FCC/ISED MPE TEST REPORT

Project Number	**: EA1807C-145**
Test Report Number	**: TR-W1901-026**
Type of Equipment	**: Elements™ IC Obturation System**
Model Name	**: Elements™ IC Dual Charger**
FCC ID	**: 2AQVD-9730610**
ISED Cert. Number	**: IC: 24715-9730610**
Multiple Model Name	**: N/A**
Applicant	**: META SYSTEMS CO., LTD.**
Address	**: #1214-18, Sicox tower 12F, 484, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 13229, Korea**
Manufacturer	**: META SYSTEMS CO., LTD.**
Address	**: #1214-18, Sicox tower 12F, 484, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 13229, Korea**
Regulation	**: FCC Part 1.1310, KDB 680106 , RSS-216 issued 2, section 6.4.4, RSS-102**
Total page of Report	**: 17 Pages**
Date of Receipt	**: 2018-07-30**
Date of Issue	**: 2019-01-29**
Test Result	**: PASS**

This test report only contains the result of a single test of the sample supplied for the examination.
It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by Song, In-young / Senior Engineer _____ (Signature) 2019-01-29 (Date)

Reviewed by Choi, Yeong-min / Technical Manager _____ (Signature) 2019-01-29 (Date)

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Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W1901-026	2019-01-29	Initial Release
-	-	-

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1. EUT (Equipment Under Test)

1.1 General Description

The META SYSTEMS CO., LTD., Model Elements™ IC Dual Charger (Hereafter referred to as the EUT in this report) is a part of Elements™ IC Obturation System, which is consist of Downpack device, Backfill device, Dual charger, and an AC/DC Adapter. The Downpack device provides instantaneous heating and cooling of the heat plugger with precisely controlled temperature and timing, making it perfect for single motion downpack obturation of the apical portion of the root canal. Utilizing single-use gutta percha needle cartridges, the ergonomic Backfill device has a motorized extruder system for precise temperature and speed control for a 3-dimensional obturation of the root canal system. The product specification described herein was obtained from product data sheet or user's manual. The product specification described herein was obtained from product data sheet or user's manual.

Trade mark	Kerr ENDODONTICS
Kind of Class acc. to FCC	DCD- Part 15 Low Power Transmitter Below 1 705 kHz
Kind of Type acc. to ISED	Type 3 (Category I)
WPT(Wireless Power Transfer) Frequency	140 kHz – 148.5 kHz
Power Transfer Function	Multiple power transfer zones, multiple clients
Modulation Types	Amplitude Modulation (AM)
Generated or used Freq. in EUT	8 MHz
Type of Antenna	■ Integrated Type (Loop Coil Type) □ Dedicated Type
	40 x 40 mm and 8 turns, 2 antennas each
Operating Temperature	-20 °C ~ + 55 °C
Normal Test Voltage	DC 9 V (powered by AC/DC adapter)
Adapter	Input: 100-240 V, 50/60 Hz, Output: 9 V, 2 A
Maximum Power Consumption	5 W
Software Version	Ver 1.00
Hardware Version	Ver 1.0

1.2 Additional Model

- None

2. TEST CONDITION

2.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description		Model No.	FCC/ISED ID	Serial No.	Manufacturer.
Elements™ IC Obturation System	Dual Charger	Elements™ IC Dule Charger	FCC ID: 2AQVD-9730610 ISED ID: IC:24715-9730610	N/A	META SYSTEMS CO., LTD
	Downpack Device	Elements™ IC Downpack	N/A	N/A	META SYSTEMS CO., LTD
	Backfill Device	Elements™ IC Backfill	N/A	N/A	META SYSTEMS CO., LTD
	AC/DC Adapter	BPM020S09F04	N/A	N/A	Wendeng Jell Elec

2.2 Mode of operation during the test

The EUT consists of WPT source and receive-only WPT clients together, so the client device, Elements™ IC Backfill, Elements™ IC Downpack with dummy load was inserted into charging dock of WPT source, dual charger. Dual charger continuously transmitted maximum power for charging client device.

