# FCC Measurement/Technical Report on

# NAR Compensor
# LTE-MBC-NAR-JLR

# FCC ID: RK7MBC-NAR
# IC: 4774A-MBCNAR

**Test Report Reference:** MDE_MOLEX_1906_FCC01

**Test Laboratory:**
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle D-PL-12140-01-00

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# 1 APPLIED STANDARDS AND TEST SUMMARY

## 1.1 APPLIED STANDARDS

**Type of Authorization**
Certification for an Wideband Consumer signal Booster.

**Applicable FCC Rules**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 20, 22, 24, 27 (10-1-18 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 20, Commercial Mobiles Serviced

§ 20.21 Signal Boosters

Part 22, Subpart H – Cellular Radiotelephone Service

§ 22.905 – Channels for cellular service
$ 22.913 – Effective radiated power limits
§ 22.917 – Emission limitations for cellular equipment

Part 24 E – Personal Communication Services

§ 24.229 - Frequencies
§ 24.232 – Power and antenna height limits
§ 24.238 – Emission limitations for Broadband PCS equipment

Part 27 – Miscellaneous Wireless Communication Services

§ 27.5 (b), (c) - Frequencies
§ 27.50 (b) (c) – Power limits and duty cycle
§ 27.53 (c), (f), (g), (h) – Emission limits

The tests were selected and performed with reference to the **FCC Public Notice 935210** applying **"Wideband Consumer Signal Booster Compliance Measurement Guidance" 935210 D03 v04r03, 2019-04-15.**

**Summary Test Results:**

**The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.**

## 1.2 FCC-IC CORRELATION TABLE

### Correlation of measurement requirements for Wideband Consumer Signal Booster from FCC and ISED Canada

| Measurement | FCC reference | ISED reference |
|---|---|---|
| Anti-oscillation | §20.21(e)(8)(ii)(A)<br>§20.21(e)(5) | RSS-131 Issue 3: 5.1.1.1 |
| Gain control | §20.21(e)(8)(ii)(B) | RSS-131 Issue 3: 5.1.1.2 |
| Power down | §20.21(e)(8)(i)(H) | RSS-131 Issue 3: 5.1.1.3 |
| Interference avoidance for wireless subsystems | §20.21(e)(8)(ii)(C) | RSS-131 Issue 3: 5.1.1.4 |
| Bidirectional capability | §20.21(e)(8)(i)(B) | RSS-131 Issue 3: 5.1.2 |
| Noise limits | §20.21(e)(8)(i)(A) | RSS-131 Issue 3: 5.1.3.1 |
| Gain limits | §20.21(e)(8)(i)(C)(1) | RSS-131 Issue 3: 5.1.3.2 |
| Power limits | §20.21(e)(8)(i)(D) | RSS-131 Issue 3: 5.1.3.3 |
| Out-of-band emission limits | §20.21(e)(8)(i)(E) | RSS-131 Issue 3: 5.1.3.4 |
| Intermodulation limits | §20.21(e)(8)(i)(F) | RSS-131 Issue 3: 5.1.3.5 |
| Transmit power off mode | §20.21(e)(8)(i)(H) | RSS-131 Issue 3: 5.1.3.6 |
| Uplink inactivity | §20.21(e)(8)(i)(I) | RSS-131 Issue 3: 5.1.3.7 |

## 1.3 MEASUREMENT SUMMARY / SIGNATURES

| **47 CFR CHAPTER I FCC PART 20 §20.21** | **§ 20.21 (e)(8)(i)(D) Power Limits; § 20.21 (e)(8)(i)(B) Bidirectional Capability** |
|---|---|

Maximum Power
The measurement was performed according to KDB 935210 D03 **Final Result**

| **OP-Mode** | **Setup** | **Date** | **FCC** | **IC** |
|---|---|---|---|---|
| Frequency Band, Direction, Signal Type | | | | |
| Band 2, Downlink, Pulsed CW | S01_AA01 | 2019-10-01 | Passed | Passed |
| Band 2, Uplink, Pulsed CW | S01_AA01 | 2019-10-02 | Passed | Passed |
| Band 5, Downlink, Pulsed CW | S01_AA01 | 2019-10-01 | Passed | Passed |
| Band 5, Uplink, Pulsed CW | S01_AA01 | 2019-10-02 | Passed | Passed |

| **47 CFR CHAPTER I FCC PART 20 §20.21** | **§ 2.1051 Spurious emissions at antenna terminals** |
|---|---|

Conducted Spurious Emissions
The measurement was performed according to KDB 935210 D03 **Final Result**

| **OP-Mode** | **Setup** | **Date** | **FCC** | **IC** |
|---|---|---|---|---|
| Frequency Band, Direction | | | | |
| Band 2, Downlink | S01_AA01 | 2019-10-01 | Passed | Passed |
| Band 2, Uplink | S01_AA01 | 2019-10-01 | Passed | Passed |
| Band 5, Downlink | S01_AA01 | 2019-10-01 | Passed | Passed |
| Band 5, Uplink | S01_AA01 | 2019-10-01 | Passed | Passed |

N/A: Not applicable
N/P: Not performed

## 2 REVISION HISTORY

| Report version control | | | |
|---|---|---|---|
| **Version** | **Release date** | **Change Description** | **Version validity** |
| initial | 2019-10-15 | -- | valid |
| -- | -- | -- | -- |

COMMENT: Another version of this signal booster was already completely tested. The frequency to test for Maximum Power was taken from that report (MDE_NOVER_1615_FCCA_rev1).
The tests to perform for this version were chosen by the applicant.

(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik

(responsible for testing and report)
Dipl.-Ing. Daniel Gall

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40880 Ratingen, Germany
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# 3 ADMINISTRATIVE DATA

## 3.1 TESTING LABORATORY

| | |
|---|---|
| Company Name: | 7layers GmbH |
| Address: | Borsigstr. 11<br>40880 Ratingen<br>Germany |

The test facility is accredited by the following accreditation organisation:

| | |
|---|---|
| Laboratory accreditation no: | DAkkS D-PL-12140-01-01\| D-PL-12140-01-02 \| D-PL-12140-01-03 |
| FCC Designation Number: | DE0015 |
| FCC Test Firm Registration: | 929146 |
| ISED CAB Identifier | DE0007; ISED#: 3699A |
| Responsible for accreditation scope: | Dipl.-Ing. Marco Kullik |
| Report Template Version: | 2019-06-18 |

## 3.2 PROJECT DATA

| | |
|---|---|
| Responsible for testing and report: | Dipl.-Ing. Daniel Gall |
| Employees who performed the tests: | documented internally at 7Layers |
| Date of Report: | 2019-10-15 |
| Testing Period: | 2019-10-01 to 2019-10-02 |

## 3.3 APPLICANT DATA

| | |
|---|---|
| Company Name: | Molex CVS Dabendorf GmbH |
| Address: | Märkische Straße 72<br>15806 Zossen<br>Germany |
| Contact Person: | Ines Baufeld |

## 3.4 MANUFACTURER DATA

| | |
|---|---|
| Company Name: | Molex CVS Dabendorf GmbH |
| Address: | Märkische Straße 72<br>15806 Zossen<br>Germany |
| Contact Person: | Ines Baufeld |

