# Accredited testing-laboratory

**DAR registration number: DGA-PL-176/94-D1**

**Federal Motor Transport Authority (KBA)**
**DAR registration number: KBA-P 00070-97**

**Recognized by the Federal Communications Commission**
**Anechoic chamber registration no.: 90462 (FCC)**
**Anechoic chamber registration no.: 3462C-1 (IC)**
**Certification ID: DE 0001**
**Accreditation ID: DE 0002**

**Accredited Bluetooth® Test Facility (BQTF)**



| | | |
|---|---|---|
| **Test report no.** | **:** | **1-2193-01-03/10** |
| **Type identification** | **:** | **SKM 5200-II** |
| **Applicant** | **:** | **Sennheiser electronic GmbH & Co. KG** |
| **FCC ID** | **:** | **DMOSKM5200A2** |
| **IC Certification No** | **:** | **2099A-SKM5200A2** |
| **Test standards** | **:** | **47 CFR Part 74** |
| | | **RSS - 123 Issue 1 Rev. 2** |

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# 1 General information

## 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The 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 the CETECOM ICT Services GmbH.

**Test laboratory manager:**

| **2010-05-20** | **Daniel Muyunga** | |
|---|---|---|
| Date | Name | Signature |

**Technical responsibility for area of testing:**

| **2010-05-20** | **Michael Berg** | |
|---|---|---|
| Date | Name | Signature |

## 1.2 Testing laboratory

**CETECOM ICT Services GmbH**

**Untertürkheimer Straße 6 - 10**
**66117 Saarbrücken**
**Germany**
**Phone: + 49 681 5 98 - 0**
**Fax: + 49 681 5 98 - 9075**
**e-mail: info@ICT.cetecom.de**
**Internet: http://www.cetecom-ict.de**

**State of accreditation:** **The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025**
**DAR registration number: DGA-PL-176/94-D1**

**Accredited by:** **Federal Motor Transport Authority (KBA)**
**DAR registration number: KBA-P 00070-97**

**Testing location, if different from CETECOM ICT Services GmbH:**

**Name :**
**Street :**
**Town :**
**Country :**
**Phone :**
**Fax :**

## 1.3 Details of applicant

| | |
|---|---|
| Name: | **Sennheiser electronic GmbH & Co. KG** |
| | |
| | |
| Street: | **Am Labor 1** |
| Town: | **30900 Wedemark** |
| Country: | **GERMANY** |
| | |
| Telephone: | **+49 (0) 5130 6 00 -0** |
| Fax: | **+49 (0) 5130 600 330** |
| | |
| Contact: | **Volker Bartsch** |
| E-mail: | **bartschv@sennheiser.com** |
| Telephone: | **+49 (0) 5130 600 465** |

## 1.4 Application details

| | |
|---|---|
| Date of receipt of order: | **2010-04-29** |
| | |
| Date of receipt of test item: | **2010-05-03** |
| | |
| Date of start test: | **2010-05-03** |
| Date of end test | **2010-05-20** |
| | |
| Persons(s) who have been present during the test: | |

## 2 Test standard/s

| | | |
|---|---|---|
| **47 CFR Part 74** | **2006-10** | **Title 47 of the Code of Federal Regulations; Chapter I- Federal Communications Commission<br>Experimental radio, auxiliary, special broadcast and other program distribution services** |
| **RSS - 123 Issue 1 Rev. 2** | **2000-03** | **Spectrum Management and Telecommunications Policy - Radio Standards Specification<br>Low Power Licensed Radiocommunication Devices** |

# 3 Technical tests

## 3.1 Details of manufacturer

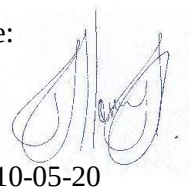
| | |
|---|---|
| Name: | **Sennheiser electronic GmbH & Co. KG** |
| | |
| | |
| Street: | **Am Labor 1** |
| Town: | **30900 Wedemark** |
| Country: | **GERMANY** |

### 3.1.1 Test item and Additional EUT information For IC Canada (appendix 2)

| | |
|---|---|
| Kind of test item: | **Handheld Transmitter** |
| Type identification: | **SKM 5200-II** |
| | |
| Open Area Test Site Industry Canada Number: | **IC 3462C-1** |
| | |
| S/N serial number: | **470.000 MHz – 638.000 MHz:**<br>**1150109256 (L)**<br>**1150109257 (L)**<br>**1150109255 (L)**<br><br>**614.075 MHz – 697.925 MHz:**<br>**1150109275 (N-US)**<br>**1150109274 (N-US)** |
| HW hardware status: | **Not specified** |
| SW software status: | **Not specified** |
| Frequency Band [MHz]: | **470 MHz – 608 MHz &**<br>**614 MHz – 698 MHz** |
| Number of Channels: | **Frequency bank "FIX" with up to 59 factory-preset frequencies**<br><br>**Frequency bank "VAR" with 20 freely selectable frequencies**<br>**(frequencies tunable in steps of 5 kHz)** |
| Measured Channels<br><br>Channel 1:<br>Channel 2:<br>Channel 3:<br>Channel 4:<br>Channel 5:<br>Channel 6: | <br><br>**470.075 MHz (L)**<br>**607.925 MHz (L)**<br>**614.075 MHz (N-US)**<br>**638.000 MHz (L)**<br>**668.000 MHz (N-US)**<br>**697.925 MHz (N-US)** |
| RF: Power [W] (max): | **Rad. ERP: 58.6 mW** |
| Type of Modulation: | **FM** |

| | |
|---|---|
| Emission Designator: | **470.075 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**112KF3E**<br>**(measured Bandwidth)**<br><br>**607.925 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**115KF3E**<br>**(measured Bandwidth)**<br><br>**614.075 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**123K2F3E**<br>**(measured Bandwidth)**<br><br>**638.000 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**88K2F3E**<br>**(measured Bandwidth)**<br><br>**668.000 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**123KF3E**<br>**(measured Bandwidth)**<br><br>**697.925 MHz**<br>**160KF3E**<br>**(2x max. Audio Frequency + 2x max. FM Deviation)**<br>**123KF3E**<br>**(measured Bandwidth)** |
| Antenna Type: | **Internal brass antenna** |
| Power Supply: | **3.0 V DC by 2 x 1.5 V (AA) Battery** |
| Temperature Range: | **-30 °C to +50 °C** |
| Occupied Bandwidth (99% BW) [kHz]: | **123.2** |
| Transmitter Spurious (worst case) [dBm]: | **-39.92** |
| IC Registration Number: | **2099A-SKM5200A2** |
| FCC ID: | **DMOSKM5200A2** |
| IC Standards: | **RSS-123 Issue 1, Rev. 2 November 6, 1999** |

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

Signature: 

Date: 2010-05-20
Test engineer: Daniel Muyunga

### 3.1.2 Description of the test

In this report we tested only the radiated emissions of the sample.

All tests were done in accordance with the EIA/TIA 603.
The substitution method (TIA/EIA 603) was used.
This products fulfils also the requirements for CANADA RSS-123

### 3.1.3 EUT operating modes

| EUT operating mode no.*) | Description of operating modes | Additional information |
|---|---|---|
| Op. 0 | Normal mode | Normal temperature and power source conditions |
| Op. 1 | | low temperature, low power source conditions |
| Op. 2 | | low temperature, high power source conditions |
| Op. 3 | | high temperature, low power source conditions |
| Op. 4 | | high temperature, high power source conditions |

*) EUT operating mode no. is used to simplify the test plan

### 3.1.4 Extreme conditions testing values

| Description | Shortcut | Unit | Value |
|---|---|---|---|
| | | | |
| Nominal Temperature | $T_{nom}$ | °C | **+20** |
| Nominal Humidity | $H_{nom}$ | % | **41** |
| Nominal Power Source | $V_{nom}$ | V | **3.0** |

Type of power source: **DC by 2 x 1.5 V (AA) Battery**

# 4 Summary of Measurement Results and list of all performed test cases

☒ **No deviations from the technical specifications were ascertained**

☐ There were deviations from the technical specifications ascertained

| Section in this Report | Test Name | Verdict |
|---|---|---|
| 3.1.1 | RF Power Output | pass |
| 3.1.2 | Frequency Stability | pass |
| 3.1.3 | Radiated Emissions | pass |
| 3.1.4 | Receiver Radiated Emissions | pass |
| 3.1.5 | Conducted Spurious Emissions | pass |
| 3.1.6 | Block Edge Compliance | pass |
| 3.1.7 | Occupied Bandwidth | pass |

# 5 Measurements and results

## 5.1 Output Power (radiated) FCC Rule Part 74.861 (e)(1)(ii)

**Method of measurement:**

Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method
(a) The measurements was performed with full rf output power and modulation.
(b) Test was performed at listed 3m test site (listed with FCC, IC).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)
(f) Set the EMI Receiver and #2 as follows:

Centre Frequency: test frequency
Resolution BW: 100 kHz
Video BW: same
Detector Mode: positive
Average: off
Span: 3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360 o about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

**Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method**

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

| | |
|---|---|
| Centre Frequency | : equal to the signal source |
| Resolution BW | : 10 kHz |
| Video BW | : same |
| Detector Mode | : positive |
| Average | : off |
| Span | : 3 x the signal bandwidth |

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)
(c) Select the frequency and E-field levels for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antennas (substitution antenna):
.DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz}.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna: .DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz }.
(g) If the DIPOLE antenna is used, tune its elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360 o about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculates the ERP/EIRP as follows:
**P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1**
**EIRP = P + G1 = P3 + L2 - L1 + A + G1**
**ERP = EIRP – 2.15 dB**
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1
Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction
(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

**Results:**

| TEST CONDITIONS | | TRANSMITTER ERP (mW) | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | **470.075 MHz** | **607.925 MHz** | **614.075 MHz** | **638.000 MHz** | **668.000 MHz** | **697.925 MHz** |
| $T_{nom}$ °C | $V_{nom}$ V | **58.6** | **56.1** | **57.9** | **57.9** | **52.1** | **52.7** |
| Maximum deviation from output power under extreme test conditions (dBc) | | ±0.2 dB | | | | | |
| Measurement uncertainty | | ±0.5dB | | | | | |

Sample calculation:

| Freg | SA Reading | SG Setting | Ant. gain | Dipol gain | Cable loss | ERP Result | ERP Result | | |
|---|---|---|---|---|---|---|---|---|---|
| MHz | dBµV | dBm | dBi | dBd | dB | dBm | mW | | |
| 638.0 | 108.5 | 13.9 | - | 0.0 | 2.9 | 11.0 | 12.6 | | |
| | | | | | | | | | |

ERP = SG (dBm) - Cable Loss (dB) + Ant. gain (dBd)

**LIMIT** **FCC Rule Part 74.861**

| Frequency range MHz | Power level mW |
|---|---|
| 54-72, 76-88, 174-216 | 50 |
| 470-608, 614-698 | 250 |

## 5.2 AFC Frequency Error vs. Voltage FCC Rule Part 74.861

**Method of measurement:**
The EUT was fixed in test fixture to a resistive coaxial attenuator of normal load impedance, and the un-modulated carrier was measured by means of a spectrum analyzer.
The input voltage was varied in a range from 1.8V to 3.3V and the maximum change in frequency was noted within one minute.
The temperature tests were performed for each frequency range on one channel

**470.075 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -770 | -0.00016 | -1.63804 |
| 2.1 | -780 | -0.00016 | -1.65931 |
| 2.4 | -770 | -0.00016 | -1.63804 |
| 2.7 | -740 | -0.00015 | -1.57422 |
| 3.0 | -650 | -0.00013 | -1.38276 |
| 3.3 | -720 | -0.00015 | -1.53167 |

**607.925 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -850 | -0.00014 | -1.39820 |
| 2.1 | -880 | -0.00014 | -1.44755 |
| 2.4 | -880 | -0.00014 | -1.44755 |
| 2.7 | -910 | -0.00015 | -1.49690 |
| 3.0 | -920 | -0.00015 | -1.51334 |
| 3.3 | -810 | -0.00013 | -1.33240 |

**614.075 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -490 | -0.00008 | -0.79795 |
| 2.1 | -480 | -0.00007 | -0.78166 |
| 2.4 | -460 | -0.00007 | -0.74909 |
| 2.7 | -430 | -0.00007 | -0.70024 |
| 3.0 | -380 | -0.00006 | -0.61882 |
| 3.3 | -310 | -0.00005 | -0.50482 |

**638.000 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -550 | -0.00009 | -0.86207 |
| 2.1 | -560 | -0.00088 | -0.87774 |
| 2.4 | -560 | -0.00088 | -0.87774 |
| 2.7 | -530 | -0.00083 | -0.83072 |
| 3.0 | -570 | -0.00089 | -0.89342 |
| 3.3 | -520 | -0.00082 | -0.81505 |

**668.000 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -440 | -0.00007 | -0.68966 |
| 2.1 | -490 | -0.00007 | -0.76803 |
| 2.4 | -480 | -0.00007 | -0.75235 |
| 2.7 | -500 | -0.00007 | -0.78370 |
| 3.0 | -500 | -0.00007 | -0.78370 |
| 3.3 | -480 | -0.00007 | -0.75235 |

**697.925 MHz**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| 1.8 | -570 | -0.00008 | -0.81671 |
| 2.1 | -610 | -0.00008 | -0.87402 |
| 2.4 | -640 | -0.00009 | -0.91700 |
| 2.7 | -650 | -0.00009 | -0.93133 |
| 3.0 | -660 | -0.00009 | -0.94566 |
| 3.3 | -660 | -0.00009 | -0.94566 |

**LIMIT** **FCC Rule Part 74.861(4)**

| The frequency tolerance of the transmitter shall be 0.005 percent |
|---|

## 5.3 AFC Frequency Error vs. Temperature FCC Rule Part 74.861

**Method of measurement:**
The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the un-modulated carrier was measured by means of a spectrum analyzer. With all power removed, the temperature was decreased to –30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency error was noted within one minute. The temperature tests were performed for each frequency range on one channel

**470.075 MHz**

| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -1770 | -0.00038 | -3.76576 |
| -20 | 50 | 0.00001 | 0.10638 |
| -10 | 570 | 0.00012 | 1.21270 |
| ±0.0 | 1700 | 0.00036 | 3.61683 |
| +10 | 800 | 0.00017 | 1.70204 |
| +20 | -770 | -0.00016 | -1.63821 |
| +30 | -1200 | -0.00025 | -2.55306 |
| +40 | -1360 | -0.00028 | -2.89346 |
| +50 | -1640 | -0.00034 | -3.48918 |

**607.925 MHz**

| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -530 | -0.00009 | -0.87182 |
| -20 | 780 | 0.00012 | 1.28305 |
| -10 | 2070 | 0.00034 | 3.40503 |
| ±0,0 | 2140 | 0.00035 | 3.52017 |
| +10 | 1570 | 0.00025 | 2.58256 |
| +20 | -880 | -0.00014 | -1.44755 |
| +30 | -1180 | -0.00019 | -1.94103 |
| +40 | -2940 | -0.00048 | -4.83612 |
| +50 | -3000 | -0.00049 | -4.93482 |

**614.075 MHz**

| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -4170 | -0.00068 | -6.79070 |
| -20 | -1730 | -0.00028 | -2.81725 |
| -10 | 100 | 0.00001 | 0.16285 |
| ±0,0 | 960 | 0.00015 | 1.56333 |
| +10 | 740 | 0.00012 | 1.20506 |
| +20 | -460 | -0.00007 | -0.74909 |
| +30 | -650 | -0.00010 | -1.05850 |
| +40 | -2210 | -0.00036 | -3.59891 |
| +50 | -2960 | -0.00048 | -4.82026 |

