# FCC test report

## Test report nr. 21416FCC15

Measurements performed in accordance with:

**FCC Rules: code of Federal Regulations (CFR) no. 47**
**PART 15 – RADIO FREQUENCY DEVICES**

| | |
|---|---|
| **Product:** | Transceiver |
| **Tested model:** | MULTITEC |
| **FCC ID** | YBU2871X09X |
| **Applicant:** | elero gmbh Antriebstechnik<br>Linsenhofer Str. 59-63<br>D-72660 Beuren |
| **Manufacturer:** | elero gmbh Antriebstechnik<br>Linsenhofer Str. 59-63<br>D-72660 Beuren |
| **Trademark:** | elero |
| **Testing Laboratory** | Nice S.p.A.<br>Via Pezza Alta, 13<br>I-31046 Rustignè di Oderzo (TV) |
| **Registration number:** | 771316 |
| **Date of receipt sample:** | 10th March 2015 |
| **Testing date:** | 16th March – 10th June 2015<br>*14th September – 15th September* |
| **Issue date:** | *18 November 2015* |
| **Tested by:** | L. Pastres |
| **Checked by:** | E. Campion |

# Contents

# 1
# General Description of Equipment under Test

## 1.1 Applicant

**Name:** elero gmbh Antriebstechnik

**Address:** Linsenhofer Str. 65
D-72660 Beuren

**Country:** GERMANY

## 1.2 Manufacturer

**Name:** elero gmbh Antriebstechnik

**Address:** Linsenhofer Str. 65
D-72660 Beuren

**Country:** GERMANY

## 1.3 Equipment classification

According to definition 15.3 (o) is a intentional Radiator operating within the *Frequencies*:

so it shall fulfil provisions of 47CFR Part 15 Subpart C – international radiators – and Section 15.209.

According to definition 15.3 (z) is a unintentional Radiator:

So it shall fulfil provisions of 47CFR Part 15 Subpart B – Unintentional radiator and section 15.*249*.

## 1.4 Basic Description of equipment under test

| Parameters | Value |
|---|---|
| Type of equipment: | Transceiver for screen applications |
| Model: | MULTITEC |
| FCC ID: | YBU2871*X*09*X* |
| Trade Name: | Elero GmbH Antriebstechnik |
| Data cable: | - |
| Telecom cable: | - |
| Power supply type: | 5Vdc (from USB cable) |
| AC power input cable: | *120V, 60Hz with dedicated power supply* |
| DC power input cable: | - |

| Model | Description |
|---|---|
| MULTITEC | The transceiver has a unidirectional transmission at 915.3MHz and bidirectional transmissions at 918.3MHz |
| | |

## 1.5 Feature of equipment under test

| Parameters | Value |
|---|---|
| Power specification | 5Vdc (from USB Cable) |
| Operating frequency: | 915.3MHz (unidirectional), 918.3MHz (bidirectional) |
| Maximum RF output power: | *56.37*dBμV/m (average), 81.96 dBμV/m (peak)<br>*918.3MHz and*<br>*55.83 dBμV/m (average), 81.86 dBμV/m (peak)*<br>*915.3MHz* |
| Occupied Bandwidth (99% BW): | *127kHz (918.3MHz)*<br>*127kHz (915.3MHz)* |
| Emission Designator (ITU): | *127KF1D (918.3MHz)*<br>*127KF1D (915.3MHz)* |
| Modulation: | FSK (915.3MHz)<br>GSFK (918.3MHz) |
| Channel spacing: | - |
| Antenna: | Integral |
| Rx Sensitivity: | - |
| Main SW identification: | - |
| Main HW board identification: | - |
| Peripherals included (for system application):<br><br>Interfaces:<br><br>Integrated interfaces<br><br>AC adapter: | -<br><br>-<br><br>-<br><br>- |

# 2
# Test configuration of equipment under test

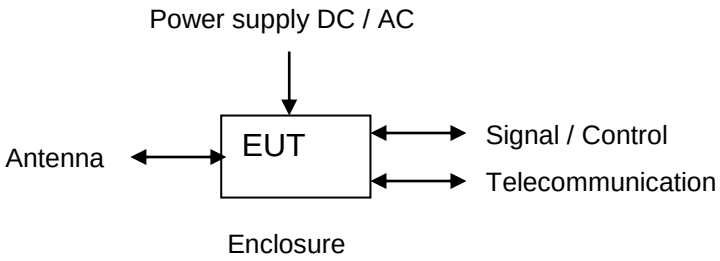
## 2.1 Environmental conditions

| Test conditions | Measured |
|---|---|
| Ambient temperature: | 20 ÷ 25°C |
| Relative humidity: | 50 ÷ 60% |
| Atmospheric pressure: | 900 ÷ 1010mb |

## 2.2 Description of support equipment

| Equipment | Manufacturer | Model |
|---|---|---|
| - | - | - |
| | | |
| | | |

## 2.3 Interface identification and connection diagram of test system




| # | Interface | Description | Maximum length | Ref. Document |
|---|---|---|---|---|
| 1 | Enclosure | Plastic | - | - |
| 2 | AC mains power input | *120V, 60Hz* | - | - |
| 3 | DC power port | 5Vdc from USB | - | - |
| 4 | Signal / control port | - | - | - |
| 5 | Antenna port | - | - | - |

# 3
# Operation of equipment under test

## 3.1 Operating test conditions

| # | Description |
|---|---|
| 1 | Receiving mode |
| 2 | Transmission mode |
| | |
| | |

# 4
# Tests identification and result

| CFR47 Part 15 Section | Title | Operating condition | Result |
|---|---|---|---|
| 15.203<br>15.247 (b)(4)(i) | Antenna requirements | - | PASS |
| 15.207 (a) | Conduced emission | #2 | PASS |
| 15.209 (a) (f) | Radiated emission | #1, 2 | PASS |
| 15.35 (c) | Timing of the transmitter | #2 | PASS |
| 15.*231* (a) | Transmit behaviour after releasing the TX-button | - | *Not Applicable* |
| 15.249 (a) | Radiated output power | #2 | PASS |
| 15.35 (c) | Typical pulse train of a signal | #2 | PASS |
| 15.249 (c) | Compliance with the limit of FCC | #2 | PASS |
| 15.249 (a) | Spurious emission - radiated | #2 | PASS |
| 15.215 (c) | Occupied bandwidth | #2 | PASS |

## 4.1 Methods of measurement

All compliance measurements has been carried out using the procedures described in the standard ANSI C63.4-2009 (excluding sub-par. 4.1.5.2, 5.7.9 and 14), C63.10-2009 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

## 4.2 Frequency range investigated

a) Conduced emission tests: from 9kHz to 30MHz.
b) Radiated emission tests: from 150kHz to tenth harmonic of fundamental.

# 5
# Tests

## 5.1 Antenna requirements

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Sections 15.203, 15.204 |

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, bu the use of a standard antenna jack or electrical connector is prohibited. This requirements does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219 or 15.221. Further, this requirements does not apply to intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

| Antenna Specification: | |
|---|---|
| N° of authorized antenna type: | - |
| Antenna type: | Integral |
| Maximum total gain: | 0dB |
| External power amplifiers: | - |

| Antenna description: | | |
|---|---|---|
| **No.** | **Manufacturer** | **Model Type** |
| - | - | - |
| | | |
| | | |

| Comments: |
|---|
| the antenna is integral to the product |

## 5.2 Conduced emission

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.207 |

1) The EUT was placed on wooden table size 80cm, raised 80cm in which is located 40cm away from the vertical wall shielded room.
2) Each EUT powered input cord was individually connected through a 50Ω/50µH LISN to the input power source.
3) Exploratory measurements were made identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was than performed over the frequency range of 0,15MHz to 30MHz.
5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 10kHz during the measurements.
6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are ≥ (Q.P. limit – 6dB)

| Test Requirements: | |
|---|---|
| Test Setup: | ANSI C63.4 |
| Limit of mains terminal disturbance voltage: | 15.207 (a) |
| Frequency range: | 9kHz – 150kHz<br>150kHz – 30MHz |
| IF Bandwidth: | 200Hz<br>9kHz |
| EMC class | B |

**Limits (1):**

| *Frequency [MHz]* | *Quasi-Peak (dBµV)* | *Average (dBµV)* |
|---|---|---|
| 0,15 – 0,5 | 66 – 56 | 56 – 46 |
| 0,5 – 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |
| | | |

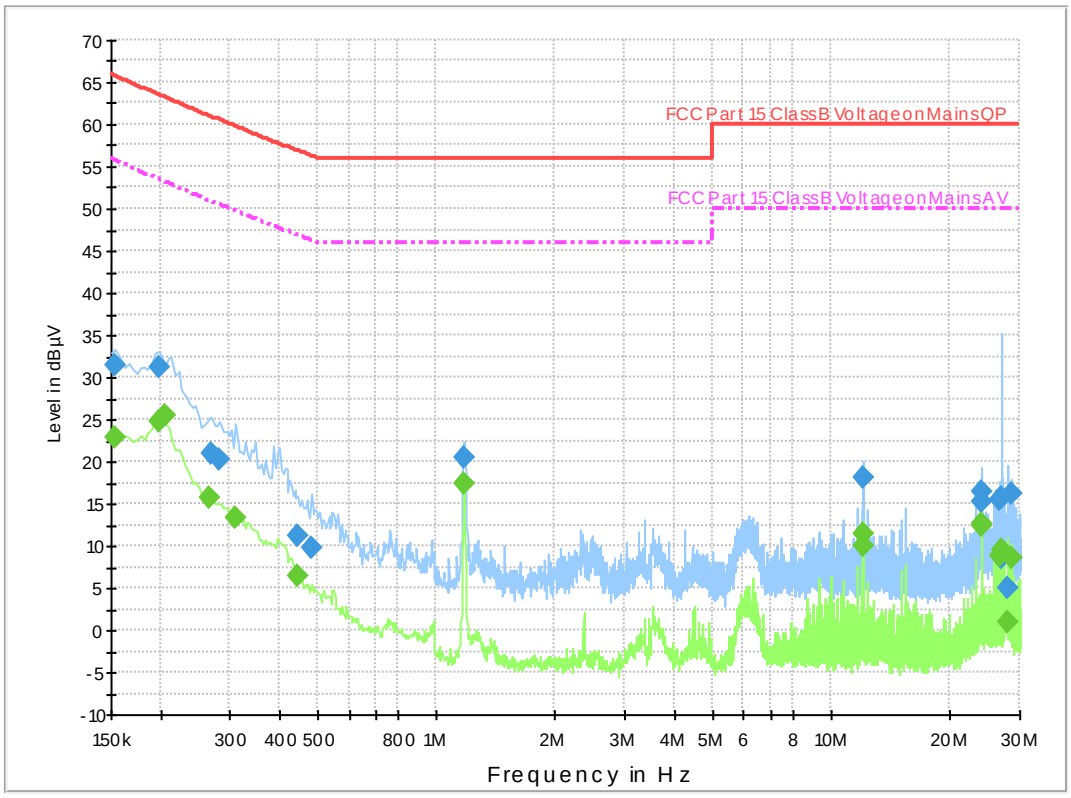
Note: (1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

**Test Data:**

| *Port under test* | *Operating condition* | *Result* |
|---|---|---|
| USB power supply 5Vdc | Transmitting (worst case) | Comply |
| *AC power supply* | *Transmitting (worst case)* | *Comply* |

**Comments:**

-


FCC Part 15 ClassB VoltageonMainsQP
FCC Part 15 ClassB VoltageonMainsAV
Level in dBµV
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
150k
300
400 500
800 1M
2M
3M
4M
5M
6
8
10M
20M
30M
Frequency in Hz

## Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.154000 | 31.5 | 1000.0 | 9.000 | GN | N | 1.6 | 34.2 | 65.8 | |
| 0.198000 | 31.2 | 1000.0 | 9.000 | GN | N | 1.0 | 32.4 | 63.5 | |
| 0.270000 | 20.9 | 1000.0 | 9.000 | GN | N | 0.6 | 40.1 | 60.9 | |
| 0.282000 | 20.2 | 1000.0 | 9.000 | GN | L1 | 0.5 | 40.3 | 60.6 | |
| 0.446000 | 11.2 | 1000.0 | 9.000 | GN | N | 0.2 | 45.7 | 56.9 | |
| 0.482000 | 9.6 | 1000.0 | 9.000 | GN | N | 0.2 | 46.6 | 56.3 | |
| 1.174000 | 20.5 | 1000.0 | 9.000 | GN | N | 0.0 | 35.5 | 56.0 | |
| 12.002000 | 18.2 | 1000.0 | 9.000 | GN | L1 | 0.5 | 41.8 | 60.0 | |
| 23.982000 | 15.3 | 1000.0 | 9.000 | GN | N | 1.2 | 44.7 | 60.0 | |
| 24.026000 | 16.3 | 1000.0 | 9.000 | GN | N | 1.2 | 43.7 | 60.0 | |
| 26.610000 | 15.6 | 1000.0 | 9.000 | GN | L1 | 1.2 | 44.4 | 60.0 | |
| 27.070000 | 8.6 | 1000.0 | 9.000 | GN | N | 1.3 | 51.4 | 60.0 | |
| 27.158000 | 15.8 | 1000.0 | 9.000 | GN | L1 | 1.2 | 44.2 | 60.0 | |
| 27.910000 | 5.0 | 1000.0 | 9.000 | GN | N | 1.4 | 55.0 | 60.0 | |
| 28.686000 | 16.3 | 1000.0 | 9.000 | GN | L1 | 1.3 | 43.7 | 60.0 | |

## Final Result 2

| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.154000 | 22.8 | 1000.0 | 9.000 | GN | L1 | 1.6 | 33.0 | 55.8 | |
| 0.198000 | 24.8 | 1000.0 | 9.000 | GN | L1 | 1.1 | 28.7 | 53.5 | |
| 0.206000 | 25.4 | 1000.0 | 9.000 | GN | N | 0.9 | 27.7 | 53.2 | |
| 0.266000 | 15.6 | 1000.0 | 9.000 | GN | L1 | 0.6 | 35.4 | 51.0 | |
| 0.310000 | 13.2 | 1000.0 | 9.000 | GN | L1 | 0.4 | 36.5 | 49.7 | |
| 0.446000 | 6.4 | 1000.0 | 9.000 | GN | N | 0.2 | 40.4 | 46.9 | |
| 1.178000 | 17.4 | 1000.0 | 9.000 | GN | N | 0.0 | 28.6 | 46.0 | |
| 11.978000 | 11.5 | 1000.0 | 9.000 | GN | N | 0.5 | 38.5 | 50.0 | |
| 12.002000 | 10.0 | 1000.0 | 9.000 | GN | L1 | 0.5 | 40.0 | 50.0 | |
| 23.982000 | 12.4 | 1000.0 | 9.000 | GN | L1 | 1.1 | 37.6 | 50.0 | |
| 24.026000 | 12.5 | 1000.0 | 9.000 | GN | N | 1.2 | 37.5 | 50.0 | |
| 26.610000 | 8.7 | 1000.0 | 9.000 | GN | N | 1.3 | 41.3 | 50.0 | |
| 27.158000 | 9.4 | 1000.0 | 9.000 | GN | N | 1.3 | 40.6 | 50.0 | |
| 27.910000 | 1.0 | 1000.0 | 9.000 | GN | L1 | 1.3 | 49.0 | 50.0 | |
| 28.686000 | 8.7 | 1000.0 | 9.000 | GN | N | 1.4 | 41.3 | 50.0 | |

## 5.3 Radiated emission

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.209 |

1) The EUT was placed on turntable which is 0,8m above the ground plane.
2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
3) The EUT is positioned 3m away from the receiving antenna which varied from 1 to 4m to find the highest emission.
4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100kHz below 1000MHz and 1MHz above 1000MHz.
5) The receiving antenna was positioned in both horizontal and vertical polarization.
6) The measurements with Quasi-Peak detector, below 1000MHz are performed only for frequencies for which the Peak values are ≥ (Q.P. limit – 6dB).

| Test Requirements: | |
|---|---|
| Test Setup: | ANSI C63.4 |
| Test facility: | Anechoic chamber |
| Test distance: | 3m |
| Limits for radiated disturbances: | 15.209 (a) |
| Frequrncy range: | 150kHz to 1GHz |
| IF bandwidth (below 30MHz): | 9kHz |
| IF badwidth (below 1000MHz): | 120kHz |
| IF badwidth (above 1000MHz): | 1MHz |
| EMC class: | B |

**Limits (1):**

| *Frequency [MHz]* | *Field Strength (µV/m)* | *Measurement distance (m)* |
|---|---|---|
| 0,0009 – 0,490 | 2400/F(kHz) | 300 |
| 0,490 – 1,750 | 24000/F(kHz) | 30 |
| 1,750 - 30 | 30 | 30 |
| 30 - 88 | 100 | 30 |
| 88 -216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| above 960 | 500 | 3 |

Note: (1) to convert the measuring distance from 3m to 300m and 30m to 300m a correction factor from 40dB/decade was used

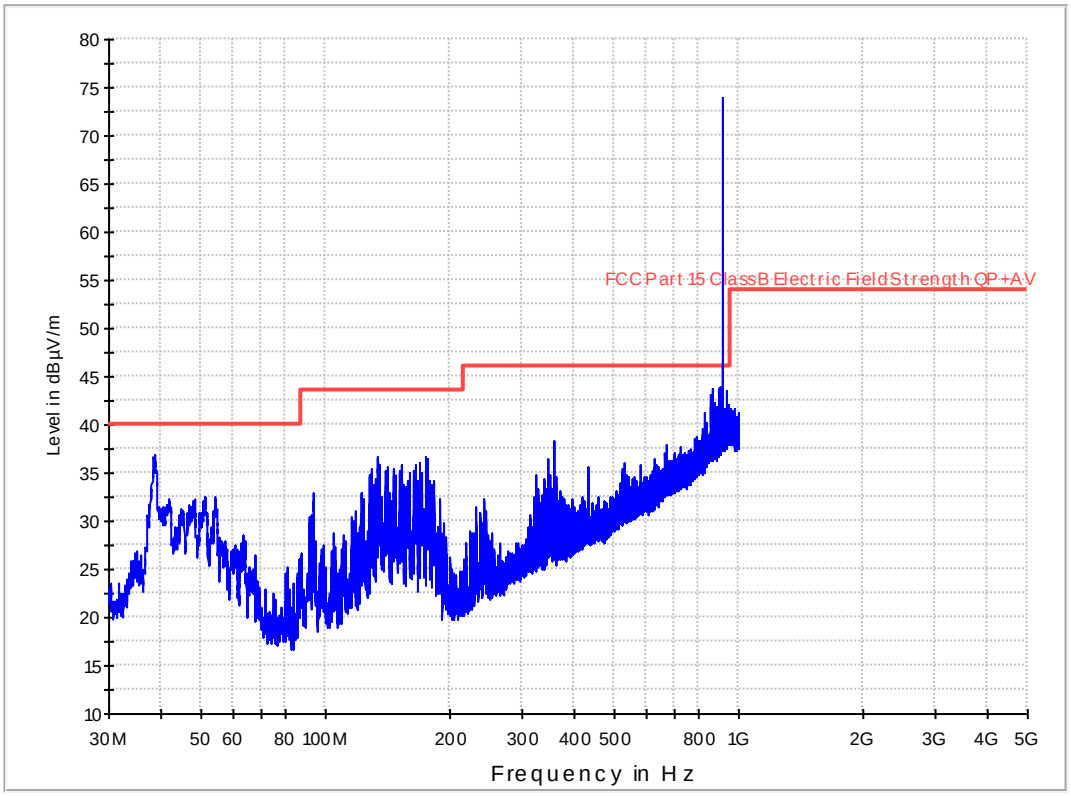
**Test Data.:**

| *Port under test* | *Operating condition* | *Result* |
|---|---|---|
| Enclosure | #1, #2 | Complies |

**Comments:**

The results represent the worst case of emissions between three polarizations verified (X, Y and Z). The table was rotate of 360° and antenna receiving moved from 1m to 4m to find the maximum emission.
Note: the frequency 918.24MHz is the CW for test. *For frequency 915.3MHz the result is same.*

Transmission (30MHz to 1GHz)



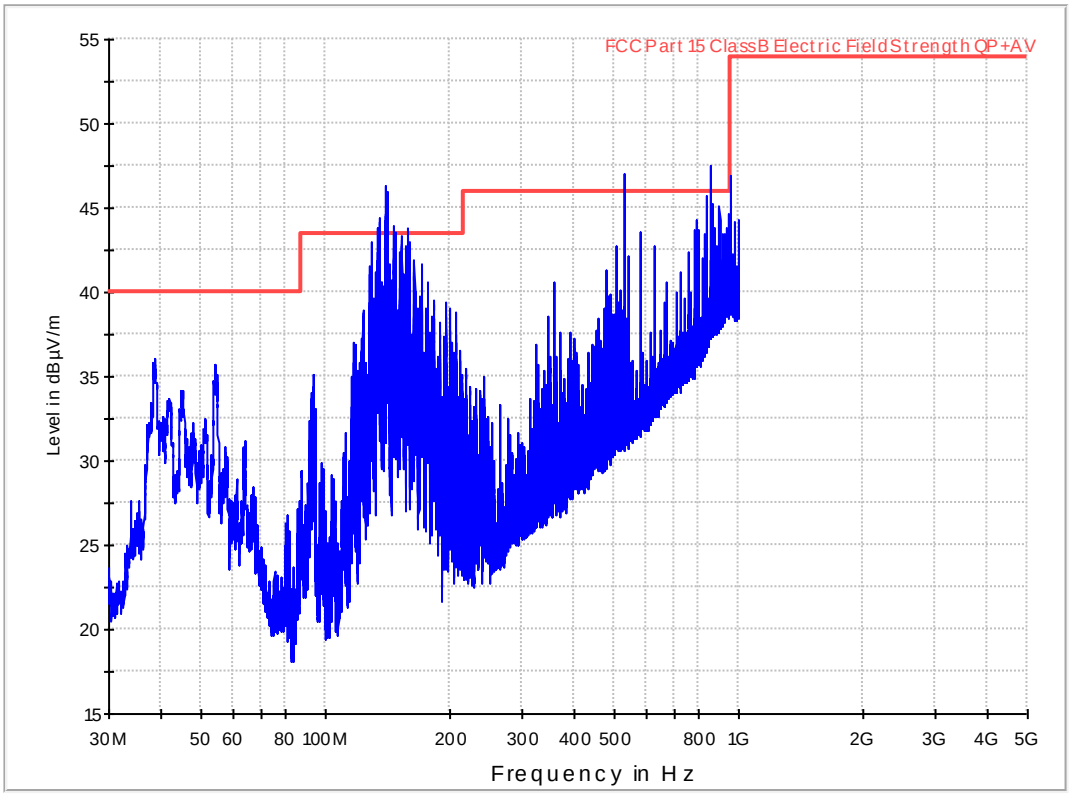
## Result Table_Single

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|
| 37.800000 | 28.7 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 13.3 | |
| 38.720000 | 32.5 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 13.3 | |
| 51.120000 | 28.1 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 14.2 | |
| 63.680000 | 23.0 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 12.6 | |
| 93.280000 | 25.9 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 10.4 | |
| 118.120000 | 23.4 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 13.7 | |
| 134.640000 | 31.5 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 15.3 | |
| 142.120000 | 36.6 | 1000.0 | 120.000 | 120.0 | H | 0.0 | 15.9 | |
| 176.080000 | 27.9 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 15.1 | |
| 224.040000 | 19.9 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 14.1 | |
| 310.160000 | 22.5 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 18.1 | |
| 360.040000 | 36.6 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 19.2 | |
| 432.040000 | 33.0 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 21.3 | |
| 624.120000 | 33.5 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 25.0 | |
| 780.120000 | 33.9 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 27.9 | |
| 828.120000 | 44.5 | 1000.0 | 120.000 | 120.0 | H | 0.0 | 28.6 | |
| 852.120000 | 45.1 | 1000.0 | 120.000 | 120.0 | H | 0.0 | 29.0 | |
| 918.240000 | 73.8 | 1000.0 | 120.000 | 120.0 | V | 0.0 | 30.0 | |

## Result Table_Single Eval

| Frequency (MHz) | Margin (dB) |
|---|---|
| 37.800000 | -11.3 |
| 38.720000 | -7.5 |
| 51.120000 | -11.9 |
| 63.680000 | -17.0 |
| 93.280000 | -17.6 |
| 118.120000 | -20.1 |
| 134.640000 | -12.0 |
| 142.120000 | -6.9 |
| 176.080000 | -15.6 |
| 224.040000 | -26.1 |
| 310.160000 | -23.5 |
| 360.040000 | -9.4 |
| 432.040000 | -13.0 |
| 624.120000 | -12.5 |
| 780.120000 | -12.1 |
| 828.120000 | -1.5 |
| 852.120000 | -0.9 |
| 918.240000 | 27.8 |

