Never stop thinking

Bipolar-Wizard
User Guide

For
TDA520X, TDA521X, TDA522X,
TDA7200, TDA7210 and TDA7210V

User Guide

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Wireless Control

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1 Introduction

This Bipolar Wizard is an Excel-based simulation tool to support your design with Infineon's bipolar receiver, products (TDA520X, TDA521X, TDA522X, TDA7200, TDA7210 and TDA7210V). You are able to enter certain parameters and conditions of your application and design (e.g. IC-type, Modulation, Data-Rate …). Based on the given information, you will get a result of some proposed values for the Data-Filter capacitors, capacitor for generating the slicing level, etc...
This will help you start your design with reasonable values of some critical external components and shorten the time-to-market of your final RF design.

2 Description of the User-Interface

Before starting the Wizard the Micros have to be enabled. Usually the Security Warning: “Macros have been disabled” appears (see Figure).
To enable the Excel Macros, press the Options button near the top of the sheet (see Figure) and then choose “Enable this content” (see Figure). Then a window named “**Select a wizard**” (see Figure 4: Select a wizard) will appear. Next you can choose a wizard by clicking on it and pressing the start button. With the Button Cancel you can close the User-Interface.

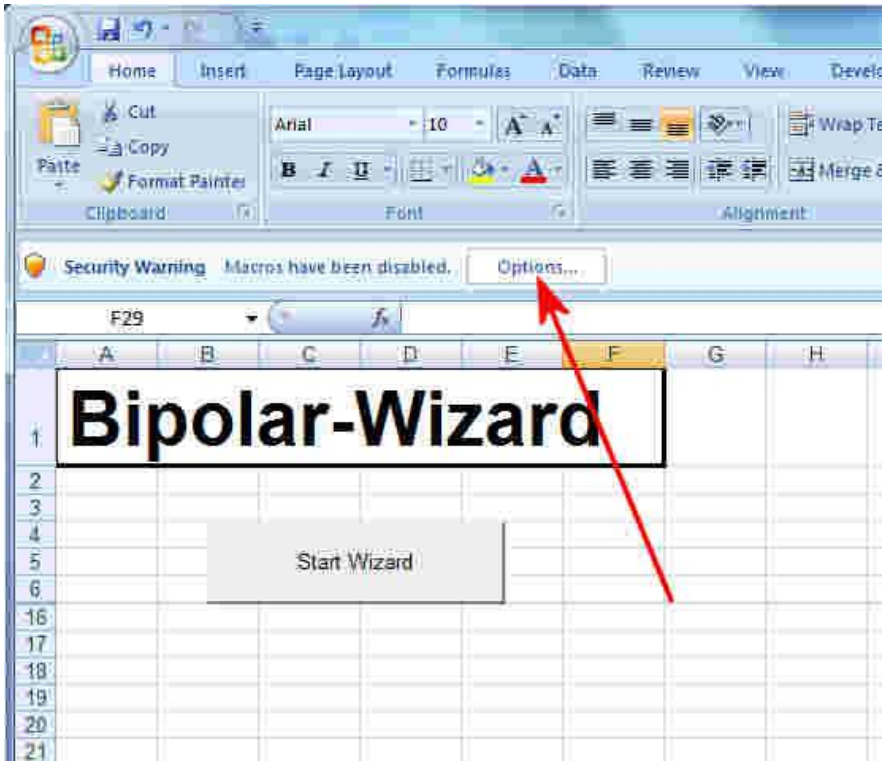


Figure 1: Security Warning

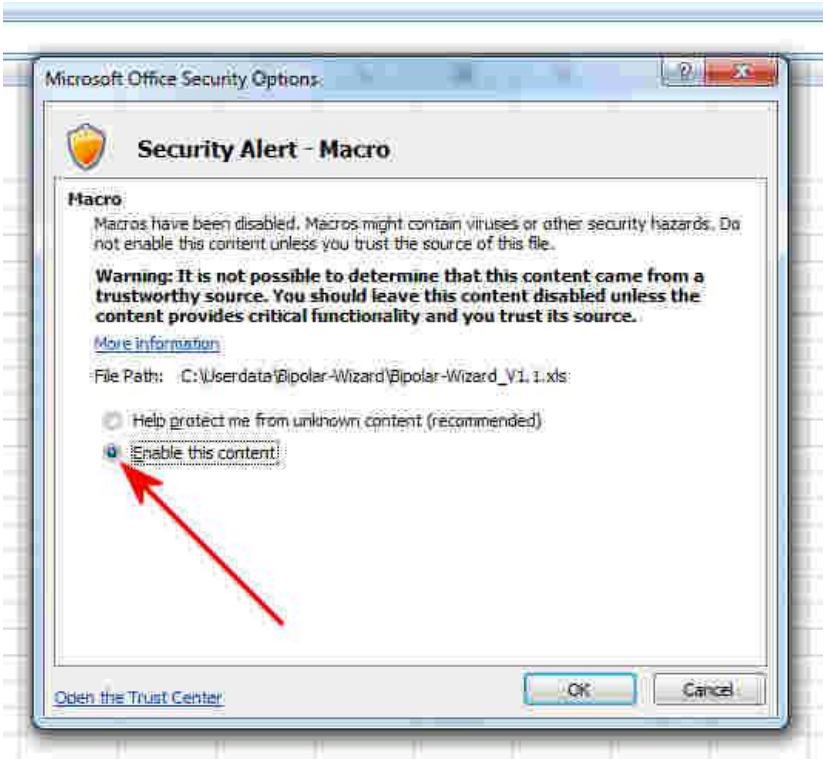


Figure 2: Enable Macros

The User-Interface is started by clicking on the „Start Wizard“ button (see Figure 3: Starting User-Interface of “Bipolar Wizard”).

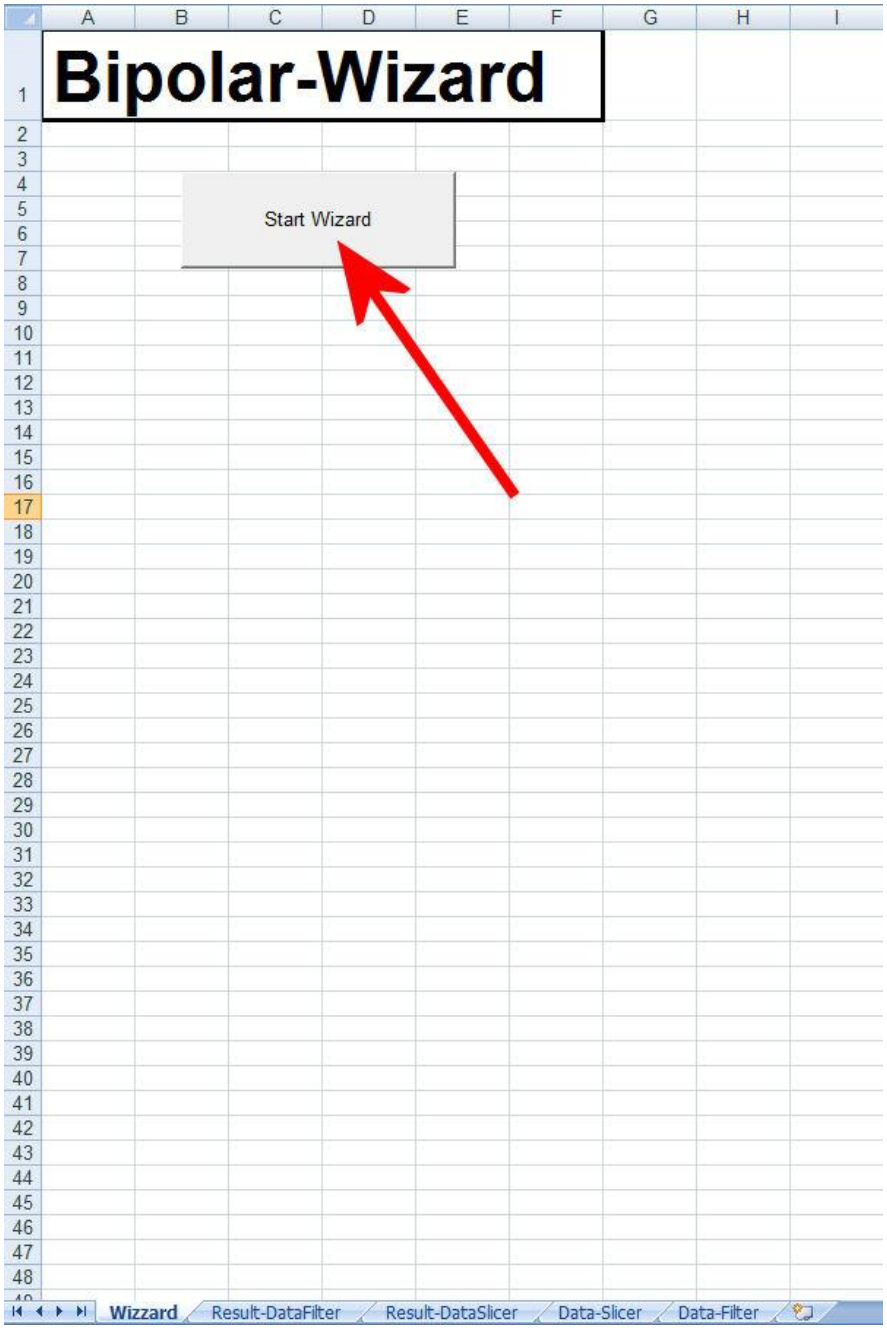


Figure 3: Starting User-Interface of “Bipolar Wizard”

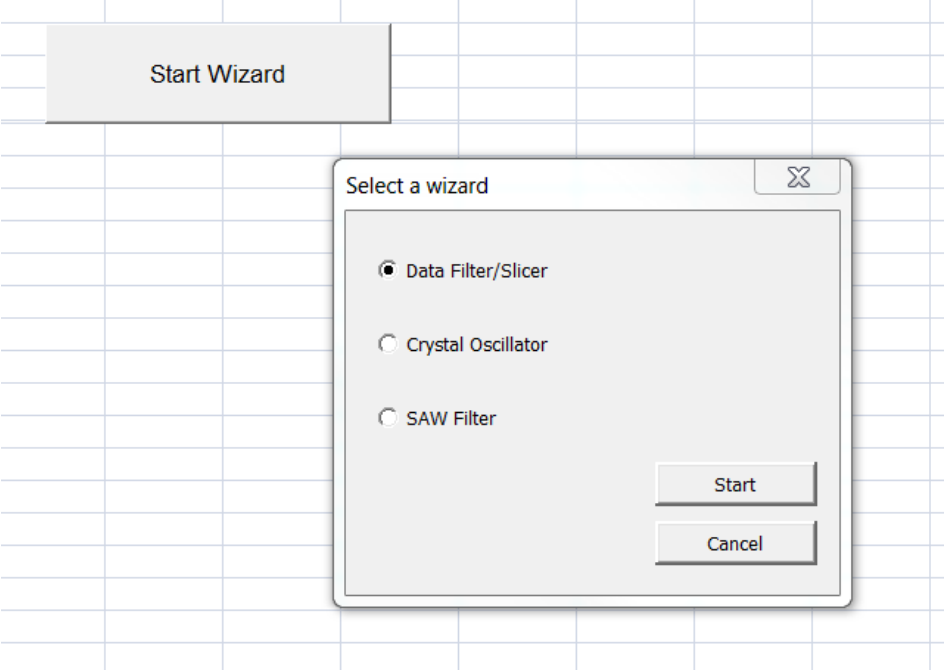


Figure 4: Select a wizard

2.1 General information

A pop-up with an explanation is displayed for most of the input and output boxes when the cursor is placed over the respective box!

2.2 Data Wizard

There are three buttons on the “Data-Filter”-tap, called “**Print Data-Filter**”, “**Print Data-Slicer**” and “**Cancel**” (see Figure 5: Data-Filter User-Interface in case of Manchester). With the help of the button “**Print Data-Filter**”, you can create the print-able version of Data-Filter (see Figure 8: Printable surface of Data-Filter User-Interface). By clicking on the button “**Print Data-Slicer**”, a print-able version of the Data-Slicer can be created (see Figure 13: Printable surface of Data-Slicer User-Interface). To close the Data Wizard, the “**Cancel**” button has to be used.
There are another three buttons at the right side of this tap, called “**Restore last settings**”, “**Load default settings**” and “**Print**” all. With the button “**Restore last settings**”, you can load the last settings from the excel sheet in the User-Interface. With a click on “**Load default settings**”, default values were load into the User-Interface. When you click at “**Print all**”, the print-able versions of Data-Filter and Data-Slicer will be created.

2.2.1 Data-Filter User-Interface

The fields „Parameter“, „Encoding“ and „Filter“ are input-fields.

Parameter:
Enter the data rate (in kbit/s) the design is intended for. In addition the intended E-series (you can chose between: E3, E6, E12, E24 and E48) and the tolerances of C12 and C14 have to be inserted.

Encoding:
Select the desired encoding scheme: For PWM entry, the shortest period of time of no signal change has to be inserted at the input field “Shortest period of no signal change” (). This input-field appears only if PWM is selected.

Filter:
Selection of the filter parameters: You can select either Bessel- or Butterworth-Filter. In that case the filter parameters are automatically calculated and indicated in the fields „a:“ and „b:“. An alternative filter type can be calculated by selecting the option „Other“ and inserting the desired filter parameters in the fields „a:“ and „b:“. The relative amplitude at the 3dB cut-off frequency, $1/\sqrt{(1-b)^2+a^2}$, has to be equal to $1/\sqrt{2}$.

Consequently not every value or combinations of „a“ and „b“ are valid. If the inserted values of „a“ and „b“ are not valid values, a warning in the field „Filter-Type“ will appear and a filter showing the same Q as the inserted invalid „a“ and „b“ values would represent and the required appropriate cut-off frequency is calculated as alternative. The calculated values of this alternative and the values representing the best approach, according the actual available capacitor values are indicated in the „Results”-field („Calculated Capacitors”-, „Suggested Capacitors”- and „Filter Characteristics”-field; see Figure 7: Data-Filter User-Interface, where Filter-type is “Other” with invalid “a” and “b” values).

Results:
In the field „Results“, the calculated values are indicated.
In sub-field „Suggested Values”, the optimum (suggested) cut-off frequency is indicated.
In the sub-field “Calculated Capacitors”, the calculated capacitor values for the suggested cut-off frequency are indicated, whereas, in sub-field “Suggested Capacitors” the best compromise for these values out of the available values of the selected E-series are indicated.
The calculated typical cut-off frequency and the minimum and maximum values, considering the suggested available capacitor values according the selected E-series and the tolerances of the components are indicated. Furthermore, the calculated quality factor „Q“ and the parameter „a“ and „b“ according the suggested available values is indicated at the bottom of this field.

