FCC TAS validation – Part 2:

Tests under dynamic transmit power scenarios

The following samples were submitted and identified on behalf of the client as:

EUT Description	Wireless module installed in Notebook PC, ASUS ExpertBook
Brand Name	REALTEK
Model No.	RTL8852CE
Host Model Number:	P5605CAA
Family Model No.	V5605CAA
Model Difference	All models are electrically identical, different model names are for marketing purpose.
Applicant	ASUSTeK Computer Inc. 1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013
FCC ID	MSQ-RTL8852CE
Date of EUT Receipt	Jan. 28, 2026
Date of Test(s)	Apr. 08, 2026 ~ Apr. 13, 2026
Date of Issue	Apr. 17, 2026

Approved By / John Yeh
John Yeh

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

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

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Ltd. Central RF Lab or testing done by SGS Taiwan Ltd. Central RF Lab in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Ltd. Central RF Lab in writing.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2601000085E5	00	Initial creation of document	Apr. 17, 2026	Cindy Chou	

Note:

1. The mark " * " is the revised version of the report due to comments submitted by the certification.
2. Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
   And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.
SGS Taiwan Ltd. 台灣檢驗科技股份有限公司
No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號
t (886-2) 2299-3279 f (886-2) 2298-0488 www.sgs.com.tw
Member of SGS Group

Contents

1 GENERAL INFORMATION 4
1.1 Description of EUT 4
1.2 Test Facility 5
2 RTK TAS Algorithm Concept 6
2.1 Background 6
2.2 TAS-base Dynamically Transmit Power Adjustment 6
3 Overview of TAS SAR Test Proposal 10
4 TAS SAR test scenarios and procedures 12
4.1 Scenarios 1 - Change Different TX Powers 12
4.2 Scenarios 2 - Change different ECI 14
4.3 Scenarios 3 – Single point SAR 15
5 TAS SAR Validation by Conducted Power Measurement 17
5.1 Conducted Power Measurement System 17
5.2 Conducted Power Measurement Results 19
5.3 SAR Measurement Results 21
6 Conclusions 22
Appendix A. System Verification 23
Appendix B. Instruments List 25
Appendix C. SAR SYSTEM VERIFICATION 26
Appendix D. UNCERTAINTY BUDGET 30
7 SAR SYSTEM CHECK RESULTS 31
8 APPENDIXES 32
8.1 SAR_Appendix E Photographs 32
8.2 SAR_Appendix F DAE & Probe Cal. Certificate 32
8.3 SAR_Appendix G Phantom Description & Dipole Cal. Certificate 32
8.4 SAR_Appendix H Dipole Extended Calibration Verification 32

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

1 GENERAL INFORMATION

1.1 Description of EUT

EUT Description	Wireless module installed in Notebook PC, ASUS ExpertBook	
Brand Name	REALTEK	
Model No.	RTL8852CE	
Host Brand Name	ASUS	
Host Model Number:	P5605CAA	
Family Model No.	V5605CAA	
Model Difference	All models are electrically identical, different model names are for marketing purpose.	
Supported radios (TX Frequency Range, MHz)	802.11 b/g/n/ac/ax	2.4GHz (2400.0 – 2483.5 MHz)
	802.11a/n/ac/ax	5.2GHz (5150.0 –5250.0 MHz) 5.3GHz (5250.0 –5350.0 MHz) 5.6GHz (5470.0 – 5725.0 MHz) 5.8GHz (5725.0 – 5850.0 MHz) 5.9GHz (5850.0 – 5895.0 MHz)
	802.11ax	6.2GHz (5925.0 – 6425.0 MHz) 6.5GHz (6425.0 – 6525.0 MHz) 6.7GHz (6525.0 – 6875.0 MHz) 7.0GHz (6875.0 – 7125.0 MHz)
	Bluetooth	2.4GHz (2400.0 – 2483.5 MHz)

Wi-Fi TAS Algorithm Parameters Definition

P_{max} (dBm)	The maximum instantaneous output power that the transmitter is capable of producing.(Enable TAS)
$P_{max\ ,unt.}$ (dBm)	The $P_{max\ ,unt.}$ is P_{max} in accordance with all applicable tolerances and uncertainties. $P_{max\ ,unt.}$ = P_{max} –tolerances and uncertainties
P_{limit} (dBm)	The maximum time average output power. Result of ensuring DUT complies with SAR regulations. (Disable TAS ,Static SAR)
$P_{limit\ ,\ unt.}$ (dBm)	The $P_{limit\ ,\ unt.}$ is P_{limit} in accordance with all applicable tolerances and uncertainties. $P_{limit\ ,\ unt.}$ = P_{limit} - tolerances and uncertainties
SAR_{limit}	Maximum 1 g or 10 g peak spatially averaged SAR (psSAR) target for the DUT. (Disable TAS ,Static SAR)
$SAR_{limit\ ,unt.}$	The $SAR_{limit\ ,unt.}$ is SAR limit in accordance with all applicable tolerances and uncertainties. $SAR_{limit\ ,unt.}$ = SAR limit - tolerances and uncertainties

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

1.2 Test Facility

Laboratory	Test Site Address	Test Site Name	Test Engineer	Project Manager	FCC Designation number/ Registration Number	IC CAB identifier/ Company Number
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	**1F, No. 8, Alley 15, Lane 120, Sec. 1, NeiHu Road, Neihu District, Taipei City, 11493, Taiwan**	SAR 2	-	-	TW0029/ 150169	TW3702/ 23862
		SAR 6	-	-		
		SAR 8	**Jason Mo**	**Jasper Wang**		
	No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 33383, Taiwan	SAR 1	-	-	TW0028/ 200037	TW3702/ 4620E
		SAR 4	-	-		
	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan	SAR 3	-	-	TW0027/ 891563	TW3702/ 4620A
		SAR 7	-	-		

Note: Test site name is remarked on a bolded mark as an indication where measurements occurred in specific test site and address.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

2 RTK TAS ALGORITHM CONCEPT

2.1 Background

This is a proposal of dynamically TX power adjustment with the WLAN module that uses Realtek Wi-Fi chipset to comply with time-averaged SAR limit. The target platforms mentioned in this document are PC and laptop. The target devices are Wi-Fi components embedded in the PC and laptop. And there are no specific requirements for the operating system.

The following sections describe how Realtek Wi-Fi devices are capable of actively monitoring and adjusting power output to comply with exposure limits, which are based on averaged exposure over a time period when it is installed into a PC or laptop machine.

2.2 TAS-base Dynamically Transmit Power Adjustment

SAR (Specific Absorption Rate) is an RF safety regulation required in a number of countries, various governments have defined maximum SAR levels for RF energy emitted by wireless devices. Hence the compliance to SAR limit is required in the system where antenna radiation is in close proximity to human contact.

In order to meet the SAR limit requirement, the traditional SAR mitigation method of wireless device is to limit the transmit power in a predefined fixed value, such as 17dBm. It means that the transmitted power can never exceed the 17dBm.

