

Report No.: SEWM2311000489RG02
 Rev.: 01
 Page: 1 of 17

TEST REPORT

Application No: SEWM2311000489RG
Applicant: Marquardt GmbH
Address of Applicant: Schloss-Straße 16, 78604 Rietheim-Weilheim, Germany
Manufacturer: Marquardt GmbH
Address of Manufacturer: Schloss-Straße 16, 78604 Rietheim-Weilheim, Germany
EUT Description: NFC Door Handle Sensor
Model No.: HH5
Trade Mark: Marquardt
FCC ID: IYZHH5
Standard(s): FCC 47 CFR Part 15, Subpart B
Date of Receipt: 2023/12/01
Date of Test: 2023/12/04 to 2023/12/04
Date of Issue: 2023/12/11

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Well Wei

Wireless Laboratory Manager



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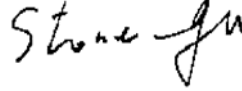
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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/12/11		Original

Prepared By		 <hr/> (King-p Li) / Test Engineer
Checked By		 <hr/> (Stone Gu) / Reviewer



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Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Radiated Emissions (30MHz-1GHz)	FCC 47 CFR Part 15, Subpart B	ANSI C63.4:2014	Class B	Pass
Radiated Emissions (above 1GHz)	FCC 47 CFR Part 15, Subpart B	ANSI C63.4:2014	Class B	Pass

Internal Source	Upper Frequency
Below 1.705MHz	30MHz
1.705MHz to 108MHz	1GHz
108MHz to 500MHz	2GHz
500MHz to 1GHz	5GHz
Above 1GHz	5th harmonic of the highest frequency or 40GHz, whichever is lower



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1 General Information

Product Name:	NFC Door Handle Sensor		
Model No. (EUT):	HH5		
Trade Mark:	Marquardt		
Hardware Version:	H12		
Software Version:	223010.0		
SN:	S04-HH5		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	NFC	13.56	13.56
<p>Remark: As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</p>			



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1.1 Description of Support Units

Description	Manufacturer	Model No.	Inventory No.
Computer	HONOR	MagicBook14	N/A

1.2 Test Location

All tests were performed at:

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	King-p Li

1.3 Test Facility

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

<ul style="list-style-type: none"> • A2LA (Certificate No. 6336.01) SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01. • Innovation, Science and Economic Development Canada SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory. CAB identifier: CN0120. IC#: 27594. • FCC –Designation Number: CN1312 SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory. Designation Number: CN1312. Test Firm Registration Number: 717327

1.4 Deviation from Standards

None

1.5 Abnormalities from Standard Conditions

None



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2 Emission Test Results

2.1 Radiated Emissions (30MHz-1GHz)

Test Requirement:	47 CFR Part 15, Subpart B		
Test Method:	ANSI C63.4:2014		
Frequency Range:	30MHz to 1GHz		
Measurement Distance:	3m		
Limit:	Frequency Range (MHz)	Limit(dBμV/m)	Detector
	30MHz -88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
960MHz-1000MHz	54.0	Quasi-peak	
Detector:	Peak for pre-scan (120kHz resolution bandwidth) 30M to1000MHz		

2.1.1 E.U.T. Operation

Temperature:	22~23°C
Humidity:	44~46% RH
Atmospheric Pressure:	101kPa
Pretest these modes to find the worst case:	a: USB (adapter input) +NFC ON
The worst case for final test:	a: USB (adapter input) +NFC ON



