

# FCC Measurement/Technical Report on

## CAP H 17E/17E/19/19 F-AC-F1-APE

### Cellular Repeater

FCC ID: XS5-CAPH17E19  
IC: 2237E-EH17E19

**Test Report Reference:** MDE\_BVNBG\_1806\_FCCb

**Test Laboratory:**

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**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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## Applied Standards and Test Summary

### 1.1 APPLIED STANDARDS

#### **Type of Authorization**

Certification for an Industrial Signal Booster.

#### **Applicable FCC Rules**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 20, 27, (10/1/18 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 20, Commercial Mobile Services

§ 20.21 Signal Boosters

Part 27; Miscellaneous Wireless Communications Services  
Subpart C – Technical standards

§ 27.50 – Power and duty cycle limits

§ 27.53 – Emission limits

§ 27.54 – Frequency stability

The tests were selected and performed with reference to:

- FCC Public Notice 935210 applying “Signal Boosters Basic Certification Requirements” 935210 D02 v04r01, 2018-06-19.
- FCC Public Notice 935210 applying “Measurement guidance for industrial and non-consumer signal booster, repeater and amplifier devices” 935210 D05 v01r02, 2017-10-27.
- FCC Public Notice 971168 applying “Measurement guidance for certification of licensed digital transmitters” 971168 D01 v03r011, 2018-04-09
- ANSI C63.26: 2015

## Summary Test Results:

The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.

## 1.2 FCC-IC CORRELATION TABLE

### Correlation of measurement requirements for Industrial Signal Booster from FCC and ISED Canada

| Measurement                                                        | FCC reference                                   | ISED reference                                                                                                                                          |
|--------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Effective radiated power, mean output power and zone enhancer gain | §2.1046<br>§27.50<br>KDB 935210 D05 v01r02: 3.5 | RSS-GEN Issue 5, 6.12<br>RSS-139 Issue 3, 6.5<br>SRSP-513, Issue 3, 5.1.1<br>RSS-130 Issue 1, 4.4<br>SRSP-518, Issue 1, 5.1.1<br>RSS-131 Issue 3: 5.2.3 |
| Peak to Average Ratio                                              | §27.50                                          | RSS 139 Issue 3: 6.5<br>RSS-130 Issue 1, 4.4                                                                                                            |
| Occupied bandwidth<br>Input-versus-output spectrum                 | §2.1049<br>KDB 935210 D05 v01r02: 3.4           | RSS-GEN Issue 5, 6.7<br>RSS-131 Issue 3: 5.2.2                                                                                                          |
| Conducted spurious Emission at Antenna Terminal                    | §2.1051<br>§27.53                               | RSS-GEN Issue 5, 6.13<br>RSS-139 Issue 3, 6.6<br>RSS-130 Issue 1: 4.6                                                                                   |
| Out-of-band emissions limits                                       | §2.1051<br>§27.53<br>KDB 935210 D05 v01r02: 3.6 | RSS-GEN Issue 5, 6.13<br>RSS-139 Issue 3, 6.6<br>RSS-130 Issue 1: 4.6                                                                                   |
| Frequency stability                                                | §2.1055<br>§27.54                               | RSS-GEN Issue 5, 6.11<br>RSS-139 Issue 3: 6.4<br>RSS-130 Issue 1: 4.3<br>RSS-131 Issue 3: 5.2.4                                                         |
| Field strength of spurious radiation                               | §2.1053<br>§27.53                               | RSS-GEN Issue 5, 6.13<br>RSS-139 Issue 3: 6.6<br>RSS-130 Issue 1: 4.6                                                                                   |
| Out-of-band rejection                                              | KDB 935210 D05 v01r02: 3.3                      | RSS-131 Issue 3: 5.2.1                                                                                                                                  |

### 1.3 MEASUREMENT SUMMARY / SIGNATURES

#### Module 1:

#### 47 CFR CHAPTER I FCC PART 27 Subpart C §2.1046, §27.50 [Base Stations/Repeater]

Effective Radiated Power, mean output power and zone enhancer gain  
The measurement was performed according to ANSI C63.26, KDB  
935210 D05 v01r02: 3.5

#### Final Result

| OP-Mode                                             | Setup    | FCC    | IC     |
|-----------------------------------------------------|----------|--------|--------|
| Frequency Band, Direction, Input Power, Signal Type |          |        |        |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |

#### 47 CFR CHAPTER I FCC PART 27 Subpart C §27.50 [Base Stations/Repeater]

Peak to Average Ratio  
The measurement was performed according to ANSI C63.26

#### Final Result

| OP-Mode                                             | Setup    | FCC    | IC     |
|-----------------------------------------------------|----------|--------|--------|
| Frequency Band, Direction, Input Power, Signal Type |          |        |        |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |

#### 47 CFR CHAPTER I FCC PART 27 Subpart C §2.1049 [Base Stations/Repeater]

Occupied Bandwidth / Input-versus-output Spectrum  
The measurement was performed according to ANSI C63.26, KDB  
935210 D05 v01r02: 3.4

#### Final Result

| OP-Mode                                             | Setup    | FCC    | IC     |
|-----------------------------------------------------|----------|--------|--------|
| Frequency Band, Direction, Input Power, Signal Type |          |        |        |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Band 4/10/66, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |

**47 CFR CHAPTER I FCC PART 27 Subpart C**  
**[Base Stations/Repeater]**

**§2.1051, §27.53**

Conducted spurious emissions at antenna terminals

The measurement was performed according to ANSI C63.26

**Final Result**

**OP-Mode**

Frequency Band, Test Frequency, Direction, Signal Type

Band 4/10/66, high, RF downlink, Narrowband

**Setup**

S01\_AA01

**FCC**

Passed

**IC**

Passed

Band 4/10/66, high, RF downlink, Wideband

S01\_AA01

Passed

Passed

Band 4/10/66, low, RF downlink, Narrowband

S01\_AA01

Passed

Passed

Band 4/10/66, low, RF downlink, Wideband

S01\_AA01

Passed

Passed

Band 4/10/66, mid, RF downlink, Narrowband

S01\_AA01

Passed

Passed

Band 4/10/66, mid, RF downlink, Wideband

S01\_AA01

Passed

Passed

**47 CFR CHAPTER I FCC PART 27 Subpart C**  
**[Base Stations/Repeater]**

**§2.1051, § 27.53**

Out-of-band emission limits

The measurement was performed according to ANSI C63.26, KDB

935210 D05 v01r02: 3.6

**Final Result**

**OP-Mode**

Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type

Lower, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Narrowband

**Setup**

S01\_AA01

**FCC**

Passed

**IC**

Passed

Lower, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Wideband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Narrowband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Wideband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Narrowband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Wideband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Narrowband

S01\_AA01

Passed

Passed

Lower, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Wideband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Narrowband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Wideband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Narrowband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Wideband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Narrowband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Wideband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Narrowband

S01\_AA01

Passed

Passed

Upper, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Wideband

S01\_AA01

Passed

Passed

**47 CFR CHAPTER I FCC PART 27 Subpart C**  
**[Base Stations/Repeater]**

**KDB 935210 D05 v01r02: 3.3**

Out-of-band rejection

The measurement was performed according to ANSI C63.26

**Final Result**

**OP-Mode**

Frequency Band, Direction

Band 4/10/66, RF downlink

**Setup**

S01\_AA01

**FCC**

Passed

**IC**

Passed

**47 CFR CHAPTER I FCC PART 27 Subpart C**  
**[Base Stations/Repeater]**

**KDB 935210 D05 v01r02: 3.3**

Out-of-band rejection

The measurement was performed according to ANSI C63.26

**Final Result**

**OP-Mode**

Frequency Band, Direction

**Setup**

**FCC**

**IC**

**47 CFR CHAPTER I FCC PART 27 Subpart C**  
**[Base Stations/Repeater]**

**§2.1053, §27.53**

Field strength of spurious radiation

The measurement was performed according to ANSI C63.26

**Final Result**

**OP-Mode**

Frequency Band, Test Frequency, Direction

**Setup**

**FCC**

**IC**

Band 4/10/66, high, RF downlink

S01\_AA01

Passed

Passed

Band 4/10/66, low, RF downlink

S01\_AA01

Passed

Passed

Band 4/10/66, mid, RF downlink

S01\_AA01

Passed

Passed

## Module 2:

### 47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater]

§2.1046, §27.50

Effective Radiated Power, mean output power and zone enhancer gain  
The measurement was performed according to ANSI C63.26, KDB  
935210 D05 v01r02: 3.5

#### Final Result

#### OP-Mode

Frequency Band, Direction, Input Power, Signal Type  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband  
Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband  
Band 4/10/66, RF downlink, 3 dB > AGC, Wideband

#### Setup

S01\_AA01  
S01\_AA01  
S01\_AA01  
S01\_AA01

#### FCC

Passed  
Passed  
Passed  
Passed

#### IC

Passed  
Passed  
Passed  
Passed

### 47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater]

§27.50

Peak to Average Ratio  
The measurement was performed according to ANSI C63.26

#### Final Result

#### OP-Mode

Frequency Band, Direction, Input Power, Signal Type  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband  
Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband  
Band 4/10/66, RF downlink, 3 dB > AGC, Wideband

#### Setup

S01\_AA01  
S01\_AA01  
S01\_AA01  
S01\_AA01

#### FCC

Passed  
Passed  
Passed  
Passed

#### IC

Passed  
Passed  
Passed  
Passed

### 47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater]

§2.1049

Occupied Bandwidth / Input-versus-output Spectrum  
The measurement was performed according to ANSI C63.26, KDB  
935210 D05 v01r02: 3.4

#### Final Result

#### OP-Mode

Frequency Band, Direction, Input Power, Signal Type  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Narrowband  
Band 4/10/66, RF downlink, 0.3 dB < AGC, Wideband  
Band 4/10/66, RF downlink, 3 dB > AGC, Narrowband  
Band 4/10/66, RF downlink, 3 dB > AGC, Wideband

#### Setup

S01\_AA01  
S01\_AA01  
S01\_AA01  
S01\_AA01

#### FCC

Passed  
Passed  
Passed  
Passed

#### IC

Passed  
Passed  
Passed  
Passed

#### 47 CFR CHAPTER I FCC PART 27 Subpart C

§2.1051, § 27.53

##### [Base Stations/Repeater]

Out-of-band emission limits

The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r02: 3.6

##### Final Result

##### OP-Mode

Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type

##### Setup

##### FCC

##### IC

|                                                               |          |        |        |
|---------------------------------------------------------------|----------|--------|--------|
| Lower, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Lower, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 1, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 1, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Narrowband | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 2, RF downlink, 0.3 dB < AGC, Wideband   | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Narrowband   | S01_AA01 | Passed | Passed |
| Upper, Band 4/10/66, 2, RF downlink, 3 dB > AGC, Wideband     | S01_AA01 | Passed | Passed |

#### 47 CFR CHAPTER I FCC PART 27 Subpart C

KDB 935210 D05 v01r02: 3.3

##### [Base Stations/Repeater]

Out-of-band rejection

The measurement was performed according to ANSI C63.26

##### Final Result

##### OP-Mode

Frequency Band, Direction

Band 4/10/66, RF downlink

##### Setup

##### FCC

##### IC

|          |        |        |
|----------|--------|--------|
| S01_AA01 | Passed | Passed |
|----------|--------|--------|

N/A: Not applicable

N/P: Not performed

The test case frequency stability was not performed, since the EUT is not equipped with signal processing capabilities.

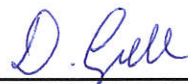
| Report version control |              |                    |                  |
|------------------------|--------------|--------------------|------------------|
| Version                | Release date | Change Description | Version validity |
| initial                | 2019-01-31   | --                 | valid            |



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(responsible for accreditation scope)  
Dipl.-Ing. Marco Kullik



(responsible for testing and report)  
Dipl.-Ing. Daniel Gall

## 2 ADMINISTRATIVE DATA

### 2.1 TESTING LABORATORY

Company Name: 7layers GmbH  
Address: Borsigstr. 11  
40880 Ratingen  
Germany

This facility has been fully described in a report submitted to the ISED and accepted under the registration number: Site# 3699A-1.

The test facility is also accredited by the following accreditation organisation:

Laboratory accreditation no: DAKKS D-PL-12140-01-00  
FCC Designation Number: DE0015  
FCC Test Firm Registration: 929146  
Responsible for accreditation scope: Dipl.-Ing. Marco Kullik  
Report Template Version: 2018-01-03

### 2.2 PROJECT DATA

Responsible for testing and report: Dipl.-Ing. Daniel Gall  
Employees who performed the tests: documented internally at 7Layers  
Date of Report: 2019-01-31  
Testing Period: 2019-01-09 to 2019-01-22

### 2.3 APPLICANT DATA

Company Name: Commscope  
Andrew Wireless Systems GmbH  
Address: Industriering 10  
86675 Buchdorf  
Germany  
Contact Person: Mr. Frank Futter

### 2.4 MANUFACTURER DATA

Company Name: please see applicant data

### 3 TEST OBJECT DATA

#### 3.1 GENERAL EUT DESCRIPTION

|                                          |                                                                                                                                                                                                                                         |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kind of Device<br>product description    | Cellular Repeater                                                                                                                                                                                                                       |
| Product name                             | Carrier Access Point with 4-Band Support for High Power AWS 1700 and PCS 1900 MIMO Applications                                                                                                                                         |
| Type                                     | CAP H 17E/17E/19/19 F-AC-F1-APE                                                                                                                                                                                                         |
| <b>Declared EUT data by the supplier</b> |                                                                                                                                                                                                                                         |
| General Product<br>Description           | The EUT is an industrial signal booster supporting the following bands:<br>Band 4 / AWS-1<br>Band 10 / AWS-1+<br>Band 66 / AWS-3 (partly)<br>Band 2 / 1900 PCS<br>Band 25 / 1900+<br>A RF operation is only supported for the downlink. |
| Booster Type                             | Industrial Signal Booster                                                                                                                                                                                                               |
| Voltage Type                             | AC                                                                                                                                                                                                                                      |
| Voltage Level                            | 100 – 240 V, 50 – 60 Hz                                                                                                                                                                                                                 |
| Maximum Output<br>Donor Port [Uplink]    | -                                                                                                                                                                                                                                       |
| Maximum Output<br>Server Port [Downlink] | Band 4/10/66 [Module 1]: 43.0 dBm<br>Band 4/10/66 [Module 2]: 43.0 dBm                                                                                                                                                                  |
| Maximum Gain [Uplink]                    | -                                                                                                                                                                                                                                       |
| Maximum Gain<br>[Downlink]               | -                                                                                                                                                                                                                                       |

The main components of the EUT are listed and described in chapter 3.2 EUT Main components.

#### 3.2 EUT MAIN COMPONENTS

| Sample Name      | Sample Code                      | Description |
|------------------|----------------------------------|-------------|
| aa01             | DE1277007aa01                    | FCC sample  |
| Sample Parameter | Value                            |             |
| Serial Number    | BGCHCA1846001                    |             |
| HW Version       | CAP H 17E/17E/19/19 7825730-0001 |             |
| SW Version       | V1.0.0.1266                      |             |
| Comment          | -                                |             |

NOTE: The short description is used to simplify the identification of the EUT in this test report.

### 3.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

| Device | Details<br>(Manufacturer, Type Model, OUT Code) | Description |
|--------|-------------------------------------------------|-------------|
| -      | -                                               | -           |

### 3.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

| Device | Details<br>(Manufacturer, HW, SW, S/N) | Description |
|--------|----------------------------------------|-------------|
| -      | --                                     | -           |

### 3.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

| Setup    | Combination of EUTs | Description and Rationale |
|----------|---------------------|---------------------------|
| S01_AA01 | aa01                | Setup for all tests       |

### 3.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

#### 3.6.1 TEST CHANNELS

| Band    | Direction | Lower Frequency Band Edge [MHz] | Upper Frequency Band Edge [MHz] | Center Frequency [MHz] | Port             |
|---------|-----------|---------------------------------|---------------------------------|------------------------|------------------|
| 4/10/66 | downlink  | 2110.00                         | 2180.00                         | 2145.00                | Donor [Module 1] |
| 4/10/66 | downlink  | 2110.00                         | 2180.00                         | 2145.00                | Donor [Module 2] |

#### 3.6.2 AUTOMATIC GAIN CONTROL LEVELS

| AGC Levels [Module 1] |           |             |                     |                             |                           |                 |            |
|-----------------------|-----------|-------------|---------------------|-----------------------------|---------------------------|-----------------|------------|
| Band                  | Direction | Signal Type | AGC Start Pin [dBm] | AGC Start Pin -0.3 dB [dBm] | AGC Start Pin +3 dB [dBm] | Frequency [MHz] | Frequency  |
| 4/10/66               | downlink  | Narrowband  | -1.2                | -1.5                        | 1.8                       | 2145.0          | Center     |
| 4/10/66               | downlink  | Wideband    | -0.4                | -0.7                        | 2.6                       | 2145.0          |            |
| 4/10/66               | downlink  | Narrowband  | 2.0                 | 1.7                         | 5.0                       | 2110.0          | Low        |
| 4/10/66               | downlink  | Wideband    | 2.2                 | 1.9                         | 5.2                       | 2110.0          |            |
| 4/10/66               | downlink  | Narrowband  | 2.8                 | 2.5                         | 5.8                       | 2180.0          | High       |
| 4/10/66               | downlink  | Wideband    | 1.8                 | 1.5                         | 4.8                       | 2180.0          |            |
| 4/10/66               | downlink  | Narrowband  | -1.2                | -1.5                        | 1.8                       | 2147.1          | Max. Power |
| 4/10/66               | downlink  | Wideband    | -0.4                | -0.7                        | 2.6                       | 2147.1          |            |

| AGC Levels [Module 2] |           |             |                     |                             |                           |                 |            |
|-----------------------|-----------|-------------|---------------------|-----------------------------|---------------------------|-----------------|------------|
| Band                  | Direction | Signal Type | AGC Start Pin [dBm] | AGC Start Pin -0.3 dB [dBm] | AGC Start Pin +3 dB [dBm] | Frequency [MHz] | Frequency  |
| 4/10/66               | downlink  | Narrowband  | -1.0                | -1.3                        | 2.0                       | 2145.0          | Center     |
| 4/10/66               | downlink  | Wideband    | -0.8                | -1.1                        | 2.2                       | 2145.0          |            |
| 4/10/66               | downlink  | Narrowband  | 2.2                 | 1.9                         | 5.2                       | 2110.0          | Low        |
| 4/10/66               | downlink  | Wideband    | 3.2                 | 2.9                         | 6.2                       | 2110.0          |            |
| 4/10/66               | downlink  | Narrowband  | 2.4                 | 2.1                         | 5.4                       | 2180.0          | High       |
| 4/10/66               | downlink  | Wideband    | 2.6                 | 2.3                         | 5.6                       | 2180.0          |            |
| 4/10/66               | downlink  | Narrowband  | -1.4                | -1.7                        | 1.6                       | 2147.3          | Max. Power |
| 4/10/66               | downlink  | Wideband    | -0.8                | -1.1                        | 2.2                       | 2147.3          |            |

### 3.7 PRODUCT LABELLING

#### 3.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

#### 3.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

## 4 TEST RESULTS

### 4.1 EFFECTIVE RADIATED POWER, MEAN OUTPUT POWER AND ZONE ENHANCER GAIN

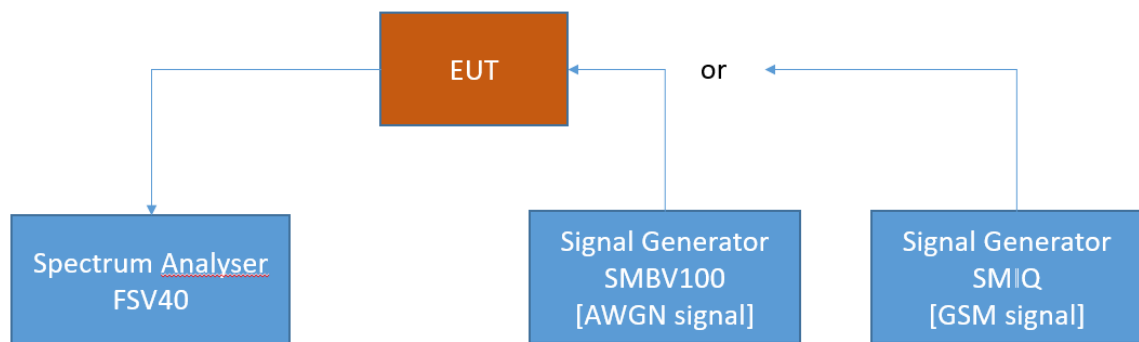
Standard FCC Part 27, §27.50

**The test was performed according to:**  
ANSI C63.26, KDB 935210 D05 v01r02: 3.5

#### 4.1.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

#### 4.1.2 TEST REQUIREMENTS / LIMITS

##### Part 27; Miscellaneous Wireless Communication Services

##### Subpart C – Technical standards

##### § 27.50

##### Band 13:

(2) Fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are

permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

(3) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts ERP in accordance with Table 2 of this section.

(4) Fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

(5) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section.

(6) Licensees of fixed or base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands at an ERP greater than 1000 watts must comply with the provisions set forth in paragraph (b)(8) of this section and §27.55(c).

#### **Band 12:**

c) The following power and antenna height requirements apply to stations transmitting in the 600 MHz band and the 698-746 MHz band:

(1) Fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section;

(2) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts ERP in accordance with Table 2 of this section;

(3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;

(4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section;

**Band 4/10/66:**

d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 3280 watts when transmitting with an emission bandwidth of 1 MHz or less;

(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;

(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(3) A licensee operating a base or fixed station in the 2110-2155 MHz band utilizing a power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025-2110 MHz band. A licensee operating a base or fixed station in the 2110-2180 MHz band utilizing power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must be coordinated in advance with the following licensees authorized to operate within 120 kilometers (75 miles) of the base or fixed station operating in this band: All Broadband Radio Service (BRS) licensees authorized under this part in the 2155-2160 MHz band and all advanced wireless services (AWS) licensees authorized to operate on adjacent frequency blocks in the 2110-2180 MHz band.

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(6) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

## **RSS-130; 4.4 Transmitter Output Power and Equivalent Isotropically Radiated Power (e.i.r.p.)**

The transmitter output power shall be measured in terms of average power.

For base and fixed equipment, refer to SRSP-518 for power limits

### **SRSP-518**

#### **5.1 Radiated Power and Antenna Height Limits**

##### **5.1.1 Fixed and base stations**

5.1.1.1 For fixed and base stations transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts with an antenna height above average terrain (HAAT)<sup>Footnote 3</sup> up to 305 metres. The same e.i.r.p. limit also applies to fixed and base stations operating at any frequency in the 700 MHz band in accordance with Section 4.1.4.

5.1.1.2 For fixed and base stations transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with a HAAT up to 305 metres. The same e.i.r.p. limit also applies to fixed and base stations operating at any frequency in the 700 MHz band in accordance with Section 4.1.4.

5.1.1.3 Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres<sup>Footnote 4</sup> and transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 metres.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector's coverage<sup>Footnote 5</sup> is located outside these large and medium population centres.

Fixed and base stations with increased e.i.r.p. must not be used to provide coverage to large and medium population centres. However, some incidental coverage of these large and medium population centres by stations with increased e.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. e.i.r.p. may be increased up to a maximum of 3280 watts).

5.1.1.4 For all installations with an antenna HAAT in excess of 305 metres, a corresponding reduction in e.i.r.p. according to the following formula shall be applied:

$$\text{EIRP}_{\text{reduction}} = 20 \log_{10}(\text{HAAT}/305) \text{ dB}$$

## **RSS-139; 6.5 Transmitter Output Power**

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110-2180 MHz.

## SRSP-513

### 5.1 Radiated Power and Antenna Height Limits

#### 5.1.1 Fixed and Base Stations

5.1.1.1 For fixed and base stations operating within the frequency range 2110-2180 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts with an antenna height above average terrain (HAAT)Footnote 4 up to 300 metres.

5.1.1.2 For fixed and base stations operating within the frequency range 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz e.i.r.p. (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres.

5.1.1.3 Fixed and base stations located in geographic areas at a distance greater than 26 km from large or medium population centres,Footnote 5 and transmitting within the frequency range 2110-2180 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 300 metres.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector's coverageFootnote 6 is located outside these large and medium population centres.

Fixed and base stations with increased e.i.r.p. must not be used to provide coverage to large and medium population centres. However, some incidental coverage of these large and medium population centres by stations with increased e.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. the e.i.r.p. may be increased up to a maximum of 3280 watts).

5.1.1.4 Fixed and base station antenna heights above average terrain may exceed 300 metres with a reduction in e.i.r.p. The maximum permissible e.i.r.p. for installations with antenna HAAT in excess of 300 metres is given in the following table:

Table 2 — Reduction to Maximum Allowable E.I.R.P. for HAAT > 300 m

| HAAT (in metres)   | Maximum e.i.r.p. (watts or watts per MHz <sup>a</sup> ) |
|--------------------|---------------------------------------------------------|
| HAAT ≤ 300         | 1640 (or 3280 <sup>b</sup> )                            |
| 300 < HAAT ≤ 500   | 1070                                                    |
| 500 < HAAT ≤ 1000  | 490                                                     |
| 1000 < HAAT ≤ 1500 | 270                                                     |
| 1500 < HAAT ≤ 2000 | 160                                                     |

Notes:

a Depending on the channel bandwidth: watts if less than 1 MHz bandwidth or else watts per MHz.

b If Section 5.1.1.3 applies.

|                    |                              |
|--------------------|------------------------------|
| HAAT ≤ 300         | 1640 (or 3280 <sup>b</sup> ) |
| 300 < HAAT ≤ 500   | 1070                         |
| 500 < HAAT ≤ 1000  | 490                          |
| 1000 < HAAT ≤ 1500 | 270                          |
| 1500 < HAAT ≤ 2000 | 160                          |

5.1.1.5 Fixed or base stations transmitting in the lower sub-band (1710-1780 MHz) shall comply with the power limits set forth in Section 5.1.2.

