



Test report No:
 NIE: 64353RAN.002

Test report

RF EXPOSURE REPORT ACCORDING TO

IEEE Std C95.3-2002
 ISED RSS-102 Issue 5:2015
 ISED RSS-102-SPR-002 Issue 1:2016

(*) Identification of item tested	Qi Wireless charger
(*) Trademark	Amphenol Tecvox
(*) Model and /or type reference	15W Wireless charger
Other identification of the product	HW version: 13, SW Version: 3.0.0 FCC ID: 2AWLR-15WWC IC ID: 26295-15WWC
Features	Qi 1.2.4, Basic & Extended Power Profiles (BPP, EPP)
Manufacturer	Amphenol Tecvox 4900 Bradford Drive Suite 1 Huntsville, Alabama 35805, USA
Test method requested, standard	IEEE Std C95.3-2002: "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz". FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus RSS-102-SPR-002 Issue 1 (2016-09). – Supplementary Procedure for Assessing Compliance with RSS-102 Nerve Stimulation Exposure Limits (3kHz a 10MHz)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José de la Plaza EMC Laboratory Director
Date of issue	2020-07-22
Report template No	FAN39_01
	(*) "Data provided by the client"

Index

Competences and guarantees	3
General conditions	3
Uncertainty	3
Data provided by the client.....	3
Usage of samples	4
Test sample description	4
Identification of the client.....	4
Testing period and place.....	4
Document history	4
First release	4
Environmental conditions	4
Remarks and comments	5
Testing verdicts.....	5
Appendix A: FCC RF Exposure.....	6
General description of the device under evaluation	7
Evaluation Results.....	7
Qi WPT Evaluation	8
NFC RF Exposure Assessment.....	12
Multiple frequencies assessment.....	12
Appendix B: ISED RF Exposure.....	13
General description of the device under evaluation	14
Evaluation Results.....	14
Qi WPT Evaluation	15
Qi WPT Evaluation - ISED Nerve Stimulation.....	17
NFC RF Exposure Assessment.....	19
Multiple frequencies assessment.....	19
Appendix C: RF Exposure Information	20
FCC RF Exposure evaluation for mobile devices.....	21
FCC MPE Evaluation	21
ISED RF Exposure evaluation for mobile devices.....	22
ISED MPE Evaluation	22
Multiple frequencies assessment.....	22
Appendix D: Photographs	23

Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U..

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document FAN40.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. Installation distance.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: the client

Sample M/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
64353/003	Charger	20500W0/52183787	0000000086	2020-05-27
64353/006	Power adapter	60714	-	2020-05-27
64353/009	Interface box	-	-	2020-05-27
64353/012	USB Cable	-	-	2020-05-27
61466/014	Smartphone	Samsung Note 10	R38M609BBAP	2019-07-26

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested".

Test sample description

The test sample consists of a Qi Wireless Charger.

Identification of the client

Amphenol Tecvox
 4900 Bradford Drive Suite 1
 Huntsville, Alabama 35805, USA

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-06-11
Date (finish)	2020-07-03

Document history

Report number	Date	Description
64353RAN.002	2020-07-22	First release

Environmental conditions

Date	Max. Temp. °C	Min. Temp. °C	Max. Hum. %	Min. Hum. %	Limit
From 2020-06-11 to 2020-07-03	24.69	20.88	60.88	40.89	10-40 °C 20-80%

Remarks and comments

- The tests have been performed by the technical personnel: Francisco J. Sánchez.
- The instrumentation utilized to perform the tests covered in this test report is listed in the following table:

	Last Cal. date	Cal. due date
1. Narda EHP-200A E and H Field Analyzer	2019/11	2021/11
2. Low Dielectric Tripod Manfrotto H-491009-01	-	-
3. Temperature and humidity logger HW GROUP HWg-STE	2019/04	2020/04

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

FCC 47 CFR § 2.1091 & ISED RSS-102 Issue 5 & ISED RSS-102-SPR-002 Issue 1	VERDICT			
	N/A	P	F	NM
Qi Wireless Charge		P		
NFC				NM ¹
1: Technology not subject to testing. Verdict has been determined through RF Exposure assessment (see Appendix A).				

