# TEST REPORT

**Test report no.: 1-2977-82-02/11**

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

## Testing laboratory

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**Accredited test laboratory:**
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025
DAkkS registration number: D-PL-12076-01-01

Area of Testing: Radio/Satellite Communications

## Applicant

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## Manufacturer

**Sony Ericsson Mobile Communications AB**
Nya Vattentornet
22188 Lund / SWEDEN

## Test standard/s

| | |
|---|---|
| 47 CFR Part 22 | Title 47 of the Code of Federal Regulations; Chapter I<br>Part 22 - Public mobile services |
| 47 CFR Part 24 | Title 47 of the Code of Federal Regulations; Chapter I<br>Part 24 - Personal communications services |
| RSS - 132 Issue 2 | Spectrum Management and Telecommunications Policy - Radio Standards Specifications<br>Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz |

For further applied test standards please refer to section 3 of this test report.

## Test item

| | |
|---|---|
| **Kind of test item:** | **Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSDPA/HSUPA FDDI/FDDII/FDDV; BT+EDR; WLAN; A-GPS; FM-Rx; ANT+** |
| **Model name:** | **AAD-3880124-BV** |
| **FCC ID:** | **PY7A3880124** |
| **IC:** | **4170B-A3880124** |
| **Frequency:** | **GSM: 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz<br>UMTS: 826.4 – 848.6 MHz, 1852.4 – 1907.6 MHz** |
| **Power supply:** | **3.7 V DC by Lithium Ion battery or power supply** |
| **Temperature range:** | **-30 °C to +60 °C** |

**Test performed:**

2011-08-25 Stefan Bös

**Test report authorised:**

2011-08-25 Marco Bertolino

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# 2 General information

## 2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2011-08-09 |
| Date of receipt of test item: | 2011-08-01 |
| Start of test: | 2011-08-01 |
| End of test: | 2011-08-24 |
| Person(s) present during the test: | -/- |

# 3 Test standard/s

| Test standard | Date | Test standard description |
|---|---|---|
| 47 CFR Part 22 | 2009-10 | Title 47 of the Code of Federal Regulations; Chapter I<br>Part 22 - Public mobile services |
| 47 CFR Part 24 | 2009-10 | Title 47 of the Code of Federal Regulations; Chapter I<br>Part 24 - Personal communications services |
| RSS - 132 Issue 2 | 2005-09 | Spectrum Management and Telecommunications Policy - Radio Standards Specifications<br>Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz |
| RSS - 133 Issue 5 | 2009-02 | Spectrum Management and Telecommunications Policy - Radio Standards Specifications<br>2 GHz Personal Communication Services |

# 4 Test environment

| | | | |
|---|---|---|---|
| Temperature: | $T_{nom}$ | +20 °C | during room temperature tests |
| | $T_{max}$ | +60 °C | during high temperature tests |
| | $T_{min}$ | -30 °C | during low temperature tests |
| Relative humidity: | | 53 % | |
| Air pressure: | | not relevant for this kind of testing | |
| Power supply: | $V_{nom}$ | 3.7 V | DC by Lithium Ion battery or power supply |
| | $V_{max}$ | 4.1 V | |
| | $V_{min}$ | 3.3 V | |

## 5 Test item

| | | |
|---|---|---|
| Kind of test item | : | Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSDPA/HSUPA FDDI/FDDII/FDDV; BT+EDR; WLAN; A-GPS; FM-Rx; ANT+ |
| Type identification | : | AAD-3880124-BV |
| | | |
| S/N serial number | : | Rad. BX902GHYNZ, BX902GQPFZ<br>Cond. BX902GHYK5, BX902GHYMW |
| HW hardware status | : | AP2 |
| SW software status | : | 4.0.1.A.0.99 |
| Frequency band [MHz] | : | GSM: 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz<br>UMTS: 826.4 – 848.6 MHz, 1852.4 – 1907.6 MHz |
| Type of modulation | : | GMSK; 8-PSK; QPSK; 16QAM |
| Antenna | : | Integrated antenna |
| Power supply | : | 3.7 V DC by Lithium Ion battery or power supply |
| Temperature range | : | -30℃ to +60 ℃ |

## 6 Test laboratories sub-contracted

None

# 7 Summary of measurement results

| | |
|---|---|
| ☒ | No deviations from the technical specifications were ascertained |
| ☐ | There were deviations from the technical specifications ascertained |

| TC identifier | Description | verdict | date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Part 22, 24<br>RSS 132, 133 | passed | 2011-08-25 | -/- |

## 7.1 GSM 850

| Test Case | temperature conditions | power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| RF Output Power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Frequency Stability | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Block Edge Compliance | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Occupied Bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |

**Note:**
NA = Not applicable; NP = Not performed

## 7.2 PCS 1900

| Test Case | temperature conditions | power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| RF Output Power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Frequency Stability | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Block Edge Compliance | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Occupied Bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |

**Note:**
NA = Not applicable; NP = Not performed

## 7.3 UMTS band II

| Test Case | temperature conditions | power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| RF Output Power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Frequency Stability | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Block Edge Compliance | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Occupied Bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |

**Note:**
NA = Not applicable; NP = Not performed

## 7.4 UMTS band V

| Test Case | temperature conditions | power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| RF Output Power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Frequency Stability | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Spurious Emissions Conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Block Edge Compliance | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |
| Occupied Bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |

**Note:**
NA = Not applicable; NP = Not performed

## 7.5 Receiver

| Test Case | temperature conditions | power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|
| Spurious Emissions Radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | |

**Note:**
NA = Not applicable; NP = Not performed

# 8 RF measurements

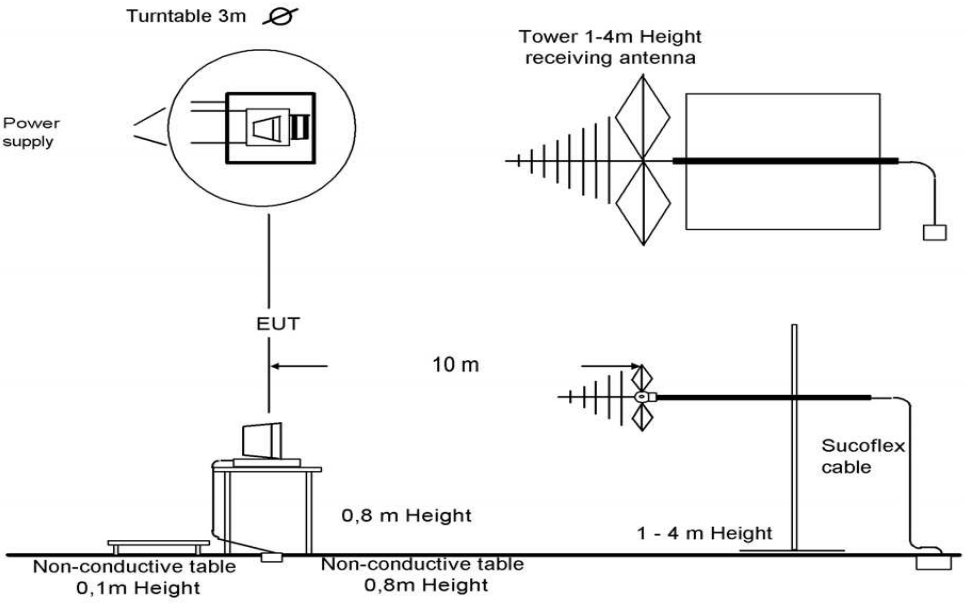
## 8.1 Description of test setup

For the spurious measurements we use the substitution method according TIA/EIA 603.

### 8.1.1 Radiated measurements

The radiated emissions from the EUT are performed in a semi anechoic chamber. The EUT is placed on a conductive turntable and powered with nominal voltage. The signalling is performed either from outside the chamber with a signalling unit (AP or other) by air link using a signalling antenna or directly by special test software from the customer.

Semi anechoic chamber

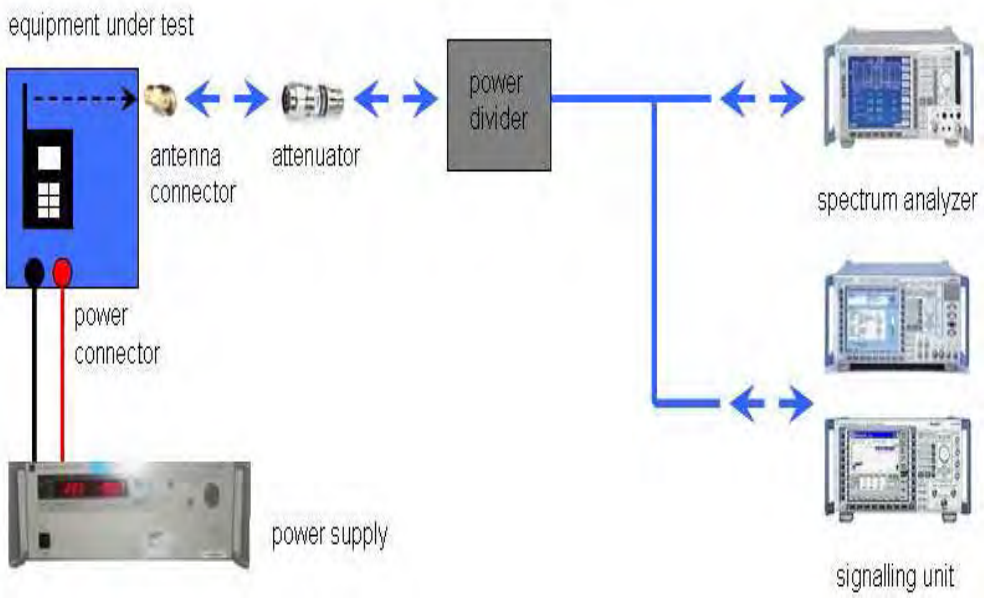



**Picture 1: Diagram radiated measurements**

| | |
|---|---|
| 9 kHz - 30 MHz: | active loop antenna |
| 30 MHz – 1 GHz: | tri-log antenna |
| > 1 GHz: | horn antenna |

### 8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the signalling unit (AP or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm. If special software is used, there is no power divider necessary.




**Picture 2: Diagram conducted measurements**

The term measuring receiver refers to either a selective voltmeter or a spectrum analyser.

| Frequency being measured f | Measuring receiver bandwidth 6 dB | Spectrum analyser bandwidth 3dB |
|---|---|---|
| f < 150 kHz | 200 Hz or | 300 Hz |
| 150 kHz ≤ f < 25 MHz | 9 kHz or | 10 kHz |
| 25 MHz ≤ f < 1000 MHz | 120 kHz or | 100 kHz |
| 1000 MHz ≤ f | | 1 MHz |
| NOTE: Specific requirements in CEPT/ERC/Recommendation 70-03 [2] shall be applied where applicable. | | |

## 8.2 RSP100 test report cover sheet / performance test data

| | | | | | |
|---|---|---|---|---|---|
| Test Report Number : | 1-2977-82-02/11 | | | | |
| Equipment Model Number : | AAD-3880124-BV | | | | |
| Certification Number : | 4170B-A3880124 | | | | |
| Manufacturer (complete Address) : | Sony Ericsson Mobile Communications AB<br>Nya Vattentornet<br>22188 Lund / SWEDEN | | | | |
| Tested to radio standards specification no. : | RSS - 132 Issue 2, RSS - 133 Issue 5 | | | | |
| Open Area Test Site IC No. : | IC 3462C-1 | | | | |
| Frequency Range : | GSM: 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz<br>UMTS: 826.4 – 848.6 MHz, 1852.4 – 1907.6 MHz | | | | |
| GPS receiver turned : | On | | | | |
| RF-power [W] (max.) : | Band | Conducted | ERP / EIRP | Mode | |
| | GSM850 | 32.0 dBm | 30.4 dBm | GMSK | |
| | | 25.3 dBm | 23.9 dBm | 8-PSK | |
| | GSM1900 | 29.8 dBm | 29.2 dBm | GMSK | |
| | | 24.8 dBm | 24.2 dBm | 8-PSK | |
| | WDCMA 850 | 23.6 dBm | 22.1 dBm | QPSK | |
| | WDCMA 1900 | 22.1 dBm | 21.6 dBm | QPSK | |
| Occupied bandwidth (99%-BW) [kHz] : | GSM850 | 289 | | GMSK | |
| | | 287 | | 8-PSK | |
| | GSM1900 | 283 | | GMSK | |
| | | 271 | | 8-PSK | |
| | WDCMA 850 | 4557 | | QPSK | |
| | WDCMA 1900 | 4569 | | QPSK | |
| Type of modulation : | GMSK; 8-PSK; QPSK; 16QAM | | | | |
| Emission Designator (TRC-43) : | GSM850 | 289KGXW | | GMSK | |
| | | 287KG7W | | 8-PSK | |
| | GSM1900 | 283KGXW | | GMSK | |
| | | 271KG7W | | 8-PSK | |
| | WDCMA 850 | 4M56F9W | | QPSK | |
| | WDCMA 1900 | 4M57F9W | | QPSK | |
| Antenna Information : | integrated antenna | | | | |
| Transmitter Spurious (worst case) [dBm] : | -26.6 dBm @ 1648 MHz | | | | |
| Receiver Spurious (worst case) [µV/m @ 3m]: | 112 µV/m (noise floor) | | | | |

**ATTESTATION:**
**DECLARATION OF COMPLIANCE:**

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

**Laboratory Manager:**

| 2011-08-25 | Stefan Bös | |
|---|---|---|
| Date | Name | Signature |

## 8.3 Results GSM 850

All GSM-band measurements are done in GSM mode only (circuit switched).
All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

### 8.3.1 RF output power

**Description:**

This paragraph contains average power, peak output power and ERP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

**Measurement:**

The mobile was set up for the maximum output power with pseudo random data modulation.

| Measurement parameters | |
|---|---|
| Detector: | Peak and RMS (Power in Burst) |
| Sweep time: | Auto |
| Video bandwidth: | 1 MHz |
| Resolution bandwidth: | 1 MHz |
| Span: | Zero Span |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.913<br>CFR Part 2.1046 | RSS 132, Issue 2, Section 4.4 and 6.4 |
| Nominal Peak Output Power | |
| +38.45 dBm<br>In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB. | |

**Results:**

| Output Power (conducted) GMSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 824.2 | 32.0 | 1.0 |
| 836.4 | 31.9 | 0.9 |
| 848.8 | 31.8 | 0.8 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (conducted) 8-PSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 824.2 | 25.0 | 3.3 |
| 836.4 | 25.1 | 3.4 |
| 848.8 | 25.3 | 3.2 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (radiated) GMSK mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) - ERP** |
| 824.2 | 29.0 |
| 836.4 | 29.6 |
| 848.8 | 30.4 |
| Measurement uncertainty | ± 2.0 dB |

| Output Power (radiated) 8-PSK mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) - ERP** |
| 824.2 | 22.0 |
| 836.4 | 22.8 |
| 848.8 | 23.9 |
| Measurement uncertainty | ± 2.0 dB |

**Result:** **The result of the measurement is passed.**

## 8.3.2 Frequency stability

**Description:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with $V_{nom}$, connected to the CMU200 and in a simulated call on channel 189 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +60℃. Allow at least 1.5 hours at e ach temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with $V_{nom}$. Vary supply voltage from $V_{min}$ to $V_{max}$, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at $V_{nom}$ for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Measured with CMU200 |
| Sweep time: | |
| Video bandwidth: | |
| Resolution bandwidth: | |
| Span: | |
| Trace-Mode: | |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.355<br>CFR Part 2.1055 | RSS 132, Issue 2, Section 4.3 and 6.3 |
| Frequency Stability | |
| ± 0.1 ppm | |

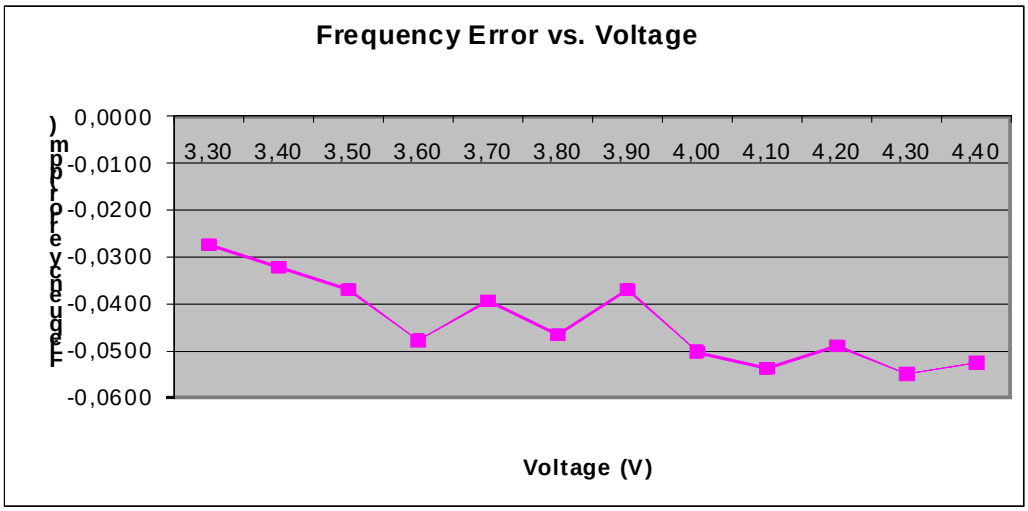
**Results:**

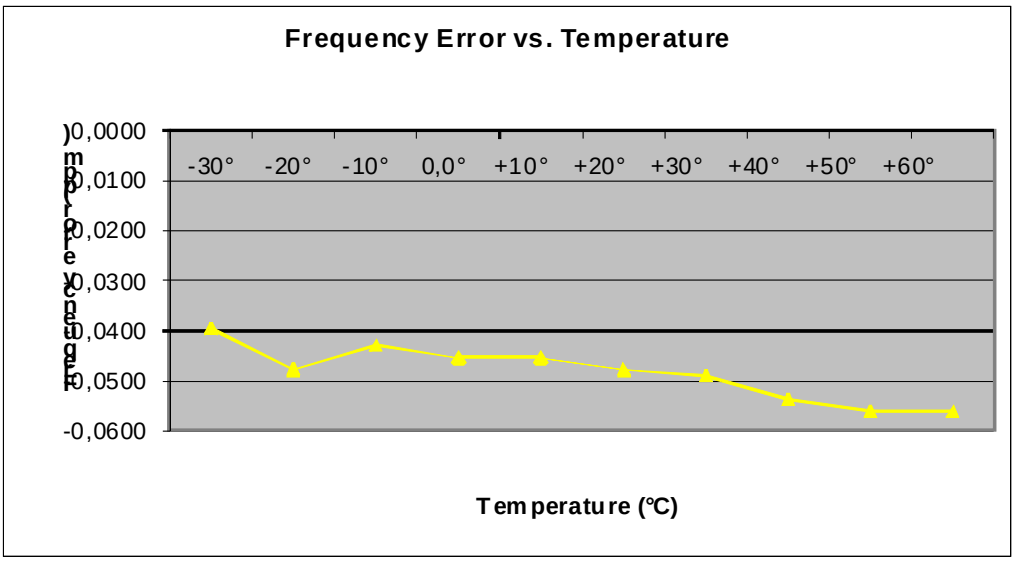
**AFC FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 3.3 | -23 | -0,00000275 | -0,0275 |
| 3.4 | -27 | -0,00000323 | -0,0323 |
| 3.5 | -31 | -0,00000371 | -0,0371 |
| 3.6 | -40 | -0,00000478 | -0,0478 |
| 3.7 | -33 | -0,00000395 | -0,0395 |
| 3.8 | -39 | -0,00000466 | -0,0466 |
| 3.9 | -31 | -0,00000371 | -0,0371 |
| 4.0 | -42 | -0,00000502 | -0,0502 |
| 4.1 | -45 | -0,00000538 | -0,0538 |
| 4.2 | -41 | -0,00000490 | -0,0490 |
| 4.3 | -46 | -0,00000550 | -0,0550 |
| 4.4 | -44 | -0,00000526 | -0,0526 |

**AFC FREQ ERROR versus TEMPERATURE**

| Temperature (℃) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -33 | -0,00000395 | -0,0395 |
| -20 | -40 | -0,00000478 | -0,0478 |
| -10 | -36 | -0,00000430 | -0,0430 |
| ± 0 | -38 | -0,00000454 | -0,0454 |
| 10 | -38 | -0,00000454 | -0,0454 |
| 20 | -40 | -0,00000478 | -0,0478 |
| 30 | -41 | -0,00000490 | -0,0490 |
| 40 | -45 | -0,00000538 | -0,0538 |
| 50 | -47 | -0,00000562 | -0,0562 |
| 60 | -47 | -0,00000562 | -0,0562 |




**Result:** **The result of the measurement is passed.**

### 8.3.3 Spurious emissions radiated

**Description:**

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 848.8 MHz. This was rounded up to 12 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the GSM-850 band.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603 .

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | 2 sec. |
| Video bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Resolution bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Span: | 100 MHz Steps |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1053 | RSS 132, Issue 2, Section 4.5 and 6.5 |
| Spurious Emissions Radiated | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the GSM-850 band (824.2 MHz, 836.4 MHz and 848.8 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the GSM-850 band into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

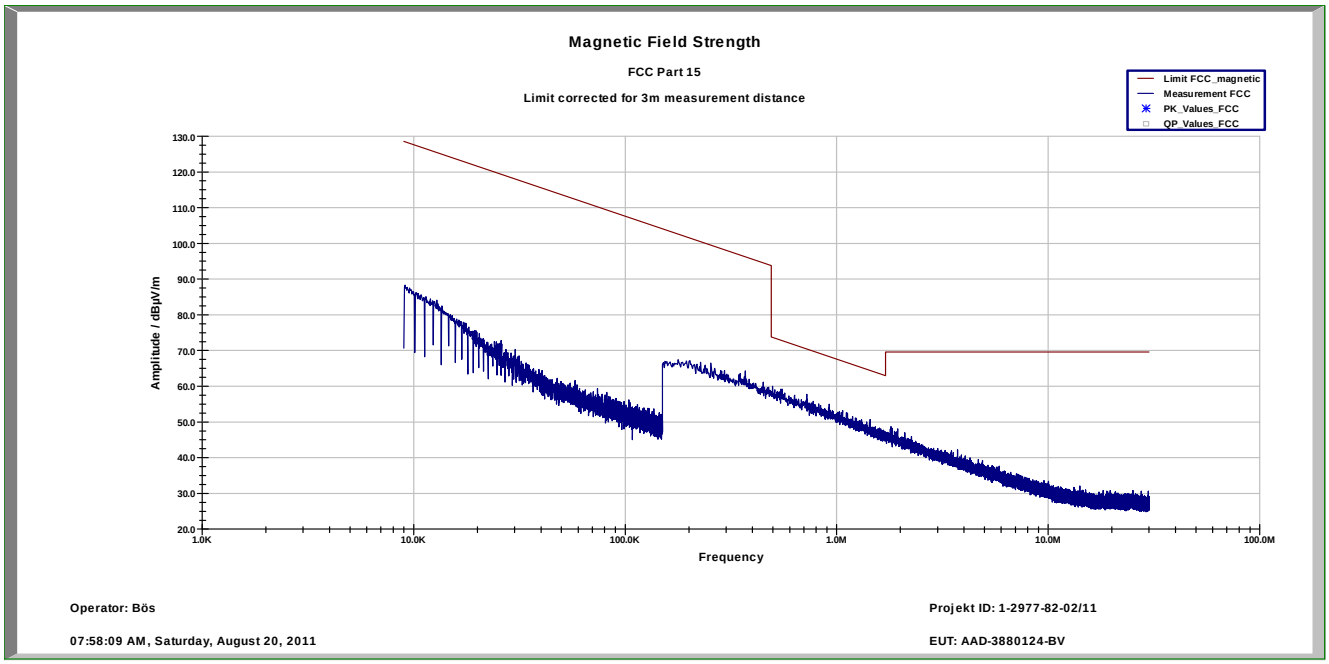
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

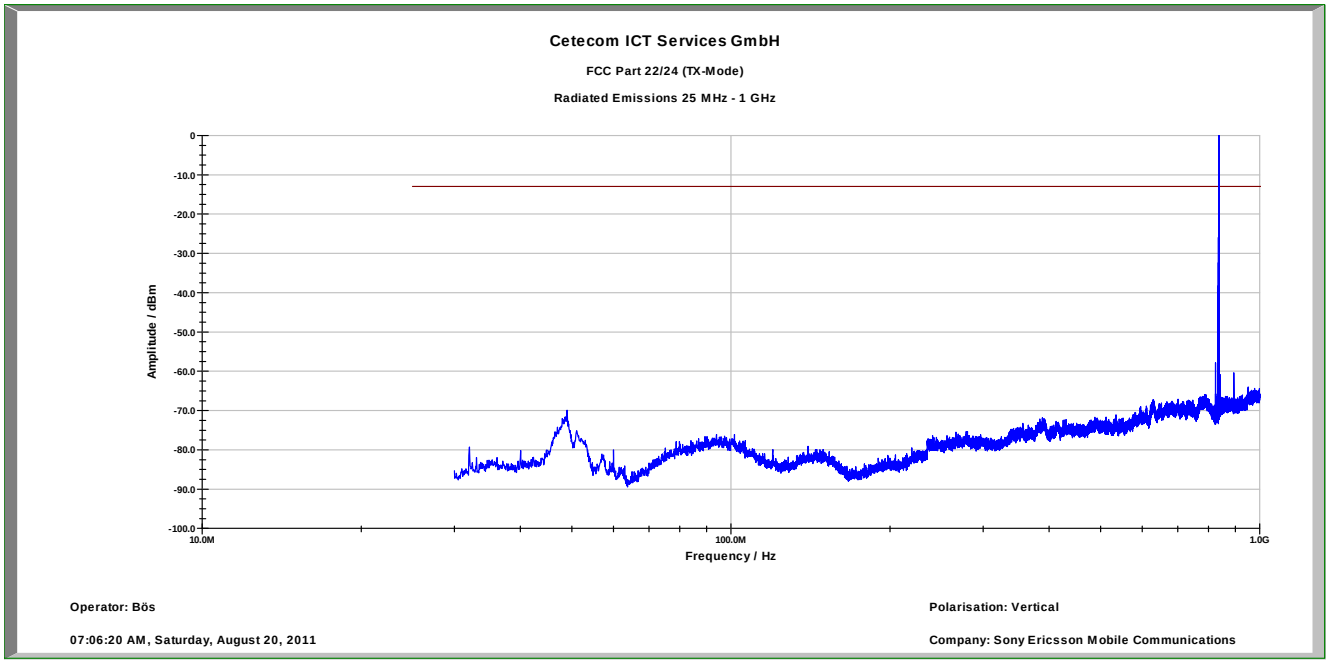
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 128 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 189 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 251 Freq. (MHz) | Level [dBm] |
| 2 | 1648.4 | -26.6 | 2 | 1672.8 | -27.3 | 2 | 1697.6 | -27.1 |
| 3 | 2472.6 | -34.5 | 3 | 2509.2 | -32.9 | 3 | 2546.4 | -32.8 |
| 4 | 3296.8 | - | 4 | 3345.6 | - | 4 | 3395.2 | - |
| 5 | 4121.0 | - | 5 | 4182.0 | - | 5 | 4244.0 | - |
| 6 | 4945.2 | - | 6 | 5018.4 | - | 6 | 5092.8 | - |
| 7 | 5769.4 | - | 7 | 5854.8 | - | 7 | 5941.6 | - |
| 8 | 6593.6 | - | 8 | 6691.2 | - | 8 | 6790.4 | - |
| 9 | 7417.8 | - | 9 | 7527.6 | - | 9 | 7639.2 | - |
| 10 | 8242.0 | - | 10 | 8364.0 | - | 10 | 8488.0 | - |
| Measurement uncertainty | | | ± 3dB | | | | | |

**Result:** **The result of the measurement is passed.**

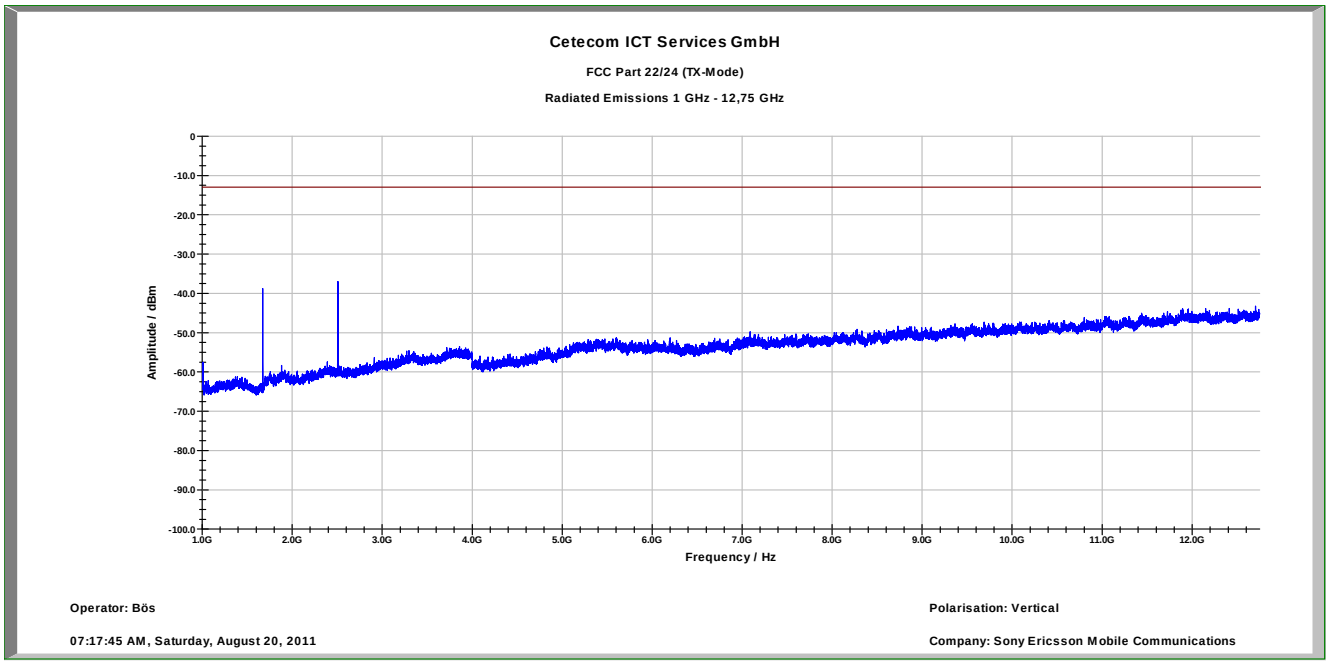
## Plot 1: Channel 189 (Traffic mode up to 30 MHz)




## Plot 2: Channel 189 (30 MHz - 1 GHz)



## Plot 3: Channel 189 (1 GHz – 12.75 GHz)



## 8.3.4 Spurious emissions conducted

**Description:**

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 12 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

GSM-850 Transmitter Channel Frequency
128 824.2 MHz
189 836.4 MHz
251 848.8 MHz

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Resolution bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Span: | 10 MHz – 25 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

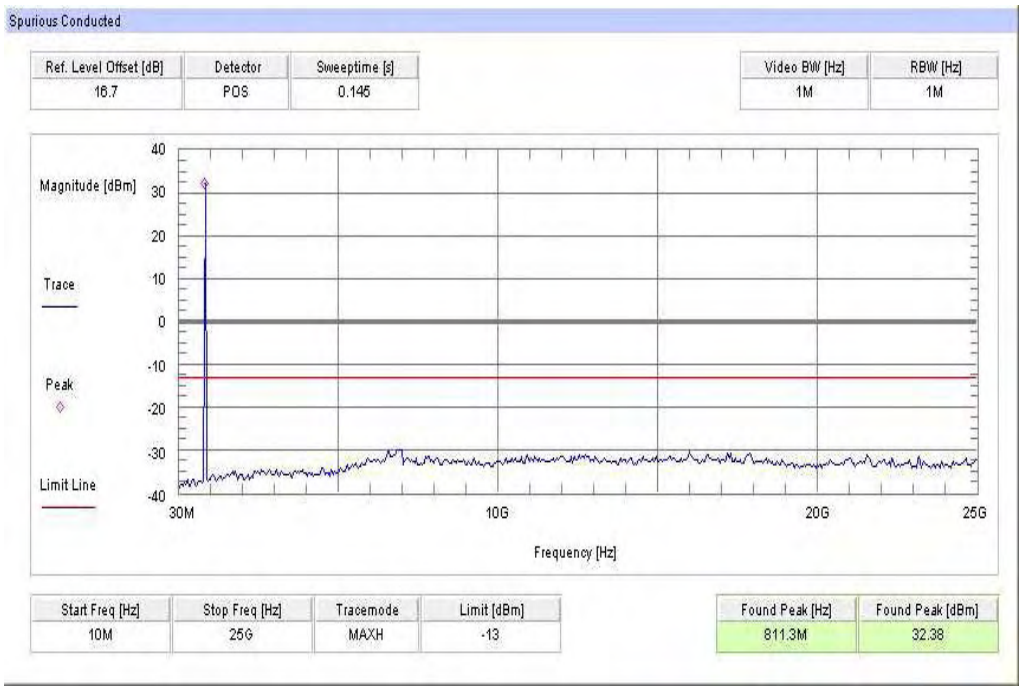
| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132, Issue 2, Section 4.5 and 6.5 |
| Spurious Emissions Conducted | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

