TEST REPORT

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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677 Rep. of Korea
- Date of Receipt : 2022-09-05

2. Use of Report : Certification

3. Name of Product and Model : Notebook PC
- Model Number : NP345XNA
- Manufacturer and Country of Origin : Samsung Electronics Co., Ltd. / VIETNAM

4. FCC ID : A3LNP345XNA

5. Date of Test : 2022-09-30~ 2022-10-20

6. Location of Test : ■ Permanent Testing Lab ☐ On Site Testing
(Address: 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

7. Test Standards : IEEE 1528-2013, ANSI/IEEE C95.1, KDB Publication

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Mungi Jeong (Signature)	Technical Manager Name : Jongwon Ma (Signature)

2022-11-04

Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2022-10-28	Originally issued	-
2022-11-03	Revised the section 2.7.1 title Revised the section 7.1 Tissue Verification (Conductivity recommended limit of 6 995.0㎒)	8 15

Note: The Report No. KR22-SPF0050 is superseded by the report No. KR22-SPF0050-A.

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

1. Identification when information is provided by the customer: Information marked " # " is provided by the customer. - Disclaimer: This information is provided by the customer and can affect the validity of results.

CONTENTS

1. General information

Client	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Laboratory	:	Eurofins KCTL Co.,Ltd.
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Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-3327, G-198, C-3706, T-1849 CAB Identifier: KR0040, ISED Number: 8035A KOLAS No.: KT231

1.1 Report Overview

This report details the results of testing carried out on the samples listed in section 2, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this test report is used in any configuration other than that detailed in the test report, the manufacturer must ensure the new configuration complies with all relevant standards and certification requirements. Any mention of Eurofins KCTL Co.,Ltd. Wireless lab or testing done by Eurofins KCTL Co.,Ltd. Wireless lab made in connection with the distribution or use of the tested product must be approved in writing by Eurofins KCTL Co.,Ltd. Wireless lab.

2. Device information

2.1 Basic description

Product Name		Notebook PC
Product Model Number		NP345XNA
Product Manufacturer		Samsung Electronics Co., Ltd
Product Serial Number	Radiation	KCUQ930T800404V, KCUQ930T900408T
	WLAN Conduction	KCUQ930T800387H , KCUQ930T800388N
Mode of Operation		WLAN 802.11a/ax
Device Overview		U-NII-5: 5 955.0 ㎒ ~ 6 415.0 ㎒
		U-NII-6: 6 435.0 ㎒ ~ 6 515.0 ㎒
		U-NII-7: 6 535.0 ㎒ ~ 6 855.0 ㎒
		U-NII-8: 6 875.0 ㎒ ~ 7 115.0 ㎒

2.2 Summary of SAR Test Results

Band	Equipment Class	Highest Reported	
		1g SAR (W/kg)	PD 4cm^2 (W/m^2)
U-NII-5	6XD	0.39	1.77
U-NII-6	6XD	0.38	2.06
U-NII-7	6XD	**0.48**	**2.46**
U-NII-8	6XD	0.47	2.28

2.3 #Antenna information

Antenna Type		FPCB antenna			
Band		U-NII-5	U-NII-6	U-NII-7	U-NII-8
Peak gain (dBi)	Main	-8.02	-8.01	-8.02	-8.02
	Aux	-8.02	-8.12	-8.06	-8.06

2.4 Measurement date and environment

Date	Environment	
	Temperature (°C)	Humidity (%)
2022-09-30	21.0 ~ 21.5	55.9
2022-10-12	21.4 ~ 21.9	49.1
2022-10-13	20.4 ~ 20.5	48.5
2022-10-20	21.2 ~ 21.5	49.5

2.5 #Maximum Tune-up power

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

For WLAN 6 GHz of this device, individual antenna operation is not supported, only MIMO operation is supported.

2.5.1 #Maximum WLAN Output Power

Band / Mode	Supported Antennas		
	Main (Ant.1)	Aux (Ant.2)	MIMO
WLAN 6 GHz	No	No	Yes

Band	Mode	Channel	Output Power (dBm)			
			Normal		Back-off (Grip sensor)	
			Target	Max. Allowed	Target	Max. Allowed
U-NII-5, U-NII-6, U-NII-7, U-NII-8 (MIMO)	802.11a	All Channel	12.00	**13.00**	11.00	**12.00**
	SU 20 MHz	All Channel	12.00	**13.00**	11.00	**12.00**
	SU 40/80/160 MHz	All Channel	11.50	**12.50**	10.50	**11.50**
	RU 26T_ 20/40/80/160 MHz	233	3.00	**4.00**	5.00	**6.00**
		Except 233	5.00	**6.00**		
	RU 52T_ 2040/80/160 MHz	All Channel	5.00	**6.00**	5.00	**6.00**
	RU 106T_ 2040/80/160 MHz	All Channel	8.00	**9.00**	8.00	**9.00**
	RU 242T_ 20 MHz	All Channel	12.00	**13.00**	11.00	**12.00**
	RU 242T_ 40/80/160 MHz	All Channel	10.00	**11.00**	10.00	**11.00**
	RU 484T_ 40 MHz	All Channel	11.50	**12.50**	10.50	**11.50**
	RU 484T_ 80/160 MHz	All Channel	10.00	**11.00**	10.00	**11.00**
	RU 996T_ 80 MHz	All Channel	11.50	**12.50**	10.50	**11.50**
	RU 996T_ 160 MHz	All Channel	10.00	**11.00**	10.00	**11.00**
	RU 2x996T_ 160 MHz	All Channel	11.50	**12.50**	10.50	**11.50**

2.6 SAR Test Configurationsd

2.6.1 #DUT Antenna Locations

A diagram showing the location of the device antennas can be found in Appendix B.

2.6.2 SAR Test Exclusion Considerations

Band	Device Edge for SAR Testing (Front View)					
	Front	Rear	Left Edge	Right Edge	Top	Bottom
WLAN 6 ㎓	No	Yes	No	No	No	No

2.7 SAR Test Methods and Procedures

The tests documented in this report were performed in accordance with IEEE 1528-2013 and the following published KDB procedures:

- IEEE 1528-2013
- IEC/IEEE 62209-1528:2020
- IEC 62479:2010
- IEC TR 63170:2018
- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 865664 D01 SAR measurement 100 ㎒ to 6 ㎓ v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 616217 D04 SAR for laptop and tablets v01r02
- April 2019 TCB Workshop Notes (Tissue Simulating Liquids)
- TCB Workshop–October 2021 : RF Exposure Policies and Procedures
- SPEAG DASY6 System Handbook (June 2020)
- SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz)

2.7.1 6-7 GHz Tested Conditions

The Device was operated utilizing proprietary software and each channel was measured using a broadband power meter to determine the maximum average power.

As per the Interim Procedures for 6-7GHz RF Exposure, explained in RF Exposure Policies and Procedures: TCB Workshop – October 2020, the testing has been performed on SAR following IEC/IEEE 62209-1528:2020 and then on Power Density for the highest SAR test configurations.

