



Passive Track: Key device for communication systems ~Bandpass filter design competition~
Create a printed circuit board (PCB) bandpass filter.

Applicants: student

Preliminary review: No

1. Target specifications

- (a) Frequency: The filter should pass through $4.0 \text{ GHz} \pm 100 \text{ MHz}$ 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 3.5 GHz and 4.5 GHz to 7.0 GHz : more than 20 dB
- (e) Size (Does not include connector, but includes case) : The size must be $40 \text{ mm} \times 40 \text{ mm} \times 20 \text{ mm}$ or smaller.

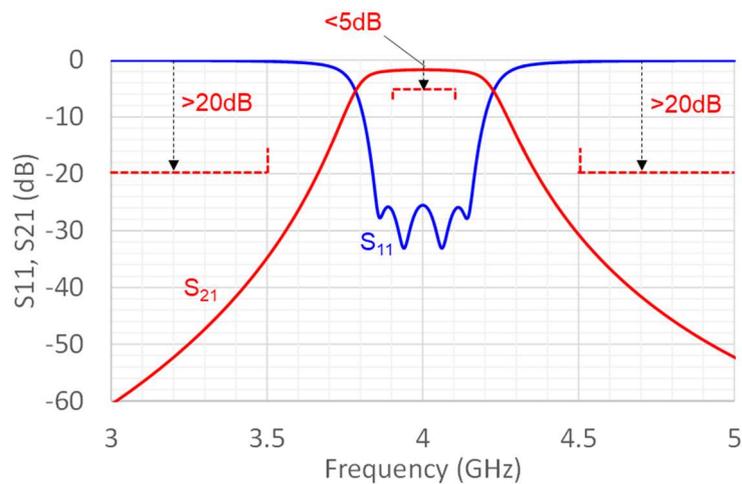


Figure 1. Target specifications of S_{21}

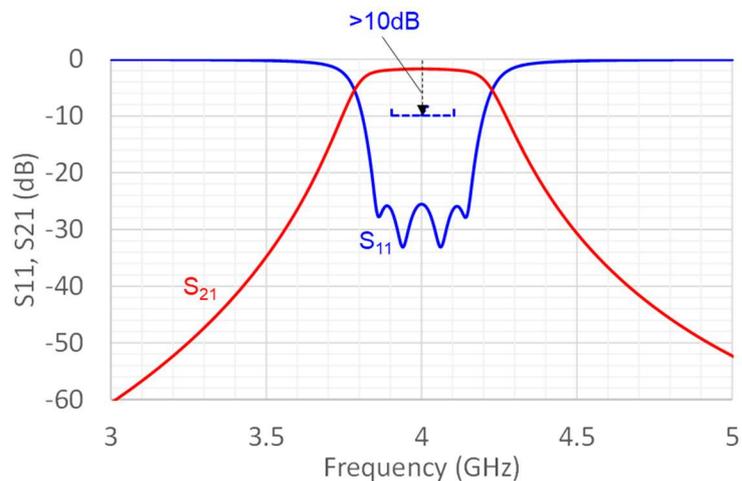


Figure 2. Target specification of S_{11}



2. 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.

All items that do not meet the required specifications will receive zero points.

If the number of teams meeting the required specifications is N , the score for the k^{th} place in the Rej category is $(N+1-k) \times 20/N$ points.

○Rej : Minimum rejection over 1.0 GHz to 3.5 GHz and 4.5 GHz to 7.0 GHz (Figure 3)

○IL : Maximum insertion loss over 3.9 GHz to 4.1 GHz (Figure 3 and 4)

○Size : Area $X \times Y \text{ mm}^2$ (Figure 5). The smaller the size, the higher the score.

The measurement will be done with a network analyzer from 1.0 GHz to 7.0 GHz with 5MHz resolution.

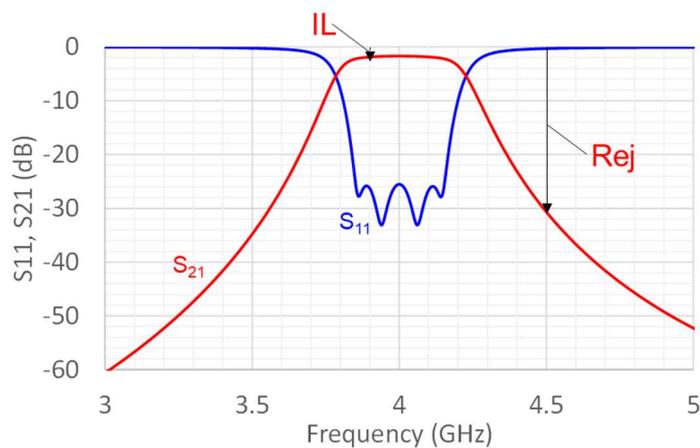


Figure 3. What Rej and IL mean (Example).

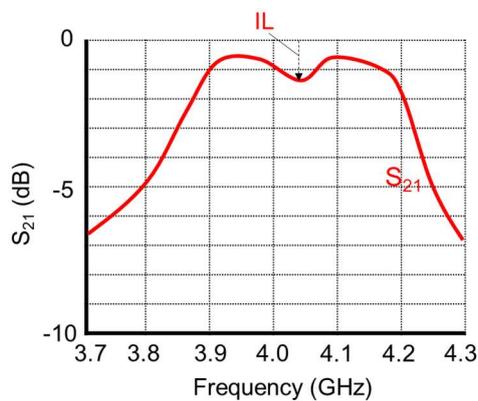


Figure 4. Enlarged view of IL.

