

# Test report

## 294626-1TRFWL

Date of issue: February 4, 2016

Applicant:

**Culligan International**

Product:

**ClearLink**

EUT Model:

**CuIRF-M**

Host Model:

**ClearLink (includes ClearLink D, ClearLink RI, and ClearLink PB)**

Model variants:

**ClearLink R**

FCC ID:

**V7U-010291CL**

IC Registration number:

**6510B-010291CL**

Specifications:

**FCC 47 CFR Part 15 Subpart C, §15.249**

◆ Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz

**RSS-210, Issue 8, December 2010, Annex 2.9**

◆ Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application

#### Test location

|              |                                                      |
|--------------|------------------------------------------------------|
| Company name | Nemko Canada Inc.                                    |
| Address      | 303 River Road                                       |
| City         | Ottawa                                               |
| Province     | Ontario                                              |
| Postal code  | K1V 1H2                                              |
| Country      | Canada                                               |
| Telephone    | +1 613 737 9680                                      |
| Facsimile    | +1 613 737 9691                                      |
| Toll free    | +1 800 563 6336                                      |
| Website      | www.nemko.com                                        |
| Site number  | FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber) |

|                    |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| Tested by          | Kevin Rose, Wireless/EMC Specialist                                                 |
| Reviewed by        | Andrey Adelberg, Senior Wireless/EMC Specialist                                     |
| Review date        | February 4, 2016                                                                    |
| Reviewer signature |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between 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. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

#### Copyright notification

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

## Table of contents

|                                                                                             |           |
|---------------------------------------------------------------------------------------------|-----------|
| <b>Table of contents .....</b>                                                              | <b>3</b>  |
| <b>Section 1. Report summary .....</b>                                                      | <b>4</b>  |
| 1.1 Applicant and manufacturer .....                                                        | 4         |
| 1.2 Test specifications .....                                                               | 4         |
| 1.3 Test methods.....                                                                       | 4         |
| 1.4 Statement of compliance .....                                                           | 4         |
| 1.5 Exclusions.....                                                                         | 4         |
| 1.6 Test report revision history .....                                                      | 4         |
| <b>Section 2. Summary of test results.....</b>                                              | <b>5</b>  |
| 2.1 FCC Part 15 Subpart C, general requirements test results.....                           | 5         |
| 2.2 FCC Part 15 Subpart C, intentional radiators test results.....                          | 5         |
| 2.3 IC RSS-GEN, Issue 4, test results .....                                                 | 5         |
| 2.4 IC RSS-210, Issue 8, test results .....                                                 | 5         |
| <b>Section 3. Equipment under test (EUT) details .....</b>                                  | <b>6</b>  |
| 3.1 Sample information.....                                                                 | 6         |
| 3.2 EUT information .....                                                                   | 6         |
| 3.3 Technical information .....                                                             | 6         |
| 3.4 Product description and theory of operation .....                                       | 6         |
| 3.5 EUT exercise details.....                                                               | 6         |
| 3.6 EUT setup diagram .....                                                                 | 7         |
| 3.7 EUT sub assemblies .....                                                                | 7         |
| <b>Section 4. Engineering considerations.....</b>                                           | <b>8</b>  |
| 4.1 Modifications incorporated in the EUT.....                                              | 8         |
| 4.2 Technical judgment .....                                                                | 8         |
| 4.3 Deviations from laboratory tests procedures .....                                       | 8         |
| <b>Section 5. Test conditions .....</b>                                                     | <b>9</b>  |
| 5.1 Atmospheric conditions .....                                                            | 9         |
| 5.2 Power supply range.....                                                                 | 9         |
| <b>Section 6. Measurement uncertainty .....</b>                                             | <b>10</b> |
| 6.1 Uncertainty of measurement .....                                                        | 10        |
| <b>Section 7. Test equipment .....</b>                                                      | <b>11</b> |
| 7.1 Test equipment list.....                                                                | 11        |
| <b>Section 8. Testing data .....</b>                                                        | <b>12</b> |
| 8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits .....            | 12        |
| 8.2 FCC 15.215(c) and RSS-Gen 6.6 Occupied (Emission) bandwidth .....                       | 16        |
| 8.3 FCC 15.249(a) RSS 210 A2.9(a) Field strength of emissions not in restricted bands ..... | 18        |
| 8.4 FCC 15.249(d) RSS 210 A2.9(b) Spurious emissions (except for harmonics).....            | 20        |
| <b>Section 9. Block diagrams of test set-ups .....</b>                                      | <b>24</b> |
| 9.1 Radiated emissions set-up.....                                                          | 24        |
| 9.2 Radiated emissions set-up for frequencies below 1 GHz.....                              | 24        |
| 9.3 Radiated emissions set-up for frequencies above 1 GHz.....                              | 25        |
| 9.4 Conducted emissions set-up .....                                                        | 25        |

## Section 1. Report summary

---

### 1.1 Applicant and manufacturer

---

|                 |                                    |
|-----------------|------------------------------------|
| Company name    | Culligan International             |
| Address         | 9399 West Higgins Road, Suite 1100 |
| City            | Rosemont                           |
| Province/State  | IL                                 |
| Postal/Zip code | 60018                              |
| Country         | USA                                |

### 1.2 Test specifications

---

|                                              |                                                                                                 |
|----------------------------------------------|-------------------------------------------------------------------------------------------------|
| FCC 47 CFR Part 15, Subpart C, Clause 15.249 | Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz                 |
| RSS-210, Issue 8 Annex 2.9                   | Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application |

### 1.3 Test methods

---

|                   |                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------|
| ANSI C63.10 v2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
|-------------------|------------------------------------------------------------------------------------------------|

### 1.4 Statement of compliance

---

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

### 1.5 Exclusions

---

None

### 1.6 Test report revision history

---

| Revision # | Details of changes made to test report |
|------------|----------------------------------------|
| TRF        | Original report issued                 |

## Section 2. Summary of test results

### 2.1 FCC Part 15 Subpart C, general requirements test results

| Part        | Test description          | Verdict           |
|-------------|---------------------------|-------------------|
| \$15.207(a) | Conducted limits          | Pass              |
| \$15.31(e)  | Variation of power source | Pass <sup>1</sup> |
| \$15.203    | Antenna requirement       | Pass <sup>2</sup> |
| \$15.215(c) | 20 dB bandwidth           | Pass              |

Notes: <sup>1</sup> Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

### 2.2 FCC Part 15 Subpart C, intentional radiators test results

| Part        | Test description                                          | Verdict        |
|-------------|-----------------------------------------------------------|----------------|
| \$15.249(a) | Radiated emissions not in restricted bands                | Pass           |
| \$15.249(b) | Fixed Point-to-Point operation in the 24.0–24.25 GHz band | Not applicable |
| \$15.249(d) | Spurious emissions (except harmonics)                     | Pass           |

### 2.3 IC RSS-GEN, Issue 4, test results

| Part  | Test description                                                         | Verdict        |
|-------|--------------------------------------------------------------------------|----------------|
| 6.6   | Occupied bandwidth                                                       | Pass           |
| 7.1.2 | Receiver radiated emission limits                                        | Not applicable |
| 7.1.3 | Receiver conducted emission limits                                       | Not applicable |
| 8.8   | Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus | Pass           |

Notes: <sup>1</sup> According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

### 2.4 IC RSS-210, Issue 8, test results

| Part      | Test description                           | Verdict |
|-----------|--------------------------------------------|---------|
| \$A2.9(a) | Radiated emissions not in restricted bands | Pass    |
| \$A2.9(b) | Spurious emissions (except harmonics)      | Pass    |

Notes: None

## Section 3. Equipment under test (EUT) details

---

### 3.1 Sample information

---

|                        |                    |
|------------------------|--------------------|
| Receipt date           | September 17, 2015 |
| Nemko sample ID number | 133-001845         |

### 3.2 EUT information

---

|                                     |                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------|
| Product name: (RF module)           | CulRF-M                                                                                      |
| Models with the RF module installed | ClearLink (Includes ClearLinkD, ClearLinkR, ClearLinkPB, ClearLinkRI)                        |
| Part numbers                        | 01028870 (ClearLinkD), 01029111 (ClearLinkR), 01028884 (ClearLinkPB), 01028729 (ClearLinkRI) |

### 3.3 Technical information

---

|                                                   |                                                                                                                                           |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency band                                    | 2400–2483.5 MHz                                                                                                                           |
| Frequency range                                   | 2402–2480 MHz                                                                                                                             |
| Field strength of fundamental (Peak), Units @ 3 m | 89.04 dB $\mu$ V/m                                                                                                                        |
| Channel bandwidth                                 | 2.468 MHz                                                                                                                                 |
| Type of modulation                                | OOK                                                                                                                                       |
| Emission classification (F1D, G1D, D1D)           | F1D                                                                                                                                       |
| Transmitter spurious, Units @ 3 m                 | 2483.5 MHz @ 35.77 dB $\mu$ V/m                                                                                                           |
| Power requirements                                | DC power is via 120 VAC, 60 Hz power supply, 5 V <sub>DC</sub> , 1 A                                                                      |
| Antenna information                               | The Antenna is a PWB mounted antenna 1 dBi<br>The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. |

### 3.4 Product description and theory of operation

---

The EUT is a BLE module JF24D which is renamed as CulRF-M

### 3.5 EUT exercise details

---

EUT was programmed to transmit at low, middle, and high channels

3.6 EUT setup diagram

---

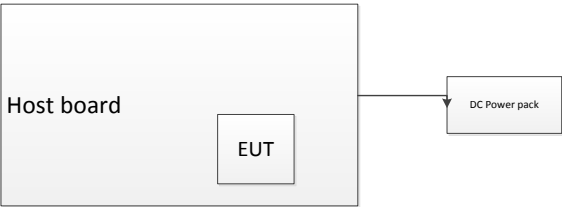


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

---

Table 3.7-1: EUT sub assemblies

| Description                         | Brand name | Model/Part number | Serial number |
|-------------------------------------|------------|-------------------|---------------|
| ClearLink Control Box               | Culligan   | 01028844/01029110 | N/A           |
| ClearLink Button                    | Culligan   | 01028846          | N/A           |
| SureLock Frame Assm. with ClearLink | Culligan   | 01029099          | N/A           |
| ClearLink Control Box for SureLock  | Culligan   | 01028845          | N/A           |
| ClearLink Battery Box               | Culligan   | 01028847          | N/A           |

## Section 4. Engineering considerations

---

### 4.1 Modifications incorporated in the EUT

---

There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

---

ClearLink R is a depopulated version of the ClearLink D. The TDS circuit is removed from the ClearLink D.

### 4.3 Deviations from laboratory tests procedures

---

No deviations were made from laboratory procedures.

# Section 5. Test conditions

---

## 5.1 Atmospheric conditions

---

|                   |               |
|-------------------|---------------|
| Temperature       | 15–30 °C      |
| Relative humidity | 20–75 %       |
| Air pressure      | 860–1060 mbar |

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.

## 5.2 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.



Section 6. Measurement uncertainty

---

6.1 Uncertainty of measurement

---

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of  $K = 2$  with 95% certainty.

| Test name                         | Measurement uncertainty, dB |
|-----------------------------------|-----------------------------|
| All antenna port measurements     | 0.55                        |
| Conducted spurious emissions      | 1.13                        |
| Radiated spurious emissions       | 3.78                        |
| AC power line conducted emissions | 3.55                        |

## Section 7. Test equipment

### 7.1 Test equipment list

*Table 7.1-1: Equipment list*

| Equipment                   | Manufacturer    | Model no.                     | Asset no. | Cal cycle | Next cal.  |
|-----------------------------|-----------------|-------------------------------|-----------|-----------|------------|
| 3 m EMI test chamber        | TDK             | SAC-3                         | FA002047  | 1 year    | Feb. 25/16 |
| Flush mount turntable       | Sunol           | FM2022                        | FA002082  | —         | NCR        |
| Controller                  | Sunol           | SC104V                        | FA002060  | —         | NCR        |
| Antenna mast                | Sunol           | TLT2                          | FA002061  | —         | NCR        |
| Receiver/spectrum analyzer  | Rohde & Schwarz | ESU 26                        | FA002043  | 1 year    | Jan. 07/16 |
| Horn antenna (1–18 GHz)     | EMCO            | 3115                          | FA000825  | 1 year    | Apr. 01/16 |
| Pre-amplifier (1–18 GHz)    | JCA             | JCA118-503                    | FA002091  | 1 year    | May 05/16  |
| Pre-amplifier (18–26 GHz)   | Narda           | BBS-1826N612                  | FA001550  | —         | VOU        |
| Horn antenna (18–40 GHz)    | EMCO            | 3116                          | FA001847  | 1 year    | Jan. 09/16 |
| LISN                        | FCC             | FCC-LISN-5-25-1-01-CISPR25-10 | FA002221  | 1 year    | Jan. 08/16 |
| Bilog antenna (20–3000 MHz) | Sunol           | JB3                           | FA002108  | 1 year    | Apr. 12/16 |

Note: NCR - no calibration required, VOU - verify on use

## Section 8. Testing data

### 8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

#### 8.1.1 Definitions and limits

**FCC:**

Except as shown in paragraphs (b) and (c) of this section, for 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.

**IC:**

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which 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 table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

**Table 8.1-1: Conducted emissions limit**

| Frequency of emission,<br>MHz | Quasi-peak | Conducted limit, dB $\mu$ V | Average** |
|-------------------------------|------------|-----------------------------|-----------|
| 0.15–0.5                      | 66 to 56*  |                             | 56 to 46* |
| 0.5–5                         | 56         |                             | 46        |
| 5–30                          | 60         |                             | 50        |

Note: \* - The level decreases linearly with the logarithm of the frequency.

\*\* - A linear average detector is required.

#### 8.1.2 Test summary

|               |                    |                   |           |
|---------------|--------------------|-------------------|-----------|
| Verdict       | Pass               |                   |           |
| Test date     | September 17, 2015 | Temperature       | 22 °C     |
| Test engineer | Kevin Rose         | Air pressure      | 1004 mbar |
| Test location | Ottawa             | Relative humidity | 40 %      |

### 8.1.3 Observations, settings and special notes

---

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Model Clearlink RI and Clearlink D use a AC to DC wall adapter therefore both were tested

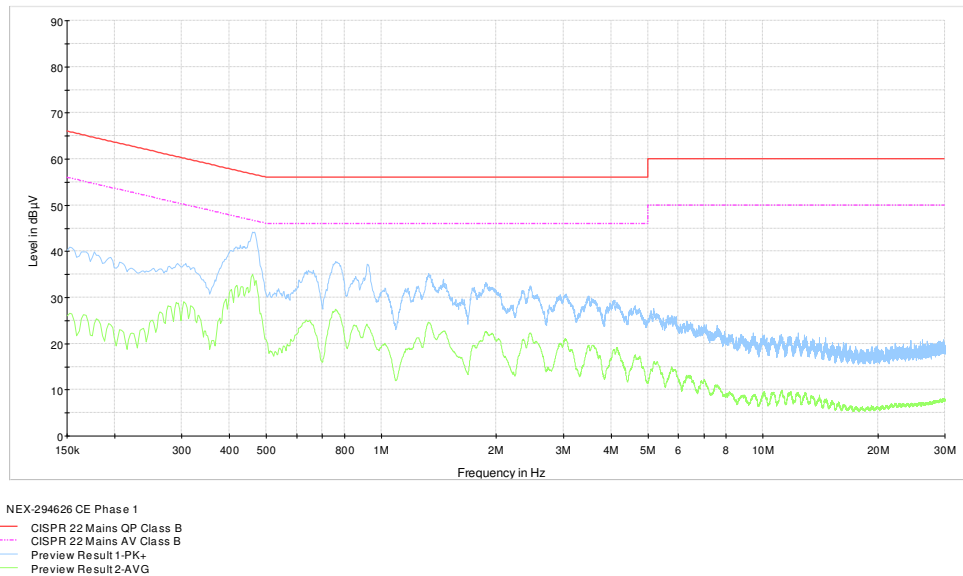
Receiver settings for preview measurements:

|                      |                  |
|----------------------|------------------|
| Resolution bandwidth | 9 kHz            |
| Video bandwidth      | 30 kHz           |
| Detector mode        | Peak and Average |
| Trace mode           | Max Hold         |
| Measurement time     | 1000 ms          |

Receiver settings for final measurements:

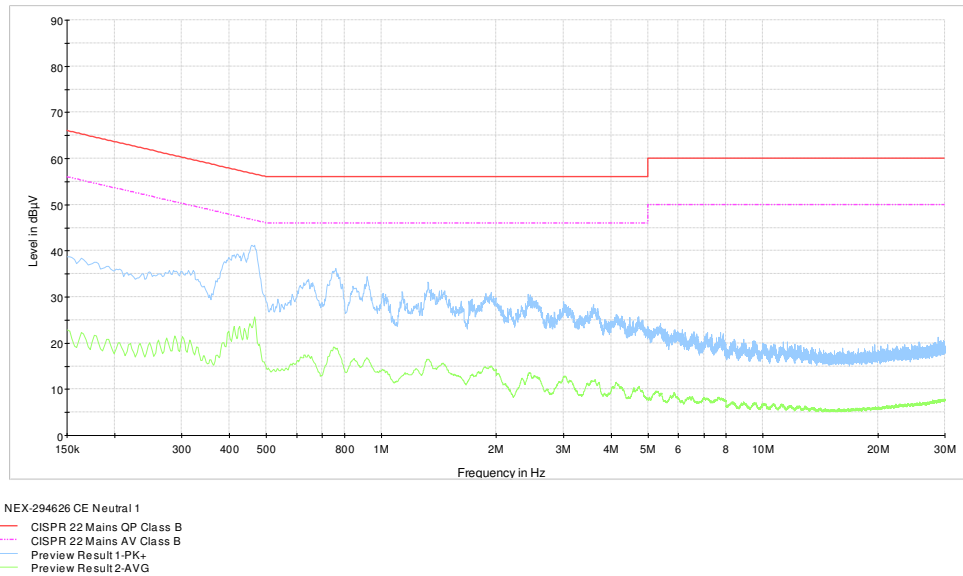
|                      |                        |
|----------------------|------------------------|
| Resolution bandwidth | 9 kHz                  |
| Video bandwidth      | 30 kHz                 |
| Detector mode        | Quasi-Peak and Average |
| Trace mode           | Max Hold               |
| Measurement time     | 1000 ms                |

8.1.4 Test data



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

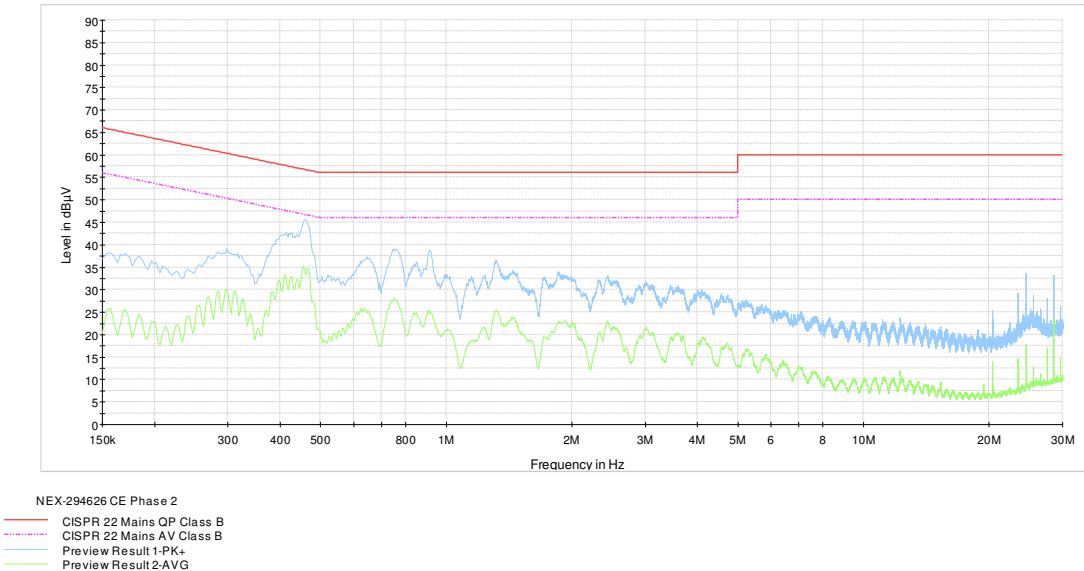
Figure 8.1-1: Conducted disturbance at mains port spectral plot on phase line Model Clearlink D



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

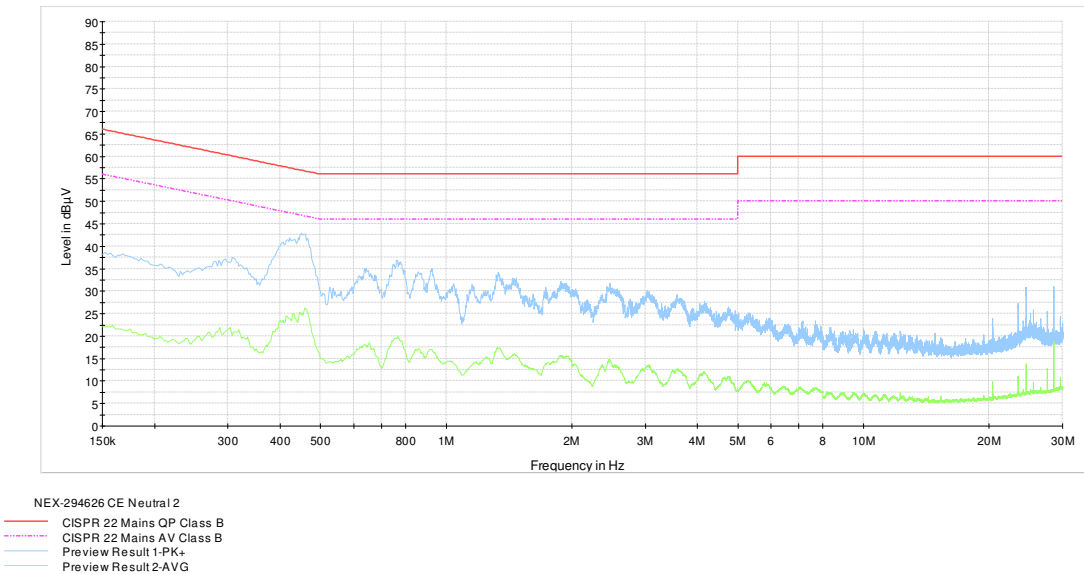
Figure 8.1-2: Conducted disturbance at mains port spectral plot on neutral line Model Clearlink D

8.1.1 Test data



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.1-3: Conducted disturbance at mains port spectral plot on phase line Model Clearlink RI



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.1-4: Conducted disturbance at mains port spectral plot on neutral line Model Clearlink RI

## 8.2 FCC 15.215(c) and RSS-Gen 6.6 Occupied (Emission) bandwidth

### 8.2.1 Definitions and limits

#### FCC

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 a 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.

#### IC

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

### 8.2.2 Test summary

|               |                    |                   |           |
|---------------|--------------------|-------------------|-----------|
| Verdict       | Pass               |                   |           |
| Test date     | September 18, 2015 | Temperature       | 23 °C     |
| Test engineer | Kevin Rose         | Air pressure      | 1003 mbar |
| Test location | Ottawa             | Relative humidity | 41 %      |

### 8.2.3 Observations, settings and special notes

Model Clearlink RI , Clearlink D, and Clearlink PB use the same RF model and therefore

Spectrum analyser settings:

|                      |                            |
|----------------------|----------------------------|
| Resolution bandwidth | 100 kHz                    |
| Video bandwidth      | $\geq 3 \times \text{RBW}$ |
| Frequency span       | 10 MHz                     |
| Detector mode        | Peak                       |
| Trace mode           | Max Hold                   |

## 8.2.4 Test data

Table 8.2-1: 20 dB bandwidth results Clearlink PB

| Frequency, MHz | 20 dB bandwidth, MHz |
|----------------|----------------------|
| 2402           | 1.298                |
| 2440           | 1.426                |
| 2480           | 1.266                |

Note: 99% occupied bandwidth is 2.468 MHz

Table 8.2-2: 20 dB bandwidth results Clearlink RI

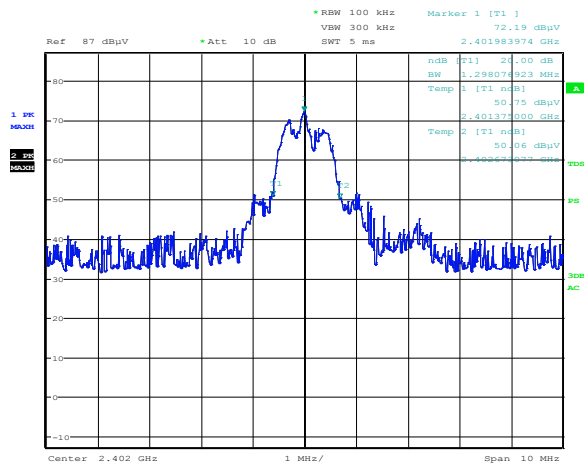
| Frequency, MHz | 20 dB bandwidth, MHz |
|----------------|----------------------|
| 2402           | 1.298                |
| 2440           | 1.298                |
| 2480           | 1.364                |

Note: 99% occupied bandwidth is 1.674 MHz

Table 8.2-3: 20 dB bandwidth results Clearlink D

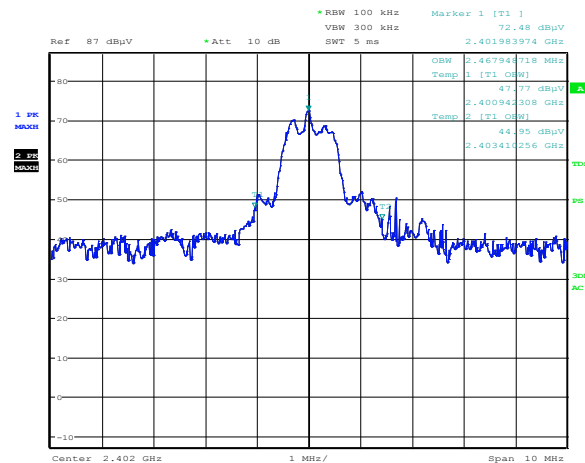
| Frequency, MHz | 20 dB bandwidth, MHz |
|----------------|----------------------|
| 2402           | 1.234                |
| 2440           | 2.011                |
| 2480           | 1.995                |

Note: 99% occupied bandwidth is 1.683 MHz



Date: 18.SEP.2015 01:25:55

Figure 8.2-1: 20 dB bandwidth sample plot



Date: 18.SEP.2015 01:32:53

Figure 8.2-2: 99% dB bandwidth sample plot

## 8.3 FCC 15.249(a) RSS 210 A2.9(a) Field strength of emissions not in restricted bands

### 8.3.1 Definitions and limits

In addition to the provisions of §15.205 and RSS-Gen the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.

**Table 8.3-1: Field strength limits**

| Fundamental frequency (MHz) | Field strength of fundamental (mV/m) | Field strength of fundamental (dBμV/m) | Field strength of spurious emissions (μV/m) | Field strength of spurious emissions (dBμV/m) |
|-----------------------------|--------------------------------------|----------------------------------------|---------------------------------------------|-----------------------------------------------|
| 902–928                     | 50                                   | 94                                     | 500                                         | 54                                            |
| 2400–2483.5                 | 50                                   | 94                                     | 500                                         | 54                                            |
| 5725–5875                   | 50                                   | 94                                     | 500                                         | 54                                            |
| 24.0–24.25                  | 250                                  | 108                                    | 2500                                        | 68                                            |

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter (128 dBμV/m) at 3 meters along the antenna azimuth.

### 8.3.2 Test summary

|               |                    |                   |           |  |
|---------------|--------------------|-------------------|-----------|--|
| Verdict       | Pass               |                   |           |  |
| Test date     | September 18, 2015 | Temperature       | 23 °C     |  |
| Test engineer | Kevin Rose         | Air pressure      | 1003 mbar |  |
| Test location | Ottawa             | Relative humidity | 41 %      |  |

### 8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.  
Radiated measurements were performed at a distance of 3 m.  
Spectrum analyzer settings for peak radiated measurements:

|                       |          |
|-----------------------|----------|
| Resolution bandwidth: | 1 MHz    |
| Video bandwidth:      | 3 MHz    |
| Detector mode:        | Peak     |
| Trace mode:           | Max Hold |

### 8.3.4 Test data

**Table 8.3-2: Radiated field strength of fundamental measurement results for Clearlink PB**

| Channel | Frequency, MHz | Peak Field strength, dBμV/m | Average Limit, dBμV/m | Margin, dB |
|---------|----------------|-----------------------------|-----------------------|------------|
| Low     | 2402           | 77.44                       | 94                    | 16.56      |
| Mid     | 2440           | 81.14                       | 94                    | 12.86      |
| High    | 2480           | 83.98                       | 94                    | 10.02      |

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.  
Peak field Strength is less than the Average limit.

**Table 8.3-3: Radiated field strength of fundamental measurement results for Clearlink D**

| Channel | Frequency, MHz | Peak Field strength, dBμV/m | Average Limit, dBμV/m | Margin, dB |
|---------|----------------|-----------------------------|-----------------------|------------|
| Low     | 2402           | 81.17                       | 94                    | 12.83      |
| Mid     | 2440           | 82.47                       | 94                    | 11.53      |
| High    | 2480           | 83.85                       | 94                    | 10.15      |

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.  
Peak field Strength is less than the Average limit.

**Table 8.3-4: Radiated field strength of fundamental measurement results for Clearlink RI**

| Channel | Frequency, MHz | Peak Field strength, dBμV/m | Average Limit, dBμV/m | Margin, dB |
|---------|----------------|-----------------------------|-----------------------|------------|
| Low     | 2402           | 83.89                       | 94                    | 10.11      |
| Mid     | 2440           | 85.48                       | 94                    | 8.52       |
| High    | 2480           | 89.04                       | 94                    | 4.96       |

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.  
Peak field Strength is less than the Average limit.

No harmonics of the fundamental frequencies were detected above the noise floor.

## 8.4 FCC 15.249(d) RSS 210 A2.9(b) Spurious emissions (except for harmonics)

### 8.4.1 Definitions and limits

**FCC:**  
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

**IC:**  
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

**Table 8.4-1: FCC §15.209 and RSS-Gen – Radiated emission limits**

| Frequency,<br>MHz | Field strength of emissions |                                 | Measurement distance, m |
|-------------------|-----------------------------|---------------------------------|-------------------------|
|                   | µV/m                        | dBµV/m                          |                         |
| 0.009–0.490       | 2400/F                      | $67.6 - 20 \times \log_{10}(F)$ | 300                     |
| 0.490–1.705       | 24000/F                     | $87.6 - 20 \times \log_{10}(F)$ | 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: 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

**Table 8.4-2: IC restricted frequency bands**

| MHz             | MHz                 | MHz           | GHz         |
|-----------------|---------------------|---------------|-------------|
| 0.090–0.110     | 12.51975–12.52025   | 399.9–410     | 5.35–5.46   |
| 2.1735–2.1905   | 12.57675–12.57725   | 608–614       | 7.25–7.75   |
| 3.020–3.026     | 13.36–13.41         | 960–1427      | 8.025–8.5   |
| 4.125–4.128     | 16.42–16.423        | 1435–1626.5   | 9.0–9.2     |
| 4.17725–4.17775 | 16.69475–16.69525   | 1645.5–1646.5 | 9.3–9.5     |
| 4.20725–4.20775 | 16.80425–16.80475   | 1660–1710     | 10.6–12.7   |
| 5.677–5.683     | 25.5–25.67          | 1718.8–1722.2 | 13.25–13.4  |
| 6.215–6.218     | 37.5–38.25          | 2200–2300     | 14.47–14.5  |
| 6.26775–6.26825 | 73–74.6             | 2310–2390     | 15.35–16.2  |
| 6.31175–6.31225 | 74.8–75.2           | 2655–2900     | 17.7–21.4   |
| 8.291–8.294     | 108–138             | 3260–3267     | 22.01–23.12 |
| 8.362–8.366     | 156.52475–156.52525 | 3332–3339     | 23.6–24.0   |
| 8.37625–8.38675 | 156.7–156.9         | 3345.8–3358   | 31.2–31.8   |
| 8.41425–8.41475 | 240–285             | 3500–4400     | 36.43–36.5  |
| 12.29–12.293    | 322–335.4           | 4500–5150     | Above 38.6  |

Note: Certain frequency bands listed in table above and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

**Table 8.4-3: FCC restricted frequency bands**

| 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       |                     |               |             |

#### 8.4.2 Test summary

|               |                    |                   |           |
|---------------|--------------------|-------------------|-----------|
| Verdict       | Pass               |                   |           |
| Test date     | September 18, 2015 | Temperature       | 23 °C     |
| Test engineer | Kevin Rose         | Air pressure      | 1003 mbar |
| Test location | Ottawa             | Relative humidity | 41 %      |

#### 8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.  
Radiated measurements were performed at a distance of 3 m

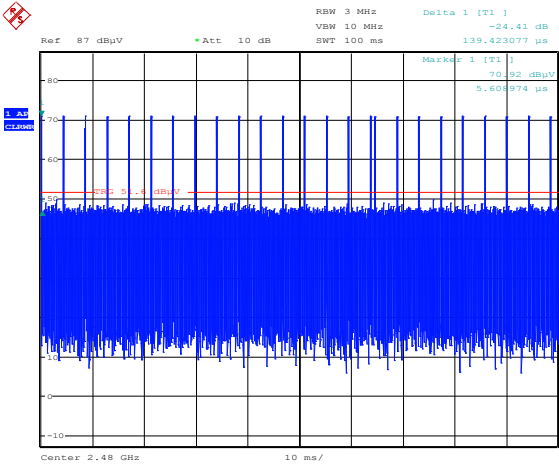
Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

|                       |          |
|-----------------------|----------|
| Resolution bandwidth: | 100 kHz  |
| Video bandwidth:      | 300 kHz  |
| Detector mode:        | Peak     |
| Trace mode:           | Max Hold |