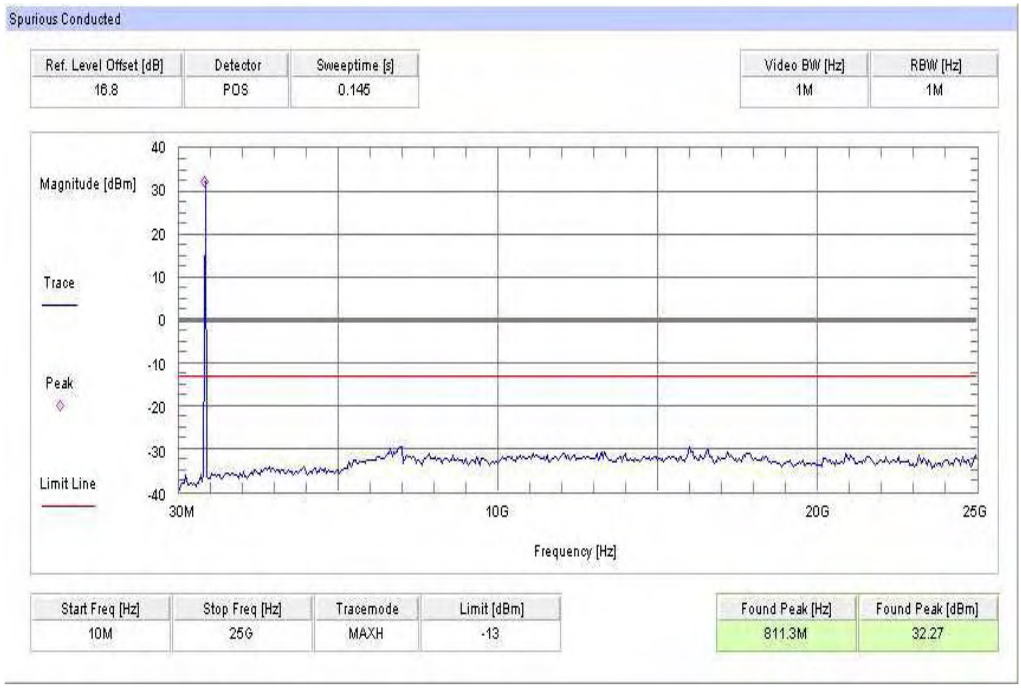
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 128 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 189 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 251 Freq. (MHz) | Level [dBm] |
| 2 | 1648.4 | - | 2 | 1672.8 | - | 2 | 1697.6 | - |
| 3 | 2472.6 | - | 3 | 2509.2 | - | 3 | 2546.4 | - |
| 4 | 3296.8 | - | 4 | 3345.6 | - | 4 | 3395.2 | - |
| 5 | 4121.0 | - | 5 | 4182.0 | - | 5 | 4244.0 | - |
| 6 | 4945.2 | - | 6 | 5018.4 | - | 6 | 5092.8 | - |
| 7 | 5769.4 | - | 7 | 5854.8 | - | 7 | 5941.6 | - |
| 8 | 6593.6 | - | 8 | 6691.2 | - | 8 | 6790.4 | - |
| 9 | 7417.8 | - | 9 | 7527.6 | - | 9 | 7639.2 | - |
| 10 | 8242.0 | - | 10 | 8364.0 | - | 10 | 8488.0 | - |
| Measurement uncertainty | | | | ± 3dB | | | | |

**Result:** **The result of the measurement is passed.**

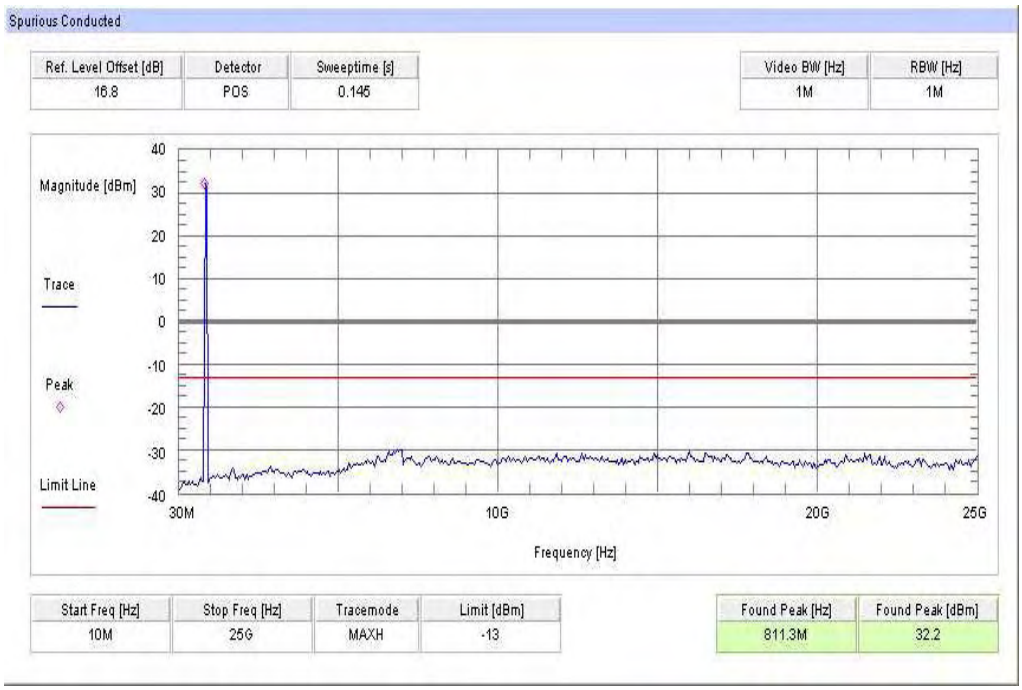
**Plot 1: Channel 128 (10 MHz - 25 GHz)**




**Plot 2: Channel 189 (10 MHz - 25 GHz)**



**Plot 3: Channel 251 (10 MHz - 25 GHz)**



### 8.3.5 Block edge compliance

**Description:**

The spectrum at the band edges must comply with the spurious emissions limits.

**Measurement:**

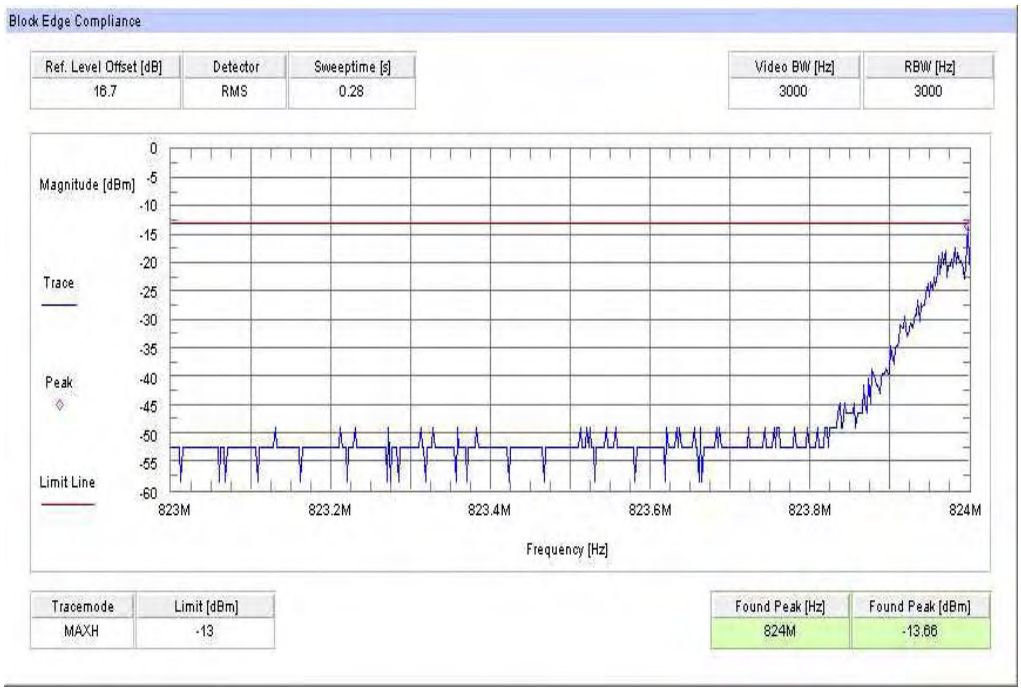
| Measurement parameters | |
|---|---|
| Detector: | RMS |
| Sweep time: | Auto |
| Video bandwidth: | 3 kHz |
| Resolution bandwidth: | 3 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

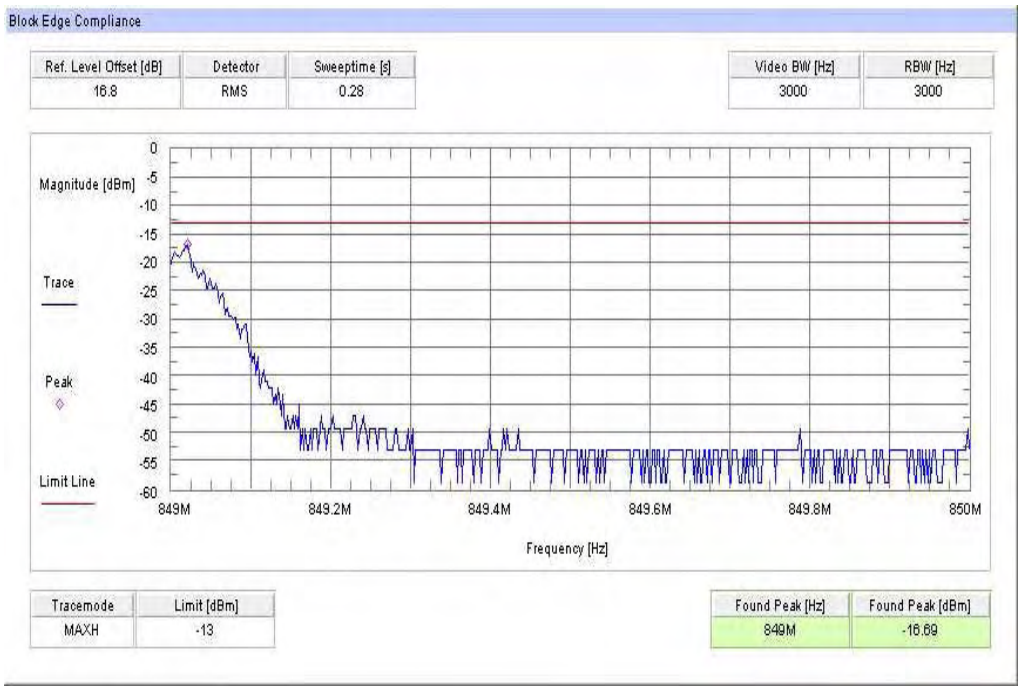
| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132, Issue 2, Section 6.5 |
| Block Edge Compliance | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

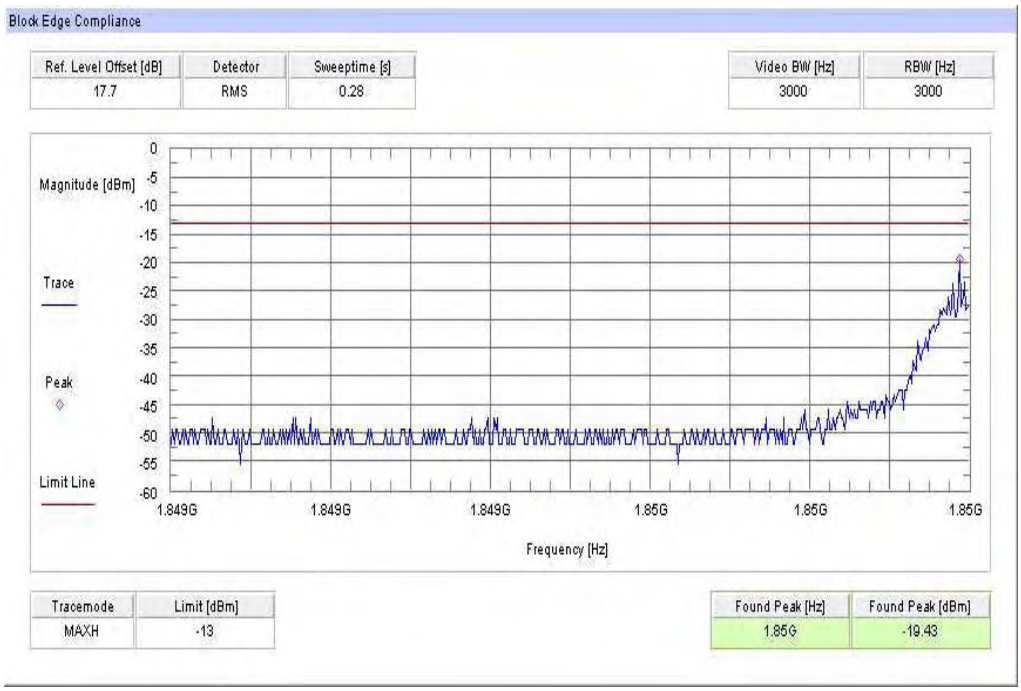
**Plot 1: Channel 128 (GSM-mode)**



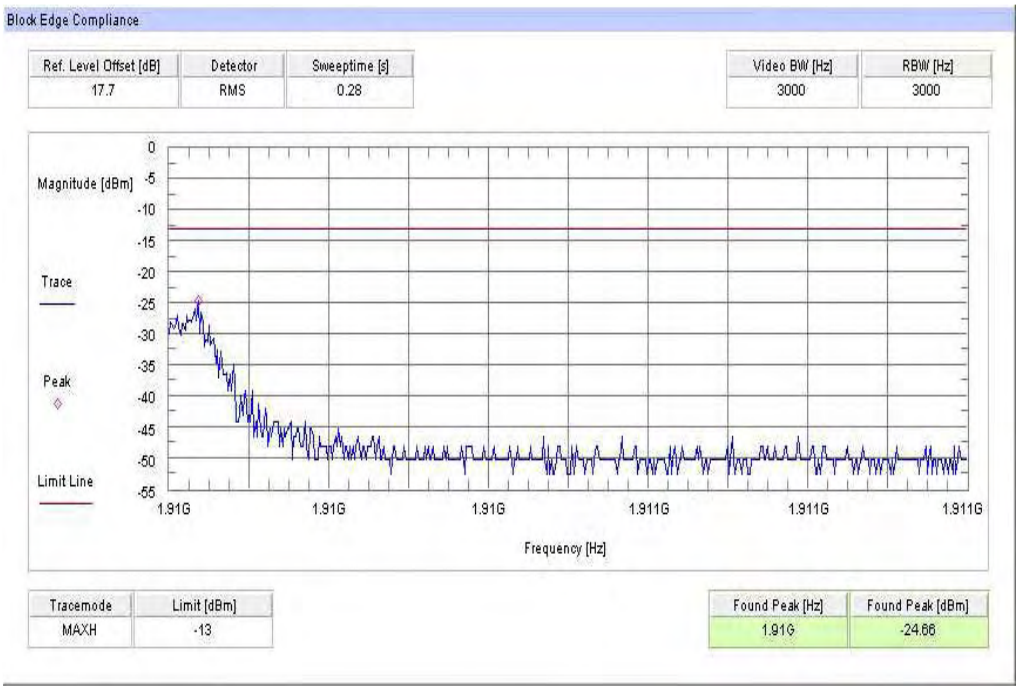

**Plot 2: Channel 251 (GSM-mode)**



**Plot 3: Channel 128 (EDGE-mode)**




**Plot 4: Channel 251 (EDGE-mode)**




**Result:** **The result of the measurement is passed.**

## 8.3.6 Occupied bandwidth

**Description:**

Measurement of the occupied bandwidth of the transmitted signal.

**Measurement:**

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the GSM-850 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 22.917 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 300 kHz, this equates to a resolution bandwidth of at least 3 kHz. For this testing, a resolution bandwidth 3.0 kHz was used.

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 3 kHz |
| Resolution bandwidth: | 3 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1049 | RSS 132, Issue 2, Section 4.5.1 |
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

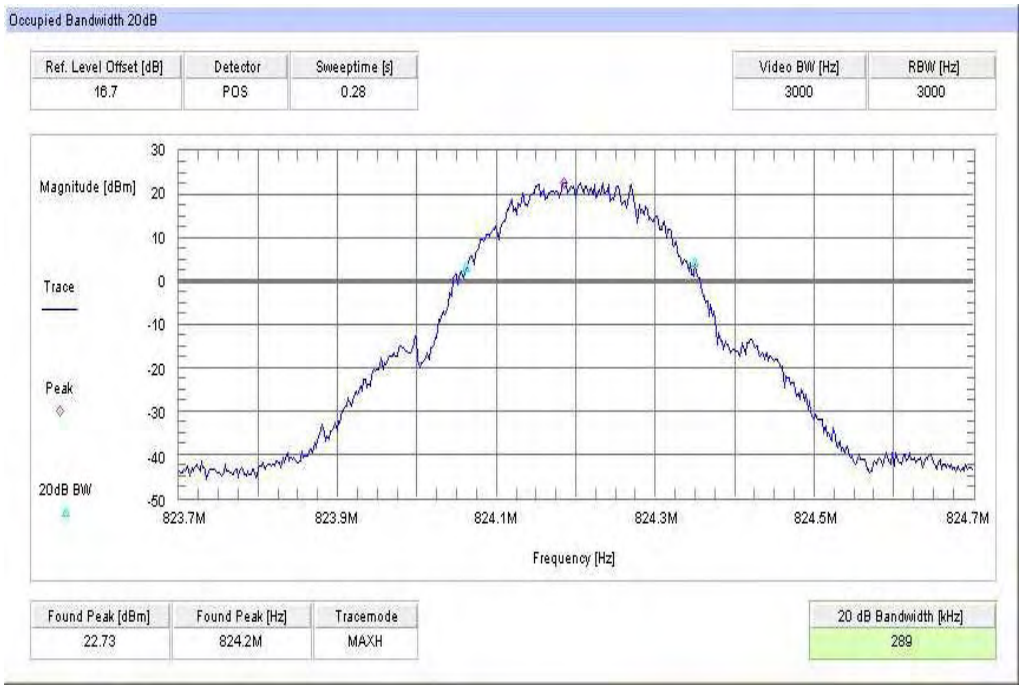
**Results:**

| Occupied Bandwidth - GMSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 824.2 | 289 | 317 |
| 836.4 | 269 | 313 |
| 848.8 | 267 | 313 |
| Measurement uncertainty | ± 3 kHz | |

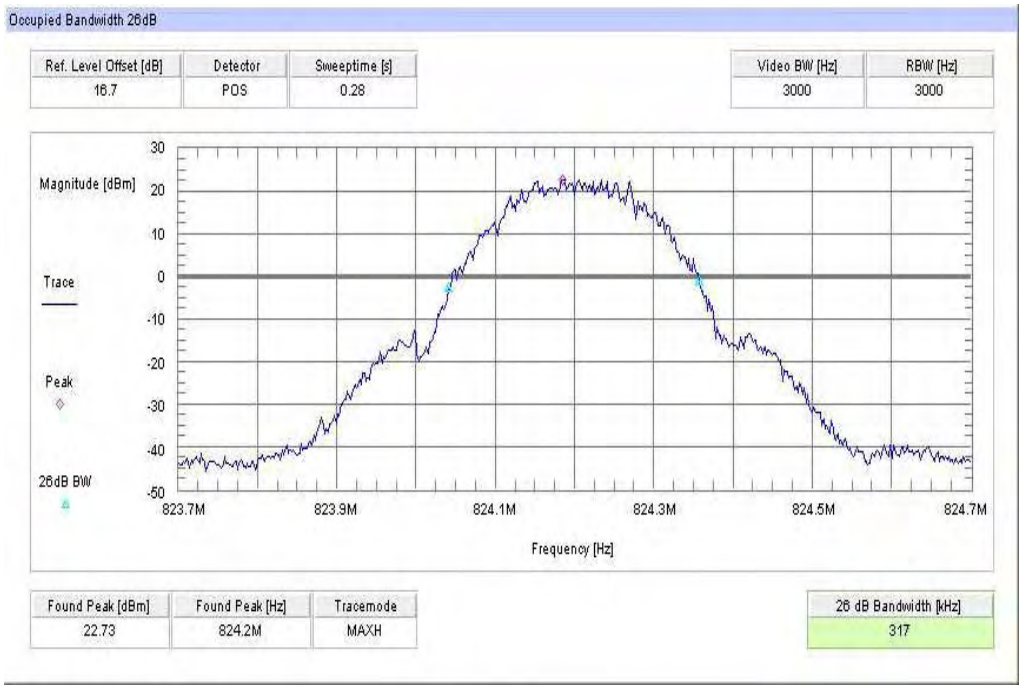
| Occupied Bandwidth - EDGE mode | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 824.2 | 279 | 315 |
| 836.4 | 279 | 313 |
| 848.8 | 287 | 307 |
| Measurement uncertainty | ± 3 kHz | |

**Result:** **The result of the measurement is passed.**

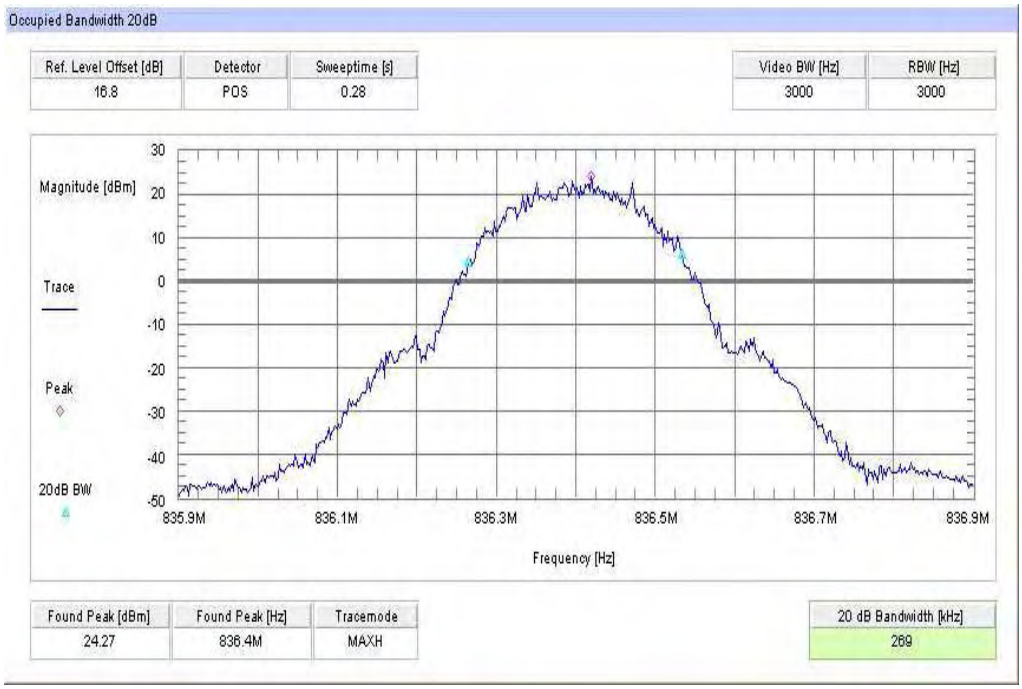
**Plot 1: Channel 128 (99% - OBW)**



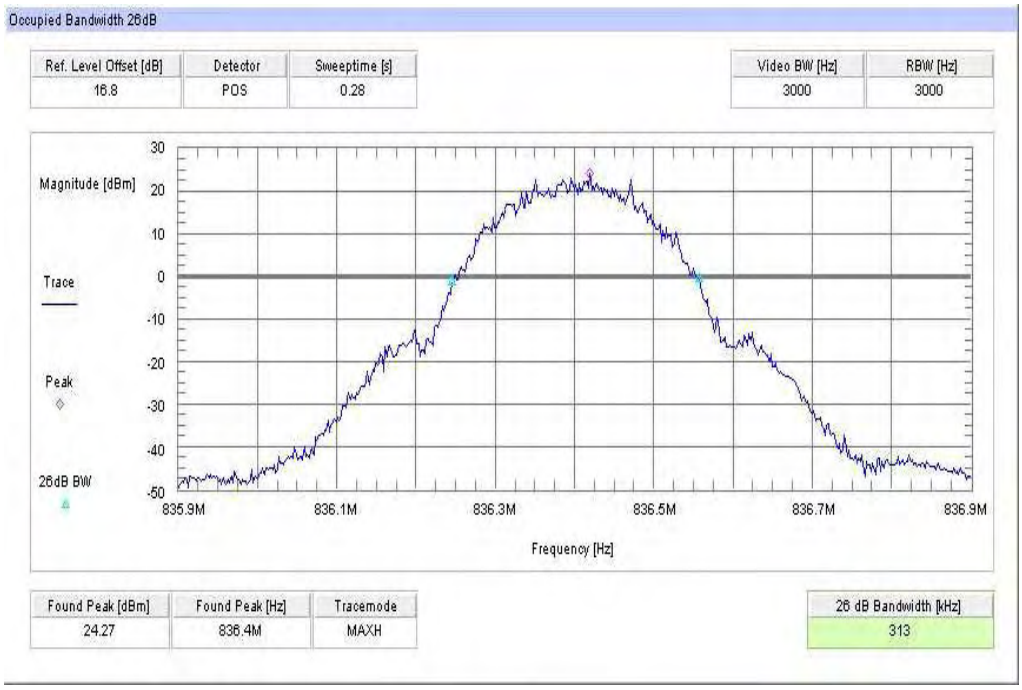

**Plot 2: Channel 128 (-26 dBc BW)**



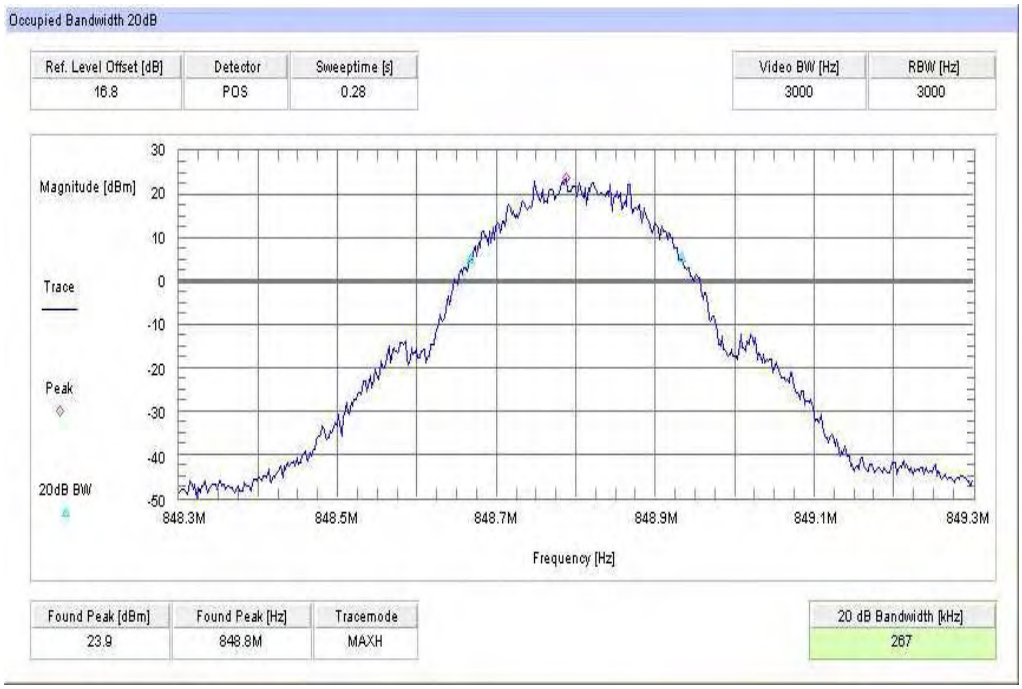
**Plot 3: Channel 189 (99% - OBW)**



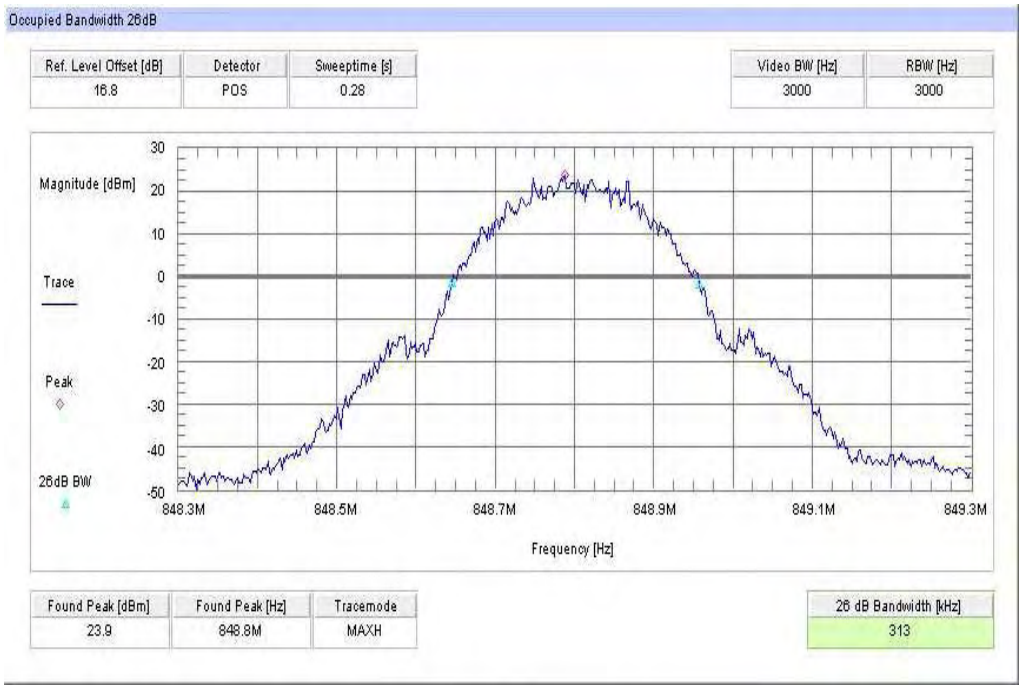

**Plot 4: Channel 189 (-26 dBc BW)**



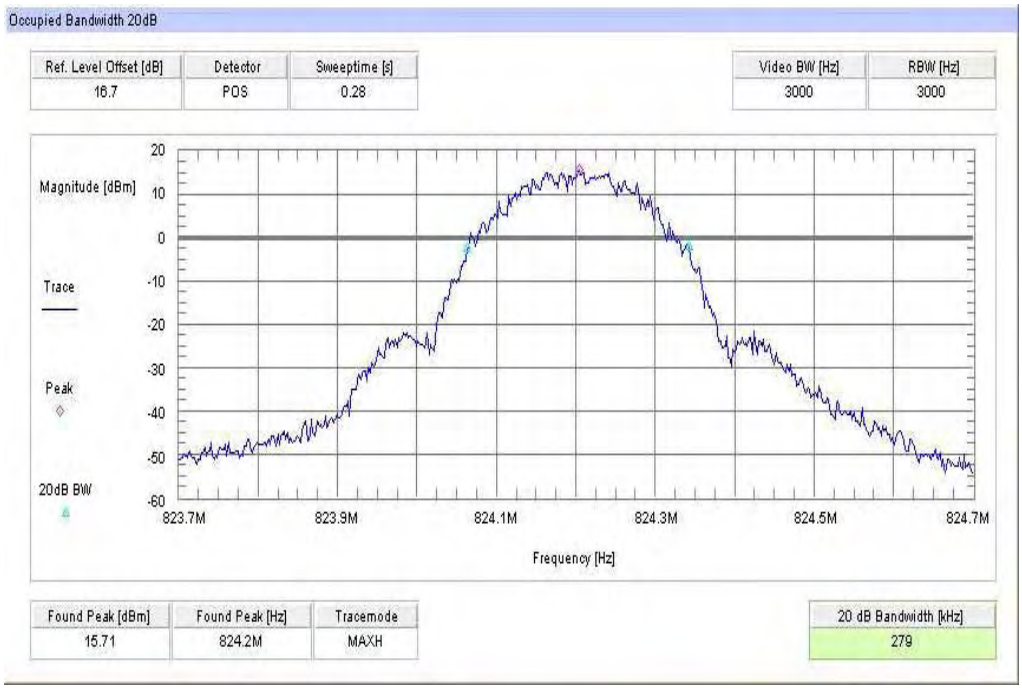
**Plot 5: Channel 251 (99% - OBW)**



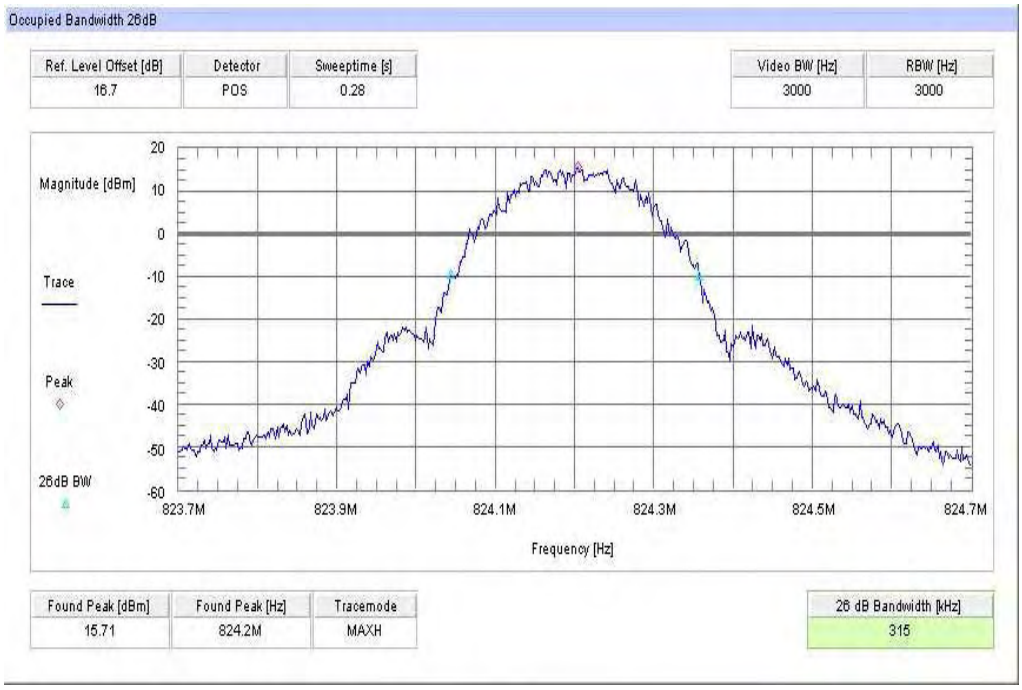

**Plot 6: Channel 251 (-26 dBc BW)**



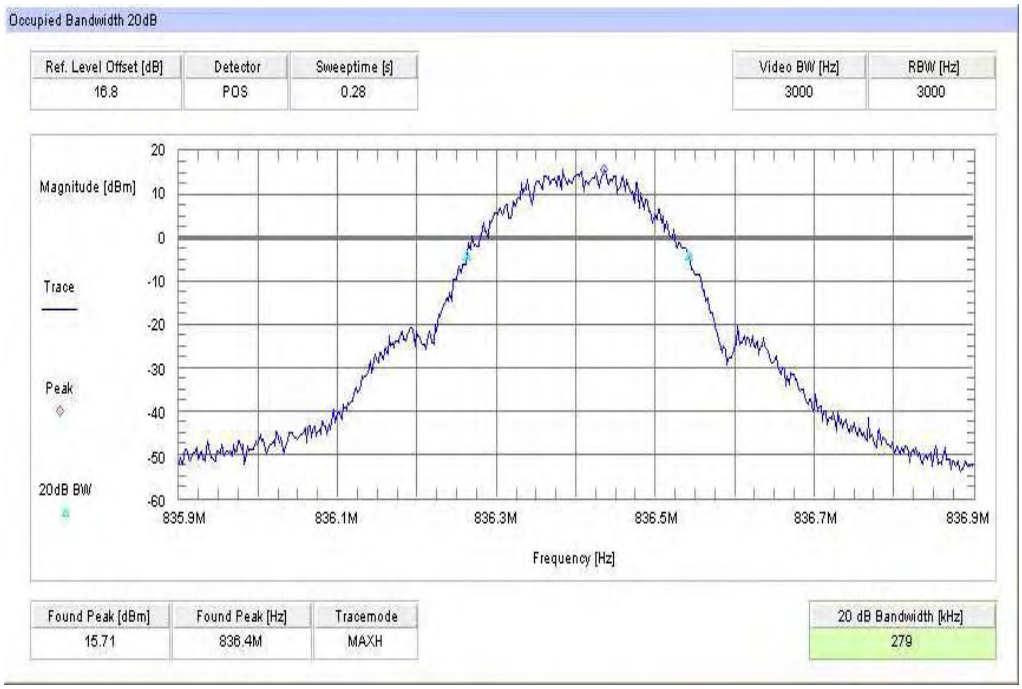
**Plot 7: Channel 128 (99% - OBW) - EDGE**



