

# Test report

**328084-5TRFWL**

Date of issue: April 12, 2019

Applicant:

**Commscope**

Product:

**ION-E**

Model:

**UAP**

Variants

**UAP-X, UAP-N25, UAP-XN25**

FCC ID:

**BCR-IONEUP**

ISED certification number:

**2237D-IONEUP**

Specifications:

**FCC Part 27, RSS-131 Issue 3, RSS-139 Issue 3**

#### Test location

|              |                                                                                    |
|--------------|------------------------------------------------------------------------------------|
| Company name | Nemko Canada Inc.                                                                  |
| Address      | 303 River Road                                                                     |
| City         | Ottawa                                                                             |
| Province     | Ontario                                                                            |
| Postal code  | K1V 1H2                                                                            |
| Country      | Canada                                                                             |
| Telephone    | +1 613 737 9680                                                                    |
| Facsimile    | +1 613 737 9691                                                                    |
| Toll free    | +1 800 563 6336                                                                    |
| Website      | www.nemko.com                                                                      |
| Site number  | FCC test site registration number: 175281, IC: 2040A-4 (3 m semi anechoic chamber) |

|             |                                                                                     |
|-------------|-------------------------------------------------------------------------------------|
| Tested by   | Kevin Rose, Wireless/EMC Specialist                                                 |
| Reviewed by | Russell Grant, Senior Technical Assessor                                            |
| Date        | April 12, 2019                                                                      |
| Signature   |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer

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|                 |                         |
|-----------------|-------------------------|
| Company name    | CommScope               |
| Address         | 620 N. Greenfield Pwky. |
| City            | Garner                  |
| Province/State  | NC                      |
| Postal/Zip code | 27529                   |
| Country         | USA                     |

### 1.2 Test specifications

---

|                                                |                                                                                                       |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| FCC Part 27                                    | MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES                                                        |
| KDB 935210 D05 Indus Booster Basic Meas v01r02 | MEASUREMENTS GUIDANCE FOR INDUSTRIAL AND NON-CONSUMER SIGNAL BOOSTER, REPEATER, AND AMPLIFIER DEVICES |
| RSS 131 Issue 3                                | Zone Enhancers                                                                                        |
| RSS 139 Issue 3                                | Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz     |

### 1.3 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

### 1.4 Exclusions

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None

### 1.5 Test report revision history

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| Revision # | Details of changes made to test report |
|------------|----------------------------------------|
| TRF        | Original report issued                 |

## Section 2. Summary of test results

### 2.1 FCC Part 27, RSS-131 Issue 3, RSS-139 Issue 3

| Part                                                         | Test description                                          | Verdict          |
|--------------------------------------------------------------|-----------------------------------------------------------|------------------|
| KDB 935210 D05 3.2                                           | Measuring AGC threshold level                             | Reported         |
| RSS-131 5.2.1, KDB 935210 D05 3.3                            | Out-of-band-rejection                                     | Pass             |
| RSS-131 5.2.2, KDB 935210 D05 3.4                            | Input-versus-output signal comparison                     | Pass             |
| FCC 27.50(d), RSS-131 5.2.3, RSS-139 6.5, KDB 935210 D05 3.5 | Mean output power and amplifier/booster gain              | Pass             |
| FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.6.2,          | Out-of-band/out-of-block emissions conducted measurements | Pass             |
| FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.6.3           | Spurious emissions conducted measurements                 | Pass             |
| FCC 27.54, RSS-131 5.2.4, RSS-139 6.4, KDB 935210 D05 3.7    | Frequency stability measurements                          | N/A <sup>1</sup> |
| FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.8             | Spurious emissions radiated measurements                  | Pass             |

Notes: <sup>1</sup>The signal booster does not alter the input signal in any way

## Section 3. Equipment under test (EUT) details

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### 3.1 Sample information

---

|                        |                  |
|------------------------|------------------|
| Receipt date           | October 26, 2018 |
| Nemko sample ID number | 1                |

### 3.2 EUT information

---

|               |       |
|---------------|-------|
| Product name  | ION-E |
| Model         | UAP   |
| Serial number | None  |

### 3.3 Technical information

---

|                                      |                                                                      |
|--------------------------------------|----------------------------------------------------------------------|
| Operating band                       | DL: 2155-2180 MHz                                                    |
| Modulation type/ Emission designator | WCDMA, LTE1.4, 3, 5, 10, 20 MHz                                      |
| Power requirements                   | 120 Vac 60 Hz                                                        |
| Gain                                 | 18 dB                                                                |
| Antenna information                  | External Antenna is not provided EUT used a 50 $\Omega$ termination. |

### 3.4 Product description and theory of operation

---

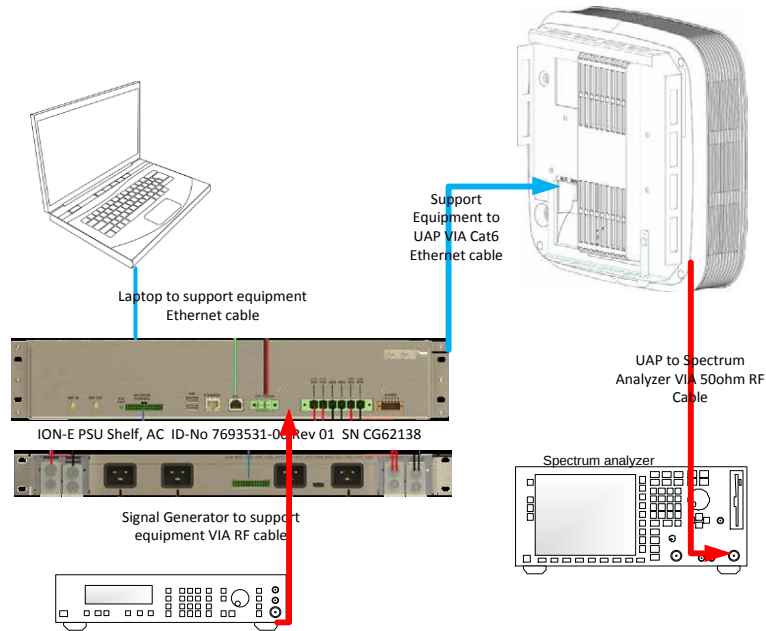
18 dB gain in DL repeater

### 3.5 EUT exercise details

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The EUT was controlled software GUI.

### 3.6 EUT setup diagram



**Figure 3.6-1:** Setup diagram

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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|                   |               |
|-------------------|---------------|
| Temperature       | 15–30 °C      |
| Relative humidity | 20–75 %       |
| Air pressure      | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

### 5.2 Power supply range

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The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.

