# An Engineering Document

# FOR

# Buddi Limited

# ON

# Buddi Colorado System - Smart Tag

# Document No. TRA-021068-02-47-01A

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| | |
|---|---|
| **TRaC Wireless Test Report** | **:** TRA-021068-02-47-01A |
| **Applicant** | **:** Buddi Limited |
| **Apparatus** | **:** Buddi Colorado System – Smart Tag |
| **Specification(s)** | **:** FCC CFR47 Part 15(c) & RSS-210 Issue 8 |
| **Purpose of Test** | **:** Certification |
| **FCC ID** | **:** ZDLST1 |
| **Authorised by** | **:**  |
| | **:** Radio Product Manager |
| **Issue Date** | **:** 8th July 2014 |
| **Authorised Copy Number** | **:** *PDF* |

Total number of pages: 65

**Contents**

## Section 1: Introduction

### 1.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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### 1.2 Tests Requested By

This testing in this report was requested by:

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### 1.3 Manufacturer

As above

### 1.4 Apparatus Assessed

The following apparatus was assessed between 17th and 25th June 2014.

- Buddi Colorado System – Smart Tag

The Smart Tag is an ankle worn device fitted with a GPS, GSM modem and SRD operating in the band 902 – 928MHz. SRD and GSM do not operate simultaneously.

Full testing is done on each of the three modes of operations listed below.

- Smart Tag Standalone
- Smart Tag with on body Charger
- Smart Tag with Docking Station

## 1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

| Test Type | FCC Regulation | IC Regulation | Measurement standard | Result |
|---|---|---|---|---|
| Spurious Emissions Radiated | Title 47 of the CFR: Part 15 Subpart (c) 15.249(a)(d) | RSS-210 Issue 8 December 2010 Annex 2 A2.9 | ANSI C63.10 | Pass |
| Unintentional Radiated Spurious Emissions | Title 47 of the CFR: Part 15 Subpart (b) 15.109 | RSS-Gen Issue 3 December 2010 Section 4.10 | ANSI C63.10 | Pass |
| AC Power conducted emissions | Title 47 of the CFR: Part 15 Subpart (c) 15.207 | RSS-Gen Issue 3 December 2010 Section 7.2.4 | ANSI C63.10 | Pass |
| Intentional Emission Frequency | Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a) | RSS-210 Issue 8 December 2010 Annex 2 A2.9 | ANSI C63.10 | Pass |
| Intentional Emission Field Strength | Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a) | RSS-210 Issue 8 December 2010 Annex 2 A2.9 | ANSI C63.10 | Pass |
| Intentional Emission Band Occupancy | Title 47 of the CFR: Part 15 Subpart (c) 15.215 (c) | RSS-Gen Issue 3 December 2010 Section 4.6.1 | ANSI C63.10 | Pass |

Abbreviations used in the above table:

CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions
ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

## 1.6 Notes relating to the assessment

With regard to this assessment, the following points should be noted:

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.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

| | |
|---|---|
| Temperature | : 20 to 22 °C |
| Humidity | : 45 to 75 % |

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

## 1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

# Section 2: Measurement Uncertainty

## 2.1 Measurement Uncertainty Values

For the test data recorded in accordance with note (iii) of Section 2.1 the following measurement uncertainty was calculated:

### Radio Testing – General Uncertainty Schedule

*All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.*

***[1] Adjacent Channel Power***

Uncertainty in test result = **1.86dB**

***[2] Carrier Power***

Uncertainty in test result (Power Meter) = **1.08dB**
Uncertainty in test result (Spectrum Analyser) = **2.48dB**

***[3] Effective Radiated Power***

Uncertainty in test result = **4.71dB**

***[4] Spurious Emissions***

Uncertainty in test result = **4.75dB**

***[5] Maximum frequency error***

Uncertainty in test result (Power Meter) = **0.113ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

***[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field***

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

***[7] Frequency deviation***

Uncertainty in test result = **3.2%**

***[8] Magnetic Field Emissions***

Uncertainty in test result = **2.3dB**

***[9] Conducted Spurious***

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result – Up to 26GHz = **3.14dB**

***[10] Channel Bandwidth***

Uncertainty in test result = **15.5%**

***[11] Amplitude and Time Measurement – Oscilloscope***

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%,**
Uncertainty in Amplitude measurement = **0.82%**

***[12] Power Line Conduction***

Uncertainty in test result = **3.4dB**

***[13] Spectrum Mask Measurements***

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

***[14] Adjacent Sub Band Selectivity***

Uncertainty in test result = **1.24dB**

***[15] Receiver Blocking – Listen Mode, Radiated***

Uncertainty in test result = **3.42dB**

***[16] Receiver Blocking – Talk Mode, Radiated***

Uncertainty in test result = **3.36dB**

***[17] Receiver Blocking – Talk Mode, Conducted***

Uncertainty in test result = **1.24dB**

***[18] Receiver Threshold***

Uncertainty in test result = **3.23dB**

***[19] Transmission Time Measurement***

Uncertainty in test result = **7.98%**

# Section 3: Modifications

## 3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

## Appendix A: Formal Emission Test Results

Abbreviations used in the tables in this appendix:

| | |
|---|---|
| Spec | : Specification |
| Mod | : Modification |
| EUT | : Equipment Under Test |
| SE | : Support Equipment |
| L | : Live Power Line |
| N | : Neutral Power Line |
| E | : Earth Power Line |
| Pk | : Peak Detector |
| QP | : Quasi-Peak Detector |
| Av | : Average Detector |
| CDN | : Coupling & decoupling network |

| | |
|---|---|
| ALSR | : Absorber Lined Screened Room |
| OATS | : Open Area Test Site |
| ATS | : Alternative Test Site |
| Ref | : Reference |
| Freq | : Frequency |
| MD | : Measurement Distance |
| SD | : Spec Distance |
| Pol | : Polarisation |
| H | : Horizontal Polarisation |
| V | : Vertical Polarisation |

## A1 Transmitter Intentional Emission Radiated

| Test Details: Smart Tag Standalone | |
|---|---|
| Regulation | Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S24 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 21.6˚C |
| Photographs | Refer to Appendix F |

| FREQ. (MHz) | MEASUREMENT Rx. READING (dBµV) | CABLE LOSS (dB) | ANT FACTOR (dB/m) | DUTY CYCLE CORRECTION (dB) | FIELD STRENGTH (dBµV/m) | FIELD STRENGTH (mV/m) |
|---|---|---|---|---|---|---|
| 914.5 | 67.9 | 4.5 | 23.4 | - | 95.7 | 61.0pk |
| 914.5 | 67.9 | 4.5 | 23.4 | 24.5 | 71.2 | 3.6av |
| 917.5 | 67.7 | 4.5 | 23.6 | - | 95.7 | 61.2pk |
| 917.5 | 67.7 | 4.5 | 23.6 | 24.5 | 71.2 | 3.6av |
| 921.0 | 67.8 | 4.5 | 23.6 | - | 95.8 | 61.9pk |
| 921.0 | 67.8 | 4.5 | 23.6 | 24.5 | 71.3 | 3.7av |
| Limit av | | | 50mV/m @ 3m | | | |

| Test Details: Smart Tag with on body charger | |
|---|---|
| Regulation | Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S10 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 21.6˚C |
| Photographs | Refer to Appendix F |

| FREQ. (MHz) | MEASUREMENT Rx. READING (dBµV) | CABLE LOSS (dB) | ANT FACTOR (dB/m) | DUTY CYCLE CORRECTION (dB) | FIELD STRENGTH (dBµV/m) | FIELD STRENGTH (mV/m) |
|---|---|---|---|---|---|---|
| 914.5 | 67.1 | 4.5 | 23.4 | - | 94.9 | 55.6pk |
| 914.5 | 67.1 | 4.5 | 23.4 | 24.5 | 70.4 | 3.3av |
| 917.5 | 66.8 | 4.5 | 23.6 | - | 94.8 | 55.2pk |
| 917.5 | 66.8 | 4.5 | 23.6 | 24.5 | 70.3 | 3.3av |
| 921.0 | 66.5 | 4.5 | 23.6 | - | 94.5 | 53.3pk |
| 921.0 | 66.5 | 4.5 | 23.6 | 24.5 | 70.0 | 3.2av |
| Limit av | | | 50mV/m @ 3m | | | |

| Test Details: Smart Tag with docking station | |
|---|---|
| Regulation | Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S07, S17 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 21.6˚C |
| Photographs | Refer to Appendix F |

| FREQ. (MHz) | MEASUREMENT Rx. READING (dBµV) | CABLE LOSS (dB) | ANT FACTOR (dB/m) | DUTY CYCLE CORRECTION (dB) | FIELD STRENGTH (dBµV/m) | FIELD STRENGTH (mV/m) |
|---|---|---|---|---|---|---|
| 914.5 | 67.4 | 4.5 | 23.4 | - | 95.2 | 57.5pk |
| 914.5 | 67.4 | 4.5 | 23.4 | 24.5 | 70.7 | 3.4av |
| 917.5 | 67.5 | 4.5 | 23.6 | - | 95.5 | 59.8pk |
| 917.5 | 67.5 | 4.5 | 23.6 | 24.5 | 71.0 | 3.6av |
| 921.0 | 68.3 | 4.5 | 23.6 | - | 96.3 | 65.5pk |
| 921.0 | 68.3 | 4.5 | 23.6 | 24.5 | 71.8 | 3.9av |
| Limit av | | | 50mV/m @ 3m | | | |

**Notes**:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Peak / 120kHz bandwidth
3 When battery powered the EUT was powered with new batteries

**Test Method**:
1 As per Radio – Noise Emissions, ANSI C63.10
2 Measuring distances 3m
3 EUT 0.8 metre above ground plane
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

## A2 Transmitter Bandwidth

| Test Details: | |
|---|---|
| Regulation | Part 15.215 (c) / RSS-Gen Issue 3 Section 4.6.1 |
| Measurement standard | ANSI C63.10:2009 |
| EUT sample number | S05 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 22.5˚C |

| Band occupancy @ -20 dBc | | | |
|---|---|---|---|
| **FREQ. (MHz)** | **f lower (MHz)** | **f higher (MHz)** | **Occ BW (kHz)** |
| 914.5 | 914.462404 | 914.532620 | 70.216 |
| 917.5 | 917.461298 | 917.531514 | 70.216 |
| 921.0 | 920.960745 | 921.030961 | 70.216 |

The 20dB Bandwidth of the carrier must be contained within the frequency band 902-928 MHz.

| 99% Band occupancy | | | |
|---|---|---|---|
| **FREQ. (MHz)** | **f lower (MHz)** | **f higher (MHz)** | **Occ BW (kHz)** |
| 914.5 | 914.330929 | 914.661058 | 330.128 |
| 917.5 | 917.334135 | 917.660256 | 326.122 |
| 921.0 | 920.837340 | 921.156250 | 318.910 |

## A3 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100 kHz. The radiated electric field emission test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Part 15 Subpart (c) Clause 15.209 (a) / RSS-Gen Issue 3 Section 7.2.5. The EUT was set to transmit as required.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site : ☐ 3m alternative test site : ☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

| Test Details: Smart Tag Standalone | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S24 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

The worst case emissions are listed below:

**Bottom Channel**

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 1828.97 | 63.0 | 3.0 | 27.1 | 36.3 | - | - | 56.8 | 694.2pk | 5011pk |
| 2. | 1828.97 | 63.0 | 3.0 | 27.1 | 36.3 | - | 24.5 | 32.3 | 41.4av | 500av |
| 3. | 2743.44 | 46.1 | 3.2 | 29.1 | 36.0 | - | - | 42.4 | 131.7av | 500av |
| 4. | 3657.92 | 48.6 | 3.1 | 31.5 | 35.7 | - | - | 47.5 | 237.4av | 500av |
| 5. | 4572.52 | 38.4 | 3.6 | 32.3 | 35.6 | - | - | 38.7 | 86.4av | 500av |
| 6. | 5486.84 | 43.3 | 3.9 | 33.9 | 35.7 | - | - | 45.4 | 186.0av | 500av |
| 7. | 7315.92 | 38.7 | 4.4 | 36.5 | 36.1 | - | - | 43.5 | 148.8av | 500av |

## Middle Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 8. | 1834.91 | 61.5 | 3.0 | 27.2 | 36.3 | - | - | 55.4 | 590.9pk | 5011pk |
| 9. | 1834.91 | 61.5 | 3.0 | 27.2 | 36.3 | - | 24.5 | 30.9 | 35.2av | 500av |
| 10. | 2752.39 | 45.0 | 3.1 | 29.1 | 36.0 | - | - | 41.2 | 114.2av | 500av |
| 11. | 3669.94 | 48.6 | 3.1 | 31.6 | 35.7 | - | - | 47.6 | 239.6av | 500av |
| 12. | 4587.40 | 39.0 | 3.6 | 32.3 | 35.6 | - | - | 39.3 | 92.4av | 500av |
| 13. | 5504.95 | 43.2 | 3.9 | 33.9 | 35.7 | - | - | 45.3 | 184.7av | 500av |
| 14. | 7339.86 | 39.3 | 4.3 | 36.6 | 36.1 | - | - | 44.1 | 160.7av | 500av |

## Top Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 15. | 1841.98 | 62.0 | 2.9 | 27.2 | 36.3 | - | - | 55.8 | 618.7pk | 5011pk |
| 16. | 1841.98 | 62.0 | 2.9 | 27.2 | 36.3 | - | 24.5 | 31.3 | 36.9av | 500av |
| 17. | 2762.99 | 43.4 | 3.2 | 29.1 | 36.0 | - | - | 39.7 | 96.1av | 500av |
| 18. | 3683.91 | 48.3 | 3.1 | 31.7 | 35.7 | - | - | 47.4 | 233.6av | 500av |
| 19. | 4604.91 | 39.0 | 3.6 | 32.3 | 35.6 | - | - | 39.3 | 92.7av | 500av |
| 20. | 5525.94 | 43.4 | 3.9 | 33.9 | 35.7 | - | - | 45.5 | 187.7av | 500av |
| 21. | 7367.94 | 39.7 | 4.4 | 36.7 | 36.2 | - | - | 44.6 | 170.0av | 500av |

**Radiated Electric Field Emissions continued:**

| Test Details: Smart Tag with on body charger | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S10 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

The worst case emissions are listed below:

**Bottom Channel**

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 1828.97 | 64.6 | 3.0 | 27.1 | 36.3 | - | - | 58.4 | 827.0pk | 5011pk |
| 2. | 1828.97 | 64.6 | 3.0 | 27.1 | 36.3 | - | 24.5 | 33.9 | 49.3av | 500av |
| 3. | 2743.44 | 47.3 | 3.2 | 29.1 | 36.0 | - | - | 43.6 | 150.5av | 500av |
| 4. | 3657.92 | 49.9 | 3.1 | 31.5 | 35.7 | - | - | 48.8 | 274.8av | 500av |
| 5. | 4572.52 | 43.6 | 3.6 | 32.3 | 35.6 | - | - | 43.9 | 156.7av | 500av |
| 6. | 5486.84 | 44.8 | 3.9 | 33.9 | 35.7 | - | - | 46.9 | 222.1av | 500av |

## Middle Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7. | 1834.91 | 63.0 | 3.0 | 27.2 | 36.3 | - | - | 56.9 | 698.2pk | 5011pk |
| 8. | 1834.91 | 63.0 | 3.0 | 27.2 | 36.3 | - | 24.5 | 32.4 | 41.6av | 500av |
| 9. | 2752.39 | 43.0 | 3.1 | 29.1 | 36.0 | - | - | 39.2 | 90.9av | 500av |
| 10. | 3669.94 | 49.7 | 3.1 | 31.6 | 35.7 | - | - | 48.7 | 270.7av | 500av |
| 11. | 4587.40 | 43.9 | 3.6 | 32.3 | 35.6 | - | - | 44.2 | 162.4av | 500av |
| 12. | 5504.95 | 44.5 | 3.9 | 33.9 | 35.7 | - | - | 46.6 | 214.3av | 500av |

## Top Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13. | 1841.98 | 61.7 | 2.9 | 27.2 | 36.3 | - | - | 55.5 | 598.4pk | 5011pk |
| 14. | 1841.98 | 61.7 | 2.9 | 27.2 | 36.3 | - | 24.5 | 31.0 | 35.6av | 500av |
| 15. | 2762.99 | 41.7 | 3.2 | 29.1 | 36.0 | - | - | 38.0 | 79.8av | 500av |
| 16. | 3683.91 | 48.5 | 3.1 | 31.7 | 35.7 | - | - | 47.6 | 239.9av | 500av |
| 17. | 4604.91 | 43.1 | 3.6 | 32.3 | 35.6 | - | - | 43.4 | 147.7av | 500av |
| 18. | 5525.94 | 45.4 | 3.9 | 33.9 | 35.7 | - | - | 47.5 | 237.4av | 500av |

