



|                             |               |
|-----------------------------|---------------|
| <b>Report Reference ID:</b> | 372462-3TRFWL |
|-----------------------------|---------------|

|                            |   |
|----------------------------|---|
| <b>Test specification:</b> | Title 47 – Telecommunication<br>Chapter I – Federal Communications Commission<br>Part 90 – Private land mobile radio services<br><br>RSS-131 Issue 3<br>Zone Enhancers<br><br>RSS-140 Issue 1<br><br>Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz |
|----------------------------|---|

|                                |  |
|--------------------------------|--|
| <b>Applicant:</b>              | <b>Andrew Wireless Systems</b><br>Industriering, 10 – 86675 Buchdorf – Germany |
| <b>Apparatus:</b>              | Carrier Access Point   |
| <b>Model:</b>                  | CAP M 4/70/80 F-AC;<br>CAP M 4/70/80 F-DC                                      |
| <b>FCC ID:</b>                 | XS5-CAPM47080  |
| <b>IC Registration Number:</b> | 2237E-CAPM47080  |

|                            |  |
|----------------------------|--|
| <b>Testing laboratory:</b> | <b>Nemko Spa</b><br>Via del Carroccio, 4 – 20853 Biassono (MB) – Italy |
|----------------------------|--|

|                     | <b>Name, function and signature</b>  | <b>Date</b> |
|---------------------|--|-------------|
| <b>Tested by:</b>   | Tessa S.  (project handler) | 2019-09-06  |
| <b>Reviewed by:</b> | Barbieri P.  (verifier)     | 2019-09-06  |

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## Section 1: Report summary

### 1.1 Test specification

|                       |  |
|-----------------------|--|
| <b>Specifications</b> | FCC Part 90 – Private land mobile radio services   |
|                       | RSS-131 Issue 3 – Zone Enhancers   |
|                       | RSS-140 Issue 1 – Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz |

### 1.2 Statement of compliance

|  |   |
|--|---|
| <b>Compliance</b>  | In the configuration tested the EUT was found compliant             |
|  | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |
| This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Spa. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, RSS-131 Issue 3 and RSS-140 Issue 1. The tests were conducted in accordance with ANSI C63.26-2015 and KDB 935210 D05 Indus Booster Basic Meas v01r03. |   |

### 1.3 Exclusions

|                   |      |
|-------------------|------|
| <b>Exclusions</b> | None |
|-------------------|------|

### 1.4 Registration number

|                   |   |
|-------------------|---|
| <b>Test site:</b> | FCC ID number 682159 (10 m Semi anechoic chamber) |
|-------------------|---|

### 1.5 Test report revision history

| Revision # | Details of changes made to test report |
|------------|--|
| 1          | Original report issued                 |

### 1.6 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. Nemko Spa authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Spa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

## Section 2: Summary of test results

### 2.1 FCC Part 90, test results

| Part                                      | Methods                          | Test description  | Verdict |
|---|----------------------------------|---|---------|
| --  | 935210 D05v01r03<br>Clause 4.2   | AGC threshold   | Pass    |
| --  | 935210 D05v01r03<br>Clause 4.3   | Out of band rejection                                     | Pass    |
| 90.219(e)(4)                              | 935210 D05v01r03<br>Clause 4.4   | Input-versus-output signal comparison                     | Pass    |
| 90.635(a)<br>90.219(e)(1)                 | 935210 D05v01r03<br>Clause 4.5   | Input/output power and amplifier/booster gain             | Pass    |
| 90.219(e)(2)                              | 935210 D05v01r03<br>Clause 4.6   | Noise Figure  | Pass    |
| 90.543(e)(3)<br>90.219(e)(3)              | 935210 D05v01r03<br>Clause 4.7.2 | Out-of-band/out-of-block emissions conducted measurements | Pass    |
| 90.543(e)(3)<br>90.543(e)(1)<br>90.543(f) | 935210 D05v01r03<br>Clause 4.7.3 | EUT spurious emissions conducted measurements             | Pass    |
| 90.539(d)                                 | 935210 D05v01r03<br>Clause 4.8   | Frequency stability measurements                          | Pass    |
| 90.543(e)(3)                              | 935210 D05v01r03<br>Clause 4.9   | Spurious emissions radiated measurements                  | Pass    |

Notes:

### 2.1 RSS-131 and RSS-140, test results

| Part   | Methods                          | Test description  | Verdict |
|--|----------------------------------|---|---------|
| --   | 935210 D05v01r03<br>Clause 4.2   | AGC threshold   | Pass    |
| RSS-131 § 5.2.1  | 935210 D05v01r03<br>Clause 4.3   | Out of band rejection                                     | Pass    |
| RSS-131 § 5.2.2  | 935210 D05v01r03<br>Clause 4.4   | Input-versus-output signal comparison                     | Pass    |
| RSS-131 § 5.2.3<br>RSS-140 § 4.3                           | 935210 D05v01r03<br>Clause 4.5   | Input/output power and amplifier/booster gain             | Pass    |
| --   | 935210 D05v01r03<br>Clause 4.6   | Noise Figure  | Pass    |
| RSS-131 § 5.2<br>RSS-140 § 4.4 (b)                         | 935210 D05v01r03<br>Clause 4.7.2 | Out-of-band/out-of-block emissions conducted measurements | Pass    |
| RSS-131 § 5.2<br>RSS-140 § 4.4 (b)<br>RSS-140 § 4.4 (a)(i) | 935210 D05v01r03<br>Clause 4.7.3 | EUT spurious emissions conducted measurements             | Pass    |
| RSS-119 § 5.2.4<br>RSS-140 § 4.2                           | 935210 D05v01r03<br>Clause 4.8   | Frequency stability measurements                          | Pass    |
| RSS-131 § 5.2<br>RSS-140 § 4.4 (b)                         | 935210 D05v01r03<br>Clause 4.9   | Spurious emissions radiated measurements                  | Pass    |

Notes:

## Section 3: Equipment under test (EUT) and application details

### 3.1 Applicant details

|                                |                                    |                         |
|--------------------------------|------------------------------------|-------------------------|
| <b>Applicant</b>               | Name:                              | Andrew Wireless Systems |
|                                | Address:                           | Industriering, 10       |
|                                | City:                              | Buchdorf                |
|                                | Province/State:                    | --                      |
|                                | Post code:                         | 86675                   |
|                                | Country:                           | Germany                 |
|                                | Federal Registration Number (FRN): | --                      |
|                                | Grantee code                       | --                      |
|                                | IC company number:                 | --                      |
|                                |                                    |                         |
| <b>Manufacturer</b>            | Name:                              | Andrew Wireless Systems |
|                                | Address:                           | Industriering, 10       |
|                                | City:                              | Buchdorf                |
|                                | Province/State:                    | --                      |
|                                | Post code:                         | 86675                   |
|                                | Country:                           | Germany                 |
| <b>Canadian representative</b> | Name:                              | Andrew Wireless Systems |
|                                | Address:                           | Industriering, 10       |
|                                | City:                              | Buchdorf                |
|                                | Province/State:                    | --                      |
|                                | Post code:                         | 86675                   |
|                                | Country:                           | Germany                 |

### 3.2 Modular equipment

|   |  |  |
|---|--|--|
| <b>a) Single modular approval</b>         | Single modular approval<br>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>         |  |
| <b>b) Limited single modular approval</b> | Limited single modular approval<br>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> |  |

### 3.3 Product details

|   |   |   |
|---|---|---|
| <b>FCC ID</b>                                   | Grantee code:   | X55                                       |
|   | Product code:   | -CAPM47080                                |
| <b>IC ID</b>                                    | Proposed certification number:  |   |
|   | 2237E-CAPM47080   |   |
| <b>Equipment class</b>                          | B9B   |   |
| <b>Description of product as it is marketed</b> | Carrier Access Point  |   |
|   | Model name:   | CAP M 4/70/80 F-AC;<br>CAP M 4/70/80 F-DC |
|   | Serial number:  | TEST 5                                    |
| <b>Product</b>                                  | The EUT is also classified as Terminal Equipment subject to IC CS-03<br>No <input checked="" type="checkbox"/> Yes <input type="checkbox"/><br>Network interface type:<br>Ringer equivalence number:<br>Single line equipment: No <input type="checkbox"/> Yes <input type="checkbox"/><br>Terminal equipment category: |   |

### 3.4 Application purpose

|                     |   |
|---------------------|---|
| Type of application | <input checked="" type="checkbox"/> Original certification<br><input type="checkbox"/> Change in identification of presently authorized equipment<br><input type="checkbox"/> Original FCC ID: Grant date:<br><input type="checkbox"/> Class II permissive change or modification of presently authorized equipment |
|---------------------|---|

### 3.5 Certification details

|                    |   |
|--------------------|---|
| Services requested | <input checked="" type="checkbox"/> New certification<br><input type="checkbox"/> New family<br><input type="checkbox"/> Re-assessment<br><input type="checkbox"/> Existing family<br><input type="checkbox"/> Multiple listing |
|--------------------|---|

### 3.6 Composite/related equipment

|                        |  |
|------------------------|--|
| a) Composite equipment | The EUT is a composite device subject to an additional equipment authorization<br>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>  |
| b) Related equipment   | The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization<br>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>  |
| c) Related FCC ID      | If either of the above is "yes":<br><input type="checkbox"/> has been granted under the FCC ID(s) listed below:<br><input type="checkbox"/> is in the process of being filled under the FCC ID(s) listed below:<br><input type="checkbox"/> is pending with the FCC ID(s) listed below:<br><input type="checkbox"/> has a mix of pending and granted statuses under the FCC ID(s) listed below:<br>i FCC ID:<br>ii FCC ID: |

### 3.7 Sample information

|                  |            |
|------------------|------------|
| Receipt date:    | 2019-06-06 |
| Nemko sample ID: | 372462-1/2 |

### 3.8 EUT technical specifications

|                      |  |
|----------------------|--|
| Operating band:      | 758 – 768 MHz  |
| Operating frequency: | Wideband   |
| Modulation type:     | G7D  |
| Occupied bandwidth:  | 12.5 kHz   |
| Channel spacing:     | Standard   |
| Emission designator: | G7D  |
| RF Output            | Down Link: 31 dBm (1.26 W)<br>Up Link: The EUT does not transmit over the air in the up-link direction |
| Gain                 | Down Link: 31 dB<br>Up Link: The EUT does not transmit over the air in the up-link direction           |
| Antenna type:        | equipment with a 50 Ω RF connector (antenna not provided)  |
| Power source:        | 100-240 Vac  |

### 3.9 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

#### Item # 1

|                        |             |
|------------------------|-------------|
| Type of equipment:     | Rack        |
| Brand name:            | CommScope   |
| Model name or number:  | 7642110-01  |
| Serial number:         | 21319110463 |
| Connection port:       | --          |
| Cable length and type: | --          |

#### Item # 2

|                        |                    |
|------------------------|--------------------|
| Type of equipment:     | SUI Card           |
| Brand name:            | CommScope          |
| Model name or number:  | 7642125-00         |
| Serial number:         | SZBEAC1839A0009    |
| Connection port:       | LAN port           |
| Cable length and type: | 2 m standard cable |

#### Item # 3

|                        |                    |
|------------------------|--------------------|
| Type of equipment:     | OPT Card           |
| Brand name:            | CommScope          |
| Model name or number:  | 7642123-00         |
| Serial number:         | SZBEAD1737A0070    |
| Connection port:       | Optical port       |
| Cable length and type: | 10 m optical fiber |

