TSL8029N

Single Channel 2 – 5 GHz 100-Watt Receiver Front End for MACRO base station

Application Note: TSL8029N EVB C

Application Note

3300 MHz~4200 MHz

5 V, 90 mA [RX-HG]

5 V, 50 mA [RX-LG]

Rev-2.0

List of Contents

1. General Description

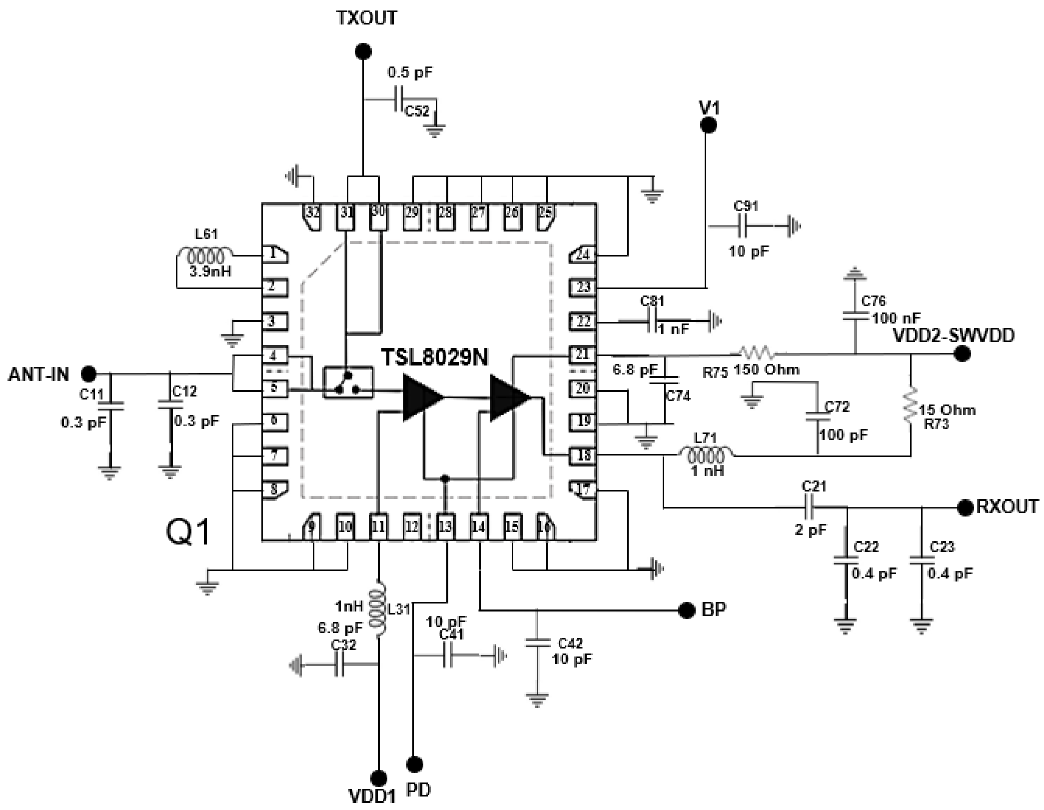
The TSL8029N is a single-channel, integrated RF, front-end, multichip module designed for different applications. The device operates from 2 GHz to 5GHz. The TSL8029N is configured with a cascading, two-stage, GaAs LNA and a GaN based SPDT switch.

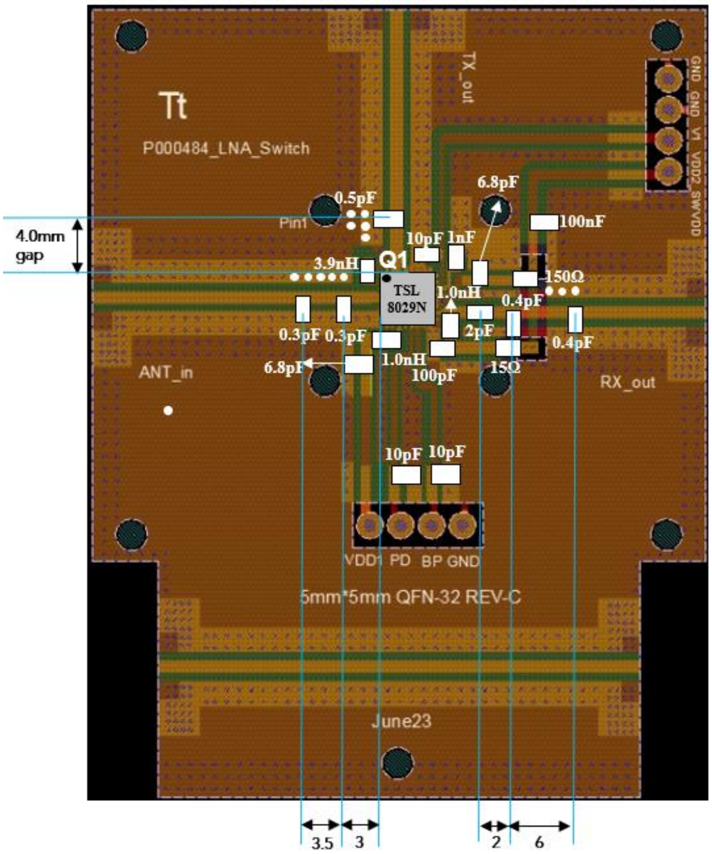
In high gain mode, the cascaded two-stage LNA and switch offer a low noise figure of 1.4 dB and a high gain of 33 dB at 3.6 GHz with an output third-order intercept point (OIP3) of 33 dBm (typical) at high gain mode. In low gain mode, one stage of the two-stage LNA is in bypass, providing 14.5 dB of gain at a lower current of 50 mA. In power-down mode, the LNAs are turned off and the device draws 4 mA.