## Section 6. Measurement uncertainty

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### 6.1 Uncertainty of measurement

---

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of  $K = 2$  with 95% certainty.

| Test name                     | Measurement uncertainty, dB |
|-------------------------------|-----------------------------|
| All antenna port measurements | 0.55                        |
| Conducted spurious emissions  | 1.13                        |
| Radiated spurious emissions   | 3.78                        |

## Section 7. Test equipment

### 7.1 Test equipment list

**Table 7.1-1: Equipment list**

| Equipment                   | Manufacturer    | Model no. | Serial no. | Asset no. | Cal./Ver. cycle | Next cal./ver. |
|-----------------------------|-----------------|-----------|------------|-----------|-----------------|----------------|
| 3 m EMI test chamber        | TDK             | SAC-3     |            | FA003012  | 1 year          | Aug. 22/19     |
| Flush mount turntable       | SUNAR           | FM2022    |            | FA003006  | —               | NCR            |
| Controller                  | SUNAR           | SC110V    | 050118-1   | FA002976  | —               | NCR            |
| Antenna mast                | SUNAR           | TLT2      | 042418-5   | FA003007  | —               | NCR            |
| AC Power source             | Chroma          |           |            | FA003020  | —               | NCR            |
| Receiver/spectrum analyzer  | Rohde & Schwarz | ESR26     | 101367     | FA002969  | 1 year          | June 1/19      |
| Spectrum analyzer           | Rohde & Schwarz | FSW43     | 104437     | FA002971  | 1 year          | June 1/19      |
| Horn antenna (1–18 GHz)     | ETS-Lindgren    | 3117      | 00052793   | FA002911  | 1 year          | Aug. 16/19     |
| Preamp (1–18 GHz)           | ETS-Lindgren    | 124334    | 00224880   | FA002956  | 1 year          | Sept 18/19     |
| Bilog antenna (30–2000 MHz) | SUNAR           | JB1       | A053018-1  | FA003009  | 1 year          | Sept. 6/19     |
| Vector Signal Generator     | Rohde & Schwarz | SMW200A   | 101857     | FA002970  | 1 year          | June 1/19      |

Note: NCR - no calibration required, VOU - verify on use

## Section 8.    Testing data

### 8.1    KDB 935210 D05 3.2, Measuring AGC threshold level

#### 8.1.1    Definitions and limits

The AGC threshold is the input power at which a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output power.

#### 8.1.2    Test summary

|               |                  |                   |           |
|---------------|------------------|-------------------|-----------|
| Test date     | October 26, 2018 | Temperature       | 22 °C     |
| Test engineer | Kevin Rose       | Air pressure      | 1003 mbar |
| Verdict       | Pass             | Relative humidity | 33 %      |

#### 8.1.3    Observations, settings and special notes

Test receiver settings:

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Detector mode         | RMS (for average), Peak (for peak)               |
| Resolution bandwidth  | 20 kHz                                           |
| Integration bandwidth | >OBW                                             |
| Video bandwidth       | >RBW                                             |
| Trace mode            | Power Average (for average), Max Hold (for peak) |
| Measurement time      | Auto                                             |

#### 8.1.4    Test data

**Table 8.1-1: AGC Threshold**

| Modulation | Frequency, MHz | RF input power AVG, dBm |
|------------|----------------|-------------------------|
| AWGN       | 2167.5         | -0.40                   |

## 8.2    RSS-131 5.2.1, KDB 935210 D05 3.3, Out-of-band-rejection

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### 8.2.1    Definitions and limits

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The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

### 8.2.2    Test summary

---

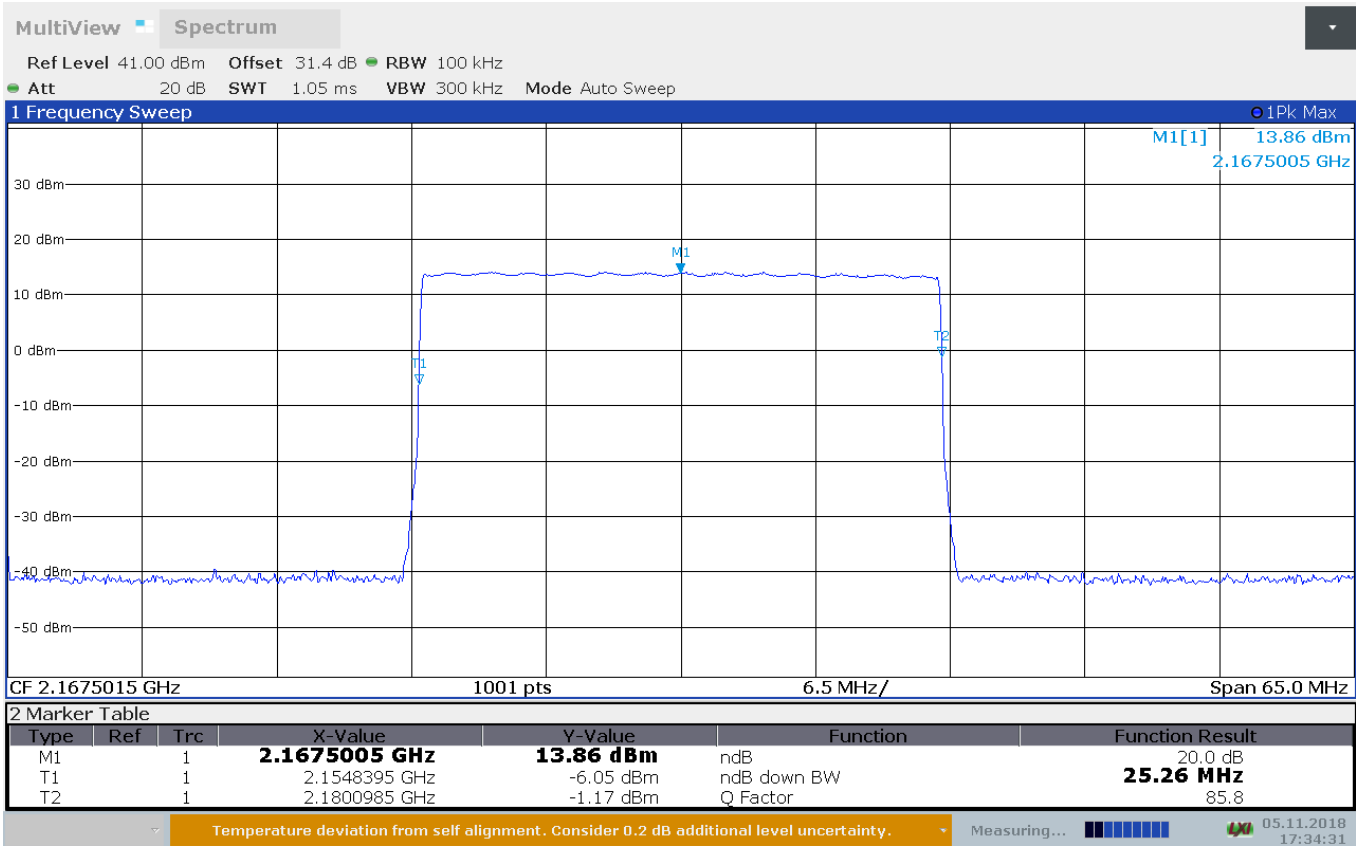
|               |                  |                   |           |
|---------------|------------------|-------------------|-----------|
| Test date     | October 26, 2018 | Temperature       | 21 °C     |
| Test engineer | Kevin Rose       | Air pressure      | 1000 mbar |
| Verdict       | Pass             | Relative humidity | 42 %      |

