



FCC RADIO TEST REPORT

FCC ID : B94TNQ225HP2TK
Equipment : Notebook PC
Brand Name : HP
Model Name : TPN-Q225
Applicant : HP Inc.
1501 Page Mill Road, Palo Alto CA 94304 USA
Standard : FCC 47 CFR Part 2, 22(H), 24(E), 27

The product was received on Jul. 10, 2020 and testing was started from Aug. 02, 2020 and completed on Aug. 14, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|
| - | §2.1046 | Conducted Output Power | - | See Note |
| | §22.913 (a)(2) | Effective Radiated Power (Band 5) (Band 26) | - | |
| | §27.50 (b)(10) §27.50 (c)(10) | Effective Radiated Power (Band 12) (Band 13) (Band 17) (Band 71) | | |
| | §24.232 (c) §27.50 (h)(2) | Equivalent Isotropic Radiated Power (Band 2) (Band 25) (Band 7) (Band 38) (Band 41) | | |
| | §27.50 (d)(4) | Equivalent Isotropic Radiated Power (Band 4) (Band 66) | | |
| - | §24.232 (d) §27.50 (d)(5) | Peak-to-Average Ratio | | - |
| - | §2.1049 | Occupied Bandwidth | - | See Note |
| - | §2.1051 §22.917 (a) §24.238 (a) §27.53 (c)(2)(4) §27.53 (g) §27.53 (h) | Conducted Band Edge Measurement (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 17) (Band 25) (Band 26) (Band 66) (Band 71) | - | See Note |
| | §2.1051 §27.53 (m)(4) | Conducted Band Edge Measurement (Band 7) (Band 38) (Band 41) | | |
| - | §2.1051 §22.917 (a) §24.238 (a) §27.53 (c)(2) §27.53 (g) §27.53 (h) | Conducted Spurious Emission (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 17) (Band 25) (Band 26) (Band 66) (Band 71) | - | See Note |
| | §2.1051 §27.53 (m)(4) | Conducted Spurious Emission (Band 7) (Band 38) (Band 41) | | |
| - | §2.1055 §22.355 §24.235 §27.54 | Frequency Stability Temperature & Voltage | - | See Note |



| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------|
| 3.2 | §2.1053 §22.917 (a) §24.238 (a) §27.53 (c)(2) §27.53 (f) §27.53 (g) §27.53 (h) | Radiated Spurious Emission (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 17) (Band 25) (Band 26) (Band 66) (Band 71) | Pass | Under limit 15.33 dB at 10341.000 MHz |
| | §2.1051 §27.53 (m)(4) | Radiated Spurious Emission (Band 7) (Band 38) (Band 41) | | |

Note: The module (Model: T99W175) makes no difference after verifying output power, this report reuses test data from the module report.

| |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Declaration of Conformity: |
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. |
| Comments and Explanations: |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |

Reviewed by: Wii Chang

Report Producer: Ruby Zou



1 General Description

1.1 Product Feature of Equipment Under Test

WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ax, Wi-Fi 5GHz 802.11a/n/ac/ax and GNSS.

| Product Specification subjective to this standard | |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Antenna Type | WWAN <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna (Rx only) <Ant. 3>: PIFA Antenna <Ant. 4>: PIFA Antenna (Rx only) WLAN <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna Bluetooth: PIFA Antenna GPS/Glonass/BDS/Galileo: PIFA Antenna |



