



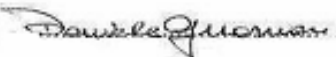
www.nemko.com  
Via del Carroccio, 4 – 20853 Biassono (MB) – Italy

|                             |               |
|-----------------------------|---------------|
| <b>Report Reference ID:</b> | 325393-2TRFWL |
|-----------------------------|---------------|

|                            |                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test specification:</b> | Title 47-Telecommunication<br>Chapter I - Federal Communications Commission<br>Subchapter A - General<br>Part 15 - Radio Frequency Devices<br>Subpart C - Intentional Radiators |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                   |                                                                                  |
|-------------------|----------------------------------------------------------------------------------|
| <b>Applicant:</b> | <b>Inpeco Spa a Socio Unico</b> Via Givoletto 15, 10040 Val della Torre TO Italy |
| <b>Apparatus:</b> | Radio Frequency Identification Device (RFID) for Sample Carriers                 |
| <b>Model:</b>     | MAIN RFID architecture                                                           |

|                            |                                                                                                                                         |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Testing laboratory:</b> | Nemko Spa<br><br>Via del Carroccio, 4 – 20853 Biassono (MB) – Italy<br><br>Telephone: +39 039 2201201<br><br>Facsimile: +39 039 2201221 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|

|                     | Name and title                                                                                                             | Date       |
|---------------------|----------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Tested by:</b>   | D. Guarnone Wireless/EMC Specialist<br> | 2017-02-23 |
| <b>Reviewed by:</b> | G. Curioni, Wireless/EMC Specialist<br> | 2017-02-23 |

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Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

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Section 1: Report summary

Report Number: 325393-2TRFWL

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## Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko S.p.A.

**Test specification:**

FCC Part 15 Subpart C

Operation within the band 125 kHz

|                         |                                                    |
|-------------------------|----------------------------------------------------|
| Compliance status:      | Complies                                           |
| Exclusions:             | None                                               |
| Non-compliances:        | None                                               |
| Report release history: | Original release                                   |
| Test location:          | Via del Carroccio, 4 – 20853 Biassono (MB) – Italy |
| Registration number:    | 481407                                             |

The date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Section 2: Equipment under test

Report Number: 325393-2TRFWL

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## Section 2: Equipment under test

### 2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

|                         |                                                           |
|-------------------------|-----------------------------------------------------------|
| Type of equipment:      | Radio Frequency Identification Device for Sample Carriers |
| Product marketing name: | MAIN RFID architecture                                    |
| Model :                 | MAIN RFID architecture                                    |
| Serial number:          | --                                                        |
| Nemko sample number:    | --                                                        |
| Date of receipt:        | 2017-02-15                                                |

### 2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

### 2.3 EUT description

The EUT is Radio Frequency Identification Device for Sample Carriers, system composed by:

- Sirius MOL, RFID base station HTRC11001T
- Philips RFID Transponder: PCF7935AA, PCF7931AS, PCF7935AS

Sirius MOL is a compact transponder base station, used to read and write RFID codes on moving objects on the fly. It supports 125k RFID tag reading via CAN Open protocol and has a serial port for reading and writing purpose. MOL features 7 digital output and 5 digital inputs and can be powered from 20 to 55 Vdc (24 Vdc nominal)



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Section 2: Equipment under test

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## Section 2: Equipment under test, continued

### 2.4 Technical specifications of the EUT

|                      |                                    |
|----------------------|------------------------------------|
| Operating frequency: | 125 kHz                            |
| Modulation type:     | 10 Vpp                             |
| Occupied bandwidth:  | 534 Hz                             |
| Emission designator: | 534H40A1D                          |
| Antenna data:        | Loop antenna                       |
| Antenna type:        | LF                                 |
| Power source         | 24 Vdc nominal (from 20 to 55 Vdc) |

### 2.5 EUT setup diagram

See page 34

### 2.6 Operation of the EUT during testing

Continuous transmission mode

### 2.7 Modifications incorporated in the EUT

None



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## Section 3: Test conditions

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## Section 3: Test conditions

### 3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

### 3.2 Test conditions, power source and ambient temperatures

|                                                               |                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Normal temperature, humidity and air pressure test conditions | Temperature: 15–30 °C<br>Relative humidity: 20–75 %<br>Air pressure: 860–1060 hPa<br><br>When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated. |
| Power supply range:                                           | The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5$ %, for which the equipment was designed.     |

### 3.3 Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements" and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device



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## Section 3: Test conditions

Report Number: 325393-2TRFWL

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### Section 3: Test conditions, continued

#### 3.4 Test equipment

|                                                                     |             |                           |            |         |
|---------------------------------------------------------------------|-------------|---------------------------|------------|---------|
| Loop antenna                                                        | R&S         | HFH2-Z2                   | 831247/011 | 02/2017 |
| Trilog Broad Band Antenna 25 MHz÷2 GHz                              | Schwarzbeck | VULB 9162                 | 9162-025   | 07/2018 |
| Bilog antenna 1 ÷18 GHz                                             | Schwarzbeck | STLP 9148                 | 9148-123   | 06/2018 |
| Broadband preamplifier 1 ÷18 GHz                                    | Schwarzbeck | BBV 9718                  | 9718-137   | 12/2017 |
| EMI receiver 20 Hz ÷ 8 GHz                                          | R&S         | ESU8                      | 100202     | 09/2017 |
| Spectrum Analyzer 9 KHz ÷ 40 GHz                                    | R&S         | FSEK                      | 848255/005 | 01/2018 |
| Semi-anechoic chamber                                               | Nemko       | 10m semi-anechoic chamber | 530        | 10/2018 |
| Shielded room                                                       | Siemens     | 10m control room          | 1947       | NCR     |
| Loop antenna                                                        | R&S         | HFH2-Z2                   | 831247/011 | 02/2017 |
| Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use |             |                           |            |         |



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## Section 4: Result summary

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## Section 4: Result summary

