# Radiated Spurious Emissions Radio Testing of the

# IPS Group Inc.
# Single Space Parking Meter Model: MK5J

In accordance with
FCC CFR Part 24, 27
RSS-133 issue 6 Amendment 1 (January 2018)
RSS-130 issue 2 (February 2019)

America

Add value.
Inspire trust.

IPS Group Inc.
7737 Kenamar Court
San Diego, CA 92121
USA

## COMMERCIAL-IN-CONFIDENCE

Date: November 2020
Document Number: 72162499C Rev.01 Issue 01 | Version Number: 01

| | | | |
|---|---|---|---|
| **Authorized Signatory** | Alex Chang | November 10, 2020 | Alex Chang |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

**EXECUTIVE SUMMARY**
A sample of this product was tested and found to be in compliance with FCC CFR Part 24, 27, RSS-133 issue 6 Amendment 1 (January 2018) and RSS-130 issue 2 (February 2019).

A2LA Cert. No. 2955.13



TÜV SÜD America, Inc.
10040 Mesa Rim Road
San Diego, CA 92121-2912

TÜV SÜD America, Inc.
Rancho Bernardo Facility
16936 Via Del Campo
San Diego, CA 92127

Phone: 858 678 1400
www.tuv-sud-america.com

| | |
|---|---|
| **REPORT ON** | Radiated Spurious Emissions Radio Testing of the IPS Group Inc.<br>Model: MK5J Single Space Parking Meter |
| **TEST REPORT NUMBER** | 72162499C Rev.01 |
| **TEST REPORT DATE** | November 2020 |
| **PREPARED FOR** | IPS Group Inc.<br>7737 Kenamar Court<br>San Diego, CA 92121<br>USA |
| **CONTACT PERSON** | Gary Thomas<br>Sr. RF Design Engineer<br>gary.thomas@ipsgroupinc.com<br>(858) 768-2401 |
| **PREPARED BY** | Xiaoying Zhang<br>**Name**<br>Authorized Signatory<br>Title: Wireless/EMC Test Engineer |

## Revision History

72162499C Rev.01
IPS Group Inc.
Model: MK5J Single Space Parking Meter

| DATE | OLD REVISION | NEW REVISION | REASON | PAGES AFFECTED | APPROVED BY |
|---|---|---|---|---|---|
| 10/21/2020 | — | Initial Release | | | Alex Chang |
| 11/10/2020 | Initial Release | Rev.01 | FCC / IC IDs correction | All | Alex Chang |
| | | | | | |
| | | | | | |
| | | | | | |

# CONTENTS

# SECTION 1

# 1 REPORT SUMMARY

Radiated Spurious Emissions Radio Testing of the
IPS Group Inc.
Model: MK5J Single Space Parking Meter

## 1.1 Introduction

The information contained in this report is intended to show verification of the IPS Group Inc. MK5J Smart Parking Meter to the requirements of FCC CFR Part 24, 27, RSS-133 issue 6 Amendment 1 (January 2018) and RSS-130 issue 2 (February 2019).

| | |
|---|---|
| Objective | To perform Class II Permissive Change verification to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.<br>Only radiated spurious emissions testing was performed. The NFC, RFID 13.56 MHz, 430 MHz, BLE and Cellular modules imbedded in the EUT were FCC certified. |
| Manufacturer | IPS Group Inc. |
| EUT | Smart Parking Meter |
| Model Name | Single Space Parking Meter |
| Model Name | MK5J |
| FCC ID | SGWIPS2007SSPM |
| IC Number | 11583A-IPS2007SSPM |
| Serial Number(s) | 0000466294 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | • FCC CFR Part 24, 27 (October 1, 2019).<br>• RSS-133 - 2 GHz Personal Communications Services (issue 6, Amendment 1, January 2018)<br>• RSS-130 - Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz (issue 2, February 2019)<br>• RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 5, November 2019 Amendment 1) |
| Start of Test | September 11, 2020 |
| Finish of Test | October 05, 2020 |
| Name of Engineer(s) | Xiaoying Zhang |
| Related Document(s) | • ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.<br>• Supporting documents for EUT certification are separate exhibits. |

## 1.2 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC CFR Part 24, 27 with cross-reference to the corresponding ISED RSS standard is shown below.

| Section | FCC Part 2, 24, 27 Spec Clause | RSS-133 | RSS-130 | Test Description | Result | Comments/ Base Standard |
|---|---|---|---|---|---|---|
| 2.1 | 2.1053<br>24.238(a)<br>27.53(c)(2) | 6.5 | 4.7 | Field Strength of Spurious Radiation | Compliant | - |

## 1.3 Product Information

### 1.3.1 Technical Description

The Equipment Under Test (EUT) was an IPS Group Inc. Single Space Parking Meter Model: MK5J. The EUT is part of the Smart Metering Collection System. It uses RFID 13.56 MHz for cashbox identification, BLE for user pay by phone interface during collection process. NFC for tap and go payment by credit cards, RFID 430 MHz to relay vehicle sensor data to main processor and Cellular for web-based Data Management System (DMS). The radiated spurious emissions of cellular modem LTE Band 2 and 13 functions of the EUT was verified under this test report.

### 1.3.2 EUT General Description

| | |
|---|---|
| EUT Description | Smart Parking Meter |
| Model Name | Single Space Parking Meter |
| Model Number(s) | MK5J |
| Rated Voltage | • Lithium Battery (3.6V) IPS Group Inc. TL-5420/5P/IPS<br>• Tadiran Batteries TLI-1550A 4V 330mAh (on-board battery) |
| Mode Verified | LTE Band 2 and 13 |
| Frequency Range | LTE Band 2: 1850 – 1910 MHz<br>LTE Band 13: 699 – 716 MHz |
| Capability | LTE Band 2, 4 and 13 |
| Primary Unit (EUT) | ☒ Production<br>☐ Pre-Production<br>☐ Engineering |
| (Client declaration, max. antenna gain covered under this test report) | Max. 0.5 dBi |

### 1.3.3 Approved Module Installed

| Technology | Model | FCC ID | Antenna Gain/Type |
|---|---|---|---|
| Cellular | Quectel BG96 | XMR201707BG96 | 0.5 dBi, IPS LTE Batwing 795-771-PCB Rev 01 |
| BLE | BGM13P32A | QOQ-BGM13P | 0.5 dBi, Mini 2.45 GHz Antenna, Johanson Technology P/N 2450AT18A100 |
| 430 MHz | MK5 SSPM | SGWIPS2007SSPM | 1.9 dBi, LINX Tech, ANT-433-HETH (helical, through-hole) |

