

1 Characteristics

Table 1: Absolute maximum ratings (limiting values)

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
P _{IN}	Input power RFIN		-	20	dBm
V _{ESD}	ESD ratings MIL STD883C (HBM: C = 100 pF, R = 1.5 Ω, air discharge)	2000	-		V
	ESD ratings machine model (MM: C = 200 pF, R = 25 W, L = 500 nH)	200	-		
T _{OP}	Operating temperature	-40	-	+105	°C

Table 2: Impedances (T_{amb} = 25 °C)

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
Z _{OUT}	Nominal differential output impedance	-	Match to BlueNRG	-	Ω
Z _{IN}	Nominal input impedance	-	50	-	Ω

Table 3: RF performance (T_{amb} = 25 °C)

Symbol	Parameter	Test condition	Value			Unit
			Min.	Typ.	Max.	
f	Frequency range (bandwidth)		2400		2500	MHz
S ₁₁	Input return loss bandwidth			-20		dB
S ₂₁	Insertion loss			-1.1		dB
S ₂₁	Harmonic rejection (differential mode)	H2		-8		dB
		H3		-38		
		H4		-31		
		H5		-23		
φ _{imb}	Output phase imbalance			7		°
A _{imb}	Output amplitude imbalance			0.5		dB

1.1 RF measurement

Figure 3: Differential transmission

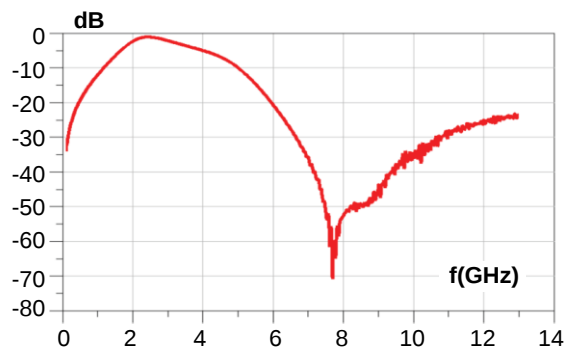


Figure 4: Return loss

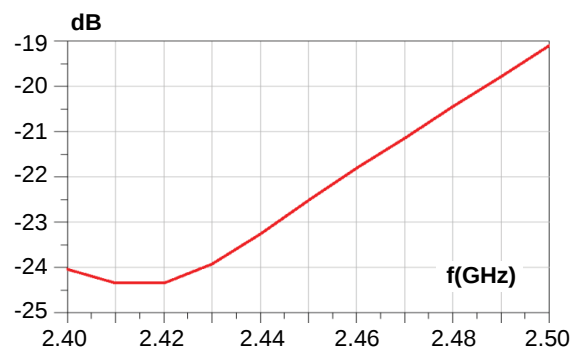


Figure 5: Insertion loss

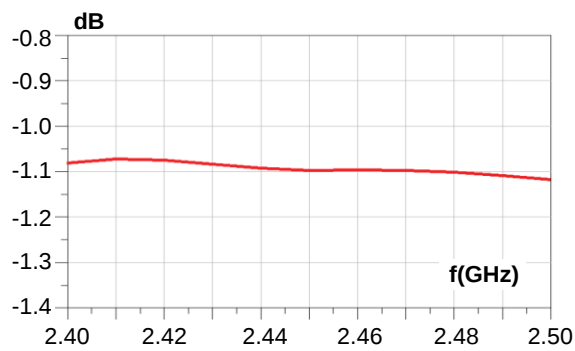


Figure 6: H2 filtering

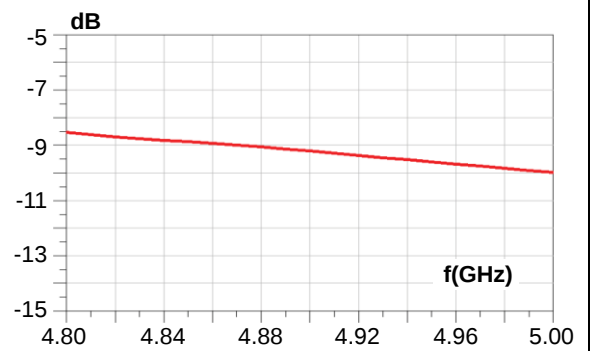


Figure 7: H3 filtering

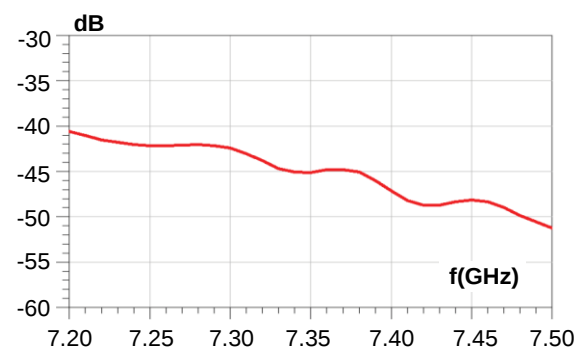


Figure 8: H4 filtering

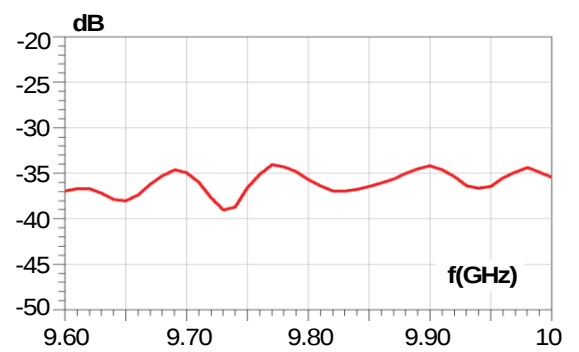


Figure 9: H5 filtering

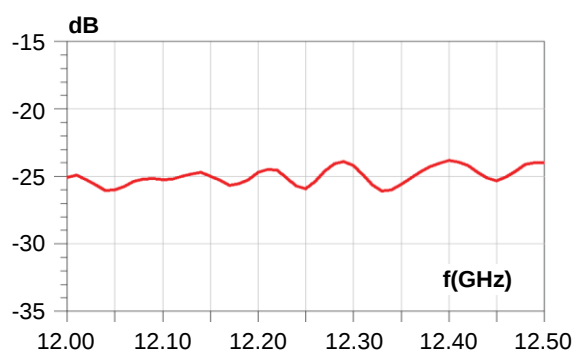


Figure 10: Amplitude imbalance

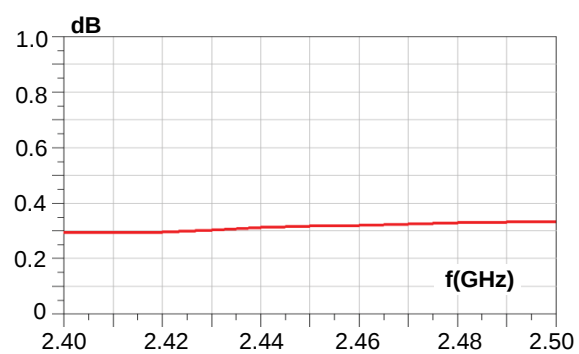
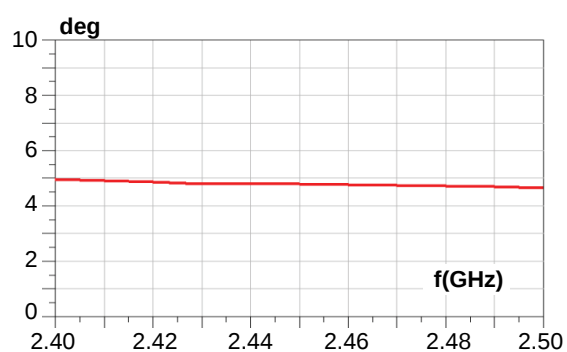


Figure 11: Phase imbalance



2 BALF-NRG-01D3 with QFN type BlueNRG

Figure 12: Application board EVB (2 layers)