### 8.2.3    Observations, settings and special notes

---

|                            |                                               |
|----------------------------|-----------------------------------------------|
| Frequency range            | 2135 MHz to 2200 MHz                          |
| Detector mode              | Peak                                          |
| Resolution bandwidth sweep | 100 kHz (below 1 GHz), 1000 kHz (above 1 GHz) |
| Video bandwidth            | 3 x RBW                                       |
| Trace mode                 | Max Hold                                      |
| Measurement time           | Auto                                          |

8.2.4 Test data



17:34:31 05.11.2018

Figure 8.2-1: Passband

## 8.3    RSS-131 5.2.2, KDB 935210 D05 3.4, Input-versus-output signal comparison

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### 8.3.1    Definitions and limits

---

The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

A 26 dB bandwidth measurement shall be performed on the input signal and the output signal; alternatively, the 99% OBW can be measured and used.

### 8.3.2    Test summary

---

|               |                  |                   |           |
|---------------|------------------|-------------------|-----------|
| Test date     | October 29, 2018 | Temperature       | 22 °C     |
| Test engineer | Kevin Rose       | Air pressure      | 1001 mbar |
| Verdict       | Pass             | Relative humidity | 32 %      |

### 8.3.3    Observations, settings and special notes

---

Receiver settings were:

|                      |                                   |
|----------------------|-----------------------------------|
| Frequency range      | 250% of OBW                       |
| Detector mode        | Peak                              |
| Resolution bandwidth | 1 % to 5 % of the anticipated OBW |
| Video bandwidth      | >RBW                              |
| Trace mode           | Max Hold                          |



8.3.4 Test data

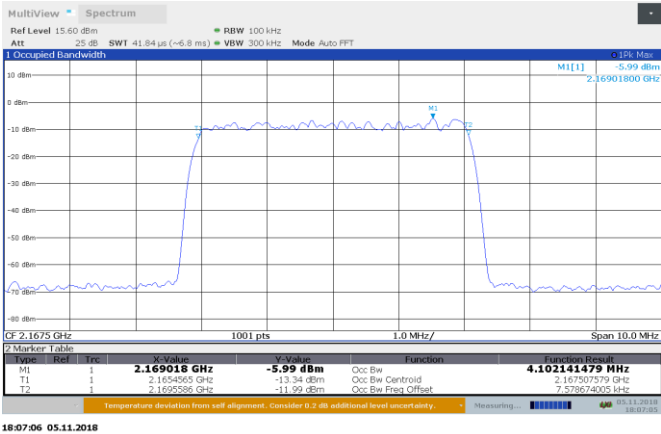


Figure 8.3-1: Input signal AGC -0.5dB 2167.5 MHz input 99% BW

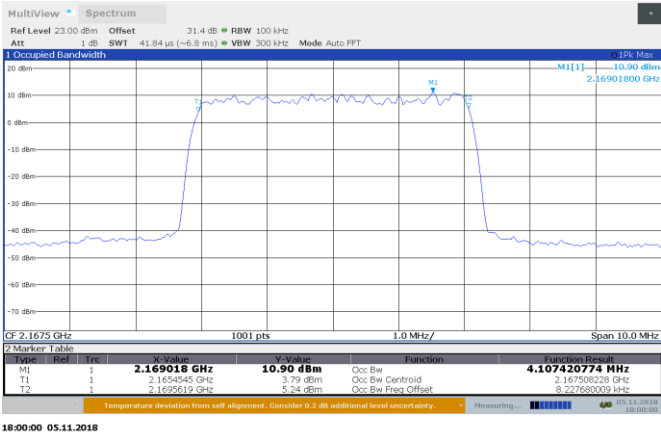


Figure 8.3-2: Output signal AGC -0.5dB 2167.5 MHz Output 99% BW

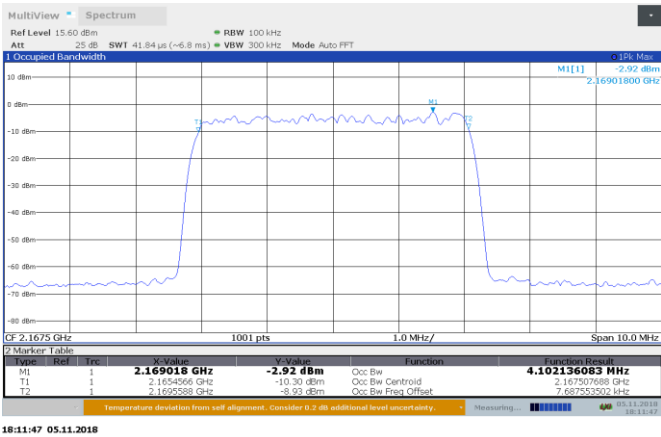


Figure 8.3-3: Input signal AGC +3dB 2167.5 MHz input 99% BW

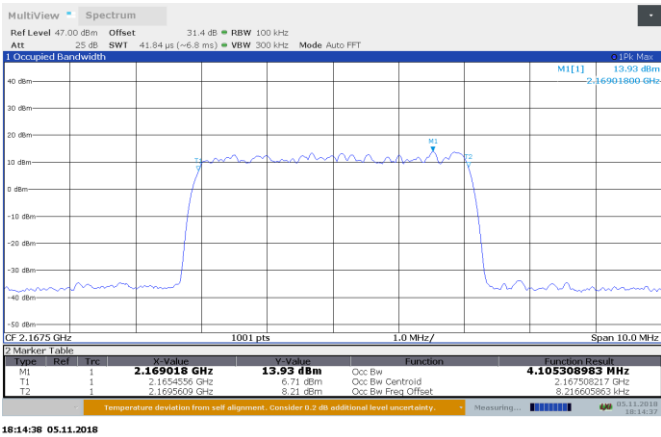


Figure 8.3-4: Output signal AGC +3dB 2167.5 MHz Output 99% BW

## 8.4 FCC 27.50(d), RSS-131 5.2.3, RSS-139 6.5, KDB 935210 D05 3.5, Mean output power and amplifier/booster gain

### 8.4.1 Definitions and limits

FCC 27.50(d)(1)(ii) / RSS-139 6.5, SRSP-513 5.1.3 Low density limit, 3280 W/MHz EIRP

