

Report on the FCC and IC Testing of the
 APTIV Services Deutschland GmbH
 Vehicle Radar. Model: SRR7PB
 In accordance with CFR 47, Part 1 §1.1310 and
 Part 2, § 2.1093 and RSS-210

Prepared for: APTIV Services Deutschland GmbH
 Am Technologiepark 1
 42119 Wuppertal
 Germany

FCC ID: LTQSRR7PB
 IC: 3659A-SRR7PB



Product Service

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COMMERCIAL-IN-CONFIDENCE

Date: 2023-12-15
 Document Number: TR-713304720-06 | Revision 0

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|----------------------|----------------|------------|---|
| Project Management | Martin Steindl | 2023-12-15 | <i>Steindl Martin</i> SIGN-ID 864780 |
| Authorised Signatory | Alex Fink | 2023-12-15 | <i>Fink</i> SIGN-ID 864825 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Parts 1 and 2 and RSS-102. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|-----------------|----------------|------------|---|
| Testing | Martin Steindl | 2023-12-15 | <i>Steindl Martin</i> SIGN-ID 864782 |

Laboratory Accreditation Laboratory recognition ISED Canada test site registration
 DAkkS Reg. No. D-PL-11321-11-03 Registration No. BNetzA-CAB-16/21-15 3050A-2
 DAkkS Reg. No. D-PL-11321-11-04

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Parts 1 and 2 and ISED RSS-102, Issue 5 + Amd. 1 (February 2021)

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Summary

| | |
|---|---|
| Prüfergebnisse / Test Results | Auftragsnummer / Order No. NA |
| Die Prüfungen wurden nach folgenden Vorschriften durchgeführt: <i>Tests were performed according to:</i> CFR 47, Parts 1 and 2 | |
| Durchgeführte Prüfung Test performed | Prüfergebnis Test result |
| Radiated Power | Pass |

Bemerkungen / Remarks:

Die Prüfergebnisse beziehen sich ausschließlich auf das zur Prüfung vorgestellte Prüfmuster. Ohne schriftliche Genehmigung des Prüflabors darf der Prüfbericht auszugsweise nicht vervielfältigt werden. *The test results relate only to the individual item which has been tested. Without the written approval of the test laboratory this report may not be reproduced in extracts.*



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1 Administrative Data

Application details

| | |
|-----------------------|---|
| Applicant: | APTIV Services Deutschland GmbH Am Technologiepark 1 42119 Wuppertal Germany |
| Contact person: | Ms. Ljiljana TRIVIC |
| Intercompany contact: | TÜV SÜD Product Service GmbH GMA Straubing Mr. Thomas Ring |
| Order number: | NA |

| | |
|------------------------------|--------------------------|
| Receipt of EUT: | 2023-09-25 |
| Return of EUT: | --- |
| Date(s) of test: | 2023-09-26 to 2023-10-05 |
| Note(s): | --- |
| Responsible for testing: | Mr. Martin Steindl |
| Responsible for test report: | Mr. Martin Steindl |
| Test report checked by: | Mr. Matthias Stumpe |

Report details

| | |
|----------------|-----------------|
| Report number: | TR-713304720-06 |
| Revision: | 0 |
| Issue date: | 2023-12-15 |



2 Details about the Test Laboratory

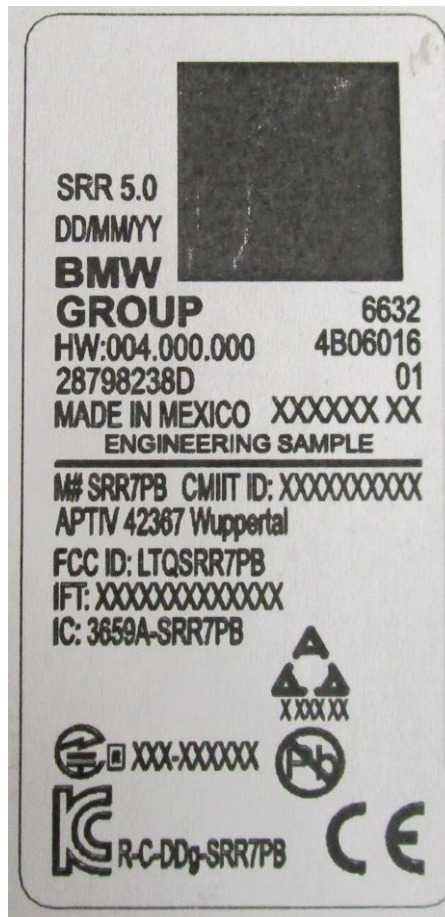
| Details about the Test Laboratory | |
|---|--|
| Company name: | TÜV SÜD Product Service GmbH |
| Address: | Äußere Frühlingstraße 45 D-94315 Straubing Germany |
| Laboratory accreditation: | DAkKS Registration No. D-PL-11321-11-03 DAkKS Registration No. D-PL-11321-11-04 |
| Laboratory recognition: | Registration No. BNetzA-CAB-16/21-15 |
| Industry Canada test site registration: | 3050A-2 |
| Contact: | Mr. Markus Biberger |
| | Phone: +49 9421 5522-0 Fax: +49 9421 5522-99 |