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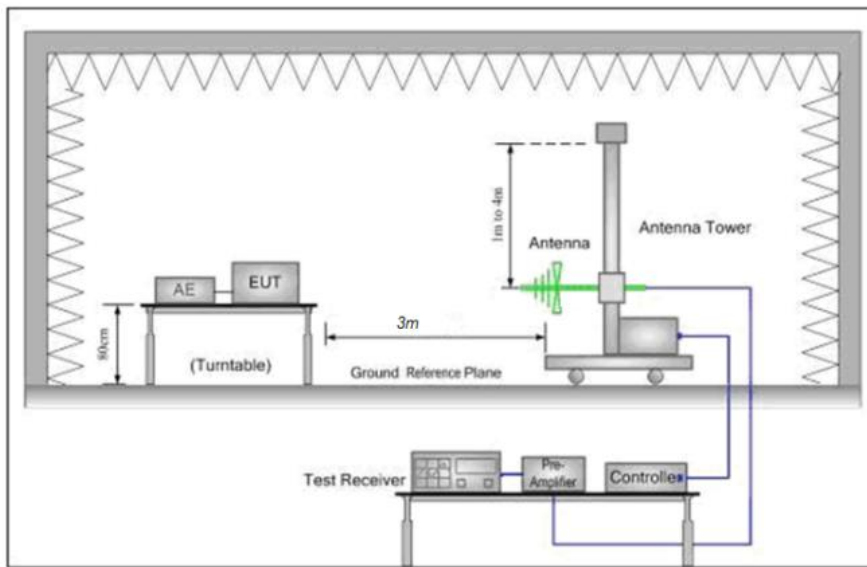
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2.1.2 Test Setup Procedures

1. The EUT was placed in a semi Anechoic Chamber as show below
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna height is adjusted between 1 to 4 meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function with specified bandwidth with Maximum Hold Mode, and the trace was allowed to stabilize.
7. If the emission level of the EUT in peak mode was 6 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.



2.1.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities. The three polarities of X,Y,Z were measured by EUT, but only the worst data had been displayed.

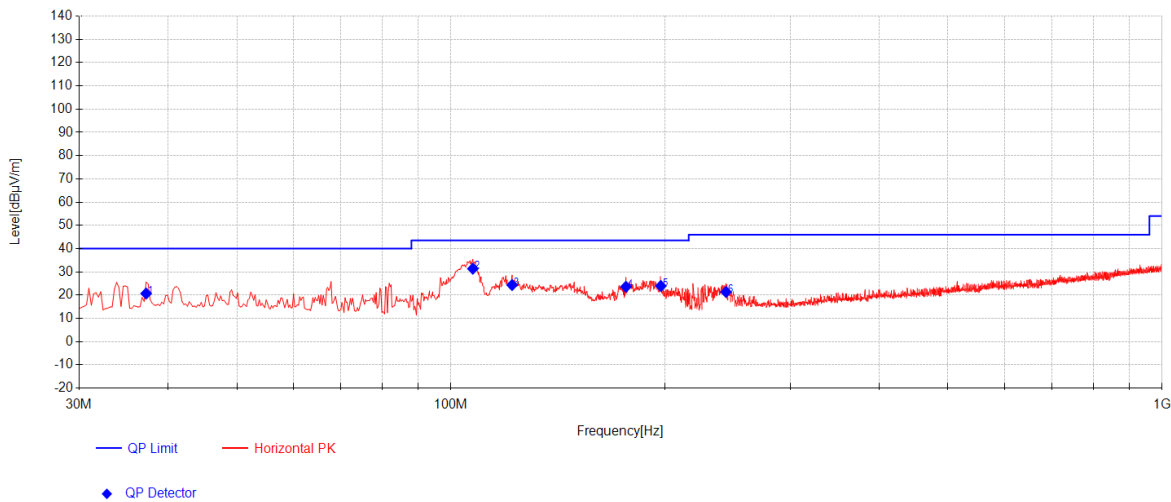


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Final Test Mode:	Mode a	Polarization:	Horizontal
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Data List

NO.	Frequency [MHz]	Reading [dBµV]	AF [dB/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity
1	37.275	35.63	19.05	-34.00	20.68	40.00	19.32	Horizontal
2	107.3575	48.63	16.16	-33.41	31.38	43.50	12.12	Horizontal
3	121.9075	40.26	17.42	-33.33	24.35	43.50	19.15	Horizontal
4	176.2275	39.65	16.84	-32.90	23.59	43.50	19.91	Horizontal
5	197.325	41.32	15.37	-32.75	23.95	43.50	19.55	Horizontal
6	243.6425	36.59	17.26	-32.48	21.37	46.00	24.63	Horizontal

Remark:

1. The Quasi-Peak measurements were performed on the EUT.

2. Value = Reading + AF + Factor:

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier (dB)