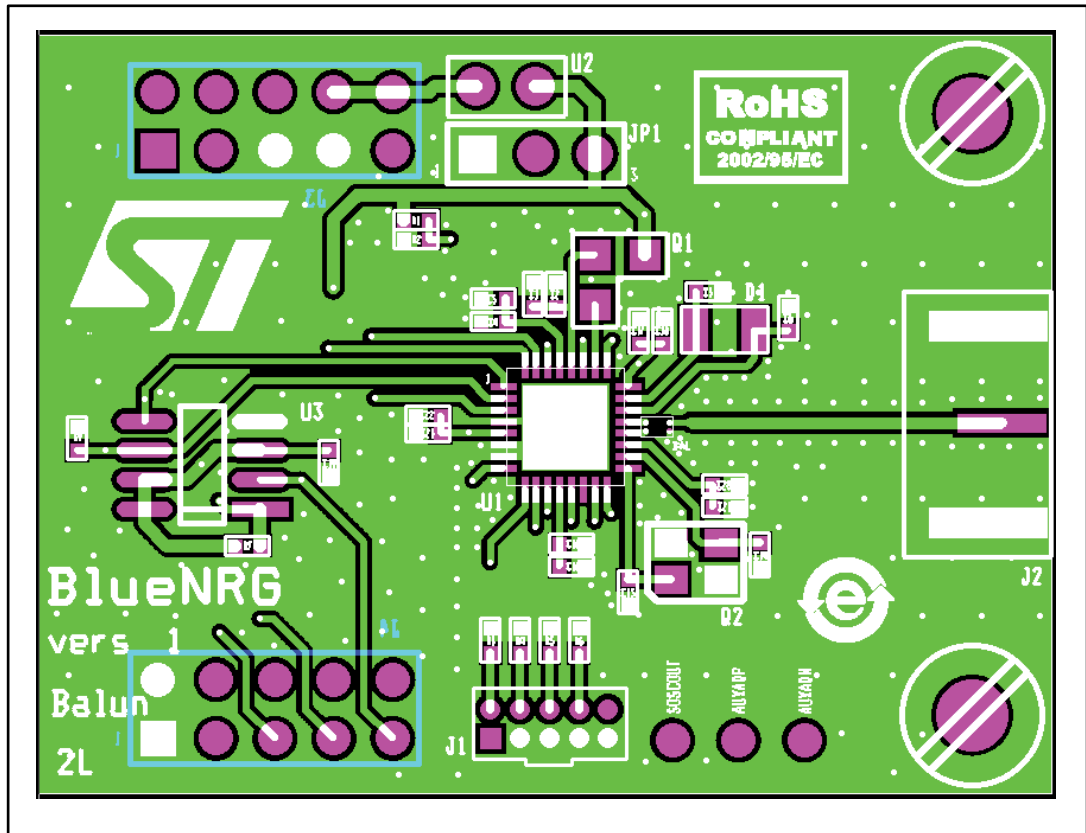
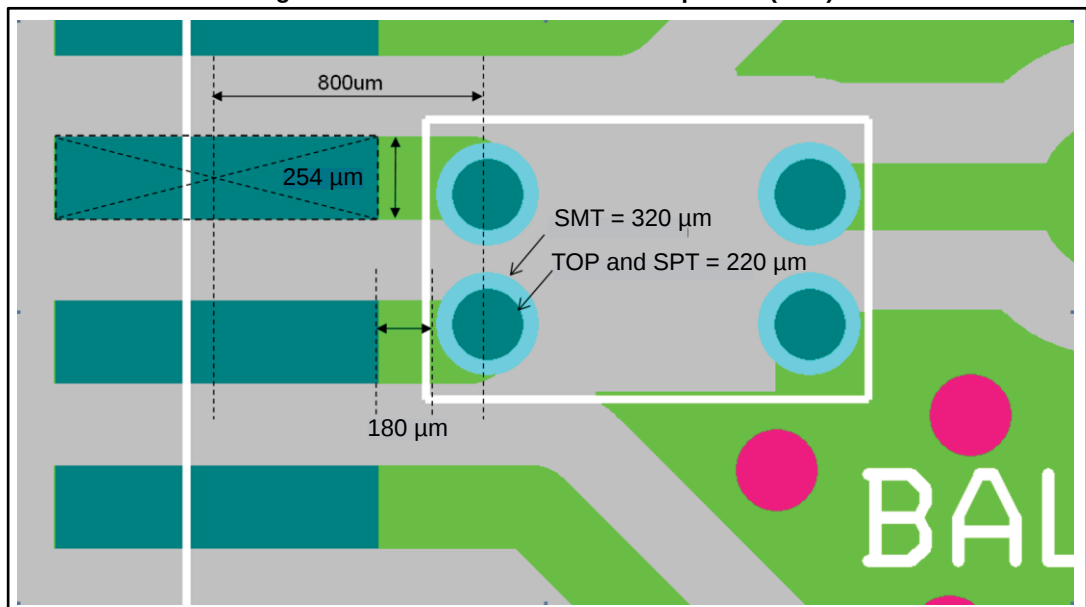


Figure 13: Recommended balun land pattern (EVB)



