

FCC Maximum Permissible RF Exposure (MPE) Estimation Report

In accordance with the requirements of

FCC 47 CFR Part 2(2.1091) and

KDB 447498 D01

Product Name: Celerway Xm2

Trademark: Celerway Xm2

Model Name: CWY-M5.4E1C2W1B

Serial Model: CWY-M5.4E1C1W1B

Report No.: S24031901405003

FCC ID: 2AW69-CWYXM

Prepared for

Celerway Communication AS

Lilleakerveien 2B, 0283 Oslo, Norway

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

No. 24 Xinfu East Road, Xiangshan Community, Xinqiao Street, Baoan District, Shenzhen,
Guangdong, People's Republic of China

Tel. 0755-23200050 Website: <http://www.ntek.org.cn>

TEST RESULT CERTIFICATION

Applicant's name : Celerway Communication AS

Address : Lilleakerveien 2B, 0283 Oslo, Norway

Manufacturer's Name : Celerway Communication AS

Address : Lilleakerveien 2B, 0283 Oslo, Norway

Product description

Product name : Celerway Xm2

Trademark : Celerway Xm2

Model and/or type reference : CWY-M5.4E1C2W1B

Serial Model..... : CWY-M5.4E1C1W1B

FCC 47 CFR Part 1(1.1310)

Standards : FCC 47 CFR Part 2(2.1091)

KDB 447498 D01

This device described above has been tested by Shenzhen NTEK. Testing has shown that this device is capable of compliance with MPE specified in FCC 47 CFR Part 2(2.1091). The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

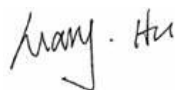
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Date of Test

Date (s) of performance of tests..... : Jul. 01, 2024 ~ Dec. 13, 2024

Date of Issue : Dec. 13, 2024

Test Result : **Pass**

Prepared : 
By : _____
Mary Hu
(Project Engineer)

Reviewed : 
By : _____
Aaron Cheng
(Supervisor)

Approved : 
By : _____
Alex Li
(Manager)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Dec. 13, 2024	Mary Hu

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1 General Information

1.1 RF Exposure Requirements

1.1.1 RF Exposure Limits

Table - 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				

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P_t * G_t}{4 * \pi * R^2}$$

Where:

S = Power density (mW/cm²)

P_t = Conducted output power (dBm)

G_t = numeric gain of the antenna in the direction of interest relative to an isotropic radiator (dBi)

R = distance to the centre of radiation of the antenna (cm)

EIRP = P_t * G_t

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

1.1.2 Additional Description

An estimation of MPE in this application for product is used to ensure if it complies to the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

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.

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 cannot exercise control over their exposure.

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC's MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

1.2 EUT Description

Device Information	
Product Name	Celerway Xm2
Trade Name	Celerway Xm2
Model Name	CWY-M5.4E1C2W1B
Serial Model	CWY-M5.4E1C1W1B
FCC ID	2AW69-CWYXM
Device Phase	Identical Prototype
Exposure Category	General population / Uncontrolled environment
Frequency Bands	WCDMA Band II/IV/V LTE Band 2/4/5/7/12/13/14/17/25/26/30/38/41/42/43/48/66/71 NR Band 2/5/7/12/13/14/25/26/30/38/41/48/66/71/77/78 WLAN 2.4G/5G GPS
Antenna Description:	WCDMA/LTE/NR Main Ant1: WCDMA Band II: -0.66dBi; WCDMA Band IV: -0.66dBi; WCDMA Band V: -3.86dBi; LTE Band 2: -0.66dBi; LTE Band 4: -0.66dBi; LTE Band 5: -3.86dBi; LTE Band 7: 2.57dBi; LTE Band 12: -3.88dBi; LTE Band 13: -3.88dBi; LTE Band 14: -3.88dBi; LTE Band 17: -3.88dBi; LTE Band 25: -0.66dBi; LTE Band 26: -3.86dBi; LTE Band 30: 0.9dBi; LTE Band 38: 2.57dBi; LTE Band 41: 2.57dBi; LTE Band 42: 0.5dBi; LTE Band 43: 0.5dBi; LTE Band 48: 0.5dBi; LTE Band 66: -0.66dBi; LTE Band 71: -3.88dBi; NR Band 2: -0.66dBi; NR Band 5: -3.86dBi; NR Band 7: 2.57dBi; NR Band 12: -3.88dBi; NR Band 13: -3.88dBi; NR Band 14: -3.88dBi; NR Band 25: -0.66dBi; NR Band 26: -3.86dBi; NR Band 30: 0.9dBi; NR Band 38: 2.57dBi; NR Band 41: 2.57dBi; NR Band 48: 0.5dBi; NR Band 66: -0.66dBi; NR Band 71: -3.88dBi; NR Band 77: 0.5dBi; NR Band 78: 0.5dBi; WCDMA/LTE/NR Main Ant2: WCDMA Band II: 3.49dBi; WCDMA Band IV: 3.49dBi; WCDMA Band V: -2.19dBi; LTE Band 2: 3.49dBi; LTE Band 4: 3.49dBi; LTE Band 5: -2.19dBi; LTE Band 7: 3.33dBi; LTE Band 12: -2.96dBi; LTE Band 13: -2.96dBi; LTE Band 14: -2.96dBi; LTE Band 17: -2.96dBi; LTE Band 25: 3.49dBi; LTE Band 26: -2.19dBi; LTE Band 30: 0.9dBi; LTE Band 38: 3.59dBi; LTE Band 41: 3.59dBi; LTE Band 42: 0.5dBi; LTE Band 43: 0.5dBi; LTE Band 48: 0.5dBi; LTE Band 66: 3.49dBi; LTE Band 71: -2.96dBi; NR Band 2: 3.49dBi; NR Band 5: -2.19dBi; NR Band 7: 3.33dBi; NR Band 12: -2.96dBi; NR Band 13: -2.96dBi; NR Band 14: -2.96dBi; NR Band 25: 3.49dBi; NR Band 26: -2.19dBi; NR Band 30: 0.9dBi; NR Band 38: 3.59dBi; NR Band 41: 3.59dBi; NR Band 48: 0.5dBi; NR Band 66: 3.49dBi; NR Band 71: -2.96dBi; NR Band 77: 0.5dBi; NR Band 78: 0.5dBi; WLAN 2.4G Ant1: 0.46dBi; WLAN 2.4G Ant2: 0.22dBi; WLAN 5.2G/5.8G Ant1: 2.79dBi;