Appendix A: FCC RF Exposure

General description of the device under evaluation

The test sample consists of a Qi Wireless charger, which supports Qi Wireless Charge and NFC.

According to the manufacturer, during its normal use, the separation distance between the device and the body of nearby users will be greater than 28 cm once installed.

RF Exposure evaluation for the Qi wireless technology has been conducted through field measurements (see Qi WPT Evaluation section below).

NFC technology is not subject to testing and verdict can be determined through RF Exposure assessment (see NFC RF Exposure Assessment section below).

Evaluation Results

Following results correspond to maximum measured field values:

Technology	Frequency (MHz)	Max. E-field (V/m)	Max. H-field (A/m)	Max Power Density (mW/cm ²)	E-field Limit (V/m)	H-field Limit (A/m)	Power Density Limit (mW/cm ²)	Verdict
Qi WPT	0.1278	9.68	0.632	-	614.00	1.630	-	PASS
NFC	13.56	-	-	0.000000005	-	-	0.98	PASS

Table 1: FCC Results

Qi WPT Evaluation

E-Field and H-Field measurements have been made from all sides of the device using a separation distance from 10 cm to 20 cm, measured from the center of the probe to the edge of the device. Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m.

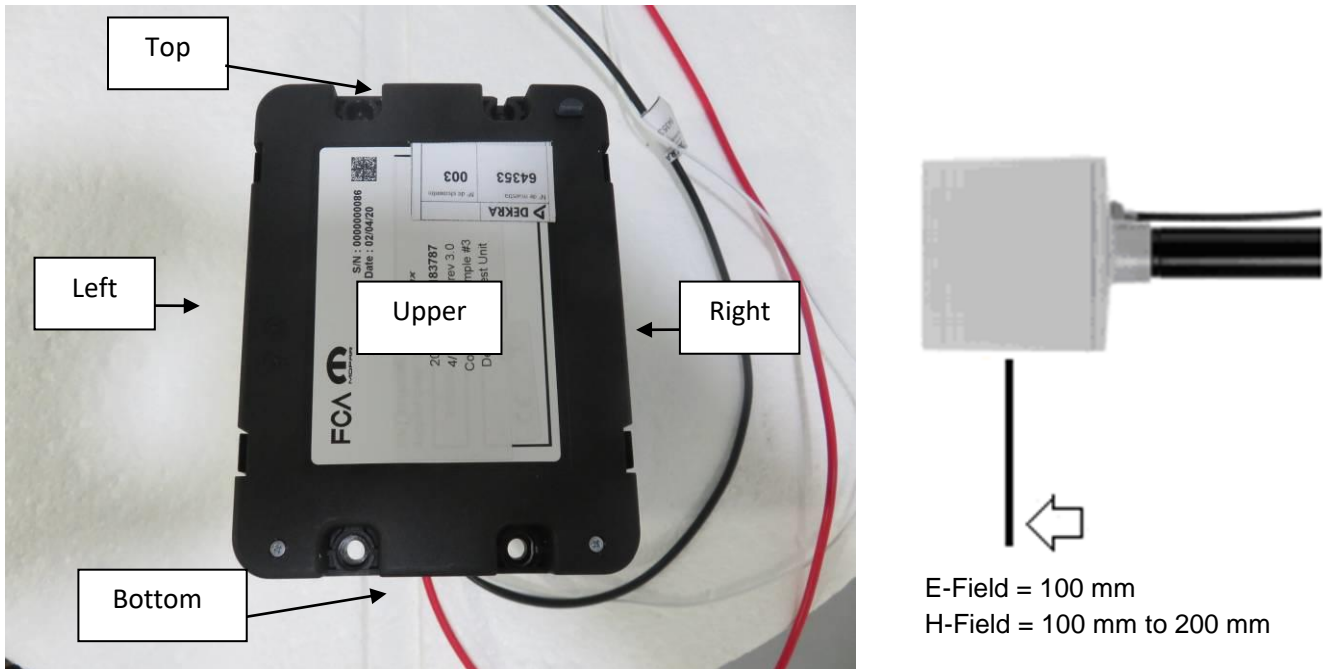


Figure 1: WPT measurement setup

Two testing setups have been measured in order to assess compliance for the device:

- Setup 1 – Charging setup with a Smartphone

For the normal charging setup, measurements at 10 cm distance have been performed for all device sides except for the back side, at different battery charge levels.

- Setup 2 – Charger:

Measurements at 10 cm distance over the charger without any device charging were performed for all device sides except for the back side of the charger.

Additional H-Field measurements (**A.M.**) at further distances (15 and 20 cm) were performed in specific positions where the 10 cm distance measurement value exceeded 50% of the MPE limit.

- Setup 1 Measurements

