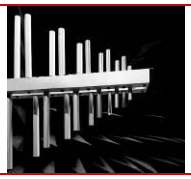
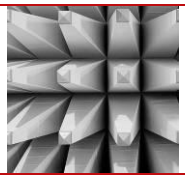




CETECOM ICT Services
consulting - testing - certification

# TEST REPORT

**Test report no.: 1-6838/13-01-02**

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

## Testing laboratory


**CETECOM ICT Services GmbH**
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com


**Accredited Testing Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01
Area of Testing:
Radio Communications & Compatibility Testing (RCT)

## Applicant


**Techem Energy Services GmbH**
Hauptstraße 89
65760 Eschborn / GERMANY
Phone: +49 6196 522-0
Fax: +49 6196 522-342302
Contact: Reiner Borgstedt
e-mail: reiner.borgstedt@techem.de
Phone: +49 6196 522-2302


## Manufacturer


**Techem Energy Services GmbH**
Hauptstraße 89
65760 Eschborn / GERMANY

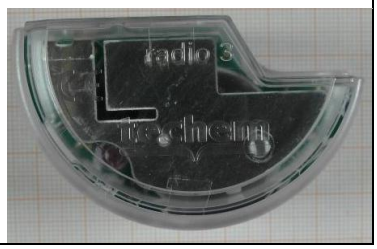

## Test standard/s

| | |
|---|---|
| 47 CFR Part 15 | Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |

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

## Test Item

| | |
|---|---|
| **Kind of test item:** | **Radio module for water meter** |
| **Model name:** | **Mod5 meter transmitter** |
| **FCC ID:** | **2AAW6MOD5TX** |
| Frequency: | DTS band 902 MHz to 928 MHz |
| Technology tested: | Proprietary radio technology |
| Antenna: | Integrated antenna |
| Power supply: | 3 V DC by Li-battery (Type: BR2477A) |




This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test report authorised:

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2013.09.27 12:06:34 +02'00'

Marco Bertolino
Testing Manager

## Test performed:

cn=Andreas Luckenbill, o=CETECOM ICT Services GmbH, ou=LUC-111202, email=andreas.luckenbill@cetecom.com, c=DE
2013.09.27 12:50:50 +02'00'

Andreas Luckenbill
Expert

# 1 Table of contents

# 2 General information

## 2.1 Notes and disclaimer

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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2013-09-02 |
| Date of receipt of test item: | 2013-09-10 |
| Start of test: | 2013-09-10 |
| End of test: | 2013-09-10 |
| Person(s) present during the test: | Mr. Reiner Borgstedt |

# 3 Test standard/s

| Test standard | Date | Test standard description |
|---|---|---|
| 47 CFR Part 15 | 01.10.2012 | Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |

## 3.1 Measurement guidance

| | | |
|---|---|---|
| DTS : KDB 558074 | 2013-04 | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 |

## 4 Test environment

| | | |
|---|---|---|
| Temperature: | $T_{nom}$ | +22 °C during room temperature tests |
| | $T_{max}$ | no tests under extreme conditions |
| | $T_{min}$ | no tests under extreme conditions |
| Relative humidity content: | | 42 % |
| Barometric pressure: | | not relevant for this kind of testing |
| Power supply: | $V_{nom}$ | 3 V DC by Li-battery (Type: BR2477A) |
| | $V_{max}$ | no tests under extreme conditions |
| | $V_{min}$ | no tests under extreme conditions |

## 5 Test item

| | | |
|---|---|---|
| **Kind of test item** | **:** | **Radio module for water meter** |
| **Type identification** | **:** | **Mod5 meter transmitter** |
| | | |
| **S/N serial number** | **:** | **Radiated units: 31051088; 31050613**<br>**Conducted units: 31051053** |
| **HW hardware status** | **:** | **02.14** |
| **SW software status** | **:** | **1.2.7-0x301** |
| **Frequency band [MHz]** | **:** | **DTS band 902 MHz to 928 MHz** |
| **Type of radio transmission**<br>**Use of frequency spectrum** | **:**<br>**:** | **Modulated carrier** |
| **Type of modulation** | **:** | **FSK** |
| **Number of channels** | **:** | **1** |
| **Antenna** | **:** | **Integrated antenna** |
| **Power supply** | **:** | **3 V DC by Li-battery (Type: BR2477A)** |
| **Temperature range** | **:** | **0°C to +70°C** |

### 5.1 Additional information

Test setup- and EUT-photos are included in test report: 1-6838/13-01-01_AnnexA
1-6838/13-01-01_AnnexB
1-6838/13-01-01_AnnexC

