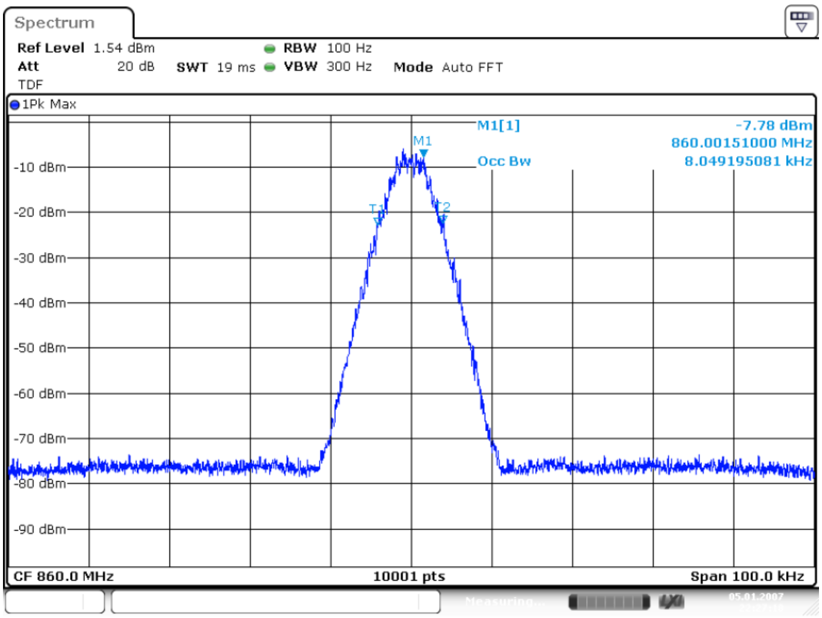
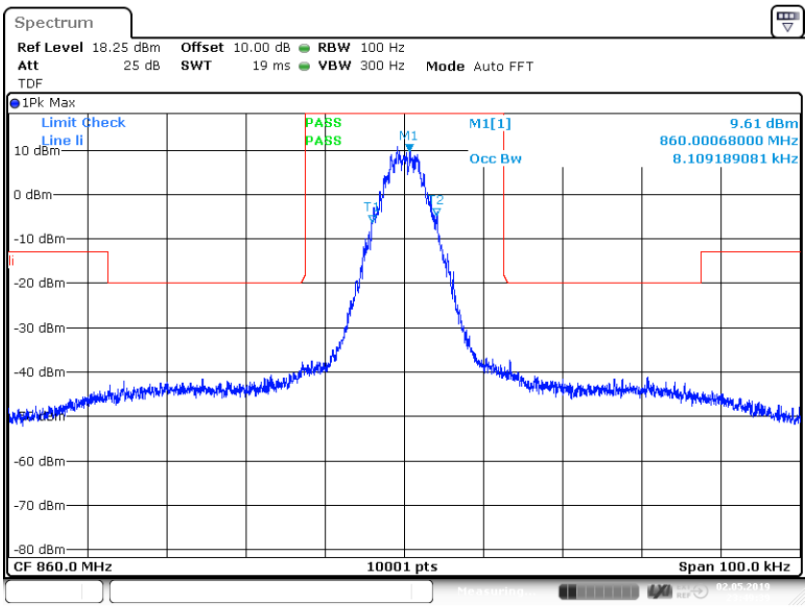
Output SignalFrequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 8K10F1D at $f_{customer}$




8K10F1D-0.3;860.0000000M _99

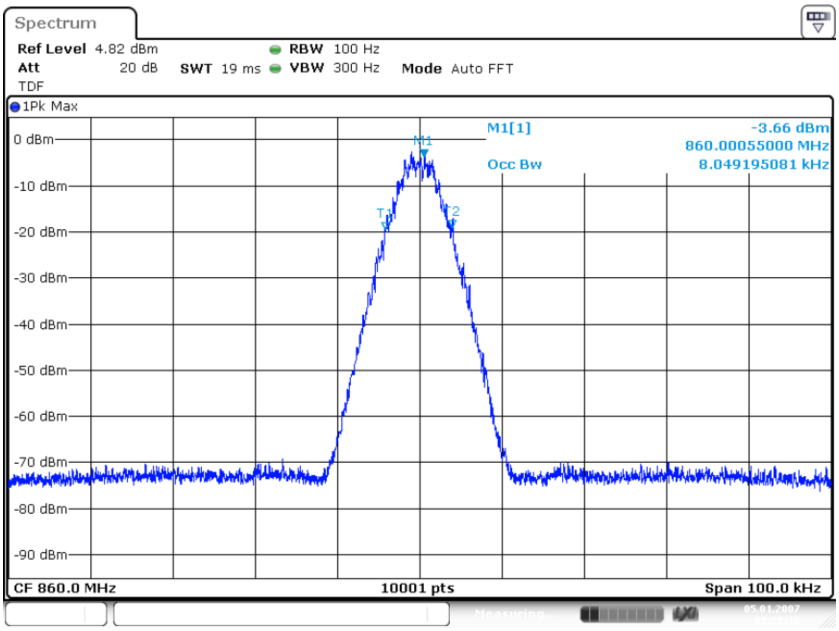
Input Signal




8K10F1D-0.3;860.000000M _99

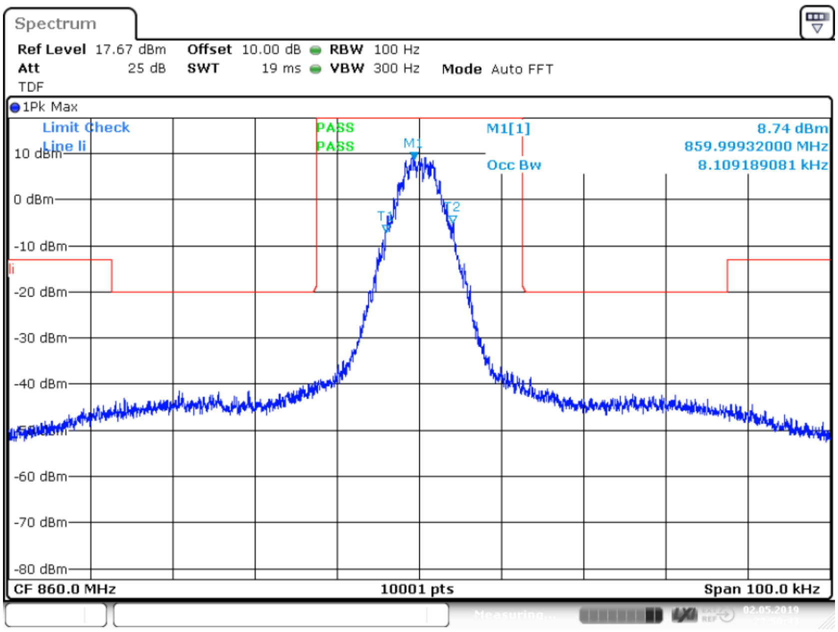
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 8K10F1D at $f_{customer}$




8K10F1D+3;860.0000000M _99

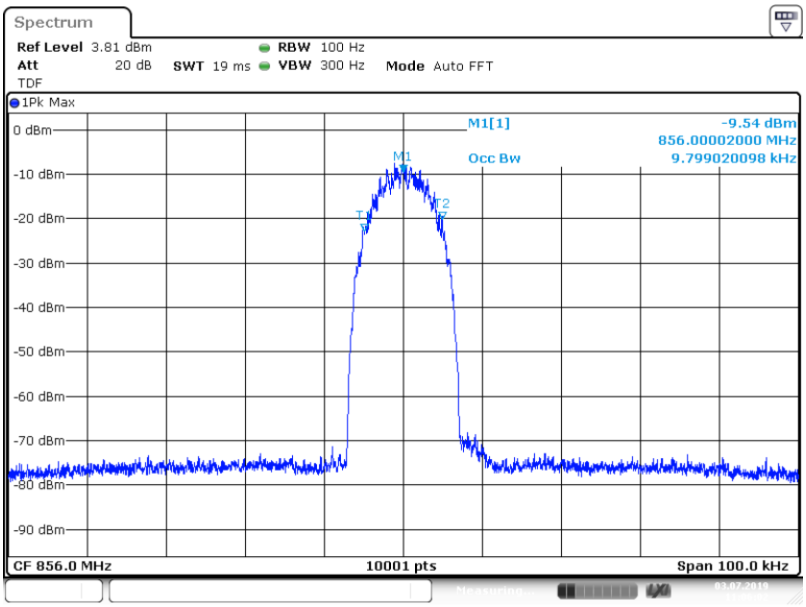
Input Signal




8K10F1D+3;860.000000M _99

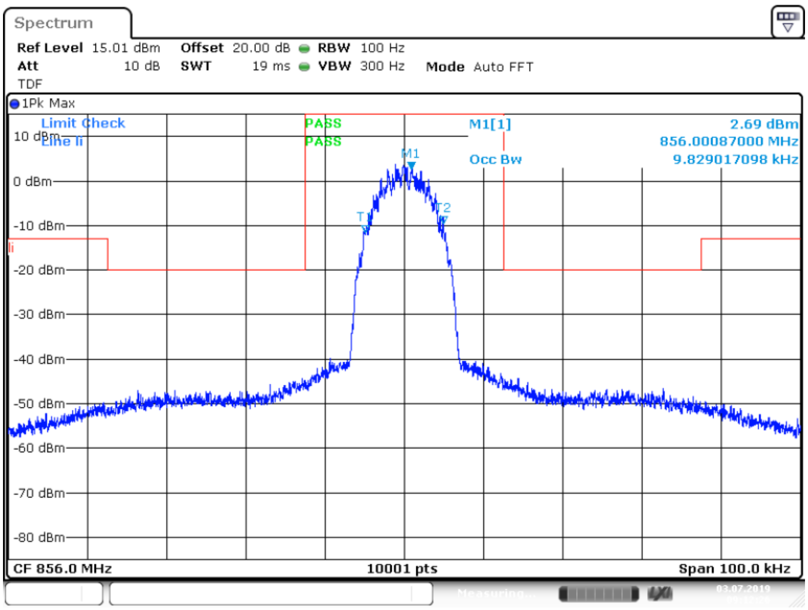
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 9K80D7W at $f_m$




9K80D7W-0.3;856.0000000M _99

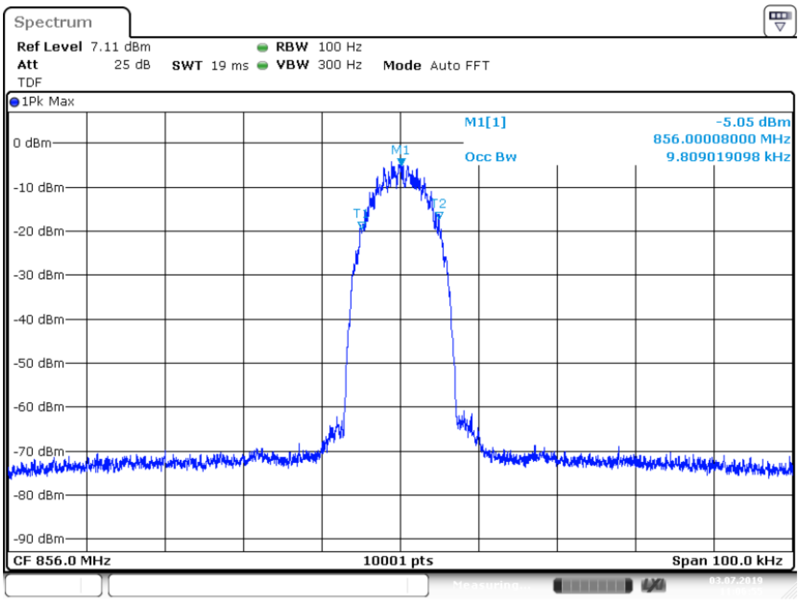
Input Signal




9K80D7W-0.3;856.000000M _99

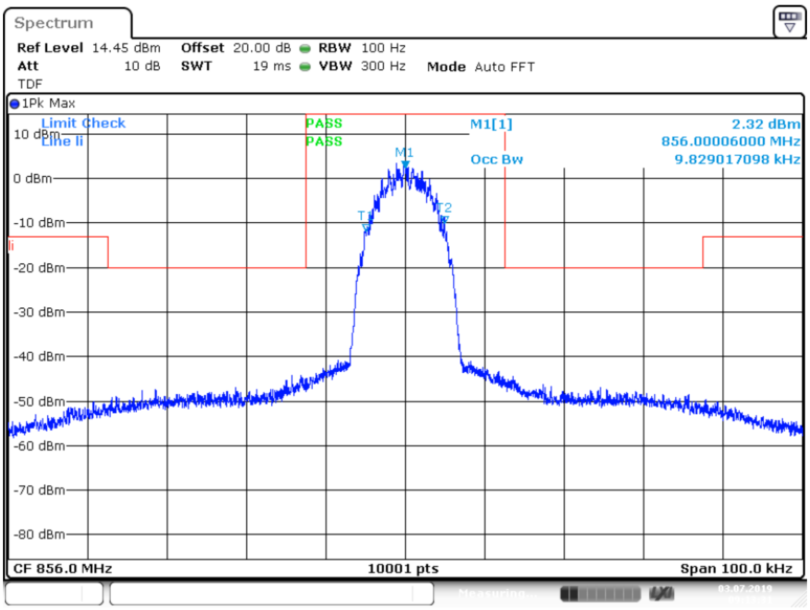
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 9K80D7W at $f_m$




