Innovation, Science and Economic Development Canada
Innovation, Sciences et Développement économique Canada

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Spectrum Management and Telecommunications

Supplementary Procedure

Time-Averaged Specific Absorption Rate (TAS) Assessment Procedures for Wireless Devices Operating in the 4 MHz – 6 GHz Frequency Band

Aussi disponible en français – PRS-004

Canada

Preface

This Innovation, Science and Economic Development Canada compliance procedure describes the various technical requirements and processes to be followed when demonstrating compliance against the Canadian SAR limits of wireless devices implementing device-based time averaging methods.

Issued under the authority of
the Minister of Innovation, Science and Industry

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Director General
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Contents

1. Scope

Supplementary Procedure SPR-004, issue 1, for Radio Standards Specification RSS-102, *Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*, sets out the general test methods to be followed when carrying out an RF exposure compliance assessment of wireless devices implementing device-based time averaging methods for the management and/or mitigation of Specific Absorption Rate (SAR) in the 4 MHz – 6 GHz frequency band.

SPR-004 covers the requirements to determine SAR; however, it does not cover requirements that are based on power density (basic restrictions and reference levels above 6 GHz) or requirements to protect against nerve stimulation (NS) for the frequency range from 3 kHz to 10 MHz. A full compliance assessment of a device under test (DUT), including other transmitters within the device, must consider all exposure limits and requirements set forth in RSS-102.

2. Purpose and application

This supplementary procedure sets out the general test methods to assess the compliance with the SAR exposure limits set forth in RSS-102 for wireless wide area network (WWAN) enabled devices implementing device-based time averaging methods in the 4 MHz – 6 GHz frequency band intended to be used at 20 cm or less from the user and/or bystander.

Wireless local area network (WLAN) enabled devices as well as devices operating above 6 GHz will require additional instructions on test setup, specific test procedures and/or technical requirements. As such, prior to assessing RF exposure compliance for these devices, an inquiry must be submitted to the Certification and Engineering Bureau of Innovation, Science and Economic Development Canada (ISED), using the online form.

The inquiry shall include sufficient information pertaining to the technology and operation of the device in order for ISED to determine the applicable technical and administrative requirements for the specific device.

2.1. Consultation with ISED prior to seeking equipment certification for new and emerging technologies

When there are no standardized test procedures explicitly defined for new and emerging technologies, ISED shall be consulted to determine the required test methodologies for demonstrating compliance with applicable Canadian requirements (e.g. Canadian RF exposure limits).

To minimize delay in obtaining Canadian regulatory approval, applicants and other responsible parties (e.g. recognized test laboratories, certification bodies, product integrators etc.) should contact ISED as early as possible via the general inquiry web page.

2.2. Product certification requirements

Manufacturers, importers, distributors and vendors have a legal obligation to ensure that Category I radio apparatus introduced in the Canadian marketplace have been certified and comply with applicable Canadian technical standards.

As per the requirements set forth in Section 4 (3) of the Radiocommunication Act, "No person shall manufacture, import, distribute, lease, offer for sale or sell any radio apparatus, interference-causing equipment or radio-sensitive equipment for which technical standards have been established under paragraph 6(1)(a), unless the apparatus or equipment complies with those standards."

As per the requirements set forth in RSS-Gen , ***"No person shall import, distribute, lease, offer for sale, or sell Category I radio apparatus in Canada unless they are listed on ISED's REL".***

3. Normative references

The following documents shall be consulted for the application of SPR-004. The most recent versions of these reference publications shall be used for showing compliance.

- Radio Standards Specification RSS-102, *Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*
- RSS-Gen, *General Requirements for Compliance of Radio Apparatus*
- RSP-100, *Certification of Radio Apparatus and Broadcasting Equipment*
- *Safety Code 6: Health Canada's Radiofrequency Exposure Guidelines*
- *Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines*
- International Electrotechnical Commission/Institute of Electrical and Electronics Engineers (IEC/IEEE) 62209-1528, *Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-worn wireless communication devices - Part 1528: Human models, instrumentation and procedures (Frequency range of 4 MHz to 10 GHz)*

  Note: The principles supporting TAS are outlined in Section 7.6 and Annex Q of IEC/IEEE 62209-1528. However, ISED does not accept the TAS methodologies of IEC/IEEE 62209-1528 for compliance assessment. Guidance is hereby provided to meet ISED requirements.