2.1 BALF-NRG-01D3 measurements on QFN EVB

Figure 14: Harmonics

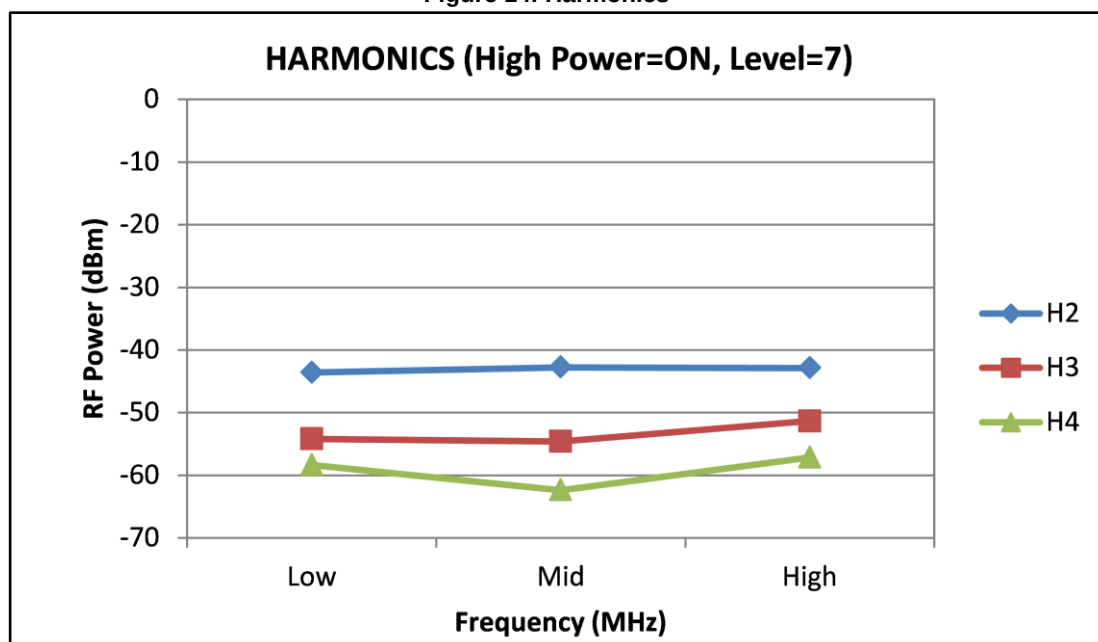


Figure 15: Sensitivity

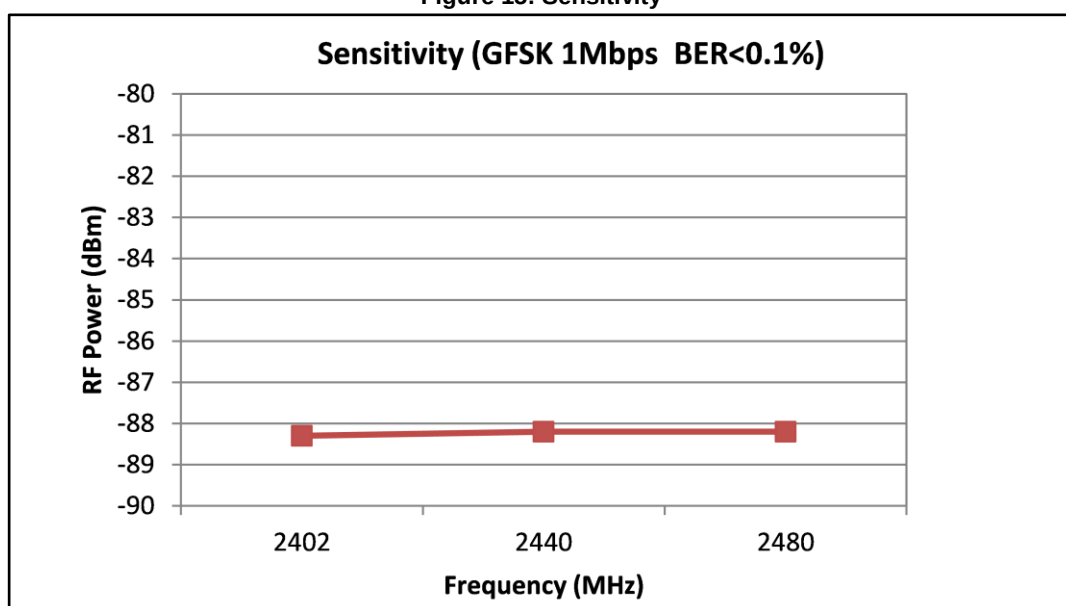
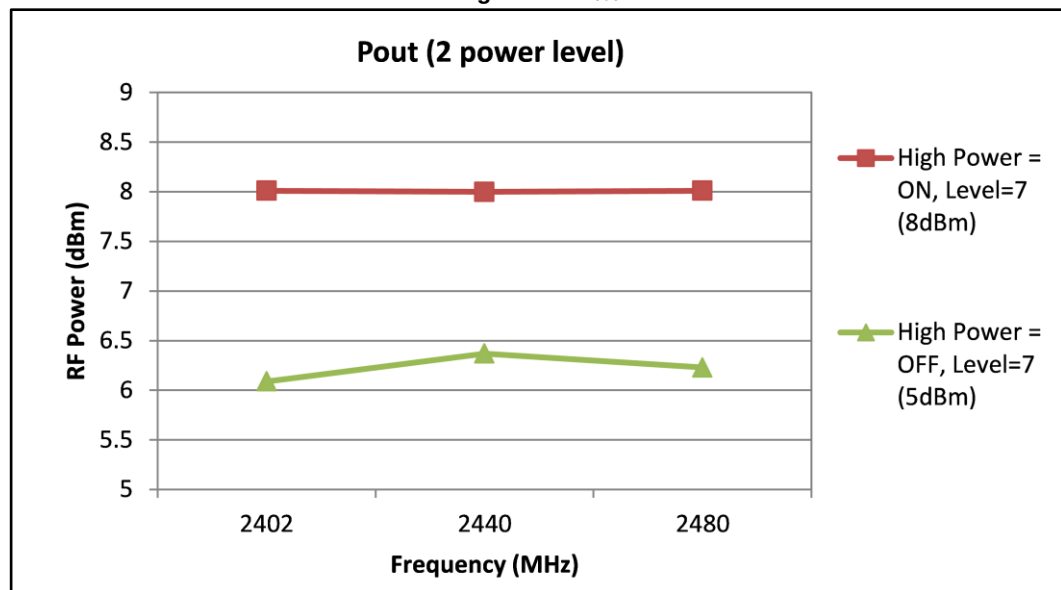