**Radiated Electric Field Emissions continued:**

| Test Details: Smart Tag with docking station | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S7, S17 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

The worst case emissions are listed below:

**Bottom Channel**

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 1828.97 | 61.9 | 3.0 | 27.1 | 36.3 | - | - | 55.7 | 608.1av | 500av |
| 2. | 1828.97 | 59.8 | 3.0 | 27.1 | 36.3 | - | - | 53.6 | 480.3av | 500av |
| 3. | 2743.44 | 43.5 | 3.2 | 29.1 | 36.0 | - | - | 39.8 | 98.2av | 500av |
| 4. | 3657.92 | 47.2 | 3.1 | 31.5 | 35.7 | - | - | 46.1 | 200.7av | 500av |
| 5. | 5486.84 | 41.6 | 3.9 | 33.9 | 35.7 | - | - | 43.7 | 152.4av | 500av |

## Middle Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6. | 1834.91 | 61.2 | 3.0 | 27.2 | 36.3 | - | - | 55.1 | 571.5av | 500av |
| 7. | 1834.91 | 59.6 | 3.0 | 27.2 | 36.3 | - | - | 53.5 | 473.2av | 500av |
| 8. | 2752.39 | 42.6 | 3.1 | 29.1 | 36.0 | - | - | 38.8 | 87.0av | 500av |
| 9. | 3669.94 | 45.7 | 3.1 | 31.6 | 35.7 | - | - | 44.7 | 172.6av | 500av |
| 10. | 5504.95 | 41.5 | 3.9 | 33.9 | 35.7 | - | - | 43.6 | 151.2av | 500av |

## Top Channel

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | HPF Loss (dB) | Duty Cycle correction (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11. | 1841.98 | 60.7 | 2.9 | 27.2 | 36.3 | - | - | 54.5 | 532.1av | 500av |
| 12. | 1841.98 | 59.0 | 2.9 | 27.2 | 36.3 | - | - | 52.8 | 437.5av | 500av |
| 13. | 2762.99 | 42.5 | 3.2 | 29.1 | 36.0 | - | - | 38.8 | 86.8av | 500av |
| 14. | 3683.91 | 45.3 | 3.1 | 31.7 | 35.7 | - | - | 44.4 | 165.4av | 500av |
| 15. | 5525.94 | 41.3 | 3.9 | 33.9 | 35.7 | - | - | 43.4 | 148.6av | 500av |

**Notes:**

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1. For emissions below 30MHz the cable losses are assumed to be negligible.
2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
4 For Frequencies below 1 GHz, RBW= 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

| | |
|---|---|
| Peak | RBW=VBW= 1MHz |
| Average | RBW=VBW= 1MHz |

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).
Radiated emission limits 47 CFR part 15- Clause 15.209 / RSS-Gen Issue 3 Section 7.2.5 for all emissions.

| Frequency of emission (MHz) | Field strength (μV/m) | Measurement Distance (m) | Field strength (dBμV/m) |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 | 67.6/F (kHz) |
| 0.490-1.705 | 24000/F(kHz) | 30 | 87.6/F (kHz) |
| 1.705-30 | 30 | 30 | 29.5 |
| 30-88 | 100 | 3 | 40.0 |
| 88-216 | 150 | 3 | 43.5 |
| 216-960 | 200 | 3 | 46.0 |
| Above 960 | 500 | 3 | 54.0 |

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation}\,(\text{dB}) = 20\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels:

| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---|---|---|---|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | ✓ | | | |
| Effect of Position of EUT cables & samples on emission levels | | | | ✓ |

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

## A4 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109 and in RSS- GEN Section 7.2.3. The EUT was set to receive mode only on its lowest, centre and highest carrier frequency in turn.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site : ☐ 3m alternative test site : ☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

| **Test Details : Smart Tag Standalone** | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10 |
| Measurement standard | ANSI C63.10:2009 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S24 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

No emissions detected within 20dB of the limit.

**Unintentional Radiated Emissions continued:**

| Test Details : Smart Tag with on body charger | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S10 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

The worst case emissions are listed below:

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | Field ST'GH (dBµV/m) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|
| 1. | 32.50 | 6.9 | 0.7 | 18.1 | - | 25.7 | 19.3 | 100 |
| 2. | 37.60 | 14.1 | 0.8 | 15.3 | - | 30.2 | 32.4 | 100 |
| 3. | 43.90 | 17.8 | 0.9 | 11.9 | - | 30.6 | 33.7 | 100 |
| 4. | 44.20 | 18.9 | 0.9 | 11.7 | - | 31.5 | 37.5 | 100 |
| 5. | 50.20 | 22.4 | 0.9 | 8.5 | - | 31.9 | 39.1 | 100 |
| 6. | 50.50 | 22.3 | 0.9 | 8.4 | - | 31.6 | 38.2 | 100 |
| 7. | 50.90 | 18.9 | 0.9 | 8.4 | - | 28.2 | 25.8 | 100 |
| 8. | 51.35 | 21.9 | 1.0 | 8.0 | - | 30.9 | 35.1 | 100 |
| 9. | 89.20 | 18.1 | 1.3 | 9.3 | - | 28.7 | 27.3 | 150 |
| 10. | 91.20 | 18.4 | 1.3 | 9.6 | - | 29.3 | 29.2 | 150 |
| 11. | 808.25 | -0.1 | 4.1 | 22.1 | - | 26.1 | 20.2 | 200 |
| 12. | 867.65 | 0.7 | 4.3 | 22.4 | - | 27.4 | 23.3 | 200 |
| 13. | 900.95 | 0.5 | 4.4 | 23.0 | - | 27.8 | 24.7 | 200 |
| 14. | 945.05 | -0.1 | 4.5 | 24.3 | - | 28.7 | 27.2 | 200 |
| 15. | 949.75 | -0.1 | 4.6 | 24.0 | - | 28.5 | 26.5 | 200 |

**Unintentional Radiated Emissions continued:**

| Test Details : Smart Tag with docking station | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz-16GHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S7, S17 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23.6˚C |

No emissions detected within 20dB of the limit.

**Notes:**

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1. For emissions below 30MHz the cable losses are assumed to be negligible.

2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.

3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.

4 For Frequencies below 1 GHz, RBW = 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

| | |
|---|---|
| Peak (pk) | RBW=VBW= 1MHz |
| Average (Av) | RBW=VBW= 1MHz |

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.109 / RSS-Gen Issue 3 section 6.1 for all emissions:

| Frequency of emission (MHz) | Field strength (μV/m) | Measurement Distance (m) | Field strength (dBμV/m) |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 | 67.6/F (kHz) |
| 0.490-1.705 | 24000/F(kHz) | 30 | 87.6/F (kHz) |
| 1.705-30 | 30 | 30 | 29.5 |
| 30-88 | 100 | 3 | 40.0 |
| 88-216 | 150 | 3 | 43.5 |
| 216-960 | 200 | 3 | 46.0 |
| Above 960 | 500 | 3 | 54.0 |

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation}\,(\text{dB}) = 20\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---|---|---|---|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | ✓ | | | |
| Effect of Position of EUT cables & samples on emission levels | | | | ✓ |

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

## A5 Power Line Conducted Emissions

Preview power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector.

| Test Details: Smart Tag with on body charger | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4 |
| Measurement standard | ANSI C63.10:2009 |
| Frequency range | 150kHz to 30MHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S10 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

The worst-case power line conducted emission measurements are listed below:

**Results measured using the average detector compared to the average limit**

| Ref No. | Freq (MHz) | Conductor | Result (dBµV) | Spec Limit (dBµV) | Margin (dB) | Result Summary |
|---|---|---|---|---|---|---|
| 1 | 0.590 | Nuetral Line | 31.85 | 46 | 14.15 | Pass |

**Results measured using the quasi-peak detector compared to the quasi–peak limit**

| Ref No. | Freq (MHz) | Conductor | Result (dBµV) | Spec Limit (dBµV) | Margin (dB) | Result Summary |
|---|---|---|---|---|---|---|
| 1 | 0.590 | Nuetral Line | 39.48 | 56 | 16.52 | Pass |
| 2 | 0595 | Live Line | 37.30 | 56 | 18.70 | Pass |

**Power Line Conducted Emissions continued:**

| Test Details: Smart Tag with docking station | |
|---|---|
| Regulation | Part 15 Subpart (c) Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4 |
| Measurement standard | ANSI C63.10:2009 |
| Frequency range | 150kHz to 30MHz |
| EUT sample number | S28 |
| Modification state | 0 |
| SE in test environment | S7, S17 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

No emissions detected within 20dB of the limit.

**Specification limits :**

Conducted emission limits (47 CFR Part 15:Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4):

Conducted disturbance at the mains ports.

| Frequency range MHz | Limits dBμV | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.5 | 66 to 56[2] | 56 to 46[2] |
| 0.5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

Notes:
1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

(a) The levels may have been rounded for display purposes.

(b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---|---|---|---|
| Effect of EUT operating mode on emission levels | | ✓ | | |
| Effect of EUT internal configuration on emission levels | | ✓ | | |

(i) Parameter defined by standard and / or single possible, refer to Appendix C
(ii) Parameter defined by client and / or single possible, refer to Appendix C
(iii) Parameter had a negligible effect on emission levels, refer to Appendix C
(iv) Worst case determined by initial measurement, refer to Appendix C

**Appendix B: Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

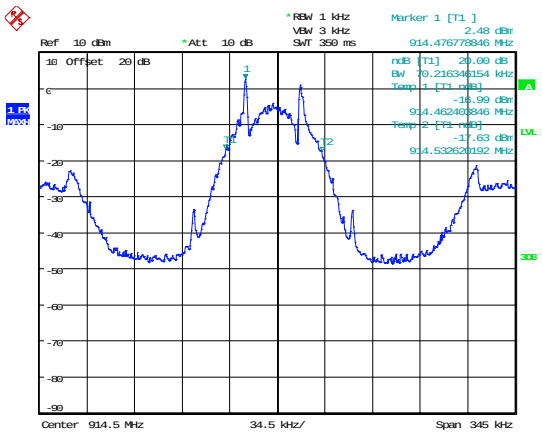
(b) The time and date on the plots do not necessarily equate to the time of the test.

(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

(d) Appendix C details the numbering system used to identify the sample and its modification state.

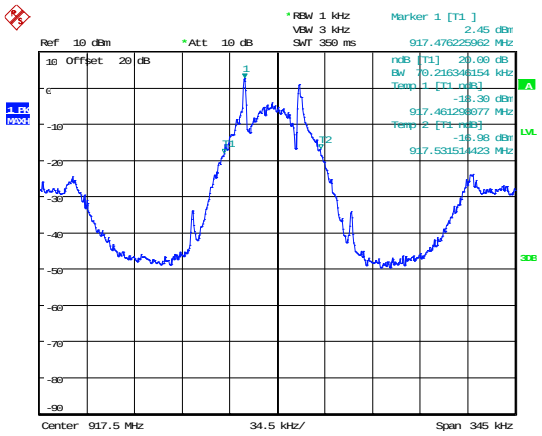
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