WLAN 5.2G/5.8G Ant2: 3.61dBi;

1.3 Test specification(s)

FCC 47 CFR Part 1(1.1310)
FCC 47 CFR Part 2(2.1091)
KDB 447498 D01 General RF Exposure Guidance

1.4 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

1.5 Power Results

Mode	Max. conducted output power (including tune-up) (dBm)	Antenna Gain (dBi)	ERP (dBm) Max.	EIRP (dBm) Max.
WCDMA Band II	24.5	3.49	/	27.99
WCDMA Band IV	24.5	3.49	/	27.99
WCDMA Band V	24.5	-2.19	22.31	24.46
LTE Band 2	24	3.49	/	27.49
LTE Band 4	24	3.49	/	27.49
LTE Band 5	24	-2.19	21.81	23.96
LTE Band 7	24	3.33	/	27.33
LTE Band 12	24	-2.96	21.04	23.19
LTE Band 13	24	-2.96	21.04	23.19
LTE Band 14	24	-2.96	21.04	23.19
LTE Band 17	24	-2.96	21.04	23.19
LTE Band 25	24	3.49	/	27.49
LTE Band 26	24	-2.19	21.81	23.96
LTE Band 30	23	0.9	/	23.9
LTE Band 38	24	3.59	/	27.59
LTE Band 41	26.5	3.59	/	30.09
LTE Band 42	22.5	0.5	/	23
LTE Band 43	22.5	0.5	/	23
LTE Band 48	22.5	0.5	/	23
LTE Band 66	24	3.49	/	27.49
LTE Band 71	24	-2.96	21.04	23.19

NR Band 2	24.5	3.49	/	27.99
NR Band 5	24.5	-2.19	22.31	24.46
NR Band 7	24.5	3.33	/	27.83
NR Band 12	24	-2.96	21.04	23.19
NR Band 13	24	-2.96	21.04	23.19
NR Band 14	24	-2.96	21.04	23.19
NR Band 25	24.5	3.49	/	27.99
NR Band 26	24	-2.19	21.81	23.96
NR Band 30	23	0.9	/	23.9
NR Band 38	25	3.59	/	28.59
NR Band 41	27.5	3.59	/	31.09
NR Band 48	22.5	0.5	/	23
NR Band 66	24.5	3.49	/	27.99
NR Band 71	24.5	-2.96	21.54	23.69
NR Band 77	27.5	0.5	/	28
NR Band 78	27.5	0.5	/	28
WIFI 2.4G SISO Ant1	17.9	0.46	/	18.36
WIFI 2.4G SISO Ant2	18.23	0.22	/	18.45
WIFI 2.4G MIMO	17.58	/	/	17.96
WIFI 5.2G SISO Ant1	15.03	2.79	/	17.82
WIFI 5.2G SISO Ant2	15.47	3.61	/	19.08
WIFI 5.2G MIMO	16.31	/	/	19.78
WIFI 5.8G SISO Ant1	13.95	2.79	/	16.74
WIFI 5.8G SISO Ant2	13.88	3.61	/	17.49
WIFI 5.8G MIMO	16.62	/	/	20

