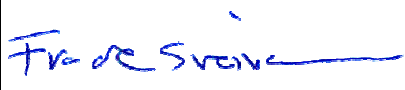


# Test Report

|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>                                                                                                                                                                                                                                                                                                                                                                                     | Telematics unit for mounting on forklifts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Name and address of the applicant</b>                                                                                                                                                                                                                                                                                                                                                           | Toyota Material Handling, Inc.<br>5559 Inwood Drive, Columbus<br>IN 47201, USA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Name and address of the manufacturer</b>                                                                                                                                                                                                                                                                                                                                                        | Toyota Material Handling, Inc.<br>5559 Inwood Drive, Columbus<br>IN 47201, USA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Model</b>                                                                                                                                                                                                                                                                                                                                                                                       | DHUnx                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Rating</b>                                                                                                                                                                                                                                                                                                                                                                                      | External DC supply (12-48 V <sub>DC</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Trademark</b>                                                                                                                                                                                                                                                                                                                                                                                   | TOYOTA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Serial number</b>                                                                                                                                                                                                                                                                                                                                                                               | 2117000000251                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Additional information</b>                                                                                                                                                                                                                                                                                                                                                                      | WiFi, BT Classic, BLE, WCDMA, LTE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Tested according to</b>                                                                                                                                                                                                                                                                                                                                                                         | <b>Parts of FCC Part 15</b><br><b>Parts of FCC Parts 22 / 24 / 27 / 90</b><br><b>Parts of Canada RSS-247, Issue 2</b><br><b>Parts of Canada RSS-130 / RSS-132 / RSS-133 / RSS-139 / RSS-199</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Order number</b>                                                                                                                                                                                                                                                                                                                                                                                | 433049                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Tested in period</b>                                                                                                                                                                                                                                                                                                                                                                            | 2021-09-15 to 2021-10-26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Issue date</b>                                                                                                                                                                                                                                                                                                                                                                                  | 2022-02-24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Name and address of the testing laboratory</b>                                                                                                                                                                                                                                                                                                                                                  | <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> <br/> Instituttveien 6<br/>Kjeller, Norway<br/>www.nemko.com </div> <div style="text-align: center;"> CAB Number:<br/>FCC: NO0001<br/>ISED: NO0470 </div> <div style="text-align: center;"> <br/>  </div> </div> <p style="text-align: center; color: red;">An accredited technical test executed under the Norwegian accreditation scheme</p> |
| <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <br/> Prepared by [Frode Sveinsen] </div> <div style="text-align: center;"> <br/> Approved by [G.Suhanthakumar] </div> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| This report shall not be reproduced except in full without the written approval of Nemko. Opinions and interpretations expressed within this report are not part of the current accreditation. This report was originally distributed electronically with digital signatures. For more information contact Nemko.                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## Revision history

| Revision | Date       | Comment       | Sign |
|----------|------------|---------------|------|
| 00       | 2022-02-24 | First edition | FS   |
|          |            |               |      |

## CONTENTS

|          |                                            |           |
|----------|--------------------------------------------|-----------|
| <b>1</b> | <b>INFORMATION .....</b>                   | <b>4</b>  |
| 1.1      | Test Item .....                            | 4         |
| 1.2      | Normal test conditions .....               | 4         |
| 1.3      | Test Engineer .....                        | 5         |
| 1.4      | EUT Operating Modes .....                  | 5         |
| 1.5      | Radio Modules .....                        | 5         |
| 1.6      | Mobile Frequency Bands and Standards ..... | 5         |
| 1.7      | Comments .....                             | 5         |
| <b>2</b> | <b>TEST REPORT SUMMARY .....</b>           | <b>6</b>  |
| 2.1      | General .....                              | 6         |
| 2.2      | Test Summary .....                         | 7         |
| <b>3</b> | <b>TEST RESULTS .....</b>                  | <b>8</b>  |
| 3.1      | Radiated Emissions, Interoperability ..... | 8         |
| <b>4</b> | <b>Measurement Uncertainty .....</b>       | <b>19</b> |
| <b>5</b> | <b>LIST OF TEST EQUIPMENT .....</b>        | <b>20</b> |
| <b>6</b> | <b>BLOCK DIAGRAM .....</b>                 | <b>21</b> |
| 6.1      | Test Site Radiated Emission .....          | 21        |

## 1 INFORMATION

### 1.1 Test Item

|                                  |                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name                             | Toyota                                                                                                                                                                                                                                                                                          |
| Model/version                    | DHUnx                                                                                                                                                                                                                                                                                           |
| FCC ID                           | 2A226-TELETMH01                                                                                                                                                                                                                                                                                 |
| ISED ID                          | 27732-TELETMH01                                                                                                                                                                                                                                                                                 |
| Serial number                    | 2117000000251                                                                                                                                                                                                                                                                                   |
| Hardware identity and/or version | Rev. B                                                                                                                                                                                                                                                                                          |
| Software identity and/or version | dv_b1_2021-05-05                                                                                                                                                                                                                                                                                |
| Number of antennas               | 1 for BT/BLE/WiFi<br>2 for WCDMA/LTE (only 1 is used for TX, both are used for RX)<br>1 for GPS (RX only)                                                                                                                                                                                       |
| Supported Radio Technologies     | Bluetooth Classic<br>Bluetooth Low energy<br>WiFi 2.4 GHz / 5 GHz<br>WCDMA 850 / 1900 / 2100<br>LTE (FDD/TDD)                                                                                                                                                                                   |
| Antenna Connector                | Quad MiniFakra                                                                                                                                                                                                                                                                                  |
| Antenna Type                     | Molex Antenna, P/N: 2144500750<br>(P/N is for version with 750mm cable length, longer cables may also be used)<br><br>Antenna element LTE1: Rx/Tx<br>Antenna element LTE2: Rx Only<br>Antenna element WiFi/BT: Rx/Tx 2.4GHz WiFi/BT/BLE and 5GHz WiFi<br>Antenna element GNSS: Rx Only GNSS/GPS |
| Antenna Diversity Supported      | Yes, but only for RX on LTE                                                                                                                                                                                                                                                                     |
| Smart Antenna System             | No                                                                                                                                                                                                                                                                                              |
| Power Source                     | External DC Supply (12-48V <sub>DC</sub> , supplied through MX23 connector)                                                                                                                                                                                                                     |
| Interfaces                       | MX23 Connector<br><br>HSD Connector (100TX Ethernet)                                                                                                                                                                                                                                            |

### Description of Test Item

The EUT is a telematics unit with radio modules for BT/BLE/WiFi and Mobile. Both radio modules are certified radio modules. The EUT also contains a GPS receiver.

