

RF Exposure Evaluation Report

APPLICANT : Emerson Climate Technologies -
Transportation Solutions ApS

EQUIPMENT : RMM-X

BRAND NAME : Emerson

MODEL NAME : 8500-160

FCC ID : 2ARHA-C10001

STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Mar. 09, 2023 and completed on Mar. 09, 2023. We, Sporton International Inc. (Shenzhen), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.



Approved by: Si Zhang

Sporton International Inc. (Shenzhen)

***1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055
People's Republic of China***



Table of Contents

1. ADMINISTRATION DATA	4
1.1. Testing Laboratory	4
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	5
3. MAXIMUM RF AVERAGE OUTPUT TUNE UP POWER AMONG PRODUCTION UNITS	6
4. RF EXPOSURE LIMIT INTRODUCTION	7
5. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION	8
5.1. Standalone Power Density Calculation	8
5.2. Collocated Power Density Calculation.....	9

**Revision History**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA262315	Rev. 01	Initial issue of report.	Mar. 20, 2023



1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-SZ	CN1256	421272

Applicant	
Company Name	Emerson Climate Technologies - Transportation Solutions ApS
Address	Boeletvej 1, DK-8680 Ry, Denmark

Manufacturer	
Company Name	Emerson Climate Technologies Suzhou Co., LTD
Address	No.69 Suhong Road, Suzhou Industrial Part, Jiangsu, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	RMM-X
Brand Name	Emerson
Model Name	8500-160
FCC ID	2ARHA-C10001
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz LTE Category M1: LTE Band 2 : 1850 MHz ~ 1910 MHz LTE Band 4 : 1710 MHz ~ 1755 MHz LTE Band 5 : 824 MHz ~ 849 MHz LTE Band 12 : 699 MHz ~ 716 MHz LTE Band 13 : 777 MHz ~ 787 MHz LTE Band 26 : 814 MHz ~ 849 MHz NB-IOT Category NB1 : NB-IOT Band 2 : 1850 MHz ~ 1910 MHz NB-IOT Band 4 : 1710 MHz ~ 1755 MHz NB-IOT Band 5 : 824 MHz ~ 849 MHz NB-IOT Band 12 : 699 MHz ~ 716 MHz NB-IOT Band 13 : 777 MHz ~ 787 MHz NB-IOT Band 26 : 814 MHz ~ 849 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GPRS/EGPRS LTE Category M1: QPSK / 16QAM NB-IOT Category NB1 :BPSK / QPSK Bluetooth LE
Antenna Type	WWAN: OTS Antenna / Dull Antenna Bluetooth: OTS Antenna / Dull Antenna
HW Version	Rev. C
SW Version	Ver. 1.0.1.0
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This product has two antenna types with the same conducted output power level, so chose the maximum antenna gain to perform MPE calculation conservatively.
3. The OTS antenna or Dull antenna are optional, only one of the antennas will be in-box.

Comments and Explanations:

1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain and the safe distance used for evaluate RF exposure were declared by manufacturer.

**WWAN/Bluetooth Antenna Gain table:**

Mode	Frequency Bands	OTS Antenna Gain (dBi)	Dull Antenna Gain (dBi)
GSM	GSM 850	2.7	1.3
	GSM 1900	5.1	4.2
LTE Cat M1 / NB-IOT	LTE Band 2	5.1	4.2
	LTE Band 4	5.1	4.2
	LTE Band 5	2.7	1.3
	LTE Band 12	2.7	1.3
	LTE Band 13	2.7	1.3
	LTE Band 26	2.7	1.3
BT	Bluetooth	3.4	5.9

3. Maximum RF average output tune up power among production units**<GSM>**

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GPRS (GMSK, 1 Tx slot)	33.00	29.50
GPRS (GMSK, 2 Tx slots)	33.00	29.50
GPRS (GMSK, 3 Tx slots)	32.00	29.50
GPRS (GMSK, 4 Tx slots)	31.00	29.50
EDGE (8PSK, 1 Tx slot)	27.00	26.00
EDGE (8PSK, 2 Tx slots)	27.00	26.00
EDGE (8PSK, 3 Tx slots)	27.00	26.00
EDGE (8PSK, 4 Tx slots)	27.00	26.00

