



# Radio Test Report

**Zinwave Ltd**

**Uniwave Remote Unit**

**308-0007-1**

47 CFR Part 22H Effective Date 1st October 2021

↳ 47CFR part 2J Effective Date 1st October 2021

Test Date: 21st March 2023 to 24th April 2023

Report Number: 04-14169-1-23 Issue 01

The testing was carried out by RN Electronics Ltd, an independent test house, at their test facility located at:

***R.N. Electronics Ltd.***

Arnolds Court  
Arnolds Farm Lane  
Mountnessing  
Essex  
CM13 1UT  
U.K.

[www.RNelectronics.com](http://www.RNelectronics.com)

Telephone: +44 (0) 1277 352219  
Email: [sales@RNelectronics.com](mailto:sales@RNelectronics.com)

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF communiqué dated April 2017).

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Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT

## Certificate of Test 14169-1

The equipment noted below has been tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of 47 CFR Part 22H. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

|                                                         |                                                                                                    |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Equipment:                                              | Uniwave Remote Unit                                                                                |
| Model Number:                                           | 308-0007-1                                                                                         |
| Unique Serial Number:                                   | 810110000190                                                                                       |
| Applicant:                                              | Zinwave Ltd<br>Harston Mill, Royston Road<br>Harston, Cambridge<br>CB22 7GG                        |
| Proposed FCC ID                                         | UPO308-0007-1                                                                                      |
| Full measurement results are detailed in Report Number: | 04-14169-1-23 Issue 01                                                                             |
| Test Standards:                                         | 47 CFR Part 22H Effective Date 1st October 2021<br>↳ 47CFR part 2J Effective Date 1st October 2021 |

### NOTE:

Certain tests were not performed based upon applicant's declarations. Certain other requirements are subject to applicant's declaration only and have not been tested/verified. For details refer to section 3 of this report.

### DEVIATIONS:

No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Date Of Test: 21st March 2023 to 24th April 2023

Test Engineer:  
Jack Chilvers

Digitally signed by: Jack Chilvers  
DN: CN = Jack Chilvers email = Jack.  
Chilvers@kiwa.com C = GB O = RN Electronics  
OU = RN Electronics  
Date: 2023.05.19 15:53:24 Z

Approved By:  
Radio Approvals Manager

Digitally signed by: Daniel Sims  
DN: CN = Daniel Sims C = GB  
O = RN Electronics Ltd  
Date: 2023.05.19 16:16:12 Z

Customer  
Representative:



File Name: Zinwave Ltd.14169-1 Issue 01

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## 2 Equipment under test (EUT)

### 2.1 Equipment specification

|                           |                                                                                                                       |        |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------|--------|
| Applicant                 | Zinwave Ltd<br>Harston Mill<br>Royston Road<br>Harston<br>Cambridge<br>CB22 7GG                                       |        |
| Manufacturer of EUT       | Zinwave Ltd                                                                                                           |        |
| Full Name of EUT          | Uniwave Remote Unit                                                                                                   |        |
| Model Number of EUT       | 308-0007-1                                                                                                            |        |
| Serial Number of EUT      | 810110000190                                                                                                          |        |
| Date Received             | 17th March 2023                                                                                                       |        |
| Date of Test:             | 21st March 2023 to 12th April 2023                                                                                    |        |
| Purpose of Test           | To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.              |        |
| Date Report Issued        | 14th April 2023                                                                                                       |        |
| Main Function             | Remote Unit in distributed antenna system. Takes RF over fibre and amplifies it before feeding to a wideband antenna. |        |
| Information Specification | Height                                                                                                                | 70 mm  |
|                           | Width                                                                                                                 | 218 mm |
|                           | Depth                                                                                                                 | 270 mm |
|                           | Weight                                                                                                                | 5.5 kg |
|                           | Voltage                                                                                                               | 48 VDC |
|                           | Current                                                                                                               | 0.85 A |

## 2.2 Configurations for testing

| General Parameters                 |                                                                                             |
|------------------------------------|---------------------------------------------------------------------------------------------|
| EUT Normal use position            | Wall Mounted                                                                                |
| Choice of model(s) for type tests  | Production Unit                                                                             |
| Antenna details                    | Omnidirectional Ceiling Mounted - Laird/TE CFD69383P1 or Laird/TE CFS60383P (Gain: 5.2 dBi) |
| Antenna port                       | 1 Tx port and 1 Rx port                                                                     |
| Baseband Data port (yes/no)?       | No                                                                                          |
| Highest Signal generated in EUT    | 894 MHz for this band of operation                                                          |
| Lowest Signal generated in EUT     | 11 MHz                                                                                      |
| Hardware Version (HVIN)            | 1                                                                                           |
| Software Version                   | 5.21rc06 (Primary Hub)                                                                      |
| Firmware Version (FVIN)            | 5.65 (EUT)                                                                                  |
| Type of Equipment                  | Booster, Distributed Antenna System                                                         |
| Technology Type                    | Various Cellular – wideband distributed antenna system                                      |
| Geo-location (yes/no)              | No                                                                                          |
| TX Parameters                      |                                                                                             |
| Alignment range – transmitter      | 150-3980MHz Booster range (this band/report covers 869-894 MHz service band)                |
| EUT Declared Modulation Parameters | Device supports Public Mobile Radios services under this rule part                          |
| EUT Declared Power level           | +21 dBm                                                                                     |
| EUT Declared Signal Bandwidths     | Device supports Public Mobile Radios services under this rule part                          |
| EUT Declared Channel Spacing's     | Device supports Public Mobile Radios services under this rule part                          |
| EUT Declared Duty Cycle            | up to 100%                                                                                  |
| Unmodulated carrier available?     | Yes - EUT provides at its output whatever is presented to its input                         |
| Declared frequency stability       | 0ppm (DAS without frequency translation)                                                    |
| RX Parameters                      |                                                                                             |
| Alignment range – receiver         | As per transmitter range                                                                    |
| EUT Declared RX Signal Bandwidth   | As per transmitter                                                                          |
| Receiver Signal Level (RSL)        | N/A                                                                                         |
| Method of Monitoring Receiver BER  | N/A                                                                                         |

## 2.3 Functional description

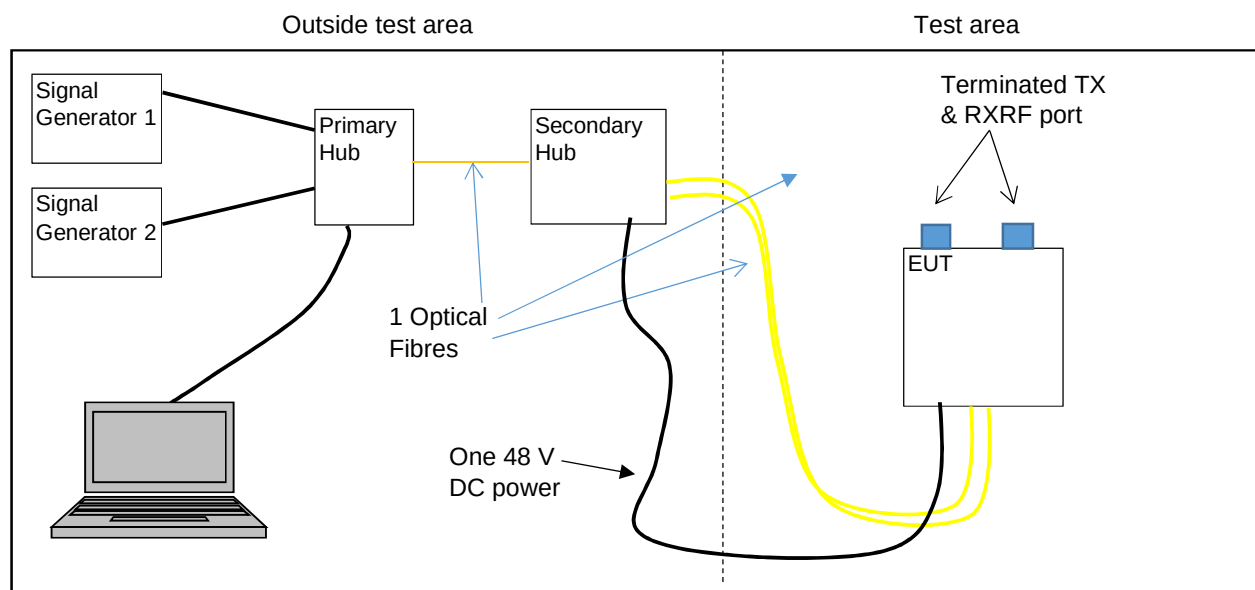
The Distributed Antenna System comprises a primary hub which accepts cellular base-station signals; this connects to 1 - 8 secondary hubs, each of which fan out the base-station signal to up to 8 Remote Units. The Remote Units require FCC certification since they are connected to a transmitting antenna.

## 2.4 Modes of operation

| Mode Reference | Description                                                    | Used for testing |
|----------------|----------------------------------------------------------------|------------------|
| Mode 1         | CW Sweep from 869-894 MHz to determine f0                      | Yes              |
| Mode 2         | Single mode Channel AWGN at f0 (891.5 MHz) in band 869-894 MHz | Yes              |
| Mode 3         | Single Low channel AWGN at 871.5 MHz                           | Yes              |
| Mode 4         | Single Mid channel AWGN at 881.5 MHz                           | Yes              |
| Mode 5         | Single High channel AWGN at 891.5 MHz                          | Yes              |
| Mode 6         | Dual Low channel AWGN at 871.5 MHz & 876.5 MHz                 | Yes              |
| Mode 7         | Dual High channel AWGN at 886.5 MHz & 891.5 MHz                | Yes              |

Note: This report only pertains to the operation of the equipment to 47 CFR part 22, for details of testing to other rule parts please see RN reports: 04-14169-2-23 (Part 27) & 04-14169-3-23 (Part 96)

## 2.5 Emissions configuration



The EUT was powered from the secondary hub at 48V DC. The unit was configured using the supplied network management software using the settings files prepared by Zinwave Ltd. The unit provided either 24dB or 21 dB of gain, this was dependent on service band usage and single/dual channel usage. Target output power was set at +21dBm at the TX output port in conjunction with the signal generator settings. Any attenuation introduced by the Primary/secondary hub system was also accounted for in the set-up files provided by Zinwave Ltd. Test channels and required modulations were set using the signal generators connected to the primary hub. Single channel operation was provided by generator 1 and dual channel was using two signal generators. Output power of the signal generators was set to provide the target powers of the device under test. The transmit mode was 100% continuous with EUT output power maintained at required target output power. Test channels and combinations used are stated in test modes section 2.4. The system supports operation with a number of wideband services, so testing was performed with AWGN modulation signal as per KDB 935210 D05, and a CW signal for determination of f0.

For conducted RF tests the RF ports were connected via suitable attenuation and filtering where required and connected directly to a spectrum analyser, with losses accounted for in the measurement results.

The system is designed for operation with antennas having a maximum gain of 5.2 dBi or 3.06 dBd. This is the value used for determining EIRP or ERP where required.

### 2.5.1 Signal leads

| Port Name       | Cable Type     | Connected |
|-----------------|----------------|-----------|
| DC power 1      | 2 cores        | Yes       |
| Fibre TX 1      | Fibre          | Yes       |
| Fibre RX 1      | Fibre          | Yes       |
| Transmit port 1 | N-type coaxial | Yes       |
| Receive port 1  | N-type coaxial | Yes       |

### 3 Summary of test results

The Uniwave Remote Unit, 308-0007-1 was tested for compliance to the following standard(s):

47 CFR Part 22H Effective Date 1st October 2021  
↳ 47CFR part 2J Effective Date 1st October 2021

Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the essential requirements of the directive, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

| Title                                      | References                                                    | Results                     |
|--------------------------------------------|---------------------------------------------------------------|-----------------------------|
| <b>Transmitter Tests</b>                   |                                                               |                             |
| 1. RF Power Output (ERP / EIRP)            | 47CFR part 2J Clause 2.1046,<br>47 CFR Part 22H Clause 22.913 | PASSED                      |
| 2. Occupied bandwidth                      | 47CFR part 2J Clause 2.1049,<br>47 CFR Part 22H Clause 22.917 | PASSED                      |
| 3. Spurious emissions at antenna terminals | 47CFR part 2J Clause 2.1051,<br>47 CFR Part 22H Clause 22.917 | PASSED <sup>1</sup>         |
| 4. Band Edge compliance                    | 47CFR part 2J Clause 2.1051,<br>47 CFR Part 22H Clause 22.917 | PASSED                      |
| 5. Field strength of spurious emissions    | 47CFR part 2J Clause 2.1053,<br>47 CFR Part 22H Clause 22.917 | PASSED <sup>1</sup>         |
| 6. Frequency stability                     | 47CFR part 2J Clause 2.1055,<br>47 CFR Part 22H Clause 22.355 | NOT APPLICABLE <sup>2</sup> |
| 7. Modulation Characteristics              | 47CFR part 2J Clause 2.1051                                   | NOT TESTED <sup>3</sup>     |
| 8. Determination of $f_0$                  | KDB 935210 D05 Clause 3.3                                     | PERFORMED                   |

<sup>1</sup> Spectrum investigated started at a frequency of 30MHz up to a frequency of 9GHz based on 10 times the highest channel of 894 MHz for this service band.

<sup>2</sup> EUT does not contain an oscillator and only reproduces what is provided at its input.

<sup>3</sup> EUT uses digital modulation techniques. Modulation schemes and information is detailed in section 2.2 of this report.

## 4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

### 4.1 Relevant standards

| Ref.  | Standard Number       | Version | Description                                                                                                                                                          |
|-------|-----------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1.1 | 47 CFR Part 22H       | 2021    | Part 22 Subpart H - Cellular Radiotelephone Service                                                                                                                  |
| 4.1.2 | 47CFR part 2J         | 2021    | Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations                                                                               |
| 4.1.3 | KDB 971168 D01 v03    | 2017    | Federal Communications Commission Office of Engineering and Technology Laboratory Division; Measurement Guidance for Certification of Licensed Digital Transmitters  |
| 4.1.4 | ANSI C63.26           | 2015    | American National Standard for Compliance testing of transmitters used in Licensed radio services                                                                    |
| 4.1.5 | KDB 662911 D01 v02r01 | 2013    | Federal Communications Commission Office of Engineering and Technology Laboratory Division; Emissions Testing of Transmitters with Multiple Outputs in the Same Band |
| 4.1.6 | KDB 935210 D05 v01r04 | 2020    | Measurement guidance for industrial and Non-consumer signal Booster, Repeater and amplifier devices                                                                  |

### 4.2 Deviations

No Deviations have been applied.

## 5 Tests, methods and results

### 5.1 RF Power Output (ERP)

#### 5.1.1 Test methods

|                    |                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Test Requirements: | 47CFR part 2J Clause 2.1046 [Reference 4.1.2 of this report],<br>47 CFR Part 22H Clause 22.913 [Reference 4.1.1 of this report] |
| Test Method:       | ANSI C63.26 Clause 5.2 [Reference 4.1.4 of this report]<br>KDB 935210 D05 Clause 3.5 [Reference 4.1.6 of this report]           |
| Limits:            | 47 CFR Part 22H Clause 22.913 [Reference 4.1.1 of this report]                                                                  |

#### 5.1.2 Configuration of EUT

The EUT was measured on a bench using a power meter & spectrum analyser connected to the external RF port. The EUT was operated in Mode 2 for this test.

#### 5.1.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section.

The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required and the frequency under test was set to an appropriate channel to include  $f_0$  as determined in section 5.8. An Analyser was used to measure channel power over 5MHz BW using an RMS detector. CCDF function of the analyser was then used to determine Peak to Average Power Ratio.

Measurements were made in site N.