This test report only covers only interoperability tests for simultaneous operation of the two radio modules.

### 1.2 Normal test conditions

|                      |                                                    |
|----------------------|----------------------------------------------------|
| Temperature:         | 20 - 24 °C                                         |
| Relative humidity:   | 20 - 50 %                                          |
| Normal test voltage: | 24V DC (2x 12V lead acid batteries, Fiamm FG20451) |

The EUT was powered from two fully charged batteries during all tests.  
The values are the limit registered during the test period.

## 1.3 Test Engineer

Frode Sveinsen

## 1.4 EUT Operating Modes

All tests were performed with WiFi / BT / BLE programmed from the Qualcomm Radio Control Software.

Power values for these technologies are noted in the individual test reports.

The mobile transmitter was programmed from the CMW500 for WCDMA and LTE. The mobile signal was programmed to the maximum output power supported for each technology.

## 1.5 Radio Modules

| Data for radio modules |          |                                                                               |                                            |               |
|------------------------|----------|-------------------------------------------------------------------------------|--------------------------------------------|---------------|
| Manufacturer           | Model No | Identification                                                                | Original Test Report                       | Technology    |
| Quectel                | FC20     | FCC ID: XMR201703FC20<br>IC: 10224A-201703FC20<br><br>P/N: FC20-Q73           | Siemic 16050028-FCC-R3<br>TA R2105A0465-R2 | BT Classic    |
|                        |          |                                                                               | Siemic 16050028-FCC-R4<br>TA R2105A0465-R1 | BT Low Energy |
|                        |          |                                                                               | Siemic 16050028-FCC-R1<br>TA R2105A0465-R1 | WLAN          |
|                        |          |                                                                               | Siemic 16050028-FCC-R2<br>TA R2105A0465-R3 | UNII 2TX      |
|                        |          |                                                                               | TA R2105A0465-R4V1                         | DFS           |
| Quectel                | EG25     | FCC ID: XMR201903EG25G<br>IC: 10224A-201903EG25G<br><br>P/N: EG25GGB-256-SGNS | SGS HR/2019/1001601<br>SGS HR/2019/1001603 | WCDMA / LTE   |

## 1.6 Mobile Frequency Bands and Standards

| Band | FCC                  | ISED Canada                         | Uplink Freq                | Downlink Freq              | Technology | Common Name |
|------|----------------------|-------------------------------------|----------------------------|----------------------------|------------|-------------|
| B02  | Part 24E             | RSS-133 Issue 6 A1                  | 1850-1910 MHz              | 1930-1990 MHz              | WCDMA, LTE | 1900 PCS    |
| B04  | Part 27C             | RSS-139 Issue 3                     | 1710-1755 MHz              | 2110-2155 MHz              | WCDMA, LTE | AWS-1       |
| B05  | Part 22H             | RSS-132 Issue 3                     | 824-849 MHz                | 869-894 MHz                | WCDMA, LTE | 850         |
| B07  | Part 27C             | RSS-199 Issue 3                     | 2500-2570 MHz              | 2620-2690 MHz              | LTE        | 2600        |
| B12  | Part 27C             | RSS-130 Issue 2                     | 699-716 MHz                | 729-746 MHz                | LTE        | 700a        |
| B13  | Part 27C             | RSS-130 Issue 2                     | 777-787 MHz                | 746-756 MHz                | LTE        | 700c        |
| B25  | Part 24E             | RSS-133 Issue 6 A1                  | 1850-1915 MHz              | 1930-1995 MHz              | LTE        | 1900+       |
| B26  | Part 90S<br>Part 22H | RSS-119 Issue 12<br>RSS-132 Issue 3 | 814-824 MHz<br>824-849 MHz | 859-869 MHz<br>869-894 MHz | LTE        | 850+        |
| B38  | Part 27C             | RSS-199 Issue 3                     | 2570-2620 (TDD)            |                            | LTE        | TD 2600     |
| B41  | Part 27C             | RSS-199 Issue 3                     | 2496-2690 (TDD)            |                            | LTE        | TD 2600+    |

## 1.7 Comments

All ports were populated during spurious emission measurements.

This test report covers only selected tests for new antennas, all other tests are covered by the original Test Report.

All results are tested to limits for FCC 15.209 since these are the strictest limits.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

Tests were performed in accordance with ANSI C63.4-2014, ANSI C63.10-2013 and ANSI C63.26-2015.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 3m.

A description of the test facility is on file with the FCC and ISSED.

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

**PCB** Equipment Code

☐ Family Listing



#### THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

Nemko Group authorizes the above named entity to reproduce this report provided it is reproduced in its entirety and for use by the entity's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party caused by decisions made or actions based on this report.

## 2.2 Test Summary

| Name of test                  | FCC Part 15 reference               | RSS-247 Issue 2,<br>RSS-GEN Issue 5<br>reference | ANSI C63.10-2013<br>Reference             | Result   |
|-------------------------------|-------------------------------------|--------------------------------------------------|-------------------------------------------|----------|
| Spurious Emissions (Radiated) | 15.247(c)<br>15.109(a)<br>15.209(a) | 5.5 (RSS-247)<br>7.3 (RSS-GEN)<br>8.9 (RSS-GEN)  | 6.3, 6.5, 6.6, 6.10<br>11.12, 11.13 (DTS) | Complies |

## 3 TEST RESULTS

### 3.1 Radiated Emissions, Interoperability

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

**Detector:** Peak Detector for Pre-scan (Measurements with Quasi-Peak Detector below 1 GHz)

**Measuring distance:** 3m (1 – 18 GHz)

A 2.4 GHz Band Reject Filter was used for measurements from 1 GHz to 18 GHz

The limit for Part 15.209 was used for all tests since this is the strictest limit.

The limit for most of the tested licensed bands are -13 dBm average, which is equivalent to 82 dB $\mu$ V/m @3m.

Antenna factor, PreAmp Gain and Cable Loss are included in spectrum analyzer "Transducer factor".

Results are shown below. No other emissions related to intermodulation were detected.

