

- How to rank?
  - A team or individual who satisfy “Minimum requirement” can go to the next step, “precision measurement”. In the “Precision measurement”, following three items are measured.
    - Accuracy of cut-off frequency
    - Insertion loss at pass band
    - Attenuation at stopband
  - A team or individual gets points for each measurement item by following rule.
    - measurement value of each measurement items are compared with reference value. From the nearest team/individual to the reference value get following point. 1<sup>st</sup> :5point, 2<sup>nd</sup> :4point, 3<sup>rd</sup>:3point, 4<sup>th</sup>:2point, 5<sup>th</sup>: 1point.
  - Sum of the points is used for final ranking.
  - Example
    - Accuracy of cut-off frequency: 3<sup>rd</sup>: 3point, Insertion loss at pass band: 6<sup>th</sup>: nothing, Attenuation at stopband: 2<sup>nd</sup>: 4point = 7point.
  - If some teams get the same total points, ranking of individual point is used for final ranking by following order. 1<sup>st</sup> :Accuracy of cut-off frequency, 2<sup>nd</sup>: Insertion loss at pass band, 3<sup>rd</sup>: Attenuation at stopband
    - Example) TEAM A )Accuracy of cut-off frequency: 3<sup>rd</sup>: 3point, Insertion loss at pass band: 6<sup>th</sup>: nothing, Attenuation at stopband: 2<sup>nd</sup>: 4point = 7point. TEAM B) Accuracy of cut-off frequency: 1<sup>st</sup> : 5point, Insertion loss at pass band: 5<sup>th</sup>:1point, Attenuation at stopband: 5<sup>th</sup> : 1point = 7point. Total point is same, but by this rule, Team B has 1<sup>st</sup> ranking in “Accuracy of cut-off frequency”, so Team B has upper rank in final ranking.

## 2019.06.10 UPDATED

- S parameter value is measured, then the data is rounded off to the second or third decimal place. (rounded off position will be determined at the venue after checking the VNA condition. )
- Setting of VNA (TBD at venue)
  - Frequency range : from minimum to 6 GHz
  - Number of points : 801
  - IF BW : 100 kHz
  - Average : 10 times
- Each team of Dept. B has maximum three chances to fix the LPF after measurement. So, maximum measurement is four times. The best value set in each measurement from the four measurement is used for ranking.

# 2019.06.10 UPDATED

- Definition of point calculation

$$\text{Total point} = A + B + C$$

A = ranking point of “Accuracy of cut-off frequency”

B = ranking point of “Insertion loss at pass band”

C = ranking point of “Attenuation at stopband”

## Ranking point

1st :5point, 2nd :4point, 3rd:3point, 4th:2point, 5th: 1point.

Measurement value of each measurement items are compared with reference value. From the nearest team/individual to the reference value get the ranking point.

Winner of the SDC is determined by the “total point”.

# 2019.06.10 UPDATED

- Definition of measurement for ranking point
  - A) Difference between measured cut-off frequency and reference value (2.45 GHz)
    - Measurement value:  $F1 = |f_{\text{mea}} - f_{\text{ref}}|$  (GHz)
      - $|S_{11}| = |S_{21}| @ f_{\text{mea}}, f_{\text{ref}} = 2.45$  GHz
  - B) Minimum value of  $|S_{21}|$  at pass band
    - In other word, worst value of insertion loss
    - Measurement value:  $F2 = \min |S_{21}|$  (dB) in 100 MHz – 2 GHz
  - C) Maximum value of  $|S_{21}|$  at stopband
    - In other word, worst value of attenuation
    - Measurement value:  $F3 = \max |S_{21}|$  (dB) in 3 GHz – 6 GHz

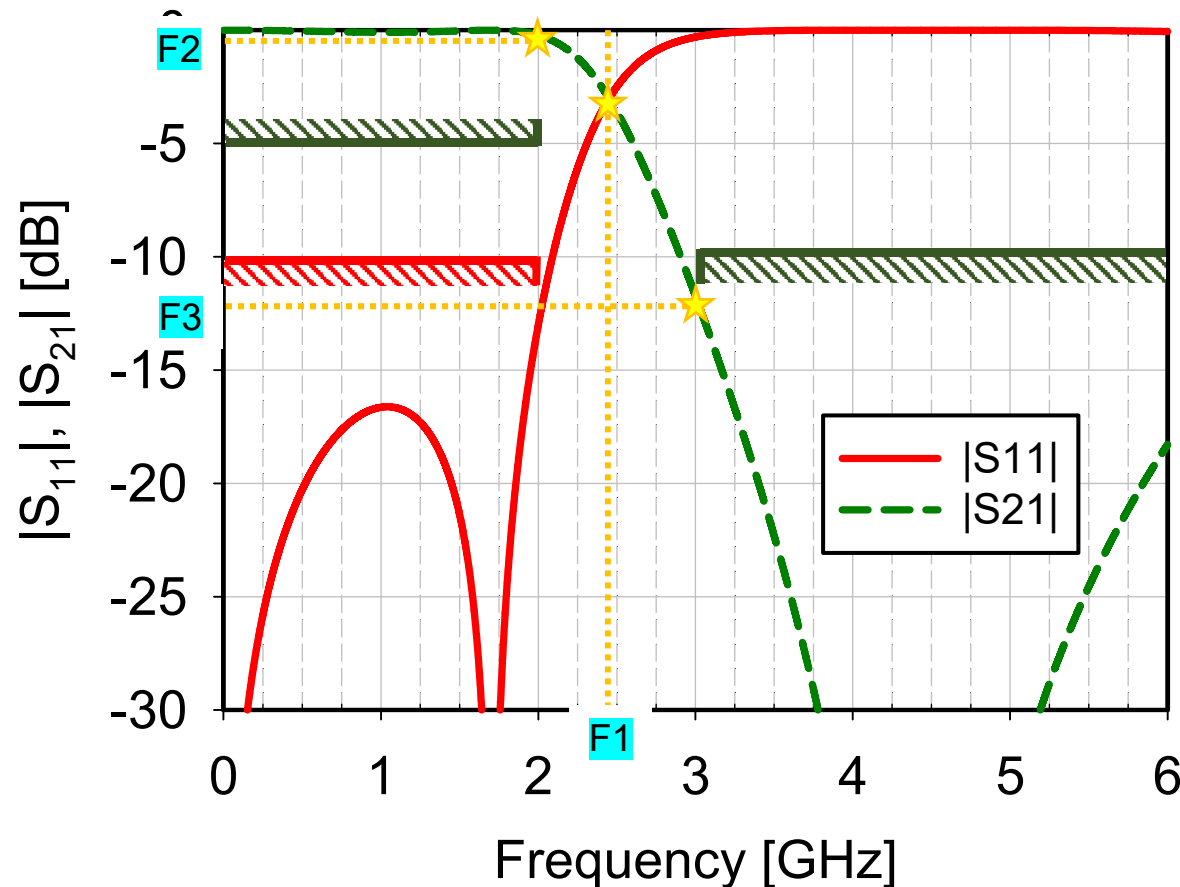
2019.06.10 UPDATED

Minimum requirement for precision measurement

- i)  $|S_{11}|$  should be below -10 dB from 100 MHz to 2 GHz.
- ii)  $|S_{21}|$  should be over -5 dB from 100 MHz to 2 GHz.
- iii)  $|S_{21}|$  should be below -10 dB from 3 GHz to 6 GHz.

\*if these conditions are not satisfied, you can't go to next precision measurement.

Cut-off frequency is defined as a frequency of  $|S_{11}| = |S_{21}|$ .



\*Reference plane of S-parameter measurement is 3.5mm coaxial cable.

### Item of precision measurement

Following three items are measured.

A) Difference between measured cut-off frequency and reference value (2.45 GHz)  
Measurement value: **F1**

B) Minimum value of  $|S_{21}|$  at pass band  
Measurement value: **F2**

C) Maximum value of  $|S_{21}|$  at stopband  
Measurement value: **F3**

Details of the measurement value is shown in another slide. Please refer the slide.