#### 5.1.4 Test equipment

E558, H071

See Section 8 for more details

#### 5.1.5 Test results

|                                 |        |
|---------------------------------|--------|
| Temperature of test environment | 20°C   |
| Humidity of test environment    | 50%    |
| Pressure of test environment    | 102kPa |

Setup Table

|                 |                               |
|-----------------|-------------------------------|
| Band            | 869-894 MHz                   |
| Power Level     | 21 dBm                        |
| Channel Spacing | 5 MHz                         |
| Mod Scheme      | AWGN                          |
| Single channel  | 891.5 MHz (determined $f_0$ ) |

| Test Instance (e.g. modulation or Resource block) | Average Cond Power (dBm) TX Chain 1 | Antenna Gain dBi (dBd) | TX Power ERP (dBm) | TX Power ERP (W) | Power Limit (dBm) | Power Margin (dB) |
|---------------------------------------------------|-------------------------------------|------------------------|--------------------|------------------|-------------------|-------------------|
| AWGN at channel closest $F_0$                     | 20.98                               | 5.2 (3.06)             | 24.04              | 0.254            | 57                | -32.96            |

Note: 5.2dBi Antenna gain (3.06dBd) is used. 891.5 MHz is the lowest 5MHz channel centre frequency within the band of operation and encompasses  $f_0$  of 893.7075 MHz. Please refer to input/output plot for channel power measurement.

| Peak to AV ratio (dB) | Plot reference    | PK to AV Limit (dB) | PK to AV Margin (dB) |
|-----------------------|-------------------|---------------------|----------------------|
| 7.97                  | 14169-1 891.5 MHz | 13                  | -5.03                |

Any plots referred to in the above table may be found in section 6.

**LIMITS:**

Part 22H, 22.913(a) the ERP of base stations and repeaters must not exceed— 500W ERP.

Part 22.913 (d) The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
<± 1.0 dB

## 5.2 Occupied bandwidth / Input versus output signal

### 5.2.1 Test methods

Test Requirements: 47 CFR part 2J Clause 2.1049 [Reference 4.1.2 of this report],  
Test Method: ANSI C63.26 Clause 5.4 [Reference 4.1.4 of this report]  
KDB 935210 D05 Clause 3.3 / 3.4 [Reference 4.1.5 of this report]  
Limits: None.

### 5.2.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested on the channel that encompassed the determined  $f_0$  in each applicable band. The EUT was operated in Mode 2.

### 5.2.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required and the frequency under test was set to an appropriate channel to include  $f_0$  as determined in section 5.8. An RMS detector was set, and sweeps made comparing the 99% BW input and the output signals and their -26dBc BW points indicated on the plots taken. Tests were performed using Test Site N.

### 5.2.4 Test equipment

E558, H071

See Section 8 for more details

### 5.2.5 Test results

Temperature of test environment 20°C  
Humidity of test environment 50%  
Pressure of test environment 102kPa

|                 |                |
|-----------------|----------------|
| Band            | 869-894 MHz    |
| Power Level     | 21 dBm         |
| Channel Spacing | 5 MHz          |
| Mod Scheme      | AWGN           |
| Single channel  | 891.5 MHz (FO) |

| Single channel                                         |                                   |
|--------------------------------------------------------|-----------------------------------|
| 99 % Bandwidth (MHz) Nominal Temp & Volts              | 4.42                              |
| Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts     | 891.5 MHz (channel closest to FO) |
| 26 dB BW (MHz) Nominal Temp & Volts                    | 4.58                              |
| Plot for 26 dB BW Bandwidth (MHz) Nominal Temp & Volts | 891.5 MHz (channel closest to FO) |

Analyser plots for bandwidth can be found in Section 6 of this report.

#### LIMITS:

Emissions to be contained within the applicable emissions mask/band edges.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
<± 1.9 %

## 5.3 Spurious emissions at antenna terminals

### 5.3.1 Test methods

|                    |                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Test Requirements: | 47CFR part 2J Clause 2.1051 [Reference 4.1.2 of this report],<br>47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report] |
| Test Method:       | ANSI C63.26 Clause 5.7 [Reference 4.1.4 of this report]<br>KDB 935210 D05 Clause 3.6 [Reference 4.1.5 of this report]           |
| Limits:            | 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]                                                                  |

### 5.3.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested across Low, Middle and High channels within the service band in a single channel input mode and in a dual channel input mode, modes tested were 3, 4, 5, 6 and 7.

### 5.3.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required. A complete scan of emissions from the lowest frequency generated/ used within the equipment up to 10 times the highest frequency generated/ used was made, to identify any signals within 20dB of the limits. Measurements were made and plots taken in the required Resolution bandwidths, where applicable results are referenced to EIRP limits by consideration of the antenna gain used with the EUT of 5.2dBi (3.06dBd) and indicated. Tests were performed in site N.

### 5.3.4 Test equipment

E558, E701, F030, F031, F931, H071

See Section 8 for more details

### 5.3.5 Test results

|                                 |        |
|---------------------------------|--------|
| Temperature of test environment | 20°C   |
| Humidity of test environment    | 50%    |
| Pressure of test environment    | 102kPa |

## Single Channel Results

|                 |             |
|-----------------|-------------|
| Band            | 869-894 MHz |
| Power Level     | 21 dBm      |
| Channel Spacing | 5 MHz       |
| Mod Scheme      | AWGN        |
| Low channel     | 871.5 MHz   |

| Spurious Frequency (MHz) | Measured Spurious Level (dBm) | Difference to Limit (dB) |
|--------------------------|-------------------------------|--------------------------|
| 1743                     | -35.3                         | -22.3                    |

| Plots                                        |
|----------------------------------------------|
| CSE, Band 869-894 MHz, Single, 10MHz-869 MHz |
| CSE, Band 869-894 MHz, Single, 894 MHz-1 GHz |
| CSE, Band 869-894 MHz, Single, 1-10 GHz      |

|      |             |
|------|-------------|
| Band | 869-894 MHz |
|------|-------------|

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|                 |           |
|-----------------|-----------|
| Power Level     | 21 dBm    |
| Channel Spacing | 5 MHz     |
| Mod Scheme      | AWGN      |
| Low2 channel    | 881.5 MHz |

| Spurious Frequency (MHz) | Measured Spurious Level (dBm) | Difference to Limit (dB) |
|--------------------------|-------------------------------|--------------------------|
| 1763                     | -37.7                         | -24.7                    |

Note: Mid channel plots are shown as second trace on Low channel plot file referenced above.

|                 |             |
|-----------------|-------------|
| Band            | 869-894 MHz |
| Power Level     | 21 dBm      |
| Channel Spacing | 5 MHz       |
| Mod Scheme      | AWGN        |
| Mid channel     | 891.5 MHz   |

| Spurious Frequency (MHz) | Measured Spurious Level (dBm) | Difference to Limit (dB) |
|--------------------------|-------------------------------|--------------------------|
| 1783                     | -38.5                         | -25.5                    |

Note: High channel plots are shown as third trace on Low channel plot file referenced above.

## Dual Channel Results

|                 |                   |
|-----------------|-------------------|
| Band            | 869-894 MHz       |
| Power Level     | 21 dBm            |
| Channel Spacing | 5 MHz             |
| Mod Scheme      | AWGN              |
| High1 channel   | 871.5 + 876.5 MHz |

| Spurious Frequency (MHz) | Measured Spurious Level (dBm) | Difference to Limit (dB) |
|--------------------------|-------------------------------|--------------------------|
| 1748                     | -40.5                         | -27.5                    |

| Plots                                      |
|--------------------------------------------|
| CSE, Band 869-894 MHz, Dual, 10MHz-869 MHz |
| CSE, Band 869-894 MHz, Dual, 894 MHz-1 GHz |
| CSE, Band 869-894 MHz, Dual, 1-10 GHz      |
|                                            |

|                 |                   |
|-----------------|-------------------|
| Band            | 869-894 MHz       |
| Power Level     | 21 dBm            |
| Channel Spacing | 5 MHz             |
| Mod Scheme      | AWGN              |
| High2 channel   | 886.5 + 891.5 MHz |

| Spurious Frequency (MHz) | Measured Spurious Level (dBm) | Difference to Limit (dB) |
|--------------------------|-------------------------------|--------------------------|
| 1778                     | -41.1                         | -28.1                    |

Note: High Dual mode channel plots are shown as second trace on Low Dual channel plot file referenced above.

The plots referred to in the above table may be found in section 6. Band edge results can be found in section 5.4.

**LIMITS:**

Part 22.917, -13 dBm

**Out of band emissions.** The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
 $\pm 2.8$  dB up to 26.5 GHz.

## 5.4 Band Edge compliance

### 5.4.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1051 [Reference 4.1.2 of this report],  
47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]  
Test Method: ANSI C63.26 Clause 5.7 [Reference 4.1.4 of this report]  
KDB 935210 D05 Clause 3.6 [Reference 4.1.6 of this report]  
Limits: 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]

### 5.4.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit / receive port. The EUT was operated in Modes 3, 5, 6 and 7 for this test, encompassing low and high channels in both single and dual channel modes.

### 5.4.3 Test procedure

Tests were made in accordance with the Test Method noted above, using the measuring equipment listed in the 'Test Equipment' Section. A 51kHz RBW (1% of EBW), 3x VBW, auto sweep time and max hold settings using an RMS detector were used to show the EUT's spectrum at the band/block edges integrated back to the appropriate RBW and limit. AWGN modulation and 5MHz channel bandwidth was used per KDB 935210 to measure upper and lower channel frequency signals with ACP function on the analyser enabled and plotted.

The EUT was tested in Site N.

### 5.4.4 Test equipment

E558, H071

See Section 8 for more details

### 5.4.5 Test results

Temperature of test environment 20°C  
Humidity of test environment 50%  
Pressure of test environment 102kPa

|                    |                   |
|--------------------|-------------------|
| Band               | 869-894 MHz       |
| Power Level        | 21 dBm            |
| Channel Spacing    | 5 MHz             |
| Mod Scheme         | AWGN              |
| Low channel        | 871.5 MHz         |
| High channel       | 891.5 MHz         |
| Dual Low channels  | 871.5 + 876.5 MHz |
| Dual High channels | 886.5 + 891.5 MHz |

| Test Instance (e.g. modulation or Resource block) | Band edge result SISO Port 1 (dBm) | Plot reference Port 1 | SISO Port 1 (dB) Margin |
|---------------------------------------------------|------------------------------------|-----------------------|-------------------------|
| AWGN Single Low Channel                           | -39.91                             | 14169-1 871.5 MHz     | -26.91                  |
| AWGN Single High Channel                          | -42.61                             | 14169-1 891.5 MHz     | -29.61                  |

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|                         |        |                           |        |
|-------------------------|--------|---------------------------|--------|
| AWGN Dual Low Channels  | -40.84 | 14169-1 871.5 + 876.5 MHz | -27.84 |
| AWGN Dual High Channels | -41.68 | 14169-1 886.5 + 891.5 MHz | -28.68 |

The plots referred to in the above table may be found in section 6.

**LIMITS:**

Part 22.917, -13 dBm

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

± 2.8 dB up to 26.5 GHz.

## 5.5 Field strength of spurious emissions

### 5.5.1 Test methods

|                    |                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Test Requirements: | 47CFR part 2J Clause 2.1053 [Reference 4.1.2 of this report],<br>47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report] |
| Test Method:       | ANSI C63.26 Clause 5.5 [Reference 4.1.4 of this report]<br>KDB 935210 D05 Clause 3.6 [Reference 4.1.6 of this report]           |
| Limits:            | 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]                                                                  |

### 5.5.2 Configuration of EUT

The EUT was examined in its declared normal use position. The transmit port was terminated into a 30dB Attenuator and a 50Ohm load. RX port was terminated into a 50 Ohm load. EUT was tested in Modes 3, 4, 5, 6 and 7 for this test. Both RF ports were active during tests with the same channel frequency settings for single channel and dual channel modes of operation, therefore MIMO operation is also covered under the results listed below.

### 5.5.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached. Peak field strength from the EUT was maximised by rotating it 360 degrees. Appropriate band-pass filters were used to ensure the fundamental did not distort the results. An RMS detector was used for final measurements.

25MHz - 1GHz.

The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Substitution method was performed using tuned dipoles / a calibrated bi-conical antenna.

1GHz – 10GHz.

The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas. Tests were performed in site M.

### 5.5.4 Test equipment

CAL07, CAL08, E007-2, E136, E268, E411, E428, E433, E624, E642, E743, E856, E904, E932, LPE364, MS812, TMS82

See Section 8 for more details

### 5.5.5 Test results

|                                 |        |
|---------------------------------|--------|
| Temperature of test environment | 19°C   |
| Humidity of test environment    | 51%    |
| Pressure of test environment    | 103kPa |

Setup Table

|                 |             |
|-----------------|-------------|
| Band            | 869-894 MHz |
| Power Level     | 21 dBm      |
| Channel Spacing | 5 MHz       |
| Mod Scheme      | AWGN        |
| Low channel     | 871.5 MHz   |

| Spurious Frequency (MHz)                             | Measured Spurious Level (dBm) | Difference to Limit (dB) | Antenna Polarisation | EUT Polarisation |
|------------------------------------------------------|-------------------------------|--------------------------|----------------------|------------------|
| No spurious emissions observed within 20 dB of limit |                               |                          |                      |                  |

Setup Table

|                 |             |
|-----------------|-------------|
| Band            | 869-894 MHz |
| Power Level     | 21 dBm      |
| Channel Spacing | 5 MHz       |
| Mod Scheme      | AWGN        |
| Mid channel     | 881.5 MHz   |

| Spurious Frequency (MHz)                             | Measured Spurious Level (dBm) | Difference to Limit (dB) | Antenna Polarisation | EUT Polarisation |
|------------------------------------------------------|-------------------------------|--------------------------|----------------------|------------------|
| No spurious emissions observed within 20 dB of limit |                               |                          |                      |                  |

Setup Table

|                 |             |
|-----------------|-------------|
| Band            | 869-894 MHz |
| Power Level     | 21 dBm      |
| Channel Spacing | 5 MHz       |
| Mod Scheme      | AWGN        |
| High channel    | 891.5 MHz   |

| Spurious Frequency (MHz)                             | Measured Spurious Level (dBm) | Difference to Limit (dB) | Antenna Polarisation | EUT Polarisation |
|------------------------------------------------------|-------------------------------|--------------------------|----------------------|------------------|
| No spurious emissions observed within 20 dB of limit |                               |                          |                      |                  |

Setup Table

|                   |                   |
|-------------------|-------------------|
| Band              | 869-894 MHz       |
| Power Level       | 21 dBm            |
| Channel Spacing   | 5 MHz             |
| Mod Scheme        | AWGN              |
| Dual Low channels | 871.5 + 876.5 MHz |

| Spurious Frequency (MHz)                             | Measured Spurious Level (dBm) | Difference to Limit (dB) | Antenna Polarisation | EUT Polarisation |
|------------------------------------------------------|-------------------------------|--------------------------|----------------------|------------------|
| No spurious emissions observed within 20 dB of limit |                               |                          |                      |                  |

Setup Table

|                    |                   |
|--------------------|-------------------|
| Band               | 869-894 MHz       |
| Power Level        | 21 dBm            |
| Channel Spacing    | 5 MHz             |
| Mod Scheme         | AWGN              |
| Dual High channels | 886.5 + 891.5 MHz |

| Spurious Frequency (MHz)                             | Measured Spurious Level (dBm) | Difference to Limit (dB) | Antenna Polarisation | EUT Polarisation |
|------------------------------------------------------|-------------------------------|--------------------------|----------------------|------------------|
| No spurious emissions observed within 20 dB of limit |                               |                          |                      |                  |

Note: No Spurious emissions were found within 20 dB of limits.

