



# TEST REPORT

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>KCTL KCTL Inc.</b></p> <p style="text-align: center;">65, Sinwon-ro, Yeongtong-gu,<br/>Suwon-si, Gyeonggi-do, 16677, Korea</p> <p>TEL: 82-31-285-0894    FAX: 82-505-299-8311</p> <p style="text-align: center;"><a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Report No.:<br/>KR20-SRF0244-A</p> <p>Page (1) of (13)</p>           |                                                                               |             |                                                                         |                                                                               |
| <p><b>1. Client</b></p> <p>◦ Name : SUPREMA INC</p> <p>◦ Address : 17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)</p> <p>◦ Date of Receipt : 2020-08-31</p> <p><b>2. Use of Report</b> : Certification</p> <p><b>3. Name of Product / Model</b> : FaceStation F2 / FSF2-AB</p> <p><b>4. Manufacturer / Country of Origin</b> : SUPREMA INC / Korea</p> <p><b>5. FCC ID</b> : TKWFSF2-AB</p> <p><b>6. IC Certificate No.</b> : 23080-FSF2AB</p> <p><b>7. Date of Test</b> : 2020-09-18 to 2020-09-23</p> <p><b>8. Location of Test</b> : <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address: Address of testing location)</p> <p><b>9. Test method used</b> : FCC Part 15 Subpart C, 15.209<br/>RSS-210 Issue 10 December 2019<br/>RSS-Gen Issue 5 March 2019</p> <p><b>10. Test Results</b> : Refer to the test result in the test report</p> |                                                                         |                                                                               |             |                                                                         |                                                                               |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center; vertical-align: middle;">Affirmation</td> <td style="width: 45%; padding: 5px;"> <p>Tested by</p> <p style="text-align: center;">Name : Jungwon Seo </p> </td> <td style="width: 40%; padding: 5px;"> <p>Technical Manager</p> <p style="text-align: center;">Name : Heesu Ahn </p> </td> </tr> </table> <p style="text-align: right; margin-top: 10px;">2020-10-22</p> <p style="text-align: center; margin-top: 20px;"><b>KCTL Inc.</b></p> <p style="font-size: small; margin-top: 20px;">As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.</p>                                                                                                                               |                                                                         |                                                                               | Affirmation | <p>Tested by</p> <p style="text-align: center;">Name : Jungwon Seo </p> | <p>Technical Manager</p> <p style="text-align: center;">Name : Heesu Ahn </p> |
| Affirmation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Tested by</p> <p style="text-align: center;">Name : Jungwon Seo </p> | <p>Technical Manager</p> <p style="text-align: center;">Name : Heesu Ahn </p> |             |                                                                         |                                                                               |

## REPORT REVISION HISTORY

| Date       | Revision          | Page No |
|------------|-------------------|---------|
| 2020-09-29 | Originally issued | -       |
| 2020-10-22 | Updated           | 10      |
|            |                   |         |
|            |                   |         |
|            |                   |         |

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Note. The report No. KR20-SRF0244 is superseded by the report No. KR20-SRF0244-A.

## General remarks for test reports

Nothing significant to report.



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## 1. General information

Client : SUPREMA INC  
 Address : 17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)  
 Manufacturer : SUPREMA INC  
 Address : 17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)  
 Laboratory : KCTL Inc.  
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056  
 Industry Canada Registration No. : 8035A  
 KOLAS No.: KT231

## 2. Device information

Equipment under test : FaceStation F2  
 Model : FSF2-AB  
 Derivative model : FSF2-DB, FSF2-ABT10, FSF2-DBT10  
 Frequency range : 13.56 MHz (NFC)  
 125 kHz (RFID)  
 2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy)  
 Modulation technique : ASK (NFC,RFID), GFSK (Bluetooth Low Energy)  
 Number of channels : 40 ch (Bluetooth Low Energy), 1 ch (NFC)  
 Power source : DC 24 V  
 Antenna specification : PCB Loop antenna (NFC)  
 Coil antenna (RFID)  
 PCB Pattern antenna (Bluetooth Low Energy)  
 Antenna gain : 3.03 dBi (Bluetooth Low Energy)  
 Software version : V1.0.0  
 Hardware version : PS  
 Operation temperature : -20 °C ~ 50 °C

### 2.1. Accessory information

| Equipment | Manufacturer | Model | Serial No. | Power source |
|-----------|--------------|-------|------------|--------------|
| N/A       | -            | -     | -          | -            |

## 2.2. Information about derivative model

The difference between basic model and derivative models is:

Based on the base model, derivative model removes the SAM IC to support a specific card.

