SPECTRUM REPORT
(GPS)

Applicant:	Nebra Ltd
Address of Applicant:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells TN3 9BJ
Equipment Under Test (EUT)	
Product Name:	Nebra Smart Indoor LoRa Gateway / Nebra HNT Indoor Hotspot Miner
Model No.:	HNTIN-470-G, HNTIN-868-G, HNTIN-915-G,HNTIN-433-G, HNTIN-470,HNTIN-868, HNTIN-915,HNTIN-433
Applicable standards:	ETSI EN 303 413 V1.1.1 (2017-06)
Date of sample receipt:	12 Mar., 2021
Date of Test:	13 Mar., to 19 Apr., 2021
Date of report issue:	23 Apr., 2021
Test Result:	PASS*

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

The UKCA mark as shown below can be used, under the responsibility of the manufacturer, after completion of an UKCA Declaration of Conformity and compliance with all relevant UK Radio Equipment Regulations (SI 2017/1206) Directives. The protection requirements with respect to electromagnetic compatibility contained in UK Radio Equipment Regulations (SI 2017/1206) are considered.

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*23 Apr., 2021*	*Original*

Tested by:		***Date:***	*23 Apr., 2021*
	Test Engineer		
Reviewed by:		***Date:***	*23 Apr., 2021*
	Project Engineer		

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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	Δ $C/N_0 \leq 1$ 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.				

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
Manufacturer:	Nebra Ltd
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells TN3 9BJ
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 Indoor LoRa Gateway / Nebra HNT Indoor Hotspot Miner
Model No.:	HNTIN-470-G, HNTIN-868-G, HNTIN-915-G,HNTIN-433-G, HNTIN-470,HNTIN-868, HNTIN-915,HNTIN-433
Operation Frequency:	1.57542GHz
Hardware version:	V12-15-2020-1614
Software version:	a98bfc8
Power supply:	DC 12V
AC adapter:	Model: TM-K018VP-01201500PE-Z Input: 100-240V~50/60Hz 0.45A Output: 12.0V , 1.5A
Remark:	Model No.: HNTIN-470-G, HNTIN-868-G, HNTIN-915-G,HNTIN-433-G, HNTIN-470,HNTIN-868, HNTIN-915,HNTIN-433 has the same internal circuit design, layout, components and internal wiring. The difference is that the ones with the -G suffix have GPS function, while those without the suffix do not. Each model has two appearances, except for the appearance, the interior is exactly the same. In addition, the corresponding frequency of each model of LoRa module is different, as follows: The Nebra HNT Indoor Hotspot is available in 4 variants to support multiple regions. It is available in the following frequency variants: • 433 MHz (HNTIN-433) • 470 Mhz (HNTIN-470) • 868 Mhz (HNTIN-868) • 915 Mhz (HNTIN-915)

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

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@ccis-cb.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
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-03-2021	03-02-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-18-2020	06-17-2021
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:

The C/N0 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.

Equation 4-1: Maximum degradation in C/N0

$$\Delta C/N_0 \leq 1 \text{ dB}$$

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

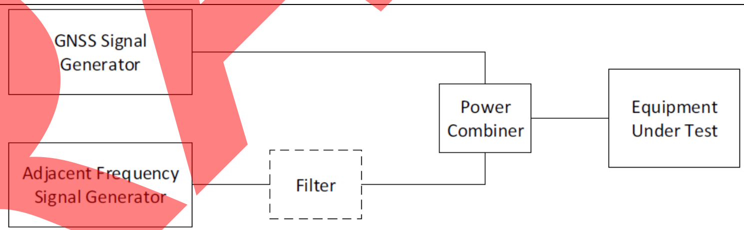
Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band
1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band
1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band
1 559 to 1 610	GUE RNSS band under test		
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

Table 4-4: Adjacent frequency signal

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:

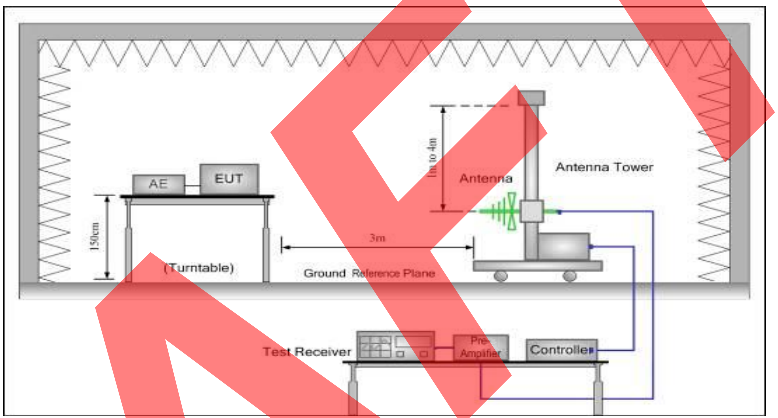
1. Configure the GNSS signal generator to simulate those GNSS and GNSS signals from table 4-1 declared as supported by the GUE, with power levels and other details as specified in clause B.2.
2. With the adjacent frequency signal switched off, the EUT shall be given sufficient time to acquire all simulated satellites from the declared GNSS system(s).
3. Record the baseline C/N0 value(s) reported by the EUT. Sufficient filtering shall be used to obtain a stable value. C/N0 may be averaged across all the satellites in view for each GNSS constellation. However, C/N0 shall not be averaged across satellite signals in different GNSS constellations. For a multi-GNSS EUT, there shall be a separate C/N0 value recorded for each GNSS constellation and each GNSS signal supported.
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.
5. The adjacent frequency signal shall be switched on, and the EUT's C/N0 value(s) recorded as in step 3) to measure the degradation with respect to the baseline value(s) recorded in step 3).
6. Test point Pass/Fail Criteria: If the C/N0 degradation from step 5)

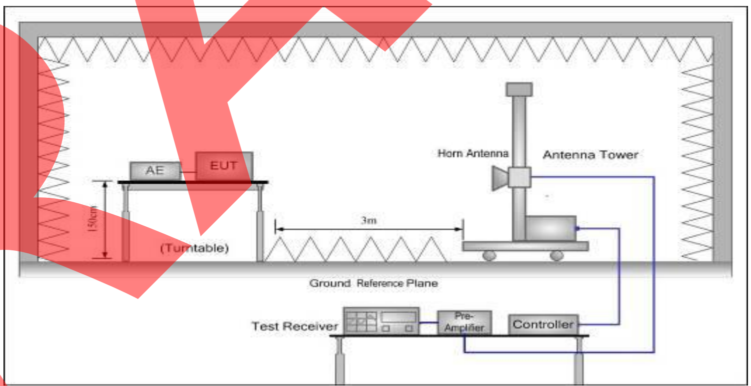
	does not exceed the value in equation 4-1, then this test point is set to "pass". If the C/N0 degradation exceeds the value in equation 4-1, then this test point is set to "fail." For a multi-GNSS and multi-signal EUT, there shall be a separate pass/fail determination for each GNSS and for each GNSS 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". 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.
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_0 (dB)			
			No interfering signal	With interfering signal	Decrease of C/N_0	Δ C/N0 ≤ 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

<table>
<tr><td>Test Requirement:</td><td colspan="2">EN 303 413 clause 4.2.2</td></tr>
<tr><td>Test Method:</td><td colspan="2">EN 303 413 clause 5.5.2</td></tr>
<tr><td>Receiver setup:</td><td colspan="2">Frequency < 1000MHz; RBW = 100kHz, VBW = 300kHz, Detector = peak
Frequency >= 1000MHz; RBW = 1MHz, VBW = 3MHz, Detector = peak.</td></tr>
<tr><td rowspan="3">Limit:</td><td>Frequency</td><td>Limit</td></tr>
<tr><td>30MHz to 1000 MHz</td><td>-57dBm</td></tr>
<tr><td>Above 1GHz</td><td>-47dBm</td></tr>
<tr><td>Test Frequency range:</td><td colspan="2">30MHz to 8.3GHz</td></tr>
<tr><td>Test setup:</td><td colspan="2">Below 1GHz


Above 1GHz

</td></tr>
<tr><td>Test procedure:</td><td colspan="2">Below 1GHz test procedure:
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.
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.
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.
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.
5. Repeat step 4 for test frequency with the test antenna polarized</td></tr>
</table>

horizontally.