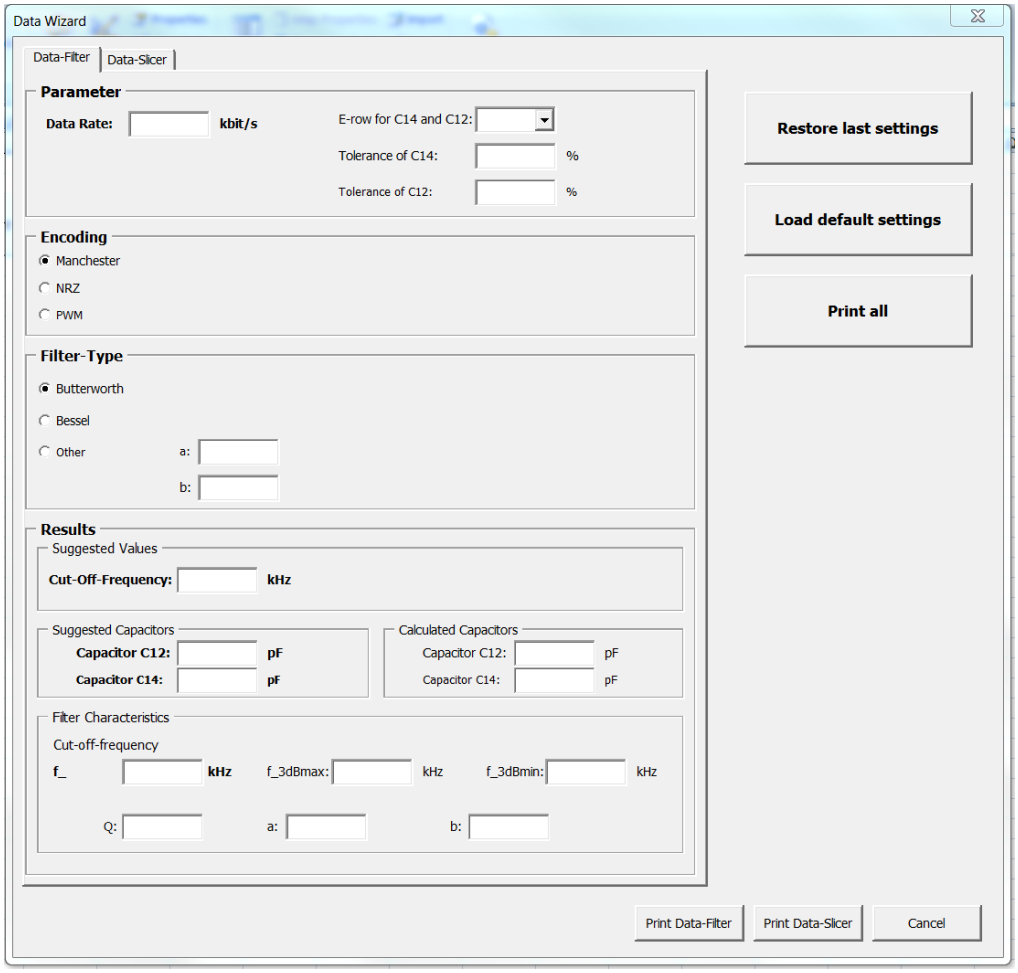


Figure 5: Data-Filter User-Interface in case of Manchester encoding

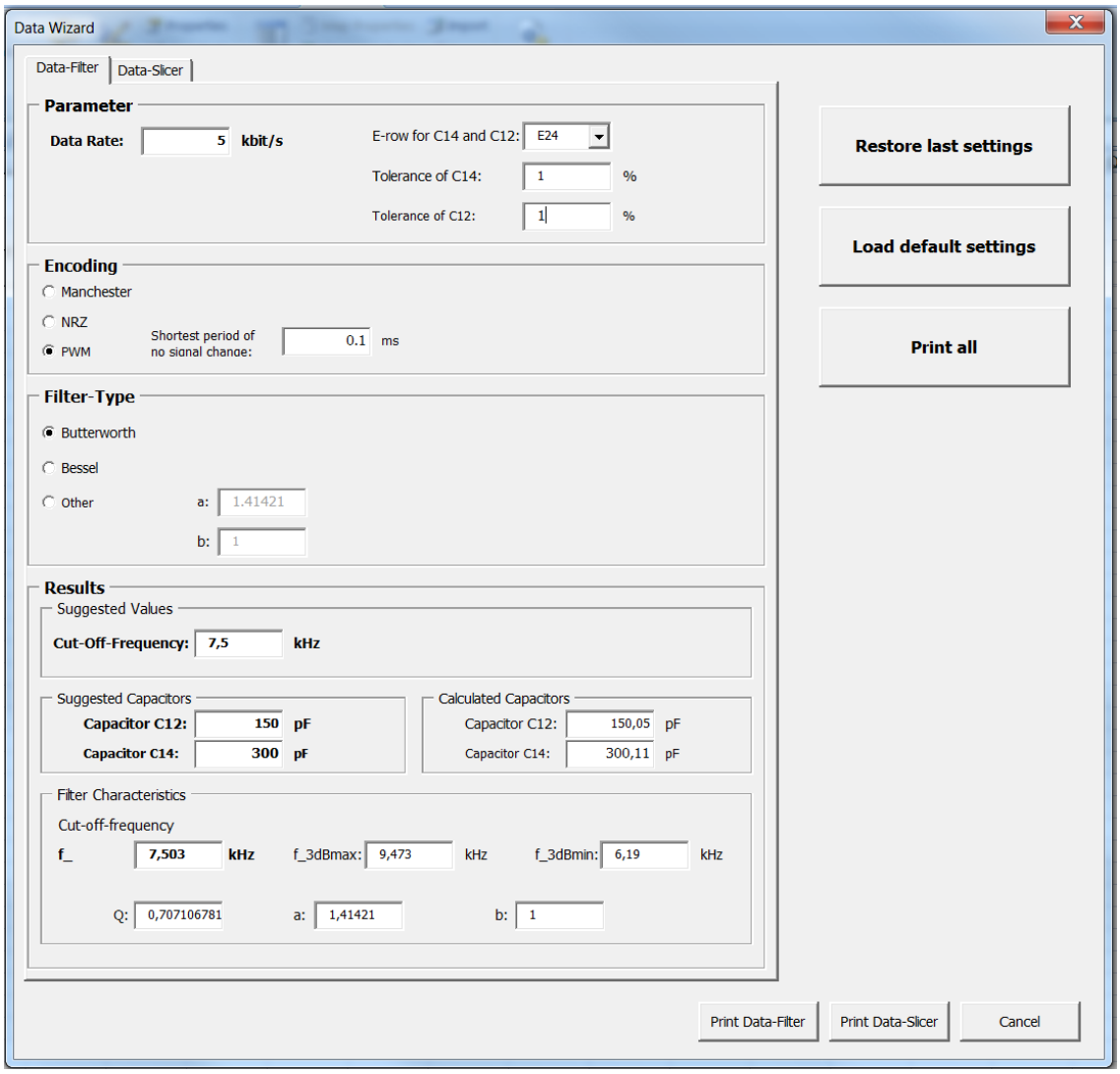


Figure 6: Data-Filter User-Interface in case of PWM

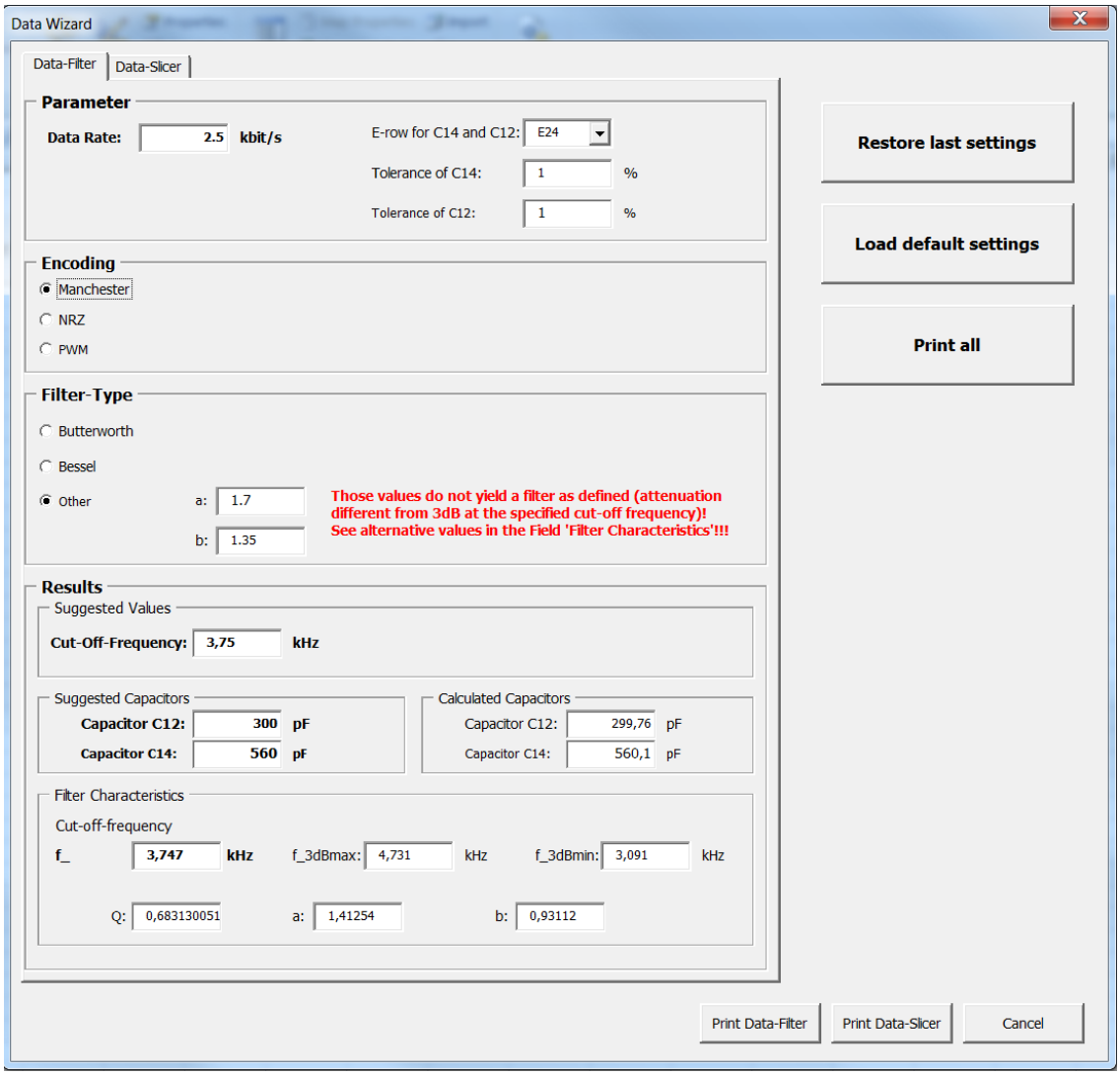


Figure 7: Data-Filter User-Interface, where Filter-type is "Other" with invalid "a" and "b" values

One click on the button „Print Data-Filter“ shows the printable surface of the Data-Filter sheet (see Figure 8: Printable surface of Data-Filter User-Interface).

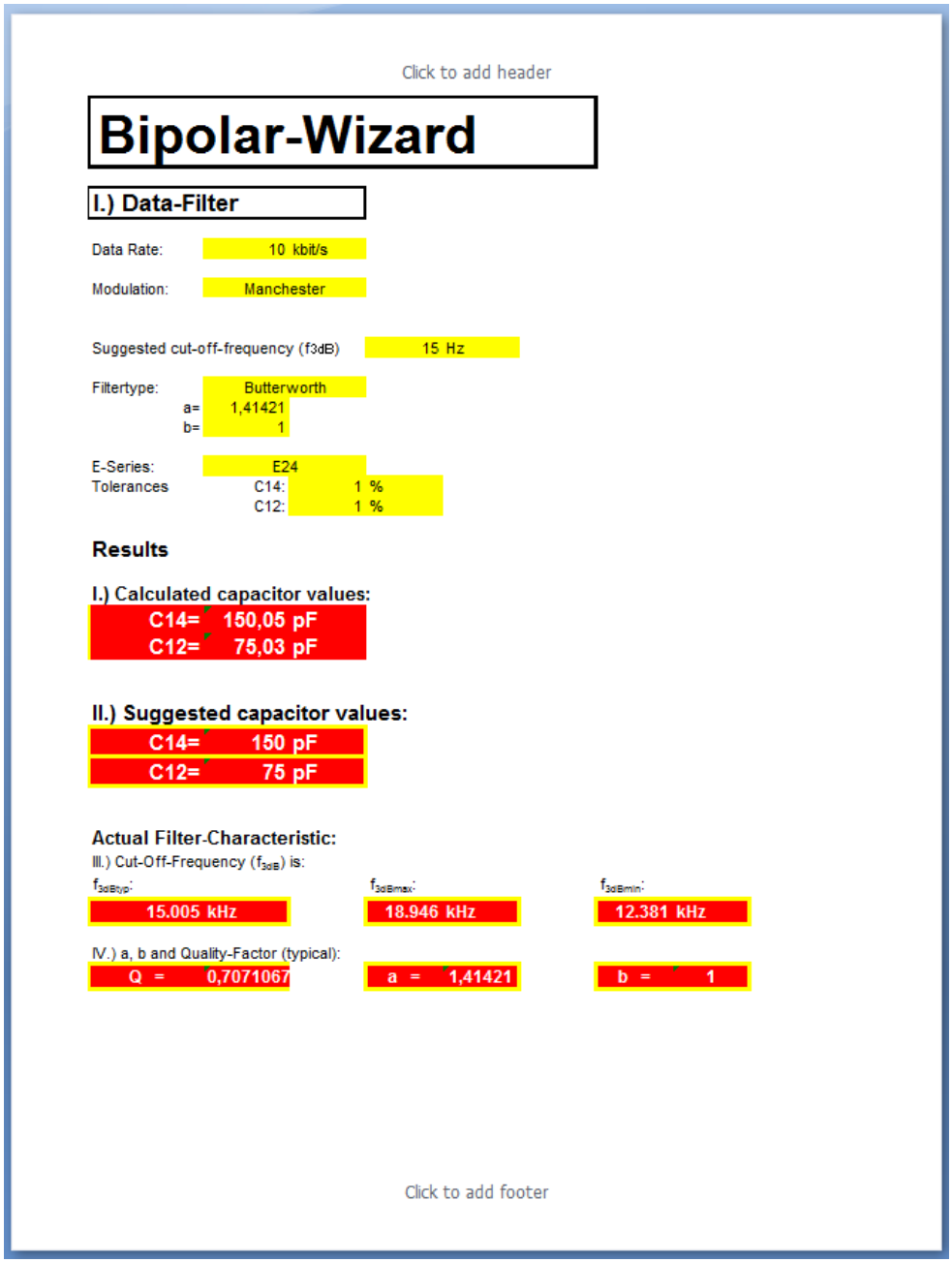


Figure 8: Printable surface of Data-Filter User-Interface

2.2.2 Data-Slicer User-Interface

The desired values have to be inserted in the input-field „Setup“. In field „Results“ the calculated values are indicated.

