R F – T E S T R E P O R T

- Human Exposure -

Type / Model Name	:	BMW FBD5S
Product Description	:	UWB LIN gateway for comfort access function in vehicles
Applicant	:	Continental Automotive GmbH
Address	:	Siemensstraße 12
		93055 REGENSBURG, GERMANY
Manufacturer	:	Continental Automotive GmbH
Address	:	Siemensstraße 12
		93055 REGENSBURG, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : T46615-00-07FX	14. June 2021 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

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FCC ID: KR5FBD5S IC: 7812D-FBD5S

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ATTACHMENT A1 and A2 as separate supplement

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1091	Radiofrequency radiation exposure evaluation: **mobile devices**.
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: **portable devices**.
KDB 447498 D01 v06	RF Exposure procedures and equipment authorisation policies for mobile and portable devices, October 23, 2015.
KDB 865664 D01 v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz, August 7, 2015.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
RSS-102, issue 5, March 2015, incl. Amendment 1, February 2021	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Health Canada Notice, January 2021	Localized human exposure limits for radiofrequency fields in the range of 6 GHz to 300 GHz
ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 Photo documentation of the EUT – See ATTACHMENT A1 and A2

2.4 Equipment type, category

UWB device, portable exposure conditions

2.5 Short description of the equipment under test (EUT)

The FBD5s is a wireless UWB transceiver with LIN gateway for comfort access function in vehicles. Four FBD5s anchors are mounted at the outer body of a vehicle.

Two additional anchors (FBD5, as described in an associated filing for FCC ID: KR5FBD5) are mounted inside the vehicle and provide additional BLE functionality for data transfer and security purposes between smartphone or ID tag. NOTE: the BLE functionality/transmitter is not present in the FBD5s device as described in this filing. The device as described in this filing only contains an UWB transmitter.

The anchors are connected to a central control unit and paired with a smartphone or wearable ID tag. The FBD5s can also communicate among each other for an initialization procedure. After initialization and training procedure the distance between FBD5s and smartphone or ID tag is measured and the position in relation to the vehicle is determined. The vehicle is unlocked, locked or started in case the smartphone or ID tag is in a permitted area around or inside the vehicle.

Number of tested samples:	1
Serial number:	FBD5S_TX_MPSD (continuous transmitting, conducted sample),
Firmware version:	A3C04888905
UWB driver version:	50D2C100_ATIC234

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.6 Variants of the EUT

There are no variants

2.7 Operation frequency and channel plan

Channel plan UWB:

Channel number	f_c (MHz)
Channel 5	6489.6
Channel 6	6988.8
Channel 8	7488.8
Channel 9	7987.2

2.8 Transmit operating modes

Modulation: variable pulse position modulation (PPM) in combination with binary phase shift keying (BPSK).

Data rate: 6.8 Mbit/s

2.8.1 Antennas

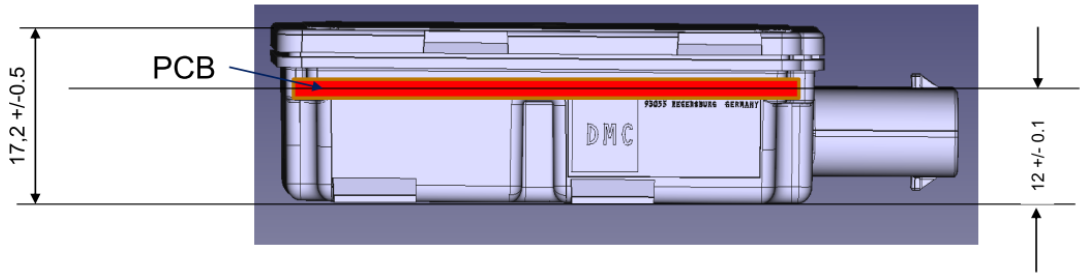
The following antennas shall be used with the EUT:

Number	Characteristic	Type	Plug	f-range (GHz)	Max. Gain (dBi)
1	Omni	PCB antenna	none	3.1 – 10.6	5.9
2	Omni	PCB antenna	none	3.1 – 10.6	5.4

2.8.2 Minimum separation distance between the radiating element(s) and any person

The applicant has provided the following drawing which indicates the inherent miminum separation distance between the radiating element(s) and any person:

FBD5s: Position of PCB (in mm)



As shown on the drawing above, the inherent minimum separation distance between the radiating element(s) and any person is stated as being 12 ± 0.1 mm.

