

TDK-EPC Corporation's Balanced Band Pass Filter and Chip Antenna for Texas Instruments CC2530 ZigBee Transceiver

June 2011

1. Introduction

The CC2530 from Texas Instruments is a single chip solution for 2.4GHz IEEE 802.15.4/RF4CE / Zigbee. To function in an end user application this IC requires a Balanced Band Pass Filter (Bal-BPF) and TDK has developed a perfectly matched part to meet this requirement. The Part Number for this Bal-BPF is DEA202450BT- 210A1. This Bal-BPF contributes to the reduction in the number of components and the PCB area. Moreover, consistent RF characteristics can be achieved with this Bal-BPF in mass production. Project collateral discussed in this document can be downloaded from the following URL: <http://www.ti.com/lit/zip/SWRA378>.

2. Reference Design

Discrete solution for CC2530 is shown in Figures 1 and 3.

TDK's Bal-BPF solution using LTCC technology is shown in Figures 2 and 4..

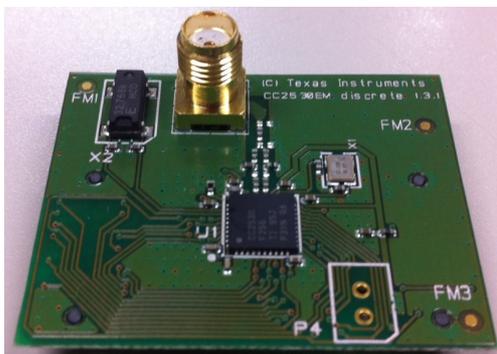


Figure 1. Photo of the discrete solution.



Figure 2. Photo of TDK filter solution

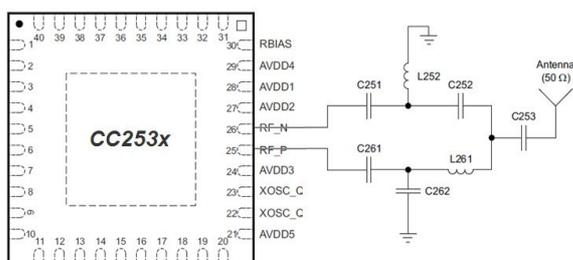


Figure 3. Discrete ref design for the CC2530

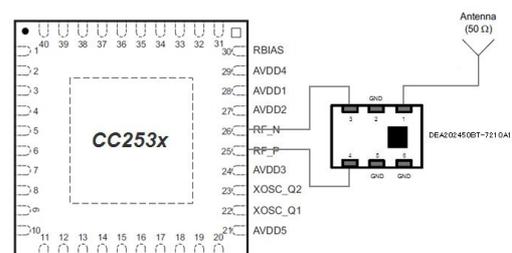


Figure 4. DEA202450BT- 210A1 for the CC2530

Easy to Place on PCB

The following layout is the evaluation board by Texas Instruments. (Figure 5)

The main RF circuit can be achieved with just the IC and the TDK filter optimized to TI CC253x series. With this easy to implement solution the PCB design time is greatly reduced..

