

Prüfbericht-Nr.: Test report no.:	CN231H2K 002	Auftrags-Nr.: Order no.:	168434627	Seite 1 von 26 Page 1 of 26
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2023-07-11	
Auftraggeber: Client:	Measurement Specialties (China), Ltd. No.26 LangShan Road, Nanshan District, Shenzhen City, 518057 Guangdong, P. R China			
Prüfgegenstand: Test item:	Wireless Humidity Sensor			
Bezeichnung / Typ-Nr.: Identification / Type no.:	5911N-EX-A-A1,5911N-EX-A-B1,5911N-NX-A-A1, 5911N-NX-A-B1 5511N-EX-B-A1,5511N-EX-B-B1,5511N-NX-B-A1,5511N-NX-B-B1			
Auftrags-Inhalt: Order content:	Test Report			
Prüfgrundlage: Test specification:	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 3 August 2023 RSS-Gen Issue 5 March 2019			
Wareneingangsdatum: Date of sample receipt:	2023-07-19	Please refer to Photo Document		
Prüfmuster-Nr.: Test sample no:	A003518892 -005~007			
Prüfzeitraum: Testing period:	2023-07-22 - 2023-08-10			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date: 2024-01-08	Signed by: Bell Hu		Ausstellungsdatum: Issue date: 2024-01-08	Signed by: Jonathan Li
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position:	Sachverständige(r)/Expert
Sonstiges / Other:	FCC ID: 2A85PA5XX1N IC: 29620-A5XX1N , HVIN: 5, FVIN: FVIN: SW_5 9XX_HCC512B_3.3.1_a .hex, SW_5 5XX_HCC512B_3.3.1_a .hex PMN: Wireless Humidity Sensor			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

Prüfbericht-Nr.: CN231H2K 002 CN231H2K
002

Seite 2 von 26
Page 2 of 26

Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
2	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. <i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i>
3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM PEAK OUTPUT POWER

RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 6dB BANDWIDTH

RESULT: Pass

5.1.5 20dB BANDWIDTH

RESULT: Pass

5.1.6 99% BANDWIDTH

RESULT: Pass

5.1.7 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 kHz BANDWIDTH

RESULT: Pass

5.1.8 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.9 CARRIER FREQUENCY SEPARATION

RESULT: Pass

5.1.10 NUMBER OF HOPPING FREQUENCY

RESULT: Pass

5.1.11 TIME OF OCCUPANCY

RESULT: Pass

Contents

1	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS	5
2	TEST SITES	6
2.1	TEST FACILITIES	6
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	6
2.3	TRACEABILITY	7
2.4	CALIBRATION	7
2.5	MEASUREMENT UNCERTAINTY.....	7
2.6	LOCATION OF ORIGINAL DATA.....	7
2.7	STATUS OF FACILITY USED FOR TESTING.....	7
3	GENERAL PRODUCT INFORMATION	8
3.1	PRODUCT FUNCTION AND INTENDED USE.....	8
3.2	RATINGS AND SYSTEM DETAILS	8
3.3	INDEPENDENT OPERATION MODES	10
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS.....	11
3.5	SUBMITTED DOCUMENTS.....	11
4	TEST SET-UP AND OPERATION MODES	12
4.1	PRINCIPLE OF CONFIGURATION SELECTION	12
4.2	TEST OPERATION AND TEST SOFTWARE.....	12
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	12
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE	12
4.5	TEST SETUP DIAGRAM	13
5	TEST RESULTS	15
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	15
5.1.1	<i>Antenna Requirement</i>	<i>15</i>
5.1.2	<i>Maximum Peak Output Power</i>	<i>16</i>
5.1.3	<i>Conducted Power Spectral Density</i>	<i>17</i>
5.1.4	<i>6dB Bandwidth</i>	<i>18</i>
5.1.5	<i>20dB Bandwidth</i>	<i>19</i>
5.1.6	<i>99% Bandwidth</i>	<i>20</i>
5.1.7	<i>Conducted Spurious Emissions Measured in 100 kHz Bandwidth</i>	<i>21</i>
5.1.8	<i>Radiated Spurious Emission</i>	<i>22</i>
5.1.9	<i>Carrier Frequency Separation.....</i>	<i>23</i>
5.1.10	<i>Number of Hopping Frequency.....</i>	<i>24</i>
5.1.11	<i>Time of Occupancy.....</i>	<i>25</i>
6	PHOTOGRAPHS OF THE TEST SET-UP	26
7	LIST OF TABLES.....	26

