



RF EXPOSURE EVALUATION REPORT

APPLICANT : Cyrus Technology GmbH
PRODUCT NAME : ConnectedRide Navigator
MODEL NAME : CRN1
BRAND NAME : BMW Motorrad
FCC ID : 2AI3KCRN1
STANDARD(S) : FCC 47 CFR Part 2(2.1091)
RECEIPT DATE : 2023-04-10
TEST DATE : 2023-06-02
ISSUE DATE : 2023-07-28



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DIRECTORY

- 1. Technical Information..... 3
- 1.1 Applicant and Manufacturer Information..... 3
- 1.2 Equipment under Test (EUT) Description..... 3
- 1.3 Applied Reference Documents 6
- 2. Device Category and RF Exposure Limit 7
- 3. Test Equipment List..... 8
- 4. RF Output Power..... 8
- 5. RF Exposure Assessment 9
- Annex A General Information 12
- Annex B Conducted Power

Change History		
Version	Date	Reason for Change
1.0	2023-07-28	First edition



1. Technical Information

Note: Provide by applicant.

1.1 Applicant and Manufacturer Information

Applicant:	Cyrus Technology GmbH
Applicant Address:	Hergelsbendenstr. 49 D-52080 Aachen Germany
Manufacturer:	Cyrus Technology GmbH
Manufacturer Address:	Hergelsbendenstr. 49 D-52080 Aachen Germany

1.2 Equipment under Test (EUT) Description

Product Name:	ConnectedRide Navigator
EUT No.:	4#
Hardware Version:	80BMW-N1.0009
Software Version:	BMW-CRN-20230421-V1.0.0
Frequency Bands:	GSM 850: 824 MHz ~ 849 MHz GSM 1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 18: 815 MHz ~ 830 MHz LTE Band 19: 830 MHz ~ 845 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 29 (RX): 717 MHz ~ 728 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 40: 2300 MHz ~ 2400 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz



	WLAN 2.4GHz: 2412 MHz ~ 2472 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.3GHz: 5260 MHz ~ 5320 MHz WLAN 5.5GHz: 5500 MHz ~ 5720 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz	
Modulation Mode:	GSM/GPRS: GMSK EDGE: 8PSK WCDMA: QPSK, 16QAM LTE: QPSK, 16QAM, 64QAM 802.11b: DSSS 802.11a/g/n-HT20/HT40/ac-VHT20/40: OFDM BR+EDR: GFSK(1Mbps), $\pi/4$ -DQPSK(2Mbps), 8-DPSK(3Mbps) Bluetooth LE: GFSK(1Mbps)	
Multi-slot Class:	GPRS: Multi-slot Class 33 EDGE: Multi-slot Class 33	
Antenna Type:	WWAN: PIFA Internal WLAN: PIFA Antenna Bluetooth: PIFA Antenna	
Antenna Gain:	Frequency Bands	Antenna Gain (dBi)
	GSM 850	1.99
	GSM 1900	3.89
	WCDMA Band II	3.89
	WCDMA Band IV	2.73
	WCDMA Band V	1.99
	LTE Band 2	3.89
	LTE Band 4	2.73
	LTE Band 5	1.99
	LTE Band 7	1.69
	LTE Band 12	0.58
	LTE Band 13	1.74
	LTE Band 17	-0.25
	LTE Band 18	1.99
	LTE Band 19	1.99
LTE Band 25	3.89	
LTE Band 26	1.99	



	LTE Band 30	2.14
	LTE Band 38	1.16
	LTE Band 40	2.95
	LTE Band 41	2.19
	LTE Band 66	3.01
	LTE Band 71	0.67
	WLAN 2.4GHz	2.78
	WLAN 5.2GHz	3.88
	WLAN 5.3GHz	3.88
	WLAN 5.5GHz	3.88
	WLAN 5.8GHz	3.23
	Bluetooth 1	2.03
	Bluetooth 2	2.61
	Bluetooth 3	2.76

Note:

1. When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.
2. For a more detailed description, please refer to Specification or User’s Manual supplied by the applicant and/or manufacturer.



1.3 Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method determination /Remark
FCC 47 CFR Part 2(2.1091)	Radio Frequency Radiation Exposure Assessment: mobile devices	No deviation
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
Note 1: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		



2. Device Category and RF Exposure Limit

Per user manual, Based on 47CFR 2.1091, this device belongs to mobile device category with General Population/Uncontrolled exposure.

Mobile Devices:

47CFR 2.1091(b)

For purposes of this section, 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. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

General Population/Uncontrolled Exposure:

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

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)
(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

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



3. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial No./ SW Version	Calibration	
				Last Cal.	Due Date
R&S	Network Emulator	CMW500	165755	2023.02.09	2024.02.08
Anritsu	Network Emulator	MT8820C	6201274521	2023.02.09	2024.02.08

Note:

The EUT was connected to Base Station Anritsu MT8820C referred to the Setup Configuration. For the maximum power, it was established between EUT and Base Station with following setting:

1. For GPRS testing, the MS TX Level was set 5 for low frequency bands and 0 for high frequency bands. For EDGE testing, the MS TX Level was set 8 for low frequency bands and 2 for high frequency bands.
2. For WCDMA testing, Power Ctrl Mode = All Up bits, and the transmitted maximum output power was recorded.
3. For LTE testing, the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and different configurations.

4. RF Output Power

Remark:

1. The output power of GSM/WCDMA/LTE/WLAN refers to the annex B of this report.
2. The output power of WLAN/Bluetooth is derived from the report SZ23030238W04/05/06/07.

