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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-1410/16-01-03



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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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

Applicant

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Phone: +49 5130 600-1465

Manufacturer

Sennheiser electronic GmbH & Co. KG
Am Labor 1
30900 Wedemark / GERMANY

Test standard/s

47 CFR Part 74 Part 74 – Experimental radio, auxiliary, special broadcast and or other program distributional services

RSS - 210 Issue 8 Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS - 210 Issue 8 Amendment 1 RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)

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

Test Item

Kind of test item: **Wireless Microphone Handheld Transmitter**

Model name: **SKM 100 G3**

FCC ID: **DMOG3SKMEMU**

IC: **2099A-G3SKMEMU**

Frequency band: 470 MHz to 608 MHz

Technology tested: Analog FM

Antenna: Integrated wire antenna

Power supply: 3.0 V DC by 2 AA type batteries

Temperature range: -10°C to +55°C



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 authorized:

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

Marco Bertolino
Lab Manager
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2 General information

2.1 Notes and disclaimer

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 generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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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: | 2016-03-18 |
| Date of receipt of test item: | 2016-03-30 |
| Start of test: | 2016-03-30 |
| End of test: | 2016-04-08 |
| Person(s) present during the test: | -/- |

3 Test standard/s and references

| Test standard | Date | Description |
|-------------------------------|---------------|--|
| 47 CFR Part 74 | -/- | Part 74 – Experimental radio, auxiliary, special broadcast and or other program distributional services |
| CFR 47 Part 2 | -/- | Frequency allocations and radio treaty matters; general rules and regulations |
| RSS - 210 Issue 8 | December 2010 | Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment |
| RSS - 210 Issue 8 Amendment 1 | February 2015 | RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015) |
| RSS – Gen Issue 4 | November 2014 | General Requirements for Compliance of Radio Apparatus |
| ETSI EN 300 422-1 V1.4.2 | 2011-08 | Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement |
| ETSI EN 300 422-2 V1.3.1 | 2011-08 | Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive |
| Guidance | Version | Description |
| ANSI C63.4-2014 | -/- | American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz |

4 Test environment

| | | | |
|---------------------------|---|-------------------------------------|---|
| Temperature | : | T_{nom} T_{max} T_{min} | +20 °C during room temperature tests +50 °C during high temperature tests -30 °C during low temperature tests |
| Relative humidity content | : | | 55 % |
| Barometric pressure | : | | not relevant for this kind of testing |
| Power supply | : | V_{nom} V_{max} V_{min} | 3.00 V DC by 2 AA type batteries 3.45 V 2.55 V |

5 Test item

5.1 General description

| | | |
|----------------------------|---|---|
| Kind of test item | : | Wireless Microphone Handheld Transmitter |
| Type identification | : | SKM 100 G3 |
| HMN | : | -/- |
| PMN | : | SKM 100 |
| HVIN | : | SKM100G3A1 |
| FVIN | : | 1.7.8. DevId25, SWR26 |
| S/N serial number | : | Radiated unit: 1036290308 |
| Hardware status | : | No information available! |
| Software status | : | No information available! |
| Frequency band | : | 470 MHz to 608 MHz (lowest channel 470.075 MHz, highest channel 516.000 MHz) |
| Type of radio transmission | : | Modulated carrier |
| Use of frequency spectrum | : | |
| Type of modulation | : | Analog FM |
| Antenna | : | Integrated wire antenna |
| Power supply | : | 3.0 V DC by 2 AA type batteries |
| Temperature range | : | -10°C to +55°C |

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

- 1-1410/16-01-14_AnnexA
- 1-1410/16-01-14_AnnexB
- 1-1410/16-01-14_AnnexC

6 Test laboratories sub-contracted

None

7 Description of the test setup

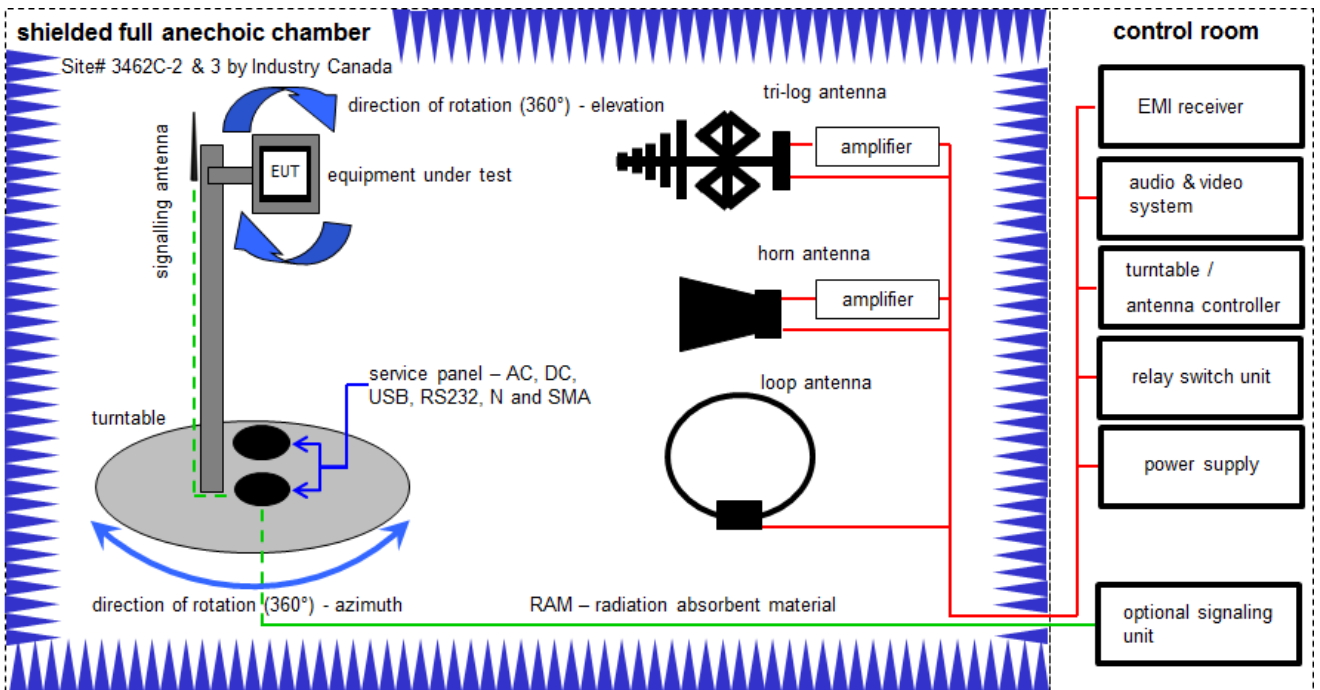
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling 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 (Lab/Item).

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 |
| vkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

7.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

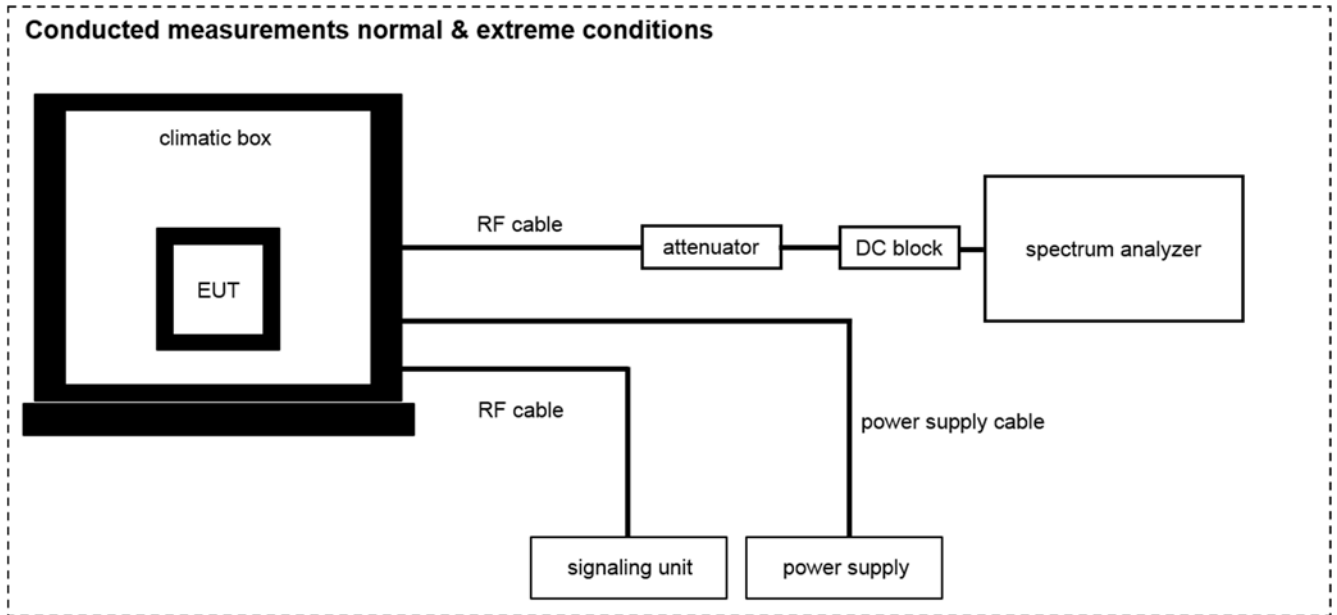
Example calculation:

$$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$$

Equipment table:

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|--|---------------------------------------|----------------------|-----------------|-----------------|---------------------|------------------|------------------|
| 1 | A | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 9709-5290 | 300000212 | k | 13.08.2015 | 13.08.2017 |
| 2 | A | EMI Test Receiver 20Hz- 26,5GHz | ESU26 | R&S | 100037 | 300003555 | k | 02.02.2016 | 02.02.2017 |
| 3 | A | Highpass Filter | WHK1.1/15G-10SS | Wainwright | 37 | 400000148 | ne | -/- | -/- |
| 4 | A | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck | 318 | 300003696 | k | 22.04.2014 | 22.04.2017 |
| 5 | A | 4U RF Switch Platform | L4491A | Agilent Technologies | MY50000032 | 300004510 | ne | -/- | -/- |
| 6 | A | Messrechner und Monitor | Intel Core i3 3220/3,3 GHz, Prozessor | Agilent Technologies | 2V2403033A54 21 | 300004591 | ne | -/- | -/- |
| 7 | A | NEXIO EMV-Software | BAT EMC | EMCO | 2V2403033A54 21 | 300004682 | ne | -/- | -/- |
| 8 | A | Active Loop Antenna 10 kHz to 30 MHz | 6502 | EMCO/2 | 8905-2342 | 300000256 | k | 24.06.2015 | 24.06.2017 |