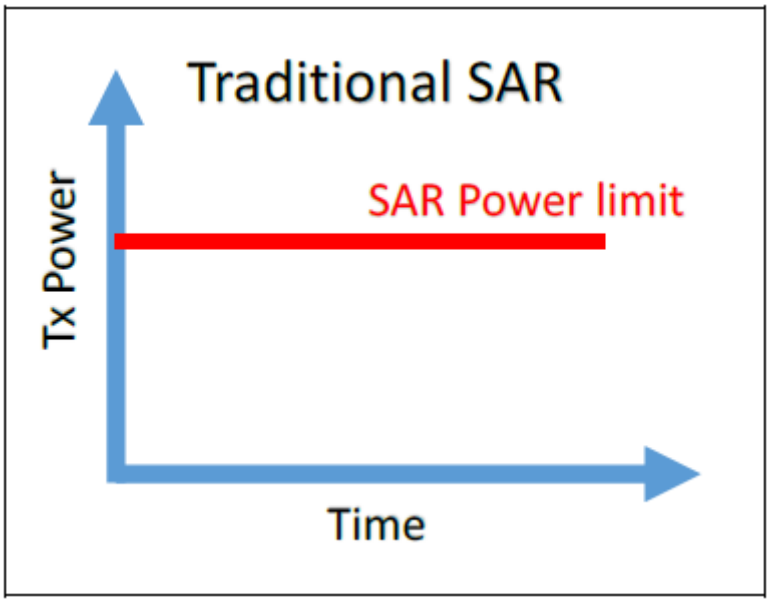


Figure 2-1

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Recently, some regulatory authorities have started to adopt the perspective of the time average SAR to define the compliance of SAR requirement. Base on the concept of time averaged SAR, a new method is proposed that can control the transmitted averaged power over any times-interval. With the new method the data throughput can be greatly increased for several tens of seconds, while still being compliant with current safety standards. The key is using appropriate power control algorithms.

The concept of time-averaged power is shown in figure 2-2. Considering a system without SAR limit, the transmitted power should change over time depends on the data rate, bandwidth or other factors. And then the time-averaged power can be calculated as:

$$Average_RF_Exposure = (\sum RF_Power_PerPacket * Tx_Time_Period) / AverageTimePeriod$$

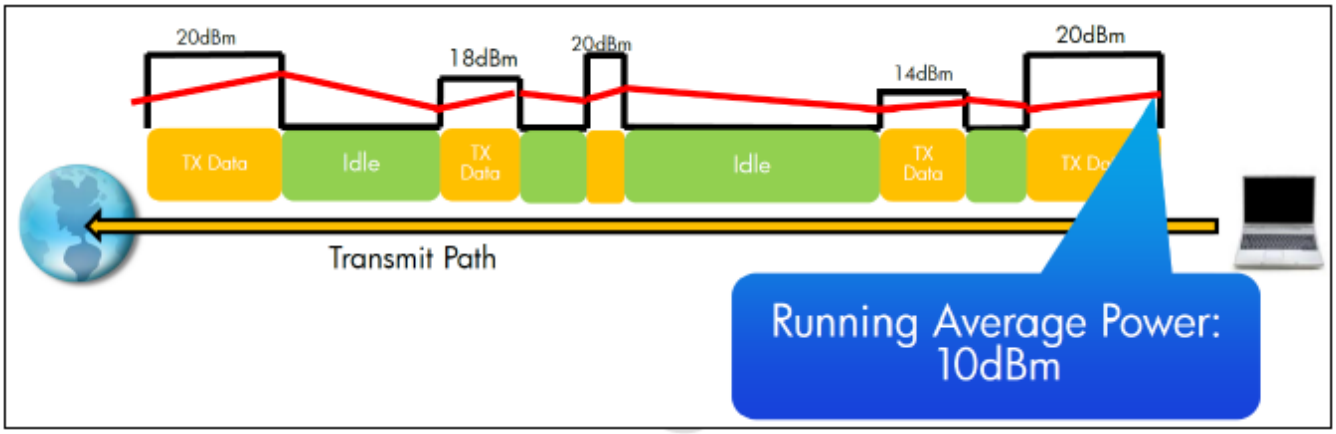


Figure 2-2

If the calculated time-averaged power over a time period (e.g. 100 seconds) is less than maximum SAR levels defined by regulatory authorities, then it can be considered that the SAR limit of wireless device is not violated over this time period. And if the time-averaged power over any 100s-interval is less than SAR limit, then we can say that the SAR compliance of wireless device is totally met.

Based on the average time period provided by FCC. Maximum 100 seconds below 3 GHz, 60 seconds from 3-6 GHz, 30 seconds maximum from 6-10 GHz. The power averaging time in the algorithm will also be developed according to this specification.

In order to achieve the above goals, the wireless device is designed to be capable of actively monitoring and adjusting transmitted power over time.
The mechanism of time average monitoring has the following basic functions:

- Can continuously track all the outgoing packets (both data and control).
- Can continuously calculate the averaged transmitted power of a pre-defined sliding window (e.g., 100s)
- Can dynamically adjust transmit power when the averaged transmitted power is less than the well-defined lower bound or reaches the upper bound.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

2.2.1 Periodically Tx duty cycle measurement

In Realtek Wi-Fi devices, we track all transmitted packets from the perspective of duty cycle instead of packet-by-packet tracking, It means the percentage of transmit time to total time in a cycle can be calculated periodically. Then we can define the time duration of the cycle as the parameter *tc* that will be used in in next section. Tracking the transmitted power over a cycle of fixed time duration can reduce the system overhead on handling TAS mechanism.

2.2.2 Periodically Averaged transmitted power calculation

With a pre-defined time period of transmit duty cycle *tc*, the average transmitted power can be calculated as:

$$New_Average = old_Tx_average * ((t - tc) / t) + ((Tx_new_value * tc / t)$$

Where:

- **Rolling average:** The averaged transmitted power over a time period.
- **t:** Total time of rolling average window (i.e. 100s)
- **tc:** Current time duration of latest Tx duty cycle measurement
- **old_Tx_average:** Previous rolling transmitted power average
- **Tx_new_value:** Current transmitted power associated with latest Tx duty cycle

This rolling averaged transmitted power will be updated periodically at each time when latest Tx duty cycle measurement is finished. According to **Tx_new_value**, driver can dynamically adjust transmit power limit for next cycle of Tx duty measurement.

2.2.3 Dynamically adjust transmit power.

With the result of periodically calculation of rolling averaged transmitted power, Realtek Wi-Fi device will dynamically determine the maximum transmit power limit to make sure every lastest rolling averaged transmit power can be under SAR limit of specific regulatory authority.

The algorithm for adjusting maximum transmit power is simply defined as follows.

- Definitions used in algorithm
  - **TX_PWR_DPR_ON_TH (dBm):**
    Transmit power threshold to trigger Dynamic Power Reduction (DPR) on.
  - **TX_PWR_DPR_OFF_TH (dB):**
    This will configure the threshold to turn off DPR (regain max power ceiling) whenever the average power has reached below this threshold.
  - **TX_PWR_DPR_ON (dB):**
    The transmit power limit is to be enforced when DPR is on.
  - **Rolling_AVG_TX_PWR (dB):**
    The averaged transmitted power over a time period.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

- Algorithm for adjusting transmit power dynamically
  1. The Dynamic Power Reduction (DPR) mechanism will be turned off from initial state.
  2. If the rolling averaged Tx power is above the value **TX_PWR_DPR_ON_TH**, Wi-Fi driver will turn on DPR mechanism and enforce to use a pre-defined fixed value **TX_PWR_DPR_ON** to limit all transmit packets from now on.
  3. If the rolling averaged Tx power is reached below **TX_PWR_DPR_OFF_TH**, Wi-Fi driver will turn off DPR mechanism and start to use maximum power this device can support to transmit packets.

Figure 2-3 shows the rolling averaged transmitted power (black line in the figure) over time if the above algorithm is applied. We can see that the rolling average transmitted power will always be less than TX_PWR_DPR_ON_TH, which is defined as the SAR limit in traditional SAR requirements. This can ensure that this dynamically transmitted power adjusting mechanism can meet FCC SAR compliance on the aspect of time averaging exposure.