Figure 16: P_{out}

3 BALF-NRG-01D3 with WLCSP type BlueNRG

Figure 17: Recommended balun land pattern (WLCSP)

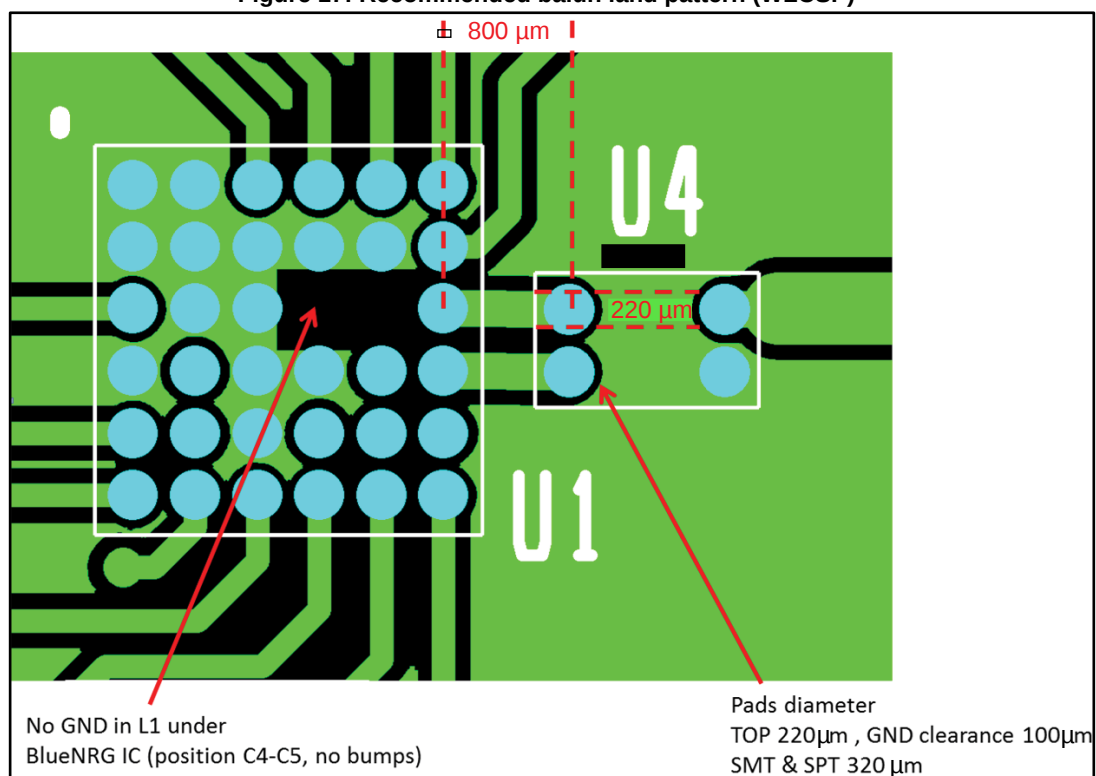


Figure 18: PCB stack-up recommendation