**638.000 MHz**

| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -3980 | -0.00062 | -6.23824 |
| -20 | -2000 | -0.00031 | -3.13480 |
| -10 | 120 | 0.00001 | 0.18809 |
| ±0.0 | 100 | 0.00001 | 0.15674 |
| +10 | 840 | 0.00013 | 1.31661 |
| +20 | -440 | -0.00006 | -0.68966 |
| +30 | -780 | -0.00012 | -1.22257 |
| +40 | -1750 | -0.00027 | -2.74295 |
| +50 | -2260 | -0.00035 | -3.54232 |

**668.000 MHz**

| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -1980 | -0.00030 | -2.96407 |
| -20 | -190 | -0.00002 | -0.28443 |
| -10 | 200 | 0.00003 | 0.29940 |
| ±0.0 | 200 | 0.00003 | 0.29940 |
| +10 | -630 | -0.00009 | -0.94311 |
| +20 | -650 | -0.00009 | -0.97305 |
| +30 | -950 | -0.00014 | -1.42216 |
| +40 | -1920 | -0.00028 | -2.87425 |
| +50 | -2120 | -0.00031 | -3.17365 |

**697.925 MHz**

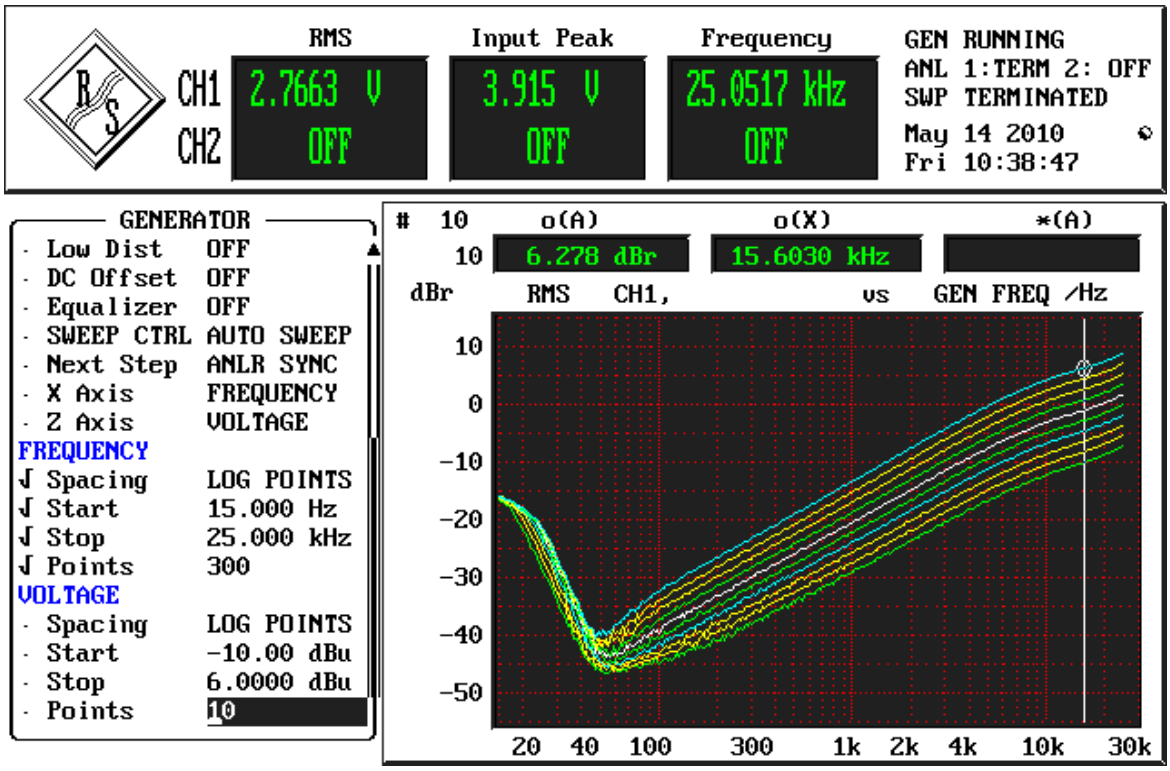
| TEMPERATURE (°C) | Frequency Error (Hz) | Frequency Error (%) | Frequency Error (ppm) |
|---|---|---|---|
| -30 | -3110 | -0.00045 | -4.45607 |
| -20 | -2050 | -0.00029 | -2.93728 |
| -10 | 300 | 0.00004 | 0.42985 |
| ±0.0 | 1080 | 0.00015 | 1.54744 |
| +10 | 770 | 0.00011 | 1.10327 |
| +20 | -640 | -0.00009 | -0.91700 |
| +30 | -700 | -0.00010 | -1.00297 |
| +40 | -2550 | -0.00036 | -3.65369 |
| +50 | -3030 | -0.00043 | -4.34144 |

**LIMIT** **FCC Rule Part 74.861**

| The frequency tolerance of the transmitter shall be 0.005 percent |
|---|

## 5.4 Characteristics of the Audio Modulation Circuitry FCC Rule Part 74 .861(e3)

**Method of measurement:**
The audio frequency responds was measured in accordance with EIA/TIA 603.
The plots shows 10 curves with different modulation levels, starting from -10 dBu to 6 dBu (30%+20 dB Modulation), the frequency is varied from 20 Hz to 25 kHz.




Max. measured frequency deviation : 60 kHz

This measurement is valid for all channels

Limit: max Deviation ±75kHz

## 5.5 Occupied Bandwidth FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049

**Test method:**
The audio frequency responds was measured in accordance with EIA/TIA 603.

Data in the plots show that all sidebands between 50 & 100% for the authorized bandwidth are attenuated by at least 25dB. From 100 to 250% of the authorized bandwidth they are attenuated by at least 35dB and beyond 250% 43 log(Po) dB. The plot shows the transmitter modulated with 15000 Hz (the highest modulation frequency), adjusted for 50% modulation plus 16 dB. The spectrum analyzer was set with the un-modulated carrier at the top of the screen. The test procedure diagram and occupied bandwidth plots follow.

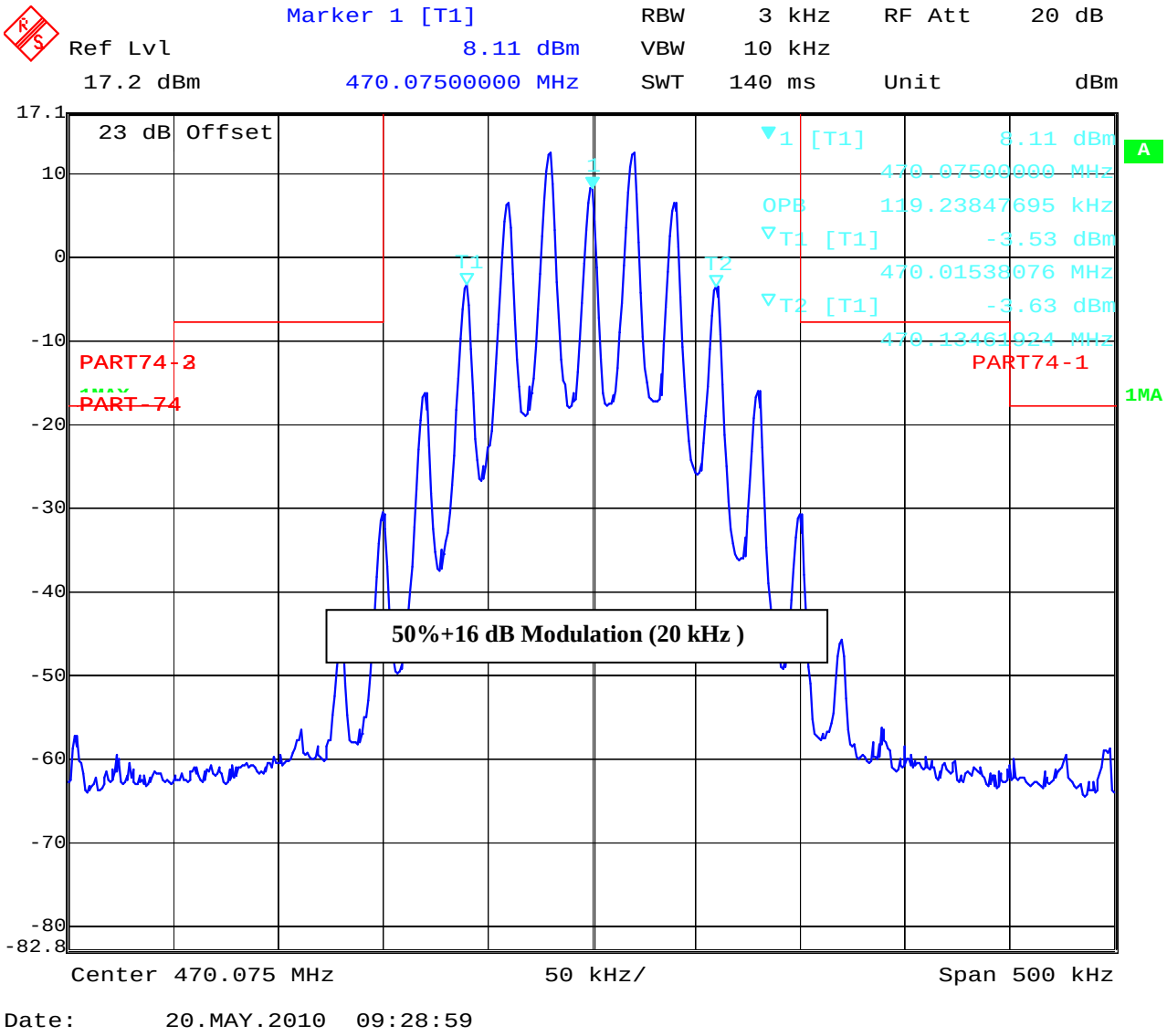
| TEST CONDITIONS | | OCCUPIED BANDWIDTH ( kHz ) | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | **470.075 MHz** | **607.925 MHz** | **614.075 MHz** | **638.000 MHz** | **668.000 MHz** | **697.925 MHz** |
| $T_{nom}$ °C | $V_{nom}$ V | 119.2 | 115.2 | 123.2 | 88.17 | 123.2 | 123.2 |
| max. Deviation (FM) | | 60 kHz | | | | | |
| Measurement uncertainty | | ±0.5% | | | | | |

**Limits** **FCC Rule Part 74.861(e)(5)**

| The operating bandwidth shall not exceed 200 kHz |
|---|

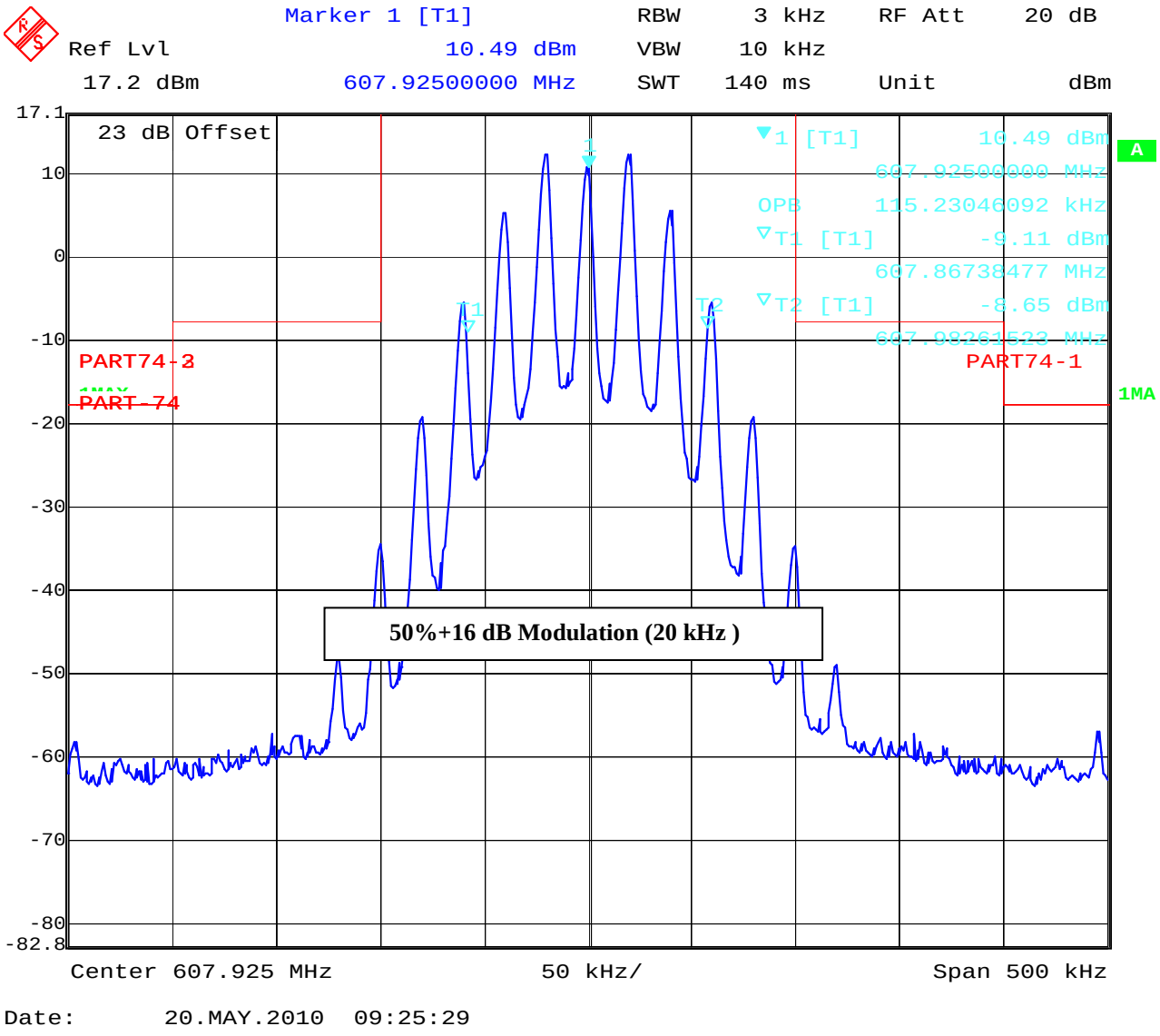
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.989**

