

FCC SAR Test Report

APPLICANT : Zebra Technologies Corporation
EQUIPMENT : Enterprise Tablet
BRAND NAME : Zebra
MODEL NAME : ET4015A
FCC ID : UZ7ET4015A
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

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA551202-16	Rev. 01	Initial issue of report	Jul. 14, 2026

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Zebra Technologies Corporation, Enterprise Tablet, ET4015A**, are as follows.

Highest 1g SAR Summary				
Equipment Class	Frequency Band		Body (Separation 0mm)	Highest Simultaneous Transmission 1g SAR (W/kg)
			1g SAR (W/kg)	
DTS	WLAN	2.4GHz WLAN	1.11	1.11
NII		5GHz WLAN	1.18	1.33
6CD		6GHz WLAN	0.88	1.55
VLP		6GHz WLAN	0.48	1.55
DSS	Bluetooth	2.4GHz Bluetooth	0.35	0.35
DSS	RFID	RFID	0.93	1.07

Equipment Class	Frequency Band	Measured APD	Scaled PD
		Body (W/m^2)	psPD (W/m^2)
6CD	6GHz WLAN	4.98	4.47
VLP	6GHz WLAN	2.68	
Date of Testing:		2026/6/9 ~ 2026/6/29	

Note: This is a variant report for ET4015A, the change notes please refer to the Operational Description of Product Equality Declaration as appendix E. According to the differences, the conducted power for WLAN 2.4GHz/5.2GHz at ant7 and WLAN 2.4GHz at ant 6+7 in sensor on (DSI3) was reduced by software, full SAR testing was performed only for WLAN bands at ant7. For other bands and antennas, the worst cases from the original test report (Sporton Report No. FA551202-09) were verified for the differences.

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 Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) specified in FCC 47 CFR part 2 (2.1093), and Human Exposure to RF Radiation Limits (1.0 mW/cm ² =10 W/m ²) specified in FCC 47 CFR part 1.1310 and ANSI/IEEE C95.1-1992, 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 Jiangsu Province 215300 People's Republic of China 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	Zebra Technologies Corporation
Address	3 Overlook Point, Lincolnshire, IL 60069 USA

Manufacturer	
Company Name	Zebra Technologies Corporation
Address	3 Overlook Point, Lincolnshire, IL 60069 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/IEEE 62209-1528:2020
- 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 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02
- 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	Enterprise Tablet
Brand Name	Zebra
Model Name	ET4015A
FCC ID	UZ7ET4015A
S/N	26140524703969
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz WLAN 6GHz U-NII 5: 5925 MHz ~ 6425 MHz WLAN 6GHz U-NII 6: 6425 MHz ~ 6525 MHz WLAN 6GHz U-NII 7: 6525 MHz ~ 6875 MHz WLAN 6GHz U-NII 8: 6875 MHz ~ 7125 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz RFID: 902.75 MHz ~ 927.25 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 2.4GHz 802.11ac/ax VHT20/HE20 WLAN 2.4GHz 802.11be EHT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax/be HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160 WLAN 6GHz 802.11a/ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11be EHT20/EHT40/EHT80/EHT160/EHT320 Bluetooth BR/EDR/LE /CS ASK/GFSK NFC: ASK RFID: ASK
MFD	20MAY26
EUT Stage	Identical Prototype
Remark: - This device does not support voice function. - The device supports WLAN2.4GHz MIMO CDD mode for 11b/g/n/ac/ax/be and WLAN5GHz MIMO CDD mode for 11a/n/ac/ax/be and Tx Beamforming mode for 11ax/be. - The device supports WIFI6GHz MIMO CDD mode for 802.11a, and support CDD & SDM & TXBF mode for 802.11ax/be. - The device supports 1S2T (CDD) and 2S2T (SDM) mode; 1S2T: Nss=1, MIMO 2Tx; 2S2T: Nss=2, MIMO 2Tx. - The device implements Proximity sensors/handheld trigger reduced power for SAR compliance at different exposure conditions (body) and the Qualcomm smart transmit will manage to ensure the power level not exceeding the associated power table. Details about sensor detection are provided in the operational description. The device will invoke corresponding work scenarios power level base on frequency bands/antennas. - The device support HBS (High Band Simultaneous) function, when the device WLAN 2.4GHz and WLAN 5GHz (or WLAN 6GHz) transmit at the same time it will limit different output power for simultaneous transmission compliance. - RFID was tested using FTM (Factory Test Mode) to perform SAR testing. - The TAS Part2 report for model name ET4015A is referenced from the original report. Only the Plimit for WLAN 2.4 GHz/5.2GHz at Ant7 and WLAN 2.4 GHz at Ant6+7 in sensor on (DSI3) was changed; no other Plimit or target changes were made. Since these changes do not affect the essential test cases already evaluated in the original assessment, no additional Part 2 testing was required. Therefore, the TAS Part2 report from the reference model is considered fully representative of the model name ET4015A variant.	

Accessories Information				
Battery	Brand Name	Zebra	Model	BT-000527
AC Adapter 1 (TYPE C Wall Charger 1)	Brand Name	Zebra	Part Number	PWR-WUA5V45W1US
Earphone 1 (Wired headset USB-C)	Brand Name	Zebra	Part Number	HDST-USBC-PTT 1-01
Earphone 2 (Rugged Bluetooth Headset)	Brand Name	Zebra	Part Number	HS3100-0TH
Earphone 3 (3.5mm PTT Headset)	Brand Name	Zebra	Part Number	HDST-35MM-PTT 1-02
Earphone 4 (Rugged Headset)	Brand Name	Zebra	Part Number	HS2100-0TH
Type C-Audio Cable (Type C to 3.5mm)	Brand Name	Zebra	Part Number	ADP-USBC-35MM1-01
3.5mm to 3.5mm audio connector	Brand Name	Zebra	Part Number	CBL-HS2100-3MS1-01
USB Cable 1 (USB-C to C Cable)	Brand Name	Zebra	Part Number	CBL-EC5X-USBC3A-01
USB Cable 3 (USB-C to C Cable)	Brand Name	Zebra	Part Number	CBL-TN28-USBC2C-01

5. Smart Transmit feature for RF Exposure compliance

The FCC RF exposure limit is defined based on time-averaged RF exposure. The product implements Qualcomm Smart Transmit feature which controls the instantaneous transmitting power for WLAN/BT/RFID transmitter to ensure the product in compliance with FCC RF exposure limit over a defined time window. To control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is compliant to the regulation requirement.

This report describes the procedures for the SAR char generation, and the parameters obtained from SAR characterization (referred to as SAR char, respectively) will be used as input for Smart Transmit. SAR char will be entered via the Embedded File System (EFS) version 22.1 to enable the Smart Transmit GEN1 Feature.

<Terminologies in this report>

P_{limit}	The time-averaged RF power which corresponds to SAR_design_target.
P_{max}	Maximum target power level
SAR_design_target:	The design target for SAR compliance. It should be less than regulatory SAR limit to account for all device design related uncertainty.
SAR char	P _{limit} for all the technologies/bands for all applicable DSI

<SAR Characterization>

SAR char must be generated to cover all radio configurations and usage scenarios that the wireless device supports for operating at WLAN/BT/RFID bands. It will then be used as input for Smart Transmit to control and manage RF exposure for WLAN/BT/RFID bands.

<SAR design target and uncertainty>

Item		Uncertainty dB (k=2)
Total uncertainty	RFID	1.0
	WLAN/BT	1.5

To account for total uncertainty, SAR_design_target should be determined as:

$$SAR_{design_target} < SAR_{regulatory_limit} \times 10^{\frac{-total\ uncertainty}{10}}$$

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of SAR_design_target, below the predefined time-averaged power limit, for each characterized technology and band.

Smart Transmit allows the device to transmit at higher power instantaneously, as high as Pmax, when needed, but enforces power limiting to maintain time-averaged transmit power to Plimit. Below table shows Plimit EFS settings and maximum tune up output power Pmax configured for this EUT for various transmit conditions (Device State Index DSI).

<Plimit for supported technologies and bands (Plimit in EFS file)>

Band	Antenna	Sensor on DSI3	Sensor off DSI0	Pmax*
WLAN2.4GHz	Ant 6	14.5	20.5	20.5
WLAN2.4GHz	Ant 7	13.5	21.5	21.5
WLAN2.4GHz	Ant 6+7	13.5	20.5	24.0
Bluetooth	Ant 6	6.0	6.0	6.0
Bluetooth	Ant 7	5.5	5.5	5.5
WLAN5.2GHz	Ant 6	8.5	18.0	18.0
WLAN5.2GHz	Ant 7	13.0	18.0	18.0
WLAN5.2GHz	Ant 6+7	8.5	18.0	21.0
WLAN5.3GHz	Ant 6	7.0	18.5	18.5
WLAN5.3GHz	Ant 7	11.0	18.0	18.0
WLAN5.3GHz	Ant 6+7	7.0	18.0	21.0
WLAN5.5GHz	Ant 6	8.0	18.5	18.5
WLAN5.5GHz	Ant 7	8.0	18.0	18.0
WLAN5.5GHz	Ant 6+7	8.0	18.0	21.0
WLAN5.8GHz	Ant 6	9.0	18.0	18.0
WLAN5.8GHz	Ant 7	10.5	18.0	18.0
WLAN5.8GHz	Ant 6+7	9.0	18.0	21.0
WLAN6E B5	Ant 6	12.0	18.5	18.5
WLAN6E B5	Ant 7	10.5	18.5	18.5
WLAN6E B5	Ant 6+7	10.5	18.5	21.5
WLAN6E B6	Ant 6	11.5	17.0	17.0
WLAN6E B6	Ant 7	10.5	18.0	18.0
WLAN6E B6	Ant 6+7	10.5	17.0	20.5
WLAN6E B7	Ant 6	11.0	18.5	18.5
WLAN6E B7	Ant 7	10.5	18.0	18.0
WLAN6E B7	Ant 6+7	10.5	18.0	21.0
WLAN6E B8	Ant 6	11.0	16.0	16.0
WLAN6E B8	Ant 7	10.5	16.5	16.5
WLAN6E B8	Ant 6+7	10.5	16.0	19.5
WLAN6E B5 VLP	Ant 6	12.0	18.5	9.5
WLAN6E B5 VLP	Ant 7	10.5	18.5	9.5
WLAN6E B5 VLP	Ant 6+7	10.5	18.5	12.5
WLAN6E B6 VLP	Ant 6	11.5	17.0	9.0
WLAN6E B6 VLP	Ant 7	10.5	18.0	9.5
WLAN6E B6 VLP	Ant 6+7	10.5	17.0	12.0
WLAN6E B7 VLP	Ant 6	11.0	18.5	9.5
WLAN6E B7 VLP	Ant 7	10.5	18.0	9.5
WLAN6E B7 VLP	Ant 6+7	10.5	18.0	12.5
WLAN6E B8 VLP	Ant 6	11.0	16.0	9.5
WLAN6E B8 VLP	Ant 7	10.5	16.5	10.5
WLAN6E B8 VLP	Ant 6+7	10.5	16.0	13.0
RFID	Ant 8	20.0	25.0	25.0

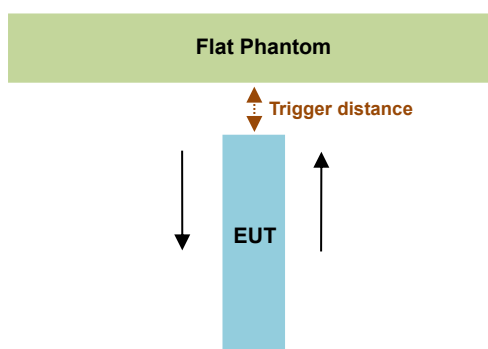
Note:

- 1) *Pmax is used for RF tune up procedure. The maximum allowed output power is equal to Pmax + Total uncertainty.
- 2) All Plimit power levels entered in the Table correspond to average power levels after accounting for duty cycle in the case TDD modulation schemes (for e.g., RFID/WLAN/BT).
- 3) The max allowed output power is the Plimit + Total uncertainty, and if Plimit is higher than Pmax, the device output power will be Pmax instead.

6. Proximity Sensor Triggering Test

<Proximity Sensor Triggering Distance (KDB 616217 D04 section 6.2)>:

1. Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency (7125MHz) and lowest frequency (900MHz) was used for proximity sensor triggering testing.
2. Capacitive proximity sensor placed coincident with antenna elements at the bottom face, Edge1, and Edge4 of the device are utilized to determine when the device comes in proximity of the user's body at the bottom face, Edge1, and Edge4 of the device. There is no need to do sensor coverage testing for the proximity sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the proximity sensor entirely covers the antenna.
3. When the sensor is active, all WLAN bands reduced power will be active.
4. The sensors used to detect the proximity of the user's body at the bottom face, Edge1, and Edge4 of the device use a detection threshold distance. The data shown in the sections below shows the distance(s).



<Ant6 Frequency Bands>

Proximity Sensor Triggering Distance (mm)				
Position	Bottom Face		Edge 4	
	Moving away	Moving towards	Moving away	Moving towards
Minimum	33	29	35	31

<Ant7 Frequency Bands>

Proximity Sensor Triggering Distance (mm)				
Position	Bottom Face		Edge 1	
	Moving away	Moving towards	Moving away	Moving towards
Minimum	24	21	31	25

<Ant8 Frequency Bands>

Proximity Sensor Triggering Distance (mm)						
Position	Bottom Face		Edge 1		Edge 4	
	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards
Minimum	52	42	31	19	65	45

<Proximity Sensor Triggering Coverage (KDB 616217 D04 section 6.3)>:

If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For p-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”.