- FSF2-DB : Removed SAM IC

- FSF2-ABT10, FSF2-DBT10 : FSF2-AB with customer's mark & label

The firmware is the same for each model, but the SAM IC operation is activated / deactivated by registering the model name.

## 2.3. Frequency/channel operations

This device contains the following capabilities:

NFC, 125 kHz (RFID), Bluetooth Low Energy

| Ch. | Frequency (kHz) |
|-----|-----------------|
| 01  | 125             |

Table 2.3.1. RFID

## 3. Antenna requirement

### Requirement of FCC part section 15.203:

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.

### Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

-The transmitter has permanently attached Coil antenna (internal antenna) on board.

#### 4. Summary of tests

| FCC Part section(s) | IC Rule reference        | Parameter                                           | Test results           |
|---------------------|--------------------------|-----------------------------------------------------|------------------------|
| 15.209(a)           | RSS-210<br>Issue 9 (8.9) | Field Strength of Fundamental and Spurious Emission | Pass                   |
| 2.1049              | -                        | 20dB Bandwidth                                      | Pass                   |
| -                   | RSS-Gen<br>Issue 5 (6.7) | Occupied Bandwidth                                  | Pass                   |
| 15.203              | RSS-Gen<br>Issue 5 (6.8) | Antenna requirement                                 | Pass                   |
| 15.207(a)           | RSS-Gen<br>Issue 5 (8.8) | AC Conducted Emission                               | N/A <sup>(Note2)</sup> |

**Notes:** (N/T: Not Tested, N/A: Not Applicable)

- All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- This test is not applicable because the EUT only connects DC power line.
- These tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that Y orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in Y orientation.
- The test procedure(s) in this report were performed in accordance as following.
  - ANSI C63.10-2013
- The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.
- The radiated test was performed with and without passive tag. The test results shown in the following sections represent the worst case emissions.
  - Worst Case : Without passive tag

#### 5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{CISPR}$  measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

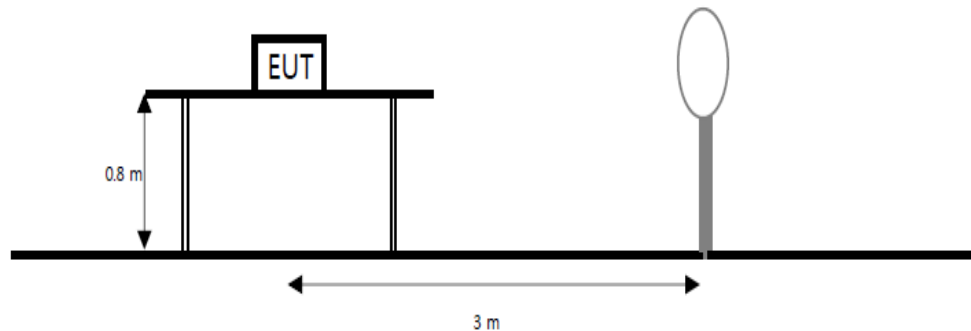
| Parameter                   | Expanded uncertainty ( $\pm$ ) |        |
|-----------------------------|--------------------------------|--------|
| Radiated spurious emissions | 9 kHz ~ 30 MHz                 | 2.3 dB |
| Conducted emissions         | 9 kHz ~ 150 kHz                | 3.7 dB |
|                             | 150 kHz ~ 30 MHz               | 3.3 dB |

## 6. Test results

### 6.1. Field Strength of Fundamental and Spurious Emission

#### Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



#### Limit

According to section 15.209(a), RSS-Gen(8.9) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field strength ( $\mu V/m$ ) | Measurement distance (m) |
|-----------------|------------------------------|--------------------------|
| 0.009 - 0.490   | $2\,400/F(\text{kHz})$       | 300                      |
| 0.490 - 1.705   | $24\,000/F(\text{kHz})$      | 30                       |
| 1.705 - 30      | 30                           | 30                       |
| 30 - 88         | 100**                        | 3                        |
| 88 - 216        | 150**                        | 3                        |
| 216 - 960       | 200**                        | 3                        |
| Above 960       | 500                          | 3                        |

\*\*Except as provided in paragraph (g), 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. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section 15.231 and 15.241.