#### Item # 4

|                        |                                     |
|------------------------|-------------------------------------|
| Type of equipment:     | 2 x RFD Card                        |
| Brand name:            | CommScope                           |
| Model name or number:  | 7633229-02                          |
| Serial number:         | SZBEAP1919A0036 and SZBEAP1919A0023 |
| Connection port:       | RF port with QMA connector          |
| Cable length and type: | 1 m Coaxial cable                   |

#### Item # 5

|                        |                            |
|------------------------|----------------------------|
| Type of equipment:     | Power supply unit          |
| Brand name:            | CommScope                  |
| Model name or number:  | 7693531-00 with 7663610-00 |
| Serial number:         | PSU_1_0 + PSU12V_1_0       |
| Connection port:       | AC mains                   |
| Cable length and type: | 1.5 m standard cable       |

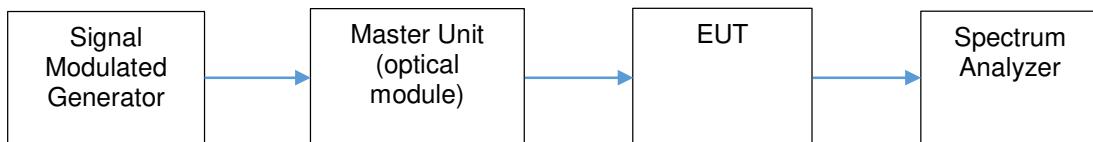
### 3.10 Operation of the EUT during testing

|                 |  |
|-----------------|--|
| <b>Details:</b> | In down-link direction, normal working at max gain with max RF power output. |
|-----------------|--|

### 3.11 EUT setup diagram

In this system, Remote Unit is the EUT. Master Unit includes only management module and optical module (to convert RF signal in optical signal in down link direction and vice versa optical signal in RF signal in up link direction). As described in “Operational description”, master unit is connected directly to base station, so the system doesn’t use another equipment to exercise the EUT. Signal generator is linked directly to the RF connector of the RFD card in the Master Unit.

#### Test setup:



#### Procedure

Connect the signal modulated generator to the input of the EUT, so that the EUT works at the max gain. Raise the input level to the EUT until reach the maximum output power. Connect the spectrum analyzer to the RF output connector of the EUT.

### 3.12 Software version

|                 |  |
|-----------------|--|
| <b>Details:</b> | <b>ERA and ION-E Software V 2.7</b> (SW is preloaded into ERA systems and to setup the system it's required a connection through LAN and access to html setup page). |
|-----------------|--|

## Section 4: Engineering considerations

### 4.1 Modifications incorporated in the EUT

|                      |   |
|----------------------|---|
| <b>Modifications</b> | Modifications performed to the EUT during this assessment<br>None <input checked="" type="checkbox"/> Yes <input type="checkbox"/> , performed by Client <input type="checkbox"/> or Nemko <input type="checkbox"/><br>Details: |
|----------------------|---|

### 4.2 Deviations from laboratory tests procedures

|                   |   |
|-------------------|---|
| <b>Deviations</b> | Deviations from laboratory test procedures<br>None <input checked="" type="checkbox"/> Yes <input type="checkbox"/> - details are listed below: |
|-------------------|---|

### 4.3 Technical judgment

|                 |      |
|-----------------|------|
| <b>Judgment</b> | None |
|-----------------|------|

## Section 5: Test conditions

### 5.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

### 5.2 Test conditions, power source and ambient temperatures

|   |  |
|---|--|
| Normal temperature, humidity and air pressure test conditions | <p>Unless different values are declared in the test case, following ambient conditions apply for the tests:</p> <p>Temperature: 18 ÷ 33 °C<br/>Relative humidity: 30 ÷ 60 %<br/>Air pressure: 980 ÷ 1060 hPa</p> <p>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.</p> |
| Power supply range:   | 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.   |

### 5.3 Equipment used for the monitoring of the environmental conditions

| Equipment                     | Manufacturer | Model   | Serial N°    |
|-------------------------------|--------------|---------|--------------|
| Thermohygrometer data loggers | Testo        | 175-H2  | 20012380/305 |
| Thermohygrometer data loggers | Testo        | 175-H2  | 38203337/703 |
| Barometer                     | MSR          | MSR145B | 330080       |

## 5.4 Measurement uncertainty

| EUT         | Type      | Test  | Range and Setup features | Measurement Uncertainty | Notes |
|-------------|-----------|---|--------------------------|-------------------------|-------|
| Transmitter | Conducted | Frequency error   | 0.001 MHz ÷ 40 GHz       | 0.08 ppm                | (1)   |
|             |           |   | 10 kHz ÷ 30 MHz          | 1.0 dB                  | (1)   |
|             |           | Carrier power<br>RF Output Power  | 30 MHz ÷ 18 GHz          | 1.5 dB                  | (1)   |
|             |           |   | 18 MHz ÷ 40 GHz          | 3.0 dB                  | (1)   |
|             |           | Adjacent channel power  | 1 MHz ÷ 18 GHz           | 1.6 dB                  | (1)   |
|             |           | Conducted spurious emissions  | 10 kHz ÷ 26 GHz          | 3.0 dB                  | (1)   |
|             |           |   | 26 GHz ÷ 40 GHz          | 4.5 dB                  | (1)   |
|             |           | Intermodulation attenuation   | 1 MHz ÷ 18 GHz           | 2.2 dB                  | (1)   |
|             |           | Attack time – frequency behaviour   | 1 MHz ÷ 18 GHz           | 2.0 ms                  | (1)   |
|             |           | Attack time – power behaviour   | 1 MHz ÷ 18 GHz           | 2.5 ms                  | (1)   |
|             |           | Release time – frequency behaviour  | 1 MHz ÷ 18 GHz           | 2.0 ms                  | (1)   |
|             |           | Release time – power behaviour  | 1 MHz ÷ 18 GHz           | 2.5 ms                  | (1)   |
|             |           | Transient behaviour of the transmitter – Transient frequency behaviour                  | 1 MHz ÷ 18 GHz           | 0.2 kHz                 | (1)   |
|             |           | Transient behaviour of the transmitter – Power level slope                              | 1 MHz ÷ 18 GHz           | 9%                      | (1)   |
|             |           | Frequency deviation - Maximum permissible frequency deviation                           | 0.001 MHz ÷ 18 GHz       | 1.3%                    | (1)   |
|             | Radiated  | Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz | 0.001 MHz ÷ 18 GHz       | 0.5 dB                  | (1)   |
|             |           | Dwell time  | -                        | 3%                      | (1)   |
|             |           | Hopping Frequency Separation  | 0.01 MHz ÷ 18 GHz        | 1%                      | (1)   |
|             |           | Occupied Channel Bandwidth  | 0.01 MHz ÷ 18 GHz        | 2%                      | (1)   |
|             |           | Modulation Bandwidth  | 0.01 MHz ÷ 18 GHz        | 2%                      | (1)   |
| Receiver    | Radiated  | Radiated spurious emissions   | 10 kHz ÷ 26.5 GHz        | 6.0 dB                  | (1)   |
|             |           |   | 26.5 GHz ÷ 40 GHz        | 8.0 dB                  | (1)   |
|             |           | Effective radiated power transmitter  | 10 kHz ÷ 26.5 GHz        | 6.0 dB                  | (1)   |
|             |           |   | 26.5 GHz ÷ 40 GHz        | 8.0 dB                  | (1)   |
|             | Conducted | Radiated spurious emissions   | 10 kHz ÷ 26.5 GHz        | 6.0 dB                  | (1)   |
|             |           |   | 26.5 GHz ÷ 40 GHz        | 8.0 dB                  | (1)   |
|             |           | Sensitivity measurement   | 1 MHz ÷ 18 GHz           | 6.0 dB                  | (1)   |
|             | Conducted | Conducted spurious emissions  | 10 kHz ÷ 26 GHz          | 3.0 dB                  | (1)   |
|             |           |   | 26 GHz ÷ 40 GHz          | 4.5 dB                  | (1)   |

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$  which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %

## 5.5 Test equipment

| Equipment                    | Manufacturer    | Model                      | Serial N° | Cal Date | Due Date |
|------------------------------|-----------------|----------------------------|-----------|----------|----------|
| Trilog Broadband Antenna     | Schwarzbeck     | VULB 9162                  | 9162-025  | 2018-07  | 2021-07  |
| Bilog antenna (1 ÷ 18 GHz)   | Schwarzbeck     | STLP 9148                  | 9148-123  | 2018-07  | 2021-07  |
| Broadband preamplifier       | Schwarzbeck     | BBV 9718                   | 9718-137  | 2018-08  | 2019-08  |
| EMI receiver (9 kHz ÷ 3 GHz) | Rohde & Schwarz | ESCI                       | 100888    | 2018-09  | 2019-09  |
| EMI receiver (20 Hz ÷ 8 GHz) | Rohde & Schwarz | ESU8                       | 100202    | 2019-01  | 2020-01  |
| EMI receiver (2 Hz ÷ 44 GHz) | Rohde & Schwarz | ESW44                      | 101620    | 2018-08  | 2019-08  |
| Signal generator             | Rohde & Schwarz | SMBV100A                   | 263397    | 2018-09  | 2019-09  |
| Signal generator             | Rohde & Schwarz | SMBV100A                   | 263254    | 2019-03  | 2020-03  |
| Semi-anechoic chamber        | Nemko           | 10 m semi-anechoic chamber | 530       | 2018-09  | 2021-09  |
| Shielded room                | Siemens         | 10 m control room          | 1947      | NSC      | --       |

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

## Section 6: Test results

### 6.1 AGC threshold

Test performed according to KDB 935210 D05 Indus Booster Basic Meas v01r03 clause 3.2.

In the case of fiber-optic distribution systems, the RF input port of the equipment under test (EUT) refers to the RF input of the supporting equipment RF to optical convertor. Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