#### Requirements/Limit

| FCC            | Part 15.209 @ frequencies defined in §15.205                     |                   |
|----------------|------------------------------------------------------------------|-------------------|
| ISED           | RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10 |                   |
| Frequency      | Radiated emission limit @3 meters                                |                   |
|                | All Limits below 1GHz are with Quasi Peak Detector               |                   |
| 30 – 88 MHz    | 100 $\mu$ V/m                                                    | 40.0 dB $\mu$ V/m |
| 88 – 216 MHz   | 150 $\mu$ V/m                                                    | 43.5 dB $\mu$ V/m |
| 216 – 960 MHz  | 200 $\mu$ V/m                                                    | 46.0 dB $\mu$ V/m |
| 960 – 1000 MHz | 500 $\mu$ V/m                                                    | 54.0 dB $\mu$ V/m |
|                | Average Detector                                                 | Peak Detector     |
| 1 – 26 GHz     | 54.0 dB $\mu$ V/m                                                | 74.0 dB $\mu$ V/m |

| Band 02 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch19000  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 1343                     | 2437                    | 1890                   | < 50                        | /       | 74             | 54      | >24         | /       |
| 2984                     | 2437                    | 1890                   | < 54                        | < 50    | 74             | 54      | >20         | >4      |

| Band 04 + WiFi               |                         |                          |                             |         |                |         |             |         |
|------------------------------|-------------------------|--------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + WCDMA1900 ch1450 |                         |                          |                             |         |                |         |             |         |
| Measured Frequency (MHz)     | Carrier Freq WiFi (MHz) | Carrier Freq WCDMA (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                              |                         |                          | Peak                        | Average | Peak           | Average | Peak        | Average |
| 1103                         | 2437                    | 1770                     | <50                         | /       | 74             | 54      | >24         | /       |
| 3104                         | 2437                    | 1770                     | <54                         | /       | 74             | 54      | >20         | /       |

| Band 04 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch20250  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 1043                     | 2437                    | 1740                   | <50                         | /       | 74             | 54      | >24         | /       |
| 3134                     | 2437                    | 1740                   | <56                         | <46     | 74             | 54      | >18         | >8      |

| Band 07 + WiFi               |                         |                        |                             |         |                |         |             |         |
|------------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE 2600 ch21175 |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz)     | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                              |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 2331.5                       | 2437                    | 2542.5                 | <60                         | <48     | 74             | 54      | >14         | >6      |
| 2648                         | 2437                    | 2542.5                 | <60                         | <48     | 74             | 54      | >14         | >6      |

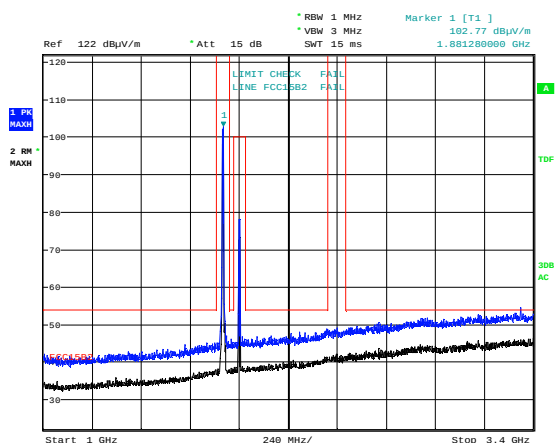
| Band 12 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch19000  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 4169                     | 2437                    | 705                    | < 50                        | /       | 74             | 54      | >24         | /       |

| Band 13 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch23230  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 4092                     | 2437                    | 782                    | < 50                        | /       | 74             | 54      | >24         | /       |

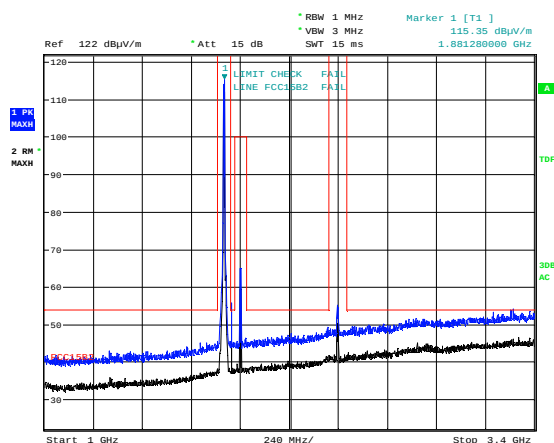
| Band 25 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch26365  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 1328                     | 2437                    | 1882.5                 | < 54                        | /       | 74             | 54      | >20         | /       |
| 2991.5                   | 2437                    | 1882.5                 | <58                         | <48     | 74             | 54      | >16         | >6      |

| Band 26 + WiFi           |                         |                        |                             |         |                |         |             |         |
|--------------------------|-------------------------|------------------------|-----------------------------|---------|----------------|---------|-------------|---------|
| WiFi ch06 + LTE ch26890  |                         |                        |                             |         |                |         |             |         |
| Measured Frequency (MHz) | Carrier Freq WiFi (MHz) | Carrier Freq LTE (MHz) | Measured Emissions (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dB) |         |
|                          |                         |                        | Peak                        | Average | Peak           | Average | Peak        | Average |
| 4040                     | 2437                    | 834                    | < 54                        | /       | 74             | 54      | >20         | /       |

## Band 2: WCDMA1900 / LTE

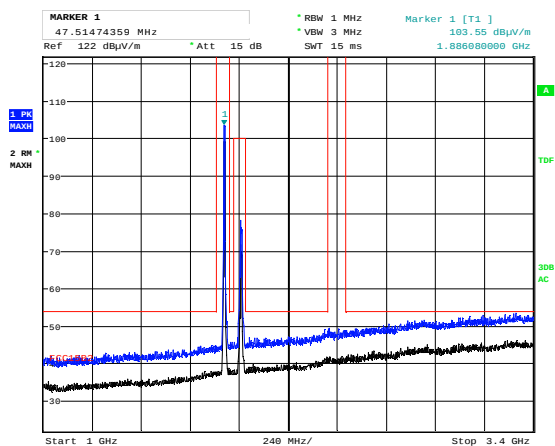


Date: 21.SEP.2021 12:48:11



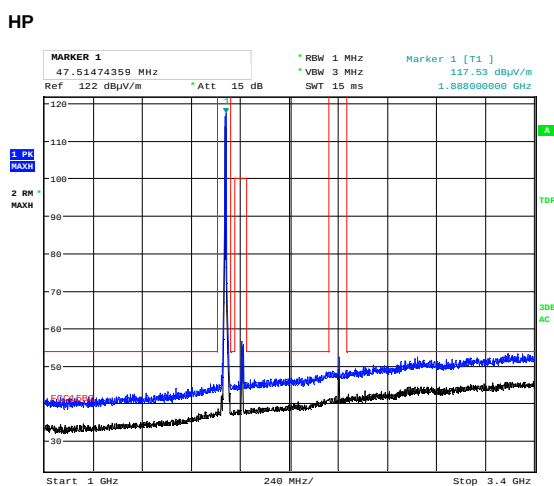
Date: 21.SEP.2021 12:50:23

1000-3400MHz, WiFi ch06 11B 1M + WCDMA ch9400 VP



Date: 21.SEP.2021 14:17:48

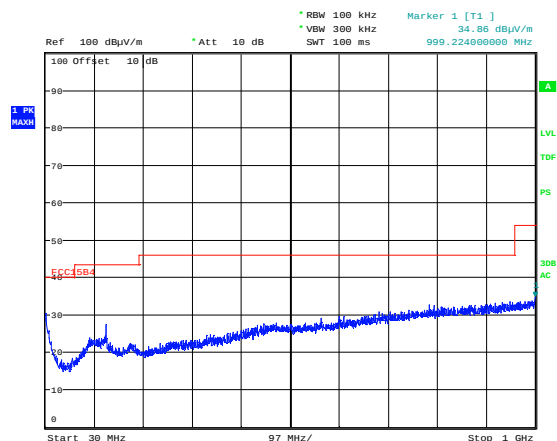
1000-3400MHz, BT GFSK ch39 + LTE ch19000 VP