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

|                       |          |
|-----------------------|----------|
| Resolution bandwidth: | 1 MHz    |
| Video bandwidth:      | 3 MHz    |
| Detector mode:        | Peak     |
| Trace mode:           | Max Hold |

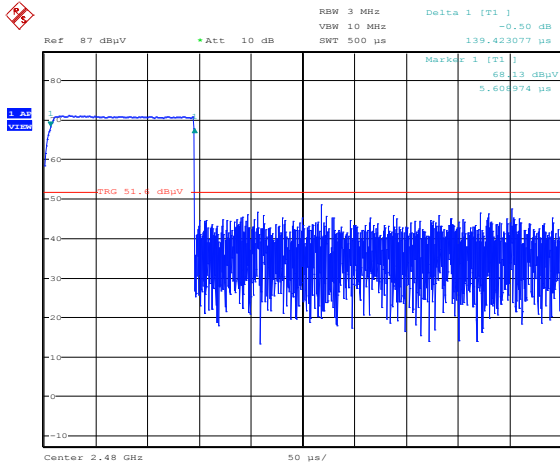
8.4.4 Test data



Date: 25.SEP.2015 01:34:54

Figure 8.4-1: Duty cycle in 100 ms (25 pulses)

Duty cycle =  $20 \log(25 \times 0.13942/100 \text{ ms}) = 29.15 \text{ dB}$  (a maximum of 20 dB was used)



Date: 25.SEP.2015 01:33:56

Figure 8.4-2: Pulse width 139.42 μs

**Table 8.4-4: Radiated field strength of band edge measurement results Clearlink PB**

| Frequency,<br>MHz | Peak Field strength, dBμV/m |       | Margin,<br>dB | Average Field strength, dBμV/m |       | Margin,<br>dB |
|-------------------|-----------------------------|-------|---------------|--------------------------------|-------|---------------|
|                   | Measured                    | Limit |               | Measured                       | Limit |               |
| 2483.5            | 50                          | 74    | 24            | 30                             | 54    | 24            |
| 2561              | 55.34                       | 74    | 18.66         | 35.34                          | 54    | 18.66         |

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

**Table 8.4-5: Radiated field strength of band edge measurement results Clearlink D**

| Frequency,<br>MHz | Peak Field strength, dBμV/m |       | Margin,<br>dB | Average Field strength, dBμV/m |       | Margin,<br>dB |
|-------------------|-----------------------------|-------|---------------|--------------------------------|-------|---------------|
|                   | Measured                    | Limit |               | Measured                       | Limit |               |
| 2483.5            | 52.43                       | 74    | 21.57         | 32.43                          | 54    | 21.57         |
| 2601.6            | 55.77                       | 74    | 18.23         | 35.77                          | 54    | 18.23         |

Notes: Field strength includes correction factor of antenna, cable loss, am

**Table 8.4-6: Radiated field strength of band edge measurement results Clearlink RI**

| Frequency,<br>MHz | Peak Field strength, dBμV/m |       | Margin,<br>dB | Average Field strength, dBμV/m |       | Margin,<br>dB |
|-------------------|-----------------------------|-------|---------------|--------------------------------|-------|---------------|
|                   | Measured                    | Limit |               | Measured                       | Limit |               |
| 2483.5            | 51.63                       | 74    | 22.37         | 31.63                          | 54    | 22.37         |
| 2561              | 55.38                       | 74    | 18.62         | 35.38                          | 54    | 18.62         |

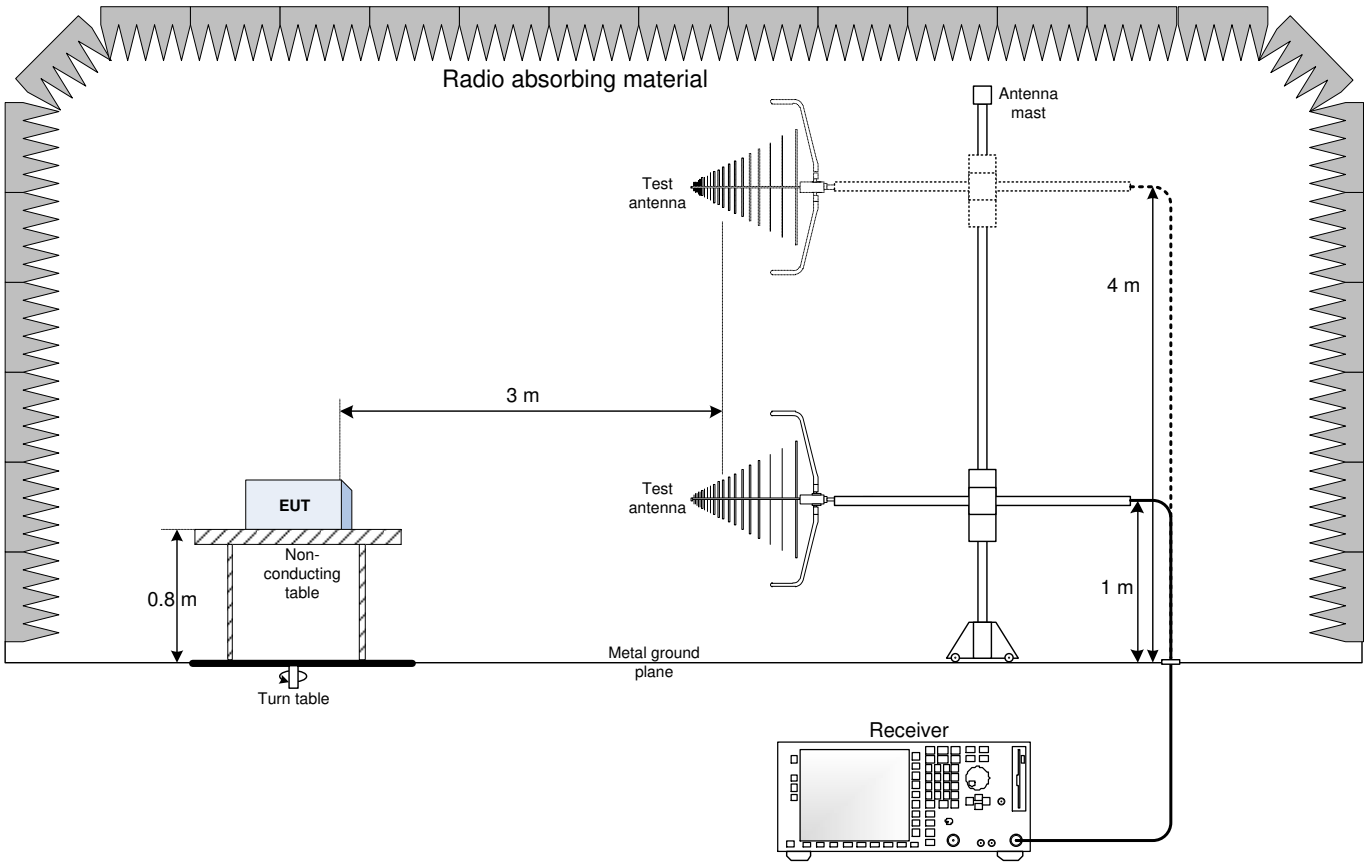
Notes: Field strength includes correction factor of antenna, cable loss, and Duty cycle correction

All other emissions were more than 20 dB below the limit.

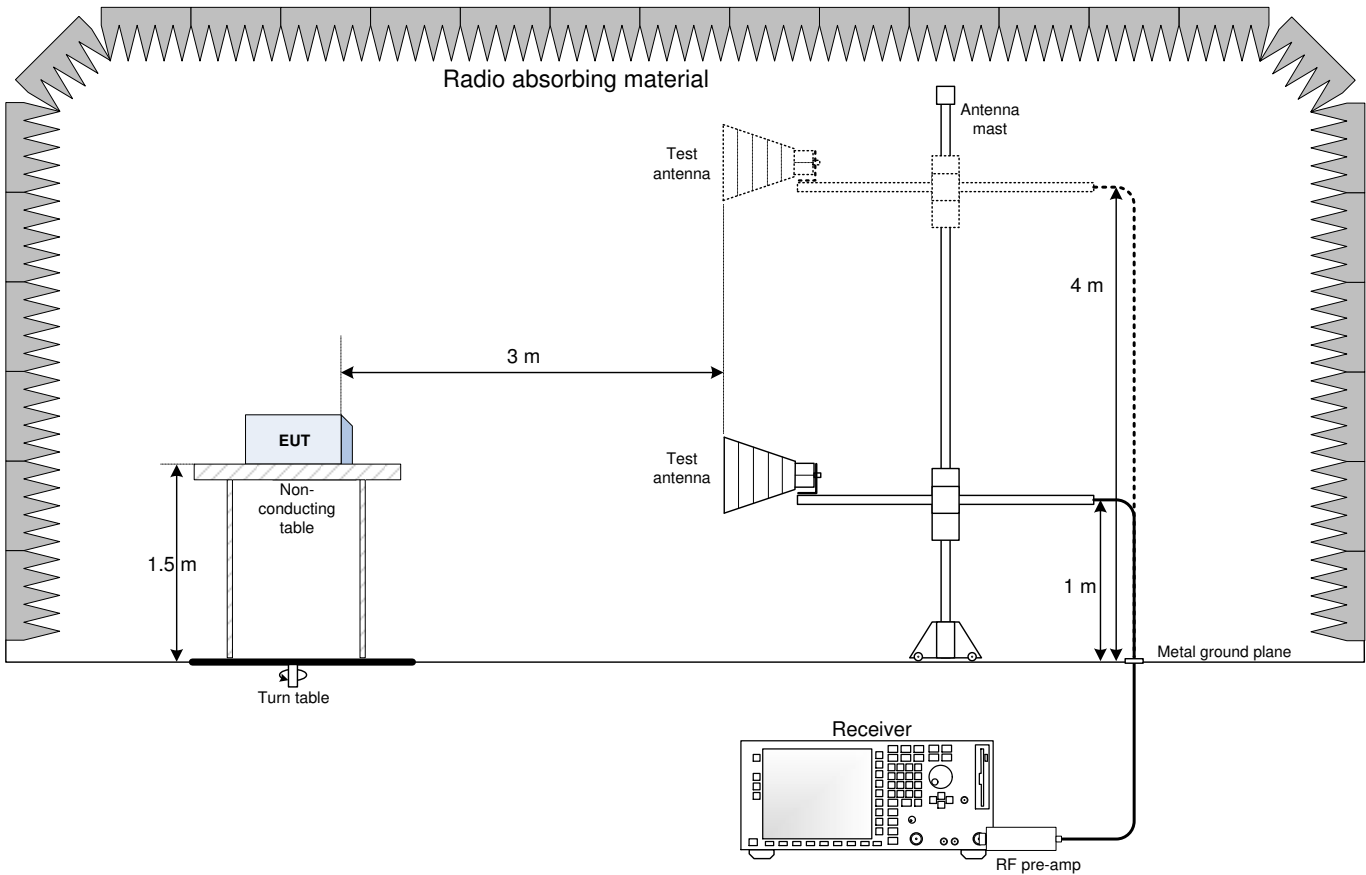
**Section 9.** Block diagrams of test set-ups

9.1 Radiated emissions set-up

9.2 Radiated emissions set-up for frequencies below 1 GHz



9.3 Radiated emissions set-up for frequencies above 1 GHz



9.4 Conducted emissions set-up