Receiving (30MHz to 1GHz)



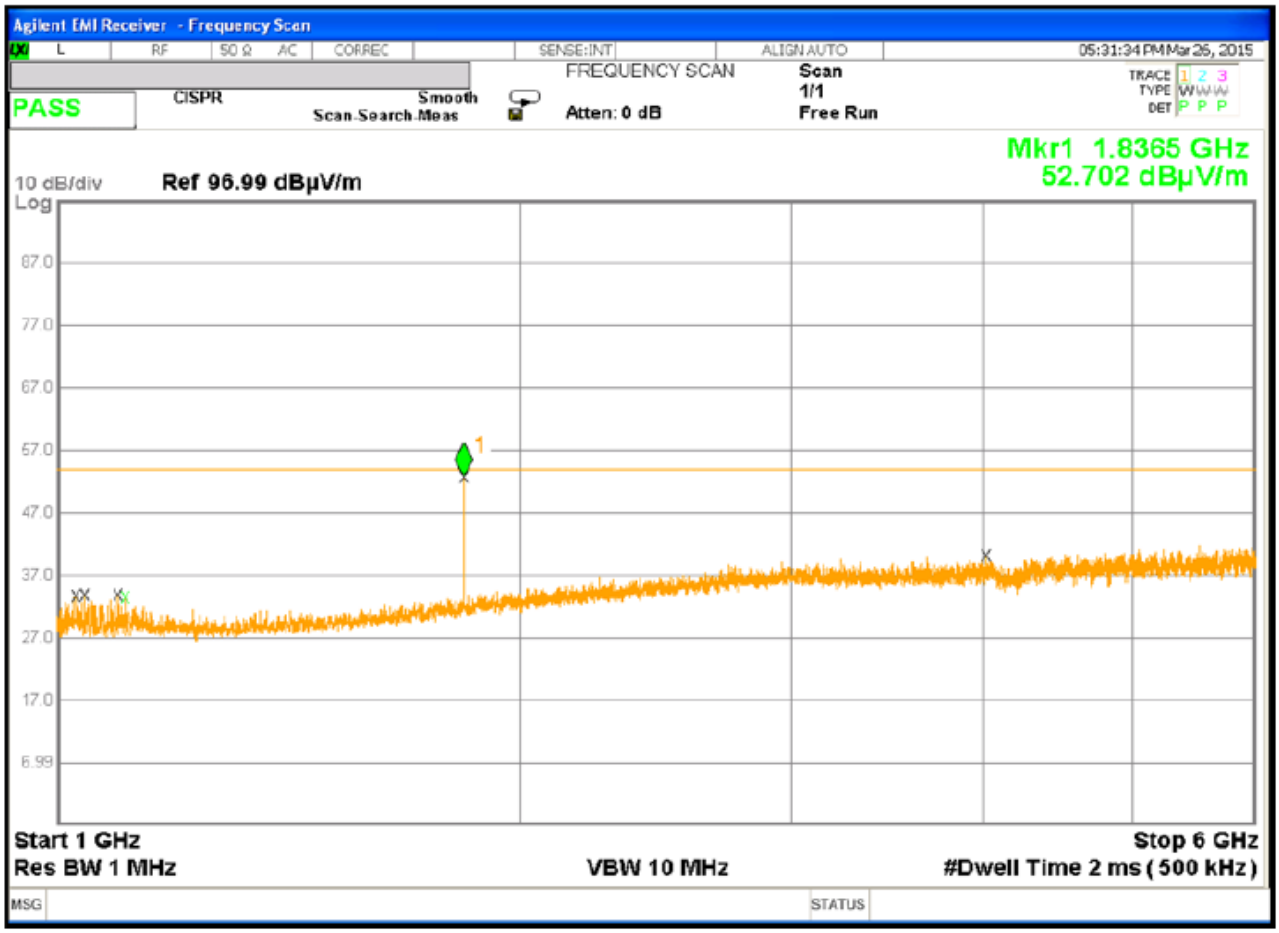
## Result Table_Single

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|
| 38.960000 | 28.7 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 13.3 | |
| 54.240000 | 23.5 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 14.0 | |
| 63.840000 | 22.4 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 12.6 | |
| 116.680000 | 30.4 | 1000.0 | 120.000 | 100.0 | H | 45.0 | 13.6 | |
| 140.680000 | 39.4 | 1000.0 | 120.000 | 120.0 | H | 0.0 | 15.7 | |
| 176.720000 | 34.0 | 1000.0 | 120.000 | 120.0 | H | 0.0 | 15.1 | |
| 348.040000 | 37.3 | 1000.0 | 120.000 | 120.0 | V | 45.0 | 18.9 | |
| 480.080000 | 40.6 | 1000.0 | 120.000 | 100.0 | H | 45.0 | 22.0 | |
| 528.080000 | 46.0 | 1000.0 | 120.000 | 100.0 | H | 45.0 | 23.1 | |
| 852.120000 | 44.6 | 1000.0 | 120.000 | 100.0 | H | 0.0 | 29.0 | |

## Result Table_Single Eval

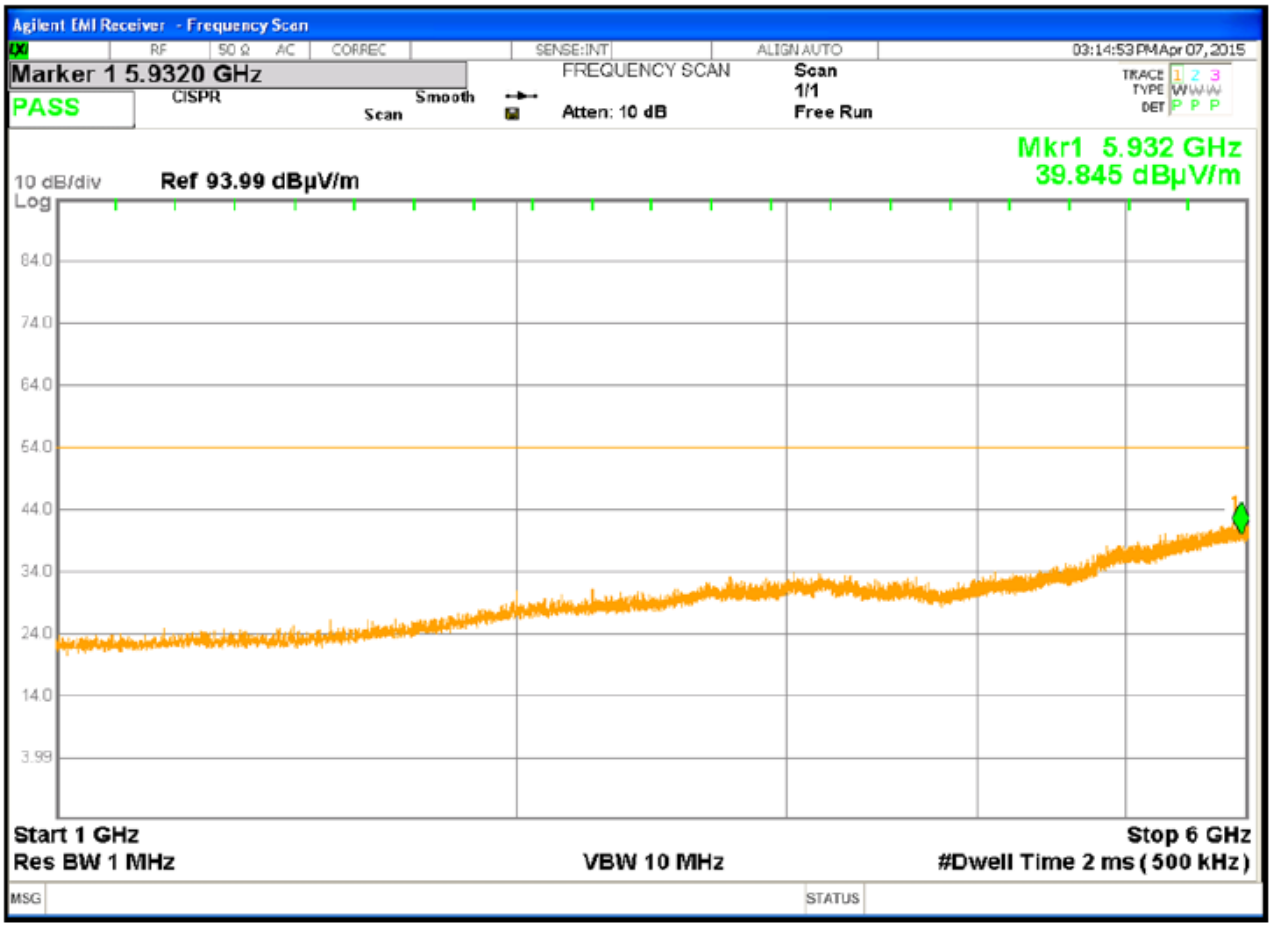
| Frequency (MHz) | Margin (dB) |
|---|---|
| 38.960000 | -11.3 |
| 54.240000 | -16.5 |
| 63.840000 | -17.6 |
| 116.680000 | -13.1 |
| 140.680000 | -4.1 |
| 176.720000 | -9.5 |
| 348.040000 | -8.7 |
| 480.080000 | -5.4 |
| 528.080000 | -0.1 |
| 852.120000 | -1.4 |

Transmission (1GHz-6GHz)



| Sig | Trc | Freq | PEAK Amptd | QPD Amptd | EAVG Amptd | PEAK vs LL1 | QPD vs LL3 | EAVG vs LL2 | RBW | RBW Type |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1.0285 GHz | 34.707 dBuV/m | 27.356 dBuV/m | 17.474 dBuV/m | --- | -26.623 dB | --- | 1.00 MHz | CISPR |
| 2 | 1 | 1.0412 GHz | 35.205 dBuV/m | 28.365 dBuV/m | 17.651 dBuV/m | --- | -25.615 dB | --- | 1.00 MHz | CISPR |
| 3 | 1 | 1.0950 GHz | 35.521 dBuV/m | 28.822 dBuV/m | 17.896 dBuV/m | --- | -25.158 dB | --- | 1.00 MHz | CISPR |
| 4 | 1 | 1.1075 GHz | 34.391 dBuV/m | 27.743 dBuV/m | 17.675 dBuV/m | --- | -26.237 dB | --- | 1.00 MHz | CISPR |
| 5 | 1 | 1.8365 GHz | 53.004 dBuV/m | 52.402 dBuV/m | 51.710 dBuV/m | --- | -1.578 dB | --- | 1.00 MHz | CISPR |
| 6 | 1 | 4.0085 GHz | 41.426 dBuV/m | 35.929 dBuV/m | 28.095 dBuV/m | --- | -18.051 dB | --- | 1.00 MHz | CISPR |

Receiving (1GHz to 6GHz)



## 5.4 Timing of the transmitter

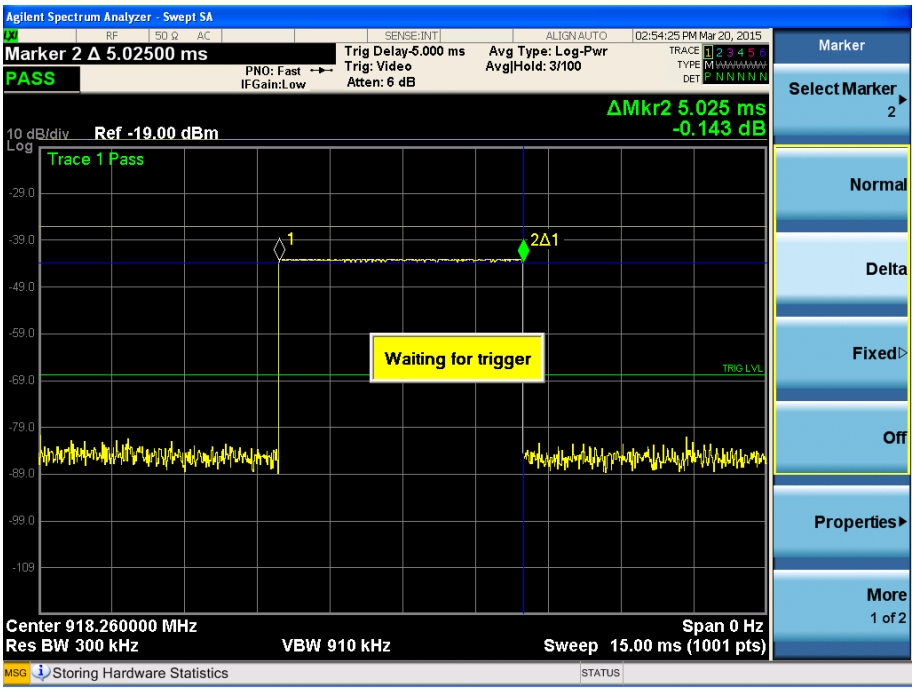
| Specify: | |
|---|---|
| Base standard: | CFR47 Part 15 Section 15.35 (c) |

