



## TEST REPORT nr. R14189801

### Federal Communication Commission (FCC)

#### Test item

Description .....: TRANSCEIVER UNIT

Trademark .....: ATEC

Model/Type .....: Model CRX

Type NH021

FCC ID .....: OQA-CRXNH022

#### Test Specification

Standard .....: FCC Rules & Regulations, Title 47:2014  
Part 15 paragraph(s): 203, 204, 207, 209 and 247

**Client's name** .....: ATEC S.r.l.

Address .....: Via Pomaroli, 65 – 36030 Caldogno (VI) – ITALY

**Manufacturer's name** : Same as client

Address .....: --

#### Report

Tested by .....: G. Gandini – Technician

Approved by .....: R. Beghetto – Laboratory Manager

Date of issue .....: 30.06.15

Contents .....: 68 pages

This test report shall not be reproduced except in full without the written approval of CMC.  
The test results presented in this report relate only to the item tested.



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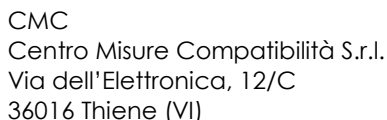
## 1. Summary

*Standard:*

FCC Rules & Regulations, Title 47:2014  
Part 15 paragraph(s): 203, 204, 207, 209 and 247

| <i>Test specifications</i> | <i>Environmental Phenomena</i> | <i>Tests sequence</i> | <i>Result</i> |
|----------------------------|--------------------------------|-----------------------|---------------|
| Part 15.203                | Antenna requirements           | 1                     | Complies      |
| Part 15.207                | Conducted emissions            | 2                     | Complies      |
| Part 15.209                | Radiated emissions             | 3                     | Complies      |
| Part 15.247                | 20dB Bandwidth                 | 4                     | Complies      |
| Part 15.247                | Channel Separation             | 6                     | Complies      |
| Part 15.247                | Number of Hopping Channel      | 7                     | Complies      |
| Part 15.247                | Time of occupancy              | 8                     | Complies      |
| Part 15.247                | Band edge                      | 9                     | Complies      |
| Part 15.209 and 15.247     | Peak Output Power              | 10                    | Complies      |
| Part 15.209                | Spurious emission              | 11                    | Complies      |

The Test Report was given to the Client representatives for necessary documentation of ratification of the tested equipment and it is valid for the FCC certification



Power supply ..... : 12-24 Vdc

Serial Number..... : --

Type of equipment ..... : ☒ Transmitter Unit  
                                      ☒ Receiver Unit

Type of station ..... : ☒ Fixed station  
                                      ☐ Portable station  
                                      ☐ Mobile station

Frequency band ..... : 915 – 928 MHz

Modulation ..... : Frequency hopping, see also the Operational Description for Model ARX Type NG022 receiving unit

Company..... : CMC Centro Misure Compatibilità S.r.l.  
Address ..... : Via dell'Elettronica, 12/C  
36016 Thiene (VI) – ITALY

Date of receipt of test item ..... : 04.11.14

Testing start date ..... : 06.11.14

Testing end date ..... : 24.03.15

Samples tested nr..... : 1

Sampling procedure. .... : Equipment used for testing was picked up by the manufacturer, at the end of the production process with random criterion

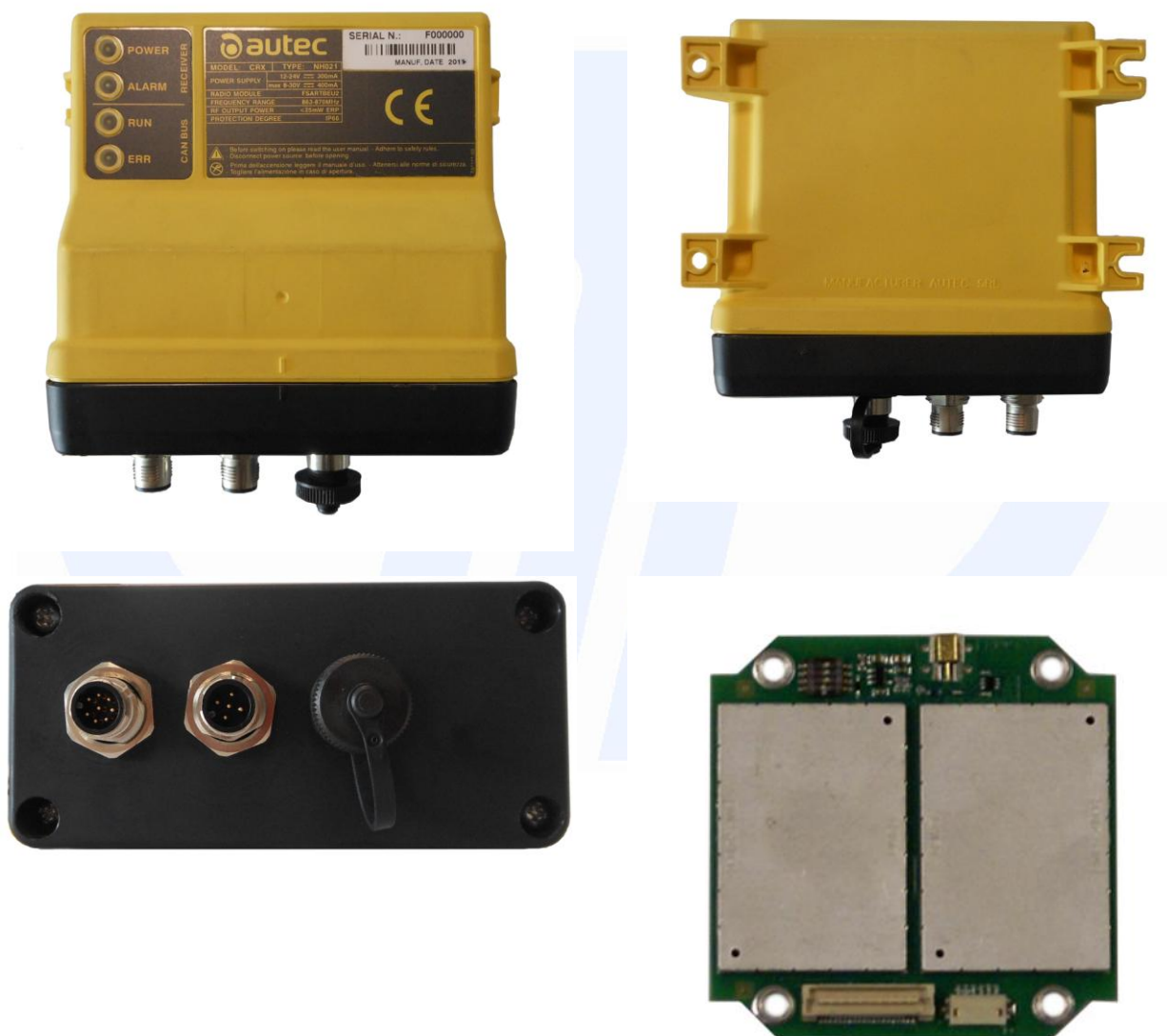
Internal identification ..... : adhesive label with the product number P141148

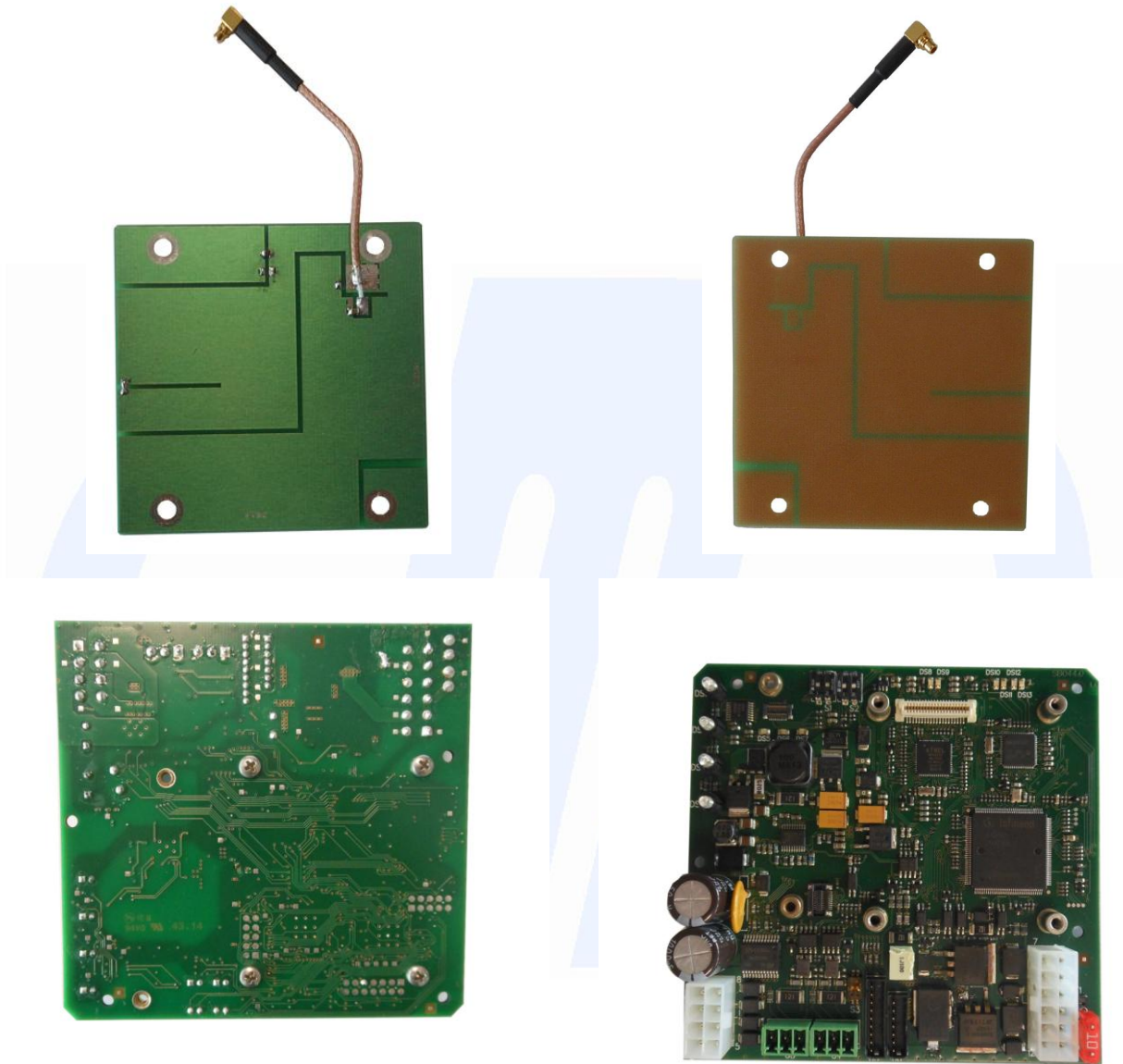
EUT exercising ..... : EUT in continuous transmission at maximum power



## 5. Photograph(s) of EUT

### 5.1 Photograph(s) of EUT







## 5.2 Photograph(s) of setup





## 6. Equipment list

| <i>Id. number</i> | <i>Manufacturer</i> | <i>Model</i> | <i>Description</i>        | <i>Serial number</i> | <i>Last calibration</i> | <i>Due date calibration</i> |
|-------------------|---------------------|--------------|---------------------------|----------------------|-------------------------|-----------------------------|
| CMC S010          | Rohde & Schwarz     | ESH3-Z2      | Impulses Limiting Device  | - - -                | January '15             | January '16                 |
| CMC S108          | EMCO                | 3115         | Horn Antenna              | 9811-5622            | May '13                 | May '16                     |
| CMC S127          | Schaffner           | HLA6120      | Loop Antenna              | 1191                 | January '13             | January '16                 |
| CMC S129          | Rohde & Schwarz     | ESPI7        | Receiver                  | 836.914/004          | January '15             | January '16                 |
| CMC S136          | Schwarzbeck         | VULB 9163    | Broadband Antenna         | 9136-205             | May '13                 | May '16                     |
| CMC S164          | Rohde & Schwarz     | ESU26        | EMC interference receiver | 100052               | January '15             | January '16                 |
| CMC S200          | Schwarzbeck         | NSLK 8128    | V-LISN                    | 8128-273             | January '15             | January '16                 |
| CMC S227          | Rohde & Schwarz     | ESR7         | EMI Test Receiver 7GHz    | 101121               | January '15             | January '16                 |



## 7. Measurement uncertainty

| Test                                                                | Expanded Uncertainty | note |
|---------------------------------------------------------------------|----------------------|------|
| <b>Conducted Emission</b>                                           |                      |      |
| (50Ω/50μH AMN) - (9 kHz – 150 kHz)                                  | ±3.6 dB              | 1    |
| (50Ω/50μH AMN) - (150 kHz – 30 MHz)                                 | ±3.0 dB              | 1    |
| (Voltage probe) - (150 kHz – 30 MHz)                                | ±2.8 dB              | 1    |
| (50Ω/5μH AMN) - (150 kHz – 108 MHz)                                 | ±2.6 dB              | 1    |
| <b>Discontinuous Conducted Emission</b>                             |                      |      |
| Conducted Emission (50Ω/50μH AMN) - (150 kHz – 30 MHz)              | ±3.0 dB              | 1    |
| <b>Disturbance Power (30 MHz – 300 MHz)</b>                         |                      |      |
|                                                                     | ±3.7 dB              | 1    |
| <b>Radiated Emission</b>                                            |                      |      |
| (0,150 MHz – 30 MHz)                                                | ±4.0 dB              | 1    |
| (30 MHz – 1000 MHz)                                                 | ±4.3 dB              | 1    |
| (1 GHz – 6 GHz)                                                     | ±4.5 dB              | 1    |
| <b>Electromagnetic field EMF</b>                                    |                      |      |
|                                                                     | ±10.5 %              | 1    |
| <b>Harmonic current emissions test</b>                              |                      |      |
|                                                                     | ±1.8 %               | 1    |
| <b>Voltage fluctuation and flicker test</b>                         |                      |      |
|                                                                     | ±2.6 %               | 1    |
| <b>Insertion loss test</b>                                          |                      |      |
|                                                                     | ±2.0 dB              | 1    |
| <b>Radiated electromagnetic disturbance test (loop antenna)</b>     |                      |      |
|                                                                     | ±2.1 dB              | 1    |
| <b>Radiated electromagnetic field immunity test</b>                 |                      |      |
|                                                                     | 0.81 V/m at 3V/m     | 1    |
| <b>Pulse modulated radiated electromagnetic field immunity test</b> |                      |      |
|                                                                     | 0.81 V/m at 3V/m     | 1    |
| <b>Injected currents immunity test</b>                              |                      |      |
|                                                                     | 0.45 V at 3V         | 1    |
| <b>Bulk current</b>                                                 |                      |      |
|                                                                     | 3.7 mA at 60 mA      | 1    |
| <b>Power frequency magnetic field immunity test</b>                 |                      |      |
|                                                                     | 0.1 A/m at 10 A/m    | 1    |
| <b>Effective radiated power (F &lt; 1GHz)</b>                       |                      |      |
|                                                                     | ±4.3 dB              | 1    |
| <b>Effective radiated power (F &gt; 1GHz)</b>                       |                      |      |
|                                                                     | ±3.7 dB              | 1    |
| <b>Frequency error</b>                                              |                      |      |
|                                                                     | < 1x10 <sup>-7</sup> | 1    |
| <b>Modulation bandwidth</b>                                         |                      |      |
|                                                                     | < 1x10 <sup>-7</sup> | 1    |
| <b>Adjacent channel power</b>                                       |                      |      |
|                                                                     | ±1.9 dB              | 1    |
| <b>Blocking</b>                                                     |                      |      |
|                                                                     | ±1.9 dB              | 1    |
| <b>Electrostatic discharge immunity test</b>                        |                      |      |
|                                                                     |                      | 2    |
| <b>Electrical fast transients / burst immunity test</b>             |                      |      |
|                                                                     |                      | 2    |
| <b>Surge immunity test</b>                                          |                      |      |
|                                                                     |                      | 2    |
| <b>Pulse magnetic field immunity test</b>                           |                      |      |
|                                                                     |                      | 2    |
| <b>Damped oscillatory magnetic field immunity test</b>              |                      |      |
|                                                                     |                      | 2    |
| <b>Short interruption immunity test</b>                             |                      |      |
|                                                                     |                      | 2    |
| <b>Voltage transient emission test</b>                              |                      |      |
|                                                                     | ±2.2 %               | 1    |
| <b>Transient immunity test</b>                                      |                      |      |
|                                                                     |                      | 2    |

### Notes

#### Note 1:

The expanded uncertainty reported according to EN55016-4-2:2011 is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of p = 95%

#### Note 2:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence, covering factor k = 2.



## 8. Reference documents

| Reference no.                                      | Description                         |
|----------------------------------------------------|-------------------------------------|
| FCC Rules and Regulation Title 47 part 15:2014     | --                                  |
| Internal Procedure PM001 rev. 2.0 (Quality Manual) | Measure Procedure                   |
| Internal procedure INC_M rev. 8.2 (Quality Manual) | Measurement uncertainty calculation |





## 9. Deviation from test specification

In agreement with the client, emission tests were performed with peak detector.

At the frequencies where the measures exceed the limit or within 6 dB from it, the test was repeated with quasi-peak detector and/or average detector.

## 10. Test case verdicts

Test case does not apply to the test object..... : N.A.

Test item does meet the requirement..... : Complies

Test item does not meet the requirement..... : Does not comply

Test not performed ..... : N.E.

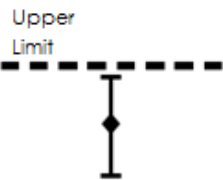
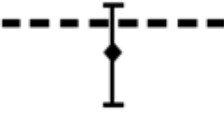
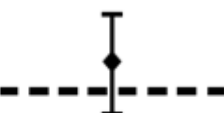


## 11. Results

In this clause tests results are reported.

Measurement uncertainty is in accordance with document CMC INC\_M rev. 8.2.

*Judgement of compliance:*

| Case 1                                                                                                            | Case 2                                                                                                                                                   | Case 3                                                                                                                                               | Case 4                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|                                  |                                                                         |                                                                    |                                 |
| The sample complies with the requirement.                                                                         | The sample complies with the requirement.                                                                                                                | The sample does not comply with the requirement.                                                                                                     | The sample does not comply with the requirement.                                                                   |
| The measurement results is within the specification limit when the measurement uncertainty is taken into account. | It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty although the measurement result is below the limit. | It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty also the measurement result is upper the limit. | The measurement results is outside the specification limit when the measurement uncertainty is taken into account. |

In agreement with ILAC-G8: 03/2009 Guidelines on the Reporting of Compliance with Specification.



## 11.1 Antenna requirements

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.203 and 15.204
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

Test site:  
Laboratory

Auxiliary equipment:  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

--  
Measurement uncertainty: See clause 7 of this test report

### Test specification

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.  
The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded

### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 18                  | 100                           | 42                       |

### Result

| Antenna Type     | External R.F.<br>power amplifier | Gain  | Remarks                                   | Results  |
|------------------|----------------------------------|-------|-------------------------------------------|----------|
| External antenna | Not Present                      | 2 dBi | External antenna with cable of 5 m length | Complies |

**Result:** The requirements are met



## 11.2 Conducted emissions

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.207
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Shielded chamber

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S010, CMC S200, CMC S206  
Measurement uncertainty: See clause 7 of this test report

### Test specification

Port: Main port  
Frequency range: 150 kHz – 30 MHz

### Environmental conditions

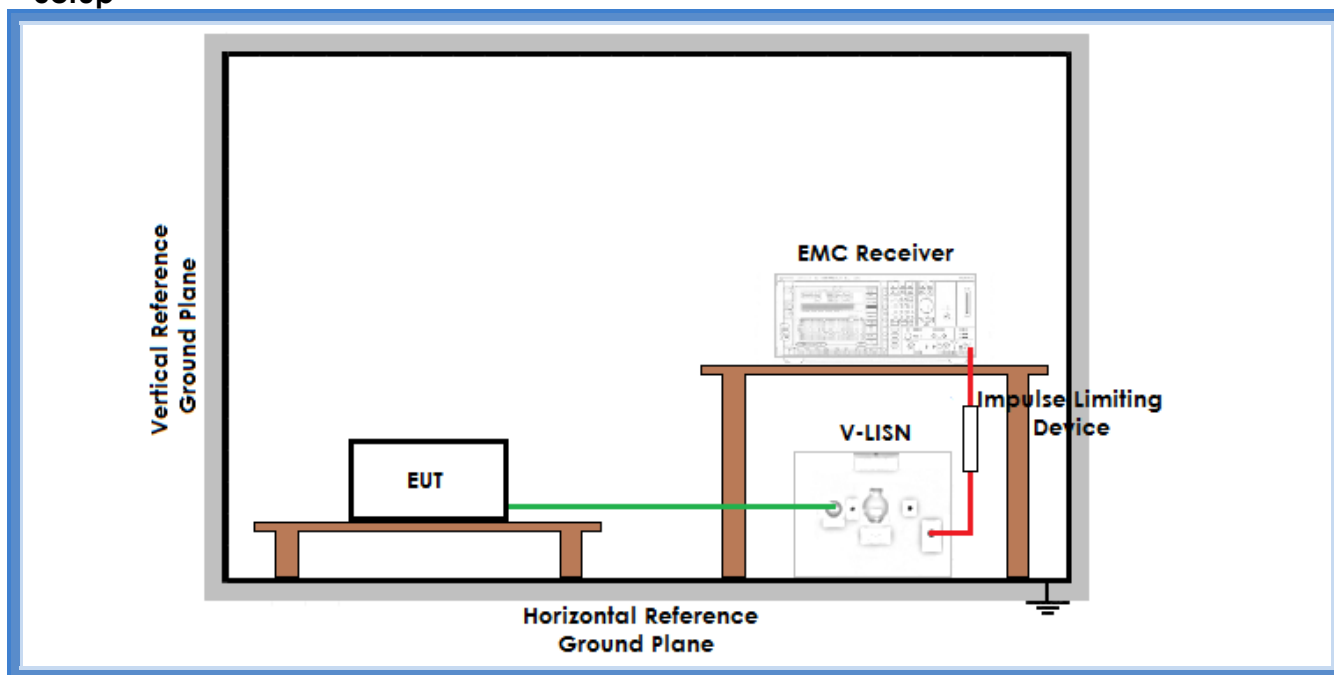
| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 21                  | 98                            | 46                       |

### Acceptance limits

| Frequency range (MHz) | dB(μV) Quasi-peak | dB(μV) Average |
|-----------------------|-------------------|----------------|
| 0,15 to 0,50          | 66 to 56          | 56 to 46       |
| 0,50 to 5             | 56                | 46             |
| 5 to 30               | 60                | 50             |



## Setup



## Result

| Line        | Graphs    | Remarks | Result   |
|-------------|-----------|---------|----------|
| +           | G14189801 | --      | Complies |
| -           | G14189802 | --      | Complies |
| Remarks: -- |           |         |          |

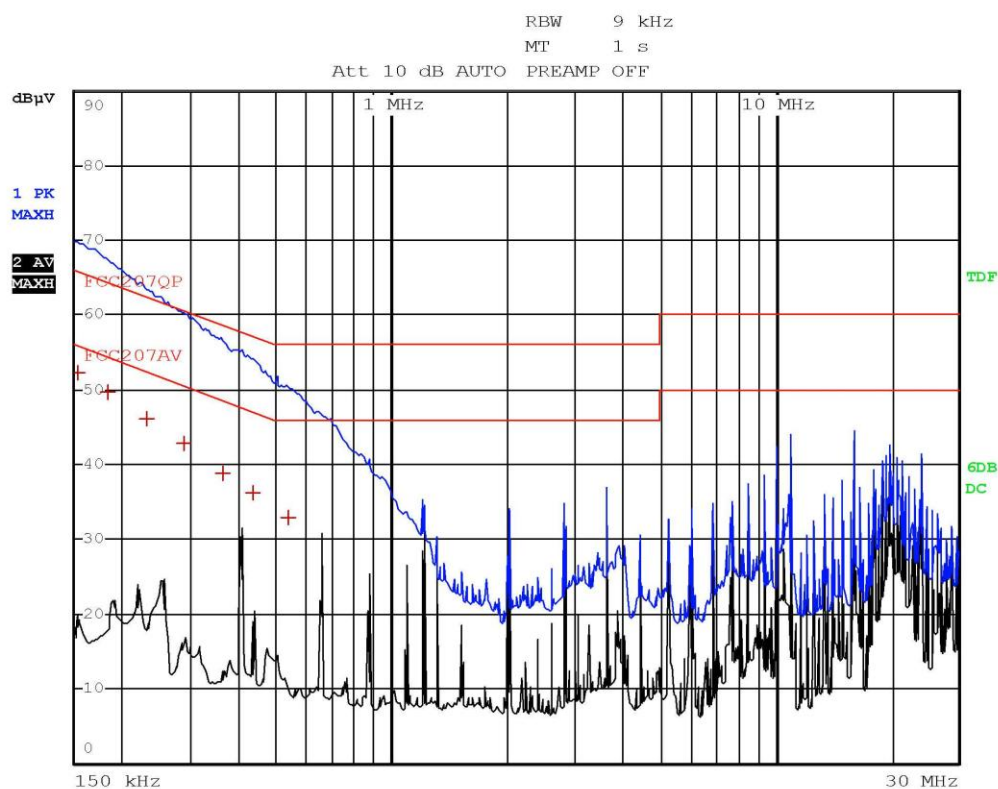
### Graphs Legend

PK: Peak; QP [1s] (quasi-peak at 1 second) values are marked with a +  
AV: Average; AV [1s] (average at 1 second) values are marked with a X



## Graphs

G14189801



Gandini 14189801-Line (+)-Tx-Rx Ant.Ext 5m

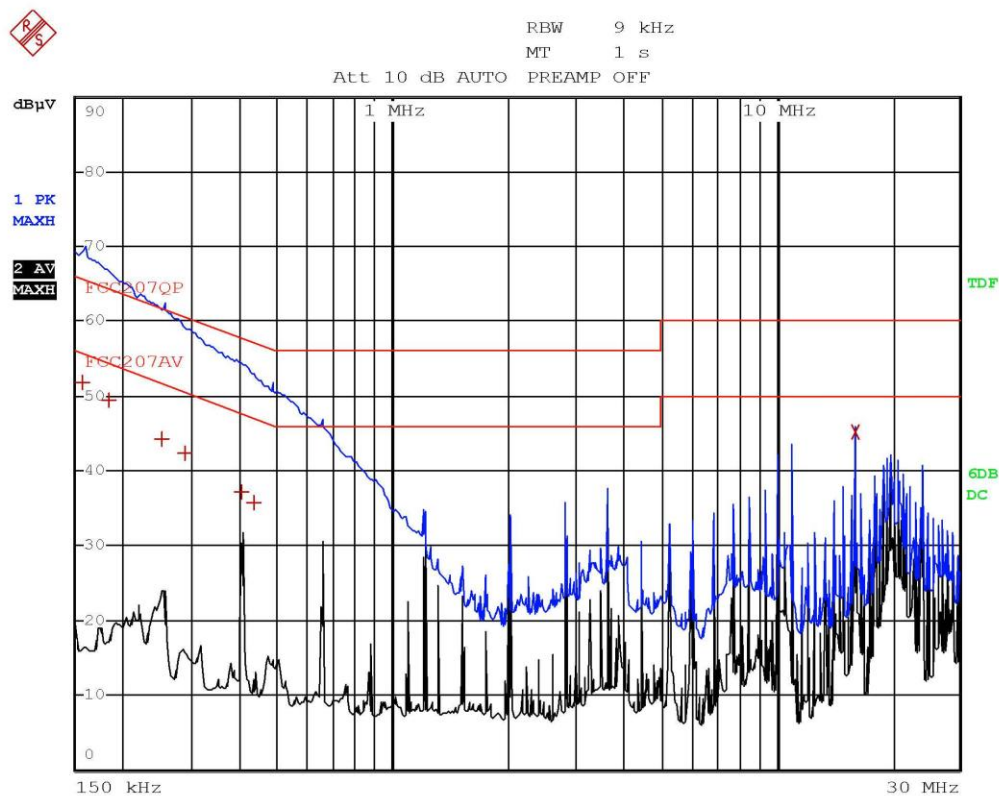


| EDIT PEAK LIST (Final Measurement Results) |           |            |                |
|--------------------------------------------|-----------|------------|----------------|
| Trace1:                                    | FCC207QP  |            |                |
| Trace2:                                    | FCC207AV  |            |                |
| Trace3:                                    | ---       |            |                |
| TRACE                                      | FREQUENCY | LEVEL dBμV | DELTA LIMIT dB |
| 1 Quasi Peak                               | 154 kHz   | 52.43      | -13.35         |
| 1 Quasi Peak                               | 186 kHz   | 49.77      | -14.43         |
| 1 Quasi Peak                               | 230 kHz   | 46.12      | -16.32         |
| 1 Quasi Peak                               | 286 kHz   | 42.90      | -17.73         |
| 1 Quasi Peak                               | 362 kHz   | 38.89      | -19.78         |
| 1 Quasi Peak                               | 434 kHz   | 36.37      | -20.80         |
| 1 Quasi Peak                               | 538 kHz   | 32.97      | -23.02         |

Gandini 14189801-Line (+)-Tx-Rx Ant.Ext 5m



G14189802



Gandini 14189802-Line (-)-Tx-Rx Ant.Ext 5m



| EDIT PEAK LIST (Final Measurement Results) |            |            |                |
|--------------------------------------------|------------|------------|----------------|
| Trace1:                                    | FCC207QP   |            |                |
| Trace2:                                    | FCC207AV   |            |                |
| Trace3:                                    | ---        |            |                |
| TRACE                                      | FREQUENCY  | LEVEL dBμV | DELTA LIMIT dB |
| 1 Quasi Peak                               | 158 kHz    | 51.81      | -13.75         |
| 1 Quasi Peak                               | 186 kHz    | 49.46      | -14.75         |
| 1 Quasi Peak                               | 254 kHz    | 44.35      | -17.26         |
| 1 Quasi Peak                               | 286 kHz    | 42.47      | -18.16         |
| 1 Quasi Peak                               | 402 kHz    | 37.26      | -20.55         |
| 1 Quasi Peak                               | 434 kHz    | 35.84      | -21.33         |
| 2 Average                                  | 16.002 MHz | 45.22      | -4.77          |

Gandini 14189802-Line (-)-Tx-Rx Ant.Ext 5m

**Result:** The requirements are met



## 11.3 Radiated emissions

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

Test site:  
Semi-anechoic chamber

Auxiliary equipment:  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S108, CMC S127, CMC S136, CMC S164  
Measurement uncertainty: See clause 7 of this test report

### Test specification

Port: Enclosure  
Frequency range: 0,009 MHz – 1000 MHz  
Antenna polarization: Horizontal (H) – Vertical (V)  
EUT – Antenna distance: 3 m

### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
|                     |                               |                          |

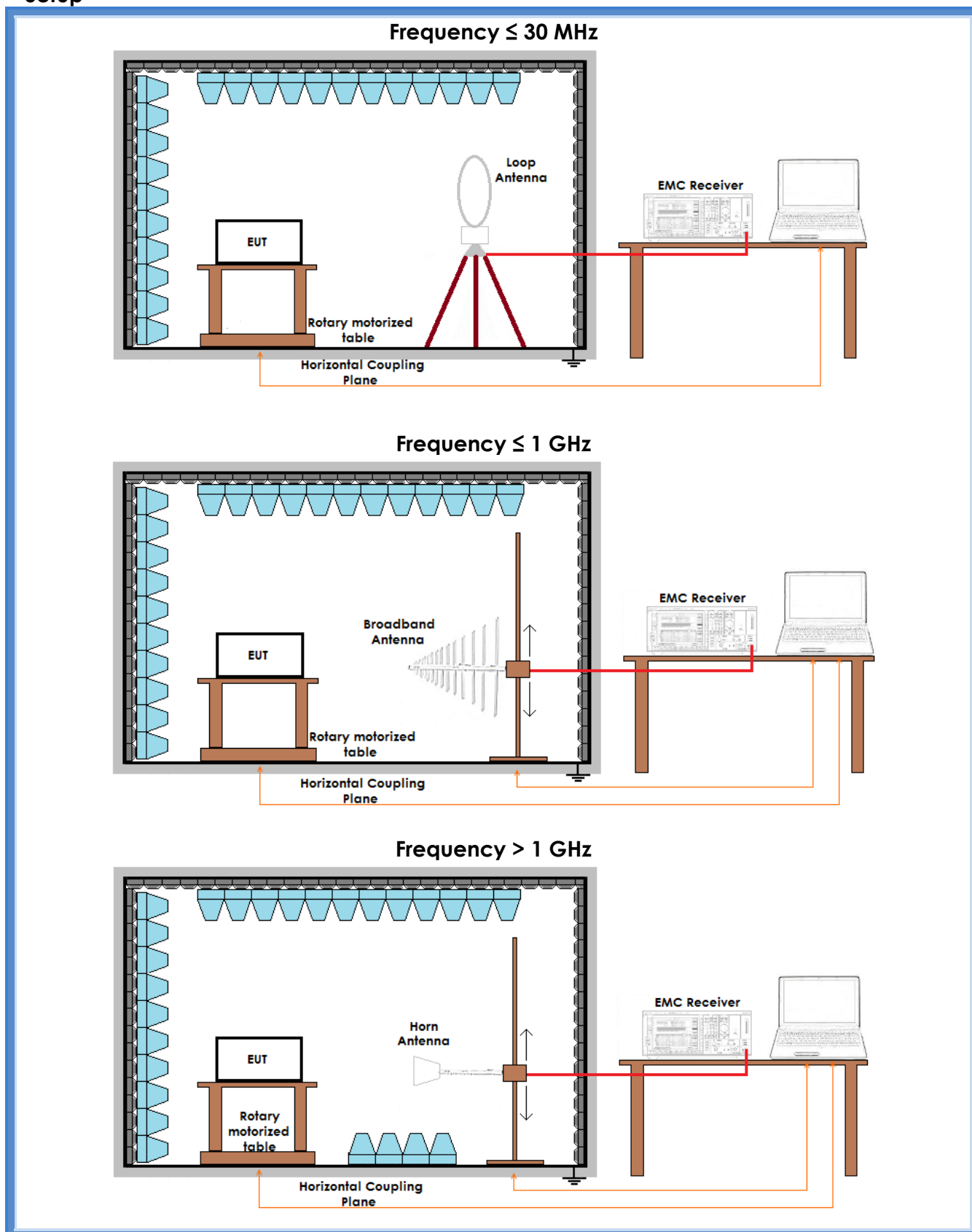
### Acceptance limits

| Frequency range<br>(MHz) | Limits<br>[dB(μV/m)] |
|--------------------------|----------------------|
| 0,009 to 0,490           | 128,51 to 93,80      |
| 0,490 to 1,705           | 73,80 to 62,97       |
| 1,705 to 30              | 69,54                |
| 30 to 88                 | 40                   |
| 88 to 216                | 43,52                |
| 216 to 960               | 46,02                |
| Above 960                | 53,98                |

**Remarks:** The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.



## Setup





## Result

| Polarization | Frequency Range (MHz) | Graphs    | Remarks         | Result   |
|--------------|-----------------------|-----------|-----------------|----------|
| Loop         | 0,009 – 30            | G14189824 | Worst case      | Complies |
| V            | 30 – 1000             | G14198916 | Lowest channel  | Complies |
| H            | 30 – 1000             | G14198917 | Lowest channel  | Complies |
| V            | 30 – 1000             | G14198918 | Medium channel  | Complies |
| H            | 30 – 1000             | G14198919 | Medium channel  | Complies |
| V            | 30 – 1000             | G14198920 | Highest channel | Complies |
| H            | 30 – 1000             | G14198921 | Highest channel | Complies |
| V            | 1000 – 10000          | G14198922 | Worst case      | Complies |
| H            | 1000 – 10000          | G14198923 | Worst case      | Complies |

**Remarks:** Peaks above the limits are caused by the nominal transmitting frequency

### Graphs Legend

PK: Peak; QP [1s] (quasi-peak at 1 second) values are marked with a +

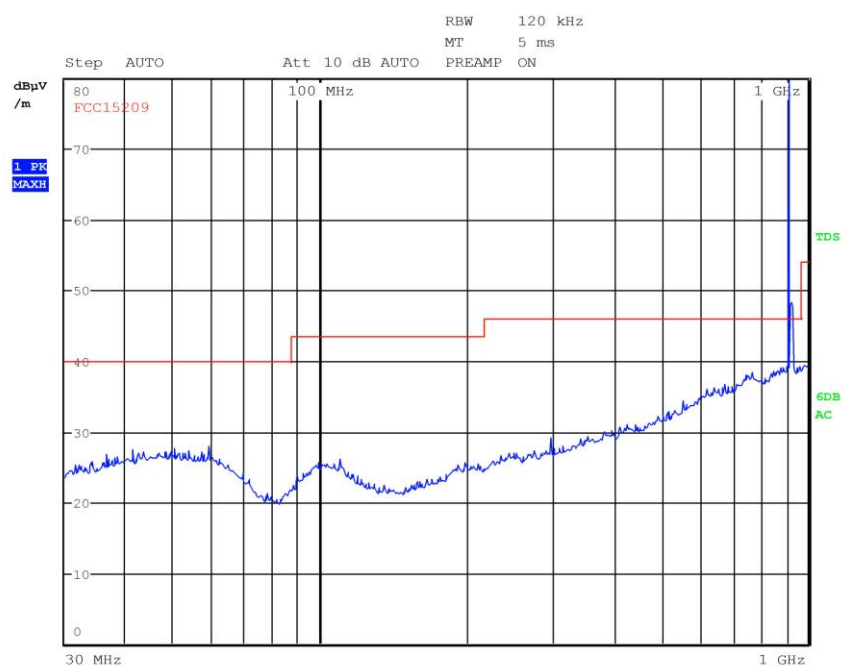
AV: Average; AV [1s] (average at 1 second) values are marked with a x



## Graphs

G14189816

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmin - Ant. Ext. 5m  
**Operator** Gandini 14189816  
**Test Spec**  
Vert



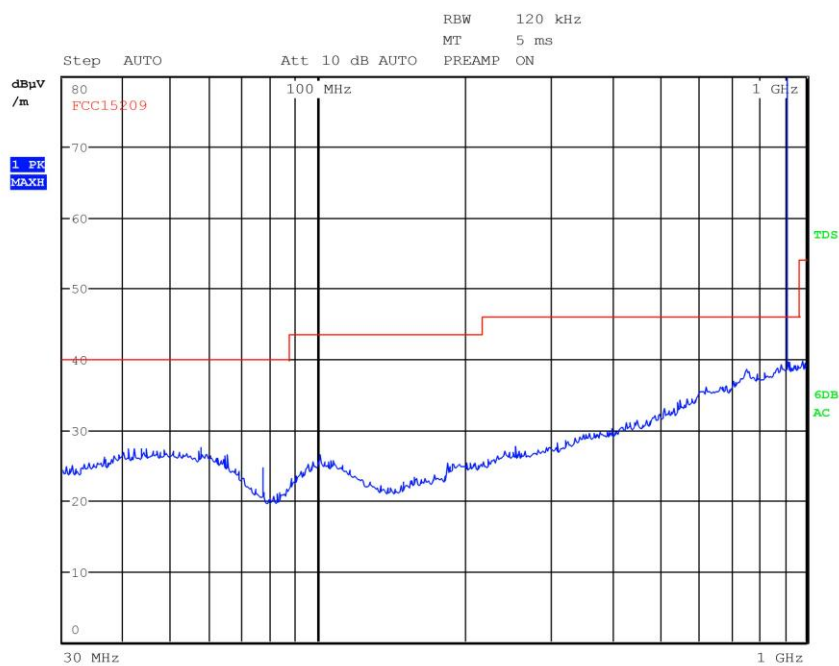
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189817

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Filocomando  
**Operator** Gandini 14189817  
**Test Spec**  
Horiz



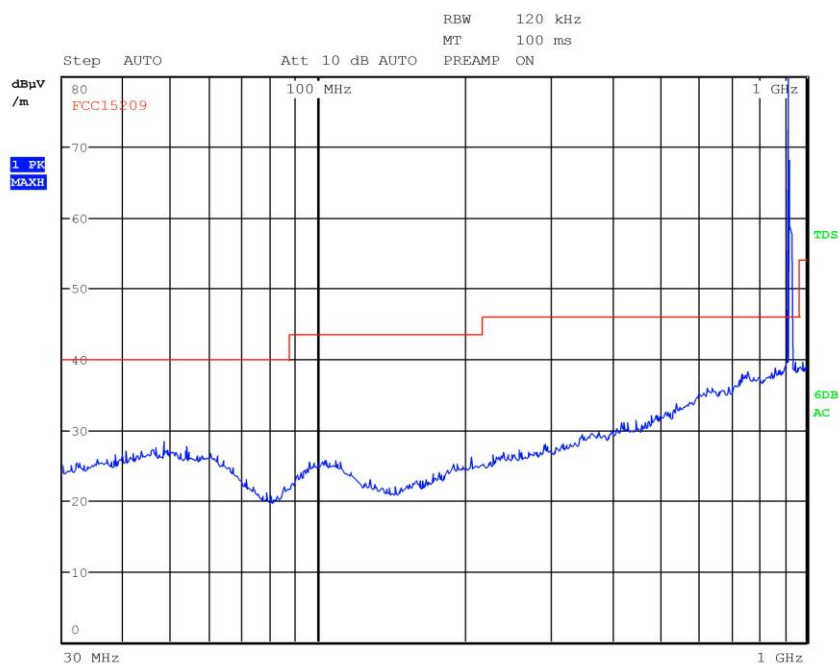
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189818

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmed - Ant. Ext. 5m  
**Operator** Gandini 14189818  
**Test Spec**  
**Vert**



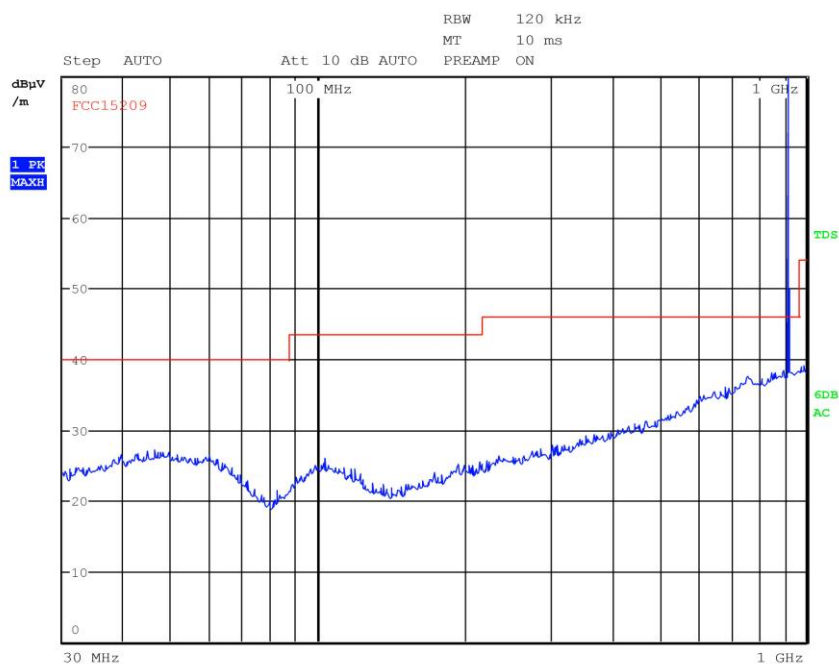
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189819

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmed - Ant. Ext. 5m  
**Operator** Gandini 14189819  
**Test Spec**  
Horiz



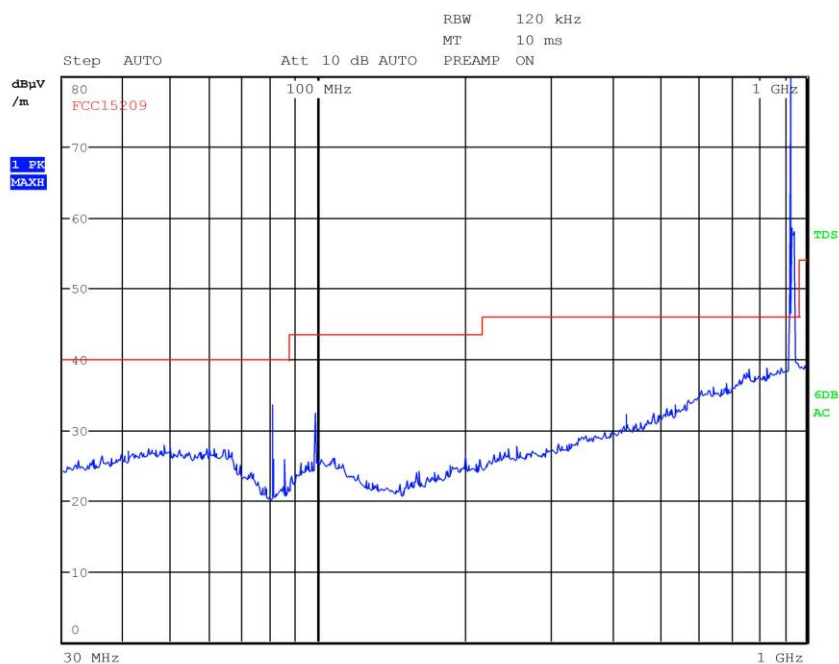
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189820

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmax -ant Ext 5 m  
**Operator** Panozzo 14189820  
**Test Spec**  
Vert.



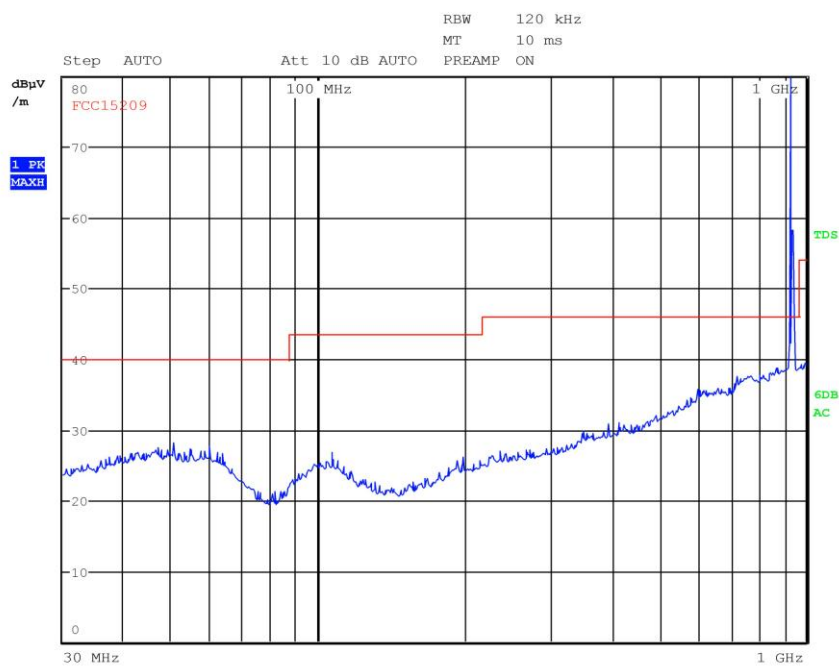
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189821

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmax -ant Ext 5 m  
**Operator** Panozzo 14189821  
**Test Spec**  
Horiz.



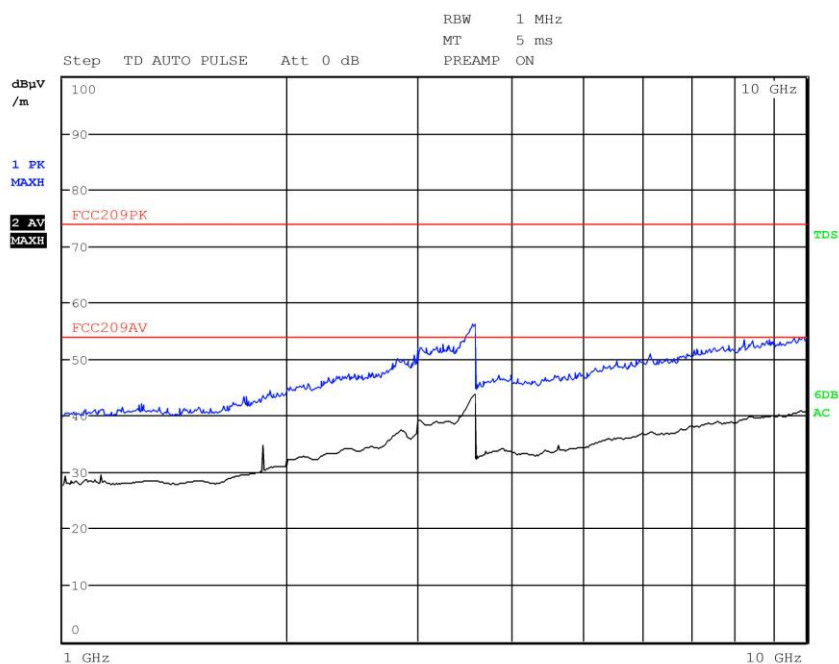
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Subranges: 0



G14189822

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmax -ant Ext 5 m  
**Operator** Panozzo 14189822  
**Test Spec**  
Vert.



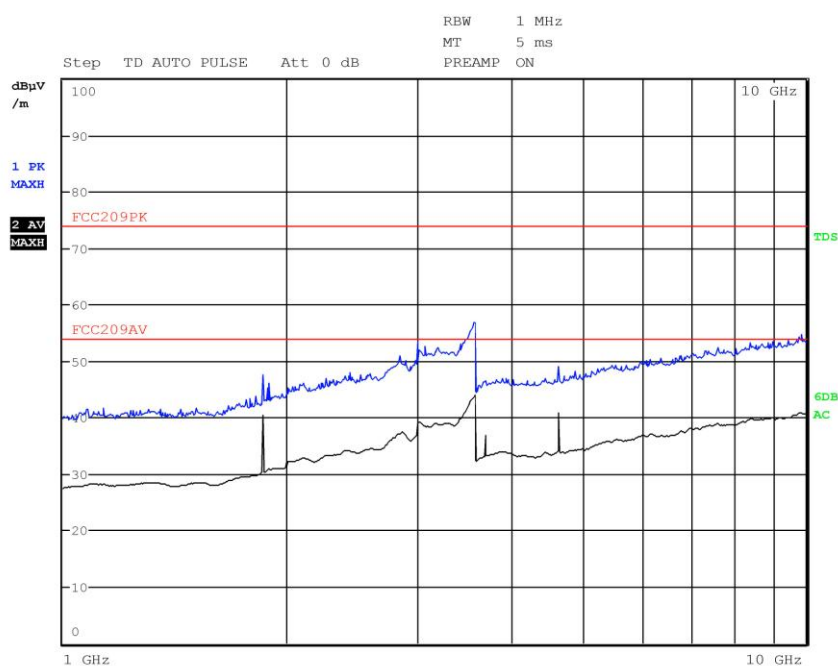
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Peaks: 0



G14189823

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmax -ant Ext 5 m  
**Operator** Panozzo 14189823  
**Test Spec**  
Horiz.



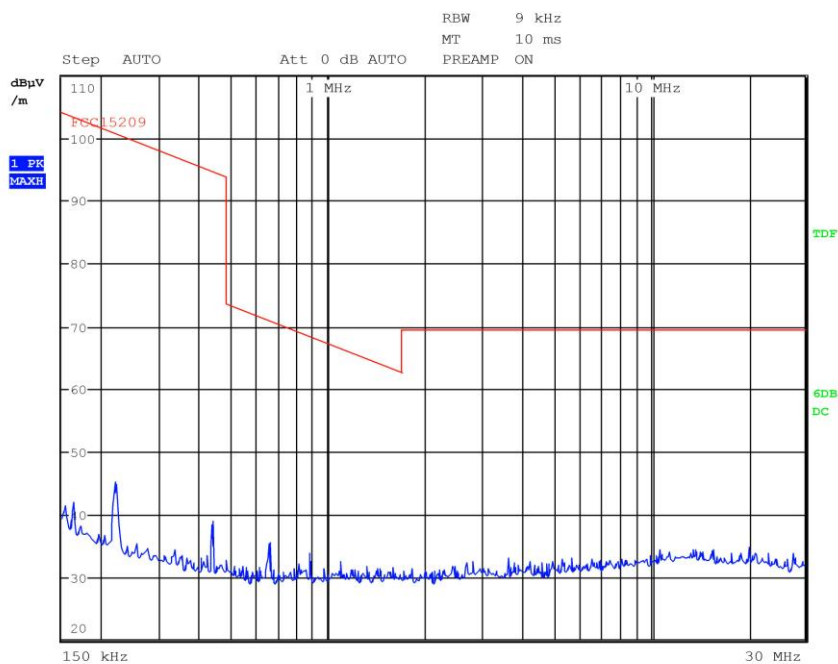
### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Peaks: 0



G14189824

**Meas Type** Emission  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx - Fmax -ant Ext 5 m  
**Operator** Panozzo 14189824  
**Test Spec**  
Loop



### Final Measurement

Meas Time: 1 s  
Margin: 6 dB  
Peaks: 0

**Result:** The requirements are met



## 11.4 20 dB bandwidth

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Laboratory

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S227  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

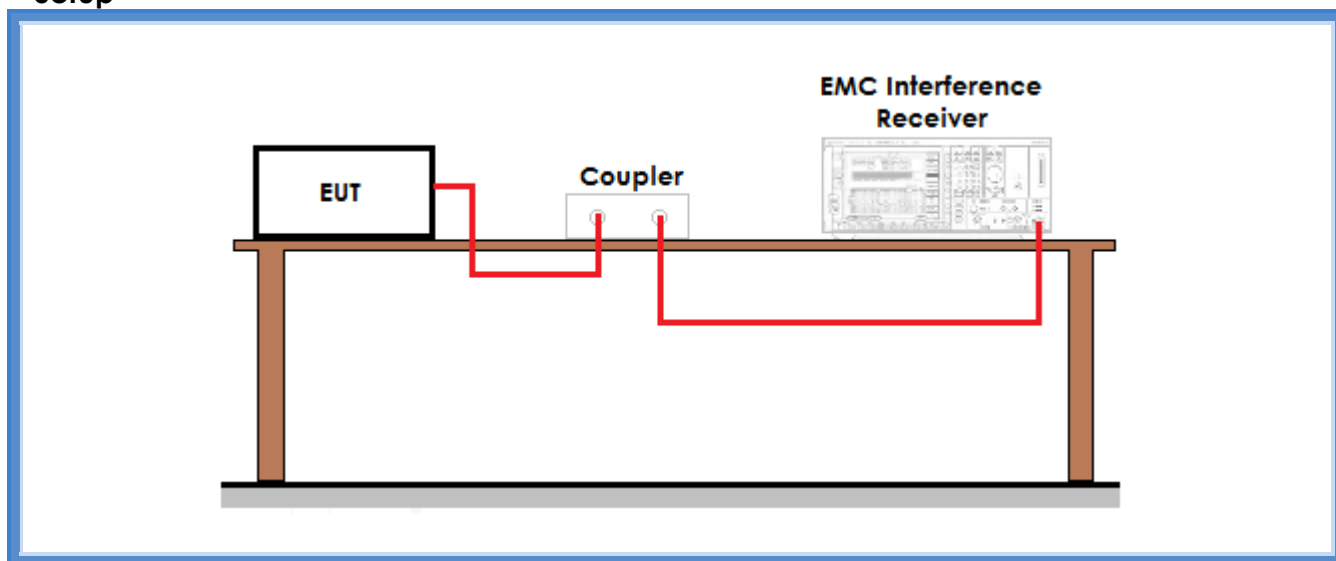
### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 100                           | 42                       |

**Acceptance limits:** The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz



## Setup



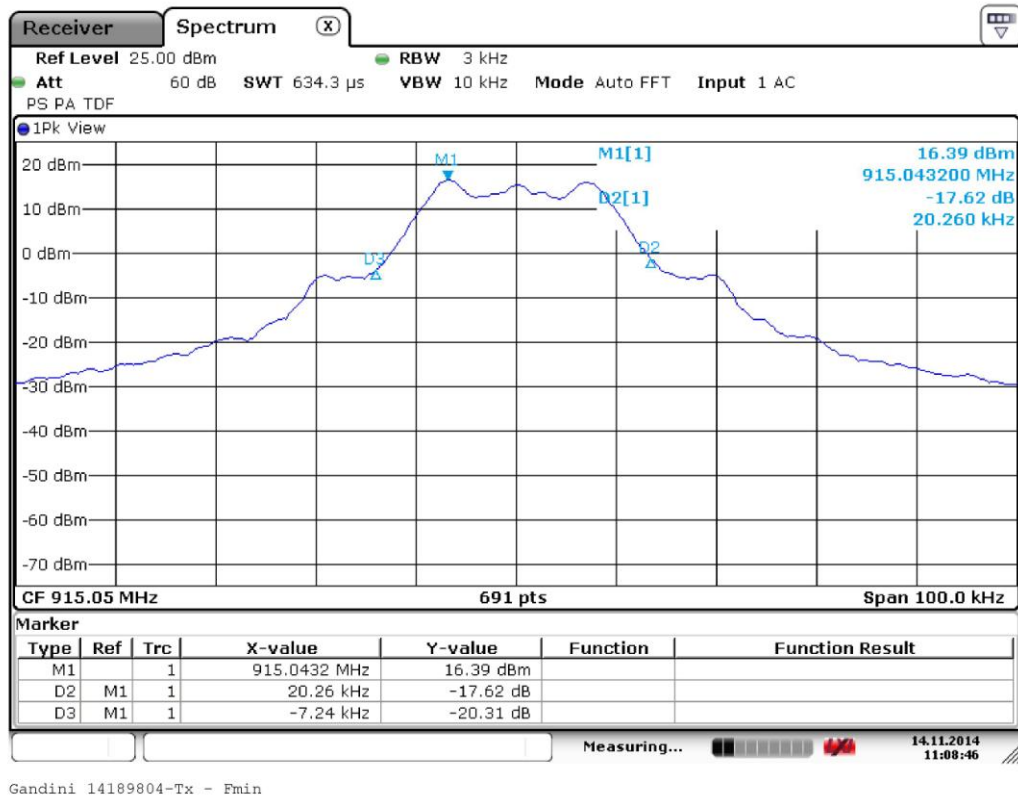
## Result

| Frequency<br>(MHz) | Graphs    | 20 dB bandwidth<br>(kHz) | Results  |
|--------------------|-----------|--------------------------|----------|
| 915,05             | G14189804 | 27,50                    | Complies |
| 921,50             | G14189814 | 27,64                    | Complies |
| 927,95             | G14189809 | 29,52                    | Complies |



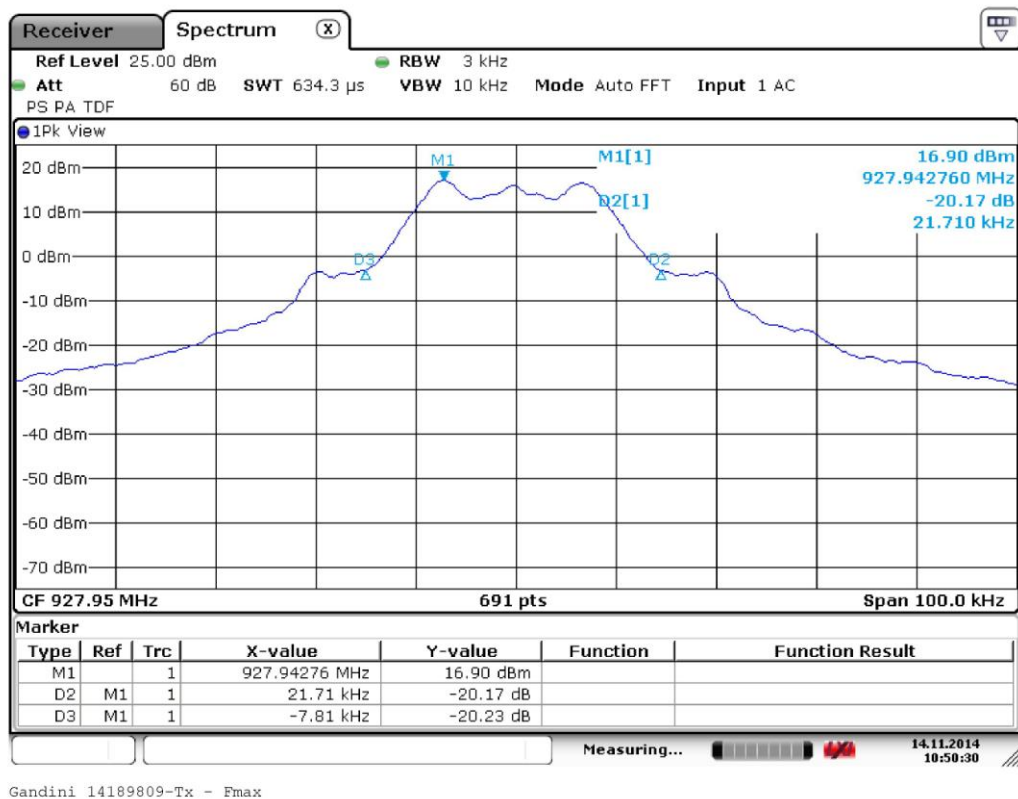
## Graphs

G14189804





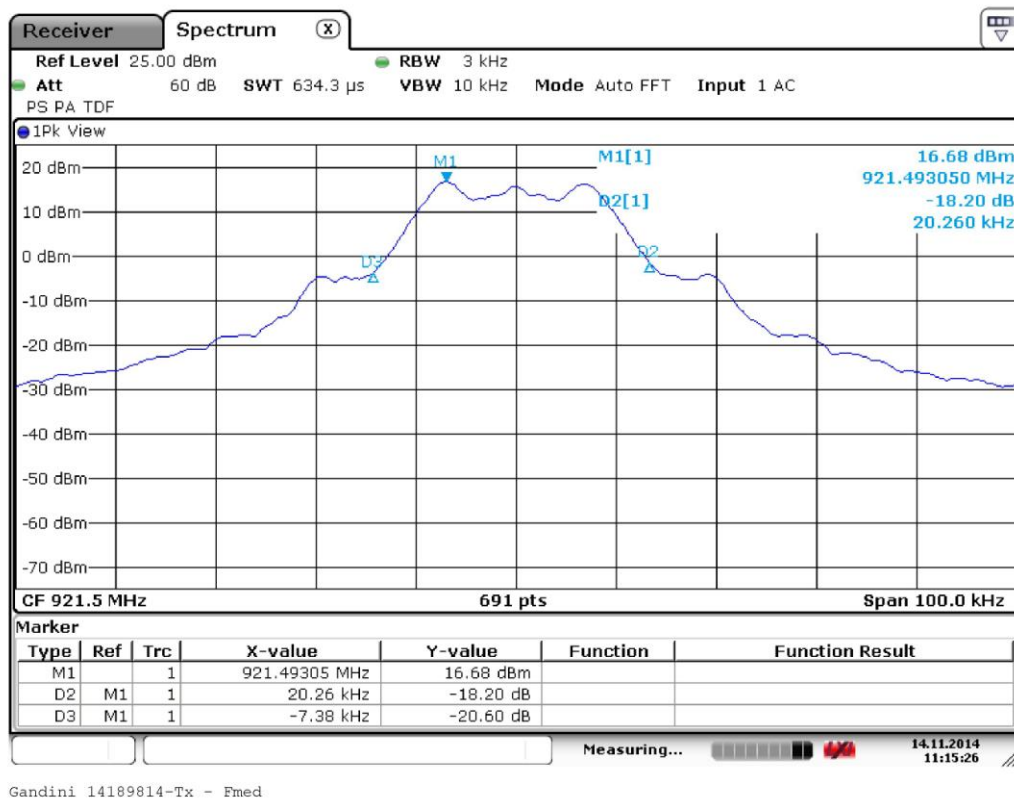
G14189809



Gandini 14189809-Tx - Fmax



G14189814



**Result:** The requirements are met



## 11.5 Channel separation

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Laboratory

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S206  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

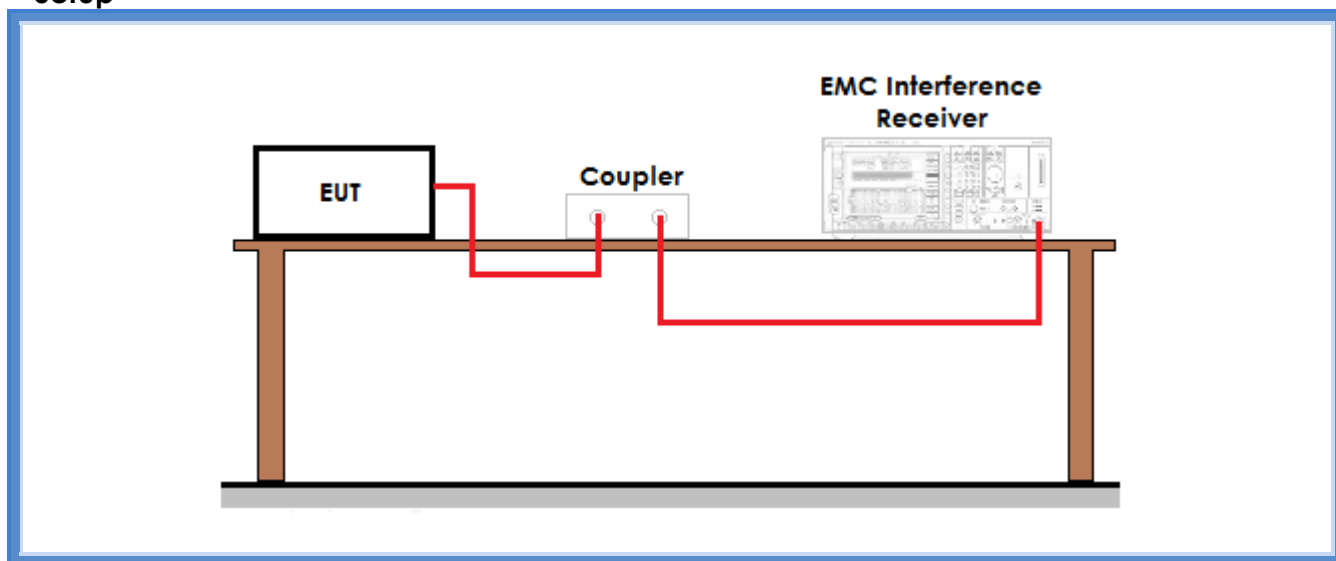
### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 100                           | 42                       |

**Acceptance limits:** Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483,5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW



## Setup



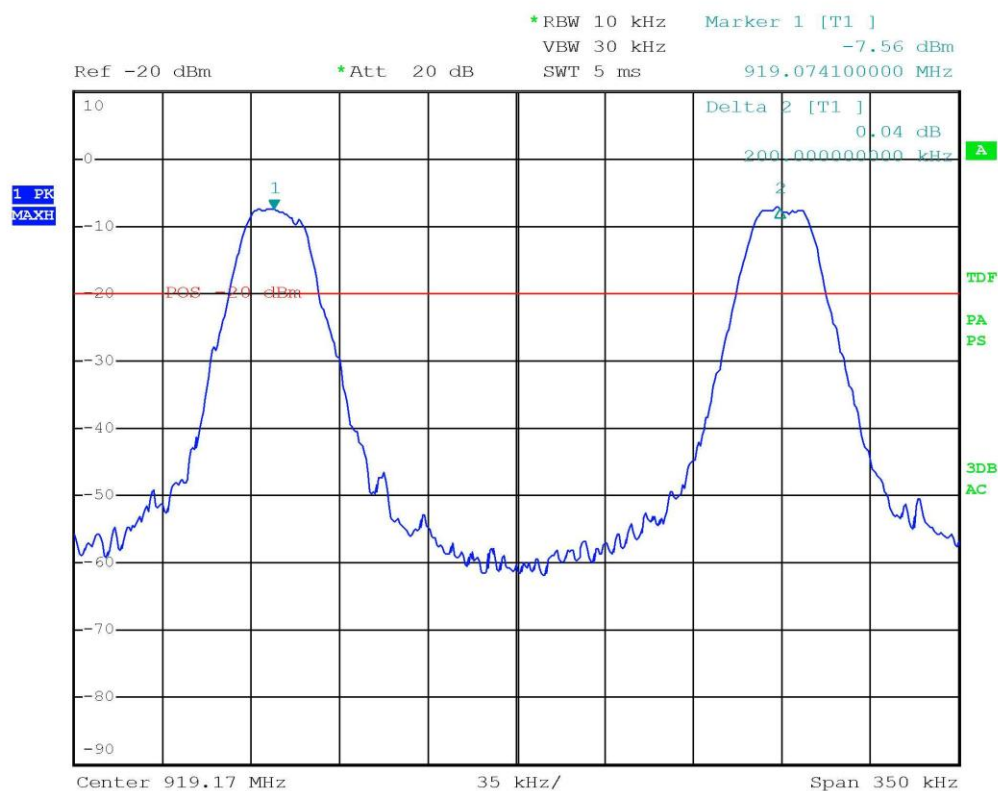
## Result

| Frequency band (MHz) | Graphs    | Channel separation (kHz) | Results  |
|----------------------|-----------|--------------------------|----------|
| 915,05               | G14189832 | 200                      | Complies |
| 927,95               | G14189833 |                          |          |



## Graphs

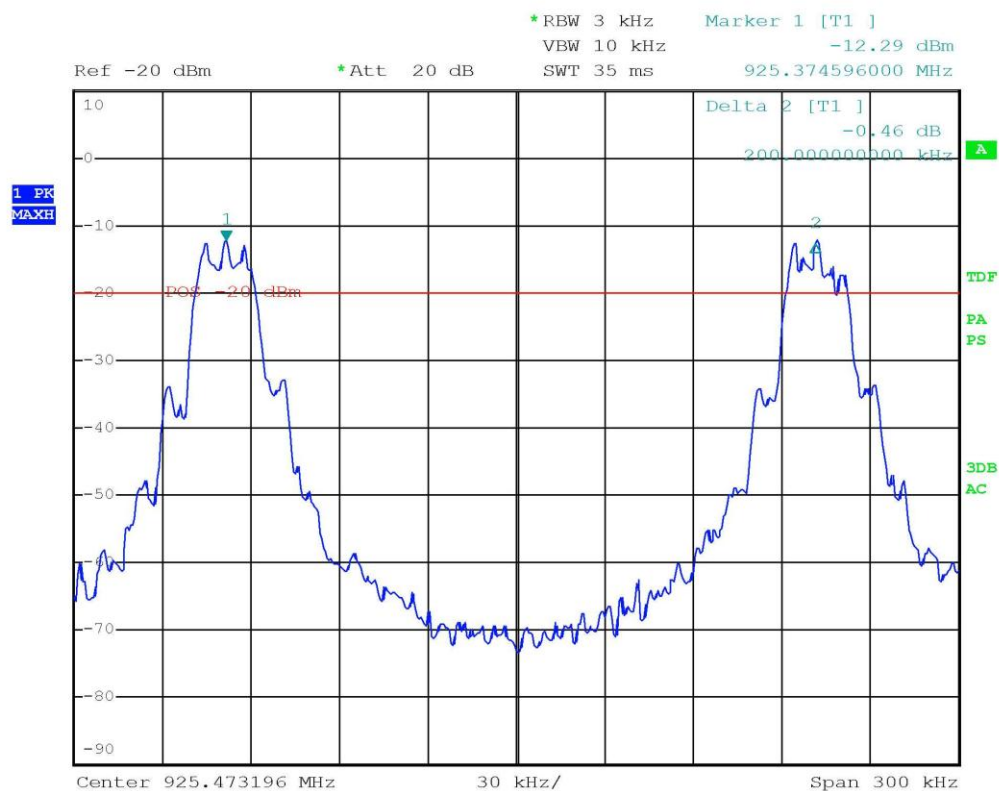
G14189832



Gandini 14189832-Tx-Rx - Fhop



G14189833



Gandini 14189833-Tx-Rx - Fhop

**Result:** The requirements are met



## 11.6 Number of hopping channels

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Laboratory

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S206  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

### Environmental conditions

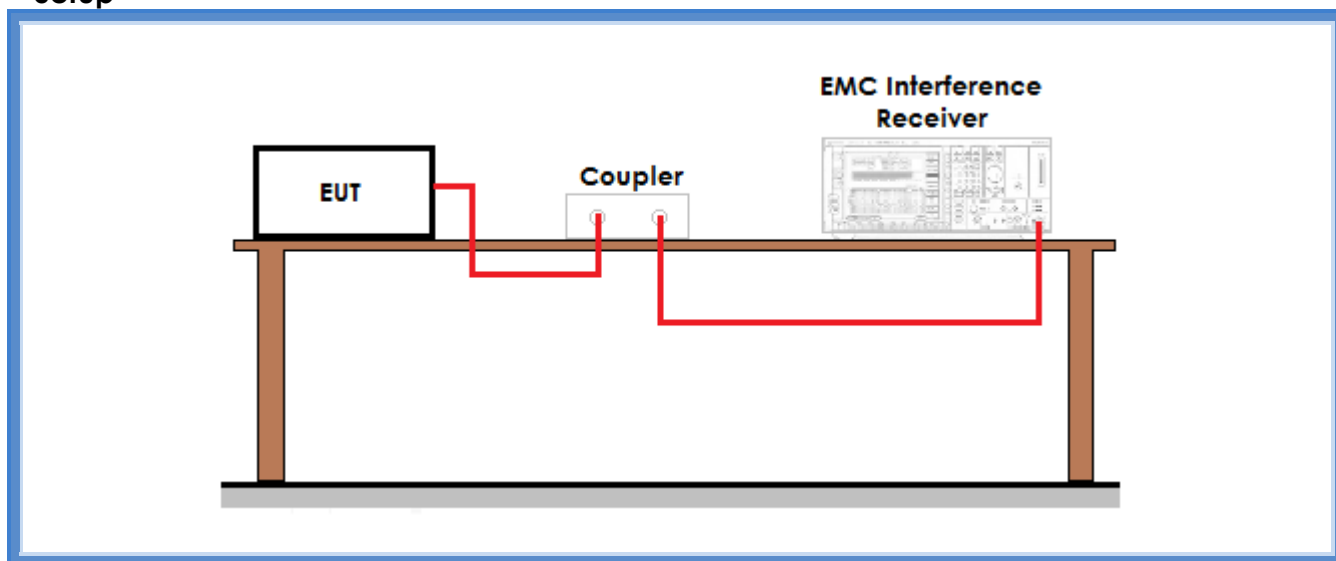
| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 101                           | 42                       |

### Acceptance limits:

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.  
If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.



## Setup



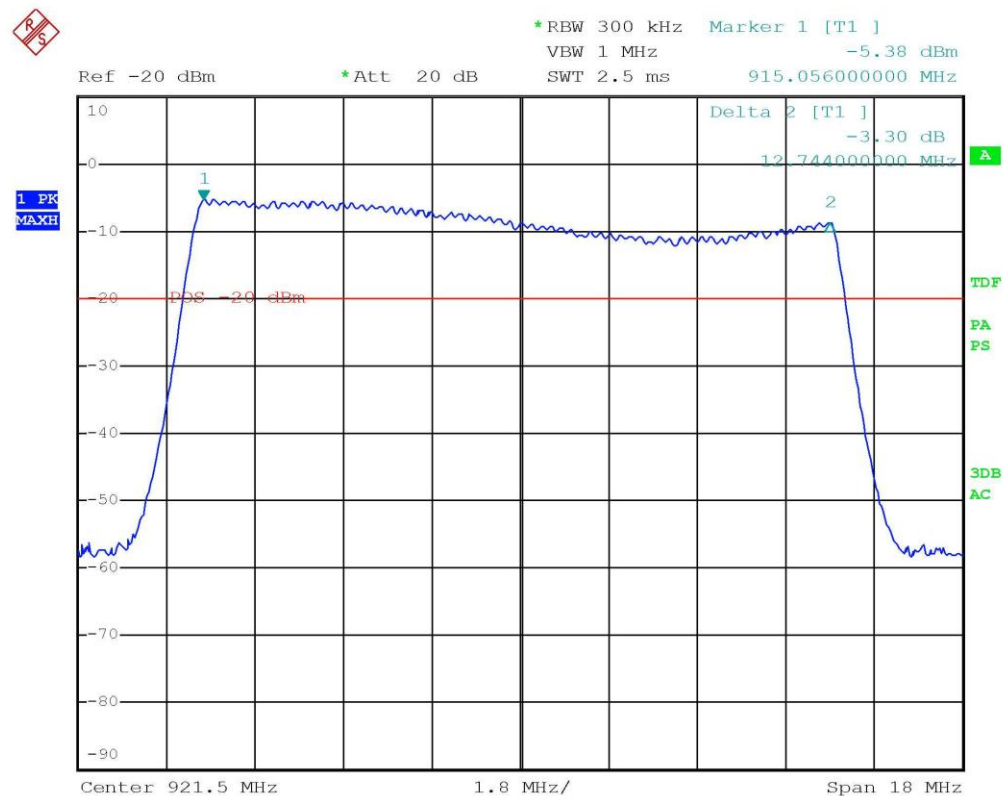
## Result

| Graphs    | Number of hopping channels | Results  |
|-----------|----------------------------|----------|
| G14189831 | 64                         | Complies |



## Graphs

G14189831



Gandini 14189831-Tx-Rx - Fhop

**Result:** The requirements are met



## 11.7 Time of occupancy

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Laboratory

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S206  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

### Environmental conditions

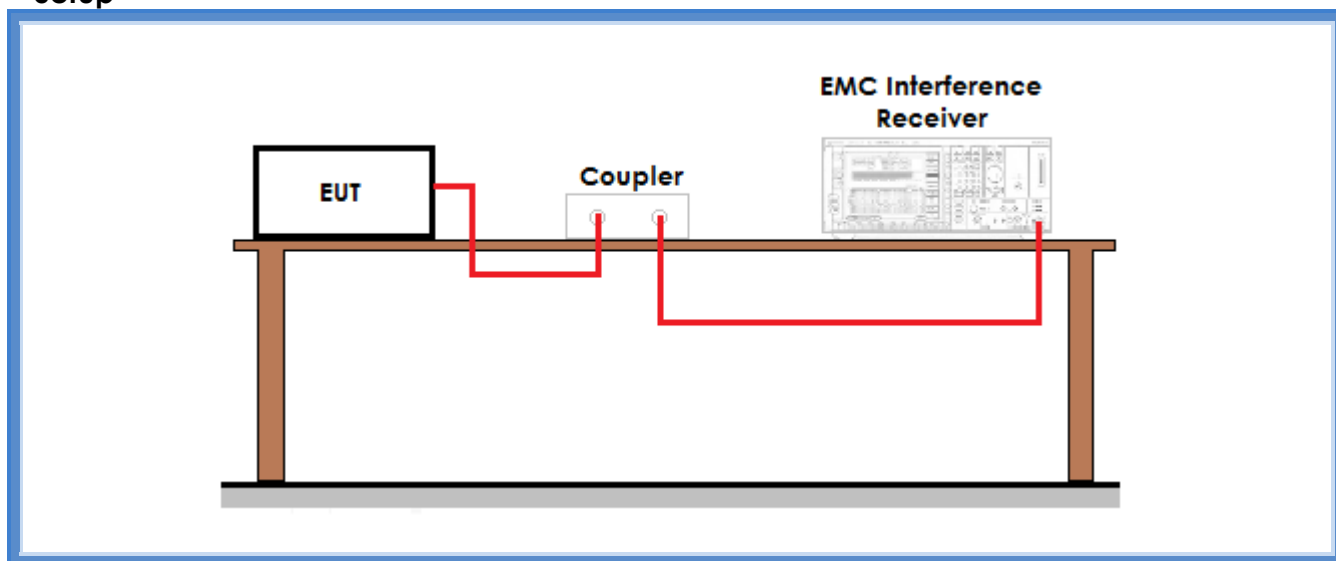
| <i>Temperature<br/>(°C)</i> | <i>Atmospheric pressure<br/>(kPa)</i> | <i>Relative humidity<br/>(%)</i> |
|-----------------------------|---------------------------------------|----------------------------------|
| 20                          | 101                                   | 42                               |

### Acceptance limits:

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 a 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 a 10 second period



## Setup



## Result

### Dwell time of transmission

| Frequency<br>(MHz) | Graphs    | Dwell time<br>(ms) |
|--------------------|-----------|--------------------|
| 915,45             | G14189834 | 14,08              |

### Number of transmissions per period

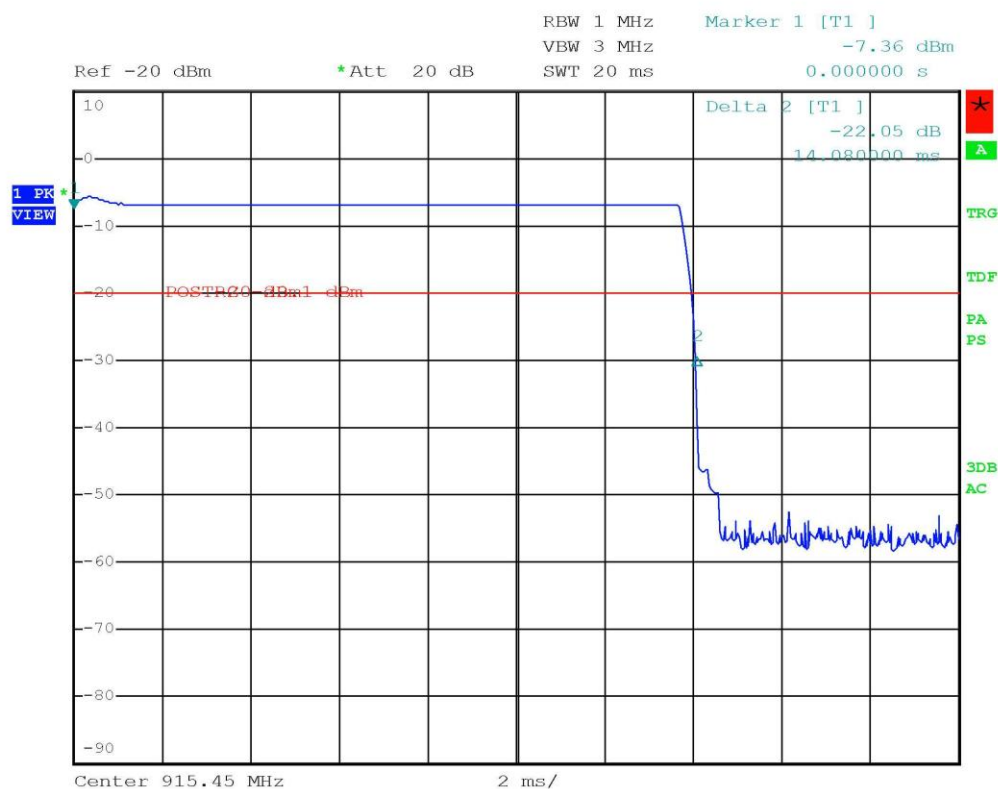
| Frequency<br>(MHz) | Time between 2 transmission on<br>different channels |         | Number of transmissions<br>(20 s / 0,0504 s / 64) |
|--------------------|------------------------------------------------------|---------|---------------------------------------------------|
| 915,45             | G14189835                                            | 50,4 ms | 6,20                                              |

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| <b>Time of occupancy<br/>(Dwell time x Number of transmissions)</b> | 87,296 ms |
|---------------------------------------------------------------------|-----------|



## Graphs

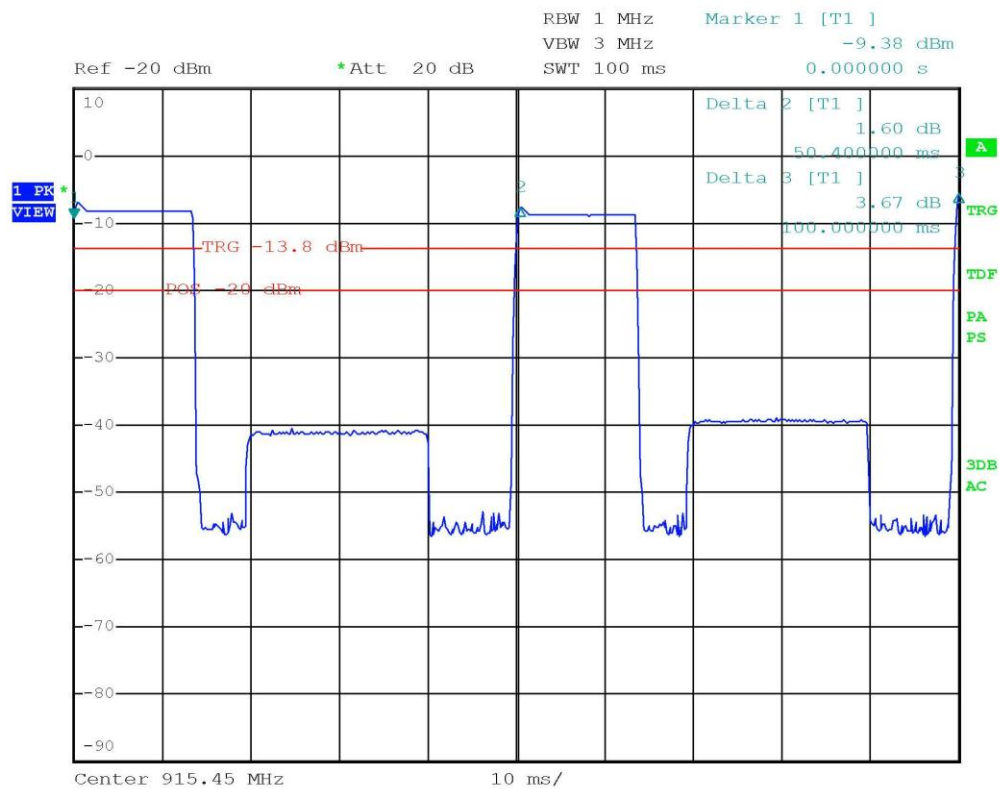
G14189834



Gandini 14189834-Tx-Rx - Fhop



G14189835



Gandini 14189835-Tx-Rx - Fhop

**Result:** The requirements are met



## 11.8 Band edge

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

*Test site:*  
Laboratory

*Auxiliary equipment:*  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S206, CMC S227  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

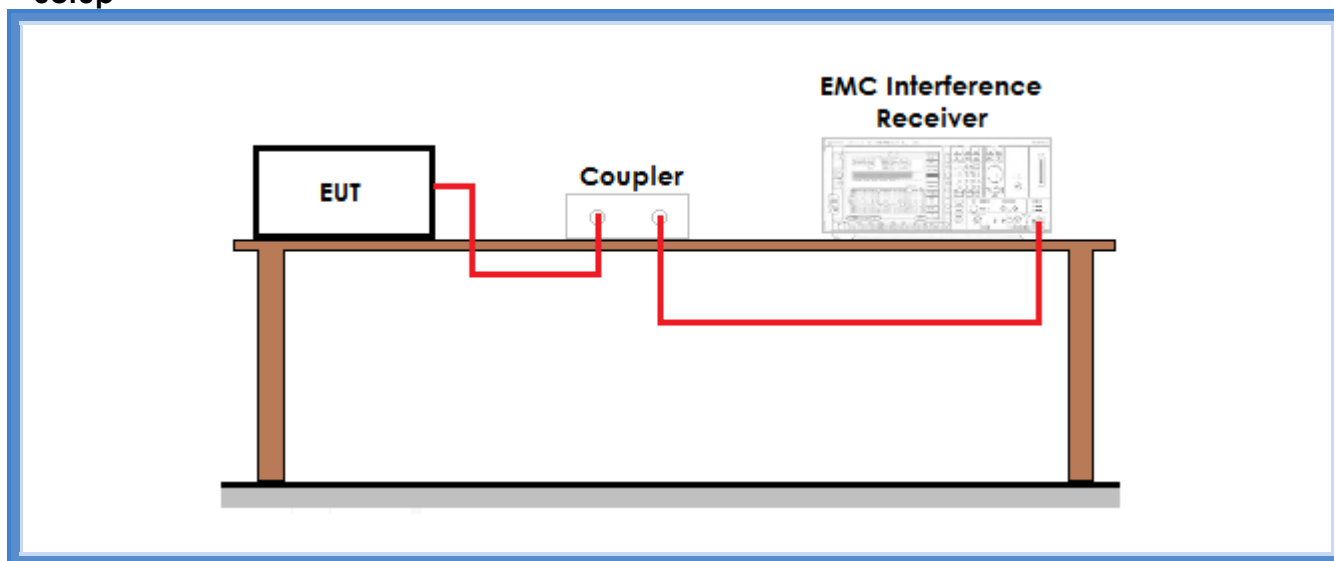
### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 101                           | 40                       |

**Acceptance limits:** operation within the band 902 – 928 MHz



## Setup



## Result

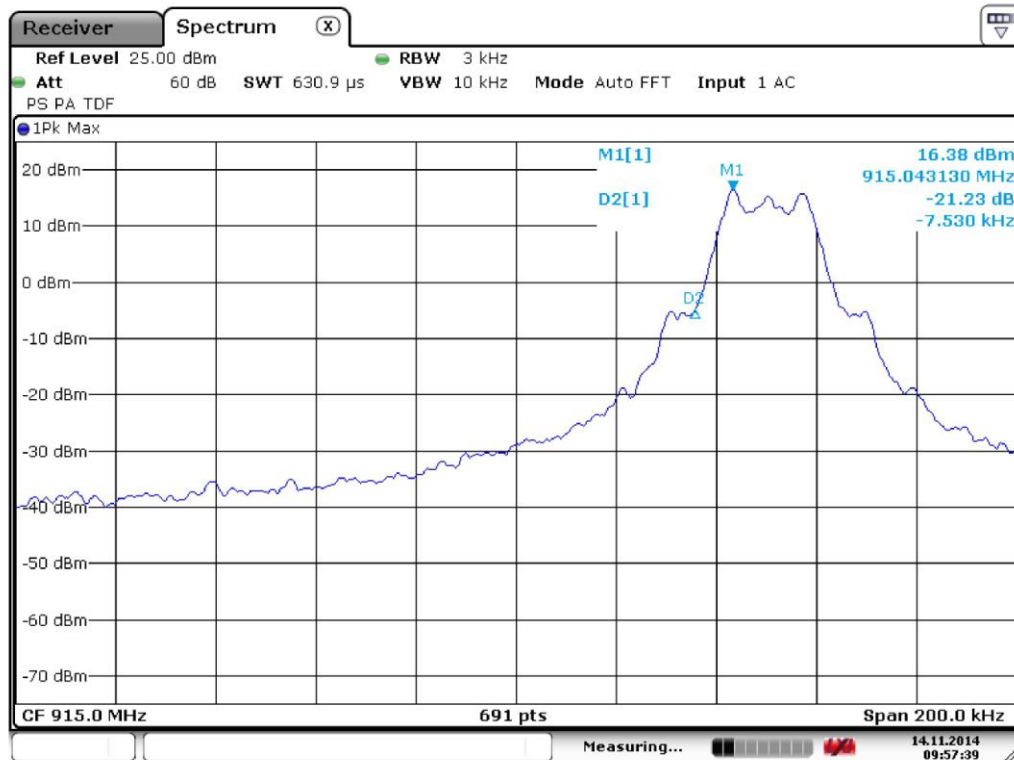
| Frequency (MHz) | Graph(s) – Hopping | Results                       |          |
|-----------------|--------------------|-------------------------------|----------|
| 915,05          | G14189836          | F <sub>L</sub> : 915,4556 MHz | Complies |
|                 | G14189837          |                               |          |
|                 | G14189838          |                               |          |
| 927,95          | G14189840          | F <sub>H</sub> : 927,9641 MHz | Complies |
|                 | G14189841          |                               |          |
|                 | G14189842          |                               |          |

| Frequency (MHz) | Graph(s) – No hopping | Results                       |          |
|-----------------|-----------------------|-------------------------------|----------|
| 915,05          | G14189806             | F <sub>L</sub> : 915,0356 MHz | Complies |
|                 | G14189807             |                               |          |
| 927,95          | G14189811             | F <sub>H</sub> : 927,9650 MHz | Complies |
|                 | G14189812             |                               |          |



## Graphs

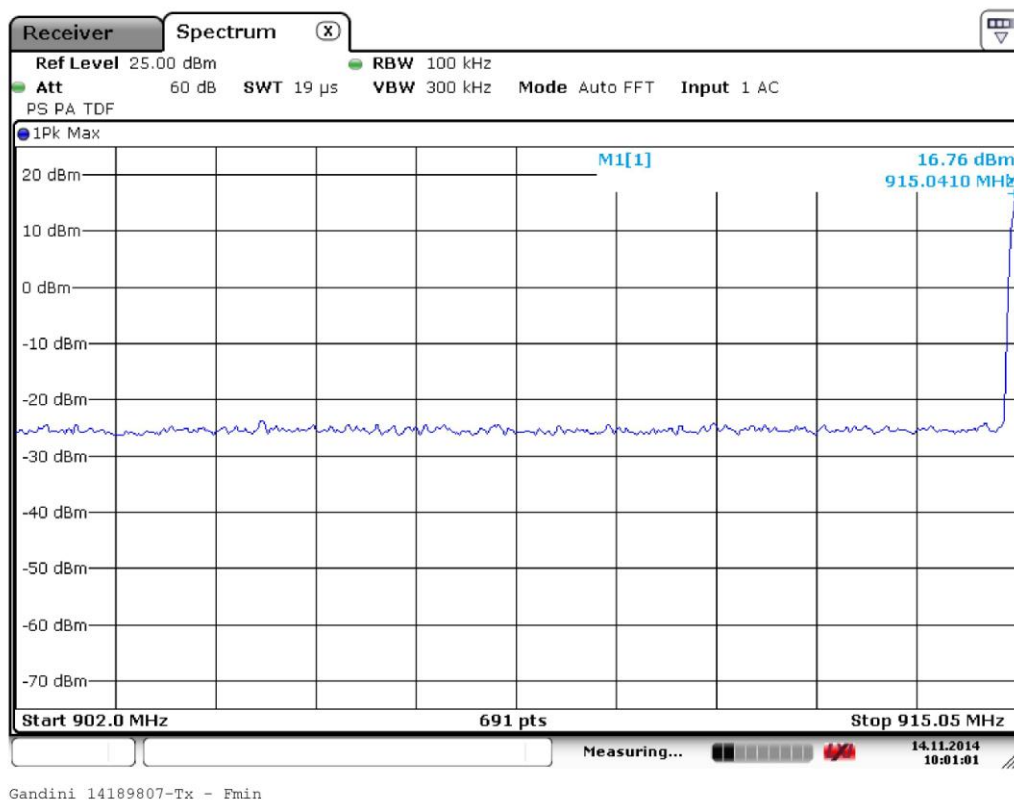
G14189806



Gandini 14189806-Tx - Fmin

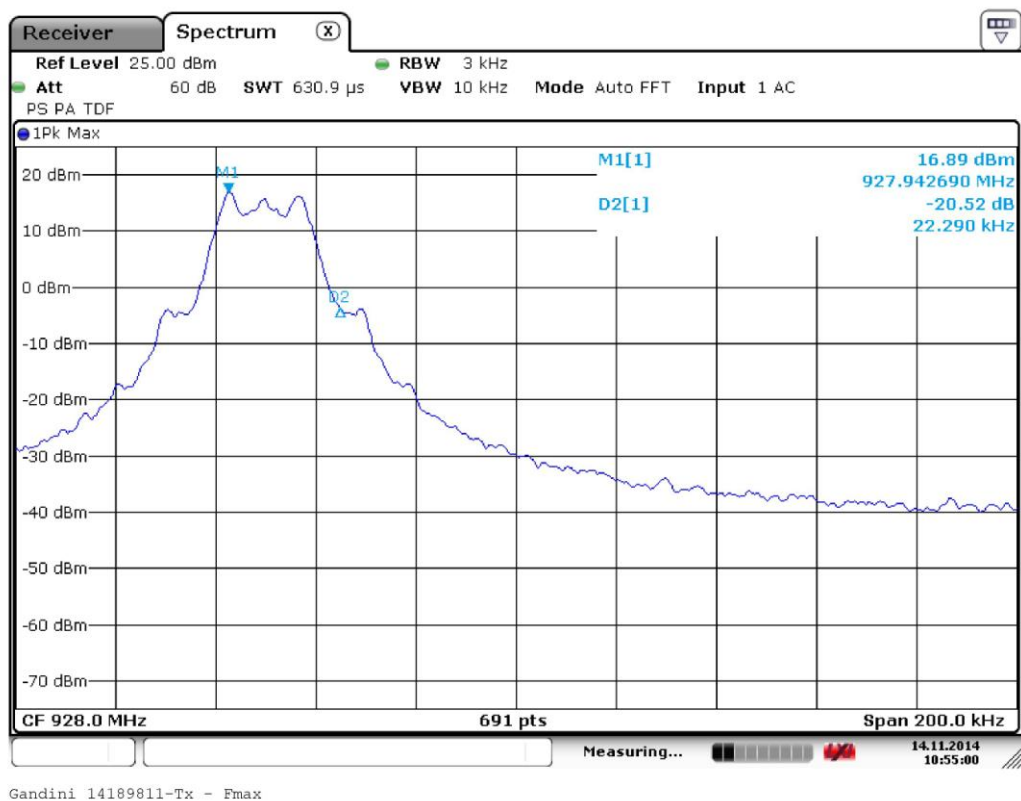


G14189807



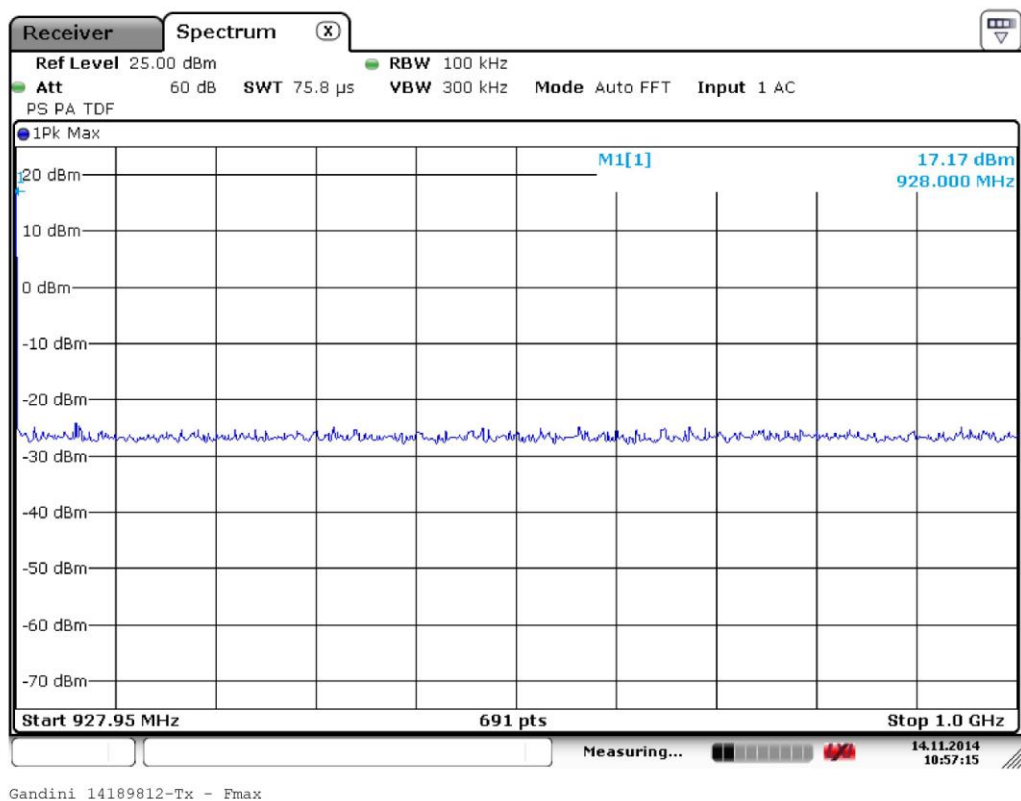


G14189811



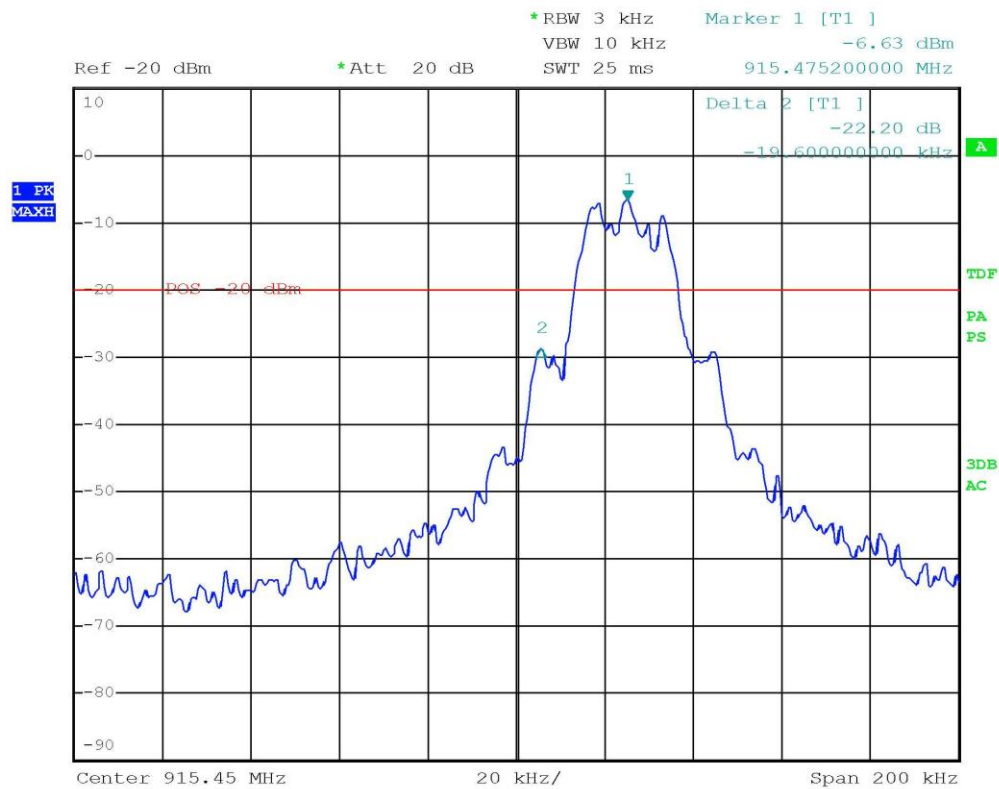


G14189812





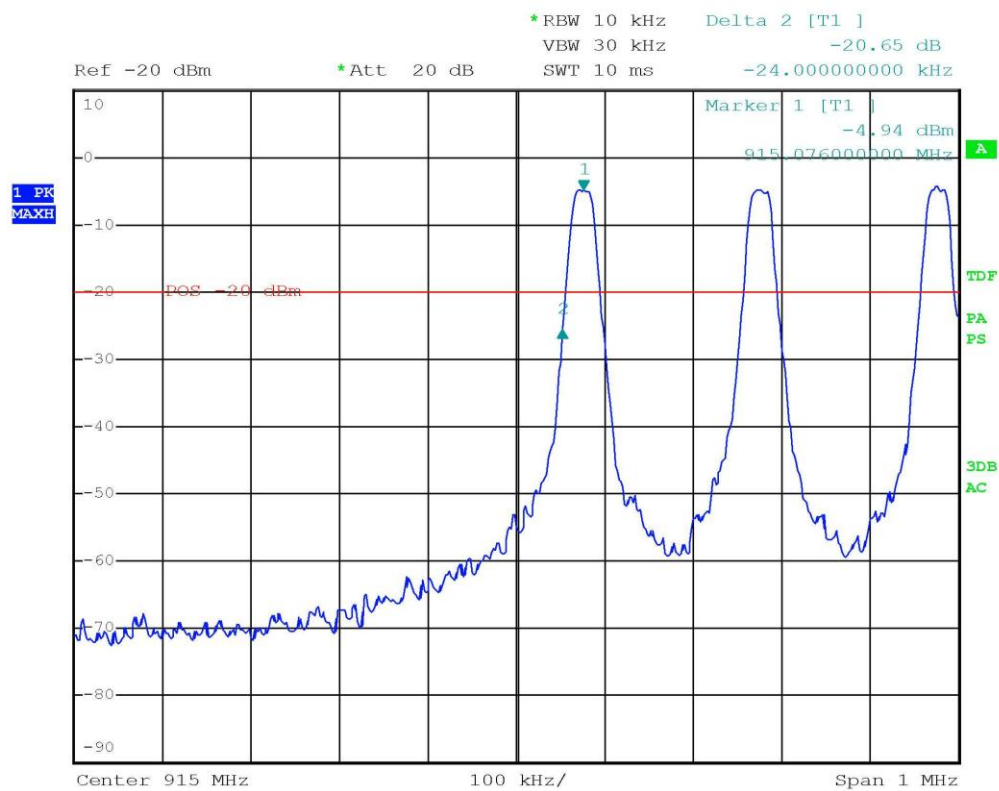
G14189836



Gandini 14189836-Tx-Rx - Fhop



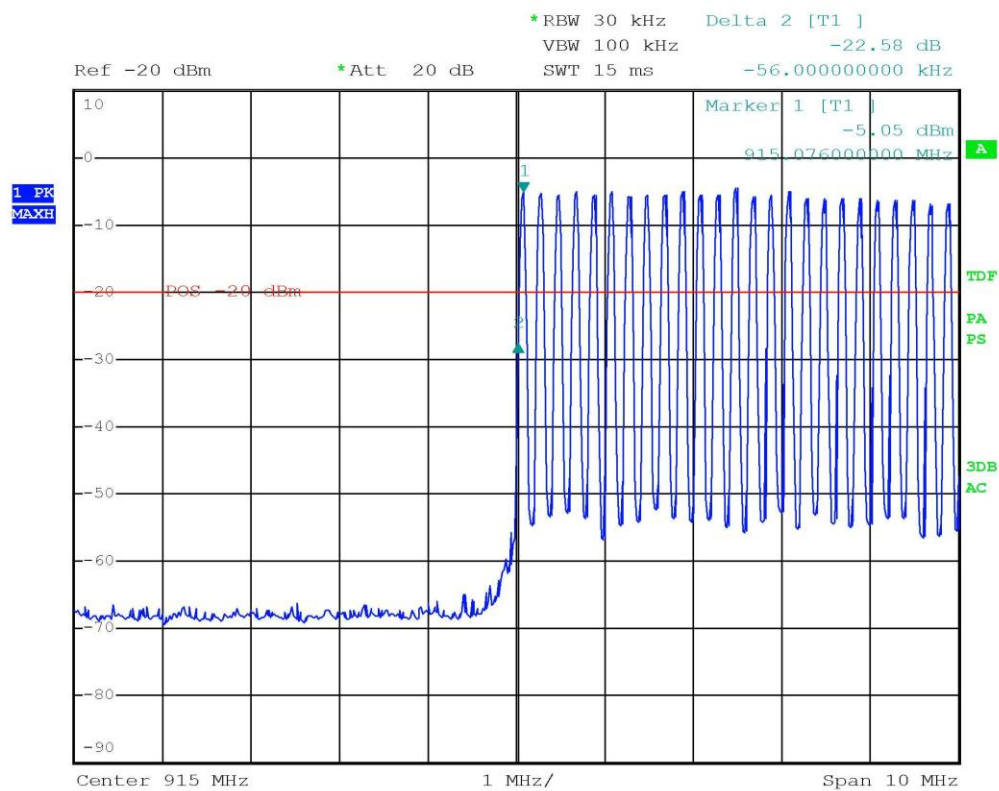
G14189837



Gandini 14199837-Tx-Rx Fhop



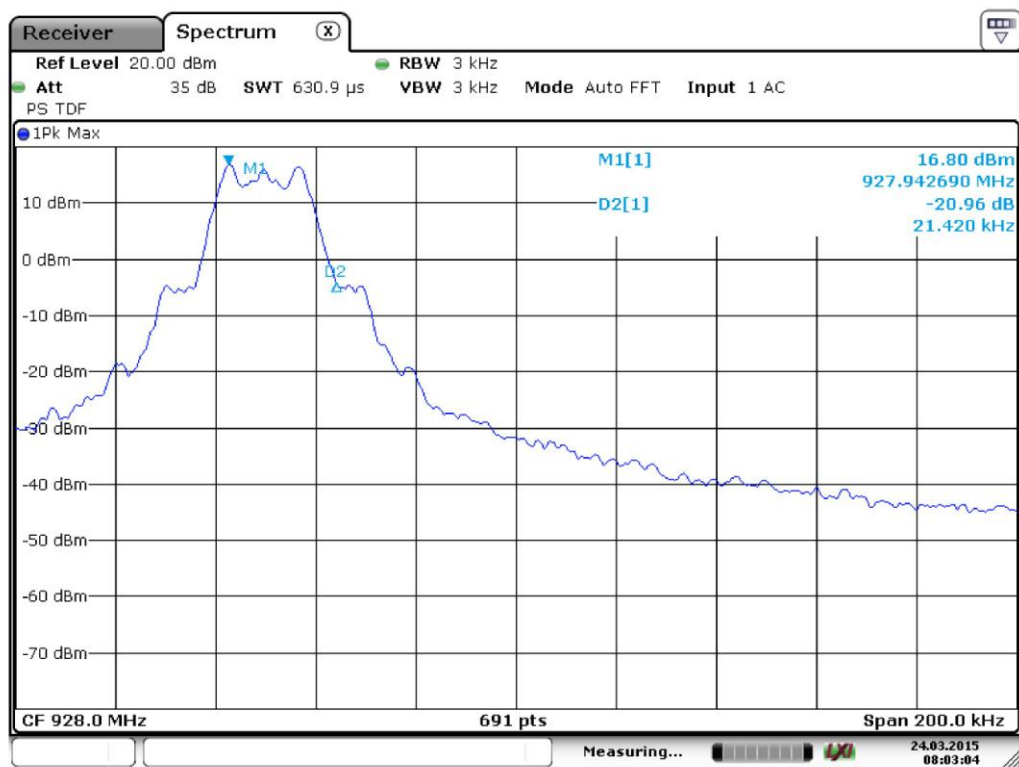
G14189838



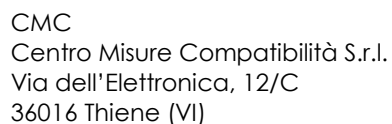
Gandini 14199838-Tx-Rx Fhop



G14189840

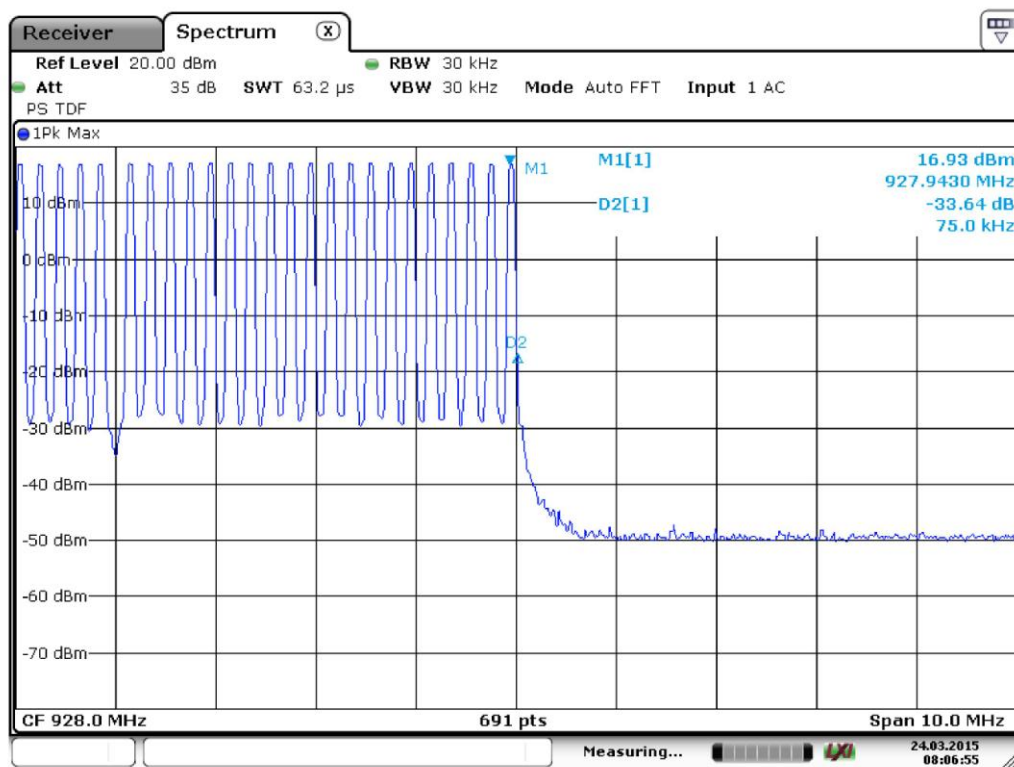


Gandini 14189840-TxRx Fhop





G14189842



Gandini 14189842-TxRx Fhop

**Result:** The requirements are met



## 11.9 Peak Output Power

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

Test site:  
Laboratory

Auxiliary equipment:  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S227  
Measurement uncertainty: See clause 7 of this test report

### Test specification

Port: Antenna

### Environmental conditions

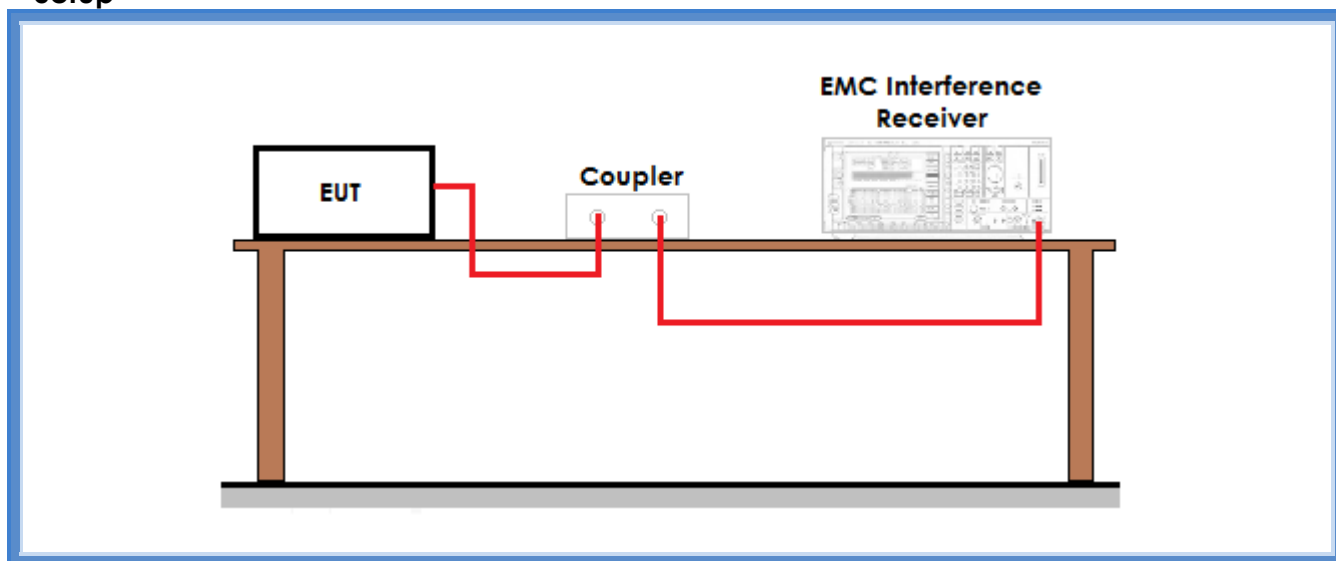
| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 101                           | 40                       |

### Acceptance limits:

For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0,25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels



## Setup



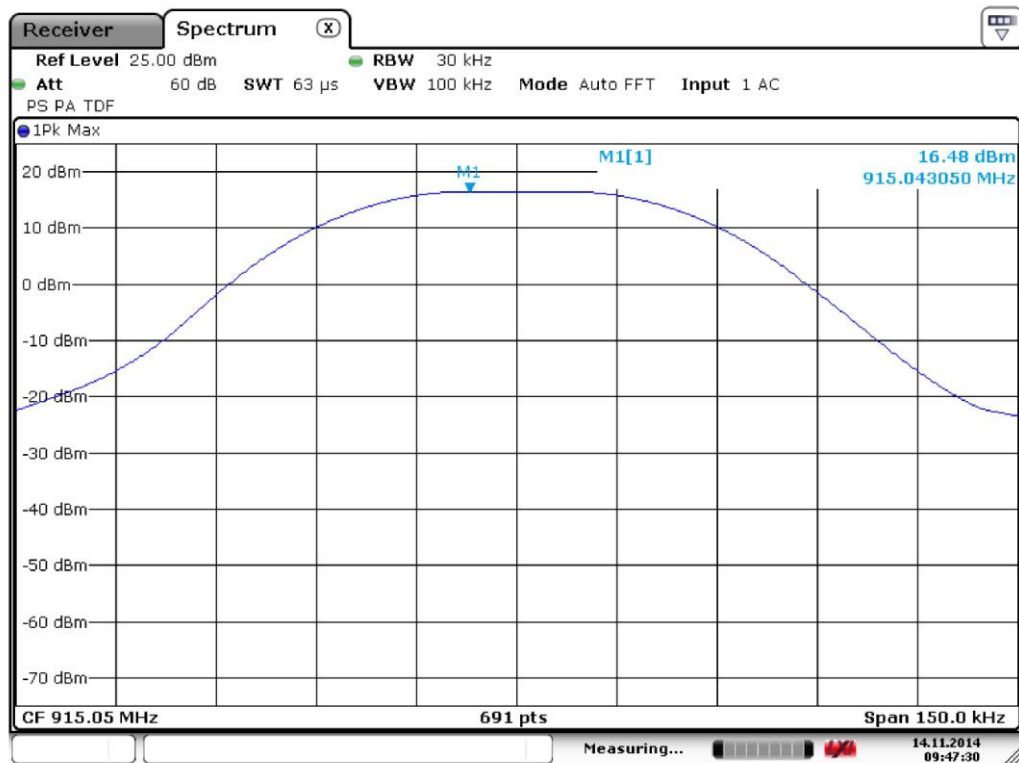
## Result

| Frequency<br>(MHz) | Graphs    | Measured QP level<br>(dBm) | Peak Output<br>Power<br>(mW) | Remarks |
|--------------------|-----------|----------------------------|------------------------------|---------|
| 915,043490         | G14189805 | 16,49                      | 44,57                        | --      |
| 921,492840         | G14189815 | 16,81                      | 47,97                        | --      |
| 927,942840         | G14189810 | 17,01                      | 50,23                        | --      |



## Graphs

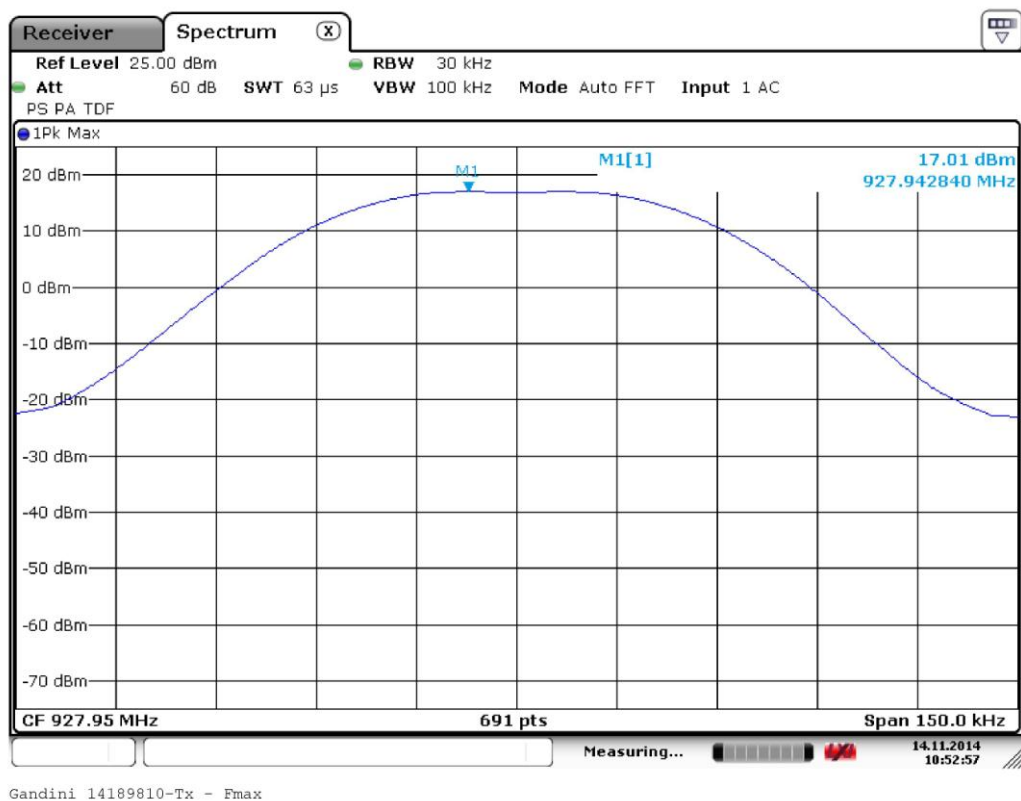
G14189805



Gandini 14189805-Tx - Fmin

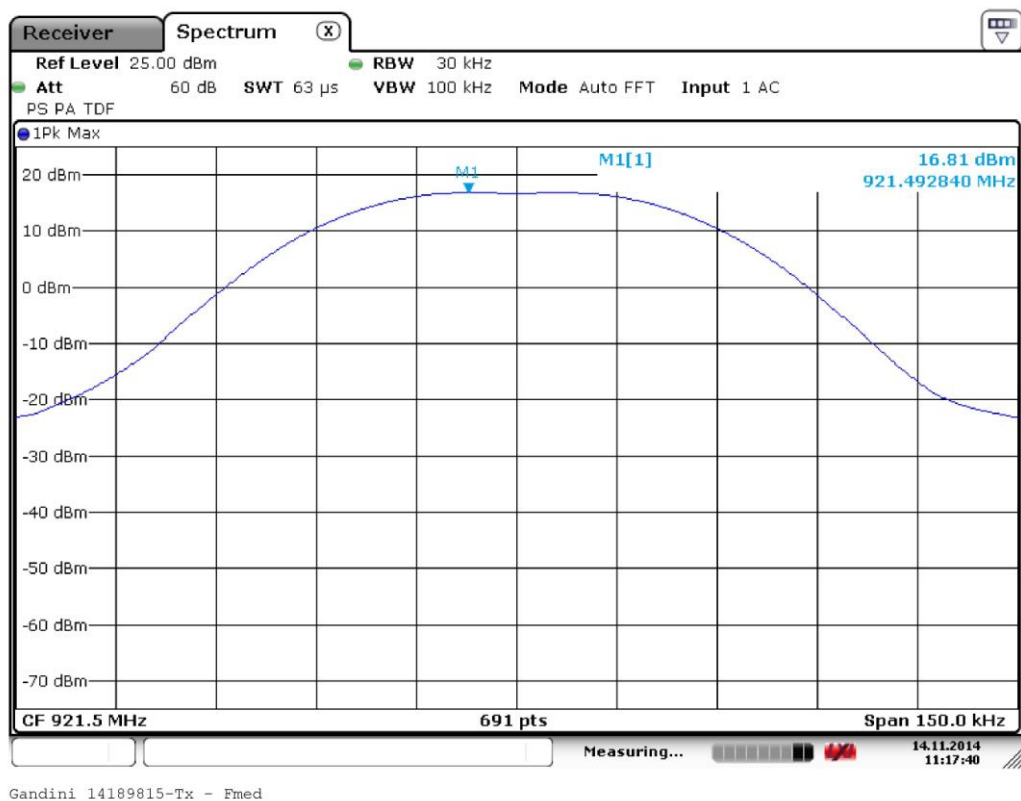


G14189810





G14189815



**Result:** The requirements are met



## 11.10 Spurious Emission

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.209
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration and test method

Test site:  
Semi-anechoic chamber

Auxiliary equipment:  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S108, CMC S136, CMC S164  
Measurement uncertainty: See clause 7 of this test report

### Test specification

Port: Enclosure  
Antenna polarization: Horizontal (H) – Vertical (V)  
EUT – Antenna distance: 3 m  
Detector AV + Peak

### Environmental conditions

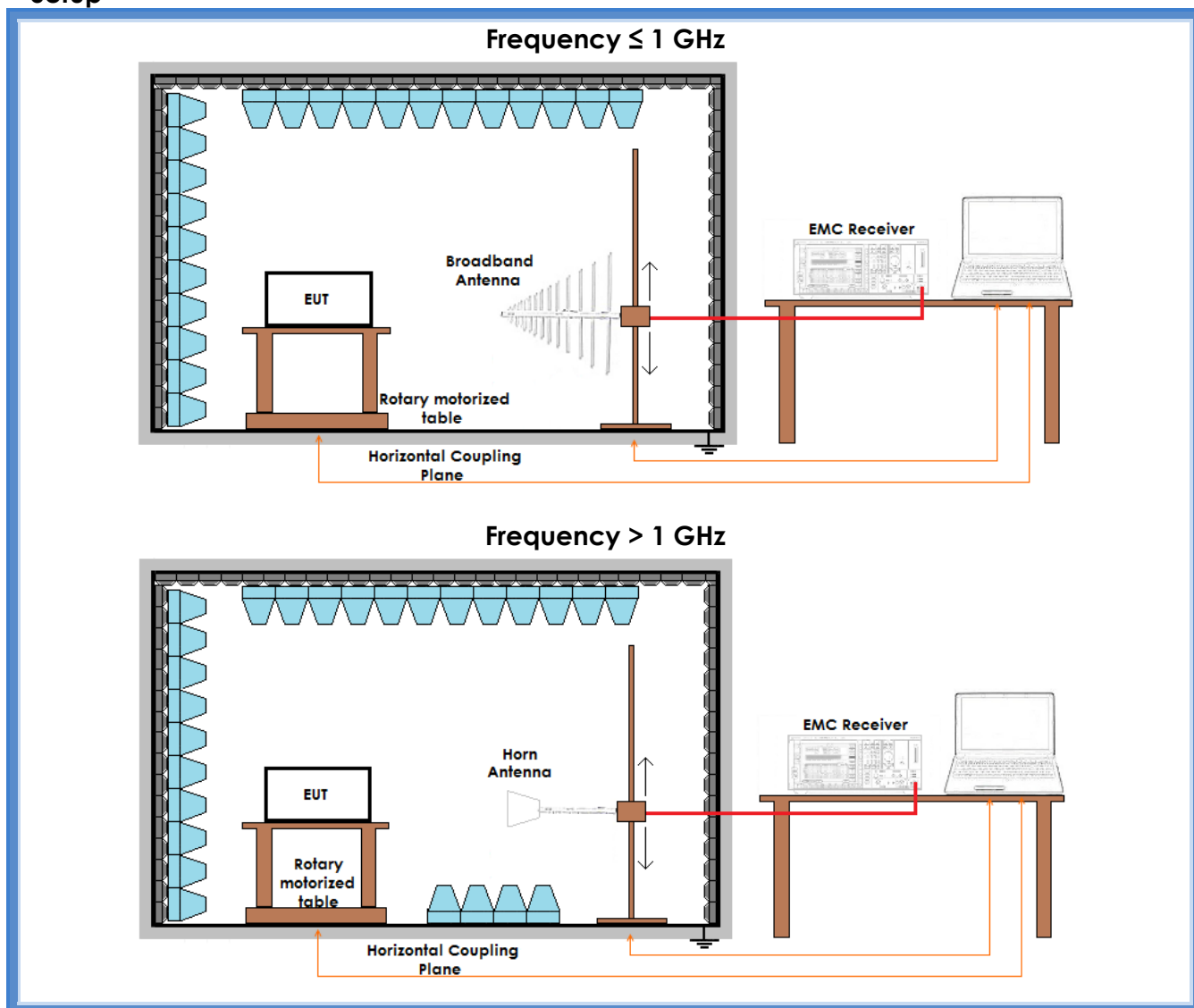
| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 20                  | 100                           | 42                       |

### Acceptance limits

| Frequency<br>(MHz) | AV limits<br>[dB(μV/m)] | Peak limits<br>[dB(μV/m)] |
|--------------------|-------------------------|---------------------------|
| > 1000             | 54                      | 74                        |



## Setup





### Result – AV detector

| Harmonic | Limits<br>(dB $\mu$ V/m) | Level (dB $\mu$ V/m)           |                                |                                | Results  |
|----------|--------------------------|--------------------------------|--------------------------------|--------------------------------|----------|
|          |                          | 915,05 MHz                     | 921,50 MHz                     | 927,95 MHz                     |          |
| II       | 54                       | 46,7                           | 46,4                           | 46,9                           | Complies |
| III      | 54                       | 42,0                           | 41,4                           | 41,6                           | Complies |
| IV       | 54                       | 48,7                           | 46,4                           | 47,0                           | Complies |
| V        | 54                       | 42,3                           | 43,1                           | 43,3                           | Complies |
| VI       | 54                       | 44,1                           | 42,4                           | 44,0                           | Complies |
| VII      | 54                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| VIII     | 54                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| IX       | 54                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| X        | 54                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |

**Remarks:** EUT was tested in 3 orthogonal planes. The results in this table show the highest values

### Result – Peak detector

| Harmonic | Limits<br>(dB $\mu$ V/m) | Level (dB $\mu$ V/m)           |                                |                                | Results  |
|----------|--------------------------|--------------------------------|--------------------------------|--------------------------------|----------|
|          |                          | 915,05 MHz                     | 921,50 MHz                     | 927,95 MHz                     |          |
| II       | 74                       | 47,9                           | 47,7                           | 47,8                           | Complies |
| III      | 74                       | 44,4                           | 44,8                           | 44,6                           | Complies |
| IV       | 74                       | 51,3                           | 50,0                           | 51,0                           | Complies |
| V        | 74                       | 48,2                           | 49,4                           | 49,0                           | Complies |
| VI       | 74                       | 51,7                           | 49,9                           | 51,6                           | Complies |
| VII      | 74                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| VIII     | 74                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| IX       | 74                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |
| X        | 74                       | More than 20 dB<br>below limit | More than 20 dB<br>below limit | More than 20 dB<br>below limit | Complies |

**Remarks:** EUT was tested in 3 orthogonal planes. The results in this table show the highest values

**Result:** The requirements are met



## 11.11 Maximum permissible exposure

### Test set-up and execution

- FCC Rules and Regulation;  
Titles 47 Part 1.1310
- Internal procedure PM001
- See clause 4 of this test report

### Test configuration

Test site:  
Laboratory

Auxiliary equipment:  
See clause 4 of this test report

### EUT exercising

See clause 4 of this test report

### Test equipment used

CMC S108, CMC S136, CMC S164  
Measurement uncertainty: See clause 7 of this  
test report

### Test specification

Port: Antenna

|                          |                                                                                |
|--------------------------|--------------------------------------------------------------------------------|
| <b>Acceptance limits</b> | 906/1500 mW/cm <sup>2</sup> = 0,60 mW/cm <sup>2</sup> max at 20 cm of distance |
|--------------------------|--------------------------------------------------------------------------------|

### Result

| Power Density Limit<br>(mW/cm <sup>2</sup> )                | Output Power<br>(mW) | Antenna Gain<br>(G) | Power Density at<br>20 cm<br>(mW/cm <sup>2</sup> ) | Remarks  |
|-------------------------------------------------------------|----------------------|---------------------|----------------------------------------------------|----------|
| 0,60                                                        | 50,23                | 1,58 (2 dBi)        | 0,016                                              | Measured |
| <b>Remarks:</b> Power Density = $(P \times G) / (4\pi R^2)$ |                      |                     |                                                    |          |

**Result:** The requirements are met