Prüfbericht - Nr.: CN231H2K 002
Test Report No.:

Seite 5 von 26
Page 5 of 26

1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up.

Appendix B: Test Results.

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China

FCC Registration No.: 694916

IC Registration No.: 25069 and the CAB identifier is CN0078.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing (TS8997)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Signal Analyzer	R&S	FSV 40	101441	2024-07-25
OSP	R&S	OSP 150	101017	2023-11-21
Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
Test Software	R&S	WMS32 (V11.00.00)	N/A	N/A
Power Meter	R&S	NRP2	107105	2023-11-21
Wideband Power Sensor	R&S	NRP-Z81	105677	2024-07-25
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2024-06-22
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2024-07-25
Signal Analyzer	R&S	FSV 40	101439	2024-07-25
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2024-07-25
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2024-07-25
Amplifier	R&S	SCU-18F	180070	2024-07-25
Amplifier	R&S	SCU40A	100475	2024-07-25
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2024-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Table 2: Measurement Uncertainty

Parameter	Uncertainty (k=2)
Occupied Channel Bandwidth	$\pm 2.08 \%$
RF output power, conducted	$\pm 0.99 \text{ dB}$
RF power density, conducted	$\pm 0.99 \text{ dB}$
Unwanted Emissions, conducted	$\pm 0.89 \text{ dB}$
All emissions, radiated	$\pm 4.17 \text{ dB}$
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	$\pm 3.70 \text{ dB} / \pm 3.30 \text{ dB}$

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The product is Wireless Humidity Sensor which support 915MHz Lora and BLE functions.

Data Rate	Configuration	Indicative physical bit rate [bit/sec]
0	LoRa Modulation: SF10 / Bandwidth 125 kHz	980
1	LoRa Modulation: SF9 / Bandwidth 125 kHz	1760
2	LoRa Modulation: SF8 / Bandwidth 125 kHz	3125
3	LoRa Modulation: SF7 / Bandwidth 125 kHz	5470
4	LoRa Modulation: SF8 / Bandwidth 500 kHz	12500

For details refer to the User Manual, Technical Description and Circuit Diagram.

Type No.:	HVIN	PMN	FVIN	Remarks
5911N-EX-A-A1 5911N-EX-A-B1 5911N-NX-A-A1 5911N-NX-A-B1	5	Wireless Humidity Sensor	SW_59XX_HCC512B_3.3.1_a l l.hex	1.All of them share the same hardware. 2.The 5911N-XX-A-X1 supports 915MHz Lora and BLE, corresponding to FVIN SW_5 9XX_HCC512B_3.3.1_a l l.hex. 3.As to 5511N-XX-A-X1, the 915MHz Lora disabled via Firmware setting, only BLE reserved, corresponding to FVIN SW_5 5XX_HCC512B_3.3.1_a l l.hex. 4.The EX or NX in Type number, standing for the different installation environment type (EX=Explosive Atmospheres; NX=Ordinary installations; The penultimate character represents whether the product has a cap (A =With cap; B=Without cap). These changes have no impact on RF characteristics.
5511N-EX-B-A1 5511N-EX-B-B1 5511N-NX-B-A1 5511N-NX-B-B1			SW_55XX_HCC512B_3.3.1_a l l.hex	