Margin = Limit[dBµV/m] -Value[dBµV/m]



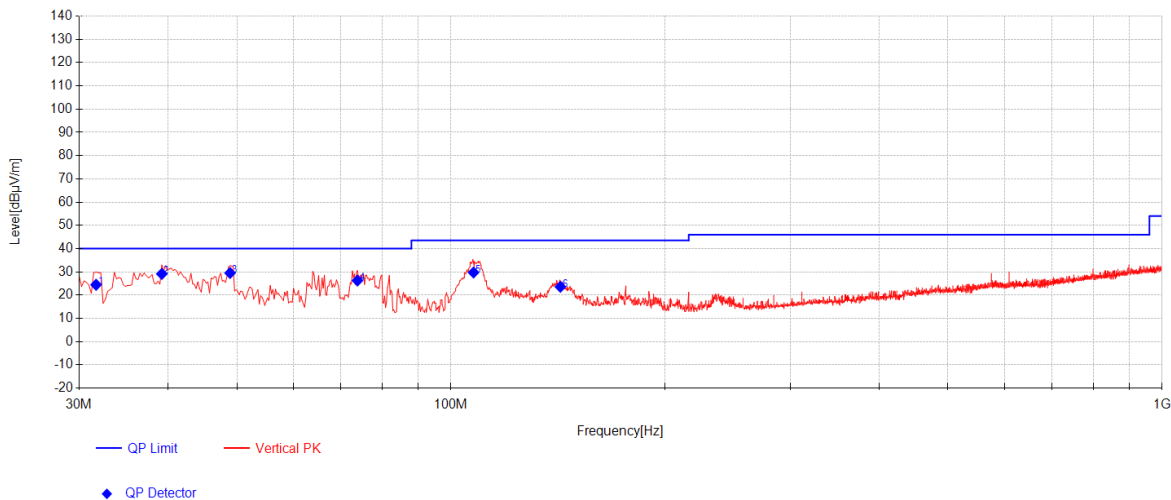
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Final Test Mode:	Mode a	Polarization:	Vertical
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Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF [dB/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity
1	31.6975	40.35	18.10	-34.01	24.45	40.00	15.55	Vertical
2	39.215	43.62	19.51	-34.00	29.14	40.00	10.86	Vertical
3	48.915	44.25	19.25	-33.98	29.52	40.00	10.48	Vertical
4	73.8925	43.62	16.36	-33.71	26.27	40.00	13.73	Vertical
5	107.6	46.96	16.18	-33.41	29.73	43.50	13.77	Vertical
6	142.52	38.24	18.56	-33.23	23.57	43.50	19.93	Vertical

Remark:

- The Quasi-Peak measurements were performed on the EUT.
- Value = Reading + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier (dB)
 Margin = Limit[dBµV/m] -Value[dBµV/m]



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2.2 Radiated Emissions (above 1GHz)

Test Requirement:	47 CFR Part 15, Subpart B		
Test Method:	ANSI C63.4:2014		
Frequency Range:	Above 1GHz		
Measurement Distance:	3m		
Limit:	Frequency (MHz)	Limit (dBµV/m)	Detector
	Above 1GHz	74 54	Peak Average
Detector:	Peak for pre-scan (1000kHz resolution bandwidth) 5th harmonic of the highest frequency or 40GHz, whichever is lower.		

2.2.1 E.U.T. Operation

Temperature:	22~23°C
Humidity:	44~46% RH
Atmospheric Pressure:	101kPa
Pretest these modes to find the worst case:	a: USB (adapter input) +NFC ON
The worst case for final test:	a: USB (adapter input) +NFC ON



