

Test Site:
FCC Test Site No.: 96997



BUREAU
VERITAS

ECL-EMC Test Report No.: 16-092

Equipment under test: **ION-M7P/85P/17EP/19P**
850MHz Path
FCC ID: **XS5-M78517E19P**
Type of test: **FCC 47 CFR Part 22 Subpart H:2016**
Cellular Radiotelephone Service

Measurement Procedures: 47 CFR Parts 2: 2016 (*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*), Part 22: 2016 (*Cellular Radiotelephone Service*), ANSI/TIA-603-C (2004), *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*

Test result: **Passed**

| | | | |
|-------------------|------------------------|------------|--|
| Date of issue: | 29.04.16 | Signature: | |
| Issue-No.: | 01 | Author: | |
| Date of delivery: | 25.04.16 | Checked: | |
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| Pages: | 55 | | |

Test Report No.: 16-092

FCC ID: XS5-M78517E19P



BUREAU
VERITAS

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General:

The purpose of this report is to show compliance to the FCC regulations for licensed devices operating under section 22 of the Code of Federal Regulations title 47.

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



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11 HISTORY55



1 Test Results Summary

| Name of Test | FCC Para. No. | FCC Method | FCC Spec. | Result |
|---|--------------------------|--------------------------|--------------------------|----------|
| RF Power Output | 22.913 | 2.1046 | 500 Watts | Complies |
| Occupied Bandwidth | KDB 935210 D02 v03r02 | 2.1049 | Input/Output | Complies |
| Spurious Emissions at Antenna Terminals | 22.917 | 2.1051 | -13dBm | Complies |
| Field Strength of Spurious Emissions | 22.917 | 2.1053 | -13dBm E.I.R.P | Complies |
| Intermodulation | KDB 935210 D02 v03r02 | KDB 935210 D02 v03r02 | KDB 935210 D02 v03r02 | Complies |
| Frequency Stability | n.a. | 2.1055 | Must stay in band | NA |
| Out of Band Rejection | KDB 935210 D02 v03r02 | KDB 935210 D03 v04 | KDB 935210 D03 v04 | Complies |

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



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

2.1 Description

| | |
|-----------------------------------|--|
| Kind of equipment | ION-M7P/85P/17EP/19P |
| Andrew Ident. Number | 7714179-0002 |
| Serial no.(SN) | 15 |
| Revision | 00 |
| Software version and ID | n. a. |
| Type of modulation and Designator | GSM (GXW) <input checked="" type="checkbox"/> GSM EDGE (G7W) <input checked="" type="checkbox"/> CDMA (F9W) <input checked="" type="checkbox"/> W-CDMA (F9W) <input checked="" type="checkbox"/> LTE (G7D) <input checked="" type="checkbox"/> |
| Frequency Translation | F1-F1 <input checked="" type="checkbox"/> F1-F2 <input type="checkbox"/> N/A <input type="checkbox"/> |
| Band Selection | Software <input type="checkbox"/> Duplexer <input checked="" type="checkbox"/> Full band <input type="checkbox"/> |

2.1.1 Downlink

| | |
|---|----------------------------|
| Pass band | Path 862 MHz – 894 MHz |
| Pass band under test | Path 869 MHz – 894 MHz |
| Max. composite output power based on one carrier per path (rated) | 43.0 dBm = 20 W |
| System Gain* | 10 dB @ Pout BTS of 33 dBm |

*see 2.1.5

2.1.2 Uplink

| | |
|----------------------------|------------------------|
| Pass band | Path 817 MHz – 849 MHz |
| Maximum rated output power | n. a. |
| System Gain* | n.a. |

*see 2.1.5

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



2.1.3 Description of EUT

CommScope's ION-M7P/85P/17EP/19P is a multi-band, multi-operator Remote Unit. It is used in conjunction with a Master Unit in the ION optical distribution system. This system transports up to 4 frequency bands simultaneously, providing a cost-effective solution for distributing capacity from one or more base stations.

This Test Report describes only the approval of the 850 MHz Path.

The ION-M7P/85P/17EP/19P Repeater system consists of one 700 MHz path, one 850 MHz path, one 1700/2100 MHz path and one 1900 MHz path with the intended use of simultaneous transmission.

The antenna(s) used with device must be fixed-mounted on permanent structures.



2.1.4 Block diagram of measurement reference points

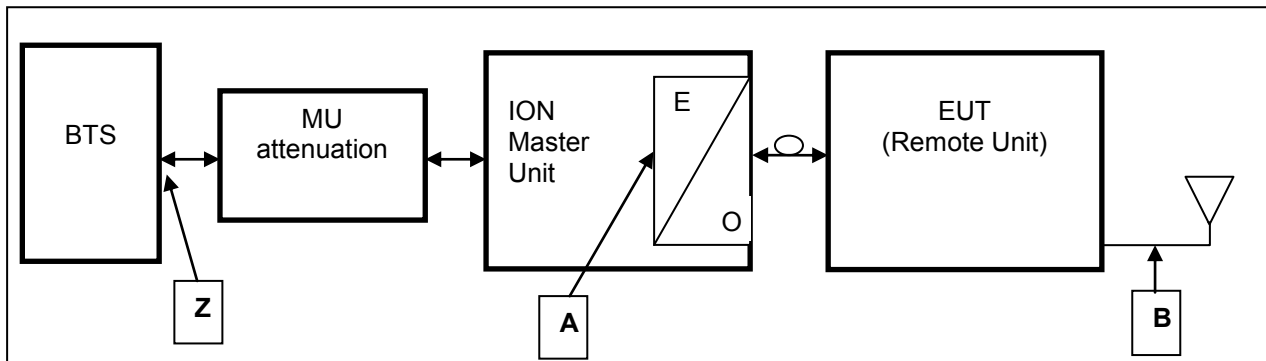


figure 2.1.4-#1 Block diagram of measurement reference points

Remote Unit (RU) is the EUT

O/E Optical/Electrical converter
 MU Master Unit

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

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

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

2.1.5 Downlink System Gain and Output Power

| System optimized for BTS power (fixed value) Z | MU Attenuation (manual leveling) | Maximum rated input power at the MU OTRX (fixed value) A | RU Gain (fixed value) A to B | Maximum rated output power at RU Antenna port (fixed value) B |
|--|----------------------------------|--|--|---|
| +33 dBm | 30 dB | +3 dBm | 40 dB | +43.0 dBm @ 1 carrier |
| System Gain Z to B | +10 dB | | | |
| +43 dBm | 40 dB | +3 dBm | 40 dB | +43.0 dBm @ 1 carrier |
| System Gain Z to B | 0 dB | | | |

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



3 Test site (Andrew Buchdorf)

3.1 Test environment

All tests were performed under the following environmental conditions:

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

3.2 Test equipment

| ANDREW Inv. No. | Test equipment | Type | Manufacturer | Serial No. | Calibration |
|-----------------|-------------------|---------------|--------------|------------|-------------|
| 9295 | Network Analyzer | ZNB20 | R&S | 101540 | 11/16 |
| 9291 | Spectrum Analyzer | FSV30 | R&S | 103090 | 06/16 |
| 9233 | Signal Generator | SMBV100A | R&S | 257777 | 06/16 |
| 8849 | Signal Generator | SMU200A | R&S | 101732 | 04/16 |
| 8671 | Power Meter | E4418B | Agilent | GB39513094 | 06/16 |
| 8672 | Power Sensor | E9300H | Agilent | US41090179 | 06/16 |
| 7306 | Circulator | C25E-1FFF | AEROTEK | 12580 | CIU |
| 7307 | Circulator | C25E-1FFF | AEROTEK | 12581 | CIU |
| 7408 | RF-Cable | 2,0m; N-N | Andrew | --- | CIU |
| 7409 | RF-Cable | 2,0m; N-N | Andrew | --- | CIU |
| 7410 | RF-Cable | 1,0m; N-N | Andrew | --- | CIU |
| 7411 | RF-Cable | 2,0m; N-N | Andrew | --- | CIU |
| 7373 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7374 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7437 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7438 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7439 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7443 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7444 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7445 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7446 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7447 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7448 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7449 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7450 | RF-Cable | Multiflex141 | Andrew | --- | CIU |
| 7440 | RF-Cable | RG-223 0.8m | Andrew | --- | CIU |
| 7441 | RF-Cable | RG-223 0.8m | Andrew | --- | CIU |
| 7453 | RF-Cable | RG223 2m SMA. | Andrew | --- | CIU |
| 7454 | RF-Cable | RG223 2m SMA. | Andrew | --- | CIU |
| 7455 | RF-Cable | RG223 2m SMA. | Andrew | --- | CIU |
| 7144 | Attenuator | 2N-20dB | Inmet 64671 | --- | CIU |
| 7336 | Power Attenuator | 769-20 | Narda | --- | CIU |
| 7368 | Matrix | | COMMSCOPE | --- | weekly |

CIU = Calibrate in use



3.3 Input and output losses

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

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

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

3.4 Measurement uncertainty

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

4 Test site (Bureau Veritas Consumer Products Services)

FCC Test site: 96997

See relevant dates under section 10.



5 RF Power Out: §22.913, §2.1046

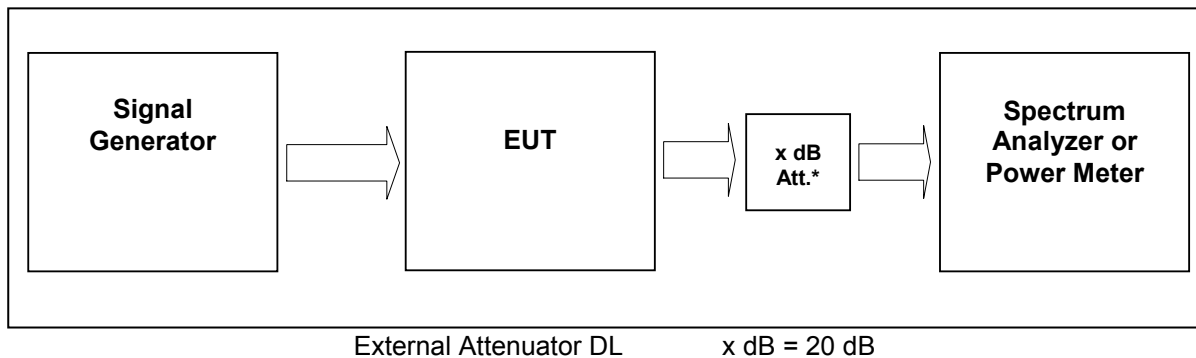


figure 5-#1 Test setup: RF Power Out: §22.913, §2.1046

| | |
|-------------------------|--|
| Measurement uncertainty | ± 0,38 dB |
| Test equipment used | 9291, 9233, 7444; 7321; 7144; 7454; 7453; 7336; 7449; 7368 |

5.1 Limit

Minimum standard:

Para. No.22.913

The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(a) *Maximum ERP.* In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. However, for those systems operating in areas more than 72 km (45 miles) from international borders that:

- (1) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or,
- (2) Extend coverage on a secondary basis into cellular unserved areas, as those areas are defined in § 22.949, the ERP of base transmitters and cellular repeaters of such systems must not exceed 1000 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

5.2 Test method

§ 2.1046 Measurements required: RF power output.

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

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



5.3 Test Results

Detector RMS.

Test signal GSM:

Signal waveform with GMSK modulation in all time slots according to 3GPP TS45.004

Test signal GSM EDGE:

Signal waveform with 8-PSK modulation in all time slots according to 3GPP TS45.004

Test signal CDMA:

Signal waveform according to table 6.2-1 of standard specification 3GPP2 C.p0051-0 v1.0 16.February 2006 pilot, sync, paging, 37 traffics, which is equal to the table 6.5.2.1 of 3GPP2 C.S0010-C v2.0 24.February 2006.

Test signal WCDMA:

Signal waveform according to Test Model 1 of standard specification 3GPP TS25.141. Signal modulated with a combination of PCCPCH, SCCPCH and Dedicated Physical Channels specified as test model 1 64 DPCH.

Test signal LTE:

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



5.3.1 Downlink

| Modulation | Measured at | Path | RBW VBW Span | RF Power (dBm) | RF Power (W) | Plot - |
|---|-------------|-----------|-------------------------|----------------|--------------|------------|
| GSM | Middle | 881.5 MHz | 1MHz 3MHz 10MHz | 43.0 | 20 | 5.3.1.1 #1 |
| EDGE | Middle | 881.5 MHz | 1MHz 3MHz 10MHz | 43.0 | 20 | 5.3.1.2 #1 |
| CDMA | Middle | 881.5 MHz | 3MHz 10MHz 15MHz | 43.0 | 20 | 5.3.1.3 #1 |
| WCDMA | Middle | 881.5 MHz | 10MHz 10MHz 50MHz | 42.5 | 18 | 5.3.1.4 #1 |
| LTE | Middle | 881.5 MHz | 3MHz 10MHz 15MHz | 43.0 | 20 | 5.3.1.5 #1 |
| Maximum output power = 43.0 dBm = 20 W | | | | | | |
| Limit Maximum output power (erp) = 1000 W | | | | | | |

table 5.3.1-#1 RF Power Out: §22.913, §2.1046 Test Results Downlink

The max RF Power out is 43 dBm, so the maximum antenna gain (x) can be calculated as follow:

Limit = 1000W (erp) = 60 dBm

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

$60 \text{ dBm} > 43 \text{ dBm} + x \text{ -----} > x = 60 \text{ dBm} - 43 \text{ dBm} = \underline{17 \text{ dBd}}$

$x \text{ dBi} = 17 \text{ dBd} + 2.15 = \underline{19.15 \text{ dBi}}$

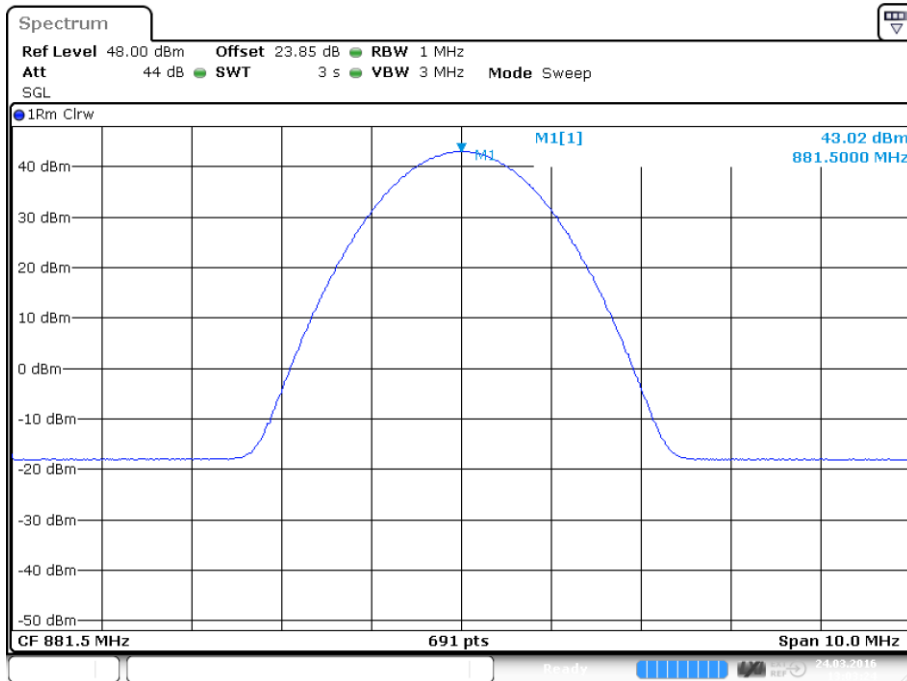
=> The antenna that will be used for the complete system have to have a gain lower than 19.15 dBi, relative to a dipol.

| Modulation | Pin / dBm (Ref. point A) |
|------------|-----------------------------|
| GSM | 3.5 |
| EDGE | 3.2 |
| CDMA | 4.0 |
| WCDMA | 3.0 |
| LTE | 3.6 |

table 5.3.1-#2 RF Power Out: §22.913, §2.1046 Test Results Downlink Input power



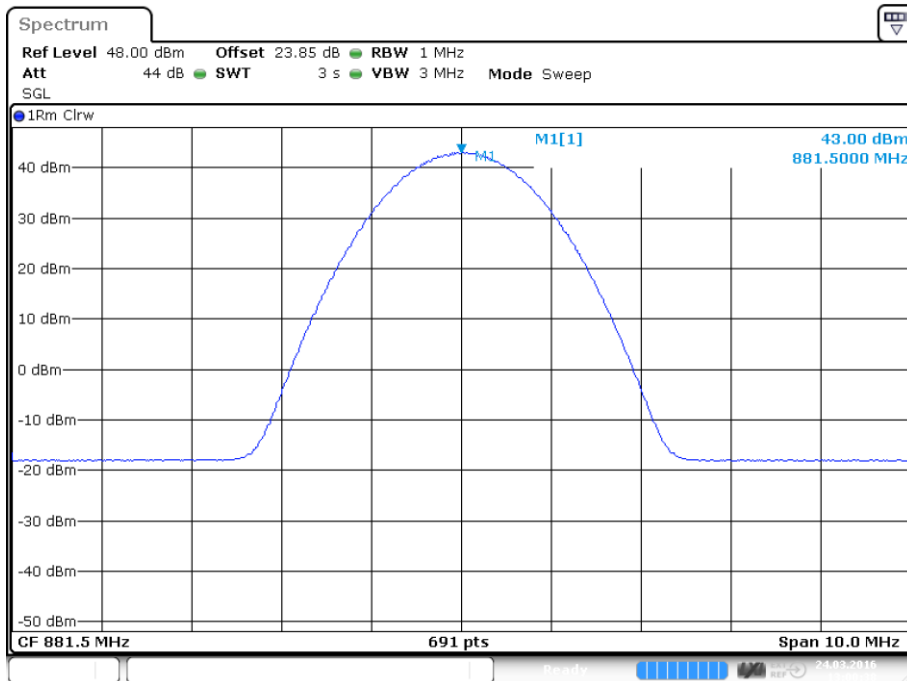
5.3.1.1 GSM



Date: 24.MAR.2016 13:03:24

plot 5.3.1.1-#1 RF Power Out: §22.913, §2.1046; Test Results; Downlink; GSM Middle