#### 4.1.3 TEST PROTOCOL

| Band 4 / 10 / 66, downlink [Module 1] |              |                 |                   |                                    |                                  |                      |           |
|---------------------------------------|--------------|-----------------|-------------------|------------------------------------|----------------------------------|----------------------|-----------|
| Signal Type                           | Input Power  | Frequency [MHz] | Input Power [dBm] | Maximum Average Output Power [dBm] | Limit Average Output Power [dBm] | Margin to Limit [dB] | Gain [dB] |
| Wideband                              | 0.3 dB < AGC | 2147.100        | -0.7              | 42.3                               | 60.0                             | 17.7                 | 43.0      |
| Wideband                              | 3 dB > AGC   | 2147.100        | 2.6               | 42.3                               | 60.0                             | 17.7                 | 39.7      |
| Narrowband                            | 0.3 dB < AGC | 2147.100        | -1.5              | 42.2                               | 60.0                             | 17.8                 | 43.7      |
| Narrowband                            | 3 dB > AGC   | 2147.100        | 1.8               | 42.2                               | 60.0                             | 17.8                 | 40.4      |

| Band 4 / 10 / 66, downlink [Module 2] |              |                 |                   |                                    |                                  |                      |           |
|---------------------------------------|--------------|-----------------|-------------------|------------------------------------|----------------------------------|----------------------|-----------|
| Signal Type                           | Input Power  | Frequency [MHz] | Input Power [dBm] | Maximum Average Output Power [dBm] | Limit Average Output Power [dBm] | Margin to Limit [dB] | Gain [dB] |
| Wideband                              | 0.3 dB < AGC | 2147.300        | -1.1              | 42.4                               | 60.0                             | 17.6                 | 43.5      |
| Wideband                              | 3 dB > AGC   | 2147.300        | 2.2               | 42.5                               | 60.0                             | 17.5                 | 40.3      |
| Narrowband                            | 0.3 dB < AGC | 2147.300        | -1.7              | 42.4                               | 60.0                             | 17.6                 | 44.2      |
| Narrowband                            | 3 dB > AGC   | 2147.300        | 1.6               | 42.3                               | 60.0                             | 17.7                 | 40.7      |

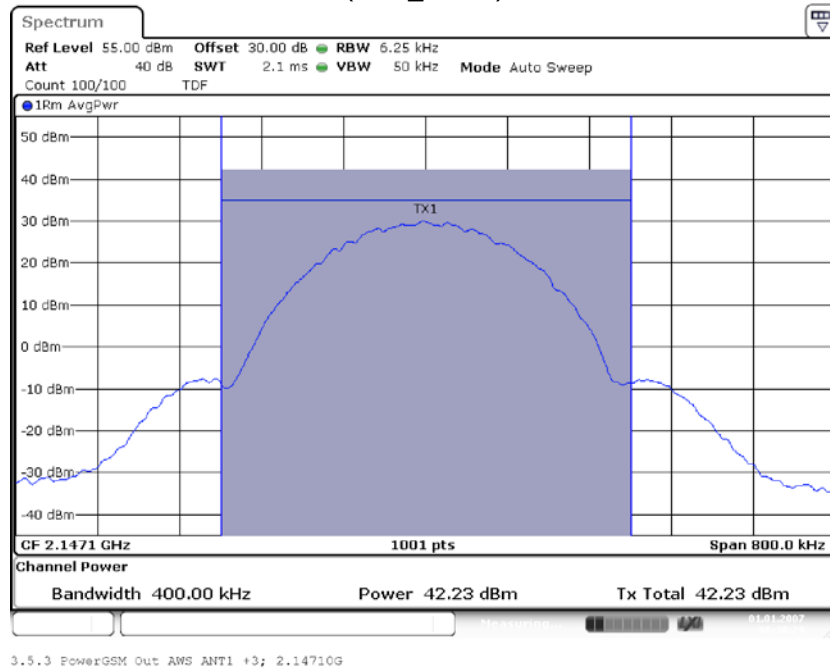
| Band 4 / 10 / 66, downlink, Composite Power Module 1 & Module 2 [MIMO] |              |                      |                      |                            |                            |                                             |                                             |                                              |                                  |                      |
|------------------------------------------------------------------------|--------------|----------------------|----------------------|----------------------------|----------------------------|---------------------------------------------|---------------------------------------------|----------------------------------------------|----------------------------------|----------------------|
| Signal Type                                                            | Input Power  | Freq. Module 1 [MHz] | Freq. Module 2 [MHz] | Input Power Module 1 [dBm] | Input Power Module 2 [dBm] | Maximum Average Output Power Module 1 [dBm] | Maximum Average Output Power Module 2 [dBm] | Maximum Average Composite Output Power [dBm] | Limit Average Output Power [dBm] | Margin to Limit [dB] |
| WB                                                                     | 0.3 dB < AGC | 2147.100             | 2147.300             | -0.7                       | -1.1                       | 42.3                                        | 42.4                                        | 45.4                                         | 60.0                             | 14.6                 |
| WB                                                                     | 3 dB > AGC   | 2147.100             | 2147.300             | 2.6                        | 2.2                        | 42.3                                        | 42.5                                        | 45.4                                         | 60.0                             | 14.6                 |
| NB                                                                     | 0.3 dB < AGC | 2147.100             | 2147.300             | -1.5                       | -1.7                       | 42.2                                        | 42.4                                        | 45.3                                         | 60.0                             | 14.7                 |
| NB                                                                     | 3 dB > AGC   | 2147.100             | 2147.300             | 1.8                        | 1.6                        | 42.2                                        | 42.3                                        | 45.3                                         | 60.0                             | 14.7                 |

Remark: Please see next sub-clause for the measurement plot.

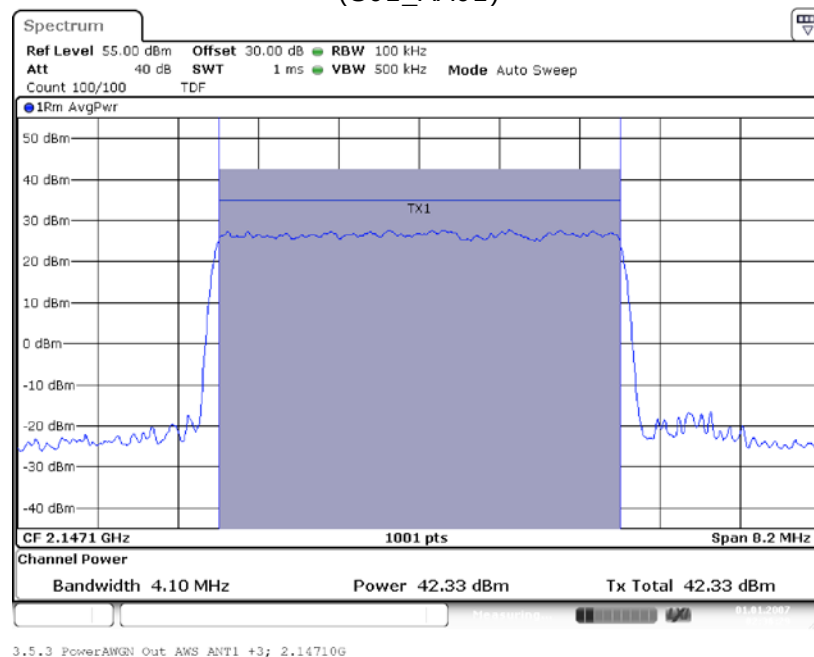
#### 4.1.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

##### MODULE 1:

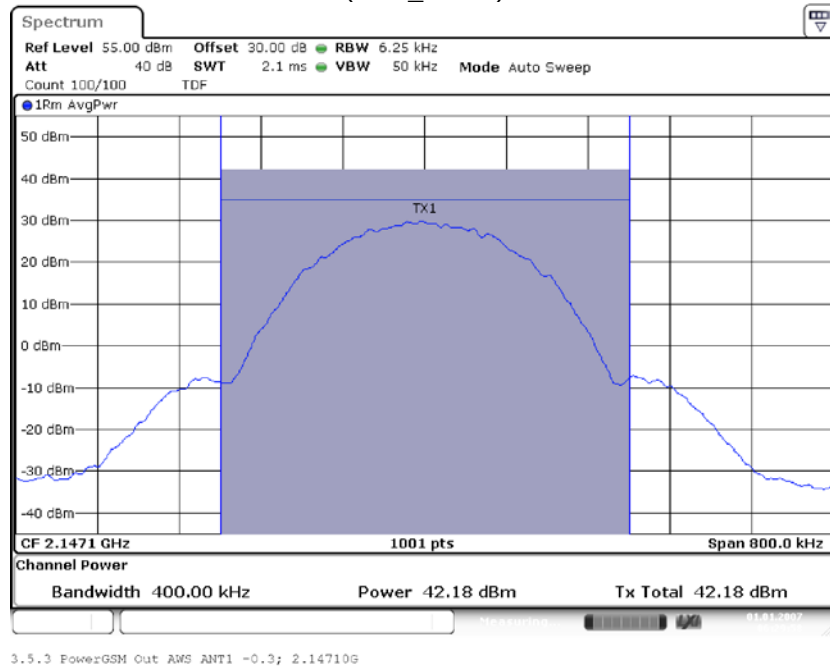
Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband  
(S01\_AA01)



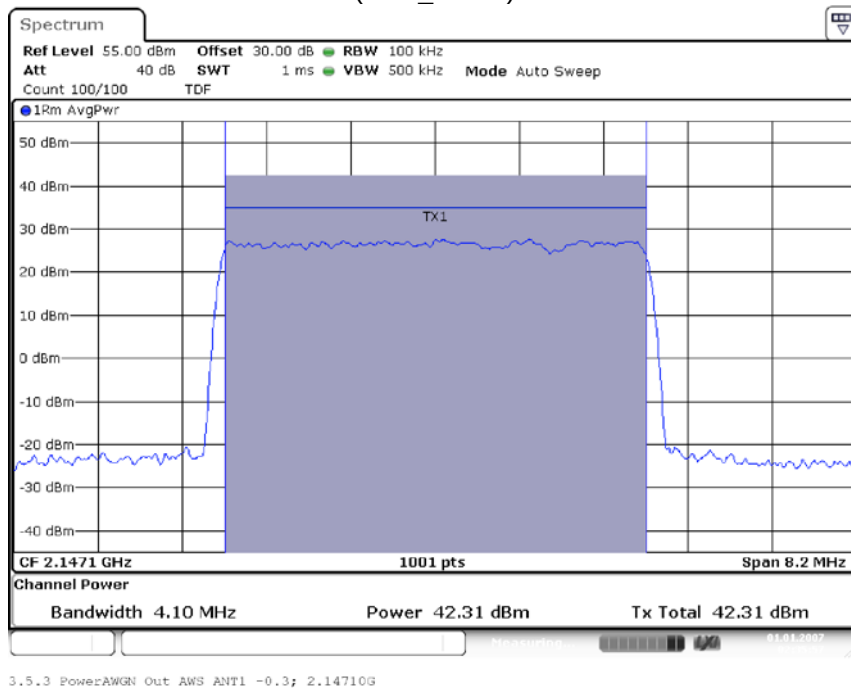
Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband  
(S01\_AA01)



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Narrowband  
(S01\_AA01)

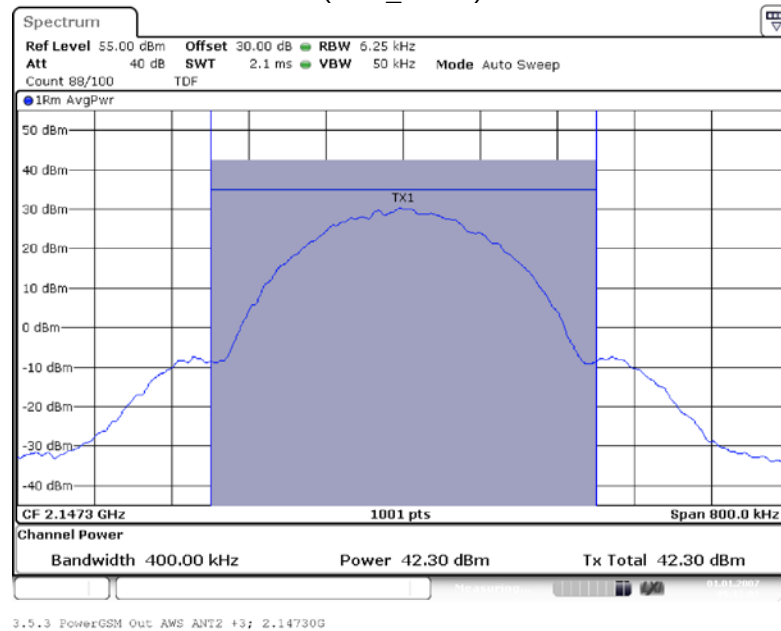


Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Wideband  
(S01\_AA01)

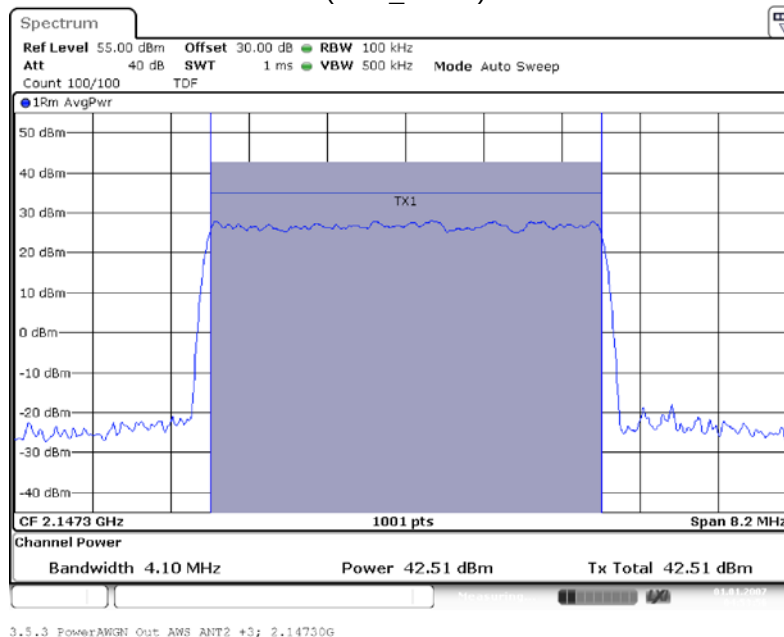


## MODULE 2:

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband  
(S01\_AA01)



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband  
(S01\_AA01)





## 4.2 PEAK TO AVERAGE RATIO

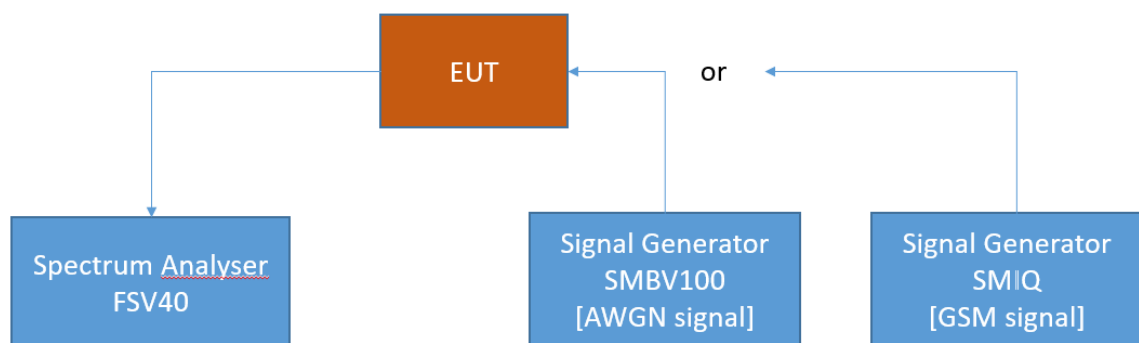
Standard FCC Part 27, §27.50

**The test was performed according to:**  
ANSI C63.26

### 4.2.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

### 4.2.2 TEST REQUIREMENTS / LIMITS

#### Part 27; Miscellaneous Wireless Communication Services

##### Subpart C – Technical standards

##### § 27.50

For the bands 4, 12, 13 exist no FCC peak-to-average power ratio (PAPR) limit.

#### **RSS-130; 4.4 Transmitter Output Power and Equivalent Isotropically Radiated Power (e.i.r.p.)**

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

## RSS-139; 6.5 Transmitter Output Power

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.

### 4.2.3 TEST PROTOCOL

| Band 4 / 10 / 66, downlink [Module 1] |              |                 |                   |           |                 |                      |
|---------------------------------------|--------------|-----------------|-------------------|-----------|-----------------|----------------------|
| Signal Type                           | Input Power  | Frequency [MHz] | Input Power [dBm] | PAPR [dB] | Limit PAPR [dB] | Margin to Limit [dB] |
| Wideband                              | 0.3 dB < AGC | 2147.100        | -0.7              | 8.8       | 13.0            | 4.2                  |
| Wideband                              | 3 dB > AGC   | 2147.100        | 1.8               | 8.8       | 13.0            | 4.2                  |
| Narrowband                            | 0.3 dB < AGC | 2147.100        | -1.5              | 0.2       | 13.0            | 12.8                 |
| Narrowband                            | 3 dB > AGC   | 2147.100        | 1.8               | 0.3       | 13.0            | 12.7                 |

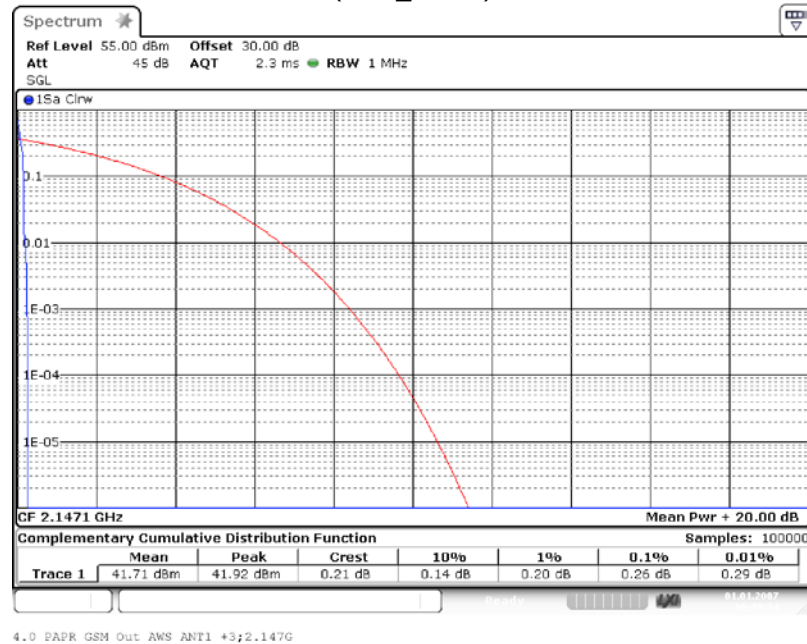
| Band 4 / 10 / 66, downlink [Module 2] |              |                 |                   |           |                 |                      |
|---------------------------------------|--------------|-----------------|-------------------|-----------|-----------------|----------------------|
| Signal Type                           | Input Power  | Frequency [MHz] | Input Power [dBm] | PAPR [dB] | Limit PAPR [dB] | Margin to Limit [dB] |
| Wideband                              | 0.3 dB < AGC | 2147.300        | -1.1              | 8.9       | 13.0            | 4.1                  |
| Wideband                              | 3 dB > AGC   | 2147.300        | 2.2               | 8.8       | 13.0            | 4.2                  |
| Narrowband                            | 0.3 dB < AGC | 2147.300        | -1.3              | 0.3       | 13.0            | 12.7                 |
| Narrowband                            | 3 dB > AGC   | 2147.300        | 2.0               | 0.2       | 13.0            | 12.8                 |

Remark: Please see next sub-clause for the measurement plot.

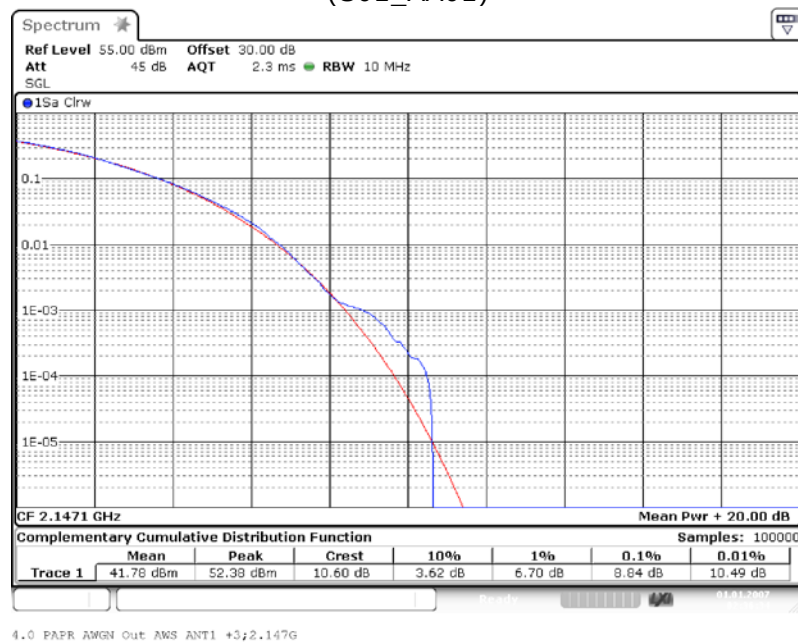
#### 4.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

##### MODULE 1:

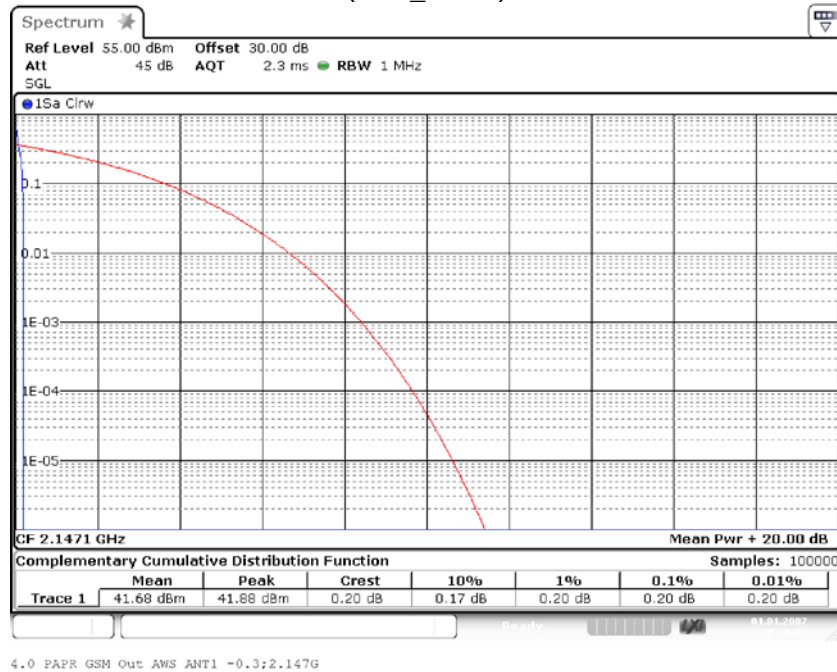
Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



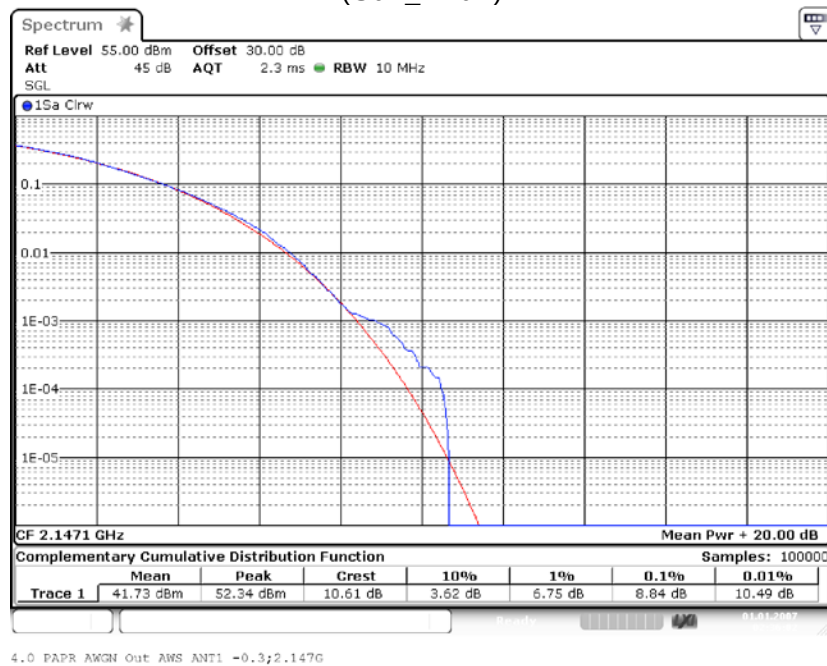
Frequency Band = Band 4/10/66, Direction = RF downlink, , Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Narrowband  
(S01\_AA01)

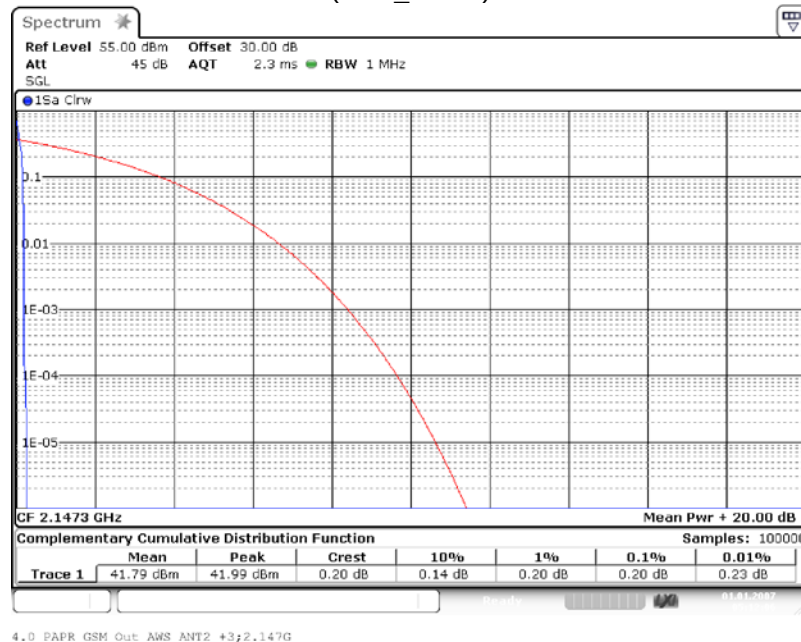


Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Wideband  
(S01\_AA01)