## 20dB Bandwidth



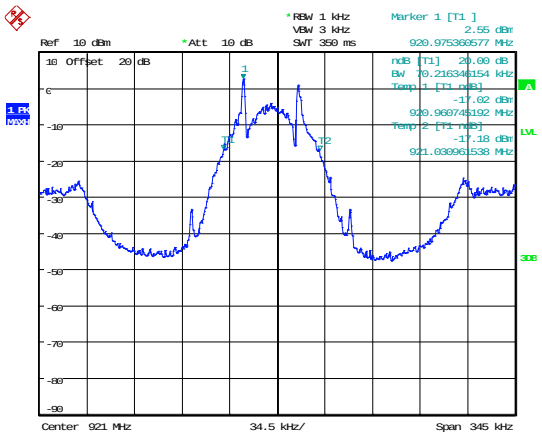

Date: 17.JUN.2014 15:29:24

20dB Bandwidth 914.5MHz




Date: 17.JUN.2014 15:37:07

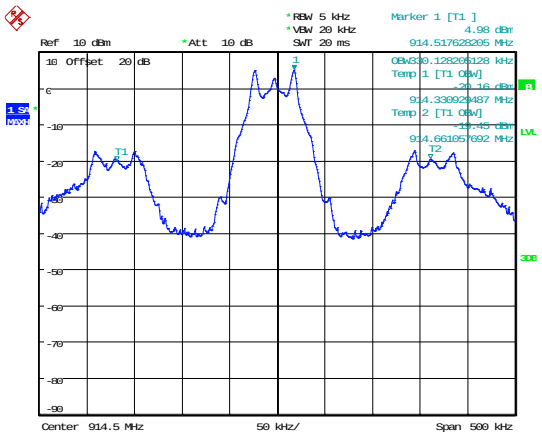
20dB Bandwidth 917.5MHz




Date: 17.JUN.2014 15:18:21

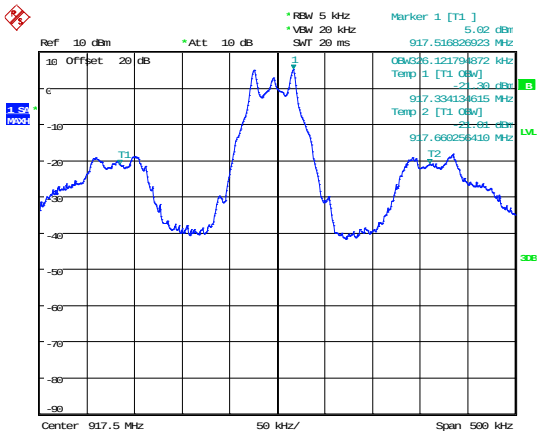
20dB Bandwidth 921MHz

## 99% Bandwidth



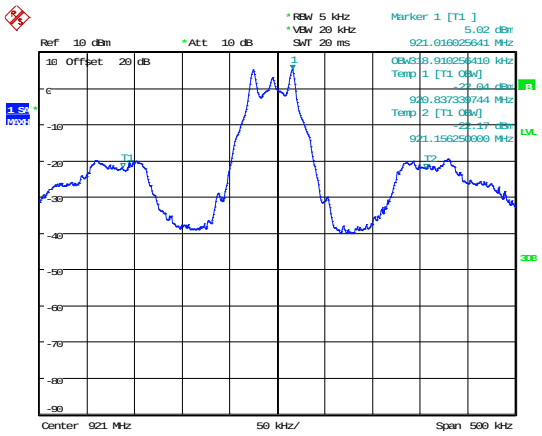

Date: 17.JUN.2014 15:31:56

99% Bandwidth 914.5MHz




Date: 17.JUN.2014 15:39:20

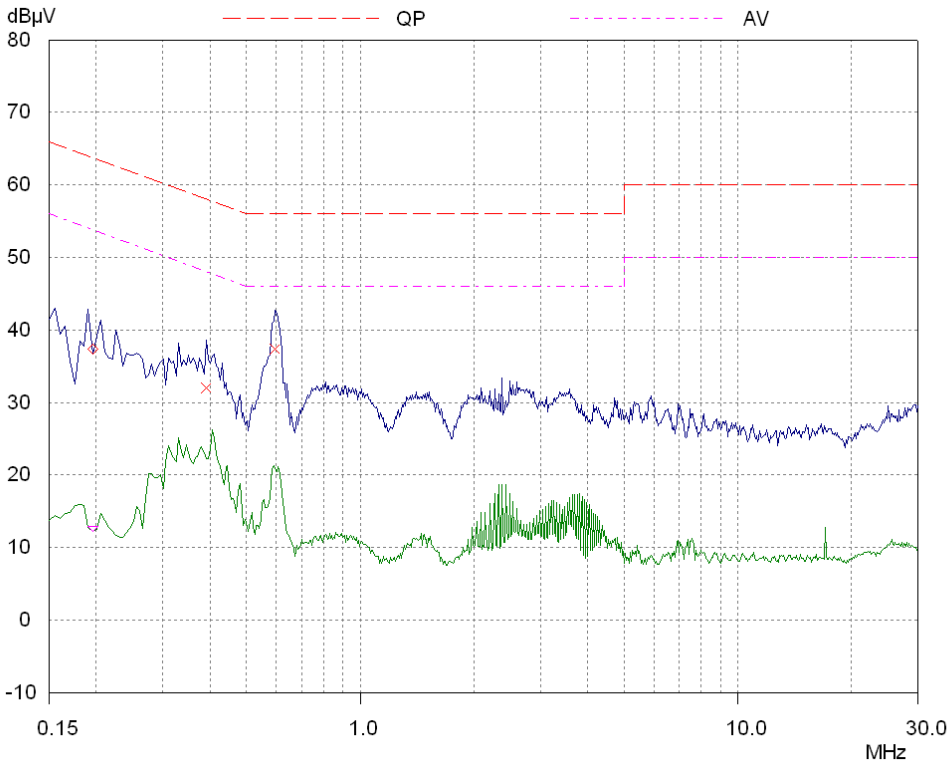
99% Bandwidth 917.5MHz



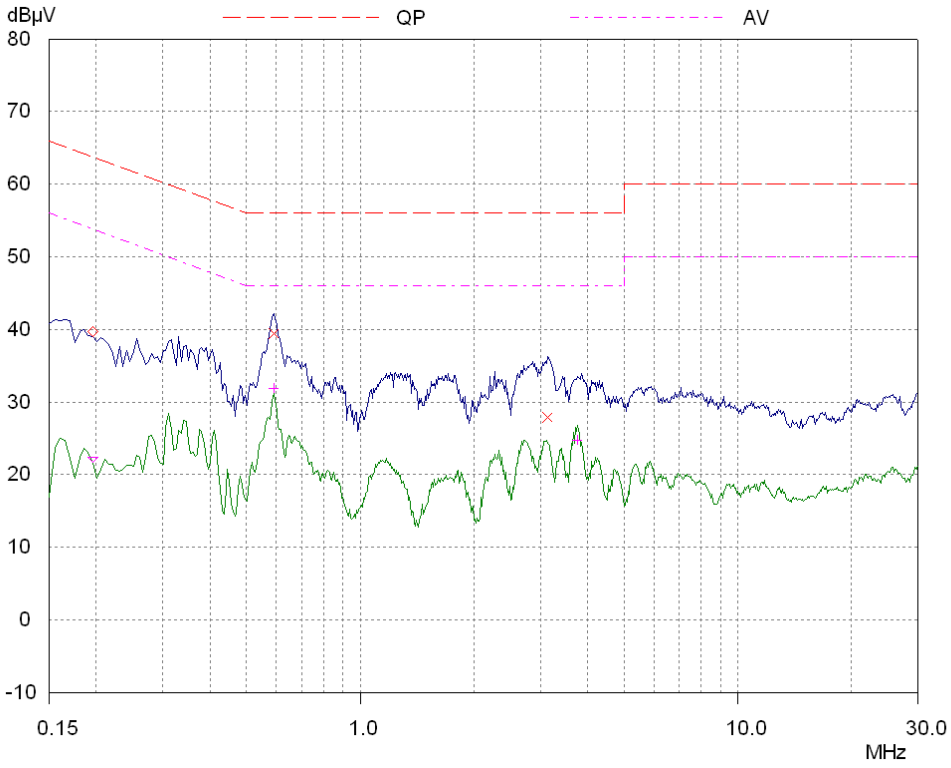

Date: 17.JUN.2014 14:48:10

99% Bandwidth 921MHz

Powerline Conducted Emissions - Smart Tag with on body charger

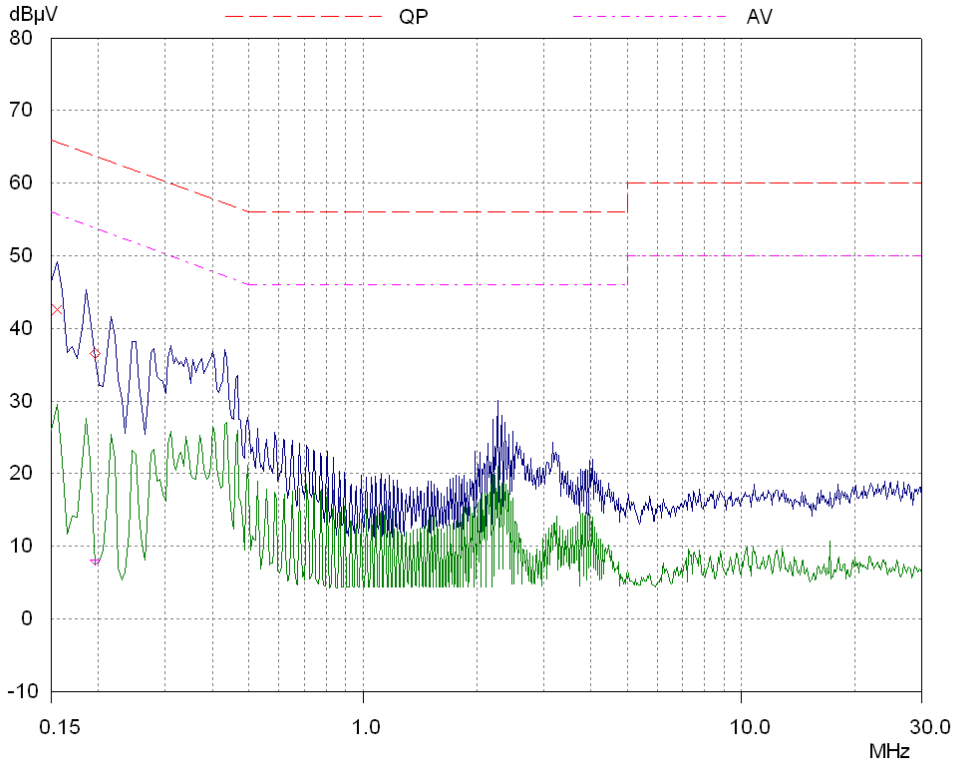



Live Line

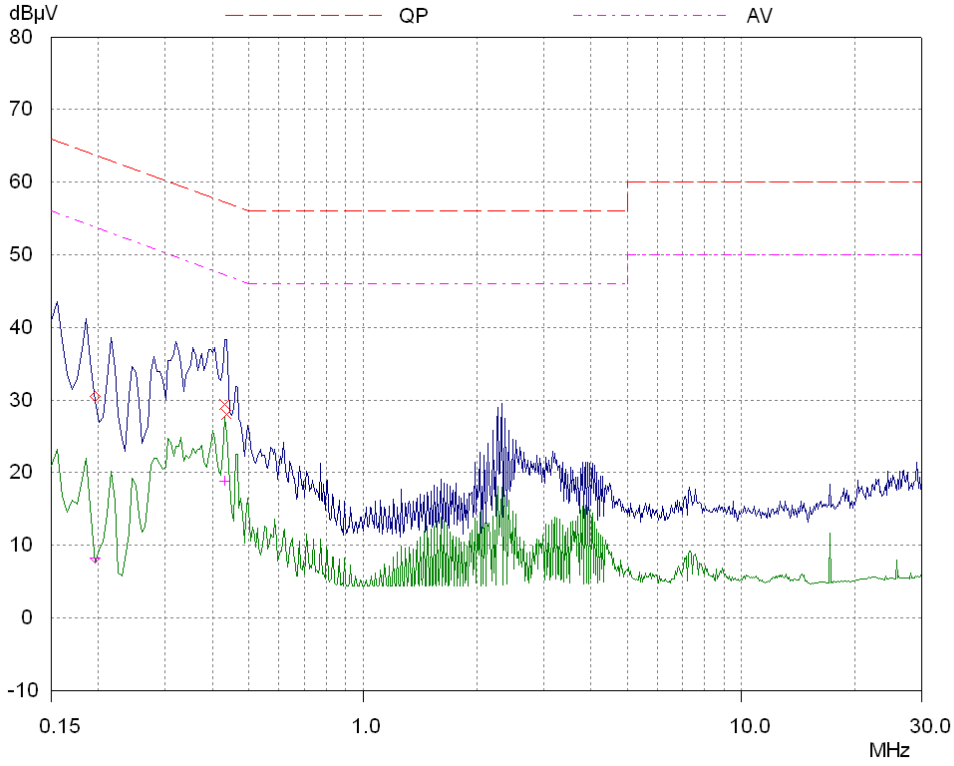



Neutral Line

Powerline Conducted Emissions - Smart Tag with docking station

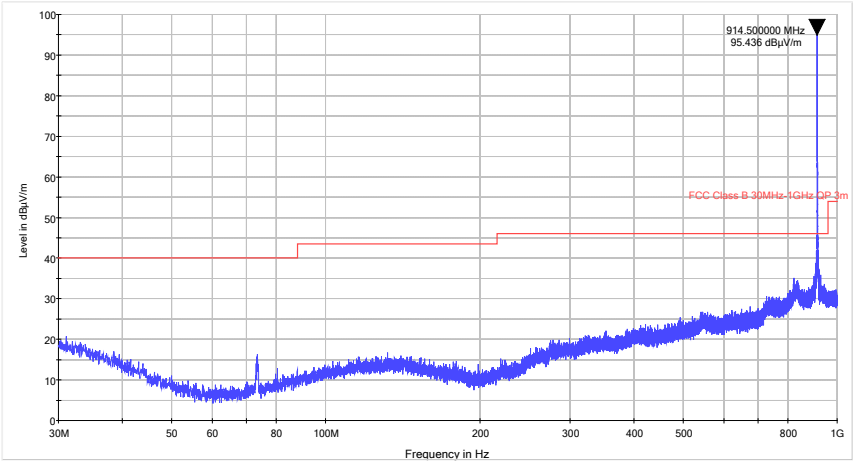



Live Line

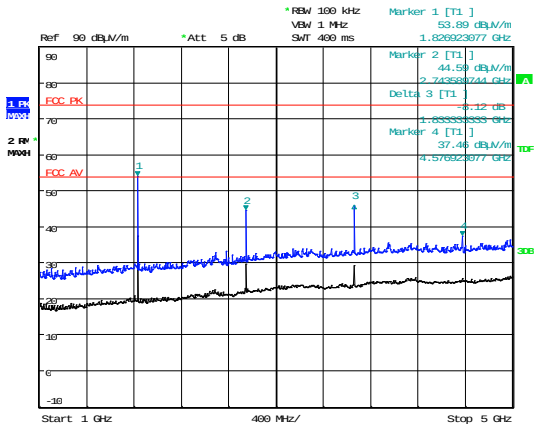



Neutral Line

Radiated Transmitter Emissions 914.5MHz - Smart Tag Standalone

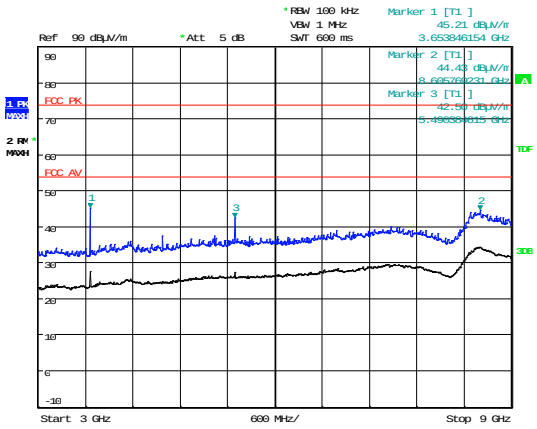



30MHz – 1GHz



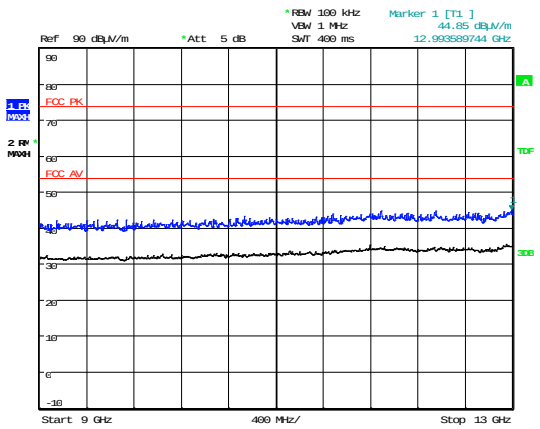

Date: 24.JUN.2014 18:42:01

1GHz – 5GHz



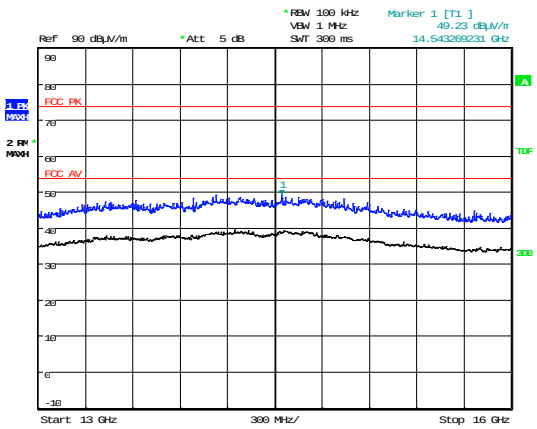

Date: 24.JUN.2014 18:43:33

5GHz – 9GHz




Date: 24.JUN.2014 18:44:05

9GHz – 13GHz

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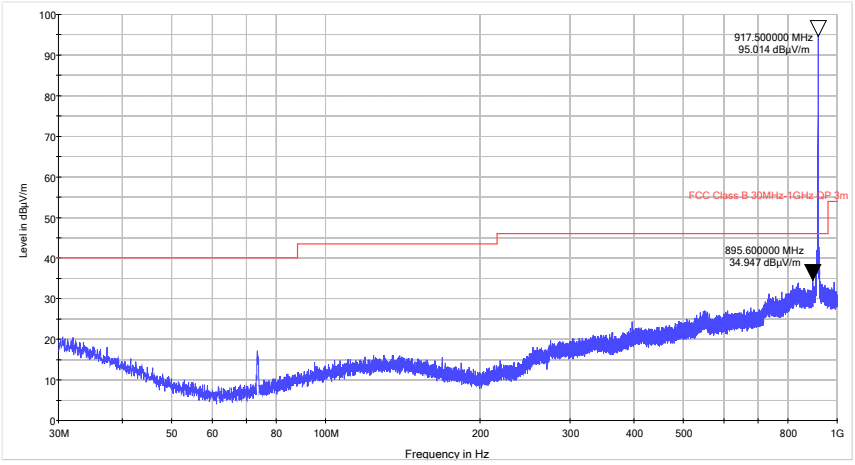
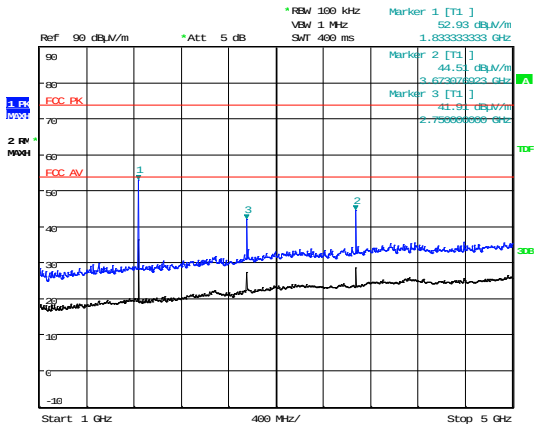
13GHz – 16GHz