| WWAN Antenna Information | | | |
|--------------------------------------------------------|-------------|--------------|-------------------------------|
| Antenna Part Number | Manufacture | Antenna Type | Peak Gain (dBi) |
| DQ6PS6G1S00 (WA-P-S6G1S6G1S6G2S6G2-02-002) Main | INPAQ | PIFA | 824-849MHz 0.79 dBi (peak) |
| | | | 880-915MHz -0.37 dBi (peak) |
| | | | 1710-1785MHz 0.85 dBi (peak) |
| | | | 1850-1910MHz -1.24 dBi (peak) |
| | | | 1920-1980MHz -1.92 dBi (peak) |
| | | | 704-716MHz -2.74 dBi (peak) |
| | | | 777-787MHz 1.06 dBi (peak) |
| | | | 832-862MHz 0.6 dBi (peak) |
| | | | 1710-1755MHz 0.85 dBi (peak) |
| | | | 2500-2570MHz -0.36 dBi (peak) |
| | | | 2305-2315MHz 0.46 dBi (peak) |
| | | | 788-798MHz 1.15 dBi (peak) |
| | | | 814-849MHz 1.26 dBi (peak) |
| | | | 3300-4200MHz -1.81 dBi (peak) |
| 3300-3800MHz -1.81 dBi (peak) | | | |
| 4400-5000MHz -1.54 dBi (peak) | | | |
| DQ6PS6G1S00 (WA-P-S6G1S6G1S6G2S6G2-02-002) Aux 1 | INPAQ | PIFA | 869-894MHz -1.69 dBi (peak) |
| | | | 925-960MHz -2.46 dBi (peak) |
| | | | 1805-1880MHz -0.51 dBi (peak) |
| | | | 1930-1990MHz -1.9 dBi (peak) |
| | | | 746-756MHz -0.28 dBi (peak) |
| | | | 791-821MHz 0.1 dBi (peak) |
| | | | 2620-2690MHz -1.92 dBi (peak) |
| | | | 3300-4200MHz 0.17 dBi (peak) |
| 3300-3800MHz 0.17 dBi (peak) | | | |
| 4400-5000MHz -1.69 dBi (peak) | | | |
| DQ6PS6G1S00 (WA-P-S6G1S6G1S6G2S6G2-02-002) Aux 2 | INPAQ | PIFA | 1805-1880MHz 1.02 dBi (peak) |
| | | | 1930-1990MHz -0.4 dBi (peak) |
| | | | 2620-2690MHz -2.08 dBi (peak) |
| | | | 2496-2593MHz -2.13 dBi (peak) |
| | | | 3300-4200MHz 0.5 dBi (peak) |
| | | | 3300-3800MHz -0.35 dBi (peak) |
| 4400-5000MHz 0.33 dBi (peak) | | | |
| DQ6PS6G1S00 (WA-P-S6G1S6G1S6G2S6G2-02-002) Aux 3 | INPAQ | PIFA | 1710-1785MHz 2.58 dBi (peak) |
| | | | 1850-1910MHz 2.75 dBi (peak) |
| | | | 1920-1980MHz 0.56 dBi (peak) |
| | | | 1710-1755MHz 2.55 dBi (peak) |
| | | | 2500-2570MHz -1.36 dBi (peak) |
| | | | 2305-2315MHz -0.93 dBi (peak) |
| | | | 3300-4200MHz 0.2 dBi (peak) |
| | | | 3300-3800MHz 0.2 dBi (peak) |
| 4400-5000MHz 1.26 dBi (peak) | | | |



1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

| | |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Test Site | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory |
| Test Site Location | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855 |
| Test Site No. | Sporton Site No. 03CH12-HY |
| Test Engineer | Jack Cheng, Lance Chiang and Chuan Chu |
| Temperature | 22.8~26.2°C |
| Relative Humidity | 56.5~68.6% |

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW0007

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.26-2015
- ♦ ANSI / TIA-603-E
- ♦ FCC 47 CFR Part 2, 22(H), 24(E), 27
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