9K80D7W+3;856.0000000M _99

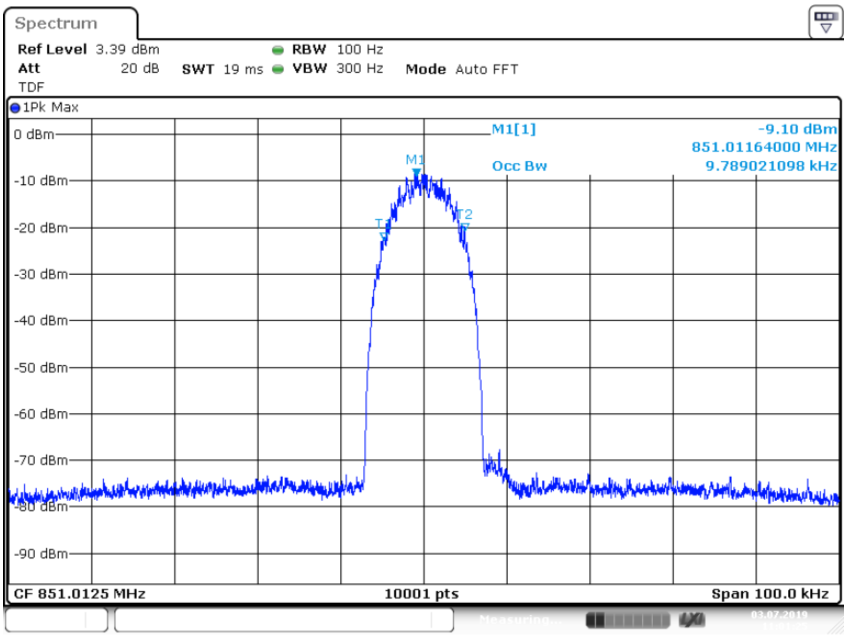
Input Signal




9K80D7W+3;856.000000M _99

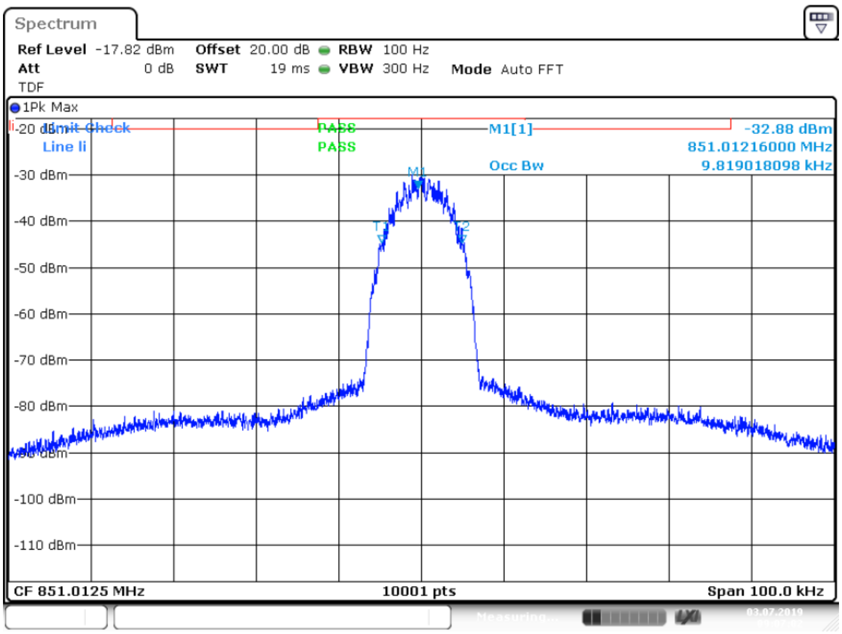
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 9K80D7W at $f_{low}$




9K80D7W-0.3;851.0125000M _99

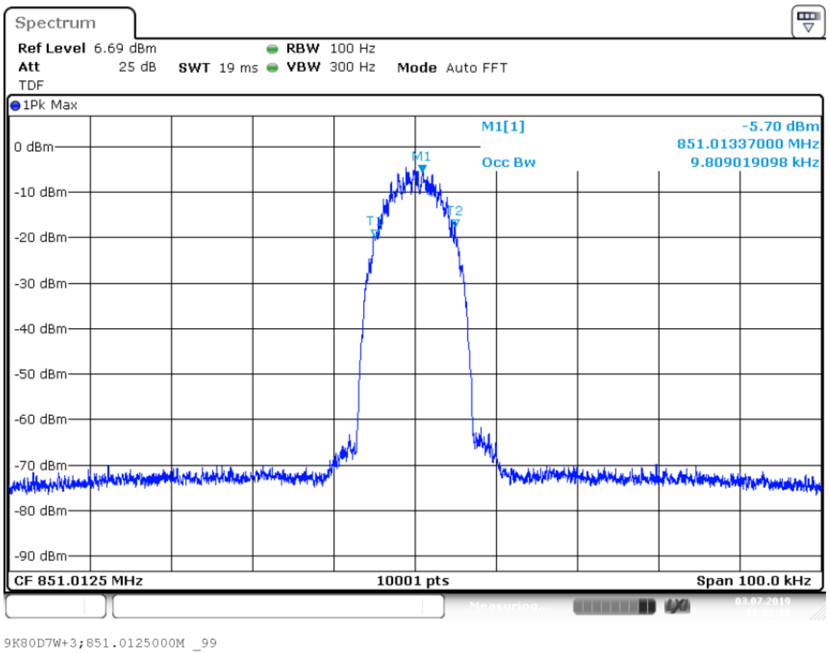
Input Signal



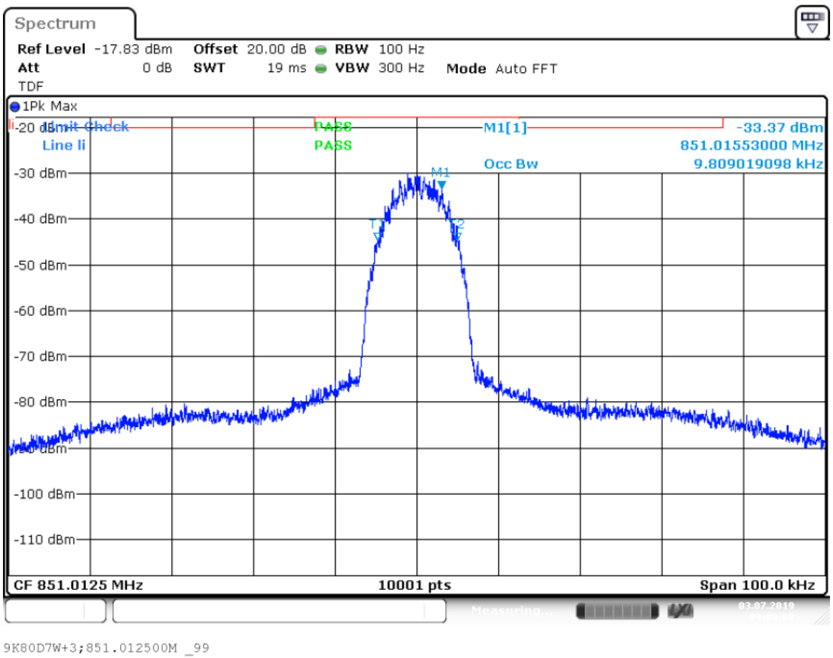

9K80D7W-0.3;851.012500M _99

Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 9K80D7W at $f_{low}$

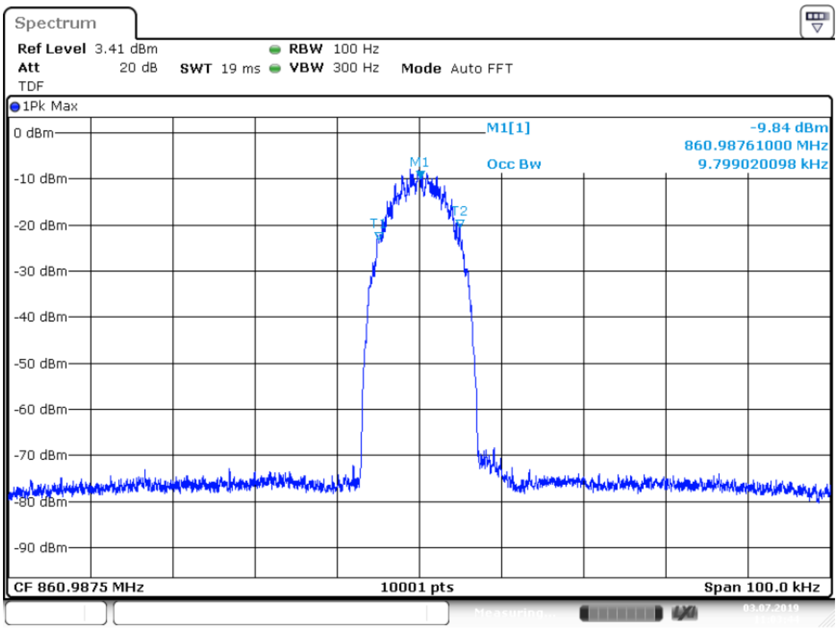



Input Signal



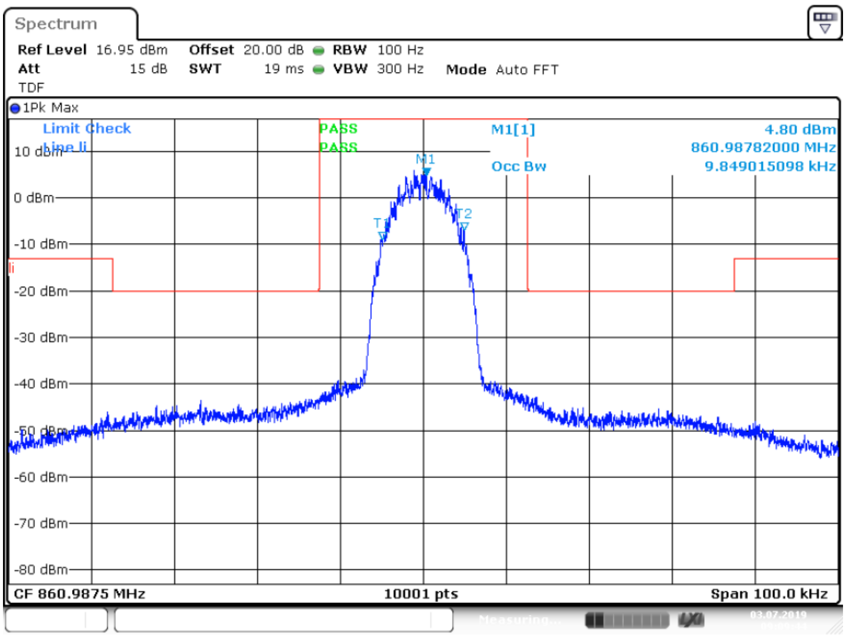

Output Signal

Output SignalFrequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 9K80D7W at $f_{high}$