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

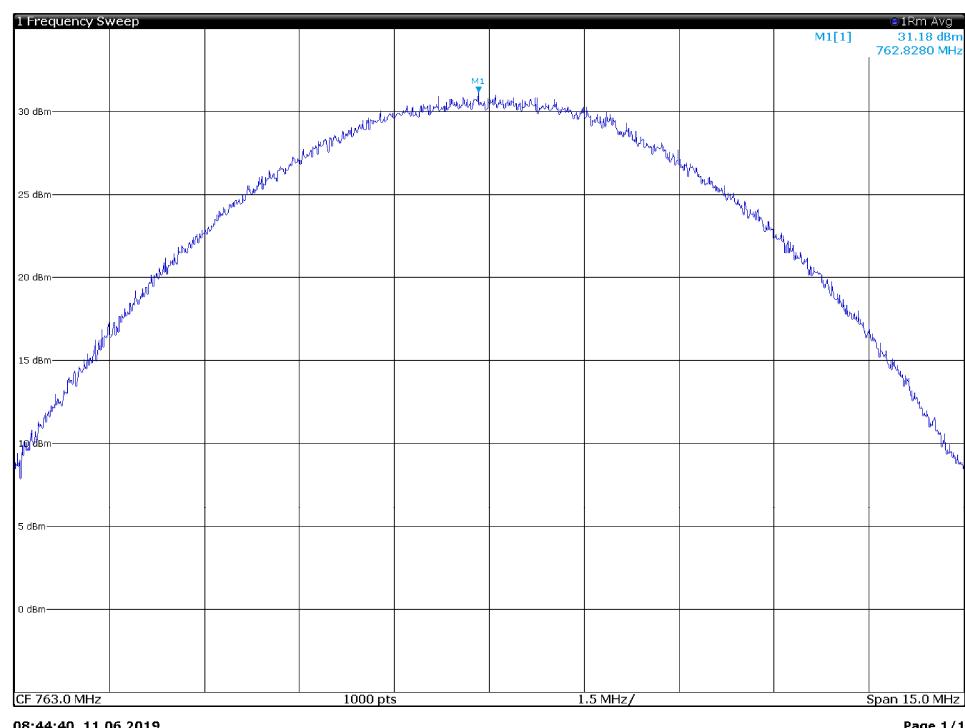
Test date: 2019-06-11

Test results: Pass

Special notes

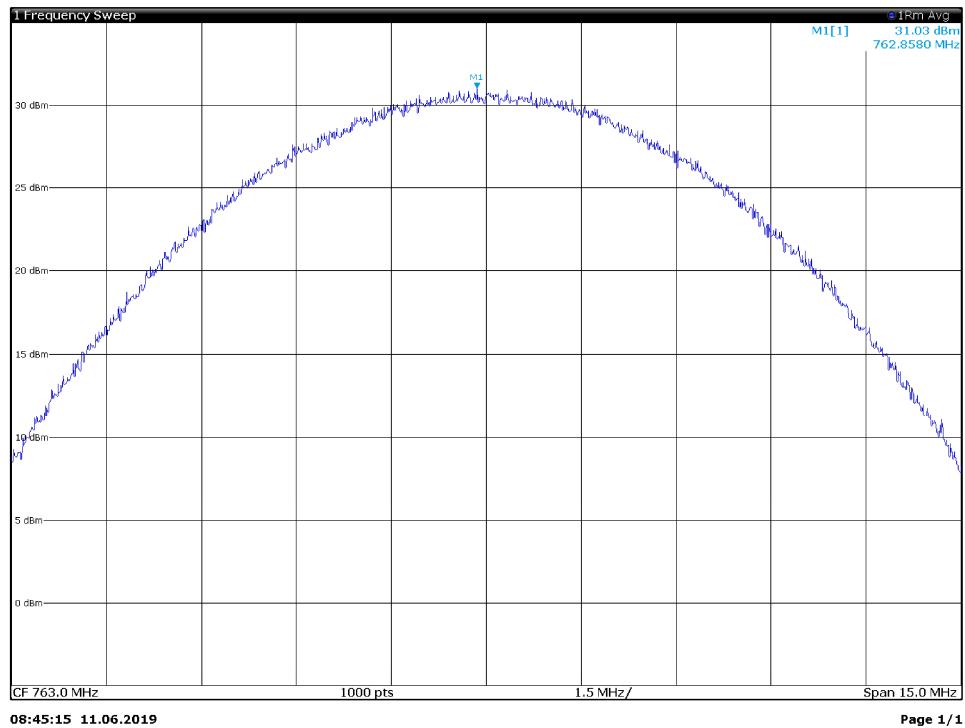
Modulation used: AWGN

Test data



Output spectral plot with input at AGC threshold with AWGN signal at 763 MHz

## Test data



Output spectral plot with input at AGC threshold + 1 dB with AWGN signal at 763 MHz

## 6.2 Out-of-band-rejection

Test performed according to KDB 935210 D05 Indus Booster Basic Meas v01r03 clause 3.3. 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.

### RSS-131 clause 5.2.1

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

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.

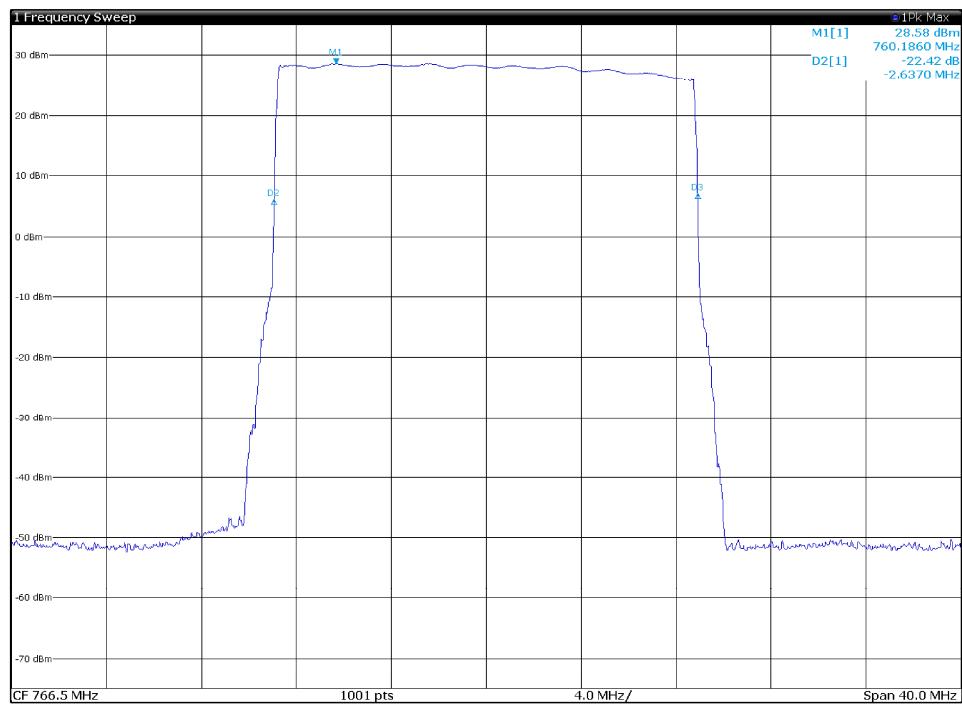
Test date: 2019-06-7

Test results: Pass

Special notes

Modulation used: CW

## Test data



### 2 Marker Table

| Type | Ref | Trc | X-Value            | Y-Value          | Function | Function Result |
|------|-----|-----|--------------------|------------------|----------|-----------------|
| M1   |     | 1   | <b>769.697 MHz</b> | <b>28.20 dBm</b> |          |                 |
| D2   | M1  | 1   | <b>-12.148 MHz</b> | <b>-22.04 dB</b> |          |                 |
| D3   | M1  | 1   | <b>5.714 MHz</b>   | <b>-21.09 dB</b> |          |                 |

## 6.3 Input-versus-output signal comparison

### FCC 90. FCC 90.219(e)(4)

A signal booster must be designed such that all signals that it retransmits meet the following requirements:

- (i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of § 90.213.
- (ii) There is no change in the occupied bandwidth of the retransmitted signals.
- (iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

### RSS-131 clause 5.2.2

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

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

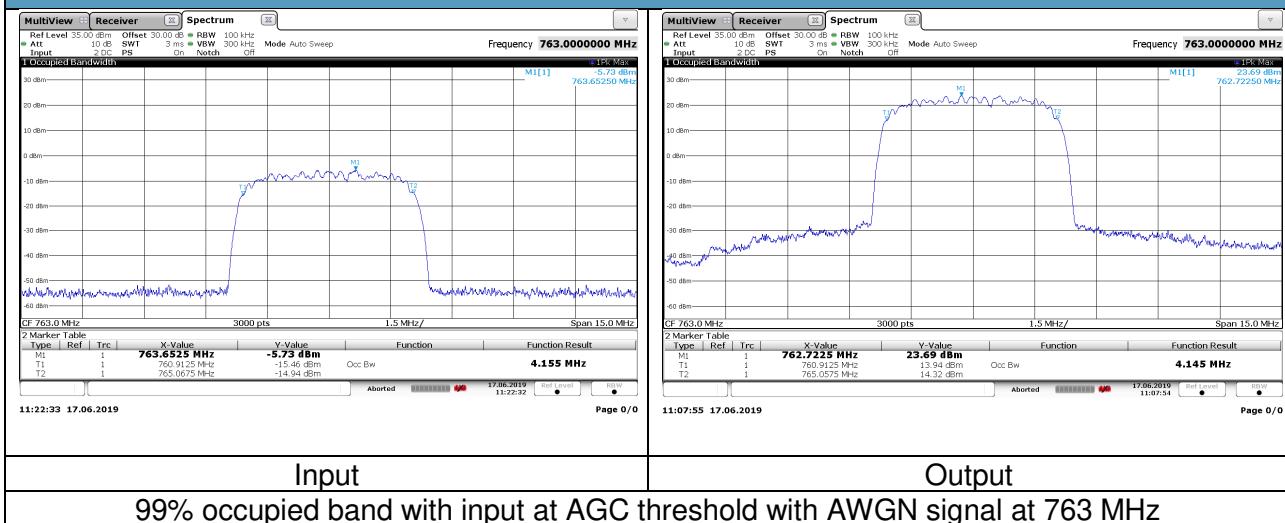
Test date: 2019-06-17

Test results: Pass

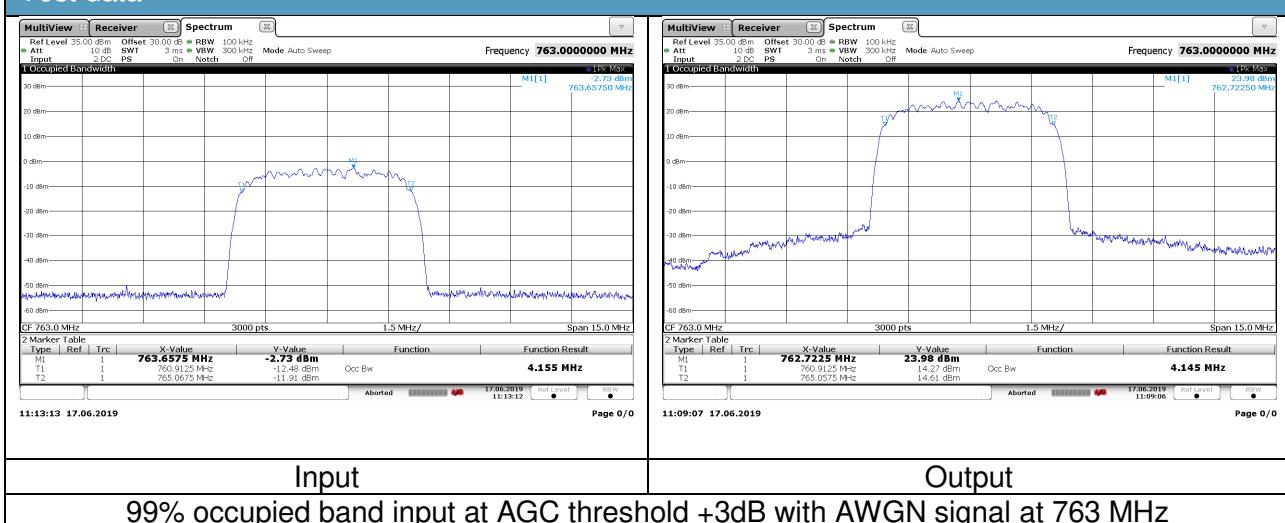
### Special notes

Modulation used: AWGN

## Test data



## Test data



## 6.4 Input/output power and amplifier/booster gain

### FCC 90.635(a)

The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

**Table 2 —Transmitter Output Power**

| Frequency Bands (MHz)                   | Transmitter Output Power (W)               |                                      |
|---|--|--------------------------------------|
|   | Base/Fixed Equipment                       | Mobile Equipment                     |
| 27.41-28 and 29.7-50                    | 300  | 30                                   |
| 72-76                                   | No limit                                   | 1                                    |
| 138-174                                 | 110  | 60                                   |
| 217-218 and 219-220                     | 110  | 30 <small>+</small>                  |
| 220-222                                 | See <a href="#">SRSP-512</a> for ERP limit | 50                                   |
| 406.1-430 and 450-470                   | 110  | 60                                   |
| 768-776 and 798-806                     | See <a href="#">SRSP-511</a> for ERP limit | 30<br>3 W ERP for portable equipment |
| 806-821/851-866 and 821-824/866-869     | 110  | 30                                   |
| 896-901/935-940                         | 110  | 60                                   |
| 929-930/931-932                         | 110  | 30                                   |
| 928-929/952-953 and 932-932.5/941-941.5 | 110  | 30                                   |
| 932.5-935/941.5-944                     | 110  | 30                                   |

### FCC 90.219(e)(1)

The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

### RSS-131 clause 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.

### RSS-140 clause 4.3

The equivalent radiated power (e.r.p.) for control and mobile equipment shall not exceed 30 W. The e.r.p. for portable equipment including handheld devices shall not exceed 3 W. Fixed and base station equipment shall comply with the e.r.p. limits in SRSP-540.

