

Test Site:  
FCC Test Site No.: 96997  
IC OATS No.: IC3475A-1



BUREAU  
VERITAS

## ECL-EMC Test Report No.: 14-197

Equipment under test: TFAH-ES70/80/50 700MHz Path  
FCC ID: XS5-TFAHES7850

Type of test: FCC 47 CFR Part 90 Subpart R: 2014  
Private Land Mobile Repeater

Measurement Procedures: 47 CFR Parts 2: 2014 (*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*),  
Part 27: 2014 (*Miscellaneous Wireless Communication Services*),  
ANSI/TIA-603-C:2004, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*

Test result: Passed

|                   |                      |          |                                                                                                                                                   |                                                                                                                                                                                                 |
|-------------------|----------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date of issue:    | 20.10.14             |          |                                                                                                                                                   | Signature:                                                                                                                                                                                      |
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| Test dates:       | 17.02. –<br>12.08.14 |          |                                                                                                                                                   |                                                                                                                                                                                                 |
| Pages:            | 36                   |          |                                                                                                                                                   |                                                                                                                                                                                                 |



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**General:**

The purpose of this report is to show compliance to the FCC regulations for devices operating under Part 27 of the Code of Federal Regulations title 47.

This report informs about the results of the EMC tests, it only refers to the equipment under test. No part of this report may be reproduced in any form, without written permission.



## Table of contents

|         |                                                                       |    |
|---------|-----------------------------------------------------------------------|----|
| 1       | TEST RESULTS SUMMARY .....                                            | 5  |
| 2       | EQUIPMENT UNDER TEST (E.U.T.) .....                                   | 6  |
| 2.1     | DESCRIPTION .....                                                     | 6  |
| 2.1.1   | DOWNLINK .....                                                        | 6  |
| 2.1.2   | UPLINK .....                                                          | 6  |
| 2.1.3   | DESCRIPTION OF EUT .....                                              | 6  |
| 2.1.4   | BLOCK DIAGRAM OF MEASUREMENT REFERENCE POINTS .....                   | 7  |
| 2.1.5   | DOWNLINK SYSTEM GAIN AND OUTPUT POWER .....                           | 7  |
| 3       | TEST SITE (ANDREW BUCHDORF) .....                                     | 8  |
| 3.1     | TEST ENVIRONMENT .....                                                | 8  |
| 3.2     | TEST EQUIPMENT .....                                                  | 8  |
| 3.3     | INPUT AND OUTPUT LOSSES .....                                         | 9  |
| 3.4     | MEASUREMENT UNCERTAINTY .....                                         | 9  |
| 4       | TEST SITE (BUREAU VERITAS CONSUMER PRODUCTS SERVICES) .....           | 10 |
| 5       | RF POWER OUT: §90.635, §2.1046 .....                                  | 11 |
| 5.1     | LIMIT .....                                                           | 11 |
| 5.2     | TEST METHOD .....                                                     | 11 |
| 5.3     | TEST RESULTS .....                                                    | 12 |
| 5.3.1   | DOWNLINK .....                                                        | 12 |
| 5.3.1.1 | LTE 758 – 768MHz .....                                                | 13 |
| 5.3.2   | UPLINK .....                                                          | 14 |
| 5.4     | SUMMARY TEST RESULT .....                                             | 14 |
| 6       | OCCUPIED BANDWIDTH: §90.210, §2.1049 .....                            | 15 |
| 6.1     | LIMIT .....                                                           | 15 |
| 6.2     | TEST METHOD .....                                                     | 15 |
| 6.3     | TEST RESULTS .....                                                    | 15 |
| 6.3.1   | DOWNLINK .....                                                        | 15 |
| 6.3.1.1 | LTE 758 – 768MHz .....                                                | 16 |
| 6.3.2   | UPLINK .....                                                          | 17 |
| 6.4     | SUMMARY TEST RESULT .....                                             | 17 |
| 7       | SPURIOUS EMISSIONS AT ANTENNA TERMINALS: §90.543, §2.1051 .....       | 18 |
| 7.1     | LIMIT .....                                                           | 18 |
| 7.2     | TEST METHOD .....                                                     | 18 |
| 7.3     | TEST RESULTS .....                                                    | 19 |
| 7.3.1   | DOWNLINK .....                                                        | 19 |
| 7.3.1.1 | LTE < 1MHz to band edge; 758 – 768MHz .....                           | 21 |
| 7.3.1.2 | LTE > 1MHz to band edge 758 – 768MHz .....                            | 22 |
| 7.3.1.3 | Measurement in the band of 1559 MHz – 1610 MHz acc. to 27.53(f) ..... | 23 |
| 7.3.2   | UPLINK .....                                                          | 23 |



|        |                                                                                                      |    |
|--------|------------------------------------------------------------------------------------------------------|----|
| 7.4    | SUMMARY TEST RESULT .....                                                                            | 23 |
| 8      | OUT OF BAND REJECTION .....                                                                          | 24 |
| 8.1    | LIMIT .....                                                                                          | 24 |
| 8.2    | TEST METHOD .....                                                                                    | 24 |
| 8.3    | TEST RESULTS .....                                                                                   | 24 |
| 8.3.1  | DOWNLINK .....                                                                                       | 25 |
| 8.3.2  | UPLINK .....                                                                                         | 25 |
| 8.4    | SUMMARY TEST RESULT .....                                                                            | 25 |
| 9      | NOISE FLOOR .....                                                                                    | 26 |
| 10     | RADIATED SPURIOUS EMISSIONS AT THE ECL (BUREAU VERITAS): §90.543, §2.1053,<br>RSS-GEN, RSS-131 ..... | 27 |
| 10.1   | METHOD OF MEASUREMENT .....                                                                          | 30 |
| 10.2   | LIMIT .....                                                                                          | 31 |
| 10.3   | RECEIVER SETTINGS .....                                                                              | 31 |
| 10.4   | CLIMATIC VALUES IN THE LAB .....                                                                     | 31 |
| 10.5   | TEST RESULTS .....                                                                                   | 32 |
| 10.5.1 | 30 MHZ TO 1 GHZ DOWNLINK (BOTTOM – MIDDLE – TOP) SUBPART H .....                                     | 32 |
| 10.5.3 | 30 MHZ TO 1 GHZ DOWNLINK (MIDDLE OF ALL PATHS) .....                                                 | 33 |
| 10.5.4 | 1 GHZ TO 21 GHZ DOWNLINK (BOTTOM – MIDDLE – TOP) SUBPART H .....                                     | 34 |
| 10.5.6 | 1 GHZ TO 22 GHZ DOWNLINK (MIDDLE OF ALL PATHS) .....                                                 | 35 |
| 11     | HISTORY .....                                                                                        | 36 |



## 1 Test Results Summary

| Name of Test                            | FCC Para. No.         | FCC Method            | FCC Spec.             | Result   |
|-----------------------------------------|-----------------------|-----------------------|-----------------------|----------|
| RF Power Output                         | 90.635                | 2.1046                | 1000 Watts ERP        | Complies |
| Occupied Bandwidth                      | 90.210                | 2.1049                | Input/Output          | Complies |
| Spurious Emissions at Antenna Terminals | 90.543                | 2.1051                | -13dBm                | Complies |
| Radiated Spurious emission              | 90.543                | 2.1053<br>TIA/EA-603  | -13dBm<br>E.I.R.P     | Complies |
| Frequency Stability                     | 90.539                | 2.1055                | Must stay in band     | NA       |
| Out of Band Rejection                   | KDB 935210<br>D02 v02 | KDB 935210<br>D02 v02 | KDB 935210<br>D02 v02 | Complies |
| Noise floor                             | KDB 935210<br>D02 v02 | KDB 935210<br>D02 v02 | KDB 935210<br>D02 v02 | Complies |

Frequency stability is given by: The system gets an electrical analog signal from the BSS which is converted into an analog optical signal, transmitted by the optical links and then reconverted in the Remote Unit into an analog electrical signal. During this process happens no frequency change/modification, so input and output have same frequency what can be seen under clause "Occupied Bandwidth".

## 2 Equipment under test (E.U.T.)

### 2.1 Description

|                                   |                                               |
|-----------------------------------|-----------------------------------------------|
| Kind of equipment                 | TFAH-ES70/80/50                               |
| Andrew Ident. Number              | Id. No. TFAH-ES70/80/50                       |
| Serial no.(SN)                    | 10                                            |
| Revision                          | 00                                            |
| Software version and ID           | n. a.                                         |
| Type of modulation and Designator | LTE (G7D) <input checked="" type="checkbox"/> |
| Frequency Translation             | F1-F1 <input checked="" type="checkbox"/>     |
|                                   | F1-F2 <input type="checkbox"/>                |
|                                   | N/A <input type="checkbox"/>                  |
| Band Selection                    | Software <input type="checkbox"/>             |
|                                   | Duplexer <input checked="" type="checkbox"/>  |
|                                   | Full band <input type="checkbox"/>            |

#### 2.1.1 Downlink

|                                                          |                   |
|----------------------------------------------------------|-------------------|
| Full pass band                                           | 758 MHz – 775 MHz |
| Pass band under test                                     | 758 MHz – 768 MHz |
| Max. composite output power based on one carrier (rated) | 31 dBm = 1.26 W   |
| Gain*                                                    | 32 dB             |

\*see 2.1.5

#### 2.1.2 Uplink

|           |       |
|-----------|-------|
| Pass band | n. a. |
| Gain*     | n. a. |

\*see 2.1.5

Note: The EUT does not transmit over the air in the uplink direction.

#### 2.1.3 Description of EUT

TFAH-ES70/80/50 is a multi-band, multi-operator remote unit configuration used in conjunction with a master unit in the ION optical distribution system. This system transports up to three frequency bands simultaneously (500 MHz, 700 MHz, and 800MHz), providing a cost-effective solution for distributing capacity from one or more base stations.