5. RF Exposure Assessment

➤ Standalone Transmission Assessment

<Standalone Antenna Transmission Assessment>

Bands	Frequency (MHz)	Tune-up Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	PD (mW/cm ²)	Limit Value (mW/cm ²)
GSM 850	836.4	22.5	1.99	281.19	0.056	0.558
GSM 1900	1880	19.5	3.89	218.27	0.043	1.0
WCDMA Band II	1880	23.0	3.89	488.65	0.097	1.0
WCDMA Band IV	1732.6	23.5	2.73	419.76	0.084	1.0
WCDMA Band V	836.4	22.5	1.99	281.19	0.056	0.558
LTE Band 2	1880	22.5	3.89	435.51	0.087	1.0
LTE Band 4	1732.5	21.5	2.73	264.85	0.053	1.0
LTE Band 5	836.5	22.0	1.99	250.61	0.050	0.558
LTE Band 7	2535	21.0	1.69	185.78	0.037	1.0
LTE Band 12	707.5	21.5	0.58	161.44	0.032	0.472
LTE Band 13	782	22.0	1.74	236.59	0.047	0.521
LTE Band 17	710	22.0	-0.25	149.62	0.030	0.473
LTE Band 18	822.5	22.0	1.99	250.61	0.050	0.548
LTE Band 19	837.5	22.0	1.99	250.61	0.050	0.558
LTE Band 25	1882.5	23.0	3.89	488.65	0.097	1.0
LTE Band 26	831.5	23.0	1.99	315.50	0.063	0.554
LTE Band 30	2310	21.5	2.14	231.21	0.046	1.0
LTE Band 38	2595	22.0	1.16	207.01	0.041	1.0
LTE Band 40	2310	21.5	2.95	278.61	0.055	1.0
LTE Band 41	2593	22.5	2.19	294.44	0.059	1.0
LTE Band 66	1745	21.5	3.01	282.49	0.056	1.0
LTE Band 71	683	23.0	0.67	232.81	0.046	0.455
WLAN 2.4GHz	2442	18.0	2.78	119.67	0.024	1.0
WLAN 5.2GHz	5180	16.0	3.88	97.27	0.019	1.0
WLAN 5.3GHz	5260	16.0	3.88	97.27	0.019	1.0
WLAN 5.5GHz	5600	17.0	3.88	122.46	0.024	1.0
WLAN 5.8GHz	5745	16.0	3.23	83.75	0.017	1.0
Bluetooth 1	2402	7.0	2.03	8.00	0.002	1.0
Bluetooth 2	2480	10.0	2.61	18.24	0.004	1.0
Bluetooth 3	2480	10.0	2.76	18.88	0.004	1.0

Note:

1. According to KDB 447498, MPE assessment is based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for



tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

2. MPE calculate method

$$S = PG/4\pi R^2$$

Where: S= Power density (in appropriate units, e.g. mW/cm²)

P = Time-average maximum tune-up power (in appropriate units, e.g. dBm)

G = numeric gain of the antenna (in appropriate units, e.g. dBi)

R = Separation distance to the centre of radiation of the antenna (20cm)

3. For GSM, the average power should be scaled with the correct factor:

Remark:

a. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots.
 The calculated method are shown as below:
 The duty cycle “x” of different time slots as below:
 1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
 Based on the calculation formula:
 Frame-averaged power = Burst averaged power + 10 log (x)
 So,
 Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
 Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
 Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
 Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01

b. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

No. of Slots:	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation:	1Up 4Down	2Up 3Down	3Up 2Down	4Up 1Down
Duty Cycle:	1:8.3	1:4.15	1:2.77	1:2.08
Correct Factor:	-9.03dB	-6.02dB	-4.26dB	-3.01dB

➤ **Simultaneous Transmission Assessment**

Multi-Band Simultaneous Transmission Consideration

Simultaneous Transmission Consideration	Position	Applicable Combination
	Hand/Body	WWAN+WLAN 2.4GHz/5GHz
		WWAN+Bluetooth 1/2/3
		WWAN+Bluetooth (1+2+3)
		WWAN+WLAN 2.4GHz+Bluetooth 1/2/3



		WWAN+WLAN 5GHz+Bluetooth 1/2/3
		WWAN+WLAN 2.4GHz+Bluetooth (1+2+3)
		WWAN+WLAN 5GHz+Bluetooth (1+2+3)

- This device contains transmitters that may operate simultaneously, therefore simultaneous transmission analysis is required.
- The worst case for the WWAN+WLAN 2.4GHz+Bluetooth (1+2+3) and WWAN+WLAN 5GHz+Bluetooth (1+2+3) mode will be calculated for transmitting simultaneously.
Formula: $Result = Power\ density_1 / limit_1 + Power\ density_2 / limit_2 + Power\ density_3 / limit_3 + \dots < 1.$
a) WWAN+WLAN 2.4GHz+Bluetooth (1+2+3)

Transmission Bands	Power Density/ SAR	Limit	Simultaneous Transmission Result
WWAN	0.063	0.554	0.148
WLAN 2.4GHz	0.024	1.0	
Bluetooth 1	0.002	1.0	
Bluetooth 2	0.004	1.0	
Bluetooth 3	0.004	1.0	

a) WWAN+WLAN 5GHz+Bluetooth (1+2+3)

Transmission Bands	Power Density/ SAR	Limit	Simultaneous Transmission Result
WWAN	0.063	0.554	0.148
WLAN 5GHz	0.024	1.0	
Bluetooth 1	0.002	1.0	
Bluetooth 2	0.004	1.0	
Bluetooth 3	0.004	1.0	

➤ **Conclusion**

According to FCC 47 CFR Part 2(2.1091), this device complies with human exposure basic restrictions.



Annex A General Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Address:	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

The FCC designation number is CN1192, the test firm registration number is 226174.

Note:

The main report is end here and the other Annex B will be submitted separately.

————— END OF REPORT —————