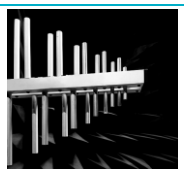
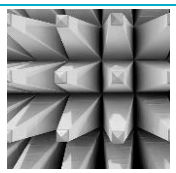

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

# TEST REPORT

**Test report no.: 1-0421/20-01-08**

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

## Testing Laboratory


**CTC advanced GmbH**
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
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Fax: + 49 681 5 98 - 9075
Internet: https://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com


**Accredited Testing Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-03

## Applicant


**FEIG ELECTRONIC GmbH**
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35781 Weilburg/GERMANY
Phone: +49 6471 31 09-0
Contact: Reinhard Monno
e-mail: reinhard.monno@feig.de
Phone: +49 6471-3109.428


## Manufacturer


**FEIG ELECTRONIC GmbH**
Lange Str. 4
35781 Weilburg/GERMANY


## Test Standard/s

| | |
|---|---|
| FCC - Title 47 CFR Part 15 | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |

For further applied test standards please refer to section 3 of this test report.

## Test Item

| | |
|---|---|
| **Kind of test item:** | **UHF RFID Reader** |
| **Model name:** | **LRU3000A/3500A** |
| **FCC ID:** | **PJMLRU3000A** |
| **IC ID:** | **6633A-LRU3000A** |
| Frequency: | DTS band 902 – 928 MHz |
| Technology tested: | RFID |
| Antenna: | Up to 4 external antennas |
| Power supply: | LRU3000: 24.0V DC by external power supply<br>LRU3500: 48.0 V DC by POE |
| Temperature range: | -25°C to +55°C |

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test report authorized:

cn=David Lang, o=CTC advanced GmbH, ou=LNG-161129, email=david.lang@ctcadvanced.com, c=DE
2020.12.22 13:26:00 +01'00'

David Lang
Lab Manager
Radio Communications

## Test performed:

cn=Michael Dorongovski, o=CTC Advanced GmbH, ou=RCE-201118, email=Michael.Dorongovski@ctcadvanced.com, c=DE
2020.12.22 13:13:53 +01'00'

Michael Dorongovski
Lab Manager
Radio Communications

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# 2 General information

## 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.
The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".
CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.
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All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH.
In no case this test report can be considered as a Letter of Approval.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2020-06-19 |
| Date of receipt of test item: | 2020-06-22 |
| Start of test: | 2020-07-13 |
| End of test: | 2020-12-21 |
| Person(s) present during the test: | -/- |

## 2.3 Test laboratories sub-contracted

None

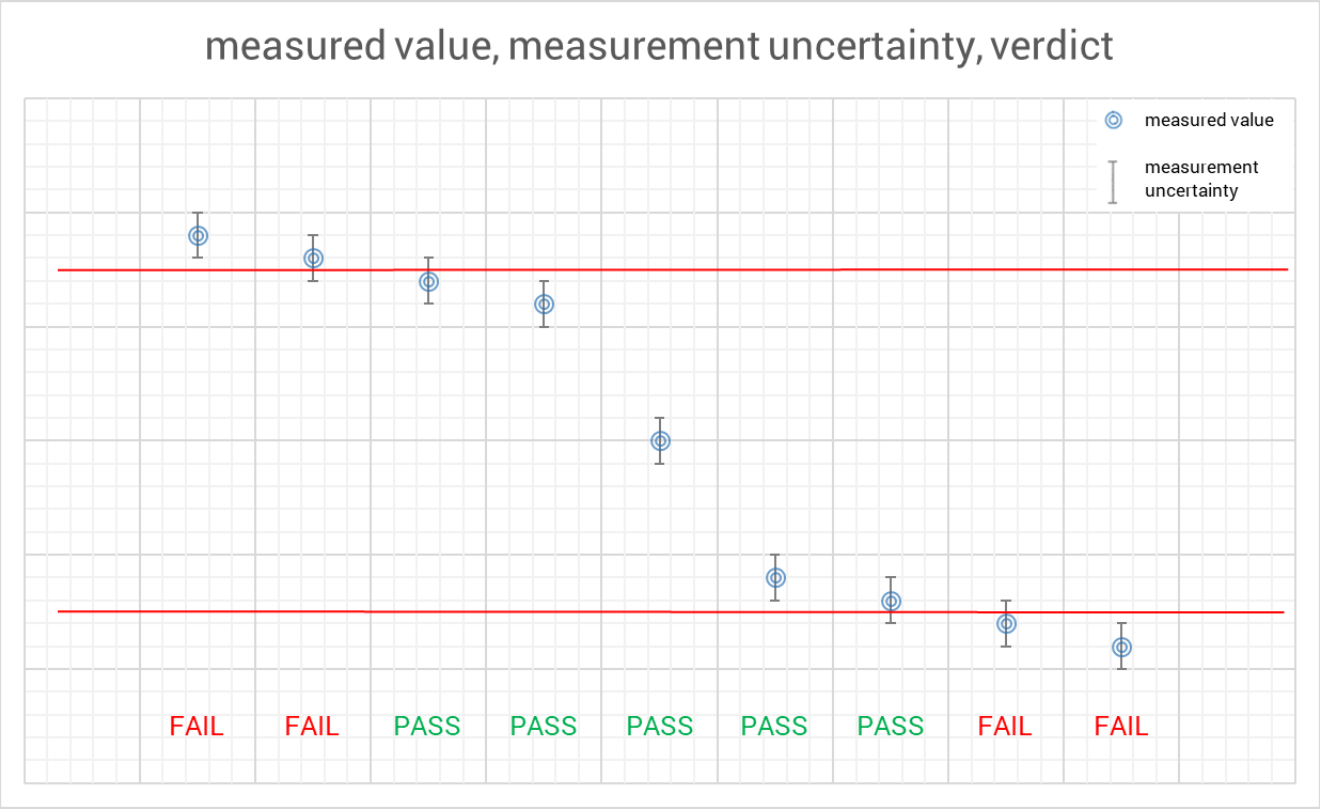
# 3 Test standard/s

| Test standard | Date | Description |
|---|---|---|
| FCC - Title 47 CFR Part 15 | | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | February 2017 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |
| RSS - Gen Issue 5 incl. Amendment 1 | March 2019 | Spectrum Management and Telecommunications Radio Standards Specification<br>- General Requirements for Compliance of Radio Apparatus |

| Guidance | Version | Description |
|---|---|---|
| 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 |

## 4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9 but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



# 5 Test environment

| | | |
|---|---|---|
| Temperature: | $T_{nom}$ | +23 °C during room temperature tests |
| | $T_{max}$ | No tests under extreme environmental conditions required. |
| | $T_{min}$ | No tests under extreme environmental conditions required. |
| Relative humidity: | | 45 % |
| Air pressure: | | not relevant for this kind of testing |
| Power supply: | $V_{nom}$ | 24.0 V DC by external power supply |
| | $V_{max}$ | No tests under extreme environmental conditions required. |
| | $V_{min}$ | No tests under extreme environmental conditions required. |

# 6 Test item

## 6.1 General description

| | | |
|---|---|---|
| Kind of test item | : | UHF RFID Reader |
| Type identification | : | LRU3000A/3500A |
| HMN | : | n/a |
| PMN | : | ID ISC.LRU3000-FCC<br>ID ISC.LRU3500-FCC |
| HVIN | : | FE784 |
| FVIN | : | n/a |
| S/N serial number | : | 7243410 |
| Hardware status | : | FE784 |
| Software status | : | -/- |
| Firmware status | : | -/- |
| Frequency band | : | DTS band 902 – 928 MHz |
| Type of radio transmission<br>Use of frequency spectrum | :<br>: | FHSS |
| Type of modulation | : | PR-ASK |
| Number of channels | : | 50 |
| Antenna | : | Up to 4 external antennas |
| Power supply | : | LRU3000A: 24.0 V DC by external power supply<br>LRU3500A: 48.0 V DC by POE |
| Temperature range | : | -25°C to +55°C |

## 6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-0421/20-01-01_AnnexA
1-0421/20-01-01_AnnexB
1-0421/20-01-01_AnnexD

# 7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

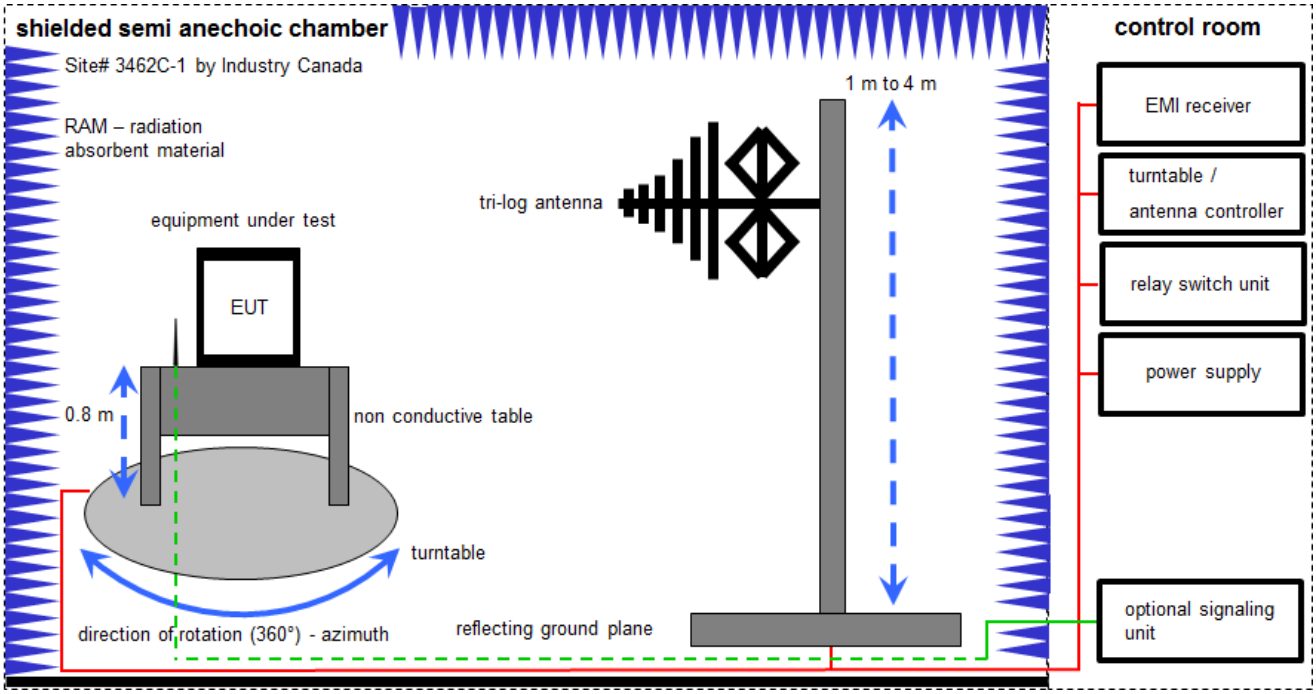
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

**Agenda:** Kind of Calibration

| | | | |
|---|---|---|---|
| k | calibration / calibrated | EK | limited calibration |
| ne | not required (k, ev, izw, zw not required) | zw | cyclical maintenance (external cyclical maintenance) |
| ev | periodic self verification | izw | internal cyclical maintenance |
| Ve | long-term stability recognized | g | blocked for accredited testing |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

## 7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.




Measurement distance: tri-log antenna 10 meter; EMC32 software version: 10.30.0

FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)
*Example calculation:*
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

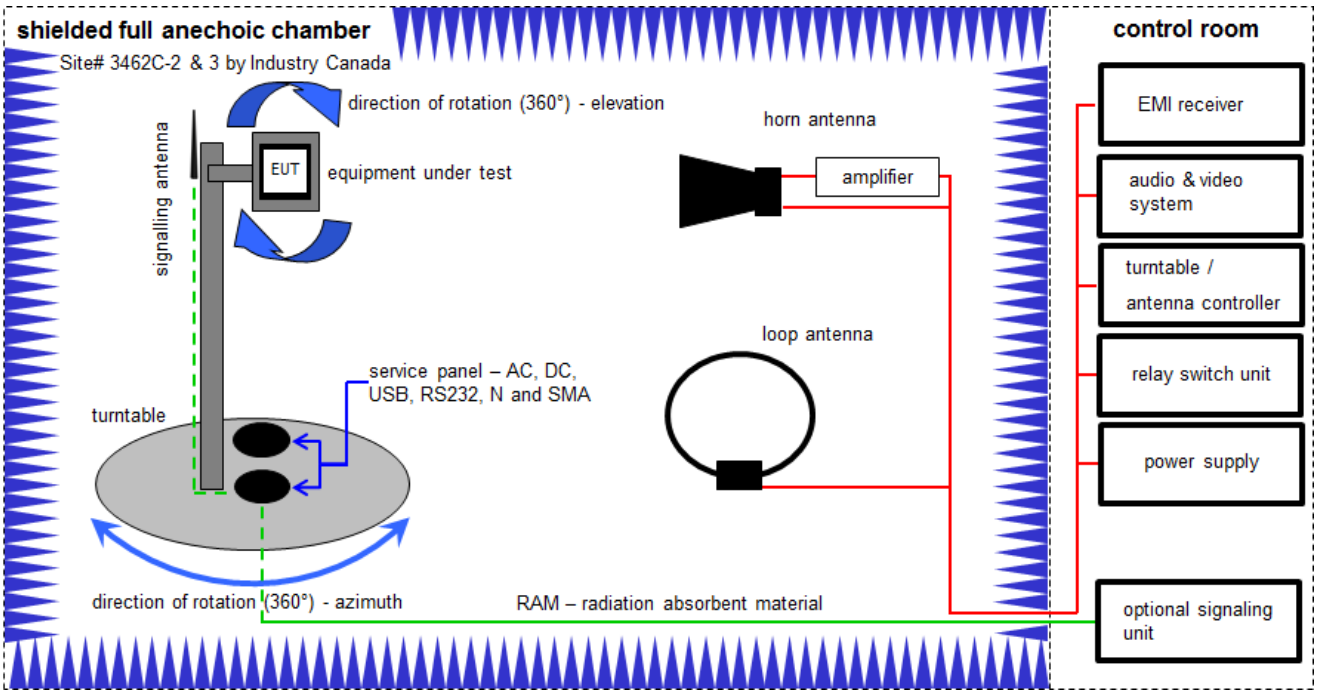
**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | EMI Test Receiver | ESR 3 | R&S | 102587 | 300005771 | k | 21.05.2019<br>10.12.2020 | 20.11.2020<br>09.06.2022 |
| 2 | A | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | Ve | 17.01.2020 | 16.01.2022 |
| 3 | A | Antenna Tower | Model 2175 | ETS-Lindgren | 64762 | 300003745 | izw | -/- | -/- |
| 4 | A | Positioning Controller | Model 2090 | ETS-Lindgren | 64672 | 300003746 | izw | -/- | -/- |
| 5 | A | Turntable Interface-Box | Model 105637 | ETS-Lindgren | 44583 | 300003747 | izw | -/- | -/- |
| 6 | A | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 295 | 300003787 | k | 19.02.2019 | 18.02.2021 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7 | A | Spectrum-Analyzer | FSU26 | R&S | 200809 | 300003874 | k | 16.12.2019<br>09.12.2020 | 15.12.2020<br>08.12.2021 |
| 8 | A | Switch-Unit | 3488A | HP | 2719A14505 | 300000368 | ev | -/- | -/- |
| 9 | A | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP | 2920A04466 | 300000580 | ne | -/- | -/- |
| 10 | A | Meßkabine 1 | HF-Absorberhalle | MWB AG 300023 | -/- | 300000551 | ne | -/- | -/- |

**NOTE: The tests were performed when all equipment was calibrated.**

## 7.2 Shielded fully anechoic chamber




Measurement distance: horn antenna 3 meter; loop antenna 3 meter

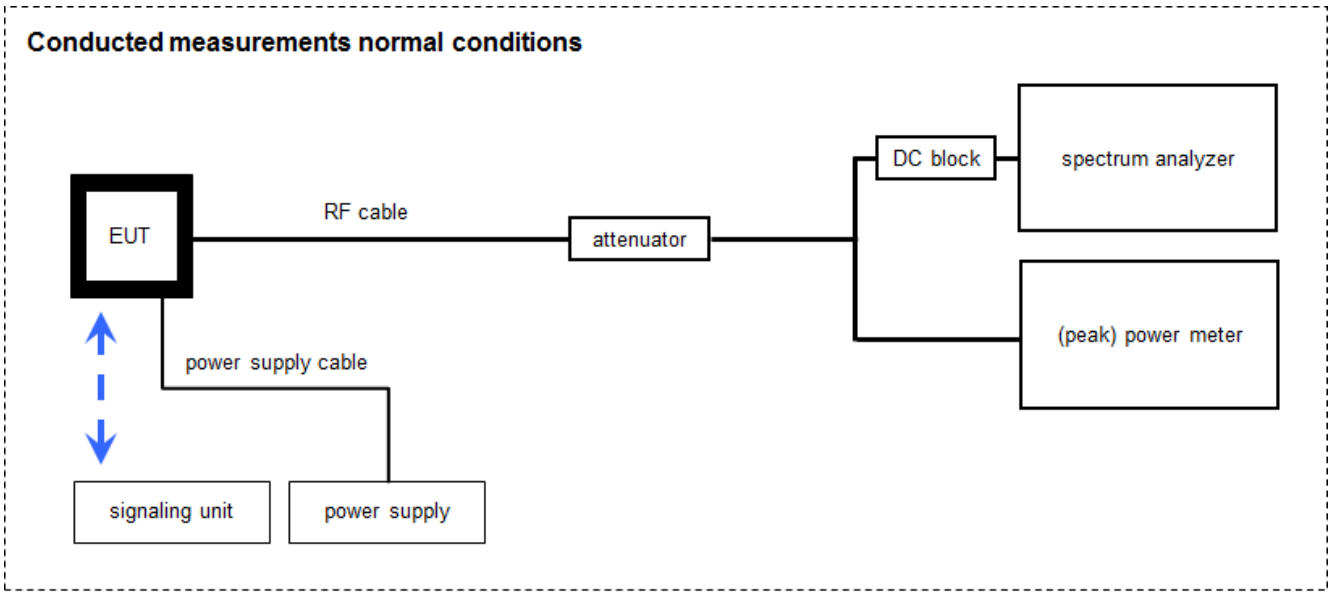
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

*Example calculation:*
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A, B | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP | 2818A03450 | 300001040 | vIKI! | 12.12.2017<br>09.12.2020 | 11.12.2020<br>08.12.2021 |
| 2 | A | Active Loop Antenna 9 kHz to 30 MHz | 6502 | EMCO | 2210 | 300001015 | vIKI! | 13.06.2019 | 12.06.2021 |
| 3 | A, B | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | -/- | -/- |
| 4 | B | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 9107-3697 | 300001605 | vIKI! | 27.02.2019 | 26.02.2021 |
| 5 | A, B | Switch / Control Unit | 3488A | HP | * | 300000199 | ne | -/- | -/- |
| 6 | A, B | EMI Test Receiver 20Hz- 26,5GHz | ESU26 | R&S | 100037 | 300003555 | k | 11.12.2019<br>11.12.2020 | 10.12.2020<br>10.12.2021 |
| 7 | B | Highpass Filter | WHK1.1/15G-10SS | Wainwright | 3 | 300003255 | ev | -/- | -/- |
| 8 | B | Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 19 | 300003790 | ne | -/- | -/- |
| 9 | B | High Pass Filter | VHF-3500+ | Mini Circuits | -/- | 400000193 | ne | -/- | -/- |
| 10 | B | Broadband Amplifier 0.5-18 GHz | CBLU5184540 | CERNEX | 22049 | 300004481 | ev | -/- | -/- |
| 11 | A, B | 4U RF Switch Platform | L4491A | Agilent Technologies | MY50000037 | 300004509 | ne | -/- | -/- |

## 7.3 Conducted measurements with peak power meter & spectrum analyzer




WLAN tester version: 1.1.13; LabView2015

OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

*Example calculation:*
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | PC | ExOne | F+W | | 300004703 | ne | -/- | -/- |
| 2 | B | EMI Test Receiver 9 kHz - 3 GHz incl. Preselector | ESPI3 | R&S | 101713 | 300004059 | k | 09.12.2019<br>10.12.2020 | 08.12.2020<br>09.12.2021 |
| 3 | A | Spectrumanalyzer | FSV30 | R&S | 100763 | 300003950 | k | 15.01.2020 | 14.01.2021 |
| 4 | C | Spectrum Analyzer | FSV30 | Rohde & Schwarz | 103809 | 300005359 | vIKI! | 08.12.2020 | 07.12.2021 |
| 5 | A, B, C | DC Power Supply 0 – 32V | 1108-32 | Heiden Elektronik | 001702 | 300001392 | vIKI! | 17.12.2019 | 16.12.2022 |

# 8 Sequence of testing

## 8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement***

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

**Final measurement**

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

## 8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 8.3 Sequence of testing radiated spurious 1 GHz to 12.75 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

# 9 Measurement uncertainty

| Measurement uncertainty | |
|---|---|
| **Test case** | **Uncertainty** |
| Antenna gain | ± 3 dB |
| Carrier frequency separation | ± 21.5 kHz |
| Number of hopping channels | -/- |
| Spectrum bandwidth | ± 21.5 kHz absolute; ± 15.0 kHz relative |
| Maximum output power | ± 1 dB |
| Detailed conducted spurious emissions @ the band edge | ± 1 dB |
| Band edge compliance radiated | ± 3 dB |
| Spurious emissions conducted | ± 3 dB |
| Spurious emissions radiated below 30 MHz | ± 3 dB |
| Spurious emissions radiated 30 MHz to 1 GHz | ± 3 dB |
| Spurious emissions radiated 1 GHz to 12.75 GHz | ± 3.7 dB |
| Spurious emissions radiated above 12.75 GHz | ± 4.5 dB |

## 10 Summary of measurement results

| | |
|---|---|
| ☐ | No deviations from the technical specifications were ascertained |
| ☐ | There were deviations from the technical specifications ascertained |
| ☐ | This test report is only a partial test report. The content and verdict of the performed test cases are listed below. |

| TC Identifier | Description | Verdict | Date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Part 15<br>RSS - 247, Issue 2 | See table below | 2020-12-22 | Tests according to customer demand |

| Test specification clause | Test case | Temperature conditions | Power source voltages | Mode | C | NC | NA | NP | Remark |
|---|---|---|---|---|---|---|---|---|---|
| §15.247(b)(4)<br>RSS - 247 / 5.4 (d) | Antenna gain | Nominal | Nominal | -/- | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (b) | Carrier frequency separation | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (d) | Number of hopping channels | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(a)(1) (iii)<br>RSS - 247 / 5.1 (d) | Time of occupancy (dwell time) | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(a)(1)<br>RSS - 247 / 5.1 (a) | Spectrum bandwidth of a FHSS system bandwidth | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(b)(1)<br>RSS - 247 / 5.4 (b) | Maximum output power | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5 | Detailed spurious emissions @ the band edge - conducted | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.205<br>RSS - 247 /<br>5.5 RSS - Gen | Band edge compliance radiated | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5 | Spurious emissions conducted | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.209(a)<br>RSS - Gen | Spurious emissions radiated below 30 MHz | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5<br>§15.109<br>RSS - Gen | Spurious emissions radiated 30 MHz to 1 GHz | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.247(d)<br>RSS - 247 / 5.5<br>§15.109<br>RSS - Gen | Spurious emissions radiated above 1 GHz | Nominal | Nominal | PR-ASK | ☒ | ☐ | ☐ | ☐ | -/- |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| §15.107(a)<br>§15.207 | Conducted emissions below 30 MHz (AC conducted) | Nominal | Nominal | -/- | ☐ | ☐ | ☒ | ☐ | -/- |

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

# 11 RF measurements

## 11.1 Additional comments

Reference documents: None

Special test descriptions: The EUT has 4 antenna ports. These ports can be used single or in a time division multiplexed mode where only one port is active in a time slot. All ports are equal in the RF performance (see Chapter 12.5). All measurements were performed in single port mode on Port 1.

Configuration descriptions: The EUT is designed to be used in combination with different antennas. All conducted measurements were performed with the highest output power supported by the EUT (1.0 Watt = 30 dBm, conducted output power limit).
The maximum antenna gain of the used antennas is 6.0 dBi when used together with the applicable cable length which is ensured by the professional installation of the devices.
The radiated tests were performed with the -Feig ID ANT.U600/270-FCC antenna which has the highest gain.
All tests were performed on the LRU3000A with 24 V DC power supply.

Antenna configuration: - Allowed antenna configurations for the EUT are:

| Antenna Type | Permitted Cable Attenuation |
|---|---|
| ID ISC.ANT.U600/270-FCC (10.5 dBic) | Min. 5,0 m of cable type Belden H155 (0,3 dB/m) or min. 3,0 m of cable type RG58 (0,5 dB/m) |
| ID ISC.ANT.U270/270-FCC (9.0 dBic) | No requirements. |
| ID ANT.U580/290-FCC (11.0 dBic) | min. 6,0 m of cable type Belden H155 (0,3 dB/m) |
| ID ANT.U290/290-FCC (9.0 dBic) | min. 2,0 m of cable type Belden H155 (0,3 dB/m) |
| IS ISC.ANT.U170/170 (4.0 dBic) | No requirements. |

Test mode: ☒ Special software was used. (ISOStart)
EUT is transmitting pseudo random data by itself

# 12 Measurement results

## 12.1 Carrier Frequency Separation

**Description:**

Measurement of the carrier frequency separation of a hopping system. We use PR-ASK-modulation to show compliance. EUT in hopping mode.

| Measurement parameters | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | 10 kHz |
| Video bandwidth | 3 MHz |
| Span | See plots |
| Trace mode | Max hold |
| Test setup | See sub clause 7.3 B |
| Measurement uncertainty | See sub clause 9 |

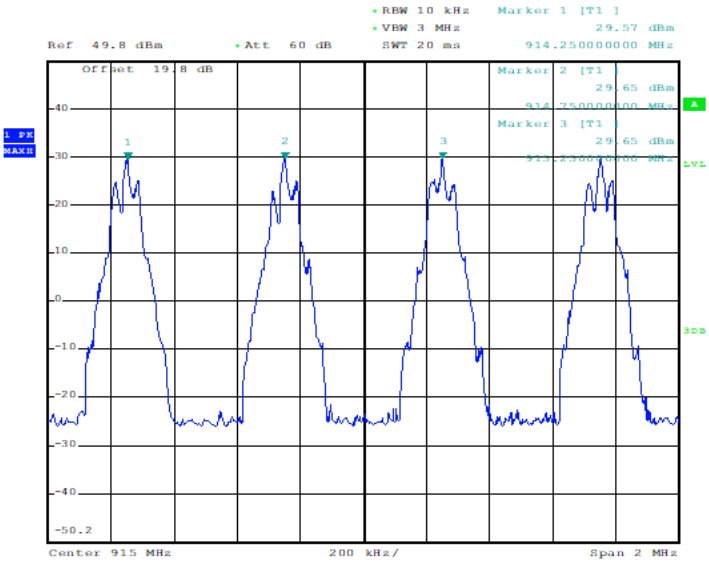
**Limits:**

| FCC | IC |
|---|---|
| Carrier frequency separation | |
| Minimum 25 kHz or two-thirds of the 20 dB bandwidth of the hopping system whichever is greater. The two-thirds of the 20 dB bandwidth for IC is only valid for the ISM band 2400 – 2483.5 MHz. | |

**Result:** The channel separation is 500 kHz.

**Plots:**

Plot 1: Frequency separation



## 12.2 Number of Hopping Channels

**Description:**

Measurement of the total number of used hopping channels. The number of hopping channels is constant for all modulation-modes. We use PR-ASK -modulation to show compliance. EUT in hopping mode.

| Measurement parameters | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | See plots |
| Video bandwidth | See plots |
| Span | See plots |
| Trace mode | Max hold |
| Test setup | See sub clause 7.3 B |
| Measurement uncertainty | See sub clause 9 |

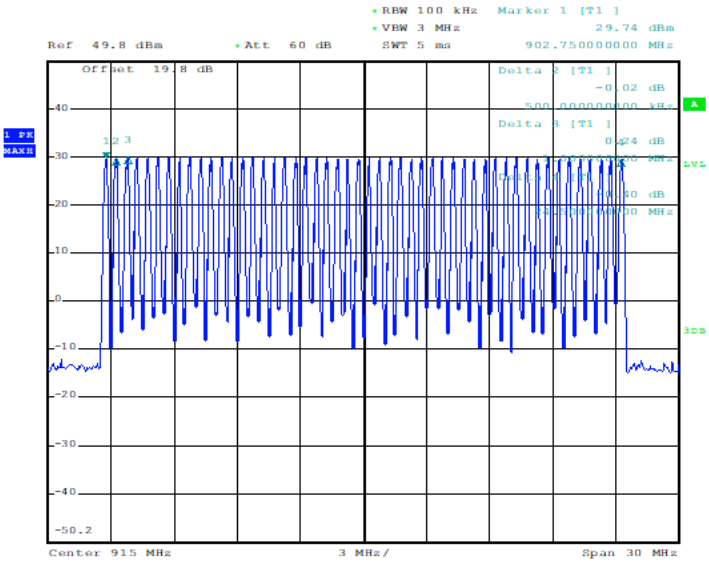
**Limits:**

| FCC | IC |
|---|---|
| Number of hopping channels | |
| At least 25 non overlapping hopping channels. If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels. | |

**Result:** The EUT uses 50 channels.

**Plots:**

Plot 1: Number of channels



## 12.3 Average Time of Occupancy (dwell time)

| Measurement parameters | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | See plots |
| Video bandwidth | See plots |
| Span | See plots |
| Trace mode | Max hold |
| Test setup | See sub clause 7.3 B |
| Measurement uncertainty | See sub clause 9 |

**Limits:**

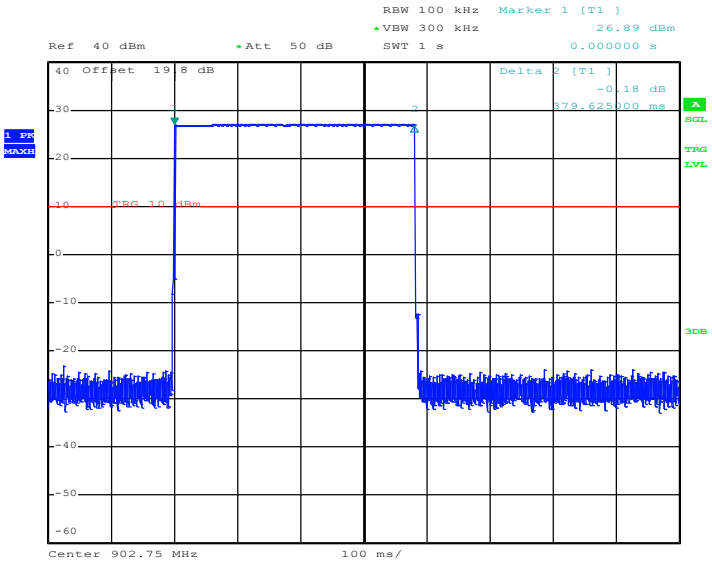
| FCC | IC |
|---|---|
| Average time of occupancy | |
| For frequency hopping systems operating in the 902-928 MHz band: If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 10 second period. | |

**Result:** The time slot length is = 380.0 ms
Number of hops / channel @ 20s = 1

Within 20 s period, the average time of occupancy in 20 s: 380.0 ms

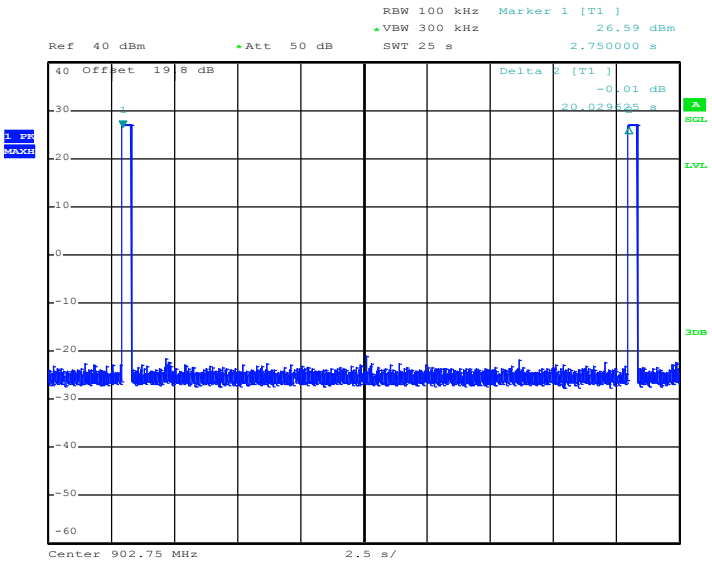
**Plots:**

Plot 1: Time slot length = 379.6 ms



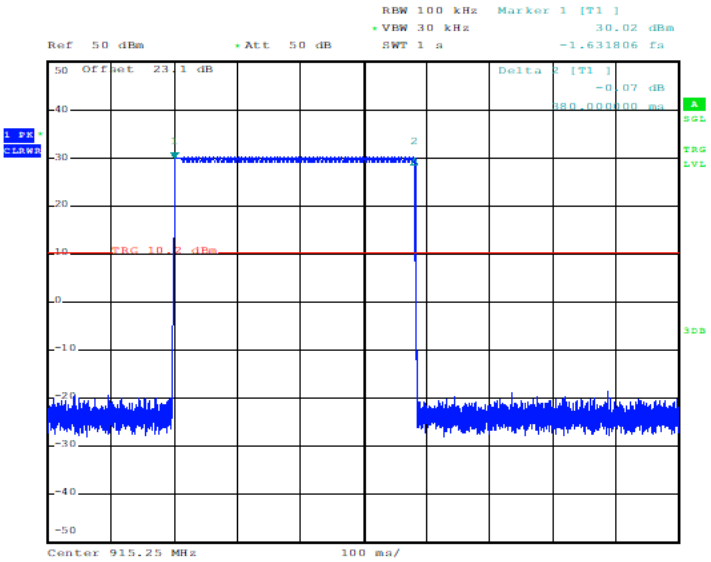

Date: 4.JAN.2003 02:32:38

Plot 2: hops / channel @ 20s = 1

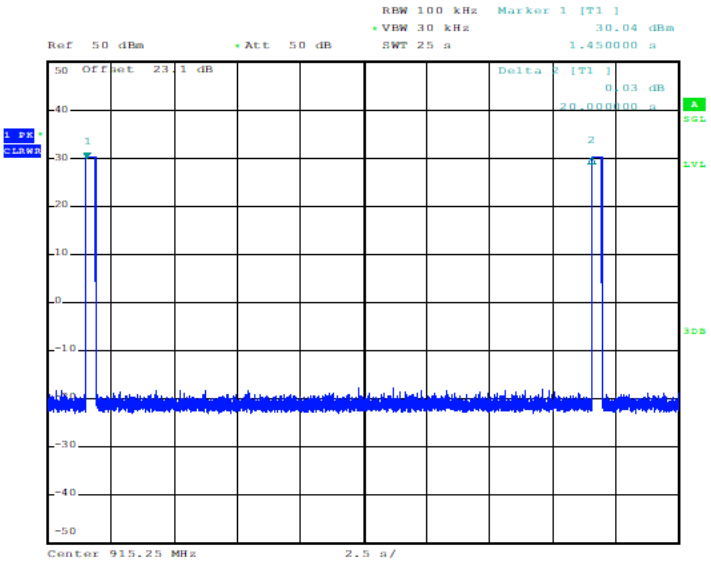



Date: 4.JAN.2003 02:40:07

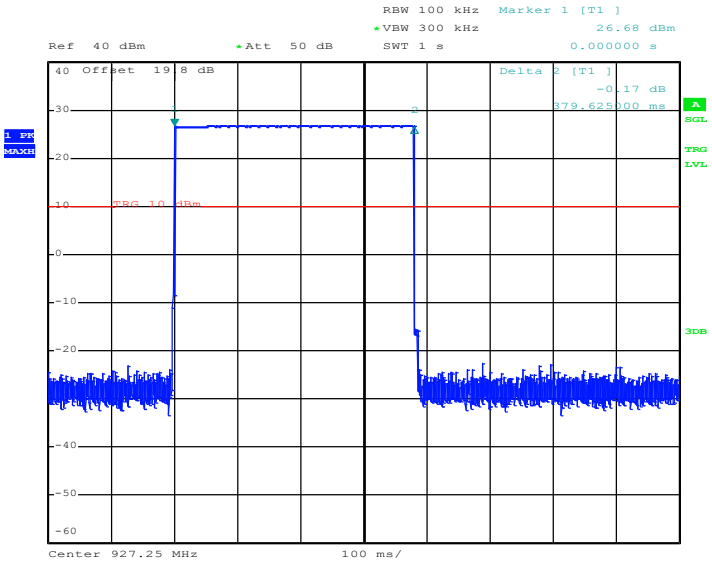
Plot 3: Time slot length = 380.0 ms




Plot 4: hops / channel @ 20s = 1

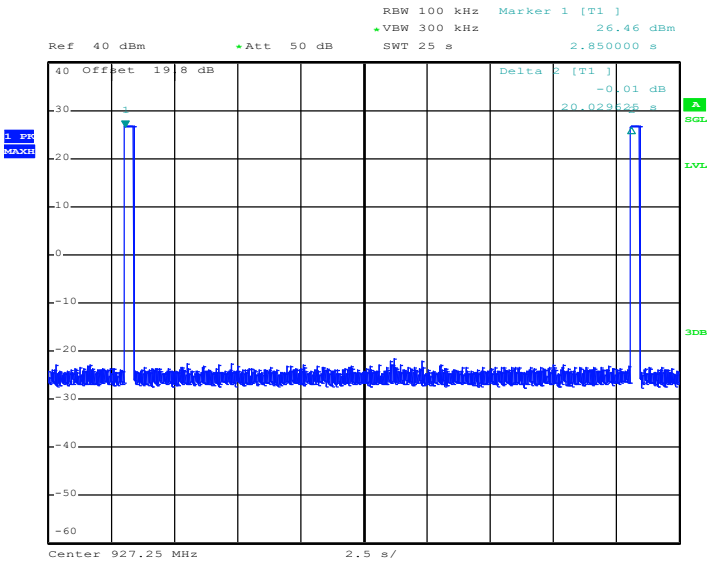


Plot 5: Time slot length = 379.6 ms




Date: 4.JAN.2003 02:33:53

Plot 6: hops / channel @ 20s = 1




Date: 4.JAN.2003 02:38:18

## 12.4 Spectrum bandwidth of a FHSS system

**Description:**

Measurement of the 20dB bandwidth and 99% bandwidth of the modulated signal. The measurement is performed according to the "Measurement Guidelines" (DA 00-705, March 30, 2000). EUT in single channel mode.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | 5 kHz |
| Video bandwidth | 30 kHz |
| Span | See plots |
| Trace mode | Max hold |
| Test setup | See sub clause 7.3 B |
| Measurement uncertainty | See sub clause 9 |

**Limits:**

| FCC | IC |
|---|---|
| Spectrum bandwidth of a FHSS system | |
| The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. | |

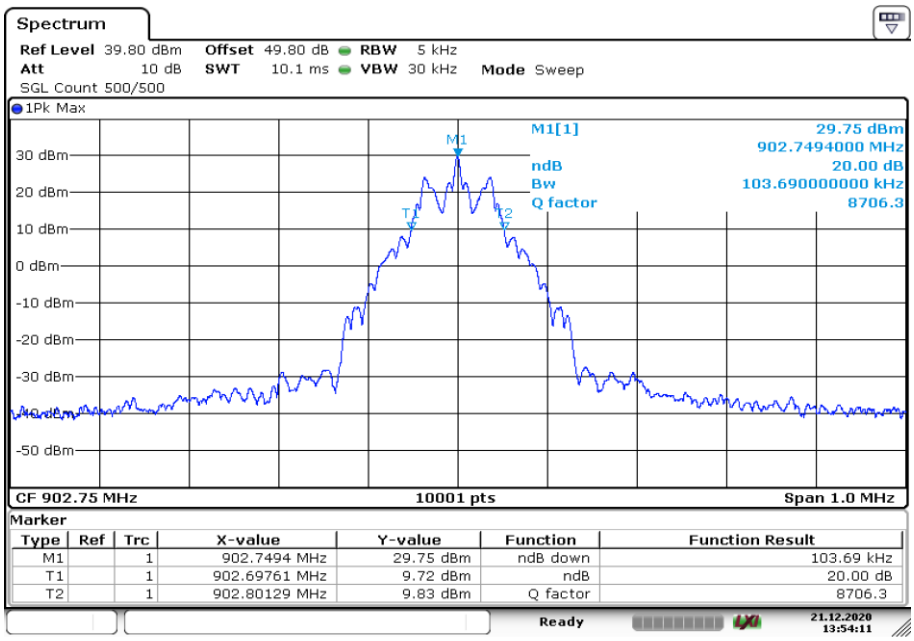
**Result:**

| Test Conditions | | 20dB BANDWIDTH [kHz] | | |
|---|---|---|---|---|
| | | Low channel | Middle channel | High channel |
| $T_{nom}$ | $V_{nom}$ | 103.7 | 104.0 | 103.8 |

| Test Conditions | | 99% BANDWIDTH [kHz] | | |
|---|---|---|---|---|
| | | Low channel | Middle channel | High channel |
| $T_{nom}$ | $V_{nom}$ | 121.6 | 122.3 | 122.2 |

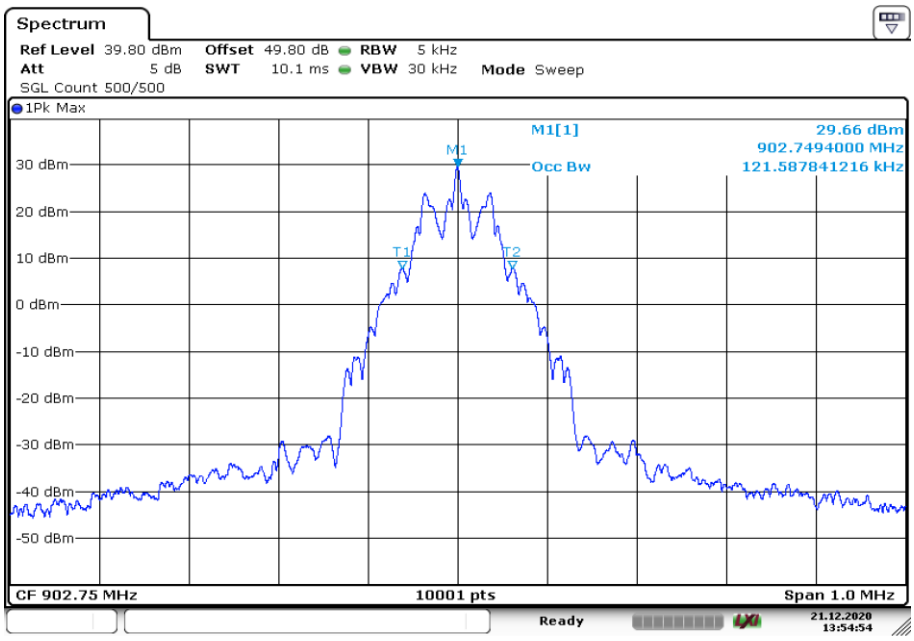
**Plots:**

Plot 1: Low Channel 20 dB-Bandwidth



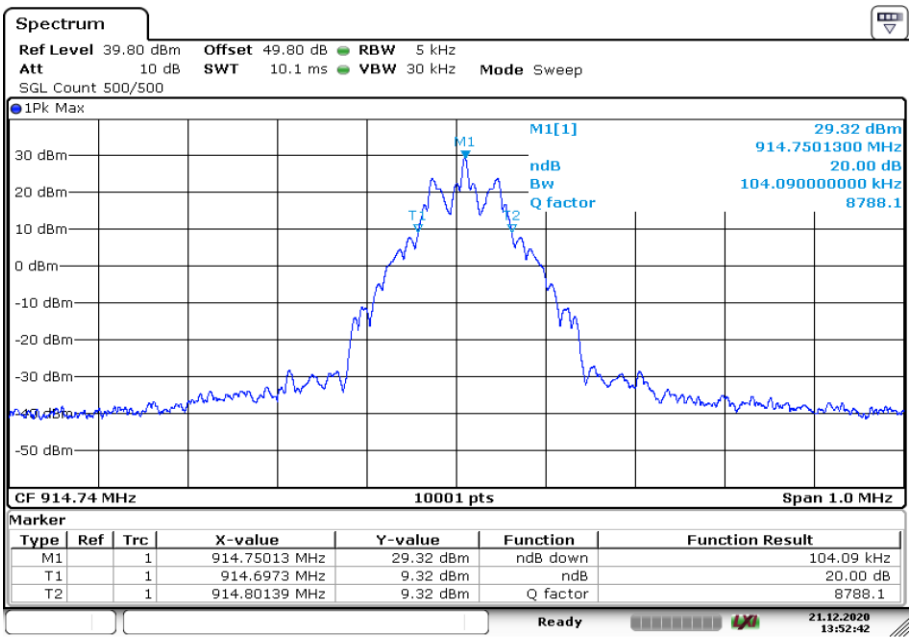

Date: 21.DEC.2020 13:54:11

Plot 2: Low Channel OBW 99



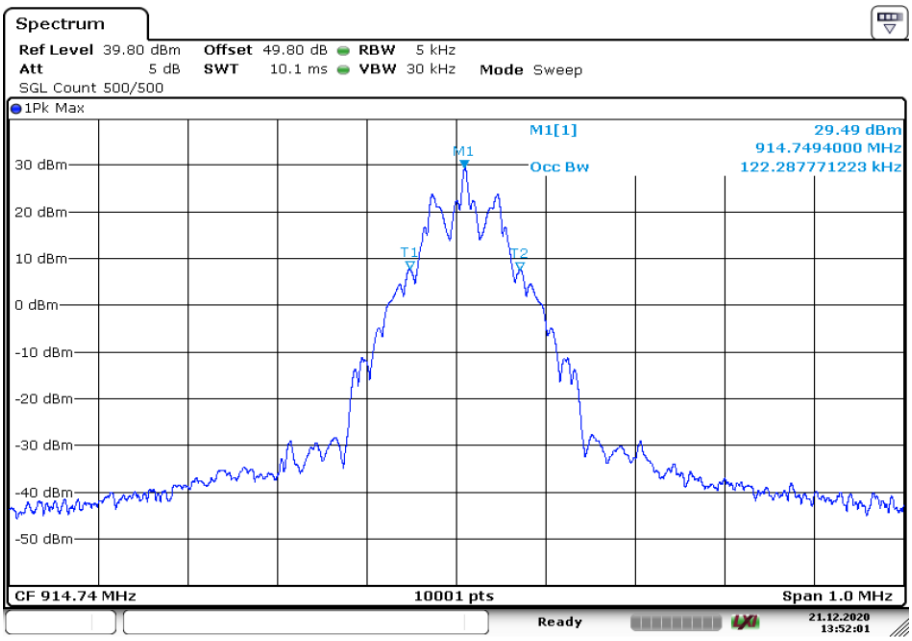

Date: 21.DEC.2020 13:54:54

Plot 3: Mid Channel 20 dB-Bandwidth



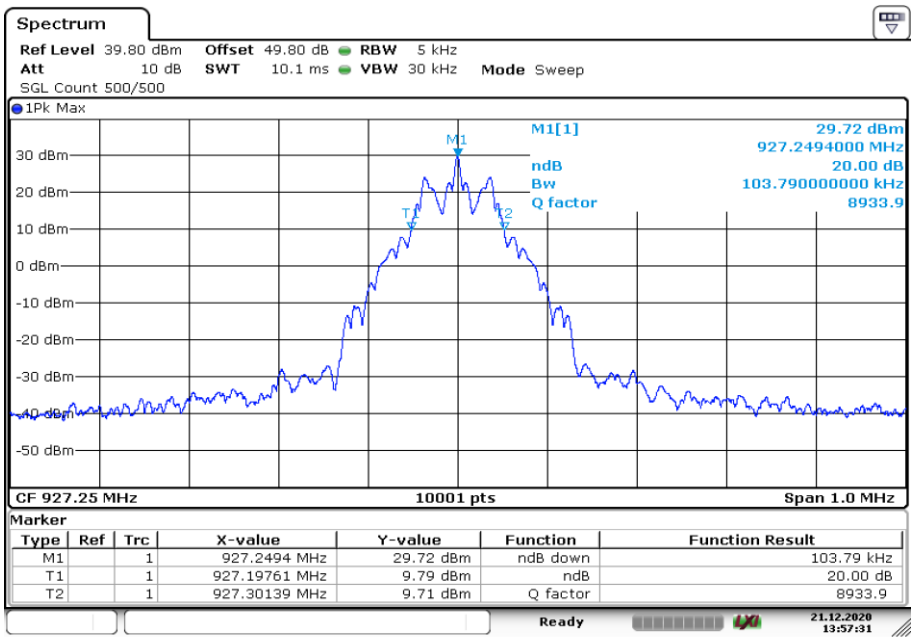

Date: 21.DEC.2020 13:52:42

Plot 4: Mid Channel OBW 99



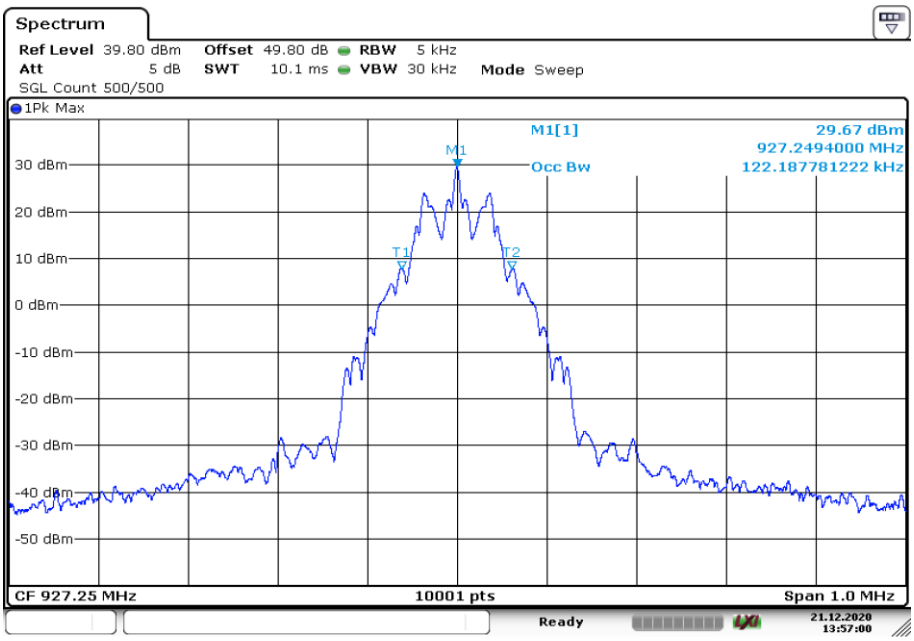

Date: 21.DEC.2020 13:52:02

Plot 5: High Channel 20 dB-Bandwidth




Date: 21.DEC.2020 13:57:31

Plot 6: High Channel OBW 99




Date: 21.DEC.2020 13:57:00

## 12.5 Maximum Peak Output Power

**Measurement:**

| Measurement parameter | |
|---|---|
| Parameter | See plots |
| Used equipment: | See chapter 7.3 C |
| Measurement uncertainty: | See chapter 9 |

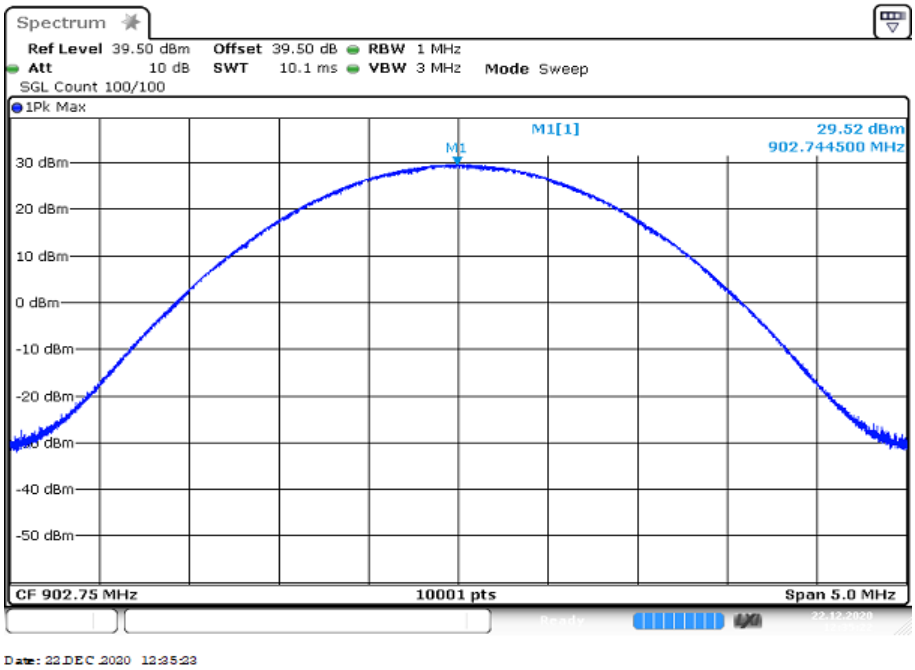
**Limits:**

| FCC | IC |
|---|---|
| Maximum Output Power Conducted | |
| For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section. | |

**Result:**

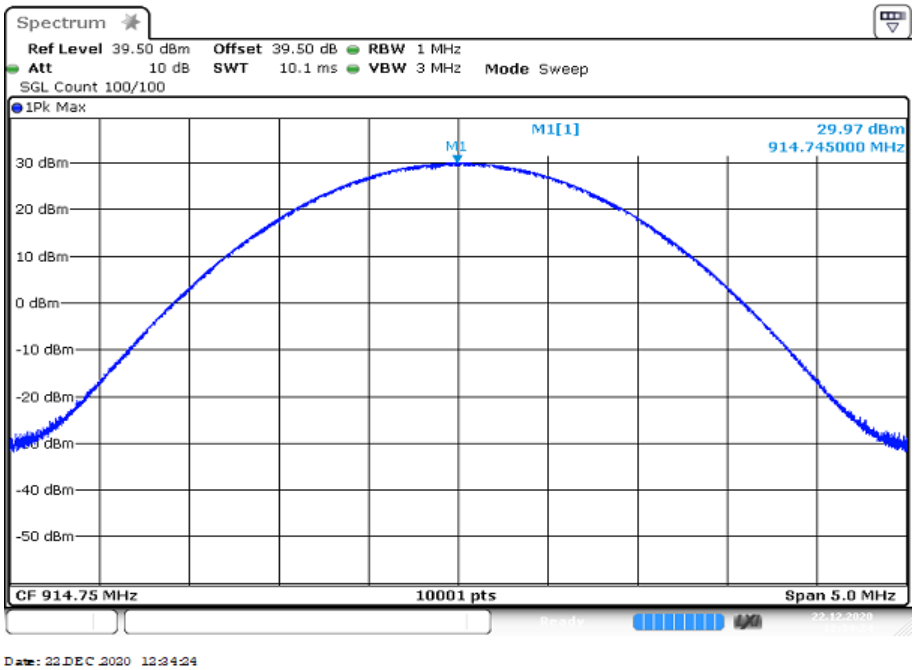
| | Maximum Peak Output Power Conducted [dBm] | | |
|---|---|---|---|
| | Low channel | Middle channel | High channel |
| Port 1 | 29.52 | 29.97 | 29.64 |
| Port 2 | 29.43 | 29.86 | 29.63 |
| Port 3 | 29.59 | 29.93 | 29.64 |
| Port 4 | 29.99 | 29.78 | 29.52 |

**Plot 1:** Lowest channel, Port 1



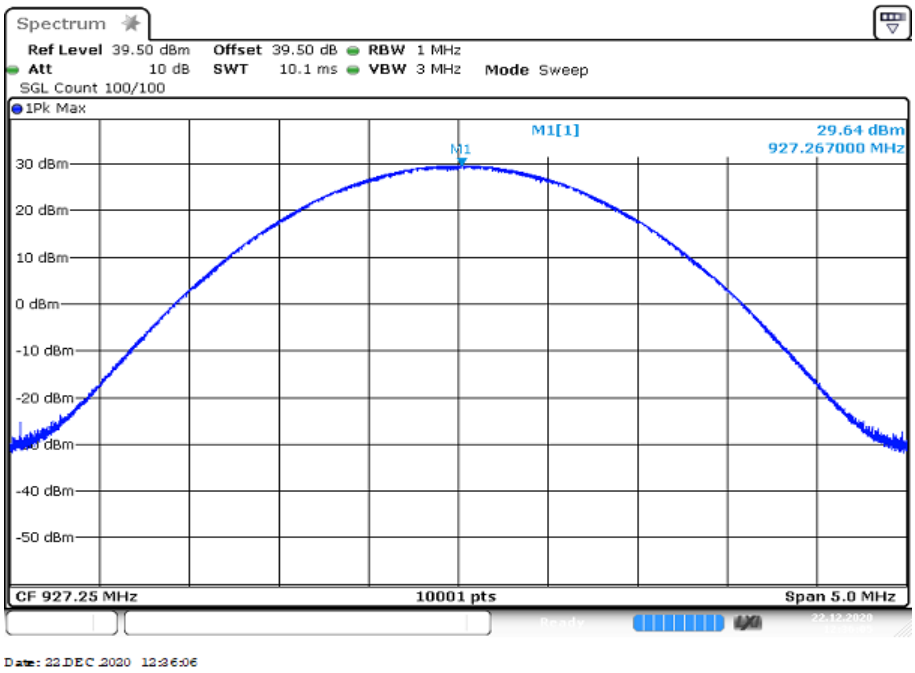

Date: 22.DEC.2020 12:25:23

**Plot 2:** Middle channel, Port 1

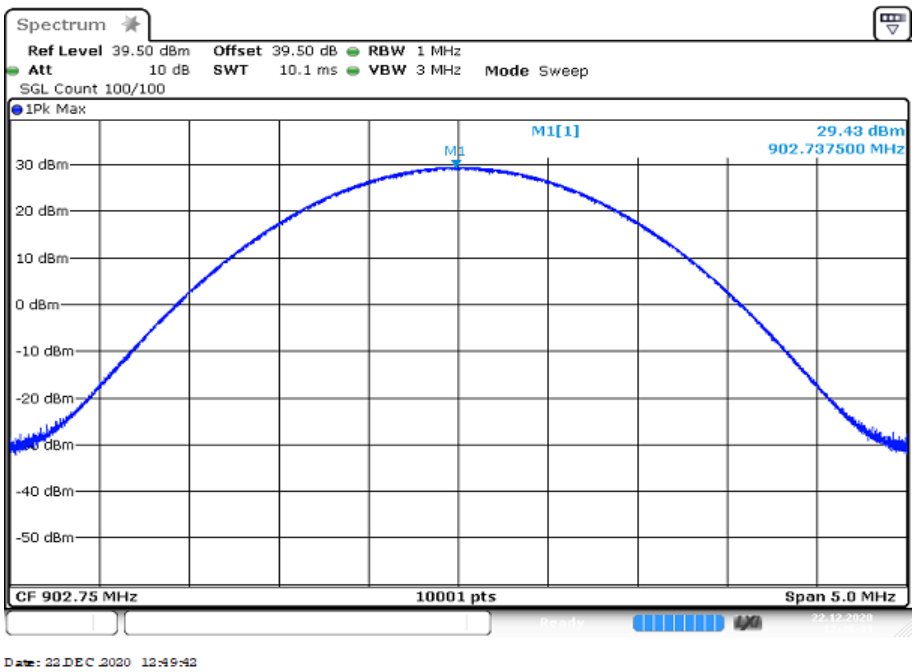



Date: 22.DEC.2020 12:24:24

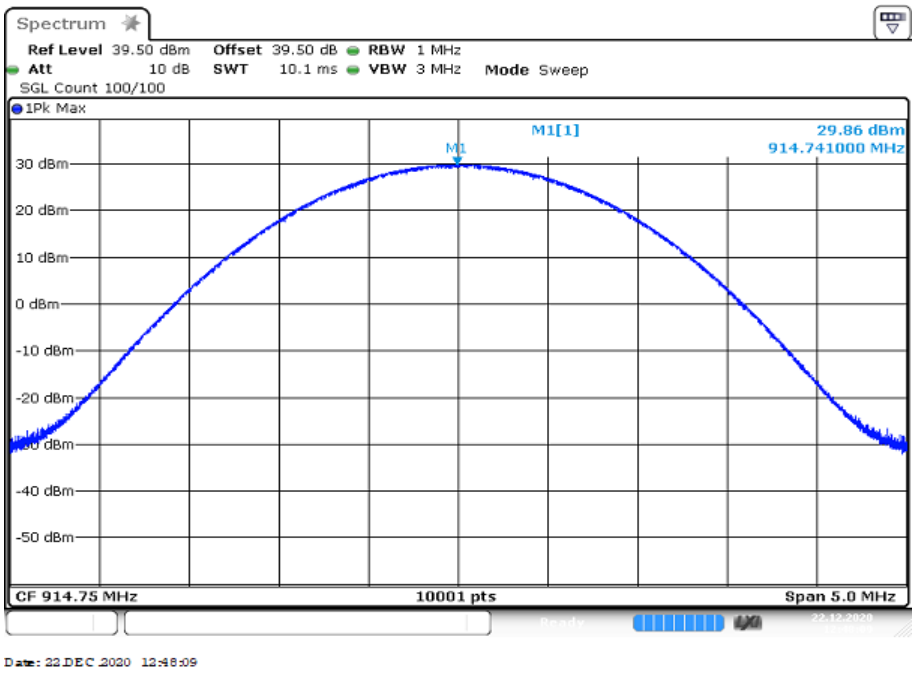
**Plot 3:** Highest channel, Port 1



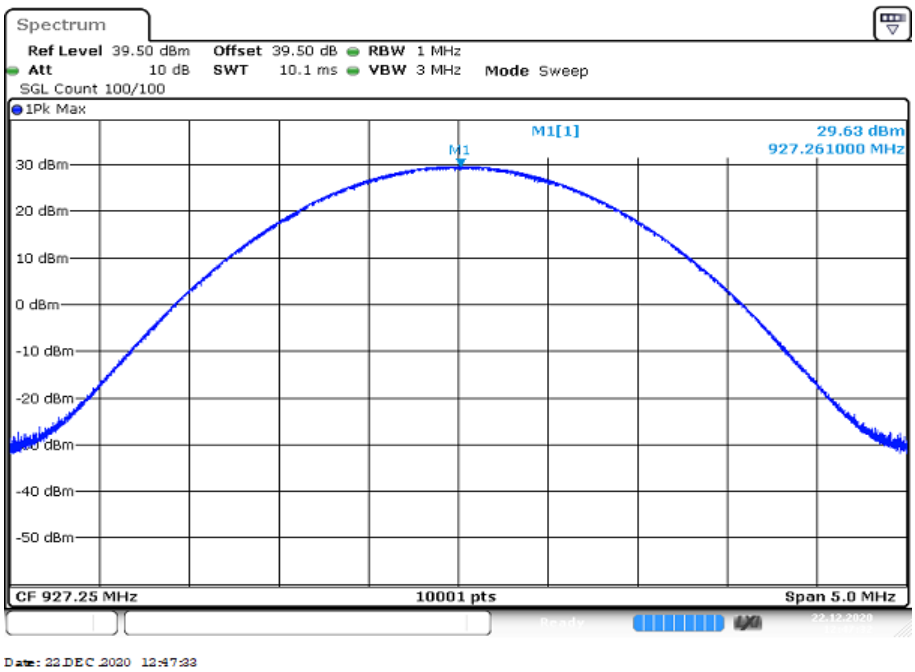

**Plot 4:** Lowest channel, Port 2



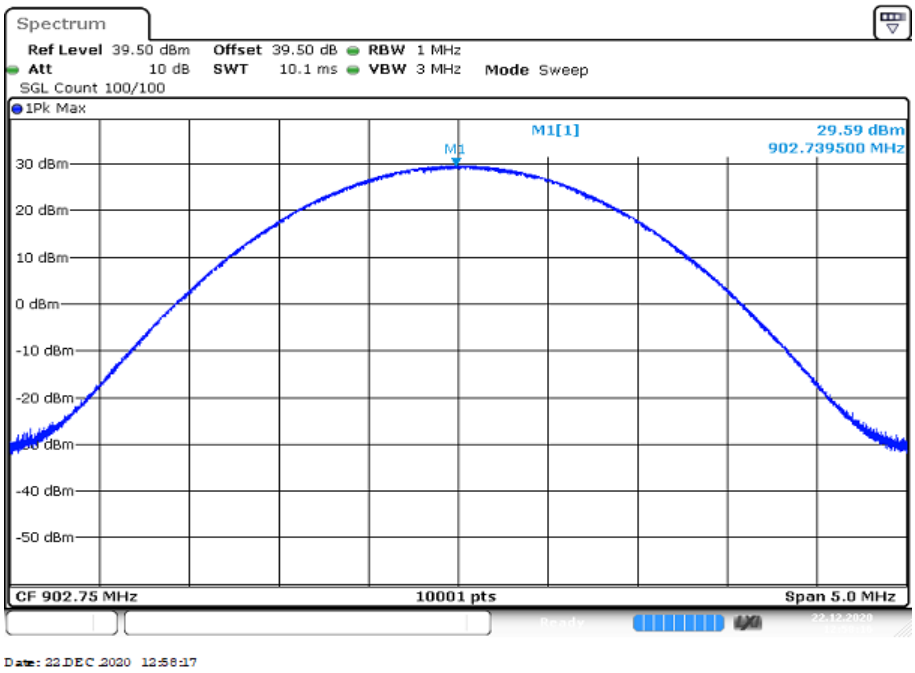
**Plot 5:** Middle channel, Port 2



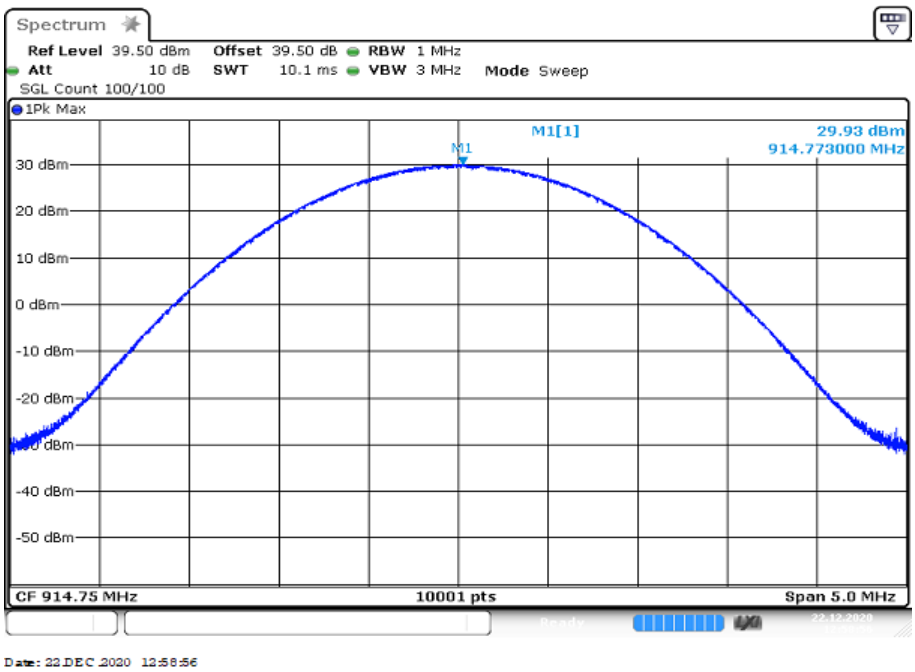

**Plot 6:** Highest channel, Port 2



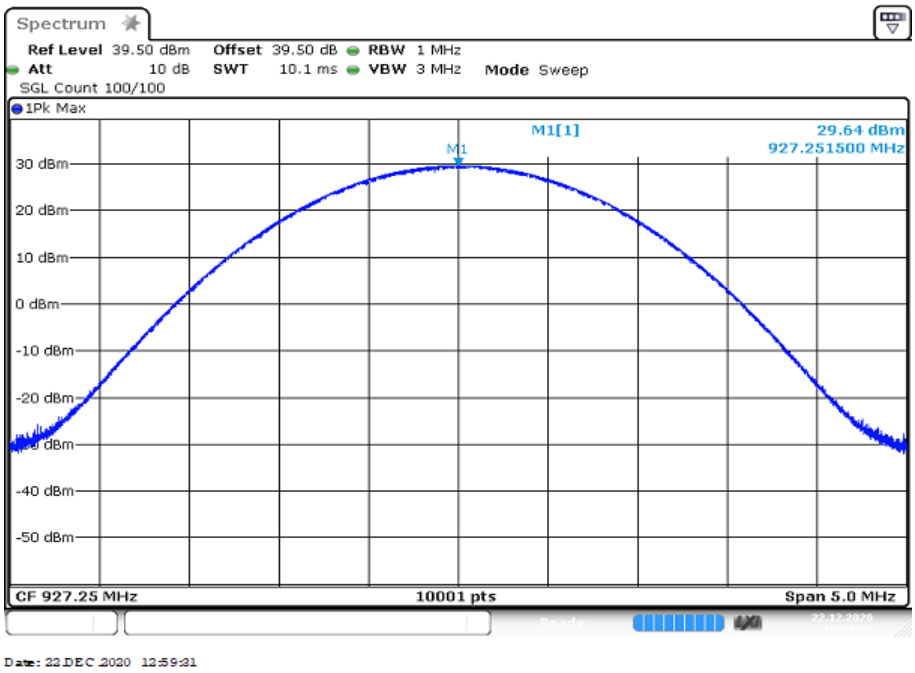
**Plot 7:** Lowest channel, Port 3



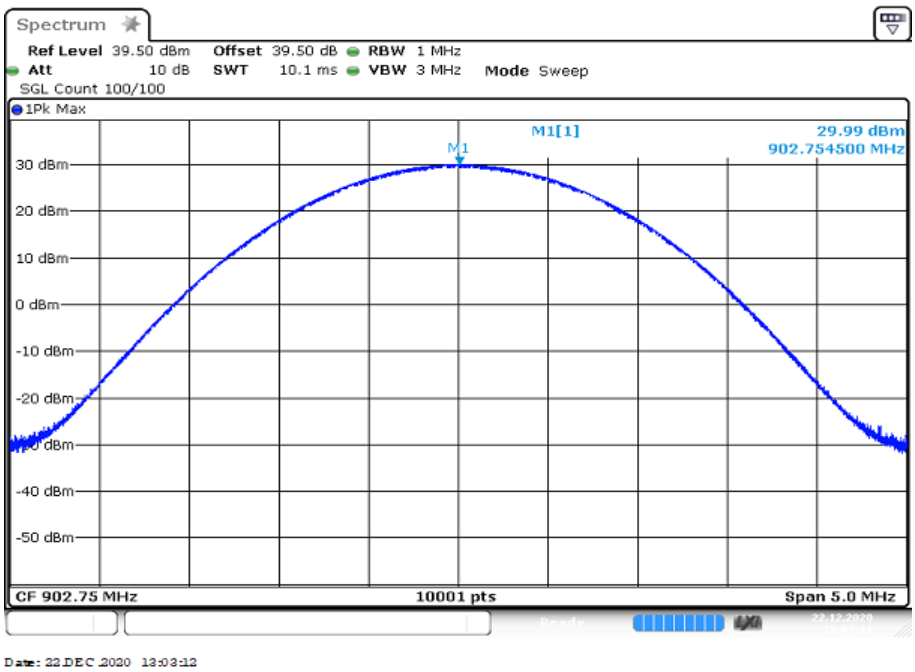

**Plot 8:** Middle channel, Port 3



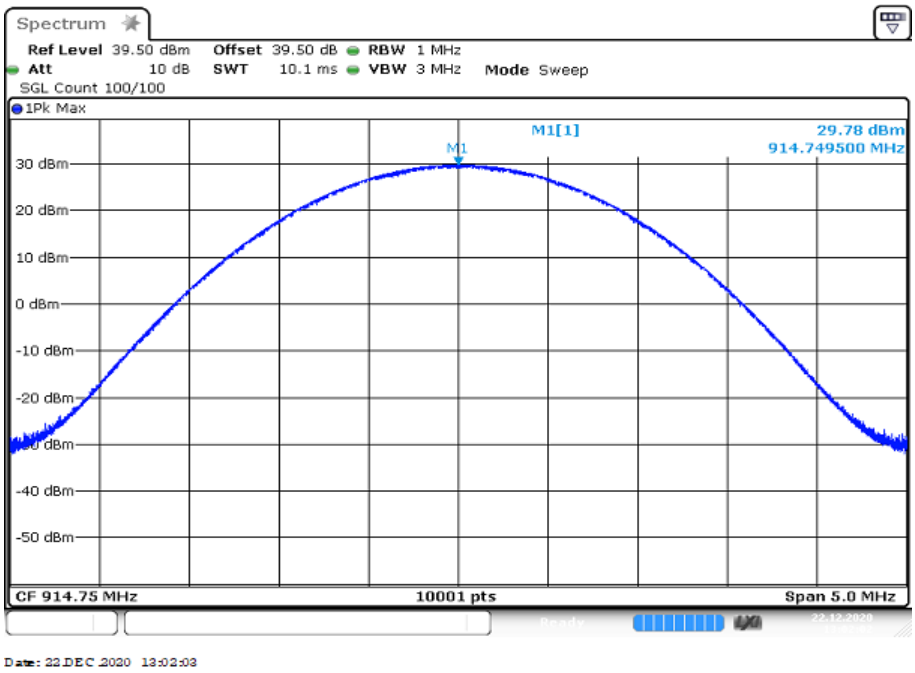
**Plot 9:** Highest channel, Port 3



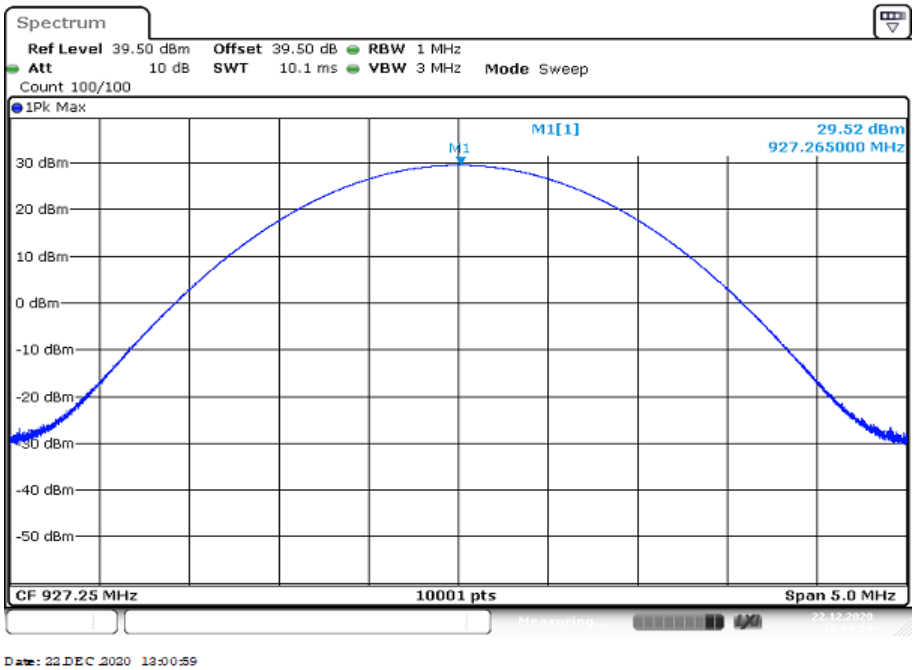

**Plot 10:** Lowest channel, Port 4



**Plot 11:** Middle channel, Port 4




**Plot 12:** Highest channel, Port 4



## 12.6 Detailed spurious emissions @ the band edge – conducted and radiated

**Description:**

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in single channel and hopping mode.

| Measurement parameters | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | 100 kHz |
| Video bandwidth | 300 kHz / 500 kHz |
| Span | Lower Band Edge: 902 MHz<br>Upper Band Edge: 928 MHz |
| Trace mode | Max hold |
| Test setup | See sub clause 7.3 B |
| Measurement uncertainty | See sub clause 9 |

**Limits:**

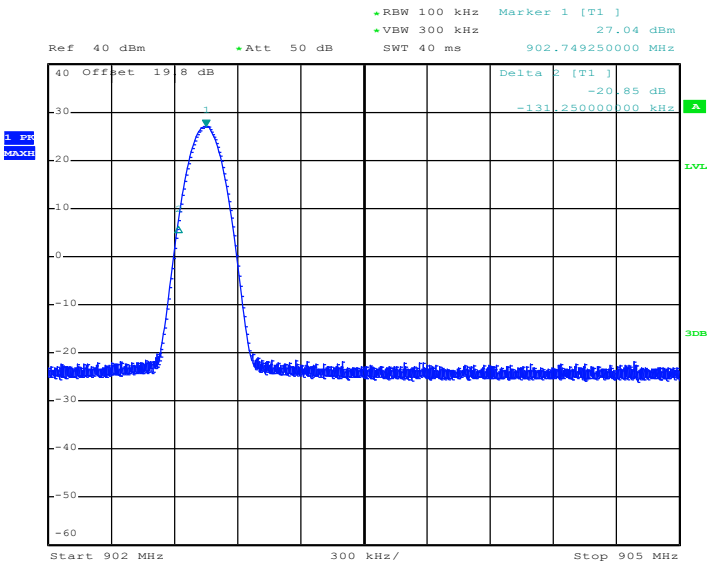
| FCC | IC |
|---|---|
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. | |

**Results conducted:**

| Scenario | Spurious band edge conducted [dB] | |
|---|---|---|
| Modulation | lowest channel | highest channel |
| Lower band edge – hopping on | > 20 dB | > 20 dB |
| Upper band edge – hopping on | > 20 dB | > 20 dB |

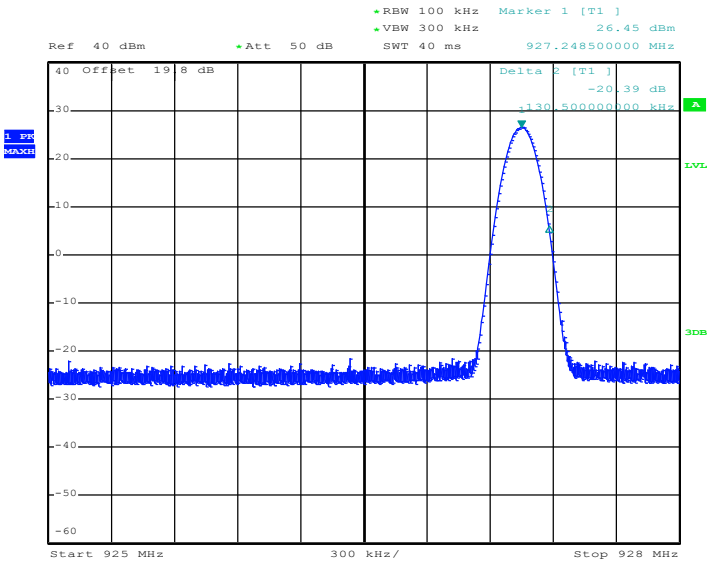
**Plots:**

**Plot 1:** 20 dB – hopping off low channel



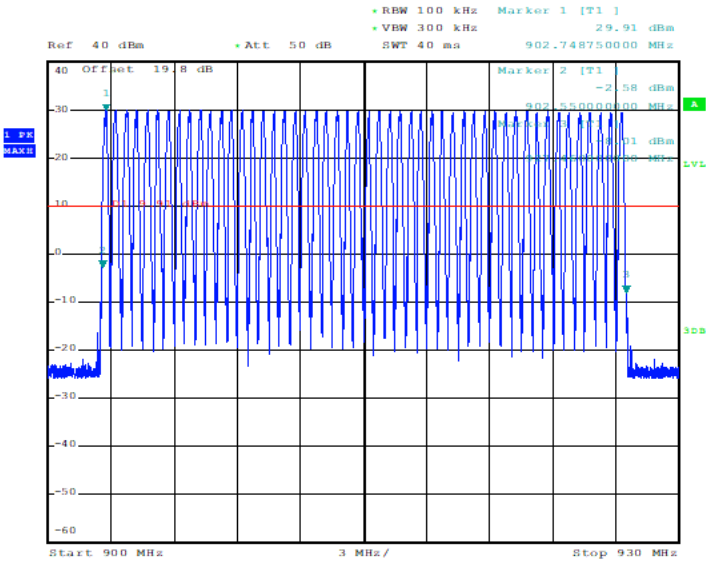

Date: 4.JAN.2003 02:20:35

**Plot 2:** 20 dB – hopping off high channel




Date: 4.JAN.2003 02:07:31

**Plot 3:** 20 dB – hopping on




Left marker frequency: 902.55 MHz
Right marker frequency: ´927.47 MHz
As even 30 dBc requirement is fulfilled, the 20 dBc requirement is also fulfilled.

**Results radiated:**

No restricted band in the range ± 2 channel bandwidths of the Band-edges of the specified emission band! (608 MHz – 614 MHz and 960 MHz – 1240 MHz).

Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2690 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | | | |

## 12.7 Spurious Emissions Conducted

**Description:**

Measurement of the conducted spurious emissions in transmit mode. The EUT is set to single channel mode. The measurement is repeated for low, mid and high channel.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | F < 1 GHz: 1 MHz<br>F > 1 GHz: 1 MHz |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 100 kHz |
| Span: | 9 kHz to 12.75 GHz |
| Trace-Mode: | Max Hold |
| Used equipment: | See chapter 7.3 A |
| Measurement uncertainty: | See chapter 9 |

**Limits:**

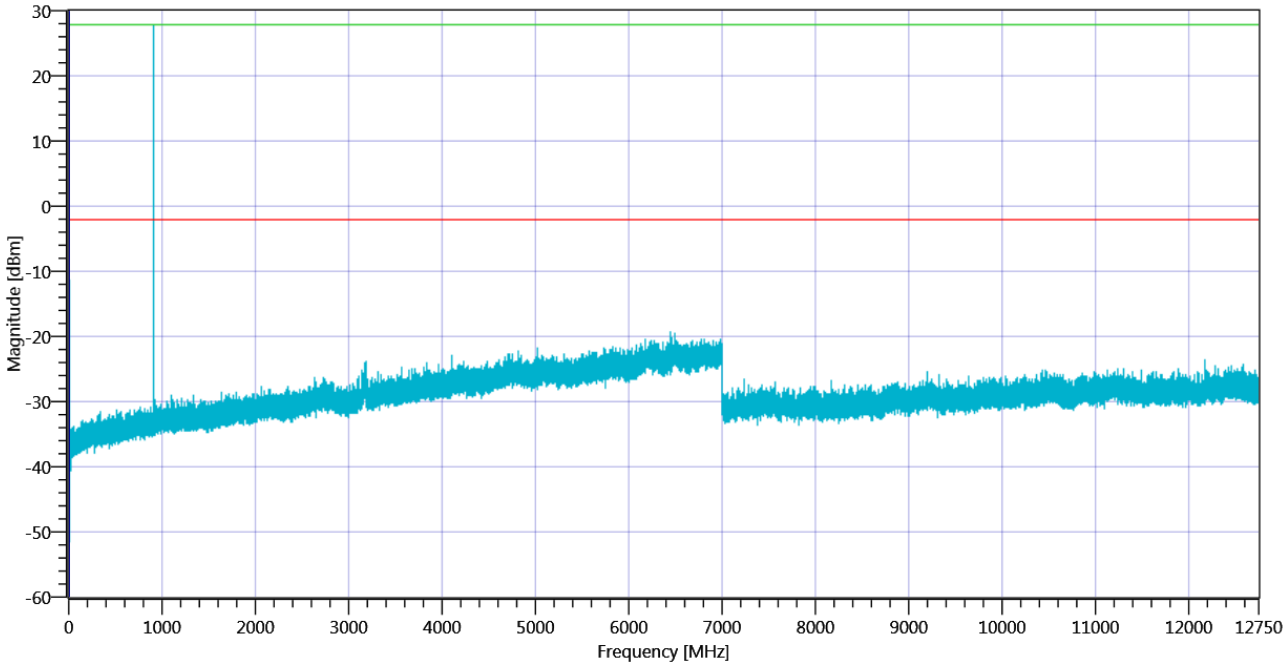
| FCC | IC |
|---|---|
| TX spurious emissions conducted | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required | |

**Result:**

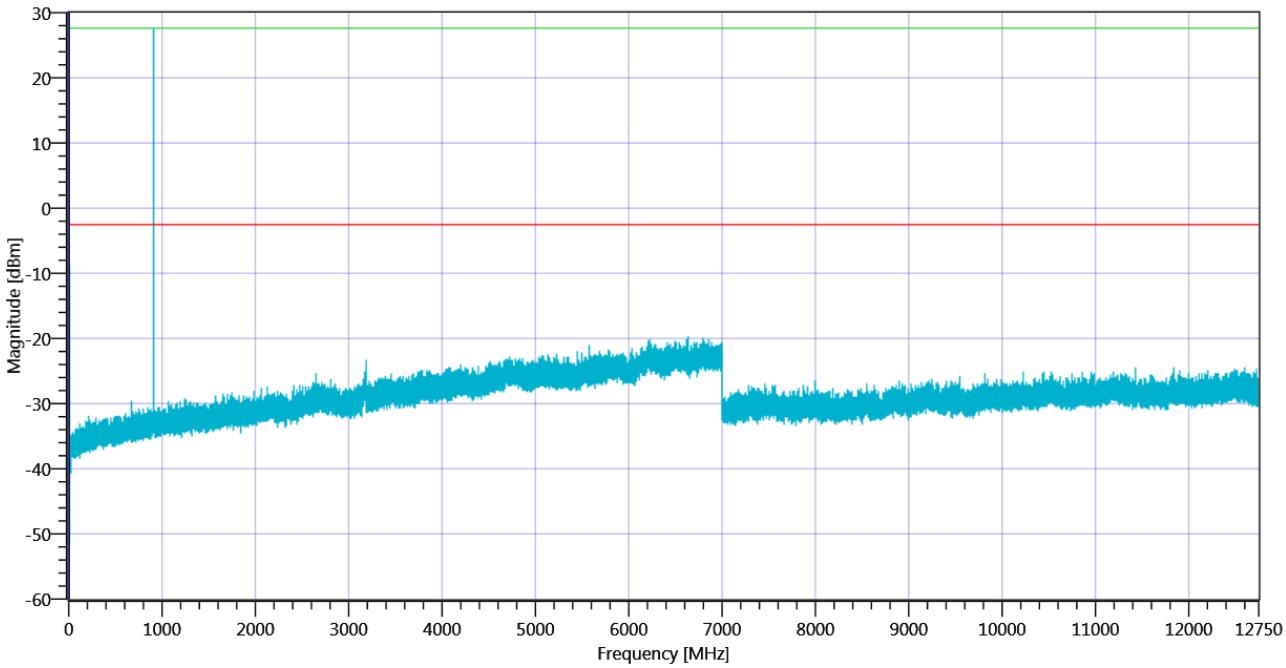
| Emission Limitation | | | | | |
|---|---|---|---|---|---|
| Frequency [MHz] | | Amplitude of emission [dBm] | Limit max. allowed emission power | actual attenuation below frequency of operation [dB] | Results |
| 902.75 | | 27.8 | 30 dBm | | Operating frequency |
| No emissions detected. | | | -20 dBc | | |
| 914.75 | | 27.5 | 30 dBm | | Operating frequency |
| No emissions detected. | | | -20 dBc | | |
| 927.25 | | 27.1 | 30 dBm | | Operating frequency |
| No emissions detected. | | | -20 dBc | | |

**Plots:**

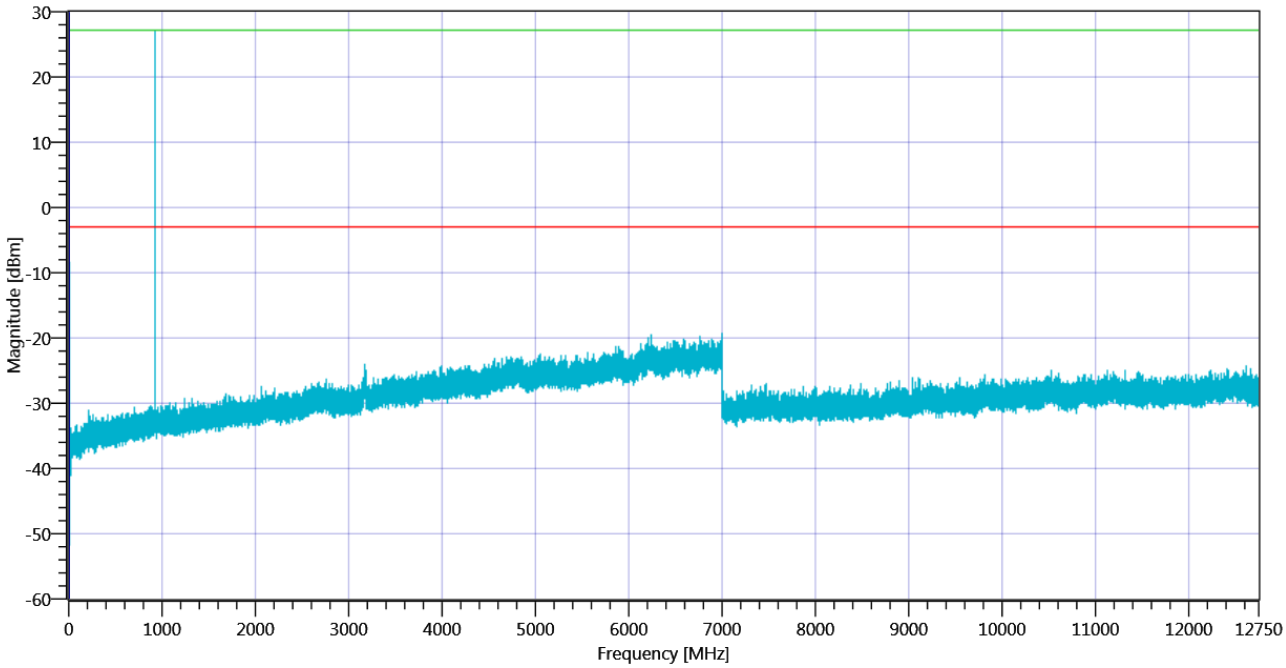
Plot 1: Low channel, 9 kHz – 12.75 GHz




Plot 2: Middle channel, 9 kHz – 12.75 GHz



Plot 3: High channel, 9 kHz – 12.75 GHz



## 12.8 Spurious Emissions Radiated < 30 MHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channels are 00; 39 and 78. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace-Mode: | Max Hold |
| Used equipment: | See chapter 7.2 A |
| Measurement uncertainty: | See sub clause 9 |

**Limits:**

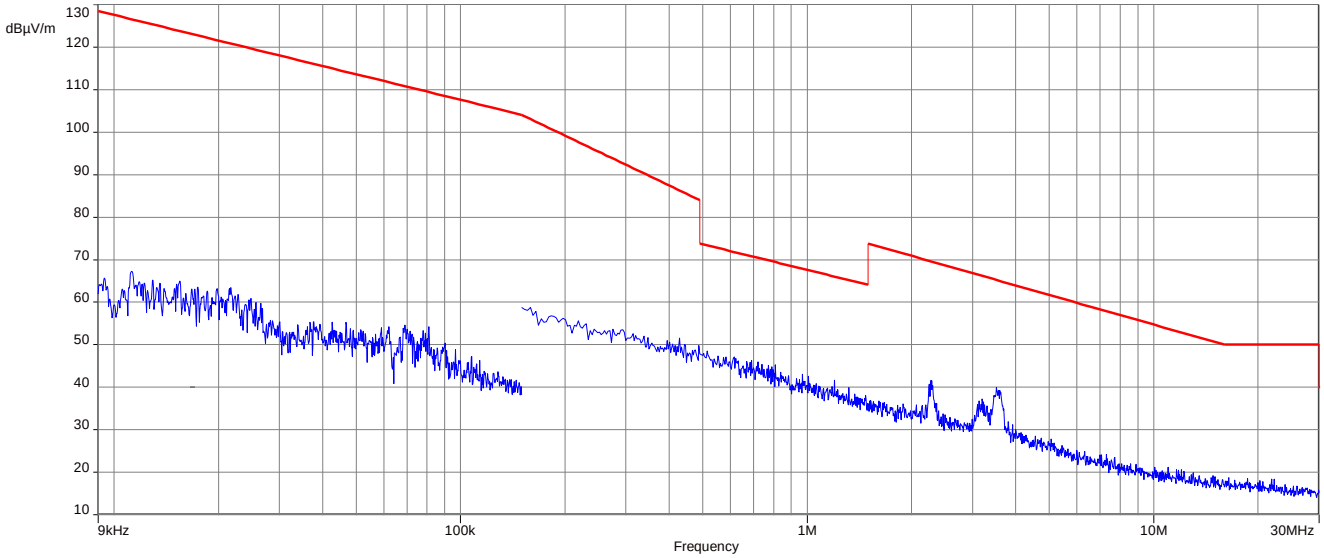
| FCC | | IC |
|---|---|---|
| TX spurious emissions radiated < 30 MHz | | |
| Frequency (MHz) | Field strength (dBµV/m) | Measurement distance |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

**Result:**

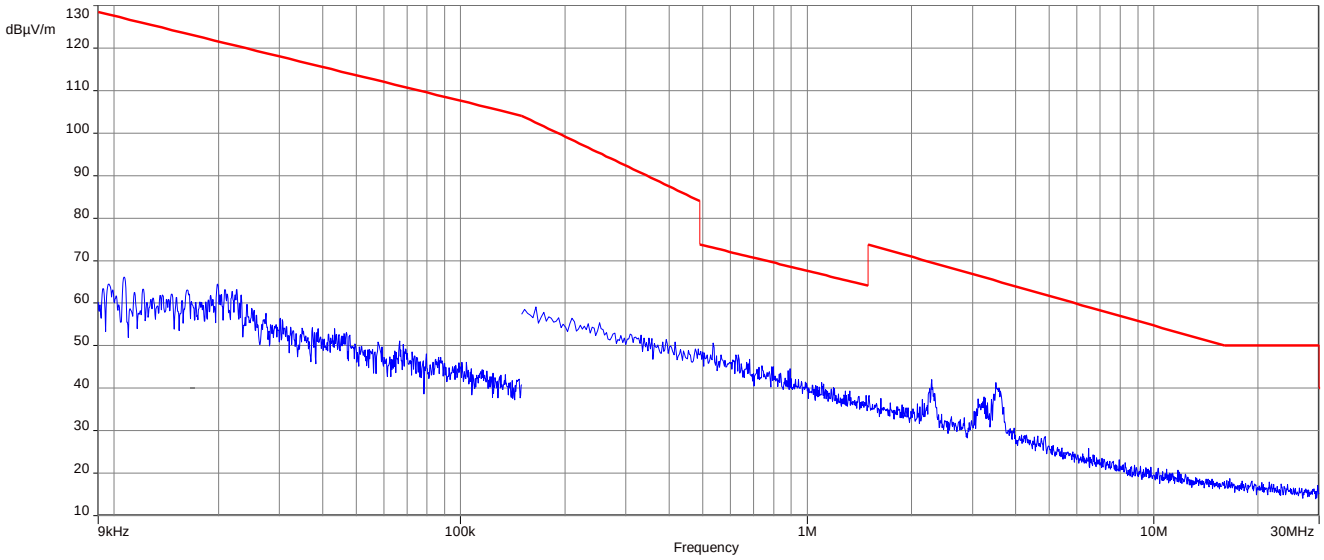
| SPURIOUS EMISSIONS LEVEL [dBµV/m] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lowest channel | | | Middle channel | | | Highest channel | | |
| Frequency [MHz] | Detector | Level [dBµV/m] | Frequency [MHz] | Detector | Level [dBµV/m] | Frequency [MHz] | Detector | Level [dBµV/m] |
| All emissions were more than 10 dB below the limit. | | | | | | | | |

**Plots:**

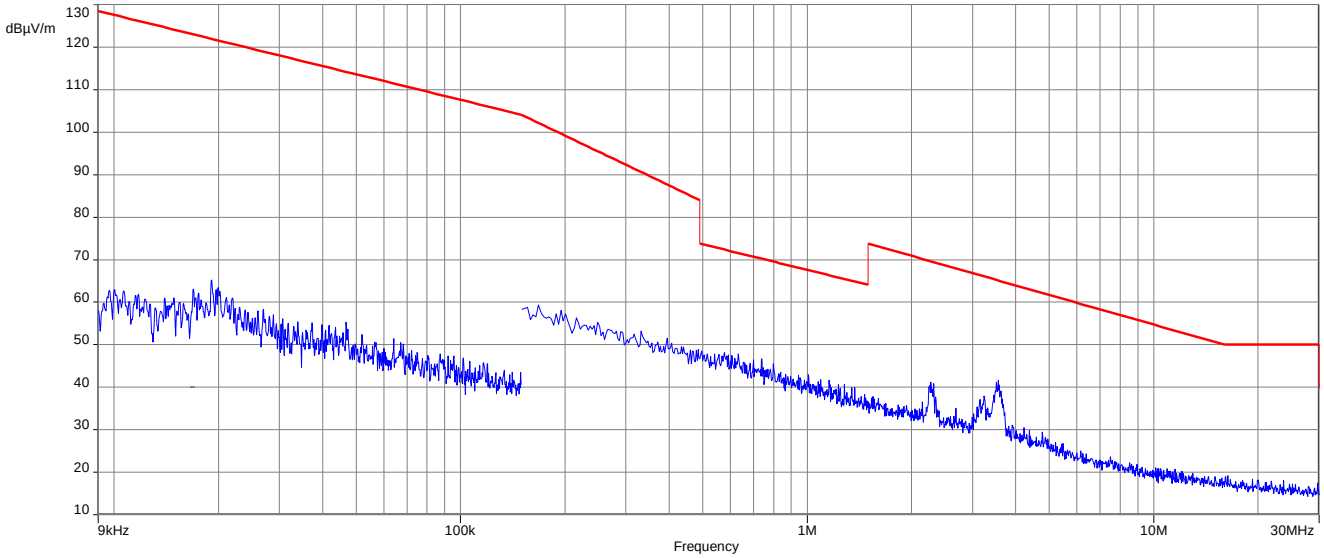
Plot 1: TX-Mode low channel




Plot 2: TX-Mode mid channel



Plot 3: TX-Mode high channel



## 12.9 Spurious Emissions Radiated > 30 MHz

### 12.9.1 Spurious emissions radiated 30 MHz to 1 GHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel low, mid and high.

**Measurement:**

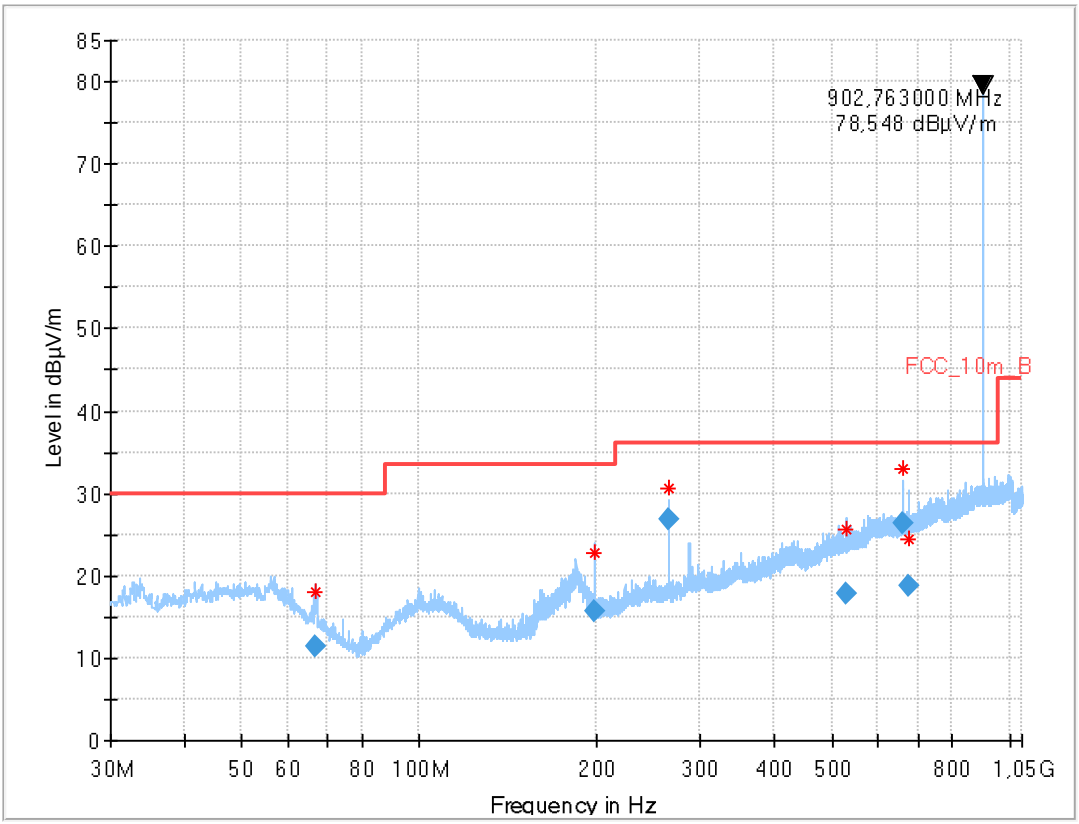
| Measurement parameters | |
|---|---|
| Detector | Peak / Quasi Peak |
| Sweep time | Auto |
| Resolution bandwidth | 3 x VBW |
| Video bandwidth | 120 kHz |
| Span | 30 MHz to 1 GHz |
| Trace mode | Max hold |
| Measured modulation | PR-ASK |
| Test setup | See sub clause 7.1 A |
| Measurement uncertainty | See sub clause 9 |

**Limits:**

| FCC | IC | |
|---|---|---|
| Band-edge Compliance of conducted and radiated emissions | | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 30 - 88 | 30.0 | 10 |
| 88 – 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |

**Plots:**

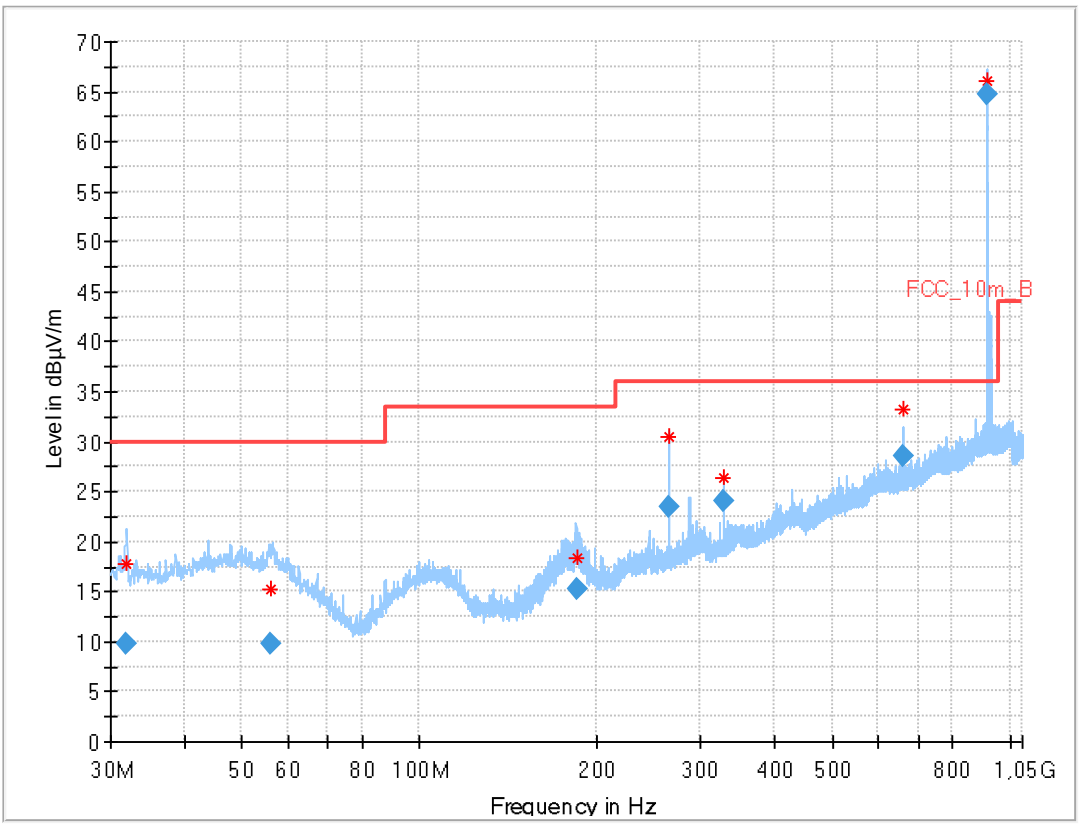
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarisation (lowest channel)




**Final results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 66.553 | 11.42 | 30.0 | 18.6 | 1000 | 120.0 | 287.0 | V | 344 | 11 |
| 198.154 | 15.65 | 33.5 | 17.9 | 1000 | 120.0 | 142.0 | V | 252 | 12 |
| 264.197 | 26.73 | 36.0 | 9.3 | 1000 | 120.0 | 124.0 | V | 160 | 13 |
| 528.371 | 17.69 | 36.0 | 18.3 | 1000 | 120.0 | 400.0 | V | -45 | 19 |
| 660.507 | 26.32 | 36.0 | 9.7 | 1000 | 120.0 | 168.0 | V | 45 | 21 |
| 675.822 | 18.75 | 36.0 | 17.3 | 1000 | 120.0 | 200.0 | V | -45 | 21 |

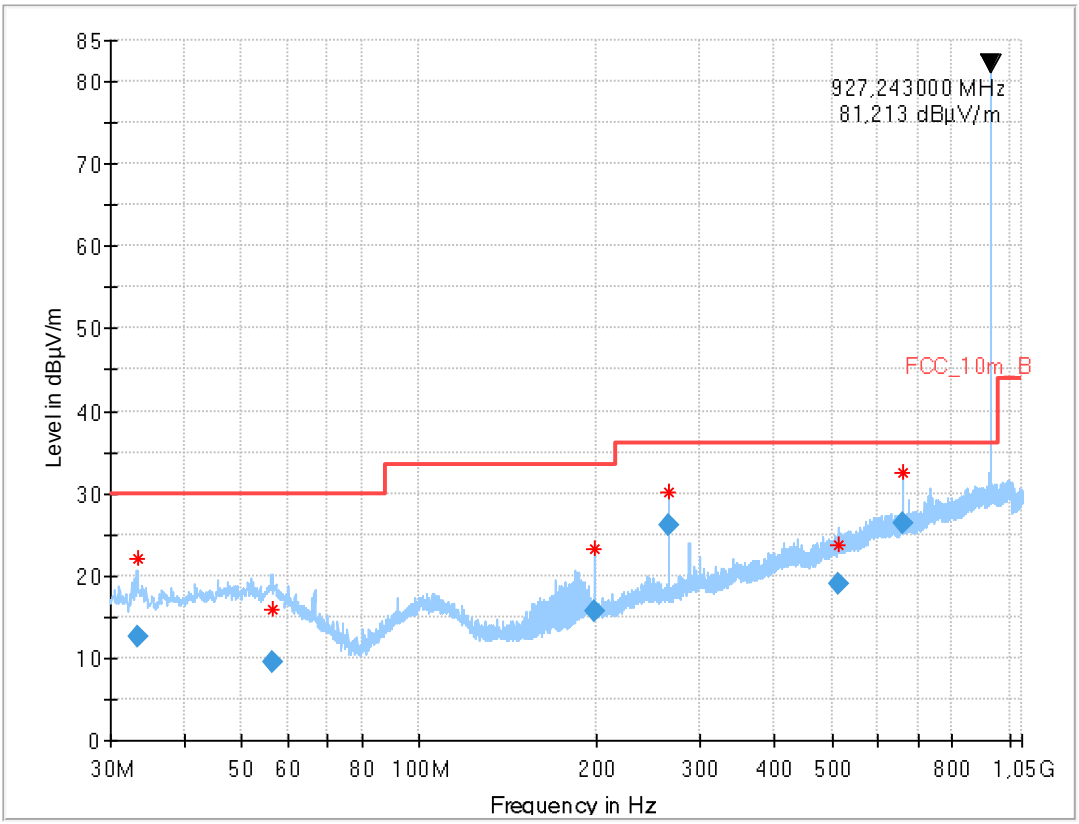
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarisation (middle channel)




**Final results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 31.767 | 9.77 | 30.0 | 20.2 | 1000 | 120.0 | 135.0 | V | -45 | 12 |
| 56.156 | 9.82 | 30.0 | 20.2 | 1000 | 120.0 | 200.0 | V | 225 | 15 |
| 184.559 | 15.24 | 33.5 | 18.3 | 1000 | 120.0 | 103.0 | V | 90 | 11 |
| 264.234 | 23.46 | 36.0 | 12.5 | 1000 | 120.0 | 400.0 | H | 166 | 13 |
| 327.675 | 24.06 | 36.0 | 11.9 | 1000 | 120.0 | 286.0 | H | -12 | 15 |
| 660.482 | 28.56 | 36.0 | 7.4 | 1000 | 120.0 | 165.0 | H | 191 | 21 |
| 914.683 | 64.76 | 36.0 | -28.8 | 1000 | 120.0 | 100.0 | H | 0 | 24 |

Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarisation (highest channel)




**Final results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 33.386 | 12.54 | 30.0 | 17.5 | 1000 | 120.0 | 120.0 | V | -38 | 12 |
| 56.338 | 9.48 | 30.0 | 20.5 | 1000 | 120.0 | 319.0 | V | 90 | 15 |
| 198.150 | 15.74 | 33.5 | 17.8 | 1000 | 120.0 | 200.0 | V | 321 | 12 |
| 264.215 | 26.13 | 36.0 | 9.9 | 1000 | 120.0 | 155.0 | V | 166 | 13 |
| 512.009 | 18.92 | 36.0 | 17.1 | 1000 | 120.0 | 104.0 | V | 180 | 19 |
| 660.439 | 26.46 | 36.0 | 9.5 | 1000 | 120.0 | 100.0 | V | 41 | 21 |

## 12.9.2 Spurious emissions radiated above 1 GHz

| Measurement parameters | |
|---|---|
| Detector | Peak / RMS |
| Sweep time | Auto |
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 x RBW |
| Span | 1 GHz to 12,75 GHz |
| Trace mode | Max hold |
| Measured modulation | PR-ASK |
| Test setup | See sub clause 7.2 B (1 GHz – 12.75 GHz) |
| Measurement uncertainty | See sub clause 9 |

**Limits:**

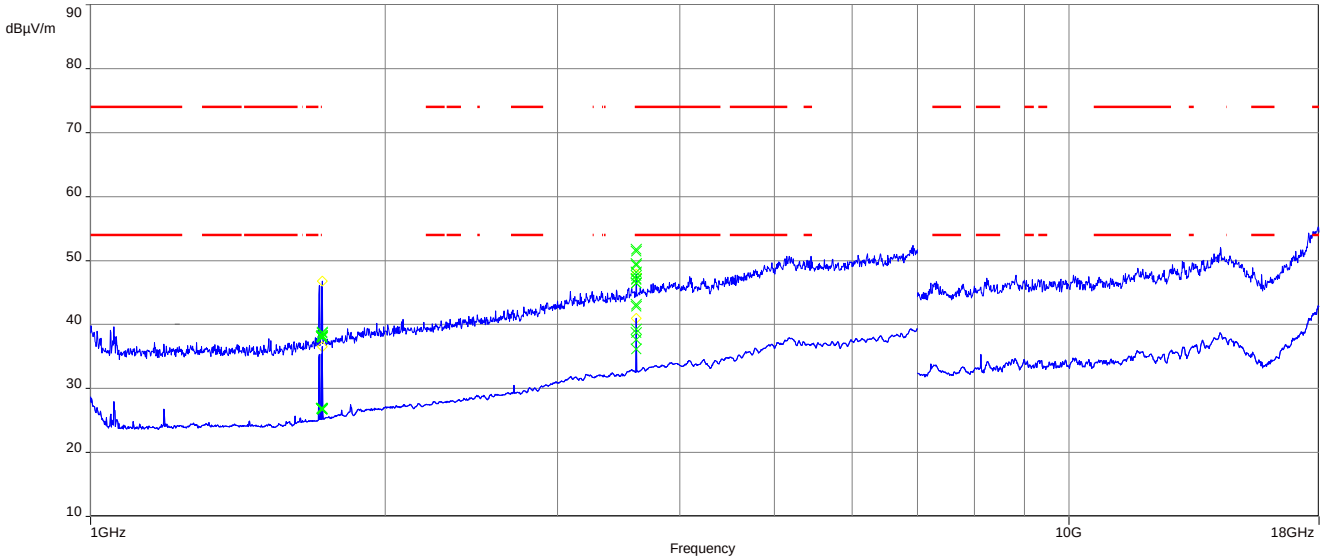
| FCC | | IC |
|---|---|---|
| TX spurious emissions radiated | | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | |
| §15.209 | | |
| Frequency (MHz) | Field strength (dBµV/m) | Measurement distance |
| Above 960 | 54.0 | 3 |

**Result:**

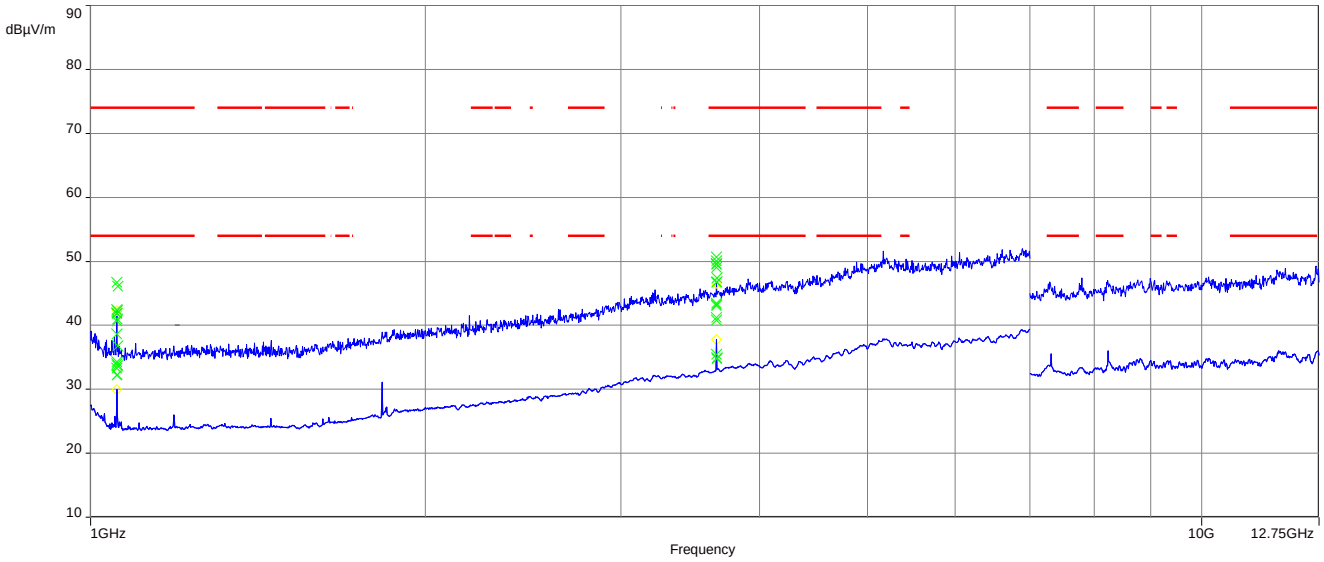
| TX spurious emissions radiated [dBµV/m] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| 3611 | Peak | 51.8 | 1056 | Peak | 46.7 | 1056 | Peak | 44.8 |
| | AVG | 47.0 | | AVG | 38.6 | | AVG | 33.3 |
| -/- | Peak | -/- | 3659 | Peak | 50.7 | 1854 | Peak | 55.0 |
| | AVG | -/- | | AVG | 43.2 | | AVG | 51.7 |
| -/- | Peak | -/- | -/- | Peak | -/- | -/- | Peak | -/- |
| | AVG | -/- | | AVG | -/- | | AVG | -/- |

**Plots:**

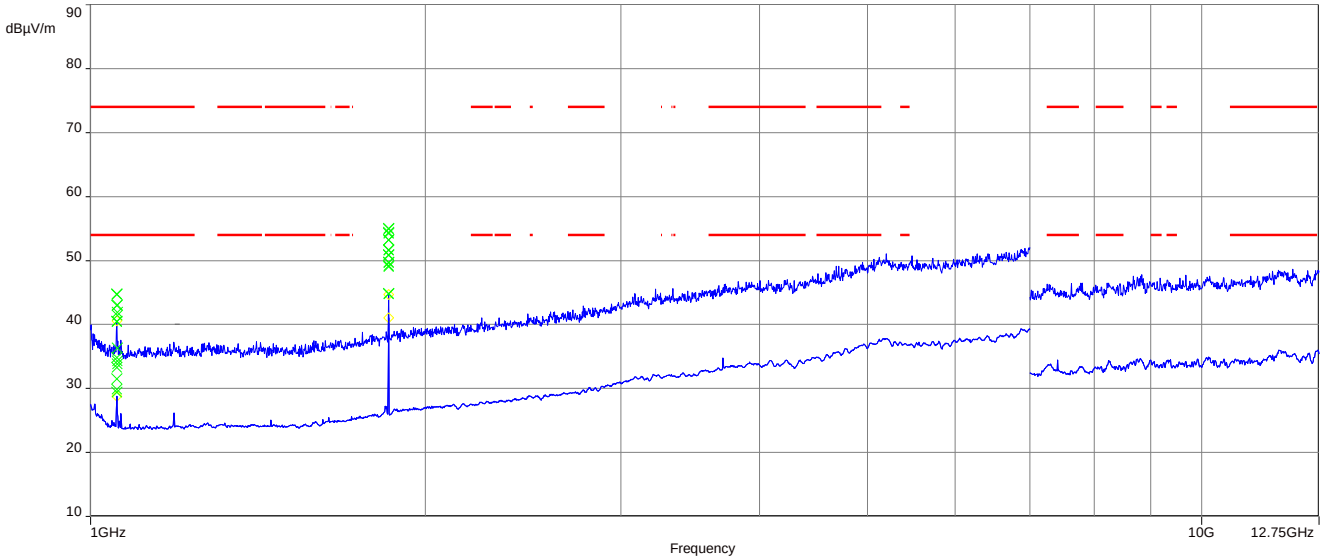
Plot 1: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (lowest channel)




Plot 2: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (middle channel)



Plot 3: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (highest channel)



## 13 Observations

No observations except those reported with the single test cases have been made.

## 14 Glossary

| | |
|---|---|
| **EUT** | Equipment under test |
| **DUT** | Device under test |
| **UUT** | Unit under test |
| **EN** | European Standard |
| **FCC** | Federal Communications Commission |
| **FCC ID** | Company Identifier at FCC |
| **IC** | Industry Canada |
| **PMN** | Product marketing name |
| **HMN** | Host marketing name |
| **HVIN** | Hardware version identification number |
| **FVIN** | Firmware version identification number |
| **EMC** | Electromagnetic Compatibility |
| **HW** | Hardware |
| **SW** | Software |
| **Inv. No.** | Inventory number |
| **S/N or SN** | Serial number |
| **C** | Compliant |
| **NC** | Not compliant |
| **NA** | Not applicable |
| **NP** | Not performed |
| **PP** | Positive peak |
| **QP** | Quasi peak |
| **AVG** | Average |
| **OC** | Operating channel |
| **OCW** | Operating channel bandwidth |
| **OBW** | Occupied bandwidth |
| **OOB** | Out of band |
| **DFS** | Dynamic frequency selection |
| **CAC** | Channel availability check |
| **OP** | Occupancy period |
| **NOP** | Non occupancy period |
| **DC** | Duty cycle |
| **PER** | Packet error rate |
| **CW** | Clean wave |
| **MC** | Modulated carrier |
| **WLAN** | Wireless local area network |
| **RLAN** | Radio local area network |
| **DSSS** | Dynamic sequence spread spectrum |
| **OFDM** | Orthogonal frequency division multiplexing |
| **FHSS** | Frequency hopping spread spectrum |

# 15 Document history

| Version | Applied changes | Date of release |
|---|---|---|
| -/- | Initial release | 2020-12-22 |

# 16 Accreditation Certificate – D-PL-12076-01-04

| first page | last page |
|---|---|

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

**Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV**
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

## Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

**CTC advanced GmbH**
**Untertürkheimer Straße 6-10, 66117 Saarbrücken**

is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:

**Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards**

The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 07 pages.

Registration number of the certificate: **D-PL-12076-01-04**

Frankfurt am Main, 09.06.2020

by order Dipl.-Ing. (FH) Ralf Egner
Head of Division

*The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.*
*https://www.dakks.de/en/content/accredited-bodies-dakks*
See notes overleaf.

Deutsche Akkreditierungsstelle GmbH

| Office Berlin | Office Frankfurt am Main | Office Braunschweig |
|---|---|---|
| Spittelmarkt 10 | Europa-Allee 52 | Bundesallee 100 |
| 10117 Berlin | 60327 Frankfurt am Main | 38116 Braunschweig |

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https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf

## 17 Accreditation Certificate – D-PL-12076-01-05

| first page | last page |
|---|---|
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################################ END OF TEST REPORT ################################