#### LIMITS:

Part 22.917, -13 dBm

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These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

30MHz - 1GHz  $\pm 3.9$  dB, 1 – 18 GHz  $\pm 3.5$ dB.

## 5.6 Frequency stability

NOT APPLICABLE: EUT does not contain an oscillator and only reproduces what is provided at its input.

## 5.7 Modulation Characteristics

NOT TESTED: EUT uses digital modulation techniques. Modulation schemes and information is detailed in section 2.2 of this report.

## 5.8 Determination of $f_0$

### 5.8.1 Test methods

Test Requirements: KDB 935210 D05 Clause 3.3 / 4.3 [Reference 4.1.5 of this report]  
Test Method: ANSI C63.26 2015 Clause 5.5 [Reference 4.1.4 of this report]  
KDB 935210 D05 Clause 3.3 / 4.3 [Reference 4.1.5 of this report]  
Limits: None.

### 5.8.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was swept across the operational band with a CW signal to determine the frequency of highest power in the band. Test performed in mode 1.

### 5.8.3 Test procedure

Tests were made in accordance with the test method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached. The EUT input signal was then swept across the applicable service band frequency and plots taken showing the frequency of highest power in the band ( $f_0$ ).

### 5.8.4 Test equipment

F075, H071, E602

See Section 8 for more details

### 5.8.5 Test results

Temperature of test environment 18-22°C  
Humidity of test environment 40-50%  
Pressure of test environment 102kPa

|                 |               |
|-----------------|---------------|
| Band            | 869 - 894 MHz |
| Power Level     | 21 dBm        |
| Channel Spacing | N/A           |
| Mod Scheme      | CW            |

| Band (MHz)    | $f_0$ determined (MHz) |
|---------------|------------------------|
| 869 – 894 MHz | 893.7075               |

Note: Measurement was performed over the service band frequency range only.

Results are also presented graphically in section 6.

#### LIMITS:

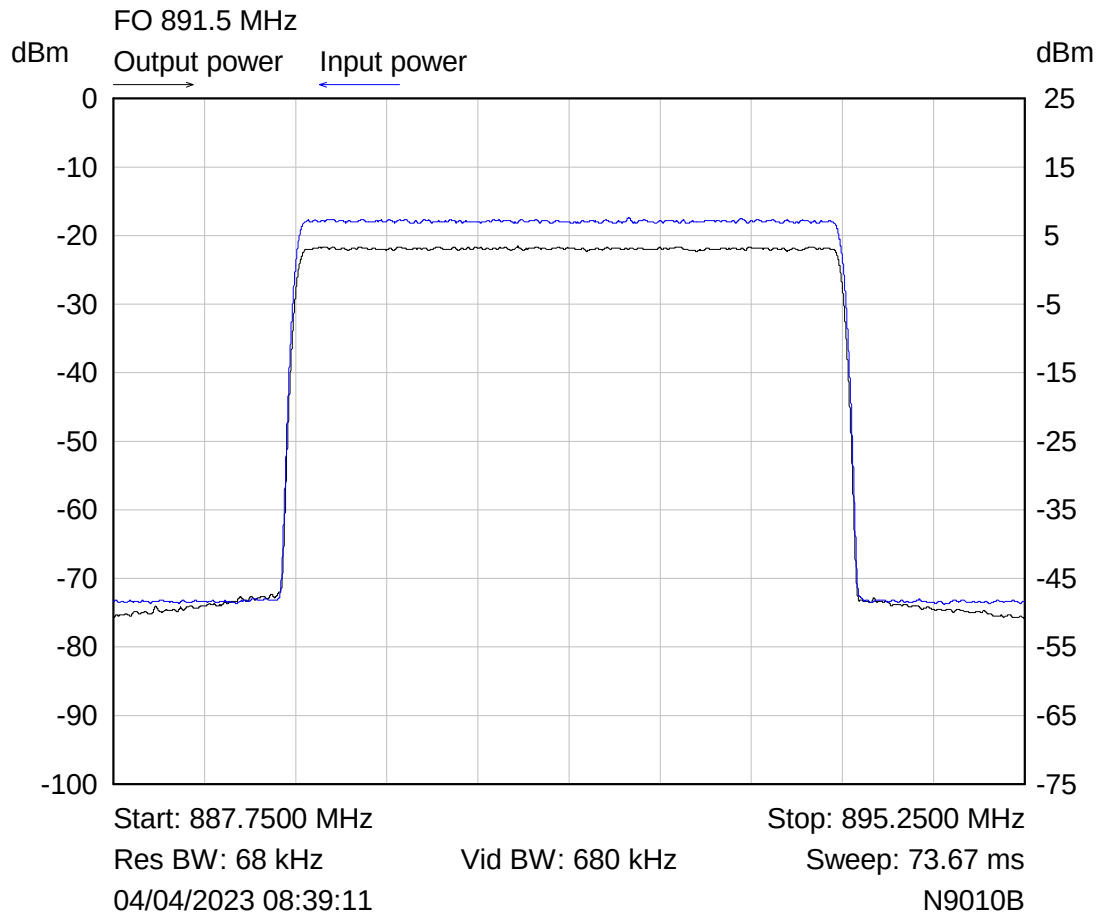
None.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
 $\leq \pm 1$  dB

## 6 Plots/Graphical results

### 6.1 RF Power Output (ERP)

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation AWGN, Channel 891.5 MHz (channel centre near to determined FO)



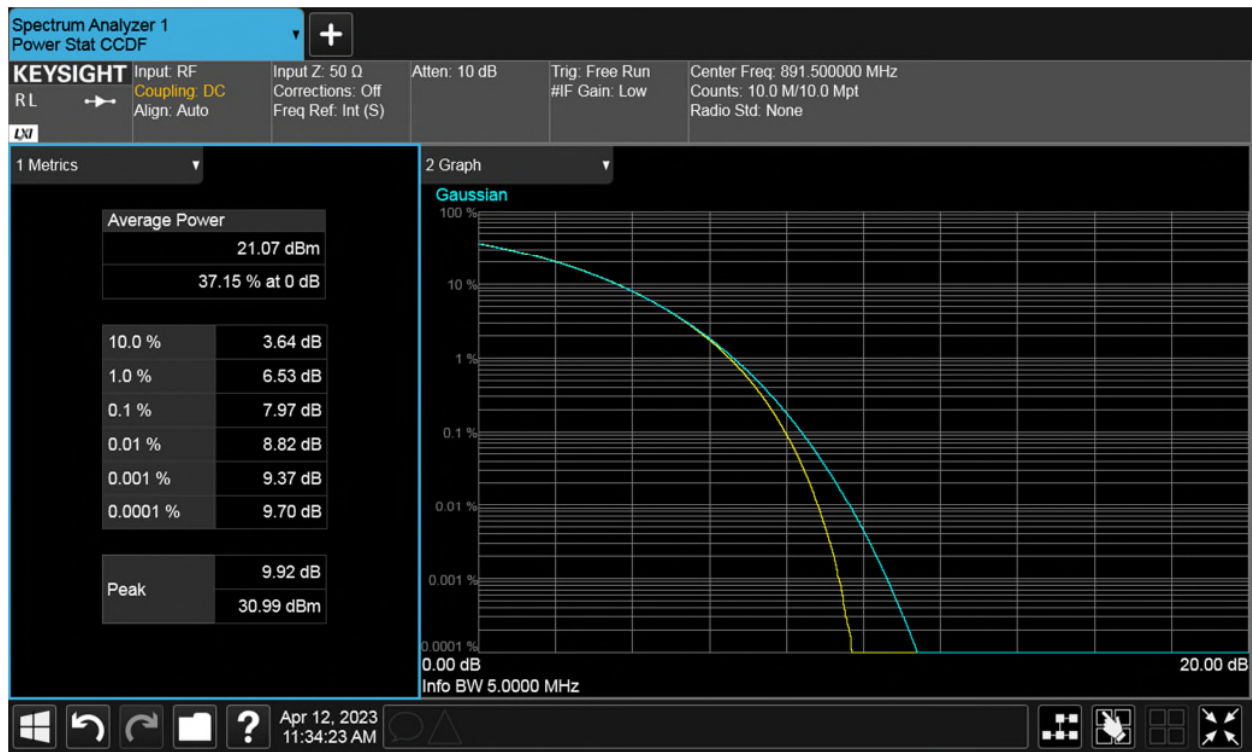
#### Input power

| Measurement Parameter  | Value         |
|------------------------|---------------|
| Total channel power    | -0.03 dBm     |
| Power Spectral Density | -7.02 dBm/MHz |

#### Output power

| Measurement Parameter  | Value         |
|------------------------|---------------|
| Total channel power    | 20.98 dBm     |
| Power Spectral Density | 13.99 dBm/MHz |

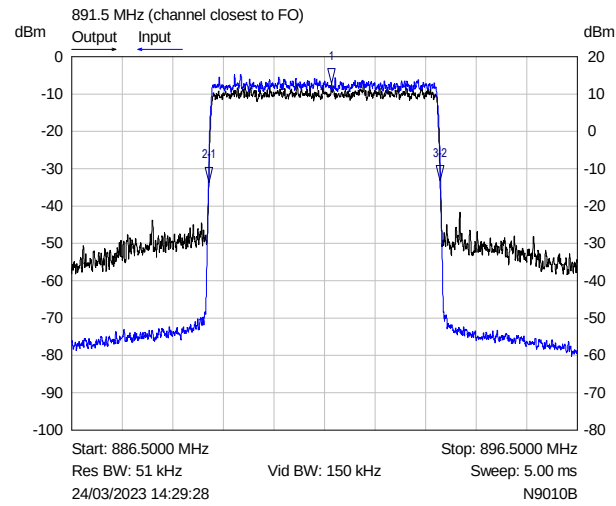
Input versus Output power Plot (channel closest to determined fo)



PAPR Plot (channel closest to determined fo)

6.2 Occupied bandwidth / Input vs Output

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, Channel 891.5 MHz (FO)



| Mkr | Trace  | X-Axis       | Value     | Notes |
|-----|--------|--------------|-----------|-------|
| 1   | Output | 891.6370 MHz | 12.78 dBm |       |
| 2-1 | Output | -2.4285 MHz  | -26.37 dB |       |
| 3-2 | Output | 4.5809 MHz   | 0.45 dB   |       |

Output

| Measurement Parameter | Value      |
|-----------------------|------------|
| Occupied Bandwidth    | 4.4228 MHz |

Input

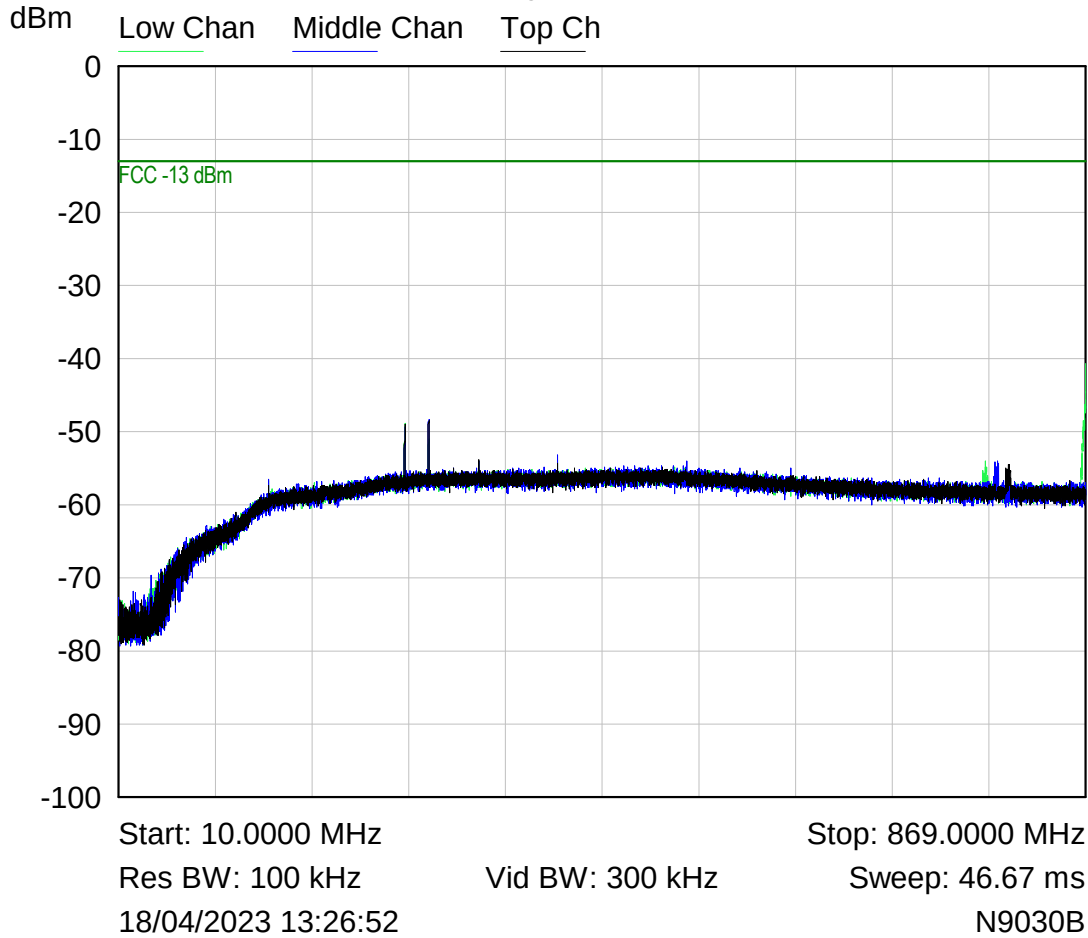
| Measurement Parameter | Value      |
|-----------------------|------------|
| Occupied Bandwidth    | 4.4241 MHz |

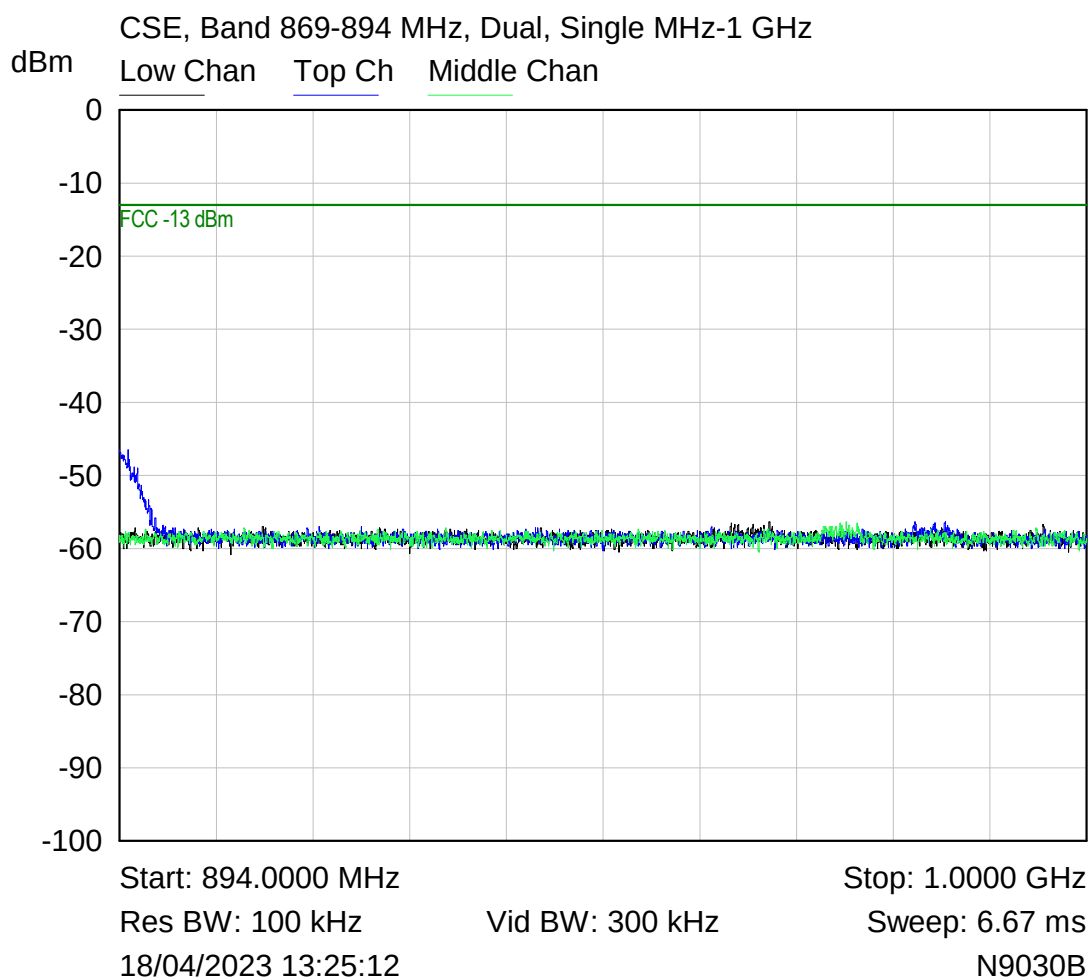
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts (channel closest to determined fo)