### 4.1 FCC Part 15 Subpart C: Test results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

|     |                                                                  |
|-----|------------------------------------------------------------------|
| N   | No : not applicable / not relevant.                              |
| Y   | Yes : Mandatory i.e. the apparatus shall conform to these tests. |
| N/T | Not Tested, mandatory but not assessed. (See report summary)     |

| Part                                                   | Test description                               | Required | Result |
|--------------------------------------------------------|------------------------------------------------|----------|--------|
| <b>General requirements for FCC Part 15</b>            |                                                |          |        |
| §15.31(e)                                              | Variation of power source                      | Y        | P      |
| §15.203                                                | Antenna requirement                            | Y        | P      |
| §15.207(a)                                             | Conducted limits                               | Y        | P      |
| §15.215(c)                                             | 20 dB bandwidth                                | Y        | P      |
| <b>Specific requirements for FCC Part 15 Subpart C</b> |                                                |          |        |
| §15.209(c)                                             | Radiated emission limits, general requirements | Y        | P      |

#### Notes:

Possible test case verdicts:

test case does not apply to the test object: N/A (Not applicable)

test object does meet the requirement: P (Pass)

test object does not meet the requirement: F (Fail)



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## Appendix A: Test results

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## Appendix A: Test results

### Clause 15.31(e) Variation of the power source

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Test date: 2017-02-15

Test results: Pass

#### Test data

Transmit output power was measured while supply voltage was varied from 7.5 – 16 Vdc (greater 85 % to 115 % of the nominal rated supply voltage). No change in transmit output power and frequency was observed.

## Clause 15.203 Antenna requirement

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, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §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.

Test date: 2017-02-15

Test results: Pass

### Test data

- EUT is designed so that the end user may replace a broken antenna.
- The EUT is professionally installed.



## Clause 15.207(a) Conducted limits

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz)                     | Conducted limit (dB $\mu$ V) |           |
|-------------------------------------------------|------------------------------|-----------|
|                                                 | Quasi-peak                   | Average   |
| 0.15–0.5                                        | 66 to 56*                    | 56 to 46* |
| 0.5–5                                           | 56                           | 46        |
| 5–30                                            | 60                           | 50        |
| *Decreases with the logarithm of the frequency. |                              |           |

Test date: 2017-02-20

Test results: P

## Special notes

### Preview measurements:

0.15 MHz to 30 MHz

Receiver settings:

- Peak and average detector
- 9 kHz RBW

### Final measurement:

0.15 MHz to 30 MHz

Receiver settings:

- Q-Peak and average detector
- 9 kHz RBW

- Spectral plots have been corrected for transducer factors; cable loss, LISN, and attenuators.
- Emissions detected within 6 dB of limit were re-measured with a quasi peak or average detector for a final measurement.



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## Appendix A: Test results

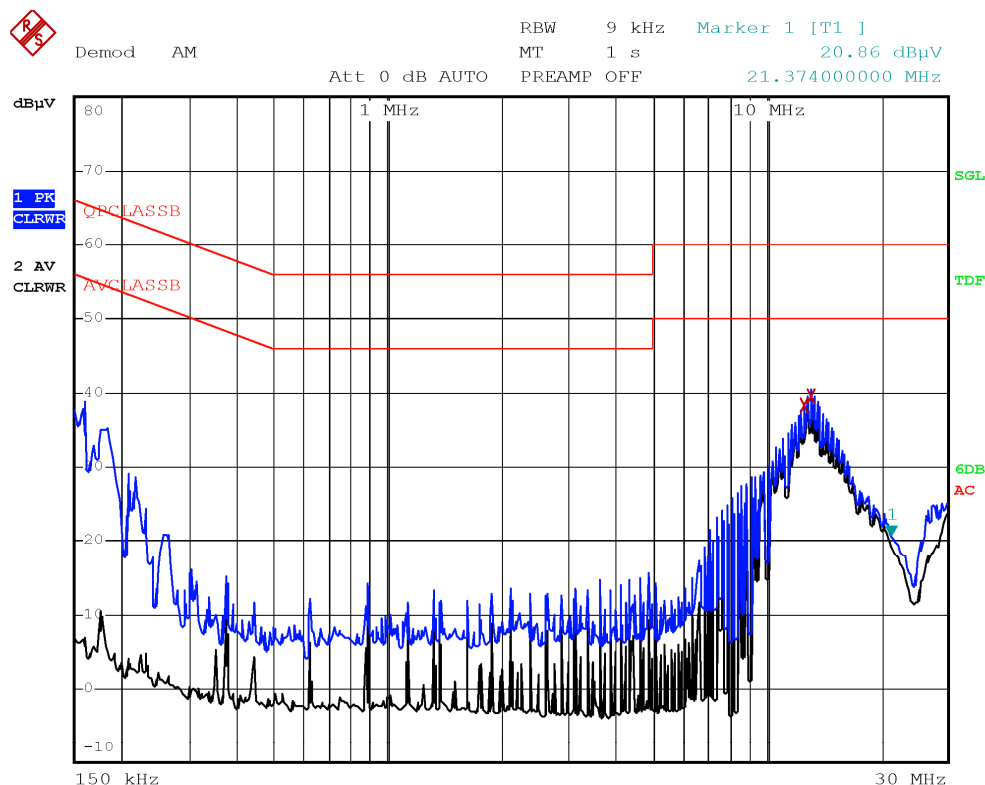
Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

### Clause 15.207(a) Conducted limits, continued

#### Test data

##### Phase line



Date: 20.FEB.2017 15:19:16

| Frequency (MHz) | Level (dBμV) | Limit (dBμV) | Margin (dB) | Detector |
|-----------------|--------------|--------------|-------------|----------|
| 12.6260         | 38.4         | 50.0         | -11.6       | AV       |
| 13.1260         | 39.4         | 50.0         | -10.6       | AV       |



