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Report On

Specific Absorption Rate Testing of the Apple Inc, A2337.

Covering FCC 47CFR 2.1093, RSS 102 Issue 5
and related documents.

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COMMERCIAL-IN-CONFIDENCE

Document 75949395 Report 17 Issue 1 **October 2020**

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COMMERCIAL-IN-CONFIDENCE

REPORT ON

Specific Absorption Rate Testing of the Apple Inc, A2337

Document 75949395 Report 17 Issue 1

October 2020

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23 October 2020

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SECTION 1

REPORT SUMMARY

Specific Absorption Rate Testing of the
A2337

1.1 REPORT MODIFICATION HISTORY

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
01	First Issue	23 October 2020

1.2 INTRODUCTION

The information contained in this report is intended to show verification of the Specific Absorption Rate testing of the A2337 to the requirements of KDB 447498 D01 v06 General RF Exposure Guidance.

Objective	To perform Specific Absorption Rate Testing to determine the Equipment Under Test's (EUT's) compliance with the requirements specified of KDB 447498 D01 v06 General RF Exposure Guidance, for the series of tests carried out.
Applicant	Apple Inc
Manufacturer	Apple Inc
Manufacturing Description	Laptop Computer
Model Number	A2337
Serial Numbers	C02D200SQ9MQ (Radiated Sample) C02D200WQ9MQ (Conducted Sample)
Number of Samples Tested	2
Hardware Version	Rev 1.0
Software Version	20A523220f
Battery Cell Manufacturer	Not Supplied
Battery Model Number	Not Supplied
Test Specification/Issue/Date	KDB 447498 D01 v06 General RF Exposure Guidance
Order Number	0540196335
Date of Receipt of EUT	27/07/2020
Start of Test	03/09/2020
Finish of Test	14/09/2020
Related Documents	FCC 47CFR 2.1093: 2019 KDB 865664 – D01 v01r04 KDB 865664 – D02 v01r02 KDB 248227 – D01 v02r02 IEEE 1528-2013
Name of Engineers	Mohamud Mohamud Stephen Dodd

1.3 BRIEF SUMMARY OF RESULTS

The measurements shown in this report were made in accordance with the procedures specified KDB 447498 D01 v06 General RF Exposure Guidance.

The maximum 1g volume averaged stand-alone SAR found during this Assessment:

Max 1g SAR (W/kg) Body	0.86 W/kg (Measured)	0.96 W/kg (Scaled)
The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure Partial Body of 1.6 W/kg.		

The maximum 1g volume averaged stand-alone Reported SAR found during this Assessment for each supported mode:

RAT	Band	Test Configuration	Max Reported SAR (W/kg)	Highest Simultaneous Transmission SAR (W/kg)
802.11ac VHT80	U-NII 2C	Bottom - 0mm	0.96	1.16
Bluetooth EDR	2.4GHz	Bottom - 0mm	0.20	
The maximum 1g volume averaged SAR level measured for all the tests performed (including simultaneous transmission analysis results) did not exceed the limits for General Population/Uncontrolled Exposure Partial Body of 1.6 W/kg.				

1.4 TEST RESULTS SUMMARY

1.4.1 System Performance / Validation Check Results

Prior to formal testing being performed a System Check was performed in accordance with KDB 865664 and the results were compared against published data in Standard IEEE 1528-2013. The following results were obtained: -

System performance / Validation results

Date	Frequency (MHz)	Fluid Tye	Measured Max 1g SAR (W/kg) *	Max 1g SAR (W/kg) Target	Percentage Drift on Reference
07/09/2020	2450	MBBL	48.09	51.20	-6.08
03/09/2020	5300	MBBL	79.61	74.20	6.80
04/09/2020	5300	MBBL	77.82	74.20	4.65
14/09/2020	5300	MBBL	76.02	74.20	2.39
04/09/2020	5600	MBBL	80.81	76.10	6.19
11/09/2020	5600	MBBL	79.81	76.10	4.88
04/09/2020	5800	MBBL	76.62	74.10	3.40
11/09/2020	5800	MBBL	76.22	74.10	2.86

*Normalised to a forward power of 1W

1.4.2 Results Summary Tables

Bluetooth - 2450 MHz - EDR - Antenna (BT Core 0) :
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm - Bottom	78	2480	15.70	16.50	0.17	0.20	3
0mm - Rear of Display	78	2480	15.70	16..50	0.02	0.03	4
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

Bluetooth - 2450 MHz - EDR - Antenna (BT Core 1):
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm - Bottom	78	2480	15.70	16.50	0.16	0.18	5
0mm - Rear of Display	78	2480	15.70	16.50	0.03	0.03	6
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - 2450 MHz - 802.11b - 20 MHz - 1 Mbps - SISO Antenna (2.4GHz Core 0):
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	6	2437	20.15	20.50	0.65	0.70	7
0mm Rear of Display	6	2437	20.15	20.50	0.10	0.11	8
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - 2450 MHz - 802.11b - 20 MHz - 1 Mbps - SISO Antenna (2.4GHz Core 1)
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm - Bottom	9	2452	20.09	20.50	0.54	0.59	9
0mm - Rear of Display	9	2452	20.09	20.50	0.09	0.09	10
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - 2450 MHz - 802.11n - HT20– 2x2 MIMO - Antenna (2.4GHz Core 0 and Core 1):
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Antenna	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	(2.4GHz Core 0)	6	2437	19.50	20.50	0.62	0.71	11
0mm Bottom	(2.4GHz Core 1)	6	2437	19.40	20.50	0.60	0.68	
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2 KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz Worst case position which was found in 2.4Ghz SISO testing was used.								

WLAN - U-NII-2A - 802.11ac - HT40 - MCS0 - SISO Antenna (5GHz Core 0)
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	54	5270	14.75	15.25	0.75	0.84	12
0mm Rear of Display	54	5270	14.75	15.25	0.15	0.17	13
0mm Bottom	62	5310	14.27	14.75	0.74	0.82	14
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - U-NII-2A - 802.11ac - HT40 - MCS0 - SISO Antenna (5GHz Core 1)
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	54	5270	14.80	15.25	0.61	0.68	15
0mm Rear of Display	54	5270	14.80	15.25	0.17	0.19	16
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - U-NII-2A - 802.11ac - 40 MHz - MCS0 - 2x2 MIMO – Antenna (5GHz Core 0 and Core 1): Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Antenna	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	(5GHz Core 0)	54	5270	14.81	15.25	0.80	0.88	17
0mm Bottom	(5GHz Core 1)	54	5270	14.75	15.25	0.56	0.62	
0mm Bottom	(5GHz Core 0)	62	5310	10.65	11.25	0.36	0.41	18
0mm Bottom	(5GHz Core 1)	62	5310	10.76	11.25	0.25	0.28	
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz Worst case position which was found in U-NII-2A SISO testing was used.								

WLAN - U-NII-2C - 802.11ac - 80 MHz - MCS0 - SISO Antenna (5GHz Core 0):
Specific Absorption Rate(Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	138	5690	14.10	14.50	0.61	0.67	19
0mm Rear of Display	138	5690	14.10	14.50	0.14	0.15	20
0mm Bottom	122	5610	14.00	14.50	0.67	0.75	21
0mm Bottom	106	5530	12.95	13.25	0.54	0.58	22
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - U-NII-2C - 802.11ac - 80 MHz - MCS0 - SISO Antenna (5GHz Core 1):
Specific Absorption Rate(Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	138	5690	14.10	14.50	0.72	0.79	23
0mm Rear of Display	138	5690	14.10	14.50	0.15	0.17	24
0mm Bottom	122	5610	14.00	14.50	0.86	**0.96**	25
0mm Bottom	106	5530	12.95	13.25	0.60	0.67	26
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - U-NII-2C - 802.11ac - 80 MHz - MCS0 - 2x2 MIMO - (5GHz Core 0 and Core 1):
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Antenna	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	(5GHz Core 0)	138	5690	14.05	14.50	0.69	0.76	27
0mm Bottom	(5GHz Core 1)	138	5690	14.15	14.50	0.68	0.74	
0mm Bottom	(5GHz Core 0)	122	5610	14.00	14.50	0.72	0.81	28
0mm Bottom	(5GHz Core 1)	122	5610	14.05	14.50	0.80	0.89	
0mm Bottom	(5GHz Core 0)	106	5530	11.60	12.00	0.32	0.35	29
0mm Bottom	(5GHz Core 1)	106	5530	11.35	12.00	0.34	0.40	

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
≤ 0.8W/kg when the transmission band is ≤ 100MHz
≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
≤ 0.4W/kg when the transmission band is ≥ 200MHz
Worst case position which was found in U-NII-C2 SISO testing was used.

WLAN - U-NII-3 - 802.11ac - 80 MHz - MCS0 - SISO Antenna (5GHz Core 0):
Specific Absorption Rate(Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	155	5775.00	14.00	14.50	0.54	0.61	30
0mm Rear of Display	155	5775.00	14.00	14.50	0.13	0.15	31

Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g)
KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is:
≤ 0.8W/kg when the transmission band is ≤ 100MHz
≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz
≤ 0.4W/kg when the transmission band is ≥ 200MHz

WLAN - U-NII-3 - 802.11ac - 80 MHz - MCS0 - SISO Antenna (5GHz Core 1):
Specific Absorption Rate(Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	155	5775.00	14.00	14.50	0.59	0.66	32
0mm Rear of Display	155	5775.00	14.00	14.50	0.14	0.15	33
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz							

WLAN - U-NII-3 - 802.11ac - 80 MHz - MCS0 - 2x2 MIMO - Antenna (5GHz Core 0 and Core 1):
Specific Absorption Rate (Maximum SAR) 1g Results

Test Position	Antenna	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Bottom	(5GHz Core 0)	155	5775	14.10	14.50	0.64	0.71	34
0mm Bottom	(5GHz Core 1)	155	5775	13.98	14.50	0.67	0.76	
Limit for General Population (Uncontrolled Exposure) 1.6 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz Worst case position which was found in U-NII-3 SISO testing was used.								

1.4.3 Simultaneous Transmission

Position	WLAN- 1 g SAR (W/kg)	Bluetooth 1 g SAR (W/kg)	Sum of 1 g SAR (W/Kg)	Peak Location Separation Ratio required?	Peak Location Separation Ratio
Bottom	0.96	0.20	1.16	No	N/A

KDB 447498 D01 - Section 4.3.2: Simultaneous test exclusion is applicable as the sum of 1-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit.

The highest overall WLAN and Bluetooth results were used for a conservative estimate.

1.4.4 Measurement Variability (KDB 865664 D01)

Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds. The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance.

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

Repeated measurements were required for the U-NII-2A and U-NII-2C frequency bands,
All results for 2.4GHz, U-NII-1 and U-NII-3 Bands were all lower than 0.8W/kg.

U-NII-2A : MIMO Measurement variabilty results.

Test Position	Antenna	Channel Number	Frequency (MHz)	Scaled 1g SAR (W/kg)	Test	Ratio
0mm Bottom	(5GHz Core 0)	54	5270	0.883	Initial	1.01
0mm Bottom	(5GHz Core 0)	54	5270	0.876	Repeated	

Test Position	Antenna	Channel Number	Frequency (MHz)	Scaled 1g SAR (W/kg)	Test	Ratio
0mm Bottom	(5GHz Core 1)	54	5270	0.623	Initial	1.01
0mm Bottom	(5GHz Core 1)	54	5270	0.627	Repeated	

U-NII-2C : SISO (5GHz Core 1) Measurement variabilty results.

Test Position	Antenna	Channel Number	Frequency (MHz)	Scaled 1g SAR (W/kg)	Test	Ratio
0mm Bottom	(5GHz Core 1)	138	5690	0.94	Initial	1.06
0mm Bottom	(5GHz Core 1)	138	5690	0.88	Repeated	

1.4.5 Standalone SAR Test Exclusion Considerations. (KDB 447498 D01)

The 1g SAR Test exclusion thresholds for 100 MHz to 6 GHz *test separation distances* ≤ 50 mm are determined by:

[(*max power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] [√f (GHz)]* ≤ 3.0, where

- f (GHz) is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the maximum test separation distance is < 5 mm, a distance of 5 mm is applied.

RAT & Band	Frequency (MHz)	Power (dBm)	Power (mW)	Test Position	Distance (mm)	Threshold	Test Exclusion
WLAN – 2450MHz	2437	20.50	112	Body	5	35.0	No
WLAN – 2450MHz	2452	20.50	112	Body	5	35.1	No
Bluetooth - 2450 MHz	2480	16.50	40	Body	5	14.2	No
WLAN – U-NII-2A	5270	15.25	33	Body	5	15.2	No
WLAN – U-NII-2A	5310	14.75	30	Body	5	13.8	No
WLAN – U-NII-2C	5530	13.25	21	Body	5	9.9	No
WLAN – U-NII-2A	5610	14.50	28	Body	5	13.3	No
WLAN – U-NII-2C	5690	14.50	28	Body	5	13.4	No
WLAN – U-NII-3	5755	14.50	28	Body	5	13.4	No

1.4.6 Technical Description

The equipment under test (EUT) was an Apple Inc, A2337 Laptop Computer. A full technical description can be found in the manufacturer's documentation.

1.4.7 Test Configuration and Modes of Operation

The testing was performed with an integral battery supplied by Apple Inc. The batteries were fully charged before each measurement and there were no external connections.

Supported technologies are Bluetooth (BDR/EDR//HDR/LE), 2.4 GHz WLAN (802.11b/g/n/ax) and 5 GHz WLAN (802.11a/n/ac/ax). 2x2 MIMO is supported for WLAN.

Transmit Beamforming is supported for Bluetooth, however this is at 2.5 dBm low power than the highest declared power SISO transmission mode (EDR), the antennas are spatially separated and were assessed in SISO modes only.

WLAN and Bluetooth testing were achieved using the devices internal software, scripts and settings supplied by the customer. For each scan, the device was configured into a continuous transmission test mode at maximum power. Testing was performed in each position at the frequency that gave the highest output power for each band. Some SAR levels were found to be higher than the thresholds set in KDB 447498 D01 therefore additional testing was required at the relevant frequencies / channels of the bands.

Conducted power measurements were performed on a modified device (accessible conducted ports) and the measured SAR results were power scaled to the maximum declared tune-up level.

For each antenna, the bottom surface and the rear of the EUT display were assessed for SAR. MIMO testing was carried out on the bottom surface of the EUT only. (Worst case position of SISO results)

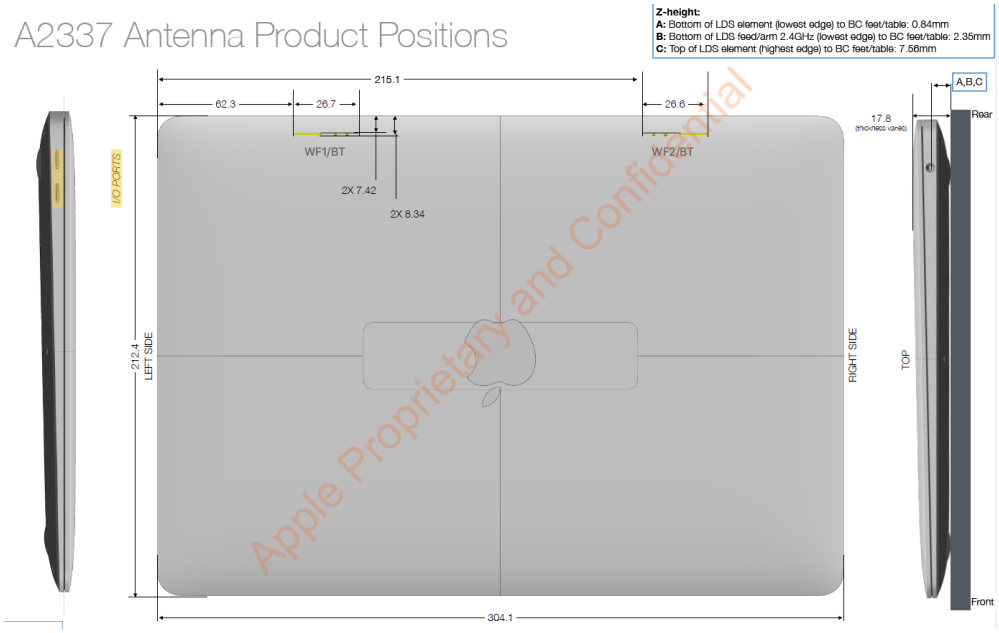

Figure 1 Antenna Location Diagram

2450 MHz 802.11g/n/ax OFDM configurations met the test exclusion requirements of KDB 248227 D01 section 5.2.2 as the highest reported SAR for DSSS was adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR was ≤ 1.2 W/kg.

For the 5GHz frequency bands the transmission mode used for testing was determined by the 802.11 configuration with the highest declared output power in each frequency band. Where multiple 802.11 configurations have the same specified output power, testing was performed using the mode with the largest channel bandwidth with the lowest order modulation and lowest data rate.

The U-NII-1 Band was not tested as this met the test exclusion requirements of KDB 248227 D01 section 5.3.1.