3.1 BALF-NRG-01D3 measurements on WLCSP EVB

Figure 19: Harmonics

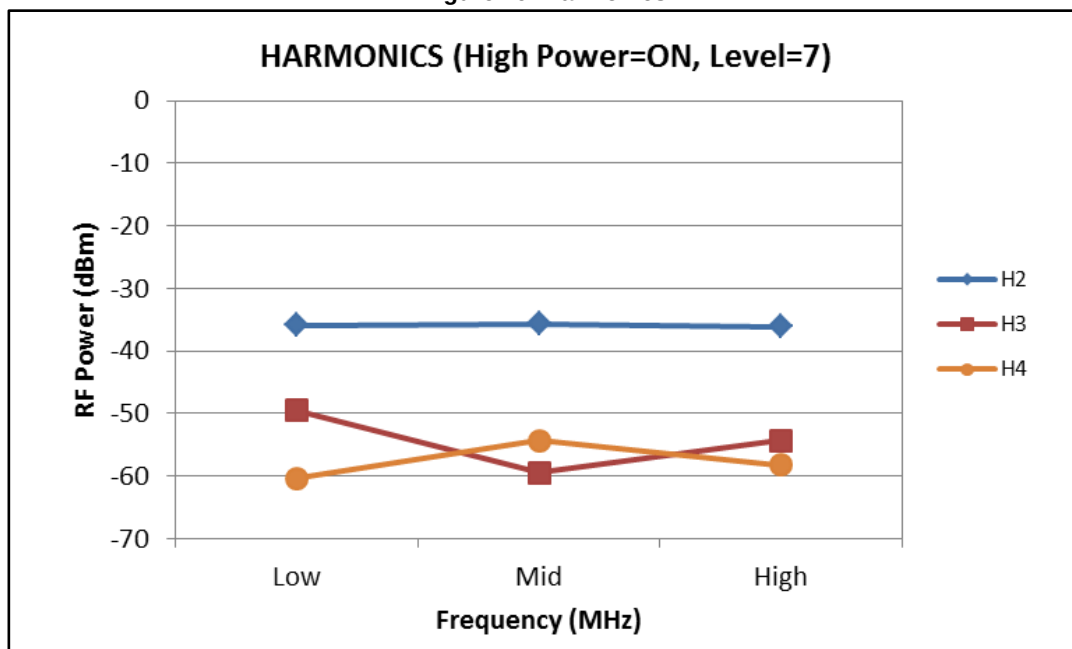


Figure 20: Sensitivity

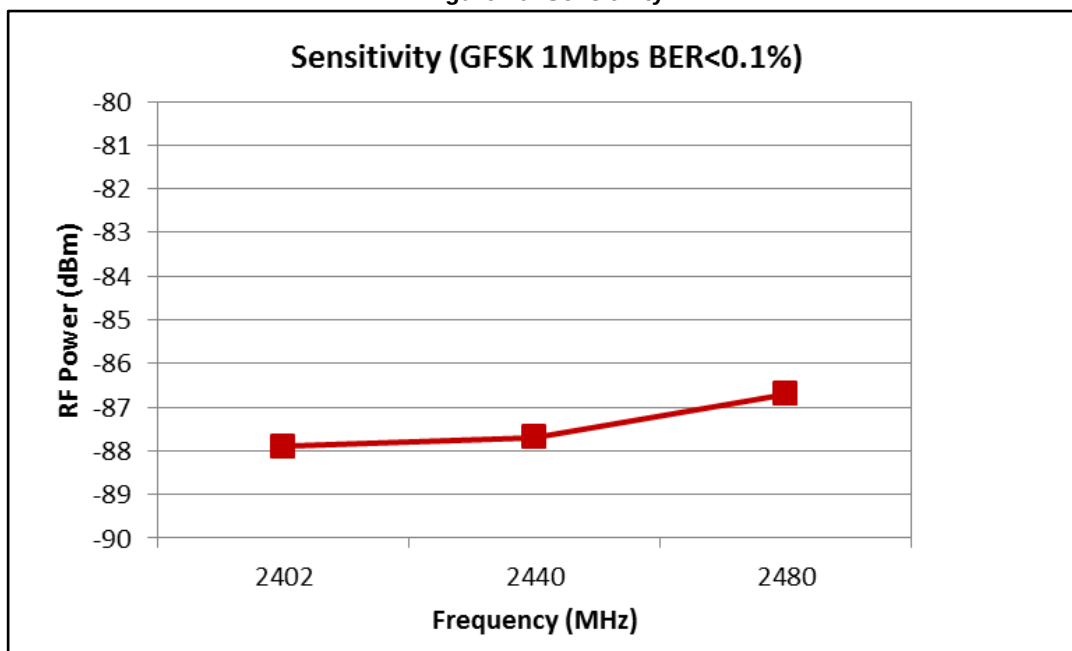
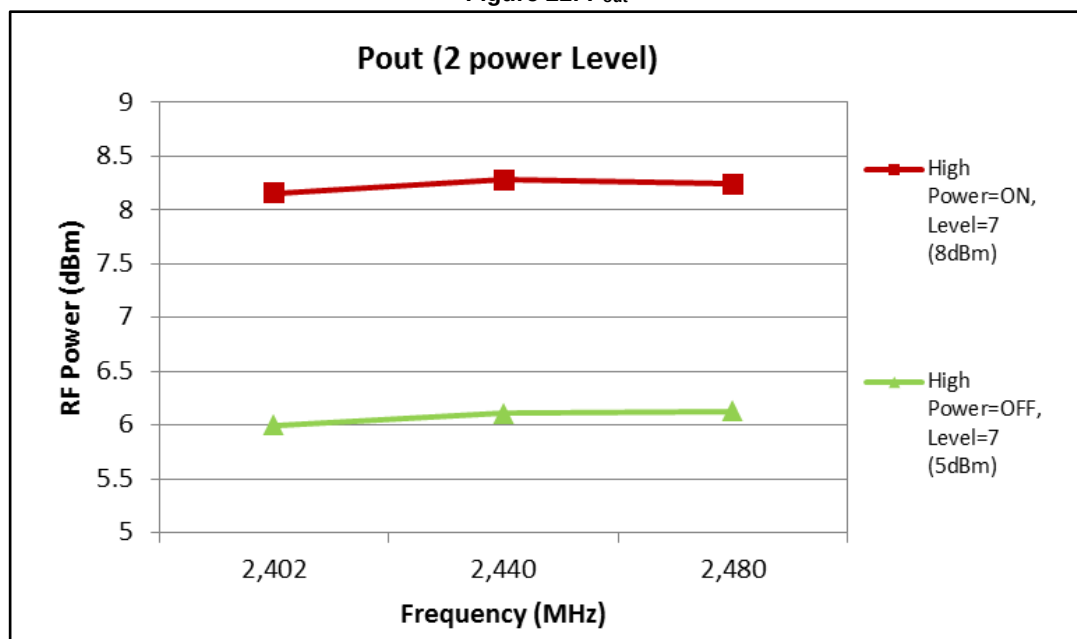


Figure 21: P_{out}

4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

- Epoxy meets UL94, V0
- Lead-free package

4.1 Flip-Chip 4 bumps package information

Figure 22: Flip-Chip 4 bumps package outline

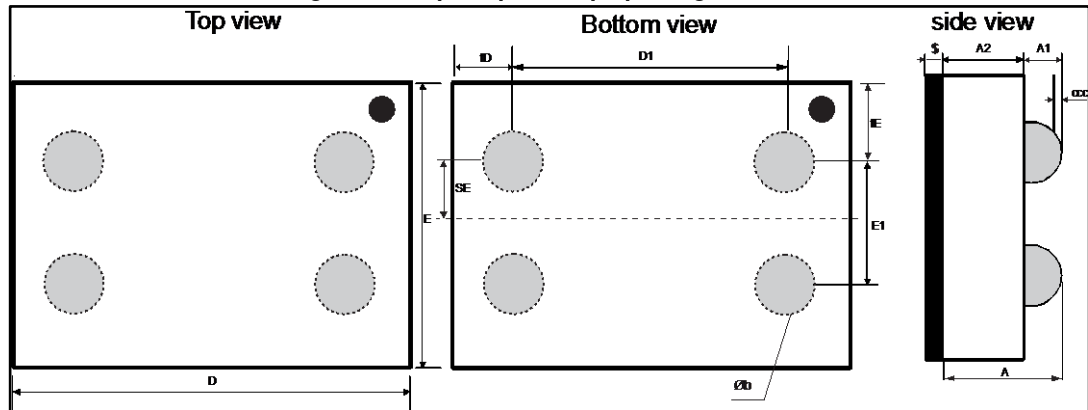


Table 4: Flip-Chip 5 bumps dimensions

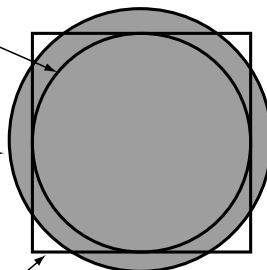
Parameter	Dimesions (in mm)		
	Min.	Typ.	Max.
A	0.580	0.630	0.680
A1	0.180	0.205	0.230
A2	0.380	0.400	0.420
b	0.230	0.255	0.280
D	1.375	1.400	1.425
D1	0.990	1.000	1.010
E	0.825	0.850	0.875
E1	0.390	0.400	0.410
SE		0.200	
fD	0.170	0.200	0.230
fE	0.195	0.225	0.255
ccc			0.050
Ø		0.025	

Figure 23: Footprint - 3 mils stencil -non solder mask defined

Copper pad diameter:
220 μm recommended
180 μm minimum
260 μm maximum

Solder mask opening:
320 μm recommended
300 μm minimum
340 μm maximum

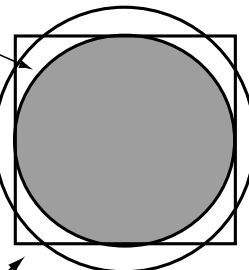
Solder stencil opening:
220 μm recommended

**Figure 24: Footprint - 3 mils stencil - solder mask defined**

Solder mask opening:
220 μm recommended
180 μm minimum
260 μm maximum

Copper pad diameter:
320 μm recommended
300 μm minimum

Solder stencil opening:
220 μm recommended

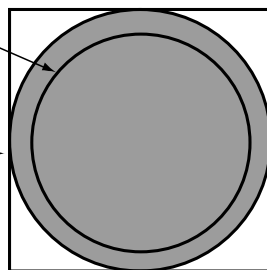
**Figure 25: Footprint - 5 mils stencil -non solder mask defined**

Copper pad diameter:
220 μm recommended
180 μm minimum
260 μm maximum

Solder mask opening:
320 μm recommended
300 μm minimum
340 μm maximum

Solder stencil opening:
330 μm recommended*

*depending on paste, it can go down to 270 μm

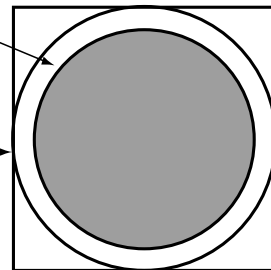
**Figure 26: Footprint - 5 mils stencil - solder mask defined**

Solder mask opening:
220 μm recommended
180 μm minimum
260 μm maximum

Copper pad diameter:
320 μm recommended
300 μm minimum

Solder stencil opening:
330 μm recommended*

*depending on paste, it can go down to 270 μm



4.2 Flip-chip 4 bumps packing information

Figure 27: Marking

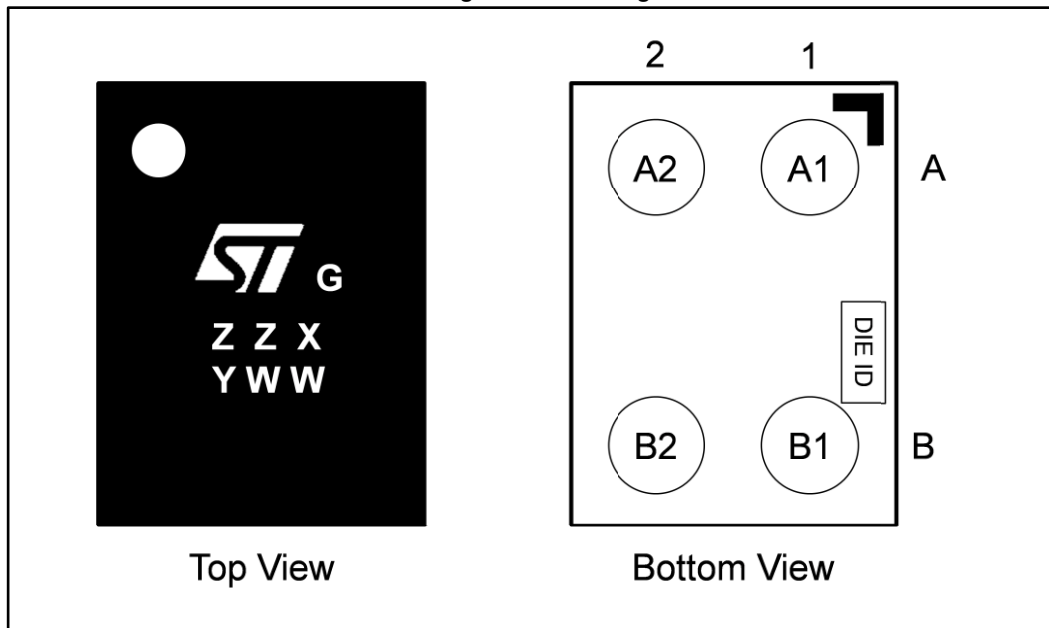
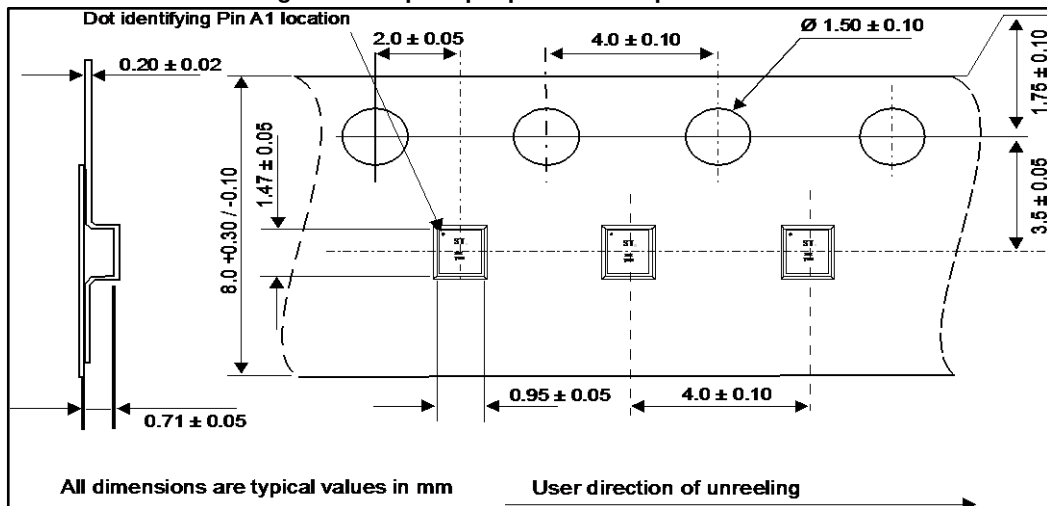


Table 5: Document revision history

Ball	Name	Description
A1	ANT	Antenna connection
A2	GND	Ground
B1	Rx_P	Balun receive positive output
B2	Rx_N	Balun receive negative output

Figure 28: Flip Chip tape and reel specifications



More packing information is available in the application note:

- AN2348 Flip-Chip: "Package description and recommendations for use"

5 Ordering information

Table 6: Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
BALF-NRG-01D3	SV	Flip-Chip package (4 bumps)	1.35 mg	5000	Tape and reel (7")

6 Revision history

Table 7: Document revision history

Date	Revision	Changes
17-Jun-2014	1	Initial release.
17-Jul-2014	2	Updated Figure 13, Figure 17, Figure 22 and package view on cover page. Corrected typo error on Table 2.
18-Aug-2014	3	Updated title and description in cover page.
29-Sep-2015	4	Updated Figure 22. Added Figure 25 and Figure 26. Reformatted to current standards.
04-May-2017	5	Updated Figure 2: "Application schematic with WLCSP type BlueNRG" .

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