September 18, 2026

Passive Track: Printed Circuit Board (PCB) Bandpass Filter Design Competition

～ Toward the Optimization of Frequency Resources in Complex RF Environments ～

Applicants: student

Preliminary review: No

1. Target specifications

(a)Frequency :

The filter should pass through 5.5 GHz ± 150 MHz signals.

(b)Insertion loss :

The filter should have less than 5 dB insertion loss over the above mentioned frequency range. (Figure 1)

(c)Return loss :

The filter should have more than 10 dB return loss over the above mentioned frequency range. (Figure 2)

(d)Rejection :

The filter should satisfy rejection characteristics shown below. (Figure 1)

・from 1.0 GHz to 4.8 GHz and 6.2 GHz to 10.0 GHz : more than 20 dB

(e)Size (Does not include connector, but includes case) :

The size must be 30 mm × 30 mm × 20 mm or smaller.

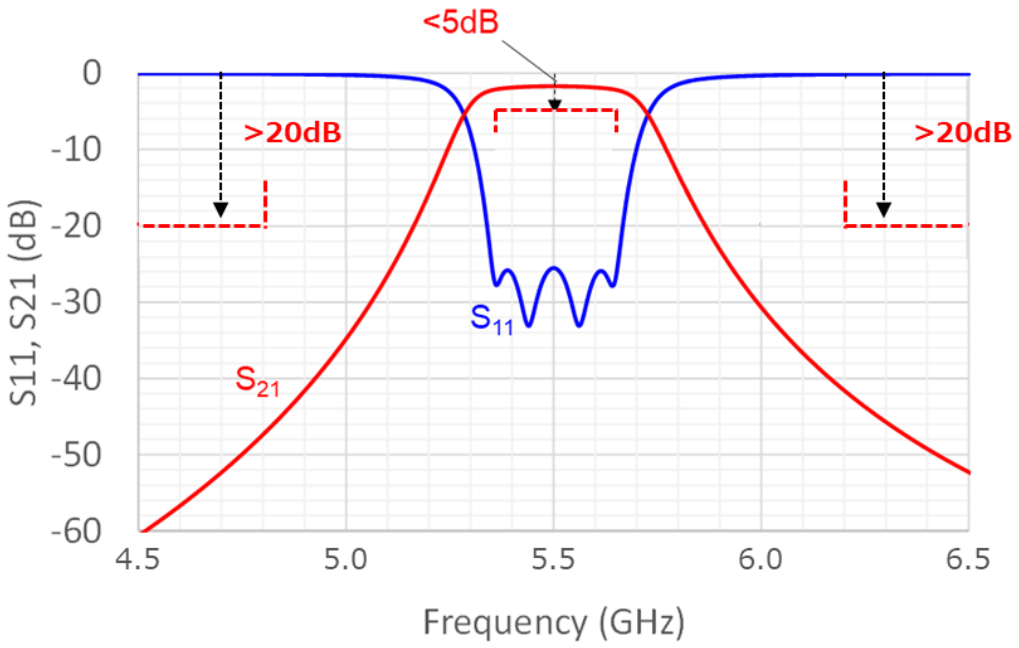


Figure 1. Target specifications of S_{21}

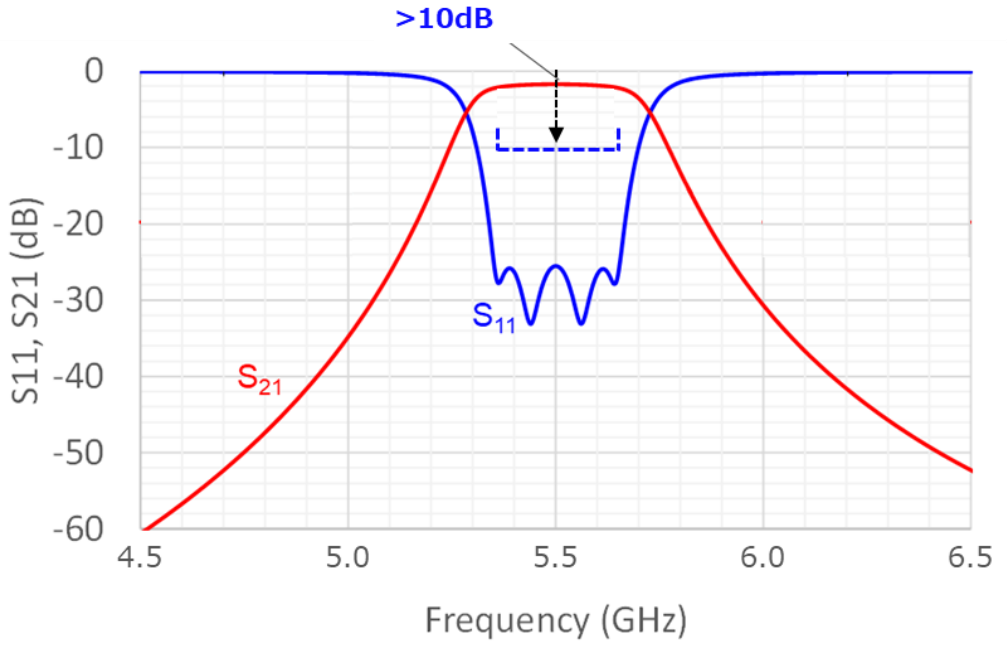


Figure 2. Target specification of S_{11}

