

FCC TEST REPORT

Product Name: Electronic Keyholder
Trade Mark: N/A
Model No.: Electronic Keyholder (HF)
Add. Model No.: N/A
Report Number: 2208231168EMC-1
Test Standards: FCC 47 CFR Part 15 Subpart B
Test Result: PASS
Date of Issue: November 11, 2022

Prepared for:

INVERS GmbH
Untere Industriestr.20, 57250 Netphen, Germany

Prepared by:

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November 11, 2022

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Version

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	INVERS GmbH
Address of Applicant:	Untere Industriestr.20, 57250 Netphen, Germany
Manufacturer:	INVERS GmbH
Address of Manufacturer:	Untere Industriestr.20, 57250 Netphen, Germany

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Electronic Keyholder
Model No.:	Electronic Keyholder (HF)
Add. Model No.:	N/A
Trade Mark:	N/A
DUT Stage:	Production Unit
Rated Voltage:	☒ 12VDC (supplied from CloudBoxx)
Classification of digital devices:	Class B
Highest Internal Frequency:	27.12 MHz
Software Version:	N/A (Provided by the customer)
Hardware Version:	1.0.1 (Provided by the customer)
Sample Received Date:	August 22, 2022
Sample Tested Date:	August 25, 2022 to August 27, 2022
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.	

1.2.2 Description of Accessories

None

1.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Cloud Box x	INVERS GmbH	CloudBoxx 4G Worldwide	N/A	Applicant
Storage Battery	Camel	58500 6-QWLZ-48	2602010594	UnionTrust
keyfob (RFID Tag)	---	---	---	Applicant
IC Card (RFID Tag) *2	---	---	---	Applicant

2) Support Cable

Description	Quantity	Cable Type	Length (m)	Supplied by
1	supply cable	N/A	1.2 Meters	Applicant

1.4 TEST LOCATION

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1.5 TEST FACILITY

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.9 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	± 3.8 dB
2	Conducted emission 150KHz-30MHz	± 3.4 dB
3	Radiated emission 9KHz-30MHz	± 4.9 dB
4	Radiated emission 30MHz-1GHz	± 4.7 dB
5	Radiated emission 1GHz-18GHz	± 5.1 dB
6	Radiated emission 18GHz-26GHz	± 5.2 dB
7	Radiated emission 26GHz-40GHz	± 5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart B Test Cases			
Test Item	Test Requirement	Test Method	Result
Conducted Emission	FCC 47 CFR Part 15.107	ANSI C63.4-2014	N/A(Note2)
Radiated Emission	FCC 47 CFR Part 15.109	ANSI C63.4-2014	PASS
Note: 1) N/A: In this whole report not applicable. 2) The EUT does not support the AC mains power input and/or output ports, not applicable for this test item.			

3. EQUIPMENT LIST

Radiated Emission Test - 3M Chamber						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	3m Chamber & Accessory Equipment	ETS-Lindgren	3m	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Loop Antenna	ETS-Lindgren	6502	00202525	11-Nov-2021	10-Nov-2023
☒	Broadband Antenna	ETS-Lindgren	3142E	00201566	11-Nov-2021	10-Nov-2023
☒	Pre-amplifier	ETS-Lindgren	118490	00204683	6-Nov-2021	5-Nov-2022
☒	Receiver	ROHDE & SCHWARZ	ESIB26	100114	5-Nov-2021	4-Nov-2022
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	11-Nov-2021	10-Nov-2023
☒	Multi device Controller	ETS-Lindgren	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