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

Test date: 2019-06-26

Test results: Pass

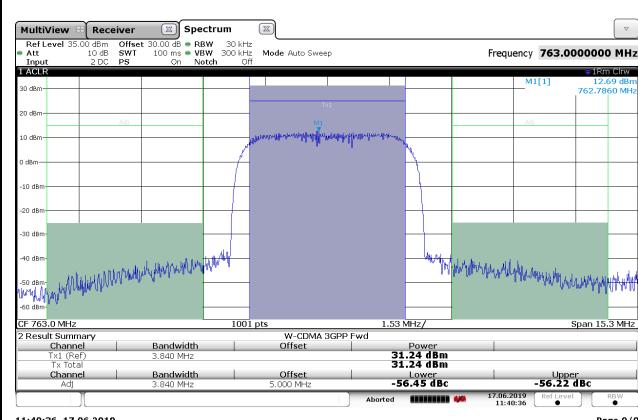
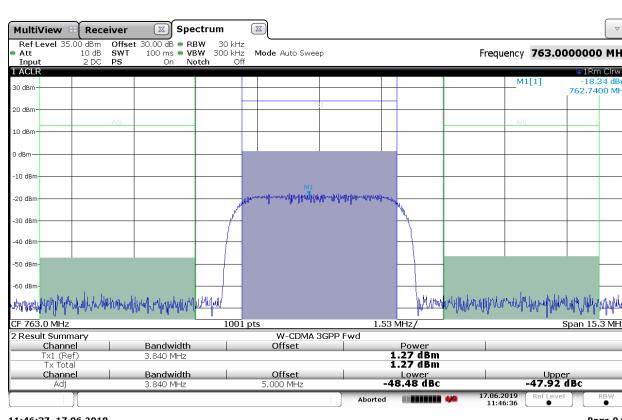
### Special notes

Modulation used: AWGN

### Test data

Gmax antenna gain (dBi) = 39.14 - 31.24 = 7.90 dBi

### Test data



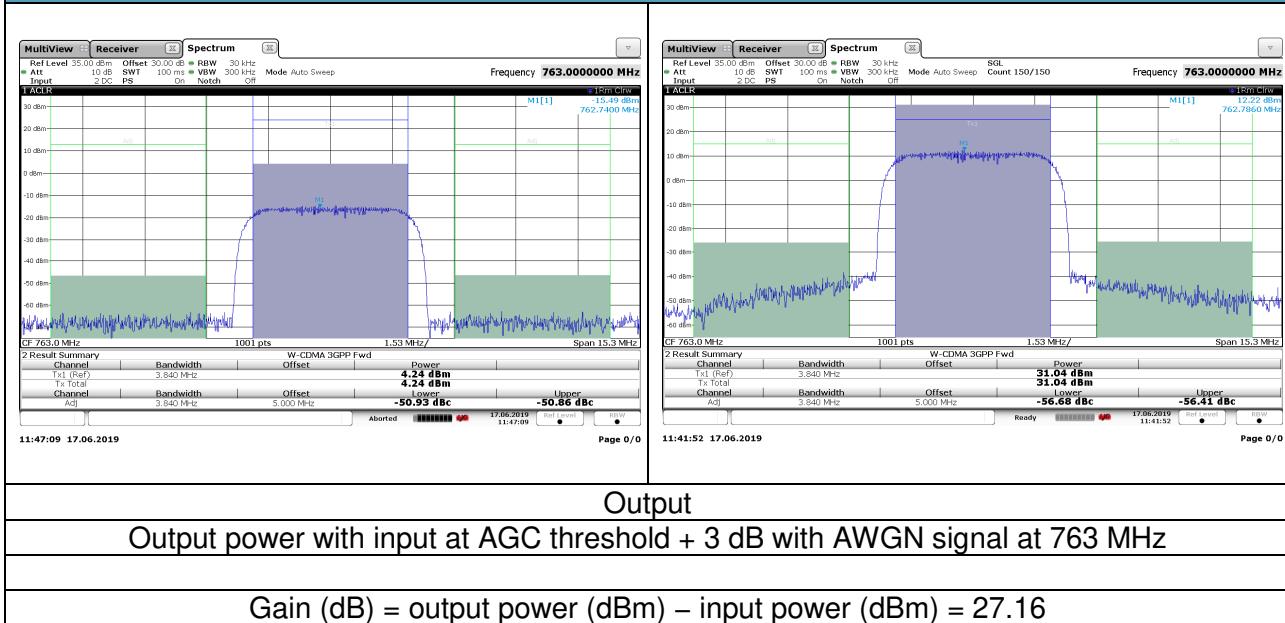
### Input

Output power with input at AGC threshold with AWGN signal at 763 MHz

### Output

Gain (dB) = output power (dBm) – input power (dBm) = 29.97

## Test data



## 6.5 Noise figure measurements

### FCC 90.219(e)(2)

The noise figure of a signal booster must not exceed 9 dB in either direction. As stated in the KDB 935210 D02 Signal Boosters Certification v04r02, for the remote unit of a conventional fiber-connected host/remote DAS booster system, it is acceptable to submit compliance information and test data consistent with Section 90.219(d)(6)(ii) (i.e., ERP of noise  $\leq -43$  dBm in 10 kHz RBW) for the downlink path only, in place of Section 90.219(e)(2) noise figure test data (i.e., NF  $\leq 9$  dB for both UL and DL). Test reports must provide explicit details about the instrumentation and test procedure used for Section 90.219(d)(6)(ii) testing.

Test date: 2019-06-26

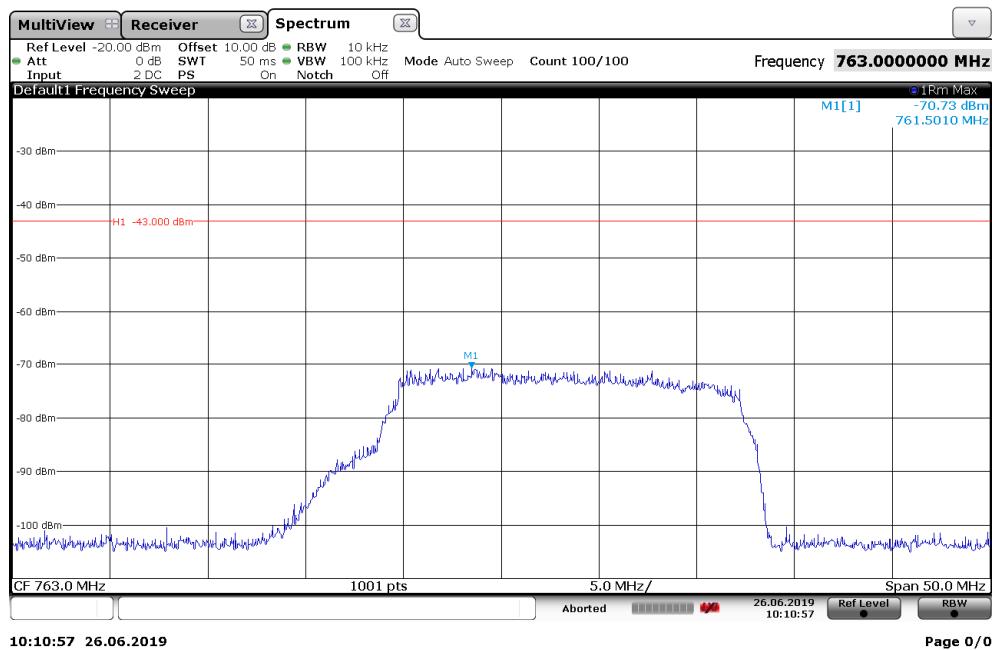
Test results: Pass

### Special notes

Spectrum analyzer settings:

|                      |                     |
|----------------------|---------------------|
| Resolution bandwidth | 10 kHz              |
| Video bandwidth      | $\geq 3 \times$ RBW |
| Frequency span       | 25 MHz              |
| Detector mode        | Rms                 |
| Trace mode           | Max Hold            |

### Test data



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

### **FCC 90.219 (e) (3)**

Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(3) Spurious emissions from a signal booster must not exceed  $-13$  dBm within any 100 kHz measurement bandwidth.

### **FCC 90.543 (e) (3)**

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

### **RSS-131 clause 5.2**

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

### **RSS-140 clause 4.4 (b)**

The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

b) For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz:  $43 + 10 \log (p)$ , dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed  $-70$  dBW/MHz for wideband emissions, and  $-80$  dBW/kHz for discrete emissions of less than 700 Hz bandwidth.

