BRO-LNA Assembly Checkout Test

IFS No: 1060321

Rev	Date	Description
1.0	13-03-2023	Initial

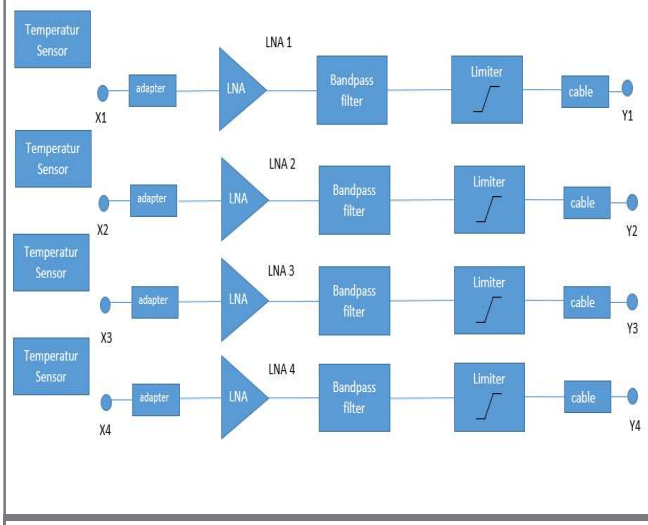
1 Contents

2 Introduction

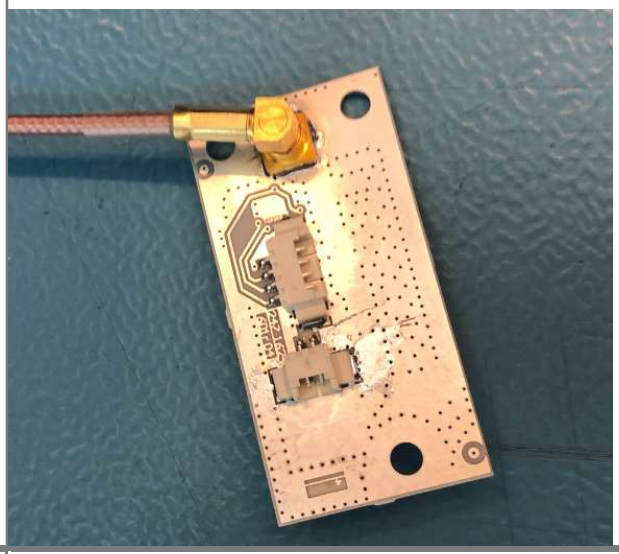
The LNA assembly consist of four separate LNA's which need to phase matched to each other.

Each LNA have one input port label the X# and an output port Y#, where the # could be 1,2,3,4 representing the LNA1, LNA2, LNA3 and LNA4. All four units are to be tested and measured separately.

The temperature is measured using TMP100 sensor and interfaced by the connector P110. Each LNA is supply by 5V by the connector P100. The RF input signal is applied on the P300 and the output on P310 connector.



LNA assembly , 4x1 LNA.



LNA, picture, bottom view

2.1 Pin connections

P100 connector	
Pin	**Description**
1	5V
2	GND

P110 connector	
Pin	**Description**
1	Vt
2	SCL
3	SDA
4	GND

3 Requirements

	Frequency	Limits	Comments
RF frequency [MHz]	3000-3100MHz		
Maximum Input RF power	3000-3100MHz	<-20dBm	Characterization outside this freq. range 2600-3600 MHz

Noise Figure@25C	3000-3100MHz	<1.4dB	Characterization outside this freq. range 2600-3600 MHz
Gain@25C	3000-3100MHz	>18dB	Characterization outside this freq. range 2600-3600 MHz
DC Power consumption		<55mA	
Limiter Threshold		4dBm	
Phase difference	3000-3100MHz	+/- <10deg difference	$\angle S^{x}_{21}$- $\angle S^{1}_{21}$<10deg, where x=2,3,4 Characterization outside this freq. range 2600-3600 MHz
Spurious signals	1 to 26GHz	-50dBm	
Temperature addresses LNA #1: **1001001** LNA #2: **1001010** LNA #3: **1001011** LNA #4: **1001100**		 Connection Connection Connection Connection	

4 Equipment

The following equipment have been used and calibrated according to Gomspace calibration program.

