

RF Exposure Assessment

Report Reference: **MDE_NETMO_1901_MPEb**

on

NB800 Rev. B02

according to:

EN 62311:2008

Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz) (IEC 62311:2007, modified)

Test Laboratory:

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Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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Summary

The RF-exposure assessment according to EN 62311:2008 shows, that the worst case

RF exposure values of the assessed radio technologies are below the selected reference levels

- of the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields, Table 7 for general public
- and the COUNCIL RECOMMENDATION of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), Table 2.



(Reviewer)

Andreas Tuebel



(responsible for report)

Patrick Lomax

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Date of Report: 27.11.2019

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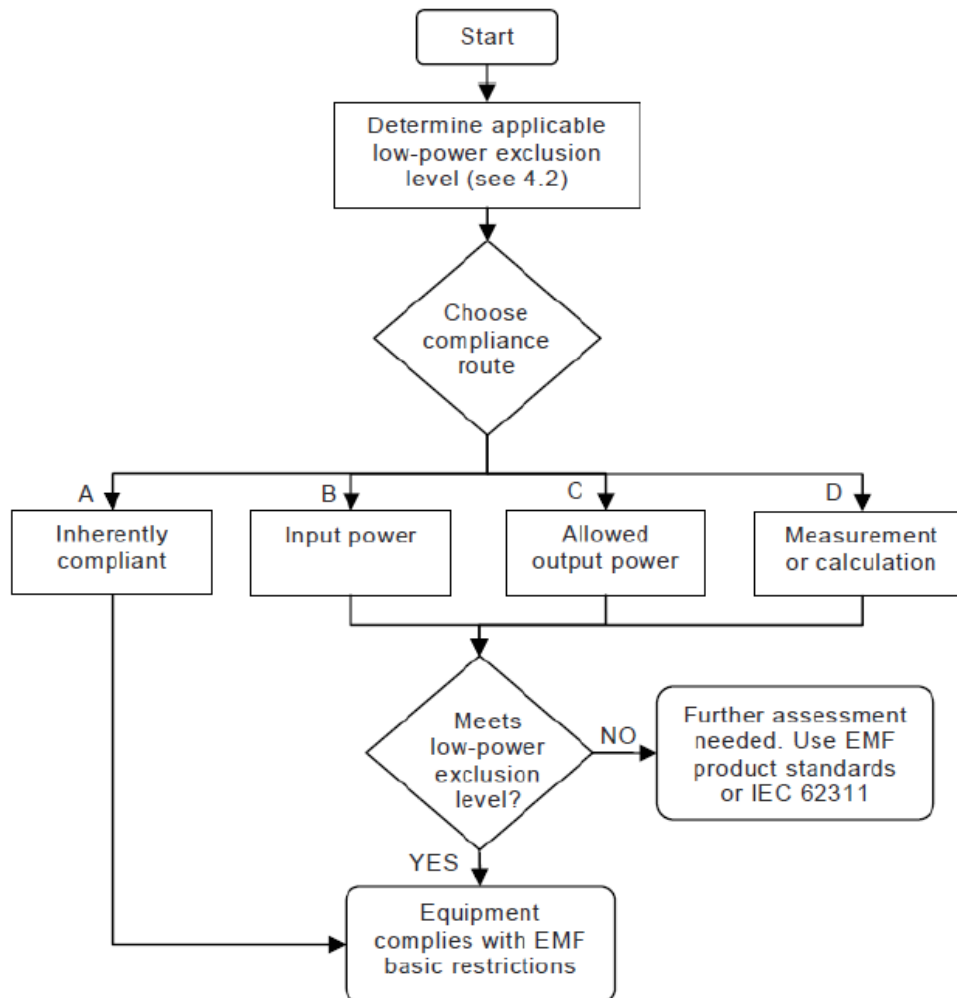
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General Description of Radio Device

Declared EUT data by the supplier	
Kind of Device product description	The NB800 Rev. B02 is a cellular industrial router with one Ethernet port and extension options (e.g. serial port, I/Os). It enables a lot of industrial IoT applications such as condition monitoring, remote management or factory automation. It has Bluetooth, W-LAN 2.4 GHz & 5 GHz and Cellular technology (GSM/UMTS/LTE).
Product name	NB800 Rev. B02
Type	Ruggedized Router
Radio technology	Integrated radio modules
Cellular	GSM 900/1800, UMTS FDDI/FDDVIII, LTE eFDD1/eFDD3/eFDD7/eFDD8/eFDD20 Module TOBY-L2
Bluetooth®	Bluetooth + BLE + Wi-Fi module WL18MODGI
W-LAN 2.4 GHz & W-LAN 5 GHz	Bluetooth + BLE + Wi-Fi module WL18MODGI

Maximum Permissible Exposure according EN 62311:2008 and EN 62479:2010

Routes to show compliance with low power exclusion level as described in EN 62479.



As the output power exceeds the maximum allowable EIRP for RF Exposure exclusion, (20mW) as described in EN 62479:2010, additional calculations are required under EN 62311:2008 which are found below.

