

MPE TEST REPORT

Test Report No. 15385574H-G-R1

Customer	ASAHI DENSO CO.,LTD.
Description of EUT	Holder
Model Number of EUT	FZ135
FCC ID	T8VFZ135
Test Regulation	FCC rule §1.1310 Radiofrequency radiation exposure limits.
Test Result	Complied
Issue Date	January 14, 2025
Remarks	*This test report has issued for MPE testing by wireless charger according to KDB 680106 D01 v04.

Representative Test EngineerKiyoshiro Okazaki
Engineer**Approved By**Shinichi Miyazono
Leader

CERTIFICATE 5107.02

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.
- ☒ There is no testing item of "Non-accreditation".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 23.0

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- The laboratory is not responsible for information provided by the customer which can impact the validity of the results.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No. 15385574H-G

This report is a revised version of 15385574H-G. 15385574H-G is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15385574H-G	October 21, 2024	-
1	15385574H-G-R1	January 14, 2025	Correction of the Limit in Clause 3.2; From "Table 1(B)" to "§1.1310(e)(1)"
1	15385574H-G-R1	January 14, 2025	Correction of the following sentence in Clause 3.2 (Page 6) "Test limit was applied to ...Wireless Charging Apps Section 3 c)."
1	15385574H-G-R1	January 14, 2025	Correction of the following sentence in Clause 3.2 (Page 7) "KDB 680106 D01 RF Exposure ...in order to exclude RF exposure evaluation."
1	15385574H-G-R1	January 14, 2025	Correction of the Uncertainty in Clause 3.4

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	ICES	Interference-Causing Equipment Standard
AC	Alternating Current	IEC	International Electrotechnical Commission
AFH	Adaptive Frequency Hopping	IEEE	Institute of Electrical and Electronics Engineers
AM	Amplitude Modulation	IF	Intermediate Frequency
Amp, AMP	Amplifier	ILAC	International Laboratory Accreditation Conference
ANSI	American National Standards Institute	ISED	Innovation, Science and Economic Development Canada
Ant, ANT	Antenna	ISO	International Organization for Standardization
AP	Access Point	JAB	Japan Accreditation Board
ASK	Amplitude Shift Keying	LAN	Local Area Network
Atten., ATT	Attenuator	LIMS	Laboratory Information Management System
AV	Average	MCS	Modulation and Coding Scheme
BPSK	Binary Phase-Shift Keying	MRA	Mutual Recognition Arrangement
BR	Bluetooth Basic Rate	N/A	Not Applicable
BT	Bluetooth	NIST	National Institute of Standards and Technology
BT LE	Bluetooth Low Energy	NS	No signal detect.
BW	BandWidth	NSA	Normalized Site Attenuation
Cal Int	Calibration Interval	NVLAP	National Voluntary Laboratory Accreditation Program
CCK	Complementary Code Keying	OBW	Occupied Band Width
Ch., CH	Channel	OFDM	Orthogonal Frequency Division Multiplexing
CISPR	Comite International Special des Perturbations Radioelectriques	P/M	Power meter
CW	Continuous Wave	PCB	Printed Circuit Board
DBPSK	Differential BPSK	PER	Packet Error Rate
DC	Direct Current	PHY	Physical Layer
D-factor	Distance factor	PK	Peak
DFS	Dynamic Frequency Selection	PN	Pseudo random Noise
DQPSK	Differential QPSK	PRBS	Pseudo-Random Bit Sequence
DSSS	Direct Sequence Spread Spectrum	PSD	Power Spectral Density
EDR	Enhanced Data Rate	QAM	Quadrature Amplitude Modulation
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	QP	Quasi-Peak
EMC	ElectroMagnetic Compatibility	QPSK	Quadri-Phase Shift Keying
EMI	ElectroMagnetic Interference	RBW	Resolution Band Width
EN	European Norm	RDS	Radio Data System
ERP, e.r.p.	Effective Radiated Power	RE	Radio Equipment
EU	European Union	RF	Radio Frequency
EUT	Equipment Under Test	RMS	Root Mean Square
Fac.	Factor	RSS	Radio Standards Specifications
FCC	Federal Communications Commission	Rx	Receiving
FHSS	Frequency Hopping Spread Spectrum	SA, S/A	Spectrum Analyzer
FM	Frequency Modulation	SG	Signal Generator
Freq.	Frequency	SVSWR	Site-Voltage Standing Wave Ratio
FSK	Frequency Shift Keying	TR	Test Receiver
GFSK	Gaussian Frequency-Shift Keying	Tx	Transmitting
GNSS	Global Navigation Satellite System	VBW	Video BandWidth
GPS	Global Positioning System	Vert.	Vertical
Hori.	Horizontal	WLAN	Wireless LAN

