

# Report on the FCC and IC Testing of:

Apple Inc, Model: A2304

In accordance with FCC 47 CFR Part 15,  
ISED RSS 247 & ISED RSS-GEN  
(Simultaneous Transmissions)

Prepared for: Apple Inc.  
One Apple Park Way Cupertino,  
California 95014 USA

FCC ID: BCGA2304

IC: 579C-A2304



Add value.  
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## COMMERCIAL-IN-CONFIDENCE

Document 75945250-15 Issue 01

### SIGNATURE

| NAME      | JOB TITLE       | RESPONSIBLE FOR      | ISSUE DATE       |
|-----------|-----------------|----------------------|------------------|
| Jon Kenny | Senior Engineer | Authorised Signatory | 28 November 2019 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

### ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15, ISED RSS-247 and ISED RSS-GEN (Simultaneous Transmission). The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME              | DATE             | SIGNATURE |
|-----------------|-------------------|------------------|-----------|
| Testing         | Malik Mohammad    | 28 November 2019 |           |
| Testing         | Cristian Onaca    | 28 November 2019 |           |
| Testing         | Faisal Malyar     | 28 November 2019 |           |
| Testing         | Ahmad Javid       | 28 November 2019 |           |
| Testing         | Jay Balendrarajah | 28 November 2019 |           |

FCC Accreditation  
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation  
12669A Octagon House, Fareham Test Laboratory

### EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15: 2018, ISED RSS-247: Issue 2 (2017-02) and ISED RSS-GEN: Issue 5 A1 (2019-03) for the tests detailed in section 1.3.



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#### ACCREDITATION

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## 1 Report Summary

### 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue    |
|-------|-----------------------|------------------|
| 1     | First Issue           | 28 November 2019 |

**Table 1**

### 1.2 Introduction

|                               |                                                                                                    |
|-------------------------------|----------------------------------------------------------------------------------------------------|
| Applicant                     | Apple Inc.                                                                                         |
| Manufacturer                  | Apple Inc.                                                                                         |
| Model Number(s)               | A2304                                                                                              |
| Serial Number(s)              | C02ZK00YNRQ8 and C02Z1006N5VL                                                                      |
| Hardware Version(s)           | REV 1.0                                                                                            |
| Software Version(s)           | 19A583 and 19A507                                                                                  |
| Number of Samples Tested      | 2                                                                                                  |
| Test Specification/Issue/Date | FCC 47 CFR Part 15: (2018)<br>ISED RSS-247: Issue 2 (2017-02)<br>ISED RSS-GEN Issue 5 A1 (2019-03) |
| Order Number                  | 0540176069                                                                                         |
| Date                          | 25-February-2019                                                                                   |
| Date of Receipt of EUT        | 18-October-2019                                                                                    |
| Start of Test                 | 18-October-2019                                                                                    |
| Finish of Test                | 29-October-2019                                                                                    |
| Name of Engineer(s)           | Malik Mohammad, Cristian Onaca, Jay Balendrarah, Ahmad Javid and Faisal Malyar                     |
| Related Document(s)           | ANSI C63.10 (2013)                                                                                 |



### 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Parts 15, ISED RSS-247 and ISED RSS-GEN (Simultaneous Transmission) is shown below.

| Section                                                    | Specification Clause                    |             |              | Test Description                                        | Result | Comments/Base Standard |
|------------------------------------------------------------|-----------------------------------------|-------------|--------------|---------------------------------------------------------|--------|------------------------|
|                                                            | FCC Part 15                             | RSS-247     | RSS-GEN      |                                                         |        |                        |
| Configuration and Mode: CoTX - 5GHz main, 2.4GHz Aux & BDR |                                         |             |              |                                                         |        |                        |
| 2.1                                                        | 15.247 (d),<br>15.407 (b)<br>and 15.209 | 5.5 and 6.2 | 8.9 and 8.10 | Radiated Spurious Emissions (Simultaneous Transmission) | Pass   | ANSI C63.10            |

**Table 2**



## 1.4 Product Information

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a rack mounted computer, with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac capabilities in the 2.4 GHz and 5 GHz bands.