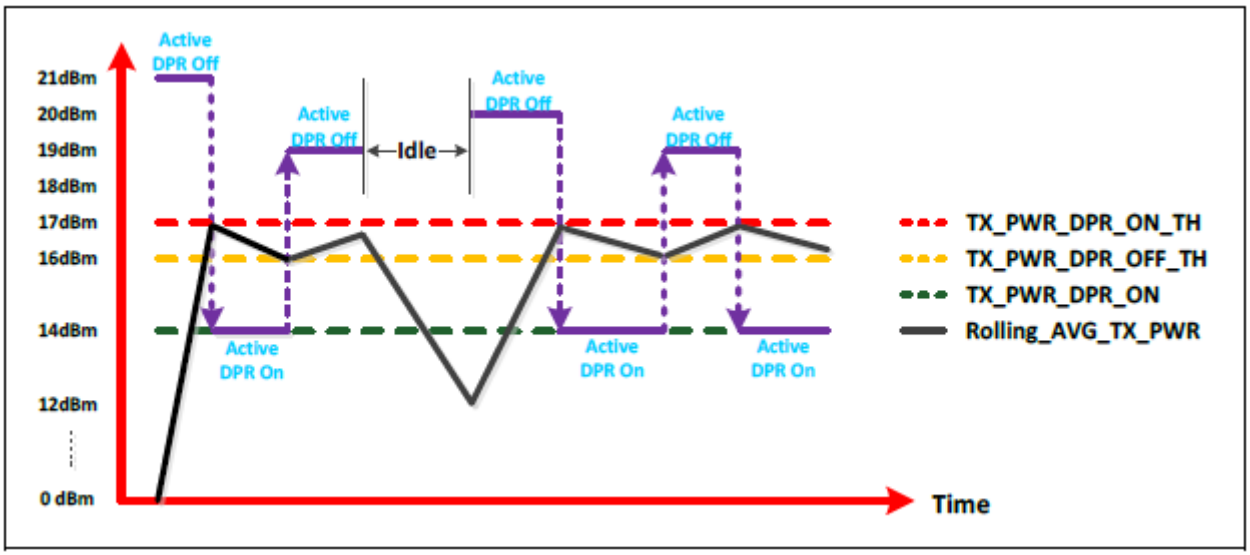


Figure 2-3

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

3 OVERVIEW OF TAS SAR TEST PROPOSAL

At present, the main application market of Realtek (RTK) chips is notebook computers. The table 3-1 is a summary of the functions supported by RTK. To complete the functions shown in the table 3-1, at least two antennas are required. But if the customer only supports SISO and MCC functions, at least one antenna is required. RTK also has support this application chipsets. This algorithm certification uses the 8852CE chipsets. It supports WIFI 6 and two Spatial Streams. Number of antennas required is two.

Table 3-1 RTK Wi-Fi Chipset Support Functions

	Wi-Fi 5	Wi-Fi 6	Wi-Fi 7
SISO	Support	Support	Support
MIMO	Support	Support	Support
MCC	Support	Support	Support
DBDC	X	Support	Support
MLO	X	X	Support

The WIFI function TAS support table is as follows, In the first phase of TAS development, RTK only support the following functions. In the future, RTK will add band handover, simultaneous transmission functions in the second phase, and will use the MCC or DBDC function to do the above verification. And provide testing procedures and reports to the FCC for review.

Table 3-2 RTK WIFI Function TAS Support

Function name	**Directions**	**TAS support**
SISO	Single Input Single Output	Yes
MIMO	Multiple Input Multiple Output	Yes
MCC	Multi-Channel Con-current	No , Not Support TAS.
DBDC	Dual Band Con-Current	No , Not Support TAS.
MLO	Multi-Link Operation	No , Not Support TAS.

According to the above RTK Wi-Fi functions, the antenna usage can be summarized in table3-3.

Table 3-3 Wi-Fi Application Configurations - Antenna

Conditions	Ant0	Ant1	Ant0 & Ant1
2.4G Band SISO	SISO	SISO	SISO (2TX 1SS)
5G Band SISO	SISO	SISO	SISO (2TX 1SS)
6G Band SISO	SISO	SISO	SISO (2TX 1SS)
2.4G Band MIMO	X	X	MIMO (2TX 2SS)
5G Band MIMO	X	X	MIMO (2TX 2SS)
6G Band MIMO	X	X	MIMO (2TX 2SS)

Note:
1. 2TX 1SS is two transmit one spatial streams. The two antenna data are the same.
2. 2TX 2SS is two transmit two spatial streams. The two antenna data are different.
3. The algorithm for antenna 0 or antenna 1 is the same. So only one antenna shall be selected for TAS verification.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

According to the RTK TA function, we design several Wi-Fi test scenarios to verify the correctness of the TAS verification algorithm. Wi-Fi test scenarios as below in table 3-4 :

Table 3-4 Wi-Fi TAS verification scenarios

Scenarios 1	Change different tx powers in one test. Use different tx power changes to verify the correctness of the verification algorithm.
Scenarios 2	Change different ECI (Exposure Condition Index) in one test. Verify the correctness of the verification algorithm under different ECI.
Scenarios 3	Signal point SAR

Note:
1. This DUT has no different ECIs. Therefore, Scenarios 2 is not required.

The verification algorithm uses 5G CH157 (802.11a). The channel is selected following section 4.1.1., and it can better verify the limit of the verification algorithm. The algorithm for antenna 0 or antenna 1 is the same. Choosing test on antenna Main is to verify the correctness of this matter.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

4 TAS SAR TEST SCENARIOS AND PROCEDURES

This chapter will define various test scenario details and related steps.

4.1 Scenarios 1 - Change Different TX Powers

Test scenario 1 can be the following situations:
Use maximum power to observe 3 TAS cycles and verify the correctness of the TAS algorithm through the above methods. The correct algorithm behavior will be SAR limit plus 4dB and SAR limit minus 2 dB. And the average power is always less than the SAR exposure standard.

SAR limit is 1.6W/kg (1g SAR) or 4W/kg (10g SAR)

4.1.1 Scenarios 1 – Frequency Band Selection

Since the algorithm does not divide frequency bands, the function of each frequency is the same. The idea of selecting test frequency is as follows:

1. $P_{max\ ,unt.}$ is greater than $P_{limit\ ,\ unt.}$
   If $P_{max\ ,unt.}$ is less than $P_{limit\ ,\ unt}$, the power of TAS algorithm will be limited by $P_{max\ ,unt.}$ There will be no power change at this frequency.

2. Select one channel with $P_{max\ ,unt}$ - $P_{limit\ ,\ unt}$ is highest.
   Because $P_{max\ ,unt.}$ power will not be suppressed, the maximum dynamic range of power changes can be obtained, the instantaneous power of the transmitter can be greater.
   The following table 4-1 lists the maximum $P_{max\ ,unt}$ - $P_{limit\ ,\ unt}$ frequencies of different bands, Since the algorithm does not divide the frequency and is different. Therefore, only one frequency is selected for each scenarios for testing (as shown in the table 4-1).