Setup:

The following needs to be selected:

- IC-Type (TDA5200, TDA5201, TDA5210, ...)
- Modulation (either ASK or FSK)
- R1
    - R1 is the resistor of the RC-lowpass filter used for the slicing level generation (should not be larger than 220kOhm)

- FSK-deviation (Peak)
- „Maximum permitted settling time“ (of the data slicer)
- „Longest period of no signal change in case of NRZ or PWM”

A pop-up, announcing that R1 shouldn’t be larger than 220k, is displayed when the cursor placed over the input box. In addition, a warning in red letters is displayed on the right side of the input box when a value bigger than 220k is inserted in the input box (see Figure 12: R1 larger than 220k Warning at Data-Slicer User-Interface).
In case of NRZ or PWM, encoding an input field „Longest period of no signal change in case of NRZ or PWM” appears (see Figure 9: Data-Slicer User-Interface in case of NRZ, for instance). The value inserted in the input box is only required for NRZ or PWM encoding. In case of Manchester encoding, the value can and has to be calculated directly from the data rate, consequently, no input box appears (see Figure 10: Data-Slicer User-Interface in case of Manchester).

Results:
In the sub-field „Summary“, you will find the value of the data rate and encoding scheme you have inserted or selected at the „Data Filter” tab.
The next value indicated is the offset voltage between the inverting and non-inverting data slicer input caused by the tiny bias current across the resistor R1 (see recommendation that R1 should be smaller than 220k).
The output box „Peak-Peak Voltage (typical)” indicates the peak-peak amplitude of the FSK-demodulator output signal as a comparison to the offset voltage. The peak-peak amplitude of the FSK-demodulator output signal has to be much bigger than the offset voltage for a proper function of the data slicer and consequently for a proper function of the receiver!
The last output boxes indicate the lower and the upper limit of capacitor C13 to fulfill all requirements (maximum permitted settling time of the data slicer and a time constant of the slicing level TA more than 3 times larger than TL; see Figure 9: Data-Slicer User-Interface in case of NRZ and Figure 10: Data-Slicer User-Interface in case of Manchester).
If the requirements can not be fulfilled (lower limit of C13 is larger than the upper limit), a warning in red letters (*„It's not possible to get a time constant TA larger 3*TL and a settling time not larger than ... ms!!!*”) below these output boxes appears (see Figure 11: Requirements are not feasible warning at Data-Slicer User-Interface)!

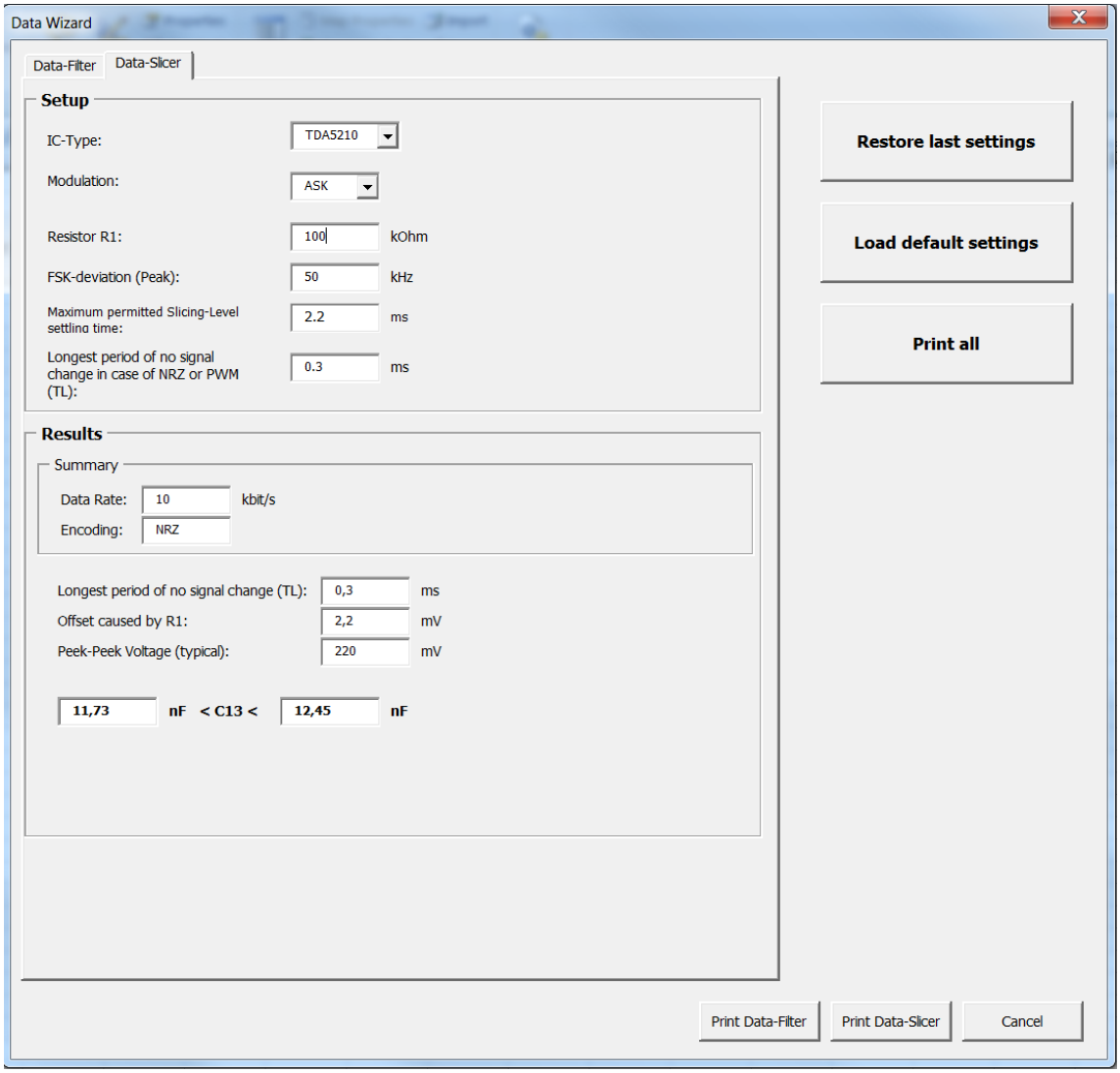


Figure 9: Data-Slicer User-Interface in case of NRZ encoding

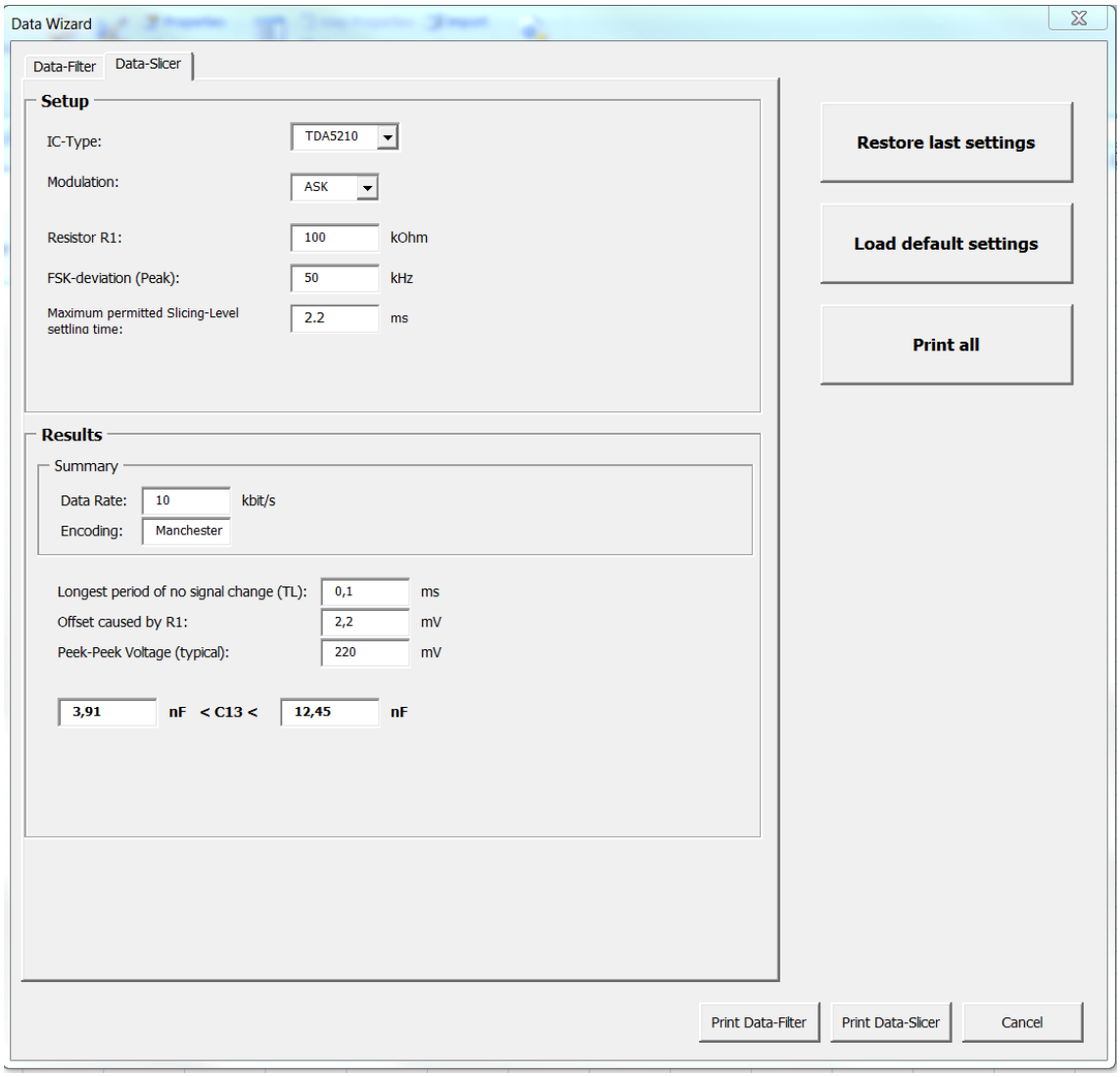


Figure 10: Data-Slicer User-Interface in case of Manchester encoding

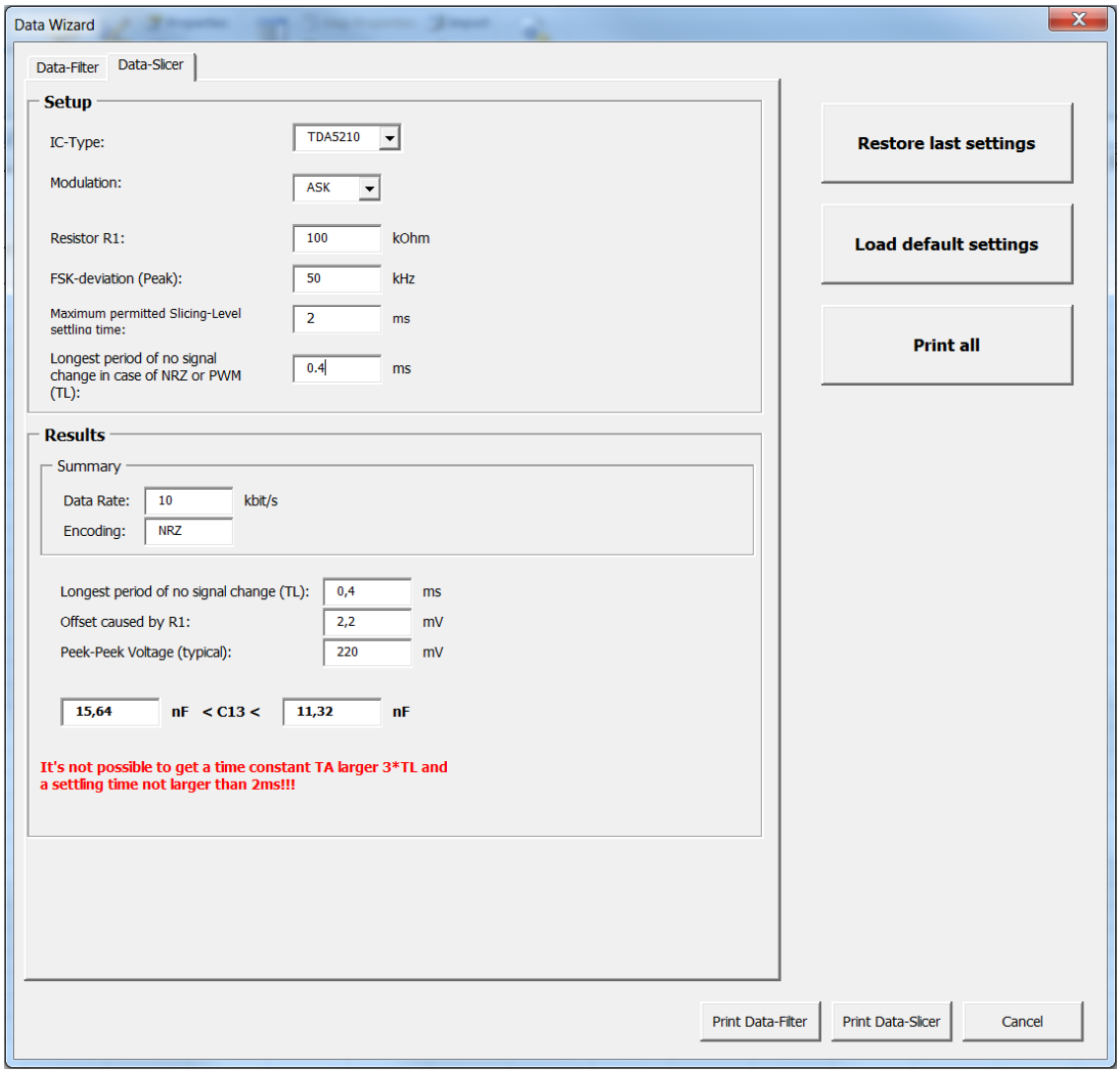


Figure 11: Requirements are not feasible warning at Data-Slicer User-Interface

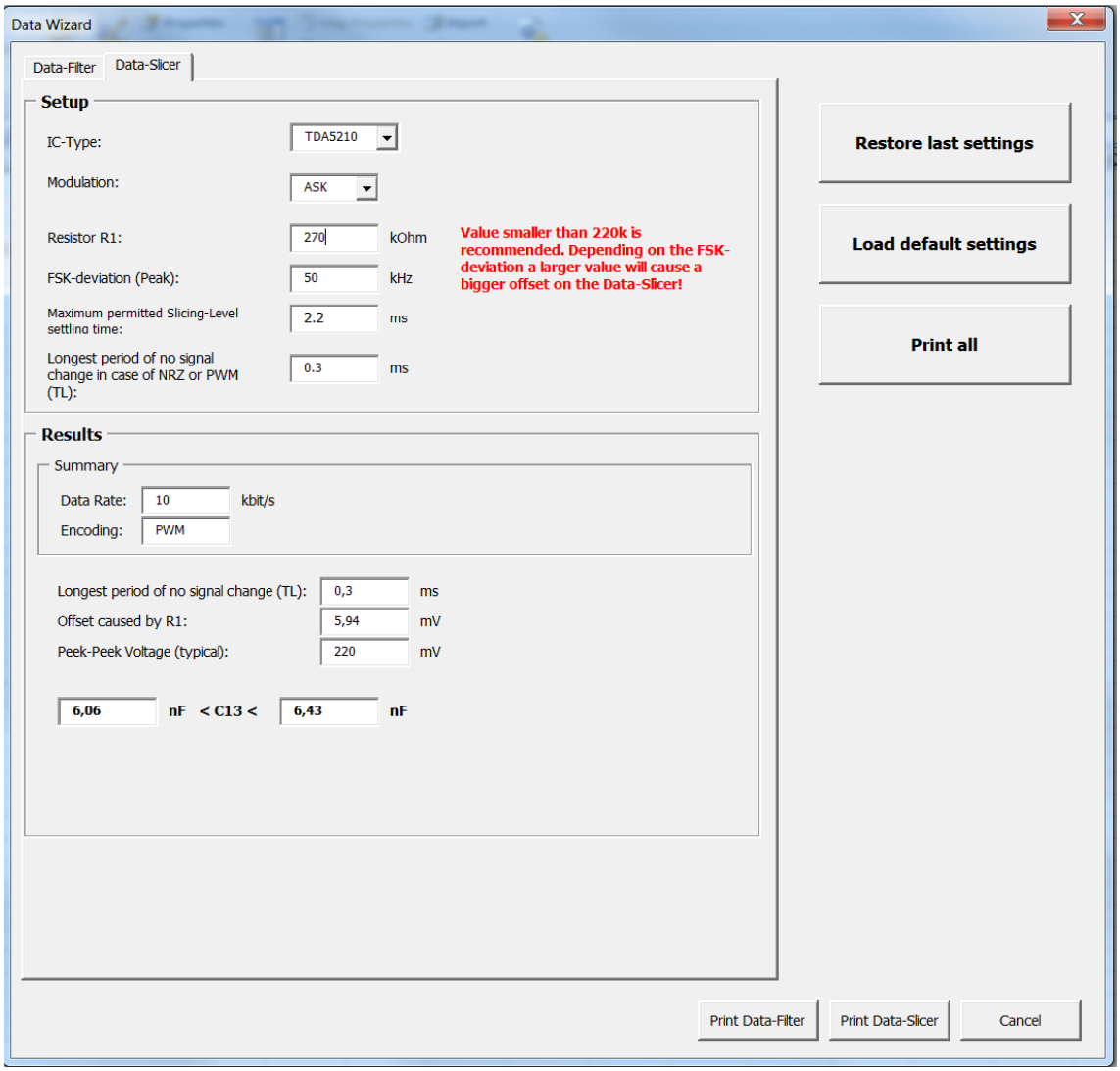


Figure 12: R1 larger than 220k Warning at Data-Slicer User-Interface

One click on the Button „Print Data-Slicer“ shows the printable surface of the Data-Filter sheet (see Figure 13: Printable surface of Data-Slicer User-Interface).

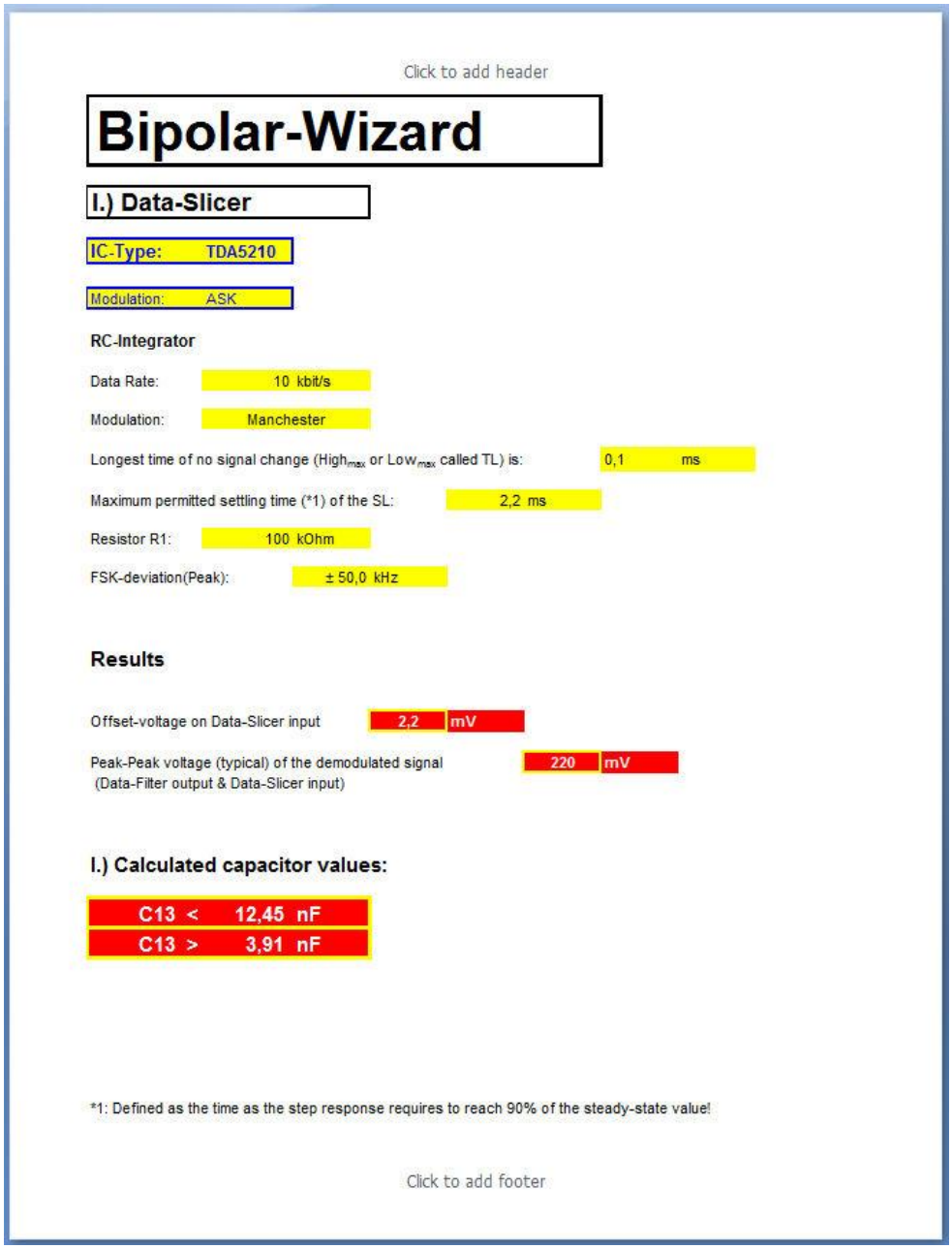


Figure 13: Printable surface of Data-Slicer User-Interface

2.3 Crystal Oscillator

Five buttons, called “**Print input**”, “**Print statistic frequency calculations**”, “**Print worst case frequency calculations**”, “**Print start up time calculations**” and “**Cancel**” can be found at the bottom of the “Crystal Oscillator” wizard window (see Figure 14: Crystal Oscillator Input, (Crystal GNDed)). With the help of the Print buttons, the print able versions of the respective tap can be created (see Figure 18: Printable surface of the Input, Figure 21: Printable Surface of the Statistic frequency calculations, Figure 24: Printable surface of the Worst case frequency calculations and Figure 27: Printable surface of the start-up time calculations). By clicking on the button “**Cancel**” the Crystal Oscillator wizard will be closed.
Two additional buttons can be found at the right side of the wizard window, called “**Restore last settings**” and “**Print**” all. With “**Restore last settings**” button, you can load the last settings from the excel sheet into the User-Interface. When you click at the “**Print all**” button, the print-able versions of “Input”, “Statistic frequency calculations”, “Worst case frequency calculations” and “Start up time calculations” will be created.

2.3.1 Input

Select TDA52xx
Selection of the device (TDA5200, TDA5201, TDA5210, TDA5211, TDA5212, TDA7210 and TDA7210V), the intended operation frequency band (315, 434, 868 and 915MHz) and the injection mode (high side or low side injection):
If the device and the frequency do not match, a warning is shown on the right side of the values (see Figure 16: Crystal Oscillator Input with warning “wrong IC Type”).

Crystal Values
Input of the crystal values like nominal frequency, C1, C0, tolerance C1 and C0, CLnom, frequency tolerance, specified max. series resistor and crystal (case) “GNDed” (yes/no):
If the crystal case is grounded, which is strongly recommended in case of a crystal with metal-cap, which is connected to the GND-pins, the input value CH1, CH2 and the tolerance CH1 and CH2 are activated (see Figure 14: Crystal Oscillator Input, (Crystal GNDed)) else they are not activated (see Figure 15: Crystal Oscillator Input, (Crystal not GNDed)).
As intermediate data, the nominal operating frequency according to the nominal crystal frequency is indicated in this field.

Capacitor Values
There are four outputs values indicated in this field, as the minimum value of Cs1, the ideal value of Cs2 and the tolerances of the inserted Cs1 and Cs2 value. The indicated minimum value of Cs1 and the ideal value of Cs2 should help to choose the proper Cs1 and Cs2 value, which have to be inserted into the respective input boxes in this field. Further input boxes in this field are the parasitic capacitances Cp1l, Cp1r, Cp2l, Cp2r and the tolerances of Cp2l and Cp2r.

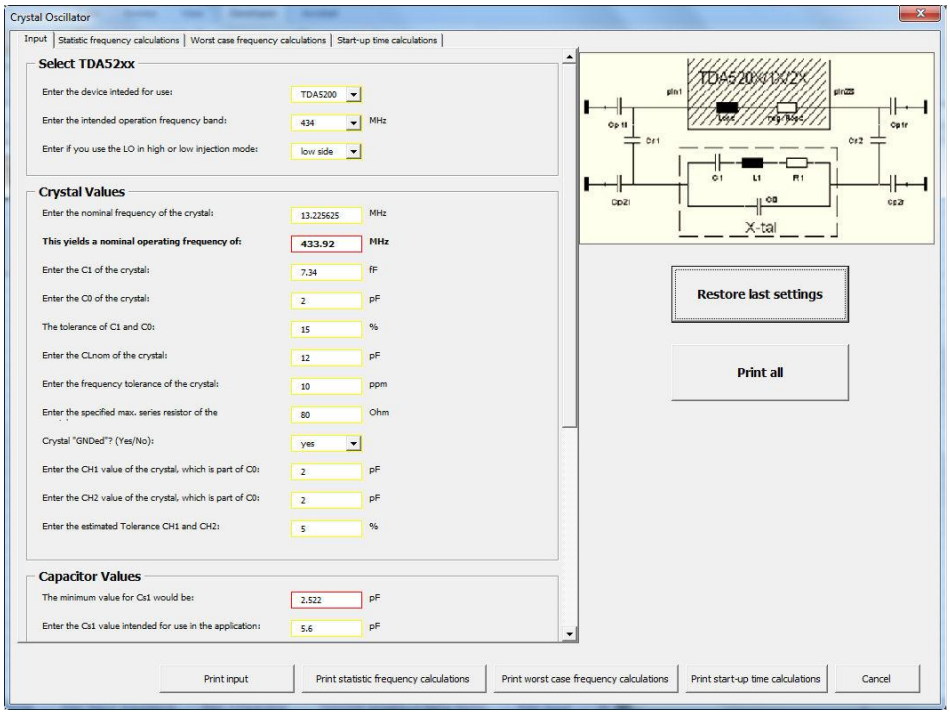


Figure 14: Crystal Oscillator Input, (Crystal GNDed)

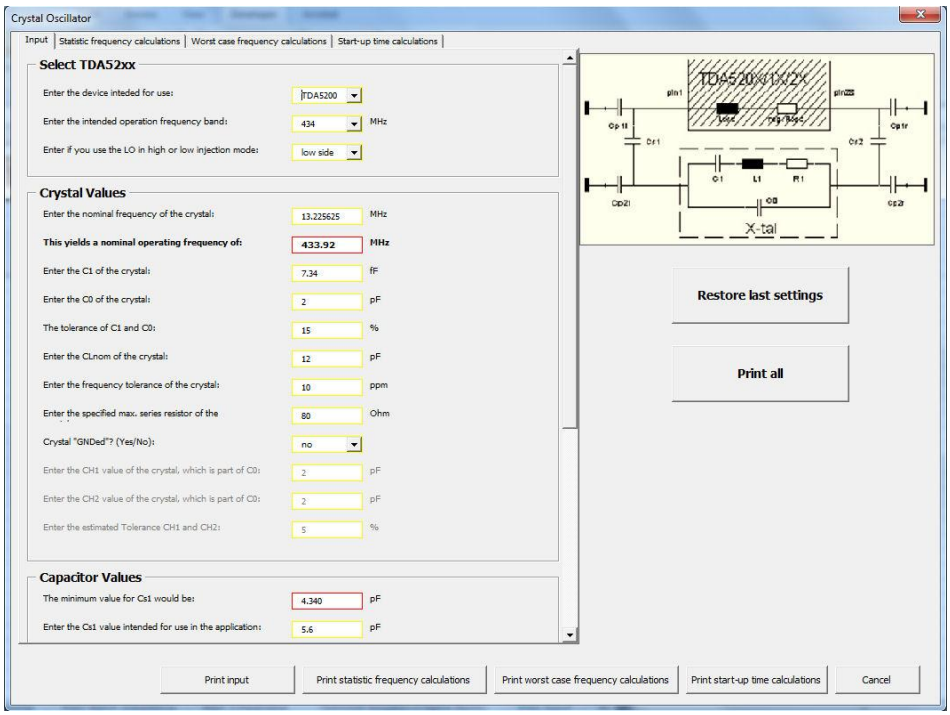


Figure 15: Crystal Oscillator Input, (Crystal not GNDed)

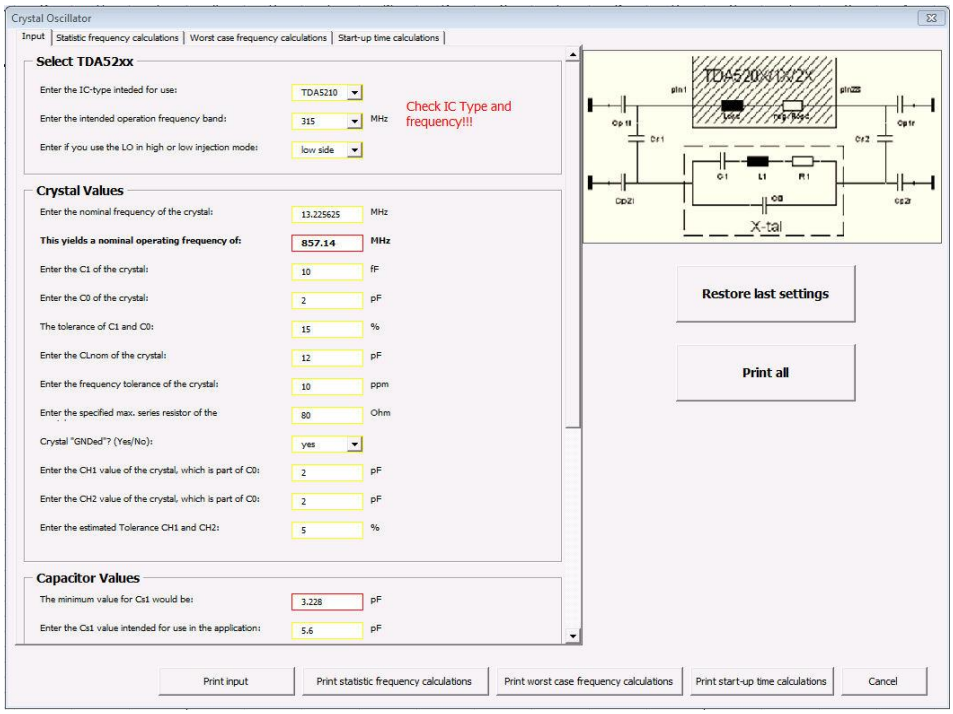


Figure 16: Crystal Oscillator Input with warning "wrong IC Type"

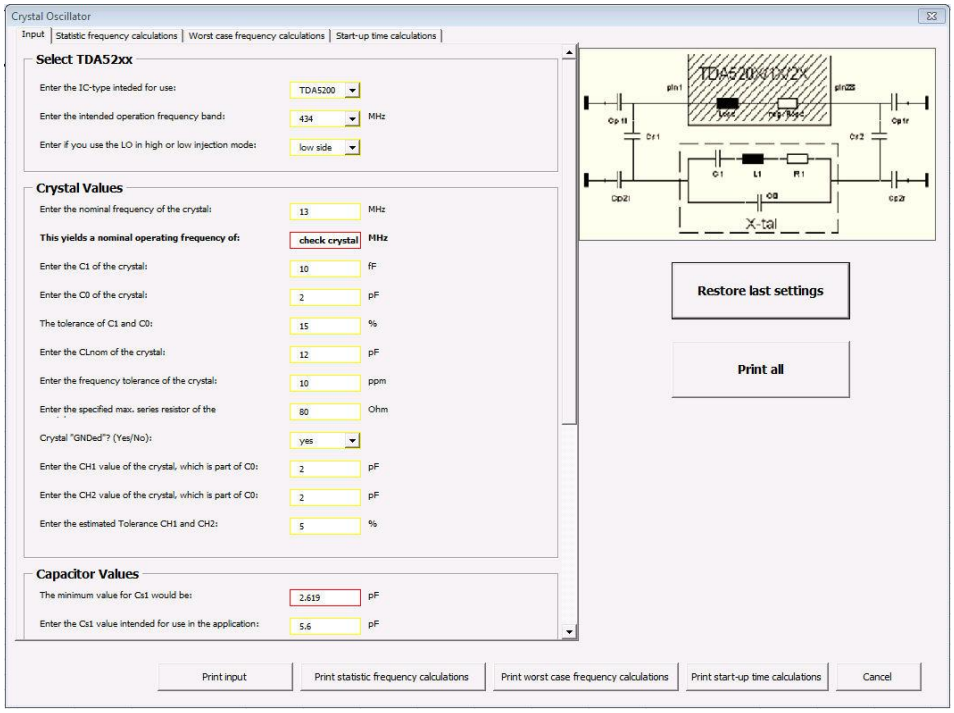
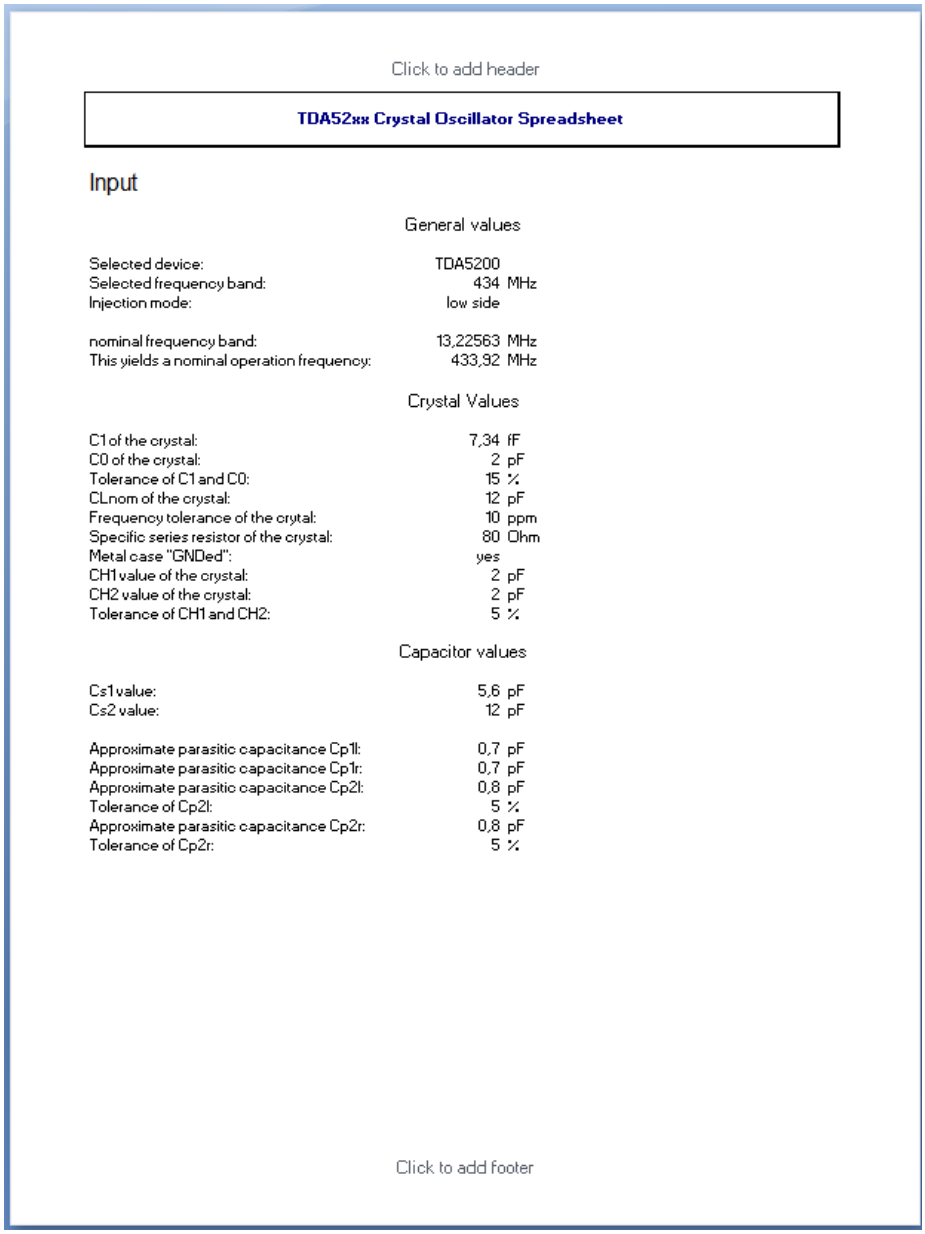


Figure 17: Crystal Oscillator Input with "check frequency" demand note



Click to add header

TDA52xx Crystal Oscillator Spreadsheet

Input

General values

Selected device:	TDA5200
Selected frequency band:	434 MHz
Injection mode:	low side
nominal frequency band:	13,22563 MHz
This yields a nominal operation frequency:	433,92 MHz

Crystal Values

C1 of the crystal:	7,34 fF
C0 of the crystal:	2 pF
Tolerance of C1 and C0:	15 %
CLnom of the crystal:	12 pF
Frequency tolerance of the crytal:	10 ppm
Specific series resistor of the crystal:	80 Ohm
Metal case "GNDed":	yes
CH1 value of the crystal:	2 pF
CH2 value of the crystal:	2 pF
Tolerance of CH1 and CH2:	5 %

Capacitor values

Cs1 value:	5,6 pF
Cs2 value:	12 pF
Approximate parasitic capacitance Cp1l:	0,7 pF
Approximate parasitic capacitance Cp1r:	0,7 pF
Approximate parasitic capacitance Cp2l:	0,8 pF
Tolerance of Cp2l:	5 %
Approximate parasitic capacitance Cp2r:	0,8 pF
Tolerance of Cp2r:	5 %

Click to add footer

Figure 18: Printable surface of the Input

2.3.2 Statistic frequency calculations

The calculated values in these fields are the statistic limits according the (statistic) limits/tolerances of each input parameter. So if, for example, all the input limits are 3-Sigma/6-Sigma values[*1], also the calculated tolerance is being a 3-Sigma/6-Sigma value.

*1: A 3-Sigma (3-σ) value, for instance, means a distance to the average (μ) or specified nominal value of 3 times the standard deviation. According the Gaussian distribution, the value of the respective parameter is within the range of μ ± 3.σ with a probability of 99.73%, whereas the probability that this parameter is within the range of μ ± 6.σ is even 99.9999998%.

Results for realistic capacitors

The results shown in this sub-field are calculated from the values inserted on the input field (like the Cs1 and Cs2 value, the crystal parameters, the IC-type, the frequency band and the LO injection). The results indicated in this sub-field are, the ideal, the typical, the lowest and highest frequency, the resulting spread in kHz and ppm regarding to the ideal frequency and regarding to the typical frequency and the maximum peak to peak deviation in kHz.

Results of ideal capacitor values

The results shown in this sub-field are calculated by assuming optimized nominal load capacitors values (Cs1 and Cs2). Or in other words, the calculations are done by assuming that the nominal value of the selected load capacitor yields exactly the ideal frequency. The results indicated in this sub-field are the ideal/optimized capacitor values (required to reach the ideal carrier frequency) and the associated tolerances according the usual rules of the E96 series*[2], the resulting total load capacitor, the ideal, lowest and highest frequency, the resulting spread in kHz and ppm according to the ideal frequency and the maximum peak to peak deviation in kHz.

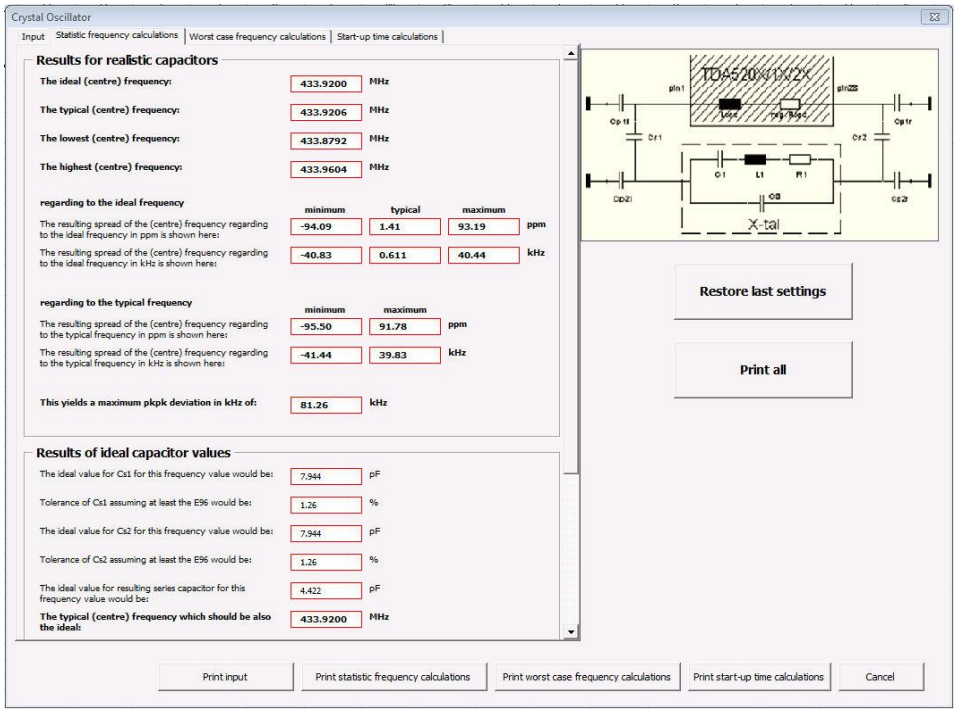


Figure 19: Statistic frequency calculations of the crystal oscillator (realistic capacitors)

*2: The tolerance is usually ±1% for capacitor values equal or larger than 10pF, and ±0.1pF for capacitor values smaller than 10pF.
For example: C = 4.7pF ± 0.1pF is equal to 4.7pF ± 2.13%

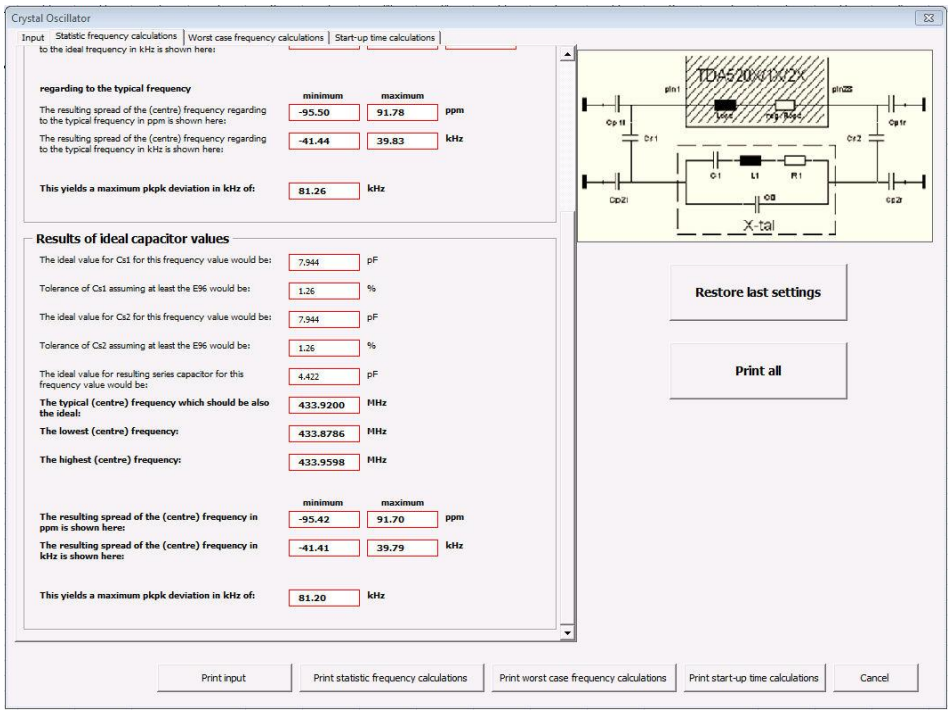
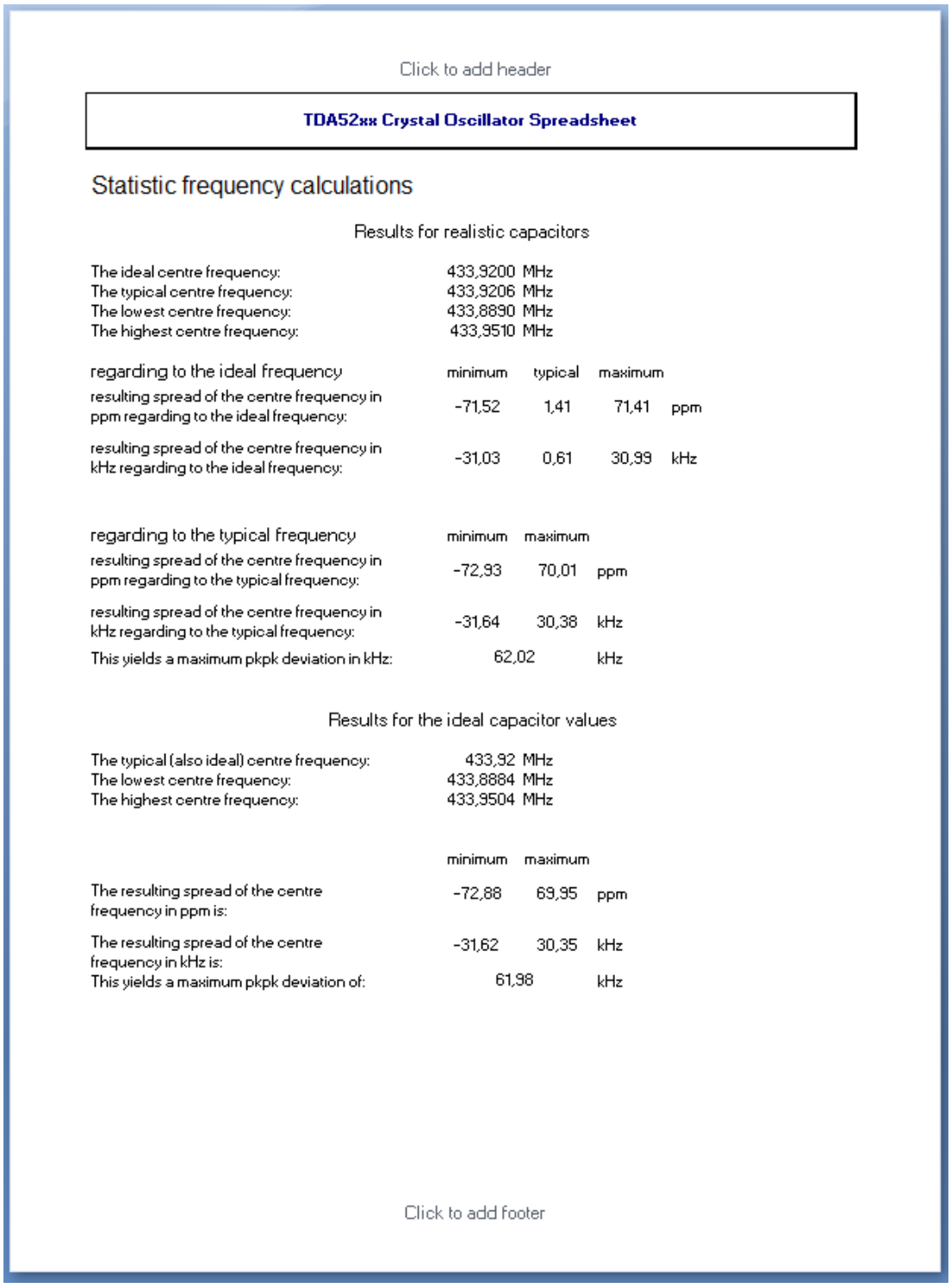


Figure 20: Statistic frequency calculations of the crystal oscillator (ideal capacitors)



Click to add header

TDA52xx Crystal Oscillator Spreadsheet

Statistic frequency calculations

Results for realistic capacitors

The ideal centre frequency:	433,9200	MHz		
The typical centre frequency:	433,9206	MHz		
The lowest centre frequency:	433,8890	MHz		
The highest centre frequency:	433,9510	MHz		
regarding to the ideal frequency	minimum	typical	maximum	
resulting spread of the centre frequency in ppm regarding to the ideal frequency:	-71,52	1,41	71,41	ppm
resulting spread of the centre frequency in kHz regarding to the ideal frequency:	-31,03	0,61	30,99	kHz
regarding to the typical frequency	minimum	maximum		
resulting spread of the centre frequency in ppm regarding to the typical frequency:	-72,93	70,01	ppm	
resulting spread of the centre frequency in kHz regarding to the typical frequency:	-31,64	30,38	kHz	
This yields a maximum pkpk deviation in kHz:	62,02		kHz	

Results for the ideal capacitor values

The typical (also ideal) centre frequency:	433,92	MHz	
The lowest centre frequency:	433,8884	MHz	
The highest centre frequency:	433,9504	MHz	
	minimum	maximum	
The resulting spread of the centre frequency in ppm is:	-72,88	69,95	ppm
The resulting spread of the centre frequency in kHz is:	-31,62	30,35	kHz
This yields a maximum pkpk deviation of:	61,98		kHz

Click to add footer

Figure 21: Printable Surface of the Statistic frequency calculations

2.3.3 Worst case frequency calculations

The values in these fields are calculated as worst case calculation.

Results for realistic capacitors

The results shown in this sub-field are calculated from the values inserted on the input field (like the Cs1 and Cs2 value, the crystal parameters, the IC-type, the frequency band and the LO injection). The results indicated in this sub-field are, the

ideal, the typical, the lowest and highest frequency, the resulting spread in kHz and ppm regarding to the ideal frequency and regarding to the typical frequency and the maximum peak to peak deviation in kHz.

Results of ideal capacitor values

The results shown in this sub-field are calculated by assuming optimized nominal load capacitors values (Cs1 and Cs2). Or in other words, the calculations are done by assuming that the nominal value of the selected load capacitor yields exactly the ideal frequency. The results indicated in this sub-field are the ideal/optimized capacitor values (required to reach the ideal carrier frequency) and the associated tolerances according the usual rules of the E96 series*[2], the resulting total load capacitor, the ideal, lowest and highest frequency, the resulting spread in kHz and ppm according to the ideal frequency and the maximum peak to peak deviation in kHz.

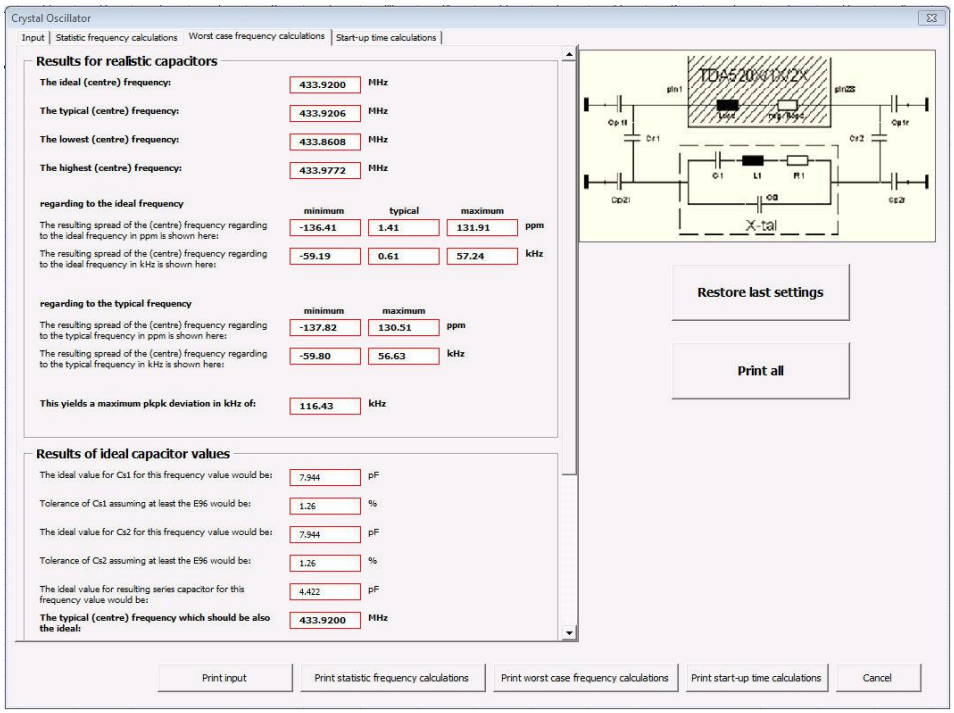


Figure 22: Worst case frequency calculations of the crystal oscillator (realistic capacitors)

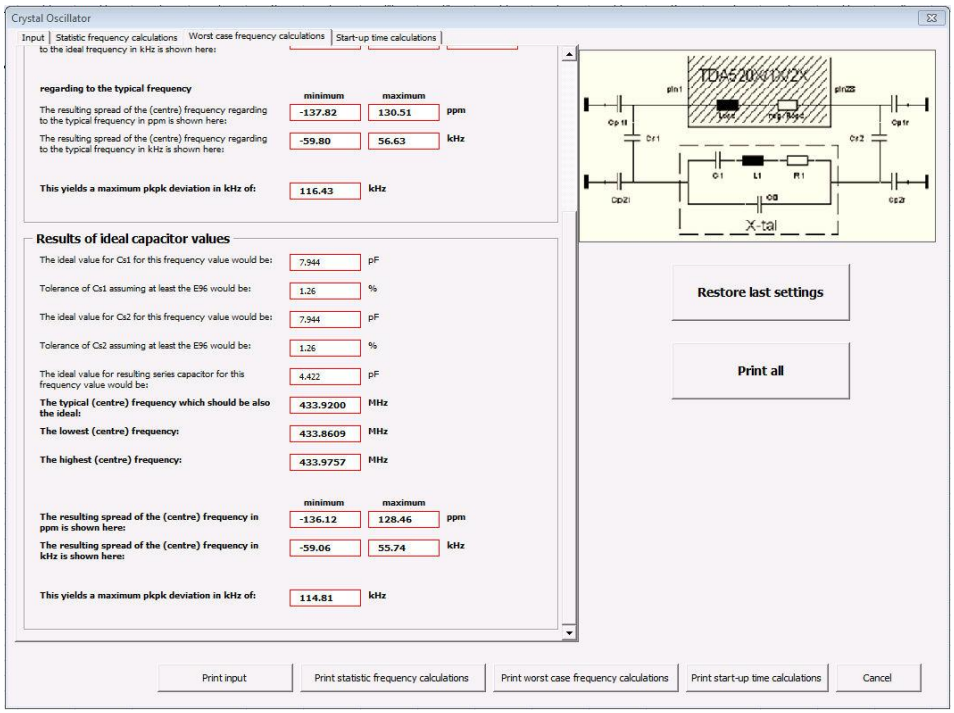
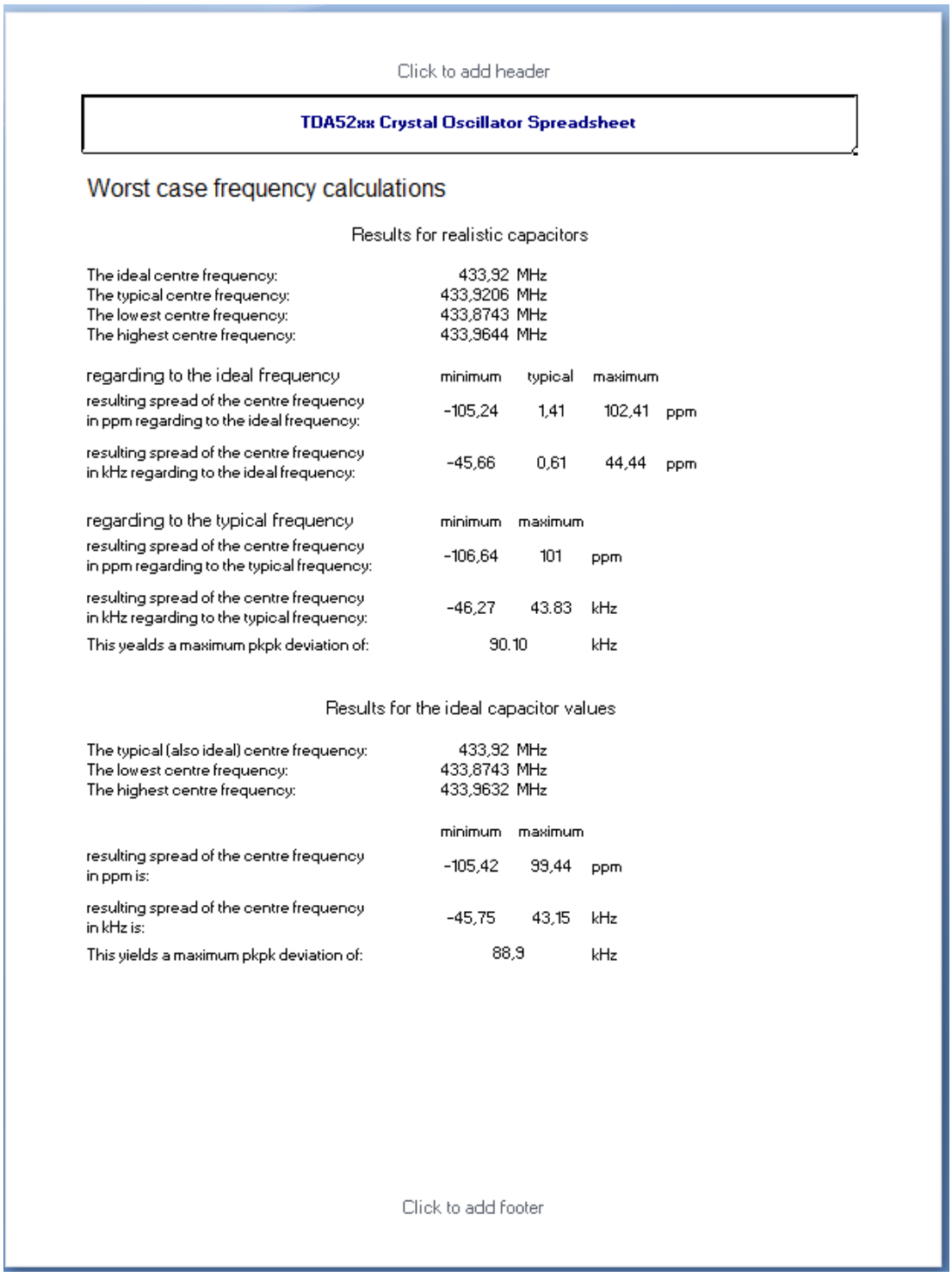


Figure 23: Worst case frequency calculations of the crystal oscillator (ideal capacitors)



Click to add header

TDA52xx Crystal Oscillator Spreadsheet

Worst case frequency calculations

Results for realistic capacitors

The ideal centre frequency:	433,92	MHz		
The typical centre frequency:	433,9206	MHz		
The lowest centre frequency:	433,8743	MHz		
The highest centre frequency:	433,9644	MHz		
regarding to the ideal frequency	minimum	typical	maximum	
resulting spread of the centre frequency in ppm regarding to the ideal frequency:	-105,24	1,41	102,41	ppm
resulting spread of the centre frequency in kHz regarding to the ideal frequency:	-45,66	0,61	44,44	ppm
regarding to the typical frequency	minimum	maximum		
resulting spread of the centre frequency in ppm regarding to the typical frequency:	-106,64	101	ppm	
resulting spread of the centre frequency in kHz regarding to the typical frequency:	-46,27	43.83	kHz	
This yealds a maximum pkpk deviation of:	90.10		kHz	

Results for the ideal capacitor values

The typical (also ideal) centre frequency:	433,92	MHz	
The lowest centre frequency:	433,8743	MHz	
The highest centre frequency:	433,9632	MHz	
	minimum	maximum	
resulting spread of the centre frequency in ppm is:	-105,42	99,44	ppm
resulting spread of the centre frequency in kHz is:	-45,75	43,15	kHz
This yields a maximum pkpk deviation of:	88,9		kHz

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Figure 24: Printable surface of the Worst case frequency calculations

2.3.4 Start-up time calculations

Input values

The maximum series resistor of the crystal inserted in the input field (see 2.3.1 Input) is indicated at the top of this sub-field. The first value inserted, is the estimated minimum resistor.

Measured values

In the sub-field “Measured values” the measured values [*3] Oscillator-Margin “jumpered” [*4], Oscillator-Margin “in-board” [*5], the measured frequency of the crystal fs’, the measured R1 value, the measured C1 value and C0 value of the crystal, the load capacitor values Cs1 and Cs2, furthermore the measured start-up time and the measured jitter of the start-up time in this field.

Calculated L1 (of the crystal), Rs and Rneg (of the oscillator)

In this sub-field the calculated value of the motional inductance of the crystal L1, the transformed resistance of R1, called Rs, seen on the crystal pads depending on the load capacitor and the C0 of the crystal, and the calculated Rneg value of the oscillator are indicated.

*3: To measure the crystal oscillator margin, set the variable resistor its minimum value and increase its value until the oscillator stops oscillation (R_{stop}). Next reduce the resistor value slowly until the oscillator starts oscillation again (R_{start}). The value of the resistor is the oscillator margin. Usually the difference between R_{stop} and R_{start} is rather small (a few ohms). If not there is either an issue with the circuit (e.g. parasitic) or even more likely an issue with the crystal (high drive level dependency (DLD)).

*4: Measure the Oscillator-Margin “jumpered” means that the oscillator margin is measured by first de-soldering all components (crystal, load capacitor) of the oscillator circuit from the board and lifting the oscillator pins (CRST1 and CRST2). Next re-connect the components by small wires, but in addition, with the potentiometer between the crystal and (one of) the load capacitor, so that there is a (small) distance between all the components and the board to keep the parasitic capacitances as small as possible.

*5: Measure the Oscillator-Margin “in-board” means that the oscillator margin is measured by simply moving up the crystal slightly on one side (of course by de-soldering it first and solder one pin of the crystal again to the board) and connecting the potentiometer between the crystal pin itself and the crystal pad of the board, so that the potentiometer is electrically placed between the crystal and (one of) the load capacitor.

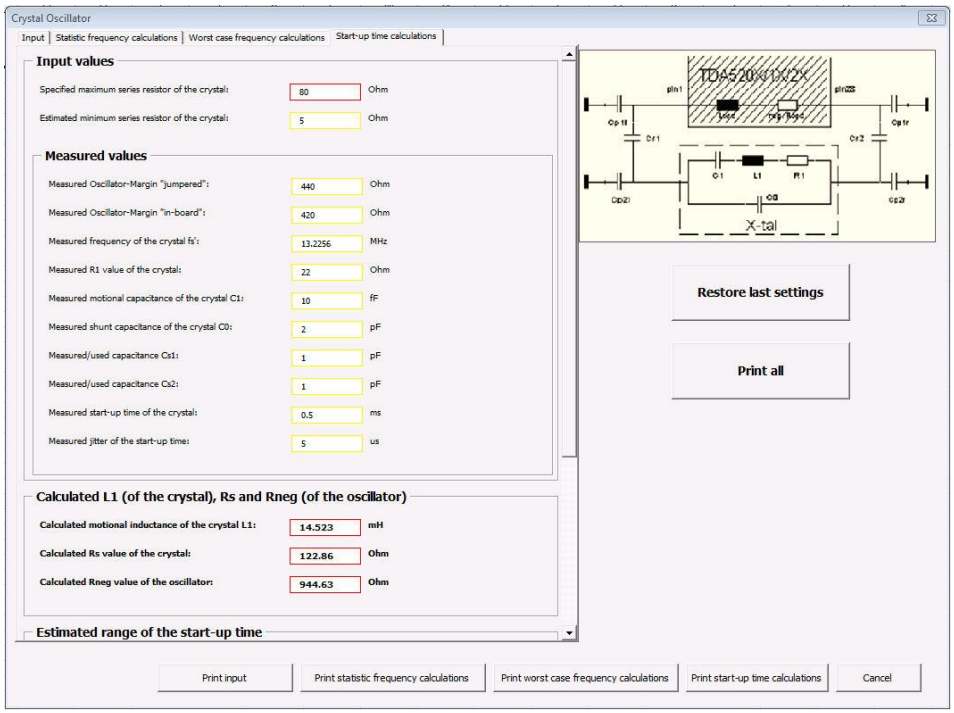


Figure 25: Start-up time calculations of the crystal oscillator (Input values)

Estimated range of the start up time

In this sub-field the estimated results for the start-up time are indicated. These values are the calculated/approximated/estimated min., typical and max. start-up time and the calculated/approximated/estimated range of the maximum start-up time considering the jitter regarding the ideal capacitors on the one hand and regarding the realistic/used capacitors on the other hand.

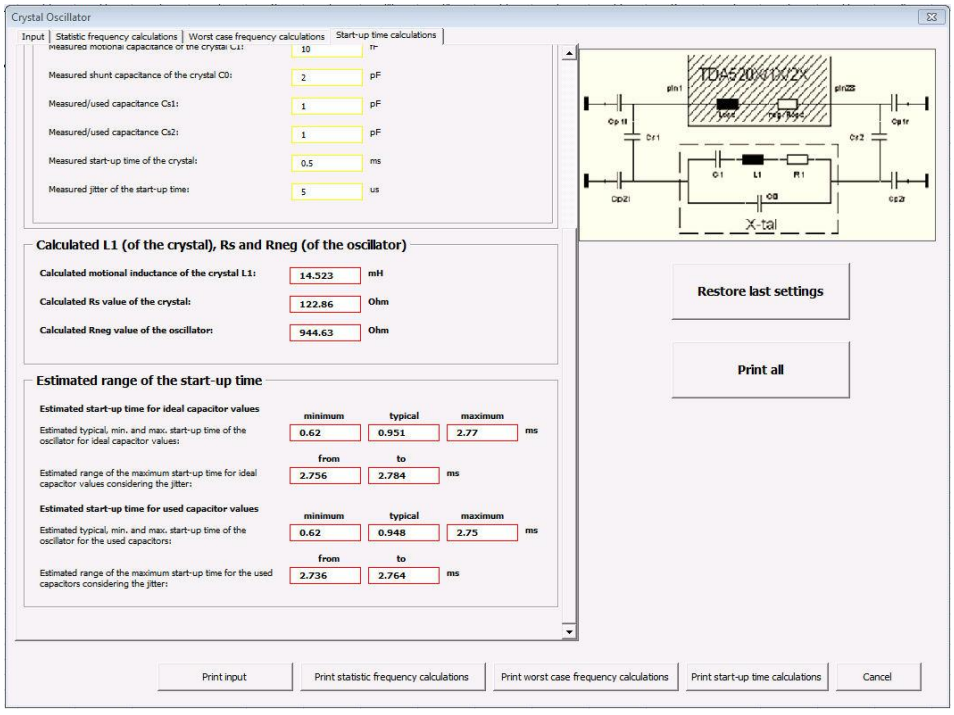
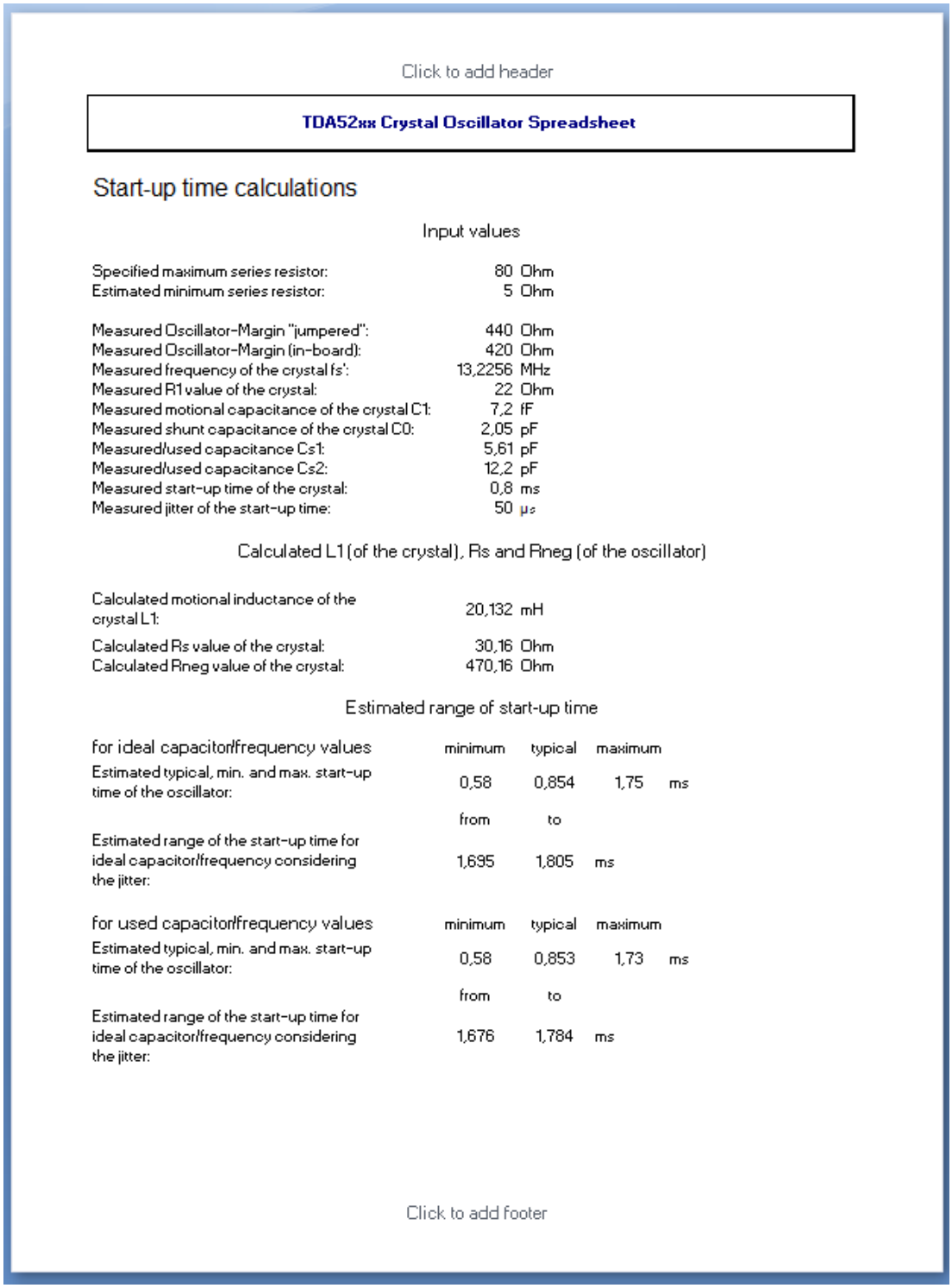


Figure 26: Start-up time calculations of the crystal oscillator (results)



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TDA52xx Crystal Oscillator Spreadsheet

Start-up time calculations

Input values

Specified maximum series resistor:	80	Ohm
Estimated minimum series resistor:	5	Ohm
Measured Oscillator-Margin "jumpered":	440	Ohm
Measured Oscillator-Margin (in-board):	420	Ohm
Measured frequency of the crystal fs':	13,2256	MHz
Measured R1 value of the crystal:	22	Ohm
Measured motional capacitance of the crystal C1:	7,2	fF
Measured shunt capacitance of the crystal C0:	2,05	pF
Measured/used capacitance Cs1:	5,61	pF
Measured/used capacitance Cs2:	12,2	pF
Measured start-up time of the crystal:	0,8	ms
Measured jitter of the start-up time:	50	µs

Calculated L1 (of the crystal), Rs and Rneg (of the oscillator)

Calculated motional inductance of the crystal L1:	20,132	mH
Calculated Rs value of the crystal:	30,16	Ohm
Calculated Rneg value of the crystal:	470,16	Ohm

Estimated range of start-up time

for ideal capacitor/frequency values	minimum	typical	maximum	
Estimated typical, min. and max. start-up time of the oscillator:	0,58	0,854	1,75	ms
	from	to		
Estimated range of the start-up time for ideal capacitor/frequency considering the jitter:	1,695	1,805	ms	

for used capacitor/frequency values	minimum	typical	maximum	
Estimated typical, min. and max. start-up time of the oscillator:	0,58	0,853	1,73	ms
	from	to		
Estimated range of the start-up time for ideal capacitor/frequency considering the jitter:	1,676	1,784	ms	

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Figure 27: Printable surface of the start-up time calculations

2.4 SAW Filter

On the right lower edge of the SAW-Filter wizard three buttons called “**Print S-Parameter**”, “**Print Match Impedance**” and “**Cancel**” can be found (see Figure 28:). With the Print buttons, the print-able versions can be created (see Figure 32: Printable surface of the Match and Attenuation, Figure 33: Printable surface of the S-Parameter). By clicking on the button “Cancel”, the SAW Filter will get closed.

Another four buttons “**Restore last settings**”, “**Load Default Settings**”, “**Print all**” and “**Update Chart**” can be found on the right side of this window. With “**Restore last settings**” you can load the last settings from the excel sheet into the User-Interface. With “**Load default settings**”, the default values were load into the User-Interface. By clicking on “**Print all**”, the printable versions of the S-Parameter called “**Print S-Parameter**” and the Matching values (at the center frequency) and Attenuation (also over frequency) called “**Print Match and Attenuation**” will be created. When the button “**Update Chart**” is colored green, the chart will be updated whenever any value is changed, which causes a longer load time. You can deactivate the permanent update of the chart by clicking at the button “**Update Chart**”, which will by changing the color of the button to red.

2.4.1 Match Impedance

SAW-Filter values at center frequency

The S-Parameter values of the SAW-Filter at the center frequency (specified or measured) and the center frequency itself has to be inserted in this sub-field.

Optimum Matching/Gamma values

At this output sub-field the calculated matching/gamma values for both source and load are indicated. These values are indicated both as combination of the absolute value and the argument (phase) and as combination of the real and imaginary part. If the values inserted at the input sub-field “SAW-Filter values at center frequency” do not deliver absolute values of gamma smaller than 1, a warning will appear “Warning: Gamma > 1 (see Figure 30: SAW-Filter Matching and Attenuation with warning “Gamma > 1”). This would mean that there is any failure in the S-Parameter values, because a passive device cannot yield a Gamma value > 1 (only active devices).