Instrument Used	Manufacture ID	Gomspace ID	Valid Calibration date
Noise source	Keysight N4000A. ENR 6dB, 10MHz-18GHz.	GS-0071	15-12-2024
Spectrum analyzer	Keysight N9000A. 26GHz	GS-0043	06-08-2024
Power supply	R&S HMC8143	GS-0720	Not calibrated
RF generator	R&S SMF100A. 20GHz	GS-0042	Not calibrated
Network analyzer	R&S ZN8. 8.5GHz	GS-0028	Not calibrated

5 Check out test

The aim of the check-out is to check the functionally and the performance of the unit before sent to the customer. This will include a visual inspection and an electrical test.

5.1 Inspection

No.	Test/Inspection	Unit	Check	PASS/FAIL
5.1	Visual inspection LNA #1			Pass
	Visual inspection LNA #2			Pass
	Visual inspection LNA #3			Pass
	Visual inspection LNA #4			Pass

5.2 Power consumption

No.	Test/Inspection	Min.	Max.	Unit	Measured	PASS/FAIL
5.2	Current consumption LNA #1	45	55	mA	51	Pass
	Current consumption LNA #2	45	55	mA	52	Pass

	Current consumption LNA #3	45	55	mA	52	Pass
	Current consumption LNA #4	45	55	mA	53	Pass