▪ **90% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.162	1.630	9.9	Pass
Left	10	0.1275	0.823	1.630	50.5	A.M.
Right	10	0.1278	0.632	1.630	38.8	Pass
Upper	10	0.1278	0.416	1.630	25.5	Pass
Bottom	10	0.1278	1.308	1.630	80.2	A.M.

Table 2: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	0.44	614.00	0.07	Pass
Left	10	0.1275	0.39	614.00	0.06	Pass
Right	10	0.1278	1.37	614.00	0.22	Pass
Upper	10	0.1278	0.52	614.00	0.08	Pass
Bottom	10	0.1278	2.14	614.00	0.35	Pass

Table 3: E-field measurement values

▪ **50% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.487	1.630	29.9	Pass
Left	10	0.1278	0.802	1.630	49.2	A.M.
Right	10	0.1278	0.449	1.630	27.6	Pass
Upper	10	0.1278	0.307	1.630	18.8	Pass
Bottom	10	0.1278	0.598	1.630	36.7	Pass

Table 4: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	2.88	614.00	0.47	Pass
Left	10	0.1278	0.46	614.00	0.07	Pass
Right	10	0.1278	1.75	614.00	0.28	Pass
Upper	10	0.1278	0.59	614.00	0.10	Pass
Bottom	10	0.1278	1.498	614.00	0.24	Pass

Table 5: E-field measurement values

▪ **10% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.209	1.630	12.8	Pass
Left	10	0.1278	1.032	1.630	63.3	A.M.
Right	10	0.1278	0.561	1.630	34.4	Pass
Upper	10	0.1278	0.160	1.630	9.8	Pass
Bottom	10	0.1278	0.602	1.630	37.0	Pass

Table 6: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	0.60	614.00	0.10	Pass
Left	10	0.1278	0.58	614.00	0.09	Pass
Right	10	0.1278	1.26	614.00	0.20	Pass
Upper	10	0.1278	0.48	614.00	0.08	Pass
Bottom	10	0.1278	0.76	614.00	0.12	Pass

Table 7: E-field measurements values

- Setup 2 Measurements

▪ **Charger:**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	4.377	1.630	268.5	A.M.
Left	10	0.1278	1.627	1.630	99.8	A.M.
Right	10	0.1278	2.013	1.630	123.5	A.M.
Upper	10	0.1278	0.195	1.630	11.9	Pass
Bottom	10	0.1278	0.155	1.630	9.5	Pass

Table 8: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	9.68	614.00	1.58	Pass
Left	10	0.1278	2.70	614.00	0.44	Pass
Right	10	0.1278	2.11	614.00	0.34	Pass
Upper	10	0.1278	0.46	614.00	0.07	Pass
Bottom	10	0.1278	0.63	614.00	0.10	Pass