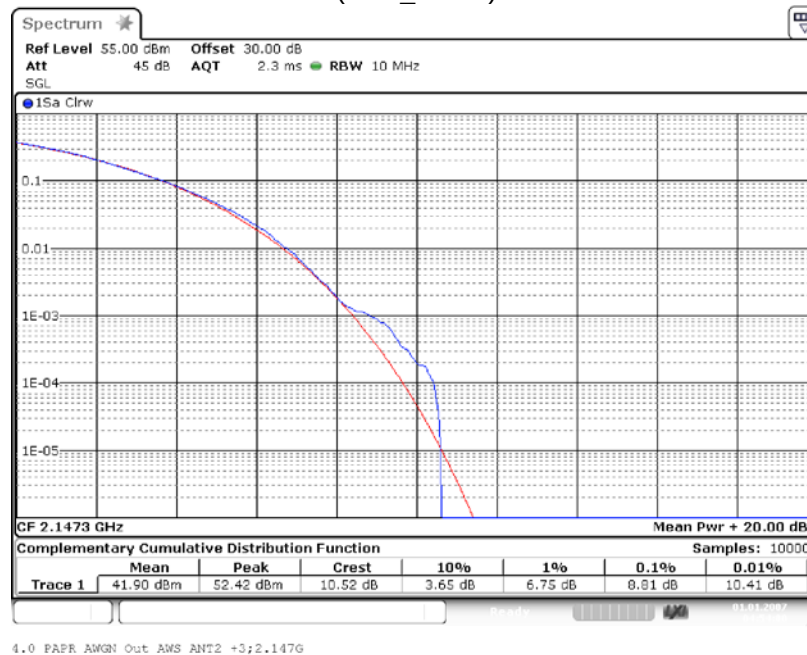


## MODULE 2:

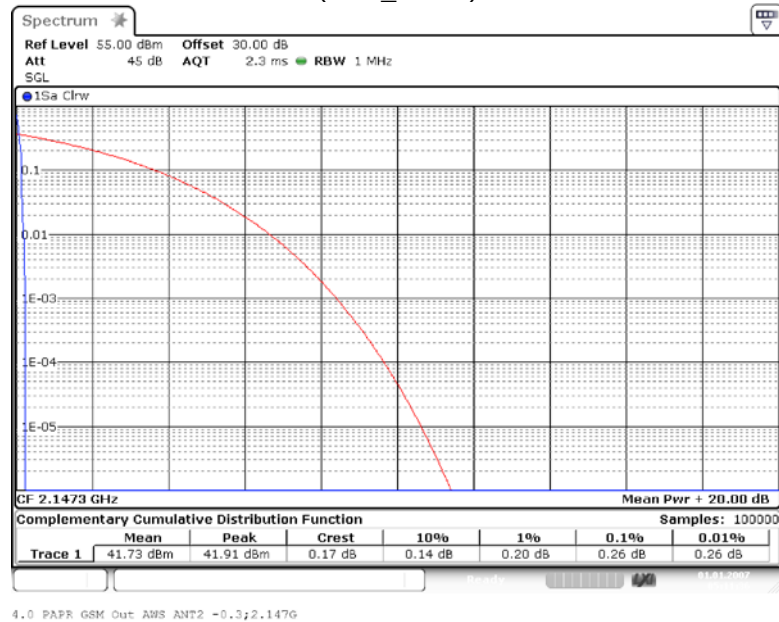
Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



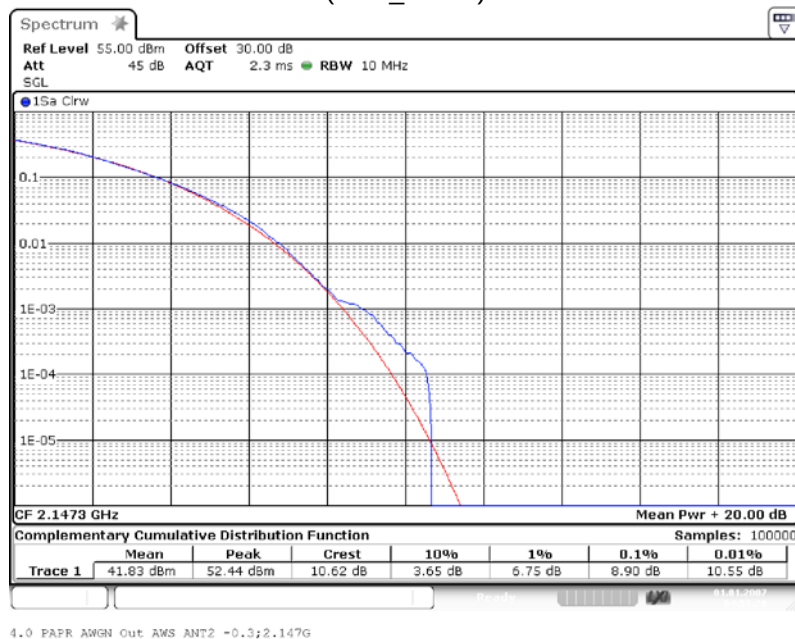
Frequency Band = Band 4/10/66, Direction = RF downlink, , Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Narrowband  
(S01\_AA01)



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Wideband  
(S01\_AA01)



#### 4.2.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

### 4.3 OCCUPIED BANDWIDTH / INPUT-VERSUS-OUTPUT SPECTRUM

Standard FCC Part 2.1049; Occupied Bandwidth

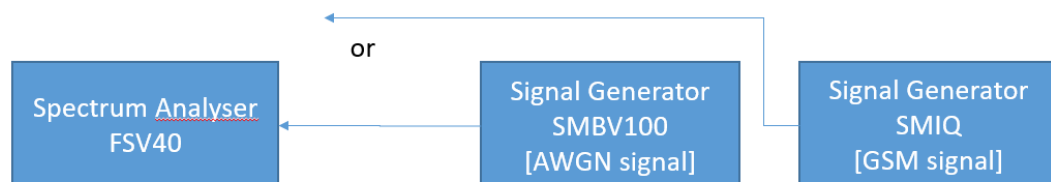
**The test was performed according to:**

ANSI C63.26, KDB 935210 D05 v01r02: 3.4

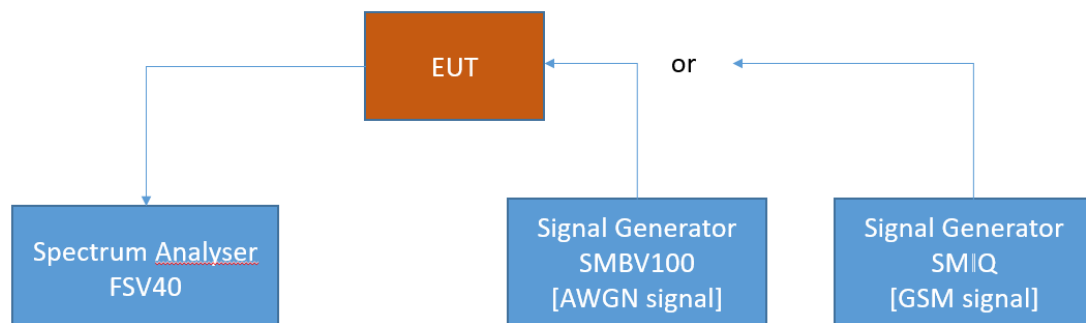
#### 4.3.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission limits per FCC §2.1049, RSS-GEN 6.4 and RSS-131-5.2.2

The EUT was connected to the test setups according to the following diagram:



FCC Part 22/24/27/90; Industrial Signal Booster  
Test Setup step 1: Measuring characteristics of test signals



FCC Part 22/24/27/90; Industrial Signal Booster  
Test Setup step 2; Occupied Bandwidth/Input-versus-output spectrum

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

#### 4.3.2 TEST REQUIREMENTS / LIMITS

##### **FCC Part 2.1049; Occupied Bandwidth:**

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 0.3 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

### **RSS-GEN; 6.6 Occupied Bandwidth**

The emission bandwidth ( $\times$ dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated  $\times$  dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least  $3\times$  the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately  $3\times$ RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.3% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the 99% occupied bandwidth.

### RSS-131; 5.2.2 Input-versus-output spectrum

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

#### 4.3.3 TEST PROTOCOL

| Band 4 / 10 / 66, downlink [Module 1] |              |                        |                             |                                  |                                |                                      |                       |
|---------------------------------------|--------------|------------------------|-----------------------------|----------------------------------|--------------------------------|--------------------------------------|-----------------------|
| Signal Type                           | Input Power  | Signal Frequency [MHz] | Occupied Bandwidth SG [kHz] | Occupied Bandwidth Booster [kHz] | Delta Occupied Bandwidth [kHz] | Limit Delta Occupied Bandwidth [kHz] | Margin to Limit [kHz] |
| Wideband                              | 0.3 dB < AGC | 2145.00                | 4327.9                      | 4329.2                           | 1.3                            | 205.0                                | 203.7                 |
| Wideband                              | 3 dB > AGC   | 2145.00                | 4327.9                      | 4329.2                           | 1.3                            | 205.0                                | 203.7                 |
| Narrowband                            | 0.3 dB < AGC | 2145.00                | 314.6                       | 314.1                            | 0.5                            | 10.0                                 | 9.5                   |
| Narrowband                            | 3 dB > AGC   | 2145.00                | 315.8                       | 314.9                            | 1.0                            | 10.0                                 | 9.0                   |

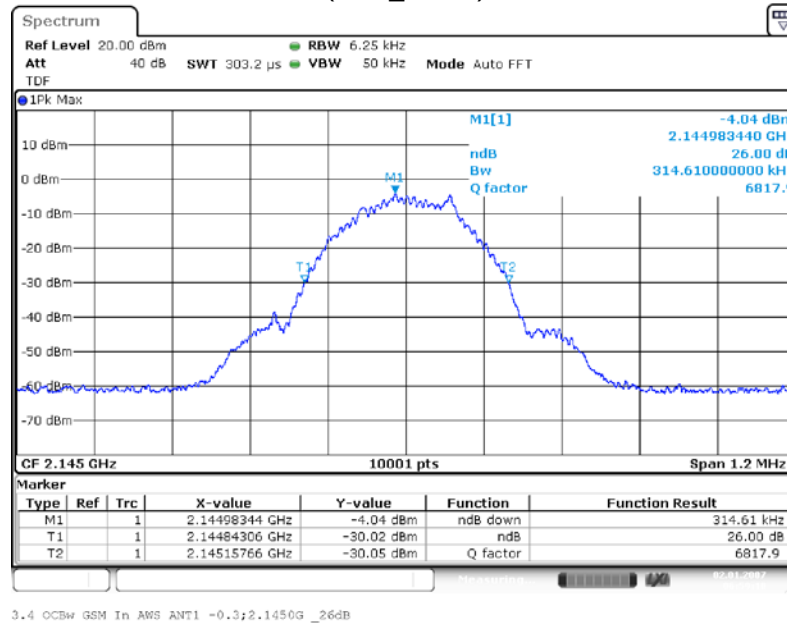
| Band 4 / 10 / 66, downlink [Module 2] |              |                        |                             |                                  |                                |                                      |                       |
|---------------------------------------|--------------|------------------------|-----------------------------|----------------------------------|--------------------------------|--------------------------------------|-----------------------|
| Signal Type                           | Input Power  | Signal Frequency [MHz] | Occupied Bandwidth SG [kHz] | Occupied Bandwidth Booster [kHz] | Delta Occupied Bandwidth [kHz] | Limit Delta Occupied Bandwidth [kHz] | Margin to Limit [kHz] |
| Wideband                              | 0.3 dB < AGC | 2145.00                | 4327.9                      | 4327.9                           | 0.0                            | 205.0                                | 205.0                 |
| Wideband                              | 3 dB > AGC   | 2145.00                | 4326.7                      | 4327.9                           | 1.2                            | 205.0                                | 203.8                 |
| Narrowband                            | 0.3 dB < AGC | 2145.00                | 311.0                       | 311.0                            | 0.0                            | 10.0                                 | 10.0                  |
| Narrowband                            | 3 dB > AGC   | 2145.00                | 313.3                       | 314.7                            | 1.4                            | 10.0                                 | 8.6                   |

Remark: Please see next sub-clause for the measurement plot.

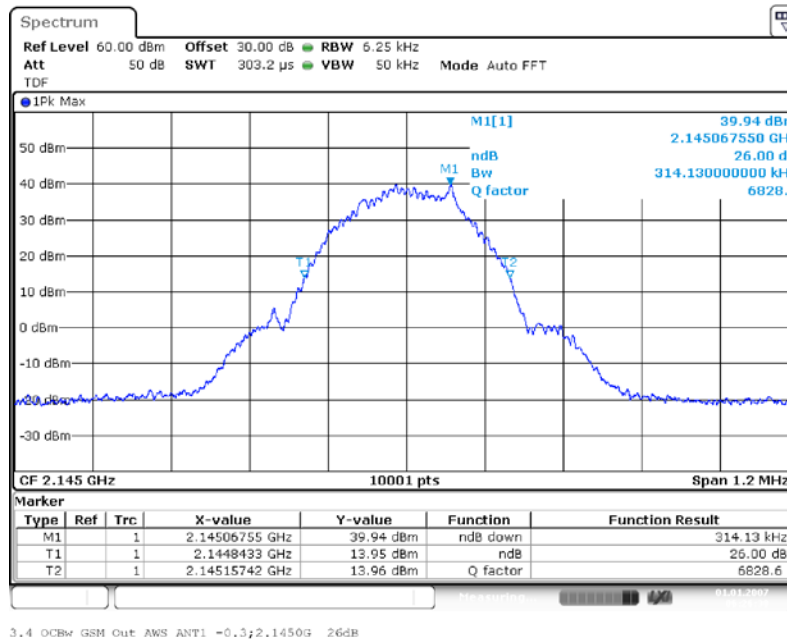
#### 4.3.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

##### MODULE 1:

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Narrowband  
(S01\_AA01)

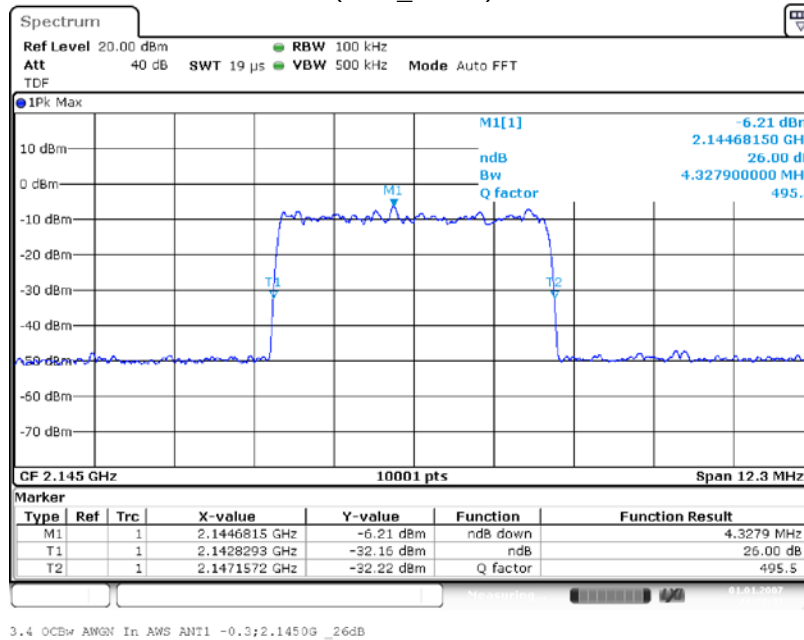


Input Signal

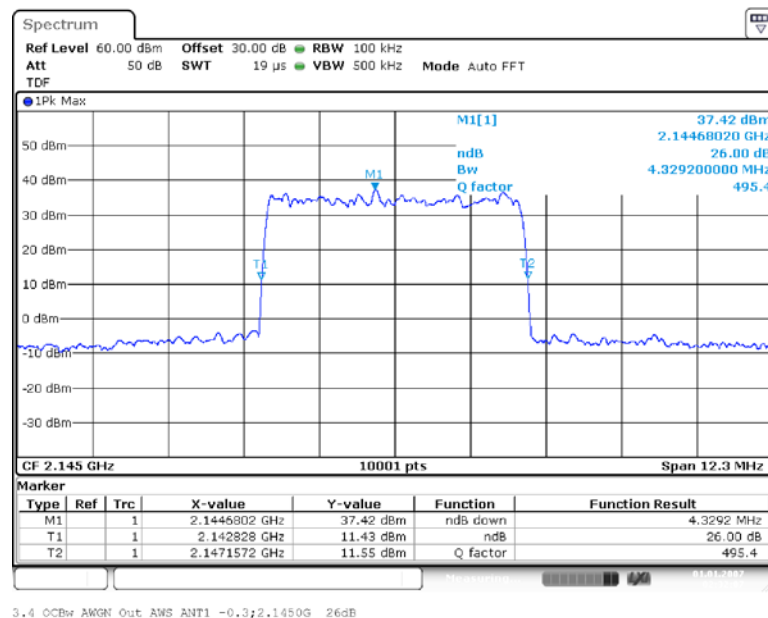


Output Signal

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Wideband  
(S01\_AA01)



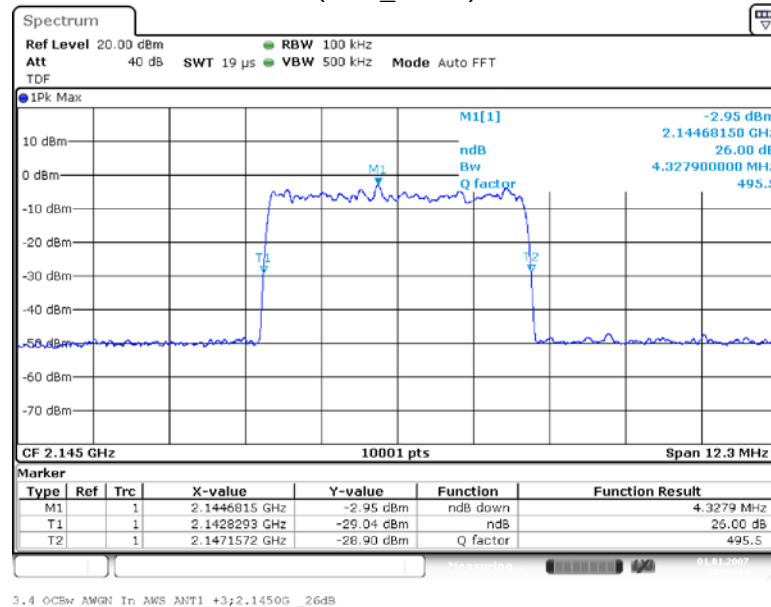
Input Signal



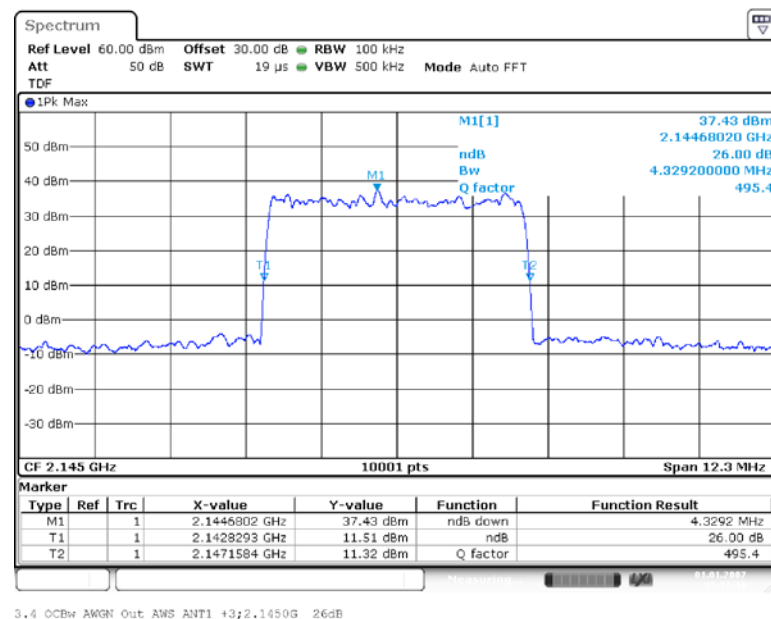
Output Signal



Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



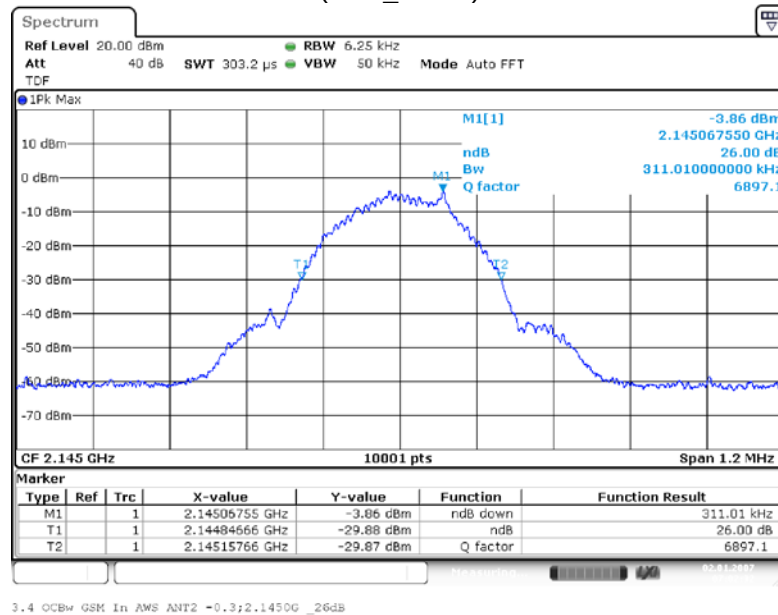
Input Signal



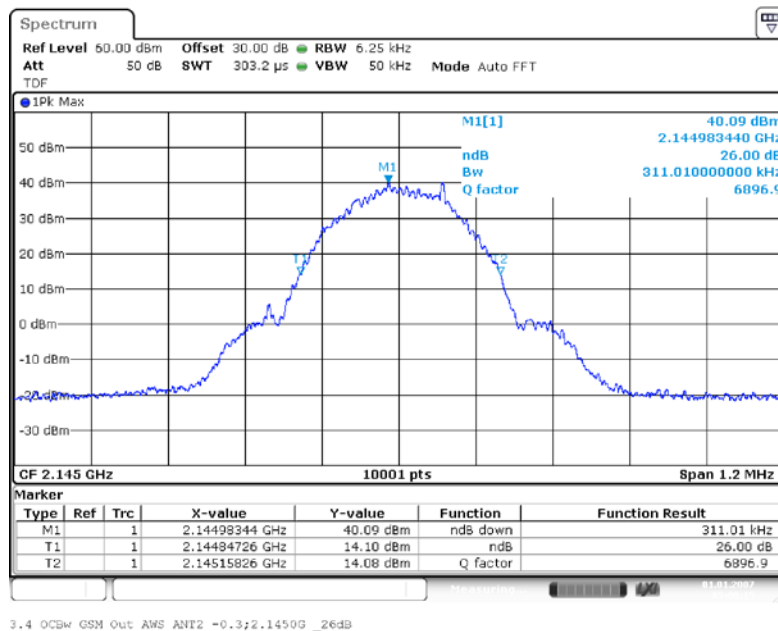
Output Signal

## MODULE 2:

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Narrowband  
(S01\_AA01)

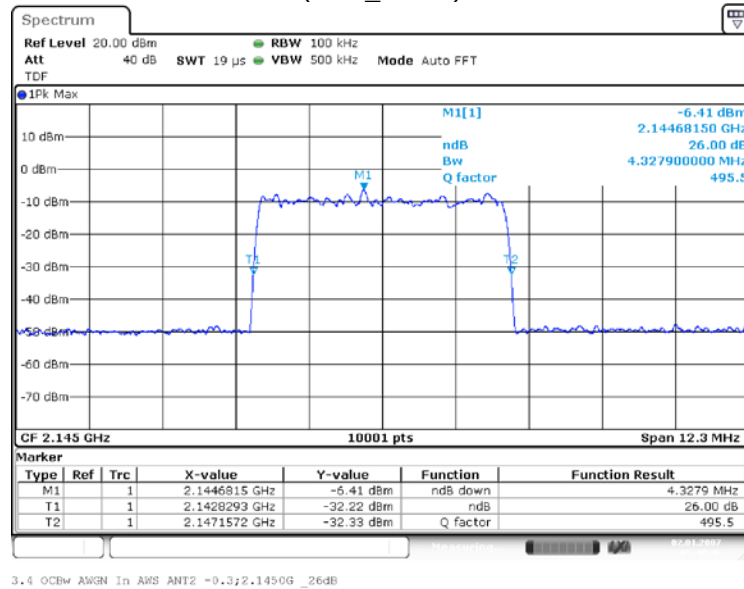


Input Signal

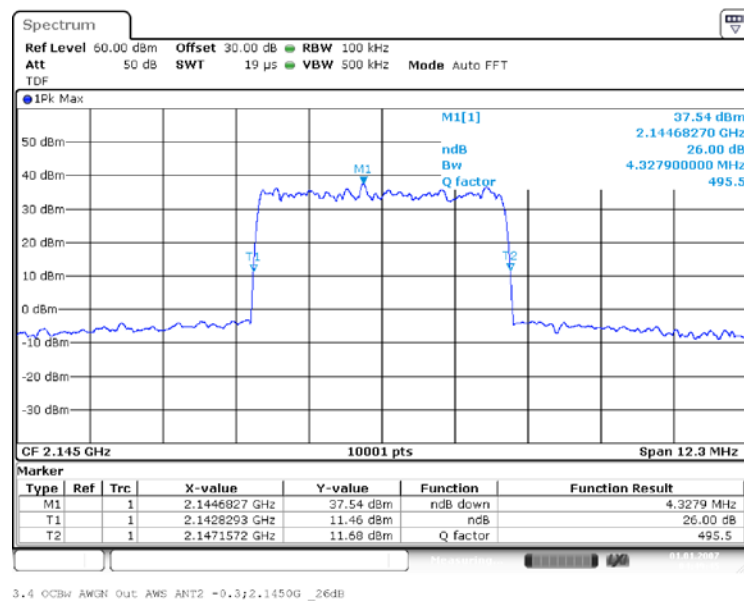


Output Signal

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 0.3 dB < AGC,  
Signal Type = Wideband  
(S01\_AA01)

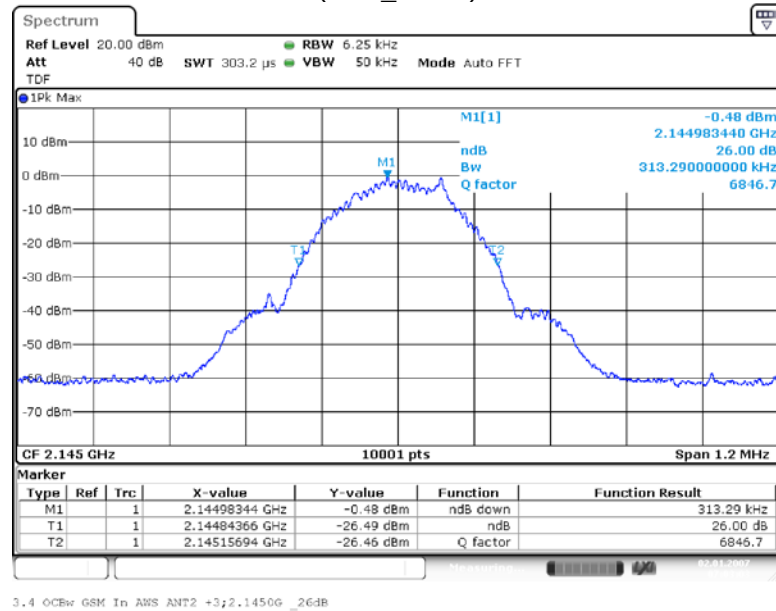


Input Signal

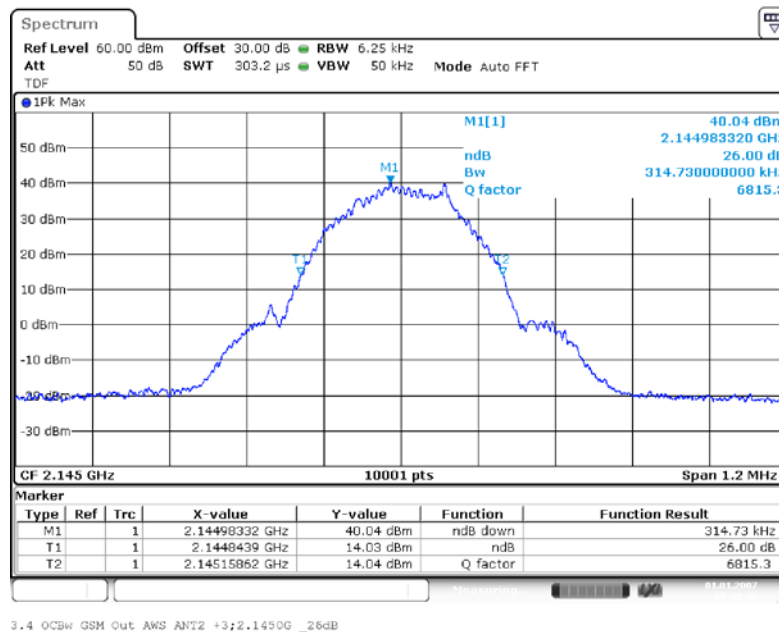


Output Signal

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)