Test date: 2019-06-17

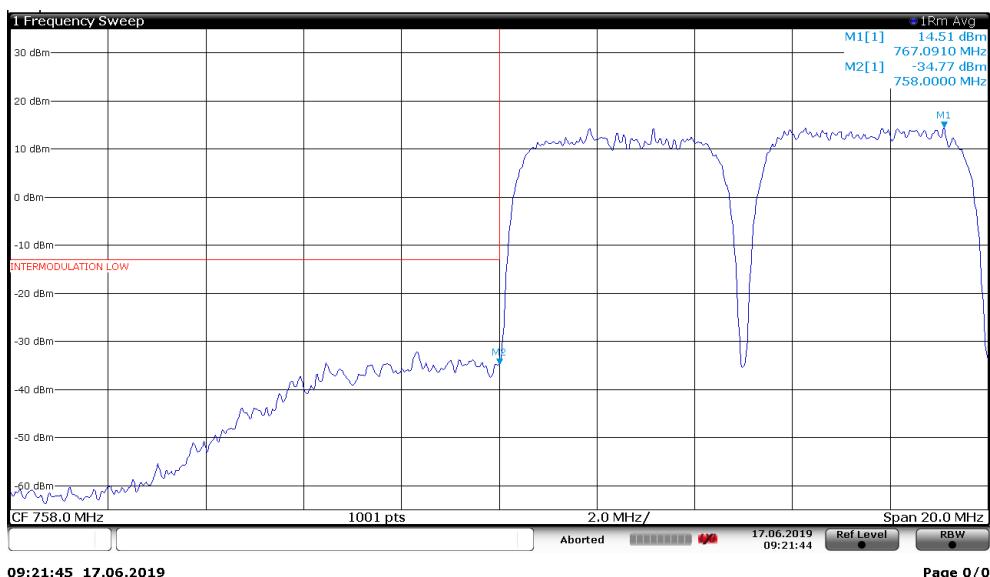
Test results: Pass

### Special notes

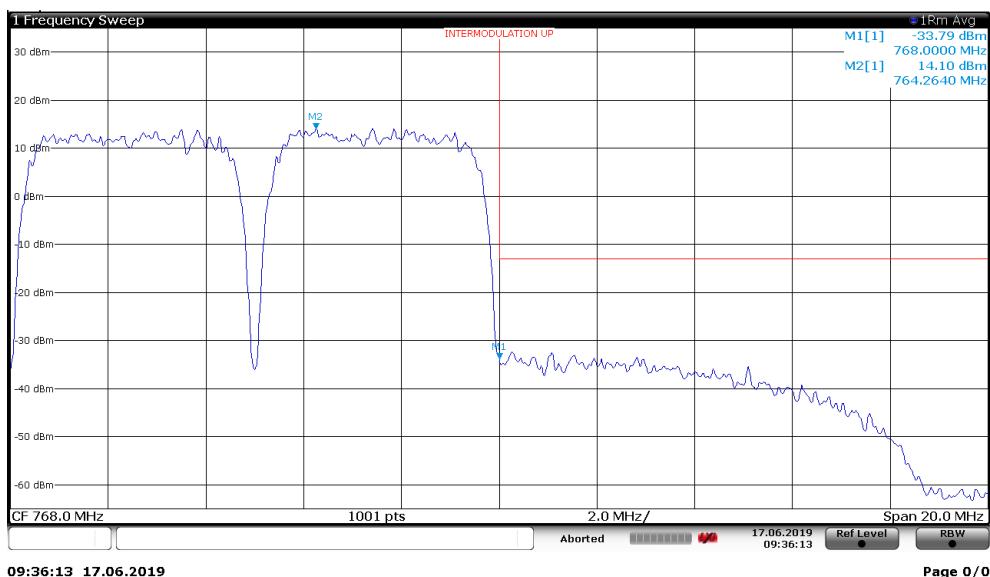
Modulation used: AWGN

Frequencies: 750.5 MHz, 765.5 MHz

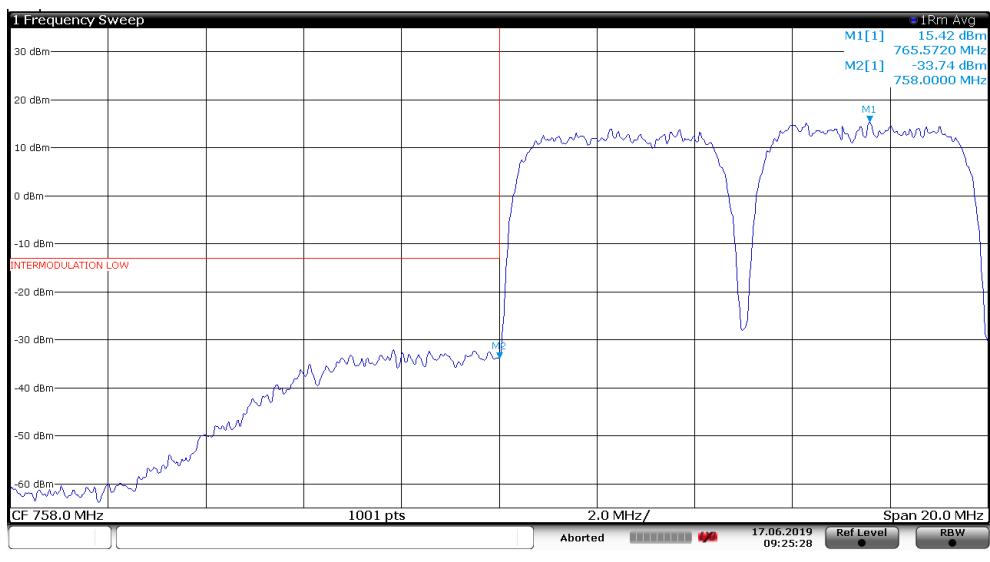
### Test data



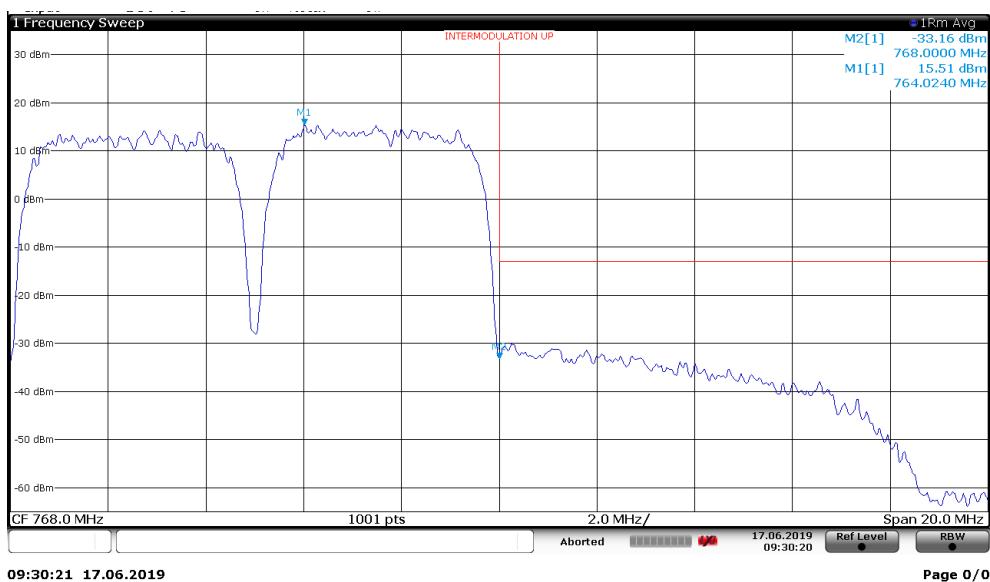
Lower block edge intermodulation with input at AGC threshold with AWGN signal



Upper block edge intermodulation with input at AGC threshold with AWGN signal



Lower block edge intermodulation with input at AGC + 3 dB threshold with AWGN signal



Upper block edge intermodulation with input at AGC threshold + 3 dB with AWGN signal

## 6.7 EUT spurious emissions conducted measurements

### **FCC 90.543 (e) (1)**

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.

### **FCC 90.543 (e) (3)**

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

### **FCC 90.543 (f)**

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

### **RSS-131 clause 5.2**

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

### **RSS-140 clause 4.4 (a)(i)**

The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

- a) For any frequency between 769-775 MHz and 799-806 MHz:
  - (i)  $76 + 10 \log (p)$ , dB in a 6.25 kHz band for fixed and base station equipment

### **RSS-140 clause 4.4 (b)**

The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

- b) For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz:  $43 + 10 \log (p)$ , dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed  $-70$  dBW/MHz for wideband emissions, and  $-80$  dBW/kHz for discrete emissions of less than 700 Hz bandwidth.