3 Description of the Equipment Under Test

| Equipment characteristics | |
|-----------------------------|--|
| Type designation: | SRR7PB |
| Parts of the system: | Radar ECU |
| Options and accessories: | --- |
| Type of equipment: | Vehicle Radar |
| Serial number: | NA |
| Manufacturer: | APTIV Services Deutschland GmbH |
| Hardware version: | N/A |
| Software version: | N/A |
| Drawing number: | --- |
| Build status: | --- |
| Power supply: | Battery supply (regulated lead-acid) Nominal: 12.0 V DC Minimum: 9 V DC Maximum: 16.0 V DC Nominal frequency: N/A - DC |
| Highest internal frequency: | |

Marking Plate(s)



Technical Description

The Device Under Test (DUT) is a 76 – 77 GHz vehicular radar. The device employs a dynamic chirp modulated transmit array. Multiple receive antennas are used to determine target angular resolution through digital beam forming. When installed on a vehicle, the device will operate when the vehicle is running. The nominal operating voltage is DC 12.0 V.

Modulation characteristics:

Non-pulsed radar

The radar is a FMCW radar; modulation type is sawtooth.

4 Operation Mode and Configuration of EUT

Operation Mode(s)

The operating modes were tested with a single modulation, as provided by the manufacturer.

List of ports and cables

| No. | Description | Classification ¹ | Cable type | Cable length | |
|-----|--------------------------------|-----------------------------|------------|--------------|----------------------|
| | | | | used | maximum ² |
| D1 | DC 12 V supply | dc power | Unshielded | 2 m | < 3 m |
| S1 | Wiring harness (CAN, Ethernet) | signal/control port | Unshielded | 2 m | < 3 m |

List of devices connected to EUT

| No. | Description | Type designation | Serial no. or ID | Manufacturer |
|-----|-------------|------------------|------------------|--------------|
| --- | --- | --- | --- | --- |

List of support devices

| No. | Description | Type designation | Serial no. or ID | Manufacturer |
|-----|-------------------|------------------|------------------|--------------|
| 1 | CAN/LIN-Interface | VN1640A | | Vector |
| 2 | Notebook | Latitude 5480 | --- | Dell |

¹ Ports shall be classified as ac power, dc power or signal/control port.

² As specified by applicant

5 Referenced Regulations

| <i>Publication</i> | <i>Title</i> |
|--|---|
| CFR 47, Part 1 | Code of Federal Regulations Part 1 (Practice and Procedure) of the Federal Communications Commission (FCC) |
| CFR 47, Part 2 | Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communications Commission (FCC) |
| CFR 47, Part 95, Subpart M | Code of Federal Regulations Part 95 (Personal Radio Services), Subpart M (76 – 77 GHz Band Radar Service) of the Federal Communications Commission (FCC) |
| RSS-102, Issue 5 (March 2015) + Amendment 1 (February 2021) | Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) |
| RSS-251, Issue 2 (July 2018) | Vehicular Radar and Airport Fixed or Mobile Radar in the 76 – 81 GHz Frequency band |
| RSS-Gen, Issue 5 (April 2018) + Amendment 1 (March 2019) + Amendment 2 (February 2021) | General Requirements for Compliance of Radio Apparatus |
| ANSI C63.4-2014 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI C63.10-2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |



6 Test Results

CFR 47, Part 1

| <i>Section(s)</i> | <i>Test performed</i> | <i>Page</i> | <i>Test Result</i> |
|-------------------|-----------------------|-------------|--------------------|
| § 1.1310 | RF Exposure Value | 11 | Test passed |

KDB 447498 D04 V01

RSS-210

| <i>Section(s)</i> | <i>Test performed</i> | <i>Page</i> | <i>Test Result</i> |
|-------------------|-----------------------|-------------|--------------------|
| 2.5.1, 2.5.2, 3 | RF Exposure Value | 11 | Test passed |



6.1 Radiated Power

| | |
|--------------|----------------------------------|
| Date of Test | 2023-09-26 |
| Operator | Martin Steindl |
| Test Site | Fully anechoic room, cabin no. 2 |

| Test Result | |
|-------------------------------------|-------------------|
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

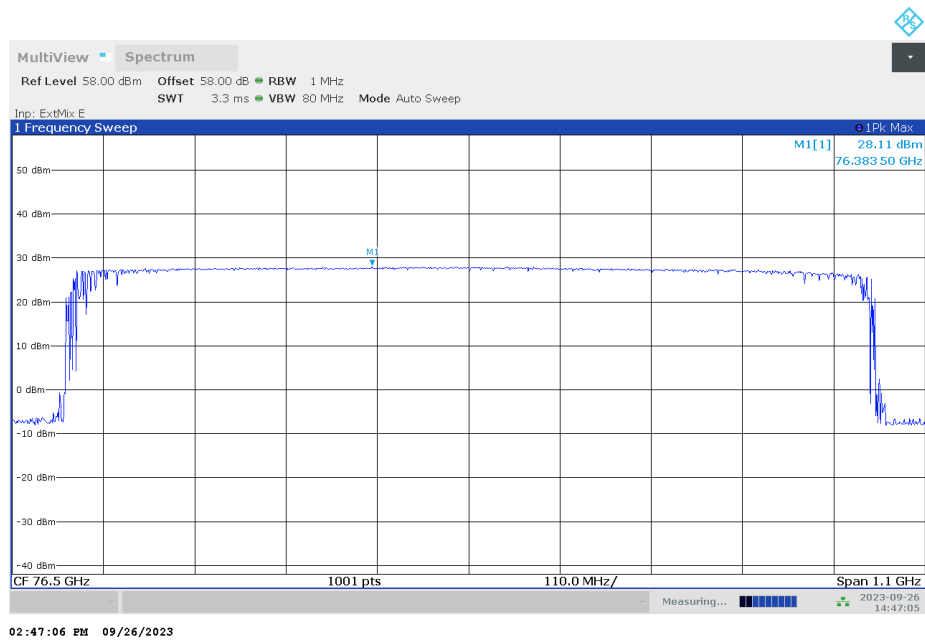
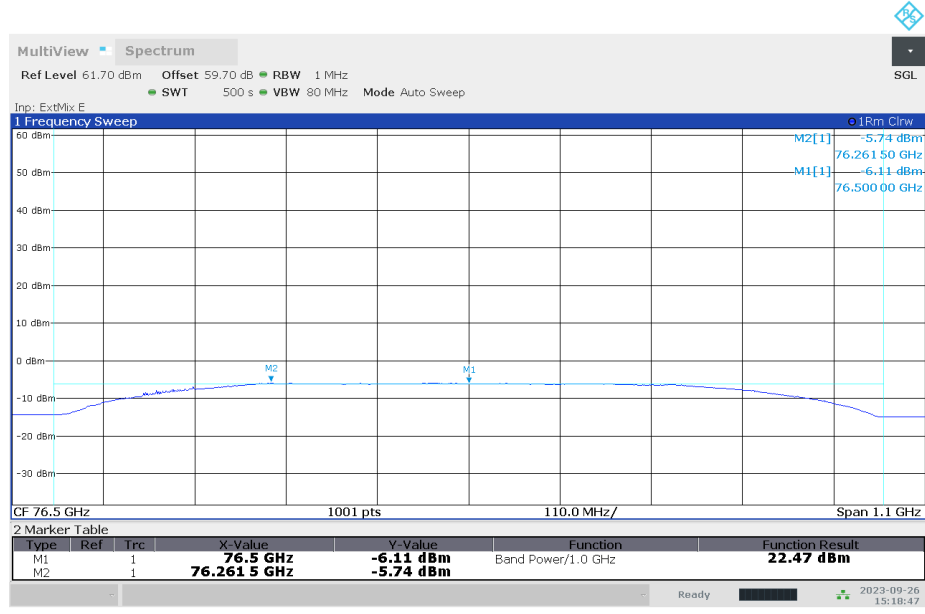
| | |
|----------------------|---------|
| Barometric pressure: | 983 hPa |
| Relative humidity: | 51 % |
| Ambient temperature: | 24 °C |