2.9 Power supply system utilised

Power supply voltage, V_{nom} : 12 VDC
Power supply voltage (alternative) : 6 – 16 VDC

3 TEST RESULT SUMMARY

FCC KDB publication	RSS Rule Part	Description	Result
KDB 447498, section 4.3.2	RSS 102, section 3	SAR test exclusion consideration	passed

3.1 Final assessment

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 04 August 2020

Testing concluded on : 15 April 2021

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document
2021.06.15 09:10:37 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

I am the author of this document
2021.06.14 16:41:45 +02'00'

Franz-Xaver Schrettenbrunner
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 °C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

5 HUMAN EXPOSURE

For test instruments and accessories used see section 6 Part **CPC 3**.

5.1 Test exclusion considerations FCC

5.1.1 Applicable standard

According to RF exposure guidance:
Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

5.1.2 UWB transmitter

The max conducted average power of the EUT is measured with a power meter.

Averaged conducted power:	-26.9 dBm	0.002 mW
Tune-up tolerance:	+ 1.5 dB	
Antenna gain:	+ 5.9 dB	
EIRP:	**-19.5 dBm**	**0.011 mW**

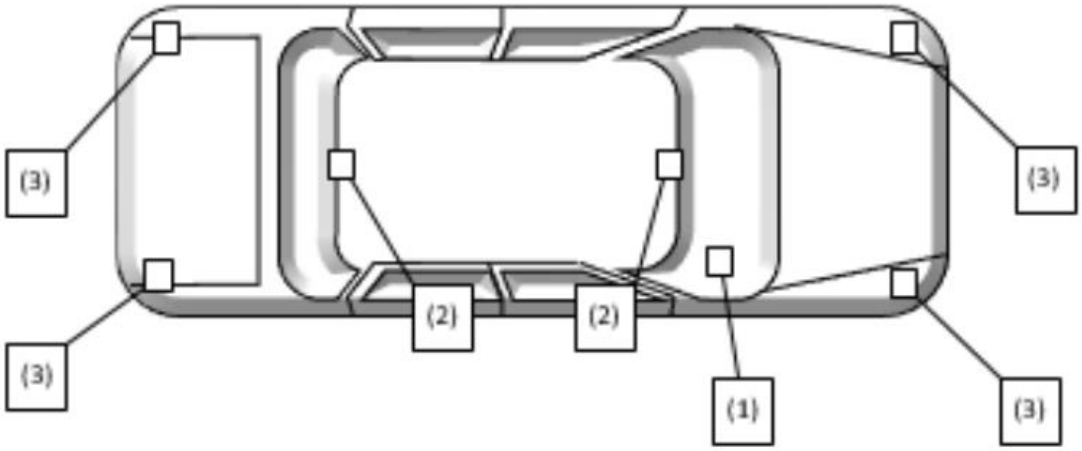
According to TCB Workshop November 2019 RF Exposure Policy Updates dated November 13th 2019, specifically slide 11:

Test exclusion based on 1 mW may be used now with the portable device f > 6 GHz FCC MPE power density limits.

Conclusion: The device is compliant with the Test Exclusion requirement of 1 mW.

5.1.3 Determination of the test exclusion threshold for simultaneous transmission

The EUT is intended to be used in vehicles. A maximum of 4 EUT's may be fitted into the vehicle at the following locations indicated by the positions (3):



Two other devices are fitted in the positions indicated by (2). These devices are described in a corresponding filing for FCC ID: KR5FBD5. Each of these devices contains an UWB transmitter similar to the UWB transmitter as described in this filing and also contain 2 BLE transmitters.

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The total system thus may contain 6 UWB transmitters and 2 BLE transmitters. While it is physically impossible that a person may be exposed to RF electromagnetic fields from all transmitters simultaneously and at the same close distance the following is considered for simultaneous transmissions in the total system:

The UWB transmitter as described in this filing, given its conducted RF output power of 0.00283 mW (including tune-up tolerance) and EIRP of 0.011 mW (including tune-up tolerance), is excluded from routine RF exposure evaluation in a stand-alone configuration.

The UWB transmitter as described in the filing for FCC ID: KR5FBD5, given its conducted RF output power of 0.00283 mW (including tune-up tolerance) and EIRP of 0.010 mW (including tune-up tolerance), is also excluded from routine RF exposure evaluation in a stand-alone configuration.

The aggregate RF output power (including tune-up tolerances) for 6 UWB transmitters (4 UWB transmitters as described in this filing and 2 UWB transmitters as described in the filing for FCC ID: KR5FBD5), assuming simultaneous transmission conditions, would be 6 x 0.00283 mW = 0.01698 mW (conducted, 1.698% of the 1 mW exclusion limit) and (4 x 0.011 mW) + (2 x 0.010 mW) = 0.064 mW (EIRP, 6.4% of the 1 mW exclusion limit).