The testing has been in both chains and four considered bands U-NII-5, U-NII-6, U-NII-7 and U-NII-8 in SAR mode.

3. Specific Absorption Rate

3.1 Introduction

The SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational / controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

3.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

3.3 Peak Spatially Averaged Power Density Assessment Based on E-field Measurements

Within a short distance from the transmitting source, power density was determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field were needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. Nevertheless, solutions based on direct measurement of E-field and H-field can be used to compute power density. The general measurement approach used for this device was:

a) The local E field on the measurement surface was measured at a reference location where the field is well above the noise level. This reference level was used at the end of this procedure to assess output power drift of the DUT during the measurement.

b) The electric field on the measurement surface was scanned. Measurements are conducted according to the instructions provided by the measurement system manufacturer. Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. The planar scan step size was configured at λ/4.

c) For cDASY6, H-field was calculated from the measured E-field using a reconstruction algorithm. As the power density calculation requires knowledge of both amplitude and phase, reconstruction algorithms can also be used to obtain field information from the measured E-field data (e.g. the phase from the amplitude if only the amplitude is measured). H-field and phase data was reconstructed from repeated measurements (three per measurement point) on two measurement planes separated by λ/4.

d) The total Peak spatially averaged power density (psPD) distribution on the evaluation surface is determined per the below equation. The spatial averaging area, A, is specified by the applicable exposure limits or regulatory requirements.

$$psPD = \frac{1}{2A_{av}} \iint_{A_{av}} || Re\{E \times H^*\} || dA$$

e) The maximum spatial-average on the evaluation surface is the final quantity to determine compliance against applicable limits.

f) The local E field reference value, at the same location as step 2, was re-measured after the scan was complete to calculate the power drift. If the drift deviated by more than 5%, the power density test and drift measurements were repeated.

4. SAR Measurement Procedures

4.1 SAR Scan Procedures

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 1.4 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.
Step 2: Area Scan & Zoom Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot and Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing1 g and 10 g of simulated tissue. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly. Area Scan & Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	½·δ·ln(2) mm 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Step 3: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

5. RF Exposure Limits

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.

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. This 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.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR [1] (Partial)	1.60 mW/g	8.00 mW/g
Partial Average SAR [2] (Whole Body)	0.08 mW/g	0.40 mW/g
Partial Peak SAR [3] (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

1) The spatial Peak value of the SAR averaged over any 1g gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2) The spatial Average value of the SAR averaged over the whole body.
3) The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

5.1 RF Exposure Limits for Frequencies Above 6 GHz

Per §1.1310 (d)(3), the MPE limits are applied for frequencies above 6 GHz. Power Density is expressed in units of W/m^2 or mW/cm^2.

Peak Spatially Averaged Power Density was evaluated over a circular area of 4 cm^2 per interim FCC Guidance for near-field power density evaluations per October 2018 TCB Workshop notes.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Power Density	1.0 mW/cm^2	5.0 mW/cm^2

Note: 1.0 mW/cm^2 is 10 W/m^2

6. RF Average Conducted Output Power

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported.

Power Measurement Setup

6.1 WLAN Average Conducted Output Power(Maximum Average Power)

Band	Mode	Freq. [MHz]	Channel	Conducted Powers (dBm)
				MIMO
U-NII-5	802.11a	5 955.0	1	**12.35**
		6 175.0	45	**11.95**
		6 415.0	93	11.85
U-NII-6		6 435.0	97	11.70
		6 475.0	105	12.02
		6 515.0	113	**12.48**
U-NII-7		6 535.0	117	11.92
		6 695.0	149	**12.59**
		6 875.0	185	12.51
U-NII-8		6 895.0	189	**12.49**
		6 995.0	209	12.25
		7 115.0	233	12.13

6.2 WLAN Average Conducted Output Power(Reduced Average Power-Grip Sensor)

Band	Mode	Freq. [MHz]	Channel	Conducted Powers (dBm)
				MIMO
U-NII-5	802.11a	5 955.0	1	**10.60**
		6 175.0	45	10.49
		6 415.0	93	**10.78**
U-NII-6		6 435.0	97	10.94
		6 475.0	105	11.19
		6 515.0	113	**11.41**
U-NII-7		6 535.0	117	10.46
		6 695.0	149	**11.67**
		6 875.0	185	11.16
U-NII-8		6 895.0	189	11.09
		6 995.0	209	**11.33**
		7 115.0	233	11.27

Note:

About verification of grip sensor, refer to Appendix D. Power Reduction Verification of Report No: KR22-SPF0048 Part 1 SAR report.

7. System Verification

7.1 Tissue Verification

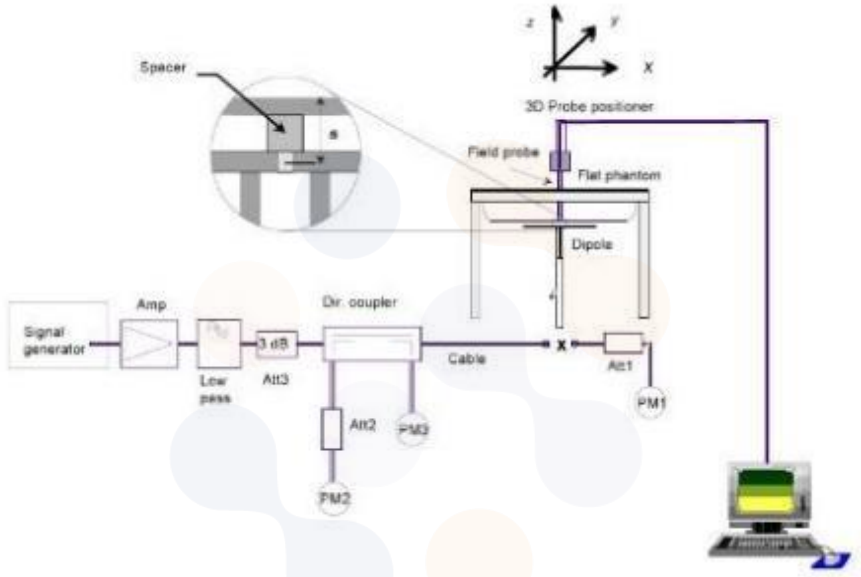
The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe in conjunction with Agilent E5071B Network Analyzer (300 kHz – 8 500 ㎒). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. The temperature variation of the Tissue Simulant Liquids was (22 ± 2) ℃.

