BFR843EL3

BFR843EL3 SiGe:C Low Noise RF Transistor in broad Band LTE (700 - 3800 MHz) LNA Application

Application Note AN328

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RF and Protection Devices

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1 Introduction

The mobile technologies for smartphones have seen phenomenal growth in recent times. The data rate of mobile devices has increased significantly over the evolution modern mobile technologies starting from the first 3G/3.5G technologies (UMTS & WCDMA, HSPA & HSPA+) to the 4G LTE. The ability of 4G LTE to support bandwidths up to 20 MHz and to have more spectral efficiency by using better modulation methods like 64QAM, is of particular importance as the demand for higher wireless data speeds continues to grow fast. LTE Advanced can aggregate up to 15 carriers (up to 100 MHz) to increase user data rates and capacity for high speed applications.

A block diagram of a typical 2G and 3G/4G modem (GSM/EDGE/UMTS/LTE/TDS-CDMA/TDS-LTE) for smart phone RF front end is shown in **Figure 1** below. It consists of a broadband antenna, a band selecting antenna switch, 3G/4G duplexers, high/low band power amplifiers, 3G/4G LNAs and various surface acoustic wave filters. **Table 1** shows the band assignment of LTE bands worldwide.

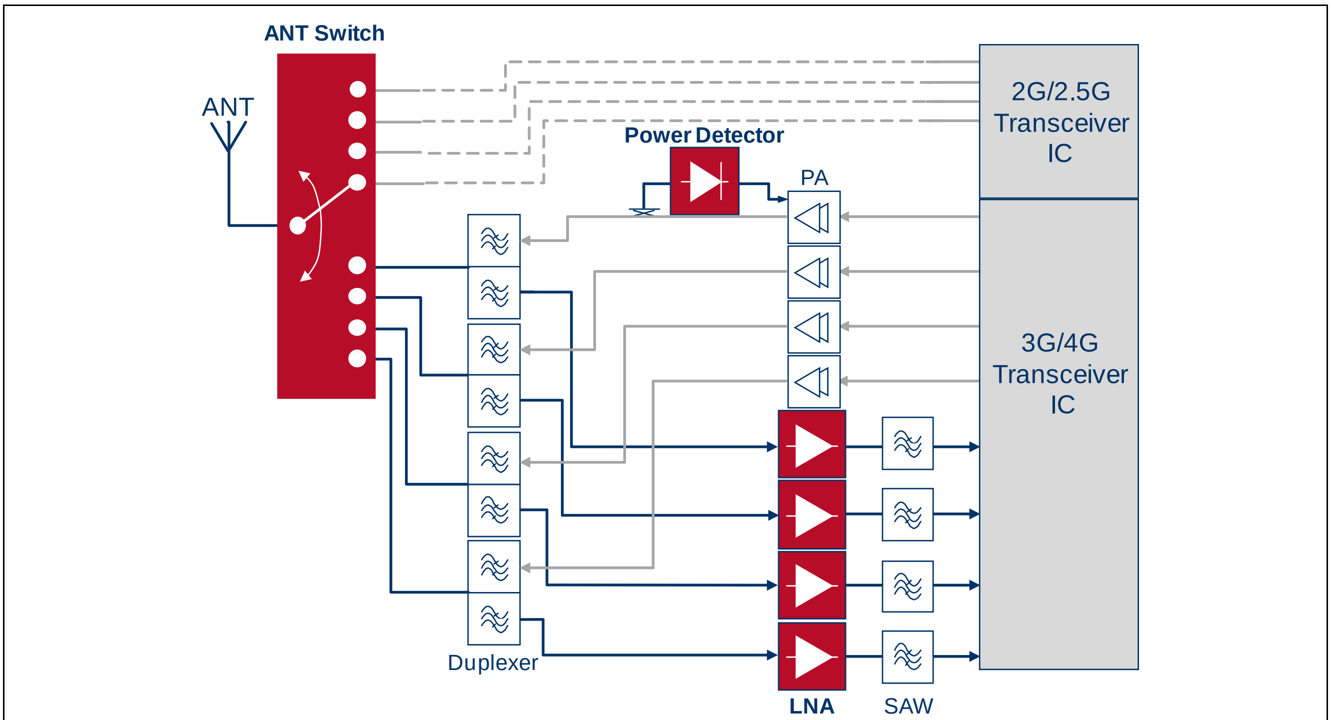

Figure 1 Example of Application Diagram of 2G/3G/4G Front-end System

In order to cover different countries with a unique device, mobile phones and 3G/4G data cards are usually equipped with more than one band. Some typical examples are the triple band combination of band 1, 2 and 5; 4, 13 and 17 or quad band combination of band 1, 2, 5 and 8.

Table 1 LTE Band Assignment

Band No.	Uplink Frequency (Tx)	Downlink Frequency (Rx)	Diplex Mode
1	1920 - 1980 MHz	2110 - 2170 MHz	FDD
2	1850 - 1910 MHz	1930 - 1990 MHz	FDD
3	1710 - 1785 MHz	1805 - 1880 MHz	FDD
4	1710 - 1755 MHz	2110 - 2155 MHz	FDD
5	824 - 849 MHz	869 - 894 MHz	FDD
6	830 - 840 MHz	875 - 885 MHz	FDD
7	2500 - 2570 MHz	2620 - 2690 MHz	FDD
8	880 - 915 MHz	925 - 960 MHz	FDD
9	1749.9 - 1784.9 MHz	1844.9 - 1879.9 MHz	FDD
10	1710 - 1770 MHz	2110 - 2170 MHz	FDD
11	1427.9 - 1452.9 MHz	1475.9 - 1500.9 MHz	FDD
12	698 - 716 MHz	728 - 746 MHz	FDD
13	777 - 787 MHz	746 - 756 MHz	FDD
14	788 - 798 MHz	758 - 768 MHz	FDD
17	704 - 716 MHz	734 - 746 MHz	FDD
18	815 - 830 MHz	860 - 875 MHz	FDD
19	830 - 845 MHz	875 - 890 MHz	FDD
20	832 - 862 MHz	791 - 821 MHz	FDD
21	1447.9 - 1462.9 MHz	1495.9 - 1510.9 MHz	FDD
22	3410 - 3500 MHz	3510 - 3600 MHz	FDD
23	2000-2020 MHz	2180-2200 MHz	FDD
24	1626.5 - 1660.5 MHz	1525 - 1559 MHz	FDD
25	1850-1915 MHz	1930-1995 MHz	FDD
26	814-849 MHz	859-894 MHz	FDD
27	807-824 MHz	852-869 MHz	FDD
28	703-748 MHz	758-803 MHz	FDD
33	1900 -1920 MHz		TDD
34	2010 - 2025 MHz		TDD
35	1850 - 1910 MHz		TDD
36	1930 - 1990 MHz		TDD
37	1910 - 1930 MHz		TDD
38	2570 - 2620 MHz		TDD
39	1880 - 1920 MHz		TDD
40	2300 - 2400 MHz		TDD
41	2496 - 2690 MHz		TDD
42	3400 - 3600 MHz		TDD
43	3600 - 3800 MHz		TDD
44	703-803 MHz		

1.1 Multiband / Broad-Band LNAs for 3G/3.5G/4G Modems

Motivated by increasing demand for mobile broadband services with higher data rates and better quality of service, the modern mobile technology has seen tremendous growth in the recent years from 2G to 3G/3.5G HSPA, HSPA+ 3.9G LTE and now recently 4G LTE advanced. LTE-advanced can support data rates of up to 1 Gbps. Such higher requirements are met by using advanced MIMO techniques and wider bandwidths of up to 100MHz enabled by carrier aggregation. LTE-Advanced can support up to 15 bands of carrier aggregation by three component carrier aggregation scenarios: intra-band contiguous, intra-band non-contiguous and inter-band non-contiguous aggregation. This in turn presents new challenges to RF front end designers such as interference from co-existing bands and harmonic generations. In order to address these requirements we need smart LNAs with the following features to achieve outstanding performance.

Low Noise Figure: An external LNA boosts the sensitivity of the system by reducing the overall noise figure. In addition due to the size constraint the modem antenna and the receiver front end cannot always be put close to the transceiver IC. The path loss in front of the integrated LNA on the transceiver IC increases the system noise figure significantly. An external LNA physically close to the antenna can help to eliminate the path loss and reduce the system noise figure. Therefore the sensitivity can be improved by several dB which means increase in the connectivity range significantly.

Recent trend of end users to download more and more data anytime and anywhere increases the need of more bandwidth and an additional receive channel called “diversity path” in smart phones. In most mobiles phones now, there is more than one antenna to employ diversity. Diversity exploits the radiowave phenomenon of multipath propagation to enhance the reception of cellular signals. The diversity antenna is usually located far from the main antenna and the transceiver IC. The received signal therefore undergoes losses along the path from the diversity switch to the transceiver IC. We need to use an LNA closer to the diversity antenna to overcome this and enhance the sensitivity of the system. The LNAs improve the receiver performance significantly by reducing the noise contribution of long route line between diversity antenna and transceiver, losses incurred due to the band pass filter and noise figure of the transceiver.

High Linearity: The presence of increased number of bands at the receiver input creates strong interference leading to high requirements in linearity characteristics such as high input compression point, IMD2 & IIP3 performance.

Low Power Consumption: Power consumption becomes even more important in today's smart phones. The latest LTE advanced uses enhanced MIMO techniques with upto 8 streams for downlink and 4 streams for uplink. Infineon's LNAs have low supply current and an integrated on / off feature which provides for low power consumption and increased standby time for 3G cellular handsets or other portable, battery-operated wireless applications.

High Integration and Simple Control Interface: The demand for size and cost reduction and performance enhancement with easy to use and low parts count has become very important in existing and future generation smartphones. Our MMIC LNAs are highly integrated with Input and output either matched or pre-matched, in-built temperature and supply voltage stabilization and fully ESD protected circuit design to ensure stable operation and a simple control interface.

This application note is focusing on the low cost discrete broad-band LNA solution using Infineons' new generation RF Transistor BFR843EL3 which has internal RC feedback to cover broad frequency range. **Figure 2** shows the modified RF Front-end block diagram using this broad-band LNA solution. Compare to **Figure 1** now, for example, four multi-band LNAs can be replaced by only one broad-band LNA. This can reduce cost, PCB area and system complexity.

Infineon does also support with RF MMIC LNAs, RF-switches, TVS-diodes for ESD protection and RF Schottky diodes for power detection for 3G/4G LTE applications.