Conclusion 1: A system consisting of 6 UWB transmitters which transmit simultaneously (4 transmiters as described in this filing and 2 transmitters as described in the filing for FCC ID: KR5FBD5) is still excluded from routing RF exposure evaluation as per "TCB Workshop November 2019 RF Exposure Policy Updates dated November 13th 2019, specifically slide 11" because the aggregrate RF output power (either conducted or EIRP) is at 1.698% and 6.4% respectively of the 1 mW exclusion limit.

The total system contains 2 devices which also contain a BLE transmitter. These devices are described in the filing for FCC ID: KR5FBD5. Please find below a summary of the worst-case RF exposure evaluation results (based on conducted RF output power and EIRP) for simultaneous transmissions of the two devices which contain a BLE transmitter (the details are described in the RF exposure report for the filing for FCC ID: KR5FBD5):

Transmitter	Transmitter	Conducted power on channel	Separation distance	Frequency	Factor for 1g SAR	SAR estimate	
Number	Model number	mW (incl. tune-up tolerance)	mm	GHz	x	W/kg	
1	FBD5	2.900	10.0	2.4800	7.5	0.06089233	
2	FBD5	2.900	10.0	2.4800	7.5	0.06089233	
					Total SAR estimate	0.122	W/kg
					Limit	0.400	W/kg
					Total SAR estimate as a percentage of the limit	30.446	%

Transmitter	Transmitter	EIRP on channel	Separation distance	Frequency	Factor for 1g SAR	SAR estimate	
Number	Model number	mW (incl. tune-up tolerance)	mm	GHz	x	W/kg	
1	FBD5	6.100	10.0	2.4800	7.5	0.12808386	
2	FBD5	6.100	10.0	2.4800	7.5	0.12808386	
					Total SAR estimate	0.256	W/kg
					Limit	0.400	W/kg
					Total SAR estimate as a percentage of the limit	64.042	%

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Conclusion 2: When combining the calculated percentages of the exclusion limits the total would be 32.14% of the limits when considering conducted RF output power and 70.44% of the limits when considering EIRP. The separation distance for the UWB transmitters is not relevant since the 1 mW exclusion limit is valid for any given separation distance between the radiating element(s) and any person, the 10 mm separation distance used in the SAR estimation calculations for the two BLE transmitters is the inherent separation distance between the radiating element(s) of the device and any person which is ensured by the design of the enclosure. For details of the devices containing the BLE transmitter see the filing for FCC ID: KR5FBD5.

Remarks: None

5.2 Localized human exposure for devices operating from 6 GHz to 300 GHz

5.2.1 Applicable standard

Health Canada Notice: Localized human exposure limits for radiofrequency fields in the range of 6 GHz to 300 GHz, January 2021.

Table 2: Reference Levels for local electromagnetic field exposure above 6 GHz up to 300 GHz:

Exposure scenario	Exposure duration (t)	Local incident energy density [kJ/m²]	Local incident power density [W/m²]
Controlled Environment	0 sec < t < 360 sec	$275/f_G^{0.177}$ X $0.36[0.05+0.95(t/360)^{0.5}]$	n/a
	t ≥ 6 min	n/a	$275/f_G^{0.177}$
Uncontrolled Environment	0 sec < t < 360 sec	$55/f_G^{0.177}$ X $0.36[0.05+0.95(t/360)^{0.5}]$	n/a
	t ≥ 6 min	n/a	$55/f_G^{0.177}$

Local incident power density limit at EUT's frequency of 6.5 GHz 39.5 W/m²
Local incident power density limit at EUT's frequency of 8 GHz 38.1 W/m²

5.2.2 Conclusion according to Health Canada Notice: Localized human exposure limits for radiofrequency fields in the range of 6 GHz to 300 GHz, January 2021

The max conducted average power of the EUT is measured with a power meter.

Averaged conducted power: -26.9 dBm 0.002 mW
Tune-up tolerance: + 1.5 dB
Antenna gain: + 5.9 dB

EIRP: **-19.5 dBm** **0.011 mW (0.000011 W)**

According to the manufacturer, and as shown in section 2.8.2 of this RF exposure evaluation, the minimum and inherent separation distance between the radiating element(s) of the EUT and any person is 12 mm (0.012 meters).

EIRP (W)	S (W/m²)	Limit S (W/m²)	Margin (W/m²)	Exposure ratio (%)
0.000011	0.0061	38.1	-38.1	0.00

The requirements are **FULFILLED.**

Remarks: None.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPC 3	NRP18T	02-02/07-19-001	02/11/2021	02/11/2020		