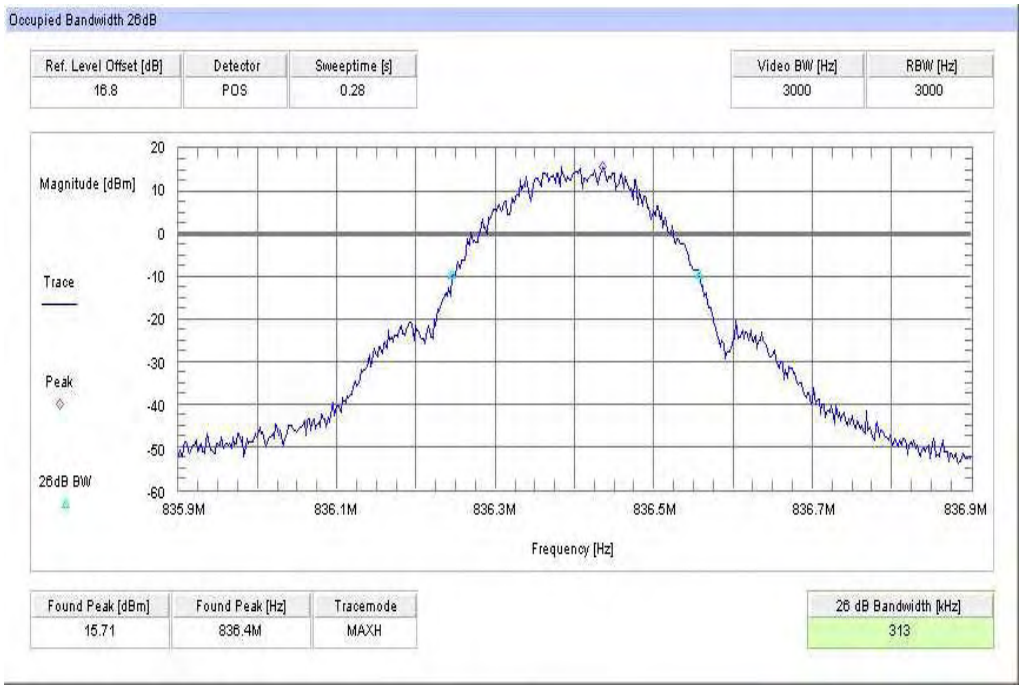

**Plot 8: Channel 128 (-26 dBc BW) - EDGE**



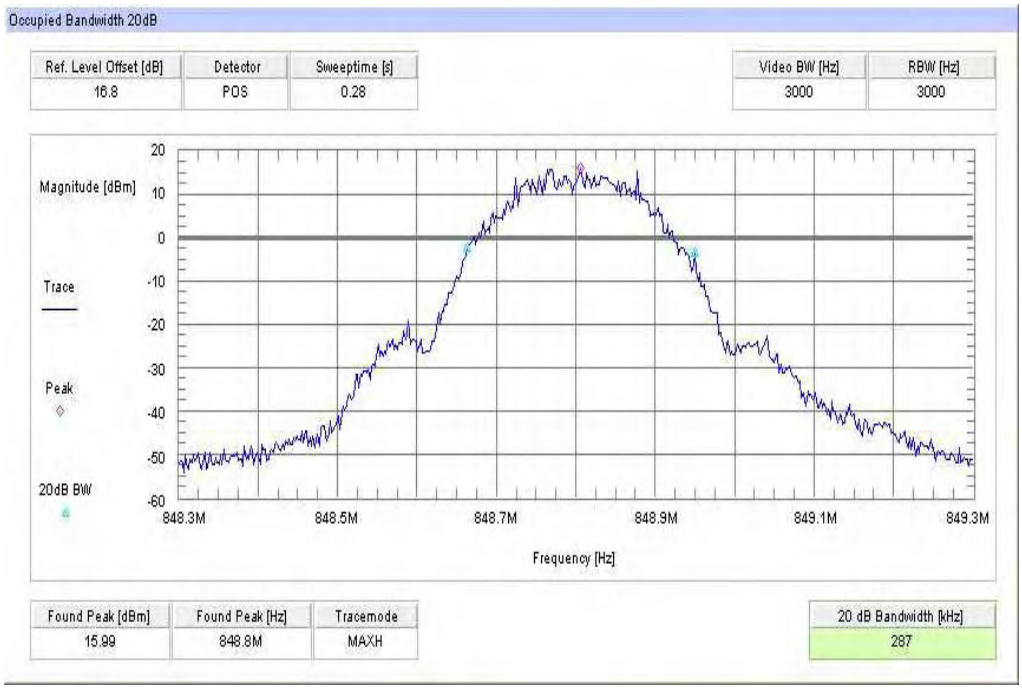
**Plot 9: Channel 189 (99% - OBW) - EDGE**



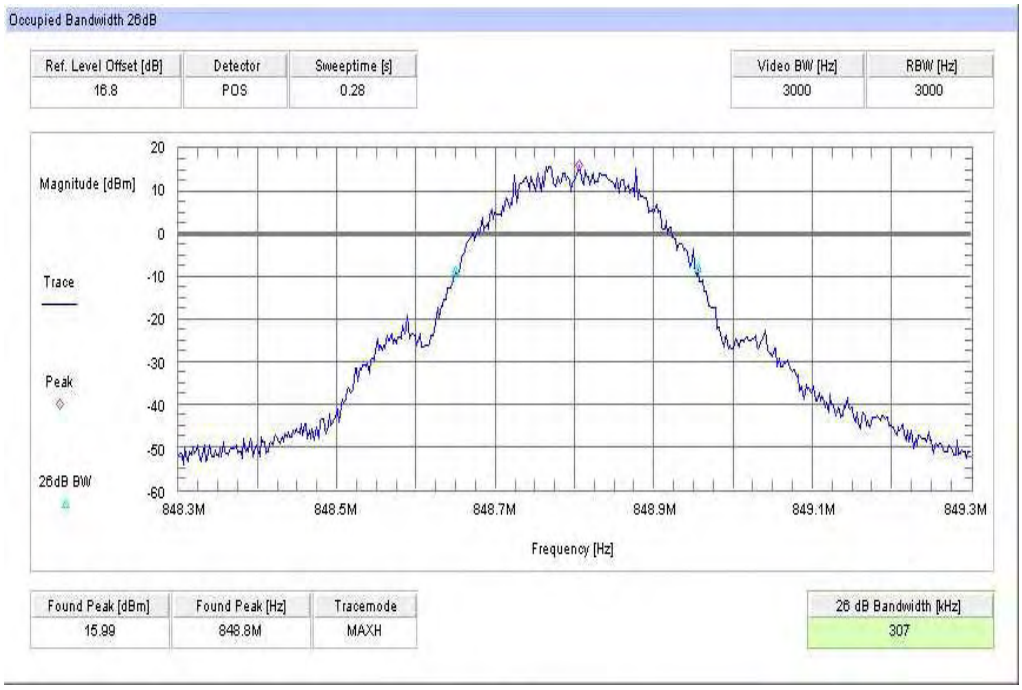

**Plot 10: Channel 189 (-26 dBc BW) - EDGE**



**Plot 11: Channel 251 (99% - OBW) - EDGE**




**Plot 12: Channel 251 (-26 dBc BW) - EDGE**



## 8.4 Results PCS 1900

All GSM-band measurements are done in GSM mode only (circuit switched).
All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

### 8.4.1 RF output power

**Description:**

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

**Measurement:**

The mobile was set up for the maximum output power with pseudo random data modulation.

| Measurement parameters | |
|---|---|
| Detector: | Peak and RMS (Power in Burst) |
| Sweep time: | Auto |
| Video bandwidth: | 1 MHz |
| Resolution bandwidth: | 1 MHz |
| Span: | Zero Span |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.232<br>CFR Part 2.1046 | RSS 133, Issue 5, Section 6.4 |
| Nominal Peak Output Power | |
| +33.00 dBm<br>In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB. | |

**Results:**

| Output Power (conducted) GMSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 1850.2 | 29.7 | 0.6 |
| 1880.0 | 29.5 | 0.6 |
| 1909.8 | 29.8 | 0.6 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (conducted) 8-PSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 1850.2 | 24.7 | 3.0 |
| 1880.0 | 24.6 | 3.1 |
| 1909.8 | 24.8 | 3.1 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (radiated) GMSK mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) - EIRP** |
| 1850.2 | 29.2 |
| 1880.0 | 27.7 |
| 1909.8 | 27.6 |
| Measurement uncertainty | ± 2.0 dB |

| Output Power (radiated) 8-PSK mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) - EIRP** |
| 1850.2 | 24.2 |
| 1880.0 | 22.8 |
| 1909.8 | 22.6 |
| Measurement uncertainty | ± 2.0 dB |

**Result:** **The result of the measurement is passed.**

## 8.4.2 Frequency stability

**Description:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with $V_{nom}$, connected to the CMU200 and in a simulated call on channel 661 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +60℃. Allow at least 1.5 hours at e ach temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with $V_{nom}$. Vary supply voltage from $V_{min}$ to $V_{max}$, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at $V_{nom}$ for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Measured with CMU200 |
| Sweep time: | |
| Video bandwidth: | |
| Resolution bandwidth: | |
| Span: | |
| Trace-Mode: | |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.235<br>CFR Part 2.1055 | RSS 133, Issue 5, Section 6.3 |
| Frequency Stability | |
| ± 0.1 ppm | |

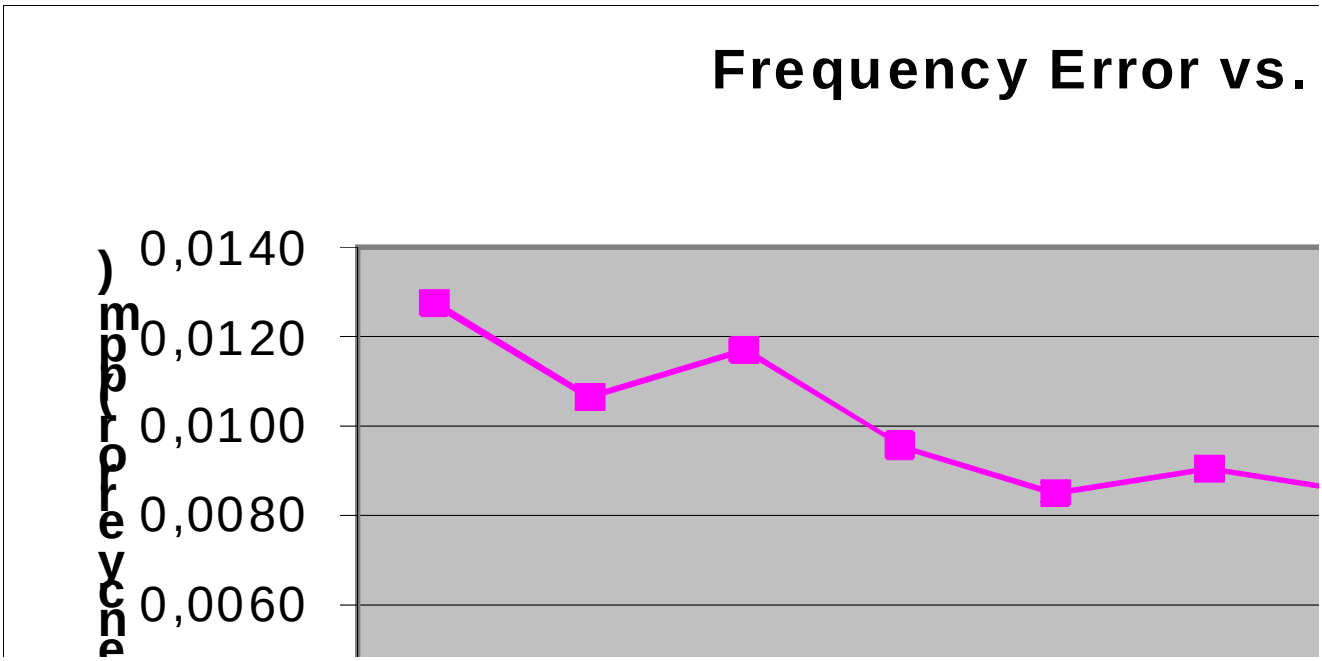
**Results:**

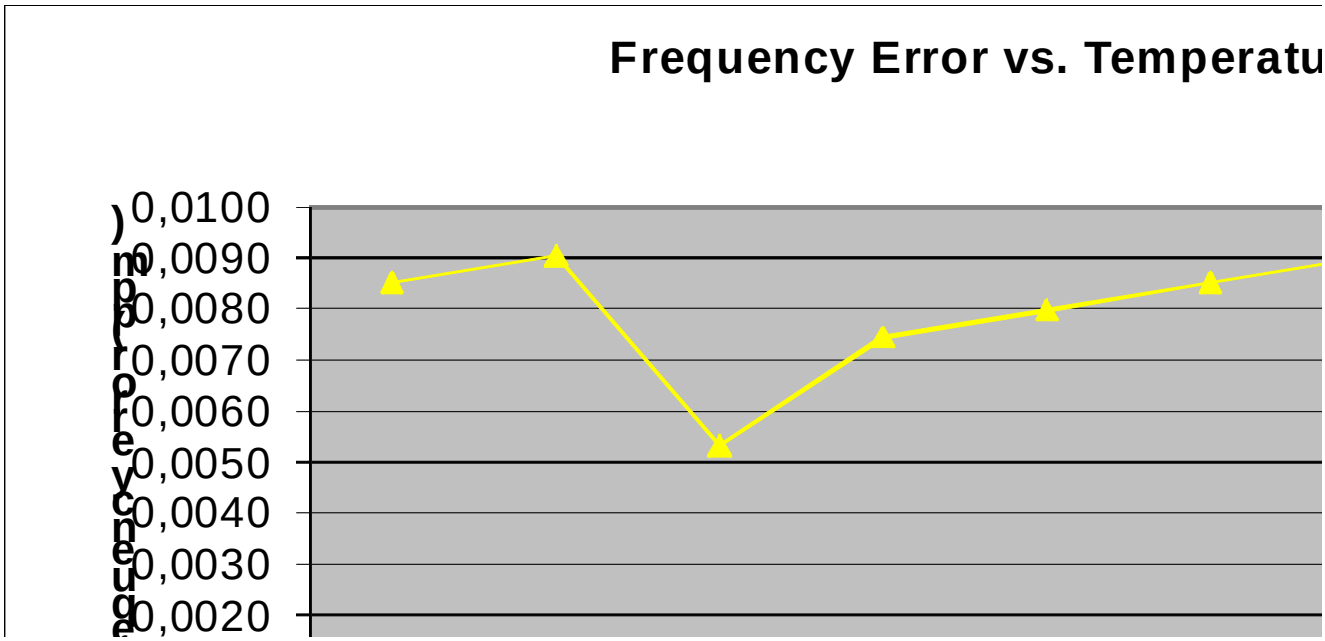
**AFC FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 3.3 | 24 | 0,00000128 | 0,0128 |
| 3.4 | 20 | 0,00000106 | 0,0106 |
| 3.5 | 22 | 0,00000117 | 0,0117 |
| 3.6 | 18 | 0,00000096 | 0,0096 |
| 3.7 | 16 | 0,00000085 | 0,0085 |
| 3.8 | 17 | 0,00000090 | 0,0090 |
| 3.9 | 16 | 0,00000085 | 0,0085 |
| 4.0 | 13 | 0,00000069 | 0,0069 |
| 4.1 | 11 | 0,00000059 | 0,0059 |
| 4.2 | 13 | 0,00000069 | 0,0069 |
| 4.3 | 15 | 0,00000080 | 0,0080 |
| 4.4 | 15 | 0,00000080 | 0,0080 |

**AFC FREQ ERROR versus TEMPERATURE**

| Temperature (℃) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | 16 | 0,00000085 | 0,0085 |
| -20 | 17 | 0,00000090 | 0,0090 |
| -10 | 10 | 0,00000053 | 0,0053 |
| ± 0 | 14 | 0,00000074 | 0,0074 |
| 10 | 15 | 0,00000080 | 0,0080 |
| 20 | 16 | 0,00000085 | 0,0085 |
| 30 | 17 | 0,00000090 | 0,0090 |
| 40 | 16 | 0,00000085 | 0,0085 |
| 50 | 15 | 0,00000080 | 0,0080 |
| 60 | 14 | 0,00000074 | 0,0074 |




**Result:** The result of the measurement is passed.

## 8.4.3 Spurious emissions radiated

**Description:**

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. This was rounded up to 20 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the PCS1900 band.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603 .

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | 2 sec. |
| Video bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Resolution bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Span: | 100 MHz Steps |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1053 | RSS 133, Issue 5, Section 6.5 |
| Spurious Emissions Radiated | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880.0 MHz and 1909.8 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the PCS1900 band into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

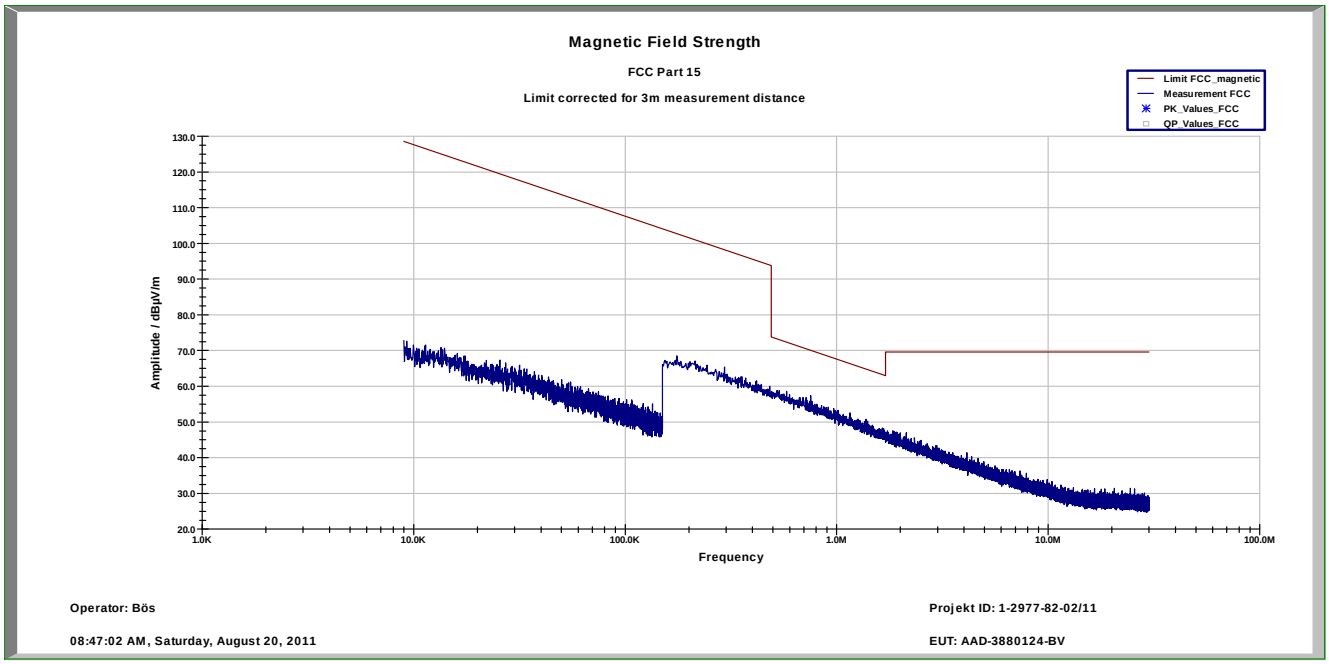
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

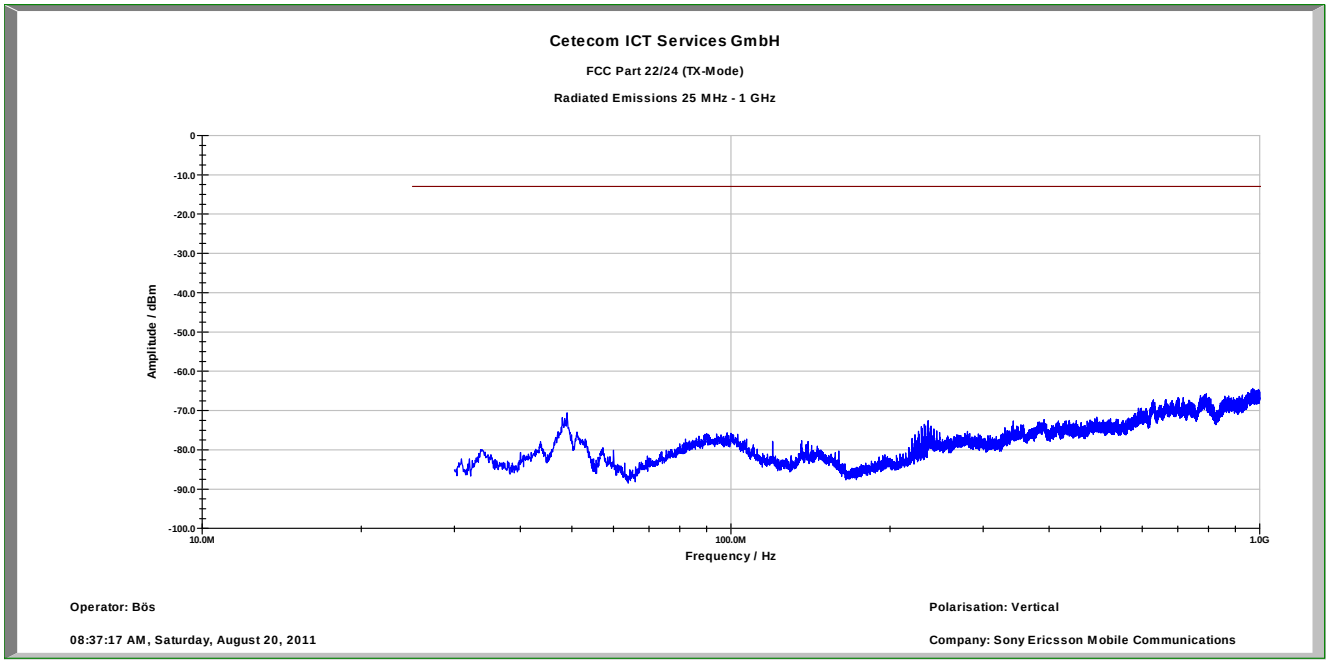
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 512 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 661 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 810 Freq. (MHz) | Level [dBm] |
| 2 | 3700.4 | - | 2 | 3760.0 | - | 2 | 3819.6 | - |
| 3 | 5550.6 | - | 3 | 5640.0 | - | 3 | 5729.4 | - |
| 4 | 7400.8 | - | 4 | 7520.0 | - | 4 | 7639.2 | - |
| 5 | 9251.0 | - | 5 | 9400.0 | - | 5 | 9549.0 | - |
| 6 | 11101.2 | - | 6 | 11280.0 | - | 6 | 11458.8 | - |
| 7 | 12951.4 | - | 7 | 13160.0 | - | 7 | 13368.6 | - |
| 8 | 14801.6 | - | 8 | 15040.0 | - | 8 | 15278.4 | - |
| 9 | 16651.8 | - | 9 | 16920.0 | - | 9 | 17188.2 | - |
| 10 | 18502.0 | - | 10 | 18800.0 | - | 10 | 19098.0 | - |
| Measurement uncertainty | | | ± 3dB | | | | | |

**Result:** **The result of the measurement is passed.**

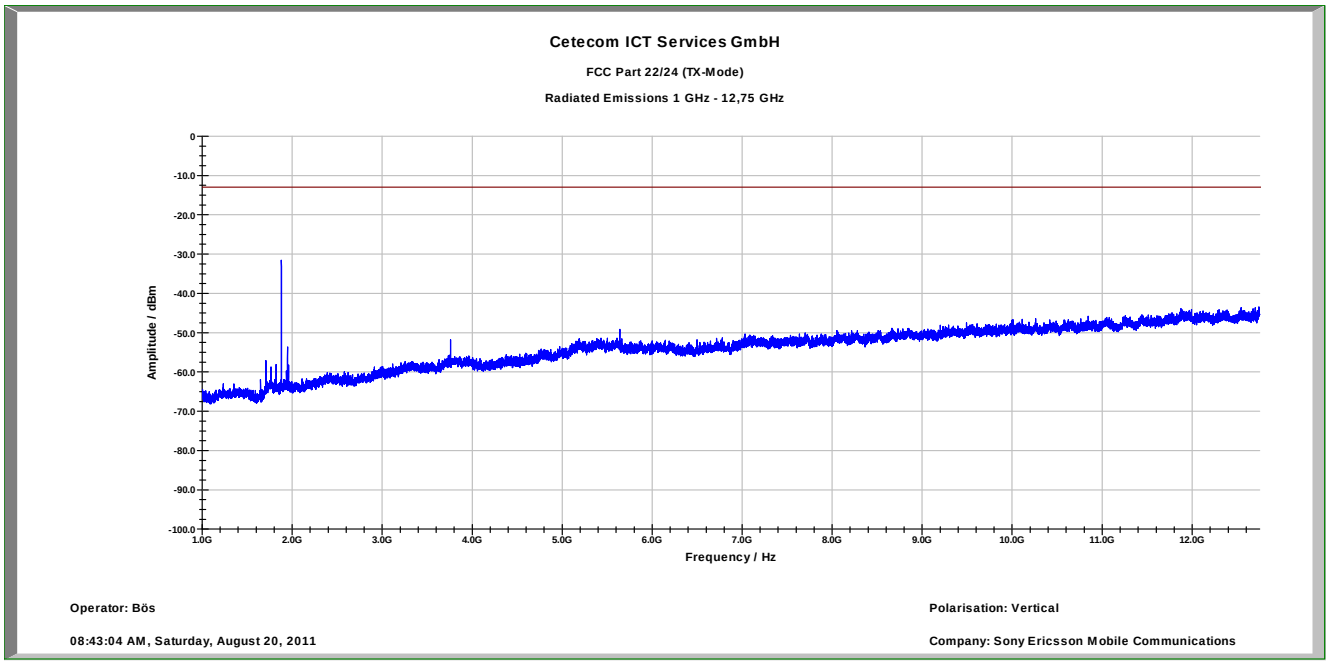
## Plot 1: Channel 661 (Traffic mode up to 30 MHz)




## Plot 2: Channel 661 (30 MHz - 1 GHz)

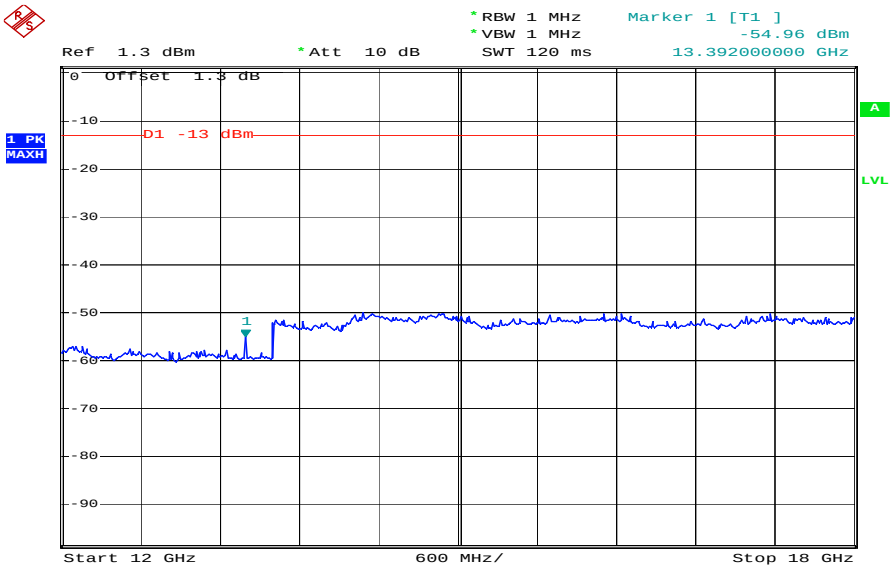


## Plot 3: Channel 661 (1 GHz – 12.75 GHz)

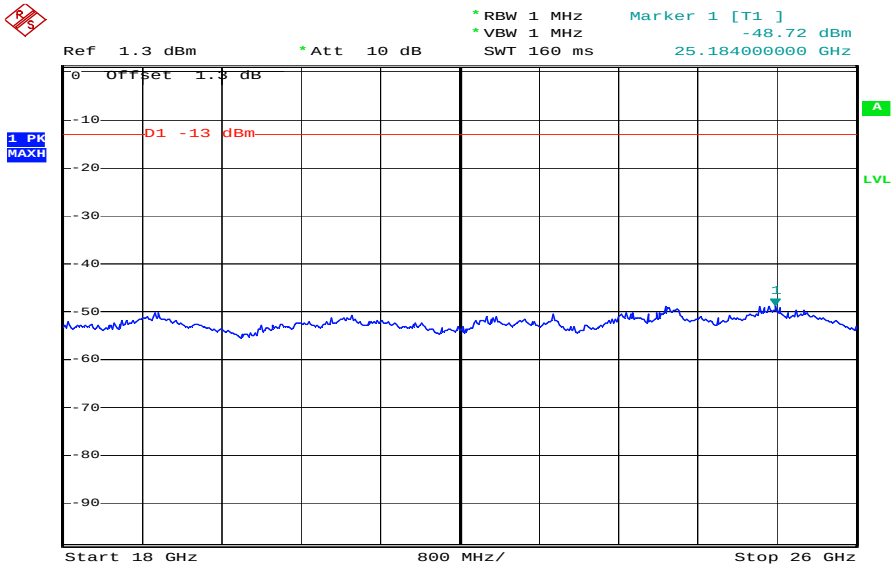



*Carrier notched with 1.9 GHz rejection filter*

## Plot 4: Channel 661 (12 GHz - 18 GHz)



## Plot 5: Channel 661 (18 GHz - 26 GHz)



## 8.4.4 Spurious emissions conducted

**Description:**

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 19.1 GHz, data taken from 10 MHz to 20 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

PCS1900 Transmitter Channel Frequency
512 1850.2 MHz
661 1880.0 MHz
810 1909.8 MHz

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Resolution bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Span: | 10 MHz – 25 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

