1 Measurement condition

Ambient temperature T_A: 23 °C

Input power level P_{in}: 0 dBm

Terminating impedance:

Input : 50 Ω

Output : 50 Ω

2 Features

- 8-band switchable SAW filter bank with 9.5 MHz channel bandwidth
- Center frequencies: 371.25 MHz to 398.25 MHz
- Control Interface compatible with MIPI 2.0 RFFE standard
- Single-channel operation
- Hermetic package
- Weight approx. 0.75 g

3 Channels

ISB41 Channels		
Channel number	**Channel name**	**Nominal frequency f_N**
Ch1	SB41AA	371.25 MHz
Ch2	SB41AB	375.75 MHz
Ch3	SB41AC	380.25 MHz
Ch4	SB41AD	384.75 MHz
Ch5	SB41AE	389.25 MHz
Ch6	SB41AF	393.75 MHz
Ch7	SB41AG	398.25 MHz
Ch8	Bypass	384.75 MHz

Generated:

Checked / Approved:

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4 Electrical specification

4.1 Module specification

Data		typ. value		tolerance / limit		
SCLK frequency					0.032 - 26	MHz
Switching time	*)			max.	4.5	µs
Supply voltage	V_{IO}				1.65 - 1.95	V
Supply current	I_{IO}			max.	250	µA
Logic control voltage high	$V_{control\ high}$			min.	0.7 * V_{IO}	V
Logic control voltage low	$V_{control\ low}$			max.	0.3 * V_{IO}	V
Input power level	P_{in}			max.	15	dBm
Operable temperature range	*OTR*				-40 … +85	°C
Storage temperature range					-55 … +125	°C

*) 50% last SCLK falling edge to 90% RF signal

4.2 Channel specification

Remark:
The maximum attenuation in the pass band is defined as the insertion loss a_e. The nominal frequency f_N is fixed without any tolerance or limit.

Filter Data		typ. value		tolerance / limit		
Insertion loss	a_e					
	Ch1 – Ch7	2.2 … 2.4	dB	max.	3.0	dB
	Ch8: Bypass	0.95	dB	max.	1.2	dB
Nominal frequency	f_N				*)	MHz
Passband	PB (Ch1 – Ch7)				f_N ± 4.75	MHz
	Ch8: Bypass				f_N ± 18.25	MHz
Passband variation	PBV (Ch1 – Ch7)	0.3 … 0.4	dB	max.	0.7	dB
Absolute attenuation	a_{abs} (Ch1 – Ch7)					
1 MHz … f_N - 25 MHz		61 … 56	dB	min.	50	dB
f_N - 25 MHz … f_N - 14 MHz		29 … 22	dB	min.	17	dB
f_N + 14 MHz … f_N + 25 MHz		24 … 20	dB	min.	17	dB
f_N + 25 MHz … f_N + 35 MHz		39 … 38	dB	min.	32	dB
f_N + 35 MHz … 750 MHz		56 … 53	dB	min.	50	dB
750 MHz … 1000 MHz		42 … 38	dB	min.	35	dB
VSWR within PB	VSWR (Ch1 – Ch7)	1.4:1 … 1.5:1		max.	1.7:1	
Group delay variation within PB	GDV (Ch1 – Ch7)	29 … 33	ns	max.	100	ns
Temperature coefficient of frequency	TC_f **)	-38	ppm/K		-	

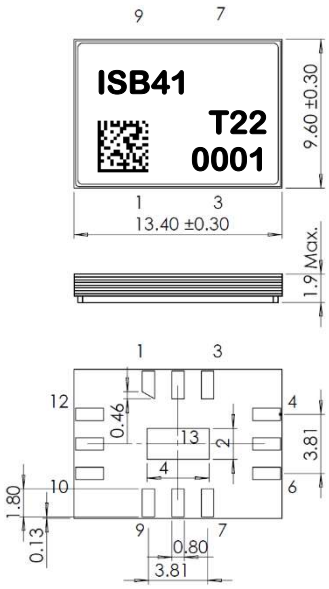
*) see page 1

**) $\Delta f = TC_f(T - T_A)f_N$

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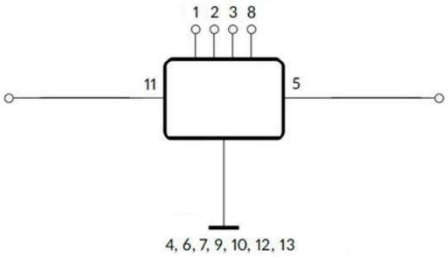
5 Construction, pin connection (all dimensions in mm)



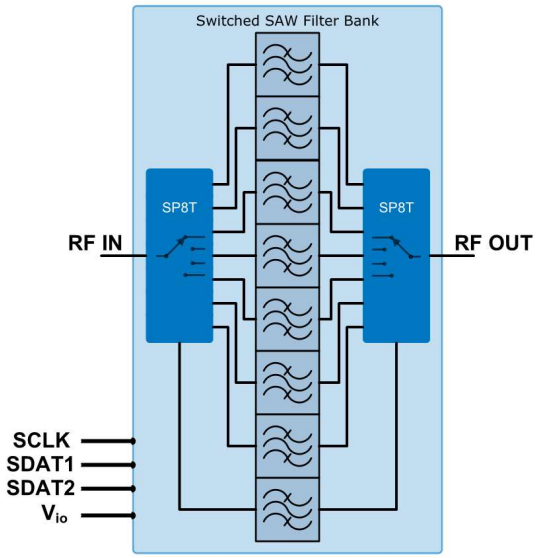
Pin	Function	Date code	Year + week
1	V_{IO}	T	2025
2	SCLK	U	2026
3	SDAT2	V	2027
4	Ground	...	
5	RF output		
6	Ground		
7	Ground		
8	SDAT1		
9	Ground		
10	Ground		
11	RF input		
12	Ground		
13	Ground		

Weight approx. 0.75 g

6 Matching Circuit



7 Internal Design



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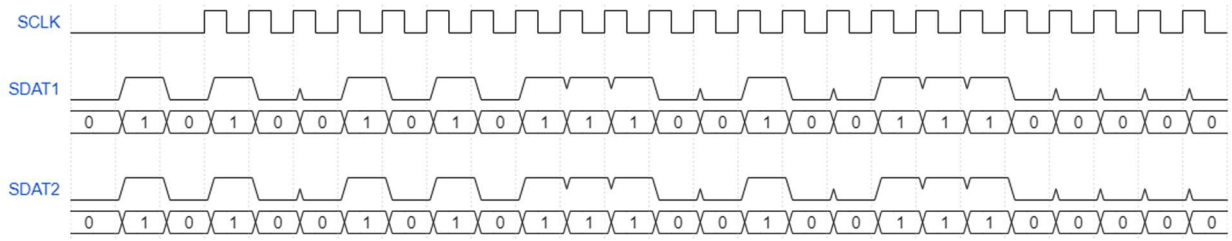
8 MIPI RFFE interface for channel selection

The ISB41 filter bank provides a control interface compatible to the MIPI 2.0 RFFE standard. It contains 2 independently programmable SP8T switches (BGS18MA12) which are controlled with separate SDAT signals and shared SCLK and V_{IO} signals. In the following section the MIPI command sequences for device initialization and channel selection are defined. For information on additional functionality, please refer to the datasheet of the SP8T-switch [1] and the Specification for the MIPI RF Front-End Control Interface [2].

