



**TEST REPORT nr. R14026601**  
**Federal Communication Commission (FCC)**

**Test item**

Description .....: TRANSCEIVER UNIT

Trademark .....: ELCA

Model/Type .....: AR BRAVO-FUNK-915

**Test Specification**

Standard .....: FCC Rules & Regulations, Title 47:2013  
Part 15 paragraph(s): 203, 204, 207, 209 and 247

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

Address .....: Via del Commercio, 7/B – 36065 Mussolente (VI) – ITALY

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

Address .....: --

**Report**

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

*G. Gandini*

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

*R. Beghetto*

Date of issue .....: 30.09.14

Contents .....: 57 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 47:2013  
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            | 6                     | Complies      |
| Part 15.209                | Radiated emissions             | 2                     | Complies      |
| Part 15.247                | 20dB Bandwidth                 | 3                     | Complies      |
| Part 15.209 and 15.247     | Peak Output Power              | 7                     | Complies      |
| Part 15.247                | Band edge                      | 4                     | Complies      |
| Part 15.209                | Spurious emission              | 5                     | 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 ..... : 8-30Vdc

Serial Number..... : --

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

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

Nominal frequency..... : 902 – 928 MHz

FCC ID ....., FCC Part 15C Class B digital device ..... : 2ABS7-ARBRFU915

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

Date of receipt of test item ..... : 12.02.14

Testing start date ..... : 20.03.14

Testing end date ..... : 07.07.14

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

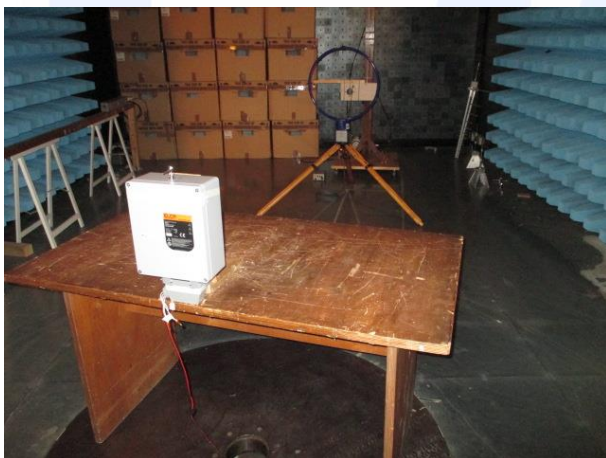
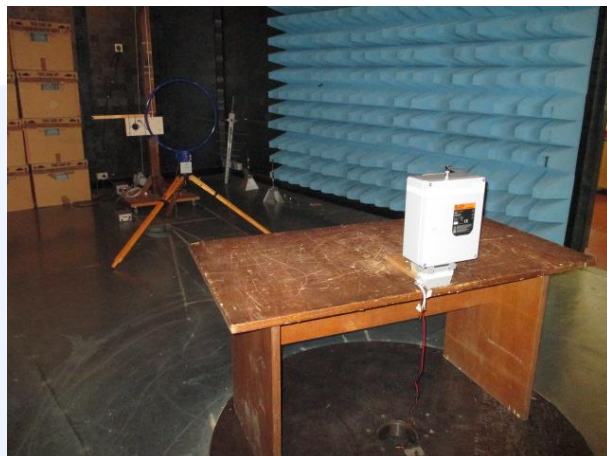
Internal identification ..... : adhesive label with the product number P140155

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



## 5. Photograph(s) of EUT

### 5.1 Photograph(s) of EUT





## 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 '14             | January '15                 |
| CMC S108          | EMCO                | 3115         | Horn Antenna              | 9811-5622            | May '13                 | May '16                     |
| CMC S127          | Schaffner           | HLA6120      | Loop Antenna              | 1191                 | January '13             | 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 '14             | January '15                 |
| CMC S200          | Schwarzbeck         | NSLK 8128    | V-LISN                    | 8128-273             | January '14             | January '15                 |
| CMC S227          | Rohde & Schwarz     | ESR7         | EMI Test Receiver 7GHz    | 101121               | January '14             | January '15                 |



## 7. Measurement uncertainty

| Test                                                                | Expanded Uncertainty | note |
|---------------------------------------------------------------------|----------------------|------|
| <b>Conducted Emission</b>                                           |                      |      |
| (50Ω/50μH AMN) - (9 kHz – 150 kHz)                                  | ±3.8 dB              | 1    |
| (50Ω/50μH AMN) - (150 kHz – 30 MHz)                                 | ±3.3 dB              | 1    |
| (Voltage probe) - (150 kHz – 30 MHz)                                | ±3.3 dB              | 1    |
| (50Ω/5μH AMN) - (150 kHz – 108 MHz)                                 | ±2.8 dB              | 1    |
| <b>Discontinuous Conducted Emission</b>                             |                      |      |
| Conducted Emission (50Ω/50μH AMN) - (150 kHz – 30 MHz)              | ±3.3 dB              | 1    |
| <b>Disturbance Power (30 MHz – 300 MHz)</b>                         |                      |      |
|                                                                     | ±3.9 dB              | 1    |
| <b>Radiated Emission</b>                                            |                      |      |
| (0,150 MHz – 30 MHz)                                                | ±4.3 dB              | 1    |
| (30 MHz – 1000 MHz)                                                 | ±4.4 dB              | 1    |
| (1 GHz – 6 GHz)                                                     | ±4.6 dB              | 1    |
| <b>Electromagnetic field EMF</b>                                    |                      |      |
|                                                                     | ±15.0 %              | 1    |
| <b>Harmonic current emissions test</b>                              |                      |      |
|                                                                     | ±2.7 %               | 1    |
| <b>Voltage fluctuation and flicker test</b>                         |                      |      |
|                                                                     | ±2.9 %               | 1    |
| <b>Insertion loss test</b>                                          |                      |      |
|                                                                     | ±2.7 dB              | 1    |
| <b>Radiated electromagnetic disturbance test (loop antenna)</b>     |                      |      |
|                                                                     | ±2.7 dB              | 1    |
| <b>Radiated electromagnetic field immunity test</b>                 |                      |      |
|                                                                     | 0.77 V/m at 3V/m     | 1    |
| <b>Pulse modulated radiated electromagnetic field immunity test</b> |                      |      |
|                                                                     | 0.77 V/m at 3V/m     | 1    |
| <b>Injected currents immunity test</b>                              |                      |      |
|                                                                     | 0.48 V at 3V         | 1    |
| <b>Bulk current</b>                                                 |                      |      |
|                                                                     | 5.3 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>                       |                      |      |
|                                                                     | ±4.4 dB              | 1    |
| <b>Effective radiated power (F &gt; 1GHz)</b>                       |                      |      |
|                                                                     | ±3.9 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>                                       |                      |      |
|                                                                     | ±2.6 dB              | 1    |
| <b>Blocking</b>                                                     |                      |      |
|                                                                     | ±2.6 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 15:2013     | --                                                                                                                                                               |
| RSS-210 Issue 8 – December 2010                    | Low-power licence-exempt radiocommunication devices (all frequency bands): Category I Equipment                                                                  |
| ANSI C63.4: 2003                                   | American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz |
| 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.