Radiated Transmitter Emissions 917.5MHz - Smart Tag Standalone

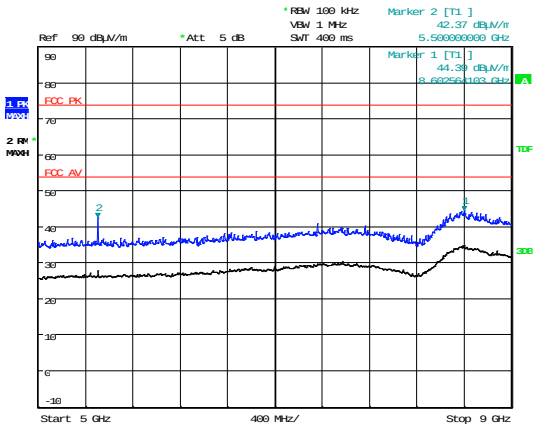



30MHz – 1GHz



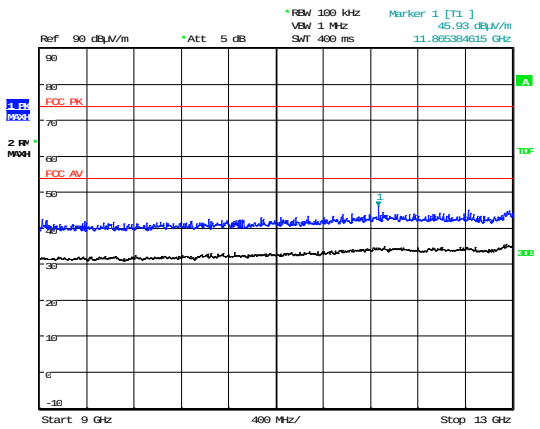

Date: 24.JUN.2014 18:57:49

1GHz – 5GHz



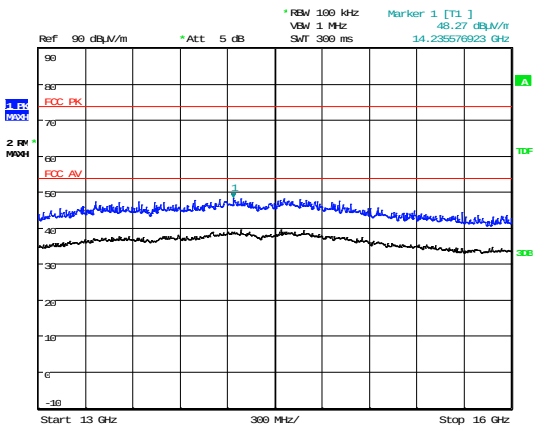

Date: 24.JUN.2014 18:56:58

5GHz – 9GHz




Date: 24.JUN.2014 18:55:48

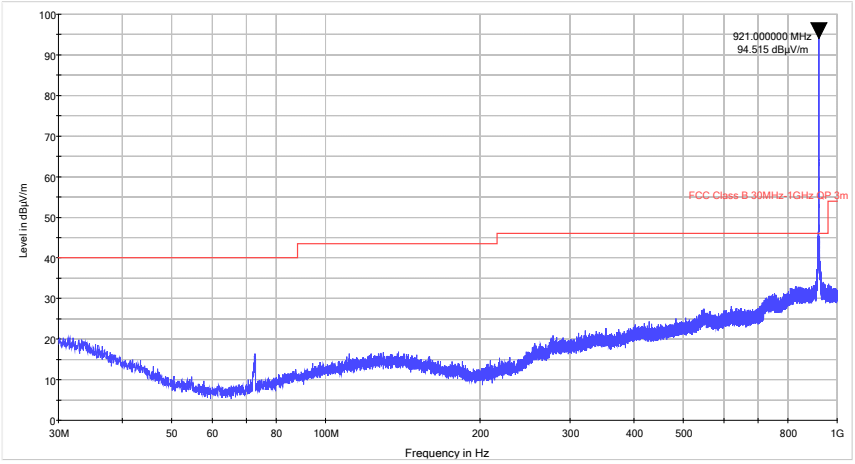
9GHz – 13GHz



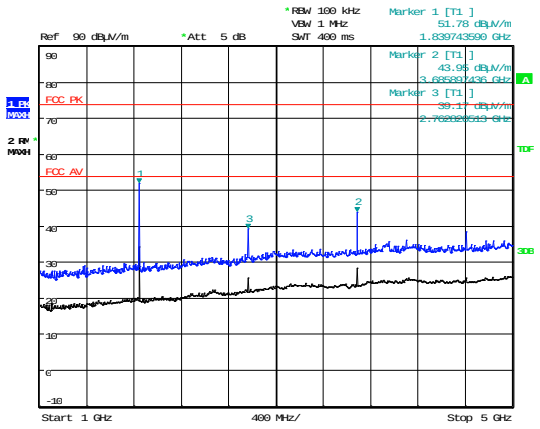

Date: 24.JUN.2014 18:55:27

13GHz – 16GHz

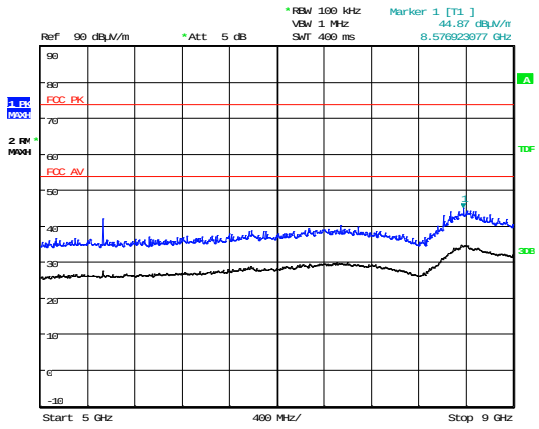
## Radiated Transmitter Emissions 921MHz - Smart Tag Standalone



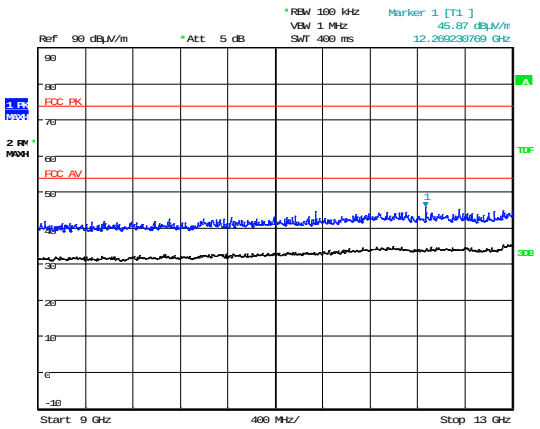

30MHz – 1GHz



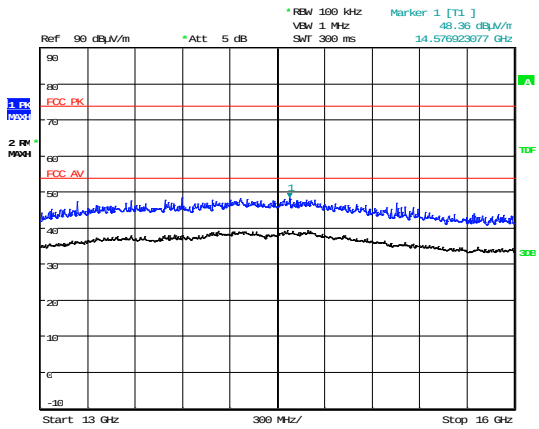

1GHz – 5GHz




5GHz – 9GHz

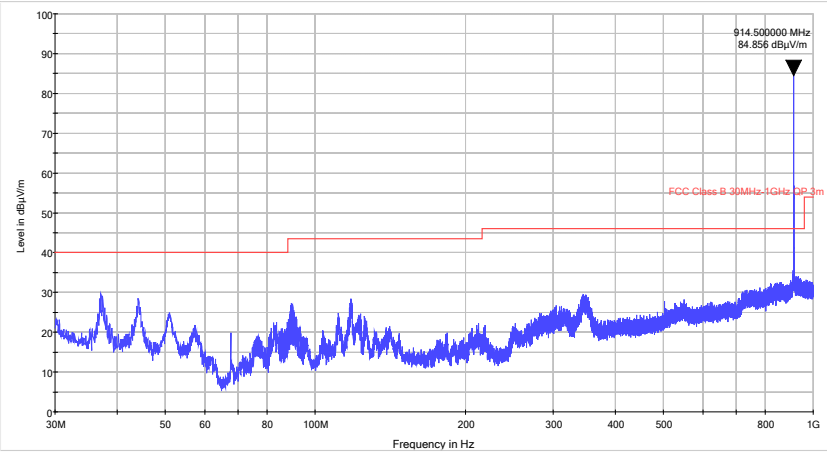



9GHz – 13GHz

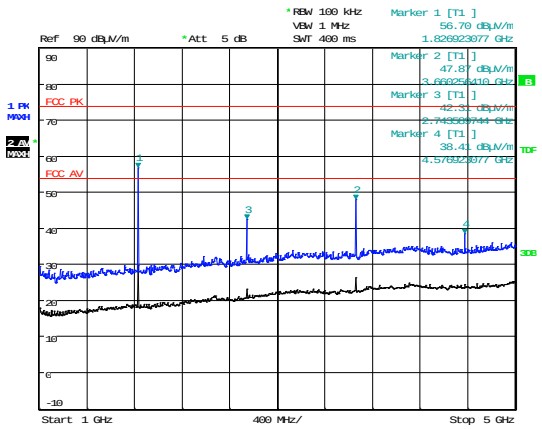



13GHz – 16GHz

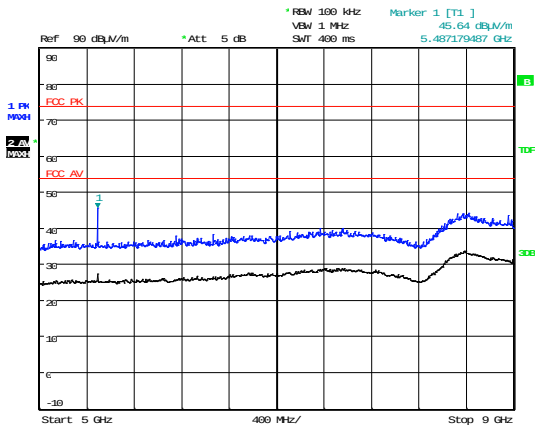
Radiated Transmitter Emissions 914.5MHz - Smart Tag with on body charger