This Test Report describes only the approval of the 700 MHz path (758 – 768 MHz)

## 2.1.4 Block diagram of measurement reference points

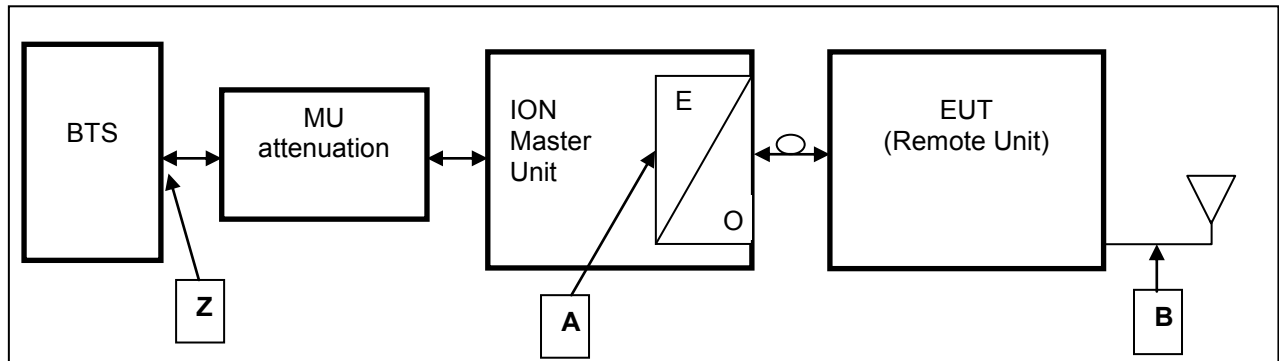


figure 2.1.4-#2 Block diagram of measurement reference points

Remote/Extension Unit is the EUT  
 O/E Optical/Electrical converter  
 SRMU SubRackMaster Unit

Reference point A, SRMU UL output, DL input  
 Reference point B, Remote Unit DL output, UL input  
 Reference point Z, BTS DL output, BTS UL input

Since a signal generator does not supply a good output signal with +33 or +43dBm, for the downlink measurement the MU Attenuation is not used.

That means for downlink measurements the signal generator is connected to measurement point A at the master optical / electrical converter and the analyzer to the measurement point B at the RU.

## 2.1.5 Downlink System Gain and Output Power

| System optimized for BTS power | MU Attenuation<br>( <i>manual leveling</i> ) | Maximum rated input power at the MU OTRX | RU Gain | Maximum rated output power at RU Antenna port |
|--------------------------------|----------------------------------------------|------------------------------------------|---------|-----------------------------------------------|
| Z                              |                                              | A                                        | A to B  | B                                             |
| +33 dBm                        | 34 dB                                        | -1 dBm                                   | +32 dB  | +31.0 dBm<br>@ 1 carrier                      |
| System Gain Z to B             | -2 dB                                        |                                          |         |                                               |
| +43 dBm                        | 44 dB                                        | -1 dBm                                   | +32 dB  | +31.0 dBm<br>@ 1 carrier                      |
| System Gain Z to B             | -12 dB                                       |                                          |         |                                               |

table 2.1.5-#1 Equipment under test (E.U.T.) Description Downlink System Gain and Output Power

### 3 Test site (Andrew Buchdorf)

#### 3.1 Test environment

All tests were performed under the following environmental conditions:

| Condition           | Minimum value         | Maximum value |
|---------------------|-----------------------|---------------|
| Barometric pressure | 86 kPa                | 106 kPa       |
| Temperature         | 15°C                  | 30°C          |
| Relative Humidity   | 20 %                  | 75 %          |
| Power supply range  | ±5% of rated voltages |               |

#### 3.2 Test equipment

| ANDREW<br>Inv. No. | Test equipment    | Type          | Manufacturer | Serial No. | Calibration |
|--------------------|-------------------|---------------|--------------|------------|-------------|
| 9102               | Network Analyzer  | ZVB14         | R&S          | 100118     | 08/14       |
| 9054               | Spectrum Analyzer | FSV13         | R&S          | 100859     | 12/14       |
| 9233               | Signal Generator  | SMBV100A      | R&S          | 257777     | 06/15       |
| 8849               | Signal Generator  | SMU200A       | R&S          | 101732     | 04/15       |
| 8671               | Power Meter       | E4418B        | Agilent      | GB39513094 | 06/15       |
| 8672               | Power Sensor      | E9300H        | Agilent      | US41090179 | 06/15       |
| 7306               | Circulator        | C25E-1FFF     | AEROTEK      | 12580      | CIU         |
| 7307               | Circulator        | C25E-1FFF     | AEROTEK      | 12581      | CIU         |
| 7408               | RF-Cable          | 2,0m; N-N     | Andrew       | ---        | CIU         |
| 7409               | RF-Cable          | 2,0m; N-N     | Andrew       | ---        | CIU         |
| 7410               | RF-Cable          | 1,0m; N-N     | Andrew       | ---        | CIU         |
| 7411               | RF-Cable          | 2,0m; N-N     | Andrew       | ---        | CIU         |
| 7373               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7374               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7437               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7438               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7439               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7443               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7444               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7445               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7446               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7447               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7448               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7449               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7450               | RF-Cable          | Multiflex141  | Andrew       | ---        | CIU         |
| 7440               | RF-Cable          | RG-223 0.8m   | Andrew       | ---        | CIU         |
| 7441               | RF-Cable          | RG-223 0.8m   | Andrew       | ---        | CIU         |
| 7453               | RF-Cable          | RG223 2m SMA. | Andrew       | ---        | CIU         |
| 7454               | RF-Cable          | RG223 2m SMA. | Andrew       | ---        | CIU         |
| 7455               | RF-Cable          | RG223 2m SMA. | Andrew       | ---        | CIU         |
| 7144               | Attenuator        | 2N-20dB       | Inmet 64671  | ---        | CIU         |
| 7341               | Power Attenuator  | 768-20        | Narda        | ---        | CIU         |
| 7368               | Matrix            |               | COMMScope    | ---        | weekly      |

CIU = Calibrate in use



---

### 3.3 Input and output losses

All recorded power levels should be referenced to the input and output connectors of the repeater, unless explicitly stated otherwise.

The test equipment used in this test has to be calibrated, so that the functionality is also checked.

All cables, attenuators, splitter, isolator, circulator and combiner etc. must be measured before testing and used for compensation during testing.

### 3.4 Measurement uncertainty

The extended measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor  $k=2$ . The true value is located in the corresponding interval with a probability of 95 %.

Test Report No.: 14-197

FCC ID: XS5-TFAHES7850



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## 4 Test site (Bureau Veritas Consumer Products Services)

FCC Test site: 96997

IC OATS: IC3475A-1

See relevant dates under section 10 of this test report.

## 5 RF Power Out: §90.635, §2.1046

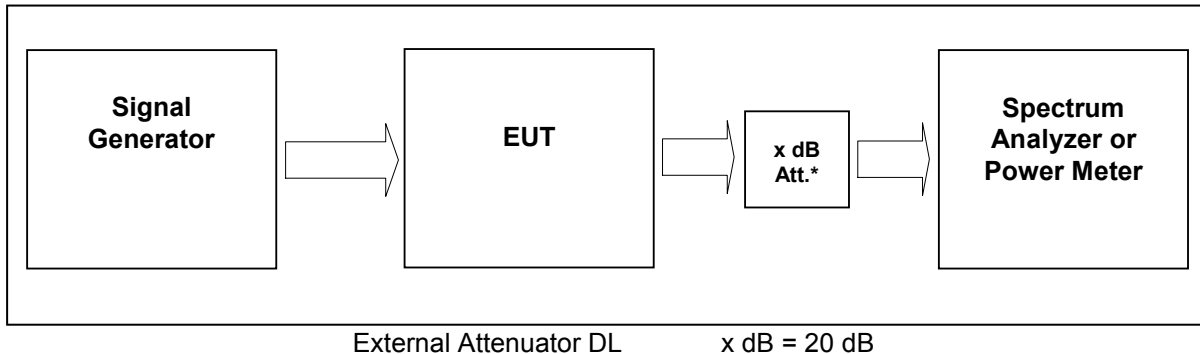


figure 5-#1 Test setup: RF Power Out: §90.635, §2.1046

|                         |                                                               |
|-------------------------|---------------------------------------------------------------|
| Measurement uncertainty | ± 0,38 dB                                                     |
| Test equipment used     | 9054, 9233, 7444; 7306; 7144; 7454; 7453;<br>7341; 7449; 7368 |

### 5.1 Limit

Minimum standard:

§90.541 Transmitting power limits.

The transmitting power of base, mobile, portable and control stations operating in the 769-775 MHz and 799-805 MHz frequency bands must not exceed the maximum limits in this section, and must also comply with any applicable effective radiated power limits in §90.545.

(a) The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b) and (c) of §90.635.

§ 90.635 Limitations on power and antenna height.

(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.

### 5.2 Test method

§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations

### 5.3 Test Results

Detector RMS.

Test signal LTE:

Signal waveform according to Test Model 1.1, E-TM1.1, clause 6.1.1.1-1, table 6.1.1.1-1 of standard specification 3GPP TS 36.141 V9.3.0 (2010-03).

