

Report No.: SEWM2212000309RG01

Rev.: 02

Page: 1 of 29

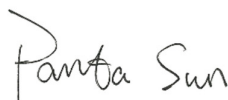
# TEST REPORT

**Application No.:** SEWM2212000309RG  
**Applicant:** Sony Corporation  
**Address of Applicant:** 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan  
**Manufacturer:** Sony Corporation  
**Address of Manufacturer:** 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan  
**EUT Description:** GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, NFC and GNSS  
**Trade Mark:** Sony  
**FCC ID:** PY7-97087H  
**Standards:** 47 CFR Part 2  
 47 CFR Part 22  
 47 CFR Part 24  
 47 CFR Part 27  
**Date of Receipt:** 2022/11/30  
**Date of Test:** 2022/12/20 to 2023/03/08  
**Date of Issue:** 2023/03/14

|                      |               |
|----------------------|---------------|
| <b>Test Result :</b> | <b>PASS *</b> |
|----------------------|---------------|

\* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Panta Sun  
Wireless Laboratory Manager



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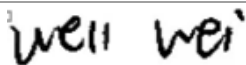
Rev.: 02

Page: 2 of 29

# 1 Version

| Revision Record |         |            |          |                                                                                                                                                              |
|-----------------|---------|------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version         | Chapter | Date       | Modifier | Remark                                                                                                                                                       |
| 01              |         | 2023/01/13 |          | Original                                                                                                                                                     |
| 02              |         | 2023/03/14 |          | 1. Updated GSM850 CH251 test plot on Page 31 and Band5-4182 test plot on Page 11.<br>2. Remarked the worst case configurations in the RSE of LTE attachment. |

This report supersedes our previous report SEWM2212000309RG01, issued on 2023/01/13, which is hereby deemed null and void.

|             |                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------|
| Prepared By | <br>(Weller Liu) / Test Engineer |
| Checked By  | <br>(Well Wei) / Reviewer        |



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## Contents

|       |                                                           |    |
|-------|-----------------------------------------------------------|----|
| 1     | Version .....                                             | 2  |
| 2     | Test Summary .....                                        | 5  |
| 2.1   | GSM850/UMTS Band 5/LTE Band 5.....                        | 5  |
| 2.2   | GSM 1900 .....                                            | 6  |
| 2.3   | LTE Band 12 .....                                         | 7  |
| 3     | General Information .....                                 | 8  |
| 3.1   | Details of Client.....                                    | 8  |
| 3.2   | Test Location .....                                       | 8  |
| 3.3   | Test Facility .....                                       | 8  |
| 3.4   | General Description of EUT .....                          | 9  |
| 3.5   | Test Mode .....                                           | 10 |
| 3.6   | Test Environment.....                                     | 10 |
| 3.7   | Description of Support Units .....                        | 10 |
| 3.8   | Technical Specification .....                             | 11 |
| 3.9   | Test Frequencies .....                                    | 12 |
| 4     | Description of Tests .....                                | 14 |
| 4.1   | Conducted Output Power .....                              | 14 |
| 4.2   | Effective (Isotropic) Radiated Power of Transmitter ..... | 15 |
| 4.3   | Occupied Bandwidth .....                                  | 16 |
| 4.4   | Band Edge at Antenna Terminals .....                      | 17 |
| 4.5   | Spurious And Harmonic Emissions at Antenna Terminal.....  | 18 |
| 4.6   | Peak-Average Ratio .....                                  | 19 |
| 4.7   | Field Strength of Spurious Radiation.....                 | 20 |
| 4.8   | Frequency Stability / Temperature Variation .....         | 21 |
| 4.9   | Test Setups.....                                          | 22 |
| 4.9.1 | Test Setup 1 .....                                        | 22 |
| 4.9.2 | Test Setup 2 .....                                        | 22 |
| 4.9.3 | Test Setup 3 .....                                        | 23 |
| 4.10  | Test Conditions .....                                     | 24 |
| 5     | Main Test Instruments .....                               | 26 |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 4 of 29

|   |                              |    |
|---|------------------------------|----|
| 6 | Measurement Uncertainty..... | 28 |
| 7 | Appendixes.....              | 29 |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 5 of 29

## 2 Test Summary

### 2.1 GSM850/UMTS Band 5/LTE Band 5

| Test Item                                        | FCC Rule No.                                 | Requirements                                                                                            | Test Result                       | Verdict |
|--------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046,<br>§22.913(a)(5)                    | ERP ≤ 7 W                                                                                               | Section 1 of Appendix B.1&B.2&B.3 | Pass    |
| Peak-Average Ratio                               | §22.913(d)                                   | Limits ≤ 13 dB                                                                                          | Section 2 of Appendix B.1&B.2&B.3 | Pass    |
| Modulation Characteristics                       | §2.1047                                      | Digital modulation                                                                                      | Section 3 of Appendix B.1&B.2&B.3 | Pass    |
| Bandwidth                                        | §2.1049                                      | OBW: No limit.<br>EBW: No limit.                                                                        | Section 4 of Appendix B.1&B.2&B.3 | Pass    |
| Band Edges Compliance                            | §2.1051,<br>§22.917(a)                       | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.               | Section 5 of Appendix B.1&B.2&B.3 | Pass    |
| Spurious Emission at Antenna Terminals           | §2.1051,<br>§22.917(a)                       | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges. | Section 6 of Appendix B.1&B.2&B.3 | Pass    |
| Field Strength of Spurious Radiation             | §2.1053,<br>§22.917(a)                       | FCC: ≤ -13 dBm/100 kHz.                                                                                 | Section 7 of Appendix B.1&B.2&B.3 | Pass    |
| Frequency Stability                              | §2.1055(a)(1)(b)<br>§2.1055(d)(2)<br>§22.355 | ≤ ±2.5ppm.                                                                                              | Section 8 of Appendix B.1&B.2&B.3 | Pass    |