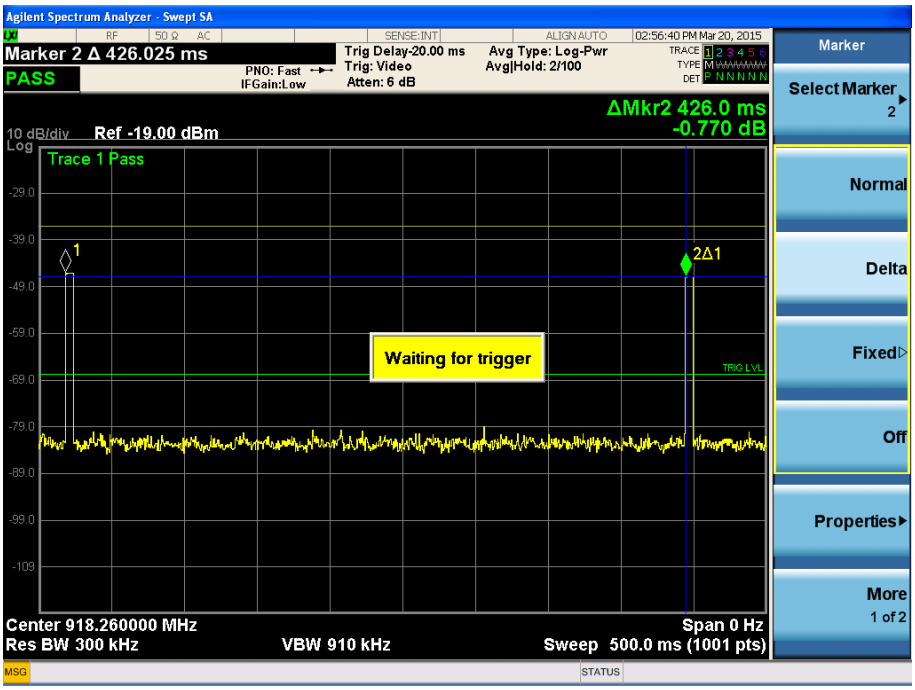
Unless otherwise specified, e.g. Section 15.225 (b), when the radiated emission limits are expressed in term of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0,1 seconds. As an alternative (provided the transmitter operates for longer than 0,1 seconds) or in cases where the pulse exceeds 0,1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0,1 second interval strength shall be submitted with any application fro certification or shall be retained in the measurement data file for equipment subjected to notification or verification.

| Test requirements: | |
|---|---|
| Test Setup: | CFR47 Part 15 Section 15.35 (c) |
| RBW: | 1MHz |
| VBW: | 3MHz |

| Test Data: | |
|---|---|
| *Frequency:* | *918.3MHz* |
| Frame period: | 100ms |
| Pause: | - |
| Pulse train length: | - |
| ON Time: | 5.025ms |
| OFF Time: | 426ms |

| Comments: |
|---|
| Every 100ms is present a single impulse with duration of 5.025ms.<br>The duty-cycle is: 5.025/100 = 0.0525, therefore the correction is 20 x log (0.0525) = -25.59dB |


Agilent Spectrum Analyzer - Swept SA
Marker 2 Δ 5.02500 ms
PASS
PNO: Fast
IFGain:Low
Trig Delay-5.000 ms
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold: 3/100
02:54:25 PM Mar 20, 2015
ΔMkr2 5.025 ms
-0.143 dB
10 dB/div
Log
Ref -19.00 dBm
Trace 1 Pass
Waiting for trigger
TRIG LVL
Center 918.260000 MHz
Res BW 300 kHz
VBW 910 kHz
Span 0 Hz
Sweep 15.00 ms (1001 pts)
Storing Hardware Statistics
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 2 Δ 426.025 ms
PASS
PNO: Fast
IFGain:Low
Trig Delay-20.00 ms
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold: 2/100
02:56:40 PM Mar 20, 2015
ΔMkr2 426.0 ms
-0.770 dB
10 dB/div
Log
Ref -19.00 dBm
Trace 1 Pass
Waiting for trigger
TRIG LVL
Center 918.260000 MHz
Res BW 300 kHz
VBW 910 kHz
Span 0 Hz
Sweep 500.0 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

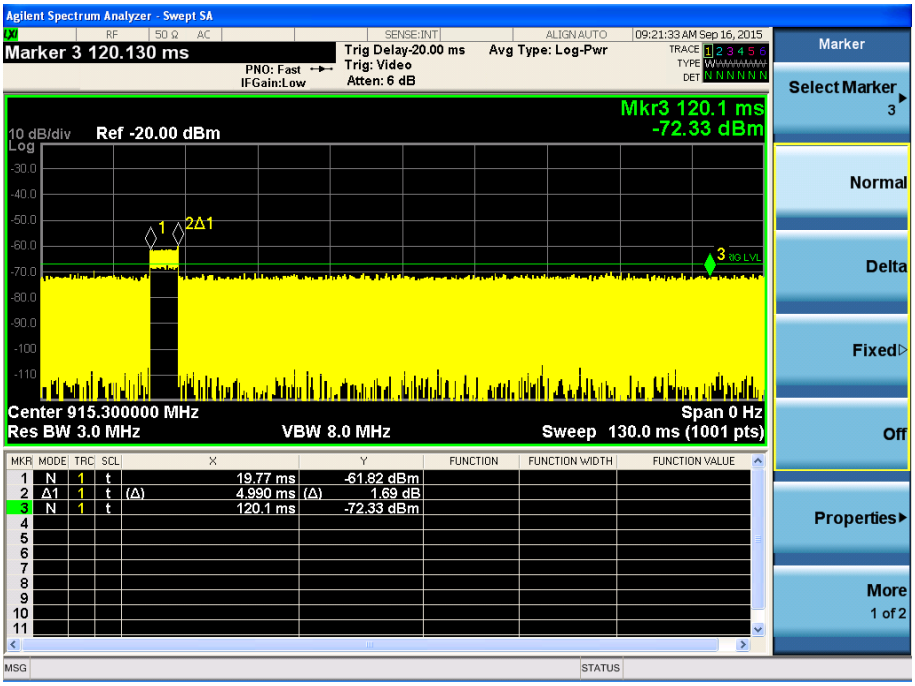
| Specify: | |
|---|---|
| Base standard: | CFR47 Part 15 Section 15.35 (c) |

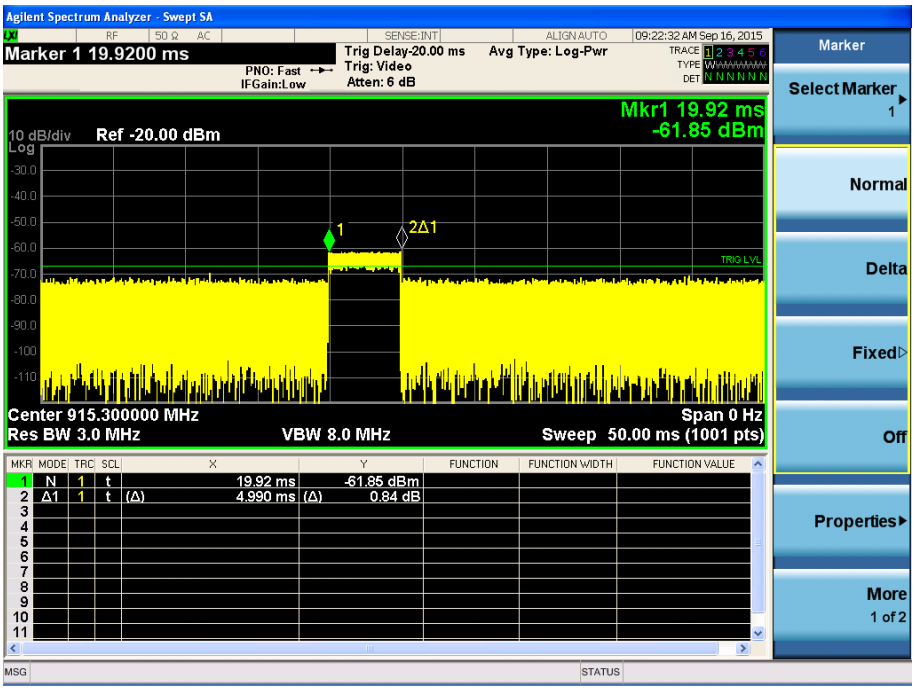
Unless otherwise specified, e.g. Section 15.225 (b), when the radiated emission limits are expressed in term of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0,1 seconds. As an alternative (provided the transmitter operates for longer than 0,1 seconds) or in cases where the pulse exceeds 0,1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0,1 second interval strength shall be submitted with any application fro certification or shall be retained in the measurement data file for equipment subjected to notification or verification.

| Test requirements: | |
|---|---|
| Test Setup: | CFR47 Part 15 Section 15.35 (c) |
| RBW: | 1MHz |
| VBW: | 3MHz |

| Test Data: | |
|---|---|
| *Frequency:* | *915.3MHz* |
| *Frame period:* | *100ms* |
| *Pause:* | *-* |
| *Pulse train length:* | *-* |
| *ON Time:* | *4.990* |
| *OFF Time:* | *> 100ms* |

| Comments: |
|---|
| *Every 100ms is present a single impulse with duration of 4.990ms.*<br>*The duty-cycle is: 4.990/100 = 0.04990, therefore the correction is 20 x log (0.05025) = -26.03dB* |




Agilent Spectrum Analyzer - Swept SA
Marker 1 19.9200 ms
PNO: Fast
IFGain:Low
Trig Delay-20.00 ms
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
09:22:32 AM Sep 16, 2015
Mkr1 19.92 ms
-61.85 dBm
10 dB/div
Log
Ref -20.00 dBm
Center 915.300000 MHz
Res BW 3.0 MHz
VBW 8.0 MHz
Span 0 Hz
Sweep 50.00 ms (1001 pts)
1 N 1 t 19.92 ms -61.85 dBm
2 Δ1 1 t (Δ) 4.990 ms (Δ) 0.84 dB
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

## 5.5 Transmit behaviour after releasing the TX-button

| ~~Specify:~~ | |
|---|---|
| ~~Base standard:~~ | ~~47CFR Part 15 Section 15.*231*(a)~~ |

| ~~Test requirements:~~ | |
|---|---|
| ~~Test Setup:~~ | ~~47CFR Part 15 Section 15.35 (c)~~ |
| ~~RBW:~~ | ~~1MHz~~ |
| ~~VBW:~~ | ~~3MHz~~ |

| ~~Test data:~~ | |
|---|---|
| ~~T1:~~ | ~~-~~ |
| ~~T2:~~ | ~~-~~ |
| ~~T2-T1:~~ | ~~-~~ |