Selection rules

Rank and score the following three items to determine the overall score. The first to third places are determined based on the total score.
In case of a tie, the order of IL, Rej, and size is used to determine the ranking.

The score for Rej and IL is 20 points, and the score for size is 10 points. The score is determined by the rank of each item.

Any submission that fails to meet even one of the required specifications will receive zero points for all evaluation items.

If the number of participants meeting the required specifications is N, the score for the kth place in the Rej category is (N+1-k) × 20/N points.

○Rej : Minimum rejection over 1.0 GHz to 4.8 GHz and 6.2 GHz to 10.0 GHz (Figure 3)
○IL : Maximum insertion loss over 5.35 GHz to 5.65 GHz (Figure 3 and 4)
○Size : Minimum volume X × Y mm^2 (Figure 5)
The measurement will be done with a network analyzer from 1.0 GHz to 10.0 GHz with 5MHz resolution.

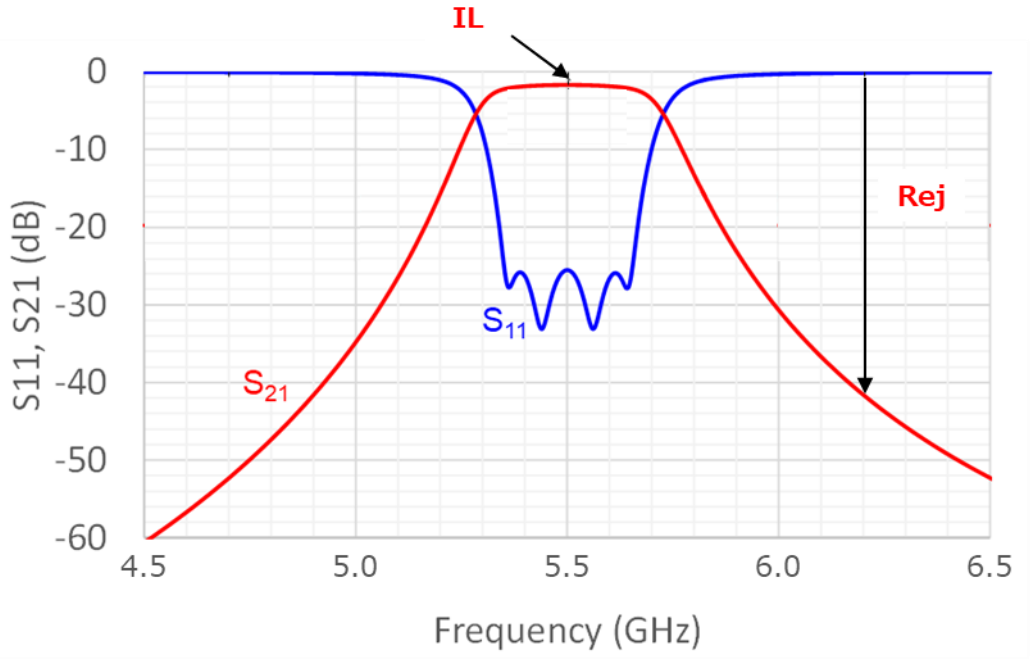


Figure 3. What Rej and IL mean (Example).