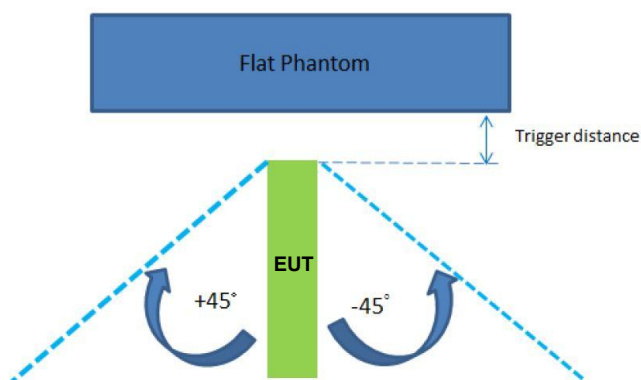
Illustrated in the internal photo exhibit, although the sensor is spatially offset, there is no trigger condition where the antenna is next to the user but the sensor is laterally further away, therefore proximity sensor coverage testing is not required.

This procedure is not required because antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

<Tablet Tilt angle influences to proximity sensor triggering (KDB 616217 D04 section 6.4)>:

The influence of table tilt angles to proximity sensor triggering was determined by positioning each tablet edge that contains a transmitting antenna, perpendicular to the flat phantom, at 31mm at Edge 4 separation for Ant6 bands and 25mm at Edge 1 for Ant7 Bands and 19mm at Edge 1, 45mm at Edge 4 for Ant8 Bands.

Rotating the tablet around the edge next to the phantom in $\leq 10^\circ$ increments until the tablet is $\pm 45^\circ$ from the vertical position at 0° , and the maximum output power remains in the reduced mode.



<Ant6 Frequency Bands>

The Sensor Trigger Distance (mm)	
Position	Edge 4
Minimum	31

<Ant7 Frequency Bands>

The Sensor Trigger Distance (mm)	
Position	Edge 1
Minimum	25

<Ant8 Frequency Bands>

The Sensor Trigger Distance (mm)		
Position	Edge 1	Edge 4
Minimum	19	45

Proximity sensor power reduction

Exposure Position / wireless mode for Ant6	Bottom Face ⁽¹⁾	Edge 1	Edge 2	Edge 3	Edge 4 ⁽¹⁾
WLAN 2.4GHz	6.0 dB	0 dB	0 dB	0 dB	6.0 dB
WLAN 5.2GHz	9.5 dB	0 dB	0 dB	0 dB	9.5 dB
WLAN 5.3GHz	11.5 dB	0 dB	0 dB	0 dB	11.5 dB
WLAN 5.5GHz	10.5 dB	0 dB	0 dB	0 dB	10.5 dB
WLAN 5.8GHz	9.0 dB	0 dB	0 dB	0 dB	9.0 dB
WLAN 6GHz U-NII 5	6.5 dB	0 dB	0 dB	0 dB	6.5 dB
WLAN 6GHz U-NII 6	5.5 dB	0 dB	0 dB	0 dB	5.5 dB
WLAN 6GHz U-NII 7	7.5 dB	0 dB	0 dB	0 dB	7.5 dB
WLAN 6GHz U-NII 8	5.0 dB	0 dB	0 dB	0 dB	5.0 dB

Exposure Position / wireless mode for Ant7	Bottom Face ⁽¹⁾	Edge 1 ⁽¹⁾	Edge 2	Edge 3	Edge 4
WLAN 2.4GHz	8.0 dB	8.0 dB	0 dB	0 dB	0 dB
WLAN 5.2GHz	5.0 dB	5.0 dB	0 dB	0 dB	0 dB
WLAN 5.3GHz	7.0 dB	7.0 dB	0 dB	0 dB	0 dB
WLAN 5.5GHz	10.0 dB	10.0 dB	0 dB	0 dB	0 dB
WLAN 5.8GHz	7.5 dB	7.5 dB	0 dB	0 dB	0 dB
WLAN 6GHz U-NII 5	8.0 dB	8.0 dB	0 dB	0 dB	0 dB
WLAN 6GHz U-NII 6	7.5 dB	7.5 dB	0 dB	0 dB	0 dB
WLAN 6GHz U-NII 7	7.5 dB	7.5 dB	0 dB	0 dB	0 dB
WLAN 6GHz U-NII 8	6.0 dB	6.0 dB	0 dB	0 dB	0 dB

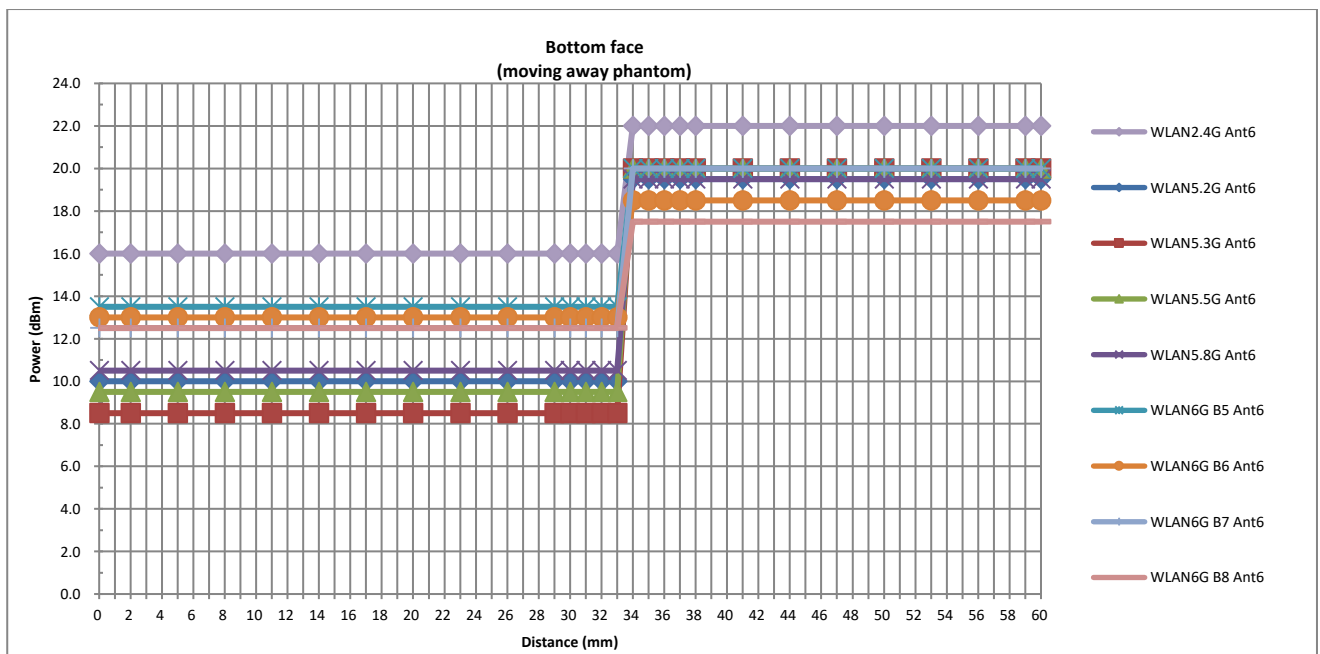
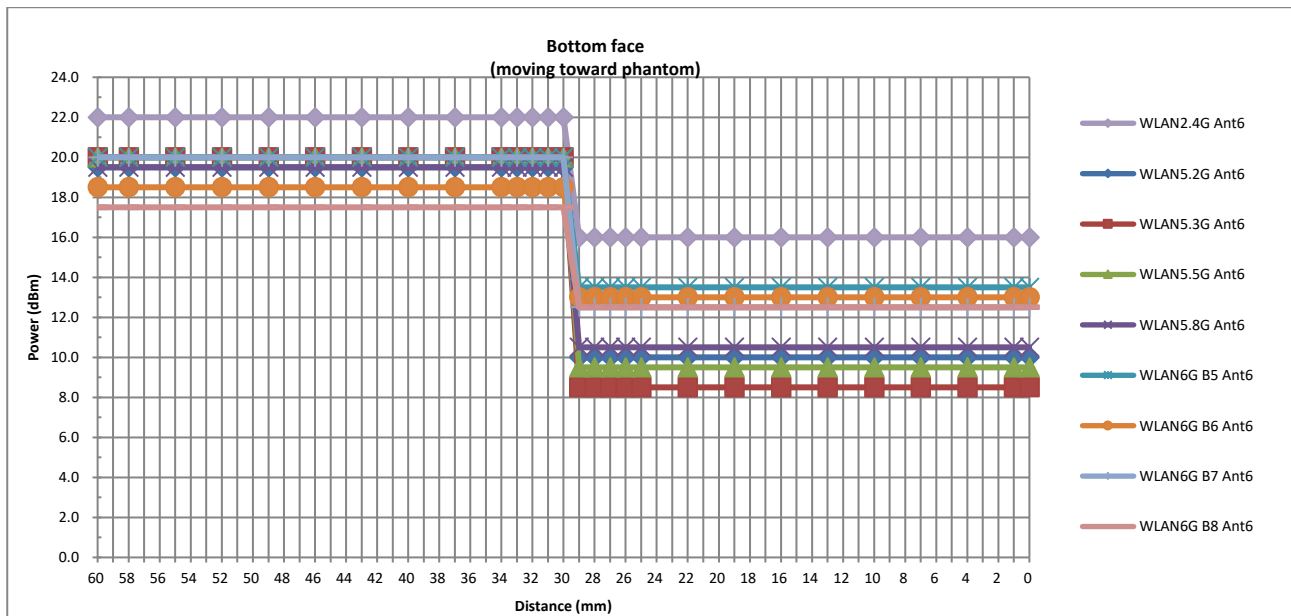
Exposure Position / wireless mode for Ant8	Bottom Face ⁽¹⁾	Edge 1 ⁽¹⁾	Edge 2	Edge 3	Edge 4 ⁽¹⁾
RFID	5.0 dB	5.0 dB	0 dB	0 dB	5.0 dB

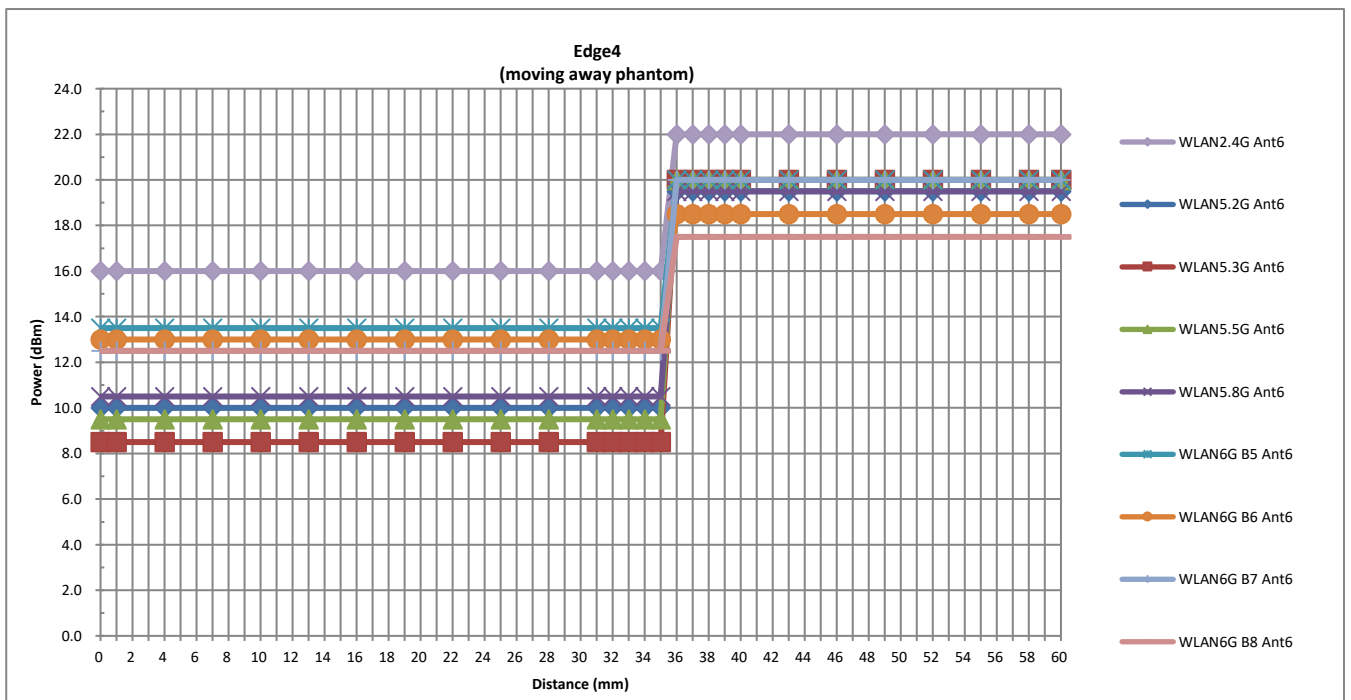
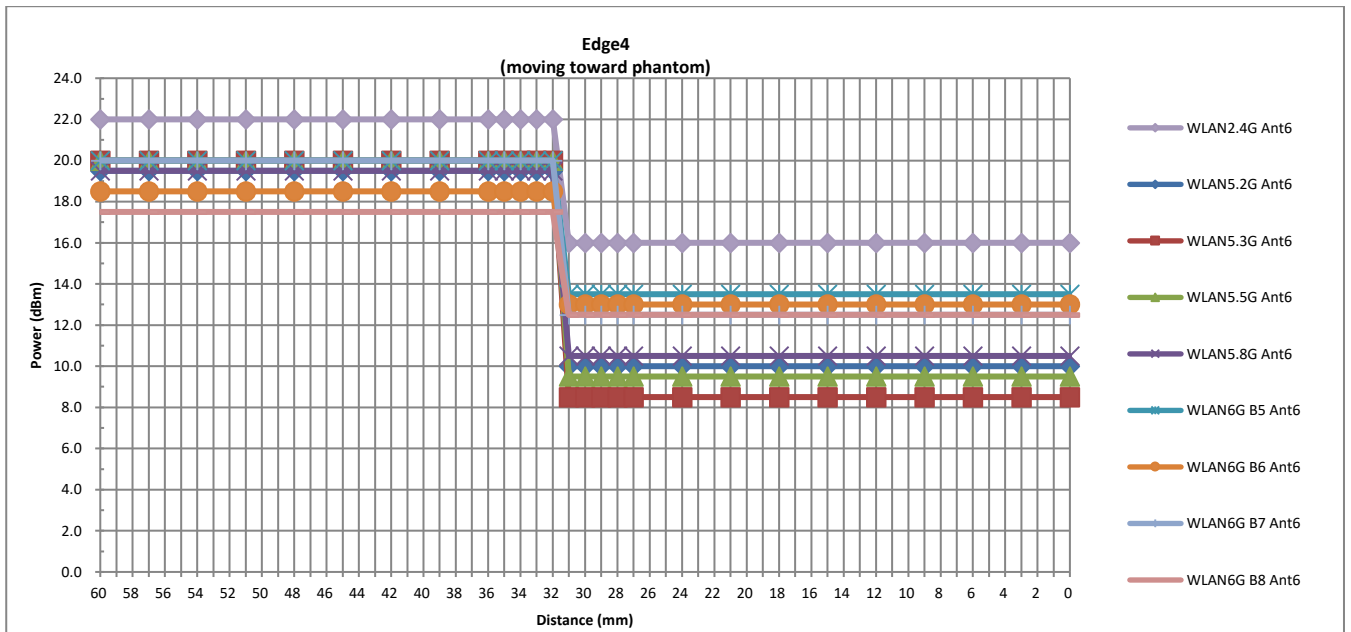
Remark:

- ⁽¹⁾: Reduced maximum limit applied by activation of proximity sensor.
- Power reduction is not applicable for Bluetooth.
- Tests were performed in accordance with KDB 616217 D04 section 6.1, 6.2, 6.3, 6.4 and 6.5 and compliant results are shown and described in exhibit "P-Sensor operational description"
- For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed:
 For Ant 6:
 - Bottom Face: 28mm
 - Edge 4: 30mm
 For Ant 7:
 - Bottom Face: 20mm
 - Edge 1: 24mm
 For Ant 8:
 - Bottom Face: 41mm
 - Edge 1: 18mm
 - Edge 4: 44mm

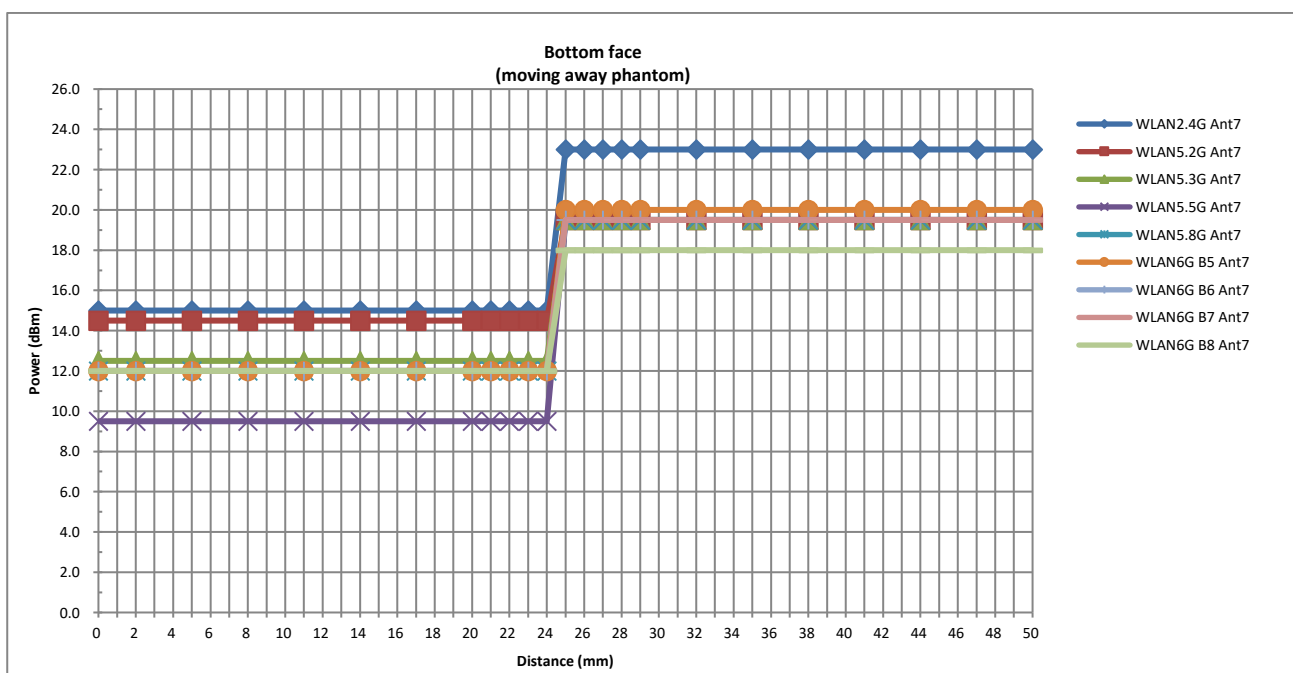
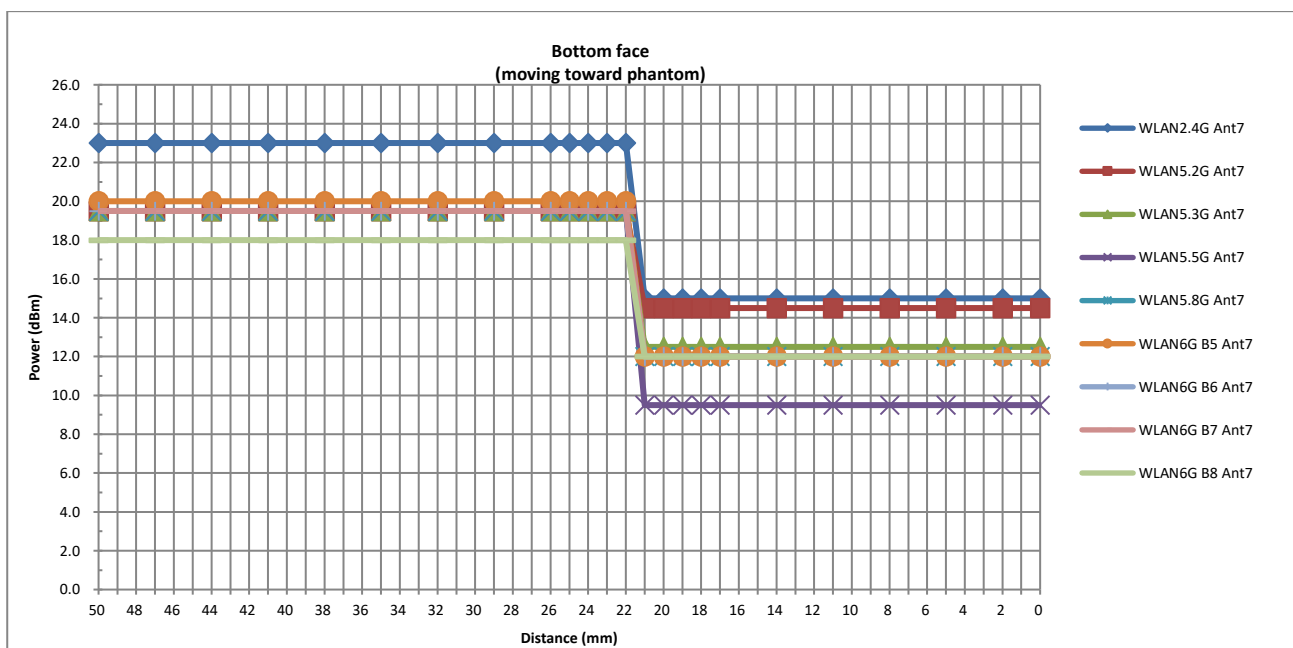
Power Measurement during Sensor Trigger distance testing

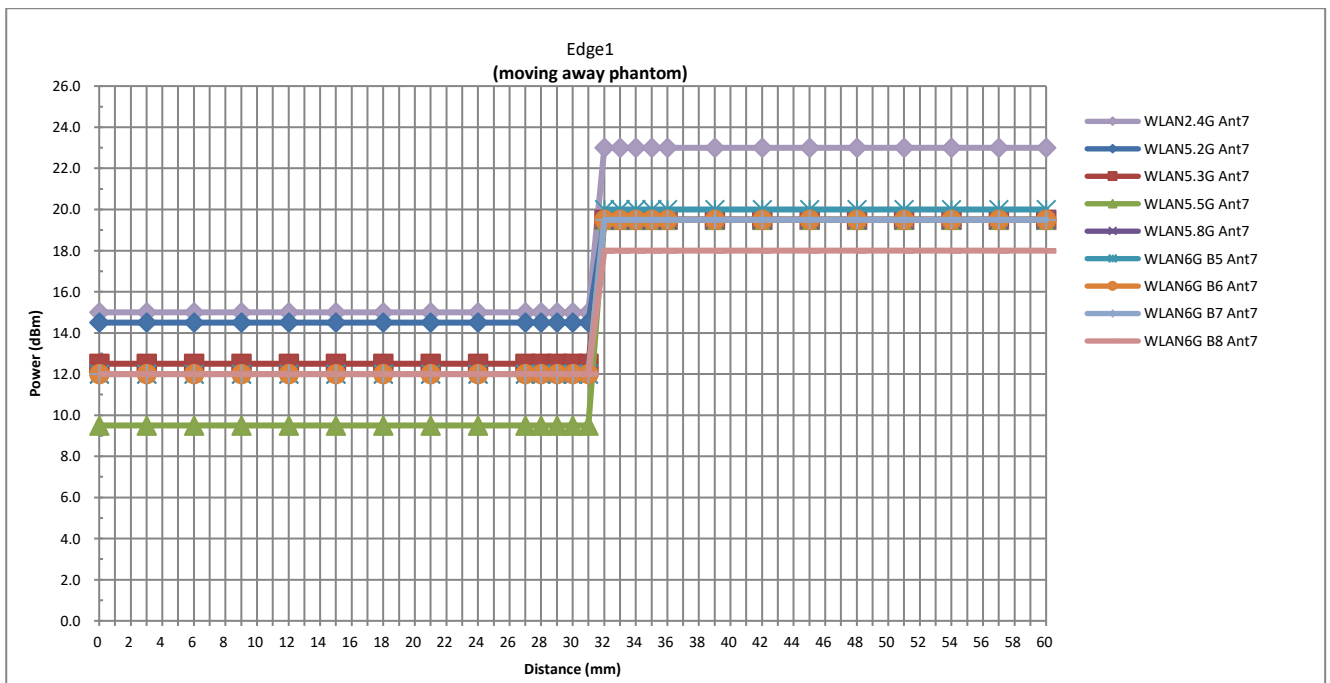
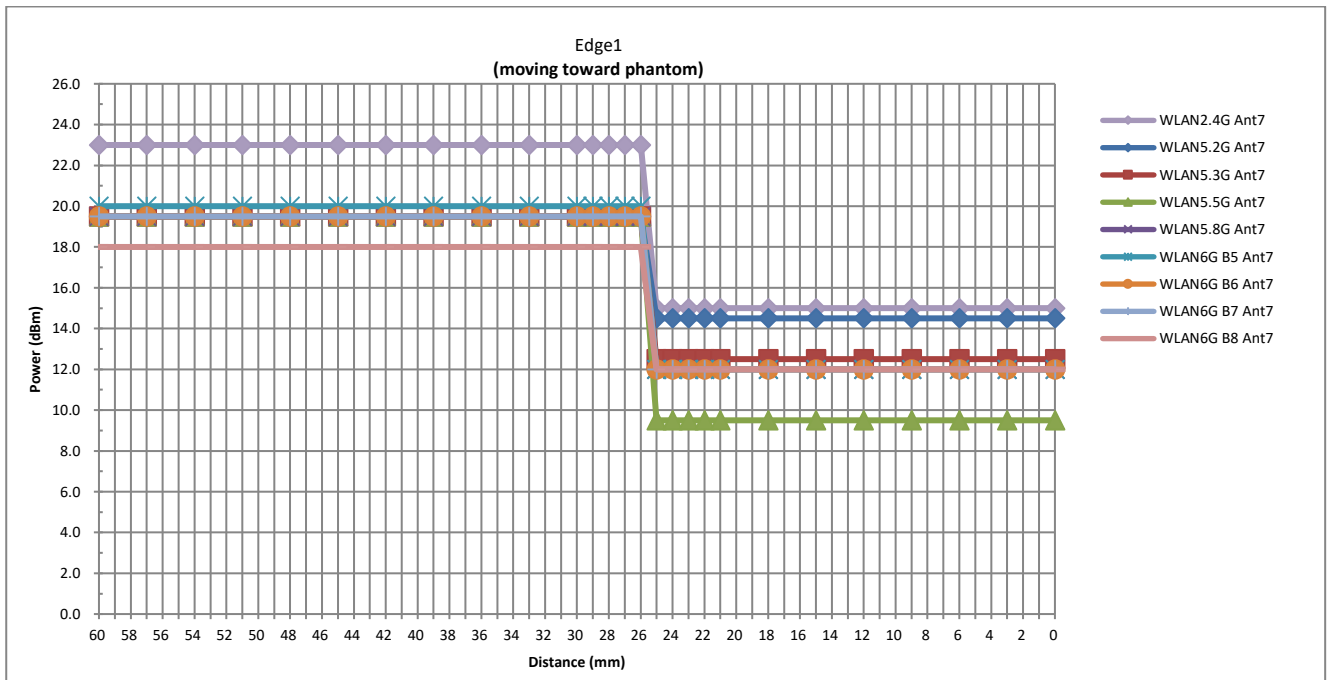
Band/Mode for Ant6	Measured power reduction (dBm)		Reduction Levels (dB)
	w/o power back-off	w/ power back-off	
WLAN 2.4GHz	22.00	16.00	6.0
WLAN 5.2GHz	19.50	10.00	9.5
WLAN 5.3GHz	20.00	8.50	11.5
WLAN 5.5GHz	20.00	9.50	10.5
WLAN 5.8GHz	19.50	10.50	9.0
WLAN 6GHz U-NII 5	20.00	13.50	6.5
WLAN 6GHz U-NII 6	18.50	13.00	5.5
WLAN 6GHz U-NII 7	20.00	12.50	7.5
WLAN 6GHz U-NII 8	17.50	12.50	5.0