The model supporting both BLE and Lora was selected in test.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Wireless Humidity Sensor
Type Designation	5911N-EX-A-A1,5911N-EX-A-B1,5911N-NX-A-A1, 5911N-NX-A-B1 5511N-EX-B-A1,5511N-EX-B-B1,5511N-NX-B-A1,5511N-NX-B-B1
FCC ID	2A85PA5X11N
IC ID	29620-A5X11N
PMN	Wireless Humidity Sensor
HVIN	5
FVIN	SW_59XX_HCC512B_3.3.1_a l l.hex SW_55XX_HCC512B_3.3.1_a l l.hex
Operating Voltage	3.6V DC (Supplied by internal battery)
Testing Voltage	3.6V DC(Full battery)
Extreme Temperature Range	-30°C to +75 °C
Technical Specification of Lora DTS	
Operating Frequency	903 – 914.2MHz

Type of Modulation	Lora
Data Rate	SF8 / DR4
Channel Number	8 channels (Upstream)
Channel Separation	1.6 MHz
Occupied Bandwidth	500 KHz
Antenna Type	Integral Antenna
Antenna Gain	0.02 dBi
Technical Specification of Lora FHSS	
Frequency Range	902.3 – 914.9MHz
Type of Modulation	Lora
Data Rate	SF7 to SF10 / DR0 to DR3
Channel Number	64 channels (Upstream)
Channel Separation	200 KHz
Occupied Bandwidth	125 KHz
Antenna Type	Integral Antenna
Antenna Gain	0.02 dBi

Table 4: RF Channel and Frequency of Lora DTS

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
64	903.0	66	906.2	68	909.4	70	912.6
65	904.6	67	907.8	69	911.0	71	914.2

Table 5: RF Channel and Frequency of Lora FHSS

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	902.3	16	905.5	32	908.7	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	908.5	47	911.7	63	914.9

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Lora transmitting mode (FHSS)
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Lora transmitting mode (DTS)
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- C. On, Transmitting on Hopping channel (Lora FHSS)
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- | | |
|--|--|
| ☒ User Manual | ☒ Rating Label |
| ☐ Circuit Diagram | ☒ PCB Layout |
| ☐ Block Diagram | ☒ Photo Document |
| ☐ Schematics | ☐ Parts List |
| ☐ Model Difference Letter | |

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

According to clause 3.1, all tests were performed on model 5911N-NX-A-A1 in this report.

Power setting:

4.3 Special Accessories and Auxiliary Equipment

Table 6: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A
Portable Laptop	Lenovo	T14	PF2V5EB6	N/A
USB board	NORDIC	400250	/	/

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 30MHz)