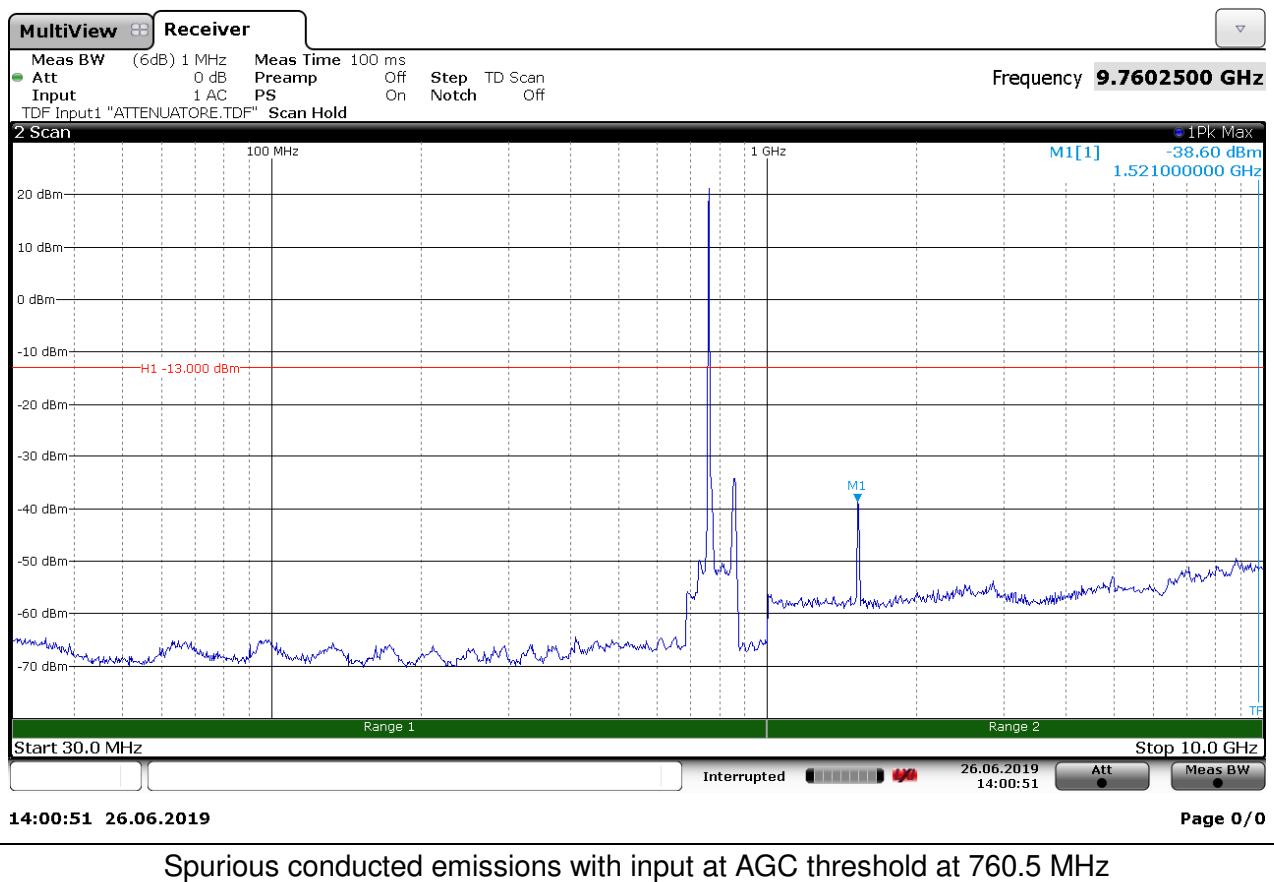
Test date: 2019-06-26 and 2019-09-06

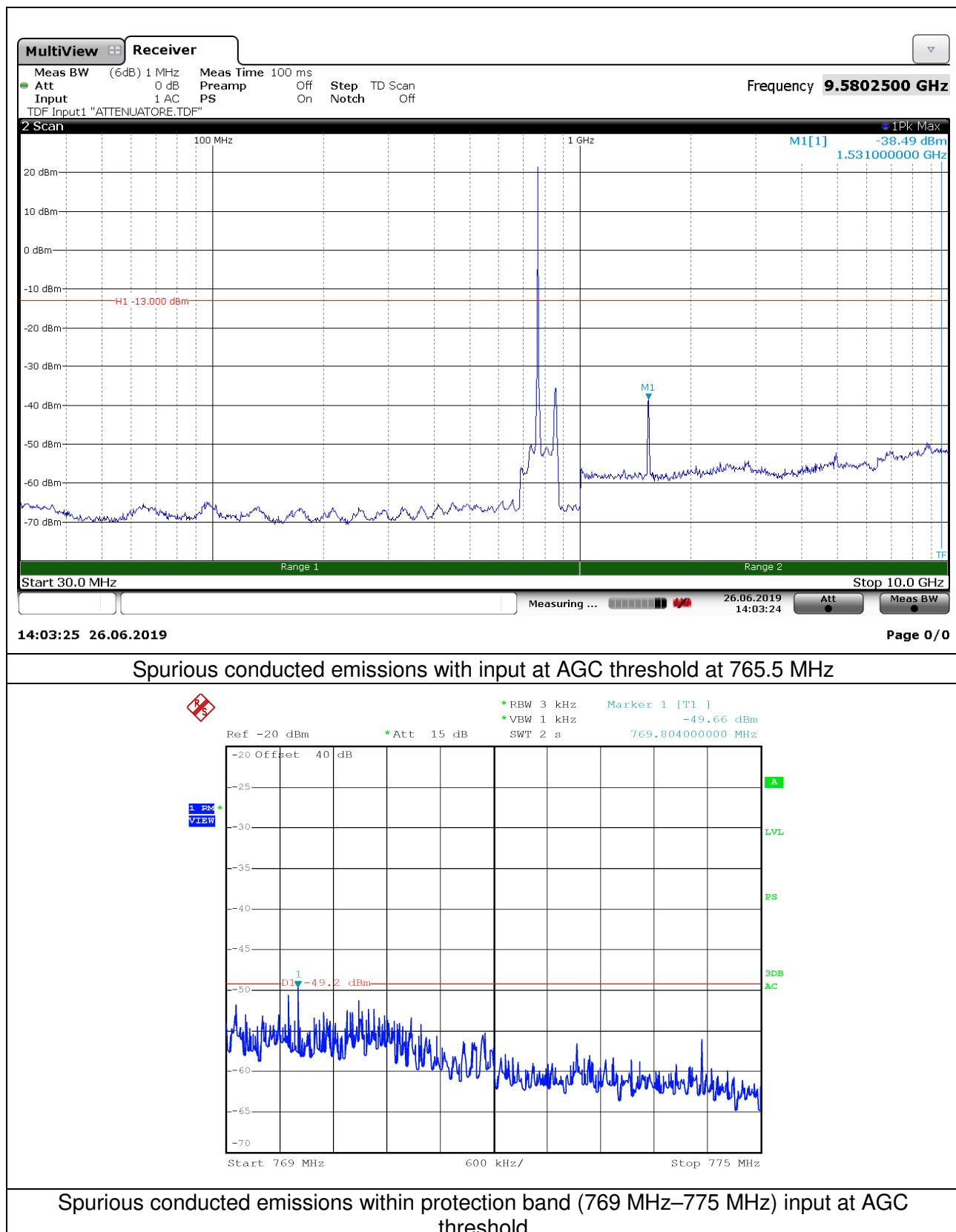
Test results: Pass

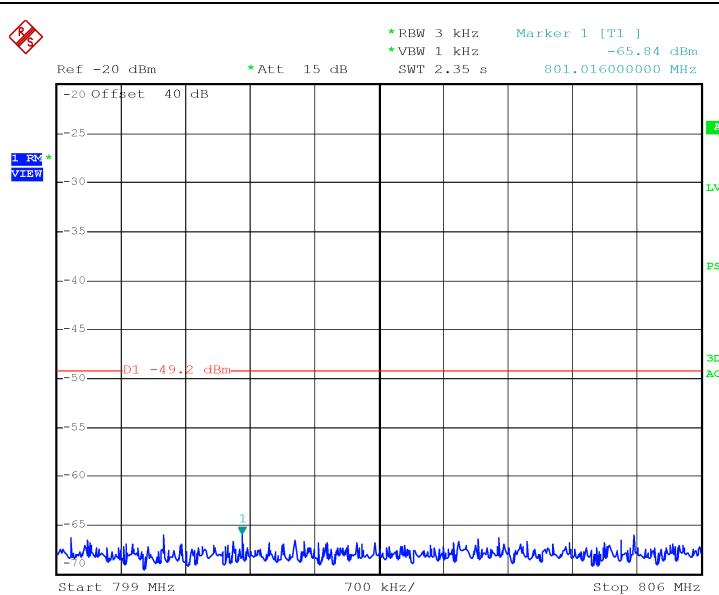
### Special notes

Modulation used: CW

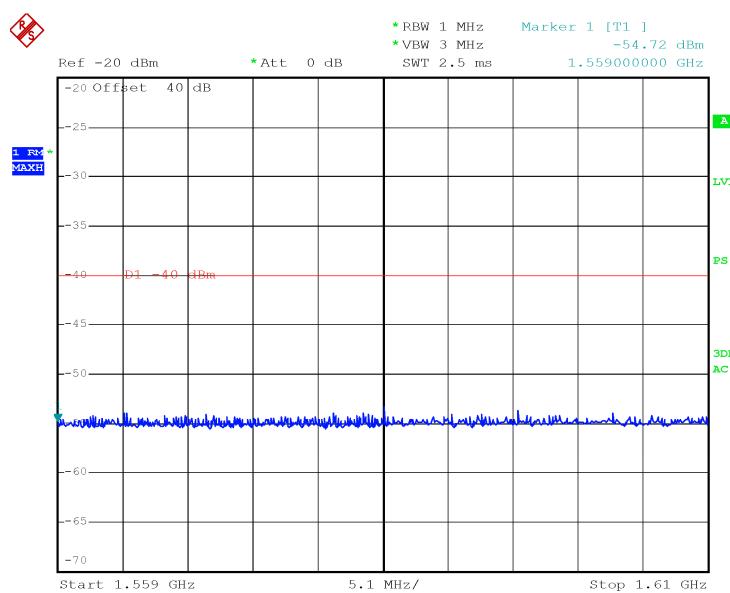
### Test data







Spurious conducted emissions within protection band (799 MHz–806 MHz) input at AGC threshold



Spurious conducted emissions within protection band (1559 MHz–1610 MHz) input at AGC threshold

## 6.8 Frequency stability measurements

### **FCC 90.539(d)**

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the frequency stability requirements in this section.

- d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better

### **RSS-131 clause 5.2.4**

Industrial zone enhancers shall comply with the frequency stability given in the RSS that applies to the equipment with which the zone enhancer is to be used. In cases where the frequency stability limit is not given in the applicable RSS, the equipment shall comply with a frequency stability of  $\pm 1.5$  ppm.

For zone enhancers with no input signal processing capability, the frequency stability measurement in this section is not required.

### **RSS-140 clause 4.2**

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested at the temperature and supply voltage variations specified in RSS-Gen.

|                                      |
|--------------------------------------|
| Test date: 2019-06-18 and 2019-06-19 |
| Test results: Pass                   |

|                      |
|----------------------|
| Special notes        |
| Modulation used: CW. |

| Test data       |                |           |     |
|-----------------|----------------|-----------|-----|
| Test conditions | Frequency, GHz | Drift, Hz | ppm |

| Test conditions | Frequency, GHz | Drift, Hz        | ppm              |
|-----------------|----------------|------------------|------------------|
| +50 °C, Nominal | 762.999.433    | 17               | 0,02             |
| +40 °C, Nominal | 762.999.409    | 41               | 0,05             |
| +30 °C, Nominal | 762.999.374    | 76               | 0,10             |
| +20 °C, +15 %   | 762.999.440    | 10               | 0,01             |
| +20 °C, Nominal | 762.999.450    | <i>Reference</i> | <i>Reference</i> |
| +20 °C, -15 %   | 762.999.457    | -7               | -0,01            |
| +10 °C, Nominal | 762.999.444    | 6                | 0,01             |
| 0 °C, Nominal   | 762.999.433    | 17               | 0,02             |
| -10 °C, Nominal | 762.999.400    | 50               | 0,07             |
| -20 °C, Nominal | 762.999.410    | 40               | 0,05             |
| -30 °C, Nominal | 762.999.390    | 60               | 0,08             |

## 6.9 Spurious emissions radiated measurements

### **FCC 90.543(e)(3)**

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

### **RSS-131 clause 5.2**

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

### **RSS-140 clause 4.4 (b)**

The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:

- a) For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz:  $43 + 10 \log (p)$ , dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

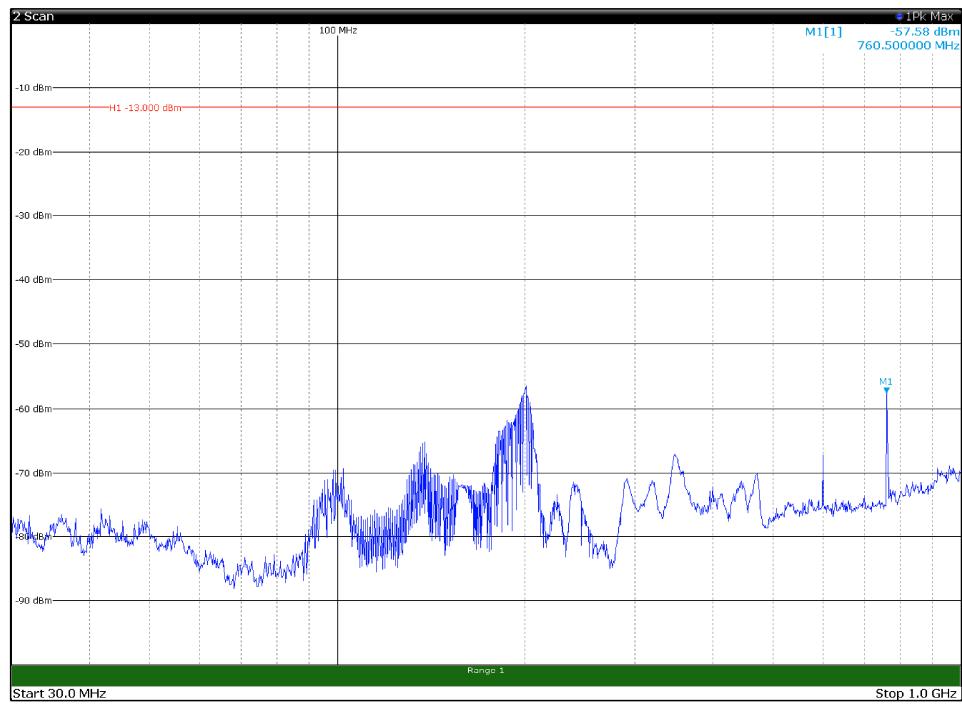
In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed -70 dBW/MHz for wideband emissions, and -80 dBW/kHz for discrete emissions of less than 700 Hz bandwidth.

Test date: 2019-06-10 and 2019-06-11

Test results: Pass

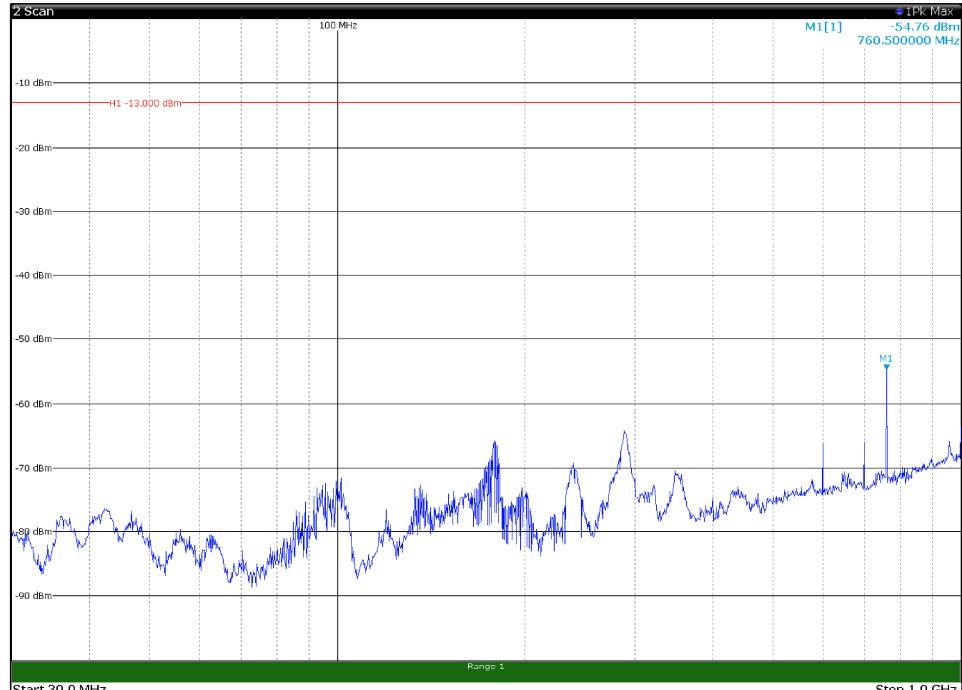
Special notes

Modulation used: AWGN

**Test data**
**Spurious radiated emissions 30 MHz to 1 GHz**
**Spurious radiated emissions with input at AGC threshold with AWGN signal at 760.5 MHz**