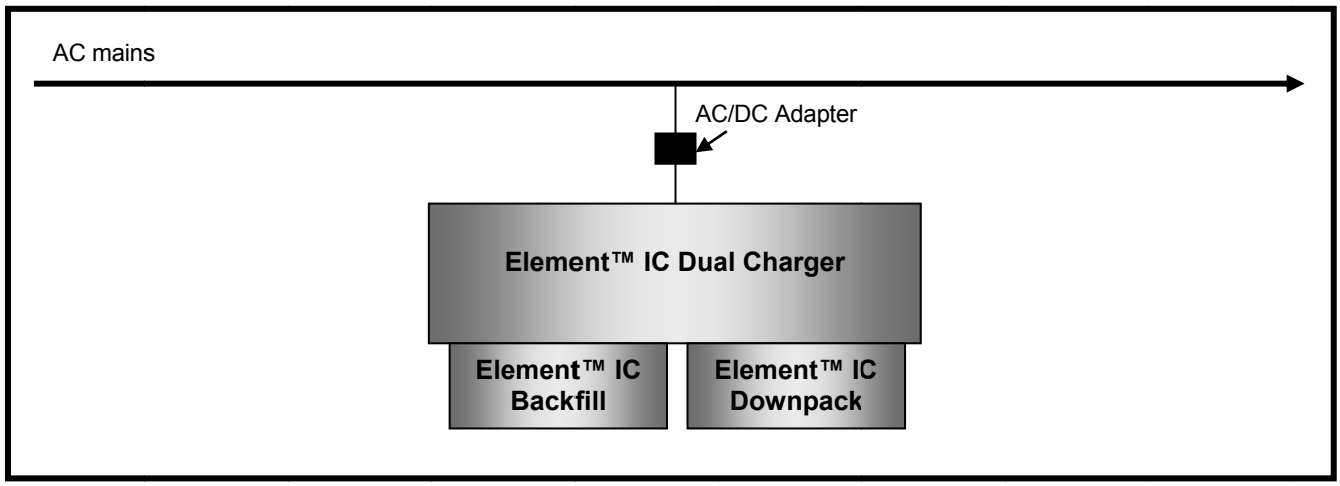
Test Mode	Description
# 1	The EUT was operated in standby mode
# 2	The client device, Banckfill and Downpack Device with dummy load was inserted into charging dock on dual charger and then continuously charged with maximum power.

2.3 Preliminary Testing for Worst case configuration

For finding worst case configuration and operating mode, preliminary testing was performed with the EUT set to transmit with the highest output power as worst case scenario.

The Dual charger has 2 charging dock, so the test was performed as following 2 operating condition, but worst operating configuration was recorded in this test report.

Client configuration		Electric Field Strength	Magnetic Field Strength
Left Power Transfer Zone	Right Power Transfer Zone		
Element™ IC Downpack	Element™ IC Backfill	8.72 V/m	0.54 A/m
Element™ IC Backfill	Element™ IC Downpack	8.17 V/m	0.52 A/m



3. TEST RESULT

3.1 Environmental evaluation and exposure limit

FCC LIMIT

According to FCC §1.1310;

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of FCC part 2.1093 of this chapter

[Table – Limits for Maximum Permissible Exposure (MPE)]

Frequency Range [MHz]	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm2]	Average Time [minutes]
(A) Limits for Occupational / Control Exposures (Note 1)				
0.3 – 3.0	614	1.63	*(100)	6
3.0 – 30	1 842/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 (Note 2)				
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/1 500	30
1,500 – 100,000			1.0	30

f = frequency in MHz, * = Plane wave equivalent power density

Note 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 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.

ISED Canada LIMIT

According to RSS-102 Issue 5, Paragraph 4 “Exposure Limits”, Industry Canada has adopted the SAR and 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	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

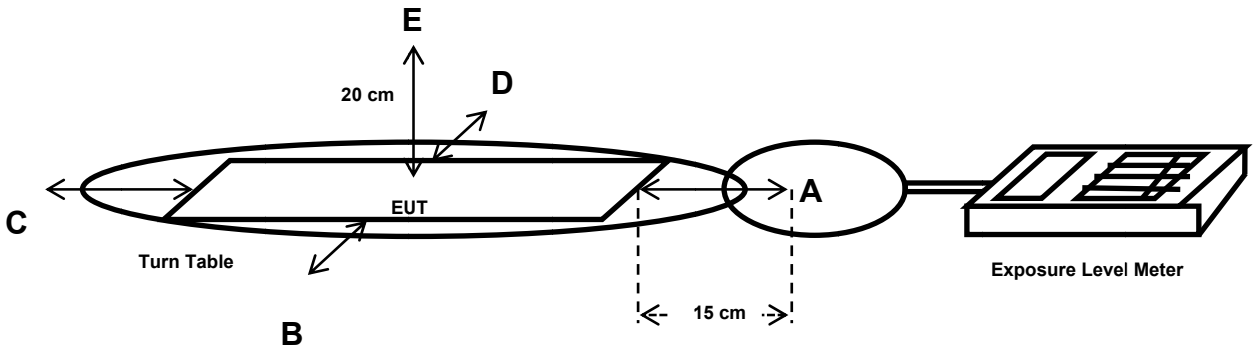
Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

f = frequency in MHz, * = Plane wave equivalent power density

According to RSS-216 Issue2, RF exposure shall be evaluated with the client devices charged/powered by the source device at maximum output power. Additionally, all transmitters, including those not used for wireless power transfer, must be active simultaneously and at maximum power. For WPT devices designed for desktop applications (e.g. wireless charging pads), RF exposure shall be evaluated at 10 cm away from all sides and from the top of the WPT device / system. The 10 cm shall be as measured from the probe centre to the WPT device / system edge.

3.2 FCC Field Strength Measurements

3.2.1 Procedure



1) The RF exposure test was performed in anechoic chamber.

2) The aggregate H-field strengths at 15 cm surrounding the device and 20 cm above the top surface.

3) The highest emission level of each points (A, B, C, D, E) were measured.

4) The EUT was measured according to the dictates of KDB 680106 D01 v03.

5) Different probes were used for Electric Field and Magnetic Field measurement and highest emission level was recorded.

3.2.2 Declaration compliance of KDB 680106 D01 V03 section5, b)

(1) Power transfer frequency is less than 1 MHz.

- The device operates at a frequency of 140 kHz to 148.5 kHz

(2) Output power from each primary coil is less than or equal to 15 watts.

- Output power from each primary coil is less than 10 watts.

(3) The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.

- The transfer system including a charging system with two primary coils are to detect and allow coupling only between individual pairs of coils

(4) Client device is placed directly in contact with the transmitter.

- Client devices were placed directly in contact with the transmitter.

(5) Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).

- The device is classified as mobile device that are not used by the battery.

(6) The aggregate H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit.

(a) Electric field strength levels of EUT < 50 % of the MPE limit (614 V/m).

6.75 V/m(Max. at 15 cm) < 307 V/m

(b) Magnetic field strength levels of EUT < 50 % of the MPE limit (1.63 A/m).

0.51 A/m(Max. at 15 cm) < 0.815 A/m

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3.2.3 Electric Field Strength Measurement Data

Date of Test	2019-01-18	Temperature	(21.0 ± 1.2) °C
		Relative humidity	(44.4 ± 1.0) % R.H.
Measurement Distance	***15 cm / 20 cm***	Test Mode	Mode #1 and Mode #2
Test Result	***PASS***	Tested by	In Yong, Song 

Test Mode	Measured Electric Field Strength [V/m]					Limit [V/m]
	Position A	Position B	Position C	Position D	Position E	
Mode #1: Standby Mode	1.15	0.61	1.31	0.82	0.80	83
Mode #2: Charging Mode with Clients **(Element™ IC Downpack and Element™ IC Backfill)**	1.31	0.96	1.63	1.36	6.75	83

3.2.4 Magnetic Field Strength Measurement Data

Date of Test	2019-01-18	Temperature	(21.0 ± 1.2) °C
		Relative humidity	(44.4 ± 1.0) % R.H.
Measurement Distance	***15 cm / 20 cm***	Test Mode	Mode #1 and Mode #2
Test Result	***PASS***	Tested by	In Yong, Song

Test Mode	Measured Electric Field Strength [A/m]					Limit [A/m]
	Position A	Position B	Position C	Position D	Position E	
Mode #1: Standby Mode	0.18	0.18	0.18	0.18	0.18	90
Mode #2: Charging Mode with Clients **(Element™ IC Downpack and Element™ IC Backfill)**	0.26	0.18	0.21	0.18	0.51	90

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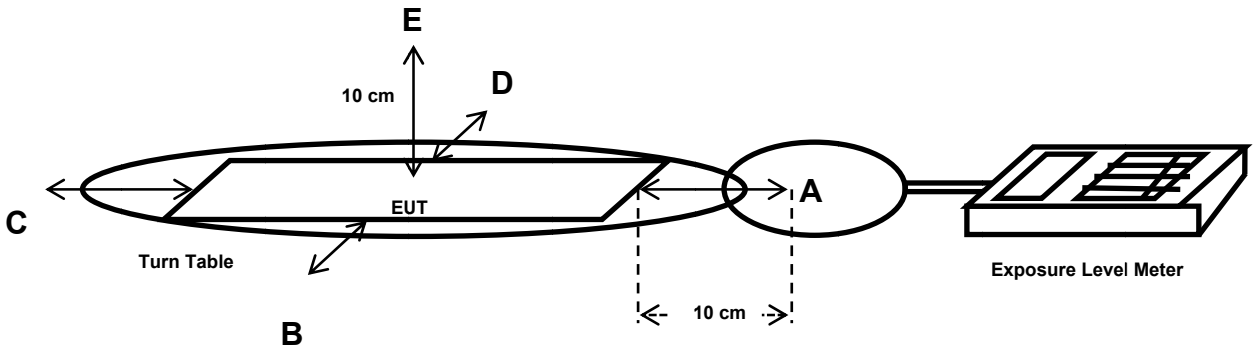
3.3 ISED Field Strength Measurements

3.3.1 Procedure



1) The RF exposure test was performed in anechoic chamber.

2) The aggregate H-field strengths at 10 cm surrounding the device and 10 cm above the top surface.

3) The highest emission level of each points (A, B, C, D, E) were measured.

4) The EUT was measured according to the dictates of RSS-216 issued 2, section 6.4.4.

5) Different probes were used for Electric Field and Magnetic Field measurement and highest emission level was recorded.

3.3.2 Declaration compliance of RSS-216 issue 2 section 6.4.4

(1) Wireless power transfer frequency is below 1 MHz

- The device operates at a frequency of 140 kHz to 148.5 kHz

(2) Output power from each primary coil (i.e. transmitter coil in the WPT source device) is less than or equal to 5 W

- Output power from each primary coil is Maximum 5 W

(3) The WPT device is only capable of wireless power transfer between one source and one client at a time. This includes WPT systems with multiple primary coils (i.e. in the WPT source) as long as they only allow wireless power transfer to take place through a single pair of coils at any given time (one in the source and the other in the client). It also includes WPT systems where the source may use two or more overlapping smaller coils to form a fixed charging/powering zone, as long as they only allow wireless power transfer to take place between this zone and a single client device

- The transfer system including a charging system with two primary coils are to detect and allow coupling only between individual pairs of coils

(4) The WPT client device is placed in direct contact with or docked onto the WPT source

- Client devices were placed directly in contact with the dock of WPT source.

(5) The maximum coupling surface area of the WPT source is less than or equal to 400 cm^2

- The EUT coupling surface area = π x radius of antenna$(cm)^2$ x two of antennas

  3.141592 x (4 $cm)^2$ x 2= 100.54 cm^2 < 400 cm^2

  Further, since the areas of dock onto the WPT source are smaller than antenna area, so actual maximum coupling area is smaller than 100.54 square of centimeters.

(6) The total leakage fields from all simultaneous transmitting coils are proven to be less than 30% of the applicable Health Canada's Safety Code 6 limits for uncontrolled environments, as set out in RSS-102, at 10 cm from the WPT system in all directions. The total leakage fields shall be calculated or measured based on actual and typical WPT clients of types selected such that they provide worst-case conditions. For WPT source devices with multiple fixed wireless power transfer zones that are only capable of powering/charging one client at a time, this requirement shall be met separately for each zone.

(a) Electric field strength levels of EUT < 30 % of the MPE limit(83 V/m).

8.72 V/m(Max. at 10 cm) < 24.9 V/m

(b) Magnetic field strength levels of EUT < 30 % of the MPE limit(90 A/m).

0.54 A/m(Max. at 10 cm) < 27 A/m

3.3.3 Electric Field Strength Measurement Data

Date of Test	2019-01-18	Temperature	(21.0 ± 1.2) °C
		Relative humidity	(44.4 ± 1.0) % R.H.
Measurement Distance	***10 cm***	Test Mode	Mode #1 and Mode #2
Test Result	***PASS***	Tested by	In Yong, Song

Test Mode	Measured Electric Field Strength [V/m]					Limit [V/m]
	Position A	Position B	Position C	Position D	Position E	
Mode #1: Standby Mode	1.22	0.63	1.38	0.87	0.84	83
Mode #2: Charging Mode with Clients **(Element™ IC Downpack and Element™ IC Backfill)**	1.61	1.17	1.81	1.56	8.72	83

3.3.4 Magnetic Field Strength Measurement Data

Date of Test	2019-01-18	Temperature	(21.0 ± 1.2) °C
		Relative humidity	(44.4 ± 1.0) % R.H.
Measurement Distance	***10 cm***	Test Mode	Mode #1 and Mode #2
Test Result	***PASS***	Tested by	In Yong, Song

Test Mode	Measured Electric Field Strength [A/m]					Limit [A/m]
	Position A	Position B	Position C	Position D	Position E	
Mode #1: Standby Mode	0.21	0.19	0.21	0.19	0.21	90
Mode #2: Charging Mode with Clients **(Element™ IC Downpack and Element™ IC Backfill)**	0.28	0.20	0.23	0.19	0.54	90

Appendix I. Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
Exposure Leve Meter	ELT-400	N-0754	NARDA	2019.09.13
Broadband Field Meter	NBM-550	E-1275	NARDA	2019.12.27
Slidacs	DSD-1105	M06-117	DIGITAK POWER	N/A

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.