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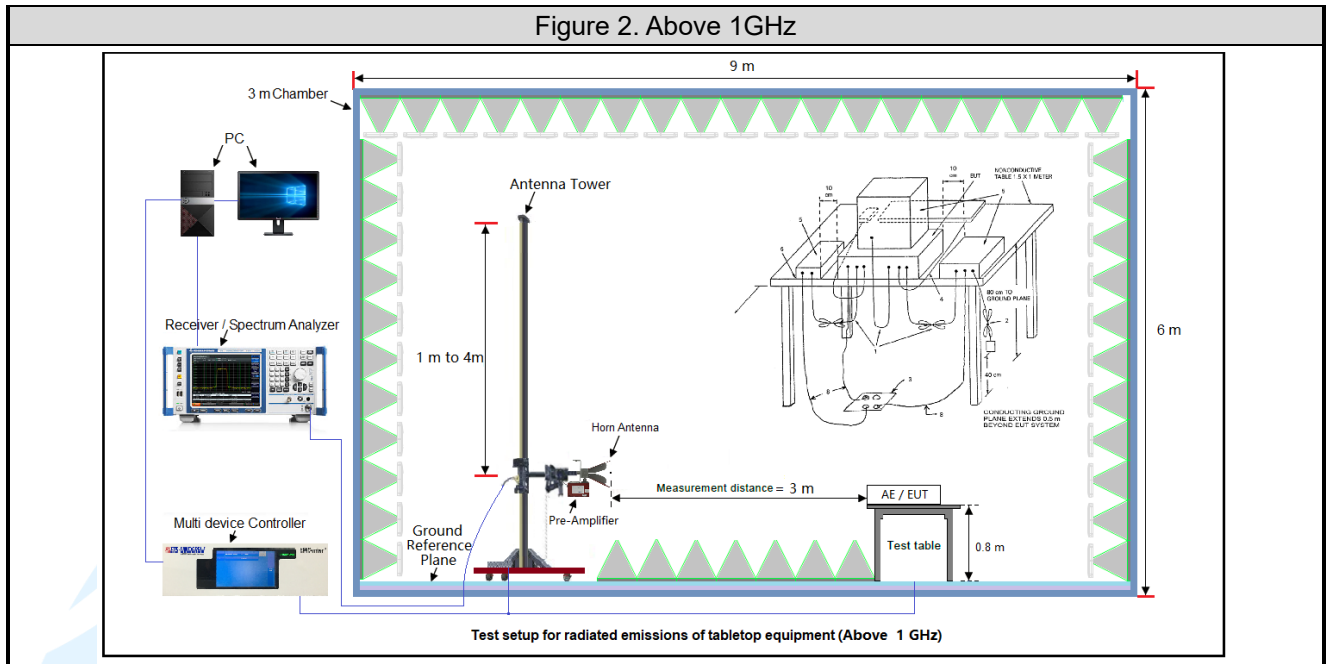
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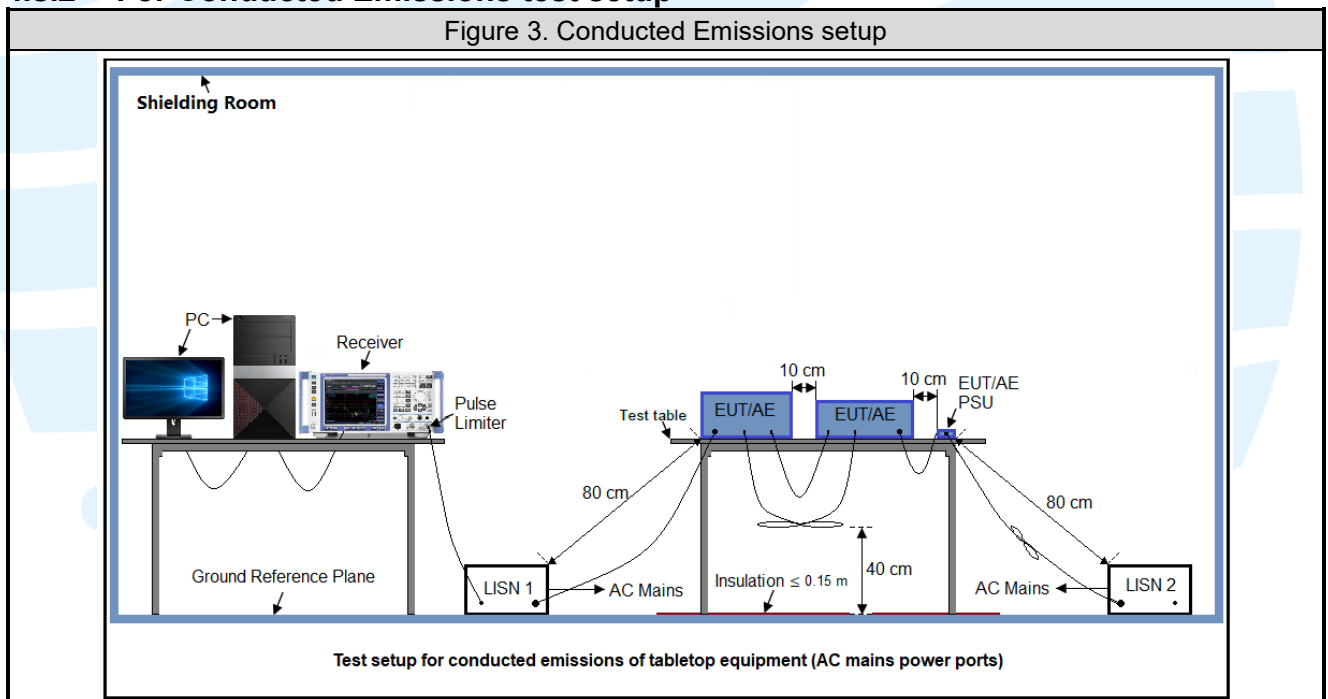
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Figure 2. Above 1GHz