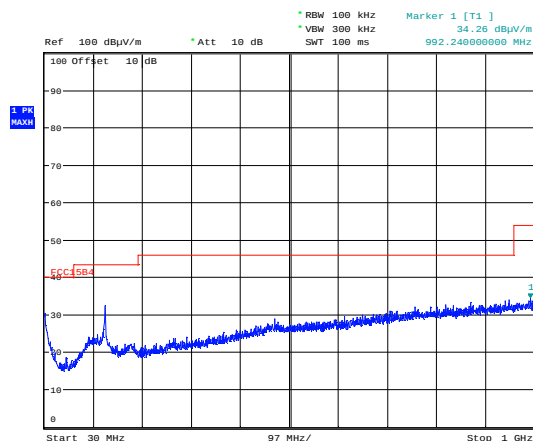
Date: 21.SEP.2021 14:15:48

**HP**

## Band 4: WCDMA1800 / LTE

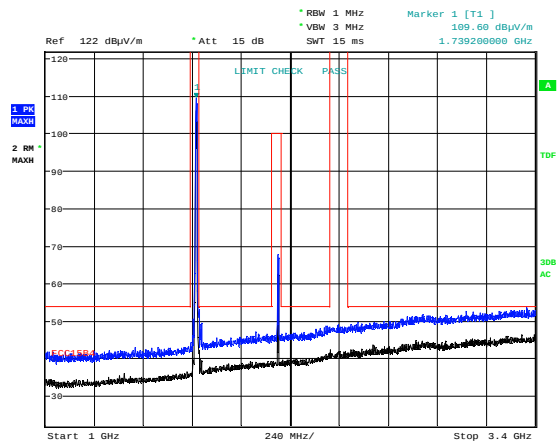


Date: 23.SEP.2021 14:04:21



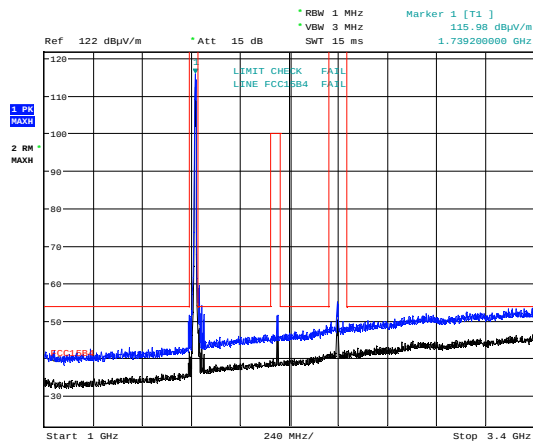
Date: 23.SEP.2021 14:06:10

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch20175 VP



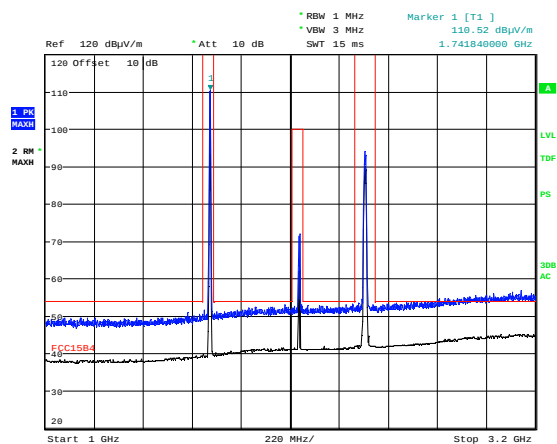
Date: 21.SEP.2021 12:29:46

## HP



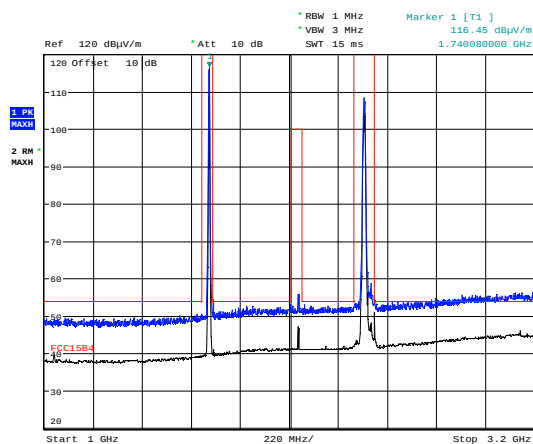
Date: 21.SEP.2021 12:31:59

## 1000-3400MHz, WiFi ch06 11b 1M + WCDMA ch1450 VP



Date: 21.SEP.2021 10:51:43

## HP

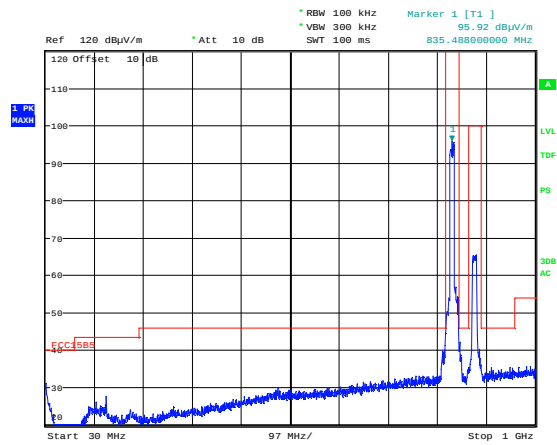


Date: 21.SEP.2021 10:53:54

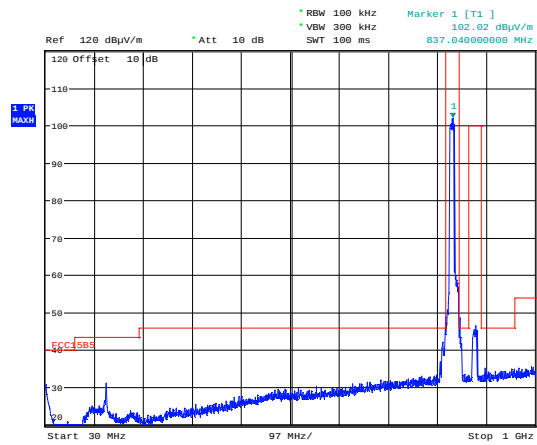
## 1000-3200MHz, WiFi ch06 11b 1M + LTE ch20250 VP