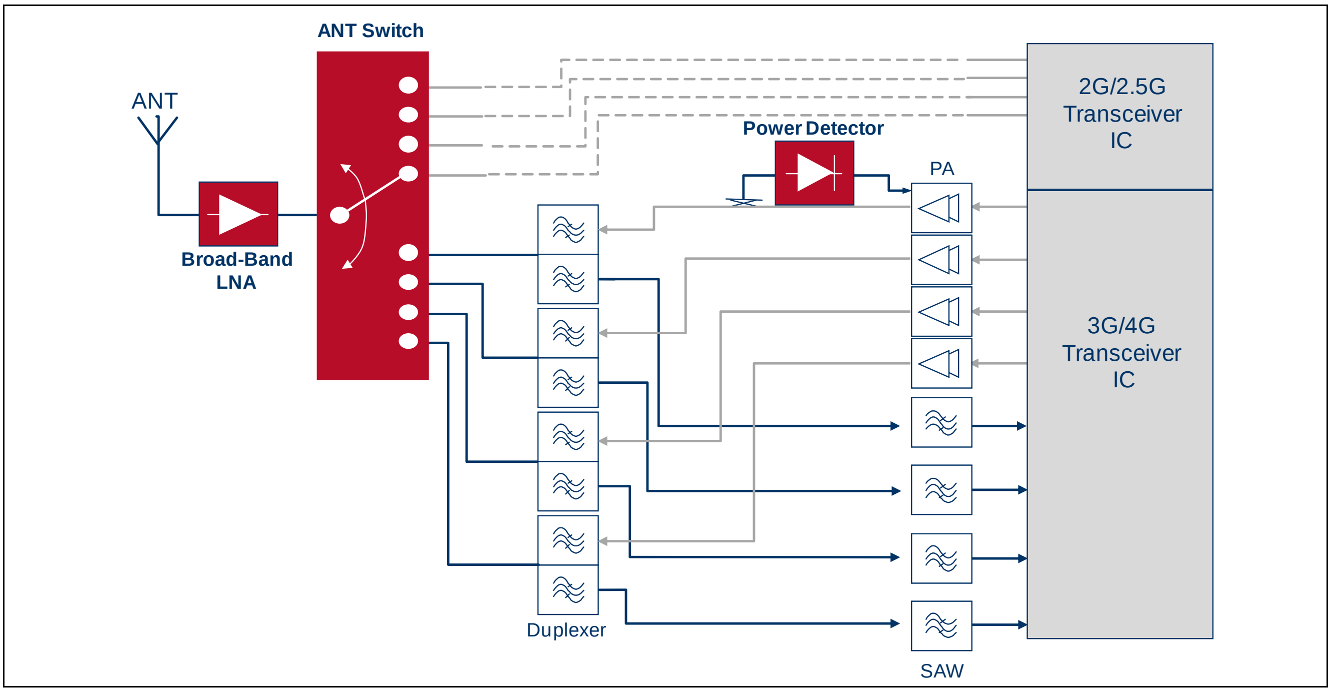

Figure 2 Example of Application Diagram of 2G/3G/4G Front-end System using BFR843EL3 Broad-Band LNA

2 BFR843EL3 Overview

2.1 Features

- Low noise broadband NPN RF transistor based on Infineon´s reliable, high volume SiGe:C bipolar technology
- High maximum RF input power and ESD robustness
- Unique combination of high RF performance, robustness and ease of use
- Low noise figure: NF_{min} = 0.95 dB at 700 MHz and 1.1 dB at 3.8 GHz, 1.8 V, 8 mA
- High gain $|S21|^2$ = dB at 600 MHz and 16.5 dB at 3.8 GHz, 1.8 V, 15 mA
- *OIP*3 = 22 dBm at 600 MHz and dBm at 3.8 GHz, 1.8 V, 15 mA
- Ideal for low voltage applications e.g. V_{CC} = 1.2 V and 1.8 V (2.85 V, 3.3 V, 3.6 V requires corresponding collector resistor)
- Low power consumption, ideal for mobile applications
- Thin small flat Pb-free (RoHS compliant) and halogen-free package
- Qualification report according to AEC-Q101 available

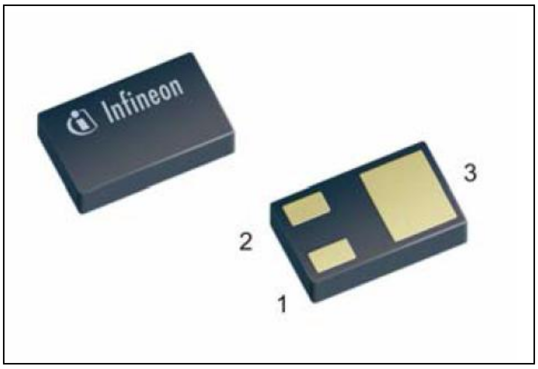

Figure 3 BFR843EL3 in TSLP-3-9

2.2 Key Applications of BFR843EL3

As Low Noise Amplifier (LNA) in:

- Wireless Communications: 2.4 GHz Wireless LAN IEEE802.11b/g/n, 5 - 6 GHz Wireless LAN IEEE802.11a/n/ac, WiMAX, 3G, 3.5G, 4G LTE-Advanced
- Satellite navigation systems (e.g. GPS, GLONASS, COMPASS...) and satellite C-band LNB (1st and 2nd stage LNA)
- Broadband amplifiers: Dualband WLAN, multiband mobile phone, UWB up to 10 GHz
- ISM bands up to 10 GHz

3 BFR843EL3 as Broad Band LNA for 700 MHz – 3.8 GHz LTE Applications

3.1 Description

BFR843EL3 is a discrete SiGe:C hetero-junction bipolar transistor (HBT) designed for high performance broad band Low Noise Amplifier (LNA) solutions for LTE and Wi-Fi connectivity applications. This has been developed using Infineon's latest B9HFM technology. The key features of this technology are very high transition frequency (f_T = 80 GHz) and low parasitics, which enable to achieve higher gain and lower noise figure compared to the previous generation RF transistor BFR740L3RH. BFR843EL3 features an integrated on-chip R-C feedback network. The negative feedback reduces the effects of performance variations of the amplifier. The design is therefore less sensitive to variations in PCB layout resulting in an amplifier with broader bandwidth, easier impedance matching and improved stability margin. However the price paid for using negative feedback is slight degradation of noise figure and decrease in gain.

The BFR843EL3 is housed in low-height 0.31mm TSLP-3-9 package specially fitting into modules. It is also available in other packages, e.g. BFP843 in SOT343 and BFP843F in TSFP-4-1 package.

The BFR843EL3 has an integrated 1.5 kV HBM ESD protection which makes the device robust against electrostatic discharge and extreme RF input power. The device offers its high performance at low current and voltage and is especially well-suited for portable battery powered applications in which energy efficiency is a key requirement.

Figure 4 shows the pin assignment of package of BFR843EL3 in the top view:

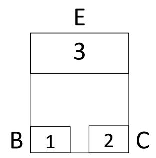

Figure 4 Package and pin connections of BFR843EL3 in Topview

This application note presents the measurement results of the broad-band LTE LNA covering 700 MHz to 3800 MHz using BFR843EL3. The application circuit requires 9 passive 0201 Surface Mounted Device (SMD) components. It operates with 2.8 Volt and consumes 8 mA biasing current. At 700 MHz band it provides 20.5 dB power gain and at Band 43 (3600 - 3800 MHz) the power gain is 14 dB. The NF varies from 0.92 dB to 1.22 dB (SMA and PCB losses are subtracted) over the complete frequency range. The circuit achieves an input and output return loss better than 11 dB from 700 MHz to 3800 MHz. Furthermore, the circuit is unconditionally stable up to 10 GHz.

At 700 MHz, -19.5 dBm input compression point (IP1dB) is achieved, together with the 15 dBm output third intercept point (OIP3) measured with 1MHz tone spacing. At 3800 MHz, -13.7 dBm input compression point (IP1dB) is achieved, together with the 14.3 dBm output third intercept point (OIP3) measured with 1MHz tone spacing. However, higher P1dB can be achieved at the cost of higher biasing voltage and current. For example, OP1dB is 4 to 5 dBm higher with 3 volt and 13 mA biasing condition.

3.2 Performance Overview

Device: BFR843EL3

Application: Broad-Band LNA for 700 - 3800 MHz LTE Applications

PCB Marking: BFR843EL3 **M130129**

(designed for 0201 SMD)

Table 2 Summary of Measurement Results of Band 5, 6, 12, 13, 14, 17, 18, 19, 20, 26, 27, 28, 44 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	703 – 894	MHz	
Gain	G	20.5	dB	
Noise Figure	NF	1.09	dB	SMA and PCB losses of 0.03 dB are subtracted
Input Return Loss	RL_{in}	12.6	dB	
Output Return Loss	RL_{out}	14.1	dB	
Reverse Isolation	IRev	25.5	dB	
Input P1dB	IP1dB	-19.5	dBm	
Output P1dB	OP1dB	0	dBm	
Input IP3	IIP3	-5.4	dBm	
Output IP3	OIP3	15.1	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 806 MHz.

Table 3 Summary of Measurement Results of Band 11, 21, 24 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	1475.9 - 1559	MHz	
Gain	G	19.2	dB	
Noise Figure	NF	0.92	dB	SMA and PCB losses of 0.06 dB are subtracted
Input Return Loss	RL_{in}	14.3	dB	
Output Return Loss	RL_{out}	11.2	dB	
Reverse Isolation	IRev	25.5	dB	
Input P1dB	IP1dB	-16.9	dBm	
Output P1dB	OP1dB	1.3	dBm	
Input IP3	IIP3	-3.0	dBm	
Output IP3	OIP3	16.2	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 1503 MHz.

Table 4 Summary of Measurement Results of Band 2, 3, 9, 25, 33, 35, 36, 37, 39 (at room temperature)

Parameter	**Symbol**	**Value**	**Unit**	**Note/Test Condition**
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	1805 - 1995	MHz	
Gain	G	18.1	dB	
Noise Figure	NF	0.95	dB	SMA and PCB losses of 0.06 dB are subtracted
Input Return Loss	RL_{in}	13.3	dB	
Output Return Loss	RL_{out}	10.9	dB	
Reverse Isolation	IRev	25.8	dB	
Input P1dB	IP1dB	-16.4	dBm	
Output P1dB	OP1dB	0.7	dBm	
Input IP3	IIP3	-2.7	dBm	
Output IP3	OIP3	15.4	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 1900 MHz.

Table 5 Summary of Measurement Results of Band 1, 4, 10 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	2110 - 2170	MHz	
Gain	G	17.5	dB	
Noise Figure	NF	0.98	dB	SMA and PCB losses of 0.07 dB are subtracted
Input Return Loss	RL_{in}	12.9	dB	
Output Return Loss	RL_{out}	10.9	dB	
Reverse Isolation	IRev	26.0	dB	
Input P1dB	IP1dB	-16.4	dBm	
Output P1dB	OP1dB	0.1	dBm	
Input IP3	IIP3	-2.5	dBm	
Output IP3	OIP3	15.0	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 2140 MHz.

Table 6 Summary of Measurement Results of Band 23 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	2180 - 2200	MHz	
Gain	G	17.3	dB	
Noise Figure	NF	1.0	dB	SMA and PCB losses of 0.07 dB are subtracted
Input Return Loss	RL_{in}	12.6	dB	
Output Return Loss	RL_{out}	10.8	dB	
Reverse Isolation	IRev	26.1	dB	
Input P1dB	IP1dB	-15.9	dBm	
Output P1dB	OP1dB	0.4	dBm	
Input IP3	IIP3	-2.3	dBm	
Output IP3	OIP3	15.0	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 2190 MHz.

Table 7 Summary of Measurement Results of Band 40 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	2300 - 2400	MHz	
Gain	G	16.9	dB	
Noise Figure	NF	1.0	dB	SMA and PCB losses of 0.07 dB are subtracted
Input Return Loss	RL_{in}	12.4	dB	
Output Return Loss	RL_{out}	10.9	dB	
Reverse Isolation	IRev	26.2	dB	
Input P1dB	IP1dB	-15.8	dBm	
Output P1dB	OP1dB	0.1	dBm	
Input IP3	IIP3	-1.4	dBm	
Output IP3	OIP3	15.5	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 2350 MHz.