FCC 27.50(d)(2)(ii) / RSS-139 6.5, SRSP-513 5.1.2 High density limit 1640 W/MHz EIRP

RSS-131 5.2.3 The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

SRSP-503 1640 W EIRP

### 8.4.2 Test summary

|               |                |                   |          |
|---------------|----------------|-------------------|----------|
| Test date     | March 27, 2019 | Temperature       | 22 °C    |
| Test engineer | Kevin Rose     | Air pressure      | 980 mbar |
| Verdict       | Pass           | Relative humidity | 31 %     |

### 8.4.3 Observations, settings and special notes

The 99% occupied bandwidth was used.

Spectrum analyzer settings:

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Detector mode         | RMS (for average), Peak (for peak)               |
| Resolution bandwidth  | 100 kHz                                          |
| Integration bandwidth | >OBW                                             |
| Video bandwidth       | >RBW                                             |
| Trace mode            | Power Average (for average), Max Hold (for peak) |
| Measurement time      | Auto                                             |

**Table 8.4-1: Output power results**

| Frequency, MHz | RF output power, dBm |
|----------------|----------------------|
| 2167.5         | 18.8                 |



8.4.1 Test data

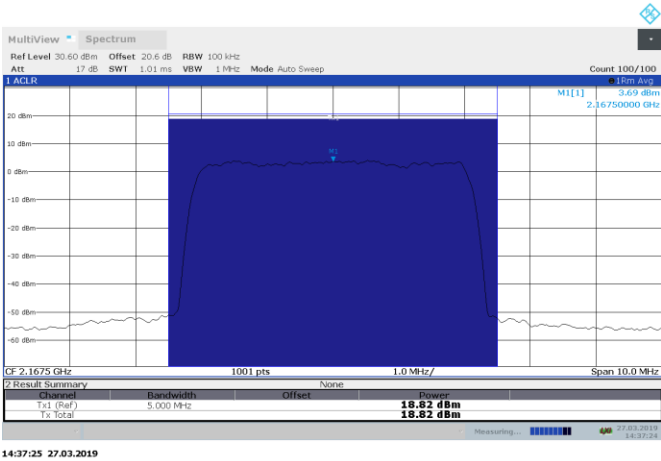


Figure 8.4-1: AGC-0.5 dB 2169.018 MHz output power

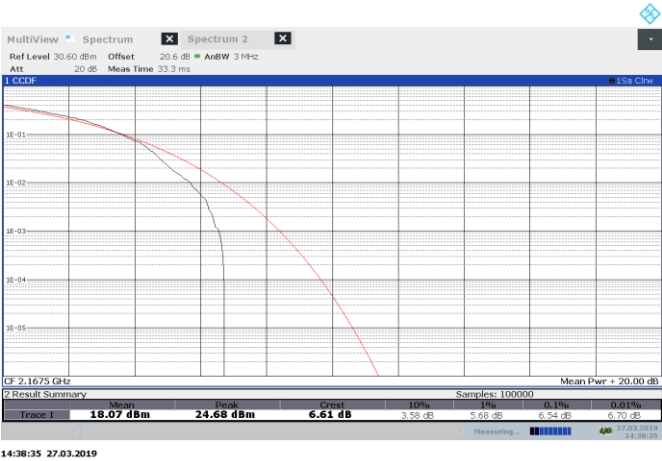


Figure 8.4-2: AGC-0.5 dB 2169.018 MHz output power PAPR

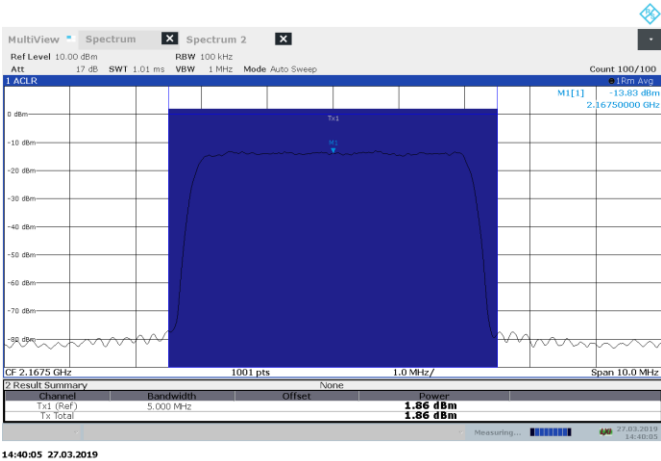


Figure 8.4-3: AGC-0.5 dB 2169.018 MHz input power

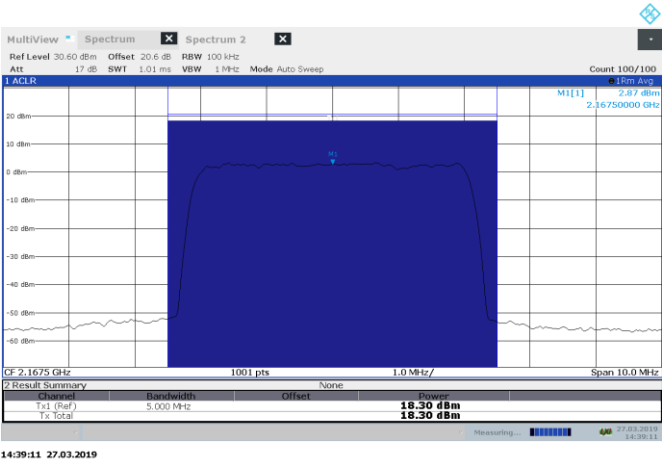


Figure 8.4-4: AGC+3 dB 2169.018 MHz output power

## 8.5 FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.6.2, Out-of-band/out-of-block emissions conducted measurements