**Frequency: 470.075 MHz / max. deviation: ± 60 kHz (Limit ± 75 kHz )**



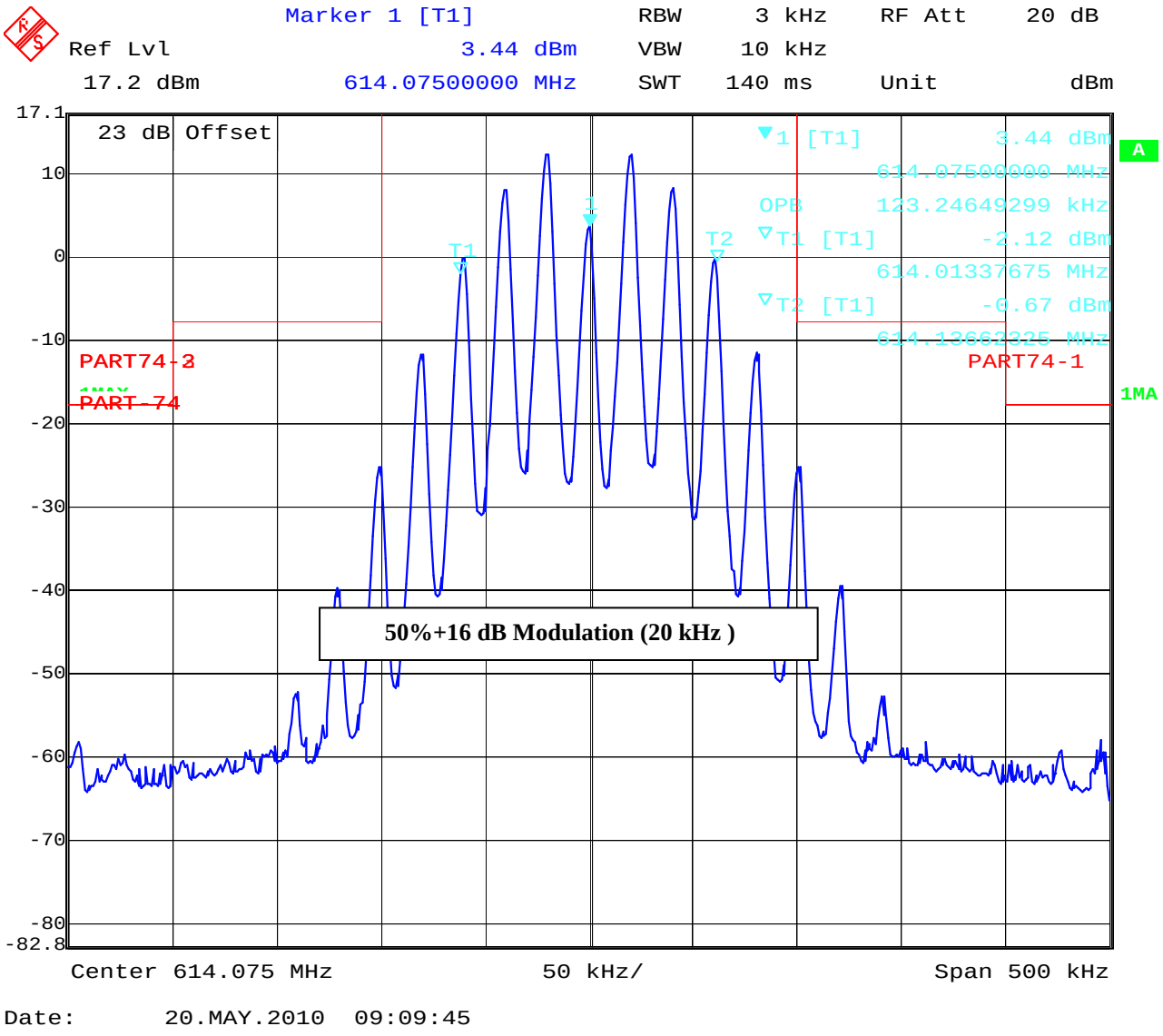
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

**Frequency: 607.925 MHz / max. deviation : ± 60 kHz (Limit ± 75 kHz )**



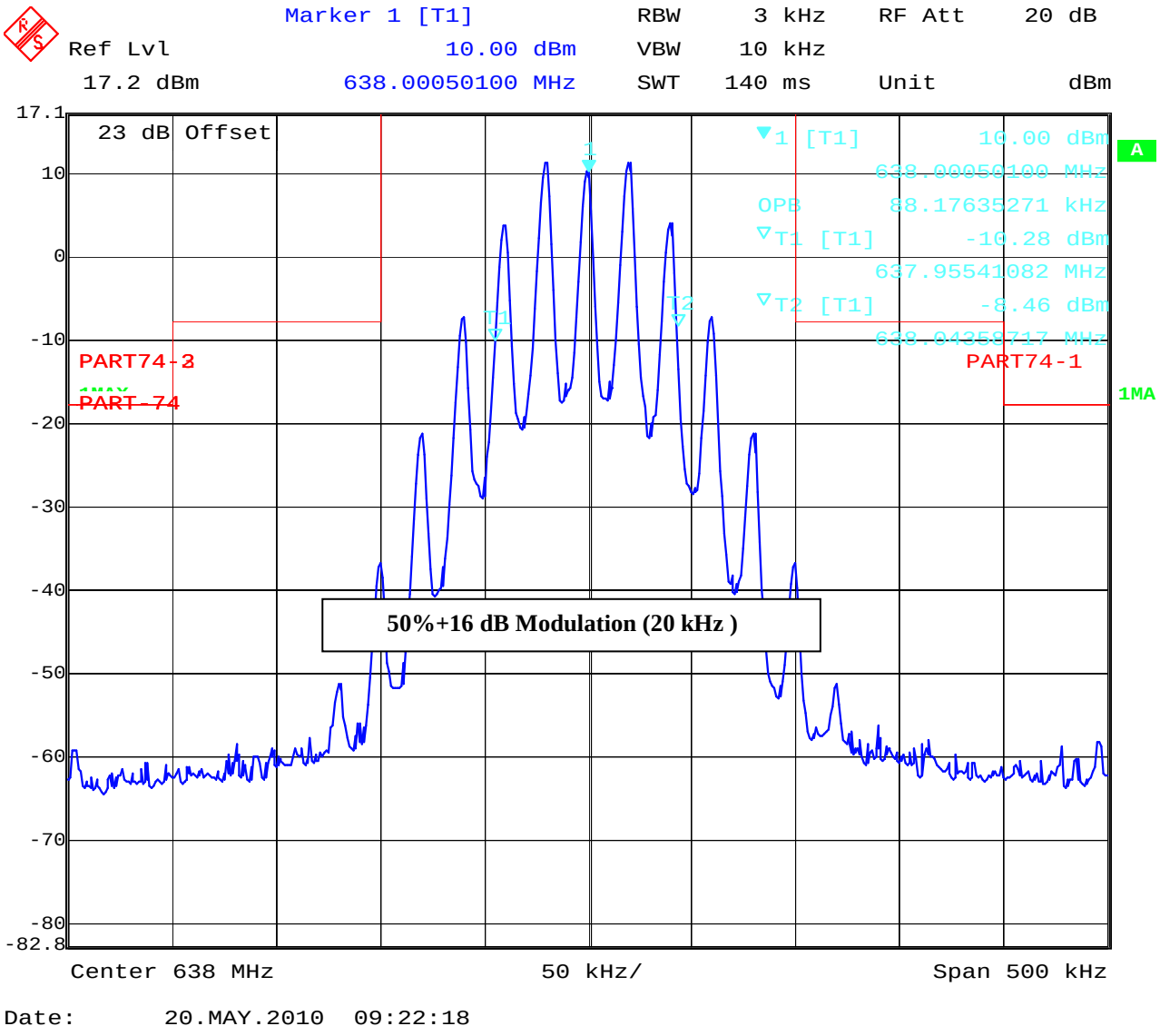
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

**Frequency: 614.075 MHz / max. deviation : ± 60 kHz (Limit ± 75 kHz )**



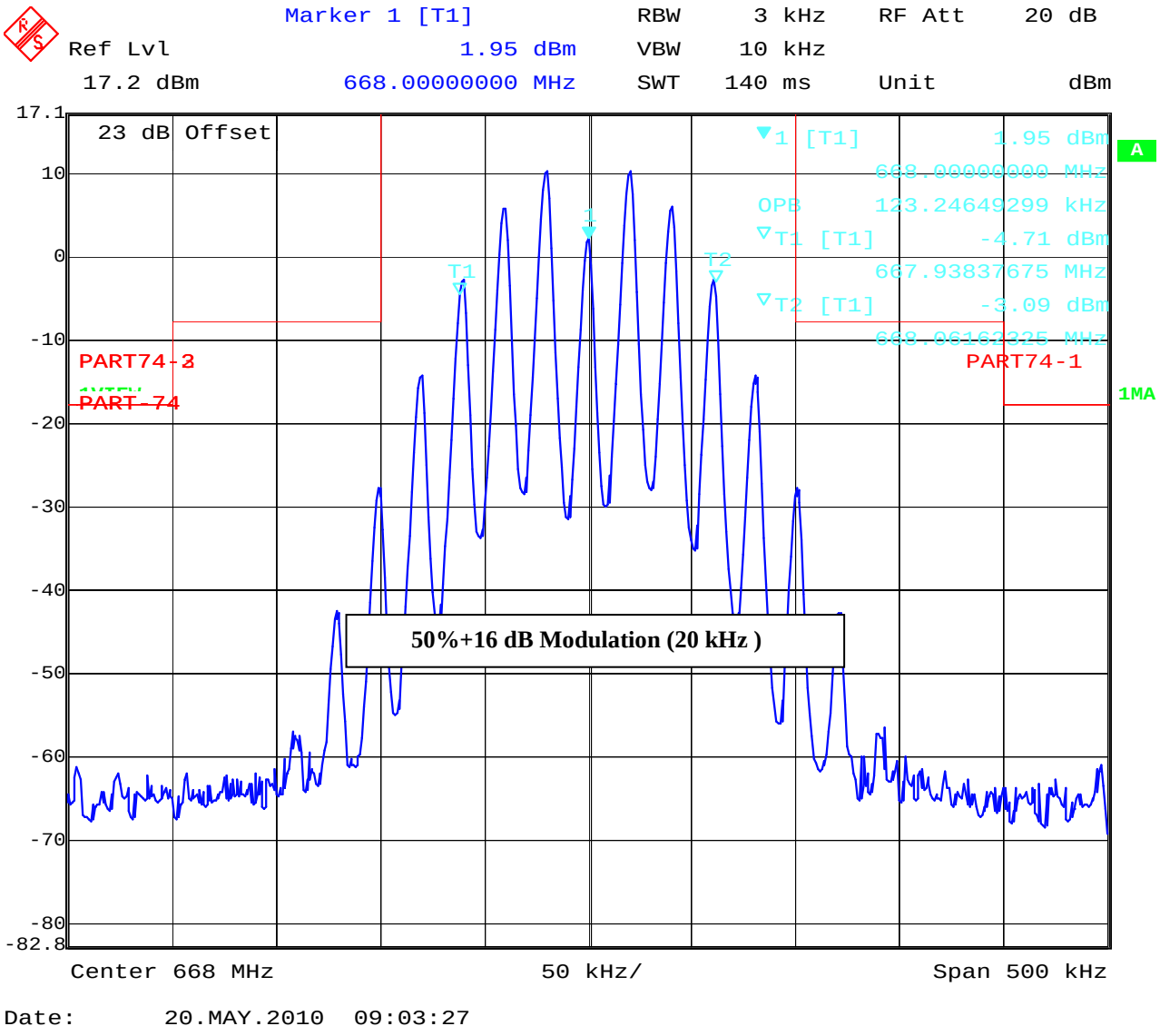
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.989**

**Frequency: 638 MHz / max. deviation : ± 60 kHz (Limit ± 75 kHz )**



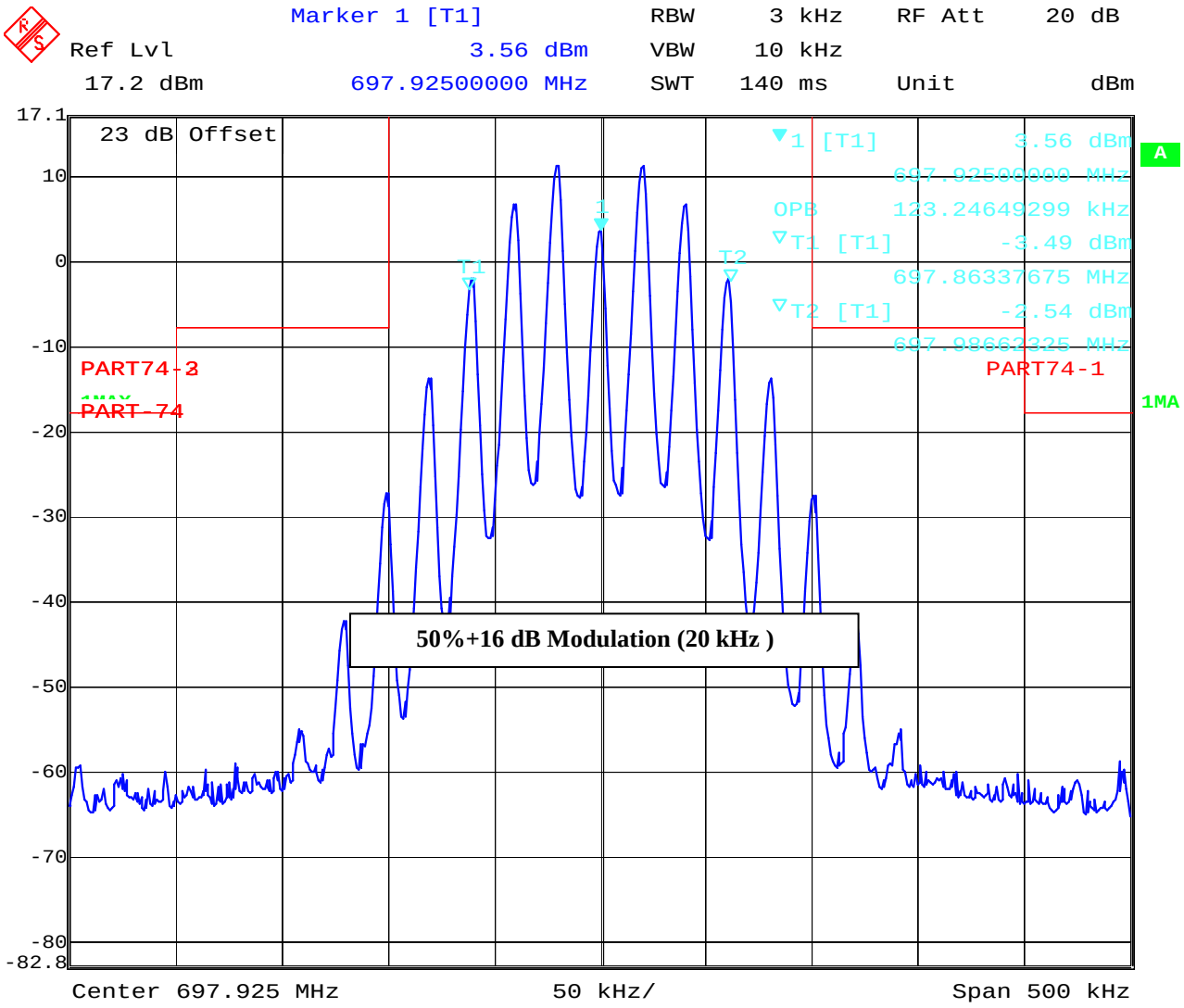
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