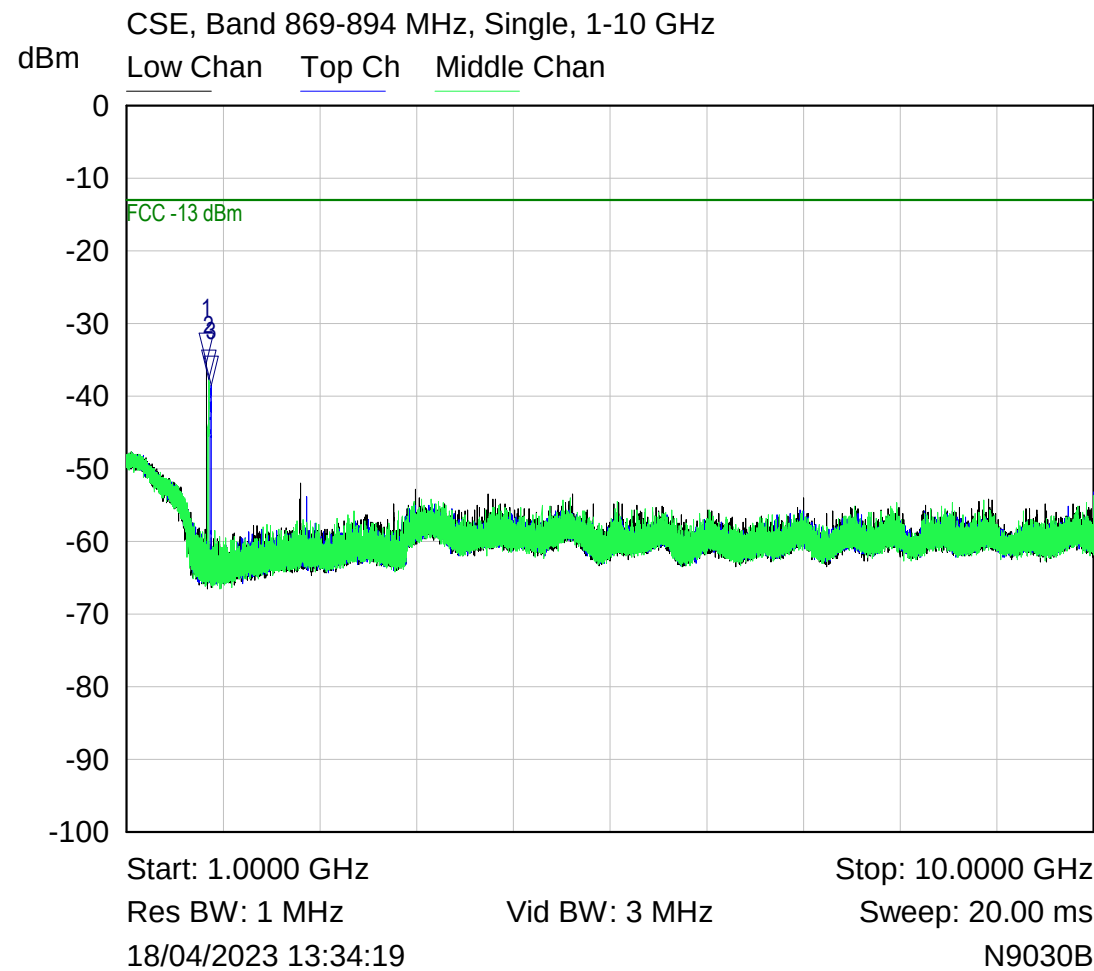
### 6.3 Spurious emissions at antenna terminals

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, single channel mode

CSE, Band 869-894 MHz, Single, 10MHz-869 MHz

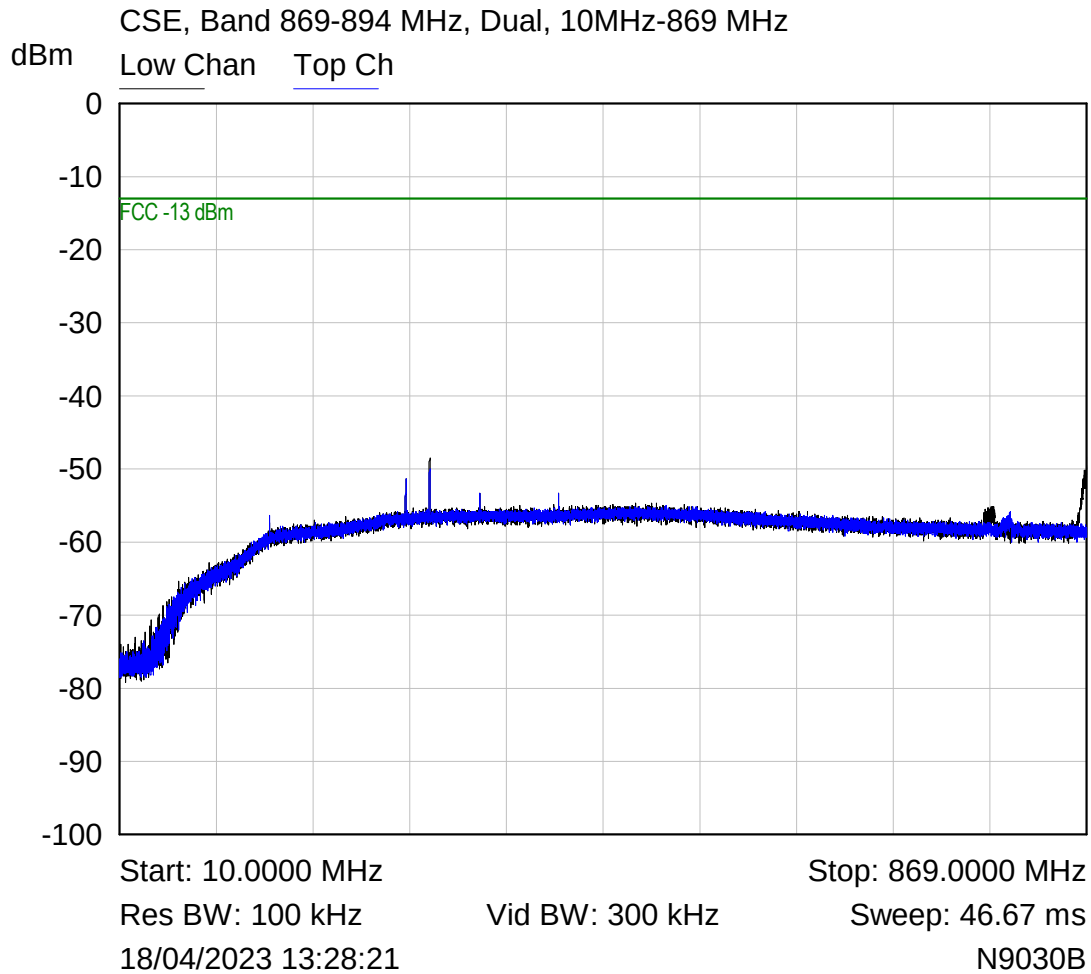


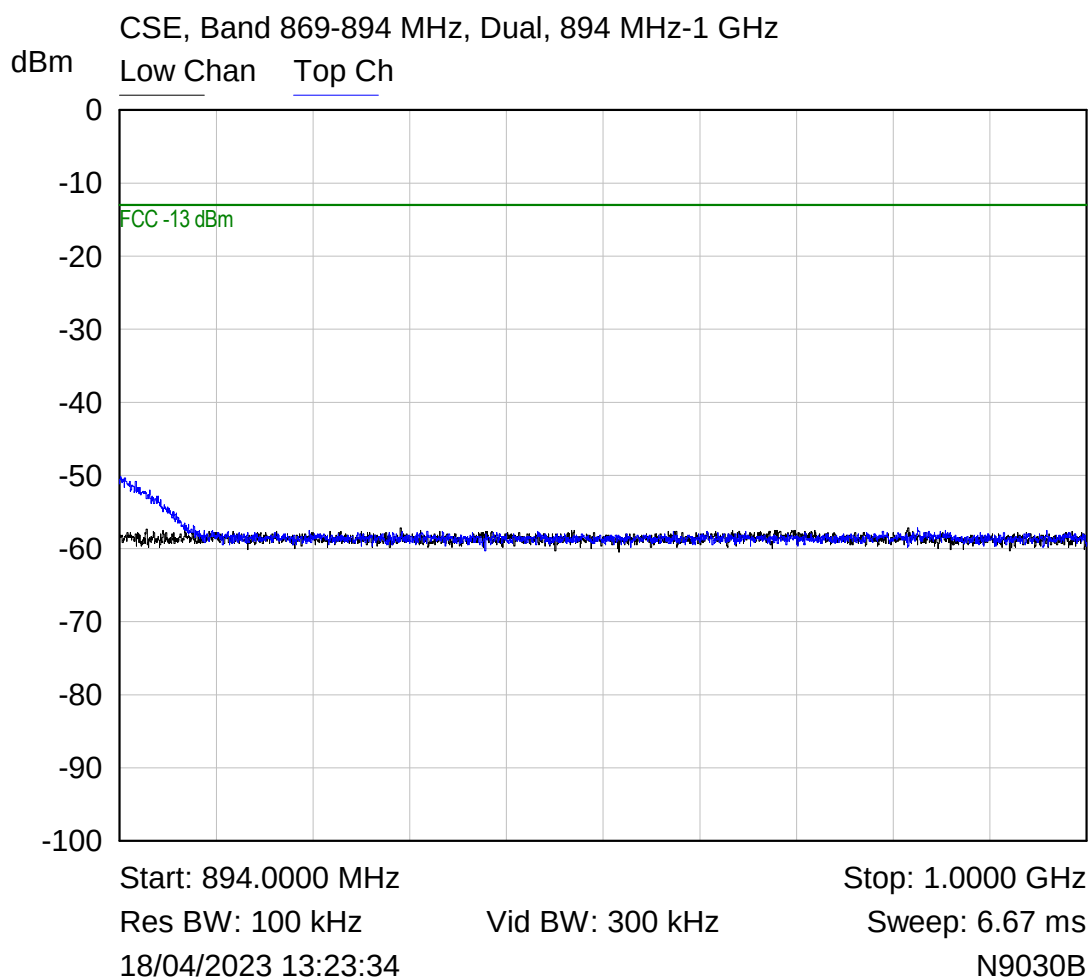


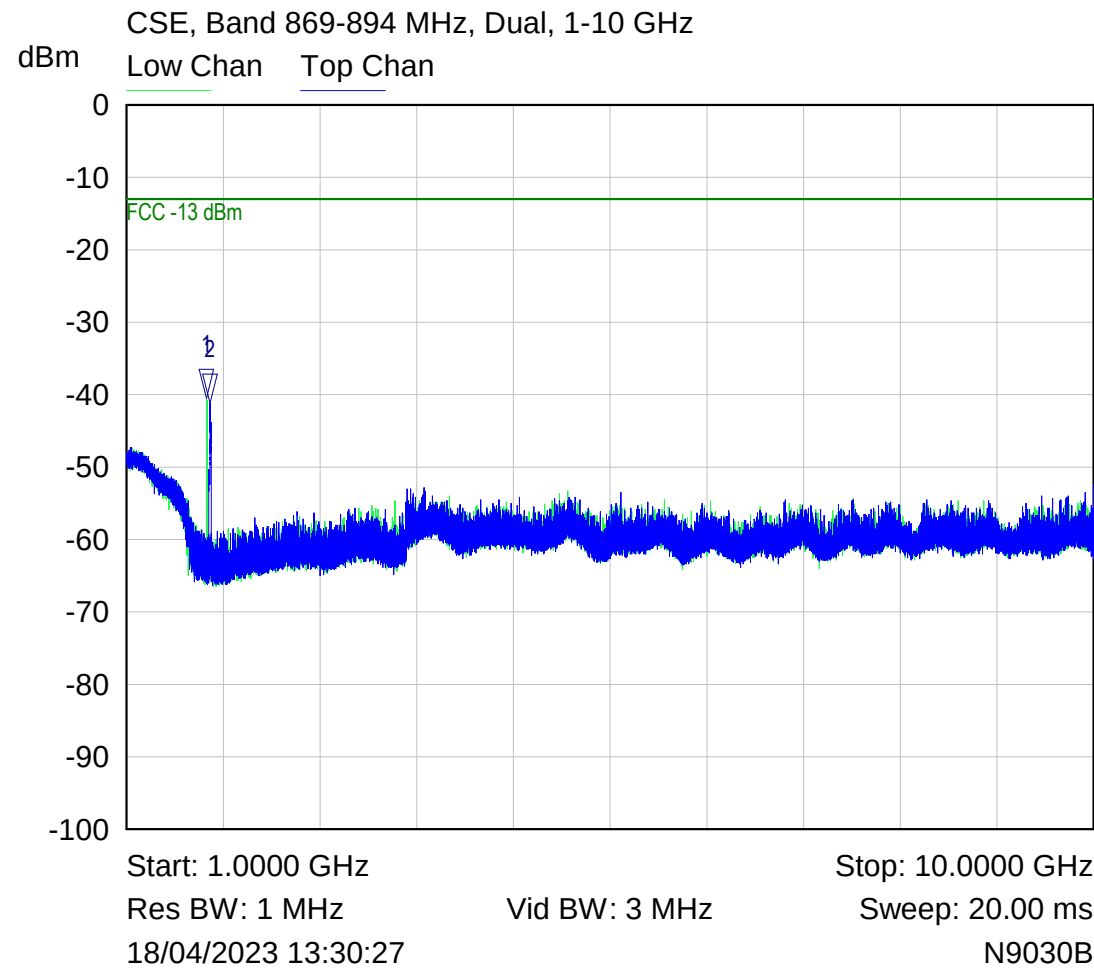


| Mkr | Trace       | X-Axis     | Value      | Notes |
|-----|-------------|------------|------------|-------|
| 1 ▾ | Low Chan    | 1.7425 GHz | -35.32 dBm |       |
| 2 ▾ | Middle Chan | 1.7630 GHz | -37.70 dBm |       |
| 3 ▾ | Top Ch      | 1.7830 GHz | -38.46 dBm |       |