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.
7. Feed the substitution antenna at the transmitter end with a signal genera to 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.
8. Repeat step 7 with both antennas horizontally polarized for each test frequency.
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:

   ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

   Where: Pg is the generator output power into the substitution antenna.

Above 1GHz test procedure:

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.

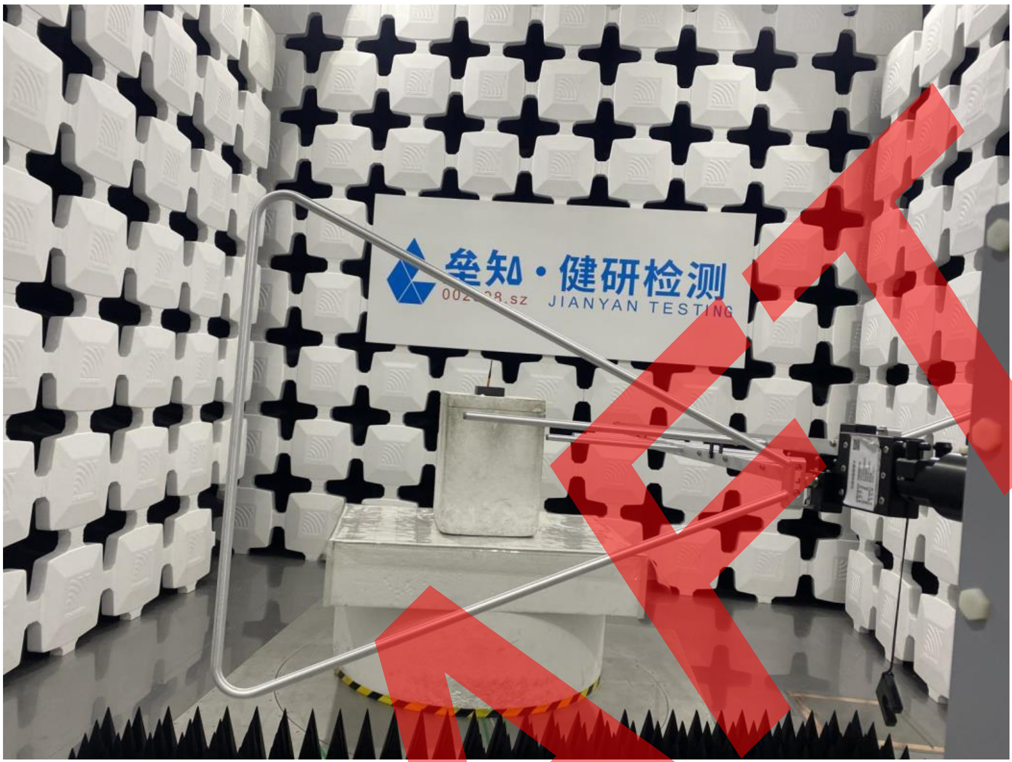
Test Instruments:	See the section 5.8
Test mode:	Receiving mode
Test Result:	Pass

Measurement Data:

Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
67.67	Vertical	-67.68	2nW/ -57dBm below 1GHz, 20nW/ -47dBm above 1GHz.	Pass
162.61	V	-67.71		
3150.84	V	-56.42		
271.32	Horizontal	-67.66		
948.76	H	-68.37		
3150.84	H	-56.90		

7 Test setup photo

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz

8 EUT Constructional Details

Reference to the test report No. JYTSZB-R01-2100195

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