

# SPECTRUM REPORT

## (GPS)

**Applicant:** Nebra LTD.

**Address of Applicant:** Unit 4 Bells Yew Green Business Court, Bells Yew Green,  
Tunbridge Wells TN3 9BJ United Kingdom

**Equipment Under Test (EUT)**

Product Name: Nebra Smart Outdoor LoRa Gateway / Nebra HNT Outdoor  
Hotspot Miner

Model No.: HNTOUT-868-G-LT+, HNTOUT-868-G-LT, HNTOUT-868-LT+,  
HNTOUT-868-G, HNTOUT-868-LT, HNTOUT-868

Trade mark: Nebra

**Applicable standards:** ETSI EN 303 413 V1.1.1 (2017-06)

**Date of sample receipt:** 31 May, 2021

**Date of Test:** 31 May, to 08 Jul., 2021

**Date of report issue:** 09 Jul., 2021

**Test Result:** PASS\*

\* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.



Bruce Zhang  
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

## 2 Version

Version No.	Date	Description
00	09 Jul., 2021	Original

Draft

**Tested by:**

**Date:**

09 Jul., 2021

\_\_\_\_\_  
**Test Engineer**

**Reviewed by:**

**Date:**

09 Jul., 2021

\_\_\_\_\_  
**Project Engineer**

### 3 Contents

	Page
1 COVER PAGE.....	1
2 VERSION .....	2
3 CONTENTS .....	3
4 TEST SUMMARY.....	4
5 GENERAL INFORMATION.....	5
5.1 CLIENT INFORMATION .....	5
5.2 GENERAL DESCRIPTION OF E.U.T. ....	5
5.3 TEST ENVIRONMENT AND MODE, AND TEST SAMPLES PLANS .....	6
5.4 DESCRIPTION OF SUPPORT UNITS.....	6
5.5 MEASUREMENT UNCERTAINTY .....	6
5.6 LABORATORY FACILITY .....	7
5.7 LABORATORY LOCATION .....	7
5.8 TEST INSTRUMENTS LIST.....	7
6 RADIO REQUIREMENTS SPECIFICATION IN ETSI EN 303 413 .....	8
6.1 GUE ADJACENT FREQUENCY BAND SELECTIVITY PERFORMANCE .....	8
6.2 RECEIVER SPURIOUS EMISSIONS .....	10
7 TEST SETUP PHOTO .....	12
8 EUT CONSTRUCTIONAL DETAILS .....	13

Draft

## 4 Test Summary

Radio Spectrum Matter (RSM) Part of Receiver				
Test Items	Test Requirement	Test method	Limit/Severity	Result
GUE adjacent frequency band selectivity performance	EN 303 413 section 4.2.1	EN 303 413 section 5.4.3	$\Delta C/N_0 \leq 1 \text{ dB}$	PASS
Receiver spurious emissions	EN 303 413 section 4.2.2	EN 303 413 section 5.5.2	Table 4-5	PASS
Remark: Pass: The EUT complies with the essential requirements in the standard.				

Draft

## 5 General Information

### 5.1 Client Information

Applicant:	Nebra LTD.
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells TN3 9BJ United Kingdom
Manufacturer:	Nebra LTD.
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells TN3 9BJ United Kingdom
Factory:	SUNSOAR TECH CO., LIMITED
Address:	4/F, Block E, Fengze Building, Huafeng No.2 Industrial Park, Hangkong Road, XiXiang Town, BaoAn District, Shenzhen, China

### 5.2 General Description of E.U.T.

Product Name:	Nebra Smart Outdoor LoRa Gateway / Nebra HNT Outdoor Hotspot Miner
Model No.:	HNTOUT-868-G-LT+, HNTOUT-868-G-LT, HNTOUT-868-LT+, HNTOUT-868-G, HNTOUT-868-LT, HNTOUT-868
Operation Frequency:	1.57542GHz
Hardware version:	V01-16-2021-1820
Software version:	4dc8745
Power supply:	AC: AC 230V / 50Hz POE: DC48V
AC adapter:	Model No.: HNTOUT-868-G-LT+, HNTOUT-868-G-LT, HNTOUT-868-LT+, HNTOUT-868-G, HNTOUT-868-LT, HNTOUT-868 The difference: we will offer the unit with or without a GPS module included. Models with the GPS Included are indicated with a -G on the end of the model number. For example a unit with model no HNTOUT-868 is 868 Mhz, no GPS. A unit with Model No HNTOUT-868-G, is 915Mhz with GPS. We offer the unit using the Raspberry Pi Compute Module 3+ 32GB by standard (no suffix) but have an -LT variant which uses the Raspberry Pi Compute Module 3 Lite with a 32 GB eMMC to SD adapter card and a -LT+ variant which uses the Raspberry Pi Compute Module 3+ Lite with a 32 GB eMMC to SD adapter card. These suffixes can be applied to the models both with and without GPS as described above. We also provide customers the ability to, optionally, add both cellular connectivity and an additional 8 channel LoRa gateway to any of these models by using an mPCIe module however these come as optional extras.