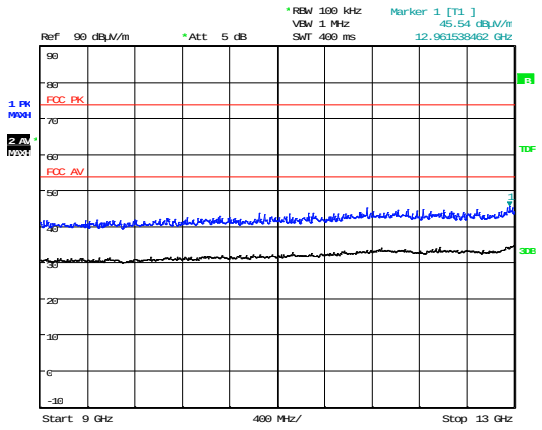

30MHz – 1GHz



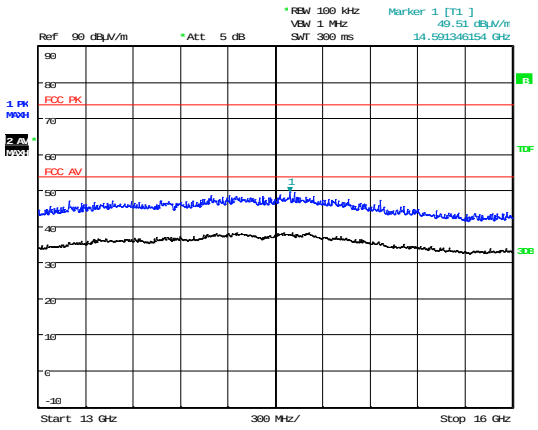

1GHz – 5GHz




5GHz – 9GHz

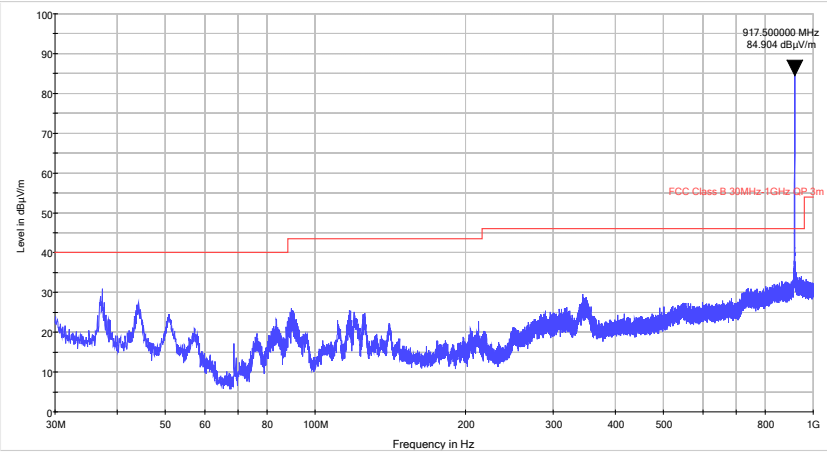



9GHz – 13GHz

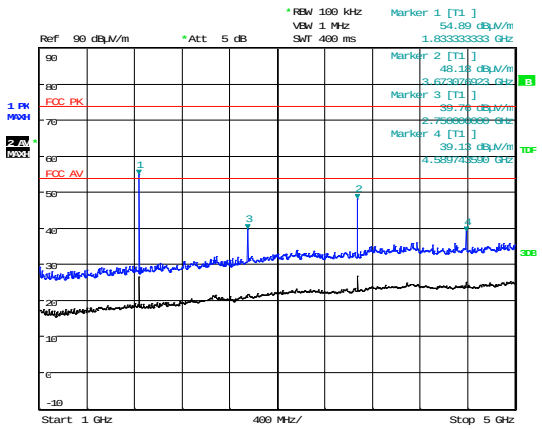



13GHz – 16GHz

Radiated Transmitter Emissions 917.5MHz - Smart Tag with on body charger

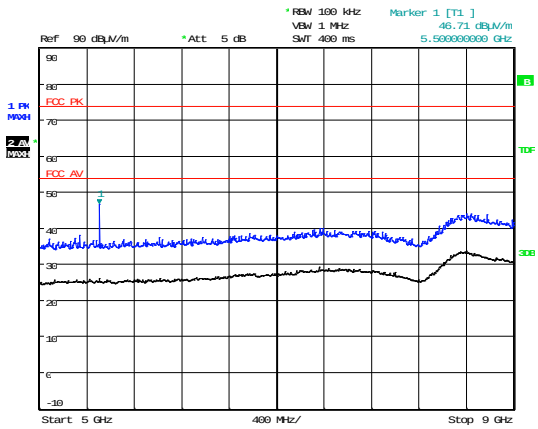



30MHz – 1GHz



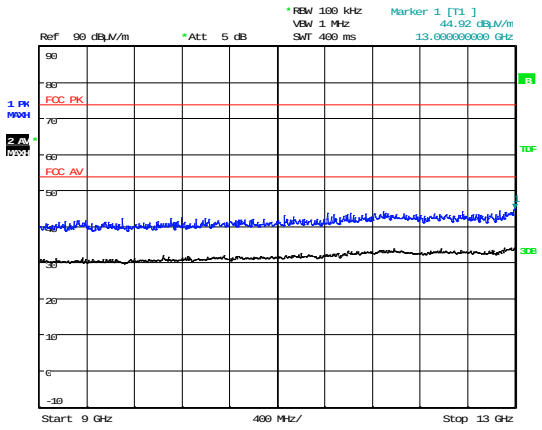

Date: 24.JUN.2014 15:40:56

1GHz – 5GHz



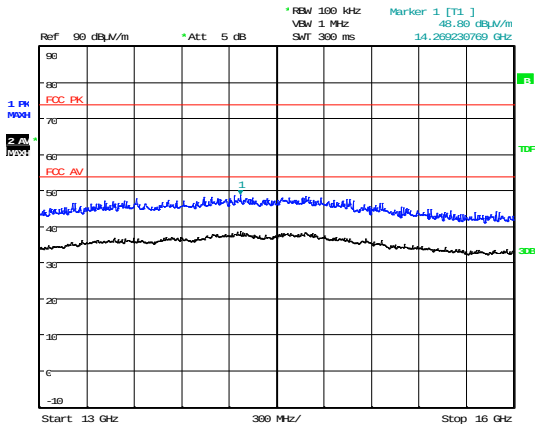

Date: 24.JUN.2014 15:41:54

5GHz – 9GHz




Date: 24.JUN.2014 15:42:09

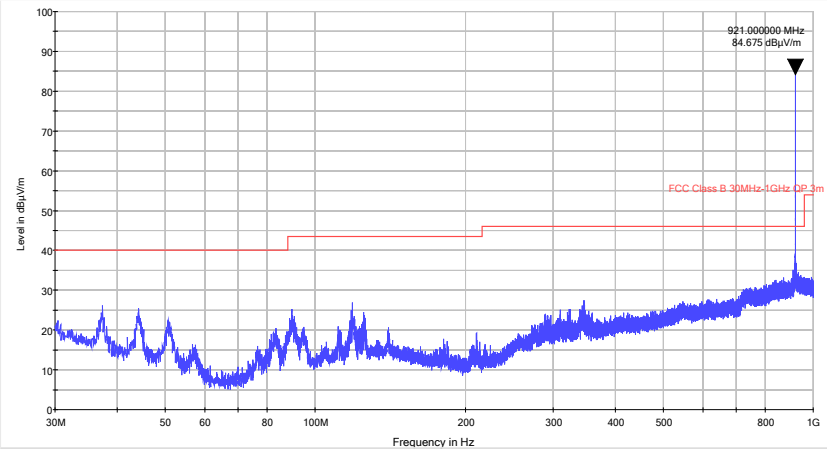
9GHz – 13GHz



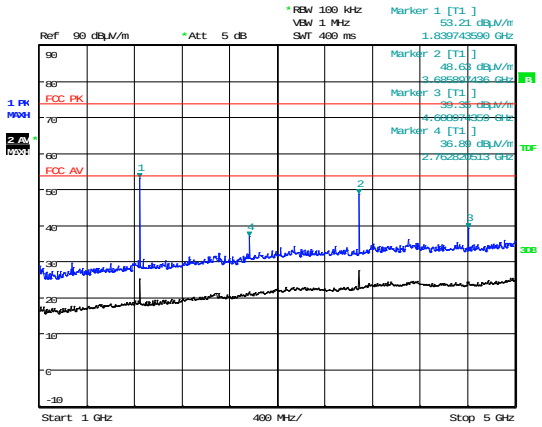

Date: 24.JUN.2014 15:42:32

13GHz – 16GHz

Radiated Transmitter Emissions 921MHz - Smart Tag with on body charger

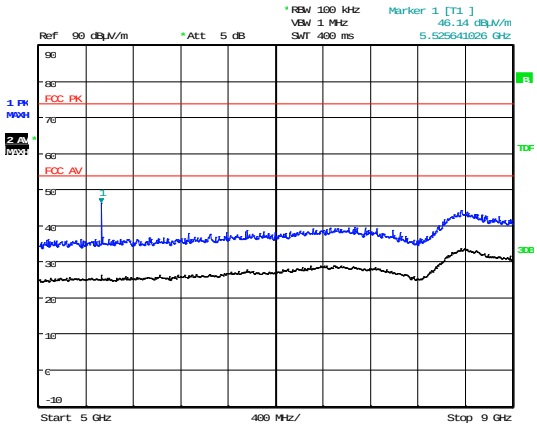



30MHz – 1GHz



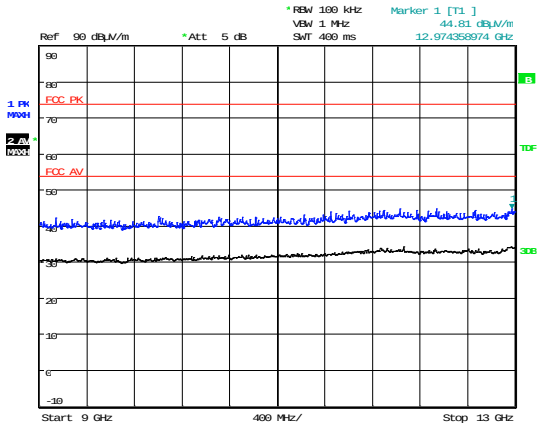

Date: 24.JUN.2014 15:50:59

1GHz – 5GHz



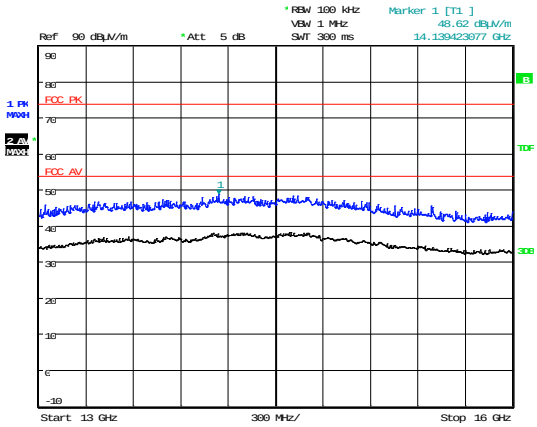

Date: 24.JUN.2014 15:50:06

5GHz – 9GHz




Date: 24.JUN.2014 15:49:16

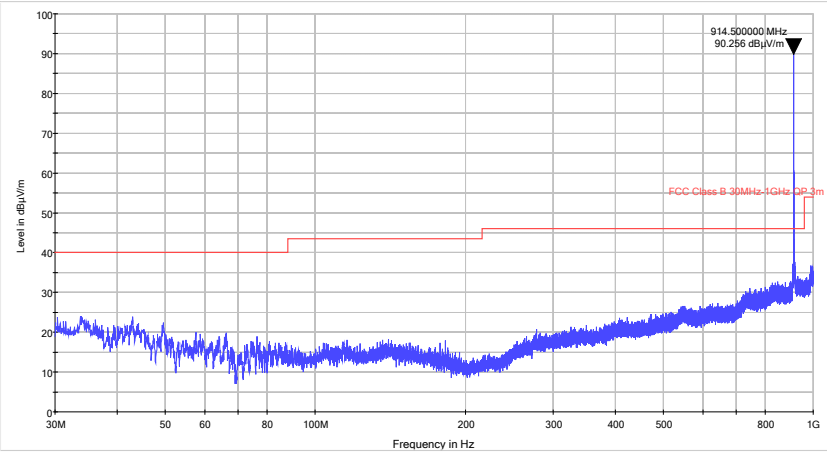
9GHz – 13GHz



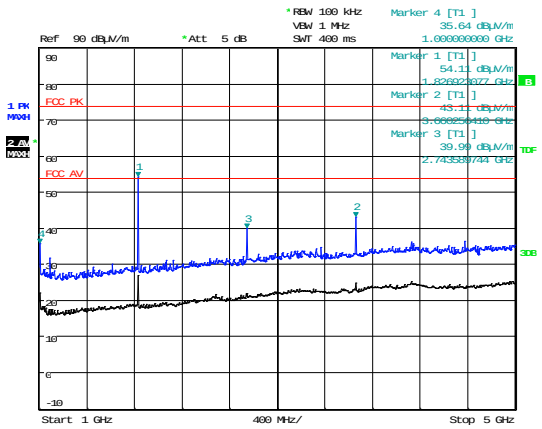

Date: 24.JUN.2014 15:48:56

13GHz – 16GHz

Radiated Transmitter Emissions 914.5MHz - Smart Tag with docking station

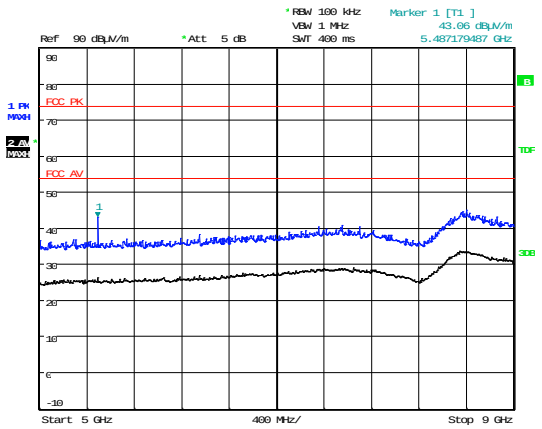



30MHz – 1GHz



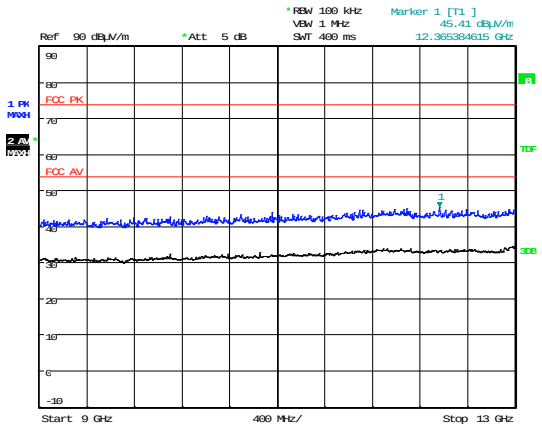

Date: 24.JUN.2014 12:01:20

1GHz – 5GHz



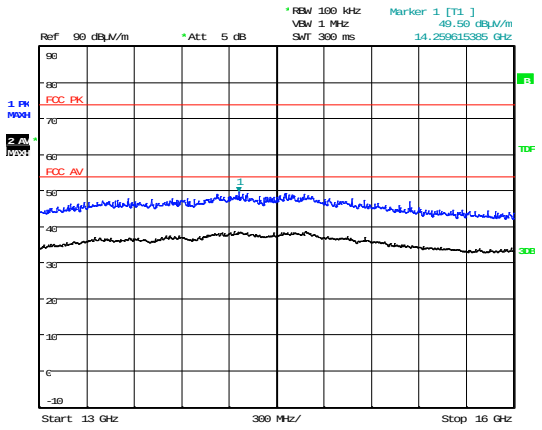

Date: 24.JUN.2014 12:00:21

5GHz – 9GHz




Date: 24.JUN.2014 11:59:25

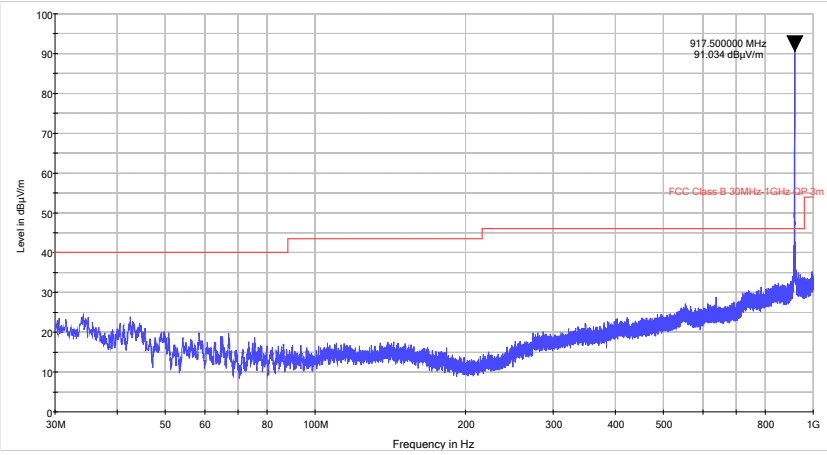
9GHz – 13GHz



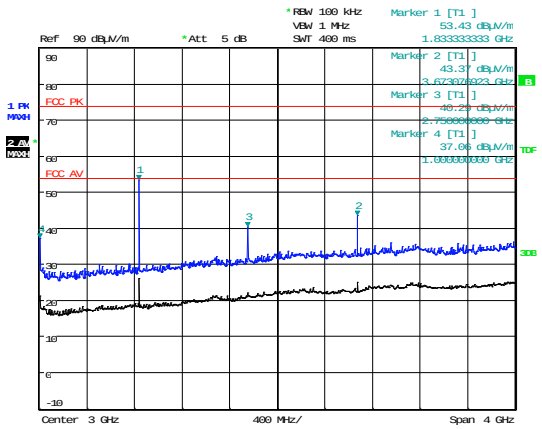

Date: 24.JUN.2014 11:58:31

13GHz – 16GHz

Radiated Transmitter Emissions 917.5MHz - Smart Tag with docking station

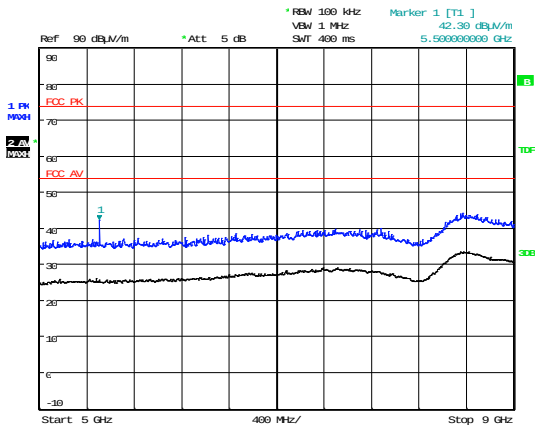



30MHz – 1GHz



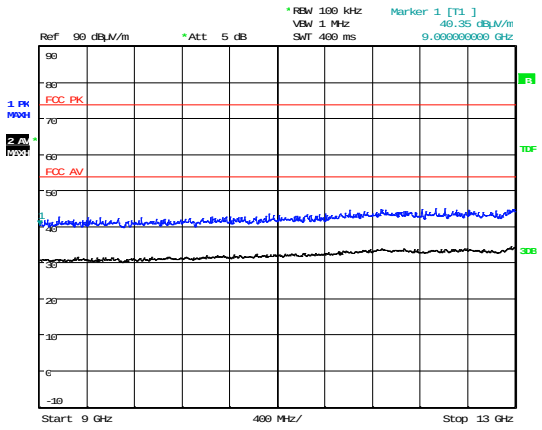

Date: 24.JUN.2014 12:03:42

1GHz – 5GHz



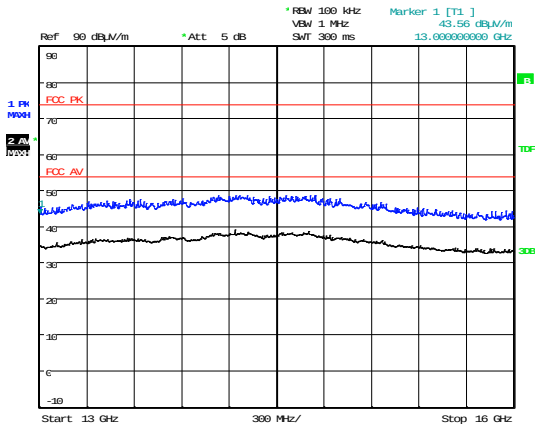

Date: 24.JUN.2014 12:04:48

5GHz – 9GHz




Date: 24.JUN.2014 12:05:48

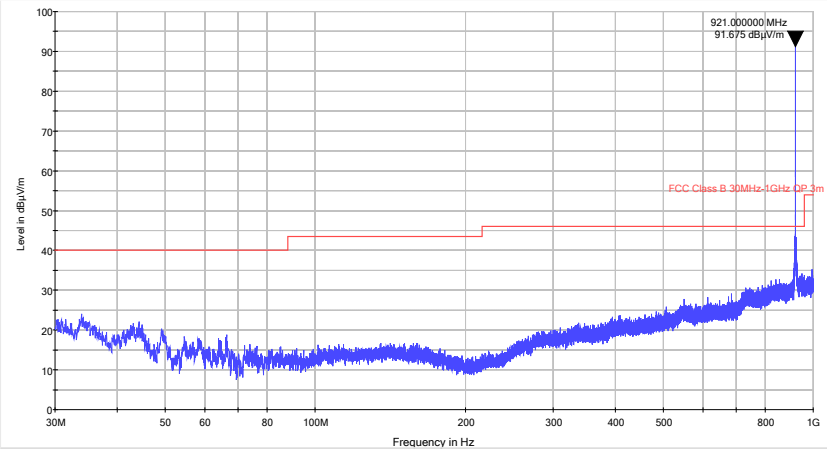
9GHz – 13GHz



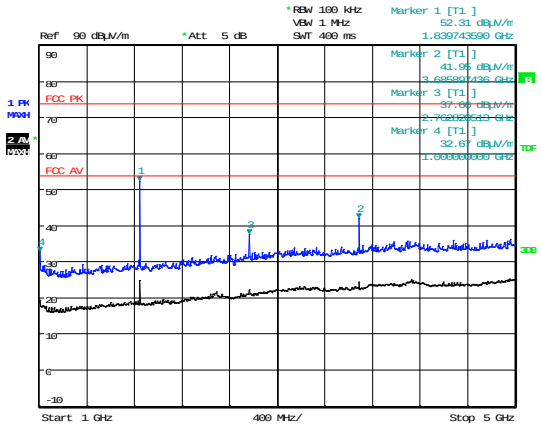

Date: 24.JUN.2014 12:06:44

13GHz – 16GHz

## Radiated Transmitter Emissions 921MHz - Smart Tag with docking station

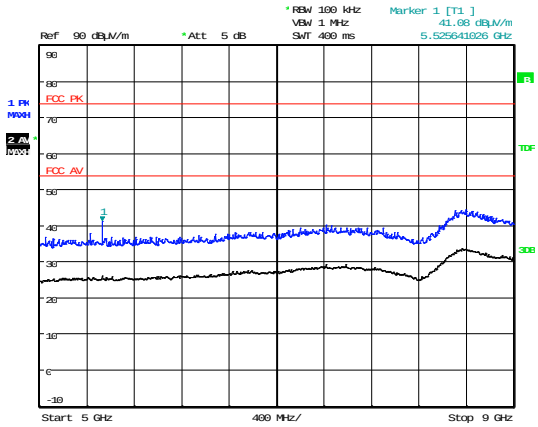



30MHz – 1GHz



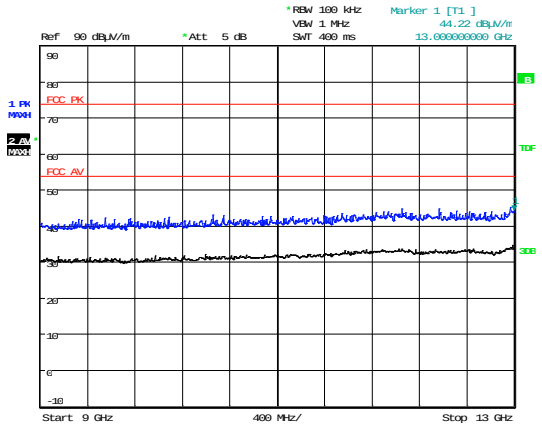

Date: 24.JUN.2014 12:18:02

1GHz – 5GHz



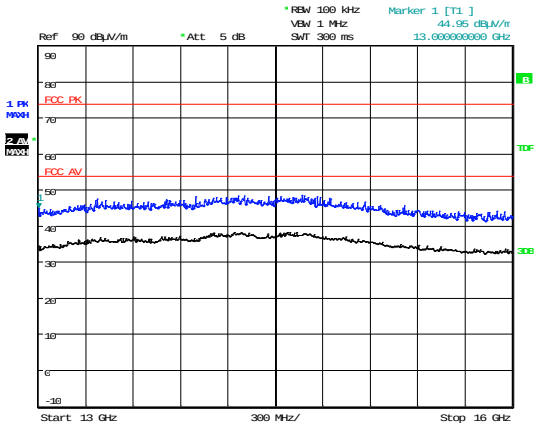

Date: 24.JUN.2014 12:17:04

5GHz – 9GHz




Date: 24.JUN.2014 12:16:05

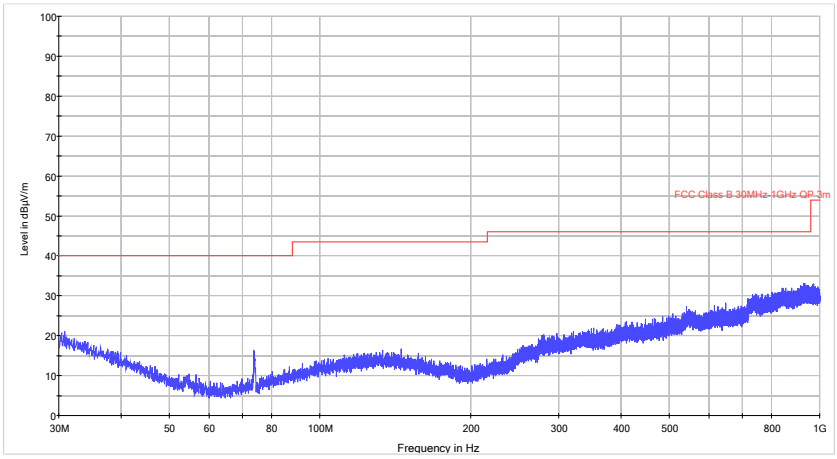
9GHz – 13GHz



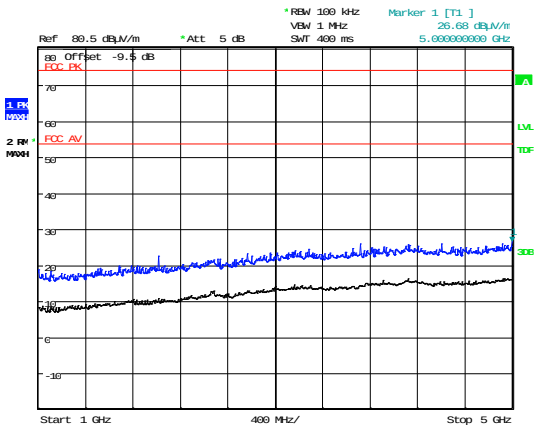

Date: 24.JUN.2014 12:15:47

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag Standalone

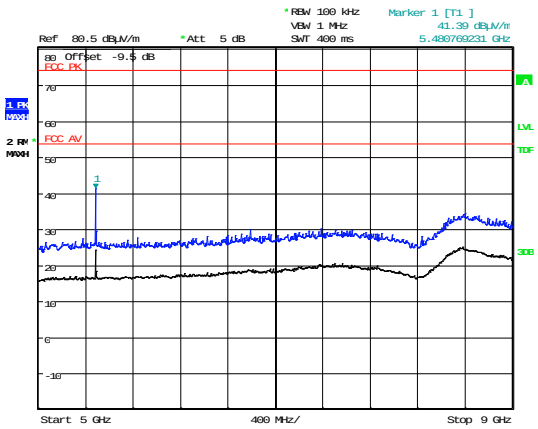



30MHz – 1GHz



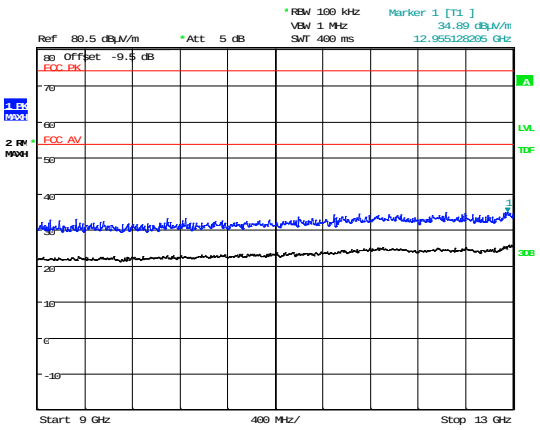

Date: 24.JUN.2014 18:28:35