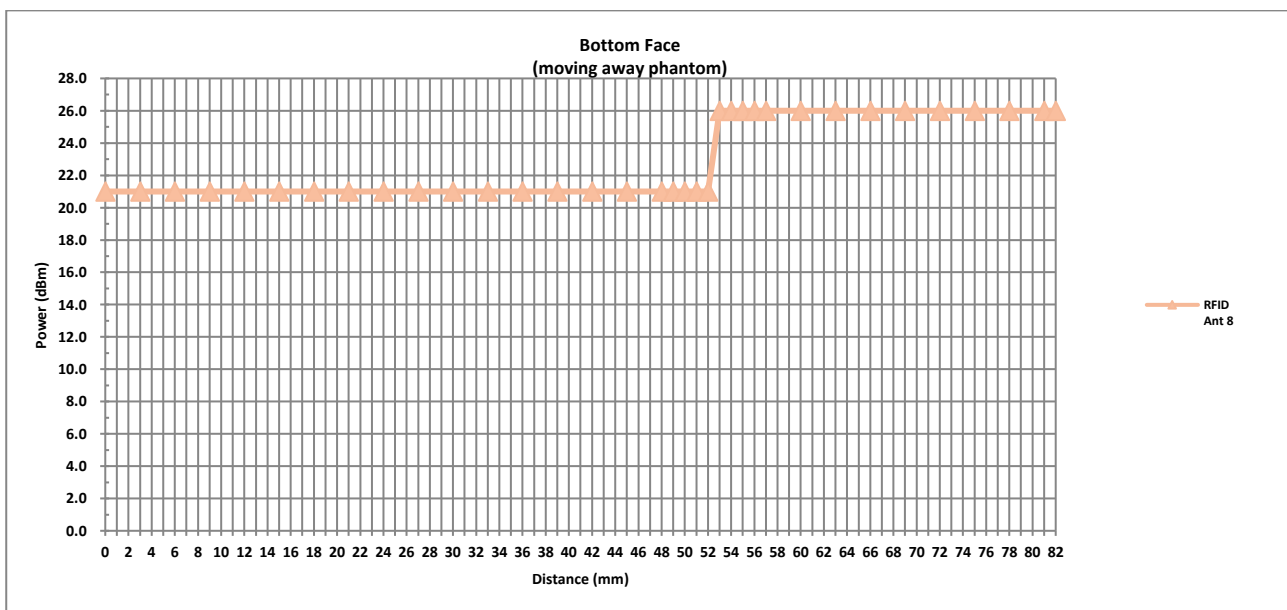
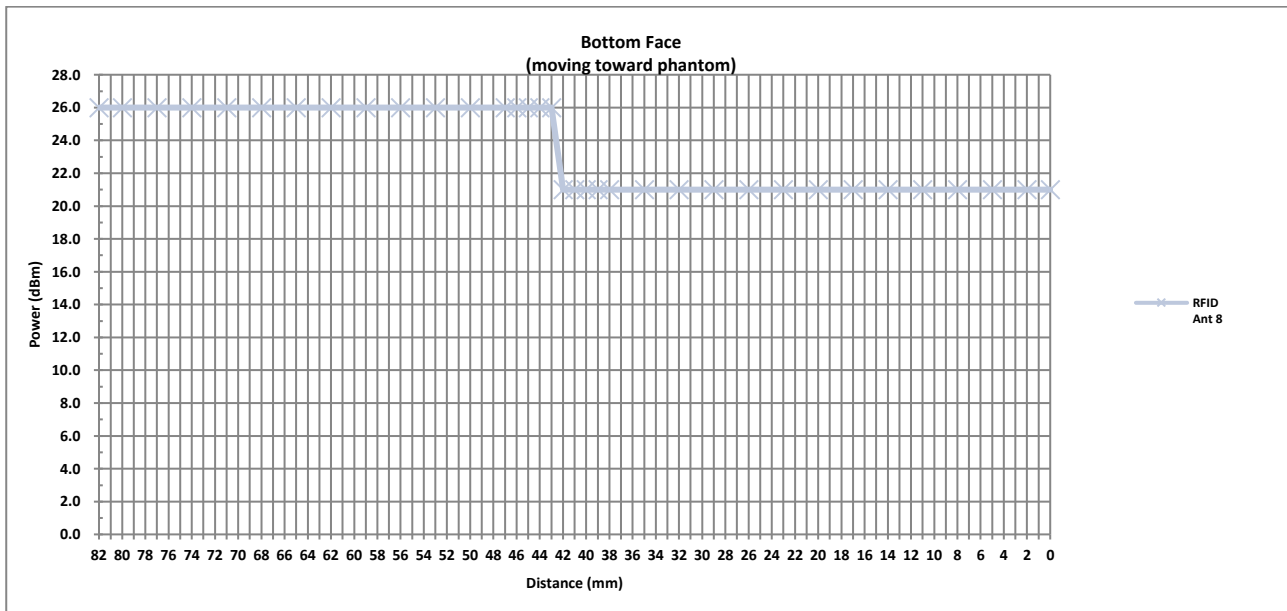


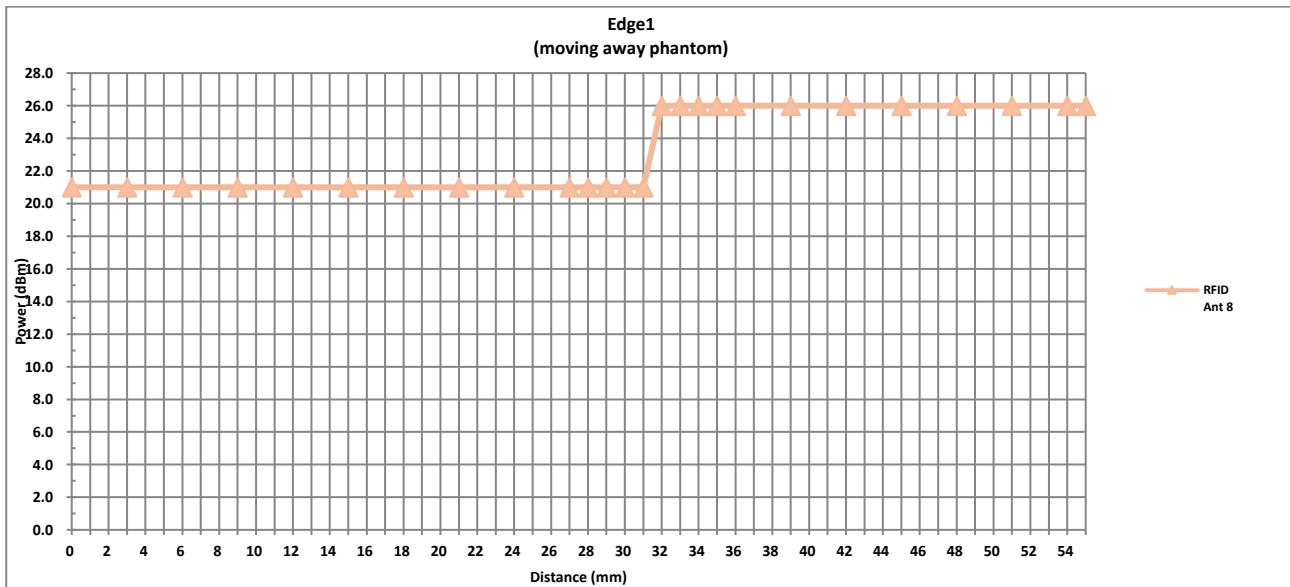
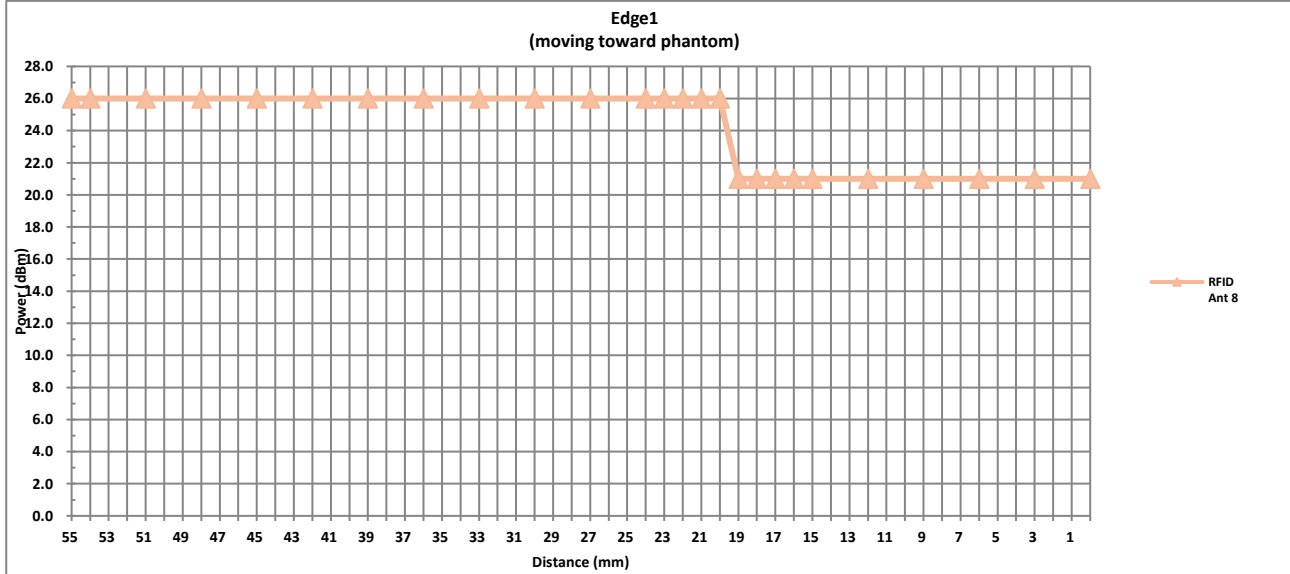
Band/Mode for Ant7	Measured power reduction (dBm)		Reduction Levels (dB)
	w/o power back-off	w/ power back-off	
WLAN 2.4GHz	23.00	15.00	8.0
WLAN 5.2GHz	19.50	14.50	5.0
WLAN 5.3GHz	19.50	12.50	7.0
WLAN 5.5GHz	19.50	9.50	10.0
WLAN 5.8GHz	19.50	12.00	7.5
WLAN 6GHz U-NII 5	20.00	12.00	8.0
WLAN 6GHz U-NII 6	19.50	12.00	7.5
WLAN 6GHz U-NII 7	19.50	12.00	7.5
WLAN 6GHz U-NII 8	18.00	12.00	6.0