11:25:37 11.06.2019

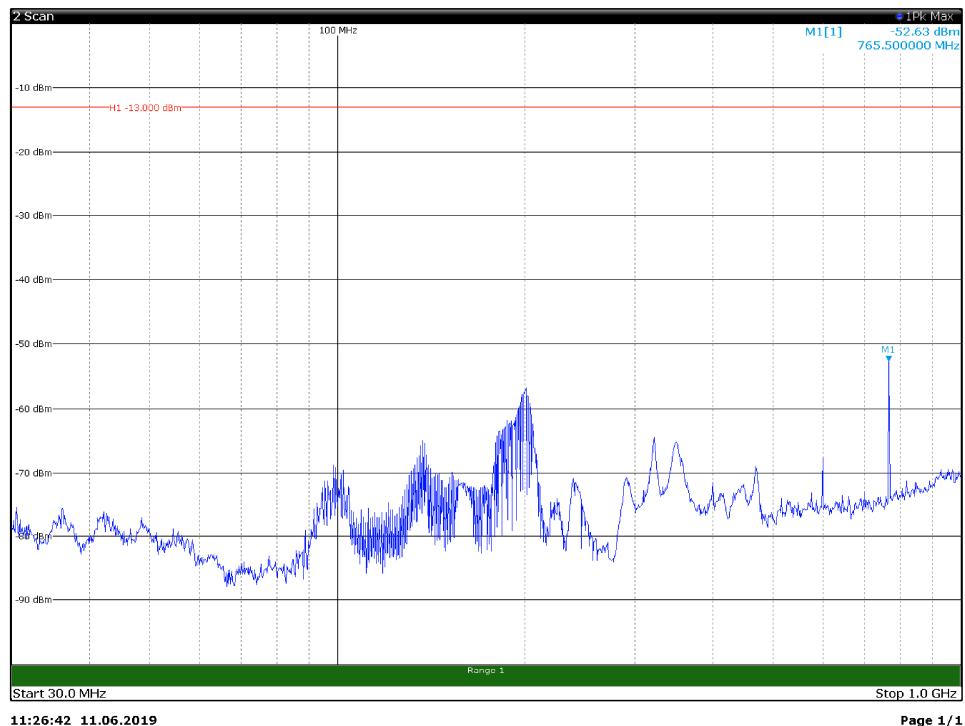
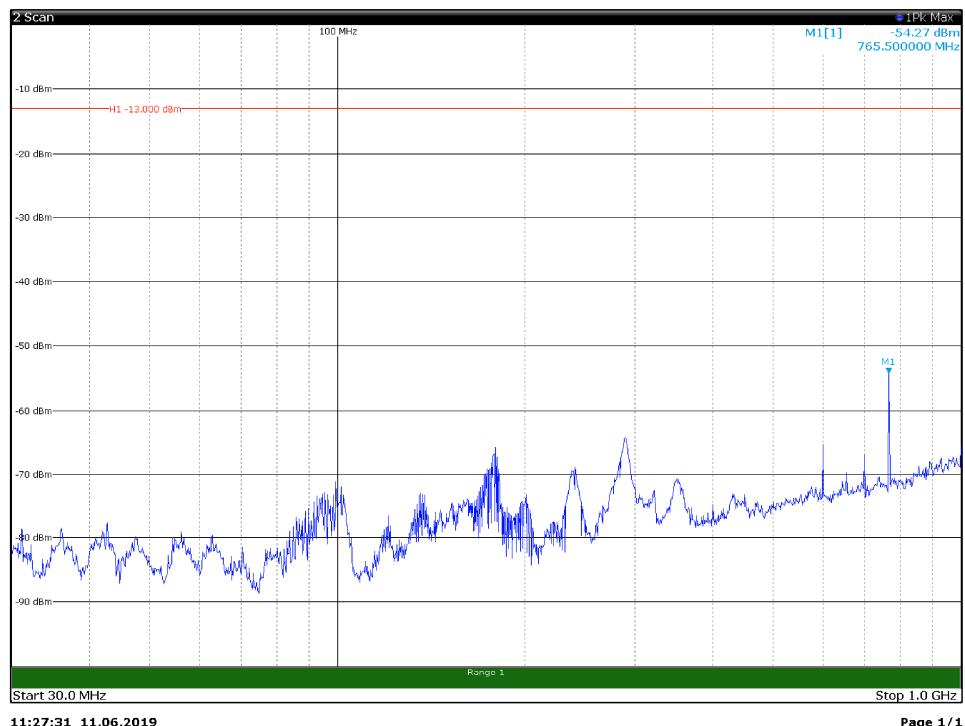
Page 1/1

**Horizontal polarization**


11:27:54 11.06.2019

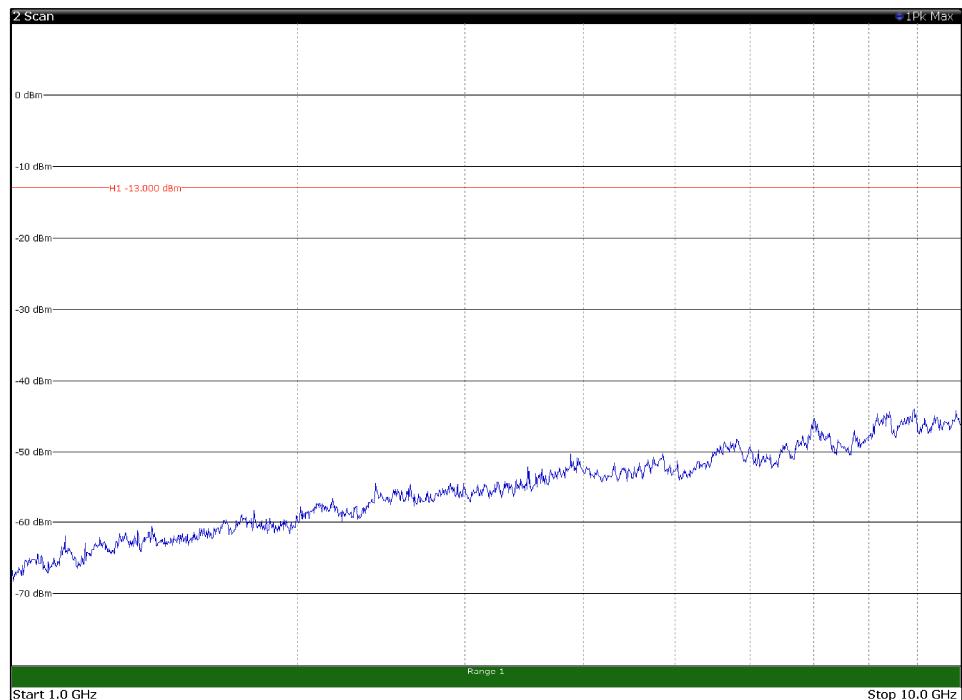
Page 1/1

**Vertical polarization**

**Spurious radiated emissions with input at AGC threshold with AWGN signal at 765.5 MHz**

**Horizontal polarization**

**Vertical polarization**

## Spurious radiated emissions 1 GHz to 10 GHz

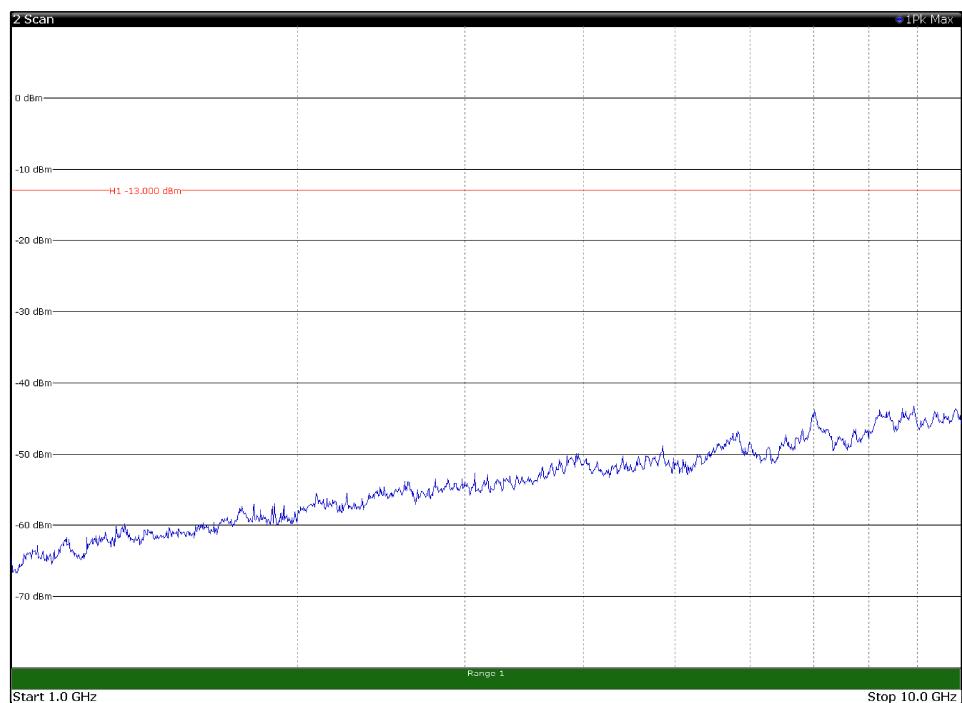
## Spurious radiated emissions with input at AGC threshold with AWGN signal at 760.5 MHz



