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RF Exposure Assessment Report

EUT Information

Manufacturer	Wachendorff
Model Name	Operating Terminal X 35
FCC ID	2ADFIOPX35
EUT Type	operating terminal
EUT Category	mobile device
Intended Use of EUT	≥ 20 cm separation distance to human body

Prepared by

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Prepared for

Applicant	Wachendorff Elektronik GmbH & Co KG Industriestraße 7 65366 Geisenheim Germany
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Test Specification

Standard Applied	FCC: 47CFR §1.1310, 47CFR §2.1091
Exposure Category	General Public / Uncontrolled Exposure

Report Information

Data Stored	60120_6160410_Wachendorff
Issue Date	December 06, 2016
Revision Date	February 27, 2017
Revision Number	2

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1 Subject of Investigation

The Operating Terminal X 35 is a vehicle-mounted device which can be operated with an external power supply. It uses the Bluetooth technology and has an integrated antenna.

1.1 Technical Data of EUT

Product Specifications	
Frequency Range	2402 MHz – 2480 MHz
Operating Band	Bluetooth
Modulation	GFSK, 4DQPSK, 8DPSK
Maximum Output Power	9.9 dBm EIRP
Antenna Type	Integrated (Yageo ANT2012LL13R2400A)
EUT Category	mobile device
Intended Use of EUT	≥ 20 cm separation distance to human body

Table 1: Product specifications.

1.2 Pictures of EUT



Fig. 1: Front and back view of the EUT.

1.3 Test Specification / Normative References

The tests documented in this report were performed according to the standards and rules described below.

Test Specifications		
Test Standard / Rule	Description	Issue Date
<input checked="" type="checkbox"/> FCC CFR 47 § 2.1091	Code of Federal Regulations; Title 47. Radiofrequency radiation exposure evaluation: Mobile Devices.	October 01, 2010
<input checked="" type="checkbox"/> FCC CFR 47 § 1.1310	Code of Federal Regulations; Title 47. Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure	October 01, 2010

2 Exposure Assessment

2.1 Assessment Procedure

For purposes of analyzing mobile transmitting devices, the time-averaging provisions of the MPE guidelines identified in 47 CFR §1.1310 can be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels. According to 47CFR §2.1091, the Operating Terminal X 35 from Wachendorff has been defined as a mobile device, used in such a way that a separation distance of at least 20 cm is normally maintained between the device and the user. The human exposure to RF emissions from such devices could be evaluated based on the exposure limits adopted by the FCC.

2.2 Device Categories

Three different categories of devices are defined and shown in table 2.

Fixed Transmitter
Fixed transmitter is defined as a device physically secured at one location and is not able to be easily moved to another location. <i>Intended use: ≥ 20 cm separation distance to human body</i>
Mobile Device
A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. <i>Intended use: ≥ 20 cm separation distance to human body</i>
Portable Device
A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. <i>Intended use: < 20 cm separation distance to human body</i>

Table 2: Device categories.

2.3 RF Exposure Categories

General Public / Uncontrolled Exposure
General population comprises individuals of all ages and of varying health status, and may include particularly susceptible groups or individuals. In many cases, members of the public are unaware of their exposure to electromagnetic fields. Moreover, individual members of the public cannot reasonably be expected to take precautions to minimize or avoid exposure.
Occupational / Controlled Exposure
The occupationally exposed population consists of adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions.

Table 3: RF exposure categories.

2.4 RF Exposure Limits adopted by FCC

The following limits are in accordance with 47CFR §1.1310, 47CFR §2.1091.

General Public / Uncontrolled Exposure				
Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm ²]	Averaging Time E ² , H ² or S [min]
0.3 – 3.0	614	1.63	(100)*	30
3.0 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1,500			f/1500	30
1,500 – 100,000			1.0	

Table 4: Limits for General Population / Uncontrolled Exposure.

Occupational / Controlled Exposure				
Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm ²]	Averaging Time E ² , H ² or S [min]
0.3 – 3.0	614	1.63	(100)*	6
3.0 – 30	1842/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1,500			f/300	
1,500 – 100,000			5	

Note/s: f = frequency in MHz; * Plane – wave equivalent power density

Table 5: Limits for Occupational / Controlled Exposure.

2.5 Assessment Relations

Calculation Formulas			
Power Density (S) [W/m ²]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Separation Distance (r) [m]
$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$	$E = \frac{\sqrt{30PG}}{r}$	$H = \frac{E}{\eta_0}$	$r = \sqrt{\frac{PG}{S \times 4\pi}}$
Where:	S = Power density [mW/cm ²] P = maximum RF output power [W] G = antenna gain [numeric] = 10 ^{G [dB] / 10} EIRP = equivalent isotropic radiated power [W] r = separation distance to the antenna [m] η ₀ = free space wave impedance [Ω] = 120 π = 377		

2.6 Assessment Results FCC

Assessment Results for General Public / Uncontrolled Exposure								
Calculated Power Density								
Band	Frequency Range [MHz]	r [cm]	EIRP		S @20 cm [W/m²]	Limit of Power Density (S) [W/m²]	Margin of Compliance [%]	Verdict
			[dBm]	[W]				
Bluetooth	2402 - 2480	20	15.43	0.035	0.069	1.000	93.1	Complies
Note/s: EIRP value obtained from the radio emission test report provided by CTC advanced GmbH								

3 Statement of Compliance

The Operating Terminal X 35 from Wachendorff is in compliance with the maximum permissible exposure (MPE) limits for the power density given by the FCC.

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4 Revision History

Revision History				
Revision	Description of Revision	Date	Revised Page	Revised By
/	Initial Release	December 06, 2016	-	-
1	Product description, intended use information and pictures added	January 24, 2017	2	AR
2	EIRP value and calculation of power density updated	February 27, 2017	5	AR

END OF ASSESSMENT REPORT