7.2 Conducted measurements normal and extreme conditions



OP = AV + CA
 (OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|---|-------------------|-------------------|------------------|-----------------|---------------------|------------------|------------------|
| 1 | A, B, C | DC Power Supply 0 - 32V | 1108-32 | Heiden Elektronik | 001802 | 300001383 | Ve | 29.01.2014 | 29.01.2017 |
| 2 | B | Temperature Test Chamber | VT 4002 | Heraeus Voetsch | 521/83761 | 300002326 | ev | 03.09.2015 | 03.09.2017 |
| 3 | A, B, C | Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm | FSP30 | R&S | 100886 | 300003575 | k | 27.01.2016 | 27.01.2018 |
| 4 | A, B, C, D | RF-Cable | ST18/SMAm/SMAm/72 | Huber & Suhner | Batch no. 699714 | 400001184 | ev | -/- | -/- |
| 5 | A, B, C, D | DC-Blocker 0.1-40 GHz | 8141A | Inmet | Batch no. 699714 | 400001185 | ev | -/- | -/- |
| 6 | C | Radiocom. Analyzer Multifunction synthesizer DC-600 kHz | CMTA 84 | R&S | 894199/012 | 300001176 | vIKI! | 07.03.2016 | 07.03.2018 |
| 7 | A, B, C, D | Audio Analyzer | 8904A | HP | 2822A01203 | 300001367 | Ve | 30.01.2014 | 30.01.2017 |
| 8 | C | Signal Analyzer 40 GHz | UPA | R&S | 841074/009 | 300001236 | k | 02.02.2016 | 02.02.2018 |
| 9 | D | | FSV40 | R&S | 101353 | 300004819 | k | 24.08.2015 | 24.08.2016 |

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 12.75 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

| Measurement uncertainty | |
|--|--|
| Test case | Uncertainty |
| Transmitter output power | ± 3 dB |
| Occupied bandwidth | ± 3 kHz to 10 kHz (depends on the used RBW) |
| Transmitter frequency stability | ± 1 Hz to 1 kHz (depends on the used RBW) |
| Transmitter unwanted emissions (radiated or conducted) | Radiated: ± 3 dB Conducted: ± 0.5 dB |
| Modulation characteristics | -/- |
| Necessary bandwidth (BN) for analogue systems | ± 1 kHz (depends on the used RBW) |
| Frequency modulation | ± 3 kHz (depends on the used RBW) |

10 Summary of measurement results

| | |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | No deviations from the technical specifications were ascertained |
| <input type="checkbox"/> | There were deviations from the technical specifications ascertained |
| <input type="checkbox"/> | This test report is only a partial test report. The content and verdict of the performed test cases are listed below. |

| TC Identifier | Description | Verdict | Date | Remark |
|---------------|---|------------|------------|--------|
| RF-Testing | FCC Part 74 RSS - 210, Issue 8, Amendment 1 RSS-Gen Issue 4 | See table! | 2016-06-02 | -/- |

| Test specification clause | Test case | Temperature conditions | Voltage conditions | C | NC | NA | NP | Remark |
|---|--|------------------------|--------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------|
| FCC Part 74.861 (e)(1)(ii) RSS-210 A1 – 5.1 & 5.3.2 RSS-Gen – 6.12 | Transmitter output power | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| FCC Part 74.861 (e)(5) FCC Part 2.1049 RSS-210 A1 – 6.2 RSS-Gen – 6.6 | Occupied bandwidth | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| FCC Part 74.861 (e)(4) FCC Part 2.1055 RSS-210 A1 – 6.3 RSS-Gen – 6.11 | Transmitter frequency stability | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| | | Extreme | Extreme | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| FCC Part 74.861 (e)(6) RSS-210 A1 – 6.4.1 | Transmitter unwanted emissions (radiated or conducted) | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| FCC Part 2.1049 | Modulation characteristics | Nominal | Nominal | -/- | | | | -/- |
| FCC Part 74.861 (e)(7) ETSI EN 300 422-1 8.3.1 | Necessary bandwidth (BN) for analogue systems | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| FCC Part 74.861 (e)(3) RSS-210 A1 – 6.6.2 | Frequency modulation | Nominal | Nominal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -/- |
| RSS-210 A1 – 6.5 RSS-Gen | Receiver spurious emissions | Nominal | Nominal | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | No receiver integrated! |

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

11 Additional comments

Reference documents: None

Special test descriptions: No dedicated antenna available (fix mounted dipole antenna), so all measurements are performed with a radiated test set-up.

Configuration descriptions: EUT tested with a sensitivity setting of -30 dB – pre-setting from manufacturer.

Test mode:

- No test mode available.
Test signal is applied to the transmitter.
- Special software is used.
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

- Operating mode 1 (single antenna)**
 - *Equipment with 1 antenna,*
 - *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
 - *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*
- Operating mode 2 (multiple antennas, no beamforming)**
 - *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*
- Operating mode 3 (multiple antennas, with beamforming)**
 - *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.*

12 Measurement results

12.1 Transmitter output power

Measurement:

| Measurement parameter | |
|--------------------------|---|
| Detector: | Peak (worst case) / Average (RMS) |
| Sweep time: | Auto / |
| Resolution bandwidth: | > emission bandwidth |
| Video bandwidth: | > resolution bandwidth |
| Span: | > 2 times emissions bandwidth |
| Trace mode: | Max. hold |
| EUT configuration: | Peak: Unmodulated carrier RMS: Modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce a frequency deviation of ± 75 kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less. |
| Test setup: | See sub clause 7.2 – A |
| Measurement uncertainty: | See sub clause 9 |

Limits:

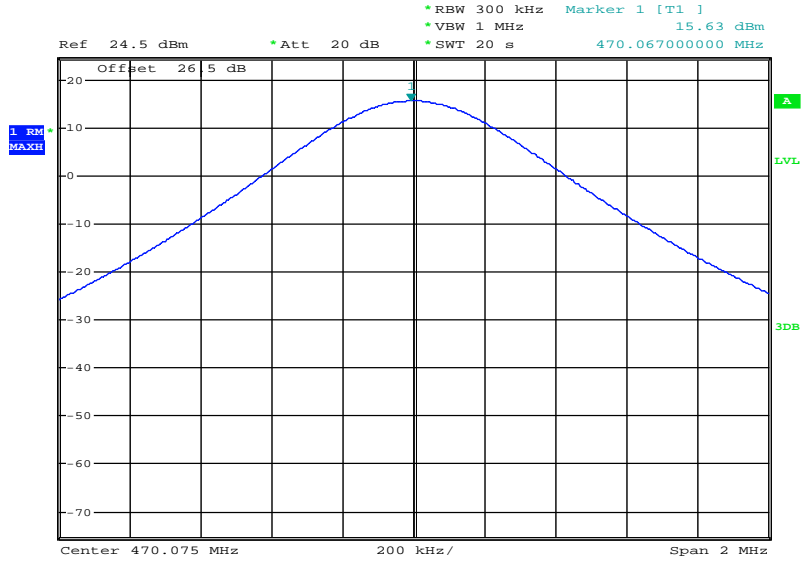
| FCC & IC |
|--|
| 470 MHz to 608 MHz 250 mW (average) / 24 dBm (average) |

Result:

| Frequency (MHz) | transmitter output power (dBm) | |
|-----------------|--------------------------------|---------|
| | Peak | Average |
| 470.075 | 15.92 | 15.63 |
| 493.000 | 16.35 | 15.97 |
| 516.000 | 15.98 | 15.61 |

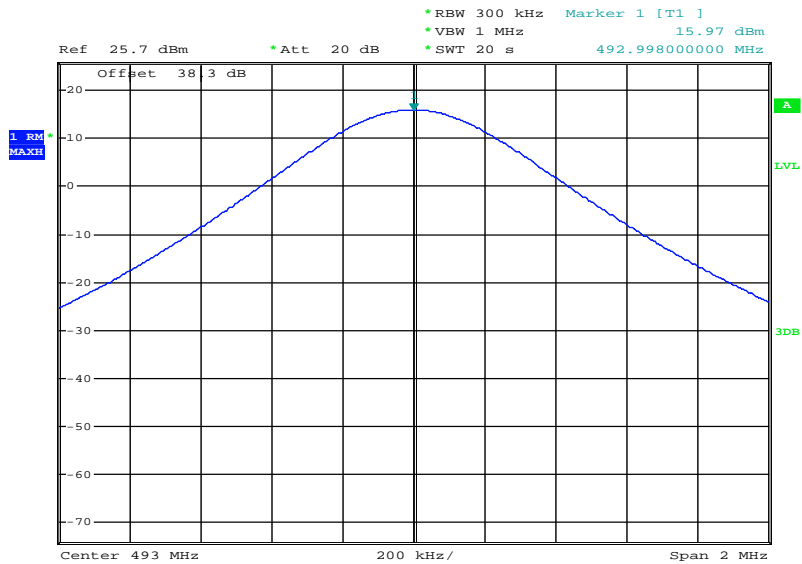
Plots:

Plot 1: lowest channel



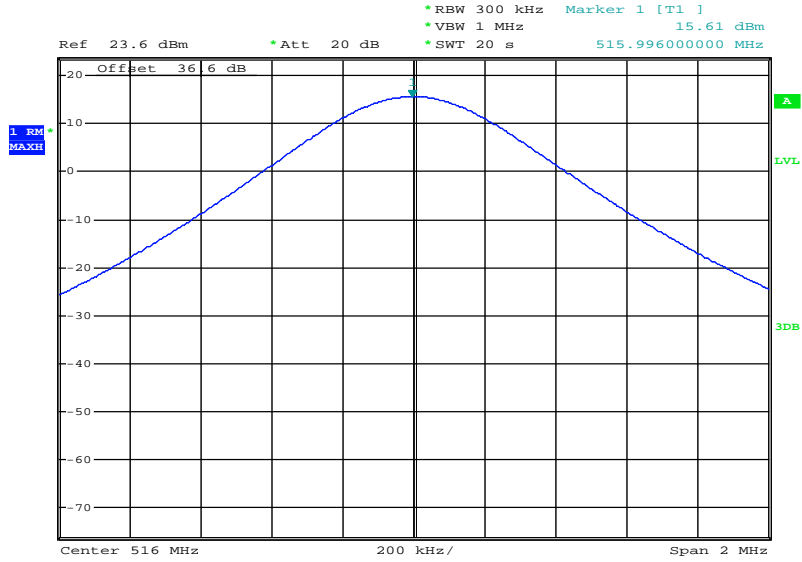
Date: 30.MAR.2016 16:33:20

Plot 2: middle channel



Date: 30.MAR.2016 16:30:30

Plot 3: highest channel



Date: 30.MAR.2016 16:27:58

12.2 Occupied bandwidth

Measurement:

| Measurement parameter | |
|--------------------------|--|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 % to 5 % of the occupied bandwidth |
| Video bandwidth: | 3 x resolution bandwidth |
| Span: | 2 x emission bandwidth |
| Trace mode: | Max. hold |
| Analyzer function: | 99% power occupied bandwidth function |
| EUT: | Modulated signal with max. frequency deviation |
| Test setup: | See sub clause 7.2 - A |
| Measurement uncertainty: | See sub clause 9 |