8.1 Device initialization

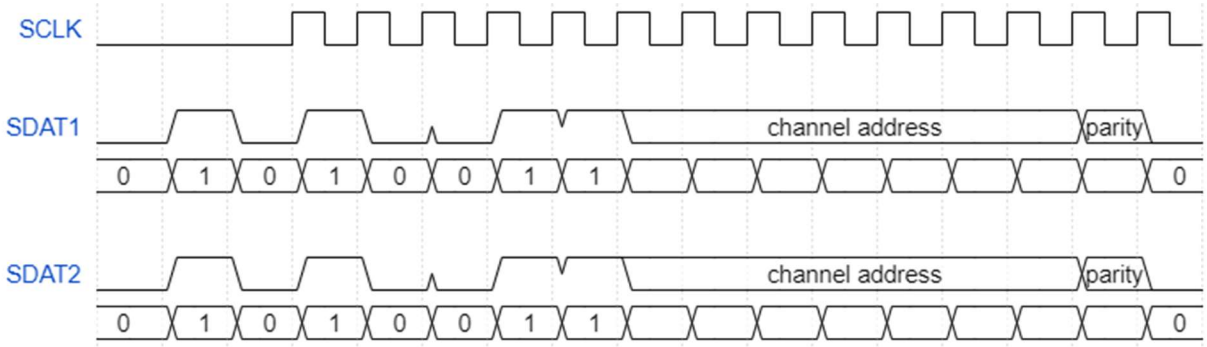
Upon power-up, the internal SP8T RF switches are in low power mode. To operate the filter-bank the internal SP8T switches need to be initialized.

The following Register Write Command Sequence should be used to initialize the filter bank.



8.2 Channel selection

Channel selection of the filter bank is executed by using a MIPI Register 0 Write Sequence.



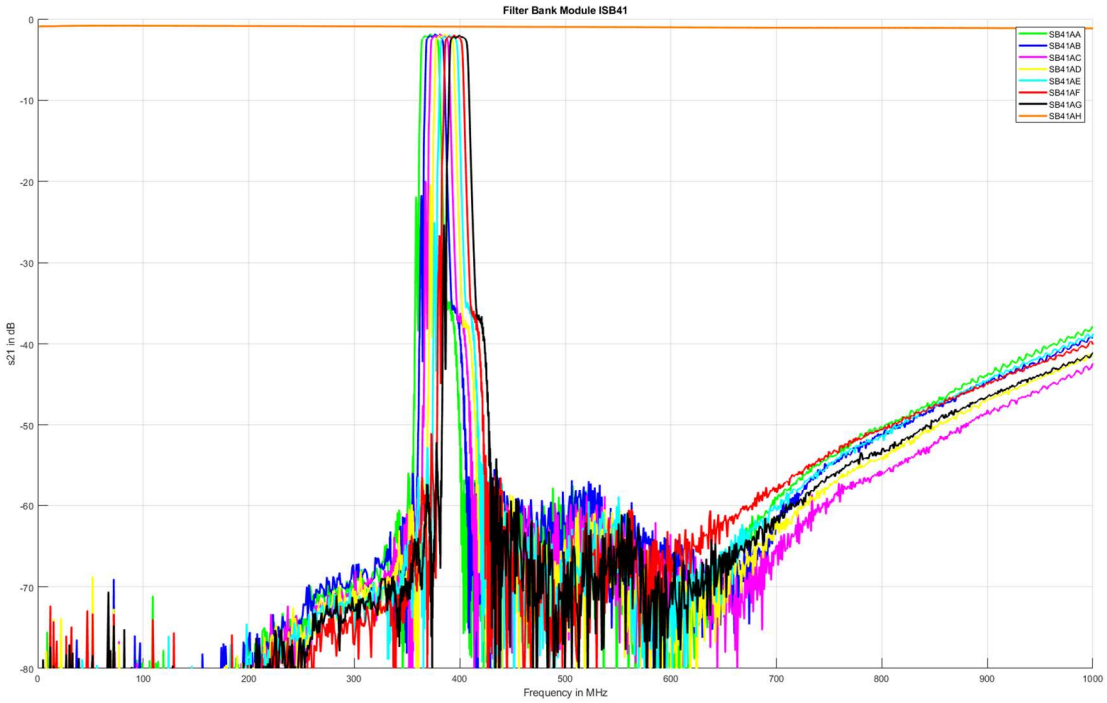
Channel Number	Channel Address	Parity
Ch1	0000001	1
Ch2	0000010	1
Ch3	0000100	1
Ch4	0001000	1
Ch5	0010000	1
Ch6	0100000	1
Ch7	1000000	1
Ch8	1000001	0

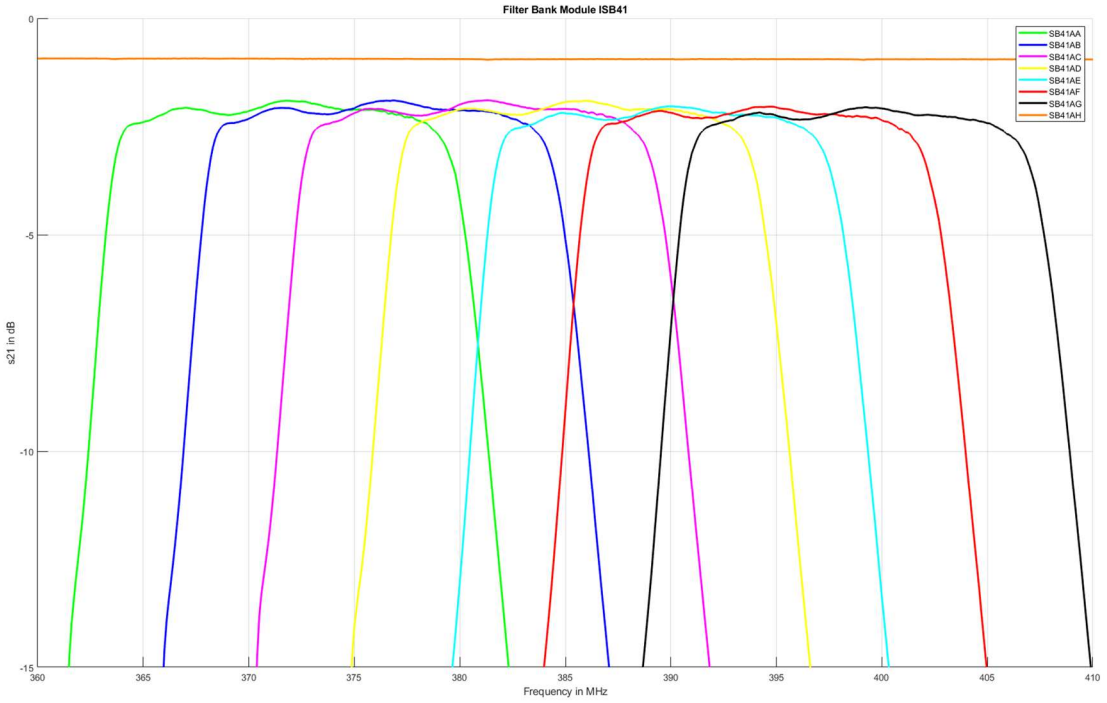
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9 Channel characteristics