#### 5.3.1 Downlink

| Modulation                                       | Measured at | Path      | RBW<br>VBW<br>Span     | RF Power<br>(dBm) | RF Power<br>(W) | Plot -        |
|--------------------------------------------------|-------------|-----------|------------------------|-------------------|-----------------|---------------|
| LTE                                              | Middle      | 763.0 MHz | 3MHz<br>10MHz<br>50MHz | 31.0              | 1.26            | 5.3.1.1<br>#1 |
| Maximum output power = 31.0 dBm = 1.26 W         |             |           |                        |                   |                 |               |
| Limit Maximum output power 60 dBm = 1000 W (erp) |             |           |                        |                   |                 |               |

table 5.3.1-#1 RF Power Out: §90.635, §2.1046 Test Results Downlink

The max RF Power out is 31 dBm, so the maximum antenna gain (x) can be calculated as follow:

**Limit = 1000W (erp) = 60 dBm**

Info: 1000W (erp) = 1640W (eirp)

60 dBm > 31 dBm + x -----> x = 60 dBm – 31 dBm = 29 dBd

x dBi = 29 dBd + 2.15 = 31.15 dBi

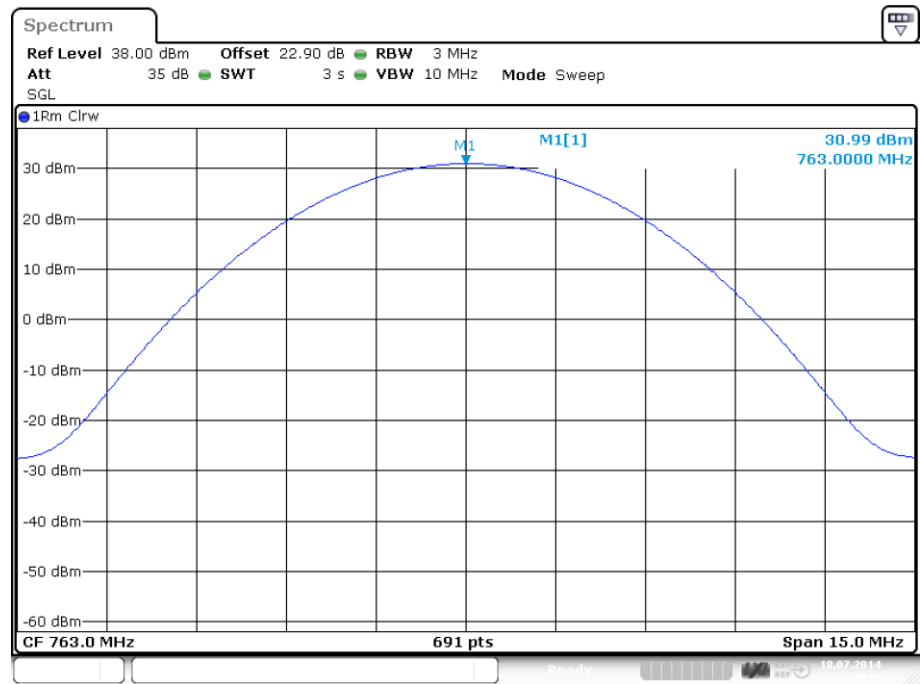
=> The antenna that will use for the complete system have to have a gain lower than 31.15 dBi, relative to a dipol.

| Modulation | Pin / dBm<br>(Ref. point A) |
|------------|-----------------------------|
| LTE        | -3.5                        |

table 5.3.1-#2 RF Power Out: §90.635, §2.1046 Test Results Downlink Input power



5.3.1.1 LTE 758 – 768MHz



plot 5.3.1.1-#1 RF Power Out: \$90.635, \$2.1046; Downlink; LTE 758 – 768MHz Middle



### 5.3.2 Uplink

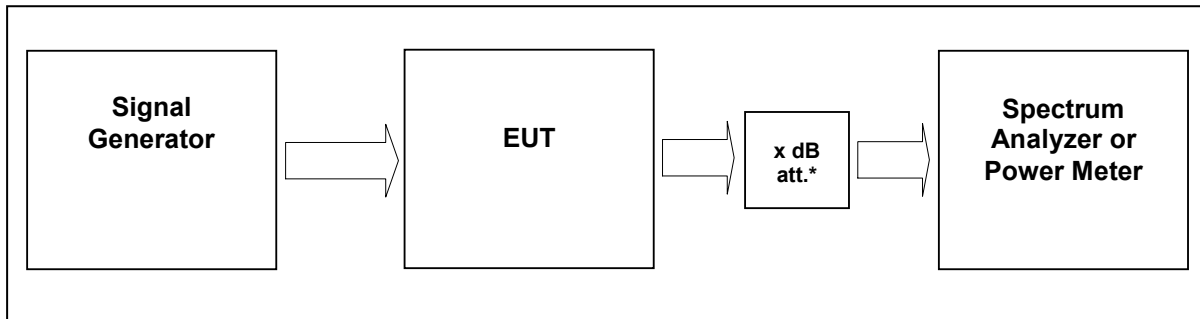
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

### 5.4 Summary test result

|             |                                     |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by:  | M. Leinfelder                       |
| Date:       | 18.07.2014                          |

## 6 Occupied Bandwidth: §90.210, §2.1049



External Attenuator DL      x dB = 20 dB  
figure 6-#1 Test setup: Occupied Bandwidth: §90.210, §2.1049

|                         |                                          |
|-------------------------|------------------------------------------|
| Measurement uncertainty | ± 0,38 dB                                |
| Test equipment used     | 9054, 9052, 7366, 7367, 7299, 7280, 7363 |

### 6.1 Limit

The spectral shape of the output should look similar to input for all modulations.

### 6.2 Test method

Para. No.2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

### 6.3 Test results

#### 6.3.1 Downlink

Detector RMS.

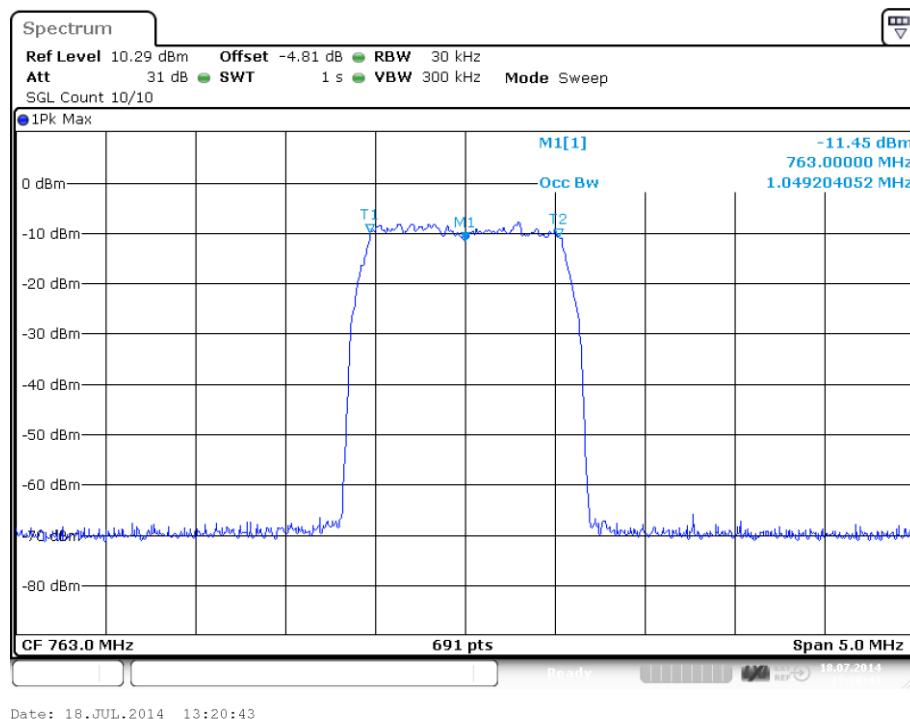
| Modulation | Measured at | Path      | RBW<br>VBW<br>Span         | Occupied<br>Bandwidth /<br>MHz | Plot #            |
|------------|-------------|-----------|----------------------------|--------------------------------|-------------------|
| LTE        | Middle      | 763.0 MHz | 30 kHz<br>300 kHz<br>5 MHz | 1.1                            | 6.3.1.1<br>#1, #2 |

table 6.3-#1 Occupied Bandwidth: §90.210, §2.1049 Test results

## 6.3.1.1 LTE 758 – 768MHz



plot 6.3.1.1-#1 Occupied Bandwidth: \$90.210, \$2.1049; Test results; Downlink; LTE 758 – 768MHz Output



plot 6.3.1.1-#2 Occupied Bandwidth: \$90.210, \$2.1049; Test results; Downlink; LTE 758 – 768MHz Input



### 6.3.2 Uplink

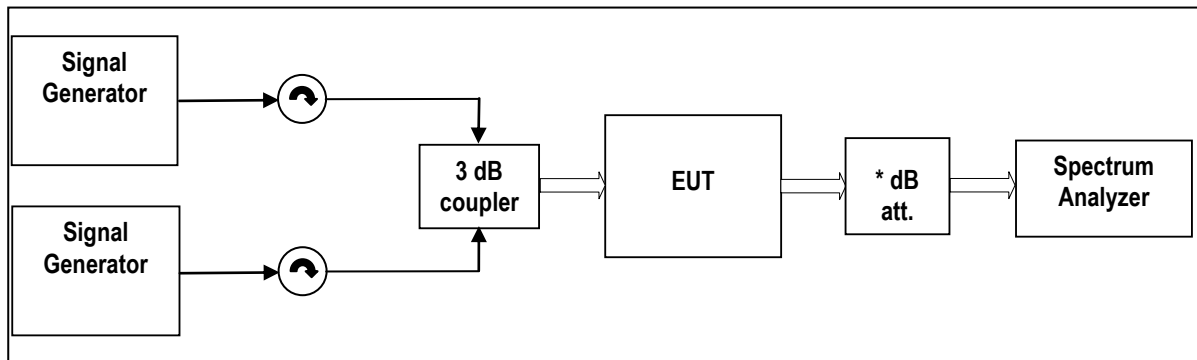
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

### 6.4 Summary test result

|             |                                     |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by:  | M. Leinfelder                       |
| Date:       | 18.07.2014                          |

## 7 Spurious Emissions at Antenna Terminals: §90.543, §2.1051



External Attenuator DL x dB = 20 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §90.543, §2.1051

|                         |                                                                                 |                                                     |
|-------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------|
| Measurement uncertainty | $\pm 0,54$ dB<br>$\pm 1,2$ dB<br>$\pm 1,5$ dB                                   | 9 kHz to 3 GHz<br>3 GHz to 7 GHz<br>7 GHz to 26 GHz |
| Test equipment used     | 9054, 9233, 8849; 7444; 7443; 7306; 7307;<br>7144; 7454; 7453; 7341; 7449; 7368 |                                                     |

### 7.1 Limit

#### § 90.543 Emission limitations.

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 763–768 MHz and 793–798 MHz bands must meet the emission limitations in (e) of this section.