4.3.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



4.4 SYSTEM TEST CONFIGURATION

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic (according to KDB 896810 D02 SDoC FAQ v01r01) of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part15 Subpart B	Unintentional Radiators
2	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
3	KDB 174176 D01 Line Conducted FAQ v01r01	AC power-line conducted emission frequency asked questions
4	KDB 896810 D02 SDoC FAQ v01r02	Supplier's Declaration of Conformity frequency asked questions

6. EMC REQUIREMENTS SPECIFICATION

6.1 RADIATED EMISSION

Test Requirement: FCC 47 CFR Part 15.109

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
$30 \leq f \leq 1\,000$	Quasi Peak	120 kHz	300 kHz
$f \geq 1000$	Peak	1 MHz	3 MHz
	Average	1 MHz	3 MHz

Measured frequency range

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Limits:

Limits for Class B devices

Frequency (MHz)	limits at 3m (dB μ V/m)		
	QP Detector	PK Detector	AV Detector
30-88	40.0	--	--
88-216	43.5	--	--
216-960	46.0	--	--
960 to 1000	54.0	--	--
Above 1000	--	74.0	54.0

Remark:

- The lower limit shall apply at the transition frequencies.
- Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
- For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.3.1 for details.

Test Procedures:

- From 30 MHz to 1GHz test procedure as below:

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- 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
- 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- 3) For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

2. Above 1GHz test procedure as below:

- 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
- 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- 3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Equipment Used: Refer to section 3 for details.