# 4 TEST OBJECT DATA

## 4.1 GENERAL EUT DESCRIPTION

| | |
|---|---|
| Kind of Device product description | Consumer Signal Booster supporting bands 2 ,4, 5, 12, 13 |
| Product name | LTE-MBC-NAR-JLR |
| Type | - |
| **Declared EUT data by the supplier** | |
| General Product Description | The EUT is wideband consumer signal booster used in road vehicles. |
| Booster Type | Mobile Wideband Consumer Signal Booster |
| Booster Connection | Direct Contact Coupling (e.g. craddle type) |
| Voltage Type | DC |
| Voltage Level | 14.0 V |
| The EUT provides the following ports: | Donor Port: Input BS-Signal, Output MS-Signal<br>Server Port: Input MS-Signal, Output BS-Signal<br>DC Port |

**The main components of the EUT are listed and described in chapter 3.2 EUT Main components.**

## 4.2 EUT MAIN COMPONENTS

| **Sample Name** | **Sample Code** | **Description** |
|---|---|---|
| EUT A | DE1386007aa01 | |
| **Sample Parameter** | **Value** | |
| Serial No. | FKW-00104.09.197E610032 | |
| HW Version | 002 | |
| SW Version | 0001 | |
| Comment | | |

NOTE:The short description is used to simplify the identification of the EUT in this test report.

## 4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

| **Device** | **Details (Manufacturer, Type Model, OUT Code)** | **Description** |
|---|---|---|
| - | - | - |

## 4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless Auxiliary Equipment can influence the test results.

| **Device** | **Details (Manufacturer, Type Model, HW, SW, S/N)** | **Description** |
|---|---|---|
| - | - | - |

## 4.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

| **Setup** | **Combination of EUTs** | **Description and Rationale** |
|---|---|---|
| S01_AA01 | EUT A | Conducted Setup |

## 4.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

### 4.6.1 TEST CHANNELS

| **Band** | **Direction** | **Lower Frequency Band Edge [MHz]** | **Upper Frequency Band Edge [MHz]** | **Center Frequency [MHz]** | **Port** |
|---|---|---|---|---|---|
| 2 | downlink | 1930.00 | 1990.00 | 1960.00 | Donor |
| 5 | downlink | 869.00 | 894.00 | 881.50 | Donor |
| 2 | uplink | 1850.00 | 1910.00 | 1880.00 | Server |
| 5 | uplink | 824.00 | 849.00 | 836.50 | Server |

## 4.7 PRODUCT LABELLING

### 4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

### 4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

# 5 TEST RESULTS

## 5.1 MAXIMUM POWER

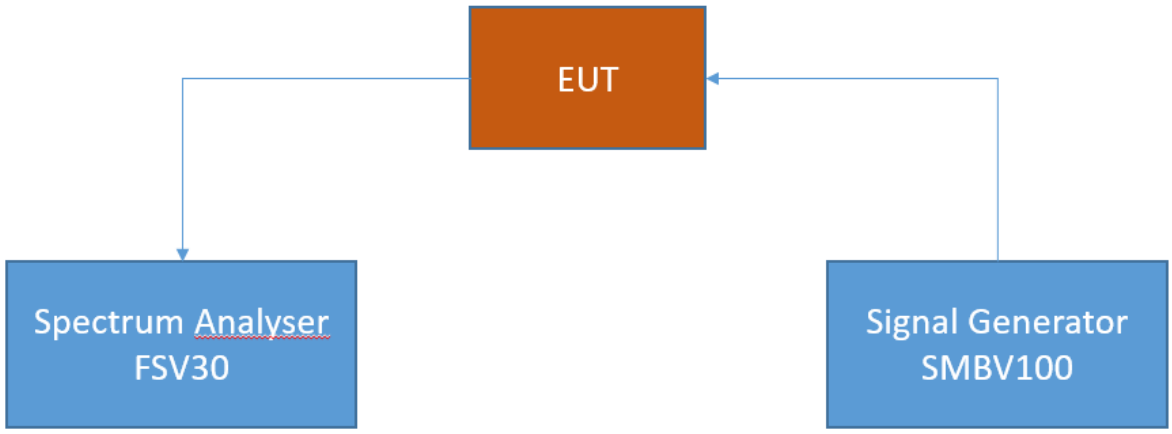
Standard

**The test was performed according to:**
KDB 935210 D03

### 5.1.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power limits and requirements as specified in §§ 20.21(e)(8)(i)(D) and 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:




FCC Part 20.21; Consumer Signal Booster – Test Setup 7.2; Maximum Power

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

### 5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(D)

*Power Limits.* A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

FCC Part 20, § 20.21(e)(8)(i)(B)

*Bidirectional Capability.* Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (*i.e.,* uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

### 5.1.3 TEST PROTOCOL

**Ambient temperature:** 25 °C
**Air Pressure:** 1010 hPa
**Humidity:** 40 %

| **Band 2, downlink** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Signal Type** | **Frequency [MHz]** | **Input Power [dBm]** | **Output Power [dBm]** | **Lower Limit Output Power [dBm]** | **Upper Limit Output Power [dBm]** | **Margin to Lower Limit [dB]** | **Margin to Upper Limit [dB]** |
| Pulsed CW | 1949.060 | -23.7 | -2.6 | --- | 17.0 | --- | 19.6 |
| Pulsed CW | 1949.060 | -21.7 | -1.4 | --- | 17.0 | --- | 18.4 |
| Pulsed CW | 1949.060 | -20.0 | -0.6 | --- | 17.0 | --- | 17.6 |

| **Band 5, downlink** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Signal Type** | **Frequency [MHz]** | **Input Power [dBm]** | **Output Power [dBm]** | **Lower Limit Output Power [dBm]** | **Upper Limit Output Power [dBm]** | **Margin to Lower Limit [dB]** | **Margin to Upper Limit [dB]** |
| Pulsed CW | 880.5 | -22.4 | -1.8 | --- | 17.0 | --- | 18.8 |
| Pulsed CW | 880.5 | -20.4 | -0.6 | --- | 17.0 | --- | 17.6 |
| Pulsed CW | 880.5 | -20.0 | -0.4 | --- | 17.0 | --- | 17.4 |