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, Dual channel mode



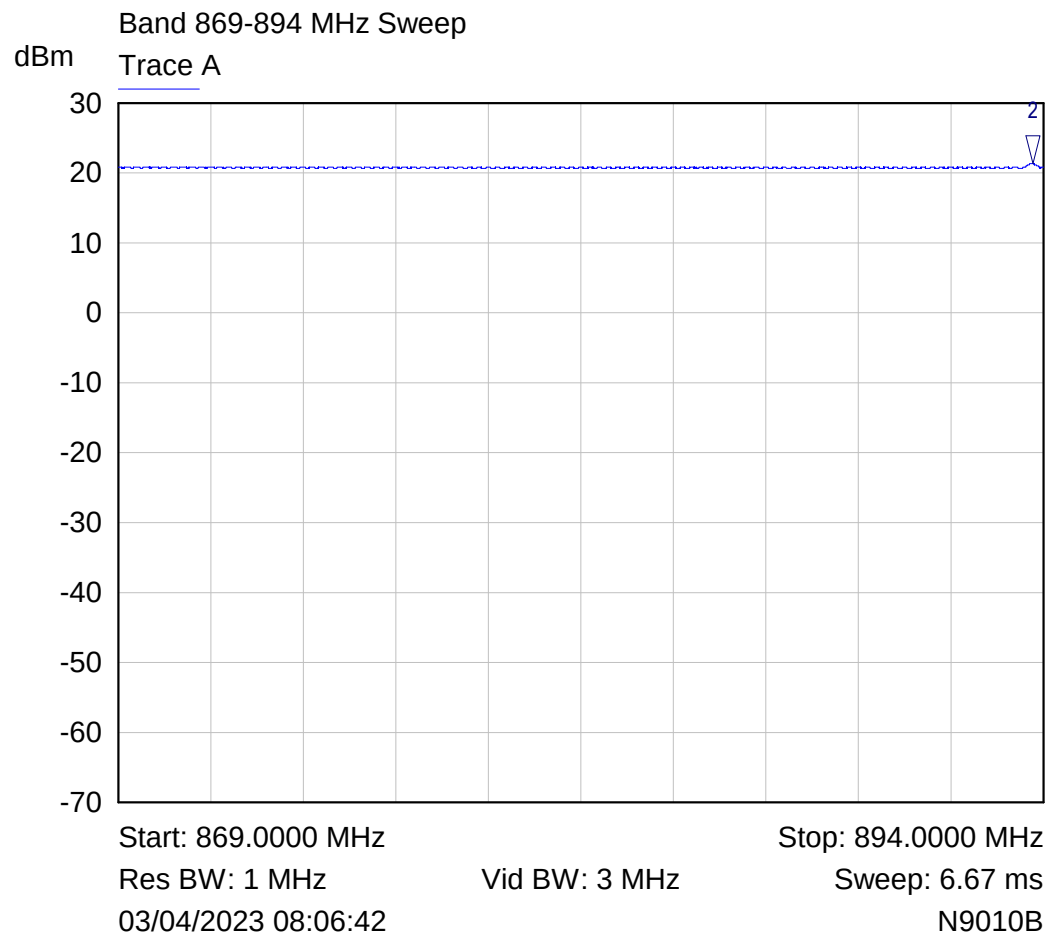




| Mkr | Trace    | X-Axis     | Value      | Notes |
|-----|----------|------------|------------|-------|
| 1 ▽ | Low Chan | 1.7480 GHz | -40.51 dBm |       |
| 2 ▽ | Top Chan | 1.7778 GHz | -41.10 dBm |       |

6.4 Determination of fo

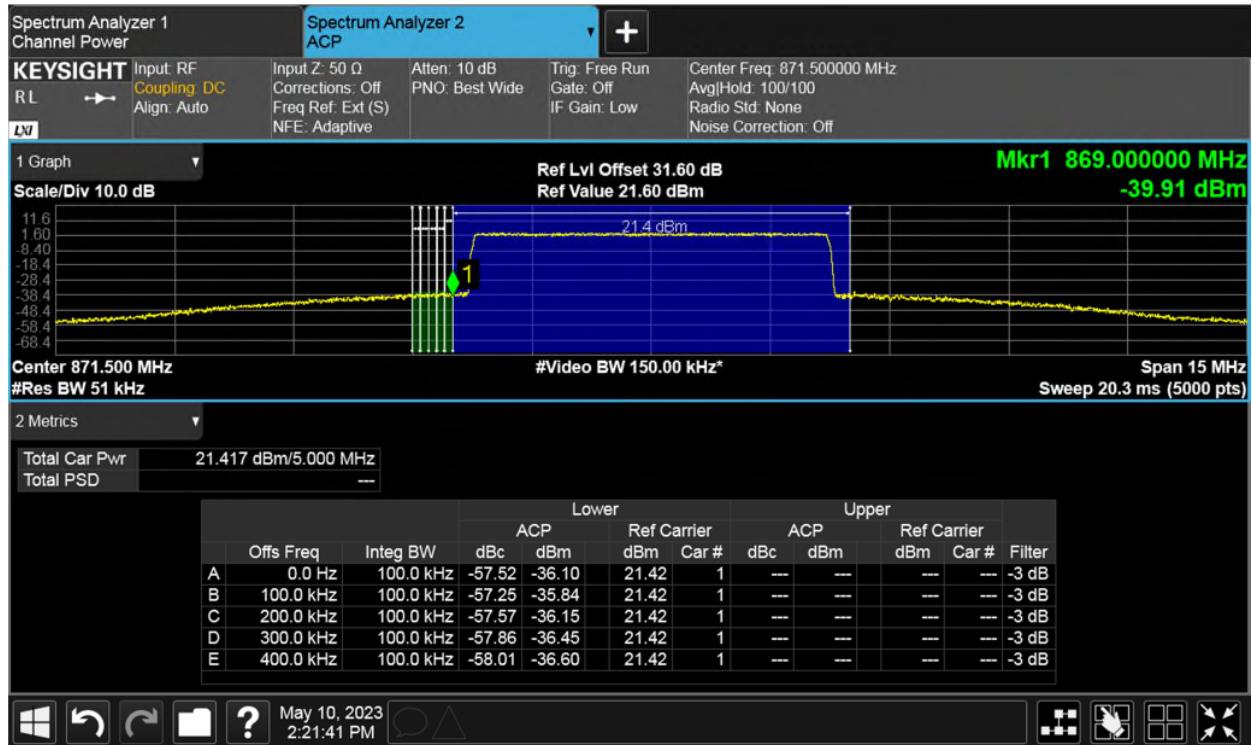
RF Parameters: Band 869-894 MHz, Power 21 dBm, CW frequency sweep, determination of fo



| Mkr | Trace   | X-Axis       | Value     | Notes |
|-----|---------|--------------|-----------|-------|
| 2 ▾ | Trace A | 893.7075 MHz | 21.29 dBm |       |

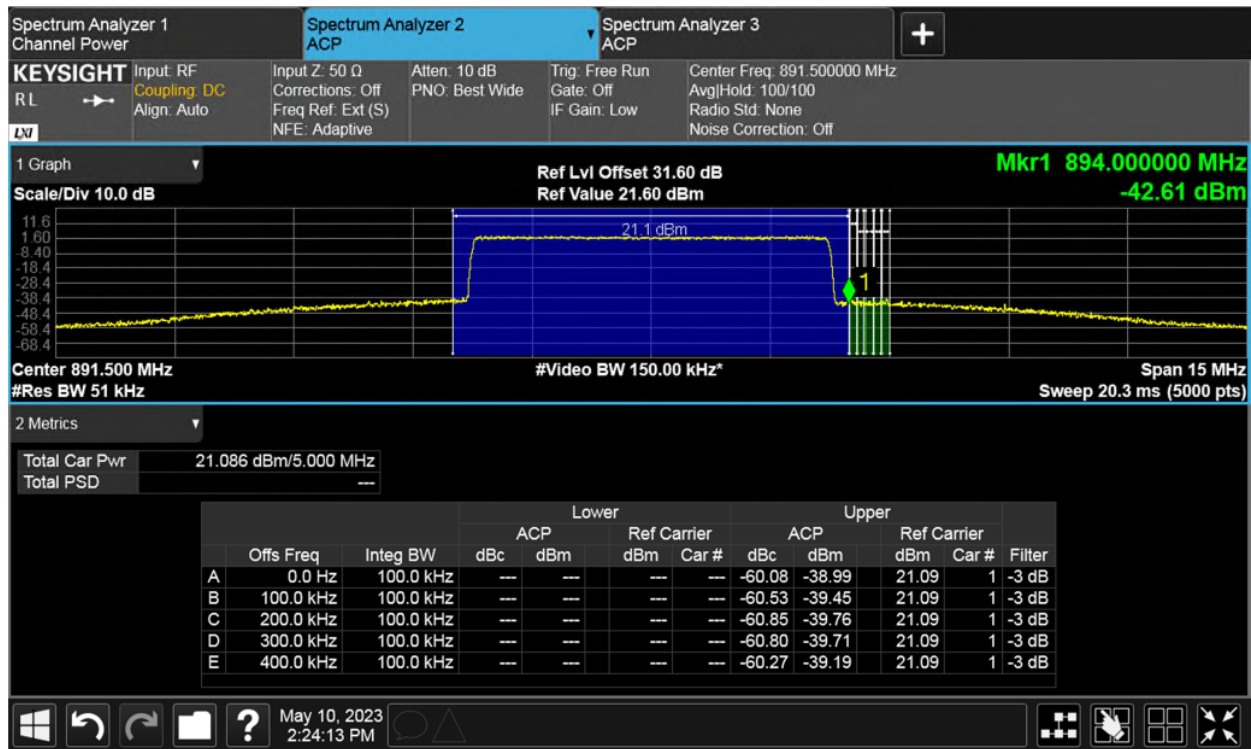
## 6.5 Band edges

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation AWGN, single Low channel mode



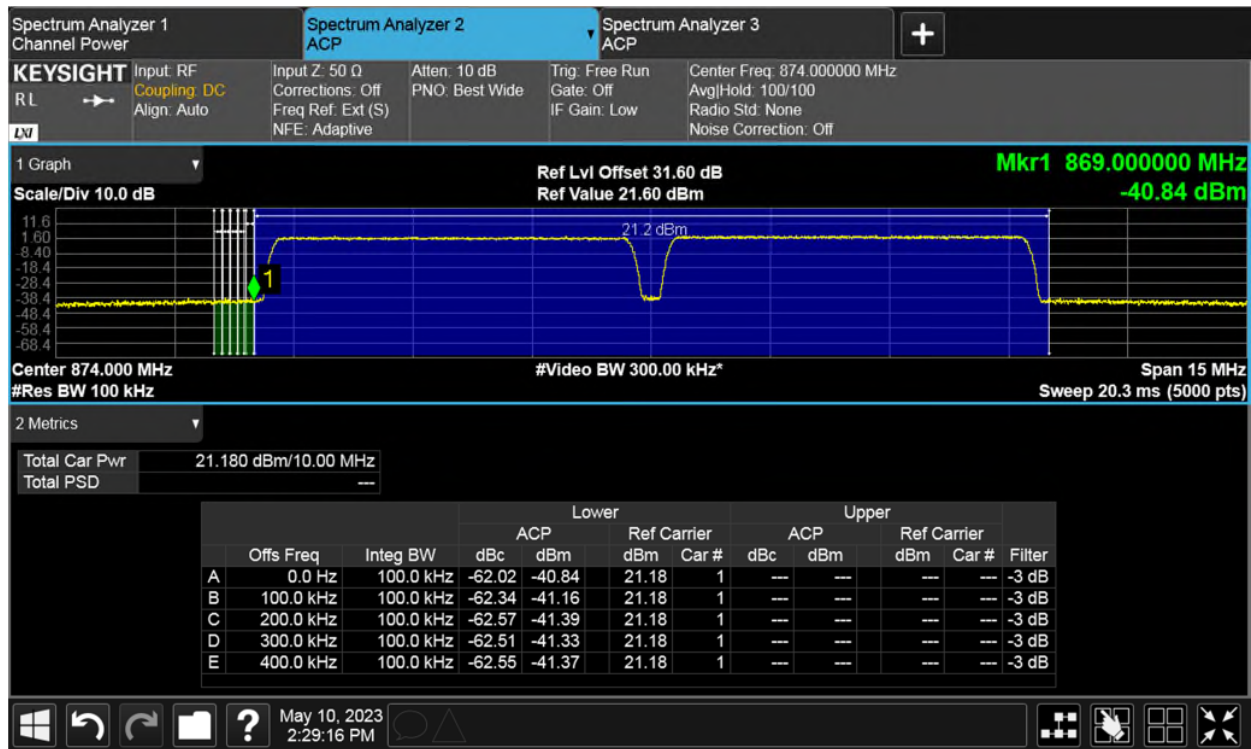
Low channel Band edge

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, single High channel mode



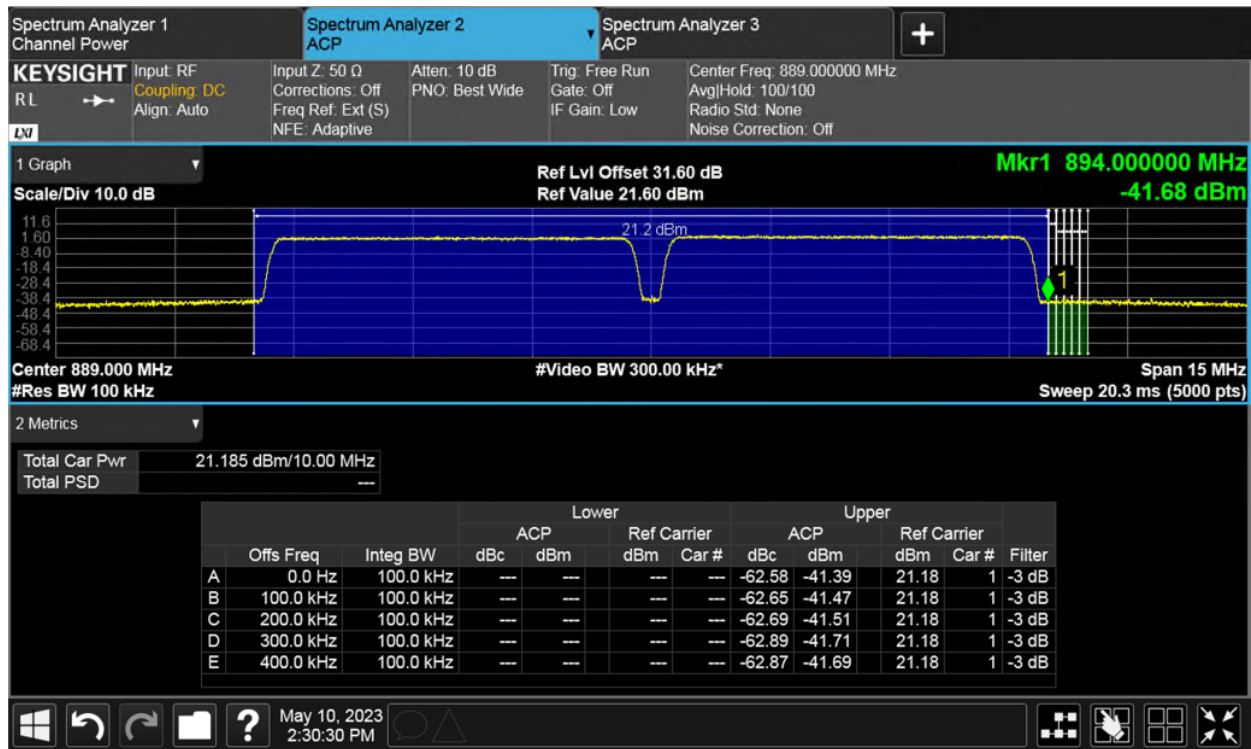
High channel Band edge

RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, single Dual Low channel mode



