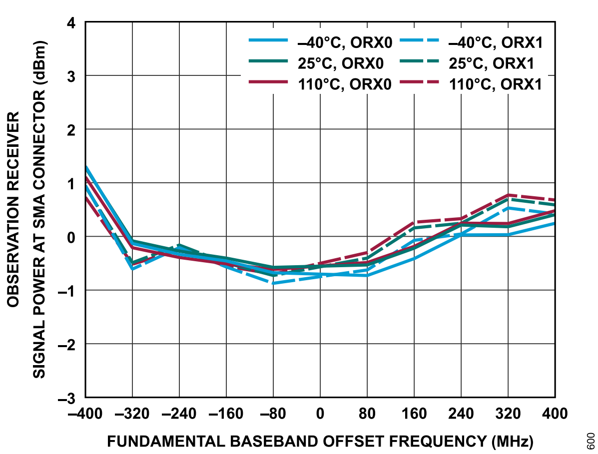


Figure 598. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

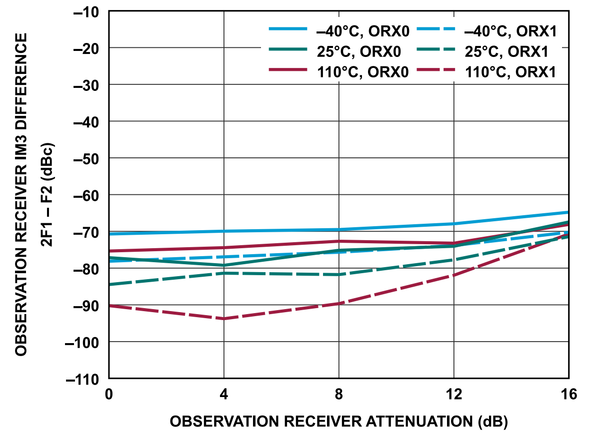


Figure 599. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 6302 MHz, F2 = 6312 MHz

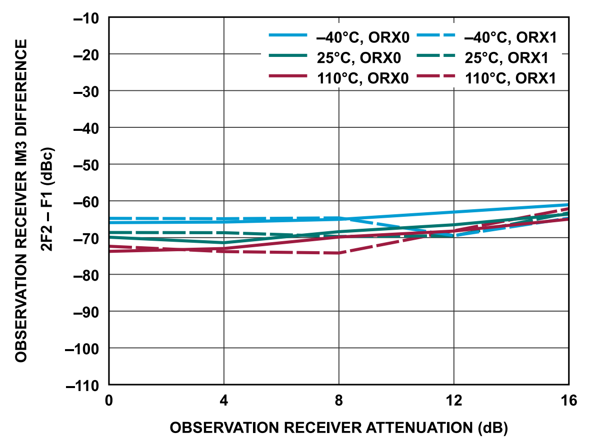


Figure 600. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 6302 MHz, F2 = 6312 MHz

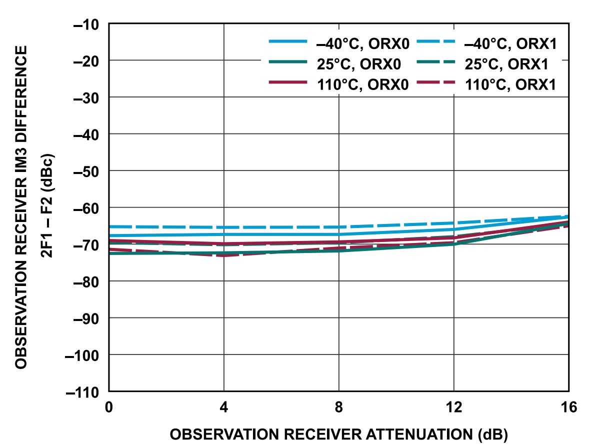


Figure 601. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 6302 MHz, F2 = 6312 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

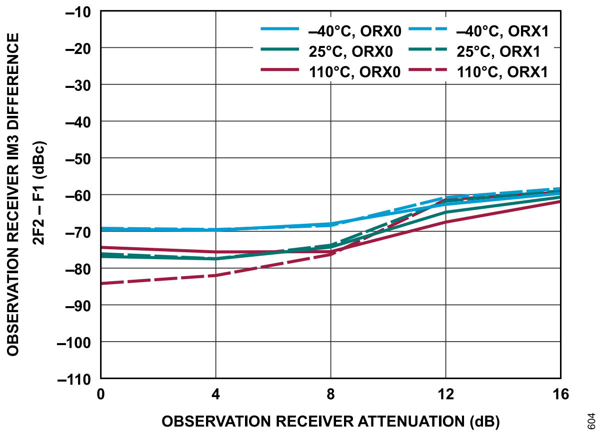


Figure 602. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 6302 MHz, F2 = 6312 MHz

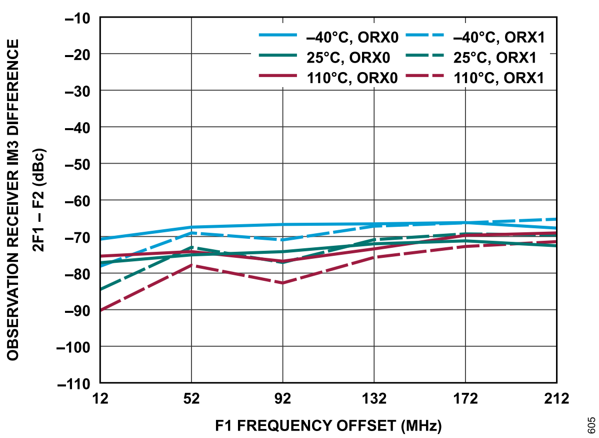


Figure 603. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 6302 MHz

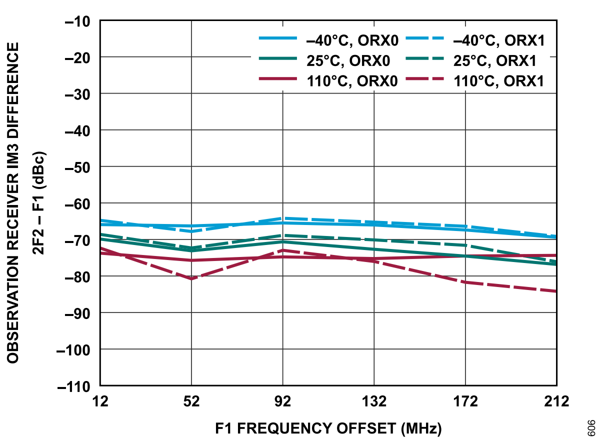


Figure 604. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 6302 MHz

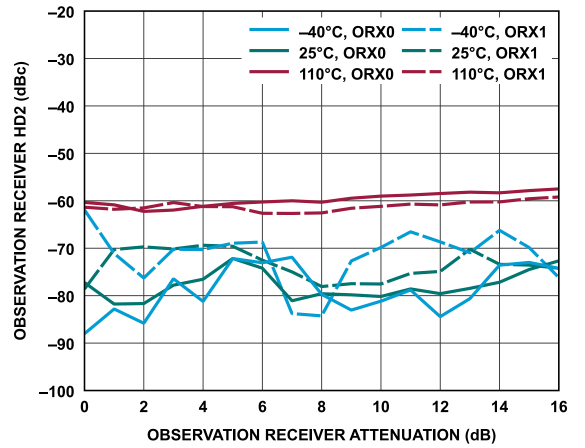


Figure 605. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

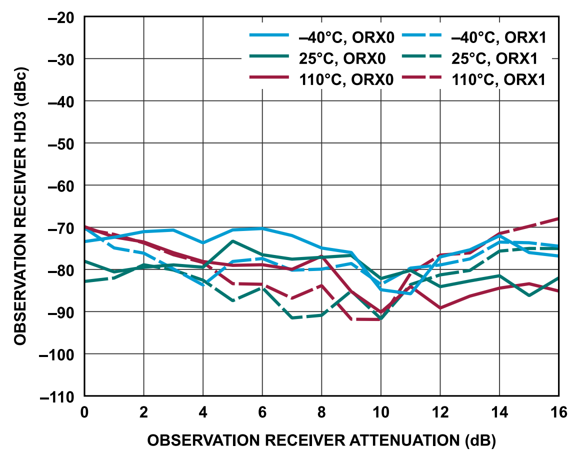


Figure 606. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

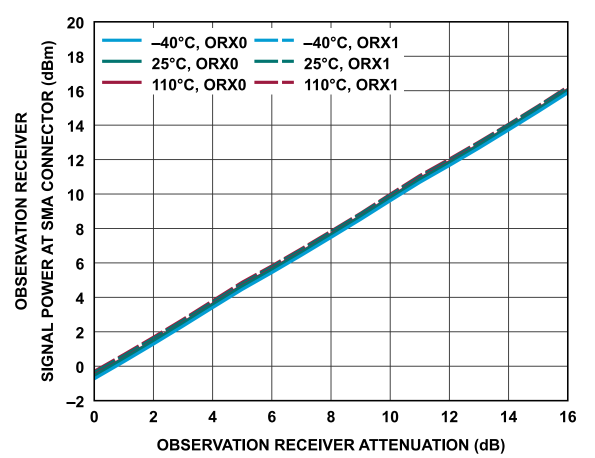


Figure 607. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

7100 MHZ BAND

The temperature settings refer to the die temperature. All LO frequencies set to 7100 MHz, unless otherwise noted.

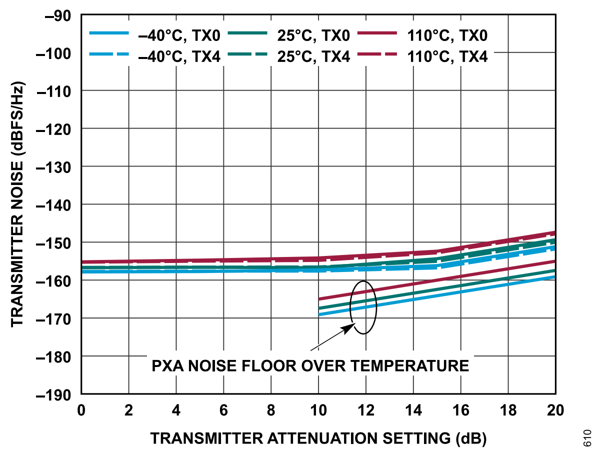


Figure 608. Transmitter Noise vs. Transmitter Attenuation Setting, 150 MHz Offset

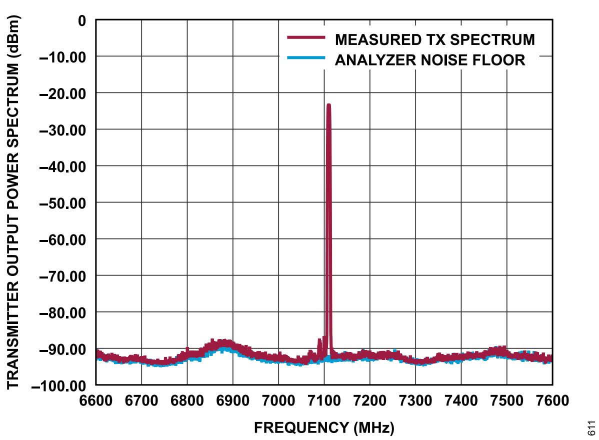


Figure 609. Transmitter Output Power Spectrum vs. Frequency, Tx0, 5 MHz LTE, 10 MHz Offset, −6 dBFS RMS, 1 MHz Resolution Bandwidth, T_J = 25°C

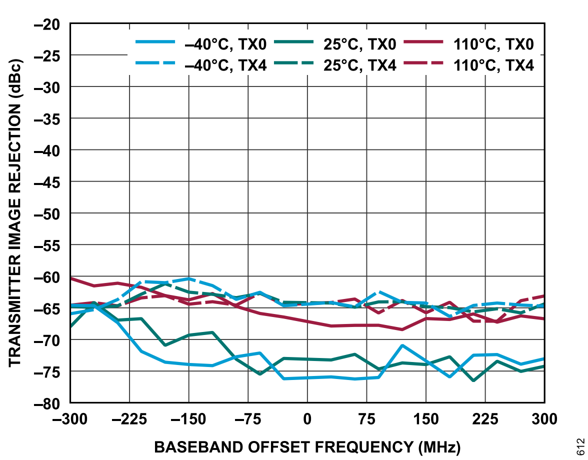


Figure 610. Transmitter Image Rejection vs. Baseband Offset Frequency, −12 dBFS CW Signal

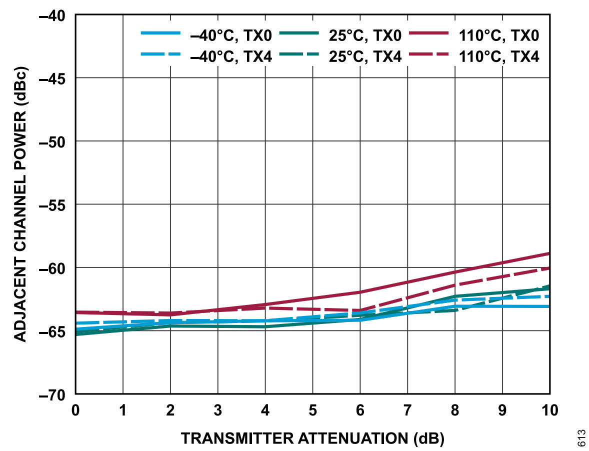


Figure 611. Adjacent Channel Power vs. Transmitter Attenuation, 290 MHz Offset, 20 MHz LTE, PAR = 12 dB

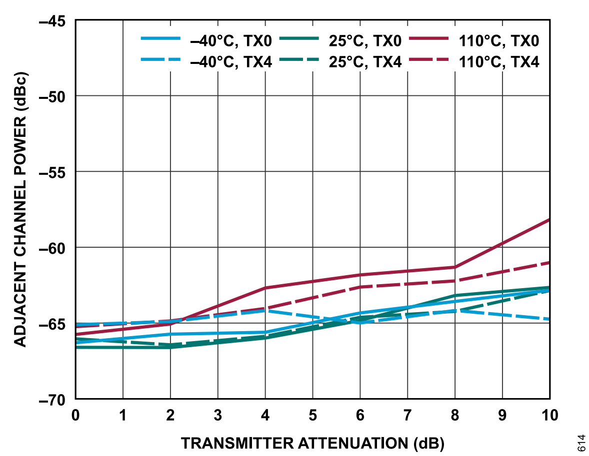


Figure 612. Adjacent Channel Power vs. Transmitter Attenuation, −10 MHz Offset, 20 MHz LTE, PAR = 12 dB

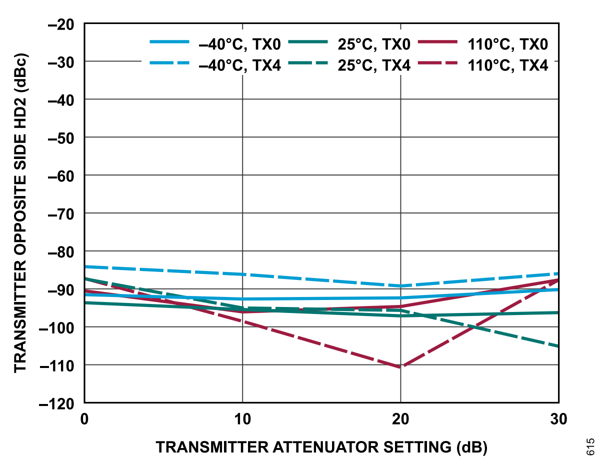


Figure 613. Transmitter Opposite Side Second Harmonic Distortion (HD2) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

TYPICAL PERFORMANCE CHARACTERISTICS

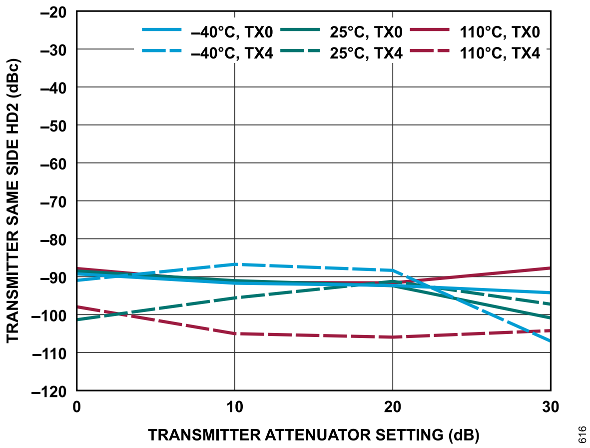


Figure 614. Transmitter Same Side HD2 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

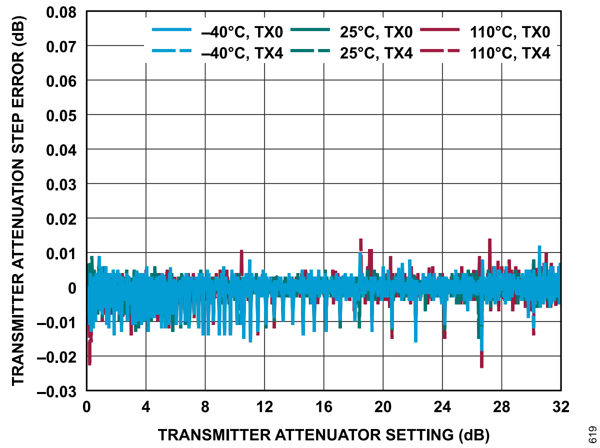


Figure 617. Transmitter Attenuation Step Error vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

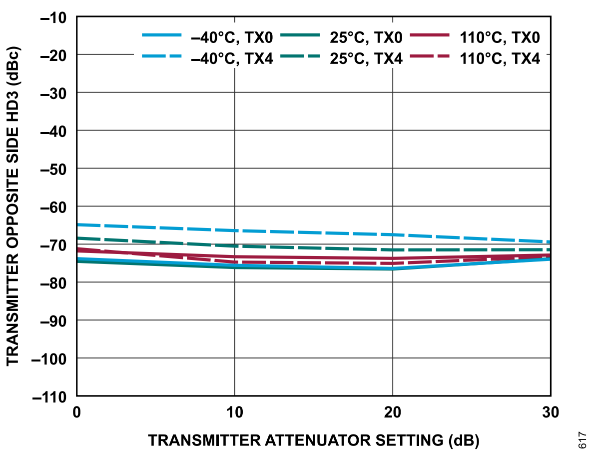


Figure 615. Transmitter Opposite Side Third Harmonic Distortion (HD3) vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

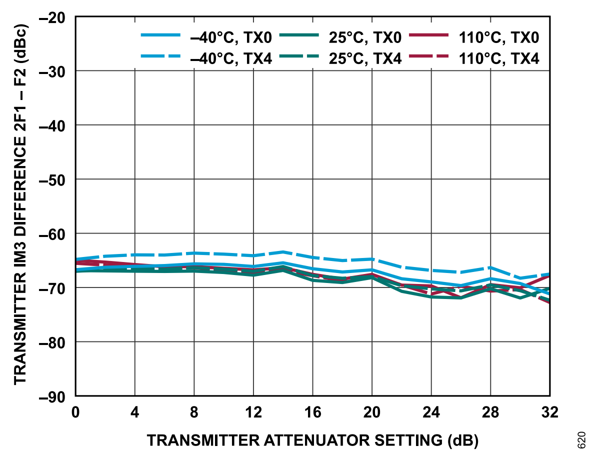


Figure 618. Transmitter IM3 Difference, 2F1 − F2 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