*Information contained in this table were declared by the manufacturer.*

## 1.4 EUT Test configuration

### 1.4.1 Test Configuration Description

| *Test Configuration* | *Description* |
|---|---|
| Default | Transmit Mode. EUT in Diagnostic Mode and NFC, RFID 13.56 MHz, 420 MHz RFID turned on. BLE set to single channel transmit mode and the cellular radio set to active mode. A CMW500 was used to establish a call using LTE Bands 2, 4 and 13. |

### 1.4.2 EUT Exercise Software

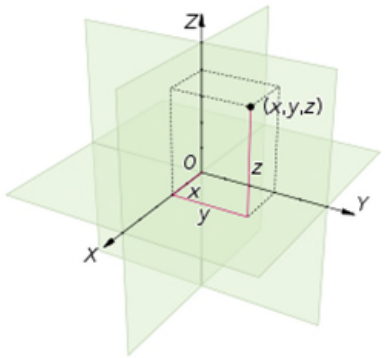
The EUT was running Diagnostic Software Version 52.79.9 when verified.

### 1.4.3 Support Equipment and I/O cables

| *Manufacturer* | *Equipment/Cable* | *Description* |
|---|---|---|
| Protek | DC Power Suppy Unit | Model: 18020M<br>Output: 0 – 18 VDC 20A |

### 1.4.4 Worst Case Configuration

For radiated measurements, the EUT only works at Y orientations. The verification was done at “Y” as worst-case configuration.




### 1.4.5 Simplified Test Configuration Diagrams

Not required. EUT verified on standalone configuration. EUT is battery operated, nonetheless DC power input connections were provided by the manufacturer in order for the EUT to sustain extended testing time without totally draining the battery.

### 1.5 Deviations from the Standard

No deviations from the applicable test standards or test plan were made during testing.

### 1.6 Modification Record

| Description of Modification | Modification Fitted By | Date Modification Fitted |
|---|---|---|
| Serial Number: 0000466294 | | |
| N/A | — | — |

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

### 1.7 Test Methodology

All measurements contained in this report were conducted with ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

For conducted and radiated emissions, the equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

### 1.8 Test Facility Location

#### 1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: (858) 678 1400 Fax: (858) 546 0364

#### 1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: (858) 678 1400 Fax: (858) 546 0364.

### 1.9 Test Facility Registration

#### 1.9.1 FCC – Designation No.: US1146

TÜV SÜD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Designation is US1146.

### 1.9.2 Innovation, Science and Economic Development Canada (ISED) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

### 1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TÜV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

### 1.9.4 NCC (National Communications Commission - US0102)

TÜV SÜD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP0002 for Low-Power RF Device type of testing.

### 1.9.5 VCCI – Registration No. A-0280 and A-0281

TÜV SÜD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

### 1.9.6 RRA – Identification No. US0102

TÜV SÜD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

### 1.9.7 OFCA – U.S. Identification No. US0102

TÜV SÜD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

# SECTION 2

# 2 TEST DETAILS

Radio Testing of the
IPS Group Inc.
Model: MK5J Single Space Parking Meter

## 2.1 Field Strength of Spurious Radiation

### 2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 24, Clause 24.238(a)
FCC 47 CFR Part 27, Clause 27.53(c)(2)
RSS-133, Clause 6.5
RSS-130, Clause 4.7

### 2.1.2 Standard Applicable

FCC 47 CFR Part 24.238
(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC 47 CFR Part 27.53
(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

### 2.1.3 Equipment Under Test and Modification State

Serial No: 0000466294 / Default Test Configuration

### 2.1.4 Date of Test/Initial of test personnel who performed the test

September 11 and October 05, 2020 / XYZ

### 2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

| | |
|---|---|
| Ambient Temperature | 23.6 - 24.6 °C |
| Relative Humidity | 30.7 - 46.7 % |
| ATM Pressure | 98.9 - 99.0 kPa |

### 2.1.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to 18 GHz (to satisfy intentional emitter composite emissions requirement KDB996369 D04 Module Integration Guide V01, e.g. inclusion of NFC, RFID 13.56 MHz, 420 MHz, BLE and Cellular RF module).
- Only noise floor observed after 18GHz. Data presented is up to 18GHz only.
- Initial prescan indicates similar spurious response between LTE Bands. BW and Modulations also does not impact the test results. LTE verification was performed using LTE Band 2 and 13 5 MHz BW and QPSK modulation.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.1.8 for sample computation.

