

**Johanson Technology Impedance Matched Balun Filter Integrated Passive for
Nordic's nRF24L01 and nRF24L01+ Chipsets**

November 2009 (Last update: 06/13/2012)

1. Introduction

The nRF24L01/nRF24L01+ from Nordic Semiconductor is a 2.45GHz one chip, ultra low power transceiver.

Johanson Technology's, 2450BM14A0002 LPF-Balun was specifically designed for use with the nRF24L01/nRF24L01+ chipsets. This matched balun greatly simplifies the RF front-end by considerably reducing component count, system variability, implementation size area, and PCB sensitivity.

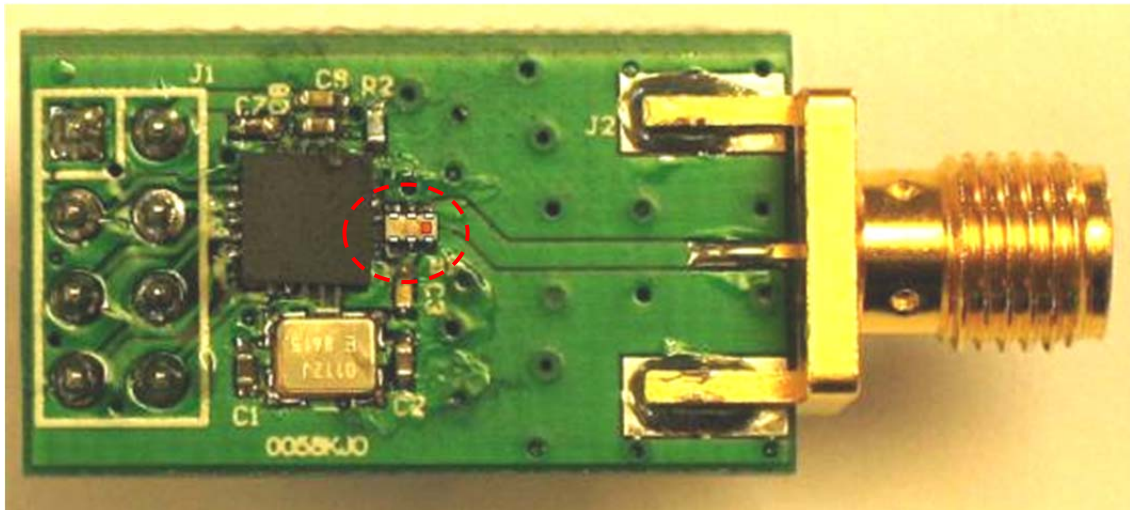


Figure 1. Component picture.

The 2450BM14A0002 is an SMD six-pin LTCC device with a small foot print of only 1.6 mm x 0.8 mm (EIA 0603).

2. Description of the Reference Design

Johanson Technology has developed a solution with a chip Balun-Harmonic filter integrated passive component that is especially matched for the nRF24L01/nRF24L01+ ICs, the 2450BM15A0002, shown in Figure 1.

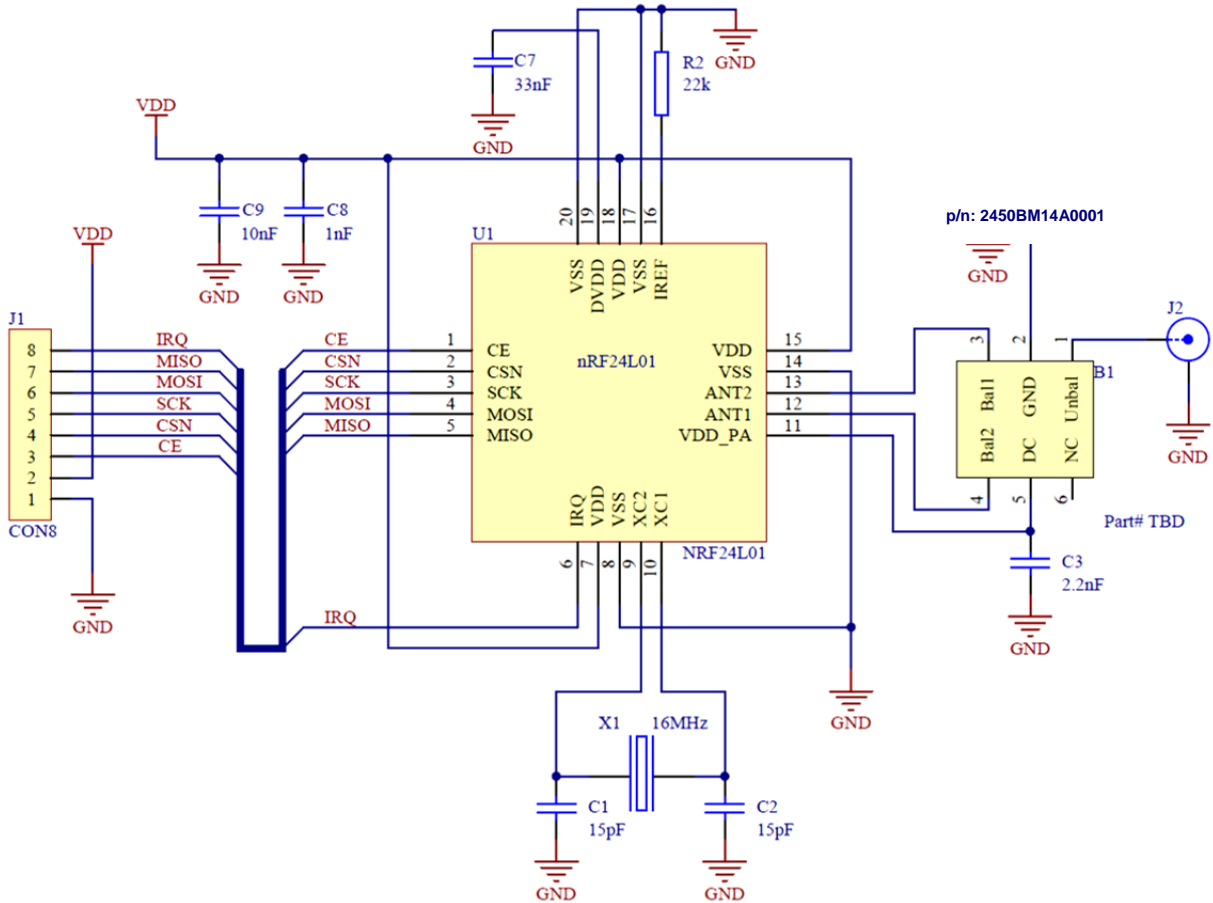


Figure 2. Integrated Reference Design
 The rightmost is the JTI matched balun 2450BM14A0002.

Please refer to Appendix A for the datasheet of the balun filter component. For more updated information from the Johanson Technology web site at:
<http://johansontechnology.com/nordic>

The traditional reference design for RF balun has been the discrete solution shown in Figure 2.

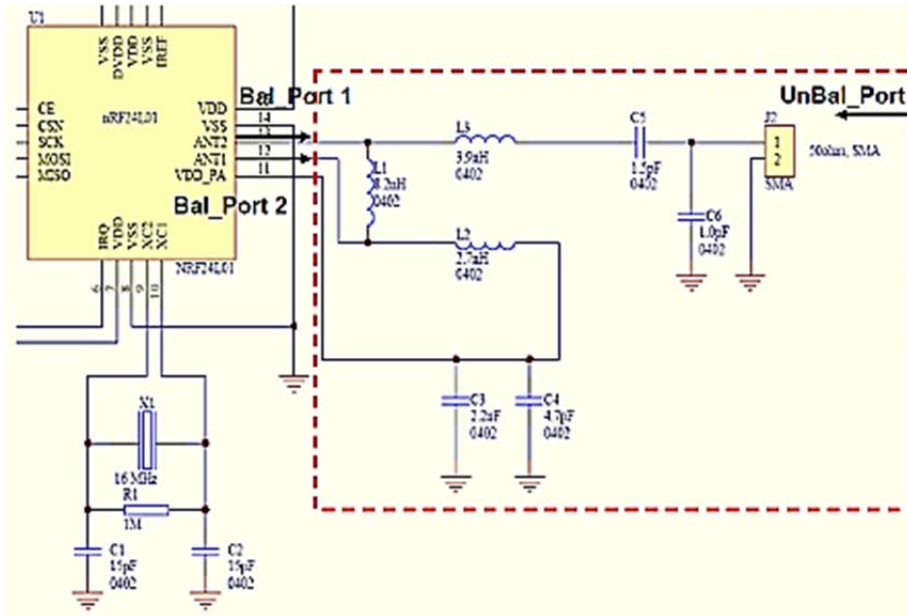


Figure 2. Discrete Reference Design

3. Layout

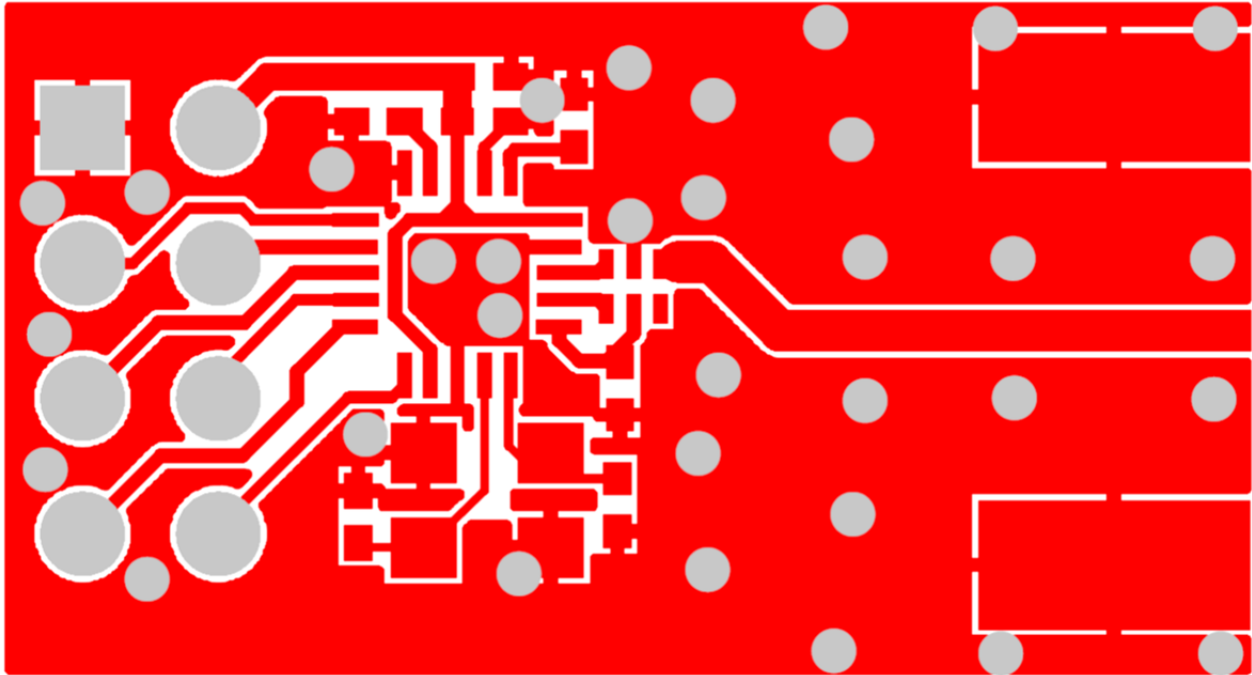


Figure 3. Layer 1 of the Reference Design Layout

In the event that the reference design can not be copied, then the routing from the RF pins ANT1 and ANT2 must be symmetrical to the matched balun component, 2450BM14A0002. The length of the tracks should be kept to a minimum and preferably the same length and width that are used in the reference design. If this routing is not symmetrical, then the output power may be reduced and the harmonics may increase.

The component placement influences the RF performance. It is recommended that the reference PCB layout be copied as closely as possible. In particular, the designer should make note of all dimensions between the nRF24L01/nRF24L01+ and 2450BM14A0002.

4. Measurement Results

All results presented in this chapter are based on measurements performed with nRF24L01/nRF24L01+ and 2450BM14A0002 Reference Design board. All measurement results presented are the average of each batch tested from typical devices.

Johanson’s 2450BM14A0002 Harmonic Filter - Balun offers improved suppressed 2nd and 3rd harmonics, it eases implementation and increases margin to FCC/ETSI compliance when compared to solution with discrete passives.

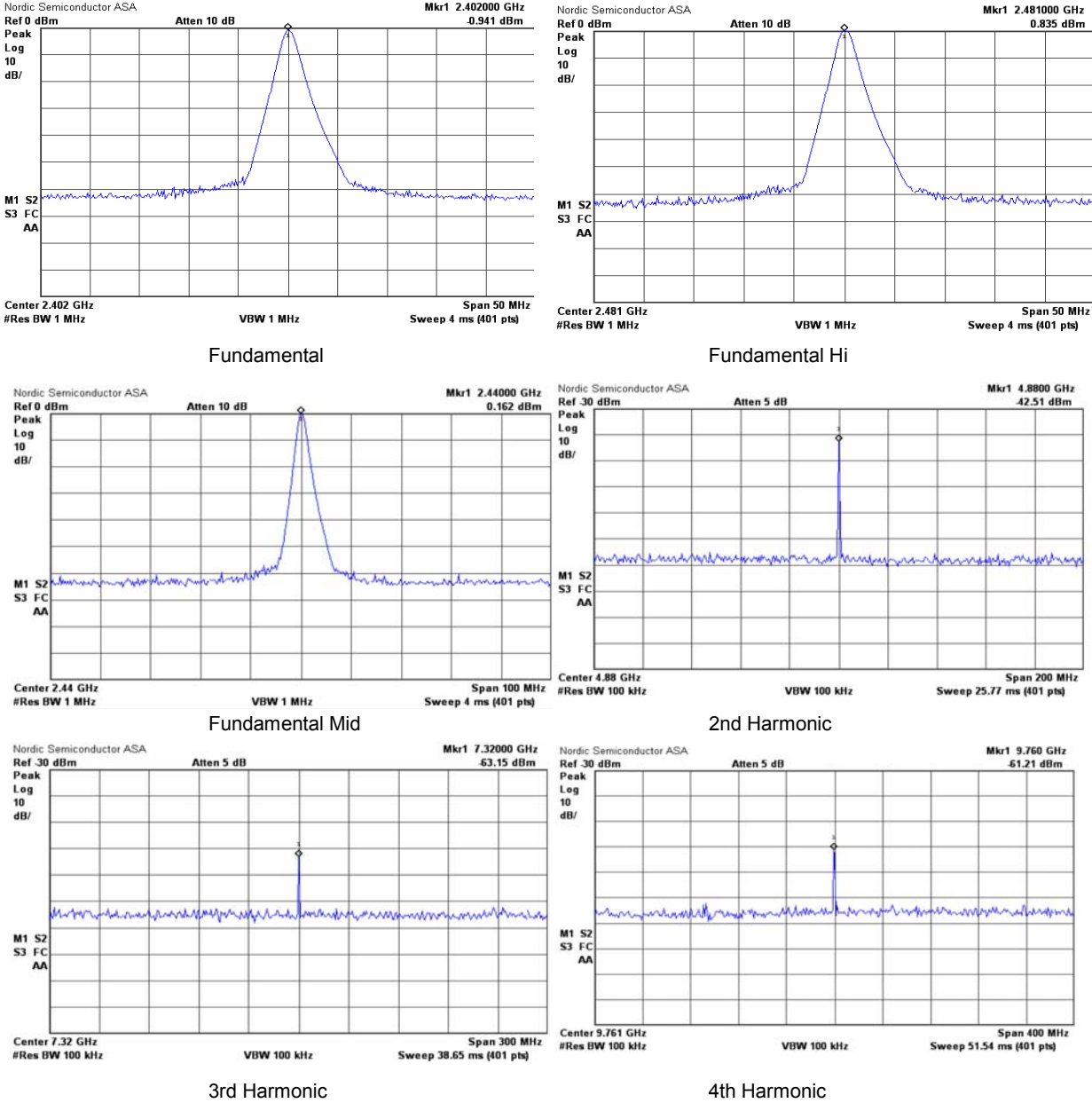
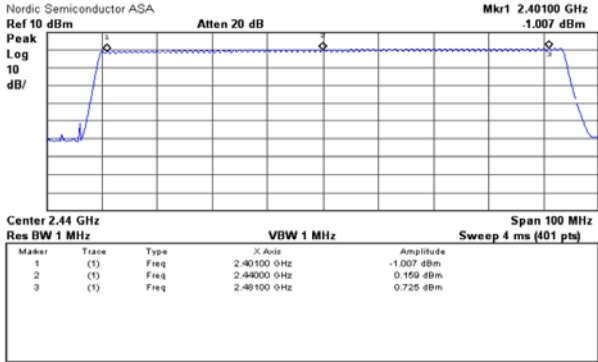
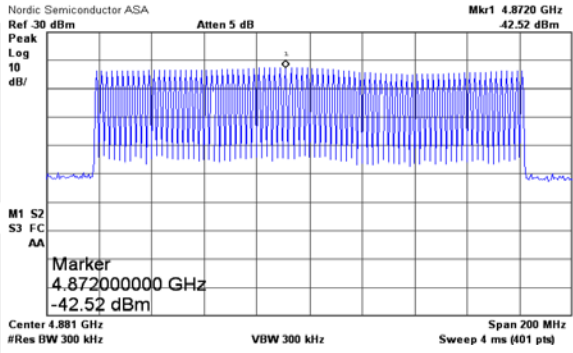


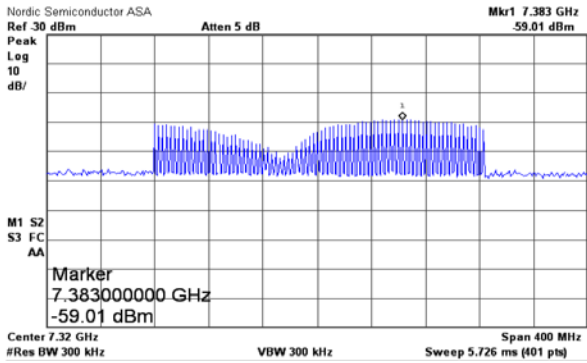
Figure 4. Active Measurement Results



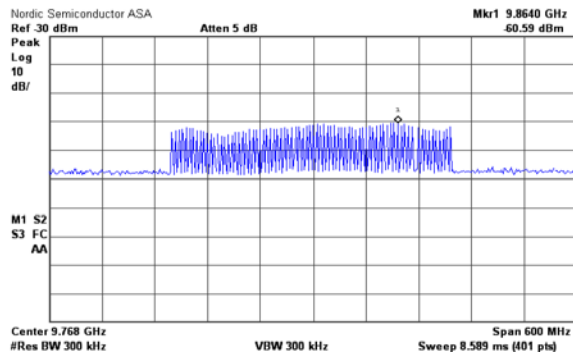
Carrier Sweep



2nd Harmonic Sweep



3rd Harmonic Sweep



4th Harmonic Sweep

Figure 5. Sweep Measurement Results

Appendix A

High Frequency Ceramic Solutions

2.45 GHz Impedance Matched Balun-Filter: Optimized for Nordic's Chipset nRF24L01, nRF24L01+, nRF24LE1, nRF24LU1, nRF24AP2, and nRF8001 P/N 2450BM14A0002
 Detail Specification: 6/13/2012 Page 1 of 2

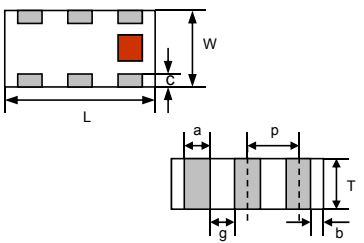
General Specifications	
Part Number	2450BM14A0002
Frequency (MHz)	2400 - 2500
Unbalanced Impedance	50 Ω
Differential Balanced Impedance	Imp. Conjugate match to Nordic nRF24L01, nRF24L01+, nRF24LE1, nRF24LU1, nRF24AP2, and nRF8001
Attenuation: Differential Mode	15 min. @4800~5000MHz 15 min. @7200~7500MHz
Attenuation: Common Mode	20 min. @4800~5000MHz

Insertion Loss	2.0 dB max.
Return Loss	9.5 dB min.
Phase Difference	160° ± 15°
Amplitude Difference	3.5 ± 1.5 dB
Reel Quantity	4,000
Operating Temperature	-40 to +85°C
Recommended Storage Conditions	+5 to +35°C, Humidity: 45-75%RH, 18 mos. Max

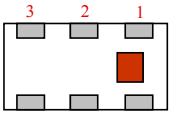
Part Number Explanation			
P/N	Packaging Style*	Bulk	Suffix = S Eg. 2450BM14A0002S
		T & R	Suffix = T Eg. 2450BM14A0002T
Suffix	Termination Style	100% Tin	Suffix = None Eg. 2450BM14A0002(T or S)
		Tin / Lead	Please consult Factory

For more packaging info go to: <http://www.johansontechnology.com/ipcpackaging.html>

Mechanical Dimensions		
	In	mm
L	0.063 ± 0.004	1.60 ± 0.10
W	0.031 ± 0.004	0.80 ± 0.10
T	0.024 ± 0.004	0.60 ± 0.10
a	0.008 ± 0.004	0.20 ± 0.10
b	0.008 +.004/-.006	0.20 +0.1/-0.15
c	0.006 ± 0.004	0.15 ± 0.10
g	0.012 ± 0.004	0.30 ± 0.10
p	0.020 ± 0.002	0.50 ± 0.05



Terminal Configuration	
No.	Function
1	Unbalanced Port
2	GND
3	Balanced Port
4	Balanced Port
5	DC Feed+RF GND or GND
6	NC



Mounting Considerations

Mount these devices w with maroon mark facing up.

* Line width should be designed to provide 50 Ω impedance matching characteristics.

Nordic Chipset

Units: mm

2.2nF Capacitor**

Solder Resist

Land

Through-hole (φ 0.35)

**Use this cap when utilizing with DC Feed

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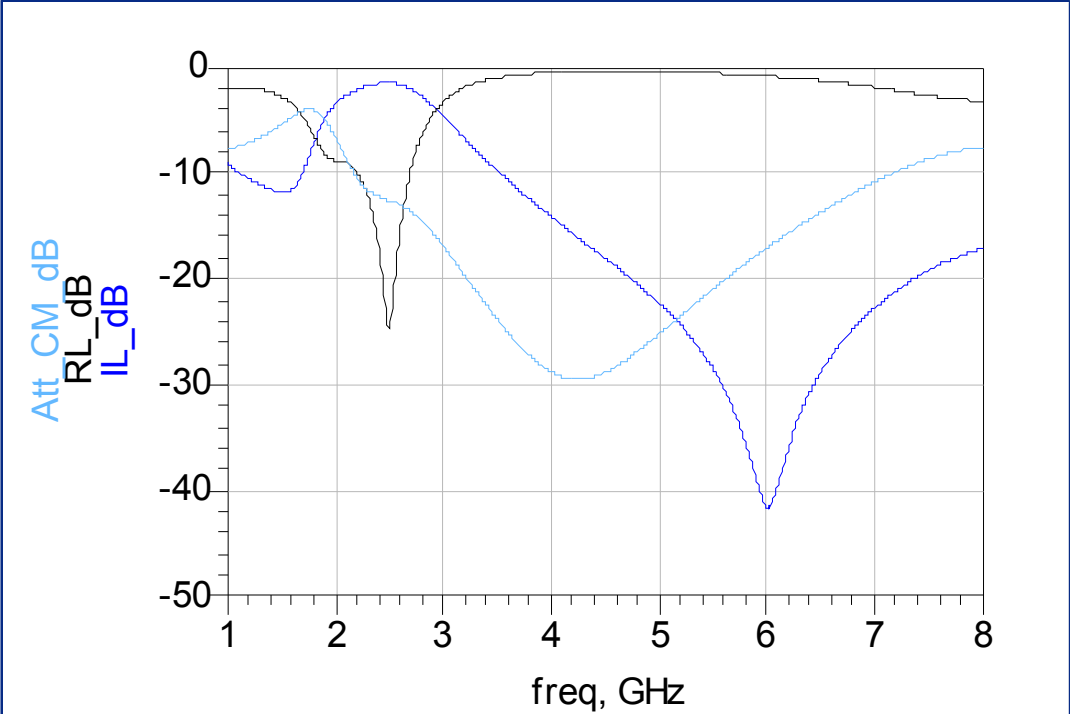
High Frequency Ceramic Solutions

2.45 GHz Impedance Matched Balun-Filter: Optimized for Nordic's Chipset nRF24L01, nRF24L01+, nRF24LE1, nRF24LU1, nRF24AP2, and nRF8001 P/N 2450BM14A0002

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Typical RF Electrical Performance (T=25°C)



For reference design notes and additional technical info please visit our Nordic Semiconductor dedicated page at:

<http://johansontechnology.com/nordic>

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The latest specification can be downloaded from the following link:

<http://johansontechnology.com/nordic>