### 8.5.1 Definitions and limits

FCC 27.53(h) *AWS emission limits*—(1) *General protection levels*. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB. RSS-139 6.6(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB. (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

### 8.5.2 Test summary

|               |                  |                   |           |
|---------------|------------------|-------------------|-----------|
| Test date     | October 29, 2018 | Temperature       | 22 °C     |
| Test engineer | Kevin Rose       | Air pressure      | 1001 mbar |
| Verdict       | Pass             | Relative humidity | 32 %      |

### 8.5.3 Observations, settings and special notes

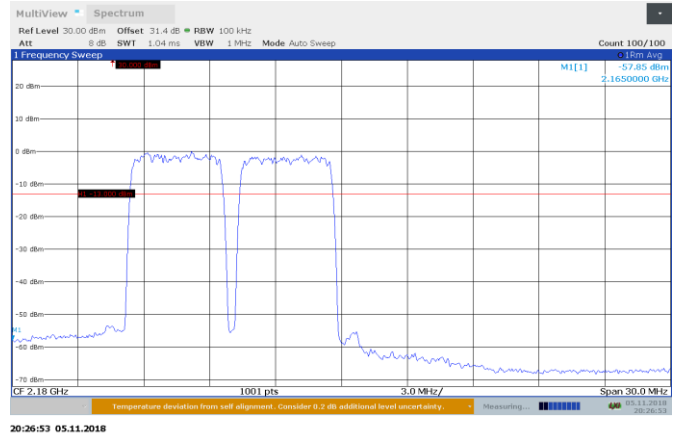
Test receiver settings:

|                       |                            |
|-----------------------|----------------------------|
| Detector mode         | RMS                        |
| Resolution bandwidth  | 3 kHz                      |
| Integration bandwidth | >OBW                       |
| Video bandwidth       | >RBW                       |
| Trace mode            | Power Average (100 sweeps) |
| Measurement time      | Auto                       |

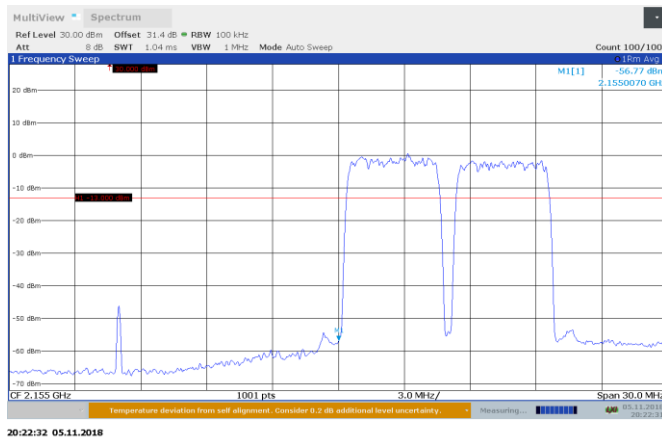
### 8.5.4 Test data



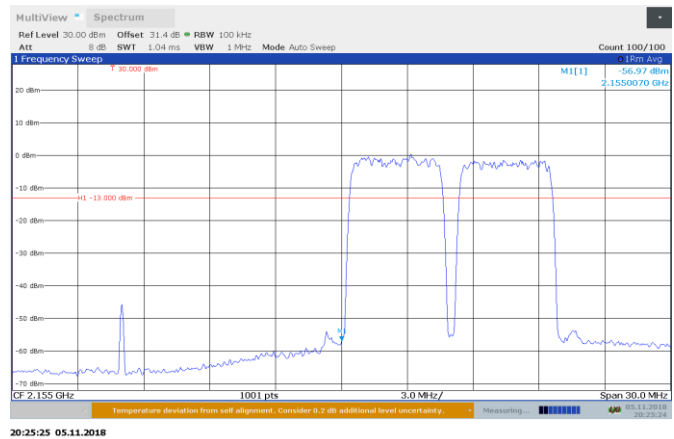
**Figure 8.5-1: 2172.5 and 2177.5 MHz AGC -0.5 Upper Edge Out-of-block**