Note: EIRP=ERP+2.15

2 RF Exposure Evaluation

Mode	Max. EIRP	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	MPE	Result
	(dBm)				Ratio	
WCDMA Band II	27.99	20	0.125	1	0.125	Pass
WCDMA Band IV	27.99	20	0.125	1	0.125	Pass
WCDMA Band V	24.46	20	0.056	0.549	0.102	Pass
LTE Band 2	27.49	20	0.112	1	0.112	Pass
LTE Band 4	27.49	20	0.112	1	0.112	Pass
LTE Band 5	23.96	20	0.050	0.549	0.091	Pass
LTE Band 7	27.33	20	0.108	1	0.108	Pass
LTE Band 12	23.19	20	0.041	0.466	0.088	Pass
LTE Band 13	23.19	20	0.041	0.518	0.079	Pass
LTE Band 14	23.19	20	0.041	0.525	0.078	Pass
LTE Band 17	23.19	20	0.041	0.469	0.087	Pass
LTE Band 25	27.49	20	0.112	1	0.112	Pass
LTE Band 26	23.96	20	0.050	0.543	0.092	Pass
LTE Band 30	23.9	20	0.049	1	0.049	Pass
LTE Band 38	27.59	20	0.114	1	0.114	Pass
LTE Band 41	30.09	20	0.203	1	0.203	Pass
LTE Band 42	23	20	0.040	1	0.040	Pass
LTE Band 43	23	20	0.040	1	0.040	Pass
LTE Band 48	23	20	0.040	1	0.040	Pass
LTE Band 66	27.49	20	0.112	1	0.112	Pass
LTE Band 71	23.19	20	0.041	0.442	0.093	Pass
NR Band 2	27.99	20	0.125	1	0.125	Pass
NR Band 5	24.46	20	0.056	0.549	0.102	Pass
NR Band 7	27.83	20	0.121	1	0.121	Pass
NR Band 12	23.19	20	0.041	0.466	0.088	Pass
NR Band 13	23.19	20	0.041	0.518	0.079	Pass
NR Band 14	23.19	20	0.041	0.525	0.078	Pass
NR Band 25	27.99	20	0.125	1	0.125	Pass
NR Band 26	23.96	20	0.050	0.543	0.092	Pass
NR Band 30	23.9	20	0.049	1	0.049	Pass
NR Band 38	28.59	20	0.144	1	0.144	Pass
NR Band 41	31.09	20	0.256	1	0.256	Pass
NR Band 48	23	20	0.040	1	0.040	Pass
NR Band 66	27.99	20	0.125	1	0.125	Pass
NR Band 71	23.69	20	0.047	0.442	0.106	Pass
NR Band 77	28	20	0.126	1	0.126	Pass
NR Band 78	28	20	0.126	1	0.126	Pass
WIFI 2.4G SISO Ant1	18.36	20	0.014	1	0.014	Pass
WIFI 2.4G SISO Ant2	18.45	20	0.014	1	0.014	Pass
WIFI 5.2G SISO Ant1	17.82	20	0.012	1	0.012	Pass

WIFI 5.2G SISO Ant2	19.08	20	0.016	1	0.016	Pass
WIFI 5.8G SISO Ant1	16.74	20	0.009	1	0.009	Pass
WIFI 5.8G SISO Ant2	17.49	20	0.011	1	0.011	Pass

Note: Minimum distance of 20cm is declared by the applicant.

Mode	Ant	Max. Conducted power including tune-up	Antenna Gain	Max. EIRP	R(cm)	S (mW/cm ²)	Total S (mW/cm ²)	MPE Limit (mW/cm ²)	MPE	Result
		(dBm)	(dBi)	(dBm)					Ratio	
WIFI 2.4G MIMO	1	15.69	0.46	16.15	20	0.008	0.012	1	0.012	Pass
	2	13.06	0.22	13.28	20	0.004				
WIFI 5.2G MIMO	1	9.14	2.79	11.93	20	0.003	0.019	1	0.019	Pass
	2	15.39	3.61	19.00	20	0.016				
WIFI 5.8G MIMO	1	11.26	2.79	14.05	20	0.005	0.020	1	0.020	Pass
	2	15.13	3.61	18.74	20	0.015				

Note: Minimum distance of 20cm is declared by the applicant.

Mode		S (mW/cm ²)	MPE Limit (mW/cm ²)	MPE Ratio	Total MPE	Total MPE Limit	Result
EN-DC	LTE	0.203	1	0.203	0.459	1	Pass
	NR	0.256	1	0.256			

Note: Minimum distance of 20cm is declared by the applicant.

3 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table (A) and Table (B). To comply with the MPE, the fraction of the MPE in terms of E², H² (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

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

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

Simultaneous Tx Combination	Configuration
1	WCDMA/LTE/NR+WLAN 2.4G
2	WCDMA/LTE/NR+WLAN 5G

WWAN	WLAN	Sum of rations	Limit
0.459	0.020	0.479	<1

According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.

Therefore the product also meets the requirements under multiple sources condition.

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