Table 9: E-field measurement values

- Additional H-Field Measurements for setup 1

▪ **90% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Left	15	0.1278	0.259	1.630	15.9	Pass
Bottom	15	0.1278	0.452	1.630	27.7	Pass

Table 10: H-field measurement values

▪ **50% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Left	15	0.1278	0.120	1.630	7.4	Pass

Table 11: H-field measurement values

▪ **10% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Left	15	0.1278	0.103	1.630	6.3	Pass

Table 12: H-field measurement values

- Additional H-Field Measurements for setup 2

▪ **Charger:**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	15	0.1278	0.918	1.630	56.3	<i>A.M.</i>
Left	15	0.1278	0.460	1.630	28.2	Pass
Right	15	0.1278	0.431	1.630	26.4	Pass

Table 13: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	20	0.1278	0.451	1.630	27.7	Pass

Table 14: H-field measurement values

All H-Field and E-Field values are less than 50% of the MPE limit shown into §1.1310, paragraph (e), "Table 1: limits for Maximum Permissible Exposure (MPE) at 15 cm surrounding the device and 20 cm above the top surface.

NFC RF Exposure Assessment

For the NFC technology, the equivalent isotropically radiated power is calculated using Field Strength Approach formula (linear terms):

$$E.I.R.P = P_t \times G_t = (Exd)^2/30$$

Where:

P_t = transmitter output power in watts

G_t = numeric gain of the transmitting antenna (unitless)

E = electric field strength in V/m, --- $10^{((dB\mu V/m)/20)}/10^6$.

For measuring equipment calibrated in $dB\mu V/m$, the reading should be reduced by 51.5 dB to be converted to $dB\mu A/m$, therefore $E = H + 51.5$ dB.

d = measurement distance in meters (m) = 3m

As stated into DEKRA Certification, Inc. test report 2670ERM.003 the maximum measured field strength for the operating frequency is:

Frequency (MHz)	Maximum H-field strength (dB μ A/m) measured at 3 m
13.56	-2.05

Table 15: RF Measurement Results

$$P_t = (Exd)^2/(30 \times G_t)$$

E-Field strength = -2.05 dB μ A/m + 51.5 = 49.45 dB μ V/m @ 3m

Antenna gain = 0.0 dBi, so numeric gain = 1.0

Therefore

$$P_t = \{ [10^{(49.45/20)}/10^6 \times 3]^2 / (30 \times 1.0) \} \times 1000 \text{ mW} = 0.00003 \text{ mW} = -45.78 \text{ dBm}$$

Technology	Frequency (MHz)	Max. RF output power (dBm)	Max. Antenna gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
NFC	13.56	-45.78	+0.0	-45.78	0.00003

Table 16: Equipment specifications

Limits for Maximum Permissible Exposure (MPE) to comply with FCC 47 CFR § 2.1091 are defined in “§1.1310 Radiation Exposure limits, paragraph (e)”:

Technology	Frequency (MHz)	Distance (cm)	Power density (mW/cm ²)	FCC General Population Limit (mW/cm ²)	Verdict
NFC	13.56	20.0	0.000000005	0.98	Pass

Table 17: Assessment result and verdict

Multiple frequencies assessment

Simultaneous technologies and modes	Result	Limit	Verdict
Qi Wireless Charging (H-Field + E-Field) + NFC	0.41	1.0	Pass

Table 18: Multiple frequency assessment result and verdict

Appendix B: ISED RF Exposure

General description of the device under evaluation

The test sample consists of a Qi Wireless charger, which supports Qi Wireless Charge and NFC.

According to the manufacturer, during its normal use, the separation distance between the device and the body of nearby users will be greater than 28 cm once installed.

RF Exposure evaluation for the Qi wireless technology has been conducted through field measurements (see Qi WPT Evaluation section below).