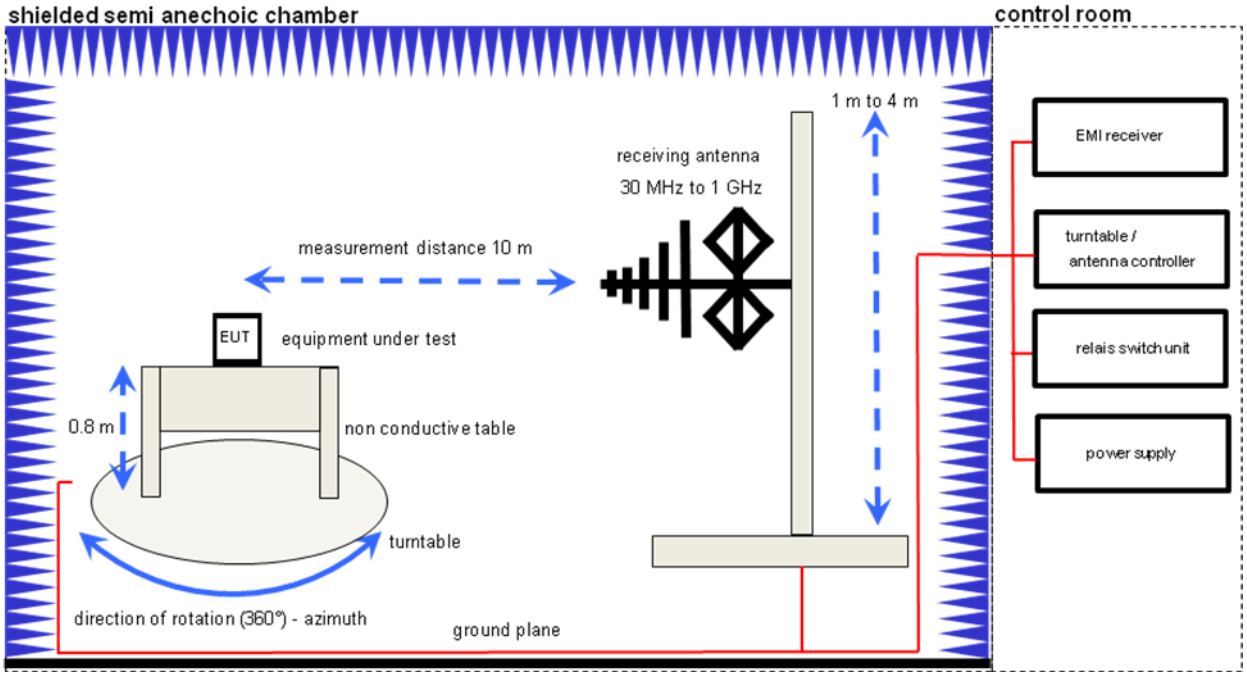
## 6 Test laboratories sub-contracted

None

# 7 Description of the test setup

## 7.1 Radiated measurements chamber F

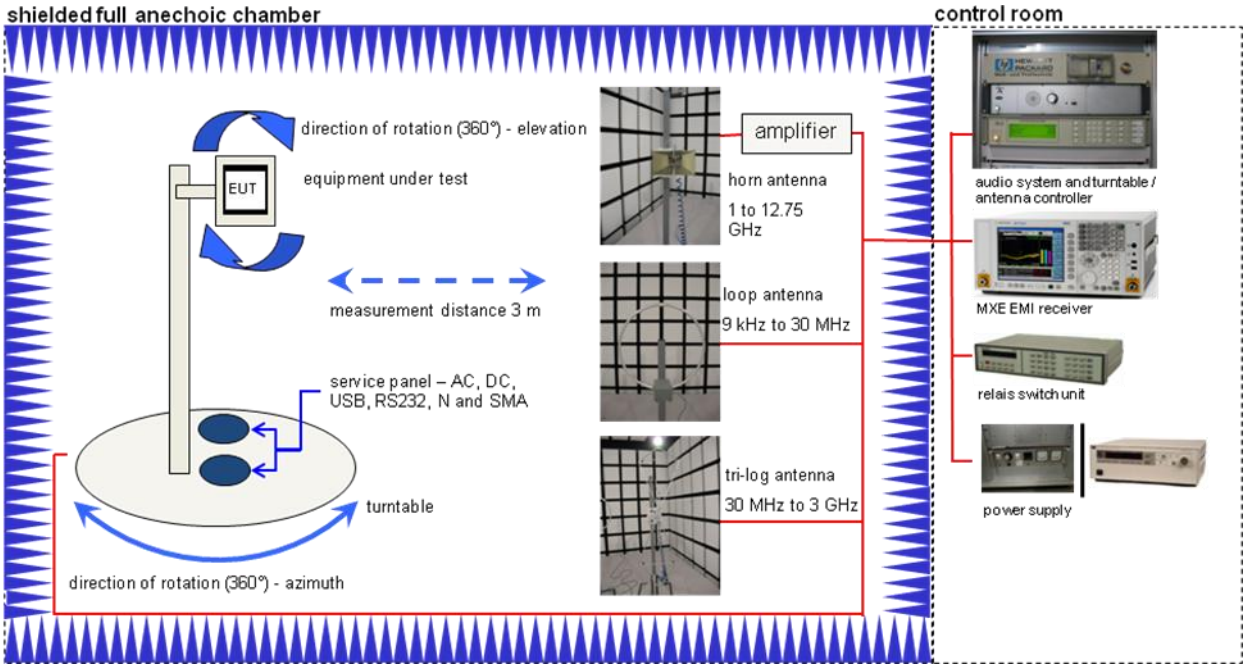
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.




**Equipment table:**

| Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom |
|---|---|---|---|---|
| Switch-Unit | 3488A | HP Meßtechnik | 2719A14505 | 300000368 |
| DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP Meßtechnik | 2920A04466 | 300000580 |
| EMI Test Receiver | ESCI 3 | R&S | 100083 | 300003312 |
| Amplifier | JS42-00502650-28-5A | MITEQ | 1084532 | 300003379 |
| Antenna Tower | Model 2175 | ETS-LINDGREN | 64762 | 300003745 |
| Positioning Controller | Model 2090 | ETS-LINDGREN | 64672 | 300003746 |
| Turntable Interface-Box | Model 105637 | ETS-LINDGREN | 44583 | 300003747 |
| TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 295 | 300003787 |

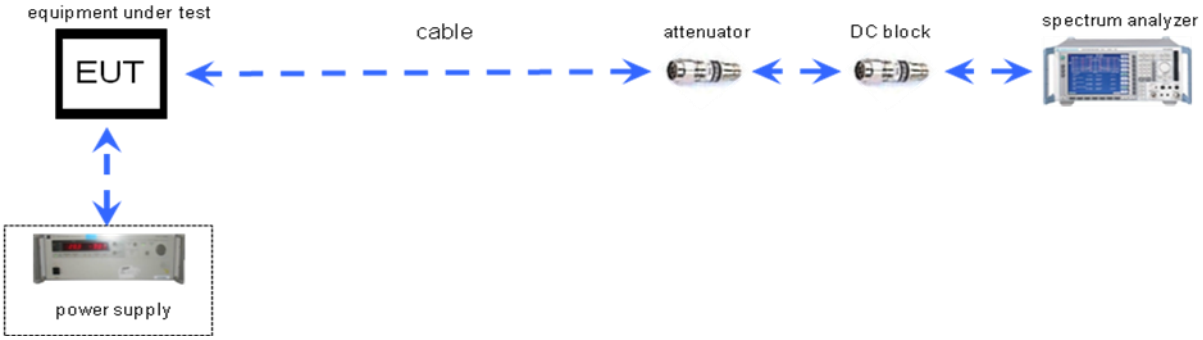
## 7.2 Radiated measurements chamber C




**Equipment table:**

| Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom |
|---|---|---|---|---|
| MXE EMI Receiver 20 Hz bis 26,5 GHz | N9038A | Agilent Technologies | MY51210197 | 300004405 |
| TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 371 | 300003854 |
| Band Reject filter | WRCG2400/2483-2375/2505-50/10SS | Wainwright | 11 | 300003351 |
| Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 18 | 300003789 |
| Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3088 | 300001032 |
| Active Loop Antenna | 6502 | EMCO | 8905-2342 | 300000256 |
| Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 |
| Switch / Control Unit | 3488A | HP Meßtechnik | * | 300000199 |
| Switch / Control Unit | 3488A | HP Meßtechnik | 2719A15013 | 300001156 |
| Isolating Transformer | MPL IEC625 Bus Regeltrenntravo | Erfi | 91350 | 300001155 |
| Three-Way Power Splitter, 50 Ohm | 11850C | HP Meßtechnik | | 300000997 |
| Amplifier | js42-00502650-28-5a | Parzich GMBH | 928979 | 300003143 |

## 7.3 Conducted measurements




**Equipment table:**

| Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom |
|---|---|---|---|---|
| Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 |