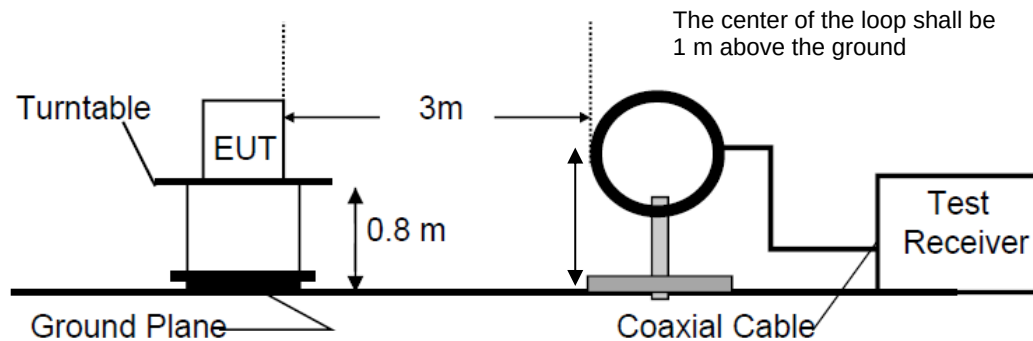


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

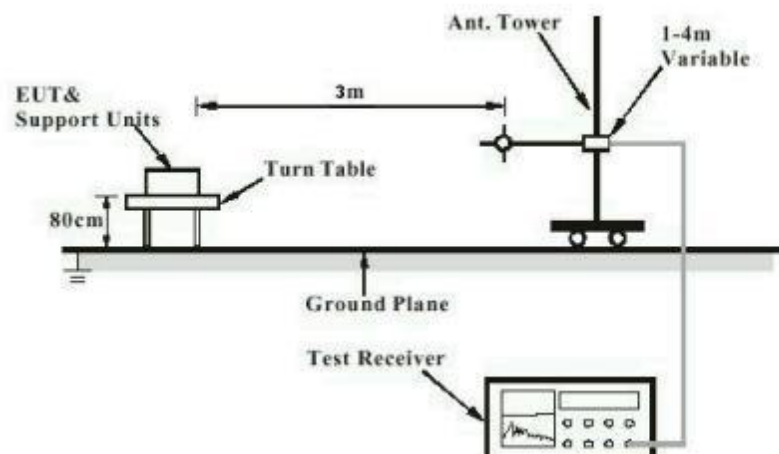


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

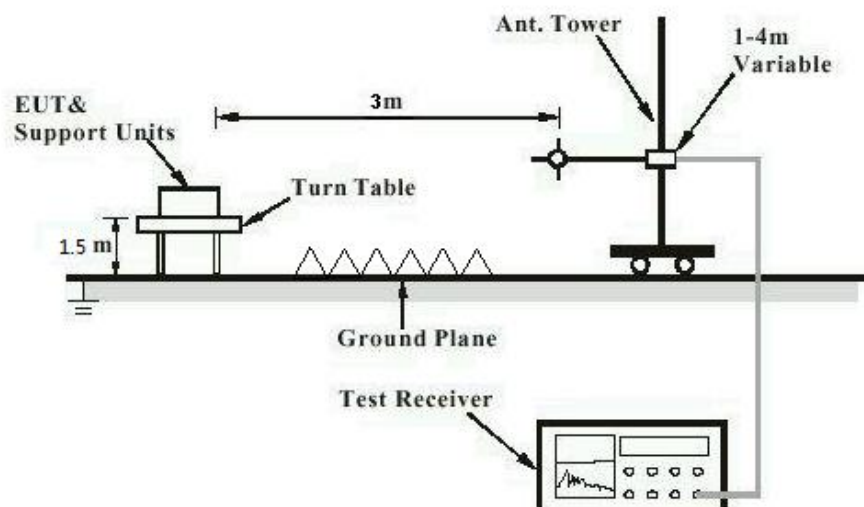


Diagram of Measurement Configuration for Mains Conduction Measurement

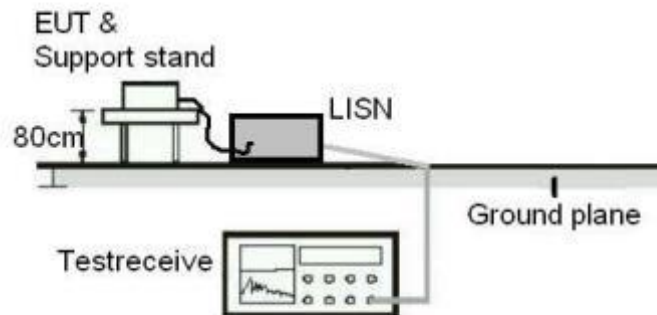
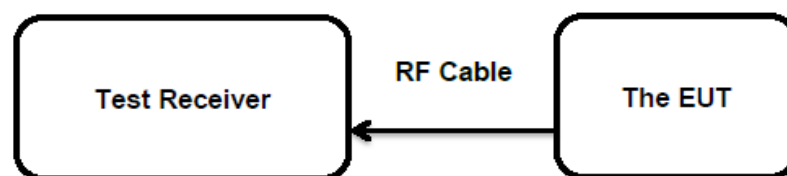


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 6.8

The EUT has an Integral antenna, the maximum directional gain of antenna is 0.02dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.
Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

Prüfbericht - Nr.: CN231H2K 002
Test Report No.:

Seite 16 von 26
Page 16 of 26

5.1.2 Maximum Peak Output Power

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(b)(2)&(3)
 RSS-247 Clause 5.4(a)&(d)
 Basic standard : ANSI C63.10: 2013
 Limits : < 1.0 W (30 dBm) for antenna gain less than 6dBi
 Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-29 to 2023-08-09
 Input voltage : Full Battery
 Operation mode : A,B
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