Limits:

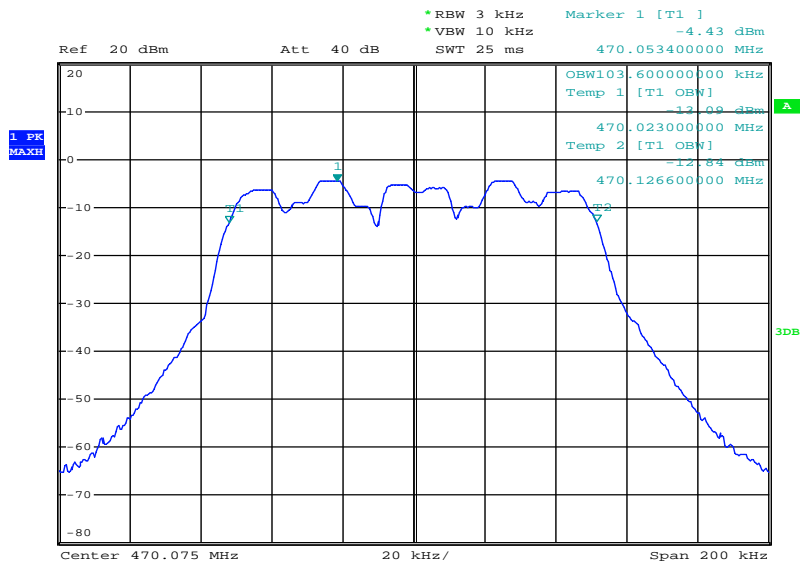
| FCC & IC |
|---|
| 470 MHz to 608 MHz 200 kHz |
| Occupied bandwidth 99%. Other than single sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit. |

Result:

| Frequency (MHz) | occupied bandwidth (kHz) | |
|-----------------|--------------------------|--------------|
| | 1 kHz tone | 2.5 kHz tone |
| 470.075 | 103.6 | 104.0 |
| 493.000 | 101.6 | 102.4 |
| 516.000 | 101.6 | 102.4 |

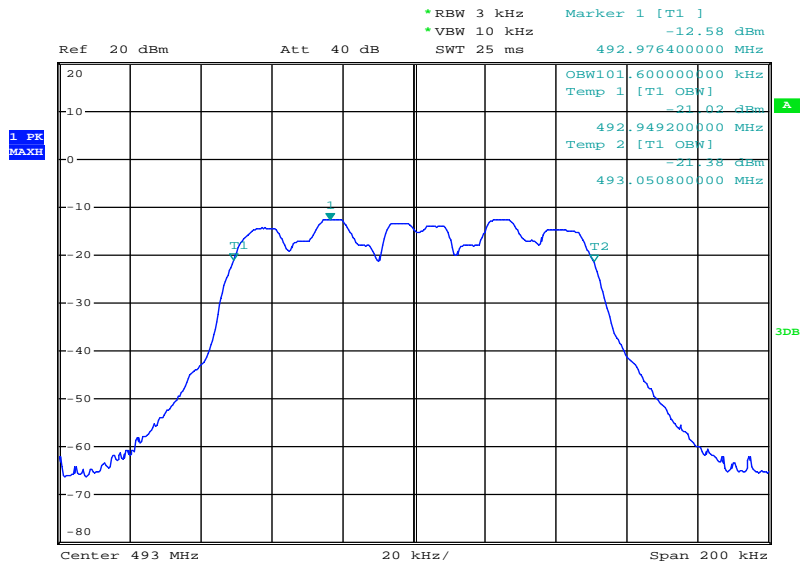
Plots:

Plot 1: lowest channel, 1 kHz tone



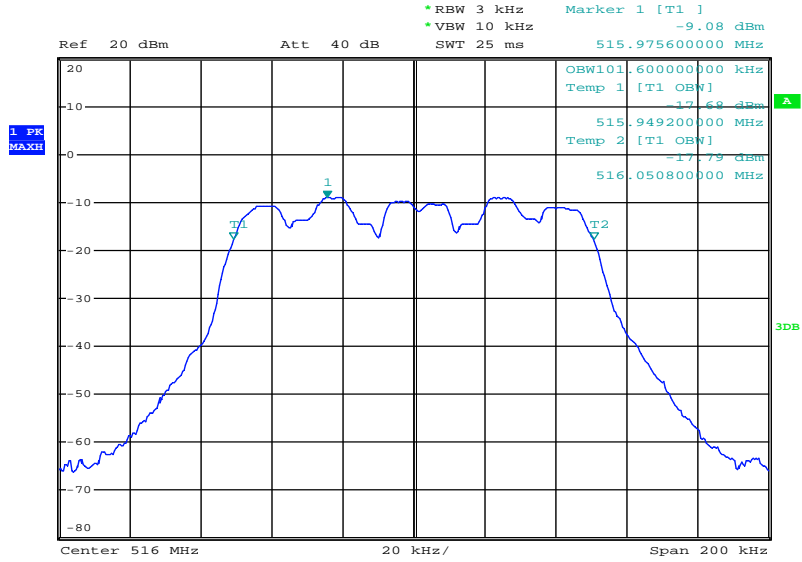
Date: 1.APR.2016 19:37:48

Plot 2: middle channel, 1 kHz tone



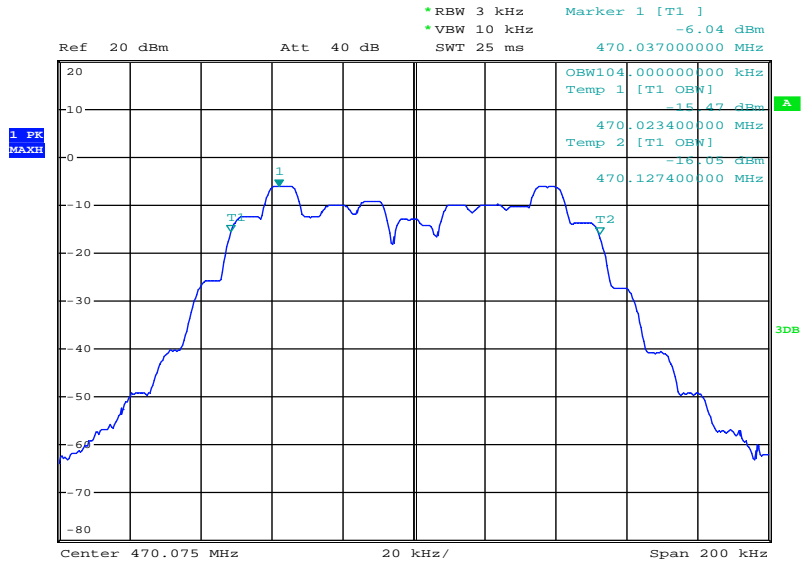
Date: 1.APR.2016 19:25:55

Plot 3: highest channel, 1 kHz tone



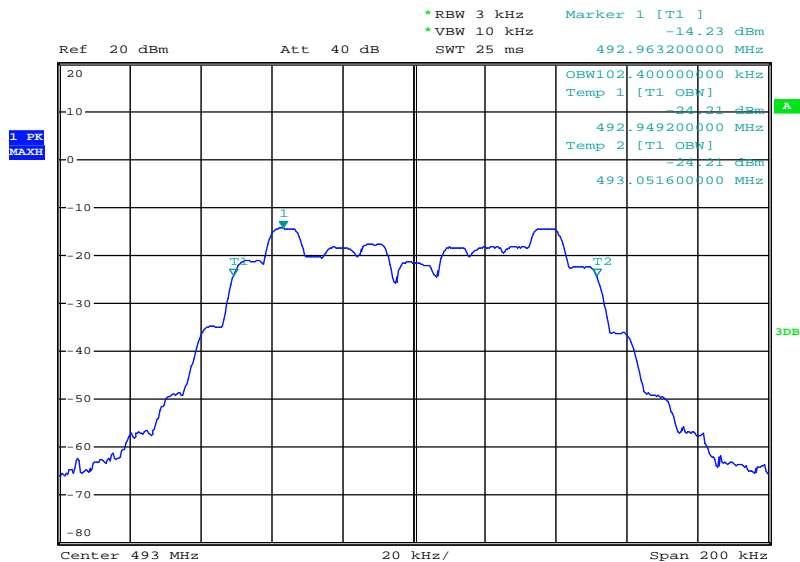
Date: 1.APR.2016 19:24:21

Plot 4: lowest channel, 2.5 kHz tone



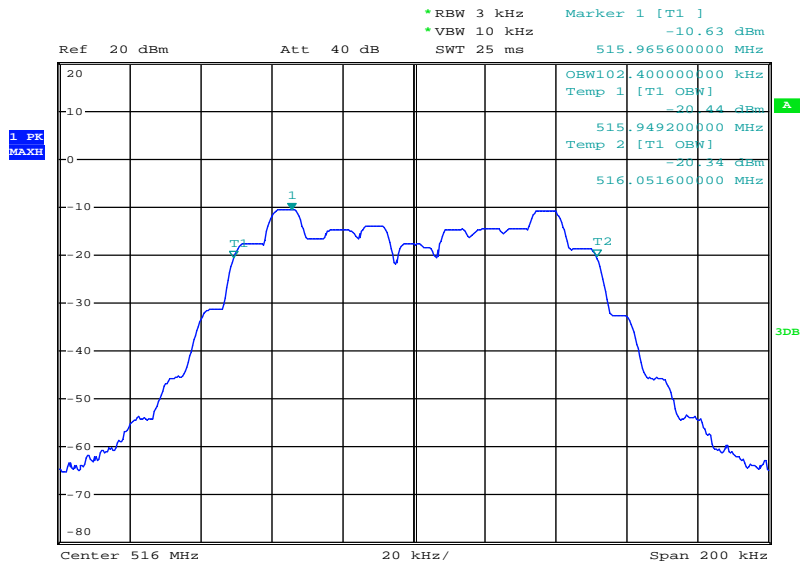
Date: 1.APR.2016 19:38:51

Plot 5: middle channel, 2.5 kHz tone



Date: 1.APR.2016 19:26:24

Plot 6: highest channel, 2.5 kHz tone



Date: 1.APR.2016 19:23:48

12.3 Transmitter frequency stability**Measurement:**

| Measurement parameter | |
|--------------------------|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 Hz / 10 Hz / 100 Hz |
| Video bandwidth: | 3 x resolution bandwidth |
| Span: | wide enough to follow the frequency drift |
| Trace mode: | clear/write/view |
| EUT: | CW signal or MC with measurement method description |
| Test setup: | See sub clause 7.2 - B |
| Measurement uncertainty: | See sub clause 9 |