Limit -13dBm

### 7.2 Test method

Para. No 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

[39 FR 5919, Feb. 15, 1974. Redesignated and amended at 63 FR 36599, July 7, 1998]



### 7.3 Test results

#### 7.3.1 Downlink

##### <1MHz from Band Edge

Detector: RMS.

| Modulation | Measured at Band Edge | Carriers               | RBW<br>VBW<br>Span      | Max. level (dBm) | Plot -        |
|------------|-----------------------|------------------------|-------------------------|------------------|---------------|
| LTE        | Lower Edge            | 758,7 MHz<br>760,1 MHz | 30kHz<br>300kHz<br>6MHz | -23.2            | 7.3.1.1<br>#1 |
|            | Upper Edge            | 765,9 MHz<br>767,3 MHz |                         |                  | #2            |

table 7.3-#1 Spurious Emissions at Antenna Terminals: §90.543, §2.1051 Test results <1MHz from Band

##### >1MHz from Band Edge

Detector: RMS.

| Modulation | Carrier   | RBW<br>VBW<br>Span              | Max. level (dBm) | Plot -        |
|------------|-----------|---------------------------------|------------------|---------------|
| LTE        | 763.0 MHz | 1MHz<br>3MHz<br>30MHz –<br>8GHz | -29.5            | 7.3.1.2<br>#1 |

table 7.3-#2 Spurious Emissions at Antenna Terminals: §90.543, §2.1051 Test results >1MHz from Band Edge



**Calculation of the limit according to §27.53 (c)(3):**

On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations;

$P_{out} = 31\text{dBm} = 1.26 \text{ W}$ .

$76 + 10 \cdot \log(20\text{W}/1\text{W}) \text{ dB} = 77 \text{ dB}$  Attenuation  $\Rightarrow 31\text{dBm} - 77\text{dB} = -46 \text{ dBm}$  in a 6.25 kHz band segment  
Spurious measured in the plot with a RBW of 1MHz so the limit is calculated:

$\Rightarrow -46\text{dBm} / 6,25\text{kHz} + 10 \cdot \log(10\text{kHz}/6,25\text{kHz}) = -43,96\text{dBm} / 10\text{kHz}$   
(in the frequency range 763–775 MHz and 793–805 MHz)

maximum measured emission level for frequencies between 763–775 MHz and 793–805 MHz is below  
-58 dBm / 10kHz.

Test passed.

**Considerations to §27.53 (f):**

To see if the standard 27.53(f) were met a calculation of the radiated power is necessary. The modulated carrier in the range of 747-757 MHz is working with maximum power and the frequency range of 1559-1610MHz is measured. For the calculation of the radiated power in this band, it was calculated with a typical antenna gain and typical cable loss.

Used 700 MHz narrow band antennas offer a gain of 0 dBi in the in the frequency range 1559 - 1610 MHz, furthermore an antenna cable with a loss of 2 dB is used.

The measured conducted emissions in the frequency range of 1599 - 1610 MHz are below -48 dBm/MHz (see at plot 7.3.1.3).

Conducted emissions ( $< -48 \text{ dBm}$ ) + antenna gain (0 dBi) - cable loss (0 dB) = radiated emissions ( $< -48 \text{ dBm}$ ) which is below the limit of Part 27.53(f).

Even with an antenna gain of 7 dBi (more than worst case) in the frequency range of 1599 - 1610 MHz, we are still under the limit of Part 27.53(f) with a radiated emission of -41 dBm.

Therefore the emission limit is met.

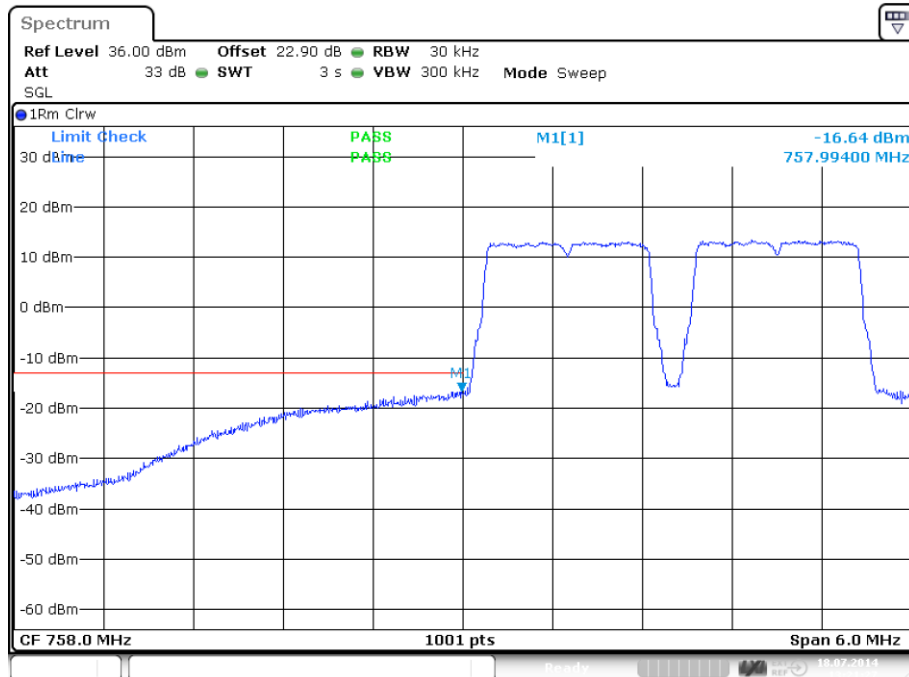
Test passed.

Plots with test result see

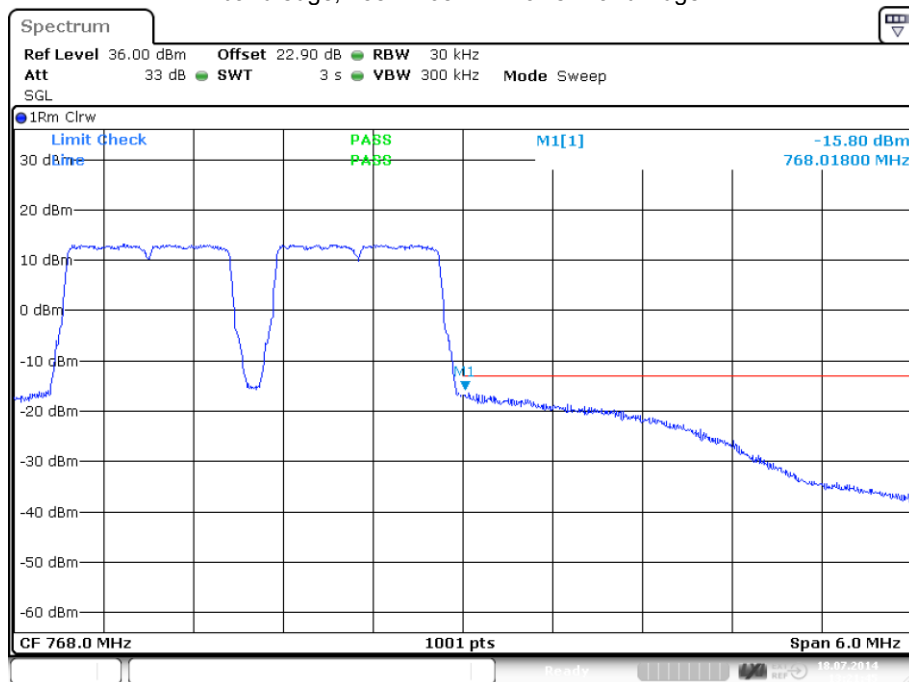
7.3.1.3 Measurement in the band of 1559 MHz – 1610 MHz



## 7.3.1.1 LTE &lt; 1MHz to band edge; 758 – 768MHz

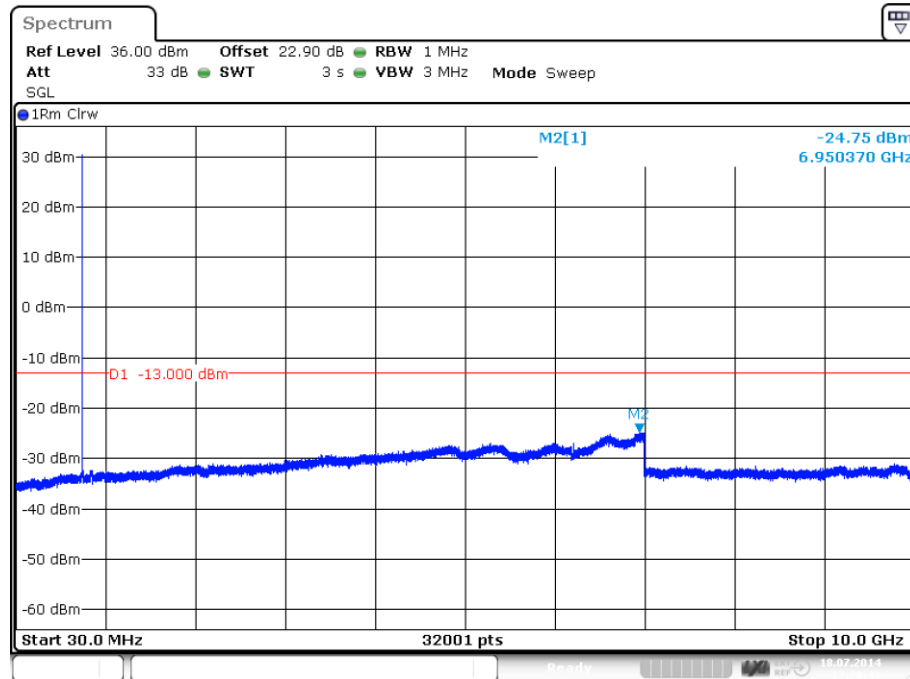


plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §90.543, §2.1051; Test results; Downlink; LTE &lt; 1MHz to band edge; 758 – 768MHz Lower Band Edge