| ~~Comments:~~ |
|---|
| ~~-~~ |

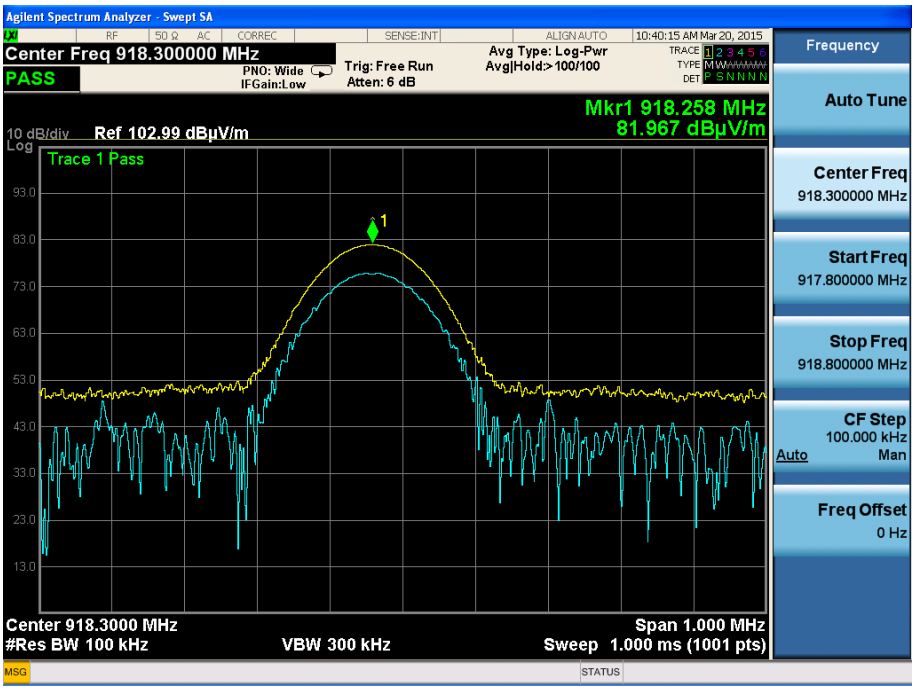
## 5.6 Radiated output power

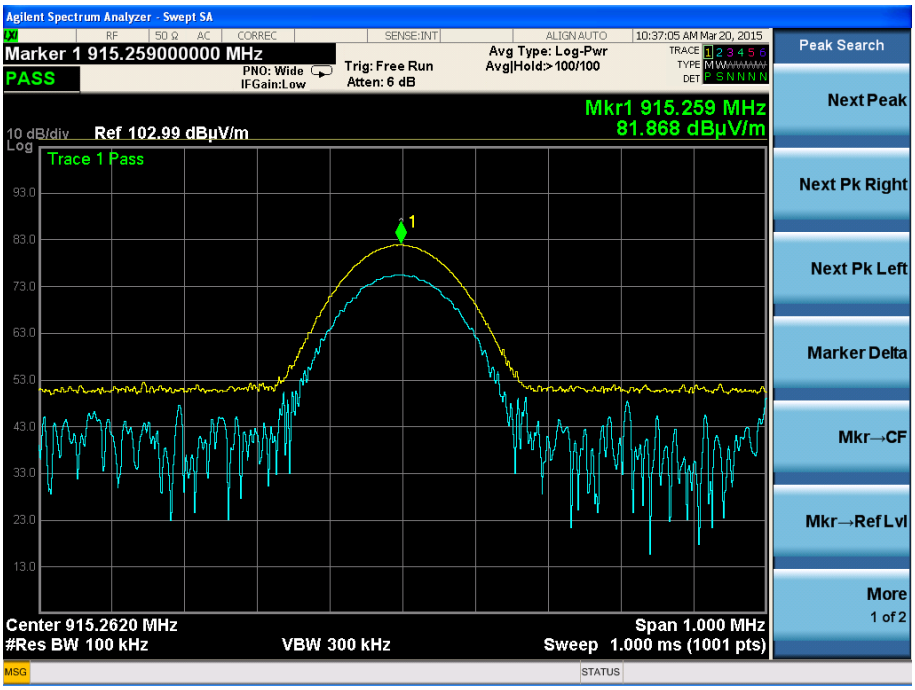
| Specify: | |
|---|---|
| Base standard: | FCC 15.249 (a) |

| Test Requirements: | |
|---|---|
| RBW / VBW: | 200Hz (f < 150kHz)<br>9kHz (150kHz < f < 30MHz)<br>120kHz (30MHz < f < 1000MHz)<br>1MHz (f > 1000MHz) |

| Test data: | |
|---|---|
| Output radiated power (3m of distance): | *(81.96 – 25.59) dBµV/m = 56.37dBµV/m < 94dBµV/m (918.3MHz)*<br>*(81.86 – 26.03) dBµV/m = 55.83dBµV/m < 94dBµV/m (915.3MHz)* |

| Comments: |
|---|
| The results represent the worst case of emissions between three polarizations verified (X, Y and Z). The table was rotate of 360° and antenna receiving moved from 1m to 4m to find the maximum emission. |




Agilent Spectrum Analyzer - Swept SA
Marker 1 915.259000000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
10:37:05 AM Mar 20, 2015
Mkr1 915.259 MHz
81.868 dBµV/m
10 dB/div
Log
Ref 102.99 dBµV/m
Trace 1 Pass
93.0
83.0
73.0
63.0
53.0
43.0
33.0
23.0
13.0
Center 915.2620 MHz
#Res BW 100 kHz
VBW 300 kHz
Span 1.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

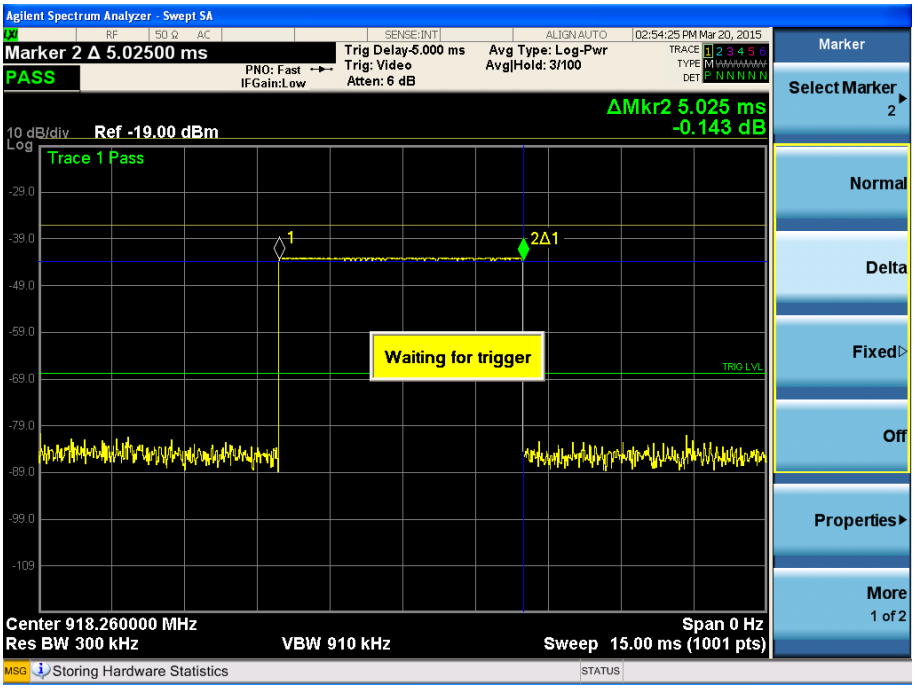
## 5.7 Typical pulse train of a signal

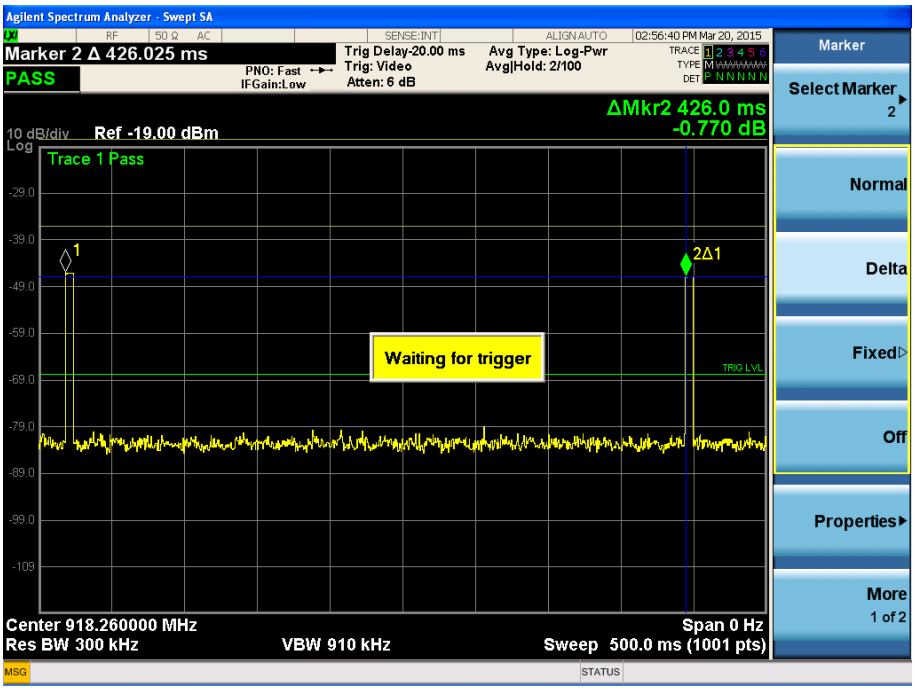
| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.35 (c) |

| Test Setup: | |
|---|---|
| RBW: | 1MHz |
| VBW: | 3MHz |

| Test Data: | |
|---|---|
| *Frequency* | *918.3MHz* |
| Duty-cycle | 0.0525 |
| TX on | 5.025ms |
| TX off | 100ms |
| Average correction factor (20*log(duty cycle): | 20 log (5.025 / 100ms) = -25.97dB |

| Comments: |
|---|
| Every 100ms is present a single impulse with duration of 5.025ms.<br>The duty-cycle is: 5.025/100 = 0.05025, therefore the correction is 20 x log (0.05025) = -25.97dB |



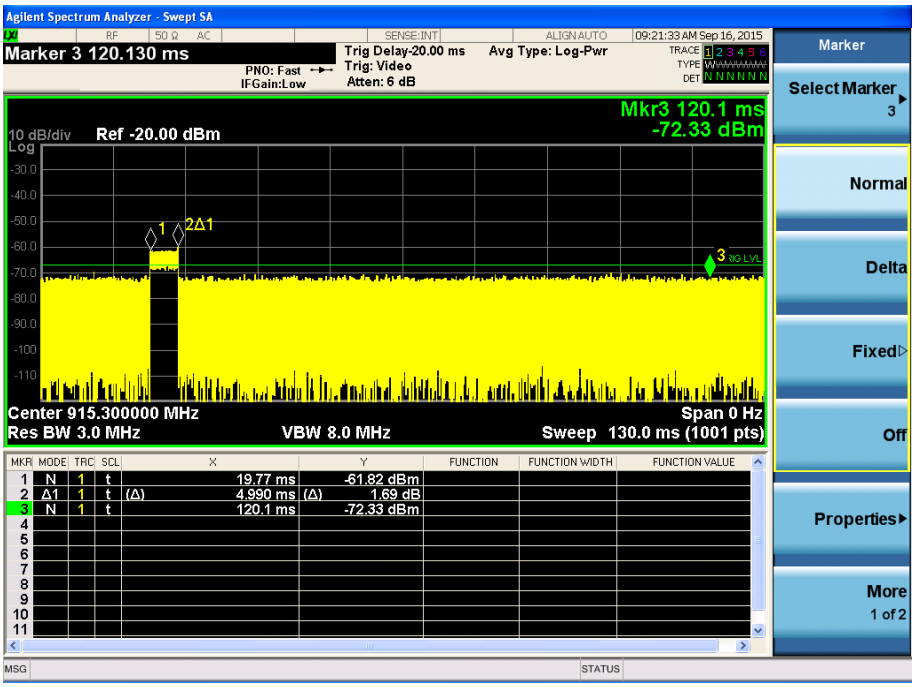

Agilent Spectrum Analyzer - Swept SA
Marker 2 Δ 426.025 ms
PASS
PNO: Fast
IFGain:Low
Trig Delay-20.00 ms
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold: 2/100
02:56:40 PM Mar 20, 2015
ΔMkr2 426.0 ms
-0.770 dB
10 dB/div
Log
Ref -19.00 dBm
Trace 1 Pass
Waiting for trigger
TRIG LVL
Center 918.260000 MHz
Res BW 300 kHz
VBW 910 kHz
Span 0 Hz
Sweep 500.0 ms (1001 pts)
Marker
Select Marker 2
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