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## Appendix A: Test results

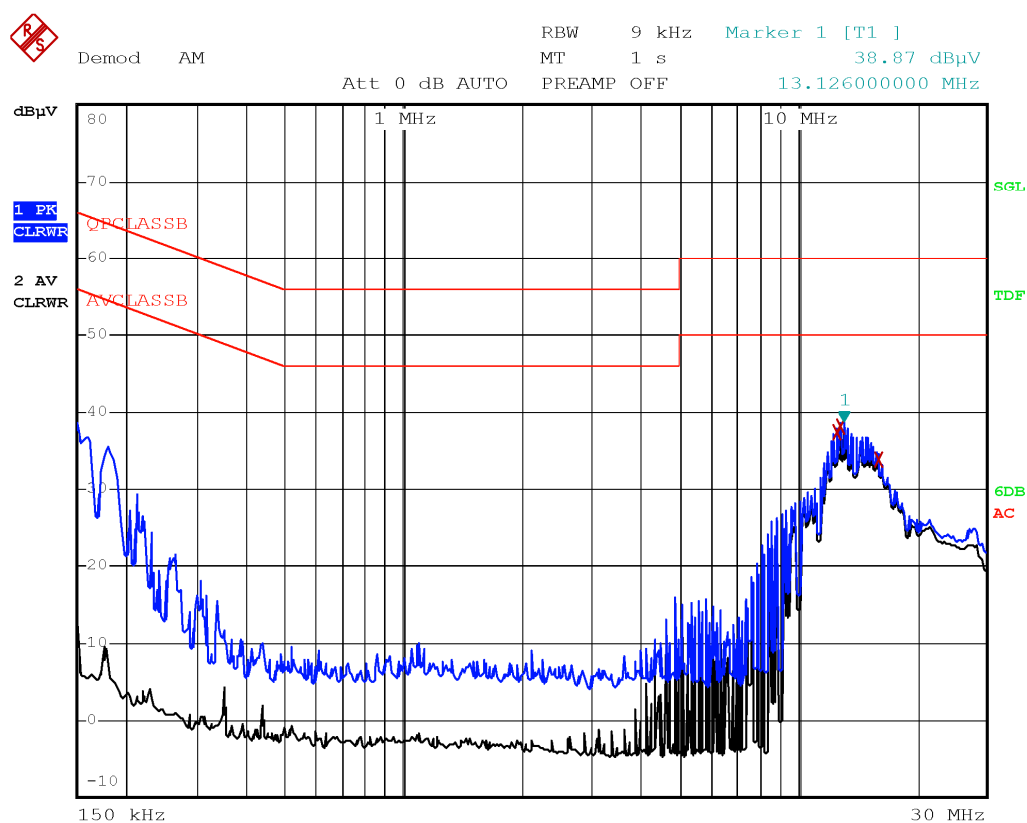
Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

### Clause 15.207(a) Conducted limits, continued

#### Test data

Neutral line



Date: 20.FEB.2017 15:25:00

| Frequency (MHz) | Level (dBμV) | Limit (dBμV) | Margin (dB) | Detector |
|-----------------|--------------|--------------|-------------|----------|
| 12.6260         | 37.5         | 50.0         | -12.5       | AV       |
| 12.8740         | 38.0         | 50.0         | -12.0       | AV       |
| 16.1260         | 33.8         | 50.0         | -16.2       | AV       |



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Appendix A: Test results

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Specification: FCC 15 subpart C

#### Clause 15.207(a) Conducted limits, continued

#### Set up photo





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Appendix A: Test results

Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

### Clause 15.215(c) 20 dB bandwidth

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

Test date: 2017-02-16

Test results: Pass

### Special notes

None



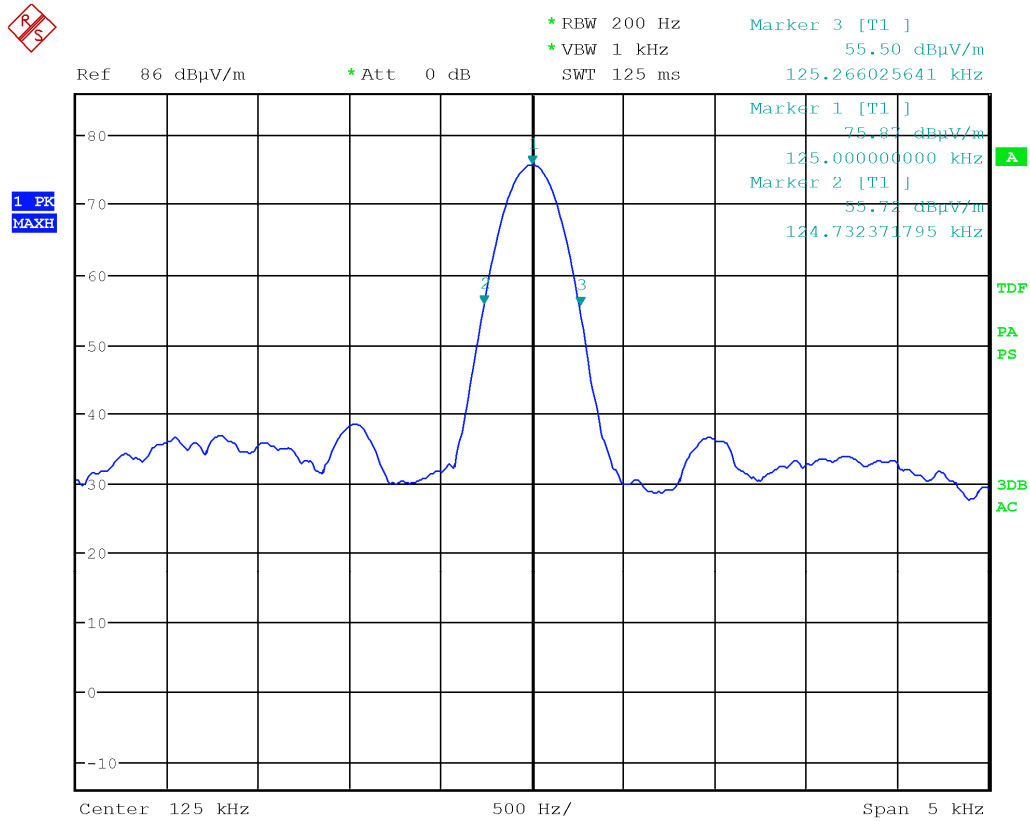
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## Appendix A: Test results

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### Test data



Date: 16.FEB.2017 20:14:12

| 20 dB bandwidth | Limit           | Margin |
|-----------------|-----------------|--------|
| 534 Hz          | No requirements | --     |



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Appendix A: Test results

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Specification: FCC 15 subpart C