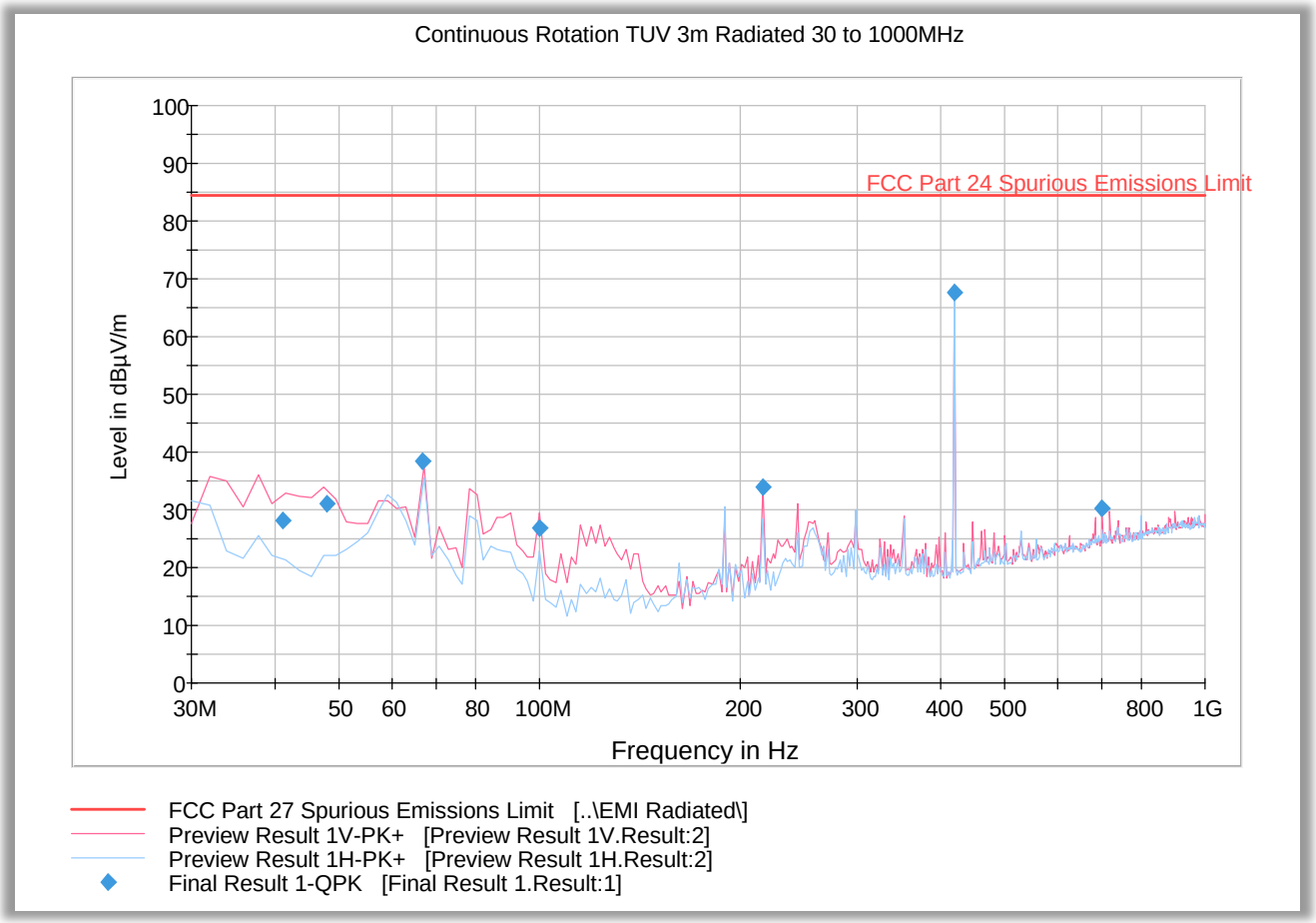
### 2.1.8 Sample Computation (Radiated Emission)

| | | | |
|---|---|---|---|
| Measuring equipment raw measurement (dBµV) @ 30 MHz | | | 24.4 |
| Correction Factor (dB) | Asset# 1066 (cable) | 0.3 | -12.6 |
| | Asset# 1172 (cable) | 0.3 | |
| | Asset# 1016 (preamplifier) | -30.7 | |
| | Asset# 1175(cable) | 0.3 | |
| | Asset# 1002 (antenna) | 17.2 | |
| **Reported QuasiPeak Final Measurement (dBµV/m) @ 30MHz** | | | **11.8** |

### 2.1.9 Test Results

See attached plots.

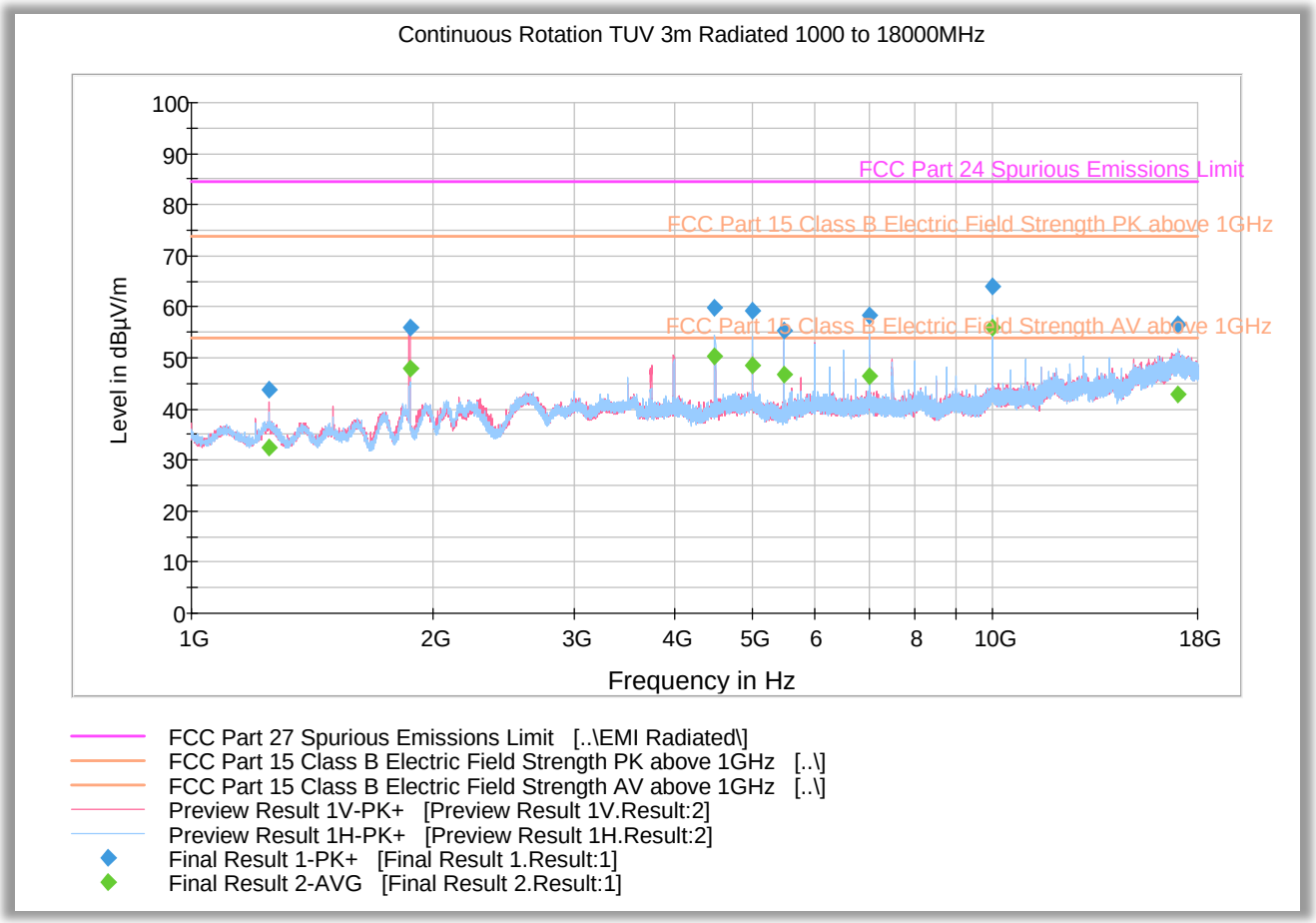
### 2.1.10 Test Results 30MHz to 1GHz (LTE Band 2 with NFC, RFID 13.56 MHz, 420 MHz, and BTLE Active)