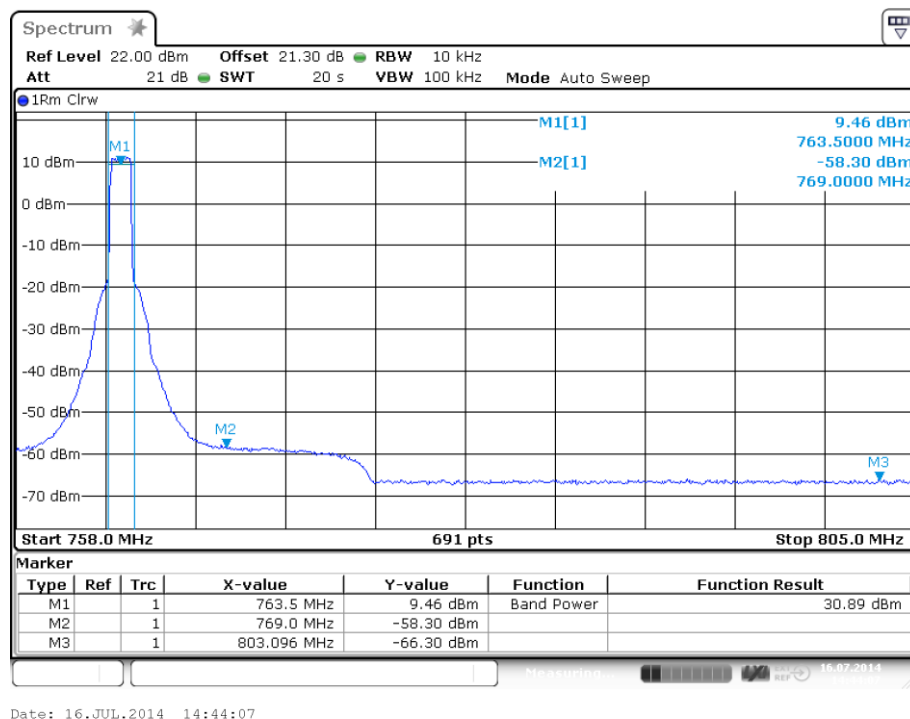


plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §90.543, §2.1051; Test results; Downlink; LTE &lt; 1MHz to band edge; 758 – 768MHz Upper Band Edge

## 7.3.1.2 LTE &gt; 1MHz to band edge 758 – 768MHz

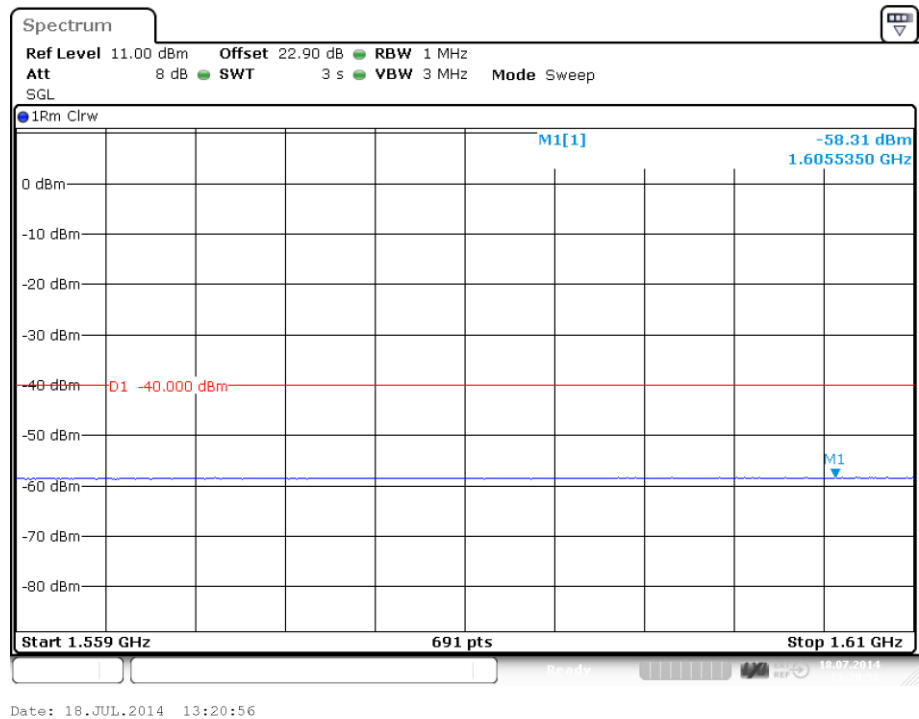


plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §90.543, §2.1051; Test results; Downlink; LTE > 1MHz to band edge 758 – 768MHz; 30 MHz – 10 GHz



plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §90.543, §2.1051; Test results; Downlink; LTE > 1MHz to band edge 758 – 768MHz; 763 MHz – 805 MHz

7.3.1.3 Measurement in the band of 1559 MHz – 1610 MHz acc. to 27.53(f)  
Calculation see 7.3.1 Test results Downlink



plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §90.543, §2.1051; Test results; Downlink; Measurement in the band of 1559 MHz – 1610 MHz acc. to 27.53(f)

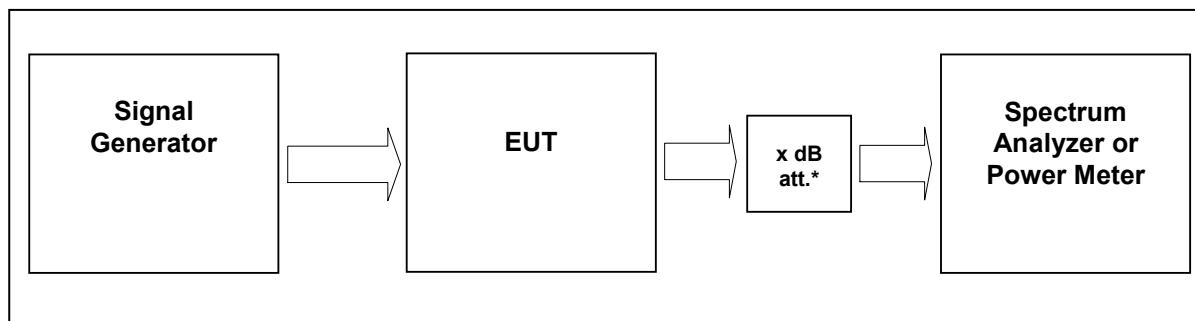
7.3.2 Uplink  
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

7.4 Summary test result

|             |                                     |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by:  | M. Leinfelder                       |
| Date:       | 18.07.2014                          |

## 8 Out of Band Rejection



External Attenuator DL      x dB = 20 dB  
figure 8-#1 Test setup: Out of Band Rejection

|                         |                                                         |
|-------------------------|---------------------------------------------------------|
| Measurement uncertainty | ± 0,38 dB                                               |
| Test equipment used     | 9054, 9233, 7444; 7306; 7144; 7454; 7453;<br>7341; 7449 |

### 8.1 Limit

KDB 935210 D02 v02

Clause: D.3 POLICIES AND PROCEDURES;

Subclause:

(I) Out of Band Rejection – Test for rejection of out of band signals. Filter frequency response plots are acceptable.

### 8.2 Test method

KDB 935210 D02 v02

Clause: D.3 POLICIES AND PROCEDURES;

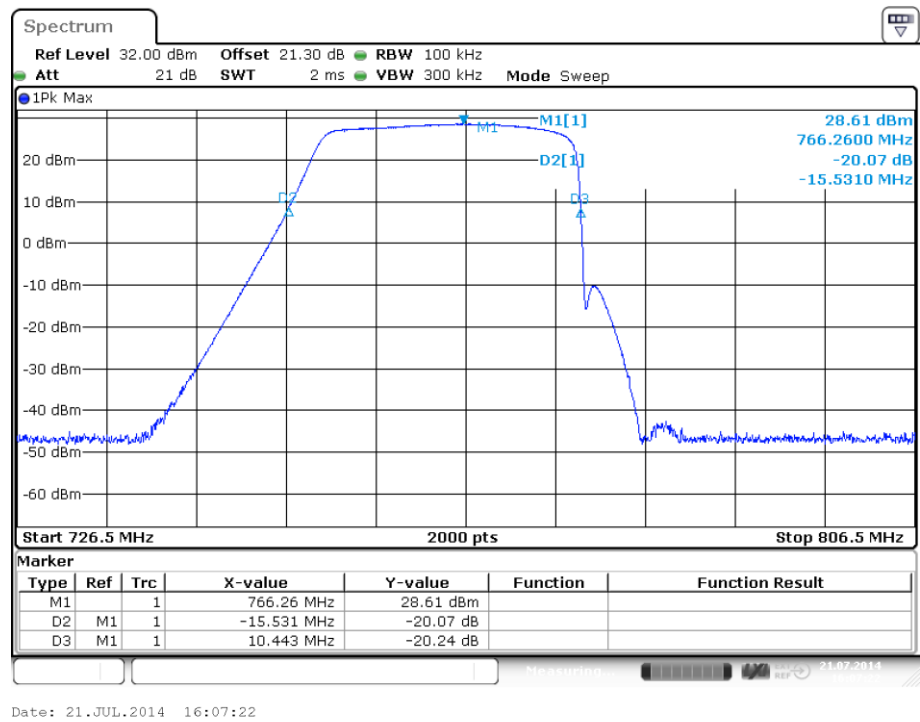
Subclause:

(I) Out of Band Rejection – Test for rejection of out of band signals. Filter frequency response plots are acceptable.

### 8.3 Test results

Detector Peak max hold

8.3.1 Downlink



plot 8.3.1-#1 Out of Band Rejection; Test results; Downlink;

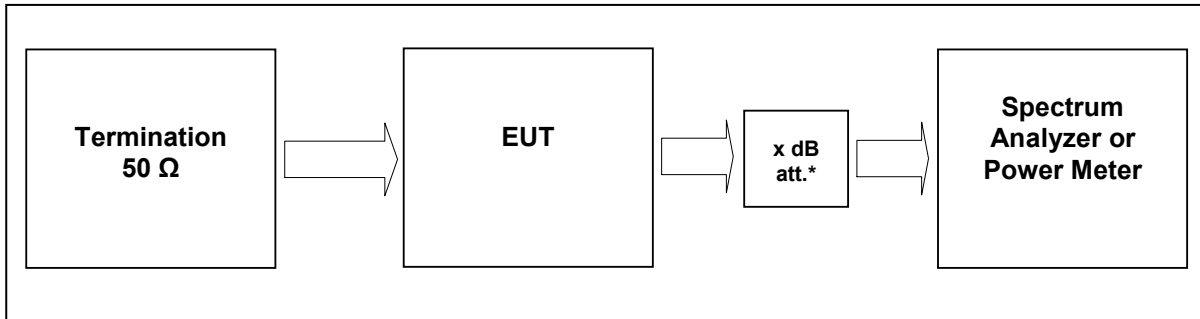
8.3.2 Uplink

n.a.  
Note: The EUT does not transmit over the air in the uplink direction.