9.1 Channel overview

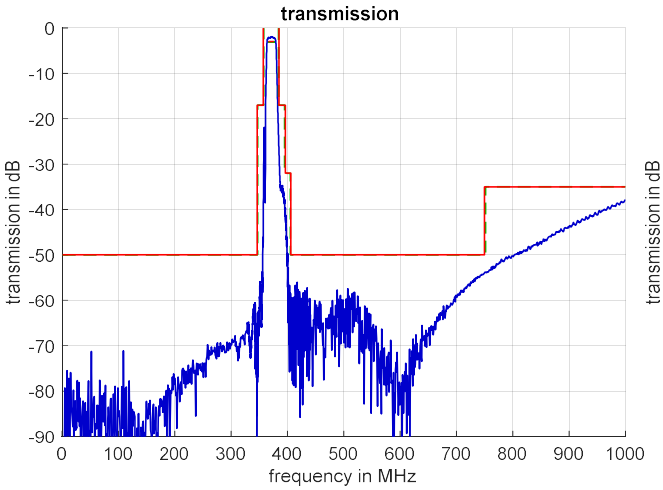




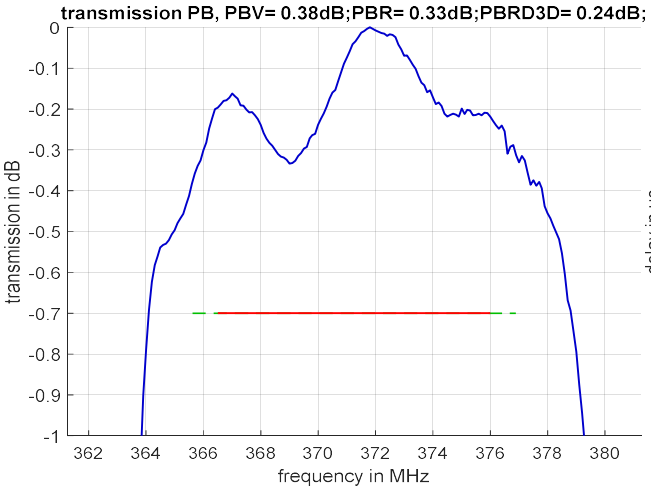
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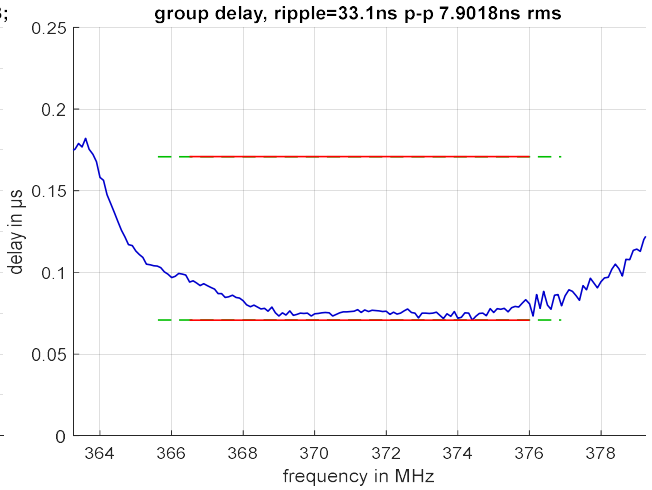
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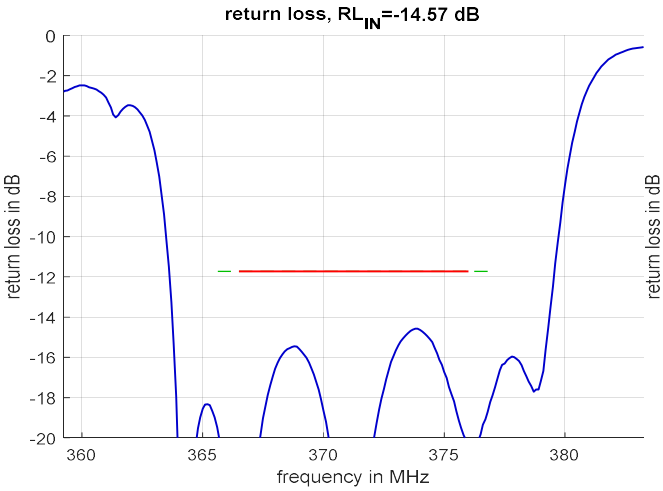
9.2 SB41AA (Channel 1, f_N = 371.25 MHz)

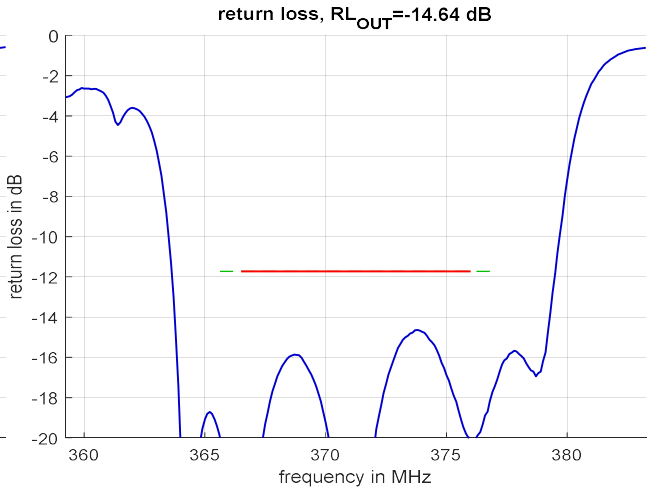








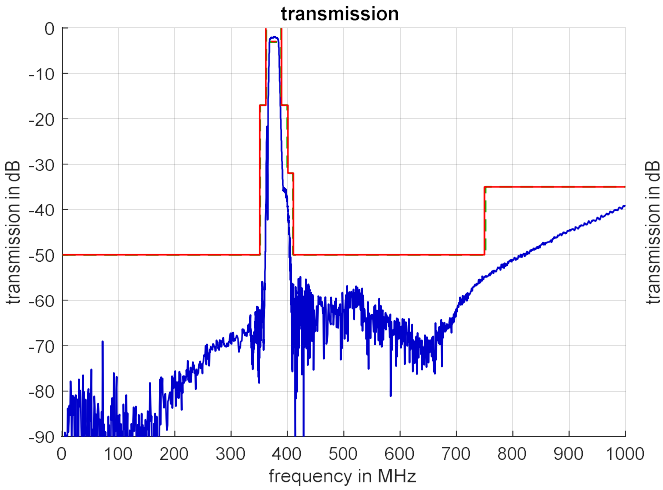


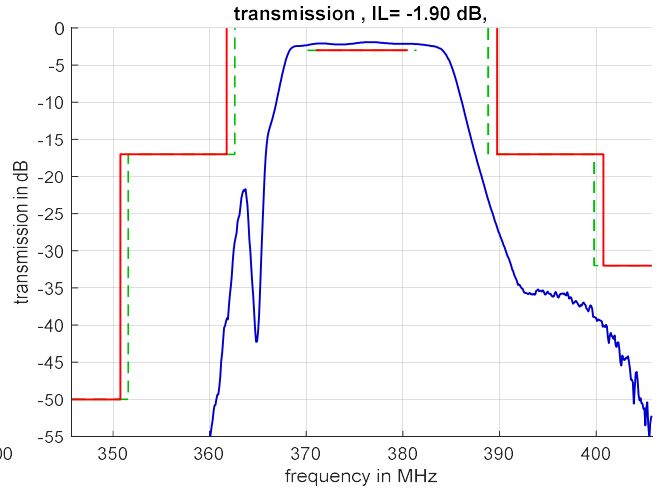


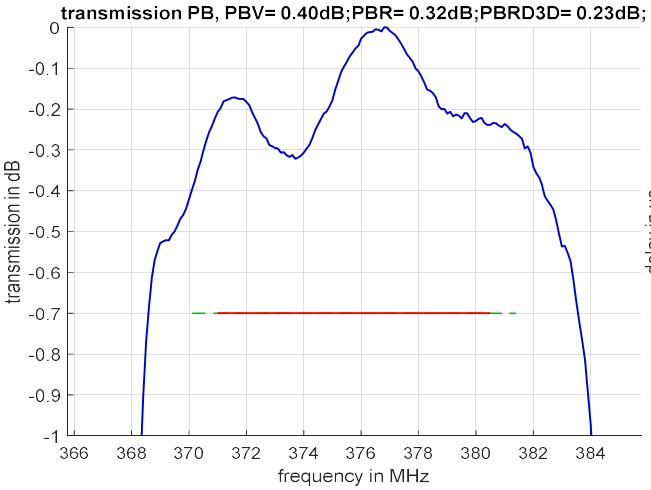
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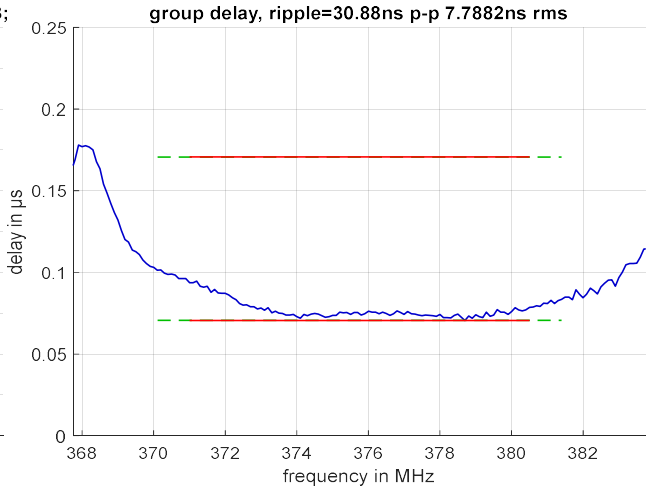
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9.3 SB41AB (Channel 2, f_N = 375.75 MHz)