Freq. (㎒)	Limit/Measured		Permittivity (ρ)	Conductivity (σ)	Temp. (°C)
6 500.0	Recommended Limit		34.50 ± 5 % (32.78~36.23)	6.07 ± 5 % (5.77~6.37)	22 ± 2
	Measured	2022-09-30	33.90	6.04	20.91
6 175.0	Recommended Limit		34.89 ± 5 % (33.15~36.63)	5.69 ± 5 % (5.40~5.97)	22 ± 2
	Measured	2022-09-30	35.14	5.67	20.91
6 415.0	Recommended Limit		34.60 ± 5 % (32.87~36.33)	5.97 ± 5 % (5.67~6.27)	22 ± 2
	Measured	2022-09-30	34.10	5.93	20.91
6 435.0	Recommended Limit		34.58 ± 5 % (32.85~36.31)	5.99 ± 5 % (5.69~6.29)	22 ± 2
	Measured	2022-09-30	34.02	5.95	20.91
6 475.0	Recommended Limit		34.53 ± 5 % (32.80~36.26)	6.04 ± 5 % (5.74~6.34)	22 ± 2
	Measured	2022-09-30	33.93	6.02	20.91
6 515.0	Recommended Limit		34.48 ± 5 % (32.76~36.21)	6.09 ± 5 % (5.78~6.39)	22 ± 2
	Measured	2022-09-30	33.90	6.06	20.91
6 535.0	Recommended Limit		34.46 ± 5 % (32.74~36.18)	6.11 ± 5 % (5.81~6.42)	22 ± 2
	Measured	2022-09-30	33.77	6.08	20.91
6 695.0	Recommended Limit		34.27 ± 5 % (32.55~35.98)	6.30 ± 5 % (5.98~6.61)	22 ± 2
	Measured	2022-09-30	33.20	6.28	20.91
6 875.0	Recommended Limit		34.05 ± 5 % (32.35~35.75)	6.51 ± 5 % (6.18~6.83)	22 ± 2
	Measured	2022-09-30	32.92	6.56	20.91
6 895.0	Recommended Limit		34.03 ± 5 % (32.32~35.73)	6.53 ± 5 % (6.20~6.85)	22 ± 2
	Measured	2022-09-30	32.90	6.57	20.91
6 995.0	Recommended Limit		33.91 ± 5 % (32.21~35.60)	6.64 ± 5 % (6.31~6.98)	22 ± 2
	Measured	2022-09-30	32.70	6.75	20.91
7 115.0	Recommended Limit		33.76 ± 5 % (32.07~35.45)	6.79 ± 5 % (6.45~7.12)	22 ± 2
	Measured	2022-09-30	32.50	6.96	20.91
6 500.0	Recommended Limit		34.50 ± 5 % (32.78~36.23)	6.07 ± 5 % (5.77~6.37)	22 ± 2
	Measured	2022-10-20	33.70	6.26	20.85
5 955.0	Recommended Limit		35.15 ± 5 % (33.39~36.90)	5.43 ± 5 % (5.16~5.70)	22 ± 2
	Measured	2022-10-20	34.97	5.57	20.85

<Table 1. Measurement result of Tissue electric parameters>

7.1.1 SAR Test System Verification

The microwave circuit arrangement for system verification is sketched below picture.
The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within ± 10% from the t arget SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the Table 2. During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) ℃, th e relative humidity was in the range(50 ± 20)% and the liquid depth Above the ear/grid refer ence points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

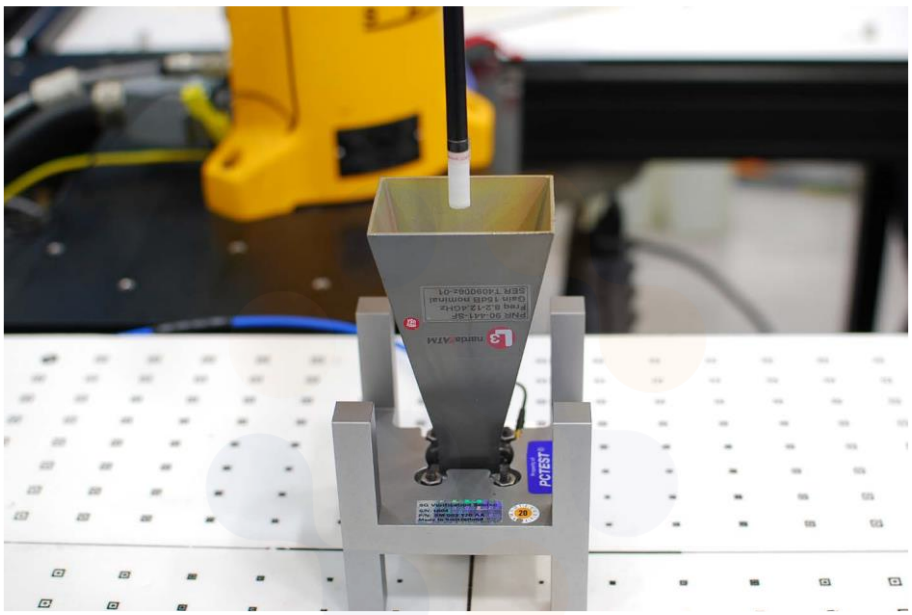


Verification Kit	Probe S/N	Frequency (㎒)	Tissue Type	Input Power (㎽)	Date	Limit/Measured (Normalized to 1 W)
D6.5GHzV2 SN: 1005	EX3DV4 SN: 7541	6 500.0	HSL	10	Measured	277.00 ± 10 % (249.30~304.70)
					2022-09-30	272.00
					2022-10-20	292.00

<Table 2. System Verification Result>

7.1.2 Power Density Test System Verification

The system was verified to be within ± 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.



[Figure 3. System Verification Setup Photo]

Source (S/N)	Probe (S/N)	Frequency (GHz)	Date	Prad (mW)	Total 4 cm² psPD (W/m²)	Input Power (mW)	Total 4 cm² psPD (W/m²)		Deviation (dB)	Limit (dB)
					Target		Measured	Normalized		
1023	9489	10	2022-10-12	86.1	51.5	10	6.03	51.9	0.03	± 0.66
1023	9489	10	2022-10-13	86.1	51.5	10	6.37	54.8	0.27	± 0.66
1023	9489	10	2022-10-20	86.1	51.5	10	5.99	51.6	0.01	± 0.66

Notes
1) 10 ㎜ distance spacing was used from the reference horn antenna aperture to the probe element.
2) According to IEC TR 63170, the power density measurement results should be normalized to the delivered input power to an input power level of 0 ㏈m and compared to the appropriate target values of the calibrated reference sources.

