



# Test report

**Number:** T251-0xxx/17  
**Project file:** C20171222  
**Date:** 2017-08-21  
**Pages:** 59

**Product:** Reader board HF NFC

**Type reference:** ST25R3911B-DISCO

**Ratings:** USB: 5 VDC 5%/500 mA;  
Operating clock frequency: 13.56 MHz  
Protection class: III

**Trademark:** STMicroelectronics Austria GmbH

**Applicant:** STMicroelectronics Austria GmbH  
Kratkystrasse 2, AT-8020 Graz, Austria

**Manufacturer:** ASTRON Electronic GmbH  
Feistritz 333, AT-9613 Feistritz an der Gail, Austria

**Place of manufacture:** ASTRON Electronic GmbH  
Feistritz 333, AT-9613 Feistritz an der Gail, Austria

## Summary of testing

**Testing method:** ANSI C63.10-2013

**Testing location:** SIQ Ljubljana, Trpinčeva ulica 37 A, SI-1000 Ljubljana, Slovenia

**Remarks:** Date of receipt of test items: 2017-04-04  
Number of items tested: 2  
Date of performance of tests: 2017-04-25 - 2017-05-23  
The test results presented in this report relate only to the items tested.  
The product complies with the requirements of the testing methods.

/

**Tested by:** Andrej Škof

**Approved by:** Marjan Mak

*The report shall not be reproduced except in full.*



| <b>CONTENTS</b>                                                                                             | <b>page</b>      |
|-------------------------------------------------------------------------------------------------------------|------------------|
| <b><u>1 GENERAL</u></b>                                                                                     | <b><u>3</u></b>  |
| 1.1 EQUIPMENT UNDER TEST                                                                                    | 3                |
| <b><u>2 TEST SUMMARY</u></b>                                                                                | <b><u>5</u></b>  |
| 2.1 OPERATING VOLTAGES/FREQUENCIES USED FOR TESTING                                                         | 5                |
| <b><u>3 CONVERSION FACTORS AND ALL OTHER FORMULAS</u></b>                                                   | <b><u>6</u></b>  |
| <b><u>4 EMISSION TESTS</u></b>                                                                              | <b><u>7</u></b>  |
| 4.1 OCCUPIED BANDWIDTH (§2.202 OF FCC 47 CRF 15 AND CLAUSE 6.6 OF RSS-GEN ISSUE 4)                          | 7                |
| 4.2 ANTENNA REQUIREMENTS (§15.203)                                                                          | 10               |
| 4.3 RESTRICTED BANDS OF OPERATION (§15.205 OF FCC 47 CRF 15 AND TABLE 6 OF RSS-GEN ISSUE 4)                 | 11               |
| 4.4 CONDUCTED EMISSION MEASUREMENT (§15.107, §15.207 OF FCC 47 CRF 15 AND TABLE 3 OF RSS-GEN ISSUE 4)       | 12               |
| 4.5 RADIATED EMISSION MEASUREMENT (§15.109, §15.209 OF FCC 47 CRF 15 AND TABLES 4 AND 5 OF RSS-GEN ISSUE 4) | 29               |
| 4.6 BANDWIDTH OF THE EMISSION (§15.215)                                                                     | 51               |
| 4.7 SPECTRUM MASK (§15.225 (A)-(D) OF FCC 47 CRF 15 AND ANNEX B.6 OF RSS-210 ISSUE 9)                       | 54               |
| 4.8 FREQUENCY TOLERANCE OF THE CARRIER SIGNAL (§15.225 (E))                                                 | 57               |
| <b><u>5 TEST EQUIPMENT</u></b>                                                                              | <b><u>59</u></b> |

# 1 GENERAL

| History sheet |              |                             |          |
|---------------|--------------|-----------------------------|----------|
| Date          | Report No.   | Change                      | Revision |
| 2017-08-21    | T251-0FCC/17 | Initial Test Report issued. | --       |

**Environmental conditions:**

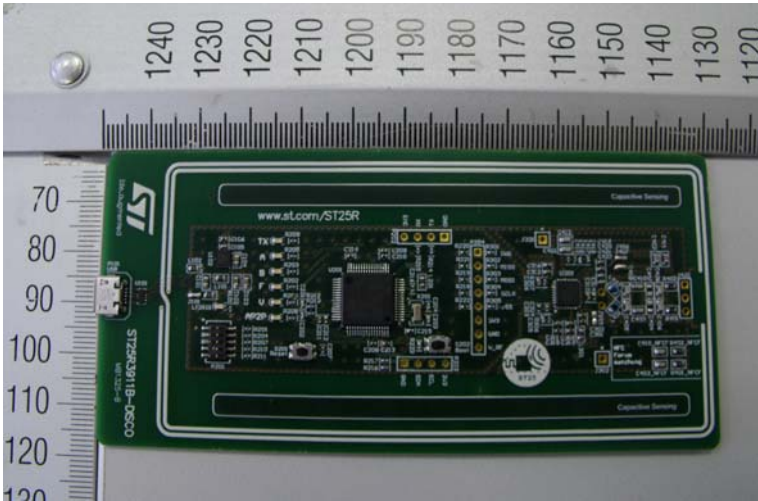
Ambient temperature: 15°C to 35°C  
 Relative humidity: 30% to 60%  
 Atmospheric pressure: 860 mbar to 1060 mbar

## 1.1 Equipment under test

**Reader board HF NFC**

Type: **ST25R3911B-DISCO**  
 FCC ID: YCPST25R3911BDISCO

Tested SIQ sample number: S20172498 (original sample)  
 Tested SIQ sample number: S20173130 (sample with dummy load)



Picture of EUT



### 1.1.1 General product information

|                                      |                                                     |
|--------------------------------------|-----------------------------------------------------|
| <b>Product</b>                       | Reader Board HF NFC                                 |
| <b>Type / Model</b>                  | ST25R3911B-DISCO                                    |
| <b>Supply voltage of transmitter</b> | 5 VDC via USB                                       |
| <b>Operating frequency</b>           | 13,56 MHz (NFC tag)                                 |
| <b>Antenna type</b>                  | 105 mm x 52 mm, two turns antenna etched on the PCB |
| <b>Modulation type:</b>              | ISO14443A, ISO14443B, ISO15693 and FeliCa™          |
| <b>Hardware version:</b>             | MB1325-B01                                          |
| <b>Software version:</b>             | SW (PC GUI): 1.0.4.0<br>FW (MCU): 1.0.4.0           |
| <b>Card reading/Writing distance</b> | From 10 mm to 45mm with CLOUD-ST25TA tag            |

### 1.1.2 Auxiliary equipment used during testing

- Laptop: HP EliteBook 8560p
- Test software ST25R3911B Discovery GUI, Version: 1.0.4.0

## 2 TEST SUMMARY

| STANDARD                                                                                                        | Tested                              |                          | Sample                              |                          |
|-----------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|
|                                                                                                                 | yes                                 | no                       | pass                                | not pass                 |
| ANSI C63.10-2013                                                                                                |                                     |                          |                                     |                          |
| FCC 47 CFR Part 15, Subpart B (§15.107, §15.109)                                                                |                                     |                          |                                     |                          |
| FCC 47 CFR Part 15, Subpart C (§2.202, §15.203, §15.205, §15.207, §15.209, §15.215, §15.225 (a-d), §15.225 (e)) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RSS-210 Issue 9 (Annex B.6)                                                                                     |                                     |                          |                                     |                          |
| RSS-Gen issue 4 (clause 6.6 and tables 3,4,5 and 6)                                                             |                                     |                          |                                     |                          |

| Clause<br>(FCC 47 CFR Part 15) | Clause<br>(RSS-Gen issue 4) | Clause<br>(RSS-210 issue 9) | Test description   | Section<br>within the<br>report | Conclusion |
|--------------------------------|-----------------------------|-----------------------------|--------------------|---------------------------------|------------|
| §15.107                        |                             |                             | Conducted emission | 4.4                             | PASS       |
| §15.109                        |                             |                             | Radiated emission  | 4.5                             | PASS       |

| Clause<br>(FCC 47 CFR Part 15) | Clause<br>(RSS-Gen issue 4) | Clause<br>(RSS-210 issue 9) | Test description                            | Section<br>within the<br>report | Conclusion |
|--------------------------------|-----------------------------|-----------------------------|---------------------------------------------|---------------------------------|------------|
| §2.202                         | 6.6                         |                             | Occupied bandwidth                          | 4.1                             | PASS       |
| §15.203                        |                             |                             | Antenna requirements                        | 4.2                             | PASS       |
| §15.205                        | Table 6                     |                             | Restricted bands of operation               | 4.3                             | PASS       |
| §15.207                        | Table 3                     |                             | Conducted emission                          | 4.4                             | PASS       |
| §15.209                        | Table 4 and 5               |                             | Radiated emission – general requirements    | 4.5                             | PASS       |
| §15.215                        |                             |                             | 20 dB Bandwidth                             | 4.6                             | PASS       |
| §15.225 (a-d)                  |                             | Annex B.6                   | Operation within the band 13.110-14.010 MHz | 4.7                             | PASS       |
| §15.225 (e)                    |                             | Annex B.6                   | Carrier Frequency stability                 | 4.8                             | PASS       |

### 2.1 Operating voltages/frequencies used for testing

| Clause<br>(FCC 47 CFR Part 15) | Clause<br>(RSS-Gen issue 4) | Clause<br>(RSS-210 issue 9) | Test description                            | Operating conditions     |
|--------------------------------|-----------------------------|-----------------------------|---------------------------------------------|--------------------------|
| §15.107                        |                             |                             | Conducted emission                          | 120 V / 60 Hz            |
| §15.109                        |                             |                             | Radiated emission                           | 120 V / 60 Hz (PC power) |
| §2.202                         | 6.6                         |                             | Occupied bandwidth                          | 5 VDC via USB            |
| §15.203                        |                             |                             | Antenna requirements                        | /                        |
| §15.205                        | Table 6                     |                             | Restricted bands of operation               | 5 VDC via USB            |
| §15.207                        | Table 3                     |                             | Conducted emission                          | 5 VDC via USB            |
| §15.209                        | Table 4 and 5               |                             | Radiated emission – general requirements    | 5 VDC via USB            |
| §15.215                        |                             |                             | 20 dB Bandwidth                             | 5 VDC via USB            |
| §15.225 (a-d)                  |                             | Annex B.6                   | Operation within the band 13.110-14.010 MHz | 5 VDC via USB            |
| §15.225 (e)                    |                             | Annex B.6                   | Carrier Frequency stability                 | 4.25 VDC - 5.75 VDC      |

### 3 CONVERSION FACTORS AND ALL OTHER FORMULAS

| Unit                   | Conversion unit          | Formula of conversion                                            |
|------------------------|--------------------------|------------------------------------------------------------------|
| $\text{dB}\mu\text{V}$ | $\text{dB}\mu\text{V/m}$ | $\text{dB}\mu\text{V/m} = \text{dB}\mu\text{V} + \text{AF}$      |
| $\mu\text{V/m}$        | $\text{dB}\mu\text{V/m}$ | $\text{dB}\mu\text{V/m} = 20\log(X(\mu\text{V/m})/1\mu\text{V})$ |

| Test distance stated in standard | Test distance of measurement | Conversion factor          |
|----------------------------------|------------------------------|----------------------------|
| 3 m                              | 3 m                          | /                          |
| 10 m                             | 3 m                          | 20dB/decade (over 30 MHz)  |
|                                  |                              | 40dB/decade (under 30 MHz) |

## 4 EMISSION TESTS

### 4.1 Occupied bandwidth (§2.202 of FCC 47 CFR 15 and clause 6.6 of RSS-Gen Issue 4)

#### Requirement §2.202

The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. In some cases, for example multichannel frequency-division systems, the percentage of 0.5 percent may lead to certain difficulties in the practical application of the definitions of occupied and necessary bandwidth; in such cases a different percentage may prove useful.

The occupied bandwidth according to ANSI C63.10 is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

| Fundamental frequency | Minimum resolution bandwidth |
|-----------------------|------------------------------|
| 9 kHz to 30 MHz       | 1 kHz                        |
| 30 MHz to 1000 MHz    | 10 kHz                       |
| 1000 MHz to 40 GHz    | 100 kHz                      |

The video bandwidth shall be at least three times greater than the resolution bandwidth.

#### Conclusion:

PASS; Occupied bandwidth is 2,26 kHz

#### Requirement RSS-Gen Issue 4

If not specified in the applicable RSS the occupied bandwidth is measured as the 99% emission bandwidth.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.



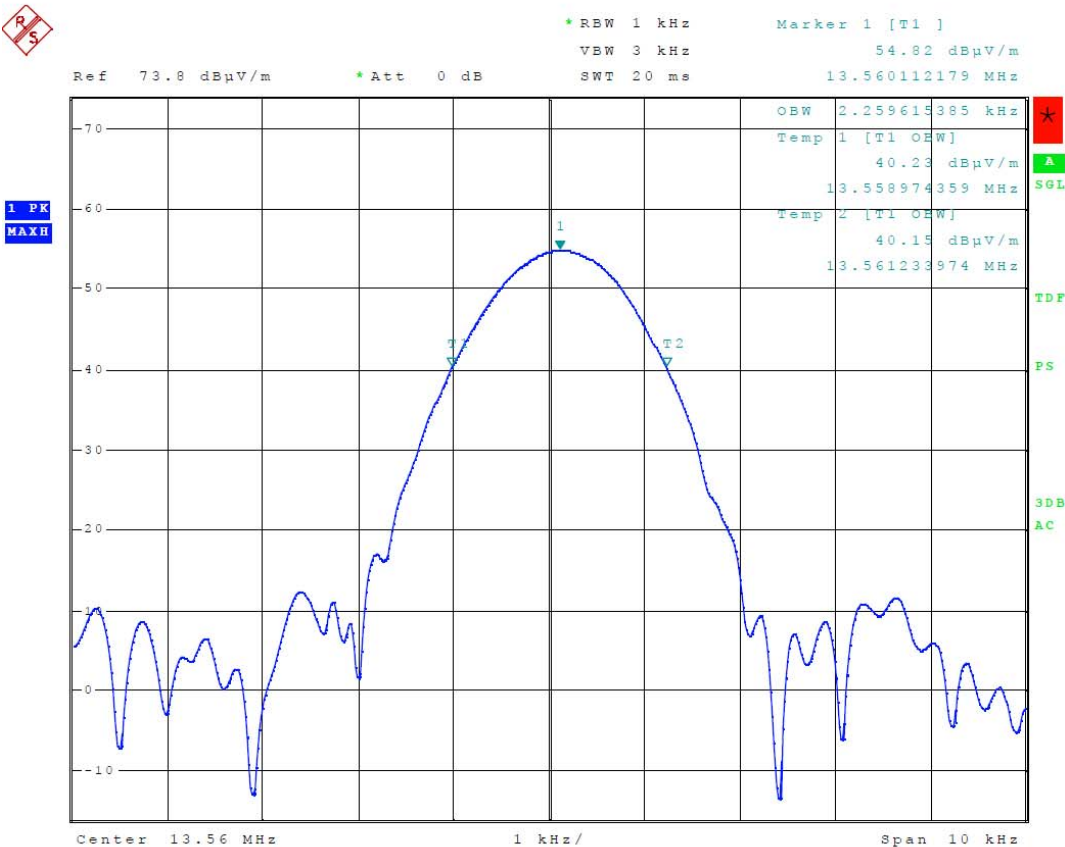
**C20171222**

02.Jun 17 23:41

**Meas Type** 99% OCCUPIED BANDWIDTH  
**Equipment under Test** ST25R3911B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING  
**Operator** Andrej Skof  
**Test Spec**  
Antenna: 340 deg, Sample: 20 deg

**Sweep Settings Screen A**

|                  |               |                  |               |
|------------------|---------------|------------------|---------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 73.800 dBμV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB      |
| Span             | 10.000000 kHz | Ref Position     | 100.000 %     |
| Start Frequency  | 13.555000 MHz | Level Range      | 90.000 dB     |
| Stop Frequency   | 13.565000 MHz | RF Att           | 0.000 dB      |
| RBW              | 1.000000 kHz  |                  |               |
| VBW              | 3.000000 kHz  | X-Axis           | LIN           |
| Sweep Time       | 20.00 ms      | Y-Axis           | LOG           |





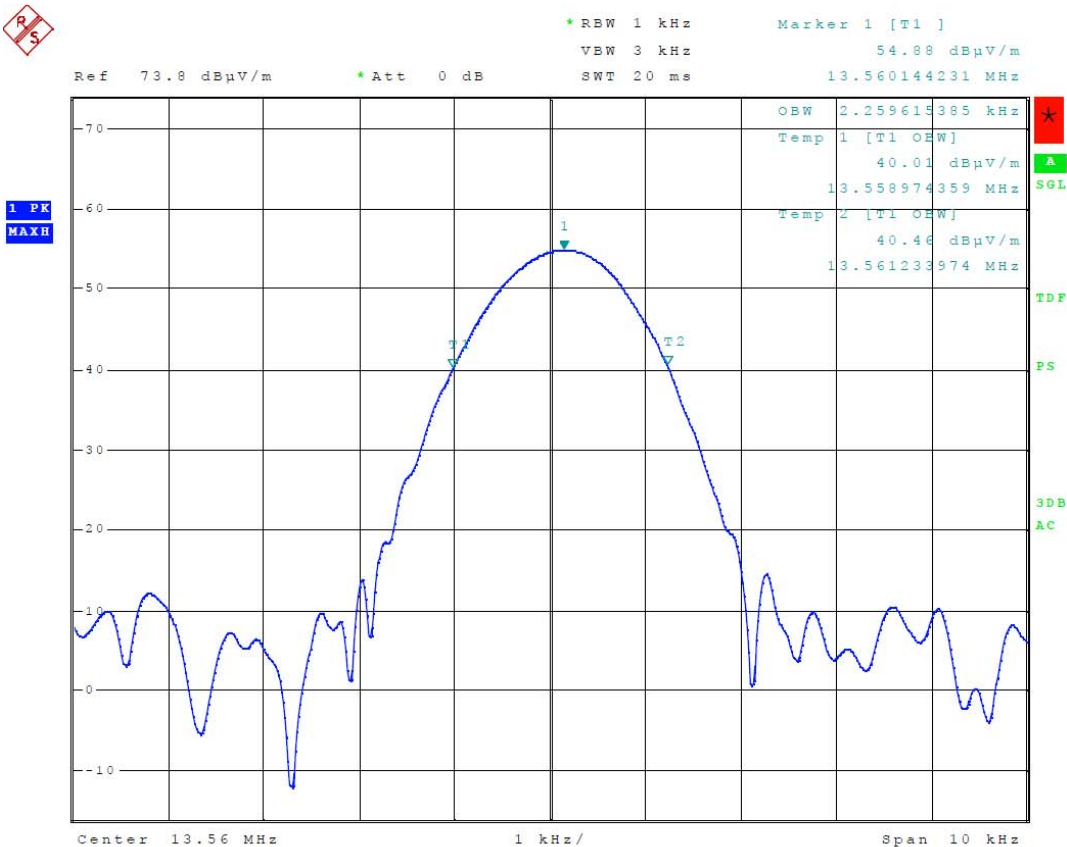
C20171222

02.Jun 17 23:40

Meas Type 99% OCCUPIED BANDWIDTH  
Equipment under Test ST25R3911B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition READING  
Operator Andrej Skof  
Test Spec  
Antenna: 340 deg, Sample: 20 deg

Sweep Settings Screen A

|                  |               |                  |               |
|------------------|---------------|------------------|---------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 73.800 dBμV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB      |
| Span             | 10.000000 kHz | Ref Position     | 100.000 %     |
| Start Frequency  | 13.555000 MHz | Level Range      | 90.000 dB     |
| Stop Frequency   | 13.565000 MHz | RF Att           | 0.000 dB      |
| RBW              | 1.000000 kHz  |                  |               |
| VBW              | 3.000000 kHz  | X-Axis           | LIN           |
| Sweep Time       | 20.00 ms      | Y-Axis           | LOG           |





## 4.2 Antenna requirements (§15.203)

### Requirement

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.

### Conclusion:

PASS; EUT has PCB antenna which is not detachable

### 4.3 Restricted bands of operation (§15.205 of FCC 47 CFR 15 and Table 6 of RSS-Gen Issue 4)

#### 4.3.1 Requirement

Except as shown in paragraph (d) of §15.205 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         |
| <sup>1</sup> 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     | ( <sup>2</sup> ) |
| 13.36-13.41              |                     |               |                  |

<sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup>Above 38.6

#### 4.3.2 Test results

See Radiated emission results under 4.4 Radiated emission and 4.6 Spectrum mask.



#### 4.4 Conducted emission measurement (§15.107, §15.207 of FCC 47 CFR 15 and Table 3 of RSS-Gen Issue 4)

##### 4.4.1 Requirement

| Frequency Range<br>(MHz) | Limits (dBµV) |          |
|--------------------------|---------------|----------|
|                          | Quasi-peak    | Average  |
| 0.15 to 0.5              | 66 – 56*      | 56 – 46* |
| 0.5 to 5.0               | 56            | 46       |
| 5.0 to 30.0              | 60            | 50       |

\* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

##### 4.4.2 Test procedure

- As per clause 6.2 from ANSI C63.10-2013.
- The EUT is placed on a non-conductive 0.8 meters high table, 0.4 meters from the vertical conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). LISN provide 50 Ohm / 50 µH + 5 Ohm of coupling impedance for the measuring instrument.
- Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
- AC power lines of EUT are checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz is searched using PEAK, QUASI-PEAK and AVERAGE function of the receiver to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band. Bandwidth is set to 9 kHz.
- Measurement repeated with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band.

#### 4.4.3 Test results

Device passed the requirements stated



**ROHDE & SCHWARZ**

**C20171222**

Meas Type CONDUCTED EMISSION  
 Equipment under Test ST25R391B-DISCO  
 Manufacturer STMicroelectronics Austria GmbH  
 OP Condition STANDBY; 120 V, 60 Hz  
 Operator ANDREJ SKOF  
 Test Spec  
 PHASE

#### Time Domain Scan (1 Range)

Scan Start: 150 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK Trace 2: Average  
 Transducer: ENV216

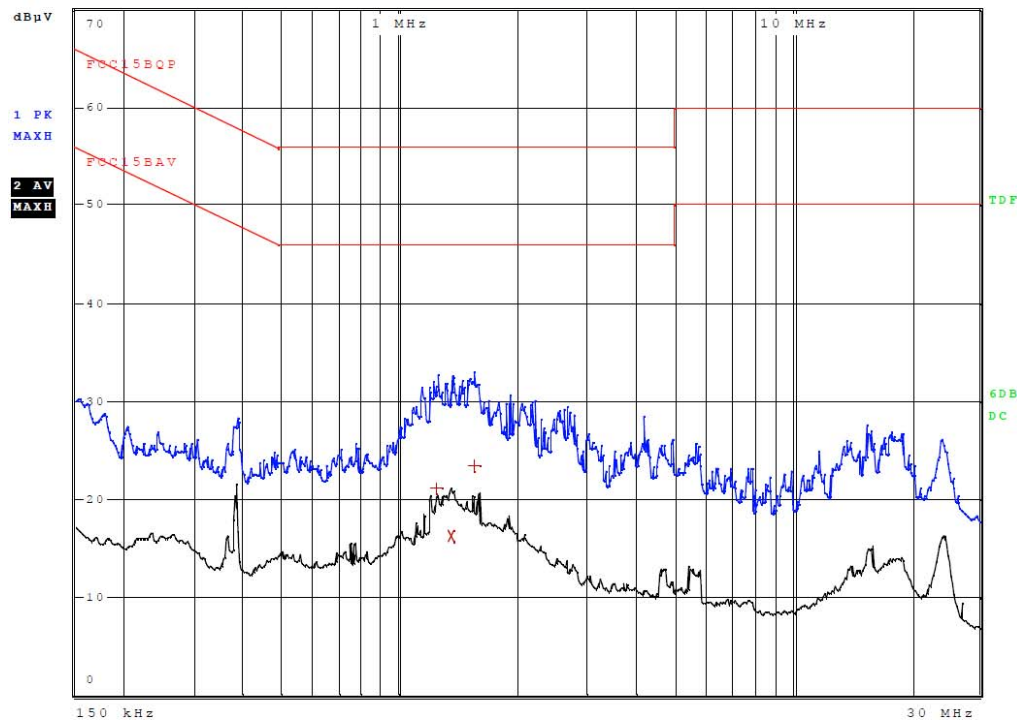
| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |



REBW 9 kHz

MT 1 s

Step TD AUTO PULSE Att 10 dB AUTO PREAMP OFF



**C20171222**

Meas Type CONDUCTED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition STANDBY; 120 V, 60 Hz  
Operator ANDREJ SKOF  
Test Spec  
PHASE

**Final Measurement**

Meas Time: 1 s  
Margin: 25 dB  
Subranges: 3

| Trace | Frequency       | Level (dBμV) | Detector     | Delta Limit/dB |
|-------|-----------------|--------------|--------------|----------------|
| 2     | 1.351500000 MHz | 16.30        | CISPR Averag | -29.70         |
| 1     | 1.545000000 MHz | 23.53        | Quasi Peak   | -32.47         |
| 1     | 1.245750000 MHz | 21.07        | Quasi Peak   | -34.93         |

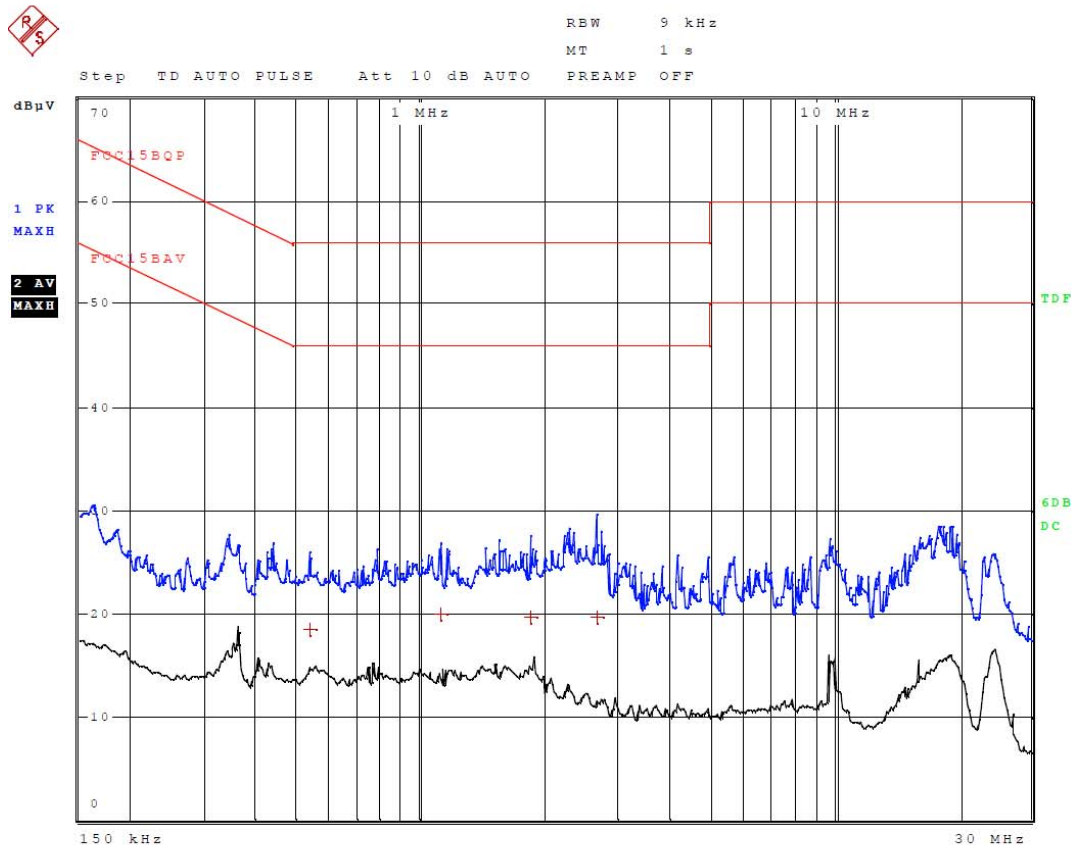
### C20171222

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** STANDBY; 120 V, 60 Hz  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### Time Domain Scan (1 Range)

**Scan Start:** 150 kHz  
**Scan Stop:** 30 MHz  
**Detector:** Trace 1: MAX PEAK Trace 2: Average  
**Transducer:** ENV216

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |



**C20171222**

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** STANDBY; 120 V, 60 Hz  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 30 dB  
**Subranges:** 4

| Trace | Frequency         | Level (dBμV) | Detector   | Delta Limit/dB |
|-------|-------------------|--------------|------------|----------------|
| 1     | 1.115250000 MHz   | 19.94        | Quasi Peak | -36.06         |
| 1     | 1.853250000 MHz   | 19.67        | Quasi Peak | -36.33         |
| 1     | 2.667750000 MHz   | 19.62        | Quasi Peak | -36.38         |
| 1     | 539.250000000 kHz | 18.45        | Quasi Peak | -37.55         |

Meas Type CONDUCTED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition Uin: 120 V, 60 Hz, READING  
Operator ANDREJ SKOF

Test Spec

PHASE

### Time Domain Scan (1 Range)

Scan Start: 150 kHz  
Scan Stop: 30 MHz  
Detector: Trace 1: MAX PEAK Trace 2: Average  
Transducer: ESH2-Z5

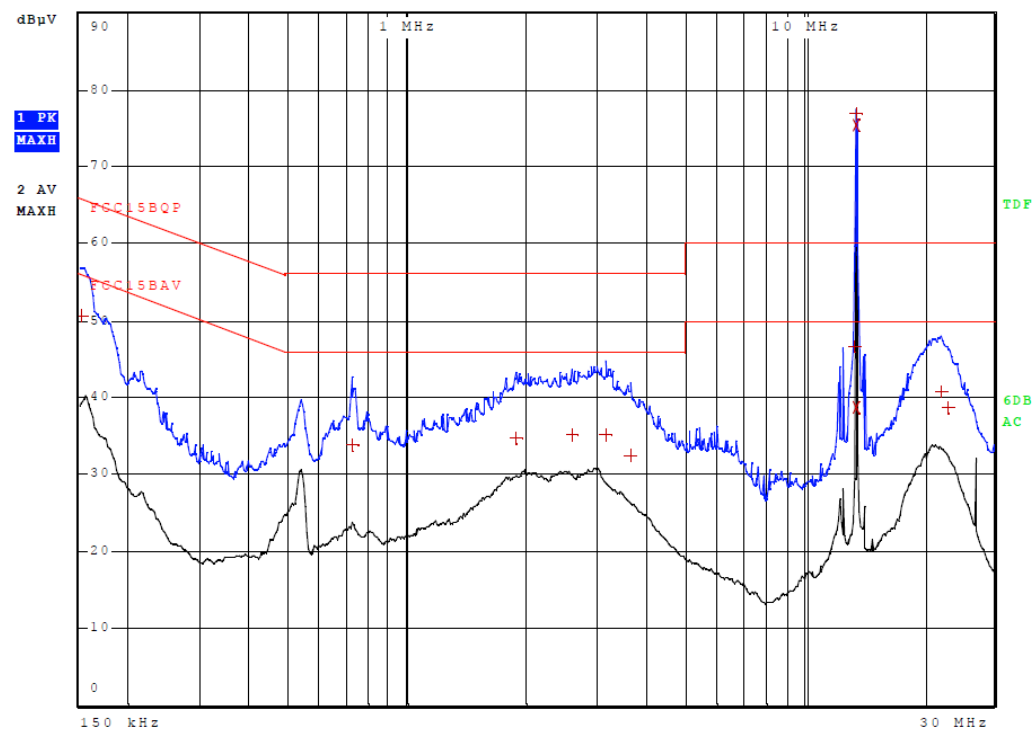
| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |



RBW 9 kHz

MT 1 s

Step TD AUTO PULSE Att 10 dB AUTO PREAMP OFF





**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, READING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 PHASE

### **Final Measurement**

Meas Time: 1 s  
 Margin: 15 dB  
 Subranges: 12

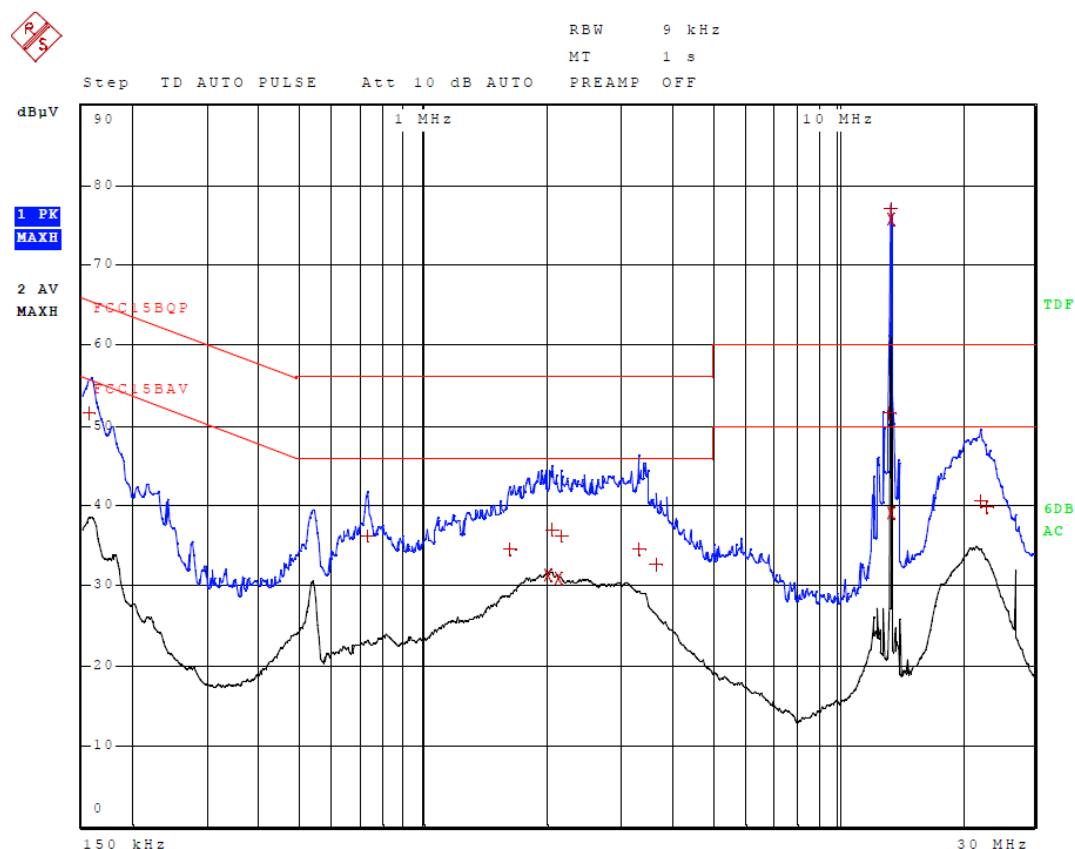
| Trace | Frequency         | Level (dB $\mu$ V) | Detector     | Delta Limit/dB |
|-------|-------------------|--------------------|--------------|----------------|
| 2     | 13.560000000 MHz  | 75.43              | CISPR Averag | 25.43          |
| 1     | 13.560000000 MHz  | 76.93              | Quasi Peak   | 16.93          |
| 2     | 13.548750000 MHz  | 38.75              | CISPR Averag | -11.25         |
| 1     | 13.454250000 MHz  | 46.63              | Quasi Peak   | -13.37         |
| 1     | 152.250000000 kHz | 50.66              | Quasi Peak   | -15.21         |
| 1     | 22.179750000 MHz  | 40.81              | Quasi Peak   | -19.19         |
| 1     | 3.158250000 MHz   | 35.05              | Quasi Peak   | -20.95         |
| 1     | 2.593500000 MHz   | 35.00              | Quasi Peak   | -21.00         |
| 1     | 1.887000000 MHz   | 34.78              | Quasi Peak   | -21.22         |
| 1     | 23.039250000 MHz  | 38.62              | Quasi Peak   | -21.38         |
| 1     | 726.000000000 kHz | 33.75              | Quasi Peak   | -22.25         |
| 1     | 3.648750000 MHz   | 32.43              | Quasi Peak   | -23.57         |

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, READING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### Time Domain Scan (1 Range)

**Scan Start:** 150 kHz  
**Scan Stop:** 30 MHz  
**Detector:** Trace 1: MAX PEAK Trace 2: Average  
**Transducer:** ESH2-Z5

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |





**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, READING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### Final Measurement

Meas Time: 1 s  
 Margin: 15 dB  
 Subranges: 15

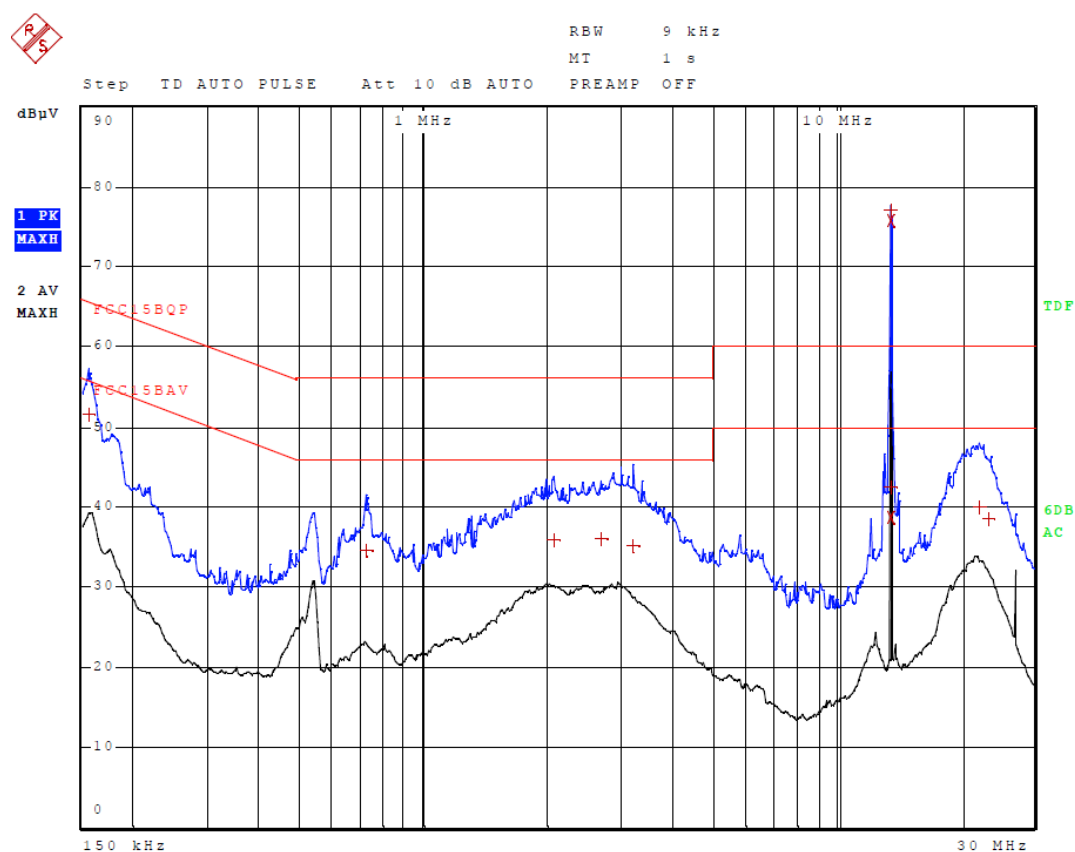
| Trace | Frequency          | Level (dBμV) | Detector     | Delta Limit/dB |
|-------|--------------------|--------------|--------------|----------------|
| 2     | 13.5600000000 MHz  | 75.77        | CISPR Averag | 25.77          |
| 1     | 13.5600000000 MHz  | 77.10        | Quasi Peak   | 17.10          |
| 1     | 13.3485000000 MHz  | 51.48        | Quasi Peak   | -8.52          |
| 2     | 13.5487500000 MHz  | 38.98        | CISPR Averag | -11.02         |
| 1     | 156.7500000000 kHz | 51.59        | Quasi Peak   | -14.04         |
| 2     | 2.0017500000 MHz   | 31.25        | CISPR Averag | -14.75         |
| 2     | 2.1277500000 MHz   | 30.86        | CISPR Averag | -15.14         |
| 1     | 2.0490000000 MHz   | 36.96        | Quasi Peak   | -19.04         |
| 1     | 22.2922500000 MHz  | 40.52        | Quasi Peak   | -19.48         |
| 1     | 2.1637500000 MHz   | 36.21        | Quasi Peak   | -19.79         |
| 1     | 730.5000000000 kHz | 36.19        | Quasi Peak   | -19.81         |
| 1     | 23.0685000000 MHz  | 39.87        | Quasi Peak   | -20.13         |
| 1     | 1.6192500000 MHz   | 34.56        | Quasi Peak   | -21.44         |
| 1     | 3.3337500000 MHz   | 34.43        | Quasi Peak   | -21.57         |
| 1     | 3.6375000000 MHz   | 32.59        | Quasi Peak   | -23.41         |

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, WAITING  
**Operator** ANDREJ SKOF  
**Test Spec**  
**PHASE**

### Time Domain Scan (1 Range)

**Scan Start:** 150 kHz  
**Scan Stop:** 30 MHz  
**Detector:** Trace 1: MAX PEAK Trace 2: Average  
**Transducer:** ESH2-Z5

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |





**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, WAITING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 PHASE

### **Final Measurement**

**Meas Time:** 1 s  
**Margin:** 15 dB  
**Subranges:** 11

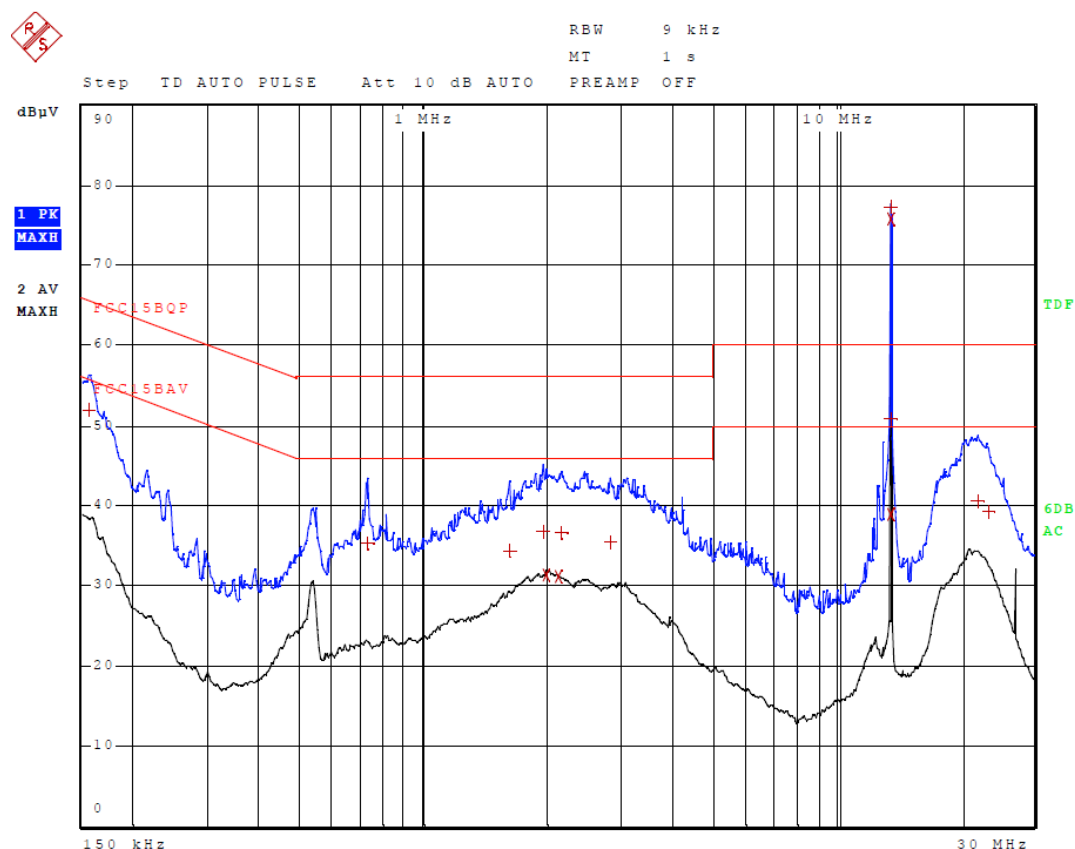
| Trace | Frequency         | Level (dBµV) | Detector     | Delta Limit/dB |
|-------|-------------------|--------------|--------------|----------------|
| 2     | 13.560000000 MHz  | 75.71        | CISPR Averag | 25.71          |
| 1     | 13.560000000 MHz  | 77.10        | Quasi Peak   | 17.10          |
| 2     | 13.548750000 MHz  | 38.71        | CISPR Averag | -11.29         |
| 1     | 154.500000000 kHz | 51.54        | Quasi Peak   | -14.21         |
| 1     | 13.481250000 MHz  | 42.38        | Quasi Peak   | -17.62         |
| 1     | 2.681250000 MHz   | 36.09        | Quasi Peak   | -19.91         |
| 1     | 22.105500000 MHz  | 39.90        | Quasi Peak   | -20.10         |
| 1     | 2.058000000 MHz   | 35.76        | Quasi Peak   | -20.24         |
| 1     | 3.214500000 MHz   | 35.05        | Quasi Peak   | -20.95         |
| 1     | 726.000000000 kHz | 34.47        | Quasi Peak   | -21.53         |
| 1     | 23.309250000 MHz  | 38.41        | Quasi Peak   | -21.59         |

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, WAITING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### Time Domain Scan (1 Range)

Scan Start: 150 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK Trace 2: Average  
 Transducer: ESH2-Z5

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 30 ms     | Auto     | 0 dB   | INPUT2 |





**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz, WAITING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### **Final Measurement**

Meas Time: 1 s  
 Margin: 15 dB  
 Subranges: 14

| Trace | Frequency          | Level (dB $\mu$ V) | Detector     | Delta Limit/dB |
|-------|--------------------|--------------------|--------------|----------------|
| 2     | 13.5600000000 MHz  | 75.75              | CISPR Averag | 25.75          |
| 1     | 13.5600000000 MHz  | 77.16              | Quasi Peak   | 17.16          |
| 1     | 13.5330000000 MHz  | 50.75              | Quasi Peak   | -9.25          |
| 2     | 13.5487500000 MHz  | 38.83              | CISPR Averag | -11.17         |
| 1     | 154.5000000000 kHz | 51.81              | Quasi Peak   | -13.95         |
| 2     | 1.9927500000 MHz   | 31.21              | CISPR Averag | -14.79         |
| 2     | 2.1232500000 MHz   | 31.12              | CISPR Averag | -14.88         |
| 1     | 1.9522500000 MHz   | 36.76              | Quasi Peak   | -19.24         |
| 1     | 2.1592500000 MHz   | 36.61              | Quasi Peak   | -19.39         |
| 1     | 21.8715000000 MHz  | 40.50              | Quasi Peak   | -19.50         |
| 1     | 2.8320000000 MHz   | 35.48              | Quasi Peak   | -20.52         |
| 1     | 23.1517500000 MHz  | 39.24              | Quasi Peak   | -20.76         |
| 1     | 730.5000000000 kHz | 35.21              | Quasi Peak   | -20.79         |
| 1     | 1.6170000000 MHz   | 34.31              | Quasi Peak   | -21.69         |

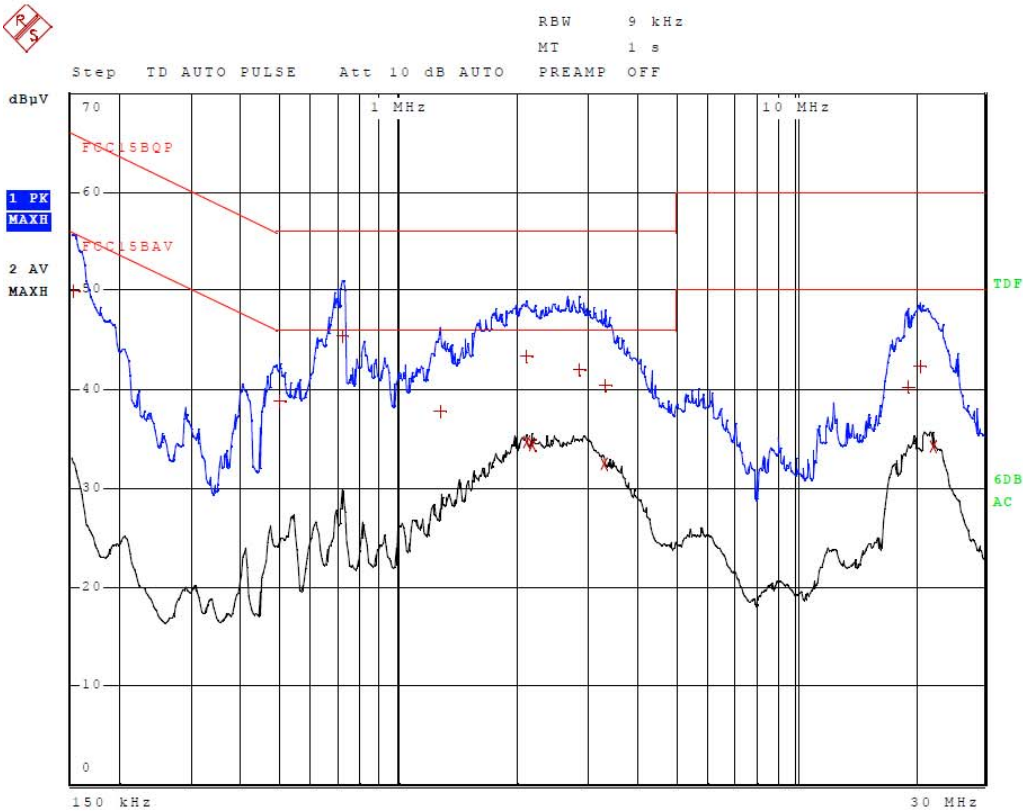
Measurement with a dummy load in lieu of the antenna:

Meas Type CONDUCTED EMISSION  
 Equipment under Test ST25R391B-DISCO  
 Manufacturer STMicroelectronics Austria GmbH  
 OP Condition Uin: 120 V, 60 Hz; with Dummy load  
 Operator ANDREJ SKOF  
 Test Spec  
 PHASE

Time Domain Scan (1 Range)

Scan Start: 150 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK Trace 2: Average  
 Transducer: ESH2-Z5

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 20 ms     | Auto     | 0 dB   | INPUT2 |





**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz; with Dummy load  
**Operator** ANDREJ SKOF  
**Test Spec**  
 PHASE

### **Final Measurement**

**Meas Time:** 1 s  
**Margin:** 15 dB  
**Subranges:** 13

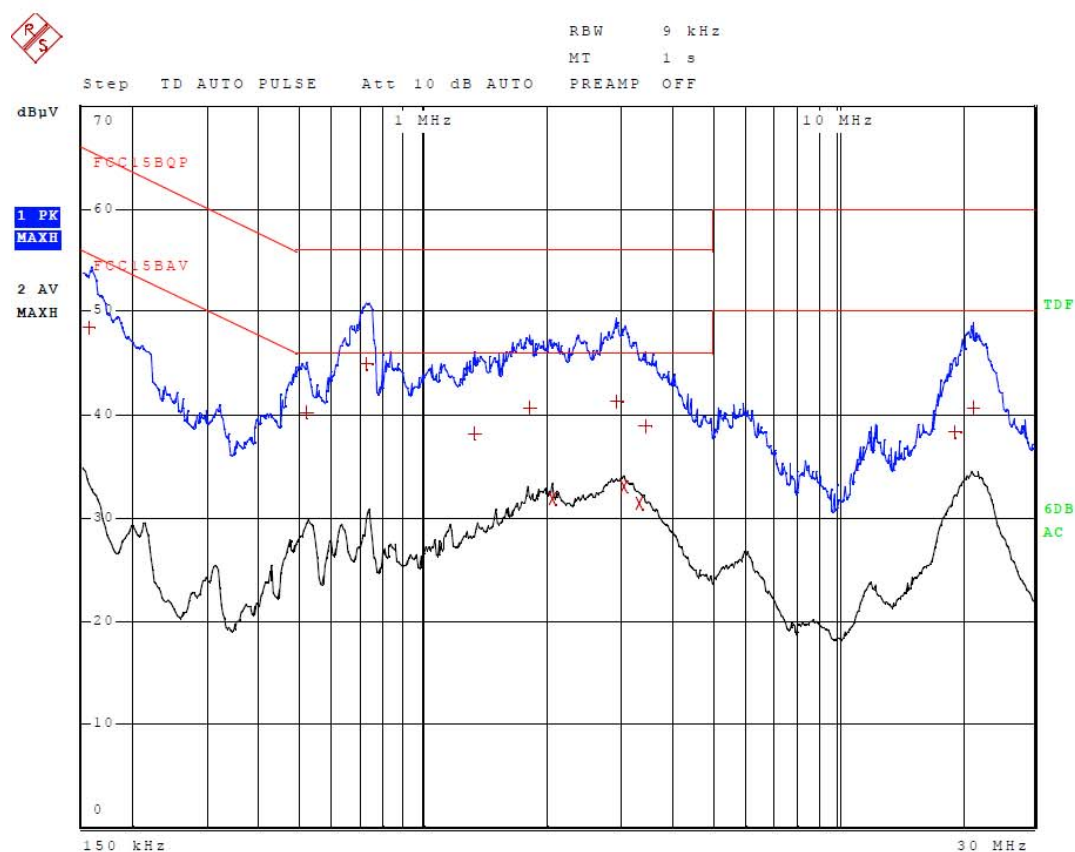
| Trace | Frequency         | Level (dBμV) | Detector     | Delta Limit/dB |
|-------|-------------------|--------------|--------------|----------------|
| 1     | 719.250000000 kHz | 45.32        | Quasi Peak   | -10.68         |
| 2     | 2.103000000 MHz   | 34.56        | CISPR Averag | -11.44         |
| 2     | 2.175000000 MHz   | 34.36        | CISPR Averag | -11.64         |
| 1     | 2.094000000 MHz   | 43.38        | Quasi Peak   | -12.62         |
| 2     | 3.306750000 MHz   | 32.41        | CISPR Averag | -13.59         |
| 1     | 2.845500000 MHz   | 41.96        | Quasi Peak   | -14.04         |
| 1     | 3.329250000 MHz   | 40.34        | Quasi Peak   | -15.66         |
| 2     | 22.209000000 MHz  | 34.24        | CISPR Averag | -15.76         |
| 1     | 152.250000000 kHz | 49.86        | Quasi Peak   | -16.02         |
| 1     | 498.750000000 kHz | 38.75        | Quasi Peak   | -17.27         |
| 1     | 20.591250000 MHz  | 42.25        | Quasi Peak   | -17.75         |
| 1     | 1.272750000 MHz   | 37.75        | Quasi Peak   | -18.25         |
| 1     | 19.214250000 MHz  | 40.23        | Quasi Peak   | -19.77         |

**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz; with Dummy load  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### Time Domain Scan (1 Range)

Scan Start: 150 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK Trace 2: Average  
 Transducer: ESH2-Z5

| Start Frequency | Stop Frequency | Step Size | Res BW   | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|----------|-----------|----------|--------|--------|
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz | 20 ms     | Auto     | 0 dB   | INPUT2 |



**Meas Type** CONDUCTED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** Uin: 120 V, 60 Hz; with Dummy load  
**Operator** ANDREJ SKOF  
**Test Spec**  
 NEUTRAL

### **Final Measurement**

**Meas Time:** 1 s  
**Margin:** 15 dB  
**Subranges:** 12

| Trace | Frequency         | Level (dB $\mu$ V) | Detector     | Delta Limit/dB |
|-------|-------------------|--------------------|--------------|----------------|
| 1     | 728.250000000 kHz | 44.94              | Quasi Peak   | -11.06         |
| 2     | 3.050250000 MHz   | 32.98              | CISPR Averag | -13.02         |
| 2     | 2.053500000 MHz   | 31.83              | CISPR Averag | -14.17         |
| 2     | 3.322500000 MHz   | 31.45              | CISPR Averag | -14.55         |
| 1     | 2.919750000 MHz   | 41.21              | Quasi Peak   | -14.79         |
| 1     | 1.797000000 MHz   | 40.65              | Quasi Peak   | -15.35         |
| 1     | 521.250000000 kHz | 40.22              | Quasi Peak   | -15.78         |
| 1     | 156.750000000 kHz | 48.48              | Quasi Peak   | -17.15         |
| 1     | 3.426000000 MHz   | 38.83              | Quasi Peak   | -17.17         |
| 1     | 1.331250000 MHz   | 38.15              | Quasi Peak   | -17.85         |
| 1     | 21.441750000 MHz  | 40.61              | Quasi Peak   | -19.39         |
| 1     | 19.239000000 MHz  | 38.26              | Quasi Peak   | -21.74         |

## 4.5 Radiated emission measurement (§15.109, §15.209 of FCC 47 CFR 15 and Tables 4 and 5 of RSS-Gen Issue 4)

### 4.5.1 Requirement

| Frequency Range (MHz) | Limits (dBµV/m)                      | Test distance (m) |
|-----------------------|--------------------------------------|-------------------|
| 0.009 to 0.490        | $20 \cdot \log(2400/F(\text{kHz}))$  | 300               |
| 0.490 to 1.705        | $20 \cdot \log(24000/F(\text{kHz}))$ | 30                |
| 1.705 to 30.0         | 30                                   | 30                |
| 30 to 88              | 40**                                 | 3                 |
| 88 to 216             | 43.5**                               | 3                 |
| 216 to 960            | 46**                                 | 3                 |
| Above 960             | 54                                   | 3                 |

\*\* Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications

### 4.5.2 Test procedure

#### Measurements from 9 kHz to 30 MHz

- As per clause 6.4 from ANSI C63.10-2013
- Radiated emission in the frequency range 9 kHz to 30 MHz are measured Active loop Antenna.
- First preliminary measurements were performed in Semi-anechoic chamber at a distance of 3 m using active loop antenna.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table and antenna was rotated 360 degrees to determine the position of the highest radiation.
- Final measurements were done at a distance of 10 m at Open Area Test Site due to low emissions measured during preliminary measurements acc. to the clauses from Part 15, Sections 15.31(d) and 15.31(f)(2). Test results were extrapolated by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

#### Measurements from 30 MHz to 1 GHz

- As per clause 6.5 from ANSI C63.10-2013
- The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
- The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to PEAK and QUAS-PEAK Detect Function and Specified Bandwidth with Maximum Hold Mode.
- The highest points would be re-tested one by one using the quasi-peak method.

### 4.5.3 Test results

Device passed the requirements stated  
Preliminary measurements at 3 m:



**ROHDE & SCHWARZ**

**C20171222**

03.May 17 14:01

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition READING  
Operator ANDREJ SKOF

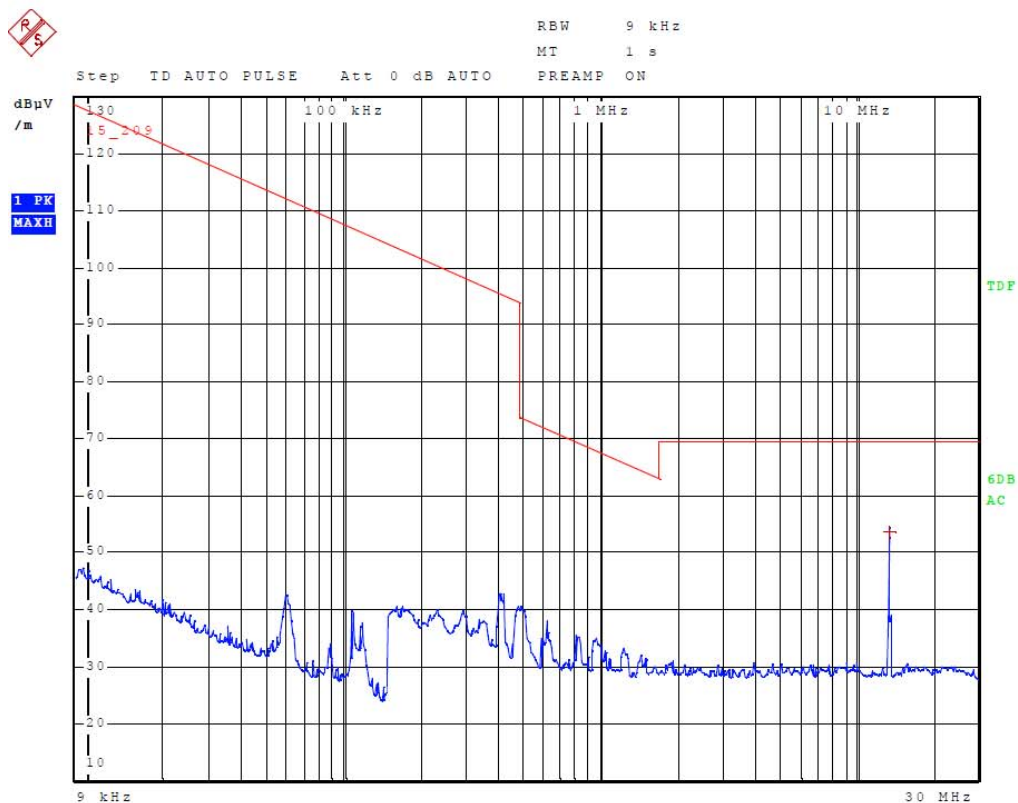
#### Test Spec

Antenna: 0 deg, Sample: 0 deg

#### Time Domain Scan (2 Ranges)

Scan Start: 9 kHz  
Scan Stop: 30 MHz  
Detector: Trace 1: MAX PEAK  
Transducer: HFH2-Z2V

| Start Frequency | Stop Frequency | Step Size | Res BW    | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|-----------|-----------|----------|--------|--------|
| 9.000000 kHz    | 149.950000 kHz | 50.00 Hz  | 200.00 Hz | 300 ms    | Auto     | 20 dB  | INPUT2 |
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz  | 30 ms     | Auto     | 20 dB  | INPUT2 |



**ROHDE & SCHWARZ****C20171222**

03.May 17 14:01

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition READING  
Operator ANDREJ SKOF

**Test Spec**

Antenna: 0 deg, Sample: 0 deg

**Final Measurement**

Meas Time: 1 s  
Margin: 20 dB  
Subranges: 1

| Trace | Frequency        | Level (dB $\mu$ V/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------------|------------|----------------|
| 1     | 13.560000000 MHz | 53.51                | Quasi Peak | -15.99         |

**C20171222**

03.May 17 14:10

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING  
**Operator** ANDREJ SKOF

**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Time Domain Scan (2 Ranges)**

Scan Start: 9 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK  
 Transducer: HFH2-Z2V

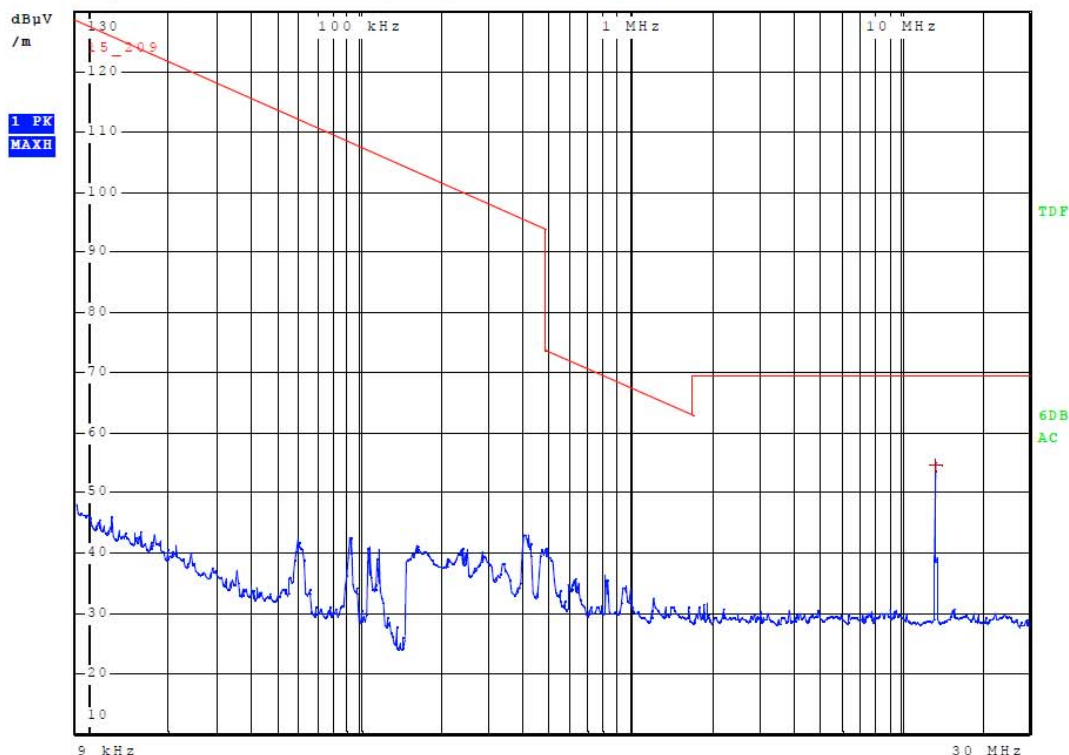
| Start Frequency | Stop Frequency | Step Size | Res BW    | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|-----------|-----------|----------|--------|--------|
| 9.000000 kHz    | 149.950000 kHz | 50.00 Hz  | 200.00 Hz | 300 ms    | Auto     | 20 dB  | INPUT2 |
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz  | 30 ms     | Auto     | 20 dB  | INPUT2 |



RBW 9 kHz

MT 1 s

Step ID AUTO PULSE Att 0 dB AUTO PREAMP ON



**ROHDE & SCHWARZ****C20171222**

03.May 17 14:10

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition READING  
Operator ANDREJ SKOF

**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Final Measurement**

Meas Time: 1 s  
Margin: 20 dB  
Subranges: 1

| Trace | Frequency        | Level (dB $\mu$ V/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------------|------------|----------------|
| 1     | 13.560000000 MHz | 54.39                | Quasi Peak | -15.11         |

**C20171222**

03.May 17 13:59

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING  
**Operator** ANDREJ SKOF

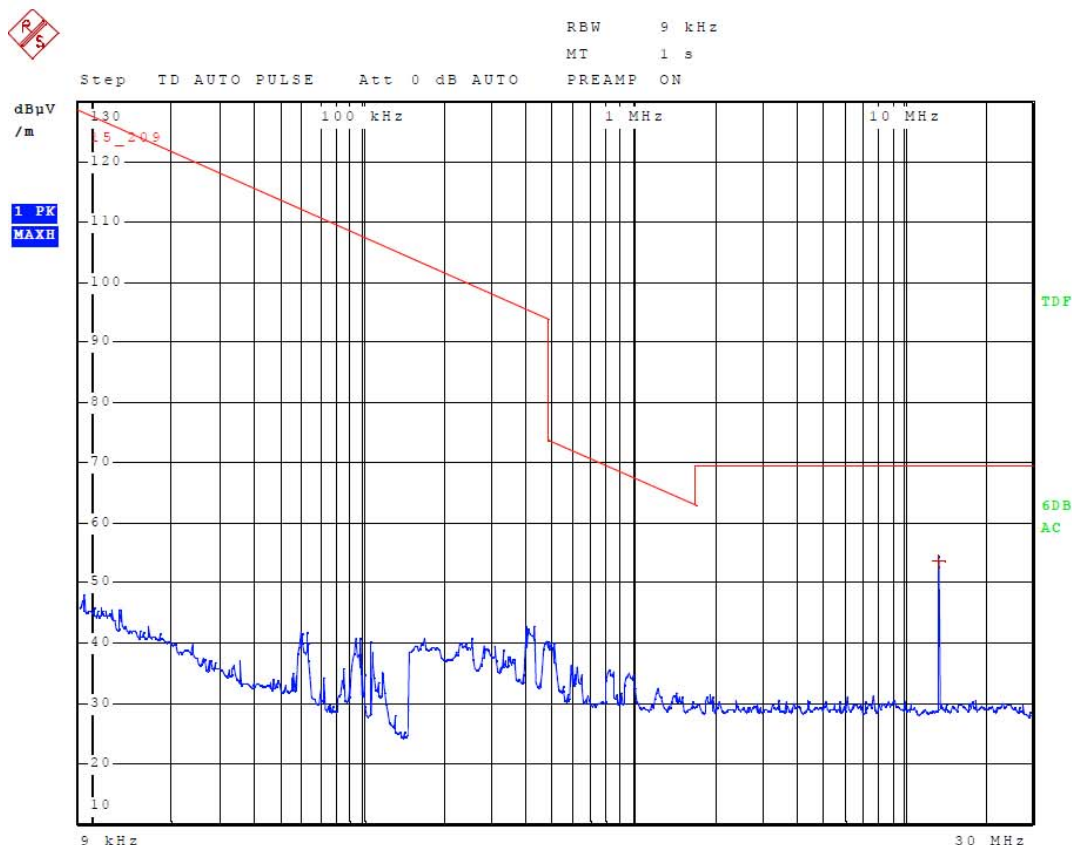
**Test Spec**

Antenna: 0 deg, Sample: 0 deg

**Time Domain Scan (2 Ranges)**

Scan Start: 9 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK  
 Transducer: HFH2-Z2V

| Start Frequency | Stop Frequency | Step Size | Res BW    | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|-----------|-----------|----------|--------|--------|
| 9.000000 kHz    | 149.950000 kHz | 50.00 Hz  | 200.00 Hz | 300 ms    | Auto     | 20 dB  | INPUT2 |
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz  | 30 ms     | Auto     | 20 dB  | INPUT2 |



**ROHDE & SCHWARZ****C20171222**

03.May 17 13:59

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition WAITING  
Operator ANDREJ SKOF

**Test Spec**

Antenna: 0 deg, Sample: 0 deg

**Final Measurement**

Meas Time: 1 s  
Margin: 20 dB  
Subranges: 1

| Trace | Frequency        | Level (dB $\mu$ V/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------------|------------|----------------|
| 1     | 13.560000000 MHz | 53.59                | Quasi Peak | -15.91         |

**C20171222**

03.May 17 14:12

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING  
**Operator** ANDREJ SKOF

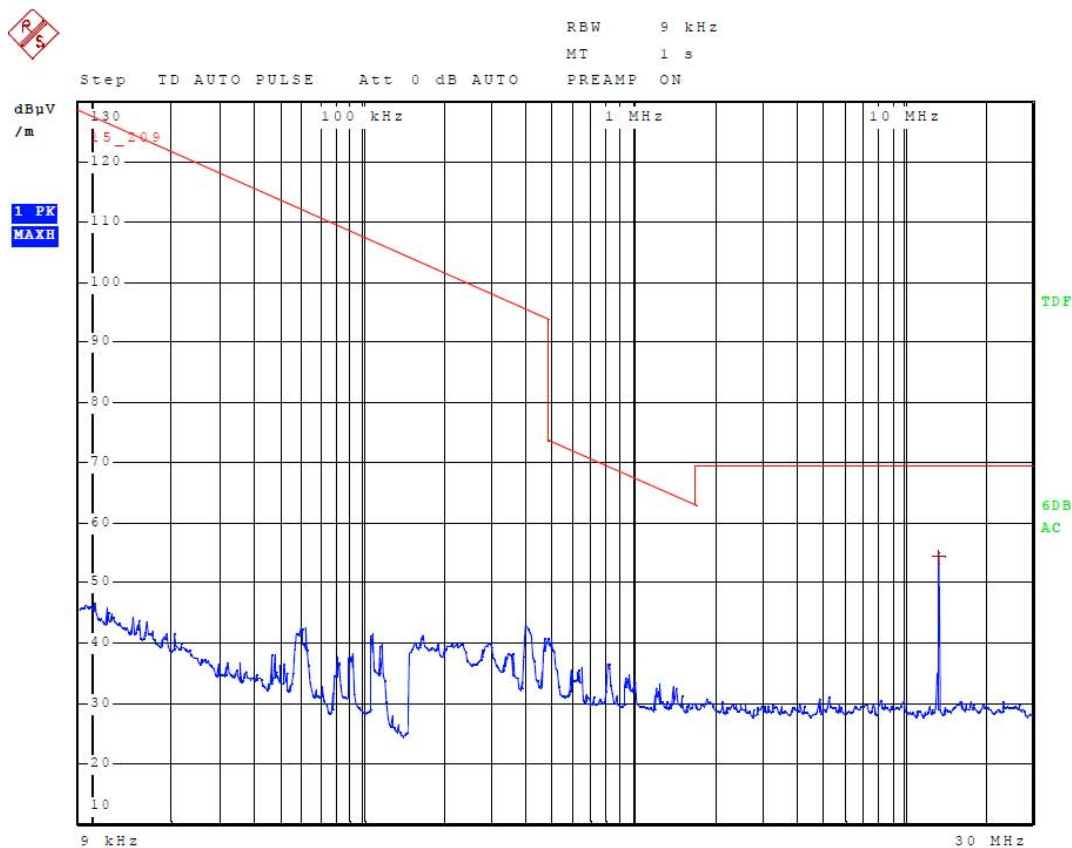
**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Time Domain Scan (2 Ranges)**

Scan Start: 9 kHz  
 Scan Stop: 30 MHz  
 Detector: Trace 1: MAX PEAK  
 Transducer: HFH2-Z2V

| Start Frequency | Stop Frequency | Step Size | Res BW    | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|-----------|-----------|----------|--------|--------|
| 9.000000 kHz    | 149.950000 kHz | 50.00 Hz  | 200.00 Hz | 300 ms    | Auto     | 20 dB  | INPUT2 |
| 150.000000 kHz  | 30.000000 MHz  | 2.25 kHz  | 9.00 kHz  | 30 ms     | Auto     | 20 dB  | INPUT2 |



**ROHDE & SCHWARZ****C20171222**

03.May 17 14:12

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition WAITING  
Operator ANDREJ SKOF

**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Final Measurement**

Meas Time: 1 s  
Margin: 20 dB  
Subranges: 1

| Trace | Frequency        | Level (dB $\mu$ V/m) | Detector   | Delta Limit/dB |
|-------|------------------|----------------------|------------|----------------|
| 1     | 13.560000000 MHz | 54.29                | Quasi Peak | -15.21         |



## Final measurement at 10 m on OATS

| Results with measuring distance of 10 m |                 |                               |                      |             |
|-----------------------------------------|-----------------|-------------------------------|----------------------|-------------|
| Mode                                    | Frequency (MHz) | Measured value (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| Reading                                 | 13.56           | 37.65                         | 104.00               | 66.35       |
| Waiting                                 | 13.56           | 37.49                         | 104.00               | 66.51       |

| Calculated value from 10 m to 30 m |                 |                                       |                                          |                                         |                              |             |
|------------------------------------|-----------------|---------------------------------------|------------------------------------------|-----------------------------------------|------------------------------|-------------|
| Mode                               | Frequency (MHz) | Measured value at 10 m (dB $\mu$ V/m) | Correction factor from 10 m to 30 m (dB) | Calculated value at 30 m (dB $\mu$ V/m) | Limit at 30 m (dB $\mu$ V/m) | Margin (dB) |
| Reading                            | 13.56           | 37.65                                 | 20                                       | 17.65                                   | 84.00                        | 66.35       |
| Waiting                            | 13.56           | 37.49                                 | 20                                       | 17.49                                   | 84.00                        | 66.51       |

**NOTE:** Antenna factor and cable loss are included in measurement correction.

Final measurements from 30 MHz to 1 GHz



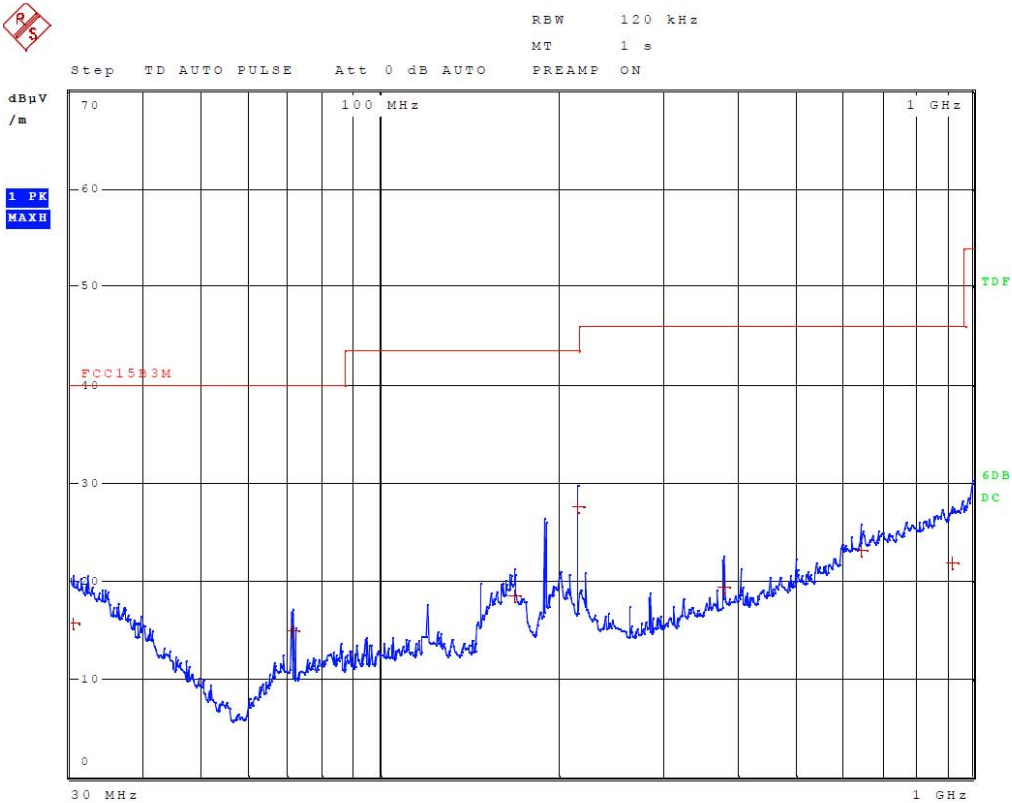
**C20171222**

Meas Type                    RADIATED EMISSION  
 Equipment under Test    ST25R391B-DISCO  
 Manufacturer            STMicroelectronics Austria GmbH  
 OP Condition            STANDBY  
 Operator                 ANDREJ SKOF  
 Test Spec  
 VERTICAL 100 cm, 270 deg

**Time Domain Scan (1 Range)**

Scan Start:            30 MHz  
 Scan Stop:            1 GHz  
 Detector:             Trace 1: MAX PEAK  
 Transducer:          S2\_HL562

| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 5 ms      | Auto     | 20 dB  | INPUT2 |



**C20171222**

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** STANDBY  
**Operator** ANDREJ SKOF

**Test Spec**  
 VERTICAL 100 cm, 270 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 25 dB  
**Subranges:** 7

| Trace | Frequency         | Level (dB $\mu$ V/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------------|------------|----------------|
| 1     | 215.970000000 MHz | 27.55                | Quasi Peak | -15.95         |
| 1     | 648.030000000 MHz | 23.09                | Quasi Peak | -22.91         |
| 1     | 924.900000000 MHz | 21.91                | Quasi Peak | -24.09         |
| 1     | 30.330000000 MHz  | 15.61                | Quasi Peak | -24.39         |
| 1     | 168.000000000 MHz | 18.45                | Quasi Peak | -25.05         |
| 1     | 71.280000000 MHz  | 14.86                | Quasi Peak | -25.14         |
| 1     | 380.340000000 MHz | 19.41                | Quasi Peak | -26.59         |



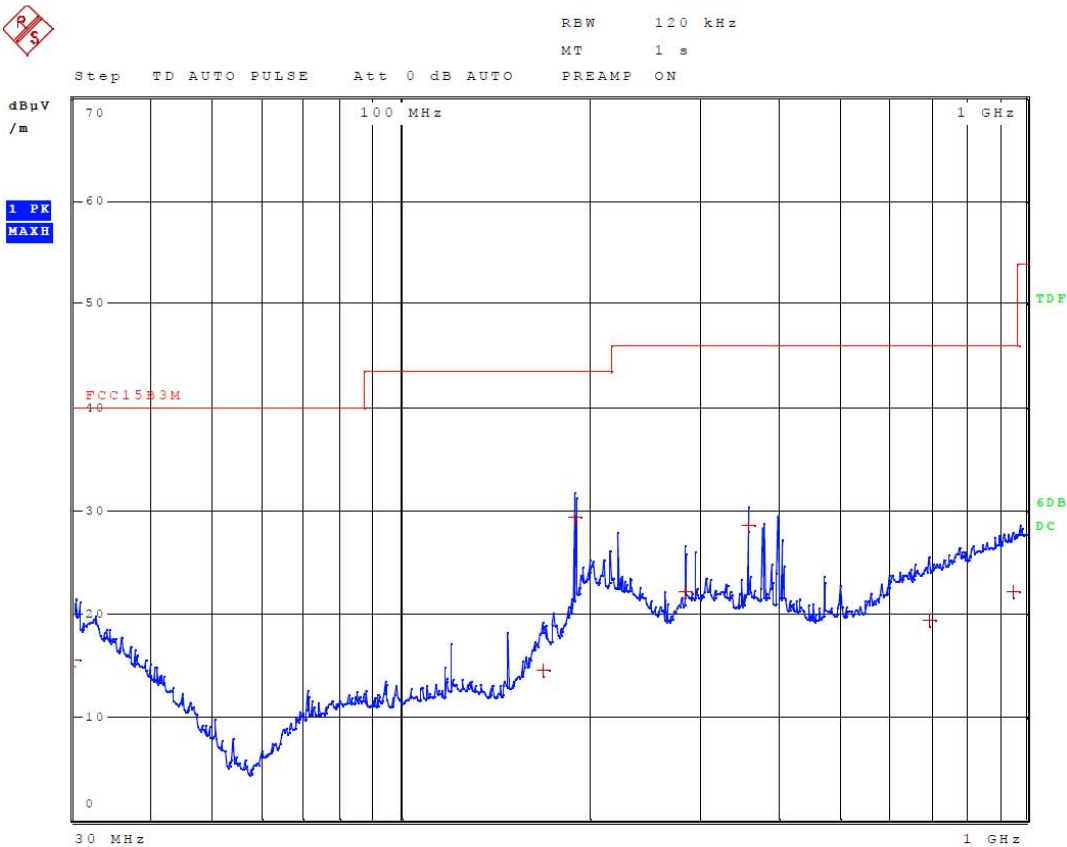
C20171222

Meas Type RADIATED EMISSION  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition STANDBY  
Operator ANDREJ SKOF  
Test Spec  
HORIZONTAL 100 cm, 90 deg

Time Domain Scan (1 Range)

Scan Start: 30 MHz  
Scan Stop: 1 GHz  
Detector: Trace 1: MAX PEAK  
Transducer: S2\_HL562

| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 5 ms      | Auto     | 20 dB  | INPUT2 |



**C20171222**

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** STANDBY  
**Operator** ANDREJ SKOF

**Test Spec**  
 HORIZONTAL 100 cm, 90 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 25 dB  
**Subranges:** 7

| Trace | Frequency         | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------|------------|----------------|
| 1     | 189.180000000 MHz | 29.36          | Quasi Peak | -14.14         |
| 1     | 360.000000000 MHz | 28.66          | Quasi Peak | -17.34         |
| 1     | 283.710000000 MHz | 22.12          | Quasi Peak | -23.88         |
| 1     | 948.480000000 MHz | 22.07          | Quasi Peak | -23.93         |
| 1     | 30.060000000 MHz  | 15.51          | Quasi Peak | -24.49         |
| 1     | 699.090000000 MHz | 19.28          | Quasi Peak | -26.72         |
| 1     | 168.480000000 MHz | 14.47          | Quasi Peak | -29.03         |


**ROHDE & SCHWARZ**
**C20171222**

27.Apr 17 10:06

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING A TAG  
**Operator** Andrej Skof  
**Test Spec**  
 VERTICAL 100 cm, 0 deg

**Time Domain Scan (1 Range)**

**Scan Start:** 30 MHz  
**Scan Stop:** 1 GHz  
**Detector:** Trace 1: MAX PEAK  
**Transducer:** 3142B-3M

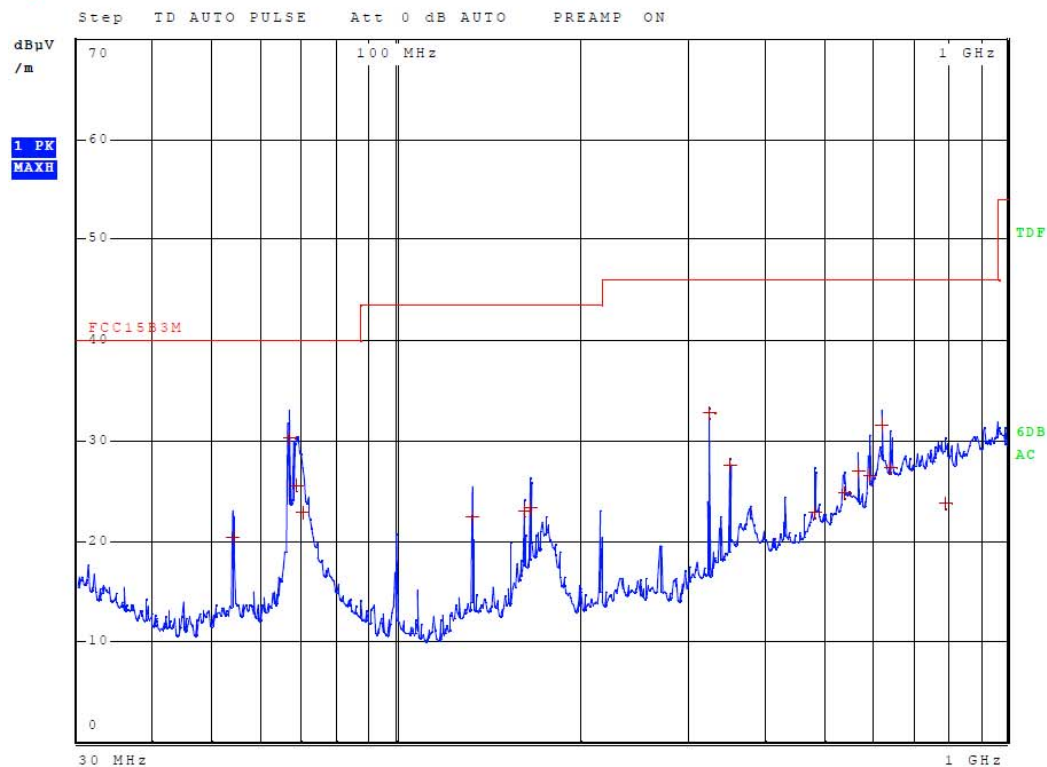
| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 2 ms      | Auto     | 20 dB  | INPUT2 |



RBW 120 kHz

MT 1 s

PREAMP ON



**C20171222**

27.Apr 17 10:06

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING A TAG  
**Operator** Andrej Skof

**Test Spec**  
 VERTICAL 100 cm, 0 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 20 dB  
**Peaks:** 16

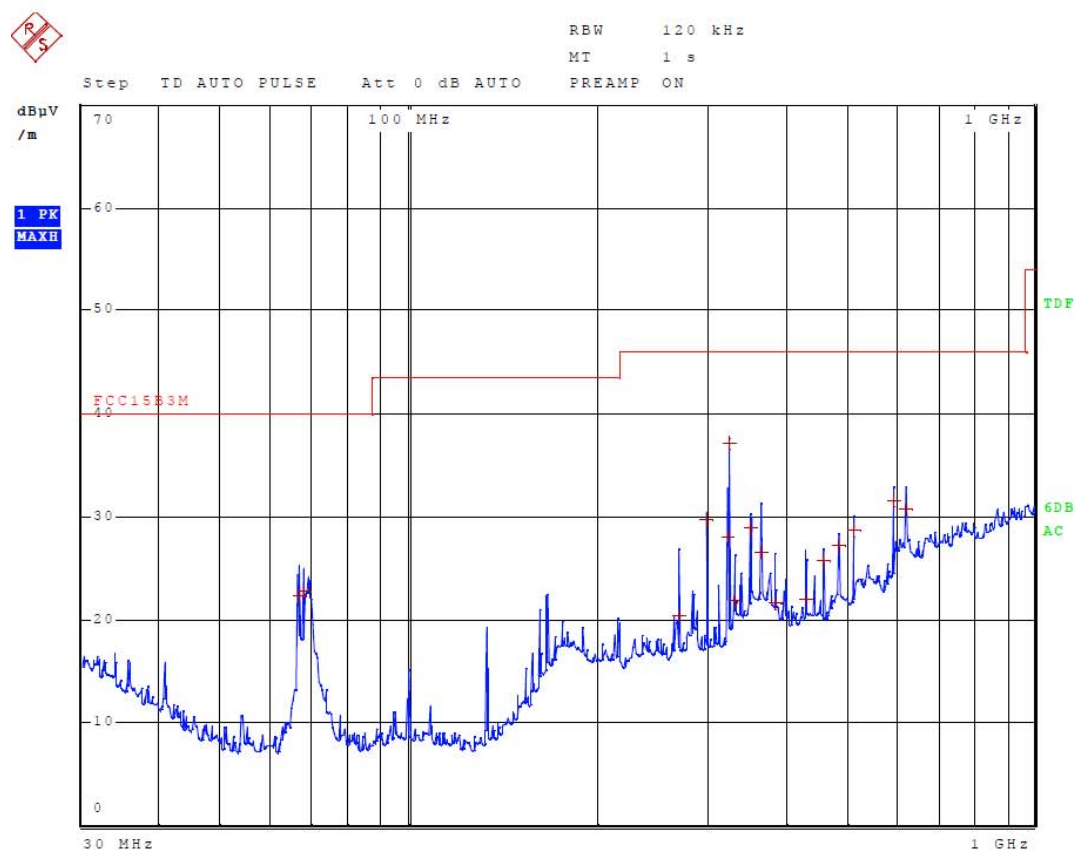
| Trace | Frequency         | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------|------------|----------------|
| 1     | 66.630000000 MHz  | 30.18          | Quasi Peak | -9.82          |
| 1     | 325.440000000 MHz | 32.79          | Quasi Peak | -13.21         |
| 1     | 623.760000000 MHz | 31.58          | Quasi Peak | -14.42         |
| 1     | 68.670000000 MHz  | 25.48          | Quasi Peak | -14.52         |
| 1     | 70.080000000 MHz  | 22.91          | Quasi Peak | -17.09         |
| 1     | 352.560000000 MHz | 27.60          | Quasi Peak | -18.40         |
| 1     | 646.500000000 MHz | 27.33          | Quasi Peak | -18.67         |
| 1     | 569.520000000 MHz | 26.94          | Quasi Peak | -19.06         |
| 1     | 594.930000000 MHz | 26.49          | Quasi Peak | -19.51         |
| 1     | 53.940000000 MHz  | 20.36          | Quasi Peak | -19.64         |
| 1     | 165.990000000 MHz | 23.31          | Quasi Peak | -20.19         |
| 1     | 162.060000000 MHz | 23.04          | Quasi Peak | -20.46         |
| 1     | 132.810000000 MHz | 22.45          | Quasi Peak | -21.05         |
| 1     | 542.430000000 MHz | 24.84          | Quasi Peak | -21.16         |
| 1     | 795.180000000 MHz | 23.75          | Quasi Peak | -22.25         |
| 1     | 484.860000000 MHz | 22.91          | Quasi Peak | -23.09         |

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING A TAG  
**Operator** Andrej Skof  
**Test Spec**  
 HORIZONTAL 100 cm, 0 deg

**Time Domain Scan (1 Range)**

**Scan Start:** 30 MHz  
**Scan Stop:** 1 GHz  
**Detector:** Trace 1: MAX PEAK  
**Transducer:** 3142B-3M

| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 2 ms      | Auto     | 20 dB  | INPUT2 |



**C20171222**

27.Apr 17 10:04

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING A TAG  
**Operator** Andrej Skof

**Test Spec**  
 HORIZONTAL 100 cm, 0 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 20 dB  
**Peaks:** 16

| Trace | Frequency         | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------|------------|----------------|
| 1     | 325.440000000 MHz | 37.20          | Quasi Peak | -8.80          |
| 1     | 596.640000000 MHz | 31.58          | Quasi Peak | -14.42         |
| 1     | 623.790000000 MHz | 30.63          | Quasi Peak | -15.37         |
| 1     | 298.320000000 MHz | 29.60          | Quasi Peak | -16.40         |
| 1     | 352.560000000 MHz | 28.95          | Quasi Peak | -17.05         |
| 1     | 67.800000000 MHz  | 22.70          | Quasi Peak | -17.30         |
| 1     | 515.280000000 MHz | 28.64          | Quasi Peak | -17.36         |
| 1     | 66.630000000 MHz  | 22.26          | Quasi Peak | -17.74         |
| 1     | 323.280000000 MHz | 28.04          | Quasi Peak | -17.96         |
| 1     | 488.160000000 MHz | 27.09          | Quasi Peak | -18.91         |
| 1     | 366.510000000 MHz | 26.53          | Quasi Peak | -19.47         |
| 1     | 461.040000000 MHz | 25.70          | Quasi Peak | -20.30         |
| 1     | 431.010000000 MHz | 21.92          | Quasi Peak | -24.08         |
| 1     | 331.980000000 MHz | 21.79          | Quasi Peak | -24.21         |
| 1     | 385.260000000 MHz | 21.62          | Quasi Peak | -24.38         |
| 1     | 270.390000000 MHz | 20.37          | Quasi Peak | -25.63         |

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING FOR A TAG  
**Operator** Andrej Skof  
**Test Spec**  
 VERTICAL 100 cm, 0 deg

**Time Domain Scan (1 Range)**

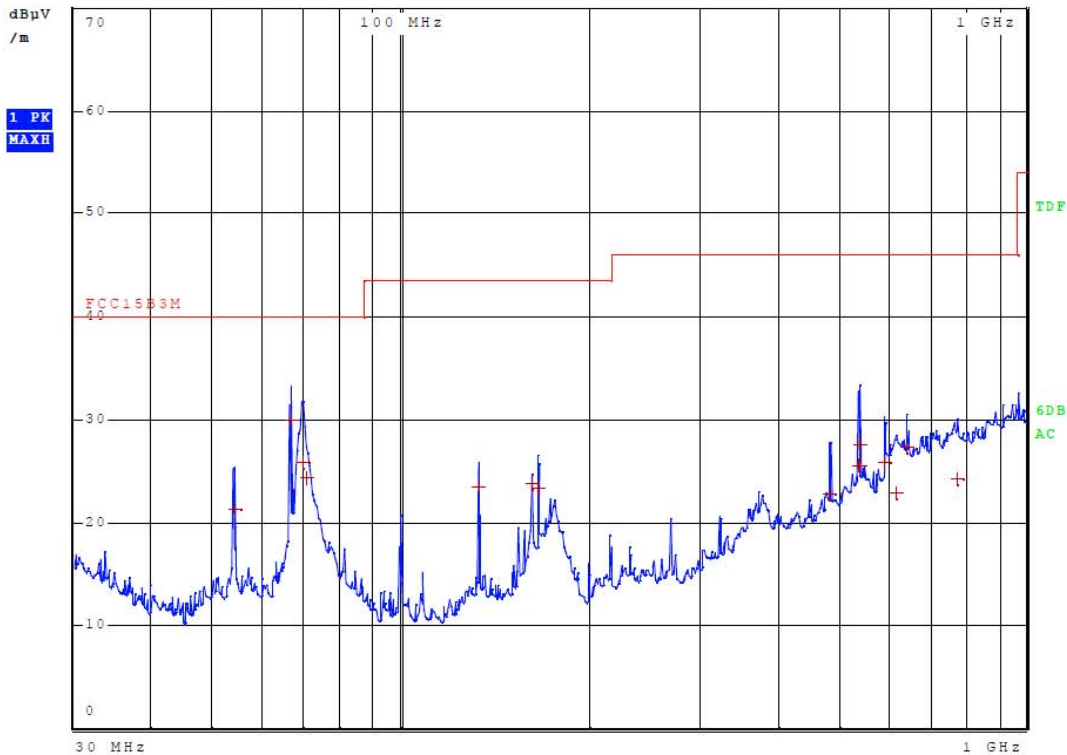
**Scan Start:** 30 MHz  
**Scan Stop:** 1 GHz  
**Detector:** Trace 1: MAX PEAK  
**Transducer:** 3142B-3M

| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 2 ms      | Auto     | 20 dB  | INPUT2 |



RBW 120 kHz  
 MT 1 s  
 PREAMP ON

Step TD AUTO PULSE Att 0 dB AUTO



**C20171222**

27.Apr 17 10:01

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING FOR A TAG  
**Operator** Andrej Skof

**Test Spec**  
 VERTICAL 100 cm, 0 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 20 dB  
**Peaks:** 15

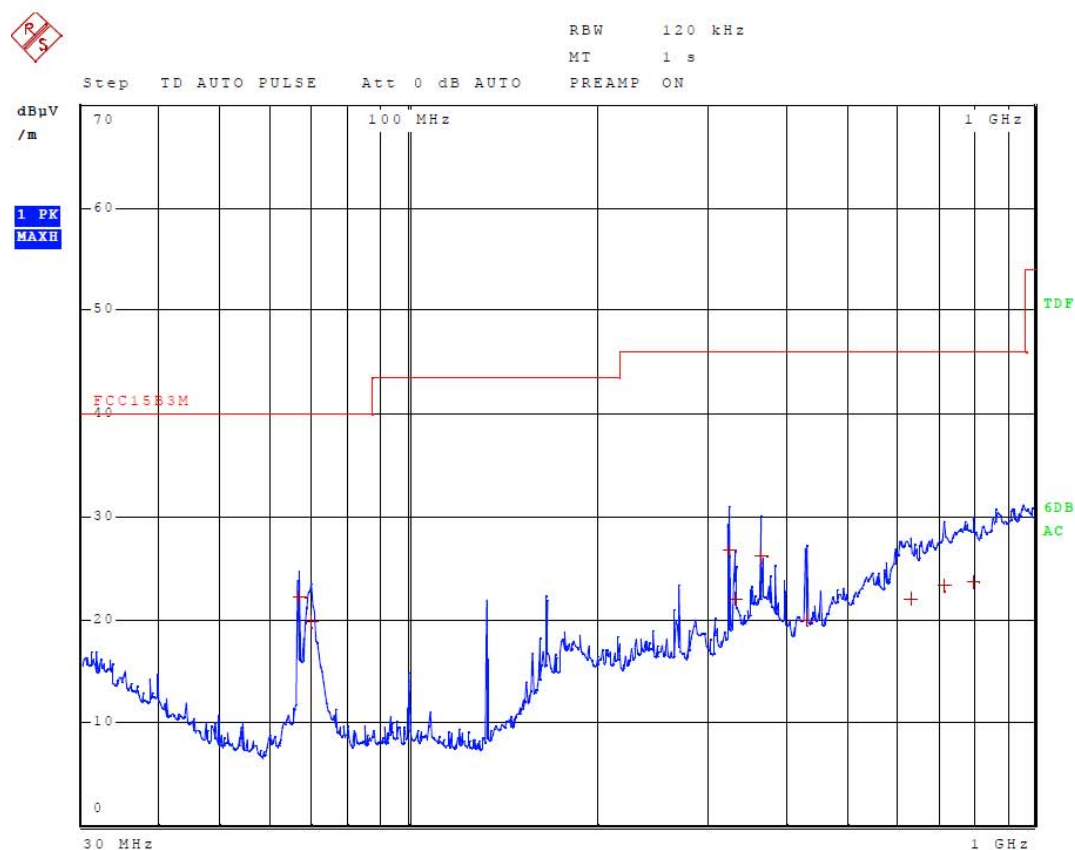
| Trace | Frequency         | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------|------------|----------------|
| 1     | 66.630000000 MHz  | 30.00          | Quasi Peak | -10.00         |
| 1     | 69.480000000 MHz  | 25.82          | Quasi Peak | -14.18         |
| 1     | 70.380000000 MHz  | 24.36          | Quasi Peak | -15.64         |
| 1     | 540.870000000 MHz | 27.52          | Quasi Peak | -18.48         |
| 1     | 646.470000000 MHz | 27.33          | Quasi Peak | -18.67         |
| 1     | 54.060000000 MHz  | 21.30          | Quasi Peak | -18.70         |
| 1     | 162.210000000 MHz | 23.70          | Quasi Peak | -19.80         |
| 1     | 132.810000000 MHz | 23.46          | Quasi Peak | -20.04         |
| 1     | 165.990000000 MHz | 23.34          | Quasi Peak | -20.16         |
| 1     | 592.560000000 MHz | 25.76          | Quasi Peak | -20.24         |
| 1     | 540.360000000 MHz | 25.51          | Quasi Peak | -20.49         |
| 1     | 539.580000000 MHz | 25.47          | Quasi Peak | -20.53         |
| 1     | 777.240000000 MHz | 24.24          | Quasi Peak | -21.76         |
| 1     | 620.910000000 MHz | 22.84          | Quasi Peak | -23.16         |
| 1     | 484.890000000 MHz | 22.75          | Quasi Peak | -23.25         |

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING FOR A TAG  
**Operator** Andrej Skof  
**Test Spec**  
 HORIZONTAL 100 cm, 0 deg

### Time Domain Scan (1 Range)

**Scan Start:** 30 MHz  
**Scan Stop:** 1 GHz  
**Detector:** Trace 1: MAX PEAK  
**Transducer:** 3142B-3M

| Start Frequency | Stop Frequency | Step Size | Res BW     | Meas Time | RF Atten | Preamp | Input  |
|-----------------|----------------|-----------|------------|-----------|----------|--------|--------|
| 30.000000 MHz   | 1.000000 GHz   | 30.00 kHz | 120.00 kHz | 2 ms      | Auto     | 20 dB  | INPUT2 |




**ROHDE & SCHWARZ**
**C20171222**

27.Apr 17 10:03

**Meas Type** RADIATED EMISSION  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING FOR A TAG  
**Operator** Andrej Skof

**Test Spec**  
 HORIZONTAL 100 cm, 0 deg

**Final Measurement**

**Meas Time:** 1 s  
**Margin:** 20 dB  
**Peaks:** 9

| Trace | Frequency         | Level (dBμV/m) | Detector   | Delta Limit/dB |
|-------|-------------------|----------------|------------|----------------|
| 1     | 66.600000000 MHz  | 22.15          | Quasi Peak | -17.85         |
| 1     | 324.480000000 MHz | 26.67          | Quasi Peak | -19.33         |
| 1     | 365.190000000 MHz | 26.03          | Quasi Peak | -19.97         |
| 1     | 69.600000000 MHz  | 19.75          | Quasi Peak | -20.25         |
| 1     | 798.990000000 MHz | 23.59          | Quasi Peak | -22.41         |
| 1     | 719.190000000 MHz | 23.30          | Quasi Peak | -22.70         |
| 1     | 635.910000000 MHz | 22.03          | Quasi Peak | -23.97         |
| 1     | 333.180000000 MHz | 21.92          | Quasi Peak | -24.08         |
| 1     | 432.780000000 MHz | 19.88          | Quasi Peak | -26.12         |

## **4.6 Bandwidth of the emission (§15.215)**

### **4.6.1 Requirements**

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through 15.257 and in subpart E of FCC Part 15, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### **4.6.2 Test procedure**

1. As per Clause 6.9.2 from ANSI C63.10-2013
2. The EUT is placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
3. The EUT is set 3 m away from the interference-receiving antenna.
4. Resolution bandwidth is set to a value greater than 5% of the allowed bandwidth.

## 4.6.3 Test results

Device passed the requirements stated



ROHDE &amp; SCHWARZ

**C20171222**

03.May 17 14:25

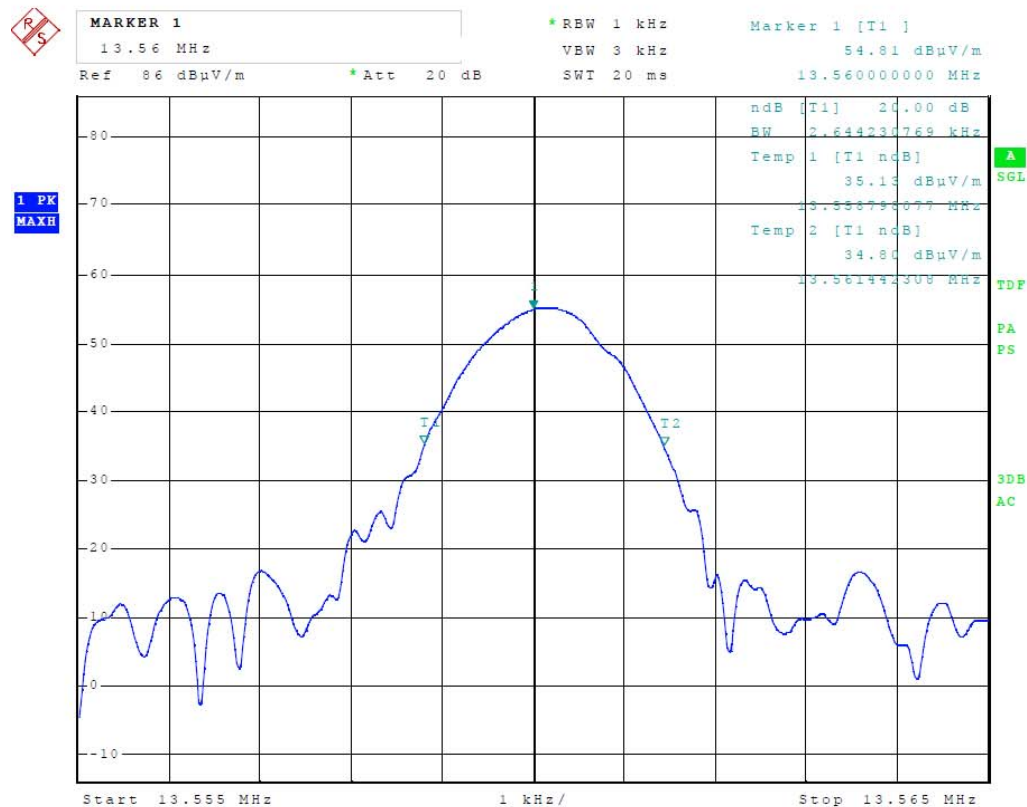
**Meas Type** OCCUPIED BANDWIDTH  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** READING  
**Operator** ANDREJ SKOF

**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Sweep Settings Screen A**

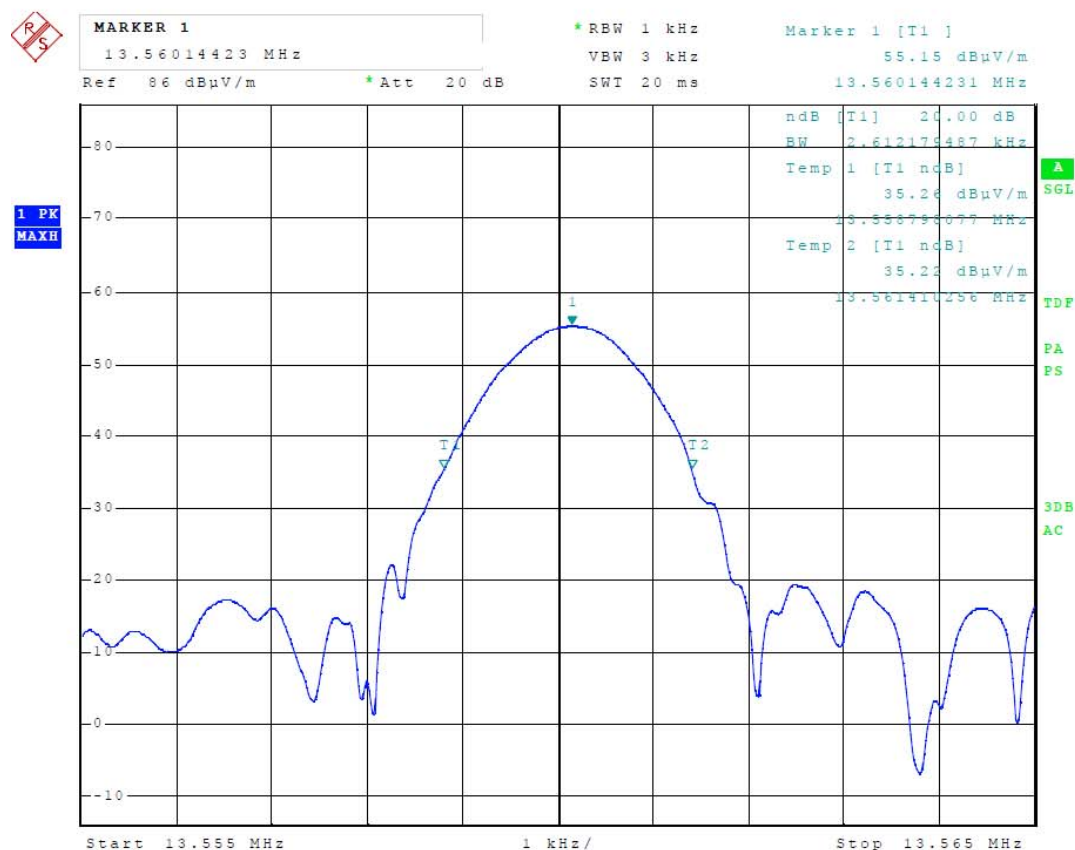
|                  |               |                  |               |
|------------------|---------------|------------------|---------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 86.000 dBuV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB      |
| Span             | 10.000000 kHz | Ref Position     | 100.000 %     |
| Start Frequency  | 13.555000 MHz | Level Range      | 100.000 dB    |
| Stop Frequency   | 13.565000 MHz | RF Att           | 20.000 dB     |
| RBW              | 1.000000 kHz  |                  |               |
| VBW              | 3.000000 kHz  | X-Axis           | LIN           |
| Sweep Time       | 20.00 ms      | Y-Axis           | LOG           |



**Meas Type** OCCUPIED BANDWIDTH  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING  
**Operator** ANDREJ SKOF  
**Test Spec**  
 Antenna: 340 deg, Sample: 20 deg

## Sweep Settings Screen A

|                  |               |                  |               |
|------------------|---------------|------------------|---------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 86.000 dBuV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB      |
| Span             | 10.000000 kHz | Ref Position     | 100.000 %     |
| Start Frequency  | 13.555000 MHz | Level Range      | 100.000 dB    |
| Stop Frequency   | 13.565000 MHz | RF Att           | 20.000 dB     |
| RBW              | 1.000000 kHz  |                  |               |
| VBW              | 3.000000 kHz  | X-Axis           | LIN           |
| Sweep Time       | 20.00 ms      | Y-Axis           | LOG           |



| Frequency (MHz) | Permitted frequency band (MHz) | 20 dB bandwidth (kHz) | PASS/FAIL |
|-----------------|--------------------------------|-----------------------|-----------|
| 13.56           | 13.110 – 14.010                | 2.64                  | PASS      |



## **4.7 Spectrum mask (§15.225 (a)-(d) of FCC 47 CRF 15 and Annex B.6 of RSS-210 issue 9)**

### **4.7.1 Requirements**

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

### **4.7.2 Test procedure**

1. As per clause 6.4 from ANSI C63.10-2013
2. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
3. The EUT was set 3 m away from the interference-receiving antenna.
4. Frequencies with maximum emission were retested on OATS.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

### 4.7.3 Test results

Device passed the requirements stated



**C20171222**

03.May 17 14:21

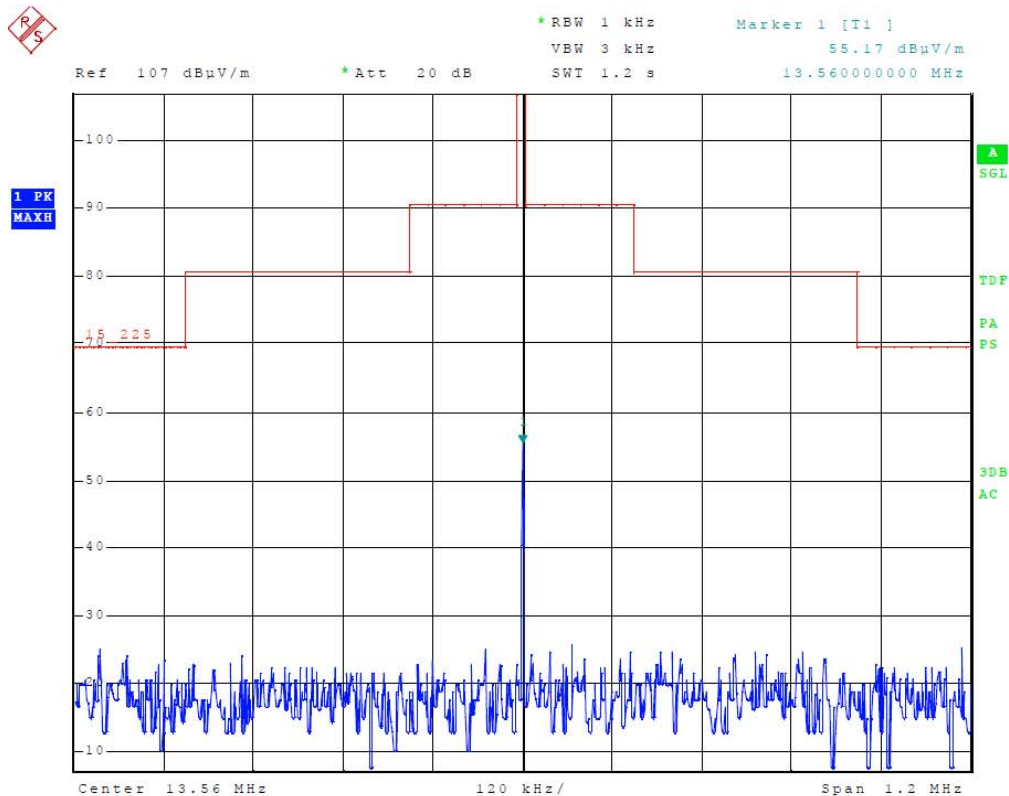
Meas Type SPECTRUM MASK  
Equipment under Test ST25R391B-DISCO  
Manufacturer STMicroelectronics Austria GmbH  
OP Condition READING  
Operator ANDREJ SKOF

#### Test Spec

Antenna: 340 deg, Sample: 20 deg

#### Sweep Settings Screen A

|                  |               |                  |                |
|------------------|---------------|------------------|----------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 107.000 dBμV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB       |
| Span             | 1.200000 MHz  | Ref Position     | 100.000 %      |
| Start Frequency  | 12.960000 MHz | Level Range      | 100.000 dB     |
| Stop Frequency   | 14.160000 MHz | RF Att           | 20.000 dB      |
| RBW              | 1.000000 kHz  |                  |                |
| VBW              | 3.000000 kHz  | X-Axis           | LIN            |
| Sweep Time       | 1.20 s        | Y-Axis           | LOG            |



**C20171222**

03.May 17 14:20

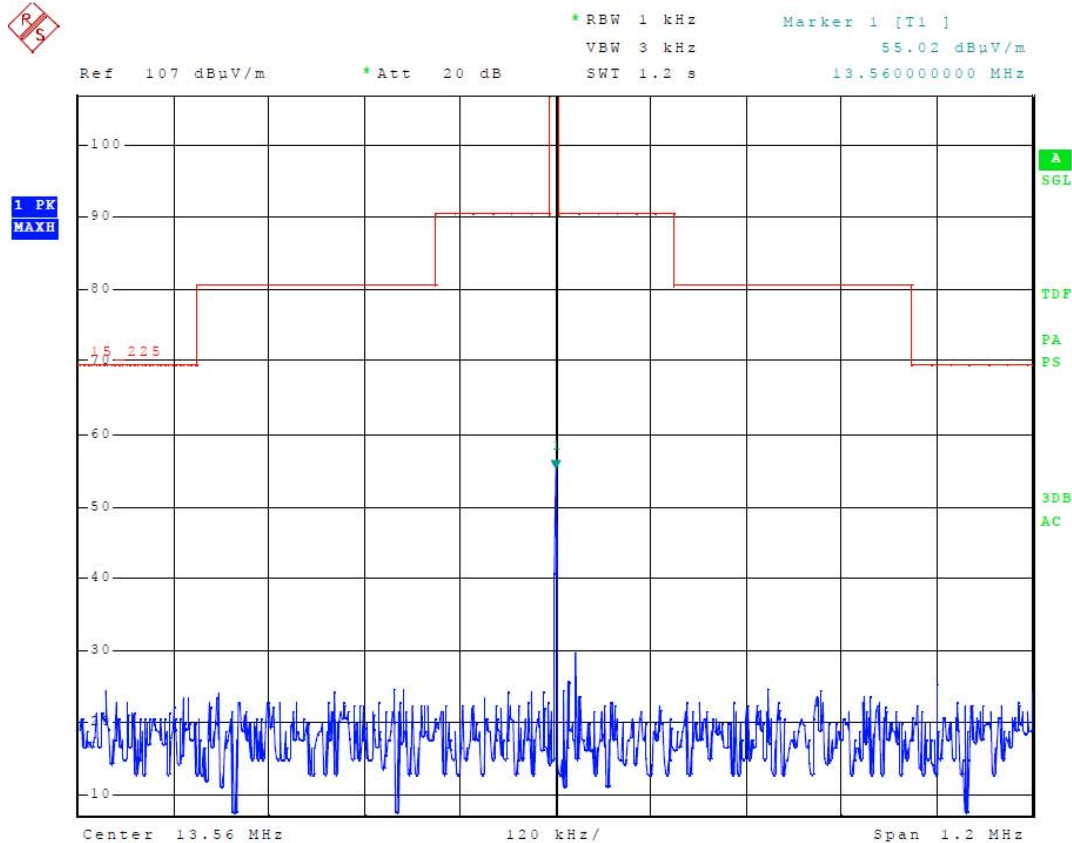
**Meas Type** SPECTRUM MASK  
**Equipment under Test** ST25R391B-DISCO  
**Manufacturer** STMicroelectronics Austria GmbH  
**OP Condition** WAITING  
**Operator** ANDREJ SKOF

**Test Spec**

Antenna: 340 deg, Sample: 20 deg

**Sweep Settings Screen A**

|                  |               |                  |                |
|------------------|---------------|------------------|----------------|
| Center Frequency | 13.560000 MHz | Ref Level        | 107.000 dBuV/m |
| Frequency Offset | 0.000000 Hz   | Ref Level Offset | 0.000 dB       |
| Span             | 1.200000 MHz  | Ref Position     | 100.000 %      |
| Start Frequency  | 12.960000 MHz | Level Range      | 100.000 dB     |
| Stop Frequency   | 14.160000 MHz | RF Att           | 20.000 dB      |
| RBW              | 1.000000 kHz  |                  |                |
| VBW              | 3.000000 kHz  | X-Axis           | LIN            |
| Sweep Time       | 1.20 s        | Y-Axis           | LOG            |



## **4.8 Frequency tolerance of the carrier signal (§15.225 (e))**

### **4.8.1 Requirement**

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### **4.8.2 Test procedure**

1. As per clause 6.8 from ANSI C63.10-2013.
2. The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.
3. If the EUT provides an antenna connector the spectrum analyzer is connected to this port. In cases where the EUT does not provide an antenna connector a test fixture is used.
4. The peak detector of the spectrum analyzer is selected and the resolution bandwidth as well as the video bandwidth is set to values appropriate to the shape of the spectrum of the EUT.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.



#### 4.8.3 Test results

Device passed the requirements stated

| Temperature (°C) | Supply voltage (V DC) | Minutes after switch on | Measured Frequency (MHz) | Allowed tolerance (kHz) | Measured tolerance (kHz) | RESULT |
|------------------|-----------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------|
| 50               | 5,00                  | 0                       | 13,560116800             | Fref±1.356 kHz          | -0,059                   | PASS   |
| 50               | 5,00                  | 2                       | 13,560117800             | Fref±1.356 kHz          | -0,058                   | PASS   |
| 50               | 5,00                  | 5                       | 13,560120800             | Fref±1.356 kHz          | -0,055                   | PASS   |
| 50               | 5,00                  | 10                      | 13,560121800             | Fref±1.356 kHz          | -0,054                   | PASS   |
| 40               | 5,00                  | 0                       | 13,560127800             | Fref±1.356 kHz          | -0,048                   | PASS   |
| 40               | 5,00                  | 2                       | 13,560117800             | Fref±1.356 kHz          | -0,058                   | PASS   |
| 40               | 5,00                  | 5                       | 13,560117800             | Fref±1.356 kHz          | -0,058                   | PASS   |
| 40               | 5,00                  | 10                      | 13,560118800             | Fref±1.356 kHz          | -0,057                   | PASS   |
| 30               | 5,00                  | 0                       | 13,560159700             | Fref±1.356 kHz          | -0,016                   | PASS   |
| 30               | 5,00                  | 2                       | 13,560134800             | Fref±1.356 kHz          | -0,041                   | PASS   |
| 30               | 5,00                  | 5                       | 13,560134800             | Fref±1.356 kHz          | -0,041                   | PASS   |
| 30               | 5,00                  | 10                      | 13,560126800             | Fref±1.356 kHz          | -0,049                   | PASS   |
| 20               | 4,25                  | 0                       | 13,560188700             | Fref±1.356 kHz          | 0,013                    | PASS   |
| 20               | 4,25                  | 2                       | 13,560177700             | Fref±1.356 kHz          | 0,002                    | PASS   |
| 20               | 4,25                  | 5                       | 13,560174700             | Fref±1.356 kHz          | -0,001                   | PASS   |
| 20               | 4,25                  | 10                      | 13,560174700             | Fref±1.356 kHz          | -0,001                   | PASS   |
| 20               | 5,00                  | 0                       | 13,560194800             | Fref±1.356 kHz          | 0,019                    | PASS   |
| 20               | 5,00                  | 2                       | 13,560182800             | Fref±1.356 kHz          | 0,007                    | PASS   |
| 20               | 5,00                  | 5                       | 13,560177800             | Fref±1.356 kHz          | 0,002                    | PASS   |
| 20               | 5,00                  | 10                      | 13,560175800             | Fref                    | 0,000                    | PASS   |
| 20               | 5,75                  | 0                       | 13,560198700             | Fref±1.356 kHz          | 0,023                    | PASS   |
| 20               | 5,75                  | 2                       | 13,560180700             | Fref±1.356 kHz          | 0,005                    | PASS   |
| 20               | 5,75                  | 5                       | 13,560175700             | Fref±1.356 kHz          | 0,000                    | PASS   |
| 20               | 5,75                  | 10                      | 13,560174700             | Fref±1.356 kHz          | -0,001                   | PASS   |
| 10               | 5,00                  | 0                       | 13,560245994             | Fref±1.356 kHz          | 0,070                    | PASS   |
| 10               | 5,00                  | 2                       | 13,560229167             | Fref±1.356 kHz          | 0,053                    | PASS   |
| 10               | 5,00                  | 5                       | 13,560223558             | Fref±1.356 kHz          | 0,048                    | PASS   |
| 10               | 5,00                  | 10                      | 13,560220353             | Fref±1.356 kHz          | 0,045                    | PASS   |
| 0                | 5,00                  | 0                       | 13,560255609             | Fref±1.356 kHz          | 0,080                    | PASS   |
| 0                | 5,00                  | 2                       | 13,560250000             | Fref±1.356 kHz          | 0,074                    | PASS   |
| 0                | 5,00                  | 5                       | 13,560245192             | Fref±1.356 kHz          | 0,069                    | PASS   |
| 0                | 5,00                  | 10                      | 13,560250000             | Fref±1.356 kHz          | 0,074                    | PASS   |
| -10              | 5,00                  | 0                       | 13,560244833             | Fref±1.356 kHz          | 0,069                    | PASS   |
| -10              | 5,00                  | 2                       | 13,560253647             | Fref±1.356 kHz          | 0,078                    | PASS   |
| -10              | 5,00                  | 5                       | 13,560256051             | Fref±1.356 kHz          | 0,080                    | PASS   |
| -10              | 5,00                  | 10                      | 13,560256051             | Fref±1.356 kHz          | 0,080                    | PASS   |
| -20              | 5,00                  | 0                       | 13,560215987             | Fref±1.356 kHz          | 0,040                    | PASS   |
| -20              | 5,00                  | 2                       | 13,560243231             | Fref±1.356 kHz          | 0,067                    | PASS   |
| -20              | 5,00                  | 5                       | 13,560244833             | Fref±1.356 kHz          | 0,069                    | PASS   |
| -20              | 5,00                  | 10                      | 13,560244032             | Fref±1.356 kHz          | 0,068                    | PASS   |

## 5 TEST EQUIPMENT

| Manufacturer & Description                          | Model No.   | SIQ No.       | Last Calibration | Next Calibration | Used |
|-----------------------------------------------------|-------------|---------------|------------------|------------------|------|
| ETS,<br>Anechoic chamber                            | RFD-F/A-100 | 103949        | 2015-11          | 2017-11          | X    |
| Rohde & Schwarz,<br>RFI test receiver               | ESU8        | 105187        | 2015-11          | 2017-11          | X    |
| Rohde & Schwarz,<br>RFI receiver                    | ESU26       | 106897        | 2016-02          | 2018-02          | /    |
| EMCO, Antenna                                       | 3142B       | 104351        | 2015-09          | 2017-09          | X    |
| EMCO, Antenna                                       | 3115        | 103002        | 2015-09          | 2017-09          | /    |
| Rohde & Schwarz,<br>Test Probe Antenna              | HFH2-Z4     | SN:879743/12  | N/A              | NA               | X    |
| Rohde & Schwarz,<br>Loop Antenna                    | HFH2-Z2     | SN: 879605/15 | 2015-09          | 2017-09          | X    |
| Heinrich Deisel, Turn table                         | DS 420.00   | 103337        | N/A              | NA               | X    |
| ETS, Antenna tower                                  | 2175        | /             | N/A              | NA               | X    |
| ETS, Controller for turn table<br>and antenna tower | 2090        | /             | N/A              | NA               | X    |
| Rohde & Schwarz,<br>Artificial main network         | ESH 2-Z5    | 106899        | 2015-05          | 2017-05          | X    |
| Rohde & Schwarz,<br>Artificial main network         | ENV216      | 106765        | 2016-09          | 2018-09          | /    |
| Rohde & Schwarz,<br>Current probe                   | EZ-17       | 106862        | 2016-11          | 2018-11          | /    |
| Schwarzbeck,<br>High voltage probe                  | TK 9420     | 106898        | 2015-05          | 2017-05          | /    |
| Kambič,<br>Temperature chamber                      | I-190 CK    | 107298        | N/A              | NA               | X    |
| Iskra, DC power source                              | MA 4181     | IKM 1790      | N/A              | NA               | X    |
| Fluke, Digital Multimeter                           | 179         | 2839652       | 2016-11          | 2018-11          | X    |
| Fluke, Digital Multimeter                           | 179         | 2839648       | 2016-11          | 2018-11          | X    |