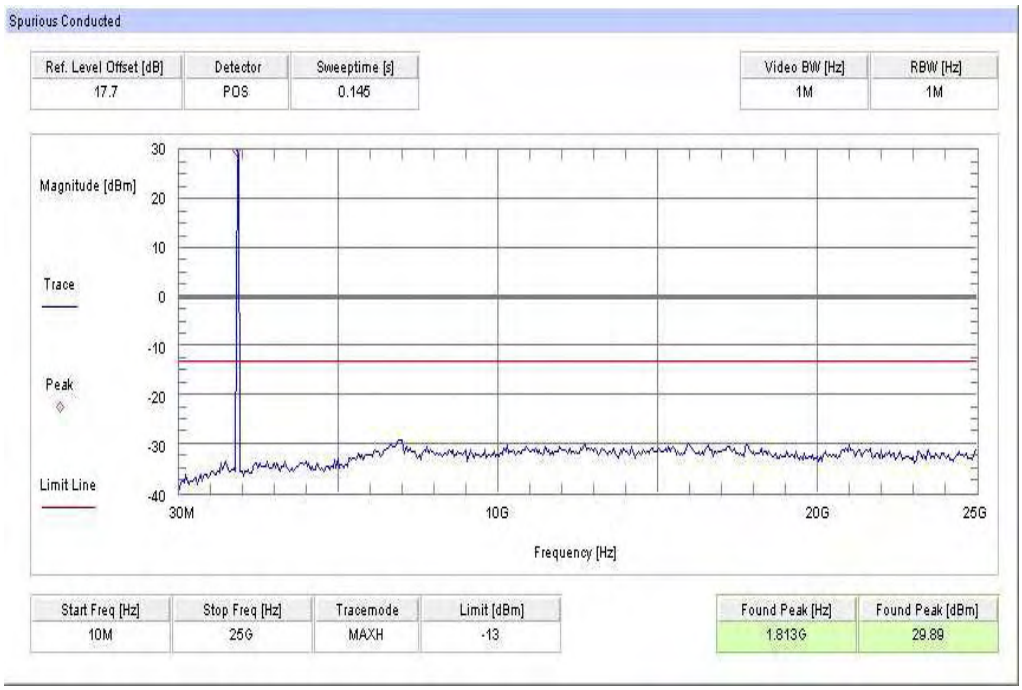
| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1051 | RSS 133, Issue 5, Section 6.5 |
| Spurious Emissions Conducted | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

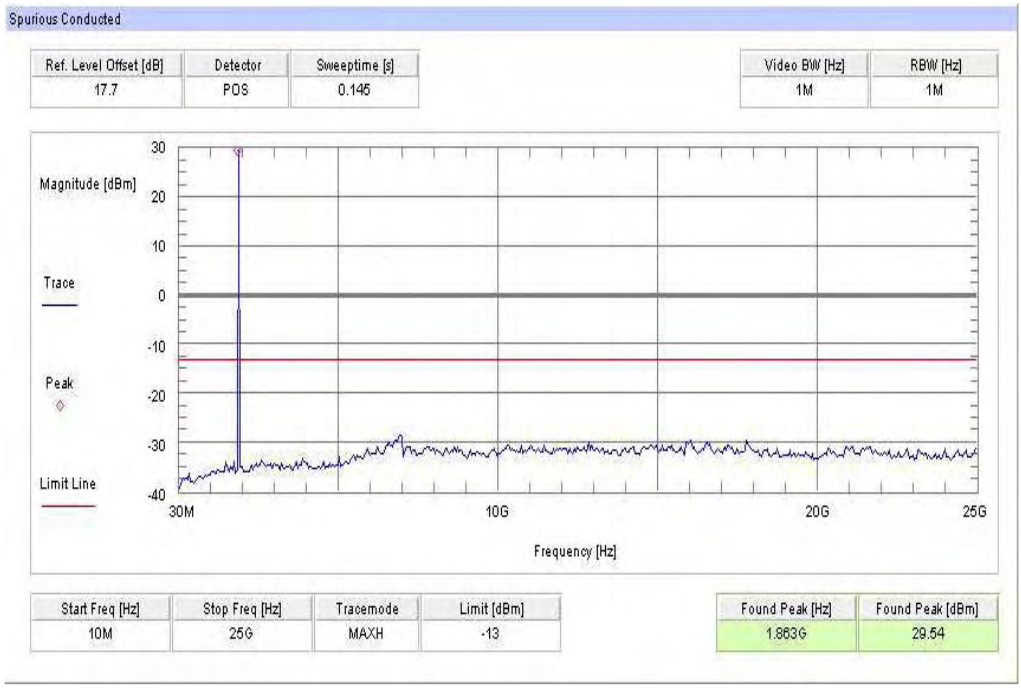
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 512 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 661 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 810 Freq. (MHz) | Level [dBm] |
| 2 | 3700.4 | - | 2 | 3760.0 | - | 2 | 3819.6 | - |
| 3 | 5550.6 | - | 3 | 5640.0 | - | 3 | 5729.4 | - |
| 4 | 7400.8 | - | 4 | 7520.0 | - | 4 | 7639.2 | - |
| 5 | 9251.0 | - | 5 | 9400.0 | - | 5 | 9549.0 | - |
| 6 | 11101.2 | - | 6 | 11280.0 | - | 6 | 11458.8 | - |
| 7 | 12951.4 | - | 7 | 13160.0 | - | 7 | 13368.6 | - |
| 8 | 14801.6 | - | 8 | 15040.0 | - | 8 | 15278.4 | - |
| 9 | 16651.8 | - | 9 | 16920.0 | - | 9 | 17188.2 | - |
| 10 | 18502.0 | - | 10 | 18800.0 | - | 10 | 19098.0 | - |
| Measurement uncertainty | | | | ± 3dB | | | | |

**Result:** **The result of the measurement is passed.**

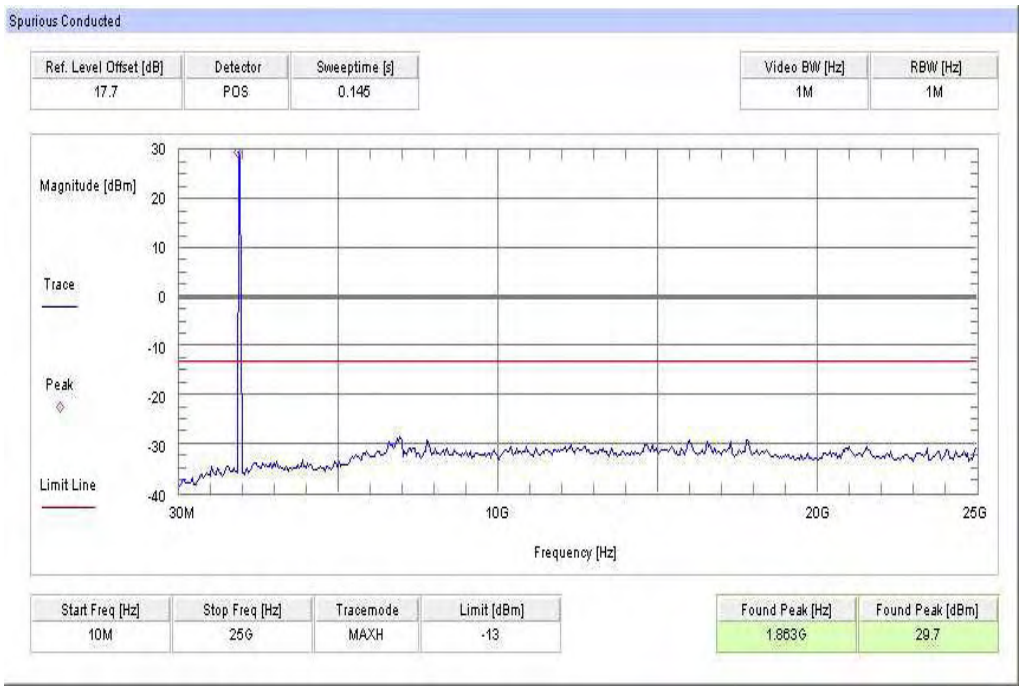
**Plot 1: Channel 512 (10 MHz - 25 GHz)**




**Plot 2: Channel 661 (10 MHz - 25 GHz)**



**Plot 3: Channel 810 (10 MHz - 25 GHz)**



### 8.4.5 Block edge compliance

**Description:**

The spectrum at the band edges must comply with the spurious emissions limits.

**Measurement:**

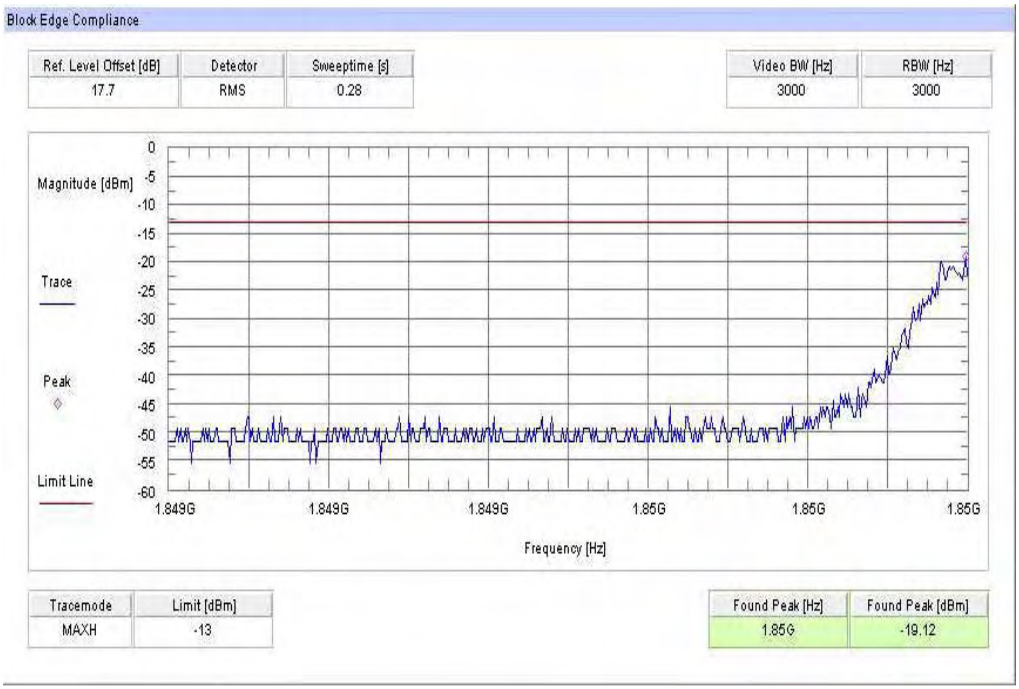
| Measurement parameters | |
|---|---|
| Detector: | RMS |
| Sweep time: | Auto |
| Video bandwidth: | 3 kHz |
| Resolution bandwidth: | 3 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

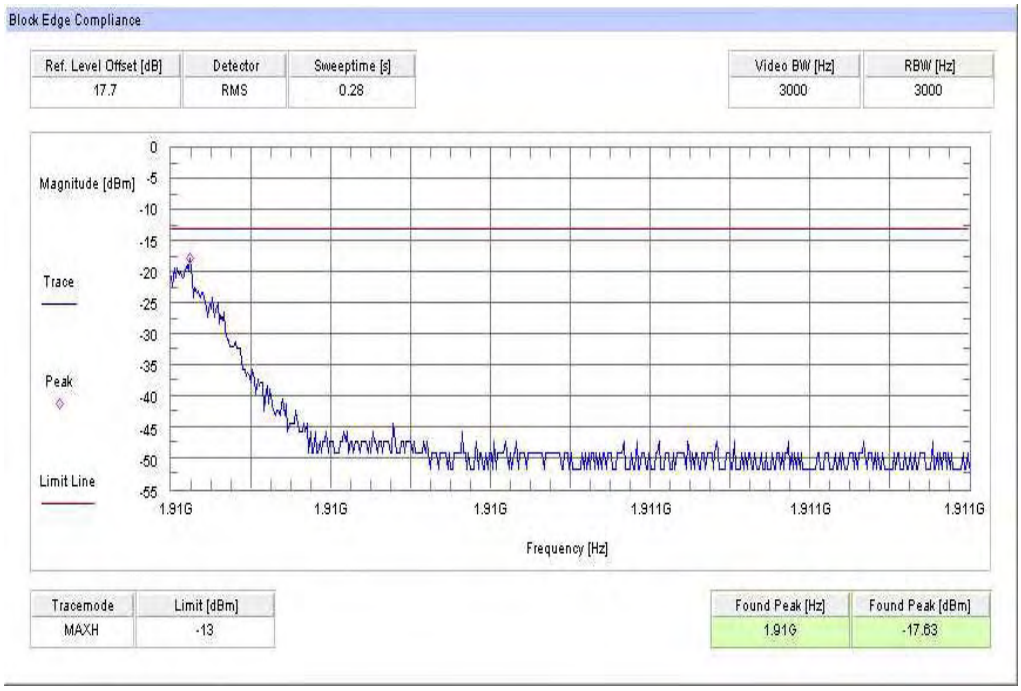
| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1051 | RSS 133, Issue 5, Section 6.5 |
| Block Edge Compliance | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

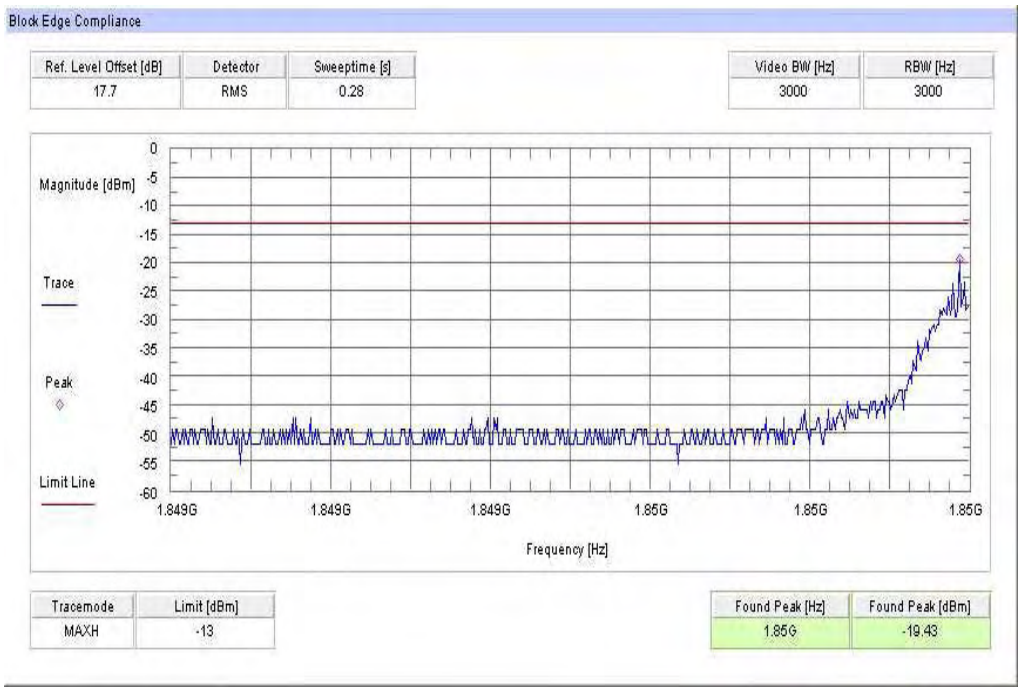
**Plot 1: Channel 512 (GSM-mode)**



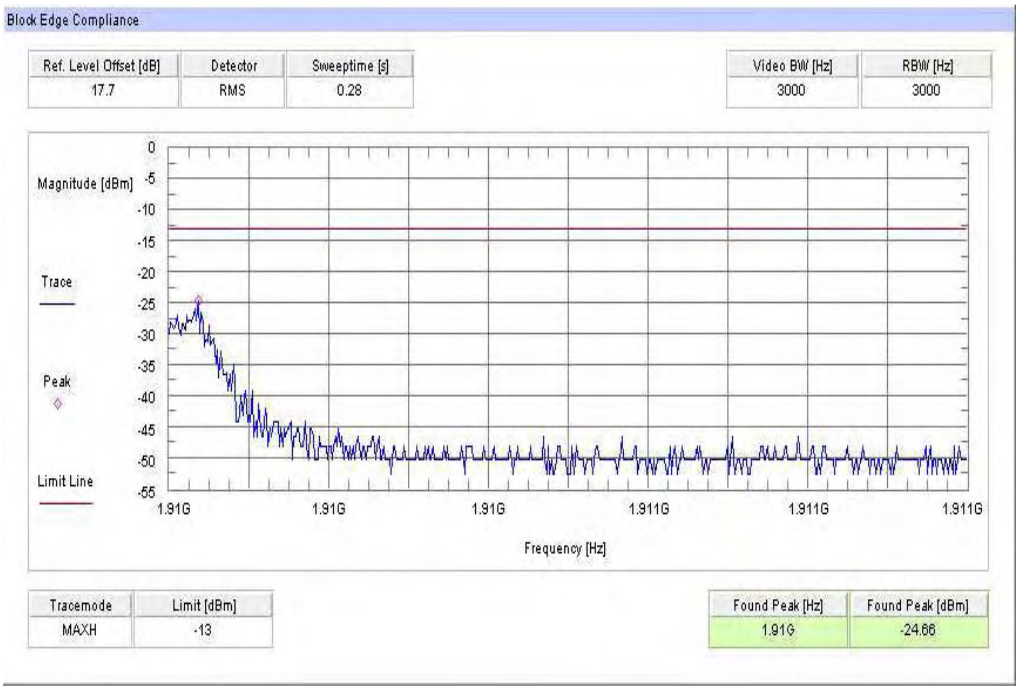

**Plot 2: Channel 810 (GSM-mode)**



**Plot 3: Channel 512 (EDGE-mode)**




**Plot 4: Channel 810 (EDGE-mode)**




**Result:** **The result of the measurement is passed.**

## 8.4.6 Occupied bandwidth

**Description:**

Measurement of the occupied bandwidth of the transmitted signal.

**Measurement:**

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the PCS1900 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 24.238 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 300 kHz, this equates to a resolution bandwidth of at least 3.0 kHz. For this testing, a resolution bandwidth 3.0 kHz was used.

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 3 kHz |
| Resolution bandwidth: | 3 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1049 | RSS 133, Issue 5, Section 6.5 |
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

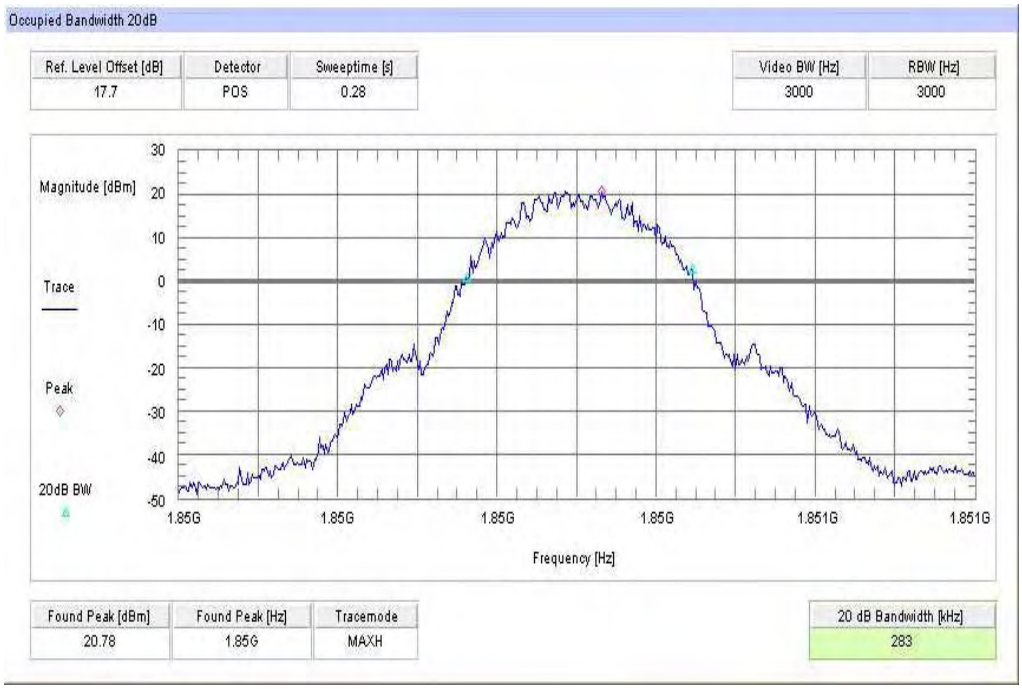
**Results:**

| Occupied Bandwidth - GMSK mode | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 1850.2 | 283 | 313 |
| 1880.0 | 271 | 311 |
| 1909.8 | 271 | 303 |
| Measurement uncertainty | ± 3 kHz | |

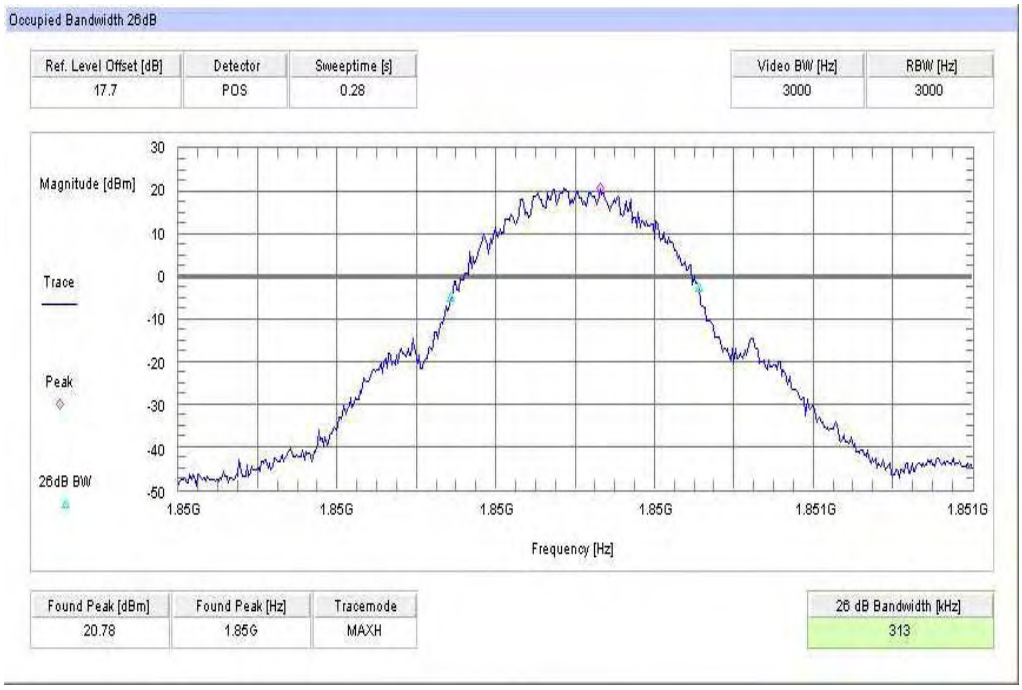
| Occupied Bandwidth - EDGE mode | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 1850.2 | 269 | 307 |
| 1880.0 | 271 | 305 |
| 1909.8 | 271 | 307 |
| Measurement uncertainty | ± 3 kHz | |