**Figure 8.5-2: 2172.5 and 2177.5 MHz AGC + 3 Upper Edge Out-of-block**



**Figure 8.5-3: 2157.5 and 2162.5 MHz AGC - 0.5 Lower Edge Out-of-block**



**Figure 8.5-4: 2157.5 and 2162.5 MHz AGC + 3 Lower Edge Out-of-block**

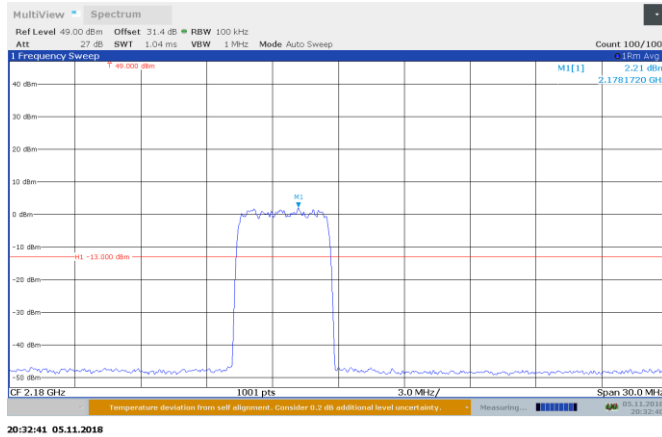


Figure 8.5-5: 2177.5 MHz AGC - 0.5 Upper Edge Out-of-block

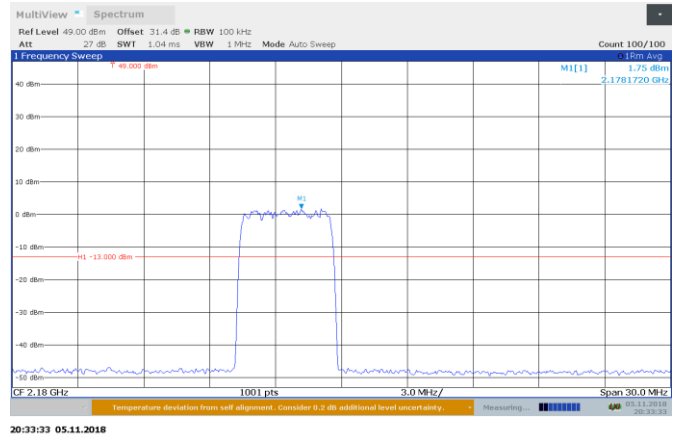


Figure 8.5-6: 2177.5 MHz AGC + 3 Upper Edge Out-of-block

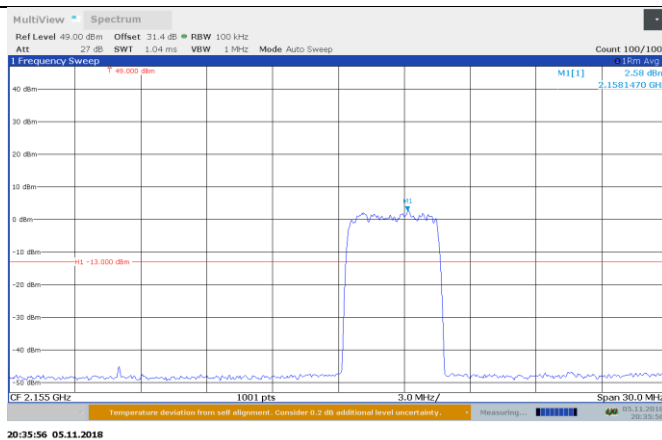


Figure 8.5-7: 2157.5 MHz AGC - 0.5 Lower Edge Out-of-block

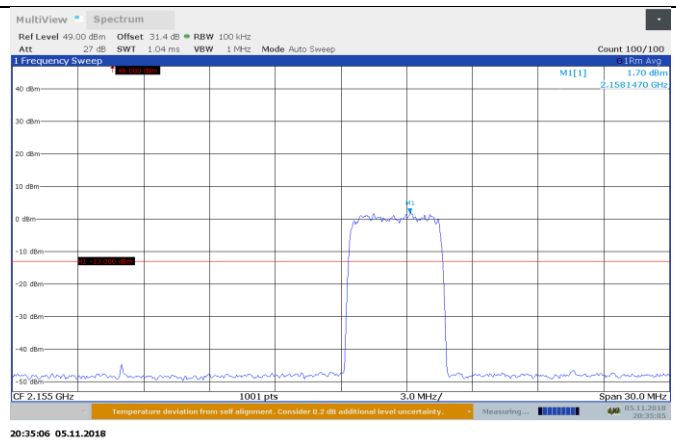


Figure 8.5-8: 2157.5 MHz AGC + 3 Lower Edge Out-of-block

## 8.6 FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.6.3, Spurious emissions conducted measurements

FCC 27.53(h) *AWS emission limits*—(1) *General protection levels*. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.

RSS-139 6.6(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} P$  (watts) dB. (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} P$  (watts) dB.

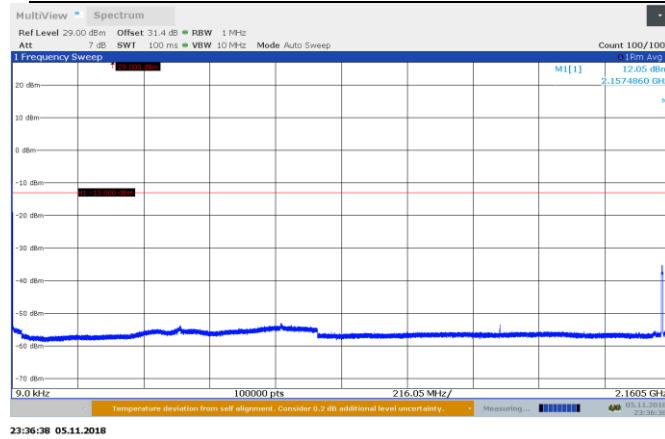
### 8.6.1 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | June 27, 2018 | Temperature       | 21 °C     |
| Test engineer | Kevin Rose    | Air pressure      | 1000 mbar |
| Verdict       | Pass          | Relative humidity | 42 %      |

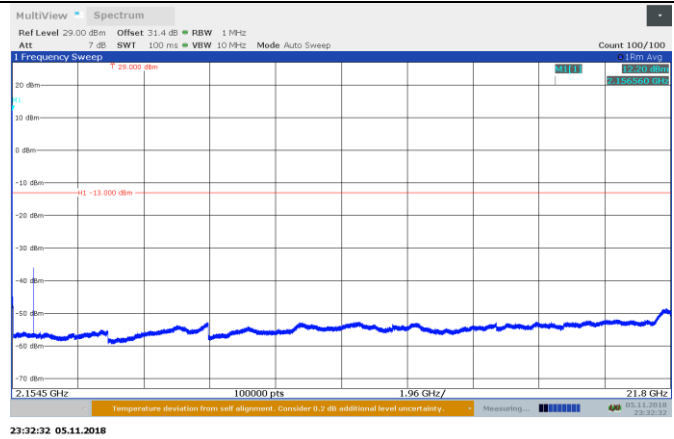
### 8.6.2 Observations, settings and special notes

|                            |                                               |
|----------------------------|-----------------------------------------------|
| Frequency range            | 9 KHz to 21.8 GHz                             |
| Detector mode              | Peak                                          |
| Resolution bandwidth sweep | 100 kHz (below 1 GHz), 1000 kHz (above 1 GHz) |
| Video bandwidth            | >RBW                                          |
| Trace mode                 | Max Hold                                      |
| Measurement time           | Auto                                          |

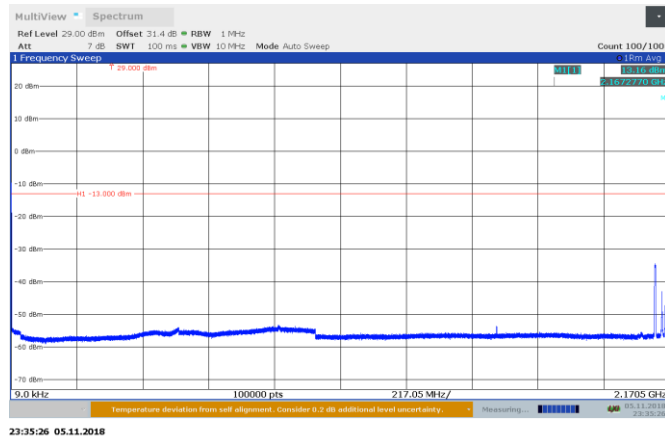
### 8.6.3 Test data



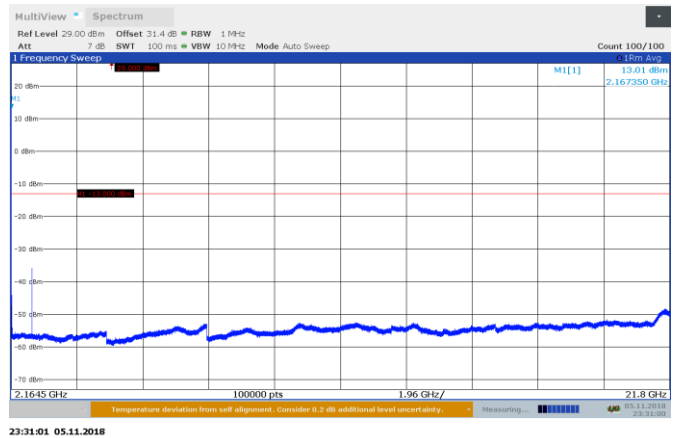
**Figure 8.6-1:** Low Frequency 2157.5 MHz AGC -0.5dB  
9 KHz-2.1605GHz conducted emission