In transmit operation, when RF inputs are connected to a termination pin (TX), the switch provides low insertion loss of 0.5 dB at 3.6GHz and handles long-term evolution (LTE) average power (8 dB peak to average ratio (PAR)) of 50 dBm for full lifetime operation.

The device comes in an RoHS compliant, compact, 5 mm × 5 mm x 0.85 mm, 32-lead QFN. TSL8029N EVB-C is tuned for 3.3-4.2 GHz.

2. TSL8029N-EVB-C Board Details





Note: Series cap on ANT and TX ports should have 250 V voltage ratings to handle 100W power. The heatsink needs to be added at bottom of this board for proper power spreading.

Figure 2.1 TSL8029N-EVB-C 3300 MHz ~ 4200 MHz Schematic and EVB Layout

3. TSL8029N-EVB-C Bill of Material

Component ID	Value	Manufacturer	Recommended Part Number	Qty
C11, C12	0.3 pF	Murata	600S0R3BT250XT	2
C21	2 pF	Murata	GJM1555C1H2R0BB01D	1
C22, C23	0.4 pF	Murata	GJM1555C1HR40BB01J	2
L31, L71	1 nH	Coil craft	0402DC-1N0XJRW	2
C32, C74	6.8 pF	Murata	GJM1555C1H6R8BB01D	2
C41, C42, C91	10 pF	Murata	GJM1555C1H100JB01D	3
C52	0.5 pF	Murata	600S0R5BT250XT	1
L61	3.9 nH	Coil craft	0402DC-3N9XGRW	1
C72	100 pF	AVX	04025A101JAT4A	1
R73	15 Ω	Panasonic	ERJ-H2RD15R0X	1
R75	150 Ω	Panasonic	ERJ-2RHD1500X	1
C76	100 nF	TDK	C1005X7R1H104K050BE	1
C81	1 nF	Murata	04025C102JAT2A	1
Q1	GaAs LNA + GaN Switch	Tagore Tech	TSL8029N	1
PCB	Rogers RO4350B, 20 mils, 1 oz copper			1

Table 3.1 TSL8029N-EVB-C BOM

4. TSL8029N-EVB-C Biasing Sequence

Turn ON Device	Turn OFF Device
1. Apply bias to the VDD2_SWVDD and VDD1=5 V test points. 2. Apply bias to the V1 test point. 3. Apply bias to the BP test points. 4. Apply bias to the PD test point. 5. Apply an RF input signal.	1. Turn RF power off. 2. Turn off V1, BP and PD 3. Turn off VDD2_SWVDD and VDD1=5 V test points.

Table 4.1 TSL8029N-EVB-C Bias and Sequencing

5. TSL8029N-EVB-C Board Measurement Summary

Frequency (MHz)	Mode	S21 (dB)	S11 (dB)	S22 (dB)	EVB Noise Figure(dB)	OP1dBm	OIP3dBm
3300	RX Low Gain	13.8	-13.1	-6.9	1.5	12	22
3600		14.1	-15.9	-9.2	1.5	12.3	20
3900		13.4	-19.1	-8.8	1.5	11	22
4200		12.7	-24.8	-9	1.5	10.8	20
3300	RX High Gain	32.4	-10.6	-7.2	1.5	20	31
3600		32.3	-10.6	-9	1.5	20.8	32
3900		30.8	-12.4	-16	1.5	19	33
4200		29.5	-14.9	-25.9	1.6	19.2	37
3300	TX	-0.7	-17.1	-15.7			
3600		-0.7	-19.6	-18.1			
3900		-0.7	-24.4	-20.2			
4200		-0.7	-22.9	-17.5			

Table 5.1 TSL8029N-EVB-C Electrical Characteristics Summary

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6. TSL8029N-EVB-C Test Results

All the tests are carried out at room temperature.

