

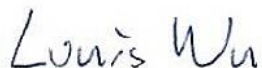


FCC RADIO TEST REPORT

FCC ID : UZ7CRD-TC-WCVC
Equipment : Wireless Charging Vehicle Cradle
Brand Name : Zebra
Model Name : CRD-TC-WCVC
Applicant : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Manufacturer : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : FCC Part 15 Subpart C §15.209

The product was received on Jun. 24, 2022 and testing was performed from Jul. 13, 2022 to Jul. 25, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



Table of Contents

1. General Description	5
1.1 Product Feature of Equipment Under Test	5
1.2 Product Specification of Equipment Under Test	5
1.3 Modification of EUT	5
1.4 Testing Location	6
1.5 Applicable Standards.....	6
2. Test Configuration of Equipment Under Test.....	7
2.1 Descriptions of Test Mode	7
2.2 Connection Diagram of Test System	7
2.3 Support Unit used in test configuration and system	8
2.4 EUT Operation Test Setup	8
3. Test Results	9
3.1 20dB and 99% OBW Spectrum Bandwidth Measurement.....	9
3.2 Radiated Emissions Measurement.....	10
3.3 Antenna Requirements.....	13
4. List of Measuring Equipment	14
5. Uncertainty of Evaluation	15
Appendix A. Test Results of RF Near Field Test Items	
Appendix B. Test Results of Radiated Test Items	
B2. Results of Radiated Emissions (9 kHz~30MHz)	
B3. Results of Radiated Emissions (30MHz~1GHz)	
Appendix C. Setup Photographs	



History of this test report

Report No.	Version	Description	Issued Date
FR212627-05	01	Initial issue of report	Aug. 11, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.207	AC Power Line Conducted Emissions	Not Required	-
3.1	15.215(c)	20dB Spectrum Bandwidth	Reporting only	-
	2.1049	99% OBW Spectrum Bandwidth	Reporting only	-
3.2	15.209	Field Strength of Fundamental Emissions	Pass	Max level 2.80 dB μ V/m at 0.144 MHz
		Radiated Spurious Emissions	Pass	8.88 dB under the limit at 921.430 MHz
3.3	15.203	Antenna Requirements	Pass	-

Note:

1. Not required means after assessing, test items are not necessary to carry out.
2. The power source method of the EUT is to use power supply (DC power source), and there is no other AC power port, after assessing, AC Conduction Emission test is not required.

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Wei Chen

Report Producer: Clio Lo

1. General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Wireless Charging Vehicle Cradle
Brand Name	Zebra
Model Name	CRD-TC-WCVC
FCC ID	UZ7CRD-TC-WCVC
EUT supports Radios application	WPT
HW Version	DV
MFD	25MAY22
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
DC cable	Brand Name	Zebra	Part Number	CHG-AUTO-HWIRE1-01
Cigarette Light Cable	Brand Name	Zebra	Part Number	CHG-AUTO-CLA1-01

Supported Unit Used in Test Configuration and System				
Battery	Brand Name	Zebra	Model Name	BT-000442
			Part Number	BT-000442-002A
Terminal	Brand Name	Zebra	Model Name	TC58A1
TC53/TC58 RUGGED BOOT	Brand Name	Zebra	Part Number	SG-NGTC5EXO1-01

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx/Rx Frequency Range	100 kHz ~ 205 kHz
99% Occupied Bandwidth	0.666 kHz for DC 12V 0.660 kHz for DC 24V
Antenna Type	Single Coil Antenna
Type of Modulation	ASK

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. TH03-HY
Test Engineer	Cotty Hsu
Temperature (°C)	22~24
Relative Humidity (%)	53~55

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH11-HY (TAF Code: 3786)
Test Engineer	Troye Hsieh
Temperature (°C)	20.3~21.4
Relative Humidity (%)	56.5~66.8
Remark	The Radiated Emission test item subcontracted to Sporton International Inc. Wensan Laboratory.

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW1190 and TW3786

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.209
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2. Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations.

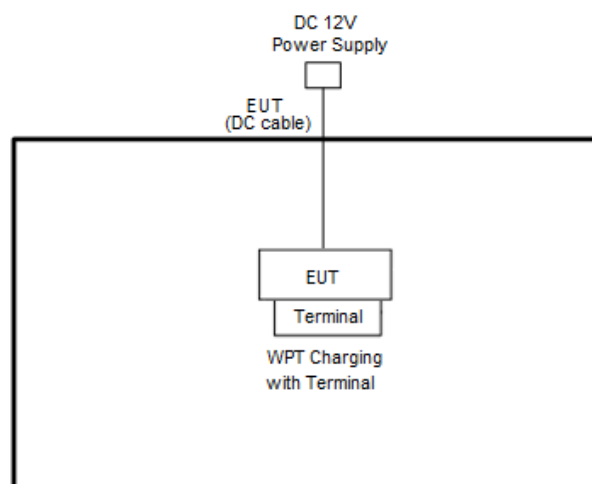
The following table is a list of the test modes shown in this test report.

Test Items	
Field Strength of Fundamental Emissions	20dB Spectrum Bandwidth
Radiated Emissions 9kHz~30MHz	Radiated Emissions 30MHz~1GHz

The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Z plane as worst plane.