Dual Low channel Band edge

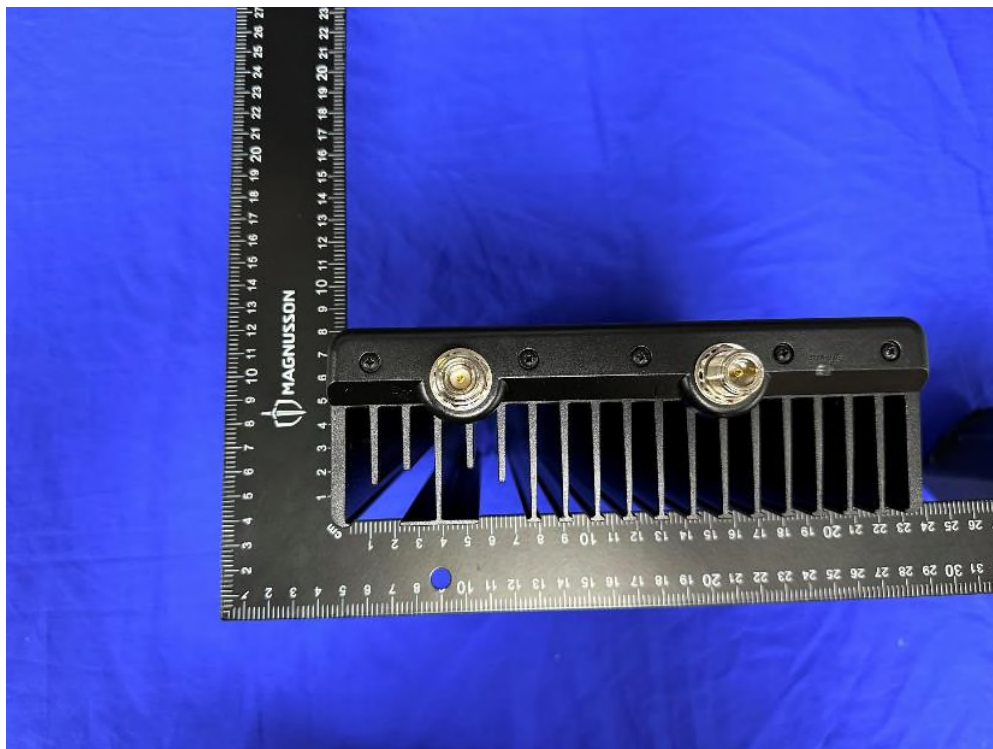
RF Parameters: Band 869-894 MHz, Power 21 dBm, Channel Spacing 5 MHz, Modulation  
AWGN, single Dual High channel mode



Dual High channel Band edge

## 7 Photographs

### 7.1 EUT Front View



## 7.2 EUT Reverse Angle





### 7.3 EUT Left side View



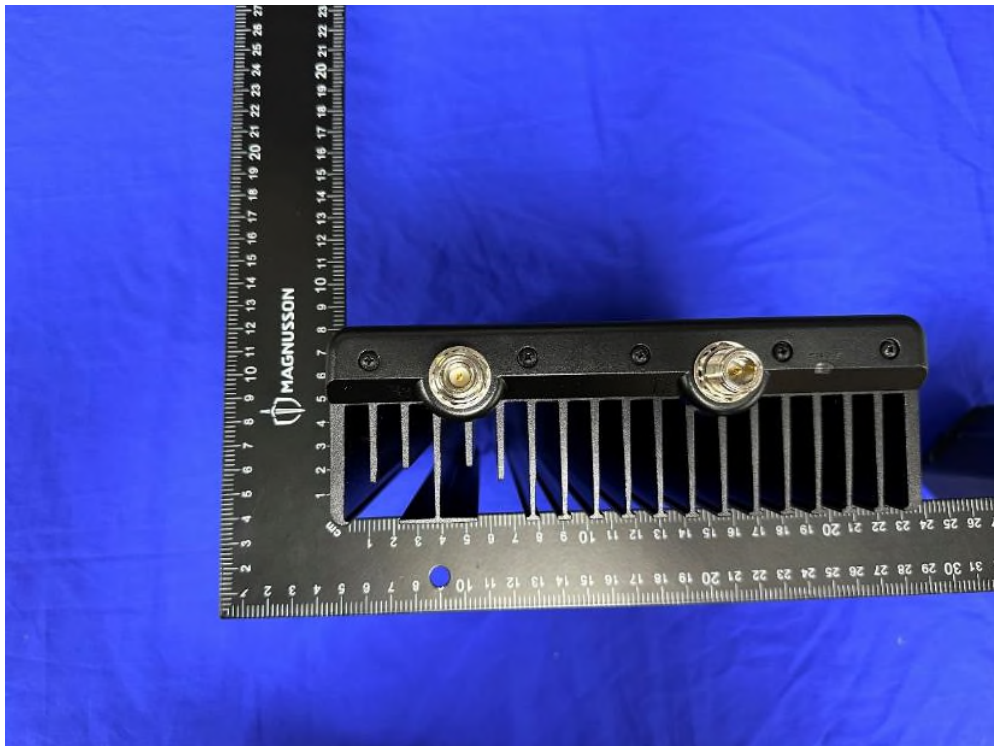
## 7.4 EUT Right side View



## 7.5 EUT Antenna Ports



## 7.6 EUT Display & Controls



## 7.7 EUT Internal photos

EUT not disassembled for internal photographs due to complexity of unit.

File Name: Zinwave Ltd.14169-1 Issue 01

QMF21J - Issue 05 - RNE Issue 03; 47 CFR Part 22H 2021

## 7.8 EUT ID Label



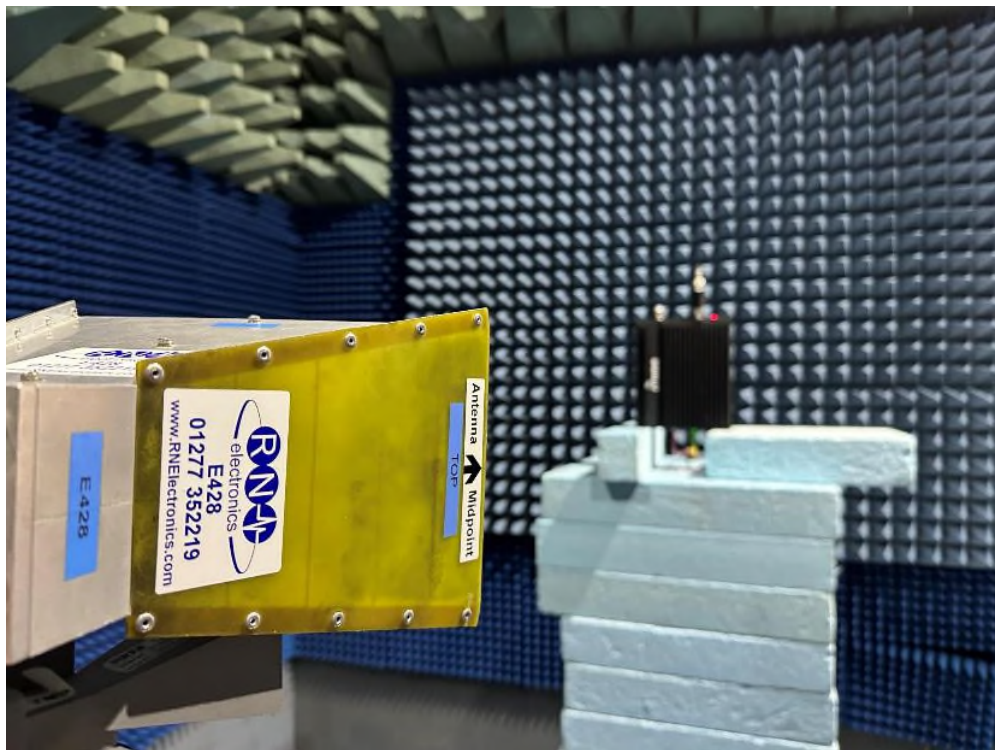
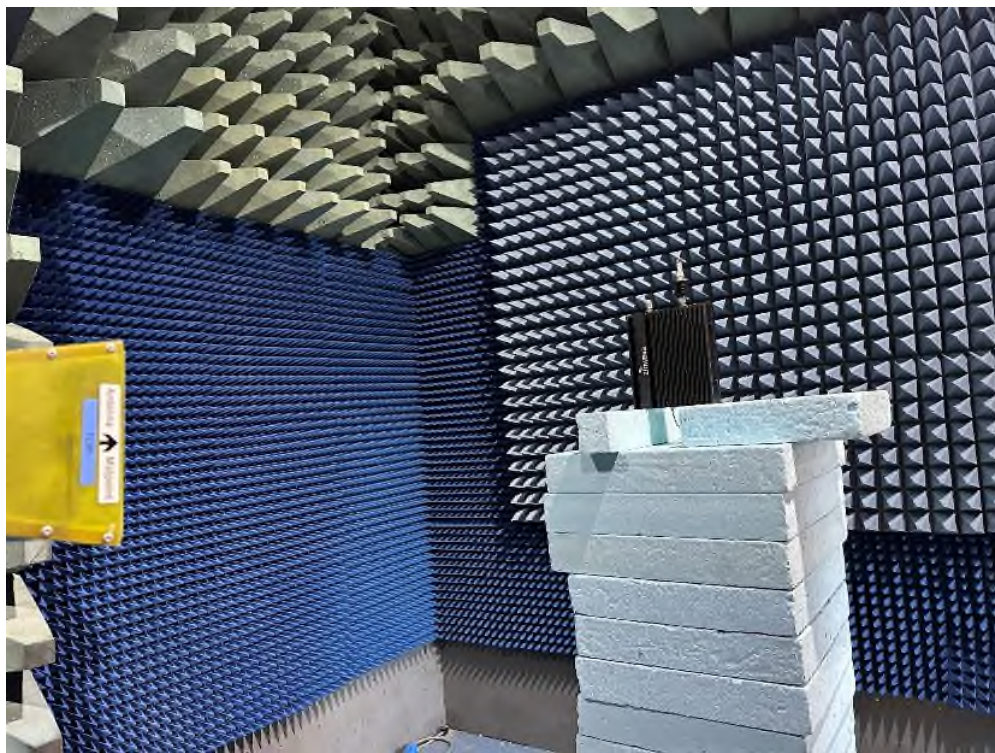


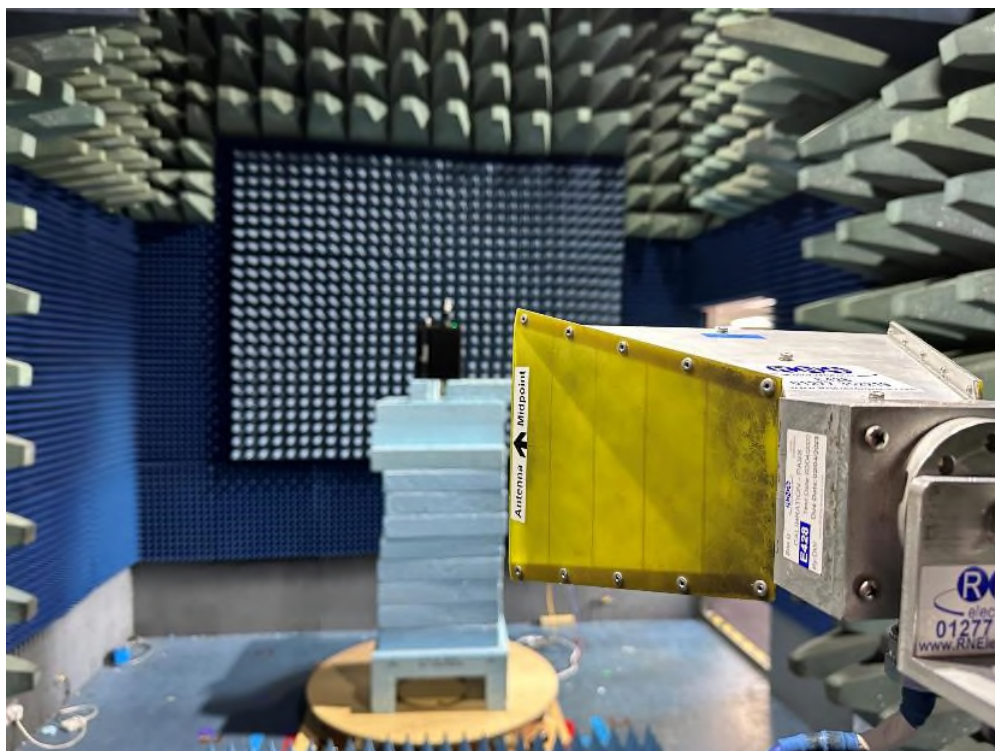


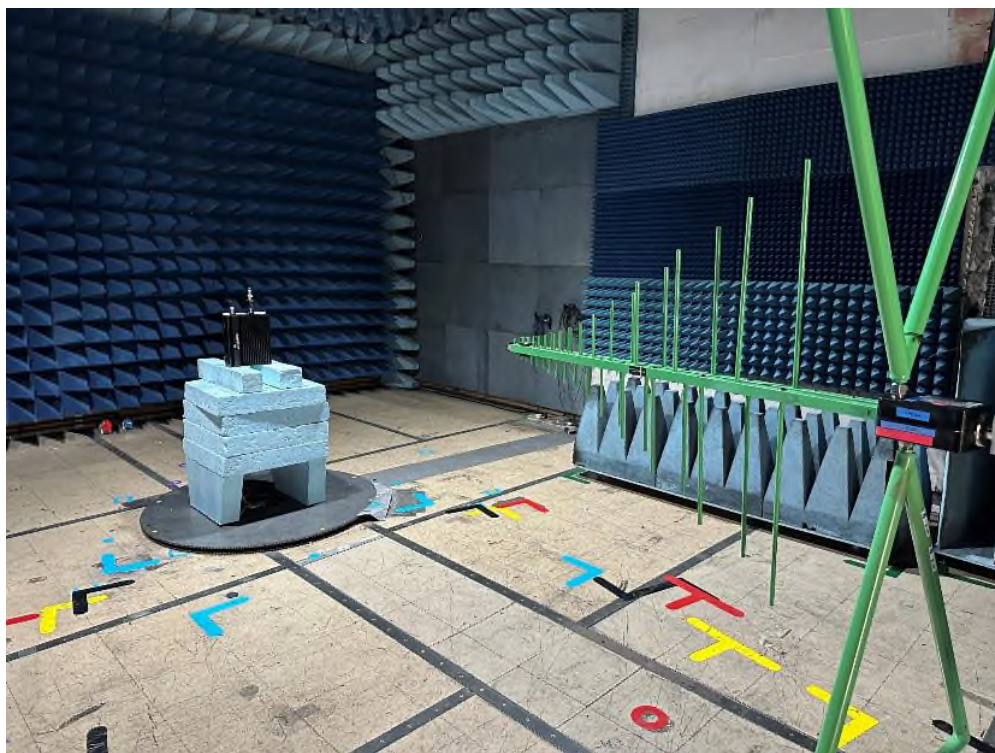
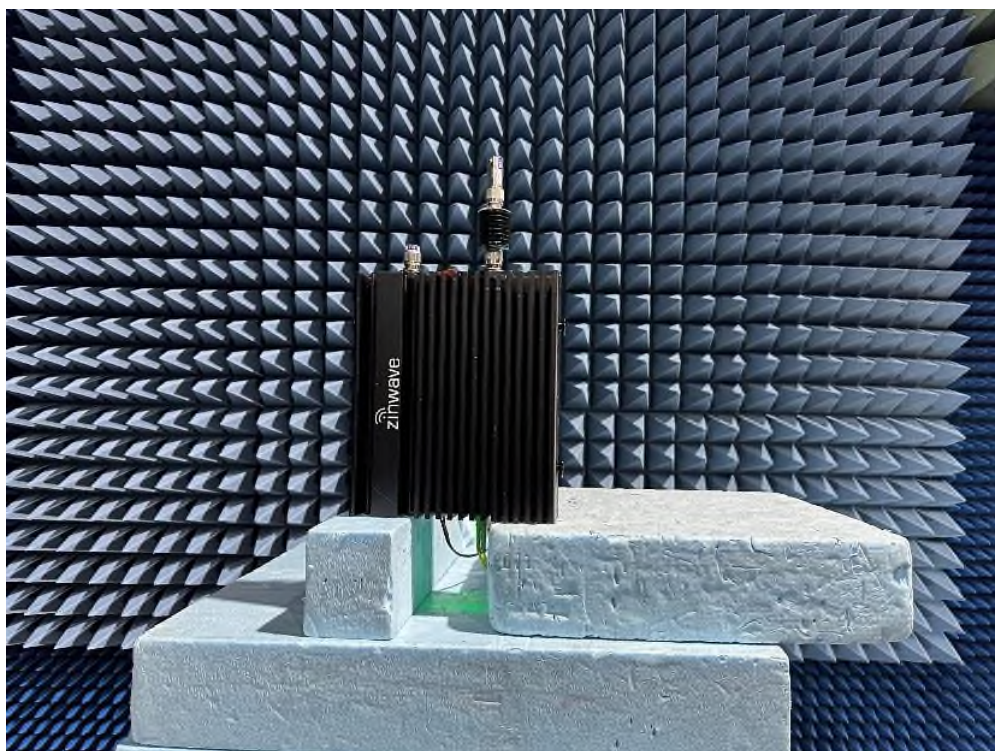
## 7.9 EUT Chassis