**Quasi Peak Data (§15.209 Limits)**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 41.135551 | 28.1 | 1000.0 | 120.000 | 100.0 | V | 221.0 | -14.4 | 56.3 | 84.4 |
| 47.974990 | 31.1 | 1000.0 | 120.000 | 127.0 | V | 235.0 | -15.1 | 53.3 | 84.4 |
| 66.533868 | 38.4 | 1000.0 | 120.000 | 100.0 | V | 6.0 | -18.1 | 46.0 | 84.4 |
| 99.779960 | 26.8 | 1000.0 | 120.000 | 115.0 | V | -7.0 | -13.7 | 57.6 | 84.4 |
| 216.933226 | 33.9 | 1000.0 | 120.000 | 139.0 | V | 85.0 | -11.4 | 50.5 | 84.4 |
| 420.721443 | 67.6 | 1000.0 | 120.000 | 301.0 | V | 64.0 | -5.2 | 420 MHz Fundamental | |
| 700.001283 | 30.2 | 1000.0 | 120.000 | 109.0 | V | 191.0 | 1.6 | 54.2 | 84.4 |

### 2.1.11 Test Results above 1GHz (LTE Band 2 with NFC, RFID 13.56 MHz, 420 MHz, and BTLE Active)




**Peak Data**

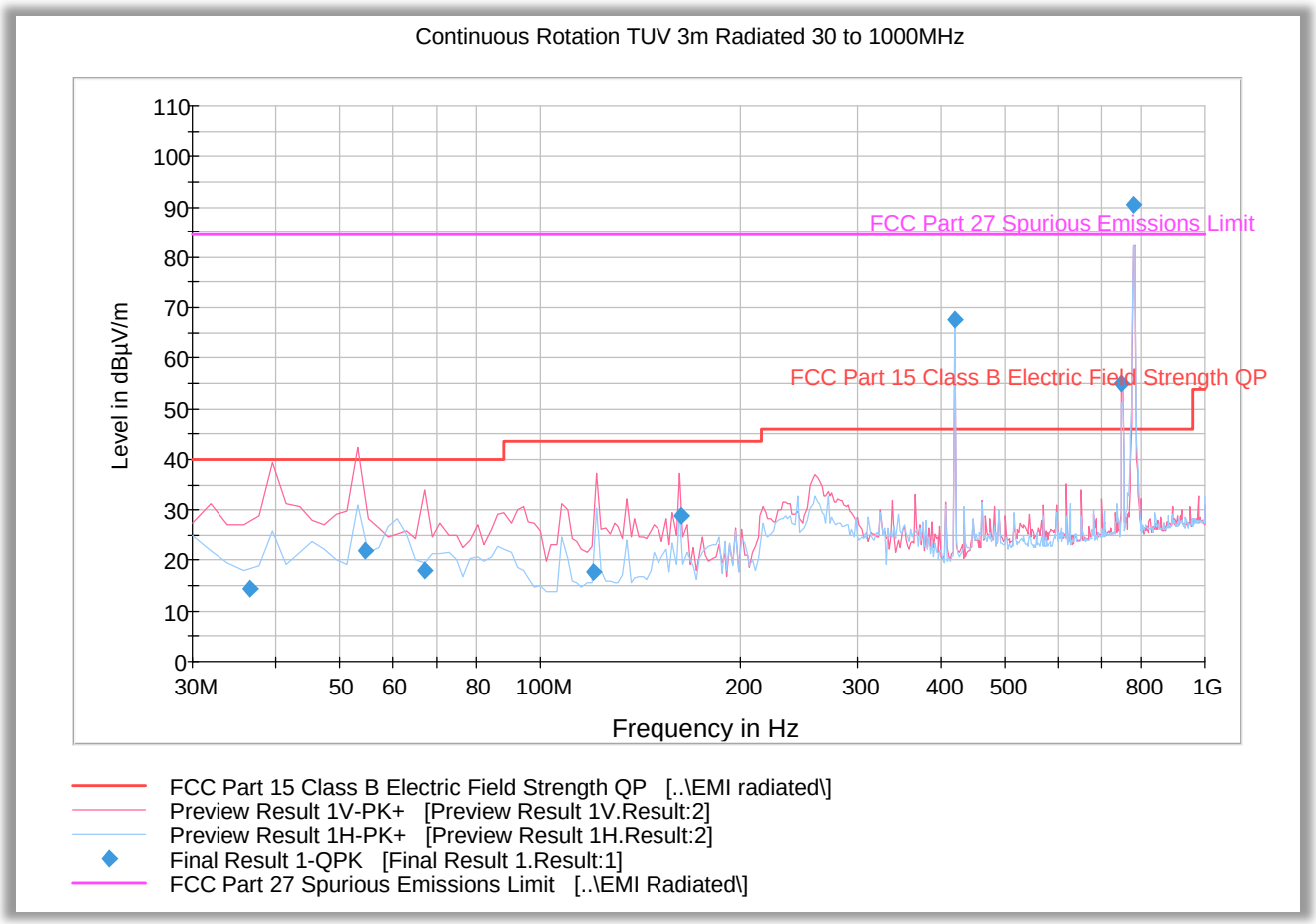
| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1249.73333 | 43.8 | 1000.0 | 1000.000 | 103.7 | V | 161.0 | -5.9 | 40.6 | 84.4 |
| 1871.33333 | 56.0 | 1000.0 | 1000.000 | 152.6 | V | 34.0 | -2.8 | 18.4 | 84.4 |
| 4499.93333 | 59.9 | 1000.0 | 1000.000 | 152.6 | H | 57.0 | 4.4 | 24.5 | 84.4 |
| 4999.93333 | 59.3 | 1000.0 | 1000.000 | 152.6 | H | 54.0 | 4.9 | 25.1 | 84.4 |
| 5500.10000 | 55.4 | 1000.0 | 1000.000 | 325.1 | H | 5.0 | 5.8 | 29.0 | 84.4 |
| 7000.10000 | 58.4 | 1000.0 | 1000.000 | 251.3 | H | -2.0 | 7.5 | 26.0 | 84.4 |
| 10000.0000 | 64.1 | 1000.0 | 1000.000 | 204.5 | H | 13.0 | 9.7 | 20.3 | 84.4 |
| 16999.8000 | 56.5 | 1000.0 | 1000.000 | 269.3 | H | 12.0 | 18.4 | 27.9 | 84.4 |