5.3.1.2 EDGE

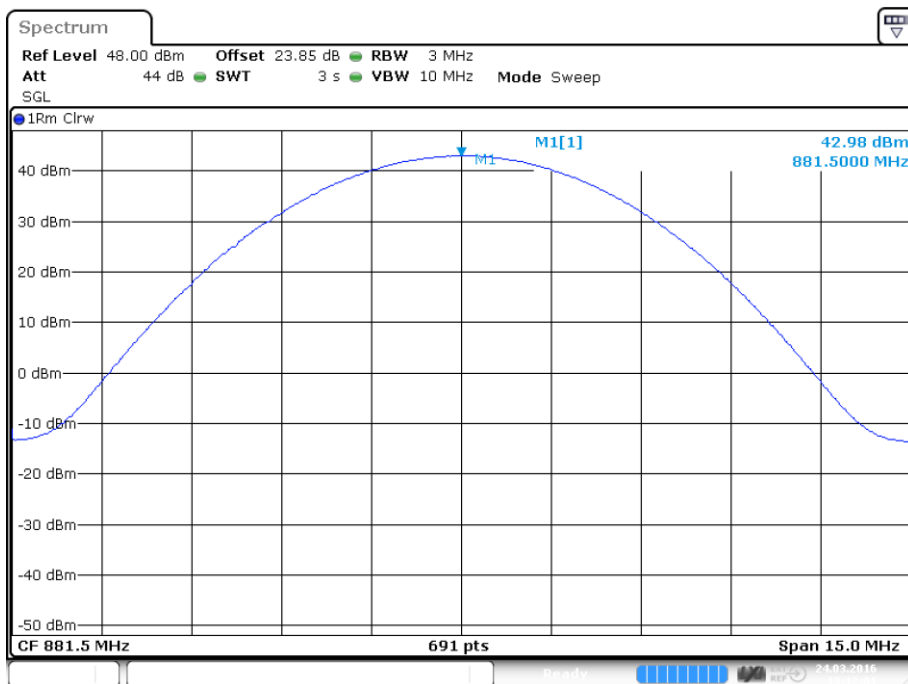


Date: 24.MAR.2016 13:00:38

plot 5.3.1.2-#1 RF Power Out: §22.913, §2.1046; Test Results; Downlink; EDGE Middle



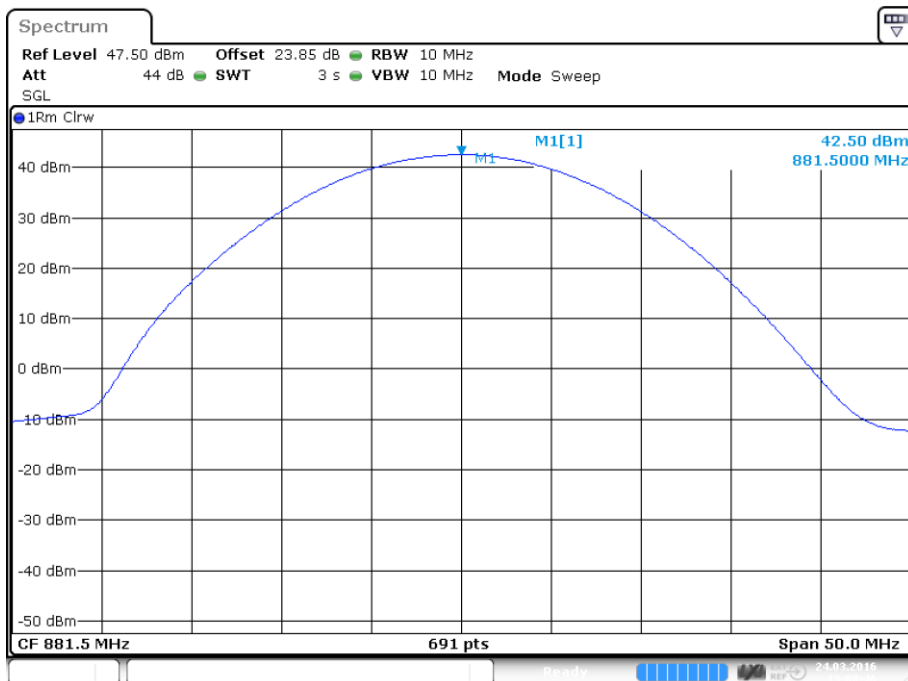
5.3.1.3 CDMA



Date: 24.MAR.2016 13:12:02

plot 5.3.1.3-#1 RF Power Out: §22.913, §2.1046; Test Results; Downlink; CDMA Middle

5.3.1.4 WCDMA

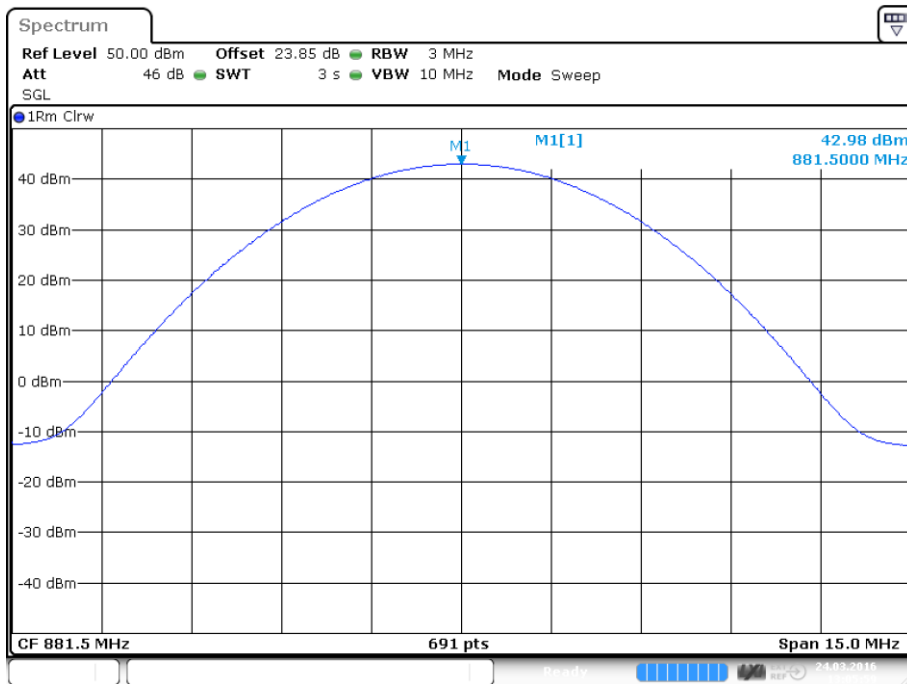


Date: 24.MAR.2016 13:08:47

plot 5.3.1.4-#1 RF Power Out: §22.913, §2.1046; Test Results; Downlink; WCDMA Middle



5.3.1.5 LTE



Date: 24.MAR.2016 13:05:59

plot 5.3.1.5-#1 RF Power Out: §22.913, §2.1046; Test Results; Downlink; LTE Middle

5.3.2 Uplink

n.a.

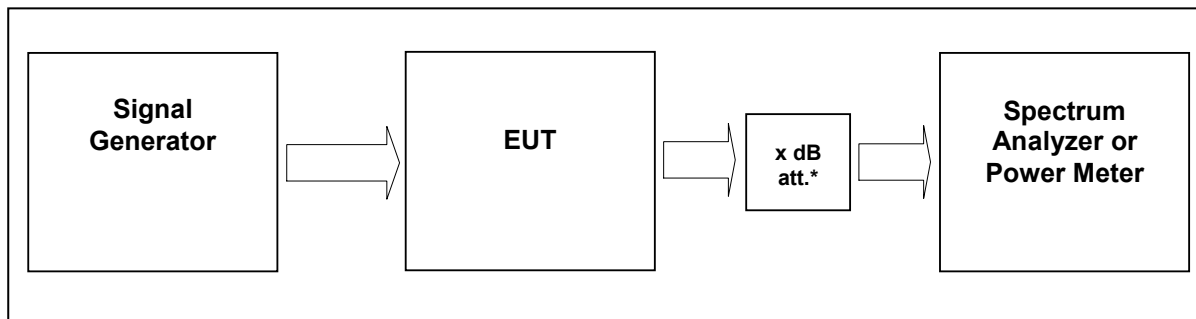
Note: The EUT does not transmit over the air in the uplink direction.

5.4 Summary test result

| | |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by: | M. Leinfelder |
| Date: | 24.03.2016 |



6 Occupied Bandwidth: §2.1049



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

| | |
|-------------------------|---|
| Measurement uncertainty | ± 0,38 dB |
| Test equipment used | 9291, 9233, 7444; 7321; 7144; 7454; 7453; 7336; 7449; 7368 |

6.1 Limit

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

6.2 Test method

Para. No.2.1049

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



6.3 Test results

6.3.1 Downlink

Detector PK.

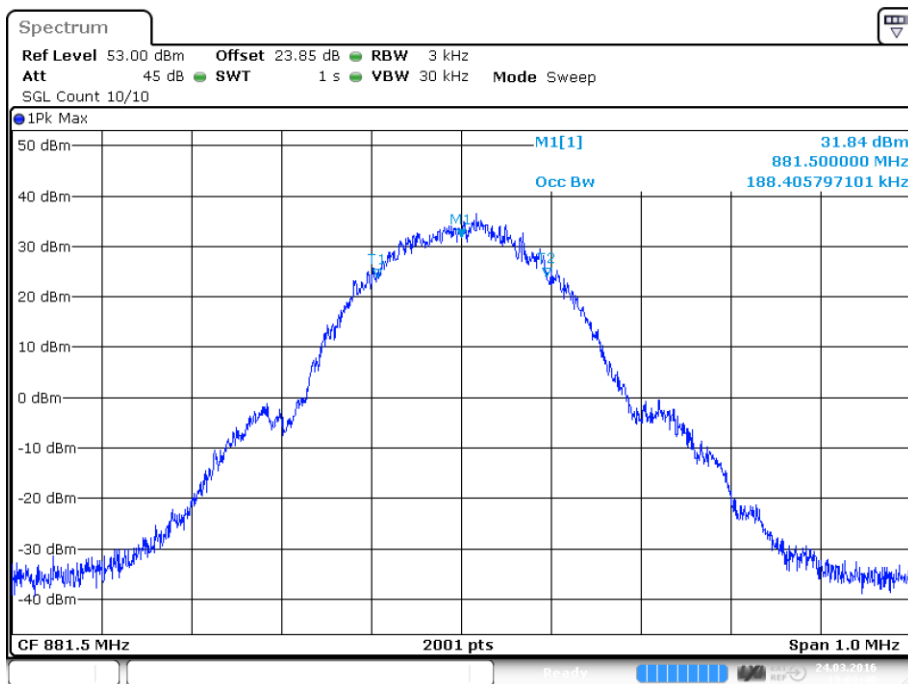
| Modulation | Measured at | Carrier /MHz | RBW VBW Span | Occupied Bandwidth | Plot # |
|------------|-------------|--------------|----------------------------|--------------------|-------------------|
| GSM | Middle | 881.5 MHz | 3 kHz 30 kHz 1 MHz | 188.4 kHz | 6.3.1.1 #1, #2 |
| EDGE | Middle | 881.5 MHz | 3 kHz 30 kHz 1 MHz | 191.9 kHz | 6.3.1.2 #1, #2 |
| CDMA | Middle | 881.5 MHz | 30 kHz 300 kHz 5 MHz | 1.18 MHz | 6.3.1.3 #1, #2 |
| WCDMA | Middle | 881.5 MHz | 100 kHz 1 MHz 10 MHz | 3.79 MHz | 6.3.1.4 #1, #2 |
| LTE | Middle | 881.5 MHz | 30 kHz 300 kHz 5 MHz | 1.05 MHz | 6.3.1.5 #1, #2 |

| Modulation | Measured at | Carrier /MHz | RBW VBW Span | 26dB Bandwidth | Plot # |
|------------|-------------|--------------|----------------------------|----------------|-------------------|
| GSM | Middle | 881.5 MHz | 3 kHz 30 kHz 1 MHz | 322.8 kHz | 6.3.2.1 #1, #2 |
| EDGE | Middle | 881.5 MHz | 3 kHz 30 kHz 1 MHz | 313.3 kHz | 6.3.2.2 #1, #2 |
| CDMA | Middle | 881.5 MHz | 30 kHz 300 kHz 5 MHz | 1.43 MHz | 6.3.2.3 #1, #2 |
| WCDMA | Middle | 881.5 MHz | 100 kHz 1 MHz 10 MHz | 4.69 MHz | 6.3.2.4 #1, #2 |
| LTE | Middle | 881.5 MHz | 30 kHz 300 kHz 5 MHz | 1.3 MHz | 6.3.2.5 #1, #2 |

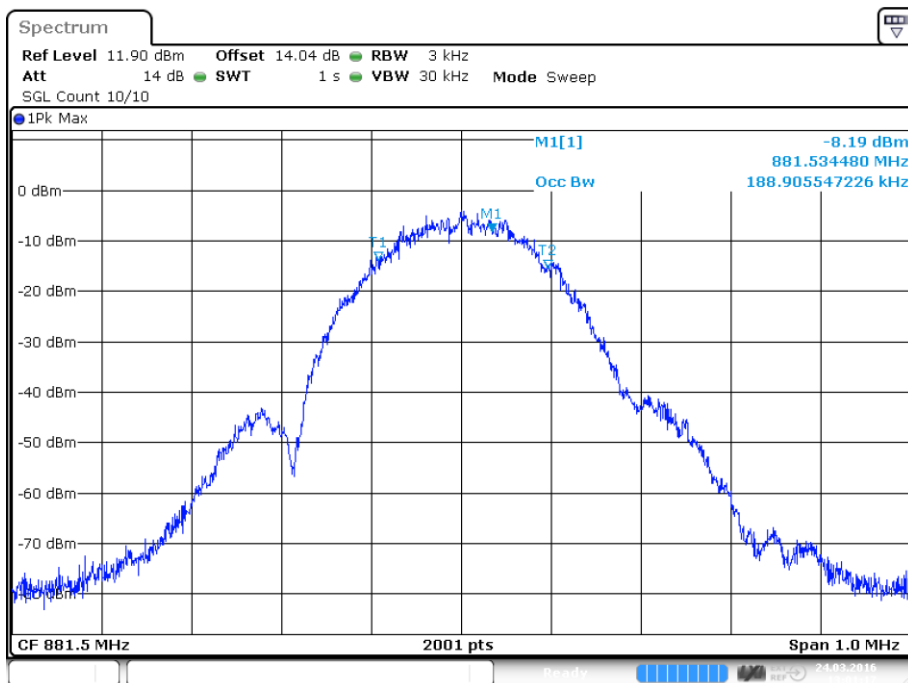
table 6.3-#1 Occupied Bandwidth: §2.1049 Test results



6.3.1.1 GSM



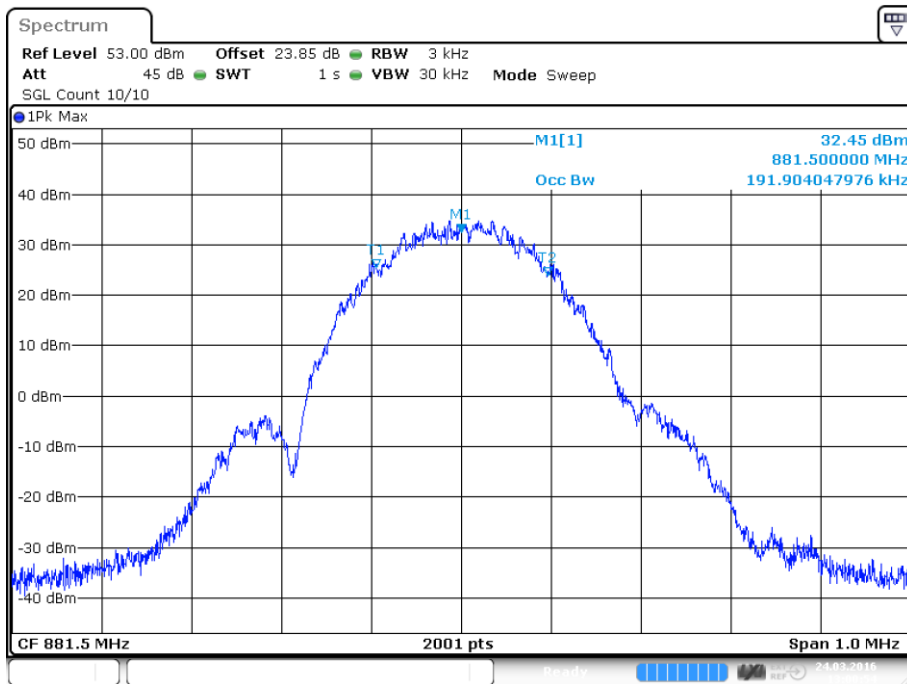
plot 6.3.1.1-#1 Occupied Bandwidth: \$2.1049; Test results; Downlink; GSM Output



plot 6.3.1.1-#2 Occupied Bandwidth: \$2.1049; Test results; Downlink; GSM Input

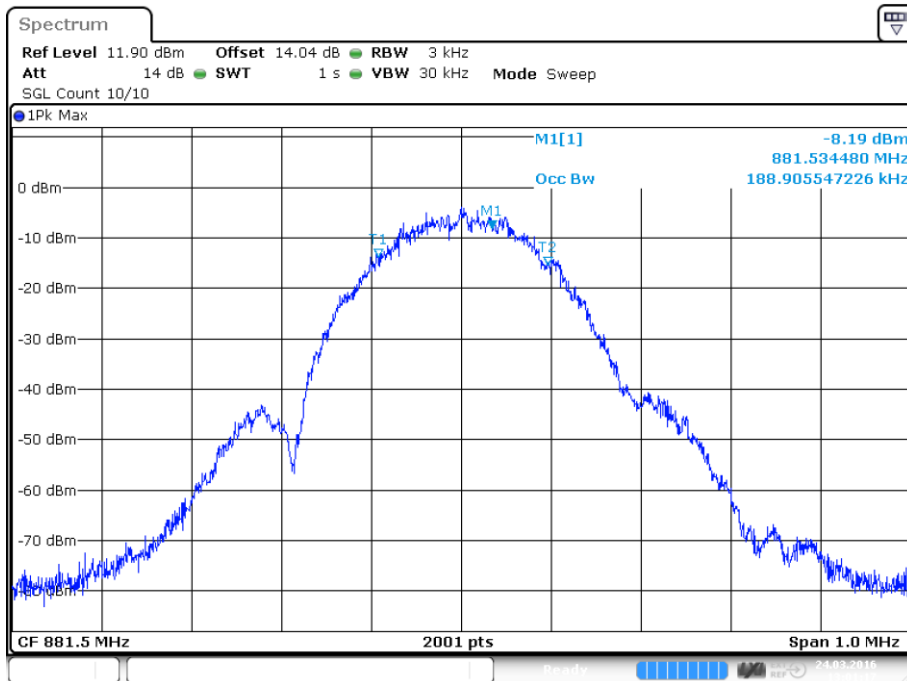


6.3.1.2 EDGE



Date: 24.MAR.2016 13:00:54

plot 6.3.1.2-#1 Occupied Bandwidth: \$2.1049; Test results; Downlink; EDGE Output