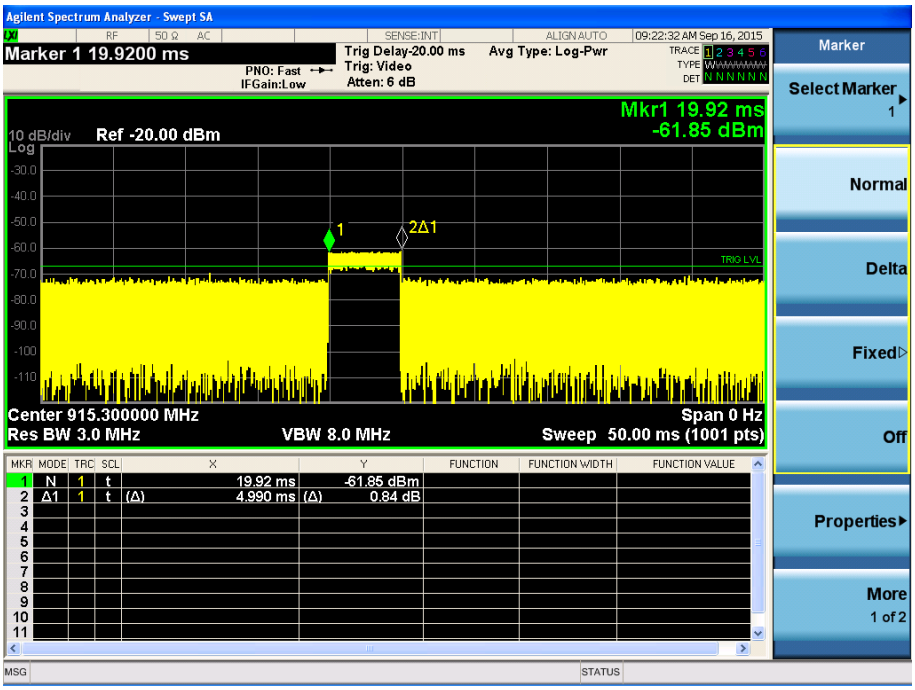
| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.35 (c) |

| Test Setup: | |
|---|---|
| RBW: | 1MHz |
| VBW: | 3MHz |

| Test Data: | |
|---|---|
| *Frequency* | *915.3MHz* |
| *Duty-cycle* | *0.04990* |
| *TX on* | *4.990ms* |
| *TX off* | *> 100ms* |
| *Average correction factor (20*log(duty cycle):* | *20 log (4.990 / 100ms) = -26.03dB* |

| Comments: |
|---|
| *Every 100ms is present a single impulse with duration of 4.990ms.*<br>*The duty-cycle is: 4.990/100 = 0.04990, therefore the correction is 20 x log (0.05025) = -26.03dB* |




Agilent Spectrum Analyzer - Swept SA
Marker 1 19.9200 ms
PNO: Fast
IFGain:Low
Trig Delay-20.00 ms
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
09:22:32 AM Sep 16, 2015
Mkr1 19.92 ms
-61.85 dBm
10 dB/div
Log
Ref -20.00 dBm
Center 915.300000 MHz
Res BW 3.0 MHz
VBW 8.0 MHz
Span 0 Hz
Sweep 50.00 ms (1001 pts)
1 N 1 t 19.92 ms -61.85 dBm
2 Δ1 1 t (Δ) 4.990 ms (Δ) 0.84 dB
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

## 5.8 Compliance with the limit of FCC

| Specify: | |
|---|---|
| Base standard: | 47CFRF Part 15 Section 15.249 (c) |

| Test Setup: | |
|---|---|
| RBW / VBW: | 200Hz (f < 150kHz)<br>9kHz (150kHz < f < 30MHz)<br>120kHz (30MHz < f < 1000MHz)<br>1MHz (f > 1000MHz) |

| Limits: | | |
|---|---|---|
| **Frequency [MHz]** | **Field Strength of the fundamental** | **Field Strength of spurious emissions** |
| 902 - 928 | 50mV/m / 94dBμV/m | 500μV/m / 54dBμV/m |
| | | |
| Note: - | | |

| Test Result: | |
|---|---|
| Frequency: | |
| Calculated average (3m of distance): | *(81.96 – 25.59) dBμV/m = 56.37dBμV/m < 94dBμV/m (918.3MHz)*<br>*(81.86 – 26.03) dBμV/m = 55.83dBμV/m < 94dBμV/m (915.3MHz)* |

| Comments: |
|---|
| The results represent the worst case of emissions between three polarizations verified (X, Y and Z). The table was rotate of 360° and antenna receiving moved from 1m to 4m to find the maximum emission. |

## 5.9 Spurious emission - radiated

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.249 (c) |

| Test Setup: | |
|---|---|
| - | - |

| Limits: | | |
|---|---|---|
| **Frequency [MHz]** | **Field Strength of the fundamental** | **Field Strength of spurious emissions** |
| above 470 | 50mV/m / 94dBµV/m | 500µV/m / 54dBµV/m |
| | | |
| Note: - | | |

**Test Result:**

| Frequency [MHz] | Peak Amplitude of emission (dBµV/m) | Average Amplitude of emission (dBµV/m) | Limit maximum allowed emission power | Actual attenuation below frequency of operation (dB) | Results |
|---|---|---|---|---|---|
| 918.258 | 81.96 | *56.37* | 94dBµV/m | *37.63* | operating frequency |
| 1836.516 | 43.47 | 23.27 | 54 | 30.73 | Complies |
| 2754.787 | 34.27 | 14.27 | 54 | 39.73 | Complies |
| 3673.041 | 32.71 | 12.71 | 54 | 41.49 | Complies |
| 4591.299 | 32.43 | 12.43 | 54 | 41.57 | Complies |
| 5509.551 | 44.12 | 24.12 | 54 | 29.88 | Complies |
| 6427.816 | 28.12 | > 10 | 54 | > 44 | Complies |
| 7346.101 | 38.74 | 18.74 | 54 | 35.26 | Complies |
| 8264.331 | 38.54 | 18.54 | 54 | 35.46 | Complies |
| 9182.596 | 48.33 | 28.33 | 54 | 25.67 | Complies |

| Comments: |
|---|
| The results represent the worst case of emissions between three polarizations verified (X, Y and Z). The table was rotate of 360° and antenna receiving moved from 1m to 4m to find the maximum emission. |

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15 Section 15.249 (c) |

| Test Setup: | |
|---|---|
| - | - |

**Limits:**

| Frequency [MHz] | Field Strength of the fundamental | Field Strength of spurious emissions |
|---|---|---|
| above 470 | 50mV/m / 94dBμV/m | 500μV/m / 54dBμV/m |
| | | |
| Note: - | | |

**Test Result:**

| Frequency [MHz] | Peak Amplitude of emission (dBμV/m) | Average Amplitude of emission (dBμV/m) | Limit maximum allowed emission power | Actual attenuation below frequency of operation (dB) | Results |
|---|---|---|---|---|---|
| *915.259* | *81.86* | *55.63* | *94dBμV/m* | *38.37* | *operating frequency* |
| *1830.525* | *51.05* | *31.05* | *54* | *22.95* | *Complies* |
| *2745.540* | *35.99* | *15.99* | *54* | *38.01* | *Complies* |
| *3662.815* | *33.94* | *13.94* | *54* | *40.06* | *Complies* |
| *4576.210* | *30.68* | *10.68* | *54* | *43.32* | *Complies* |
| *5491.540* | *43.22* | *23.22* | *54* | *30.78* | *Complies* |
| *6406.645* | *37.95* | *17.95* | *54* | *36.05* | *Complies* |
| *7321.735* | *37.39* | *17.39* | *54* | *36.61* | *Complies* |
| *8237.215* | *36.58* | *16.58* | *54* | *37.42* | *Complies* |
| *9152.555* | *38.76* | *18.76* | *54* | *35.24* | *Complies* |

**Comments:**

*The results represent the worst case of emissions between three polarizations verified (X, Y and Z). The table was rotate of 360° and antenna receiving moved from 1m to 4m to find the maximum emission.*

## 5.10 Occuped bandwith

| Specify: | |
|---|---|
| Base standard: | 47CFR Part 15.15 (c) |

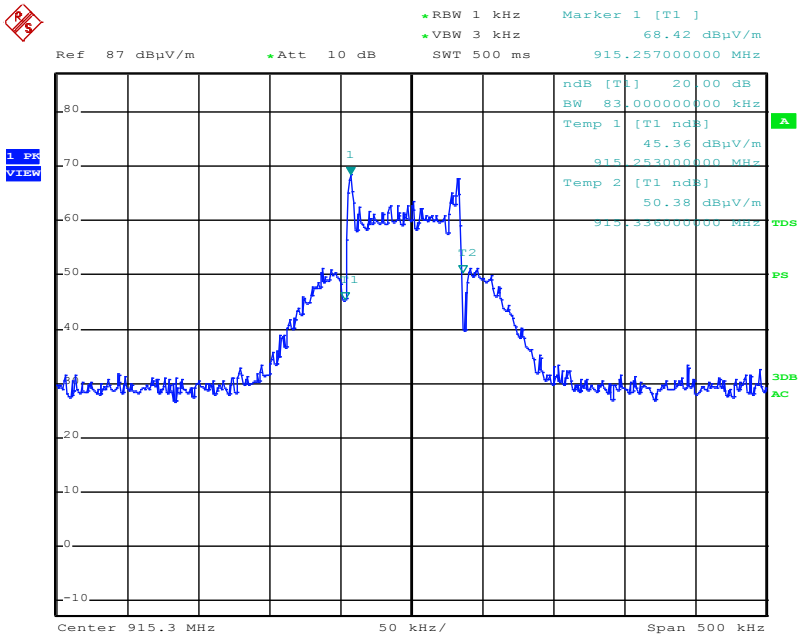
The bandwidth of the emission shall be no wider than 0,25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0,5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

| Test Setup: | |
|---|---|
| RBW: | *1*kHz |
| VBW: | 3kHz |

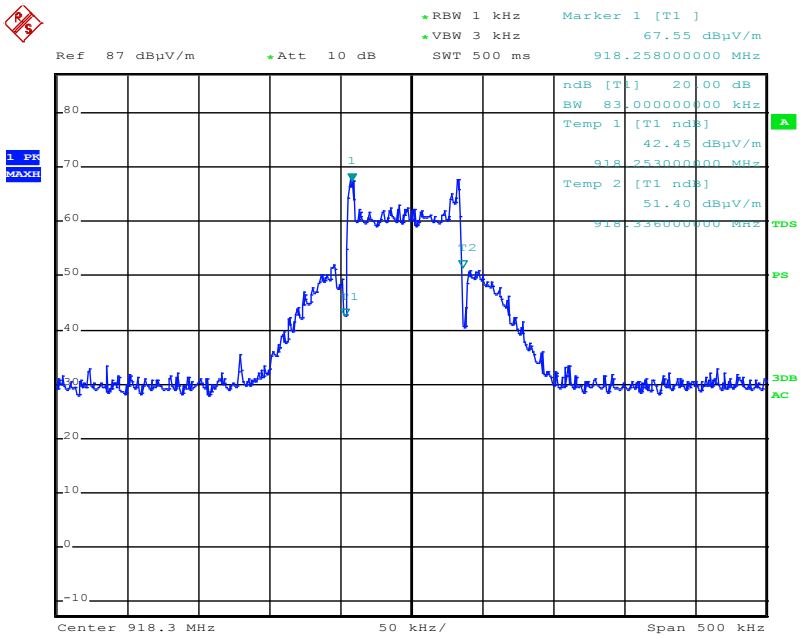
| Limits: |
|---|
| < 0,5% of the centre frequency, here 4.57MHz |

| Test Data: | |
|---|---|
| Occupied bandwidth at –20dB: | *83*kHz < 4.57MHz *(918.3MHz)*<br>*83kHz < 4.57MHz (915.3MHz)* |