9K80D7W-0.3;860.9875000M _99

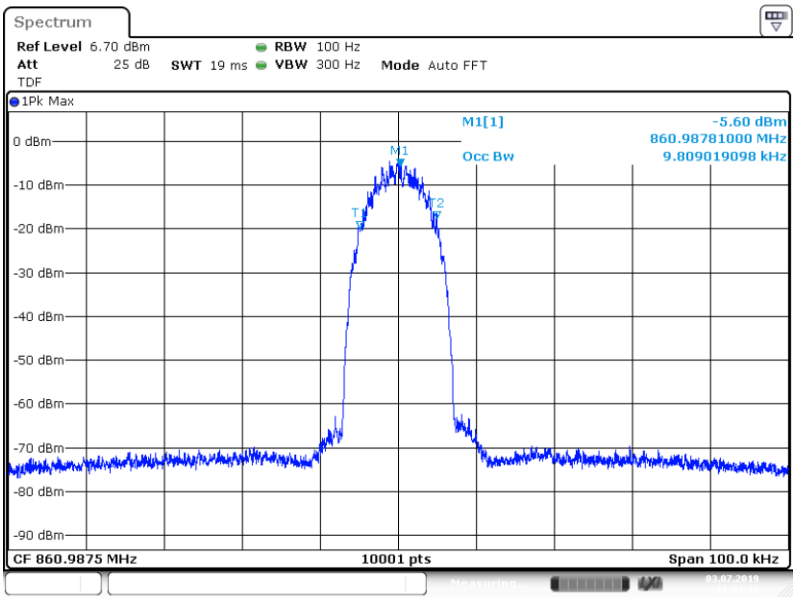
Input Signal




9K80D7W-0.3;860.987500M _99

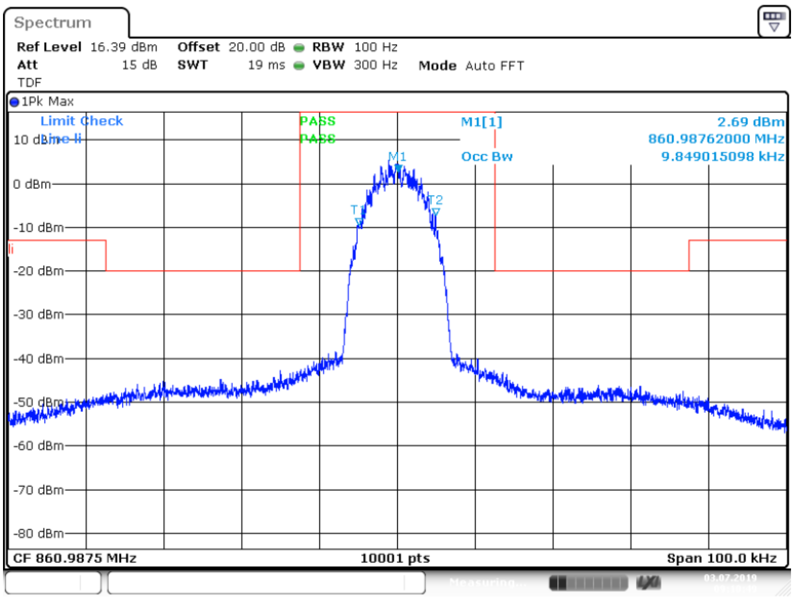
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 9K80D7W at $f_{high}$




9K80D7W+3;860.9875000M _99

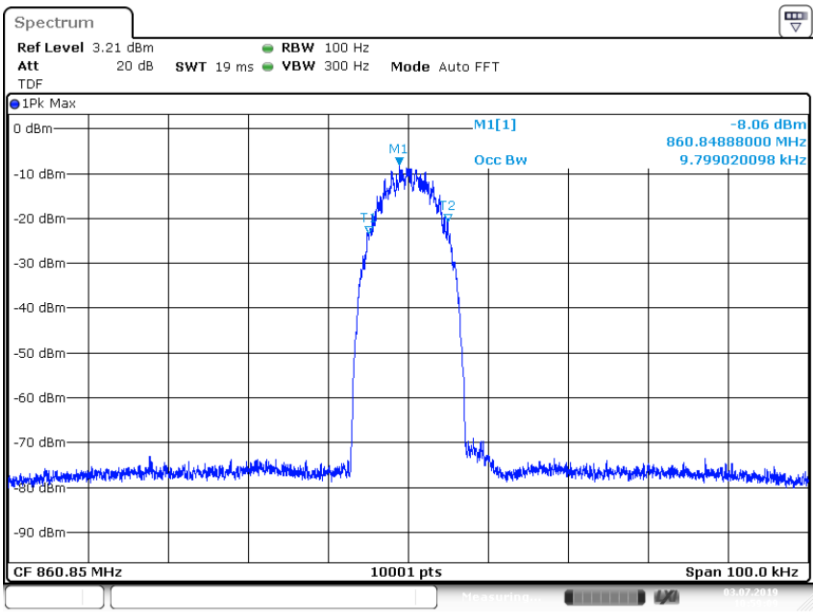
Input Signal




9K80D7W+3;860.987500M _99

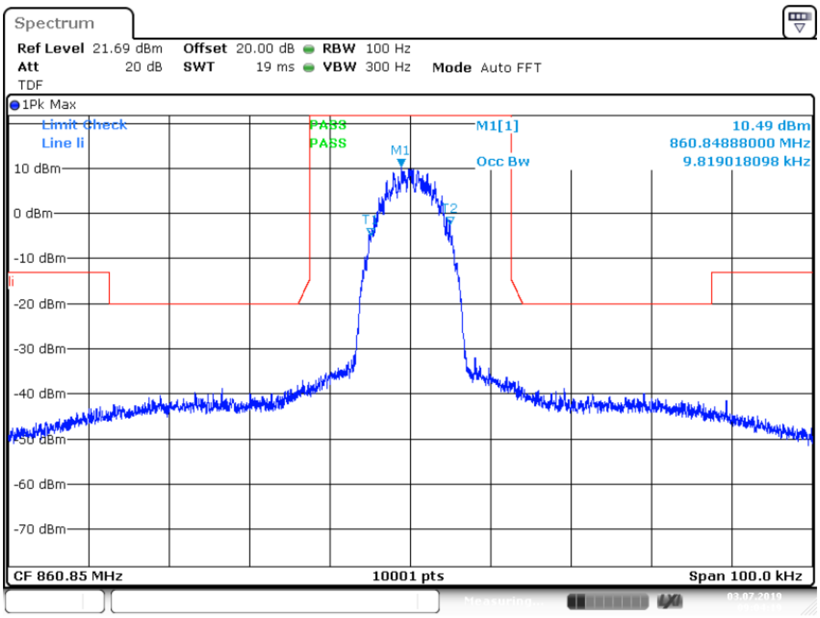
Output Signal

Output SignalFrequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 9K80D7W at $f_0$




9K80D7W-0.3;860.8500000M _99

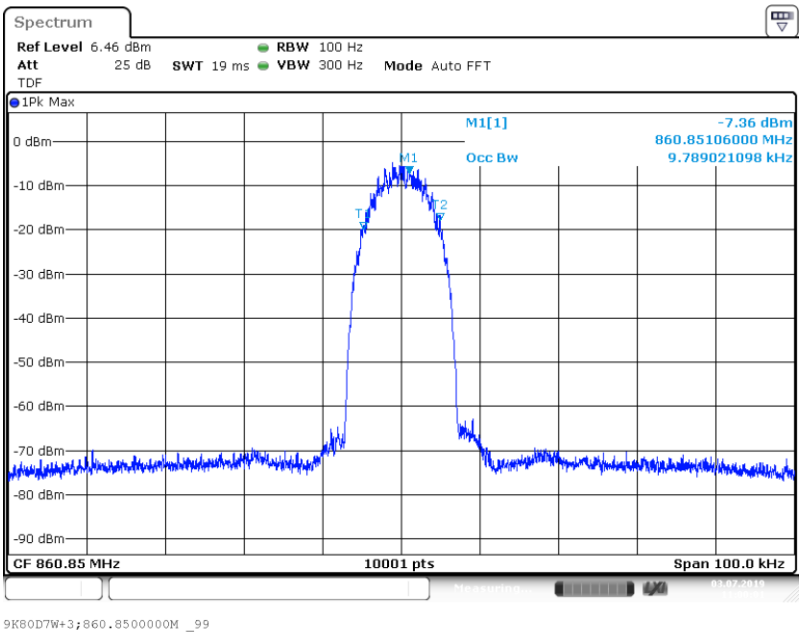
Input Signal



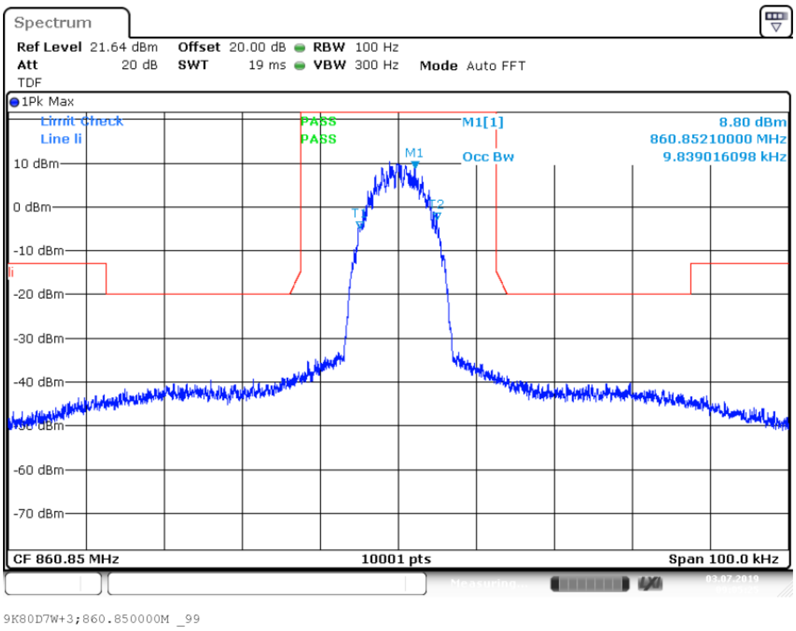

9K80D7W-0.3;860.850000M _99

Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 9K80D7W at $f_0$

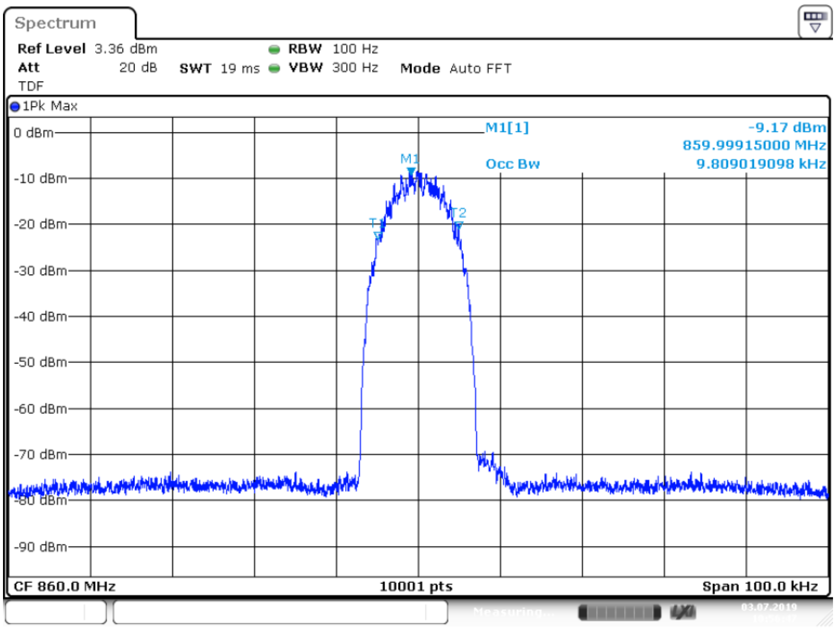



Input Signal




Output Signal

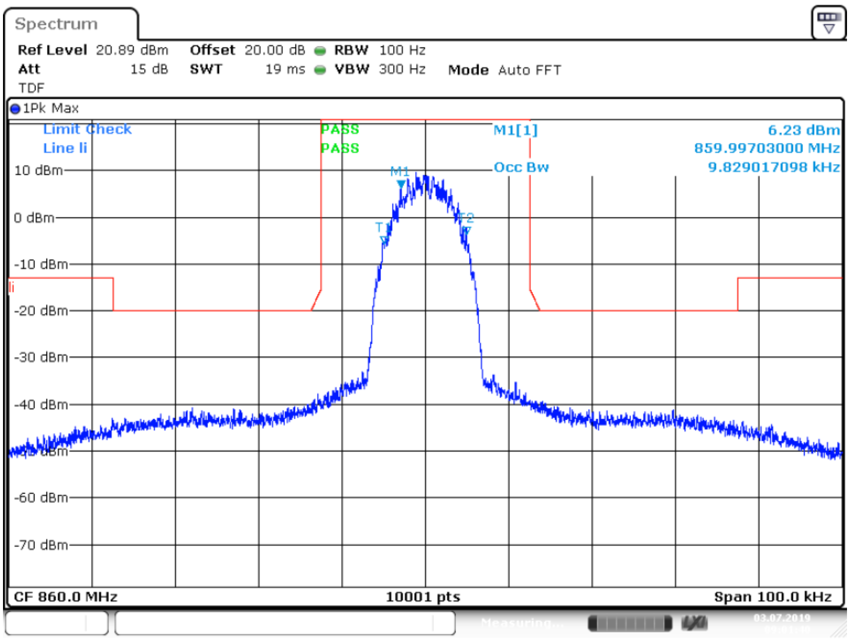
Output SignalFrequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink, Input Power = 0.3 dB < AGC, Emission Designator = 9K80D7W at $f_{customer}$