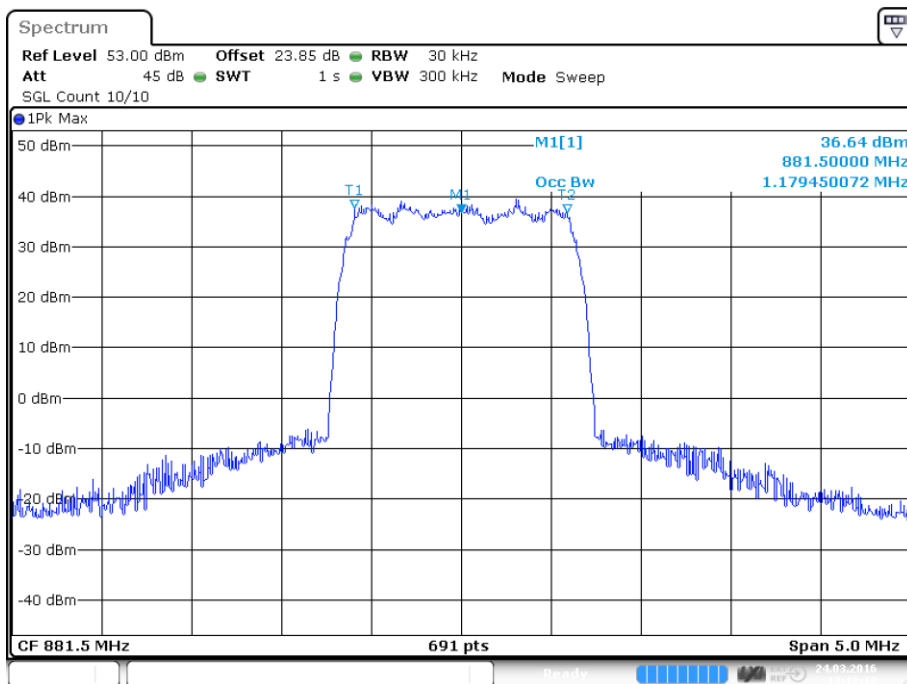


Date: 24.MAR.2016 13:01:18

plot 6.3.1.2-#2 Occupied Bandwidth: \$2.1049; Test results; Downlink; EDGE Input

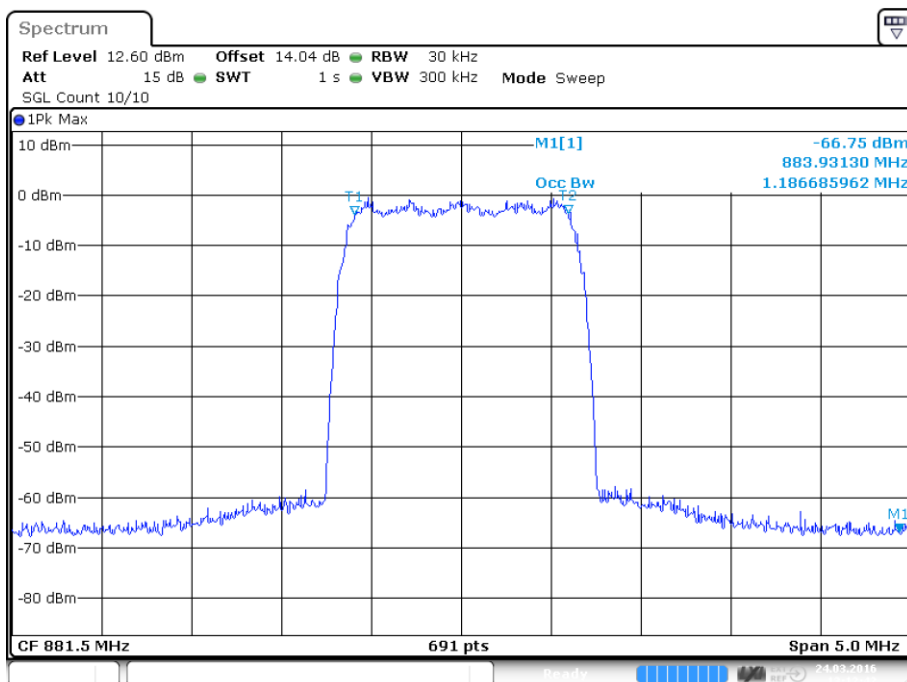


6.3.1.3 CDMA



Date: 24.MAR.2016 13:12:18

plot 6.3.1.3-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; CDMA Output

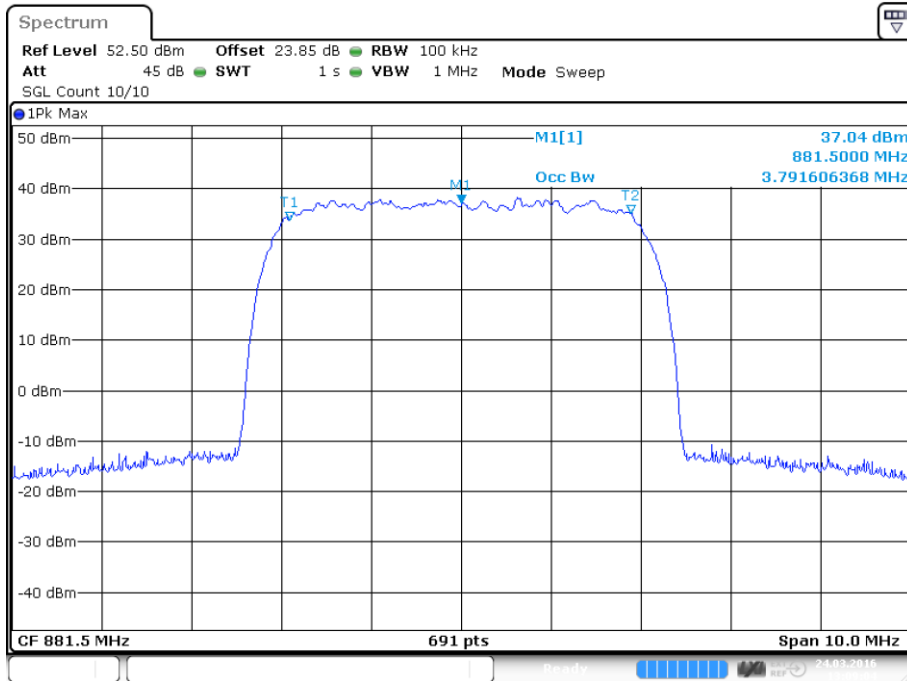


Date: 24.MAR.2016 13:12:42

plot 6.3.1.3-#2 Occupied Bandwidth: §2.1049; Test results; Downlink; CDMA Input

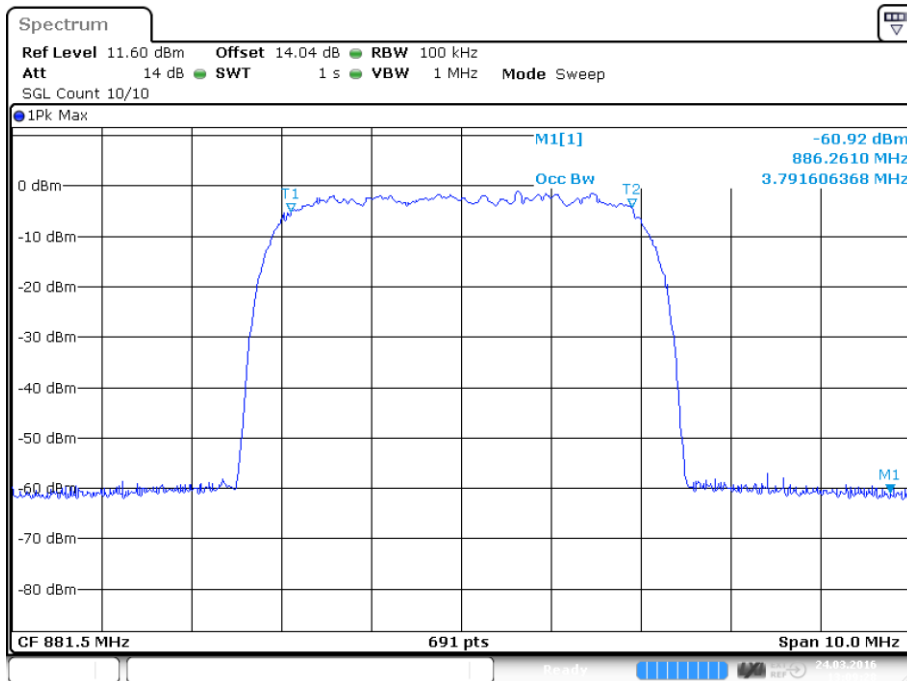


6.3.1.4 WCDMA



Date: 24.MAR.2016 13:09:04

plot 6.3.1.4-#1 Occupied Bandwidth: \$2.1049; Test results; Downlink; WCDMA Output

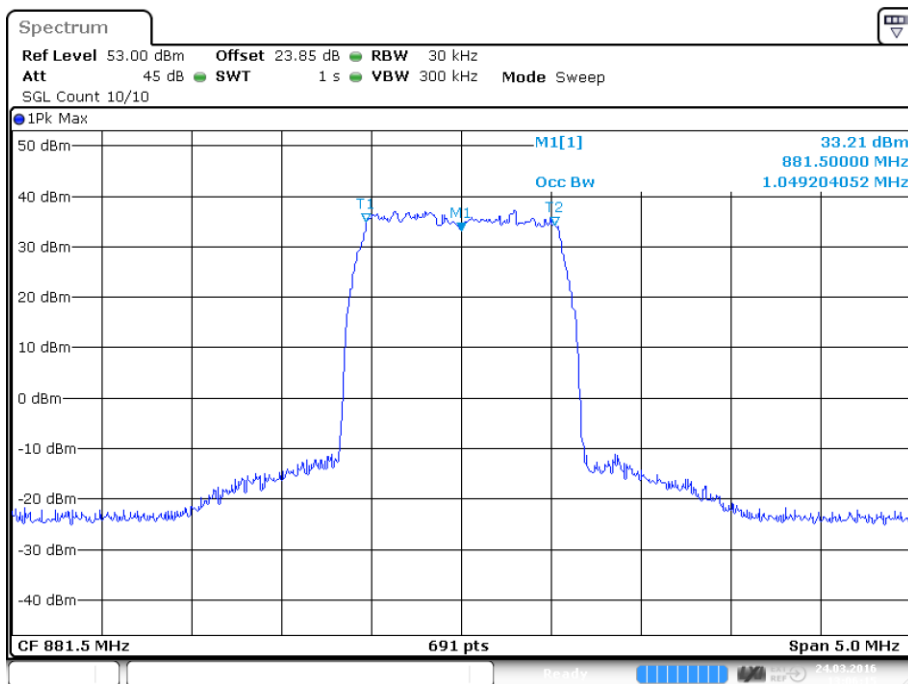


Date: 24.MAR.2016 13:09:28

plot 6.3.1.4-#2 Occupied Bandwidth: \$2.1049; Test results; Downlink; WCDMA Input

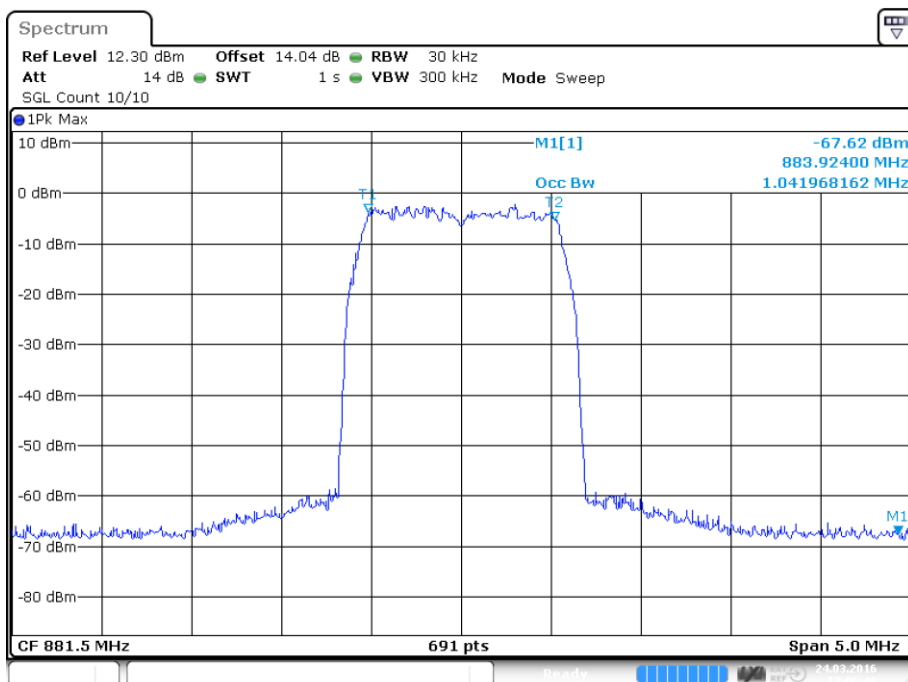


6.3.1.5 LTE



Date: 24.MAR.2016 13:06:16

plot 6.3.1.5-#1 Occupied Bandwidth: \$2.1049; Test results; Downlink; LTE Output



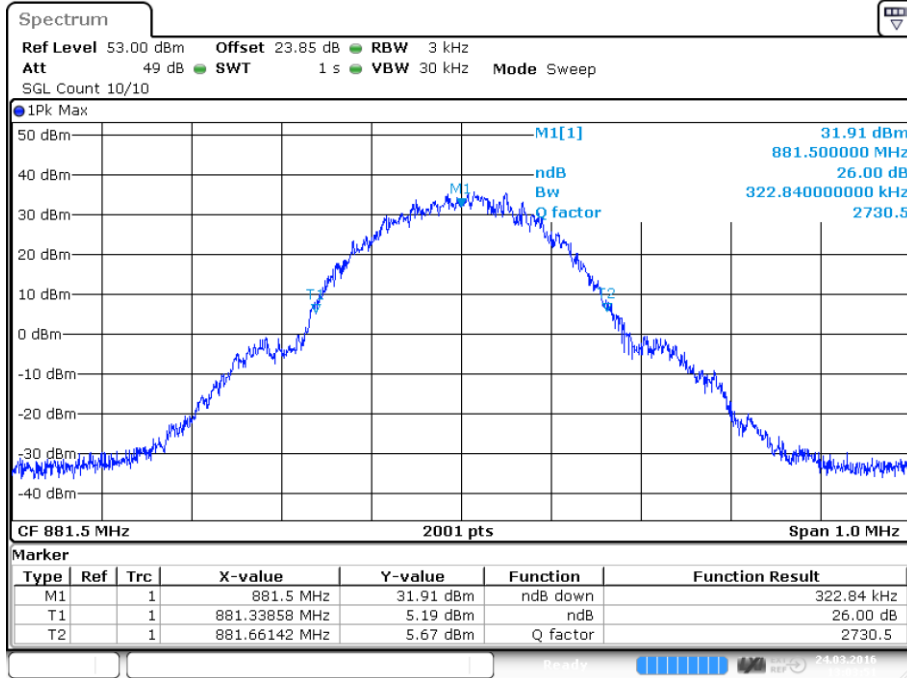
Date: 24.MAR.2016 13:06:39

plot 6.3.1.5-#2 Occupied Bandwidth: \$2.1049; Test results; Downlink; LTE Input



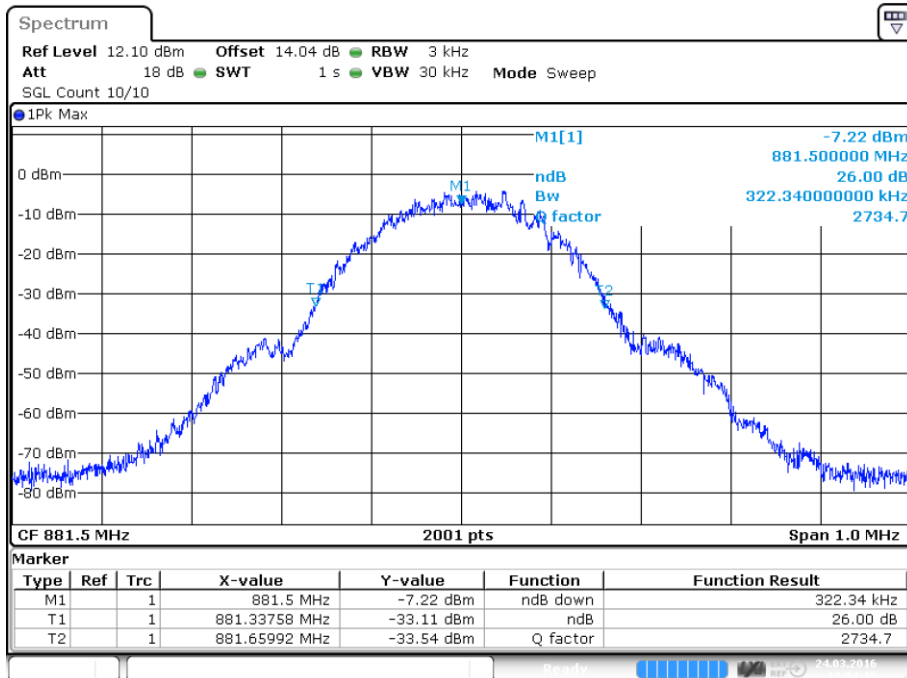
6.3.2 26dB Bandwidth

6.3.2.1 GSM



Date: 24.MAR.2016 13:03:52

plot 6.3.2.1-#1 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; GSM Output