## 8 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 15 | Passed | 2013-09-27 | -/- |

| Test specification clause | Test case | Temperature conditions | Power source voltages | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|---|
| §15.247(b)(4) | Antenna gain | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(e) | Power spectral density | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(a)(2 | Spectrum bandwidth 6dB bandwidth | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| for information only! | Spectrum bandwidth 20dB bandwidth | Nominal | Nominal | ☐ | ☐ | ☐ | ☐ | for information only |
| §15.247(b)(3) | Maximum output power | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(d) | Band edge compliance conducted | Nominal | Nominal | ☐ | ☐ | ☒ | ☐ | No restricted band! |
| §15.205 | Band edge compliance radiated | Nominal | Nominal | ☐ | ☐ | ☒ | ☐ | No restricted band! |
| §15.247(d) | TX spurious emissions conducted | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(d) | TX spurious emissions radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.109 | RX spurious emissions radiated | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.209(a) | TX spurious emissions radiated < 30 MHz | Nominal | Nominal | ☒ | ☐ | ☐ | ☐ | complies |
| §15.107(a) | Conducted emissions < 30 MHz | Nominal | Nominal | ☐ | ☐ | ☒ | ☐ | Battery powered only! |

**Note:** NA = Not Applicable; NP = Not Performed

## 8.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode: ☐ No test mode available.

☒ Special software is used.
EUT is transmitting pseudo random data by itself

# 9 Measurement results

## 9.1 Maximum output power & antenna gain

**Description:**

Measurement of the maximum output power conduced and radiated

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | 3 MHz |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |

**Result:**

| Modulation<br>Frequency | Maximum output power conducted [dBm] |
|---|---|
| 916.44 MHz | 10.59 |
| Measurement uncertainty | ± 1 dB |

| Modulation<br>Frequency | Maximum output power radiated - EIRP [dBm] |
|---|---|
| 916.44 MHz | 11.95 |
| Measurement uncertainty | ± 3 dB |

**Result:** **Passed**

**Plots:**

**Plot 1:** 916.44 MHz

## 9.2 Antenna gain

**Measurement:**

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

**Measurement parameters:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 3 MHz |
| Resolution bandwidth: | 3 MHz |
| Span: | 3 MHz |
| Trace-Mode: | Max hold |

**Limits:**

| FCC | |
|---|---|
| Antenna Gain | |
| 6 dBi | |

**Results:**

| | |
|---|---|
| Conducted power [dBm] Measured | 10.59 |
| Radiated power [dBm] Measured | 11.95 |
| Gain [dBi] Calculated | +1.36 |

**Result:** **Passed**

## 9.3 Power spectral density

**Description:**

Measurement of the power spectral density of a digital modulated system. The measurement is repeated at the lowest, middle and highest channel.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 3 kHz |
| Video bandwidth: | 10 kHz |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | |
|---|---|
| Power Spectral Density | |
| The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration. | |

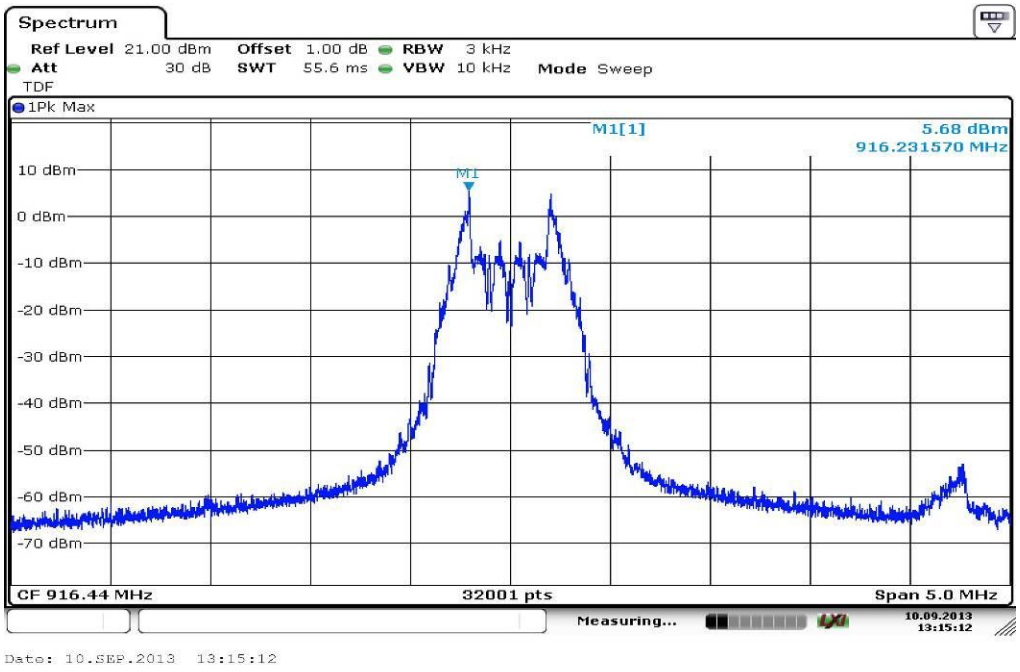
**Results:**

| Modulation active | Power Spectral density [dBm/3kHz] |
|---|---|
| 916.44 MHz | 5.68 |
| Measurement uncertainty | ± 1.5 dB |

**Result:** **Passed**

**Plots:**

**Plot 1:** 916.44 MHz



## 9.4 Spectrum bandwidth – 6 dB bandwidth

**Description:**

Measurement of the 6 dB bandwidth of the modulated signal.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 100 kHz |
| Video bandwidth: | 300 kHz |
| Span: | See plots |
| Trace-Mode: | Max Hold |
| Measurement function: | 75% bandwidth |

**Limits:**

| FCC | |
|---|---|
| Spectrum Bandwidth – 6 dB Bandwidth | |
| Systems using digital modulation techniques may operate in the 902 - 928 MHz band.<br>The minimum 6 dB bandwidth shall be at least 500 kHz. | |

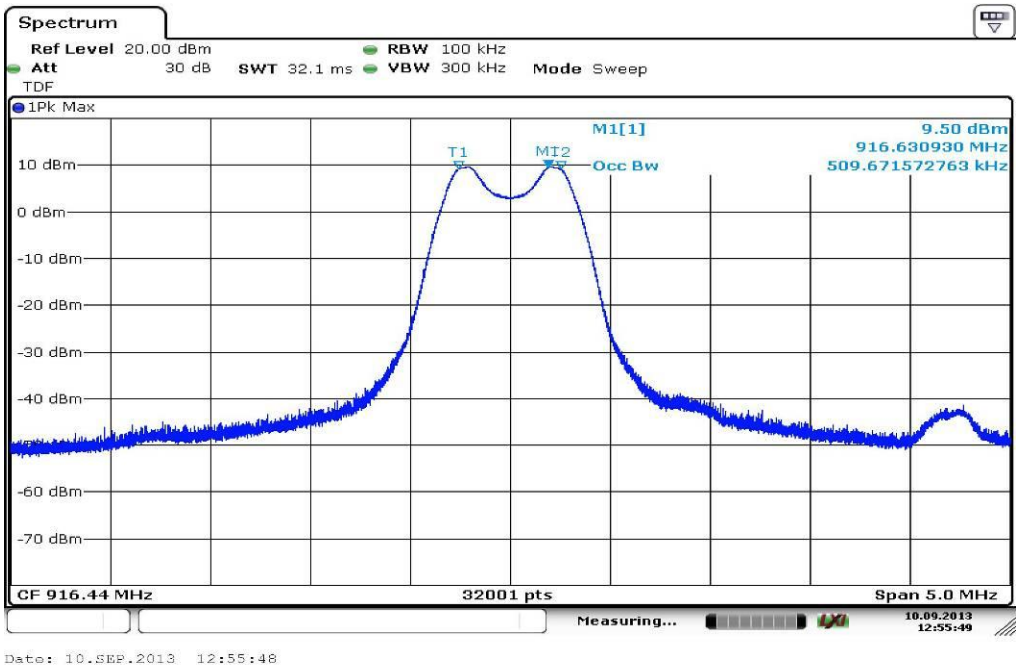
**Results:**

| Modulation active | 6 dB bandwidth [MHz] |
|---|---|
| Frequency | |
| 916.44 MHz | 509.67 |
| Measurement uncertainty | ± 100 kHz |

**Result:** **Passed**

**Plots:**

**Plot 1:** 916.44 MHz



## 9.5 Spectrum bandwidth – 20 dB bandwidth

**Description:**

Measurement of the 20 dB bandwidth of the modulated signal.