Annexes within SPR-004 are normative.

ISED may consider assessment methods not covered by SPR-004 or the referenced publications. Consult ISED's Certification and Engineering Bureau website to determine the acceptability of any alternative measurement methods, or send an inquiry with detailed information on the alternative assessment method(s).

4. Definitions and abbreviations

This section contains definitions for terms used throughout this document, as well as explanations for acronyms, abbreviations and SI (International System of Units) units used herein.

4.1. Definitions

Reference period: Time period used for averaging temporally non-uniform RF field exposures. The correct interpretation of this is that exposures lasting less than reference period may exceed the RF exposure limit(s), provided that the averaged exposure over the reference period does not exceed the RF exposure limits.

Output power: Below 6 GHz, output power is considered as the conducted power.

Operating state: Represents a discrete set of configurations and modes of operation for a specific exposure condition. It contains the following parameters:

- Exposure condition
- SAR averaging volume (1g or 10g)
- Applicable testing distance

Operating state is also known as a device state index (DSI) in some implementations.

Single point SAR: Local SAR measurement. Single point SAR is not averaged within a local region based on a specific averaging mass of tissue (1 or 10 g).

4.2. Abbreviations and acronyms

This document uses the following abbreviations and acronyms:

3GPP	3rd Generation Partnership Project
5G NR	5th Generation New Radio
CEB	Certification and Engineering Bureau – the Bureau
dB	decibel(s)
dBm	dB relative to 1 milliwatt
DUT	device under test
IEC	International Electrotechnical Commission

IEEE	Institute of Electrical and Electronics Engineers
ISED	Innovation, Science and Economic Development Canada
FDD	Frequency-division duplexing
LTE	Long Term Evolution
MCS	modulation and coding scheme
psSAR	peak Spatial-Average SAR
QAM	quadrature amplitude modulation
QPSK	quadrature Phase Shift Keying
RF	radio frequency
RL	reference level
RSS	Radio Standards Specification
SAM	specific anthropomorphic mannequin
SAR	specific absorption rate
TAS	device-based time-averaged SAR
TDD	Time-division duplex
TMS	test mode software
Tol	tolerance
WCDMA	Wideband Code Division Multiple Access

5. RF exposure compliance assessment approach

The Canadian SAR limits are defined as specific thresholds averaged over any 6 minute (360 second) reference period (see RSS-102 or Health Canada’s Safety Code 6). While the limits are intrinsically based on SAR averaged over a 6 minute period, devices were not previously capable of calculating or limiting their transmit power or duty factor in real time. As a result, SAR assessments have historically been conducted with wireless devices transmitting continuously at maximum power.

In reality, wireless devices operate at much lower power levels to preserve battery life, maximize call time and optimize network performance. Evaluating wireless devices using methods supporting device-based time-averaging SAR (TAS) would enable a more representative assessment of the SAR levels a user may be exposed to during normal day-to-day use.

5.1. Time-averaging period

For compliance with the SAR limits set forth in Safety Code 6, the following requirements shall be met at all times:

- A reference period of 6 minutes (360 seconds) shall be used; and
- Compliance shall be demonstrated over any 360 second time interval (rolling time average window).

Products using a different averaging period may be considered on a case-by-case basis provided the TAS implementation yields equivalent or more conservative results than 360 seconds. An inquiry with ISED is required.

5.2. Averaging methodology

As per Health Canada's Technical Guide for Safety Code 6, the arithmetic mean shall be used when averaging SAR to demonstrate compliance with the Canadian radio frequency (RF) exposure limits. Averaging methods employing weighting factors are not accepted.

6. TAS implementation and validation considerations

The following are the criteria that shall be considered for proper validation of all TAS implementations.

6.1. Key parameters

While compliance is performed against key parameters that have static values (static power settings), validation is carried out via dynamic power evaluation. Applicants are responsible for characterizing the devices and determining the key parameters of the TAS implementation. As part of this characterization, the following parameters shall be determined:

Pmax – the maximum output power that the transmitter is capable of producing.

