EN IEC 62311:2020

Assessment of electronic and electrical equipment

related to human exposure restrictions for electromagnetic fields (0Hz – 300GHz)

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Prepared for

Blues, Inc.

50 Harbor St, Manchester, MA 01944

This report presents Maximum Permissible Exposure for NOTE WBGLW, NBGLW, NBNAW, WBEXW, WBNAW

Prepared by _____

Brandon Quan

Test Engineer

Approved by _____

Suresh Kondapalli

Reviewing Engineer

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1.0 PERFORMANCE ASSESSMENTS

Assessment methods

The demonstration of compliance to limits regarding human exposure shall be done by means of an assessment. One or more of the assessment methods listed in Table 1 may be used for the assessment. The standards in the column 'Applicable standard, for example' are only examples of applicable standards. Other standards or measurement and calculation methods may be used if they are appropriate for the applied assessment method.

From Table1 the following method was selected

Assessment method	Subject of assessment		Applicability area and limitations	Applicable method standard, for example
Simplified assessment (possible particular cases)	Basic Restrictions	Power Density	Power density can be calculated in far Field Regions	IEC 62232

1.1 ANTENNA REGIONS

There are three regions defined in EN 62311 Standard: Far field region, radiating near-field region and reactive near-field region. For each region there is a preferred (or "reference") evaluation method and possible alternatives. When an alternative method is used it typically provides a more conservative evaluation of the RF hazard.

The region is determined, based on the minimum separation distance from the device antennas to persons and the size/gain of the antenna. The minimum separation distance is based on either a distance specified in the installation/user's manual or on an evaluation of intended use.

1.2 PREFERRED EVALUATION METHODS

Based on the Operating Frequency Range and the possible distance from the antenna and human body, the Preferred Assessment Method is Far Field Calculation.

The Far field region is the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna. In this region (also called the free space region), the field has a predominantly plane-wave character, i.e., locally uniform distribution of electric field strength and magnetic field strength in planes transverse to the direction of propagation.

1.3 FAR FIELD CALCULATION

For calculating the field in the far-field region the free space formulas below is used to determine the Electric field (1) or Power Density (2) at a distance R from the transmitting antenna.

$$E = \frac{\sqrt{30\,P\,G}}{R} \qquad (1)$$

$$S = \frac{P\,G}{4\pi R^2} \qquad (2)$$

S =
E = Field Strength in V/m
P = Power in Watts
G = Gain of antenna (numeric gain)
R = distance in meters

or calculating the field in the far-field region the free space formulas below is used to determine the Electric field (1) or Power Density (2) at a distance R from the transmitting antenna.

1.4 LIMITS

The limits are taken from the reference levels detailed in either Annex II or Annex III of Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). Annex III reference levels may only be used when the exposure is not highly localized.

Compliance with the basic restrictions is ensured where the ratio of the measured/calculated value to the basic restriction / reference level is less than or equal to 1.

1.5 REFERENCE LEVELS

The limits are taken from the reference levels detailed in either Annex II or Annex III of Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). Annex III reference levels may only be used when the exposure is not highly localized.

Compliance with the basic restrictions is ensured where the ratio of the measured/calculated value to the basic restriction / reference level is less than or equal to 1.

1.6 COUNCIL RECOMMENDATION

From Annex III of the Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz), the following Reference Levels apply.

Reference Levels for electric, magnetic and electromagnetic fields					
Frequency range	**Electric field strength [V/m]**	**H-field strength [A/m]**	**B-field [μT]**	**Power density[W/m^2]**	**Averaging time [min]**
Limits for General Population / Uncontrolled Exposure (1999/519/EC)					
0 – 1Hz		$3.2 \cdot 10^4$	$4 \cdot 10^4$		
1 – 8Hz	10000	$3.2 \cdot 10^4/f^2$	$4 \cdot 10^4/f^2$		
8 – 25Hz	10000	4000/f	5000/f		
0.025 – 0.8kHz	250/f	4/f	5/f		
0.8 – 3kHz	250/f	5	6.25		
3 – 150kHz	87	5	6.25		6*
0.15 – 1MHz	87	0.73/f	0.92/f		6*
1 – 10MHz	$87/f^{0.5}$	0.73/f	0.92/f		6*
10 – 400MHz	28	0.073	0.092	2	6*
400 – 2000MHz	$1.375 \cdot f^{0.5}$	$0.0037 \cdot f^{0.5}$	$0.0046 \cdot f^{0.5}$	f/200	6*
2 – 300GHz	61	0.16	0.20	10	$6 / 68/f^{1.05}$ *

* = For frequencies between 100kHz and 10GHz S, E^2, H^2 and B^2 are to be averaged over six minute period.
For frequencies exceeding 10GHz S, E2, H2 and B2 are to be averaged over any 68/f1.05- minute period (f in GHz). f as indicated in frequency range column.

From Annex IV of the Council Recommendation 1999/519/EC for Sources with multiple frequencies a (n frequencies) compliance with the basic restrictions is ensured if the calculation per equation below is meet.

$$\sum_{i=1}^{n} (S\,i/Li) < \ 1$$

Where *S i – Power Density at i-frequency*

L i – Limit of Power Density at i-frequency

2.0 RESULT OF EVALUATION

Frequency Band (MHz)	Max Power (dBm)	Max Power (mW)	Turn-Up Tolerance	Antenna Gain (dBi)	Distance (cm)	Power Density (W/m^2)	Limit (W/m^2) F/200	Ratio (Si/Li) (PD/PD Limit)
LTE B5 (850MHz)	31.565	1434	±1dB	2.3	25.00	4.199	4.25	0.988
WCDMA B2 (1900MHz)	31.443	1394	±1dB	2.3	25.00	4.083	9.5	0.430
GSM1900 (1850-1910MHz)	31.443	1394	±1dB	2.3	25.00	4.083	9.25	0.441

Note: Power levels are taken from the module report.

The highest power density calculated for single radio transmission is 4.905 (W/m^2)

$$\sum_{i=1}^{n}(Si/Li) = 0.988$$

As states in the IEC 62311 Standard, the apparatus is deemed to fulfill the requirements of this standard if the measured (or calculated) values are less than or equal to the limit and if the actual assessment uncertainty is less than the maximum measurement uncertainty specified for the applied assessment method(s).

Generally, a relative uncertainty of 30 % is used for a number of EMF assessment methods. Therefore, this level of relative uncertainty is used as a default maximum in this generic standard.

If the relative uncertainty is less than 30 %, then the measured value Lm shall be compared directly with the applicable limit Llim for evaluation of compliance.

Base on the original module MPE calculations, the relative uncertainty did not take into the consideration; therefore, the actual uncertainty shall not be included in this evaluation of compliance with the limit.

The Blues NOTE WBGLW, WBNAW, NBGLW, NBNAW, and WBEXW; in the configurations detailed within this report, was evaluated and found in compliance with the relevant requirements of EN 62311 for cellular transmission.

3.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
CJJ-TNY-P23060072-3	BQ	SK	10/12/2023	Original document
CJJ-TNY-P23060072-3_Rev1	BQ	SK	10/13/2023	Revised model names