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Rev.: 02

Page: 6 of 29

## 2.2 GSM 1900

| Test Item                                        | FCC Rule No.                                 | Requirements                                                                                                 | Test Result               | Verdict |
|--------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §24.232(c)                          | EIRP ≤ 2 W                                                                                                   | Section 1 of Appendix B.1 | Pass    |
| Peak-Average Ratio                               | §24.232(d)                                   | Limit ≤ 13 dB                                                                                                | Section 2 of Appendix B.1 | Pass    |
| Modulation Characteristics                       | §2.1047                                      | Digital modulation                                                                                           | Section 3 of Appendix B.1 | Pass    |
| Bandwidth                                        | §2.1049                                      | OBW: No limit.<br>EBW: No limit.                                                                             | Section 4 of Appendix B.1 | Pass    |
| Band Edges Compliance                            | §2.1051, §24.238(a)                          | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.                    | Section 5 of Appendix B.1 | Pass    |
| Spurious Emission at Antenna Terminals           | §2.1051, §24.238(a)                          | ≤ -13 dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges. | Section 6 of Appendix B.1 | Pass    |
| Field Strength of Spurious Radiation             | §2.1053, §24.238(a)                          | ≤ -13 dBm/1 MHz.                                                                                             | Section 7 of Appendix B.1 | Pass    |
| Frequency Stability                              | §2.1055(a)(1)(b)<br>§2.1055(d)(2)<br>§24.235 | Within authorized bands of operation/frequency block.                                                        | Section 8 of Appendix B.1 | Pass    |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 7 of 29

## 2.3 LTE Band 12

| Test Item                                        | FCC Rule No.                                | Requirements                                                                                                        | Test Result               | Verdict |
|--------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046<br>§27.50(c)(10)                    | ERP ≤ 3 W.                                                                                                          | Section 1 of Appendix B.4 | Pass    |
| Peak-Average Ratio                               | ---                                         | Limit≤13 dB                                                                                                         | Section 2 of Appendix B.4 | Pass    |
| Modulation Characteristics                       | §2.1047                                     | Digital modulation                                                                                                  | Section 3 of Appendix B.4 | Pass    |
| Bandwidth                                        | §2.1049                                     | OBW: No limit.<br>EBW: No limit.                                                                                    | Section 4 of Appendix B.4 | Pass    |
| Band Edges Compliance                            | §2.1051,<br>§27.53(g)                       | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.                           | Section 5 of Appendix B.4 | Pass    |
| Spurious Emission at Antenna Terminals           | §2.1051,<br>§27.53(g)                       | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges. | Section 6 of Appendix B.4 | Pass    |
| Field Strength of Spurious Radiation             | §2.1053,<br>§27.53(g)                       | FCC: ≤ -13 dBm/100 kHz.                                                                                             | Section 7 of Appendix B.4 | Pass    |
| Frequency Stability                              | §2.1055(a)(1)(b)<br>§2.1055(d)(2)<br>§27.54 | Within authorized bands of operation/frequency block.                                                               | Section 8 of Appendix B.4 | Pass    |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 8 of 29

### 3 General Information

#### 3.1 Details of Client

|                          |                                             |
|--------------------------|---------------------------------------------|
| Applicant:               | Sony Corporation                            |
| Address of Applicant:    | 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan |
| Manufacturer:            | Sony Corporation                            |
| Address of Manufacturer: | 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan |

#### 3.2 Test Location

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Company:       | SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.                                                               |
| Address:       | South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone |
| Post code:     | 215000                                                                                                                 |
| Test engineer: | Weller Liu, Tizzy Song                                                                                                 |

#### 3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

• **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 9 of 29

### 3.4 General Description of EUT

|                                                                                                                                                                   |                                                                |                   |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------|---------------------------|
| EUT Description:                                                                                                                                                  | GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, NFC and GNSS |                   |                           |
| Trade Mark:                                                                                                                                                       | Sony                                                           |                   |                           |
| Hardware Version:                                                                                                                                                 | A                                                              |                   |                           |
| Software Version:                                                                                                                                                 | 0.129                                                          |                   |                           |
| SN:                                                                                                                                                               | RF Conducted                                                   | HQ62B206A1        |                           |
|                                                                                                                                                                   | RSE                                                            | HQ62B2066A        |                           |
| Antenna Type:                                                                                                                                                     | PIFA Antenna                                                   |                   |                           |
| Antenna Gain:                                                                                                                                                     | GSM850:                                                        | -1.3dBi(Ant0)     | GSM1900: 1.8dBi(Ant1)     |
|                                                                                                                                                                   | WCDMA Band V:                                                  | -1.3dBi(Ant0)     | LTE Band 5: -1.3dBi(Ant0) |
|                                                                                                                                                                   | LTE Band 12:                                                   | -2.3dBi(Ant0)     |                           |
| RF Cable:                                                                                                                                                         | 0.8dB(Below 1GHz)                                              | 1.0dB(1.0~2.4GHz) | 1.2dB(2.4~3.4GHz)         |
|                                                                                                                                                                   | 1.5dB(Above 3.4GHz)                                            |                   |                           |
| Remark:                                                                                                                                                           |                                                                |                   |                           |
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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 10 of 29