## HP

## Band 5: WCDMA850 / LTE

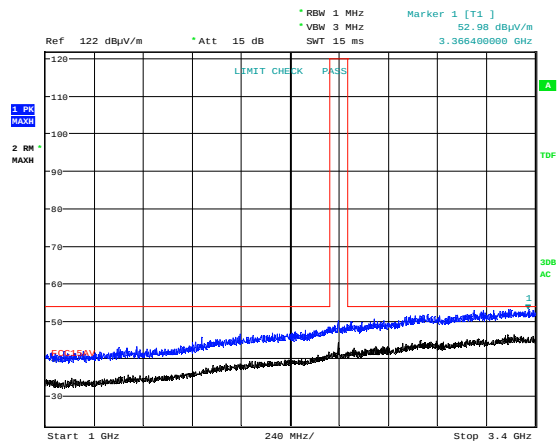


Date: 23.SEP.2021 14:58:43



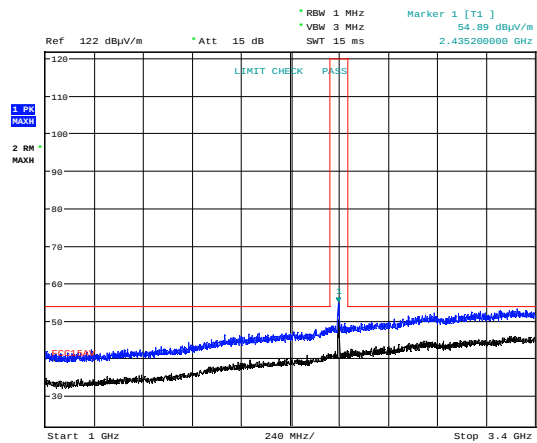
Date: 23.SEP.2021 14:52:31

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch20510 VP



Date: 21.SEP.2021 12:55:17

## HP

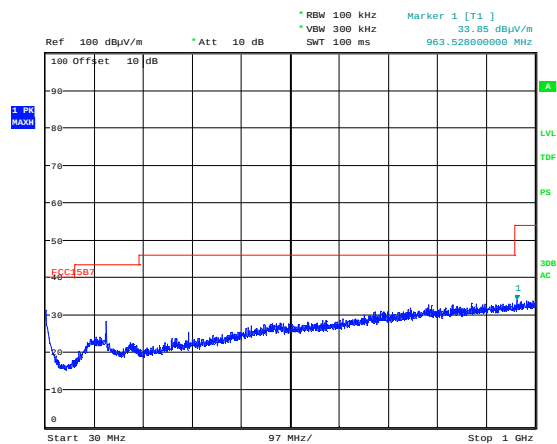


Date: 21.SEP.2021 12:59:04

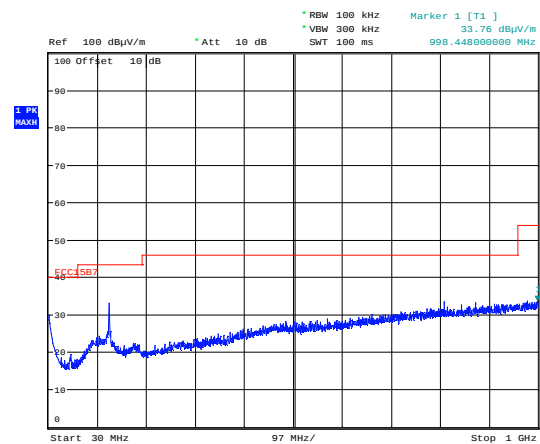
## 1000-3400MHz, WiFi ch06 11b 1M + WCDMA ch4180 VP