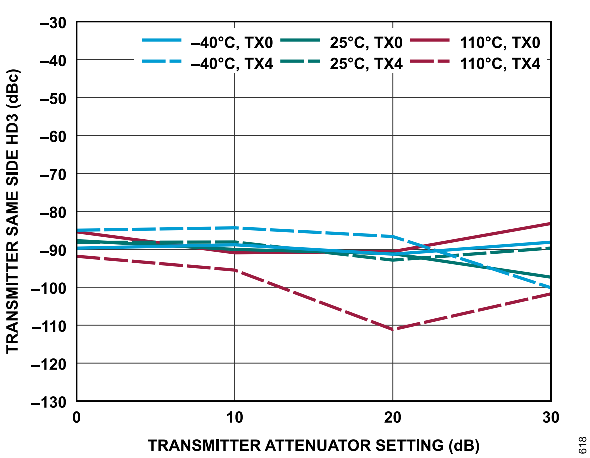


Figure 616. Transmitter Same Side HD3 vs. Transmitter Attenuation Setting, 30 MHz Offset, −12 dBFS CW Signal

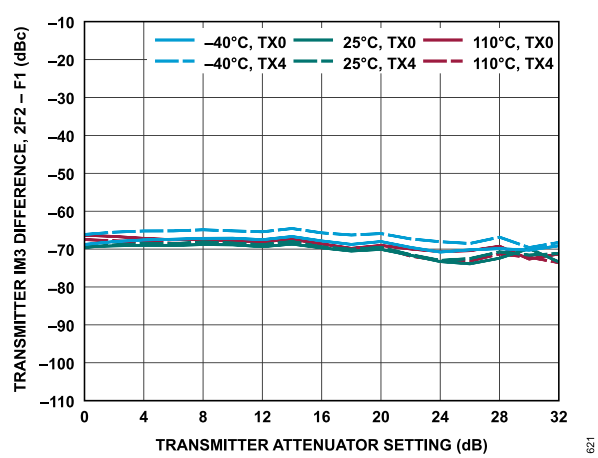


Figure 619. Transmitter IM3 Difference, 2F2 − F1 vs. Transmitter Attenuation Setting, −15 dBFS Signal Level per Tone, F1 = 160 MHz Offset, F2 = 165 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

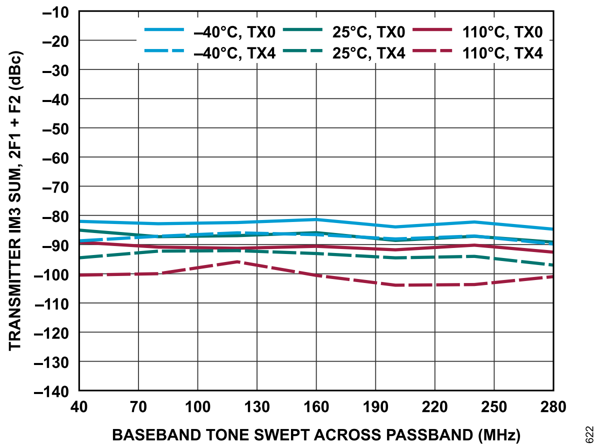


Figure 620. Transmitter IM3 Sum, 2F1 + F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

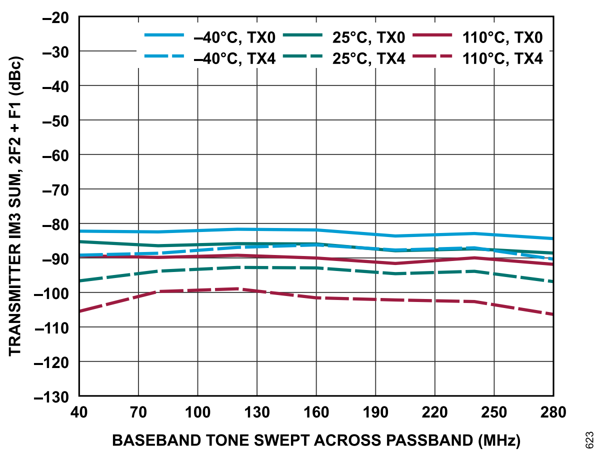


Figure 621. Transmitter IM3 Sum, 2F2 + F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

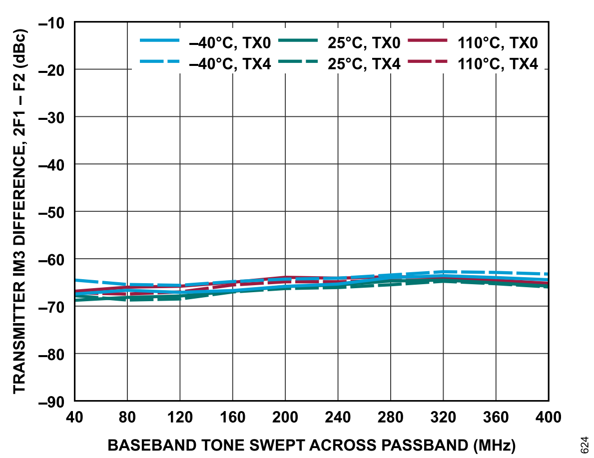


Figure 622. Transmitter IM3 Difference, 2F1 − F2 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

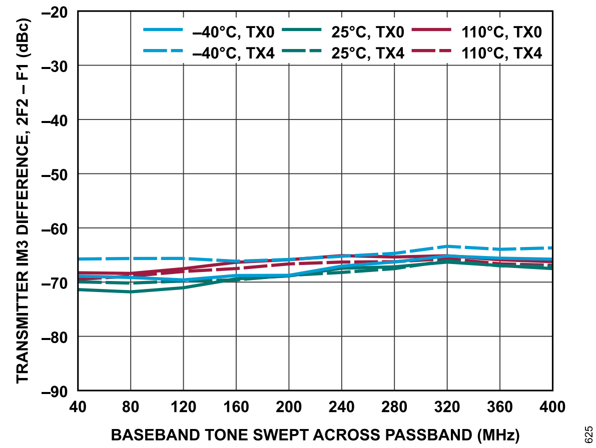


Figure 623. Transmitter IM3 Difference, 2F2 − F1 vs. Baseband Tone Swept Across Passband, −15 dBFS Signal Level per Tone, F2 = F1 + 5 MHz

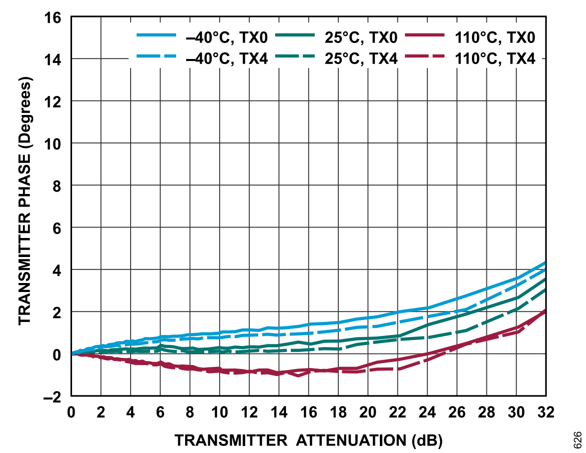


Figure 624. Transmitter Phase vs. Transmitter Attenuation

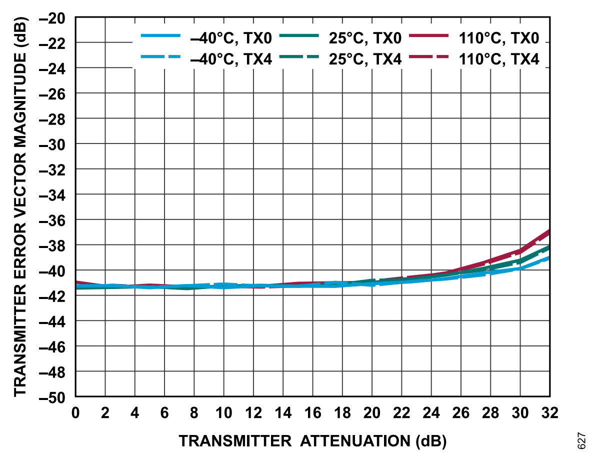


Figure 625. Transmitter Error Vector Magnitude vs. Transmitter Attenuation, 20 MHz LTE, PAR = 12 dB

TYPICAL PERFORMANCE CHARACTERISTICS

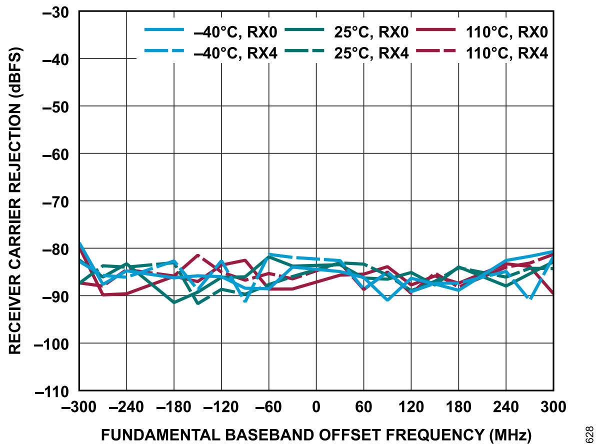


Figure 626. Receiver Carrier Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

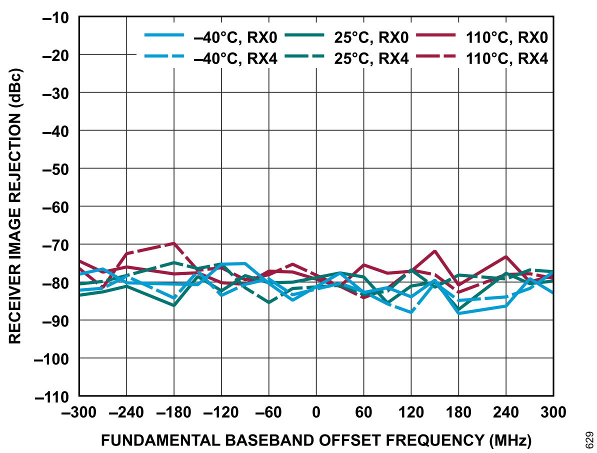


Figure 627. Receiver Image Rejection vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

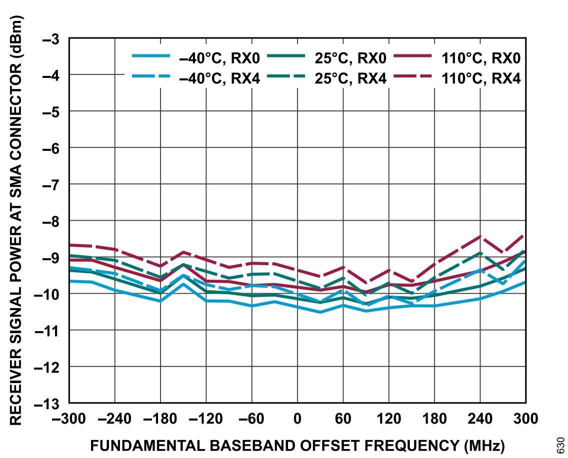


Figure 628. Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −1 dBFs input Signal (Match Not De-Embedded)

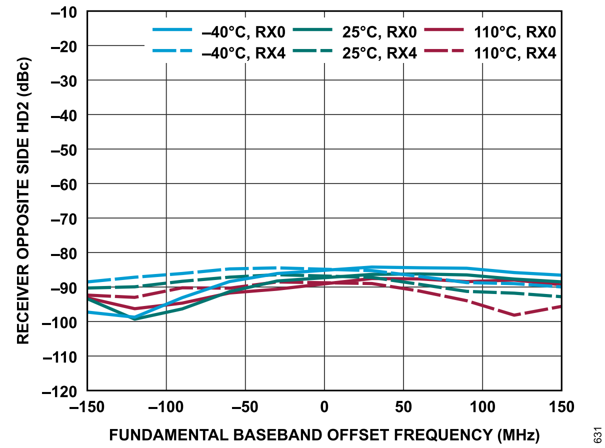


Figure 629. Receiver Opposite Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

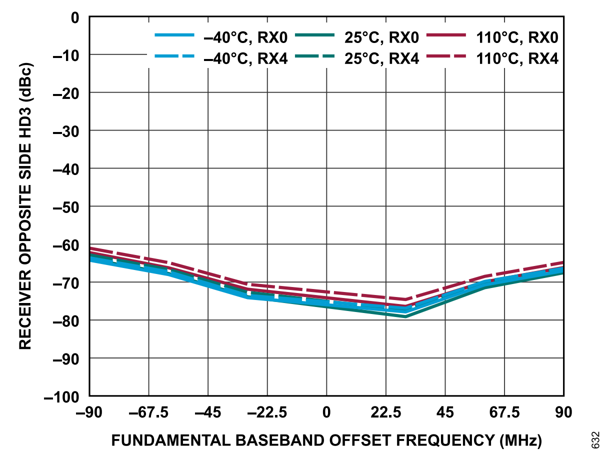


Figure 630. Receiver Opposite Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

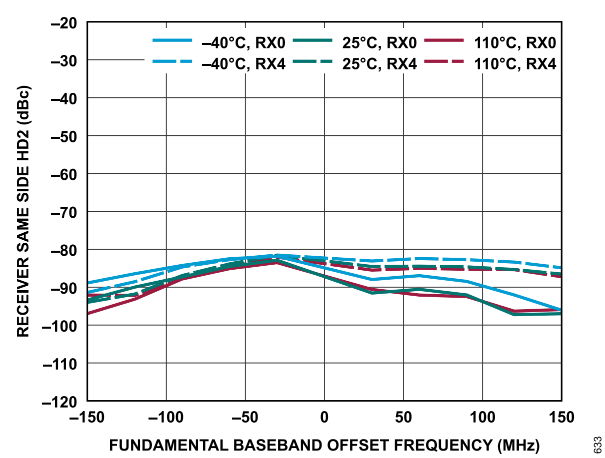


Figure 631. Receiver Same Side HD2 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

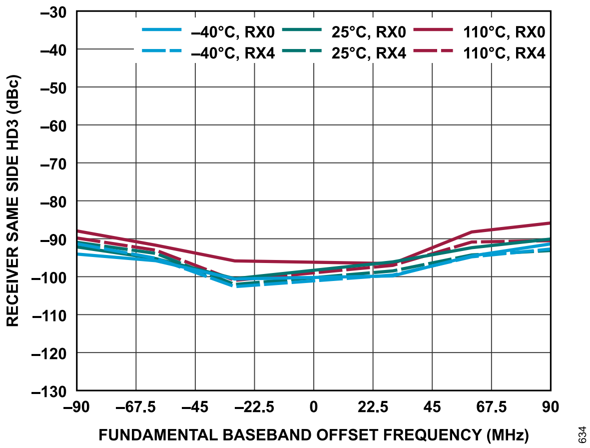


Figure 632. Receiver Same Side HD3 vs. Fundamental Baseband Offset Frequency, −1 dBFS Input Signal

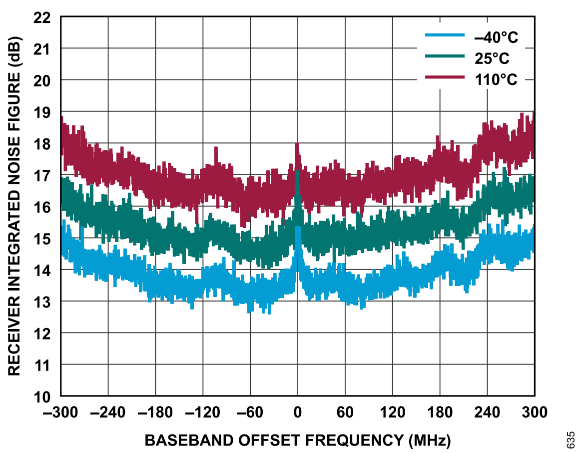


Figure 633. Receiver Integrated Noise Figure vs. Baseband Offset Frequency, 200 kHz Integration Steps, 983.04 MSPS Sample Rate

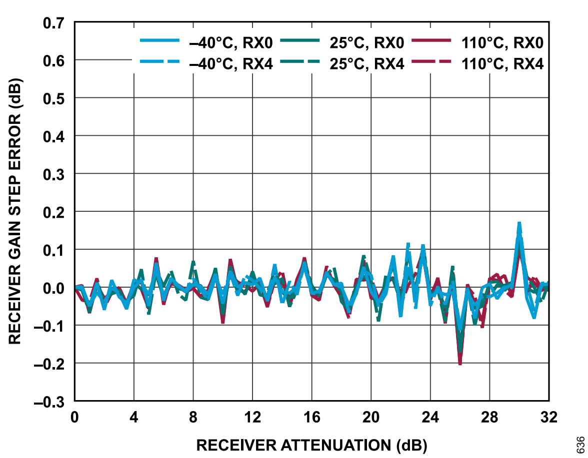


Figure 634. Receiver Gain Step Error vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal (Measured Using High Band Gain Table)

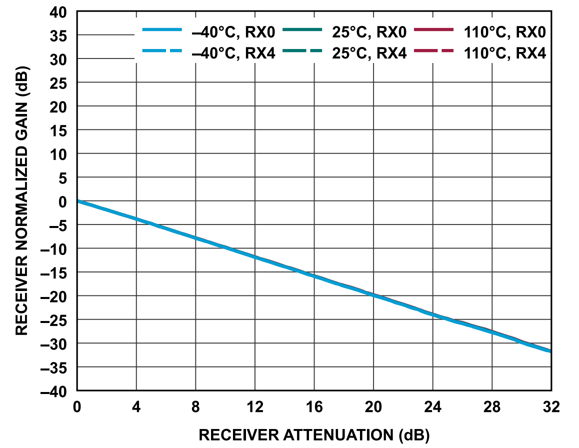


Figure 635. Receiver Normalized Gain vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

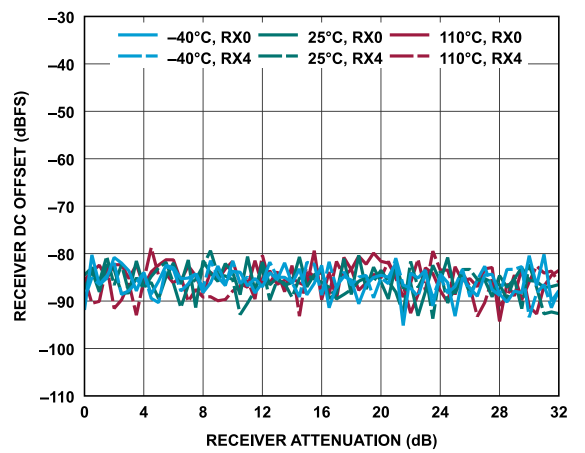


Figure 636. Receiver DC Offset vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

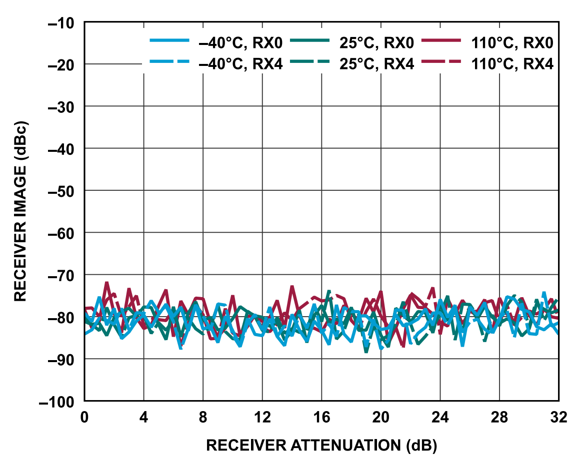


Figure 637. Receiver Image vs. Receiver Attenuation, 30 MHz Offset, −1 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