**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1249.73333 | 32.5 | 1000.0 | 1000.000 | 103.7 | V | 161.0 | -5.9 | 51.9 | 84.4 |
| 1871.33333 | 48.0 | 1000.0 | 1000.000 | 152.6 | V | 34.0 | -2.8 | 36.4 | 84.4 |
| 4499.93333 | 50.4 | 1000.0 | 1000.000 | 152.6 | H | 57.0 | 4.4 | 34.0 | 84.4 |
| 4999.93333 | 48.4 | 1000.0 | 1000.000 | 152.6 | H | 54.0 | 4.9 | 36.0 | 84.4 |
| 5500.10000 | 46.6 | 1000.0 | 1000.000 | 325.1 | H | 5.0 | 5.8 | 37.8 | 84.4 |
| 7000.10000 | 46.5 | 1000.0 | 1000.000 | 251.3 | H | -2.0 | 7.5 | 37.9 | 84.4 |
| 10000.0000 | 55.8 | 1000.0 | 1000.000 | 204.5 | H | 13.0 | 9.7 | 28.6 | 84.4 |
| 16999.8000 | 42.7 | 1000.0 | 1000.000 | 269.3 | H | 12.0 | 18.4 | 41.7 | 84.4 |

Test Notes: A 2.4GHz Notch and 1.8 GHz Notch were used during the testing. 10GHz spurious is verified not from BT low energy and the highest limit FCC Part 24 limit applies. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures. BLE operation will be ignored for this test.

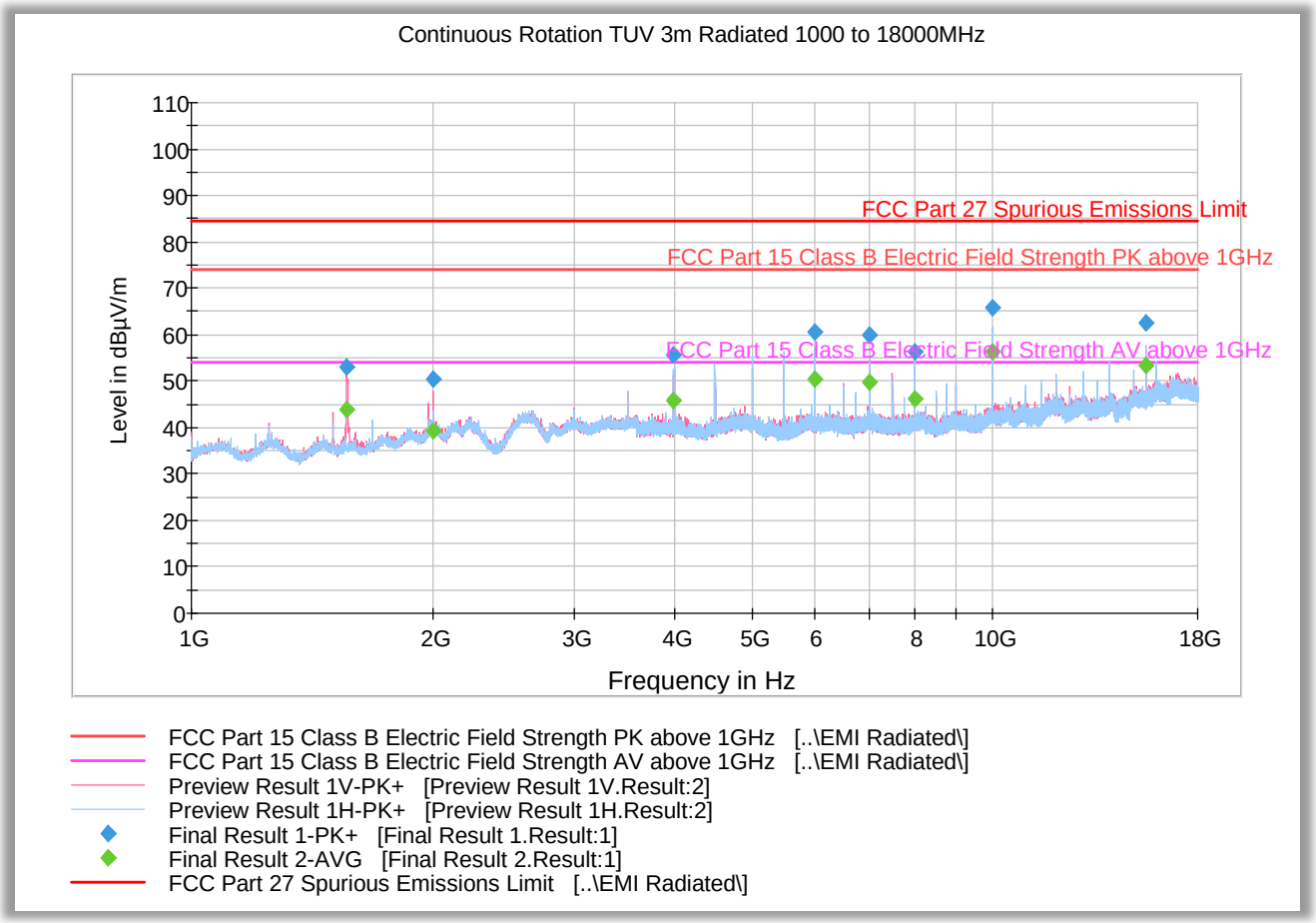
### 2.1.12 Test Results 30MHz to 1GHz (LTE Band 13 with NFC, RFID 13.56 MHz, 420 MHz, and BTLE Active)