## HP

## Band 7: LTE 2600

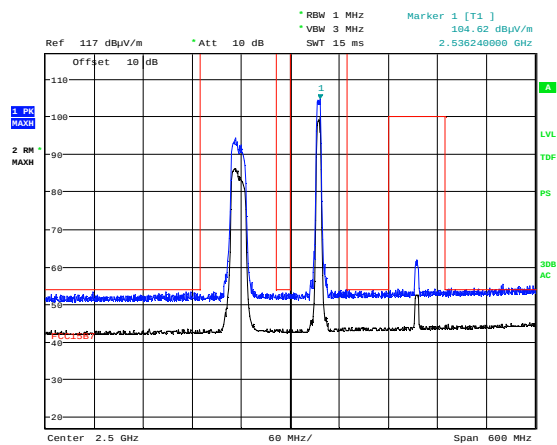


Date: 23.SEP.2021 14:19:06



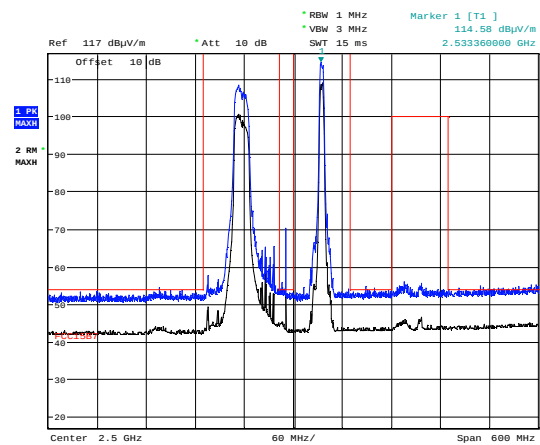
Date: 23.SEP.2021 14:20:54

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch21100 VP



Date: 21.SEP.2021 09:58:52

## HP

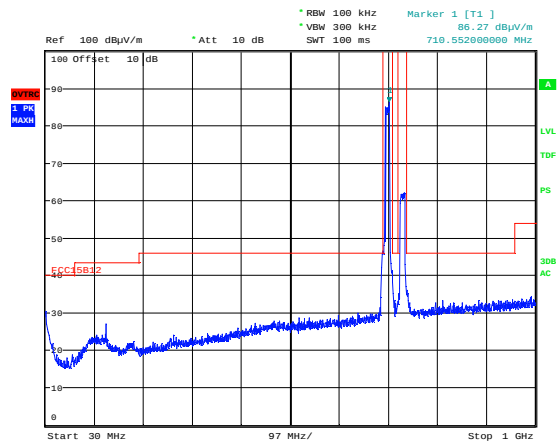


Date: 21.SEP.2021 09:53:05

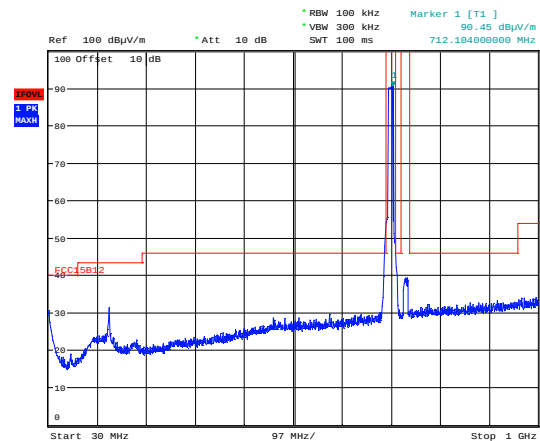
## 2200-2800MHz, WiFi ch06 11g 6M + LTE ch21175 VP

## HP

## Band 12: LTE

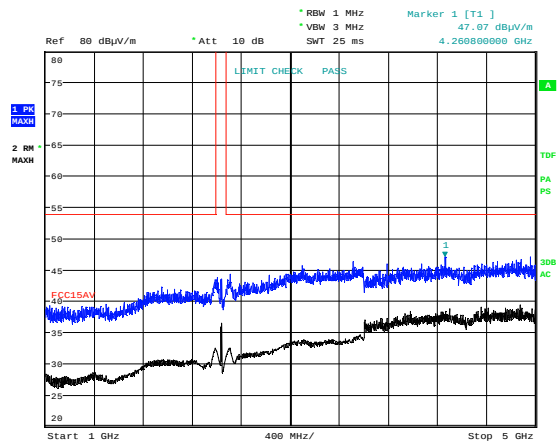


Date: 23.SEP.2021 14:25:54



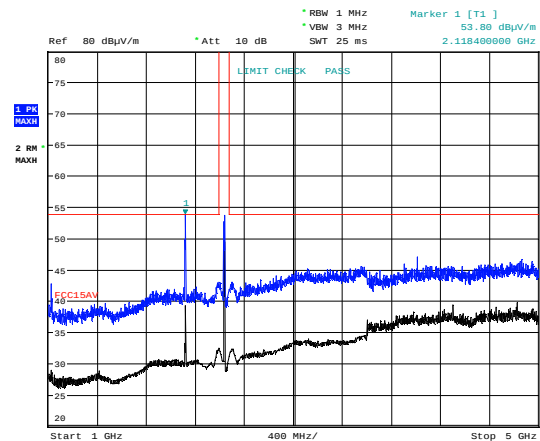
Date: 23.SEP.2021 14:27:43

## 30-1000MHz, WiFi ch06 11b 1M + LTE ch23095 VP



Date: 21.SEP.2021 12:02:20

## HP

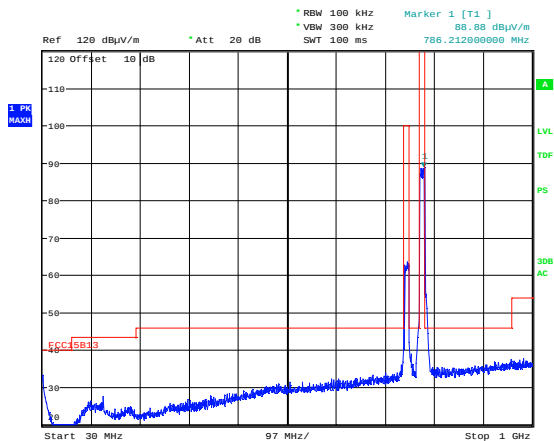


Date: 21.SEP.2021 12:04:33

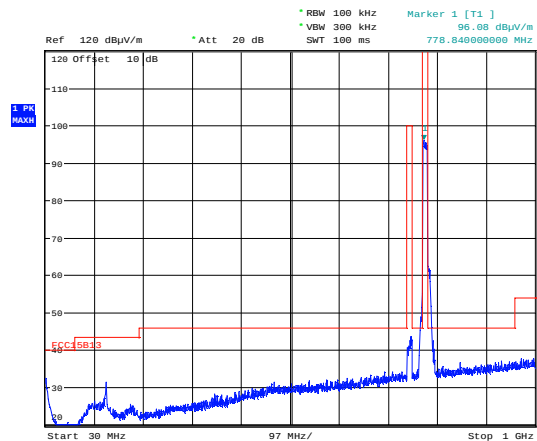
## 1000-5000MHz, WiFi ch06 11b 1M + LTE ch23070 VP