SAR Target Value – a nominal 1g or 10g peak-spatially averaged SAR (psSAR) design target value specified for a device to ensure compliance with the applicable SAR limit, taking into account the total device design uncertainty. Values are specified for each combination of wireless operating mode, frequency band, exposure condition, and the associated device design uncertainty.

$$\text{SAR Target Value} = \text{Applicable SAR limit} \times 10^{\frac{-\text{total device design uncertainty}}{10}} \quad (1)$$

Plimit – the maximum time-averaged output power for which the measured SAR will be within the tune-up tolerance range of the corresponding *SAR Target Value*.

$$P_{limit} = \frac{P_{max} \cdot \text{SAR Target Value}}{SAR_{Pmax}}$$

where SAR_{Pmax} is the measured SAR at *Pmax*.

Pmin – the minimum output power that is necessary to maintain the time averaged power at or below *Plimit*.

Some TAS implementations may use additional parameters such as:

Pctrl – an optional parameter that identifies a time-averaged output power threshold for switching between power control states (i.e. *Pmax* and *Pmin*) in certain TAS implementations.

All of the parameters related to output power are illustrated in Figure *1*.

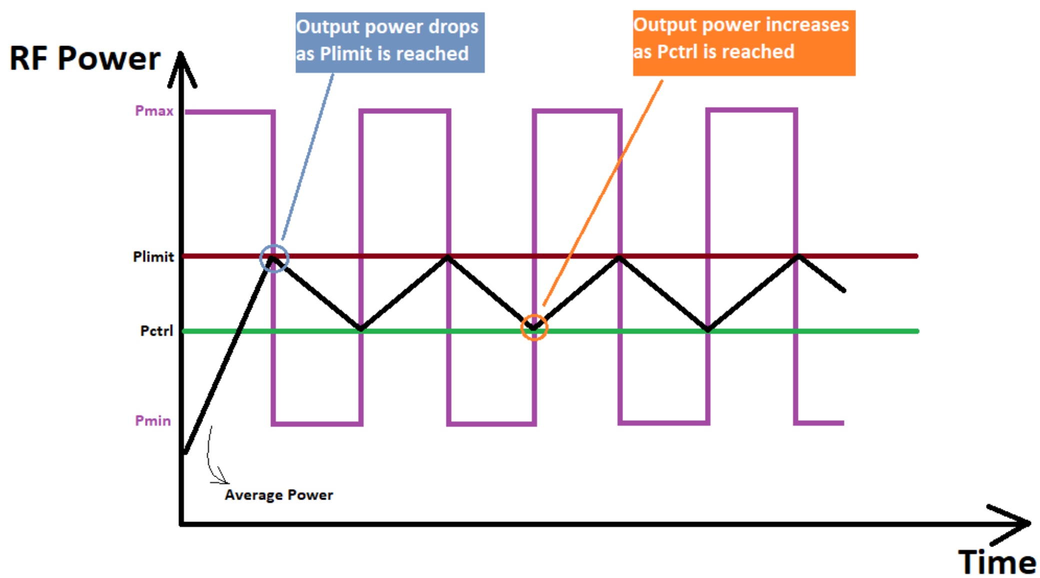

Figure 1: Key Parameters

The applicant shall define the different operating states and associated *Plimit* values for the DUT. In addition, the applicant shall clearly define the mechanisms and sensors used to trigger operating states changes.

6.2. Validation criteria

To ensure that the TAS implementation can accurately and consistently bound the device-based time-averaged SAR below the designed SAR targets (accounting for the tune-up tolerance) over the reference period, device manufacturers shall validate the TAS implementation.

The applicant shall:

- clearly define pass / fail criteria;
- use a calibrated and reproducible measurement setup; and
- ensure all tests are conducted over a sufficient amount of time to ensure that the maximum time-averaged output power or SAR has been captured. This may require two or more reference periods.

In addition to the RF technical brief requirements set forth in RSS-102, the applicant shall provide a separate TAS validation report as per *Annex B: Information to be included in the certification filing*.