**Quasi Peak Data (§15.209 Limits)**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 36.639439 | 14.3 | 1000.0 | 120.000 | 116.0 | V | 325.0 | -13.1 | 70.1 | 84.4 |
| 54.726653 | 22.0 | 1000.0 | 120.000 | 150.0 | V | 19.0 | -16.0 | 62.4 | 84.4 |
| 67.213868 | 18.1 | 1000.0 | 120.000 | 155.0 | V | 232.0 | -18.0 | 66.3 | 84.4 |
| 120.082725 | 17.8 | 1000.0 | 120.000 | 100.0 | V | 73.0 | -15.4 | 66.6 | 84.4 |
| 162.704369 | 28.7 | 1000.0 | 120.000 | 100.0 | V | 194.0 | -12.9 | 55.7 | 84.4 |
| 420.481443 | 67.8 | 1000.0 | 120.000 | 109.0 | H | 355.0 | -5.2 | 420 MHz Fundamental | |
| 749.982365 | 55.1 | 1000.0 | 120.000 | 129.0 | V | 314.0 | 1.7 | Call Box signal | |
| 782.788457 | 90.4 | 1000.0 | 120.000 | 150.0 | V | 175.0 | 2.5 | LTE Band 13 Fundamental | |

### 2.1.13 Test Results above 1GHz (LTE Band 13 with NFC, RFID 13.56 MHz, 420 MHz, and BTLE Active)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1563.83333 | 53.1 | 1000.0 | 1000.000 | 131.7 | V | 132.0 | -6.0 | 31.3 | 84.4 |
| 1999.96666 | 50.3 | 1000.0 | 1000.000 | 113.7 | V | 152.0 | -1.9 | 34.1 | 84.4 |
| 3999.73333 | 55.5 | 1000.0 | 1000.000 | 103.7 | H | 18.0 | 3.6 | 28.9 | 84.4 |
| 5999.90000 | 60.7 | 1000.0 | 1000.000 | 191.5 | H | 96.0 | 6.3 | 23.7 | 84.4 |
| 7000.06666 | 59.9 | 1000.0 | 1000.000 | 152.2 | H | 68.0 | 7.5 | 24.5 | 84.4 |
| 7999.86666 | 56.3 | 1000.0 | 1000.000 | 186.6 | V | 68.0 | 7.7 | 28.1 | 84.4 |
| 10000.0000 | 65.8 | 1000.0 | 1000.000 | 152.2 | H | 16.0 | 9.7 | 18.6 | 84.4 |
| 15500.0666 | 62.4 | 1000.0 | 1000.000 | 162.7 | H | 27.0 | 16.4 | 22.0 | 84.4 |

**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1563.83333 | 43.9 | 1000.0 | 1000.000 | 131.7 | V | 132.0 | -6.0 | 40.5 | 84.4 |
| 1999.96666 | 39.3 | 1000.0 | 1000.000 | 113.7 | V | 152.0 | -1.9 | 45.1 | 84.4 |
| 3999.73333 | 46.0 | 1000.0 | 1000.000 | 103.7 | H | 18.0 | 3.6 | 38.4 | 84.4 |
| 5999.90000 | 50.4 | 1000.0 | 1000.000 | 191.5 | H | 96.0 | 6.3 | 34.0 | 84.4 |
| 7000.06666 | 49.6 | 1000.0 | 1000.000 | 152.2 | H | 68.0 | 7.5 | 34.8 | 84.4 |
| 7999.86666 | 46.1 | 1000.0 | 1000.000 | 186.6 | V | 68.0 | 7.7 | 38.3 | 84.4 |
| 10000.0000 | 56.3 | 1000.0 | 1000.000 | 152.2 | H | 16.0 | 9.7 | 28.1 | 84.4 |
| 15500.0666 | 53.5 | 1000.0 | 1000.000 | 162.7 | H | 27.0 | 16.4 | 30.9 | 84.4 |

Test Notes: A 2.4GHz Notch was used during the testing. 10GHz spurious is verified not from BT low energy and the highest limit FCC Part 27 limit applies. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures. BLE operation will be ignored for this test.

# SECTION 3

# 3 TEST EQUIPMENT USED

### 3.1 Test Equipment Used

List of absolute measuring and other principal items of test equipment.

| ID Number (SDGE/SDRB) | Test Equipment | Type | Serial Number | Manufacturer | Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| ***Radiated Emission*** | | | | | | |
| 1033 | Bilog Antenna | 3142C | 00044556 | EMCO | 11/06/18 | 11/06/20 |
| 7575 | Double-ridged waveguide horn | 3117 | 00155511 | EMCO | 06/22/20 | 06/22/22 |
| 8628 | Pre-amplifier | QLI-01182835-JO | 8986002 | Quinstar | 02/26/20 | 02/26/21 |
| 6628 | Loop Antenna | HFH 2 –Z2 | 880 458/25 | Rhode & Schwarz | 05/22/20 | 05/22/22 |
| 1040 | EMI Test Receiver | ESIB40 | 100292 | Rhode & Schwarz | 10/11/19 | 10/11/20 |
| 7620 | EMI Test Receiver | ESU 40 | 100399 | Rhode & Schwarz | 10/18/19 | 10/18/20 |
| 1016 | Pre-amplifier | PAM-0202 | 187 | A.H. Systems, Inc. | 02/26/20 | 02/26/21 |
| 7562 | Wideband Radio Communication | CMW 500 | 1201.0002k50 /103829 | Rhode & Schwarz | For signalling | |
| ***Miscellaneous*** | | | | | | |
| 11312 | Mini Environmental Quality Meter | 850027 | CF099-56010-340 | Sper Scientific | 05/22/20 | 05/22/21 |
| - | Test Software | EMC32 | V8.53 | Rhode & Schwarz | N/A | |