For SAR assessment, the relevant surfaces of the device were placed against an Elliptical phantom with a 0mm separation distance.

The Elliptical Flat Phantom dimensions are 600mm major axis and 400mm minor axis with a shell thickness of 2mm. The phantom was filled to a minimum depth of 150mm with the appropriate body simulant liquid. The dielectric properties were measured and found to be in accordance with the requirements specified in KDB 865665.

Included in this report are descriptions of the test method; the equipment used and an analysis of the test uncertainties applicable and diagrams indicating the locations of maximum SAR for each test position along with photographs indicating the positioning of the EUT against the elliptical phantom as appropriate.

1.4.8 Deviations from Standard

Initially, area scans were completed covering the whole of the bottom surface of the EUT to determine that there were no other RF radiators (unintentional) other than the antennas. The actual SAR measurements were completed using smaller area scans covering the antenna locations only.

1.5 POWER TABLES (TUNE UP VALUES)

Note: Power levels highlighted in green apply to ISED only and values highlighted in blue apply to FCC only. All other values are same between FCC & ISED.

All levels in dBm

Bluetooth

BT Core	PA	Channel	BDR (dBm)	EDR (dBm)	LE Data (dBm)	LE ADV (dBm)	HDR4 (dBm)	HDR8 (dBm)
0	iPA	All	12.5	10	12.5	12.5	6	5
0	ePA		12.5	16.5	12.5	12.5	13	13
1	iPA		12.5	10	12.5	12.5	6	5
1	ePA		12.5	16.5	12.5	12.5	13	13

Bluetooth - TXBF

BT Core	PA	Channel	BDR (dBm)	EDR (dBm)	LE Data (dBm)	LE ADV (dBm)	HDR4 (dBm)	HDR8 (dBm)
0	iPA	All	12.5	10	12.5	11	6	4.5
0	ePA		12.5	14	12.5	11	13	13
1	iPA		12.5	10	12.5	11	6	4.5
1	ePA		12.5	14	12.5	11	13	13

WLAN

2.4GHz - SISO

Channel	Center Frequency (MHz)	b (SISO)	g (SISO)	11n/11ac HT20 (SISO)	11ax HE20 (SISO)	11ax HE20 RU106 (SISO)	11ax HE20 RU52 (SISO)	11ax HE20 RU26 (SISO)
1	2412	20	15	15	13.5	13.5	13.5	13.5
2	2417	20.5	18.5	18.5	17	17	17	14
3	2422	20.5	19.25	19.25	17.75	17.75	17	14
4	2427	20.5	20.5	20.5	19	19	17	14
5	2432	20.5	20.5	20.5	19.5	19.5	17	14
6	2437	20.5	20.5	20.5	20.5	20	17	14
7	2442	20.5	20.5	20.5	19.5	19.5	17	14
8	2447	20.5	20	20	18.5	18.5	17	14
9	2452	20.5	18.25	18.25	16.75	16.75	16.75	14
10	2457	20	17.5	17.5	16	16	16	14
11	2462	19	13.5	13.5	12	12	12	12
12	2467	16	11.5	11.5	10	10	10	10
13	2472	13	2	2	0.5	0.5	0.5	0.5

2.4GHz - MIMO

Channel	Center Frequency (MHz)	11n/11ac HT20 (2Tx, nonTXBF)	11ax HE20 (2Tx, nonTXBF)	11ax HE20 RU106 (2Tx, nonTXBF)	11ax HE20 RU52 (2Tx, nonTXBF)	11ax HE20 RU26 (2Tx, nonTXBF)
1	2412	14	12.5	16.5	16.5	14
2	2417	17.5	16	17.5	17	14
3	2422	18.5	17	19.5	17	14
4	2427	19.5	18	20	17	14
5	2432	20	18.5	20	17	14
6	2437	20.5	19.5	20	17	14
7	2442	19.75	18.25	20	17	14
8	2447	18.5	17	20	17	14
9	2452	17.5	16	18.75	17	14
10	2457	16	14.5	18	17	14
11	2462	12	10.5	17.25	17	14
12	2467	9.5	8	14.25	15	14
13	2472	-0.5	-2	0	0	0

5GHz - 20MHz BW - SISO

Channel	Center Frequency (MHz)	a (SISO)	11n/11ac HT20 (SISO)	11ax HE20 (SISO)	11ax HE20 RU106 (SISO)	11ax HE20 RU52 (SISO)	11ax HE20 RU26 (SISO)
36	5180	15	15	15	13	14.75	7
40	5200	15	15	15	15	15	12
44	5220	15	15	15	15	15	12
48	5240	15	15	15	15	15	12
36	5180	14.25	14.25	14.25	12.25	9.25	6.25
40	5200	14.25	14.25	14.25	12.25	9.25	6.25
44	5220	14.25	14.25	14.25	12.25	9.25	6.25
48	5240	14.25	14.25	14.25	12.25	9.25	6.25
52	5260	15.25	15.25	15.25	15.25	15	NS
56	5280	15.25	15.25	15.25	15.25	15	NS
60	5300	15.25	15.25	15.25	15.25	15	NS
64	5320	15.25	15.25	15	13	10	NS
100	5500	14.5	14.5	14.5	14.5	14.5	NS
104	5520	14.5	14.5	14.5	14.5	14.5	NS
108	5540	14.5	14.5	14.5	14.5	14.5	NS
112	5560	14.5	14.5	14.5	14.5	14.5	NS
116	5580	14.5	14.5	14.5	14.5	14.5	NS
120	5600	14.5	14.5	14.5	14.5	14.5	NS
124	5620	14.5	14.5	14.5	14.5	14.5	NS
128	5640	14.5	14.5	14.5	14.5	14.5	NS
132	5660	14.5	14.5	14.5	14.5	14.5	NS
136	5680	14.5	14.5	14.5	14.5	14.5	NS
140	5700	14.5	13	13	14.5	14.5	NS
144	5720	14.5	14.5	14.5	14.5	14.5	NS
149	5745	14.5	14.5	14.5	14.5	14.5	12
153	5765	14.5	14.5	14.5	14.5	14.5	12
157	5785	14.5	14.5	14.5	14.5	14.5	12
161	5805	14.5	14.5	14.5	14.5	14.5	12
165	5825	14.5	14.5	14.5	14.5	14.5	12

5GHz - 20MHz BW - MIMO

Channel	Center Frequency (MHz)	11n/11ac HT20 (2Tx, CDD, nonTX BF)	11ax HE20 (2Tx, CDD, nonTX BF)	11ax HE20 RU106 (2Tx, CDD, nonTX BF)	11ax HE20 RU52 (2Tx, CDD, nonTX BF)	11ax HE20 RU26 (2Tx, CDD, nonTX BF)	11n/11ac HT20 (2Tx, SDM, nonTX BF)	11ax HE20 (2Tx, SDM, nonTX BF)	11ax HE20 RU106 (2Tx, SDM, nonTX BF)	11ax HE20 RU52 (2Tx, SDM, nonTX BF)	11ax HE20 RU26 (2Tx, SDM, nonTX BF)	11n/11ac HT20 (2Tx, TxBF)
36	5180	15	12.75	11	9.75	8	15	12.75	11	9.75	8	13
40	5200	15	15	14	11	8	15	15	15	12	9	15
44	5220	15	15	14	11	8	15	15	15	12	9	15
48	5240	15	15	14	11	8	15	15	15	12	9	15
36	5180	9	9	7	4	1	12	12	10	7	4	9
40	5200	9	9	7	4	1	12	12	10	7	4	9
44	5220	9	9	7	4	1	12	12	10	7	4	9
48	5240	9	9	7	4	1	12	12	10	7	4	9
52	5260	15.25	15.25	15	12	NS	15.25	15.25	15	12	NS	15.25
56	5280	15.25	15.25	15	12	NS	15.25	15.25	15	12	NS	15.25
60	5300	15.25	15.25	15	12	NS	15.25	15.25	15	12	NS	15.25
64	5320	15	12.75	12.5	11.25	NS	15	12.75	12.5	11.25	NS	13
100	5500	14.5	12.75	14.5	12	NS	14.5	12.75	14.5	12	NS	13
104	5520	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
108	5540	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
112	5560	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
116	5580	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
120	5600	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
124	5620	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
128	5640	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
132	5660	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
136	5680	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
140	5700	13.75	12.5	13.5	11.5	NS	13	12.5	13.5	12	NS	12.75
144	5720	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
149	5745	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5
153	5765	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5
157	5785	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5
161	5805	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5
165	5825	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5

5GHz - 40MHz BW - SISO

Channel	Center Frequency (MHz)	11n/11ac HT40 (SISO)	11ax HE40 (SISO)	11ax HE40 RU106 (SISO)	11ax HE40 RU52 (SISO)	11ax HE40 RU26 (SISO)
38	5190	15	13.75	13.75	13.75	7
46	5230	15	15	15	15	12
38	5190	15	13.75	12.25	9.25	6.25
46	5230	15	15	12.25	9.25	6.25
54	5270	15.25	15.25	15.25	15	NS
62	5310	14.75	13.5	14.25	14.25	NS
102	5510	14.5	14.25	14.5	13.75	NS
110	5550	14.5	14.5	14.5	14.5	NS
118	5590	14.5	14.5	14.5	14.5	NS
126	5630	14.5	14.5	14.5	14.5	NS
134	5670	14.5	14.5	14.5	14.5	NS
142	5710	14.5	14.5	14.5	14.5	NS
151	5755	14.5	14.5	14.5	14.5	12
159	5795	14.5	14.5	14.5	14.5	12

5GHz - 40MHz BW - MIMO

Channel	Center Frequency (MHz)	11n/11ac HT40 (2Tx, CDD, nonTXBF)	11ax HE40 (2Tx, CDD, nonTXBF)	11ax HE40 RU106 (2Tx, CDD, nonTXBF)	11ax HE40 RU52 (2Tx, CDD, nonTXBF)	11ax HE40 RU26 (2Tx, CDD, nonTXBF)	11n/11ac HT40 (2Tx, SDM, nonTXBF)	11ax HE40 (2Tx, SDM, nonTXBF)	11ax HE40 RU106 (2Tx, SDM, nonTXBF)	11ax HE40 RU52 (2Tx, SDM, nonTXBF)	11ax HE40 RU26 (2Tx, SDM, nonTXBF)	11n/11ac HT40 (2Tx, TxBF)
38	5190	12.5	10	12	11	8	12.5	10	12	12	9	10.5
46	5230	15	15	14	11	8	15	15	15	12	9	15
38	5190	11.5	10	7	4	1	12.5	10	10	7	4	10.5
46	5230	11.5	11.5	7	4	1	14.5	14.5	10	7	4	11.5
54	5270	15.25	15.25	15	12	NS	15.25	15.25	15	12	NS	15.25
62	5310	11.25	9.75	12.75	11.5	NS	11.25	9.75	12.75	11.5	NS	9.25
102	5510	13.5	10.75	13.5	12	NS	13.5	10.75	13.5	12	NS	11.5
110	5550	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
118	5590	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
126	5630	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
134	5670	14.5	14.25	14.5	12	NS	14.5	14.25	14.5	12	NS	13.5
142	5710	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
151	5755	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5
159	5795	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5

5GHz - 80MHz BW - SISO

Channel	Center Frequency (MHz)	11ac VHT80 (SISO)	11ax HE80 (SISO)	11ax HE80 RU106 (SISO)	11ax HE80 RU52 (SISO)	11ax HE80 RU26 (SISO)
42	5210	13.75	13.5	12	12	11
42	5210	13.75	13.5	12	9.25	6.25
58	5290	13.5	13.25	13.75	8	NS
106	5530	13.25	14.25	14	11	NS
122	5610	14.5	14.5	14.5	14.5	NS
138	5690	14.5	14.5	14.5	14.5	NS
155	5775	14.5	14.5	14.5	14.5	12

5GHz - 80MHz BW - MIMO

Channel	Center Frequency (MHz)	11ac VHT80 (2Tx, CDD, nonTX BF)	11ax HE80 (2Tx, CDD, nonTX BF)	11ax HE80 RU106 (2Tx, CDD, nonTX BF)	11ax HE80 RU52 (2Tx, CDD, nonTX BF)	11ax HE80 RU26 (2Tx, CDD, nonTX BF)	11ac VHT80 (2Tx, SDM, nonTX BF)	11ax HE80 (2Tx, SDM, nonTX BF)	11ax HE80 RU106 (2Tx, SDM, nonTX BF)	11ax HE80 RU52 (2Tx, SDM, nonTX BF)	11ax HE80 RU26 (2Tx, SDM, nonTX BF)	11ac VHT80 (2Tx, TxBF)
42	5210	10	8.5	9	9	8	10	8.5	11.5	10	8.25	8
42	5210	10	8.5	7	4	1	10	8.5	10	7	4	8
58	5290	9.25	7.75	10.5	5	NS	9.25	7.75	10.5	5	NS	7.25
106	5530	12	10.5	12.75	8	NS	12	10.5	12.75	8	NS	10
122	5610	14.5	14.5	14	11.25	NS	14.5	14.5	14	11.25	NS	14.5
138	5690	14.5	14.5	14.5	12	NS	14.5	14.5	14.5	12	NS	14.5
155	5775	14.5	14.5	14.5	14.5	12	14.5	14.5	14.5	14.5	12	14.5

NS = Not Supported.

1.6 POWER MEASUREMENTS

1.6.1 Method

Conducted power measurements were performed with a power meter.

Bluetooth - EDR

(BT Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Packet Type	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
EDR	0	PSK	77.0	3-DH5	2402	15.65	16.50
EDR	39	PSK	77.0	3-DH5	2441	15.66	16.50
EDR	78	PSK	77.0	3-DH5	2480	15.70	16.50

(BT Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Packet Type	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
EDR	0	PSK	77.0	3-DH5	2402	15.45	16.50
EDR	39	PSK	77.0	3-DH5	2441	15.38	16.50
EDR	78	PSK	77.0	3-DH5	2480	15.53	16.50

Power measurements performed for EDR SISO mode only as this had the highest declared output power.

WLAN 2450 MHz - SISO

(2.4GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11b	2	BPSK	100	1	2417	20.08	20.50
802.11b	6	BPSK	100	1	2437	20.15	20.50
802.11b	9	BPSK	100	1	2452	20.10	20.50

- Channels 2-9 have the highest declared out put powers , hence channels 2,6,9 selected for testing.
- Power measurements were not performed for OFDM modes, OFDM configurations met the test exclusion requirements of KDB 248227 D01 section 5.2.2.

(2.4GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11b	2	BPSK	100	1	2417	20.08	20.50
802.11b	6	BPSK	100	1	2437	20.15	20.50
802.11b	9	BPSK	100	1	2452	20.10	20.50

- Channels 2-9 have the highest declared out put powers , hence channels 2,6,9 selected for testing.
- Power measurements were not performed for OFDM modes OFDM configurations met the test exclusion requirements of KDB 248227 D01 section 5.2.2.