### 3.5 Test Mode

| Test Mode                                                                                    | Test Modes Description                |
|----------------------------------------------------------------------------------------------|---------------------------------------|
| GSM/TM1                                                                                      | GSM system, GSM/GPRS, GMSK modulation |
| GSM/TM2                                                                                      | GSM system, EGPRS, 8PSK modulation    |
| UMTS/TM1                                                                                     | UMTS system, WCDMA, QPSK modulation   |
| UMTS/TM2                                                                                     | UMTS system, WCDMA, 16QAM modulation  |
| LTE/TM1                                                                                      | LTE system, QPSK modulation           |
| LTE/TM2                                                                                      | LTE system, 16QAM modulation          |
| LTE/TM3                                                                                      | LTE system, 64QAM modulation          |
| Remark: The test mode(s) are selected according to relevant radio technology specifications. |                                       |

### 3.6 Test Environment

| Environment Parameter  | 101.0 kPa Selected Values During Tests |                                   |
|------------------------|----------------------------------------|-----------------------------------|
| Relative Humidity      | 44-46 % RH Ambient                     |                                   |
| Value                  | Temperature(°C)                        | Voltage(V)                        |
| NTNV                   | 22~23                                  | 3.89                              |
| LTLV                   | -30                                    | 3.40                              |
| LTHV                   | -30                                    | 4.48                              |
| HTLV                   | 50                                     | 3.40                              |
| HTHV                   | 50                                     | 4.48                              |
| Remark:                |                                        |                                   |
| NV: Normal Voltage     | LV: Low Extreme Test Voltage           | HV: High Extreme Test Voltage     |
| NT: Normal Temperature | LT: Low Extreme Test Temperature       | HT: High Extreme Test Temperature |

### 3.7 Description of Support Units

The EUT has been tested as an independent unit.



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### 3.8 Technical Specification

| Characteristics                                                                                                                                                                   | Description                                                                                                                   |                                             |                                           |                                           |                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------|-------------------------------------------|--------------------------------------------|
| Radio System Type                                                                                                                                                                 | <input checked="" type="checkbox"/> GSM                                                                                       | <input checked="" type="checkbox"/> UMTS    |                                           | <input checked="" type="checkbox"/> LTE   |                                            |
| Supported Frequency Range                                                                                                                                                         | Band                                                                                                                          | TX                                          |                                           | RX                                        |                                            |
|                                                                                                                                                                                   | GSM850                                                                                                                        | 824 to 849 MHz                              |                                           | 869 to 894 MHz                            |                                            |
|                                                                                                                                                                                   | GSM1900                                                                                                                       | 1850 to 1910 MHz                            |                                           | 1930 to 1990 MHz                          |                                            |
|                                                                                                                                                                                   | UMTS Band V                                                                                                                   | 824 to 849 MHz                              |                                           | 869 to 894 MHz                            |                                            |
|                                                                                                                                                                                   | LTE Band 5                                                                                                                    | 824 to 849 MHz                              |                                           | 869 to 894 MHz                            |                                            |
|                                                                                                                                                                                   | LTE Band 12                                                                                                                   | 699 to 716 MHz                              |                                           | 729 to 746 MHz                            |                                            |
| Supported Channel Bandwidth                                                                                                                                                       | GSM system:                                                                                                                   | <input checked="" type="checkbox"/> 0.2 MHz |                                           |                                           |                                            |
|                                                                                                                                                                                   | UMTS system:                                                                                                                  | <input checked="" type="checkbox"/> 5 MHz   |                                           |                                           |                                            |
|                                                                                                                                                                                   | LTE Band 5                                                                                                                    | <input checked="" type="checkbox"/> 1.4 MHz | <input checked="" type="checkbox"/> 3 MHz | <input checked="" type="checkbox"/> 5 MHz | <input checked="" type="checkbox"/> 10 MHz |
|                                                                                                                                                                                   | LTE Band 12                                                                                                                   | <input checked="" type="checkbox"/> 1.4 MHz | <input checked="" type="checkbox"/> 3 MHz | <input checked="" type="checkbox"/> 5 MHz | <input checked="" type="checkbox"/> 10 MHz |
|                                                                                                                                                                                   | Note1: WCDMA supports HSUPA, HSDPA, DC-HSDPA,HSPA+, but only the worst case was tested and the data displayed in this report. |                                             |                                           |                                           |                                            |
| Characteristics                                                                                                                                                                   | Description                                                                                                                   |                                             |                                           |                                           |                                            |
| Designation of Emissions<br>(Remark: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.) | GSM:                                                                                                                          | GMSK                                        | 8PSK                                      |                                           |                                            |
|                                                                                                                                                                                   | GSM850                                                                                                                        | 247KGXW                                     | 247KG7W                                   |                                           |                                            |
|                                                                                                                                                                                   | GSM1900                                                                                                                       | 245KGXW                                     | 250KG7W                                   |                                           |                                            |
|                                                                                                                                                                                   | UMTS:                                                                                                                         | QPSK                                        |                                           |                                           |                                            |
|                                                                                                                                                                                   | Band V                                                                                                                        | 4M15F9W                                     |                                           |                                           |                                            |
|                                                                                                                                                                                   | E-UTRA:                                                                                                                       | QPSK                                        | 16QAM                                     | 64QAM                                     |                                            |
|                                                                                                                                                                                   | LTE Band 5                                                                                                                    | 1M08G7D                                     | 1M09W7D                                   | 1M09W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 2M69G7D                                     | 2M69W7D                                   | 2M69W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 4M47G7D                                     | 4M47W7D                                   | 4M48W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 8M95G7D                                     | 8M93W7D                                   | 8M95W7D                                   |                                            |
|                                                                                                                                                                                   | LTE Band 12                                                                                                                   | 1M10G7D                                     | 1M09W7D                                   | 1M09W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 2M69G7D                                     | 2M69W7D                                   | 2M69W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 4M47G7D                                     | 4M47W7D                                   | 4M48W7D                                   |                                            |
|                                                                                                                                                                                   |                                                                                                                               | 8M93G7D                                     | 8M91W7D                                   | 8M93W7D                                   |                                            |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 12 of 29