Test Cases	
Radiated Spurious Emission	Mode 1 : WPT Charging with Terminal

2.2 Connection Diagram of Test System





2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	GW Instek	Power Supply	GET874629	N/A	N/A	N/A

2.4 EUT Operation Test Setup

The Wireless Charging with Terminal via wireless power transfer function.

The EUT is transmitting wireless power to the Terminal.

3. Test Results

3.1 20dB and 99% OBW Spectrum Bandwidth Measurement

3.1.1 Limit

Reporting only

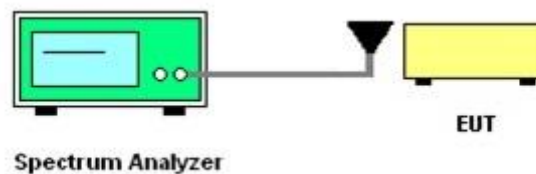
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. The resolution bandwidth of 300 Hz and the video bandwidth of 300 Hz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Measured the 99% OBW.

3.1.4 Test Setup



3.1.5 Test Result of RF Near Field Test Items

Please refer to Appendix A.

3.2 Radiated Emissions Measurement

3.2.1 Limit

The field strength of any emissions which appear band shall not exceed the general radiated emissions limits.

Frequencies (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Measuring Instrument Setting

The following table is the setting of receiver:

Receiver Parameter	Setting
Attenuation	Auto
Frequency Range: 9kHz~150kHz	RBW 200Hz for QP
Frequency Range: 150kHz~30MHz	RBW 9kHz for QP
Frequency Range: 30MHz~1000MHz	RBW 120kHz for Peak

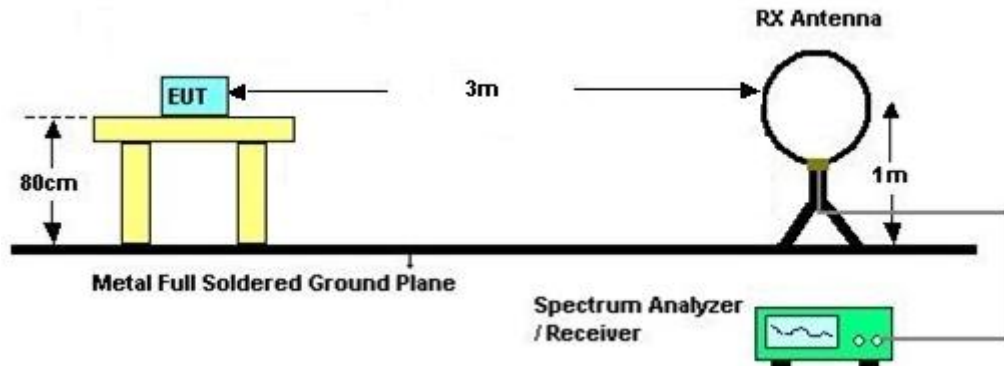
Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz and 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

3.2.4 Test Procedures

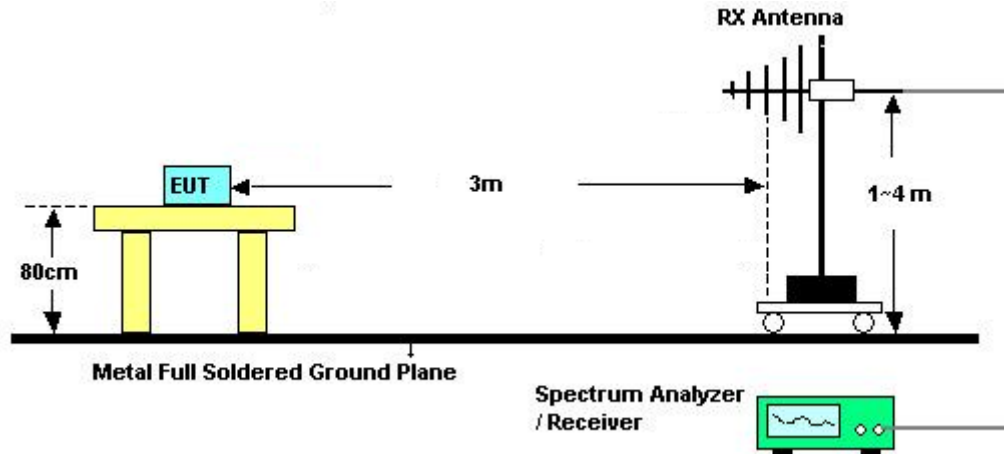
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver.
8. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.

3.2.5 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



3.2.6 Test Result of Radiated Emissions Measurement

Please refer to Appendix B.

Remark:

1. There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.
2. According to C63.10 radiated test, the EUT pre-scanned horizontal, vertical, and ground-parallel three polarization's, the worst case is horizontal & vertical polarization, test data of two mode was reported.