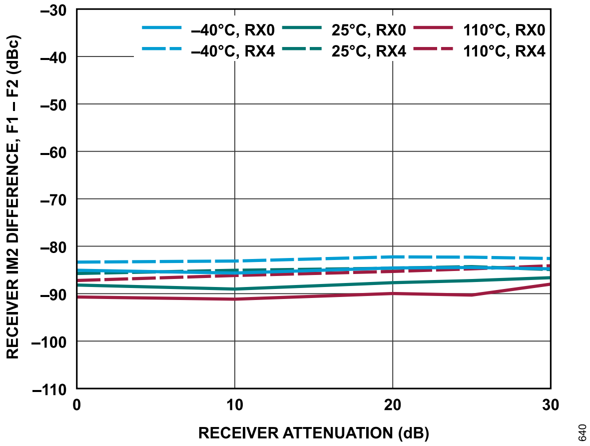


Figure 638. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

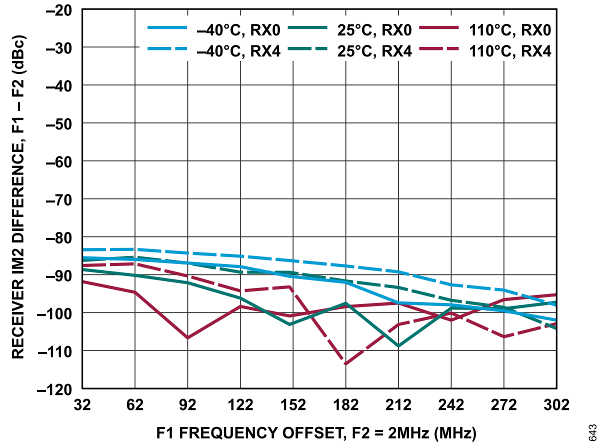


Figure 641. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

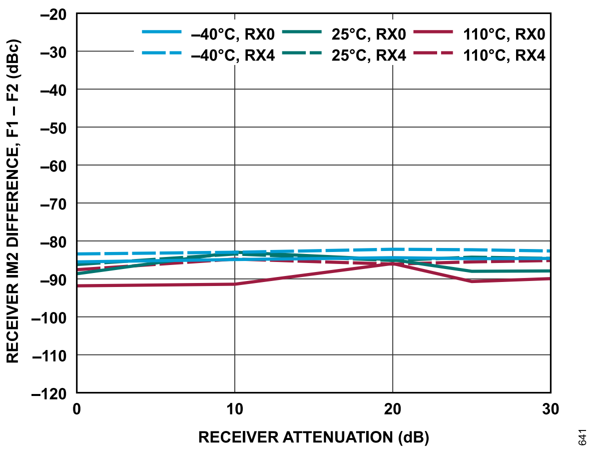


Figure 639. Receiver IM2 Difference, F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

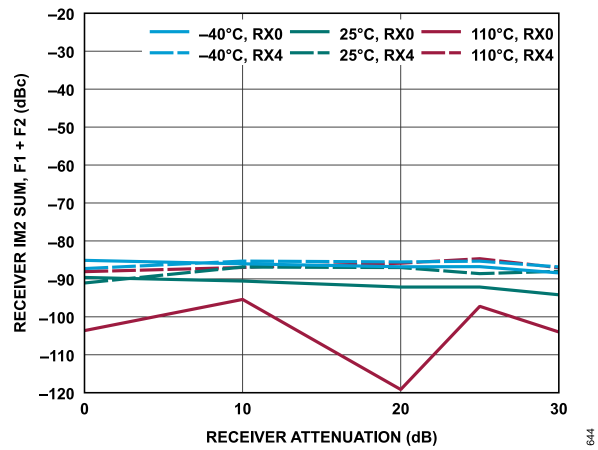


Figure 642. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

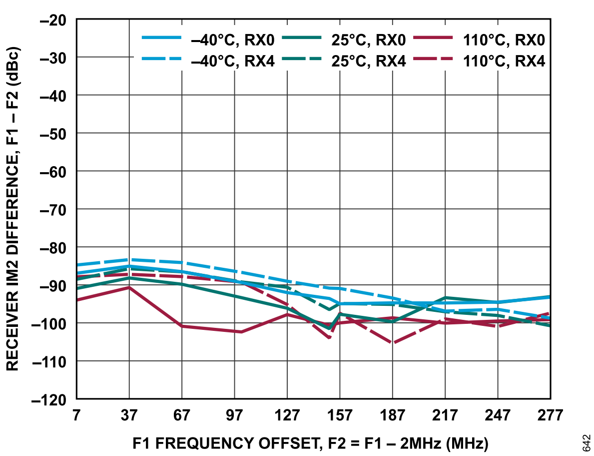


Figure 640. Receiver IM2 Difference, F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

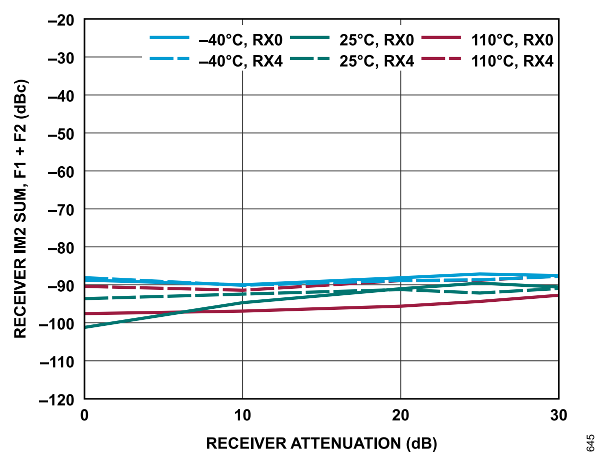


Figure 643. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 127 MHz Offset, F2 = 125 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

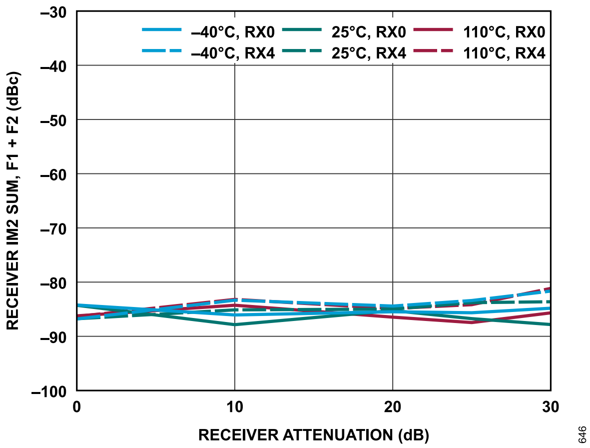


Figure 644. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

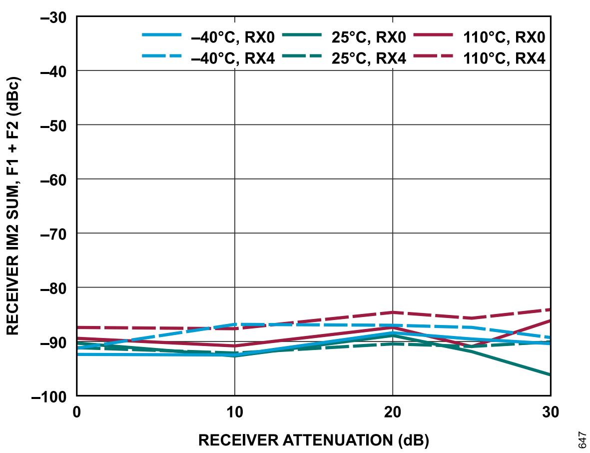


Figure 645. Receiver IM2 Sum, F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 272 MHz Offset, F2 = 2 MHz Offset

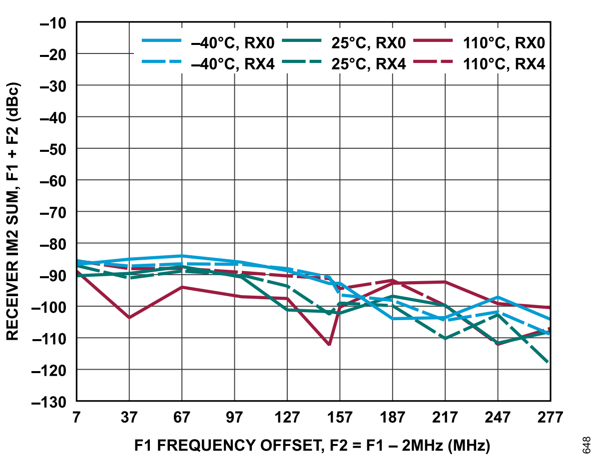


Figure 646. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

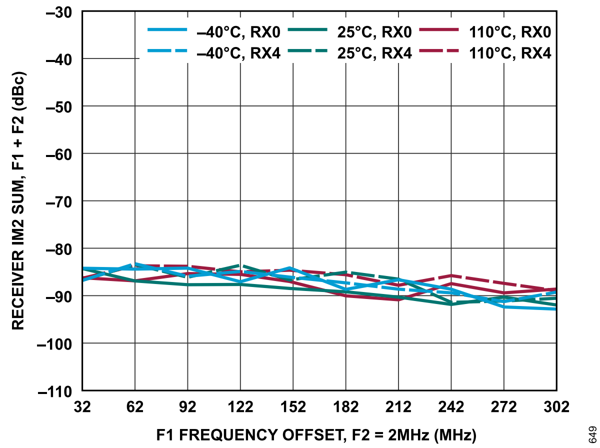


Figure 647. Receiver IM2 Sum, F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

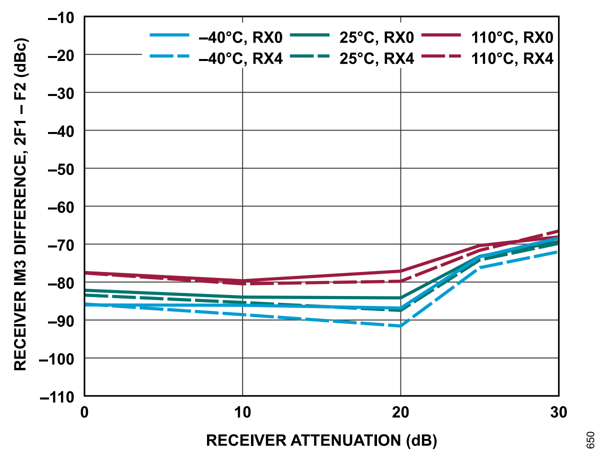


Figure 648. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

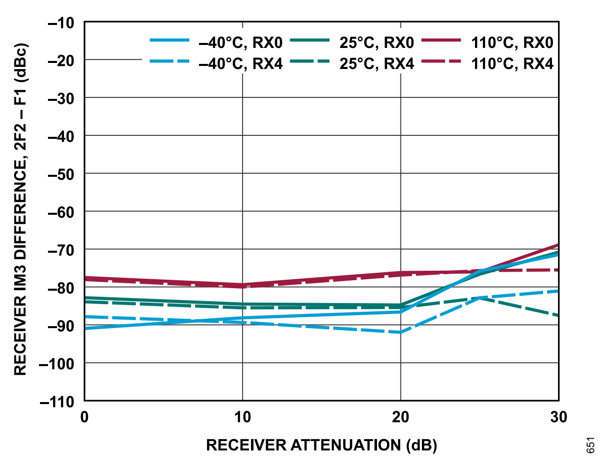


Figure 649. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

TYPICAL PERFORMANCE CHARACTERISTICS

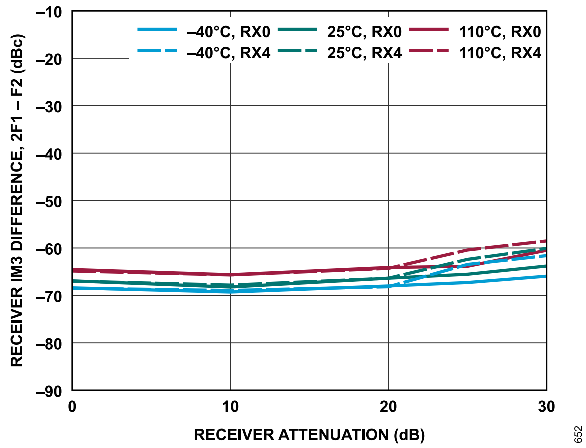


Figure 650. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 277 MHz Offset, F2 = 275 MHz Offset

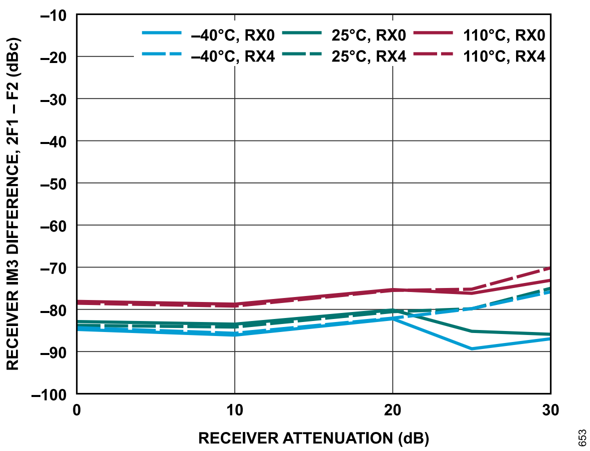


Figure 651. Receiver IM3 Difference, 2F1 − F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

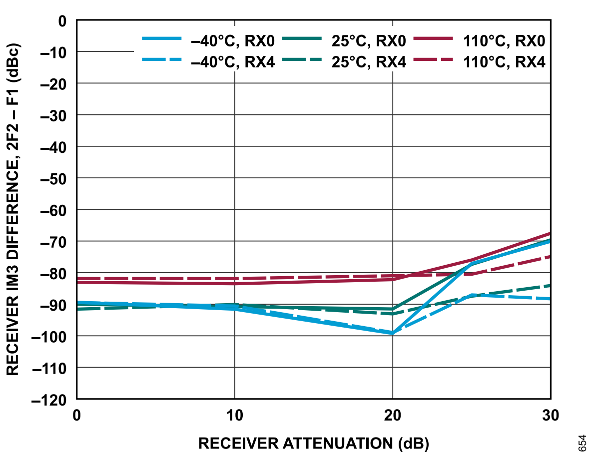


Figure 652. Receiver IM3 Difference, 2F2 − F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

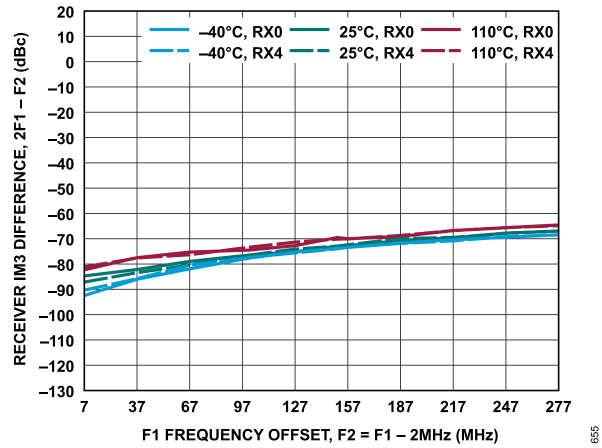


Figure 653. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

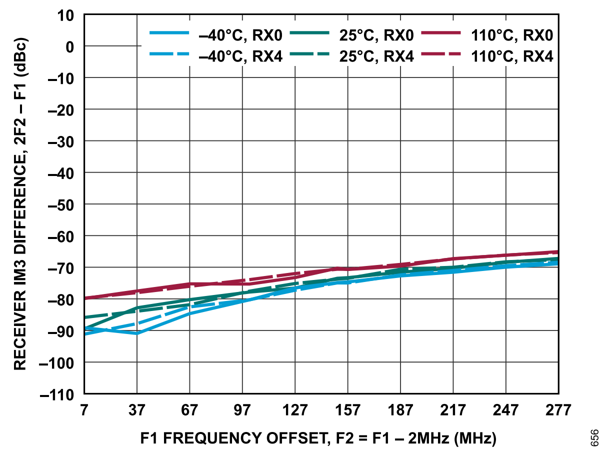


Figure 654. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

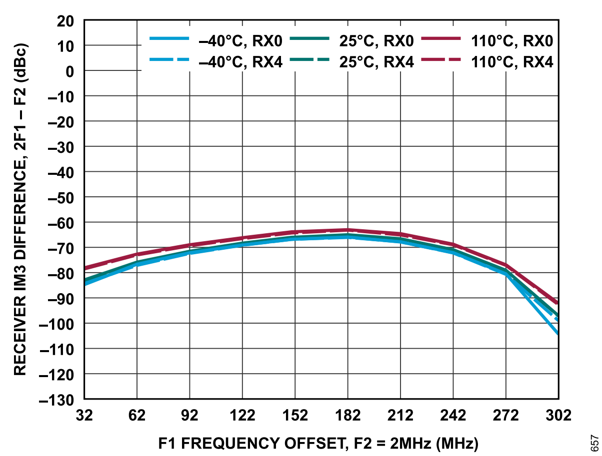


Figure 655. Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

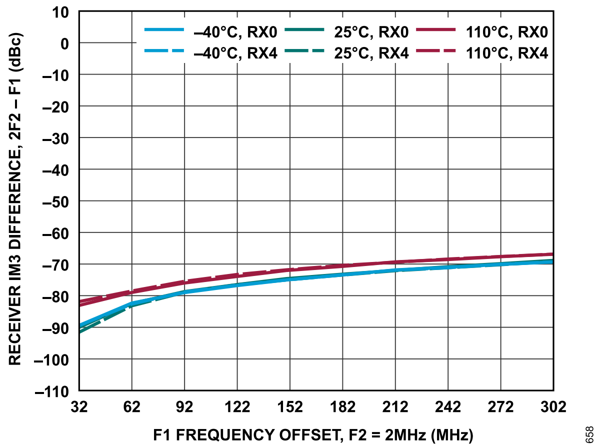


Figure 656. Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

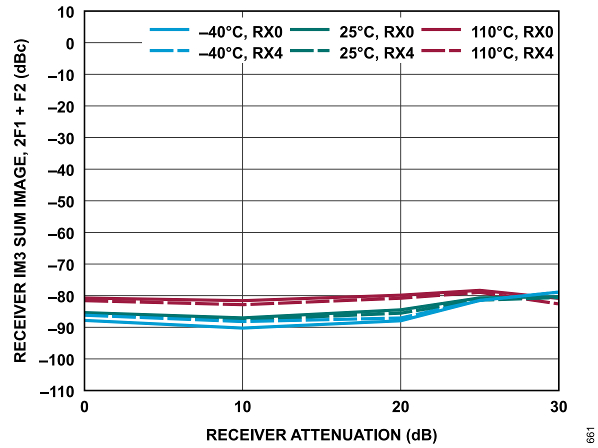


Figure 659. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

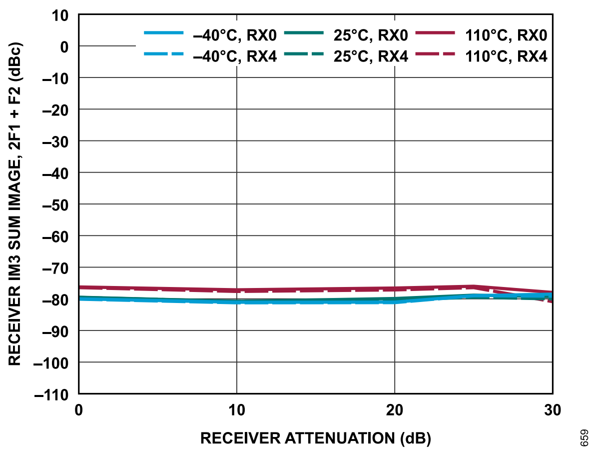


Figure 657. Receiver IM3 Sum Image, 2F1 + F2 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