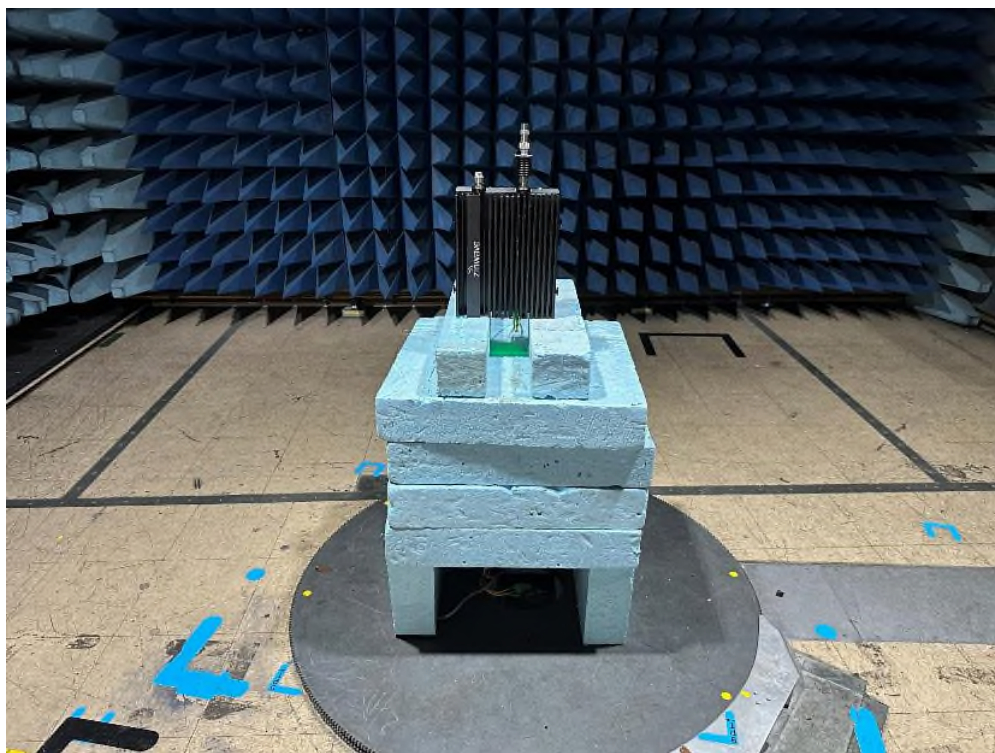
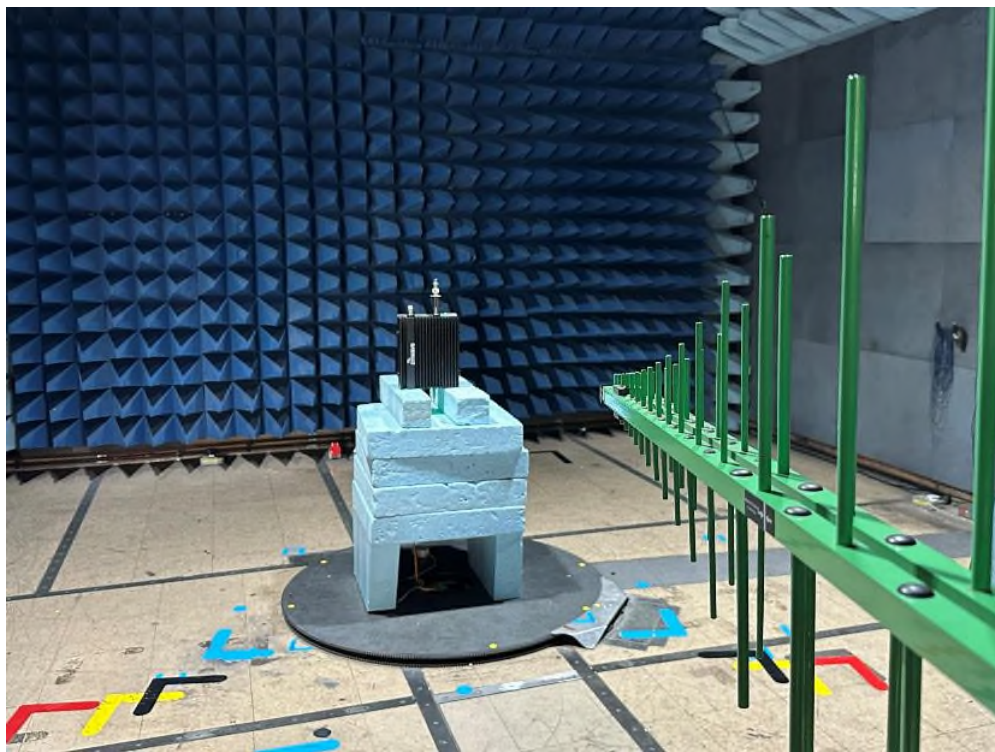


## 7.9 Spurious emission Test Set-up photos

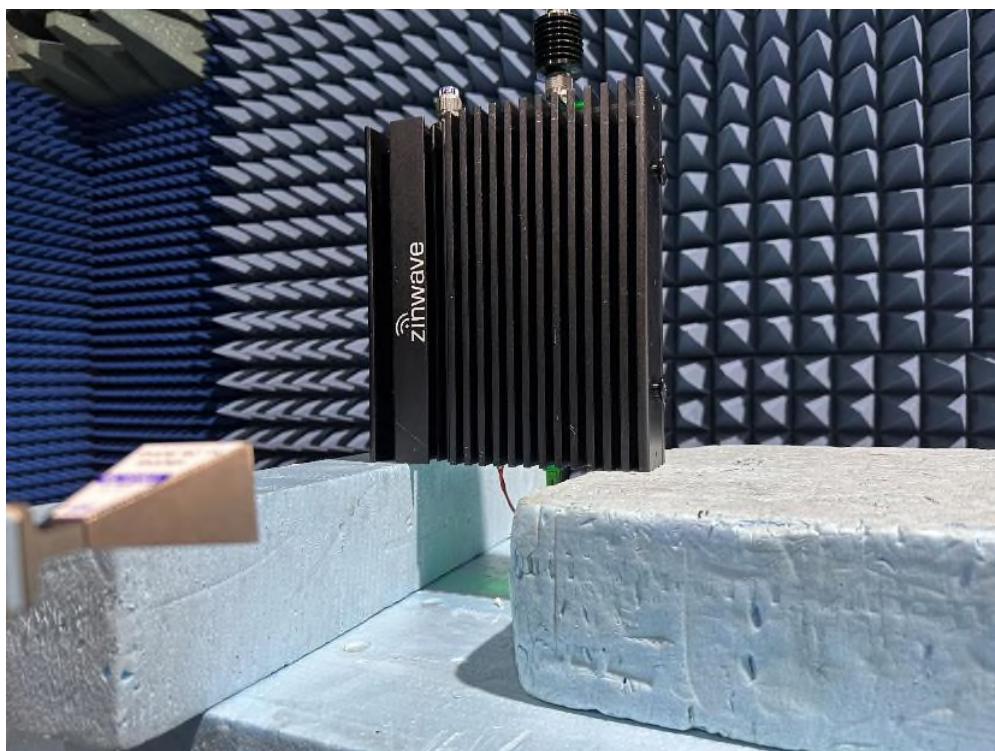


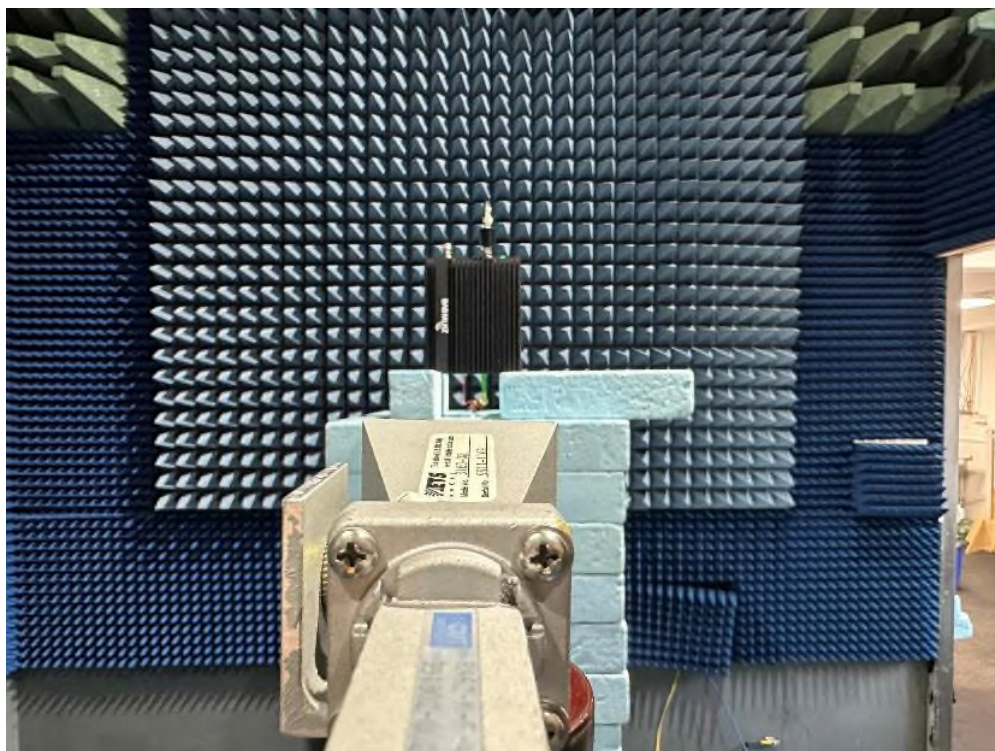
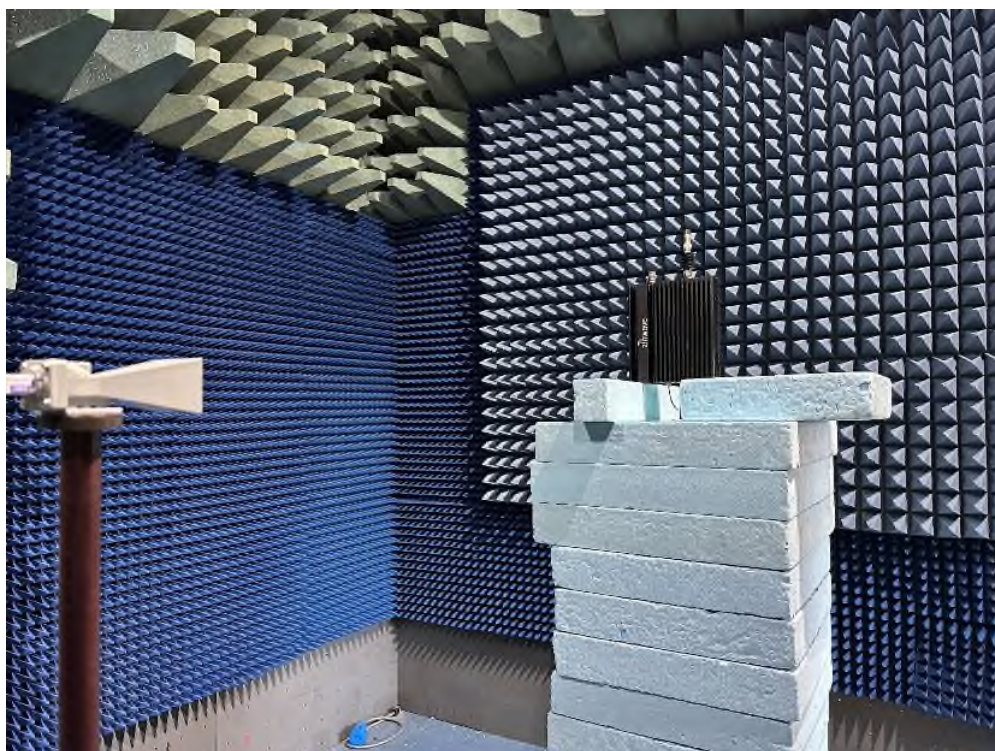