## Clause 15.209(c) Field Strength of any emissions

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency<br>(MHz) | Field strength |                | Measurement distance<br>(m) |
|--------------------|----------------|----------------|-----------------------------|
|                    | ( $\mu$ V/m)   | (dB $\mu$ V/m) |                             |
| 0.009–0.490        | 2400/F         | 67.6–20log(F)  | 300                         |
| 0.490–1.705        | 24000/F        | 87.6–20log(F)  | 30                          |
| 1.705–30.0         | 30             | 29.5           | 30                          |
| 30–88              | 100            | 40.0           | 3                           |
| 88–216             | 150            | 43.5           | 3                           |
| 216–960            | 200            | 46.0           | 3                           |
| above 960          | 500            | 54.0           | 3                           |

Notes:

- F = frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Test date: 2017-02-16

Test results: Pass

## Clause 15. 209 Field Strength of any emissions continued

### Special notes

- The spectrum was searched from 9 kHz to the 10<sup>th</sup> harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m (9 kHz to 30 MHz) and 3 m (30 MHz to 6 GHz)
- All measurements were performed:
  - below 30 MHz: using a quasi-peak detector with 9 kHz/30 kHz RBW/VBW,
  - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
    - and using averagedetector with 1 MHz/10 Hz RBW/VBW for average results
  - Only the worst data presented in the test report.

### § 15.205 Restricted bands of operation.

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110       | 16.42–16.423        | 399.9–410     | 4.5–5.15    |
| 0.495–0.505       | 16.69475–16.69525   | 608–614       | 5.35–5.46   |
| 2.1735–2.1905     | 16.80425–16.80475   | 960–1240      | 7.25–7.75   |
| 4.125–4.128       | 25.5–25.67          | 1300–1427     | 8.025–8.5   |
| 4.17725–4.17775   | 37.5–38.25          | 1435–1626.5   | 9.0–9.2     |
| 4.20725–4.20775   | 73–74.6             | 1645.5–1646.5 | 9.3–9.5     |
| 6.215–6.218       | 74.8–75.2           | 1660–1710     | 10.6–12.7   |
| 6.26775–6.26825   | 108–121.94          | 1718.8–1722.2 | 13.25–13.4  |
| 6.31175–6.31225   | 123–138             | 2200–2300     | 14.47–14.5  |
| 8.291–8.294       | 149.9–150.05        | 2310–2390     | 15.35–16.2  |
| 8.362–8.366       | 156.52475–156.52525 | 2483.5–2500   | 17.7–21.4   |
| 8.37625–8.38675   | 156.7–156.9         | 2690–2900     | 22.01–23.12 |
| 8.41425–8.41475   | 162.0125–167.17     | 3260–3267     | 23.6–24.0   |
| 12.29–12.293      | 167.72–173.2        | 3332–3339     | 31.2–31.8   |
| 12.51975–12.52025 | 240–285             | 3345.8–3358   | 36.43–36.5  |
| 12.57675–12.57725 | 322–335.4           | 3600–4400     | Above 38.6  |
| 13.36–13.41       |                     |               |             |



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## Appendix A: Test results

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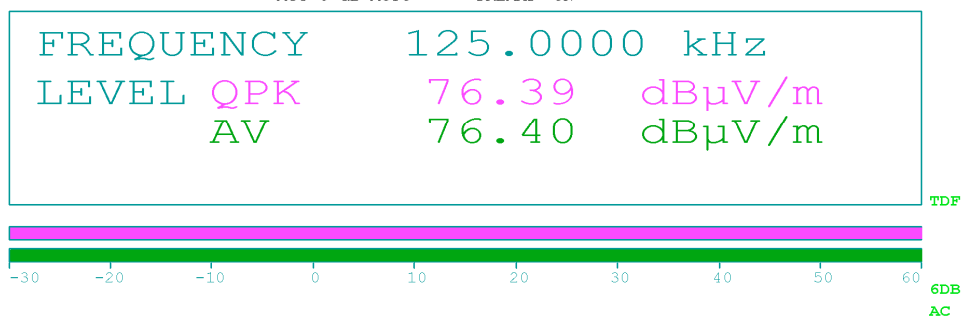
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### Clause 15. 209 Field Strength of any emissions

#### Test data, continued



Demod AM RBW 200 Hz  
MT 100 ms  
Att 0 dB AUTO PREAMP ON



Loop antenna @ 3 m



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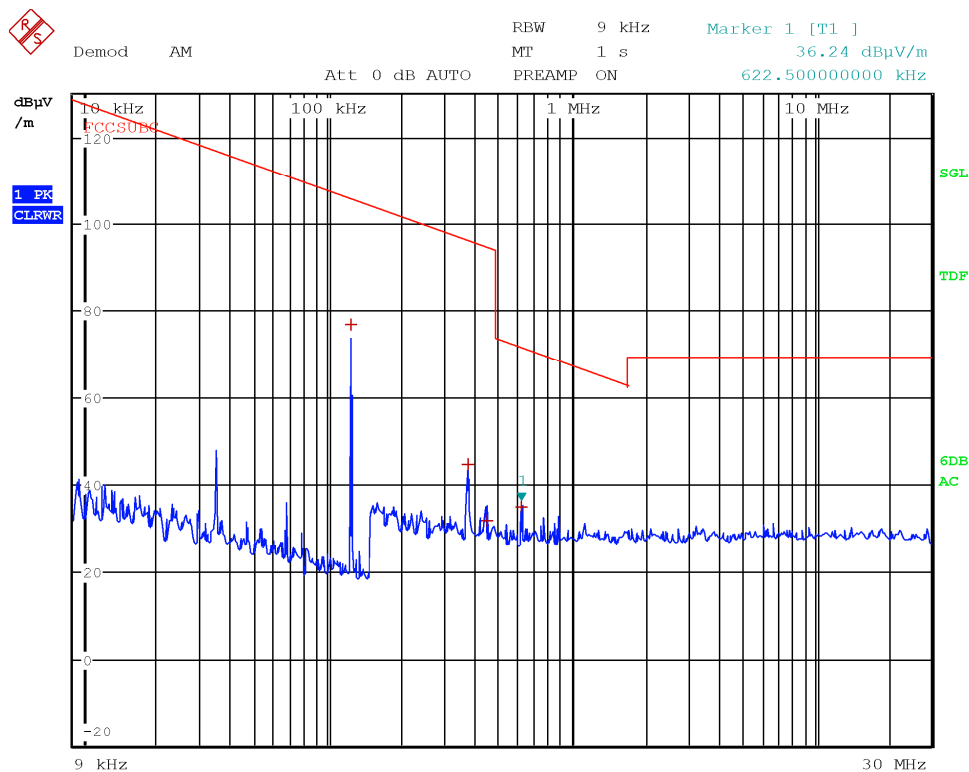
## Appendix A: Test results

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### Clause 15. 209 Field Strength of any emissions

#### Test data, continued



Date: 16.FEB.2017 18:59:58

Loop antenna @ 3 m

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 0.1250          | 77.0           | 105.7          | -28.6       | QP       |
| 0.3750          | 44.7           | 96.1           | -51.4       | QP       |
| 0.4450          | 31.7           | 94.6           | -62.9       | QP       |
| 0.6225          | 34.9           | 71.7           | -36.8       | QP       |



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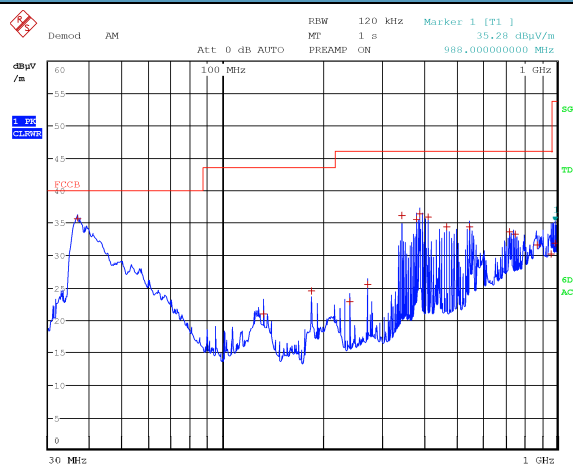
## Appendix A: Test results

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### Clause 15. 209 Field Strength of any emissions

#### Test data, continued



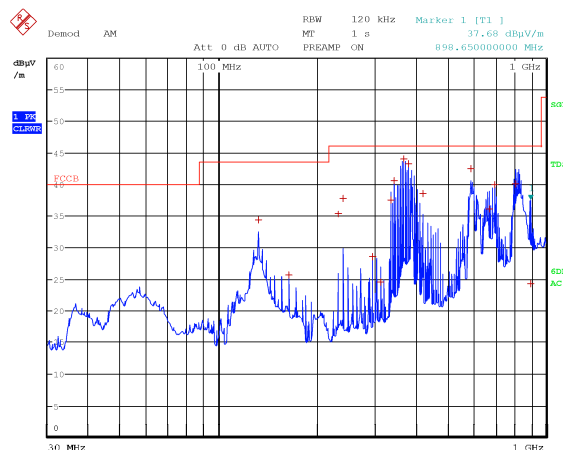
Date: 16.FEB.2017 16:59:51

Antenna in vertical polarization @ 3 m

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 36.7500         | 35.7           | 40.0           | -4.3        | QP       |
| 132.0000        | 21.0           | 43.5           | -22.5       | QP       |
| 184.0000        | 24.5           | 43.5           | -19.0       | QP       |
| 240.0000        | 22.9           | 46.0           | -23.2       | QP       |
| 272.0000        | 25.5           | 46.0           | -20.5       | QP       |
| 344.0000        | 36.3           | 46.0           | -9.7        | QP       |
| 380.0000        | 35.6           | 46.0           | -10.4       | QP       |
| 388.0000        | 36.5           | 46.0           | -9.5        | QP       |
| 412.0000        | 35.9           | 46.0           | -10.1       | QP       |
| 468.0000        | 34.3           | 46.0           | -11.7       | QP       |
| 548.0000        | 34.4           | 46.0           | -11.6       | QP       |
| 719.9750        | 33.6           | 46.0           | -12.4       | QP       |
| 752.0000        | 33.2           | 46.0           | -12.8       | QP       |
| 876.0000        | 31.6           | 46.0           | -14.4       | QP       |
| 964.0000        | 30.2           | 54.0           | -23.8       | QP       |
| 988.0000        | 31.9           | 54.0           | -22.1       | QP       |

### Clause 15. 209 Field Strength of any emissions

## Test data, continued



Date: 16.FEB.2017 16:49:04

Antenna in Horizontal polarization @ 3 m

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 132.0000        | 34.4           | 43.5           | -9.2        | QP       |
| 163.8750        | 25.6           | 43.5           | -17.9       | QP       |
| 232.0000        | 35.4           | 46.0           | -10.6       | QP       |
| 240.0000        | 37.9           | 46.0           | -8.1        | QP       |
| 296.0000        | 28.5           | 46.0           | -17.5       | QP       |
| 312.0000        | 24.5           | 46.0           | -21.5       | QP       |
| 336.0000        | 37.7           | 46.0           | -8.4        | QP       |
| 344.0000        | 40.7           | 46.0           | -5.3        | QP       |
| 368.0000        | 44.0           | 46.0           | -2.0        | QP       |
| 380.0000        | 43.3           | 46.0           | -2.8        | QP       |
| 420.0000        | 38.7           | 46.0           | -7.4        | QP       |
| 588.0000        | 42.5           | 46.0           | -3.5        | QP       |
| 672.0000        | 36.2           | 46.0           | -9.8        | QP       |
| 696.0000        | 40.1           | 46.0           | -6.0        | QP       |
| 808.0000        | 40.2           | 46.0           | -5.9        | QP       |
| 898.6500        | 24.2           | 46.0           | -21.8       | QP       |



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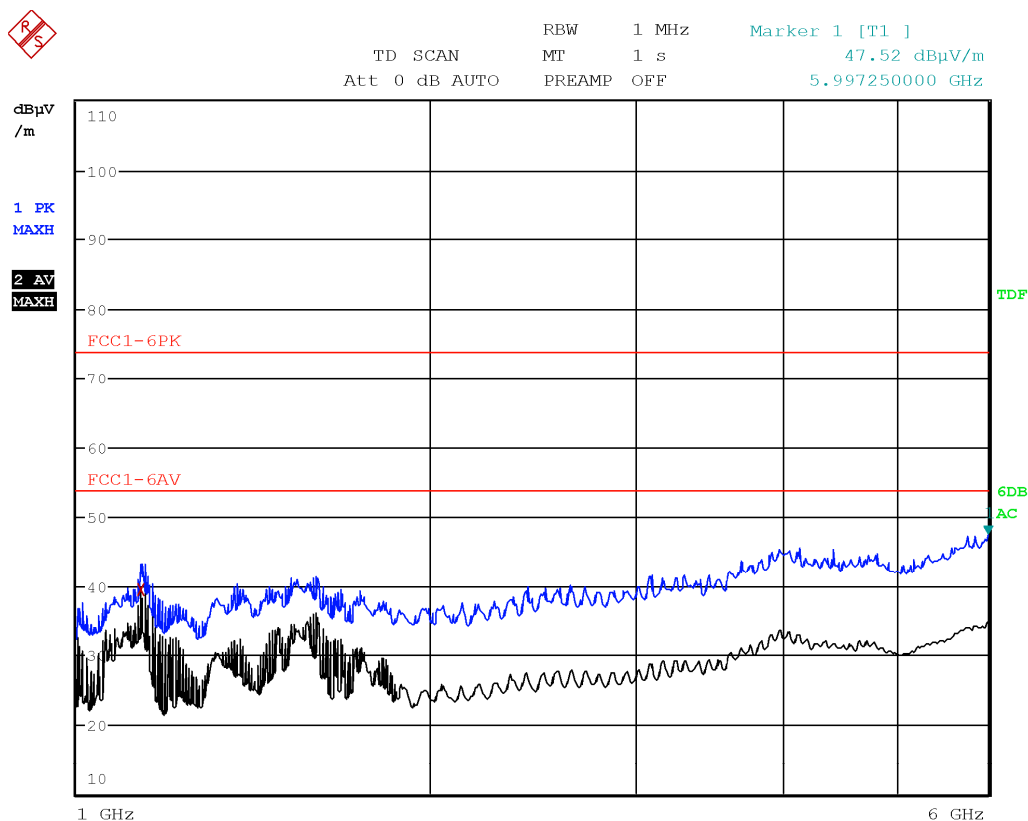
## Appendix A: Test results

Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

### Clause 15. 209 Field Strength of any emissions

#### Test data, continued



Date: 16.FEB.2017 17:30:30

Antenna in horizontal polarization @ 3 m

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 1136.0000       | 39.6           | 54.0           | -14.4       | AV       |



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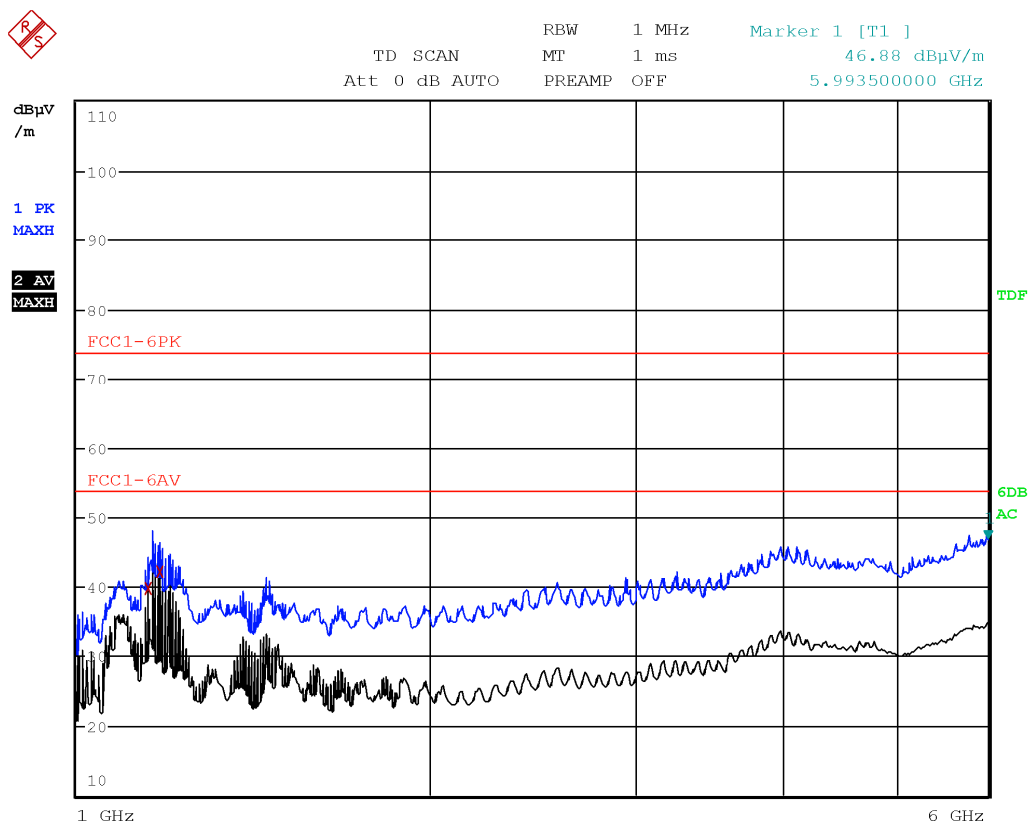
## Appendix A: Test results

Report Number: 325393-2TRFWL

Specification: FCC 15 subpart C

### Clause 15. 209 Field Strength of any emissions

#### Test data, continued



Date: 16.FEB.2017 17:32:58

Antenna in vertical polarization @ 3 m – EUT with 570 mm cable

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 1152.0000       | 39.7           | 54.0           | -14.3       | AV       |
| 1176.0000       | 42.3           | 54.0           | -11.7       | AV       |

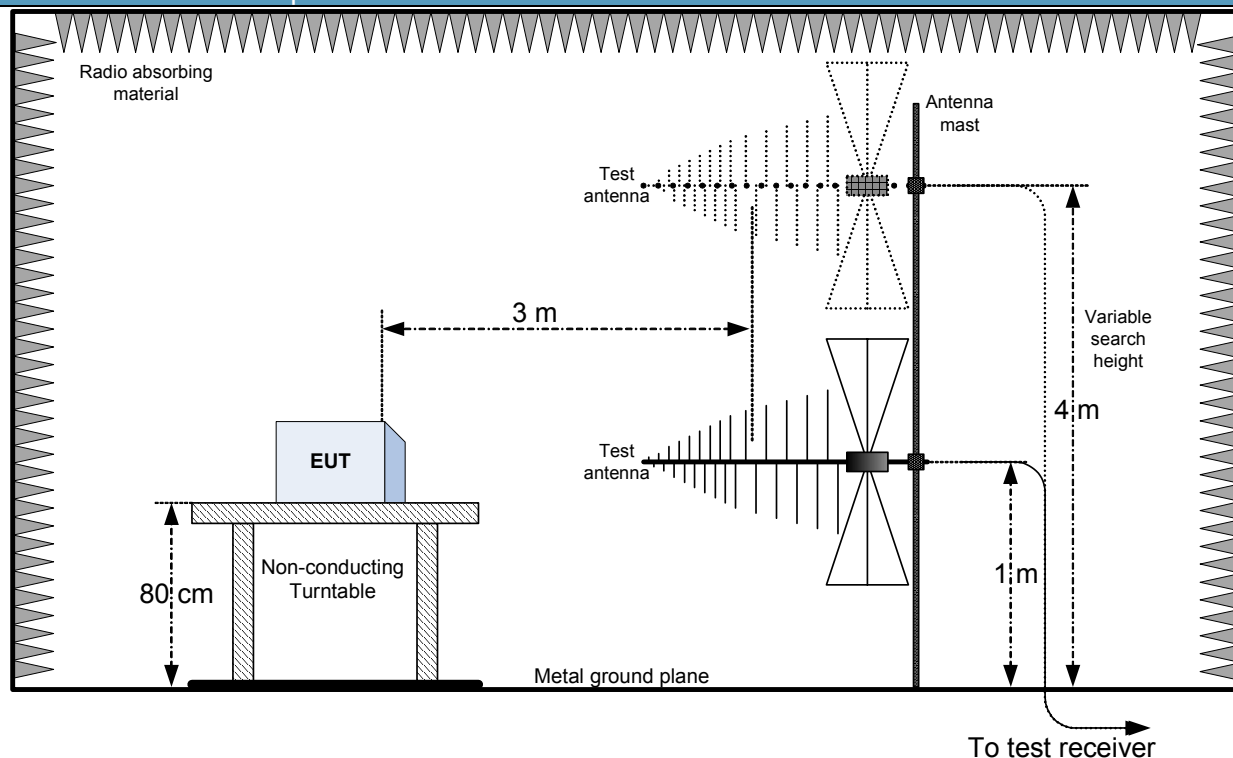
## Clause 15. 209 Field Strength, continued