8. SAR Test Results

8.1 Standalone Body SAR and Absorbed Power Density Test Results

U-NII-5												
Mode	Ant.	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Estimated 4㎠ APD (W/m²)	Plot No.
802.11a	Grip Sensor off											
	MIMO	Rear	4	5 955.0	12.35	13.00	1.161	1.080	0.231	0.290	1.72	
		Rear	4	6 175.0	11.95	13.00	1.274	1.080	0.152	0.209	1.21	
	Grip Sensor on											
	MIMO	Rear	0	6 415.0	10.78	12.00	1.324	1.080	0.271	**0.388**	1.81	1
		Rear	0	5 955.0	10.60	12.00	1.380	1.080	0.245	0.365	1.60	

U-NII-6												
Mode	Ant.	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Estimated 4㎠ APD (W/m²)	Plot No.
802.11a	Grip Sensor off											
	MIMO	Rear	4	6 515.0	12.48	13.00	1.127	1.080	0.211	0.257	1.54	
	Grip Sensor on											
	MIMO	Rear	0	6 515.0	11.41	12.00	1.146	1.080	0.310	**0.384**	2.12	2

U-NII-7												
Mode	Ant.	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Estimated 4㎠ APD (W/m²)	Plot No.
802.11a	Grip Sensor off											
	MIMO	Rear	4	6 695.0	12.59	13.00	1.099	1.080	0.272	0.323	1.99	
	Grip Sensor on											
	MIMO	Rear	0	6 695.0	11.67	12.00	1.079	1.080	0.411	**0.479**	2.74	3

U-NII-8												
Mode	Ant.	EUT Position	Distance (㎜)	Frequency (㎒)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1g SAR (W/㎏)	Scaled 1g SAR (W/㎏)	Estimated 4㎠ APD (W/m²)	Plot No.
802.11a	Grip Sensor off											
	MIMO	Rear	4	6 895.0	12.49	13.00	1.125	1.080	0.234	0.284	1.68	
	Grip Sensor on											
	MIMO	Rear	0	6 995.0	11.33	12.00	1.167	1.080	0.375	**0.473**	2.31	4

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
5. All modes of operation were investigated, and worst-case results are reported.
6. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
7. Per FCC guidance, SAR was performed using 6.5 GHz SAR probe calibration factors. Per October 2020 TCB Workshop notes, 5 channels were tested. Absorbed power density (APD) using a 4㎠ averaging area is reported based on SAR measurements.

WLAN Notes:

1. 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. The reported SAR was scaled to the 100% transmission duty factor to determine compliance.
2. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
3. WLAN transmission was verified using a spectrum analyzer.
4. Since this EUT was not supported individual antennas operation, so evaluated on MIMO state.

9. Power Density Test Results

9.1 Standalone Body Power Density Test Results

U-NII-5											
Mode	Ant.	EUT Position	Distance (㎜)	Frequency (㎒)	Max. Tune-up Power (dBm)	iPD	Grid Step (λ)	Measurement Uncertainty	Measured Total 4㎠ psPD (W/m²)	Scaled Total 4㎠ psPD (W/m²)	Plot No.
802.11a	Grip Sensor on										
	MIMO	Rear	2	6 415.0	12.00	-	0.0625	1.462	1.21	**1.77**	5
		Rear	2	5 955.0	12.00	-	0.0625	1.462	1.01	1.48	

U-NII-6											
Mode	Ant.	EUT Position	Distance (㎜)	Frequency (㎒)	Max. Tune-up Power (dBm)	iPD	Grid Step (λ)	Measurement Uncertainty	Measured Total 4㎠ psPD (W/m²)	Scaled Total 4㎠ psPD (W/m²)	Plot No.
802.11a	Grip Sensor on										
	MIMO	Rear	2	6 515.0	12.00	-	0.0625	1.462	1.41	**2.06**	6

U-NII-7											
Mode	Ant.	EUT Position	Distance (㎜)	Frequency (㎒)	Max. Tune-up Power (dBm)	iPD	Grid Step (λ)	Measurement Uncertainty	Measured Total 4㎠ psPD (W/m²)	Scaled Total 4㎠ psPD (W/m²)	Plot No.
802.11a	Grip Sensor on										
	MIMO	Rear	2	6 695.0	12.00	3.03	0.0625	1.462	1.68	**2.46**	7
		Rear	8.96	6 695.0	12.00	2.55	0.0625	1.462	0.89	1.30	

U-NII-8											
Mode	Ant.	EUT Position	Distance (㎜)	Frequency (㎒)	Max. Tune-up Power (dBm)	iPD	Grid Step (λ)	Measurement Uncertainty	Measured Total 4㎠ psPD (W/m²)	Scaled Total 4㎠ psPD (W/m²)	Plot No.
802.11a	Grip Sensor on										
	MIMO	Rear	2	6 995.0	12.00	-	0.0625	1.462	1.56	**2.28**	8

Power Density General Notes:

1. Batteries are fully charged at the beginning of the measurements.
2. Power density was calculated by repeated E-field measurements on two measurement planes separated by λ/4.
3. 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.
4. 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 2.46 dB (76.198%) was used to determine the psPD measurement scaling factor.
5. Per equipment manufacturer guidance, power density was measured at d=2mm and d=λ/5mm using the same grid size and grid step size for some frequencies and surfaces. The integrated Power Density (iPD) was calculated based on these measurements. Since iPD ratio between the two distances is < 1dB, the grid step was sufficient for determining compliance at d=2mm.

10. Simultaneous Transmission

Refer to the sec 13. Simultaneous Transmission of Report No: KR22-SPF0048 SAR report for the value.

11. SAR Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) **Repeated measurements are not required when the original highest measured SAR is < 0.80 W/㎏.**
2) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
3) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Band	Mode	Ant.	EUT Position	Separation Distance (㎜)	Frequency (㎒)	Measured 1 g SAR (W/㎏)	Repeated 1 g SAR (W/㎏)	Ratio
N/A								

12. Measurement Uncertainty

12.1 SAR Measurement Uncertainty

Per KDB 865664 D01 SAR measurement 100㎒ to 6㎓, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of *k* = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Standard 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

12.2 Power Density Measurement Uncertainty

Source f uncertainty	Uncertainty Value (± dB)	Probability distribution	Div.	c_i	Standard Uncertainty (± dB)	v_i
Measurement system						
Calibration	0.49	N	1.00	1.00	0.49	∞
Probe correction	0.00	R	1.73	1.00	0.00	∞
Frequency response (BW ≤ 1 GHz)	0.20	R	1.73	1.00	0.12	∞
Sensor cross coupling	0.00	R	1.73	1.00	0.00	∞
Isotropy	0.50	R	1.73	1.00	0.29	∞
Linearity	0.20	R	1.73	1.00	0.12	∞
Probe scattering	0.00	R	1.73	1.00	0.00	∞
Probe positioning offset	0.30	R	1.73	1.00	0.17	∞
Probe positioning repeatability	0.04	R	1.73	1.00	0.02	∞
Sensor mechanical offset	0.00	R	1.73	1.00	0.00	∞
Probe spatial resolution	0.00	R	1.73	1.00	0.00	∞
Field impedance dependance dependence	0.00	R	1.73	1.00	0.00	∞
Amplitude and phase drift	0.00	R	1.73	1.00	0.00	∞
Amplitude and phase noise	0.04	R	1.73	1.00	0.02	∞
Measurement area truncation	0.00	R	1.73	1.00	0.00	∞
Data acquisition	0.03	N	1.00	1.00	0.03	∞
Sampling	0.00	R	1.73	1.00	0.00	∞
Field reconstruction	1.77	R	1.73	1.00	1.02	∞
Forward transformation	0.00	R	1.73	1.00	0.00	∞
Power density scaling	-	R	1.73	1.00	-	∞
Spatial averaging	0.10	R	1.73	1.00	0.06	∞
System detection limit	0.04	R	1.73	1.00	0.02	∞
DUT and environmental factors						
Probe coupling with DUT	0.00	R	1.73	1.00	0.00	∞
Modulation response	0.40	R	1.73	1.00	0.23	∞
Integration time	0.00	R	1.73	1.00	0.00	∞
Response time	0.00	R	1.73	1.00	0.00	∞
Device holder influence	0.10	R	1.73	1.00	0.06	∞
DUT alignment	0.00	R	1.73	1.00	0.00	∞
RF ambient conditions	0.04	R	1.73	1.00	0.02	∞
Ambient reflections	0.04	R	1.73	1.00	0.02	∞
Immunity / secondary reception	0.00	R	1.73	1.00	0.00	∞
Drift of the DUT	0.22	R	1.73	1.00	0.13	∞
Combined standard uncertainty	RSS				1.23	
Expanded uncertainty (95 % confidence interval)	*k* = 2				2.46	