| | |
|-----------------|--|
| Specifications: | Part 1, § 1.1310 RSS-102 |
| Description: | The test was performed in accordance with KDB 447498 D04 V01. Average RF power test was performed according to ANSI C63.10, section 10.3.5. |
| Operation mode: | Transmitting continuously on frequency with modulation bandwidth as stated in table below |
| Comment : | Test was performed as radiated test. The test distance was 3 m. A correction factor of -58 dB and mixer conversion loss table were used to account for the test antenna gain, free-space loss and external mixer loss. The evaluation distance for power density of 20 cm was declared by the applicant. For details on tests refer to test reports TR-713304720-00 and TR-713304720-03. |

| Detector | E.I.R.P. | | Power Density (20 cm) | Limit | Note |
|----------|-----------|-----------|--------------------------|------------------------|------|
| Average | 22.47 dBm | 176.60 mW | 0.035 mW/cm ² | 1.0 mW/cm ² | 2 |
| Peak | 28.11 dBm | 647.14 mW | 0.129 mW/cm ² | 1.0 mW/cm ² | |

| | | | | | |
|---------------------------------|--|--|--|--|--|
| Note(s): | | | | | |
| 1 Maximum RMS value | | | | | |
| 2 Integrated value within 1 GHz | | | | | |

+
Plots taken during test



Operating mode – Continuously Transmitting - 12.0 V DC power supply

7 Measurement Uncertainty Values

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to EN 55016-4-2: 2011 + A1 + A2 + AC and CISPR16-4-2: 2011 + A1 + A2 + Cor1 (UCISPR). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

For a 95% confidence level, the measurement uncertainties for defined systems are:

| Radio Testing | | | |
|---|------|-----------------------|------|
| Test Name | kp | Expanded Uncertainty | Note |
| Occupied Bandwidth | 2.0 | ±1.14 % | 2 |
| RF-Frequency error | 1.96 | ±1 · 10 ⁻⁷ | 7 |
| RF-Power, conducted carrier | 2 | ±0.079 dB | 2 |
| RF-Power uncertainty for given BER | 1.96 | +0.94 dB / -1.05 | 7 |
| RF power, conducted, spurious emissions | 1.96 | +1.4 dB / -1.6 dB | 7 |
| RF power, radiated | | | |
| 25 MHz – 4 GHz | 1.96 | +3.6 dB / -5.2 dB | 8 |
| 1 GHz – 18 GHz | 1.96 | +3.8 dB / -5.6 dB | 8 |
| 18 GHz – 26.5 GHz | 1.96 | +3.4 dB / -4.5 dB | 8 |
| 40 GHz – 170 GHz | 1.96 | +4.2 dB / -7.1 dB | 8 |
| Spectral Power Density, conducted | 2.0 | ±0.53 dB | 2 |
| Maximum frequency deviation | | | |
| 300 Hz – 6 kHz | 2 | ±2,89 % | 2 |
| 6 kHz – 25 kHz | 2 | ±0.2 dB | 2 |
| Maximum frequency deviation for FM | 2 | ±2,89 % | 2 |
| Adjacent channel power 25 MHz – 1 GHz | 2 | ±2.31 % | 2 |
| Temperature | 2 | ±0.39 K | 4 |
| (Relative) Humidity | 2 | ±2.28 % | 2 |
| DC- and low frequency AC voltage | | | |
| DC voltage | 2 | ±0.01 % | 2 |
| AC voltage up to 1 kHz | 2 | ±1.2 % | 2 |
| Time | 2 | ±0.6 % | 2 |

