

Prüfbericht-Nr.: <i>Test report no.:</i>	NN22LX7U 001	Auftrags-Nr.: <i>Order no.:</i>	168394207	Seite 1 von 21 <i>Page 1 of 21</i>	
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022-10-14		
Auftraggeber: <i>Client:</i>	Signify (China) Investment Co Ltd Bldg 9 Ln 888, Tianlin Rd, Minhang District Shanghai 200233, China				
Prüfgegenstand: <i>Test item:</i>	Sensor				
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	9290035638, 9290035639 (Trademark: PHILIPS)				
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval				
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 February 2021 ANSI C63.10:2013				
Wareneingangsdatum: <i>Date of receipt:</i>	2022-10-15	Please refer to photo documents			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A003349095-005-010				
Prüfzeitraum: <i>Testing period:</i>	2022-10-15 – 2022-11-11				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von: <i>tested by:</i>			genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i>	2022-11-18		Ausstellungsdatum: <i>Issue date:</i>	2022-11-18	
Stellung / Position	Department Manager		Stellung / Position	Reviewer	
Sonstiges / Other:	FCC ID: 2AGBW9290035638X IC: 20812-35638X HVIN: 35638				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>				
* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet	
Legend:	1 = very good	2 = good	3 = satisfactory	4 = sufficient	5 = poor
	P(ass) = passed a.m. test specifications(s)	F(ail) = failed a.m. test specifications(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. <i>This test report only relates to the a. m. 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.</i>					

V05

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 99%dB BANDWIDTH

RESULT: Pass

5.1.5 6dB BANDWIDTH

RESULT: Pass

5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.8 CONDUCTED EMISSION ON AC MAINS

RESULT: Not applicable

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Pass

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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: Test Results of Conducted & Radiated Testing

Appendix B: Photographs of the Test Set-up

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No. 362 Huanguan Road Middle, Longhua District, Shenzhen 518110, People's Republic of 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 (SRD-Tonscend)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Wireless Connectivity Tester	R&S	CMW270	101375	2023-08-02
Signal Analyzer	R&S	FSV 40	101441	2023-08-01
Vector Signal Generator	R&S	SMBV100A	263301	2023-08-01
Signal Generator	R&S	SMB100A	115186	2023-08-01
OSP	R&S	OSP 150	101017	2022-12-02
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	2022-12-02
Power Sensor	R&S	NRP-Z81	105677	2023-08-01
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2023-08-02
Signal Analyzer	R&S	FSV 40	101439	2023-08-01
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2023-08-01
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2023-08-02
Amplifier	R&S	SCU-18F	180070	2023-08-02
Amplifier	R&S	SCU40A	100475	2023-08-02
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-06-08
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-06-08
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2024-06-08
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

Conducted Emissions				
Equipment	Manufacturer	M/N	S/N	Calibrated until
EMI Test Receiver	R&S	ESR3	102680	2023-02-27
Artificial Mains Network	R&S	ENV216	101445	2023-02-27
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A

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.

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 of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) 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 Road Middle, Longhua District, Shenzhen 518110, People's Republic of 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 EUT is Sensor which supports 2.4GHz ZigBee wireless technology.

All the models has the same construction and inner layout, the different model name is only for the appearance color.

For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Sensor
Type Designation	9290035638, 9290035639
Trademark	PHILIPS
FCC ID	2AGBW9290035638X
IC	20812-35638X
HVIN	35638
Operating Voltage	DC 3.0 via Battery CR2
Testing Voltage	DC 3.3V From USB debugging board
Technical Specification of ZigBee	
Characteristic	Description
Frequency Range	2405.0 - 2480.0 MHz
Type of Modulation	DSSS(OQPSK)
Channel Number	16 channels
Channel Separation	5 MHz
Receiver Categories	Receiver category 2
Antenna Type	IFA Antenna
Antenna Gain	3.5 dBi

Table 3: RF Channel and Frequency of ZigBee

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
11	2405.0	15	2425.0	19	2445.0	23	2465.0
12	2410.0	16	2430.0	20	2450.0	24	2470.0
13	2415.0	17	2435.0	21	2455.0	25	2475.0
14	2420.0	18	2440.0	22	2460.0	26	2480.0

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Test frequencies are lowest channel: 2405.0 MHz, middle channel: 2445.0 MHz and highest channel: 2480 .0MHz.