### 1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

### 1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

| Modification State                        | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|-------------------------------------------|-------------------------------------------------|------------------------|--------------------------|
| Model: A2304: Serial Number: C02Z1006N5VL |                                                 |                        |                          |
| 0                                         | As supplied by the customer                     | Not Applicable         | Not Applicable           |
| Model: A2304: Serial Number: C02ZK00YNRQ8 |                                                 |                        |                          |
| 0                                         | As supplied by the customer                     | Not Applicable         | Not Applicable           |

**Table 3**

### 1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

| Test Name                                                    | Name of Engineer(s)                                                              | Accreditation |
|--------------------------------------------------------------|----------------------------------------------------------------------------------|---------------|
| Configuration and Mode: CoTX – 5 GHz main, 2.4 GHz Aux & BDR |                                                                                  |               |
| Radiated Spurious Emissions (Simultaneous Transmission)      | Malik Mohammad, Cristian Onaca, Jay Balendrarajah, Ahmad Javid and Faisal Malyar | UKAS          |

**Table 4**

Office Address:

Octagon House  
Concorde Way  
Segensworth North  
Fareham  
Hampshire  
PO15 5RL  
United Kingdom



## 2 Test Details

### 2.1 Radiated Spurious Emissions (Simultaneous Transmission)

#### 2.1.1 Specification Reference

FCC 47 CFR Parts 15, Clause 15.247 (d), 15.407 (b) and 15.209  
ISED RSS 247, Clause 5.5 and 6.2  
ISED RSS GEN, Clause 8.9 and 8.10

#### 2.1.2 Equipment Under Test and Modification State

A2304, S/N: C02ZK00YNRQ8 - Modification State 0  
A2304, S/N: C02Z1006N5VL - Modification State 0

#### 2.1.3 Date of Test

18-October-2019 to 29-October-2019

#### 2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clauses 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10 using an average (RMS) detector and max hold trace to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to the relevant limits outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

For frequencies > 18 GHz, the measurement distance was reduced to 1 meter and the limit line was increased by  $20 \cdot \log(3/1) = 9.54$  dB.

#### 2.1.5 Environmental Conditions

Ambient Temperature 21.0 - 23.0 °C  
Relative Humidity 45.0 - 62.7 %

#### 2.1.6 Test Results

CoTX - 5 GHz main and 2.4 GHz Aux & BDR

The EUT was configured for simultaneous transmission in the following mode of operation:

| Technology                 | Frequency Band (MHz)   | Channel Frequency (MHz) |
|----------------------------|------------------------|-------------------------|
| 802.11n - 20 MHz Bandwidth | U-NII 2c               | 5500                    |
| 802.11b                    | 2400 MHz to 2483.5 MHz | 2442                    |
| Bluetooth                  | 2400 MHz to 2483.5 MHz | 2480                    |

**Table 5 - Modes of Operation**

| Frequency (MHz) | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|-----------------|----------------------|----------------------|-------------|----------|-----------|-------------|--------------|-------------|
| 38.2            | 23.8                 | 40                   | 16.2        | QP       | 240       | 187         | Vertical     | N/A         |
| 168.1           | 31.7                 | 44                   | 12.3        | QP       | 15        | 142         | Horizontal   | N/A         |
| 408.4           | 31.5                 | 46                   | 14.5        | QP       | 340       | 100         | Horizontal   | N/A         |
| 969.5           | 37.9                 | 54                   | 16.1        | QP       | 188       | 100         | Vertical     | N/A         |

**Table 6 - 30 MHz to 1 GHz Emissions Results**

All other emissions that were detected are within the unrestricted bands and are therefore at least 20 dB from the applicable test limit.