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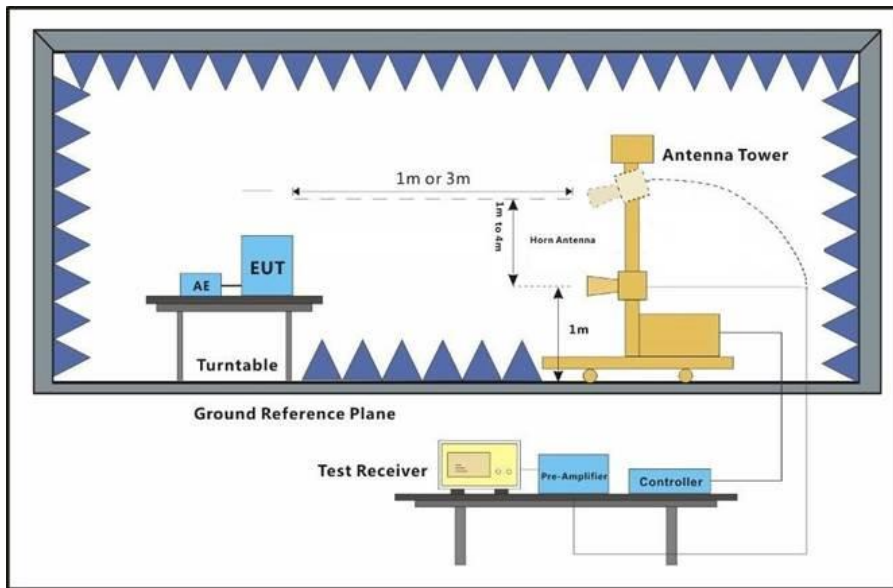
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SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Wireless Laboratory

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2.2.2 Test Setup Procedures

1. The EUT was placed in a full Anechoic Chamber as show below
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation
(Distance from antenna to EUT is 1m for measurements >18GHz).
4. The antenna height is adjusted between 1 to 4 meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak and AV Detect Function with specified bandwidth with Maximum Hold Mode, and the trace was allowed to stabilize.
7. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.



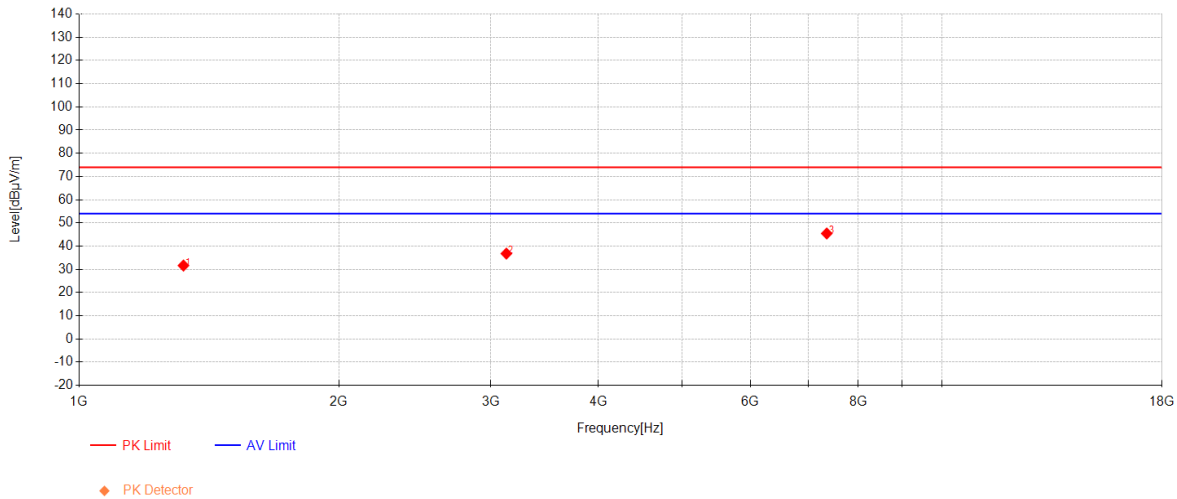
2.2.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Average measurements were conducted based on the peak sweep graph. The EUT was measured by Horn antenna with 2 orthogonal polarities.

The three polarities of X, Y, Z were measured by EUT, but only the worst data had been displayed. Scan from 5th harmonic of the highest frequency or 40GHz, whichever is lower, the disturbance above 18GHz was very low. The points marked on below plots are the highest emissions could be found when testing, so only below points had been displayed.