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SECTION 1: Customer Information

Company Name	ASAHI DENSO CO.,LTD.
Address	6-2-1 Somejidai, Hamana-ku, Hamamatsu City, Shizuoka, 434-0046 Japan
Telephone Number	+81-53-586-7383
Contact Person	Tomohiro Yaguchi

The information provided by the customer is as follows;

- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Holder
Model Number	FZ135
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	June 17, 25 and July 9, 2024
Test Date	August 5, 2024

2.2 Product Description

General Specification

Rating	DC 12.0 V
Operating temperature	Radio operating temperature range: -18 deg. C to 60 deg. C
	Usable temperature range in combination with FZ134: 0 deg. C to 40 deg. C
Clock frequency (ies) in the system	32 MHz (Main CPU)

Radio Specification

Wireless Power Transmission

Operating Frequency	136.75 kHz
Rated Output Power	2 W
Coil system	Single Coil
Charging distance	Contact

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Title	FCC rule §1.1310 Radiofrequency radiation exposure limits.
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3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst Margin	Result
MPE Limit	KDB 680106 D01 RF Exposure Wireless Charging Apps v04	§1.1310(e)(1)	N/A	Refer to section.5	Complied

*These tests were performed without any deviations from test procedure.

Table 1—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposures				
0.3 - 3.0	614	1.63	*(100)	≤6
3.0 - 30	1842/f	4.89/f	*(900/f ²)	<6
30 - 300	61.4	0.163	1.0	<6
300 - 1,500			f/300	<6
1,500 - 100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3 - 1.34	614	1.63	*(100)	<30
1.34 - 30	824/f	2.19/f	*(180/f ²)	<30
30 - 300	27.5	0.073	0.2	<30
300 - 1,500			f/1500	<30
1,500 - 100,000			1.0	<30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Test limit was applied to the test limit of 300 kHz based on FCC rule Section 1.1310, according to KDB 680106 D01 RF Exposure Wireless Charging Apps Section 3.2.

KDB 680106 D01 RF Exposure Wireless Charging Apps requires following contents in order to exclude ECR KDB.

- (1) The power transfer frequency is below 1 MHz.
- (2) The output power from each transmitting element (e.g., coil) is less than or equal to 15 watts.
- (3) A client device providing the maximum permitted load is placed in physical contact with the transmitter (i.e., the surfaces of the transmitter and client device enclosures need to be in physical contact).
- (4) Only § 2.1091-*Mobile* exposure conditions apply (i.e., this provision does not cover § 2.1093-*Portable* exposure conditions).
- (5) The E-field and H-field strengths, at and beyond 20 cm surrounding the device surface, are demonstrated to be less than 50% of the applicable MPE limit, per KDB 447498, Table 1. These measurements shall be taken along the principal axes of the device, with one axis oriented along the direction of the estimated maximum field strength, and for three points per axis or until a $1/d$ (inverse distance from the emitter structure) field strength decay is observed. Symmetry considerations may be used for test reduction purposes. The device shall be operated in documented worst-case compliance scenarios (i.e., the ones that lead to the maximum field components), and while all the radiating structures (e.g., coils or antennas) that by design can simultaneously transmit are energized at their nominal maximum power.
- (6) For systems with more than one radiating structure, the conditions specified in (5) must be met when the system is fully loaded (i.e., clients absorbing maximum power available), and with all the radiating structures operating at maximum power at the same time, as per design conditions. If the design allows one or more radiating structures to be powered at a higher level while other radiating structures are not powered, then those cases must be tested as well. For instance, a device may use three RF coils powered at 5 W, or one coil powered at 15 W: in this case, both scenarios shall be tested.