Requirements for a proper validation are outlined in the following sections. For each validation criterion, consideration should be given to the technologies and associated operating states which resulted in the highest SAR test configurations, as presented in the SAR RF exposure technical brief, unless instructed otherwise.

6.2.1. SAR and Output power TAS Validation

The majority of current-generation TAS implementations rely on a combination of output power and SAR measurements to characterize the RF exposure of a device. Characterization is performed with the device transmitting in a static power mode, i.e. with the TAS algorithm disabled, in order to determine the *Plimit* values necessary to maintain compliance.

Most TAS validations are performed via output power measurements with the TAS algorithm enabled; however, output power measurements alone may not capture the near-field coupling and associated radiating characteristics of the device. Consequently, it cannot be assumed that a relative change in output power will always result in an equivalent change in SAR. Therefore, the TAS algorithm shall be validated using both output power measurements and SAR measurements.

6.2.1.1 Output Power Test Considerations

For a given test case, validation of the TAS algorithm is achieved by demonstrating that the time-averaged output power remains less-than-or-equal-to *Plimit* over any complete reference period. The instantaneous measured output power at the n-th time step can be written as $P_{\mathrm{meas}}[n]$. A complete reference period consists of M time steps:

$$M = \frac{T_{\mathrm{ref}}}{T_{\mathrm{meas}}} \qquad (2)$$

where T_{meas} is the time interval between subsequent output power measurements and T_{ref} is the reference period, e.g. 360 seconds. The rolling time-averaged output power at the n-th time step, denoted by $P[n]$, is obtained by summing the current (n-th) and $M-1$ previous values of P_{meas}, and dividing the result by M. This can be expressed analytically as:

$$P[n] = \frac{1}{M}\sum_{m=0}^{M-1} P_{\text{meas}}[n-m] \tag{3}$$

where m is the index of the rolling time-averaging window. For test cases in which *Plimit* remains constant, the TAS algorithm shall be validated by demonstrating that $P[n] \leq P_{\text{limit}}$ (taking into tune-up tolerance) for all n, i.e. for every time step associated with the test.

For test cases involving transitions between operating states with different *Plimit* values , i.e. *Plimit* changes over time, $P_{\text{meas}}[n]$ shall be normalized by $P_{\text{limit}}[n]$ prior to applying the rolling time-average. The normalized, rolling time-averaged output power, given by $p[n]$, can be expressed analytically as:

$$p[n] = \frac{1}{M}\sum_{m=0}^{M-1} \frac{P_{\text{meas}}[n-m]}{P_{\text{limit}}[n-m]} \tag{4}$$

The TAS algorithm shall be validated for these test cases by demonstrating that $p[n] \leq 1$ for all n, i.e. for every time step associated with the test.

6.2.1.2 SAR Test Considerations

The following procedure must be followed to ensure a high level of accuracy and repeatability in the evaluation of the TAS algorithm:

1. SAR measurements shall be conducted in an environment which prevents uncontrolled variations in the link budget over time, i.e. time-varying multipath.
2. A reduced set of SAR measurements may be used for validation purposes, relative to output power measurements.
    a) At a minimum, to account for linearity, single point SAR shall be measured on each antenna for at least one frequency. Whenever possible, each antenna should be validated using a different frequency.
    b) The same configurations and operating states selected for output power measurements shall be considered for SAR measurements to facilitate correlation between output power and SAR evaluations.
3. The configurations may be limited to measurements performed using the flat phantom where the relative position of the device is consistent and repeatable throughout the measurement process. This is especially important in situations where the device needs to be configured using test mode software and/or charged between measurements. The configurations must also match those configurations evaluated for SAR compliance to facilitate direct correlation with the SAR measurements performed in the RF exposure technical brief.
4. This separation distance for TAS validation shall be the same as the compliance distance.
5. The following shall be considered:
    a) <u>Define max SAR location</u>
    With the TAS algorithm disabled and the power set to *Plimit*, perform an area

scan in accordance with the requirements of IEC/IEEE 62209-1528 to identify the location of the maximum SAR value. The remaining steps shall be performed at this location.