Final Test Mode:	Mode a	Polarization:	Horizontal
------------------	--------	---------------	------------



Data List

NO.	Frequency [MHz]	Reading [dBµV]	AF [dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	1321.3	53.99	25.14	-47.49	31.63	74.00	42.37	Horizontal
2	3127.975	51.23	29.53	-43.96	36.79	74.00	37.21	Horizontal
3	7355.45	46.84	36.43	-37.82	45.44	74.00	28.56	Horizontal

Remark:

- The Peak and Average measurements were performed on the EUT.
- Level = Reading Level + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier gain(dB)
 Margin = Limit[dBµV/m] – Level[dBµV/m]

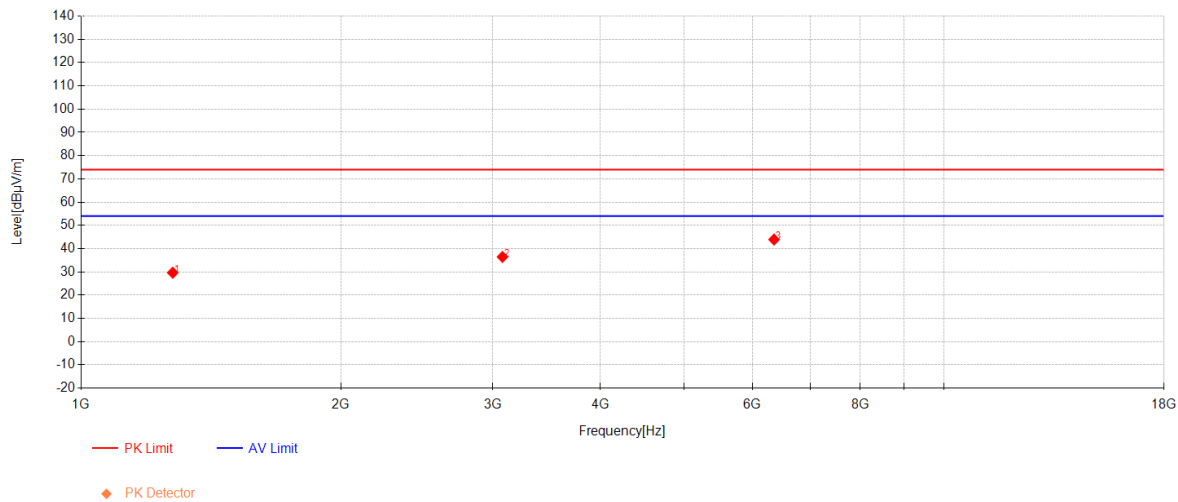


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Final Test Mode:	Mode a	Polarization:	Vertical
------------------	--------	---------------	----------



Data List

NO.	Frequency [MHz]	Reading [dBµV]	AF [dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	1277.1	52.06	25.16	-47.58	29.64	74.00	44.36	Vertical
2	3079.1	50.93	29.52	-43.99	36.45	74.00	37.55	Vertical
3	6356.7	47.87	35.51	-39.46	43.92	74.00	30.08	Vertical

Remark:

- The Peak and Average measurements were performed on the EUT.
- Level = Reading Level + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier gain(dB)
 Margin = Limit[dBµV/m] – Level[dBµV/m]



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3 Equipment List

RE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-01	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2023/02/07	2024/02/06
Signal Analyzer	ROHDE & SCHWARZ	FSW43	SUWI-01-02-04	2023/05/11	2024/05/10
Test receiver	ROHDE & SCHWARZ	ESR7	SUWI-01-10-01	2023/02/08	2024/02/07
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9163	SUWI-01-11-01	2023/05/13	2024/05/12
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-02	2023/05/13	2024/05/12
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2023/05/12	2024/05/11
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-01	2023/02/06	2024/02/05
Amplifier	Tonscend	TAP01018050	SUWI-01-14-02	2023/02/06	2024/02/05
Amplifier	Tonscend	TAP18040048	SUWI-01-14-03	2023/02/08	2024/02/07
Measurement Software	Tonscend	JS32-RE 4.0.0.0	SUWI-02-09-04	NCR	NCR



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4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radiated Emission	± 4.8dB (30M -1GHz)
		± 4.8dB (1GHz to 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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5 Photographs

5.1 Test Setup

Refer to Appendix A.1 15B Setup Photos.

---End of Report---



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