Table 4-1 Wi-Fi TAS verification scenarios

	2G CH6 20M	5G CH157 20M	6G CH38 80M
$P_{max\ ,unt}$ (52CE),	17.5 dBm	16.5 dBm	12dBm
$P_{limit\ ,\ unt}$ (52CE),	13.5 dBm	12.5 dBm	8 dBm
Scenarios case	X	Scenarios1 & 3	X

Note:
2. This DUT has no different ECIs. Therefore, Scenarios 2 is not required.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

4.1.2 Scenarios 1 – Procedures

Complete the SAR test of Scenario 1 according to the following test steps:

Step 1: Set AP Band and Channel according to section 4.1.1.
Step 2: Connect to AP.
Step 3: Perform script settings country code and TAS enable.
Step 4: Clear Spectrum data and execute iperf.
Step 5: Execute script settings scenarios. (Scenario 1)
Step 6: Convert the measured conducted TX power from Step 5 into 1g-SAR or 10g-SAR value using the following equation.

Mathematical expression:

For TAS SAR :
1g or 10g SAR (t) = (instantaneous conducted TX power (t) / $P_{limit\ ,\ unt.}$) * 1g or 10g SAR $_{limit\ ,unt}$

SAR limit is 1.6W/kg (1g SAR) or 4W/kg (10g SAR)

Step 7: Plot and label relevant parameters. Two pictures will be provided.
One is time-average power relationship diagram. other is time-average SAR relationship diagram.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

4.2 Scenarios 2 - Change different ECI

This scenario tests that when the exposure condition index changes, the time-averaged TX power is always less than the predefined $SAR_{target,nom}$, This application occurs when the laptop switches between tablet and laptop modes. This scenario selects any frequency band with two different $SAR_{limit,unt}$ values less than $P_{SAR\text{-}max,nom}$ in the two ECI groups. One test is sufficient as the functional operation is technology and frequency band independent.

Note:
1. This DUT has no different ECIs. Therefore, This Scenario is not required to be tested.

4.2.1 Scenarios 2 – Procedures

Complete the SAR tested of Scenario 2 according to the following test steps:

Step 1: Set AP Band and Channel. The channel selection follows section 4.1.1
Step 2: Connect to AP.
Step 3: Execute script settings country code and TAS enable.
Step 4: Clear Spectrum data and execute iperf.
Step 5: Execute script settings scenarios. (Scenarios 2, ECI change)
When the TAS algorithm is stable (3 TAS cycles), switch to another ECI and execute 3 TAS cycles to verify the correctness of the algorithm. In this situation, the conducted power is set to max power.
Step 6: Convert the measured conducted TX power from Step 5 into 1g-SAR or 10g-SAR value using the following equation.

Mathematical expression:

$$\text{1g or 10g SAR_1 (t)} = (\text{inst. conducted TX power_1 (t)} / P_{limit,unt_1}) * \text{1g or 10g } SAR_{limit,unt_1}$$

$$\text{1g or 10g SAR_2 (t)} = (\text{inst. conducted TX power_2 (t)} / P_{limit,unt_2}) * \text{1g or 10g } SAR_{limit,unt_2}$$

$$\text{Normalize SAR_1(t)} = ((1/T_{SAR}) * \int_{t-TSAR}^{t} \text{1g or 10g SAR_1 (t)}\ dt\ ) / \text{FCC SAR limit (1g SAR)}$$

$$\text{Normalize SAR_2(t)} = ((1/T_{SAR}) * \int_{t-TSAR}^{t} \text{1g or 10g SAR_2 (t)}\ dt\ ) / \text{FCC SAR limit (1g SAR)}$$

Conditions for passing :

$$(\text{Normalize time-average SAR_1(t) \& Normalize time-average SAR_2(t)}) \leqq 1$$

Step 7: Plot and label relevant parameters. Two pictures will be provided.
One is time-average power relationship diagram. Another is the normalize time-average SAR relationship diagram.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

4.3 Scenarios 3 – Single point SAR

Single point SAR measurements shall be performed to validate the TAS algorithm; however, compared with the requirements for conducted power measurements, fewer test cases are required: Single-point SAR measurements need to be performed only for changes in requested power and only for configurations involving a single transmitter, i.e., not for simultaneous transmission.
The purpose of this test is to connect single-point SAR to conducted power measurements and RF exposure.

4.3.1 Scenarios 3 –Single Point SAR Measurement Method

The single-point SAR measurement method is as follows,
Location of maximum SAR:
Disable the TAS algorithm and set the DUT output power to $P_{limit\ ,\ unt.}$, and perform an area scan to determine the maximum 1g SAR. Then, move the probe to the peak SAR point in the maximum 1g SAR. The remaining measurements should be taken at this point.

Point SAR $P_{limit\ ,\ unt.}$ Measurement :
Single-point SAR measurements are performed with the TAS algorithm disabled and the DUT output power set to $P_{limit\ ,\ unt.}$.
In order to ensure the stability of $P_{limit\ ,\ unt.}$, this test uses a fixed frequency tool. Because dynamic software will have a certain proportion of RX time, so the overall $P_{limit\ ,\ unt.}$ will not be concentrated.

Instantaneous Point SAR Measurement :
Enable the TAS algorithm and perform the given verification steps when measuring single-point SAR.

4.3.2 Scenarios 3 – Procedures

Since the single point SAR is connected to the conducted power, the test scenarios uses condition
1. The purpose is to compare at the same conditions.

Step 1: Set AP Band and Channel according to section 4.1.1.
Step 2: Connect to AP.
Step 3: Execute script settings country code and TAS enable.
Step 4: execute iperf and fixed frequency tool .
Step 5: Follow the measurement steps in section 4.3.1. and use scenario1 test.
Step 6: Convert the measured 1g-SAR or 10g-SAR value using the following equation.

Mathematical expression:

For TAS SAR :

$$1g \text{ or } 10g \text{ SAR } (t) = (\text{single point SAR}(t) \,/\, \text{single point SAR } P_{limit\ ,\ unt.}) * 1g \text{ or } 10g \text{ SAR}_{limit\ ,unt}$$

$$\text{time-average SAR}(t) = (1/\ T_{SAR}) * \int_{t-TSAR}^{t} 1g \text{ or } 10g \text{ SAR } (t)\ dt$$

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Step 7: Plot and label relevant parameters. one pictures will be provided.
The pictures is time-average SAR relationship diagram.