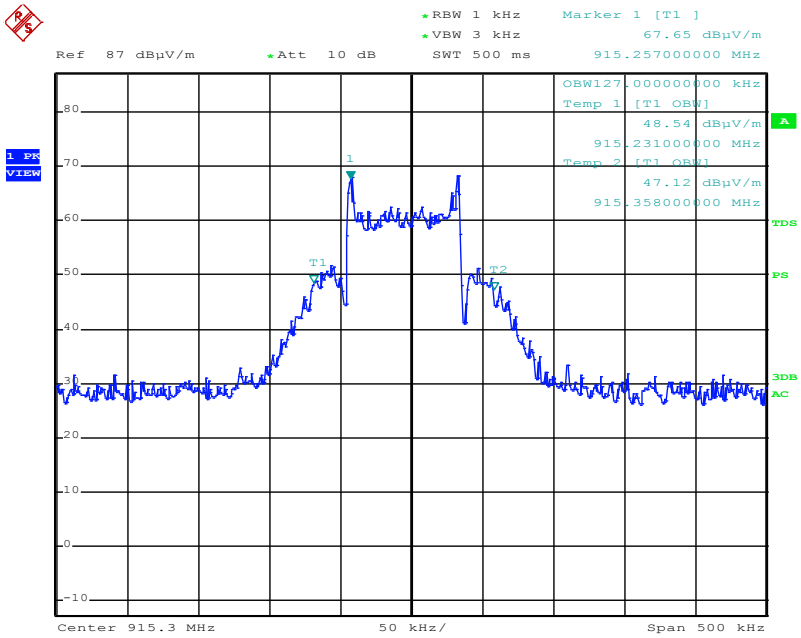
| Comments: |
|---|
| - |



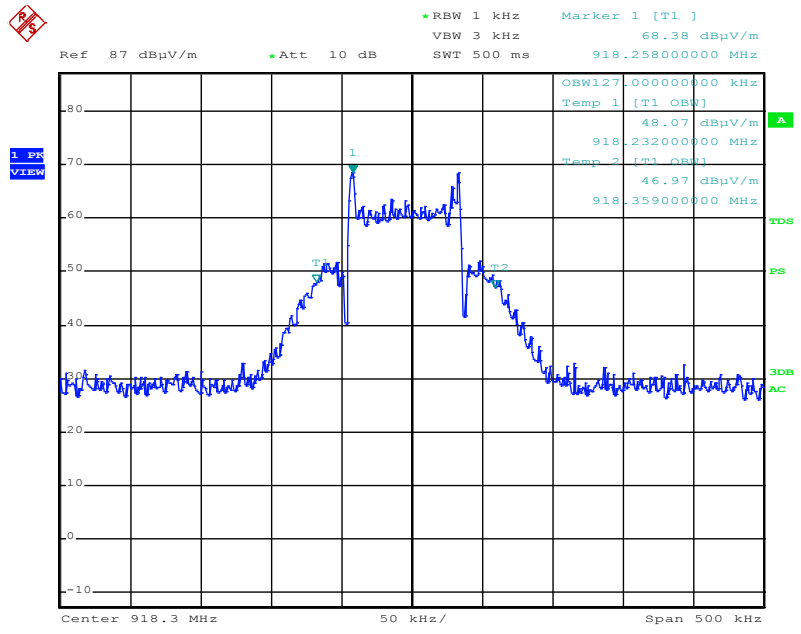

Date: 2.NOV.2015 15:46:37




Date: 2.NOV.2015 15:42:12




Date: 2.NOV.2015 15:47:36




Date: 18.NOV.2015 08:57:47

# 6
# Measurement and Test Equipment instrumentation

| Code | nr. | Manufacturer | Model | Serial number | Date of Calibration | Calibration Due |
|---|---|---|---|---|---|---|
| ANA | 7 | Agilent | N9020A | MY48011101 | 19/03/2014 | 18/03/2016 |
| ANT | 1 | EMCO | 3121C DB-4 | 9312-901 | | |
| ANT | 3 | Schwarzbeck | VULB9160 | 3180 | 24/07/2015 | 23/07/2017 |
| ANT | 4 | AH System | SAS-571 | 684 | 23/07/2015 | 22/07/2017 |
| ANT | 5 | AH System | SAS-562B | 236 | 24/07/2015 | 23/07/2019 |
| ANT | 6 | AH System | SAS-571 | 1025 | 23/07/2015 | 22/07/2017 |
| ANT | 7 | Aaronia | BicoLOG 30100 | 1293 | 23/07/2015 | 22/07/2017 |
| ATT | 1 | - | PE7021-6 | | | |
| ATT | 2 | Tyco Electronics Co. | 50WCW | - | | |
| ATT | 5 | RADIALL | R414.710.000 | - | | |
| ATT | 6 | RADIALL | R414.710.000 | - | | |
| ATT | 7 | RADIALL | R414.720.000 | - | | |

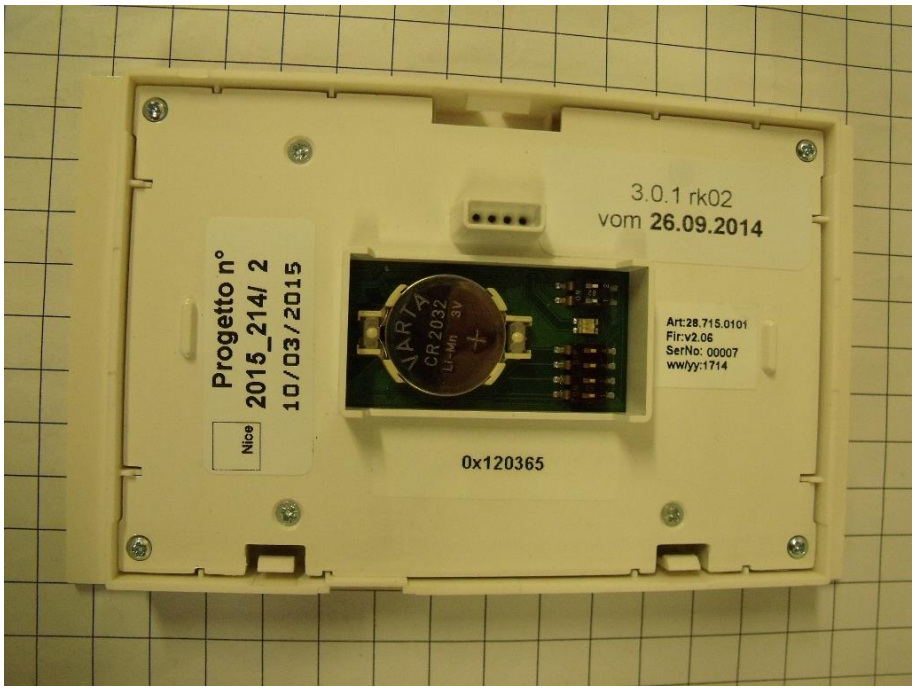
| | | | | | | |
|---|---|---|---|---|---|---|
| CAV | 1 | Rohde & Schwarz | HFU2-Z5 | - | 18/09/2013 | 18/09/2015 |
| CAV | 2 | Rohde & Schwarz | HFU2-Z4 | - | 18/09/2013 | 18/09/2015 |
| CAV | 3 | TESEO | CAVO A | - | 18/09/2013 | 18/09/2015 |
| CAV | 5 | TESEO | CAVO C | - | 18/09/2013 | 18/09/2015 |
| CAV | 6 | TESEO | CAVO D | - | 18/09/2013 | 18/09/2015 |
| CAV | 7 | TESEO | CAVO E | - | 18/09/2013 | 18/09/2015 |
| CAV | 13 | TESEO | CAVO G | - | 18/09/2013 | 18/09/2015 |
| CAV | 14 | TESEO | CAVO H | - | 18/09/2013 | 18/09/2015 |
| CAV | 15 | TESEO | CAVO I | - | 18/09/2013 | 18/09/2015 |
| CAV | 16 | Rohde & Schwarz | 9111505/200 (CAVO J) | 5995-12-161-6890 | 18/09/2013 | 18/09/2015 |
| CAV | 17 | Nice | CAVO K | - | 18/09/2013 | 18/09/2015 |
| CAV | 18 | Nice | CAVO L | - | 18/09/2013 | 18/09/2015 |
| CAV | 19 | Nice | Cavo M | - | 18/09/2013 | 18/09/2015 |

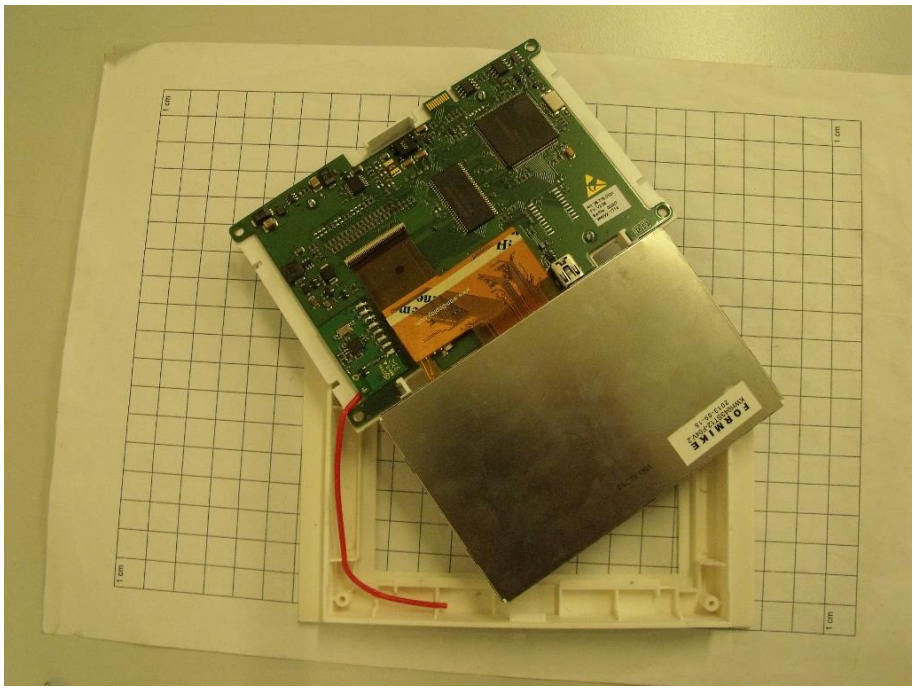
| | | | | | | |
|---|---|---|---|---|---|---|
| CAV | 20 | Nice | Cavo N | - | 18/09/2013 | 18/09/2015 |
| CAV | 21 | Nice | Cavo P | - | 18/09/2013 | 18/09/2015 |
| CAV | 22 | Nice | Cavo R | - | 18/09/2013 | 18/09/2015 |
| CSA | 1 | TESEO | EN 55022<br>EN 610004-3 | NSA | 11/08/2015 | 10/08/2016 |
| CSA | 1 | TESEO | EN 55022<br>EN 610004-3 | CISPR 16-1-4 | 14/04/2009 | 14/04/2019 |
| CSA | 1 | TESEO | EN 55022<br>EN 610004-3 | EN 61000-4-3 | 14/10/2014 | 14/10/2015 |
| GEN | 7 | Rohde & Schwarz | SML 03 | 102178 | 22/07/2014 | 21/07/2016 |
| GEN | 8 | Agilent | N5182A | MY48180288 | 23/09/2013 | 22/09/2016 |
| LIS | 2 | Rohde & Schwarz | ESH2-Z5 | 100183 | 23/07/2015 | 22/07/2017 |
| PAS | 1 | FCC | F-202 | 197 | 11/06/2012 | 11/06/2016 |
| POW | 1 | Rohde & Schwarz | NRVD | 101221 | 12/02/2014 | 12/02/2016 |
| POW | 2 | Rohde & Schwarz | NRV-Z5 | 100314 | 14/02/2014 | 14/02/2016 |
| POW | 3 | Rohde & Schwarz | NRV-Z5 | 100315 | 14/02/2014 | 14/02/2016 |
| PRE | 2 | Schwarzbeck | BBV 9718 | 9718-178 | 30/07/2014 | 29/07/2016 |

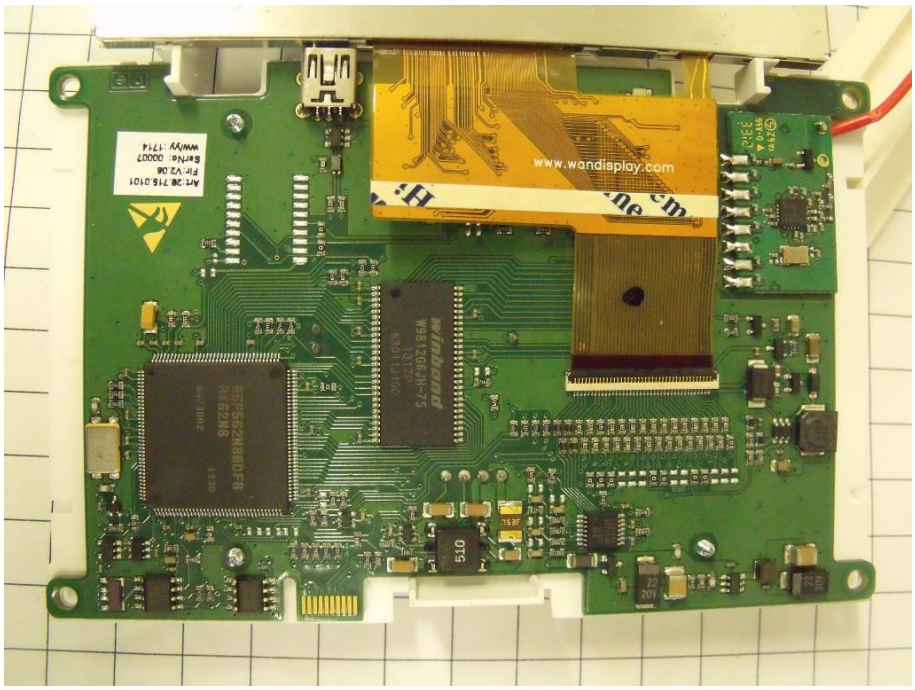
| | | | | | | |
|---|---|---|---|---|---|---|
| *RIC* | *1* | *Rohde & Schwarz* | *ESCI* | *100140* | *18/03/2015* | *17/03/2016* |
| *SOF* | *1* | *Rohde & Schwarz* | *EMC32* | *V8.54.0* | | |