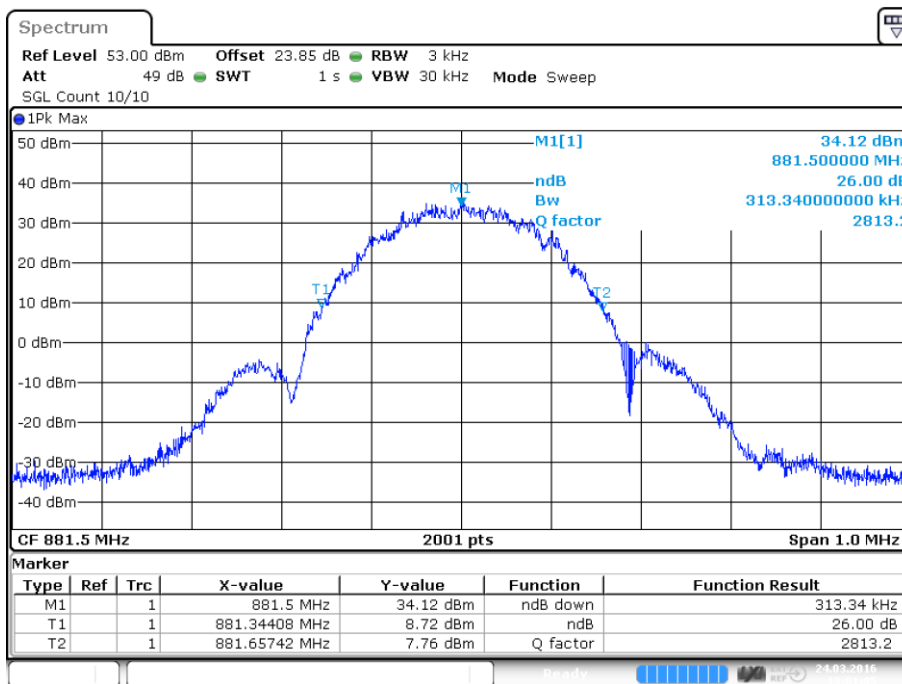


Date: 24.MAR.2016 13:04:15

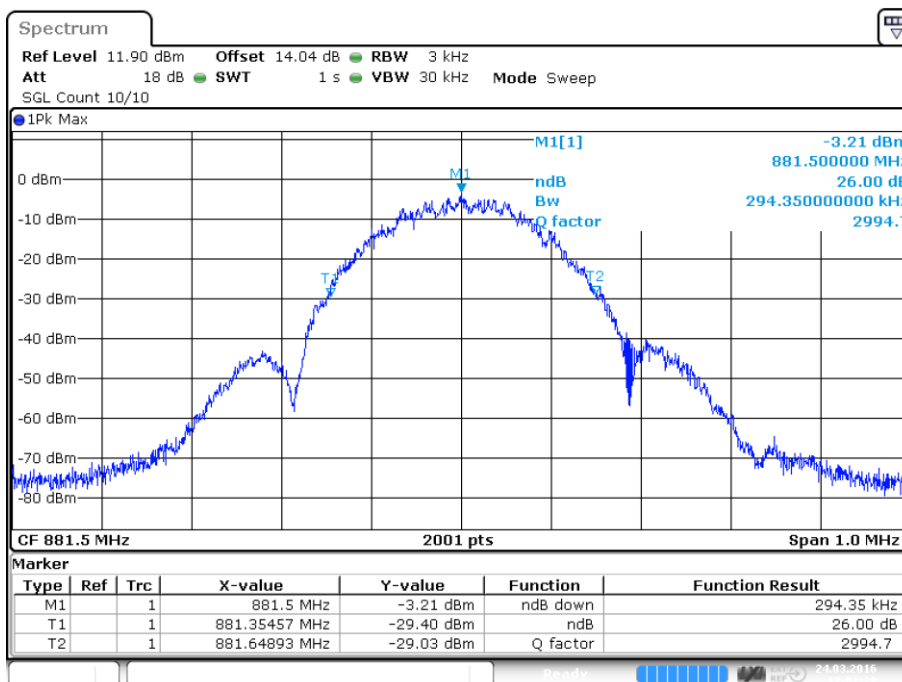
plot 6.3.2.1-#2 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; GSM Input



6.3.2.2 EDGE



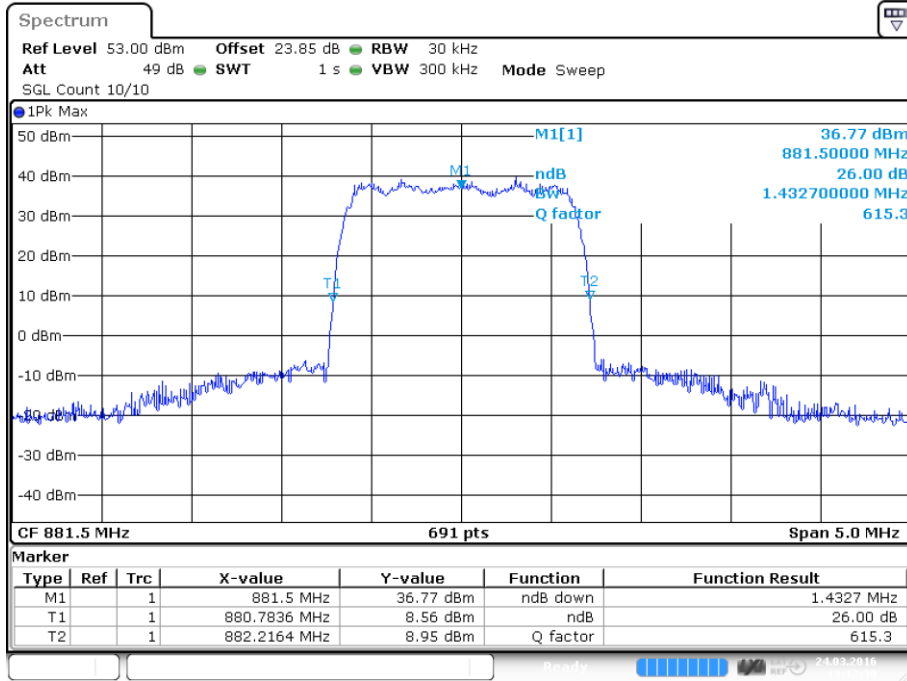
plot 6.3.2.2-#1 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; EDGE Output



plot 6.3.2.2-#2 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; EDGE Input

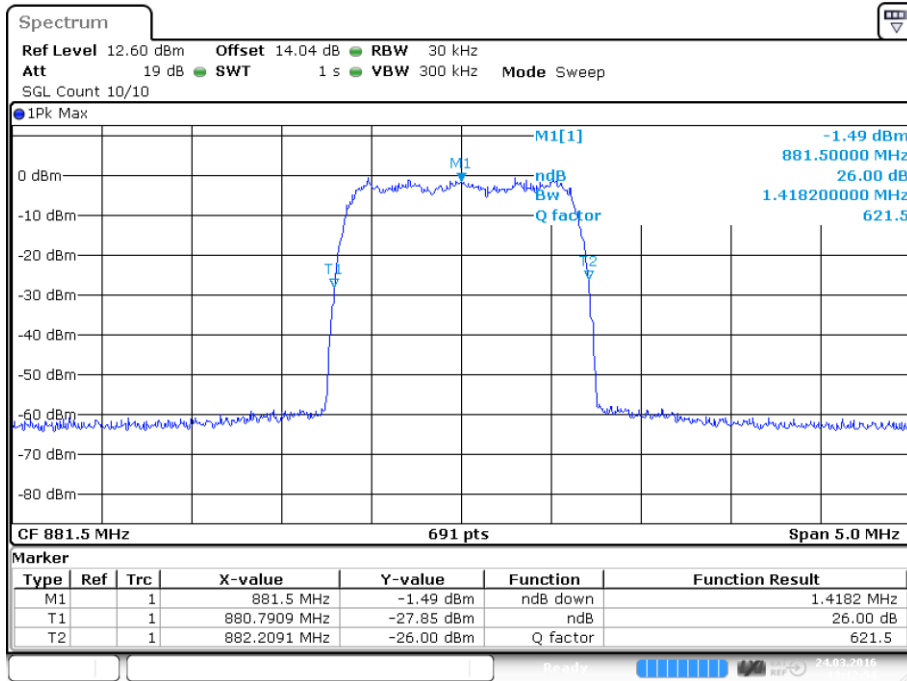


6.3.2.3 CDMA



Date: 24.MAR.2016 13:12:30

plot 6.3.2.3-#1 Occupied Bandwidth: §2.1049; Test results; 26dB Bandwidth; CDMA Output

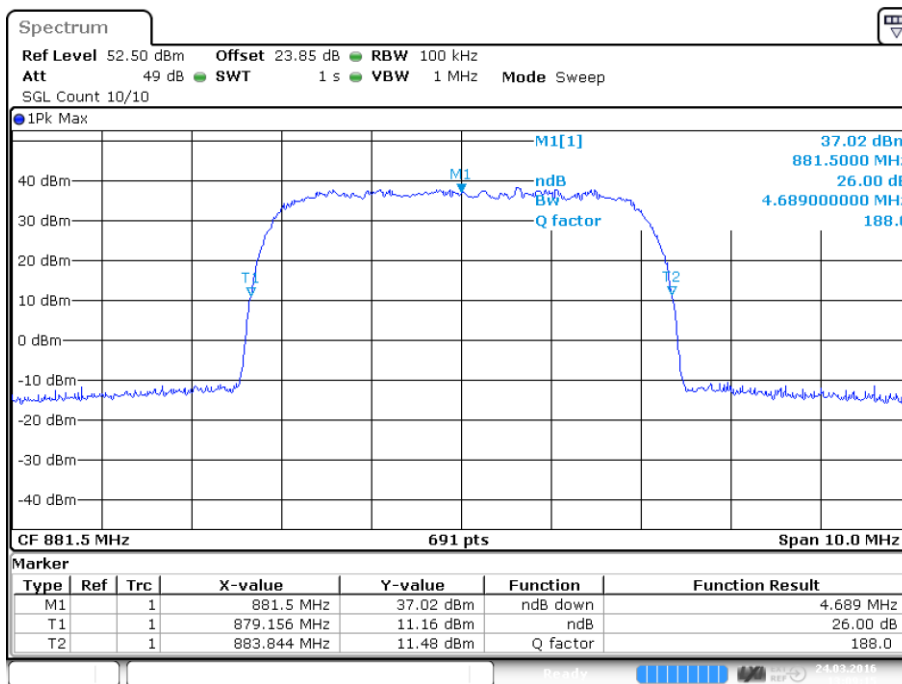


Date: 24.MAR.2016 13:12:54

plot 6.3.2.3-#2 Occupied Bandwidth: §2.1049; Test results; 26dB Bandwidth; CDMA Input

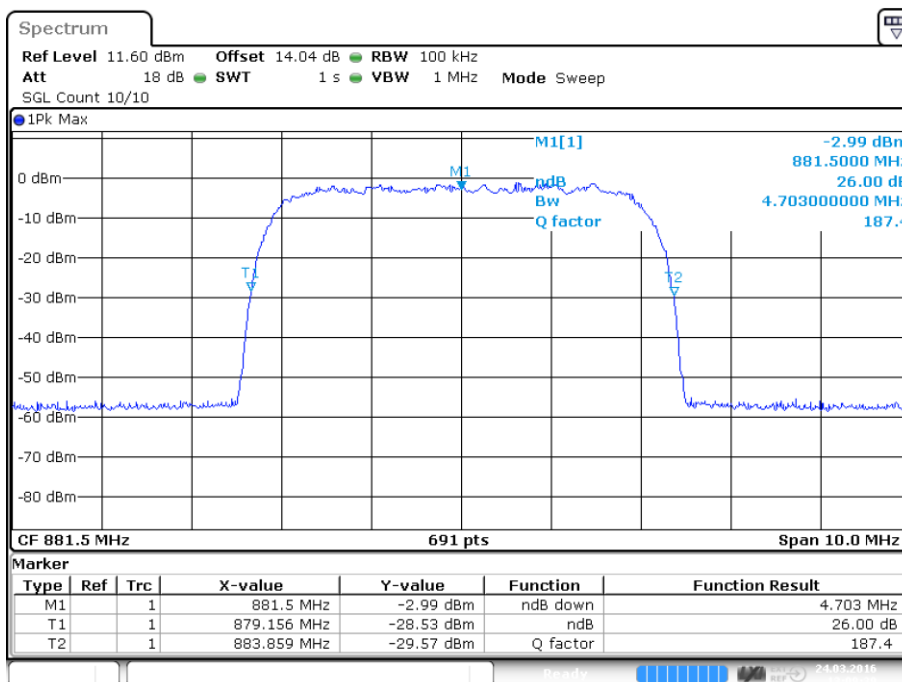


6.3.2.4 WCDMA



Date: 24.MAR.2016 13:09:15

plot 6.3.2.4-#1 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; WCDMA Output

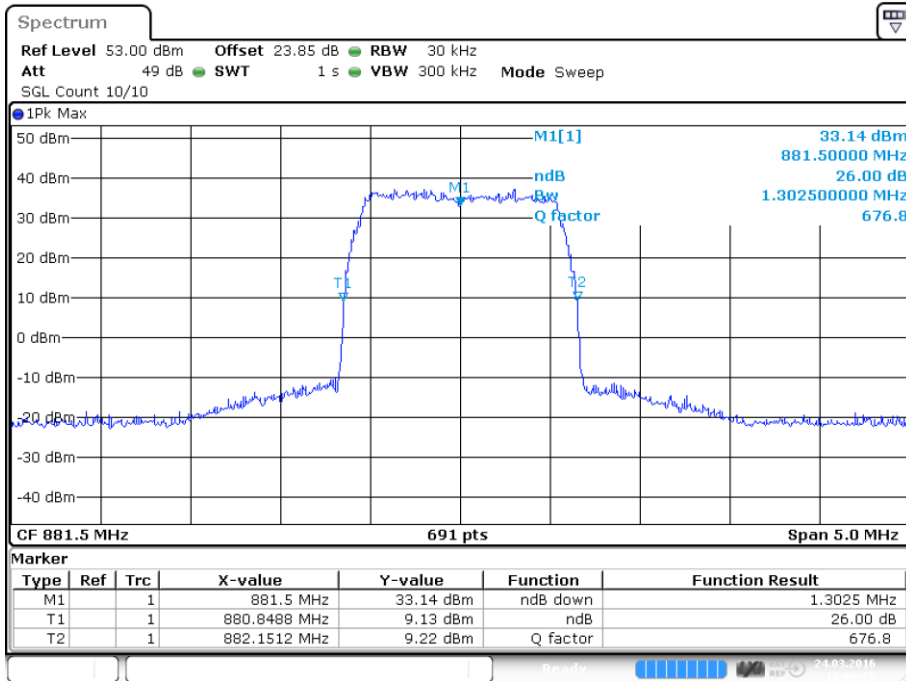


Date: 24.MAR.2016 13:09:39

plot 6.3.2.4-#2 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; WCDMA Input

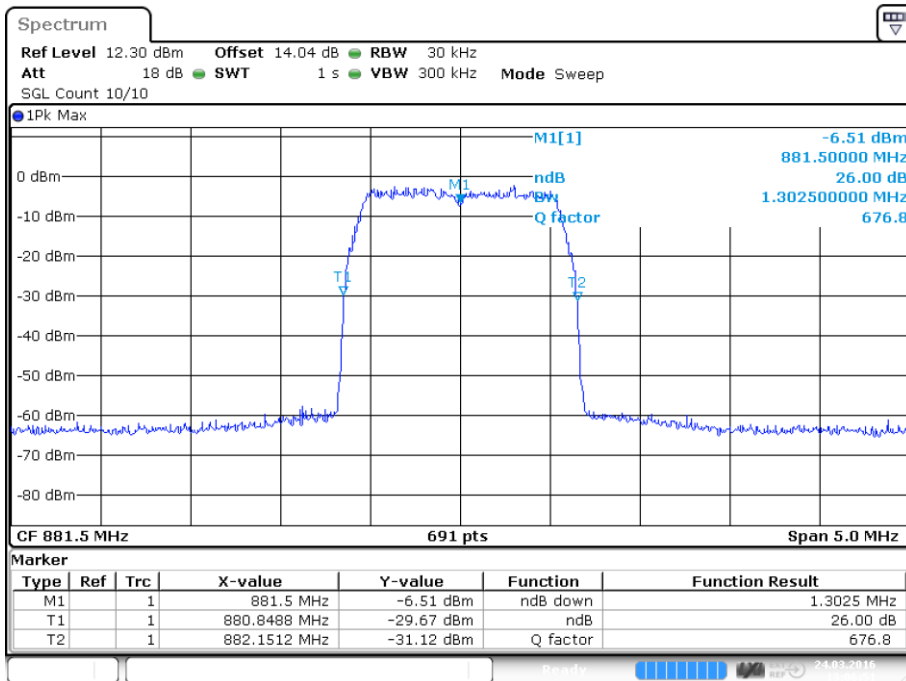


6.3.2.5 LTE



Date: 24.MAR.2016 13:06:27

plot 6.3.2.5-#1 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; LTE Output



Date: 24.MAR.2016 13:06:51

plot 6.3.2.5-#2 Occupied Bandwidth: \$2.1049; Test results; 26dB Bandwidth; LTE Input



6.3.3 Uplink

n.a.

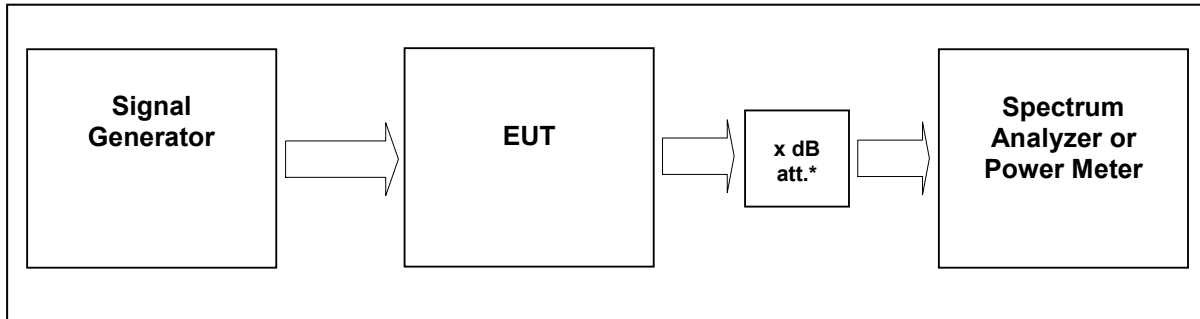
Note: The EUT does not transmit over the air in the uplink direction.