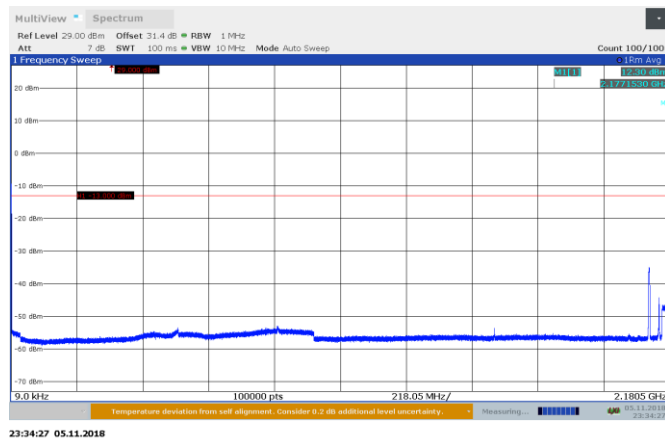
**Figure 8.6-2:** Low Frequency 2157.5 MHz AGC -0.5dB  
2.1545-21.8 GHz conducted emission



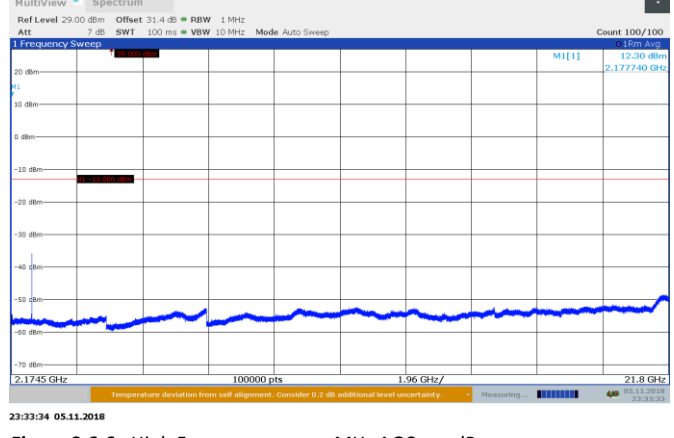
**Figure 8.6-3:** Mid Frequency 2167.5 MHz AGC -0.5dB  
9 KHz-2.1705GHz conducted emission



**Figure 8.6-4:** Mid Frequency 2167.5 MHz AGC -0.5dB  
2.1645-21.8 GHz conducted emission



**Figure 8.6-5:** High Frequency 2177.5 MHz AGC -0.5dB  
9 KHz-2.1805GHz conducted emission



**Figure 8.6-6:** High Frequency 2177.5 MHz AGC -0.5dB  
2.1745-21.8 GHz conducted emission

## 8.7 FCC 27.53(h)(1), RSS-139 6.6, KDB 935210 D05 3.8, Spurious emissions radiated measurements

### 8.7.1 Definitions and limits

FCC 27.53(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.

RSS-139 6.6(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB. (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

### 8.7.2 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | June 27, 2018 | Temperature       | 21 °C     |
| Test engineer | Kevin Rose    | Air pressure      | 1000 mbar |
| Verdict       | Pass          | Relative humidity | 42 %      |

### 8.7.3 Observations, settings and special notes

Worst case examples are provided. No emissions within 20 dB of the limit were detected.

Receiver settings were:

|                      |                                               |
|----------------------|-----------------------------------------------|
| Frequency range      | 30 MHz to 18GHz                               |
| Detector mode        | Peak                                          |
| Resolution bandwidth | 100 kHz (below 1 GHz), 1000 kHz (above 1 GHz) |
| Video bandwidth      | >RBW                                          |
| Trace mode           | Max Hold                                      |