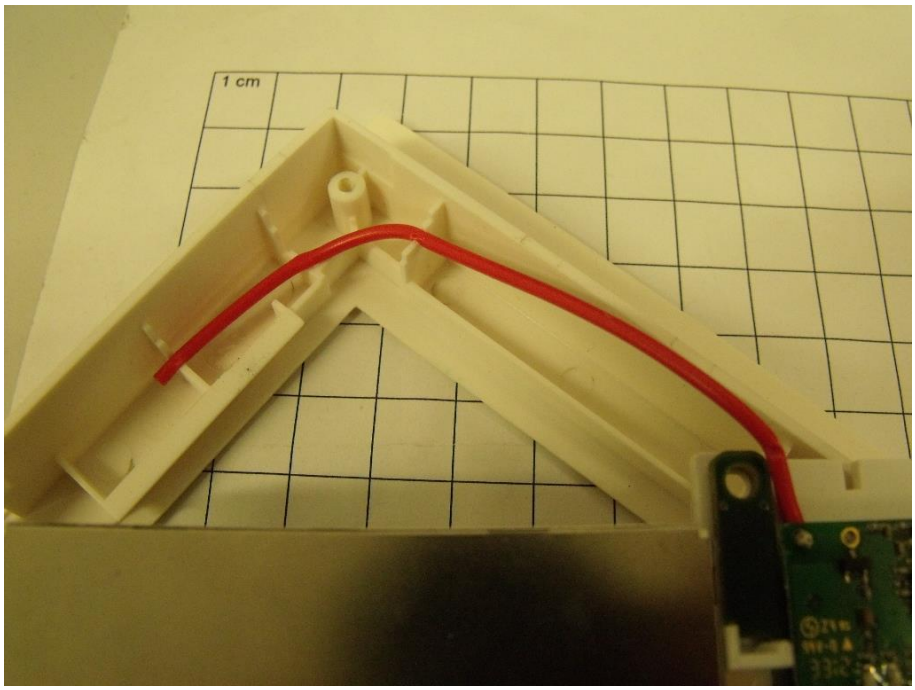
# 7
# Photographic Documentation

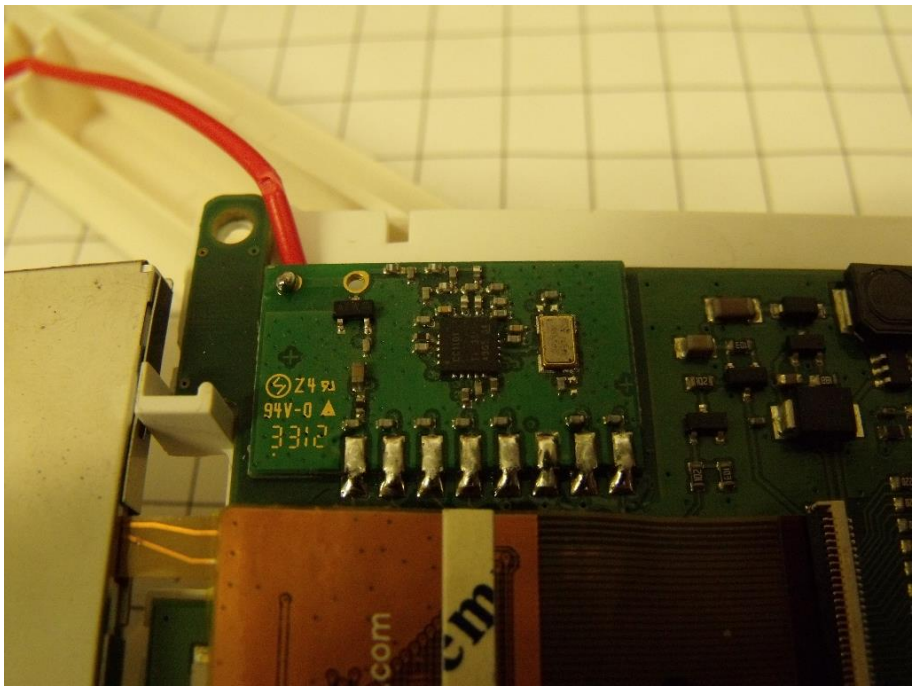
## 8.1 EUT Identification

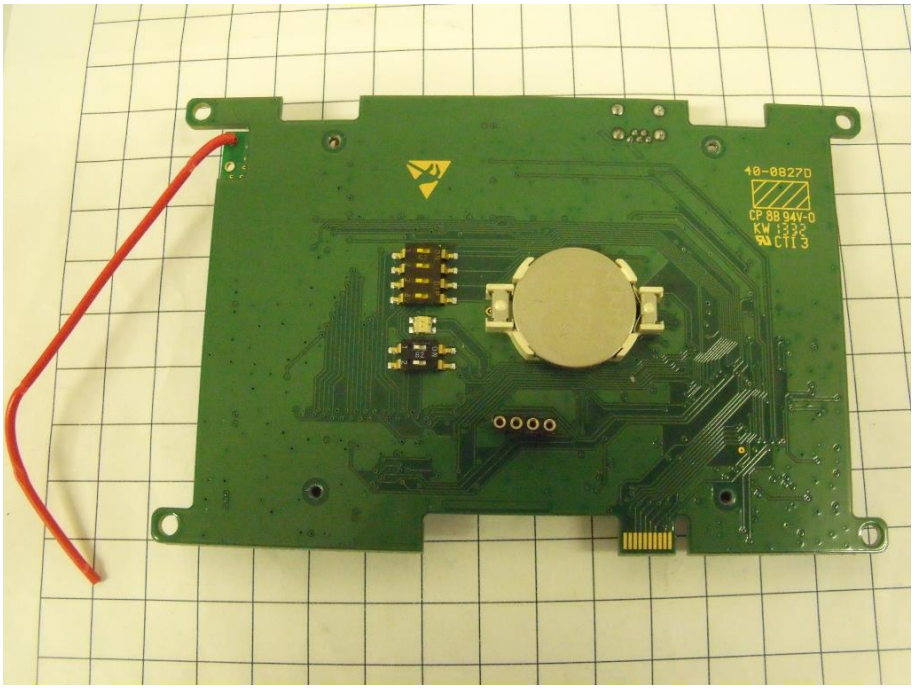






www.wandisplay.com


1 cm



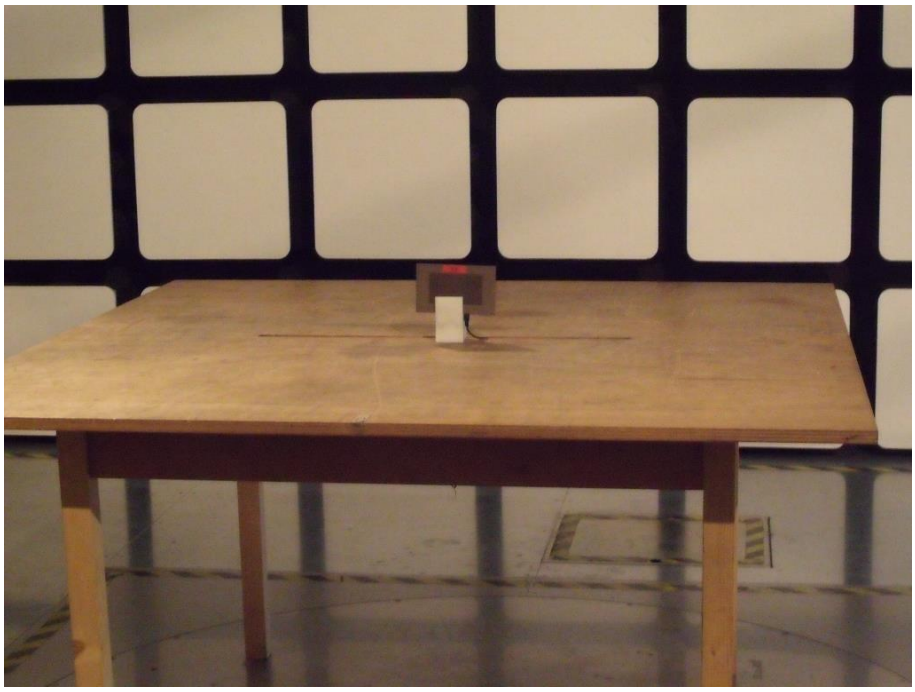

10-0827D
CP 88 94V-0
KW 1332
CTI 3

## 8.2 Test Set-up

Conduced emissions:


915 MHZ
eler

Radiated emissions:




CW Test
Device
KANALÜBERSICHT

# Annex 1

Technical files

**RF module system "Proline2" for Combio- XXX MHz, RolTop-XXX MHz**

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For: transceiver modules TMWA for Combio, RolTop

Brand: Elero GmbH Antriebstechnik
Linsenhoferstrasse 65
D- 72660 Beuren (Germany)

**1. Description of the product**

The RF modul for using as transceiver in different products ( Combio- XXX MHz, RolTop-XXX MHz) based on the transceiver chip CC1101 (TI) with antenna matching networks .
The CC1101 module is controlled by a application MCU via SPI using a protocol stack for RX and TX mode for the RF communication, only in the bidirectional application mode the CC1101 will be used as transmitter and receiver simultanously. All TX- and RX transmissions for bidirectional communication are packet oriented for short transmission times and use suitable LBT and CCA processes.

**1.1 technical specifications**

***1.1.1 Duty cycle estimation***

a) Transmitting specification Proline2 remote controls

| | | |
|---|---|---|
| Size of data protocol | 41 Byte | min.( 1 Destination or Group) |
| (including PHY) | 68 Byte | max. (10 Destinations) |
| transfer rate packet mode | 76.800 Bps | |
| transfer PHY | 869,525 MHz/ deviation 32 kHz /RBW 210 kHz or<br>918,300 MHz/ deviation 32 kHz/ RBW 210 kHz | |
| Traffictime (time to air) | min. 4,3 ms / data protocol<br>max. 7,1 ms / data protocol | |
| Normally volume of traffic: | **</= 8 x traffic events/d** by user about transmitter<br>( = 0,33 traffic events per hour) | |

b) Transmission modes

- Broadcast transmission (group > 10 destinations, no routing path)
  - ⇨ transmission of max. 1 * data protocol ( 4,3 ms)
  - ⇨ **< 5 ms** / user initiated event
- Unicast for 1 destination
  - ⇨ transmission of max. 2 * data protocol ( 2 * 4,3ms, cut off > 100 ms between sendings)
  - ⇨ **< 9 ms** / user initiated event
- Unicast for 10 destination
  - ⇨ transmission of max. 2 * data protocol (2 * 7,1 ms, cut off > 100 ms between sendings)
  - ⇨ **< 15 ms** / user initiated event

c) Estimation of duty cycle (worst case)

- Broadcast (group)
  max. traffic time = 5 ms
  - ⇨ max. traffic time * Normally volume of traffic per hour = 5 ms * 0,33 **= 0,0016 s / h**
- Unicast for 1 destination
  max. traffic time = 9 ms
  - ⇨ max. traffic time * Normally volume of traffic per hour = 9 ms * 0,33 **= 0,003 s / h**
- Unicast for 10 destinations
  max. traffic time = 15 ms
  - ⇨ max. traffic time * Normally volume of traffic per hour = 15 ms * 0,33 **= 0,005 s / h**

| Files | Project | Author | Rev. No. | Rev. Date |
|---|---|---|---|---|
| technical files_RF system Proline2 | Proline2 UL | PRR | | 11.02.2013 |

# Annex 2

**FEDERAL COMMUNICATIONS COMMISSION**

**Laboratory Division**
**7435 Oakland Mills Road**
**Columbia, MD 21046**

May 17, 2013

Registration Number: 771316

NICE S.p.A.
Via Pezza Alta, 13,
,
Oderzo, 31046
Italy

Attention: Enrico Campion, Mr.

Re: Measurement facility located at Via Pezza Alta, 13 - I-31046 Oderzo
Anechoic chamber (3 meter)
Date of Renewal: May 17, 2013

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst