

Measurement of 5G NR FR2 Electromagnetic Fields



Downconverter-Antennas for omnidirectional and directional measurement of fields and their sources in the frequency range from 24.25 GHz to 29.5 GHz

With the downconverter antennas, the user gets the possibility to extend the frequency range of the SRM-3006 to frequencies from 24.25 GHz to 29.5 GHz. One of the main applications is to demonstrate compliance with the EMF limits in frequency range FR2 of the 5G NR mobile radio service. Of course all other applications in this frequency range can also be measured. The two antennas differ in their reception characteristics: The Model 3591/01 features a directional characteristic, while the Model 3591/02 offers an omnidirectional characteristic.

- › Extends SRM-3006 to cover 24.25 GHz to 29.5 GHz.
- › Calibrated antennas for reliable measurements
- › Measurements are displayed in field strength or in percent of limit values, e.g. ICNIRP, FCC...
- › Omnidirectional antenna design for environmental measurements
- › Directional antenna design for weak signals
- › Easy to setup
- › Simple operation
- › Fast and reliable measurement results



Available Antenna Models

Two different antenna models are available. A directional antenna with high sensitivity and an omnidirectional antenna. Both antennas include a downconverter that converts the millimeter wave between 24.25 GHz to 29.5 GHz into the SRM-3006's receive band. This means that the RF cable between antenna and basic unit only transmits frequencies up to a maximum of 6 GHz, which greatly reduces the cable loss compared with a 20 GHz cable. In addition, the downconverter in the antenna avoids the need to modify the base unit, so the antenna can be used on all SRM-3006 devices without hardware modifications. Only a firmware update is required, which can be done by the user.

The antennas have their own batteries, independent from the basic unit. So the runtime of the SRM is not affected by the operation of the downconverter antenna. The battery integrated in the antenna can be charged via an USB-C socket. Connected to a USB power bank, long-term measurements can also be performed.

Narda recommends to operate the antennas only via an extension cable with the SRM.

Measurement of weak signals (e.g. indoors):

For measurements inside buildings, the field strengths are often very low. For example, a modern, coated glass window can attenuate a signal at 24 GHz by about 30 dB. To be able to detect such a field strength, a high gain antenna is needed. However, such antennas have a high directivity due to their principle. The antenna model 3591/01 has such a characteristic.

In addition, the directional characteristic can be used to detect the field strength of geographically separated base stations..

Outdoor environmental measurements:

For EMF measurements, national as well as international standards recommend an isotropic measurement. Such antennas are not available for the FR2 frequency range. The antenna 3591/02 offers an omnidirectional reception characteristic that roughly corresponds to that of a donut. Ideal reception results are therefore obtained from an X-Y spatial plane. To cover all three spatial axes for isotropic measurements, the antenna must be connected to the basic unit via an RF cable and moved accordingly during the measurement.

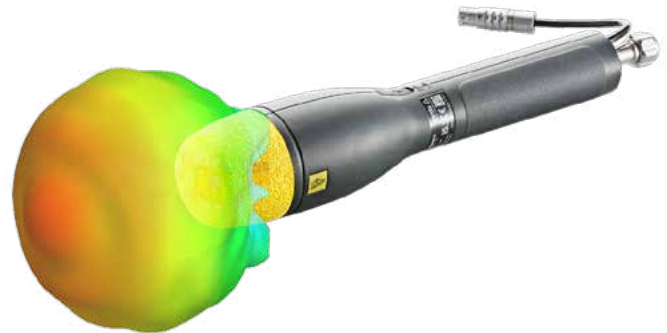


Fig. 1. 3591/01 Directional Antenna (Horn antenna)



Fig. 2. 3591/02 Omnidirectional

Conditions

Unless otherwise noted, specifications apply after 30 minutes warm-up time within the specified environmental conditions. The product is within the recommended calibration cycle.

Specifications with limits

These describe product performance for the given parameter covered by warranty. Specifications with limits (shown as $<$, \leq , $>$, \geq , \pm , max., min.) apply under the given conditions for the product and are tested during production, considering measurement uncertainty.

Specifications without limits

These describe product performance for the given parameter covered by warranty. Specifications without limits represent values with negligible deviations, which are ensured by design (e.g. dimensions or resolution of a setting parameter).

Typical values (typ.)

These characterize product performance for the given parameter that is not covered by warranty. When stated as a range or as a limit (shown as $<$, \leq , $>$, \geq , \pm , max., min.), they represent the performance met by approximately 80% of the instruments. Otherwise, they represent the mean value. The measurement uncertainty is not taken into account.