3.3 Antenna Requirements

3.3.1 Standard Applicable

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 09, 2021	Jul. 21, 2022~ Jul. 22, 2022	Oct. 08, 2022	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100330	9 kHz~30 MHz	Nov. 08, 2021	Jul. 21, 2022~ Jul. 22, 2022	Nov. 07, 2022	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 10, 2021	Jul. 21, 2022~ Jul. 22, 2022	Dec. 09, 2022	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 15, 2021	Jul. 21, 2022~ Jul. 22, 2022	Oct. 14, 2022	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 21, 2021	Jul. 21, 2022~ Jul. 22, 2022	Oct. 20, 2022	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 10, 2022	Jul. 21, 2022~ Jul. 22, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz-30MHz	Mar. 10, 2022	Jul. 21, 2022~ Jul. 22, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30MHz-18GHz	Mar. 10, 2022	Jul. 21, 2022~ Jul. 22, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
Filter	Wainwright	WHK20/1000C 7/40SS	SN2	20M High Pass	Sep. 13, 2021	Jul. 21, 2022~ Jul. 22, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jul. 21, 2022~ Jul. 22, 2022	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jul. 21, 2022~ Jul. 22, 2022	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jul. 21, 2022~ Jul. 22, 2022	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Jul. 21, 2022~ Jul. 22, 2022	N/A	Radiation (03CH11-HY)
Hygrometer	TECEPEL	DTM-303B	TP140325	N/A	Nov. 26, 2021	Jul. 21, 2022~ Jul. 22, 2022	Nov. 25, 2022	Radiation (03CH11-HY)
Hygrometer	TECEPEL	DTM-303B	TP200880	QA-3-031	Sep. 30, 2021	Jul. 21, 2022~ Jul. 22, 2022	Sep. 29, 2022	Radiation (03CH11-HY)
Hygrometer	TECEPEL	DTM-303B	TP210073	N/A	Nov. 16, 2021	Jul. 13, 2022~ Jul. 25, 2022	Nov. 15, 2022	RF Near Field (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Sep. 30, 2021	Jul. 13, 2022~ Jul. 25, 2022	Sep. 29, 2022	RF Near Field (TH03-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~4A	Oct. 06, 2021	Jul. 13, 2022~ Jul. 25, 2022	Oct. 05, 2022	RF Near Field (TH03-HY)

5. Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.7 dB
--	--------

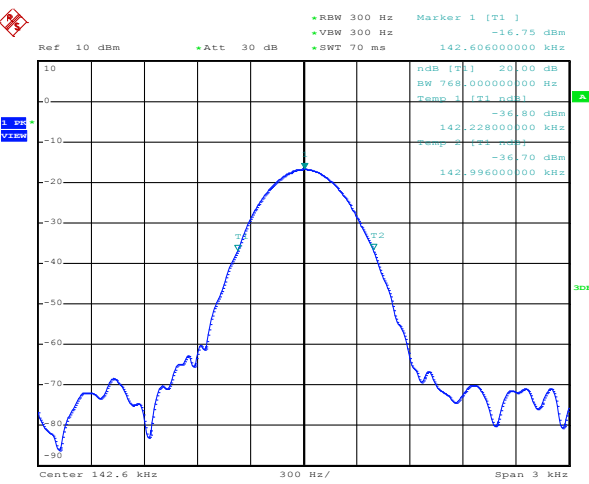
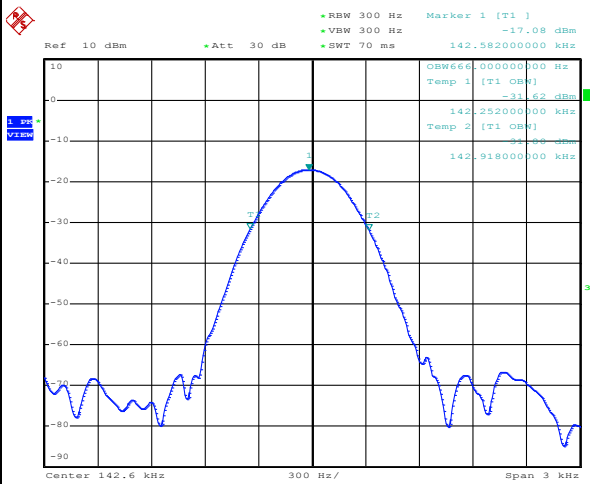
Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.8 dB
--	--------

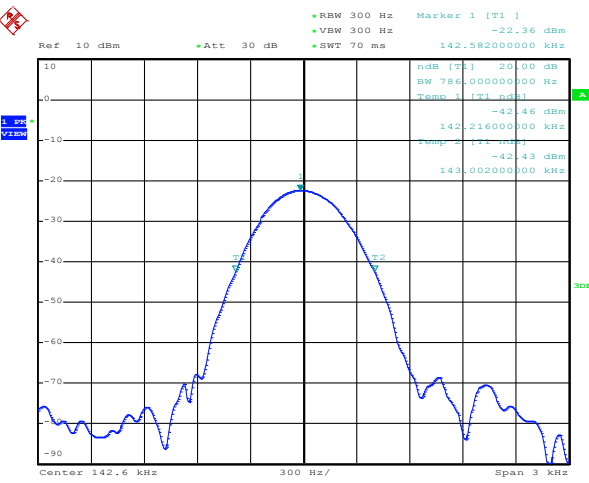
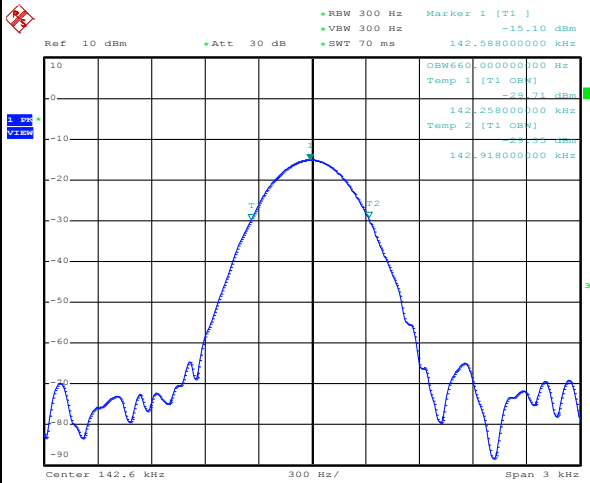