All requests were complied.

Also, Test data used Exposure Level Tester is complied KDB 680106 D01 RF Exposure Wireless Charging Apps Section 3.2.

3.3 Confirmation

UL Japan, Inc. hereby confirms that EUT, in the configuration tested, complies with the specifications KDB 680106 D01 RF Exposure Wireless Charging Apps.

3.4 Uncertainty

Although this standard determines only the limit value of uncertainty, there is no applicable rule of uncertainty in this. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

EMF

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

3 kHz to 10 MHz (E-Field)	±19.71 %
3 kHz to 10 MHz (H-Field)	±11.96 %

*The worst value in the test range was applied.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone: +81-596-24-8999

*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

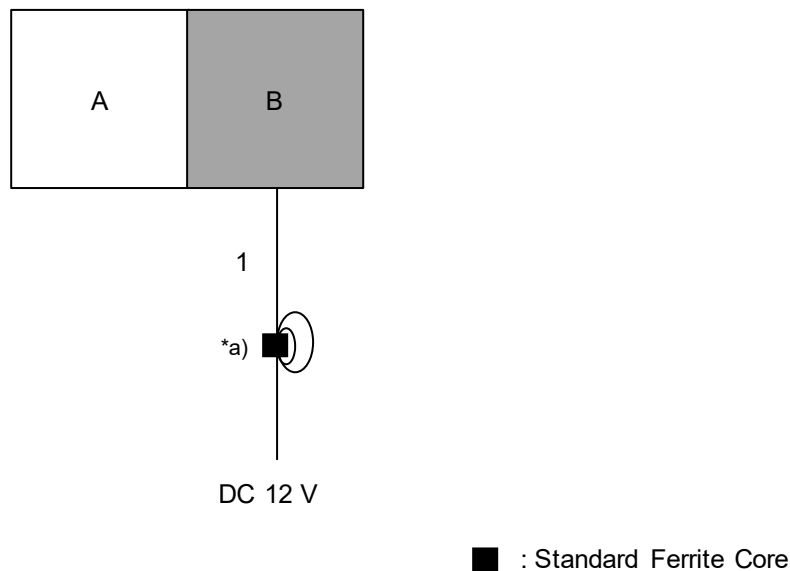
4.1. Operating Mode(s)

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use. Test configuration was adjusted maximum output power of EUT.

Test sequence is used:

Test mode	Remarks
1) Power Supply mode (Transmitting) (Tx)	136.75 kHz
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.	

4.2. Configuration and peripherals



*Cabling and setup were taken into consideration and test data was taken under worse case conditions.

*a) Ferrite Core Model No. E04sr2000935A (Manufacture seiwa) 10 cm from Item B, 3 turns

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Controller	FZ134	2	ASAHI DENSO CO.,LTD.	-
B	Holder	FZ135	1	ASAHI DENSO CO.,LTD.	EUT

List of cables used

No.	Name	Length (m)	Shield Cable	Connector	Remark
1	DC Cable	2.0	Unshielded	Unshielded	-

SECTION 5: MPE Limit [KDB 680106 Section 3) (FCC §1.1310)]

5.1. Operating environment

Date	See data
Test place	See data
Temperature	See data
Humidity	See data
Test engineer	See data
Mode	See data

5.2. Test configuration

The EUT was placed on a non-metallic of 0.8 m above the reference ground plane.
Worst position is shown in the photos in Appendix 2.

5.3. Test conditions

The maximum radiation axis was scanned on each side (Top, Bottom, Left, Right, Front, Back), and final measurements were taken at three or more points on each detected maximum radiation axis.
Since the measurement detects the worst radiation, the maximum value during 6 minutes was reported.
During testing, the EUT was set to transmit at maximum power. The measurement value was corrected so that the measurement distance of 0 cm was the distance from the sensing element of the measurement probe to the EUT surface.
The 20 cm distance value was used to demonstrate that it was less than 50 % of the MPE limit.

5.4. Test procedure

The test of the weighted result has been performed using time domain evaluation.

Sensor locations	Around from 10 cm to 40 cm
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5.5. Results

Summary of the test results	Complied
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APPENDIX 1: Test data

Electric, Magnetic and Electromagnetic fields

Test place Ise EMC Lab.
Semi Anechoic Chamber No.7
Date August 5, 2024
Temperature/ Humidity 23 deg. C / 57 % RH
Engineer Kiyoshiro Okazaki
Mode Mode 1

Front

(E-Field) 3 kHz to 10 MHz

Distance *1)	Electric field strength (Result) *2)	Limit	Result
[cm]	[V/m]	[V/m]	
20	0.57	614.00	Pass *3)

Front

(H-Field) 3 kHz to 10 MHz

Distance *1)	Magnetic field strength* (Result) *2)	Limit	Result
[cm]	[A/m]	[A/m]	
20	0.01	1.63	Pass *3)

Right

(E-Field) 3 kHz to 10 MHz

Distance *1)	Electric field strength (Result) *2)	Limit	Result
[cm]	[V/m]	[V/m]	
20	0.81	614.00	Pass *3)

Right

(H-Field) 3 kHz to 10 MHz

Distance *1)	Magnetic field strength* (Result) *2)	Limit	Result
[cm]	[A/m]	[A/m]	
20	0.02	1.63	Pass *3)

Rear

(E-Field) 3 kHz to 10 MHz

Distance *1)	Electric field strength (Result) *2)	Limit	Result
[cm]	[V/m]	[V/m]	
20	0.45	614.00	Pass *3)

Rear

(H-Field) 3 kHz to 10 MHz

Distance *1)	Magnetic field strength* (Result) *2)	Limit	Result
[cm]	[A/m]	[A/m]	
20	0.01	1.63	Pass *3)

Carrier Frequency	
0.13675	MHz

*1) Distance between measurement probe surface and EUT.

*2) These values were measured by RMS detection.

*3) The result is less than 50% of MPE limit.

Electric, Magnetic and Electromagnetic fields

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.7
Date	August 5, 2024
Temperature/ Humidity	23 deg. C / 57 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 1

Left

(E-Field) 3 kHz to 10 MHz

Distance *1)	Electric field strength (Result) *2)	Limit	Result
[cm]	[V/m]	[V/m]	
20	0.33	614.00	Pass *3)

Left

(H-Field) 3 kHz to 10 MHz

Distance *1)	Magnetic field strength* (Result) *2)	Limit	Result
[cm]	[A/m]	[A/m]	
20	0.02	1.63	Pass *3)

Top

(E-Field) 3 kHz to 10 MHz

Distance *1)	Electric field strength (Result) *2)	Limit	Result
[cm]	[V/m]	[V/m]	
20	0.92	614.00	Pass *3)

Top

(H-Field) 3 kHz to 10 MHz

Distance *1)	Magnetic field strength* (Result) *2)	Limit	Result
[cm]	[A/m]	[A/m]	
20	0.02	1.63	Pass *3)

Carrier Frequency	
0.13675	MHz

- *1) Distance between measurement probe surface and EUT.
 *2) These values were measured by RMS detection.
 *3) The result is less than 50% of MPE limit.

APPENDIX 2: Test instruments

Test equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
EMF	141360	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	070900532	01/31/2024	12
EMF	141572	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	3401	01/10/2024	12
EMF	142178	Measure, Tape	PROMART	SEN1635	-	-	-
EMF	234777	Magnetic Amplitude and Gradient Probe System	Schmid & Partner Engineering AG	MAGPy-8H3D+E3D / MAGPy-DAS	3057	09/13/2023	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

EMF: Electromagnetic field