6.1. S parameters

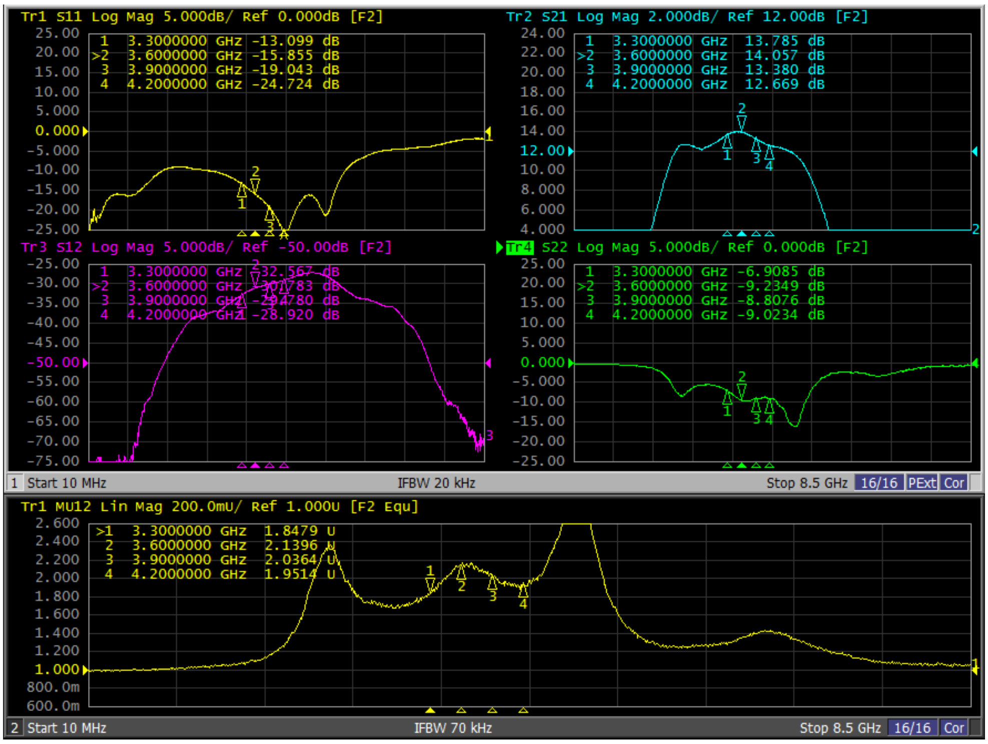

Figure 6.1.1. S parameters of TSL8029N-EVB-C RX-LG 5 V, 50 mA

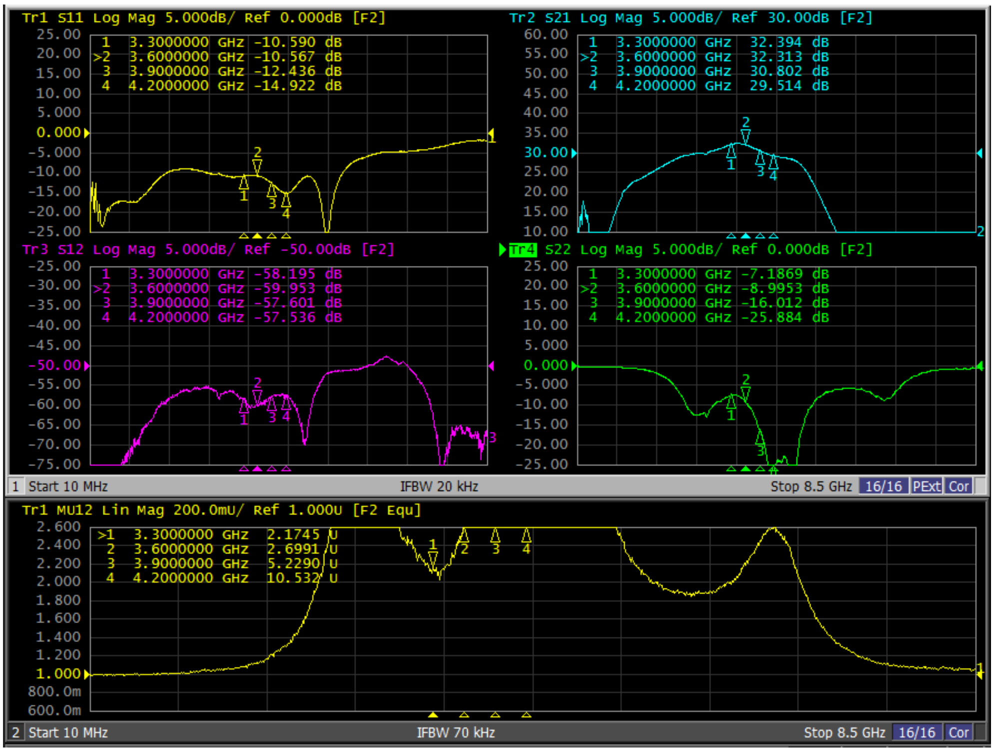

Figure 6.1.2. S parameters of TSL8029N-EVB-C RX-HG 5 V, 90 mA

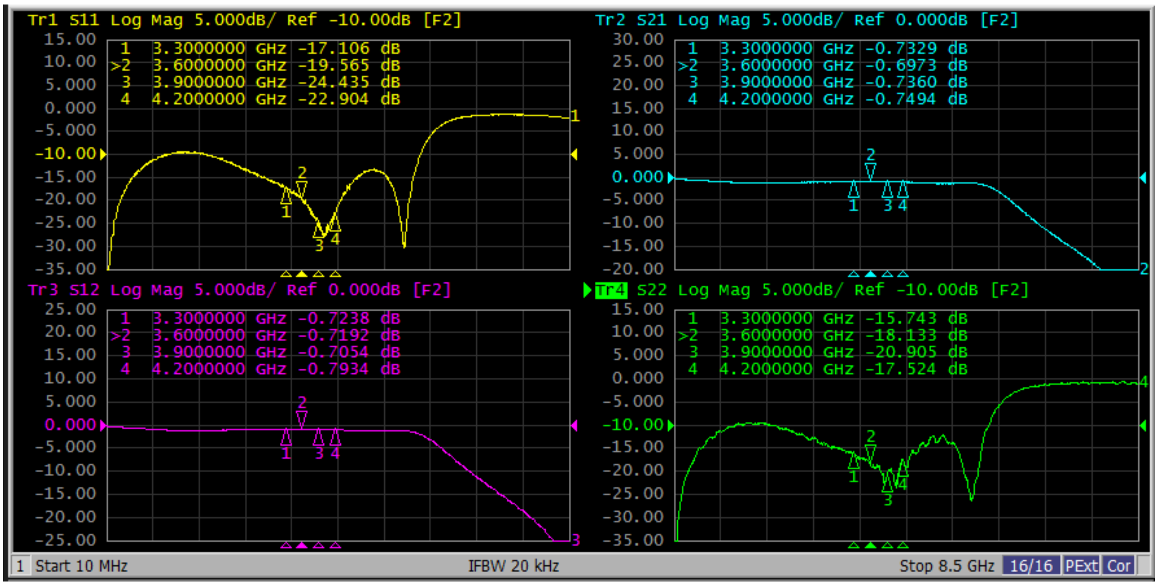

Figure 6.1.3. S parameters of TSL8029N-EVB-C TX

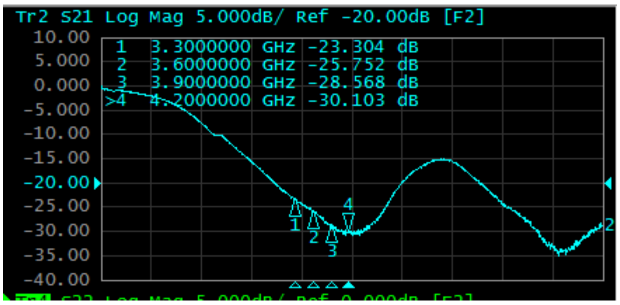

Figure 6.1.4. ANT to TX isolation of TSL8029N-EVB-C when RX-LG is on