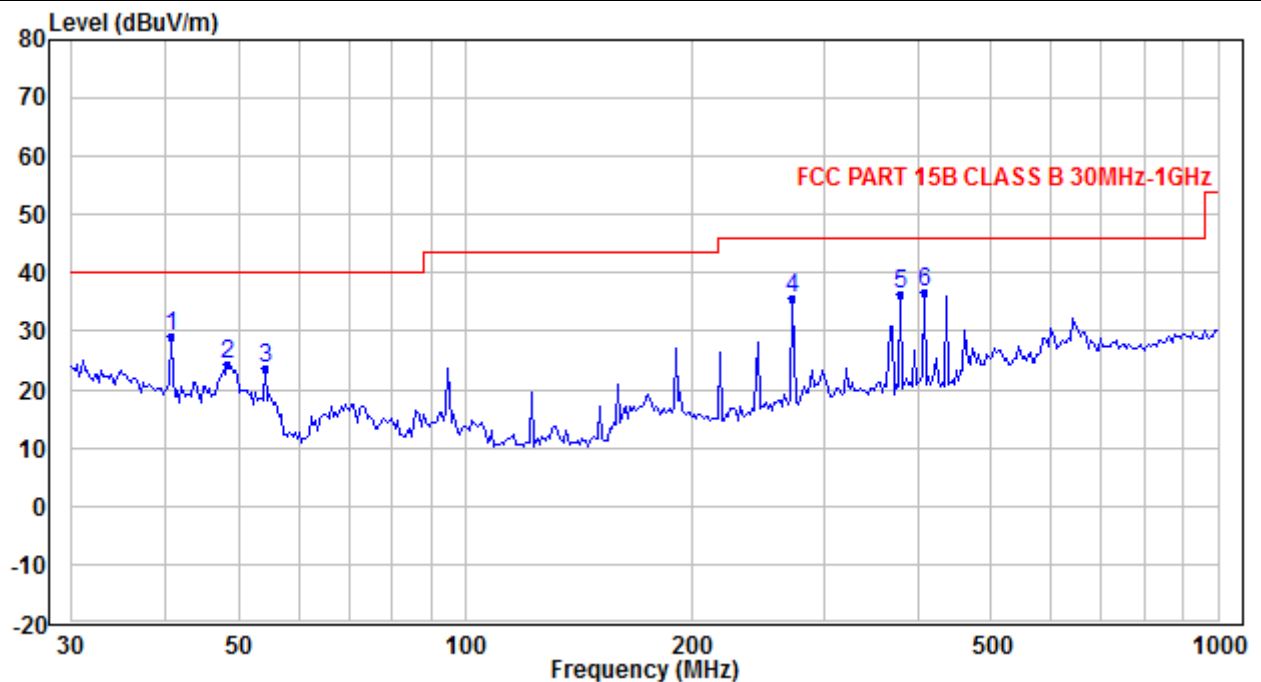
Test Result: Pass

The measurement data as follows:

Below 1GHz (Quasi Peak):

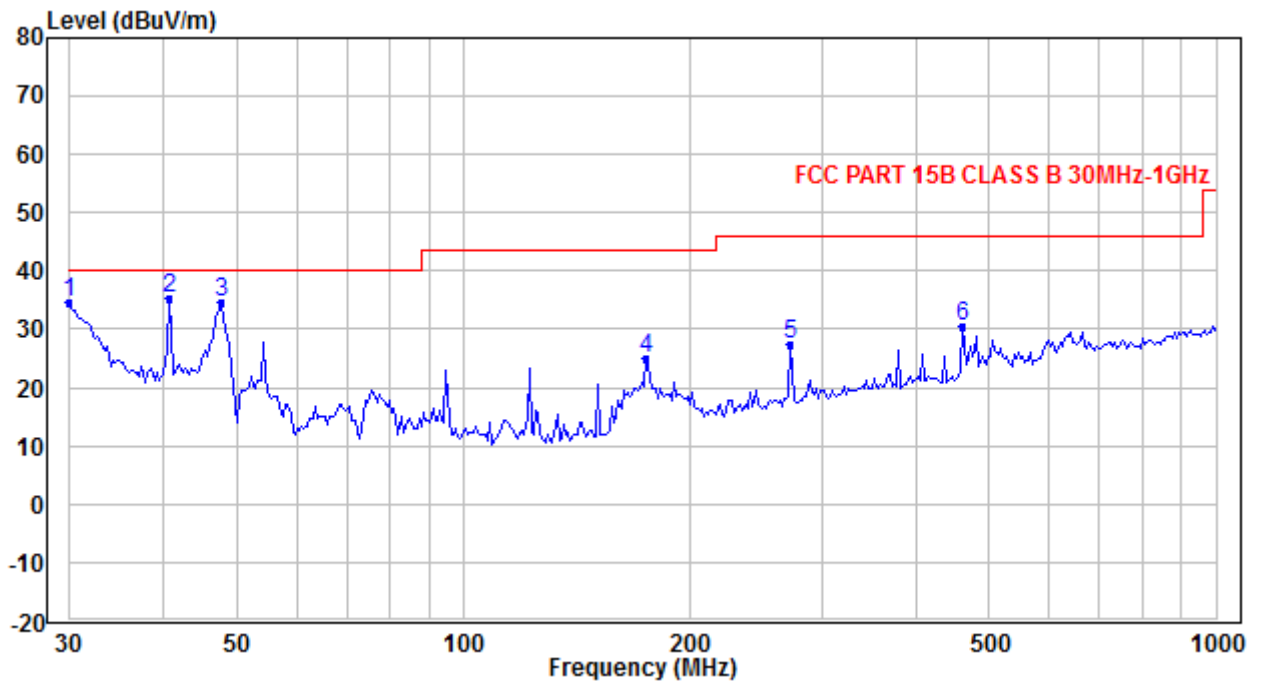
Test Mode 1: Active Mode (Equipped with all RFID tags)