WLAN 2450 MHz - 2x2 MIMO

(2.4GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11n	1	BPSK	100	13.5	2412	13.95	14.00
802.11n	2	BPSK	100	13.5	2417	17.00	17.50
802.11n	3	BPSK	100	13.5	2422	17.99	18.50
802.11n	4	BPSK	100	13.5	2427	18.90	19.50
802.11n	5	BPSK	100	13.5	2432	19.60	20.00
802.11n	6	BPSK	100	13.5	2437	19.90	20.50
802.11n	7	BPSK	100	13.5	2442	19.21	19.75
802.11n	8	BPSK	100	13.5	2447	18.01	18.50
802.11n	9	BPSK	100	13.5	2452	17.02	17.50
802.11n	10	BPSK	100	13.5	2457	15.55	16.00
802.11n	11	BPSK	100	13.5	2462	11.65	12.00
802.11n	12	BPSK	100	13.5	2467	N/M	9.50
802.11n	13	BPSK	100	13.5	2472	N/M	-0.50

N/M = Not measured

(2.4GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11n	1	BPSK	100	13.5	2412	14.05	14.00
802.11n	2	BPSK	100	13.5	2417	17.10	17.50
802.11n	3	BPSK	100	13.5	2422	18.05	18.50
802.11n	4	BPSK	100	13.5	2427	19.00	19.50
802.11n	5	BPSK	100	13.5	2432	19.63	20.00
802.11n	6	BPSK	100	13.5	2437	20.00	20.50
802.11n	7	BPSK	100	13.5	2442	19.25	19.75
802.11n	8	BPSK	100	13.5	2447	18.00	18.50
802.11n	9	BPSK	100	13.5	2452	17.05	17.50
802.11n	10	BPSK	100	13.5	2457	15.62	16.00
802.11n	11	BPSK	100	13.5	2462	11.80	12.00
802.11n	12	BPSK	100	13.5	2467	N/M	9.50
802.11n	13	BPSK	100	13.5	2472	N/M	-0.50

N/M = Not measured

WLAN U-NII 2A - SISO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac HT40	54	BPSK	100	13.5	5270	14.75	15.25
802.11ac HT40	62	BPSK	100	13.5	5310	14.28	14.75

(5GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac HT40	54	BPSK	100	13.5	5270	14.80	15.25
802.11ac HT40	62	BPSK	100	13.5	5310	14.30	14.75

WLAN U-NII 2A - 2x2 MIMO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac HT40	54	BPSK	100	13.5	5270	14.81	15.25
802.11ac HT40	62	BPSK	100	13.5	5310	10.65	11.25

(5GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac HT40	54	BPSK	100	13.5	5270	14.75	15.25
802.11ac HT40	62	BPSK	100	13.5	5310	10.76	11.25

WLAN U-NII 2C - SISO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	106	BPSK	100	29.3	5530	12.95	13.25
802.11ac VHT80	122	BPSK	100	29.3	5610	14.00	14.50
802.11ac VHT80	138	BPSK	100	29.3	5690	14.10	14.50

(5GHz Core 1

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	106	BPSK	100	29.3	5530	12.80	13.25
802.11ac VHT80	122	BPSK	100	29.3	5610	14.02	14.50
802.11ac VHT80	138	BPSK	100	29.3	5690	14.10	14.50

WLAN U-NII 2C - 2x2 MIMO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	106	BPSK	100	29.3	5530	11.60	12.0
802.11ac VHT80	122	BPSK	100	29.3	5610	14.00	14.50
802.11ac VHT80	138	BPSK	100	29.3	5690	14.05	14.50

(5GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	106	BPSK	100	29.3	5530	11.60	12.0
802.11ac VHT80	122	BPSK	100	29.3	5610	14.00	14.50
802.11ac VHT80	138	BPSK	100	29.3	5690	14.05	14.50

WLAN U-NII 3 - SISO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	155	BPSK	100	29.3	5775	14.00	14.50

WLAN U-NII 3 - SISO

(5GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	155	BPSK	100	29.3	5775	14.00	14.50

WLAN U-NII 3 - 2x2 MIMO

(5GHz Core 0)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	155	BPSK	100	29.3	5775	14.10	14.50

(5GHz Core 1)

Technology	Channel	Modulation	Duty Cycle (%)	Rate (Mbps)	Frequency (MHz)	Measured Power (dBm)	Tune Up (dBm)
802.11ac VHT80	155	BPSK	100	29.3	5775	13.98	14.50

SECTION 2

TEST DETAILS

Specific Absorption Rate Testing of the
A2337

2.1 DASY5 MEASUREMENT SYSTEM

2.1.1 System Description

The DASY5 system for performing compliance tests consists of the following items:

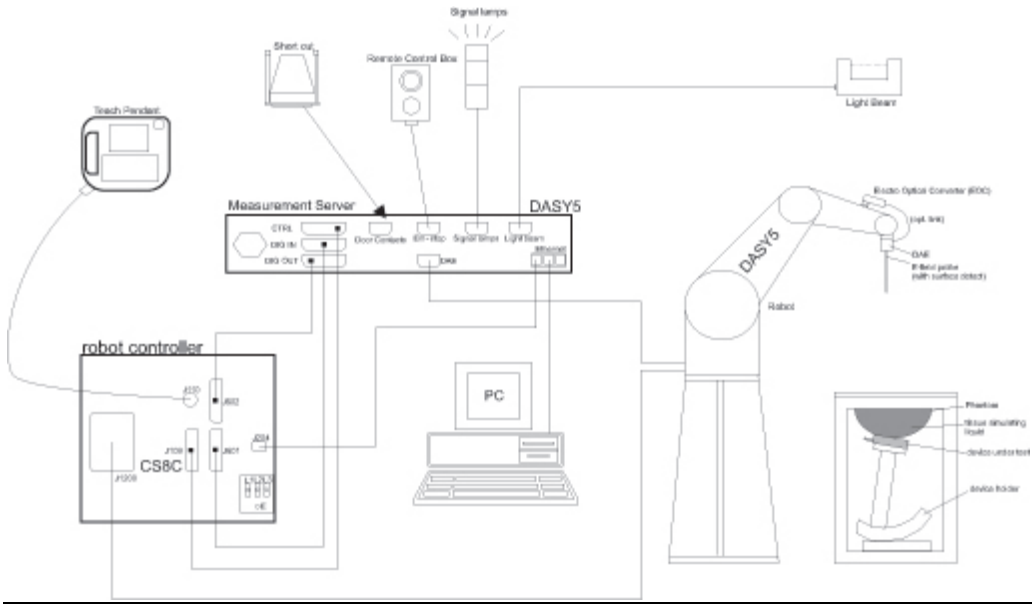

Figure 2 System Description Diagram

A standard high precision 6-axis robot (Stäubli TX=RX family) 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 the DASY5 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.

2.1.2 Probe Specification

The probes used by the DASY system are isotropic E-field probes, constructed with a symmetric design and a triangular core. The probes have built-in shielding against static charges and are contained within a PEEK enclosure material. These probes are specially designed and calibrated for use in liquids with high permittivities. The frequency range of the probes are from 6 MHz to 6 GHz.

2.1.3 Data Acquisition Electronics

The data acquisition electronics (DAE4 or DAE3) consist 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 with a 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 mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of both the DAE4 as well as of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

2.1.4 SAR Evaluation Description

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values.

Based on the IEEE 1528 standard, a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of 30mm3 (7x7x7 points). The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the centre of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Post processing engine (SEMCAD X). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD X). 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:

1. extraction of the measured data (grid and values) from the Zoom Scan
2. calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. generation of a high-resolution mesh within the measured volume
4. interpolation of all measured values from the measurement grid to the high-resolution grid
5. extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. calculation of the averaged SAR within masses of 1g and 10g

2.1.5 Interpolation, Extrapolation and Detection of Maxima

The probe is calibrated at the centre of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY5, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and extrapolation routines. The interpolation, extrapolation and maximum search routines are all based on the modified Quadratic Shepard's method. Thereby, the interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The DASY5 routines construct a once-continuously differentiable function that interpolates the measurement values as follows:

For each measurement point a trivariate (3-D) / bivariate (2-D) quadratic is computed.
It interpolates the measurement values at the data point and forms a least-square fit to neighbouring measurement values. The spatial location of the quadratic with respect to the measurement values is attenuated by an inverse distance weighting. This is performed since the calculated quadratic will fit measurement values at nearby points more accurate than at points located further away.

After the quadratics are calculated for at all measurement points, the interpolating function is calculated as a weighted average of the quadratics.

There are two control parameters that govern the behaviour of the interpolation method. One specifies the number of measurement points to be used in computing the least-square fits for the local quadratics. These measurement points are the ones nearest the input point for which the quadratic is being computed. The second parameter specifies the number of measurement points that will be used in calculating the weights for the quadratics to produce the final function. The input data points used there are the ones nearest the point at which the interpolation is desired. Appropriate defaults are chosen for each of the control parameters

The trivariate quadratics that have been previously computed for the 3-D interpolation and whose input data are at the closest distance from the phantom surface, are used in order to extrapolate the fields to the surface of the phantom.

In order to determine all the field maxima in 2-D (Area Scan) and 3-D (Zoom Scan), the measurement grid is refined by a default factor of 10 and the interpolation function is used to evaluate all field values between corresponding measurement points. Subsequently, a linear search is applied to find all the candidate maxima. In a last step, non-physical maxima are removed and only those maxima which are within 2 dB of the global maximum value are retained.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extrema of the SAR distribution. The uncertainty on the locations of the extrema is less than 1/20 of the grid size. Only local maxima within 2 dB of the global maximum are searched and passed for the Zoom Scan measurement.

In the Zoom Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1g and 10g cubes, the extrapolation distance should not be larger than 5mm.

2.1.6 Averaging and Determination of Spatial Peak SAR

The interpolated data is used to average the SAR over the 1g and 10g cubes by spatially discretising the entire measured volume. The resolution of this spatial grid used to calculate the averaged SAR is 1mm or about 42875 interpolated points. The resulting volumes are defined as cubical volumes containing the appropriate tissue parameters that are cantered at the location. The location is defined as the centre of the incremental volume (voxel).

The spatial-peak SAR must be evaluated in cubical volumes containing a mass that is within 5%of the required mass. The cubical volume centred at each location, as defined above, should be expanded in all directions until the desired value for the mass is reached, with no surface boundaries of the averaging volume extending beyond the outermost surface of the considered region. In addition, the cubical volume should not consist of more than 10% of air. If these conditions are not satisfied, then the centre of the averaging volume is moved to the next location. Otherwise, the exact size of the final sampling cube is found using an inverse polynomial approximation algorithm, leading to results with improved accuracy. If one boundary of the averaging volume reaches the boundary of the measured volume during its expansion, it will not be evaluated at all. Reference is kept of all locations used and those not used for averaging the SAR. All average SAR values are finally assigned to the centred location in each valid averaging volume.

All locations included in an averaging volume are marked to indicate that they have been used at least once. If a location has been marked as used but has never been assigned to the centre of a cube, the highest averaged SAR value of all other cubical volumes which have used this location for averaging is assigned to this location. Only those locations that are not part of any valid averaging volume should be marked as unused. For the case of an unused location, a new averaging volume must be constructed which will have the unused location centred at one surface of the cube. The remaining five surfaces are expanded evenly in all directions until the required mass is enclosed, regardless of the amount of included air. Of the six possible cubes with one surface centred on the unused location, the smallest cube is used, which still contains the required mass.

If the final cube containing the highest averaged SAR touches the surface of the measured volume, an appropriate warning is issued within the Post-processing engine.

2.2 BLUETOOTH 2450 MHz BODY SAR TEST RESULTS

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	2.019 S/m
DUT CONFIGURATION:	SISO (BT Core 0)	**RELATIVE PERMITTIVITY:**	53.722
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	Bluetooth EDR	**SCAN TYPE:**	Full
FREQUENCY:	2480 MHz	**DRIFT:**	-0.01 dB
MODULATION:	PSK	**PEAK SAR:**	0.26 W/kg
DUTY CYCLE:	77 %	**SAR (1g):**	0.20 W/kg

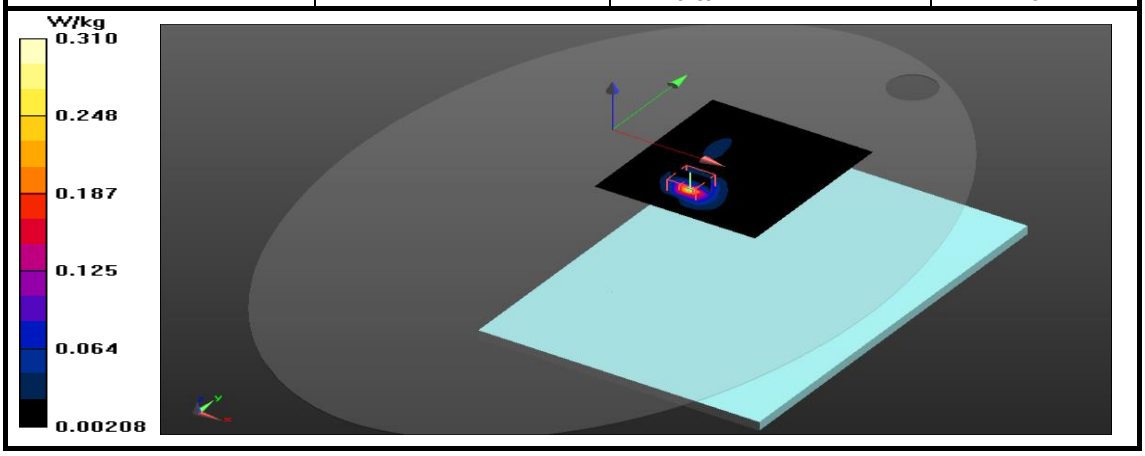

Figure 3: SAR Body Testing Results for the A2337 at 2480 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	2.019 S/m
DUT CONFIGURATION:	SISO (BT Core 0)	**RELATIVE PERMITTIVITY:**	53.722
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	Bluetooth EDR	**SCAN TYPE:**	Full
FREQUENCY:	2480 MHz	**DRIFT:**	-0.01 dB
MODULATION:	PSK	**PEAK SAR:**	0.04 W/kg
DUTY CYCLE:	77 %	**SAR (1g):**	0.03 W/kg

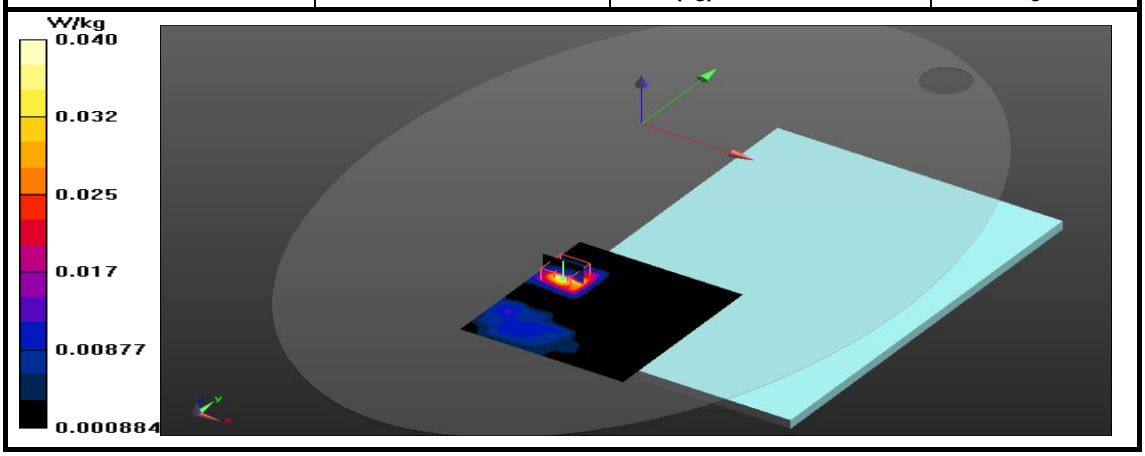

Figure 4: SAR Body Testing Results for the A2337 at 2480 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	2.019 S/m
DUT CONFIGURATION:	SISO (BT Core 1)	**RELATIVE PERMITTIVITY:**	53.722
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	Bluetooth EDR	**SCAN TYPE:**	Full
FREQUENCY:	2480 MHz	**DRIFT:**	-0.10 dB
MODULATION:	PSK	**PEAK SAR:**	0.24 W/kg
DUTY CYCLE:	77 %	**SAR (1g):**	0.18 W/kg

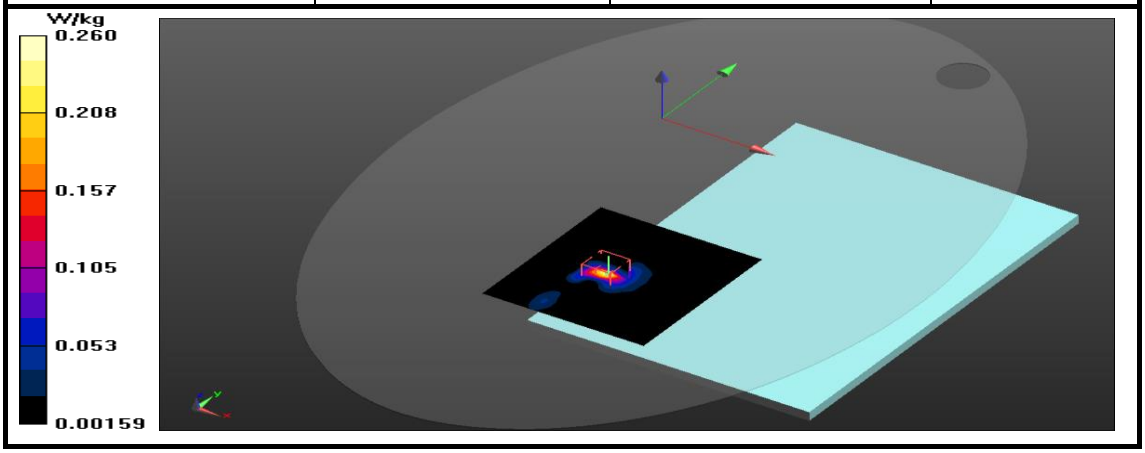

Figure 5: SAR Body Testing Results for the A2337 at 2480 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	2.019 S/m
DUT CONFIGURATION:	SISO (BT Core 1)	**RELATIVE PERMITTIVITY:**	53.722
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	Bluetooth EDR	**SCAN TYPE:**	Full
FREQUENCY:	2480 MHz	**DRIFT:**	-0.09 dB
MODULATION:	PSK	**PEAK SAR:**	0.04 W/kg
DUTY CYCLE:	77 %	**SAR (1g):**	0.03 W/kg

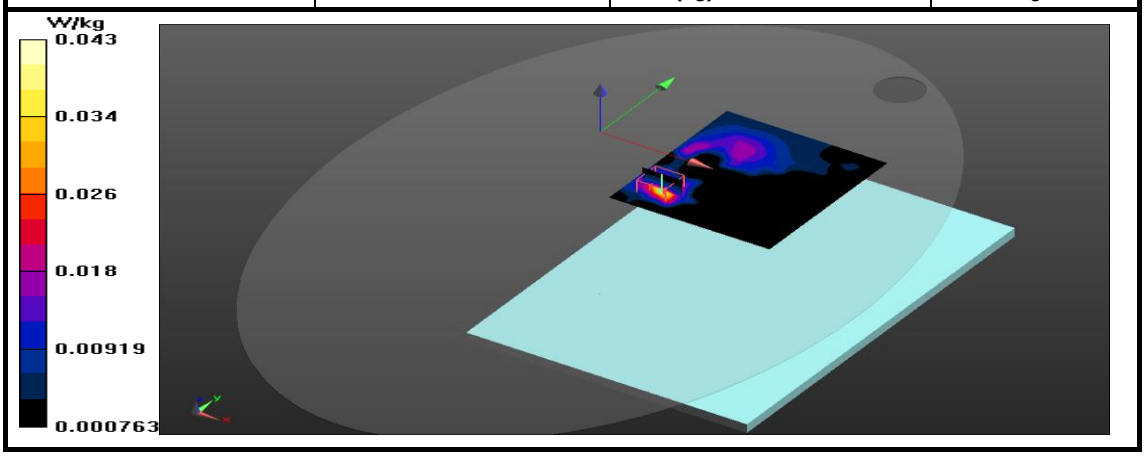

Figure 6: SAR Body Testing Results for the A2337 at 2480 MHz.