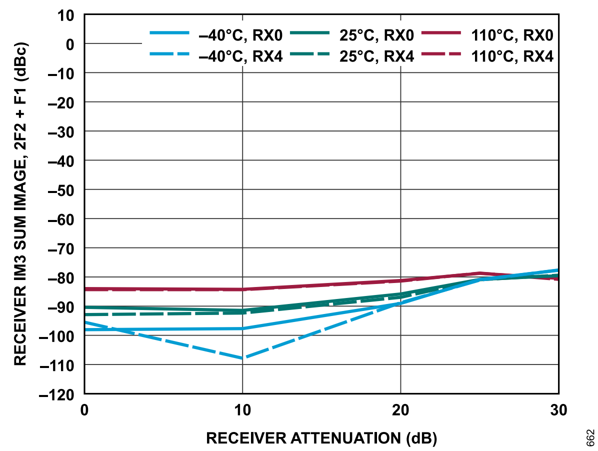


Figure 660. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 32 MHz Offset, F2 = 2 MHz Offset

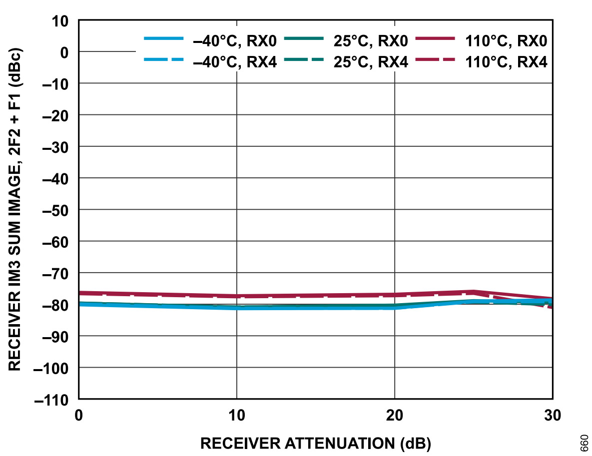


Figure 658. Receiver IM3 Sum Image, 2F2 + F1 vs. Receiver Attenuation, −7 dBFS Signal Level per Tone, F1 = 37 MHz Offset, F2 = F1 − 2 MHz Offset

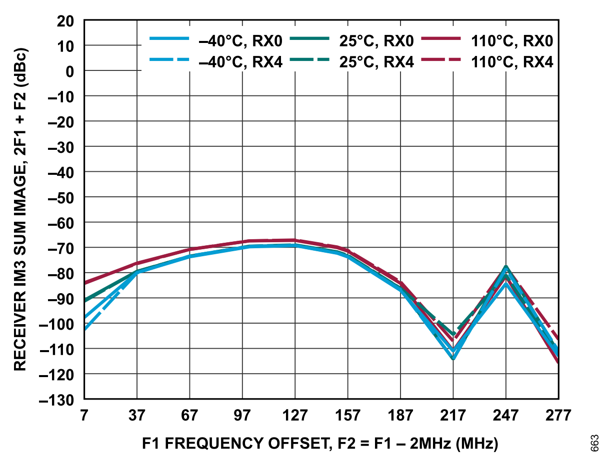


Figure 661. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

TYPICAL PERFORMANCE CHARACTERISTICS

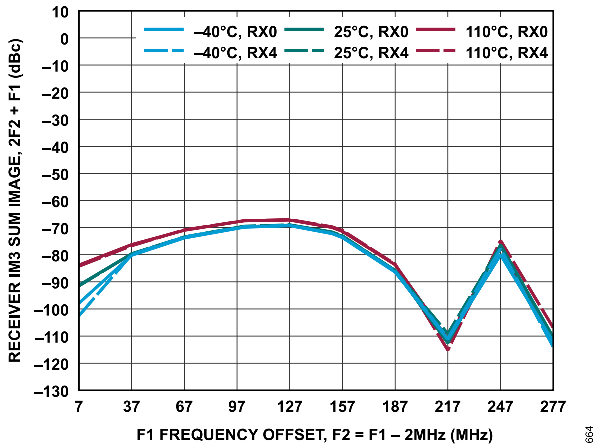


Figure 662. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = F1 − 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

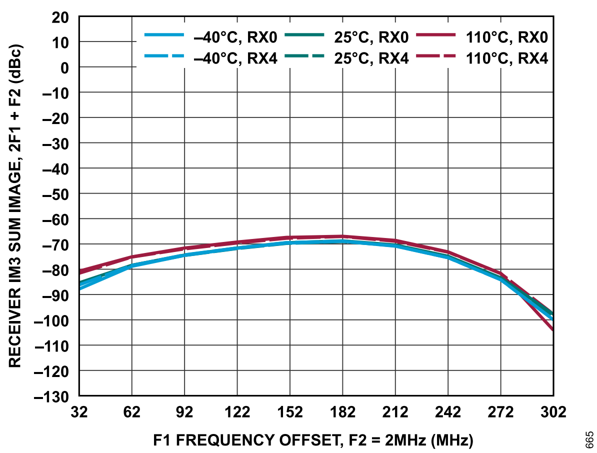


Figure 663. Receiver IM3 Sum Image, 2F1 + F2 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

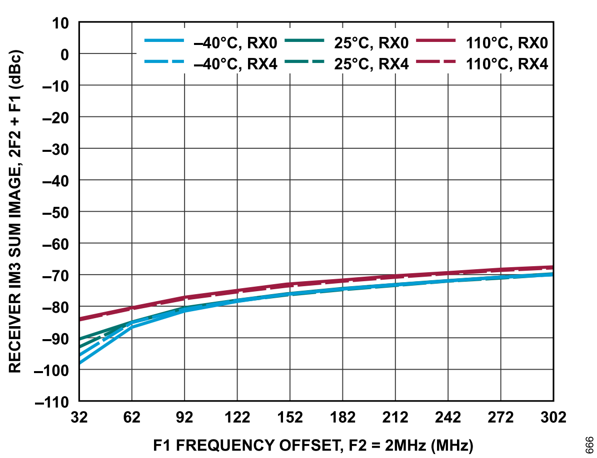


Figure 664. Receiver IM3 Sum Image, 2F2 + F1 vs. F1 Frequency Offset, F2 = 2 MHz, Baseband Tone Swept Across Passband, −7 dBFS Signal Level per Tone

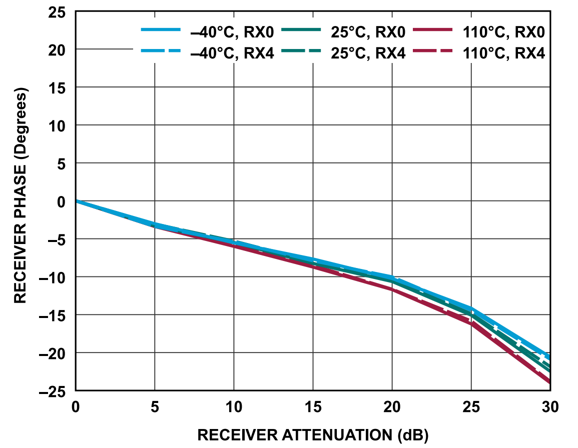


Figure 665. Receiver Phase vs. Receiver Attenuation

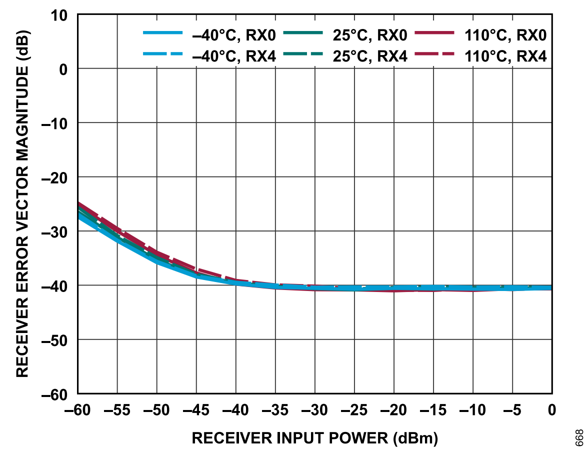


Figure 666. Receiver Error Vector Magnitude vs. Receiver Input Power, 20 MHz LTE, TDD Mode, AGC Enabled

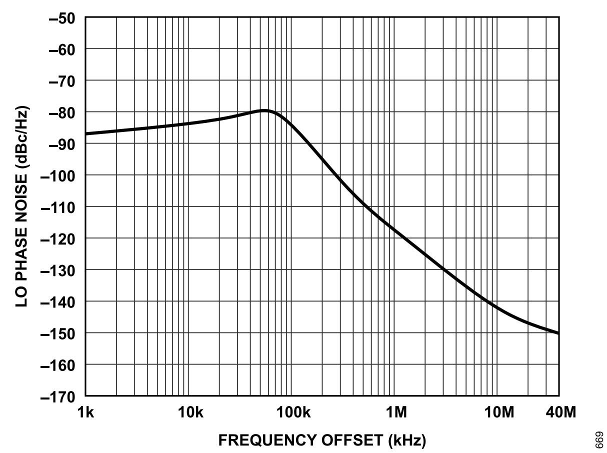


Figure 667. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 60 kHz, Phase Margin = 55°

TYPICAL PERFORMANCE CHARACTERISTICS

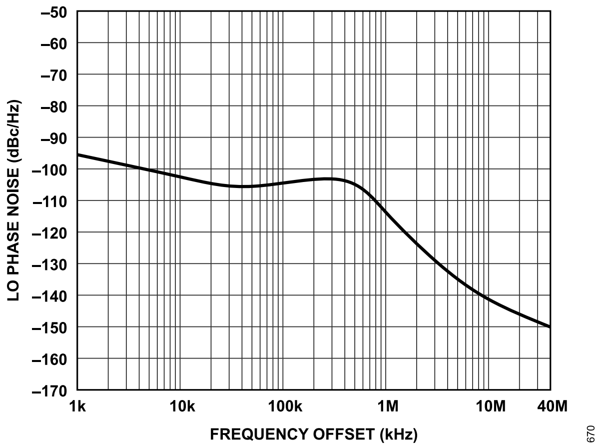


Figure 668. LO Phase Noise vs. Frequency Offset, Loop Bandwidth = 500 kHz, Phase Margin = 55°

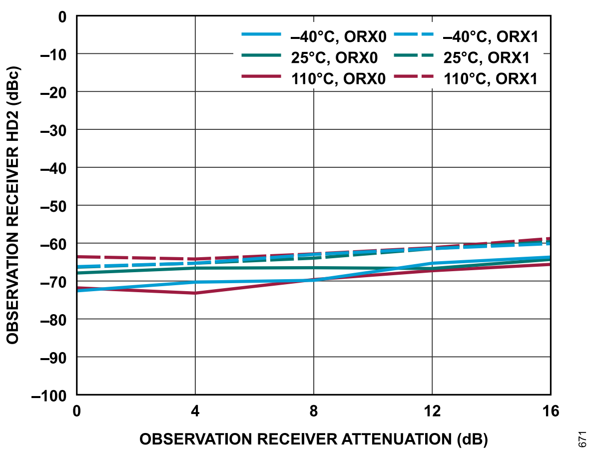


Figure 669. Observation Receiver HD2 vs. Observation Receiver Attenuation, −10 dBFS Input Signal

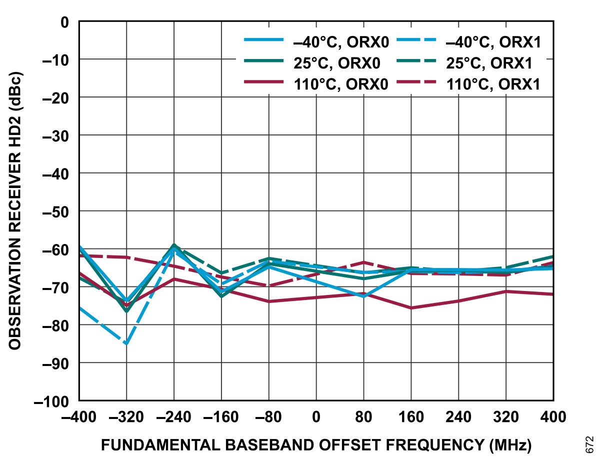


Figure 670. Observation Receiver HD2 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

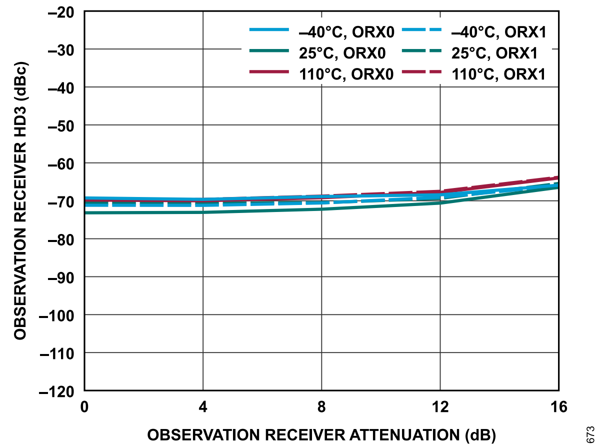


Figure 671. Observation Receiver HD3 vs. Observation Receiver Attenuation, −10 dBFS Input Signal

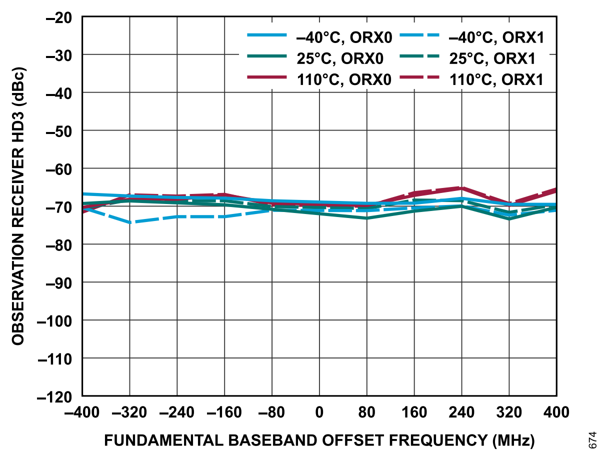


Figure 672. Observation Receiver HD3 vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal

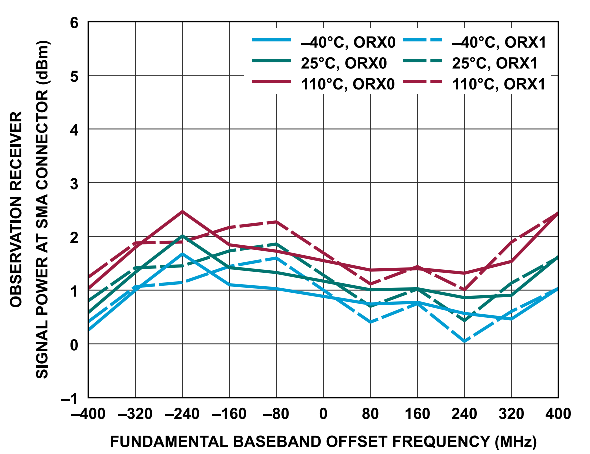


Figure 673. Observation Receiver Signal Power at SMA Connector vs. Fundamental Baseband Offset Frequency, −10 dBFS Input Signal (Match Not De-Embedded)

TYPICAL PERFORMANCE CHARACTERISTICS

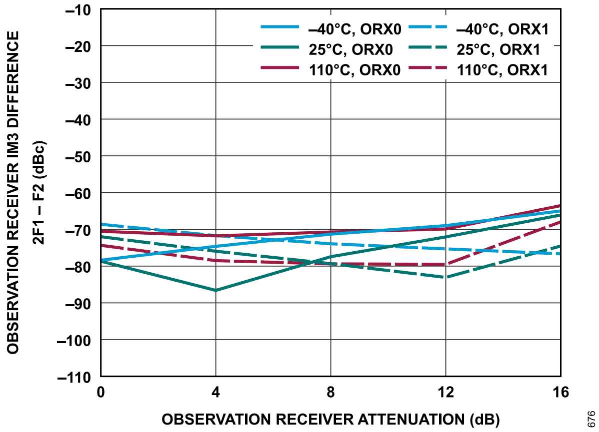


Figure 674. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 7102 MHz, F2 = 7112 MHz

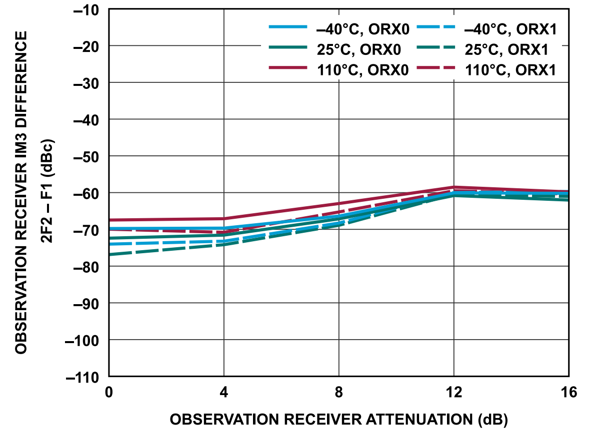


Figure 677. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 7102 MHz, F2 = 7112 MHz

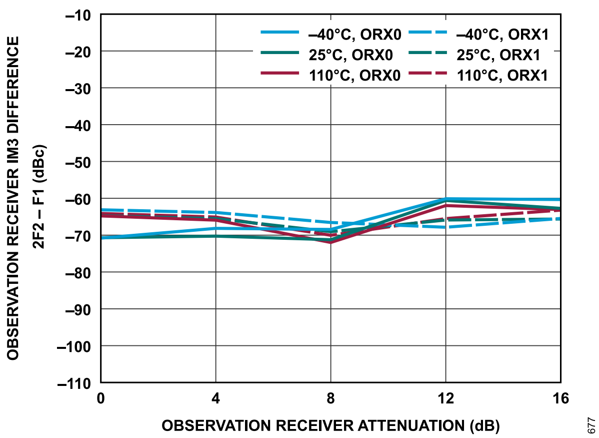


Figure 675. Observation Receiver IM3 Difference, 2F2 − F1 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 7102 MHz, F2 = 7112 MHz

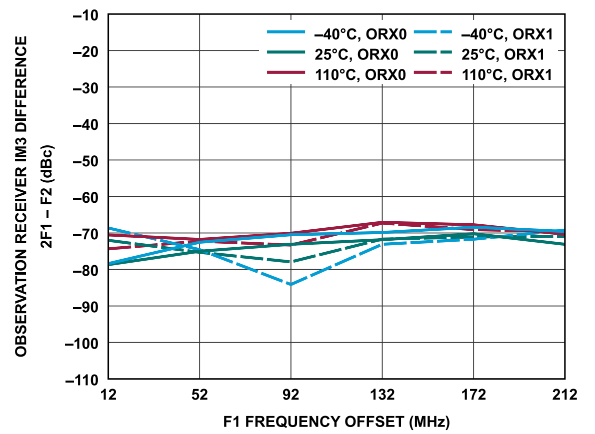


Figure 678. Observation Receiver IM3 Difference, 2F1 − F2 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 7102 MHz

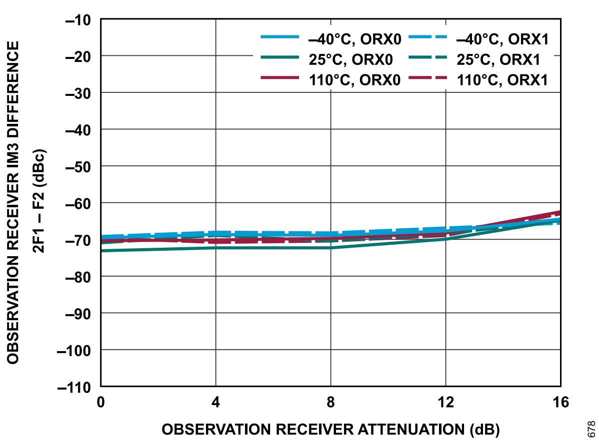


Figure 676. Observation Receiver IM3 Difference, 2F1 − F2 vs. Observation Receiver Attenuation, −13 dBFS Signal Level per Tone, F1 = 7102 MHz, F2 = 7112 MHz

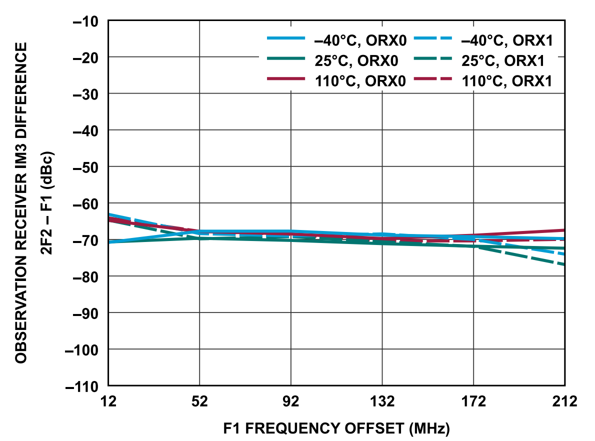


Figure 679. Observation Receiver IM3 Difference, 2F2 − F1 vs. F1 Frequency Offset, Baseband Tone Swept Across Passband, −13 dBFS Signal Level per Tone, F2 = 7102 MHz

TYPICAL PERFORMANCE CHARACTERISTICS

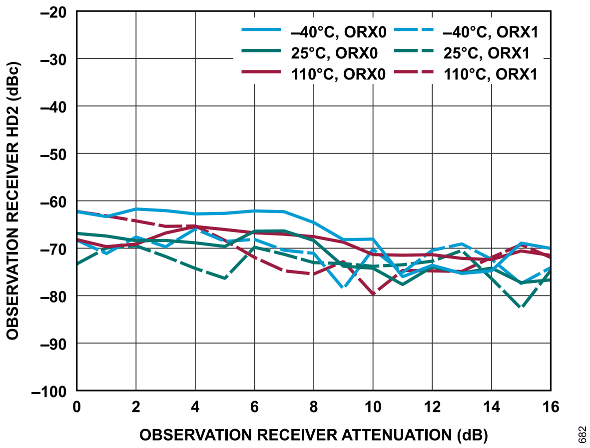


Figure 680. Observation Receiver HD2 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

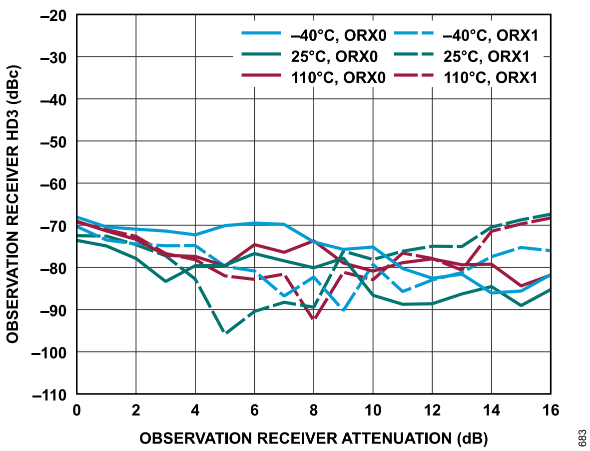


Figure 681. Observation Receiver HD3 vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

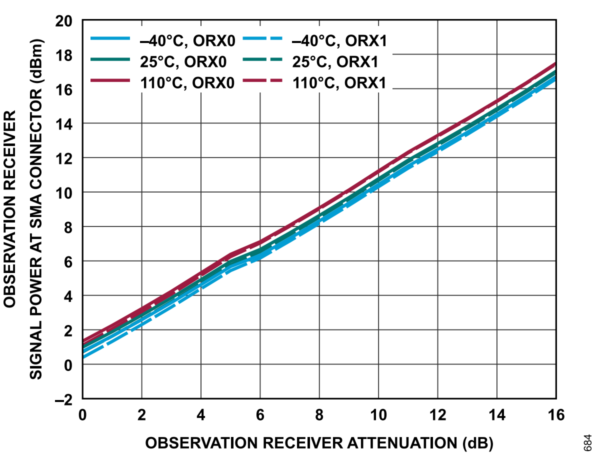


Figure 682. Observation Receiver Signal Power at SMA Connector vs. Observation Receiver Attenuation, 80 MHz Offset, −10 dBFS Input Signal

TYPICAL PERFORMANCE CHARACTERISTICS

ACROSS LO FREQUENCY

Ultralow Band Match

The ultralow band match board frequency range is 100 MHz to 1000 MHz. The temperature settings refer to the die temperature.

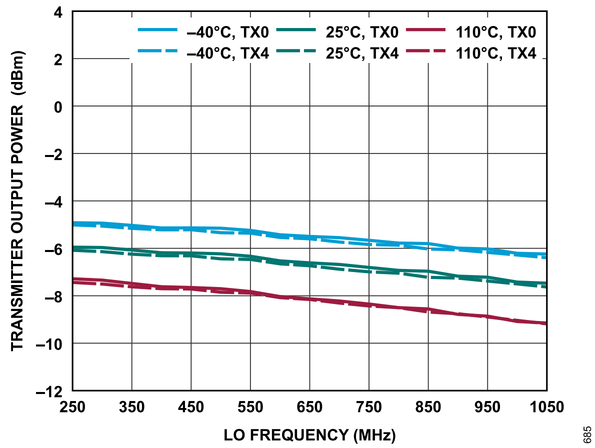


Figure 683. Transmitter Output Power vs. LO Frequency, 10 MHz Offset, 0 dB RF Attenuation, −12 dBFS Signal Level

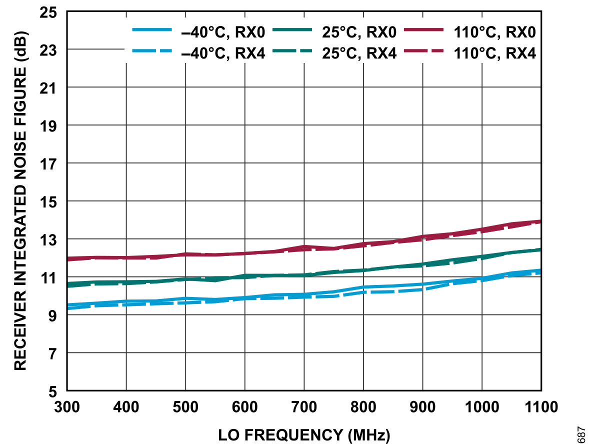


Figure 685. Receiver Integrated Noise Figure vs. LO Frequency, 200 MHz Integration Bandwidth

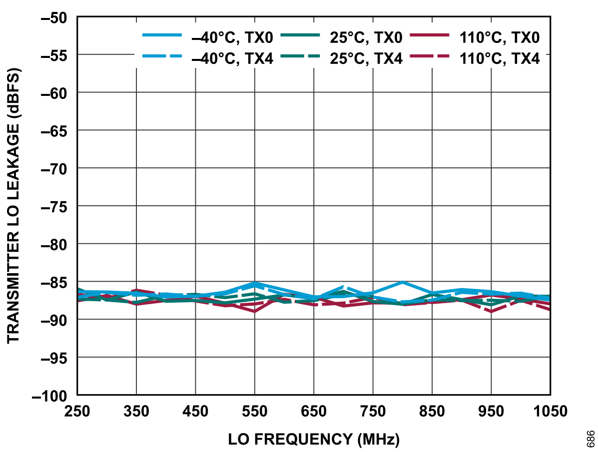


Figure 684. Transmitter LO Leakage vs. LO Frequency

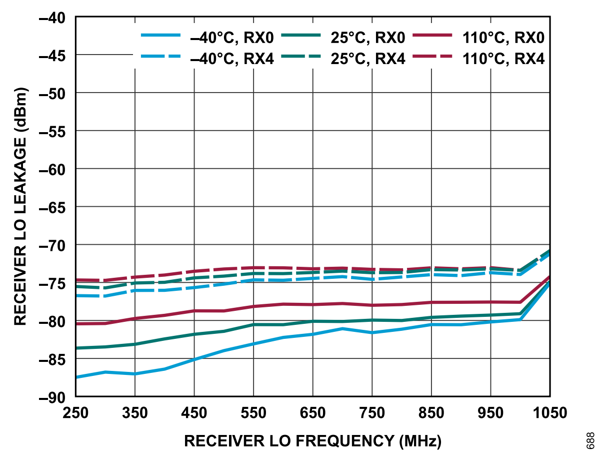


Figure 686. Receiver LO Leakage vs. Receiver LO Frequency, Maximum Receiver Gain

TYPICAL PERFORMANCE CHARACTERISTICS

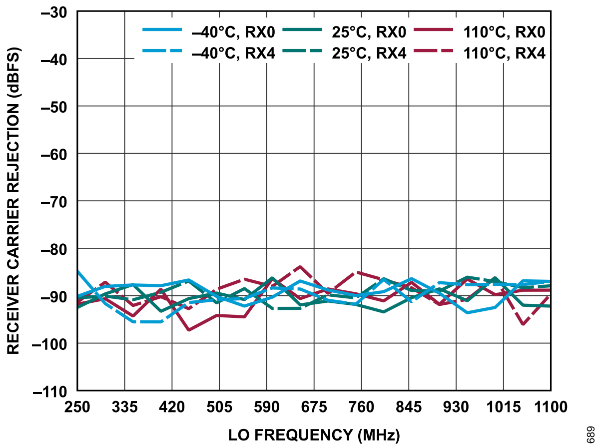


Figure 687. Receiver Carrier Rejection vs. LO Frequency

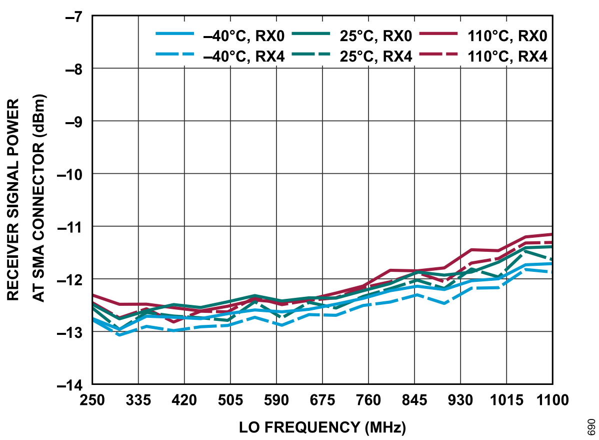


Figure 688. Receiver Signal Power at SMA Connector vs. LO Frequency

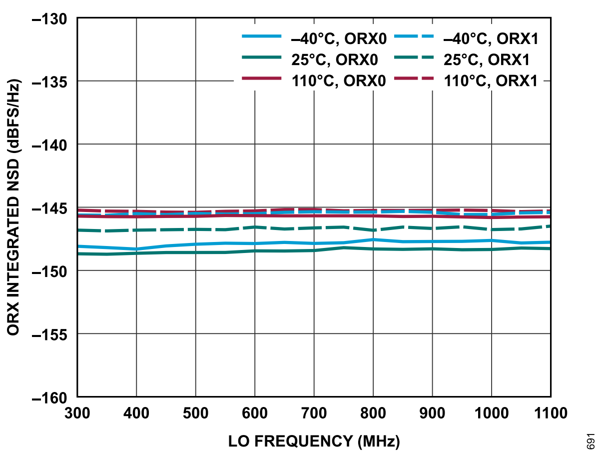


Figure 689. Observation Receiver (ORX) Integrated NSD vs. LO Frequency, 5898.24 MSPS Sample Rate

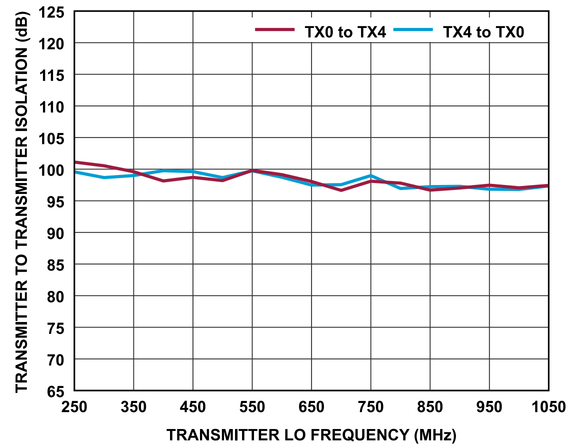


Figure 690. Transmitter to Transmitter Isolation vs. Transmitter LO Frequency

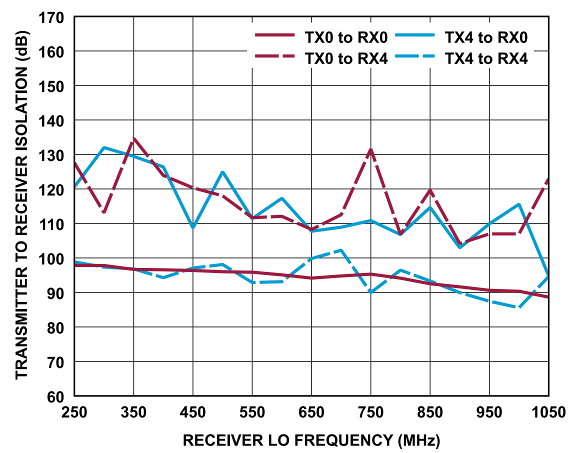


Figure 691. Transmitter to Receiver Isolation vs. Receiver LO Frequency

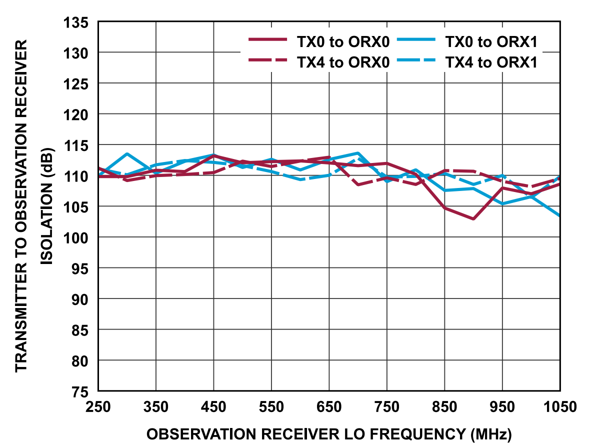


Figure 692. Transmitter to Observation Receiver Isolation vs. Observation Receiver LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

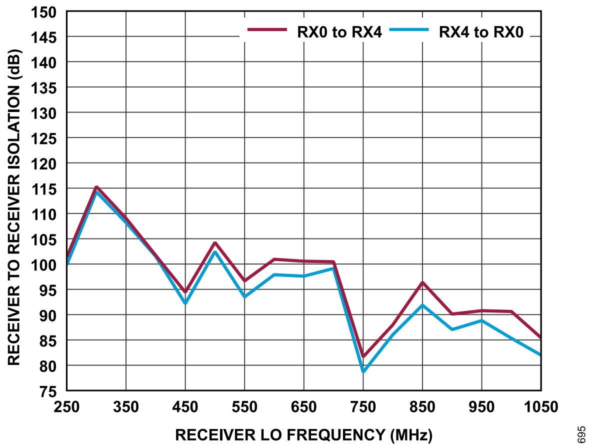


Figure 693. Receiver to Receiver Isolation vs. Receiver LO Frequency

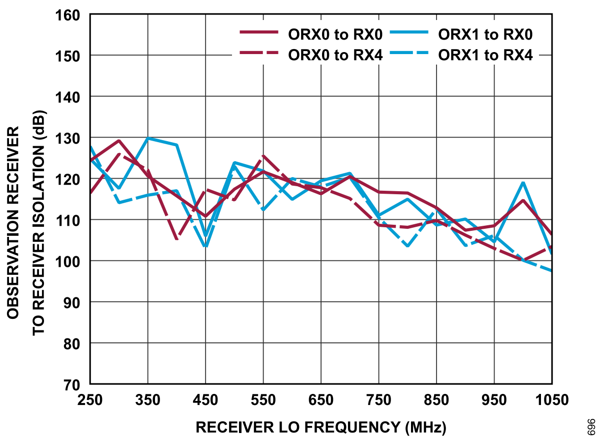


Figure 694. Observation Receiver to Observation Receiver Isolation vs. Receiver LO Frequency

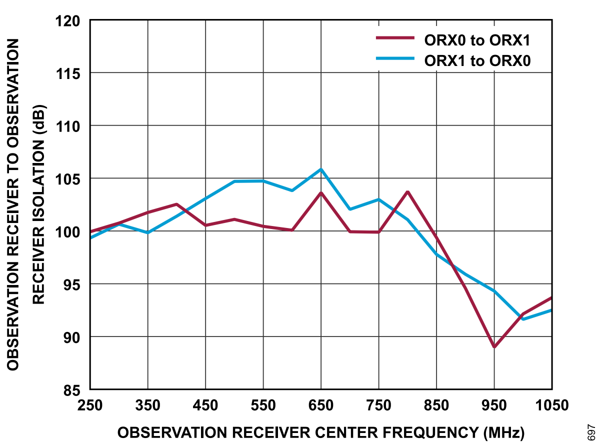


Figure 695. Observation Receiver to Observation Receiver Isolation vs. Observation Receiver Center Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

Low Band Match

The low band match board frequency range is 600 MHz to 2800 MHz. The temperature settings refer to the die temperature.

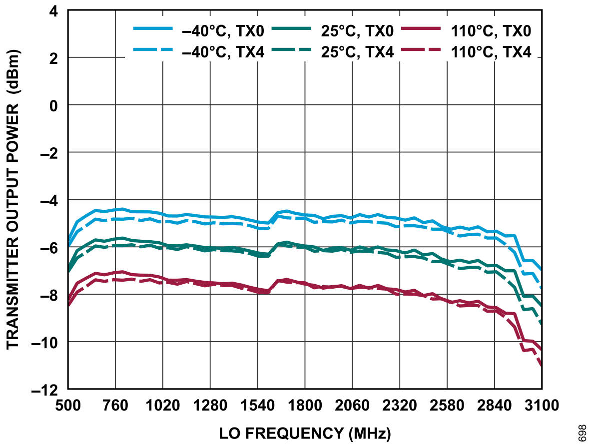


Figure 696. Transmitter Output Power vs. LO Frequency, 30 MHz Offset, 0 dB RF Attenuation, −12 dBFS Signal Level

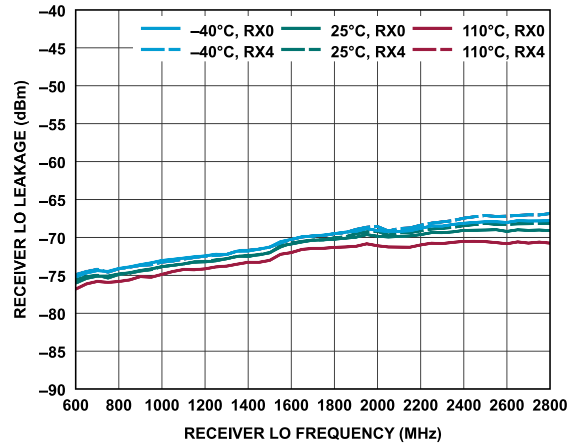


Figure 699. Receiver LO Leakage vs. Receiver LO Frequency, Maximum Receiver Gain

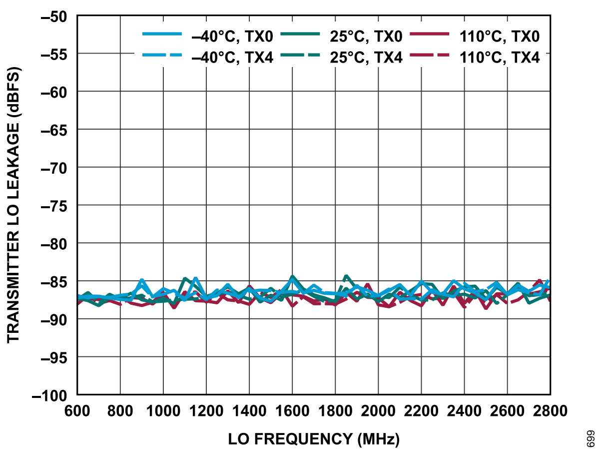


Figure 697. Transmitter LO Leakage vs. LO Frequency

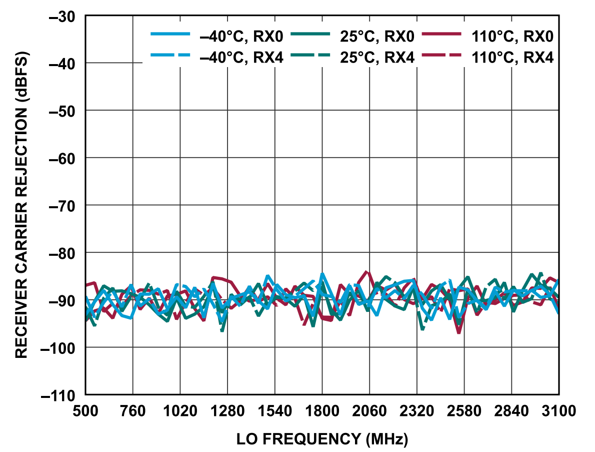


Figure 700. Receiver Carrier Rejection vs. LO Frequency

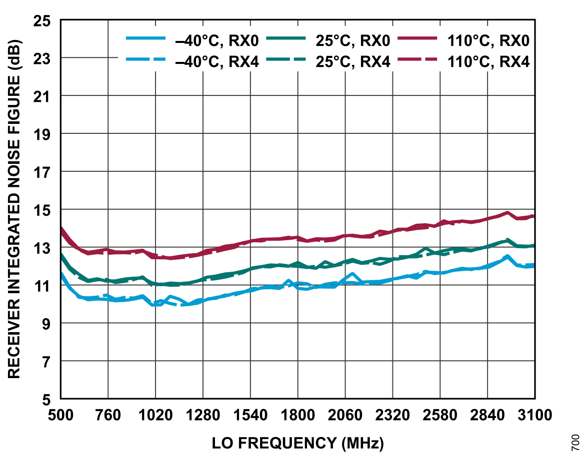


Figure 698. Receiver Integrated Noise Figure vs. LO Frequency, 400 MHz Integration Bandwidth

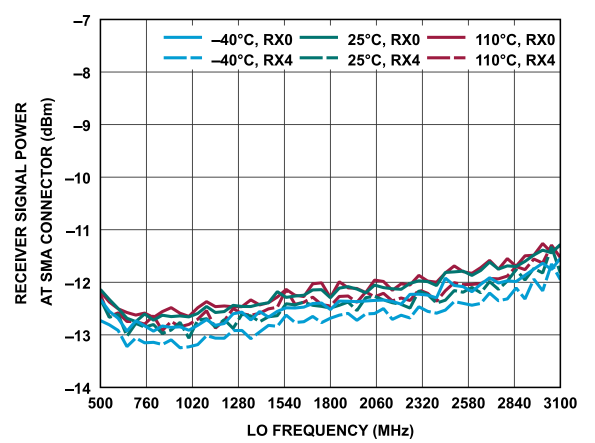


Figure 701. Receiver Signal Power at SMA Connector vs. LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

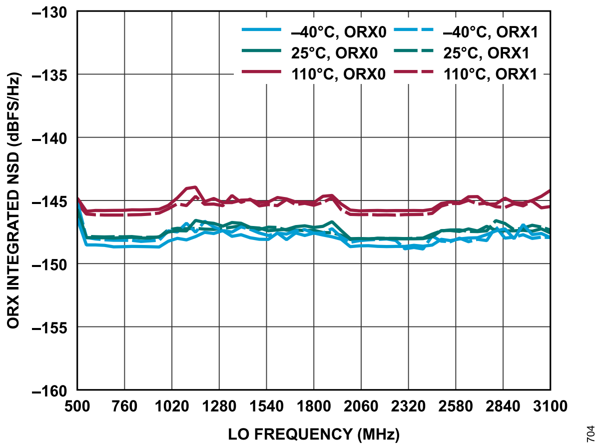


Figure 702. Observation Receiver (ORX) Integrated NSD vs. LO Frequency, 5898.24 MSPS Sample Rate

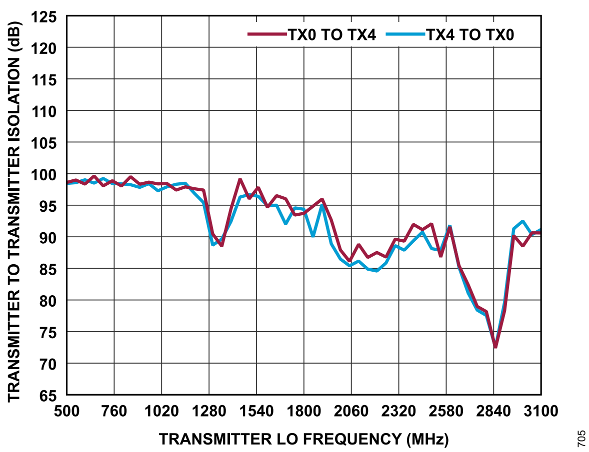


Figure 703. Transmitter to Transmitter Isolation vs. Transmitter LO Frequency

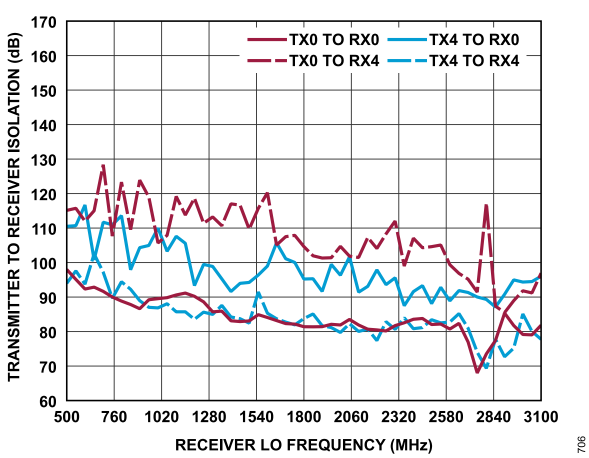


Figure 704. Transmitter to Receiver Isolation vs. Receiver LO Frequency

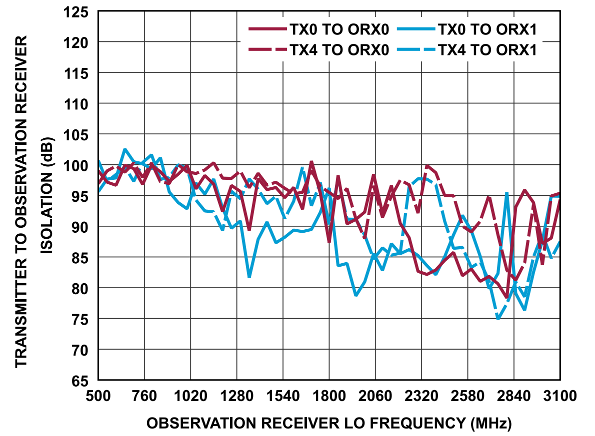


Figure 705. Transmitter to Observation Receiver Isolation vs. Observation Receiver LO Frequency

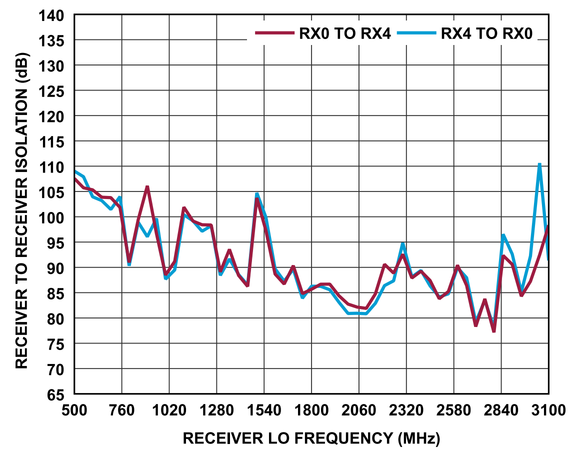


Figure 706. Receiver to Receiver Isolation vs. Receiver LO Frequency

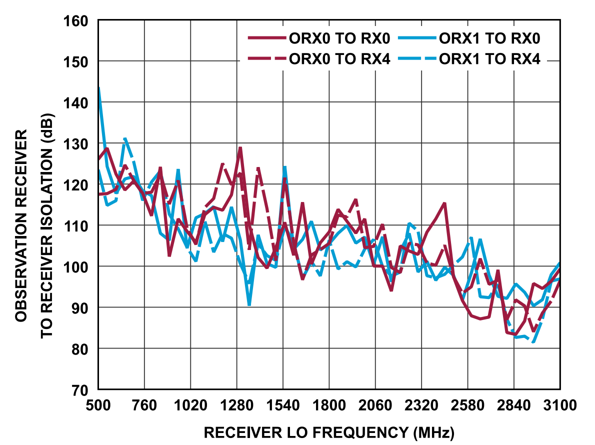


Figure 707. Observation Receiver to Receiver Isolation vs. Receiver LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

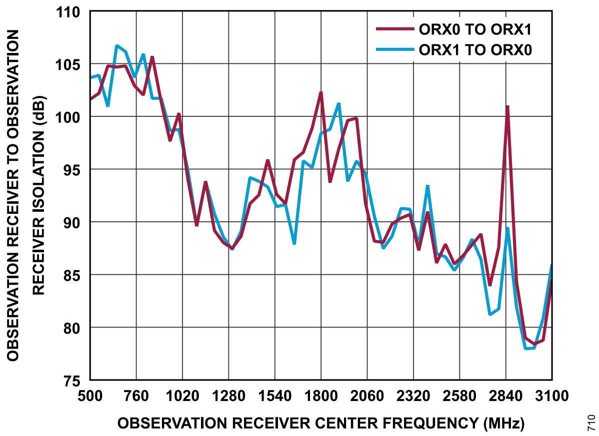


Figure 708. Observation Receiver to Observation Receiver Isolation vs. Observation Receiver Center Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

Midband Match

The midband match board frequency range is 1800 MHz to 4800 MHz. The temperature settings refer to the die temperature.

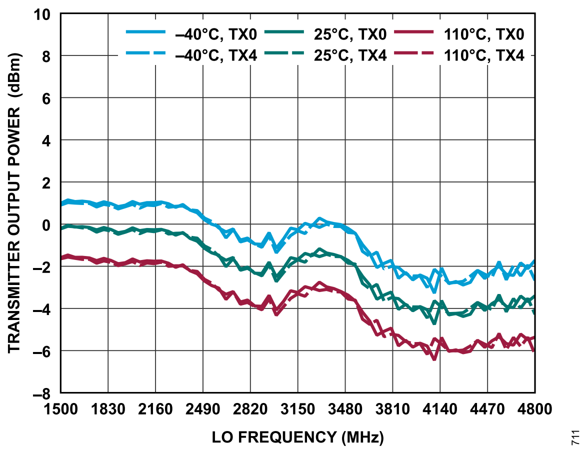


Figure 709. Transmitter Output Power vs. LO Frequency, 30 MHz Offset, 0 dB RF Attenuation, −6 dBFS Signal Level

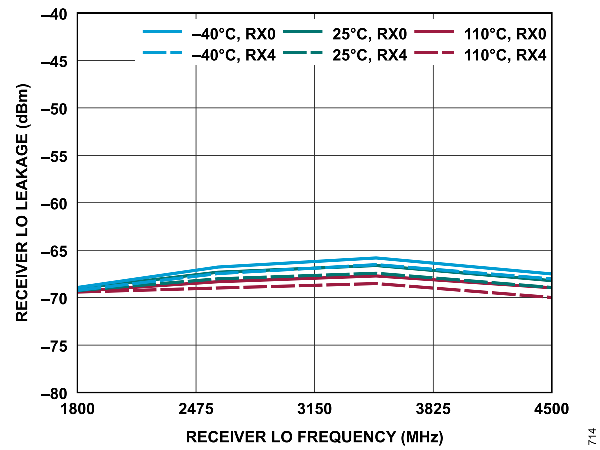


Figure 712. Receiver LO Leakage vs. Receiver LO Frequency, Maximum Receiver Gain

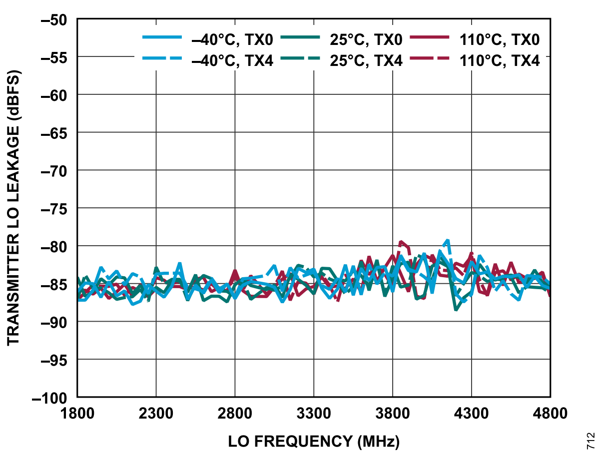


Figure 710. Transmitter LO Leakage vs. LO Frequency

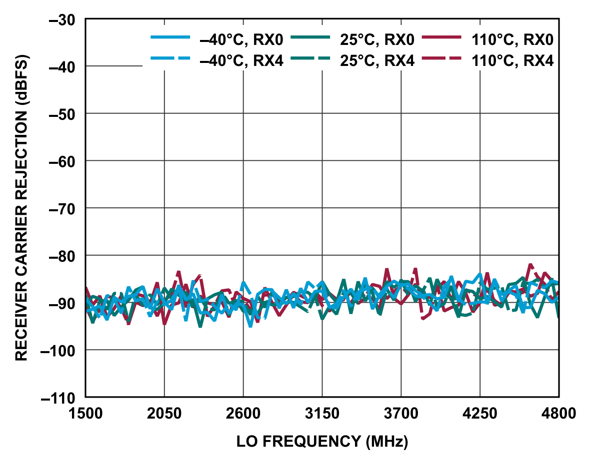


Figure 713. Receiver Carrier Rejection vs. LO Frequency

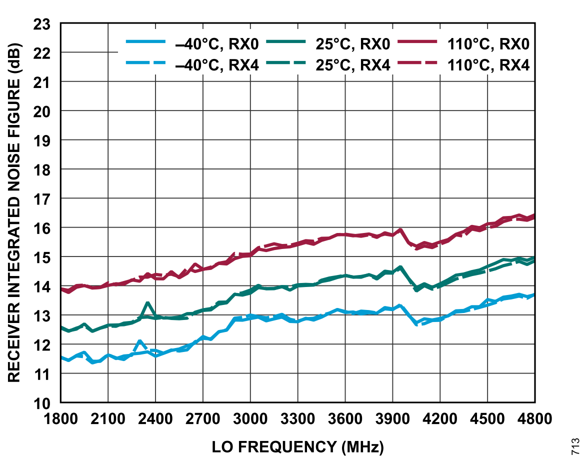


Figure 711. Receiver Integrated Noise Figure vs. LO Frequency, 600 MHz Integration Bandwidth

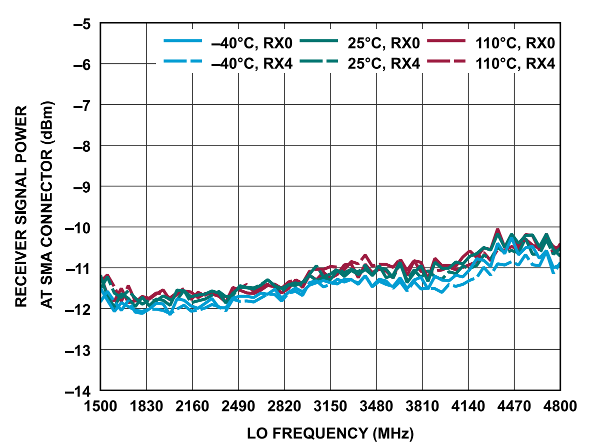


Figure 714. Receiver Signal Power at SMA Connector vs. LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

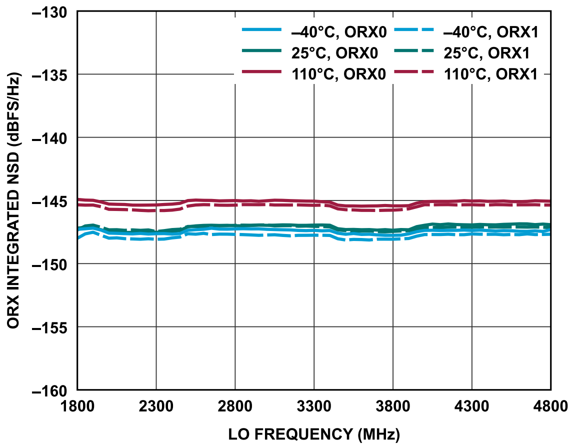


Figure 715. Observation Receiver (ORX) Integrated NSD vs. LO Frequency, 5898.24 MSPS Sample Rate

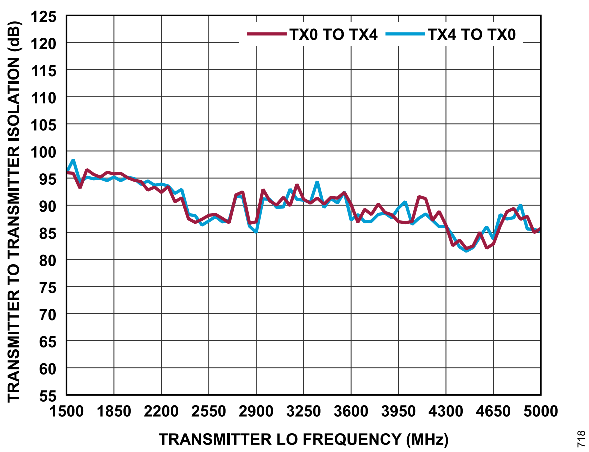


Figure 716. Transmitter to Transmitter Isolation vs. Transmitter LO Frequency

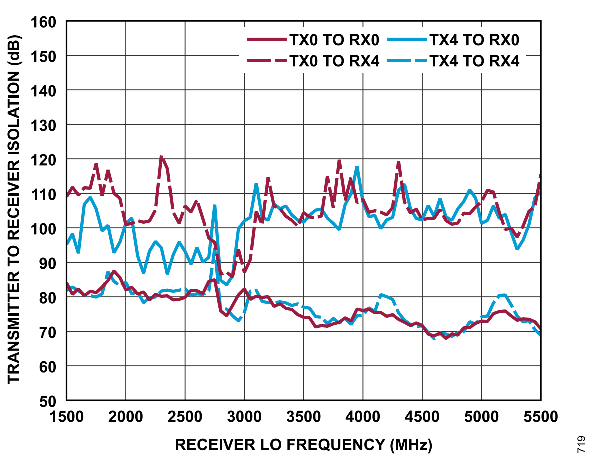


Figure 717. Transmitter to Receiver Isolation vs. Receiver LO Frequency

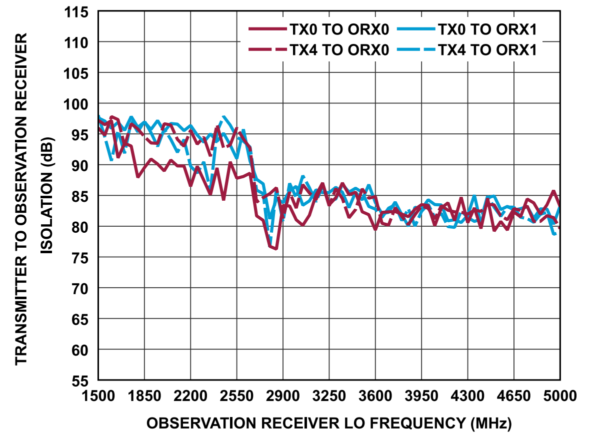


Figure 718. Transmitter to Observation Receiver Isolation vs. Observation Receiver LO Frequency

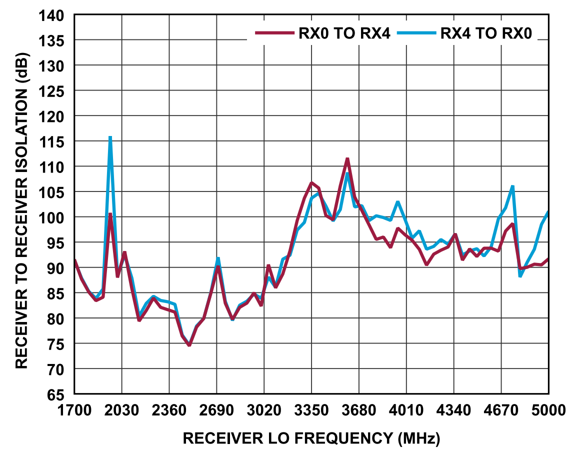


Figure 719. Receiver to Receiver Isolation vs. Receiver LO Frequency

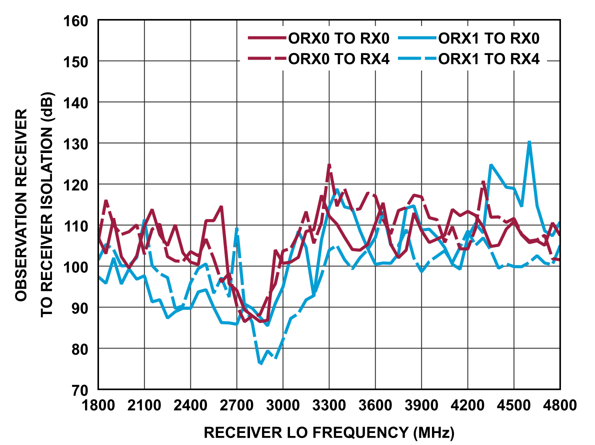


Figure 720. Observation Receiver to Receiver Isolation vs. Receiver LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

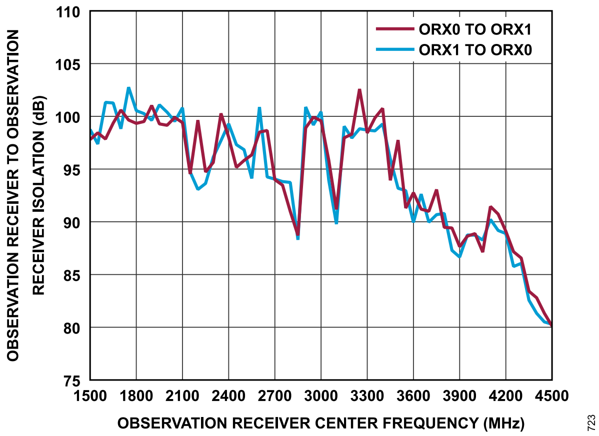


Figure 721. Observation Receiver to Observation Receiver Isolation vs. Observation Receiver Center Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

High Band Match

The high band match board frequency range is 4500 MHz to 6000 MHz. The temperature settings refer to the die temperature.

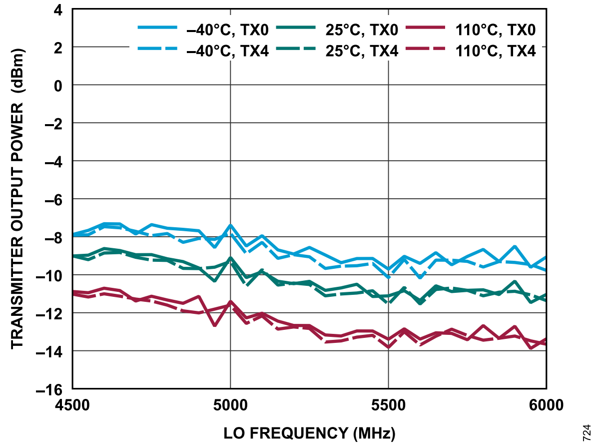


Figure 722. Transmitter Output Power vs. LO Frequency, 10 MHz Offset, 0 dB RF Attenuation, −12 dBFS Signal Level

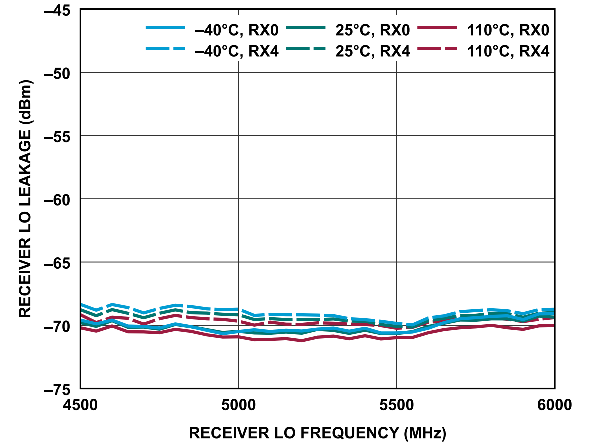


Figure 725. Receiver LO Leakage vs. LO Frequency, Maximum Receiver Gain

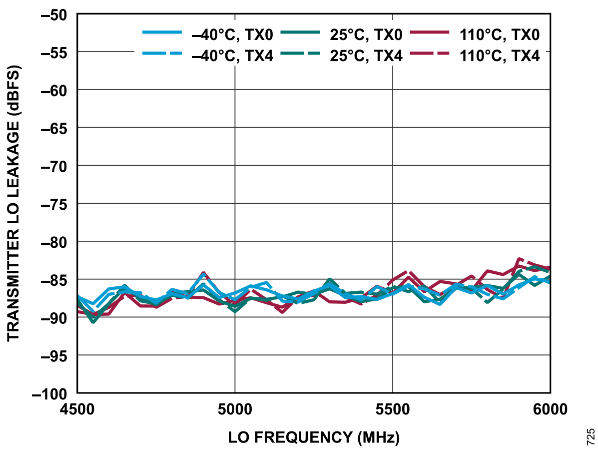


Figure 723. Transmitter LO Leakage vs. LO Frequency

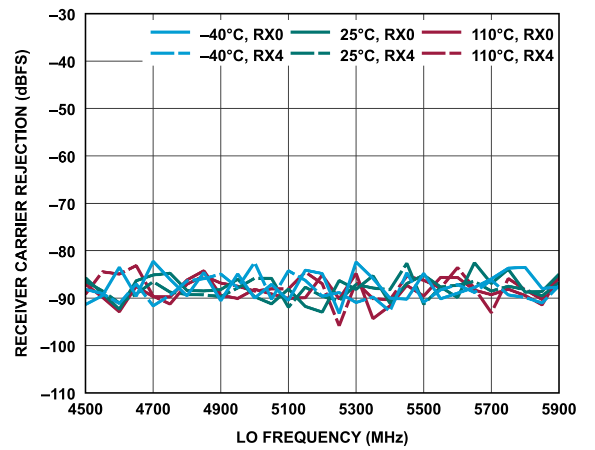


Figure 726. Receiver Carrier Rejection vs. LO Frequency

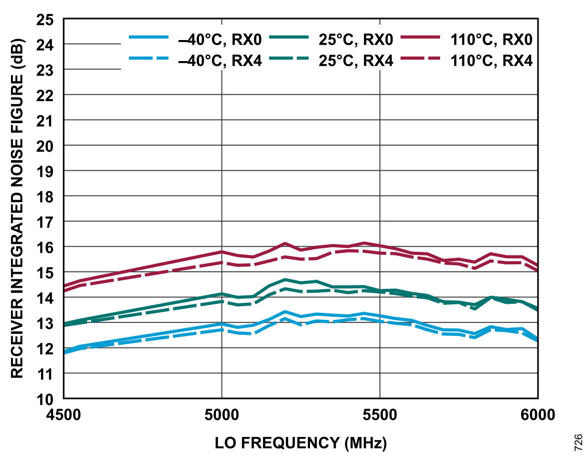


Figure 724. Receiver Integrated Noise Figure vs. LO Frequency, 200 MHz Integration Bandwidth

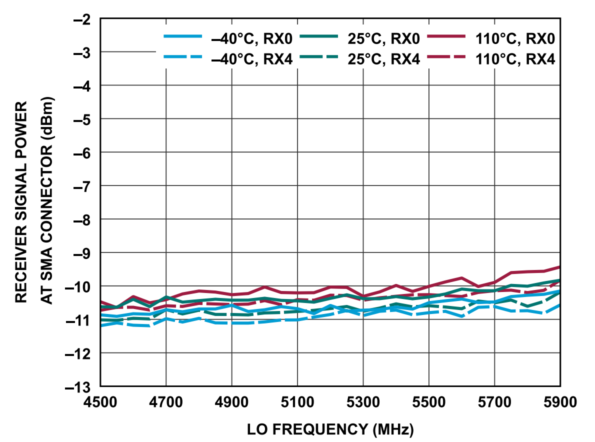


Figure 727. Receiver Signal Power at SMA Connector vs. LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

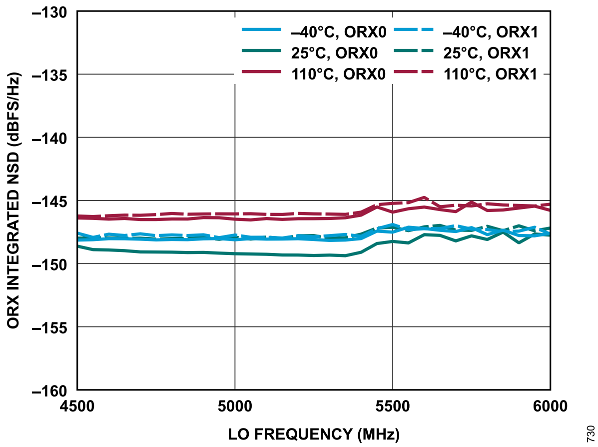


Figure 728. Observation Receiver (ORX) Integrated NSD vs. LO Frequency, 7864.32 MSPS Sample Rate

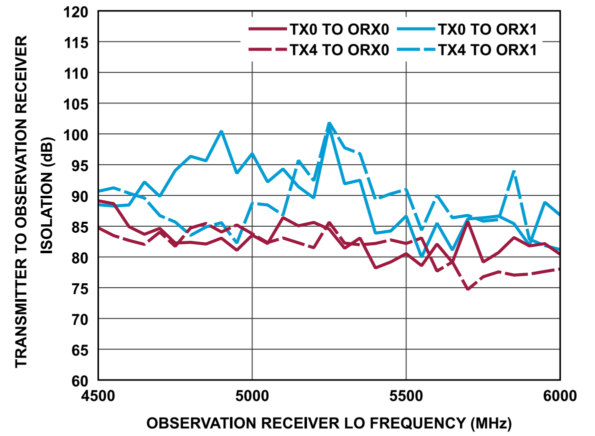


Figure 731. Transmitter to Observation Receiver Isolation vs. Observation Receiver LO Frequency

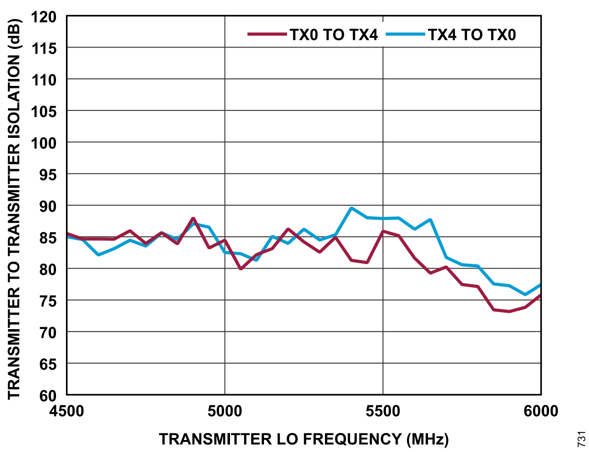


Figure 729. Transmitter to Transmitter Isolation vs. Transmitter LO Frequency

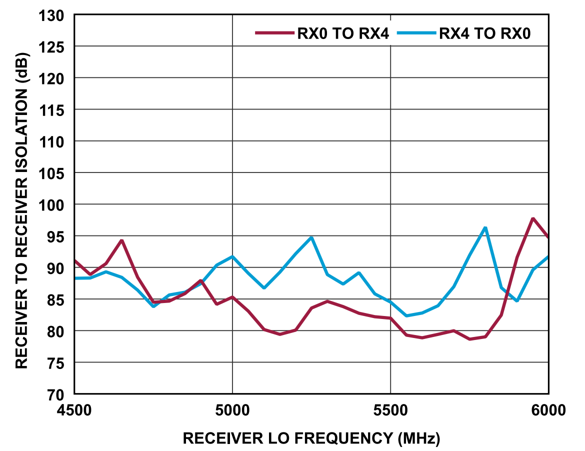


Figure 732. Receiver to Receiver Isolation vs. Receiver LO Frequency

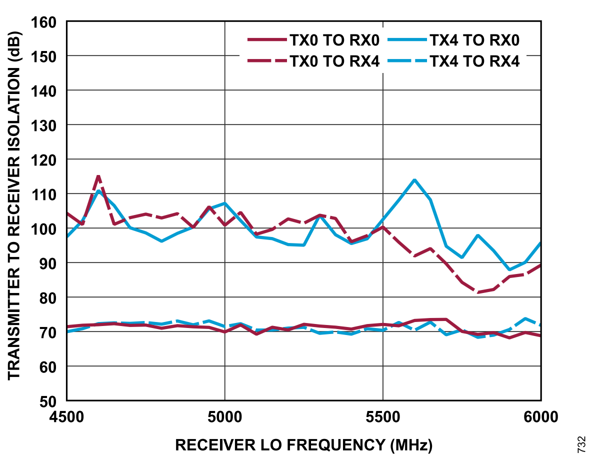


Figure 730. Transmitter to Receiver Isolation vs. Receiver LO Frequency

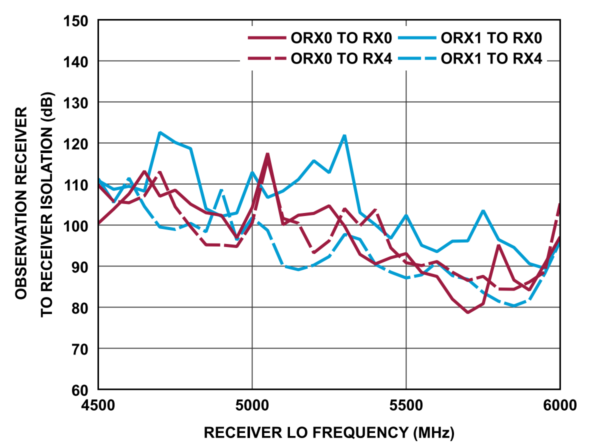


Figure 733. Observation Receiver to Receiver Isolation vs. Receiver LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

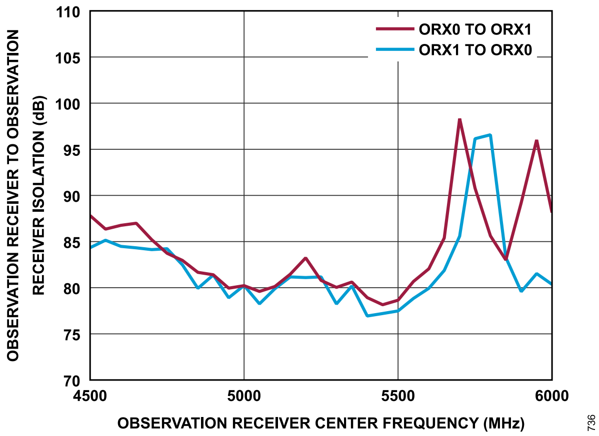


Figure 734. Observation Receiver to Observation Receiver Isolation vs. Observation Receiver Center Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

Ultrahigh Band Match

The ultrahigh band match board frequency range is 6000 MHz to 7100 MHz. The temperature settings refer to the die temperature.

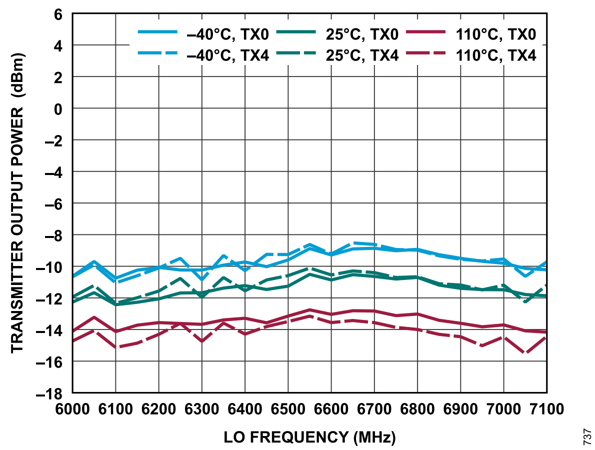


Figure 735. Transmitter Output Power vs. LO Frequency, 10 MHz Offset, 0 dB RF Attenuation, −12 dBFS Signal Level

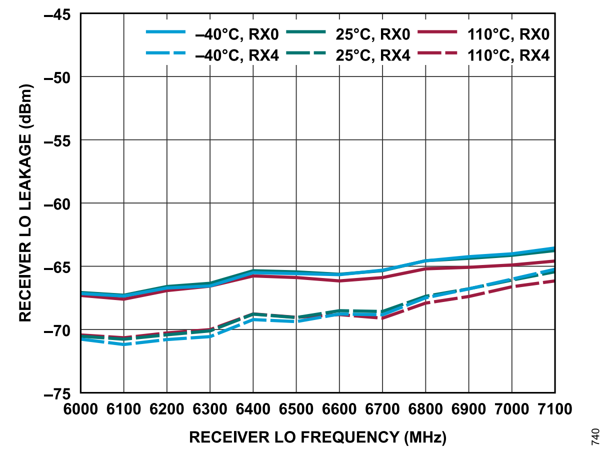


Figure 738. Receiver LO Leakage vs. Receiver LO Frequency, Maximum Receiver Gain

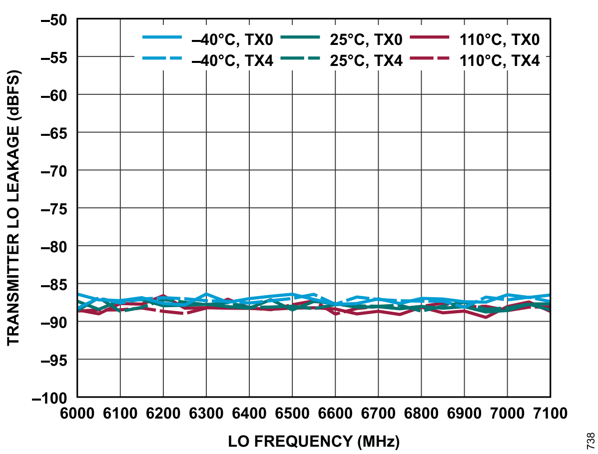


Figure 736. Transmitter LO Leakage vs. LO Frequency

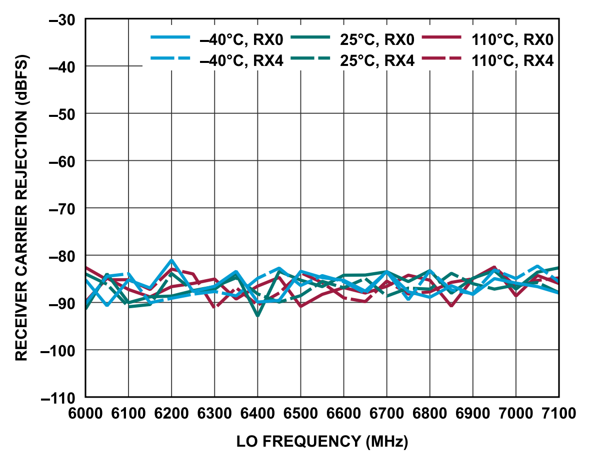


Figure 739. Receiver Carrier Rejection vs. LO Frequency

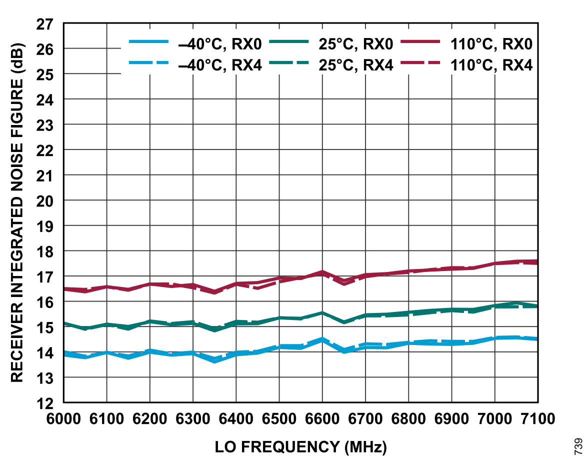


Figure 737. Receiver Integrated Noise Figure vs. LO Frequency, 200 MHz Integration Bandwidth

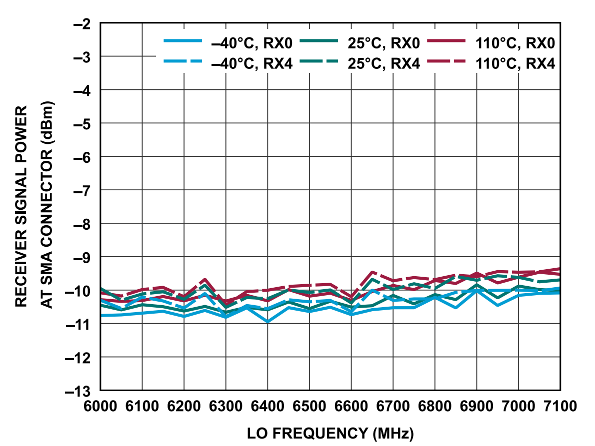


Figure 740. Receiver Signal Power at SMA Connector vs. LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

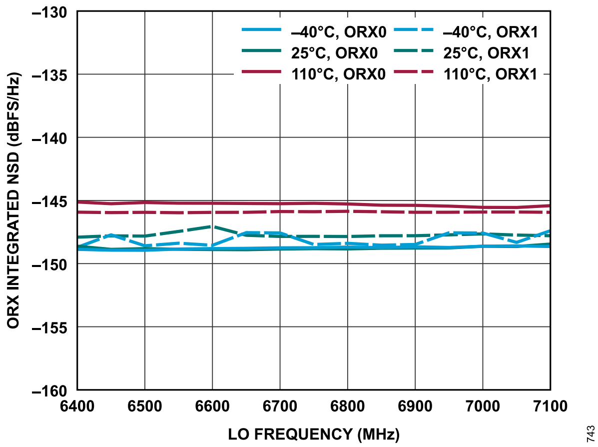


Figure 741. Observation Receiver (ORX) Integrated NSD vs. LO Frequency, 7864.32 MSPS Sample Rate

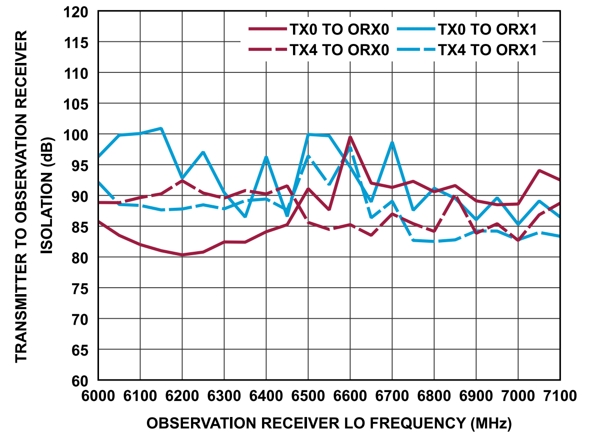


Figure 744. Transmitter to Observation Receiver Isolation vs. Observation Receiver LO Frequency

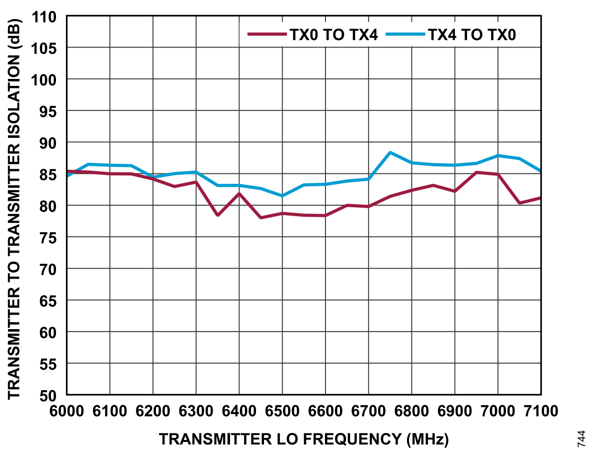


Figure 742. Transmitter to Transmitter Isolation vs. Transmitter LO Frequency

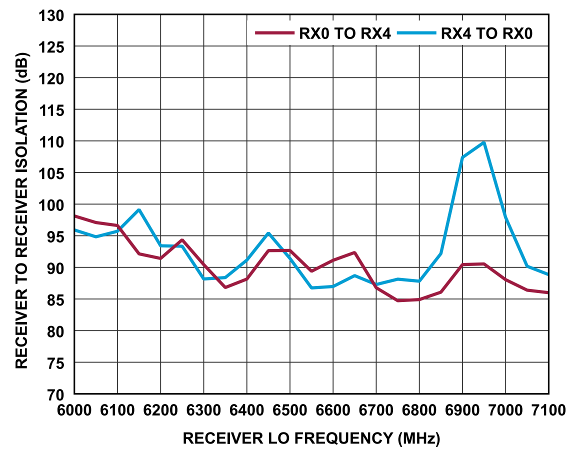


Figure 745. Receiver to Receiver Isolation vs. Receiver LO Frequency

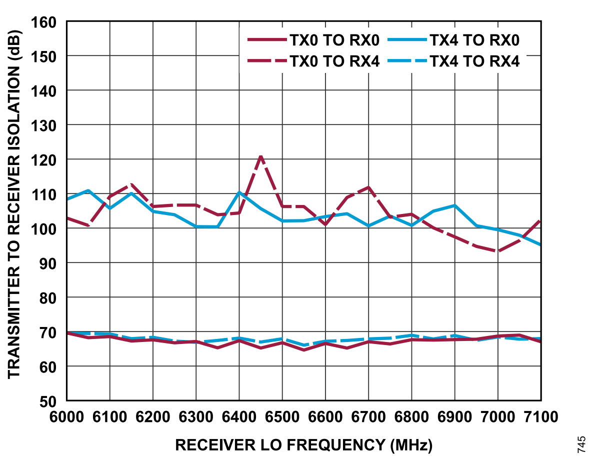


Figure 743. Transmitter to Receiver Isolation vs. Receiver LO Frequency

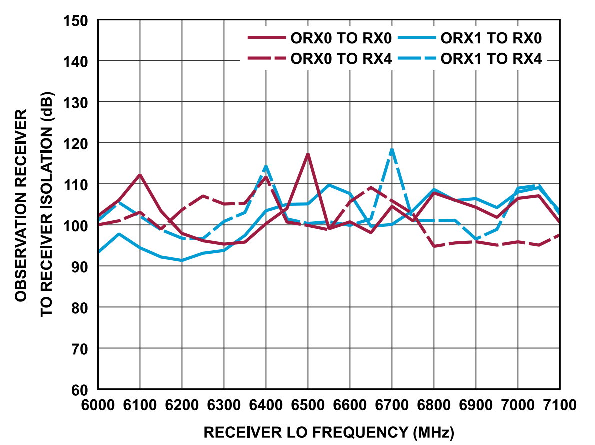


Figure 746. Observation Receiver to Receiver Isolation vs. Receiver LO Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

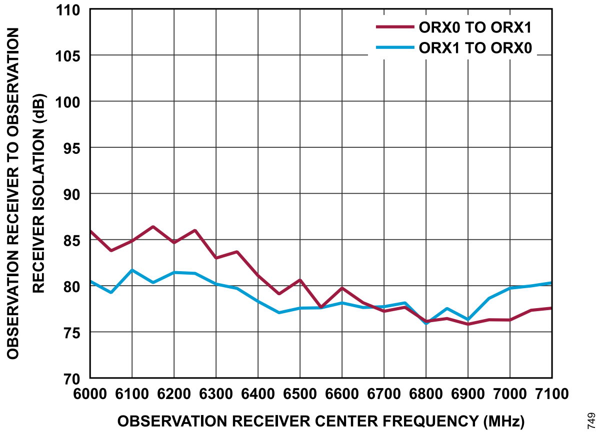


Figure 747. Observation Receiver to Observation Receiver Isolation vs. Observation Receiver Center Frequency

THEORY OF OPERATION

The ADRV9032R is a highly integrated RF transceiver capable of configuration for a wide range of applications. The device integrates all the RF, mixed-signal, and digital blocks necessary to provide all transmitter, traffic receiver, and observation receiver functions in a single device. Programmability allows the device to be adapted for use in many applications.

Two observation receiver channels monitor the transmitter outputs and provide tracking correction of DC offset, quadrature error, and transmitter LO leakage to maintain a high-performance level under varying temperatures and input signal conditions. Firmware supplied with the device implements all initialization and calibration with no user interaction. Additionally, the device includes test modes allowing system designers to debug designs during prototyping and to optimize radio configurations.

The ADRV9032R contains eight high-speed serial interface (SERDES) links for the transmit chain and eight high-speed links shared by the receiver and observation receiver chains (JESD204B Subclass 1 compliant and supports JESD204C).

TRANSMITTER

The ADRV9032R transmitter section consists of two identical and independently controlled channels that provide all the digital processing, mixed-signal, and RF blocks necessary to implement a direct conversion system while sharing a common frequency synthesizer. The digital data from the SERDES lanes pass through a digital processing block that includes a series of programmable half-band filters, interpolation stages, and FIR filters, including a programmable FIR filter with variable interpolation rates and up to 24 taps. The output of this digital chain is connected to the digital-to-analog converter (DAC). The DAC sample rate is adjustable for either 2949.12 MHz or 3932.16 MHz. The in-phase (I) and quadrature (Q) channels are identical in each transmitter signal chain.

After conversion to baseband analog signals, the I and Q signals are filtered to remove sampling artifacts and fed to the upconversion mixers. Each transmit chain provides a wide attenuation adjustment range with fine granularity to help designers optimize SNR.

RECEIVER

The ADRV9032R provides two independent receiver channels. Each channel contains all the blocks necessary to receive RF signals and convert these signals to digital data usable by a baseband processor. Each channel contains a programmable attenuator stage, followed by matched I and Q mixers that downconvert received signals to baseband for digitization.

Two gain-control options are available, as follows:

- Users can implement their own gain-control algorithms using their baseband processor to manage manual gain-control mode.
- Users can use the on-chip AGC system.

Performance is optimized by mapping each gain-control setting to specific attenuation levels at each adjustable gain block in the receive signal path. Additionally, each channel contains independent receive signal power measurement capability, DC offset tracking, and all the circuitry necessary for self-calibration.

The receivers include ADCs and adjustable sample rates that produce data streams from the received signals. The signals can be conditioned further by a series of decimation filters and a programmable FIR filter with additional decimation settings. The sample rate of each digital filter block is adjustable by changing decimation factors to produce the desired output data rate. All receiver outputs are connected to the SERDES block, where the data is formatted and serialized for transmission to the baseband processor.

OBSERVATION RECEIVER

The ADRV9032R provides two independent observation receiver inputs. Unlike the receiver channels, the observation receiver channels' path implements direct RF sampling. An RF ADC eliminates the need for a LO, which eliminates spurious often seen with LO coupling. Each channel also contains a programmable attenuator stage that provides 16 dB attenuation in analog domain with roughly 1 dB step size.

REFERENCE CLOCK INPUT

The ADRV9032R requires a differential clock connected to the DEVCLK± pins. The frequency of the clock input must be between 61.44 MHz and 491.52 MHz and must have low phase noise because this signal generates the RF LO and internal sampling clocks.

SYNTHESIZERS

The ADRV9032R contains four fractional-N PLLs to generate the RF LO for the signal paths and all internal clock sources. This group of PLLs includes two RF PLLs for transmit and receive LO generation, an SERDES PLL, and a clock PLL. Each PLL is independently controlled with no need for external components to set frequencies.

RF Synthesizers

The two RF synthesizers use fractional-N PLLs to generate RF LOs for multiple receiver and transmitter channels. The fractional-N PLL incorporates a four-core internal voltage-controlled oscillator (VCO) and loop filter, capable of generating low phase noise signals with no external components required. An internal LO multiplexer (mux) enables each PLL to supply LOs to the desired receivers and transmitters (for example, LO1 to all transmitters, LO2 to all receivers), resulting in maximum flexibility when configuring the device for TDD operation. The LOs on multiple devices can be phase synchronized to support active antenna systems and beam forming applications.

THEORY OF OPERATION

SERDES Synthesizer

The SERDES synthesizer uses a single core VCO fractional-N PLL to generate the required clock for the serializer/deserializer physical layer (SERDES PHY) to achieve the desired lane rate.

Clock Synthesizer

The ADRV9032R contains a single core VCO fractional-N PLL synthesizer that generates all baseband related clock signals and SERDES clocks. This fractional-N PLL is programmed based on the data rate and sample rate requirements of the system, which typically require the system to operate in integer mode.

External LO Inputs

The ADRV9032R provides two external LO inputs, which allow an external synthesizer to be used with the device. These inputs must be at least 2× the desired LO frequency. See the external LO input section in Table 1 for more information.

SPI

The ADRV9032R uses an SPI to communicate with the baseband processor. This interface can be configured as a 4-wire interface with dedicated receive and transmit ports, or the interface can be configured as a 3-wire interface with a bidirectional data communications port. This bus allows the baseband processor to set all device control parameters using a simple address data serial bus protocol.

Write commands follow a 24-bit format. The first bit sets the bus direction of the bus transfer. The next 15 bits set the address where data is written. The final eight bits are the data being transferred to the specific register address.

Read commands follow a similar format with the exception that the first 16 bits are transferred on the SPI_DIO pin, and the final eight bits are read from the ADRV9032R, either on the SPI_DO pin in 4-wire mode or on the SPI_DIO pin in 3-wire mode.

GPIO_X PINS

The ADRV9032R provides 24 GPIOs referenced to VIF that can be configured for numerous functions. When configured as outputs, certain pins can provide real-time signal information to the baseband processor, allowing the baseband processor to determine receiver performance. A pointer register selects what information is output to these pins.

The signals used for manual gain mode, calibration flags, state machine status, and various receiver parameters are among the outputs that can be monitored on the GPIO pins. Additionally, certain GPIO pins can be configured as inputs and used for various functions, such as setting the receiver gain in real time.

GPIO_ANA_x

The ADRV9032R contains 16 analog GPIOs ports that can be used to control other analog devices or receive control inputs referenced to the VDDA_1P8 supply.

APPLICATIONS INFORMATION

POWER SUPPLY SEQUENCE

The ADRV9032R requires a specific power-up sequence to avoid undesired power-up currents. In the optimal power-up sequence, the VDIG_0P8 supply is activated first. After the VDIG_0P8 source is enabled, the VANA_1P0 supplies must be enabled next, followed by the VANA_1P8 supplies. Note that the VIF_1P8 supply can be enabled at any time without affecting the other circuits in the device. In addition to this sequence, it is also recommended to toggle the $\overline{\text{RESET}}$ signal after power has stabilized before initializing the device.

The power-down sequence recommendation is similar to power-up. All supplies must be disabled in reverse order (or all together) before VDIG_0P8 is disabled. If such a sequence is not possible, then all supplies must have their sources disabled simultaneously to ensure no back feeding to circuits that have been powered down.

DATA INTERFACE

The digital data interface for the ADRV9032R implements the JESD204B and JESD204C JEDEC standards. The serial interface operates at speeds of up to 16,500 Mbps.

OUTLINE DIMENSIONS

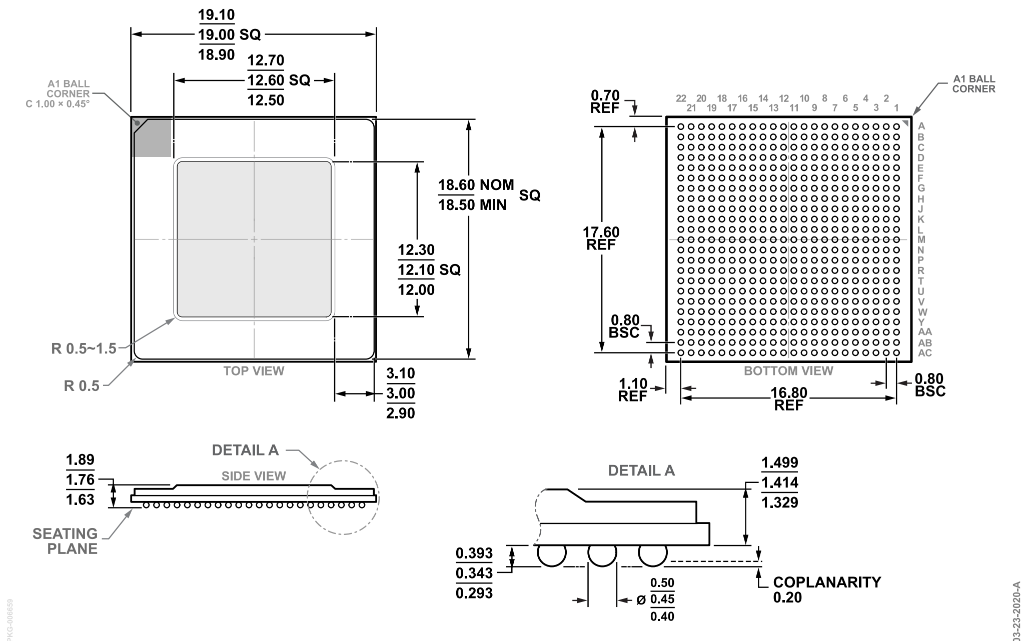


Figure 748. 506-Ball Grid Array Thermally Enhanced [BGA_ED]
(BP-506-1)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
ADRV9032BBPZ-2T1	−40°C to +110°C	506-Ball Ball Grid Array, Thermally Enhanced [BGA_ED]	BP-506-1
ADRV9032BBPZRL-2T1	−40°C to +110°C	506-Ball Ball Grid Array, Thermally Enhanced [BGA_ED]	BP-506-1

[1] Z = RoHS Compliant Part.

EVALUATION BOARDS

Table 12. Evaluation Boards

Model[1]	Description
ADRV903X-MB/PCBZ	Midband Evaluation Board, 1.8 GHz to 4.8 GHz
ADRV903X-UB/PCBZ	Upper Band Evaluation Board, 6 GHz to 7.125 GHz
ADS10-V1EBZ	ADS10 Motherboard

[1] Z = RoHS-Compliant Part.

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