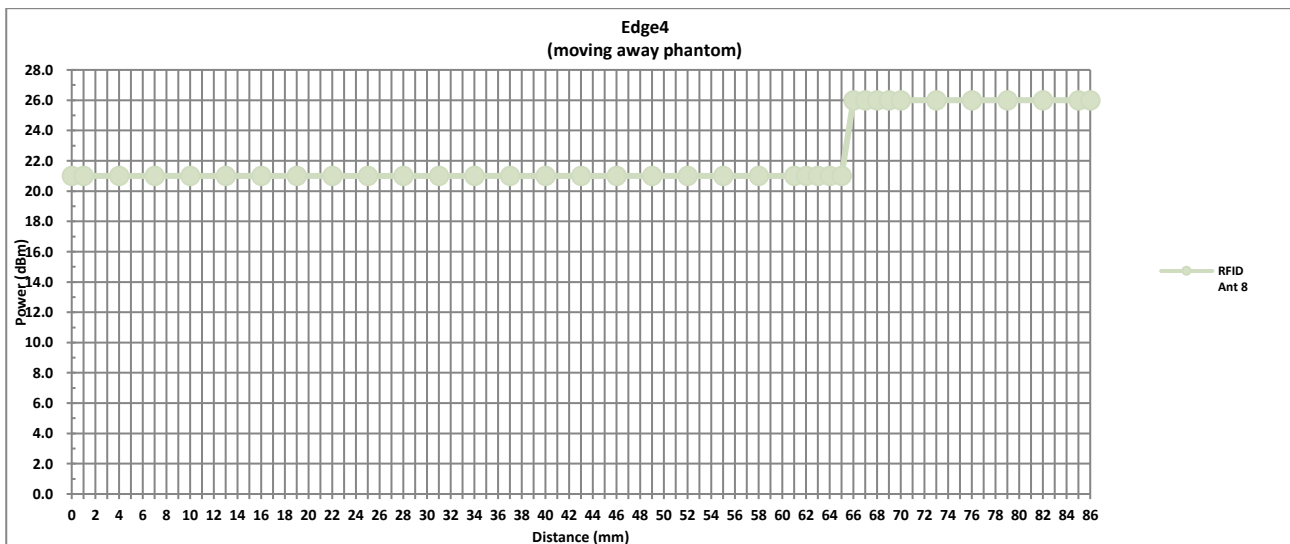
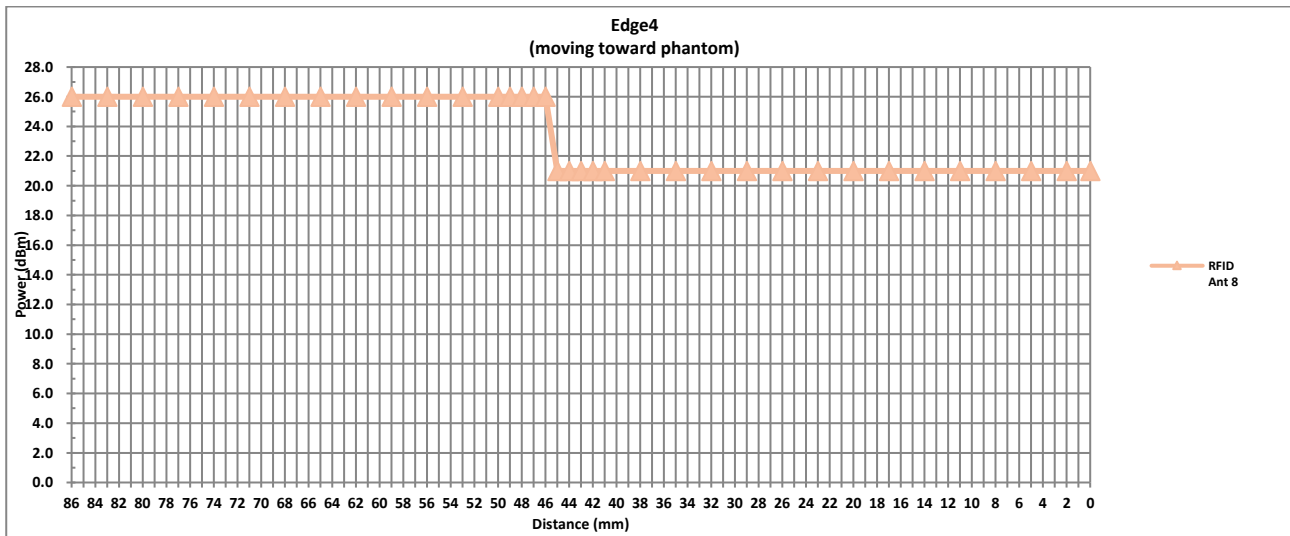




Band/Mode for Ant8	Measured power reduction (dBm)		Reduction Levels
	w/o power back-off	w/ power back-off	(dB)
RFID	26.00	21.00	5.0







7. RF Exposure Limits

7.1 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.

7.2 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.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

7.3 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/m² or mW/cm².

Peak Spatially Averaged Power Density was evaluated over a square area of 4cm² 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 ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	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/cm² is 10 W/m²

8. Specific Absorption Rate (SAR)

8.1 Introduction

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.

8.2 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:

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

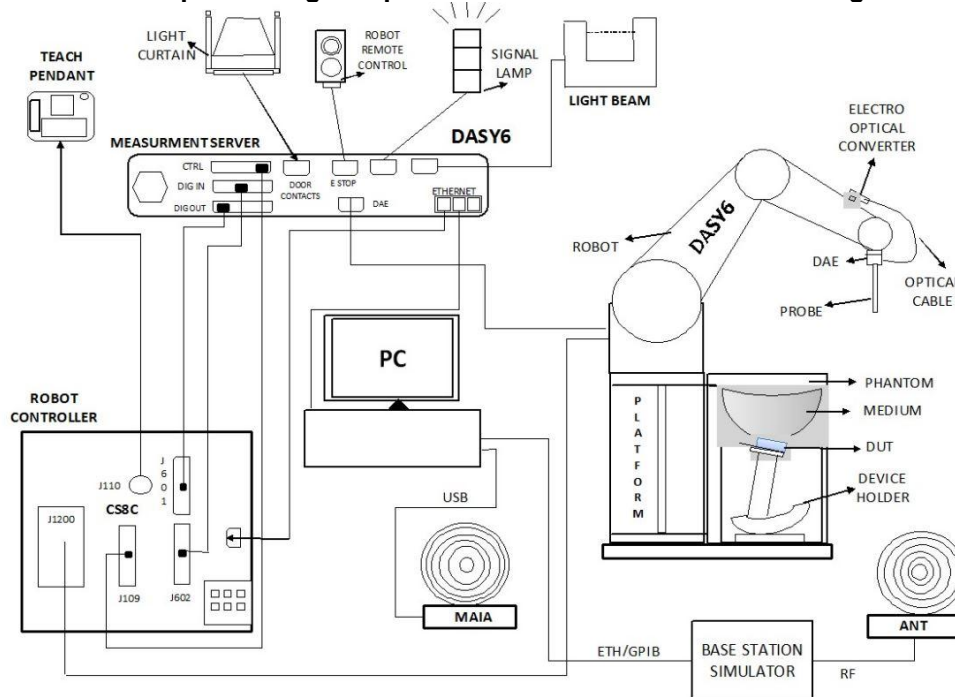
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

9. 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 Win7 or Win10 and the DASY5 or DASY6⁽¹⁾ 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 V3.2.0.1840 and older generations and used the developed Plane-to-Plane Phase Reconstruction (PTP-PR) Algorithm which was used in PD measurement.

9.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	4 MHz – 10 GHz Linearity: ± 0.2 dB (30 MHz – 10 GHz)	
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 μ W/g – >100 mW/g Linearity: ± 0.2 dB (noise: typically <1 μ W/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

9.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



Photo of DAE

9.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.

9.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Mounting Device for Laptops

10. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

10.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

10.2 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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

10.3 Area 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. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), 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 parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

10.4 Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 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: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
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 draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 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.				

10.5 Volume Scan Procedures

The volume scan is used to assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

10.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASy measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

11. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Last Cal.	Due Date
SPEAG	900MHz System Validation Kit	D900V2	1d186	2025/3/12	2027/3/10
SPEAG	2450MHz System Validation Kit	D2450V2	1095	2024/2/8	2027/2/5
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	2025/9/17	2026/9/16
SPEAG	6500MHz System Validation Kit	D6.5GHzV2	1031	2026/4/20	2027/4/19
SPEAG	5G Verification Source	10GHz	2005	2026/1/12	2027/1/11
SPEAG	Data Acquisition Electronics	DAE4	1649	2025/8/27	2026/8/26
SPEAG	Data Acquisition Electronics	DAE4	1358	2025/7/15	2026/7/14
SPEAG	Dosimetric E-Field Probe	EX3DV4	7774	2025/7/25	2026/7/24
SPEAG	Dosimetric E-Field Probe	EX3DV4	7918	2026/3/12	2027/3/11
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2026/4/17	2027/4/16
SPEAG	EUmmWV Probe Tip Protection	EUmmWV4	9553	2026/3/17	2027/3/16
SPEAG	mmWave Phantom	mmWave	1065	NCR	NCR
SPEAG	ELI Phantom	ELI V8.0	TP-2134	NCR	NCR
SPEAG	ELI Phantom	ELI V8.0	TP-1201	NCR	NCR
Beichuang	Thermo-Hygrometer	HTC-1	1980332	2026/4/11	2027/4/10
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Rohde & Schwarz	Signal Generator	SMR40	100455	2025/12/26	2026/12/25
Keysight	Preamplifier	83017A	MY57280106	2026/4/9	2027/4/8
Agilent	ENA Series Network Analyzer	E5071C	MY46112129	2025/7/2	2026/7/1
SPEAG	Dielectric Probe Kit	DAK-3.5	1144	2025/8/26	2026/8/25
Anritsu	Vector Signal Generator	MG3710A	6201682672	2025/12/26	2026/12/25
Rohde & Schwarz	Power Meter	NRVD	102081	2025/7/2	2026/7/1
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2025/7/2	2026/7/1
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2025/7/2	2026/7/1
Rohde & Schwarz	Power Sensor	NRP50S	101385	2025/10/14	2026/10/13
Rohde & Schwarz	Spectrum Analyzer	FSV7	101631	2025/10/11	2026/10/10
TES	DIGITAC THERMOMETER	TYPE-K	200505600	2025/7/5	2026/7/4
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note 1	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note 1	
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	
ARRA	Power Divider	A3200-2	N/A	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	
mini-circuits	amplifier	ZVE-3W-83+	162601250	Note 1	

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.

12. System Verification

12.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1.



Fig 10.1 Photo of Liquid Height for Body SAR

12.2 Tissue Verification

The tissue dielectric parameters of tissue-equivalent media used for SAR measurements must be characterized within a temperature range of 18°C to 25°C, measured with calibrated instruments and apparatuses, such as network analyzers and temperature probes. The temperature of the tissue-equivalent medium during SAR measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized. The tissue dielectric measurement system must be calibrated before use. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements.

The depth of the tissue-equivalent liquid in the phantom was at least 15 cm for all SAR testing.

The SPEAG DASY Measurement system implement a SAR error compensation algorithm as documented in IEEE Std 1528-2013 to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, according to KDB 865664 D01 and IEC/IEEE 62209-1528, the tolerance for "Delta (σ)" and "Delta (ϵ_r)" can be relaxed to $\pm 10\%$.

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Liquid Temp (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
900	22.8	0.950	42.486	0.97	41.50	-2.06	2.38	± 5	2026/6/25
2450	22.7	1.770	39.300	1.80	39.20	-1.67	0.26	± 5	2026/6/9
5250	22.6	4.640	36.200	4.71	35.95	-1.49	0.70	± 5	2026/6/10
5600	22.8	5	36	5.07	35.50	-1.38	1.41	± 5	2026/6/11
5800	22.9	5.21	35.6	5.27	35.30	-1.14	0.85	± 5	2026/6/22
6500	22.8	6.070	34.200	6.07	34.50	0.00	-0.87	± 5	2026/6/28

12.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2026/6/25	900	50	D900V2-1d186	EX3DV4 - SN3857	DAE4 Sn1649	0.509	10.800	10.18	-5.74	0.339	6.930	6.78	-2.16
2026/6/9	2450	50	D2450V2-1095	EX3DV4 - SN7918	DAE4 Sn1358	2.560	52.600	51.2	-2.66	1.260	24.700	25.2	2.02
2026/6/10	5250	50	D5GHzV2-1113	EX3DV4 - SN7918	DAE4 Sn1358	4.110	78.100	82.2	5.25	1.230	22.400	24.6	9.82
2026/6/11	5600	50	D5GHzV2-1113	EX3DV4 - SN7918	DAE4 Sn1358	4.180	80.000	83.6	4.50	1.220	23.000	24.4	6.09
2026/6/22	5800	50	D5GHzV2-1113	EX3DV4 - SN7918	DAE4 Sn1358	4.020	77.900	80.4	3.21	1.210	22.300	24.2	8.52
2026/6/28	6500	50	D6.5GHzV2-1031	EX3DV4 - SN7774	DAE4 Sn1358	14.900	283.000	298	5.30	2.760	54.800	55.2	0.73

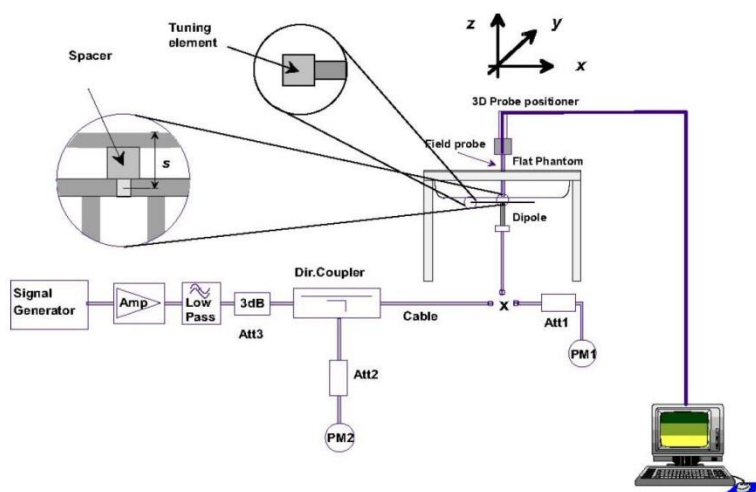


Fig 10.3.1 System Performance Check Setup



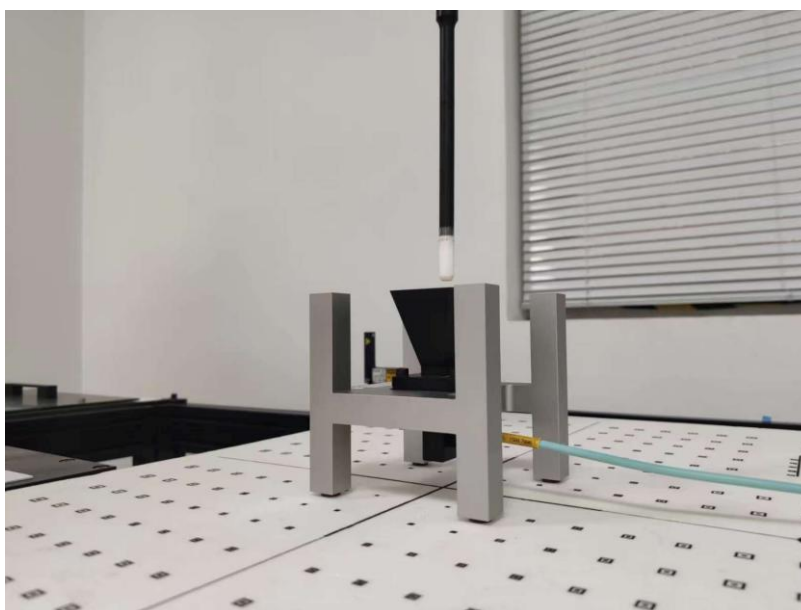
Fig 10.3.2 Setup Photo

12.4 PD System Verification Results

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.