2.3 WLAN 2450 MHz BODY SAR TEST RESULTS

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	1.981 S/m
DUT CONFIGURATION:	SISO (2.4GHz Core 0)	**RELATIVE PERMITTIVITY:**	53.784
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11b	**SCAN TYPE:**	Full
FREQUENCY:	2437 MHz	**DRIFT:**	0.13 dB
MODULATION:	BPSK	**PEAK SAR:**	1.06 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.70 W/kg

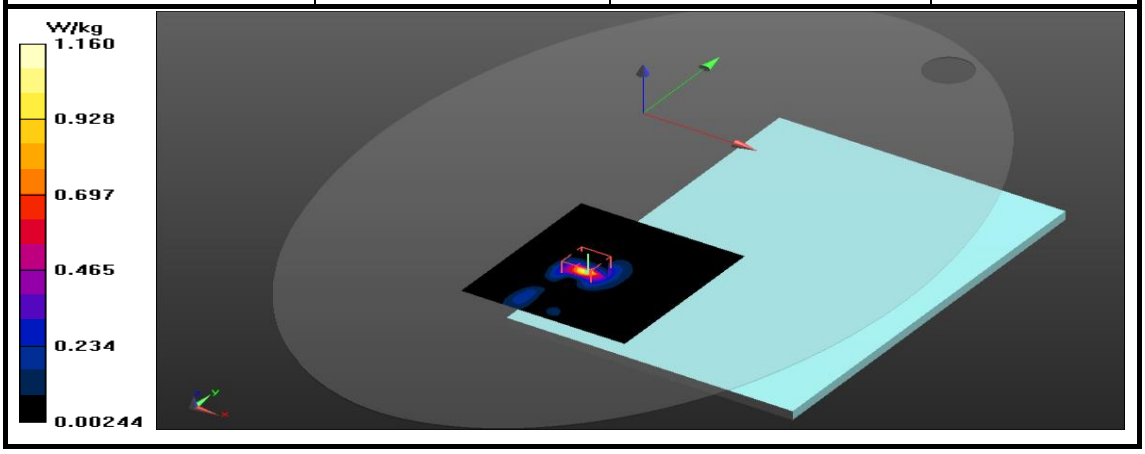

Figure 7: SAR Body Testing Results for the A2337 at 2437 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	1.981 S/m
DUT CONFIGURATION:	SISO (2.4GHz Core 0)	**RELATIVE PERMITTIVITY:**	53.784
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11b	**SCAN TYPE:**	Full
FREQUENCY:	2437 MHz	**DRIFT:**	-0.10 dB
MODULATION:	BPSK	**PEAK SAR:**	0.15 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.11 W/kg

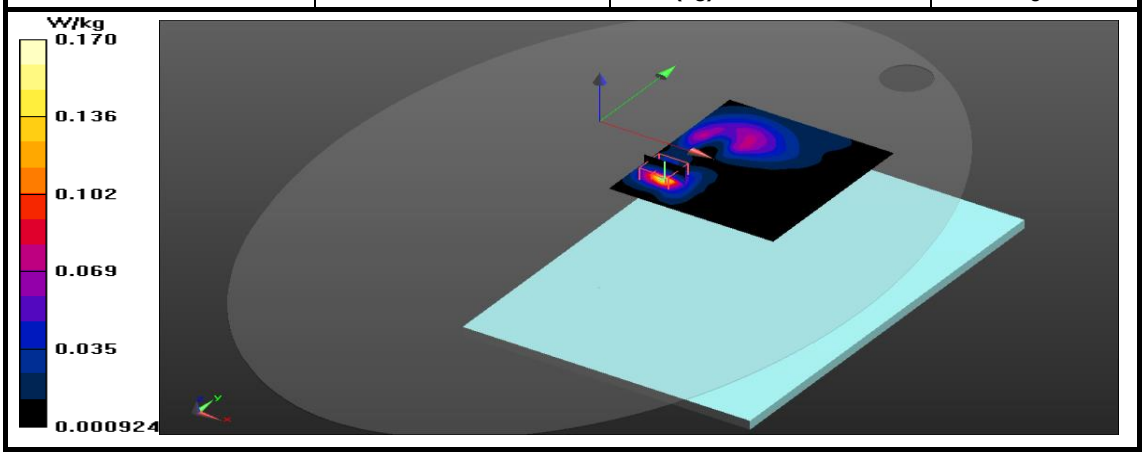

Figure 8: SAR Body Testing Results for the A2337 at 2437 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	1.994 S/m
DUT CONFIGURATION:	SISO (2.4GHz Core 1)	**RELATIVE PERMITTIVITY:**	53.765
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11b	**SCAN TYPE:**	Full
FREQUENCY:	2452 MHz	**DRIFT:**	-0.20 dB
MODULATION:	BPSK	**PEAK SAR:**	0.91 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.59 W/kg

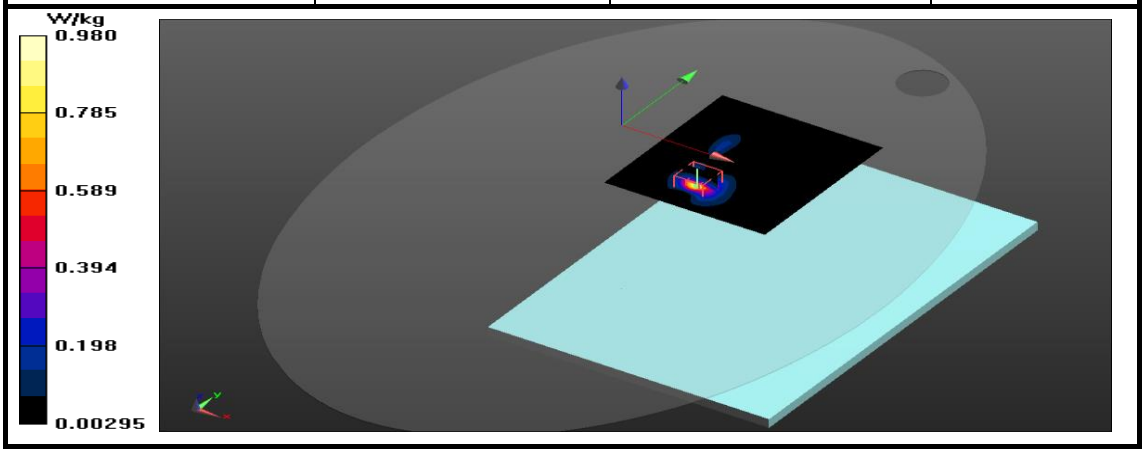

Figure 9: SAR Body Testing Results for the A2337 at 2452 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	1.994 S/m
DUT CONFIGURATION:	SISO (2.4GHz Core 1)	**RELATIVE PERMITTIVITY:**	53.765
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11b	**SCAN TYPE:**	Full
FREQUENCY:	2452 MHz	**DRIFT:**	-0.04 dB
MODULATION:	BPSK	**PEAK SAR:**	0.14 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.09 W/kg

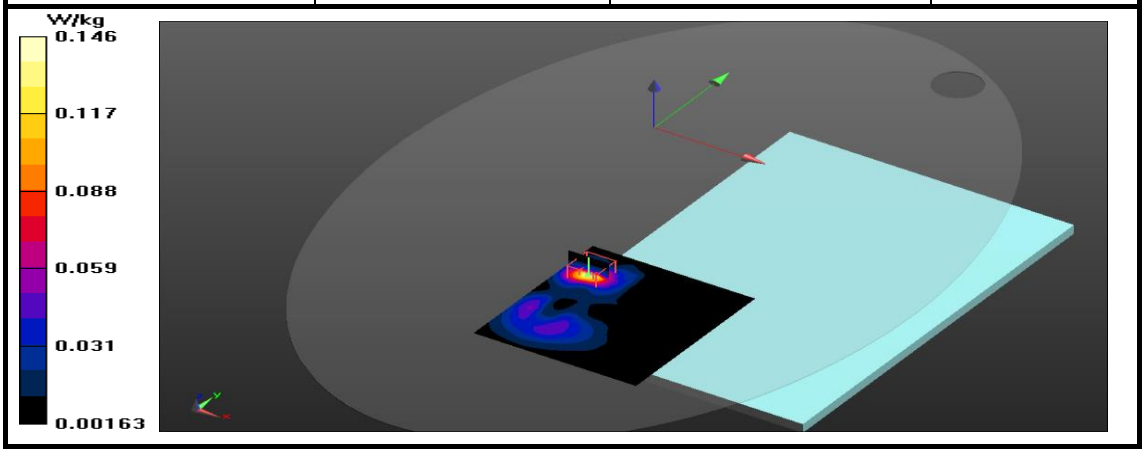

Figure 10: SAR Body Testing Results for the A2337 at 2452 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	1.981 S/m
DUT CONFIGURATION:	MIMO (2.4GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	53.784
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11n HT20	**SCAN TYPE:**	Full
FREQUENCY:	2437 MHz	**DRIFT:**	-0.05 dB
MODULATION:	MCS0	**PEAK SAR:**	1.13 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.71 W/kg

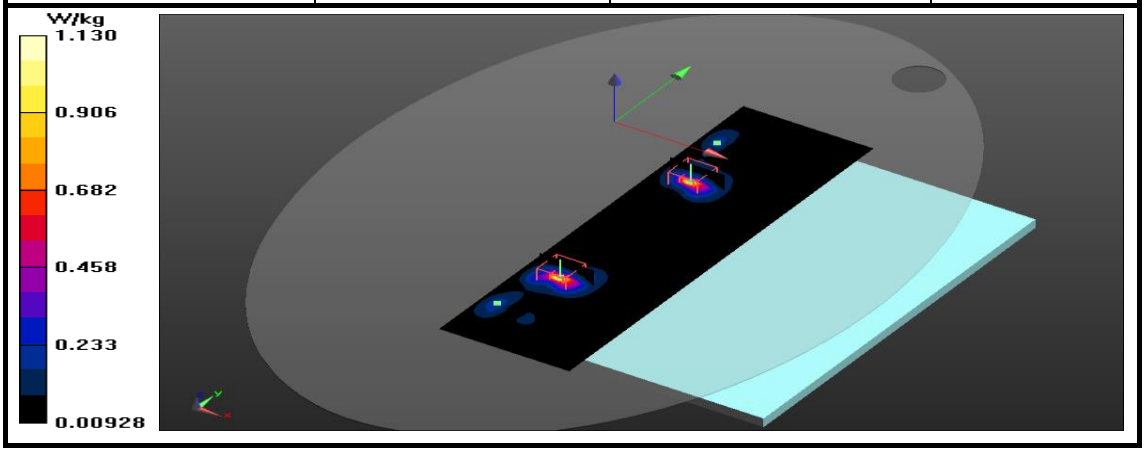

Figure 11: SAR Body Testing Results for the A2337 at 2437 MHz.

2.4 WLAN U-NII 2A BODY SAR TEST RESULTS

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	22.1 °C
DATE:	03/09/2020	**RELATIVE HUMIDITY:**	43.1 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.463 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	47.329
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.2 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5270 MHz	**DRIFT:**	-0.01 dB
MODULATION:	MCS0	**PEAK SAR:**	1.80 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.84 W/kg

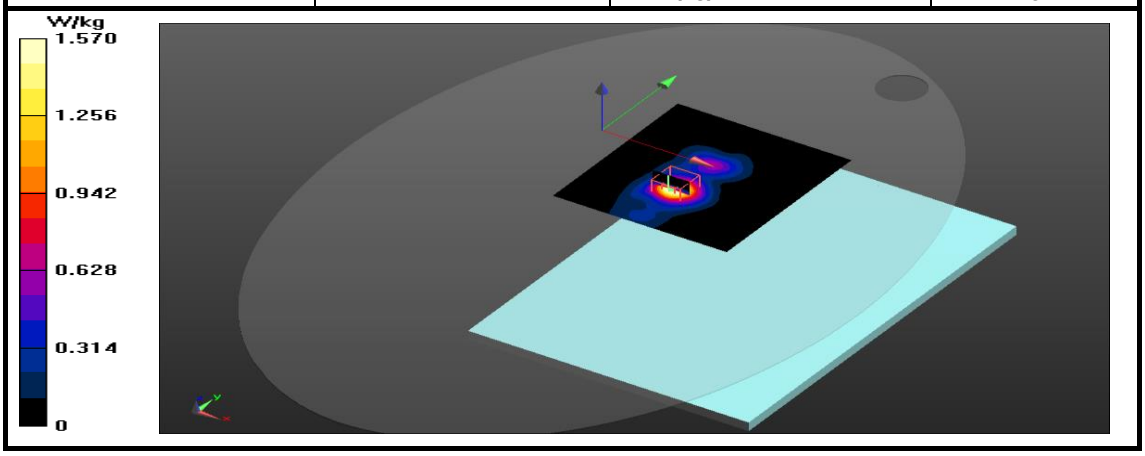

Figure 12: SAR Body Testing Results for the A2337 at 5270 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.463 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	47.329
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5270 MHz	**DRIFT:**	0.01 dB
MODULATION:	MCS0	**PEAK SAR:**	0.31 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.17 W/kg

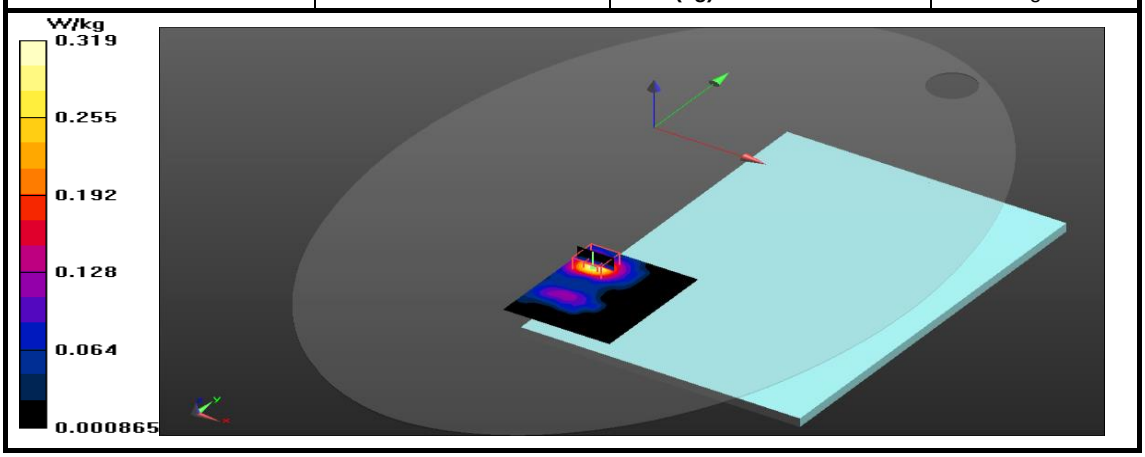

Figure 13: SAR Body Testing Results for the A2337 at 5270 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.48 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.879
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5310 MHz	**DRIFT:**	-0.17 dB
MODULATION:	MCS0	**PEAK SAR:**	1.84 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.82 W/kg