6.4 Summary test result

| | |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by: | M. Leinfelder |
| Date: | 24.03.2016 |



7 Spurious Emissions at Antenna Terminals: §22.917, §2.1051



External Attenuator DL x dB = 20 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §22.917, §2.1051

| | | |
|-------------------------|---|---|
| Measurement uncertainty | ± 0,54 dB ± 1,2 dB ± 1,5 dB | 9 kHz to 3 GHz 3 GHz to 7 GHz 7 GHz to 26 GHz |
| Test equipment used | 9291, 9233, 7444; 7321; 7144; 7454; 7453; 7336; 7449; 7368 | |

7.1 Limit

Minimum standard:

Para. No.22.917

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

7.2 Test method

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

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

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



7.3 Test results

7.3.1 Downlink

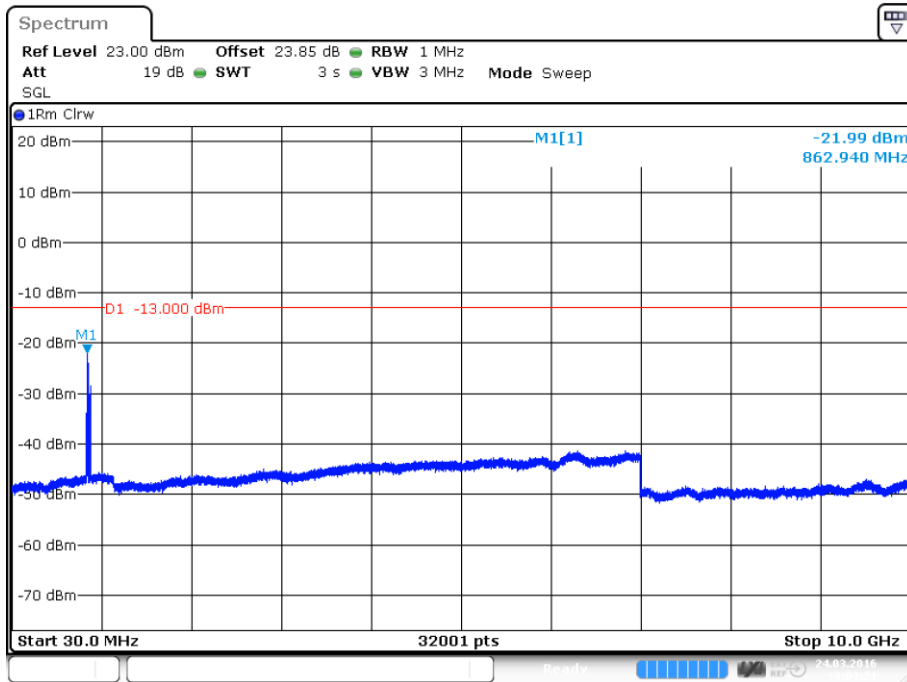
Detector: RMS.

| Modulation | Carrier | RBW VBW Span | Max. level (dBm) | Plot - |
|------------|-----------|-------------------------------|------------------|---------------|
| GSM | 881,5 MHz | 1MHz 3MHz 30MHz – 10GHz | -22.0 | 7.3.1.1 #1 |
| EDGE | 881,5 MHz | 1MHz 3MHz 30MHz – 10GHz | -22.0 | 7.3.1.2 #1 |
| CDMA | 881,5 MHz | 1MHz 3MHz 30MHz – 10GHz | -21.5 | 7.3.1.3 #1 |
| WCDMA | 881,5 MHz | 1MHz 3MHz 30MHz – 10GHz | -21.6 | 7.3.1.4 #1 |
| LTE | 881,5 MHz | 1MHz 3MHz 30MHz – 10GHz | -22.0 | 7.3.1.5 #1 |

table 7.3-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051 Test results



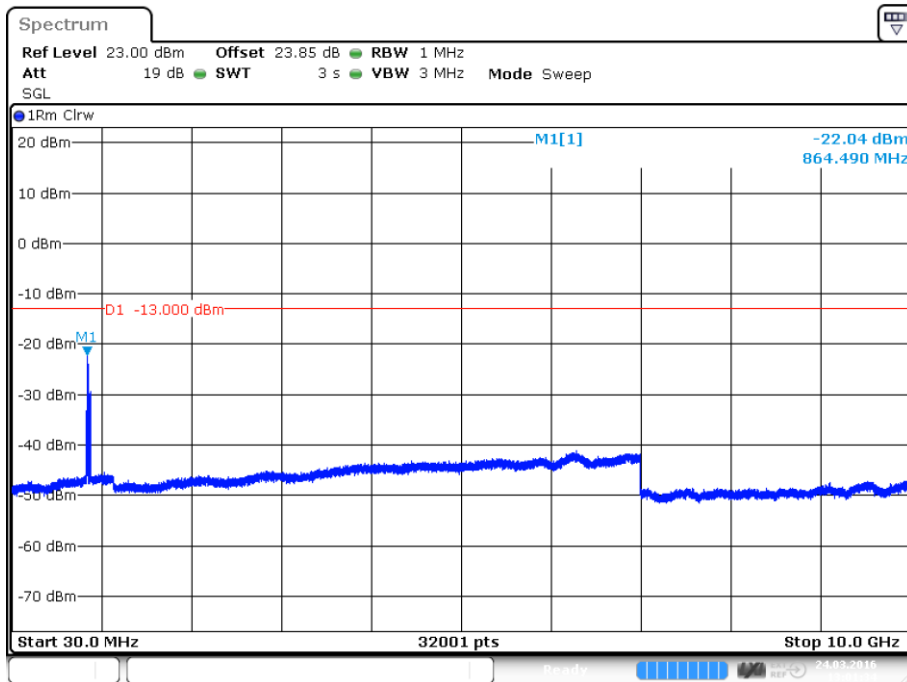
7.3.1.1 GSM



Date: 24.MAR.2016 13:04:21

plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; Test results; Downlink; GSM; carrier (881,5MHz) notched

7.3.1.2 EDGE

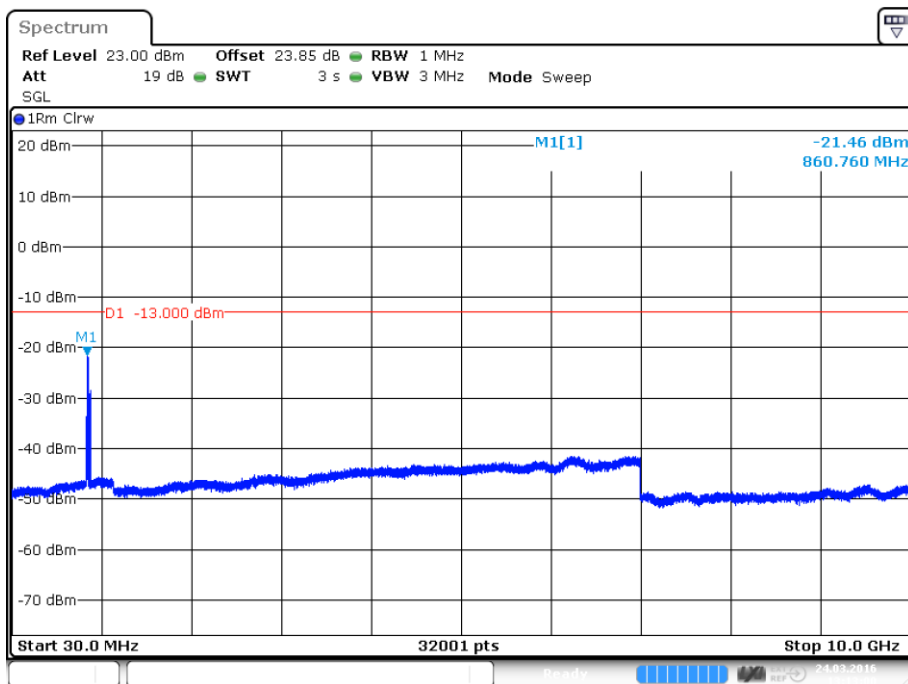


Date: 24.MAR.2016 13:01:35

plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; Test results; Downlink; EDGE; carrier (881,5MHz) notched



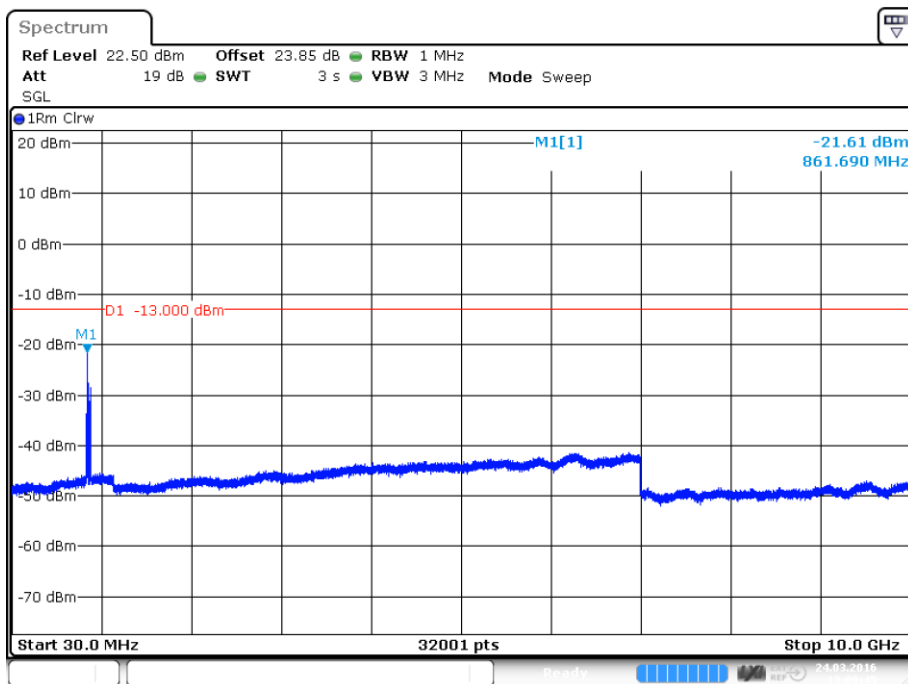
7.3.1.3 CDMA



Date: 24.MAR.2016 13:13:00

plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; Test results; Downlink; CDMA; carrier (881,5MHz) notched

7.3.1.4 WCDMA

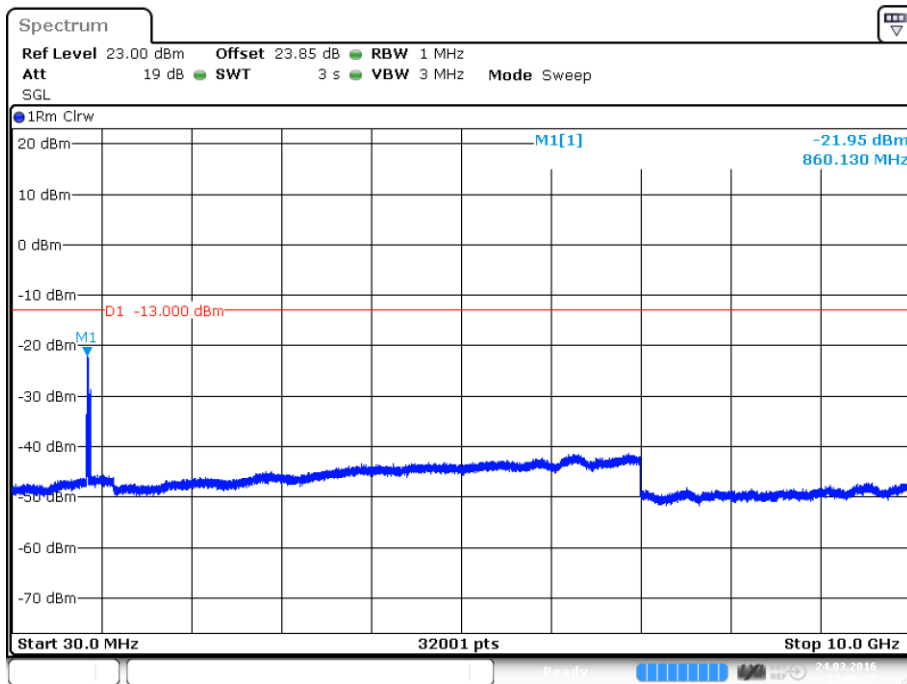


Date: 24.MAR.2016 13:09:46

plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; Test results; Downlink; WCDMA; carrier (881,5MHz) notched



7.3.1.5 LTE



Date: 24.MAR.2016 13:06:57

plot 7.3.1.5-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; Test results; Downlink; LTE; carrier (881,5MHz) notched

7.3.2 Uplink

n.a.

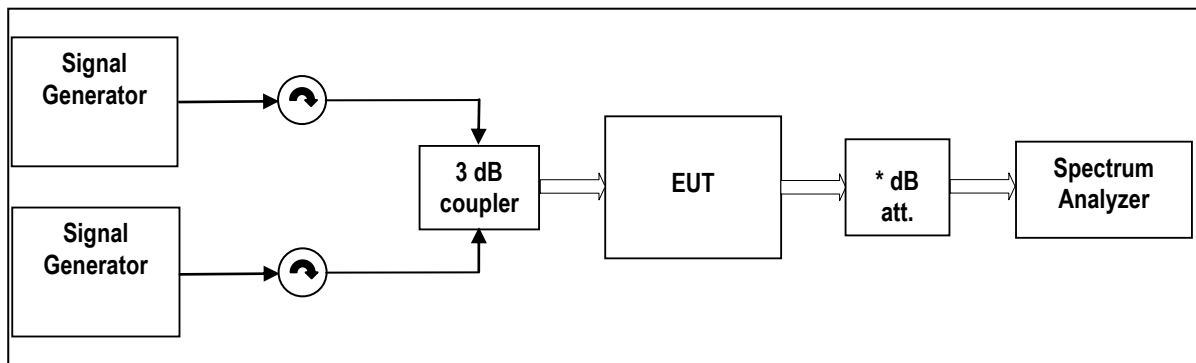
Note: The EUT does not transmit over the air in the uplink direction.

7.4 Summary test result

| | |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by: | M. Leinfelder |
| Date: | 24.03.2016 |



8 Intermodulation: §22.917, §2.1051



External Attenuator DL x dB = 20 dB
figure 8-#1 Test setup: Intermodulation: §22.917, §2.1051

| | | |
|-------------------------|---|---|
| Measurement uncertainty | ± 0,54 dB ± 1,2 dB ± 1,5 dB | 9 kHz to 3 GHz 3 GHz to 7 GHz 7 GHz to 26 GHz |
| Test equipment used | 9291, 8849; 9233, 7444; 7321; 7326; 7144; 7454; 7453; 7336; 7449; 7368 | |

8.1 Limit

Minimum standard:

Para. No.22.917

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

8.2 Test method

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

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

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



8.3 Test results

8.3.1 Downlink

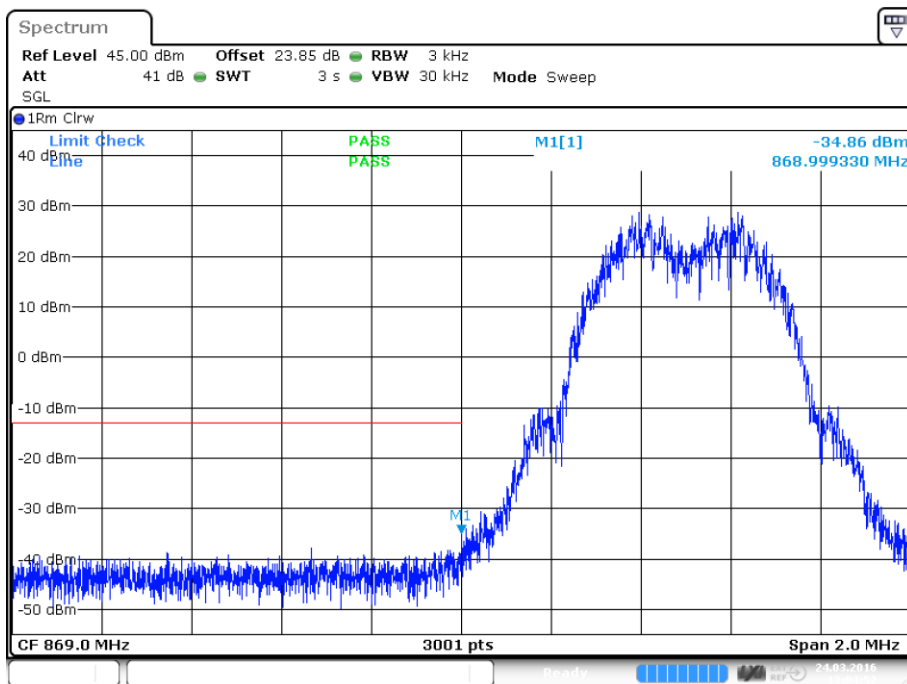
Detector: RMS.

| Modulation | Measured at Band Edge | Carriers | RBW VBW Span | Max. level (dBm) | Plot - |
|------------|-----------------------|----------------------------|-------------------------|------------------|---------------|
| GSM | Lower Edge | 869.4 MHz 869.6 MHz | 3kHz 30kHz 2MHz | -34.3 | 8.3.1.1 #1 |
| | Upper Edge | 893.4 MHz 893.6 MHz | | | #2 |
| EDGE | Lower Edge | 869.4 MHz 869.6 MHz | 3kHz 30kHz 2MHz | -36.3 | 8.3.1.2 #1 |
| | Upper Edge | 893.4 MHz 893.6 MHz | | | #2 |
| CDMA | Lower Edge | 869.775 MHz 871.025 MHz | 30kHz 300kHz 6MHz | -21.3 | 8.3.1.3 #1 |
| | Upper Edge | 891.975 MHz 893.225 MHz | | | #2 |
| WCDMA | Lower Edge | 871.6 MHz 876.6 MHz | 100kHz 1MHz 15MHz | -25.7 | 8.3.1.4 #1 |
| | Upper Edge | 886.4 MHz 891.4 MHz | | | #2 |
| LTE | Lower Edge | 869.7 MHz 871.1 MHz | 30kHz 300kHz 6MHz | -23.1 | 8.3.1.5 #1 |
| | Upper Edge | 891.9 MHz 893.3 MHz | | | #2 |

table 8.3-#1 Intermodulation: §22.917, §2.1051 Test results

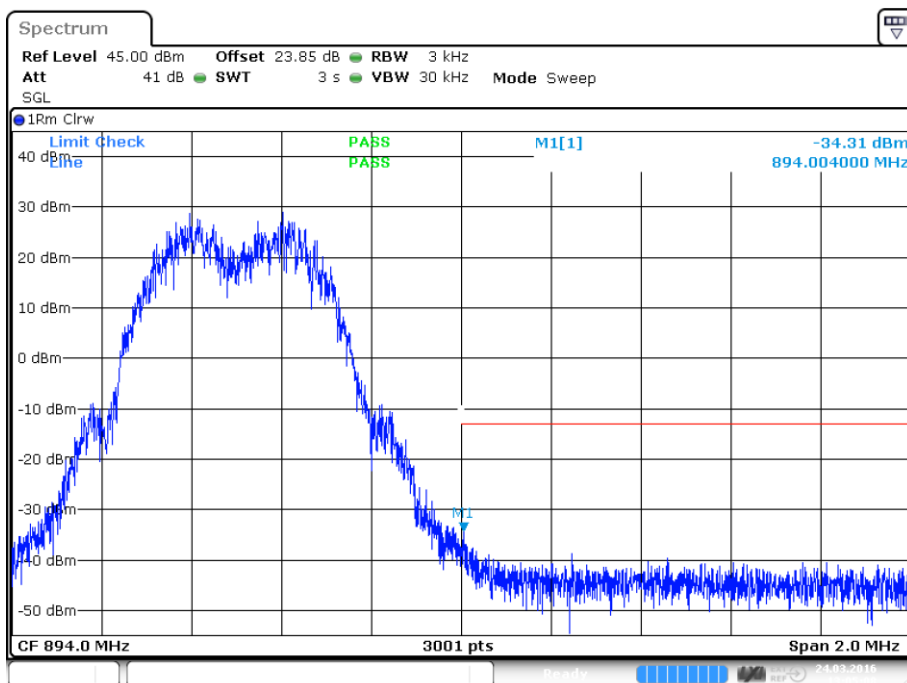


8.3.1.1 GSM



Date: 24.MAR.2016 13:04:52

plot 8.3.1.1-#1 Intermodulation: §22.917, §2.1051; Test results; Downlink; GSM Lower Band Edge