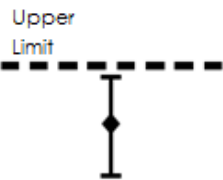
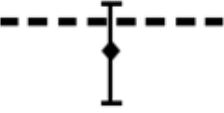
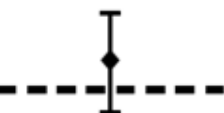


## 11. Results

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 is Complies.                                                                                           | The sample is Complies.                                                                                                                                  | The sample is Not Complies.                                                                                                                          | The sample is Not Complies.                                                                                        |
| 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
- 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>(%) |
|---------------------|-------------------------------|--------------------------|
| 22                  | 98                            | 49                       |

### Result

| Antenna Type | External R.F.<br>power amplifier | Gain  | Remarks                       | Results  |
|--------------|----------------------------------|-------|-------------------------------|----------|
| Dedicated    | Not Present                      | 2 dBi | Antenna<br>connector:<br>MMCX | 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 S227  
Measurement uncertainty: See clause 7 of this test report

### Test specification

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

### Environmental conditions

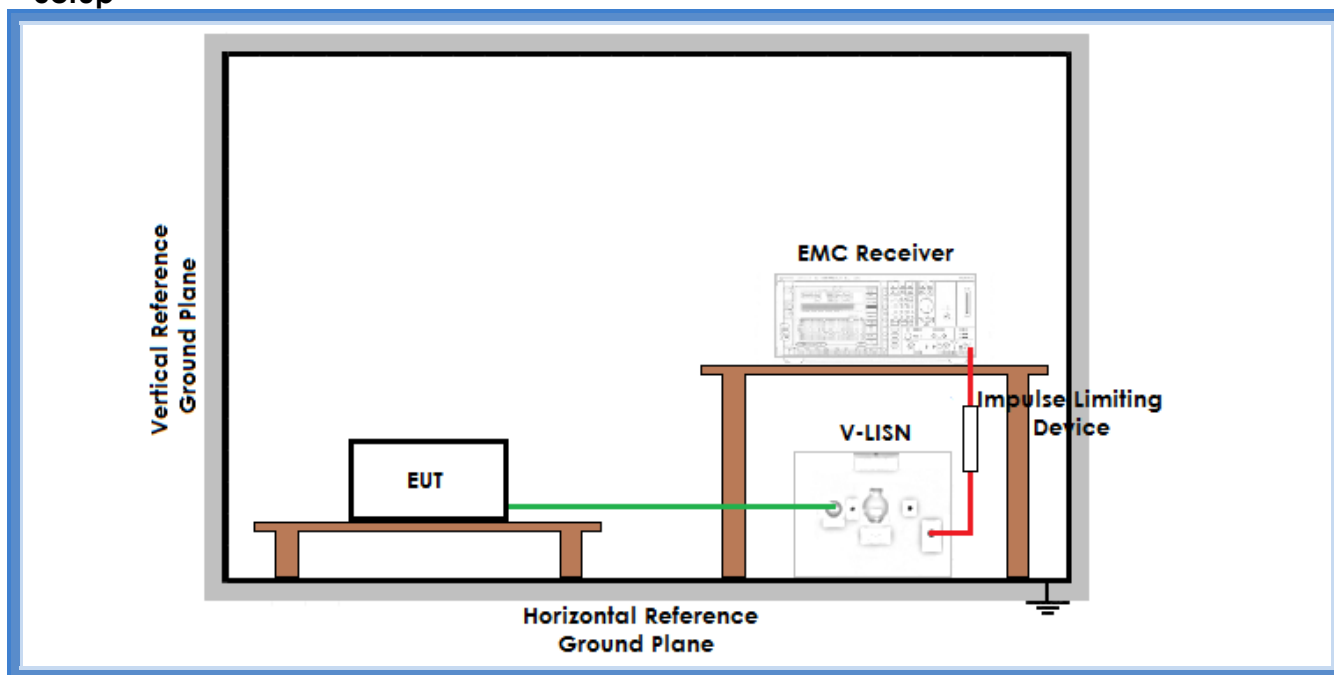
| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
|                     |                               |                          |

### 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   |
|-------------|-----------|---------|----------|
| N           | G14026650 | --      | Complies |
| L1          | G14026651 | --      | Complies |
| Remarks: -- |           |         |          |