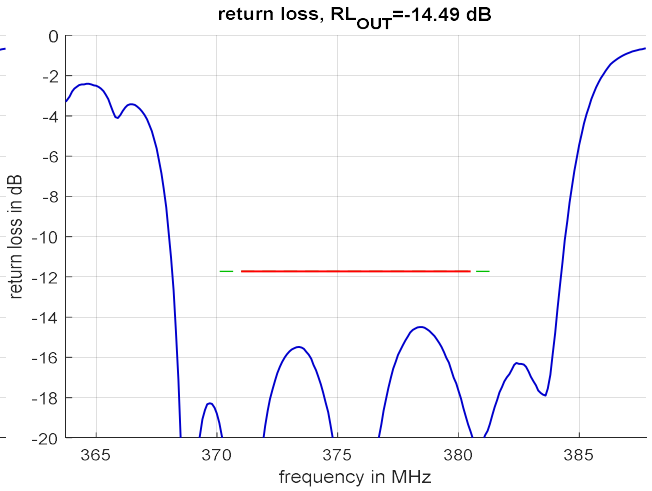








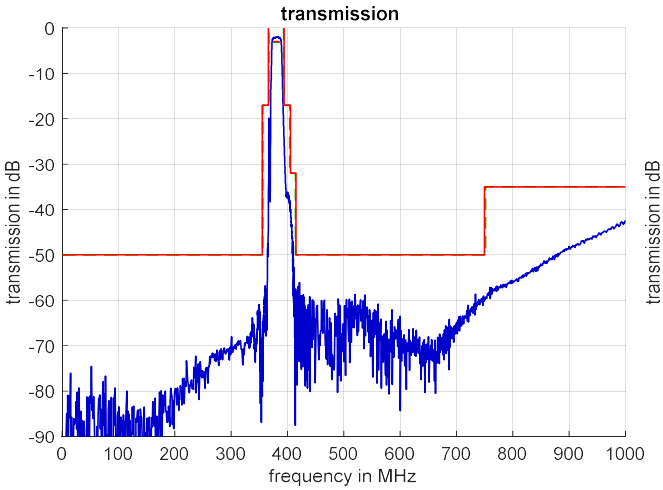


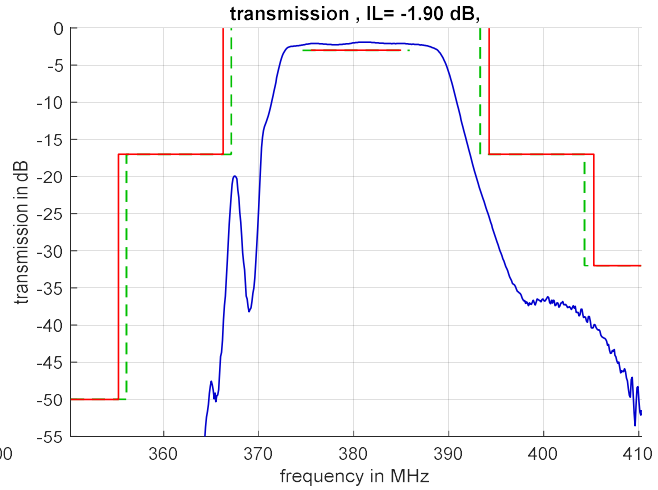


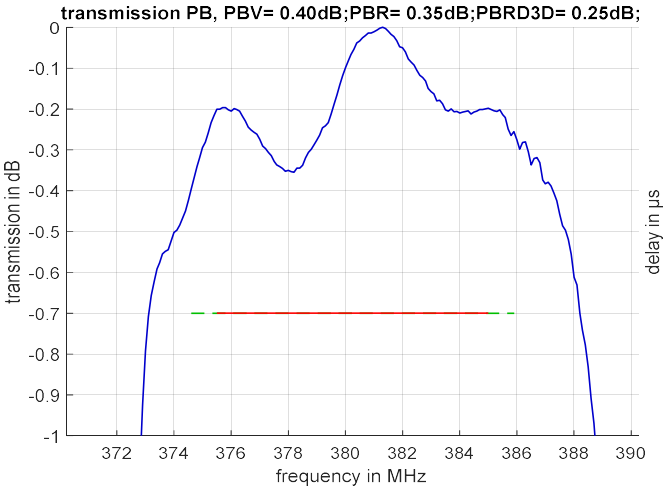
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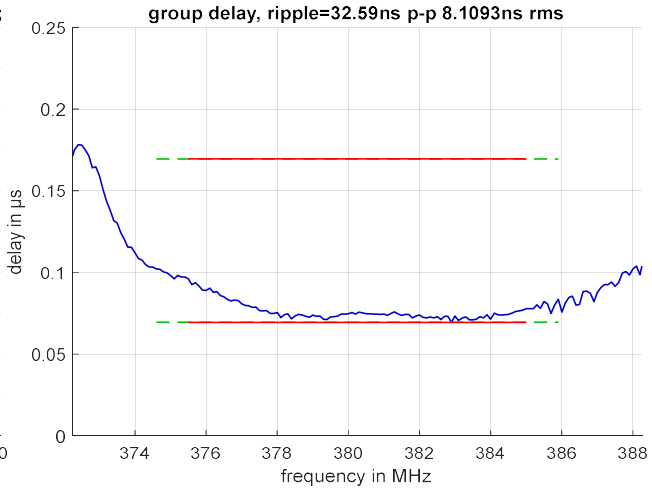
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9.4 SB41AC (Channel 3, f_N = 380.25 MHz)