Insertion loss at centre frequency

The insertion loss (attenuation) at the centre frequency is shown in this output sub-field.

Attenuation as a function of the frequency

In this sub-field the measured S-Parameter values at the different frequencies and the corresponding frequencies have to be inserted. The wizard will automatically calculate the corresponding attenuation values and indicate these values in the “Attenuation [dB] output boxes (in dB). Furthermore, these attenuation values are used to draw the chart.

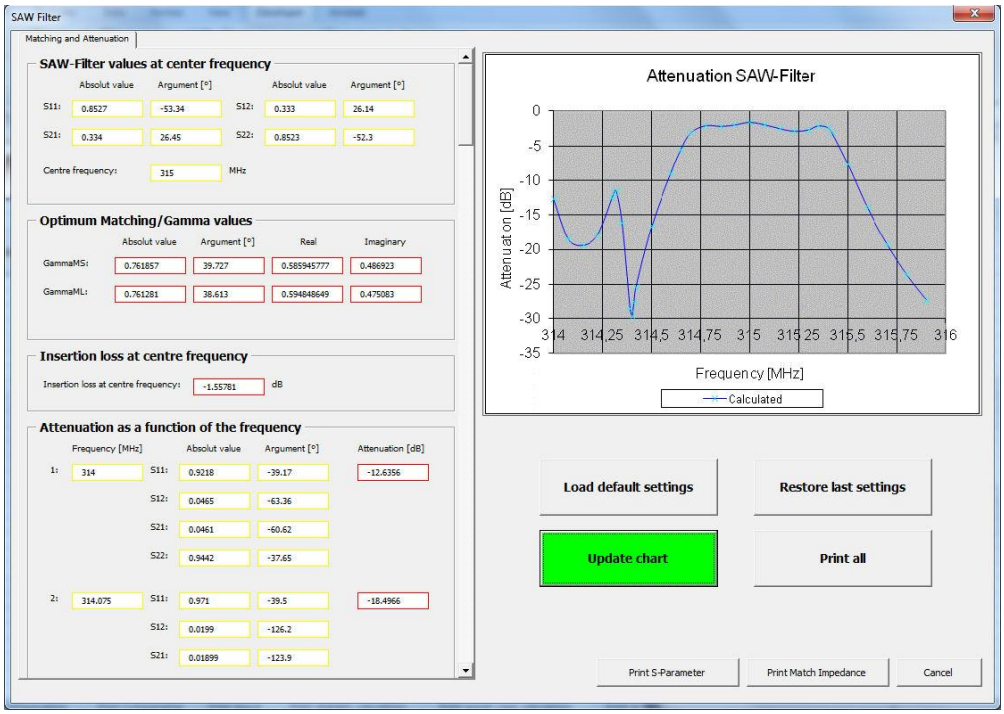


Figure 28: SAW-Filter Matching and Attenuation (Update chart enabled)

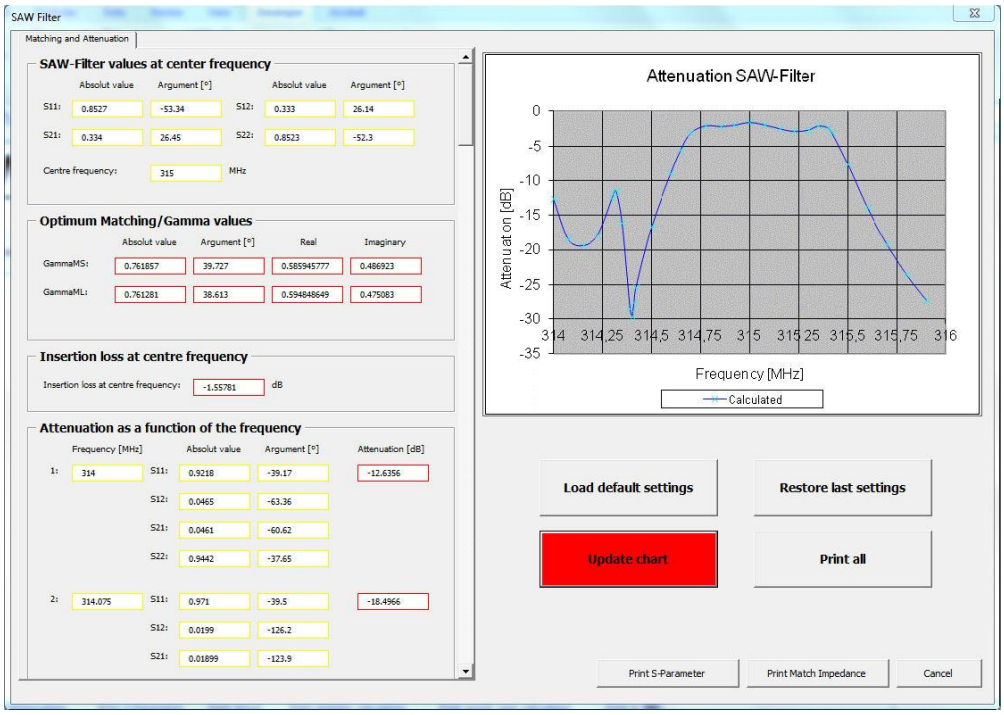


Figure 29: SAW-Filter Matching and Attenuation (Update chart disabled)



Figure 30: SAW-Filter Matching and Attenuation with warning "Gamma > 1"

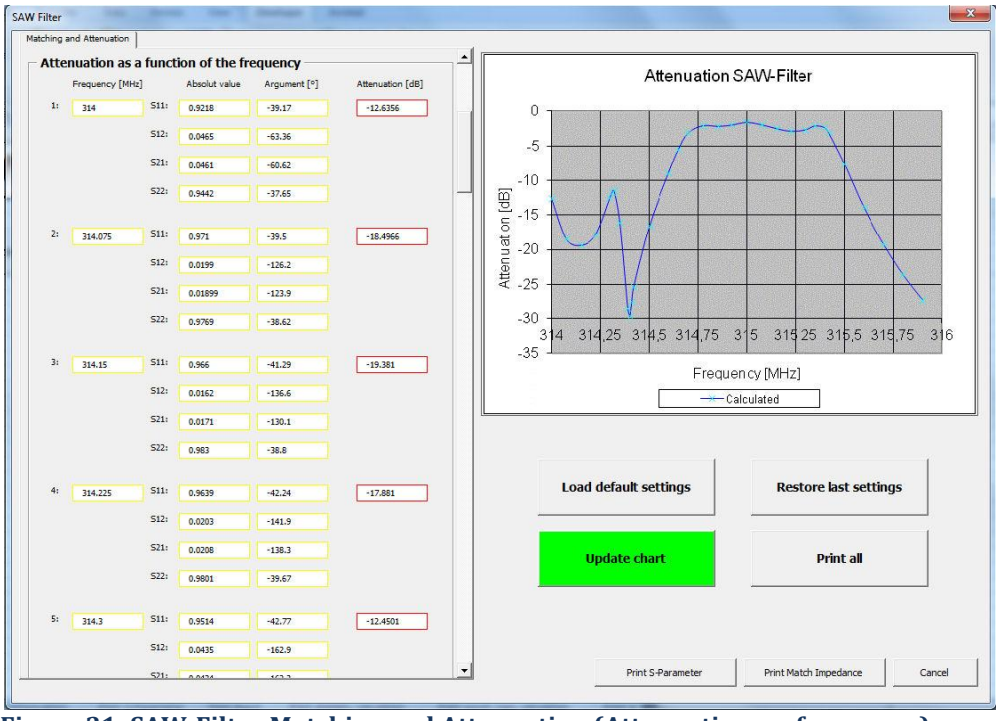
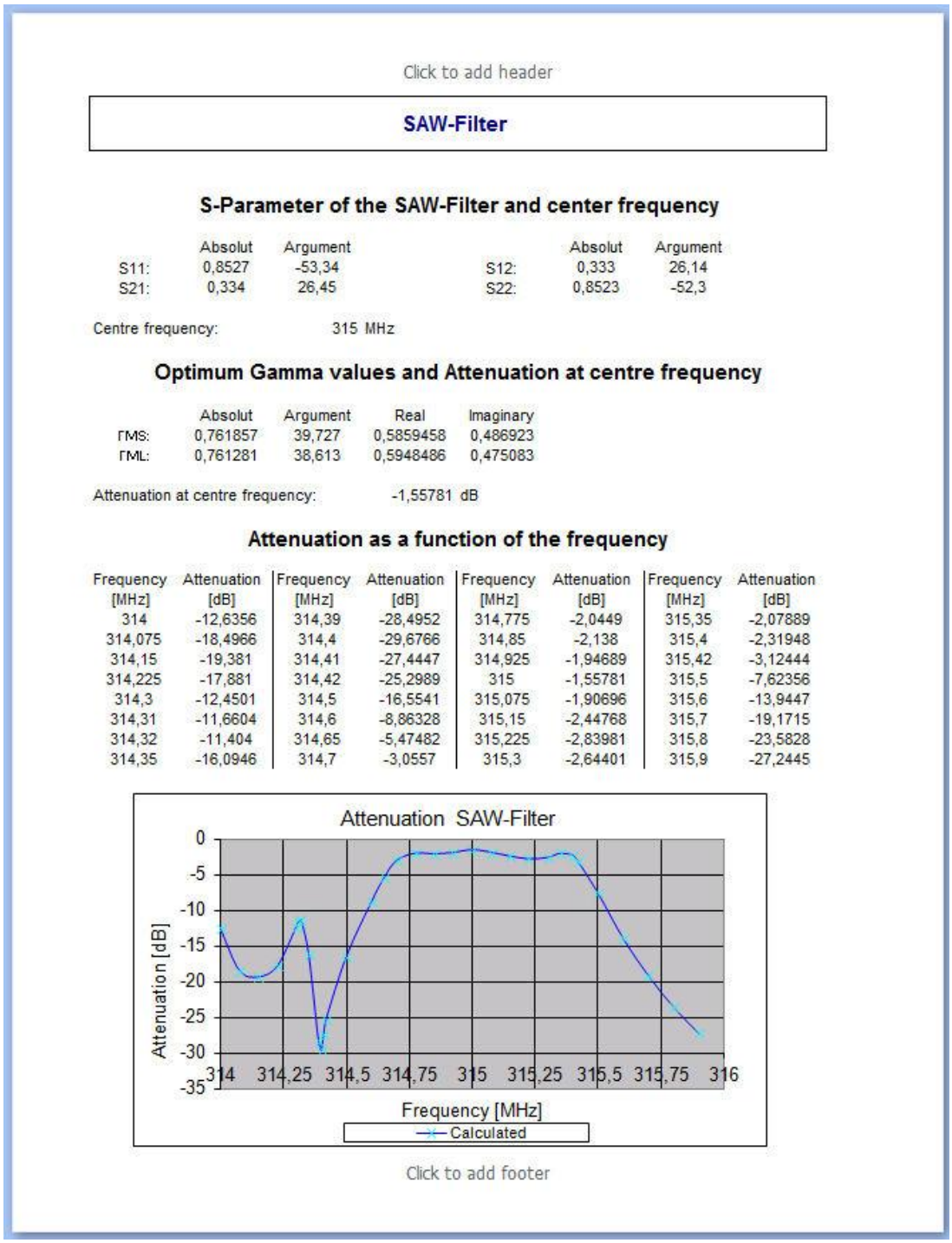


Figure 31: SAW-Filter Matching and Attenuation (Attenuation vs. frequency)



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SAW-Filter

S-Parameter of the SAW-Filter and center frequency

	Absolut	Argument		Absolut	Argument
S11:	0,8527	-53,34	S12:	0,333	26,14
S21:	0,334	26,45	S22:	0,8523	-52,3

Centre frequency: 315 MHz

Optimum Gamma values and Attenuation at centre frequency

	Absolut	Argument	Real	Imaginary
ΓMS:	0,761857	39,727	0,5859458	0,486923
ΓML:	0,761281	38,613	0,5948486	0,475083

Attenuation at centre frequency: -1,55781 dB

Attenuation as a function of the frequency

Frequency [MHz]	Attenuation [dB]	Frequency [MHz]	Attenuation [dB]	Frequency [MHz]	Attenuation [dB]	Frequency [MHz]	Attenuation [dB]
314	-12,6356	314,39	-28,4952	314,775	-2,0449	315,35	-2,07889
314,075	-18,4966	314,4	-29,6766	314,85	-2,138	315,4	-2,31948
314,15	-19,381	314,41	-27,4447	314,925	-1,94689	315,42	-3,12444
314,225	-17,881	314,42	-25,2989	315	-1,55781	315,5	-7,62356
314,3	-12,4501	314,5	-16,5541	315,075	-1,90696	315,6	-13,9447
314,31	-11,6604	314,6	-8,86328	315,15	-2,44768	315,7	-19,1715
314,32	-11,404	314,65	-5,47482	315,225	-2,83981	315,8	-23,5828
314,35	-16,0946	314,7	-3,0557	315,3	-2,64401	315,9	-27,2445

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Figure 32: Printable surface of the Match and Attenuation

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SAW-Filter

S-Parameter

Nr.	Frequency		Absolut value	Argument [°]
1	314	S11:	0,9218	-39,17
		S12:	0,0465	-63,36
		S21:	0,0461	-60,62
		S22:	0,9442	-37,65
2	314,075	S11:	0,971	-39,5
		S12:	0,0199	-126,2
		S21:	0,01899	-123,9
		S22:	0,9769	-38,62
3	314,15	S11:	0,966	-41,29
		S12:	0,0162	-136,6
		S21:	0,0171	-130,1
		S22:	0,983	-38,8
4	314,225	S11:	0,9639	-42,24
		S12:	0,0203	-141,9
		S21:	0,0208	-138,3
		S22:	0,9801	-39,67
5	314,3	S11:	0,9514	-42,77
		S12:	0,0435	-162,9
		S21:	0,0434	-162,3
		S22:	0,9574	-41,01
6	314,31	S11:	0,9346	-45,15
		S12:	0,0524	-178,4
		S21:	0,0518	-176,3
		S22:	0,9412	-41,5
7	314,32	S11:	0,9138	-41,92
		S12:	0,05625	154,7
		S21:	0,05609	154,9
		S22:	0,9304	-39,39
8	314,35	S11:	0,9432	-40,75
		S12:	0,0285	105,6
		S21:	0,0283	106
		S22:	0,9596	-38,16
9	314,39	S11:	0,9628	-42
		S12:	0,0061	125,6
		S21:	0,0062	130,6
		S22:	0,975	-39,18

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Figure 33: Printable surface of the S-Parameter

3 Important Note

The calculated values are suggested values assuming certain circumstances and parameters also depending on the application. Infineon does not guarantee the proper function of the application for the values calculated with this “Bipolar-Wizard”! The function of the application has to be verified by the customer!

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