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	40.584	37.30	-8.21	29.09	40.00	-10.91	QP
2	48.378	38.05	-13.61	24.44	40.00	-15.56	QP
3	54.135	40.37	-16.71	23.66	40.00	-16.34	QP
4	272.525	43.54	-7.71	35.83	46.00	-10.17	QP
5	379.178	41.44	-5.10	36.34	46.00	-9.66	QP
6	406.782	40.92	-4.37	36.55	46.00	-9.45	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.000	39.21	-4.40	34.81	40.00	-5.19	QP
2	40.584	43.54	-8.21	35.33	40.00	-4.67	QP
3	47.703	47.66	-13.04	34.62	40.00	-5.38	QP
4	175.040	35.53	-10.68	24.85	43.50	-18.65	QP
5	272.525	35.25	-7.71	27.54	46.00	-18.46	QP
6	461.631	34.18	-3.62	30.56	46.00	-15.44	QP

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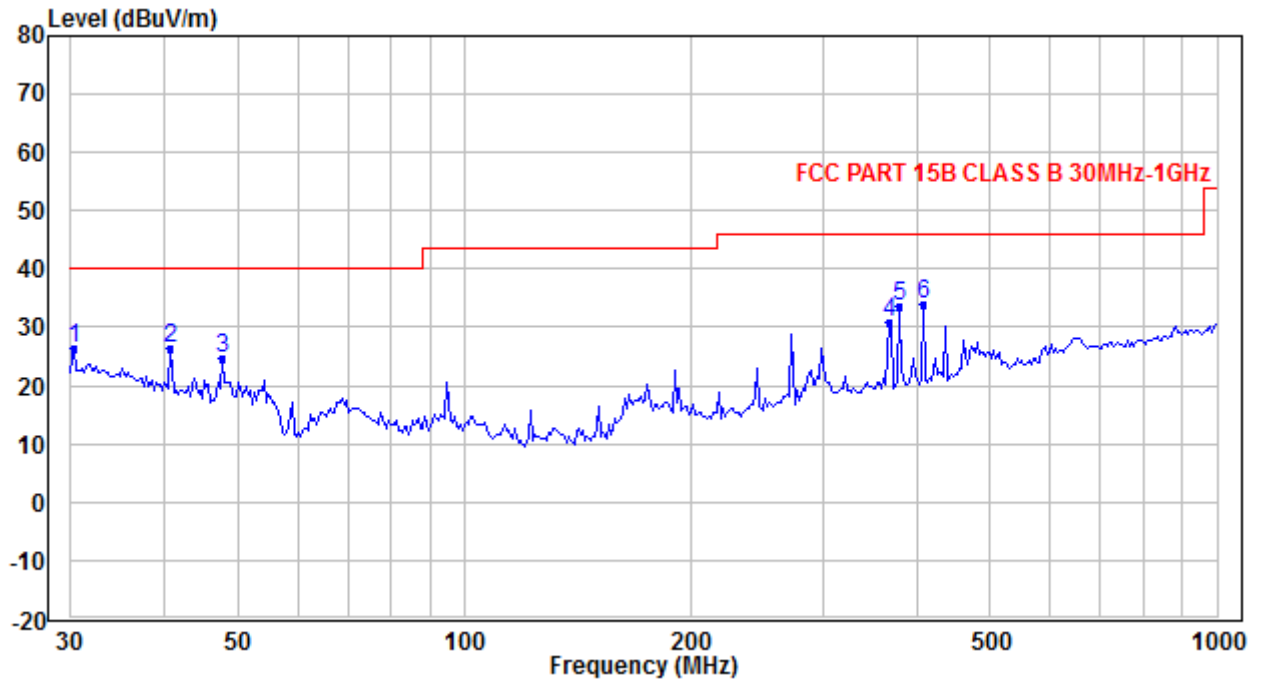
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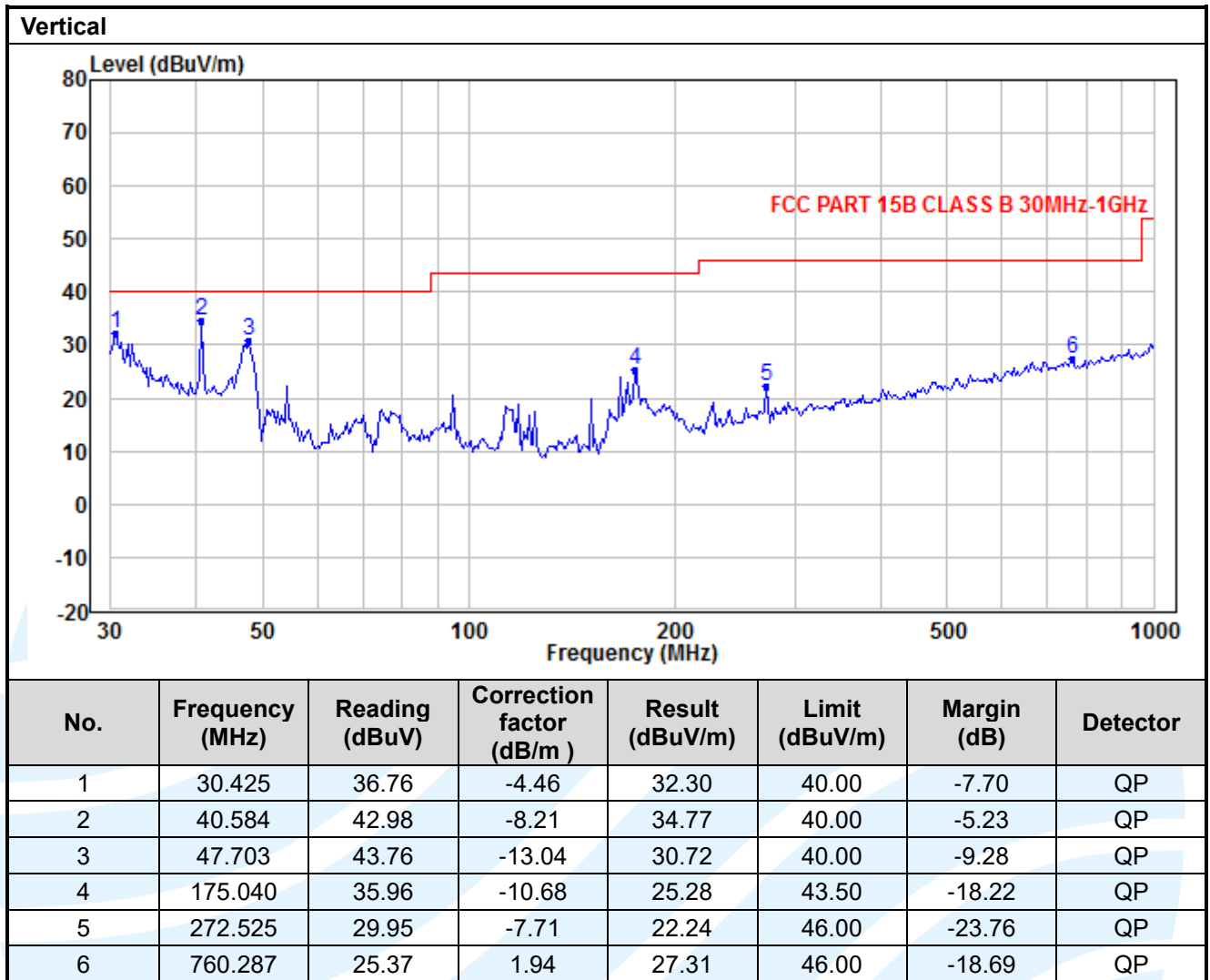
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Below 1GHz (Quasi Peak):
 Test Mode 2: Standby Mode (Not equipped with RFID tag)
 Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.212	30.73	-4.42	26.31	40.00	-13.69	QP
2	40.584	34.63	-8.21	26.42	40.00	-13.58	QP
3	47.703	37.56	-13.04	24.52	40.00	-15.48	QP
4	366.087	35.85	-5.11	30.74	46.00	-15.26	QP
5	379.178	38.64	-5.10	33.54	46.00	-12.46	QP
6	406.782	38.32	-4.37	33.95	46.00	-12.05	QP



Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

6.2 CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15.107

Test Method: ANSI C63.4-2014

Limits:

Limits for Class B devices

Frequency range (MHz)	Limits (dB(μV))	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.3.2 for details.