08:57:25 10.06.2019

Page 1/1

## Horizontal polarization

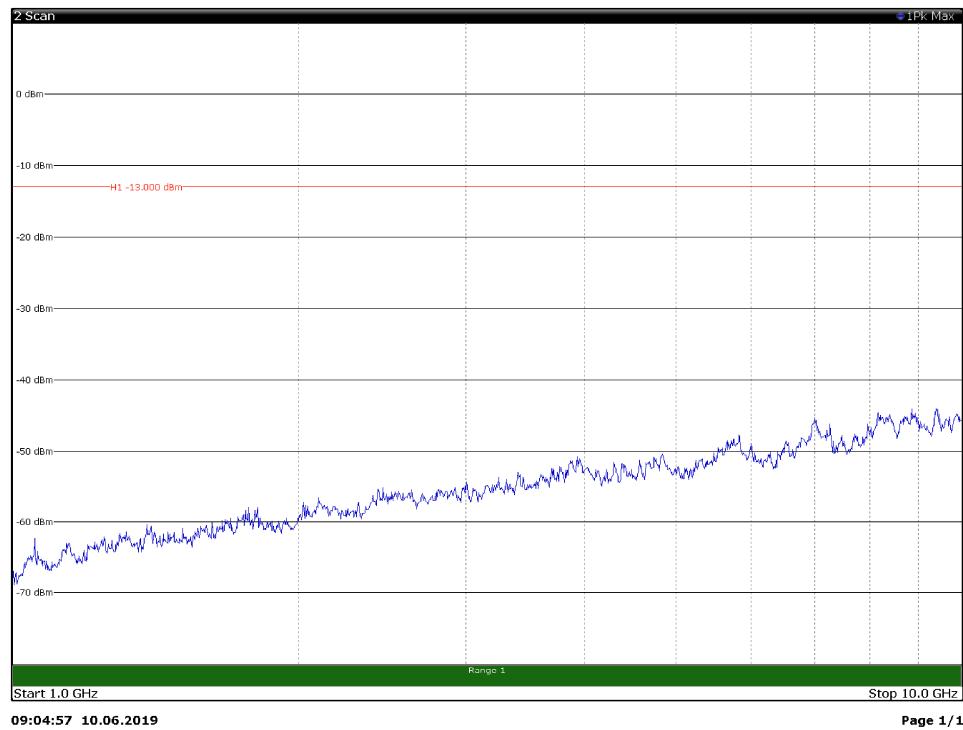


09:00:18 10.06.2019

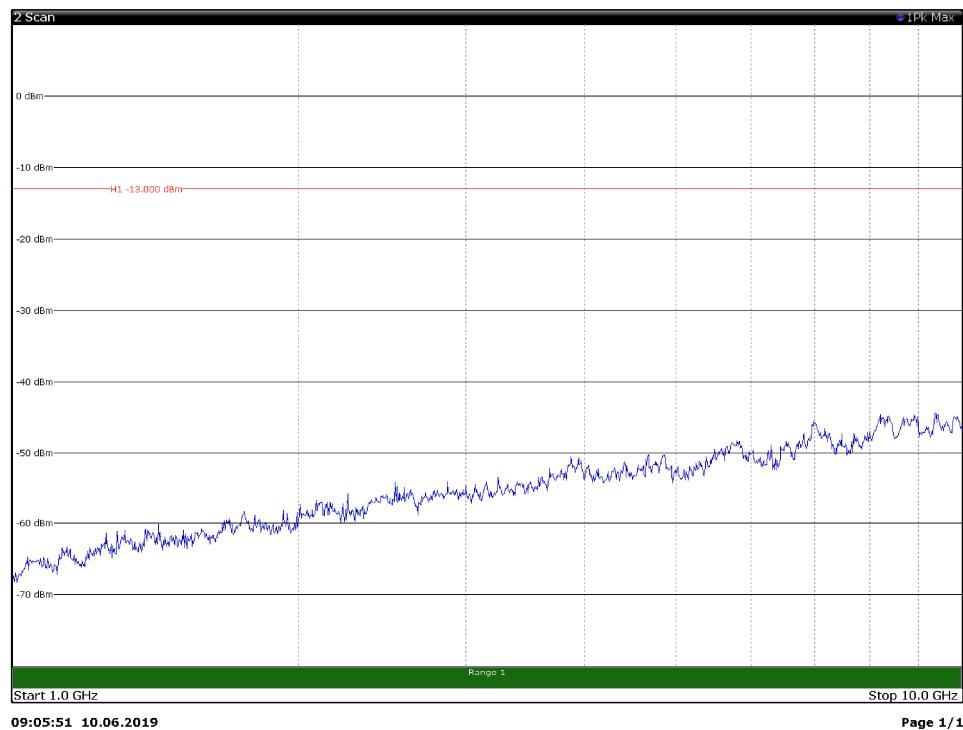
Page 1/1

## Vertical polarization

## Spurious radiated emissions with input at AGC threshold with AWGN signal at 765.5 MHz



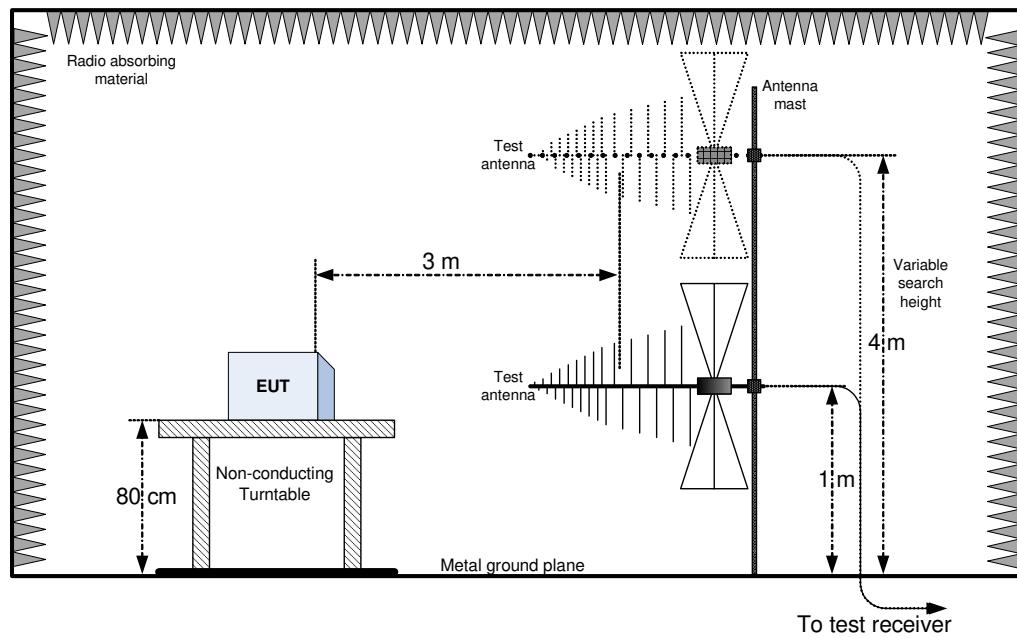
## Horizontal polarization



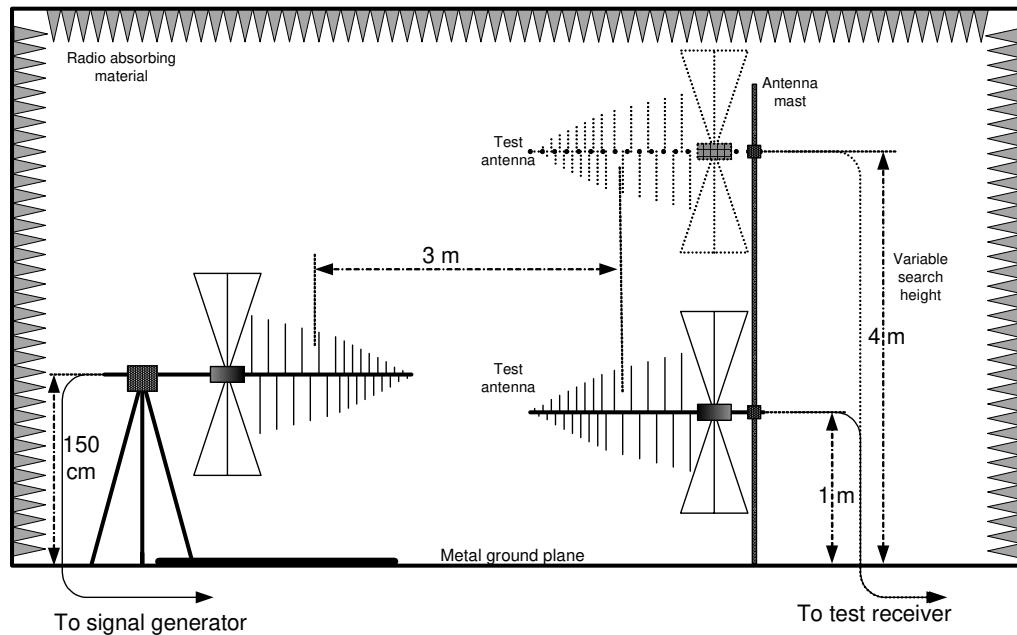
## Vertical polarization

## Appendix A: Block diagrams of test set-ups

### Radiated emissions set-up

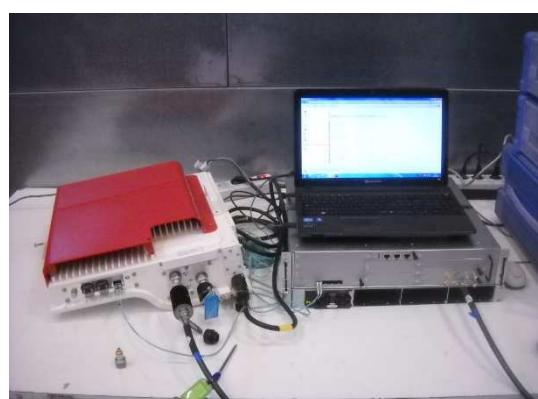
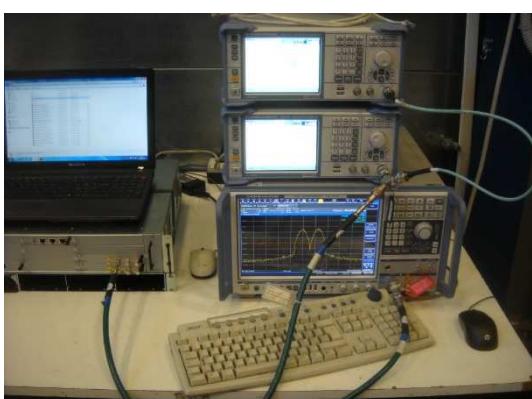
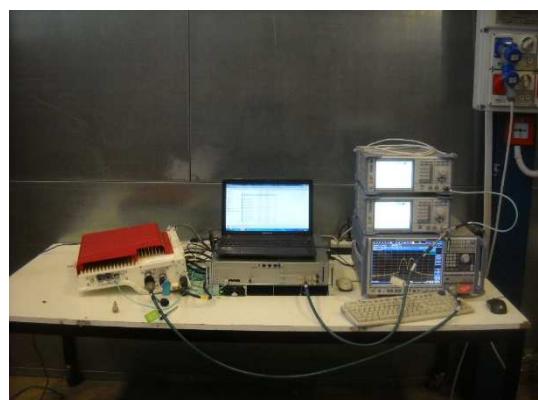
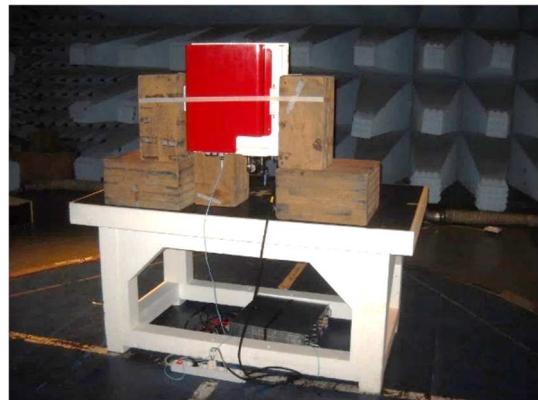


### Substitution method set-up

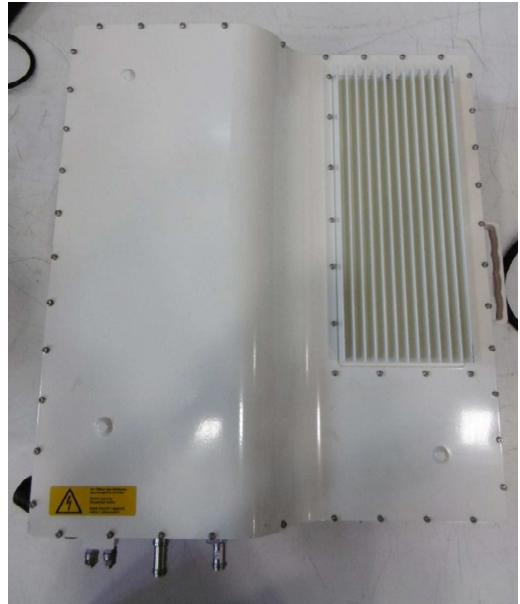


## Appendix B: Photos

### Set-up photos



**EUT photos**



End of report