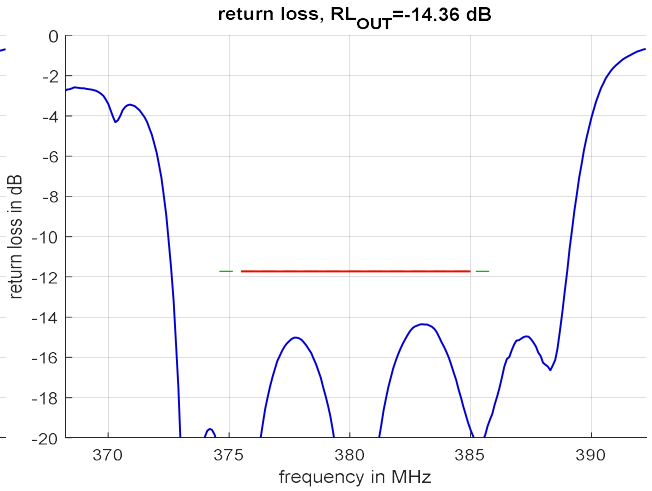








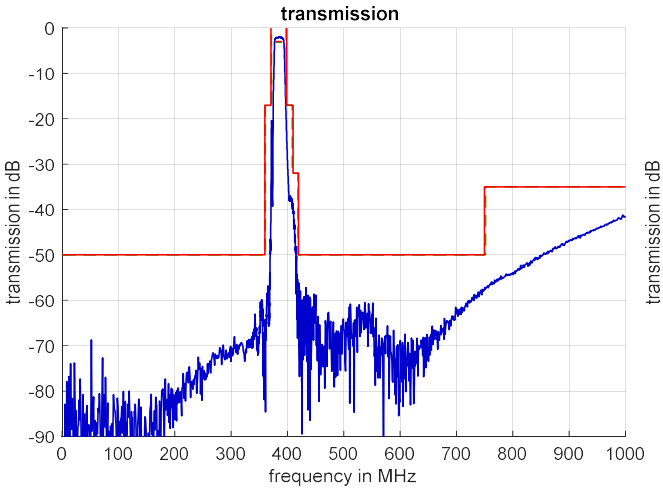


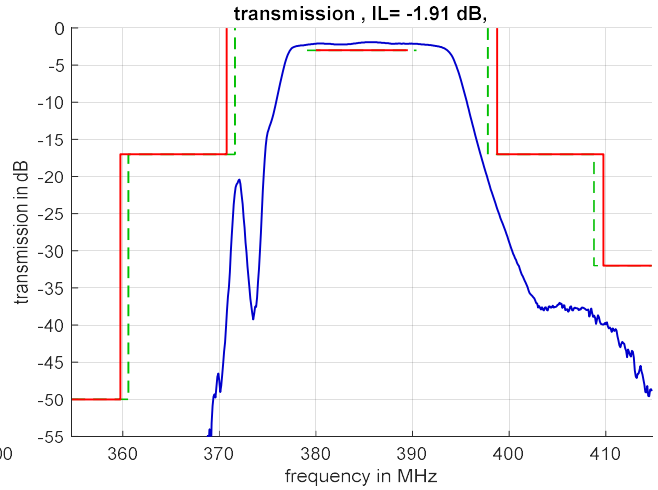


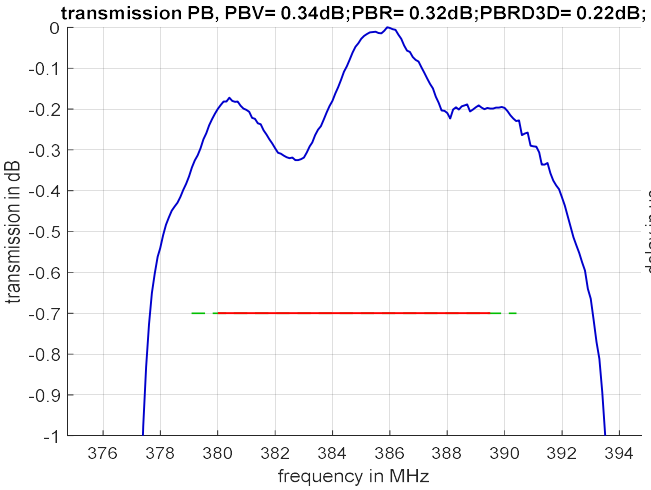
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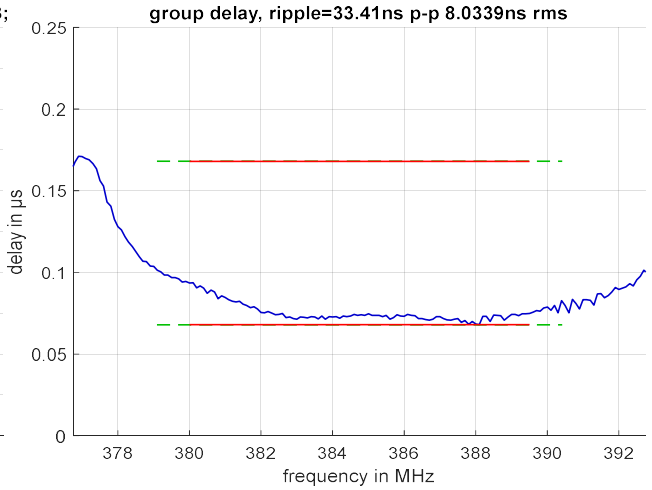
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9.5 SB41AD (Channel 4, f_N = 384.75 MHz)