Appendix A. Test Results of RF Near Field Test Items

<for DC 12V>

Test mode		WPC Tx	
 Ref 10 dBm Att 30 dB RBW 300 Hz VBW 300 Hz SWT 70 ms Marker 1 [T1] ndb [T1] -16.75 dBm BW 768.00000000 Hz Temp 1 [T1] ndb1 142.22800000 kHz Temp 2 [T1] ndb2 142.99600000 kHz Center 142.6 kHz 300 Hz/ Span 3 kHz Date: 25.JUL.2022 13:41:21		 Ref 10 dBm Att 30 dB RBW 300 Hz VBW 300 Hz SWT 70 ms Marker 1 [T1] OBW666.00000000 Hz Temp 1 [T1] OBW1 -17.08 dBm 142.25200000 kHz Temp 2 [T1] OBW2 142.91800000 kHz Center 142.6 kHz 300 Hz/ Span 3 kHz Date: 25.JUL.2022 13:39:00	
20dB Bandwidth (kHz)	0.768	99% Occupied BW(kHz)	0.666

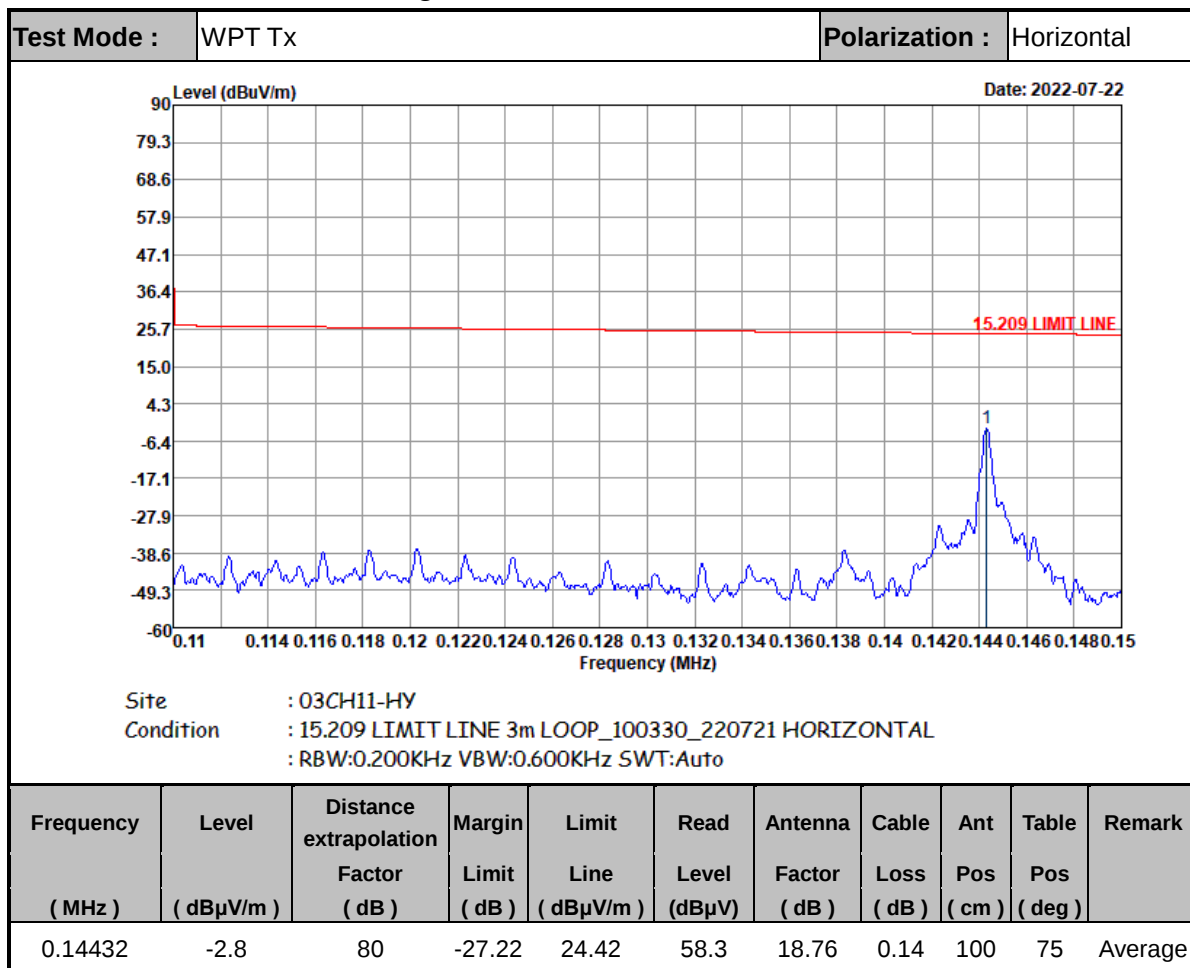
<for DC 24V>