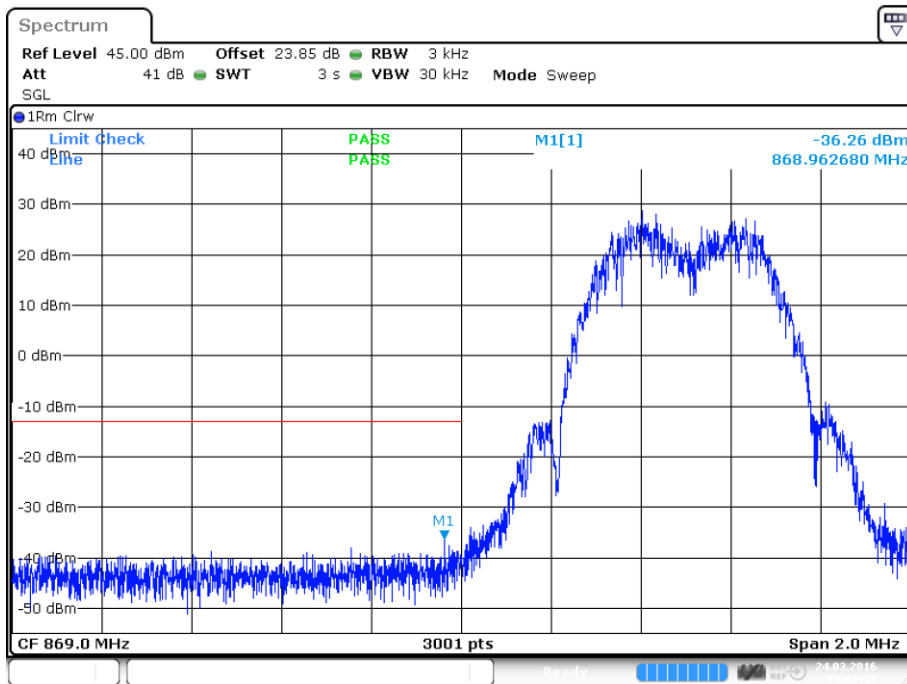


Date: 24.MAR.2016 13:05:08

plot 8.3.1.1-#2 Intermodulation: §22.917, §2.1051; Test results; Downlink; GSM Upper Band Edge

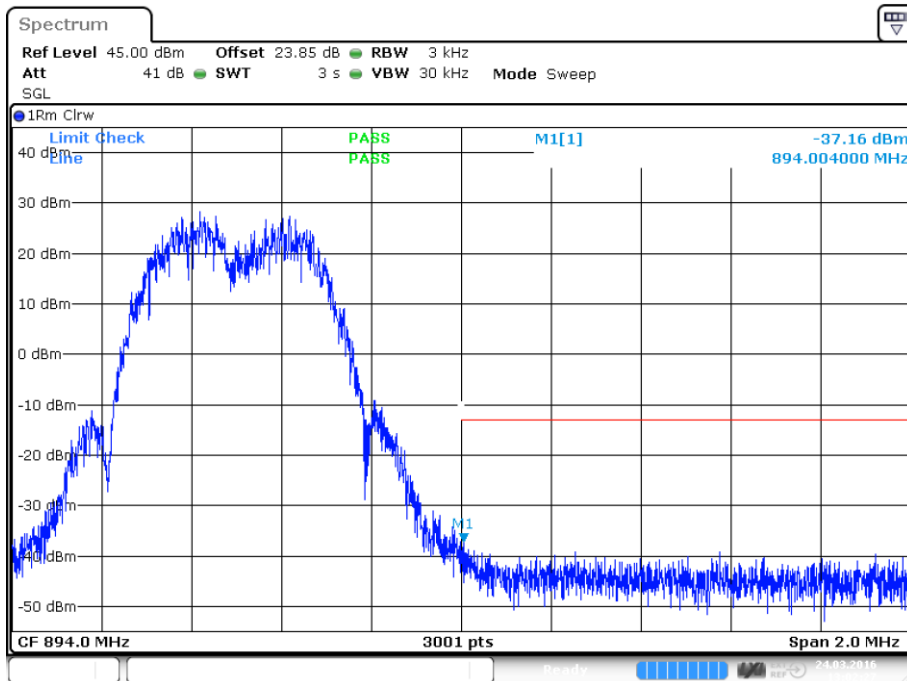


8.3.1.2 EDGE



Date: 24.MAR.2016 13:02:11

plot 8.3.1.2-#1 Intermodulation: §22.917, §2.1051; Test results; Downlink; EDGE Lower Band Edge

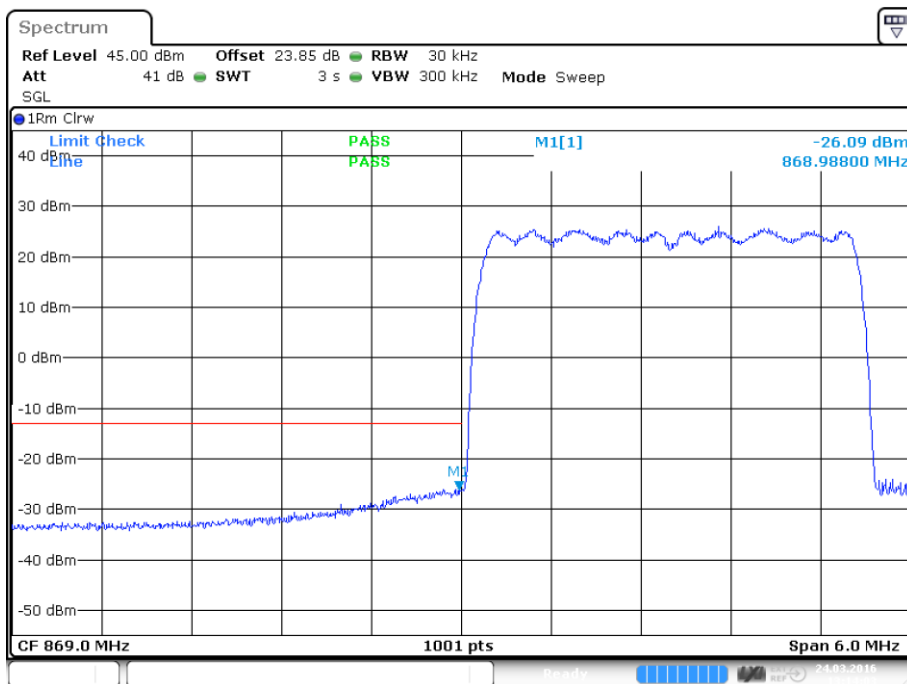


Date: 24.MAR.2016 13:02:27

plot 8.3.1.2-#2 Intermodulation: §22.917, §2.1051; Test results; Downlink; EDGE Upper Band Edge

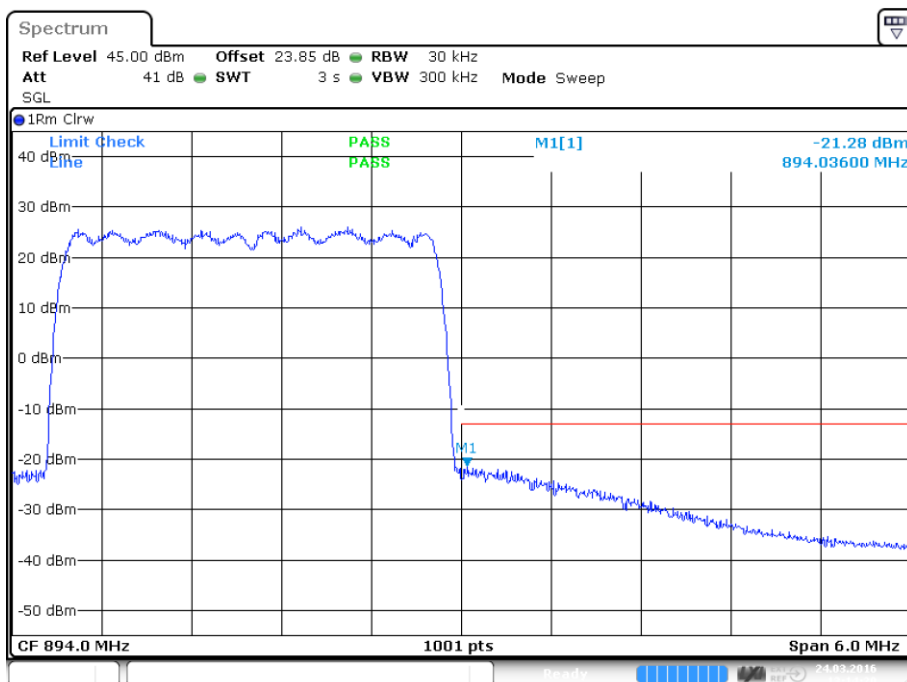


8.3.1.3 CDMA



Date: 24.MAR.2016 13:14:03

plot 8.3.1.3-#1 Intermodulation: §22.917, §2.1051; Test results; Downlink; CDMA Lower Band Edge

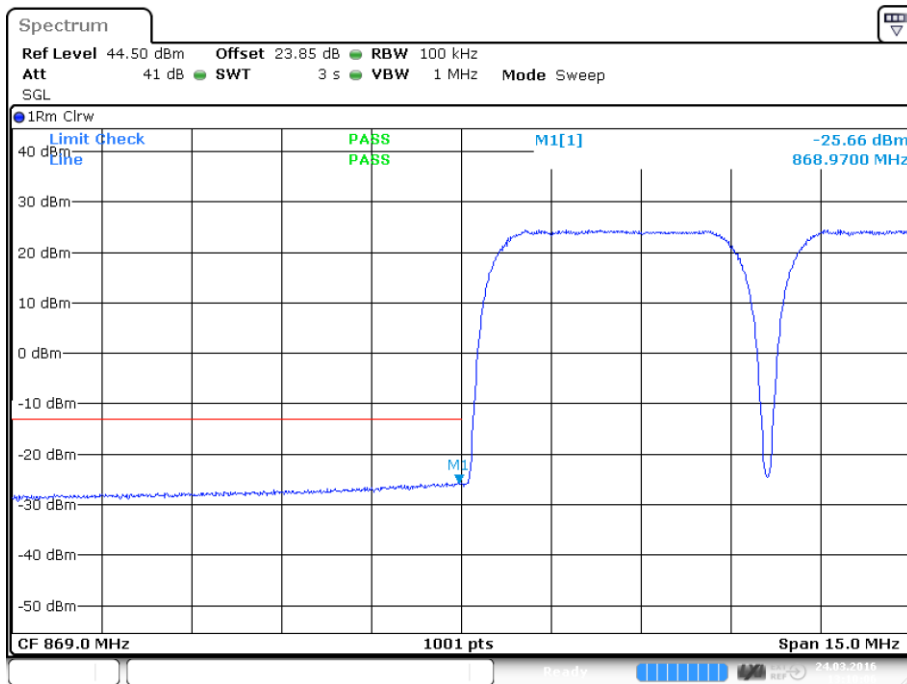


Date: 24.MAR.2016 13:14:20

plot 8.3.1.3-#2 Intermodulation: §22.917, §2.1051; Test results; Downlink; CDMA Upper Band Edge

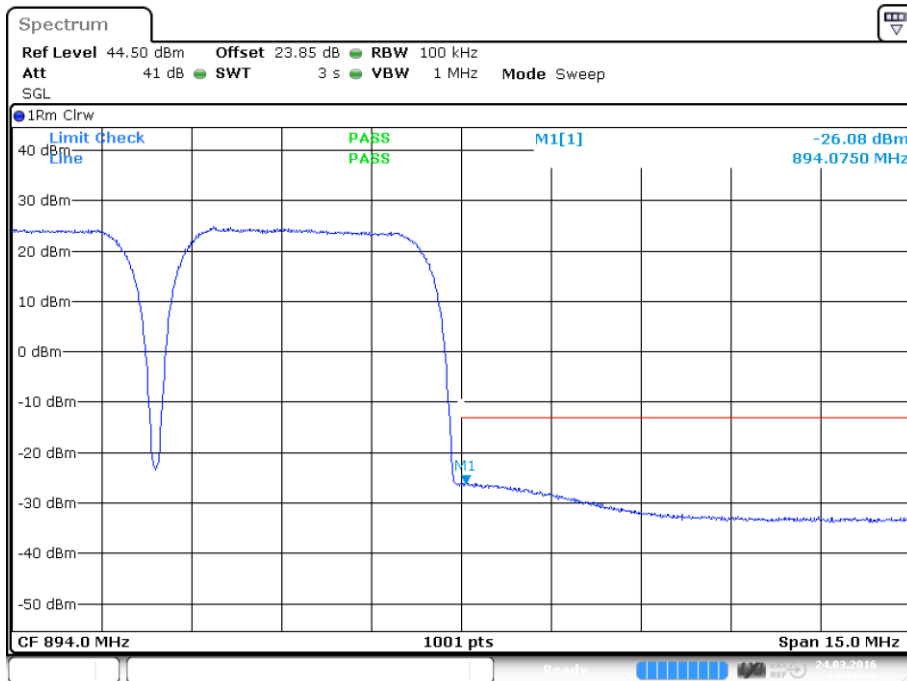


8.3.1.4 WCDMA



Date: 24.MAR.2016 13:10:06

plot 8.3.1.4-#1 Intermodulation: §22.917, §2.1051; Test results; Downlink; WCDMA Lower Band Edge

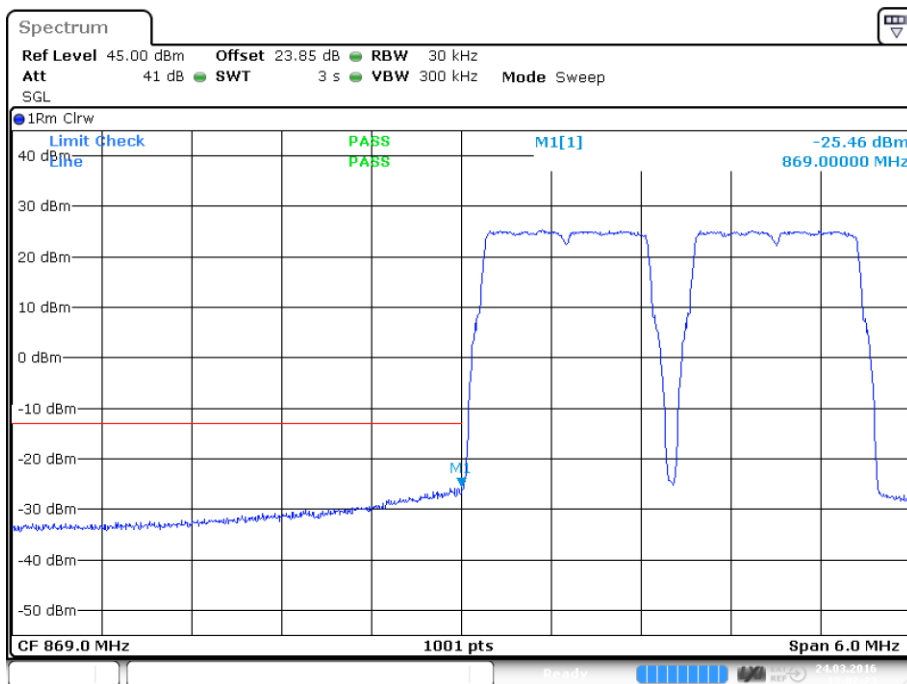


Date: 24.MAR.2016 13:10:23

plot 8.3.1.4-#2 Intermodulation: §22.917, §2.1051; Test results; Downlink; WCDMA Upper Band Edge

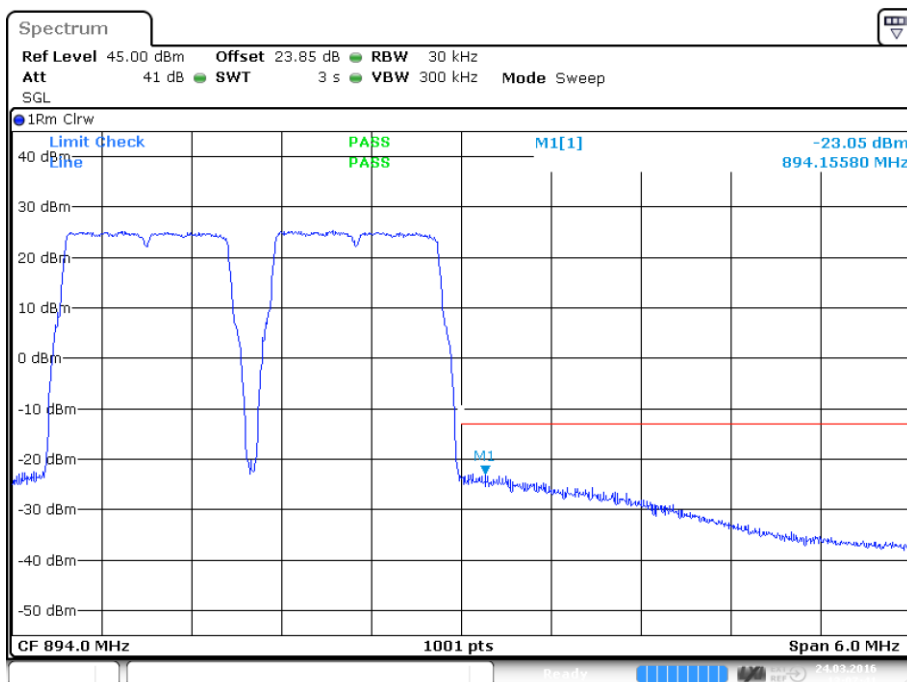


8.3.1.5 LTE



Date: 24.MAR.2016 13:07:24

plot 8.3.1.5-#1 Intermodulation: §22.917, §2.1051; Test results; Downlink; LTE Lower Band Edge



Date: 24.MAR.2016 13:07:40

plot 8.3.1.5-#2 Intermodulation: §22.917, §2.1051; Test results; Downlink; LTE Upper Band Edge

Test Report No.: 16-092

FCC ID: XS5-M78517E19P



**BUREAU
VERITAS**

8.3.2 Uplink

n.a.

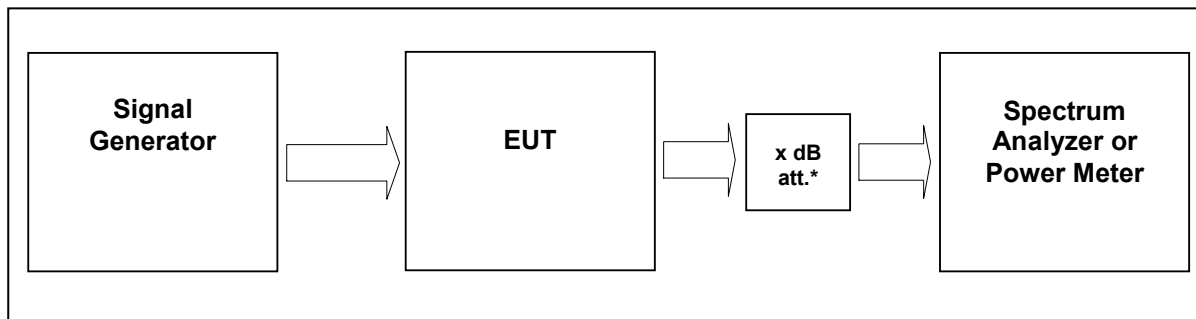
Note: The EUT does not transmit over the air in the uplink direction.