NFC technology is not subject to testing and verdict can be determined through RF Exposure assessment (see NFC RF Exposure Assessment section below).

Evaluation Results

Following results correspond to maximum measured field values:

Technology	Frequency (MHz)	Max. E-field (V/m)	Max. H-field (A/m)	Max Power Density (W/m ²)	E-field Limit (V/m)	H-field Limit (A/m)	Power Density Limit (W/m ²)	Verdict
Qi WPT	0.1278	-	4.377	-	-	5.712	-	PASS
Qi WPT - NS	0.1278	3.07	1.260	-	83.0	90.0	-	PASS
NFC	13.56	-	-	0.0000000021	-	-	2.0	PASS

Table 19: ISED Results

Qi WPT Evaluation

Measurements at 10 cm test distance were performed using the equipment listed in the “Used Instrumentation” paragraph of this document to compare the measured H-Field values with the limits shown on table 4 of RSS-102 Issue 5, Paragraph “4.Exposure Limits”, Industry of Canada.

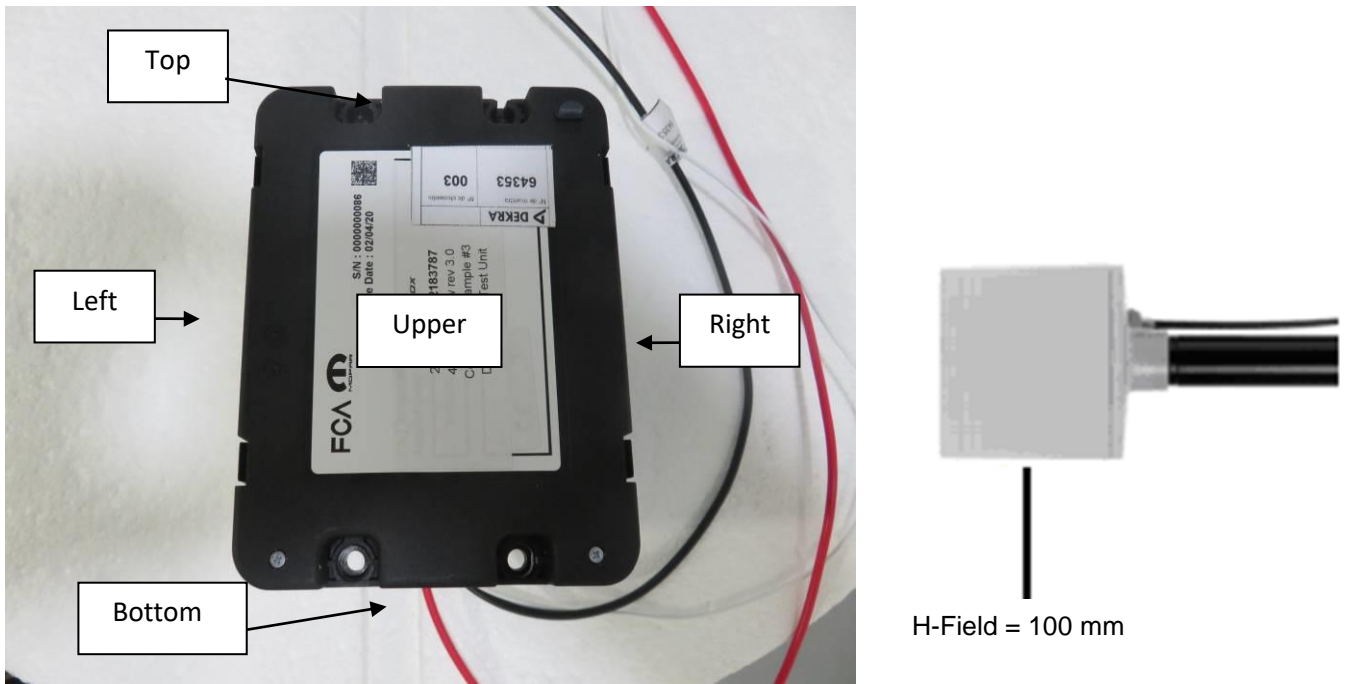


Figure 2: WPT measurement setup

Two testing setups have been measured in order to assess compliance for the device.