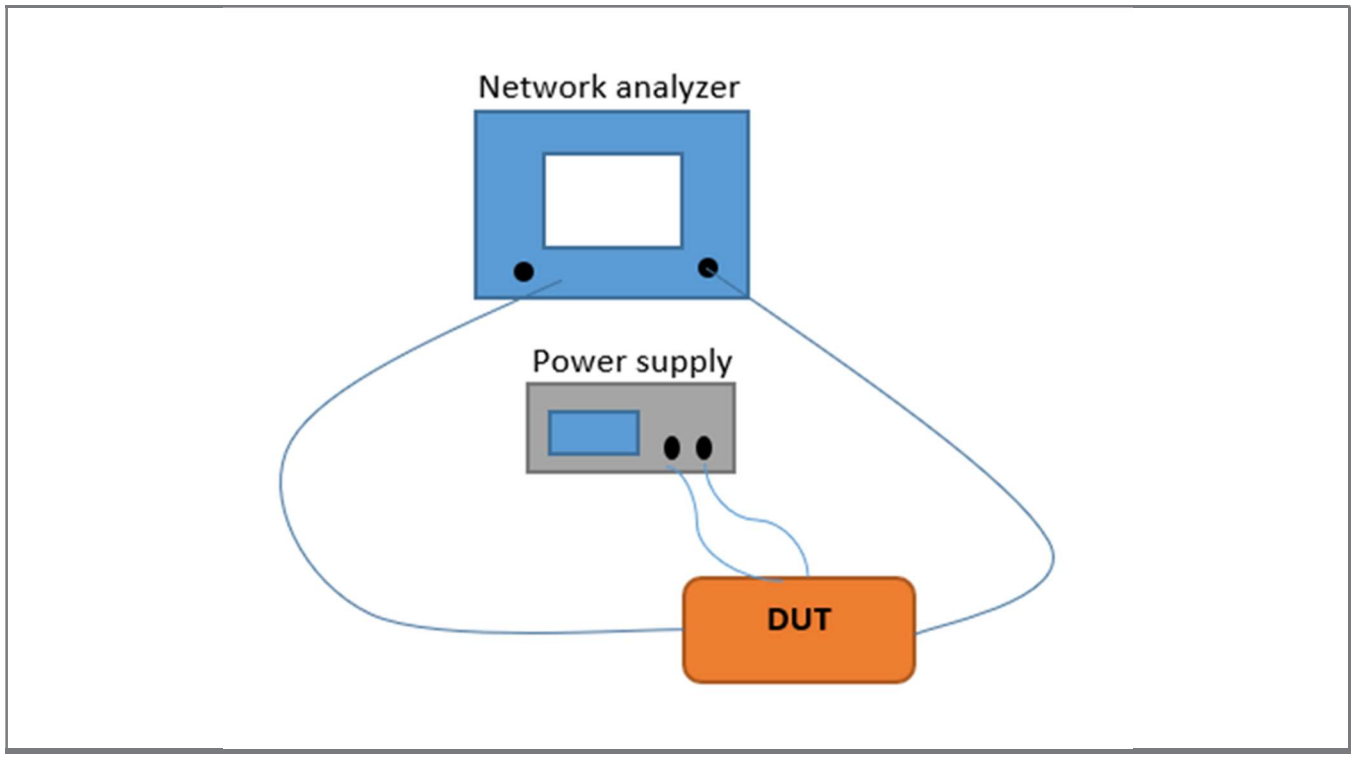
5.3 Communication ports

No.	Test/Inspection	Min.	Max.	Unit	Check	PASS/FAIL
5.3.1	Check Addresses **LNA #1:** 1001001 **LNA #2:** 1001010 **LNA #3:** 1001011 **LNA #4:** 1001100	-	-	-	pass	Pass Pass Pass Pass
5.3.2*	Temperature readings LNA #1	20	30	C	25.2	Pass
	Temperature readings LNA #2	20	30	C	26.1	Pass
	Temperature readings LNA #3	20	30	C	24.9	Pass
	Temperature readings LNA #4	20	30	C	25.7	Pass
5.3.3**	Check temperature LNA #1	-	-	-	Pass	Pass
	Check temperature LNA #2	-	-	-	Pass	Pass
	Check temperature LNA #3	-	-	-	Pass	Pass
	Check temperature LNA #4	-	-	-	pass	Pass

*) measured a room temperature.
**) apply heat to sensor and check if it increases.

5.4 Transmission

5.4.1 Setup



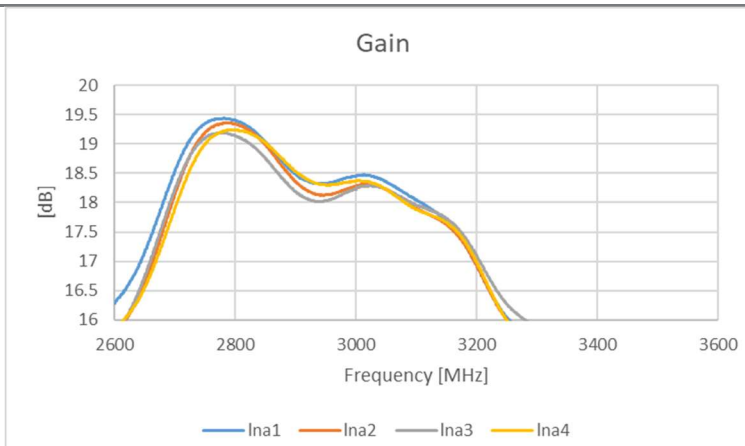
Instrument Used	Manufacture ID	Gomspace ID
Power supply	R&S HMC8143	GS-0731
Network analyzer	R&S ZN20. 20GHz	GS-0050