### 3.9 Test Frequencies

| Test Mode | TX / RX | RF Channel  |             |             |
|-----------|---------|-------------|-------------|-------------|
|           |         | Low (L)     | Middle (M)  | High (H)    |
| GSM850    | TX      | Channel 128 | Channel 190 | Channel 251 |
|           |         | 824.2MHz    | 836.6 MHz   | 848.8 MHz   |
|           | RX      | Channel 128 | Channel 190 | Channel 251 |
|           |         | 869.2 MHz   | 881.6 MHz   | 893.8 MHz   |

| Test Mode | TX / RX | RF Channel  |             |             |
|-----------|---------|-------------|-------------|-------------|
|           |         | Low (L)     | Middle (M)  | High (H)    |
| GSM1900   | TX      | Channel 512 | Channel 661 | Channel 810 |
|           |         | 1850.2MHz   | 1880.0 MHz  | 1909.8 MHz  |
|           | RX      | Channel 512 | Channel 661 | Channel 810 |
|           |         | 1930.2 MHz  | 1960.0 MHz  | 1989.8 MHz  |

| Test Mode    | TX / RX | RF Channel   |              |              |
|--------------|---------|--------------|--------------|--------------|
|              |         | Low (L)      | Middle (M)   | High (H)     |
| WCDMA Band V | TX      | Channel 4132 | Channel 4182 | Channel 4233 |
|              |         | 826.4MHz     | 836.4 MHz    | 846.6 MHz    |
|              | RX      | Channel 4357 | Channel 4407 | Channel 4458 |
|              |         | 871.4 MHz    | 881.4 MHz    | 891.6 MHz    |

| Test Mode  | Bandwidth | TX / RX | RF Channel    |               |               |
|------------|-----------|---------|---------------|---------------|---------------|
|            |           |         | Low (L)       | Middle (M)    | High (H)      |
| LTE Band 5 | 1.4MHz    | TX      | Channel 20407 | Channel 20525 | Channel 20643 |
|            |           |         | 824.7 MHz     | 836.5 MHz     | 848.3 MHz     |
|            |           | RX      | Channel 2407  | Channel 2525  | Channel 2643  |
|            |           |         | 869.7 MHz     | 881.5 MHz     | 893.3 MHz     |
|            | 3MHz      | TX      | Channel 20415 | Channel 20525 | Channel 20635 |
|            |           |         | 825.5 MHz     | 836.5 MHz     | 847.5 MHz     |
|            |           | RX      | Channel 2415  | Channel 2525  | Channel 2635  |
|            |           |         | 870.5 MHz     | 881.5 MHz     | 892.5 MHz     |
|            | 5MHz      | TX      | Channel 20425 | Channel 20525 | Channel 20625 |
|            |           |         | 826.5 MHz     | 836.5 MHz     | 846.5 MHz     |
|            |           | RX      | Channel 2425  | Channel 2525  | Channel 2625  |
|            |           |         | 871.5 MHz     | 881.5 MHz     | 891.5 MHz     |
|            | 10MHz     | TX      | Channel 20450 | Channel 20525 | Channel 20600 |
|            |           |         | 829 MHz       | 836.5 MHz     | 844 MHz       |
|            |           | RX      | Channel 2450  | Channel 2525  | Channel 2600  |
|            |           |         | 874 MHz       | 881.5 MHz     | 889 MHz       |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 13 of 29

| Test Mode   | Bandwidth | TX / RX | RF Channel    |               |               |
|-------------|-----------|---------|---------------|---------------|---------------|
|             |           |         | Low (L)       | Middle (M)    | High (H)      |
| LTE Band 12 | 1.4MHz    | TX      | Channel 23017 | Channel 23095 | Channel 23173 |
|             |           |         | 699.7 MHz     | 707.5 MHz     | 715.3 MHz     |
|             |           | RX      | Channel 5017  | Channel 5095  | Channel 5173  |
|             |           |         | 729.7 MHz     | 737.5 MHz     | 745.3 MHz     |
|             | 3MHz      | TX      | Channel 23025 | Channel 23095 | Channel 23165 |
|             |           |         | 700.5 MHz     | 707.5 MHz     | 714.5 MHz     |
|             |           | RX      | Channel 5025  | Channel 5095  | Channel 5165  |
|             |           |         | 730.5 MHz     | 737.5 MHz     | 744.5 MHz     |
|             | 5MHz      | TX      | Channel 23035 | Channel 23095 | Channel 23155 |
|             |           |         | 701.5 MHz     | 707.5 MHz     | 713.5 MHz     |
|             |           | RX      | Channel 5035  | Channel 5095  | Channel 5155  |
|             |           |         | 731.5 MHz     | 737.5 MHz     | 743.5 MHz     |
|             | 10MHz     | TX      | Channel 23060 | Channel 23095 | Channel 23130 |
|             |           |         | 704 MHz       | 707.5 MHz     | 711 MHz       |
|             |           | RX      | Channel 5060  | Channel 5095  | Channel 5130  |
|             |           |         | 734 MHz       | 737.5 MHz     | 741 MHz       |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 14 of 29

## 4 Description of Tests

### 4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.2.1

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters.

**Remark: Reference test setup 1**



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 15 of 29

## 4.2 Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.8.4

Calculate power in dBm by the following formula:

ERP (dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP(dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP=ERP+2.15dB



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 16 of 29

### 4.3 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2 & 4.3

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel). The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

**Remark: Reference test setup 1**

#### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 17 of 29

#### 4.4 Band Edge at Antenna Terminals

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at two frequencies (low channel and high channel). in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to rms.

#### Remark: Reference test setup 1

##### Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 18 of 29

## 4.5 Spurious And Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

### Remark: Reference test setup 1

#### Test Settings

1. Start frequency was set to 9kHz and stop frequency was set to at least 10\* the fundamental frequency (Separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 19 of 29

## 4.6 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.2

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.

### Remark: Reference test setup 1

#### Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 20 of 29

## 4.7 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.8

### Below 1GHz test procedure as below:

- 1). The EUT was powered ON and placed on a 80cm high table in the chamber. The antenna of the transmitter was extended to its maximum length.
- 2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 4). Test the EUT in the lowest channel, the middle channel ,the Highest channel.
- 5). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.
- 6). Repeat above procedures until all frequencies measured was complete.

$E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + (\text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)} - \text{AMP(dB)})$

$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8$ ; where D is the measurement distance in meters

### Above 1GHz test procedure as below:

- 1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber
- 2) Calculate power in dBm by the following formula:  
 $E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + (\text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)} - \text{AMP(dB)})$   
 $\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8$ ; where D is the measurement distance in meters
- 3). Test the EUT in the lowest channel, the middle channel the Highest channel
- 4). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.
- 5). Repeat above procedures until all frequencies measured was complete

Remark1: Reference test setup 2

Remark2: The emission below 18G were measured at a 3m test distance, while emissions above 18GHz were measured at a 1m test distance. At a measurement distance of 1 meter the limit line was increased by  $20 \cdot \log(3/1) = 9.54 \text{ dB}$ .

### Remark: Reference test setup 2

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & AMP. The basic equation with a sample calculation is as follows:

$\text{AF} = \text{Antenna Factor (dB/m)}$

$\text{Factor} = \text{Cable Factor (dB)} - \text{Preamplifier (dB)}$

$\text{Level} = \text{Reading Level} + \text{AF} + \text{Factor} - 95.26$

$\text{Margin} = \text{Limit} - \text{Level}$

- 2) Scan from 9kHz to 40GHz, The disturbance between 9kHz to 30MHz and 18GHz to 40GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

- 3) All modes have been tested, but only the worst case data displayed in this report.



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 21 of 29

## 4.8 Frequency Stability / Temperature Variation

### Measurement Procedure:

Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01; Section 9

. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm ) of the center frequency.

### Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

**Remark: Reference test setup 3**



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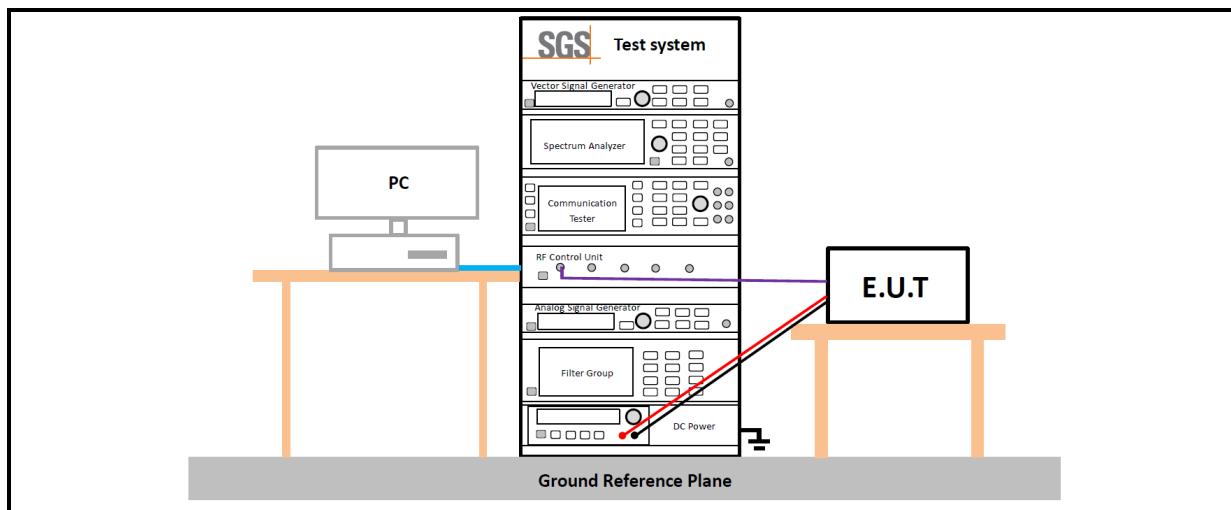
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### 4.9 Test Setups

#### 4.9.1 Test Setup 1



#### 4.9.2 Test Setup 2

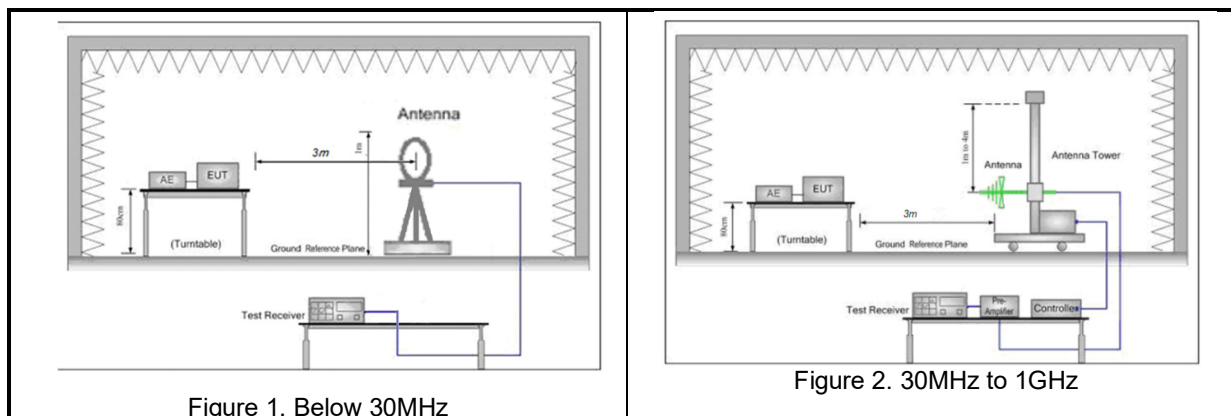


Figure 1. Below 30MHz

Figure 2. 30MHz to 1GHz

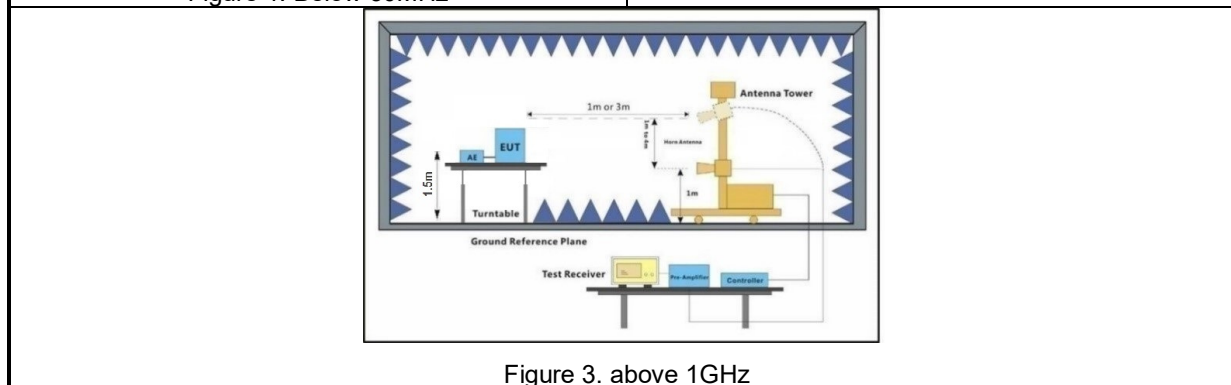


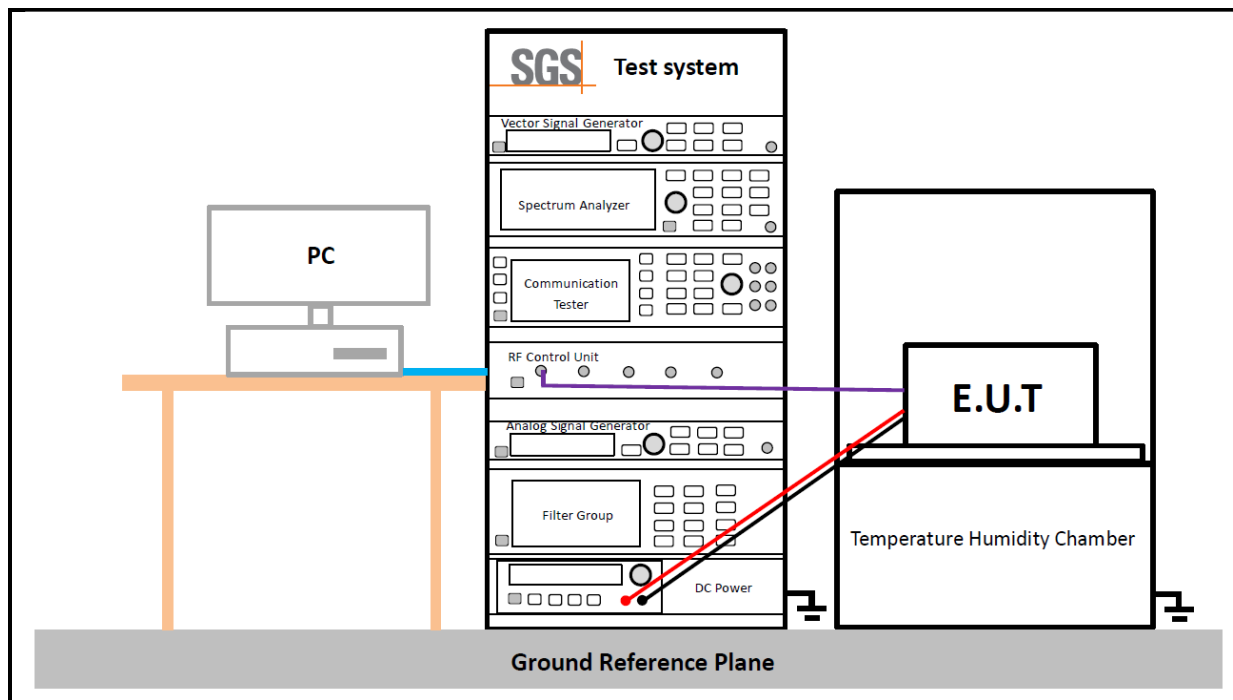
Figure 3. above 1GHz

Report No.: SEWM2212000309RG01

Rev.: 02

Page: 23 of 29

### 4.9.3 Test Setup 3



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## 4.10 Test Conditions

| Transmit Output Power Data - Average Power, Total |                                                               |
|---------------------------------------------------|---------------------------------------------------------------|
| Test Case                                         | Test Conditions                                               |
| Test Environment                                  | Ambient Climate & Rated Voltage                               |
| Test Setup                                        | Test Setup 1                                                  |
| RF Channels (TX)                                  | L, M, H (L= low channel, M= middle channel, H= high channel)  |
| Test Mode                                         | GSM/TM1;UMTS/TM1;LTE/TM1;LTE/TM2;LTE/TM3                      |
| Peak-to-Average Ratio                             |                                                               |
| Test Case                                         | Test Conditions                                               |
| Test Environment                                  | Ambient Climate & Rated Voltage                               |
| Test Setup                                        | Test Setup 1                                                  |
| RF Channels (TX)                                  | L, M, H (L= low channel, M= middle channel, H= high channel)  |
| Test Mode                                         | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1;LTE/TM2;LTE/TM3              |
| Modulation Characteristics                        |                                                               |
| Test Case                                         | Test Conditions                                               |
| Test Environment                                  | Ambient Climate & Rated Voltage                               |
| Test Setup                                        | Test Setup 1                                                  |
| RF Channels (TX)                                  | M (M= middle channel)                                         |
| Test Mode                                         | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1;LTE/TM2;LTE/TM3              |
| Bandwidth - Occupied Bandwidth                    |                                                               |
| Test Case                                         | Test Conditions                                               |
| Test Environment                                  | Ambient Climate & Rated Voltage                               |
| Test Setup                                        | Test Setup 1                                                  |
| RF Channels (TX)                                  | L, M, H (L= low channel, M= middle channel, H= high channel ) |
| Test Mode                                         | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1;LTE/TM2;LTE/TM3              |
| Bandwidth - Emission Bandwidth                    |                                                               |
| Test Case                                         | Test Conditions                                               |
| Test Environment                                  | Ambient Climate & Rated Voltage                               |
| Test Setup                                        | Test Setup 1                                                  |
| RF Channels (TX)                                  | L, M, H (L= low channel, M= middle channel, H= high channel ) |
| Test Mode                                         | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1;LTE/TM2;LTE/TM3              |
| Band Edges Compliance                             |                                                               |
| Test Case                                         | Test Conditions                                               |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 25 of 29

|                                               |                                                                                                                                                    |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Environment                              | Ambient Climate & Rated Voltage                                                                                                                    |
| Test Setup                                    | Test Setup 1                                                                                                                                       |
| RF Channels (TX)                              | L, H (L= low channel, H= high channel)                                                                                                             |
| Test Mode                                     | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1                                                                                                                   |
| <b>Spurious Emission at Antenna Terminals</b> |                                                                                                                                                    |
| <b>Test Case</b>                              | <b>Test Conditions</b>                                                                                                                             |
| Test Environment                              | Ambient Climate & Rated Voltage                                                                                                                    |
| Test Setup                                    | Test Setup 1                                                                                                                                       |
| RF Channels (TX)                              | L, M, H (L= low channel, M= middle channel, H= high channel)                                                                                       |
| Test Mode                                     | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1                                                                                                                   |
| <b>Field Strength of Spurious Radiation</b>   |                                                                                                                                                    |
| <b>Test Case</b>                              | <b>Test Conditions</b>                                                                                                                             |
| Test Environment                              | Ambient Climate & Rated Voltage                                                                                                                    |
| Test Setup                                    | Test Setup 2                                                                                                                                       |
| RF Channels (TX)                              | L, M, H (L= low channel, M= middle channel, H= high channel)                                                                                       |
| Test Mode                                     | GSM/TM1;UMTS/TM1;LTE/TM1<br>Remark: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected. |
| <b>Frequency Stability</b>                    |                                                                                                                                                    |
| <b>Test Case</b>                              | <b>Test Conditions</b>                                                                                                                             |
| Test Environment                              | (1) -30 °C to +50 °C with step 10 °C at Rated Voltage<br>(2) VL, VN and VH of Rated Voltage at Ambient Climate.                                    |
| Test Setup                                    | Test Setup 3                                                                                                                                       |
| RF Channels (TX)                              | M (M= middle channel)                                                                                                                              |
| Test Mode                                     | GSM/TM1;GSM/TM2;UMTS/TM1;LTE/TM1                                                                                                                   |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 26 of 29

## 5 Main Test Instruments

| RF conducted test                         |               |                                       |               |                           |                              |
|-------------------------------------------|---------------|---------------------------------------|---------------|---------------------------|------------------------------|
| Test Equipment                            | Manufacturer  | Model No.                             | Inventory No. | Cal. date<br>(yyyy/mm/dd) | Cal.Due date<br>(yyyy/mm/dd) |
| Shielding Room                            | Brilliant-emc | N/A                                   | SUWI-04-01-06 | 2021/05/08                | 2024/05/07                   |
| Temperature and humidity meter            | MingGao       | TH101B                                | SUWI-01-01-07 | 2022/02/16                | 2023/02/15                   |
|                                           |               |                                       |               | 2023/02/06                | 2024/02/05                   |
| Signal Analyzer                           | ROHDE&SCHWARZ | FSV3030                               | SUWI-01-02-02 | 2022/05/17                | 2023/05/16                   |
| Measurement Software                      | Tonscend      | JS1120-3 Test System<br>V 2.6.88.0336 | SUWI-02-09-09 | NCR                       | NCR                          |
| Radio Communication Analyzer              | Anritsu       | MT8821C                               | SUWI-01-26-03 | 2022/11/23                | 2023/11/22                   |
| Wideband Radio Communication Tester       | ROHDE&SCHWARZ | CMW500                                | SUWI-01-16-05 | 2022/02/14                | 2023/02/13                   |
|                                           |               |                                       |               | 2023/02/06                | 2024/02/05                   |
| DC Power Supply                           | HYELEC        | HY3005B                               | SUWI-01-18-01 | 2022/02/15                | 2023/02/14                   |
|                                           |               |                                       |               | 2023/02/06                | 2024/02/05                   |
| Temperature Chamber                       | ESPEC         | SU-242                                | SUWI-01-13-01 | 2022/02/15                | 2023/02/14                   |
|                                           |               |                                       |               | 2023/02/06                | 2024/02/05                   |
| Wideband Radio Communication Test Ststion | Anritsu       | MT8000A                               | SUWI-01-34-02 | 2022/09/16                | 2023/09/15                   |
| Signal Analyzer                           | ROHDE&SCHWARZ | FSW43                                 | SUWI-01-02-04 | 2022/05/28                | 2023/05/27                   |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 27 of 29

| RSE Test System                     |                            |                  |               |                        |                           |
|-------------------------------------|----------------------------|------------------|---------------|------------------------|---------------------------|
| Test Equipment                      | Manufacturer               | Model No.        | Inventory No. | Cal. date (yyyy/mm/dd) | Cal.Due date (yyyy/mm/dd) |
| Semi-Anechoic Chamber               | Brilliant-emc              | N/A              | SUWI-04-02-02 | 2021/11/25             | 2024/11/24                |
| Temperature and humidity meter      | MingGao                    | TH101B           | SUWI-01-01-15 | 2022/02/16             | 2023/02/15                |
|                                     |                            |                  |               | 2023/02/07             | 2024/02/06                |
| Signal Analyzer                     | ROHDE&SCHWARZ              | FSW43            | SUWI-01-02-04 | 2022/05/28             | 2023/05/27                |
| Signal Analyzer                     | KEYSIGHT                   | N9020A           | SUWI-01-02-06 | 2022/11/23             | 2023/11/22                |
| Test receiver                       | ROHDE&SCHWARZ              | ESR7             | SUWI-01-10-01 | 2022/02/19             | 2023/02/18                |
|                                     |                            |                  |               | 2023/02/08             | 2024/02/07                |
| Receiving antenna                   | SCHWRZBECK MESS-ELEKTRONIK | VULB 9163        | SUWI-01-11-04 | 2021/12/05             | 2023/12/04                |
| Receiving antenna                   | SCHWRZBECK MESS-ELEKTRONIK | BBHA 9120D       | SUWI-01-11-05 | 2021/12/05             | 2023/12/04                |
| Receiving antenna                   | SCHWRZBECK MESS-ELEKTRONIK | BBHA 9170        | SUWI-01-11-03 | 2021/05/14             | 2023/05/13                |
| Active Loop Antenna                 | SCHWRZBECK MESS-ELEKTRONIK | FMZB 1519B       | SUWI-01-21-01 | 2021/06/10             | 2023/06/09                |
| Amplifier                           | Tonscend                   | TAP9K3G32        | SUWI-01-14-06 | 2022/11/23             | 2023/11/22                |
| Amplifier                           | Tonscend                   | TAP01018050      | SUWI-01-14-04 | 2022/11/23             | 2023/11/22                |
| Amplifier                           | Tonscend                   | TAP30M7G30       | SUWI-01-14-05 | 2022/11/23             | 2023/11/22                |
| Wideband Radio Communication Tester | Anritsu                    | MT8820C          | SUWI-01-16-08 | 2022/02/14             | 2023/02/13                |
|                                     |                            |                  |               | 2023/02/06             | 2024/02/05                |
| Measurement Software                | Tonscend                   | JS32-RE V4.0.0.0 | SUWI-02-09-04 | NCR                    | NCR                       |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 28 of 29

## 6 Measurement Uncertainty

For a 95% confidence level ( $k = 2$ ), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

| No.                                                                                                                                                                                                                                                                                                                                             | Item                          | Measurement Uncertainty  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------|
| 1                                                                                                                                                                                                                                                                                                                                               | Total RF power, conducted     | ±0.54dB                  |
| 2                                                                                                                                                                                                                                                                                                                                               | RF power density, conducted   | ±1.03dB                  |
| 3                                                                                                                                                                                                                                                                                                                                               | Spurious emissions, conducted | ±0.54dB                  |
| 4                                                                                                                                                                                                                                                                                                                                               | Radio Frequency               | ±1.0 %                   |
| 5                                                                                                                                                                                                                                                                                                                                               | Duty Cycle                    | ±0.37%                   |
| 6                                                                                                                                                                                                                                                                                                                                               | Occupied Bandwidth            | ±1.0 %                   |
| 7                                                                                                                                                                                                                                                                                                                                               | Radiated Emission             | ± 3.13dB (9k -30MHz)     |
|                                                                                                                                                                                                                                                                                                                                                 |                               | ± 4.88dB (30M -1GHz)     |
|                                                                                                                                                                                                                                                                                                                                                 |                               | ± 4.75dB (1GHz to 18GHz) |
|                                                                                                                                                                                                                                                                                                                                                 |                               | ± 4.77dB (Above 18GHz)   |
| Remark:<br>The U <sub>lab</sub> (lab Uncertainty) is less than U <sub>cispr/ETSI</sub> (CISPR/ETSI Uncertainty), so the test results<br>– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;<br>– non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit. |                               |                          |



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Report No.: SEWM2212000309RG01

Rev.: 02

Page: 29 of 29

## 7 Appendixes

|              |                   |
|--------------|-------------------|
| Appendix A.3 | WWAN Setup Photos |
| Appendix B.1 | GSM 850 & 1900    |
| Appendix B.2 | WCDMA Band V      |
| Appendix B.3 | LTE Band 5        |
| Appendix B.4 | LTE Band 12       |

---End of Report---



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