## 3.2 Measurement Uncertainty

Calculation of Measurement Uncertainty per CISPR 16-4-2:2011 with Corr. 1

### 3.2.1 Radiated Measurements (Below 1GHz)

| | Input Quantity (Contribution) $X_i$ | Value | | Prob. Dist. | Divisor | $u_i(x)$ | $u_i(x)^2$ |
|---|---|---|---|---|---|---|---|
| 1 | Receiver reading | 0.10 | dB | Normal, k=1 | 1.000 | 0.10 | 0.01 |
| 2 | Attenuation: antenna-receiver | 0.20 | dB | Normal, k=2 | 2.000 | 0.10 | 0.01 |
| 3 | Antenna factor AF | 0.75 | dB | Normal, k=2 | 2.000 | 0.38 | 0.14 |
| 4 | Receiver sinewave accuracy | 1.10 | dB | Normal, k=2 | 2.000 | 0.55 | 0.30 |
| 5 | Receiver pulse amplitude | 1.50 | dB | Rectangular | 1.732 | 0.87 | 0.75 |
| 6 | Receiver pulse repetition rate | 1.50 | dB | Rectangular | 1.732 | 0.87 | 0.75 |
| 7 | Noise floor proximity | 0.50 | dB | Rectangular | 1.732 | 0.29 | 0.08 |
| 8 | Mismatch: antenna-receiver | 0.95 | dB | U-shaped | 1.414 | 0.67 | 0.45 |
| 9 | AF frequency interpolation | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 10 | AF height deviations | 0.10 | dB | Rectangular | 1.732 | 0.06 | 0.00 |
| 11 | Directivity difference at 3 m | 3.12 | dB | Rectangular | 1.732 | 1.80 | 3.24 |
| 12 | Phase center location at 3 m | 1.00 | dB | Rectangular | 1.732 | 0.58 | 0.33 |
| 13 | Cross-polarisation | 0.90 | dB | Rectangular | 1.732 | 0.52 | 0.27 |
| 14 | Balance | 0.00 | dB | Rectangular | 1.732 | 0.00 | 0.00 |
| 15 | Site imperfections | 3.91 | dB | Triangular | 2.449 | 1.60 | 2.55 |
| 16 | Separation distance at 3 m | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 17 | Effect of setup table material | 0.40 | dB | Rectangular | 1.732 | 0.23 | 0.05 |
| 18 | Table height at 3 m | 0.10 | dB | Normal, k=2 | 2.000 | 0.05 | 0.00 |
| 19 | Near-field effects | 0.00 | dB | Triangular | 2.449 | 0.00 | 0.00 |
| 20 | Effect of ambient noise on OATS | 0.00 | dB | | | | 0.00 |
| | Combined standard uncertainty | | | Normal | 3.00 | dB | |
| | **Expanded uncertainty** | | | **Normal, k=2** | **6.00** | **dB** | |

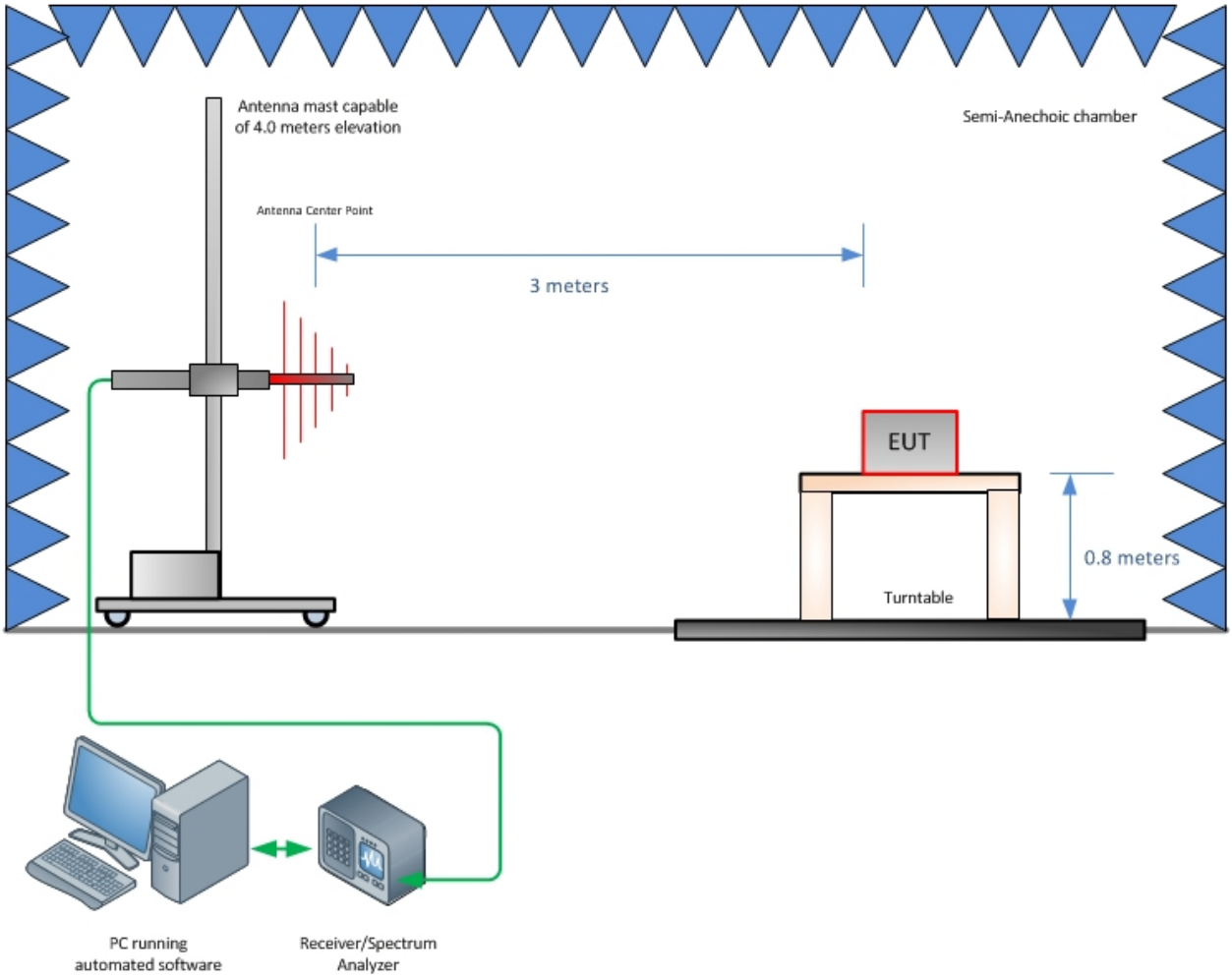
### 3.2.2 Radiated Emission Measurements (Above 1GHz)