Limits:

| FCC & IC |
|-----------------------------|
| 470 MHz to 608 MHz ± 50 ppm |

Results: lowest channel

| Temperature / Voltage | Frequency (MHz) | Deviation (kHz / ppm) |
|-----------------------------------|-----------------|-----------------------|
| -30 °C / V_{nom} | 470.0731 | -1.9 / -4.0 |
| -20 °C / V_{nom} | 470.0740 | -1.0 / -2.1 |
| -10 °C / V_{nom} | 470.0756 | 0.6 / 1.3 |
| 0 °C / V_{nom} | 470.0755 | 0.5 / 1.1 |
| +10 °C / V_{nom} | 470.0755 | 0.5 / 1.1 |
| +20 °C / V_{nom} | 470.0751 | 0.1 / 0.2 |
| +30 °C / V_{nom} | 470.0748 | -0.2 / -0.4 |
| +40 °C / V_{nom} | 470.0744 | -0.6 / -1.3 |
| +50 °C / V_{nom} | 470.0751 | 0.1 / 0.2 |
| +55 °C / V_{nom} (not required) | 470.0751 | 0.1 / 0.2 |
| +20 °C / $V_{nom} - 15\%$ | 470.0751 | 0.1 / 0.2 |
| +20 °C / V_{nom} | 470.0751 | 0.1 / 0.2 |
| +20 °C / $V_{nom} + 15\%$ | 470.0751 | 0.1 / 0.2 |

Results: middle channel

| Temperature / Voltage | Frequency (MHz) | Deviation (kHz / ppm) |
|-----------------------------------|-----------------|-----------------------|
| -30 °C / V_{nom} | 493.0000 | 0.0 / 0.0 |
| -20 °C / V_{nom} | 493.0004 | 0.4 / 0.8 |
| -10 °C / V_{nom} | 493.0012 | 1.2 / 2.4 |
| 0 °C / V_{nom} | 493.0006 | 0.6 / 1.2 |
| +10 °C / V_{nom} | 493.0005 | 0.5 / 1.0 |
| +20 °C / V_{nom} | 493.0003 | 0.3 / 0.6 |
| +30 °C / V_{nom} | 492.9999 | -0.1 / -0.2 |
| +40 °C / V_{nom} | 492.9995 | -0.5 / -1.0 |
| +50 °C / V_{nom} | 493.0003 | 0.3 / 0.6 |
| +55 °C / V_{nom} (not required) | 493.0003 | 0.3 / 0.6 |
| <hr/> | | |
| +20 °C / V_{nom} - 15% | 493.0002 | 0.2 / 0.4 |
| +20 °C / V_{nom} | 493.0003 | 0.3 / 0.6 |
| +20 °C / V_{nom} + 15% | 493.0003 | 0.3 / 0.6 |

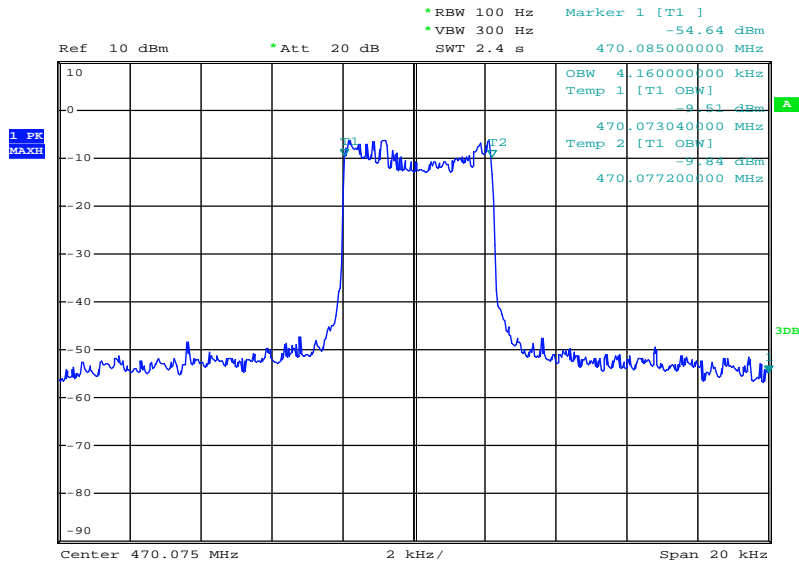
Results: highest channel

| Temperature / Voltage | Frequency (MHz) | Deviation (kHz / ppm) |
|-----------------------------------|-----------------|-----------------------|
| -30 °C / V_{nom} | 515.9966 | -3.4 / -6.5 |
| -20 °C / V_{nom} | 515.9978 | -2.2 / 0.1 |
| -10 °C / V_{nom} | 516.0006 | 0.6 / 1.2 |
| 0 °C / V_{nom} | 516.0006 | 0.6 / 1.2 |
| +10 °C / V_{nom} | 516.0006 | 0.6 / 1.2 |
| +20 °C / V_{nom} | 516.0003 | 0.3 / 0.6 |
| +30 °C / V_{nom} | 516.0000 | 0.0 / 0.0 |
| +40 °C / V_{nom} | 515.9995 | -0.5 / -1.0 |
| +50 °C / V_{nom} | 516.0003 | 0.3 / 0.6 |
| +55 °C / V_{nom} (not required) | 516.0003 | 0.3 / 0.6 |
| <hr/> | | |
| +20 °C / V_{nom} - 15% | 516.0003 | 0.3 / 0.6 |
| +20 °C / V_{nom} | 516.0003 | 0.3 / 0.6 |
| +20 °C / V_{nom} + 15% | 516.0003 | 0.3 / 0.6 |

Plots:

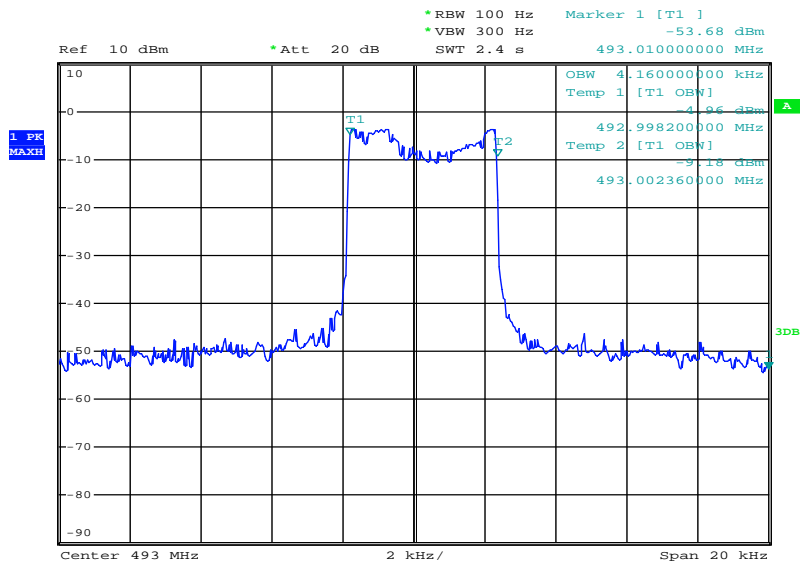
The carrier frequency drift is calculated with the right and the left marker (see plots below) from the integrated 99% OBW function.

Plot 1: lowest channel, T_{nom} / V_{nom}



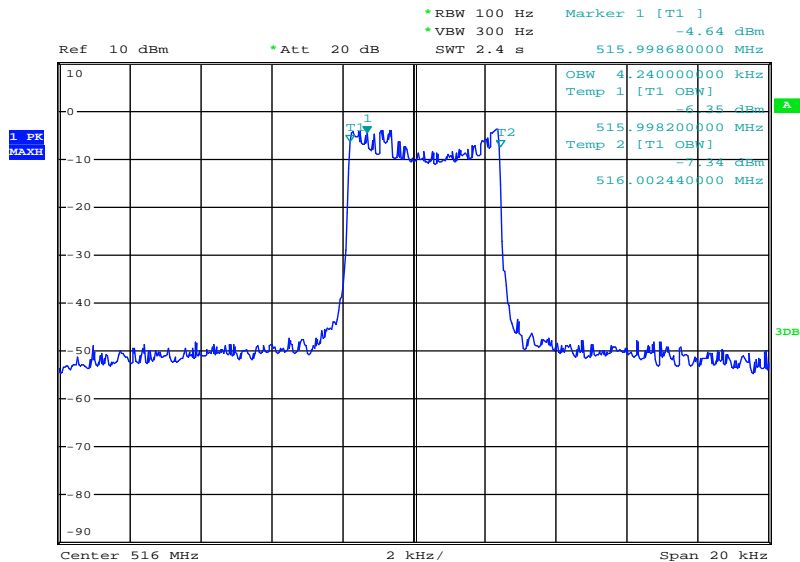
Date: 30.MAR.2016 17:38:22

Plot 2: middle channel, T_{nom} / V_{nom}



Date: 30.MAR.2016 17:33:45

Plot 3: highest channel, T_{nom} / V_{nom}



Date: 30.MAR.2016 17:29:26

12.4 Transmitter unwanted emissions (radiated)

Measurement:

| Measurement parameter | | |
|--------------------------|---|--------------------------------|
| Detector: | Peak | |
| Sweep time: | Auto | |
| Resolution bandwidth: | 25 dBc and 35 dBc-criteria: | 1% of the authorized bandwidth |
| | $55+10\log_{10}(P_{MEAN}$ in Watts) dB - criteria | 30 kHz |
| | $43+10\log_{10}(P_{MEAN}$ in Watts) dB - criteria | 120 kHz / 1 MHz |
| Video bandwidth: | 3 x resolution bandwidth | |
| Trace mode: | Max. hold | |
| EUT: | MC with max frequency deviation | |
| Test setup: | See sub clause 7.1 – A See sub clause 7.2 – A | |
| Measurement uncertainty: | See sub clause 9 | |

Limits:

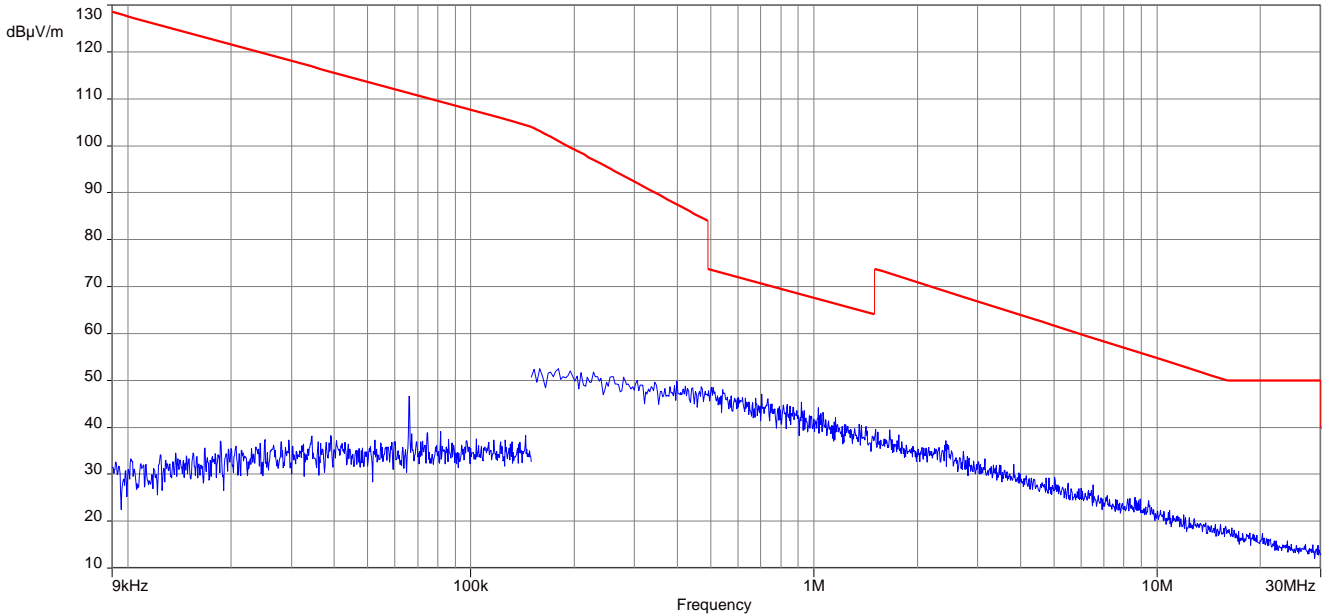
| IC |
|--|
| <ul style="list-style-type: none"> at least 25 dB on any frequency that is removed from the operating frequency by more than 50%, up to and including 100% of the authorized bandwidth; and (FCC & IC) at least 35 dB on any frequency that is removed from the operating frequency by more than 100%, up to and including 250% of the authorized bandwidth. (FCC & IC) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10 \cdot \log_{10}$ (mean output power in watts) dB. (FCC) at least $55 + 10 \cdot \log_{10}$ (P_{MEAN} in Watts) dB on any frequency removed from the operating frequency by more than 250% of the authorized bandwidth. (IC) |

Results:

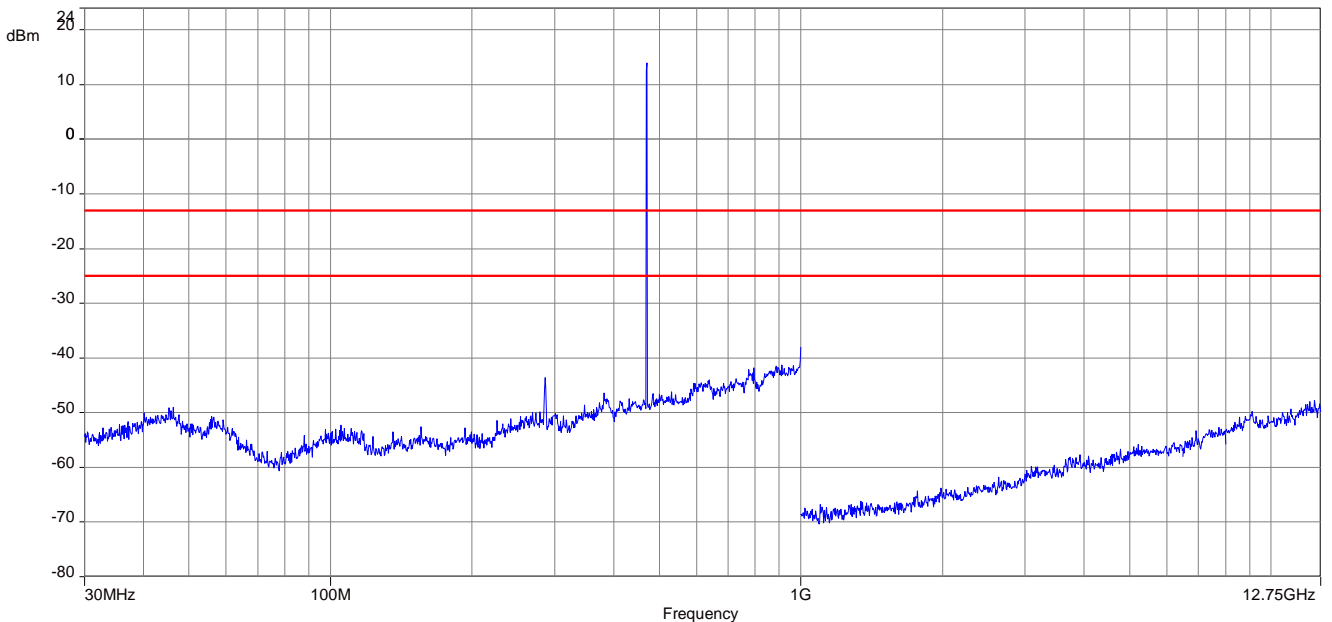
| carrier frequency (MHz) | unwanted emission frequency (MHz) | Limit | level (dB) / (dBm) or remark |
|---|-----------------------------------|-------|------------------------------|
| All detected emissions are more than 20 dB below the limit. | | | |
| | | | |
| | | | |

Plots:

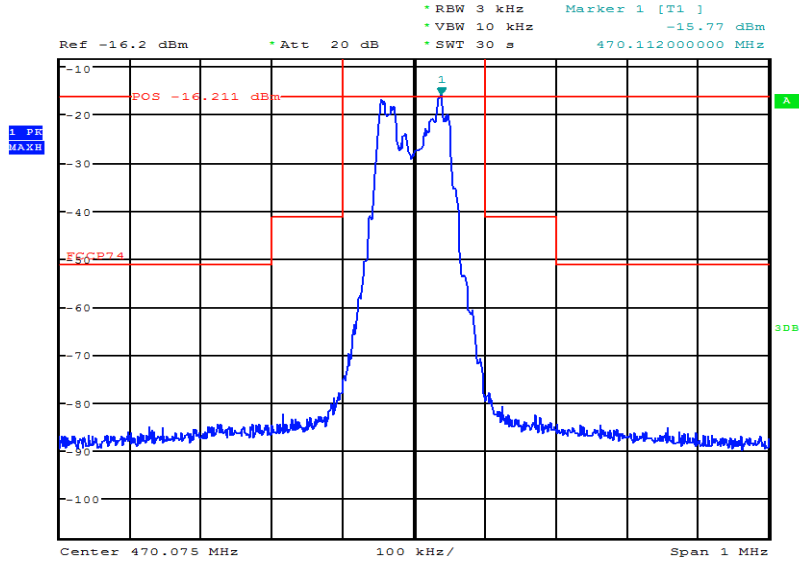
Plot 1: lowest channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 2: lowest channel, spurious emissions, 30 MHz – 12.75 GHz

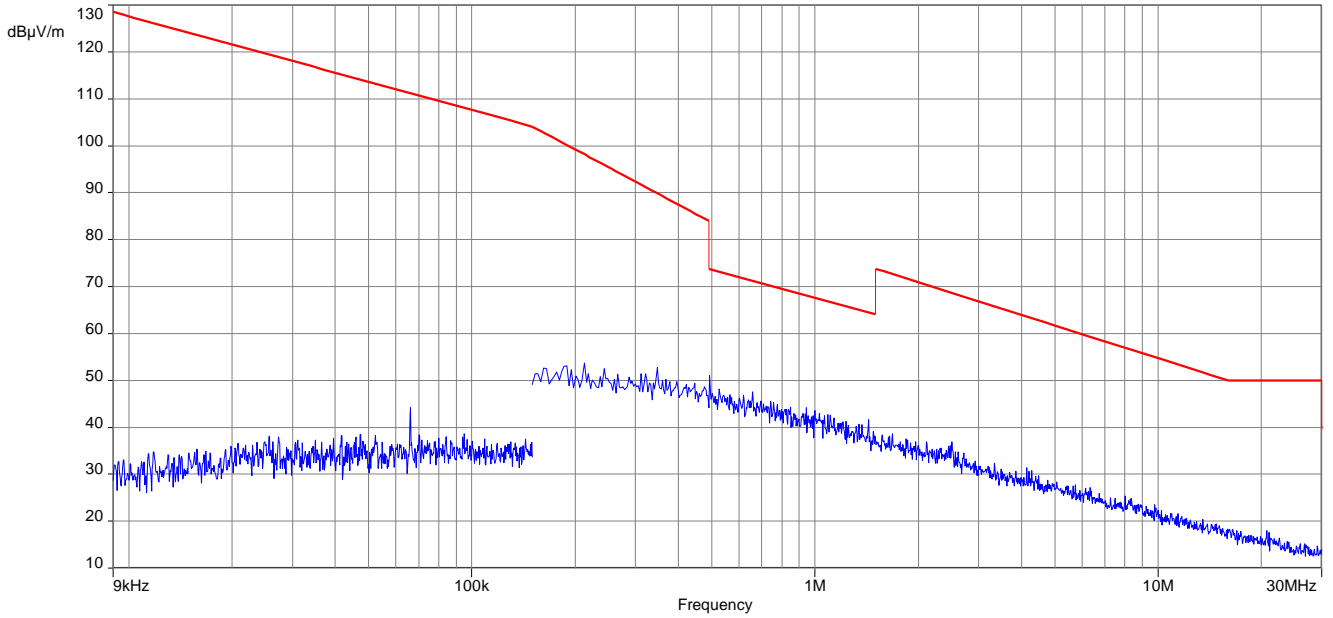


Plot 3: lowest channel, spectrum mask

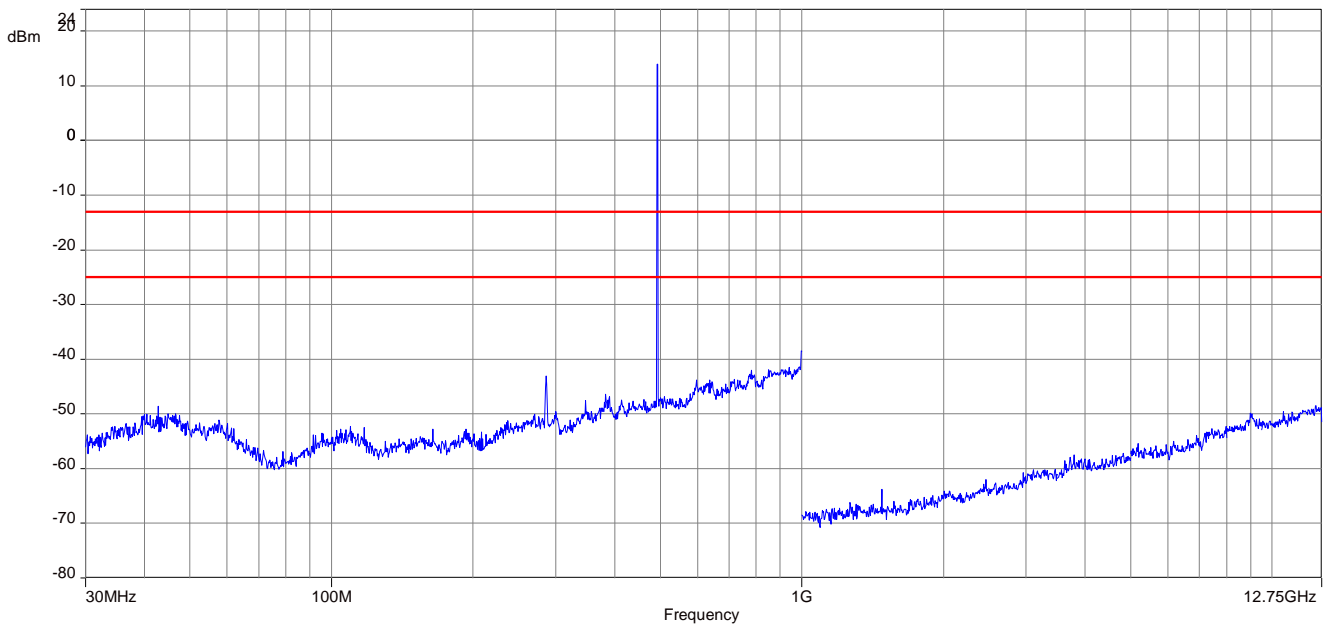


Date: 30.MAR.2016 17:00:59

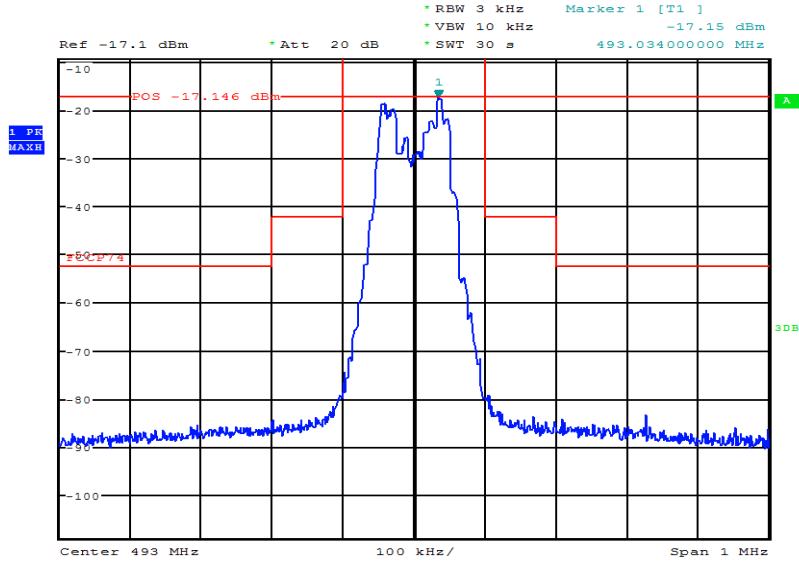
Plot 4: middle channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 5: middle channel, spurious emissions, 30 MHz – 12.75 GHz

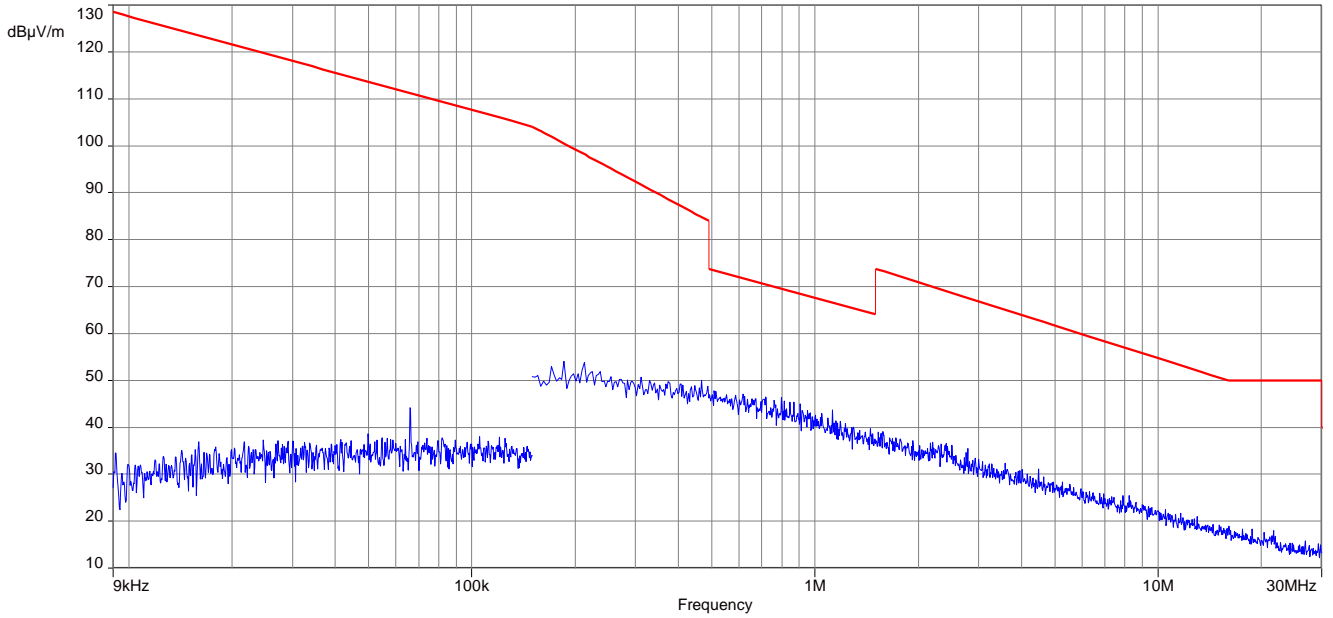


Plot 6: middle channel, spectrum mask

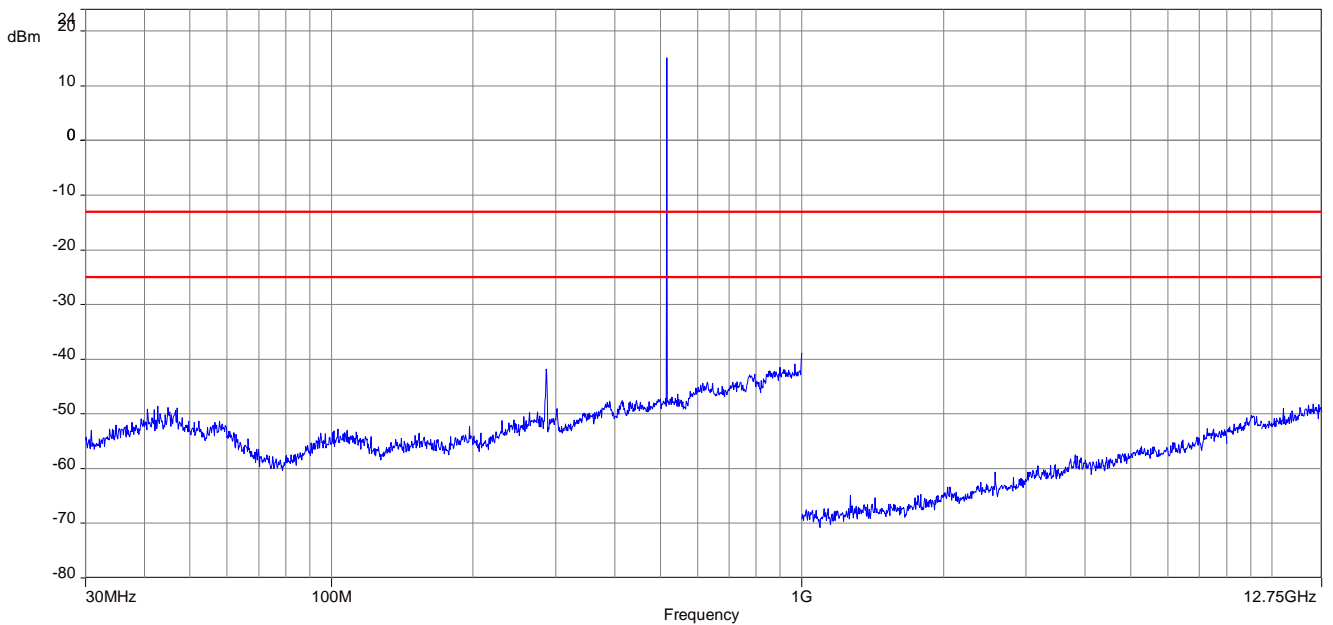


Date: 30.MAR.2016 17:06:42

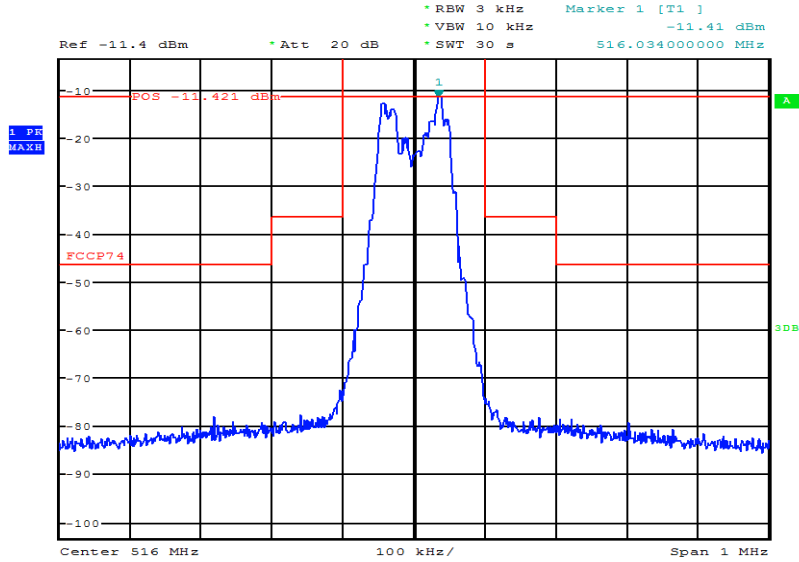
Plot 7: highest channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 8: highest channel, spurious emissions, 30 MHz – 12.75 GHz



Plot 9: highest channel, spectrum mask



Date: 30.MAR.2016 17:13:08

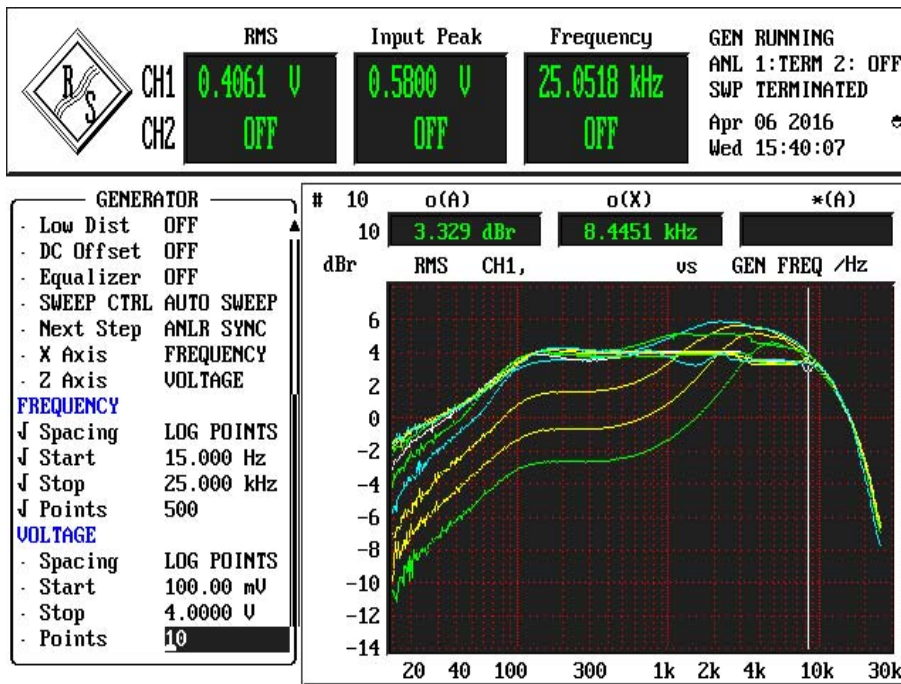
12.5 Modulation characteristics

Method of measurement:

The audio frequency response was measured in accordance with EIA/TIA 603. The plots shows 10 curves with different modulation levels, the test frequency is varied from 15 Hz to 20 kHz.

Plots:

Plot 1: 10 curves with voltage and frequency variation

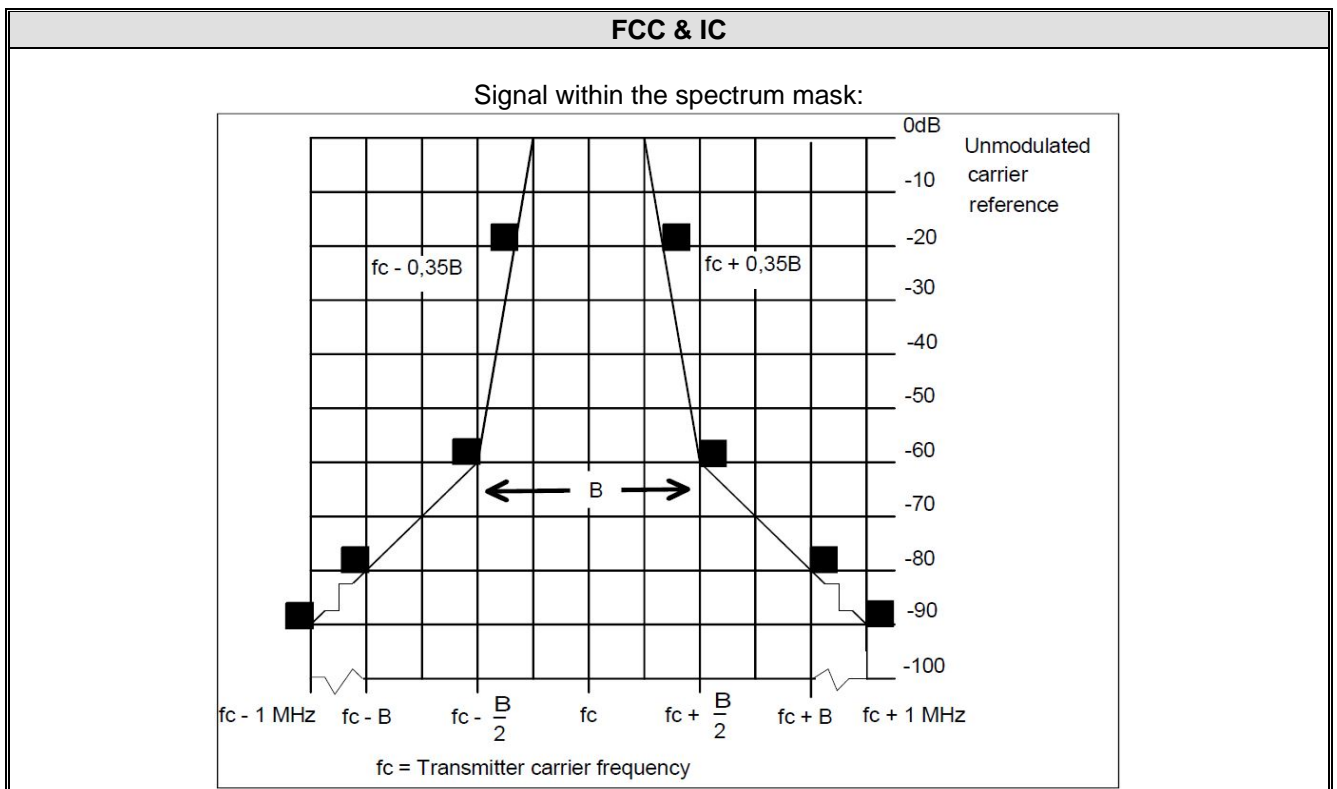


12.6 Necessary bandwidth (BN) for analogue systems

Measurement:

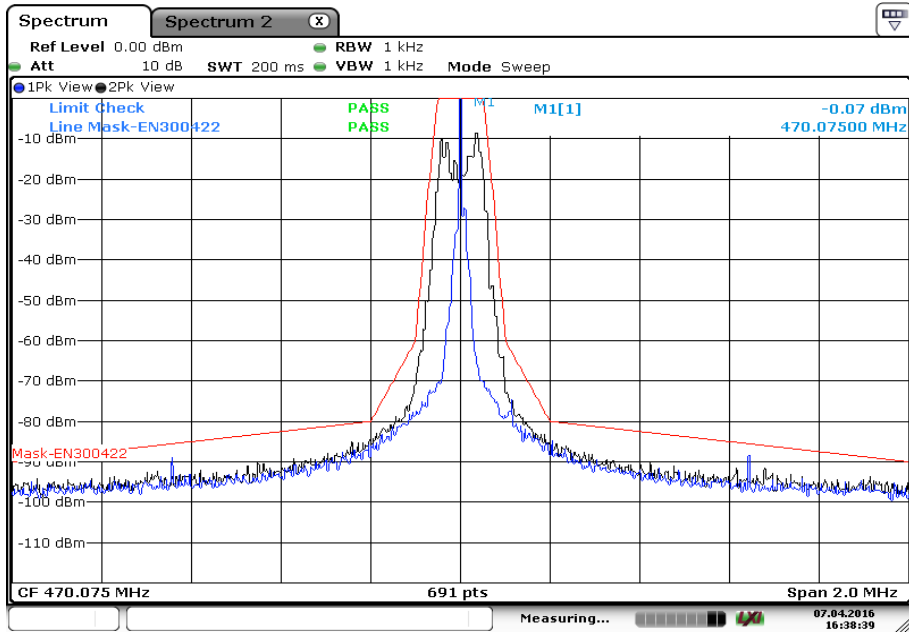
| Measurement parameter | |
|--------------------------|--|
| Detector: | Peak / Average (-90 dBc point only) |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 kHz |
| Video bandwidth: | 1 kHz |
| Span: | $f_c - 1 \text{ MHz}$ to $f_c + 1 \text{ MHz}$ (2 MHz) |
| Trace mode: | Max hold/view |
| EUT: | CW and MC |
| Test setup: | See sub clause 7.2 - D |
| Measurement uncertainty: | See sub clause 9 |

Limits:



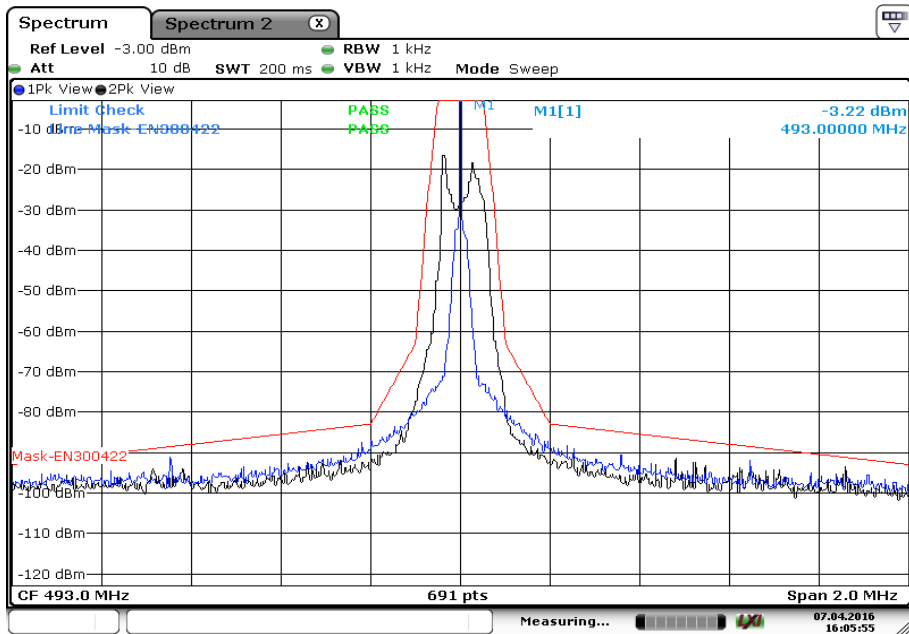
Plots:

Plot 1: lowest channel, unmodulated carrier for reference and modulated carrier



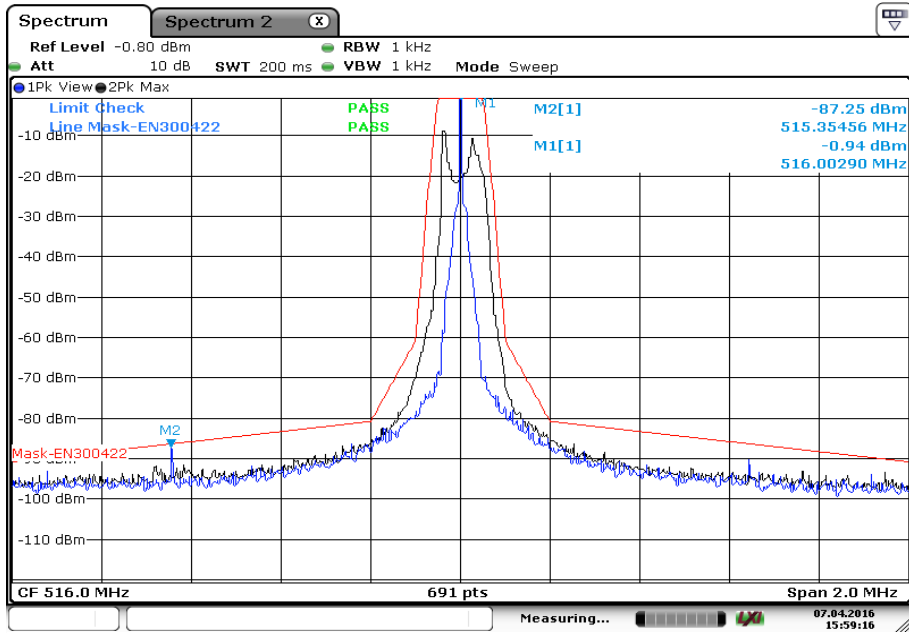
Date: 7 APR 2016 16:38:39

Plot 2: middle channel, unmodulated carrier for reference and modulated carrier



Date: 7 APR 2016 16:05:55

Plot 3: highest channel, unmodulated carrier for reference and modulated carrier



Date: 7 APR 2016 15:59:17

12.7 Frequency modulation

Measurement:

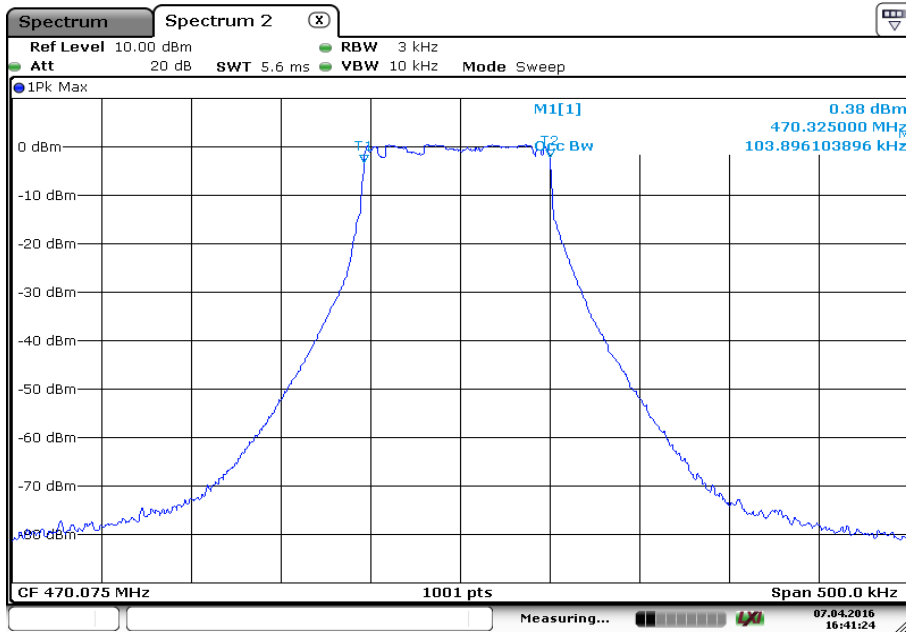
| Measurement parameter | |
|--------------------------|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 % to 5 % of the occupied bandwidth |
| Video bandwidth: | 3 x resolution bandwidth |
| Span: | 2 x emission bandwidth |
| Trace mode: | Max. hold |
| Analyzer function: | 99% power occupied bandwidth function |
| EUT: | Modulated signal with frequency varied between 50 Hz and 15 kHz |
| Test setup: | See sub clause 7.2 - D |
| Measurement uncertainty: | See sub clause 9 |

Limits:

| FCC & IC |
|---|
| Frequency deviation up to a maximum of ± 75 kHz |

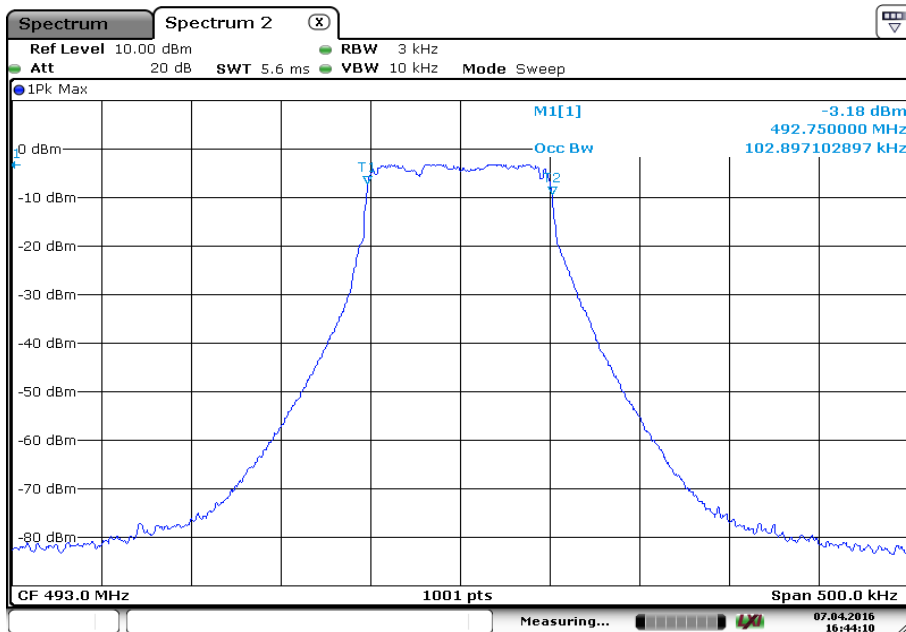
Plots:

Plot 1: lowest channel, max hold with frequency variation from 50 Hz to 15 kHz



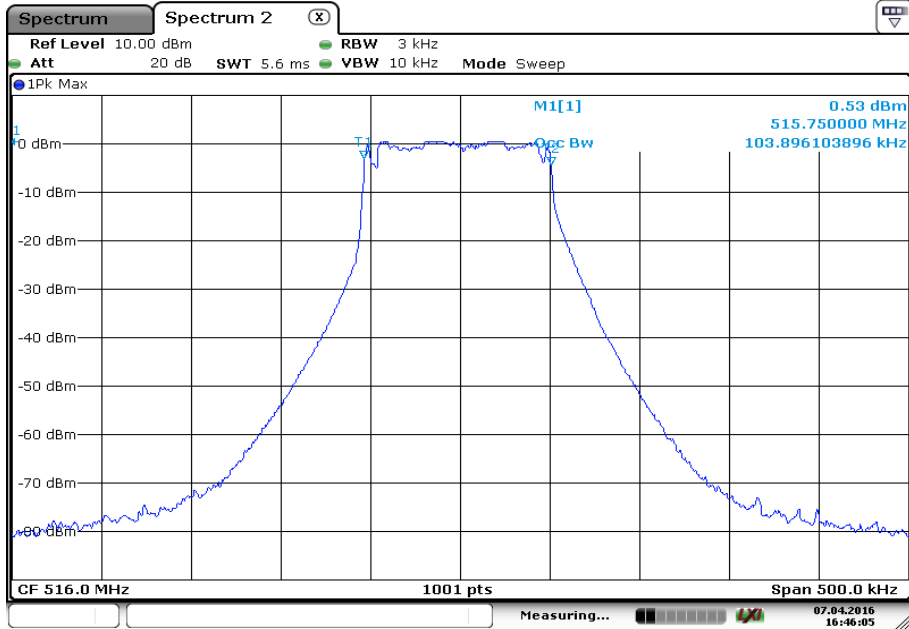
Date: 7 APR 2016 16:41:24

Plot 2: middle channel, max hold with frequency variation from 50 Hz to 15 kHz



Date: 7 APR 2016 16:44:10

Plot 3: highest channel, max hold with frequency variation from 50 Hz to 15 kHz



Date: 7 APR 2016 16:46:06

13 Observations

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

Annex A Document history

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| | Initial release | 2016-06-02 |

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 |
| PMN | - | Product marketing name |
| HMN | - | Host marketing name |
| HVIN | - | Hardware version identification number |
| FVIN | - | Firmware version identification number |

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
 Unterzeichnerin der Multilateralen Abkommen
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

- Funk
- Mobilfunk (GSM / DCS) + OTA
- Elektromagnetische Verträglichkeit (EMV)
- Produktsicherheit
- SAR / EMF
- Umwelt
- Smart Card Technology
- Bluetooth®
- Automotive
- Wi-Fi-Services
- Kanadische Anforderungen
- US-Anforderungen
- Akustik
- Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 04.05.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 04.05.2016

Im Auftrag Dir. Ing. (FH) Ralf Eigner
 Abteilungsleiter

Siehe Hinweise auf der Rückseite

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
 Spittelmarkt 10
 10117 Berlin

Standort Frankfurt am Main
 Europa-Allee 52
 60327 Frankfurt am Main

Standort Braunschweig
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 38116 Braunschweig

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 IAF: www.iaf.nu

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