**A Note on the Application of Several Parameters**

**1. USBLimit & LSBLimit (Line 26 & 27)**

These two parameters are band limits of a channel of a microwave radiometer. For example, from Table 1 below, we can infer that:

USBlimit =[121.1554, 121.3474], and LSBlimit=[116.1526,116.3447].

Table 1 is for a DSB (Double Side Band) radiometer; for a SSB (Single Side Band) radiometer, the band limit is the one of LSBlimit or USBlimit, where LSBlimit is the same as USBlimit.

**Table 1 bands and corresponding frequencies of the channel 7 of MWHS on FY-3D satellite**

|  |  |  |
| --- | --- | --- |
| Band | Frequency(GHz) | Spectral response function (Weights) |
| LSB | 116.1526 | 0.034773 |
| 116.1674 | 0.039172 |
| 116.1821 | 0.041576 |
| 116.1969 | 0.041576 |
| 116.2117 | 0.046835 |
| 116.2265 | 0.046835 |
| 116.2412 | 0.036907 |
| 116.256 | 0.036907 |
| 116.2708 | 0.034773 |
| 116.2856 | 0.034773 |
| 116.3003 | 0.030869 |
| 116.3151 | 0.029084 |
| 116.3299 | 0.024326 |
| 116.3447 | 0.021594 |
| USB | 121.1554 | 0.021594 |
| 121.1701 | 0.024326 |
| 121.1849 | 0.029084 |
| 121.1997 | 0.030869 |
| 121.2145 | 0.034773 |
| 121.2292 | 0.034773 |
| 121.2440 | 0.036907 |
| 121.2588 | 0.036907 |
| 121.2736 | 0.046835 |
| 121.2883 | 0.046835 |
| 121.3031 | 0.041576 |
| 121.3179 | 0.041576 |
| 121.3327 | 0.039172 |
| 121.3474 | 0.034773 |

How to use these two parameters? They are used for computing bandwidthCorrectionCoefficients (Line 25 in the data dictionary) for hotTargetTB and coldTargetTB in advance in CA\_SCF. IF SRF (see Section 3) is given from the sensor’s manufacturer, the band limit can be informed for them, but this is NOT the general case for band limits.

**2. polarizationMode (Line 28)**

For microwave remote sensing, modified Stokes parameters are often used to describe the polarization characteristic. Under the Rayleigh-Jeans approximation, the modified Stokes parameters in brightness temperature (TB) are given by:



Where Tv, Th, T3 and T4 are, respectively, the vertically and horizontally polarized and the third and fourth Stokes parameters.

When we have a TB to be calibrated, we should simultaneously declare the corresponding polarization mode. Therefore, polarizationMode is one choice from the set {‘v-pol’,’h-pol’,’U-pol’,’V-pol’}. For example, if polarizationMode=’h-pol’, we can know that the TB is restrict to the horizontally polarization. Each TB to be calibrated is accompanied by a polarizationMode.

**3. spectralResponseFunction (SRF, Line 32)**

SRF is defined as:

<frequency><real>;

<weight><real>

where frequencies are in form of array within the bandwidth.

How to use the SRF?

① If the receiver type is SSB (Single Side Band), the frequency includes the first and the last frequencies, and the other frequencies representing the fluctuation trend of band pass response within the band. The weight is normalized ratio of the frequency to the whole band pass. The following formula is for weighted  received by SSB receiver,

 (1)

(1) can be de discretized to (2)

 (2)

where n is the total number within the SSB band.  is the brightness temperature at the ith frequency within the band，which is computed by the radiative transfer model. The weighted  is used for comparing with the measured brightness temperature by OMB method for finding the errors in the measurements.

② If the receiver type is DSB (Double side Band), the frequency includes the first and the last frequencies with in the lower and the upper bands, and the other frequencies representing the trend of fluctuation of band pass response within each of the side bands.

 (3)

The discretization of (3) is the same as (2). Usually, table 1 is given for SRF used for computing .The sum of all the weights in Table 1 equals one.

The function of TB weighted by SRF can be in the format as

*Tbweighted=function(tb(frequency),weights)*

Where *tb(frequency)* refer to TBs at each frequency in the table.

Notes on SRF:

① It should be noted that SRF is an error source which has been neglected for a long time, till recently the requirements for consistent dataset of microwave radiance for the climate researches are put forward. The table of SRF usually is NOT necessarily be given from manufacturer of the sensor, so in many case, the weight is treated equally, or treat as a rectangle function, where the band limits are required.

② Another thing we want to say is that, the parameter spectralResponseFunction is usually used in TA calibration stage, so it would be clearer and easier to be implemented if it is shifted from Table B.4 (Auxiliary Data) to Table B.6 (TA calibration) in the data dictionary (and shifted in the UML accordingly).

**4. Nonlinearity（Line 63）**

Nonlinearity of a channel or frequency a radiometer is given by table of at least two columns:

<receiverTemperature (in K, real)>;

< nonlinearTerm (real)>

After careful consideration, we think that the “nonlinear term (with a unit of Kelvin)” is preferable in radiometer calibration model than the “nonlinearity coefficient (*u* parameter, with a unit of 1/Kelvin)”, for it is more flexible and more general. So we replace *u* parameter by the in Eq. (4):

(4)

where is the nonlinear term, is the hot target TB after correction, =+ is the cold target TB after correction, *VC* is the voltage at the cold target*, VH* is the voltage at the hot target, *VA* is the voltage at the antenna.

Note that the Eq.（4）is the same as Eq. (D.1) in Annex D of the draft document. In addition, the uncertainty of or u is not always available, so it is included in the definition.

How to use the nonlinearity? The application of in calibration is done by looking up or interpolating real-time from the table according to the real instrument temperature as:

1) Giving the channel number,

2) Finding the receiver temperature (*Trcv*),

3) Looking up or interpolating it from the table.

*=interp1(table(:,1), table(:,2), Trcv)*

the function *interp1(·)* can fulfill the interpolation.

4) is the term due to nonlinearity, from which we can derive the antenna temperature by Eq. (4).