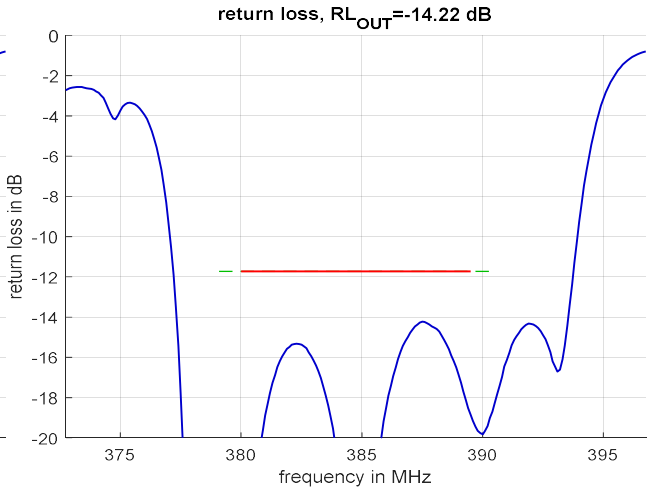








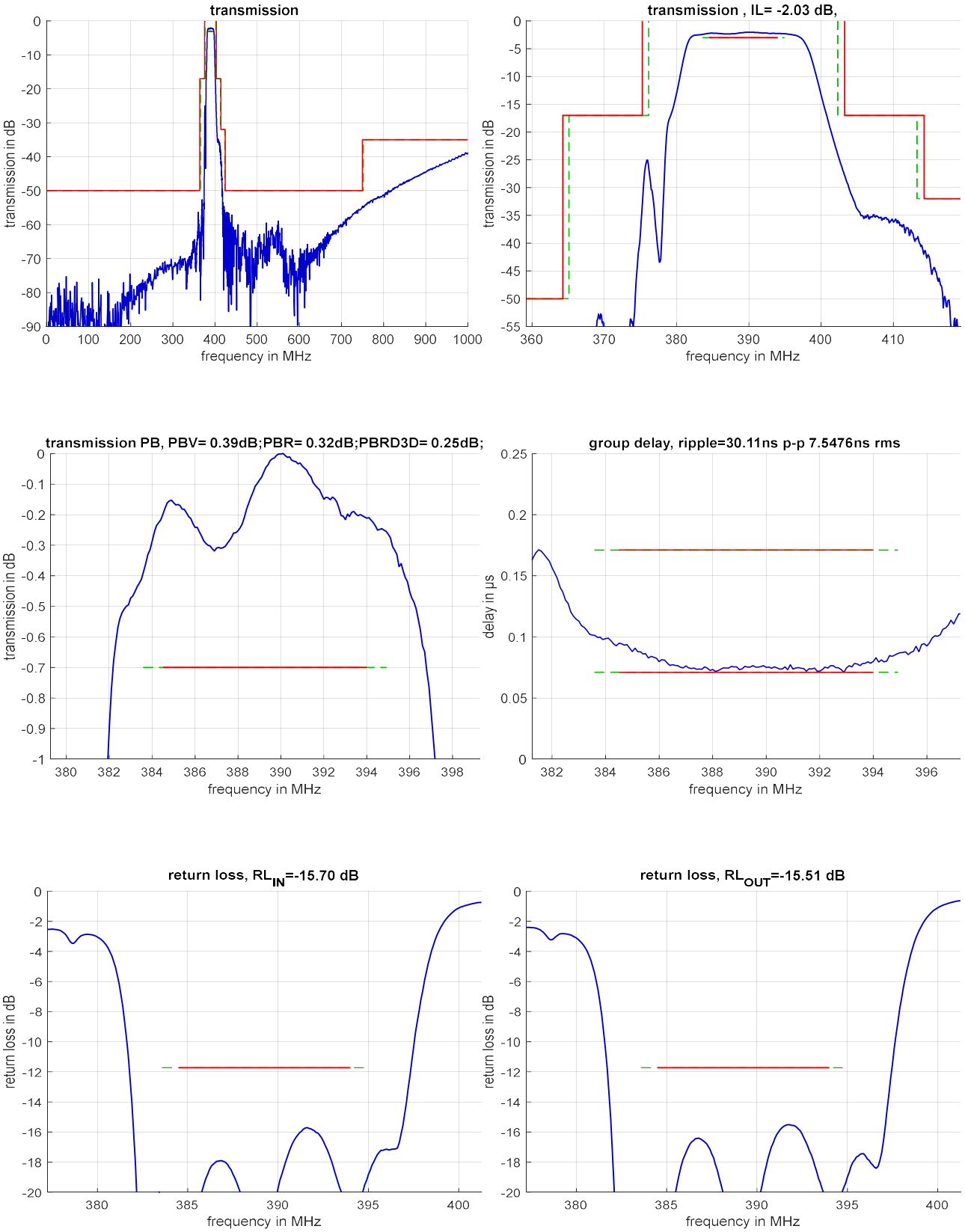




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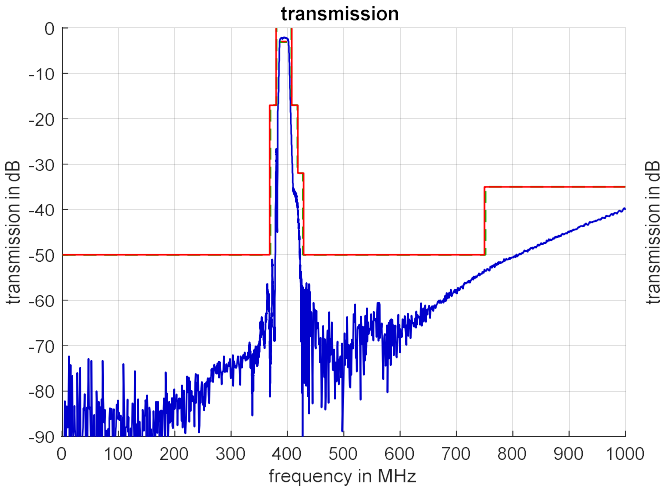
9.6 SB41AE (Channel 5, f_N = 389.25 MHz)

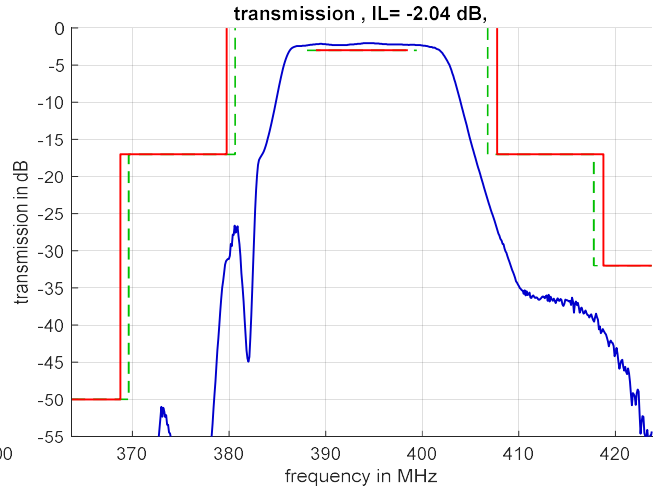


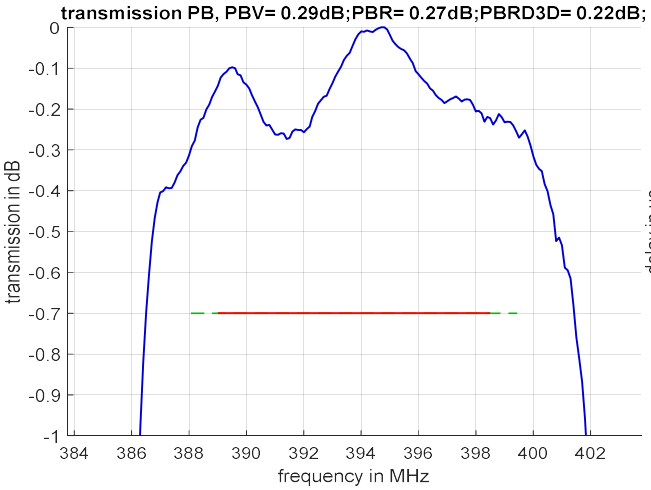
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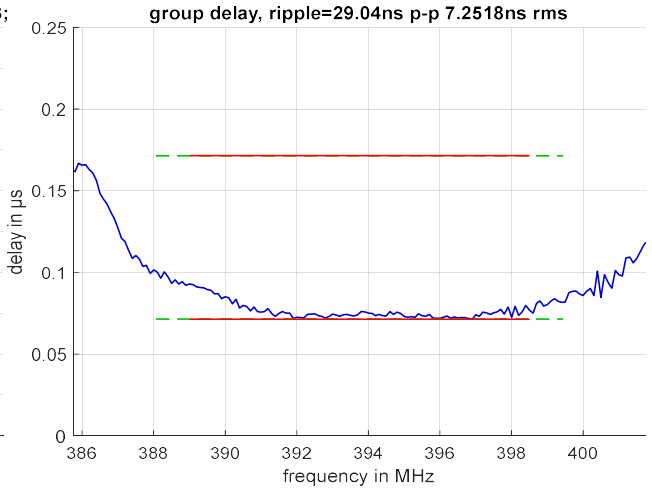
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9.7 SB41AF (Channel 6, f_N = 393.75 MHz)