**IC**

According to section RSS-Gen(8.9), except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

**Table 5 – General field strength limits at frequencies above 30 MHz**

| Frequency (MHz) | Field strength (µV/m at 3 m) |
|-----------------|------------------------------|
| 30 – 88         | 100                          |
| 88 – 216        | 150                          |
| 216 – 960       | 200                          |
| Above 960       | 500                          |

**Table 6 – General field strength limits at frequencies below 30 MHz**

| Frequency                | Magnetic field strength (H-Field) (µA/m) | Measurement distance (m) |
|--------------------------|------------------------------------------|--------------------------|
| 9 - 490 kHz <sup>1</sup> | 6.37/F (F in kHz)                        | 300                      |
| 490 - 1705 kHz           | 63.7/F (F in kHz)                        | 30                       |
| 1.705 - 30 MHz           | 0.08                                     | 30                       |

**Note 1:** The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

**Test procedure**

ANSI C63.10-2013

**Test settings****Test Procedures for emission from 9 kHz to 30 MHz**

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode.
- Below 30 MHz frequency range, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported and the worse orientations of Face-on and Face-off were set for final test.
  - Face-on = Parallel, Face-off = Perpendicular

**Notes:**

1.  $f < 30$  MHz, extrapolation factor of 40 dB/decade of distance.  $F_d = 40 \log(D_m/D_s)$

Where:

$F_d$  = Distance factor in dB

$D_m$  = Measurement distance in meters

$D_s$  = Specification distance in meters

2. The test measurement distance is 3 meter

3. Limit (dB( $\mu$ V/m)) =
- |                            |                                               |
|----------------------------|-----------------------------------------------|
| For 0.009 MHz - 0.490 MHz, | $20 \log(2400/F(\text{kHz}))$ dB( $\mu$ V/m)  |
| For 0.490 MHz - 1.705 MHz, | $20 \log(24000/F(\text{kHz}))$ dB( $\mu$ V/m) |
| For 1.705 MHz - 30 MHz,    | $20 \log(30) = 29.54$ dB( $\mu$ V/m)          |

**KCTL**

## Test results

### Radiated Emissions Fundamental & 9 kHz to 30 MHz

[Face-on]

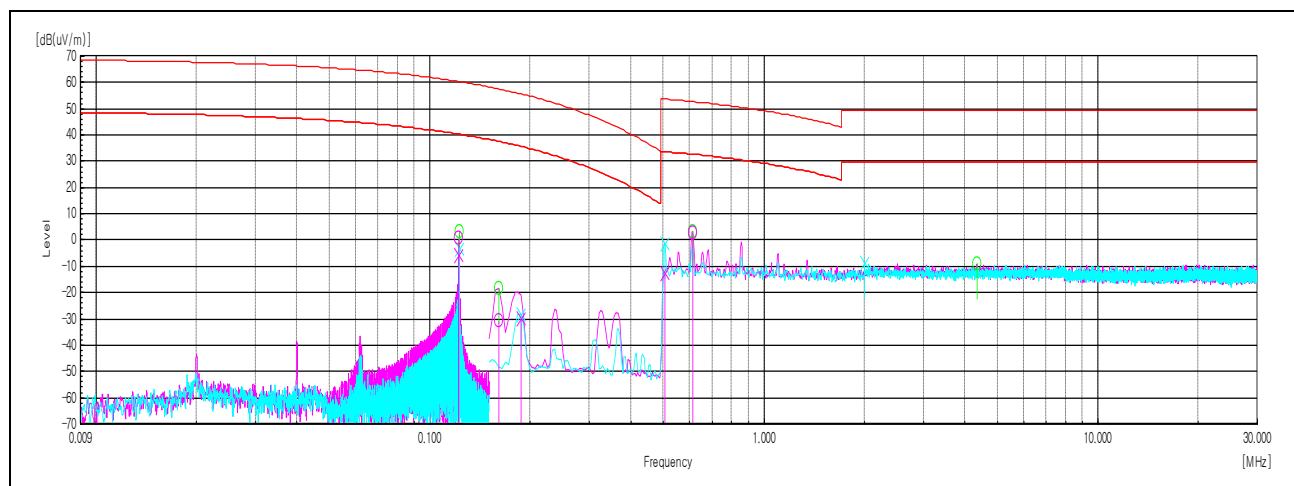
| Frequency | Reading  | Detector | Ant. Factor | Amp. + Cable | Distance factor | Factor | Result     | Limit      | Margin |
|-----------|----------|----------|-------------|--------------|-----------------|--------|------------|------------|--------|
| (MHz)     | (dB(μV)) | Mode     | (dB)        | (dB)         | (dB)            | (dB)   | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| 0.122     | 95.50    | PK       | 19.9        | -32.4        | -80.0           | -92.5  | 2.97       | 25.86      | 22.89  |
| 0.122     | 86.80    | AV       | 19.9        | -32.4        | -80.0           | -92.5  | -5.73      | 25.86      | 31.59  |
| 0.161     | 65.50    | AV       | 19.9        | -32.4        | -80.0           | -92.5  | -27.03     | 23.45      | 50.48  |
| 0.613     | 54.90    | QK       | 19.9        | -32.4        | -40.0           | -52.5  | 2.37       | 31.83      | 29.46  |
| 4.336     | 40.30    | QK       | 20.1        | -31.9        | -40.0           | -51.8  | -11.50     | 29.56      | 41.06  |

[Face-off]

| Frequency | Reading  | Detector | Ant. Factor | Amp. + Cable | Distance factor | Factor | Result     | Limit      | Margin |
|-----------|----------|----------|-------------|--------------|-----------------|--------|------------|------------|--------|
| (MHz)     | (dB(μV)) | Mode     | (dB)        | (dB)         | (dB)            | (dB)   | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| 0.122     | 89.00    | PK       | 19.9        | -32.4        | -80.0           | -92.5  | -3.53      | 25.86      | 29.39  |
| 0.122     | 80.40    | AV       | 19.9        | -32.4        | -80.0           | -92.5  | -12.13     | 25.86      | 37.99  |
| 0.187     | 62.80    | AV       | 19.9        | -32.4        | -80.0           | -92.5  | -29.69     | 22.15      | 51.84  |
| 0.504     | 40.10    | QK       | 19.9        | -32.5        | -40.0           | -52.6  | -12.45     | 33.53      | 45.98  |
| 2.001     | 40.40    | QK       | 20.0        | -32.1        | -40.0           | -52.1  | -11.72     | 29.56      | 41.28  |

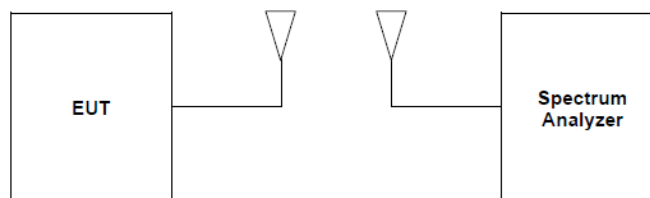
Note.

- 1) Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)
- 2) -80 is distance factor =  $40 \cdot \log(3/300)$ , -40 is distance factor =  $40 \cdot \log(3/30)$
- 3) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of  $377\Omega$ .  
 For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit



## 6.2. 20dB Bandwidth & Occupied Bandwidth

### Test setup



### Limit

For reporting purpose only

### Test settings

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level 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 (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

**Test results****20dB Bandwidth**

| Frequency (kHz) | 20dB Bandwidth (kHz) | Occupied Bandwidth (kHz) | Limit                  |
|-----------------|----------------------|--------------------------|------------------------|
| 125             | 0.98                 | 9.32                     | Reporting purpose only |

**Test Plots**

Note. Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

## 7. Measurement equipment

| Equipment Name          | Manufacturer    | Model No.            | Serial No. | Next Cal. Date |
|-------------------------|-----------------|----------------------|------------|----------------|
| Vector Signal Generator | R&S             | SMBV100A             | 257566     | 21.07.13       |
| Signal Generator        | R&S             | SMB100A              | 176206     | 21.01.21       |
| Spectrum Analyzer       | R&S             | FSW50                | 101013     | 21.07.13       |
| DC Power Supply         | AGILENT         | E3632A               | MY40008800 | 21.07.28       |
| Amplifier               | L-3 Narda-MITEQ | AFS5-00101800-25-S-5 | 2054570    | 21.05.22       |
| EMI TEST RECIEVER       | R&S             | ESCI7                | 100732     | 21.03.04       |
| Bilog Antenna           | Teseq GmbH      | CBL6112D             | 37876      | 22.09.02       |
| Loop Antenna            | R&S             | HFH2-Z2              | 100355     | 22.08.21       |
| Attenuator              | AGILENT         | 8491B-006            | MY37270292 | 22.09.02       |
| Amplifier               | SONOMA          | 310N                 | 284608     | 21.08.20       |
| Antenna Mast            | Innco Systems   | MA4000-EP            | 303        | N/A            |
| Turn Table              | Innco Systems   | DT2000               | 79         | N/A            |

End of test report