Frequency (GHz)	5G Verification Source	Probe S/N	DAE S/N	Distance (mm)	Input Power (mW)	Measured psPDn+ 4 cm ² (W/m ²)	Normalized ⁽¹⁾ psPDn+ 4 cm ² (W/m ²)	Targeted psPDn+ 4 cm ² (W/m ²)	Deviation (dB)	Measured psPDtot+ 4 cm ² (W/m ²)	Normalized ⁽¹⁾ psPDtot+ 4 cm ² (W/m ²)	Targeted psPDtot+ 4 cm ² (W/m ²)	Deviation (dB)	Measured psPDmod+ 4 cm ² (W/m ²)	Normalized ⁽¹⁾ psPDmod+ 4 cm ² (W/m ²)	Targeted psPDmod+ 4 cm ² (W/m ²)	Deviation (dB)	Date
10	10GHz_2005	9553	1358	10	100	94.6	149.9	167	-0.47	95	150.5	168	-0.48	97	153.7	172	-0.49	2026/6/29

Note: (1) indicates that the measured PD was normalized to the Prad power, which can be found in the DASY Calibration Certificate in Appendix C.



System Verification Setup Photo

13. RF Exposure Positions

13.1 SAR Testing for Tablet

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

13.2 Miscellaneous Testing Considerations

- Evaluate SAR using 6-7 GHz parameters per IEC/IEEE 62209-1528:2020.
- Per procedures of KDB Pubs. 447498 and 248227, and applicable product-specific procedures among KDB Pubs.
- Where supported by the test system, also report estimated absorbed (epithelial) power density (for reference purposes only, not specifically for compliance) and estimated incident PD, derived from measured SAR.
- In addition, for the highest SAR test configurations evaluate incident PD using the mmw near-field probe and total-field/power-density reconstruction method (2 mm closest meas. plane)
 - Adjust measured results per amount that measurement uncertainty exceeds 30 % (see e.g. IEC 62479:2010)

<EUT Setup Photos>

Please refer to Appendix D for the test setup photos.

14. Conducted RF Output Power (Unit: dBm)

<WLAN Conducted Power>

General Note:

1. For each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.
2. For each frequency band or when MIMO mode was not performed, due to for each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.
3. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is $< 1.6\text{W/kg}$ and SAR peak to location ratio ≤ 0.04 , no additional SAR measurements for MIMO.
4. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration. Additional output power measurements were not necessary.
5. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
6. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
7. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
8. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
 - a. When the reported SAR of the initial test position is $\leq 0.4\text{ W/kg}$, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
 - b. When the reported SAR of the test position is $> 0.4\text{ W/kg}$, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is $\leq 0.8\text{ W/kg}$ or all required test position are tested.
 - c. For all positions/configurations, when the reported SAR is $> 0.8\text{ W/kg}$, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is $\leq 1.2\text{ W/kg}$ or all required channels are tested.
9. Per April 2019 TCB workshops, General principles of FCC KDB Publication 248227 D01 can be applied to determine the SAR Initial Test Configurations and test reduction for 802.11ax SAR testing. For the table below the 802.11ax maximum power is SU (non-OFDMA), and the SU maximum power also higher than RU (OFDMA)

10. In applying the test guidance, the IEEE 802.11 mode with the maximum output power (out of all modes) should be considered for testing
11. For modes with the same maximum output power, the guidance from section 5.3.2 a) of FCC KDB Publication 248227 D01 should be applied, with 802.11ax being considered as the highest 802.11 mode for the appropriate frequency bands
12. When SAR testing for 802.11ax is required
 - a. If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power
 - b. Otherwise, consider the fully allocated channel for SAR testing
 - c. When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel
13. 802.11 ax/be supports both full tone size mode and partial tone size mode, after verification on partial tone size mode that partial size tone mode power will not be higher than full tone size mode, therefore, full tone mode power was chosen to be measured in this report.
14. The 2.4GHz/5GHz/6GHz WLAN can transmit in SISO/MIMO antenna mode.
15. For the conducted power measurement is MIMO chains transmitting simultaneously and measured the separately conducted power for both chains and then based on the conducted power of two antennas respectively to calculate sum of the power for MIMO mode.
16. The device supports WLAN 2.4GHz/5GHz Tx Beamforming mode for 11ax/be, and the Tx Beamforming power/EIRP is not greater than CDD mode, so conducted power of CDD mode can represent Tx Beamforming mode.
17. For WLAN6GHz SISO & MIMO(CDD) & MIMO(SDM) & TX Beamforming mode of 802.11ax, follow the steps below:
 - 1) For Standard Client, due to WLAN SISO & TX Beamforming mode power level is not greater than WLAN MIMO(SDM) & MIMO(CDD) mode, so conducted power of WLAN SISO & Tx Beamforming mode is not required.
 - 2) For Indoor Client, due to WLAN SISO & MIMO(CDD) & TX Beamforming mode power level is not greater than WLAN MIMO(SDM) mode, so conducted power of WLAN SISO & MIMO(CDD) & Tx Beamforming mode is not required.

<2.4GHz WLAN_Ant 7_DSI 3>

2.4GHz WLAN_Ant 7_DSI 3			Ant 7		
Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
802.11b 1Mbps	1	2412	14.71	15.00	99.06
	6	2437	14.73	15.00	99.06
	11	2462	14.75	15.00	99.06
802.11g 6Mbps	1	2412	Not Required	15.00	Not Required
	6	2437	Not Required	15.00	Not Required
	11	2462	Not Required	15.00	Not Required
802.11n-HT20 MCS0	1	2412	Not Required	15.00	Not Required
	6	2437	Not Required	15.00	Not Required
	11	2462	Not Required	15.00	Not Required
802.11ac-VHT20 MCS0	1	2412	Not Required	15.00	Not Required
	6	2437	Not Required	15.00	Not Required
	11	2462	Not Required	15.00	Not Required
802.11ax-HE20 MCS0	1	2412	Not Required	15.00	Not Required
	6	2437	Not Required	15.00	Not Required
	11	2462	Not Required	15.00	Not Required
802.11be-EHT20 MCS0	1	2412	Not Required	15.00	Not Required
	6	2437	Not Required	15.00	Not Required
	11	2462	Not Required	15.00	Not Required



<2.4GHz WLAN_Ant MIMO_DSI 3>					
2.4GHz WLAN_Ant MIMO_DSI 3			Ant MIMO		
Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
802.11b 1Mbps	1	2412	18.14	18.50	99.06
	6	2437	18.22	18.50	99.06
	11	2462	18.41	18.50	99.06
802.11g 6Mbps	1	2412	Not Required	18.50	Not Required
	6	2437	Not Required	18.50	Not Required
	11	2462	Not Required	18.50	Not Required
802.11n-HT20 MCS0	1	2412	Not Required	18.50	Not Required
	6	2437	Not Required	18.50	Not Required
	11	2462	Not Required	18.50	Not Required
802.11ac-VHT20 MCS0	1	2412	Not Required	18.50	Not Required
	6	2437	Not Required	18.50	Not Required
	11	2462	Not Required	18.50	Not Required
802.11ax-HE20 MCS0	1	2412	Not Required	18.50	Not Required
	6	2437	Not Required	18.50	Not Required
	11	2462	Not Required	18.50	Not Required
802.11be-EHT20 MCS0	1	2412	Not Required	18.50	Not Required
	6	2437	Not Required	18.50	Not Required
	11	2462	Not Required	18.50	Not Required

<5.2GHz WLAN_Ant 7_DSI 3>

5.2GHz WLAN_FCC_Ant 7_DSI 3			Ant 7		
Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
802.11a 6Mbps	36	5180	Not Required	14.50	Not Required
	40	5200	Not Required	14.50	Not Required
	44	5220	Not Required	14.50	Not Required
	48	5240	Not Required	14.50	Not Required
802.11n-HT20 MCS0	36	5180	Not Required	14.50	Not Required
	40	5200	Not Required	14.50	Not Required
	44	5220	Not Required	14.50	Not Required
	48	5240	Not Required	14.50	Not Required
802.11n-HT40 MCS0	38	5190	Not Required	14.50	Not Required
	46	5230	Not Required	14.50	Not Required
802.11ac-VHT20 MCS0	36	5180	Not Required	14.50	Not Required
	40	5200	Not Required	14.50	Not Required
	44	5220	Not Required	14.50	Not Required
	48	5240	Not Required	14.50	Not Required
802.11ac-VHT40 MCS0	38	5190	Not Required	14.50	Not Required
	46	5230	Not Required	14.50	Not Required
802.11ac-VHT80 MCS0	42	5210	14.32	14.50	100.00
802.11ax-HE20 MCS0	36	5180	Not Required	14.50	Not Required
	40	5200	Not Required	14.50	Not Required
	44	5220	Not Required	14.50	Not Required
	48	5240	Not Required	14.50	Not Required
802.11ax-HE40 MCS0	38	5190	Not Required	14.50	Not Required
	46	5230	Not Required	14.50	Not Required



802.11ax-HE80 MCS0	42	5210	Not Required	14.50	Not Required
802.11be-EHT20 MCS0	36	5180	Not Required	14.50	Not Required
	40	5200	Not Required	14.50	Not Required
	44	5220	Not Required	14.50	Not Required
	48	5240	Not Required	14.50	Not Required
802.11be-EHT40 MCS0	38	5190	Not Required	14.50	Not Required
	46	5230	Not Required	14.50	Not Required
802.11be-EHT80 MCS0	42	5210	Not Required	14.50	Not Required

<5.2GHz WLAN_Ant MIMO_DSI 3>					
5.2GHz WLAN_FCC_Ant MIMO_DSI 3			Ant MIMO		
Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
802.11a 6Mbps	36	5180	Not Required	15.80	Not Required
	40	5200	Not Required	15.80	Not Required
	44	5220	Not Required	15.80	Not Required
	48	5240	Not Required	15.80	Not Required
802.11n-HT20 MCS0	36	5180	Not Required	15.80	Not Required
	40	5200	Not Required	15.80	Not Required
	44	5220	Not Required	15.80	Not Required
	48	5240	Not Required	15.80	Not Required
802.11n-HT40 MCS0	38	5190	Not Required	15.80	Not Required
	46	5230	Not Required	15.80	Not Required
802.11ac-VHT20 MCS0	36	5180	Not Required	15.80	Not Required
	40	5200	Not Required	15.80	Not Required
	44	5220	Not Required	15.80	Not Required
	48	5240	Not Required	15.80	Not Required
802.11ac-VHT40 MCS0	38	5190	Not Required	15.80	Not Required
	46	5230	Not Required	15.80	Not Required
802.11ac-VHT80 MCS0	42	5210	15.67	15.80	100.00
802.11ax-HE20 MCS0	36	5180	Not Required	15.80	Not Required
	40	5200	Not Required	15.80	Not Required
	44	5220	Not Required	15.80	Not Required
	48	5240	Not Required	15.80	Not Required
802.11ax-HE40 MCS0	38	5190	Not Required	15.80	Not Required
	46	5230	Not Required	15.80	Not Required
802.11ax-HE80 MCS0	42	5210	Not Required	15.80	Not Required
802.11be-EHT20 MCS0	36	5180	Not Required	15.80	Not Required
	40	5200	Not Required	15.80	Not Required
	44	5220	Not Required	15.80	Not Required
	48	5240	Not Required	15.80	Not Required
802.11be-EHT40 MCS0	38	5190	Not Required	15.80	Not Required
	46	5230	Not Required	15.80	Not Required
802.11be-EHT80 MCS0	42	5210	Not Required	15.80	Not Required

15. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN/ Bluetooth signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
 - c. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
4. Per FCC guidance, SAR was performed using 6.5 GHz SAR probe calibration factors.
5. Per October 2020 TCB Workshop Interim procedures, start instead with a minimum of 5 test channels across the full band, then adapt and apply conducted power and SAR test reduction procedures of KDB Pub. 248227 v02r02.
6. For testing the WLAN 6GHz of this DUT, the selection of test channels was based on FCC guidance, with five channels selected across the entire WLAN 6GHz Bands. For the U-NII-5/U-NII-7 band supporting Standard AP mode and indoor Client mode, the higher output mode was measured among the selected channels.
7. For determination of the scaling factor for report SAR of MIMO mode, if the hot spots are separated the scaling factors are individually determined from each transmit chain. Further simplification chose the worse SAR value and the worst scaling factor from each transmit chain perform reported SAR calculation conservatively. If the hot spots are not spatially separated, the scaling factor is determined from the worst number of each transmit chain.
8. Absorbed power density (APD) using a 4cm² averaging area is reported based on SAR measurements.
9. WLAN 6GHz is categorized into three classes: Standard Client, Indoor Client and VLP (Very Low Power). Since the power level of Standard Client and Indoor Client is not less than power VLP (Very Low Power), so SAR for Standard Client and Indoor Client is evaluated more conservatively than VLP (Very Low Power) SAR. However, VLP (Very Low Power) SAR still spot-checks the worst-case SAR of Standard Client and Indoor Client.