- Setup 1 – Charging setup with a Smartphone

For the normal charging setup, measurements at 10 cm distance have been performed for all device sides except for the back side, at different battery charge levels.

- Setup 2 – Charger:

Measurements at 10 cm distance over the charger without any device charging were performed for all device sides except for the back side of the charger.

- Setup 1 Measurements

▪ **90% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.156	5.712	2.7	Pass
Left	10	0.1278	0.726	5.712	12.7	Pass
Right	10	0.1278	0.644	5.712	11.3	Pass
Upper	10	0.1278	0.427	5.712	7.5	Pass
Bottom	10	0.1278	1.28	5.712	22.5	Pass

Table 20: H-field measurement values

▪ **50% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.501	5.712	8.8	Pass
Left	10	0.1278	0.605	5.712	10.6	Pass
Right	10	0.1278	0.446	5.712	7.8	Pass
Upper	10	0.1278	0.302	5.712	5.3	Pass
Bottom	10	0.1278	0.92	5.712	16.1	Pass

Table 21: H-field measurement values

▪ **10% Battery Charge level**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.207	5.712	3.6	Pass
Left	10	0.1278	1.002	5.712	17.5	Pass
Right	10	0.1278	0.806	5.712	14.1	Pass
Upper	10	0.1278	0.122	5.712	2.1	Pass
Bottom	10	0.1278	0.607	5.712	10.6	Pass

Table 22: H-field measurement values

- Setup 2 Measurements

▪ **Charger:**

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	4.377	5.712	76.6	Pass
Left	10	0.1278	1.627	5.712	28.5	Pass
Right	10	0.1278	2.013	5.712	35.2	Pass
Upper	10	0.1278	0.195	5.712	3.4	Pass
Bottom	10	0.1278	0.155	5.712	2.7	Pass

Table 23: H-field measurement values

All H-Field values are in compliance to values shown into “Table 4: RF Field Strength Limits for Devices Used by the General Public” for the frequency range used by the device.

Qi WPT Evaluation - ISED Nerve Stimulation

According to RSS-102 Issue 5, Nerve Stimulation exposure limits shall be evaluated for transmission into the frequency range from 0.003 to 10 MHz. Supplementary Procedure SPR-002, Issue 1, for Radio Standards Specification RSS-102 sets out the general test methods to be followed when carrying out an assessment to the nerve stimulation exposure requirements of RSS-102 Issue 5.

Measurements have been performed at a compliance distance of 10 cm from the probe edge to the device edge, placing the device in the edge of the table, using the equipment listed in the “Used Instrumentation” paragraph of this document, and following the measurement method shown in paragraph 6.6.1.1 of “Supplementary Procedure for Assessing Compliance with RSS-102 Nerve Stimulation Exposure Limits SPR-002”:

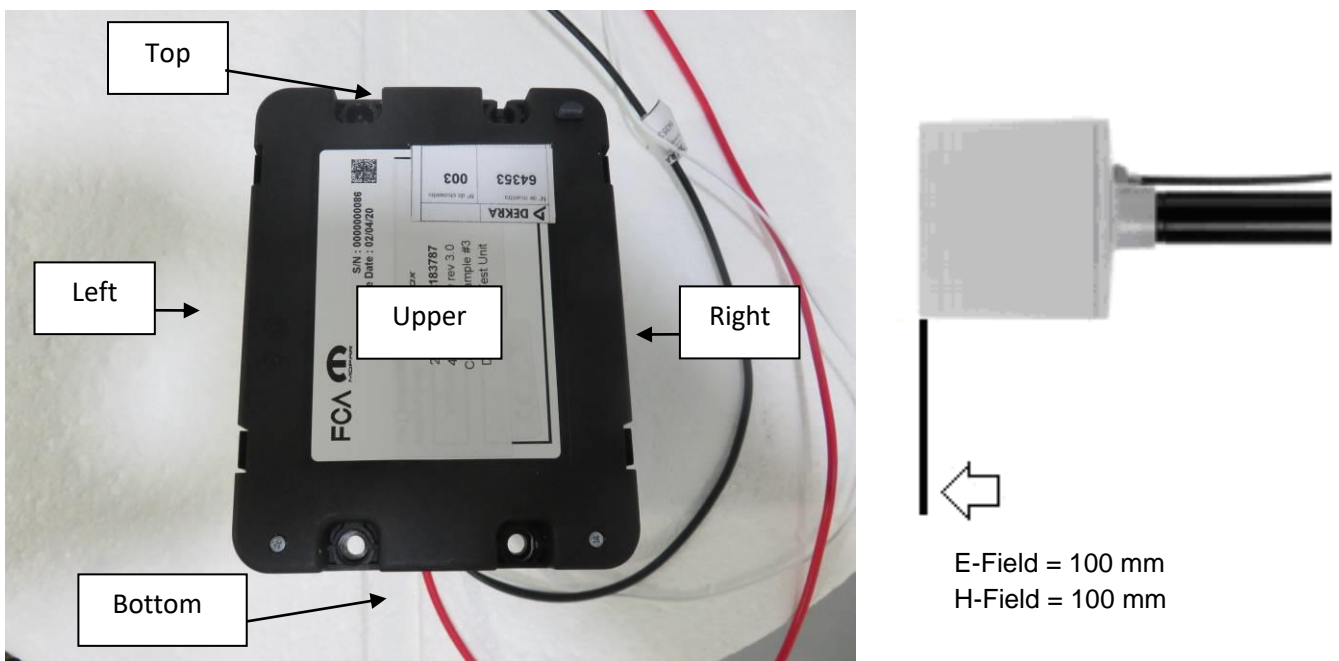


Figure 3: WPT NS measurement setup

Two testing setups have been measured in order to assess compliance for the device.

- Setup 1 – Charging setup with a Smartphone

For the normal charging setup, measurements at 10 cm distance have been performed for all device sides except for the back side, at different battery charge levels.

- Setup 2 – Charger:

Measurements at 10 cm distance over the charger without any device charging were performed for all device sides except for the back side of the charger.

- Setup 1 – Charging setup with a Smartphone

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.339	90	0.4	Pass
Left	10	0.1278	0.301	90	0.3	Pass
Right	10	0.1278	0.196	90	0.2	Pass
Upper	10	0.1278	0.179	90	0.2	Pass
Bottom	10	0.1275	0.416	90	0.5	Pass

Table 24: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	0.59	83	0.7	Pass
Left	10	0.1180	0.38	83	0.5	Pass
Right	10	0.1278	0.62	83	0.8	Pass
Upper	10	0.1278	0.57	83	0.7	Pass
Bottom	10	0.1275	0.92	83	1.1	Pass

Table 25: E-field measurements values

- Setup 2 Measurements

Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
Top	10	0.1278	0.468	90	0.5	Pass
Left	10	0.1275	1.097	90	1.2	Pass
Right	10	0.1278	1.260	90	1.4	Pass
Upper	10	0.1278	0.106	90	0.1	Pass
Bottom	10	0.1278	0.145	90	0.2	Pass

Table 26: H-field measurement values

Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
Top	10	0.1278	3.07	83	3.7	Pass
Left	10	0.1280	0.82	83	1.0	Pass
Right	10	0.1278	1.09	83	1.3	Pass
Upper	10	0.1278	0.53	83	0.6	Pass
Bottom	10	0.1278	0.59	83	0.7	Pass

Table 27: E-field measurements values

All H-Field and E-Field values are in compliance to values shown into “Table 4: RF Field Strength Limits for Devices Used by the General Public” for the frequency range used by the device.