Table 7: Test Result of Maximum Conducted Output Power

Test Mode	Test Channel (MHz)	Maximum Conducted Peak Power		Power setting	Limit (W)
		(dBm)	(W)		
Lora DTS SF8	903.0	12.59	0.0182	14	< 1.0
	907.8	12.62	0.0183		
	914.2	12.39	0.0173		
Lora FHSS SF7	902.3	13.08	0.0203	14	< 1.0
	908.5	12.97	0.0198		
	914.9	12.84	0.0192		
Lora FHSS SF10	902.3	13.06	0.0202	14	< 1.0
	908.5	12.95	0.0197		
	914.9	12.83	0.0192		
Max. Measured Value		13.08	0.0203		

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) : 0.02 dBi,
Maximum e.i.r.p.=13.10dBm, which is far below the 4 W.

Prüfbericht - Nr.: CN231H2K 002
Test Report No.:

Seite 17 von 26
 Page 17 of 26

5.1.3 Conducted Power Spectral Density

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(e), FCC Part 15.247(f)
 RSS-247 Clause 5.2(b), RSS-247 Clause 5.3
 Basic standard : ANSI C63.10: 2013
 Limits : < 8 dBm / 3kHz for antenna gain less than 6dBi
 Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-29 to 2023-08-09
 Input voltage : Full Battery
 Operation mode : B
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 8: Test Result of Maximum Peak Power Spectral Density, Lora DTS

Test Mode	Test Channel (MHz)	Measured Peak Power Spectral Density (dBm/3KHz)
Lora DTS	903.0	2.73
	907.8	2.80
	914.2	2.40
Maximum Measured Value		2.80

Prüfbericht - Nr.: **CN231H2K 002**
Test Report No.:Seite 18 von 26
Page 18 of 26

5.1.4 6dB Bandwidth

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(a)(2)
RSS-247 Clause 5.2(a)
Basic standard : ANSI C63.10: 2013
Limits : At least 500kHz for bandwidth(DTS)
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-29 to 2023-08-09
Input voltage : Full Battery
Operation mode : B
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 9: Test Result of 6dB Bandwidth, Lora DTS

Test Mode	Test Channel (MHz)	6dB Bandwidth (KHz)	Limit (KHz)
Lora DTS	903.0	637.4	>500KHz
	907.8	629.4	
	914.2	627.4	
Minimum Measured Value		627.4	

5.1.5 20dB Bandwidth

RESULT:
Pass
Test Specification

Test standard	: FCC Part 15.247(a)(1) (i) RSS-247 Clause 5.1(a)
Basic standard	: ANSI C63.10: 2013 Not more than 500kHz and
Limits	: < 250KHz for at least 50 hopping frequencies >=250KHz for at least 25 hopping frequencies
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-07-30 to 2023-08-09
Input voltage	: Full Battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

Table 10: Test Result of 20dB Bandwidth, FHSS

Test Mode	Test Channel (MHz)	20dB Bandwidth (kHz)	Limit (KHz)
Lora FHSS SF7	902.3	146.16	<500KHz
	908.5	146.89	
	914.9	146.89	
Lora FHSS SF10	902.3	142.55	
	908.5	141.82	
	914.9	143.27	
Maximum Measured Value		146.89	

Prüfbericht - Nr.: CN231H2K 002
Test Report No.:

Seite 20 von 26
 Page 20 of 26

5.1.6 99% Bandwidth

RESULT:

Pass

Test Specification

Test standard : RSS-Gen Clause 6.7
 Basic standard : ANSI C63.10: 2013
 Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-30 to 2023-08-09
 Input voltage : Full Battery
 Operation mode : A,B
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 11: Test Result of 99% Bandwidth, Lora DTS

Test Mode	Test Channel (MHz)	99% Bandwidth (KHz)	Limit (KHz)
Lora DTS SF8	903.0	535.46	/
	907.8	535.46	
	914.2	535.46	
Lora FHSS SF7	902.3	126.63	
	908.5	128.08	
	914.9	128.08	
Lora FHSS SF10	902.3	125.90	
	908.5	125.90	
	914.9	125.90	
Minimum Measured Value		535.46	