Table 8 Summary of Measurement Results of Band 7, 38, 41 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	2469 - 2690	MHz	
Gain	G	16.3	dB	
Noise Figure	NF	1.01	dB	SMA and PCB losses of 0.09 dB are subtracted
Input Return Loss	RL_{in}	12.3	dB	
Output Return Loss	RL_{out}	11.2	dB	
Reverse Isolation	IRev	26.3	dB	
Input P1dB	IP1dB	-15.5	dBm	
Output P1dB	OP1dB	-0.2	dBm	
Input IP3	IIP3	-1.4	dBm	
Output IP3	OIP3	14.9	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 2620 MHz.

Table 9 Summary of Measurement Results of Band 42 (at room temperature)

Parameter	Symbol	Value	Unit	Note/Test Condition
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	3400 - 3600	MHz	
Gain	G	14.4	dB	
Noise Figure	NF	1.13	dB	SMA and PCB losses of 0.12 dB are subtracted
Input Return Loss	RL_{in}	12.0	dB	
Output Return Loss	RL_{out}	12.2	dB	
Reverse Isolation	IRev	26.6	dB	
Input P1dB	IP1dB	-14.1	dBm	
Output P1dB	OP1dB	-0.7	dBm	
Input IP3	IIP3	0.2	dBm	
Output IP3	OIP3	14.6	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 3500 MHz.

Table 10 Summary of Measurement Results of Band 43 (at room temperature)

Parameter	**Symbol**	**Value**	**Unit**	**Note/Test Condition**
DC Voltage	V_{CC}	2.8	V	
DC Current	I_{CC}	8	mA	
Frequency Range	Freq	3600 - 3800	MHz	
Gain	G	14.0	dB	
Noise Figure	NF	1.09	dB	SMA and PCB losses of 0.12 dB are subtracted
Input Return Loss	RL_{in}	12.0	dB	
Output Return Loss	RL_{out}	12.7	dB	
Reverse Isolation	IRev	26.6	dB	
Input P1dB	IP1dB	-13.7	dBm	
Output P1dB	OP1dB	-0.7	dBm	
Input IP3	IIP3	0.3	dBm	
Output IP3	OIP3	14.3	dBm	Power @ Input: -30 dBm
Stability	k	> 1	--	Stability measured from 10MHz to 10GHz

*This measurement is done at 3700 MHz.

3.3 Schematics and Bill-of-Materials

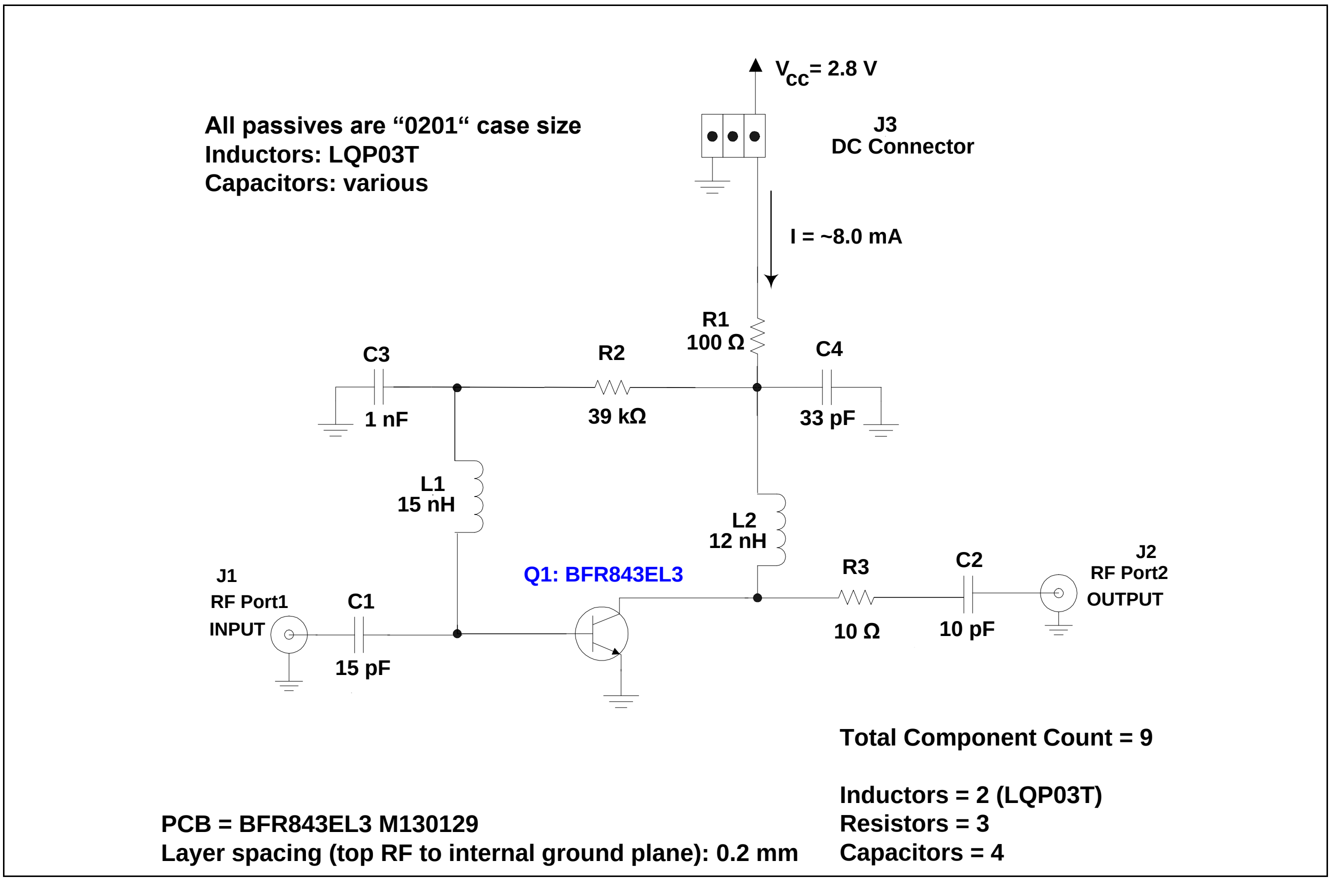

Figure 5 Schematic Diagram of the Application Circuit

Table 11 Bill-of-Materials

Symbol	Value	Unit	Size	Manufacturer	Comment
C1	15	pF	0201	Various	Input DC block & input matching
C2	10	pF	0201	Various	Output DC block & output matching
C3	1	nF	0201	Various	RF decoupling / blocking cap
C4	33	pF	0201	Various	RF decoupling & output matching
L1	15	nH	0201	LQP03T	Input matching & Base biasing
L2	12	nH	0201	LQP03T	Output matching & Collector biasing
R1	100	Ω	0201	Various	DC biasing (provides DC negative feedback to stabilize DC operating point over temperature variation, transistor h_{FE} variation, etc.)
R2	39	kΩ	0201	Various	DC biasing
R3	10	Ω	0201	Various	Output matching
Q1			TSLP-3-9	Infineon Technologies	BFR843EL3 SiGe:C Heterojunction Bipolar RF Transistor

4 Measurement Graphs

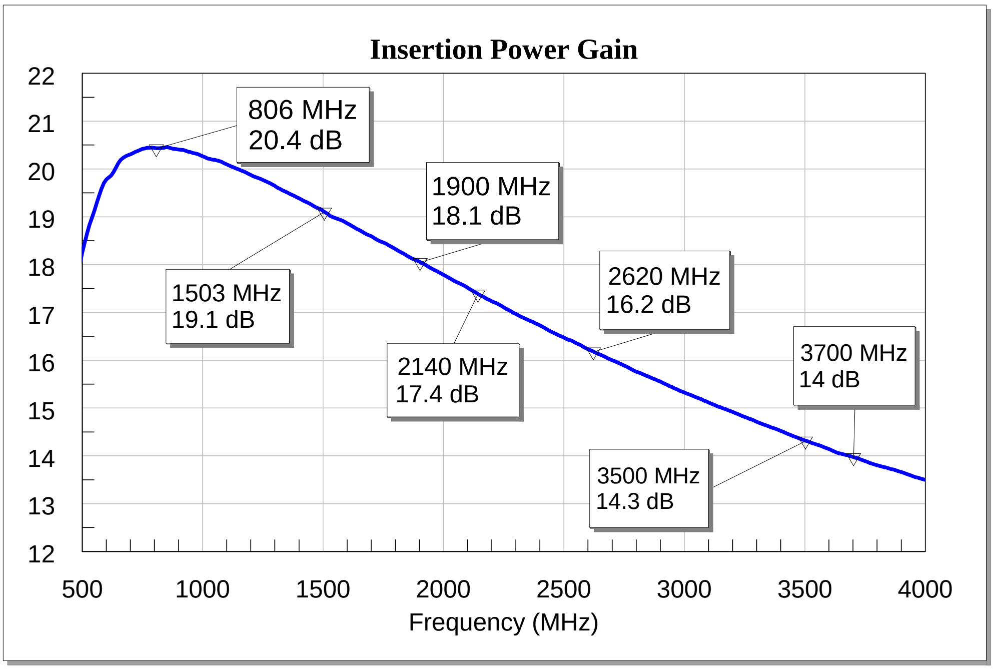

Figure 6 Power Gain of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

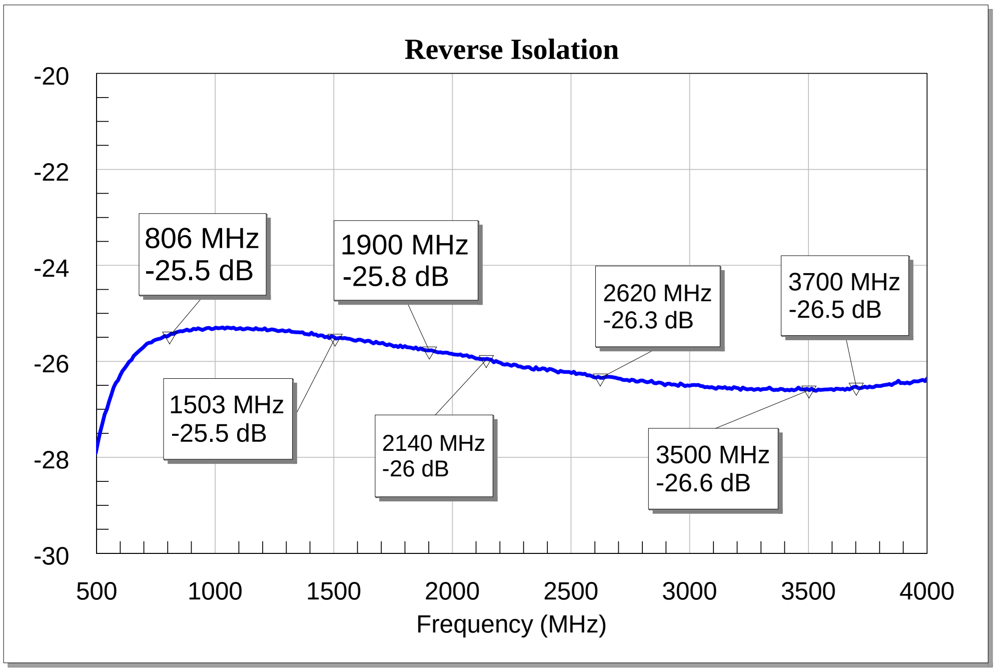

Figure 7 Reverse Isolation of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