13. Test Equipment Information

Test Platform	SPEAG DASY6 System			
Version	DASY6: 16.0.2.136 / DASY6 mmWave: 3.0.0.841			
Location	Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea			
Manufacture	SPEAG			
Hardware Reference				
Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Shield Room	-	8F - 4	-	-
DASY6 Robot	TX60 Lspeag	F/19/0007289/A/001	-	-
Phantom	2mm Oval Phantom ELI5	2098	-	-
Phantom	mmWave Phantom	1062	-	-
Mounting Device	Laptop Holder	-	-	-
mmWave Device Holder	mmWave Device Holder	1116	-	-
DAE	DAE4	1342	2022-05-31	2023-05-31
Probe	EX3DV4	7541	2022-07-22	2023-07-22
Isotropic E-Field Probe	EUmmWV4	9489	2022-05-25	2023-05-25
PSG Analog Signal Generator	E8257D	MY60020337	2022-01-26	2023-01-26
Dual Power Meter	EPM-442A	GB37480680	2022-05-02	2023-05-02
Power Sensor	8481H	2703A11902	2022-05-02	2023-05-02
Power Sensor	8481H	3318A18090	2022-05-02	2023-05-02
Attenuator	8491A	21552	2022-05-02	2023-05-02
Attenuator	8491A	35560	2022-05-02	2023-05-02
Attenuator	8491A	35934	2022-05-02	2023-05-02
Dual Directional Coupler	772D	2839A160504	2022-05-02	2023-05-02
Power Amplifier	AMP2027ADB	10005	2022-07-06	2023-07-06
Low Pass Filter	PE87FL1016	20-1	2021-11-11	2022-11-11
Low Pass Filter	PE87FL1017	2134	2022-01-06	2023-01-06
Dipole Validation Kits	D6.5GHzV2	1005	2022-04-29	2024-04-29
System Verification Device	5G Verification Source 10 GHz	1023	2022-01-20	2023-01-20
Network Analyzer	E5071B	MY42403524	2022-02-15	2023-02-15
Dielectric Assessment Kit	DAK-3.5	1078	2022-05-30	2023-05-30
Humidity/Temp	MHB-382SD	46301	2022-02-25	2023-02-25
Spectrum Analyzer	FSQ40	200062	2022-05-02	2023-05-02

14. SAR Test System Verification and Test Results

Eurofins KCTL Co.,Ltd.

Measurement Report for Dipole D6.5GHzV2, FRONT, Validation band, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
Dipole D6.5GHzV2, Speag	16.0 x 6.0 x 300.0	1005	Validation Dipole

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	FRONT, 5.00	Validation band	CW, 0--	6500.0, 6500	5.4	6.04	33.9

Hardware Setup

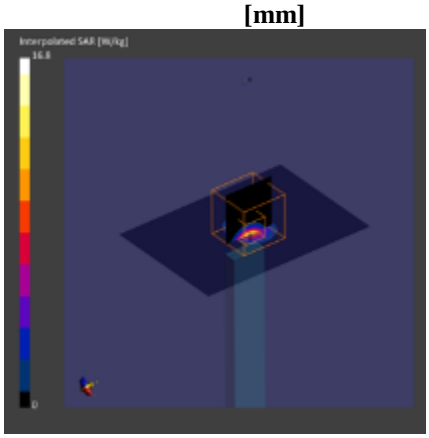
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Sep-30	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 85.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	6.0 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N/A	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-09-30	2022-09-30
psSAR1g [W/kg]	2.37	2.72
psSAR8g [W/kg]	0.583	0.629
psSAR10g [W/kg]	0.482	0.518
psAPD (1.0cm2, sq) [W/m2]		27.2
psAPD (4.0cm2, sq) [W/m2]		12.6
Power Drift [dB]		-0.03
M2/M1 [%]		51.0
Dist 3dB Peak [mm]		5.2



Eurofins KCTL Co.,Ltd.

Measurement Report for Dipole D6.5GHzV2, FRONT, Validation band, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
Dipole D6.5GHzV2, Speag	16.0 x 6.0 x 300.0	1005	Validation Dipole

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	FRONT, 5.00	Validation band	CW, 0--	6500.0, 6500	5.4	6.26	33.7

Hardware Setup

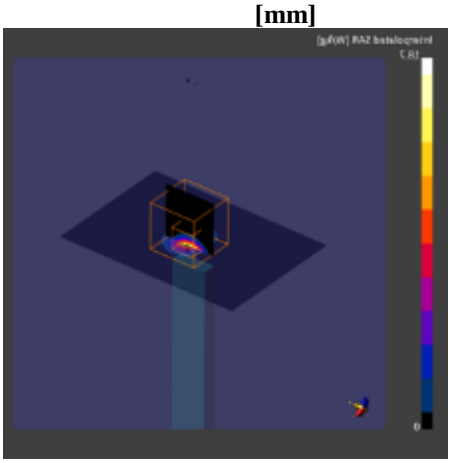
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Oct-20	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 85.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	6.0 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N/A	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-10-20	2022-10-20
psSAR1g [W/kg]	2.54	2.92
psSAR8g [W/kg]	0.611	0.673
psSAR10g [W/kg]	0.506	0.553
psAPD (1.0cm2, sq) [W/m2]		29.2
psAPD (4.0cm2, sq) [W/m2]		13.5
Power Drift [dB]		-0.02
M2/M1 [%]		48.9
Dist 3dB Peak [mm]		4.9



1)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 93 (6415.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	324.0 x 224.0 x 15.0	KCUQ930T800404V	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	Custom Band	CW, 10417-AAC	6415.0, 93	5.4	5.93	34.1