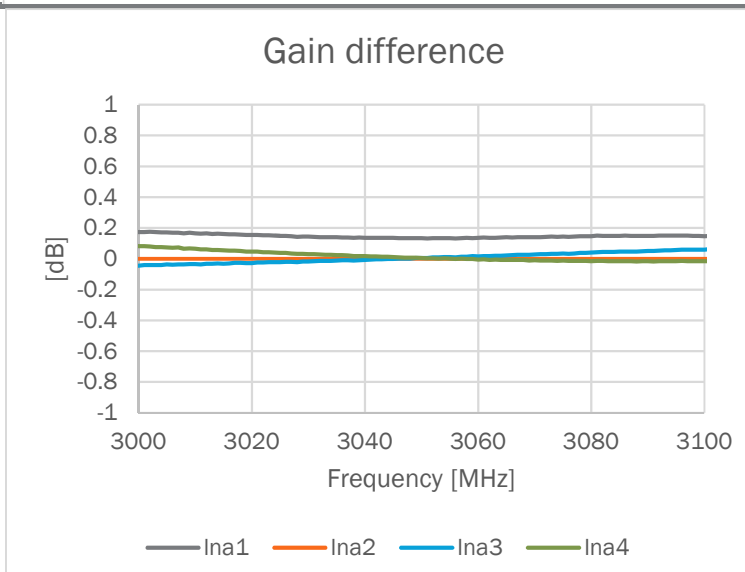
Network analyzer settings	
Frequency	2600-3600MHz
IF BW	300Hz
Power Level	-20dBm
Points	1001

5.4.2 Gain vs Frequency Test

No.	Test/Inspection	Min.	Max.	Unit	Measured	PASS/FAIL
5.4.2	Gain delta between LNA's, Pin=-20dBm.	-1	1	dB	0.2/-0.2	Pass

*) see graph below.

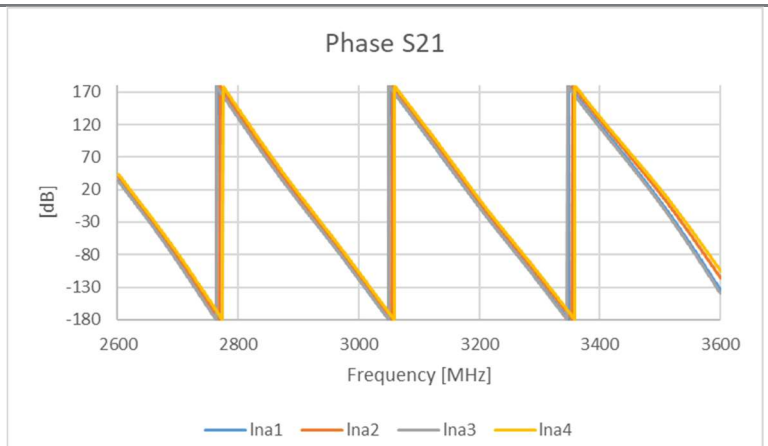


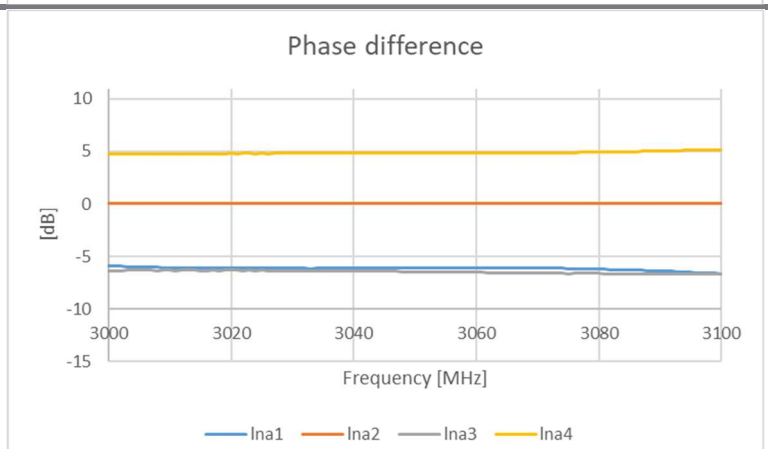


5.4.3 S21, Phase Test

No.	Test/Inspection	Min.	Max.	Unit	Measured	PASS/FAIL
5.4.3	Delta Delta between LNA's Pin=-20dBm. Frequency 3000-3100MHz.	-10	10	deg	+5.2/-6.7	Pass