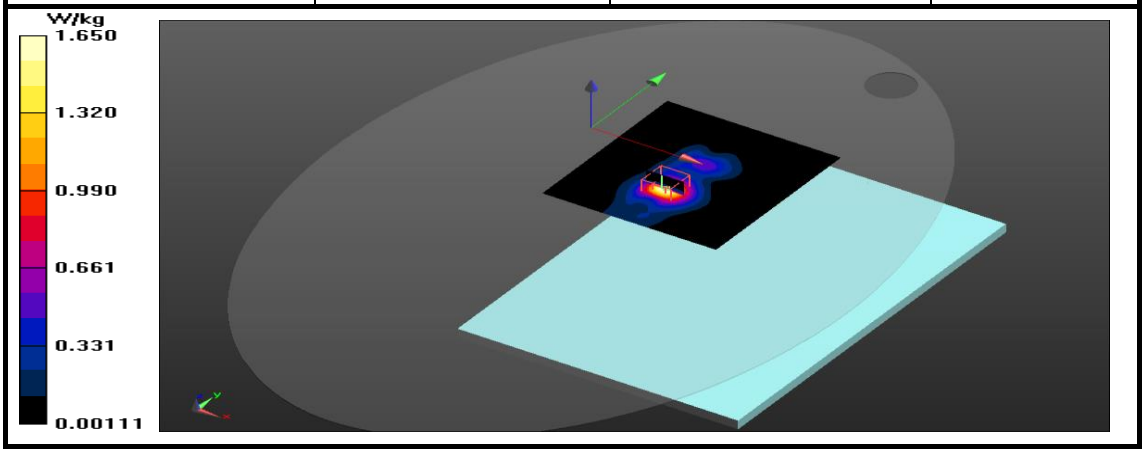

Figure 14: SAR Body Testing Results for the A2337 at 5310 MHz

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.5 °C
DATE:	14/09/2020	**RELATIVE HUMIDITY:**	63.1 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.509 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.367
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.3 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5270 MHz	**DRIFT:**	-0.08 dB
MODULATION:	MCS0	**PEAK SAR:**	1.26 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.68 W/kg

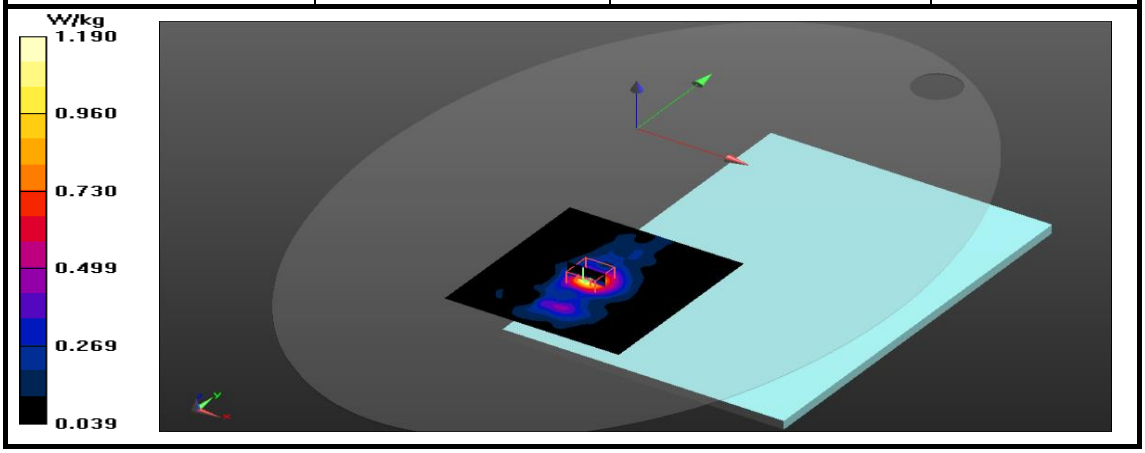

Figure 15: SAR Body Testing Results for the A2337 at 5270 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.5 °C
DATE:	14/09/2020	**RELATIVE HUMIDITY:**	63.1 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.509 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.367
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	21.3 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5270 MHz	**DRIFT:**	-0.16 dB
MODULATION:	MCS0	**PEAK SAR:**	0.26 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.19 W/kg

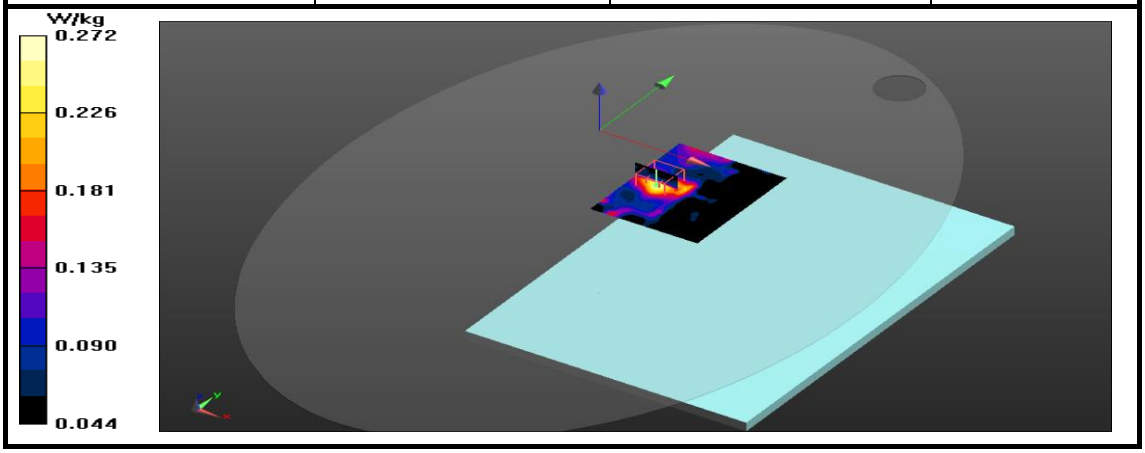

Figure 16: SAR Body Testing Results for the A2337 at 5270 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.5 °C
DATE:	14/09/2020	**RELATIVE HUMIDITY:**	63.1 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.509 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	48.367
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.3 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5270 MHz	**DRIFT:**	0.02 dB
MODULATION:	MCS0	**PEAK SAR:**	1.73 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.88 W/kg

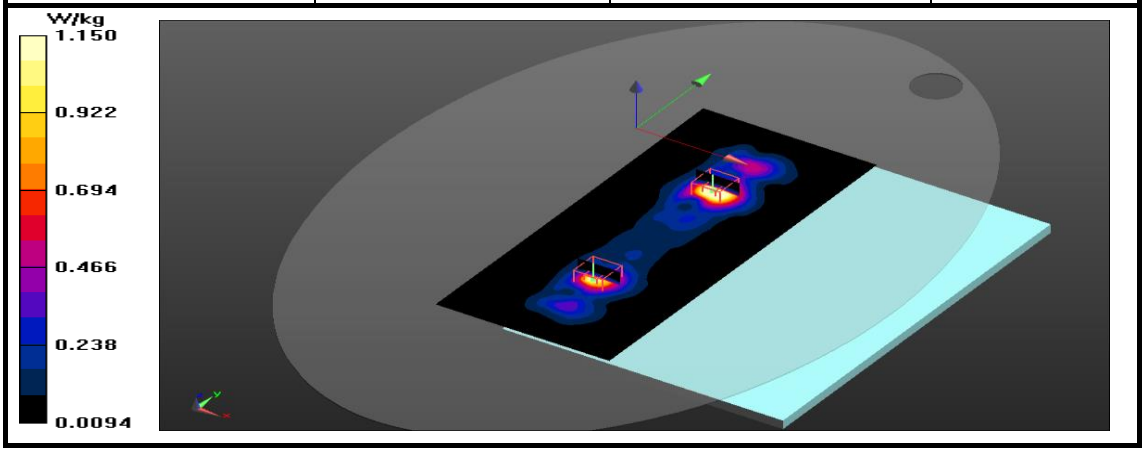

Figure 17: SAR Body Testing Results for the A2337 at 5270 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.5 °C
DATE:	14/09/2020	**RELATIVE HUMIDITY:**	63.1 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.568 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	48.275
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.3 °C
RAT:	802.11ac VHT40	**SCAN TYPE:**	Full
FREQUENCY:	5310 MHz	**DRIFT:**	-0.17 dB
MODULATION:	MCS0	**PEAK SAR:**	0.65 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.41 W/kg

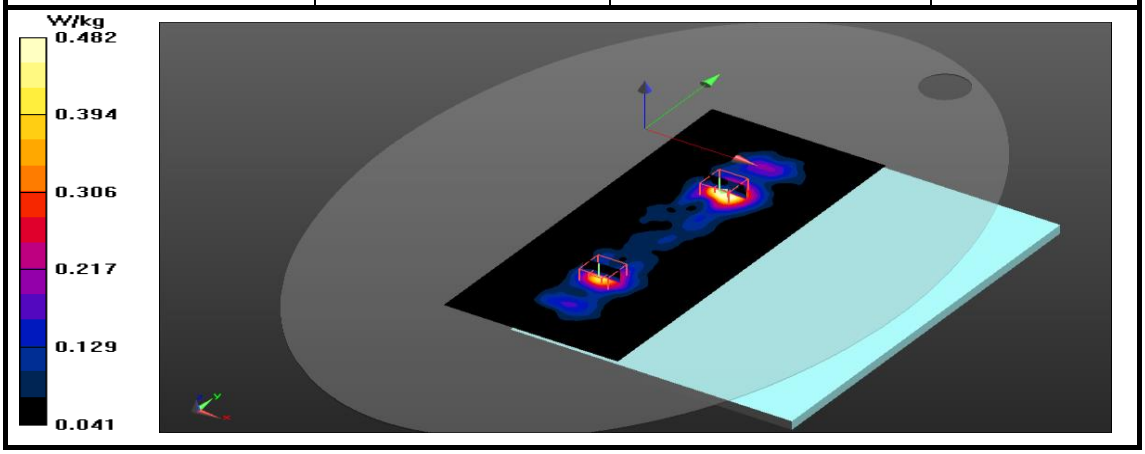

Figure 18: SAR Body Testing Results for the A2337 at 5310 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.026 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.149
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5690 MHz	**DRIFT:**	-0.14 dB
MODULATION:	MCS0	**PEAK SAR:**	1.28 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.67 W/kg

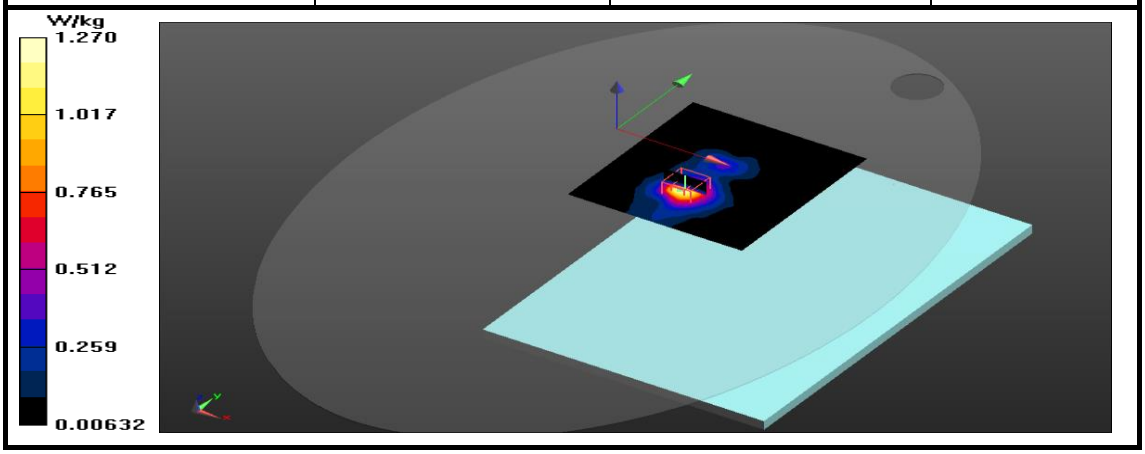

Figure 19: SAR Body Testing Results for the A2337 at 5690 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.026 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.149
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5690 MHz	**DRIFT:**	0.02 dB
MODULATION:	MCS0	**PEAK SAR:**	0.28 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.15 W/kg

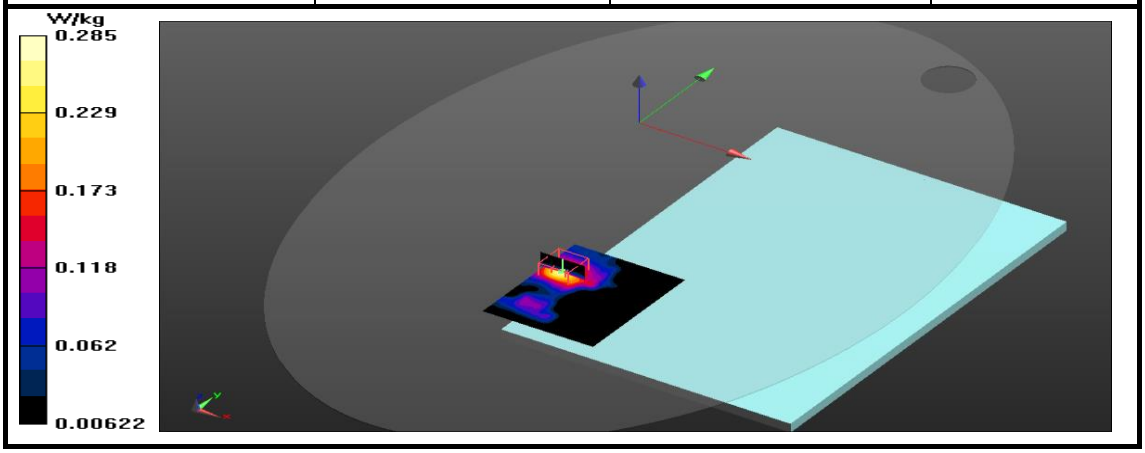

Figure 20: SAR Body Testing Results for the A2337 at 5690 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.911 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.292
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5610 MHz	**DRIFT:**	-0.19 dB
MODULATION:	MCS0	**PEAK SAR:**	1.54 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.75 W/kg

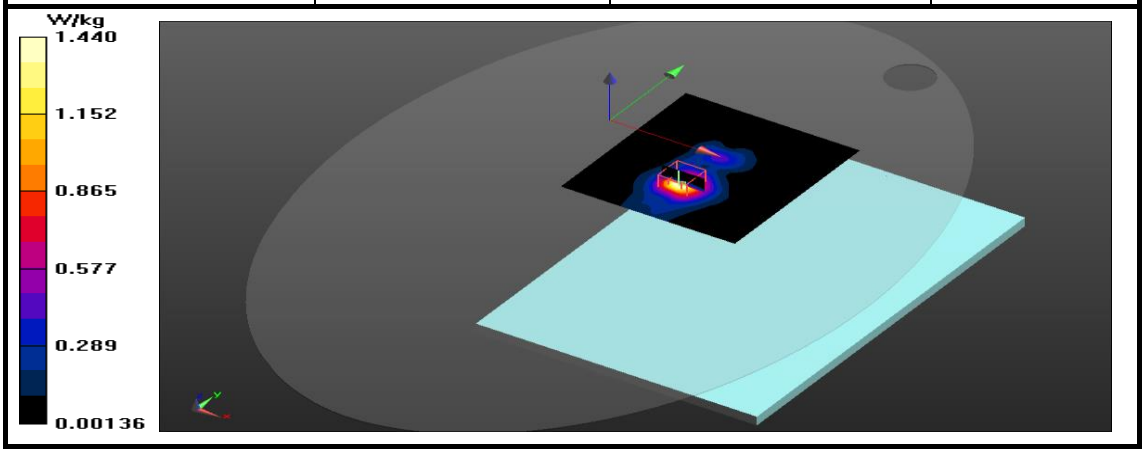

Figure 21: SAR Body Testing Results for the A2337 at 5610 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.797 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.437
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5530 MHz	**DRIFT:**	-0.07 dB
MODULATION:	MCS0	**PEAK SAR:**	1.22 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.58 W/kg

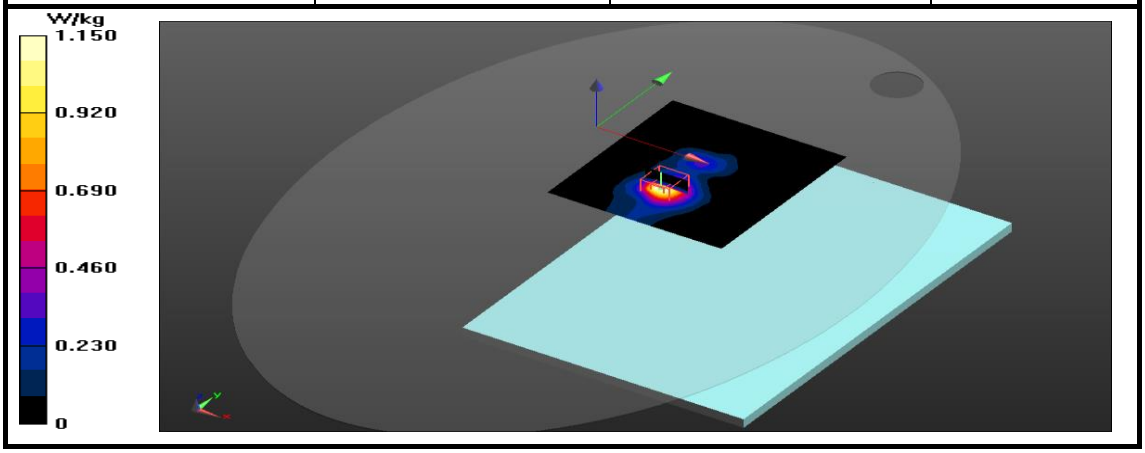

Figure 22: SAR Body Testing Results for the A2337 at 5530 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.026 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	48.149
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5690 MHz	**DRIFT:**	-0.05 dB
MODULATION:	MCS0	**PEAK SAR:**	1.54 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.79 W/kg