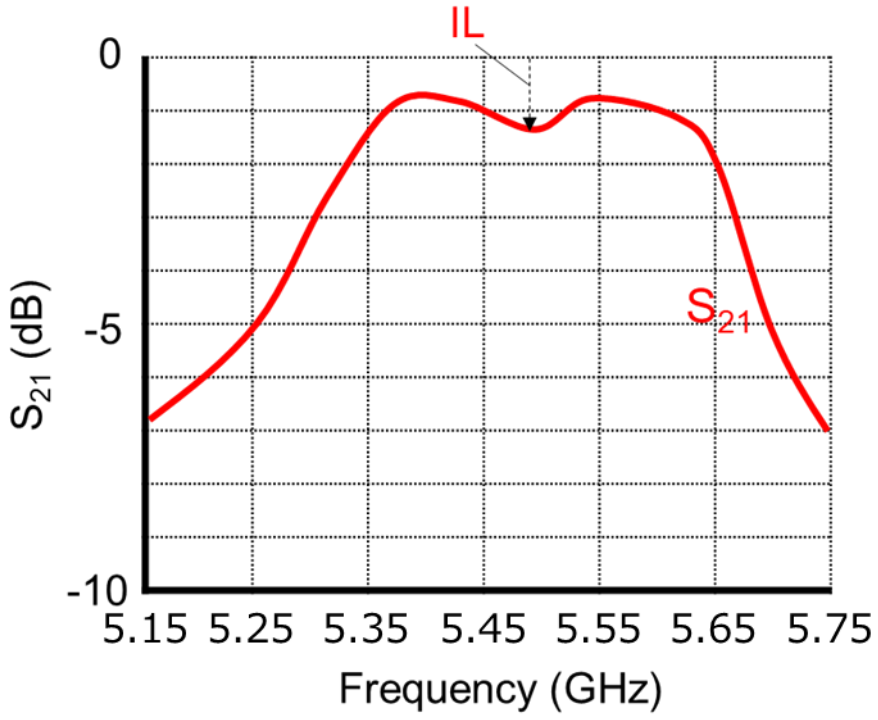
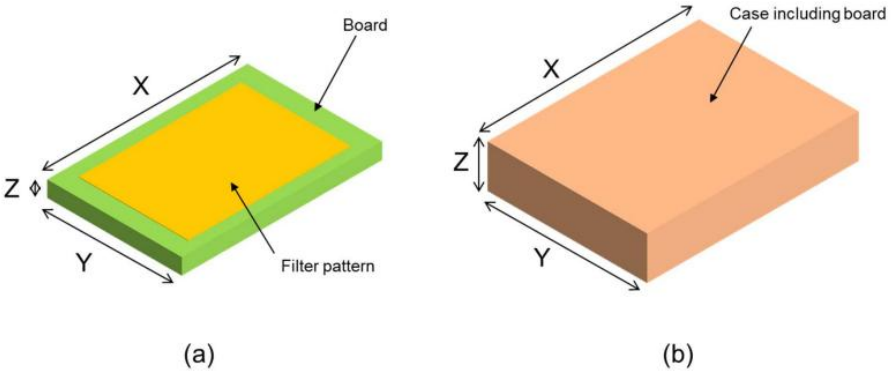


Figure 4. Enlarged view of IL.



(a) (b)

Figure 5. Dimensions. (a) Board. (b) Case including board.

2. Design conditions

(1) Board:

One-side or both-sides resin printed circuit board. Multilayer board is not allowed.

(2) Pattern formation:

One-side or both-sides pattern formation is acceptable. Vias and through holes can be used. No via or through hole size specified.