1GHz – 5GHz



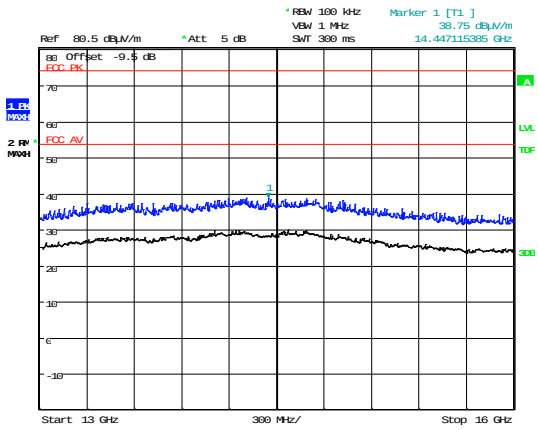

Date: 24.JUN.2014 18:30:25

5GHz – 9GHz




Date: 24.JUN.2014 18:30:43

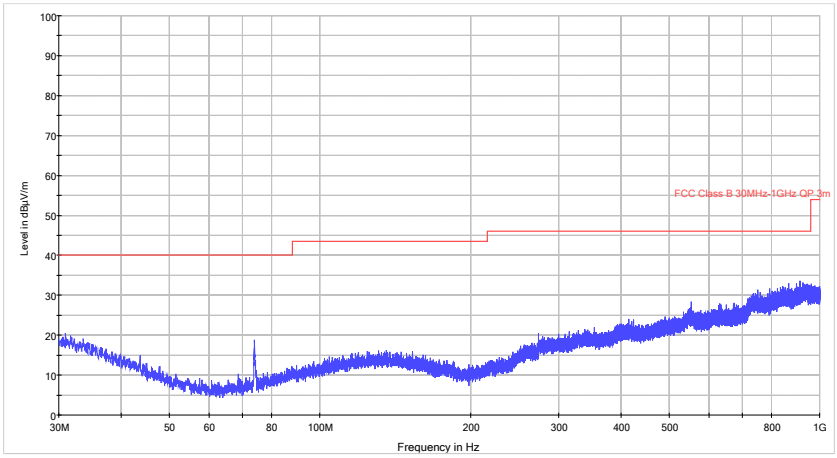
9GHz – 13GHz



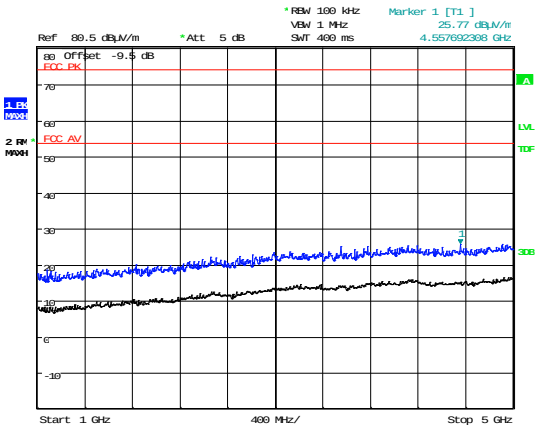

Date: 24.JUN.2014 18:30:58

13GHz – 16GHz

## Unintentional Radiated Emissions 917.5MHz - Smart Tag Standalone

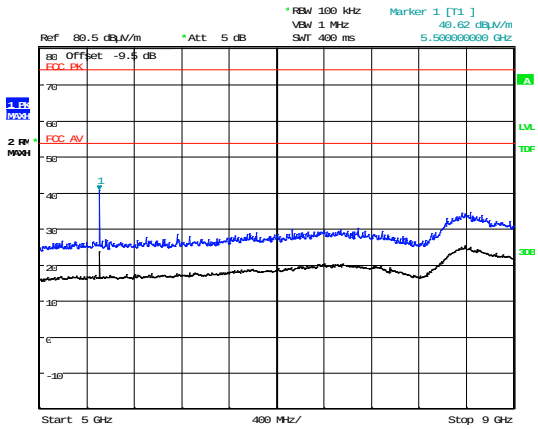



30MHz – 1GHz



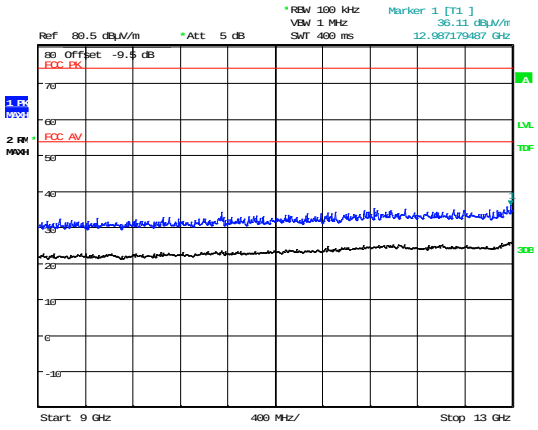

Date: 24.JUN.2014 18:36:08

1GHz – 5GHz



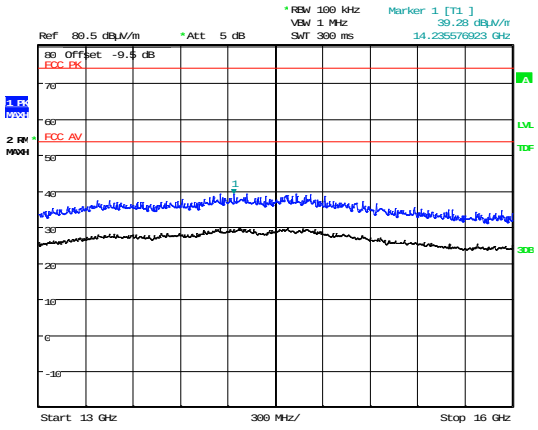

Date: 24.JUN.2014 18:36:45

5GHz – 9GHz




Date: 24.JUN.2014 18:35:49

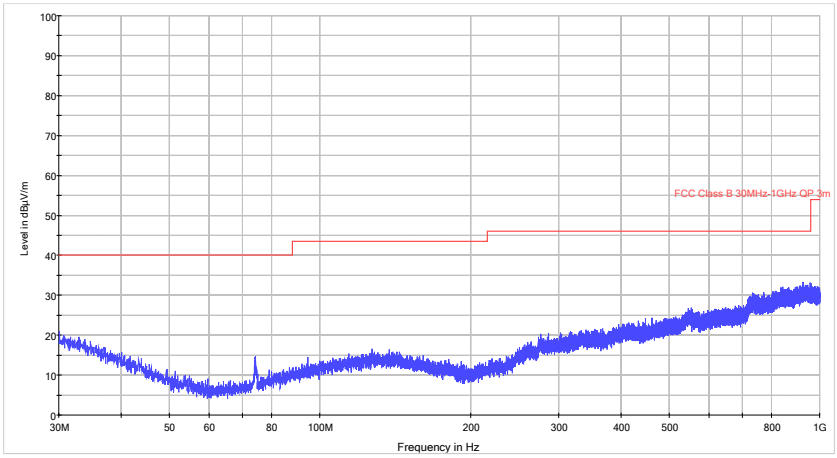
9GHz – 13GHz



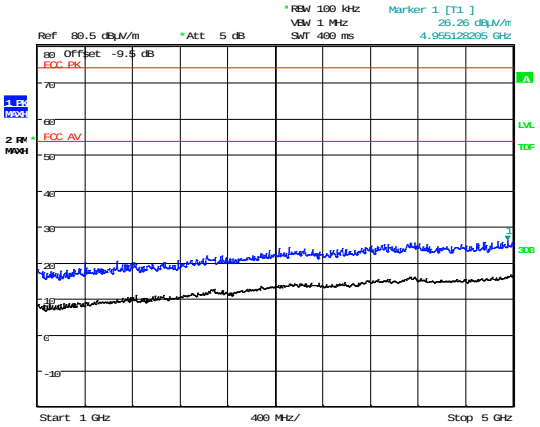

Date: 24.JUN.2014 18:35:15

13GHz – 16GHz

## Unintentional Radiated Emissions 921MHz - Smart Tag Standalone

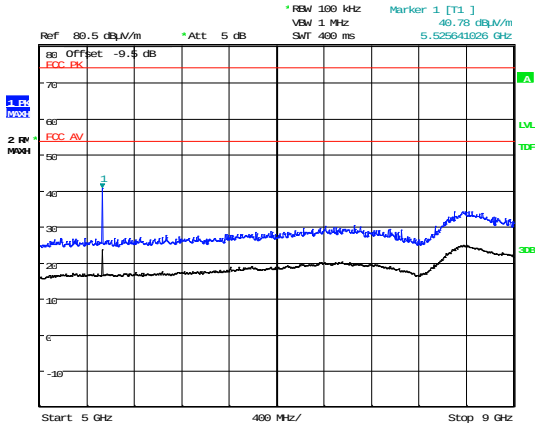



30MHz – 1GHz



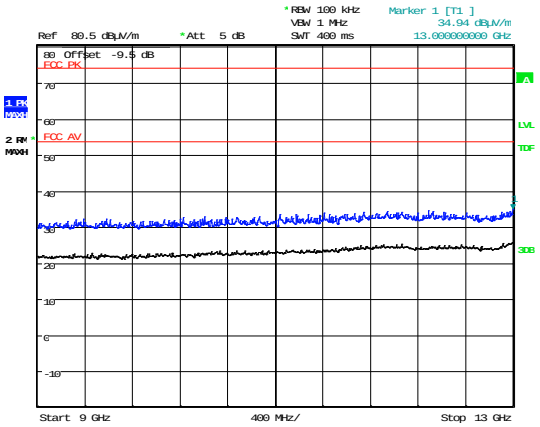

Date: 24.JUN.2014 18:26:12

1GHz – 5GHz



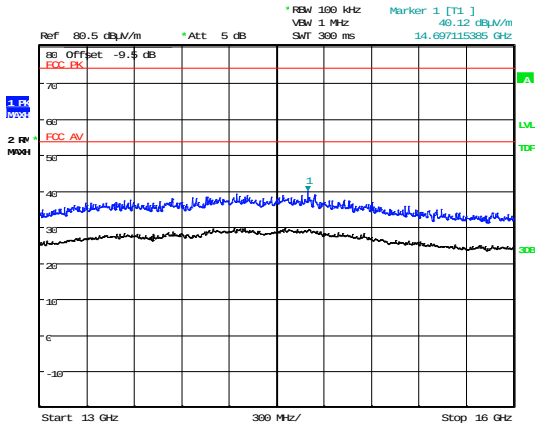

Date: 24.JUN.2014 18:25:42

5GHz – 9GHz




Date: 24.JUN.2014 18:24:46

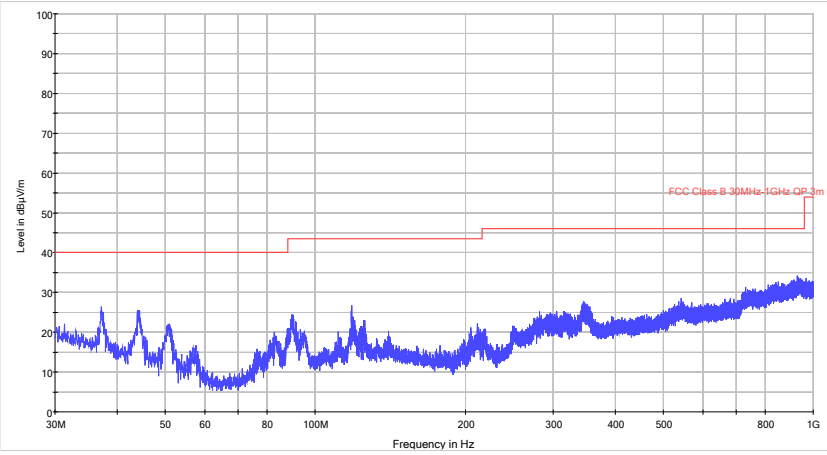
9GHz – 13GHz



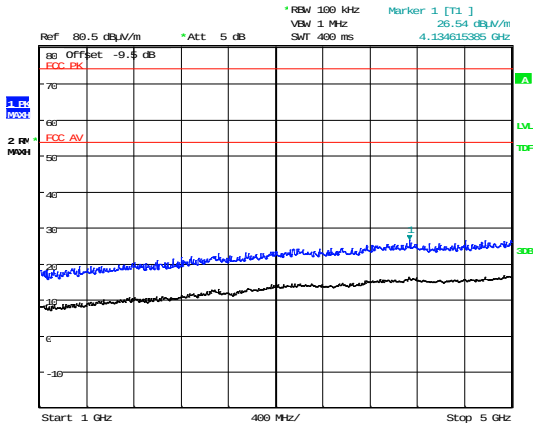

Date: 24.JUN.2014 18:24:28

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag with on body charger

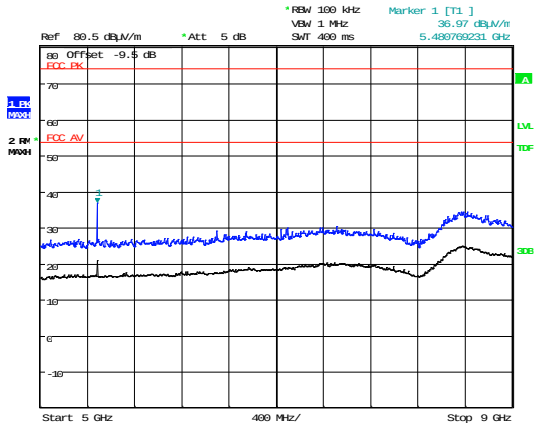



30MHz – 1GHz



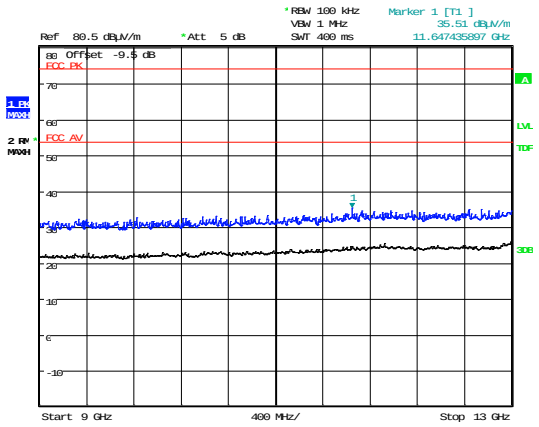

Date: 24.JUN.2014 17:56:27

1GHz – 5GHz



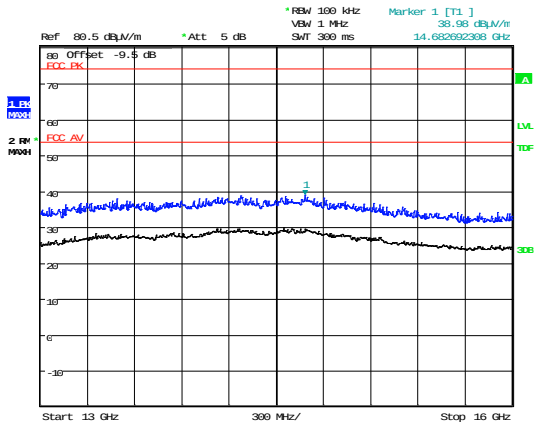

Date: 24.JUN.2014 17:57:14

5GHz – 9GHz




Date: 24.JUN.2014 17:57:31

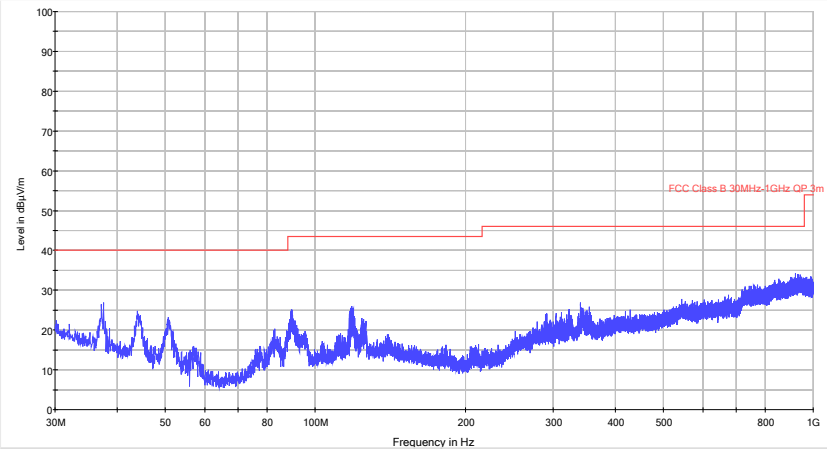
9GHz – 13GHz



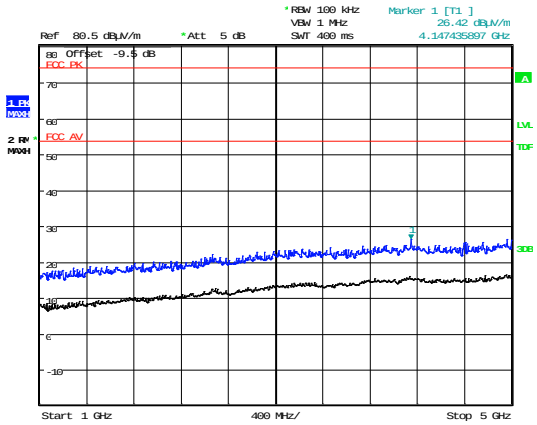

Date: 24.JUN.2014 17:57:47

13GHz – 16GHz

Unintentional Radiated Emissions 917.5MHz - Smart Tag with on body charger

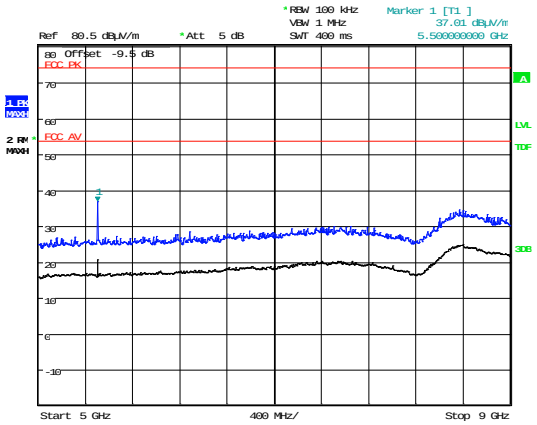



30MHz – 1GHz



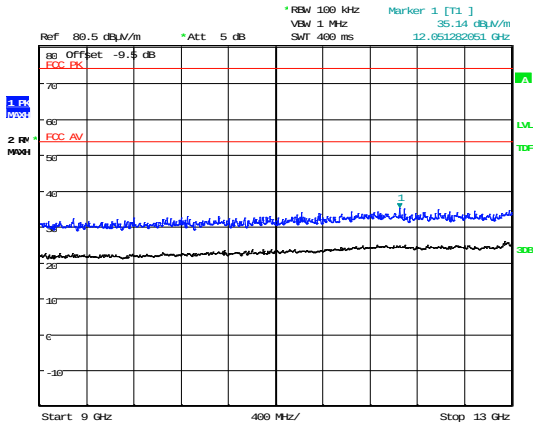

Date: 24.JUN.2014 18:05:04

1GHz – 5GHz



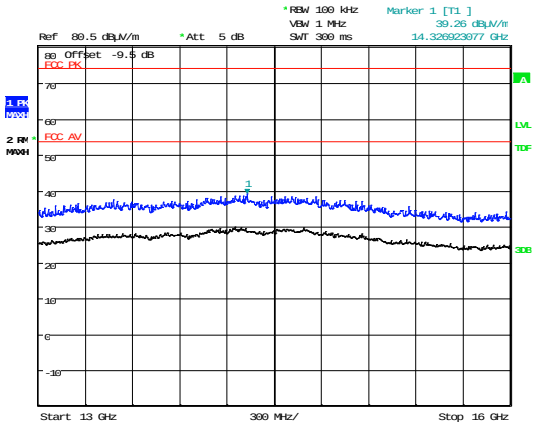

Date: 24.JUN.2014 18:04:47

5GHz – 9GHz




Date: 24.JUN.2014 18:04:07

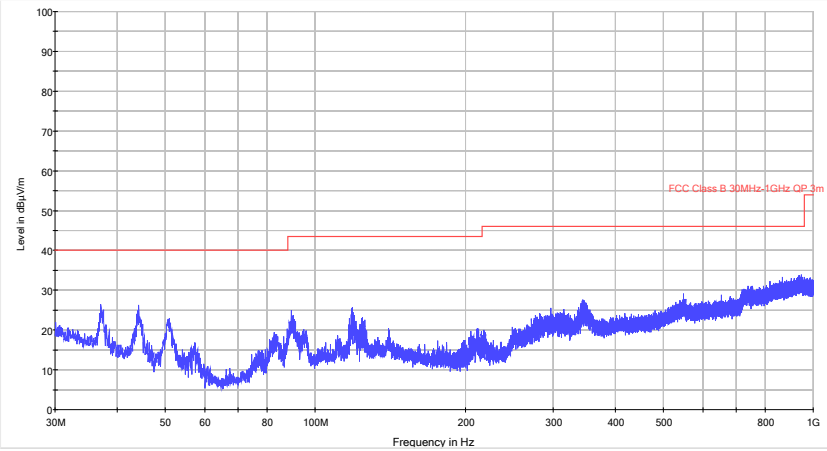
9GHz – 13GHz



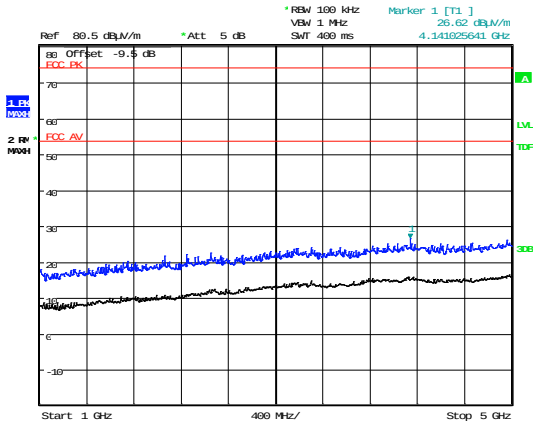

Date: 24.JUN.2014 18:03:48

13GHz – 16GHz

Unintentional Radiated Emissions 921MHz - Smart Tag with on body charger

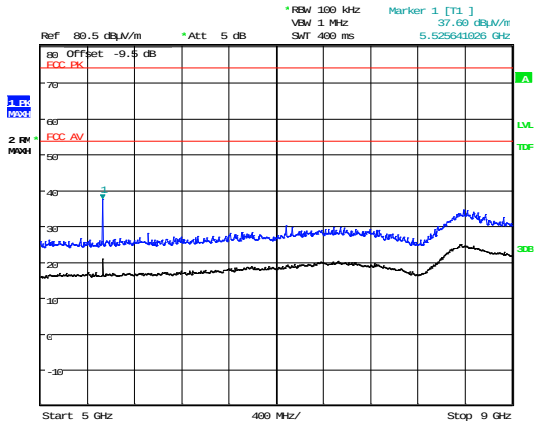



30MHz – 1GHz



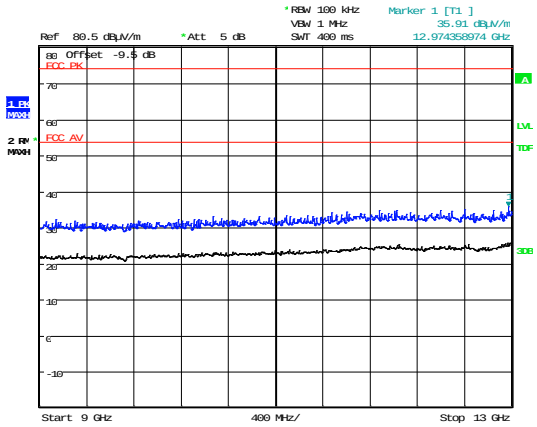

Date: 24.JUN.2014 18:06:25

1GHz – 5GHz



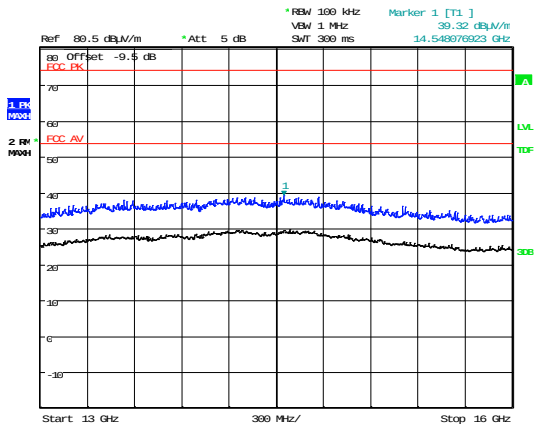

Date: 24.JUN.2014 18:06:48

5GHz – 9GHz




Date: 24.JUN.2014 18:07:05

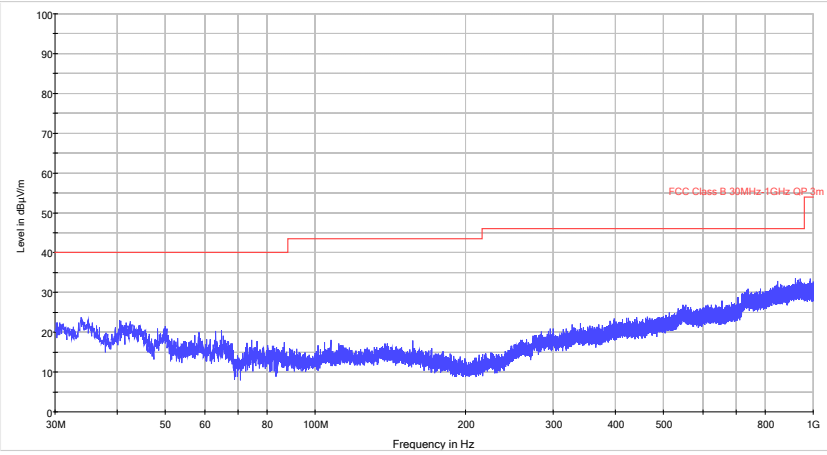
9GHz – 13GHz



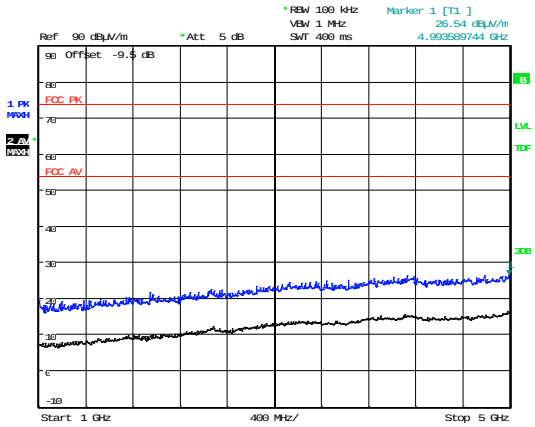

Date: 24.JUN.2014 18:07:24

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag with docking station

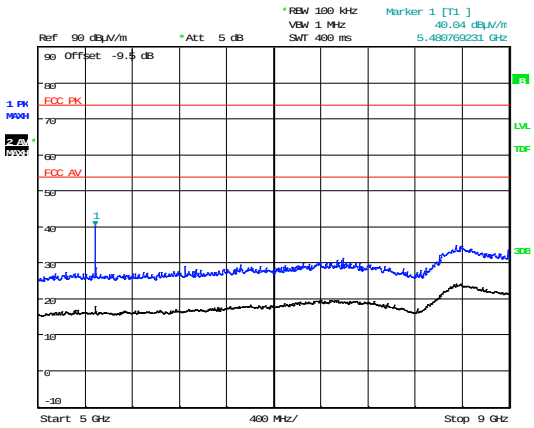



30MHz – 1GHz



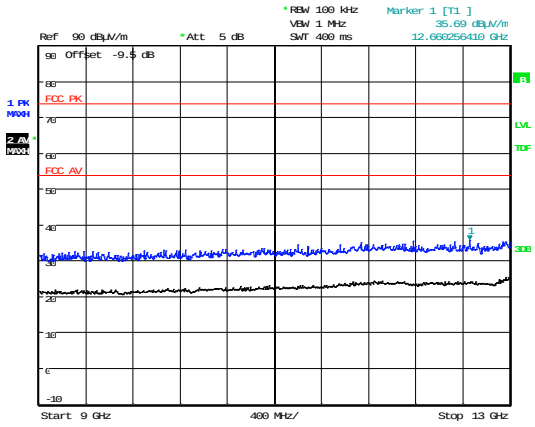