Hardware Setup

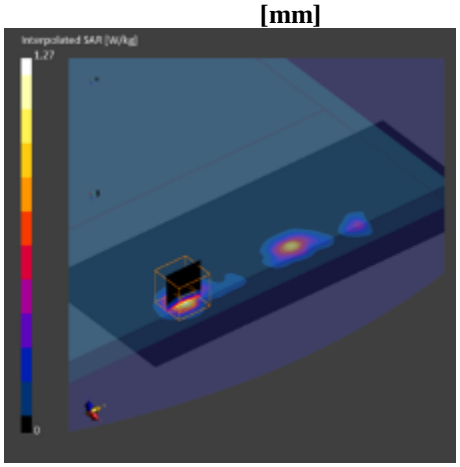
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Sep-30	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	102.0 x 238.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	8.5 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N.A	1.4
MAIA	N/A	N.A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-09-30	2022-09-30
psSAR1g [W/kg]	0.242	0.271
psSAR8g [W/kg]	0.083	0.090
psSAR10g [W/kg]	0.072	0.078
psAPD (1.0cm2, sq) [W/m2]		2.71
psAPD (4.0cm2, sq) [W/m2]		1.81
Power Drift [dB]		0.10
M2/M1 [%]		52.9
Dist 3dB Peak [mm]		6.7



2)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 113 (6515.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	324.0 x 224.0 x 15.0	KCUQ930T800404V	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	Custom Band	CW, 10417-AAC	6515.0, 113	5.4	6.06	33.9

Hardware Setup

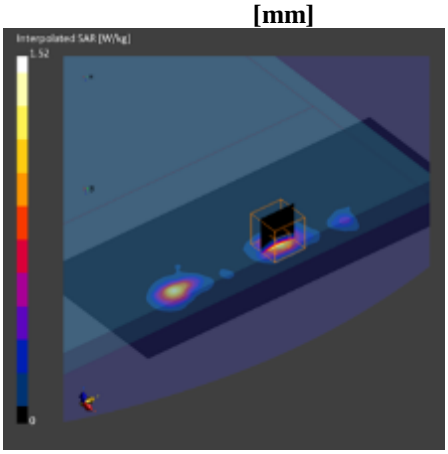
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Sep-30	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	102.0 x 238.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	8.5 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N/A	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-09-30	2022-09-30
psSAR1g [W/kg]	0.283	0.310
psSAR8g [W/kg]	0.098	0.106
psSAR10g [W/kg]	0.085	0.092
psAPD (1.0cm2, sq) [W/m2]		3.10
psAPD (4.0cm2, sq) [W/m2]		2.12
Power Drift [dB]		-0.01
M2/M1 [%]		51.5
Dist 3dB Peak [mm]		6.8



3)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 149 (6695.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	324.0 x 224.0 x 15.0	KCUQ930T800404V	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	Custom Band	CW, 10417-AAC	6695.0, 149	5.4	6.28	33.2

Hardware Setup

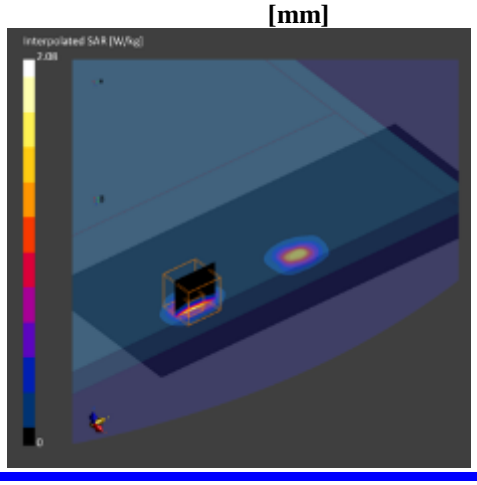
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Sep-30	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	102.0 x 238.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	8.5 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N/A	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-09-30	2022-09-30
psSAR1g [W/kg]	0.410	0.411
psSAR8g [W/kg]	0.133	0.137
psSAR10g [W/kg]	0.115	0.118
psAPD (1.0cm2, sq) [W/m2]		4.11
psAPD (4.0cm2, sq) [W/m2]		2.74
Power Drift [dB]		0.17
M2/M1 [%]		51.1
Dist 3dB Peak [mm]		6.1



4)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 209 (6995.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	324.0 x 224.0 x 15.0	KCUQ930T800404V	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	Custom Band	CW, 10417-AAC	6995.0, 209	4.67	6.75	32.7

Hardware Setup

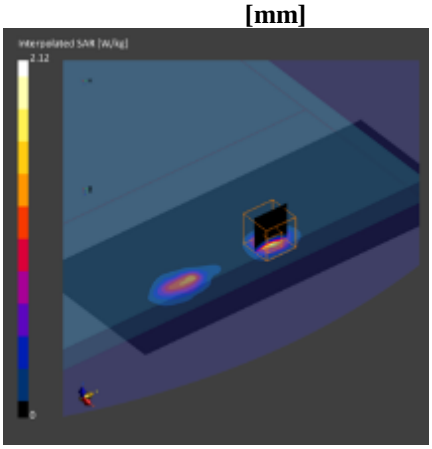
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V8.0 (20deg probe tilt) - 2098	HBBL-600-10000 , 2022-Sep-30	EX3DV4 - SN7541, 2022-07-22	DAE4 Sn1342, 2022-05-31

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	102.0 x 238.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	8.5 x 8.5	3.4 x 3.4 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	No	Yes
Grading Ratio	N/A	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-09-30	2022-09-30
psSAR1g [W/kg]	0.335	0.375
psSAR8g [W/kg]	0.106	0.116
psSAR10g [W/kg]	0.091	0.098
psAPD (1.0cm2, sq) [W/m2]		3.75
psAPD (4.0cm2, sq) [W/m2]		2.31
Power Drift [dB]		-0.06
M2/M1 [%]		46.3
Dist 3dB Peak [mm]		6.3



15. PD Test System Verification and Test Results

Eurofins KCTL Co.,Ltd.