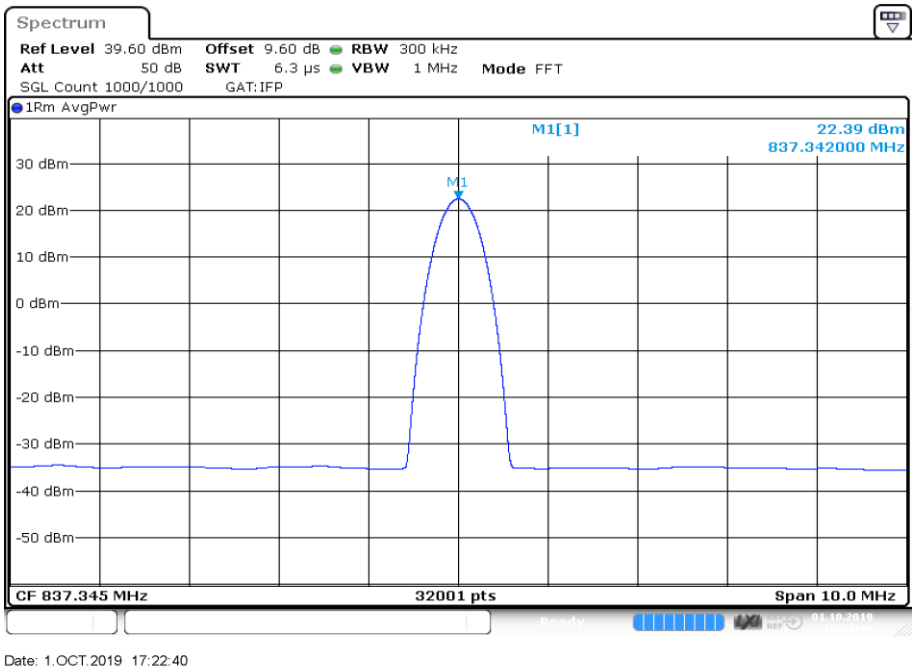
| Band 2, uplink | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Signal Type** | **Frequency [MHz]** | **Input Power [dBm]** | **Output Power [dBm]** | **Lower Limit Output Power [dBm]** | **Upper Limit Output Power [dBm]** | **Margin to Lower Limit [dB]** | **Margin to Upper Limit [dB]** |
| Pulsed CW | 1889.6 | 2.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 4.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 6.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 8.6 | 22.1 | 17.0 | 30.0 | 5.1 | 7.9 |
| Pulsed CW | 1889.6 | 10.6 | 21.7 | 17.0 | 30.0 | 4.7 | 8.3 |
| Pulsed CW | 1889.6 | 12.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 14.6 | 22.3 | 17.0 | 30.0 | 5.3 | 7.8 |
| Pulsed CW | 1889.6 | 16.6 | 21.8 | 17.0 | 30.0 | 4.8 | 8.2 |
| Pulsed CW | 1889.6 | 18.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 20.6 | 22.2 | 17.0 | 30.0 | 5.2 | 7.8 |
| Pulsed CW | 1889.6 | 22.6 | 21.8 | 17.0 | 30.0 | 4.8 | 8.2 |
| Pulsed CW | 1889.6 | 23.0 | 21.9 | 17.0 | 30.0 | 4.9 | 8.1 |

| Band 5, uplink | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Signal Type** | **Frequency [MHz]** | **Input Power [dBm]** | **Output Power [dBm]** | **Lower Limit Output Power [dBm]** | **Upper Limit Output Power [dBm]** | **Margin to Lower Limit [dB]** | **Margin to Upper Limit [dB]** |
| Pulsed CW | 837.3 | 2.6 | 22.9 | 17.0 | 30.0 | 5.9 | 7.1 |
| Pulsed CW | 837.3 | 4.6 | 22.7 | 17.0 | 30.0 | 5.7 | 7.3 |
| Pulsed CW | 837.3 | 6.6 | 22.8 | 17.0 | 30.0 | 5.8 | 7.2 |
| Pulsed CW | 837.3 | 8.6 | 22.7 | 17.0 | 30.0 | 5.7 | 7.3 |
| Pulsed CW | 837.3 | 10.6 | 22.9 | 17.0 | 30.0 | 5.9 | 7.1 |
| Pulsed CW | 837.3 | 12.6 | 22.5 | 17.0 | 30.0 | 5.5 | 7.6 |
| Pulsed CW | 837.3 | 14.6 | 22.5 | 17.0 | 30.0 | 5.5 | 7.5 |
| Pulsed CW | 837.3 | 16.6 | 22.8 | 17.0 | 30.0 | 5.8 | 7.2 |
| Pulsed CW | 837.3 | 18.6 | 22.4 | 17.0 | 30.0 | 5.4 | 7.6 |
| Pulsed CW | 837.3 | 20.6 | 22.9 | 17.0 | 30.0 | 5.9 | 7.1 |
| Pulsed CW | 837.3 | 22.6 | 22.4 | 17.0 | 30.0 | 5.4 | 7.6 |
| Pulsed CW | 837.3 | 23.0 | 22.7 | 17.0 | 30.0 | 5.7 | 7.3 |

Remark: Please see next sub-clause for the measurement plot.

## 5.1.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

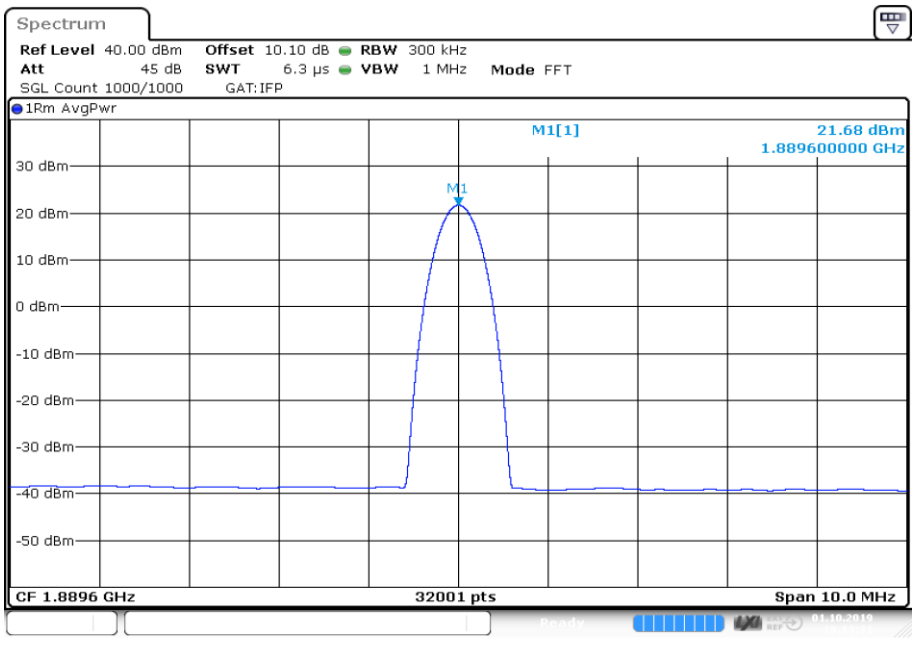
Frequency Band = Band 5, Direction = Uplink, Signal Type = Pulsed CW (S01_AA01)




Date: 1.OCT.2019 17:22:40

Input Level 18.6 dBm

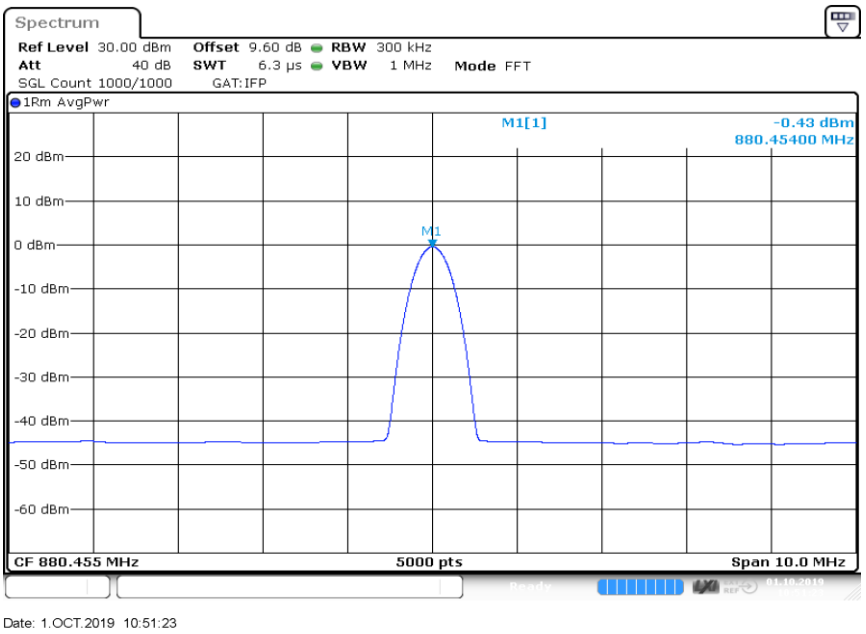
Frequency Band = Band 2, Direction = Uplink, Signal Type = Pulsed CW (S01_AA01)