9K80D7W-0.3;860.0000000M _99

Input Signal

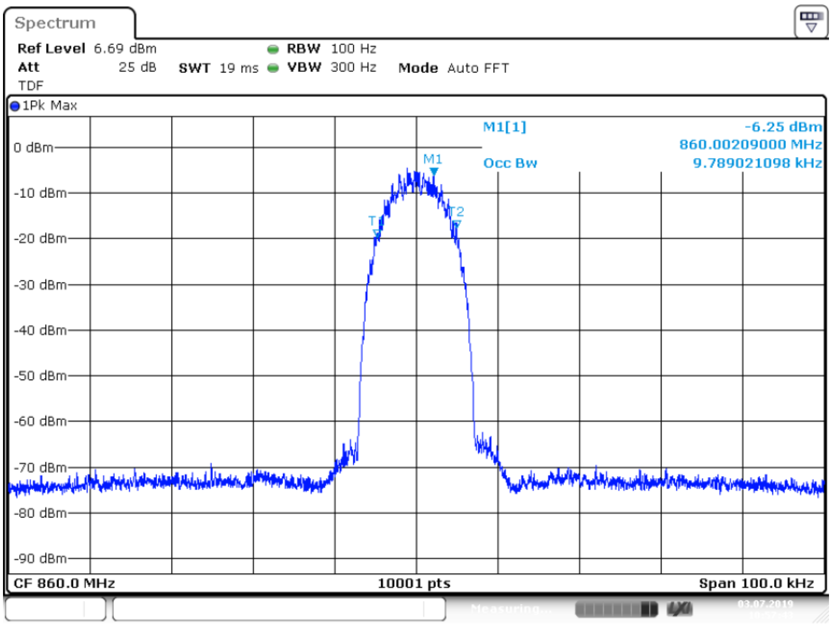
a




9K80D7W-0.3;860.000000M _99

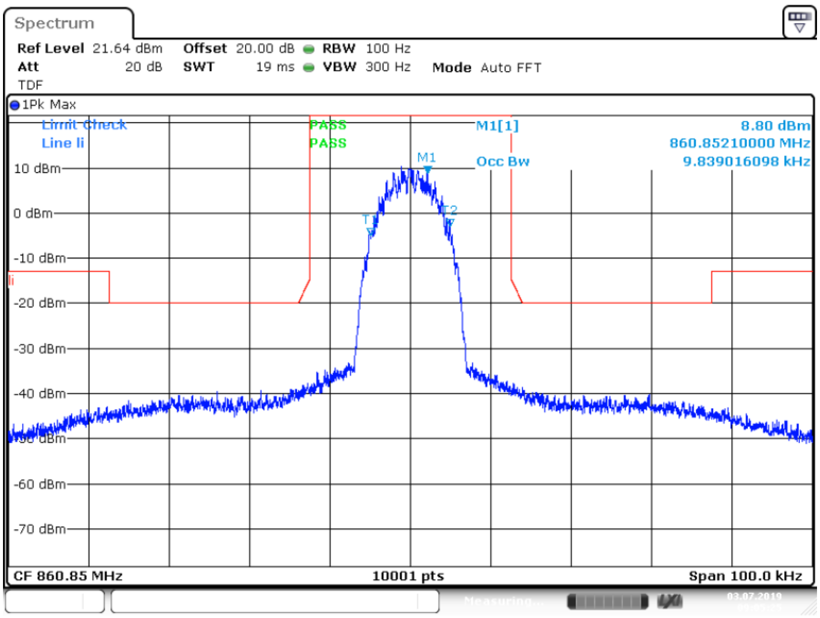
Output Signal

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Input Power = 3 dB > AGC, Emission Designator = 9K80D7W at $f_{customer}$




9K80D7W+3;860.0000000M _99

Input Signal




9K80D7W+3;860.850000M _99

Output Signal

## 4.3.5 TEST EQUIPMENT USED

FCC Conducted Base Station / Repeater

## 4.4 CONDUCTED SPURIOUS EMISSIONS AT ANTENNA TERMINALS

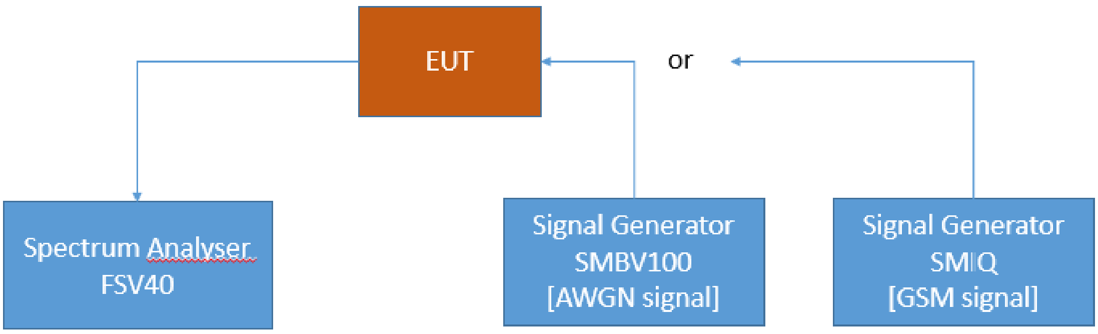
Standard FCC Part 2.1051, FCC Part 90: §90.219

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

### 4.4.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission limits per § 2.1051. The limit comes from the applicable rule part for the 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; Conducted Spurious 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.

### 4.4.2 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 90, §90.219 (e)**

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

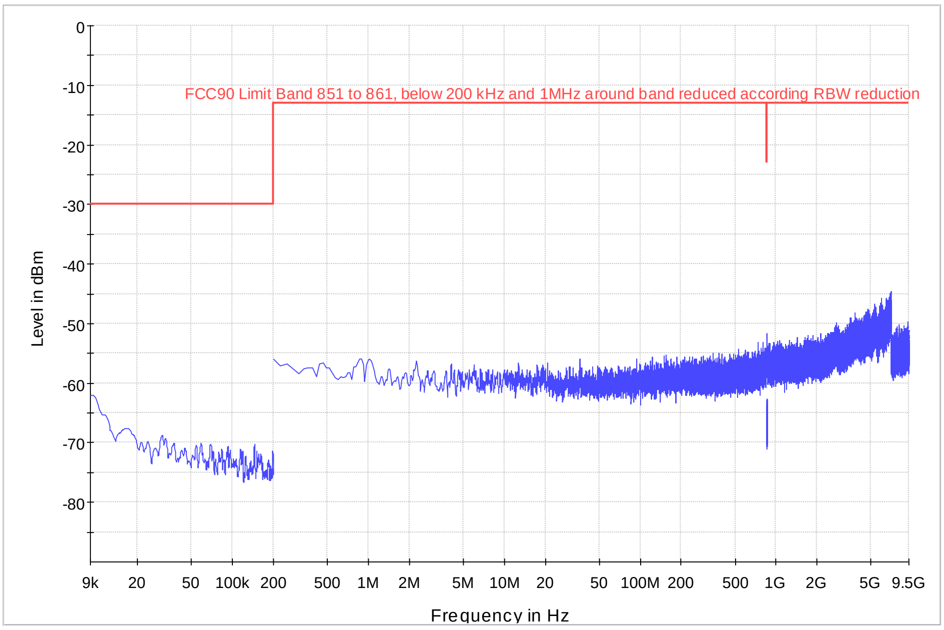
## 4.4.3 TEST PROTOCOL

| Band 851 MHz – 861 MHz, downlink | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Frequency** | **Signal Type** | **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| low | CW | 6989.2 | -44.6 | Peak | 100 | -13.0 | 31.6 |
| mid | CW | 6982.2 | -45.1 | Peak | 100 | -13.0 | 32.1 |
| high | CW | 861.1 | -47.8 | Peak | 10 | -23.0 | 24.8 |

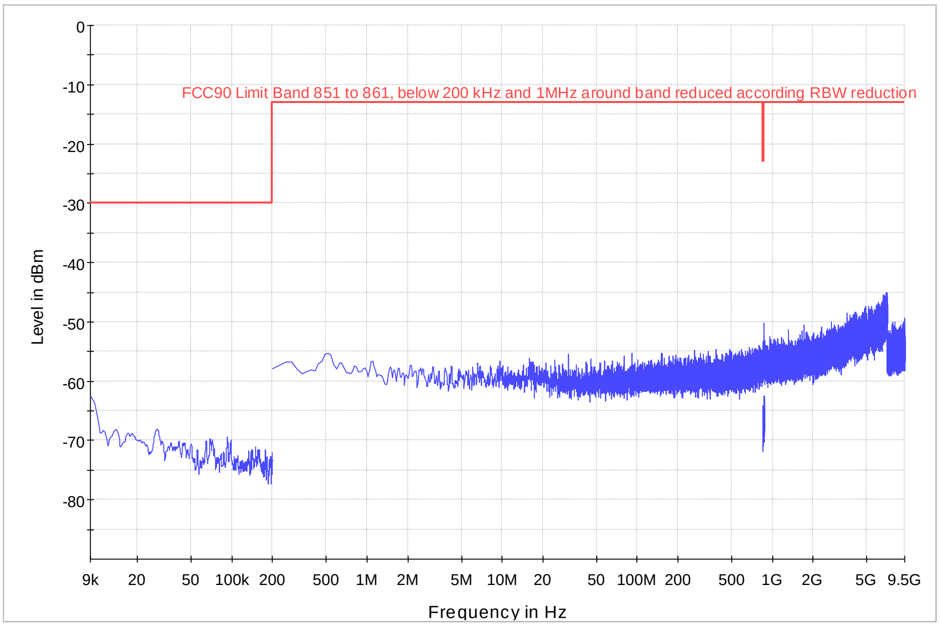
Remark: Please see next sub-clause for the measurement plot.