8.4 Summary test result

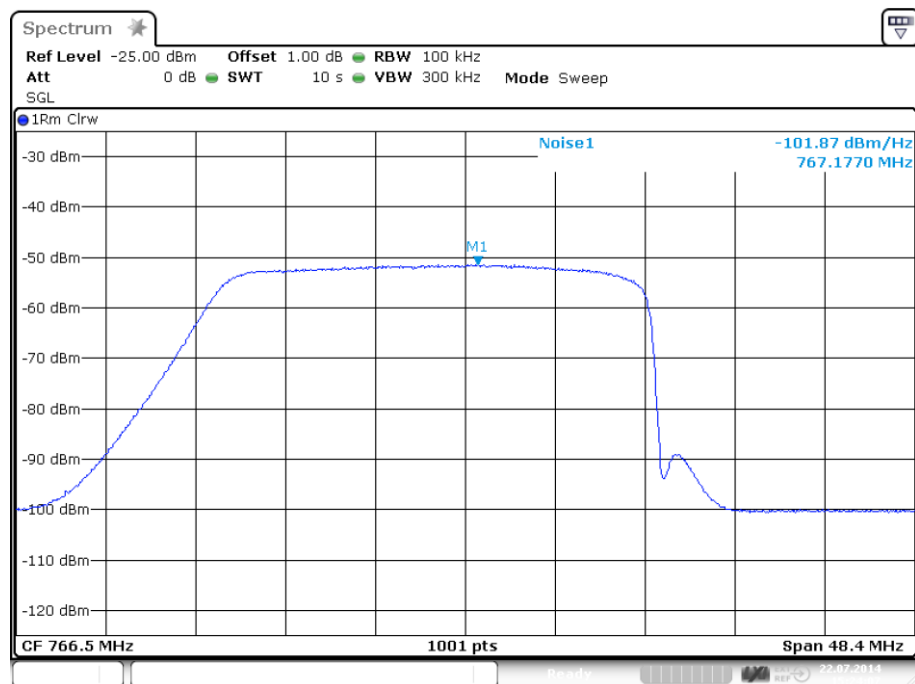
|             |                                     |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by:  | M. Leinfelder                       |
| Date:       | 21.07.2014                          |

## 9 Noise floor



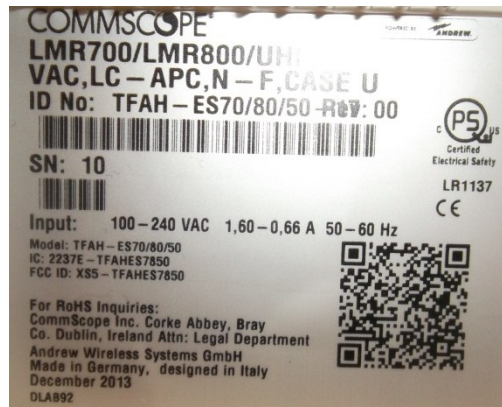
External Attenuator DL      x dB = 0 dB  
figure 9-#1 Test setup: Noise floor

|                         |                               |
|-------------------------|-------------------------------|
| Measurement uncertainty | ± 0,38 dB                     |
| Test equipment used     | 9054, 7144; 7454; 7453; 7449; |

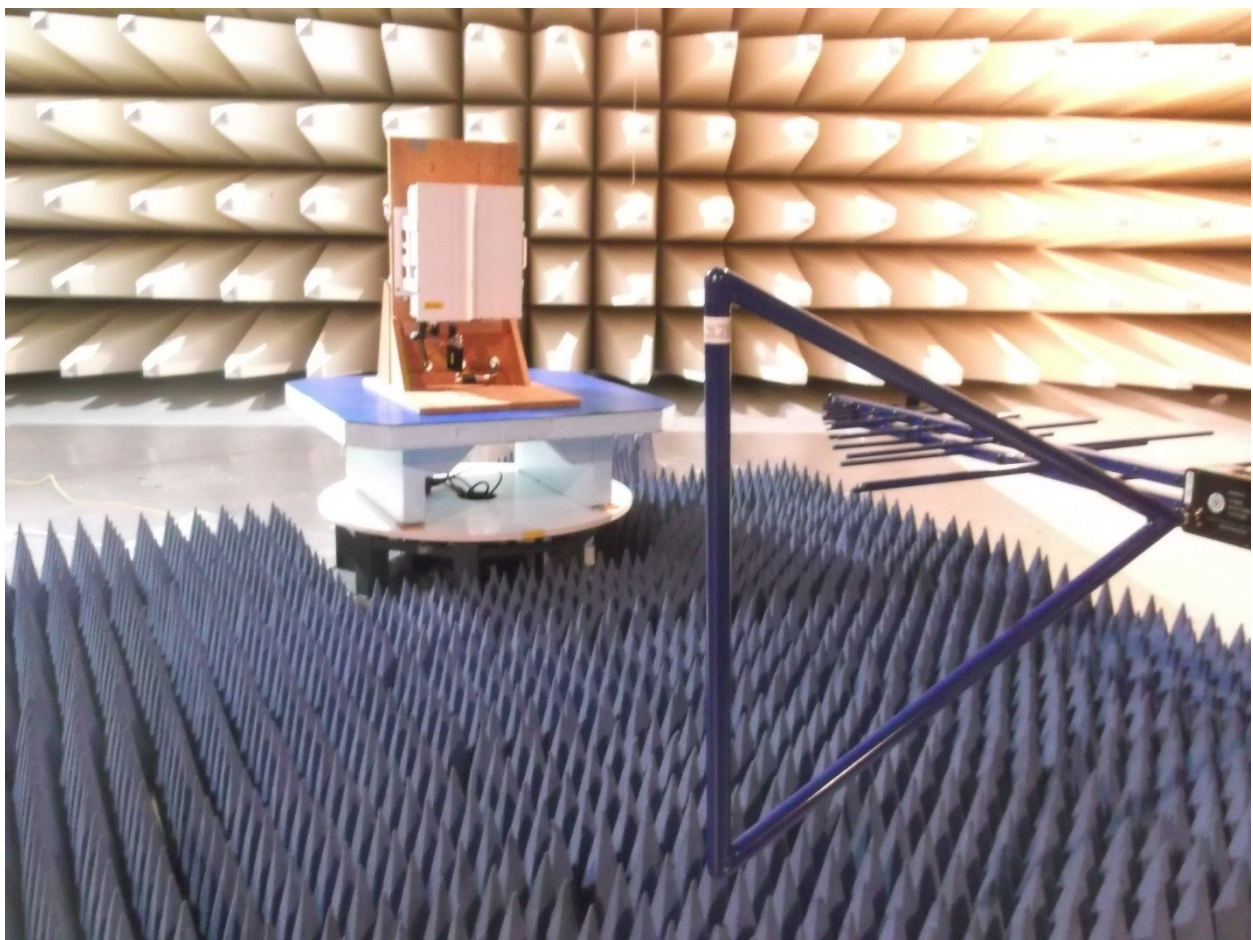


plot 9-#1 Noise floor;

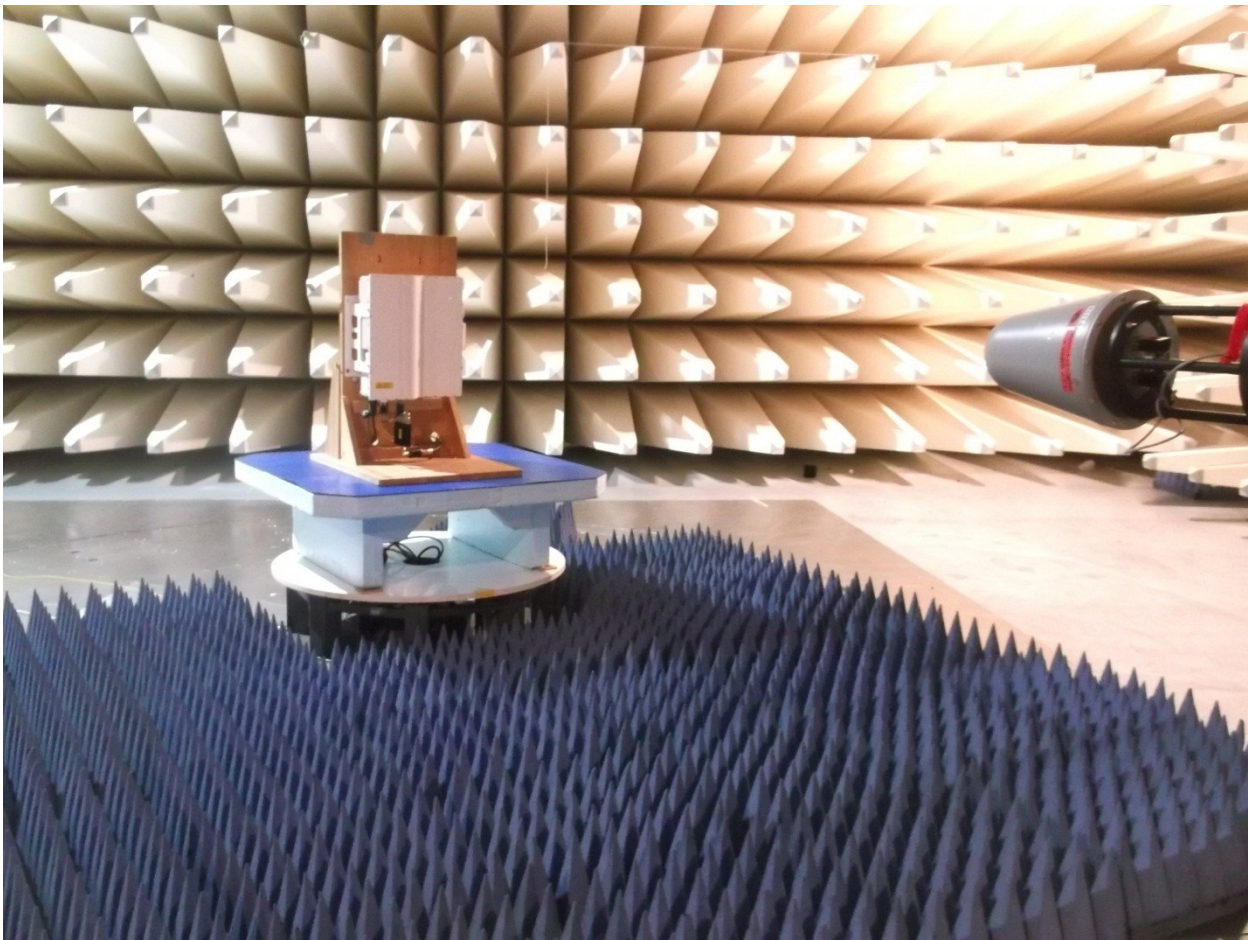
## 10 Radiated Spurious Emissions at the ECL (Bureau Veritas): §90.543, §2.1053, RSS-Gen, RSS-131