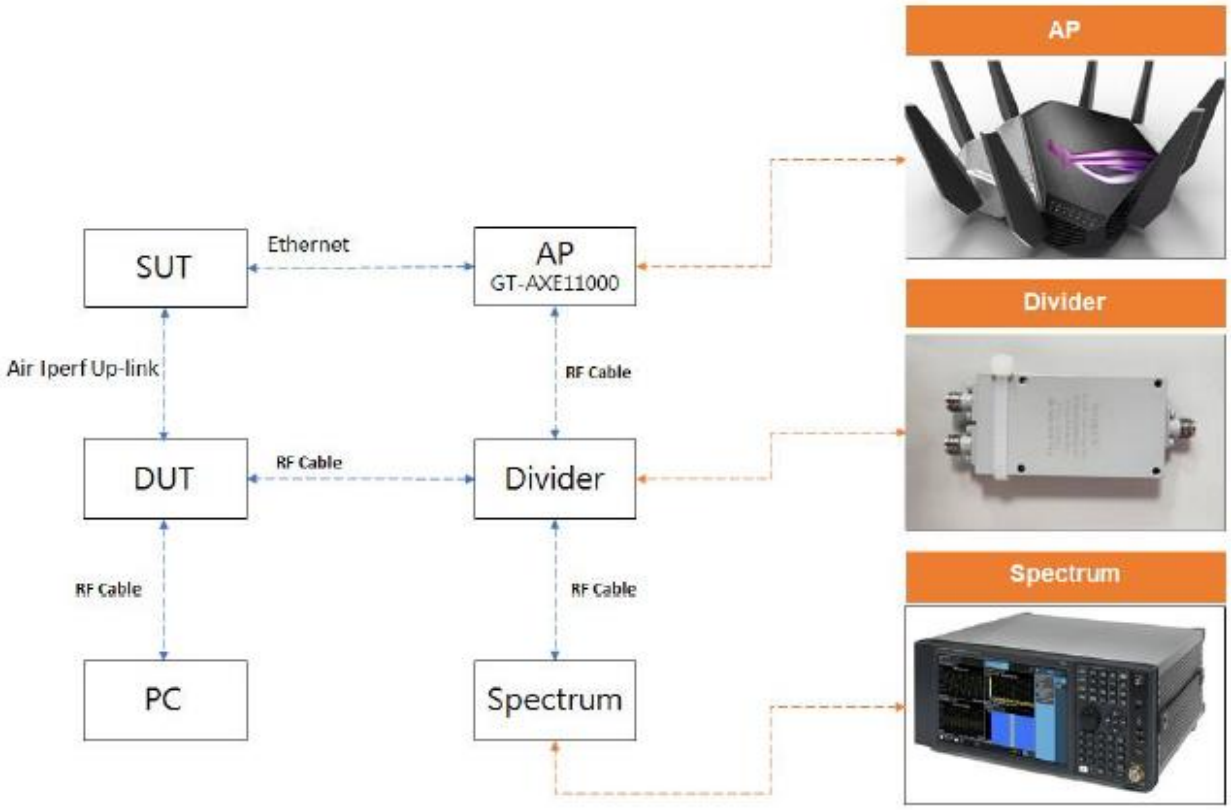
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

5 TAS SAR VALIDATION BY CONDUCTED POWER MEASUREMENT

5.1 Conducted Power Measurement System

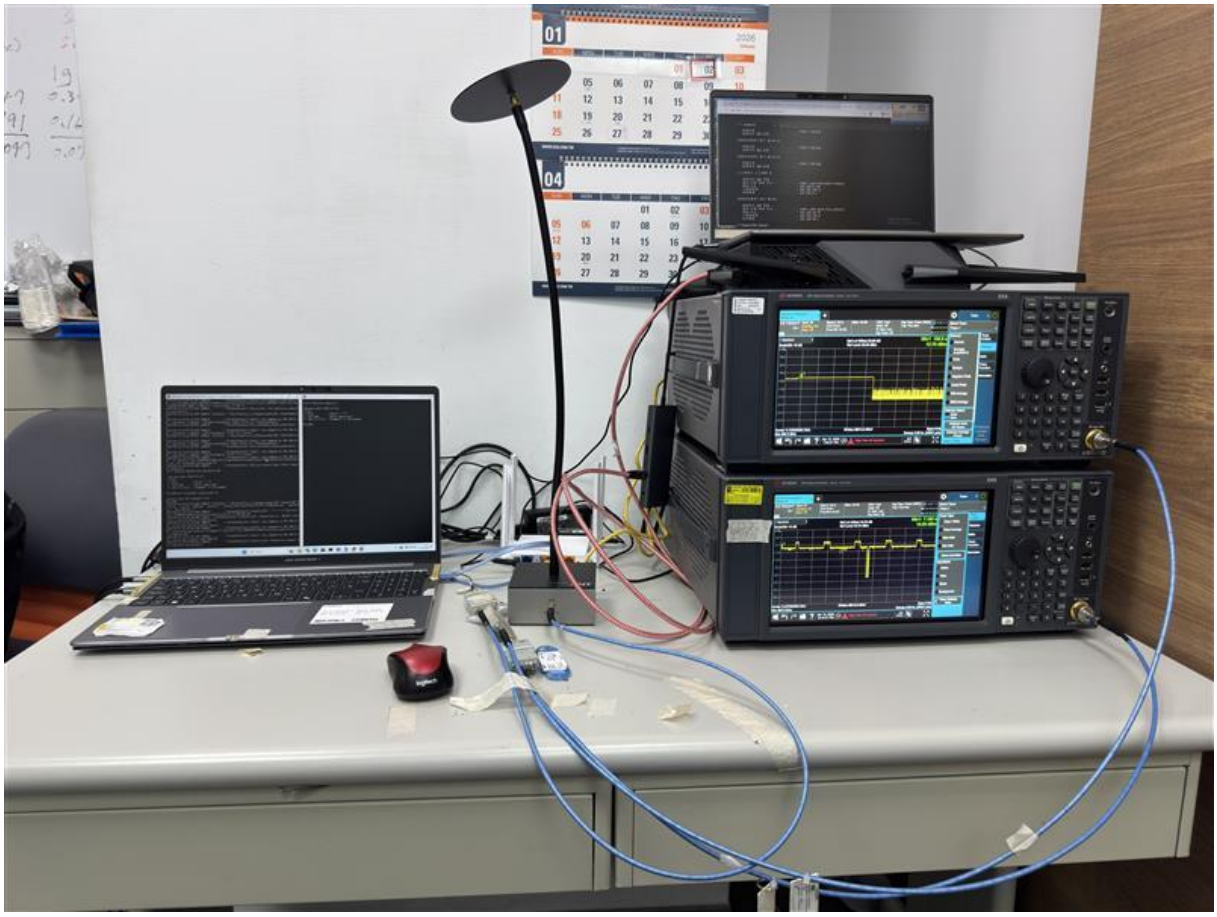
The conducted power measurement test setup is described in the following.

a. The DUT is a PC which contains Realtek 8852CE Wlan NIC.
b. DUT connects to AP via RF cable link and signal also pass through cable link to Spectrum Analyzer.
c. The SUT connects to AP via Ethernet cable and is under the same local area network with DUT.
d. DUT performs throughput tests with SUT.
e. Uplink signal power is monitored by the Spectrum Analyzer.
f. After collecting all the power results, the PC can calculate the average power values and plot the diagram.



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Actual Conducted test setup photo:



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

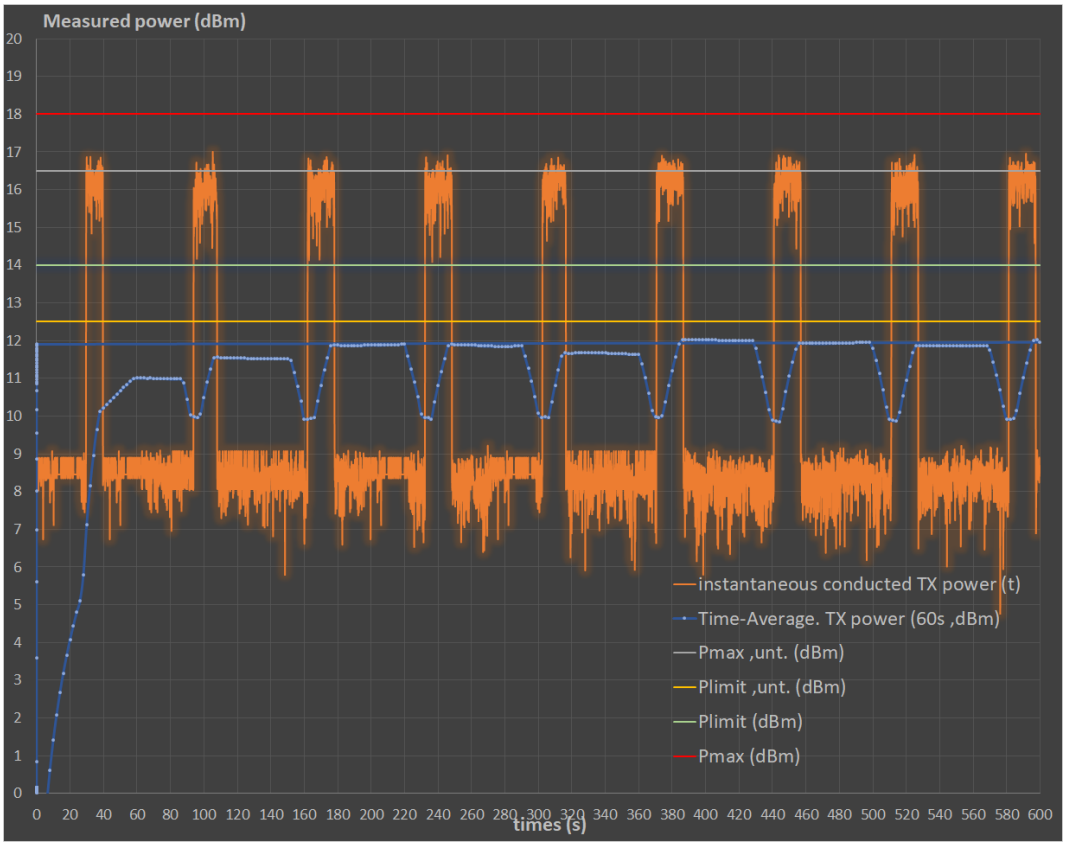
5.2 Conducted Power Measurement Results

The measurement results based on the test behaviors and steps in Chapter 4 of section 4.1 and 4.2 are placed in this chapter.

5.2.1 Scenarios 1 -Change Different TX Powers

The behavior of this test is to conduct experiments according to the description in Chapter 4-1. The relevant process and parameter calculation are as described in 4-1. This test is a measurement of the conduction power change of 5G CH157. The passing standard is that the time average power is less than P_{limit}. However, considering the uncertainties such as production, more optimizations have been done in the algorithm, so that even if the instantaneous power exceeds $P_{max\ ,unt.}$, the time average power can be less than $P_{limit\ ,\ unt.}$.

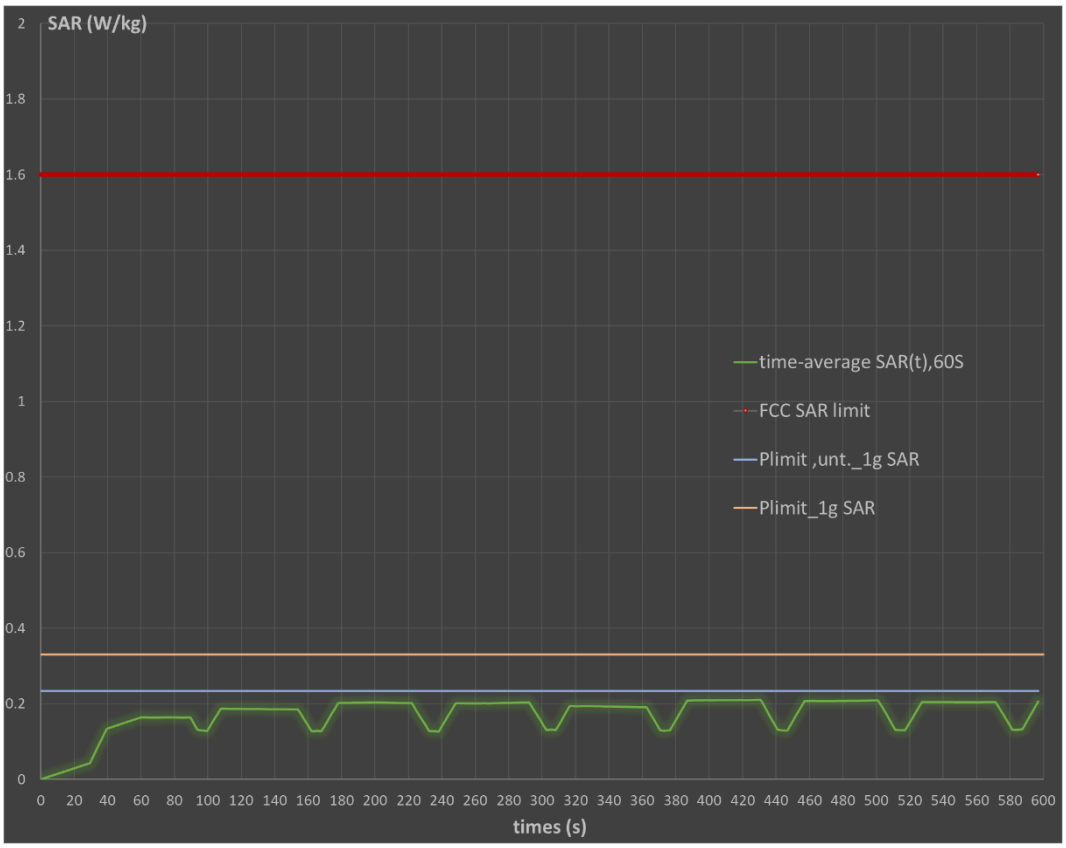
Scenarios 1: 5G CH157 Ant Main, Roll_Period_60 sec , Check_Period 1 sec					
TSAR (sec.)	P_{max} (dBm)	$P_{max\ ,unt.}$ (dBm)	P_{limit} (dBm)	$P_{limit\ ,\ unt.}$ (dBm)	Validation Result
60	18	16.5	14	12.5	PASS



Note : The instantaneous power of this sample is greater than $P_{max\ ,unt.}$, but does not exceed P_{max} . It is qualified from a production perspective.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

According to the TA SAR conversion mathematical formula in Section 4.1.2, it can be converted into the SAR form in the figure below. From the perspective of FCC SAR standards, RTK's TAS algorithm is also compliant.