## 7.10 Radiated emission diagrams

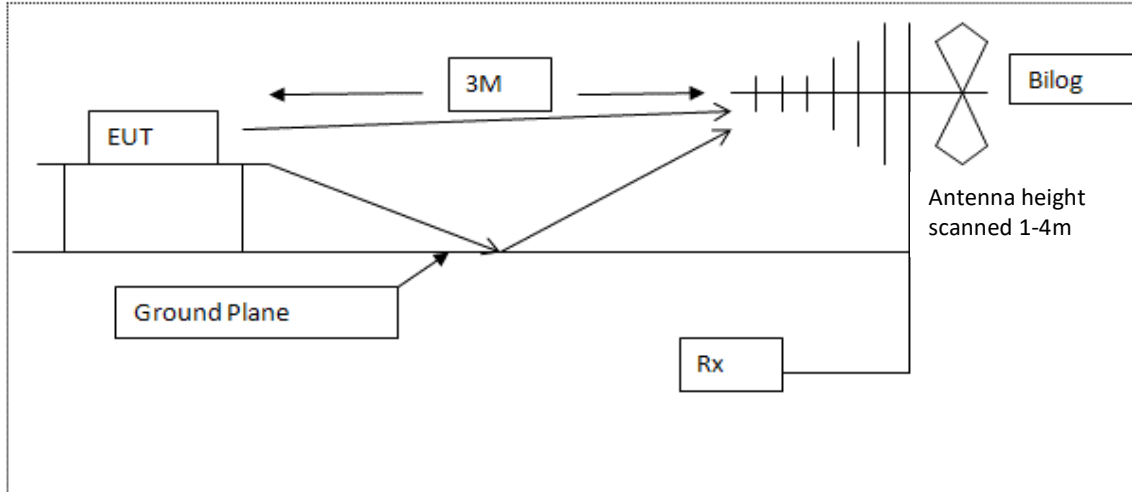


Diagram of the radiated emissions test setup 30 - 1000 MHz

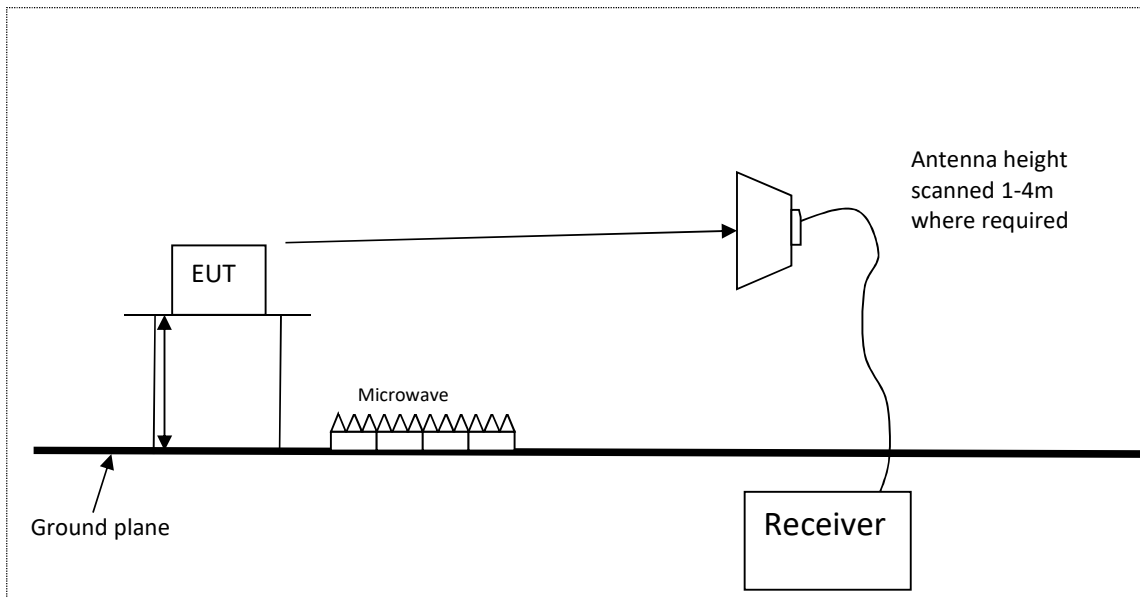


Diagram of the radiated emissions test setup above 1GHz

## 8 Test equipment calibration list

The following is a list of the test equipment used by R.N. Electronics Ltd to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

| RN No. | Model No.                | Description                         | Manufacturer          | Calibration date     | Cal period |
|--------|--------------------------|-------------------------------------|-----------------------|----------------------|------------|
| CAL07  | MWX221                   | Cable N Type to SMA Blue 2m         | Junflon               | 16-Dec-2022          | 6 months   |
| CAL08  | MWX221                   | Cable N Type to SMA Blue 2m         | Junflon               | 12-Aug-2022          | 12 months  |
| E007-2 | VHA9103                  | Antenna Bi-con                      | Schwarzbeck           | 23-Apr-2021          | 36 months  |
| E136   | 3105                     | Horn Antenna 1 - 12.5 GHz           | EMCO                  | #02-Apr-2023         | 12 months  |
| E268   | BHA 9118                 | Horn Antenna 1 - 18 GHz             | Schaffner             | #02-Apr-2023         | 12 months  |
| E411   | N9039A                   | 9 kHz - 1 GHz RF Filter Section     | Agilent Technologies  | 07-Jul-2022          | 12 months  |
| E428   | HF906                    | Horn Antenna 1 - 18 GHz             | Rohde & Schwarz       | #02-Apr-2023         | 12 months  |
| E433   | MG3693A                  | Signal Generator 2 GHz - 30 GHz     | Anritsu               | 03-Oct-2022          | 12 months  |
| E558   | 18N20W-30dB              | Attenuator 30dB 20W                 | Inmet                 | 17-Mar-2023          | 12 months  |
| E624   | E4440A                   | PSA 3 Hz - 26.5 GHz                 | Agilent Technologies  | 06-Jul-2022          | 24 months  |
| E642   | E4440A                   | PSA 3 Hz - 26.5 GHz                 | Agilent Technologies  | 06-Dec-2022          | 24 months  |
| E701   | MG3710A                  | Signal Generator 0.1 - 6000 MHz     | Anritsu               | 09-Feb-2023          | 12 months  |
| E743   | 2017 4/2dB               | Attenuator 4/2dB 30-1000MHz         | RN Electronics        | 15-Mar-2023          | 12 months  |
| E856   | N9039A                   | 9 kHz - 1 GHz RF Filter Section     | Agilent Technologies  | 06-Dec-2022          | 12 months  |
| E904   | 5086-7805                | Pre-Amplifier 1GHz - 26.5GHz        | Hewlett Packard       | #03-Mar-2023         | 12 months  |
| E932   | N5181A                   | Signal Generator 100kHz to 6GHz     | Agilent Technologies  | 08-Jun-2022          | 12 months  |
| F030   | X6L120-1250-0017-0001-00 | Filter Low Pass 1250MHz             | K&L Microwave Inc     | Checked prior to use |            |
| F031   | X6L120-1250-0017-0001-00 | Filter Low Pass 1250MHz             | K&L Microwave Inc     | Checked prior to use |            |
| H071   | N9010B                   | EXA Signal Analyser 10 Hz to 44 GHz | Keysight Technologies | 12-Dec-2022          | 24 months  |
| LPE364 | CBL6112A                 | Antenna BiLog 30MHz - 2GHz          | Chase Electronics Ltd | 28-Mar-2022          | 24 months  |
| TMS82  | 8449B                    | Pre-Amplifier 1GHz - 26.5GHz        | Agilent Technologies  | 16-Dec-2022          | 12 months  |

# Equipment was within calibration dates for tests and has been re-calibrated since/during date of tests.

## 9 Auxiliary and peripheral equipment

### 9.1 Customer supplied equipment

| Item No. | Model No. | Description   | Manufacturer | Serial No.           |
|----------|-----------|---------------|--------------|----------------------|
| 1        | 308-0001  | Primary Hub   | Zinwave Ltd  | 00-17-68-00-31-E2    |
| 2        | 4977761   | Secondary Hub | Zinwave Ltd  | 620200002612 Artesyn |

### 9.2 RN Electronics supplied equipment

| RN No. | Model No.   | Description                     | Manufacturer    | Serial No  |
|--------|-------------|---------------------------------|-----------------|------------|
| E558   | 18N20W-30dB | Attenuator 30dB 20W             | Inmet           | -          |
| E701   | MG3710A     | Signal Generator 0.1 - 6000 MHz | Anritsu         | 6201305571 |
| F390   | 908A        | Termination N Type m 4GHz       | Hewlett Packard | -          |
| F391   | R404131000  | Termination N type 4GHz         | Radiall         | -          |
| I258   | HP 250 G6   | Laptop HP 250 G6                | Hewlett Packard | CND82494B7 |

## 10 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

### 10.1 Modifications before test

Software was upgraded from 0.01(b5b8d31) to 0.01(4b3aq2e) in the primary hub before test to so its internal calibration could be performed correctly. The Software was upgraded again from 0.01(4b3aq2e) to 0.01(e15853b) in the primary hub during test to resolve an emissions problem at 91 MHz away from the fundamental which was cause by fibre communication. Although the Primary hub is not under test the EUT can't operate without it and it contributes to test results.

### 10.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

## 11 Description of test sites

|           |                                                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------|
| Site A    | Radio Laboratory and Anechoic Chamber                                                                                            |
| Site B    | Semi-Anechoic Chamber and Control Room<br>FCC Registration No. 293246, ISED Registration No. 5612A-4                             |
| Site C    | Transient Laboratory                                                                                                             |
| Site D    | Screened Room (Conducted Immunity)                                                                                               |
| Site E    | Screened Room (Control Room for Site D)                                                                                          |
| Site F    | Screened Room (Conducted Emissions)                                                                                              |
| Site G    | Screened Room (Control Room for Site H)                                                                                          |
| Site H    | 3m Semi-Anechoic Chamber (indoor OATS)<br>FCC Registration No. 293246, ISED Registration No. 5612A-2, VCCI Registration No. 4065 |
| Site J    | Transient Laboratory                                                                                                             |
| Site K    | Screened Room (Control Room for Site M)                                                                                          |
| Site M    | 3m Semi-Anechoic Chamber (indoor OATS)<br>FCC Registration No. 293246, ISED Registration No. 5612A-3                             |
| Site N    | Radio Laboratory                                                                                                                 |
| Site Q    | Fully-Anechoic Chamber                                                                                                           |
| Site OATS | 3m and 10m Open Area Test Site<br>FCC Registration No. 293246, ISED Registration No. 5612A-1                                     |
| Site R    | Screened Room (Conducted Immunity)                                                                                               |
| Site S    | Safety Laboratory                                                                                                                |
| Site T    | Transient Laboratory                                                                                                             |

RN Electronics CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002

RN Electronics CAB identifier as issued by FCC is UK0015

## 12 Abbreviations and units

|              |                                                                      |                 |                                                   |
|--------------|----------------------------------------------------------------------|-----------------|---------------------------------------------------|
| %            | Percent                                                              | dB $\mu$ V      | decibels relative to 1 $\mu$ V                    |
| $\lambda$    | Wavelength                                                           | dB $\mu$ V/m    | decibels relative to 1 $\mu$ V/m                  |
| $\mu$ A/m    | microAmps per metre                                                  | dBc             | decibels relative to Carrier                      |
| $\mu$ V      | microVolts                                                           | dBd             | decibels relative to dipole gain                  |
| $\mu$ W      | microWatts                                                           | dB <sub>i</sub> | decibels relative to isotropic gain               |
| AC           | Alternating Current                                                  | dBm             | decibels relative to 1mW                          |
| ACK          | ACKnowledgement                                                      | dB <sub>r</sub> | decibels relative to a maximum value              |
| ACP          | Adjacent Channel Power                                               | dBW             | decibels relative to 1W                           |
| AFA          | Adaptive Frequency Agility                                           | DC              | Direct Current                                    |
| ALSE         | Absorber Lined Screened Enclosure                                    | DFS             | Dynamic Frequency Selection                       |
| AM           | Amplitude Modulation                                                 | DMO             | Dynamic Modulation Order                          |
| Amb          | Ambient                                                              | DSSS            | Direct Sequence Spread Spectrum                   |
| ANSI         | American National Standards Institute                                | DTA             | Digital Transmission Analyser                     |
| ATPC         | Automatic Transmit Power Control                                     | EIRP            | Equivalent Isotropic Radiated Power               |
| AVG          | Average                                                              | emf             | electromotive force                               |
| AWGN         | Additive White Gaussian Noise                                        | ERC             | European Radiocommunications Committee            |
| BER          | Bit Error Rate                                                       | ERP             | Effective Radiated Power                          |
| BPSK         | Binary Phase Shift Keying                                            | ETSI            | European Telecommunications Standards Institute   |
| BT           | BlueTooth                                                            | EU              | European Union                                    |
| BLE          | BlueTooth Low Energy                                                 | EUT             | Equipment Under Test                              |
| BW           | Bandwidth                                                            | FCC             | Federal Communications Commission                 |
| °C           | Degrees Celsius                                                      | FER             | Frame Error Rate                                  |
| C/I          | Carrier / Interferer                                                 | FHSS            | Frequency Hopping Spread Spectrum                 |
| CAC          | Channel Availability Check                                           | FM              | Frequency Modulation                              |
| CCA          | Clear Channel Assessment                                             | FSK             | Frequency Shift Keying                            |
| CEPT         | European Conference of Postal and Telecommunications Administrations | FSS             | Fixed Satellite Service                           |
| CFR          | Code of Federal Regulations                                          | g               | Grams                                             |
| CISPR        | Comité International Spécial des Perturbations Radioélectriques      | GHz             | GigaHertz                                         |
| cm           | centimetre                                                           | GNSS            | Global Navigation Satellite System                |
| COFDM        | Coherent OFDM                                                        | GPS             | Global Positioning System                         |
| COT          | Channel Occupancy Time                                               | Hz              | Hertz                                             |
| CS           | Channel Spacing                                                      | IEEE            | Institute of Electrical and Electronics Engineers |
| CW           | Continuous Wave                                                      | IF              | Intermediate Frequency                            |
| DAA          | Detect And Avoid                                                     | ISED            | Innovation Science and Economic Development       |
| dB           | decibels                                                             | ITU             | International Telecommunications Union            |
| dB $\mu$ A/m | decibels relative to 1 $\mu$ A/m                                     | KDB             | Knowledge DataBase                                |

|        |                                            |       |                                                |
|--------|--------------------------------------------|-------|------------------------------------------------|
| kg     | kilogram                                   | pW    | picoWatts                                      |
| kHz    | kiloHertz                                  | QAM   | Quadrature Amplitude Modulation                |
| kPa    | Kilopascal                                 | QP    | Quasi Peak                                     |
| LBT    | Listen Before Talk                         | QPSK  | Quadrature Phase Shift Keying                  |
| LISN   | Line Impedance Stabilisation Network       | RBW   | Resolution Band Width                          |
| LNA    | Low Noise Amplifier                        | RED   | Radio Equipment Directive                      |
| LNB    | Low Noise Block                            | R&TTE | Radio and Telecommunication Terminal Equipment |
| LO     | Local Oscillator                           | Ref   | Reference                                      |
| m      | metre                                      | RF    | Radio Frequency                                |
| mA     | milliAmps                                  | RFC   | Remote Frequency Control                       |
| max    | maximum                                    | RFID  | Radio Frequency IDentification                 |
| Mbit/s | MegaBits per second                        | RLAN  | Radio Local Area Network                       |
| MCS    | Modulation and Coding Scheme               | RMS   | Root Mean Square                               |
| MHz    | MegaHertz                                  | RNSS  | Radio Navigation Satellite Service             |
| mic    | Microphone                                 | RSL   | Received Signal Level                          |
| MIMO   | Multiple Input, Multiple Output            | RSSI  | Received Signal Strength Indicator             |
| min    | minimum                                    | RTP   | Room Temperature and Pressure                  |
| mm     | millimetres                                | RTPC  | Remote Transmit Power Control                  |
| ms     | milliseconds                               | Rx    | Receiver                                       |
| mW     | milliWatts                                 | s     | Seconds                                        |
| NA     | Not Applicable                             | SINAD | Signal to Noise And Distortion                 |
| NFC    | Near Field Communications                  | SRD   | Short Range Device                             |
| nom    | Nominal                                    | Tx    | Transmitter                                    |
| nW     | nanoWatt                                   | UKAS  | United Kingdom Accreditation Service           |
| OATS   | Open Area Test Site                        | UKCA  | United Kingdom Conformity Assessed             |
| OBW    | Occupied Band Width                        | UKRER | United Kingdom Radio Equipment Regulations     |
| OCW    | Occupied Channel Width                     | UHF   | Ultra High Frequency                           |
| OFDM   | Orthogonal Frequency Division Multiplexing | U-NII | Unlicensed National Information Infrastructure |
| OOB    | Out Of Band                                | USB   | Universal Serial Bus                           |
| ppm    | Parts per million                          | UWB   | Ultra Wide Band                                |
| PER    | Packet Error Rate                          | V     | Volts                                          |
| PK     | Peak                                       | V/m   | Volts per metre                                |
| PMR    | Private Mobile Radio                       | VBW   | Video Band Width                               |
| PRBS   | Pseudo Random Bit Sequence                 | VHF   | Very High Frequency                            |
| PRF    | Pulse Repetition Frequency                 | VSAT  | Very Small Aperture Terminal                   |
| PSD    | Power Spectral Density                     | W     | Watts                                          |
| PSU    | Power Supply Unit                          |       |                                                |

===== END OF TEST REPORT =====