### 5.3 Test environment and mode, and test samples plans

Operating Environment:	
Temperature:	15°C ~ 35 °C
Humidity:	20 % ~ 75%
Atmospheric Pressure:	1008 mbar
Test mode:	
Receiving mode:	Keep the EUT in continuously Receiving mode.

### 5.4 Description of Support Units

The EUT was test as an independent unit
---

### 5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB

Draft

## 5.6 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

● **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

● **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

## 5.7 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

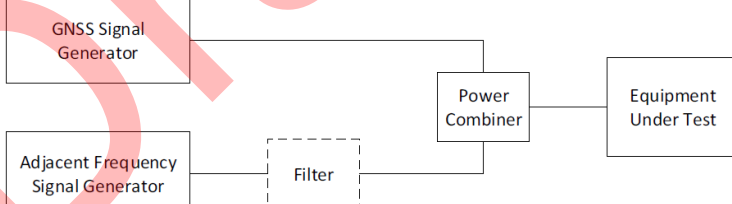
Email: info-JYTee@lets.com, Website: <http://www.ccis-cb.com>

## 5.8 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	ETS	9m*6m*6m	966	01-19-2021	01-18-2024
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-03-2021	03-02-2022
Biconical Antenna	SCHWARZBECK	VUBA9117	359	06-18-2020	06-17-2021
				06-17-2021	06-16-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-03-2021	03-02-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-18-2020	06-17-2021
				06-17-2021	06-16-2022
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-03-2021	03-02-2022
Pre-amplifier	CD	PAP-1G18	11804	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022
Signal Generator	Rohde & Schwarz	SMX	835454/016	03-03-2021	03-02-2022
Signal Generator	R&S	SMR20	1008100050	03-03-2021	03-02-2022
Vector Signal Generator	Agilent	N5182A	MY49060014	11-16-2020	11-15-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-03-2021	03-02-2022
Cable	MICRO-COAX	MFR64639	K10742-5	03-03-2021	03-02-2022
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-03-2021	03-02-2022