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

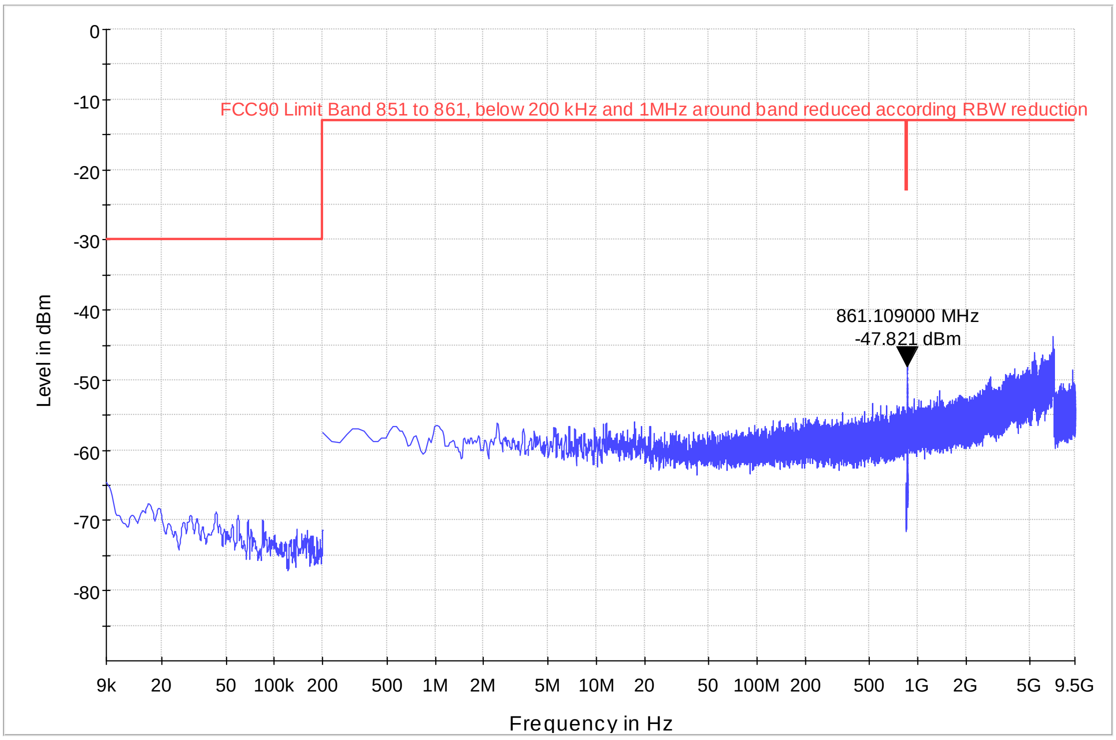
Frequency Band = Band 851 MHz – 861 MHz, Test Frequency = low, Direction = RF downlink, Signal Type = CW
(S01_AA01)




Frequency Band = Band 851 MHz – 861 MHz, Test Frequency = mid, Direction = RF downlink, Signal Type = CW
(S01_AA01)



Frequency Band = Band 851 MHz – 861 MHz, Test Frequency = high, Direction = RF downlink, Signal Type = CW
(S01_AA01)




## 4.4.5 TEST EQUIPMENT USED

- R&S TS8997

## 4.5 OUT-OF-BAND EMISSION LIMITS

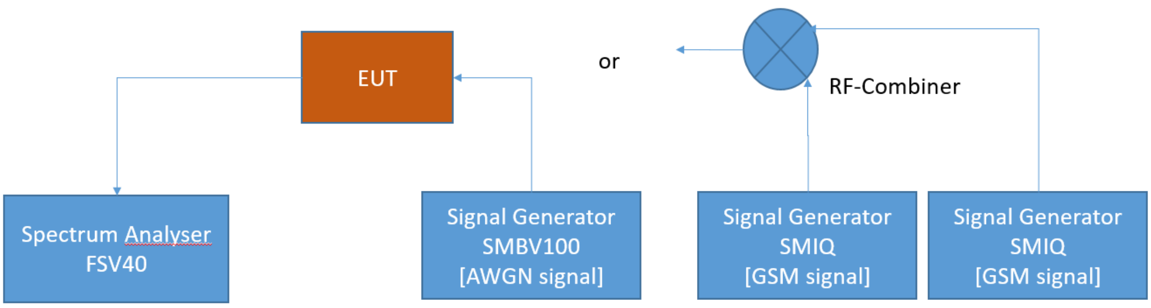
Standard FCC Part 90; §90.213, §90.691

**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 90, Subpart I/S**

**Band 851 MHz – 861 MHz**

**§90.219 – Use of signal boosters**

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

(d)(6)(i) In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth.

**Part 90, Subpart I/R**

**Band 851 MHz – 861 MHz**

**§90.691 - Emission mask requirements for EA-based systems.**

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

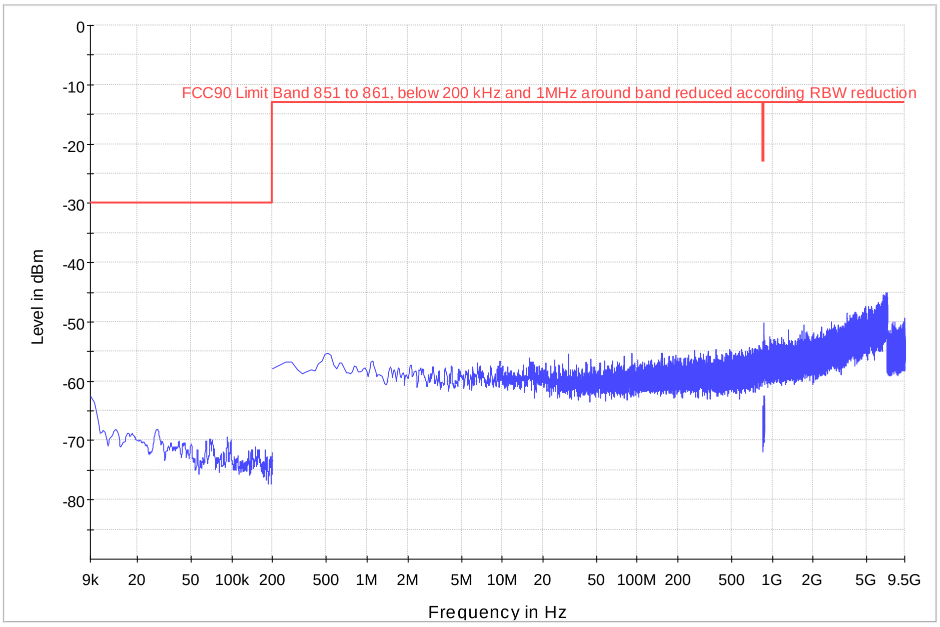
## 4.5.3 TEST PROTOCOL

| Band 851 MHz – 861 MHz, Downlink, Number of Input Signals = 1 | | | | | | |
|---|---|---|---|---|---|---|
| **Emission Designator** | **Input Power** | **Signal Frequency [MHz]** | **Input Power [dBm]** | **Maximum Out-of-band Power [dBm]** | **Limit Out-of-band Power [dBm]** | **Margin to Limit [dB]** |
| CW | 0.3 dB < AGC | 856.0000 | 0.7 | -45.1 | -13.0 | 32.1 |

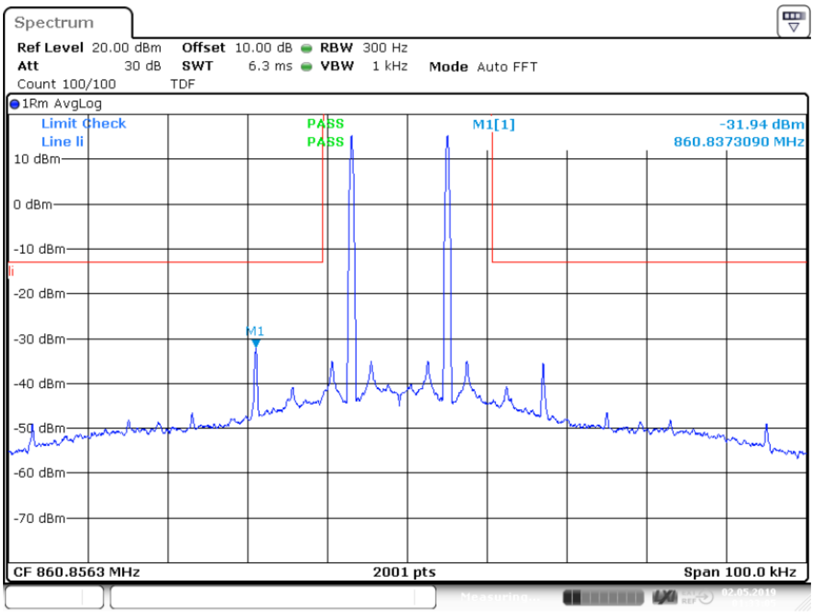
| Band 851 MHz – 861 MHz, Downlink, Number of Input Signals = 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Emission Designator with Channel Bandwidth [kHz]** | **Input Power** | **Signal Frequency f1 [MHz]** | **Signal Frequency f2 [MHz]** | **Input Power [dBm]** | **Maximum Out-of-band Power [dBm]** | **Limit Out-of-band Power [dBm]** | **Margin to Limit [dB]** |
| CW at 12.5 | 0.3 dB < AGC | 860.8500 | 860.8625 | 1.3 | -31.9 | -13.0 | 18.9 |
| CW at 12.5 | 3 dB > AGC | 860.8500 | 860.8625 | 4.6 | -32.7 | -13.0 | 19.7 |
| CW at 25 | 0.3 dB < AGC | 860.8500 | 860.8750 | 1.3 | -32.9 | -13.0 | 19.9 |
| CW at 25 | 3 dB > AGC | 860.8500 | 860.8750 | 4.6 | -32.5 | -13.0 | 19.5 |

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

Frequency Band = 851 MHz – 861 MHz, Number of signals = 1, Direction = RF downlink, Input Power = 3 dB < AGC, Signal Type = CW
(S01_AA01)

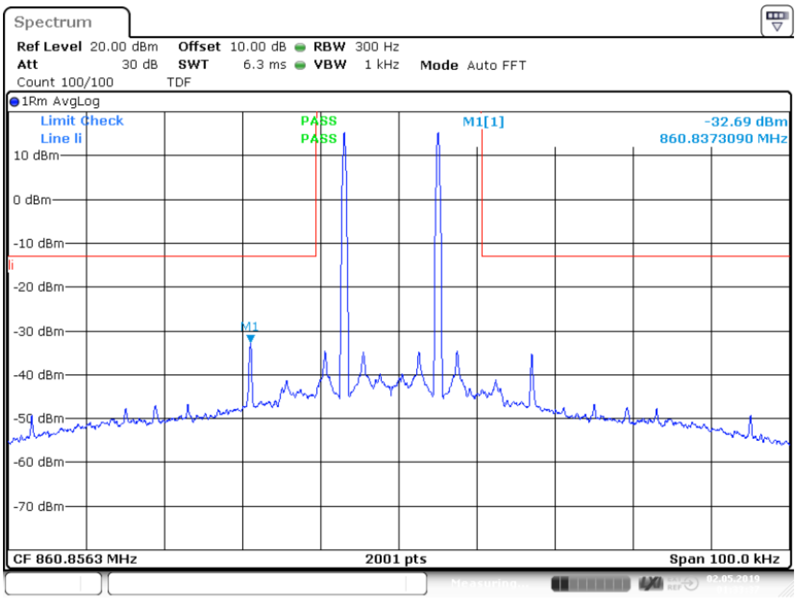


Frequency Band = 851 MHz – 861 MHz, Channel Bandwidth = 12.5 kHz, Number of Signals = 2, Direction = RF Downlink, Input Power = = 0.3 dB < AGC, Emission Designator = CW



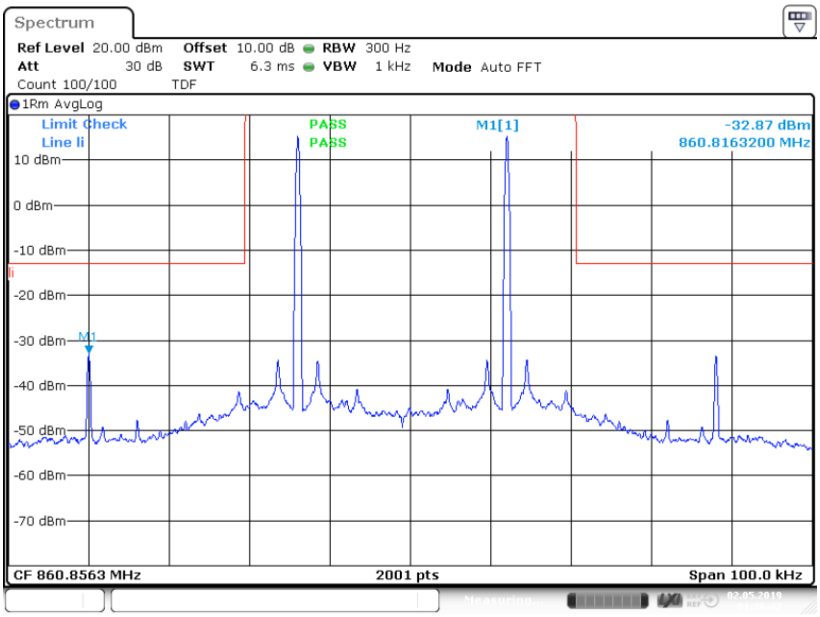

out of band emi;CW;2 carrier -0.3 dB;860.85630M;100.000k

Frequency Band = 851 MHz – 861 MHz, Channel Bandwidth = 12.5 kHz, Number of Signals = 2, Direction = RF Downlink, downlink, Input Power = 3 dB > AGC, Emission Designator = CW