Prüfbericht - Nr.: **CN231H2K 002**
Test Report No.:Seite 21 von 26
Page 21 of 26**5.1.7 Conducted Spurious Emissions Measured in 100 kHz Bandwidth****RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-07-30 to 2023-08-09
Input voltage	: Full Battery
Operation mode	: A,B
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: **CN231H2K 002**
Test Report No.:Seite 22 von 26
Page 22 of 26

5.1.8 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2023-07-30 to 2023-08-09
Input voltage	: Full Battery
Operation mode	: A,B
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

5.1.9 Carrier Frequency Separation

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(a)(1)
RSS-247 Clause 5.1(b)
Basic standard : ANSI C63.10: 2013
Limits : $\geq 20\text{dB}$ bandwidth
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-30 to 2023-08-09
Input voltage : Full Battery
Operation mode : C
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 12: Test Result of Carrier Frequency Separation

Test Mode	Channel	Measured Channel Separation (KHz)	Limit (kHz)	Result
Lora FHSS SF7	Low Channel	200.6	≥ 20dB bandwidth	Pass
	Adjacency Channel			
	Middle Channel	200.6		Pass
	Adjacency Channel			
	High Channel	200.6		Pass
	Adjacency Channel			
Lora FHSS SF10	Low Channel	200.6	≥ 20dB bandwidth	Pass
	Adjacency Channel			
	Middle Channel	200.6		Pass
	Adjacency Channel			
	High Channel	200.6		
	Adjacency Channel			Pass

Note:

The limit is maximum 20 dB bandwidth: 146.89KHz.

Prüfbericht - Nr.: **CN231H2K 002**
Test Report No.:Seite 24 von 26
Page 24 of 26**5.1.10 Number of Hopping Frequency****RESULT:****Pass****Test Specification**

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(d)
Basic standard : ANSI C63.10: 2013
Limits : ≥ 50 non-overlapping channels
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-30 to 2023-08-09
Input voltage : Full Battery
Operation mode : C
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 13: Test result of hopping channel number

Test Mode	20dB Bandwidth(kHz)	Hopping frequencies	Limit
Lora FHSS SF7	20dB Bandwidth < 250	64	≥ 50
Lora FHSS SF10	20dB Bandwidth < 250	64	≥ 50

5.1.11 Time of Occupancy

RESULT:

Pass

Test Specification

Test standard : FCC part 15.247(f)
RSS-247 Clause 5.3

Basic standard : ANSI C63.10: 2013

Limits : < 0.4s

Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-07-30 to 2023-08-09

Input voltage : Full Battery

Operation mode : C

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 14: Test result of Channel Occupancy

Test Mode	20dB Bandwidth(kHz)	Period (s)	Channel Occupancy Time (ms)	Limit (ms)
Lora FHSS SF7	20dB Bandwidth < 250	20	274.8	400
Lora FHSS SF10	20dB Bandwidth < 250	20	231.9	400

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

7 List of Tables

Table 1: List of Test and Measurement Equipment.....	6
Table 2: Measurement Uncertainty	7
Table 3: Technical Specification of EUT	8
Table 4: RF Channel and Frequency of Lora DTS	9
Table 5: RF Channel and Frequency of Lora FHSS.....	9
Table 6: Auxiliary Equipment Used during Test	12
Table 7: Test Result of Maximum Conducted Output Power.....	16
Table 8: Test Result of Maximum Peak Power Spectral Density, Lora DTS	17
Table 9: Test Result of 6dB Bandwidth, Lora DTS.....	18
Table 10: Test Result of 20dB Bandwidth, FHSS	19
Table 11: Test Result of 99% Bandwidth, Lora DTS.....	20
Table 12: Test Result of Carrier Frequency Separation	23
Table 13: Test result of hopping channel number	24
Table 14: Test result of Channel Occupancy	25