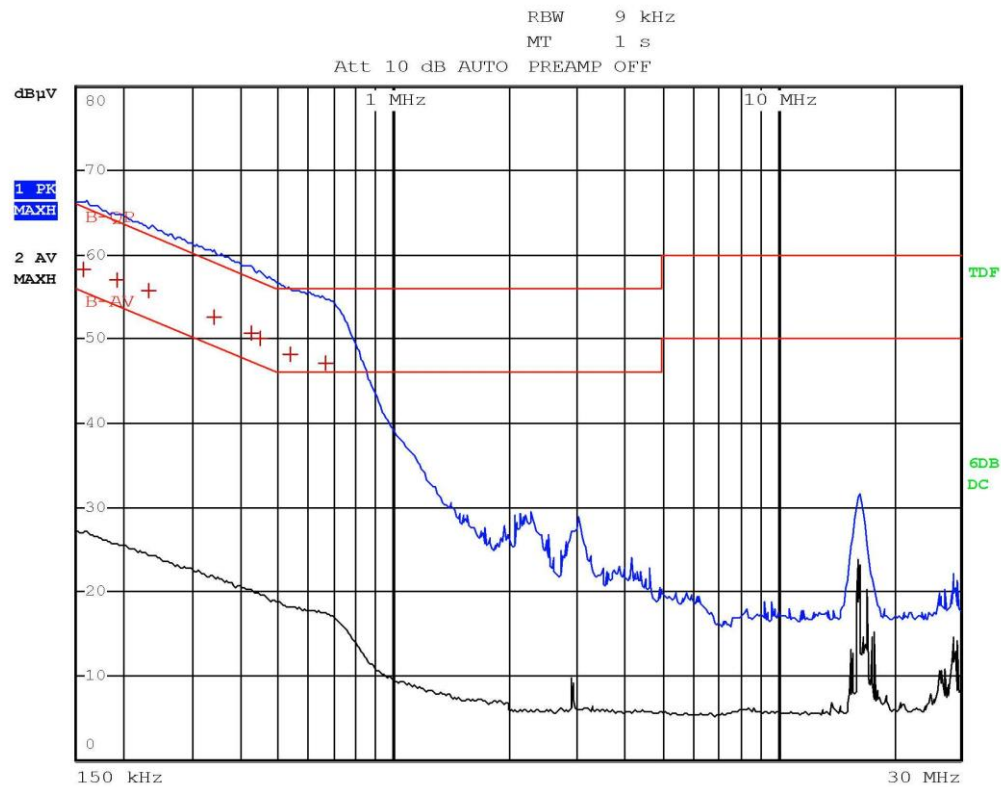
### Graphs Legend

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

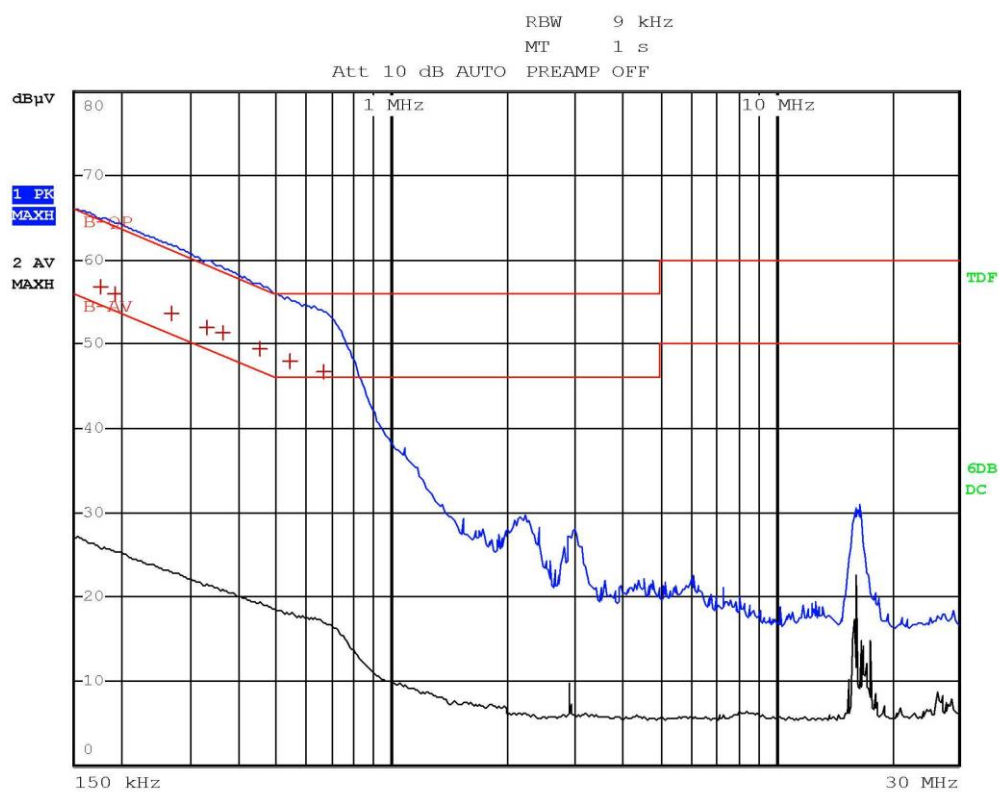
G14026650



Gandini 14026650-Line N (-)-Tx-Rx



G14026651



Gandini 14026651-Line L (+)-Tx-Rx

**Result:** The requirements are met



## 11.3 Radiated emissions

### Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- 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>(%) |
|---------------------|-------------------------------|--------------------------|
| 21                  | 99                            | 50                       |

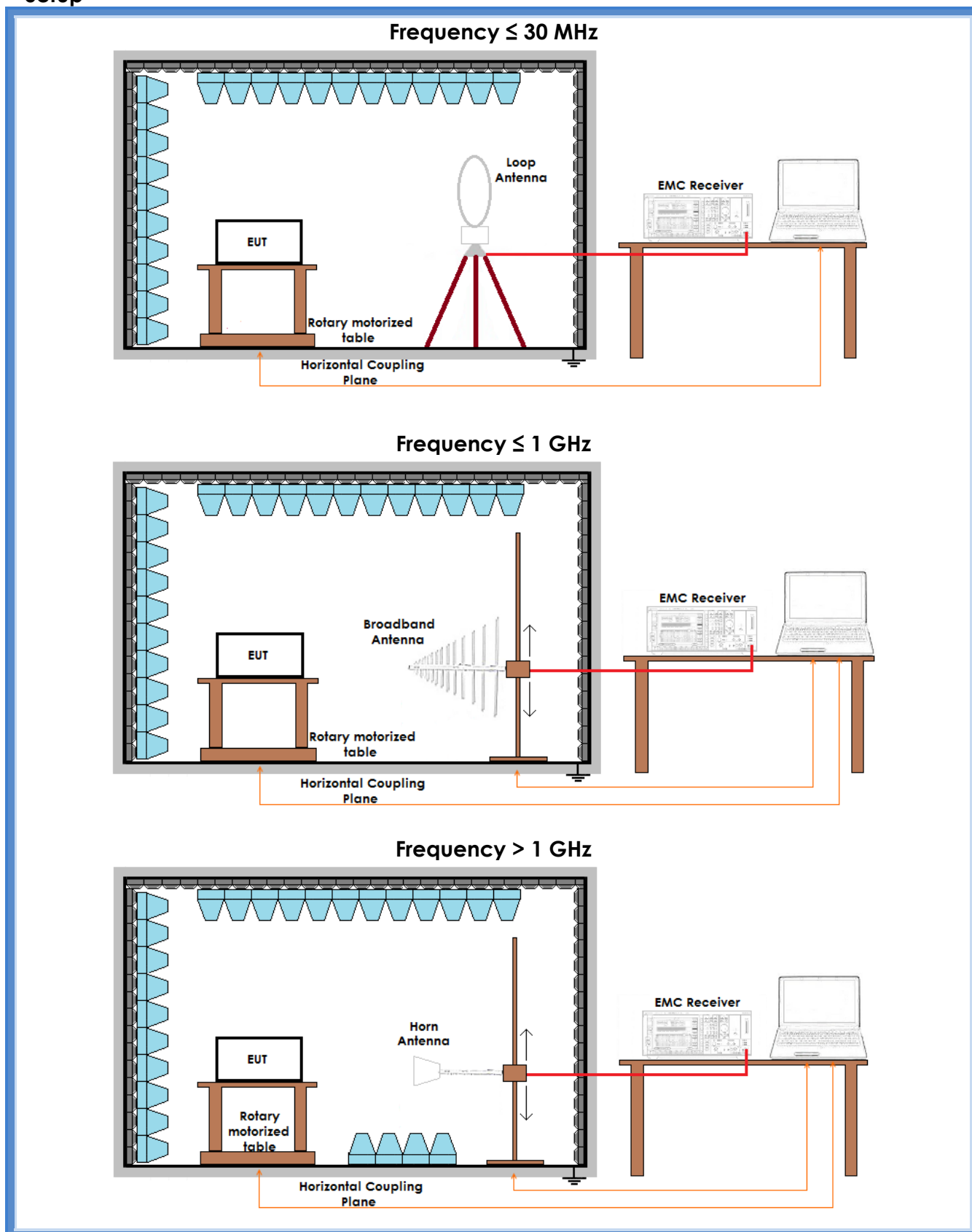
### Acceptance limits

| 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

| Channel | Polarization | Frequency Range (MHz) | Graphs    | Remarks | Result   |
|---------|--------------|-----------------------|-----------|---------|----------|
| --      | Loop         | 0,009 – 30            | G14026601 | --      | Complies |
| 915,050 | H            | 30 – 1000             | G14026626 | --      | Complies |
| 915,050 | V            | 30 – 1000             | G14026627 | --      | Complies |
| 921,000 | V            | 30 – 1000             | G14026628 | --      | Complies |
| 921,000 | H            | 30 – 1000             | G14026629 | --      | Complies |
| 927,950 | V            | 30 – 1000             | G14026624 | --      | Complies |
| 927,950 | H            | 30 – 1000             | G14026625 | --      | Complies |
| 927,950 | V            | 1000 – 10000          | G14026632 | --      | Complies |
| 927,950 | H            | 1000 – 10000          | G14026633 | --      | Complies |

Remarks: --

### Graphs Legend

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

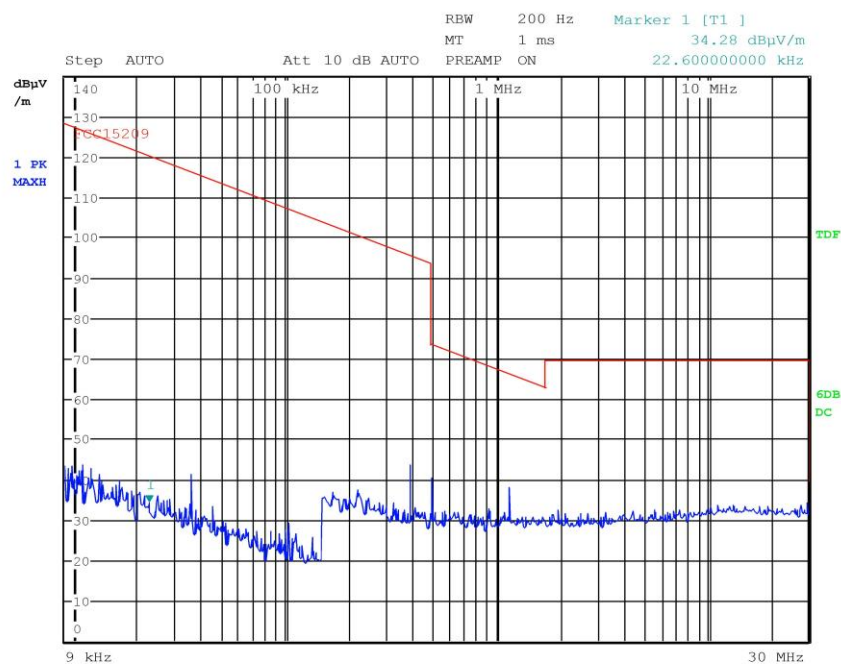
AV: Average; AV [1s] (average at 1 second) values are marked with a x



