

GOODYEAR

Test Report TW-TT20-MT2813

Test World Oy is a testing laboratory No: T236 accredited by FINAS Finnish Accreditation Service according to ISO17025:2017

Recognized Expert by Traficom (Finnish Transport and Communications Agency) for studded tyre approvals

Designated as a Technical Service by RDW for EC/92/23, ECE30, ECE54, ECE108, ECE109, ECE117

| Test World Oy | Testitie 1, 99800 Ivalo | Finland |

| Tel: +358 (0)44 778 8800 | www.testworld.fi |

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1. Objective

The objective of the study was to test the performance of Goodyear Arctic 2 against competitors and the customer's old model Goodyear Ice Arctic. The order was placed to Test World by Goodyear S.A..

2. Tyres

2.1. Tyre specifications

| Brand | Specification | Size | DOT |
|--------------|----------------------|-------------------|-----------------|
| Goodyear | UltraGrip Arctic 2 | 225/55R17 101T XL | A500 PN1R 4120 |
| Goodyear | UltraGrip Ice Arctic | 225/55R17 101T XL | A500 JCER 3119 |
| Continental | IceContact 2 | 225/55R17 101T XL | CP00 CUK4 4119 |
| Michelin | X-Ice North 4 | 225/55R17 101T XL | 22 8K 09MX 3920 |
| Nokian Tyres | Hakkapeliitta 9 | 225/55R17 101T XL | 60C7 5420 |

2.2. Tyre purchases

All tyres except Goodyear UltraGrip Arctic 2 were located and purchased by Test World. The Goodyear UltraGrip Arctic 2 was not available in the market and thus received from the customer.

2.3. Tyre preparations

Prior to testings, tyres were mounted, balanced and run-in 500 km by Test World. After running in all tyres were cleaned and checked before entering tests.

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2.4. Tyre photos

| | |
|---|---|
|  |  |
| Goodyear UltraGrip Arctic 2 | Goodyear UltraGrip Ice Arctic |
|  |  |
| Continental IceContact 2 | Michelin X-Ice North 4 |
|  | |
| Nokian Tyres Hakkapeliitta 9 | |

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3. Test basics

3.1. Test car

All tests were done using the following test vehicle

| Make | Model | Transmission | Gearbox |
|------|-------|------------------|-----------|
| BMW | 530d | Rear wheel drive | Automatic |

3.2. Car load

The test car weights were the following level.

| Front left | Front right | Rear left | Rear right |
|------------|-------------|-----------|------------|
| 490 kg | 470kg | 460 kg | 450 kg |

3.3. Rims

All tests were done using the 7.5 x 17" ET27 rims.

3.4. Tyre pressures

Tyres were pressurized to 2.2 bar, according to the vehicle manufacturer recommendations. Tyre pressures were always checked before tests.

3.5. Test devices

The following test devices were used for measurements

| Item | Measuring device | Serial |
|-----------------|------------------|--------------|
| Temperature | Fluke 52-II | TM-LM12 |
| Speed, timing | Vbox 3i | 054182 |
| Weight | Dini Argeo | 635432B1..B4 |
| Tyre pressure | Wika | TW-IPM-028 |
| Snow hardness | CTI Penetrometer | TW-PM004 |
| Stud protrusion | Mitutoyo | TW-SP002 |

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4. Tests and measurements

4.1. Tests

The following tests were included in the program.

| Test | Temperature target |
|-------------------|--------------------|
| Ice braking | -10 °C ... -15 °C |
| Ice acceleration | -10 °C ... -15 °C |
| Ice handling | -10 °C ... -15 °C |
| Snow braking | -10 °C ... -15 °C |
| Snow acceleration | -10 °C ... -15 °C |
| Snow handling | -10 °C ... -15 °C |
| Wet braking | +1 °C ... +5 °C |
| Dry braking | +1 °C ... +5 °C |

All tests were carried out by Test World engineers and drivers. Ice and snow tests were done in on Test World outdoor winter test tracks in Ivalo, Finland. Wet and dry tests were done in Test World indoor test facilities in Ivalo, Finland. All tests were done in January 2019.

4.2. Measurements

Stud protrusions were measured before ice tests after each test day. Ambient and surface temperatures were recorded during tests.

4.3. Test data

The complete test and measurement data has been delivered to the customer in MS Excel format.

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5. Results summary

5.1. Ice test results

5.1.1. Ice braking

| <i>Tyre</i> | <i>Index</i> | <i>Stud protrusion</i> |
|---------------------------|--------------|------------------------|
| Goodyear Arctic 2 | 127.9 | 1.07 mm |
| Michelin X-Ice North 4 | 113.1 | 1.02 mm |
| Goodyear Ice Arctic | 100.0 | 1.09 mm |
| Nokian Hakkapeliitta 9 | 89.8 | 0.95 mm |
| Continental Ice Contact 2 | 78.5 | 0.98 mm |

Test date: 19.1.2021

Test location: Test World, Airport #1

Test date: 19.1.2021

Test method: ABS braking

Test speed: 25-5 km/h

Ambient temperature: -10 °C

Surface temperature: -10 °C

5.1.2. Ice acceleration

| <i>Tyre</i> | <i>Index</i> | <i>Stud protrusion</i> |
|---------------------------|--------------|------------------------|
| Michelin X-Ice North 4 | 150.3 | 1.05 mm |
| Goodyear Arctic 2 | 134.1 | 1.15 mm |
| Nokian Hakkapeliitta 9 | 108.9 | 0.98 mm |
| Continental Ice Contact 2 | 105.4 | 1.03 mm |
| Goodyear Ice Arctic | 100.0 | 1.14 mm |

Test date: 19.1.2021

Test location: Test World, Airport #1

Test method: TCS acceleration

Test speed: 8-25 km/h

Ambient temperature: -10 °C

Surface temperature: -10 °C

5.1.3. Ice handling

| <i>Tyre</i> | <i>Index</i> | <i>Stud protrusion</i> |
|---------------------------|--------------|------------------------|
| Michelin X-Ice North 4 | 111.7 | 1.09 mm |
| Goodyear Arctic 2 | 109.5 | 1.05 mm |
| Nokian Hakkapeliitta 9 | 107.2 | 1.11 mm |
| Continental Ice Contact 2 | 102.1 | 0.98 mm |
| Goodyear Ice Arctic | 100.0 | 1.01 mm |

Test date: 20.1.2021

Test location: Test World, Airport #7

Test method: Lap timing

Ambient temperature: -10 °C

Surface temperature: -11 °C

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5.2. Snow test results

5.2.1. Snow braking

| <i>Tyre</i> | <i>Index</i> |
|---------------------------|---------------------|
| Goodyear Arctic 2 | 103.8 |
| Michelin X-Ice North 4 | 102.1 |
| Nokian Hakkapeliitta 9 | 101.2 |
| Continental Ice Contact 2 | 100.5 |
| Goodyear Ice Arctic | 100.0 |

Test date: 19.1.2021

Test location: Test World, Mellatracks #23

Test method: ABS braking

Test speed: 50-5 km/h

Ambient temperature: -13 °C

Surface temperature: -14 °C

5.2.2. Snow acceleration

| <i>Tyre</i> | <i>Index</i> |
|---------------------------|---------------------|
| Nokian Hakkapeliitta 9 | 106.2 |
| Michelin X-Ice North 4 | 104.2 |
| Goodyear Arctic 2 | 102.5 |
| Continental Ice Contact 2 | 100.5 |
| Goodyear Ice Arctic | 100.0 |

Test date: 19.1.2021

Test location: Test World, Mellatracks #23

Test method: TCS Acceleration

Test speed: 8-30 km/h

Ambient temperature: -13 °C

Surface temperature: -14 °C

5.2.3. Snow handling

| <i>Tyre</i> | <i>Index</i> |
|---------------------------|---------------------|
| Goodyear Arctic 2 | 105.2 |
| Michelin X-Ice North 4 | 104.8 |
| Nokian Hakkapeliitta 9 | 103.9 |
| Continental Ice Contact 2 | 103.3 |
| Goodyear Ice Arctic | 100.0 |

Test date: 21.1.2021

Test location: Test World, Airport #8

Test method: Lap timing

Ambient temperature: -10 °C

Surface temperature: -10 °C

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5.3. Wet and dry test results

5.3.1. Wet braking

| <i>Tyre</i> | <i>Index</i> |
|---------------------------|---------------------|
| Nokian Hakkapeliitta 9 | 100.9 |
| Goodyear Ice Arctic | 100.0 |
| Goodyear Arctic 2 | 96.3 |
| Michelin X-Ice North 4 | 93.1 |
| Continental Ice Contact 2 | 91.4 |

Test date: 22.1.2021

Test location: Test World, Indoor #4/5

Test method: ABS braking

Test speed: 80-5 km/h

Ambient temperature: +2 °C

Surface temperature: +3 °C

5.3.2. Dry braking

| <i>Tyre</i> | <i>Index</i> |
|---------------------------|---------------------|
| Michelin X-Ice North 4 | 106.5 |
| Nokian Hakkapeliitta 9 | 103.6 |
| Goodyear Arctic 2 | 100.8 |
| Goodyear Ice Arctic | 100.0 |
| Continental Ice Contact 2 | 98.1 |

Test date: 23.1.2021

Test location: Test World, Indoor #4/5

Test method: ABS braking

Test speed: 80-5 km/h

Ambient temperature: +2 °C

Surface temperature: +3 °C

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6. Statement

This programme was conducted in accordance with Test World's quality systems and the customer's requirements. Test World hereby confirms that the test results are representative for the tyre selection when tested under the outlined conditions using the reported cars, tracks and methods. Test World does not accept responsibility for any liabilities arising from conclusions drawn from the test results.

This report, any tests results and test data are owned exclusively by the customer. The customer may freely share or publish the report in its entirety but cannot share or publish in any form any extract(s) from the report when using the Test World name or brand without the express written permission of a Director of Test World which shall not be unreasonably withheld.

Ivalo 18.2.2021



Jukka Antila
Technical Director

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