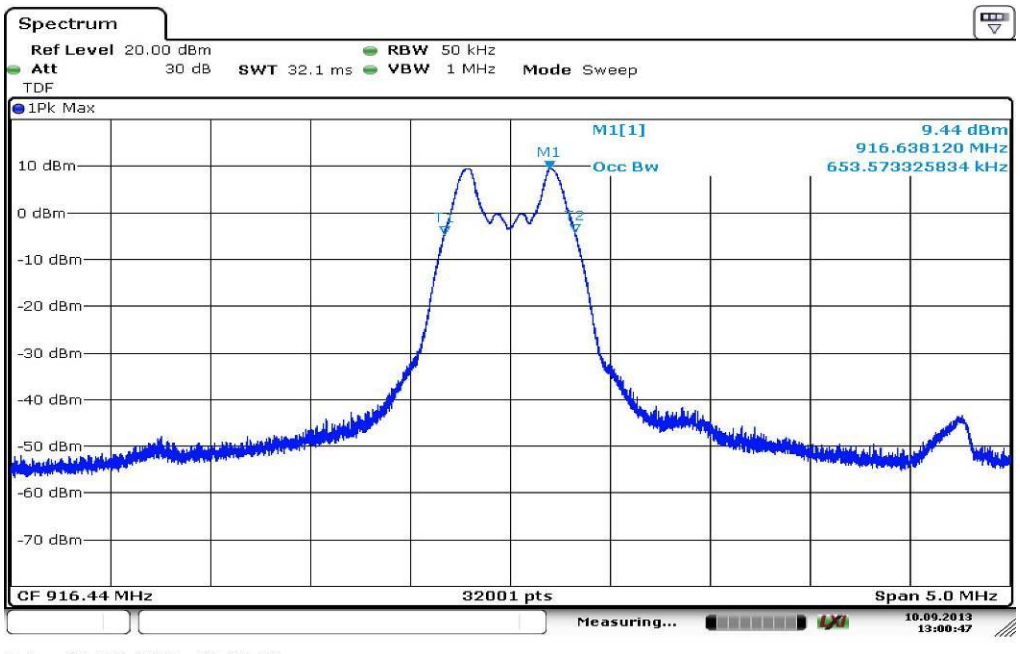
**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 50 kHz |
| Video bandwidth: | 1 MHz |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |

**Results:**

| Modulation active<br>Frequency | 20 dB bandwidth [MHz] |
|---|---|
| 916.44 MHz | 653.57 |
| Measurement uncertainty | ± 100 kHz |

**Plot 1:** 916.44 MHz



## 9.6 Band edge compliance conducted

Not applicable - no restricted band!

## 9.7 Band edge compliance radiated

Not applicable - no restricted band!

## 9.8 TX spurious emissions conducted

**Description:**

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 100 kHz |
| Video bandwidth: | F < 1 GHz: 300 kHz<br>F > 1 GHz: 300 kHz |
| Span: | 9 kHz to 12.75 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | |
|---|---|
| TX Spurious Emissions Conducted | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required | |

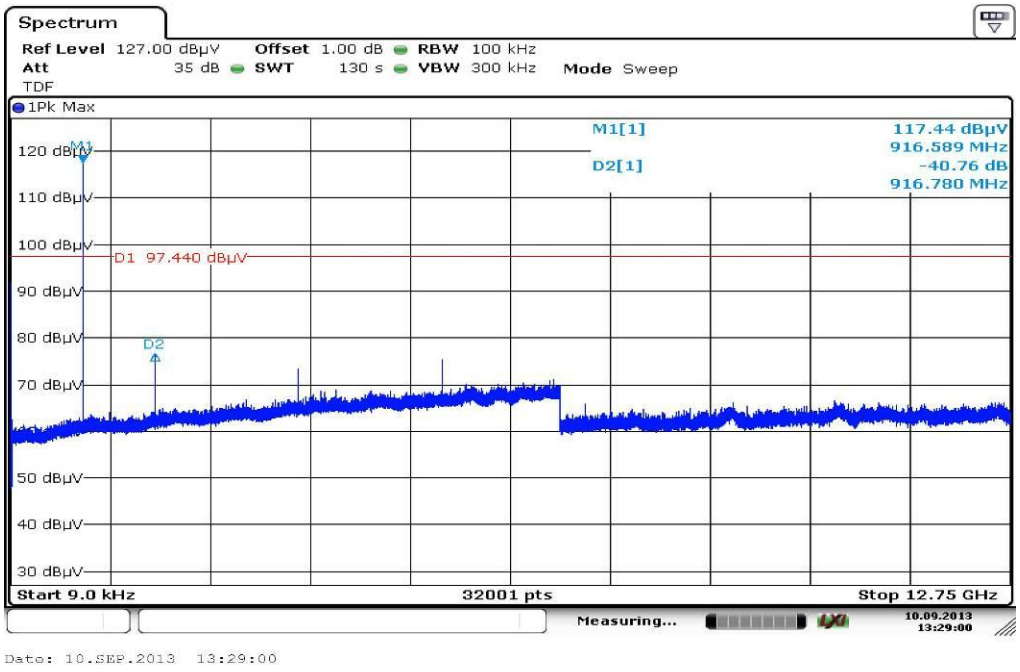
**Results:**

| TX Spurious Emissions Conducted | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| f [MHz] | | amplitude of emission [dBµV/m @ 3m] | limit max. allowed emission power | actual attenuation below frequency of operation [dB] | results |
| 916.44 | | 117.44 | -20 dBc | | Operating frequency |
| No emissions detected closer than 20 dBc below the limit. | | | | | complies |
| | | | | | |
| | | | | | |
| Measurement uncertainty | | | ± 3 dB | | |

**Result:** **Passed**

**Plots:**

**Plot 1:** 916.44 MHz



## 9.9 TX spurious emissions radiated

**Description:**

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | Sweep: 100 kHz<br>Remeasurement: 10 Hz |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 1 MHz |
| Span: | 30 MHz to 12.75 GHz |
| Trace-Mode: | Max Hold |