WLAN/Bluetooth Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.
6. 802.11ax/be supports full tone size and partial tone size, after verification for the partial tone size mode power level will not higher than full tone size power level, so chose full tone power to be measured in this report.
7. The 2.4GHz/5GHz/6GHz WLAN can transmit in SISO/MIMO antenna mode.
8. For each antenna, transmit power in SISO operation is larger than or equal to the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode. So WLAN SAR testing was performed on SISO antenna, MIMO SAR base on standalone SAR summed together as MIMO SAR.



15.1 Body SAR

Plot No	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-Up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 6	DSI 3	11	2462	Without Scanner	15.97	16	1.007	99.06	1.009	-0.01	1.060	1.077
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 6	DSI 3	1	2412	Without Scanner	15.91	16	1.021	99.06	1.009	0.01	0.986	1.016
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 7	DSI 3	11	2462	Without Scanner	14.75	15	1.059	99.06	1.009	-0.03	0.981	1.048
01	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 7	DSI 3	6	2437	Without Scanner	14.73	15	1.064	99.06	1.009	-0.01	1.030	1.106
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	0mm	Ant 7	DSI 3	11	2462	Without Scanner	14.75	15	1.059	99.06	1.009	-0.02	0.575	0.614
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 7	DSI 0	6	2437	Without Scanner	22.99	23	1.002	99.06	1.009	0.05	0.470	0.475
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	20mm	Ant 7	DSI 0	6	2437	Without Scanner	22.99	23	1.002	99.06	1.009	0.01	0.328	0.332
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	24mm	Ant 7	DSI 0	6	2437	Without Scanner	22.99	23	1.002	99.06	1.009	-0.03	0.436	0.441
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 6	DSI 3	42	5210	Without Scanner	9.81	10	1.045	100	1.000	0.09	1.070	1.118
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 7	DSI 3	42	5210	Without Scanner	14.38	14.5	1.028	100	1.000	-0.03	0.700	0.72
02	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 7	DSI 3	42	5210	Without Scanner	14.38	14.5	1.028	100	1.000	-0.02	1.150	1.182
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 4	0mm	Ant 7	DSI 0	42	5210	Without Scanner	19.33	19.5	1.040	100	1.000	0.01	0.119	0.124
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	20mm	Ant 7	DSI 0	42	5210	Without Scanner	19.33	19.5	1.040	100	1.000	0.03	0.288	0.3
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	24mm	Ant 7	DSI 0	42	5210	Without Scanner	19.33	19.5	1.040	100	1.000	-0.02	0.272	0.283
	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 6	DSI 3	50	5250	Without Scanner	8.41	8.5	1.021	100	1.000	-0.01	1.050	1.072
08	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 7	DSI 3	50	5250	Without Scanner	12.32	12.5	1.042	100	1.000	0.08	1.080	1.125
	WLAN5GHz	802.11ac-VHT160 MCS0	Edge 1	0mm	Ant 7	DSI 3	50	5250	Without Scanner	12.32	12.5	1.042	100	1.000	-0.05	0.869	0.905
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 4	0mm	Ant 7	DSI 0	58	5290	Without Scanner	19.02	19.5	1.117	100	1.000	0.02	0.180	0.201
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	20mm	Ant 7	DSI 0	58	5290	Without Scanner	19.02	19.5	1.117	100	1.000	-0.01	0.492	0.55
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	24mm	Ant 7	DSI 0	58	5290	Without Scanner	19.02	19.5	1.117	100	1.000	-0.04	0.324	0.362
03	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 6	DSI 3	114	5570	Without Scanner	9.45	9.5	1.012	100	1.000	0.02	1.000	1.012
	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 7	DSI 3	114	5570	Without Scanner	9.39	9.5	1.026	100	1.000	-0.06	0.837	0.859
	WLAN5GHz	802.11ac-VHT160 MCS0	Edge 1	0mm	Ant 7	DSI 3	114	5570	Without Scanner	9.39	9.5	1.026	100	1.000	0.02	0.536	0.55
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 4	0mm	Ant 7	DSI 0	106	5530	Without Scanner	19.26	19.5	1.057	100	1.000	-0.04	0.351	0.371
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	20mm	Ant 7	DSI 0	106	5530	Without Scanner	19.26	19.5	1.057	100	1.000	-0.09	0.501	0.53
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	24mm	Ant 7	DSI 0	106	5530	Without Scanner	19.26	19.5	1.057	100	1.000	0.01	0.490	0.518
04	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 6	DSI 3	155	5775	Without Scanner	10.49	10.5	1.002	100	1.000	0.09	1.100	1.102
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 7	DSI 3	155	5775	Without Scanner	11.68	12	1.076	100	1.000	-0.17	0.888	0.955
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 7	DSI 3	155	5775	Without Scanner	11.68	12	1.076	100	1.000	-0.04	0.813	0.875
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 4	0mm	Ant 7	DSI 0	155	5775	Without Scanner	19.13	19.5	1.089	100	1.000	0.02	0.382	0.416
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	20mm	Ant 7	DSI 0	155	5775	Without Scanner	19.13	19.5	1.089	100	1.000	0.05	0.300	0.327
	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	24mm	Ant 7	DSI 0	155	5775	Without Scanner	19.13	19.5	1.089	100	1.000	-0.09	0.157	0.171
05	Bluetooth	BT6.0 GFSK 1Mbps	Bottom Face	0mm	Ant 6	DSI 3	76	2478	Without Scanner	7.32	7.5	1.042	100	1.000	0.01	0.337	0.351
	Bluetooth	BT6.0 GFSK 1Mbps	Edge 1	0mm	Ant 7	DSI 3	76	2478	Without Scanner	6.57	7	1.104	100	1.000	0.01	0.038	0.042
06	UHF RFID	BT6.0 GFSK 1Mbps	Bottom Face	0mm	Ant 8	DSI 3		914.75	Without Scanner	19.93	21	1.279	100	1.000	0.03	0.725	0.927

Plot No	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-Up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Measured APD (W/m^2)
	WLAN6GHz	802.11be-EHT320 MCS0	Edge4	0mm	Ant 6	DSI 3	95	6425	With Scanner	13.41	13.5	1.021	100	1	-0.03	0.821	0.838	4.340
07	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	31	6105	With Scanner	11.81	12	1.045	100	1	-0.06	0.837	0.875	4.980
	WLAN6GHz	802.11be-EHT320 MCS0	Edge1	0mm	Ant 7	DSI 3	31	6105	With Scanner	11.81	12	1.045	100	1	-0.03	0.693	0.724	4.330
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	63	6265	With Scanner	11.41	11.5	1.021	100	1	0.01	0.663	0.677	4.140
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	95	6425	With Scanner	11.63	12	1.089	100	1	0.02	0.416	0.453	2.600
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	127	6585	With Scanner	11.52	12	1.117	100	1	-0.05	0.303	0.338	1.890
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	159	6745	With Scanner	11.81	12	1.045	100	1	0.02	0.340	0.355	2.130
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	191	6905	With Scanner	11.59	12	1.099	100	1	-0.03	0.426	0.468	2.660
	WLAN6GHz	802.11be-EHT320 MCS0	Edge4	0mm	Ant 7	DSI 0	159	6745	With Scanner	19.59	20	1.099	100	1	0.01	0.501	0.551	3.430
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	20mm	Ant 7	DSI 0	95	6425	With Scanner	19.58	20	1.102	100	1	-0.05	0.325	0.358	2.030
	WLAN6GHz	802.11be-EHT320 MCS0	Edge1	24mm	Ant 7	DSI 0	95	6425	With Scanner	19.58	20	1.102	100	1	0.02	0.289	0.318	1.810
	WLAN6GHz VLP	802.11ax-EHT160 MCS0	Edge1	0mm	Ant 7	DSI 3	207	6985	With Scanner	11.54	12	1.112	100	1	-0.06	0.428	0.476	2.680



15.2 6GHz PD Test Result

<WLAN PD>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Grid Step (A)	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	802.11be-EHT320 MCS0	Edge 4	2mm	Ant 6	DSI 3	127	6585	12.53	13.00	1.114	100	1.000	0.0625	1.5535	0.02	2.21	3.83	2.58	4.47
	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	2mm	Ant 7	DSI 3	31	6105	11.81	12.00	1.045	100	1.000	0.0625	1.5535	0.06	1.47	2.39	2.02	3.28

15.3 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-Up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Ratio
1st	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 6	DSI 3	11	2462	15.47	15.5	1.007	99.06	1.009	-0.01	1.060	1.077	-
2nd	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 6	DSI 3	11	2462	15.47	15.5	1.007	99.06	1.009	0.04	1.030	1.047	1.03
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 7	DSI 3	42	5210	14.38	14.5	1.028			-0.02	1.150	1.182	-
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 7	DSI 3	42	5210	14.38	14.5	1.028			0.09	1.110	1.141	1.04
1st	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 6	DSI 3	114	5570	9.45	9.5	1.012			0.02	1.000	1.012	-
2nd	WLAN5GHz	802.11ac-VHT160 MCS0	Bottom Face	0mm	Ant 6	DSI 3	114	5570	9.45	9.5	1.012			0.01	0.987	0.999	1.01
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 6	DSI 3	155	5775	10.49	10.5	1.002			0.09	1.100	1.102	-
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 6	DSI 3	155	5775	10.49	10.5	1.002			-0.03	1.050	1.052	1.05
1st	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	31	6105	11.81	12	1.045			-0.06	0.837	0.875	-
2nd	WLAN6GHz	802.11be-EHT320 MCS0	Bottom face	0mm	Ant 7	DSI 3	31	6105	11.81	12	1.045			-0.01	0.823	0.86	1.02

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured* SAR.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

16. Simultaneous Transmission Analysis

No.	Simultaneous Transmission Configurations			Touch Computer
				Body
1.	RFID	+	WLAN2.4GHz + Bluetooth	Yes
2.			WLAN5GHz + Bluetooth	Yes
3.			WLAN6GHz + Bluetooth	Yes
4.			WLAN5.2GHz/5.3GHz + WLAN6GHz	Yes
5.			WLAN2.4GHz + WLAN5GHz	Yes
6.			WLAN2.4GHz + WLAN6GHz	Yes
7.			WLAN5.2GHz/5.3GHz + WLAN5.5GHz/5.8GHz	Yes
8.			WLAN2.4GHz + WLAN5GHz + Bluetooth	Yes
9.			WLAN2.4GHz + WLAN6GHz + Bluetooth	Yes
10.			WLAN5.2GHz/5.3GHz + WLAN6GHz + Bluetooth	Yes
11.			WLAN5.2GHz/5.3GHz + WLAN5.5GHz/5.8GHz + Bluetooth	Yes
12.			WLAN2.4GHz + Bluetooth + NFC	Yes
13.			WLAN5GHz + Bluetooth+ NFC	Yes
14.			WLAN6GHz + Bluetooth+ NFC	Yes
15.			WLAN5.2GHz/5.3GHz + WLAN6GHz+ NFC	Yes
16.			WLAN2.4GHz + WLAN5GHz+ NFC	Yes
17.			WLAN2.4GHz + WLAN6GHz+ NFC	Yes
18.			WLAN5.2GHz/5.3GHz + WLAN5.5GHz/5.8GHz+ NFC	Yes
19.			WLAN2.4GHz + WLAN5GHz + Bluetooth+ NFC	Yes
20.			WLAN2.4GHz + WLAN6GHz + Bluetooth+ NFC	Yes
21.			WLAN5.2GHz/5.3GHz + WLAN6GHz + Bluetooth+ NFC	Yes
22.			WLAN5.2GHz/5.3GHz + WLAN5.5GHz/5.8GHz + Bluetooth + NFC	Yes
23.			NFC	Yes

General Note:

- Simultaneous transmission analysis for all bands and all positions are based on the maximum SAR results selected between the original filing and the spot check verification data. The NFC SAR test results were taken from the original report (Sporton Report No. FA551202-09A) for co-located analysis.
- According to the EUT characteristic, when WLAN 2.4GHz and Bluetooth share the same antenna path and cannot transmit simultaneously; when WLAN2.4GHz Ant 7 and Bluetooth Ant 6 are located on different antennas, they can transmit simultaneously.
- According to the EUT characteristic, WLAN 5GHz and WLAN 6GHz can transmit simultaneously.
- WLAN standalone SAR summed together as WLAN MIMO SAR.
- The Bluetooth can transmit in SISO mode only and they have no MIMO mode.
- According to the EUT characteristic, WLAN 5GHz/WLAN 6GHz and Bluetooth can transmit simultaneously.
- According to the EUT characteristic, WLAN 5GHz/WLAN 6GHz and WLAN 2.4GHz can transmit simultaneously.
- NFC can transmit simultaneously with other Radios in body exposure condition.
- All licensed modes share the same antenna part and cannot transmit simultaneously.
- The reported SAR summation is calculated based on the same configuration and test position.
- When the NFC standalone SAR (except front face) is far below 0.001, it is not necessary to do the co-located SAR summation.
- The equipment under test (EUT) contains the Qualcomm modems supporting WLAN/BT/RFID technologies. These modems are always enabled with Qualcomm Smart Transmit feature to control and manage transmitting power in real time and to ensure the time-averaged RF exposure follows the FCC requirement. Smart Transmit algorithm controls the total RF exposure from all WLAN/BT/RFID to not exceed FCC limit. In addition, each antenna needs to satisfy simultaneous transmission analysis with External radios (NFC) in this report.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
 - $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined

- from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where $(x1, y1, z1)$ and $(x2, y2, z2)$ are the coordinates of the extrapolated peak SAR locations in the zoom scan.
- iii) If $SPLSR \leq 0.04$ for 1g SAR and $SPLSR \leq 0.10$ for 10g SAR, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.
 - v) The SPLSR calculated results please refer to section 16.3.