**Frequency: 668.000 MHz / max. deviation : ± 60 kHz (Limit ± 75 kHz )**



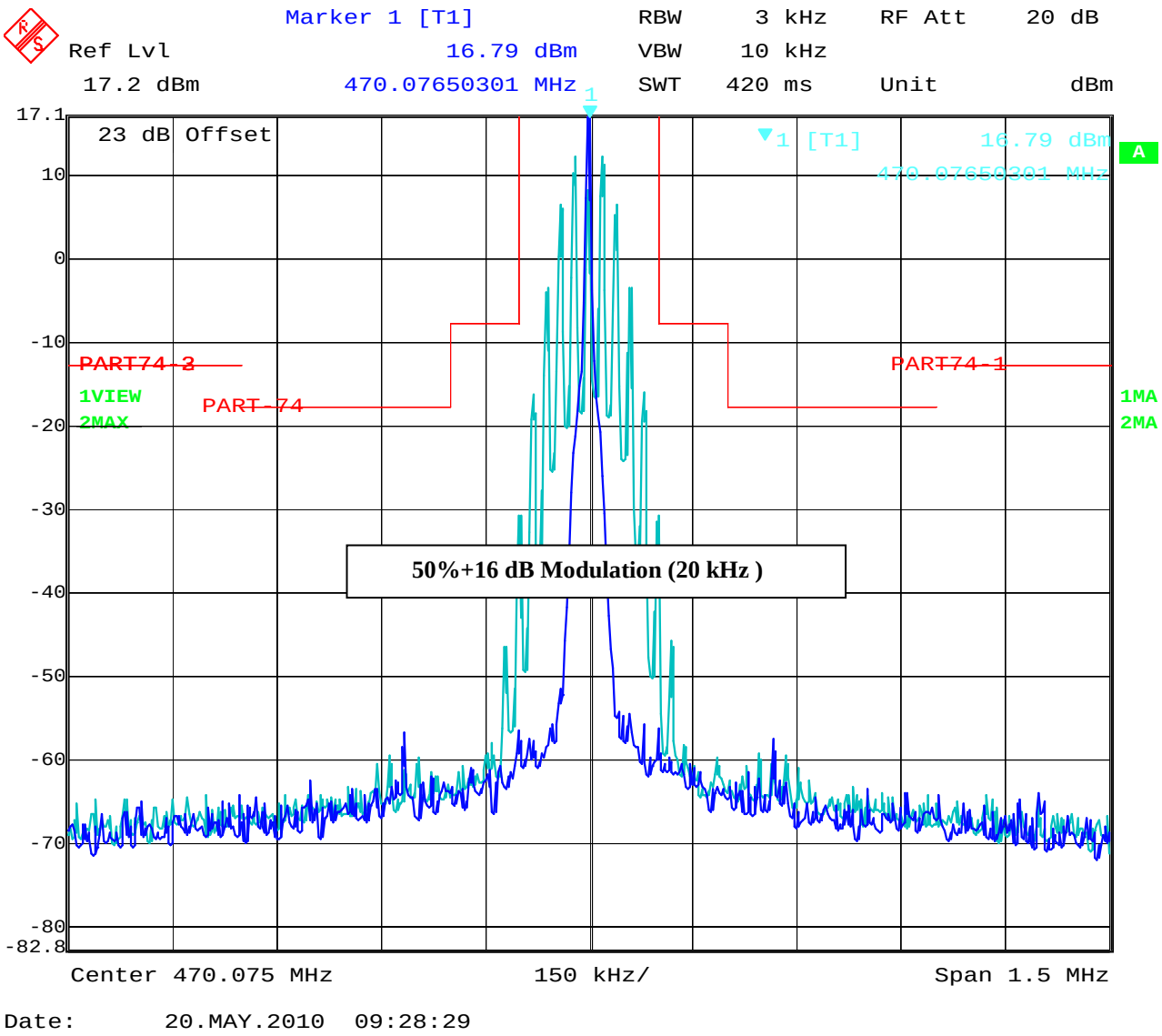
**OCCUPIED BANDWIDTH** **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

**Frequency: 697.925 MHz / max. deviation : ± 60 kHz (Limit ± 75 kHz )**



## 5.6 Emission mask FCC 74 861(e)(6)

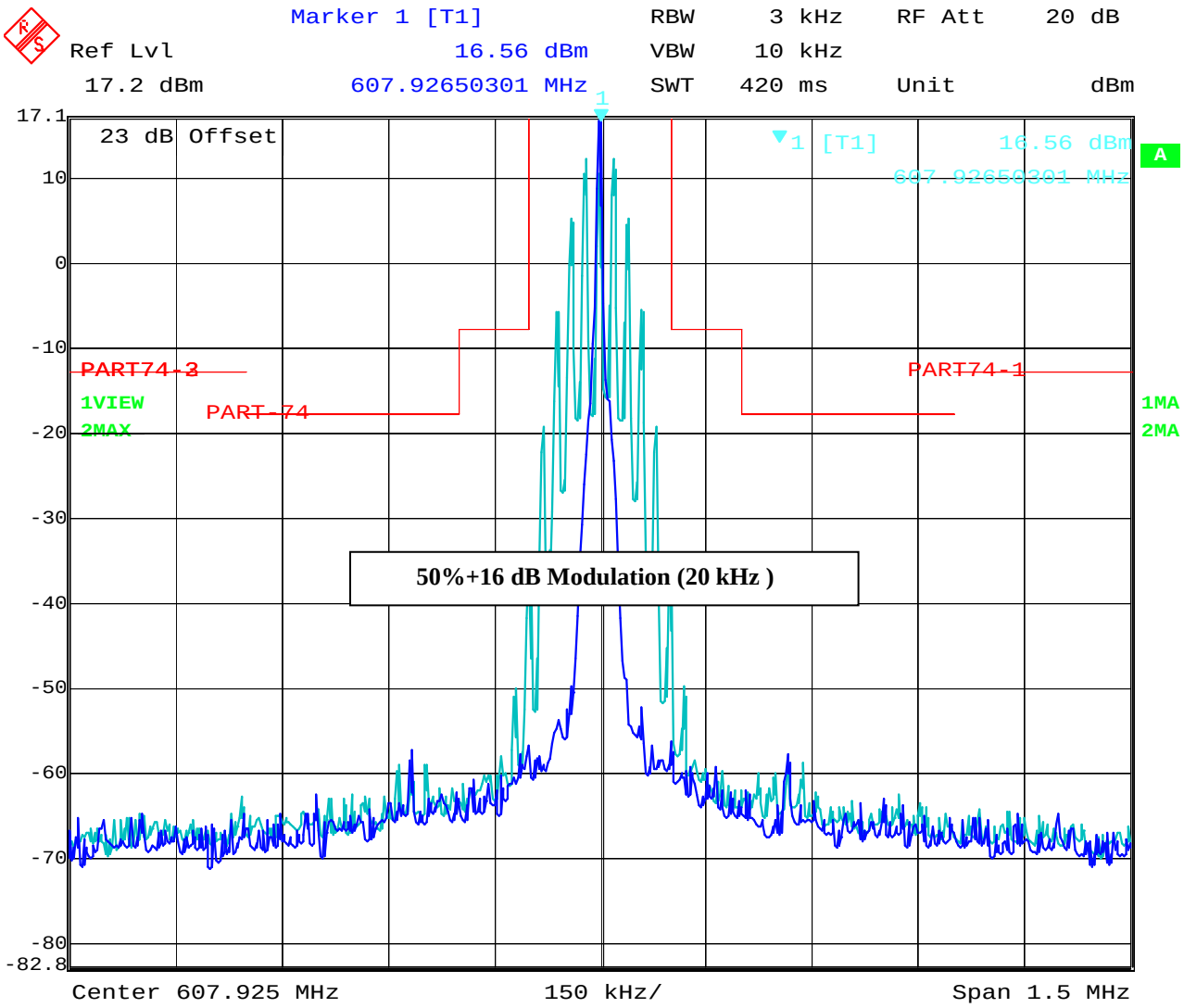
**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 470.075 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

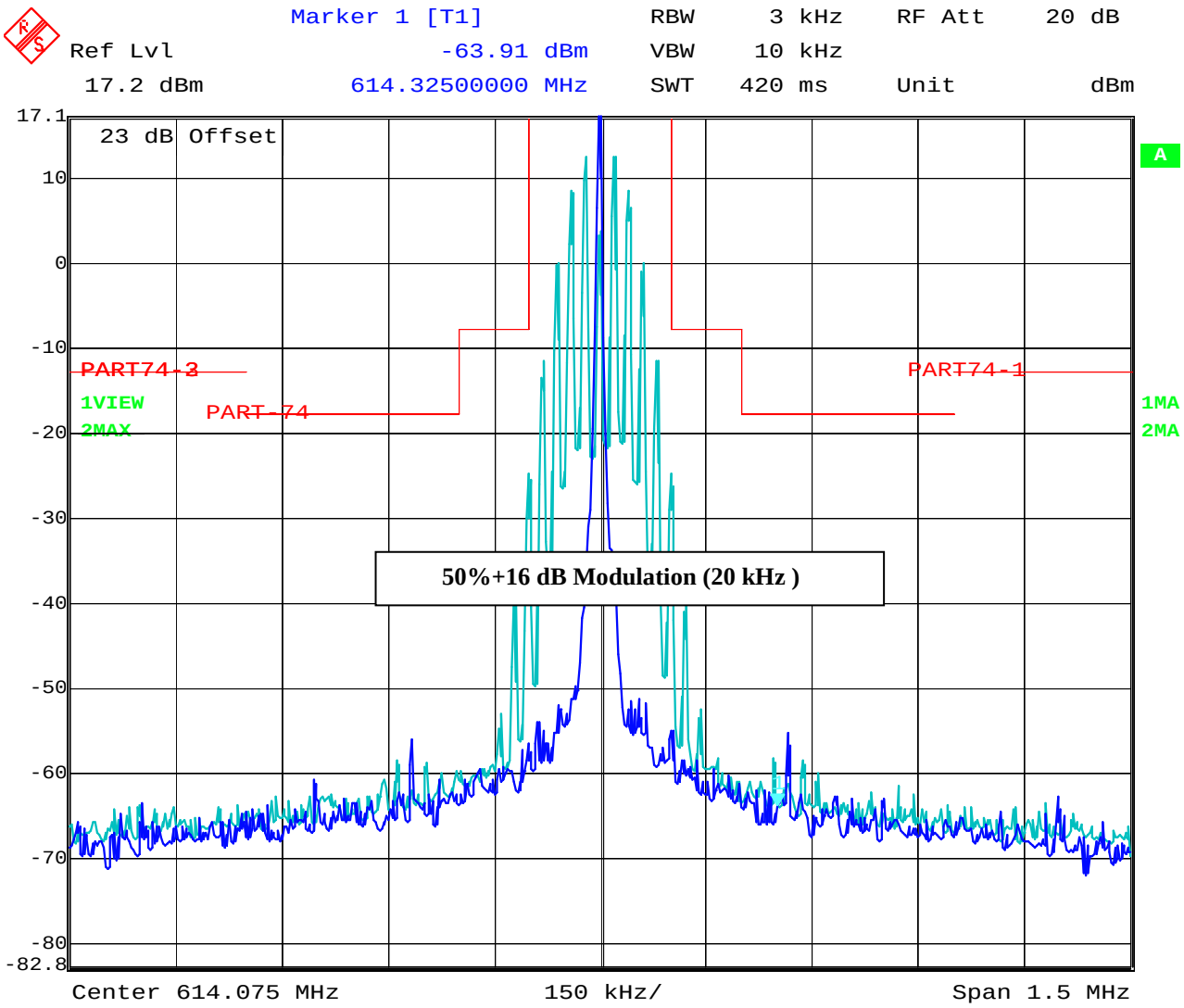
**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 607.925 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

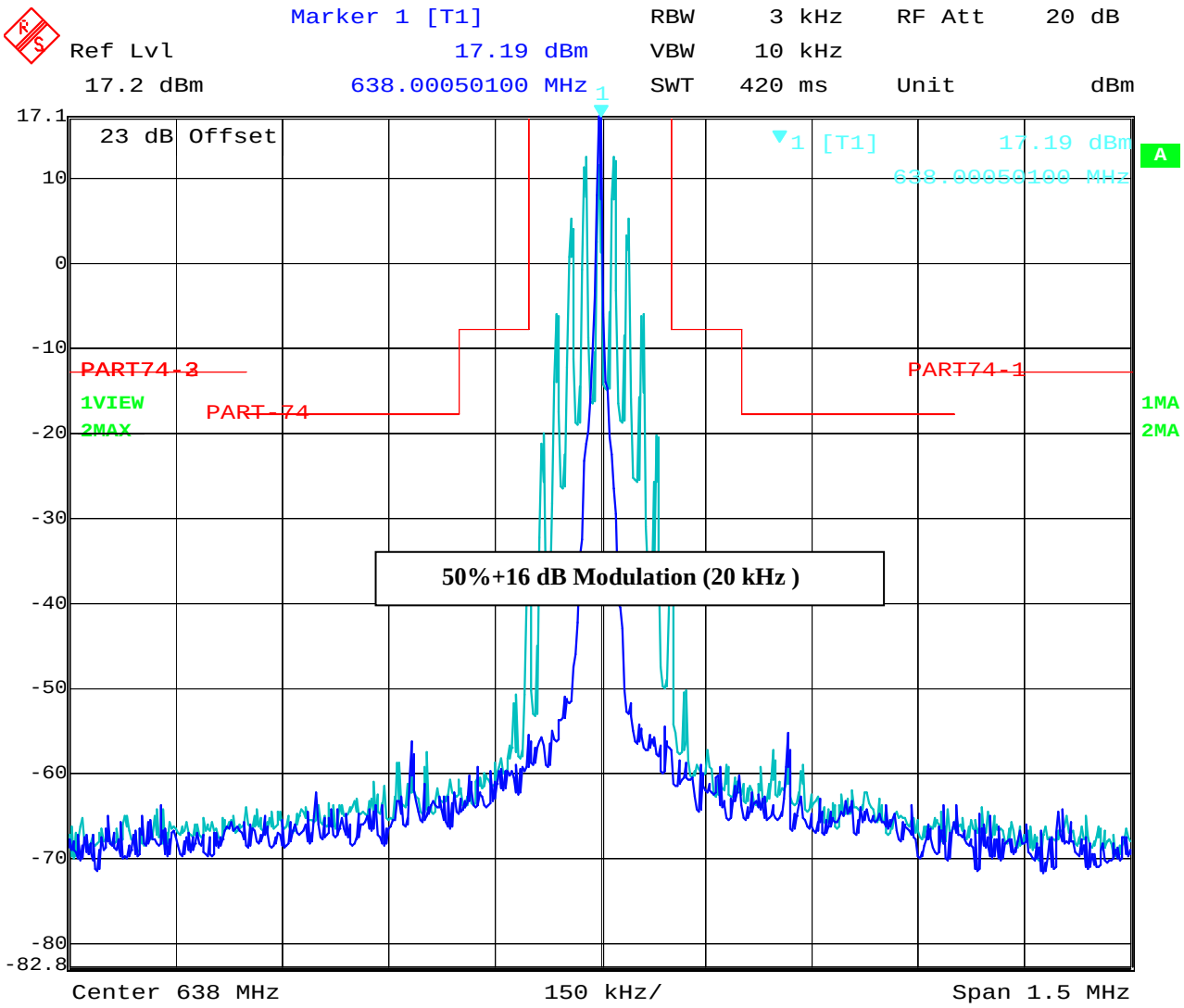
**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 614.075 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

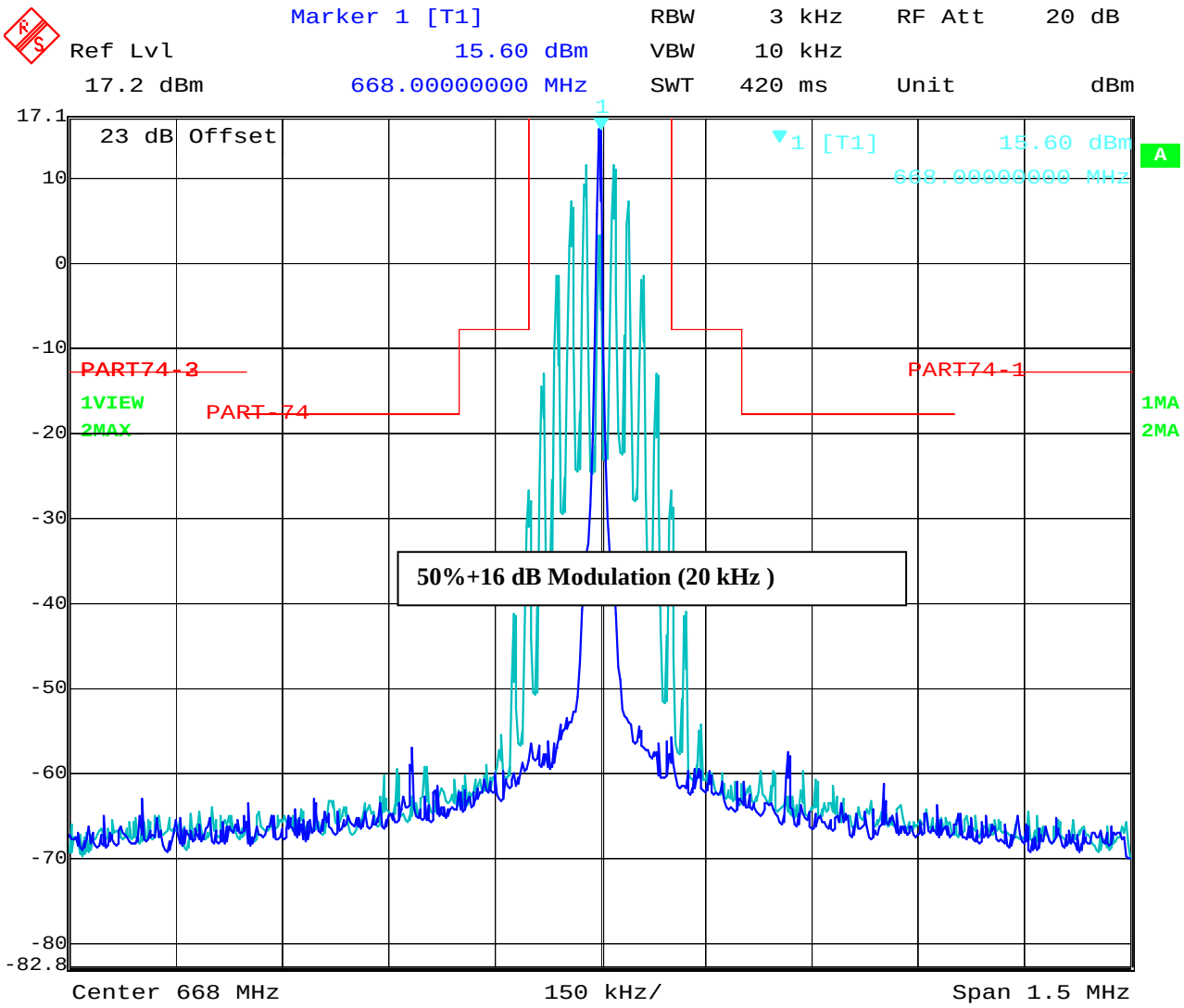
**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 638.000 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