(3) Board material:

Composite material containing glass, ceramic filler, etc. are acceptable.

(4) Board shape and size:

Square or rectangular. No regulation with substrate thickness.

The size must be 30 mm × 30 mm × 20 mm or smaller. For board only, see the Figure 6.

If a case is used, refer to the Figure 7.

(5) Number of printed circuit boards:

One.

(6) Interface for input and output signals:

50 Ω female SMA connector (Standard SMA, 1/4-36 UNS thread) .

(7) Available components:

Only passive components (R, L, C) may be used. Any active components or devices are NOT allowed.

(8) Case:

Radio shielding case can be used. However, ensure that the judges can check the inside.

Therefore, the case should be ready to be opened immediately.

(9) Design consideration:

Design with consideration of variation due to measurement environment

(e.g. :temperature fluctuation).

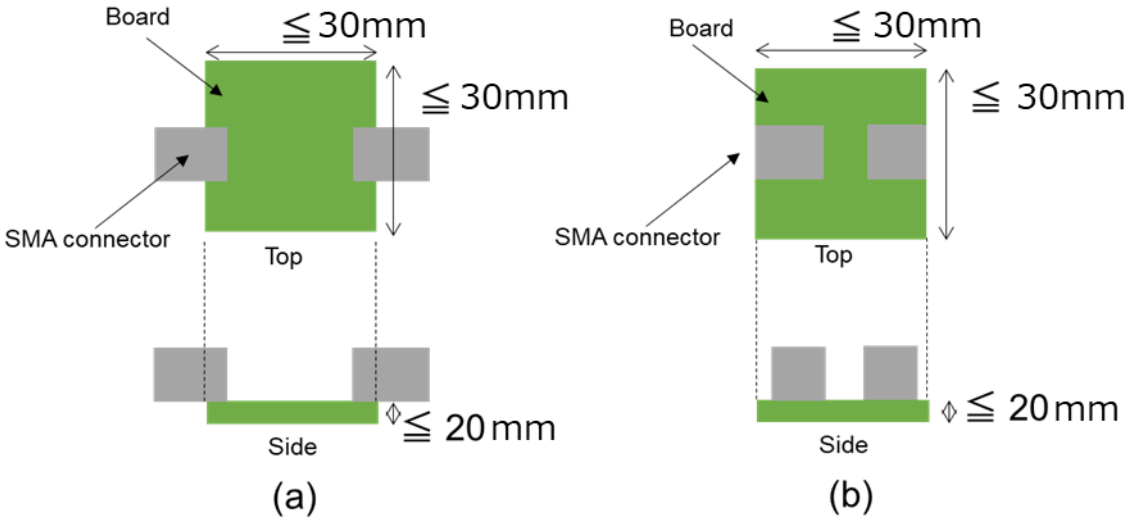


Figure 6. Board size regulation examples. (a) SMA right angle. (b) SMA vertical angle.

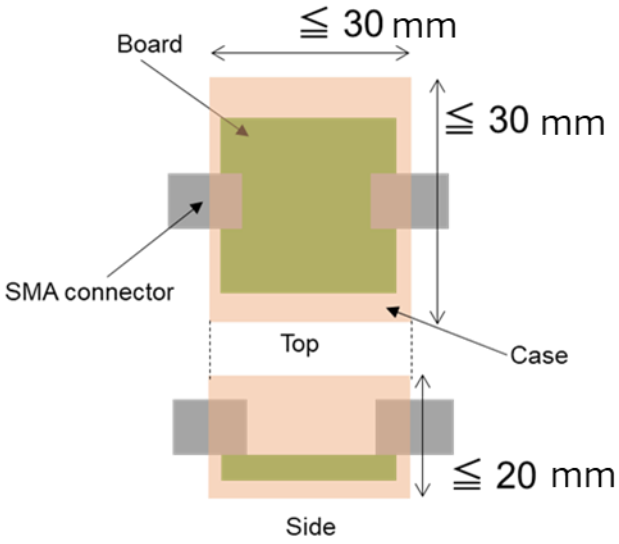


Figure 7. Example of size regulation of case including board.