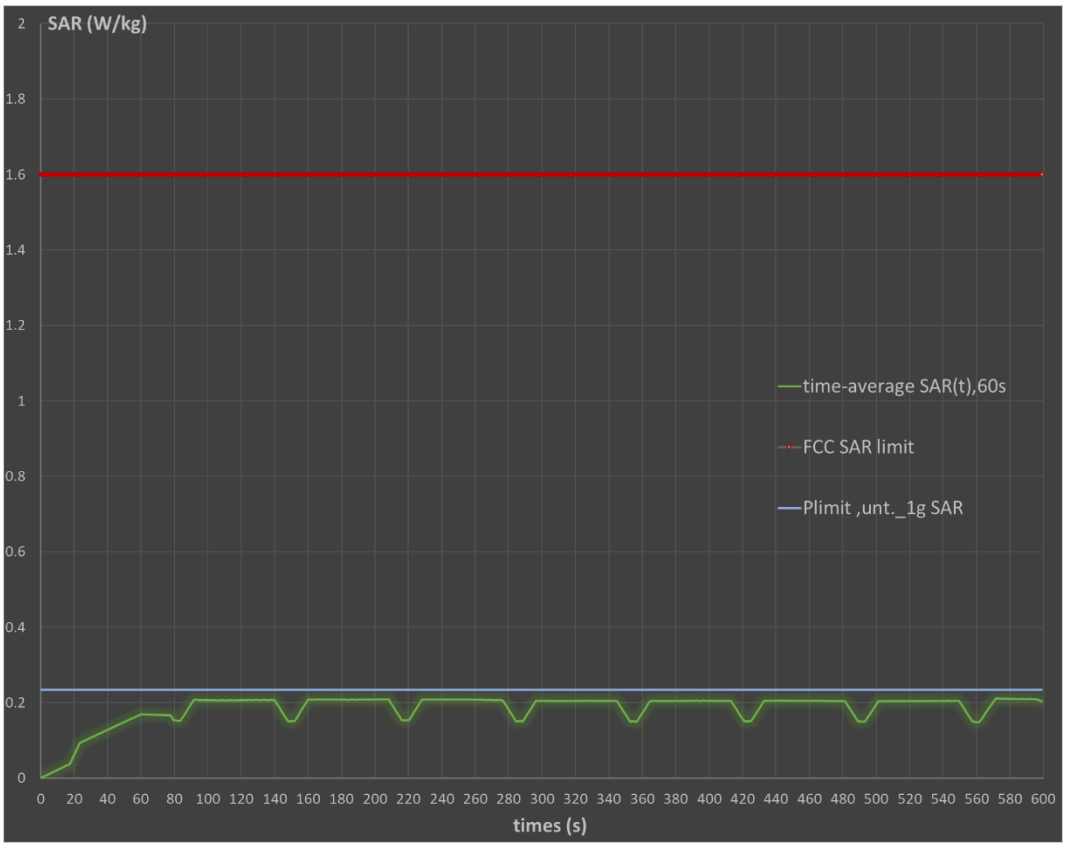


Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

5.3 SAR Measurement Results

The behavior of this test is to conduct experiments according to the description in Chapter 4-3. The relevant process and parameter calculation are as described in 4-3. This test is using SPEAG DASY8 system to measured 5G CH157.

Scenarios 3: 5G CH157 Ant Main, Roll_Period_60 sec , Check_Period 1 sec					
TSAR (sec.)	P_{max} (dBm)	$P_{max\ ,unt.}$ (dBm)	P_{limit} (dBm)	$P_{limit\ ,\ unt.}$ (dBm)	Validation Result
60	18	16.5	14	12.5	PASS



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

6 CONCLUSIONS

This TAS algorithm validation report presents Wi-Fi TA-SAR test scenarios and procedures. One test scenario is conducted for this DUT, conduction and SAR, are proposed to verify the TAS algorithm. And the conducted power is converted to the SAR value through calculation to further confirm the correctness of the TAS verification algorithm.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

APPENDIX A. SYSTEM VERIFICATION

EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 5750 MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Tip diameter: 2.5 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

PHANTOM (ELI)

Model	ELI	
Construction	The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	

DEVICE HOLDER

Construction	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	 Device Holder

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

APPENDIX B. INSTRUMENTS LIST

Equipment List					
Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
SPEAG	Data acquisition Electronics	DAE4	1824	Jul/14/2025	Jul/13/2026
SPEAG	Dosimetric E-Field Probe	EX3DV4	7686	Sep/29/2025	Sep/28/2026
SPEAG	System Validation Dipole	D5GHzV2	1349	Mar/19/2024	Mar/18/2027
Keysight	EXA Signal Analyzer	N9010B	MY60242396	Nov/14/2025	Nov/13/2026
Keysight	EXA Signal Analyzer	N9010B	MY60242392	Dec/24/2025	Dec/23/2026
R&S	MXG Analog Signal Generator	SMB100A03	182996	Apr/19/2025	Apr/18/2026
Agilent	Dual-directional coupler	772D	MY46151258	Oct/08/2025	Oct/07/2026
Agilent	Dual-directional coupler	778D	MY46151242	Sep/09/2025	Sep/08/2026
EMCI	Amplifier	EMC 2830P	980156	Calibration not required	Calibration not required
R&S	Power Meter	NRX	102191	Mar/03/2026	Mar/02/2027
R&S	Power Sensor	NRP18S	109065	Sep/05/2025	Sep/04/2026
R&S	Power Sensor	NRP18S	101974	Nov/26/2025	Nov/25/2026
SPEAG	Dielectric Assessment Kit	DAK-3.5	1342	May/19/2025	May/18/2026
Agilent	Network Analyzer	E5071C	MY46107530	Apr/24/2025	Apr/23/2026
Keysight	Economy calibration kit	85032E	MY61410221	May/29/2025	May/28/2026
SPEAG	Software	DASY 6 V16.0.2.136	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	ELI	N/A	Calibration not required	Calibration not required
TECPEL	Digital thermometer	DTM-303A	TP190085	Jan/12/2026	Jan/11/2027

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

APPENDIX C. SAR SYSTEM VERIFICATION

Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with homogeneous tissue simulating liquid. For head SAR testing, the liquid height from the ear rint (ERP) of the phantom to the liquid top surface is larger than 15cm. For body SAR testing, the liquid height fromeference po the center of the flat phantom to the liquid top surface is larger than 15cm.

Tissue Simulant Liquid measurement

The dielectric properties for this Head-simulant fluid were measured by using the SPEAG Dielectric Assessment Kit (DAK-3.5)
All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The measured conductivity and permittivity are all within ± 5% of the target values.

Measurement results of Tissue Simulant Liquid

Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev εr	% dev σ	Limit	Measurement Date
5750	35.350	5.220	36.219	5.358	2.46%	2.64%	± 5%	Apr. 13, 2026
5785	35.315	5.255	36.155	5.394	2.38%	2.65%	± 5%	Apr. 13, 2026

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

The composition of the tissue simulating liquid:

Simulating Liquids for 600 MHz -10 GHz, Manufactured by SPEAG:

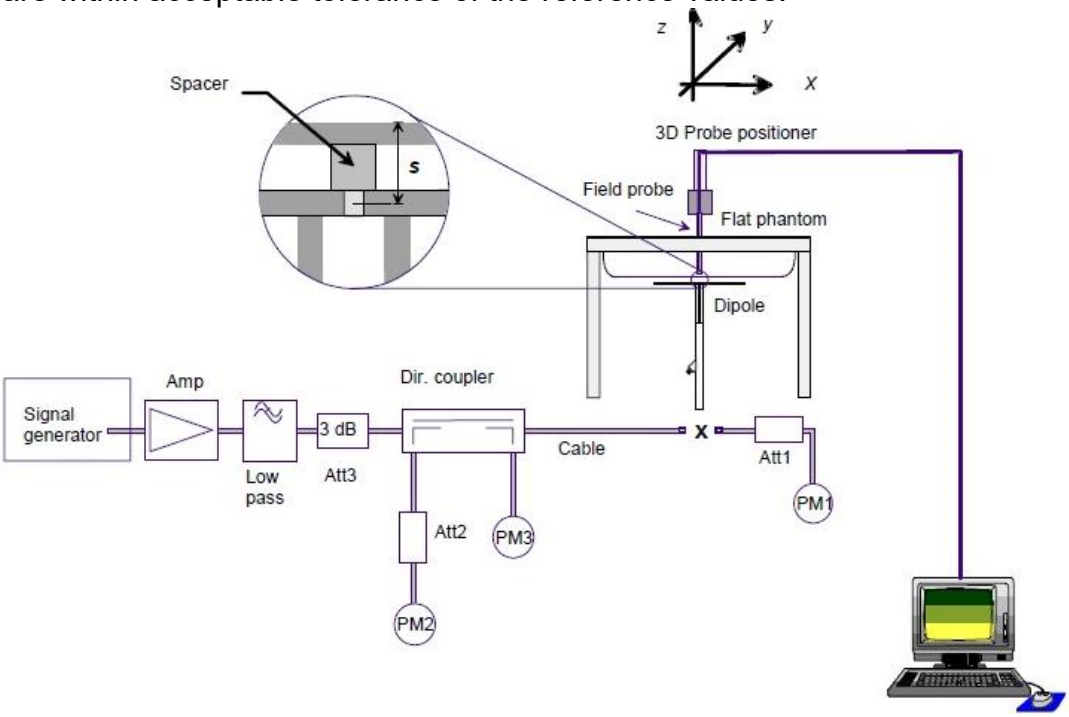
Broad-band head tissue simulating liquids	SPEAG Product	Frequency range (MHz)	Main Ingredients
	HBBL600-10000V6	600 - 10000	Water, Oil

System check

The microwave circuit arrangement for system check is sketched in below. The daily system accuracy verification occurs within the flat section of the SAM phantom and ELI phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values.