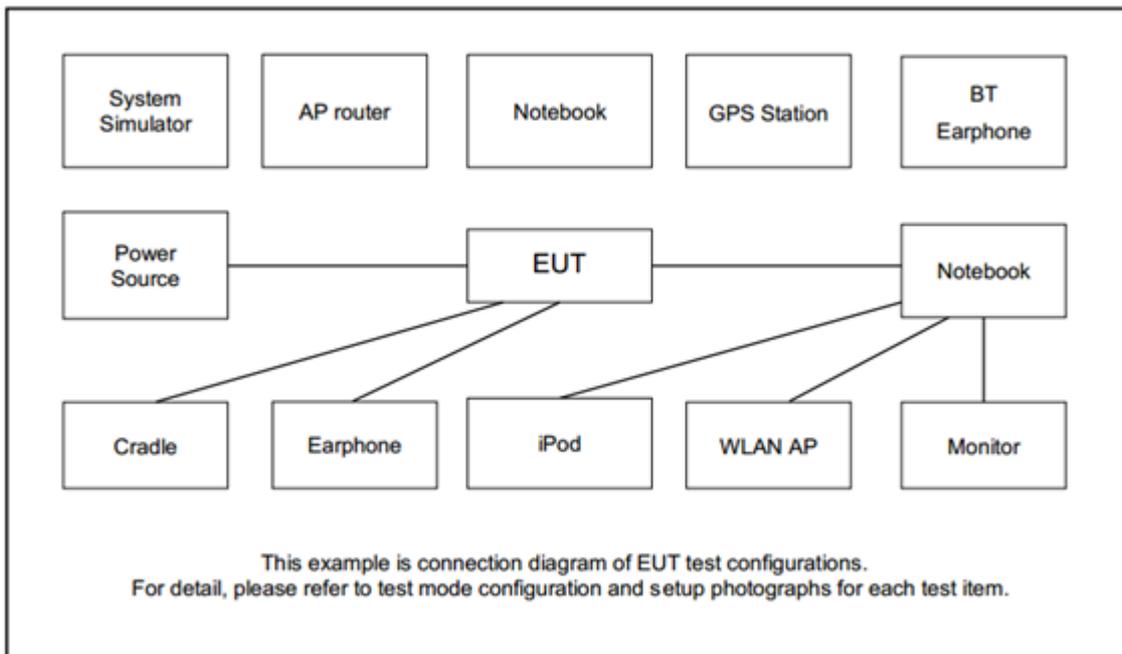
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in Tablet type (three orthogonal panels, X, Y, Z) and Notebook type. The worst cases (Notebook type) were recorded in this report.

| Test Items | Band | Bandwidth (MHz) | | | | | | Modulation | | | RB # | | | Test Channel | | | |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|---|----|----|----|------------|-------|-------|------|------|------|--------------|---|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 64QAM | 1 | Half | Full | L | M | H | |
| Radiated Spurious Emission | 41 | - | - | | | | v | v | | | | v | | | v | v | v |
| Remark | <ol style="list-style-type: none"> The mark "v" means that this configuration is chosen for testing The mark "-" means that this bandwidth is not supported. The device is investigated from 1GHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. | | | | | | | | | | | | | | | | |

2.2 Connection Diagram of Test System





2.3 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model No. | FCC ID | Data Cable | Power Cord |
|------|------------------|------------|-----------|--------------|-------------------|-------------------|
| 1. | iPod Earphone | Apple | N/A | Verification | Unshielded, 1.0 m | N/A |
| 2. | System Simulator | Anritsu | 8821C | N/A | N/A | Unshielded, 1.8 m |

2.4 Frequency List of Low/Middle/High Channels

| LTE Band 41 Channel and Frequency List | | | | |
|----------------------------------------|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 39750 | 40620 | 41490 |
| | Frequency | 2506.0 | 2593.0 | 2680.0 |

