AN11035

50 Ohm FM LNA for embedded Antenna in Portable applications with BGU7003W

Rev. 1.0 — 15 July 2011 Application note

Document information

Info	Content
Keywords	BGU7003W, LNA, FM, embedded Antenna
Abstract	The document provides circuit, layout, BOM and performance information on FM band using BGU7003W

Revision history

Rev	Date	Description
1.0	20110715	Initial document

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1. Introduction

„Music" as mobile value proposition has become increasingly popular in recent years. Transferring MP3 from the PC and playing on the mobile is now common, eased by decline in memory prices. This trend has re-ignited interest in FM Radio on Mobile as people want to keep up with the news, listen to new music, in addition to playing their MP3 collection.

With NXP„s FM LNA"s consumers can listen to FM Radio on their mobile phone speaker. They amplify the weak signal solving impedance mismatch between embedded antennas and the FM Radio receiver.

2. Application Circuit

The FM LNA application circuit is built with BGU7003W (LNA MMIC). It needs 10 (11 components used in the EVB) external components for matching, biasing and decoupling. The layout has also additional foot print for 0402 components, those are reserved for different applications or ESD protection and matching purpose.

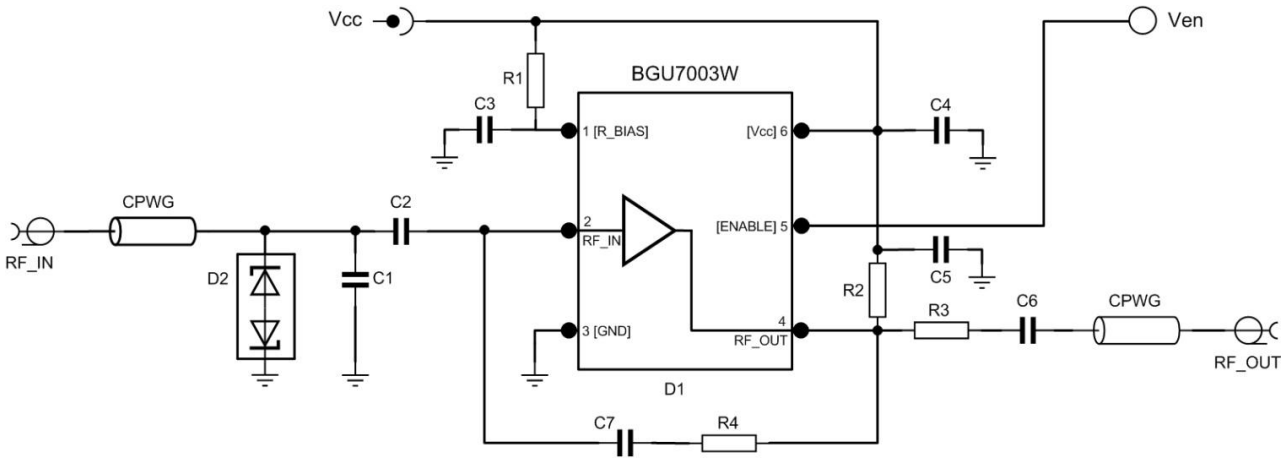

Fig 1. 50 Ohm FM LNA schematic

2.1 Components

Table 1. Bill of materials

Component	Position on Layout	Value	Unit	Type	Remark
C1	Z3	0.56	pF	MurataGRM1555	Stability (in case of using D2, C1 is not necessary)
C2, C6, C7	Z4, Z15, Z8	330	pF	MurataGRM1555	DC blocking
C3, C5, C4	Z6, Z9, Z20	47	nF		DC decoupling (C4 is not necessary)
R1	Z7	4.7	kΩ		Bias setting
R2	Z11	180	Ω		Stability / Matching
R3	Z13	10	Ω		Stability
R4	Z12	680	Ω		Feedback / Matching
	Z1, Z16, Z19, Z21	0	Ω		Jumper Reserved for ESD & matching
	Z5, Z10, Z14, Z17, Z18	NC			Not connected Reserved for ESD & matching
D1	D1			BGU7003W	
D2	Z2			PESD5V0F1BL	ESD Diode (optional)

2.2 PCB Layout

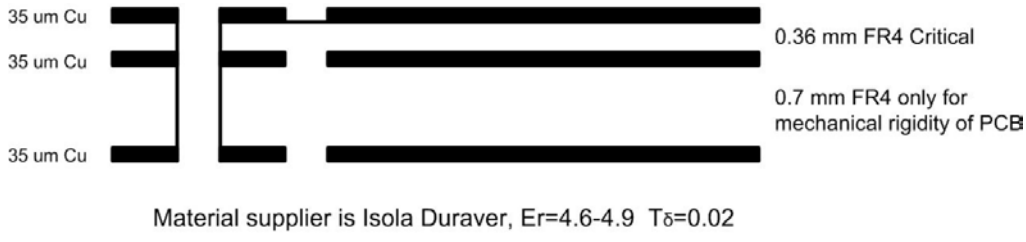

Fig 2. PCB material stack

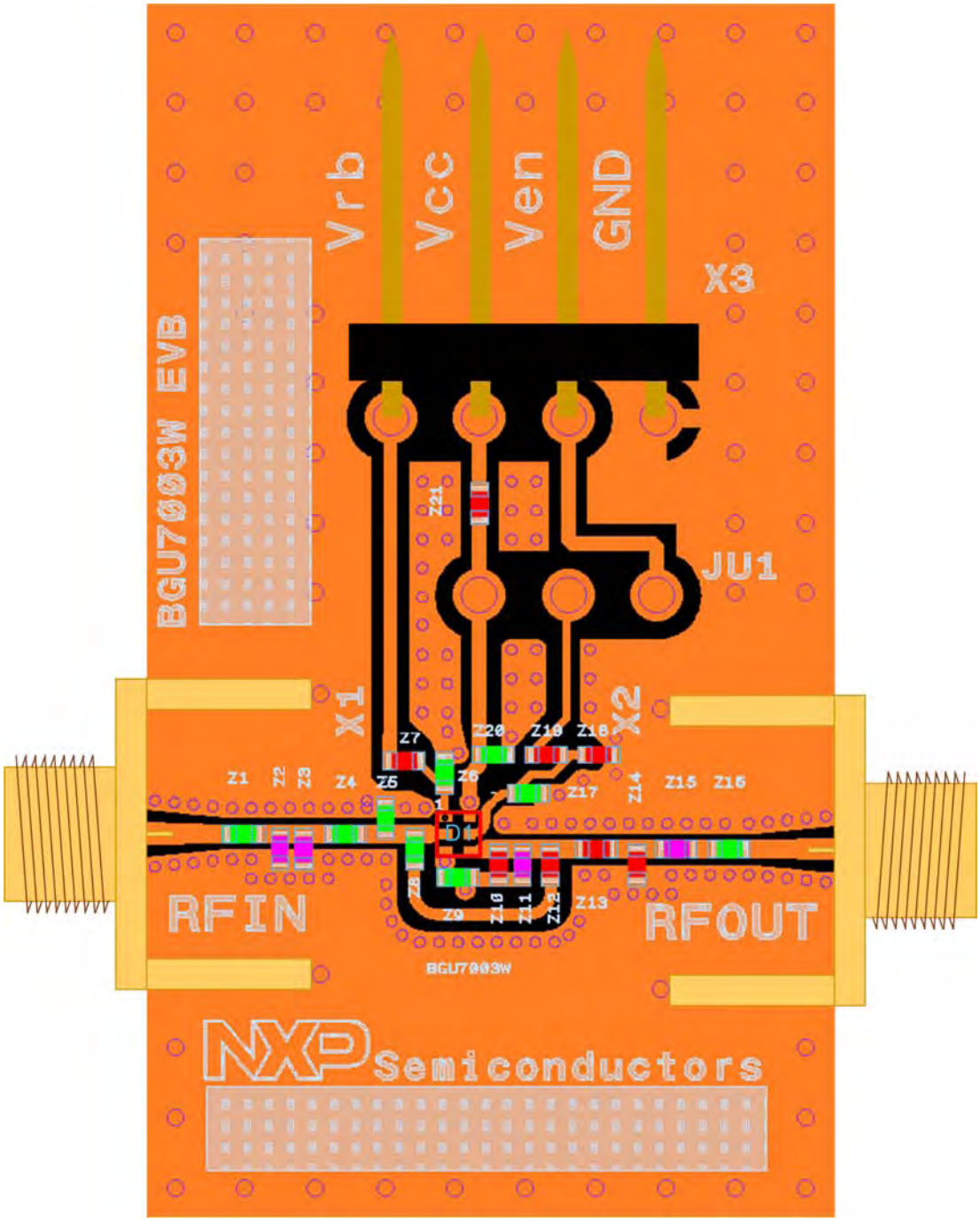

Fig 3. Layout and assembly

3. Measurement results

3.1 Measurement results

Table 2. Typical measurement results measured on the evaluation board

Tamb = 25 °C; Vcc = Ven = Vrb = 2.8 V; $I_{CC(tot)}$ = 4.3 mA [1]; f = 100 MHz; $Z_S = Z_L$ = 50 Ω unless otherwise specified. All measurements are done with SMA-connectors as reference plane.

Parameter	Symbol	Value	Unit	Remark
supply voltage	Vcc	2.8	V	
supply current	Icc [1]	4.3	mA	
noise figure	NF	1.5	dB	
insertion power gain	$\lvert S21 \rvert^2$	15	dB	
input return loss	RL_{in}	9	dB	
output return loss	RL_{out}	14	dB	
input power at 1 dB gain compression	$P_{i(1dB)}$	-20	dBm	
output power at 1 dB gain compression	$P_{o(1dB)}$	-6	dBm	
input third-order intercept point	$IP3_I$ [2]	-12.5	dBm	
output third-order intercept point	$IP3_O$ [2]	2.5	dBm	

[1] $I_{CC(tot)} = I_{CC} + I_{RF\_OUT} + I_{R\_BIAS}$

[2] The third order intercept point is measured at -30 dBm per tone at RF_IN (f_1 = 100 MHz; f_2 = 100.2 MHz)

3.2 Graphs

All the measurements have done on the application board. The reference planes for the measurements are the SMA-connectors on the application board.

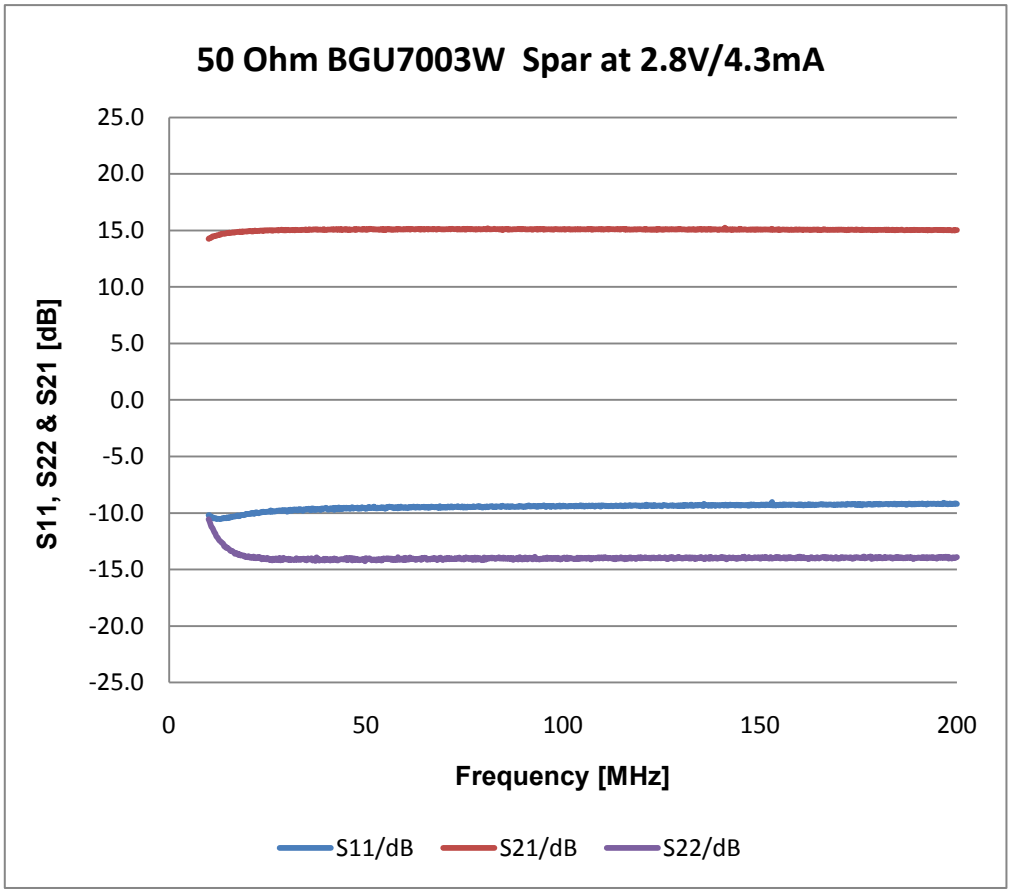

Fig 4. Gain, Input and Output Matching

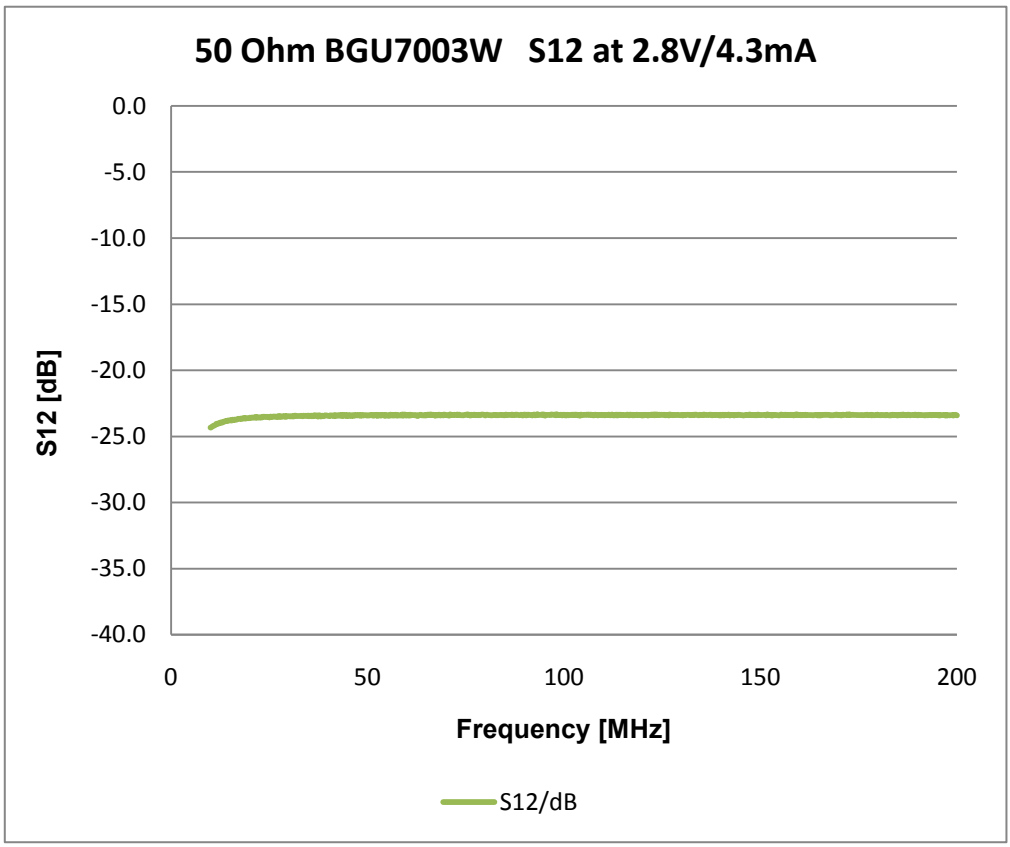

Fig 5. Isolation

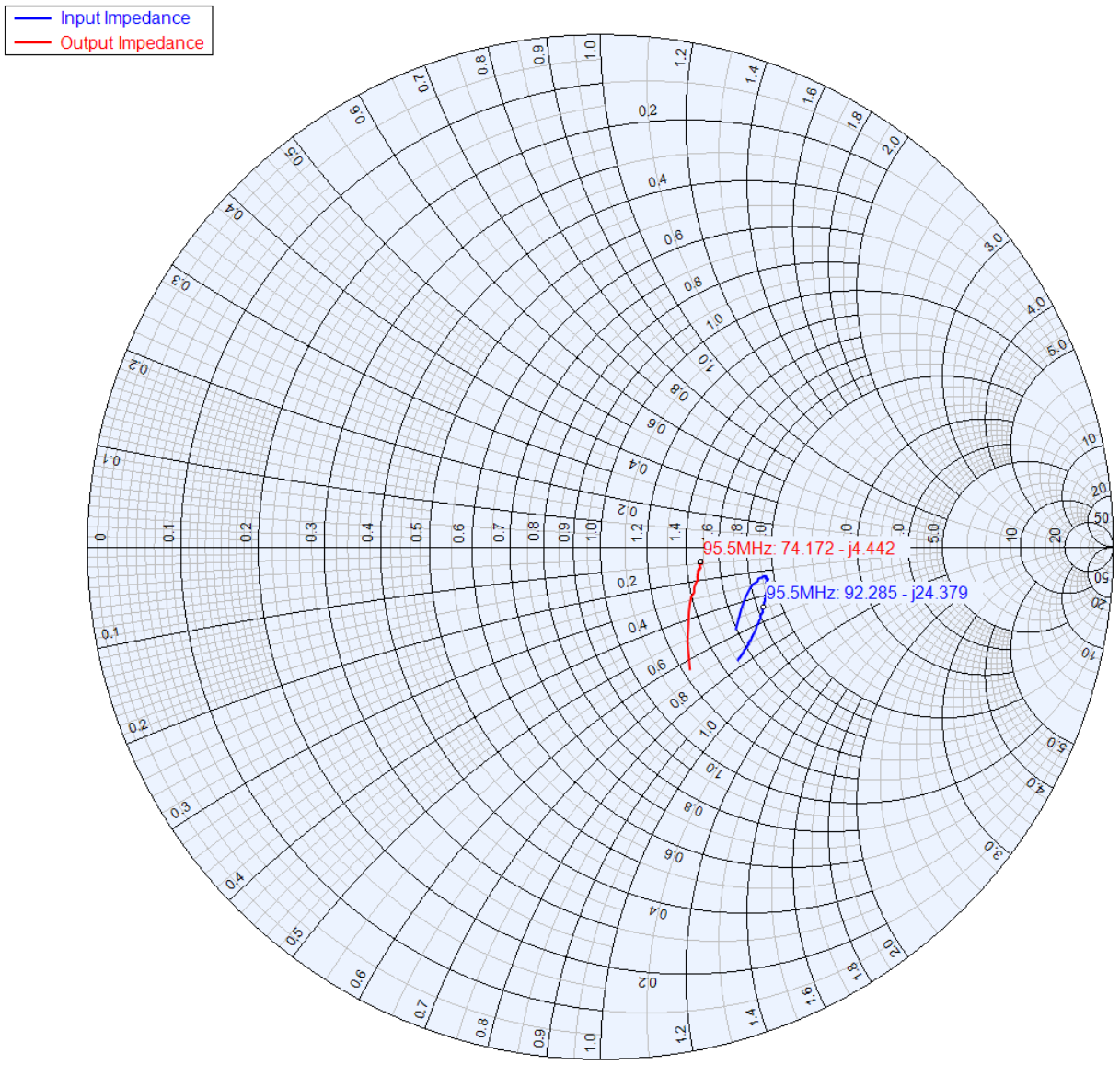

Fig 6. Input and Output Impedance

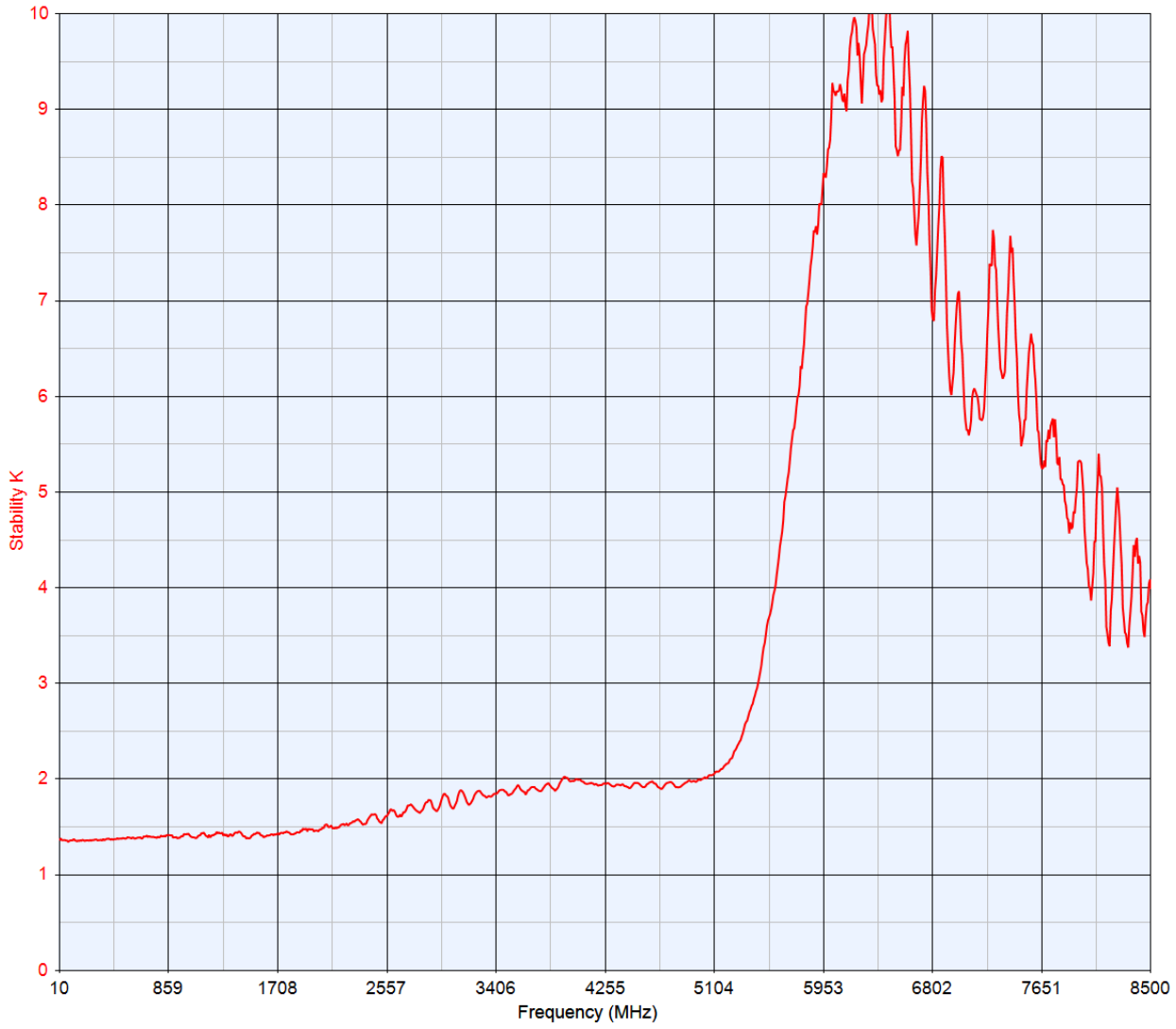

Fig 7. Stability

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Date of release: 15 July 2011
Document identifier: AN11035