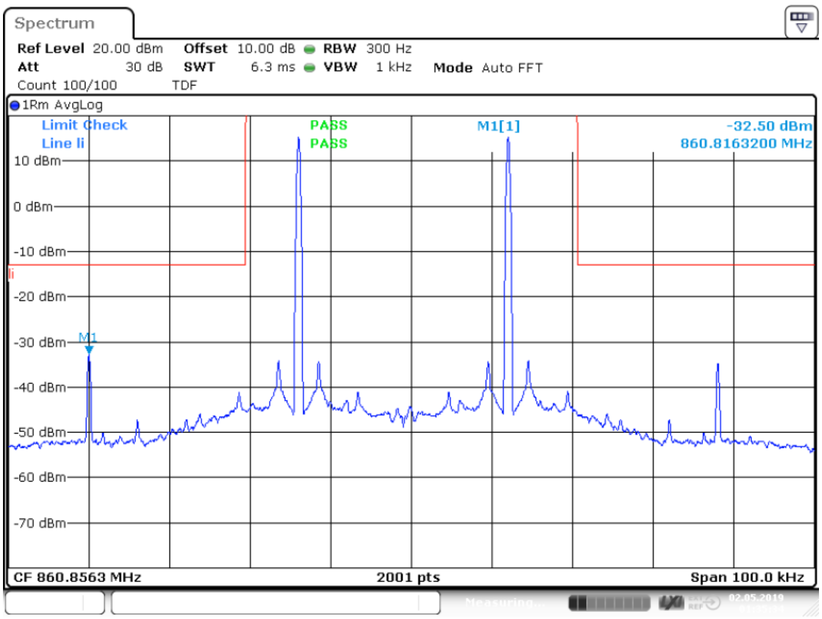

out of band emi;CW;2 carrier +3 dB;860.85630M;100.000k

Frequency Band = 851 MHz – 861 MHz, Channel Bandwidth = 25 kHz, Number of Signals = 2, Direction = RF Downlink, Input Power = = 0.3 dB < AGC, Emission Designator = CW




out of band emi;CW 25k;2 carrier -0.3 dB;860.85630M;100.000k

Frequency Band = 851 MHz – 861 MHz, Channel Bandwidth = 25 kHz, Number of Signals = 2, Direction = RF Downlink, downlink, Input Power = 3 dB > AGC, Emission Designator = CW




out of band emi;CW 25k;2 carrier +3 dB;860.85630M;100.000k

## 4.5.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

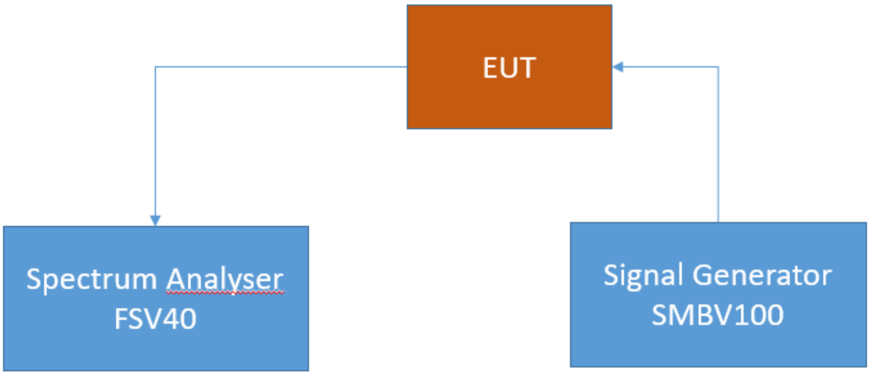
## 4.6 OUT-OF-BAND REJECTION

Standard FCC Part 90

**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

**§90.219 – Use of signal boosters**

(d)(7) Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.

For this test case exists no applicable limit

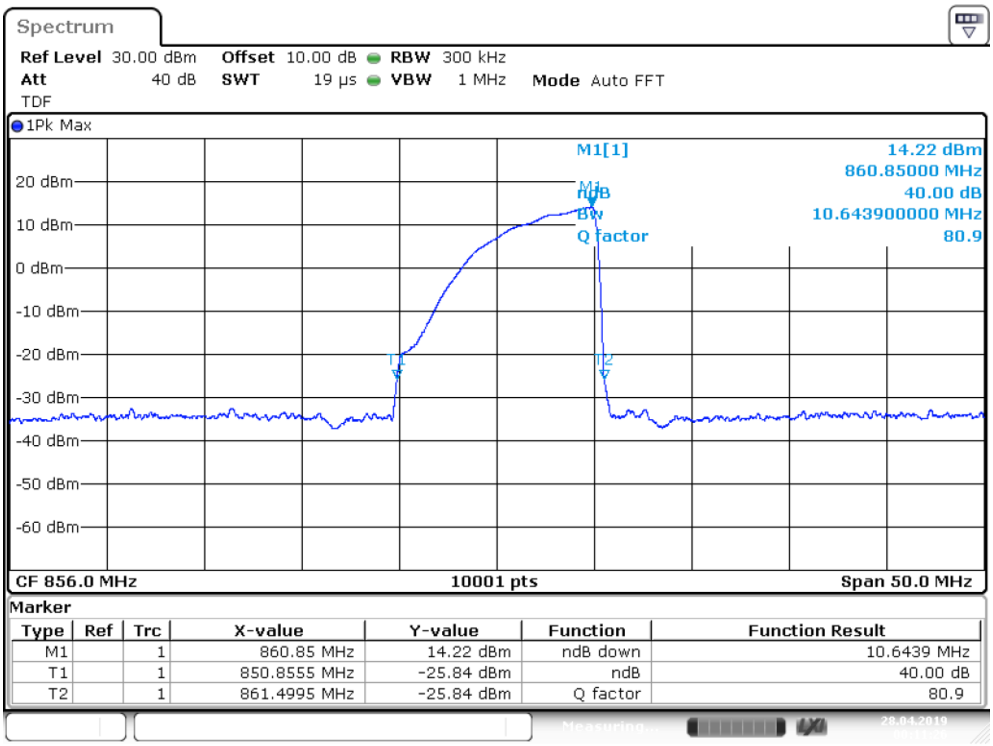
## 4.6.3 TEST PROTOCOL

| Band 851 MHz – 861 MHz, Downlink | | | | |
|---|---|---|---|---|
| **Highest Power Frequency [MHz]** | **Output Power [dBm]** | **Lower Highest Power -40 dB Frequency [MHz]** | **Upper Highest Power -40 dB Frequency [MHz]** | **40 dB Bandwidth [kHz]** |
| 860.8500 | 14.22 | 850.8555 | 861.4995 | 10644.0 |

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

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

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF Downlink




Out of band rejection 856.00000M
_20dB

## 4.6.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

## 4.7 NOISE

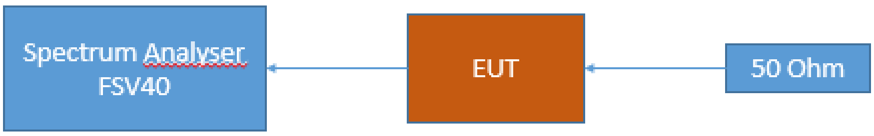
Standard FCC Part 90, §90.219

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

### 4.7.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to noise 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; Noise

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.

### 4.7.2 TEST REQUIREMENTS / LIMITS

**Part 90, Subpart I/S**

**§90.219 – Use of signal boosters**

(e)(2) The noise figure of a signal booster must not exceed 9 dB in either direction.

(d)(6)(ii) In general, the ERP of noise within the passband should not exceed −43 dBm in 10 kHz measurement bandwidth.

(d)(6)(iii) In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in a 10 kHz measurement bandwidth.

## 4.7.3 TEST PROTOCOL

| **Band 851 MHz – 861 MHz, downlink** | | | | | |
|---|---|---|---|---|---|
| **Test Step** | **Max noise Level [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| passband | <-65 | PEAK | 10 | -43.0 | >20 |
| Out of passband | -71.0 | PEAK | 10 | -70.0 | 1.0 |

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

Customer declaration concerning the noise figure:

- The noise power at the output of a RF 2-port is dependent on noise figure NF and gain G; i.e  a high NF does not mean necessarily high noise power at the output;
- FCC limits the noise figure NF of a signal booster to max. 9 dB;
- FCC defines: "signal boosters" as all manners of amplifiers, repeaters, boosters, distributed antenna systems and in-building radiation that serve to amplify signals between a device and a wireless network;
- Noise figure NF is a useful and common manner for the characterization of a noisy RF 2-port;
- The DUT (DAS) uses also an optical medium (fiber) and the digital domain for signal transport (i.e. not solely RF lines / waveguides); after the DAC we clearly have a RF 2-port (output DAC to output remote unit);

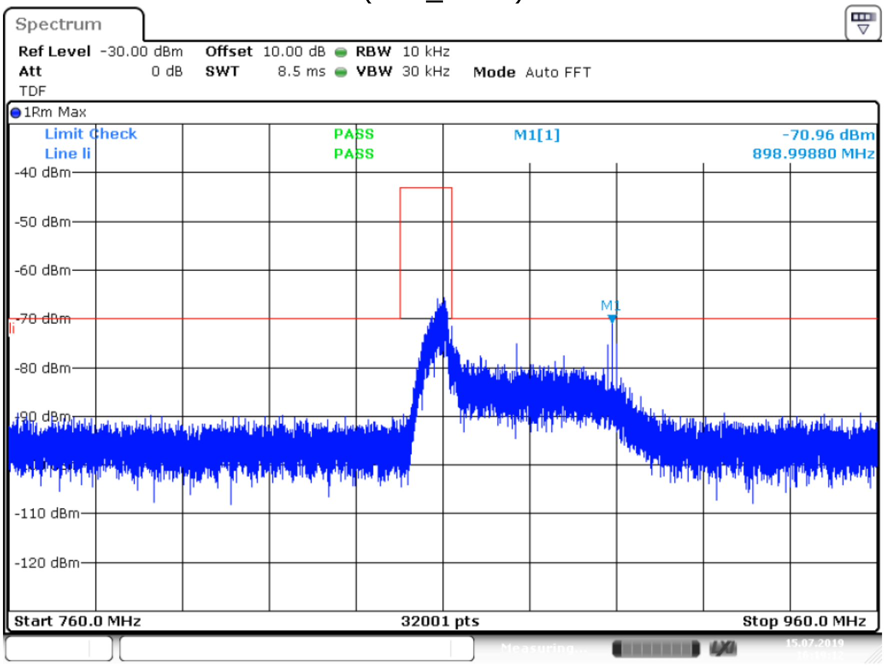
→ The DUT shows an overall attenuation up to the position right after the DAC (including balun); only from the position right after the DAC to the output of the remote unit the DUT is amplifying (this chain of RF components
is the only complete and cohesive chain with predominantly amplifying stages (including the output port) (output port shall be included, since noise power at the output is of interest));
→ above mentioned FCC definition of signal boosters ("serve to amplify signals") + definition of "noise figure" for RF 2-ports entail to set the reference planes for determining NF of the DL at the position right after the
DAC and the output of the remote unit;
This means that NF of the DUT in DL has to be determined between these two reference planes (NF of the amplification stages between output of the DAC and output of the remote unit);

This noise figure is essentially below 9 dB!

To verify this fact, it would be necessary to carry out a second NF measurement with a reference remote unit, containing only the elements up to the DAC (DAC inclusive).
Knowing both noise figures (complete DUT + reference remote), NF of the required amplification stages can be calculated.
Another way to get the NF of the required amplification stages, is to accept line up calculation.
This should be acceptable, since NF of the amplification stages is essentially lower than 9 dB.
In addition to that, the output noise level, which is crucial, was measured and is below the limit.