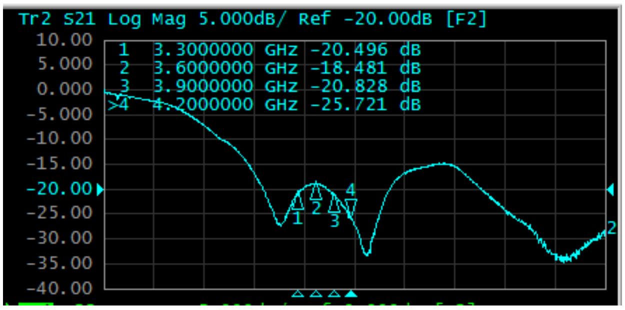

Figure 6.1.5. ANT to TX isolation of TSL8029N-EVB-C when RX-HG is on

****Note:** The trace loss is within the range of 0.2 dB, resulting in a de-embedded NF of 1.3 to 1.4 dB

6.2. SMA-SMA Noise Figure Test Results

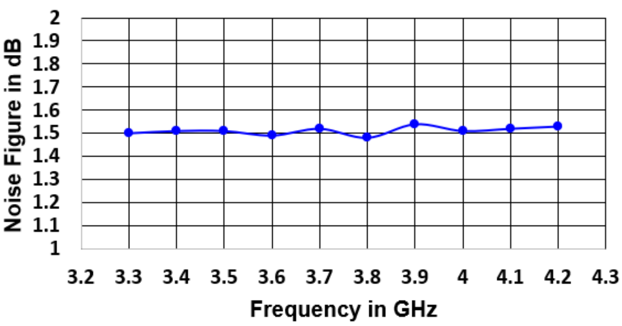

Figure 6.2.1. SMA-SMA Noise Figure of TSL8029N-EVB-D for 5 V, 50 mA for RX-LG mode