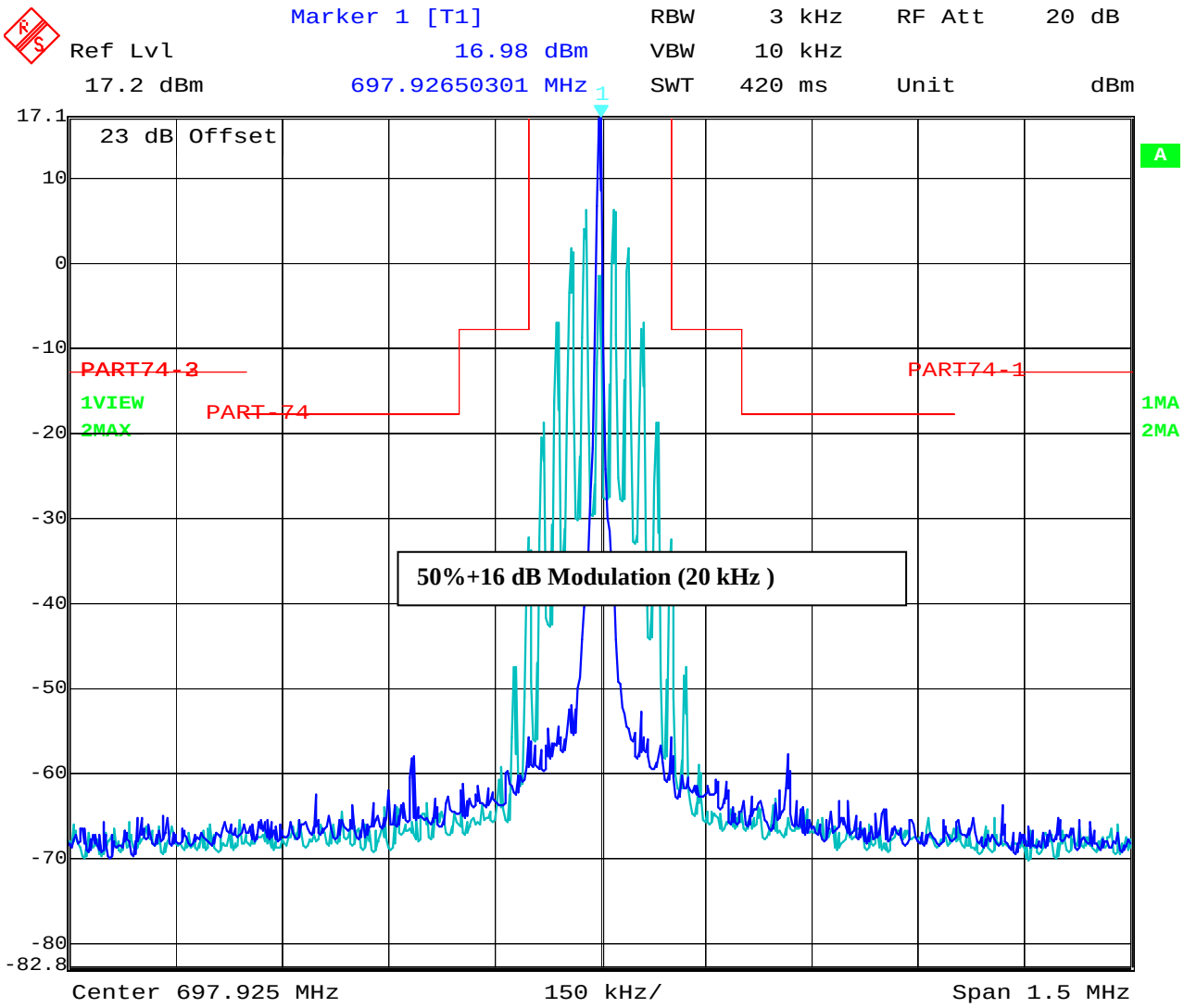
**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 668.000 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

**Emission mask** **FCC 74 861(e)(6)**
**Frequency: 697.925 MHz**




**Limits** **FCC Rule Part 74.861(e)(6)**

| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

## 5.7 Radiated Emissions FCC Rule Part 74 subpart H

**Test procedure**

1). on a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
2). the test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
3). the output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
4). the transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
5). the test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6). the transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7). the test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8). the maximum signal level detected by the measuring receiver shall be noted.
9). the transmitter shall be replaced by a substitution antenna (tuned dipole for f less than 1GHz and horn for frequency higher than 1GHz).
10). the substitution antenna shall be oriented for vertical polarization and the length (if a dipole antenna is used) of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11). the substitution antenna shall be connected to a calibrated signal generator.
12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13). the test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
14). the input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
15). the input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16). the measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
17). the measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.
18). Repeat above substitution measurement procedure for fundamental and all harmonica emissions.

### 5.7.1 Results of the measurements

| Freg | SA Reading | SG Setting | Ant. gain | Dipole gain | Cable loss | ERP Result | Limit | Margin | Pol |
|---|---|---|---|---|---|---|---|---|---|
| **MHz** | **dBµV** | **dBm** | **dBi** | **dBd** | **dB** | **dBm** | **dBm** | **dBm** | **H/V** |
| | | | | | | | | | |
| **All found peaks > 25 dB below Limit and not critical** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **All results worst case** | | | | | | | | | |

**Limits** **FCC Rule Part 74.861(e)(6)**

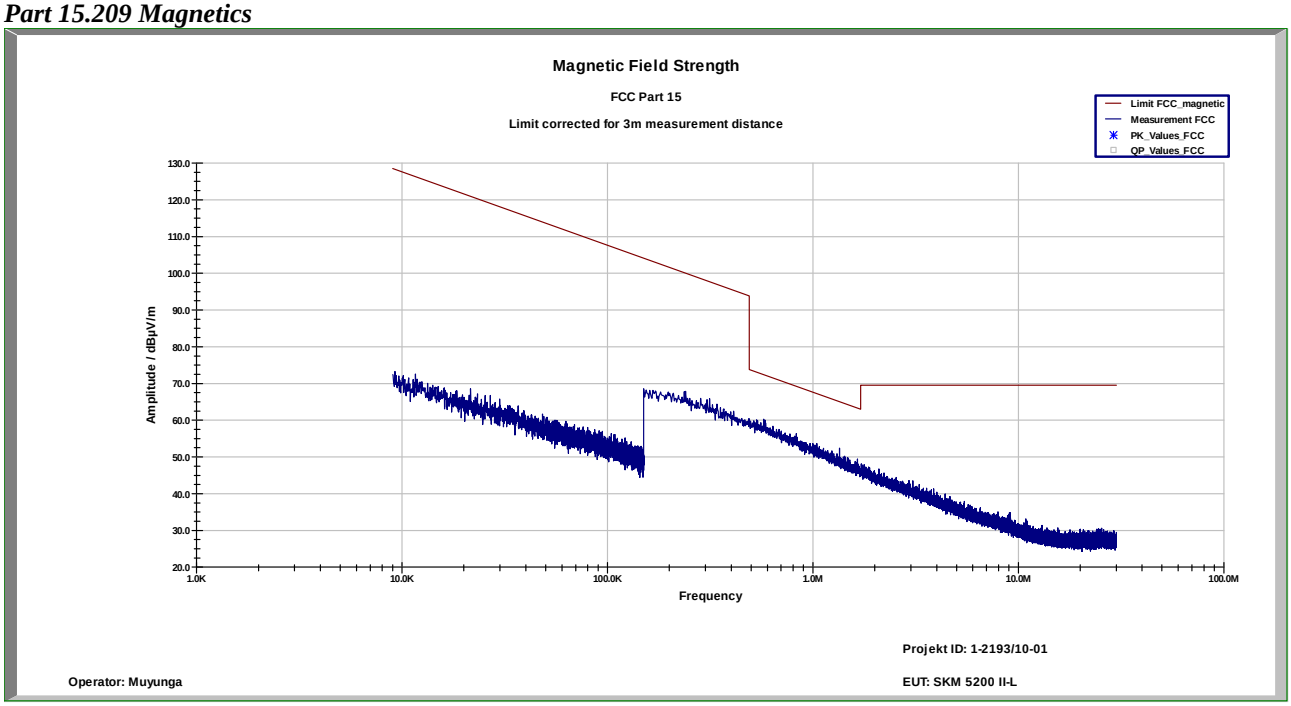
| f ± 100 kHz to f ± 200 kHz | f ± 200 kHz to f ± 500 kHz | f ± 500 kHz |
|---|---|---|
| 25 dBc | 35 dBc | -43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power |

### 5.7.2 Plots of the measurements

**RADIATED EMISSIONS** **FCC Rule Part 74 subpart H**
**Pilot-ton activated**

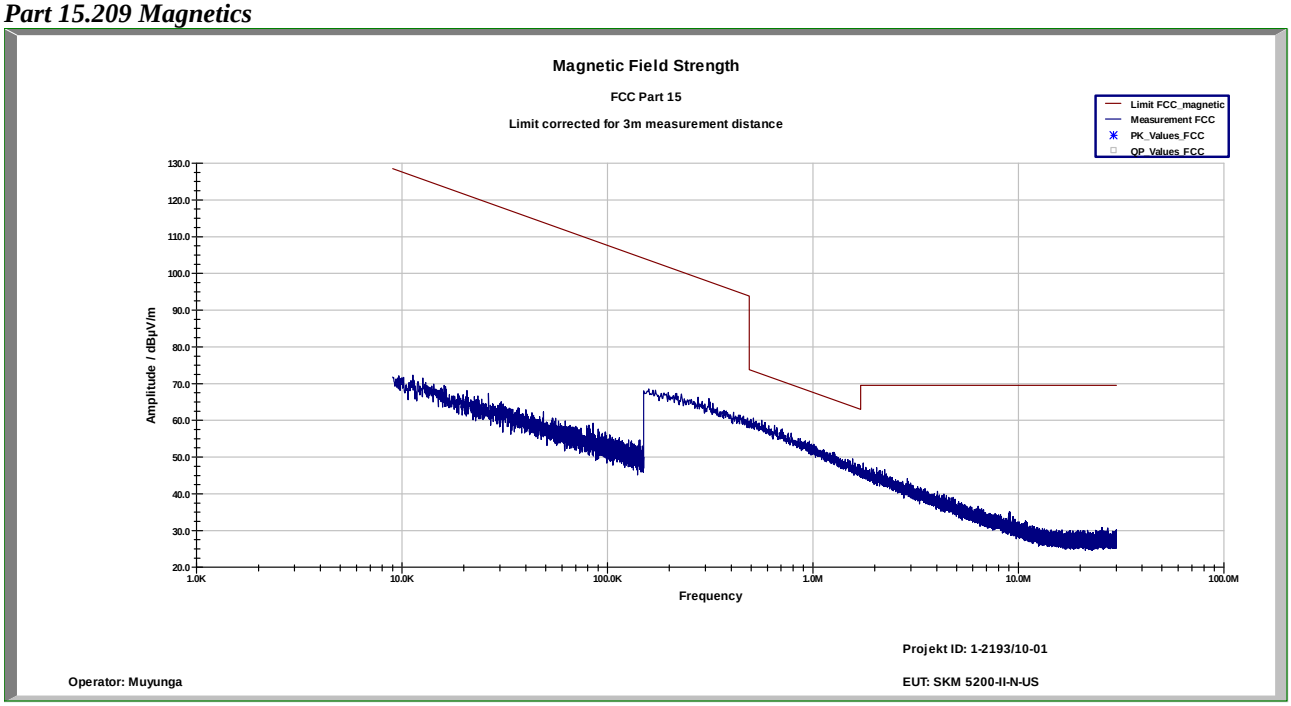
**SKM-5200-II L**
**(This plot is valid for all channels)**