## 6 Radio Requirements Specification in ETSI EN 303 413

### 6.1 GUE adjacent frequency band selectivity performance

Test Requirement:	EN 303 413 clause 4.2.1																																											
Test Method:	EN 303 413 clause 5.4.3																																											
Limit:	<p>The C/N<sub>0</sub> metric reported by the GUE for all GNSS and GNSS signals given in table 4-1 and supported by the GUE shall not degrade by more than the value given in equation 4-1 when an adjacent frequency signal is applied. The adjacent frequency signal is defined in table 4-4, with the frequencies and power levels defined in table 4-2 and/or in table 4-3 depending on the RNSS bands supported by the GUE.</p> <p>Equation 4-1: Maximum degradation in C/N<sub>0</sub></p> $\Delta C/N_0 \leq 1 \text{ dB}$ <p>Table 4-2: Frequency bands, adjacent frequency signal test point centre frequencies and power levels for the 1 559 MHz to 1 610 MHz RNSS band</p> <table><tr><th>Frequency band (MHz)</th><th>Test point centre frequency (MHz)</th><th>Adjacent frequency signal power level (dBm)</th><th>Comments</th></tr><tr><td>1 518 to 1 525</td><td>1 524</td><td>-65</td><td>MSS (space-to-Earth) band</td></tr><tr><td>1 525 to 1 549</td><td>1 548</td><td>-95</td><td>MSS (space-to-Earth) band</td></tr><tr><td>1 549 to 1 559</td><td>1 554</td><td>-105</td><td>MSS (space-to-Earth) band</td></tr><tr><td>1 559 to 1 610</td><td></td><td></td><td>GUE RNSS band under test</td></tr><tr><td>1 610 to 1 626</td><td>1 615</td><td>-105</td><td>MSS (Earth-to-space) band</td></tr><tr><td>1 626 to 1 640</td><td>1 627</td><td>-85</td><td>MSS (Earth-to-space) band</td></tr></table> <p>Table 4-4: Adjacent frequency signal</p> <table><tr><th>Parameter</th><th>Value</th><th>Comments</th></tr><tr><td>Frequency</td><td>See table 4-2 and table 4-3</td><td></td></tr><tr><td>Power level</td><td>See table 4-2 and table 4-3</td><td></td></tr><tr><td>Bandwidth</td><td>1 MHz</td><td>See clause B.1 for details</td></tr><tr><td>Format</td><td>AWGN</td><td></td></tr></table>	Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments	1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band	1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band	1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band	1 559 to 1 610			GUE RNSS band under test	1 610 to 1 626	1 615	-105	MSS (Earth-to-space) band	1 626 to 1 640	1 627	-85	MSS (Earth-to-space) band	Parameter	Value	Comments	Frequency	See table 4-2 and table 4-3		Power level	See table 4-2 and table 4-3		Bandwidth	1 MHz	See clause B.1 for details	Format	AWGN	
Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments																																									
1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band																																									
1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band																																									
1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band																																									
1 559 to 1 610			GUE RNSS band under test																																									
1 610 to 1 626	1 615	-105	MSS (Earth-to-space) band																																									
1 626 to 1 640	1 627	-85	MSS (Earth-to-space) band																																									
Parameter	Value	Comments																																										
Frequency	See table 4-2 and table 4-3																																											
Power level	See table 4-2 and table 4-3																																											
Bandwidth	1 MHz	See clause B.1 for details																																										
Format	AWGN																																											
Test Frequency range:	1 559 MHz to 1 610 MHz																																											
Test setup:																																												
Test procedure:	<ol style="list-style-type: none"><li>1. Configure the GNSS signal generator to simulate those GNSS and GNSS signals from table 4-1 declared as supported by the GUE, with power levels and other details as specified in clause B.2.</li><li>2. With the adjacent frequency signal switched off, the EUT shall be given sufficient time to acquire all simulated satellites from the declared GNSS system(s).</li><li>3. Record the baseline C/N<sub>0</sub> value(s) reported by the EUT. Sufficient filtering shall be used to obtain a stable value. C/N<sub>0</sub> may be averaged across all the satellites in view for each GNSS constellation. However, C/N<sub>0</sub> shall not be averaged across satellite signals in different GNSS constellations. For a multi-GNSS EUT, there shall be a separate C/N<sub>0</sub> value recorded for each GNSS constellation and each GNSS signal supported.</li><li>4. The adjacent frequency signal generator shall be configured to generate the signal defined in table 4-4, at the first test point centre frequency and signal power level as specified in table 4-2.</li><li>5. The adjacent frequency signal shall be switched on, and the EUT's C/N<sub>0</sub> value(s) recorded as in step 3) to measure the degradation with respect to the baseline value(s) recorded in step 3).</li><li>6. Test point Pass/Fail Criteria: If the C/N<sub>0</sub> degradation from step 5)</li></ol>																																											

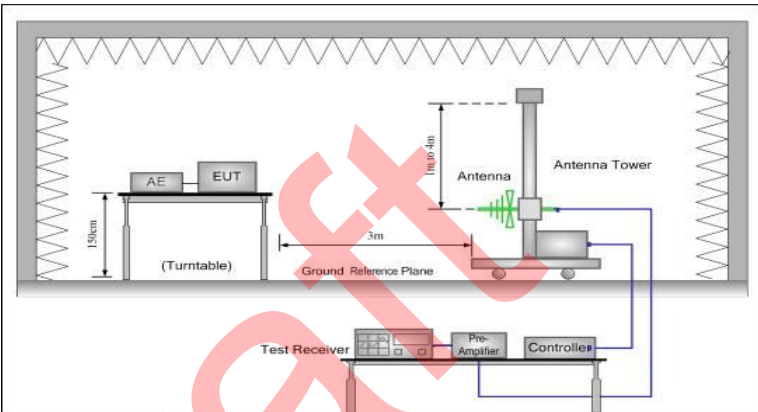
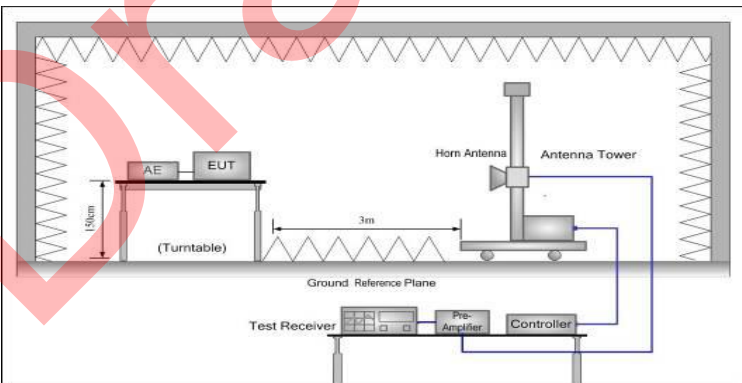