Measurement Report for 10 GHz Verification Source, FRONT, Validation band, UID 0 -, Channel 10000 (10000.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
10 GHz Verification Source, Speag	100.0 x 172.0 x 100.0	1023	Validation Dipole

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 10.00	10000.0, 10000	1.0

Hardware Setup

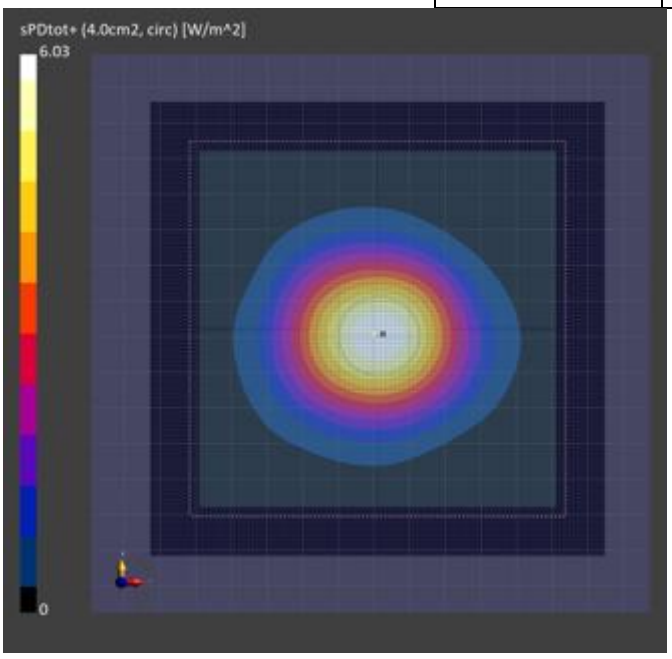
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup

Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 120.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	10.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-12
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	6.01
psPDtot+ [W/m^2]	6.03
E_{max} [V/m]	51.0
Power Drift [dB]	0.11



Eurofins KCTL Co.,Ltd.

Measurement Report for 10 GHz Verification Source, FRONT, Validation band, UID 0 -, Channel 10000 (10000.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
10 GHz Verification Source, Speag	100.0 x 172.0 x 100.0	1023	Validation Dipole

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 10.00	10000.0, 10000	1.0

Hardware Setup

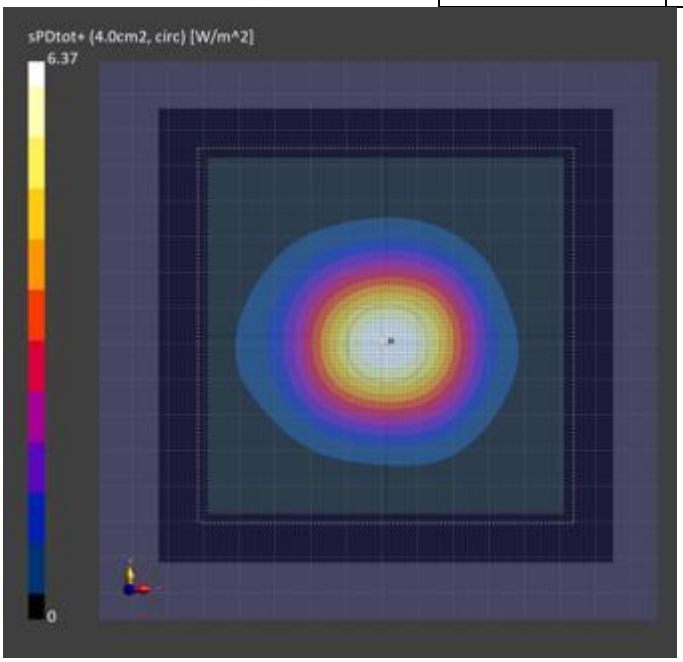
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup

Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 120.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	10.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-13
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	6.33
psPDtot+ [W/m^2]	6.37
E_{max} [V/m]	52.0
Power Drift [dB]	-0.07



Eurofins KCTL Co.,Ltd.

Measurement Report for 10 GHz Verification Source, FRONT, Validation band, UID 0 -, Channel 10000 (10000.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
10 GHz Verification Source, Speag	100.0 x 172.0 x 100.0	1023	Validation Dipole

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 10.00	10000.0, 10000	1.0

Hardware Setup

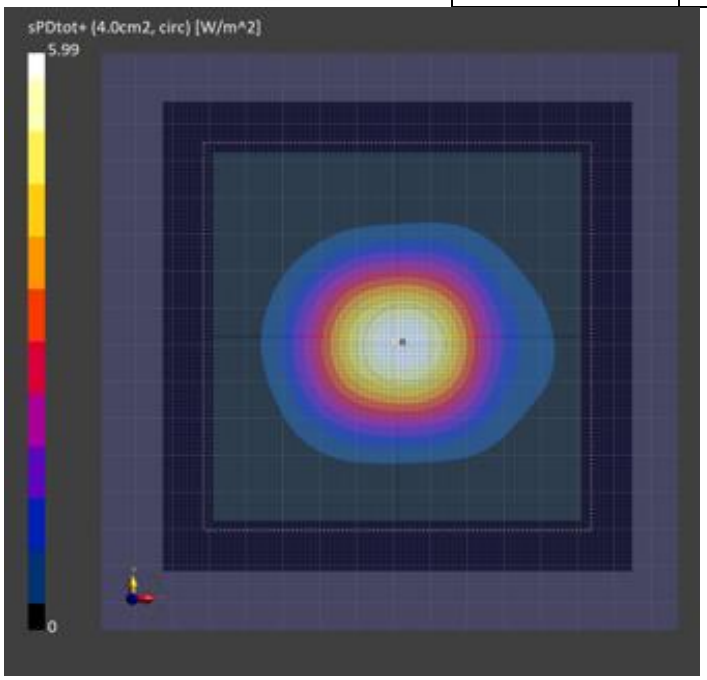
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup

Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 120.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	10.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-20
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	5.95
psPDtot+ [W/m^2]	5.99
E_{max} [V/m]	50.6
Power Drift [dB]	0.14



5)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 93 (6415.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	224.0 x 15.0 x 324.0	KCUQ930T900408T	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	BACK, 2.00	6415.0, 93	1.0

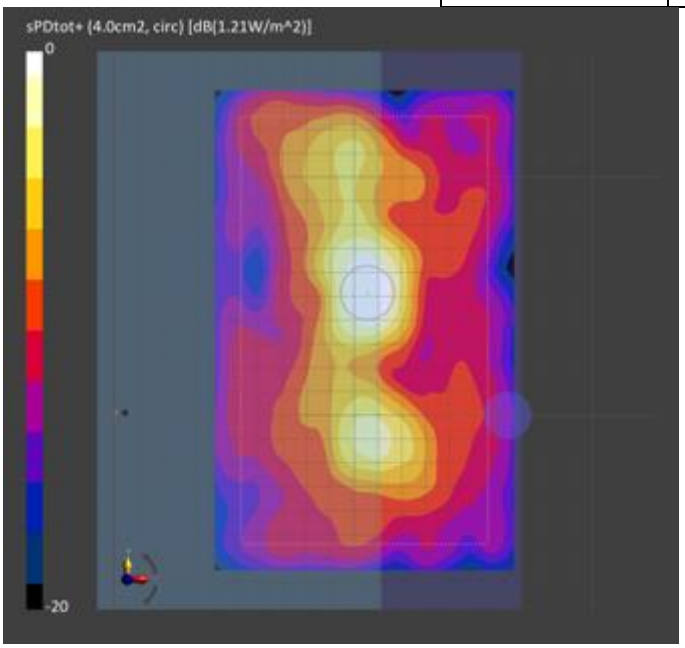
Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup
Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 200.0
Grid Steps [lambda]	0.0625 x 0.0625
Sensor Surface [mm]	2.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-13
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	0.959
psPDtot+ [W/m^2]	1.21
E_{max} [V/m]	31.5
Power Drift [dB]	0.07