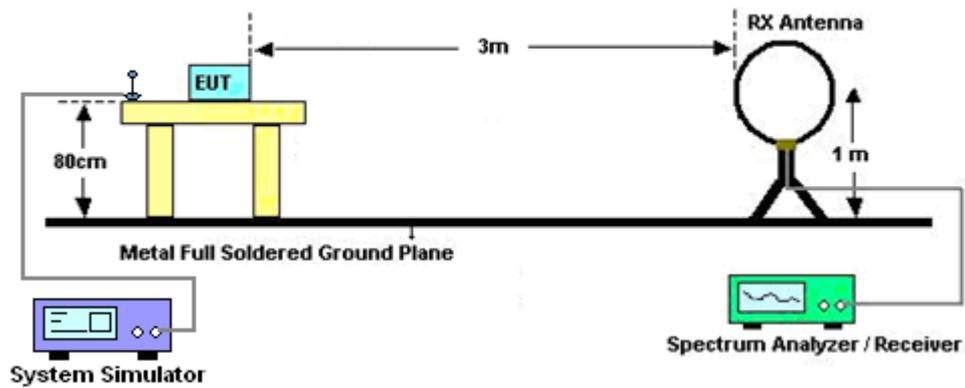
3 Radiated Test Items

3.1 Measuring Instruments

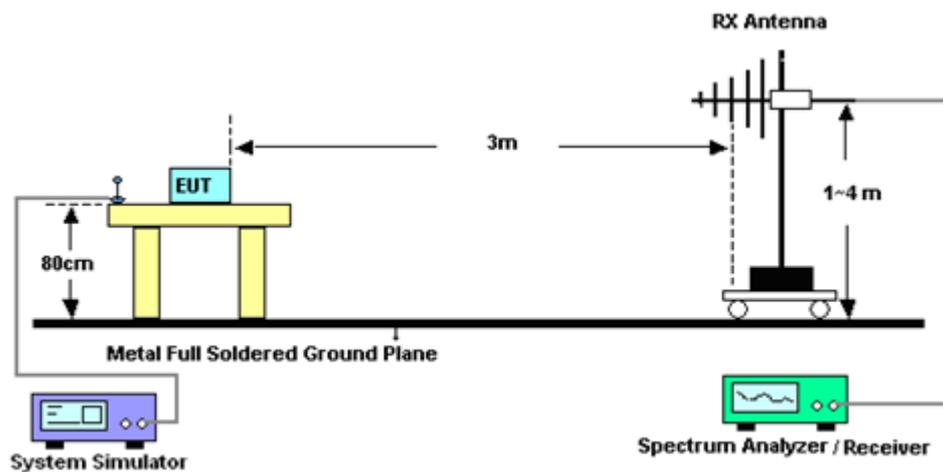
See list of measuring instruments of this test report.