The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed with SAR values normalized to 1W forward power delivered to the dipole.

During the tests, the liquid depth from the center of the flat phantom to the liquid top surface was 15 cm above in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



The block diagram of system check

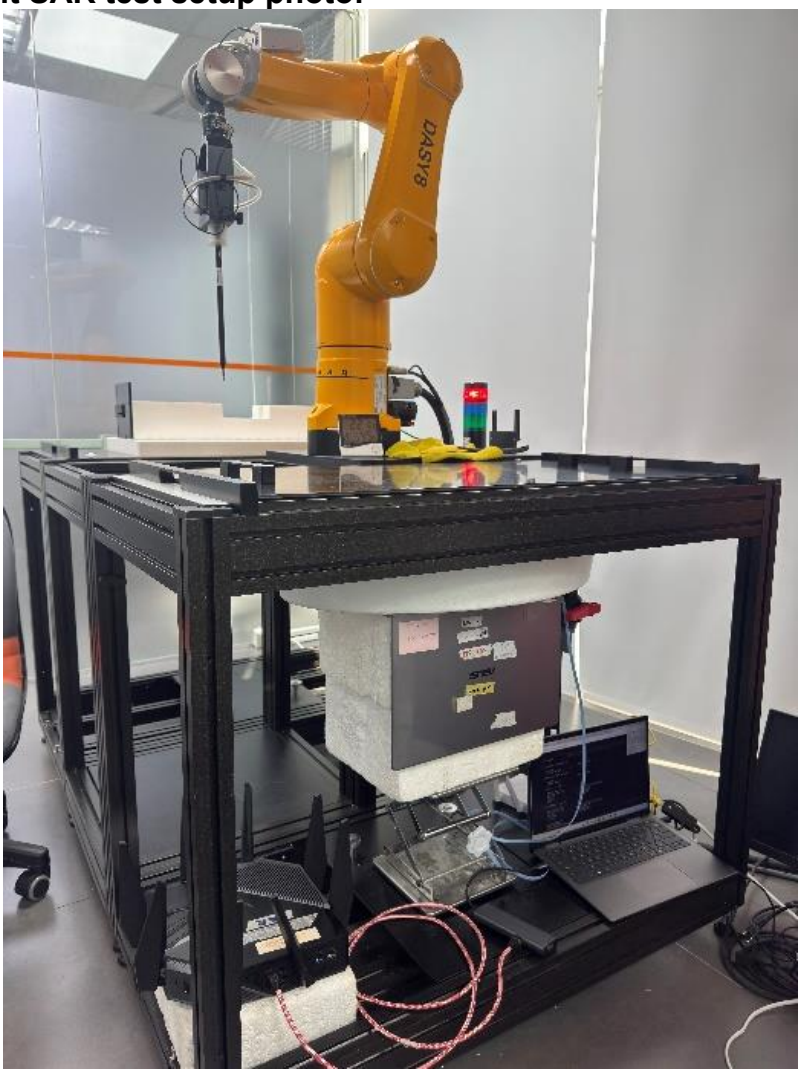
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

System check results

Validation Kit	S/N	Frequency (MHz)	1W Target 1g-SAR (W/kg)	pin=100mW Measured 1g-SAR (W/kg)	Normalized to 1W 1g-SAR (W/kg)	Deviation (%)	Limit	Measurement Date
D5GHzV2	1349	5750	80.8	8.06	80.6	-0.25	± 10%	Apr.13,2026

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Actual Single point SAR test setup photo:



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

APPENDIX D. UNCERTAINTY BUDGET

Measurement Uncertainty evaluation template for DUT SAR test (3-6G)

A	c	D	e		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probability Distributio	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.55%	N	1	1	1	1	6.55%	6.55%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom shell	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Liquid permittivity (mea.)	2.46%	N	1	1	0.64	0.43	1.57%	1.06%	M
Liquid Conductivity (mea.)	2.65%	N	1	1	0.6	0.49	1.59%	1.30%	M
Combined standard uncertainty		RSS					11.93%	11.83%	
Expant uncertainty (95% confidence interval), K=2							23.86%	23.65%	

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

7 SAR SYSTEM CHECK RESULTS

Report No. :TESA2601000085E5
Dipole_D5750-SN:1349
Ambient temperature: 22.4°C; Liquid temperature: 22.1°C

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat,HSL	FRONT, 5.00	5750.000, 75	5.64	5.358	36.219

Hardware Setup

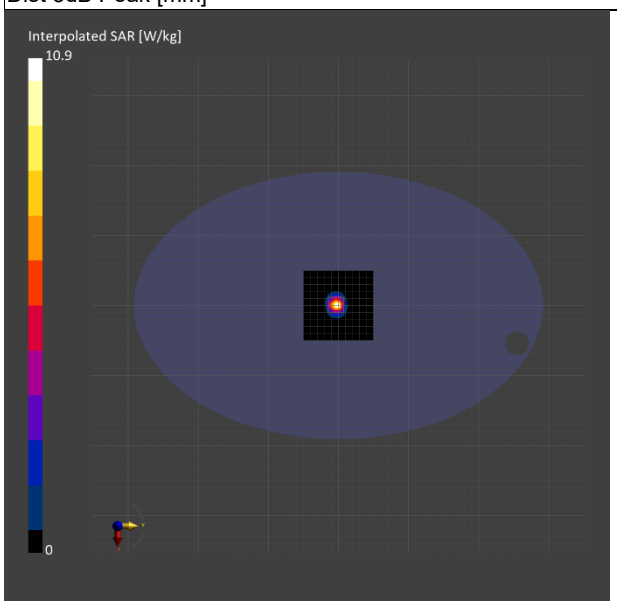
Phantom	Probe, Calibration Date	DAE, Calibration Date
ELI	EX3DV4 - SN7686, 2025-09-29	DAE4ip Sn1824, 2025-07-14

Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	100.0 x 100.0	24.0 x 24.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 1.4
Sensor Surface [mm]	3.0	1.4

Measurement Results

	Area Scan	Zoom Scan
Date	2026-04-13	2026-04-13
psSAR1g [W/kg]	7.15	8.06
psSAR8g [W/kg]	2.44	2.68
psSAR10g [W/kg]	2.11	2.30
psPDab (4.0cm2, sq) [W/m2]		N/A
Power Drift [dB]	0.03	0.02
M2/M1 [%]		59.9
Dist 3dB Peak [mm]		7.4



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

8 APPENDIXES

Refer to separated files for the following appendixes.

8.1 SAR_Appendix E Photographs

8.2 SAR_Appendix F DAE & Probe Cal. Certificate

8.3 SAR_Appendix G Phantom Description & Dipole Cal. Certificate

8.4 SAR_Appendix H Dipole Extended Calibration Verification

- End of report -

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。
This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.