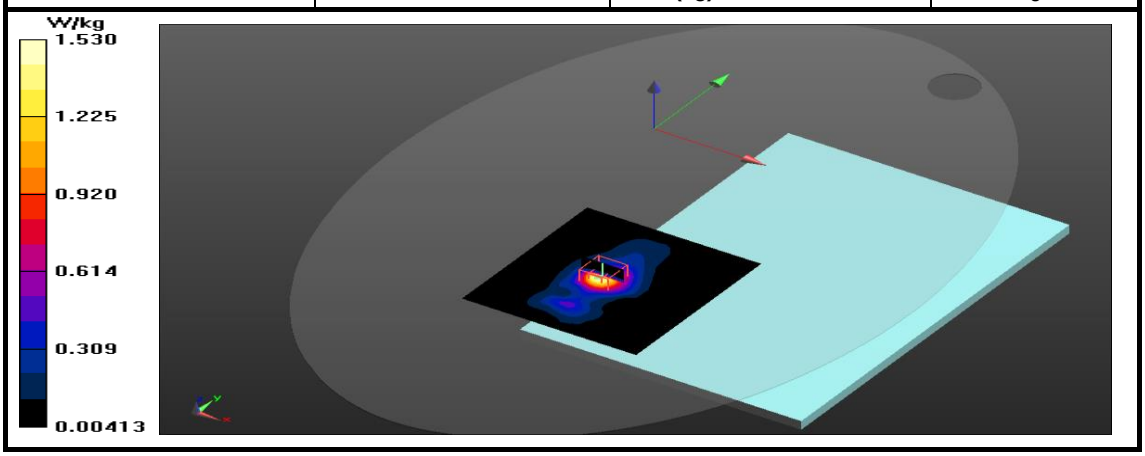

Figure 23: SAR Body Testing Results for the A2337 at 5690 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.026 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	48.149
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5690 MHz	**DRIFT:**	-0.11 dB
MODULATION:	MCS0	**PEAK SAR:**	0.33 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.17 W/kg

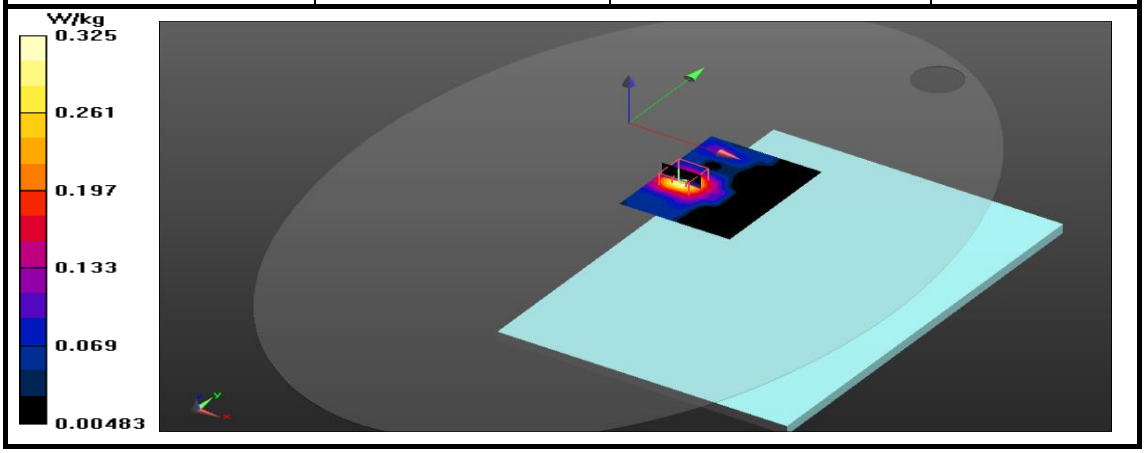

Figure 24: SAR Body Testing Results for the A2337 at 5690 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.958 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	46.645
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5610 MHz	**DRIFT:**	0.00 dB
MODULATION:	MCS0	**PEAK SAR:**	1.77 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.96 W/kg

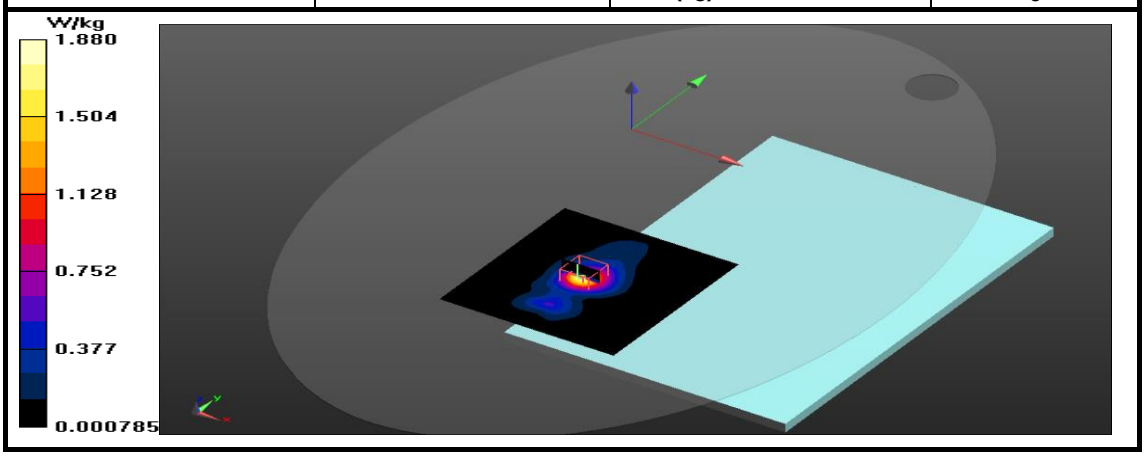

Figure 25: SAR Body Testing Results for the A2337 at 5610 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.84 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	46.796
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5530 MHz	**DRIFT:**	0.00 dB
MODULATION:	MCS0	**PEAK SAR:**	1.26 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.67 W/kg

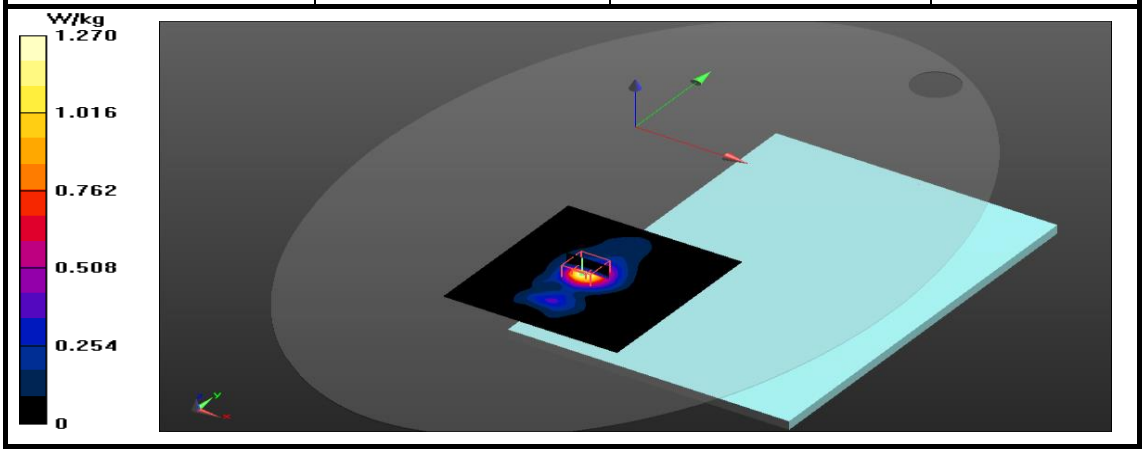

Figure 26: SAR Body Testing Results for the A2337 at 5530 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	11/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.026 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	48.149
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5690 MHz	**DRIFT:**	-0.06 dB
MODULATION:	MCS0	**PEAK SAR:**	1.55 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.76 W/kg

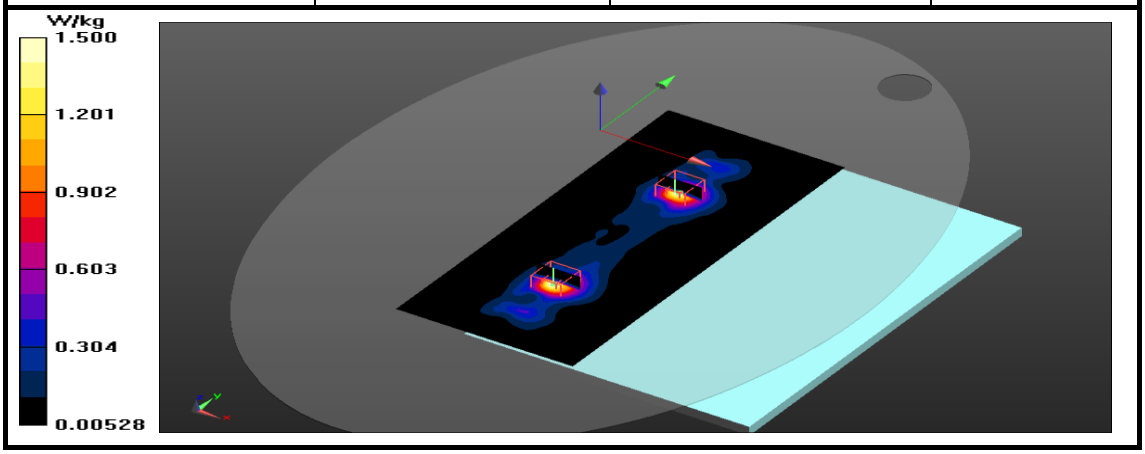

Figure 27: SAR Body Testing Results for the A2337 at 5690 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	11/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.911 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	48.292
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5610 MHz	**DRIFT:**	-0.02 dB
MODULATION:	MCS0	**PEAK SAR:**	1.77 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.89 W/kg

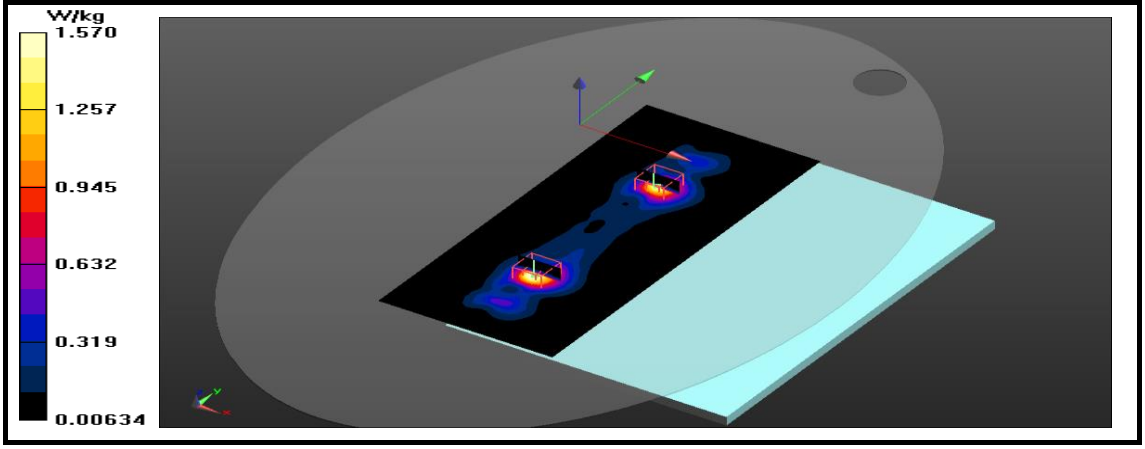

Figure 28: SAR Body Testing Results for the A2337 at 5610 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	21.1 °C
DATE:	07/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.797 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	48.437
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	20.8 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5530 MHz	**DRIFT:**	-0.00 dB
MODULATION:	MCS0	**PEAK SAR:**	0.75 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.40 W/kg

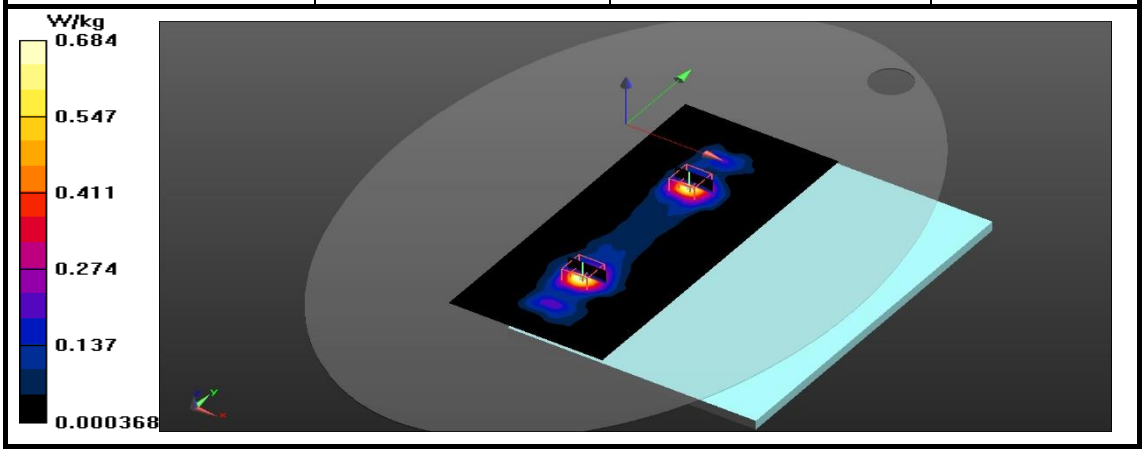

Figure 29: SAR Body Testing Results for the A2337 at 5530 MHz.

2.5 WLAN U-NII 3 BODY SAR TEST RESULTS

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	5.797 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	48.437
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5775 MHz	**DRIFT:**	-0.07 dB
MODULATION:	MCS0	**PEAK SAR:**	1.22 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.61 W/kg

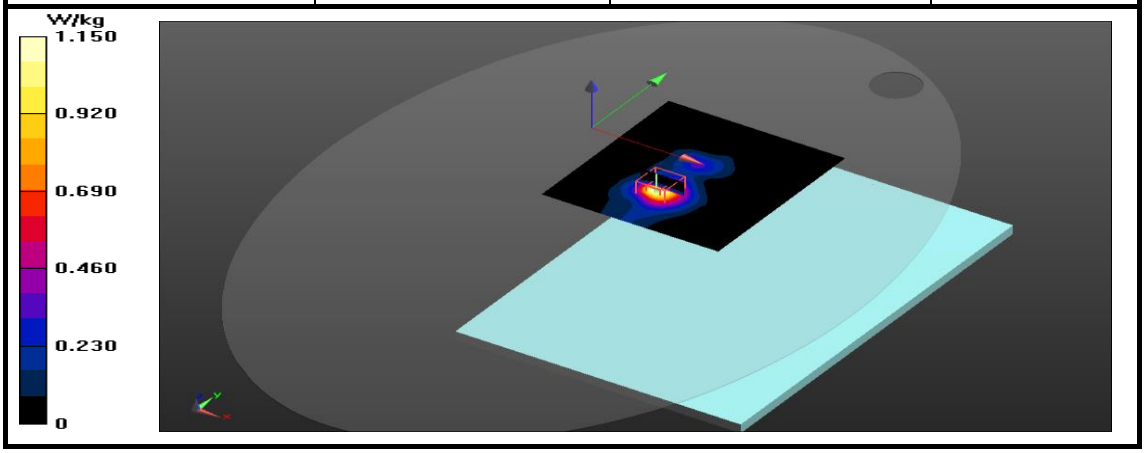

Figure 30: SAR Body Testing Results for the A2337 at 5775 MHz

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.2 °C
DATE:	05/09/2020	**RELATIVE HUMIDITY:**	45.6 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.154 S/m
DUT CONFIGURATION:	SISO (5GHz Core 0)	**RELATIVE PERMITTIVITY:**	47.996
DUT POSITION:	0mm - Rear of Display	**LIQUID TEMPERATURE:**	22.1 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5775 MHz	**DRIFT:**	-0.09 dB
MODULATION:	MCS0	**PEAK SAR:**	0.30 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.15 W/kg