b) Perform reference measurement (point SAR *Plimit*)
Perform single point SAR measurement with the algorithm disabled and the power set to *Plimit*.

c) Perform relative instantaneous measurements (point SAR (t))
Perform single point SAR measurements with the algorithm enabled.

d) To facilitate direct correlation with the *SAR Target Value* and/or the reported SAR from the RF exposure technical brief, normalization of the single point SAR results will be required. This shall be performed as follows:

$$SAR\,(t) = \frac{point\ SAR\,(t)}{point\ SAR_{Plimit}} \cdot SAR_{Plimit} \quad (5)$$

where:

point SAR(t) is a relative instantaneous single point SAR measurement (see step c) above)

point SAR_{Plimit} is the reference point SAR (see step b) above)

SAR_{Plimit} is the applicable measured SAR value at *Plimit* obtained from the RF exposure technical brief

e) Furthermore, the SAR(t) values shall be averaged over the reference period.

$$\text{TAS Value } = \sum \frac{SAR(t)}{total\ number\ of\ points\ within\ aveaging\ window} \quad (6)$$

To pass this validation requirement, within any rolling averaging window, the maximum of TAS value shall be:

i. less than or equal to the reported SAR from the RF exposure technical brief; and

ii. within the total device design uncertainty of the measured SAR_{Plimit}.

6.2.2. Change in requested output power

The performance of the TAS algorithm shall be validated when a base station requests different output power levels to manage the link budget.

At least one (1) band per technology shall be validated. The chosen band should have the largest difference between *Plimit* and *Pmax*. Whenever possible, avoid repeating the same band for different technologies. FDD and TDD implementations shall be treated as separate technologies.

6.2.2.1 Start-up test sequences

Two distinct sequences shall be applied to validate the start-up behaviour of the TAS algorithm:

1. Upon start-up, request an output power level of P_{max} for a period of at least 540 seconds, followed by an output power of $P_{\mathrm{min}} - 3$ dB for a period of at least 180 seconds.
2. Upon start-up, request an output power level of 0 dBm for a period of at least 360 seconds, followed by an output power of P_{max} for a period of at least 540 seconds.

6.2.2.2 Pseudo-random test sequence

A pseudo-random sequence of output power requests shall be applied to validate the dynamic behaviour of the TAS algorithm. Each test shall be performed with a unique sequence consisting of 150 independent output power level requests. These levels are calculated as follows:

$$P_{\mathrm{req}} = P_{\mathrm{max}} - x(P_{\mathrm{max}} - P_{\mathrm{limit}}) \qquad (7)$$

where P_{req} is the requested output power in dBm and x is a random value drawn from the Weibull distribution with shape and scale parameters of 2.0 and 0.8, respectively. These values were chosen to ensure that P_{req} exceeds P_{limit} on average, while maintaining a reasonable likelihood that some P_{req} values will fall well below P_{limit}. The corresponding request durations are given by:

$$T_{\mathrm{req}} = 2(1 + 2y) \qquad (8)$$

where T_{req} is the duration of the output power request in seconds and y is a uniformly distributed random value between 0 and 1.

Note 1: if necessary, P_{req} may be rounded to the nearest 0.5 dB. In addition, a lower bound may be applied to ensure continuous and reliable communication with the base station (e.g. $P_{\mathrm{req}} \geq 0$ dBm).

Note 2: values for x can be generated in Microsoft Excel (for example) using the following syntax: =0.8*(-LN(1-RAND()))^0.5.

Note 3: if necessary, T_{req} may be rounded to the nearest second.

Note 4: values for y can be generated in Microsoft Excel (for example) using the following syntax: =RAND().

Figure 2 shows an example requested output power sequence for $P_{\mathrm{limit}} = 20$ dBm, $P_{\mathrm{max}} = 26$ dBm and $P_{\mathrm{req}} \geq 0$ dBm. Rounding has been applied to both the requested power levels and durations. As per Annex B, similar plots of P_{req} versus time shall be included in the certification filing, along with tabulated summaries of the P_{req} and T_{req} values.

