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Compliance test report ID

221407-1TRFWL

Date of issue
January 16, 2013

FCC 47 CFR Part 15 Subpart C, §15.249

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz

RSS-210, Issue 8 Annex 2

Devices Operating in Frequency Bands for Any Application
A2.9 Bands 902–928, 2400–2483.5 and 5725–5875 MHz

Applicant **9266-5777 Quebec inc.**
Product **reelyActive tag**
Model **RA-T411-02**
FCC ID **QASRA-T411-02**
IC Reg. **10707A-RAT41102**

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation



Test location

Nemko Canada Inc.
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FCC test site registration number: 176392 and IC registered site number: 2040A-4 (3 m semi anechoic chamber)

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Reviewed by  January 16, 2013

Kevin Rose, Wireless/EMC Specialist

Date

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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1: Report summary

1.1 Applicant

9266-5777 Quebec Inc.
501-1015 rue William
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H3C 1P4 Canada

1.2 Manufacturer

Digico Electronic Manufacturing Inc.
950 rue Berger
Laval, QC
H7L 5A1 Canada

1.3 Test specifications

FCC 47 CFR Part 15 Subpart C, §15.249

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz

RSS-210, Issue 8 Annex 2

Devices Operating in Frequency Bands for Any Application
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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 general requirements' test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	N/A
§15.215(c)	20 dB bandwidth	Pass

Notes: The EUT is battery operated

2.2 FCC Part 15 Subpart C, 15.249 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	N/A
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: The EUT operates within 902–928 MHz band

2.3 IC RSS-GEN, Issue 3, test results

Part	Test description	Verdict
4.6.1	Occupied bandwidth	Pass
6.1	Receiver spurious emissions limits (radiated)	N/A ¹
6.2	Receiver spurious emissions limits (antenna conducted)	N/A ¹
7.2.4	AC power lines conducted emission limits	N/A ²

Notes: ¹ According to Notice 2012-DRS0126 (from January 2012) section 2.2 of RSS-Gen, Issue 3 has been revised. The EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

² The EUT is battery operated

2.4 IC RSS-210, Issue 8, test results

Part	Test description	Verdict
A2.9(a)	Radiated emissions of fundamental and harmonics	Pass
A2.9(b)	Spurious emissions (except harmonics)	Pass

Section 3: Equipment under test (EUT) details

3.1 Sample information

Receipt date September 20, 2012
Nemko sample ID number 1

3.2 EUT information

Product name reelyActive tag
Model RA-T411-02
Serial number None

3.3 Technical information

Operating band 902–928 MHz
Operating frequency 915 MHz
Modulation type GFSK
Occupied bandwidth 512.8 kHz (99 % OBW)
Emission designator 513KF1D
Power requirements 3 V_{DC} from single CR2032 battery (All tests were performed with new battery.)
Antenna information Integral ceramic chip antenna (Johanson 0915AT43A0026E, 902–928 MHz, 1 dBi gain). No interface available. The EUT uses a non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT operates within 915 MHz ISM band is a RF module that is part of compact RFID tag which transmits unique identifier at a configurable period. Typical period is 1 second.

3.5 EUT exercise details

EUT was forced to continuously transmit with near 100 % duty cycle for throughout the testing.

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

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

Section 5: Test conditions

5.1 Atmospheric conditions

Temperature: 15–30 °C

Relative humidity: 20–75 %

Air pressure: 86–106 kPa

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

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/13
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Bilog antenna	Sunol	JB3	FA002108	1 year	Feb. 07/13
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 24/13
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	July 03/13

Note: NCR = no cal required

Section 8: Testing data

8.1 FCC 15.215(c) and RSS-Gen 4.6.1 Emission bandwidth

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 an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

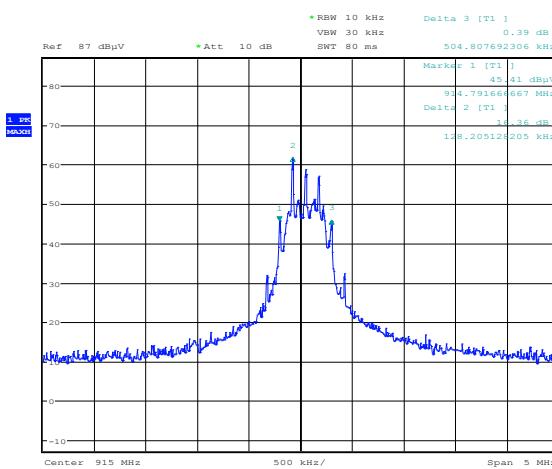
8.2.1 Test summary

Test date	September 20, 2012	Test engineer	Andrey Adelberg	Verdict	Pass
Temperature	23 °C	Air pressure	1005 mbar	Relative humidity	37 %

8.2.2 Observations/special notes

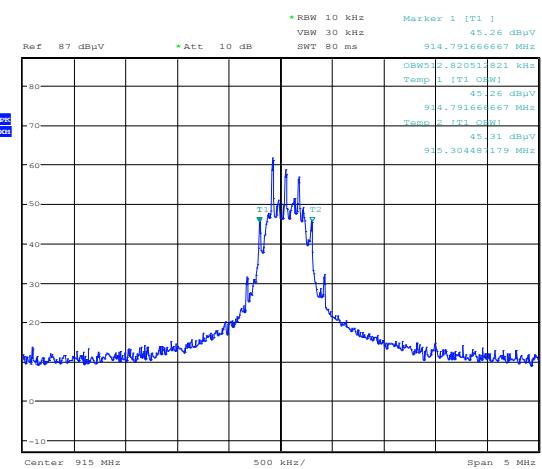
The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

8.2.3 Test data



Date: 20.SEP.2012 11:30:01

Plot 8.2-1: 20 dB bandwidth = 504.8 kHz



Date: 20.SEP.2012 11:30:34

Plot 8.2-2: 99 % occupied bandwidth = 512.8 kHz

Section 8**Test name****Standard**

Testing data

FCC 15.249(a) and RSS-210 A2.9(a) Field strength of radiated emissions not in restricted bands

FCC Part 15 Subpart C and RSS-210 A2.9

8.2 FCC 15.249(a) and RSS-210 A2.9(a) Field strength of radiated emissions not in restricted bands

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Table 8.2-1: Field strength limits

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength of fundamental (dB μ V/m)	Field strength of spurious emissions (μ V/m)	Field strength of spurious emissions (dB μ V/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 dB μ V/m) at 3 meters along the antenna azimuth.

8.2.1 Test summary

Test date	September 20, 2012	Test engineer	Andrey Adelberg	Verdict	Pass
Temperature	23 °C	Air pressure	1005 mbar	Relative humidity	37 %

8.2.2 Observations/special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
 - and using a duty cycle/average factor for average results calculations.

EUT employs sleep-wake-transmit cycle configurable from 0.001 Hz to 32 Hz (1 Hz typical).
 This is up to 1 pulse every 31.25 ms. So the worst case duty cycle could be: $20 \times \log_{10} (3 \times 0.5 / 100) = -36.5 \text{ dB}$

Section 8**Test name**

Testing data

FCC 15.249(a) and RSS-210 A2.9(a) Field strength of radiated emissions not in restricted bands

Standard

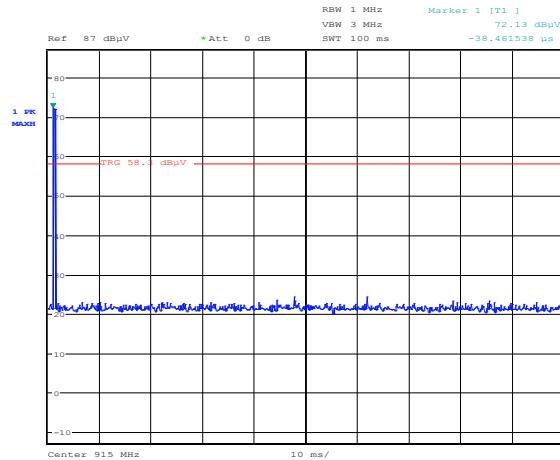
FCC Part 15 Subpart C and RSS-210 A2.9

8.2.3 Test data**Duty cycle/average factor calculations**

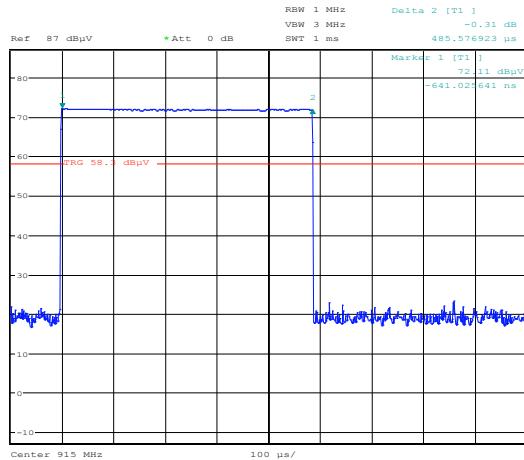
§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle/average factor calculations:

$$\text{Duty cycle/ average factor} = 20 \times \log_{10} \left(\frac{T_x_{100ms}}{100ms} \right)$$



Date: 20.SEP.2012 12:30:10

Plot 8.2-1: Number of transmissions within 100 ms time frame

Date: 20.SEP.2012 12:31:19

Plot 8.2-2: Transmission duration

$$\text{Duty cycle correction factor} = 20 \times \log_{10} \left(\frac{0.485 ms}{100 ms} \right) = -46.3 dB$$

Table 8.2-2: Field strength of fundamental

Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
915	90.52	94.00	3.48

Table 8.2-3: Field strength of harmonics outside restricted bands

Frequency (MHz)	Peak Field strength (dBµV/m)	Peak limit (dBµV/m)	Margin (dB)	Duty cycle factor* (dB)	Average Field strength (dBµV/m)	Avg. limit (dBµV/m)	Margin (dB)
2744.7	47.34	74.00	26.66	-36.50	10.84	54.00	43.16
3659.7	66.50	74.00	7.50	-36.50	30.00	54.00	24.00
4574.6	61.21	74.00	12.79	-36.50	24.71	54.00	29.29

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

*Please refer to section 8.2.2 for details.

8.3 FCC 15.249(d) and RSS-210 A2.9(b) Spurious emissions (except for harmonics)

(d) 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.

Table 8.3-1: Field strength limits

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009–0.490	2400/F	67.6–20×log ₁₀ (F)	300
0.490–1.705	24000/F	87.6–20×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:

- F = fundamental 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.

8.3.1 Test summary

Test date	September 20, 2012	Test engineer	Andrey Adelberg	Verdict	Pass
Temperature	23 °C	Air pressure	1005 mbar	Relative humidity	37 %

8.3.2 Observations/special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results

8.3.3 Test data

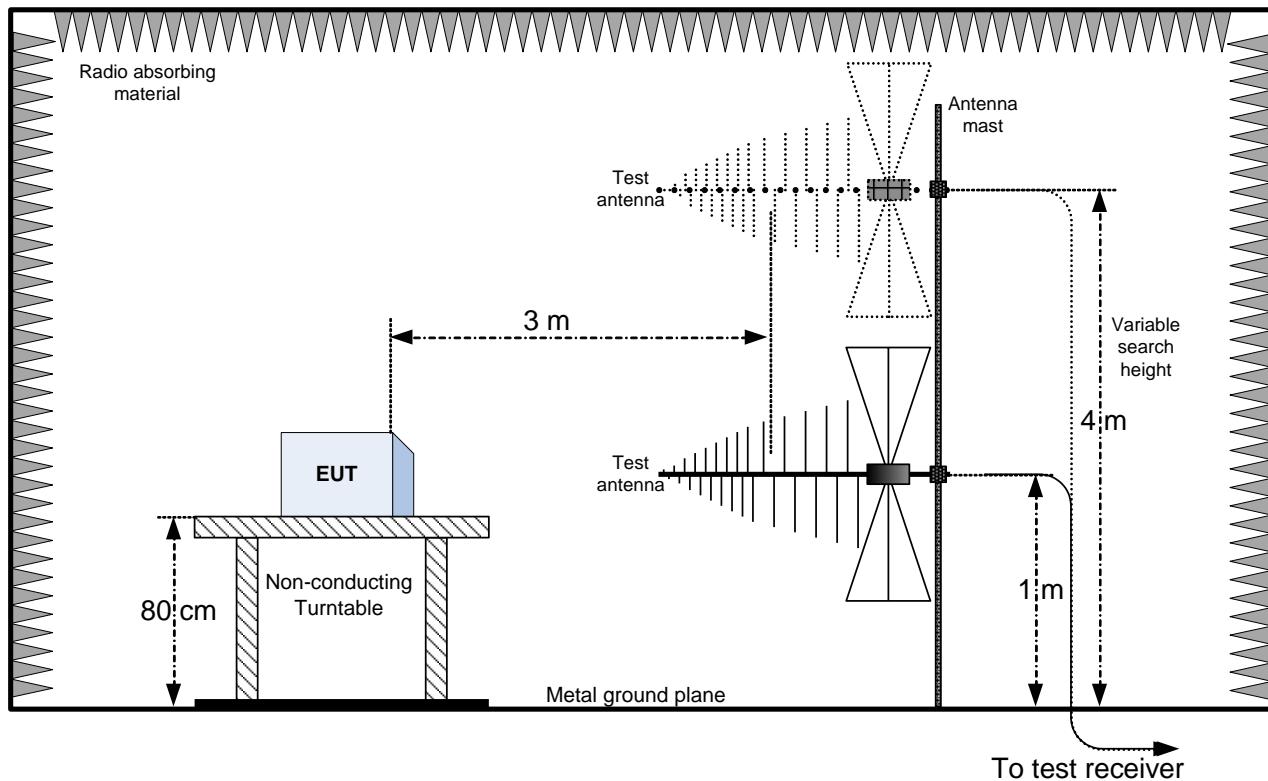
Table 8.3-2: Field strength results

Frequency (MHz)	Peak Field strength (dBµV/m)	Peak limit (dBµV/m)	Margin (dB)
63.99	18.87	40.00	21.13
862.94	37.32	46.00	8.68
966.96	50.10	54.00	3.90

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

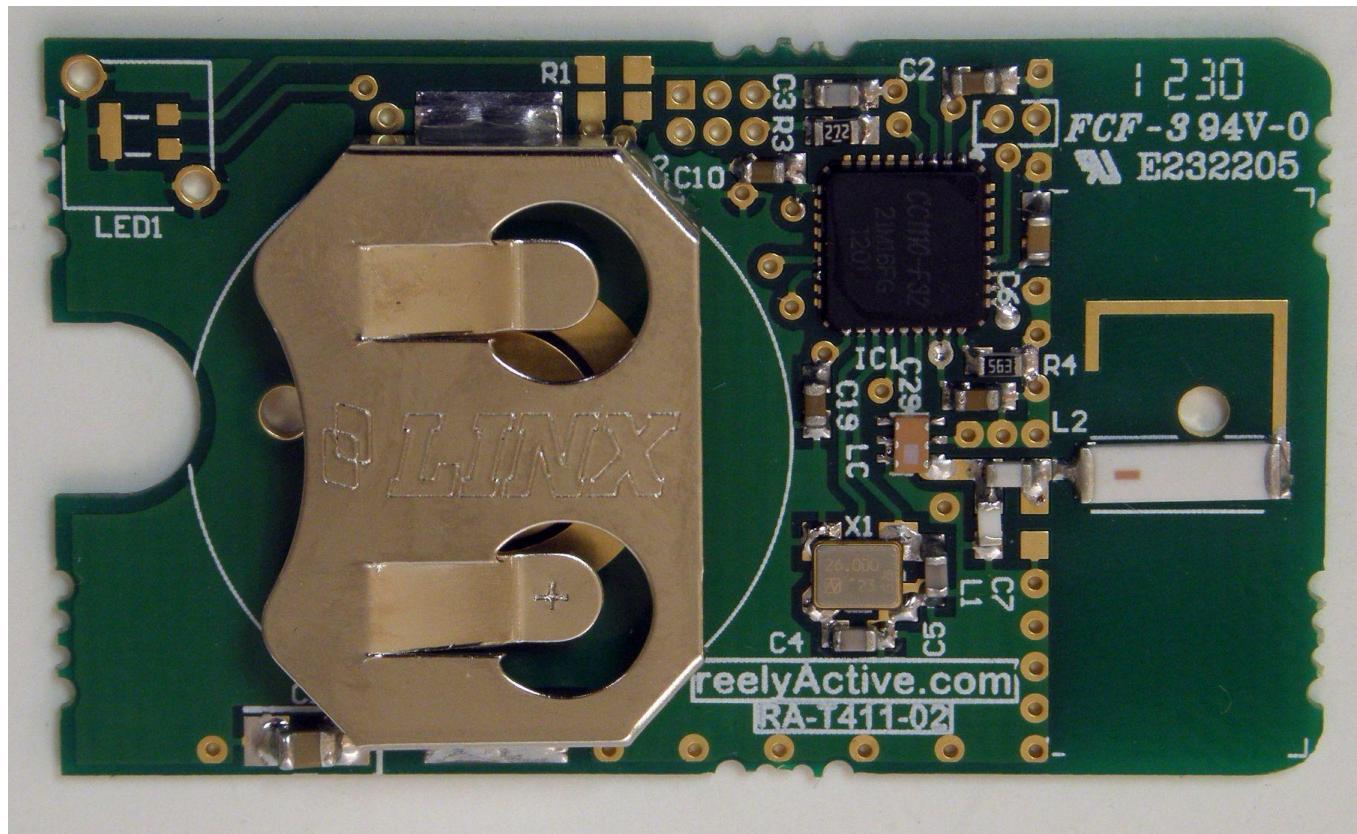
Section 9: Block diagrams of test set-ups

9.1 Radiated emissions set-up



Section 10: EUT photos

10.1 EUT top view



10.2 EUT bottom view