***Part 15.209 Magnetics***




**SKM-5200-II N-US**
**(This plot is valid for all channels)**

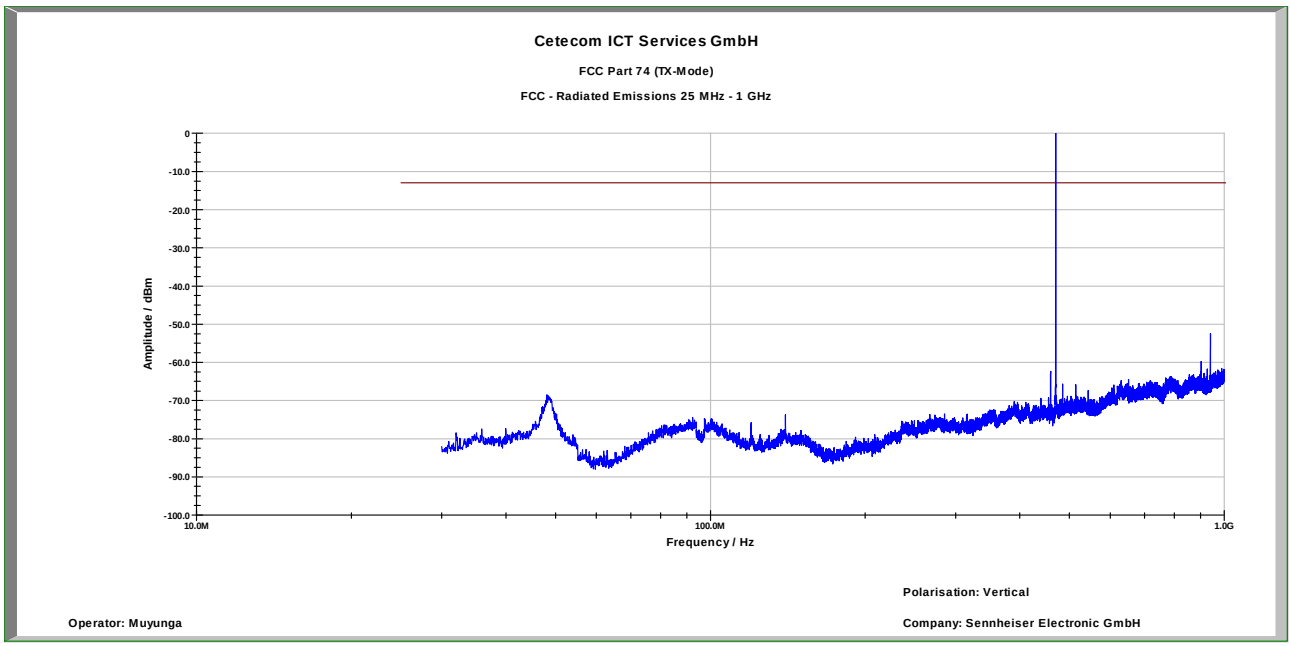
***Part 15.209 Magnetics***



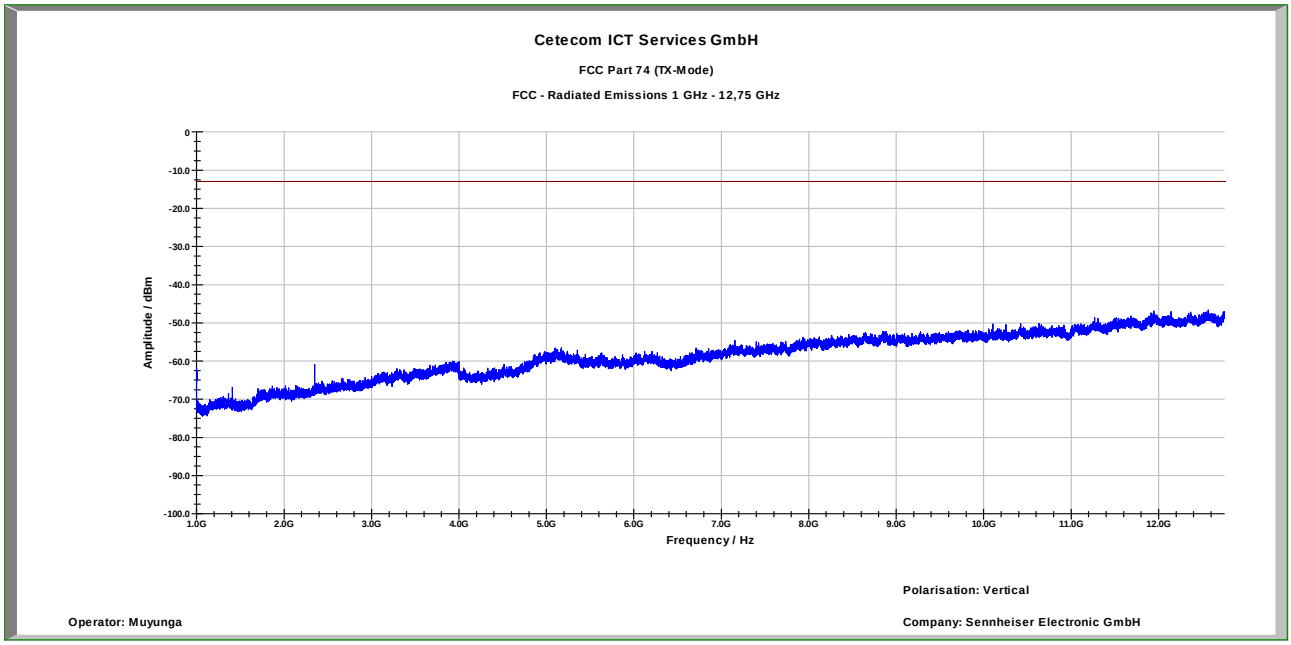
**RADIATED EMISSIONS (25 MHz to 10 GHz)** **FCC Rule Part 74 subpart H**

**470.075 MHz, Pilot-ton activated**

Plot 1:

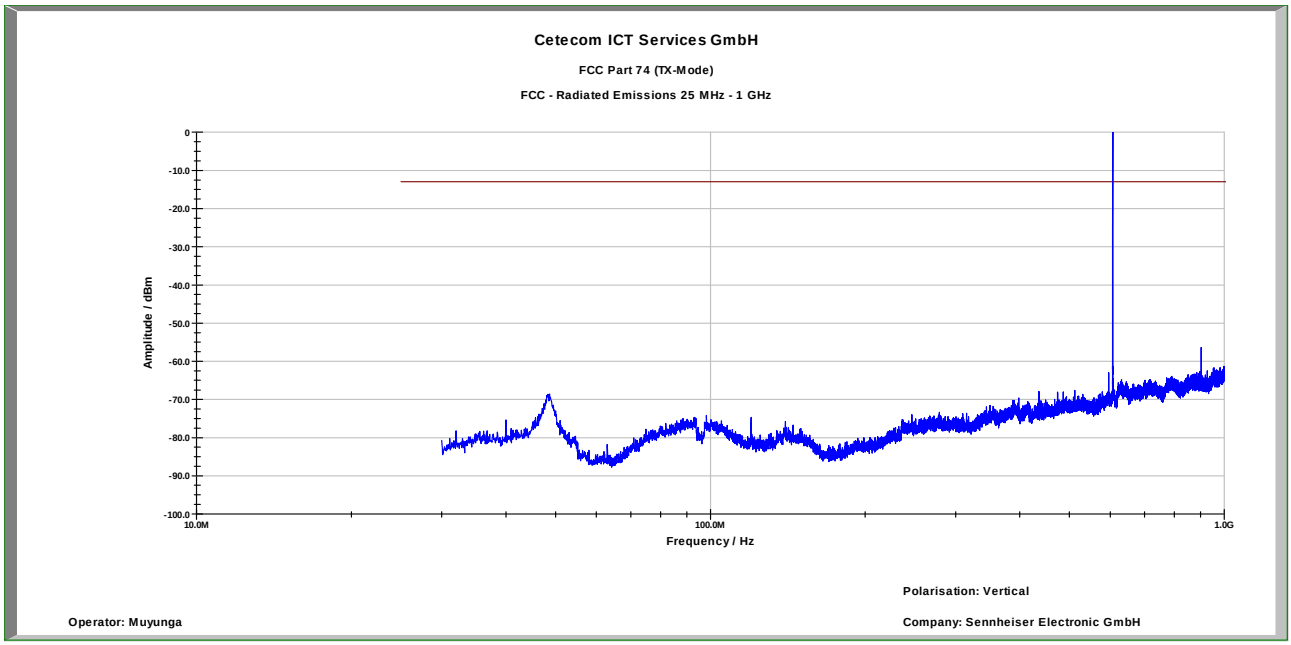



Plot 2:

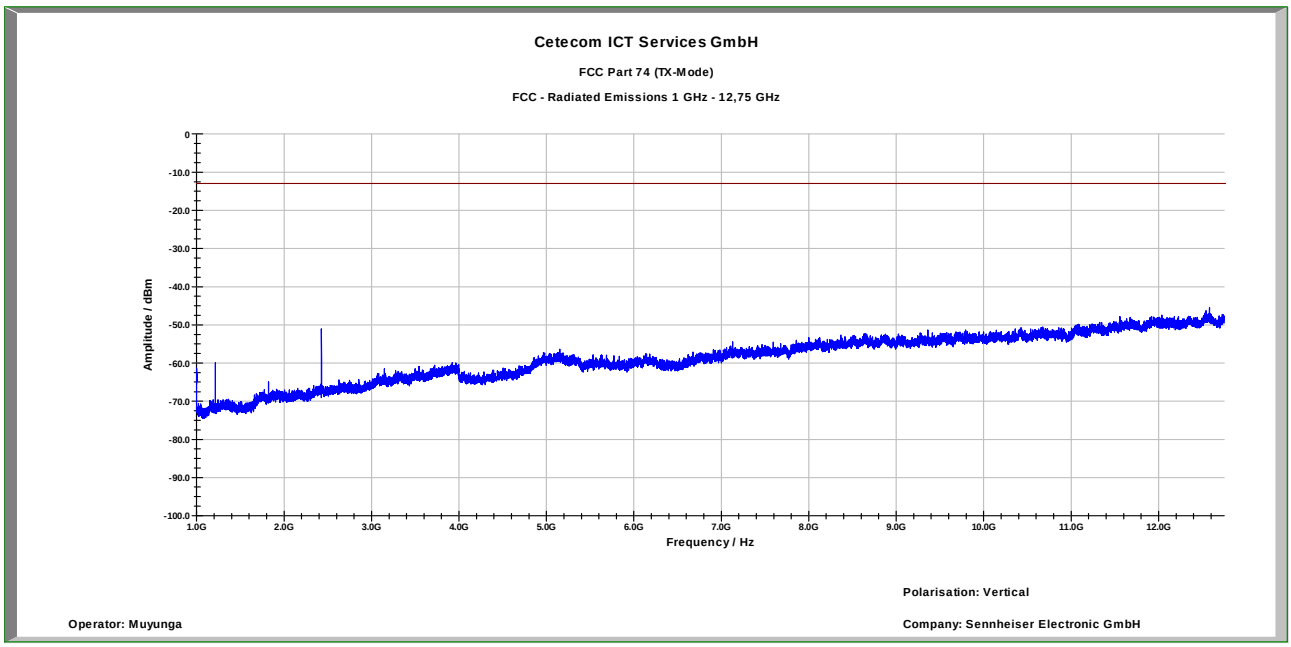


**607.925 MHz, Pilot-ton activated**

Plot 1:

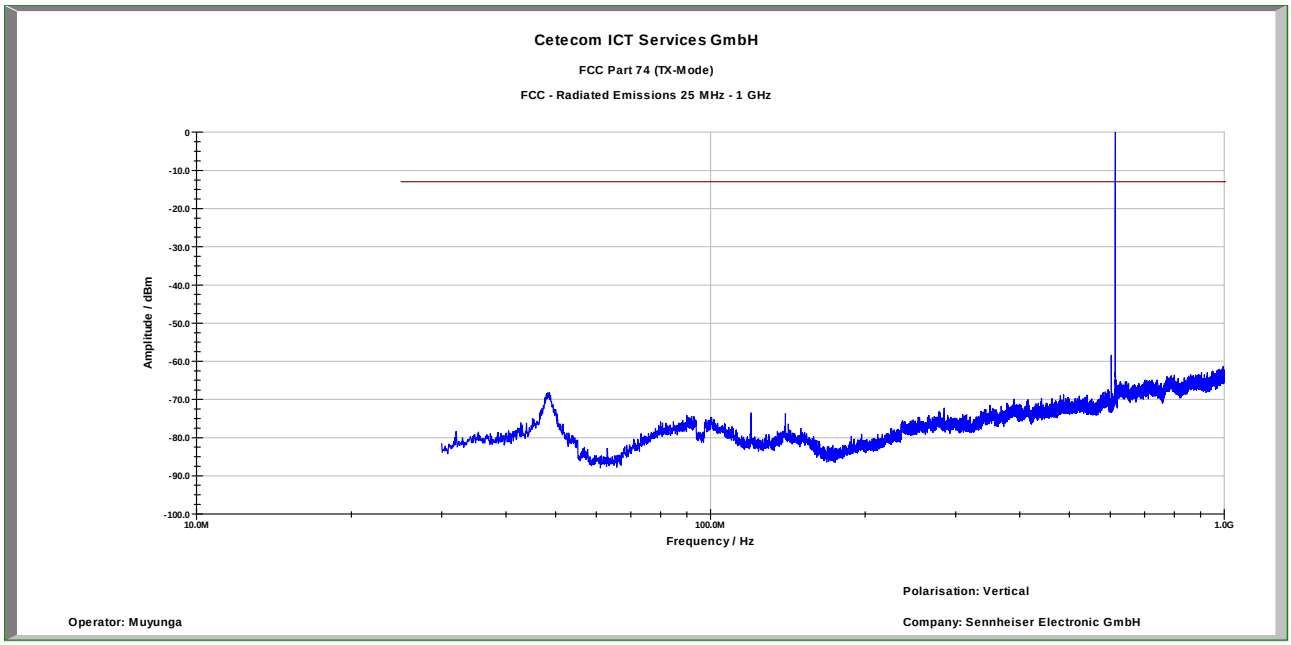



Plot 2:

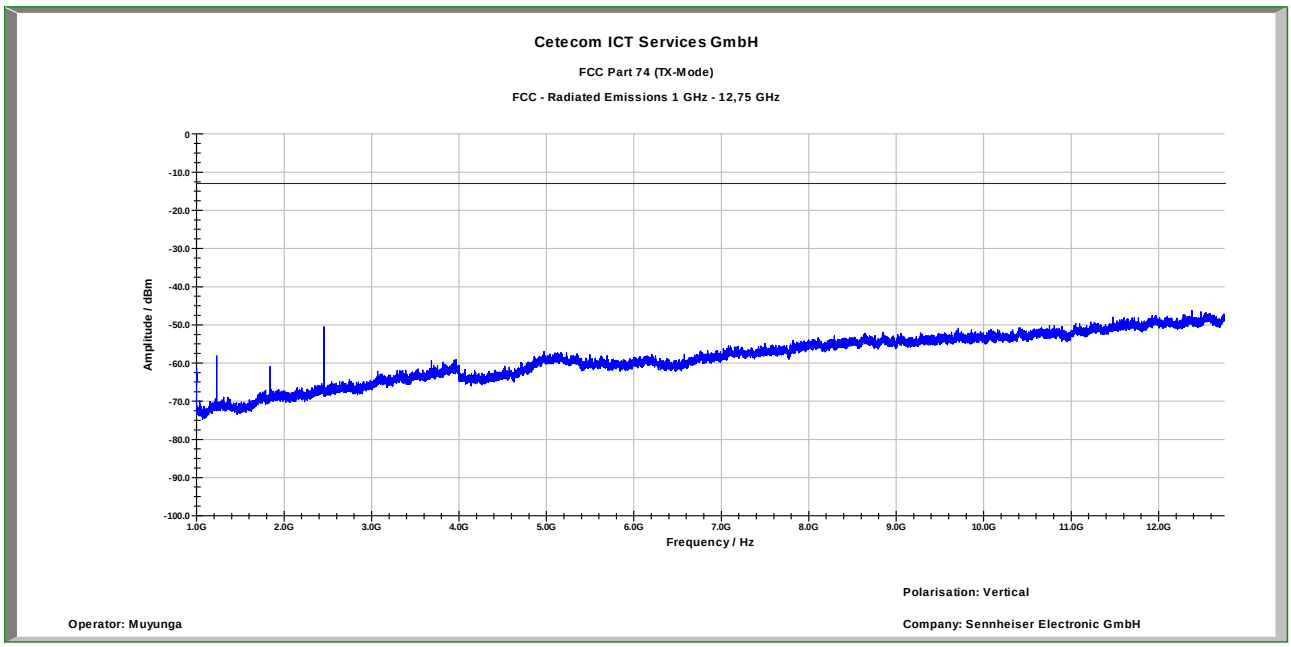


**614.075 MHz, Pilot-ton activated**

Plot 1:

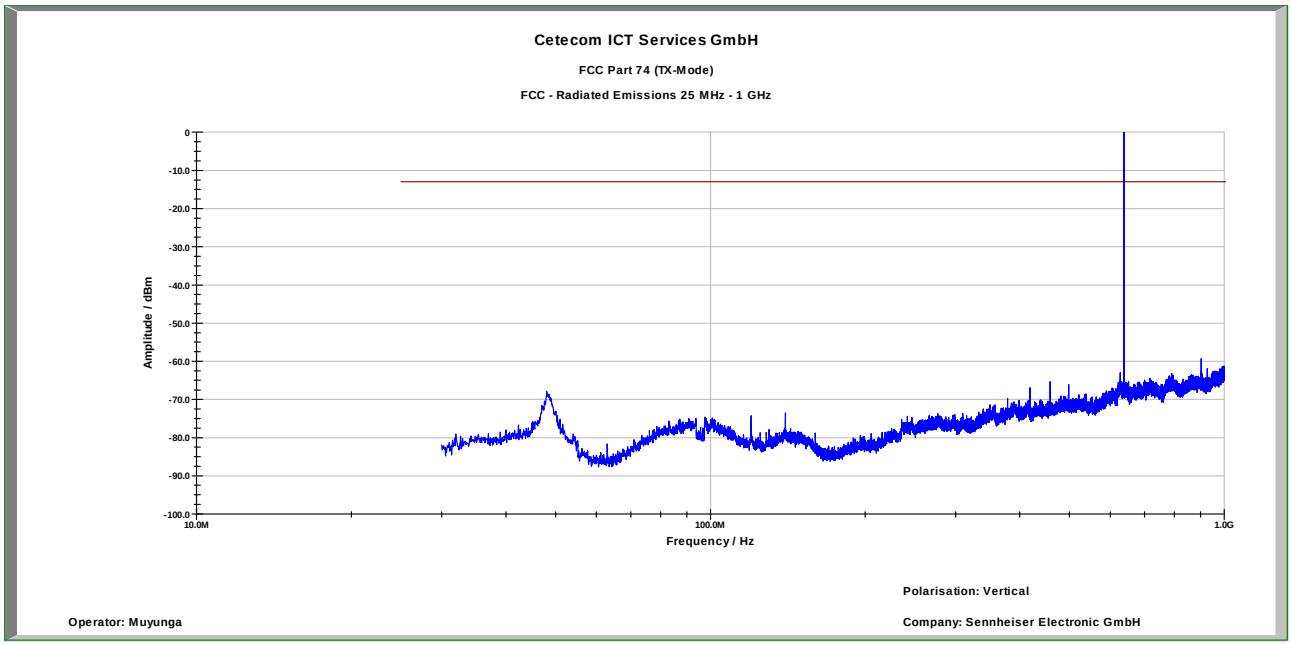



Plot 2:

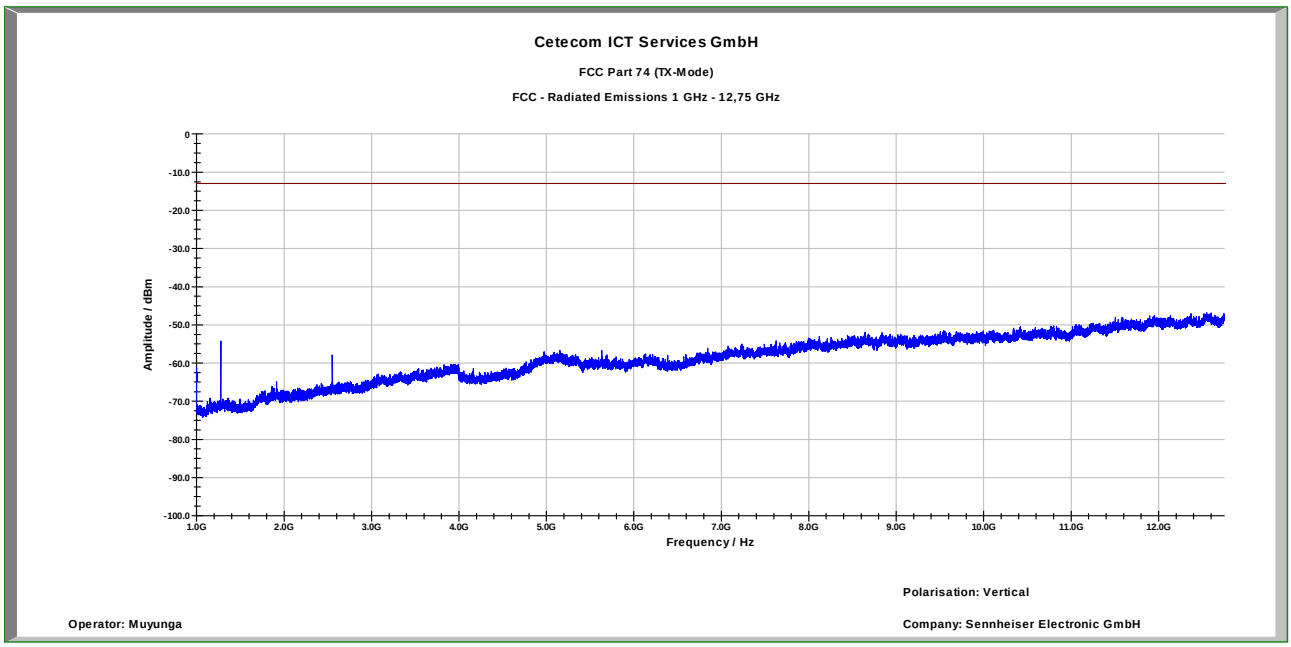


**638 MHz, Pilot-ton activated**

Plot 1:

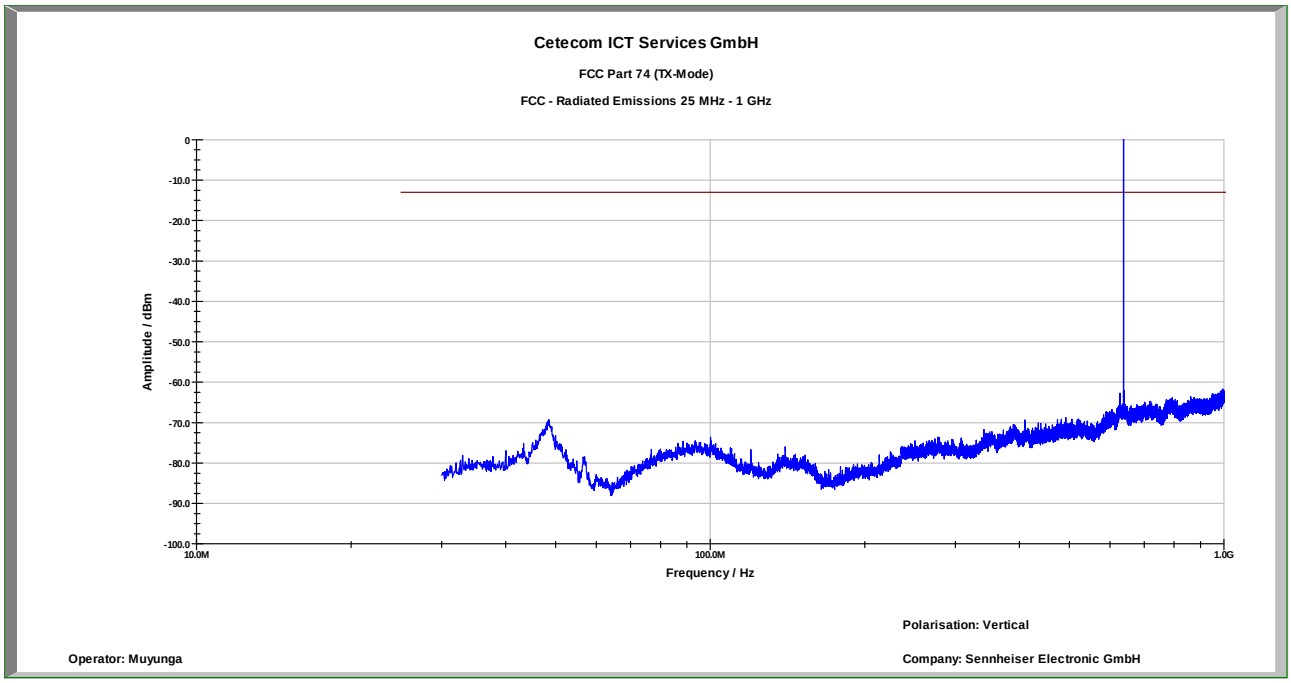



Plot 2:

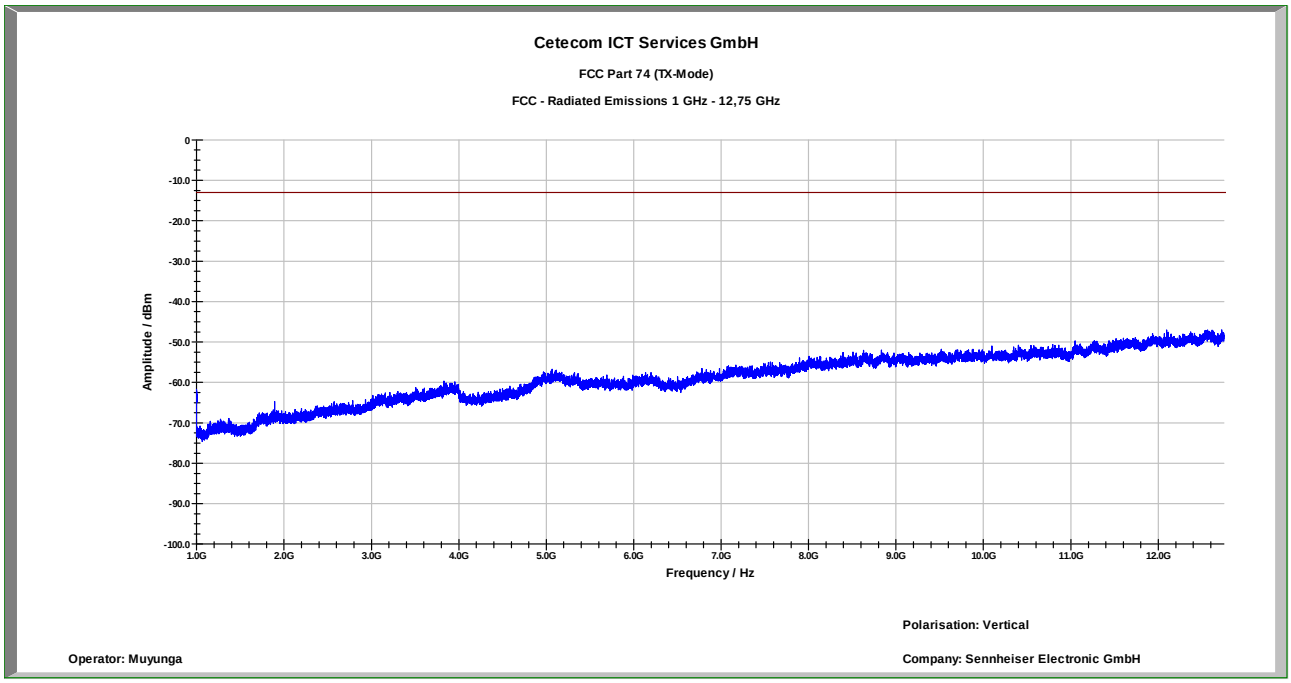


**668.000 MHz, Pilot-ton activated**

Plot 1:

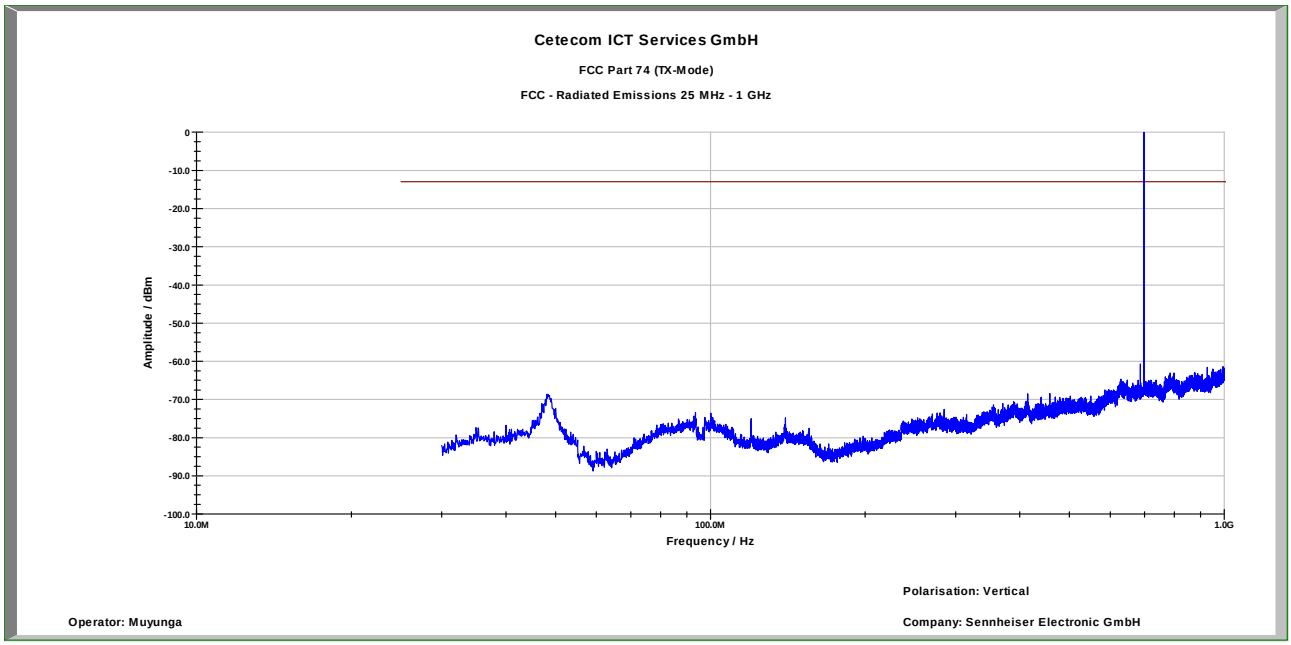



Plot 2:

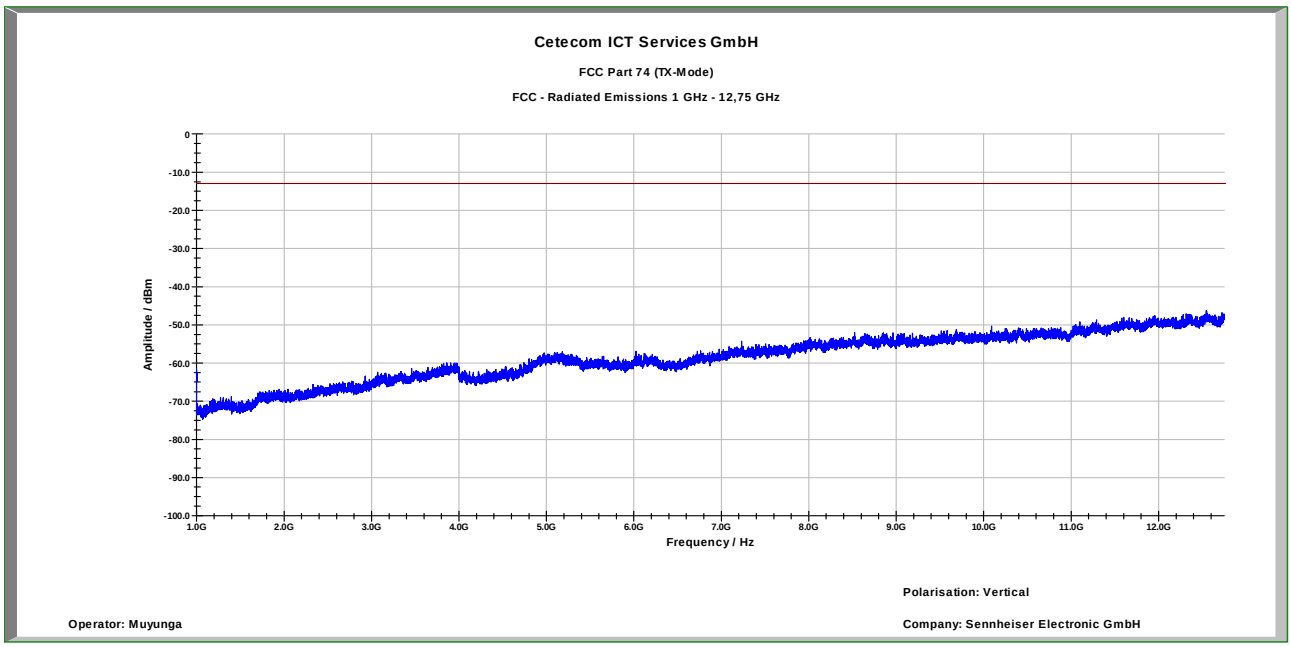


**697.925 MHz, Pilot-ton activated**

Plot 1:




Plot 2:



# 6 Test equipment and ancillaries used for tests

In order to simplify the identification of the equipment used at each specific test, each item of test equipment and ancillaries are provided with an identifier or number in the equipment list below.