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, ZigBee transmitting mode
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. On, normal operating
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- | | |
|----------------------------------|------------------|
| - Application Form | - Photo Document |
| - Block Diagram | - Schematics |
| - FCC/IC Label and Location Info | - User Manual |
| - Operation Description | |

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 testing were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model 9290035639 in this report.

Table 4: List of Power Level setting under Test

Test Mode	Power Level setting in software
ZigBee	5

4.3 Special Accessories and Auxiliary Equipment

Table 5: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8

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)

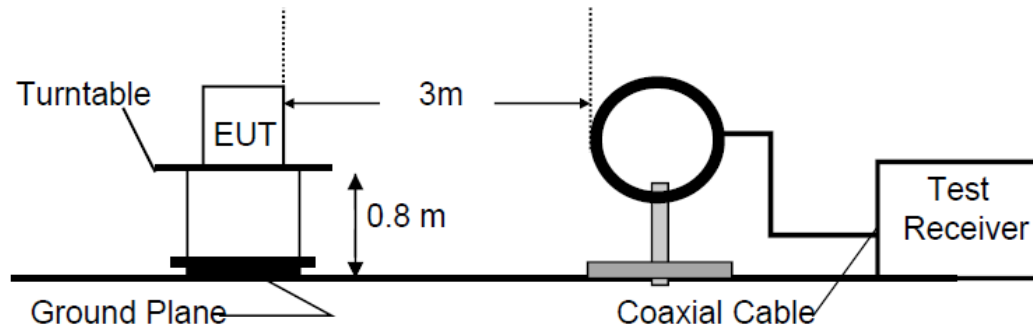


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

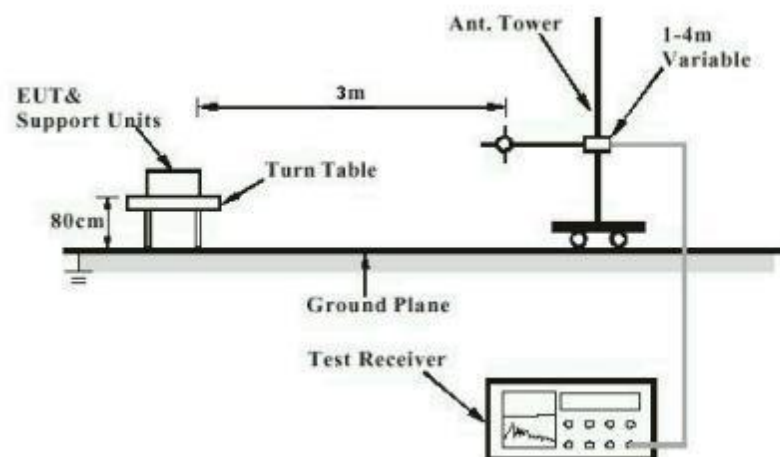


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

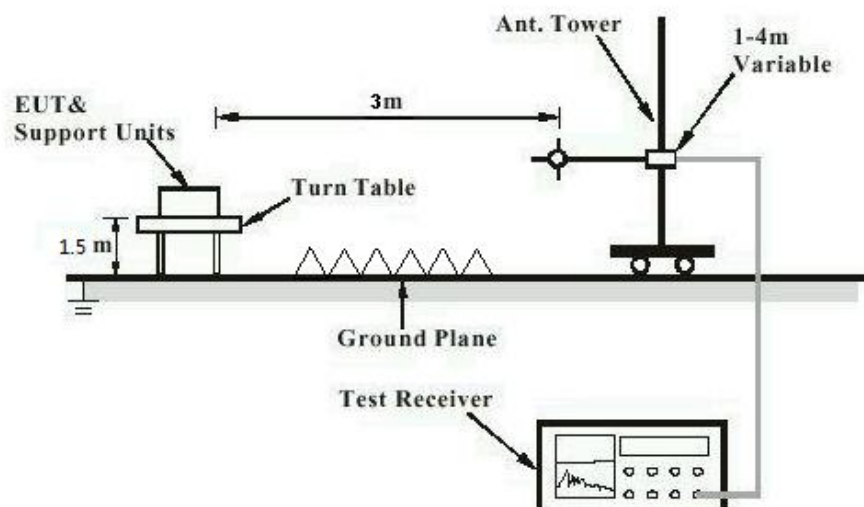


Diagram of Measurement Configuration for Mains Conduction Measurement

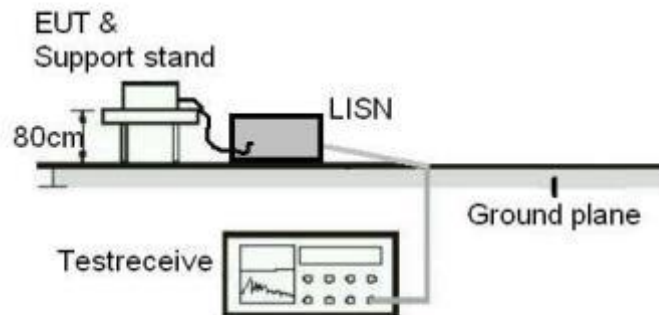
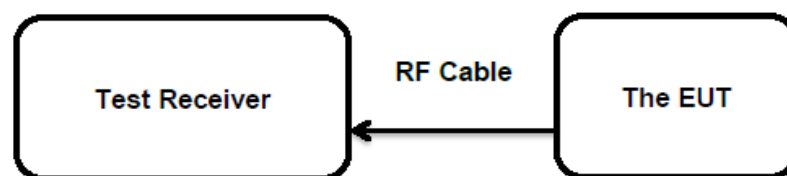


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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 6.7
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declared, the EUT has one IFA antenna, the directional gain of antennas are 3.50 dBi, 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.

5.1.2 Maximum Peak Conducted Output Power

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

Test standard	: FCC Part 15.247(b)(3)
	: RSS-247 Clause 5.4(d)
Basic standard	: ANSI C63.10: 2013
Limits	: < 1 Watt (Maximum Conducted Peak Power)
	: e.i.r.p. <4W
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-10-20
Input voltage	: DC 3.3V From USB debugging board
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 42 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 6: Test Result of Maximum Peak Conducted Output Power

Test Mode	Antenna	Test Channel (MHz)	Measured Peak Power		Limit (W)
			(dBm)	(W)	
ZigBee	Ant1	2405	5.16	0.0033	< 1.0
		2445	5.05	0.0032	
		2480	4.93	0.0031	
Maximum Measured Value			5.16	0.0033	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 3.5 dBi