Nominal values (nom.)

These characterize expected product performance for the given parameter that is not covered by warranty. Nominal values are verified during product development but are not tested during production.

Uncertainties

These characterize the dispersion of the values attributed to the measurands with an estimated confidence level of approximately 95%. Uncertainty is stated as the standard uncertainty multiplied by the coverage factor $k=2$ based on the normal distribution. The evaluation has been carried out in accordance with the rules of the "Guide to the Expression of Uncertainty in Measurement" (GUM).

Specifications

3591/01 LNB Antenna, 24.25 GHz to 29.5 GHz, directional

| General specification | | | |
|---|--|-------------------------------------|---|
| Antenna type | E-Field | | |
| Sensor type | Downconverter with directional antenna design | | |
| RF connector | N-connector, 50 Ω, male | | |
| Frequency | | | |
| Frequency range | Band A: 24.25 GHz to 27.5 GHz Band B: 26.5 GHz to 29.5 GHz The frequency band can be selected in the user interface of the basic unit. | | |
| SSB phase noise | f_c | df = 10 kHz | df = 100 kHz df = 10 MHz |
| | 26 GHz | < -83 dBc (1/Hz) | < -90 dBc (1/Hz) < -112 dBc (1/Hz) |
| Internal reference frequency | Deviation: | < 1 ppm | |
| | Aging: | < 1 ppm/year, < 5 ppm over 15 years | |
| | Thermal drift: | < 1.5 ppm (-10 °C to +50 °C) | |
| Amplitude | | | |
| Dynamic Range | Noise Figure @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | < 33 dB |
| | | 24.25 GHz ≤ f ≤ 29.5 GHz | 26 dB (typ.) |
| | 2nd order intercept point (IP2, 2 tones) @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | |
| 3rd order intercept point (IP3, 2 tones) @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | 10 dBm (typ.) | |
| | | | |
| Level uncertainty | 24.25 GHz ≤ f ≤ 29.5 GHz | < ± 1.8 dB | without cable |
| Residual spurs @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | < -80 dBm | exceptions < -60 dBm |
| IF rejection | > 60 dB | | |
| Image rejection | 70 dB typ. | | |
| Attenuator | 10 dB The attenuator of the antenna can be switched on/off in the user interface of the basic unit. | | |
| RF input | | | |
| Type | Directional antenna | | |
| RF destruction limit | 225 V/m | | |
| Max. nominal RF level | 100 V/m | | |
| Spurs Emmisions | > -70 dBm | | |
| Measurement uncertainty | | | |
| Expanded measurement uncertainty b) (in conjunction with SRM basic unit and 1.5 m RF cable) | tbd | | |

3591/02 LNB Antenna, 24.25 GHz to 29.5 GHz, omnidirectional

| General specification | | | |
|---|--|-------------------------------------|----------------------|
| Antenna type | E-Field | | |
| Sensor type | Downconverter with omnidirectional antenna design | | |
| RF connector | N-connector, 50 Ω, male | | |
| Frequency | | | |
| Frequency range | Band A: 24.25 GHz to 27.5 GHz Band B: 26.5 GHz to 29.5 GHz The frequency band can be selected in the user interface of the basic unit. | | |
| SSB phase noise | f_c | df = 10 kHz | df = 100 kHz |
| | 26 GHz | < -83 dBc (1/Hz) | < -90 dBc (1/Hz) |
| Internal reference frequency | Deviation: | < 1 ppm | |
| | Aging: | < 1 ppm/year, < 5 ppm over 15 years | |
| | Thermal drift: | < 1.5 ppm (-10 °C to +50 °C) | |
| Amplitude | | | |
| Dynamic Range | Noise Figure @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | < 33 dB |
| | | 24.25 GHz ≤ f ≤ 29.5 GHz | 26 dB (typ.) |
| | 2nd order intercept point (IP2, 2 tones) @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | |
| 3rd order intercept point (IP3, 2 tones) @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | 10 dBm (typ.) | |
| | | | |
| Level uncertainty | 24.25 GHz ≤ f ≤ 29.5 GHz | < ± 1.8 dB | without cable |
| Residual spurs @ attenuator = 0 dB | 24.25 GHz ≤ f ≤ 29.5 GHz | < -80 dBm | exceptions < -60 dBm |
| IF rejection | > 60 dB | | |
| Image rejection | 70 dB typ. | | |
| Attenuator | 10 dB The attenuator of the antenna can be switched on/off in the user interface of the basic unit. | | |
| RF input | | | |
| Type | Omnidirectional antenna | | |
| RF destruction limit | 435 V/m | | |
| Max. nominal RF level | 200 V/m | | |
| Spurs Emmissions | > -70 dBm | | |
| Measurement uncertainty | | | |
| Expanded measurement uncertainty b) (in conjunction with SRM basic unit and 1.5 m RF cable) | tbd | | |