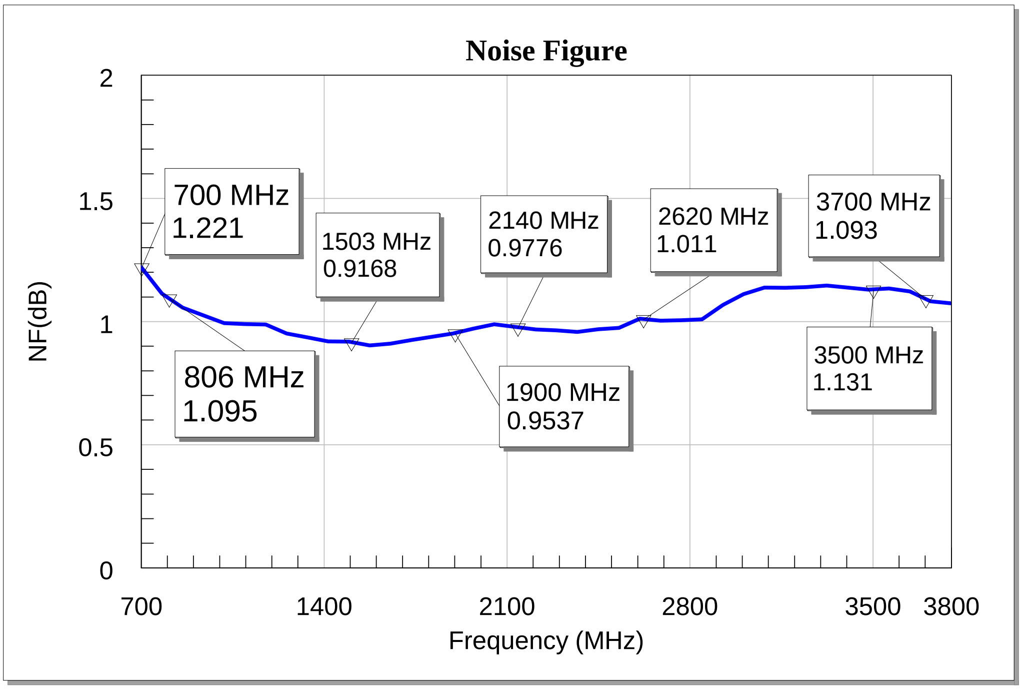

Figure 8 Noise Figure of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

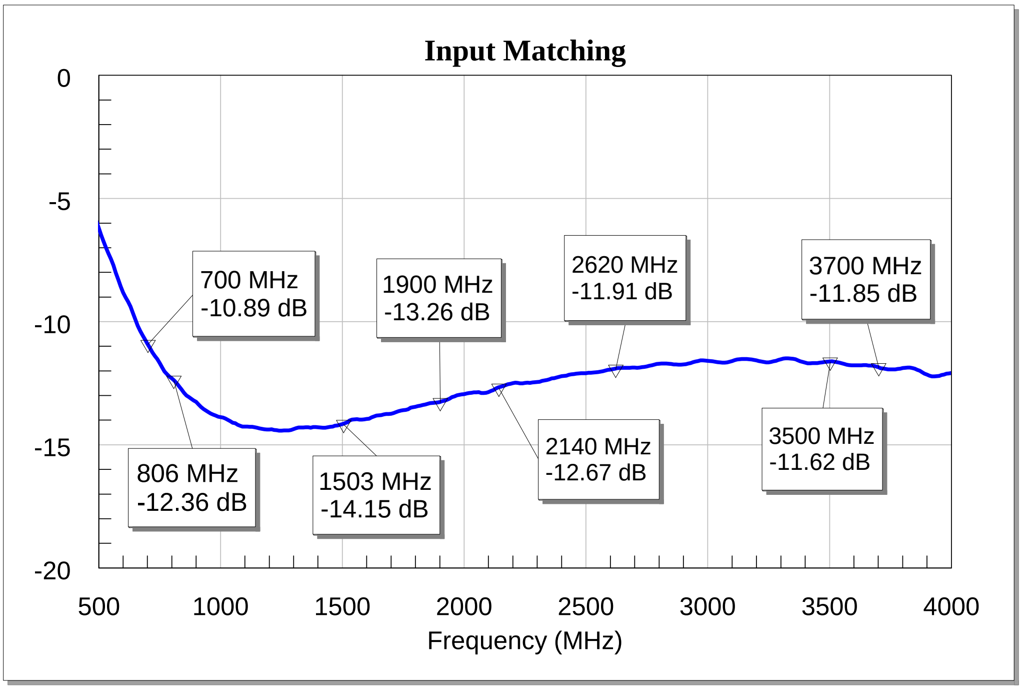

Figure 9 Input Matching of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

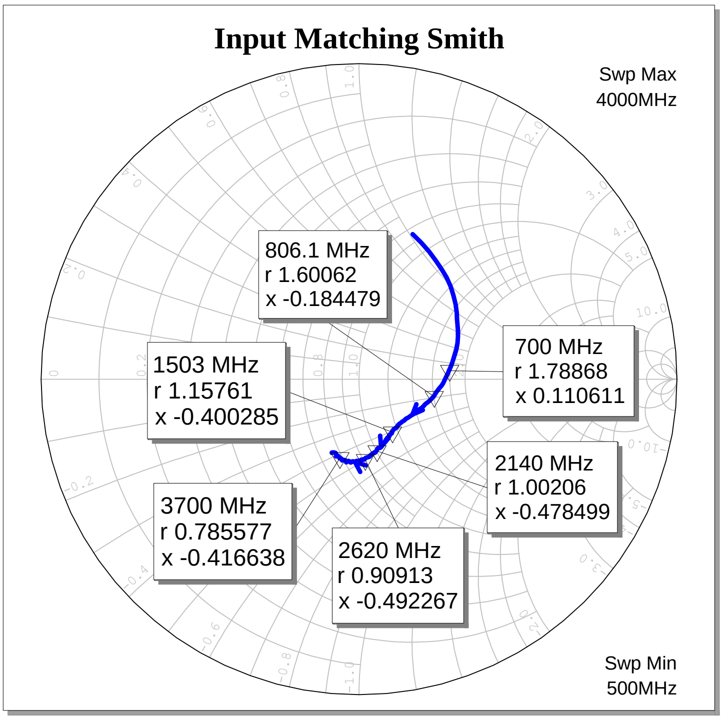

Figure 10 Input Matching of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3 (Smith Chart)

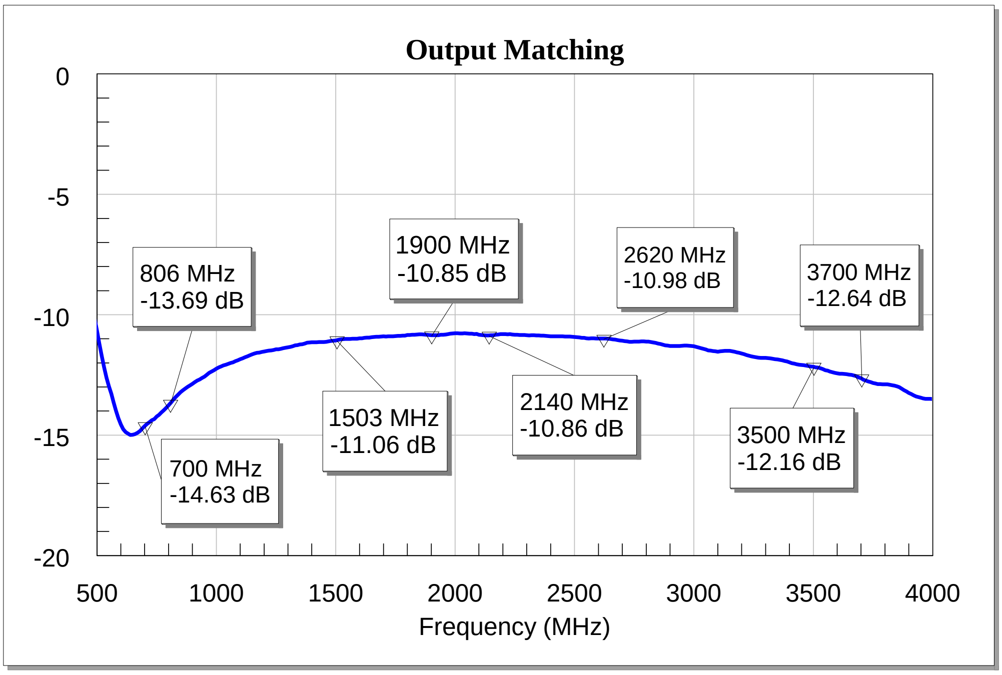

Figure 11 Output Matching of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

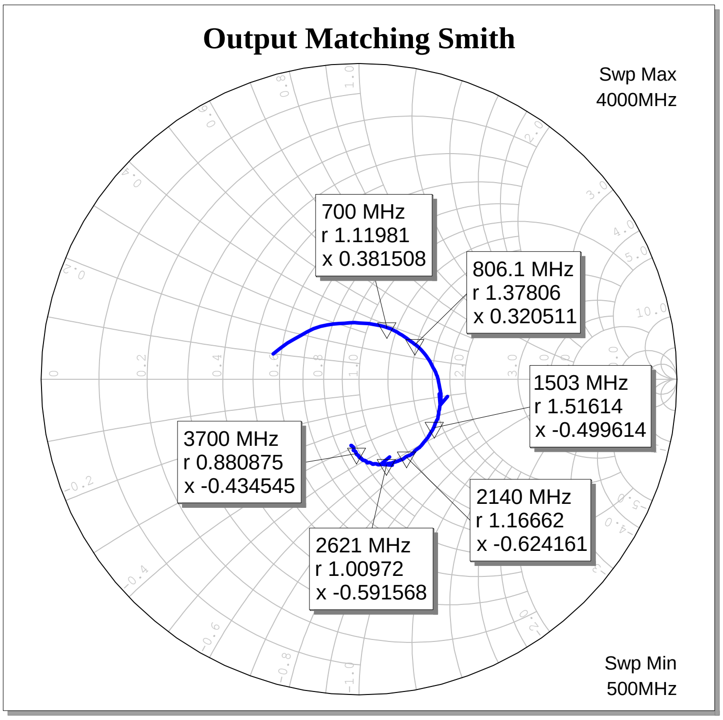

Figure 12 Output Matching of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3 (Smith Chart)