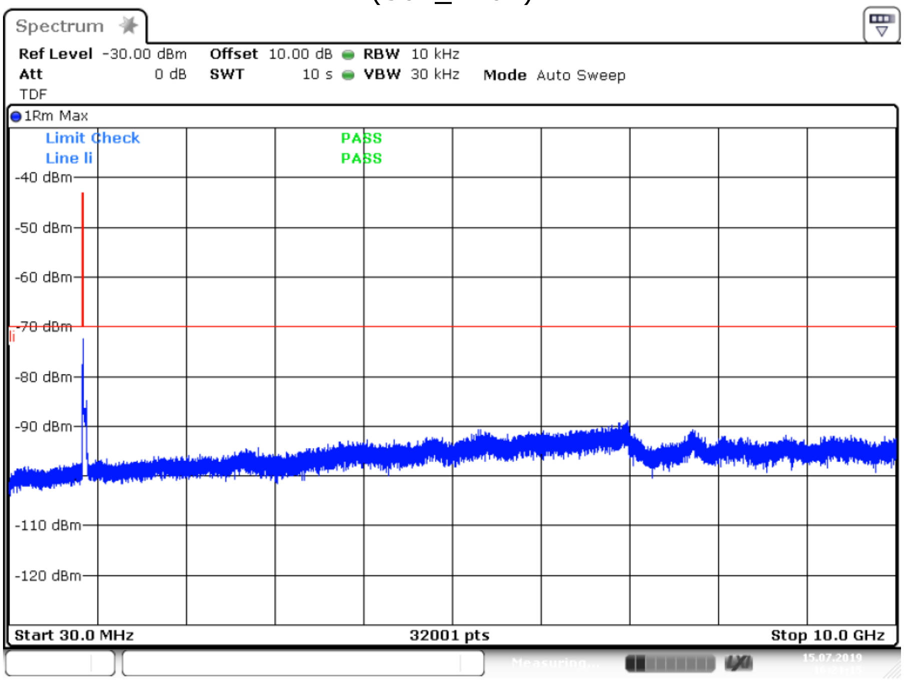
## 4.7.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Test Step = passband (S01_AA01)




Spurious emission conducted §90.219 Messung 1 ;850M 862M

Frequency Band = Band 851 MHz – 861 MHz, Direction = RF downlink, Test Step = passband (S01_AA01)




Spurious emission conducted §90.219 Messung 2 ;850M 862M

## 4.7.5 TEST EQUIPMENT USED

- FCC Conducted Base Station / Repeater

## 4.8 FIELD STRENGTH OF SPURIOUS RADIATION

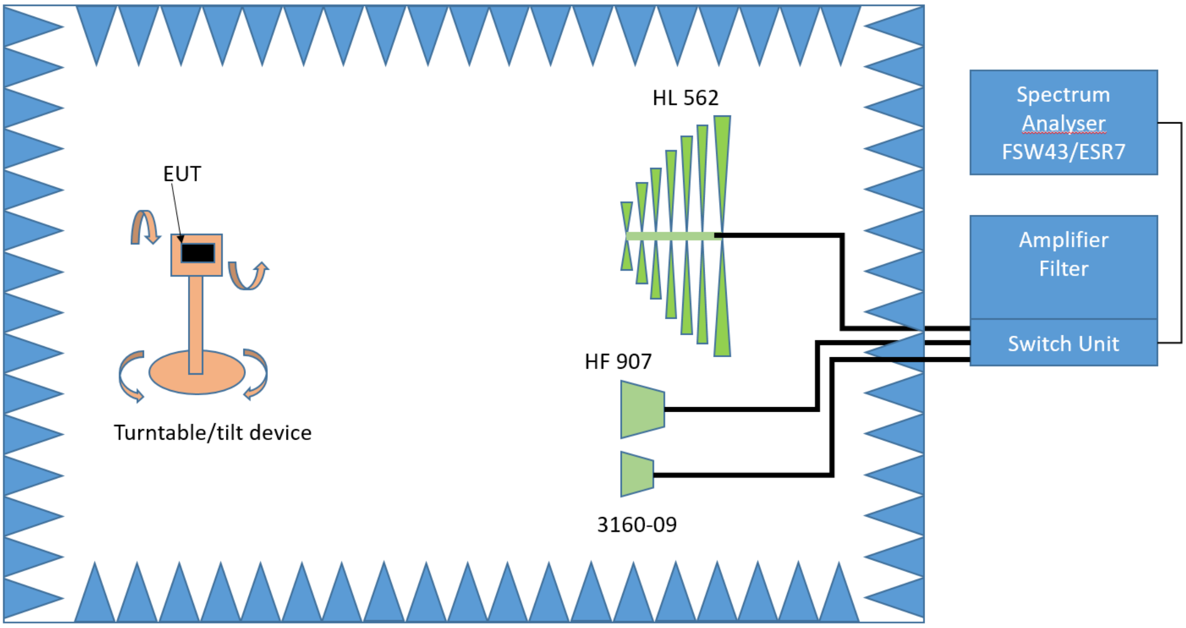
Standard FCC Part 90, §90.219

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

### 4.8.1 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 m² 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° to 90°
- Turntable step size: 90°
- 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 ± 45° 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 ± 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: ± 45 ° around the determined value
- Height variation range: ± 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 °.
The turn table step size (azimuth angle) for the preliminary measurement is 45 °.
**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 instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.

The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
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

### 4.8.2 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 90, §90.219 (e)**

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

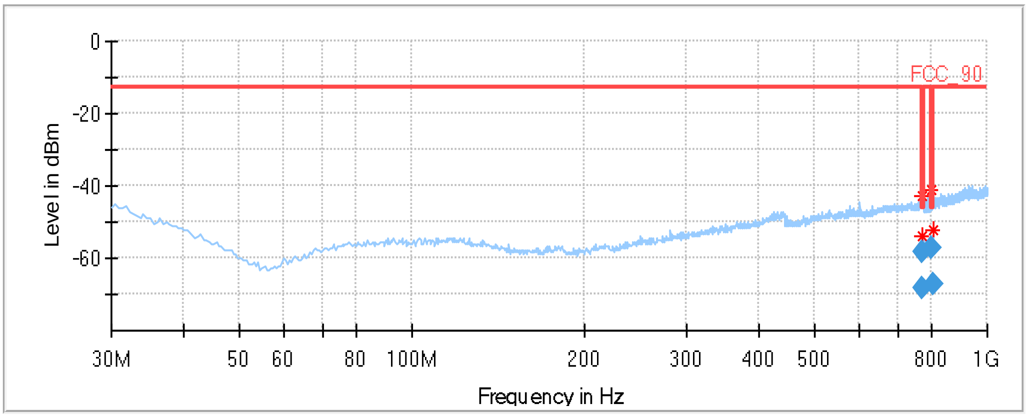
### 4.8.3 TEST PROTOCOL

| Band 851 MHz – 861 MHz, downlink; | | | | | | |
|---|---|---|---|---|---|---|
| **Spurious Freq. [MHz]** | **Spurious Level [dBm]** | **Pin [dBm]** | **Detector** | **RBW [kHz]** | **Limit [dBm]** | **Margin to Limit [dB]** |
| - | - | -4.3 | RMS | 100 | -13.0 | - - - |
| - | - | -4.3 | RMS | 100 | -13.0 | - - - |
| - | - | -4.3 | RMS | 100 | -13.0 | - - - |
| - | - | -4.3 | RMS | 100 | -13.0 | - - - |
| - | - | -4.3 | RMS | 100 | -13.0 | - - - |

Remark: Please see next sub-clause for the measurement plot.
The three required test frequencies (low, mid, high) were injected simultaneously into the EUT.

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

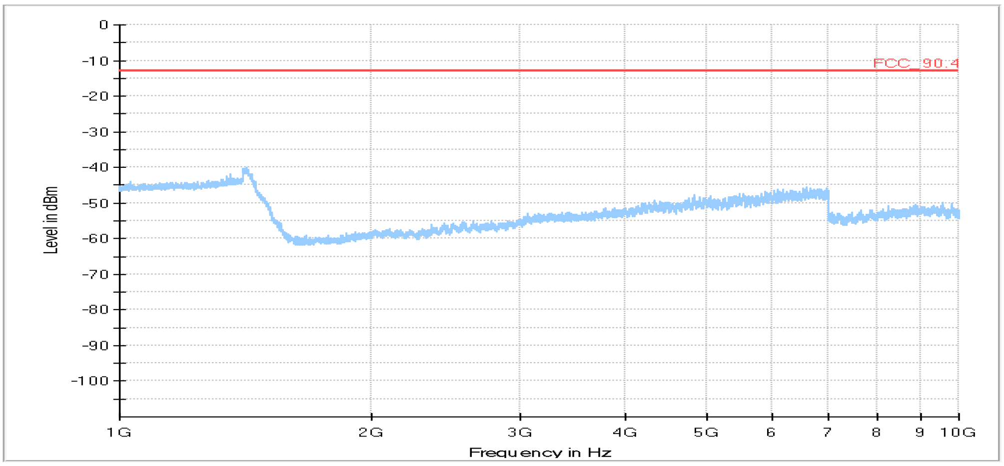
Frequency Band = Band 851 MHz – 861 MHz, Test Frequency = low/mid/high, Direction = RF downlink
(S01_AA01)




### Final_Result

| Frequency (MHz) | RMS (dBm) | Limit (dBm) | Margin | Meas. Time (ms) | Bandwidth | Height | Pol | Azimuth | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 769.000000 | -58.29 | -13.00 | 45.29 | 1000.0 | 100.000 | 153.0 | V | -5.0 | -74.6 | 09:28:23 - 2019-06-06 |
| 771.002500 | -68.23 | -46.00 | 22.23 | 1000.0 | 10.000 | 121.0 | H | 37.0 | -74.6 | 09:25:06 - 2019-06-06 |
| 799.000000 | -57.31 | -13.00 | 44.31 | 1000.0 | 100.000 | 127.0 | H | -65.0 | -74.1 | 09:21:53 - 2019-06-06 |
| 804.966250 | -67.17 | -46.00 | 21.17 | 1000.0 | 10.000 | 371.0 | V | -168.0 | -74.1 | 09:18:14 - 2019-06-06 |

30 MHz - 1 GHz




### Critical_Freqs

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| --- | --- | --- | --- | --- | --- | --- | | --- | --- | |

### Final_Result

| Frequency (MHz) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| --- | --- | --- | --- | --- | --- | --- | | --- | --- | |

1 GHz - 10 GHz

### 4.8.5 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 | 2019-06 | 2021-06 |
| 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 | 2019-05 | 2021-05 |
| 2.4 | ESW44 | EMI Test Receiver | Rohde & Schwarz | 101603 | 2018-05 | 2019-11 |
| 2.5 | Anechoic Chamber | 10.38 x 6.38 x 6.00 m³ | 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 | 2019-02 | 2021-02 |
| 2.13 | 3160-09 | Standard Gain / Pyramidal Horn Antenna 26.5 GHz | EMCO Elektronic 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 | 2019-05 | 2022-05 |
| 2.20 | 3160-10 | Standard Gain / Pyramidal Horn Antenna 40 GHz | EMCO Elektronic 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 | 2019-06 | 2021-06 |
| 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 insertion loss ESH3-Z5 | cable loss (incl. 10 dB atten-uator) |
|---|---|---|---|---|
| MHz | | dB | dB | dB |
| 0.15 | | 10.1 | 0.1 | 10.0 |
| 5 | | 10.3 | 0.1 | 10.2 |
| 7 | | 10.5 | 0.2 | 10.3 |
| 10 | | 10.5 | 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 | 10.5 |
| 20 | | 10.9 | 0.4 | 10.5 |
| 22 | | 11.1 | 0.5 | 10.6 |
| 24 | | 11.1 | 0.5 | 10.6 |
| 26 | | 11.2 | 0.5 | 10.7 |
| 28 | | 11.2 | 0.5 | 10.7 |
| 30 | | 11.3 | 0.5 | 10.8 |

**Sample calculation**

$U_{LISN}$ (dB µV) = U (dB µV) + 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 HFH-Z2) | Corr. | cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-40 dB/ decade) | $d_{Limit}$ (meas. distance (limit) | $d_{used}$ (meas. distance (used) |
|---|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | m | m |
| 0.009 | 20.50 | -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 |
| 0.5 | 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 (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (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 * LOG ($d_{Limit}$/ $d_{used}$)
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)