Date: 1.OCT.2019 18:13:32

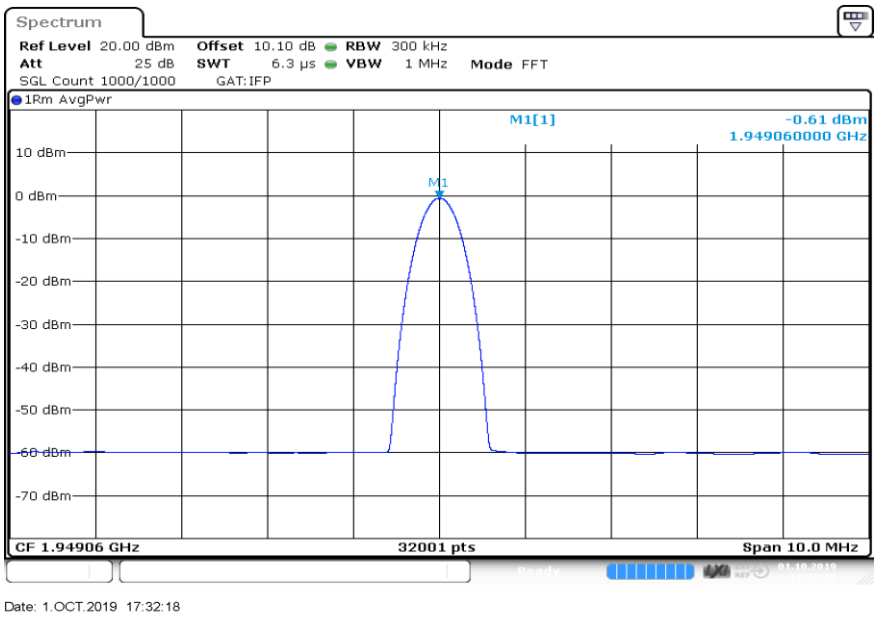
Input Power 10.6 dBm

Frequency Band = Band 5, Direction = Downlink, Signal Type = Pulsed CW (S01_AA01)




Input Level -20 dBm

Frequency Band = Band 2, Direction = Downlink, Signal Type = Pulsed CW (S01_AA01)




Input level -20 dBm

## 5.1.5 TEST EQUIPMENT USED

- R&S TS8997

## 5.2 CONDUCTED SPURIOUS EMISSIONS

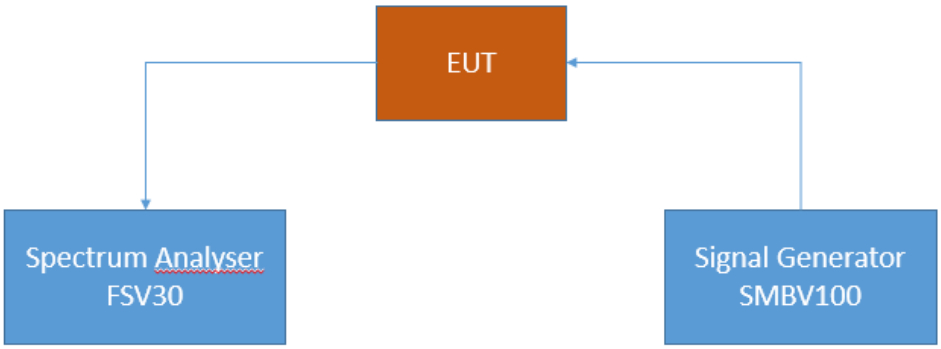
Standard

**The test was performed according to:**
KDB 935210 D03

### 5.2.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission limits per § 2.1051

The EUT was connected to the test setup according to the following diagram:




FCC Part 20.21; Consumer Signal Booster – Test Setup 7.6; Conducted Spurious Emissions

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

### 5.2.2 TEST REQUIREMENTS / LIMITS

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 20, § 20.21(e)(8)(i)(E)

*Out of Band Emission Limits*. Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

Part 22, Subpart H – Cellular Radiotelephone Service; Band 5 (Cellular)

§ 22 917 – Emission limitations for cellular equipment

*(a) Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 24 E – Personal Communication Services

§ 24.238 – Emission limitations for Broadband PCS equipment; Band 2 (Broadband PCS)

*(a) Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 27 – Miscellaneous Wireless Communication Services;

Band 4 (AWS-1)
§ 27.53 (h) – Emission limits

(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) dB.
(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.
(ii) For operations in the 2000-2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iii) For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iv) For operations in the 1995-2000 MHz band, the power of any emission between 2005-2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
Band 12 (Lower 700 MHz)
§ 27.53 (g) – Emission limits

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed

Band 13 (Upper 700 MHz)
§ 27.53 (c), (f) – Emission limits

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

### 5.2.3 TEST PROTOCOL

**Ambient temperature:** 25 °C
**Air Pressure:** 1010 hPa
**Humidity:** 40 %

| Band 2, downlink; Center frequency: 1960.00 MHz | | | | | |
|---|---|---|---|---|---|
| **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| 6981.4 | -28.0 | PEAK | 1000 | -13.0 | 15.0 |

| Band 5, downlink; Center frequency: 881.5 MHz | | | | | |
|---|---|---|---|---|---|
| **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| 6973.9 | -37.7 | RMS | 100 | -13.0 | 24.7 |

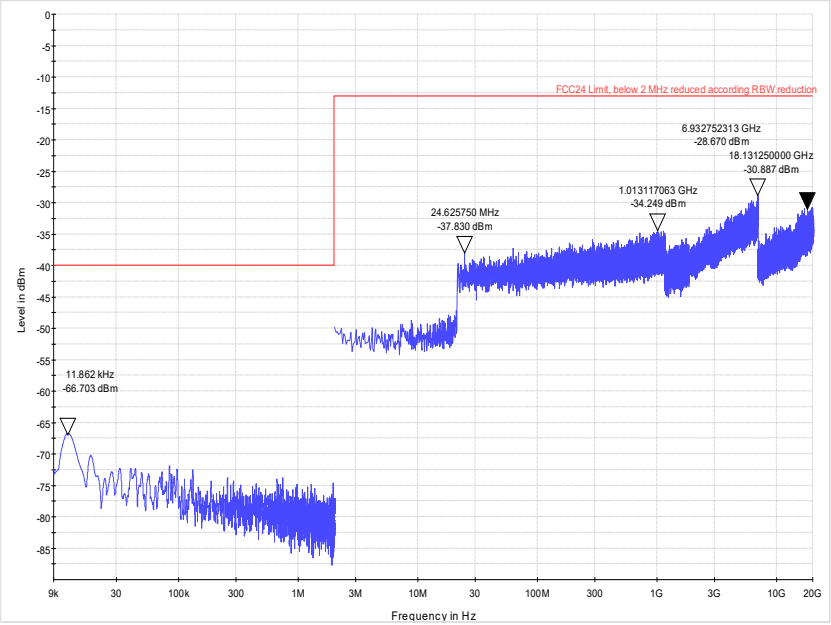
| Band 2, uplink; Center frequency: 1880.00 MHz | | | | | |
|---|---|---|---|---|---|
| **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| 6932.8 | -28.7 | RMS | 1000 | -13.0 | 15.7 |

| Band 5, uplink; Center frequency: 836.50 MHz | | | | | |
|---|---|---|---|---|---|
| **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| 6944.9 | -37.7 | RMS | 100 | -13.0 | 24.7 |

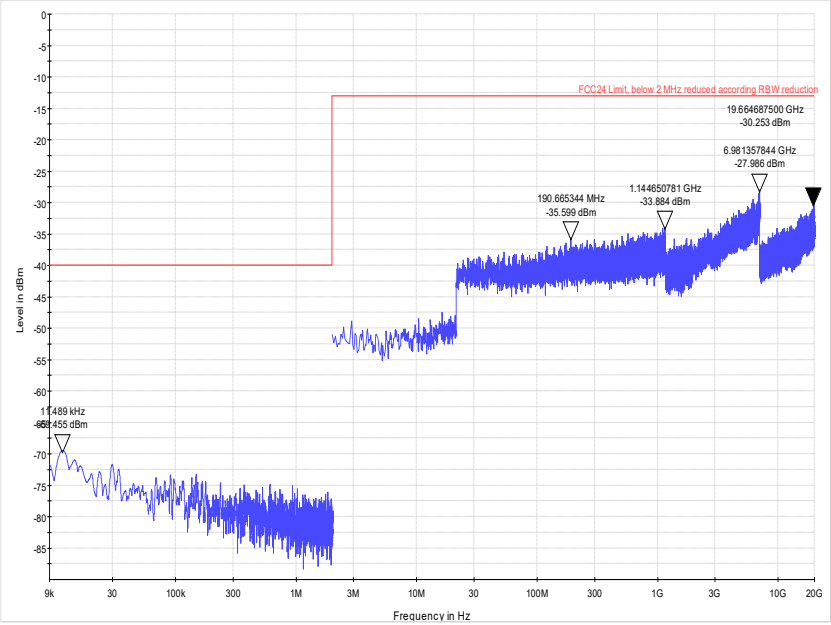
Remark: Please see next sub-clause for the measurement plot.

## 5.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

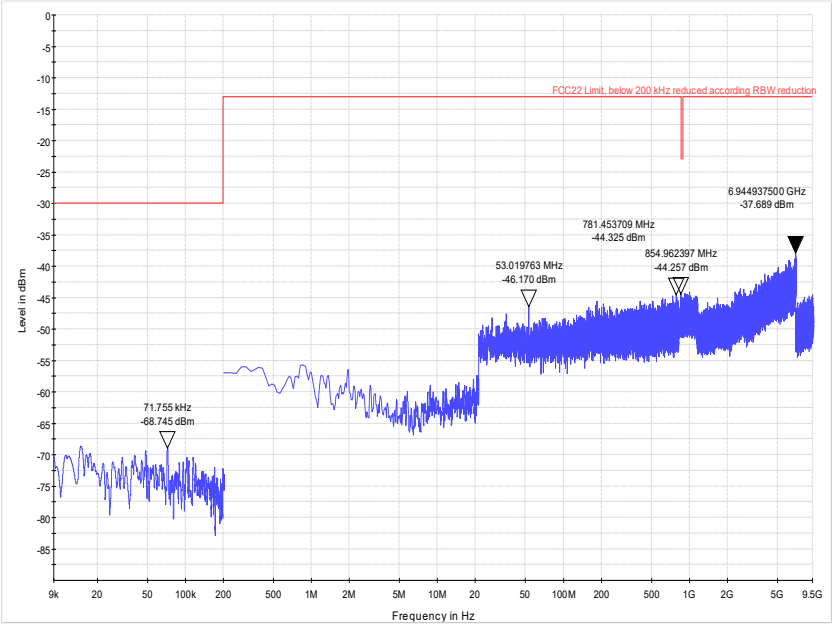
Frequency Band = Band 2, Direction = Uplink
(S01_AA01)



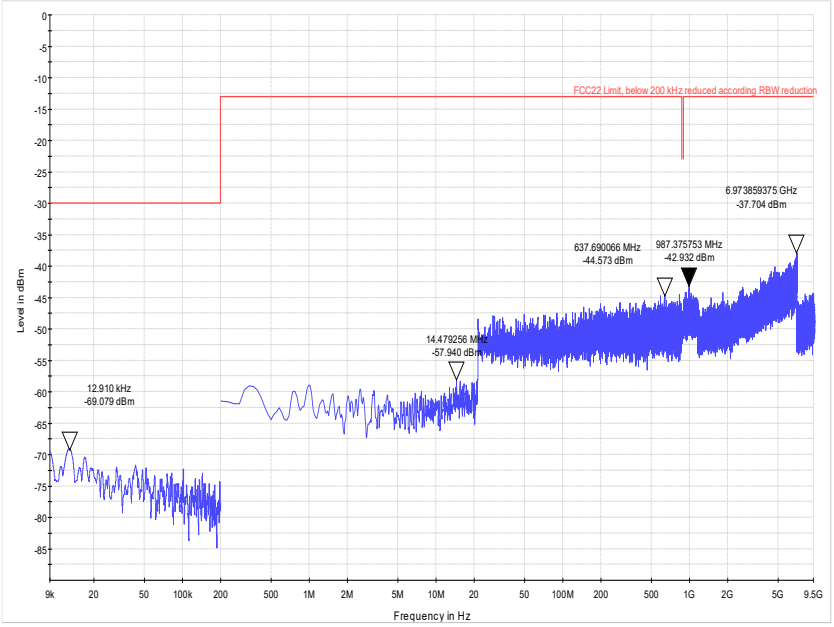

Frequency Band = Band 2, Direction = Downlink
(S01_AA01)



Frequency Band = Band 5, Direction = Uplink
(S01_AA01)




Frequency Band = Band 5, Direction = Downlink
(S01_AA01)




## 5.2.5 TEST EQUIPMENT USED

- R&S TS8997

# 6 TEST EQUIPMENT

1 R&S TS8997
EN300328/301893 Test Lab

| Ref.No. | Device Name | Description | Manufacturer | Serial Number | Last Calibration | Calibration Due |
|---|---|---|---|---|---|---|
| 1.1 | SMB100A | Signal Generator 9 kHz - 6 GHz | Rohde & Schwarz | 107695 | 2017-07 | 2020-07 |
| 1.2 | FSV30 | Signal Analyzer 10 Hz - 30 GHz | Rohde & Schwarz | 103005 | 2018-04 | 2020-04 |
| 1.3 | Fluke 177 | Digital Multimeter 03 (Multimeter) | Fluke Europe B.V. | 86670383 | 2018-04 | 2020-04 |
| 1.4 | Temperature Chamber VT 4002 | Temperature Chamber Vötsch 03 | Vötsch | 58566002150010 | 2018-04 | 2020-04 |
| 1.5 | A8455-4 | 4 Way Power Divider (SMA) | | - | | |
| 1.6 | Opus10 THI (8152.00) | ThermoHygro Datalogger 03 | Lufft Mess- und Regeltechnik GmbH | ID 7482 | 2019-06 | 2021-06 |
| 1.7 | SMBV100A | Vector Signal Generator 9 kHz - 6 GHz | Rohde & Schwarz | 259291 | 2016-10 | 2019-10 |
| 1.8 | OSP120 | Switching Unit with integrated power meter | Rohde & Schwarz | 101158 | 2018-05 | 2021-05 |

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

# 7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

## 7.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

| Frequency | | Corr. | LISN insertion loss ESH3-Z5 | cable loss (incl. 10 dB atten-uator) |
|---|---|---|---|---|
| MHz | | dB | dB | dB |
| 0.15 | | 10.1 | 0.1 | 10.0 |
| 5 | | 10.3 | 0.1 | 10.2 |
| 7 | | 10.5 | 0.2 | 10.3 |
| 10 | | 10.5 | 0.2 | 10.3 |
| 12 | | 10.7 | 0.3 | 10.4 |
| 14 | | 10.7 | 0.3 | 10.4 |
| 16 | | 10.8 | 0.4 | 10.4 |
| 18 | | 10.9 | 0.4 | 10.5 |
| 20 | | 10.9 | 0.4 | 10.5 |
| 22 | | 11.1 | 0.5 | 10.6 |
| 24 | | 11.1 | 0.5 | 10.6 |
| 26 | | 11.2 | 0.5 | 10.7 |
| 28 | | 11.2 | 0.5 | 10.7 |
| 30 | | 11.3 | 0.5 | 10.8 |

**Sample calculation**

$U_{LISN}$ (dB µV) = U (dB µV) + Corr. (dB)
U = Receiver reading
LISN Insertion loss = Voltage Division Factor of LISN
Corr. = sum of single correction factors of used LISN, cables, switch units (if used)
Linear interpolation will be used for frequencies in between the values in the table.

## 7.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

| Frequency | AF HFH-Z2) | Corr. | cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-40 dB/ decade) | $d_{Limit}$ (meas. distance (limit) | $d_{used}$ (meas. distance (used) |
|---|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | m | m |
| 0.009 | 20.50 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.01 | 20.45 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.015 | 20.37 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.02 | 20.36 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.025 | 20.38 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.03 | 20.32 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.05 | 20.35 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.08 | 20.30 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.1 | 20.20 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.2 | 20.17 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.3 | 20.14 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.49 | 20.12 | -79.6 | 0.1 | 0.1 | 0.1 | 0.1 | -80 | 300 | 3 |
| 0.490001 | 20.12 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 0.5 | 20.11 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 0.8 | 20.10 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 1 | 20.09 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 2 | 20.08 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 3 | 20.06 | -39.6 | 0.1 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 4 | 20.05 | -39.5 | 0.2 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 5 | 20.05 | -39.5 | 0.2 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 6 | 20.02 | -39.5 | 0.2 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 8 | 19.95 | -39.5 | 0.2 | 0.1 | 0.1 | 0.1 | -40 | 30 | 3 |
| 10 | 19.83 | -39.4 | 0.2 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 12 | 19.71 | -39.4 | 0.2 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 14 | 19.54 | -39.4 | 0.2 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 16 | 19.53 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 18 | 19.50 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 20 | 19.57 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 22 | 19.61 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 24 | 19.61 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 26 | 19.54 | -39.3 | 0.3 | 0.1 | 0.2 | 0.1 | -40 | 30 | 3 |
| 28 | 19.46 | -39.2 | 0.3 | 0.1 | 0.3 | 0.1 | -40 | 30 | 3 |
| 30 | 19.73 | -39.1 | 0.4 | 0.1 | 0.3 | 0.1 | -40 | 30 | 3 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -40 * LOG ($d_{Limit}$/ $d_{used}$)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values

## 7.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

**($d_{Limit}$ = 3 m)**

| Frequency | AF R&S HL562 | Corr. | cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-20 dB/ decade) | $d_{Limit}$ (meas. distance (limit) | $d_{used}$ (meas. distance (used) |
|---|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | m | m |
| 30 | 18.6 | 0.6 | 0.29 | 0.04 | 0.23 | 0.02 | 0.0 | 3 | 3 |
| 50 | 6.0 | 0.9 | 0.39 | 0.09 | 0.32 | 0.08 | 0.0 | 3 | 3 |
| 100 | 9.7 | 1.2 | 0.56 | 0.14 | 0.47 | 0.08 | 0.0 | 3 | 3 |
| 150 | 7.9 | 1.6 | 0.73 | 0.20 | 0.59 | 0.12 | 0.0 | 3 | 3 |
| 200 | 7.6 | 1.9 | 0.84 | 0.21 | 0.70 | 0.11 | 0.0 | 3 | 3 |
| 250 | 9.5 | 2.1 | 0.98 | 0.24 | 0.80 | 0.13 | 0.0 | 3 | 3 |
| 300 | 11.0 | 2.3 | 1.04 | 0.26 | 0.89 | 0.15 | 0.0 | 3 | 3 |
| 350 | 12.4 | 2.6 | 1.18 | 0.31 | 0.96 | 0.13 | 0.0 | 3 | 3 |
| 400 | 13.6 | 2.9 | 1.28 | 0.35 | 1.03 | 0.19 | 0.0 | 3 | 3 |
| 450 | 14.7 | 3.1 | 1.39 | 0.38 | 1.11 | 0.22 | 0.0 | 3 | 3 |
| 500 | 15.6 | 3.2 | 1.44 | 0.39 | 1.20 | 0.19 | 0.0 | 3 | 3 |
| 550 | 16.3 | 3.5 | 1.55 | 0.46 | 1.24 | 0.23 | 0.0 | 3 | 3 |
| 600 | 17.2 | 3.5 | 1.59 | 0.43 | 1.29 | 0.23 | 0.0 | 3 | 3 |
| 650 | 18.1 | 3.6 | 1.67 | 0.34 | 1.35 | 0.22 | 0.0 | 3 | 3 |
| 700 | 18.5 | 3.6 | 1.67 | 0.42 | 1.41 | 0.15 | 0.0 | 3 | 3 |
| 750 | 19.1 | 4.1 | 1.87 | 0.54 | 1.46 | 0.25 | 0.0 | 3 | 3 |
| 800 | 19.6 | 4.1 | 1.90 | 0.46 | 1.51 | 0.25 | 0.0 | 3 | 3 |
| 850 | 20.1 | 4.4 | 1.99 | 0.60 | 1.56 | 0.27 | 0.0 | 3 | 3 |
| 900 | 20.8 | 4.7 | 2.14 | 0.60 | 1.63 | 0.29 | 0.0 | 3 | 3 |
| 950 | 21.1 | 4.8 | 2.22 | 0.60 | 1.66 | 0.33 | 0.0 | 3 | 3 |
| 1000 | 21.6 | 4.9 | 2.23 | 0.61 | 1.71 | 0.30 | 0.0 | 3 | 3 |

**($d_{Limit}$ = 10 m)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 30 | 18.6 | -9.9 | 0.29 | 0.04 | 0.23 | 0.02 | -10.5 | 10 | 3 |
| 50 | 6.0 | -9.6 | 0.39 | 0.09 | 0.32 | 0.08 | -10.5 | 10 | 3 |
| 100 | 9.7 | -9.2 | 0.56 | 0.14 | 0.47 | 0.08 | -10.5 | 10 | 3 |
| 150 | 7.9 | -8.8 | 0.73 | 0.20 | 0.59 | 0.12 | -10.5 | 10 | 3 |
| 200 | 7.6 | -8.6 | 0.84 | 0.21 | 0.70 | 0.11 | -10.5 | 10 | 3 |
| 250 | 9.5 | -8.3 | 0.98 | 0.24 | 0.80 | 0.13 | -10.5 | 10 | 3 |
| 300 | 11.0 | -8.1 | 1.04 | 0.26 | 0.89 | 0.15 | -10.5 | 10 | 3 |
| 350 | 12.4 | -7.9 | 1.18 | 0.31 | 0.96 | 0.13 | -10.5 | 10 | 3 |
| 400 | 13.6 | -7.6 | 1.28 | 0.35 | 1.03 | 0.19 | -10.5 | 10 | 3 |
| 450 | 14.7 | -7.4 | 1.39 | 0.38 | 1.11 | 0.22 | -10.5 | 10 | 3 |
| 500 | 15.6 | -7.2 | 1.44 | 0.39 | 1.20 | 0.19 | -10.5 | 10 | 3 |
| 550 | 16.3 | -7.0 | 1.55 | 0.46 | 1.24 | 0.23 | -10.5 | 10 | 3 |
| 600 | 17.2 | -6.9 | 1.59 | 0.43 | 1.29 | 0.23 | -10.5 | 10 | 3 |
| 650 | 18.1 | -6.9 | 1.67 | 0.34 | 1.35 | 0.22 | -10.5 | 10 | 3 |
| 700 | 18.5 | -6.8 | 1.67 | 0.42 | 1.41 | 0.15 | -10.5 | 10 | 3 |
| 750 | 19.1 | -6.3 | 1.87 | 0.54 | 1.46 | 0.25 | -10.5 | 10 | 3 |
| 800 | 19.6 | -6.3 | 1.90 | 0.46 | 1.51 | 0.25 | -10.5 | 10 | 3 |
| 850 | 20.1 | -6.0 | 1.99 | 0.60 | 1.56 | 0.27 | -10.5 | 10 | 3 |
| 900 | 20.8 | -5.8 | 2.14 | 0.60 | 1.63 | 0.29 | -10.5 | 10 | 3 |
| 950 | 21.1 | -5.6 | 2.22 | 0.60 | 1.66 | 0.33 | -10.5 | 10 | 3 |
| 1000 | 21.6 | -5.6 | 2.23 | 0.61 | 1.71 | 0.30 | -10.5 | 10 | 3 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG ($d_{Limit}$/ $d_{used}$)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

## 7.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

| Frequency | AF R&S HF907 | Corr. | cable loss 1 (relay + cable inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit, atten-uator & pre-amp) | cable loss 4 (to receiver) | | |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | | |
| 1000 | 24.4 | -19.4 | 0.99 | 0.31 | -21.51 | 0.79 | | |
| 2000 | 28.5 | -17.4 | 1.44 | 0.44 | -20.63 | 1.38 | | |
| 3000 | 31.0 | -16.1 | 1.87 | 0.53 | -19.85 | 1.33 | | |
| 4000 | 33.1 | -14.7 | 2.41 | 0.67 | -19.13 | 1.31 | | |
| 5000 | 34.4 | -13.7 | 2.78 | 0.86 | -18.71 | 1.40 | | |
| 6000 | 34.7 | -12.7 | 2.74 | 0.90 | -17.83 | 1.47 | | |
| 7000 | 35.6 | -11.0 | 2.82 | 0.86 | -16.19 | 1.46 | | |

| Frequency | AF R&S HF907 | Corr. | cable loss 1 (relay inside chamber) | cable loss 2 (inside chamber) | cable loss 3 (outside chamber) | cable loss 4 (switch unit, atten-uator & pre-amp) | cable loss 5 (to receiver) | used for FCC 15.247 |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | |
| 3000 | 31.0 | -23.4 | 0.47 | 1.87 | 0.53 | -27.58 | 1.33 | |
| 4000 | 33.1 | -23.3 | 0.56 | 2.41 | 0.67 | -28.23 | 1.31 | |
| 5000 | 34.4 | -21.7 | 0.61 | 2.78 | 0.86 | -27.35 | 1.40 | |
| 6000 | 34.7 | -21.2 | 0.58 | 2.74 | 0.90 | -26.89 | 1.47 | |
| 7000 | 35.6 | -19.8 | 0.66 | 2.82 | 0.86 | -25.58 | 1.46 | |

| Frequency | AF R&S HF907 | Corr. | cable loss 1 (relay inside chamber) | cable loss 2 (High Pass) | cable loss 3 (pre-amp) | cable loss 4 (inside chamber) | cable loss 5 (outside chamber) | cable loss 6 (to receiver) |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | dB |
| 7000 | 35.6 | -57.3 | 0.56 | 1.28 | -62.72 | 2.66 | 0.94 | 1.46 |
| 8000 | 36.3 | -56.3 | 0.69 | 0.71 | -61.49 | 2.84 | 1.00 | 1.53 |
| 9000 | 37.1 | -55.3 | 0.68 | 0.65 | -60.80 | 3.06 | 1.09 | 1.60 |
| 10000 | 37.5 | -56.2 | 0.70 | 0.54 | -61.91 | 3.28 | 1.20 | 1.67 |
| 11000 | 37.5 | -55.3 | 0.80 | 0.61 | -61.40 | 3.43 | 1.27 | 1.70 |
| 12000 | 37.6 | -53.7 | 0.84 | 0.42 | -59.70 | 3.53 | 1.26 | 1.73 |
| 13000 | 38.2 | -53.5 | 0.83 | 0.44 | -59.81 | 3.75 | 1.32 | 1.83 |
| 14000 | 39.9 | -56.3 | 0.91 | 0.53 | -63.03 | 3.91 | 1.40 | 1.77 |
| 15000 | 40.9 | -54.1 | 0.98 | 0.54 | -61.05 | 4.02 | 1.44 | 1.83 |
| 16000 | 41.3 | -54.1 | 1.23 | 0.49 | -61.51 | 4.17 | 1.51 | 1.85 |
| 17000 | 42.8 | -54.4 | 1.36 | 0.76 | -62.36 | 4.34 | 1.53 | 2.00 |
| 18000 | 44.2 | -54.7 | 1.70 | 0.53 | -62.88 | 4.41 | 1.55 | 1.91 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

## 7.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

| Frequency | AF EMCO 3160-09 | Corr. | cable loss 1 (inside chamber) | cable loss 2 (pre-amp) | cable loss 3 (inside chamber) | cable loss 4 (switch unit) | cable loss 5 (to receiver) |
|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB |
| 18000 | 40.2 | -23.5 | 0.72 | -35.85 | 6.20 | 2.81 | 2.65 |
| 18500 | 40.2 | -23.2 | 0.69 | -35.71 | 6.46 | 2.76 | 2.59 |
| 19000 | 40.2 | -22.0 | 0.76 | -35.44 | 6.69 | 3.15 | 2.79 |
| 19500 | 40.3 | -21.3 | 0.74 | -35.07 | 7.04 | 3.11 | 2.91 |
| 20000 | 40.3 | -20.3 | 0.72 | -34.49 | 7.30 | 3.07 | 3.05 |
| 20500 | 40.3 | -19.9 | 0.78 | -34.46 | 7.48 | 3.12 | 3.15 |
| 21000 | 40.3 | -19.1 | 0.87 | -34.07 | 7.61 | 3.20 | 3.33 |
| 21500 | 40.3 | -19.1 | 0.90 | -33.96 | 7.47 | 3.28 | 3.19 |
| 22000 | 40.3 | -18.7 | 0.89 | -33.57 | 7.34 | 3.35 | 3.28 |
| 22500 | 40.4 | -19.0 | 0.87 | -33.66 | 7.06 | 3.75 | 2.94 |
| 23000 | 40.4 | -19.5 | 0.88 | -33.75 | 6.92 | 3.77 | 2.70 |
| 23500 | 40.4 | -19.3 | 0.90 | -33.35 | 6.99 | 3.52 | 2.66 |
| 24000 | 40.4 | -19.8 | 0.88 | -33.99 | 6.88 | 3.88 | 2.58 |
| 24500 | 40.4 | -19.5 | 0.91 | -33.89 | 7.01 | 3.93 | 2.51 |
| 25000 | 40.4 | -19.3 | 0.88 | -33.00 | 6.72 | 3.96 | 2.14 |
| 25500 | 40.5 | -20.4 | 0.89 | -34.07 | 6.90 | 3.66 | 2.22 |
| 26000 | 40.5 | -21.3 | 0.86 | -35.11 | 7.02 | 3.69 | 2.28 |
| 26500 | 40.5 | -21.1 | 0.90 | -35.20 | 7.15 | 3.91 | 2.36 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

## 7.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

| Frequency | AF EMCO 3160-10 | Corr. | cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-20 dB/ decade) | $d_{Limit}$ (meas. distance (limit) | $d_{used}$ (meas. distance (used) |
|---|---|---|---|---|---|---|---|---|---|
| GHz | dB (1/m) | dB | dB | dB | dB | dB | dB | m | m |
| 26.5 | 43.4 | -11.2 | 4.4 | | | | -9.5 | 3 | 1.0 |
| 27.0 | 43.4 | -11.2 | 4.4 | | | | -9.5 | 3 | 1.0 |
| 28.0 | 43.4 | -11.1 | 4.5 | | | | -9.5 | 3 | 1.0 |
| 29.0 | 43.5 | -11.0 | 4.6 | | | | -9.5 | 3 | 1.0 |
| 30.0 | 43.5 | -10.9 | 4.7 | | | | -9.5 | 3 | 1.0 |
| 31.0 | 43.5 | -10.8 | 4.7 | | | | -9.5 | 3 | 1.0 |
| 32.0 | 43.5 | -10.7 | 4.8 | | | | -9.5 | 3 | 1.0 |
| 33.0 | 43.6 | -10.7 | 4.9 | | | | -9.5 | 3 | 1.0 |
| 34.0 | 43.6 | -10.6 | 5.0 | | | | -9.5 | 3 | 1.0 |
| 35.0 | 43.6 | -10.5 | 5.1 | | | | -9.5 | 3 | 1.0 |
| 36.0 | 43.6 | -10.4 | 5.1 | | | | -9.5 | 3 | 1.0 |
| 37.0 | 43.7 | -10.3 | 5.2 | | | | -9.5 | 3 | 1.0 |
| 38.0 | 43.7 | -10.2 | 5.3 | | | | -9.5 | 3 | 1.0 |
| 39.0 | 43.7 | -10.2 | 5.4 | | | | -9.5 | 3 | 1.0 |
| 40.0 | 43.8 | -10.1 | 5.5 | | | | -9.5 | 3 | 1.0 |

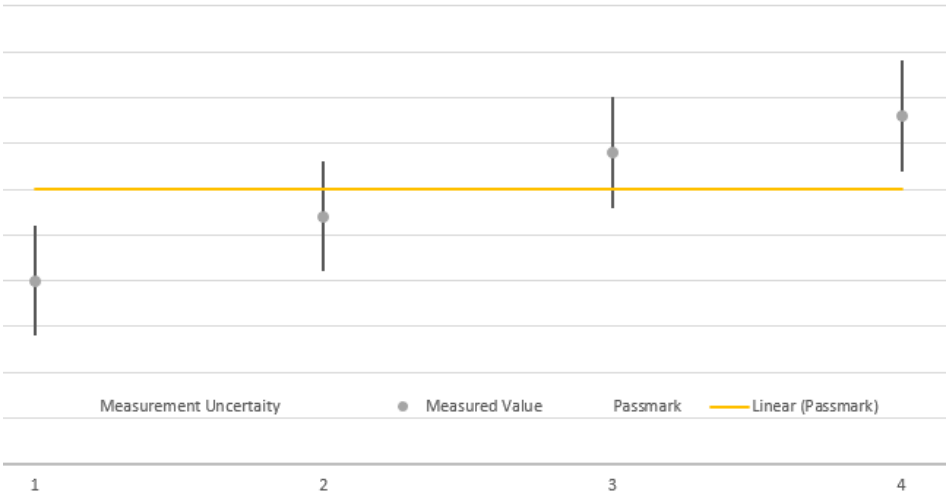
**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
distance correction = -20 * LOG ($d_{Limit}$/ $d_{used}$)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

# 8 MEASUREMENT UNCERTAINTIES

| Test Case(s) | Parameter | Uncertainty |
|---|---|---|
| 7.12 - Radiated Spurious Emissions | Power | ± 5.5 dB |
| 7.1 -Authorized Frequency Band<br>7.10 - Occupied Bandwidth (99%) | Power<br>Frequency | ± 2.9 dB<br>± 11.2 kHz |
| 7.2 - Maximum Power<br>7.3 - Maximum Booster Gain<br>7.4 – Intermodulation<br>7.7.1 – Maximum TX Power Noise,<br>7.7.2 - Variable Uplink Noise<br>7.8 - Uplink Inactivity<br>7.9.1 - Variable Gain, | Power | ± 2.2 dB |
| 7.9.2 - Variable Uplink Gain Timing<br>7.11.2 - Oscillation Shutdown<br>7.11.3 - Oscillation Mitigation | Power<br>Time | ± 2.2 dB<br>± 1 x $10^{-4}$s<br>± 120 x $10^{-3}$s |
| 7.5 - Out-of-band emissions<br>7.6 – Conducted Spurious Emissions | Power<br>Frequency | ± 2.2 dB<br>± 11.2 kHz |

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) k = 1.96. This means, that the true value is in the corresponding interval with a probability of 95 %.




The verdicts in this test report are given according the above diagram:

| Case | Measured Value | Uncertainty Range | Verdict |
|---|---|---|---|
| 1 | below pass mark | below pass mark | Passed |
| 2 | below pass mark | within pass mark | Passed |
| 3 | above pass mark | within pass mark | Failed |
| 4 | above pass mark | above pass mark | Failed |

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.