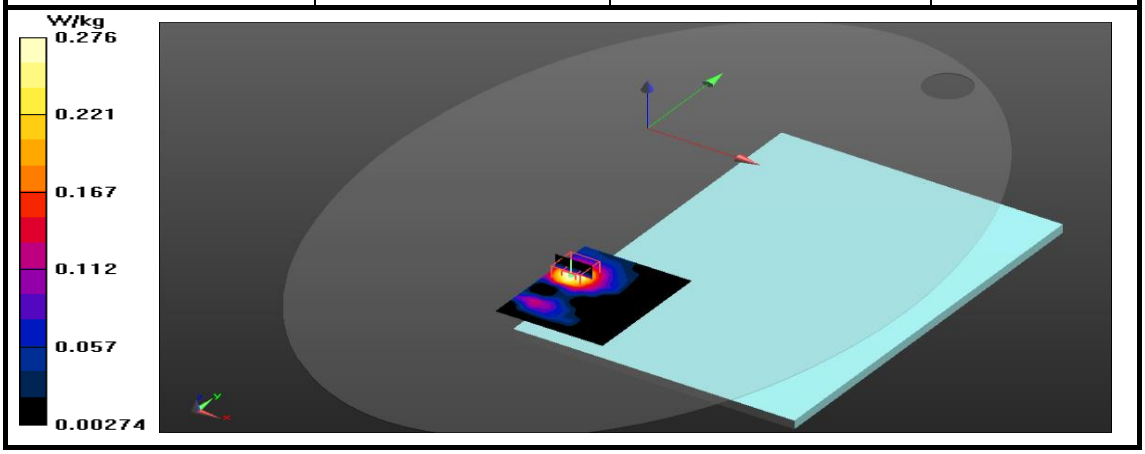

Figure 31: SAR Body Testing Results for the A2337 at 5775 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.206 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	46.342
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5775 MHz	**DRIFT:**	-0.03 dB
MODULATION:	MCS0	**PEAK SAR:**	1.18 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.66 W/kg

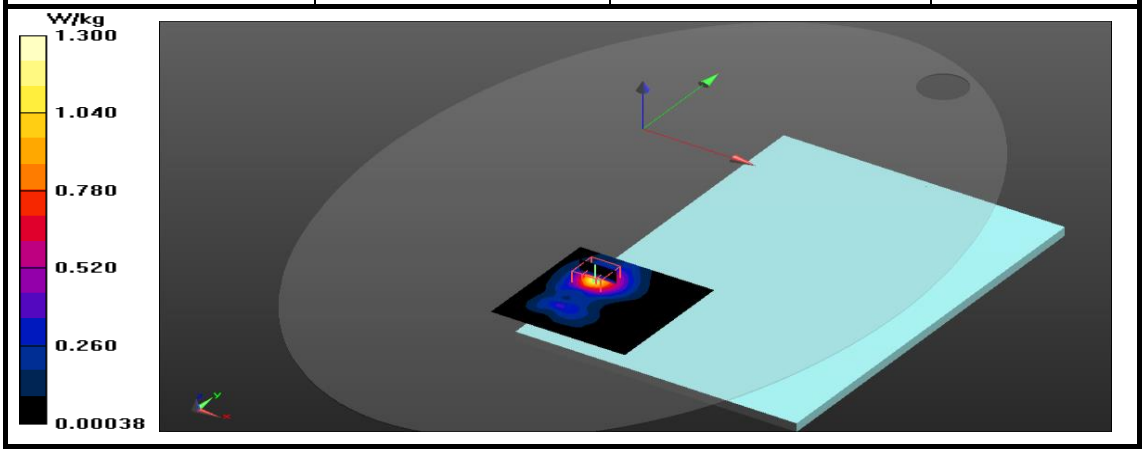

Figure 32: SAR Body Testing Results for the A2337 at 5775 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	23.1 °C
DATE:	04/09/2020	**RELATIVE HUMIDITY:**	45.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.206 S/m
DUT CONFIGURATION:	SISO (5GHz Core 1)	**RELATIVE PERMITTIVITY:**	46.342
DUT POSITION:	0mm – Rear of Display	**LIQUID TEMPERATURE:**	22.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5775 MHz	**DRIFT:**	-0.18 dB
MODULATION:	MCS0	**PEAK SAR:**	0.30 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.15 W/kg

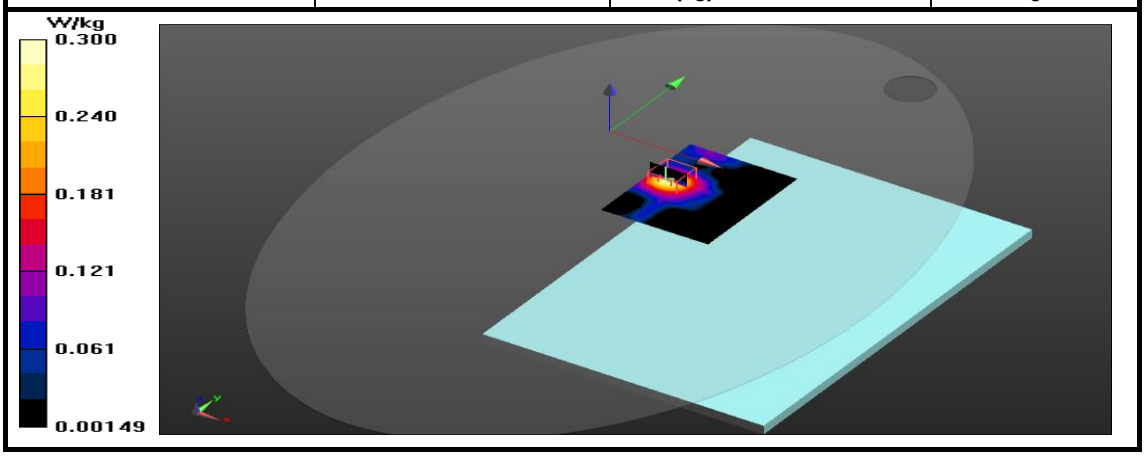

Figure 33: SAR Body Testing Results for the A2337 at 5775 MHz.

SOFTWARE VERSION:	52.10.2(1495)	**AMBIENT TEMPERATURE:**	22.3 °C
DATE:	11/09/2020	**RELATIVE HUMIDITY:**	50.3 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	6.154 S/m
DUT CONFIGURATION:	MIMO (5GHz Core 0 and Core 1)	**RELATIVE PERMITTIVITY:**	47.996
DUT POSITION:	0mm - Bottom	**LIQUID TEMPERATURE:**	21.2 °C
RAT:	802.11ac VHT80	**SCAN TYPE:**	Full
FREQUENCY:	5775 MHz	**DRIFT:**	-0.08 dB
MODULATION:	MCS0	**PEAK SAR:**	1.47 W/kg
DUTY CYCLE:	100 %	**SAR (1g):**	0.76 W/kg

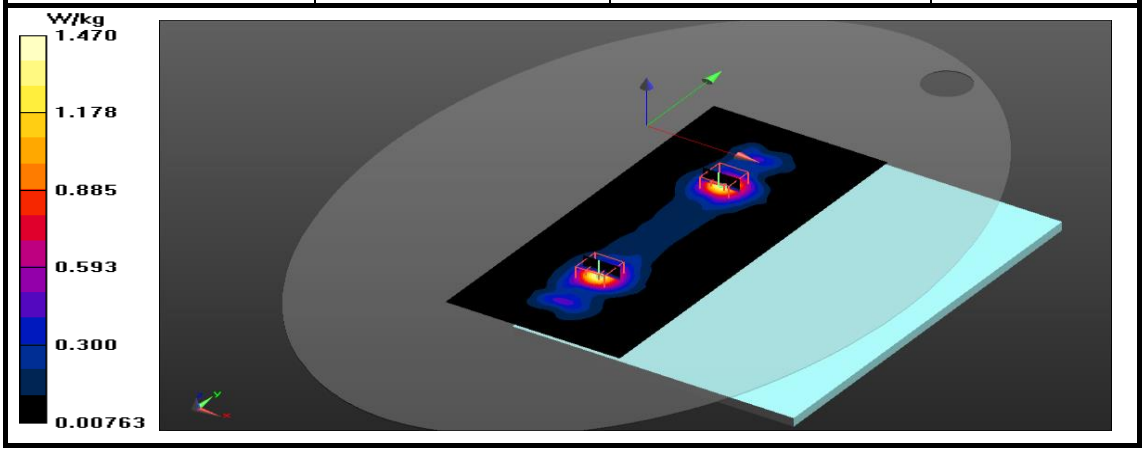

Figure 34: SAR Body Testing Results for the A2337 at 5775 MHz.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

The following test equipment was used at TÜV SÜD:

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
Attenuator (30dB, 25W)	Weinschel	46-30-34	2776	12	10-Aug-2021
Thermocouple Thermometer	Fluke	51	3172	12	02-Jan-2021
Power Meter	Rohde & Schwarz	NRP	3491	12	11-Oct-2020
Wideband Power Sensor, 50MHz - 18GHz	Rohde & Schwarz	NRP-Z81	3492	12	11-Oct-2020
Dielectric Assessment Kit	Speag	DAK 200MHz to 20GHz	4690	-	TU
Dielectric Probe Stand	Speag	Stand	4691	-	TU
Network Analyser	Keysight Technologies	E5063A	5018	12	18-Jul-2021
Hygropalm Hygrometer	Rotronic	HP21	5264	12	15-Jul-2021
Data Acquisition Electronics	Speag	DAE 4 - SD 000 D04 BN	5327	12	09-Jun-2021
Validation Dipole (5GHz)	Speag	D5GzV2	5328	12	27-Feb-2021
Validation Dipole (2450MHz)	Speag	D2450V2	5329	12	24-Jun-2021
Dosimetric SAR Probe	Speag	EX3DV4	5330	12	22-Jun-2021
Body Phantom	Speag	Oval Flat Phantom ELI v8.0	5333	-	TU
Device Holder	Speag	MD4HHTV5	5335	-	TU
Measurement server	Speag	DASY 6 Measurement Server	5337	-	TU
Robot	Stäubli	TX90 XL	5340	-	TU
Power Source for SAR system validation	Speag	POWERSOURCE1-SE UMS 160 BA	5371	12	09-Dec-2020
MBBL Fluid	Speag	Batch 3	N/A	Weekly	21-Sept-2020

TU - Traceability Unscheduled

3.2 TEST SOFTWARE

The following software was used to control the TÜV SÜD DASY Systems.

Instrument	Version Number
DASY system	52.10.2(1495)

3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required KDB 865665.

The dielectric properties of the tissue simulant liquids used for the SAR testing at TÜV SÜD are as follows:

Fluid Type and Frequency	Relative Permittivity Target (εr)	Relative Permittivity Measured (εr)	Conductivity Target (S/m)	Conductivity Measured (S/m)	Date	Fluid Temperature °C
MBBL @ 2450 MHz	52.70	52.34	1.95	1.98	03/09/2020	21.9
MBBL @ 5200 MHz	49.01	47.48	5.30	5.36	03/09/2020	21.9
MBBL @ 5300 MHz	48.88	47.27	5.42	5.51	03/09/2020	21.9
MBBL @ 5500 MHz	48.61	46.85	5.65	5.80	03/09/2020	21.9
MBBL @ 5600 MHz	48.47	46.66	5.77	5.94	03/09/2020	21.9
MBBL @ 5800 MHz	48.20	46.29	6.00	6.24	03/09/2020	21.9
MBBL @ 2450 MHz	52.70	53.23	1.95	1.98	04/09/2020	22.5
MBBL @ 5200 MHz	49.01	48.76	5.30	5.24	04/09/2020	22.5
MBBL @ 5300 MHz	48.88	48.55	5.42	5.38	04/09/2020	22.5
MBBL @ 5500 MHz	48.61	48.16	5.65	5.67	04/09/2020	22.5
MBBL @ 5600 MHz	48.47	47.98	5.77	5.81	04/09/2020	22.5
MBBL @ 5800 MHz	48.20	47.63	6.00	6.11	04/09/2020	22.5
MBBL @ 2450 MHz	52.70	53.43	1.95	2.02	09/092020	23.0
MBBL @ 5200 MHz	49.01	48.53	5.30	5.41	09/092020	23.0
MBBL @ 5300 MHz	48.88	48.30	5.42	5.55	09/092020	23.0
MBBL @ 5500 MHz	48.61	47.86	5.65	5.84	09/092020	23.0
MBBL @ 5600 MHz	48.47	47.66	5.77	5.98	09/092020	23.0
MBBL @ 5800 MHz	48.20	47.28	6.00	6.28	09/092020	23.0

3.4 TEST CONDITIONS

3.4.1 Test Laboratory Conditions

Ambient temperature: Within +15°C to +35°C.
The actual temperature during the testing ranged from 21.1°C to 23.2°C.
The actual humidity during the testing ranged from 43.1% to 63.1% RH.

3.4.2 Test Fluid Temperature Range

Frequency	Fluid Type	Min Temperature °C	Max Temperature °C
2402 - 2480 MHz	MBBL	20.8	20.8
5180 - 5320 MHz	MBBL	21.2	22.2
5500 - 5720 MHz	MBBL	20.8	22.2
5745 - 5825 MHz	MBBL	21.2	22.2

3.4.3 SAR Drift

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift was recorded as 0.20 dB

3.5 MEASUREMENT UNCERTAINTY

Full SAR Measurements, 300 MHz to 3 GHz

Source of Uncertainty	Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (1g)	v_i (v_{eff})
Measurement System						
Probe calibration	6.0	N	1.00	1.00	6.0	Infinity
Axial Isotropy	4.7	R	1.73	0.70	1.9	Infinity
Hemispherical Isotropy	9.6	R	1.73	0.70	3.9	Infinity
Boundary effect	1.0	R	1.73	1.00	0.6	Infinity
Linearity	4.7	R	1.73	1.00	2.7	Infinity
System Detection limits	1.0	R	1.73	1.00	0.6	Infinity
Modulation response	2.4	R	1.73	1.00	1.4	Infinity
Readout electronics	0.3	N	1.00	1.00	0.3	Infinity
Response time	0.8	R	1.73	1.00	0.5	Infinity
Integration time	2.6	R	1.73	1.00	1.5	Infinity
RF ambient noise	3.0	R	1.73	1.00	1.7	Infinity
RF ambient reflections	3.0	R	1.73	1.00	1.7	Infinity
Probe positioner	0.4	R	1.73	1.00	0.2	Infinity
Probe positioning	2.9	R	1.73	1.00	1.7	Infinity
Max SAR Evaluation	2.0	R	1.73	1.00	1.2	Infinity
Test sample related						
Device Positioning	2.9	N	1.00	1.00	2.9	145
Device Holder	3.6	N	1.00	1.00	3.6	5
Input Power and SAR Drift	5.0	R	1.73	1.00	2.9	Infinity
Phantom and Setup						
Phantom uncertainty	6.1	R	1.73	1.00	3.5	Infinity
SAR Correction	1.9	R	1.73	1.00	1.1	Infinity
Liquid conductivity Meas.	2.5	R	1.73	0.78	1.1	Infinity
Liquid Permittivity Meas.	2.5	R	1.73	0.23	0.3	Infinity
Temp. Unc. Conductivity	3.4	R	1.73	0.78	1.5	Infinity
Temp. Unc. Permittivity	0.4	R	1.73	0.23	0.1	Infinity
Combined Standard Uncertainty		**RSS**			11.1	361
Expanded Standard Uncertainty		**K=2**			22.2	

Full SAR Measurements, 3 GHz to 6 GHz

Source of Uncertainty	Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (1g)	v_i (v_{eff})
Measurement System						
Probe calibration	6.0	N	1.00	0.00	0.0	Infinity
Axial Isotropy	4.7	R	1.73	0.70	1.9	Infinity
Hemispherical Isotropy	9.6	R	1.73	0.70	3.9	Infinity
Boundary effect	1.0	R	1.73	1.00	0.6	Infinity
Linearity	4.7	R	1.73	1.00	2.7	Infinity
System Detection limits	1.0	R	1.73	1.00	0.6	Infinity
Modulation response	2.4	R	1.73	1.00	1.4	Infinity
Readout electronics	0.3	N	1.00	0.00	0.0	Infinity
Response time	0.8	R	1.73	0.00	0.0	Infinity
Integration time	2.6	R	1.73	1.00	1.5	Infinity
RF ambient noise	3.0	R	1.73	1.00	1.7	Infinity
RF ambient reflections	3.0	R	1.73	0.00	0.0	Infinity
Probe positioner	0.4	R	1.73	1.00	0.2	Infinity
Probe positioning	2.9	R	1.73	1.00	1.7	Infinity
Spatial x-y-Resolution	10.0	R	1.73	1.00	5.8	Infinity
Fast SAR z-Approximation	7.0	R	1.73	1.00	4.0	Infinity
Test sample related						
Device Positioning	2.9	N	1.00	1.00	2.9	145
Device Holder	3.6	N	1.00	1.00	3.6	5
Input Power and SAR Drift	5.0	R	1.73	1.00	2.9	Infinity
Phantom and Setup						
Phantom uncertainty	6.1	R	1.73	1.00	3.5	Infinity
SAR Correction	1.9	R	1.73	0.00	0.0	Infinity
Liquid conductivity Meas.	2.5	R	1.73	0.00	0.0	Infinity
Liquid Permittivity Meas.	2.5	R	1.73	0.00	0.0	Infinity
Temp. Unc. Conductivity	3.4	R	1.73	0.00	0.0	Infinity
Temp. Unc. Permittivity	0.4	R	1.73	0.00	0.0	Infinity
Combined Standard Uncertainty		**RSS**			12.2	748
Expanded Standard Uncertainty		**K=2**			24.5	