**Result:** **The result of the measurement is passed.**

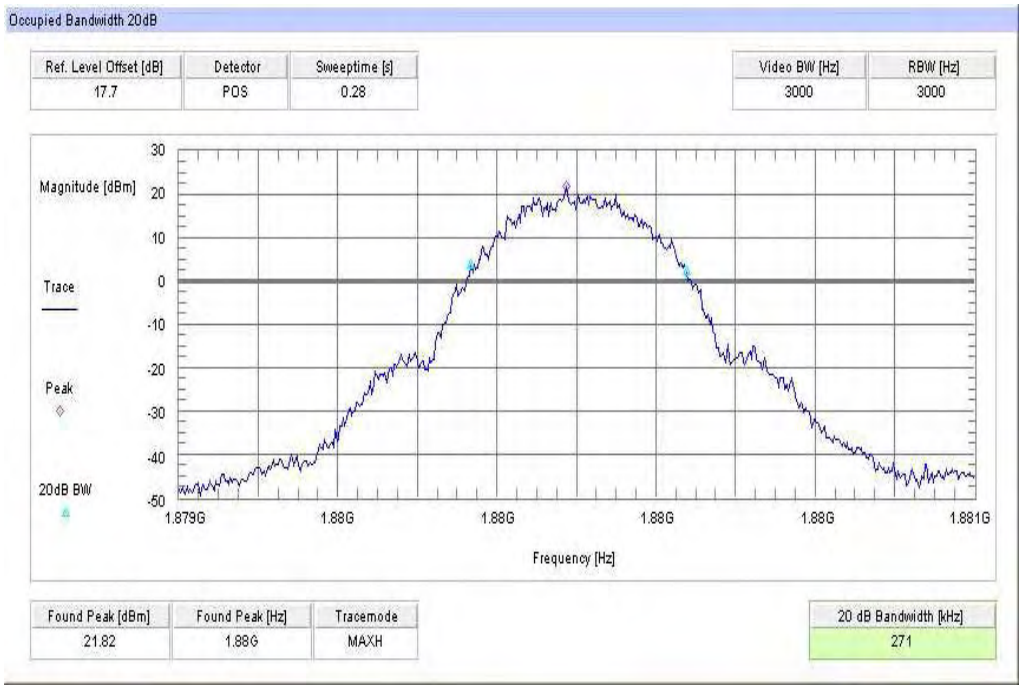
**Plot 1: Channel 512 (99% - OBW)**



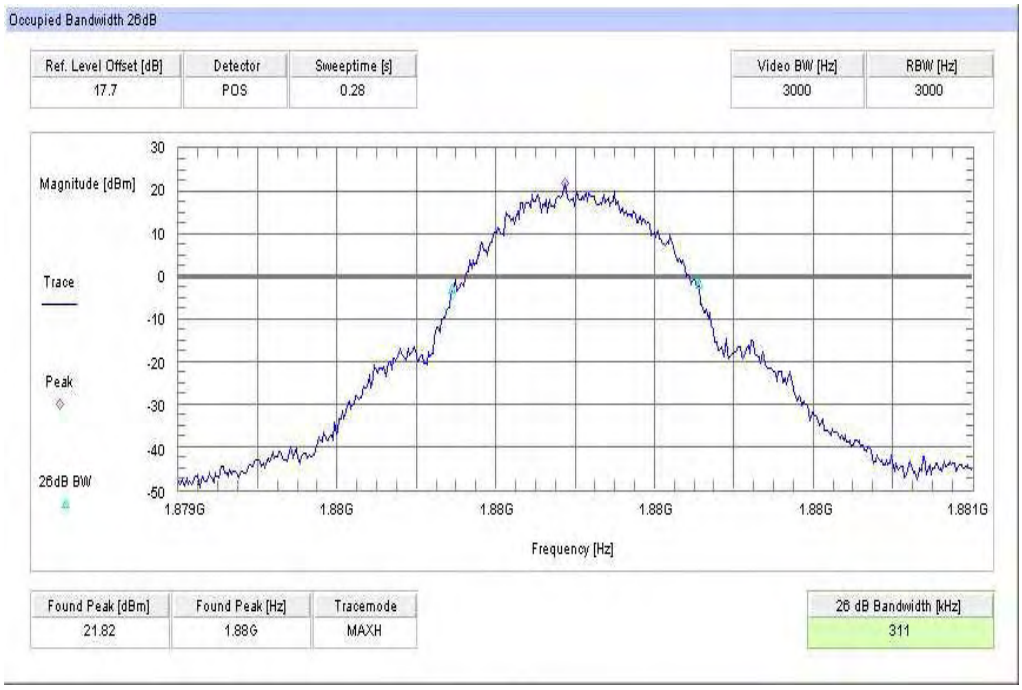

**Plot 2: Channel 512 (-26 dBc BW)**



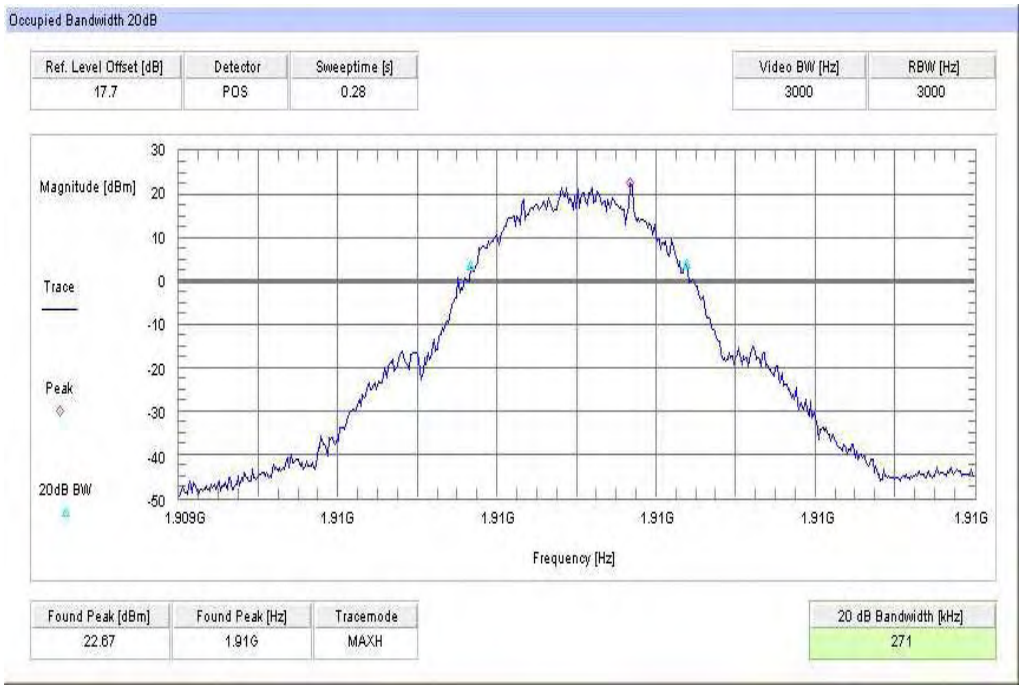
**Plot 3: Channel 661 (99% - OBW)**



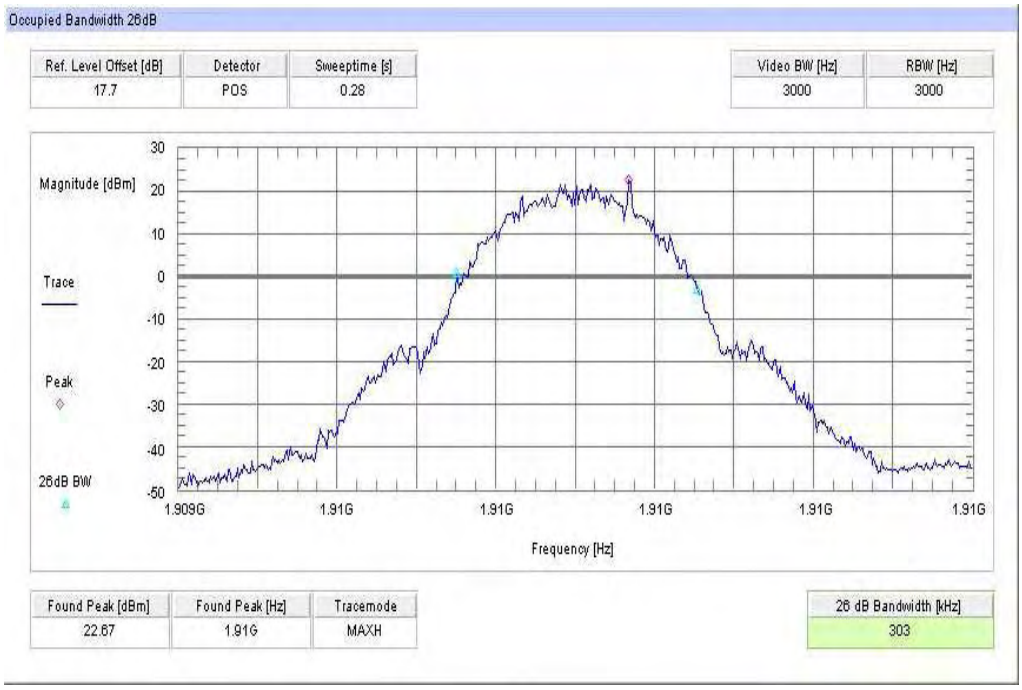

**Plot 4: Channel 661 (-26 dBc BW)**



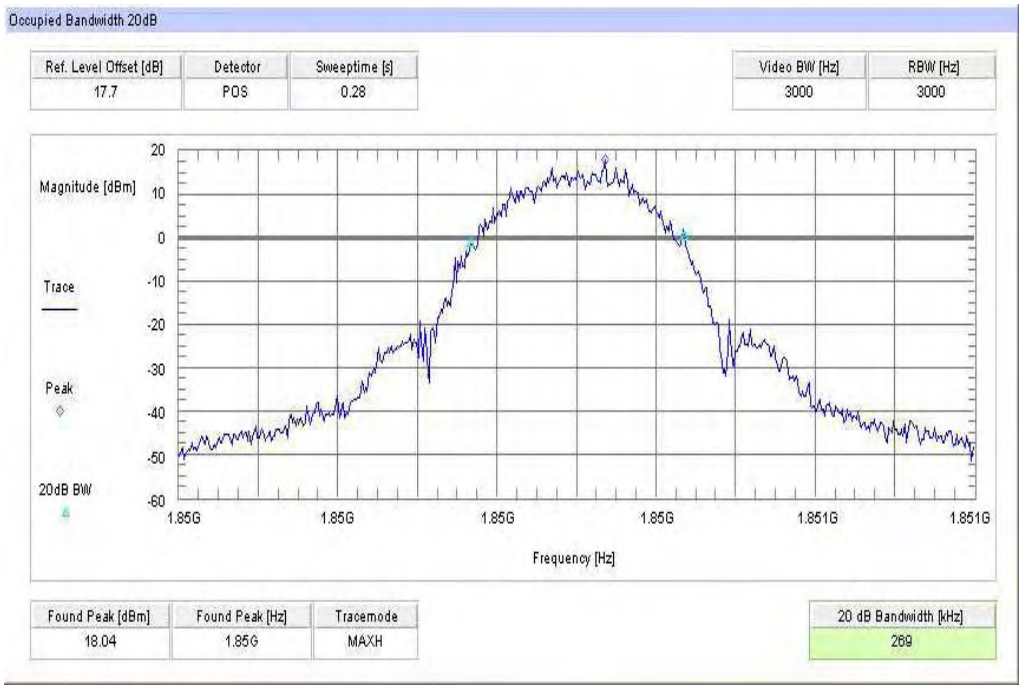
**Plot 5: Channel 810 (99% - OBW)**



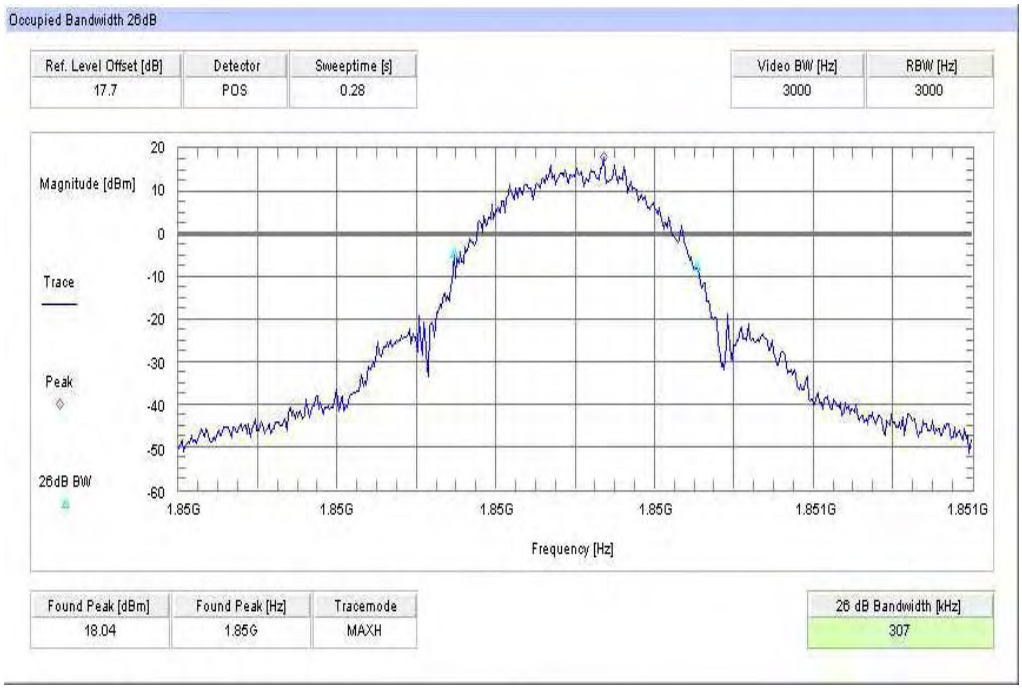

**Plot 6: Channel 810 (-26 dBc BW)**



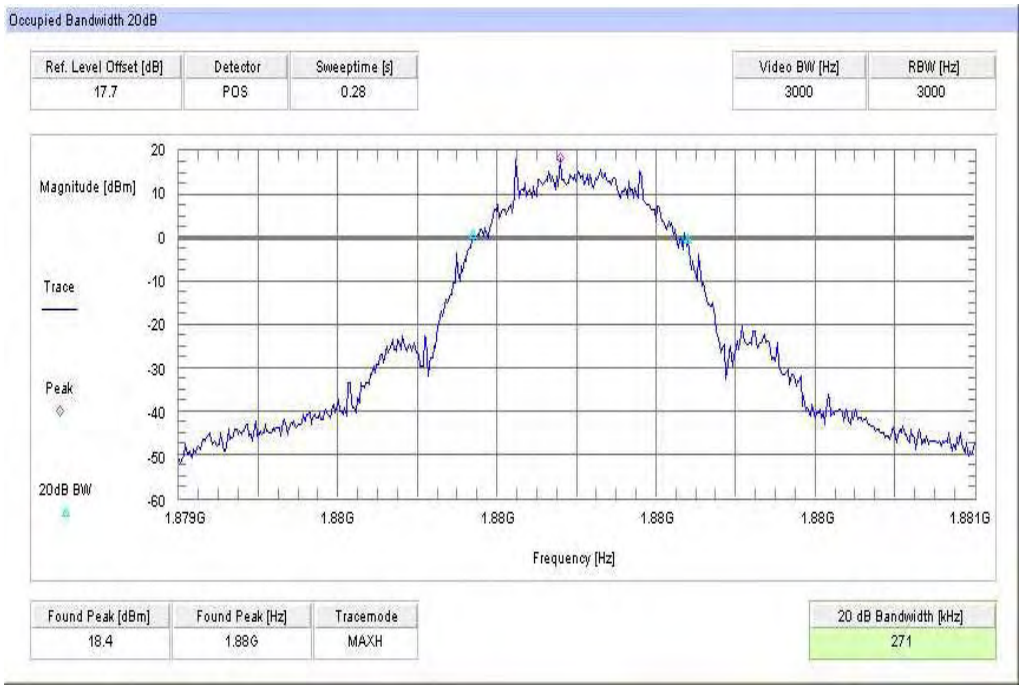
**Plot 7: Channel 512 (99% - OBW) - EDGE**



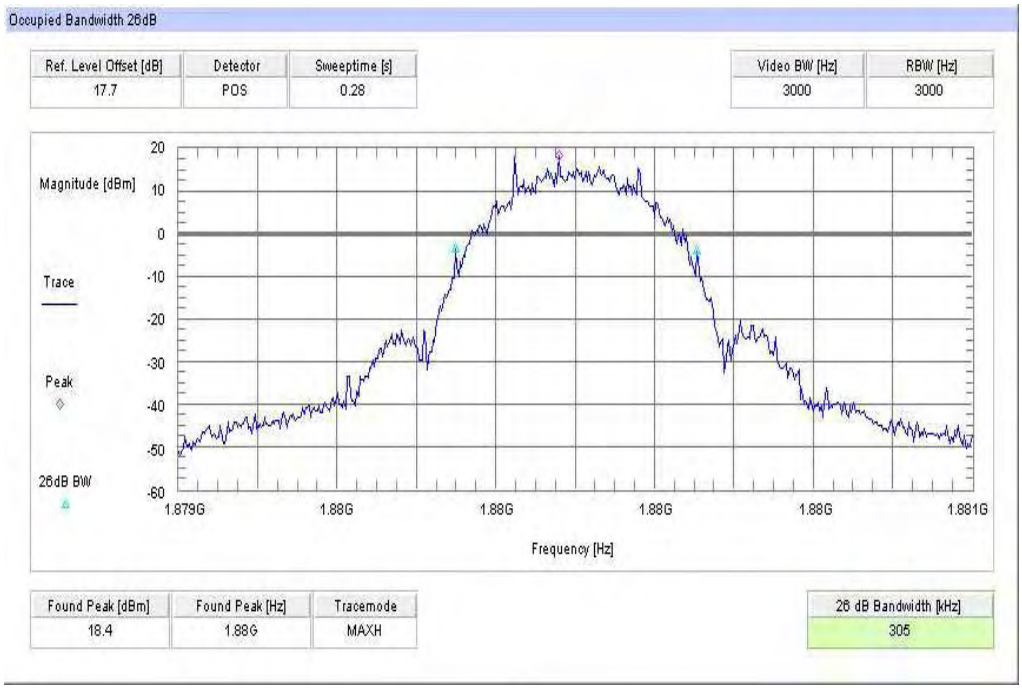

**Plot 8: Channel 512 (-26 dBc BW) - EDGE**



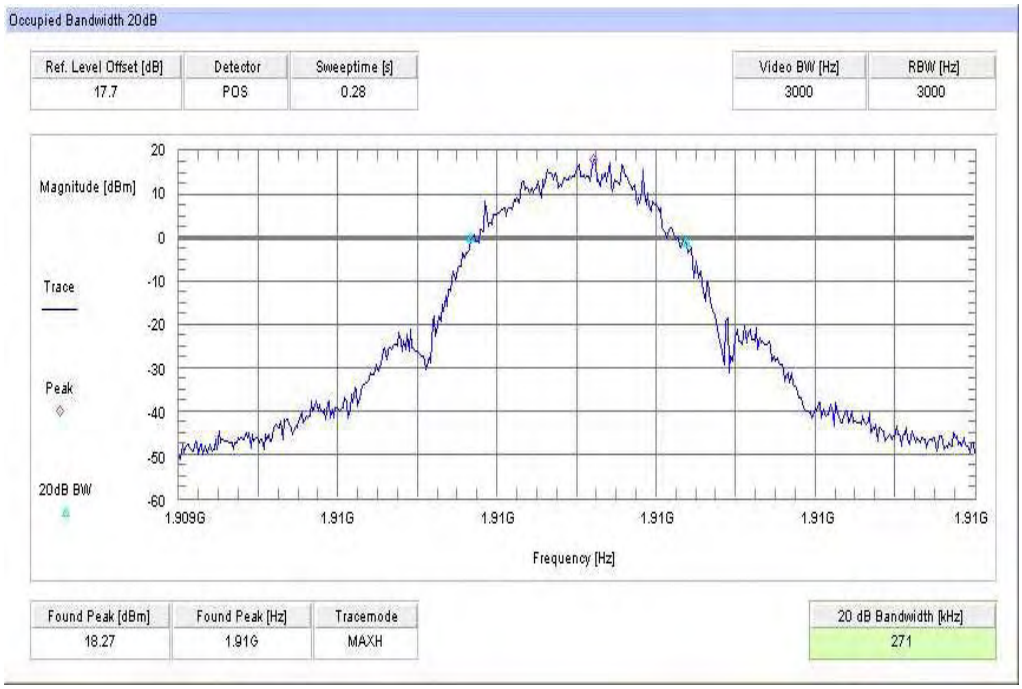
**Plot 9: Channel 661 (99% - OBW) - EDGE**



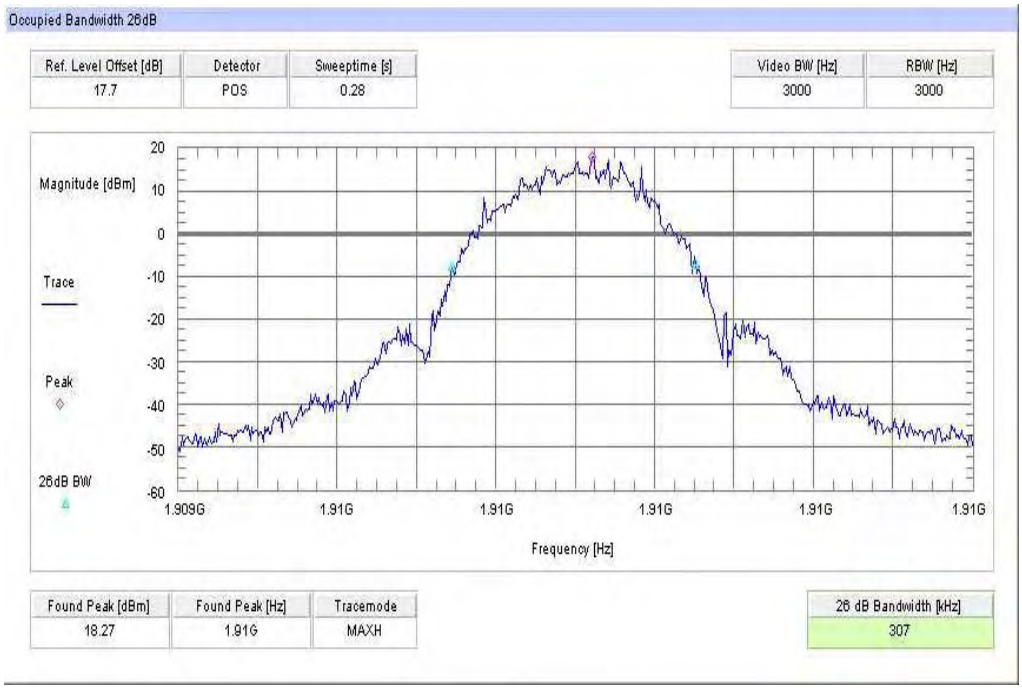

**Plot 10: Channel 661 (-26 dBc BW) - EDGE**



**Plot 11: Channel 810 (99% - OBW) - EDGE**




**Plot 12: Channel 810 (-26 dBc BW) - EDGE**



## 8.5 Results UMTS band II

All UMTS-band measurements are done in WCDMA mode only.
The connection was established with the following setup: WCDMA CS-RMC, Max Power (All Bit up)

### 8.5.1 RF output power

**Description:**

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

**Measurement:**

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

| Measurement parameters | |
|---|---|
| Detector: | Peak and RMS (Power in Burst) |
| Sweep time: | Auto |
| Video bandwidth: | 10 MHz |
| Resolution bandwidth: | 10 MHz |
| Span: | Zero Span |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.232<br>CFR Part 2.1046 | RSS 133, Issue 5, Section 6.4 |
| Nominal Peak Output Power | |
| +33.00 dBm<br>In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB. | |

**Results:**

| Output Power (conducted) WCDMA mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 1852.4 | 22.1 | 3.0 |
| 1880.0 | 22.0 | 3.1 |
| 1907.6 | 22.1 | 2.9 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (radiated) WCDMA mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) - EIRP** |
| 1852.4 | 21.6 |
| 1880.0 | 20.2 |
| 1907.6 | 19.9 |
| Measurement uncertainty | ± 2.0 dB |

**Result:** **The result of the measurement is passed.**

## 8.5.2 Frequency stability

**Description:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with $V_{nom}$, connected to the CMU200 and in a simulated call on channel 9400 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +60℃. Allow at least 1.5 hours at e ach temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with $V_{nom}$. Vary supply voltage from $V_{min}$ to $V_{max}$, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at $V_{nom}$ for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Measured with CMU200 |
| Sweep time: | |
| Video bandwidth: | |
| Resolution bandwidth: | |
| Span: | |
| Trace-Mode: | |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.235<br>CFR Part 2.1055 | RSS 133, Issue 5, Section 6.3 |
| Frequency Stability | |
| ± 0.1 ppm | |

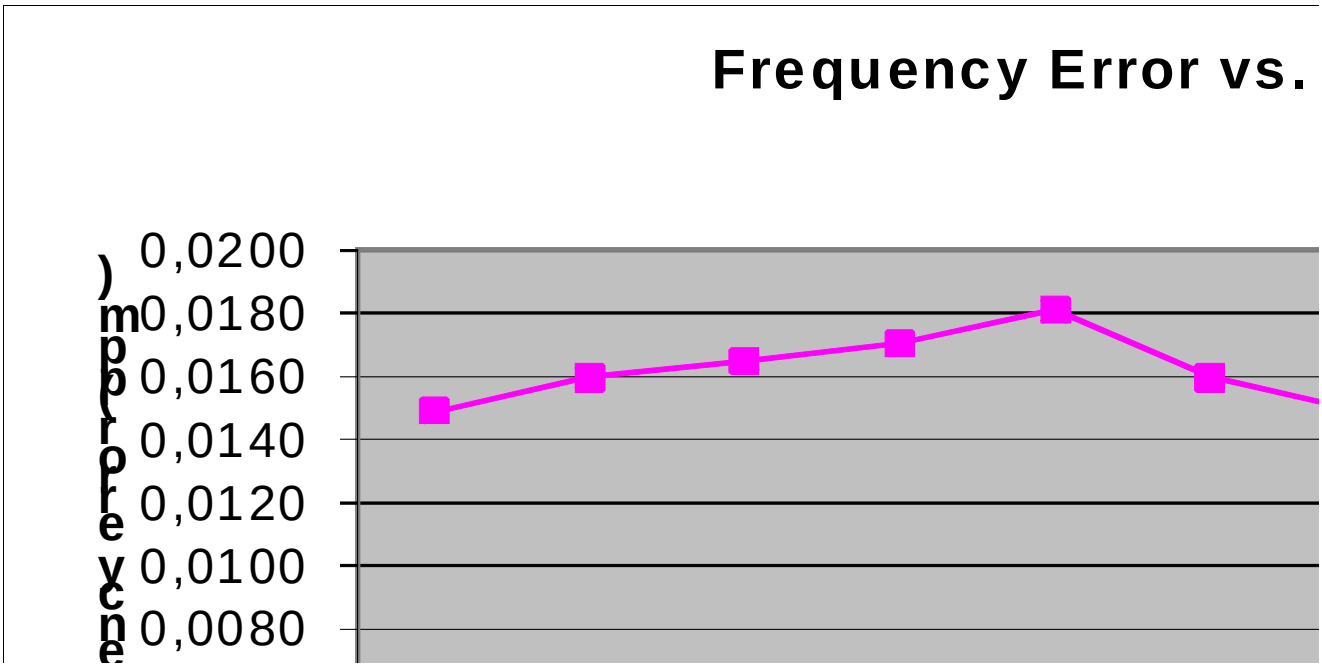
**Results:**

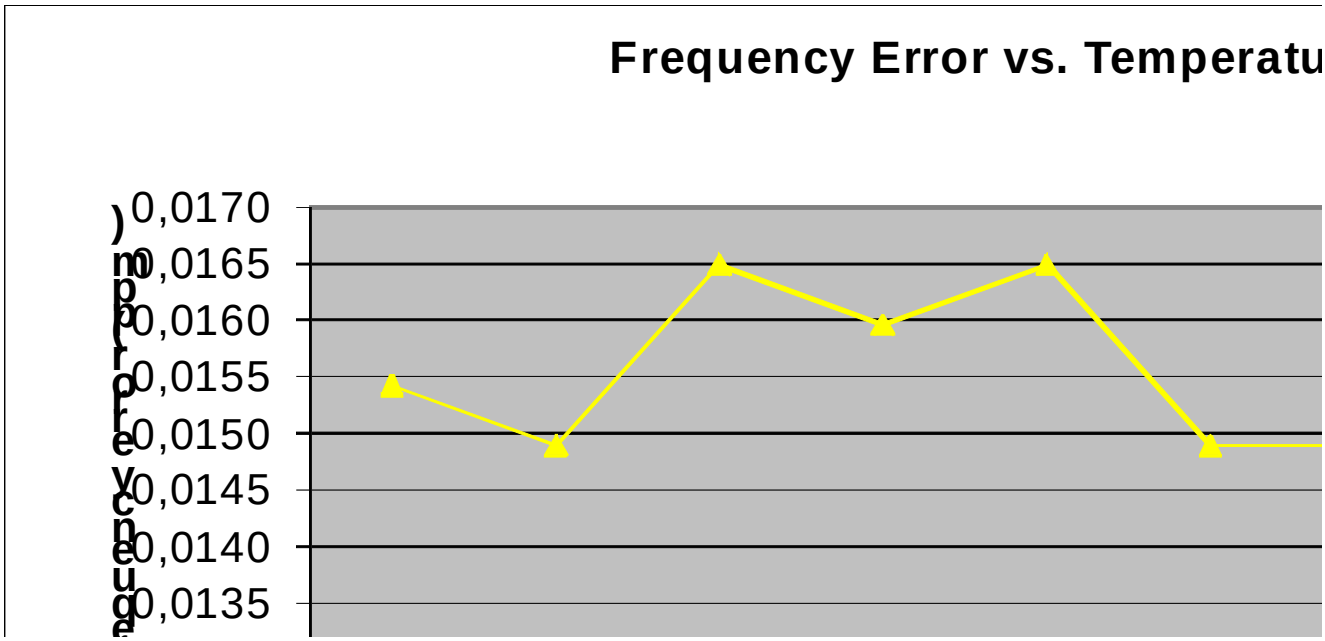
**AFC FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 3.3 | 28 | 0,00000160 | 0,0160 |
| 3.4 | 30 | 0,00000165 | 0,0165 |
| 3.5 | 31 | 0,00000170 | 0,0170 |
| 3.6 | 32 | 0,00000181 | 0,0181 |
| 3.7 | 34 | 0,00000160 | 0,0160 |
| 3.8 | 30 | 0,00000149 | 0,0149 |
| 3.9 | 28 | 0,00000154 | 0,0154 |
| 4.0 | 29 | 0,00000144 | 0,0144 |
| 4.1 | 27 | 0,00000160 | 0,0160 |
| 4.2 | 30 | 0,00000176 | 0,0176 |
| 4.3 | 33 | 0,00000186 | 0,0186 |
| 4.4 | 35 | 0,00000160 | 0,0160 |

**AFC FREQ ERROR versus TEMPERATURE**

| Temperature (℃) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | 29 | 0,00000154 | 0,0154 |
| -20 | 28 | 0,00000149 | 0,0149 |
| -10 | 31 | 0,00000165 | 0,0165 |
| ± 0 | 30 | 0,00000160 | 0,0160 |
| 10 | 31 | 0,00000165 | 0,0165 |
| 20 | 28 | 0,00000149 | 0,0149 |
| 30 | 28 | 0,00000149 | 0,0149 |
| 40 | 27 | 0,00000144 | 0,0144 |
| 50 | 26 | 0,00000138 | 0,0138 |
| 60 | 28 | 0,00000149 | 0,0149 |




**Result:** The result of the measurement is passed.

### 8.5.3 Spurious emissions radiated

**Description:**

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. This was rounded up to 20 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the UMTS band II.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603 .

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | 2 sec. |
| Video bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Resolution bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Span: | 100 MHz Steps |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1053 | RSS 133, Issue 5, Section 6.5 |
| Spurious Emissions Radiated | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the UMTS band II (1852.4 MHz, 1880.0 MHz and 1907.6 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the UMTS band II into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

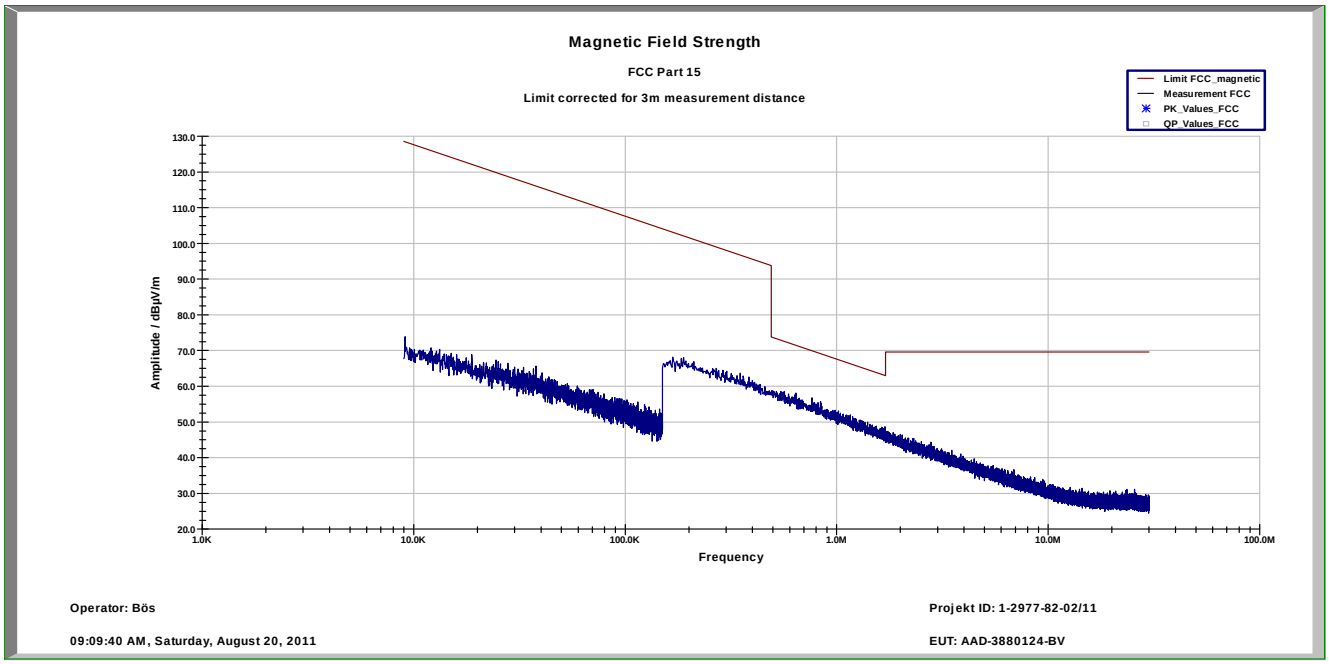
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

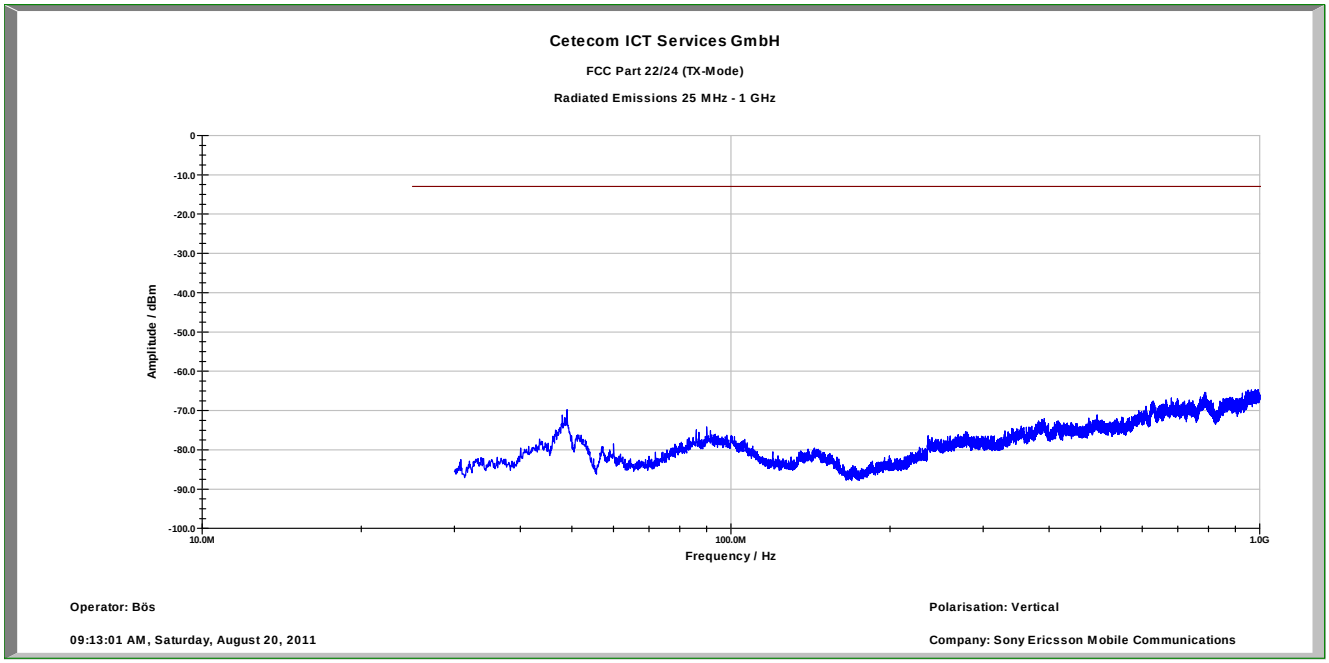
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 9262 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 9400 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 9538 Freq. (MHz) | Level [dBm] |
| 2 | 3704.8 | - | 2 | 3760.0 | - | 2 | 3815.2 | - |
| 3 | 5557.2 | - | 3 | 5640.0 | - | 3 | 5722.8 | - |
| 4 | 7409.6 | - | 4 | 7520.0 | - | 4 | 7630.4 | - |
| 5 | 9262.0 | - | 5 | 9400.0 | - | 5 | 9538.0 | - |
| 6 | 11114.4 | - | 6 | 11280.0 | - | 6 | 11445.6 | - |
| 7 | 12966.8 | - | 7 | 13160.0 | - | 7 | 13353.2 | - |
| 8 | 14819.2 | - | 8 | 15040.0 | - | 8 | 15260.8 | - |
| 9 | 16671.6 | - | 9 | 16920.0 | - | 9 | 17168.4 | - |
| 10 | 18524.0 | - | 10 | 18800.0 | - | 10 | 19076.0 | - |
| Measurement uncertainty | | | ± 3dB | | | | | |

**Result:** **The result of the measurement is passed.**

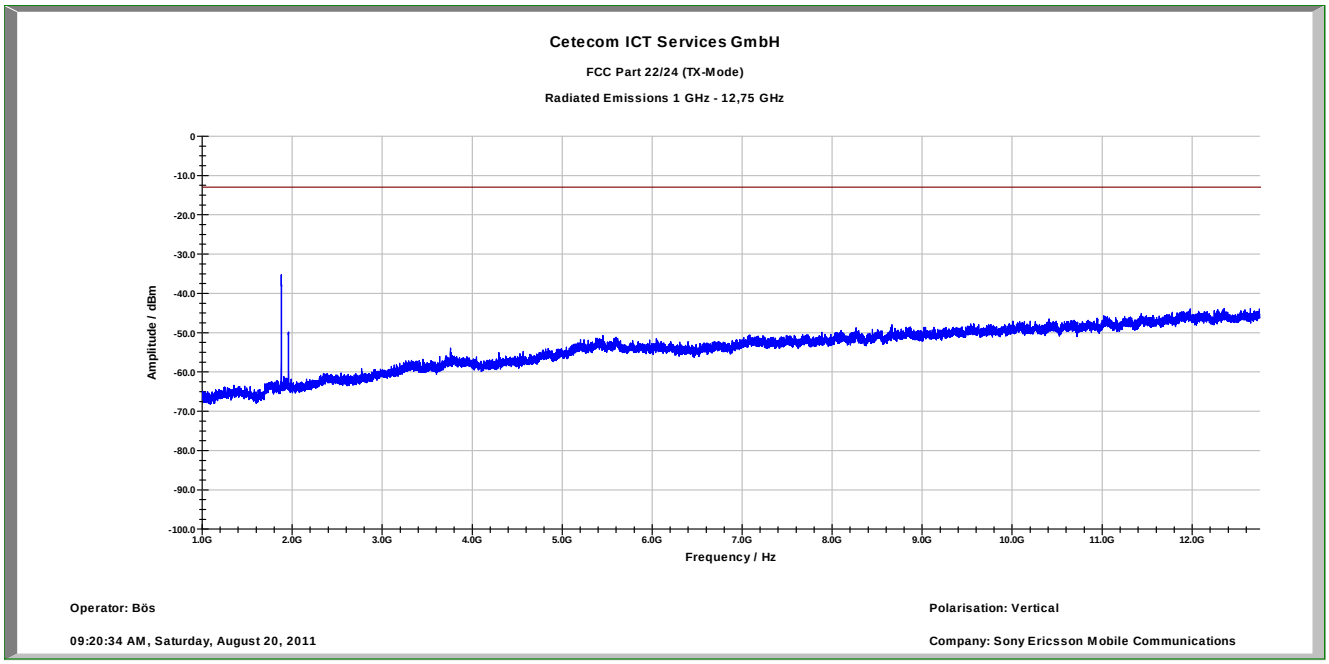
## Plot 1: Channel 9400 (Traffic mode up to 30 MHz)




## Plot 2: Channel 9400 (30 MHz - 1 GHz)

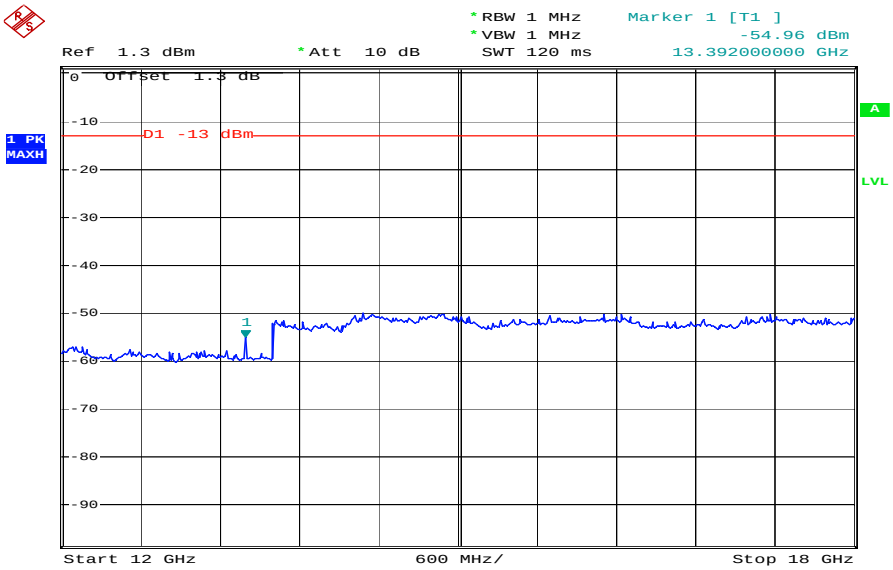


## Plot 3: Channel 9400 (1 GHz – 12.75 GHz)

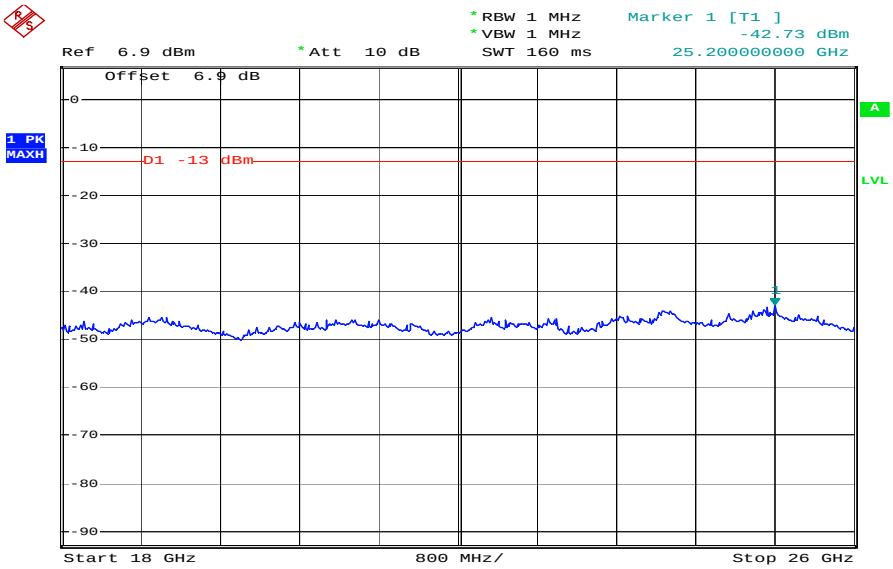



*Carrier notched with 1.9 GHz rejection filter*

## Plot 4: Channel 9400 (12 GHz - 18 GHz)



**Plot 5: Channel 9400 (18 GHz - 26 GHz)**



## 8.5.4 Spurious emissions conducted

**Description:**

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 19.1 GHz, data taken from 10 MHz to 20 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

UMTS band II Transmitter Channel Frequency
9262 1852.4 MHz
9400 1880.0 MHz
9538 1907.6 MHz

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Resolution bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Span: | 10 MHz – 25 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

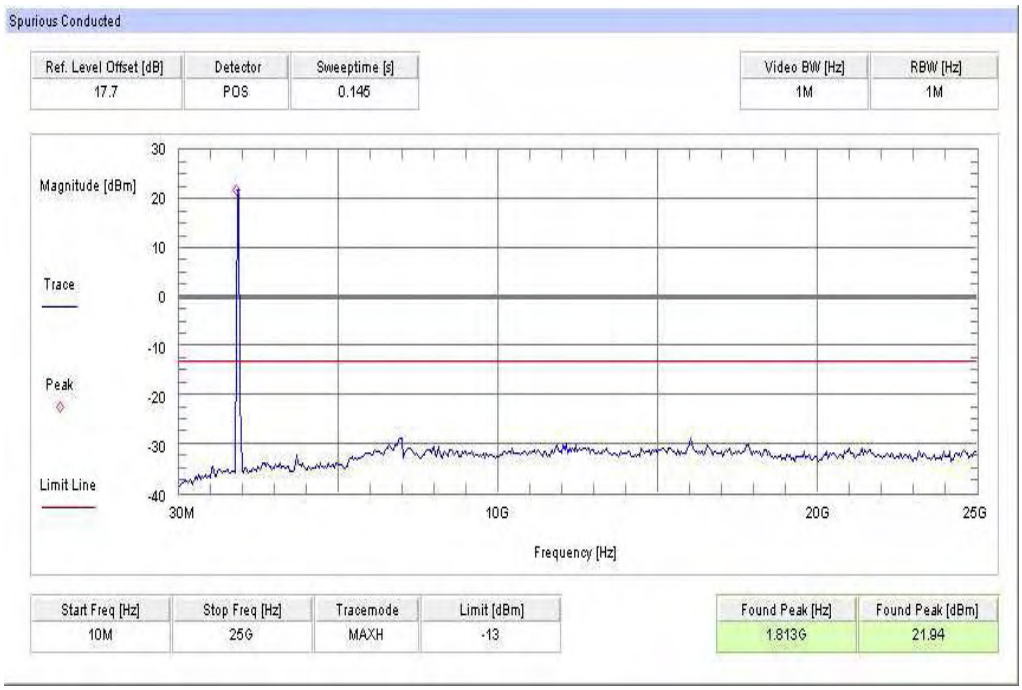
| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1051 | RSS 133, Issue 5, Section 6.5 |
| Spurious Emissions Conducted | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

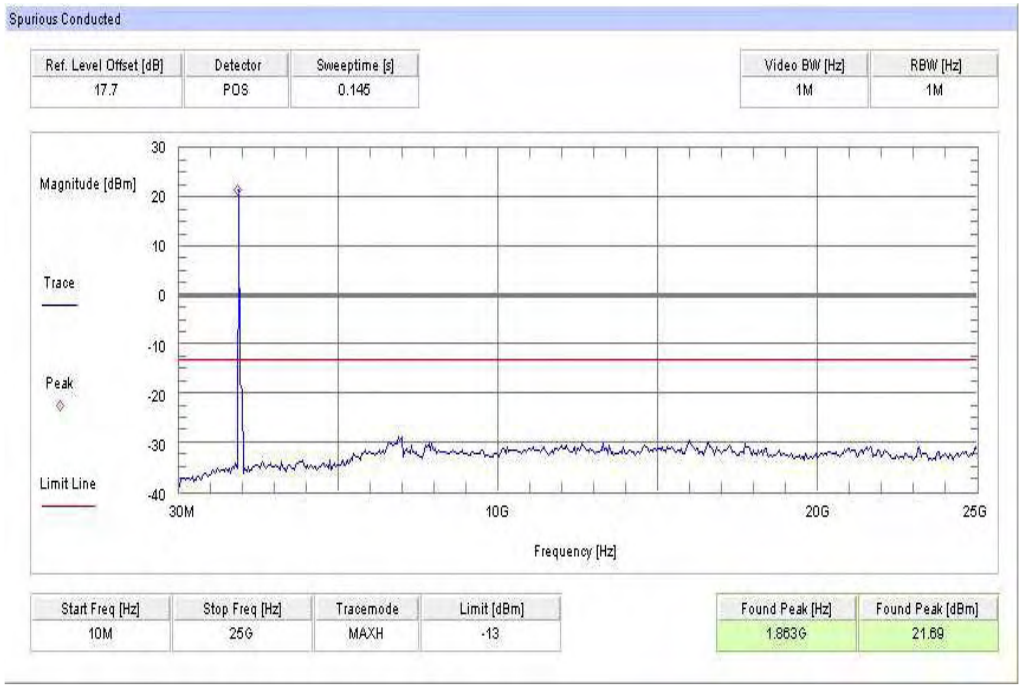
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 9262 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 9400 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 9538 Freq. (MHz) | Level [dBm] |
| 2 | 3704.8 | - | 2 | 3760.0 | - | 2 | 3815.2 | - |
| 3 | 5557.2 | - | 3 | 5640.0 | - | 3 | 5722.8 | - |
| 4 | 7409.6 | - | 4 | 7520.0 | - | 4 | 7630.4 | - |
| 5 | 9262.0 | - | 5 | 9400.0 | - | 5 | 9538.0 | - |
| 6 | 11114.4 | - | 6 | 11280.0 | - | 6 | 11445.6 | - |
| 7 | 12966.8 | - | 7 | 13160.0 | - | 7 | 13353.2 | - |
| 8 | 14819.2 | - | 8 | 15040.0 | - | 8 | 15260.8 | - |
| 9 | 16671.6 | - | 9 | 16920.0 | - | 9 | 17168.4 | - |
| 10 | 18524.0 | - | 10 | 18800.0 | - | 10 | 19076.0 | - |
| Measurement uncertainty | | | | ± 3dB | | | | |

**Result:** **The result of the measurement is passed.**

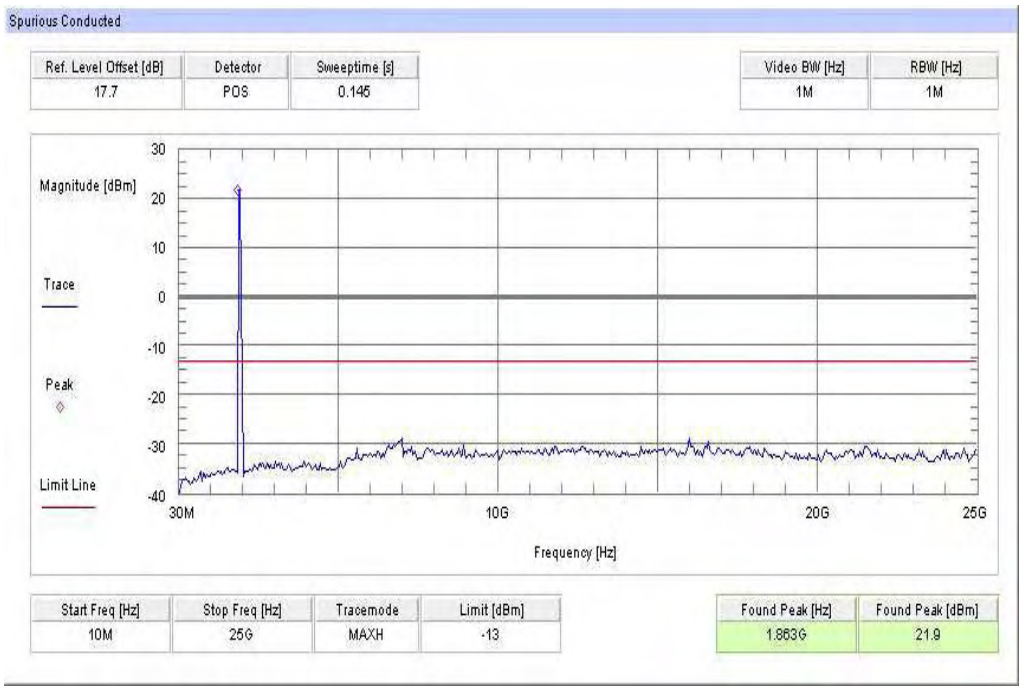
**Plot 1: Channel 9262 (10 MHz - 25 GHz)**




**Plot 2: Channel 9400 (10 MHz - 25 GHz)**



**Plot 3: Channel 9538 (10 MHz - 25 GHz)**



### 8.5.5 Block edge compliance

**Description:**

The spectrum at the band edges must comply with the spurious emissions limits.

**Measurement:**

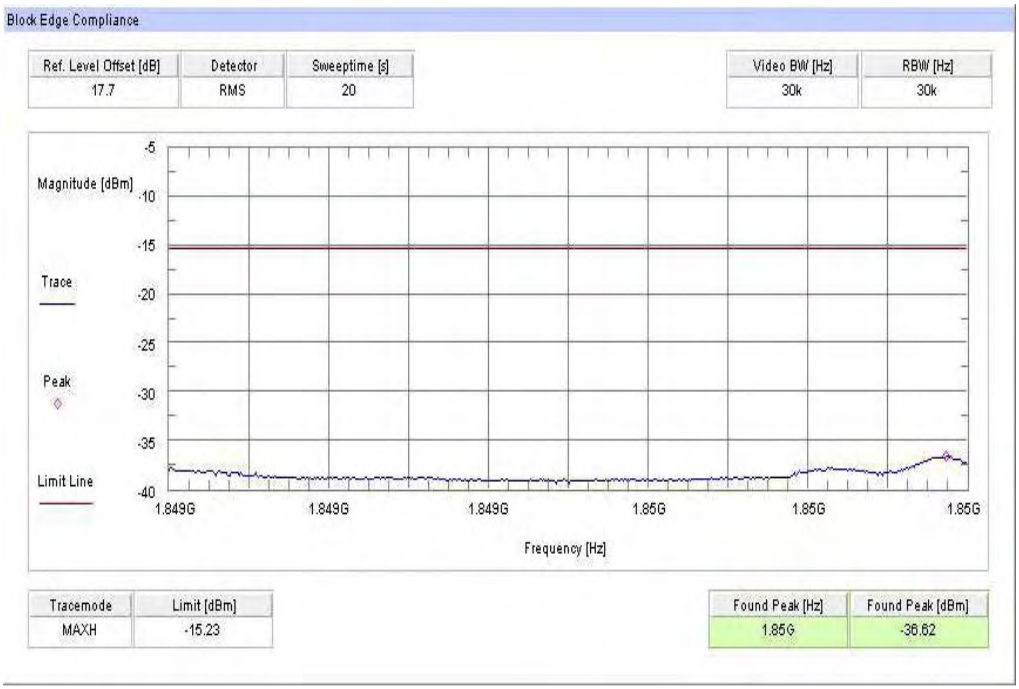
| Measurement parameters | |
|---|---|
| Detector: | RMS |
| Sweep time: | 20 sec. |
| Video bandwidth: | 30 kHz |
| Resolution bandwidth: | 30 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

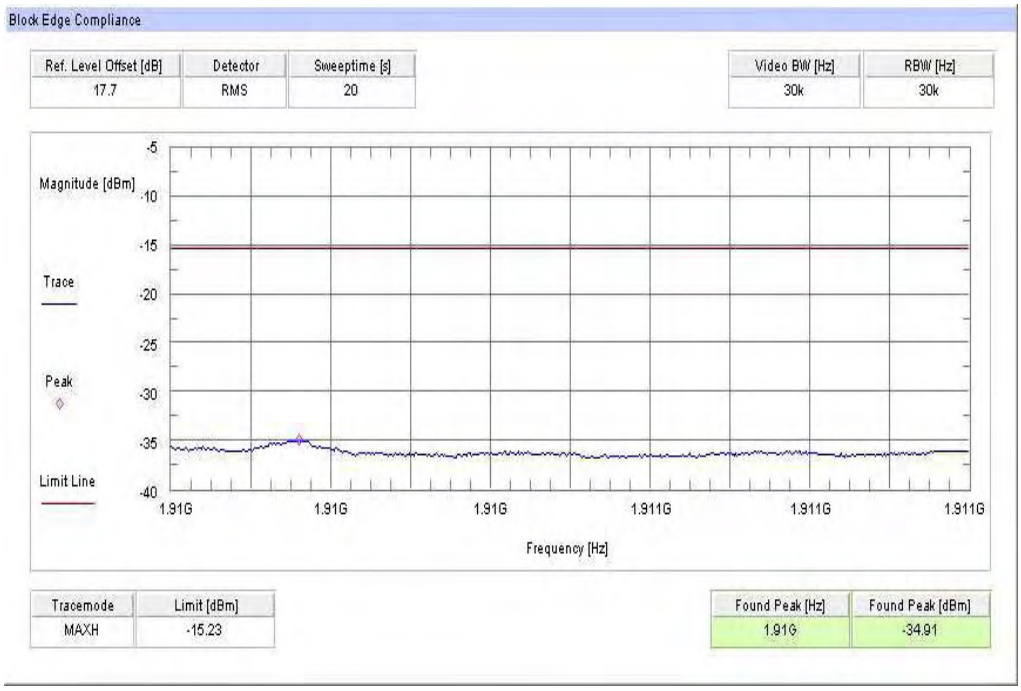
| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1051 | RSS 133, Issue 5, Section 6.5 |
| Block Edge Compliance | |
| Part 24.238 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.”<br><br>However, in publication number 890810, The FCC Office of Engineering and Technology specified the following correction to the limits when a resolution bandwidth smaller than 1% of the emission bandwidth is used:<br><br>“An alternative is to add an additional correction factor of 10 Log (RBW1/ RBW2) to the 43 +10 Log (P) limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is either the 1% emissions bandwidth or 1 MHz.”<br><br>When using a 30 kHz bandwidth, this yields a -2.2185 adjustment to the limit [10log(30kHz/50kHz) = -2.2185]. When this adjustment is applied to the limit, the limit becomes -15.2185. | |
| -15.22 dBm | |

**Results:**

**Plot 1: Channel 9262**




**Plot 2: Channel 9538**




**Result:** **The result of the measurement is passed.**

## 8.5.6 Occupied bandwidth

**Description:**

Measurement of the occupied bandwidth of the transmitted signal.

**Measurement:**

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the UMTS band II frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 24.238 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 4700 kHz, this equates to a resolution bandwidth of at least 50 kHz. For this testing, a resolution bandwidth 100 kHz was used.

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 100 kHz |
| Resolution bandwidth: | 100 kHz |
| Span: | 6 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

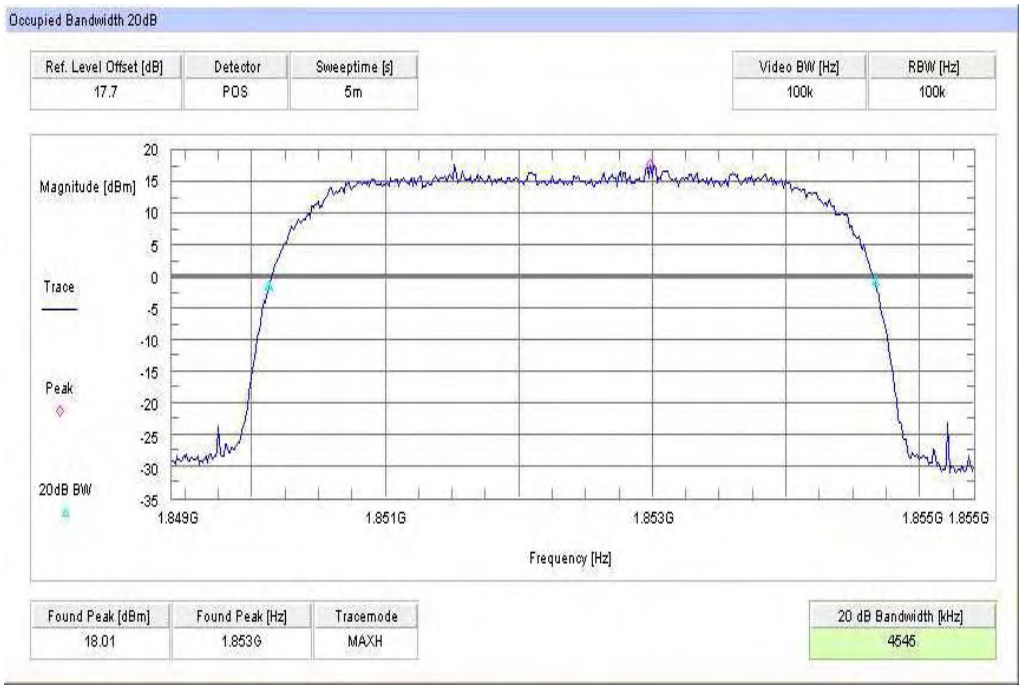
| FCC | IC |
|---|---|
| CFR Part 24.238<br>CFR Part 2.1049 | RSS 133, Issue 5, Section 6.5 |
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

**Results:**

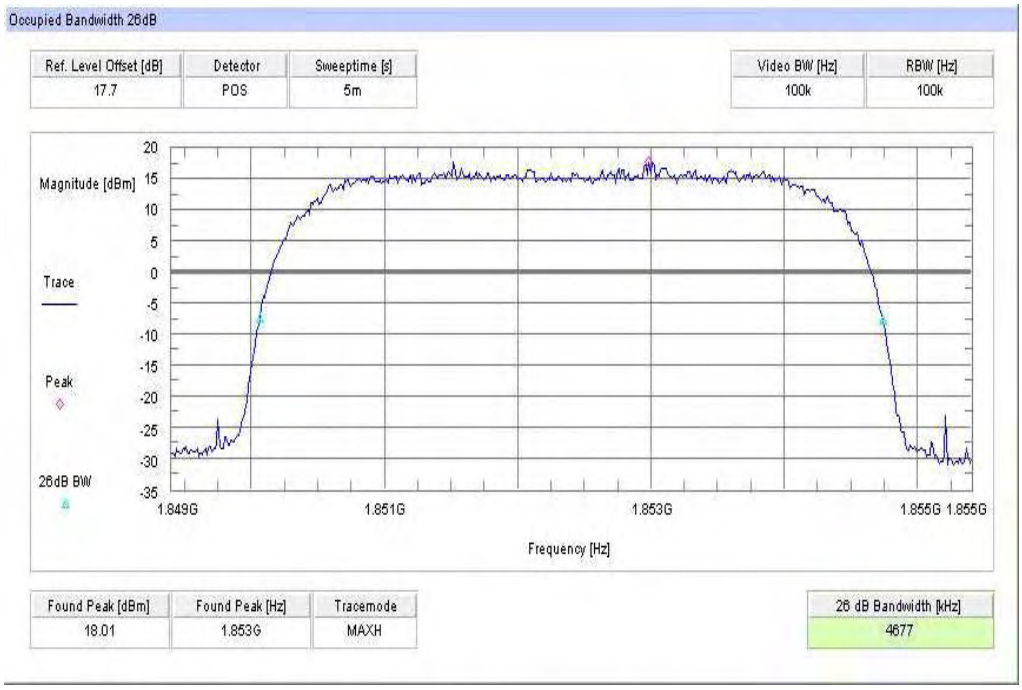
| Occupied Bandwidth | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 1852.4 | 4545 | 4677 |
| 1880.0 | 4569 | 4677 |
| 1907.6 | 4557 | 4653 |
| Measurement uncertainty | ± 100 kHz | |

**Result:** **The result of the measurement is passed.**

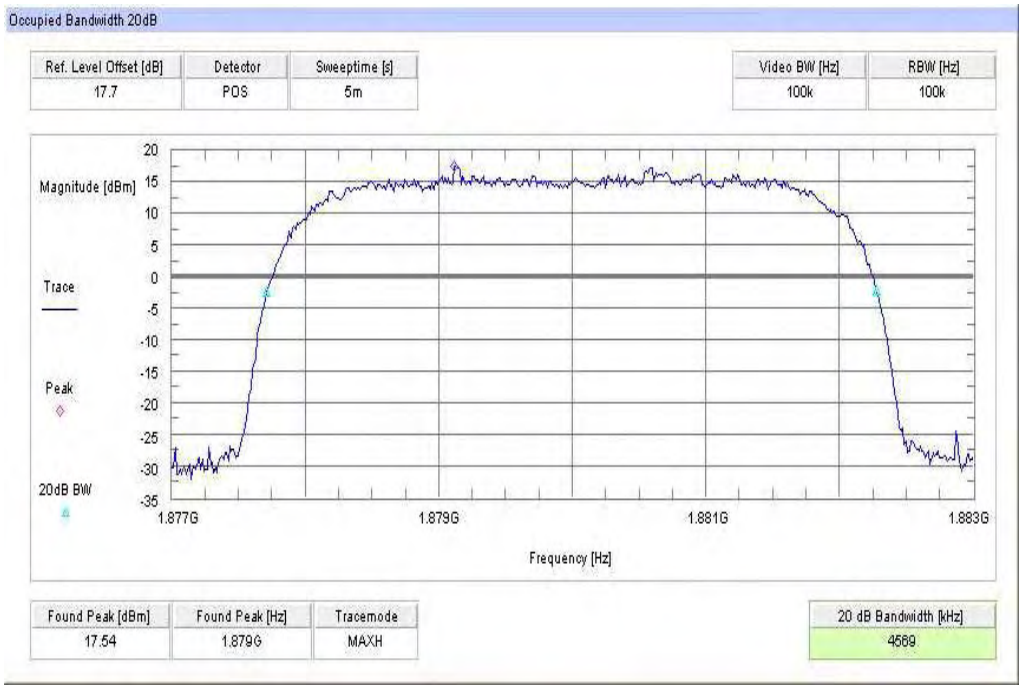
**Plot 1: Channel 9262 (99% - OBW)**



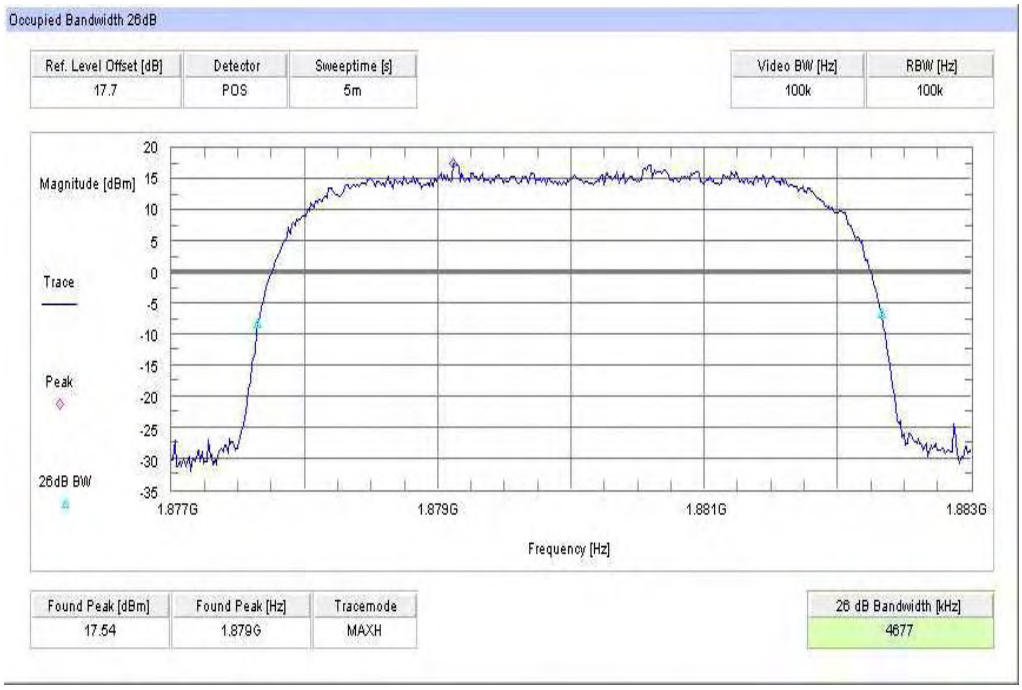

**Plot 2: Channel 9262 (-26 dBc BW)**



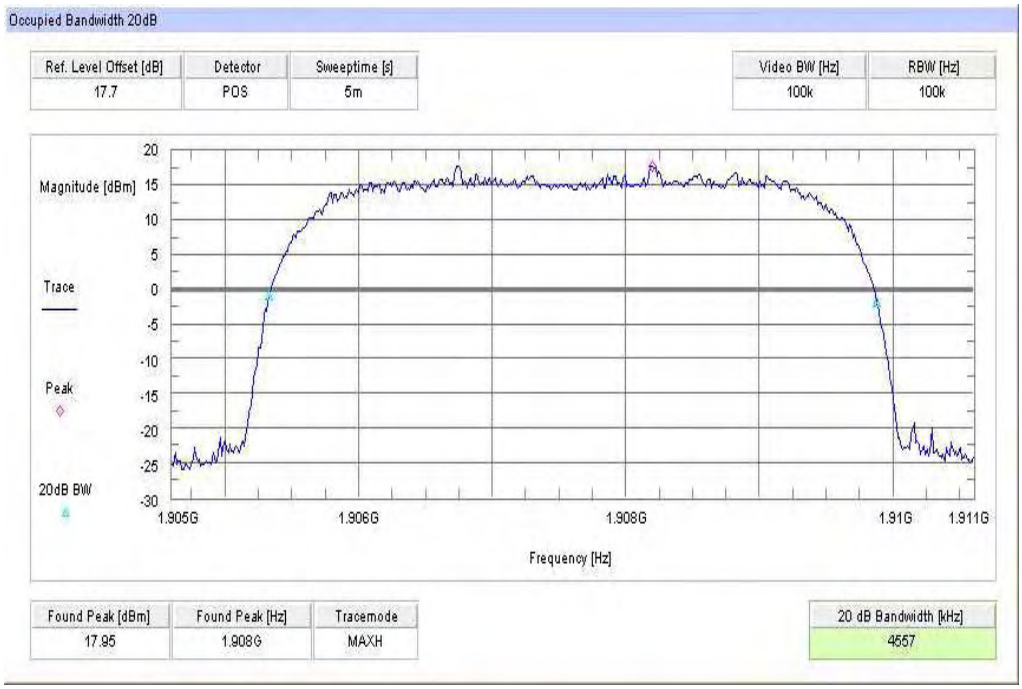
**Plot 3: Channel 9400 (99% - OBW)**



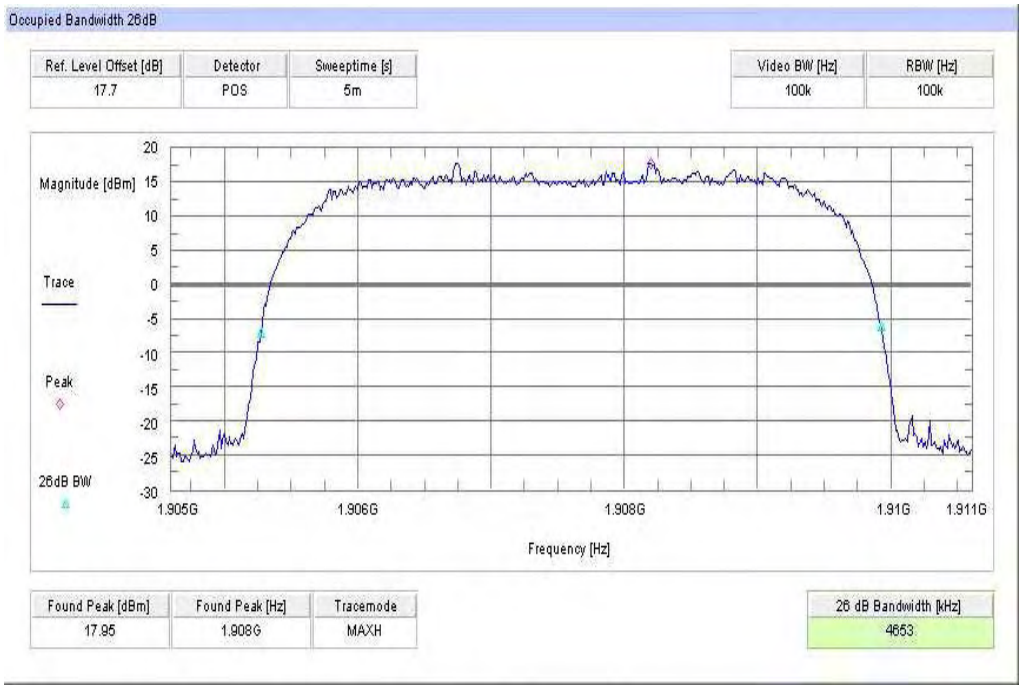

**Plot 4: Channel 9400 (-26 dBc BW)**



**Plot 5: Channel 9538 (99% - OBW)**




**Plot 6: Channel 9538 (-26 dBc BW)**



## 8.6 Results UMTS band V

All UMTS-band measurements are done in WCDMA mode only.
The connection was established with the following setup: WCDMA CS-RMC, Max Power (All Bit up)

### 8.6.1 RF output power

**Description:**

This paragraph contains average power, peak output power and ERP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

**Measurement:**

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

| Measurement parameters | |
|---|---|
| Detector: | Peak and RMS (Power in Burst) |
| Sweep time: | Auto |
| Video bandwidth: | 10 MHz |
| Resolution bandwidth: | 10 MHz |
| Span: | Zero Span |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.913<br>CFR Part 2.1046 | RSS 132, Issue 2, Section 4.4 and 6.4 |
| Nominal Peak Output Power | |
| +38.45 dBm<br>In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB. | |

**Results:**

| Output Power (conducted) WCDMA mode | | |
|---|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm)** | **Peak to Average Ratio (dB)** |
| 826.4 | 23.4 | 3.3 |
| 836.0 | 23.6 | 3.1 |
| 846.6 | 23.5 | 3.2 |
| Measurement uncertainty | ± 0.5 dB | |

| Output Power (radiated) WCDMA mode | |
|---|---|
| **Frequency (MHz)** | **Average Output Power (dBm) – ERP** |
| 826.4 | 20.1 |
| 836.0 | 21.3 |
| 846.6 | 22.1 |
| Measurement uncertainty | ± 2.0 dB |

**Result:** **The result of the measurement is passed.**

## 8.6.2 Frequency stability

**Description:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with $V_{nom}$, connected to the CMU200 and in a simulated call on channel 4180 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +60℃. Allow at least 1.5 hours at e ach temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with $V_{nom}$. Vary supply voltage from $V_{min}$ to $V_{max}$, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at $V_{nom}$ for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Measured with CMU200 |
| Sweep time: | |
| Video bandwidth: | |
| Resolution bandwidth: | |
| Span: | |
| Trace-Mode: | |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.355<br>CFR Part 2.1055 | RSS 132, Issue 2, Section 4.3 and 6.3 |
| Frequency Stability | |
| ± 0.1 ppm | |