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).

| No. | Equipment | Type | Manufact. | Serial No. | INV. No Cetecom | Kal. Art | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|
| 1 | PowerAttenuator | 8325 | Byrd | 1530 | 300001595 | | | |
| 2 | Double-Ridged Waveguide Horn Antenna 1-26.5GHz | 3115 | EMCO | 8812-3088 | 300001032 | vlKI! | 05.03.2009 | 05.03.2011 |
| 3 | Active Loop Antenna | 6502 | EMCO | 2210 | 300001015 | ne | | |
| 4 | Anechoic chamber | | MWB | 87400/02 | 300000996 | | | |
| 5 | System rack for EMI measurement solution | 85900 | HP I.V. | * | 300000222 | ne | | |
| 6 | Artificial Mains 9 kHz to 30 MHz, 4 x 25 Ampere | ESH3-Z5 | R&S | 828576/020 | 300001210 | Ve | 06.01.2010 | 06.01.2012 |
| 7 | Relais Matrix | 3488A | HP Meßtechnik | 2719A15013 | 300001156 | ne | | |
| 8 | Relais Matrix | PSU | R&S | 890167/024 | 300001168 | ne | | |
| 9 | Isolating Transformer | RT5A | Grundig | 9242 | 300001263 | ne | | |
| 10 | Three-Way Power Splitter, 50 Ohm | 11850C | HP Meßtechnik | | 300000997 | ne | | |
| 11 | Switch / Control Unit | 3488A | HP | 2605e08770 | 300001443 | ne | | |
| 12 | Band Reject filter | WRCG1855/1910-1835/1925-40/8SS | Wainwright | 7 | 300003350 | ev | | |
| 13 | Band Reject filter | WRCG2400/2483-2375/2505-50/10SS | Wainwright | 11 | 300003351 | ev | | |
| 14 | TILE-Software Emission | Quantum Change, Modell TILE-ICS/FULL | EMCO | none | 300003451 | ne | | |
| 15 | Highpass Filter | WHKX2.9/18G-12SS | Wainwright | 1 | 300003492 | ev | | |
| 16 | Highpass Filter | WHK1.1/15G-10SS | Wainwright | 3 | 300003255 | ev | | |
| 17 | Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 18 | 300003789 | ne | | |
| 18 | PSA Spectrum Analyzer 3 Hz - 26.5 GHz | E4440A | Agilent Technologies | MY48250080 | 300003812 | k | 05.08.2008 | 05.08.2010 |
| 19 | MXG Microwave Analog Signal Generator | N5183A | Agilent Technologies | MY47420220 | 300003813 | k | 06.08.2008 | 06.08.2010 |
| 20 | RF Filter Section 9kHz - 1GHz | N9039A | Agilent Technologies | MY48260003 | 300003825 | vlKI! | 19.08.2008 | 19.08.2010 |
| 21 | TRILOG Broadband Test-Antenna 30 | VULB9163 | Schwarzbeck | 371 | 300003854 | vlKI! | 17.12.2008 | 17.12.2010 |

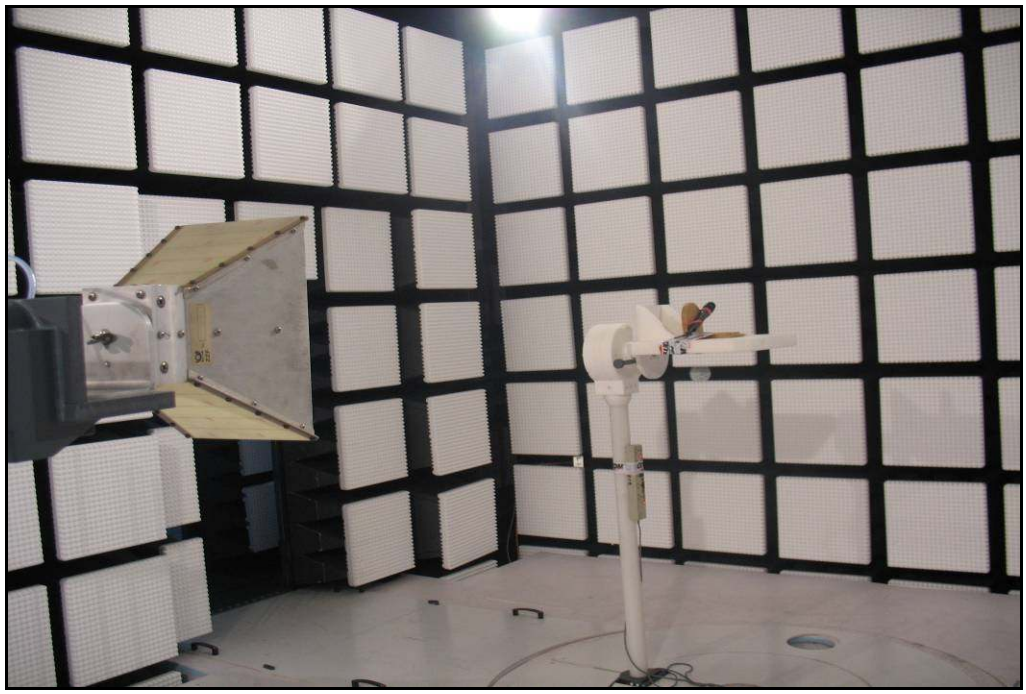
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | MHz - 3 GHz | | | | | | | |
| 22 | Radiocom. Analyzer | CMTA 54 | R&S | 894043/010 | 300001175 | NK! | 06.06.2007 | |
| 23 | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP Meßtechnik | 2920A04590 | 300001041 | Ve | 08.01.2009 | 08.01.2012 |
| 24 | Temperature Test Chamber | VT 4002 | Heraeus Voetsch | 521/83761 | 300002326 | Ve | 28.05.2009 | 28.05.2011 |
| 25 | Audio Analyzer 2Hz - 300 kHz | UPD | R&S | 841074/009 | 300001236 | k | 08.01.2010 | 08.01.2012 |
| 26 | Signal Analyzer 20Hz-26,5GHz-150 to + 30 DBM | FSiQ26 | R&S | 835111/0004 | 300002678 | Ve | 06.01.2009 | 06.01.2011 |

# 7 Photographs of the Test Set-up

Photo documentation

Photo 1:

Photo 2:



# 8 Photographs of the EUT

Photo 3:

Photo 4:


Photo 5:

Photo 6:

Photo 7: Battery packs


In red encircled: Button activating the transmission of a pilot-ton.

Photo 8: SKM 5200-II L


Photo 9: SKM 5200-II L

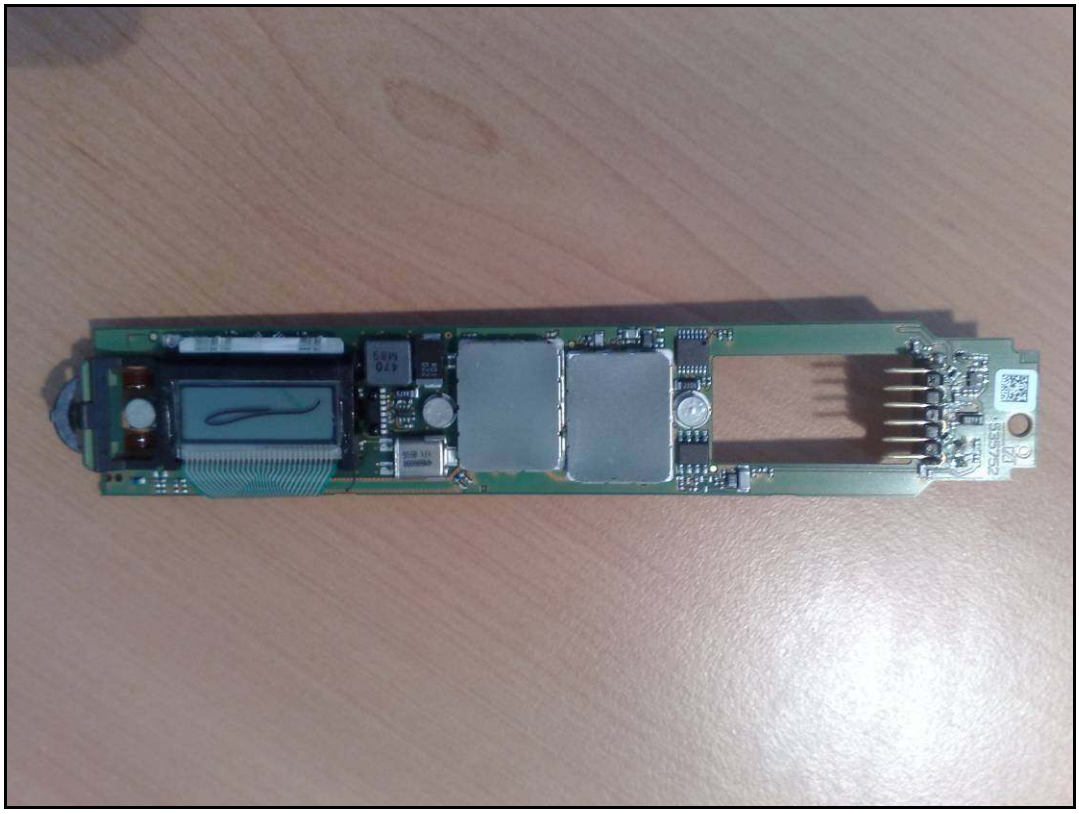


Photo 10: SKM 5200-II L

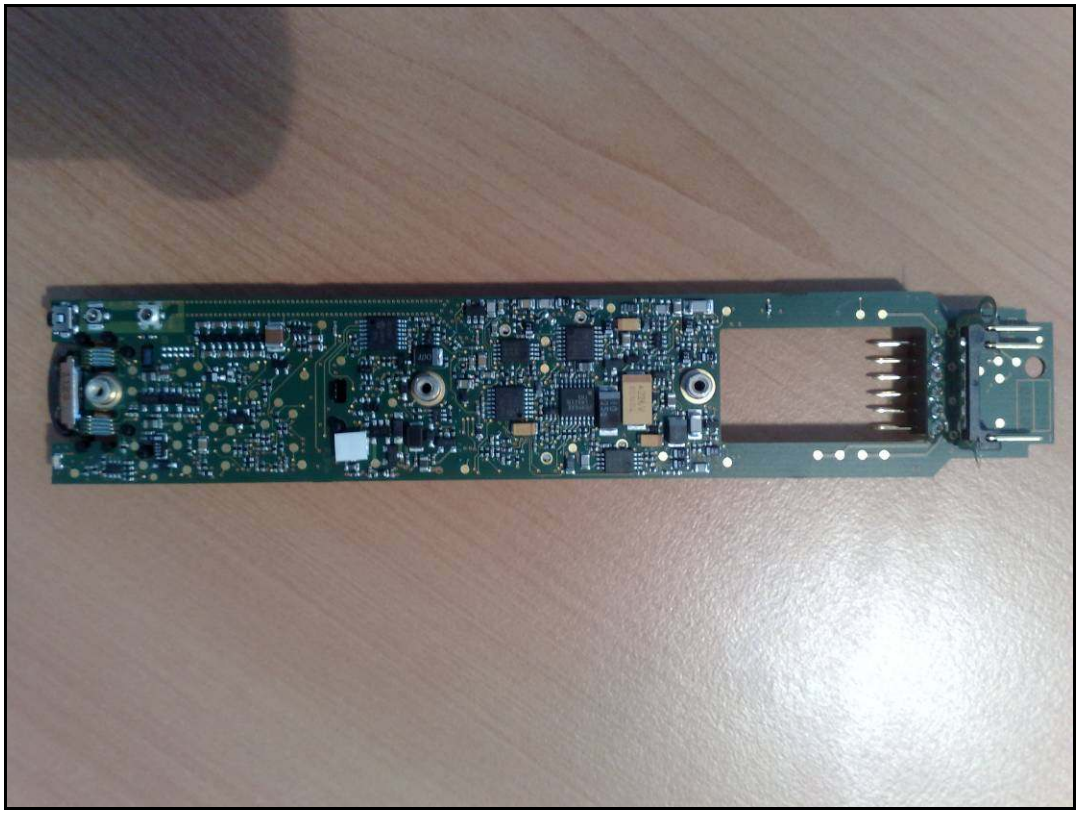


Photo 11: SKM 5200-II N US

Photo 12: SKM 5200-II N US

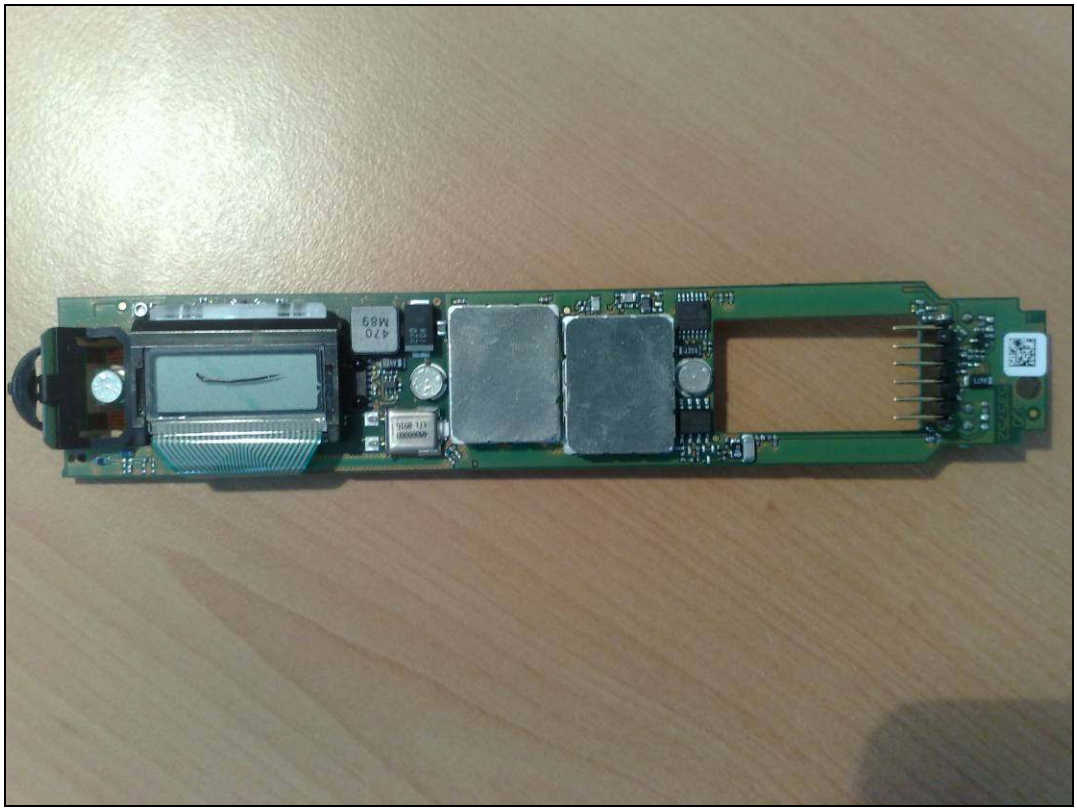


Photo 13: SKM 5200-II N US