3.1.1 Test Setup

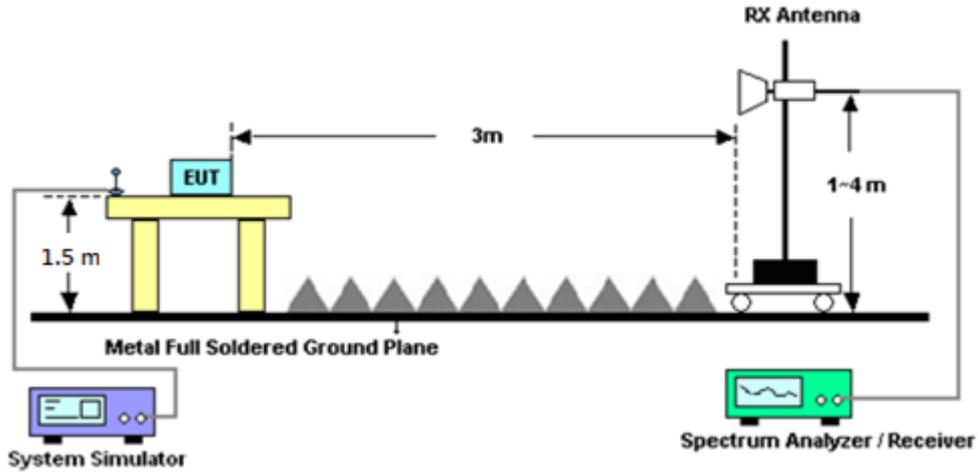
For radiated emissions below 30MHz



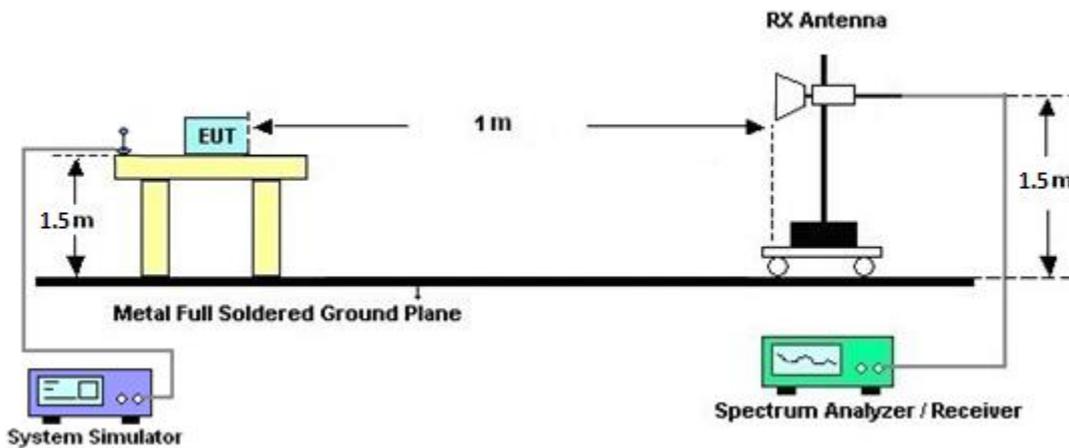
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated emissions above 18GHz



3.1.2 Test Result of Radiated Test

Please refer to Appendix A.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.



3.2 Radiated Spurious Emission Measurement

3.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB. The spectrum is scanned from 1GHz up to a frequency including its 10th harmonic.

3.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)

$EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$

$ERP \text{ (dBm)} = EIRP - 2.15$



4 List of Measuring Equipment

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-------------------------|--------------------|-----------------------------------|----------------------|----------------------------------|------------------|---------------------------------|---------------|--------------------------|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz~30 MHz | Dec. 26, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Dec. 25, 2020 | Radiation (03CH12-HY) |
| Bilog Antenna | TESEQ | CBL 6111D & 00800N1D01N -06 | 37059 & 01 | 30MHz~1GHz | Oct. 12, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Oct. 11, 2020 | Radiation (03CH12-HY) |
| Horn Antenna | SCHWARZBE CK | BBHA 9120 D | 9120D-1328 | 1GHz~18GHz | Nov. 14, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Nov. 13, 2020 | Radiation (03CH12-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA917058 4 | 18GHz~40GHz | Dec. 10, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Dec. 09, 2020 | Radiation (03CH12-HY) |
| Preamplifier | COM-POWER | PA-103 | 161075 | 10MHz~1GHz | Mar. 25, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Mar. 24, 2021 | Radiation (03CH12-HY) |
| Preamplifier | Agilent | 8449B | 3008A02375 | 1GHz~26.5GHz | Mar. 26, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Mar. 25, 2021 | Radiation (03CH12-HY) |
| Preamplifier | Jet-Power | JPA0118-55-3 03K | 1710001800 054002 | 1GHz~18GHz | Feb. 07, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Feb. 06, 2021 | Radiation (03CH12-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz~40GHz | Dec. 13, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Dec. 12, 2020 | Radiation (03CH12-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSV3044 | 101048 | 10Hz~44GHz | Apr. 29, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Apr. 28, 2021 | Radiation (03CH12-HY) |
| Signal Generator | Rohde & Schwarz | SMB100A | 101107 | 100kHz~40GHz | Aug. 27, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Aug. 26, 2020 | Radiation (03CH12-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 126E | 0058/126E | 30MHz~18GHz | Dec. 12, 2019 | Aug. 02, 2020~ Aug. 14, 2020 | Dec. 11, 2020 | Radiation (03CH12-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30MHz~40GHz | Feb. 25, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Feb. 24, 2021 | Radiation (03CH12-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 800740/2 | 30MHz~40GHz | Feb. 25, 2020 | Aug. 02, 2020~ Aug. 14, 2020 | Feb. 24, 2021 | Radiation (03CH12-HY) |
| Controller | EMEC | EM1000 | N/A | Control Turn table & Ant Mast | N/A | Aug. 02, 2020~ Aug. 14, 2020 | N/A | Radiation (03CH12-HY) |
| Antenna Mast | EMEC | AM-BS-4500-B | N/A | 1m~4m | N/A | Aug. 02, 2020~ Aug. 14, 2020 | N/A | Radiation (03CH12-HY) |
| Turn Table | EMEC | TT2000 | N/A | 0~360 Degree | N/A | Aug. 02, 2020~ Aug. 14, 2020 | N/A | Radiation (03CH12-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-000989 | N/A | N/A | Aug. 02, 2020~ Aug. 14, 2020 | N/A | Radiation (03CH12-HY) |