## HP

## Band 13: LTE

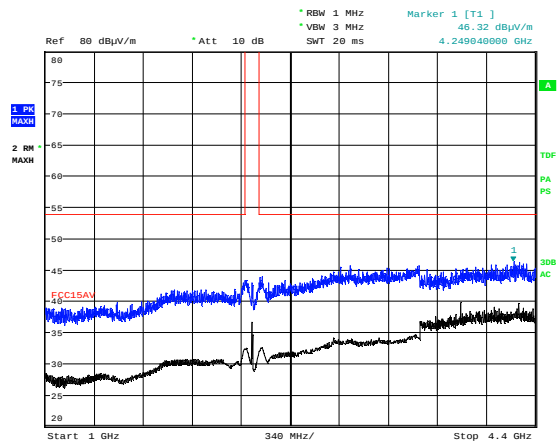


Date: 23.SEP.2021 13:51:28



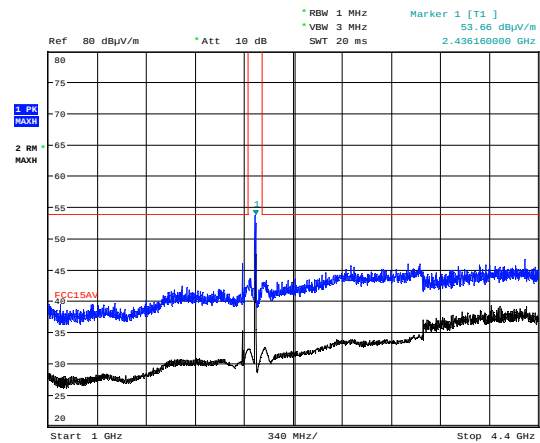
Date: 23.SEP.2021 13:53:17

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch23230 VP



Date: 21.SEP.2021 11:12:56

## HP

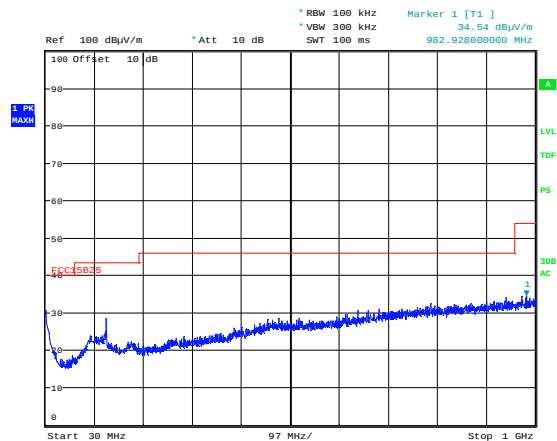


Date: 21.SEP.2021 11:15:09

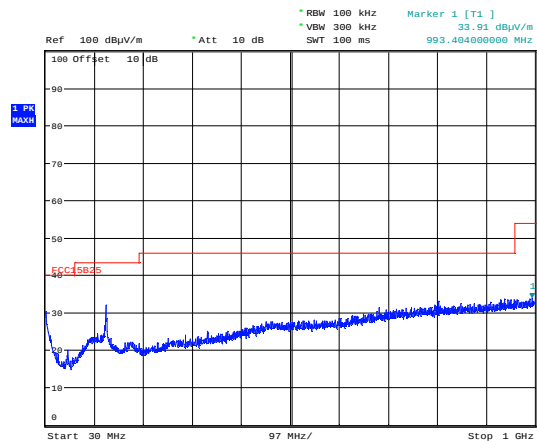
## 1000-4400MHz, WiFi ch06 11b 1M + LTE ch23230 VP

## HP

## Band 25: LTE

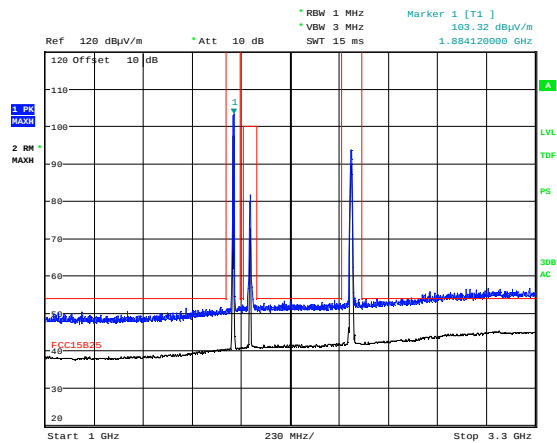


Date: 23.SEP.2021 14:09:47



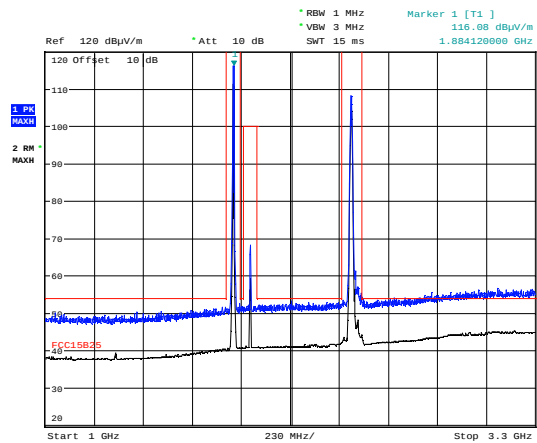
Date: 23.SEP.2021 14:11:35

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch26390 VP



Date: 21.SEP.2021 10:29:20

## HP

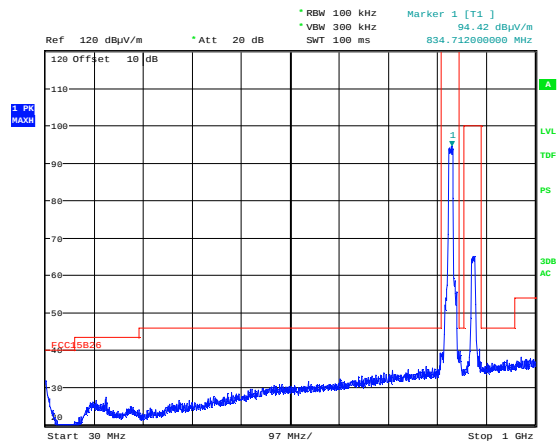


Date: 21.SEP.2021 10:31:31

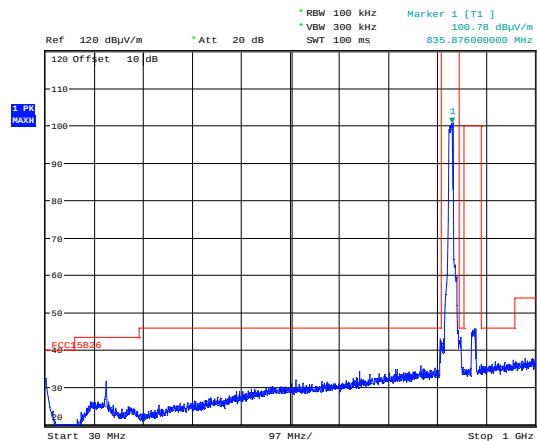
## 1000-3300MHz, WiFi ch06 11b 1M + LTE ch26365 VP