## Graphs

G14026601

**Meas Type** Emission 0.009-30MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx  
**Operator** Gandini 14026601  
**Test Spec**  
Loop



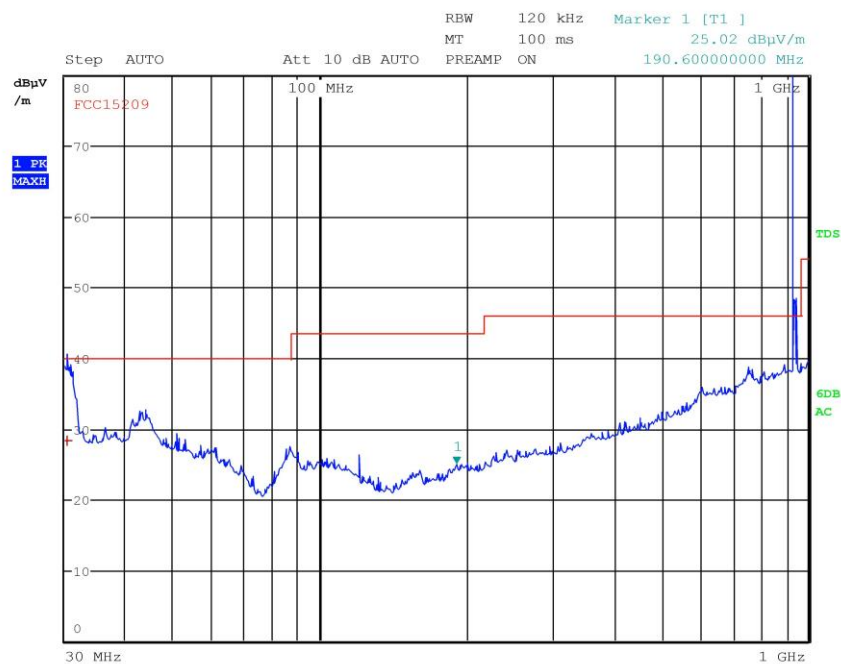
### Final Measurement

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



G14026624

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmax  
**Operator** Gandini 14026624  
**Test Spec**  
Vert



### Final Measurement

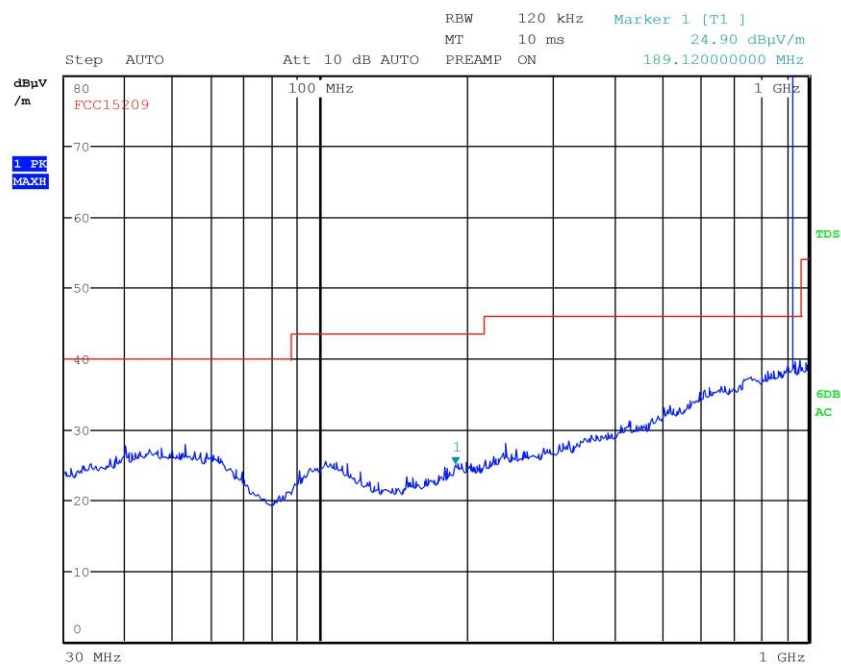
Meas Time: 1 s  
Margin: 6 dB  
Subranges: 1

| Trace | Frequency        | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------|------------|----------------|
| 1     | 30.360000000 MHz | 28.32          | Quasi Peak | -11.68         |



G14026625

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmax  
**Operator** Gandini 14026625  
**Test Spec**  
Horiz



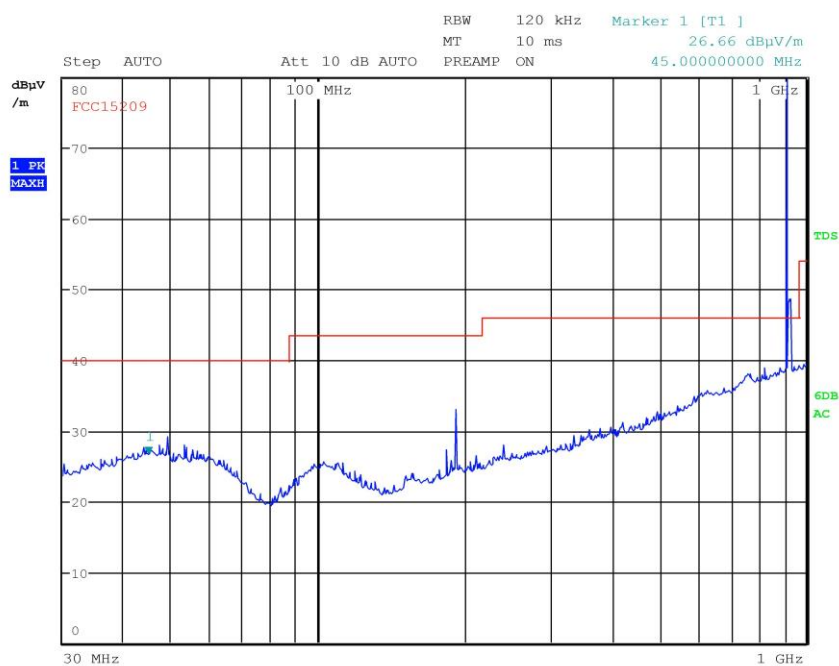
### Final Measurement

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



G14026626

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmin  
**Operator** Gandini 14026626  
**Test Spec**  
Horiz



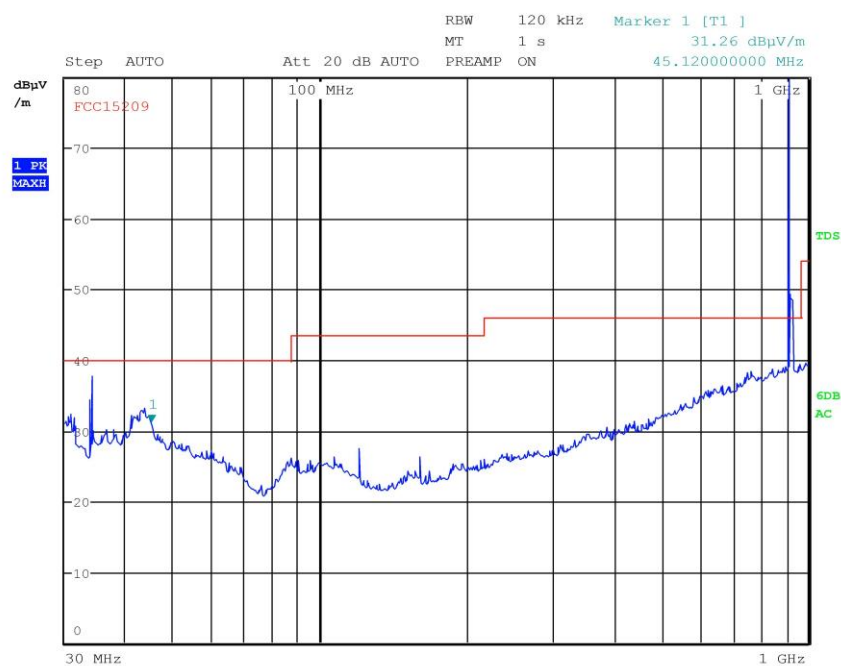
### Final Measurement

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



G14026627

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmin  
**Operator** Gandini 14026627  
**Test Spec**  
Vert.



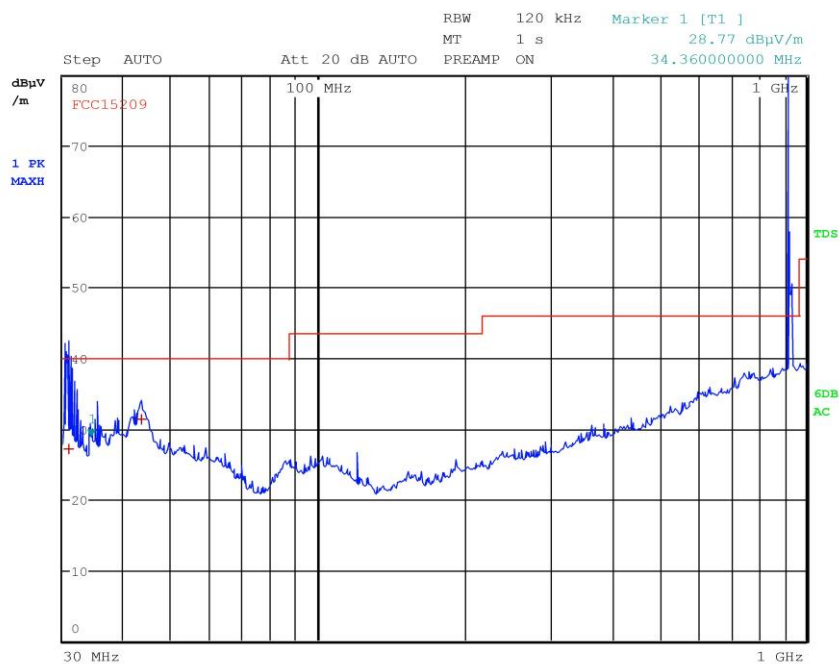
### Final Measurement

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



G14026628

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmed  
**Operator** Gandini14022628  
**Test Spec**  
Vert.



### Final Measurement

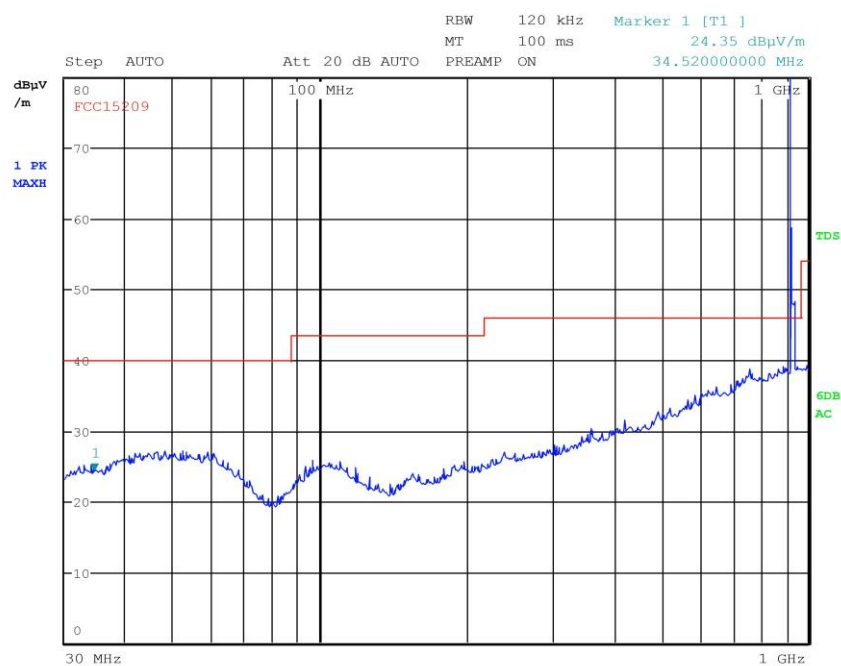
Meas Time: 1 s  
Margin: 6 dB  
Subranges: 2

| Trace | Frequency        | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------|------------|----------------|
| 1     | 30.840000000 MHz | 27.12          | Quasi Peak | -12.88         |
| 1     | 43.400000000 MHz | 31.26          | Quasi Peak | -8.74          |



G14026629

**Meas Type** Emission 30-1000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-RX Fmed  
**Operator** Gandini14022629  
**Test Spec**  
Horiz.



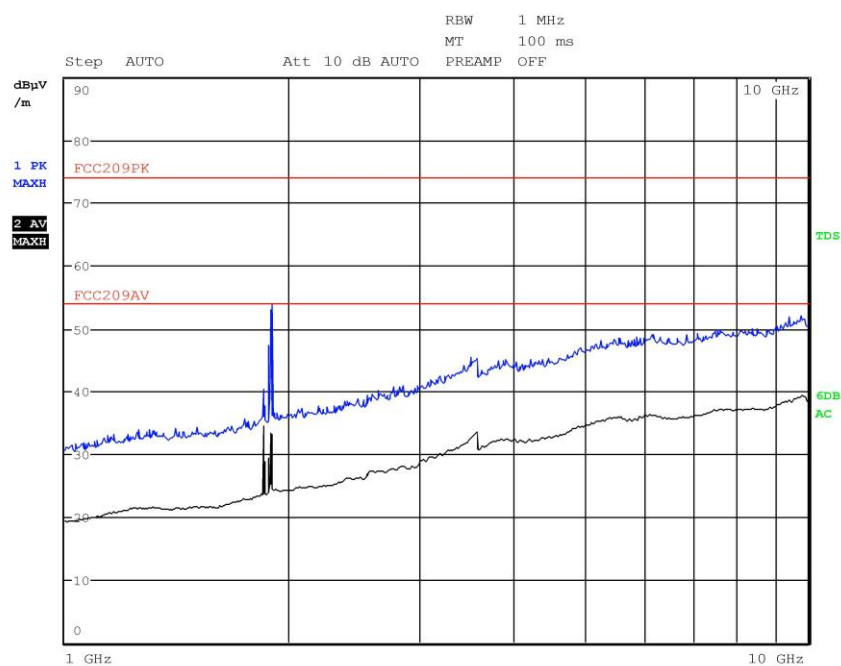
### Final Measurement

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



G14026632

**Meas Type** Emission 1000-10000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx  
**Operator** Gandini 14026632  
**Test Spec**  
Vert



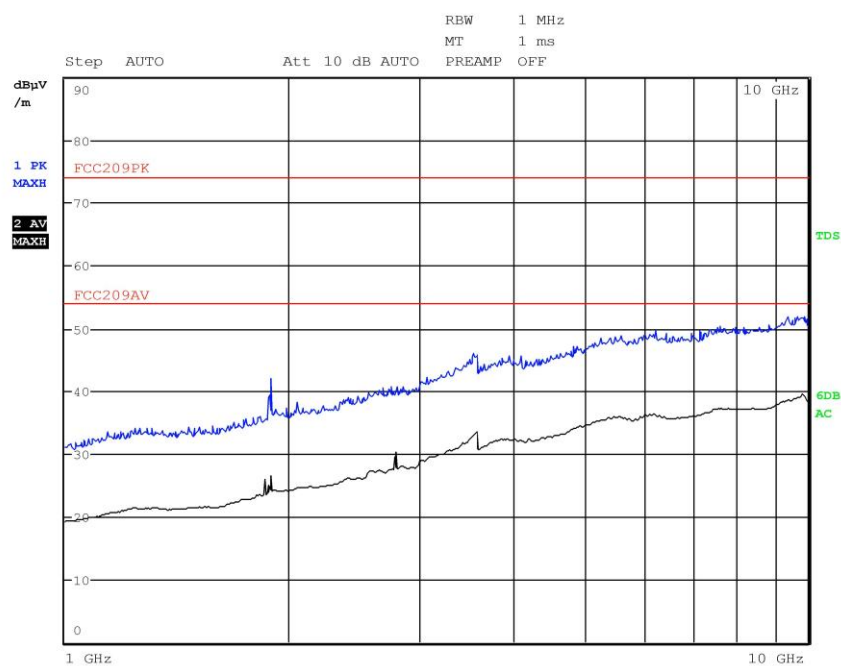
### Final Measurement

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



G14026633

**Meas Type** Emission 1000-10000MHz  
**Equipment under Test**  
**Manufacturer**  
**OP Condition** Tx-Rx  
**Operator** Gandini 14026633  
**Test Spec**  
Horiz



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

### Test specification

See FCC Part 15.247

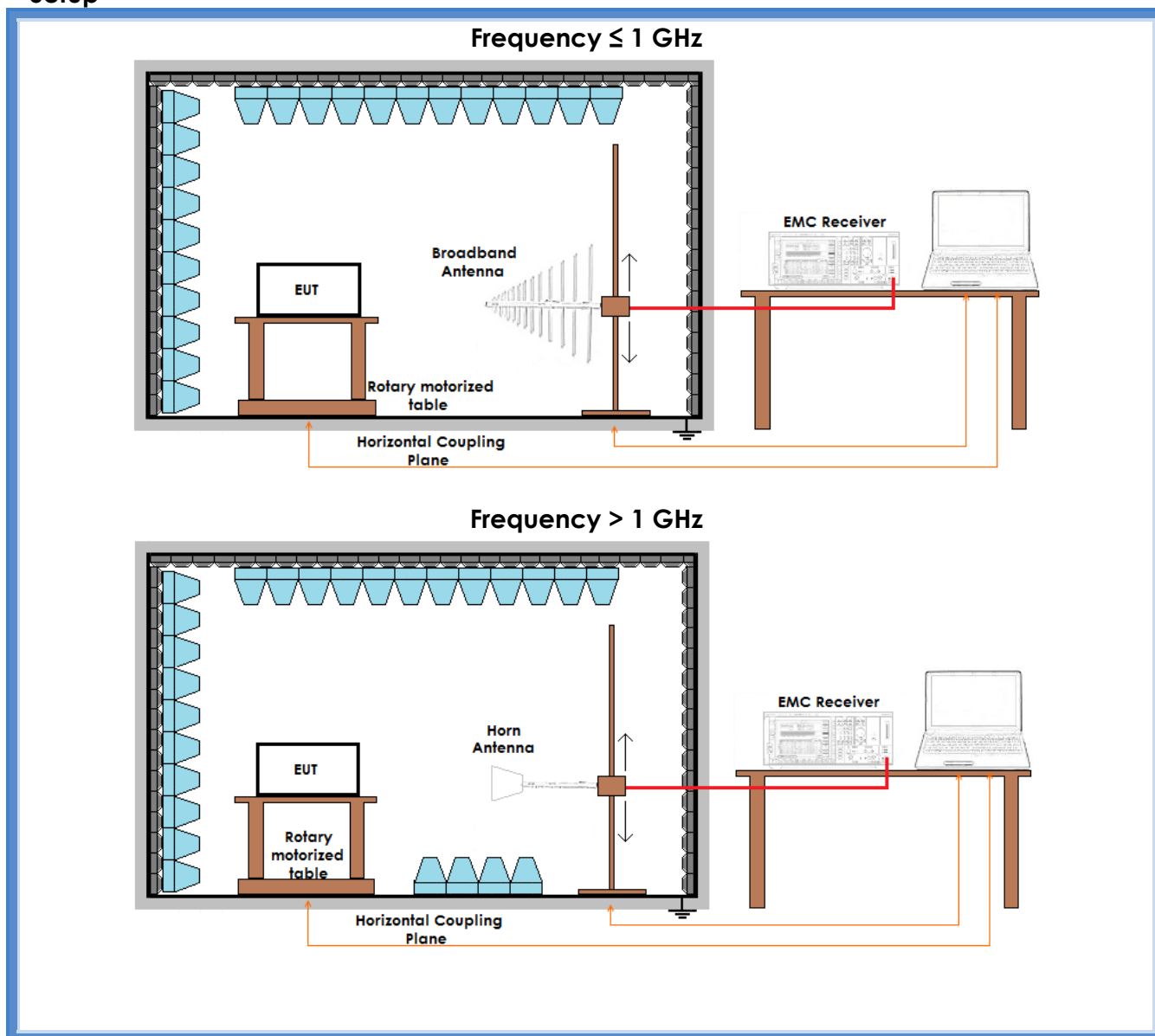
### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 22                  | 98                            | 49                       |

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



## Setup



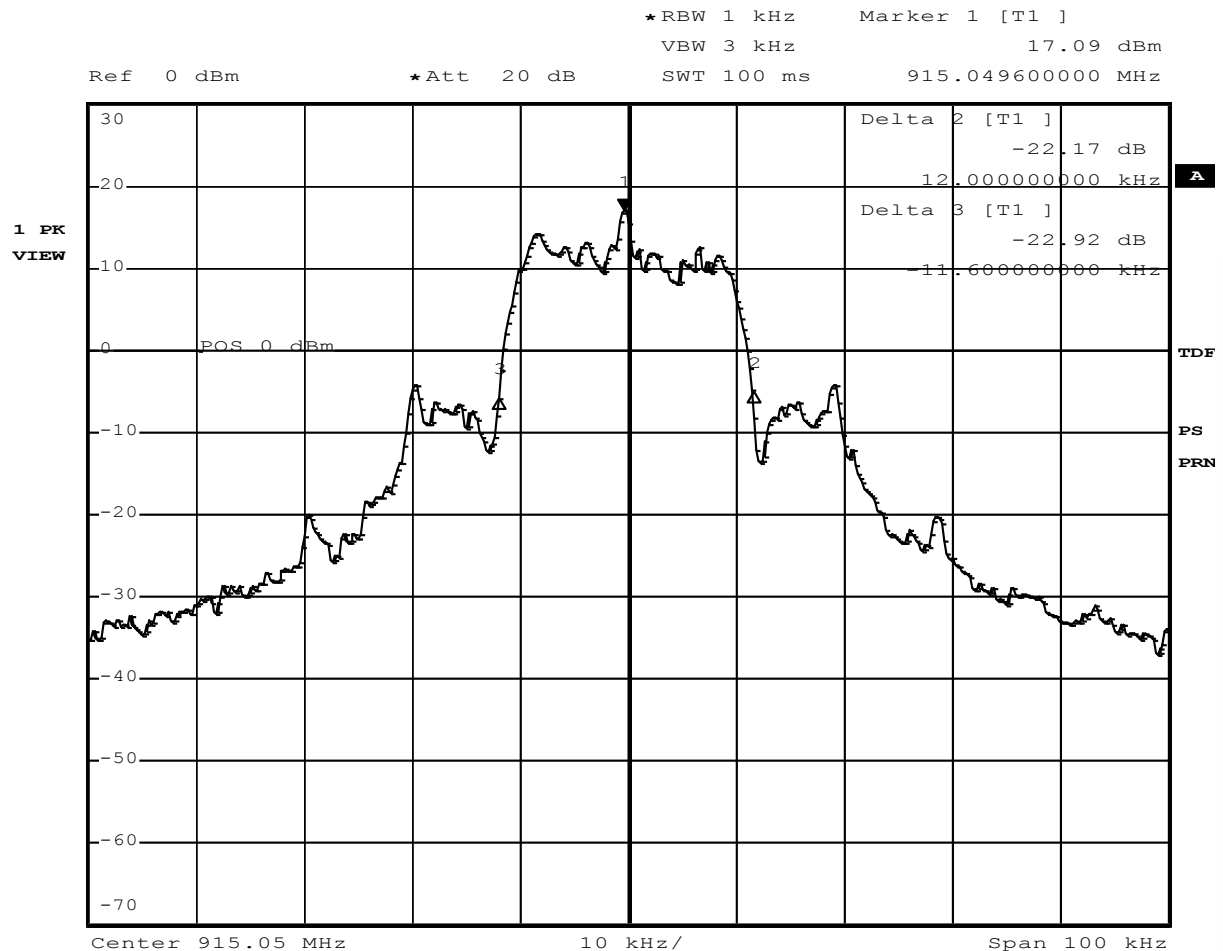
## Result

| Frequency (MHz) | Graphs    | 20 dB bandwidth (kHz) | Results  |
|-----------------|-----------|-----------------------|----------|
| 915,05          | G14026607 | 23,6                  | Complies |
| 921,50          | G14026610 | 23,4                  | Complies |
| 927,95          | G14026612 | 23,6                  | Complies |



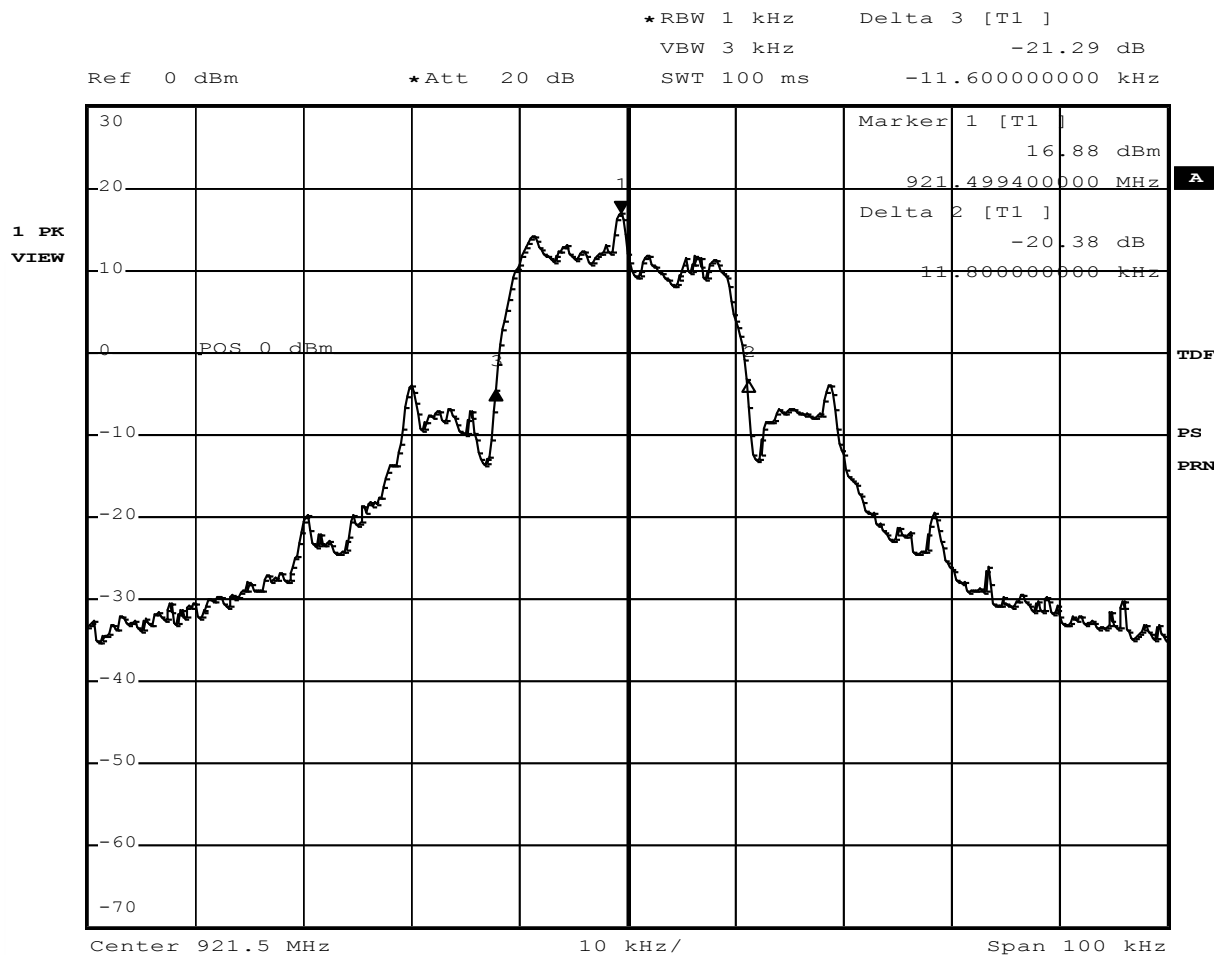
## Graphs

G14026607



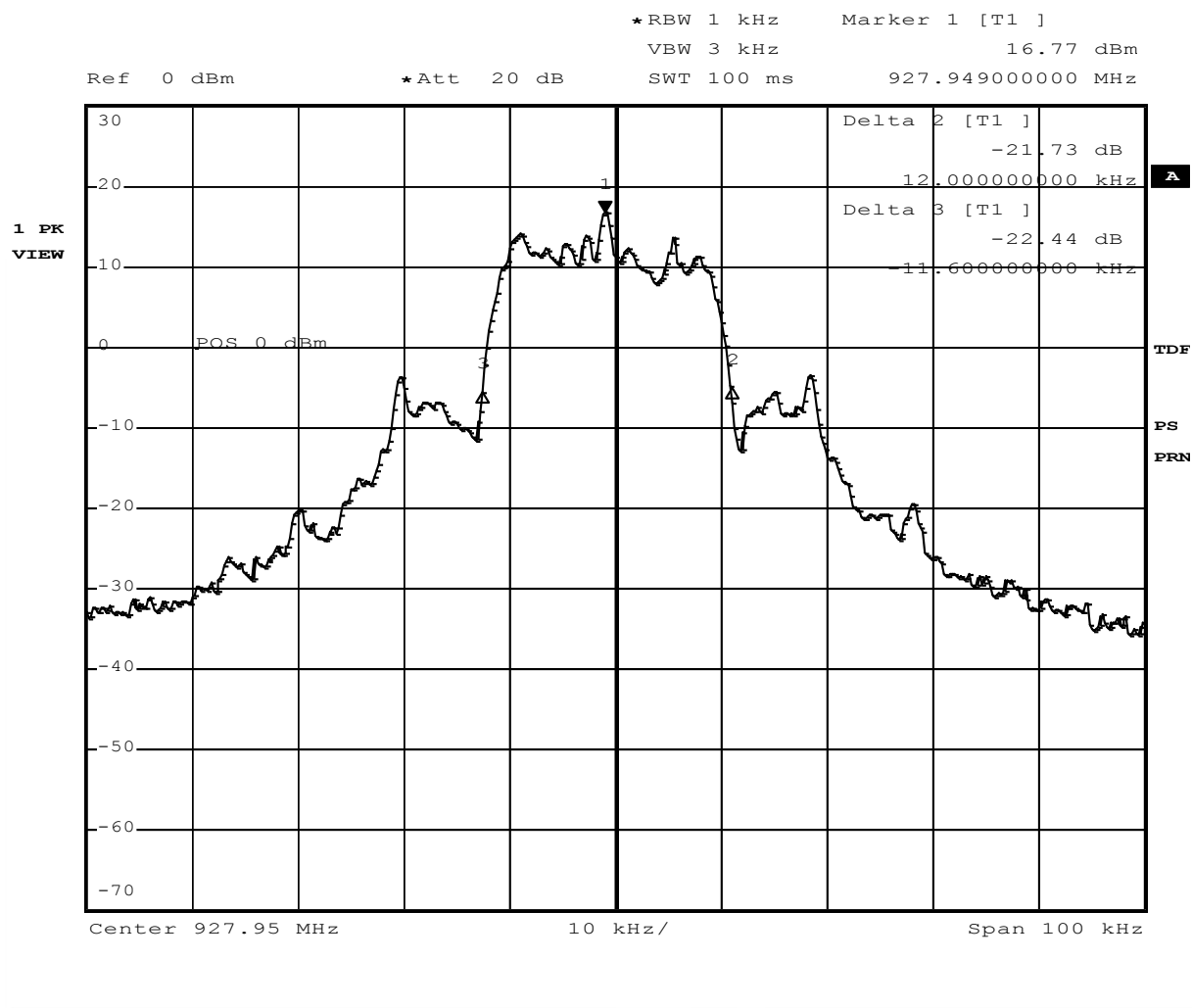


G14026610





G14026612



**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 S164  
Measurement uncertainty: See clause 7 of this test report

### Test specification

See FCC Part 15.247

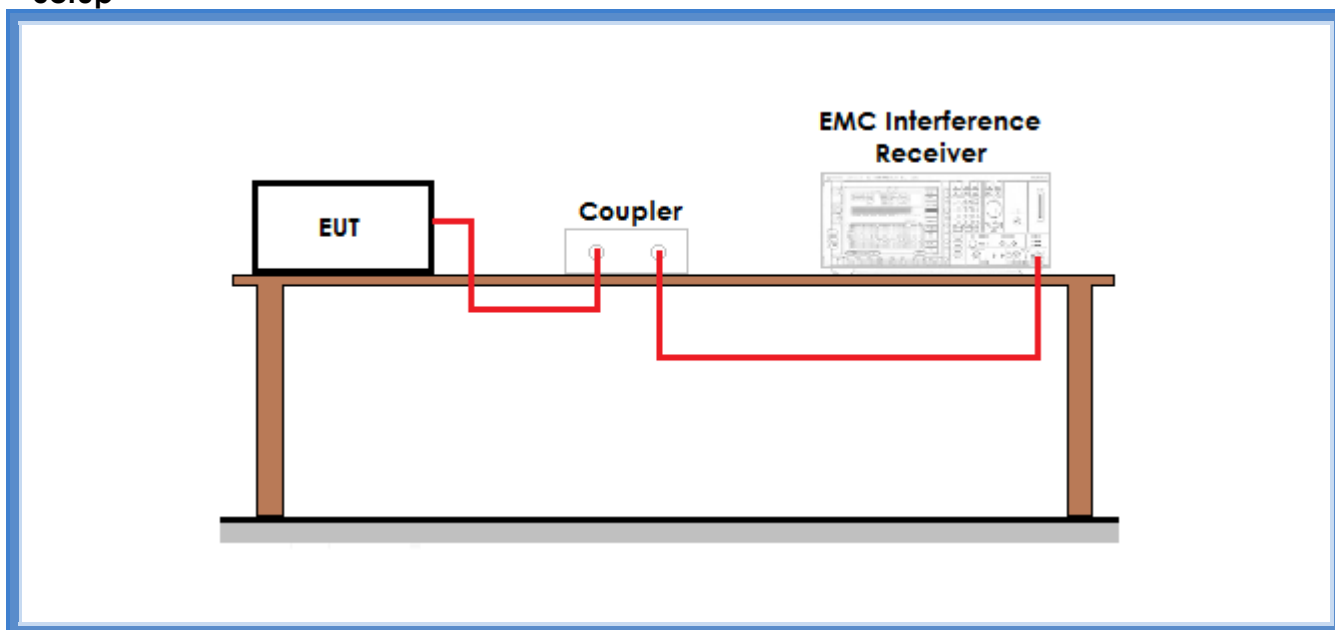
### Environmental conditions

| Temperature<br>(°C) | Atmospheric pressure<br>(kPa) | Relative humidity<br>(%) |
|---------------------|-------------------------------|--------------------------|
| 22                  | 99                            | 50                       |

**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

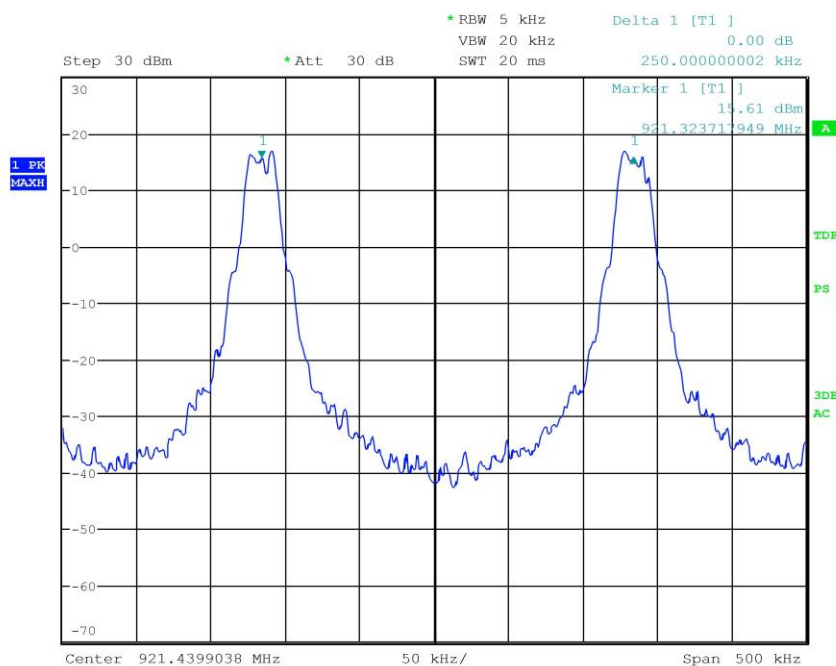
| Frequency band (MHz) | Graphs    | Channel separation (kHz) | Results  |
|----------------------|-----------|--------------------------|----------|
| 902 – 928            | G14026621 | 250                      | Complies |



## Graphs

G14026621

Meas Type Emission  
Equipment under Test  
Manufacturer  
OP Condition  
Operator Gandini 14026621  
Test Spec



**Result:** The requirements are met