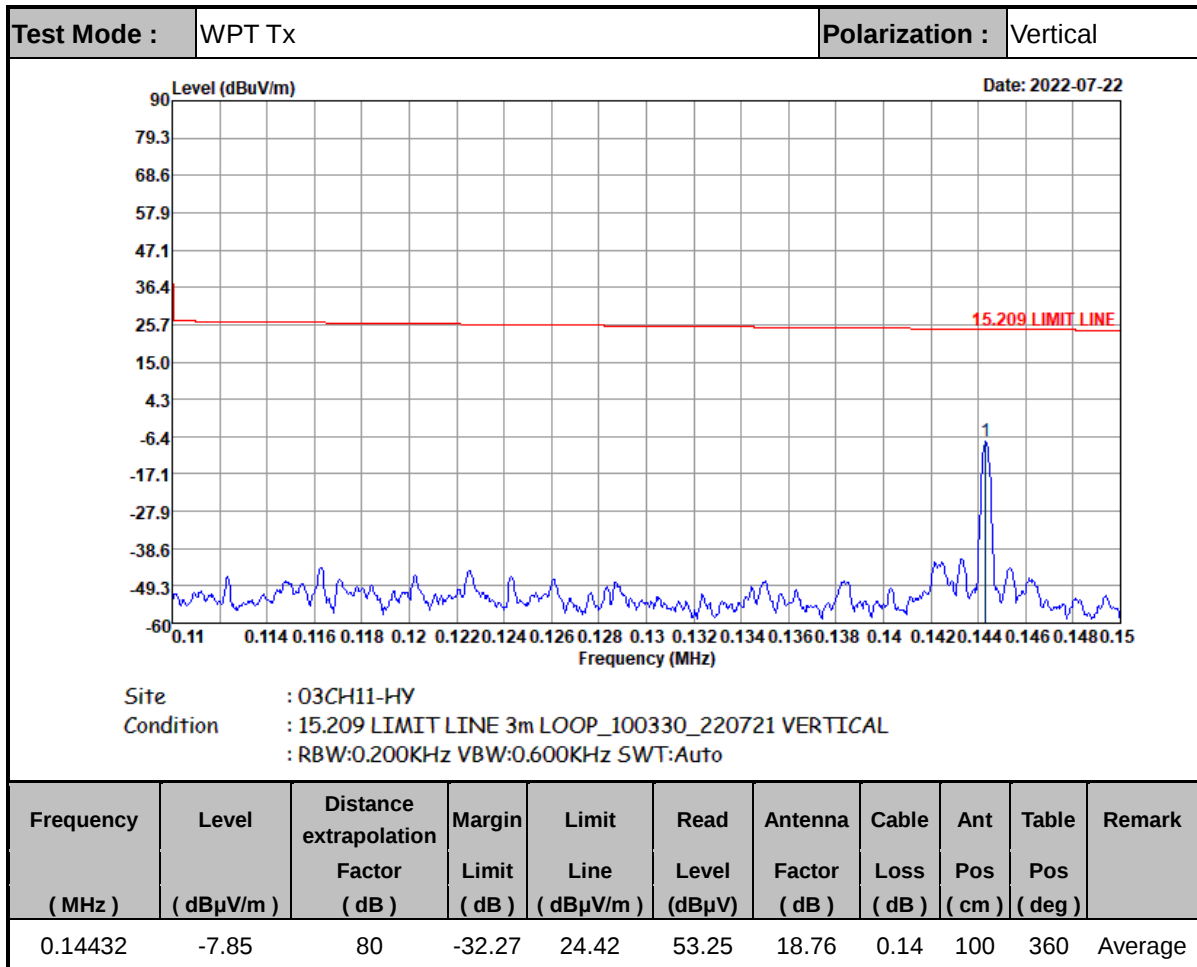
Test mode		WPC Tx	
 Ref 10 dBm Att 30 dB RBW 300 Hz VBW 300 Hz SWT 70 ms Marker 1 [T1] ndb [T1] -22.36 dBm BW 768.00000000 Hz Temp 1 [T1] ndb1 142.21600000 kHz Temp 2 [T1] ndb2 143.00200000 kHz Center 142.6 kHz 300 Hz/ Span 3 kHz Date: 25.JUL.2022 13:40:33		 Ref 10 dBm Att 30 dB RBW 300 Hz VBW 300 Hz SWT 70 ms Marker 1 [T1] OBW660.00000000 Hz Temp 1 [T1] OBW1 -15.10 dBm 142.25800000 kHz Temp 2 [T1] OBW2 142.91800000 kHz Center 142.6 kHz 300 Hz/ Span 3 kHz Date: 25.JUL.2022 13:39:52	
20dB Bandwidth (kHz)	0.786	99% Occupied BW(kHz)	0.660

Remark: Because the measured signal is CW adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