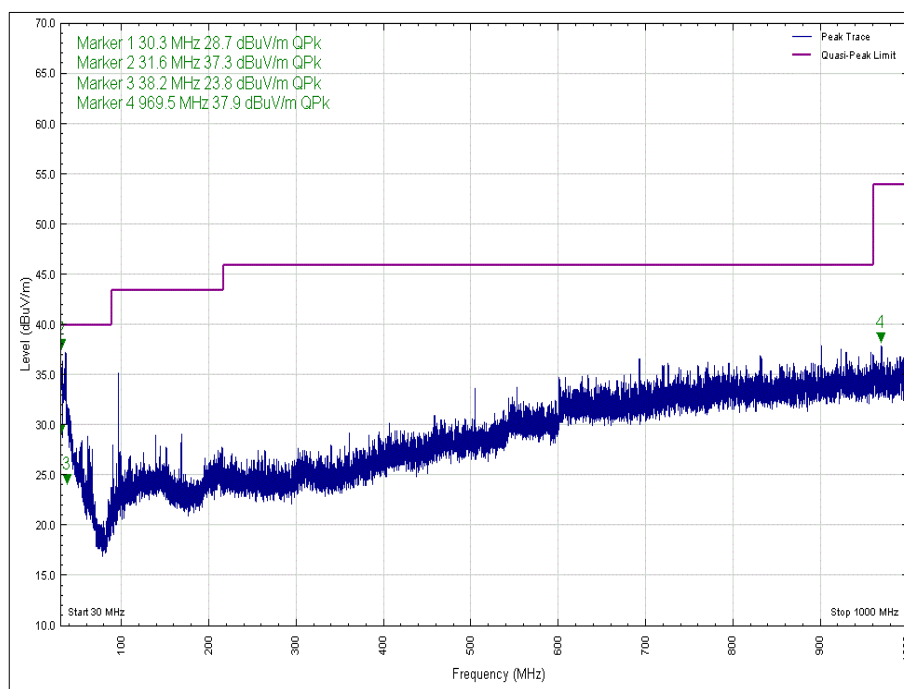


**Figure 1 - 30 MHz to 1 GHz - Vertical**

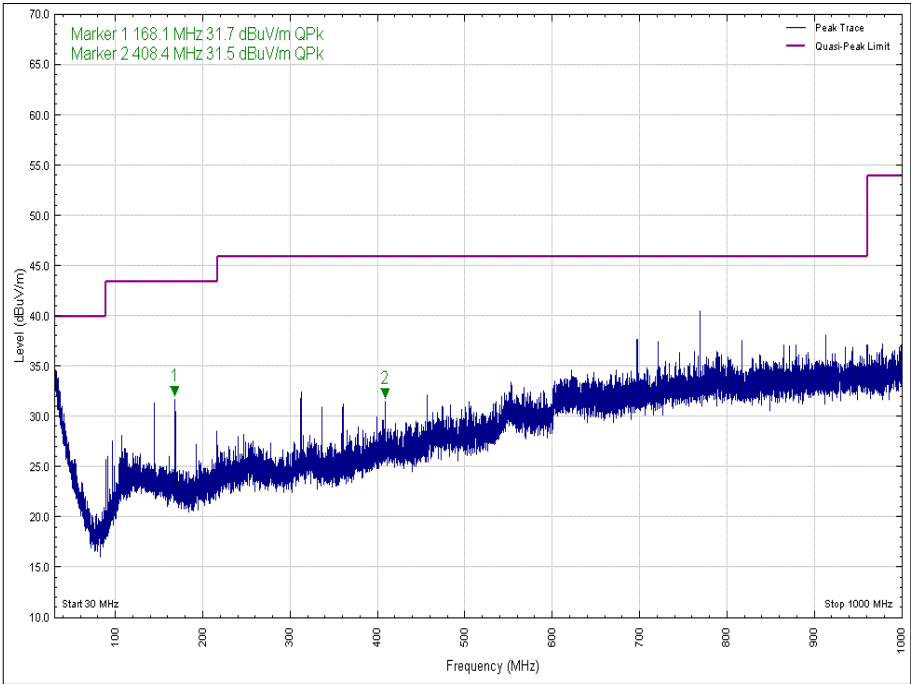


Figure 2 - 30 MHz to 1 GHz - Horizontal

| Frequency (GHz) | Result (dB $\mu$ V/m) |         | Limit (dB $\mu$ V/m) |         | Margin (dB) |         |
|-----------------|-----------------------|---------|----------------------|---------|-------------|---------|
|                 | Peak                  | Average | Peak                 | Average | Peak        | Average |
| 4884.3          | -                     | 44.0    | -                    | 54.0    | -           | 10.0    |
| 5041.8          | -                     | 42.0    | -                    | 54.0    | -           | 12.0    |

**Table 7 - 1 GHz to 40 GHz Emissions Results**

All other emissions that were detected were below 20 dB of the limit.