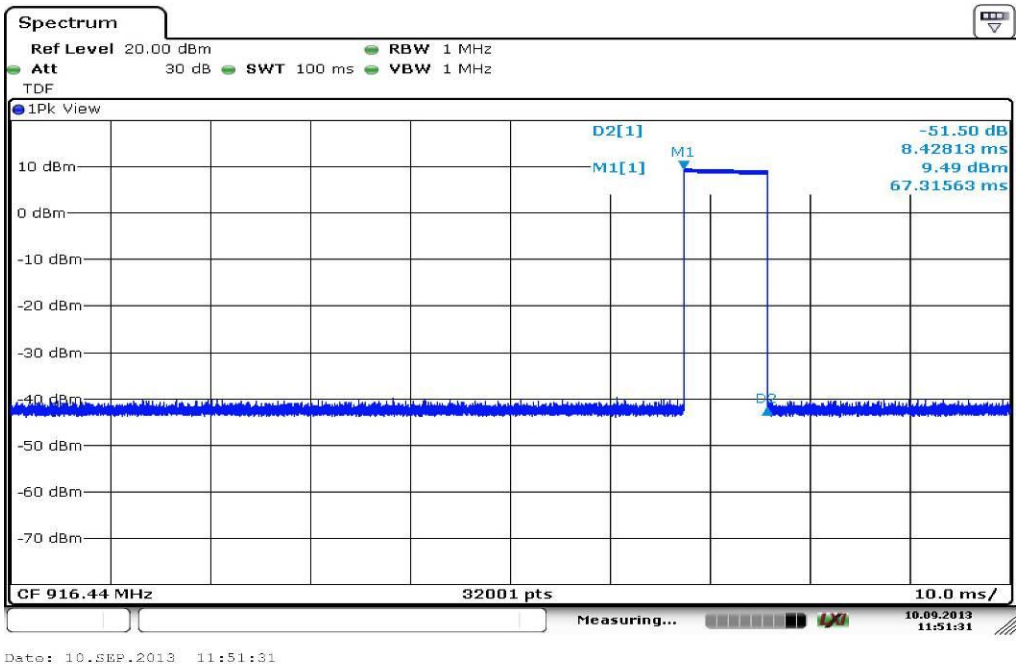
**Limits:**

| FCC | | |
|---|---|---|
| TX Spurious Emissions Radiated | | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | |
| §15.209 | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 30 - 88 | 30.0 | 10 |
| 88 – 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |

**Results:**

| TX Spurious Emissions Radiated [dBµV/m] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 916.44 MHz | | | | | | | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. | | | | | | | | |
| 2749.3 | 1 MHz PP | 63.7 | | | | | | |
| | DC AVG | 42.2 | | | | | | |
| 3665.8 | 1 MHz PP | 70.5 | | | | | | |
| | DC AVG | 49.0 | | | | | | |
| 4582.3 | 1 MHz PP | 60.0 | | | | | | |
| | DC AVG | 38.5 | | | | | | |
| | | | | | | | | |
| Measurement uncertainty | | | ± 3 dB | | | | | |

**Plot:** duty cycle




Duty cycle: 8.43 %

Duty cycle correction factor: 21.48 dB (20 log( 1/x))

**Result:** **Passed**

**Plots:**

**Plot 1:** Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization

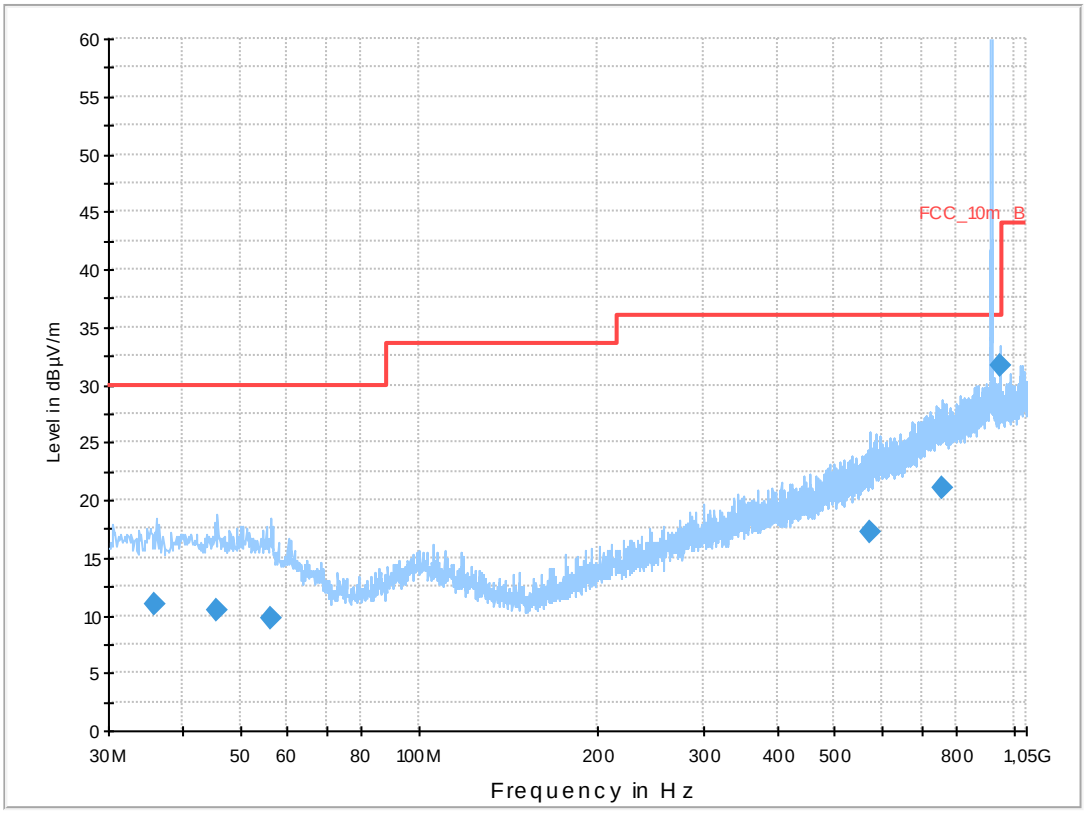
## Common Information

| | |
|---|---|
| EUT: | radio module |
| Serial Number: | 31050613 |
| Test Description: | FCC part 15 class B |
| Operating Conditions: | TX 916 MHz |
| Operator Name: | Hennemann |
| Comment: | battery powered |