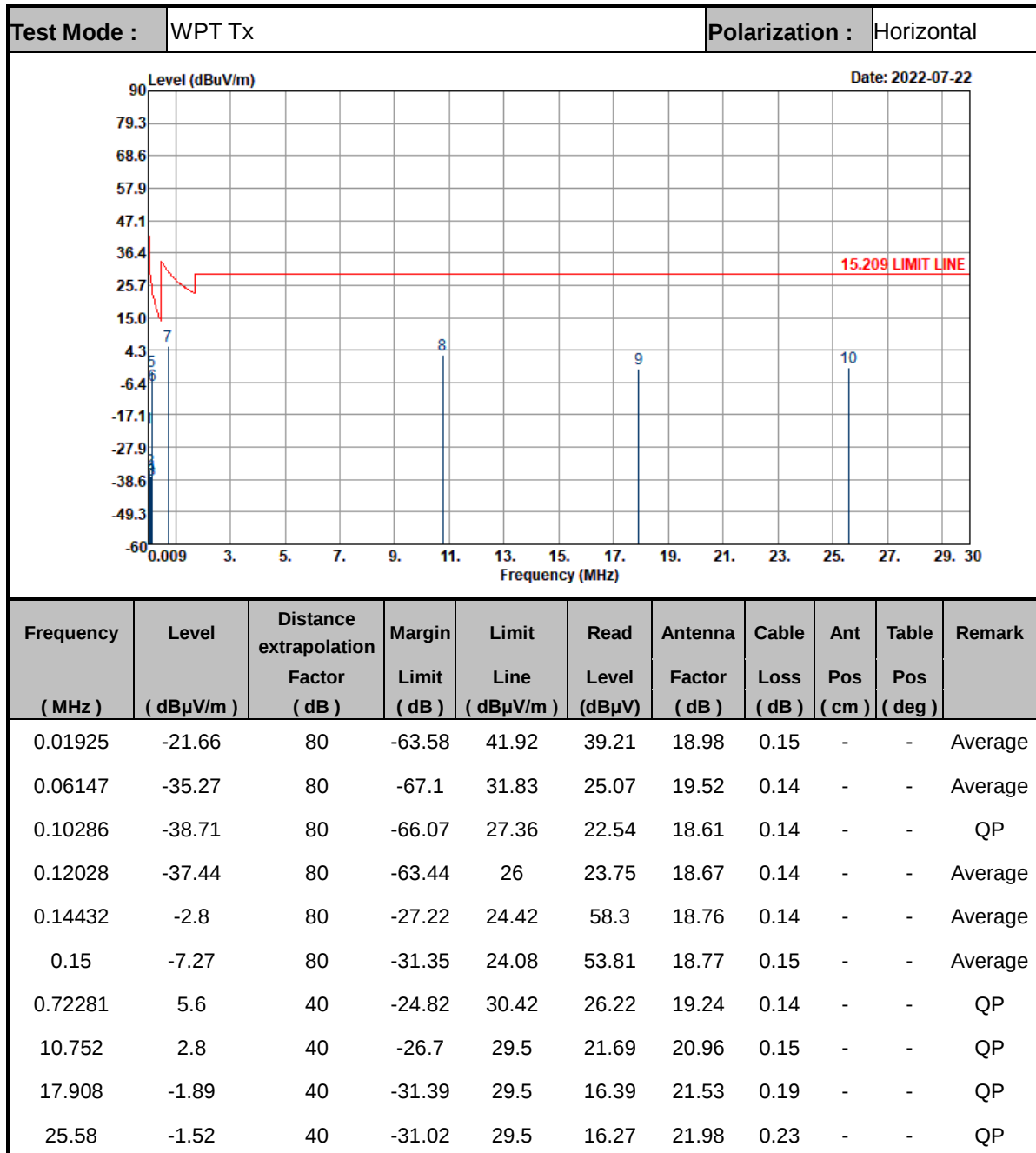
Appendix B. Test Results of Radiated Test Items

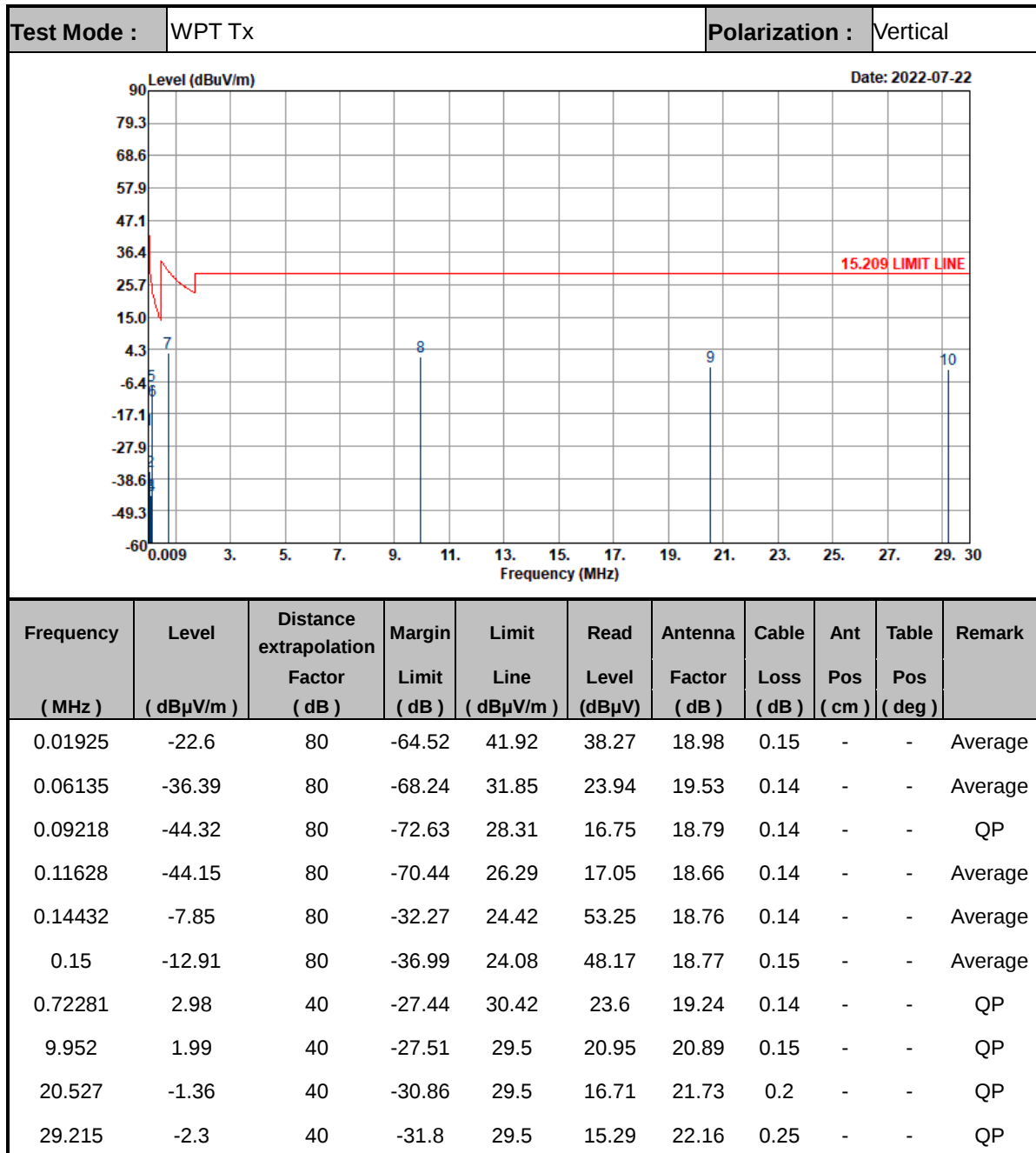
B1. Test Result of Field Strength of Fundamental Emissions



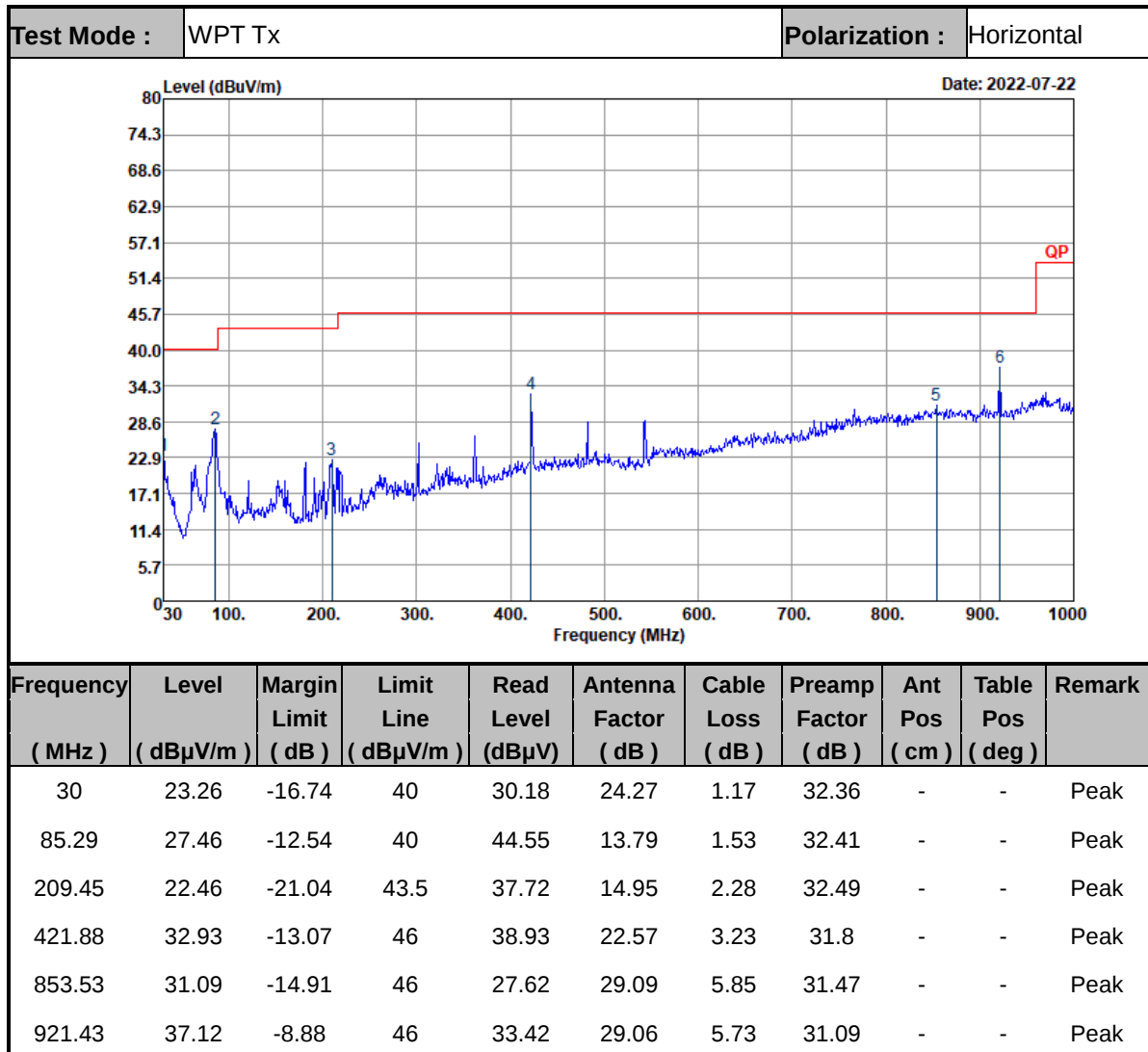

Note:

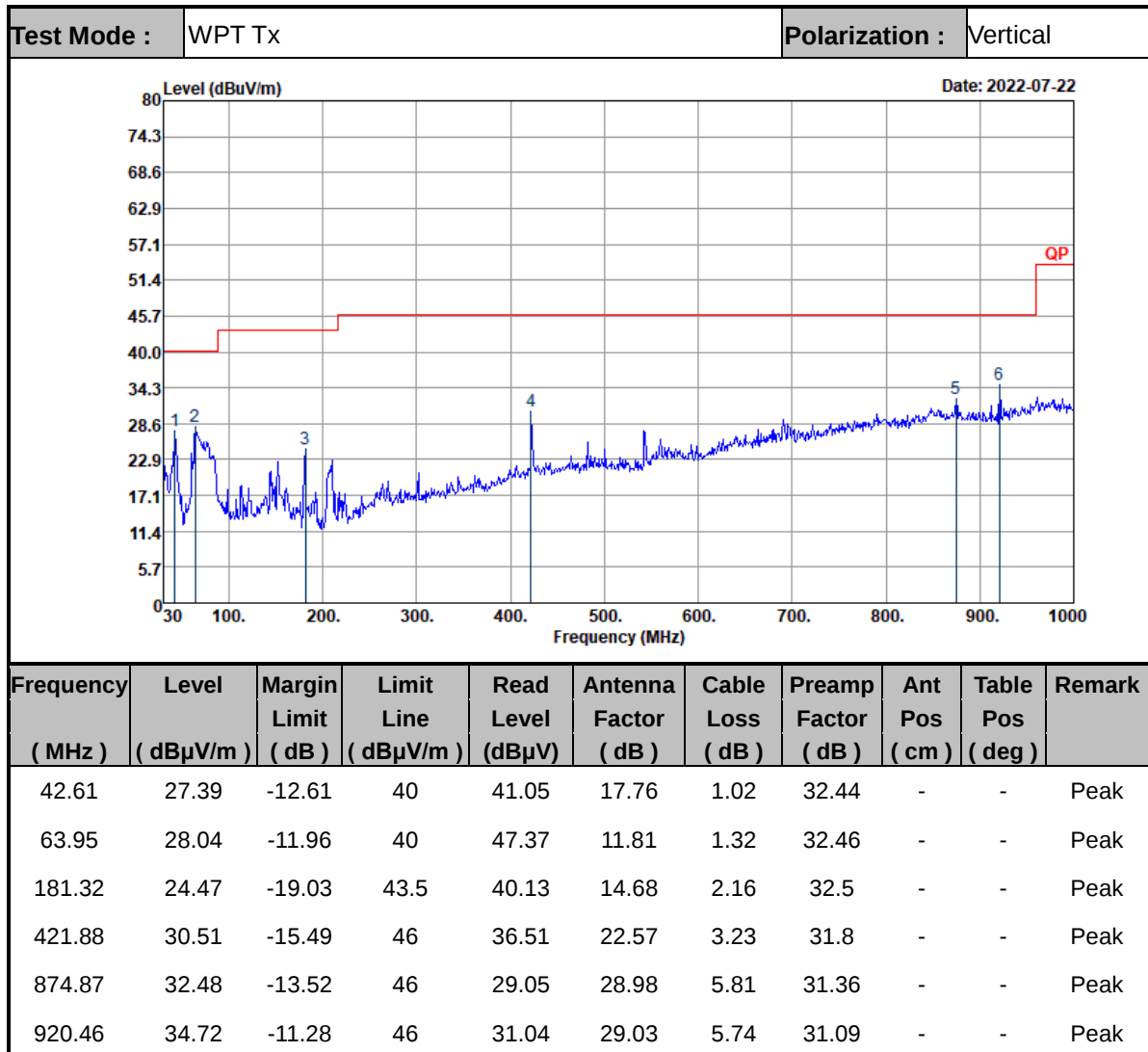
1. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);
2. Level= Read Level + Antenna Factor + Cable loss + distance extrapolation factor.

B2. Results of Radiated Spurious Emissions (9 kHz~30MHz)



Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);
3. Level= Read Level + Antenna Factor + Cable loss + distance extrapolation factor.

B3. Results of Radiated Spurious Emissions (30MHz~1GHz)



Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor= Level.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.