Test Procedures:

- 1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
- 2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- 3) For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

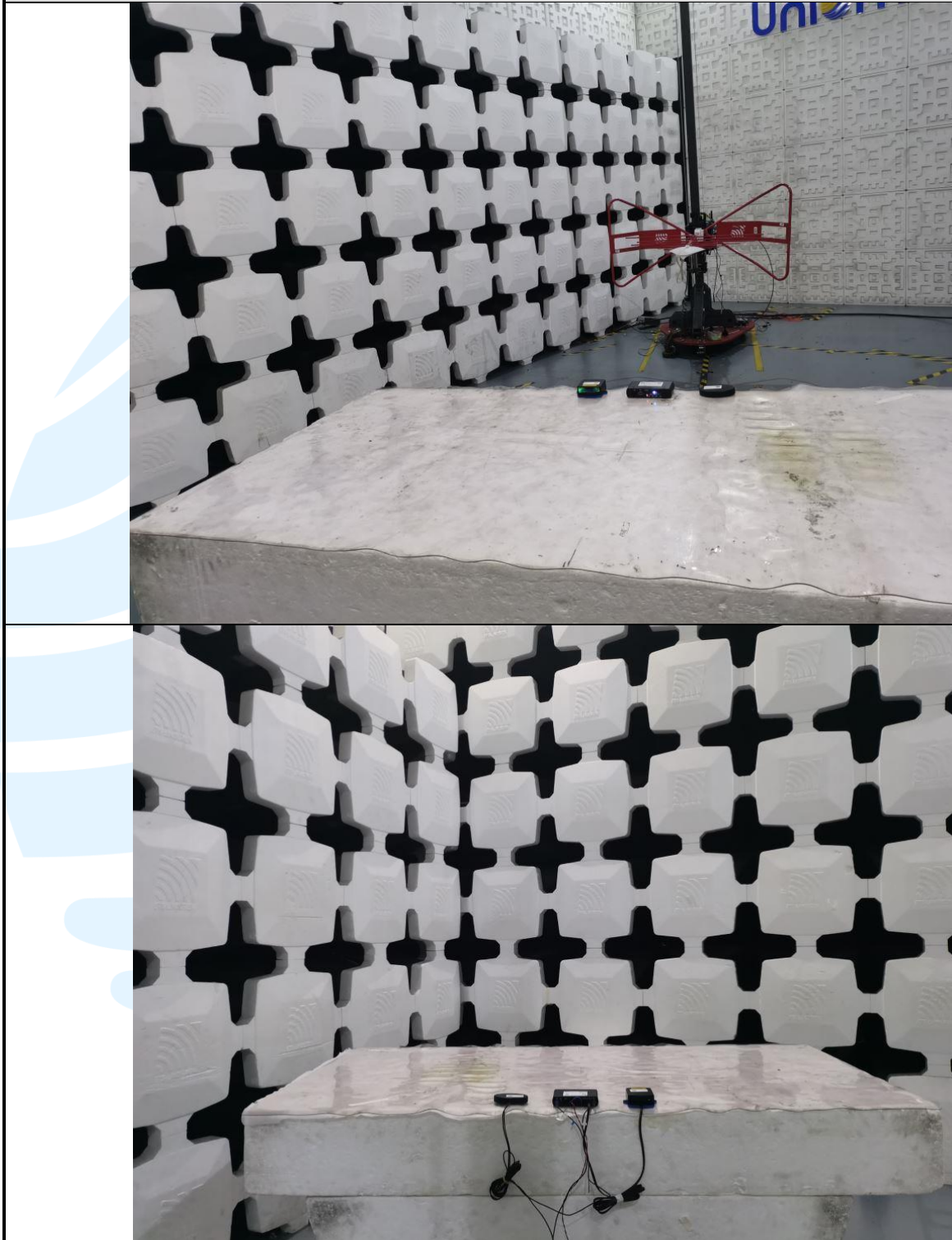
Equipment Used: Refer to section 3 for details.

N/A

Test Result: Since the EUT does not support the AC mains power input and/or output ports, not applicable for this test item.

APPENDIX 1 PHOTOS OF TEST SETUP

Radiated emission Test Setup-1 (30 MHz~1 GHz)



APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photographs.

***** End of Report *****

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