NFC RF Exposure Assessment

For the NFC technology, the equivalent isotropically radiated power is calculated using Field Strength Approach formula (linear terms):

$$E.I.R.P = P_t \times G_t = (E \cdot d)^2 / 30$$

Where:

P_t = transmitter output power in watts

G_t = numeric gain of the transmitting antenna (unitless)

E = electric field strength in V/m, --- $10^{((dB\mu V/m)/20)}/10^6$.

For measuring equipment calibrated in $dB\mu V/m$, the reading should be reduced by 51.5 dB to be converted to $dB\mu A/m$, therefore $E = H + 51.5$ dB.

d = measurement distance in meters (m) = 3m

As stated into DEKRA Certification, Inc. test report 2670ERM.003 the maximum measured field strength for the operating frequency is:

Frequency (MHz)	Maximum H-field strength (dB μ A/m) measured at 3 m
13.56	-2.05

Table 28: RF Measurement Results

$$P_t = (E \cdot d)^2 / (30 \times G_t)$$

E-Field strength = -2.05 dB μ A/m + 51.5 = 49.45 dB μ V/m @ 3m

Antenna gain = 0.0 dBi, so numeric gain = 1.0

Therefore

$$P_t = \{ [10^{(49.45/20)} / 10^6 \times 3]^2 / (30 \times 1.0) \} \times 1000 \text{ mW} = 0.00003 \text{ mW} = -45.78 \text{ dBm}$$

Technology	Frequency (MHz)	Max. RF output power (dBm)	Max. Antenna gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
NFC	13.56	-45.78	+0.0	-45.78	0.00003

Table 29: Equipment specifications

Limits for RF Field Strength to comply with RSS-102 Issue 5 are defined in "Health Canada's RF exposure guideline, Safety code 6":

Technology	Frequency (MHz)	Distance (cm)	Power density (W/m ²)	ISED General Public Limit (W/m ²)	Verdict
NFC	13.56	20.0	0.000000021	2.0	Pass

Table 30: Assessment result and verdict

Multiple frequencies assessment

Simultaneous technologies and modes	Result	Limit	Verdict
Qi Wireless Charging (H-Field) + NFC	0.77	1.0	Pass

Table 31: Multiple frequency assessment result and verdict

Appendix C: RF Exposure Information

FCC RF Exposure evaluation for mobile devices

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

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)
(A) Limits for Occupational/Controlled Exposure				
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
(B) 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

FCC MPE Evaluation

In order to perform the MPE assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[\text{mW} / \text{cm}^2] = \frac{P_{E.I.R.P.}[\text{mW}]}{4\pi R[\text{cm}]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

ISED RF Exposure evaluation for mobile devices

According to RSS-102 Issue 5, Paragraph “4. Exposure Limits”, Industry of Canada has adopted the RF field strength limits established in Health Canada’s RF exposure guideline, Safety code 6:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻³ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz.
 *Based on nerve stimulation (NS).
 ** Based on specific absorption rate (SAR).

ISED MPE Evaluation

In order to perform the MPE assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[W / m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2}$$

Where:

S = power density

*P*_{E.I.R.P.} = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

Multiple frequencies assessment

When multiple sources are introduced into an environment, it becomes necessary to address the sources interdependently, since each source will contribute some percentage of the maximum exposure toward the total exposure at a fixed location. The sum of the ratios of the exposure from each source to the corresponding maximum exposure for the frequency of each source must be evaluated.

The exposure complies with the maximum permissible exposure if the sum of the ratios is less than unity:

$$\sum_{i=1}^n \frac{S_i}{MPE_i} < 1$$

Where

*S*_{*i*} is the power density of each source;

*MPE*_{*i*} is the power density basic restriction of each source.