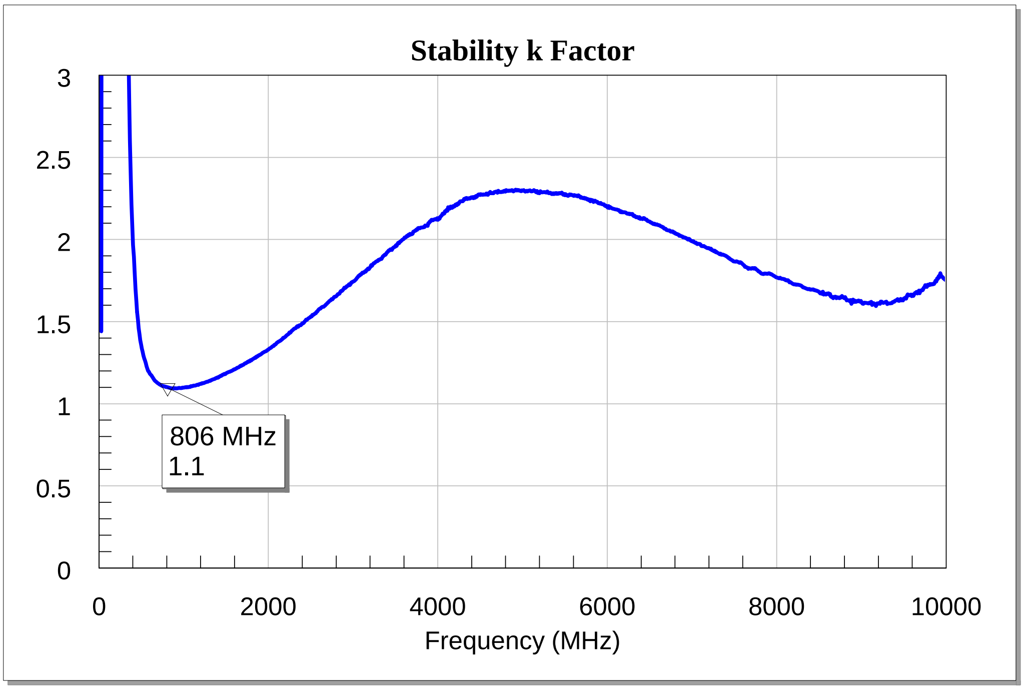

Figure 13 Stability K Factor of the Broad-Band LTE LNA with BFR843EL3

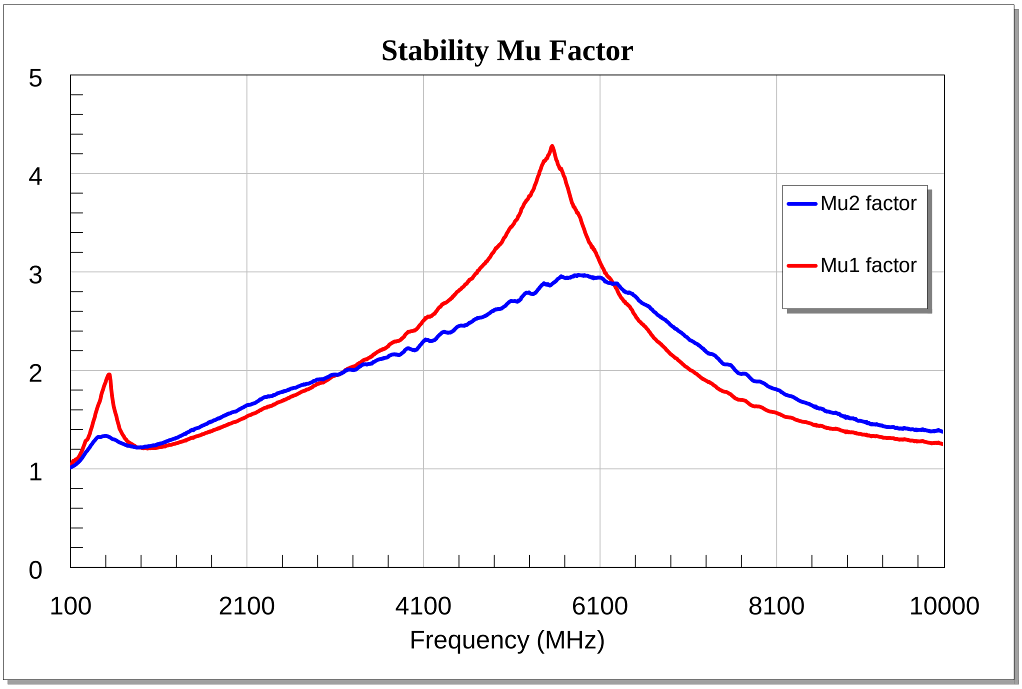

Figure 14 Stability Mu Factor of the Broad-Band LTE LNA with BFR843EL3

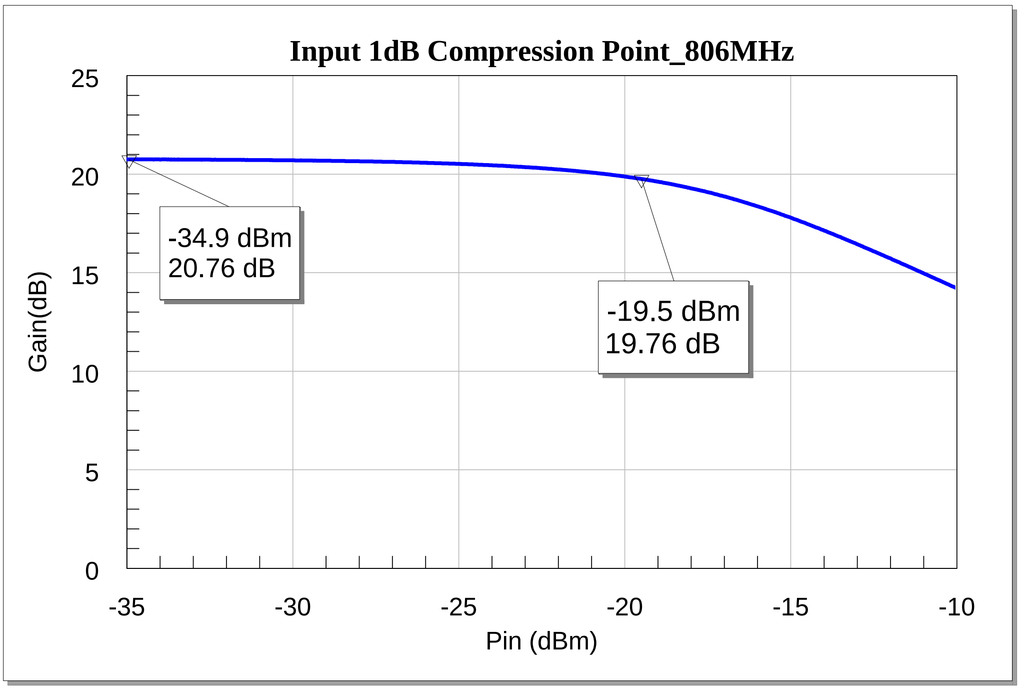

Figure 15 Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 806 MHz)

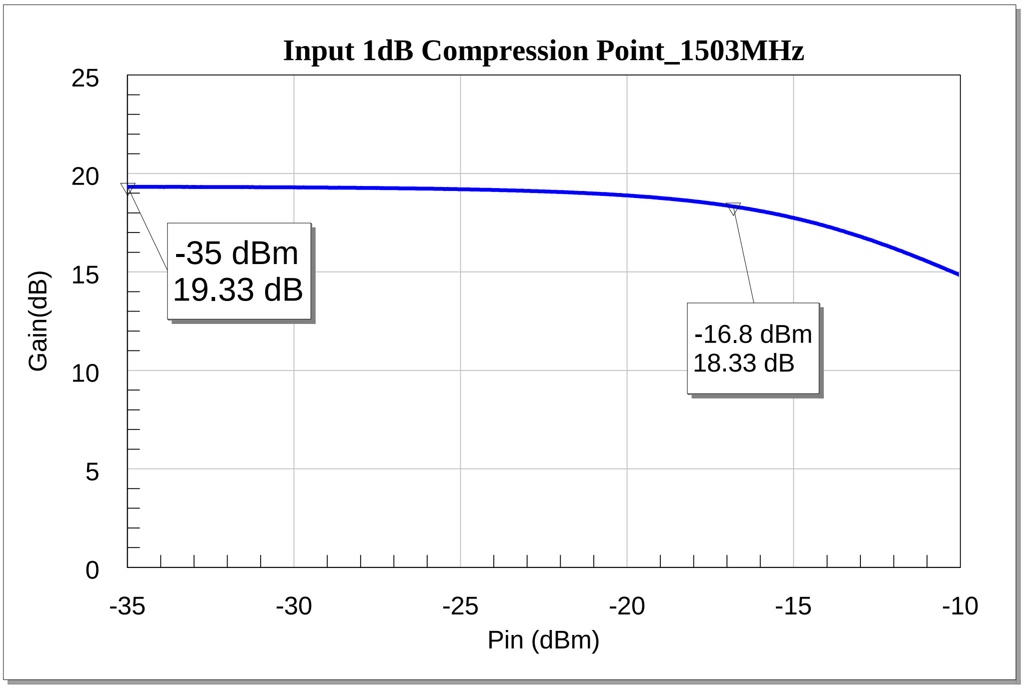

Figure 16 Input 1dB Compression Point of Broad-Band LTE LNA with BFR843EL3 (Measured at 1503 MHz)

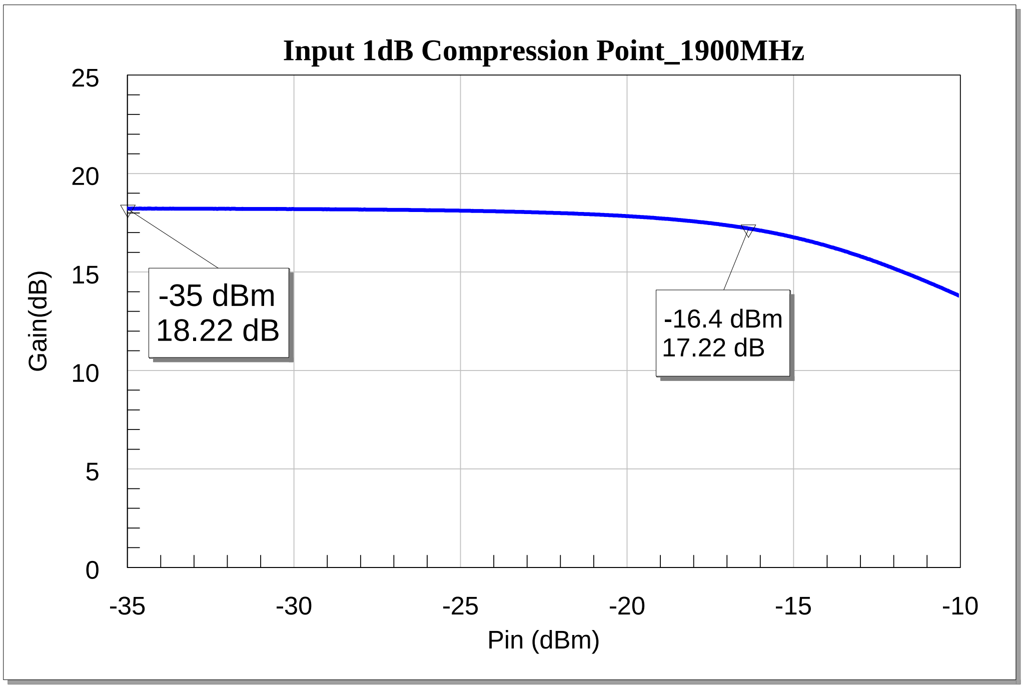

Figure 17 Input Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 1900 MHz)

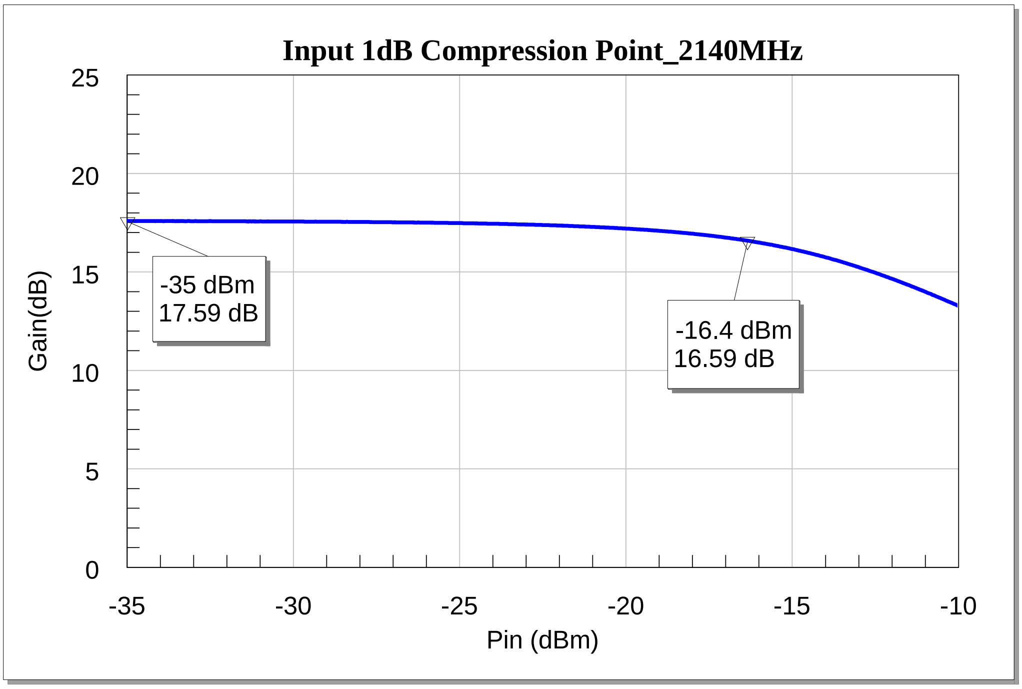

Figure 18 Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 2140 MHz)