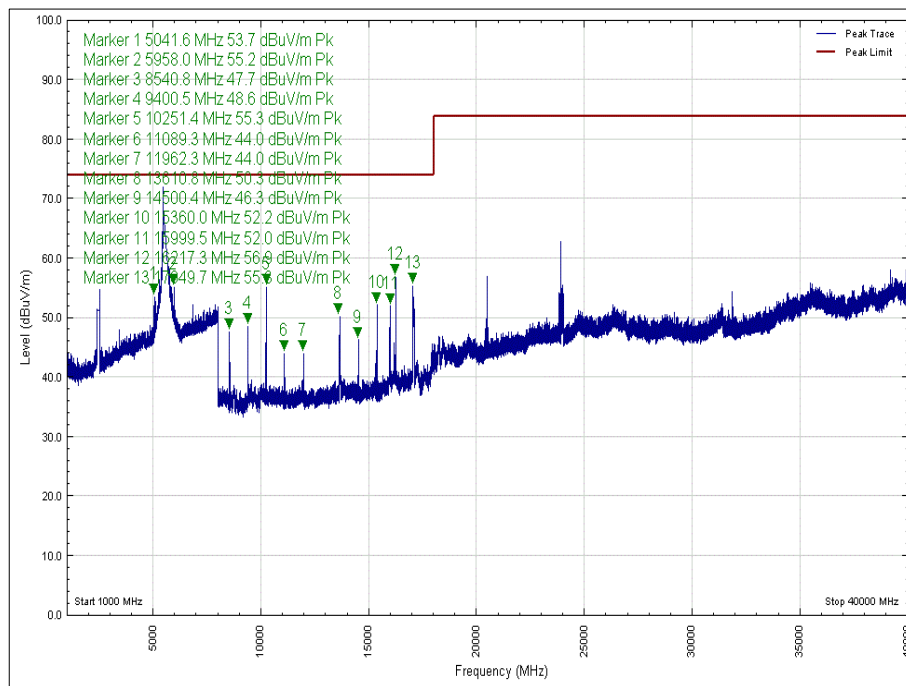


**Figure 3 – 1 GHz to 40 GHz - Horizontal**

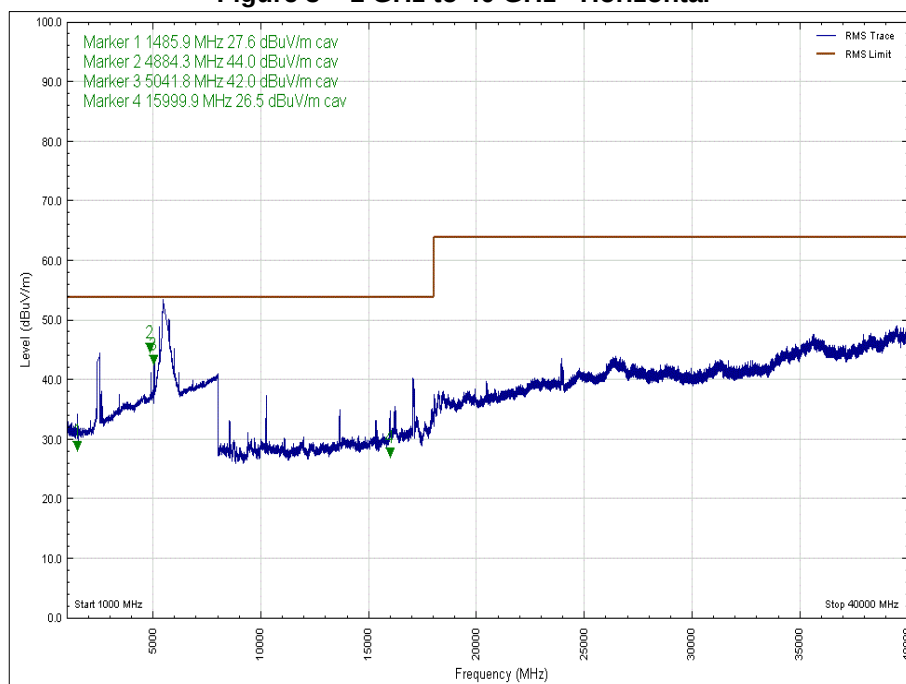


**Figure 4 – 1 GHz to 40 GHz – Horizontal**

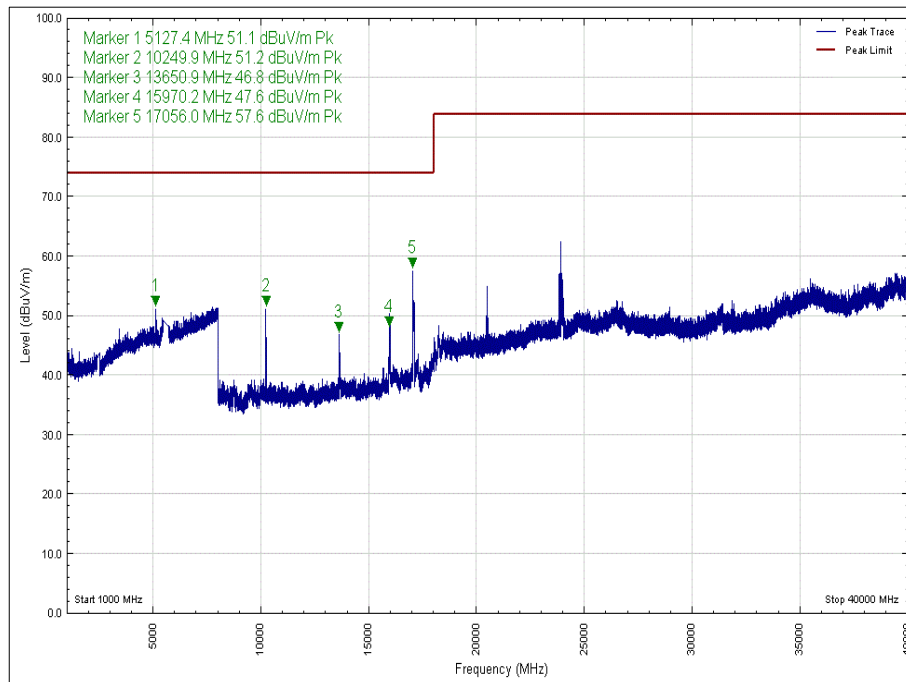


Figure 5 – 1 GHz to 40 GHz – Vertical

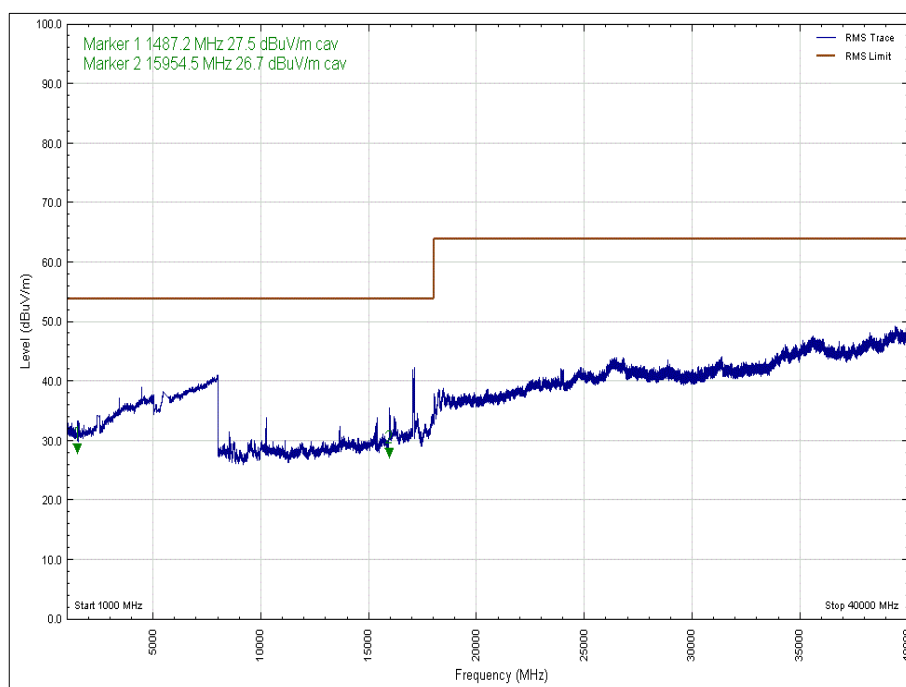


Figure 6 – 1 GHz to 40 GHz - Vertical



### Limit Clause

The least stringent limit from the applicable rule parts was used to determine compliance for Radiated Emissions testing of multiple transmission sources.

| Specification and Clause                                                | Limit                                              |
|-------------------------------------------------------------------------|----------------------------------------------------|
| FCC Part 15.247 (d)                                                     | -20 dBc                                            |
| FCC Part 15.407 (b)                                                     | -27 dBm (EIRP) / 68.2 dBμV/m at 3 m                |
| FCC Part 15.209 (Within restricted bands listed in 15.205)              | Peak: 74 dBμV/m at 3 m<br>Average 54 dBμV/m at 3 m |
| ISED RSS-247, Clause 5.5                                                | -20 dBc                                            |
| ISED RSS-247, Clause 6.2                                                | -27 dBm (EIRP) / 68.2 dBμV/m at 3 m                |