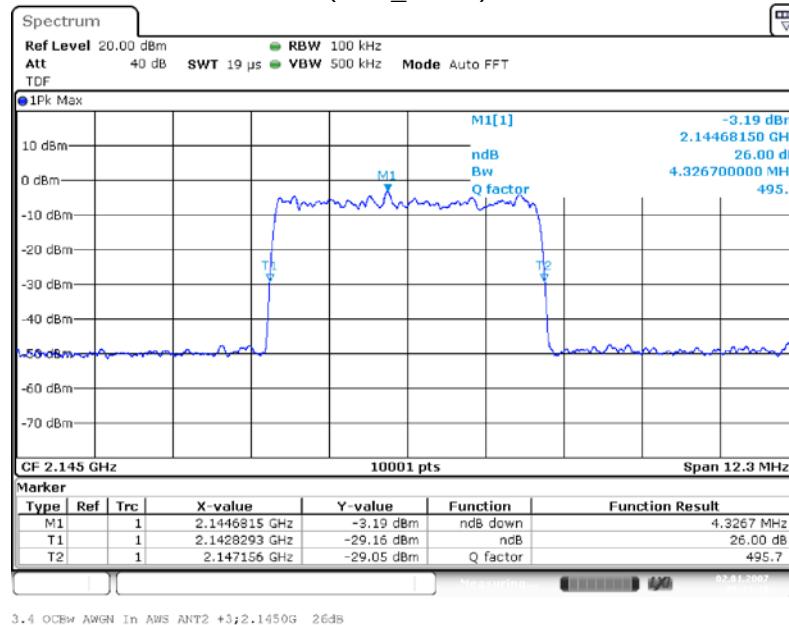


Input Signal

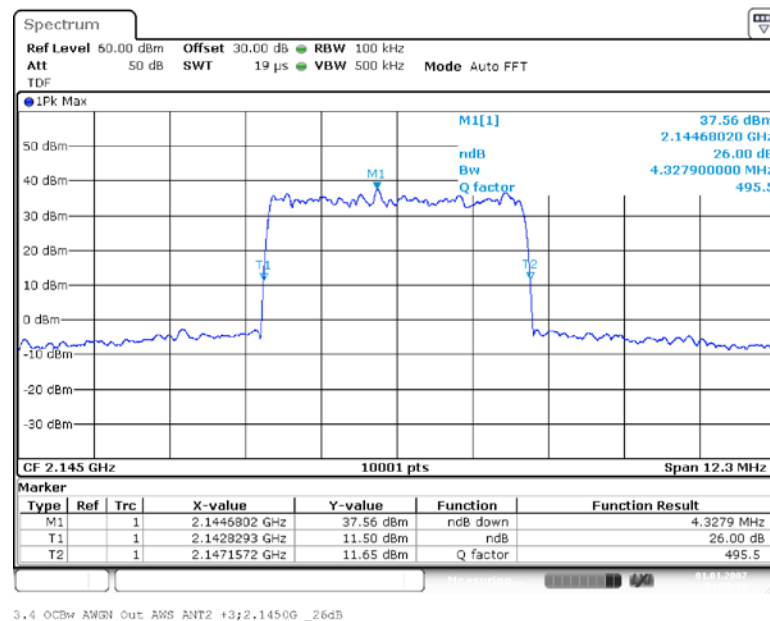


Output Signal

Frequency Band = Band 4/10/66, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



Input Signal



Output Signal

#### 4.3.5 TEST EQUIPMENT USED

FCC Conducted Base Station / Repeater

#### 4.4 CONDUCTED SPURIOUS EMISSIONS AT ANTENNA TERMINALS

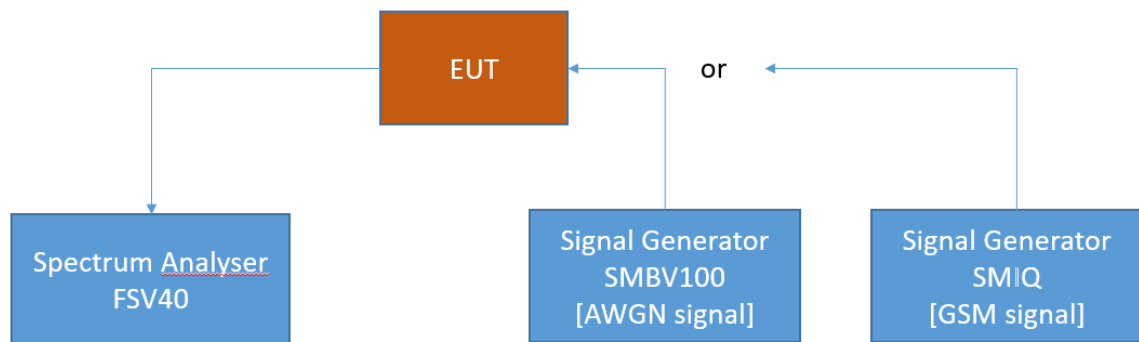
Standard FCC Part §2.1051, §27.53

**The test was performed according to:**  
ANSI C63.26

##### 4.4.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

##### 4.4.2 TEST REQUIREMENTS / LIMITS

###### **FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:**

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.

## Part 27; Miscellaneous Wireless Communication Services

### Subpart C – Technical standards

#### §27.53 – Emission limits

##### Band 13

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, 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 any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(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;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions 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.

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

##### Band 12:

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

##### Band 4:

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

#### **RSS-130; 4.6 Transmitter Unwanted Emissions**

4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power,  $P$  (dBW), by at least  $43 + 10 \log_{10} p$  (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

- (a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power,  $P$  (dBW), by at least:
  - o (i)  $76 + 10 \log_{10} p$  (watts), dB, for base and fixed equipment, and
  - o (ii)  $65 + 10 \log_{10} p$  (watts), dB, for mobile and portable equipment.
- (b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed  $-70$  dBW/MHz for wideband signal and  $-80$  dBW for discrete emission with bandwidth less than 700 Hz.
- 

#### **RSS-139; 6.6 Transmitter Unwanted Emissions**

Equipment shall comply with the limits in (i) and (ii) below.

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

#### 4.4.3 TEST PROTOCOL

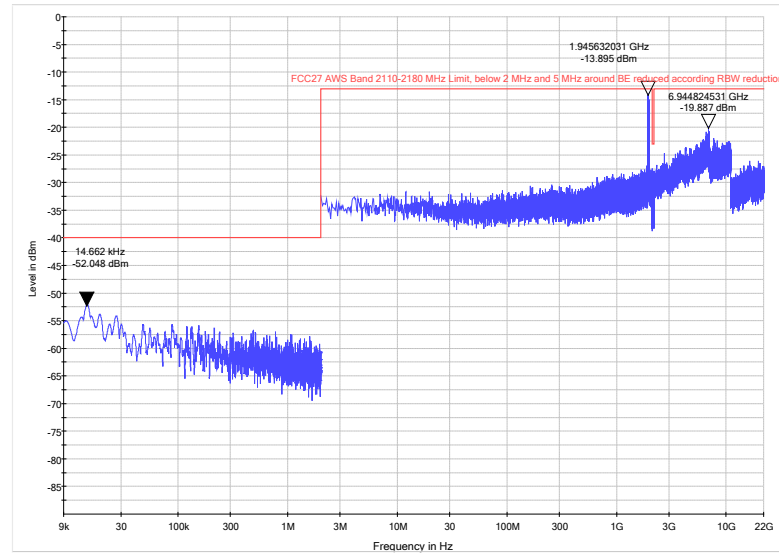
| Band 4/10/66, downlink [Module 1] |             |                      |                      |          |           |             |                      |
|-----------------------------------|-------------|----------------------|----------------------|----------|-----------|-------------|----------------------|
| Test Frequency                    | Signal Type | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| low                               | Wideband    | 0.0647               | -52.7*               | PEAK     | 2         | -40.0       | 12.7                 |
| low                               | Wideband    | 1950.3               | -14.0                | PEAK     | 1000      | -13.0       | 1.0                  |
| low                               | Wideband    | 2190.0               | -25.2                | RMS      | 100       | -23.0       | 2.2                  |
| low                               | Wideband    | 4224.0               | -18.7                | PEAK     | 1000      | -13.0       | 5.7                  |
| low                               | Wideband    | 6338.0               | -18.5                | PEAK     | 1000      | -13.0       | 5.5                  |
| mid                               | Wideband    | 84.81                | -24.0                | PEAK     | 1000      | -13.0       | 11.0                 |
| mid                               | Wideband    | 1961.6               | -13.8                | PEAK     | 1000      | -13.0       | 0.8                  |
| mid                               | Wideband    | 4289.6               | -17.8                | PEAK     | 1000      | -13.0       | 4.8                  |
| mid                               | Wideband    | 6434.1               | -16.6                | PEAK     | 1000      | -13.0       | 3.6                  |
| high                              | Wideband    | 0.0647               | -52.7                | PEAK     | 2         | -40.0       | 12.7                 |
| high                              | Wideband    | 1950.3               | -14.0                | PEAK     | 1000      | -13.0       | 1.0                  |
| high                              | Wideband    | 2181.1               | -27.8                | RMS      | 100       | -23.0       | 4.8                  |
| high                              | Wideband    | 4224.0               | -18.7                | PEAK     | 1000      | -13.0       | 5.7                  |
| high                              | Wideband    | 6338.0               | -18.5                | PEAK     | 1000      | -13.0       | 5.5                  |
| low                               | Narrowband  | 0.0239               | -52.7                | PEAK     | 2         | -40.0       | 12.7                 |
| low                               | Narrowband  | 1959.9               | -14.1                | PEAK     | 1000      | -13.0       | 1.1                  |
| low                               | Narrowband  | 6953.1               | -20.5                | PEAK     | 1000      | -13.0       | 7.6                  |
| mid                               | Narrowband  | 0.0147               | -52.0                | PEAK     | 2         | -40.0       | 12.0                 |
| mid                               | Narrowband  | 1945.6               | -13.9                | PEAK     | 1000      | -13.0       | 0.9                  |
| mid                               | Narrowband  | 6944.8               | -19.9                | PEAK     | 1000      | -13.0       | 6.9                  |
| high                              | Narrowband  | 0.0378               | -53.7                | PEAK     | 2         | -40.0       | 13.7                 |
| high                              | Narrowband  | 1952.7               | -13.4                | PEAK     | 1000      | -13.0       | 0.4                  |
| high                              | Narrowband  | 6981.7               | -20.8                | PEAK     | 1000      | -13.0       | 7.8                  |

Remark: Please see next sub-clause for the measurement plot.  
Only module 1 was measured

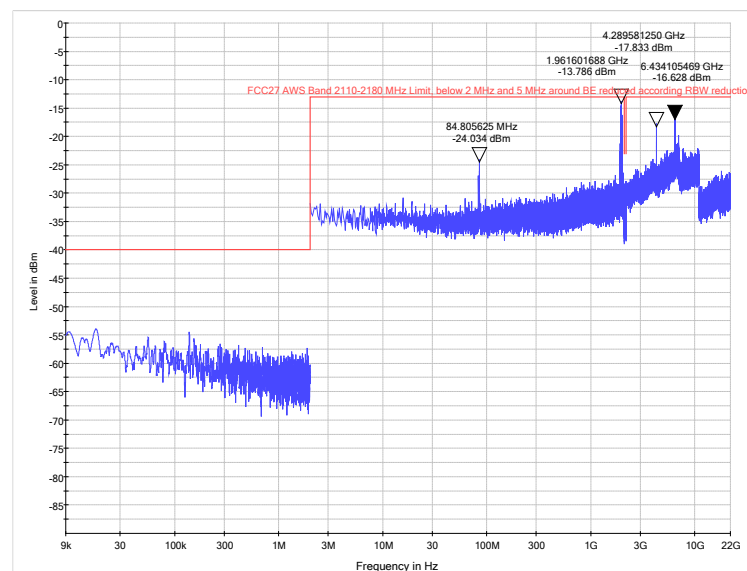
#### 4.4.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

##### Module 1:

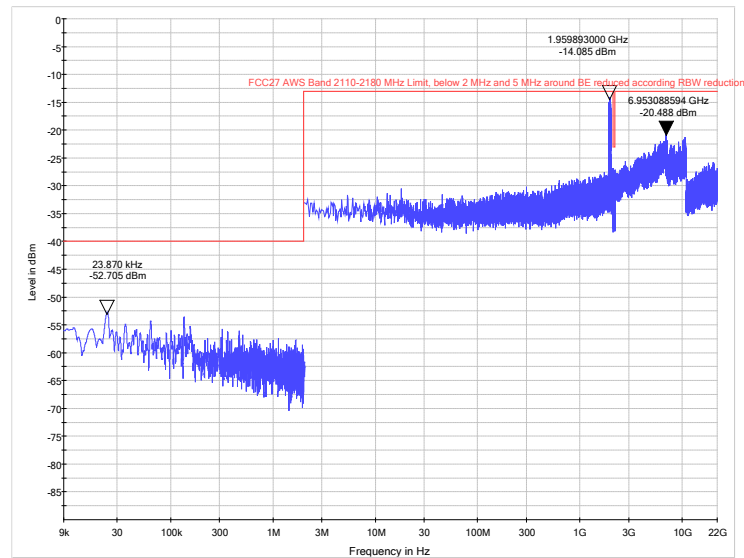
Frequency Band = Band 4/10/66, Test Frequency = mid, Direction = RF downlink, Signal Type = Narrowband  
(S01\_AA01)



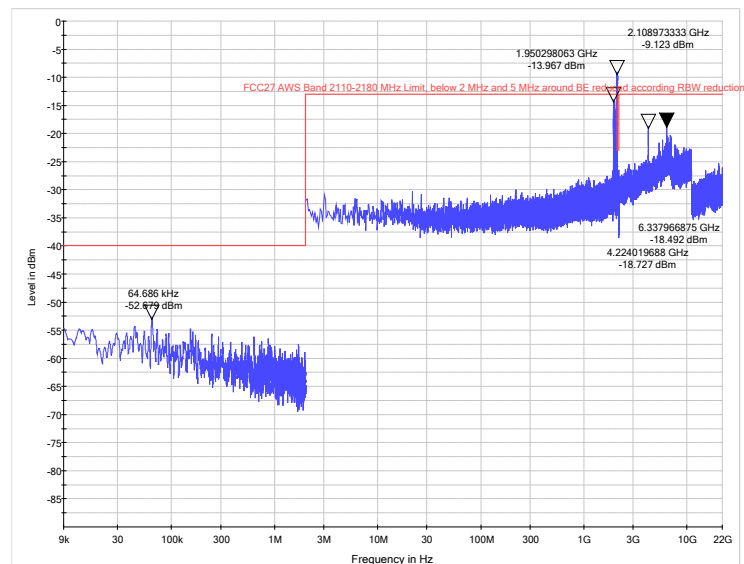
Frequency Band = Band 4/10/66, Test Frequency = mid, Direction = RF downlink, Signal Type = Wideband  
(S01\_AA01)



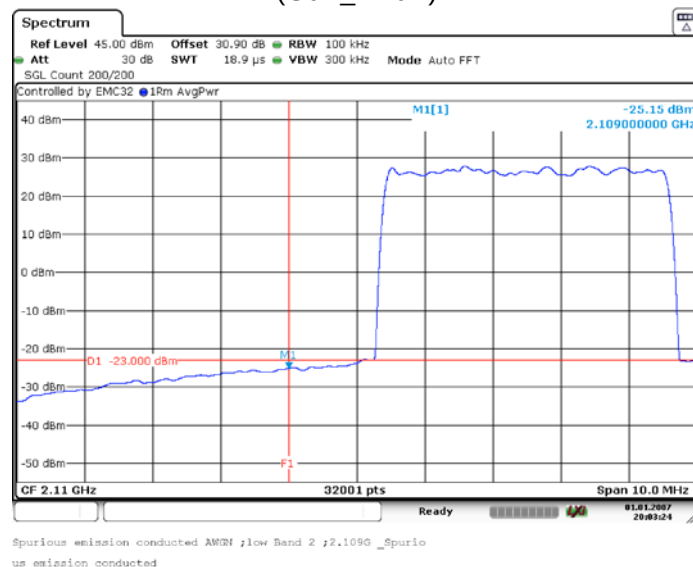
Frequency Band = Band 4/10/66, Test Frequency = low, Direction = RF downlink, Signal Type = Narrowband (S01\_AA01)



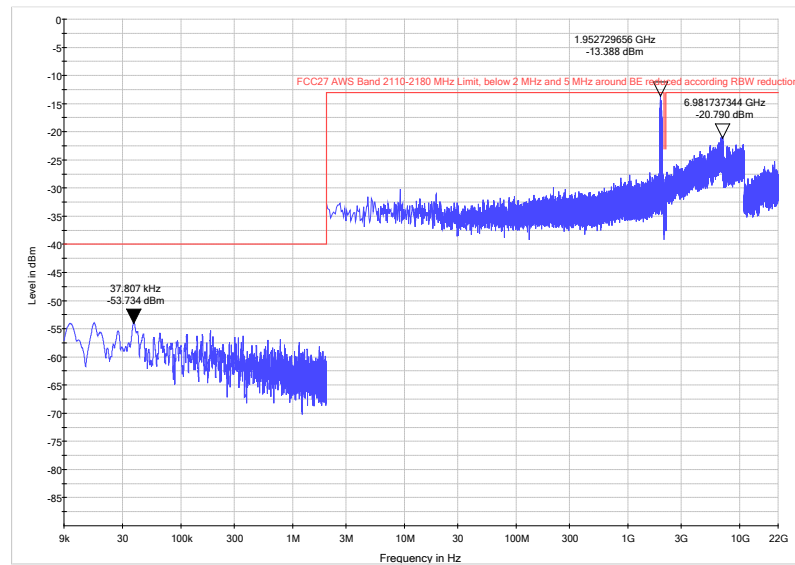
Frequency Band = Band 4/10/66, Test Frequency = low, Direction = RF downlink, Signal Type = Wideband  
(S01\_AA01)



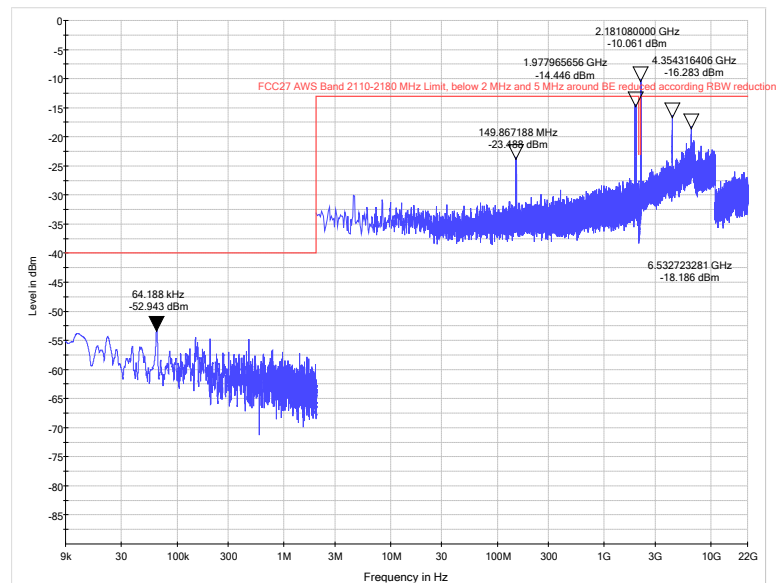
Frequency Band = Band 4/10/66, Test Frequency = low, Direction = RF downlink, Signal Type = Wideband, Final Measurement  
(S01\_AA01)



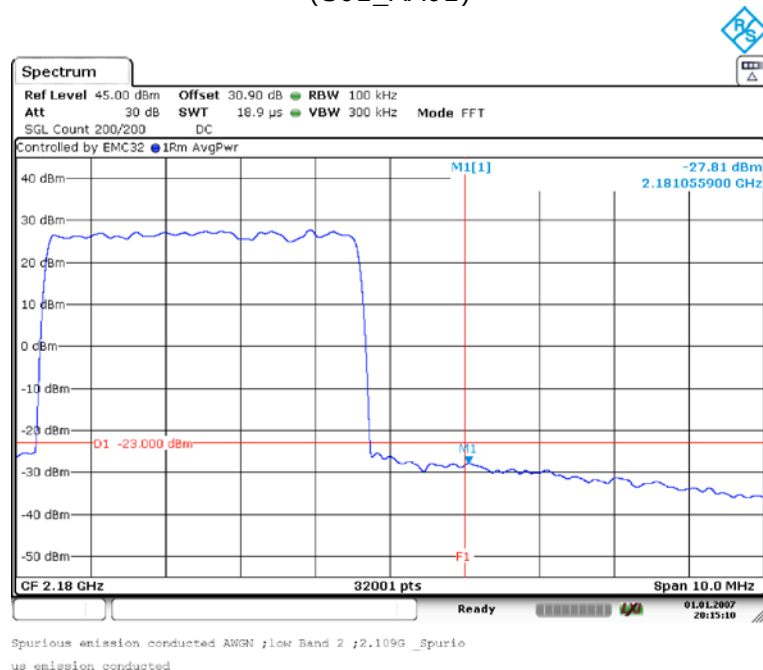
Frequency Band = Band 4/10/66, Test Frequency = high, Direction = RF downlink, Signal Type = Narrowband (S01\_AA01)



Frequency Band = Band 4/10/66, Test Frequency = high, Direction = RF downlink, Signal Type = Wideband  
(S01\_AA01)



Frequency Band = Band 4/10/66, Test Frequency = high, Direction = RF downlink, Signal Type = Wideband, Final Measurement  
(S01\_AA01)



#### 4.4.5 TEST EQUIPMENT USED

- R&S TS8997

## 4.5 OUT-OF-BAND EMISSION LIMITS

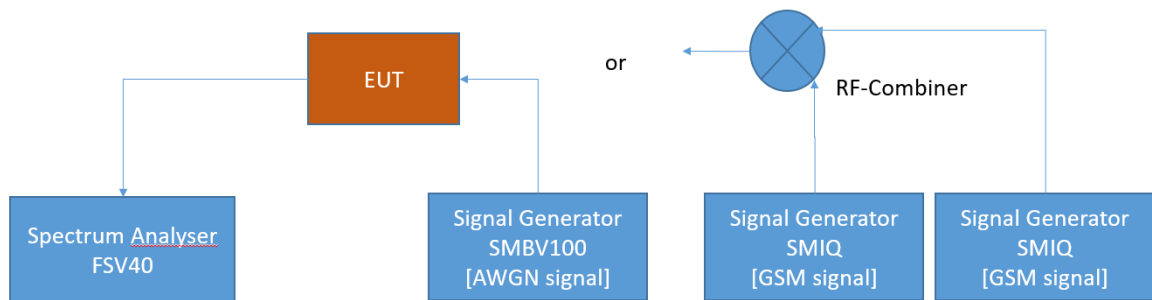
Standard FCC Part §2.1051, §27.53

**The test was performed according to:**  
ANSI C63.26, KDB 935210 D05 v01r02: 3.6

### 4.5.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the out-of-band emission limit for industrial signal boosters. The limits itself come from the applicable rule part for each operating band.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; Out-of-band emissions

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

### 4.5.2 TEST REQUIREMENTS / LIMITS

#### Part 27; Miscellaneous Wireless Communication Services

##### Subpart C – Technical standards

##### §27.53 – Emission limits

##### Band 13

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, 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 any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(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;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions 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.

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

#### **Band 12:**

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

#### **Band 4:**

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

### **RSS-130; 4.6 Transmitter Unwanted Emissions**

4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least  $43 + 10 \log_{10} p$  (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

- (a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
  - o (i)  $76 + 10 \log_{10} p$  (watts), dB, for base and fixed equipment, and
  - o (ii)  $65 + 10 \log_{10} p$  (watts), dB, for mobile and portable equipment.
- (b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed  $-70$  dBW/MHz for wideband signal and  $-80$  dBW for discrete emission with bandwidth less than 700 Hz.

## RSS-139; 6.6 Transmitter Unwanted Emissions

Equipment shall comply with the limits in (i) and (ii) below.