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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ANNEX A

PROBE CALIBRATION REPORT

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client TüV SüD UK

Certificate No: EX3-7536_Jun20

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7536
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	June 22, 2020

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Apr-21
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 23, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)^2)[A]	0.56	0.62	0.66	± 10.1 %
DCP (mV)[B]	98.2	95.4	96.8	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	149.3	± 2.7 %	± 4.7 %
		Y	0.00	0.00	1.00		141.3		
		Z	0.00	0.00	1.00		142.8		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	20.00	90.62	19.95	10.00	60.0	± 4.3 %	± 9.6 %
		Y	20.00	94.78	22.55		60.0		
		Z	15.80	86.47	18.21		60.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	20.00	91.97	19.68	6.99	80.0	± 2.7 %	± 9.6 %
		Y	20.00	97.37	22.77		80.0		
		Z	20.00	88.94	17.99		80.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	20.00	94.65	19.86	3.98	95.0	± 1.3 %	± 9.6 %
		Y	20.00	103.09	24.20		95.0		
		Z	20.00	91.32	18.09		95.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	20.00	101.15	21.88	2.22	120.0	± 1.0 %	± 9.6 %
		Y	20.00	108.35	25.37		120.0		
		Z	20.00	96.39	19.51		120.0		
10387-AAA	QPSK Waveform, 1 MHz	X	1.87	66.38	15.56	1.00	150.0	± 1.6 %	± 9.6 %
		Y	1.66	64.43	14.15		150.0		
		Z	1.76	65.82	15.06		150.0		
10388-AAA	QPSK Waveform, 10 MHz	X	2.48	68.86	16.23	0.00	150.0	± 1.1 %	± 9.6 %
		Y	2.12	66.25	14.71		150.0		
		Z	2.32	67.98	15.74		150.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	2.76	68.76	18.09	3.01	150.0	± 0.9 %	± 9.6 %
		Y	2.83	69.13	17.99		150.0		
		Z	3.01	70.65	18.99		150.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	3.57	66.95	15.80	0.00	150.0	± 0.8 %	± 9.6 %
		Y	3.50	66.46	15.34		150.0		
		Z	3.62	67.23	15.85		150.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.96	65.41	15.49	0.00	150.0	± 1.8 %	± 9.6 %
		Y	4.94	65.40	15.34		150.0		
		Z	4.83	65.11	15.28		150.0		

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	56.0	422.59	36.26	15.30	0.00	5.03	0.27	0.38	1.00
Y	51.4	385.96	35.71	13.19	0.00	5.08	1.40	0.22	1.01
Z	51.2	384.56	35.82	15.57	0.00	5.02	1.24	0.23	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	75.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an *Area Scan* job.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
2450	39.2	1.80	7.75	7.75	7.75	0.30	0.92	± 12.0 %
5200	36.0	4.66	5.44	5.44	5.44	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.29	5.29	5.29	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.82	4.82	4.82	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.73	4.73	4.73	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.79	4.79	4.79	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
2450	52.7	1.95	7.69	7.69	7.69	0.33	0.94	± 12.0 %
5200	49.0	5.30	4.90	4.90	4.90	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.75	4.75	4.75	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.46	4.46	4.46	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.37	4.37	4.37	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.30	4.30	4.30	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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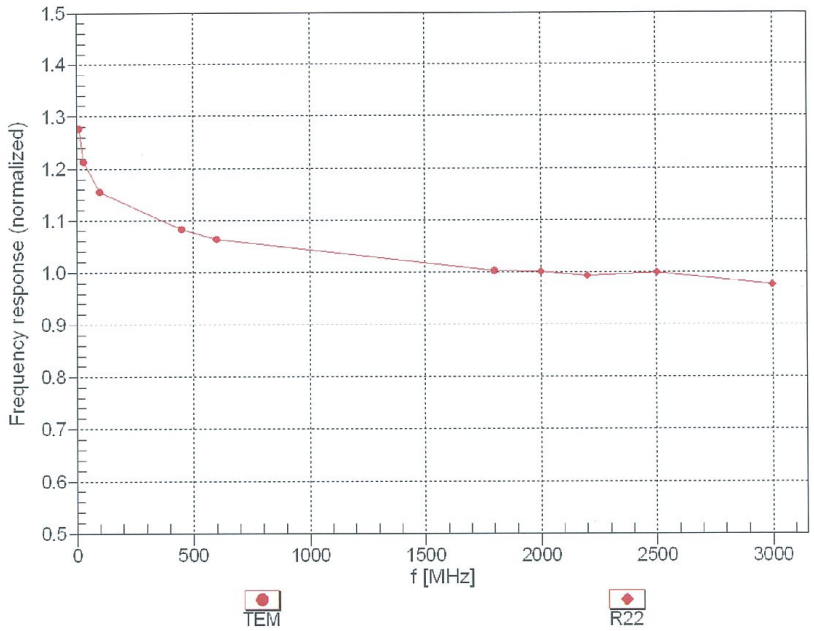
June 22, 2020

Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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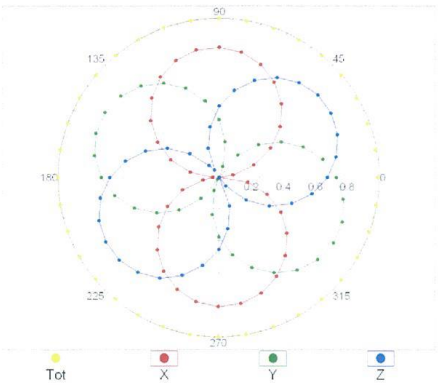
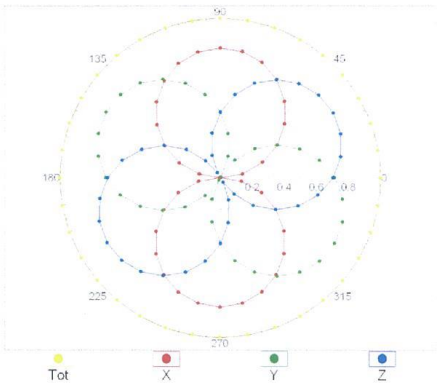
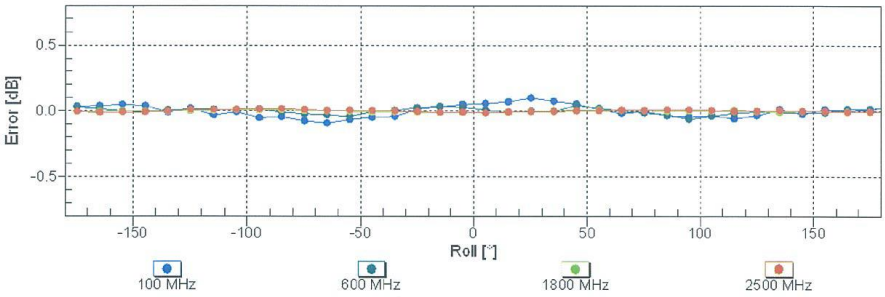
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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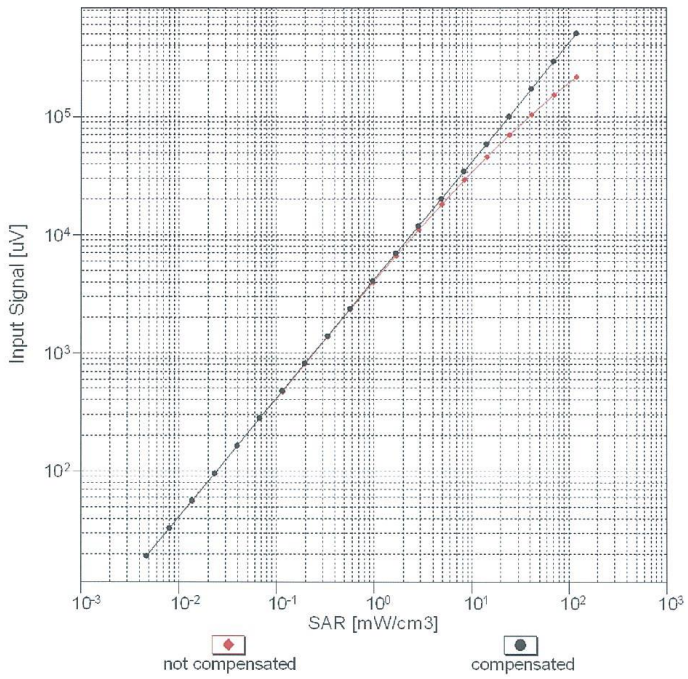
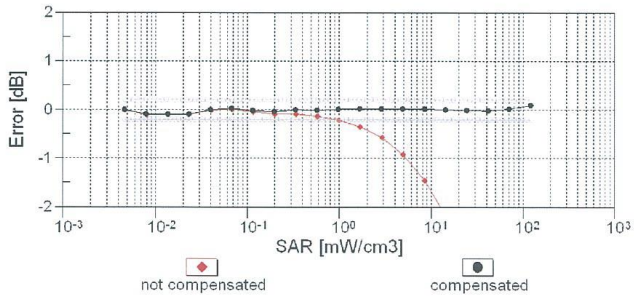
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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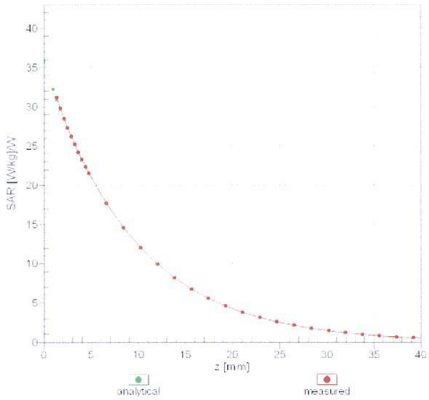
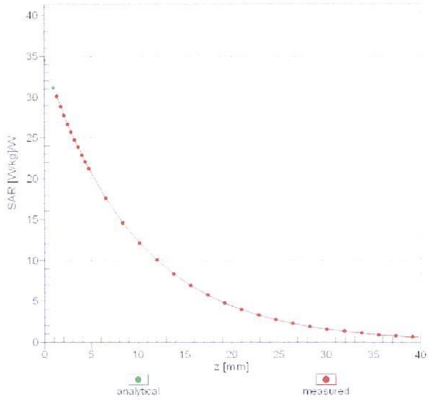
Conversion Factor Assessment

f = 2450 MHz,WGLS R22 (H_convF)

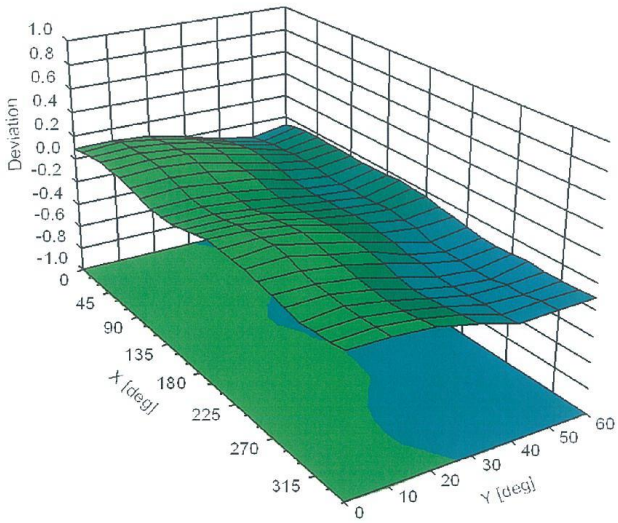


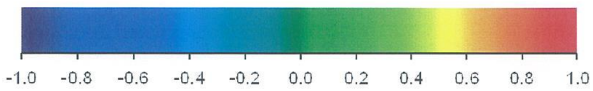
f = 2450 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc[E] (k=2)
0		CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10102	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10104	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	± 9.6 %
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	± 9.6 %

10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	± 9.6 %
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	± 9.6 %
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	± 9.6 %
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	± 9.6 %
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	± 9.6 %
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	± 9.6 %
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	± 9.6 %
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	± 9.6 %
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	± 9.6 %
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	± 9.6 %
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	± 9.6 %
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	± 9.6 %
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	± 9.6 %
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10150	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	± 9.6 %
10152	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	± 9.6 %
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	± 9.6 %
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	± 9.6 %
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	± 9.6 %
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	± 9.6 %
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	± 9.6 %
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	± 9.6 %
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	± 9.6 %
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	± 9.6 %
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10193	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10195	CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	± 9.6 %
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10197	CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10198	CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	± 9.6 %

10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	± 9.6 %
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	± 9.6 %
10224	CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10226	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10227	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10229	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10230	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	± 9.6 %
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	± 9.6 %
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	± 9.6 %
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	± 9.6 %
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	± 9.6 %
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	± 9.6 %
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	± 9.6 %
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	± 9.6 %
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	± 9.6 %
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	± 9.6 %
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	± 9.6 %
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	± 9.6 %
10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	± 9.6 %
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	± 9.6 %
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	± 9.6 %
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	± 9.6 %
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	± 9.6 %
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	± 9.6 %
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	± 9.6 %
10277	CAA	PHS (QPSK)	PHS	11.81	± 9.6 %
10278	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	PHS	11.81	± 9.6 %
10279	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	PHS	12.18	± 9.6 %
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	± 9.6 %

10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10301	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WiMAX	12.03	± 9.6 %
10302	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3CTRL)	WiMAX	12.57	± 9.6 %
10303	AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	12.52	± 9.6 %
10304	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	11.86	± 9.6 %
10305	AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC)	WiMAX	15.24	± 9.6 %
10306	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC)	WiMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC)	WiMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WiMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM,AMC 2x3)	WiMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3	WiMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	iDEN 1:3	iDEN	10.51	± 9.6 %
10314	AAA	iDEN 1:6	iDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc dc)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10317	AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	± 9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	± 9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	± 9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	± 9.6 %
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.10	± 9.6 %
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.22	± 9.6 %
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	± 9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	± 9.6 %
10400	AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc dc)	WLAN	8.37	± 9.6 %
10401	AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc dc)	WLAN	8.60	± 9.6 %
10402	AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc dc)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	± 9.6 %
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	± 9.6 %
10406	AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	CDMA2000	5.22	± 9.6 %
10410	AAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc dc)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10417	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Long)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Short)	WLAN	8.19	± 9.6 %
10422	AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	± 9.6 %
10423	AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9.6 %
10424	AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10427	AAB	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	± 9.6 %
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	± 9.6 %
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10434	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	± 9.6 %
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.56	± 9.6 %
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clippin 44%)	LTE-FDD	7.53	± 9.6 %
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Cliping 44%)	LTE-FDD	7.51	± 9.6 %
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	± 9.6 %
10451	AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	WCDMA	7.59	± 9.6 %
10453	AAD	Validation (Square, 10ms, 1ms)	Test	10.00	± 9.6 %
10456	AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc)	WLAN	8.63	± 9.6 %
10457	AAA	UMTS-FDD (DC-HSDPA)	WCDMA	6.62	± 9.6 %
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	CDMA2000	6.55	± 9.6 %
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	CDMA2000	8.25	± 9.6 %
10460	AAA	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	± 9.6 %
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.30	± 9.6 %

10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	± 9.6 %
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	± 9.6 %
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10473	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10474	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10479	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10480	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.18	± 9.6 %
10481	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	± 9.6 %
10482	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.71	± 9.6 %
10483	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, Sub)	LTE-TDD	8.39	± 9.6 %
10484	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.47	± 9.6 %
10485	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.59	± 9.6 %
10486	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.38	± 9.6 %
10487	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.60	± 9.6 %
10488	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.70	± 9.6 %
10489	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	± 9.6 %
10490	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10491	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10492	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.41	± 9.6 %
10493	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	± 9.6 %
10494	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10495	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.37	± 9.6 %
10496	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10497	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.67	± 9.6 %
10498	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.40	± 9.6 %
10499	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.68	± 9.6 %
10500	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.67	± 9.6 %
10501	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.44	± 9.6 %
10502	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.52	± 9.6 %
10503	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.72	± 9.6 %
10504	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	± 9.6 %
10505	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10506	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10507	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.36	± 9.6 %
10508	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	± 9.6 %
10509	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.99	± 9.6 %
10510	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.49	± 9.6 %
10511	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.51	± 9.6 %
10512	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10513	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.42	± 9.6 %
10514	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	± 9.6 %
10515	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc dc)	WLAN	1.58	± 9.6 %
10516	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc dc)	WLAN	1.57	± 9.6 %
10517	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc dc)	WLAN	1.58	± 9.6 %
10518	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10519	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc dc)	WLAN	8.39	± 9.6 %
10520	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc dc)	WLAN	8.12	± 9.6 %
10521	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc dc)	WLAN	7.97	± 9.6 %
10522	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc dc)	WLAN	8.45	± 9.6 %
10523	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc dc)	WLAN	8.08	± 9.6 %
10524	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc dc)	WLAN	8.27	± 9.6 %
10525	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc dc)	WLAN	8.36	± 9.6 %
10526	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc dc)	WLAN	8.42	± 9.6 %
10527	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc)	WLAN	8.21	± 9.6 %