8.7.4 Test data

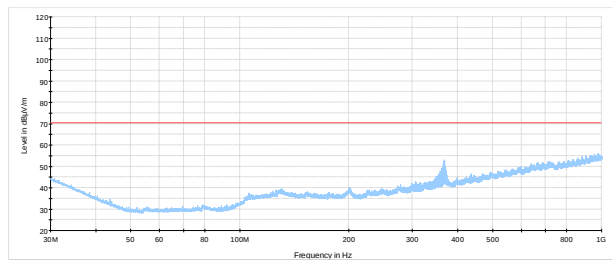


Figure 8.7-1: 30 MHz to 1 GHz Radiated

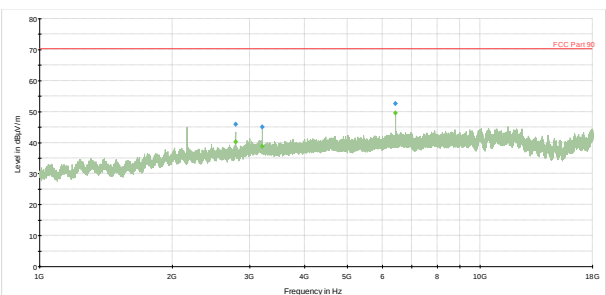


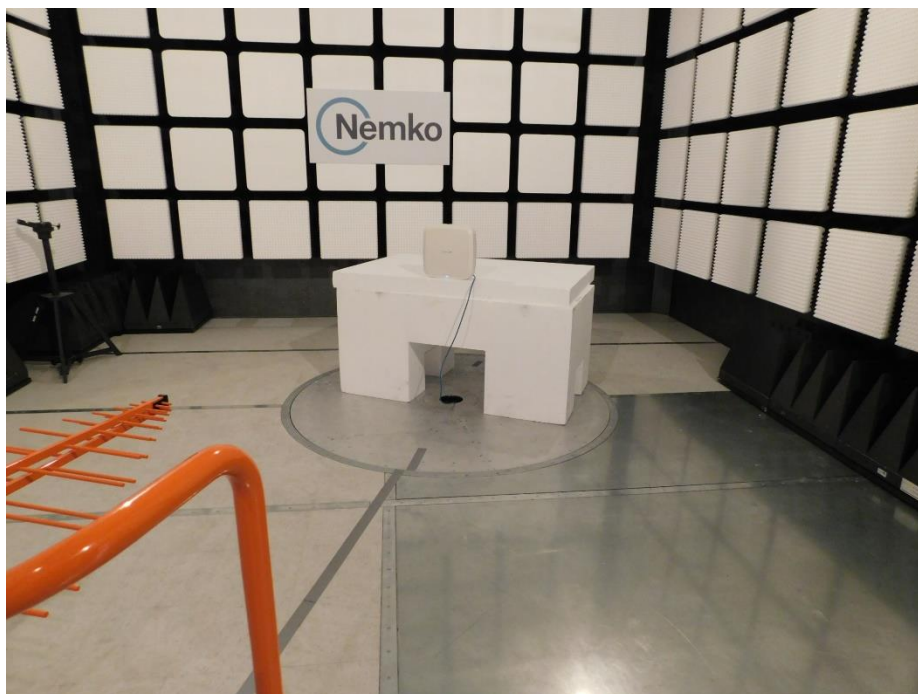
Figure 8.7-2: 1GHz to 18 GHz Radiated

## Section 9. Setup Photos

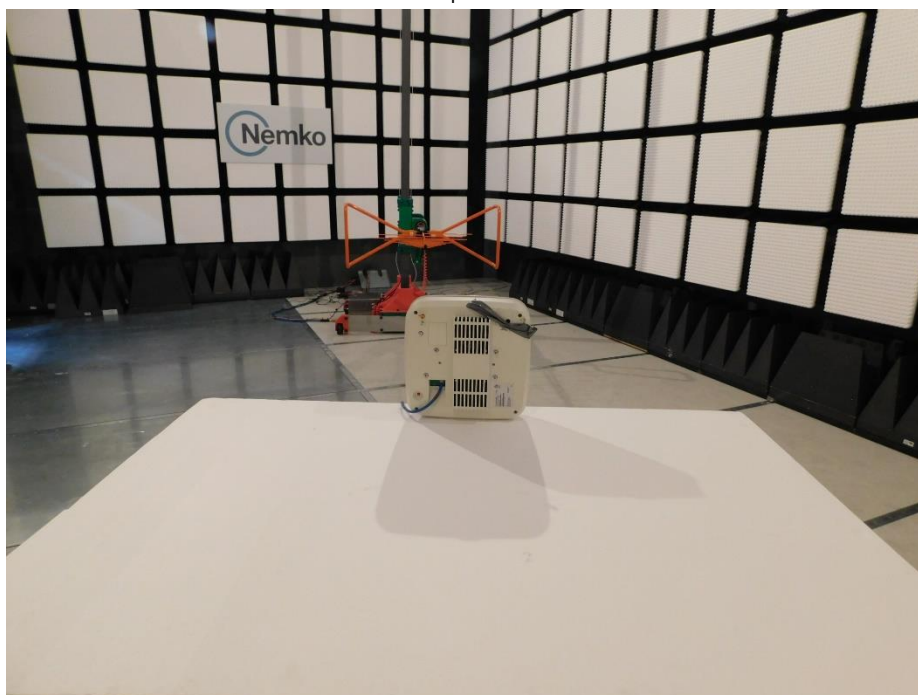
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### 9.1 Set-up

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*Figure 9.1-1: Radiated setup photo*



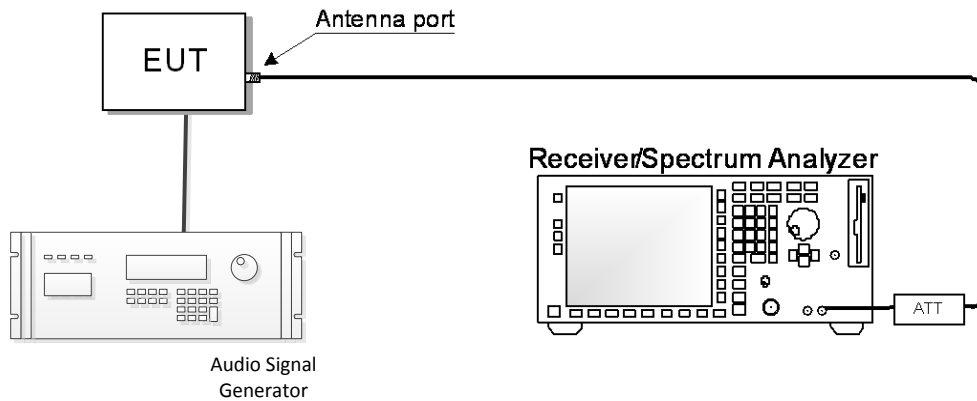
**Figure 9.1-2:** Radiated setup photo - Back

## Section 10. Block diagrams of test set-ups

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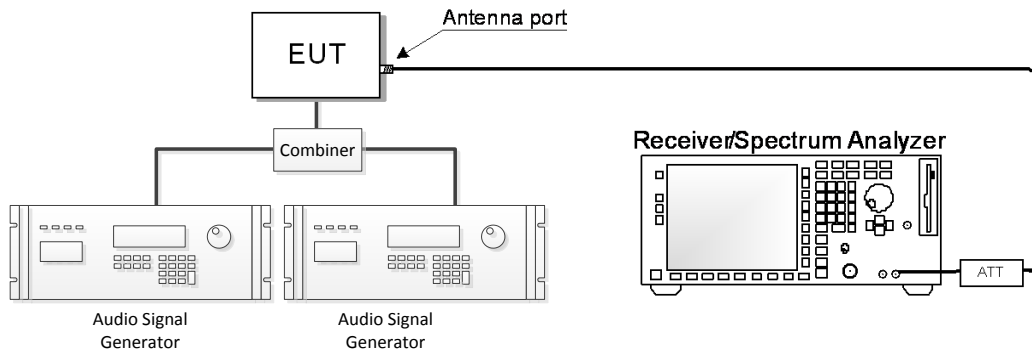
### 10.1 Measuring AGC threshold level, Out-of-band-rejection, Input-versus-output signal comparison, Mean output power and amplifier/booster gain, Spurious emissions conducted measurements

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### 10.2 Out-of-band/out-of-block emissions conducted measurements

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### 10.3 Spurious emissions radiated measurements