8.4 Summary test result

| | |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by: | M. Leinfelder |
| Date: | 24.03.2016 |



9 Out of Band Rejection



External Attenuator DL x dB = 20 dB
figure 9-#1 Test setup: Out of Band Rejection

| | |
|-------------------------|---|
| Measurement uncertainty | ± 0,38 dB |
| Test equipment used | 9291, 9233, 7444; 7321; 7144; 7454; 7453; 7336; 7449; 7368 |

9.1 Limit

KDB 935210 D02 v03r02

Test for rejection of out of band signals. Filter frequency response plots are acceptable.

9.2 Test method

935210 D03 v04

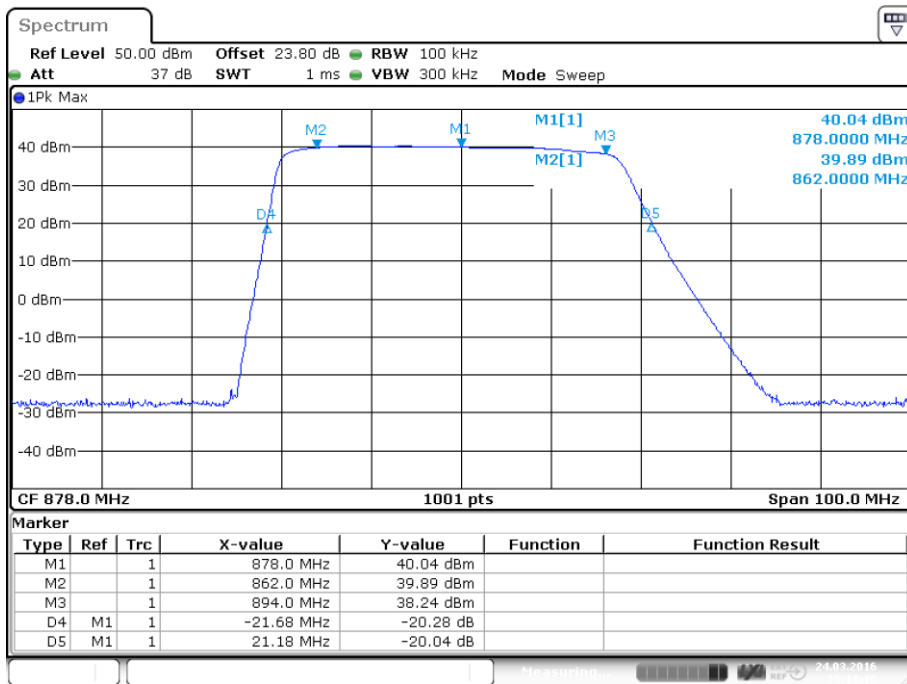
7.1 Authorized frequency band verification test

9.3 Test results

Detector Peak max hold



9.3.1 Downlink



Date: 24.MAR.2016 15:14:19

plot 9.3.1-#1 Out of Band Rejection; Test results; Downlink;

9.3.2 Uplink

n.a.

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

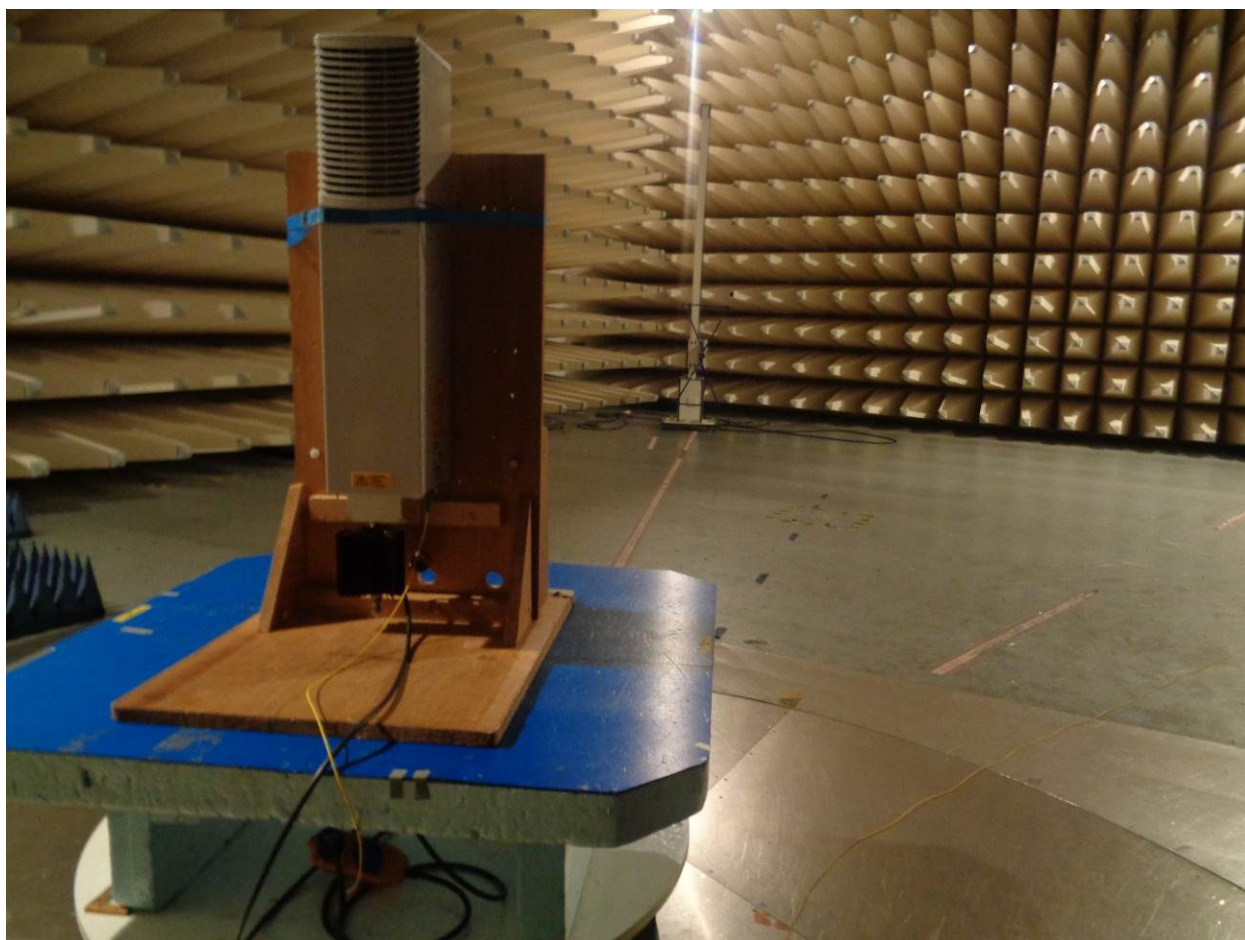
9.4 Summary test result

| | |
|-------------|-------------------------------------|
| Test result | complies, according the plots above |
| Tested by: | M. Leinfelder |
| Date: | 24.03.2016 |

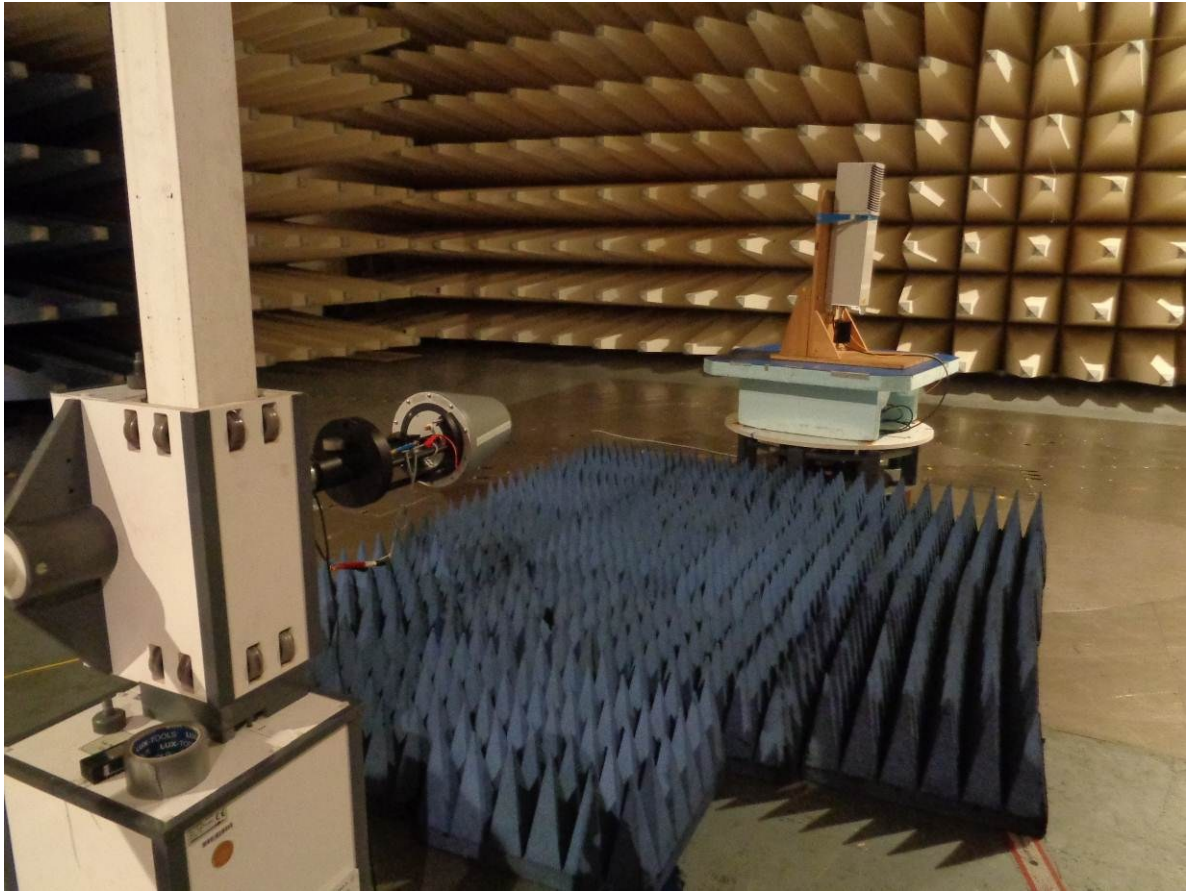
10 Field Strength of Spurious Emissions: §22.917, §2.1051



picture 8.1: label (EUT)



picture 8.3: Test setup: Field Strength Emission 30 M – 1 GHz @10m in the SAC



picture 8.4: Test setup: Field Strength Emission 1 – 18 GHz @3m in the SAC



This clause specifies requirements for the measurement of radiated emission.

| Frequency range | Distance: EUT <-> antenna / location | Limit | Test method |
|-----------------|--|-------------------------|--------------------|
| 30 MHz – 1 GHz | 10 metres / SAC | FCC 47 CFR Part §22.917 | TIA/EIA-603-C:2004 |
| 1 GHz – 18 GHz | 3 metres / SAC | IC RSS-131 sec. 4.4 | |

Test equipment used:

| Designation | Type | Manufacturer | Invent.-no. | Cal.-date | due Cal.- date | used |
|-------------------|-----------------------|-----------------|-------------|------------|-------------------|------|
| EMI test receiver | ESU40 | Rohde & Schwarz | E2025 | 25.02.2016 | 25.02.2017 | X |
| Antenna | CBL 6111 | Chase | K1026 | 12.02.2016 | 12.02.2017 | X |
| RF Cable | RG214 | Frankonia | K1121 | 16.04.2015 | 16.04.2017 | X |
| Antenna | HL 025 | R&S | K1114 | 09.02.2016 | 09.02.2017 | X |
| Preamplifier | AFS4-00102000 | Miteq | K838 | 17.06.2015 | 17.06.2016 | X |
| RF Cable | Sucoflex 100 | Suhner | K1760 | 04.08.2015 | 04.08.2016 | X |
| Antenna | JXTXLB-42-25- C-KF | A-Info | K1175 | 09.03.2015 | 09.03.2017 | X |

The REMI version 2.135 has been used to maximize radiated emission from the EUT with regards to ANSI C63.4:2009.

Test set-up:

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

Test Voltage: 110V / 60 Hz
 Type of EUT: Wall mounted

Measurement uncertainty:

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



10.1 Limit §22.917

Minimum standard:

Para. No.22.917

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The limit is -13dBm (e.i.r.p).

10.2 Test method ANSI/TIA/EA-603-C

Measurement procedure. TIA-603-C

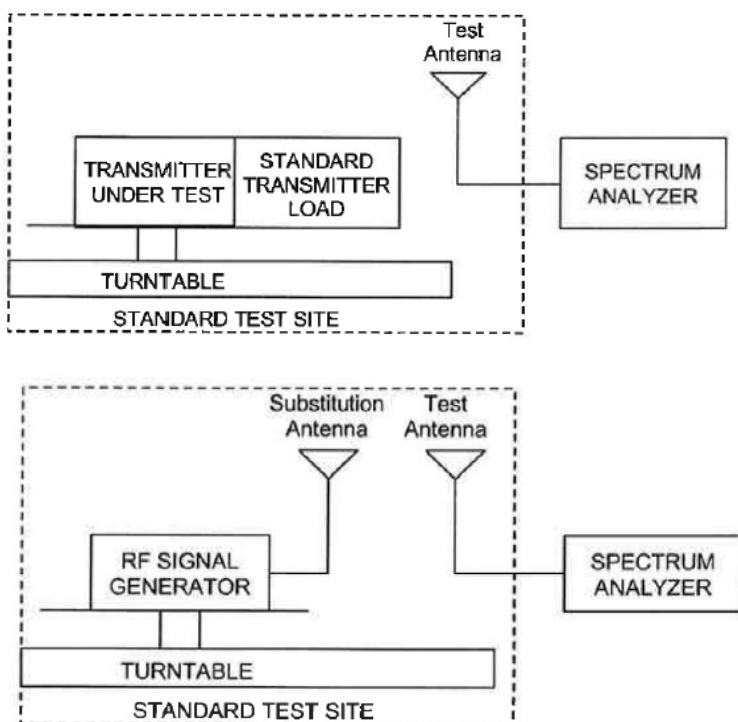
The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with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

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

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

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

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



picture 8.3: Substitution method

10.3 Climatic values in the lab

Temperature: 20°
 Relative Humidity: 45%
 Air-pressure: 1009hPa



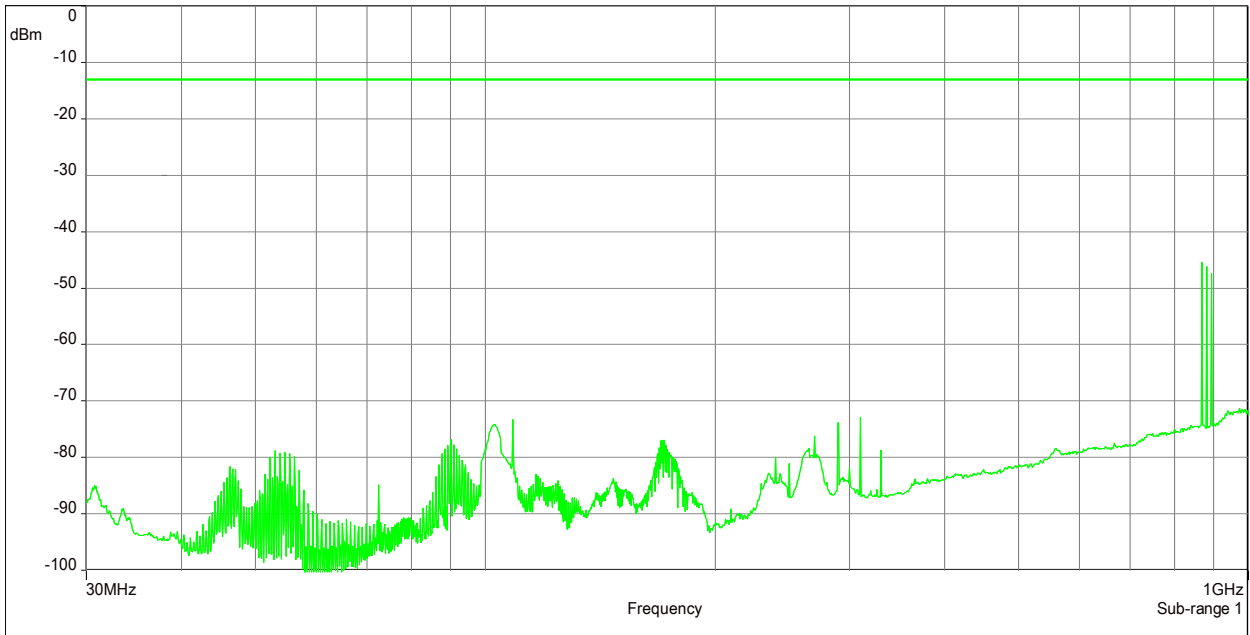
10.4 Test results

10.4.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top) Subpart H

B/M/T: 869MHz/881.5MHz/894MHz

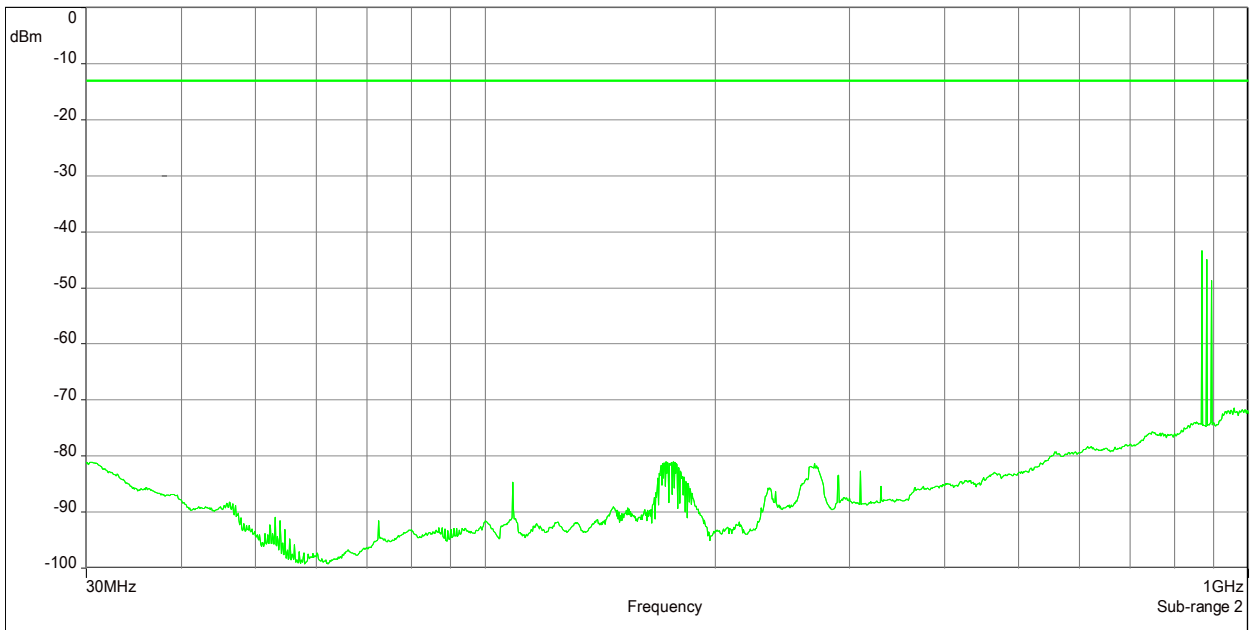
Vertikal

— FCC/-13 dBm - Average/10.0m/
— Meas.Avg (Vertical)



