

# FCC WLAN 6GHz RF Exposure

**Applicant** : Motorola Mobility LLC  
**Equipment** : Mobile Cellular Phone  
**Brand Name** : Motorola  
**Model Name** : XT2437-3  
**FCC ID** : IHDT56AS9  
**Standard** : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

**Sporton International Inc. (Kunshan)**

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People's Republic of China**



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## History of this test report

| Report No.   | Version | Description             | Issued Date   |
|--------------|---------|-------------------------|---------------|
| FA471919-01C | 01      | Initial issue of report | Aug. 23, 2024 |
|              |         |                         |               |
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## 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, XT2437-3**, are as follows.

| Band             | Tx Frequency (MHz) | Scaled PD                   |
|------------------|--------------------|-----------------------------|
|                  |                    | psPD<br>(W/m <sup>2</sup> ) |
| WLAN 6GHz        | 5925-7125          | 6.99                        |
| Date of Testing: |                    | 2024/8/15 ~2024/8/19        |

### 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.

This device is in compliance with Power density exposure limits ( $1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$ ) specified in FCC 47 CFR part 2 (2.1093), ANSI/IEEE C95.1-1992 and FCC 47 CFR Part1.1310 and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

## 2. Administration Data

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

| Testing Laboratory |  |                     |                                |
|--------------------|--|---------------------|--------------------------------|
| Test Firm          | Sporton International Inc. (Kunshan)   |                     |                                |
| Test Site Location | No. 1098, Pengxi North Road, Kunshan Economic Development Zone<br>Jiangsu Province 215300 People's Republic of China<br>TEL : +86-512-57900158 |                     |                                |
| Test Site No.      | Sporton Site No.   | FCC Designation No. | FCC Test Firm Registration No. |
|                    | SAR04-KS   | CN1257              | 314309                         |

| Applicant    |   |
|--------------|---|
| Company Name | Motorola Mobility LLC                               |
| Address      | 222 W, Merchandise Mart Plaza, Chicago IL 60654 USA |

| Manufacturer |   |
|--------------|---|
| Company Name | Motorola Mobility LLC                               |
| Address      | 222 W, Merchandise Mart Plaza, Chicago IL 60654 USA |

## 3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards.

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- IEC TR 63170:2018
- IEC 62479:2010
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- SPEAG DASY6 Application Note (Interim Procedure for Device Operation at 6GHz-10GHz)

## 4. Equipment Under Test (EUT) Information

### 4.1 General Information

| Product Feature & Specification  |  |
|--|--|
| Equipment Name   | Mobile Cellular Phone  |
| Brand Name   | Motorola   |
| Model Name   | XT2437-3   |
| FCC ID   | IHDT56AS9  |
| IMEI Code  | IMEI 1: 359867620006451<br>IMEI 2: 359867620006469   |
| Wireless Technology and Frequency Range  | WLAN 6GHz U-NII-5: 5925 MHz ~ 6425 MHz<br>WLAN 6GHz U-NII-6: 6425 MHz ~ 6525 MHz<br>WLAN 6GHz U-NII-7: 6525 MHz ~ 6875 MHz<br>WLAN 6GHz U-NII-8: 6875 MHz ~ 7125 MHz |
| Mode   | WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160  |
| HW Version   | DVT2   |
| SW Version   | U4UQ34.39  |
| EUT Stage  | Identical Prototype  |
| <b>Remark:</b> <ol style="list-style-type: none"> <li>The 6GHz WLAN can transmit in MIMO antenna mode only and it has no SISO antenna mode.</li> <li>The device does not support UNII-8_CH233 (BW=20M, Center Frequency = 7115MHz).</li> <li>The device implements Proximity sensors/receiver detect mechanism trigger reduced power for the power management for SAR compliance at different exposure conditions (head, body-worn, extremity) will manage to ensure the power level not exceeding the associated power table. Details about the power management decision and receiver detection are provided in the operational description.</li> <li>For WLAN when transmit simultaneous with WWAN, power reduction will be activated to head exposure condition. For WLAN when transmit simultaneous with WWAN and Proximity sensors trigger, power reduction will be activated to body-worn and extremity exposure conditions.</li> </ol> |  |

## **5. RF Exposure Limits**

### **5.1 Uncontrolled Environment**

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

### **5.2 Controlled Environment**

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

### **5.3 RF Exposure limit for above 6GHz**

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310. The unit of power density evaluation is W/m<sup>2</sup> or mW/cm<sup>2</sup>.