picture 10.1: name plate



picture 10.2: Test setup: Field Strength Emission <1 GHz @3m in the SAC



**picture 7.3:** Test setup: Field Strength Emission >1 GHz @3m in the SAC



This clause specifies requirements for the measurement of radiated emission.

| Frequency range | Distance:<br>EUT <-> antenna /<br>location | Limit                  | Test method        |
|-----------------|--------------------------------------------|------------------------|--------------------|
| 30 MHz - 1 GHz  | 3 metres / SAC                             | FCC 47 CFR Part 90.210 | TIA/EIA-603-C:2004 |
| 1 GHz – 21 GHz  | 3 metres / SAC                             |                        |                    |

#### Test equipment used:

| Designation       | Type          | Manufacturer    | Invent.-no. | Cal.-date  | due Cal.-<br>date | used |
|-------------------|---------------|-----------------|-------------|------------|-------------------|------|
| EMI test receiver | ESI40         | Rohde & Schwarz | E1687       | 28.11.2013 | 28.11.2014        | X    |
| Antenna           | CBL 6111      | Chase           | K1026       | 27.06.2014 | 27.06.2015        | X    |
| Pre amplifier     | AM1431        | Miteq           | K1721       | 16.04.2014 | 16.04.2015        | X    |
| Antenna           | HL 025        | R&S             | K1114       | 03.03.2014 | 03.03.2015        | X    |
| Preamplifier      | AFS4-00102000 | Miteq           | K838        | 03.04.2014 | 03.04.2015        | X    |
| RF Cable          | Sucoflex 100  | Suhner          | K1760       | 03.07.2014 | 03.07.2015        | X    |

The REMI version 2.135 has been used for max search.

#### Test set-up:

Test location: SAC  
 Both, the Fully Anechoic Chamber (FAC) and the Semi Anechoic Chamber (SAC) fulfil the requirements of ANSI C63.4 and CISPR 16-1-4 with regards to NSA and SVSWR.

Test Voltage: 115V / 60 Hz

Type of EUT: Wall mounted

#### Measurement uncertainty:

|                                                  |                                                                         |
|--------------------------------------------------|-------------------------------------------------------------------------|
| Measurement uncertainty expanded<br>(95% or K=2) | ± 4,7 dB for ANSI C63.4 measurement<br>± 0,5 dB for TIA-603 measurement |
|--------------------------------------------------|-------------------------------------------------------------------------|

## 10.1 Method of Measurement

### Measurement procedure. TIA-603-C

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic dipole (see Figure 7.2).

From KDB (AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET):

Radiated spurs (enclosure) – Use of CW signal (low, mid, and high freq.) is acceptable rather than all modulations.

The maximum RFI field strength was determined during the measurement by rotating the turntable ( $\pm 180$  degrees) and varying the height of the receive antenna ( $h = 1 \dots 4$  m) as like defined in ANSI C63.4. A measurement receiver has been used with a RBW 120 kHz up to 1 GHz and 1 MHz above 1 GHz. Steps with during pre measurement was half the RBW.

Both, the Fully Anechoic Chamber (FAC) and the Semi Anechoic Chamber (SAC) fulfil the requirements of ANSI C63.4 and CISPR 16-1-4 with regards to NSA and SVSWR.

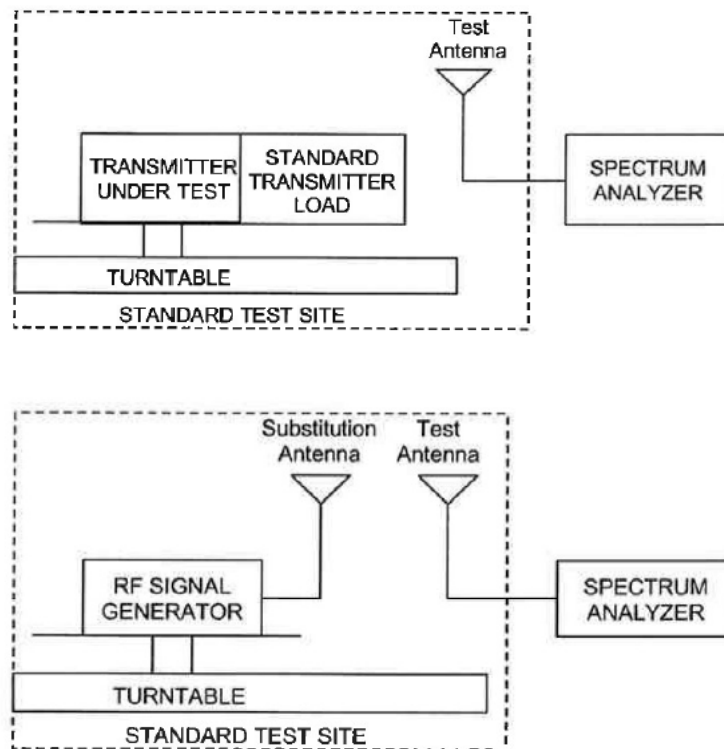


Figure #7.2 Substitution methods TIA/EIA-603-C



## 10.2 Limit

### § 90.543 Emission limitations.

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 763–768 MHz and 793–798 MHz bands must meet the emission limitations in(e) of this section.

Limit -13dBm

## 10.3 Receiver Settings

|                       | up to 1 GHz | above 1 GHz |
|-----------------------|-------------|-------------|
| Measurement bandwidth | 120 kHz     | 1 MHz       |
| Step width            | 60 kHz      | 500 kHz     |
| Dwell time            | 20ms        |             |
| Detector              | Peak        | Peak        |

## 10.4 Climatic values in the lab

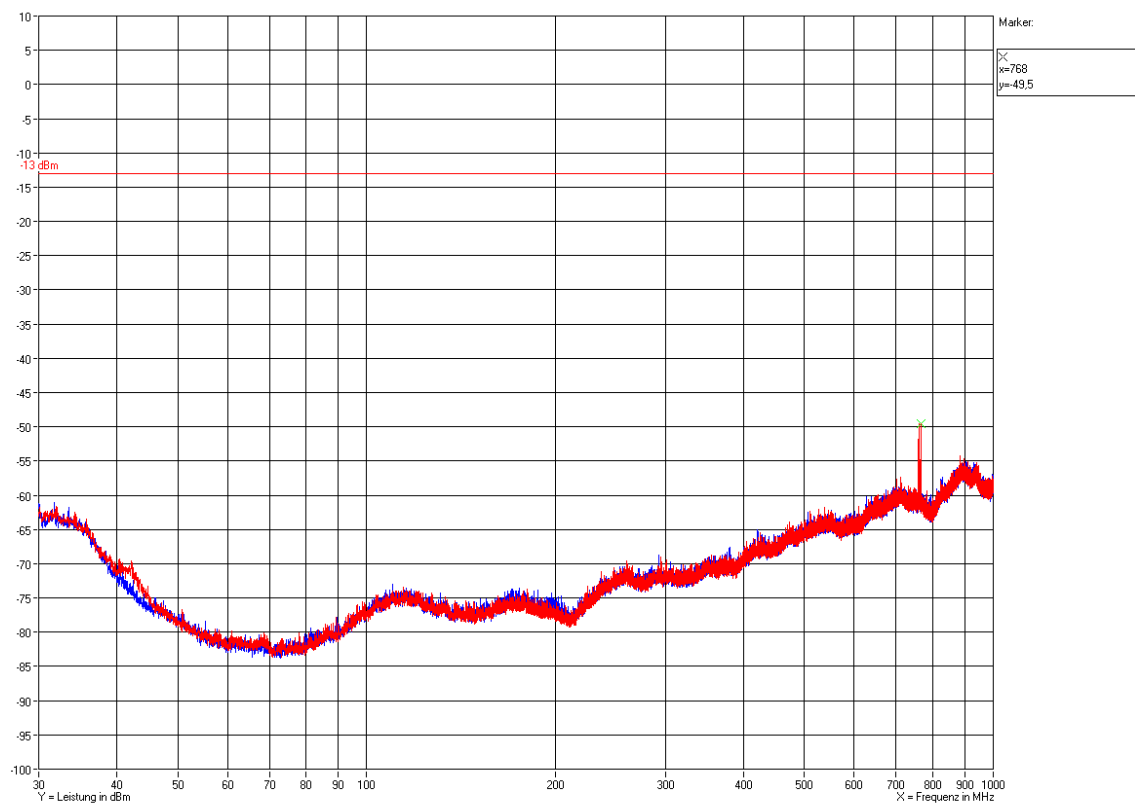
|                   |          |
|-------------------|----------|
| Temperature       | 22°C     |
| Relative Humidity | 43%      |
| Air-pressure      | 1014 hPa |