### Set up photo

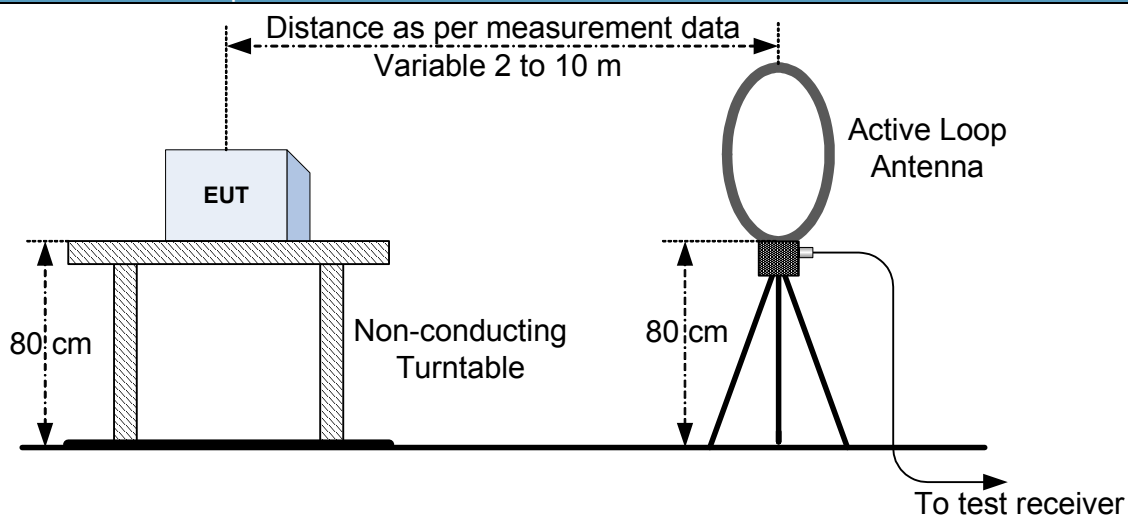


## Appendix B: Block diagrams of test set-ups

### Radiated emissions set-up above 30 MHz

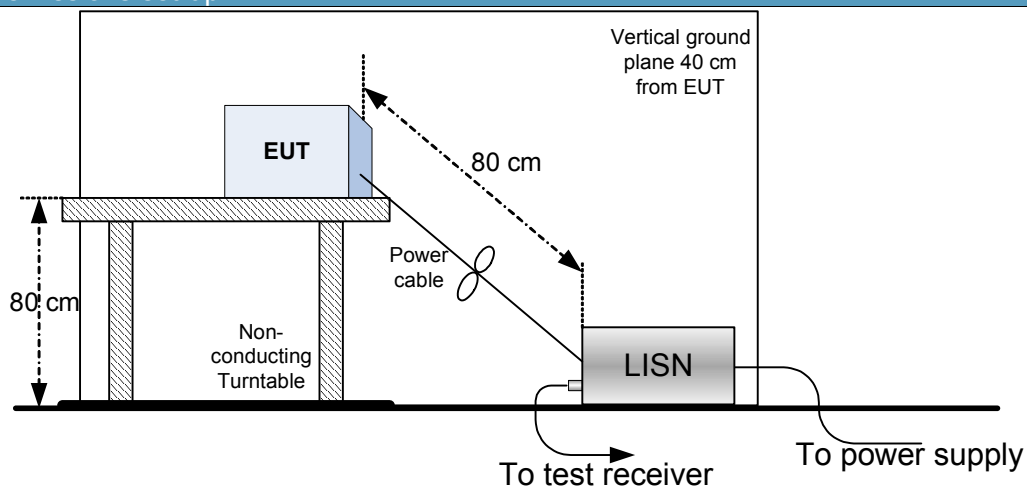


### Radiated emissions set-up below 30 MHz

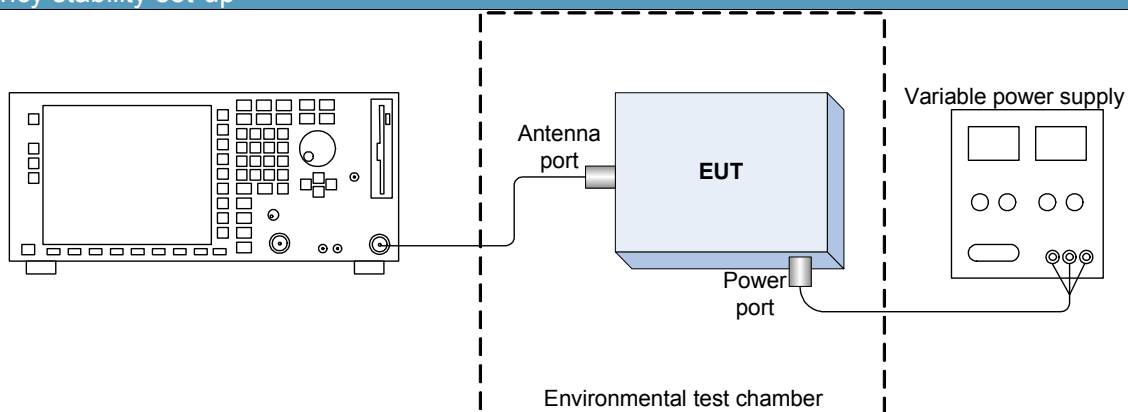


## Block diagram, continued

### Conducted emissions set-up



### Frequency stability set-up





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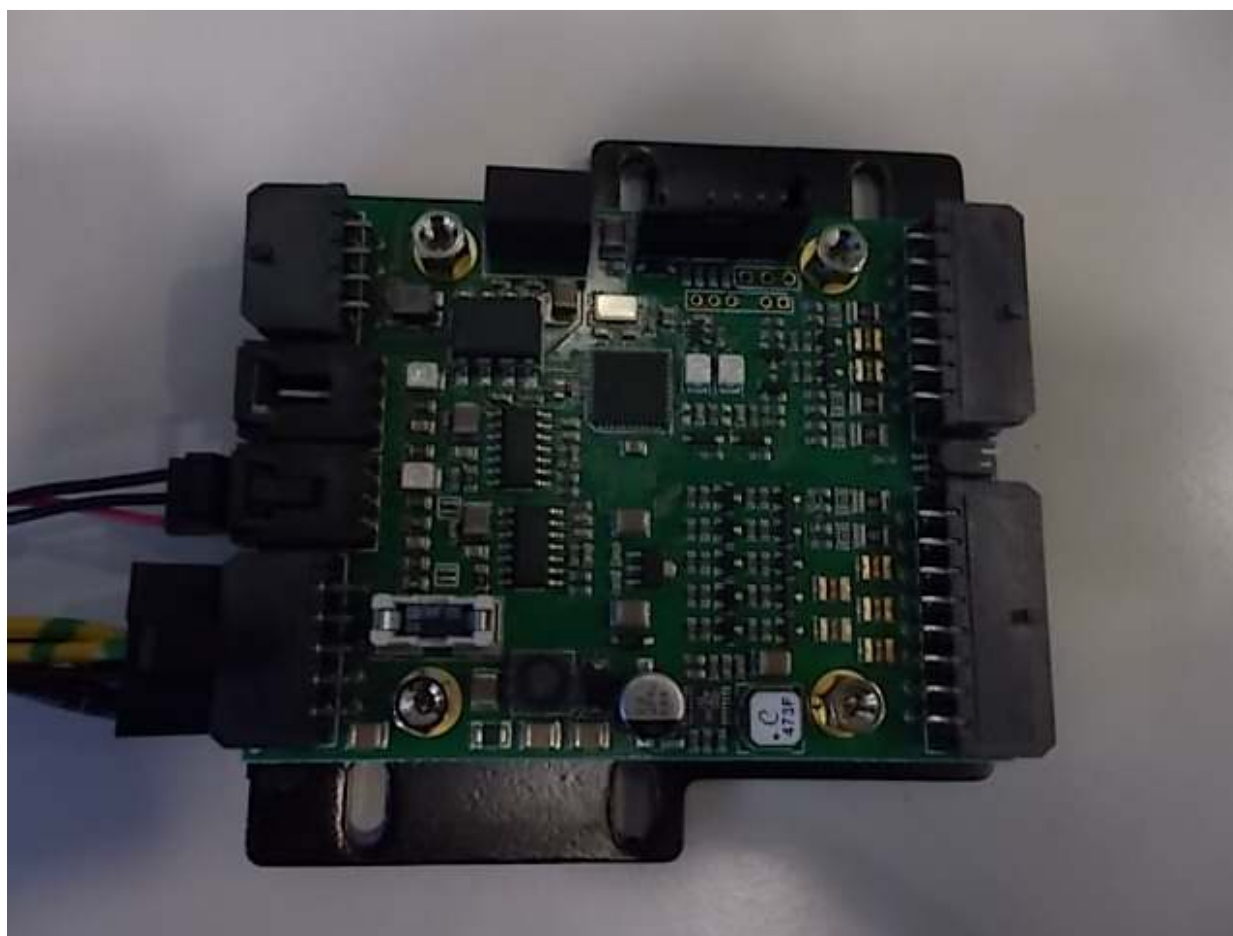
Appendix C: EUT photos

Report Number: 320534-2TRFFCC

Specification: FCC 15 subpart C

## Appendix C: EUT photos

EUT photo





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Appendix C: EUT photos

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