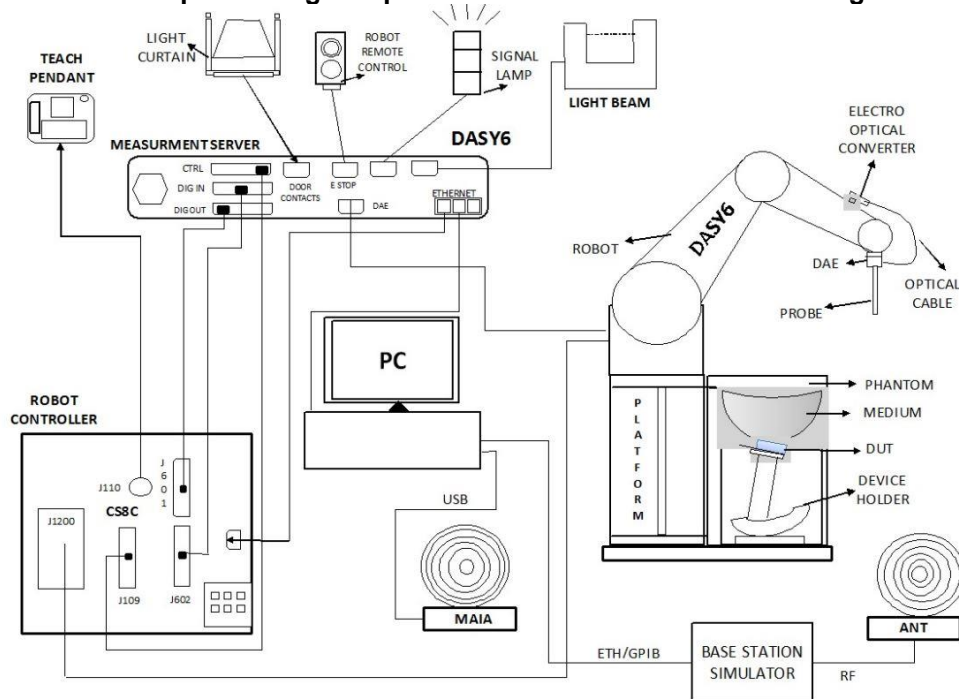
Peak Spatially Averaged Power Density was evaluated over a square area of 4cm<sup>2</sup> per interim FCC Guidance for near-field power density evaluations per October 2018 TCB Workshop notes

| Frequency range (MHz)  | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 0.3-3.0  | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0-30   | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30-300   | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1500   |                               |                               | f/300                               | 6                        |
| 1500-100,000   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30  | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30-300   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500   |                               |                               | f/1500                              | 30                       |
| 1500-100,000   |                               |                               | 1.0                                 | 30                       |

Note: 1.0 mW/cm<sup>2</sup> is 10 W/m<sup>2</sup>

## 6. System Description and Setup

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
  - An isotropic Field probe optimized and calibrated for the targeted measurement.
  - A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
  - The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
  - The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
  - The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
  - A computer running Windows 10 and the DASY6<sup>(1)</sup> software.
  - Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
  - The phantom, the device holder and other accessories according to the targeted measurement.
- Note: 1. DASY6 software used: DASY6 mmWave V3.0.0.841 and older generations and used the developed Plane-to-Plane Phase Reconstruction (PTP-PR) Algorithm which was used in PD measurement.



## 7. Test Equipment List

| Manufacturer    | Name of Equipment            | Type/Model | Serial Number | Calibration |            |
|-----------------|------------------------------|------------|---------------|-------------|------------|
|                 |                              |            |               | Last Cal.   | Due Date   |
| SPEAG           | 5G Verification Source       | 10GHz      | 2005          | 2023/11/20  | 2024/11/19 |
| SPEAG           | Data Acquisition Electronics | DAE4       | 1358          | 2024/5/23   | 2025/5/22  |
| SPEAG           | EUmmWV Probe Tip Protection  | EUmmWV4    | 9553          | 2023/10/18  | 2024/10/17 |
| SPEAG           | mmWave Phantom               | mmWave     | 1065          | NCR         | NCR        |
| Agilent         | ENA Series Network Analyzer  | E5071C     | MY46112129    | 2024/7/4    | 2025/7/3   |
| Rohde & Schwarz | Signal Generator             | SMB100A    | 100455        | 2024/1/2    | 2025/1/1   |
| Keysight        | Preamplifier                 | 83017A     | MY57280106    | 2024/4/18   | 2025/4/17  |
| Rohde & Schwarz | Power Meter                  | NRVD       | 102081        | 2024/7/4    | 2025/7/3   |
| Rohde & Schwarz | Power Sensor                 | NRV-Z5     | 100538        | 2024/7/4    | 2025/7/3   |
| Rohde & Schwarz | Power Sensor                 | NRV-Z5     | 100539        | 2024/7/4    | 2025/7/3   |
| Rohde & Schwarz | Power Sensor                 | NRP50S     | 101385        | 2023/10/11  | 2024/10/10 |
| Rohde & Schwarz | Spectrum Analyzer            | FSV7       | 101631        | 2023/10/11  | 2024/10/10 |
| Testo           | Thermo-Hygrometer            | HTC-1      | 55009         | 2024/1/4    | 2025/1/3   |
| Agilent         | Dual Directional Coupler     | 778D       | 20500         | Note 1      |            |
| Agilent         | Dual Directional Coupler     | 11691D     | MY48151020    | Note 1      |            |
| ET Industries   | Dual Directional Coupler     | C-058-10   | N/A           | Note 1      |            |
| ATM             | Dual Directional Coupler     | C122H-10   | P610410z-02   | Note 1      |            |
| MCL             | Attenuation1                 | BW-S10W5+  | N/A           | Note 1      |            |
| MCL             | Attenuation2                 | BW-S10W5+  | N/A           | Note 1      |            |
| MCL             | Attenuation3                 | BW-S10W5+  | N/A           | Note 1      |            |

### General Note:

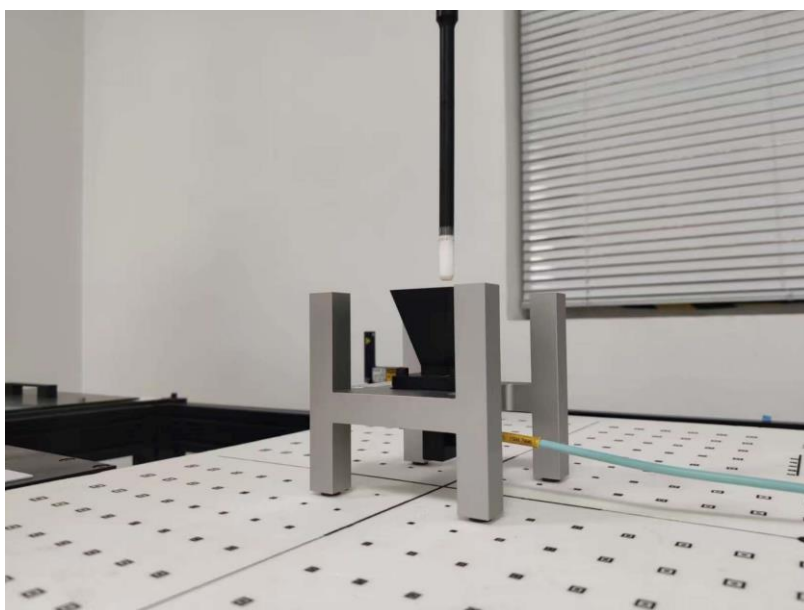
1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01. The dipoles are also not physically damaged, or repaired during the interval. The justification data in appendix C can be found which the return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration for each dipole.

## 8. PD System Verification Results

The system was verified to be within  $\pm 0.66$  dB of the power density targets on the calibration certificate according to the test system specification in the user's manual and calibration facility recommendation. The 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG's mmWave verification sources. The same spatial resolution and measurement region used in the source calibration was applied during the system check. The measured power density distribution of verification source was also confirmed through visual inspection to have no noticeable differences, both spatially (shape) and numerically (level) from the distribution provided by the manufacturer, per November 2017 TCBC Workshop Notes. The plots can be referred to Appendix A of this report.

| Frequency (GHz) | 5G Verification Source | Probe S/N | DAE S/N | Distance (mm) | Input Power (mW) | Measured 4 cm <sup>2</sup> (W/m <sup>2</sup> ) | Normalized <sup>(1)</sup> 4 cm <sup>2</sup> (W/m <sup>2</sup> ) | Targeted 4 cm <sup>2</sup> (W/m <sup>2</sup> ) | Deviation (dB) | Date      |
|-----------------|------------------------|-----------|---------|---------------|------------------|--|---|--|----------------|-----------|
| 10              | 10GHz_2005             | 9553      | 1358    | 10            | 125              | 112  | 142.0   | 161  | -0.55          | 2024/8/15 |

Note: (1) means the measured PD was normalized to Prad power which can be referred to DASY Calibration Certificate in appendix C.



System Verification Setup Photo

## 9. PD Test Result

### Power Density General Notes:

1. The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
2. Batteries are fully charged at the beginning of the measurements.
3. Absorbed power density (APD) using a 4cm<sup>2</sup> averaging area is reported based on SAR measurements.
4. Power density was calculated by repeated E-field measurements on two measurement planes separated by  $\lambda/4$ .
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools.
6. Per FCC guidance and equipment manufacturer guidance, power density results were scaled according to IEC 62479:2010 for the portion of the measurement uncertainty > 30%. Total expanded uncertainty of 2.68 dB (85.4%) was used to determine the psPD measurement scaling factor.
7. IPD is measured for all edges and surfaces of the device with a transmitting antenna located within 25 mm from that surface or edge.
8. Per April 2021 TCB Workshop, For the highest SAR test configurations also measure incident PD (total) using power-density reconstruction method in 2 mm closest measurement plane.
9. Since this device is considered a phablet and there is no different PD limit on different exposure conditions, therefore select highest phablet SAR at 0 mm test distance and configurations evaluate power density. Since there is no different PD limit on different exposure conditions, therefore the PD test was performed of a 2mm separation between Probe sensor and EUT surface to cover all exposure conditions of phablet.
10. IPD is measured for all edges and surfaces of the device with a transmitting antenna located within 25 mm from that surface or edge.
11. The conducted power measurements results are referenced from appendix E in the FCC SAR report (Sporton report no.: FA471919-01).
12. The measurement procedure consists of measuring the PD<sub>inc</sub> at two different distances: 2 mm (compliance distance) and  $\lambda/5$ . The grid extents should be large enough to fully capture the transmitted energy. The grid step should be fine enough to demonstrate that the integrated Power Density iPD<sub>n</sub> fulfill the criterion described below. Since iPD ratio between the two distances is  $\geq -1$  dB, the grid step (0.0625) was sufficient for determining compliance at d=2mm.

$$10 \cdot \log_{10} \frac{iPD_n(2mm)}{iPD_n(\lambda/5)} \geq -1$$

### <WLAN PD>

| Band     | Mode                | Test Position | Gap (mm) | Antenna    | Ch. | Freq. (MHz) | Average Power (dBm) | Grid Step ( $\lambda$ ) | iPD <sub>n</sub> | iPD ratio ( $\geq -1$ ) | Normal psPD (W/m <sup>2</sup> ) | Total psPD (W/m <sup>2</sup> ) |
|----------|---------------------|---------------|----------|------------|-----|-------------|---------------------|-------------------------|------------------|-------------------------|---------------------------------|--------------------------------|
| WLAN6GHz | 802.11ax-HE160 MCS0 | Top Side      | 2mm      | Ant 5+8(8) | 15  | 6025        | 10.78               | 0.0625                  | 1.76             | 0.58                    | 0.875                           | 1.530                          |
| WLAN6GHz | 802.11ax-HE160 MCS0 | Top Side      | 8.59mm   | Ant 5+8(8) | 15  | 6025        | 10.78               | 0.15                    | 1.54             |                         | 0.735                           | 1.32                           |
| WLAN6GHz | 802.11ax-HE160 MCS0 | Top Side      | 2mm      | Ant 5+8(5) | 207 | 6985        | 7.71                | 0.0625                  | 2.27             | 0.59                    | 1.38                            | 2.55                           |
| WLAN6GHz | 802.11ax-HE160 MCS0 | Top Side      | 10mm     | Ant 5+8(5) | 207 | 6985        | 7.71                | 0.15                    | 1.98             |                         | 1.010                           | 1.92                           |



| Plot No. | Band                | Mode                | Test Position | Gap (mm)   | Antenna    | Ch.  | Freq. (MHz) | power state | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Scaling Factor for measurement uncertainty | Power Drift (dB) | Normal psPD(W/m^2) | Scaled Normal psPD(W/m^2) | Total psPD(W/m^2) | Scaled Total psPD(W/m^2) |
|----------|---------------------|---------------------|---------------|------------|------------|------|-------------|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|--|------------------|--------------------|---------------------------|-------------------|--------------------------|
| 01       | WLAN6GHz            | 802.11ax-HE160 MCS0 | Top Side      | 2mm        | Ant 5+8(8) | 15   | 6025        | Standalone  | 10.78               | 12.50               | 1.486                  | 85.71        | 1.167                     | 1.5535                                     | -0.03            | 0.875              | 2.36                      | 1.530             | 4.12                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Top Side      | 2mm        | Ant 5+8(8) | 47   | 6185        | Standalone  | 10.74               | 12.50               | 1.500                  | 85.71        | 1.167                     | 1.5535                                     | 0.14             | 2.100              | 5.71                      | 2.570             | 6.99                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Top Side      | 2mm        | Ant 5+8(5) | 111  | 6505        | Standalone  | 9.84                | 11.50               | 1.466                  | 85.71        | 1.167                     | 1.5535                                     | 0.11             | 1.010              | 2.68                      | 1.440             | 3.83                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Top Side      | 2mm        | Ant 5+8(5) | 143  | 6665        | Standalone  | 10.02               | 11.50               | 1.406                  | 85.71        | 1.167                     | 1.5535                                     | -0.05            | 1.380              | 3.52                      | 2.100             | 5.35                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Top Side      | 2mm        | Ant 5+8(5) | 207  | 6985        | Standalone  | 7.71                | 9.50                | 1.510                  | 85.71        | 1.167                     | 1.5535                                     | 0.18             | 1.380              | 3.78                      | 2.550             | 6.98                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Front         | 2mm        | Ant 5+8(8) | 47   | 6185        | Full power  | 13.09               | 14.50               | 1.384                  | 85.71        | 1.167                     | 1.5535                                     | 0.14             | 1.030              | 2.58                      | 1.100             | 2.76                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Back          | 2mm        | Ant 5+8(8) | 47   | 6185        | Standalone  | 10.74               | 12.50               | 1.500                  | 85.71        | 1.167                     | 1.5535                                     | -0.17            | 0.355              | 0.97                      | 0.374             | 1.02                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Right Side    | 2mm        | Ant 5+8(8) | 47   | 6185        | Standalone  | 10.74               | 12.50               | 1.500                  | 85.71        | 1.167                     | 1.5535                                     | 0.17             | 1.110              | 3.02                      | 1.440             | 3.92                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Back          | 5mm        | Ant 5+8(8) | 47   | 6185        | Full power  | 13.09               | 14.50               | 1.384                  | 85.71        | 1.167                     | 1.5535                                     | -0.05            | 1.530              | 3.84                      | 1.620             | 4.06                     |
|          | WLAN6GHz            | 802.11ax-HE160 MCS0 | Right Side    | 8mm        | Ant 5+8(8) | 47   | 6185        | Full power  | 13.09               | 14.50               | 1.384                  | 85.71        | 1.167                     | 1.5535                                     | 0.01             | 1.180              | 2.96                      | 1.230             | 3.09                     |
| WLAN6GHz | 802.11ax-HE160 MCS0 | Top Side            | 14mm          | Ant 5+8(8) | 47         | 6185 | Full power  | 13.09       | 14.50               | 1.384               | 85.71                  | 1.167        | 1.5535                    | 0.1  | 1.410            | 3.54               | 1.480                     | 3.71              |                          |

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu

## 10. Uncertainty Assessment

### Declaration of Conformity:

The test results with all measurement uncertainty excluded is 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.

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

| Uncertainty Distributions          | Normal      | Rectangular  | Triangular   | U-Shape      |
|------------------------------------|-------------|--------------|--------------|--------------|
| Multi-plying Factor <sup>(a)</sup> | $1/k^{(b)}$ | $1/\sqrt{3}$ | $1/\sqrt{6}$ | $1/\sqrt{2}$ |

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b)  $k$  is the coverage factor

### Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

| cDASY6 Module mmWave Uncertainty Budget<br>Evaluation Distances to the Antennas > $\lambda/2\pi$<br>In Compliance with IEC TR 63170 |                         |             |         |      |                            |
|---|-------------------------|-------------|---------|------|----------------------------|
| Error Description   | Uncertainty Value (±dB) | Probability | Divisor | (Ci) | Standard Uncertainty (±dB) |
| <b>Uncertainty terms dependent on the measurement system</b>  |                         |             |         |      |                            |
| Probe Calibration   | 0.49                    | N           | 1       | 1    | 0.49                       |
| Probe correction  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Frequency response  | 0.20                    | R           | 1.732   | 1    | 0.12                       |
| Sensor cross coupling   | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Isotropy  | 0.50                    | R           | 1.732   | 1    | 0.29                       |
| Linearity   | 0.20                    | R           | 1.732   | 1    | 0.12                       |
| Probe scattering  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Probe positioning offset  | 0.30                    | R           | 1.732   | 1    | 0.17                       |
| Probe positioning repeatability   | 0.04                    | R           | 1.732   | 1    | 0.02                       |
| Sensor mechanical offset  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Probe spatial resolution  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Field impedance dependence  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Amplitude and phase drift   | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Amplitude and phase noise   | 0.04                    | R           | 1.732   | 1    | 0.02                       |
| Measurement area truncation   | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Data acquisition  | 0.03                    | N           | 1       | 1    | 0.03                       |
| Sampling  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Field reconstruction  | 2.00                    | R           | 1.732   | 1    | 1.15                       |
| Forward transformation  | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Power density scaling   | 0.00                    | R           | 1.732   | 1    | 0.00                       |
| Spatial averaging   | 0.10                    | R           | 1.732   | 1    | 0.06                       |
| System detection limit  | 0.04                    | R           | 1.732   | 1    | 0.02                       |
| <b>Uncertainty terms dependent on the DUT and environmental factors</b>   |                         |             |         |      |                            |
| Probe coupling with DUT   | 0.00                    | R           | 1.732   | 1    | 0.0                        |
| Modulation response   | 0.40                    | R           | 1.732   | 1    | 0.2                        |
| Integration time  | 0.00                    | R           | 1.732   | 1    | 0.0                        |
| Response time   | 0.00                    | R           | 1.732   | 1    | 0.0                        |
| Device holder influence   | 0.10                    | R           | 1.732   | 1    | 0.1                        |
| DUT alignment   | 0.00                    | R           | 1.732   | 1    | 0.0                        |
| RF ambient conditions   | 0.04                    | R           | 1.732   | 1    | 0.0                        |
| Ambient reflections   | 0.04                    | R           | 1.732   | 1    | 0.0                        |
| Immunity / secondary reception  | 0.00                    | R           | 1.732   | 1    | 0.0                        |
| Drift of the DUT  |                         | R           | 1.732   | 1    |                            |
| <b>Combined Std. Uncertainty</b>  |                         |             |         |      | <b>1.34</b>                |
| <b>Expanded STD Uncertainty (95%)</b>   |                         |             |         |      | <b>2.68</b>                |

**PD Uncertainty Budget**

## **11. References**

- [1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
- [2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
- [3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
- [4] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
- [5] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.
- [6] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [7] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.
- [8] IEC 62479:2010 Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)
- [9] IEC TR 63170: 2018 Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz
- [10] SPEAG DASY System Handbook
- [11] SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz)

-----THE END-----