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

### 4.5.3 TEST PROTOCOL

| Band 4/10/66, downlink, Number of input signals = 1 [Module 1] |              |           |                        |                   |                                 |                               |                      |
|----------------------------------------------------------------|--------------|-----------|------------------------|-------------------|---------------------------------|-------------------------------|----------------------|
| Signal Type                                                    | Input Power  | Band Edge | Signal Frequency [MHz] | Input Power [dBm] | Maximum Out-of-band Power [dBm] | Limit Out-of-band Power [dBm] | Margin to Limit [dB] |
| Wideband                                                       | 0.3 dB < AGC | upper     | 2177.50                | -0.7              | -29.3                           | -13.0                         | 16.3                 |
| Wideband                                                       | 3 dB > AGC   | upper     | 2177.50                | 1.8               | -30.0                           | -13.0                         | 17.0                 |
| Narrowband                                                     | 0.3 dB < AGC | upper     | 2179.80                | -0.7              | -18.8                           | -13.0                         | 5.8                  |
| Narrowband                                                     | 3 dB > AGC   | upper     | 2179.80                | 1.8               | -18.1                           | -13.0                         | 5.1                  |
| Wideband                                                       | 0.3 dB < AGC | lower     | 2112.50                | -0.7              | -26.6                           | -13.0                         | 13.6                 |
| Wideband                                                       | 3 dB > AGC   | lower     | 2112.50                | 1.8               | -25.3                           | -13.0                         | 12.3                 |
| Narrowband                                                     | 0.3 dB < AGC | lower     | 2110.20                | -0.7              | -20.1                           | -13.0                         | 7.1                  |
| Narrowband                                                     | 3 dB > AGC   | lower     | 2110.20                | 1.8               | -20.5                           | -13.0                         | 7.5                  |

| Band 4/10/66, downlink, Number of input signals = 2 [Module 1] |              |           |                           |                           |                   |                                 |                               |                      |
|----------------------------------------------------------------|--------------|-----------|---------------------------|---------------------------|-------------------|---------------------------------|-------------------------------|----------------------|
| Signal Type                                                    | Input Power  | Band Edge | Signal Frequency f1 [MHz] | Signal Frequency f2 [MHz] | Input Power [dBm] | Maximum Out-of-band Power [dBm] | Limit Out-of-band Power [dBm] | Margin to Limit [dB] |
| WB                                                             | 0.3 dB < AGC | upper     | 2177.50                   | 2172.50                   | -0.7              | -30.0                           | -13.0                         | 21.4                 |
| WB                                                             | 3 dB > AGC   | upper     | 2177.50                   | 2172.50                   | 1.8               | -30.8                           | -13.0                         | 20.8                 |
| NB                                                             | 0.3 dB < AGC | upper     | 2179.80                   | 2179.60                   | -0.7              | -20.6                           | -13.0                         | 14.9                 |
| NB                                                             | 3 dB > AGC   | upper     | 2179.80                   | 2179.60                   | 1.8               | -21.2                           | -13.0                         | 14.6                 |
| WB                                                             | 0.3 dB < AGC | lower     | 2112.50                   | 2117.50                   | -0.7              | -28.0                           | -13.0                         | 20.2                 |
| WB                                                             | 3 dB > AGC   | lower     | 2112.50                   | 2117.50                   | 1.8               | -27.5                           | -13.0                         | 20.9                 |
| NB                                                             | 0.3 dB < AGC | lower     | 2110.20                   | 2110.40                   | -0.7              | -21.8                           | -13.0                         | 14.8                 |
| NB                                                             | 3 dB > AGC   | lower     | 2110.20                   | 2110.40                   | 1.8               | -21.3                           | -13.0                         | 14.3                 |

| Band 4/10/66, downlink, Number of input signals = 1 [Module 2] |              |           |                        |                   |                                 |                               |                      |
|----------------------------------------------------------------|--------------|-----------|------------------------|-------------------|---------------------------------|-------------------------------|----------------------|
| Signal Type                                                    | Input Power  | Band Edge | Signal Frequency [MHz] | Input Power [dBm] | Maximum Out-of-band Power [dBm] | Limit Out-of-band Power [dBm] | Margin to Limit [dB] |
| Wideband                                                       | 0.3 dB < AGC | upper     | 2177.50                | -0.7              | -25.7                           | -13.0                         | 12.7                 |
| Wideband                                                       | 3 dB > AGC   | upper     | 2177.50                | 1.8               | -26.4                           | -13.0                         | 13.4                 |
| Narrowband                                                     | 0.3 dB < AGC | upper     | 2179.80                | -0.7              | -18.4                           | -13.0                         | 5.4                  |
| Narrowband                                                     | 3 dB > AGC   | upper     | 2179.80                | 1.8               | -18.8                           | -13.0                         | 5.8                  |
| Wideband                                                       | 0.3 dB < AGC | lower     | 2182.50                | -0.7              | -29.3                           | -13.0                         | 16.3                 |
| Wideband                                                       | 3 dB > AGC   | lower     | 2182.50                | 1.8               | -30.5                           | -13.0                         | 17.5                 |
| Narrowband                                                     | 0.3 dB < AGC | lower     | 2180.20                | -0.7              | -19.6                           | -13.0                         | 6.6                  |
| Narrowband                                                     | 3 dB > AGC   | lower     | 2180.20                | 1.8               | -19.2                           | -13.0                         | 6.2                  |

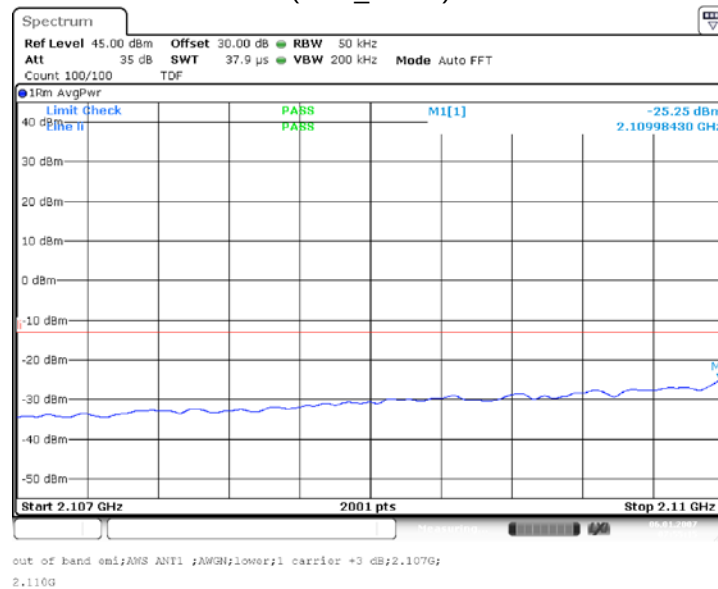
| Band 4/10/66, downlink, Number of input signals = 2 [Module 2] |              |           |                           |                           |                   |                                 |                               |                      |
|----------------------------------------------------------------|--------------|-----------|---------------------------|---------------------------|-------------------|---------------------------------|-------------------------------|----------------------|
| Signal Type                                                    | Input Power  | Band Edge | Signal Frequency f1 [MHz] | Signal Frequency f2 [MHz] | Input Power [dBm] | Maximum Out-of-band Power [dBm] | Limit Out-of-band Power [dBm] | Margin to Limit [dB] |
| WB                                                             | 0.3 dB < AGC | upper     | 2177.50                   | 2175.00                   | -0.7              | -31.2                           | -13.0                         | 18.2                 |
| WB                                                             | 3 dB > AGC   | upper     | 2177.50                   | 2175.00                   | 1.8               | -30.3                           | -13.0                         | 17.3                 |
| NB                                                             | 0.3 dB < AGC | upper     | 2179.80                   | 2179.60                   | -0.7              | -21.2                           | -13.0                         | 8.2                  |
| NB                                                             | 3 dB > AGC   | upper     | 2179.80                   | 2179.60                   | 1.8               | -21.4                           | -13.0                         | 8.4                  |
| WB                                                             | 0.3 dB < AGC | lower     | 2182.50                   | 2115.00                   | -0.7              | -30.6                           | -13.0                         | 17.6                 |
| WB                                                             | 3 dB > AGC   | lower     | 2182.50                   | 2115.00                   | 1.8               | -31.1                           | -13.0                         | 18.1                 |
| NB                                                             | 0.3 dB < AGC | lower     | 2180.20                   | 2110.40                   | -0.7              | -22.6                           | -13.0                         | 9.6                  |
| NB                                                             | 3 dB > AGC   | lower     | 2110.20                   | 2110.40                   | 1.8               | -22.1                           | -13.0                         | 9.1                  |

Remark: Please see next sub-clause for the measurement plot.

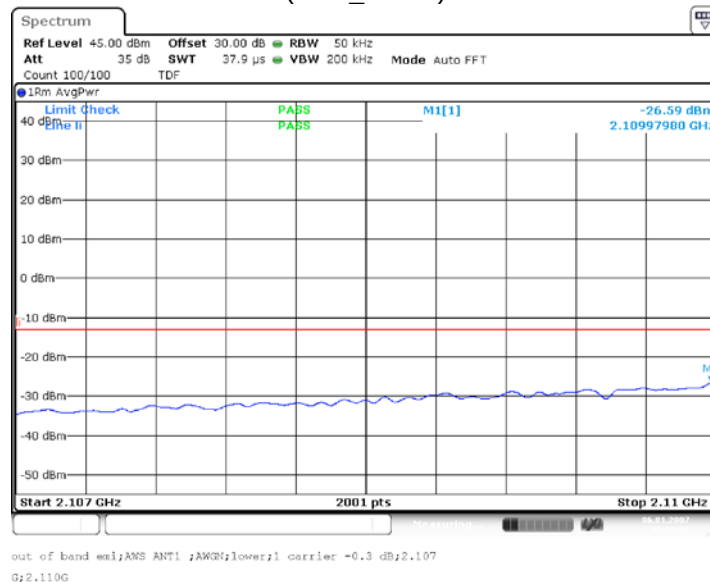
#### 4.5.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

##### Module 1:

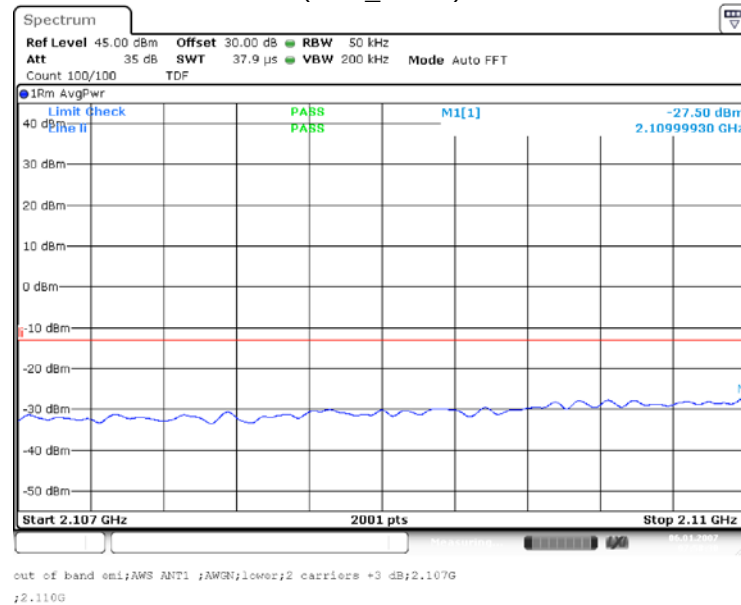
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



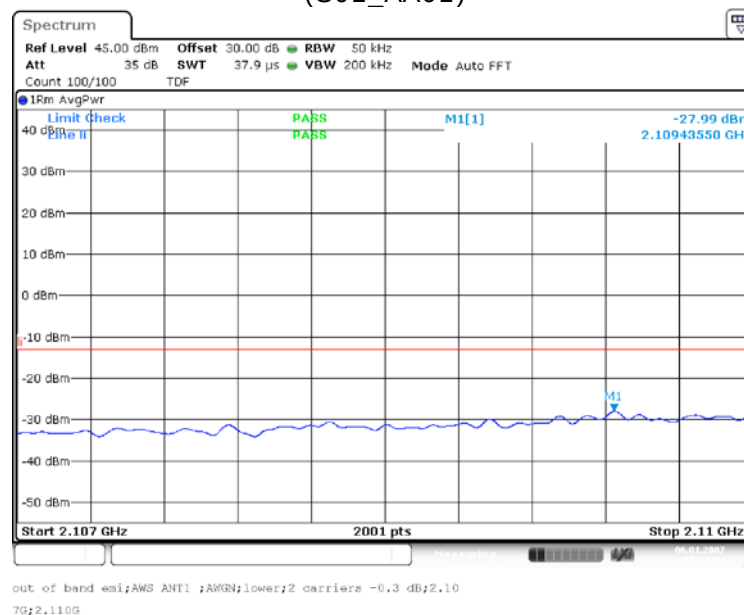
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



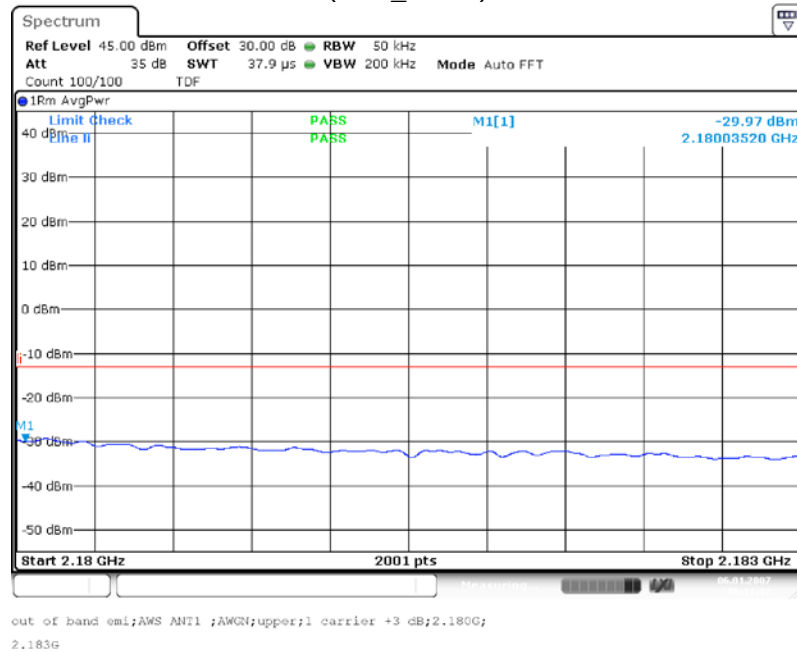
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



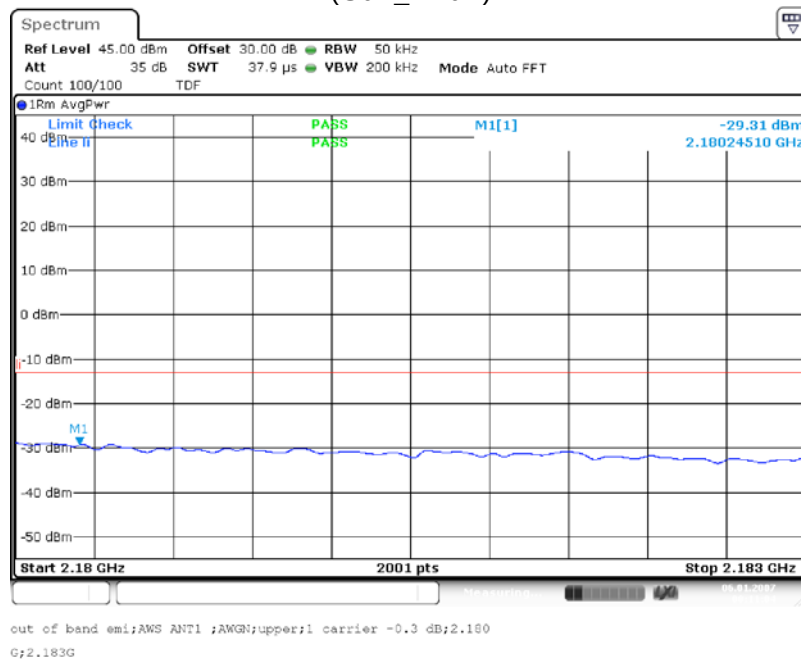
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



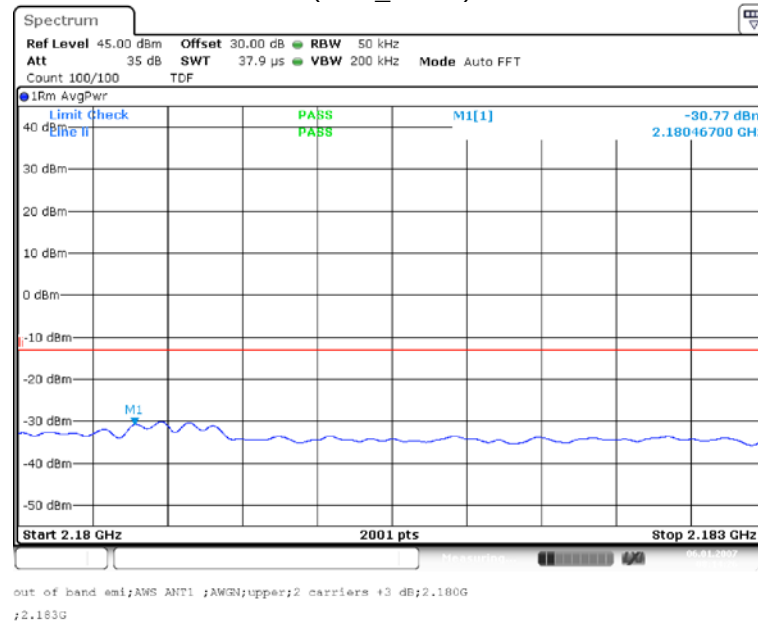
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



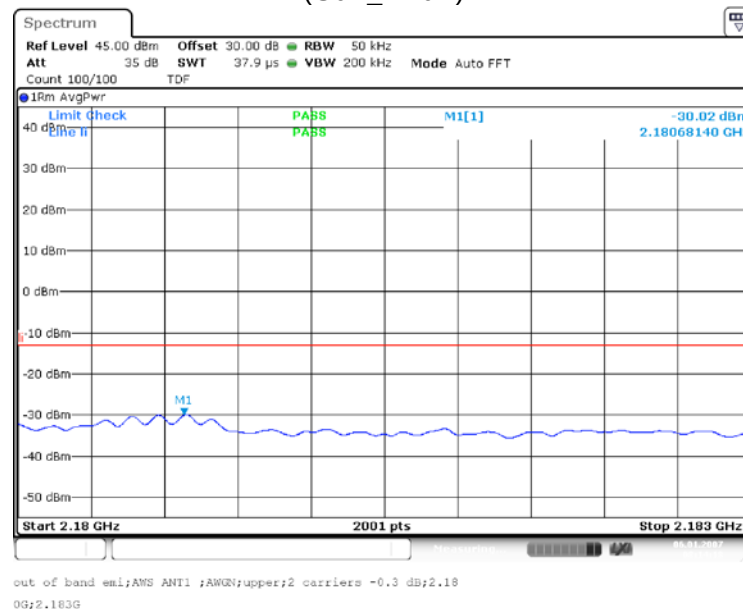
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



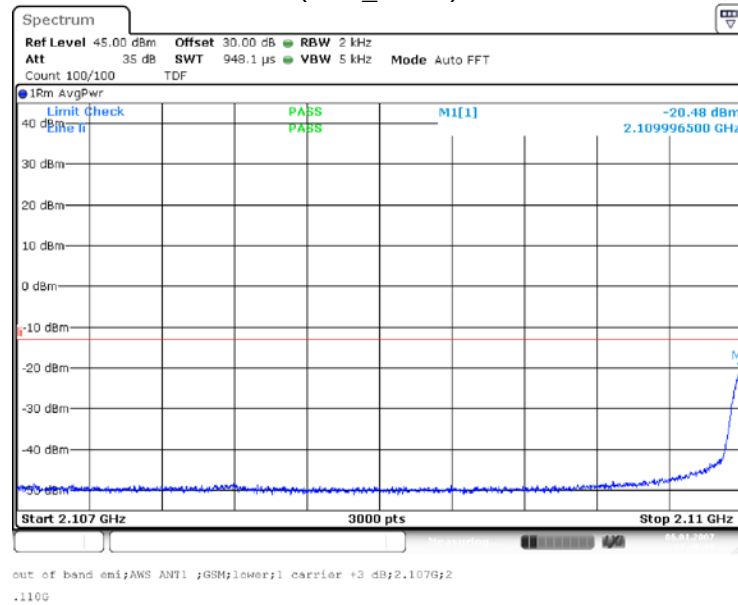
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



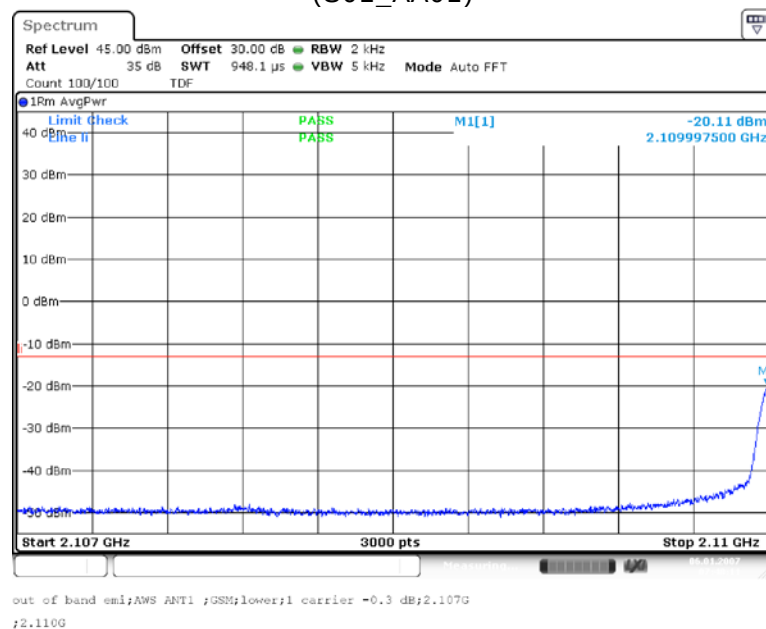
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



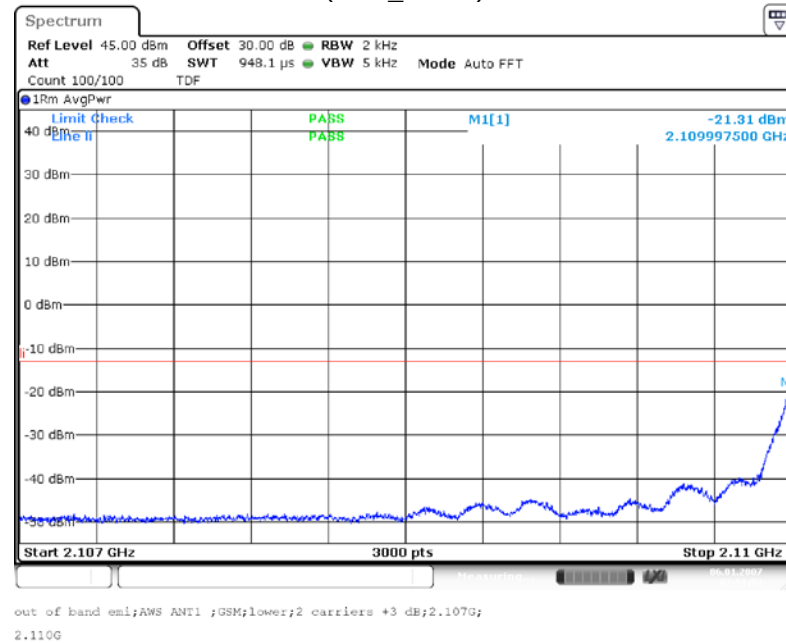
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



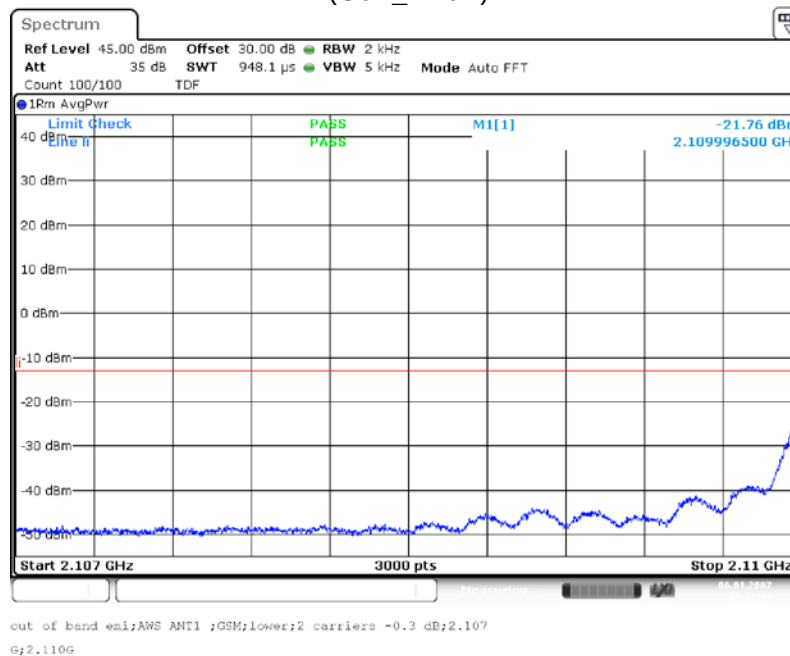
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



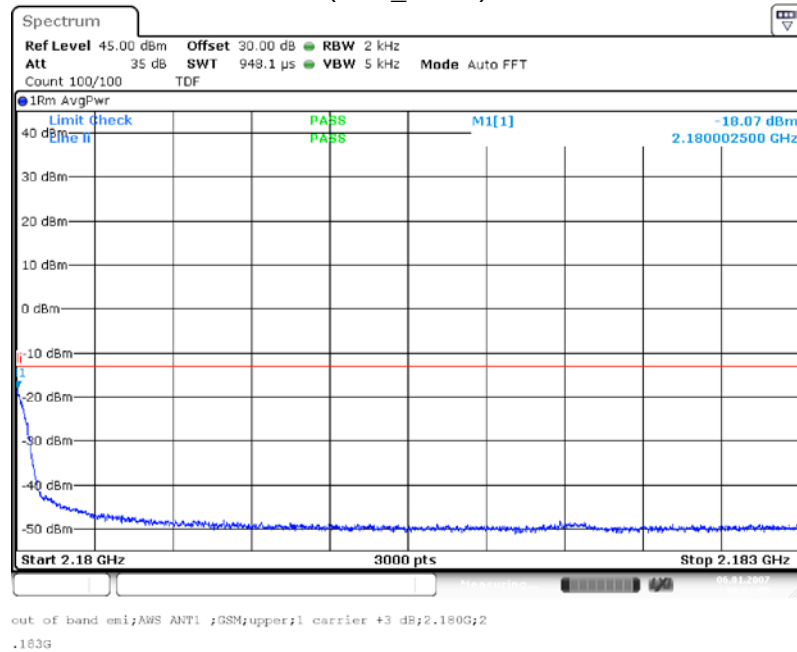
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



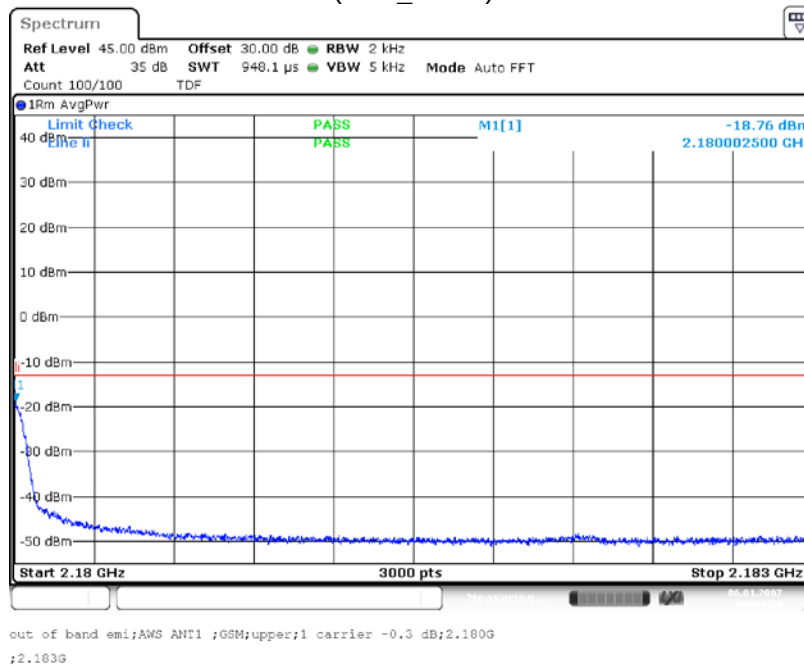
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



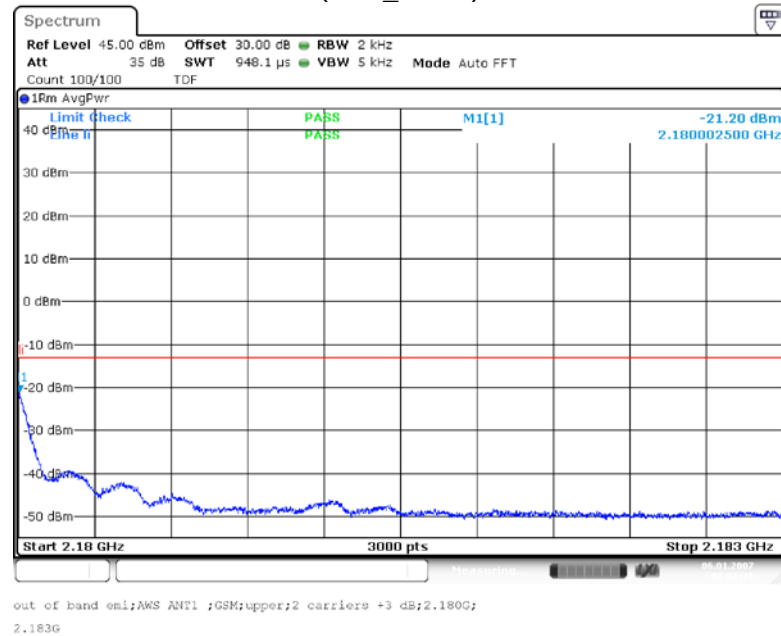
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



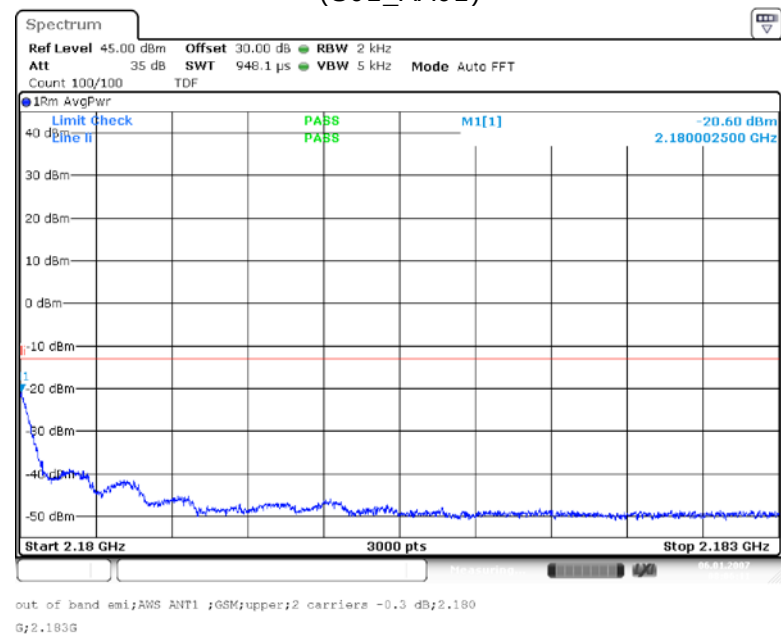
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)

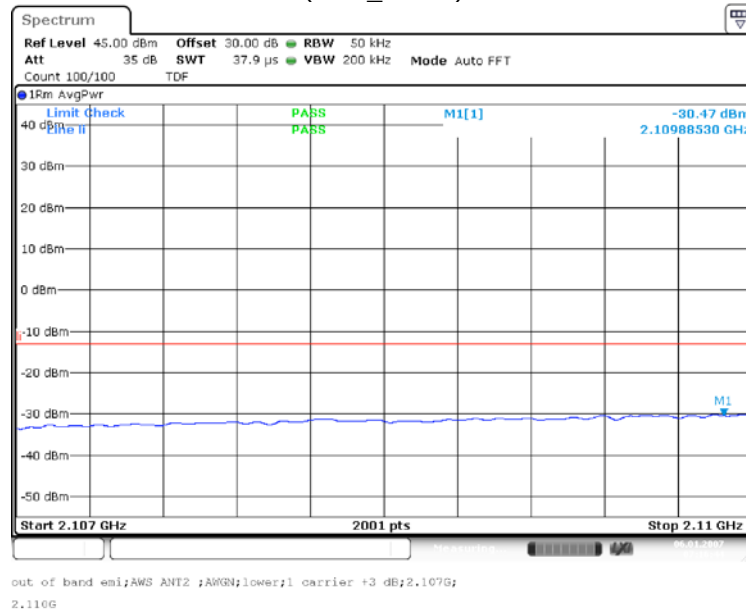


Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)

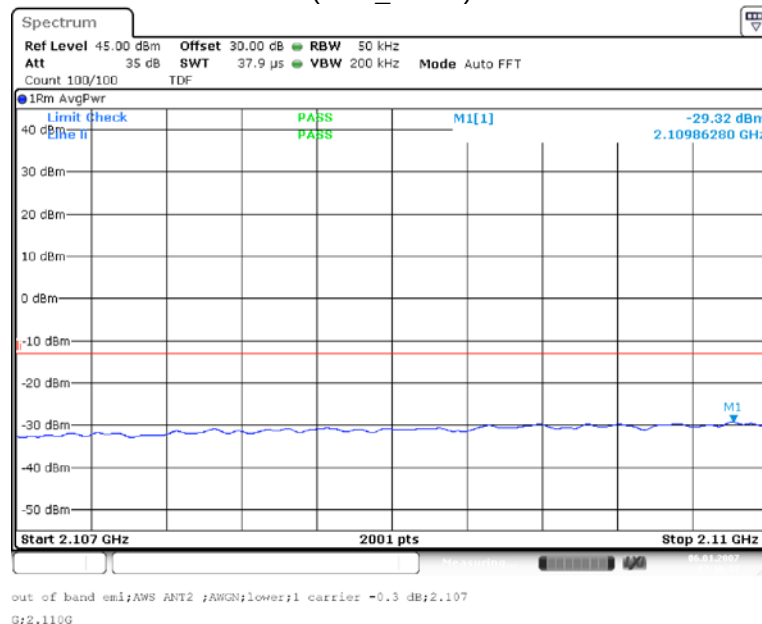


## Module 2:

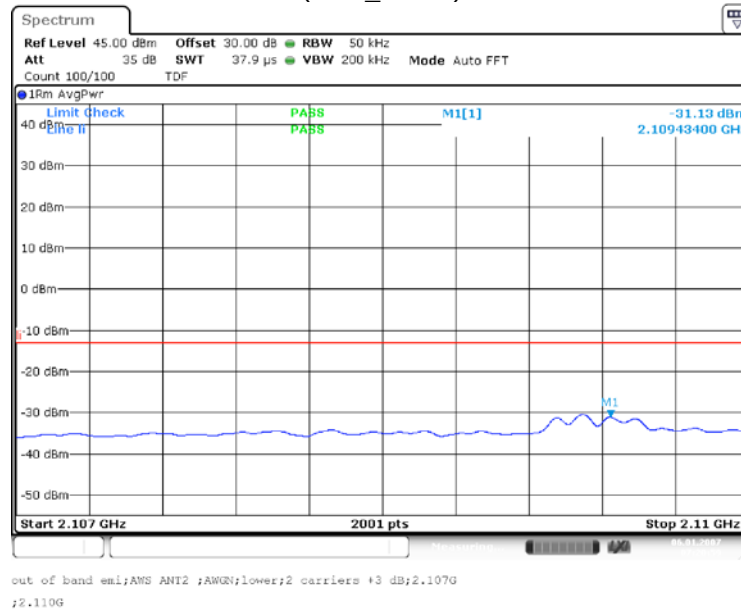
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



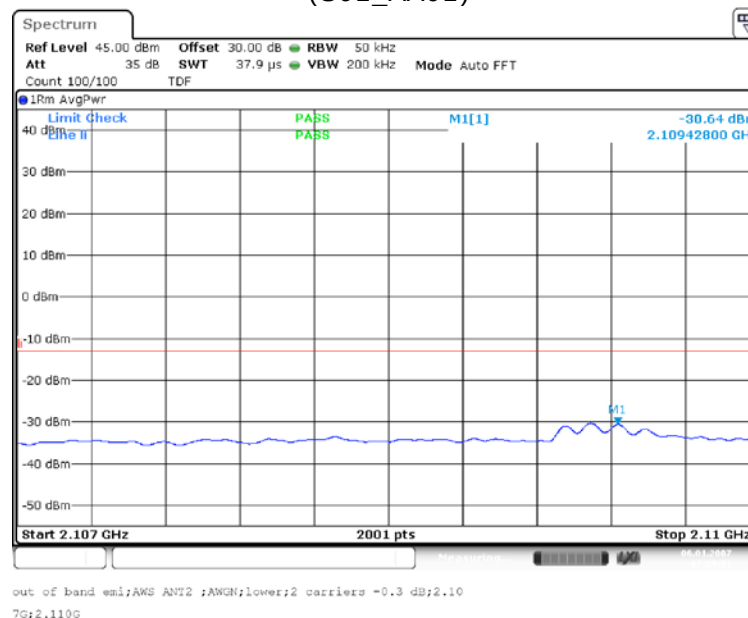
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



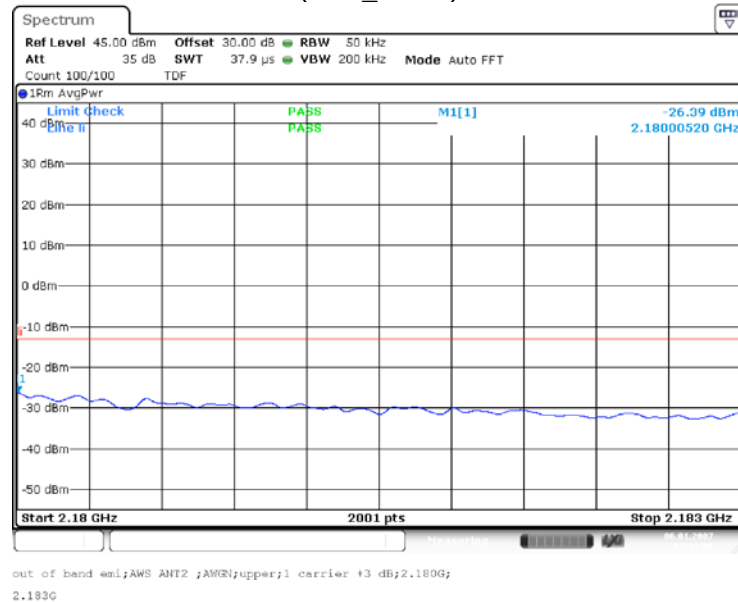
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



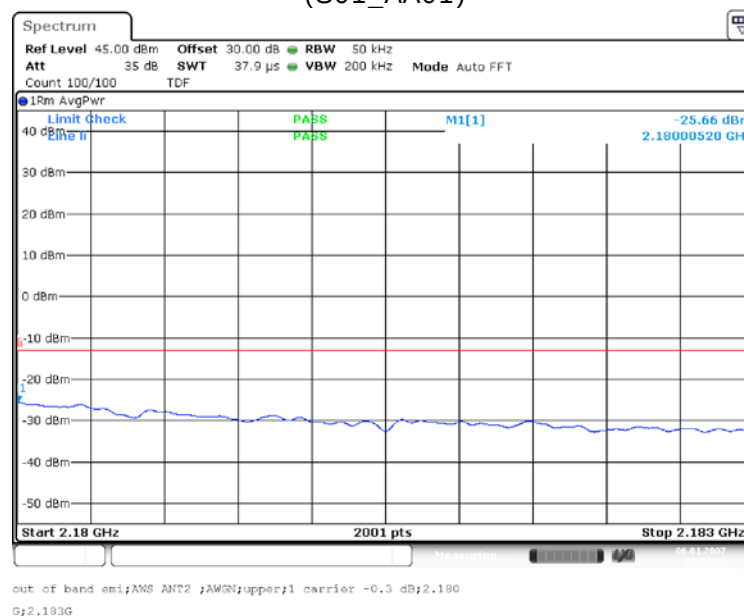
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



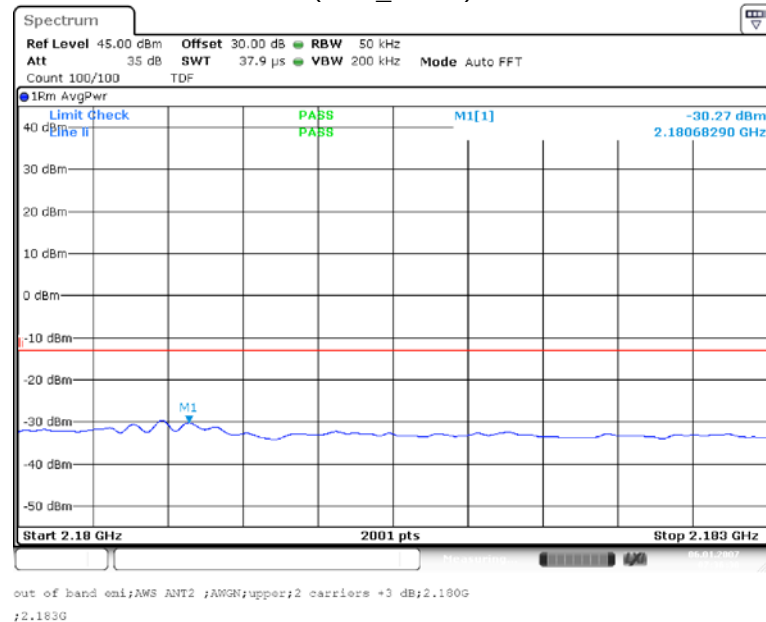
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



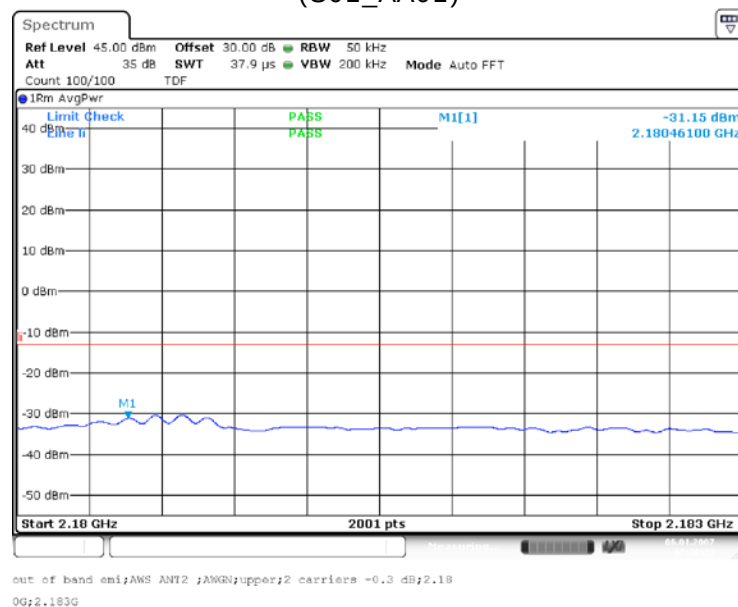
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



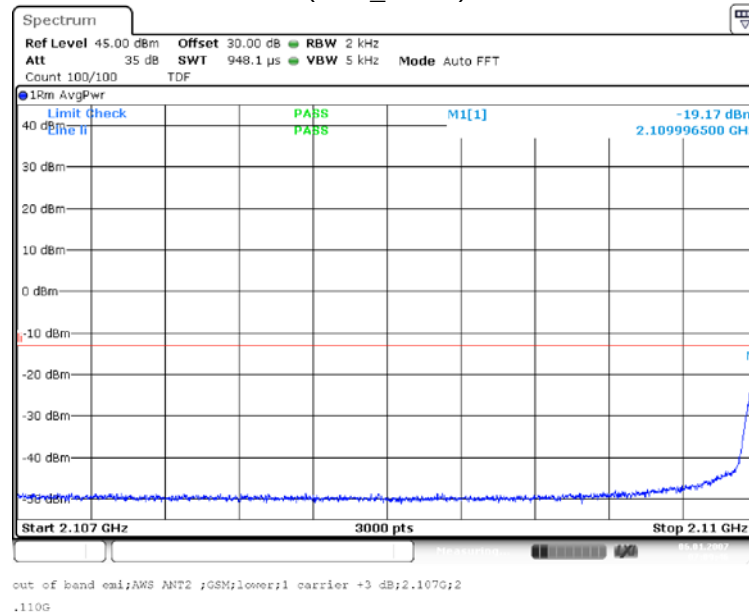
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Wideband (S01\_AA01)



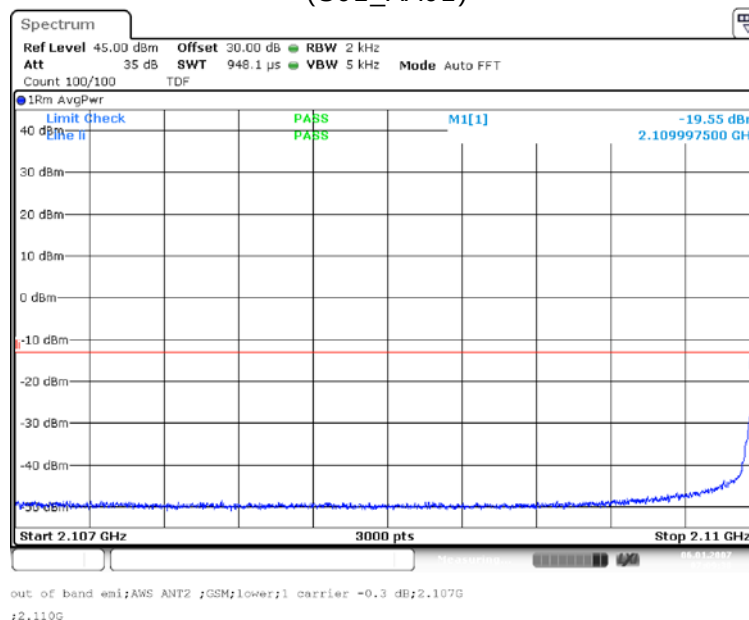
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Wideband (S01\_AA01)



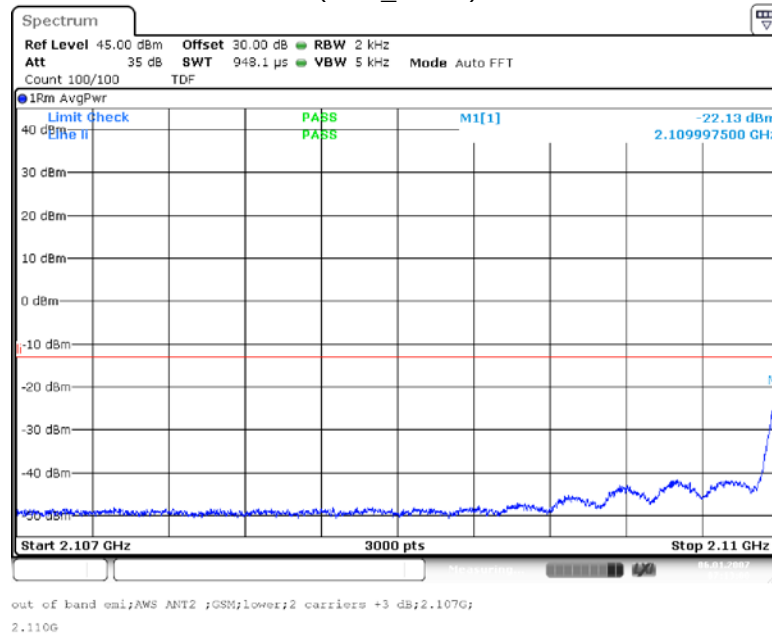
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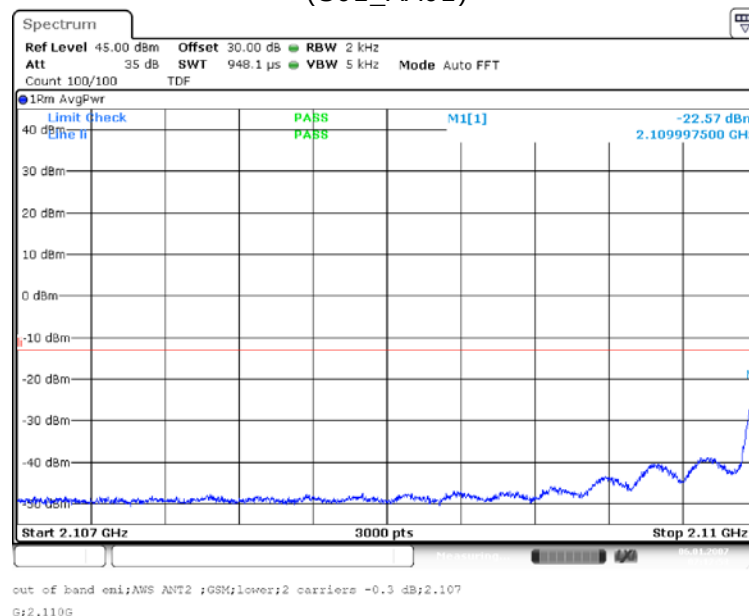
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



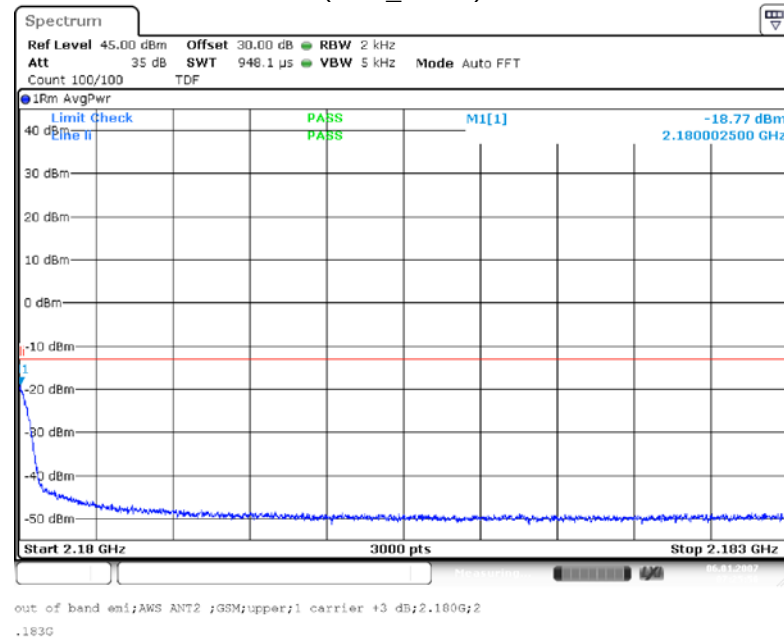
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



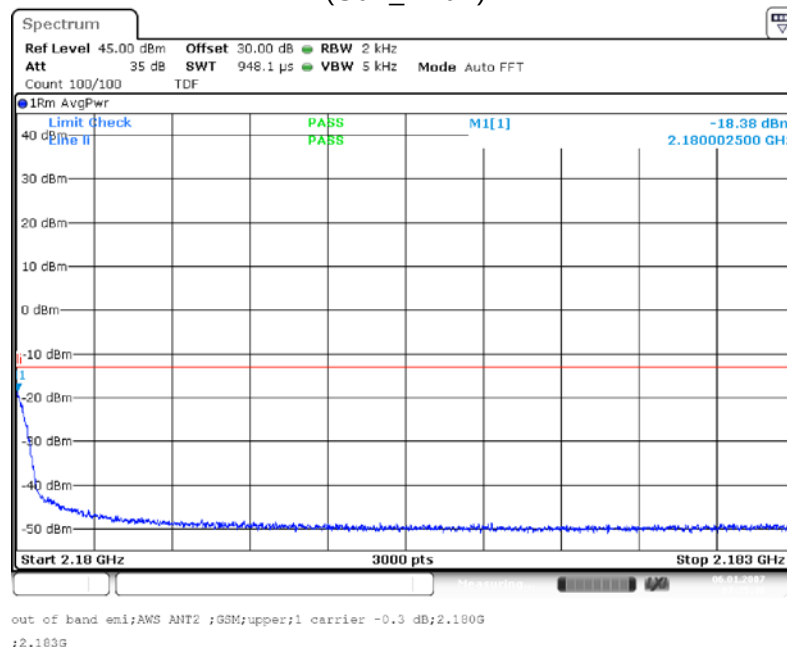
Band Edge = Lower, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



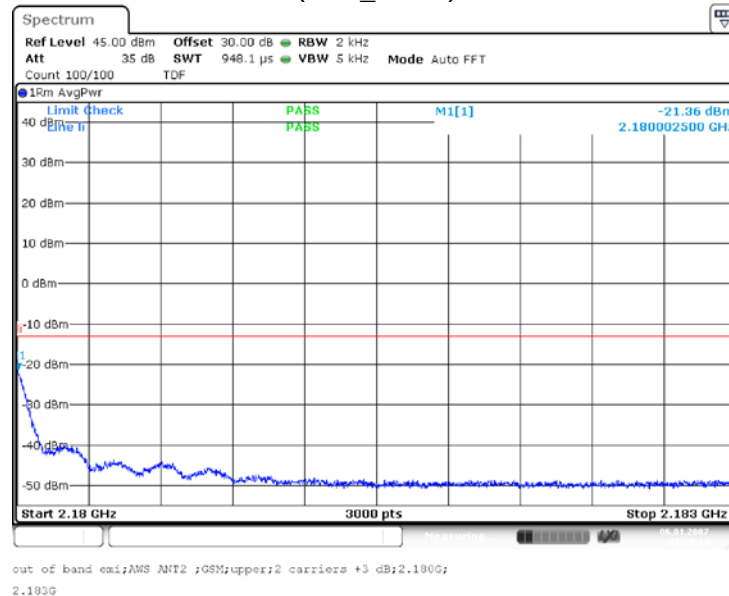
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



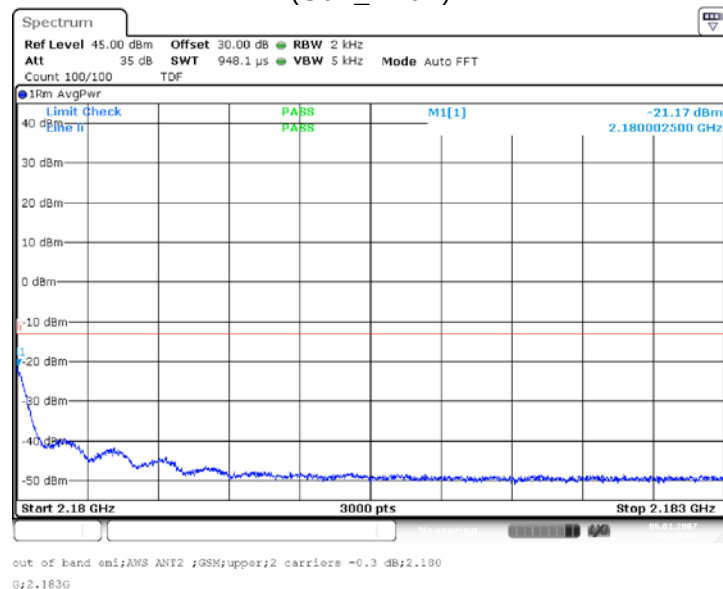
Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 1, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 3 dB > AGC, Signal Type = Narrowband (S01\_AA01)



Band Edge = Upper, Frequency Band = Band 4/10/66, Number of signals = 2, Direction = RF downlink, Input Power = 0.3 dB < AGC, Signal Type = Narrowband (S01\_AA01)



#### 4.5.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

## 4.6 OUT-OF-BAND REJECTION

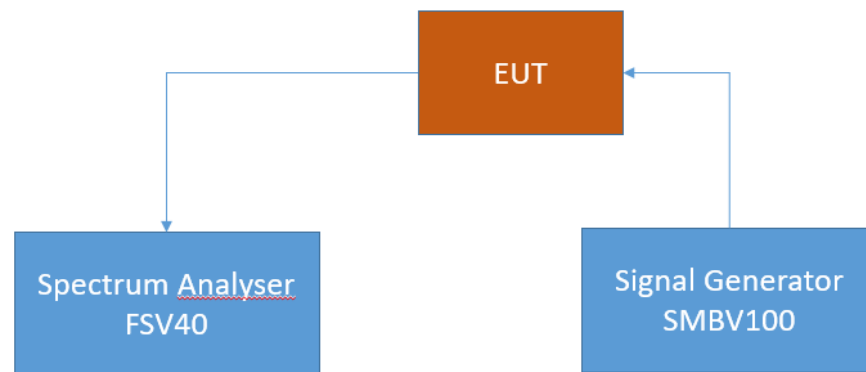
Standard FCC Part 27

**The test was performed according to:**  
ANSI C63.26

### 4.6.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the out-of-band rejection test case for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; Out-of-band rejection

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

### 4.6.2 TEST REQUIREMENTS / LIMITS

For this test case exists no applicable limit

#### 4.6.3 TEST PROTOCOL

| Band 4 / 10 / 66, downlink [Module 1] |                    |                                            |                                            |                       |
|---------------------------------------|--------------------|--------------------------------------------|--------------------------------------------|-----------------------|
| Highest Power Frequency [MHz]         | Output Power [dBm] | Lower Highest Power -20 dB Frequency [MHz] | Upper Highest Power -20 dB Frequency [MHz] | 20 dB Bandwidth [kHz] |
| 2147.100                              | 23.950             | 2107.813                                   | 2182.223                                   | 74410.0               |

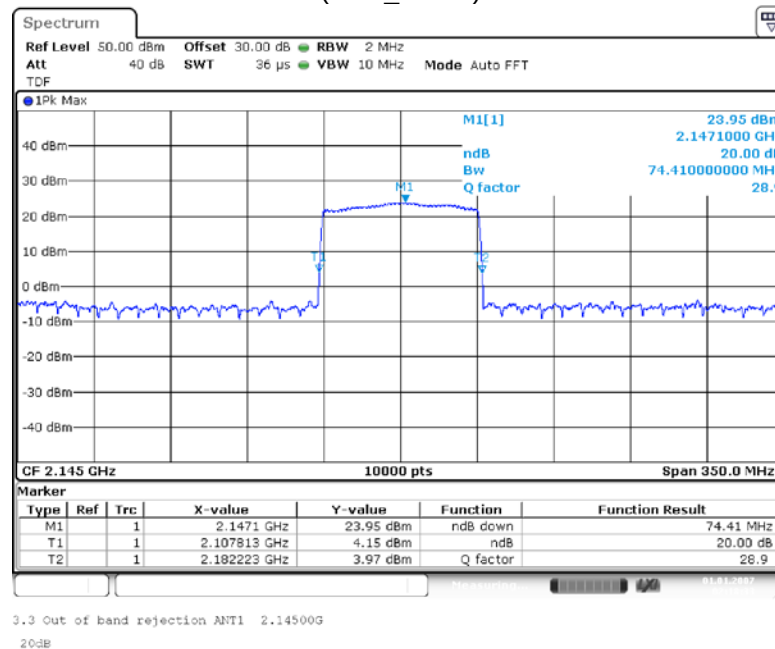
| Band 4 / 10 / 66, downlink [Module 2] |                    |                                            |                                            |                       |
|---------------------------------------|--------------------|--------------------------------------------|--------------------------------------------|-----------------------|
| Highest Power Frequency [MHz]         | Output Power [dBm] | Lower Highest Power -20 dB Frequency [MHz] | Upper Highest Power -20 dB Frequency [MHz] | 20 dB Bandwidth [kHz] |
| 2147.300                              | 24.130             | 2107.813                                   | 2182.188                                   | 74375.0               |

Remark: Please see next sub-clause for the measurement plot.

#### 4.6.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

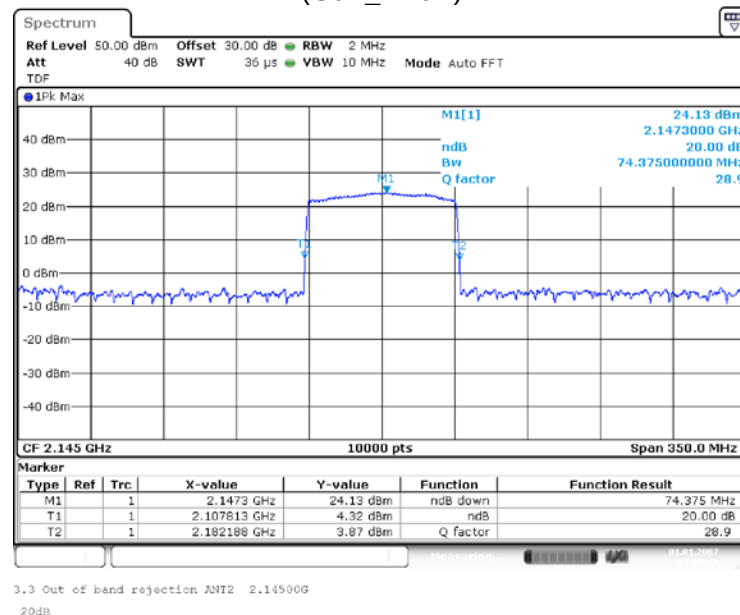
##### Module 1:

Frequency Band = Band 4/10/66, Direction = RF downlink  
(S01\_AA01)



##### Module 2:

Frequency Band = Band 4/10/66, Direction = RF downlink  
(S01\_AA01)



#### 4.6.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

## 4.7 FIELD STRENGTH OF SPURIOUS RADIATION

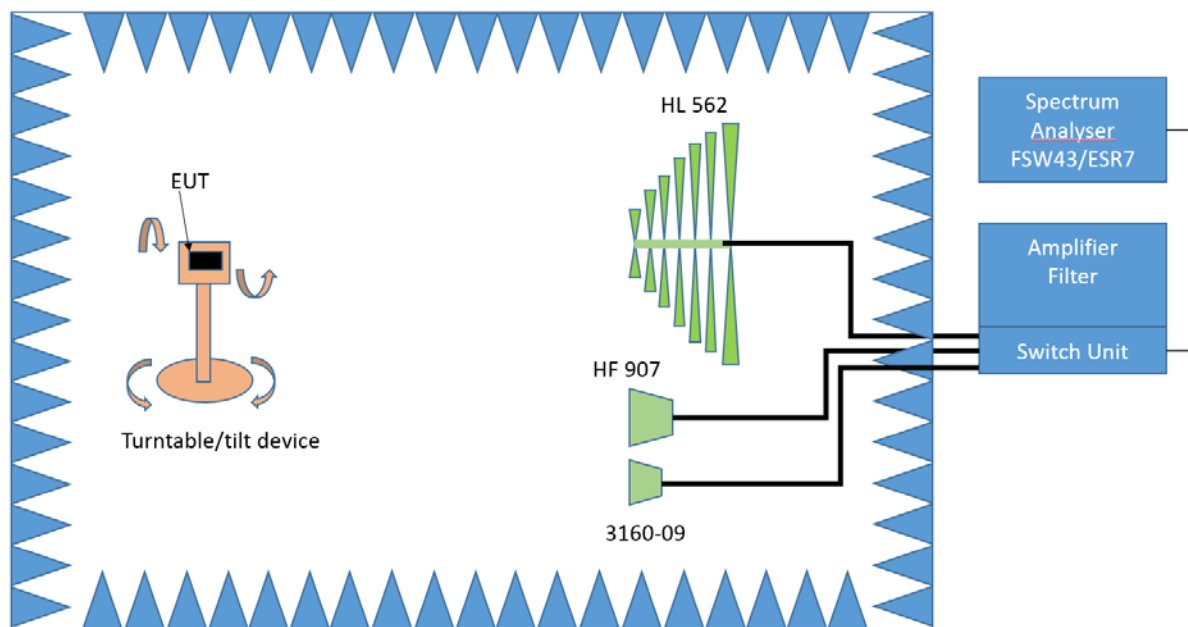
Standard FCC Part 27, §24.53

**The test was performed according to:**  
ANSI C63.26

### 4.7.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable radiated spurious emission measurements per § 2.1053

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90; Industrial Signal Booster – Test Setup; Field Strength of Spurious Radiation

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m<sup>2</sup> in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered from a DC power source.

### 1. Measurement above 30 MHz and up to 1 GHz

#### Step 1: Preliminary scan

This is a preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)
- Frequency range: 30 – 1000 MHz

- Frequency steps: 30 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range:  $-180^{\circ}$  to  $90^{\circ}$
- Turntable step size:  $90^{\circ}$
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

#### **Step 2: Adjustment measurement**

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by  $\pm 45^{\circ}$  around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by  $\pm 100$  cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $\pm 45^{\circ}$  around the determined value
- Height variation range:  $\pm 100$  cm around the determined value
- Antenna Polarisation: max. value determined in step 1

#### **Step 3: Final measurement with QP detector**

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak ( $< 1$  GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

### **3. Measurement above 1 GHz**

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

#### **Step 1:**

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of  $90^{\circ}$ .

The turn table step size (azimuth angle) for the preliminary measurement is  $45^{\circ}$ .

#### **Step 2:**

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna in step 2 is omitted. Instead of this, a maximum search with a step size  $\pm 45^{\circ}$  for the elevation axis is performed.

The turn table azimuth will slowly vary by  $\pm 22.5^\circ$ .

The elevation angle will slowly vary by  $\pm 45^\circ$

EMI receiver settings (for all steps):

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

**Step 3:**

Spectrum analyser settings for step 3:

- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

#### 4.7.2 TEST REQUIREMENTS / LIMITS

**FCC Part 2.1053; Measurement required: Field strength of spurious radiation:**

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate.

**Part 27; Miscellaneous Wireless Communication Services**

**Subpart C – Technical standards**

**§27.53 – Emission limits**

**Band 13**

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, 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 any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(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;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions 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.

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

#### **Band 12:**

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

#### **Band 4:**

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

#### **RSS-130; 4.6 Transmitter Unwanted Emissions**

4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least  $43 + 10 \log_{10} p$  (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

- (a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
  - o (i)  $76 + 10 \log_{10} p$  (watts), dB, for base and fixed equipment, and
  - o (ii)  $65 + 10 \log_{10} p$  (watts), dB, for mobile and portable equipment.
- (b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed  $-70$  dBW/MHz for wideband signal and  $-80$  dBW for discrete emission with bandwidth less than 700 Hz.

## RSS-139; 6.6 Transmitter Unwanted Emissions

Equipment shall comply with the limits in (i) and (ii) below.

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

### 4.7.3 TEST PROTOCOL

| Band 4/10/66, downlink<br>[Module 1] |                         |                       |          |              |                |                         |
|--------------------------------------|-------------------------|-----------------------|----------|--------------|----------------|-------------------------|
| Spurious Freq.<br>[MHz]              | Spurious Level<br>[dBm] | Pin Module 1<br>[dBm] | Detector | RBW<br>[kHz] | Limit<br>[dBm] | Margin to Limit<br>[dB] |
| -                                    | -                       | 2.6/-0.5/3.4          | RMS      | 100          | -13.0          | - - -                   |
| -                                    | -                       | 2.6/-0.5/3.4          | RMS      | 100          | -13.0          | - - -                   |
| -                                    | -                       | 2.6/-0.5/3.4          | RMS      | 100          | -13.0          | - - -                   |
| -                                    | -                       | 2.6/-0.5/3.4          | RMS      | 100          | -13.0          | - - -                   |
| -                                    | -                       | 2.6/-0.5/3.4          | RMS      | 100          | -13.0          | - - -                   |

Remark: Please see next sub-clause for the measurement plot.

Only module 1 was tested

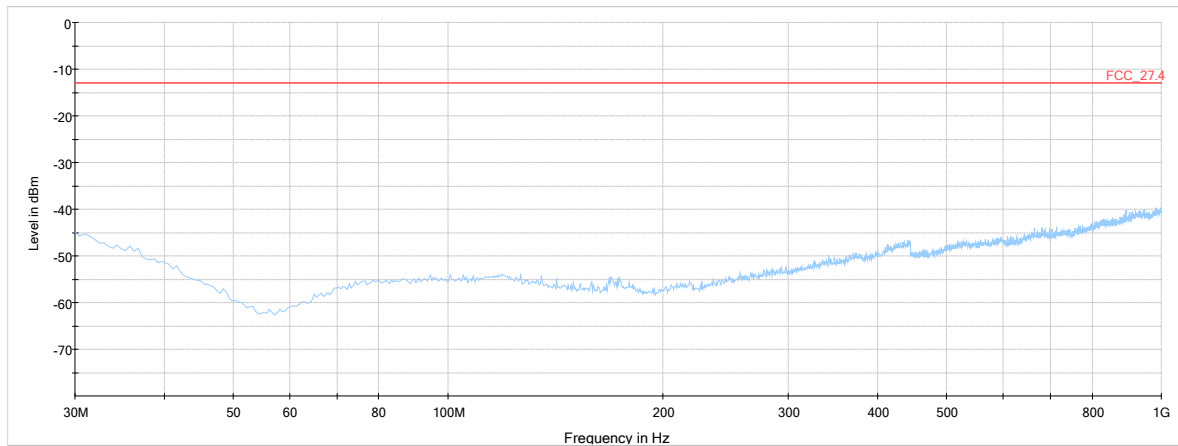
The three required test frequencies (low, mid, high) were injected simultaneously conducted into the EUT.

The RF output ports were terminated with 50 Ohm

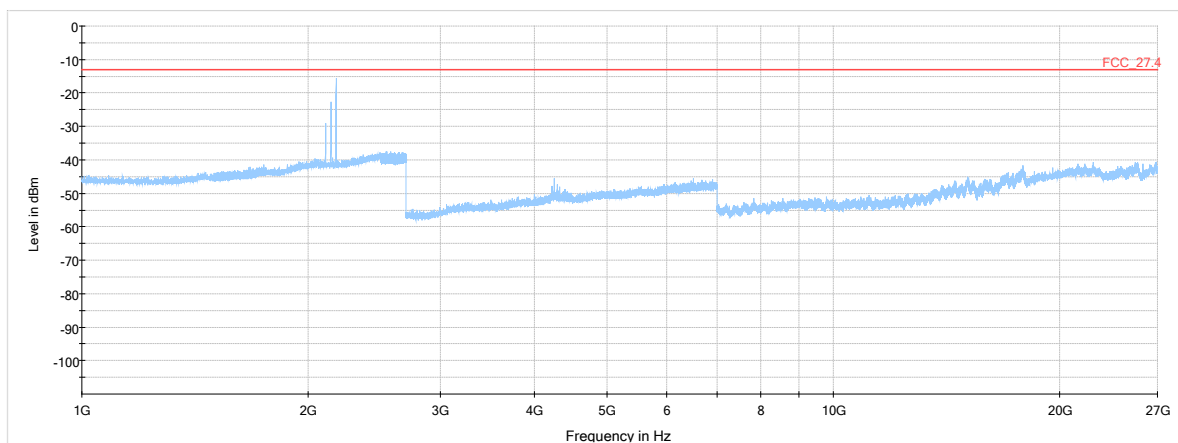
Pin: The single power of each of the three channels (bottom, middle, top).

#### 4.7.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 4/10/66, Test Frequency = low, Direction = RF downlink  
(S01\_AA01)



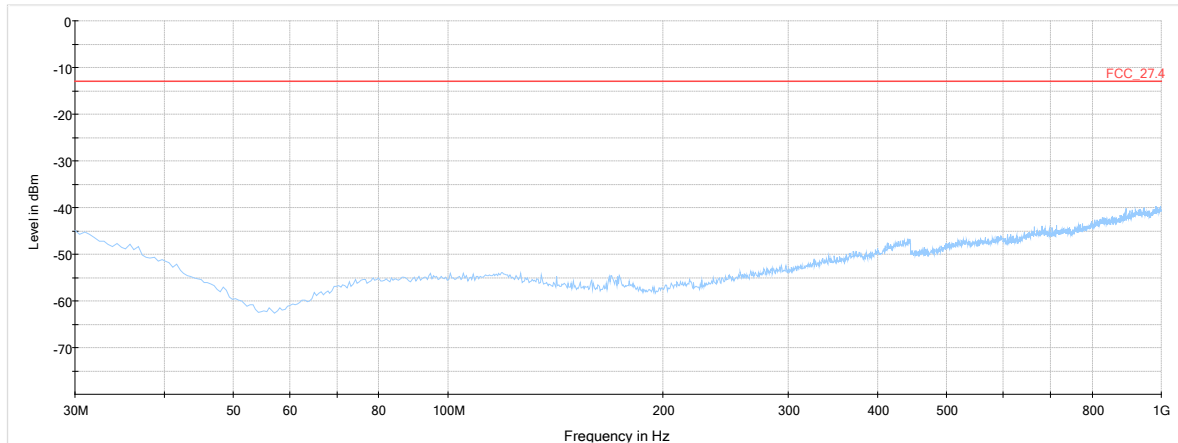
30 MHz - 1 GHz



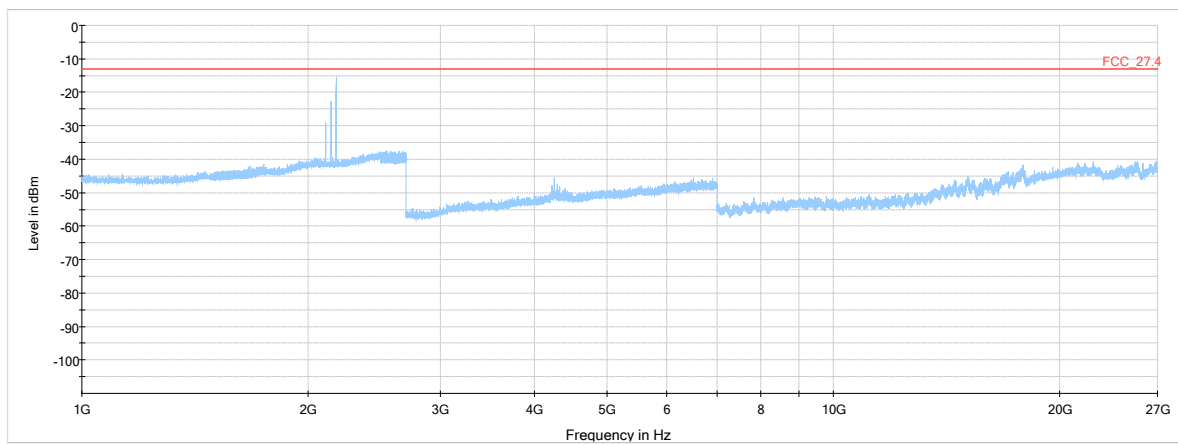
1 GHz - 27 GHz

Note: The three peaks at appr. 2150 MHz are the wanted signals.

Frequency Band = Band 4/10/66, Test Frequency = mid, Direction = RF downlink  
(S01\_AA01)



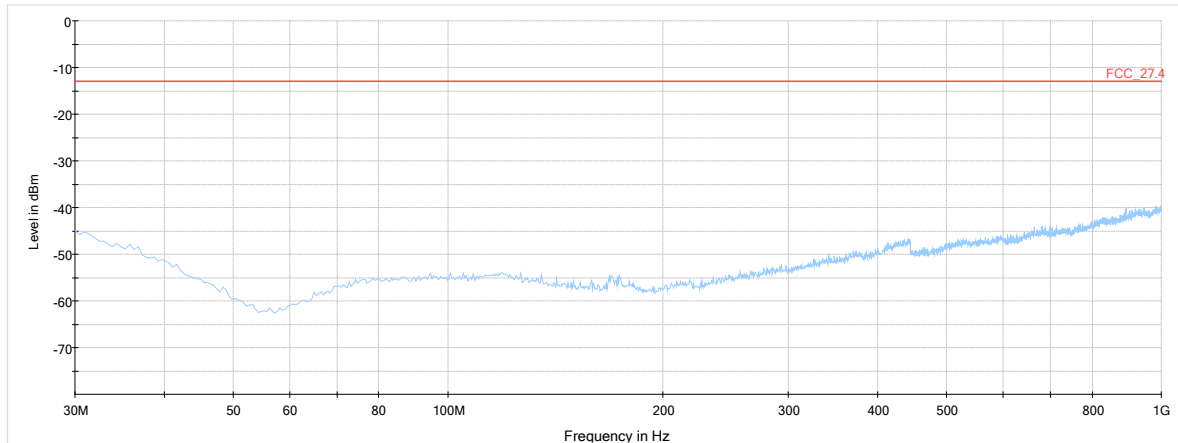
30 MHz - 1 GHz



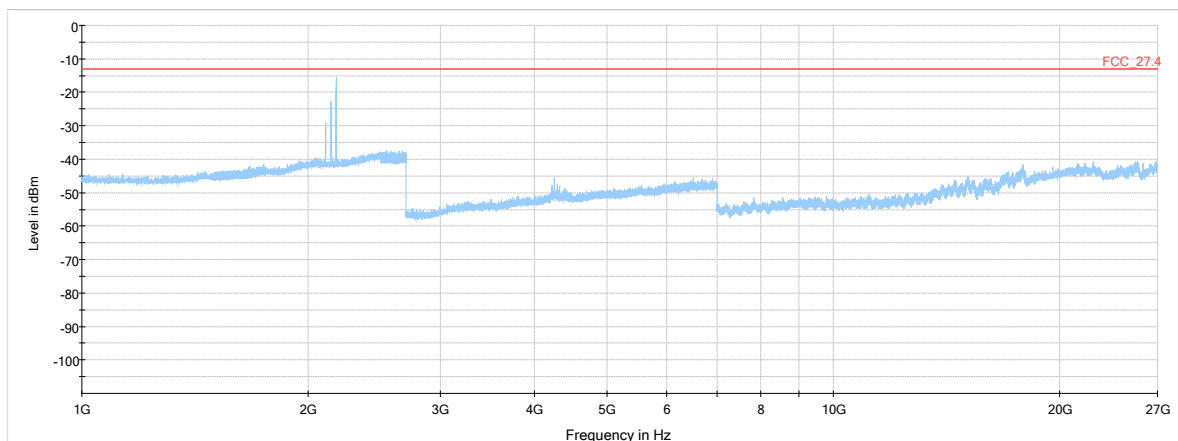
1 GHz - 27 GHz

Note: The three peaks at appr. 2150 MHz are the wanted signals.

Frequency Band = Band 4/10/66, Test Frequency = high, Direction = RF downlink  
(S01\_AA01)



30 MHz - 1 GHz



1 GHz - 27 GHz

Note: The three peaks at appr. 2150 MHz are the wanted signals.