| | Input Quantity (Contribution) $X_i$ | Value | | Prob. Dist. | Divisor | $u_i(x)$ | $u_i(x)^2$ |
|---|---|---|---|---|---|---|---|
| 1 | Receiver reading | 0.10 | dB | Normal, k=1 | 1.000 | 0.10 | 0.01 |
| 2 | Attenuation: antenna-receiver | 0.30 | dB | Normal, k=2 | 2.000 | 0.15 | 0.02 |
| 3 | Antenna factor AF | 0.20 | dB | Normal, k=2 | 2.000 | 0.10 | 0.01 |
| 4 | Receiver sinewave accuracy | 0.37 | dB | Normal, k=2 | 2.000 | 0.19 | 0.03 |
| 5 | Receiver pulse amplitude | 0.57 | dB | Rectangular | 2.000 | 0.29 | 0.08 |
| 6 | Receiver pulse repetition rate | 1.21 | dB | Rectangular | 1.732 | 0.70 | 0.49 |
| 7 | Noise floor proximity | 0.70 | dB | Rectangular | 1.732 | 0.40 | 0.16 |
| 8 | Mismatch: antenna-receiver | 1.41 | dB | U-shaped | 1.414 | 1.00 | 0.99 |
| 9 | AF frequency interpolation | 1.30 | dB | Rectangular | 1.414 | 0.92 | 0.85 |
| 10 | AF height deviations | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 11 | Directivity difference at 3 m | 1.50 | dB | Rectangular | 1.732 | 0.87 | 0.75 |
| 12 | Phase center location at 3 m | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 13 | Cross-polarisation | 0.90 | dB | Rectangular | 1.732 | 0.52 | 0.27 |
| 14 | Balance | 5.30 | dB | Rectangular | 2.449 | 2.16 | 4.68 |
| 15 | Site imperfections | 1.15 | dB | Triangular | 1.732 | 0.66 | 0.44 |
| 16 | Separation distance at 3 m | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 17 | Effect of setup table material | 0.00 | dB | Rectangular | 2.000 | 0.00 | 0.00 |
| 18 | Table height at 3 m | 0.10 | dB | Normal, k=2 | 1.000 | 0.10 | 0.01 |
| 19 | Near-field effects | 0.30 | dB | Triangular | 2.000 | 0.15 | 0.02 |
| 20 | Effect of ambient noise on OATS | 0.20 | dB | | 2.000 | 0.10 | 0.01 |
| | Combined standard uncertainty | | | Normal | 2.98 | dB | |
| | **Expanded uncertainty** | | | **Normal, k=2** | **5.96** | **dB** | |

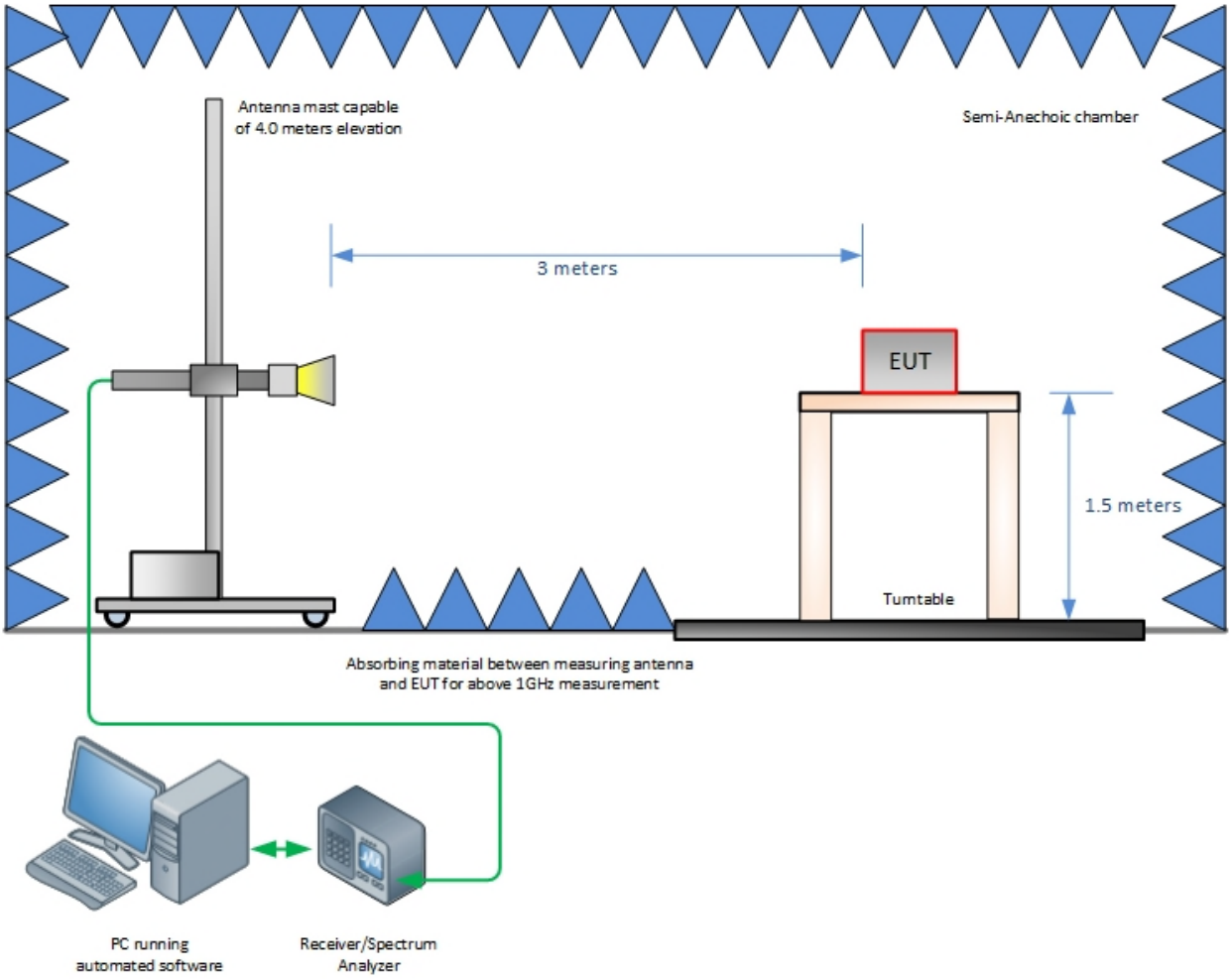
# SECTION 4

# 4 Diagram of Test Setup

## 4.1 Test Setup Diagrams




**Radiated Emission Test Setup (Below 1GHz)**




**Radiated Emission Test Setup (Above 1GHz)**

# SECTION 5

# 5 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

## 5.1 Accreditation, Disclaimers and Copyright

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