16.1 Qualcomm Smart Transmit Simultaneous Transmission Guidance

Based on Qualcomm Smart Transmit simultaneous transmission analysis guidance, If all radios are selected to be under Smart Transmit control in EFS version 19 (or higher), then RF exposure from radios are managed by Smart Transmit in the same way. No additional TER analysis is needed.

Smart Transmit current implementation assumes hotspots from all active radios are collocated. Therefore, for a total of 100% exposure margin, if primary radio uses x%, then the exposure margin left for secondary radio(s) is capped to (100-x)%. Thus, the compliance equation for simultaneous active radios, such as follow,

$$x\% * A + (100-x)\% * B \leq 1.0$$

where, A is normalized time-averaged SAR exposure corresponding to “maximum of {minimum [EFS Plimit + device uncertainty; NV setting Pmax + device uncertainty]; EFS Plimit}” from primary radio, and $A \leq 1.0$; B for secondary radio(s) is

(for legacy radio or sub6 NR): normalized time-averaged SAR exposure corresponding to “maximum of {minimum [EFS Plimit + device uncertainty; NV setting Pmax + device uncertainty]; EFS Plimit } ”

and $B \leq 1.0$. As can be seen, A and B by definition is the exposure corresponding to “maximum of {minimum [EFS Plimit + device uncertainty; NV setting Pmax + device uncertainty]; EFS Plimit}”, and it is NOT defined as reported exposure

The total RF exposure in this simultaneous transmission scenario is controlled and managed within Smart Transmit operation, and the compliance is demonstrated in Part 2 test.



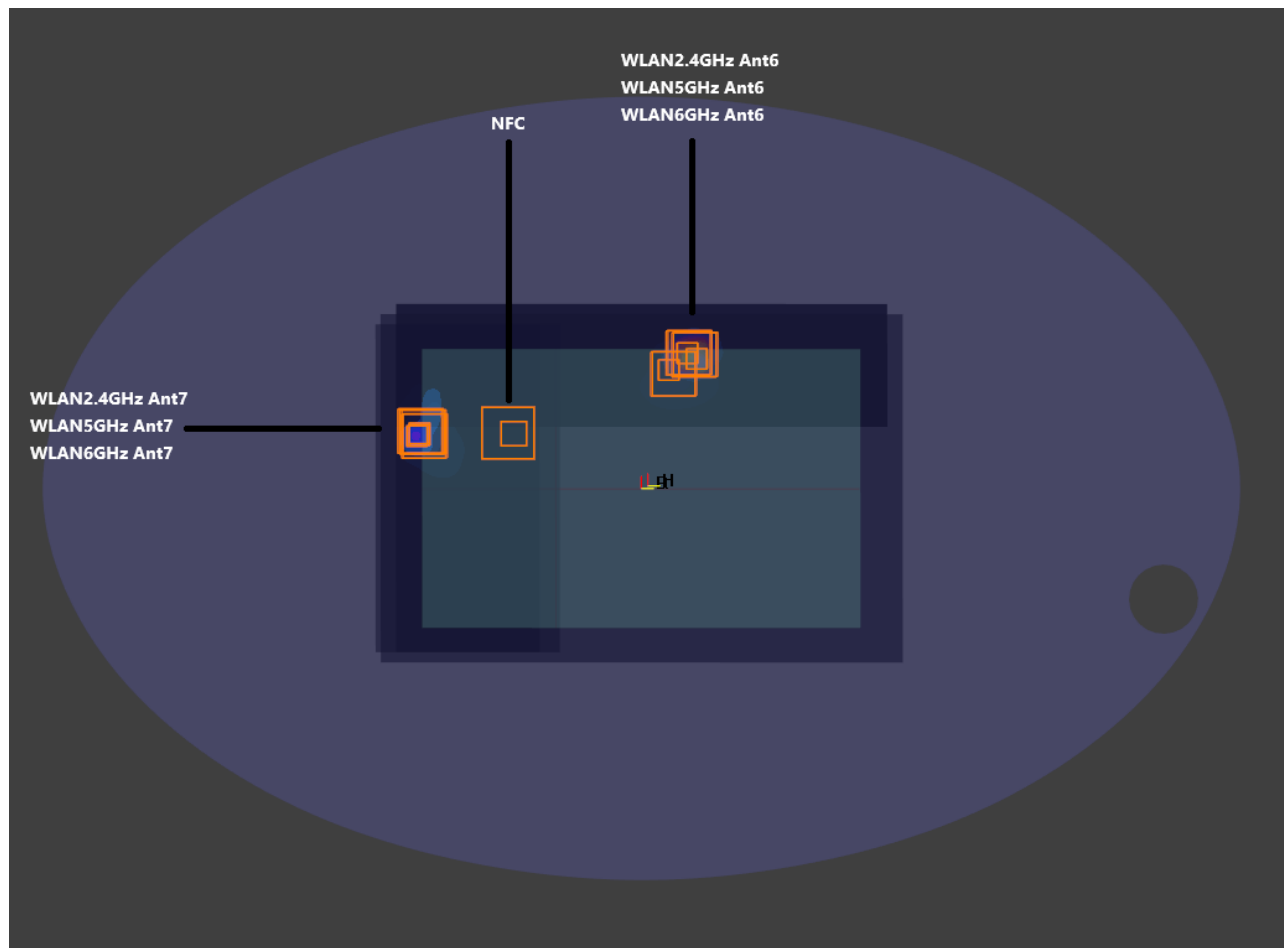
16.2 Body Exposure Conditions

Exposure Position	1	2	3	4	5	6	7	8	9	10	1+2+10 Summed 1g SAR (W/kg)	3+4+10 Summed 1g SAR (W/kg)	5+6+10 Summed 1g SAR (W/kg)	7+10 Summed 1g SAR (W/kg)	8+10 Summed 1g SAR (W/kg)	9+10 Summed 1g SAR (W/kg)	No
	2.4GHz WLAN Ant 6	2.4GHz WLAN Ant 7	5GHz WLAN Ant 6	5GHz WLAN Ant 7	6GHz WLAN Ant 6	6GHz WLAN Ant 7	Bluetooth Ant 6	Bluetooth Ant 7	RFID	NFC							
Bottom face at 0mm	1.077	1.106	1.118	1.125	0.928	0.875	0.337	0.1	1.068		2.18	2.24	1.80	0.34	0.10	1.07	Case 1&2&3
Edge1 at 0mm	0.001	0.614	0.099	1.182		0.724		0.042	0.284		0.62	1.28	0.72	0.00	0.04	0.28	
Edge2 at 0mm	0.001		0.001						0.044		0.00	0.00	0.00	0.00	0.00	0.04	
Edge3 at 0mm	0.326		0.135						0.034		0.33	0.14	0.00	0.00	0.00	0.03	
Edge4 at 0mm	0.165	0.475	0.91	0.416	1.001	0.551	0.001		0.302		0.64	1.33	1.55	0.00	0.00	0.30	
Bottom face at 28mm	0.257		0.084		0.087				0.365		0.26	0.08	0.09	0.00	0.00	0.37	
Bottom face at 20mm		0.332		0.55		0.358			0.365		0.33	0.55	0.36	0.00	0.00	0.37	
Edge1 at 24mm		0.441		0.518		0.318			0.559		0.44	0.52	0.32	0.00	0.00	0.56	
Edge4 at 30mm	0.304		0.496		0.199				0.105		0.30	0.50	0.20	0.00	0.00	0.11	

16.3 SPLSR Evaluation and Analysis

General Note:

1. When standalone SAR is measured for both antennas in the pair, the peak location separation distance is computed by the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates in the area scans or extrapolated peak SAR locations in the zoom scans, as appropriate.
2. $SPLSR = (SAR_1 + SAR_2)1.5 / (\text{min. separation distance, mm})$. If $SPLSR \leq 0.04$ for 1g SAR, simultaneously transmission SAR measurement is not necessary.



WLAN+NFC Bottom Face 0mm

Case 1	Band	Position	SAR (W/kg)	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(mm)	X	Y	Z				
	WLAN2.4GHz Ant 6	Bottom Face	1.077	0	-58.5	12.5	-177	127.1	2.18	0.03	Not required
	WLAN2.4GHz Ant 7		1.106	0	-26.5	-110.5	-177				
	WLAN2.4GHz Ant 7	Bottom Face	1.106	0	-26.5	-110.5	-177	40.3	1.11	0.03	Not required
	NFC		0	0	-23.1	-70.3	-177				
	WLAN2.4GHz Ant 6	Bottom Face	1.077	0	-58.5	12.5	-177	90.0	1.08	0.01	Not required
NFC	0		0	-23.1	-70.3	-177					
Case 2	Band	Position	SAR (W/kg)	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(mm)	X	Y	Z				
	WLAN5GHz Ant 6	Bottom Face	1.118	0	-63.8	23.2	-177	136.7	2.24	0.02	Not required
	WLAN5GHz Ant 7		1.125	0	-26.4	-108.3	-177				
	WLAN5GHz Ant 7	Bottom Face	1.125	0	-26.4	-108.3	-177	38.1	1.13	0.03	Not required
NFC	0		0	-23.1	-70.3	-177					



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	WLAN5GHz Ant 6	Bottom Face	1.118	0	-63.8	23.2	-177	102.0	1.12	0.01	Not required
	NFC		0	0	-23.1	-70.3	-177				
Case 3	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	WLAN6GHz Ant 6	Bottom Face	0.928	0	-62.6	26.7	-177	141.1	1.80	0.02	Not required
	WLAN6GHz Ant 7		0.875	0	-25.4	-109.4	-177				
	WLAN6GHz Ant 7	Bottom Face	0.875	0	-25.4	-109.4	-177	39.2	0.88	0.02	Not required
	NFC		0	0	-23.1	-70.3	-177				
	WLAN6GHz Ant 6	Bottom Face	0.928	0	-62.6	26.7	-177	104.7	0.93	0.01	Not required
	NFC		0	0	-23.1	-70.3	-177				

Test Engineer : Martin Li, Varus Wang, Light Wang

17. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, 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 $\leq 30\%$, for a confidence interval of $k = 2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 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.

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 ^(a)	$1/k^{(b)}$	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(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.

Uncertainty Budget According to IEC/IEEE 62209-1528 (Frequency band: 4 MHz - 10 GHz range)							
Error Description	Uncert. Value (±%)	Prob. Dist.	Div.	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System errors							
Probe calibration	18.6	N	2	1	1	9.3	9.3
Probe calibration drift	1.7	R	1.732	1	1	1.0	1.0
Probe linearity and detection Limit	4.7	R	1.732	1	1	2.7	2.7
Broadband signal	2.8	R	1.732	1	1	1.6	1.6
Probe isotropy	7.6	R	1.732	1	1	4.4	4.4
Other probe and data acquisition errors	2.4	N	1	1	1	2.4	2.4
RF ambient and noise	1.8	N	1	1	1	1.8	1.8
Probe positioning errors	0.006	N	1	0.5	0.5	0.0	0.0
Data processing errors	4.0	N	1	1	1	4.0	4.0
Phantom and Device Errors							
Measurement of phantom conductivity (σ)	2.5	N	1	0.78	0.71	2.0	1.8
Temperature effects (medium)	5.4	R	1.732	0.78	0.71	2.4	2.2
Shell permittivity	14.0	R	1.732	0.5	0.5	4.0	4.0
Distance between the radiating element of the DUT and the phantom medium	2.0	N	1	2	2	4.0	4.0
Repeatability of positioning the DUT or source against the phantom	1.0	N	1	1	1	1.0	1.0
Device holder effects	3.6	N	1	1	1	3.6	3.6
Effect of operating mode on probe sensitivity	2.4	R	1.732	1	1	1.4	1.4
Time-average SAR	1.7	R	1.732	1	1	1.0	1.0
Variation in SAR due to drift in output of DUT	2.5	N	1	1	1	2.5	2.5
Validation antenna uncertainty (validation measurement only)	0.0	N	1	1	1	0.0	0.0
Uncertainty in accepted power (validation measurement only)	0.0	N	1	1	1	0.0	0.0
Correction to the SAR results							
Phantom deviation from target (ϵ' , σ)	1.9	N	1	1	0.84	1.9	1.6
SAR scaling	0.0	R	1.732	1	1	0.0	0.0
Combined Std. Uncertainty						14.5%	14.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						29.0%	28.8%

SAR Uncertainty Budget for frequency range 4MHz to 10GHz

cDASY6 Module mmWave Uncertainty Budget Evaluation Distances to the Antennas > $\lambda/2\pi$ In Compliance with IEC TR 63170					
Error Description	Uncertainty Value (±dB)	Probability	Divisor	(Ci)	Standard Uncertainty (±dB)
Uncertainty terms dependent on the measurement system					
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
Uncertainty terms dependent on the DUT and environmental factors					
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	
Combined Std. Uncertainty					1.34
Expanded STD Uncertainty (95%)					2.68

PD Uncertainty Budget

18. References

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- [10] IEC/IEEE 62209-1528:2020, "Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)", Oct. 2020
- [11] 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)
- [12] 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
- [13] SPEAG DASY6 System Handbook
- [14] SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz)

Appendixes

Please refer to separated files for the following appendixes

Appendix A. Plots of System Performance Check

Appendix B. Plots of High SAR Measurement

Appendix C. DASY Calibration Certificate

Appendix D. Test Setup Photos

Appendix E. Product Equality Declaration

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