#### 4.7.5 TEST EQUIPMENT USED

- Radiated Emissions

## 5 TEST EQUIPMENT

1 R&S TS8997  
EN300328/301893/FCC cond. Test Lab

| Ref.No. | Device Name          | Description                                | Manufacturer                      | Serial Number  | Last Calibration | Calibration Due |
|---------|----------------------|--------------------------------------------|-----------------------------------|----------------|------------------|-----------------|
| 1.1     | SMB100A              | Signal Generator 9 kHz - 6 GHz             | Rohde & Schwarz                   | 107695         | 2017-07          | 2020-07         |
| 1.2     | MFS                  | Rubidium Frequency Standard                | Datum-Beverly                     | 5489/001       | 2018-07          | 2020-07         |
| 1.3     | 1515 / 93459         | Broadband Power Divider SMA (Aux)          | Weinschel Associates              | LN673          |                  |                 |
| 1.4     | FSV30                | Signal Analyzer 10 Hz - 30 GHz             | Rohde & Schwarz                   | 103005         | 2018-04          | 2020-04         |
| 1.5     | Fluke 177            | Digital Multimeter 03 (Multimeter)         | Fluke Europe B.V.                 | 86670383       | 2018-04          | 2020-04         |
| 1.6     | VT 4002              | Climatic Chamber                           | Vötsch                            | 58566002150010 | 2018-04          | 2020-04         |
| 1.7     | A8455-4              | 4 Way Power Divider (SMA)                  |                                   | -              |                  |                 |
| 1.8     | Opus10 THI (8152.00) | ThermoHygro Datalogger 03 (Environ)        | Lufft Mess- und Regeltechnik GmbH | 7482           | 2017-03          | 2019-03         |
| 1.9     | SMBV100A             | Vector Signal Generator 9 kHz - 6 GHz      | Rohde & Schwarz                   | 259291         | 2016-10          | 2019-10         |
| 1.10    | OSP120               | Switching Unit with integrated power meter | Rohde & Schwarz                   | 101158         | 2018-05          | 2021-05         |

2 Radiated Emissions  
Lab to perform radiated emission tests

| Ref.No. | Device Name           | Description                               | Manufacturer                      | Serial Number | Last Calibration | Calibration Due |
|---------|-----------------------|-------------------------------------------|-----------------------------------|---------------|------------------|-----------------|
| 2.1     | NRV-Z1                | Sensor Head A                             | Rohde & Schwarz                   | 827753/005    | 2018-07          | 2019-07         |
| 2.2     | MFS                   | Rubidium Frequency Normal MFS             | Datum GmbH                        | 002           | 2018-10          | 2020-10         |
| 2.3     | Opus10 TPR (8253.00)  | ThermoAirpressure Datalogger 13 (Environ) | Lufft Mess- und Regeltechnik GmbH | 13936         | 2017-04          | 2019-04         |
| 2.4     | ESW44                 | EMI Test Receiver                         | Rohde & Schwarz                   | 101603        | 2018-05          | 2019-05         |
| 2.5     | Anechoic Chamber      | 10.38 x 6.38 x 6.00 m <sup>3</sup>        | Frankonia                         | none          | 2018-06          | 2020-06         |
| 2.6     | HL 562                | Ultralog new biconicals                   | Rohde & Schwarz                   | 830547/003    | 2018-07          | 2021-07         |
| 2.7     | 5HC2700/12750 -1.5-KK | High Pass Filter                          | Trilithic                         | 9942012       |                  |                 |
| 2.8     | ASP 1.2/1.8-10 kg     | Antenna Mast                              | Maturo GmbH                       | -             |                  |                 |

| Ref.No. | Device Name                   | Description                                     | Manufacturer                      | Serial Number          | Last Calibration | Calibration Due |
|---------|-------------------------------|-------------------------------------------------|-----------------------------------|------------------------|------------------|-----------------|
| 2.9     | Fully Anechoic Room           | 8.80m x 4.60m x 4.05m (l x w x h)               | Albatross Projects                | P26971-647-001-PRB     | 2018-06          | 2020-06         |
| 2.10    | Fluke 177                     | Digital Multimeter 03 (Multimeter)              | Fluke Europe B.V.                 | 86670383               | 2018-04          | 2020-04         |
| 2.11    | JS4-18002600-32-5P            | Broadband Amplifier 18 GHz - 26 GHz             | Miteq                             | 849785                 |                  |                 |
| 2.12    | FSW 43                        | Spectrum Analyzer                               | Rohde & Schwarz                   | 103779                 | 2016-12          | 2018-12         |
| 2.13    | 3160-09                       | Standard Gain / Pyramidal Horn Antenna 26.5 GHz | EMCO Elektronik GmbH              | 00083069               |                  |                 |
| 2.14    | WHKX 7.0/18G-8SS              | High Pass Filter                                | Wainwright                        | 09                     |                  |                 |
| 2.15    | 4HC1600/12750-1.5-KK          | High Pass Filter                                | Trilithic                         | 9942011                |                  |                 |
| 2.16    | Chroma 6404                   | AC Power Source                                 | Chroma ATE INC.                   | 64040001304            |                  |                 |
| 2.17    | JS4-00102600-42-5A            | Broadband Amplifier 30 MHz - 26 GHz             | Miteq                             | 619368                 |                  |                 |
| 2.18    | TT 1.5 WI                     | Turn Table                                      | Maturo GmbH                       | -                      |                  |                 |
| 2.19    | HL 562 Ultralog               | Log.-per. Antenna                               | Rohde & Schwarz                   | 100609                 | 2016-04          | 2019-04         |
| 2.20    | 3160-10                       | Standard Gain / Pyramidal Horn Antenna 40 GHz   | EMCO Elektronik GmbH              | 00086675               |                  |                 |
| 2.21    | 5HC3500/18000-1.2-KK          | High Pass Filter                                | Trilithic                         | 200035008              |                  |                 |
| 2.22    | Opus10 THI (8152.00)          | ThermoHygro Datalogger 12 (Environ)             | Lufft Mess- und Regeltechnik GmbH | 12482                  | 2017-03          | 2019-03         |
| 2.23    | ESR 7                         | EMI Receiver / Spectrum Analyzer                | Rohde & Schwarz                   | 101424                 | 2019-01          | 2020-01         |
| 2.24    | JS4-00101800-35-5P            | Broadband Amplifier 30 MHz - 18 GHz             | Miteq                             | 896037                 |                  |                 |
| 2.25    | AS 620 P                      | Antenna mast                                    | HD GmbH                           | 620/37                 |                  |                 |
| 2.26    | Tilt device Maturo (Rohacell) | Antrieb TD1.5-10kg                              | Maturo GmbH                       | TD1.5-10kg/024/3790709 |                  |                 |
| 2.27    | PAS 2.5 - 10 kg               | Antenna Mast                                    | Maturo GmbH                       | -                      |                  |                 |
| 2.28    | AM 4.0                        | Antenna mast                                    | Maturo GmbH                       | AM4.0/180/11920513     |                  |                 |
| 2.29    | HF 907                        | Double-ridged horn                              | Rohde & Schwarz                   | 102444                 | 2018-07          | 2021-07         |

3 FCC Conducted Base Station / Repeater  
EN300328/301893/FCC cond. Test Lab

| Ref.No. | Device Name | Description                             | Manufacturer    | Serial Number | Last Calibration | Calibration Due |
|---------|-------------|-----------------------------------------|-----------------|---------------|------------------|-----------------|
| 3.1     | FSV40       | Signal Analyzer 10 Hz - 40 GHz          | Rohde & Schwarz | 100886        | 2018-10          | 2019-10         |
| 3.2     | SMBV100A    | Vector Signal Generator 9 kHz - 6 GHz   | Rohde & Schwarz | 255975        | 2017-08          | 2019-08         |
| 3.3     | SMIQ        | Vector Signal Generator 9 kHz – 3.3 GHz | Rohde & Schwarz | 831389/062    | 2018-10          | 2020-10         |

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

## 6 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

### 6.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

| Frequency |  | Corr. | LISN<br>insertion<br>loss<br>ESH3-<br>Z5 | cable<br>loss<br>(incl. 10<br>dB<br>atten-<br>uator) |
|-----------|--|-------|------------------------------------------|------------------------------------------------------|
| MHz       |  | dB    | dB                                       | dB                                                   |
| 0.15      |  | 10.1  | 0.1                                      | 10.0                                                 |
| 5         |  | 10.3  | 0.1                                      | 10.2                                                 |
| 7         |  | 10.3  | 0.2                                      | 10.3                                                 |
| 10        |  | 10.3  | 0.2                                      | 10.3                                                 |
| 12        |  | 10.7  | 0.3                                      | 10.4                                                 |
| 14        |  | 10.7  | 0.3                                      | 10.4                                                 |
| 16        |  | 10.8  | 0.4                                      | 10.4                                                 |
| 18        |  | 10.9  | 0.4                                      | 10.3                                                 |
| 20        |  | 10.9  | 0.4                                      | 10.3                                                 |
| 22        |  | 11.1  | 0.3                                      | 10.6                                                 |
| 24        |  | 11.1  | 0.3                                      | 10.6                                                 |
| 26        |  | 11.2  | 0.3                                      | 10.7                                                 |
| 28        |  | 11.2  | 0.3                                      | 10.7                                                 |
| 30        |  | 11.3  | 0.3                                      | 10.8                                                 |

#### Sample calculation

$U_{LISN} \text{ (dB } \mu\text{V)} = U \text{ (dB } \mu\text{V)} + \text{Corr. (dB)}$   
 $U$  = Receiver reading  
 LISN Insertion loss = Voltage Division Factor of LISN  
 Corr. = sum of single correction factors of used LISN, cables, switch units (if used)  
 Linear interpolation will be used for frequencies in between the values in the table.

## 6.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

| Frequency | AF       | Corr. | cable loss 1<br>(inside chamber) | cable loss 2<br>(outside chamber) | cable loss 3<br>(switch unit) | cable loss 4<br>(to receiver) | distance corr.<br>(-40 dB/decade) | d <sub>Limit</sub><br>(meas. distance (limit)) | d <sub>used</sub><br>(meas. distance (used)) |
|-----------|----------|-------|----------------------------------|-----------------------------------|-------------------------------|-------------------------------|-----------------------------------|------------------------------------------------|----------------------------------------------|
| MHz       | dB (1/m) | dB    | dB                               | dB                                | dB                            | dB                            | dB                                | m                                              | m                                            |
| 0.009     | 20.30    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.01      | 20.45    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.015     | 20.37    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.02      | 20.36    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.025     | 20.38    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.03      | 20.32    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.05      | 20.35    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.08      | 20.30    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.1       | 20.20    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.2       | 20.17    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.3       | 20.14    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.49      | 20.12    | -79.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -80                               | 300                                            | 3                                            |
| 0.490001  | 20.12    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 0.3       | 20.11    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 0.8       | 20.10    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 1         | 20.09    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 2         | 20.08    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 3         | 20.06    | -39.6 | 0.1                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 4         | 20.05    | -39.5 | 0.2                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 5         | 20.05    | -39.5 | 0.2                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 6         | 20.02    | -39.5 | 0.2                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 8         | 19.95    | -39.5 | 0.2                              | 0.1                               | 0.1                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 10        | 19.83    | -39.4 | 0.2                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 12        | 19.71    | -39.4 | 0.2                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 14        | 19.54    | -39.4 | 0.2                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 16        | 19.53    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 18        | 19.50    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 20        | 19.57    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 22        | 19.61    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 24        | 19.61    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 26        | 19.54    | -39.3 | 0.3                              | 0.1                               | 0.2                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 28        | 19.46    | -39.2 | 0.3                              | 0.1                               | 0.3                           | 0.1                           | -40                               | 30                                             | 3                                            |
| 30        | 19.73    | -39.1 | 0.4                              | 0.1                               | 0.3                           | 0.1                           | -40                               | 30                                             | 3                                            |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction =  $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values

### 6.3 ANTENNA R&S HL562 (30 MHz – 1 GHz)

( $d_{\text{Limit}} = 3 \text{ m}$ )

| Frequency | AF<br>R&S<br>HL562 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 30        | 18.6               | 0.6   |
| 50        | 6.0                | 0.9   |
| 100       | 9.7                | 1.2   |
| 150       | 7.9                | 1.6   |
| 200       | 7.6                | 1.9   |
| 250       | 9.5                | 2.1   |
| 300       | 11.0               | 2.3   |
| 350       | 12.4               | 2.6   |
| 400       | 13.6               | 2.9   |
| 450       | 14.7               | 3.1   |
| 500       | 15.6               | 3.2   |
| 550       | 16.3               | 3.5   |
| 600       | 17.2               | 3.5   |
| 650       | 18.1               | 3.6   |
| 700       | 18.5               | 3.6   |
| 750       | 19.1               | 4.1   |
| 800       | 19.6               | 4.1   |
| 850       | 20.1               | 4.4   |
| 900       | 20.8               | 4.7   |
| 950       | 21.1               | 4.8   |
| 1000      | 21.6               | 4.9   |

| cable<br>loss 1<br>(inside<br>chamber) | cable<br>loss 2<br>(outside<br>chamber) | cable<br>loss 3<br>(switch<br>unit) | cable<br>loss 4<br>(to<br>receiver) | distance<br>corr.<br>(-20 dB/<br>decade) | $d_{\text{Limit}}$<br>(meas.<br>distance<br>(limit)) | $d_{\text{used}}$<br>(meas.<br>distance<br>(used)) |
|----------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------|------------------------------------------|------------------------------------------------------|----------------------------------------------------|
| dB                                     | dB                                      | dB                                  | dB                                  | dB                                       | m                                                    | m                                                  |
| 0.29                                   | 0.04                                    | 0.23                                | 0.02                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.39                                   | 0.09                                    | 0.32                                | 0.08                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.36                                   | 0.14                                    | 0.47                                | 0.08                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.73                                   | 0.20                                    | 0.39                                | 0.12                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.84                                   | 0.21                                    | 0.70                                | 0.11                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.98                                   | 0.24                                    | 0.80                                | 0.13                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.04                                   | 0.26                                    | 0.89                                | 0.15                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.18                                   | 0.31                                    | 0.96                                | 0.13                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.28                                   | 0.35                                    | 1.03                                | 0.19                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.39                                   | 0.38                                    | 1.11                                | 0.22                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.44                                   | 0.39                                    | 1.20                                | 0.19                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.55                                   | 0.46                                    | 1.24                                | 0.23                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.59                                   | 0.43                                    | 1.29                                | 0.23                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.67                                   | 0.34                                    | 1.35                                | 0.22                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.67                                   | 0.42                                    | 1.41                                | 0.15                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.87                                   | 0.34                                    | 1.46                                | 0.25                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.90                                   | 0.46                                    | 1.51                                | 0.25                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.99                                   | 0.60                                    | 1.56                                | 0.27                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.14                                   | 0.60                                    | 1.63                                | 0.29                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.22                                   | 0.60                                    | 1.66                                | 0.33                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.23                                   | 0.61                                    | 1.71                                | 0.30                                | 0.0                                      | 3                                                    | 3                                                  |

( $d_{\text{Limit}} = 10 \text{ m}$ )

|      |      |      |
|------|------|------|
| 30   | 18.6 | -9.9 |
| 50   | 6.0  | -9.6 |
| 100  | 9.7  | -9.2 |
| 150  | 7.9  | -8.8 |
| 200  | 7.6  | -8.6 |
| 250  | 9.5  | -8.3 |
| 300  | 11.0 | -8.1 |
| 350  | 12.4 | -7.9 |
| 400  | 13.6 | -7.6 |
| 450  | 14.7 | -7.4 |
| 500  | 15.6 | -7.2 |
| 550  | 16.3 | -7.0 |
| 600  | 17.2 | -6.9 |
| 650  | 18.1 | -6.9 |
| 700  | 18.5 | -6.8 |
| 750  | 19.1 | -6.3 |
| 800  | 19.6 | -6.3 |
| 850  | 20.1 | -6.0 |
| 900  | 20.8 | -5.8 |
| 950  | 21.1 | -5.6 |
| 1000 | 21.6 | -5.6 |

|      |      |      |      |       |    |   |
|------|------|------|------|-------|----|---|
| 0.29 | 0.04 | 0.23 | 0.02 | -10.3 | 10 | 3 |
| 0.39 | 0.09 | 0.32 | 0.08 | -10.3 | 10 | 3 |
| 0.36 | 0.14 | 0.47 | 0.08 | -10.3 | 10 | 3 |
| 0.73 | 0.20 | 0.39 | 0.12 | -10.3 | 10 | 3 |
| 0.84 | 0.21 | 0.70 | 0.11 | -10.3 | 10 | 3 |
| 0.98 | 0.24 | 0.80 | 0.13 | -10.3 | 10 | 3 |
| 1.04 | 0.26 | 0.89 | 0.15 | -10.3 | 10 | 3 |
| 1.18 | 0.31 | 0.96 | 0.13 | -10.3 | 10 | 3 |
| 1.28 | 0.35 | 1.03 | 0.19 | -10.3 | 10 | 3 |
| 1.39 | 0.38 | 1.11 | 0.22 | -10.3 | 10 | 3 |
| 1.44 | 0.39 | 1.20 | 0.19 | -10.3 | 10 | 3 |
| 1.55 | 0.46 | 1.24 | 0.23 | -10.3 | 10 | 3 |
| 1.59 | 0.43 | 1.29 | 0.23 | -10.3 | 10 | 3 |
| 1.67 | 0.34 | 1.35 | 0.22 | -10.3 | 10 | 3 |
| 1.67 | 0.42 | 1.41 | 0.15 | -10.3 | 10 | 3 |
| 1.87 | 0.34 | 1.46 | 0.25 | -10.3 | 10 | 3 |
| 1.90 | 0.46 | 1.51 | 0.25 | -10.3 | 10 | 3 |
| 1.99 | 0.60 | 1.56 | 0.27 | -10.3 | 10 | 3 |
| 2.14 | 0.60 | 1.63 | 0.29 | -10.3 | 10 | 3 |
| 2.22 | 0.60 | 1.66 | 0.33 | -10.3 | 10 | 3 |
| 2.23 | 0.61 | 1.71 | 0.30 | -10.3 | 10 | 3 |

#### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + \text{AF (dB 1/m)} + \text{Corr. (dB)}$   
 $U$  = Receiver reading  
 $\text{AF}$  = Antenna factor  
 $\text{Corr.}$  = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)  
 $\text{distance correction} = -20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$   
 Linear interpolation will be used for frequencies in between the values in the table.  
 Tables show an extract of values.

#### 6.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 1000      | 24.4               | -19.4 |
| 2000      | 28.5               | -17.4 |
| 3000      | 31.0               | -16.1 |
| 4000      | 33.1               | -14.7 |
| 5000      | 34.4               | -13.7 |
| 6000      | 34.7               | -12.7 |
| 7000      | 35.6               | -11.0 |

| cable<br>loss 1<br>(relay +<br>cable<br>inside<br>chamber) | cable<br>loss 2<br>(outside<br>chamber) | cable<br>loss 3<br>(switch<br>unit,<br>atten-<br>uator &<br>pre-amp) | cable<br>loss 4 (to<br>receiver) |  |  |
|------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------|----------------------------------|--|--|
| dB                                                         | dB                                      | dB                                                                   | dB                               |  |  |
| 0.99                                                       | 0.31                                    | -21.51                                                               | 0.79                             |  |  |
| 1.44                                                       | 0.44                                    | -20.63                                                               | 1.38                             |  |  |
| 1.87                                                       | 0.33                                    | -19.85                                                               | 1.33                             |  |  |
| 2.41                                                       | 0.67                                    | -19.13                                                               | 1.31                             |  |  |
| 2.78                                                       | 0.86                                    | -18.71                                                               | 1.40                             |  |  |
| 2.74                                                       | 0.90                                    | -17.83                                                               | 1.47                             |  |  |
| 2.82                                                       | 0.86                                    | -16.19                                                               | 1.46                             |  |  |

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 3000      | 31.0               | -23.4 |
| 4000      | 33.1               | -23.3 |
| 5000      | 34.4               | -21.7 |
| 6000      | 34.7               | -21.2 |
| 7000      | 35.6               | -19.8 |

| cable<br>loss 1<br>(relay<br>inside<br>chamber) | cable<br>loss 2<br>(inside<br>chamber) | cable<br>loss 3<br>(outside<br>chamber) | cable<br>loss 4<br>(switch<br>unit,<br>atten-<br>uator &<br>pre-amp) | cable<br>loss 5 (to<br>receiver) | used<br>for<br>FCC<br>15.247 |
|-------------------------------------------------|----------------------------------------|-----------------------------------------|----------------------------------------------------------------------|----------------------------------|------------------------------|
| dB                                              | dB                                     | dB                                      | dB                                                                   | dB                               |                              |
| 0.47                                            | 1.87                                   | 0.33                                    | -27.58                                                               | 1.33                             |                              |
| 0.36                                            | 2.41                                   | 0.67                                    | -28.23                                                               | 1.31                             |                              |
| 0.61                                            | 2.78                                   | 0.86                                    | -27.35                                                               | 1.40                             |                              |
| 0.38                                            | 2.74                                   | 0.90                                    | -26.89                                                               | 1.47                             |                              |
| 0.66                                            | 2.82                                   | 0.86                                    | -25.58                                                               | 1.46                             |                              |

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 7000      | 35.6               | -57.3 |
| 8000      | 36.3               | -56.3 |
| 9000      | 37.1               | -55.3 |
| 10000     | 37.5               | -56.2 |
| 11000     | 37.5               | -55.3 |
| 12000     | 37.6               | -53.7 |
| 13000     | 38.2               | -53.5 |
| 14000     | 39.9               | -56.3 |
| 15000     | 40.9               | -54.1 |
| 16000     | 41.3               | -54.1 |
| 17000     | 42.8               | -54.4 |
| 18000     | 44.2               | -54.7 |

| cable<br>loss 1<br>(relay<br>inside<br>chamber) | cable<br>loss 2<br>(High<br>Pass) | cable<br>loss 3<br>(pre-<br>amp) | cable<br>loss 4<br>(inside<br>chamber) | cable<br>loss 5<br>(outside<br>chamber) | cable<br>loss 6<br>(to<br>receiver) |
|-------------------------------------------------|-----------------------------------|----------------------------------|----------------------------------------|-----------------------------------------|-------------------------------------|
| dB                                              | dB                                | dB                               | dB                                     | dB                                      | dB                                  |
| 0.36                                            | 1.28                              | -62.72                           | 2.66                                   | 0.94                                    | 1.46                                |
| 0.69                                            | 0.71                              | -61.49                           | 2.84                                   | 1.00                                    | 1.53                                |
| 0.68                                            | 0.65                              | -60.80                           | 3.06                                   | 1.09                                    | 1.60                                |
| 0.70                                            | 0.34                              | -61.91                           | 3.28                                   | 1.20                                    | 1.67                                |
| 0.80                                            | 0.61                              | -61.40                           | 3.43                                   | 1.27                                    | 1.70                                |
| 0.84                                            | 0.42                              | -59.70                           | 3.53                                   | 1.26                                    | 1.73                                |
| 0.83                                            | 0.44                              | -59.81                           | 3.75                                   | 1.32                                    | 1.83                                |
| 0.91                                            | 0.33                              | -63.03                           | 3.91                                   | 1.40                                    | 1.77                                |
| 0.98                                            | 0.34                              | -61.05                           | 4.02                                   | 1.44                                    | 1.83                                |
| 1.23                                            | 0.49                              | -61.51                           | 4.17                                   | 1.51                                    | 1.85                                |
| 1.36                                            | 0.76                              | -62.36                           | 4.34                                   | 1.53                                    | 2.00                                |
| 1.70                                            | 0.33                              | -62.88                           | 4.41                                   | 1.55                                    | 1.91                                |

#### Sample calculation

$$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.

## 6.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

| Frequency | AF<br>EMCO<br>3160-09 | Corr. | cable<br>loss 1<br>(inside<br>chamber) | cable<br>loss 2<br>(pre-<br>amp) | cable<br>loss 3<br>(inside<br>chamber) | cable<br>loss 4<br>(switch<br>unit) | cable<br>loss 5<br>(to<br>receiver) |
|-----------|-----------------------|-------|----------------------------------------|----------------------------------|----------------------------------------|-------------------------------------|-------------------------------------|
| MHz       | dB (1/m)              | dB    | dB                                     | dB                               | dB                                     | dB                                  | dB                                  |
| 18000     | 40.2                  | -23.5 | 0.72                                   | -35.85                           | 6.20                                   | 2.81                                | 2.65                                |
| 18500     | 40.2                  | -23.2 | 0.69                                   | -35.71                           | 6.46                                   | 2.76                                | 2.59                                |
| 19000     | 40.2                  | -22.0 | 0.76                                   | -35.44                           | 6.69                                   | 3.15                                | 2.79                                |
| 19500     | 40.3                  | -21.3 | 0.74                                   | -35.07                           | 7.04                                   | 3.11                                | 2.91                                |
| 20000     | 40.3                  | -20.3 | 0.72                                   | -34.49                           | 7.30                                   | 3.07                                | 3.05                                |
| 20500     | 40.3                  | -19.9 | 0.78                                   | -34.46                           | 7.48                                   | 3.12                                | 3.15                                |
| 21000     | 40.3                  | -19.1 | 0.87                                   | -34.07                           | 7.61                                   | 3.20                                | 3.33                                |
| 21500     | 40.3                  | -19.1 | 0.90                                   | -33.96                           | 7.47                                   | 3.28                                | 3.19                                |
| 22000     | 40.3                  | -18.7 | 0.89                                   | -33.57                           | 7.34                                   | 3.35                                | 3.28                                |
| 22500     | 40.4                  | -19.0 | 0.87                                   | -33.66                           | 7.06                                   | 3.75                                | 2.94                                |
| 23000     | 40.4                  | -19.5 | 0.88                                   | -33.75                           | 6.92                                   | 3.77                                | 2.70                                |
| 23500     | 40.4                  | -19.3 | 0.90                                   | -33.35                           | 6.99                                   | 3.52                                | 2.66                                |
| 24000     | 40.4                  | -19.8 | 0.88                                   | -33.99                           | 6.88                                   | 3.88                                | 2.58                                |
| 24500     | 40.4                  | -19.5 | 0.91                                   | -33.89                           | 7.01                                   | 3.93                                | 2.51                                |
| 25000     | 40.4                  | -19.3 | 0.88                                   | -33.00                           | 6.72                                   | 3.96                                | 2.14                                |
| 25500     | 40.3                  | -20.4 | 0.89                                   | -34.07                           | 6.90                                   | 3.66                                | 2.22                                |
| 26000     | 40.3                  | -21.3 | 0.86                                   | -35.11                           | 7.02                                   | 3.69                                | 2.28                                |
| 26500     | 40.3                  | -21.1 | 0.90                                   | -35.20                           | 7.15                                   | 3.91                                | 2.36                                |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

## 6.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

| Frequency | AF<br>EMCO<br>3160-10 | Corr. | cable<br>loss 1<br>(inside<br>chamber) | cable<br>loss 2<br>(outside<br>chamber) | cable<br>loss 3<br>(switch<br>unit) | cable<br>loss 4<br>(to<br>receiver) | distance<br>corr.<br>(-20 dB/<br>decade) | d <sub>Limit</sub><br>(meas.<br>distance<br>(limit)) | d <sub>used</sub><br>(meas.<br>distance<br>(used)) |
|-----------|-----------------------|-------|----------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------|------------------------------------------|------------------------------------------------------|----------------------------------------------------|
| GHz       | dB (1/m)              | dB    | dB                                     | dB                                      | dB                                  | dB                                  | dB                                       | m                                                    | m                                                  |
| 26.5      | 43.4                  | -11.2 | 4.4                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 27.0      | 43.4                  | -11.2 | 4.4                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 28.0      | 43.4                  | -11.1 | 4.5                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 29.0      | 43.5                  | -11.0 | 4.6                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 30.0      | 43.5                  | -10.9 | 4.7                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 31.0      | 43.5                  | -10.8 | 4.7                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 32.0      | 43.5                  | -10.7 | 4.8                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 33.0      | 43.6                  | -10.7 | 4.9                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 34.0      | 43.6                  | -10.6 | 5.0                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 35.0      | 43.6                  | -10.3 | 5.1                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 36.0      | 43.6                  | -10.4 | 5.1                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 37.0      | 43.7                  | -10.3 | 5.2                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 38.0      | 43.7                  | -10.2 | 5.3                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 39.0      | 43.7                  | -10.2 | 5.4                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |
| 40.0      | 43.8                  | -10.1 | 5.5                                    |                                         |                                     |                                     | -15.6                                    | 3                                                    | 0.3                                                |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

distance correction =  $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

## 7 MEASUREMENT UNCERTAINTIES

| Test Case(s)                                                                                    | Parameter          | Uncertainty                    |
|-------------------------------------------------------------------------------------------------|--------------------|--------------------------------|
| - Field strength of spurious radiation                                                          | Power              | $\pm 5.5$ dB                   |
| - Out-of-band rejection<br>- Occupied Bandwidth<br>- Input versus output spectrum               | Power<br>Frequency | $\pm 2.9$ dB<br>$\pm 11.2$ kHz |
| - Effective radiated power, mean output power and zone enhancer gain<br>- Peak to Average Ratio | Power              | $\pm 2.2$ dB                   |
| - Out-of-band emission limits<br>- Conducted Spurious Emissions at Antenna Terminal             | Power<br>Frequency | $\pm 2.2$ dB<br>$\pm 11.2$ kHz |

## 8 PHOTO REPORT

Please see separate photo report.