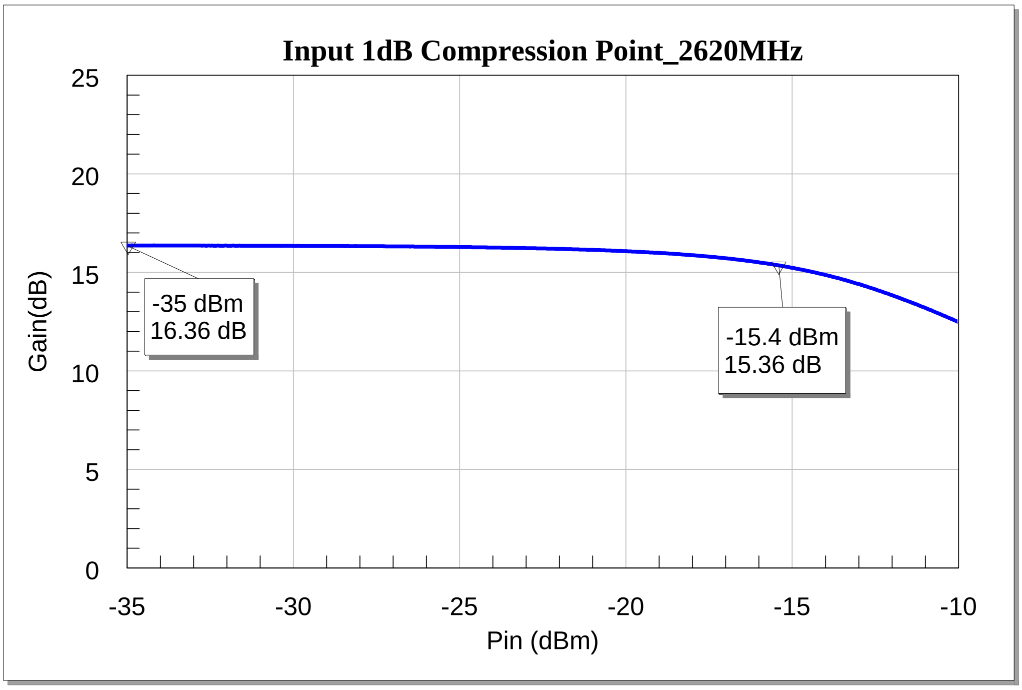

Figure 19 Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 2620 MHz)

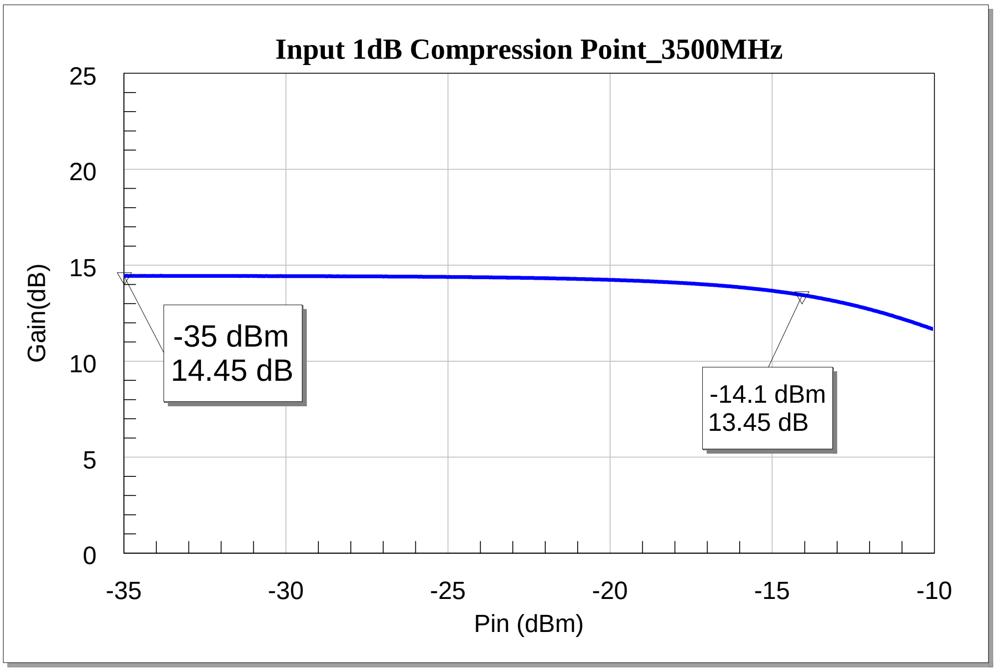

Figure 20 **Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 3500 MHz)**

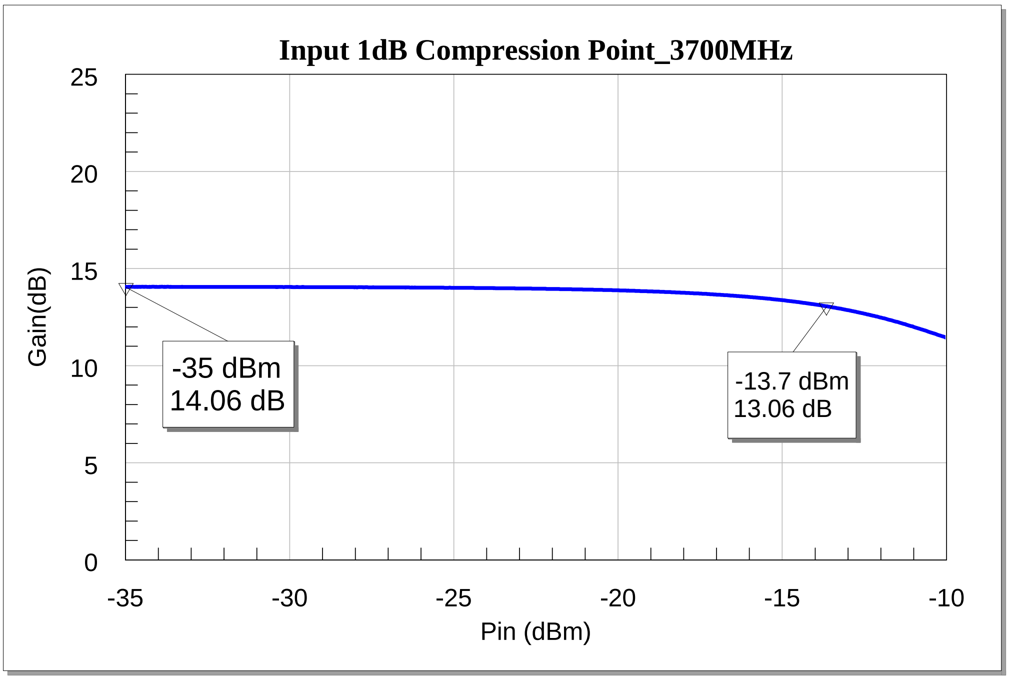

Figure 21 **Input 1dB Compression Point of the Broad-Band LTE LNA with BFR843EL3 (Measured at 3700 MHz)**

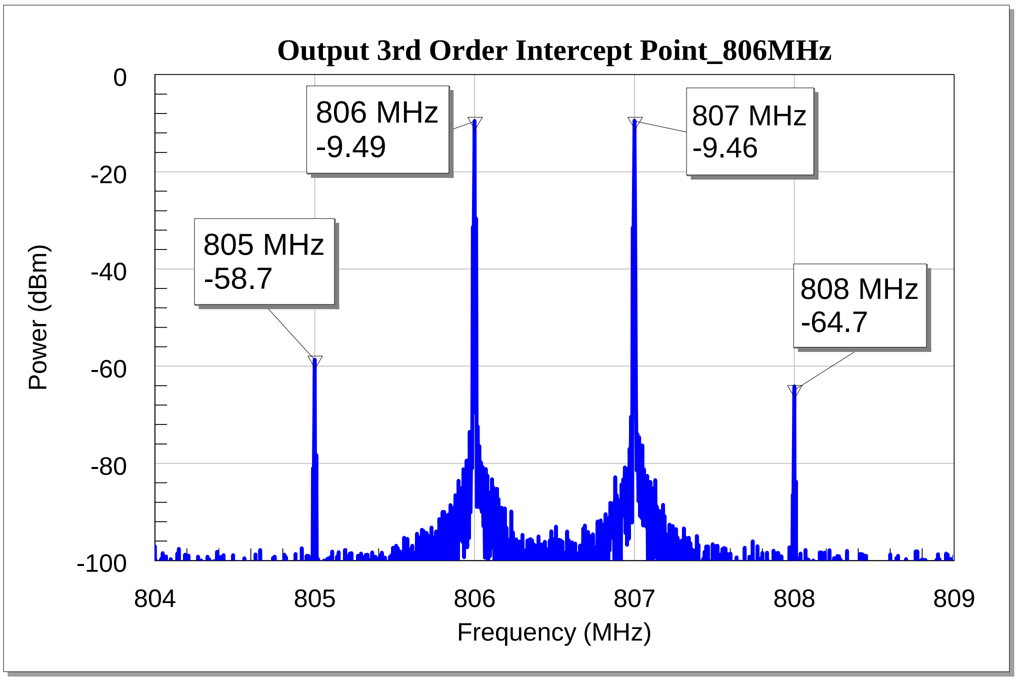

Figure 22 Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 806 MHz (LNA input power = -30 dBm)

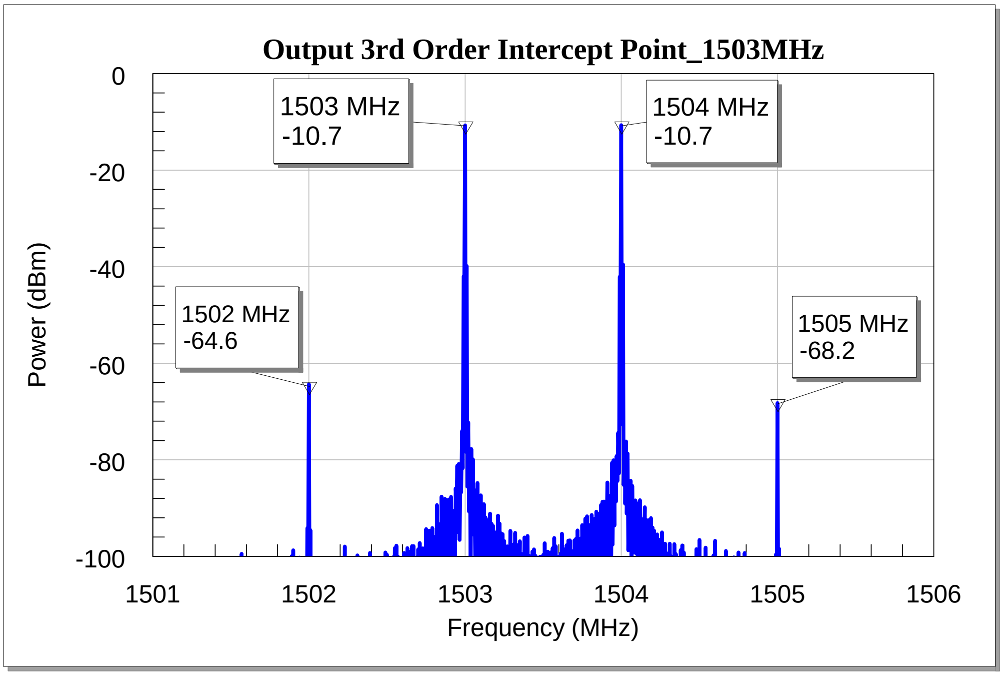

Figure 23 Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 1503 MHz (LNA input power = -30 dBm)

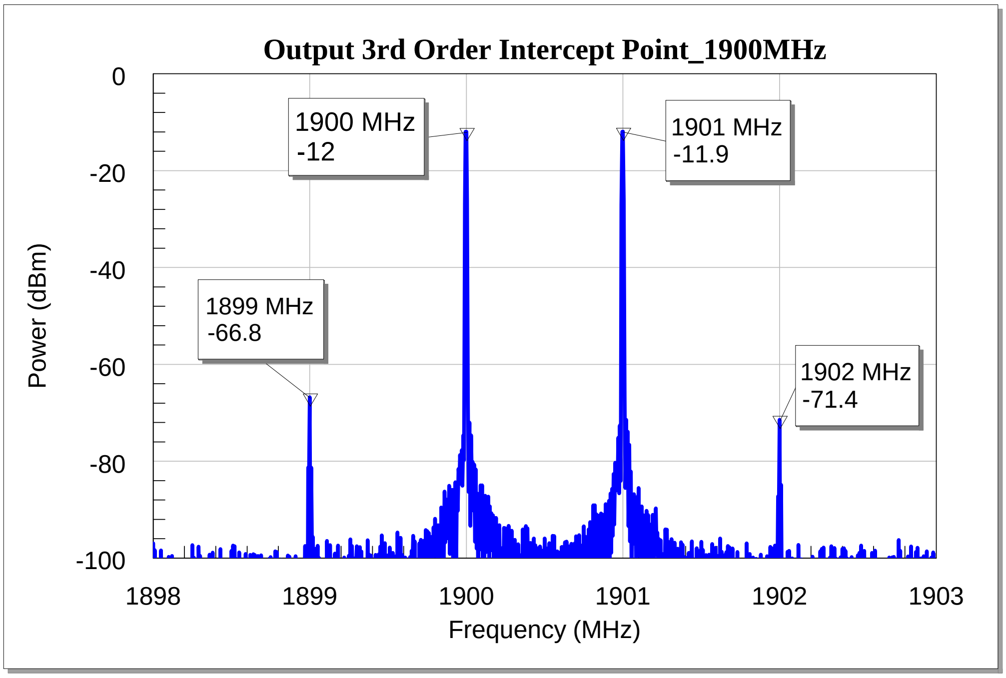

Figure 24 **Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 1900 MHz (LNA input power = -30 dBm)**

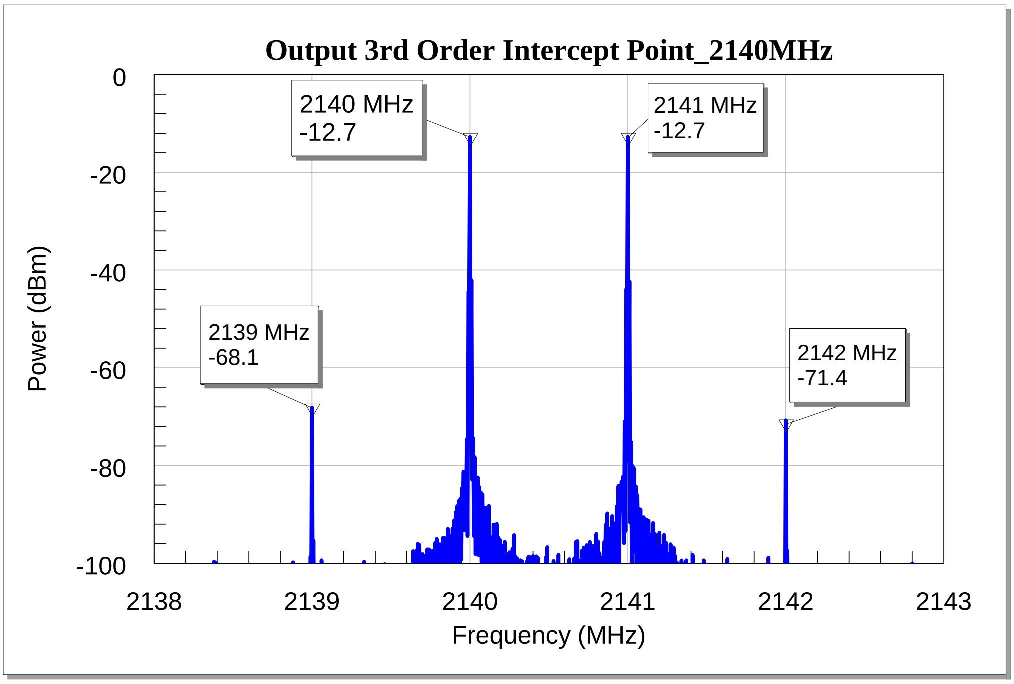

Figure 25 **Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 2140 MHz (LNA input power = -30 dBm)**

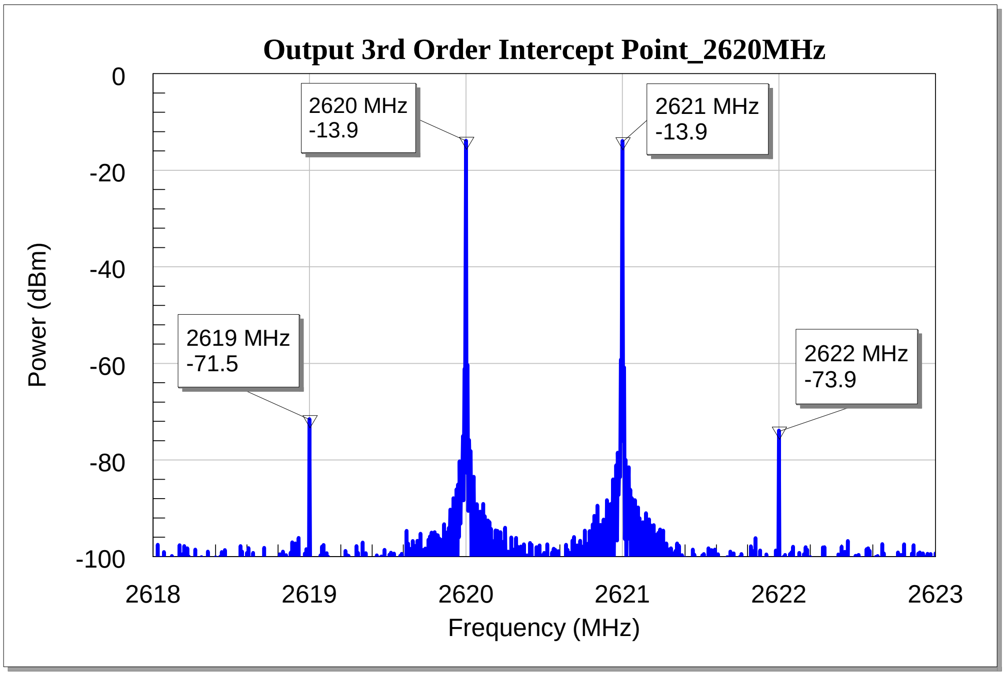

Figure 26 Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 2620 MHz (LNA input power = -30 dBm)

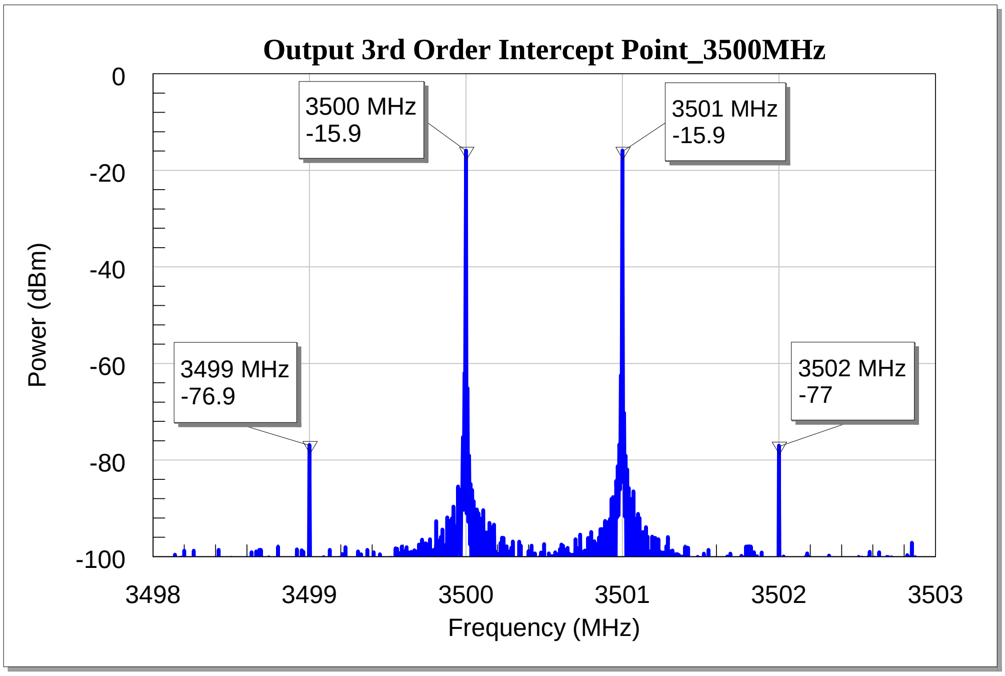

Figure 27 Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 3500 MHz (LNA input power = -30 dBm)

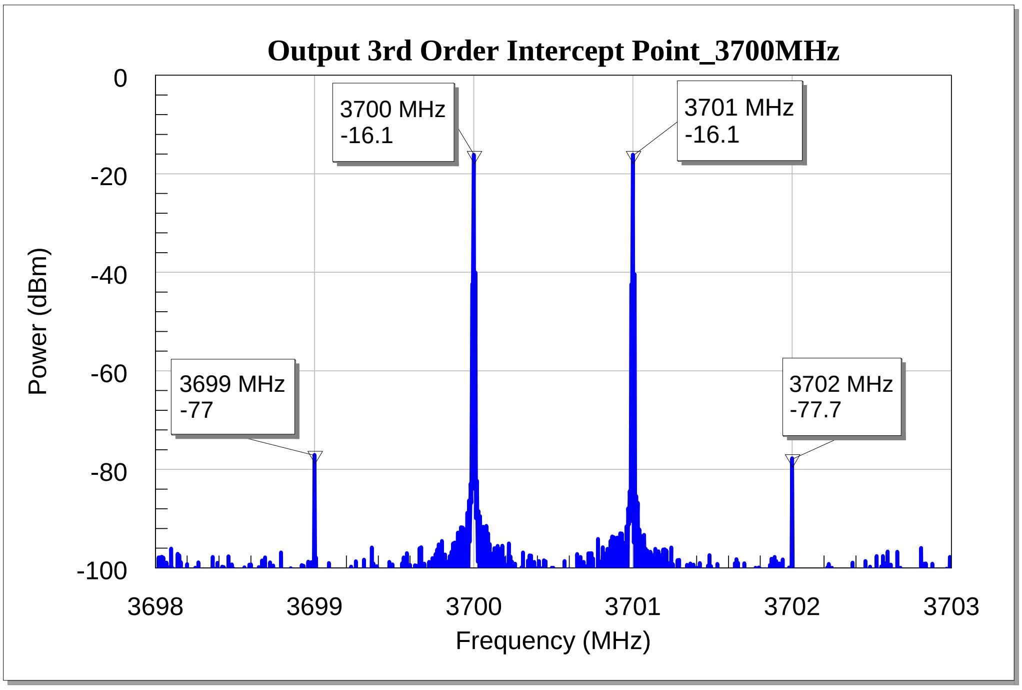

Figure 28 Output 3rd Order Intercept Point of the Broad-Band LTE LNA with BFR843EL3 at 3700 MHz (LNA input power = -30 dBm)

5 Evaluation Board and Layout Information

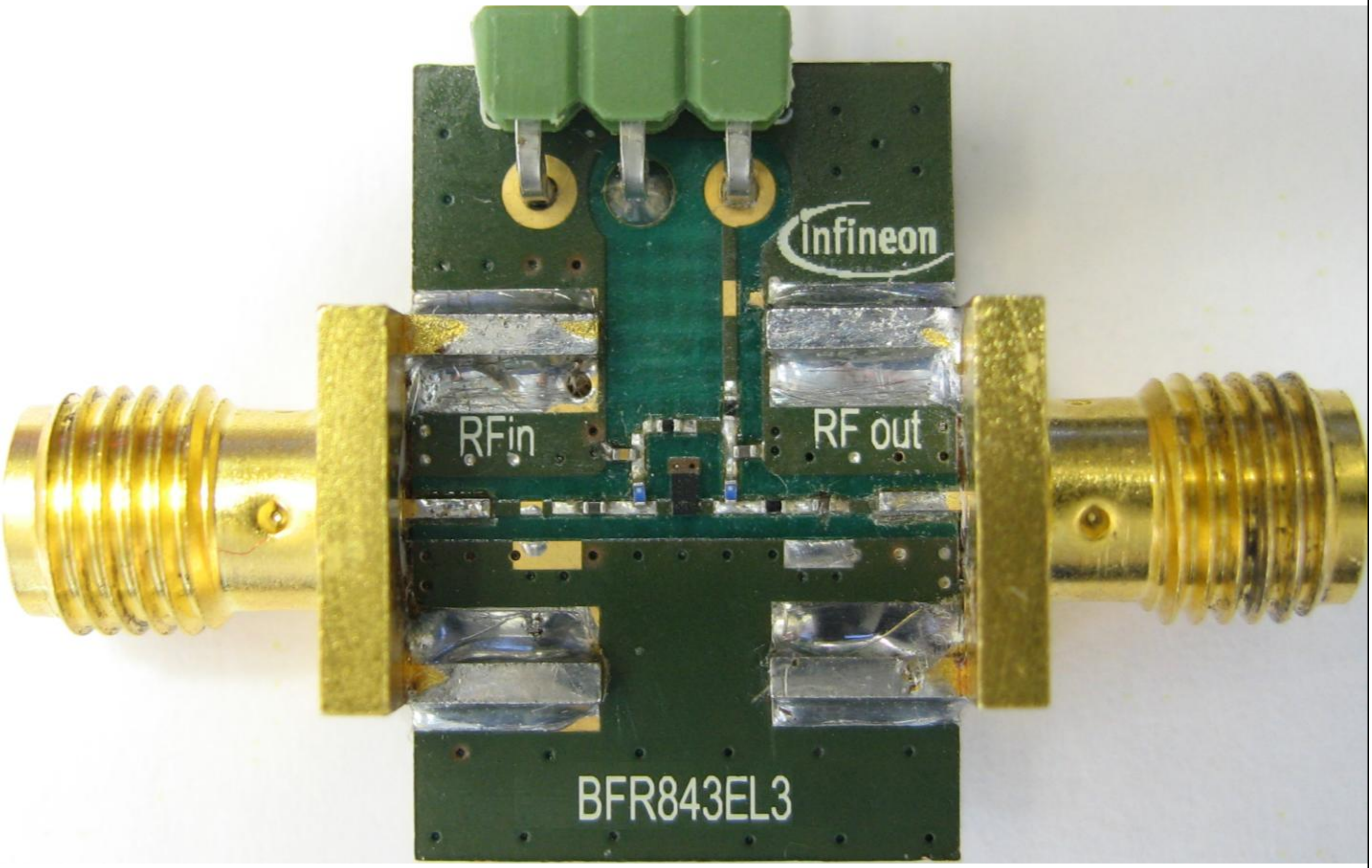

Figure 29 Photo Picture of Evaluation Board for 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

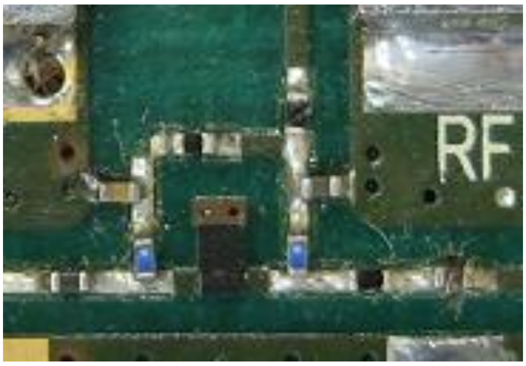

Figure 30 Zoom-In of Photo Picture

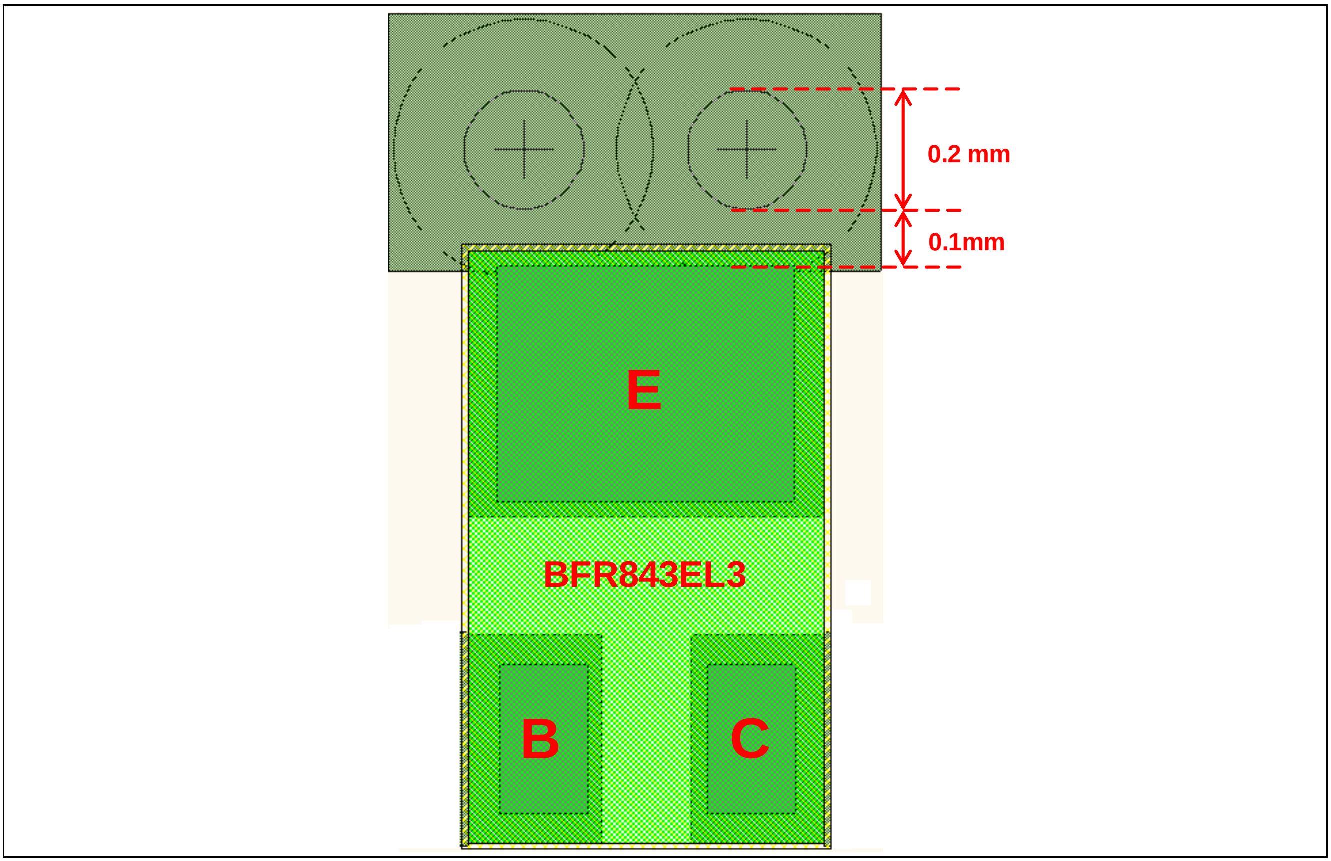

Figure 31 Layout Proposal for RF Grounding of the 700 – 3800 MHz Broad-Band LTE LNA with BFR843EL3

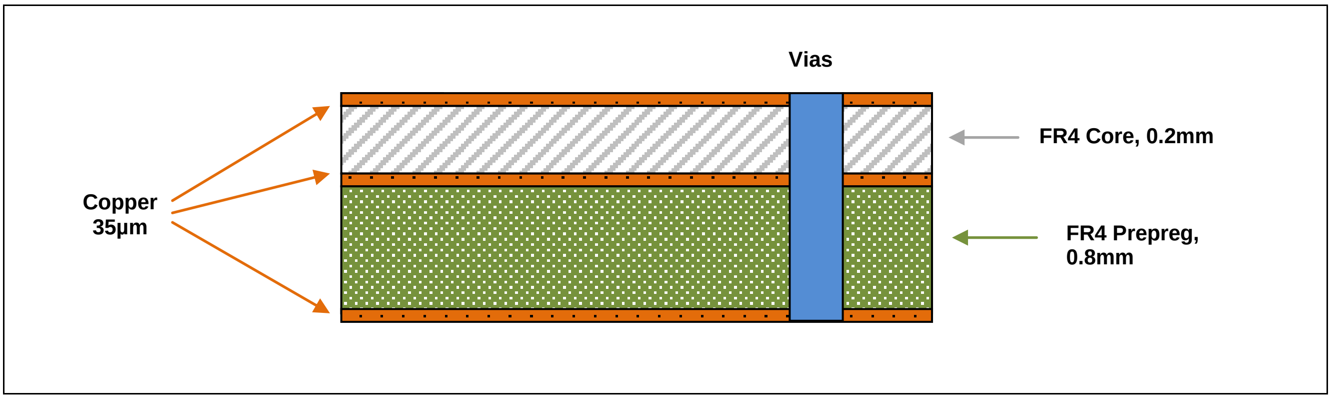

Figure 32 PCB Layer Information

6 Authors

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