6)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 113 (6515.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	224.0 x 15.0 x 324.0	KCUQ930T900408T	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	BACK, 2.00	6515.0, 113	1.0

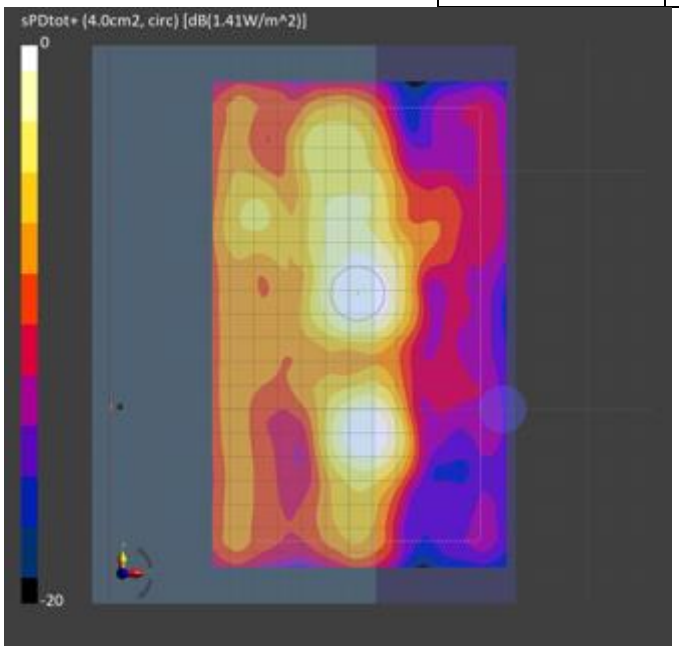
Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup
Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 200.0
Grid Steps [lambda]	0.0625 x 0.0625
Sensor Surface [mm]	2.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-13
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	1.19
psPDtot+ [W/m^2]	1.41
E_{max} [V/m]	38.1
Power Drift [dB]	-0.11



7)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 149 (6695.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	224.0 x 15.0 x 324.0	KCUQ930T900408T	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	BACK, 2.00	6695.0, 149	1.0

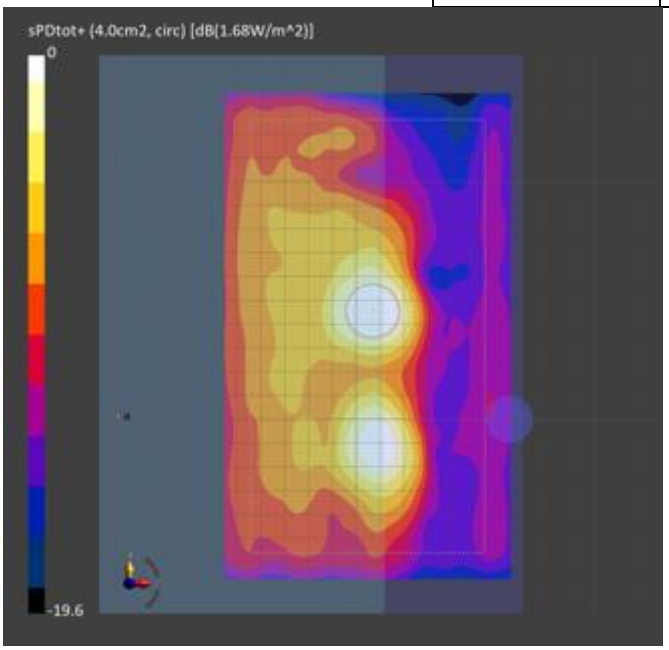
Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup
Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 200.0
Grid Steps [lambda]	0.0625 x 0.0625
Sensor Surface [mm]	2.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-12
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	1.45
psPDtot+ [W/m^2]	1.68
E_{max} [V/m]	39.4
Power Drift [dB]	0.09



8)
Eurofins KCTL Co.,Ltd.

Measurement Report for NP345XNA, BACK, Custom Band 802.11 a, UID 10417 AAC, Channel 209 (6995.0MHz)

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
NP345XNA, SAMSUNG	224.0 x 15.0 x 324.0	KCUQ930T900408T	Laptop + MIMO Antenna

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor
5G	BACK, 2.00	6995.0, 209	1.0

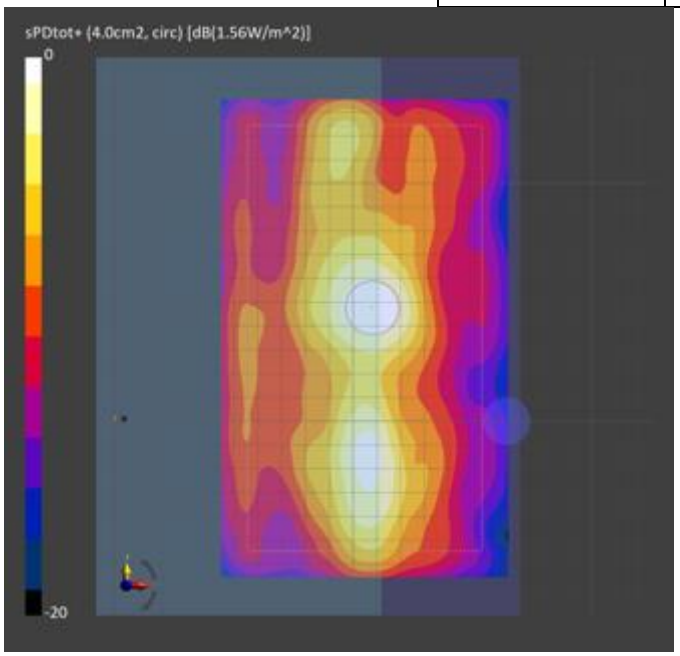
Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air	EUmmWV4 - SN9489_F1-55GHz, 2022-05-25	DAE4 Sn1342, 2022-05-31

Scans Setup
Measurement Results

Scan Type	5G Scan
Grid Extents [mm]	120.0 x 200.0
Grid Steps [lambda]	0.0625 x 0.0625
Sensor Surface [mm]	2.0
MAIA	N/A

Scan Type	5G Scan
Date	2022-10-12
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	1.38
psPDtot+ [W/m^2]	1.56
E_{max} [V/m]	35.2
Power Drift [dB]	0.05



Appendixes List

Appendix A	A.1 Probe Calibration certificate (EX3DV4_7541) A.2 Probe Calibration certificate (EUmmWV4_9489) A.3 System Calibration certificate (5G Verification Source 10GHz_SN1023) A.4 Dipole Calibration certificate (D6.5GHzV2_SN1005)
Appendix B	#Antenna Location & Distance
Appendix C	EUT Photo
Appendix D	Test Setup Photo