	<p>does not exceed the value in equation 4-1, then this test point is set to "pass". If the C/N0 degradation exceeds the value in equation 4-1, then this test point is set to "fail." For a multi-GNSS and multi-signal EUT, there shall be a separate pass/fail determination for each GNSS and for each GNSS signal supported. If the C/N0 degradation exceeds the value in equation 4-1 for any supported GNSS or supported GNSS signal, then this test point is set to "fail".</p> <p>7. Step 1) through step 6) shall be repeated for all test point centre frequencies (and associated signal power level) specified in table 4-2.</p>
Test Instruments:	See the section 5.8
Test mode:	Receive mode.
Test Result:	Pass

#### Measurement Data:

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	GPS Measured C/N <sub>0</sub> (dB)			
			No interfering signal	With interfering signal	Decrease of C/N <sub>0</sub>	$\Delta C/N_0 \leq 1$
1 518 to 1 525	1524	-65	48.64	48.49	-0.15	Pass
1 525 to 1 549	1548	-95	49.59	49.38	-0.21	Pass
1 549 to 1 559	1554	-105	49.47	49.16	-0.31	Pass
1 559 to 1 610	GUE RNSS band under test					
1 610 to 1 626	1615	-105	48.43	48.11	-0.32	Pass
1 626 to 1 640	1627	-85	49.52	49.25	-0.27	Pass

## 6.2 Receiver spurious emissions

Test Requirement:	EN 303 413 clause 4.2.2	
Test Method:	EN 303 413 clause 5.5.2	
Receiver setup:	Frequency < 1000MHz; RBW = 100kHz, VBW = 300kHz, Detector = peak Frequency >= 1000MHz; RBW = 1MHz, VBW = 3MHz, Detector = peak.	
Limit:	Frequency	Limit
	30MHz to 1000 MHz	-57dBm
	Above 1GHz	-47dBm
Test Frequency range:	30MHz to 8.3GHz	
Test setup:	<p><b>Below 1GHz</b></p>  <p><b>Above 1GHz</b></p> 	
Test procedure:	<p><b>Below 1GHz test procedure:</b></p> <ol style="list-style-type: none"> <li>1. On the test site as test setup graph above, the EUT shall be placed at the 1.5msupport on the turntable and in the position closest to normal use as declared by the provider.</li> <li>2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter. The output of the test antenna shall be connected to the measuring receiver.</li> <li>3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.</li> <li>4. The test antenna shall be raised and lowered from 1m to 4muntil a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.</li> <li>5. Repeat step 4 for test frequency with the test antenna polarized</li> </ol>	

	<p>horizontally.</p> <p>6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.</p> <p>7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.</p> <p>8. Repeat step 7 with both antennas horizontally polarized for each test frequency.</p> <p>9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:  <math display="block">ERP(dBm) = Pg(dBm) - \text{cable loss (dB)} + \text{antenna gain (dBd)}</math> Where: Pg is the generator output power into the substitution antenna.</p> <p><b>Above 1GHz test procedure:</b>  Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber, and the test antenna do not need to raise from 1 to 4m, just test in 1.5m height.</p>
Test Instruments:	See the section 5.8
Test mode:	Receiving mode
Test Result:	Pass

#### Measurement Data:

Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
623.93	Vertical	-57.84	2nW/ -57dBm below 1GHz, 20nW/ -47dBm above 1GHz.	Pass
720.155	V	-59.45		
3150.84	V	-62.23		
320.03	Horizontal	-58.36		
660.99	H	-58.82		
3150.84	H	-64.06		

## 7 Test setup photo

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



## 8 EUT Constructional Details

Reference to the test report No. JYTSZB-R01-2100336

-----End of report-----

Draft