General

| General specification | | | |
|----------------------------------|--------------------|--|--|
| Operating temperature | | -10 °C to 50 °C (same as SRM basic unit) | |
| Compliance | Climatic | Storage | 1K3 (IEC 60721-3) extended to -10 °C to +50 °C |
| | | Transport | 2K3 (IEC 60721-3) extended to -30 °C to +70 °C |
| | | Operating | 7K2 (IEC 60721-3) extended to -10 °C to +50 °C |
| | Mechanical | Storage | 1M3 (IEC 60721-3) |
| | | Transport | 2M3 (IEC 60721-3) |
| | | Operating | 7M3 (IEC 60721-3) |
| | Ingress protection | | IP 52 (USB flap closed) |
| | EMC | EU | Complies with EMC Directive 2014/30/EU and EN 61326 -1: 2013 |
| | | Immunity | EN: 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, 61000-4-6, 61000-4-8, 61000-4-11 |
| Emissions | | EN: 61000-3-2, 61000-3-3, EN 55011 (CISPR 11) Class B | |
| Safety | | Complies with European Low Voltage Directive 2014/35/EU and EN 61010-1: 2010 | |
| Material | | Complies with European RoHS Directive 2011/65/EU | |
| Air humidity (operating range) | | < 29 g/m ³ (< 93 % RH at +30 °C), non-condensing | |
| Weight | | 615 g | |
| Dimensions | | 485 mm length; 78 mm antenna head diameter (19.1" length; 3.1" antenna head diameter) | |
| Power supply | | USB C, operation and charge at least 1 A | |
| Operating time | | Appr. 4h operation with internal battery. Can also be operated with an external USB power bank. | |
| Recommended calibration interval | | 24 months | |
| Country of origin | | Germany | |

Ordering information

Your local Narda representative will inform you of all possible options as well as the current ordering information and will be pleased to provide you with advice.

Antennas

| Set 5G FR2 Antenna, directional, 24.25 to 29.5 GHz | Part number |
|--|-------------|
| Includes: | 3591/101 |
| <ul style="list-style-type: none"> › LNB Antenna, 24.25 to 29.5GHz, dir. (3591/01) › Power Supply USB-C with cable › LNB Antenna - Quick Start and Safety Instructions (3591/98.12) | |

| Set 5G FR2 Antenna, omnidir., 24.25 to 29.5 GHz | Part number |
|--|-------------|
| Includes: | 3591/102 |
| <ul style="list-style-type: none"> › LNB Antenna, 24.25 to 29.5GHz, omn. (3591/02) › Power Supply USB-C with cable › LNB Antenna - Quick Start and Safety Instructions (3591/98.12) | |

| Set 5G FR2 Antenna, dir. + omni., 24.25 to 29.5 GHz | Part number |
|---|-------------|
| Includes: | 3591/103 |
| <ul style="list-style-type: none"> › LNB Antenna, 24.25 to 29.5GHz, dir. (3591/01) › LNB Antenna, 24.25 to 29.5GHz, omn. (3591/02) › 2 x Power Supply USB-C with cable › LNB Antenna - Quick Start and Safety Instructions (3591/98.12) | |

Software

| Description | Part number |
|--|-------------|
| Software, SRM-3006 Tools, Configuration SW (free Download) | - |
| Software, SRM-3006 TS, PC Evaluation and Remote | 3006/93.10 |

Accessories

| Description | Part number |
|---|-------------|
| Power Supply USB-C PD, AU/EU/UK/US Plugs with cable | tbd |
| Car Charger Adapter, USB 5V | tbd |
| LNB Antenna - Quick Start and Safety Instruct | 3591/98.12 |
| RF-Cable, 9 kHz to 6 GHz, N 50 ohm, 1.5m | 3602/01 |
| RF-Cable, 9 kHz to 6 GHz, N 50 ohm, 5m | 3602/02 |
| Antenna Holder for Uniaxial/Triaxial Antenna | 3501/90.01 |
| Antenna Holder for Triaxial Antenna | 3501/90.02 |
| Tripod Ball Joint Adapter for 3501/90.02 | tbd |
| Tripod, Non-Conductive, 1.65 m with carrying bag | 2244/90.31 |
| Tripod Extension, 0.50m, Non-Conductive | 2244/90.45 |