## 10.5 Test results

### 10.5.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top) Subpart H

Bottom: 758 MHz; Middle: 763 MHz; Top: 768 MHz

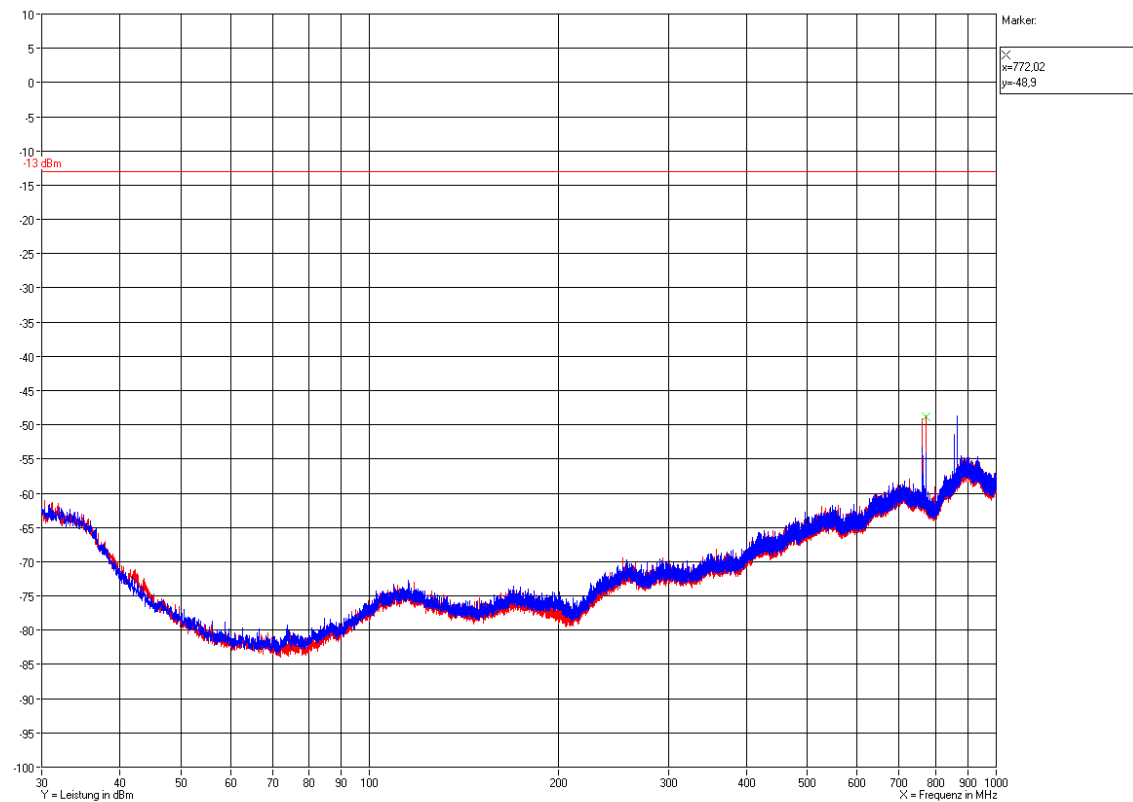
Vertikal / Horizontal



### 10.5.3 30 MHz to 1 GHz Downlink (Middle of all paths)

F1: 763 MHz; F2: 772 MHz; F3: 856.5 MHz; F4: 865.5 MHz

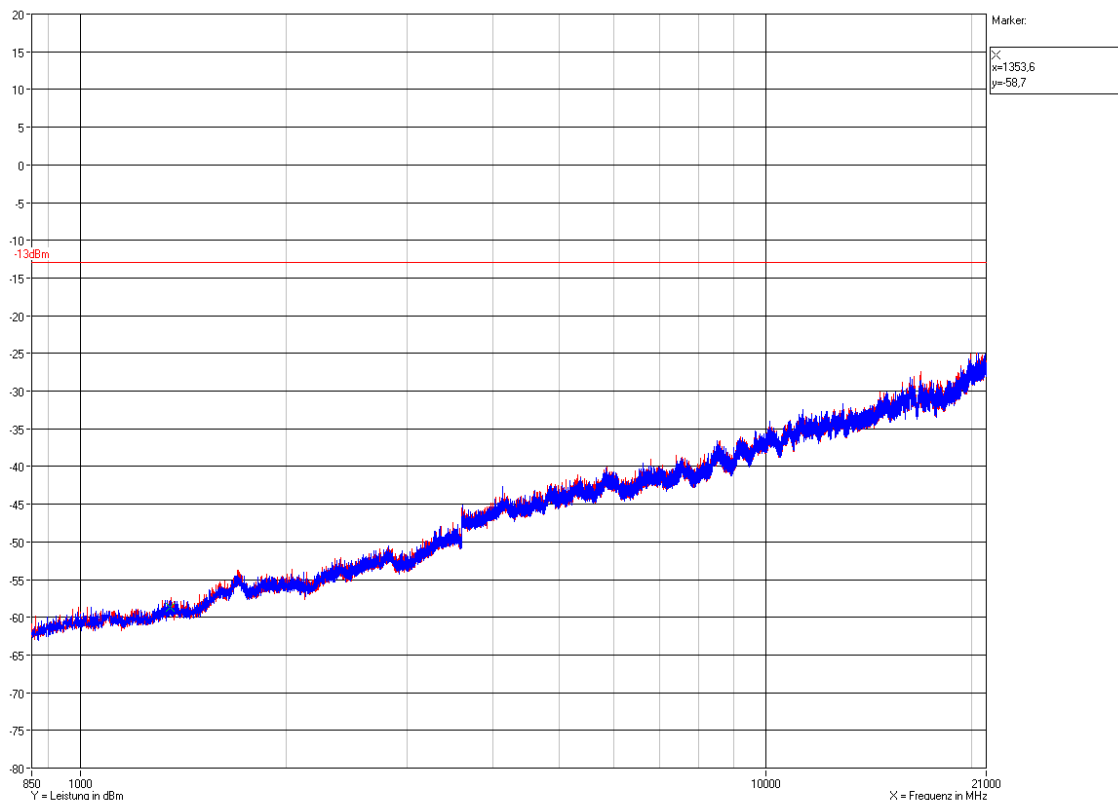
Vertikal / Horizontal



## 10.5.4 1 GHz to 21 GHz Downlink (Bottom – Middle – Top) Subpart H

Bottom: 758 MHz; Middle: 763 MHz; Top: 768 MHz

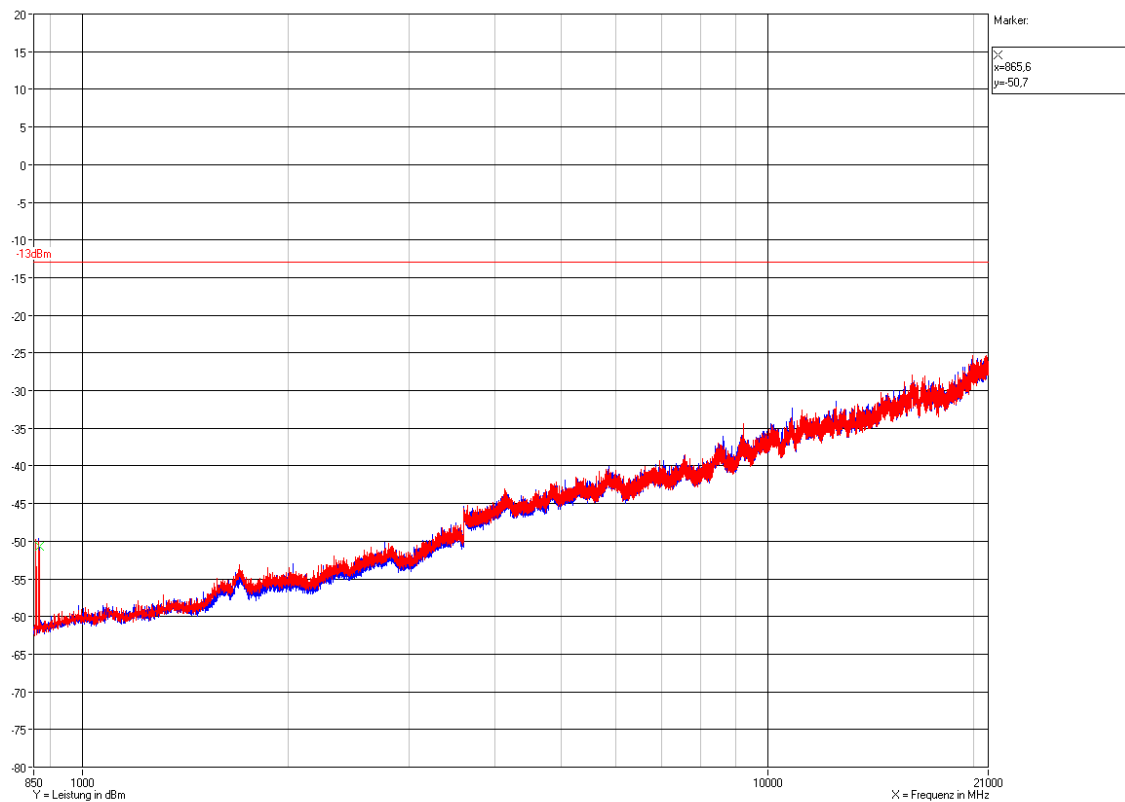
Vertikal / Horizontal



## 10.5.6 1 GHz to 22 GHz Downlink (Middle of all paths)

F1: 763 MHz; F2: 772 MHz; F3: 856.5 MHz; F4: 865.5 MHz

Vertikal / Horizontal



FEK / 12.08.2014

**The radiated spurious emission measurements have been passed!**



## 11 History

| Revision | Modification   | Date       | Name     |
|----------|----------------|------------|----------|
| 01.00    | Initial report | 11.09.2014 | Zahlmann |
|          |                |            |          |
|          |                |            |          |

\*\*\*\*\* End of test report \*\*\*\*\*