| ISED RSS-GEN, Clause 8.9 (Within restricted bands listed in clause 8.8) | Peak: 74 dBμV/m at 3 m<br>Average 54 dBμV/m at 3 m |

**Table 8 - Limit Table**

### **2.1.7 Test Location and Test Equipment Used**

This test was carried out in EMC Chamber 5 and RF Chamber 11.

| Instrument                                | Manufacturer        | Type No                | TE No | Calibration Period (months) | Calibration Due |
|-------------------------------------------|---------------------|------------------------|-------|-----------------------------|-----------------|
| Antenna with permanent attenuator (Bilog) | Schaffner           | CBL6143                | 287   | 24                          | 15-May-2020     |
| 10dB/1W SMA Attenuator dc - 18GHz         | Sealectro           | 60-674-1010-89         | 395   | -                           | O/P Mon         |
| Pre-Amplifier                             | Phase One           | PS04-0086              | 1533  | 12                          | 08-Feb-2020     |
| Screened Room (5)                         | Rainford            | Rainford               | 1545  | 36                          | 23-Jan-2021     |
| Turntable Controller                      | Inn-Co GmbH         | CO 1000                | 1606  | -                           | TU              |
| Hygrometer                                | Rotronic            | HYGROPALM 1            | 2338  | 12                          | 15-Nov-2019     |