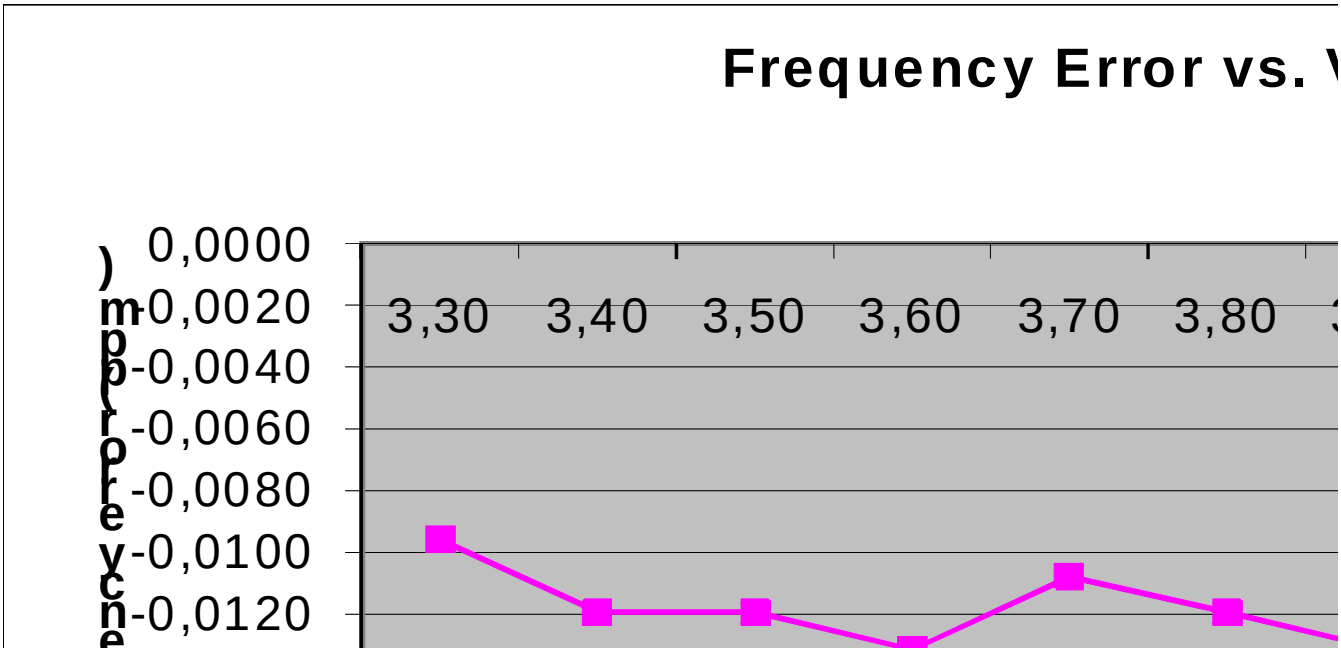
**Results:**

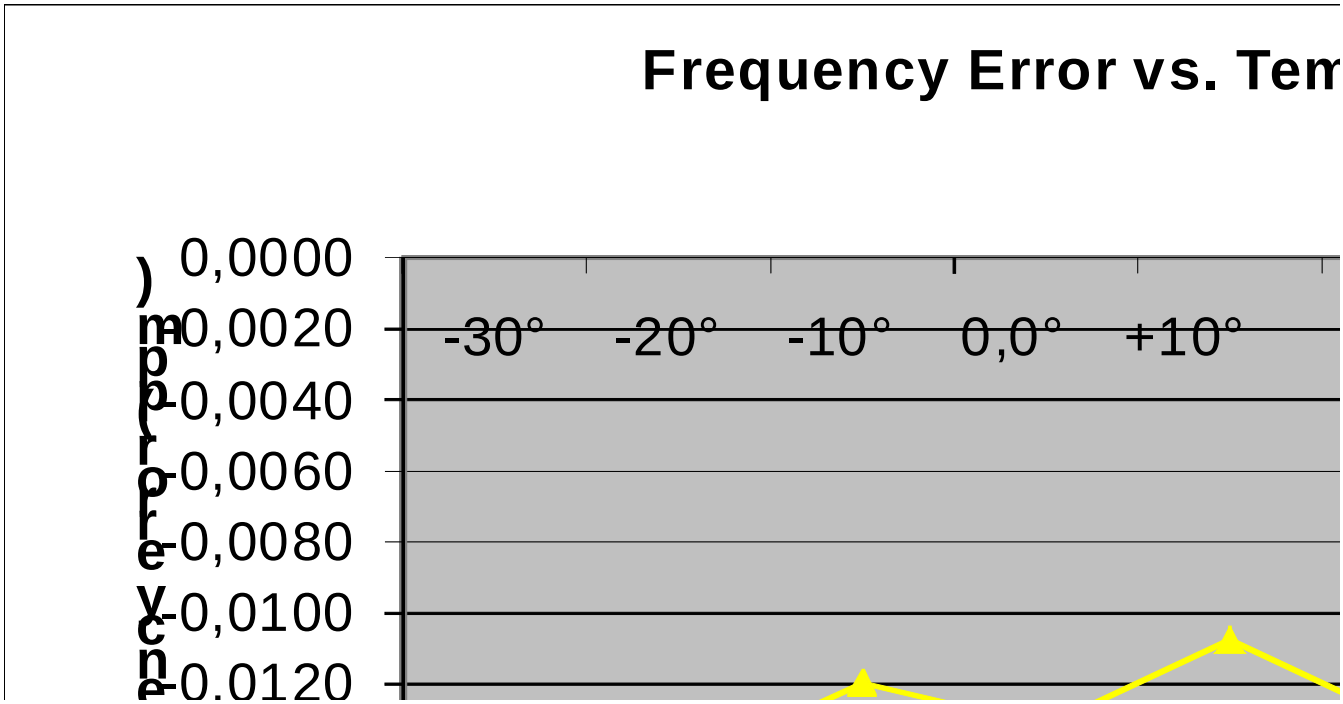
**AFC FREQ ERROR versus VOLTAGE**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 3.3 | -8 | -0,00000096 | -0,0096 |
| 3.4 | -10 | -0,00000120 | -0,0120 |
| 3.5 | -10 | -0,00000120 | -0,0120 |
| 3.6 | -11 | -0,00000132 | -0,0132 |
| 3.7 | -9 | -0,00000108 | -0,0108 |
| 3.8 | -10 | -0,00000120 | -0,0120 |
| 3.9 | -11 | -0,00000132 | -0,0132 |
| 4.0 | -13 | -0,00000156 | -0,0156 |
| 4.1 | -12 | -0,00000144 | -0,0144 |
| 4.2 | -12 | -0,00000144 | -0,0144 |
| 4.3 | -14 | -0,00000167 | -0,0167 |
| 4.4 | -15 | -0,00000179 | -0,0179 |

**AFC FREQ ERROR versus TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -14 | -0,00000167 | -0,0167 |
| -20 | -12 | -0,00000144 | -0,0144 |
| -10 | -10 | -0,00000120 | -0,0120 |
| ± 0 | -11 | -0,00000132 | -0,0132 |
| 10 | -9 | -0,00000108 | -0,0108 |
| 20 | -11 | -0,00000132 | -0,0132 |
| 30 | -9 | -0,00000108 | -0,0108 |
| 40 | -12 | -0,00000144 | -0,0144 |
| 50 | -10 | -0,00000120 | -0,0120 |
| 60 | -12 | -0,00000144 | -0,0144 |




**Result:** The result of the measurement is passed.

## 8.6.3 Spurious emissions radiated

**Description:**

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 846.6 MHz. This was rounded up to 12 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the UMTS band V.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603 .

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | 2 sec. |
| Video bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Resolution bandwidth: | Below 1 GHz: 100 kHz<br>Above 1 GHz: 1 MHz |
| Span: | 100 MHz Steps |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1053 | RSS 132, Issue 2, Section 4.5 and 6.5 |
| Spurious Emissions Radiated | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the UMTS band V (826.4 MHz, 836.0 MHz and 846.6 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the UMTS band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

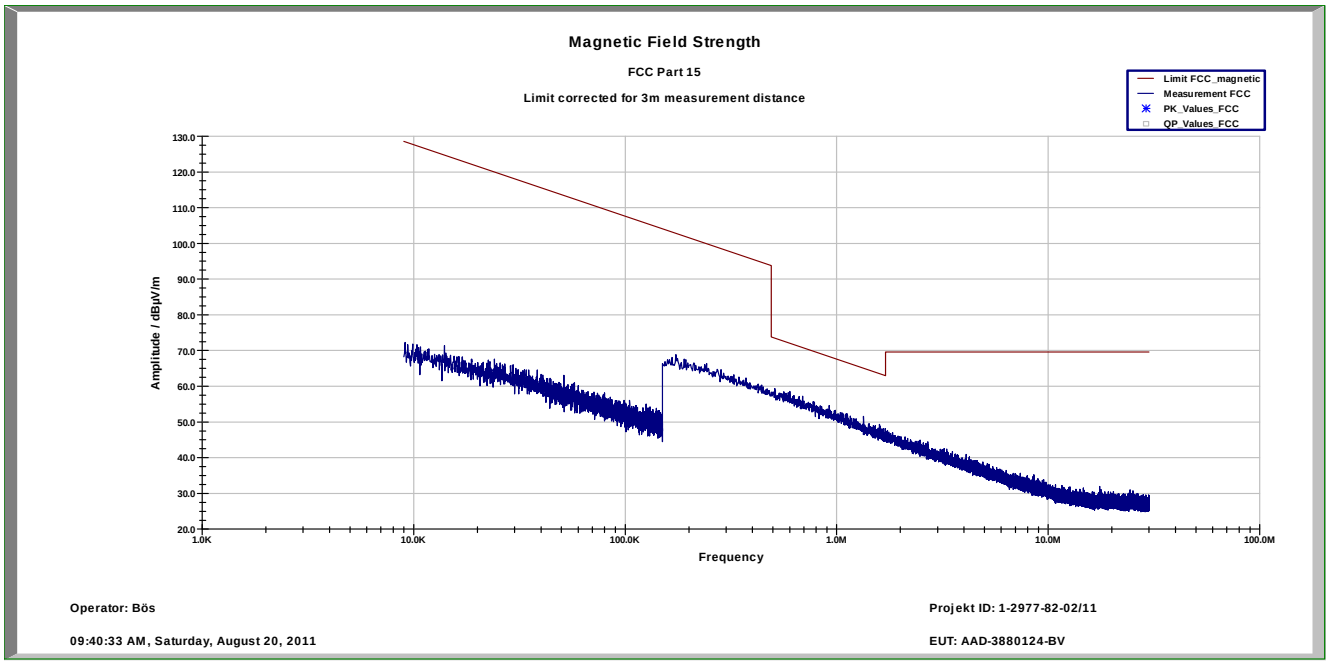
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

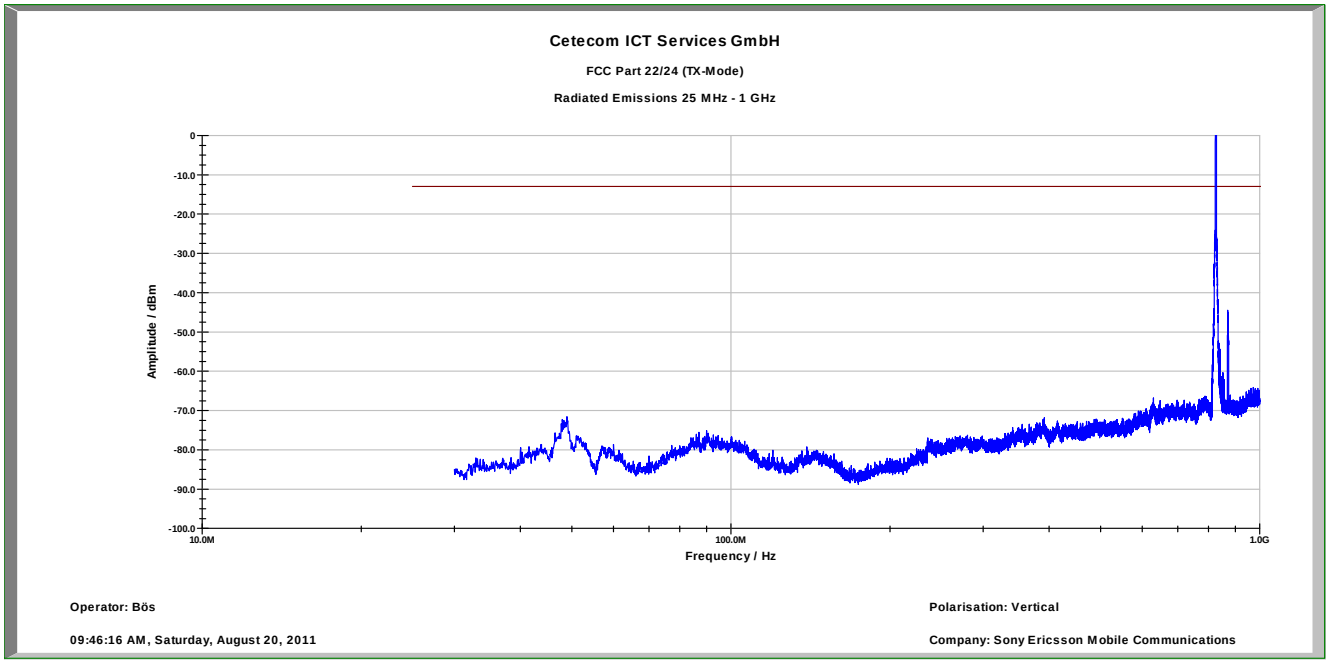
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 4132 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 4180 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 4233 Freq. (MHz) | Level [dBm] |
| 2 | 1652.8 | - | 2 | 1672.0 | - | 2 | 1693.2 | - |
| 3 | 2479.2 | - | 3 | 2508.0 | - | 3 | 2539.8 | - |
| 4 | 3305.6 | - | 4 | 3344.0 | - | 4 | 3386.4 | - |
| 5 | 4132.0 | - | 5 | 4180.0 | - | 5 | 4233.0 | - |
| 6 | 4958.4 | - | 6 | 5016.0 | - | 6 | 5079.6 | - |
| 7 | 5784.8 | - | 7 | 5852.0 | - | 7 | 5926.2 | - |
| 8 | 6611.2 | - | 8 | 6688.0 | - | 8 | 6772.8 | - |
| 9 | 7437.6 | - | 9 | 7524.0 | - | 9 | 7619.4 | - |
| 10 | 8264.0 | - | 10 | 8360.0 | - | 10 | 8466.0 | - |
| Measurement uncertainty | | | ± 3dB | | | | | |

**Result:** **The result of the measurement is passed.**

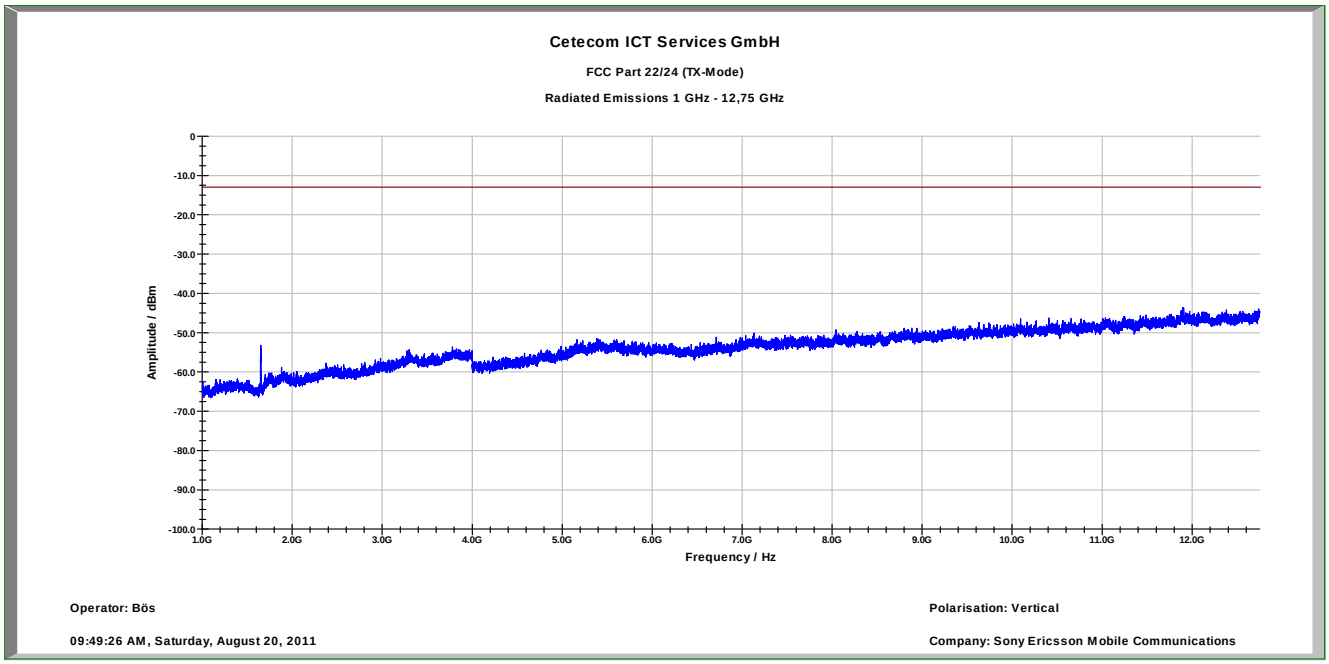
## Plot 1: Channel 4180 (Traffic mode up to 30 MHz)




## Plot 2: Channel 4180 (30 MHz - 1 GHz)



## Plot 3: Channel 4180 (1 GHz – 12.75 GHz)



## 8.6.4 Spurious emissions conducted

**Description:**

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 12 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

UMTS band V Transmitter Channel Frequency
4132 826.4 MHz
4180 836.0 MHz
4233 846.6 MHz

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Resolution bandwidth: | Pre-measurement with 1 MHz<br>On spurious detection re-measurement below 1 GHz with 100 kHz<br>Above 1 GHz with 1 MHz |
| Span: | 10 MHz – 25 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

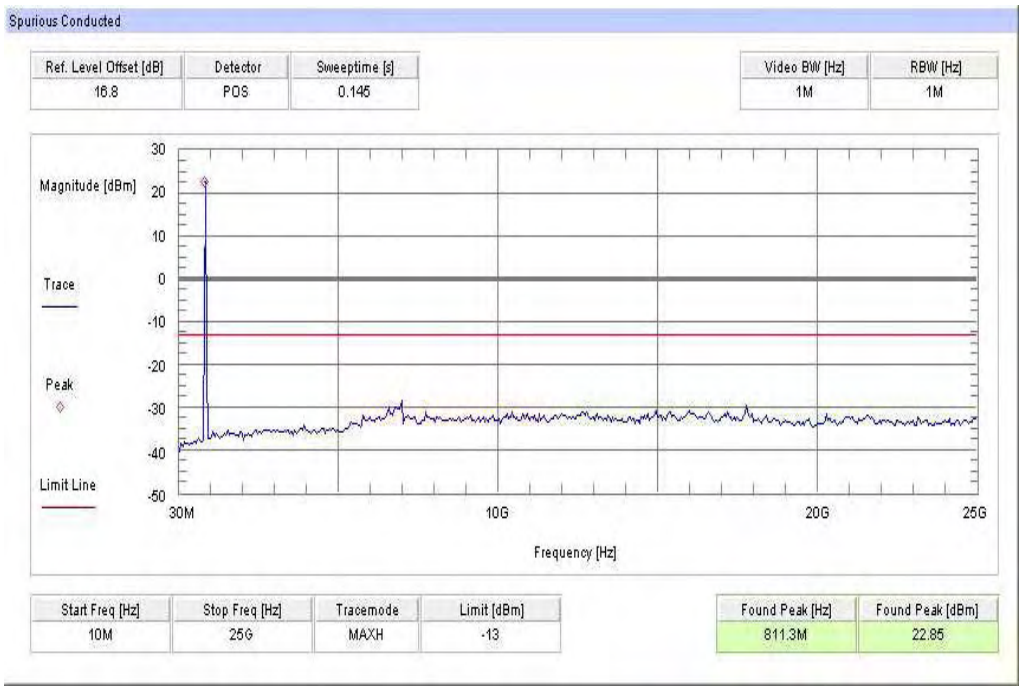
| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132, Issue 2, Section 4.5 and 6.5 |
| Spurious Emissions Conducted | |
| Attenuation ≥ 43 + 10log(P)<br>(P, Power in Watts) | |
| -13 dBm | |

**Results:**

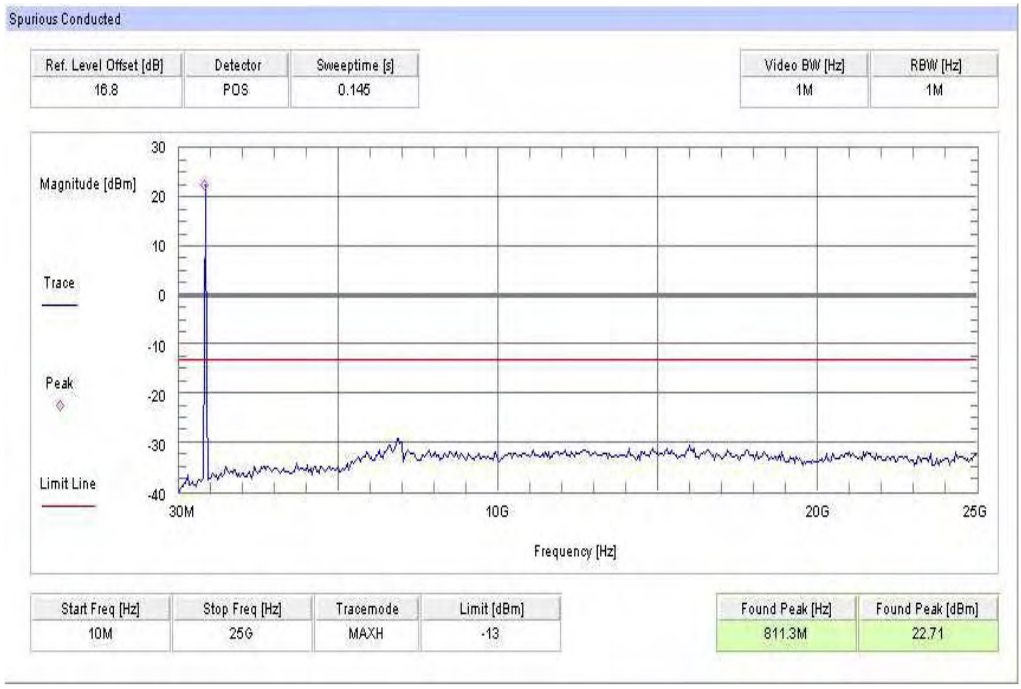
| Spurious Emission Level (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmonic | Ch. 4132 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 4180 Freq. (MHz) | Level [dBm] | Harmonic | Ch. 4233 Freq. (MHz) | Level [dBm] |
| 2 | 1652.8 | - | 2 | 1672.0 | - | 2 | 1693.2 | - |
| 3 | 2479.2 | - | 3 | 2508.0 | - | 3 | 2539.8 | - |
| 4 | 3305.6 | - | 4 | 3344.0 | - | 4 | 3386.4 | - |
| 5 | 4132.0 | - | 5 | 4180.0 | - | 5 | 4233.0 | - |
| 6 | 4958.4 | - | 6 | 5016.0 | - | 6 | 5079.6 | - |
| 7 | 5784.8 | - | 7 | 5852.0 | - | 7 | 5926.2 | - |
| 8 | 6611.2 | - | 8 | 6688.0 | - | 8 | 6772.8 | - |
| 9 | 7437.6 | - | 9 | 7524.0 | - | 9 | 7619.4 | - |
| 10 | 8264.0 | - | 10 | 8360.0 | - | 10 | 8466.0 | - |
| Measurement uncertainty | | | | ± 3dB | | | | |

**Result:** **The result of the measurement is passed.**

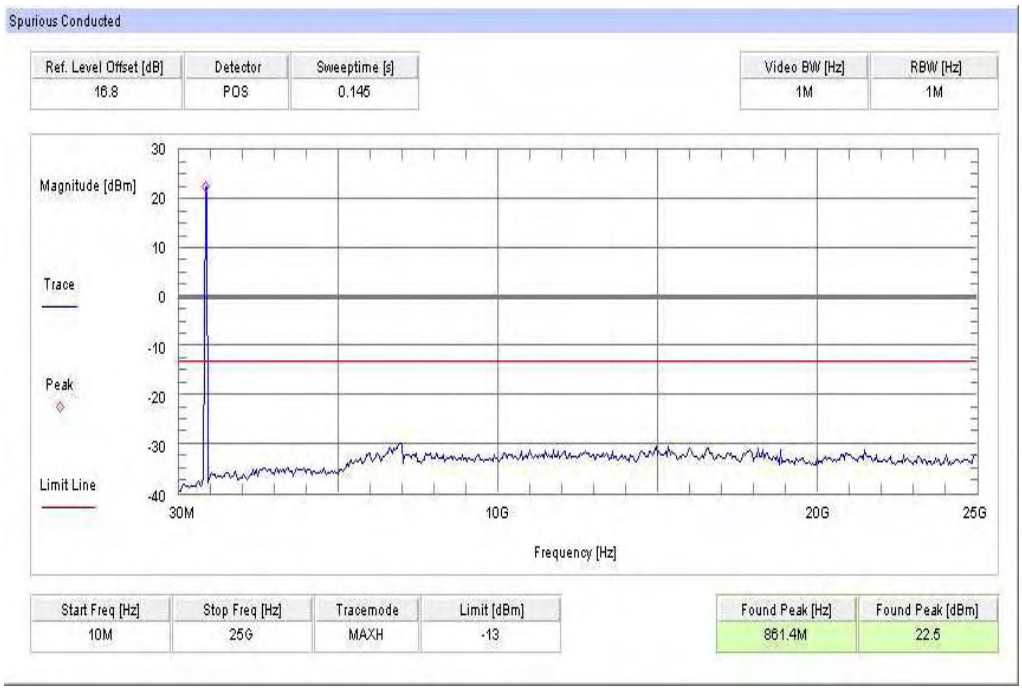
**Plot 1: Channel 4132 (10 MHz - 12 GHz)**




**Plot 2: Channel 4180 (10 MHz - 12 GHz)**



**Plot 3: Channel 4233 (10 MHz - 12 GHz)**



## 8.6.5 Block edge compliance

**Description:**

The spectrum at the band edges must comply with the spurious emissions limits.

**Measurement:**

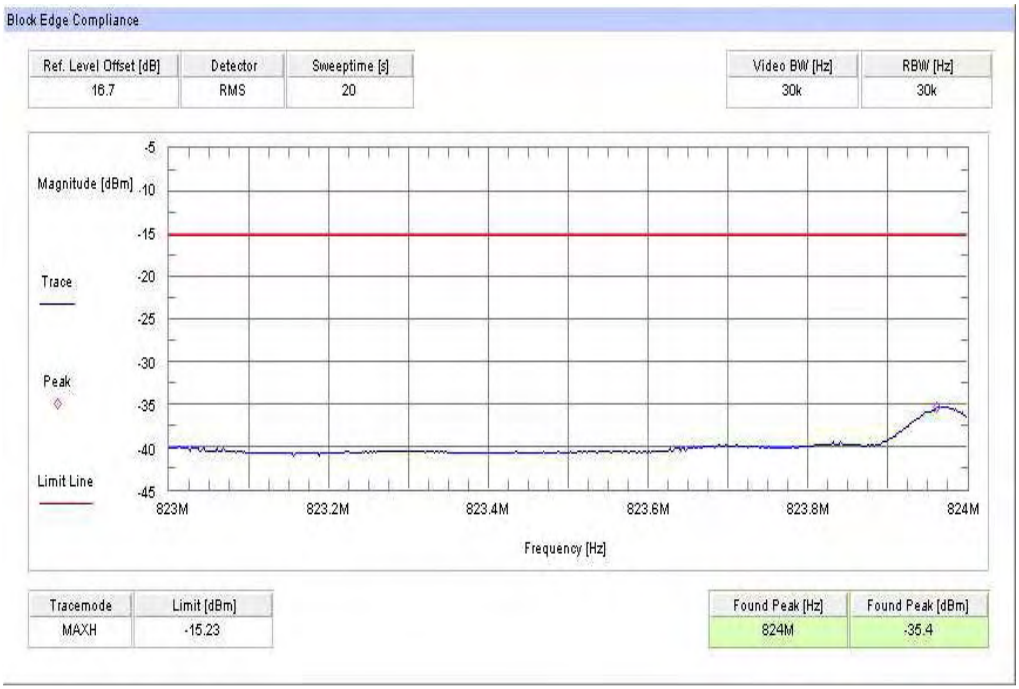
| Measurement parameters | |
|---|---|
| Detector: | RMS |
| Sweep time: | 20 sec. |
| Video bandwidth: | 30 kHz |
| Resolution bandwidth: | 30 kHz |
| Span: | 1 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

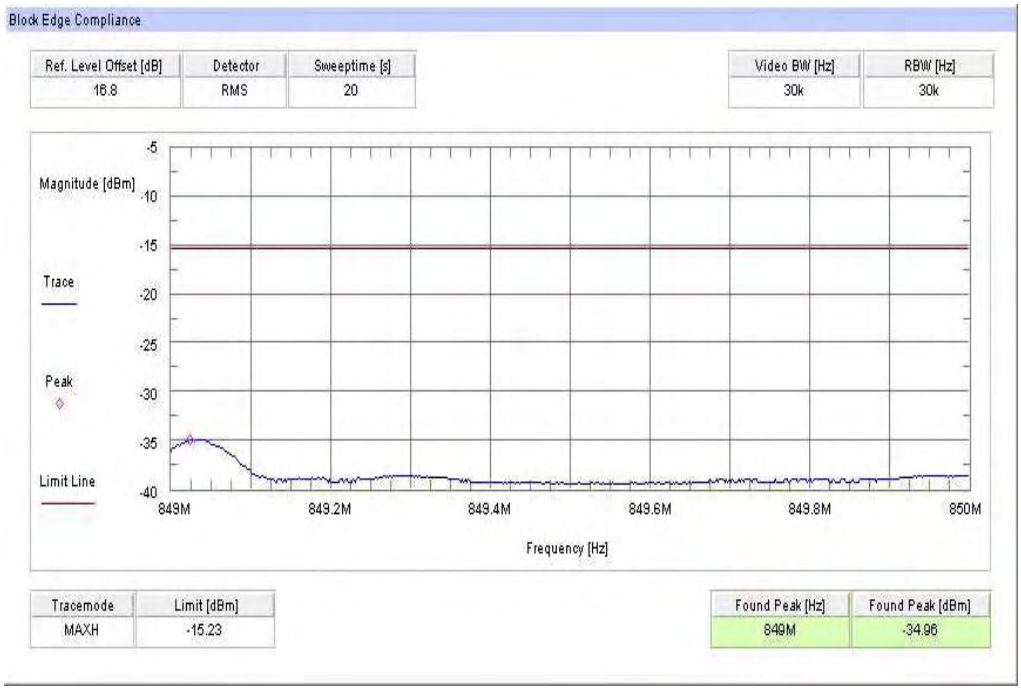
| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1051 | RSS 132, Issue 2, Section 6.5 |
| Block Edge Compliance | |
| Part 22.917 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.”<br><br>However, in publication number 890810, The FCC Office of Engineering and Technology specified the following correction to the limits when a resolution bandwidth smaller than 1% of the emission bandwidth is used:<br><br>“An alternative is to add an additional correction factor of 10 Log (RBW1/ RBW2) to the 43 +10 log(P) limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is either the 1% emissions bandwidth or 1 MHz.”<br><br>When using a 30 kHz bandwidth, this yields a -2.2185 adjustment to the limit [10 log(30kHz/50kHz) = -2.2185]. When this adjustment is applied to the limit, the limit becomes -15.2185. | |
| -15.22 dBm | |

**Results:**

**Plot 1: Channel 4132**




**Plot 2: Channel 4233**




**Result:** **The result of the measurement is passed.**

## 8.6.6 Occupied bandwidth

**Description:**

Measurement of the occupied bandwidth of the transmitted signal.