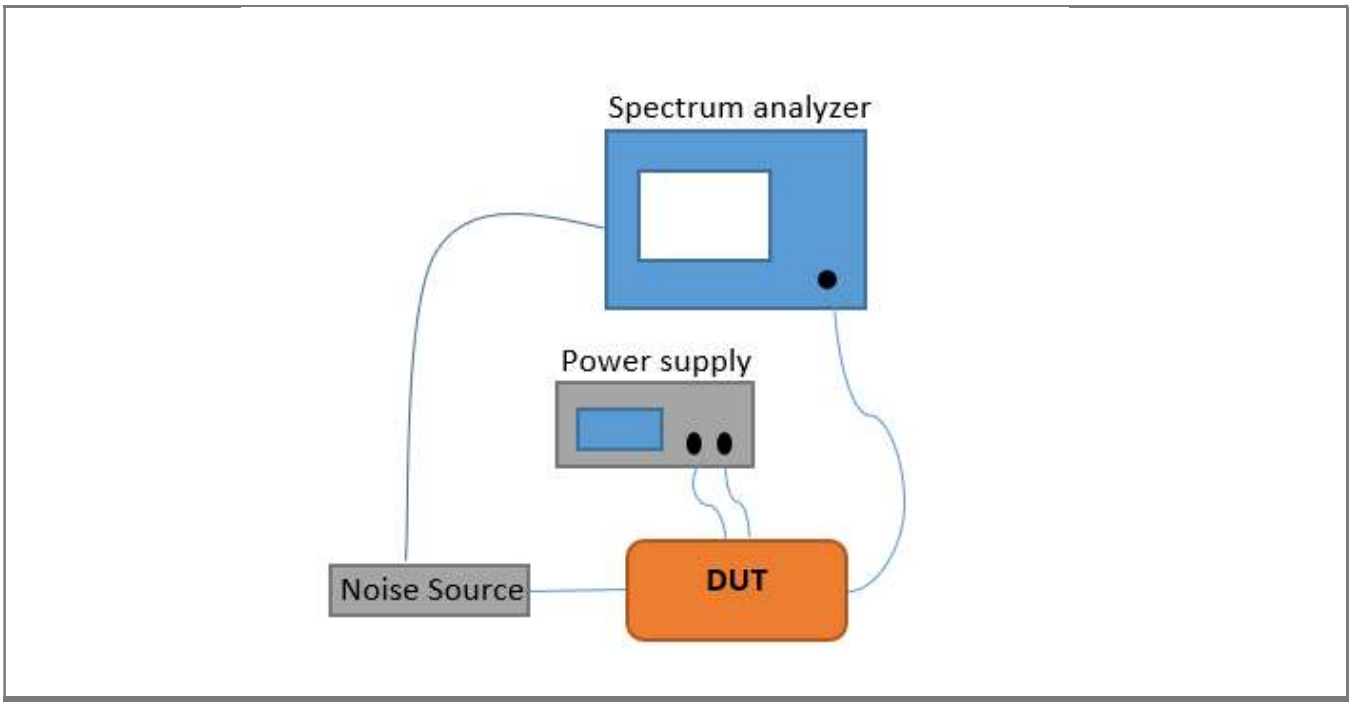
*) see graph below.





5.5 Gain & Noise Figure

5.5.1 Setup



Instrument Used	Manufacture ID	Gomspace ID
Noise source	Keysight N4000A. ENR 6dB, 10MHz-18GHz.	GS-0071
Spectrum analyzer	Keysight N9000A. 26GHz	GS-0043
Power supply	R&S HMC8143	GS-0731