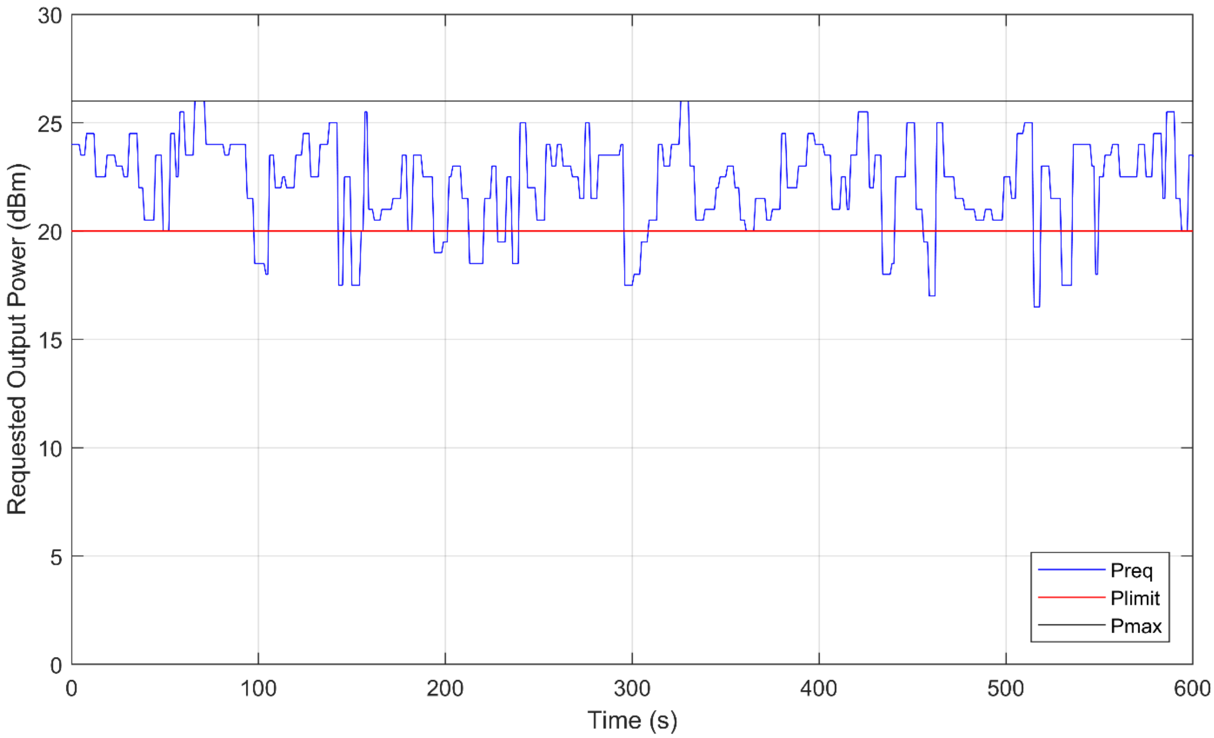

Figure 2 – Example requested output power sequence for $P_{limit} = 20$ dBm, $P_{max} = 26$ dBm and $P_{req} \geq 0$ dBm. Rounding has been applied to both the requested power levels and durations.

6.2.3. Antenna Diversity

When different *Plimit* values are applied for each transmitting antenna, the performance of the TAS algorithm and shall be validated as follows:

a) Consideration should be given to the operating states which resulted in the highest total SAR under simultaneous transmission and;
b) Changing from an antenna with a higher *Plimit* value to an antenna with a lower *Plimit* value shall be considered.

If the same *Plimit* and output power characteristics, e.g. nominal output power and tune-up tolerance(s), apply to each antenna, and it can be demonstrated that the performance of the TAS algorithm is not affected by antenna diversity, the validation requirements may be applied for a single antenna. However, simultaneous transmissions shall be considered separately.

6.2.4. Change in operating state

The performance of the TAS algorithm shall be validated when changing between operating states with different *Plimit* values. The following shall be considered:

a) Changing from an operating state to another with a lower SAR limit and corresponding *Plimit* value.

b) Changing from an operating state for which the TAS algorithm is disabled to another for which it is enabled (if applicable).