## Scan Setup: STAN_Fin [EMI radiated]

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

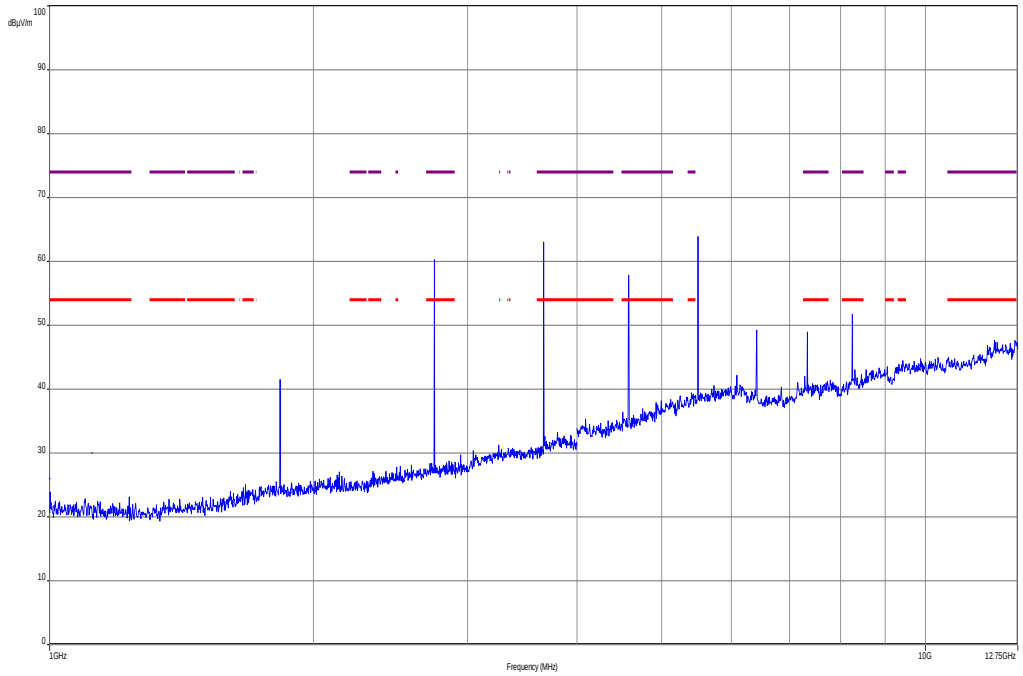
| Subrange | Step Size | Detectors | IF BW | Meas. Time | Preamp |
|---|---|---|---|---|---|
| 30 MHz - 2 GHz | 60 kHz | QPK | 120 kHz | 1 s | 20 dB |




## 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 35.955900 | 11.0 | 1000.0 | 120.000 | 174.0 | V | -50.0 | 13.1 | 19.0 | 30.0 | |
| 45.523350 | 10.5 | 1000.0 | 120.000 | 386.0 | H | 130.0 | 13.3 | 19.5 | 30.0 | |
| 56.050800 | 9.7 | 1000.0 | 120.000 | 400.0 | H | 248.0 | 12.6 | 20.3 | 30.0 | |
| 572.248950 | 17.3 | 1000.0 | 120.000 | 400.0 | H | 239.0 | 20.0 | 18.7 | 36.0 | |
| 757.581750 | 21.0 | 1000.0 | 120.000 | 200.0 | H | -50.0 | 23.7 | 15.0 | 36.0 | |
| 946.651200 | 31.7 | 1000.0 | 120.000 | 100.0 | H | 171.0 | 25.3 | 4.3 | 36.0 | |

**Plot 2:** 1 GHz to 12.75 GHz, vertical & horizontal polarization



## 9.10 RX spurious emissions radiated

**Description:**

Measurement of the radiated spurious emissions in idle/receive mode.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | Sweep: 100 kHz<br>Remeasurement: 10 Hz |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 1 MHz |
| Span: | 30 MHz to 25 GHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | | |
|---|---|---|
| RX Spurious Emissions Radiated | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 30 - 88 | 30.0 | 10 |
| 88 – 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |

**Results:**

| RX Spurious Emissions Radiated [dBµV/m] | | |
|---|---|---|
| F [MHz] | Detector | Level [dBµV/m] |
| No critical peaks detected! | | |
| | | |
| | | |
| Measurement uncertainty | ± 3 dB | |

**Result:** Passed

**Plots: RX / Idle – mode**

**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization

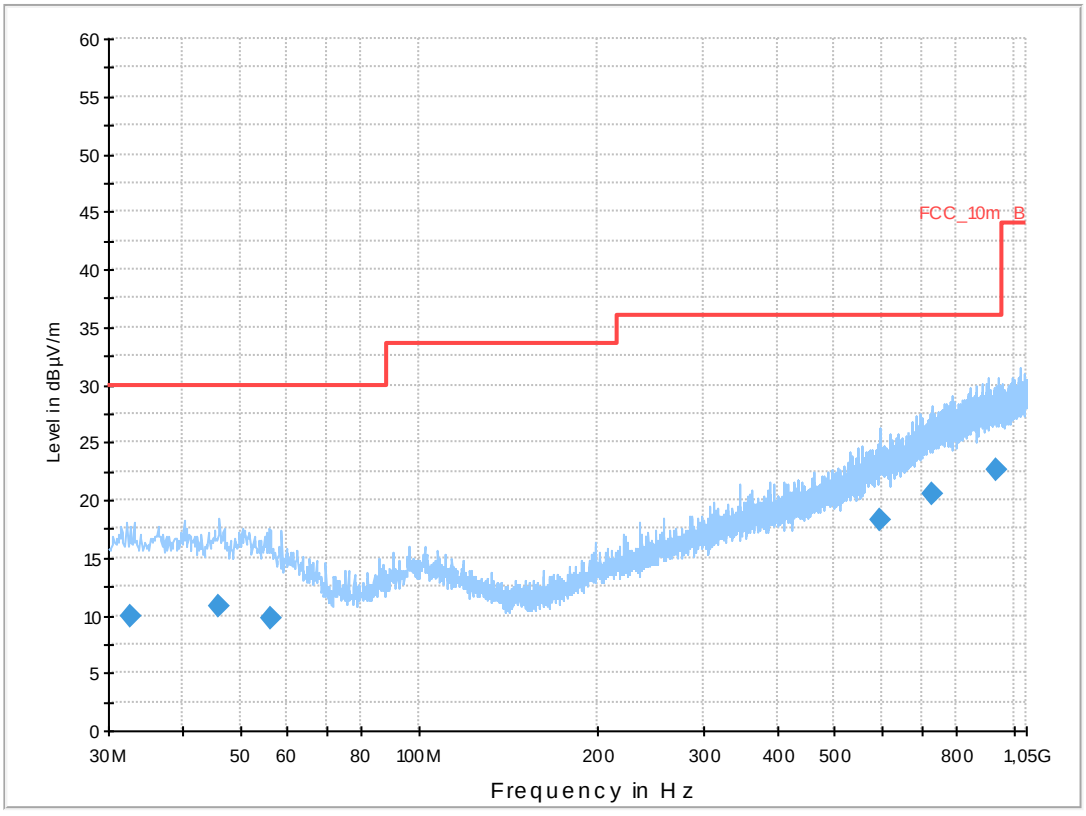
## Common Information

| | |
|---|---|
| EUT: | radio module |
| Serial Number: | |
| Test Description: | FCC part 15 class B |
| Operating Conditions: | RX |
| Operator Name: | Hennemann |
| Comment: | battery powered |

## Scan Setup: STAN_Fin [EMI radiated]

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

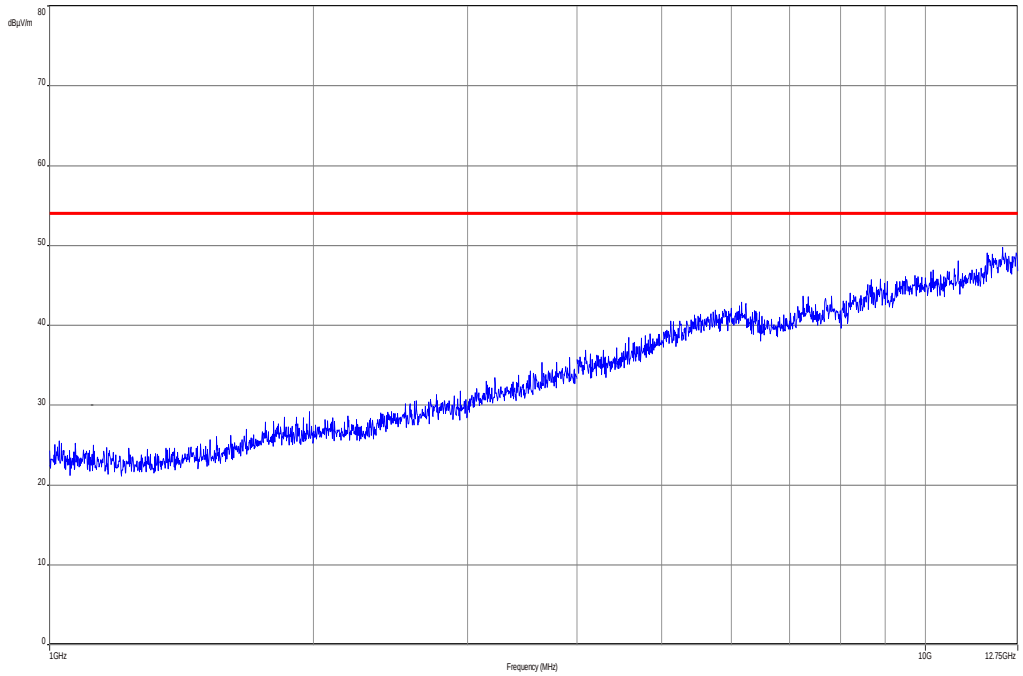
| Subrange | Step Size | Detectors | IF BW | Meas. Time | Preamp |
|---|---|---|---|---|---|
| 30 MHz - 2 GHz | 60 kHz | QPK | 120 kHz | 1 s | 20 dB |




## 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 32.798550 | 10.0 | 1000.0 | 120.000 | 200.0 | V | 23.0 | 12.8 | 20.0 | 30.0 | |
| 46.087500 | 10.9 | 1000.0 | 120.000 | 106.0 | V | 181.0 | 13.3 | 19.1 | 30.0 | |
| 56.095800 | 9.7 | 1000.0 | 120.000 | 400.0 | V | 91.0 | 12.6 | 20.3 | 30.0 | |
| 595.844700 | 18.2 | 1000.0 | 120.000 | 200.0 | H | -50.0 | 20.7 | 17.8 | 36.0 | |
| 726.811500 | 20.5 | 1000.0 | 120.000 | 200.0 | V | 183.0 | 23.1 | 15.5 | 36.0 | |
| 937.879500 | 22.6 | 1000.0 | 120.000 | 400.0 | V | 207.0 | 25.3 | 13.4 | 36.0 | |

**Plot 2:** 1 GHz to 12.75 GHz, vertical & horizontal polarization



## 9.11 TX spurious emissions radiated < 30 MHz

**Description:**

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 39. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 78 will be measured too. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace-Mode: | Max Hold |

**Limits:**

| FCC | | |
|---|---|---|
| TX Spurious Emissions Radiated < 30 MHz | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

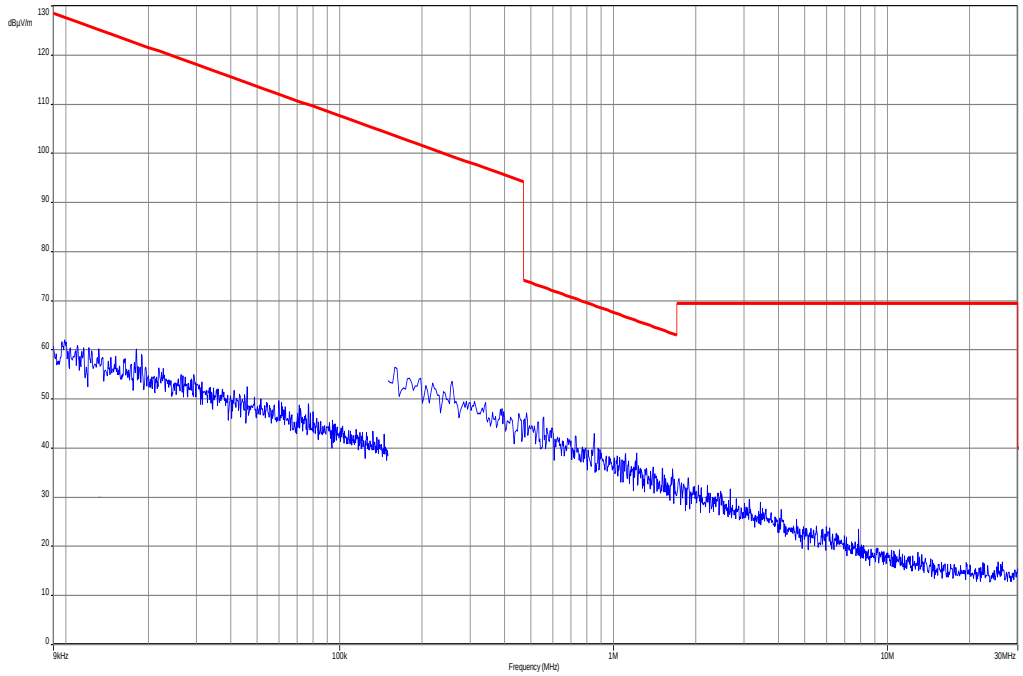
**Results:**

| TX Spurious Emissions Radiated < 30 MHz [dBµV/m] | | |
|---|---|---|
| F [MHz] | Detector | Level [dBµV/m] |
| No peaks detected! | | |
| | | |
| | | |
| Measurement uncertainty | ± 3 dB | |

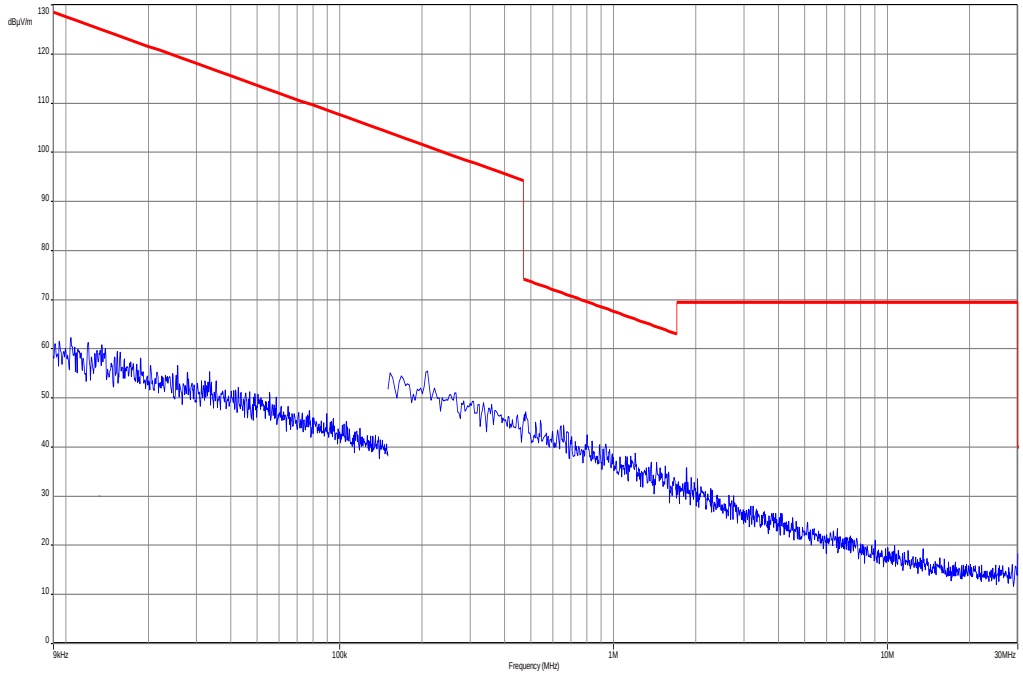
**Result:** **Passed**

**Plot:**

**Plot 1:** 9 kHz to 30 MHz, TX mode




**Plot 2:** 9 kHz to 30 MHz, RX mode



## 9.12 TX spurious emissions conducted < 30 MHz

Not applicable – battery powered only!

## 10 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 |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 45 | Switch-Unit | 3488A | HP Meßtechnik | 2719A14505 | 300000368 | g | | |
| 2 | 50 | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP Meßtechnik | 2920A04466 | 300000580 | ne | | |
| 3 | n. a. | software | SPS_PHE 1.4f | Spitzberger & Spieß | B5981; 5D1081;B5979 | 300000210 | ne | | |
| 4 | n. a. | EMI Test Receiver | ESCI 3 | R&S | 100083 | 300003312 | k | 09.01.2013 | 09.01.2014 |
| 5 | n. a. | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | Ve | 14.07.2011 | 14.01.2014 |
| 6 | n. a. | Amplifier | JS42-00502650-28-5A | MITEQ | 1084532 | 300003379 | ev | | |
| 7 | n. a. | Antenna Tower | Model 2175 | ETS-LINDGREN | 64762 | 300003745 | izw | | |
| 8 | n. a. | Positioning Controller | Model 2090 | ETS-LINDGREN | 64672 | 300003746 | izw | | |
| 9 | n. a. | Turntable Interface-Box | Model 105637 | ETS-LINDGREN | 44583 | 300003747 | izw | | |
| 10 | n. a. | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 295 | 300003787 | k | 12.04.2012 | 12.04.2014 |
| 11 | n. a. | Spectrum-Analyzer | FSU26 | R&S | 200809 | 300003874 | k | 16.01.2013 | 16.01.2014 |
| 12 | n. a. | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3088 | 300001032 | vlKl! | 08.05.2013 | 08.05.2015 |
| 13 | n. a. | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | | |
| 14 | n. a. | Switch / Control Unit | 3488A | HP Meßtechnik | * | 300000199 | ne | | |
| 15 | n. a. | Switch / Control Unit | 3488A | HP Meßtechnik | 2719A15013 | 300001156 | ne | | |
| 16 | n. a. | Three-Way Power Splitter, 50 Ohm | 11850C | HP Meßtechnik | | 300000997 | ne | | |
| 17 | 90 | Active Loop Antenna 10 kHz to 30 MHz | 6502 | Kontron Psychotech | 8905-2342 | 300000256 | k | 13.06.2013 | 13.06.2015 |
| 18 | n. a. | Amplifier | js42-00502650-28-5a | Parzich GMBH | 928979 | 300003143 | ne | | |
| 19 | n. a. | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 371 | 300003854 | vlKl! | 14.10.2011 | 14.10.2014 |
| 20 | n. a. | MXE EMI Receiver 20 Hz bis 26,5 GHz | N9038A | Agilent Technologies | MY51210197 | 300004405 | k | 21.02.2013 | 21.02.2014 |
| 21 | n. a. | Temperature Test Chamber | VT 4002 | Heraeus Voetsch | 521/83761 | 300002326 | Ve | 20.09.2011 | 20.09.2013 |
| 22 | n. a. | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 22.10.2012 | 22.10.2013 |

**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 |

## 11 Observations

No observations exceeding those reported with the single test cases have been made.

## Annex A Document history

| Version | Applied changes | Date of release |
|---|---|---|
| 1.0 | Initial release | 2013-09-27 |

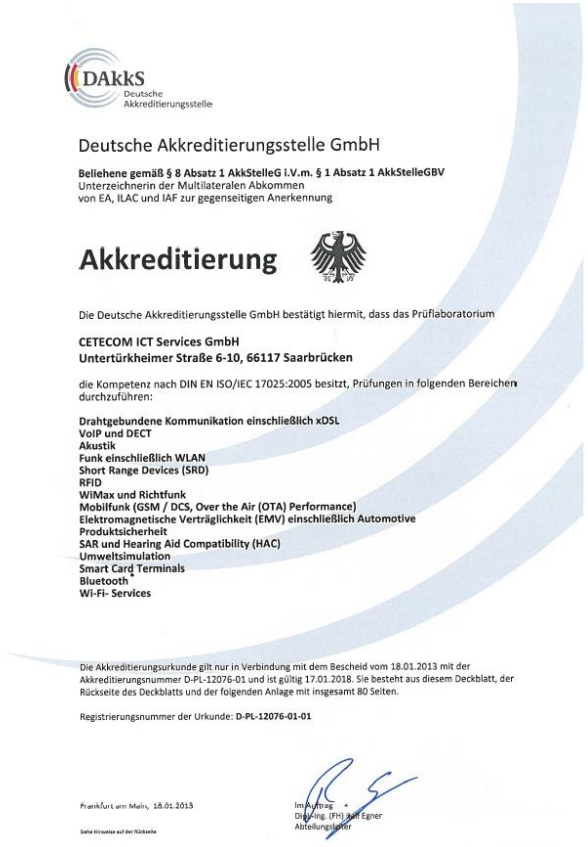
## Annex B Further information

**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

## Annex C Accreditation Certificate

Front side of certificate



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**CETECOM ICT Services GmbH**
**Untertürkheimer Straße 6-10, 66117 Saarbrücken**

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**Short Range Devices (SRD)**
**RFID**
**WiMax und Richtfunk**
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Dipl.-Ing. (FH) Karl Egner
Abteilungsleiter

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