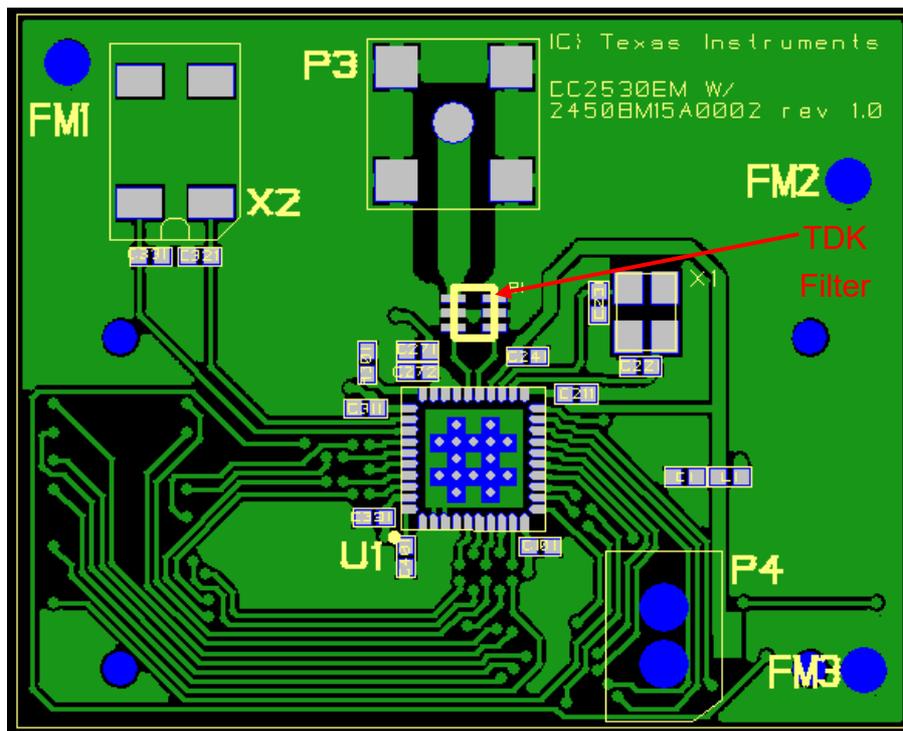


Figure 5. Texas Instruments CC2530 evaluation board with TDK DEA202450BT- 210A1

3. Measurement Result

Here we show a comparison of the results with a discrete LC solution and the TDK Bal-BPF (DEA202450BT- 210A1). All measurement data is supported by Texas Instruments .

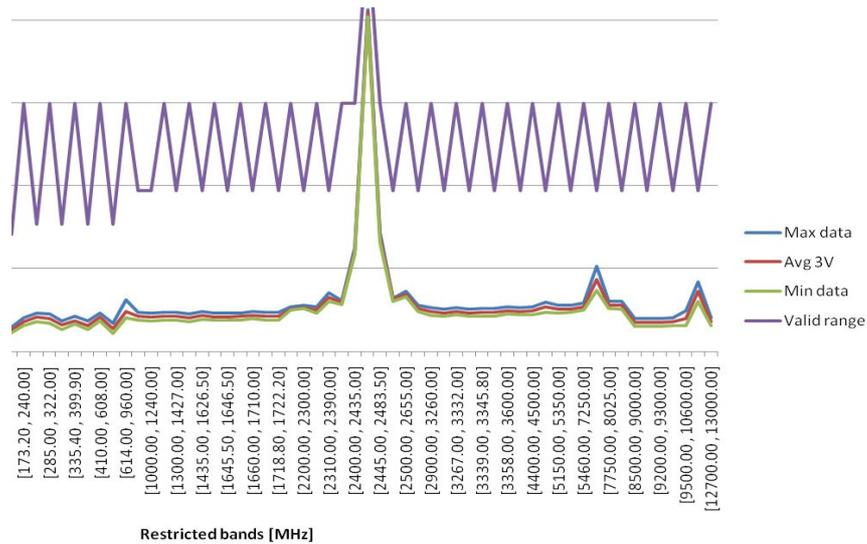
As you can see in the test result, spurious emission within FCC restricted band and harmonics level at $2f_0$ and $3f_0$ were decreased by using the TDK Bal-BPF (DEA202450BT- 210A1).

This TDK balanced filter helps to satisfy FCC/ETSI compliance.

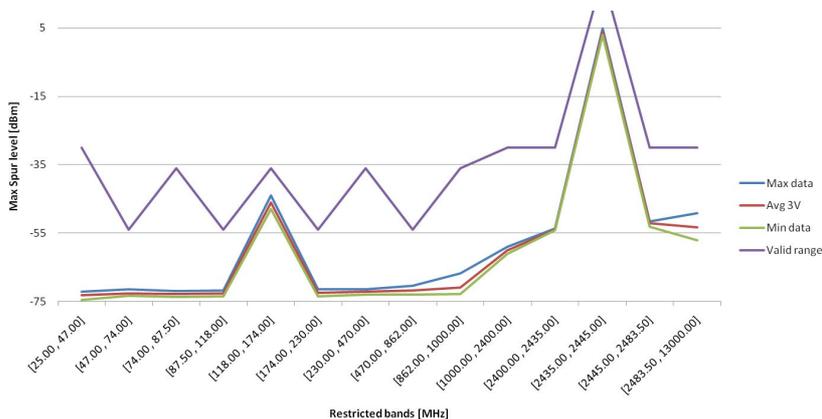
Overview

	CC2530 discrete reference design	CC2530 w/DEA202450BT- 7210A1
PER =1% as specified by [1] [1] requires -85dB	-97	-97 dBm
Delivered to a single ended 50 load through a balun using max recomended output setting (0xF5) [1] requires minimum -3dBm	4.5	4.0 dBm
25MHz-1000MHz (outside restricted bands)	-60	-70 dBm
25MHz-2400MHz (within FCC restricted bands)	-60	-71 dBm
25MHz-1000MHz (within ETSI restricted bands)	-60	-70 dBm
1800-1900MHz (ETSI restricted band)	-57	-67 dBm
5150-5300MHz (ETSI restricted band)	-55	-66 dBm
At 2xfc and 3xfc (FCC restricted band)	-42	-63 dBm
At 2xfc and 3xfc (ETSI EN 300-440 and EN300-328)	-31	-53 dBm
At 2483.5MHz and above (FCC restricted bands) fc=2480MHz	-42	-68 dBm

Spurious Emission (within FCC restricted bands)



Spurious Emission (ETSI EN 300-440)



4. Filter Specification

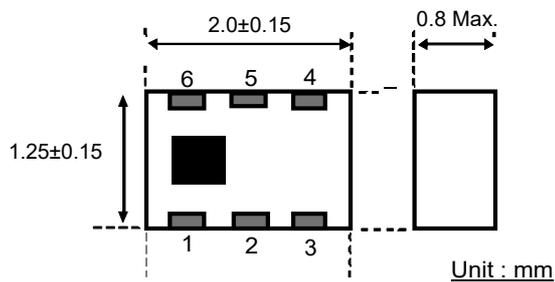
Multilayer Band Pass Filter (Balance output type)

P/N : **DEA202450BT-7210A1**

For Zigbee

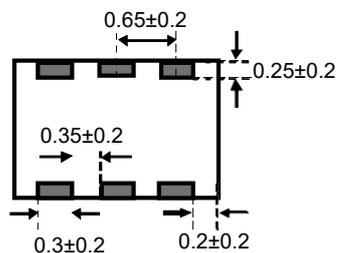
MECHANICAL DIMENSIONS

Top View



PIN ASSIGNMENT	PIN No.
Unbalanced port	1
Balanced port1	3
Balanced port2	4
GND	2,5,6

Bottom View

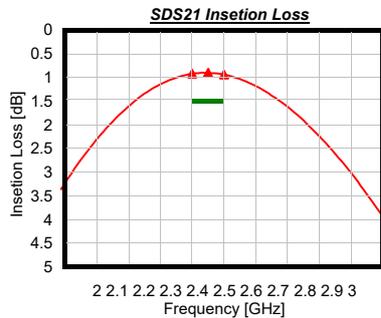


ELECTRICAL CHARACTERISTICS

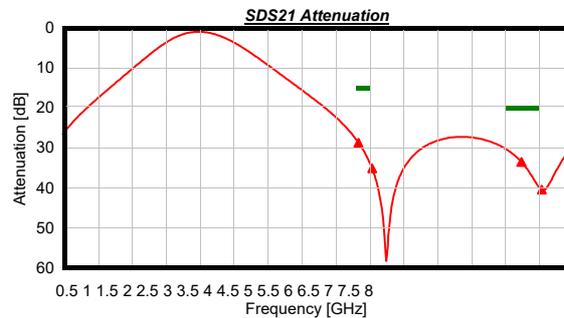
Parameter	Frequency	Specifications	Unit
Unbalanced Port Characteristics Impedance		50 (Nominal)	ohm
Balanced Port Characteristics Impedance		Matched to TI CC253x series	ohm
Insertion Loss	2400 – 2500 MHz	1.5 Max.	dB
Attenuation(Differential Mode)	4800 – 5000 MHz	15 Min.	dB
	7200 – 7500 MHz	20 Min.	dB
In/Out Return Loss		10 Min.	dB
Phase Difference at Balanced Port		180+/-15	deg
Amplitude Imbalance at Balanced Port		0+/-2	dB

FREQUENCY CHARACTERISTICS

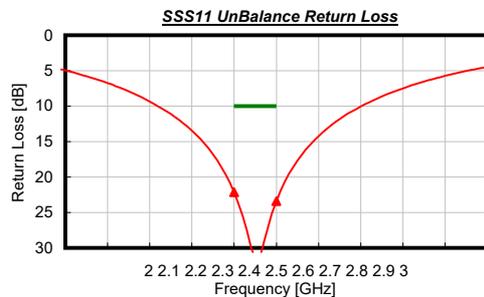
SPEC



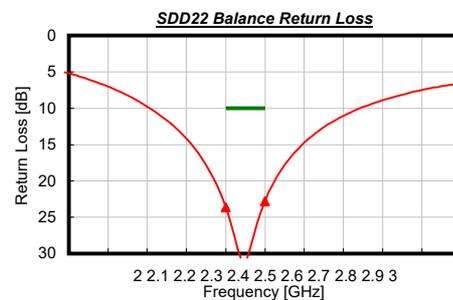
2.400	GHz
0.93	dB
2.450	GHz
0.91	dB
2.500	GHz
0.95	dB



0.824	GHz
19.60	dB
0.960	GHz
17.53	dB
4.800	GHz
28.72	dB
5.000	GHz
35.17	dB
7.200	GHz
33.52	dB
7.500	GHz
40.44	dB



2.400	GHz
22.16	dB
2.450	GHz
31.52	dB
2.500	GHz
23.42	dB



2.400	GHz
23.65	dB
2.450	GHz
31.19	dB
2.500	GHz
22.80	dB

More detail specification can be downloaded from the following link:

[http://www.tdk.co.jp/tefe02/e_21_multibpf_balance_dea0 .pdf](http://www.tdk.co.jp/tefe02/e_21_multibpf_balance_dea0.pdf)

5. Antenna

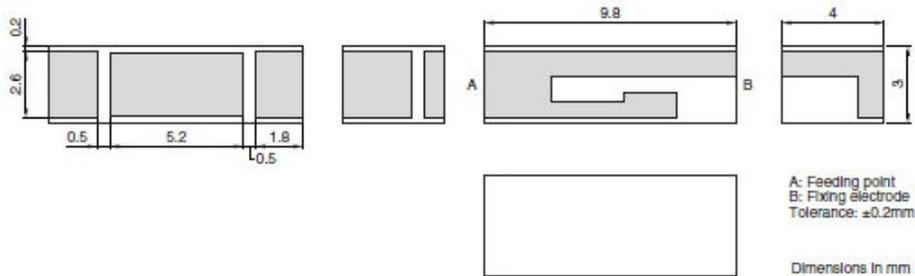
TDK has various ceramics antennas. One of them, ANT0 8030CGS2442MB1 ceramic chip antenna, is suitable for use with the CC2530 from Texas Instruments and will allow the end user to achieve stable characteristics. This ceramic chip antenna (ANT0 8030CGS2442MB1) and Balanced BPF (DEA202450BT- 210A1) will help the end user to get the best from the TI IC.

Ceramic Chip Antennas For 2.4GHz ISM band

Conformity to RoHS Directive

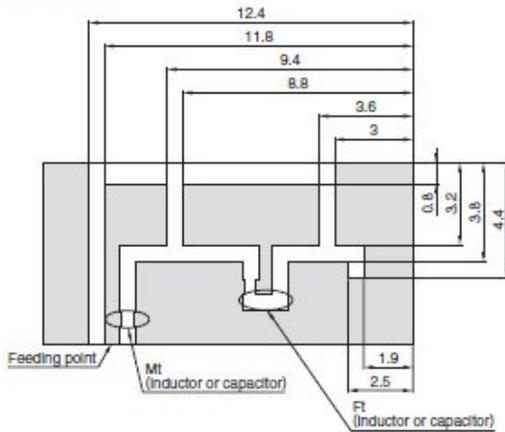
ANT Series ANT098030CGS2442MB1

SHAPES AND DIMENSIONS

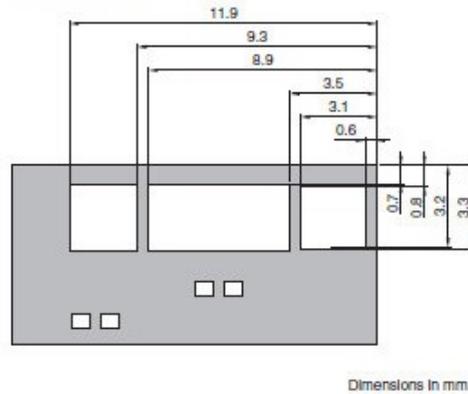


RECOMMENDED PC BOARD PATTERNS

ELECTRODE



SOLDER RESIST

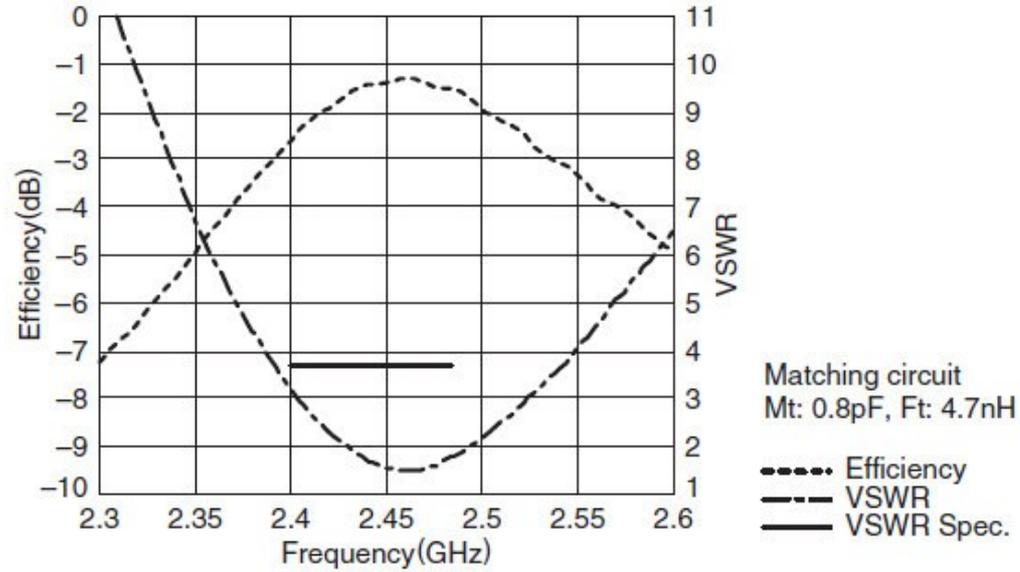


ELECTRICAL CHARACTERISTICS

Center frequency(F_0)	2442MHz	
Band width(BW)	$F_0 \pm 42\text{MHz}$	
VSWR(at BW)	3.7max.	
Polarization	Linear	
Impedance	50Ω	
PCB size	$80 \times 37 \times 1.0\text{mm}$	
Temperature range	Operating	-40 to $+85^\circ\text{C}$
	Storage	-40 to $+85^\circ\text{C}$

- This is typical antenna performance with the standard PCB.

**FREQUENCY CHARACTERISTICS
EFFICIENCY AND VSWR**



More detail specification can be downloaded from the following link:

http://www.tdk.co.jp/tefe02/e821_die_ant03.pdf

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