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5.1.3 Conducted Power Spectral Density

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(e) RSS-247 Clause 5.2(b)
Basic standard	: ANSI C63.10: 2013
Limits	: 8 dBm / 3kHz
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-10-20
Input voltage	: DC 3.3V From USB debugging board
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 42 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

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5.1.4 99%dB 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	: 2022-10-20
Input voltage	: DC 3.3V From USB debugging board
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 42 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

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5.1.5 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
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-10-20
Input voltage	:	DC 3.3V From USB debugging board
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25.2 °C
Relative humidity	:	42 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

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5.1.6 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	: 2022-10-20
Input voltage	: DC 3.3V From USB debugging board
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25.2 °C
Relative humidity	: 42 %
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 A.

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5.1.7 Radiated Spurious Emission

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

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3 & 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 4 & Table 5
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-10-25 to 2022-10-28
Input voltage	: DC 3.0 via Battery CR2
Operation mode	: A
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 A.

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5.1.8 Conducted Emission on AC Mains

RESULT:

Not applicable

Test Specification

Test standard	: FCC Part 15.207(a) RSS-Gen Clause 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a) RSS-Gen Table 4
Kind of test site	: Shielded Room

Exemption Condition(s):

Since the EUT is powered by battery 3.0V, so the test is not applicable and skipped.

6 Photographs of the Test Set-Up

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

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