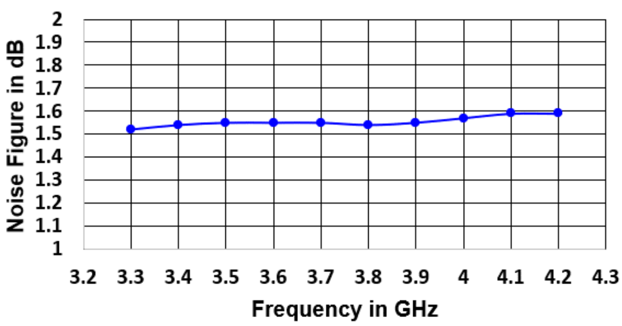

Figure 6.2.2. SMA-SMA Noise Figure of TSL8029N-EVB-D for 5 V, 90 mA for RX-HG mode

6.3. Large Signal Test Results

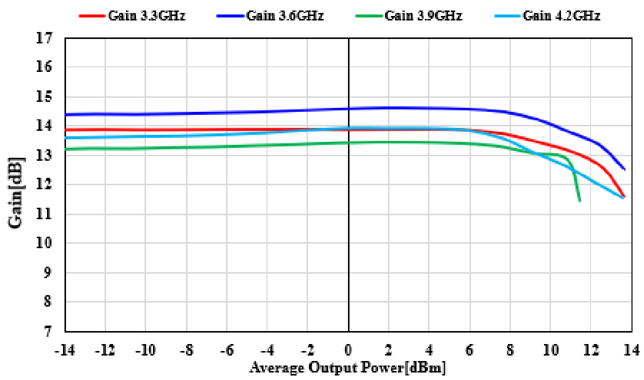

Figure 6.3.1. Gain vs P_{OUT} of TSL8029N-EVB-C for 5 V, 50 mA for RX-LG mode

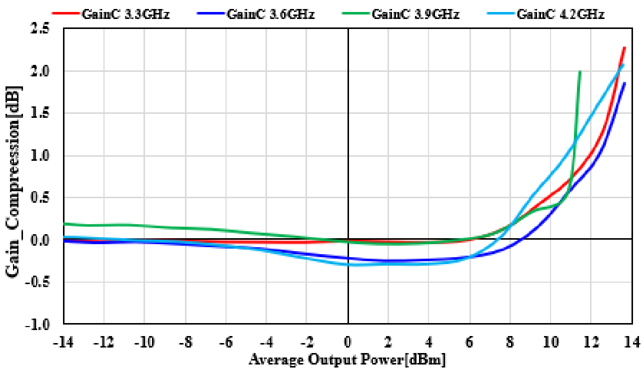

Figure 6.3.2 Gain compression vs P_{OUT} of TSL8029N-EVB-C for 5 V, 50 mA for RX-LG mode

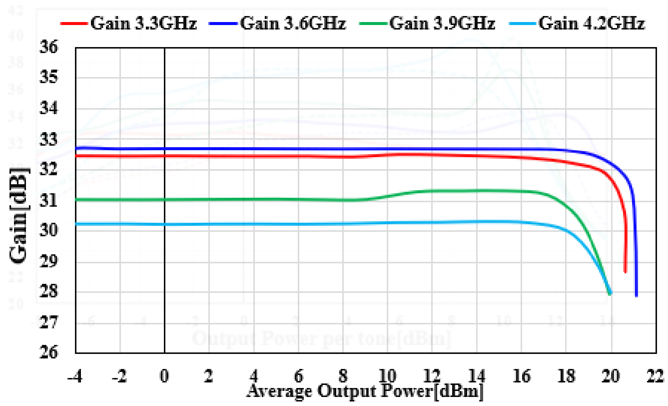

Figure 6.3.3. Gain vs P_{OUT} of TSL8029N-EVB-C for 5 V, 90 mA for RX-HG mode

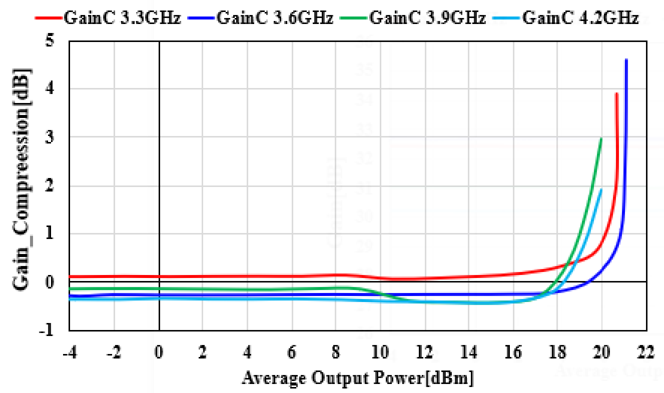

Figure 6.3.4 Gain compression vs P_{OUT} of TSL8029N-EVB-C for 5 V, 90 mA for RX-HG mode

6.4. OIP3 Test Results

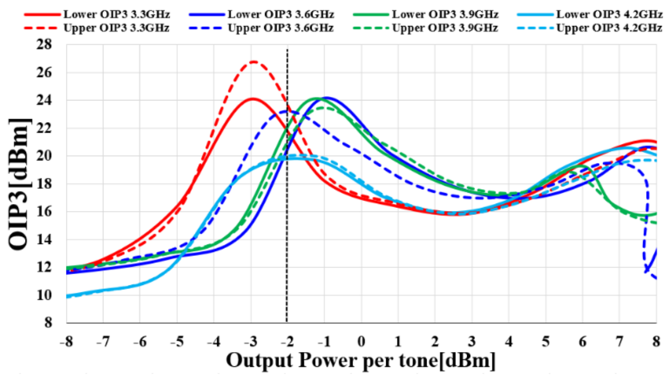

Figure 6.4.1 OIP3dBm vs P_{OUT} /tone of TSL8029N-EVB-C for 5 V, 50 mA for RX-LG mode

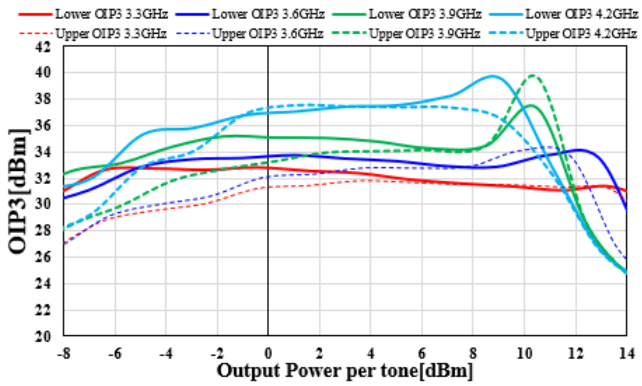

Figure 6.4.2 OIP3dBm vs P_{OUT} /tone of TSL8029N-EVB-C for 5 V, 90 mA for RX-HG mode