<LTE>

Mode		Maximum Average power(dBm)
LTE Cat M1	Band 2	24.00
	Band 4	23.00
	Band 5	24.00
	Band 12	24.00
	Band 13	23.00
	Band 26	24.00
NB-IOT	Band 2	23.00
	Band 4	23.00
	Band 5	24.00
	Band 12	23.00
	Band 13	23.00
	Band 26	23.50

<Bluetooth>

Mode		Maximum Average power(dBm)
Bluetooth	LE	4.00

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

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 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
300-1500			f/300	6
1500-100,000			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
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
GPRS 850 (1 Tx slot)	824.2	2.7	33.00	35.700	467.735	0.093	0.549	0.169
GPRS 850 (2 Tx slots)	824.2	2.7	33.00	35.700	933.254	0.186	0.549	0.338
GPRS 850 (3 Tx slots)	824.2	2.7	32.00	34.700	1106.624	0.220	0.549	0.401
GPRS 850 (4 Tx slots)	824.2	2.7	31.00	33.700	1174.898	0.234	0.549	0.426
EGPRS 850 (1 Tx slot)	824.2	2.7	27.00	29.700	117.490	0.023	0.549	0.043
EGPRS 850 (2 Tx slots)	824.2	2.7	27.00	29.700	234.423	0.047	0.549	0.085
EGPRS 850 (3 Tx slots)	824.2	2.7	27.00	29.700	349.945	0.070	0.549	0.127
EGPRS 850 (4 Tx slots)	824.2	2.7	27.00	29.700	467.735	0.093	0.549	0.169
GPRS 1900 (1 Tx slot)	1850.2	5.1	29.50	34.600	407.380	0.081	1.000	0.081
GPRS 1900 (2 Tx slots)	1850.2	5.1	29.50	34.600	724.436	0.144	1.000	0.144
GPRS 1900 (3 Tx slots)	1850.2	5.1	29.50	34.600	1081.434	0.215	1.000	0.215
GPRS 1900 (4 Tx slots)	1850.2	5.1	29.50	34.600	1445.440	0.288	1.000	0.288
EGPRS 1900 (1 Tx slot)	1850.2	5.1	26.00	31.100	162.181	0.032	1.000	0.032
EGPRS 1900 (2 Tx slots)	1850.2	5.1	26.00	31.100	323.594	0.064	1.000	0.064
EGPRS 1900 (3 Tx slots)	1850.2	5.1	26.00	31.100	483.059	0.096	1.000	0.096
EGPRS 1900 (4 Tx slots)	1850.2	5.1	26.00	31.100	645.654	0.129	1.000	0.129
Cat M1 LTE Band 2	1850.7	5.1	24.00	29.100	812.831	0.162	1.000	0.162
Cat M1 LTE Band 4	1710.7	5.1	24.00	28.100	645.654	0.129	1.000	0.129
Cat M1 LTE Band 5	824.7	2.7	24.00	26.700	467.735	0.093	0.550	0.169
Cat M1 LTE Band 12	699.7	2.7	24.00	26.700	467.735	0.093	0.466	0.200
Cat M1 LTE Band 13	779.5	2.7	23.00	25.700	371.535	0.074	0.520	0.142
Cat M1 LTE Band 26	814.7	2.7	24.00	26.700	467.735	0.093	0.543	0.171
NB-IOT Band 2	1850.1	5.1	24.00	28.100	645.654	0.129	1.000	0.129
NB-IOT Band 4	1710.1	5.1	24.00	28.100	645.654	0.129	1.000	0.129
NB-IOT Band 5	824.1	2.7	24.00	26.700	467.735	0.093	0.549	0.169
NB-IOT Band 12	699.1	2.7	24.00	25.700	371.535	0.074	0.466	0.159
NB-IOT Band 13	777.1	2.7	23.00	25.700	371.535	0.074	0.518	0.143
NB-IOT Band 26	814.1	2.7	24.00	26.200	416.869	0.083	0.543	0.153
Bluetooth	2402	5.9	4.00	9.900	9.772	0.002	1.000	0.002

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum power to do MPE analysis.

**5.2. Collocated Power Density Calculation**

WWAN Power Density / Limit	Bluetooth Power Density / Limit	Σ (Power Density / Limit) of WWAN + Bluetooth
0.426	0.002	0.428

Note:

1. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + Bluetooth.

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

-----THE END-----