Date: 24.JUN.2014 12:32:19

1GHz – 5GHz



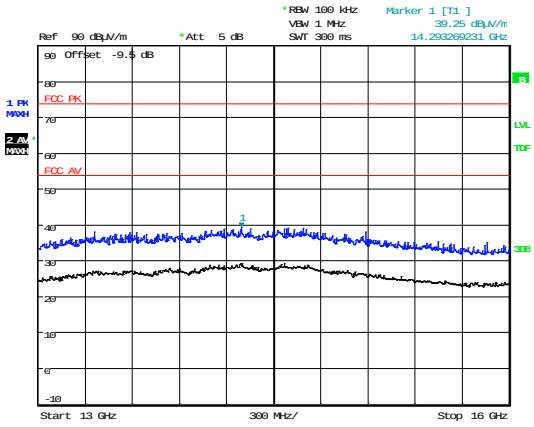

Date: 24.JUN.2014 12:31:36

5GHz – 9GHz




Date: 24.JUN.2014 12:30:21

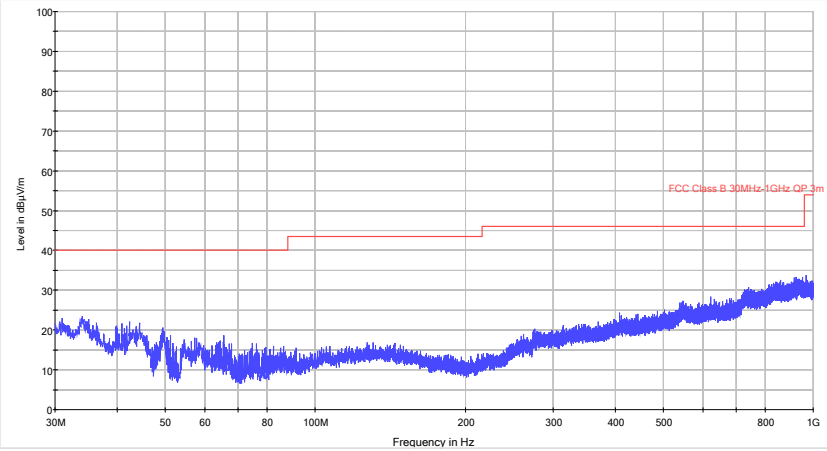
9GHz – 13GHz



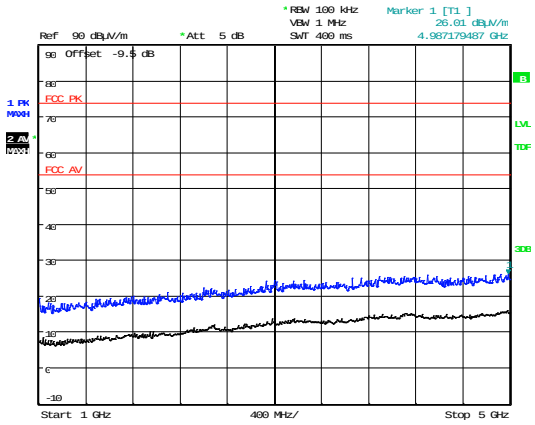

Date: 24.JUN.2014 12:29:59

13GHz – 16GHz

Unintentional Radiated Emissions 917.5MHz - Smart Tag with docking station

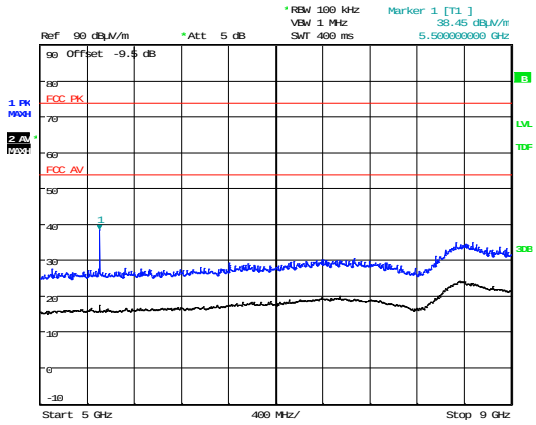



30MHz – 1GHz



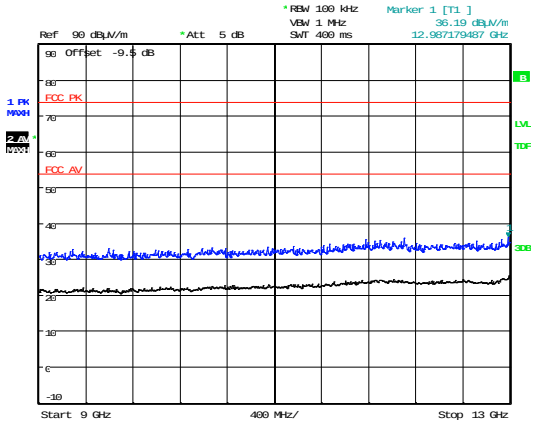

Date: 24.JUN.2014 12:33:56

1GHz – 5GHz



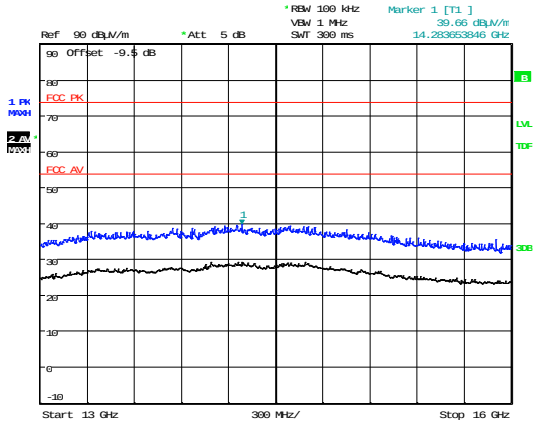

Date: 24.JUN.2014 12:34:39

5GHz – 9GHz




Date: 24.JUN.2014 12:34:59

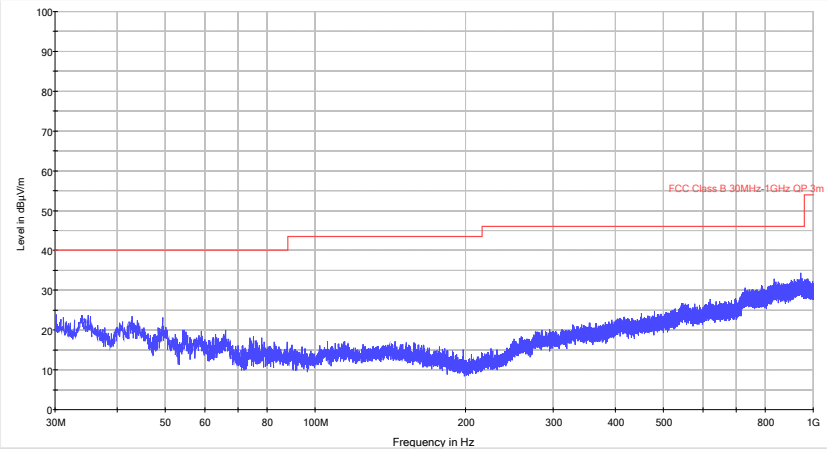
9GHz – 13GHz



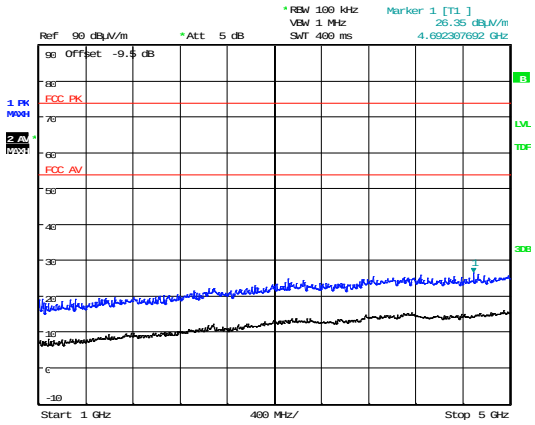

Date: 24.JUN.2014 12:35:42

13GHz – 16GHz

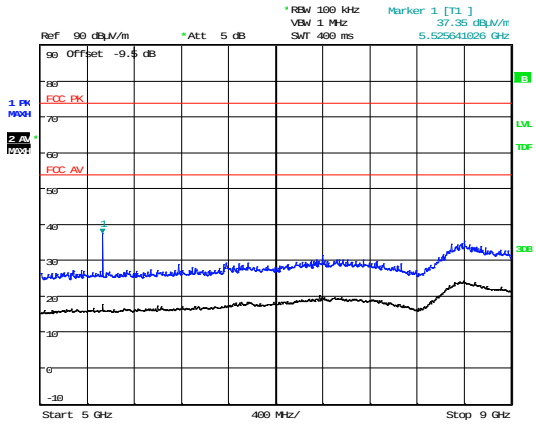
Unintentional Radiated Emissions 921MHz - Smart Tag with docking station



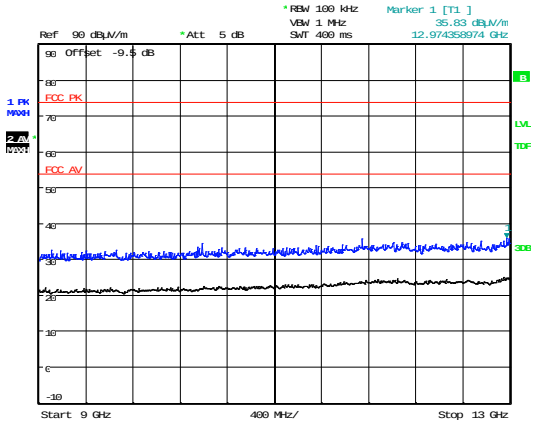

30MHz – 1GHz



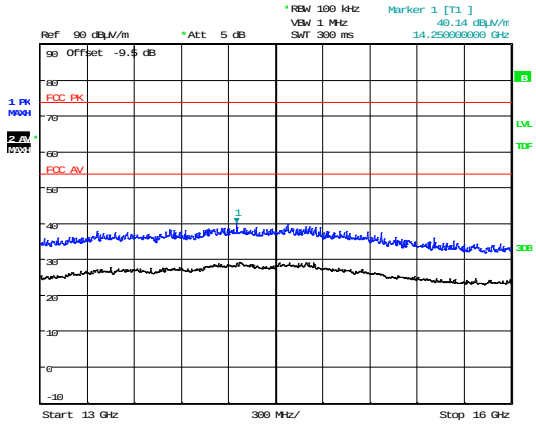

1GHz – 5GHz




5GHz – 9GHz




9GHz – 13GHz




13GHz – 16GHz

## Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

**Sample No:** Sxx Mod w

where:

xx = sample number eg. S01
w = modification number eg. Mod 2

The following terminology is used throughout the test report:

**Support Equipment (SE)** is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

**EUT configuration** refers to the internal set-up of the EUT. It may include for example:

Positioning of cards in a chassis.
Setting of any internal switches.
Circuit board jumper settings.
Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

**EUT arrangement** refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods – An Overview", which can be supplied by TraC Global upon request.

## C1 Test samples

The following samples of the apparatus were submitted by the client for testing:

| Sample No. | Description | Identification |
|---|---|---|
| S07 | Dock Power Supply | 3A-181WP06 |
| S10 | On body Charger with Power Supply | OBC00028 / EPU15 |
| S17 | Docking Station | UBIN 34030017 |
| S24 | Smart Tag Strap | None |
| S28 | Buddi Colorado System – Smart Tag | STG00038 |

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

| Sample No. | Description | Identification |
|---|---|---|
| S22 | Mode Switch Tool | T4641RW |
| | | |
| | | |

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

| Identification | Description |
|---|---|
| None | |

## C2 EUT operating mode during testing

During testing, the EUT was exercised as described in the following tables:

| Test | Description of Operating Mode: |
|---|---|
| All Transmitter Tests | EUT actively transmitting |

| Test | Description of Operating Mode: |
|---|---|
| Receiver radiated spurious emissions | EUT in receive mode |

| Test | Description of Operating Mode: |