| EMI Test Receiver                         | Rohde & Schwarz     | ESU40                  | 3506  | 12                          | 17-Dec-2019     |
| 1GHz to 8GHz Low Noise Amplifier          | Wright Technologies | APS04-0085             | 4365  | 12                          | 14-Nov-2020     |
| Cable (Rx, Km-Km 2m)                      | Scott Cables        | KPS-1501-2000-KPS      | 4526  | 6                           | 11-Dec-2019     |
| High Pass Filter (4GHz)                   | K&L Microwave       | 11SH10-4000/X18000-0/0 | 4599  | 12                          | 05-Sep-2020     |
| Double Ridged Waveguide Horn Antenna      | ETS-Lindgren        | 3117                   | 4722  | 12                          | 05-Mar-2020     |
| Mast Controller                           | Maturo GmbH         | NCD                    | 4810  | -                           | TU              |
| Tilt Antenna Mast                         | Maturo GmbH         | TAM 4.0-P              | 4811  | -                           | TU              |
| Double Ridge Broadband Horn Antenna       | Schwarzbeck         | BBHA 9120 B            | 4848  | 12                          | 11-Mar-2020     |
| 8 - 18 GHz pre amp                        | Wright Technologies | PS06-0061              | 4971  | 12                          | 07-Dec-2019     |