Horizontal

— FCC/-13 dBm - Average/10.0m/
— Meas.Avg (Horizontal)



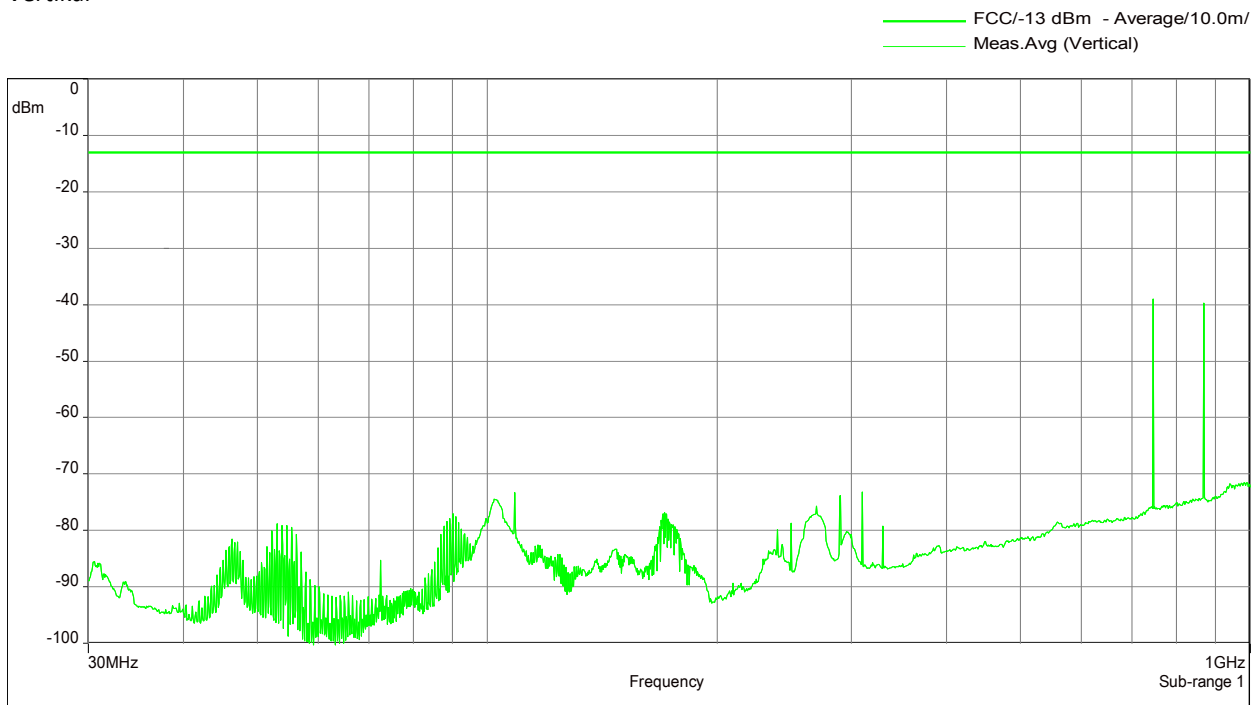
The RF output power is terminated.



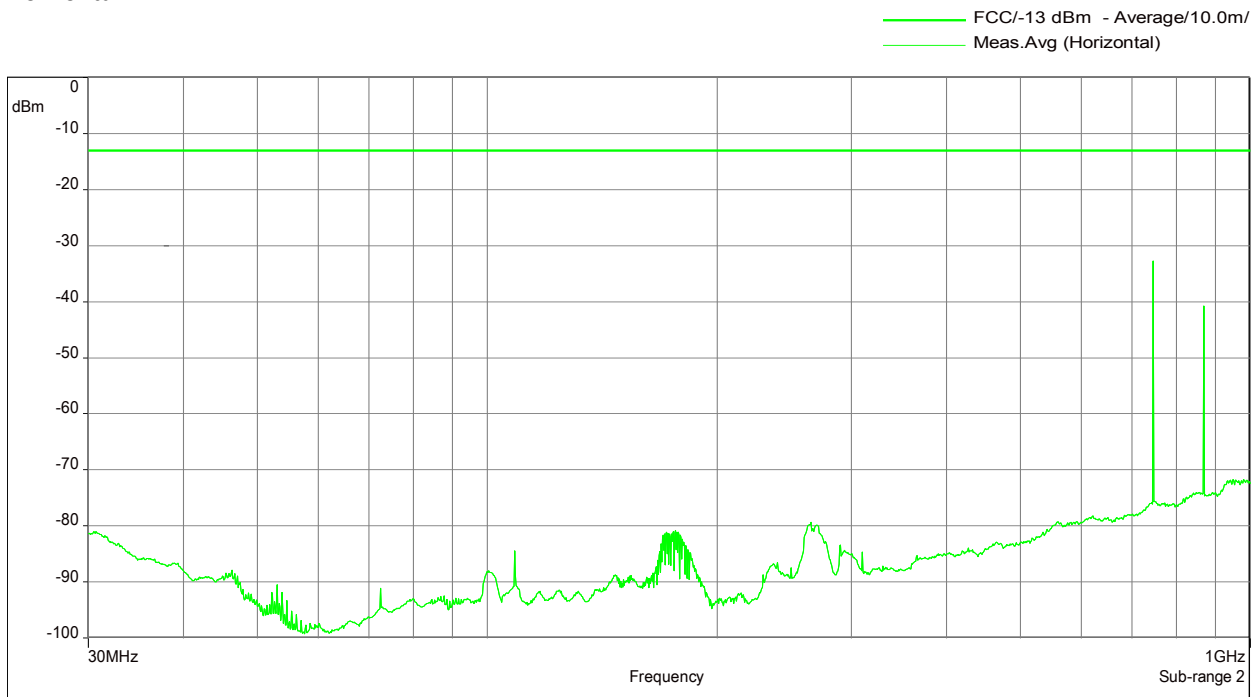
10.4.2 30 MHz to 1 GHz Downlink (Middle of all paths)

F1: 746 MHz; F2: 869 MHz; F3: 1962.5 MHz; F4: 2145 MHz

Vertikal



Horizontal



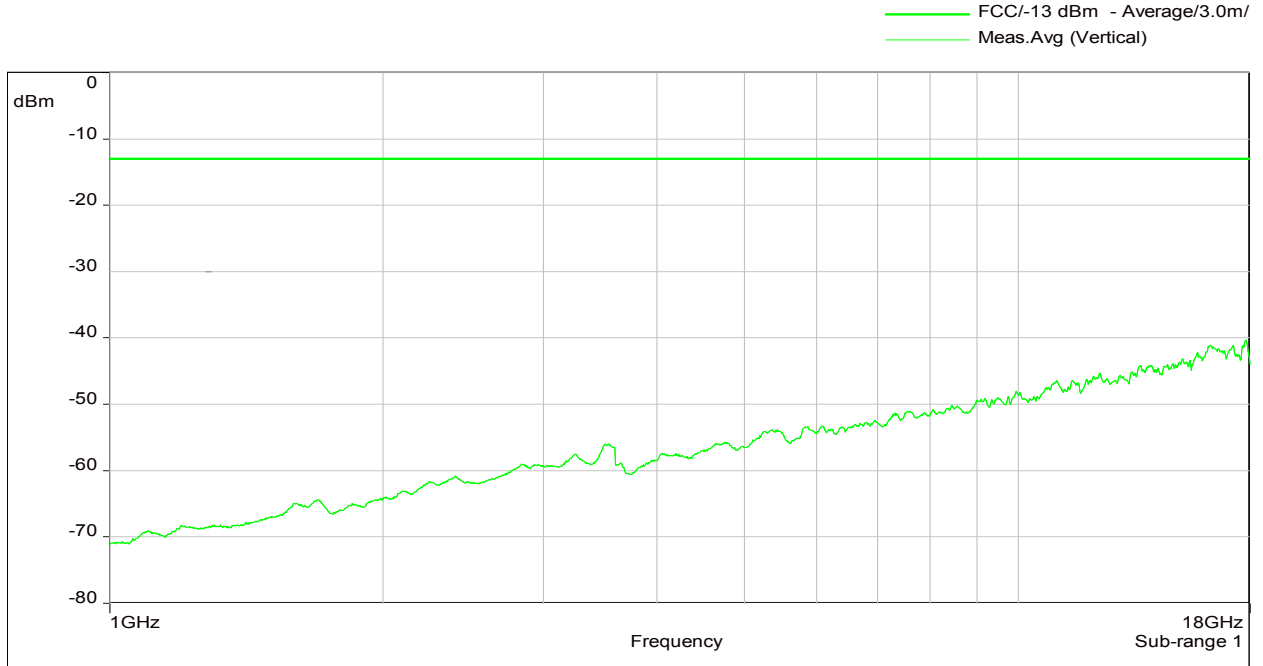
The RF output power is terminated.



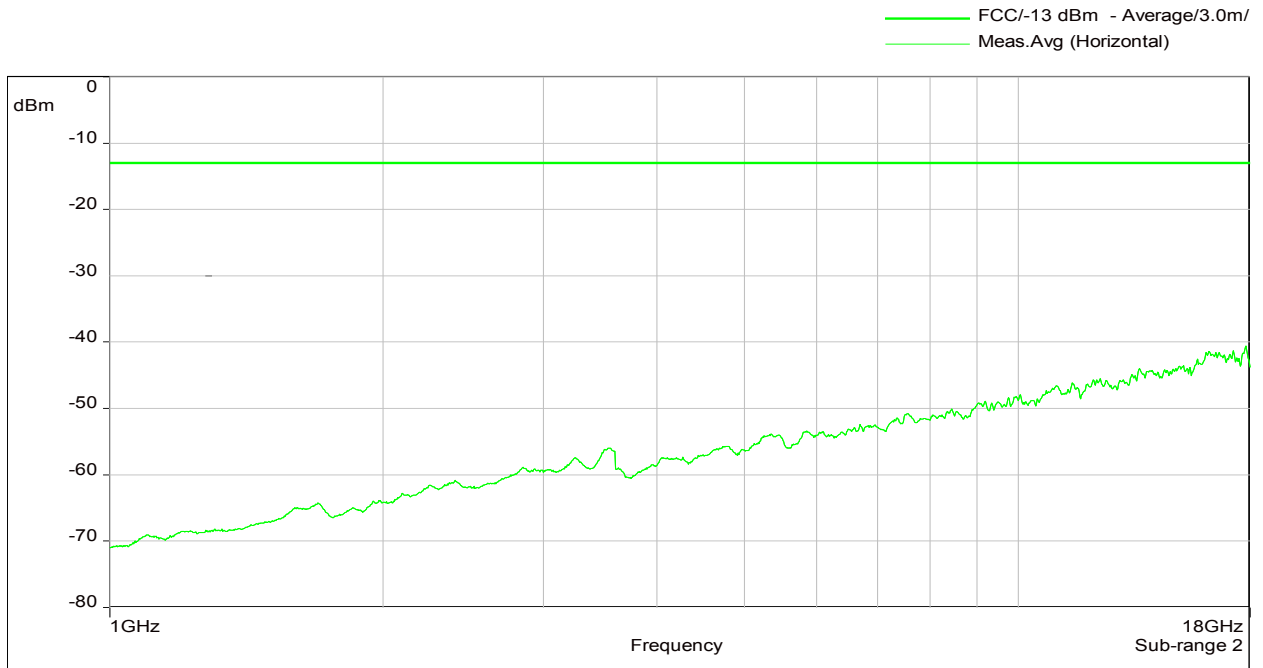
10.4.3 1 GHz to 18 GHz Downlink (Bottom – Middle – Top) Subpart H

B/M/T: 869MHz/881.5MHz/894MHz

Vertikal



Horizontal



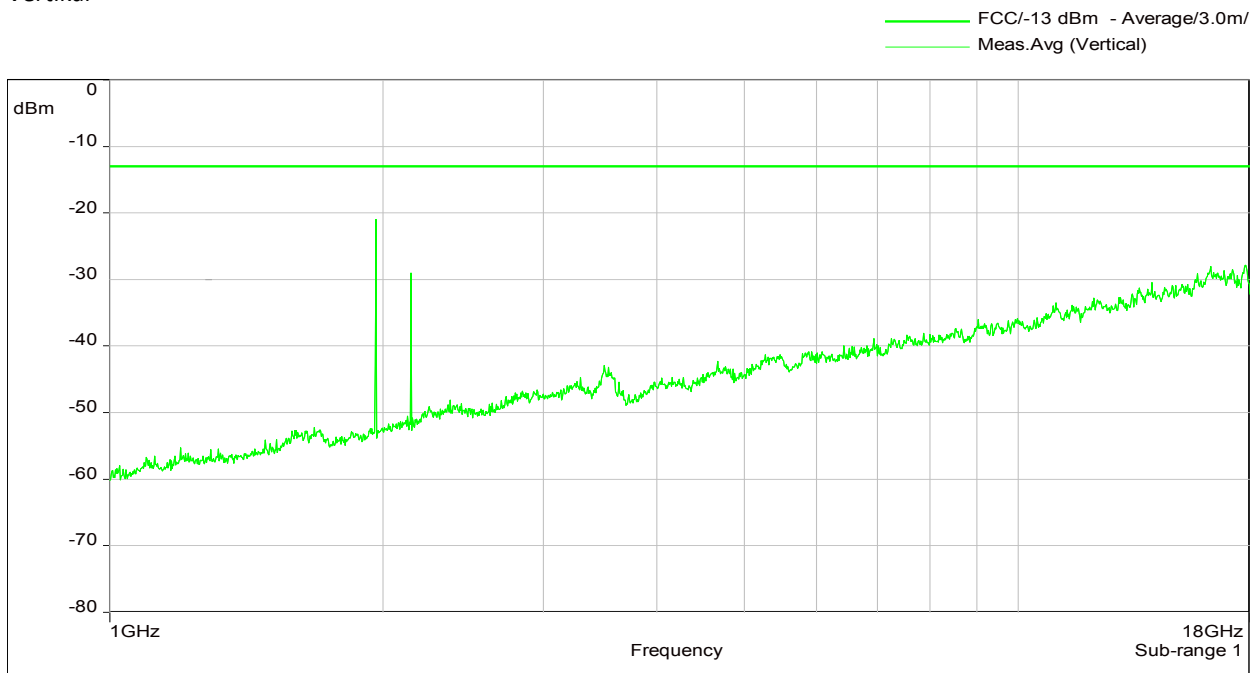
The RF output power is terminated.



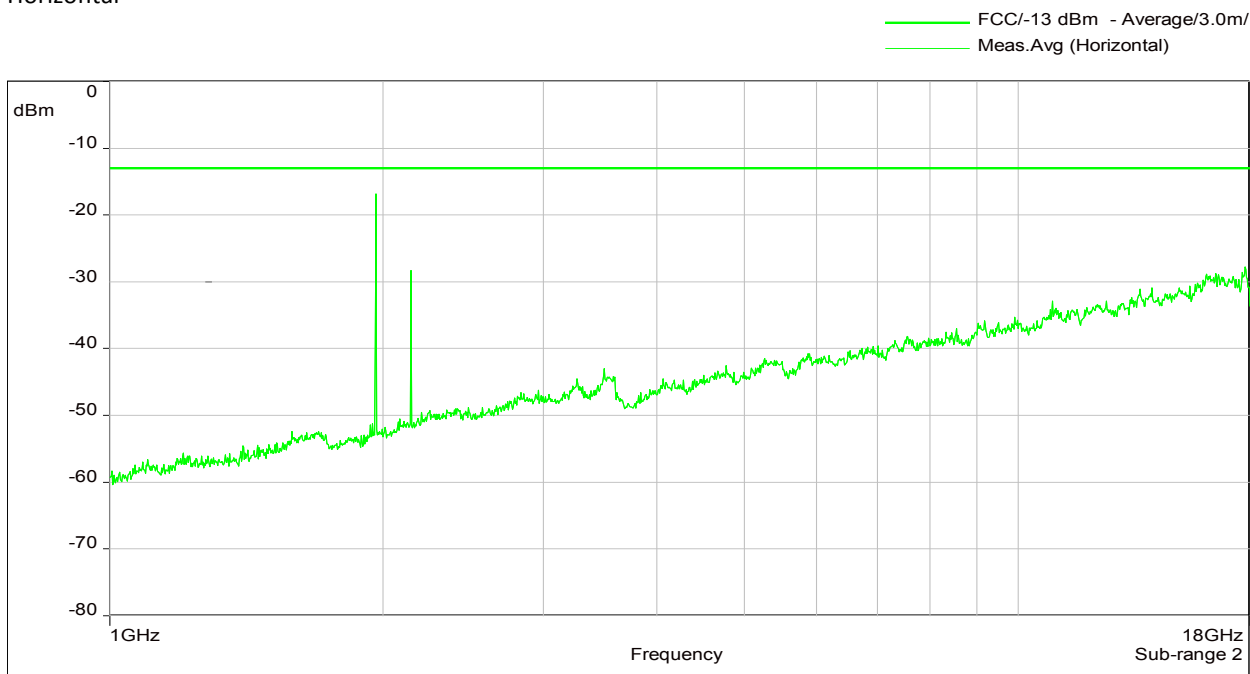
10.4.4 1 GHz to 18 GHz Downlink (Middle of all paths)

F1: 746 MHz; F2: 869 MHz; F3: 1962.5 MHz; F4: 2145 MHz

Vertikal



Horizontal



The RF output power is terminated.

Za / 26.04.2016

The radiated spurious emission measurements have been passed!

Test Report No.: 16-092

FCC ID: XS5-M78517E19P



**BUREAU
VERITAS**

11 History

| Revision | Modification | Date | Name |
|----------|---------------------|------------|--------------|
| 01.00 | Initial Test report | 29.04.2016 | Tom Zahlmann |

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