6.2.5. Frequency band hand-off or redirect

The performance of the TAS algorithm shall be validated when switching from one frequency band to another where different *Plimit* values are used. The following shall be considered:

a) Changing from a frequency band with a higher *Plimit* value to a frequency band with a lower *Plimit* value.
b) Changing from a frequency band that does not use TAS to a frequency band that does.

6.2.6. Technology hand-off

The performance of the TAS algorithm shall be validated when switching from one technology to another where different *Plimit* values are used. The following shall be considered:

a) Changing from a technology with a higher *Plimit* value to a technology with a lower *Plimit* value.
b) Changing to a technology with a different sampling rate.
c) Changing from TDD to FDD.

6.2.7. Modulation scheme

The performance of the TAS algorithm shall be validated when changes are required to the modulation scheme, such as changing from a higher order (e.g. 64 QAM) to a lower order (e.g. QPSK), and vice versa. This requirement may be waived if the same *Plimit* value is applied for all modulation schemes associated with a specific communication technology.

6.2.8. Dropped connections

The performance of the TAS algorithm during dropped connections shall be validated to ensure the algorithm is able to account for previous connection states.

Only one (1) validation is required, ideally with the frequency band or operating state which resulted in the highest SAR as presented in the RF exposure technical brief.

6.2.9. Control parameters and input variables used for TAS implementation

The performance of the TAS algorithm shall be validated when sensors, other than proximity sensors, or other mechanisms are used to either change operating states or activate the TAS algorithm.

6.2.10. Timers

The accuracy and effectiveness of timers (i.e. sampling rate and/or data acquisition) used by the TAS algorithm to evaluate and trigger changes in the instantaneous output power and associated time-averaged SAR shall be validated.

6.2.11. Accuracy of the TAS implementation and algorithm failure

The tolerance(s) associated with the TAS implementation must be conservatively assessed, taking into account host and modular specific uncertainty contributors, such as, but not limited to, the following:

- Accuracy of the module or host output power measurement and/or estimation for all modes of operation and across all applicable frequency bands.
- Antenna and near-field coupling effects, including output power vs. SAR linearity.
- Tune-up tolerance(s)

The manufacturer should ensure that mechanisms are put in place to address failures in the TAS implementation and associated electronics.

6.2.12. Consideration for the proximity sensor(s)

When proximity sensors trigger a change in operating state, the continuous operation of the TAS algorithm shall be validated.

The energy accumulated prior to the proximity sensor being triggered shall be taken into consideration. The worst-case SAR prior to the proximity sensor being triggered shall be considered. This is expected to occur at the closest distance where the proximity sensor is triggered.

Implementations where TAS is enabled at the proximity sensor level will continue to be evaluated on a case-by-case basis following the relevant principles outlined in this document, until sufficient data is available for ISED to provide detailed guidance.

6.3. TAS validation test reduction

ISED may accept data re-use or test-reduction within a product family. An inquiry must be submitted to the Certification and Engineering Bureau using the online form.

6.3.1. Data re-reuse

Data re-use is only possible when:

- The initial reference model is certified prior to the variant models. It is also possible for the reference model to be certified in Canada within the same time frame;

- Each variant has the same TX chain layout and associated components as the reference model; and
- Each variant has the same output power characteristics including *Pmax*, *Plimit*, *Pmin* and output power tune-up tolerances as the reference model.

Normalization can be performed using the output power measurements obtained for the reference model and the SAR data obtained for each subsequent variant.

6.3.2. Test reduction

Test reduction may be considered when the data re-use requirements outlined above cannot be met due to:

- physical design characteristics;
- modes of operation; or
- the variants having additional options that would result in different *Plimit* values than the reference model for common technologies and frequency bands.

Test reduction may be used for those technologies and frequency bands where different *Plimit* values are used, provided that the models have the same TX chain and components as the reference model. Otherwise, a full validation shall be performed.

7. Uncertainty evaluation

The complete uncertainty evaluation shall be based on the requirements in IEC/IEEE 62209-1528. The sampling rate uncertainty contributor shall be considered in the uncertainty evaluations for both output power and SAR measurement systems. A complete uncertainty evaluation shall be included in the validation report.

8. