



# TEST REPORT

**Test Report No. : UL-RPT-RP-13426466-516-FCC**

**Applicant** : Visteon Electronics Germany GmbH

**Model No.** : MEDIUM 5C\_21

**FCC ID** : 2AA98-MEDIUM5C21

**Technology** : RFID – 125 kHz

**Test Standard(s)** : FCC Parts 15.205,15.209(a),15.215

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Sercan, Usta  
Title: Laboratory Engineer  
Date: 17 September 2020

Approved by: Ajit, Phadtare  
Title: Lead Test Engineer  
Date: 17 September 2020



Deutsche  
Akkreditierungsstelle  
D-PL-19381-02-00

This laboratory is accredited by DAkkS.  
The tests reported herein have been performed in  
accordance with its' terms of accreditation.

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## **1. Customer Information**

### **1.1.Applicant Information**

|                                |                                            |
|--------------------------------|--------------------------------------------|
| <b>Company Name:</b>           | Visteon Electronics Germany GmbH           |
| <b>Company Address:</b>        | Visteonstrasse 4-10, Kerpen 50170, GERMANY |
| <b>Company Phone No.:</b>      | +49 02273 5950                             |
| <b>Company E-Mail:</b>         | info@visteon.com                           |
| <b>Contact Person:</b>         | Mr. Dominik Weiland                        |
| <b>Contact E-Mail Address:</b> | dweiland@visteon.com                       |
| <b>Contact Phone No.:</b>      | +49 721 4766 1624                          |

### **1.2.Manufacturer Information**

|                                |                                            |
|--------------------------------|--------------------------------------------|
| <b>Company Name:</b>           | Visteon Electronics Germany GmbH           |
| <b>Company Address:</b>        | Visteonstrasse 4-10, Kerpen 50170, GERMANY |
| <b>Company Phone No.:</b>      | +49 02273 5950                             |
| <b>Company E-Mail:</b>         | info@visteon.com                           |
| <b>Contact Person:</b>         | Mr. Dominik Weiland                        |
| <b>Contact E-Mail Address:</b> | dweiland@visteon.com                       |
| <b>Contact Phone No.:</b>      | +49 721 4766 1624                          |

## **2. Summary of Testing**

### **2.1. General Information**

#### **Applied Standards**

|                                 |                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Specification Reference:</b> | 47CFR15.205 and 47CFR15.209                                                                                                           |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications):<br>Part 15 Subpart C (Intentional Radiators) - Sections 15.205 and 15.209 |
| <b>Specification Reference:</b> | 47CFR15.215                                                                                                                           |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications):<br>Part 15 Subpart C (Intentional Radiators) - Sections 15.215            |

#### **Location**

|                                |                                                                                    |
|--------------------------------|------------------------------------------------------------------------------------|
| <b>Location of Testing:</b>    | UL International Germany GmbH<br>Hedelfinger Str. 61<br>70327 Stuttgart<br>Germany |
| <b>Test Firm Registration:</b> | 399704                                                                             |

#### **Date information**

|                      |                   |
|----------------------|-------------------|
| <b>Order Date:</b>   | 09 July 2020      |
| <b>EUT arrived:</b>  | 18 August 2020    |
| <b>Test Dates:</b>   | 04 September 2020 |
| <b>EUT returned:</b> | -/-               |

**2.2. Summary of Test Results**

| Clause            | Measurement                            | Complied                            | Did not comply           | Not performed            | Not applicable                      |
|-------------------|----------------------------------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|
| Part 15.207       | Transmitter AC Conducted Emissions     | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Part 15.215(c)    | Transmitter 20 dB Bandwidth            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| Part 15.209(a)    | Transmitter Fundamental Field Strength | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| Part 15.209(a)(c) | Transmitter Radiated Emissions         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

**Note(s):**

1. Not applicable the EUT will be powered via car DC battery.

**2.3. Methods and Procedures**

|                   |                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------|
| <b>Reference:</b> | ANSI C63.10-2013                                                                               |
| <b>Title:</b>     | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| <b>Reference:</b> | KDB 414788 D01 Radiated Test Site v01                                                          |
| <b>Title:</b>     | TEST SITES FOR RADIATED EMISSION MEASUREMENTS                                                  |

**2.4. Deviations from the Test Specification**

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

|                                   |                  |
|-----------------------------------|------------------|
| <b>Brand Name:</b>                | VISTEON          |
| <b>Model Name:</b>                | MEDIUM 5C_21     |
| <b>Test Sample Serial Number:</b> | 44048148         |
| <b>Hardware Version Number:</b>   | PWB25238         |
| <b>Software Version Number:</b>   | N/A              |
| <b>FCC ID:</b>                    | 2AA98-MEDIUM5C21 |

|                                     |                                                                              |
|-------------------------------------|------------------------------------------------------------------------------|
| <b>Antenna Reference:</b>           | Inductive Loop Coil Antenna                                                  |
| <b>Brand Name:</b>                  | HUF                                                                          |
| <b>Antenna Designation:</b>         | Mechanical Lock Coil                                                         |
| <b>Antenna Model Type:</b>          | NSS (BASIC) + WFS5c                                                          |
| <b>Antenna Nominal Inductivity:</b> | Typical =309 $\mu$ H ( $\pm$ 3%) (at $U_{rms}$ =0.5 V   F=125 kHz   T= 20°C) |
| <b>Part number:</b>                 | VW PN: 2G0.905.855                                                           |

#### **3.2. Description of EUT**

The EUT under test was an electronic instrument cluster Model Type: MEDIUM 5C\_21, with an immobilizer circuit consisting of inductive loop coil antenna interface to the immobilizer supporting RFID 125 kHz technology.

The EUT will be installed in various customized automotive housings & is intended to be supplied by a vehicle battery power system.

The product provides connections to additional sensors and control units via analog and digital inputs or a CAN bus interface. The immobilizer circuit provides connection to an external transponder coil for key authentication.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

|                                    |                                       |         |
|------------------------------------|---------------------------------------|---------|
| <b>Tested Technology:</b>          | Radio Frequency Identification (RFID) |         |
| <b>Category of Equipment:</b>      | Transceiver                           |         |
| <b>Channel Spacing:</b>            | Single channel device                 |         |
| <b>Transmit Frequency Range:</b>   | 125 kHz                               |         |
| <b>Nominal Transmit Frequency:</b> | 125 kHz                               |         |
| <b>Modulation Type:</b>            | ASK                                   |         |
| <b>Antenna Connection Type:</b>    | External                              |         |
| <b>Antenna Type:</b>               | Inductive Loop Coil Antenna           |         |
| <b>Power Supply Requirement:</b>   | $V_{nom}$                             | 12 V DC |
|                                    | $V_{min}$                             | 9 V DC  |
|                                    | $V_{max}$                             | 16 V DC |

**3.5. Support Equipment****A. Support Equipment (In-house)**

| Item | Description             | Brand Name        | Model Name or Number | Serial Number |
|------|-------------------------|-------------------|----------------------|---------------|
| 1    | Laboratory Power supply | Conrad Electronic | PS-2403D             | N/A           |

**B. Support Equipment (Manufacturer supplied)**

| Item | Description                                                                                                                      | Brand Name | Model Name or Number   | Serial Number |
|------|----------------------------------------------------------------------------------------------------------------------------------|------------|------------------------|---------------|
| 1    | Cable Bundle<br>DC Cable (1 m)<br>Can Cable (1 m)<br>Twisted Pair Cable Antenna Cable (1 m)<br>Twisted Pair Switch Cable (1.3 m) | Visteon    | Engineering prototypes | N/A           |

## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

The EUT was tested in the following operating mode(s):

☒ Cyclic test mode: Constant transmissions at 125 kHz with modulated carrier

### **4.2. Configuration and Peripherals**

The EUT was tested in the following configuration(s):

- The EUT was powered via DC power supply 12 V DC via Laboratory DC power supply.
- The customer provided test setup instructions 'Instruction guide MEDIUM 5C21.pptx' that were used to place the device into a required test mode.
- The EUT supports 3 test modes, which can be selected from the selector button which placed on the cable set.
- All tests were carried out in cyclic test mode: Permanent modulated carrier frequency at 125 kHz indicated by orange warning LED. The cluster reads the transponder ID once every 2 seconds.
- Before starting final radiated spurious emission measurements "worst case verification" with the EUT in Standing-position & Laying-position was performed by Lab.
- The EUT in Laying-position was found to be the worst case therefore this report includes relevant results.
- Radiated measurements below 30 MHz were performed with the EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 1 m.
- Radiated spurious emissions above 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- EMC32 V10.1.0 Software was used for the Radiated spurious emission measurements.

## **5. Measurements, Examinations and Derived Results**

### **5.1.General Comments**

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

## **5.2.Test Results**

### **5.2.1.Transmitter 20 dB Bandwidth**

#### **Test Summary:**

|                                   |             |                   |                   |
|-----------------------------------|-------------|-------------------|-------------------|
| <b>Test Engineer:</b>             | Sercan Usta | <b>Test Date:</b> | 04 September 2020 |
| <b>Test Sample Serial Number:</b> | 44048148    |                   |                   |
| <b>Test Site Identification</b>   | SR 9        |                   |                   |

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| <b>FCC Reference:</b>    | Part 15.215(c)                                                         |
| <b>Test Method Used:</b> | ANSI C63.10 Section 6.9.2<br>deviations in accordance with FCC Inquiry |

#### **Environmental Conditions:**

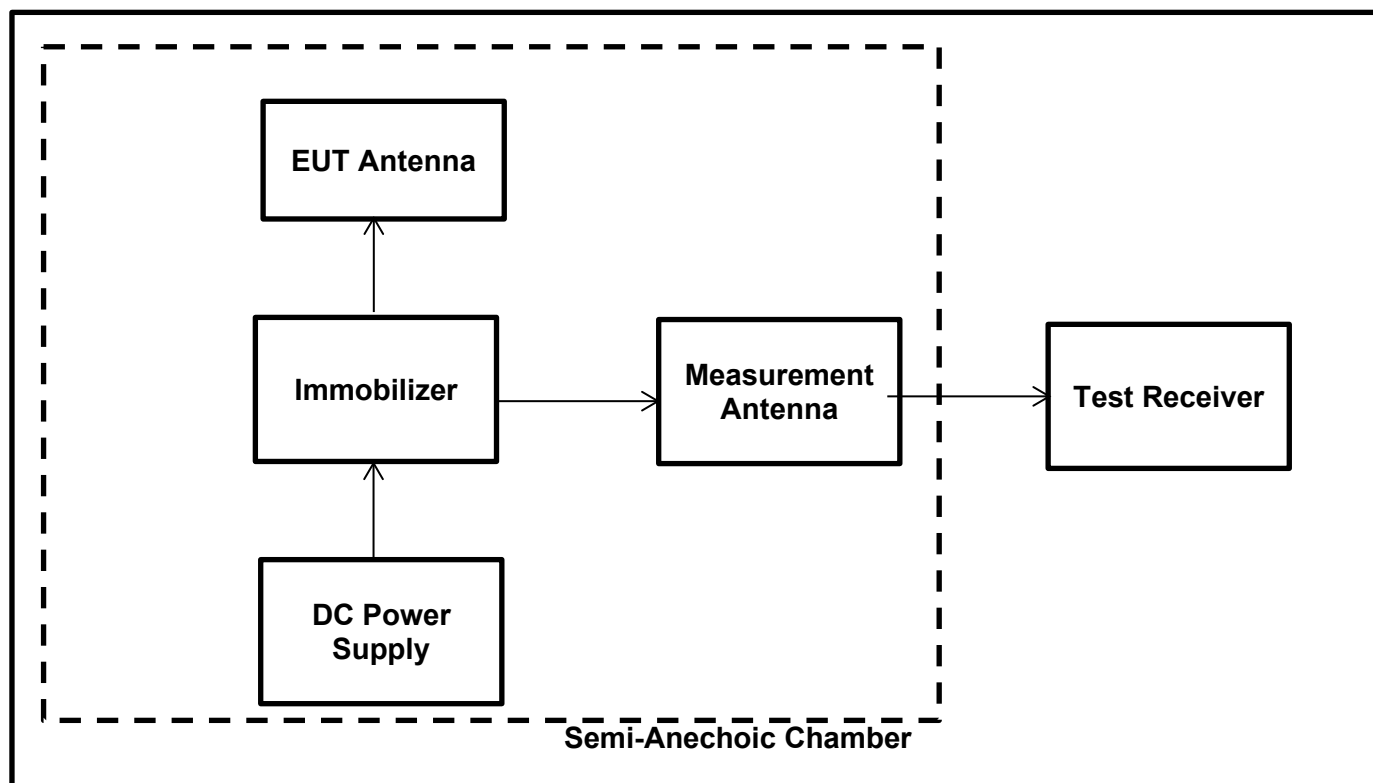
|                               |      |
|-------------------------------|------|
| <b>Temperature (°C):</b>      | 25.5 |
| <b>Relative Humidity (%):</b> | 44.8 |

#### **Settings of the Instrument:**

|                    |                |
|--------------------|----------------|
| <b>RBW/VBW:</b>    | 300 Hz / 1 kHz |
| <b>Span:</b>       | 50 kHz         |
| <b>Sweep Time:</b> | Auto           |
| <b>Detector:</b>   | Peak           |

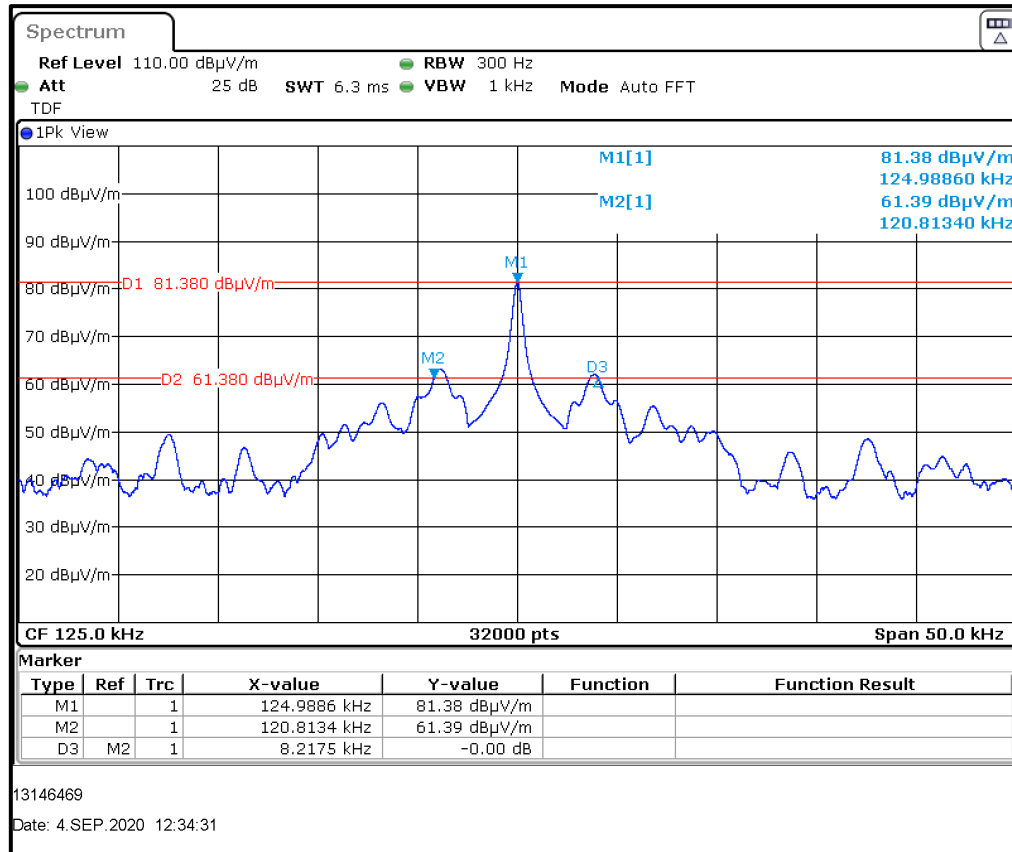
#### **Notes:**

1. In response to an FCC inquiry; reasonable deviations to test method ANSI C63.10 Section 6.9.2 were made to satisfy following requirements:
  - Larger values of RBW may be used than those mentioned in ANSI C63.10 Section 6.9.2
  - Frequency span wide enough to capture all side bands of the signal
2. The 20 dB Bandwidth fundamental emission of RFID- 125 kHz were reported below.

**Transmitter 20 dB Bandwidth (continued)****Test Setup:**

**Transmitter 20 dB Bandwidth (continued)****Results: RFID 125 kHz**

| RFID Channel (kHz) | 20 dB Bandwidth (kHz) |
|--------------------|-----------------------|
| 125                | 8.218                 |

**RFID 125 kHz****Result: Pass**

**5.2.2.Transmitter Fundamental Field Strength****Test Summary:**

|                                   |             |                   |                   |
|-----------------------------------|-------------|-------------------|-------------------|
| <b>Test Engineer:</b>             | Sercan Usta | <b>Test Date:</b> | 04 September 2020 |
| <b>Test Sample Serial Number:</b> | 44048148    |                   |                   |
| <b>Test Site Identification</b>   | SR 1/2      |                   |                   |

|                          |                         |
|--------------------------|-------------------------|
| <b>FCC Reference:</b>    | Part 15.209(d)          |
| <b>Test Method Used:</b> | ANSI C63.10 Section 6.4 |

**Environmental Conditions:**

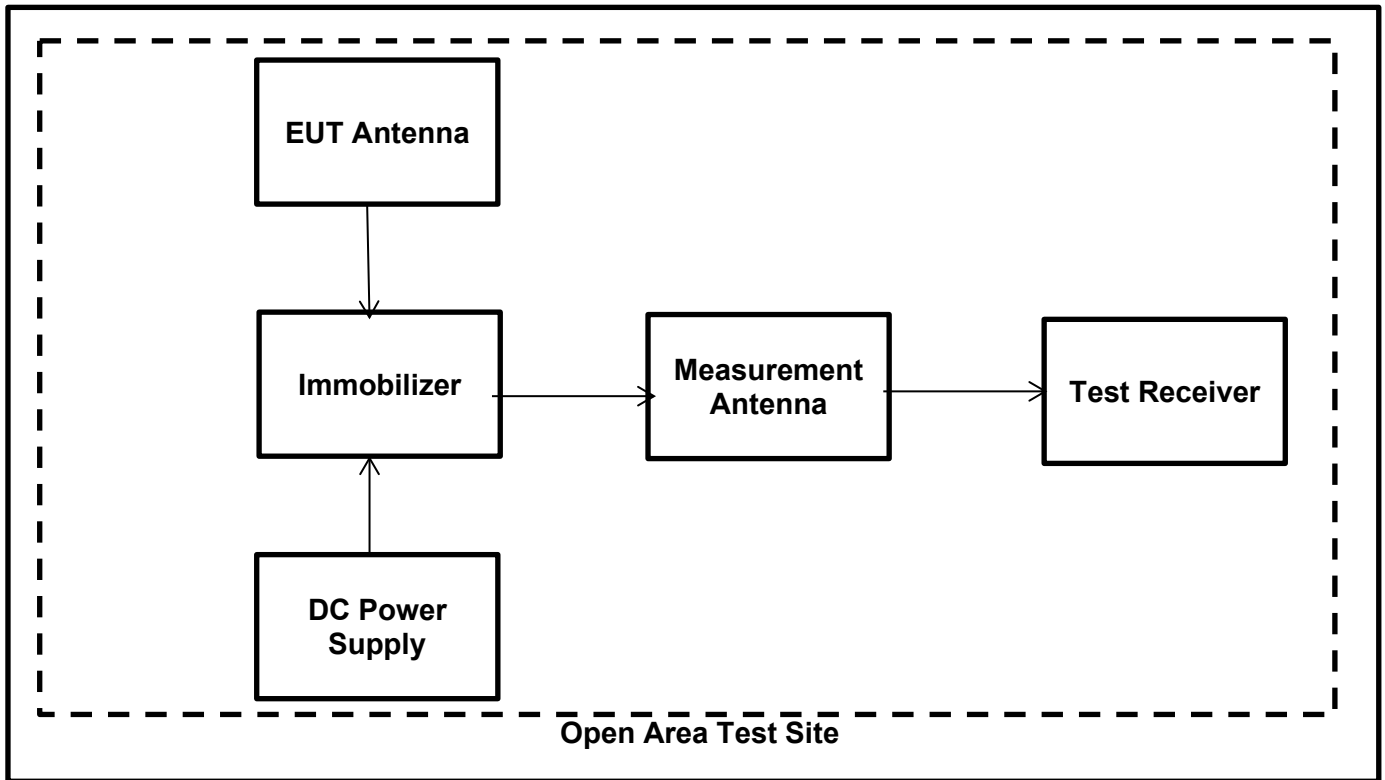
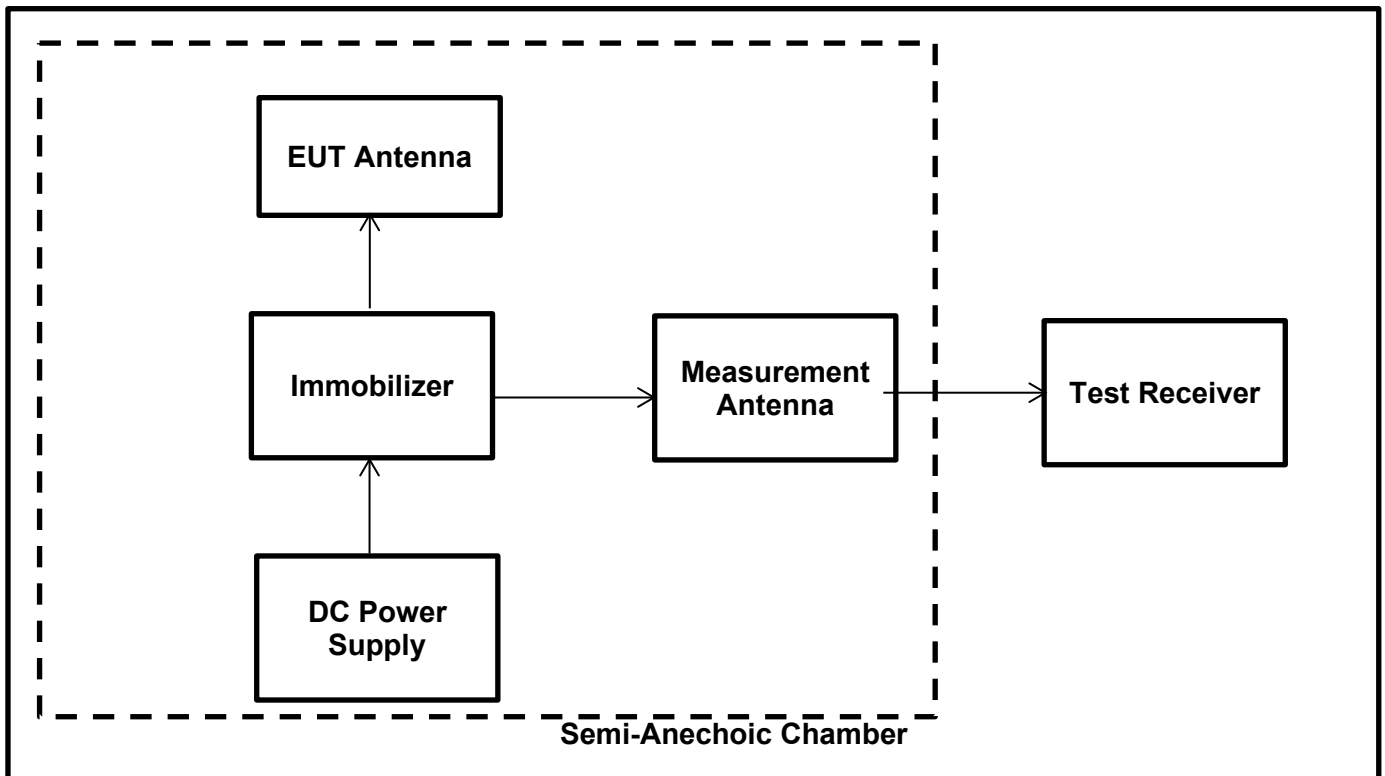
|                               |      |
|-------------------------------|------|
| <b>Temperature (°C):</b>      | 23.3 |
| <b>Relative Humidity (%):</b> | 43.7 |

**Settings of the Instrument:**

|                    |                |
|--------------------|----------------|
| <b>RBW/VBW:</b>    | 200 Hz / 1 kHz |
| <b>Span:</b>       | 50 kHz         |
| <b>Sweep Time:</b> | Auto           |
| <b>Detector:</b>   | Peak           |

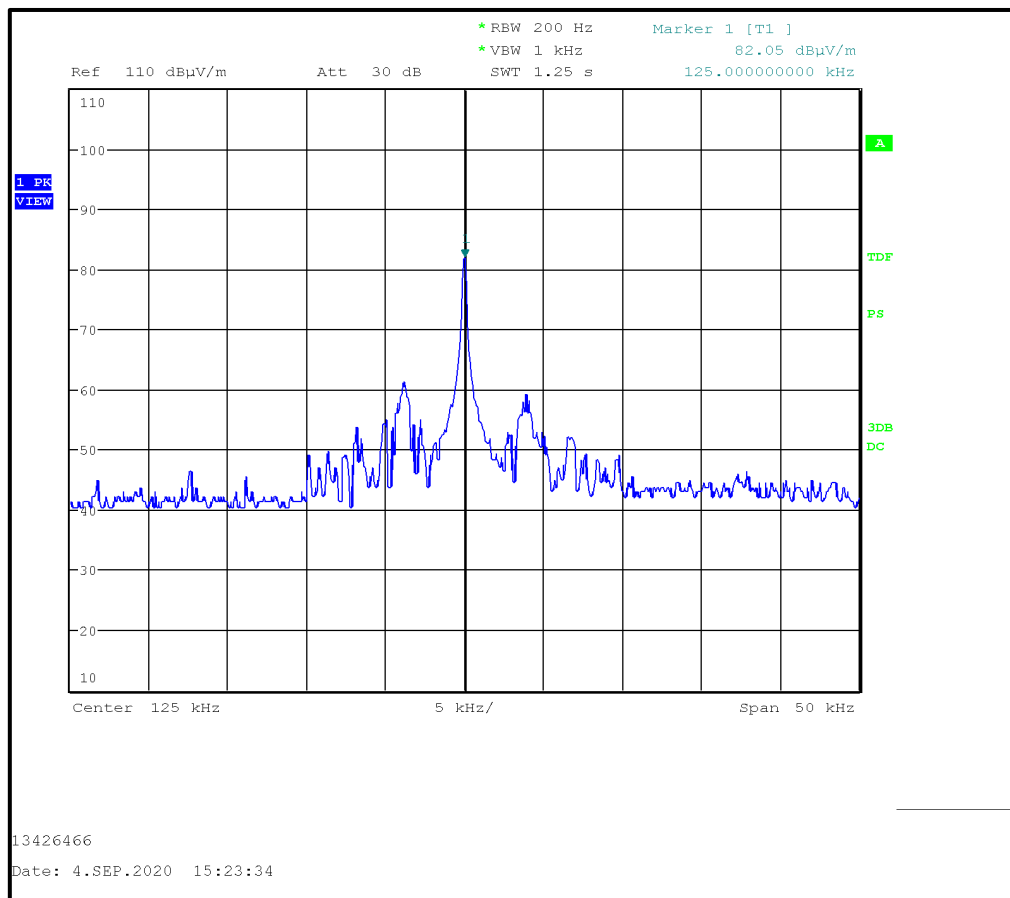
**Note(s):**

1. The limit is specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. In accordance with 414788 D01. Instead of an OATS a Semi Anechoic Chamber was used where evidence was shown that the behaviour is the same. A maximum deviation of 0.64 dB for 125 kHz was observed. This deviation is also taken into account to the result.
3. Pre-scan measurements were performed using a test receiver with a peak detector and measurement bandwidth of 200 Hz. The fundamental field strength was maximized by rotating the measurement antenna and EUT. The test receiver was then switched to test receiver mode and the final measurement on the maximized level was performed.
4. The measurement was performed at a measurement distance of 3 m. This value was later extrapolated to a distance of 300 m by subtracting 80 dB from the result.
5. A transducer factor was used on the test receiver during measurement. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.
6. Since field strength compliance was shown with MaxPeak detector, hence no quasi-peak detector measurement was required.

**Transmitter Fundamental Field Strength (continued)****Test Setup: Open Area Test Site****Test Setup: Semi Anechoic Chamber**

**Transmitter Fundamental Field Strength (continued)****Results: RFID 125 kHz**

| Frequency (kHz) | Measurement Antenna Orientation | Measured Level at 3 m (dB $\mu$ V/m) | Extrapolated Level at 300 m (dB $\mu$ V/m) | Deviation from OATS to SAC | Corrected Level at 300 m (dB $\mu$ V/m) with deviation added | Limit at 300 m (dB $\mu$ V/m) | Margin (dB) | Result |
|-----------------|---------------------------------|--------------------------------------|--------------------------------------------|----------------------------|--------------------------------------------------------------|-------------------------------|-------------|--------|
| 125.00          | 0° to EUT                       | 82.05                                | 2.05                                       | 0.64                       | 2.69                                                         | 25.67                         | 22.98       | Pass   |

**Result: Pass****RFID 125 kHz**

**5.2.3. Transmitter Radiated Spurious Emissions****Test Summary:**

|                                   |             |                   |                   |
|-----------------------------------|-------------|-------------------|-------------------|
| <b>Test Engineer:</b>             | Sercan Usta | <b>Test Date:</b> | 04 September 2020 |
| <b>Test Sample Serial Number:</b> | 44048148    |                   |                   |
| <b>Test Site Identification</b>   | SR 1/2      |                   |                   |

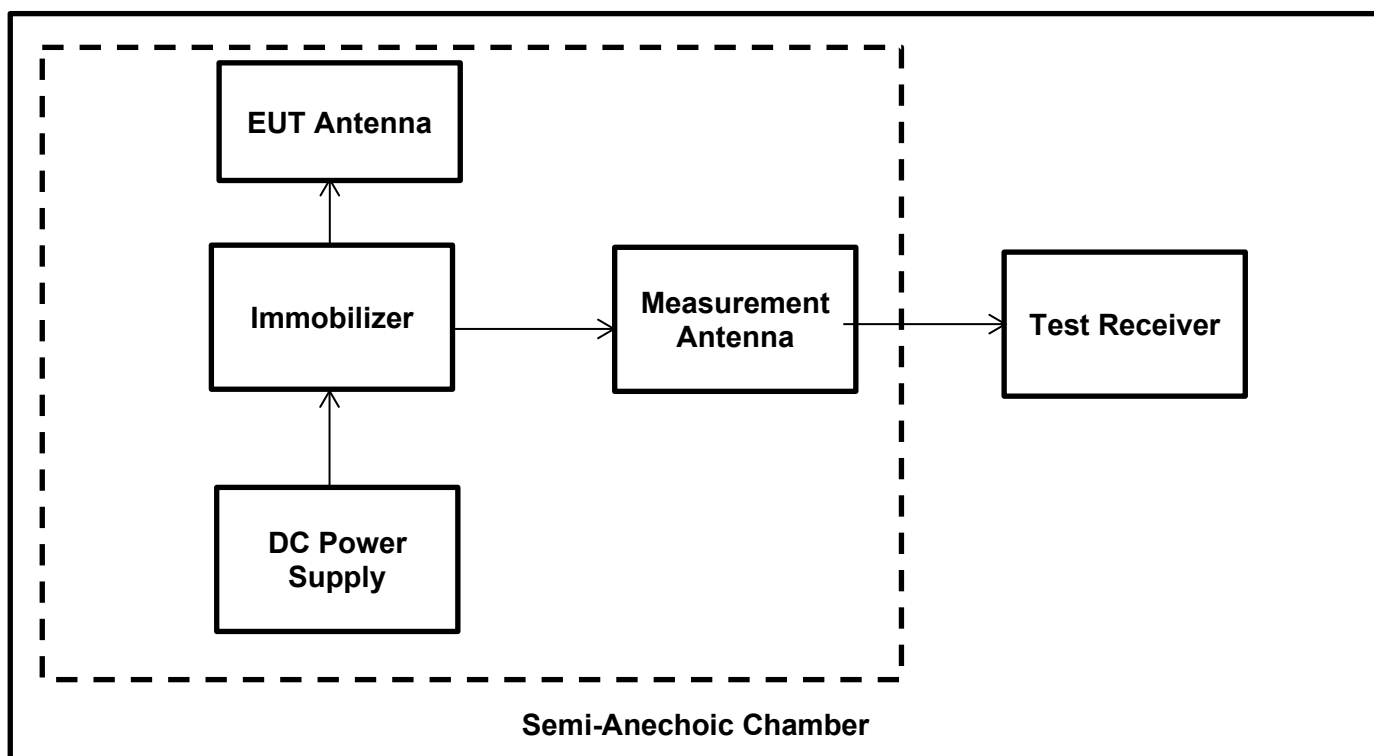
|                          |                                  |
|--------------------------|----------------------------------|
| <b>FCC Reference:</b>    | Parts 15.209(a)                  |
| <b>Test Method Used:</b> | ANSI C63.10 Sections 6.3 and 6.4 |
| <b>Frequency Range:</b>  | 9 kHz to 30 MHz                  |

**Environmental Conditions:**

|                               |      |
|-------------------------------|------|
| <b>Temperature (°C):</b>      | 23.3 |
| <b>Relative Humidity (%):</b> | 43.7 |

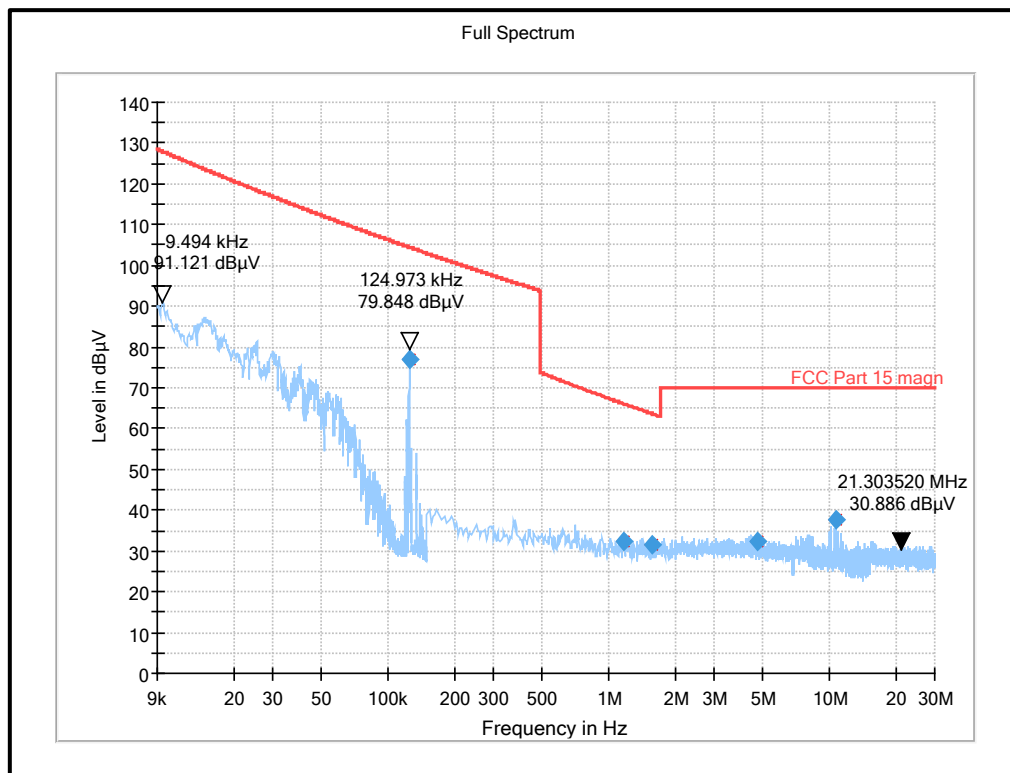
**Note(s):**

- In accordance with FCC KDB 414788, an alternative test site may be used for the measurement below 30 MHz (The OATS / SAC comparison data is available upon request). Therefore, the result from the semi-anechoic chamber tests is shown in this section of the test report.
- The limits are specified at a test distance of 30 m & 300 m. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor.
- Therefore, the limit values are extrapolated to a measurement distance of 3 m where field strength of X dBμV/m was measured.
  - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m adding 80 dB at 40 dB /decade.
  - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- All emissions shown on the pre-scan plots were investigated and found to be ambient or > 20 dB below the appropriate limit.
- Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 1 m.
- Pre-scans were performed and markers placed on the highest measured levels. The test receiver was set to:
  - Frequency range: 9 kHz-150 kHz: RBW: 1 kHz /VBW: 3 kHz
  - Frequency range: 150 kHz – 30 MHz: RBW: 9 kHz /VBW: 30 kHz
  - Detector: Max-Peak detector
  - Trace Mode: Max Hold
- Final measurements were performed on the marker frequencies and the results entered into the table below.
- The emissions shown at frequencies approximately 125 kHz on the 9 kHz to 30 MHz plots are the EUT fundamental for the tested channel.

**Transmitter Radiated Spurious Emissions (continued)****Test Setup:**

**Transmitter Radiated Spurious Emissions (continued)****Results: RFID 125 kHz**

| Frequency (MHz) | Measurement Antenna Orientation | Measured MaxPeak Level at 3 m (dB $\mu$ V/m) | Limit at 3 m (dB $\mu$ V/m) | Margin (dB) | Result |
|-----------------|---------------------------------|----------------------------------------------|-----------------------------|-------------|--------|
| 1.16            | 90° to EUT                      | 32.23                                        | 66.10                       | 33.86       | Pass   |
| 1.57            | 90° to EUT                      | 31.49                                        | 63.66                       | 32.17       | Pass   |
| 4.71            | 90° to EUT                      | 32.17                                        | 70.00                       | 37.83       | Pass   |
| 10.75           | 90° to EUT                      | 37.68                                        | 70.00                       | 32.32       | Pass   |

**Result: Pass****Plot: Transmitter Radiated Spurious Emissions (9kHz-30 MHz) @ 3m**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

**Transmitter Radiated Spurious Emissions (continued)****Test Summary:**

|                                   |             |                   |                   |
|-----------------------------------|-------------|-------------------|-------------------|
| <b>Test Engineer:</b>             | Sercan Usta | <b>Test Date:</b> | 04 September 2020 |
| <b>Test Sample Serial Number:</b> | 44048148    |                   |                   |
| <b>Test Site Identification</b>   | SR 1/2      |                   |                   |

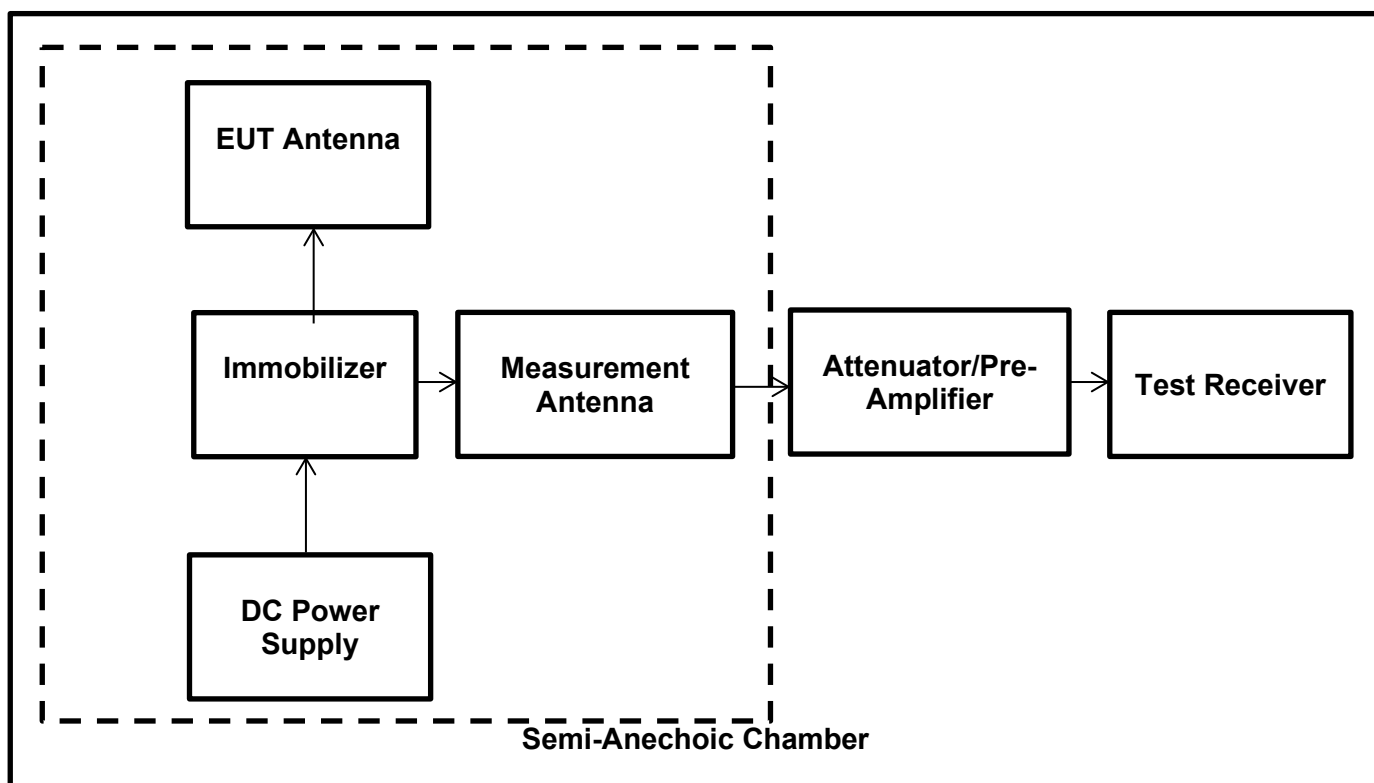
|                          |                                  |
|--------------------------|----------------------------------|
| <b>FCC Reference:</b>    | Parts 15.209(a)                  |
| <b>Test Method Used:</b> | ANSI C63.10 Sections 6.3 and 6.5 |
| <b>Frequency Range:</b>  | 30 MHz to 1000 MHz               |

**Environmental Conditions:**

|                               |      |
|-------------------------------|------|
| <b>Temperature (°C):</b>      | 23.3 |
| <b>Relative Humidity (%):</b> | 43.7 |

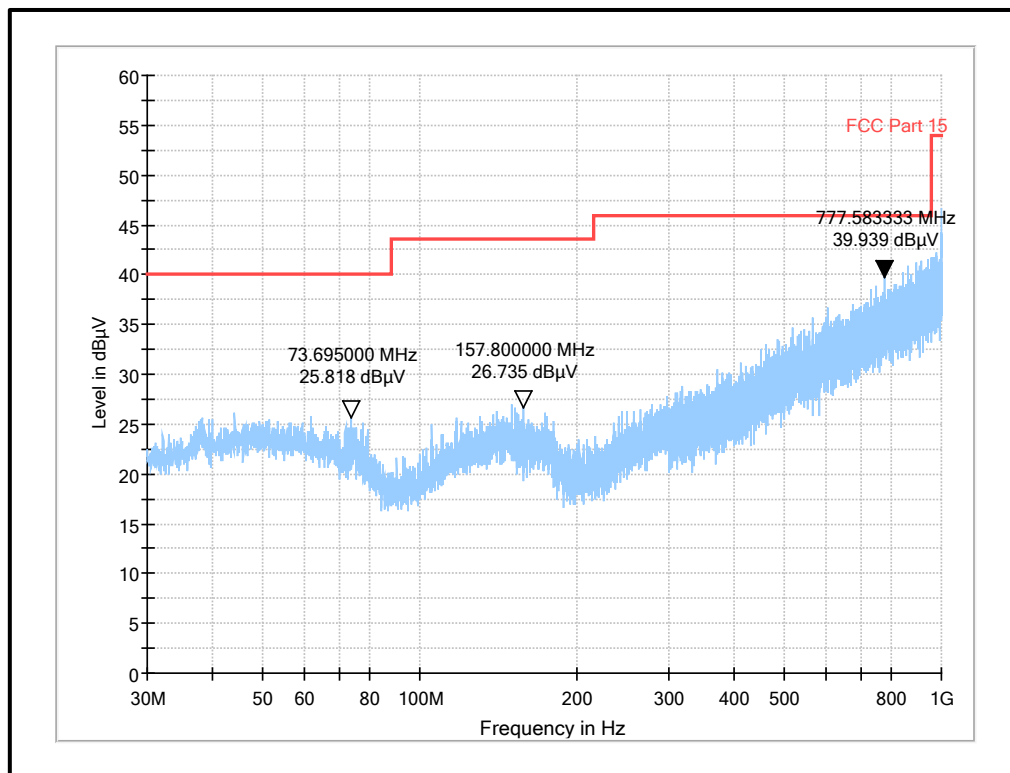
**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the appropriate limit or below the measurement system noise floor.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
5. All emissions shown on the pre-scan plots were investigated and found to be below the system noise floor.

**Transmitter Radiated Spurious Emissions (continued)****Test Setup:**

**Transmitter Radiated Spurious Emissions (continued)****Results: RFID 125 kHz**

| Frequency (MHz)                           | Antenna Polarization | Measured MaxPeak Level at 3 m (dB $\mu$ V/m) | Limit at 3 m (dB $\mu$ V/m) | Margin (dB) | Result |
|-------------------------------------------|----------------------|----------------------------------------------|-----------------------------|-------------|--------|
| No critical spurious emissions were found |                      |                                              |                             |             |        |

**Result: Pass****Plot: Transmitter Radiated Spurious Emissions (30 MHz-1000 MHz) @ 3m**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.*

## 6.Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type                       | Confidence Level (%) | Calculated Uncertainty |
|----------------------------------------|----------------------|------------------------|
| Transmitter Fundamental Field Strength | 95%                  | ±3.10 dB               |
| Radiated Spurious Emissions            | 95%                  | ±3.10 dB               |
| Transmitter 20 dB Bandwidth            | 95%                  | ±0.87 %                |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## 7.Used equipment

### Test site: SR 1/2

| ID      | Manufacturer                  | Type                            | Model      | Serial            | Calibration Date | Cal. Cycle (months) |
|---------|-------------------------------|---------------------------------|------------|-------------------|------------------|---------------------|
| 460     | Deisl                         | Turntable                       | DT 4250 S  | n/a               | n/a              | n/a                 |
| 452     | Schwarzbeck                   | Antenna, Trilog Broadband       | VULB 9163  | 9163-966          | 14/12/2019       | 24                  |
| 587     | Maturo                        | antenna mast, tilting           | TAM 4.0-E  | 011/7180311       | n/a              | n/a                 |
| 588     | Maturo                        | Controller                      | NCD        | 029/7180311       | n/a              | n/a                 |
| 591     | Rohde & Schwarz               | Receiver                        | ESU 40     | 100244/040        | 07/07/2020       | 12                  |
| 608     | Rohde & Schwarz               | Switch Matrix                   | OSP 120    | 101227            | lab verification | n/a                 |
| 628     | Maturo                        | Antenna mast                    | CAM 4.0-P  | 224/19590716      | n/a              | n/a                 |
| 629     | Maturo                        | Kipheinrichtung                 | KE 2.5-R-M | MAT002            | n/a              | n/a                 |
| -/-     | Testo                         | Thermo-Hygrometer               | 608-H1     | 01                | lab verification | n/a                 |
| 328     | SPS                           | AC/DC power distribution system | PAS 5000   | A2464 00/2 0200   | lab verification | n/a                 |
| 1603665 | Siemens Matsushita Components | semi-anechoic chamber SR1/ 2    |            | B83117-A1421-T161 | n/a              | n/a                 |

### Test site: SR 9

| ID      | Manufacturer                  | Type              | Model     | Serial            | Calibration Date                            | Cal. Cycle (months) |
|---------|-------------------------------|-------------------|-----------|-------------------|---------------------------------------------|---------------------|
| 637     | Rohde & Schwarz               | Spectrum Analyzer | FSV40     | 101587            | 08/07/2020                                  | 12                  |
| 625     | Schwarzbeck                   | Antenna, H-field  | HFSL 7101 | 109               | lab verification only relative measurements | n/a                 |
| -/-     | Testo                         | Thermo-Hygrometer | 608-H1    | 07                | lab verification                            | n/a                 |
| 1603668 | Siemens Matsushita Components | shielded room     | -/-       | B83117-B1422-T161 | n/a                                         | n/a                 |

## **8.Open-Area-Test Site comparison**

GPS coordinates

48.765746, 9.250684



## Test Setup

The following listed equipment was used for the measurement:

| Manufacturer     | Type               | Model   | Frequency Range |
|------------------|--------------------|---------|-----------------|
| Rohde & Schwarz  | Receiver, EMI Test | SML03   | 9 kHz – 30 MHz  |
| Rohde & Schwarz  | Receiver, EMI Test | ESIB7   | 20 Hz – 7 GHz   |
| Rohde & Schwarz  | Antenna, Loop      | HFH2-Z2 | 1 kHz – 30 MHz  |
| ETS LINDGREN     | Antenna, Loop      | 6512    | 1 kHz – 30 MHz  |
| Huber and Suhner | RF Cable           | -       | -               |
| Elspec           | BNC Cable          | -       | -               |

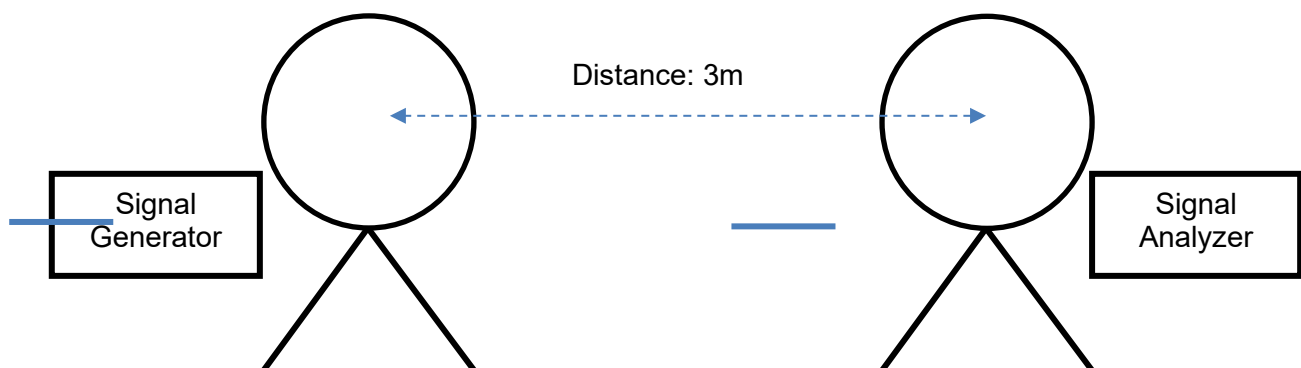
The transmit signal to the ETS Lindgren loop antenna is supplied by the SML signal generator.

The distance of the transmit and receive Antenna was 3m. No other distances can be achieved in SR1 so 10m and 30m distances are not possible. Due to this no comparison is possible.

The Results are valid for equipment which is not larger as the loop antenna which represents in the comparison the EUT.

If an EUT is bigger measurements on an OATS are needed.

The measurement was performed on the lowest frequency 9 kHz and was increased by 10 kHz Steps up to 100 kHz. Then the step size was 100 kHz up to 1000 kHz. From 1 MHz up to the last frequency of 30 MHz the step size was 1 MHz. The HFH2-Z2 loop antenna placed at 80 cm height was used as the receive antenna. The intercepted RF signal from this antenna was measured with the ESIB7 Test Receiver and the values were recorded accordingly.



**Numeric values**

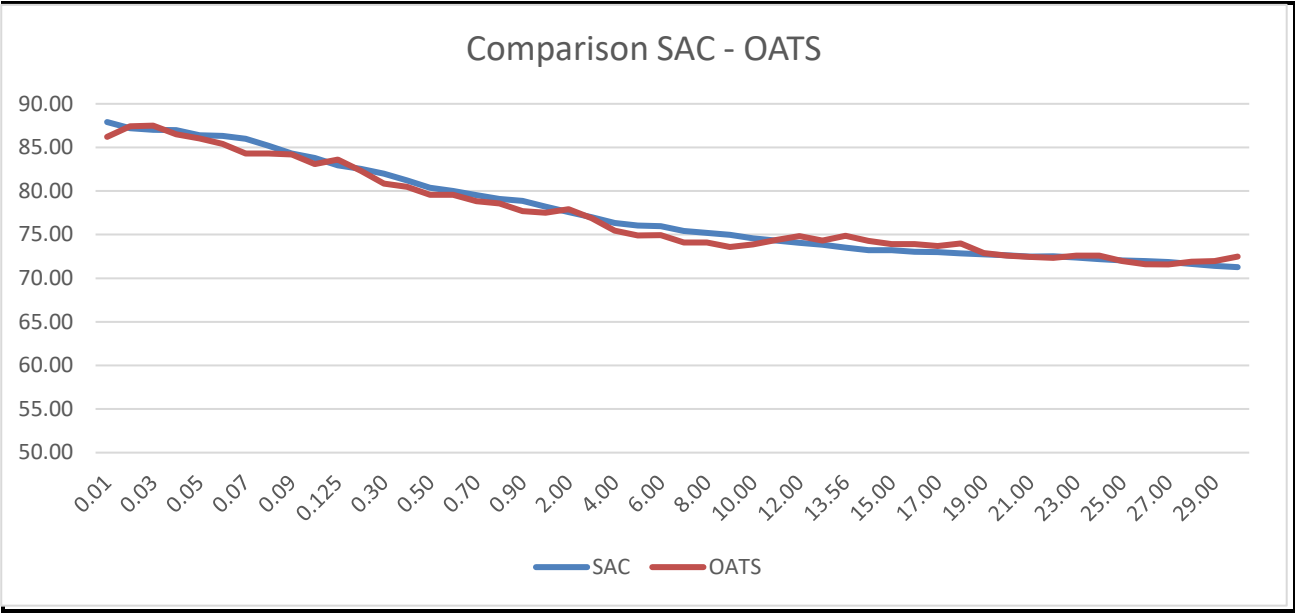
| Frequency (MHz)            | 0.01  | 0.02  | 0.03  | 0.04  | 0.05  | 0.06  | 0.07  | 0.08  | 0.09  | 0.10  | 0.125 | 0.20  |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SR1 Measured power (dBµV)  | 87.91 | 87.22 | 87.01 | 86.98 | 86.40 | 86.32 | 85.98 | 85.20 | 84.30 | 83.80 | 82.96 | 82.55 |
| OATS Measured power (dBµV) | 86.22 | 87.42 | 87.50 | 86.49 | 86.01 | 85.39 | 84.32 | 84.29 | 84.20 | 83.10 | 83.60 | 82.32 |
| Delta (dB)                 | -1.69 | 0.20  | 0.49  | -0.49 | -0.39 | -0.93 | -1.66 | -0.91 | -0.10 | -0.70 | 0.64  | -0.23 |

| Frequency (MHz)            | 0.30  | 0.40  | 0.50  | 0.60  | 0.70  | 0.80  | 0.90  | 1.00  | 2.00  | 3.00  | 4.00  | 5.00  |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SR1 Measured power (dBµV)  | 81.98 | 81.23 | 80.39 | 80.00 | 79.53 | 79.10 | 78.87 | 78.20 | 77.60 | 77.01 | 76.32 | 76.04 |
| OATS Measured power (dBµV) | 80.84 | 80.49 | 79.58 | 79.58 | 78.85 | 78.59 | 77.69 | 77.50 | 77.91 | 76.90 | 75.45 | 74.90 |
| Delta (dB)                 | -1.14 | -0.74 | -0.81 | -0.42 | -0.68 | -0.51 | -1.18 | -0.70 | 0.31  | -0.11 | -0.87 | -1.14 |

| Frequency (MHz)            | 6.00  | 7.00  | 8.00  | 9.00  | 10.00 | 11.00 | 12.00 | 13.00 | 13.56 | 14.00 | 15.00 | 16.00 |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SR1 Measured power (dBµV)  | 75.98 | 75.43 | 75.20 | 74.97 | 74.59 | 74.32 | 74.05 | 73.83 | 73.50 | 73.22 | 73.20 | 73.05 |
| OATS Measured power (dBµV) | 74.94 | 74.09 | 74.11 | 73.58 | 73.87 | 74.38 | 74.84 | 74.31 | 74.88 | 74.29 | 73.90 | 73.93 |
| Delta (dB)                 | -1.04 | -1.34 | -1.09 | -1.39 | -0.72 | 0.06  | 0.79  | 0.48  | 1.38  | 1.07  | 0.70  | 0.88  |

| Frequency (MHz)            | 17.00 | 18.00 | 19.00 | 20.00 | 21.00 | 22.00 | 23.00 | 24.00 | 25.00 | 26.00 | 27.00 | 28.00 | 29.00 | 30.00 |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SR1 Measured power (dBµV)  | 73.00 | 72.86 | 72.74 | 72.64 | 72.50 | 72.52 | 72.39 | 72.20 | 72.04 | 71.97 | 71.86 | 71.64 | 71.41 | 71.27 |
| OATS Measured power (dBµV) | 73.70 | 73.98 | 72.90 | 72.60 | 72.45 | 72.34 | 72.59 | 72.59 | 71.97 | 71.59 | 71.58 | 71.88 | 71.98 | 72.49 |
| Delta (dB)                 | 0.70  | 1.12  | 0.16  | -0.04 | -0.05 | -0.18 | 0.20  | 0.39  | -0.07 | -0.38 | -0.28 | 0.24  | 0.57  | 1.22  |

Graph



Conclusion: Maximum difference is 1.69 dB @ 9 kHz

## 9. Report Revision History

| Version Number | Revision Details |        |                 |
|----------------|------------------|--------|-----------------|
|                | Page No(s)       | Clause | Details         |
| 1.0            | 29               | -      | Initial Version |

END OF REPORT