| Radio Interference Emission Testing | | | |
|---|----|----------------------|------|
| Test Name | kp | Expanded Uncertainty | Note |
| Conducted Voltage Emission | | | |
| 9 kHz to 150 kHz (50Ω/50μH AMN) | 2 | ± 3.8 dB | 1 |
| 150 kHz to 30 MHz (50Ω/50μH AMN) | 2 | ± 3.4 dB | 1 |
| 100 kHz to 200 MHz (50Ω/5μH AMN) | 2 | ± 3.6 dB | 1 |
| Discontinuous Conducted Emission | | | |
| 9 kHz to 150 kHz (50Ω/50μH AMN) | 2 | ± 3.8 dB | 1 |
| 150 kHz to 30 MHz (50Ω/50μH AMN) | 2 | ± 3.4 dB | 1 |
| Conducted Current Emission | | | |
| 9 kHz to 200 MHz | 2 | ± 3.5 dB | 1 |
| Magnetic Fieldstrength | | | |
| 9 kHz to 30 MHz (with loop antenna) | 2 | ± 3.9 dB | 1 |
| 9 kHz to 30 MHz (large-loop antenna 2 m) | 2 | ± 3.5 dB | 1 |
| Radiated Emission | | | |
| Test distance 1 m (ALSE) | | | |
| 9 kHz to 150 kHz | 2 | ± 4.6 dB | 1 |
| 150 kHz to 30 MHz | 2 | ± 4.1 dB | 1 |
| 30 MHz to 200 MHz | 2 | ± 5.2 dB | 1 |
| 200 MHz to 2 GHz | 2 | ± 4.4 dB | 1 |
| 2 GHz to 3 GHz | 2 | ± 4.6 dB | 1 |
| Test distance 3 m | | | |
| 30 MHz to 300 MHz | 2 | ± 4.9 dB | 1 |
| 300 MHz to 1 GHz | 2 | ± 5.0 dB | 1 |
| 1 GHz to 6 GHz | 2 | ± 4.6 dB | 1 |
| Test distance 10 m | | | |
| 30 MHz to 300 MHz | 2 | ± 4.9 dB | 1 |
| 300 MHz to 1 GHz | 2 | ± 4.9 dB | 1 |
| Radio Interference Power | | | |
| 30 MHz to 300 MHz | 2 | ± 3.5 dB | 1 |
| Harmonic Current Emissions | | | |
| | | | 4 |
| Voltage Changes, Voltage Fluctuations and Flicker | | | |
| | | | 4 |

| Immunity Testing | | | |
|--|------|----------------------|------|
| Test Name | kp | Expanded Uncertainty | Note |
| Electrostatic Discharges | | | 4 |
| Radiated RF-Field | | | |
| Pre-calibrated field level | 2 | +32.2 / -24.3 % | 5 |
| Dynamic feedback field level | 2.05 | +21.2 / -17.5 % | 3 |
| Electrical Fast Transients (EFT) / Bursts | | | 4 |
| Surges | | | 4 |
| Conducted Disturbances, induced by RF-Fields | | | |
| via CDN | 2 | +15.1 / -13.1 % | 6 |
| via EM clamp | 2 | +42.6 / -29.9 % | 6 |
| via current clamp | 2 | +43.9 / -30.5 % | 6 |
| Power Frequency Magnetic Field | 2 | +20.7 / -17.1 % | 2 |
| Pulse Magnetic Field | | | 4 |
| Voltage Dips, Short Interruptions and Voltage Variations | | | 4 |
| Oscillatory Waves | | | 4 |
| Conducted Low Frequency Disturbances | | | |
| Voltage setting | 2 | ± 0.9 % | 2 |
| Frequency setting | 2 | ± 0.1 % | 2 |
| Electrical Transient Transmission in Road Vehicles | | | 4 |

Note 1:

The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 2:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 3:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2.05$, providing a level of confidence of $p = 95.45\%$

Note 4:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence.

Note 5:

The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 6:

The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 7:

The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$

Note 8:



The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$



8 Revision History

| Revision History | | | |
|------------------|-------------|------------------|----------------------|
| <i>Revision</i> | <i>Date</i> | <i>Issued by</i> | <i>Modifications</i> |
| 0 | 2023-12-15 | M. Steindl | First Edition |