**Measurement:**

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the UMTS band V. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 22.917 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 4700 kHz, this equates to a resolution bandwidth of at least 50 kHz. For this testing, a resolution bandwidth 100 kHz was used.

| Measurement parameters | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 100 kHz |
| Resolution bandwidth: | 100 kHz |
| Span: | 6 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

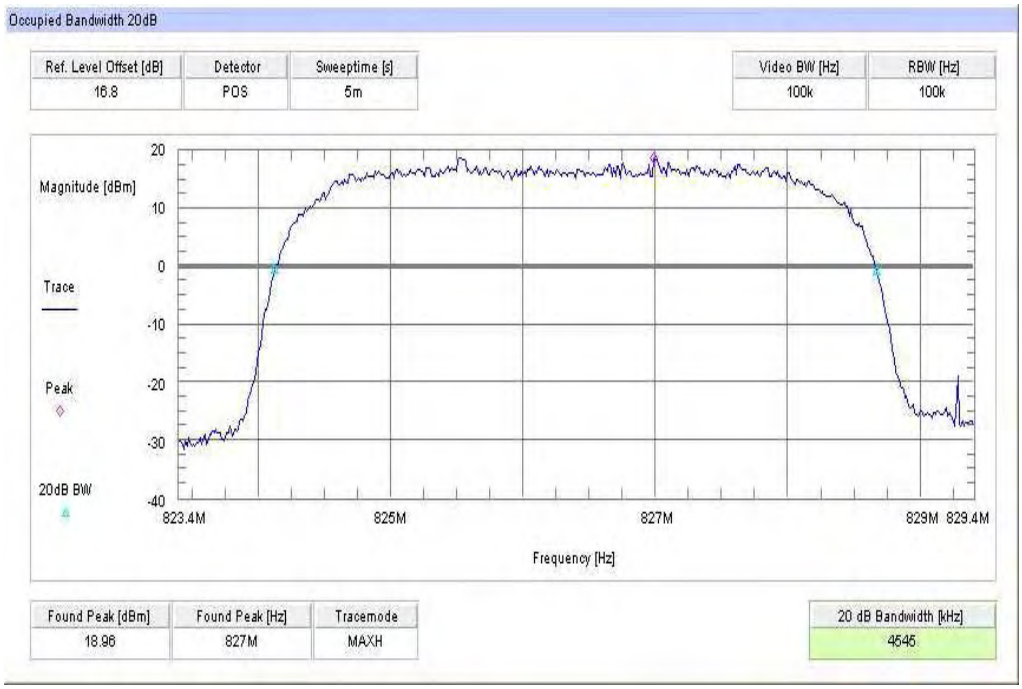
| FCC | IC |
|---|---|
| CFR Part 22.917<br>CFR Part 2.1049 | RSS 132, Issue 2, Section 4.5.1 |
| Occupied Bandwidth | |
| Spectrum must fall completely in the specified band | |

**Results:**

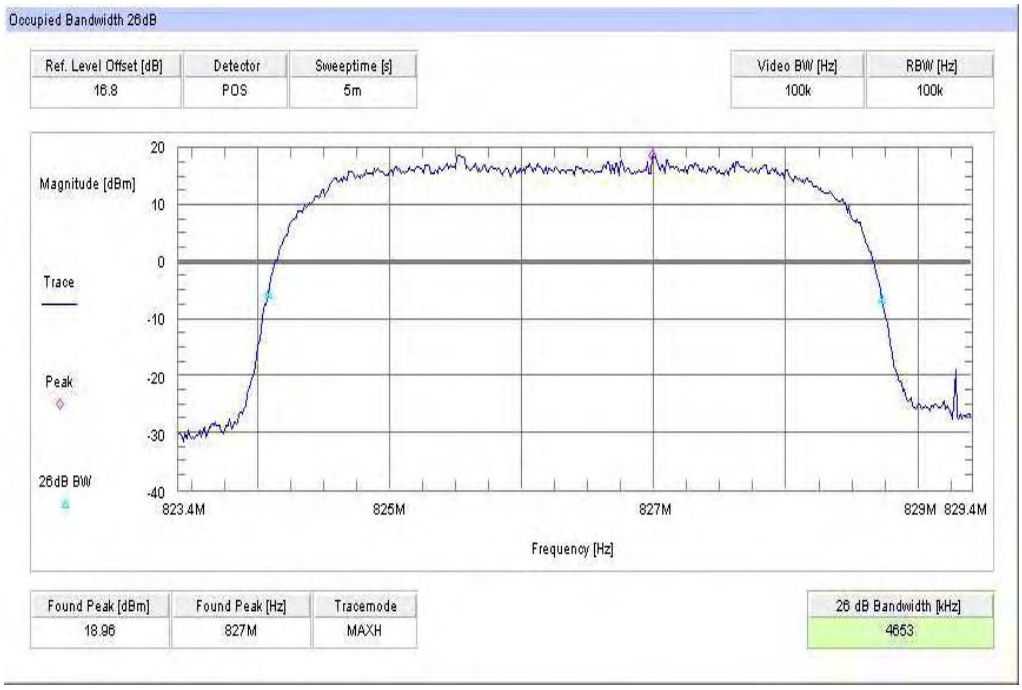
| Occupied Bandwidth | | |
|---|---|---|
| **Frequency (MHz)** | **99% OBW (kHz)** | **-26 dBc BW (kHz)** |
| 826.4 | 4545 | 4653 |
| 836.0 | 4557 | 4677 |
| 846.6 | 4545 | 4665 |
| Measurement uncertainty | ± 100 kHz | |

**Result:** **The result of the measurement is passed.**

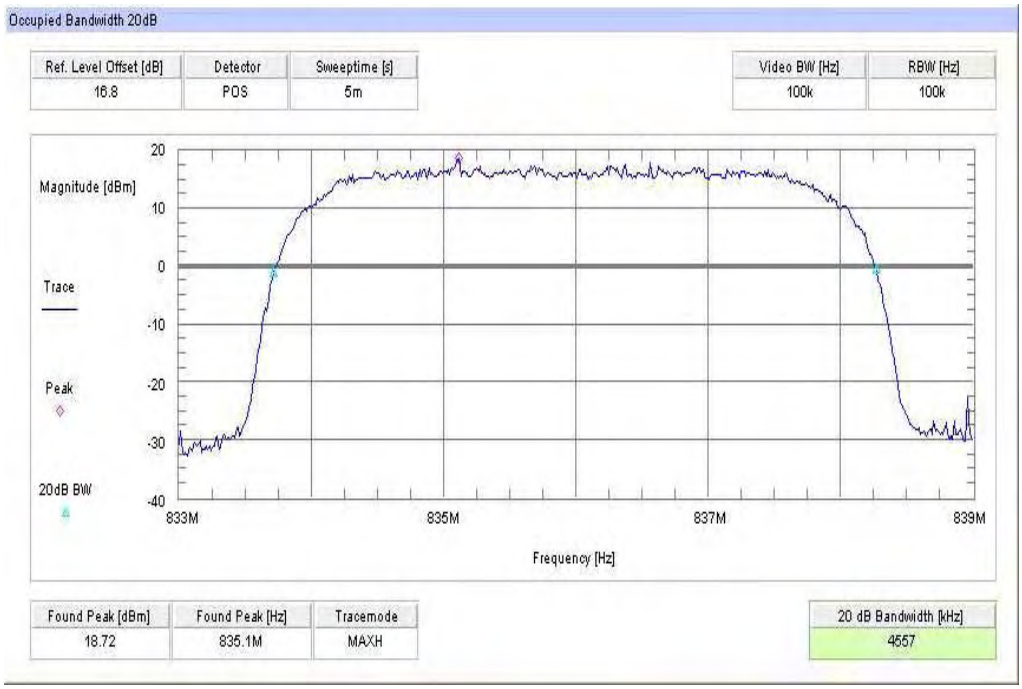
**Plot 1: Channel 4132 (99% - OBW)**



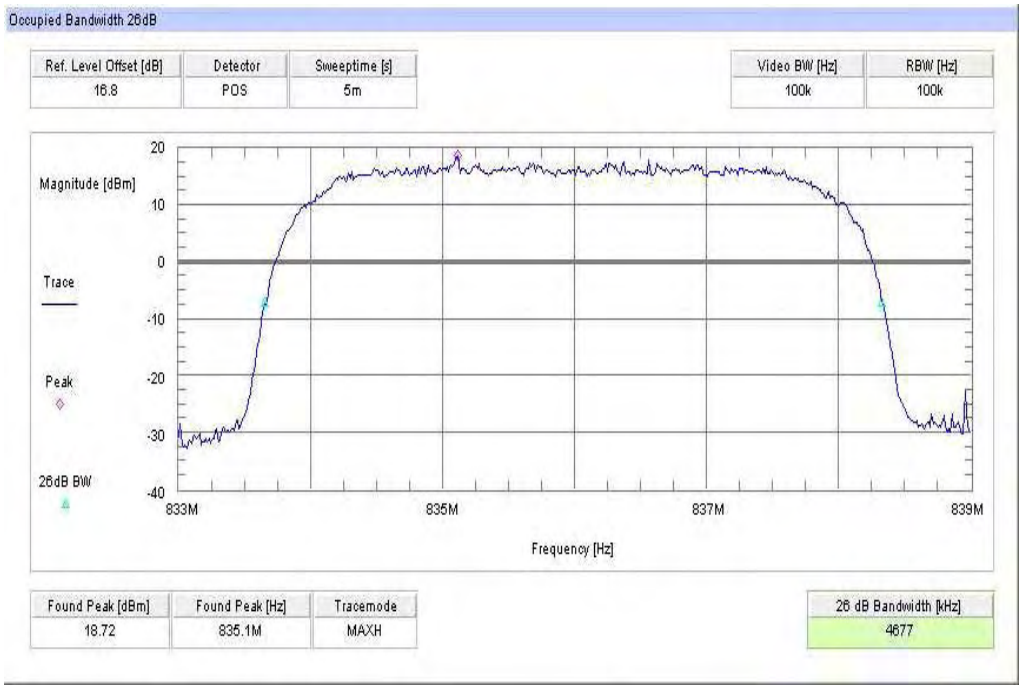

**Plot 2: Channel 4132 (-26 dBc BW)**



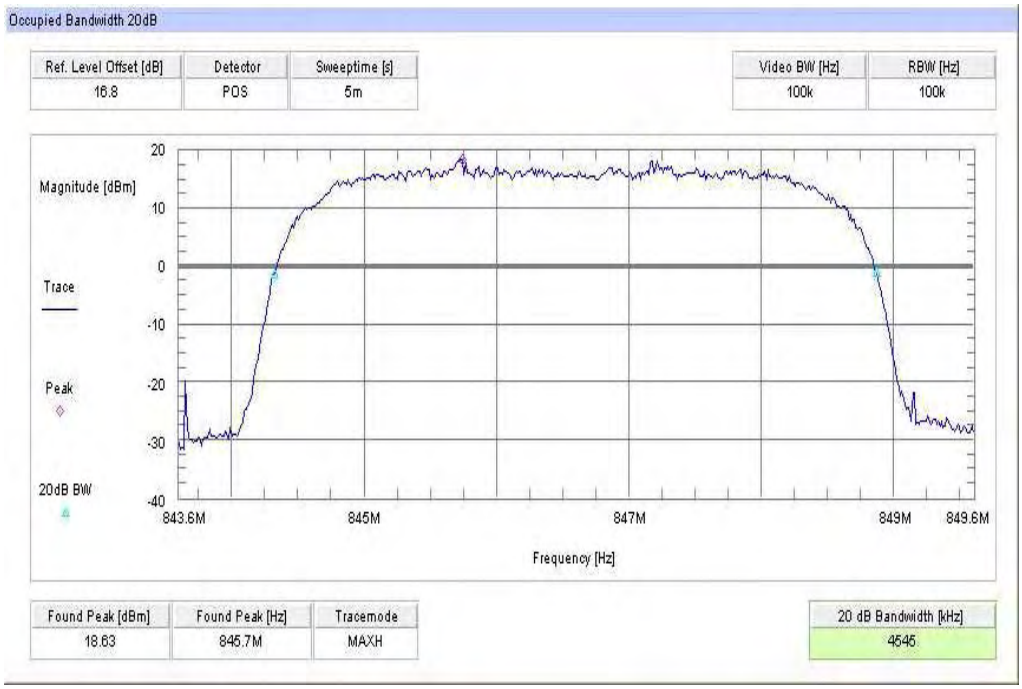
**Plot 3: Channel 4180 (99% - OBW)**



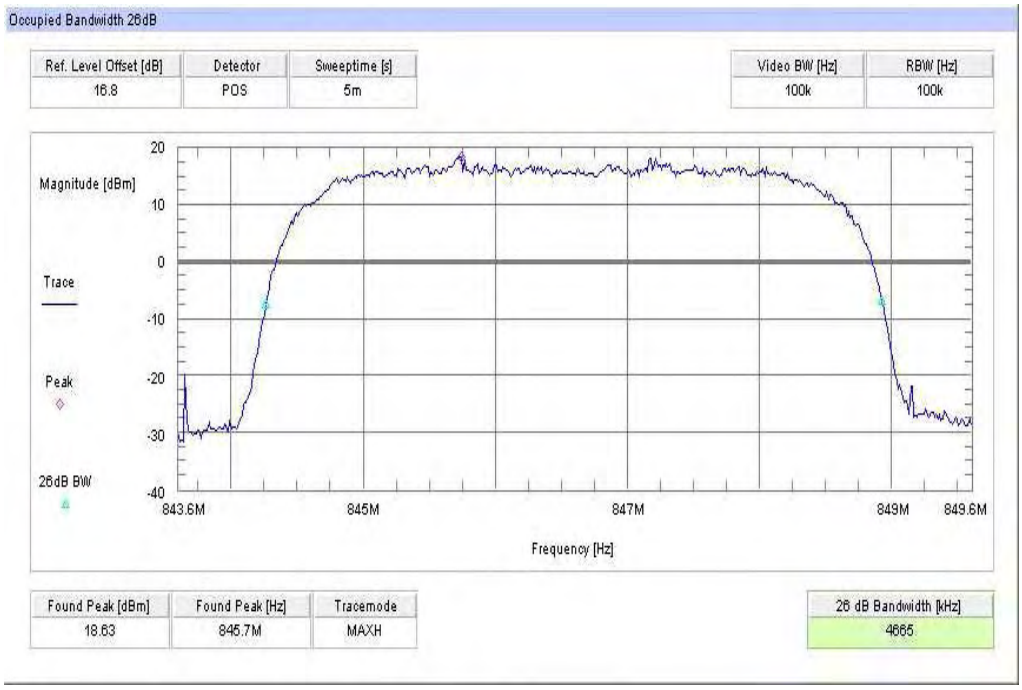

**Plot 4: Channel 4180 (-26 dBc BW)**



**Plot 5: Channel 4233 (99% - OBW)**




**Plot 6: Channel 4233 (-26 dBc BW)**



## 8.7 Results receiver mode

### 8.7.1 Spurious emissions radiated – receiver mode

**Description:**

The measurement was performed in worst case. The EUT was not connected to the CMU 200. So the EUT performs a network search. In this mode all oscillators are active.

**Measurement:**

| Measurement parameters | |
|---|---|
| Detector: | Below 1 GHz Peak / QuasiPeak<br>Above 1 GHz Peak / Average |
| Sweep time: | 2 sec |
| Video bandwidth: | Below 1 GHz 100 kHz<br>Above 1 GHz 1 MHz |
| Resolution bandwidth: | 1 MHz |
| Span: | 100 MHz Steps |
| Trace-Mode: | Max Hold |

**Limits:**

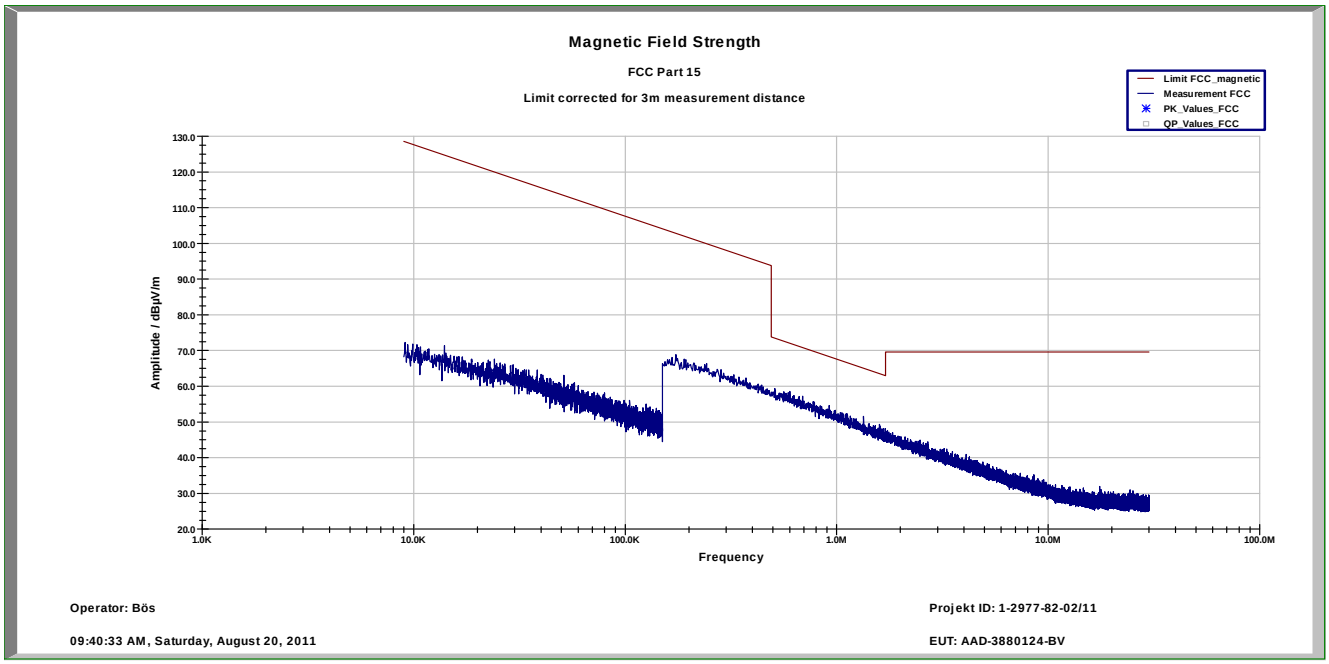
| FCC | | IC |
|---|---|---|
| CFR Part 15.109<br>CFR Part 2.1053 | | RSS Gen, Issue 2, Section 4.10 |
| Spurious Emissions Radiated – Receiver Mode | | |
| **Frequency (MHz)** | **Field Strength (dBµV/m)** | **Measurement distance (m)** |
| 30 – 88 | 30.0 | 10 |
| 88 - 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |

**Results:**

| Spurious Emission Level (dBµV/m) | | |
|---|---|---|
| **Frequency (MHz)** | **Detector** | **Level (dBµV/m)** |
| No critical peaks found – Also see plots | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Measurement uncertainty | ± 3dB | |

**Result:** **The result of the measurement is passed.**

## Plot 1: Receiver mode up to 30 MHz



## Plot 2: Receiver mode (30 MHz - 1 GHz)

### Common Information

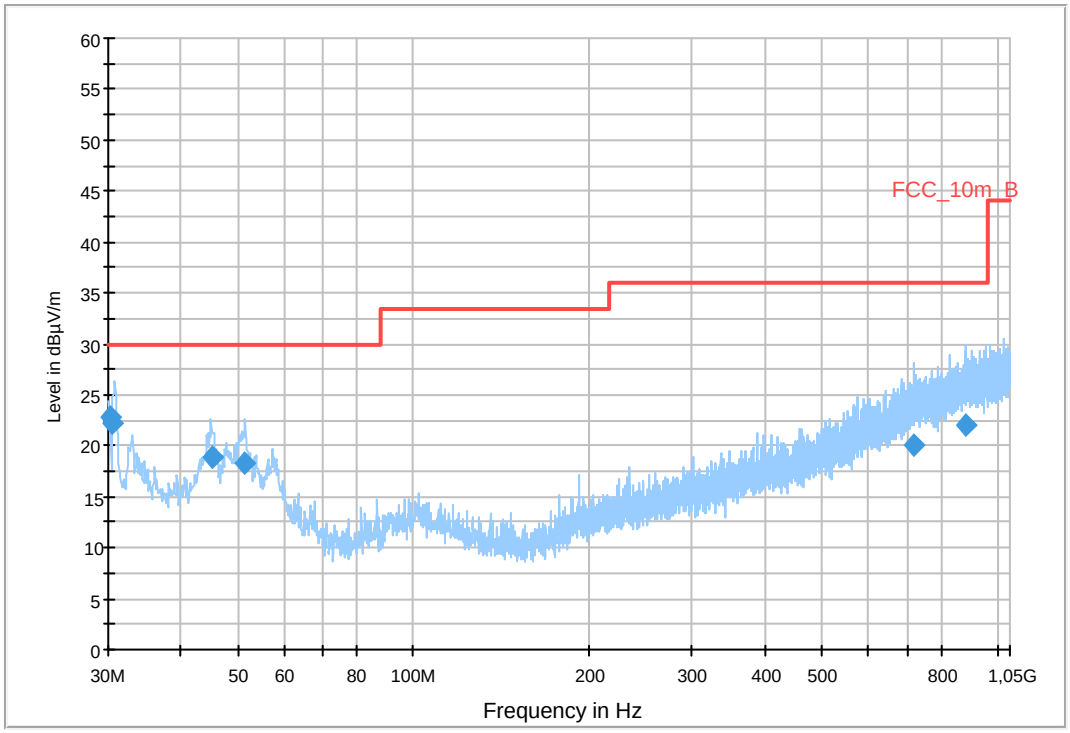
| | |
|---|---|
| EUT: | AAD-3880124-BV |
| Serial Number: | BX902GHYNZ (IMEI: 00440214-313207-8) |
| Test Description: | FCC part 15 B class B @ 10 m |
| Operating Conditions: | GSM idle + GPS idle + charging |
| Operator Name: | Hennemann |
| Comment: | AC: 115 V / 60 Hz |

### Scan Setup: STAN_Fin [EMI radiated]

| | |
|---|---|
| Hardware Setup: | Electric Field (NOS) |
| Receiver: | [ESCI 3] |
| Level Unit: | dBµV/m |

| Subrange | Step Size | Detectors | IF BW | Meas. Time | Preamp |
|---|---|---|---|---|---|
| 30 MHz - 2 GHz | 60 kHz | QPK | 120 kHz | 1 s | 20 dB |

FCC_10m(B)_3




### Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 30.296775 | 22.9 | 1000.0 | 120.000 | 98.0 | V | 184.0 | 12.5 | 7.1 | 30.0 | |
| 30.437550 | 22.3 | 1000.0 | 120.000 | 120.0 | V | 258.0 | 12.5 | 7.7 | 30.0 | |
| 45.064650 | 18.9 | 1000.0 | 120.000 | 98.0 | V | 283.0 | 13.3 | 11.1 | 30.0 | |
| 51.199350 | 18.2 | 1000.0 | 120.000 | 98.0 | V | 185.0 | 13.3 | 11.8 | 30.0 | |
| 716.870250 | 20.0 | 1000.0 | 120.000 | 160.0 | V | 264.0 | 22.9 | 16.0 | 36.0 | |
| 881.341650 | 22.1 | 1000.0 | 120.000 | 170.0 | H | 77.0 | 25.0 | 13.9 | 36.0 | |

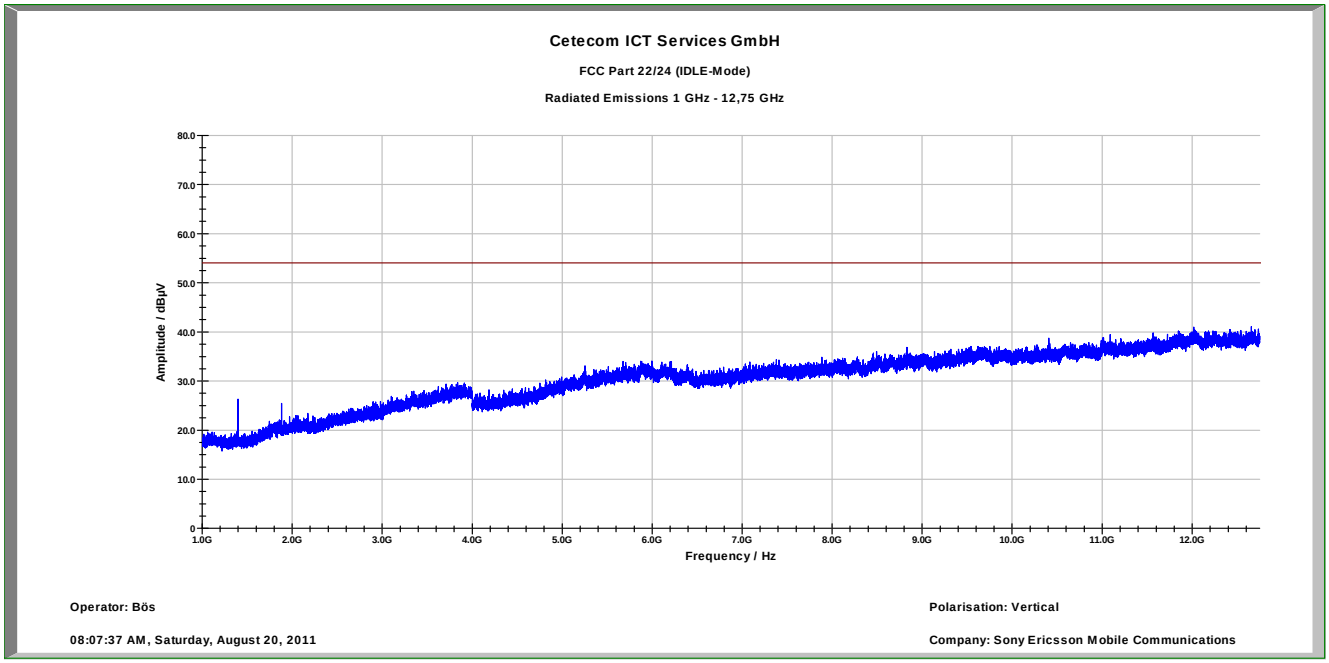
Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

Subrange 1

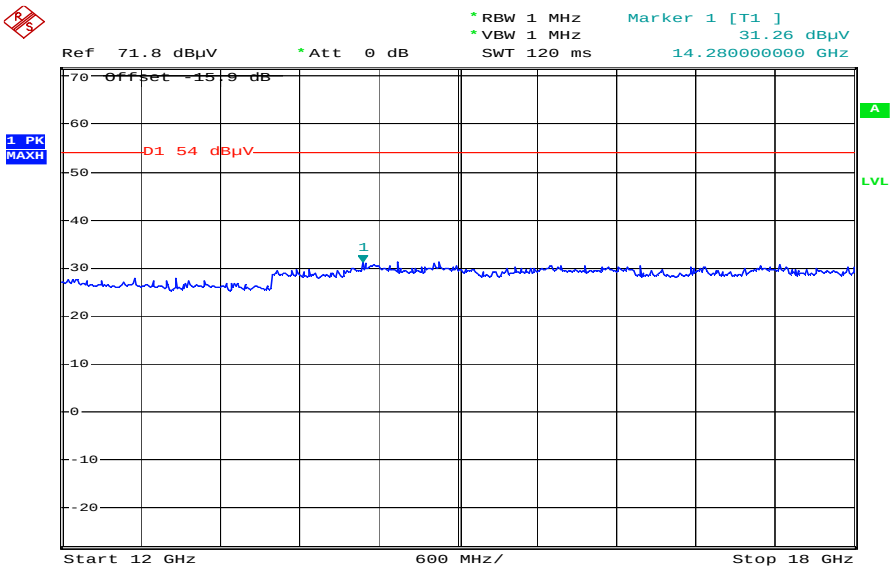
| | |
|---|---|
| Frequency Range: | 30 MHz - 2 GHz |
| Receiver: | Receiver [ESCI 3]<br>@ GPIB0 (ADR 20), SN 100083/003, FW 4.42 |
| Signal Path: | without Notch<br>FW 1.0 |
| Antenna: | VULB 9163<br>SN 9163-295, FW ---<br>Correction Table (vertical): VULP6113<br>Correction Table (horizontal): VULP6113<br>Correction Table (vertical): Cable_EN_1GHz (1005)<br>Correction Table (horizontal): Cable_EN_1GHz (1005) |
| Antenna Tower: | Tower [EMCO 2090 Antenna Tower]<br>@ GPIB0 (ADR 8), FW REV 3.12 |
| Turntable: | Turntable [EMCO Turntable]<br>@ GPIB0 (ADR 9), FW REV 3.12 |

EMC 32 Version 8.10.00

## Plot 3: Receiver mode (1 GHz – 12.75 GHz)

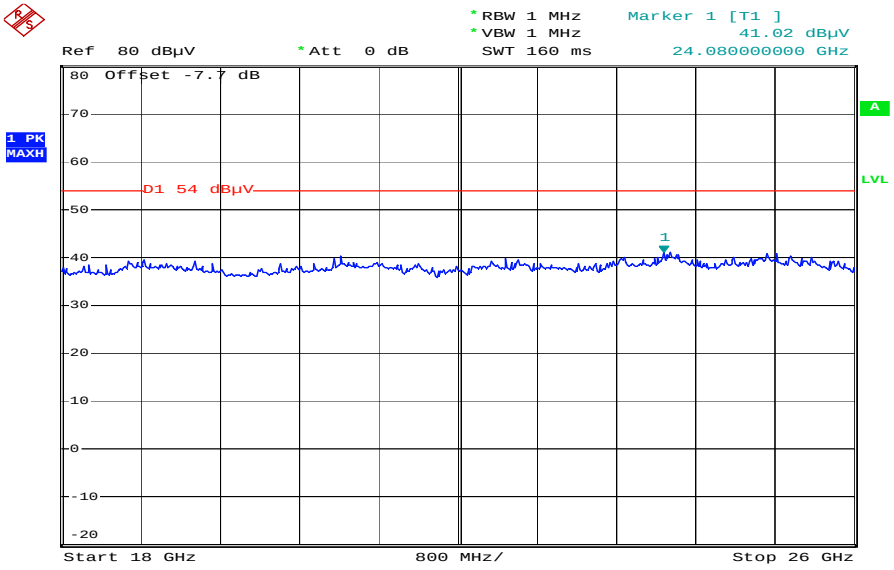


## Plot 4: Receiver mode (12 GHz – 18 GHz)




Date: 23.AUG.2011 09:13:19

## Plot 5: Receiver mode (18 GHz – 26 GHz)




Date: 23.AUG.2011 09:15:33

# 9 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

| No. | Lab / Item | Equipment | Type | Manufact. | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | n. a. | Active Loop Antenna | 6502 | EMCO | 2210 | 300001015 | ne | | |
| 2 | n. a. | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | | 23.03.2009 | |
| 3 | Spec.A. 2_2e | System rack for EMI measurement solution | 85900 | HP I.V. | * | 300000222 | ne | | |
| 4 | 9 | Artificial Mains 9 kHz to 30 MHz | ESH3-Z5 | R&S | 828576/020 | 300001210 | Ve | 06.01.2010 | 06.01.2012 |
| 5 | n. a. | Relais Matrix | 3488A | HP Meßtechnik | 2719A15013 | 300001156 | ne | | |
| 6 | n. a. | Relais Matrix | PSU | R&S | 890167/024 | 300001168 | ne | | |
| 7 | n. a. | Isolating Transformer | RT5A | Grundig | 9242 | 300001263 | ne | | |
| 8 | n. a. | Three-Way Power Splitter, 50 Ohm | 11850C | HP Meßtechnik | | 300000997 | ne | | |
| 9 | n. a. | Switch / Control Unit | 3488A | HP | 2605e08770 | 300001443 | ne | | |
| 10 | n. a. | Amplifier | js42-00502650-28-5a | Parzich GMBH | 928979 | 300003143 | ne | | |
| 11 | n. a. | Band Reject filter | WRCG1855/1910-1835/1925-40/8SS | Wainwright | 7 | 300003350 | ev | | |
| 12 | n. a. | Band Reject filter | WRCG2400/2483-2375/2505-50/10SS | Wainwright | 11 | 300003351 | ev | | |
| 13 | n. a. | TILE-Software Emission | Quantum Change, Modell TILE-ICS/FULL | EMCO | none | 300003451 | ne | | |
| 14 | n. a. | Highpass Filter | WHKX2.9/18G-12SS | Wainwright | 1 | 300003492 | ev | | |
| 15 | n. a. | Highpass Filter | WHK1.1/15G-10SS | Wainwright | 3 | 300003255 | ev | | |
| 16 | n. a. | Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 18 | 300003789 | ne | | |
| 17 | n. a. | PSA Spectrum Analyzer 3 Hz - 26.5 GHz | E4440A | Agilent Technologies | MY48250080 | 300003812 | k | 08.09.2010 | 08.09.2012 |
| 18 | n. a. | MXG Microwave Analog Signal Generator | N5183A | Agilent Technologies | MY47420220 | 300003813 | k | 13.09.2010 | 13.09.2012 |
| 19 | n. a. | RF Filter Section 9kHz - 1GHz | N9039A | Agilent Technologies | MY48260003 | 300003825 | vlKl! | 08.09.2010 | 08.09.2012 |
| 20 | n. a. | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 371 | 300003854 | vlKl! | 17.12.2008 | 17.12.2011 |
| 21 | 45 | Switch-Unit | 3488A | HP Meßtechnik | 2719A14505 | 300000368 | g | | |
| 22 | 50 | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP Meßtechnik | 2920A04466 | 300000580 | ne | | |
| 23 | n. a. | software | SPS_PHE 1.4f | Spitzberger & Spieß | B5981; 5D1081;B5979 | 300000210 | ne | | |
| 24 | n. a. | EMI Test | ESCI | R&S | 100083 | 300003312 | k | 05.01.2011 | 05.01.2013 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Receiver | 1166.5950.03 | | | | | | |
| 25 | n. a. | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | k | 14.07.2011 | 14.07.2013 |
| 26 | n. a. | Amplifier | JS42-00502650-28-5A | MITEQ | 1084532 | 300003379 | ev | | |
| 27 | n. a. | Antenna Tower | Model 2175 | ETS-LINDGREN | 64762 | 300003745 | izw | | |
| 28 | n. a. | Positioning Controller | Model 2090 | ETS-LINDGREN | 64672 | 300003746 | izw | | |
| 29 | n. a. | Turntable Interface-Box | Model 105637 | ETS-LINDGREN | 44583 | 300003747 | izw | | |
| 30 | n. a. | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 295 | 300003787 | k | 01.04.2010 | 01.04.2012 |
| 31 | n. a. | Spectrum-Analyzer | FSU26 | R&S | 200809 | 300003874 | k | 10.01.2011 | 10.01.2013 |
| 32 | n. a. | Isolating Transformer | RT5A | Grundig | 8041 | 300001626 | g | | |
| 33 | n. a. | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP Meßtechnik | 2818A03450 | 300001040 | Ve | 08.01.2009 | 08.01.2012 |
| 34 | n. a. | Coaxial Attenuator 30dB/500W | 8325 | Bird | 1530 | 300001595 | ev | | |
| 35 | n. a. | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3088 | 300001032 | vlKl! | 11.05.2011 | 11.05.2013 |

**Agenda:** Kind of Calibration

| | | | |
|---|---|---|---|
| k | calibration / calibrated | EK | limited calibration |
| ne | not required (k, ev, izw, zw not required) | zw | cyclical maintenance (external cyclical maintenance) |
| ev | periodic self verification | izw | internal cyclical maintenance |
| Ve | long-term stability recognized | g | blocked for accredited testing |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

## Annex A Document history

| Version | Applied changes | Date of release |
|---|---|---|
| 1.0 | Initial release | 2011-08-25 |

## Annex B Further information

**Glossary**

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software