6.5. Temperature Test Data

Receive Operation, Low Gain Mode, 25ºC, -40ºC, 85ºC, 105ºC

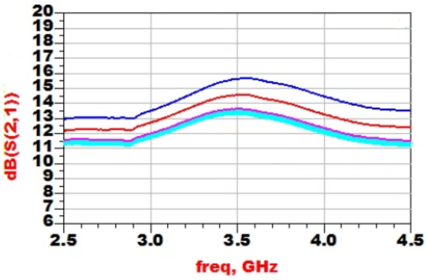

Figure 6.5.1 S21 vs Freq

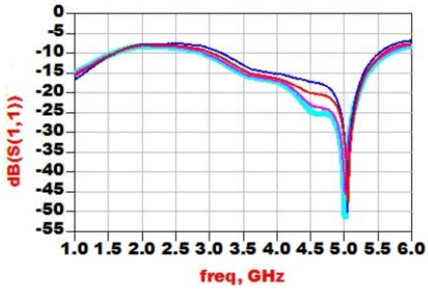

Figure 6.5.2 S11 vs Freq

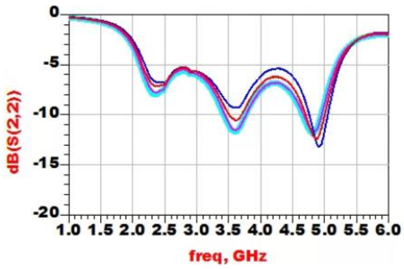

Figure 6.5.3 S22 vs Freq

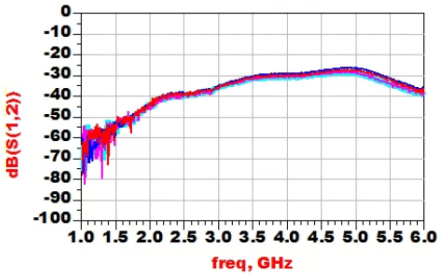

Figure 6.5.4 S12 vs Freq

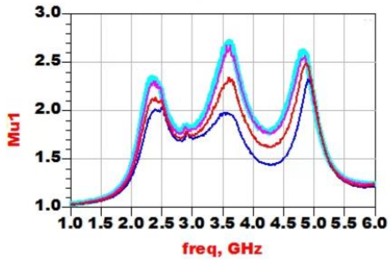

Figure 6.5.5 Stability vs Freq

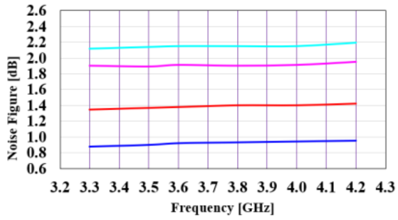

Figure 6.5.6 NF vs Freq SMA to SMA

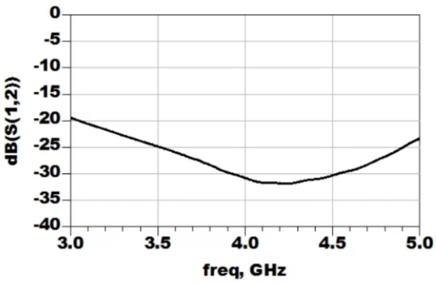

Figure 6.5.7 ANT-TX ISO vs Freq When BP=5 V and PD=0 V

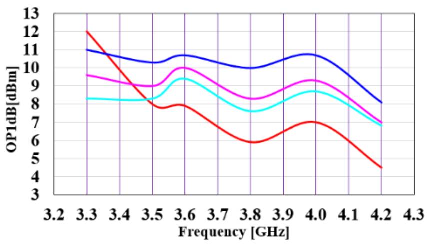

Figure 6.5.8 OP1 vs Freq

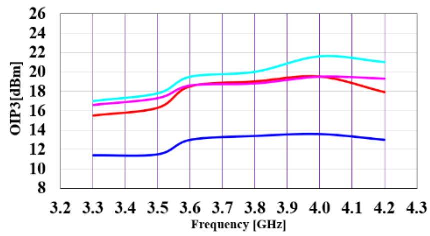

Figure 6.5.9 OIP3 vs Freq

Receive Operation, High Gain Mode, 25ºC, -40ºC, 85ºC, 105ºC

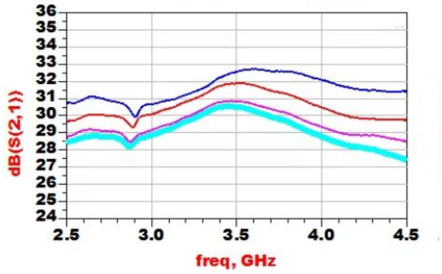

Figure 6.5.10 S21 vs Freq

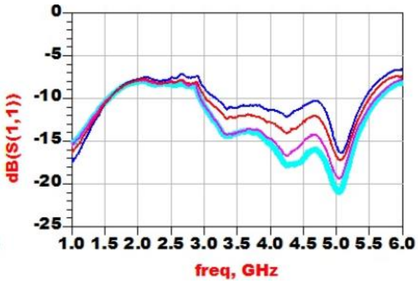

Figure 6.5.11S11 vs Freq

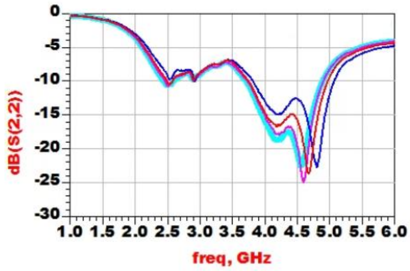

Figure 6.5.12 S22 vs Freq

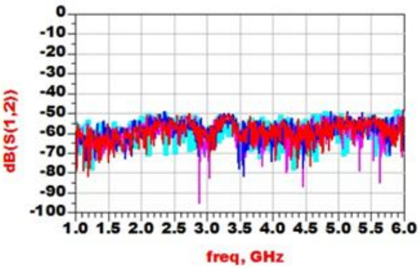

Figure 6.5.13 S12 vs Freq

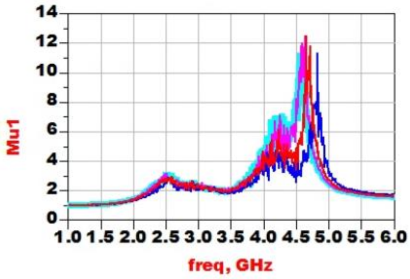

Figure 6.5.14 Stability vs Freq [10 MHz to 8.5 GHz]