|---|---|
| PLCE | EUT in transmit and receive modes |

## C3 EUT Configuration Information

The EUT was submitted for testing in one single possible configuration.

## C4 List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S28
Tests : Radiated Emissions

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|---|---|---|---|
| EUT has got no external ports | | | |

## C5 Details of Equipment Used

| TRaC No | Equipment Type | Equipment Description | Manufacturer | Last Cal Calibration | Calibration Period | Due For Calibration |
|---|---|---|---|---|---|---|
| UH191 | CBL611/A | Bilog | Chase | 13/12/2012 | 24 | 13/12/2014 |
| UH387 | ATS | Chamber 1 | Rainford EMC | 04/07/2013 | 12 | 04/07/2014 |
| UH405 | FSU26 | Spectrum Analyser | R&S | 16/04/2014 | 12 | 16/04/2015 |
| UH281 | FSU46 | Spectrum Analyser | R&S | 26/03/2014 | 12 | 26/03/2015 |
| L138 | 3115 | 1-18GHz Horn | EMCO | 17/10/2013 | 24 | 17/10/2015 |
| L317 | ESVS10 | Receiver | R&S | 12/02/2014 | 12 | 12/02/2015 |
| REF940 | ATS | Radio Chamber - PP | Rainford EMC | 09/07/2013 | 12 | 09/07/2014 |
| L572 | 8449B | Pre Amp | Agilent | 11/02/2014 | 12 | 11/02/2015 |
| UH187 | ESHS10 | Receiver | R&S | 19/02/2014 | 12 | 19/02/2015 |
| UH396 | ENV216 | Lisn | R&S | 22/05/2014 | 12 | 22/05/2015 |

## Appendix D: Additional Information

This report contains no additional information.

**Appendix E: Calculation of the duty cycle correction factor**

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsewidths and period was measured

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = 20 x ($Log_{10}$ Calculated Duty Cycle)

Therefore the calculated duty cycle was determined:

$$\text{Duty cycle} = \frac{\text{the sum of the highest average value pulse widths over 100ms}}{100\text{ms}}$$

e.g

$$= \frac{5.929ms}{100ms} = 0.05929$$

Correction factor (dB) = 20 x ($Log_{10}$ 0.05929) = 24.5dB

Duty cycle correction factor to be used is:

Txon period 5.929ms in 100ms
Worse case 5.929ms in 100ms

Therefore 20log (5.929÷100) = 24.5dB.

## Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

For Smart Tag standalone

1. Radiated electric field emissions arrangement: Overview
2. Radiated electric field emissions arrangement: Close up

For Smart tag with on body charger

3. Radiated electric field emissions arrangement: Overview
4. Radiated electric field emissions arrangement: Close up
5. AC Powerline Conducted Emissions: Overview

For Smart Tag with docking station

6. Radiated electric field emissions arrangement: Overview
7. Radiated electric field emissions arrangement: Close up
8. AC Powerline Conducted Emissions: Overview

Photograph 1


Photograph 2

Photograph 3


Photograph 4

Photograph 5

Photograph 6


Photograph 7

Photograph 8

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