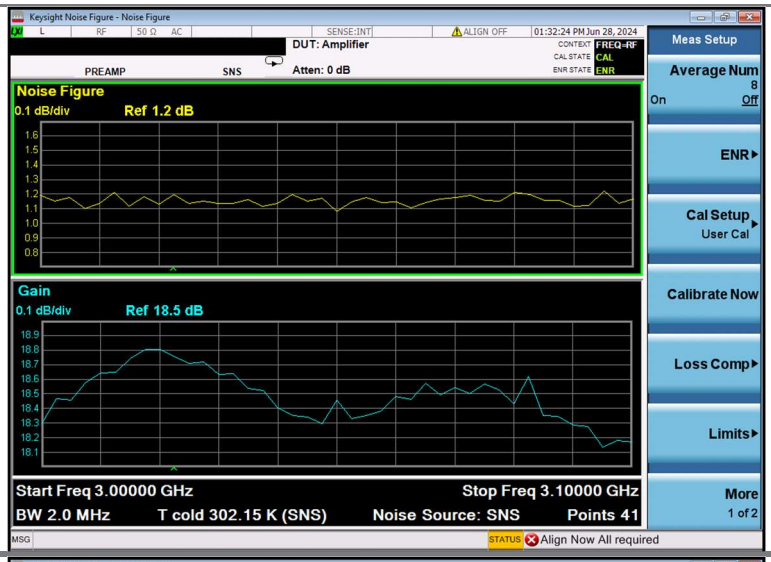
Spectrum analyzer settings	
Frequency	3002-3100MHz
IF BW	2MHz
Points	40
ENR	6dB

5.5.2 Test

Include RF cables on DUT

No.	Test/Inspection	Min.	Max.	Unit	Measured	PASS/FAIL
5.5.2	Noise figure, LNA #1*		1.4	dB	1.2	Pass
	Noise figure, LNA #2*		1.4	dB	1.3	Pass
	Noise figure, LNA #3*		1.4	dB	1.3	Pass
	Noise figure, LNA #4*		1.4	dB	1.3	Pass
5.5.3	Gain, LNA 1*	18.0	22.0	dB	18.4/18.9	Pass
	Gain, LNA 2*	18.0	22.0	dB	18.0/18.6	Pass
	Gain, LNA 3*	18.0	22.0	dB	18.0/18.6	Pass
	Gain, LNA 4*	18.0	22.0	dB	18.0/18.8	Pass

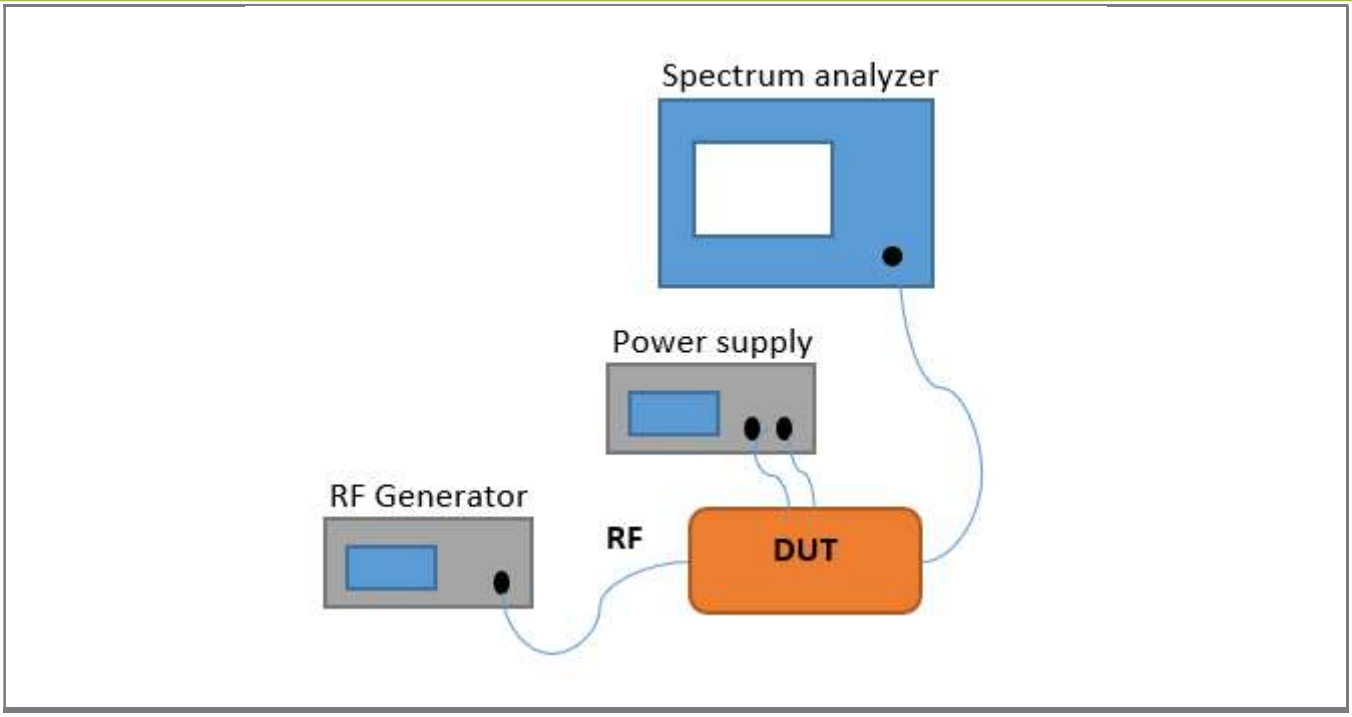
*) see graph below, include 0.15dB loss compensation of connector. Gain is measured more accurately using the s-parameters.

LNA-X1		
LNA-X2		

LNA-X3			
LNA-X4			

5.6 Spurious signals (RF frequency 3050MHz)

5.6.1 Test setup



Instrument Used	Manufacture ID	Gomspace ID
Power supply	R&S HMC8143	GS-0731
Spectrum analyzer	Keysight N9000A	GS-0071
RF generator	R&S SMF100A	GS-0042

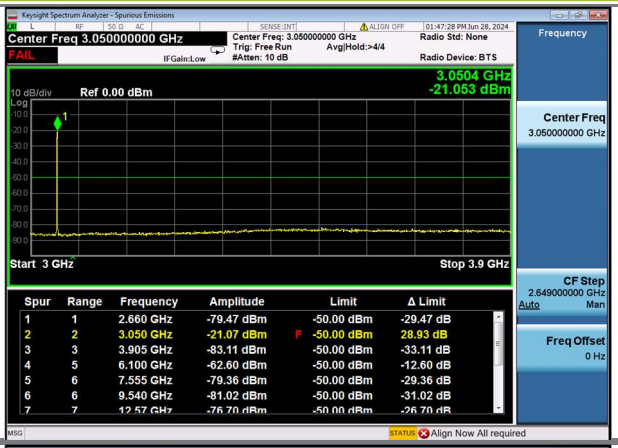
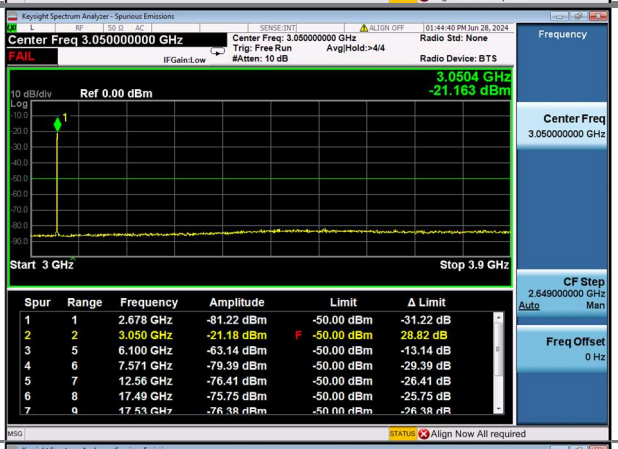
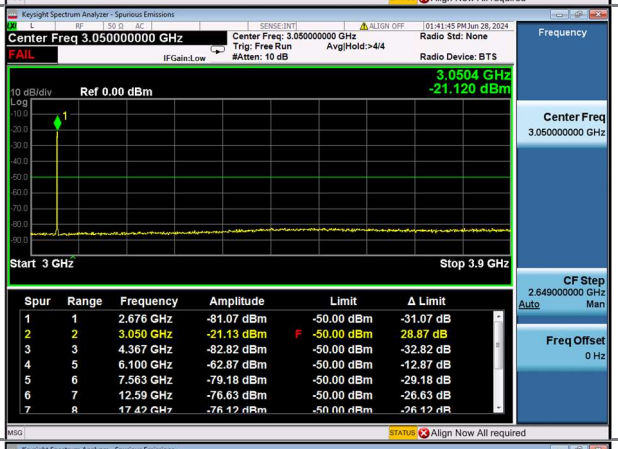
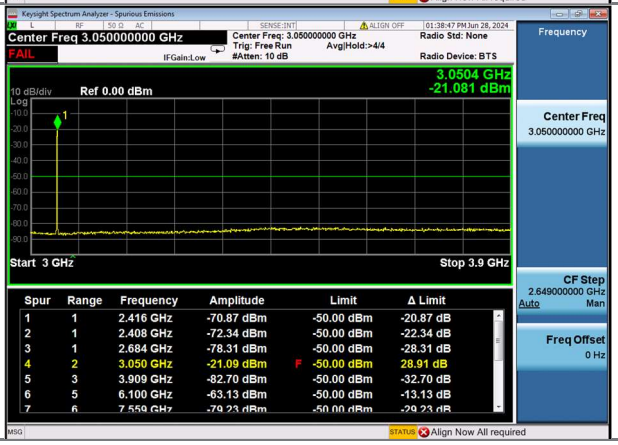
5.6.2 Spurious test

No.	Test	Condition	Limit	Measured	PASS/FAIL
5.6.2	Spurious level	Spectrum in frequency range 0 to 26GHz	-50dBm	Pass	pass

The signal from the RF generator is -40dBm@3050MHz.

	Spur frequencies	Spur magnitude [dBm]				PASS/FAIL
Req [dBm]	[MHz]	**LNA-1 [dBm]**	**LNA-2 [dBm]**	**LNA-3 [dBm]**	**LNA-4 [dBm]**	
-50	2660	-79.5	-81.2	-81.1	-78.3	Pass
-17	3055	-21.1	-21.2	-21.1	-21.1	Pass
-50	3905	-83.1			-82.7	Pass
-50	6100	-62.6	-63.1	-62.9	-63.1	Pass
-50	7555	-79.4	-79.4	-79.2	-79.2	Pass
-50	12590	-76.7	-76.4	-76.6		pass

*) Harmonics and frequency above 6GHz are beyond the range of the SDR.

LNA-X1		
LNA-X2		
LNA-X3		
LNA-X4		

6 Statement of conformity

It is hereby certified that apart from the deviations or waivers noted in the Remarks box below, the whole of the items detailed, conform I all respects to the specification(s), drawings(s) and conditions(s) or requirement(s) respect to the specification(s), drawings(s) and conditions(s) of the contract.

Remarks:

Three used instruments have not been calibrated- the vector analyzer (uncalibrated) and spectrum analyzer (calibrated) is providing the same results. The output power of generator is already affect by the cable used- and the spurious are relative to the carrier.
It is therefore concluded that LNA assembly is passing the checkout test.

Product Name: BRO3-9 LNA Assembly

Template Document No: 1049805 rev 2.0

Part no: 108340 Eng. Revision: 1

LNA#1: 107022-89, LNA#2:107022-90, LNA#3: 107022-91 LNA4: 107022-92

Shop order 11782
Serial no: 17
Tested by: max

Approved by: max Date: 28-06-2024

7 Confidentiality Notice

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