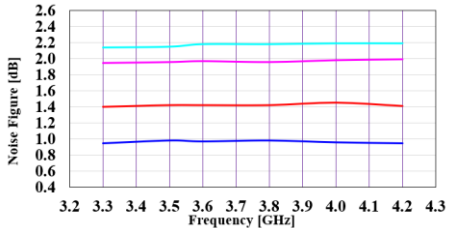

Figure 6.5.15 NF vs Freq SMA to SMA

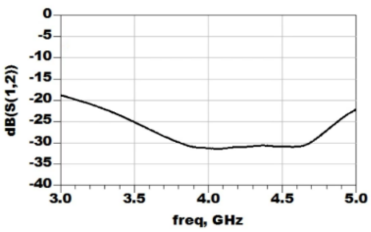

Figure 6.5.16ANT-TX ISO vs Freq When BP=0 V and PD=5 V

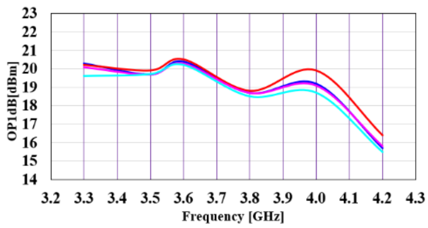

Figure 6.5.17 OP1 vs Freq

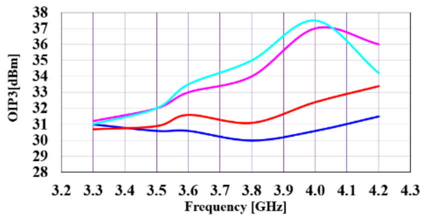

Figure 6.5.18 OIP3 vs Freq

Transmit Operation, 25°C, -40°C, 85°C, 105°C

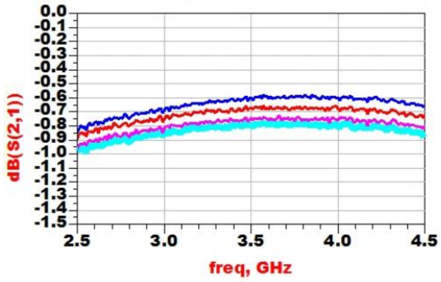

Figure 6.5.19 S21 vs Freq

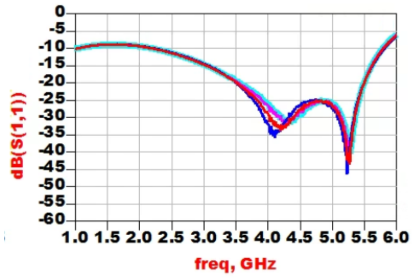

Figure 6.5.20 S11 vs Freq

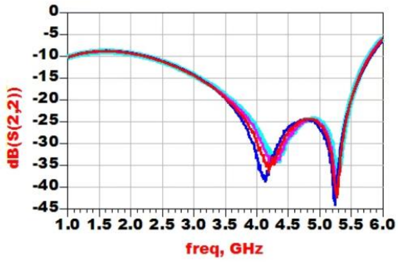

Figure 6.5.21 S22 vs Freq

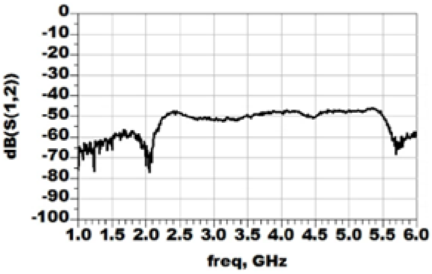

Figure 6.5.22 ANT-RX Isolation when PD=5 V and BP=0 V vs Freq

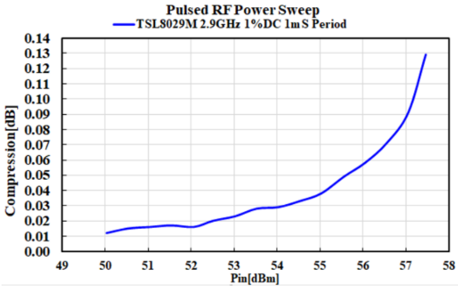

Figure 6.5.24 Compression Vs Peak Power [2.9 GHz 1% DC 1 mS Period]

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