**($d_{Limit}$ = 3 m)**

| Frequency | AF R&S HL562 | Corr. | cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-20 dB/ decade) | $d_{Limit}$ (meas. distance (limit)) | $d_{used}$ (meas. distance (used)) |
|---|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | m | m |
| 30 | 18.6 | 0.6 | 0.29 | 0.04 | 0.23 | 0.02 | 0.0 | 3 | 3 |
| 50 | 6.0 | 0.9 | 0.39 | 0.09 | 0.32 | 0.08 | 0.0 | 3 | 3 |
| 100 | 9.7 | 1.2 | 0.56 | 0.14 | 0.47 | 0.08 | 0.0 | 3 | 3 |
| 150 | 7.9 | 1.6 | 0.73 | 0.20 | 0.59 | 0.12 | 0.0 | 3 | 3 |
| 200 | 7.6 | 1.9 | 0.84 | 0.21 | 0.70 | 0.11 | 0.0 | 3 | 3 |
| 250 | 9.5 | 2.1 | 0.98 | 0.24 | 0.80 | 0.13 | 0.0 | 3 | 3 |
| 300 | 11.0 | 2.3 | 1.04 | 0.26 | 0.89 | 0.15 | 0.0 | 3 | 3 |
| 350 | 12.4 | 2.6 | 1.18 | 0.31 | 0.96 | 0.13 | 0.0 | 3 | 3 |
| 400 | 13.6 | 2.9 | 1.28 | 0.35 | 1.03 | 0.19 | 0.0 | 3 | 3 |
| 450 | 14.7 | 3.1 | 1.39 | 0.38 | 1.11 | 0.22 | 0.0 | 3 | 3 |
| 500 | 15.6 | 3.2 | 1.44 | 0.39 | 1.20 | 0.19 | 0.0 | 3 | 3 |
| 550 | 16.3 | 3.5 | 1.55 | 0.46 | 1.24 | 0.23 | 0.0 | 3 | 3 |
| 600 | 17.2 | 3.5 | 1.59 | 0.43 | 1.29 | 0.23 | 0.0 | 3 | 3 |
| 650 | 18.1 | 3.6 | 1.67 | 0.34 | 1.35 | 0.22 | 0.0 | 3 | 3 |
| 700 | 18.5 | 3.6 | 1.67 | 0.42 | 1.41 | 0.15 | 0.0 | 3 | 3 |
| 750 | 19.1 | 4.1 | 1.87 | 0.54 | 1.46 | 0.25 | 0.0 | 3 | 3 |
| 800 | 19.6 | 4.1 | 1.90 | 0.46 | 1.51 | 0.25 | 0.0 | 3 | 3 |
| 850 | 20.1 | 4.4 | 1.99 | 0.60 | 1.56 | 0.27 | 0.0 | 3 | 3 |
| 900 | 20.8 | 4.7 | 2.14 | 0.60 | 1.63 | 0.29 | 0.0 | 3 | 3 |
| 950 | 21.1 | 4.8 | 2.22 | 0.60 | 1.66 | 0.33 | 0.0 | 3 | 3 |
| 1000 | 21.6 | 4.9 | 2.23 | 0.61 | 1.71 | 0.30 | 0.0 | 3 | 3 |

**($d_{Limit}$ = 10 m)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 30 | 18.6 | -9.9 | 0.29 | 0.04 | 0.23 | 0.02 | -10.5 | 10 | 3 |
| 50 | 6.0 | -9.6 | 0.39 | 0.09 | 0.32 | 0.08 | -10.5 | 10 | 3 |
| 100 | 9.7 | -9.2 | 0.56 | 0.14 | 0.47 | 0.08 | -10.5 | 10 | 3 |
| 150 | 7.9 | -8.8 | 0.73 | 0.20 | 0.59 | 0.12 | -10.5 | 10 | 3 |
| 200 | 7.6 | -8.6 | 0.84 | 0.21 | 0.70 | 0.11 | -10.5 | 10 | 3 |
| 250 | 9.5 | -8.3 | 0.98 | 0.24 | 0.80 | 0.13 | -10.5 | 10 | 3 |
| 300 | 11.0 | -8.1 | 1.04 | 0.26 | 0.89 | 0.15 | -10.5 | 10 | 3 |
| 350 | 12.4 | -7.9 | 1.18 | 0.31 | 0.96 | 0.13 | -10.5 | 10 | 3 |
| 400 | 13.6 | -7.6 | 1.28 | 0.35 | 1.03 | 0.19 | -10.5 | 10 | 3 |
| 450 | 14.7 | -7.4 | 1.39 | 0.38 | 1.11 | 0.22 | -10.5 | 10 | 3 |
| 500 | 15.6 | -7.2 | 1.44 | 0.39 | 1.20 | 0.19 | -10.5 | 10 | 3 |
| 550 | 16.3 | -7.0 | 1.55 | 0.46 | 1.24 | 0.23 | -10.5 | 10 | 3 |
| 600 | 17.2 | -6.9 | 1.59 | 0.43 | 1.29 | 0.23 | -10.5 | 10 | 3 |
| 650 | 18.1 | -6.9 | 1.67 | 0.34 | 1.35 | 0.22 | -10.5 | 10 | 3 |
| 700 | 18.5 | -6.8 | 1.67 | 0.42 | 1.41 | 0.15 | -10.5 | 10 | 3 |
| 750 | 19.1 | -6.3 | 1.87 | 0.54 | 1.46 | 0.25 | -10.5 | 10 | 3 |
| 800 | 19.6 | -6.3 | 1.90 | 0.46 | 1.51 | 0.25 | -10.5 | 10 | 3 |
| 850 | 20.1 | -6.0 | 1.99 | 0.60 | 1.56 | 0.27 | -10.5 | 10 | 3 |
| 900 | 20.8 | -5.8 | 2.14 | 0.60 | 1.63 | 0.29 | -10.5 | 10 | 3 |
| 950 | 21.1 | -5.6 | 2.22 | 0.60 | 1.66 | 0.33 | -10.5 | 10 | 3 |
| 1000 | 21.6 | -5.6 | 2.23 | 0.61 | 1.71 | 0.30 | -10.5 | 10 | 3 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (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 = -20 * LOG ($d_{Limit}$/ $d_{used}$)
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 R&S HF907 | Corr. | cable loss 1 (relay + cable inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit, atten-uator & pre-amp) | cable loss 4 (to receiver) | | |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | | |
| 1000 | 24.4 | -19.4 | 0.99 | 0.31 | -21.51 | 0.79 | | |
| 2000 | 28.5 | -17.4 | 1.44 | 0.44 | -20.63 | 1.38 | | |
| 3000 | 31.0 | -16.1 | 1.87 | 0.53 | -19.85 | 1.33 | | |
| 4000 | 33.1 | -14.7 | 2.41 | 0.67 | -19.13 | 1.31 | | |
| 5000 | 34.4 | -13.7 | 2.78 | 0.86 | -18.71 | 1.40 | | |
| 6000 | 34.7 | -12.7 | 2.74 | 0.90 | -17.83 | 1.47 | | |
| 7000 | 35.6 | -11.0 | 2.82 | 0.86 | -16.19 | 1.46 | | |

| Frequency | AF R&S HF907 | Corr. | cable loss 1 (relay inside chamber) | cable loss 2 (inside chamber) | cable loss 3 (outside chamber) | cable loss 4 (switch unit, atten-uator & pre-amp) | cable loss 5 (to receiver) | used for FCC 15.247 |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | |
| 3000 | 31.0 | -23.4 | 0.47 | 1.87 | 0.53 | -27.58 | 1.33 | |
| 4000 | 33.1 | -23.3 | 0.56 | 2.41 | 0.67 | -28.23 | 1.31 | |
| 5000 | 34.4 | -21.7 | 0.61 | 2.78 | 0.86 | -27.35 | 1.40 | |
| 6000 | 34.7 | -21.2 | 0.58 | 2.74 | 0.90 | -26.89 | 1.47 | |
| 7000 | 35.6 | -19.8 | 0.66 | 2.82 | 0.86 | -25.58 | 1.46 | |

| Frequency | AF R&S HF907 | Corr. | cable loss 1 (relay inside chamber) | cable loss 2 (High Pass) | cable loss 3 (pre-amp) | cable loss 4 (inside chamber) | cable loss 5 (outside chamber) | cable loss 6 (to receiver) |
|---|---|---|---|---|---|---|---|---|
| MHz | dB (1/m) | dB | dB | dB | dB | dB | dB | dB |
| 7000 | 35.6 | -57.3 | 0.56 | 1.28 | -62.72 | 2.66 | 0.94 | 1.46 |
| 8000 | 36.3 | -56.3 | 0.69 | 0.71 | -61.49 | 2.84 | 1.00 | 1.53 |
| 9000 | 37.1 | -55.3 | 0.68 | 0.65 | -60.80 | 3.06 | 1.09 | 1.60 |
| 10000 | 37.5 | -56.2 | 0.70 | 0.54 | -61.91 | 3.28 | 1.20 | 1.67 |
| 11000 | 37.5 | -55.3 | 0.80 | 0.61 | -61.40 | 3.43 | 1.27 | 1.70 |
| 12000 | 37.6 | -53.7 | 0.84 | 0.42 | -59.70 | 3.53 | 1.26 | 1.73 |
| 13000 | 38.2 | -53.5 | 0.83 | 0.44 | -59.81 | 3.75 | 1.32 | 1.83 |
| 14000 | 39.9 | -56.3 | 0.91 | 0.53 | -63.03 | 3.91 | 1.40 | 1.77 |
| 15000 | 40.9 | -54.1 | 0.98 | 0.54 | -61.05 | 4.02 | 1.44 | 1.83 |
| 16000 | 41.3 | -54.1 | 1.23 | 0.49 | -61.51 | 4.17 | 1.51 | 1.85 |
| 17000 | 42.8 | -54.4 | 1.36 | 0.76 | -62.36 | 4.34 | 1.53 | 2.00 |
| 18000 | 44.2 | -54.7 | 1.70 | 0.53 | -62.88 | 4.41 | 1.55 | 1.91 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (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 EMCO 3160-09 | Corr. | cable loss 1 (inside chamber) | cable loss 2 (pre-amp) | cable loss 3 (inside chamber) | cable loss 4 (switch unit) | cable loss 5 (to 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 | 40.5 | -20.4 | 0.89 | -34.07 | 6.90 | 3.66 | 2.22 |
| 26000 | 40.5 | -21.3 | 0.86 | -35.11 | 7.02 | 3.69 | 2.28 |
| 26500 | 40.5 | -21.1 | 0.90 | -35.20 | 7.15 | 3.91 | 2.36 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (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 EMCO 3160-10 | Corr. |
|---|---|---|
| GHz | dB (1/m) | dB |
| 26.5 | 43.4 | -11.2 |
| 27.0 | 43.4 | -11.2 |
| 28.0 | 43.4 | -11.1 |
| 29.0 | 43.5 | -11.0 |
| 30.0 | 43.5 | -10.9 |
| 31.0 | 43.5 | -10.8 |
| 32.0 | 43.5 | -10.7 |
| 33.0 | 43.6 | -10.7 |
| 34.0 | 43.6 | -10.6 |
| 35.0 | 43.6 | -10.5 |
| 36.0 | 43.6 | -10.4 |
| 37.0 | 43.7 | -10.3 |
| 38.0 | 43.7 | -10.2 |
| 39.0 | 43.7 | -10.2 |
| 40.0 | 43.8 | -10.1 |

| cable loss 1 (inside chamber) | cable loss 2 (outside chamber) | cable loss 3 (switch unit) | cable loss 4 (to receiver) | distance corr. (-20 dB/ decade) | $d_{Limit}$ (meas. distance (limit) | $d_{used}$ (meas. distance (used) |
|---|---|---|---|---|---|---|
| dB | dB | dB | dB | dB | m | m |
| 4.4 | | | | -9.6 | 3 | 1.0 |
| 4.4 | | | | -9.6 | 3 | 1.0 |
| 4.5 | | | | -9.6 | 3 | 1.0 |
| 4.6 | | | | -9.6 | 3 | 1.0 |
| 4.7 | | | | -9.6 | 3 | 1.0 |
| 4.7 | | | | -9.6 | 3 | 1.0 |
| 4.8 | | | | -9.6 | 3 | 1.0 |
| 4.9 | | | | -9.6 | 3 | 1.0 |
| 5.0 | | | | -9.6 | 3 | 1.0 |
| 5.1 | | | | -9.6 | 3 | 1.0 |
| 5.1 | | | | -9.6 | 3 | 1.0 |
| 5.2 | | | | -9.6 | 3 | 1.0 |
| 5.3 | | | | -9.6 | 3 | 1.0 |
| 5.4 | | | | -9.6 | 3 | 1.0 |
| 5.5 | | | | -9.6 | 3 | 1.0 |

**Sample calculation**

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (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 * LOG ($d_{Limit}$/ $d_{used}$)
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 | ± 5.5 dB |
| - Out-of-band rejection<br>- Occupied Bandwidth<br>- Input versus output spectrum | Power<br>Frequency | ± 2.9 dB<br>± 11.2 kHz |
| - Effective radiated power, mean output power and zone enhancer gain<br>- Peak to Average Ratio | Power | ± 2.2 dB |
| - Out-of-band emission limits<br>- Conducted Spurious Emissions at Antenna Terminal | Power<br>Frequency | ± 2.2 dB<br>± 11.2 kHz |

## 8 PHOTO REPORT

Please see separate photo report.