

# System Checks on Equations Pertinent to EZ Form 312

## 1. B4Gi – ANTENNA GAIN TRANSMIT AND/OR RECEIVE

Calculate  $G_0$  = maximum antenna gain using the equation below for the two antenna efficiency values of 0.1 and 1 (i.e.  $\eta = 0.1$ ,  $\eta = 1.0$ ). Value entered by applicant on the form should fall between the two values.

$$G_0 = 10 \log_{10}[ h (p Df/c)^2 ]$$

Where:

$G_0$  = the maximum on-axis antenna gain in dBi

$h$  = antenna efficiency (Calculate for  $h = 0.1$ ,  $h = 1.0$ )

$p$  = 3.14159 ( $\pi$ ), to 7 dps)

$D$  = antenna diameter (meters), (supplied by the user in B4F- Antenna Size)

$c$  = speed of light,  $3 \times 10^8$  meters/sec, and

$f$  = mid-band frequency (Hz). (supplied by the user in B4Gii - Gain at XXX GHz. Convert to Hz)

## 2. B5H - TOTAL EIRP FOR ALL CARRIERS (dBW)

Only checked for Transmit.

Value entered in B5H (Total EIRP for all Carriers) should be  $\geq$  the largest value specified for any carrier in B7F (Max EIRP per Carrier)

If edit is violated display error message "Total EIRP for all Carriers should be greater than > display largest value specified for Max EIRP per Carrier)

## 3. B6C/B6D –RANGE OF SATELLITE ARC- EASTERN & WESTERN LIMIT

Required for Fixed Range = 0 to 180. Hemi (E/W) is required.

## 4. B7E- EMISSION DESIGNATORS

Apply the following edits to the entry of emissions:

At least one emission is required for each frequency row where data exists.

If there is a frequency row with no emission specified for that row, the following message shall display, "You are missing an emission designator in one or more of the rows on the Frequency tab.

A valid emission designator is required for each row of data entered on the Frequency tab.”

- 1) Emission designator is a 7 position alpha/numeric field [no punctuation and no blank spaces]. All positions required. The 1st 4 positions are the bandwidth and the next 3 positions are the emissions.
- 2) Always convert entries of “o” to 0( zero) (letter to numeric). The letter “O” is not allowed. User does not need to be prompted. Convert all lower case entries to uppercase.
- 3) First 4 positions (REQUIRED) must have 1 alpha and 3 numeric.
- 4) 1st position must equal H or non-zero numeric.
- 5) If 1st position is a non-zero numeric, positions 2 - 4 must include one alpha (K, G, H, or M only) and two numeric.
- 6) 5th position is alpha (REQUIRED). Valid entries: X,W,V,Q,M,L,N,A,H,R,J,B,C,F,G,D,P,K
- 7) 6th position is alpha-numeric (REQUIRED). Valid entries: 1,2,3,7,8.
- 8) 7th position is alpha (REQUIRED). Valid entries: N,A,B,C,D,E, F, W, X

If the edit on the 6<sup>th</sup> position fails, the following message shall display, “The emission designator value entered is not valid for the EZ. Modulations must be digital **or** analog.”

If any of the other edits fail, the following message shall display, “The value entered for the emission designator is not valid. Please refer to CFR parts 2.201 and 2.202 for the emission that you are proposing. You must provide a valid emission designator before this application can be processed further.”

### **5. B7F- MAXIMUM EIRP PER CARRIER (dBW)**

Calculate only for transmit (uplink) antenna gain.

**Note:** For C Band Transmit Antenna Gain will be the gain entered at a frequency value between 5.925 and 6.425 GHz. For KU Band Transmit Antenna Gain will be any gain measured at a frequency value between 14 and 14.5 GHz

Based on values entered by user in B5G (Total Input Power at Antenna flange), and B4Gi (Antenna Gain), calculate B7F (Maximum EIRP per Carrier) as follows:

B7F (Maximum EIRP per Carrier)  $\leq 10 \times \text{Log}_{10}$  (Total Input Power at Antenna flange (watts)) + B4Gi (Transmit Antenna Gain (in dBi))

If entered value is outside the tolerance range – display the following error message:  
“Maximum EIRP per Carrier exceeds value allowed on the EZ”

### **6. B7G - MAXIMUM EIRP DENSITY PER CARRIER (dBW/4kHz)**

- a) Determine modulation using the table below

Emission to Modulation Mapping (§2.201(d))

Value of 6 <sup>th</sup> Position of the Emission Designator	Analog or Digital signal	Note
1	Digital	
2	Digital	
3	Analog	
7	Digital	
8	Analog	

b) Determine if bandwidth is  $\leq 200$  kHz as follows:

If Position 2-4 of the emission designator contain the letter H, then bandwidth is  $< 200$  kHz

If Position 2-4 of the emission designator contain the letter M or G, then bandwidth is  $> 200$  kHz

If Position 2-4 of the emission designator contain the letter K,  
**And** K is in position 2, then bandwidth is  $< 200$  kHz

If Position 2-4 of the emission designator contain the letter K,  
**And** K is in position 3, then bandwidth is  $< 200$  kHz

If Position 2-4 of the emission designator contain the letter K,  
**And** K is in position 4, and positions 1, 2 and 3 are  $> 200$ , then bandwidth is  $> 200$  kHz

c) Calculate Input power density using the following equation:

$B7G$  (Maximum EIRP Density per carrier (dBW/4 kHz)) -  $B4Gi$  (Transmit Antenna Gain) =  
 Maximum Input Power density

**For C-BAND ( 5925-6425 MHz )**

If (Antenna diameter  $\geq 4.5$  meter AND modulation = "ANALOG"<sup>1</sup>  
 AND bandwidth  $\leq 200$  kHz) THEN

Max. Input power density calculated must be  $\leq +0.5$  dBW/4kHz

If (Antenna diameter  $\geq 4.5$  meter AND modulation = "DIGITAL") THEN

Max. Input power density calculated must be  $\leq -2.7$  dBW/4kHz

If calculated value is higher than values above display the following error message:

"Max. Input power density exceeds value allowed on the EZ"

**Ku-BAND (14000-14500 MHz):**

If (Antenna diameter  $\geq 1.2$  meter AND modulation = "ANALOG"<sup>2</sup>  
 AND bandwidth  $\leq 200$  kHz) THEN

Max. Input power density calculated must be  $\leq -8.0$  dBW/4 kHz

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If (Antenna diameter  $\geq$  1.2 meter AND modulation = "DIGITAL") THEN  
Max. Input power density calculated must be  $\leq$  -14 dBW/4 kHz

If calculated value is higher than values above display the following error message:  
"Max. Input power density exceeds value allowed on the EZ"