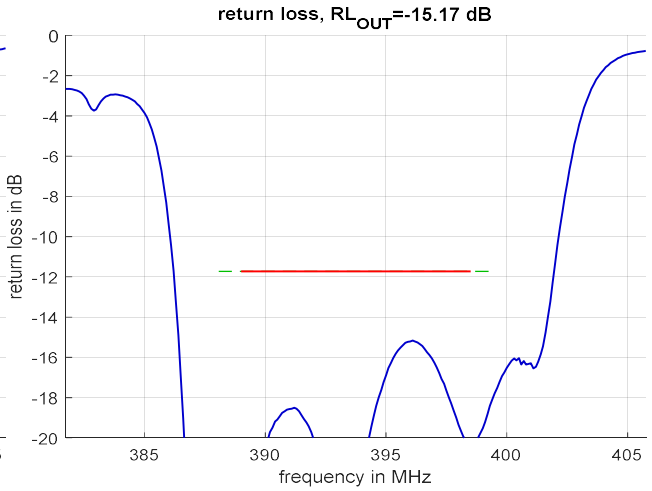








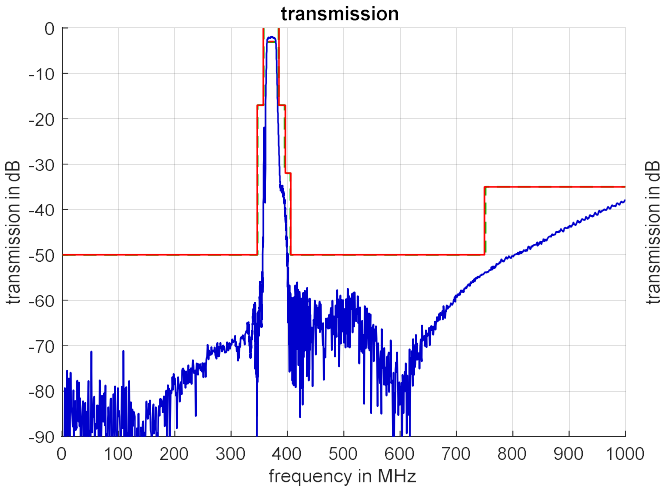




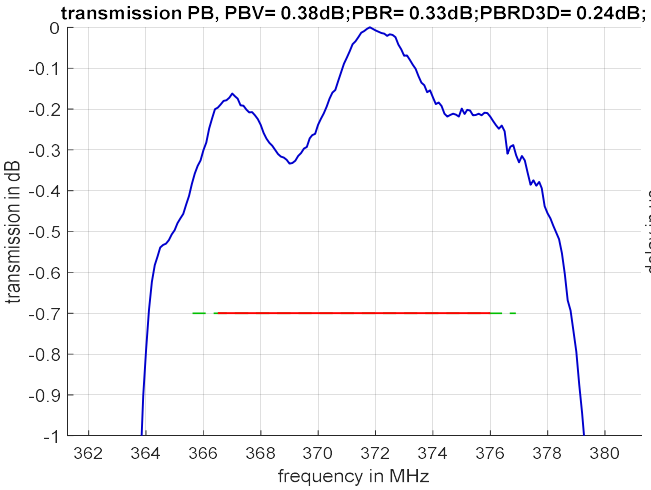
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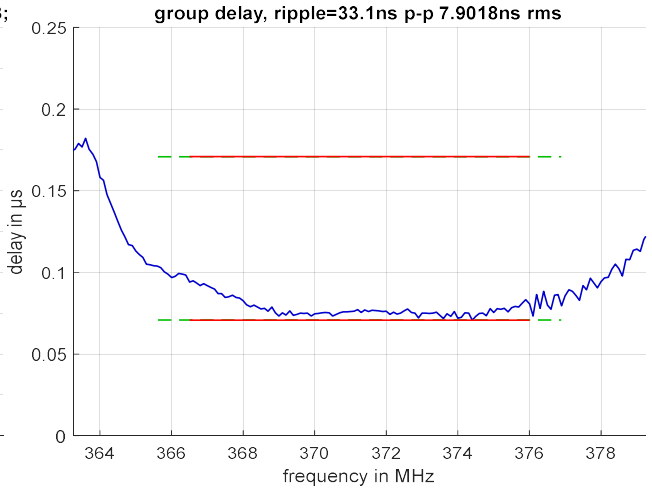
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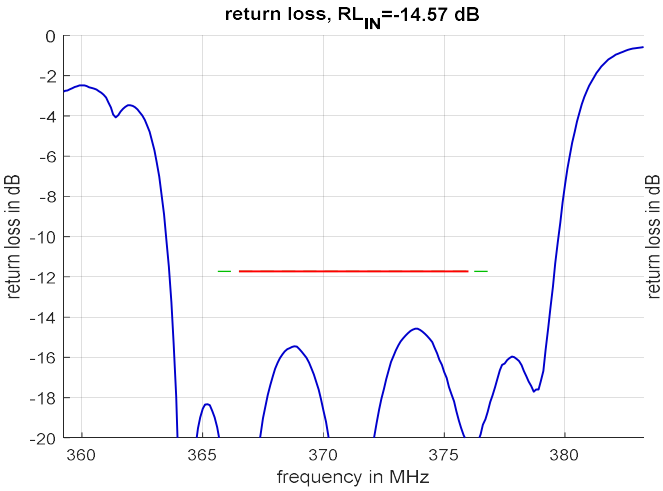
9.8 SB41AG (Channel 7 f_N = 398.25 MHz)

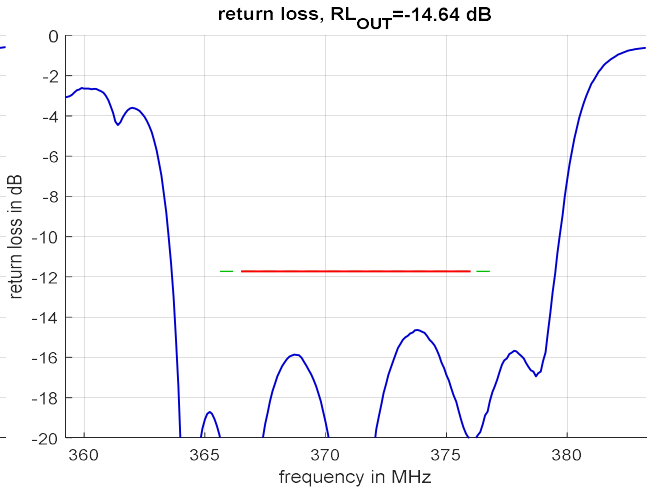








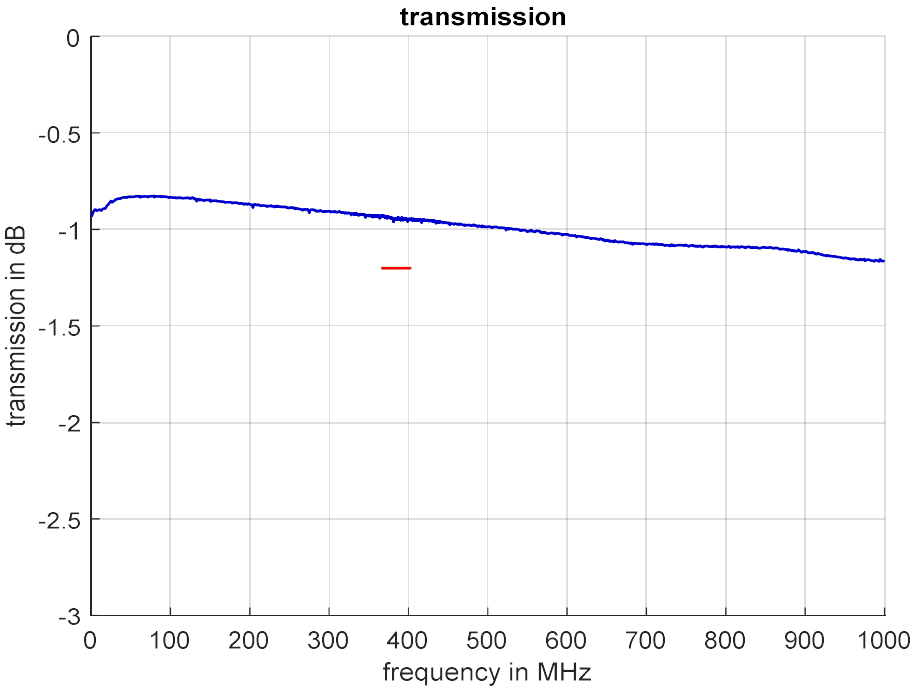


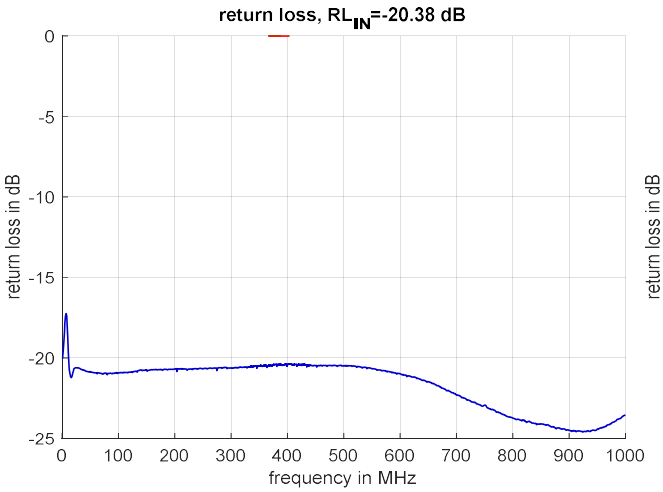


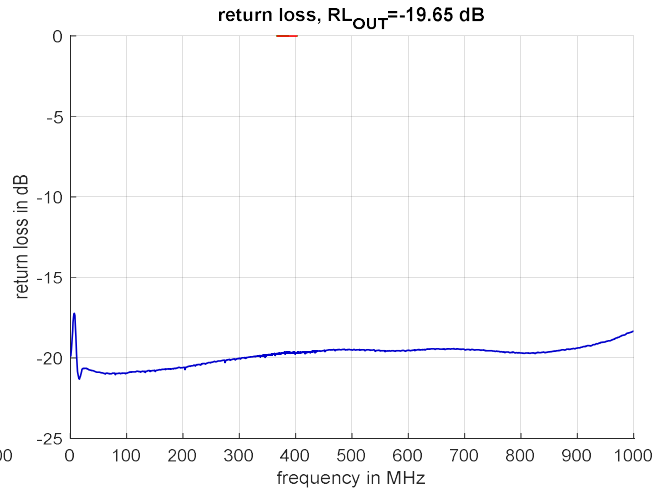
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9.9 SB41AH (Channel 8 (bypass channel))







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10 Stability characteristics, reliability

After the following tests the filter bank shall meet the whole specification:

1. Shock:	1500 g, 0.5 ms, half sine wave, 5 shocks each of the orientations acc. MIL-STD-883, Meth. 2002, Cond. B
2. Vibration:	10 Hz to 2000 Hz, 20 g acc. MIL-STD-883, Method 2007, Cond. A
3. Temperature cycling:	1000 cycles, -40 °C to +85 °C / 20 min. each[1]
4. Resistance to solder heat (reflow):	reflow possible: three times max. for temperature conditions refer to the attached "Air reflow temperature conditions" on page 15

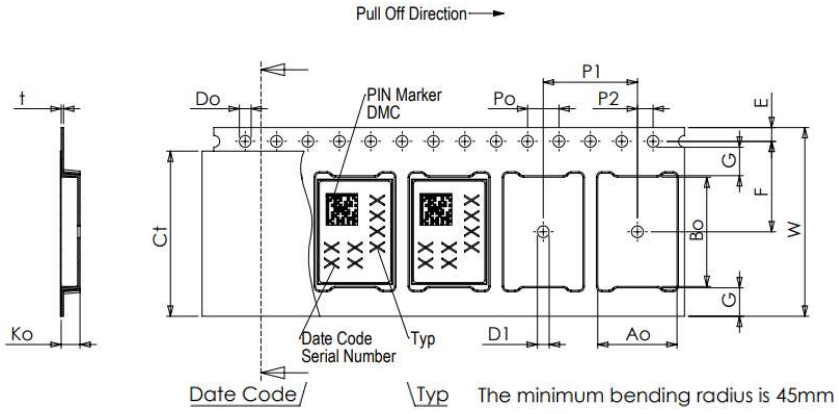
5. SAW devices are Electrostatic Discharge (ESD) sensitive devices.

The module is RoHS compliant (2011/65/EU+2015/863/EU).

11 Packing

Tape & Reel: DIN IEC 60286 - 3, with exception of value for N and minimum bending radius;
tape type II, embossed carrier tape with top cover tape on the upper side;

max. pieces of filters per reel:	1500
reel of empty components at start:	min. 300 mm
reel of empty components at start including leader:	min. 500 mm
trailer:	min. 300 mm

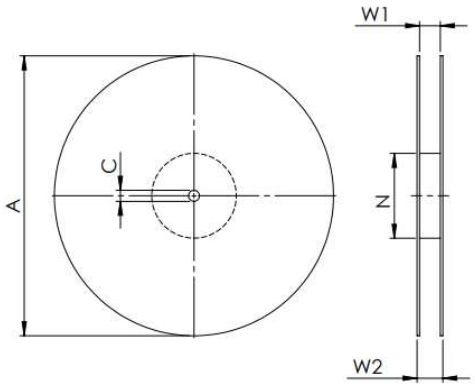


Tape (all dimensions in mm)

W	: 24.00 +0.3/-0.1
Po	: 4.00 ±0.1
Do	: 1.50 +0.1/0
E	: 1.75±0.1
F	: 11.50±0.1
G(min.)	:
P2	: 2.00±0.1
P1	: 12.00±0.1
D1(min.)	: 1.50
Ao	: 10.10±0.1
Bo	: 13.90±0.1
Ko	: 2.10±0.1
ct	: 21.00±0.1

Reel (all dimensions in mm)

A	: 330 or 180
W1	: 24.4 +2/-0
W2(max.)	: 30.4
N (min.)	: 60
C	: 13.0±0.25



[1] Confirmed by accelerated lifetime model (Norris-Landzberg): $N_{field} = N_{test}\left(\frac{t_{dwell,test}}{t_{dwell,field}}\right)^{m}\left(\frac{\Delta T_{field}}{\Delta T_{test}}\right)^{-n} e^{\frac{E_a}{k_B}\left(\frac{1}{T_{max,field}}-\frac{1}{T_{max,test}}\right)}$

Comparable second level reliability requires post-reflow underfilling.

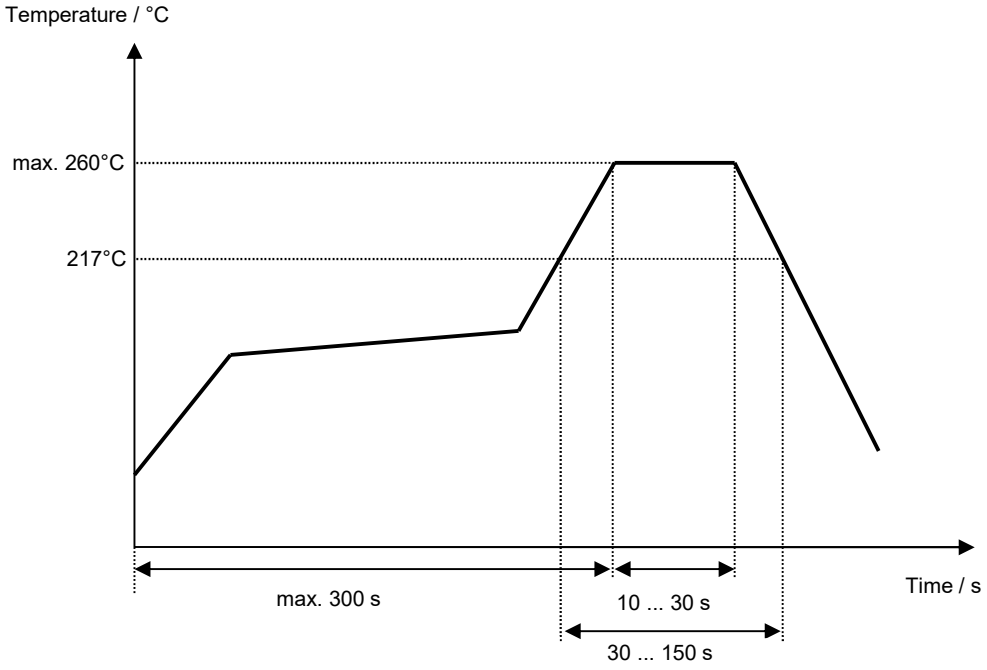
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12 Air reflow temperature conditions

Conditions	**Exposure**
Average ramp-up rate (30 °C to 217 °C)	less than 3 °C/second
> 100 °C	between 300 and 600 seconds
> 150 °C	between 240 and 500 seconds
> 217 °C	between 30 and 150 seconds
Peak temperature	max. 260 °C
Time within 5 °C of actual peak temperature	between 10 and 30 seconds
Cool-down rate (Peak to 50 °C)	less than 6 °C/second
Time from 30 °C to Peak temperature	no greater than 300 seconds

Chip-mount air reflow profile



Post-reflow underfilling process is recommended with regards to second-level reliability (low-viscosity underfill).

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13 References

[1] Infineon, „Infineon BGS18MA12,“ 06 09 2022. [Online]. Available: https://www.infineon.com/cms/en/product/rf/rf-switches-spxt-dpxt/bgs18ma12/.

[2] MIPI-Alliance, „MIPI alliance,“ 06 09 2022. [Online]. Available: https://www.mipi.org/specifications/rf-front-end.

14 History

Version	Reason of Changes	Name	Date
1.0	First version of filter bank specification.	Schönbein	24.10.2024
2.0	Data table and channel characteristics plots updated.	Schönbein	27.05.2025

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