| Instrument                      | Manufacturer    | Type No                                  | TE No | Calibration Period (months) | Calibration Due |
|---------------------------------|-----------------|------------------------------------------|-------|-----------------------------|-----------------|
| Band Reject Filter - 2.425 GHz  | Wainwright      | WRCGV14-2390-2400-2450-2460-50SS         | 5066  | 12                          | 01-Oct-2020     |
| Band Reject Filter - 2.425 GHz  | Wainwright      | WRCGV14-2390-2400-2450-2460-50SS         | 5067  | 12                          | 01-Oct-2020     |
| Band Reject Filter - 2.4585 GHz | Wainwright      | WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS | 5068  | 12                          | 01-Oct-2020     |
| Band Reject Filter - 2.4585 GHz | Wainwright      | WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS | 5069  | 12                          | 01-Oct-2020     |
| EMI Test Receiver               | Rohde & Schwarz | ESW44                                    | 5084  | 12                          | 11-Nov-2019     |
| 8m N-Type RF Cable              | Teledyne        | PR90-088-8MTR                            | 5093  | 12                          | 06-Oct-2020     |
| 8m N-Type RF Cable              | Teledyne        | PR90-088-8MTR                            | 5095  | 12                          | 04-Dec-2019     |
| Cable (18 GHz)                  | Rosenberger     | LU7-071-1000                             | 5102  | 12                          | 06-Oct-2020     |
| Cable (18 GHz)                  | Rosenberger     | LU7-071-1000                             | 5103  | 12                          | 06-Oct-2020     |
| Cable (18 GHz)                  | Rosenberger     | LU7-071-1000                             | 5104  | 12                          | 05-Dec-2019     |
| Cable (18 GHz)                  | Rosenberger     | LU7-071-1000                             | 5105  | 12                          | 06-Oct-2020     |
| Cable (18 GHz)                  | Rosenberger     | LU7-071-2000                             | 5107  | 12                          | 06-Oct-2020     |
| EmX Emissions Software          | TUV SUD         | EmX                                      | 5125  | -                           | Software        |
| 1.5m 40GHz RF Cable             | Scott Cables    | KPS-1501-2000-KPS                        | 5127  | 6                           | 11-Dec-2019     |
| Screened Room (11)              | Rainford        | Rainford                                 | 5136  | 36                          | 01-Nov-2021     |
| Mast                            | Maturo          | TAM 4.0-P                                | 5158  | -                           | TU              |
| Mast and Turntable Controller   | Maturo          | Maturo NCD                               | 5159  | -                           | TU              |
| Turntable                       | Maturo          | TT 15WF                                  | 5160  | -                           | TU              |
| 8 Meter Cable                   | Teledyne        | PR90-088-8MTR                            | 5212  | 12                          | 30-Aug-2020     |
| Horn Antenna (1-10GHz)          | Schwarzbeck     | BBHA 9120 B                              | 5215  | 12                          | 11-Mar-2020     |
| DRG Horn Antenna (7.5-18GHz)    | Schwarzbeck     | HWRD750                                  | 5216  | 12                          | 11-Mar-2020     |
| 3 GHz High pass filter          | Wainwright      | WHKX12-2580-3000-18000-80SS              | 5219  | 12                          | 15-Feb-2020     |

**Table 9**

TU – Traceability Unscheduled  
O/P Mon – Output Monitored using calibrated equipment



### 3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

| Test Name                                               | Measurement Uncertainty                                        |
|---------------------------------------------------------|----------------------------------------------------------------|
| Radiated Spurious Emissions (Simultaneous Transmission) | 30 MHz to 1 GHz: $\pm 5.2$ dB<br>1 GHz to 40 GHz: $\pm 6.3$ dB |

**Table 10**

#### Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, clause 4.4.3 and 4.5.1.