Calculations

Maximum peak output power at antenna input terminal:

Mode / Band	Prediction frequency (f) MHz	Duty Cycle correction dBi	Conducted Power dBm	Equivalent conducted output power (mW)	Prediction distance
GSM 900	897	3.01	33.25	1056.818	20 cm
GSM 1800	1747.8	3.01	30.2	523.600	20 cm
UMTS FDD1	1950	0	24.5	281.838	20 cm
UMTS FDD8	897	0	24.5	281.838	20 cm
LTE eFDD7	2535	0	24	251.189	20 cm
LTE eFDD1	1950	0	24	251.189	20 cm
LTE eFDD3	1747.5	0	24	251.189	20 cm
LTE eFDD8	897	0	24	251.189	20 cm
LTE eFDD20	847	0	24	251.189	20 cm
Bluetooth	2402	3.8	12.5	7.413	20 cm
WLAN 2.4GHz	2412	0	17.5	56.234	20 cm
WLAN 5GHz	5180	0	19.5	89.125	20 cm

Output power taken from tune-up procedure value + tolerance as declared by manufacturer.

(Limit values specified in Table 2 in EN 1999/519-EC)

Frequency range (MHz)	Power density (mW/cm ²)
400 – 2000	f/2000
2000 - 300000	1 mW/cm ²

Equation: $S = P \cdot G / (4\pi R^2)$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Mode / Band	Power density limit (mW/cm ²)	Gain dBi	Power Density (mW/cm ²)	Assessment
GSM 900	0.4485	2.9	0.410	Passed
GSM 1800	0.8739	8	0.657	Passed
UMTS FDD1	0.9750	12	0.889	Passed
UMTS FDD8	0.4485	8	0.354	Passed
LTE eFDD7	1.0000	12	0.792	Passed
LTE eFDD1	0.9750	12	0.792	Passed
LTE eFDD3	0.8738	12	0.792	Passed
LTE eFDD8	0.4485	9	0.397	Passed
LTE eFDD20	0.4235	8	0.315	Passed
Bluetooth	1.0000	6	0.006	Passed
WLAN 2.4GHz	1.0000	6	0.045	Passed
WLAN 5GHz	1.0000	6	0.071	Passed

Assessment of multi frequency devices (EN 62311:2008 8.3 (ICNIRP-based))

$$\sum_{i=100 \text{ kHz}}^{10 \text{ GHz}} \frac{SAR_i}{SAR_L} + \sum_{i>10 \text{ GHz}}^{300 \text{ GHz}} \frac{S_i}{S_L} \leq 1$$

where

SAR_i is the SAR caused by exposure at frequency i;

SAR_L is the SAR basic restriction;

S_i is the power density at frequency i;

S_L is the power density basic restriction.

Mode / Band	Equivalent conducted output power (mW)	Gain dBi	S _i (mW/cm ²)	S _i (mW/cm ²)	S _i / S _L
GSM 900	1056.82	2.9	0.410	0.4485	0.9140
GSM 1800	523.60	8	0.657	0.8739	0.7521
UMTS FDD1	281.84	12	0.889	0.9750	0.9114
UMTS FDD8	281.84	8	0.354	0.4485	0.7888
LTE eFDD7	251.19	12	0.792	1.0000	0.7920
LTE eFDD1	251.19	12	0.792	0.9750	0.8123
LTE eFDD3	251.19	12	0.792	0.8738	0.9064
LTE eFDD8	251.19	9	0.397	0.4485	0.8851
LTE eFDD20	251.19	8	0.315	0.4235	0.7445
Bluetooth	7.41	6	0.006	1.0000	0.0059
WLAN 2.4GHz	56.23	6	0.045	1.0000	0.0445
WLAN 5GHz	89.13	6	0.071	1.0000	0.0706

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Mode	Transmitters	Maximum S_i (mW/cm ²)	Sum of S_i / S_L	Compliance ≤ 1
GSM 900	GSM 900	0.9140	0.9645	Passed
	Bluetooth	0.0059		
	WLAN 2.4GHz	0.0445		
GSM 900	GSM 900	0.9140	0.9905	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
GSM 1800	GSM 1800	0.7521	0.8285	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
GSM 1800	GSM 1800	0.7521	0.8025	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
UMTS FDD1	UMTS FDD1	0.9114	0.9618	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
UMTS FDD1	UMTS FDD1	0.9114	0.9879	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
UMTS FDD8	UMTS FDD8	0.7888	0.8392	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
UMTS FDD8	UMTS FDD8	0.7888	0.8653	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
LTE eFDD7	LTE eFDD7	0.7920	0.8424	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
LTE eFDD7	LTE eFDD7	0.7920	0.8685	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
LTE eFDD1	LTE eFDD1	0.8123	0.8627	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		

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Mode	Transmitters	Maximum Si (mW/cm ²)	Sum of Si / SL	Compliance ≤ 1
LTE eFDD1	LTE eFDD1	0.8123	0.8888	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
LTE eFDD3	LTE eFDD3	0.9064	0.9569	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
LTE eFDD3	LTE eFDD3	0.9064	0.9829	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
LTE eFDD8	LTE eFDD8	0.8851	0.9355	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
LTE eFDD8	LTE eFDD8	0.8851	0.9615	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		
LTE eFDD20	LTE eFDD20	0.7445	0.7949	Passed
	WLAN 2.4GHz	0.0445		
	Bluetooth	0.0059		
LTE eFDD20	LTE eFDD20	0.7445	0.8210	Passed
	WLAN 5GHz	0.0706		
	Bluetooth	0.0059		

END OF REPORT