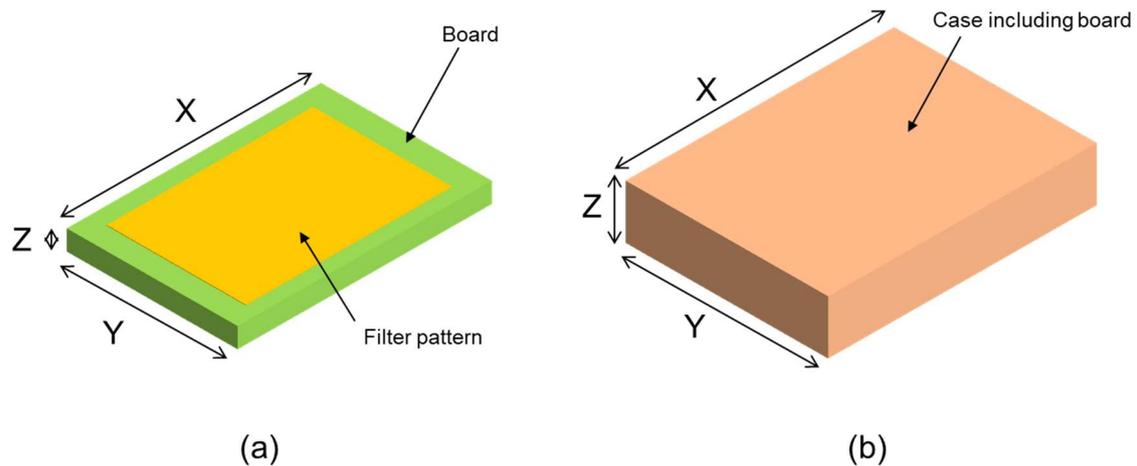


Figure 5. Dimensions. (a) Board. (b) Case including board.

3. 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 40 mm × 40 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 (ISO metric screw threads)

(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).

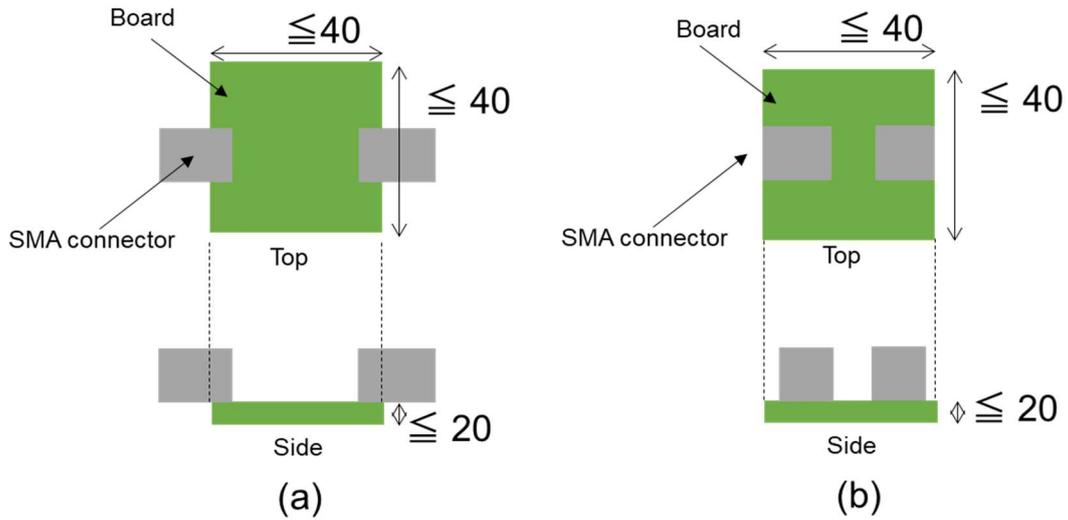


Figure 6. Board size regulation examples. (a) SMA right angle. (b) SMA vertical angle.

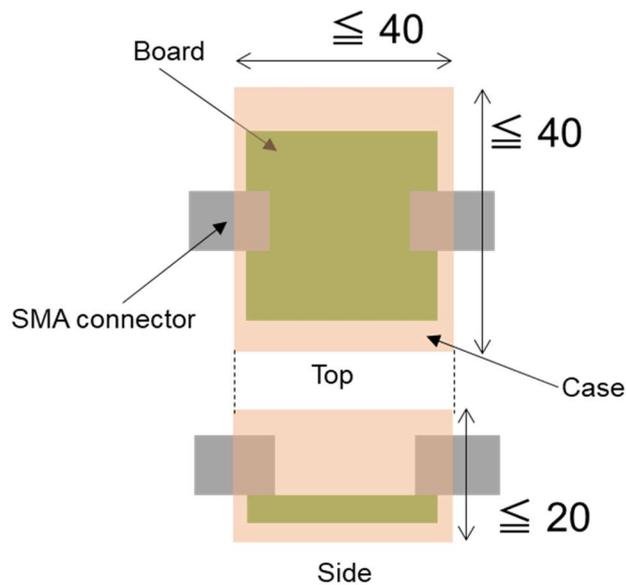


Figure 7. Example of size regulation of case including board.

4. Notes

If you cannot participate onsite, you can send your work to SDC committee. Postal address will later be notified. SDC committee will evaluate your work on your behalf. SDC committee will discard your work, not returning to you.