## HP

## Band 26: LTE

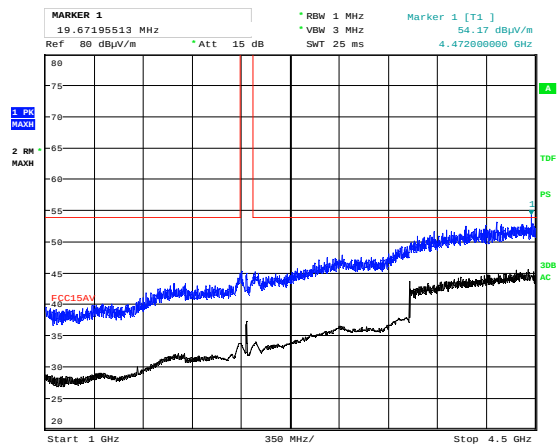


Date: 23. SEP. 2021 13:57:02



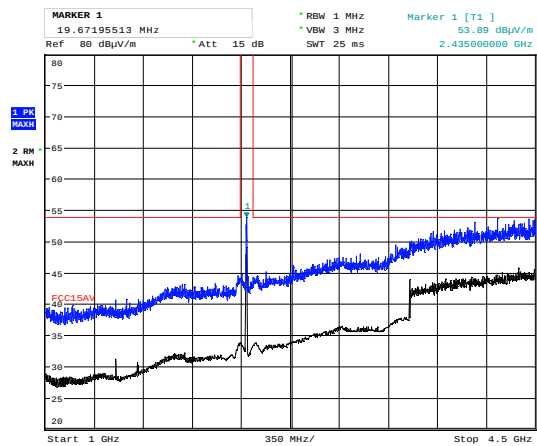
Date: 23. SEP. 2021 13:58:50

## 30-1000MHz, WiFi ch06 11g 6M + LTE ch26875 VP



Date: 21. SEP. 2021 15:05:27

## HP



Date: 21. SEP. 2021 15:07:40

## 1000-3400MHz, WiFi ch06 11b 1M + LTE ch26890 VP

## HP

## 4 Measurement Uncertainty

| Measurement Uncertainty Values   |           |                |
|----------------------------------|-----------|----------------|
| Test Item                        |           | Uncertainty    |
| Output Power                     |           | ±0.5 dB        |
| Power Spectral Density           |           | ±0.5 dB        |
| Out of Band Emissions, Conducted | < 3.6 GHz | ±0.6 dB        |
|                                  | > 3.6 GHz | ±0.9 dB        |
| Spurious Emissions, Radiated     | < 1 GHz   | ±2.5 dB        |
|                                  | > 1 GHz   | ±2.2 dB        |
| Emission Bandwidth               |           | ±4 %           |
| Power Line Conducted Emissions   |           | +2.9 / -4.1 dB |
| Spectrum Mask Measurements       | Frequency | ±5 %           |
|                                  | Amplitude | ±1.0 dB        |
| Frequency Error                  |           | ±0.6 ppm       |
| Temperature Uncertainty          |           | ±1 °C          |

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

## 5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

| No. | Model number             | Description              | Manufacturer       | Ref. no. | Cal. date | Cal. Due |
|-----|--------------------------|--------------------------|--------------------|----------|-----------|----------|
| 1   | ESU40                    | Measuring Receiver       | Rohde & Schwarz    | LR 1639  | 2021-02   | 2022-02  |
| 2   | 6810-17B                 | Attenuator               | Suhner             | LR 1669  | 2021-08   | 2022-08  |
| 3   | N0324415                 | BandStop Filter (2.4GHz) | Microwave Circuits | LR 1760  | COU       |          |
| 4   | WLK5-1100-1485-7000-40SS | Low Pass Filter (1GHz)   | Wainwright Inst.   | LR 1761  | COU       |          |
| 5   | 317                      | Preamplifier             | Sonoma Inst.       | LR 1687  | 2021-08   | 2022-08  |
| 6   | 8449A                    | Pre-amplifier            | Hewlett Packard    | LR 1322  | 2021-08   | 2022-08  |
| 7   | 3115                     | Horn Antenna             | EMCO               | LR 1330  | N/A       |          |
| 8   | 3117-PA                  | Horn Antenna +PreAmp     | EMCO               | LR 1717  | 2021-08   | 2022-08  |
| 9   | Model 638                | Antenna Horn             | Narda              | LR 1480  | N/A       |          |
| 10  | ST18/SMA/N/36            | RF Cable                 | Suhner             | LR 1627  | COU       |          |

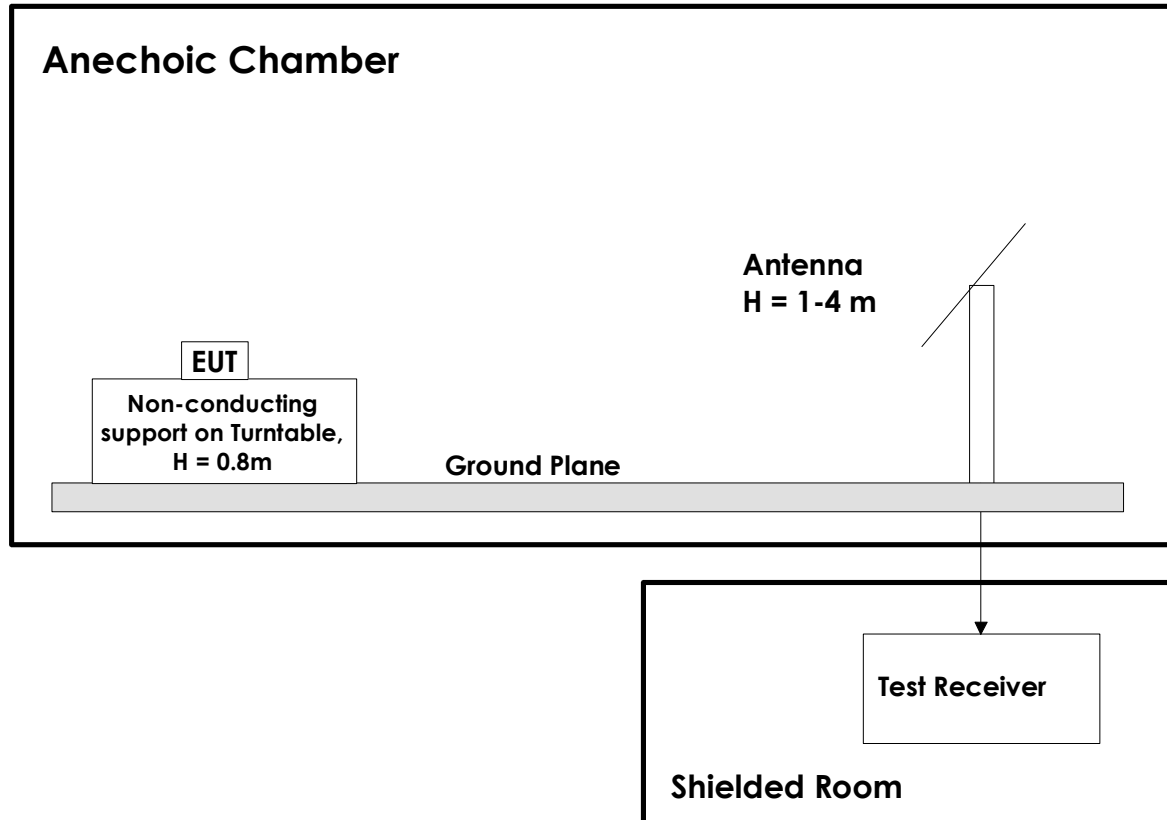
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

| No. | Manufacturer    | Name   | Version  | Comment                                 |
|-----|-----------------|--------|----------|-----------------------------------------|
| 1   | Rohde & Schwarz | EMC32  | 10.50.10 | EMC test software                       |
| 2   | Nemko AS        | RSPlot | 1.0.8.0  | Screenshots from R&S Spectrum Analyzers |
|     |                 |        |          |                                         |

## 6 BLOCK DIAGRAM

### 6.1 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.