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

| | |
|-------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 3.07 |
|-------------------------------------------------------------------------|------|

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

| | |
|-------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 3.21 |
|-------------------------------------------------------------------------|------|

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

| | |
|-------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 3.80 |
|-------------------------------------------------------------------------|------|



Appendix A. Test Results of Radiated Test

LTE Band 41 HPUE

| LTE Band 41 / 20MHz / QPSK | | | | | | | | | |
|----------------------------|-------------------|--------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel | Frequency (MHz) | EIRP (dBm) | Limit (dBm) | Over Limit (dB) | SPA Reading (dBm) | S.G. Power (dBm) | TX Cable loss (dB) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Lowest | 4998 | -47.06 | -25 | -22.06 | -73.47 | -58.05 | 1.61 | 12.60 | H |
| | 7494 | -44.43 | -25 | -19.43 | -74.89 | -53.55 | 1.99 | 11.11 | H |
| | 9999 | -42.13 | -25 | -17.13 | -75.43 | -51.03 | 2.40 | 11.30 | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | 4998 | -47.89 | -25 | -22.89 | -73.84 | -58.88 | 1.61 | 12.60 | V |
| | 7494 | -44.72 | -25 | -19.72 | -75.14 | -53.84 | 1.99 | 11.11 | V |
| | 9999 | -41.35 | -25 | -16.35 | -75.45 | -50.25 | 2.40 | 11.30 | V |
| | | | | | | | | | V |
| | | | | | | | | | V |
| | | | | | | | | | V |
| | | | | | | | | | V |
| Middle | 5172 | -47.43 | -25 | -22.43 | -73.92 | -58.62 | 1.65 | 12.84 | H |
| | 7752 | -44.81 | -25 | -19.81 | -74.62 | -53.94 | 2.03 | 11.15 | H |
| | 10341 | -40.47 | -25 | -15.47 | -74.55 | -49.10 | 2.39 | 11.03 | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | 5172 | -47.80 | -25 | -22.80 | -74.09 | -58.99 | 1.65 | 12.84 | V |
| | 7752 | -45.17 | -25 | -20.17 | -74.74 | -54.30 | 2.03 | 11.15 | V |
| | 10341 | -40.33 | -25 | -15.33 | -74.46 | -48.96 | 2.39 | 11.03 | V |
| | | | | | | | | | V |



| | | | | | | | | | |
|---------|-------|--------|-----|--------|--------|--------|------|-------|---|
| Highest | 5346 | -47.07 | -25 | -22.07 | -74.09 | -58.45 | 1.70 | 13.08 | H |
| | 8022 | -42.79 | -25 | -17.79 | -73.86 | -51.97 | 2.06 | 11.24 | H |
| | 10692 | -40.54 | -25 | -15.54 | -75.03 | -48.95 | 2.49 | 10.90 | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | | | | | | | | | H |
| | 5346 | -47.45 | -25 | -22.45 | -74.12 | -58.83 | 1.70 | 13.08 | V |
| | 8022 | -43.28 | -25 | -18.28 | -74.25 | -52.46 | 2.06 | 11.24 | V |
| | 10692 | -40.99 | -25 | -15.99 | -75.24 | -49.40 | 2.49 | 10.90 | V |
| | | | | | | | | | V |
| | | | | | | | | | V |
| | | | | | | | | | V |
| | | | | | | | | | V |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.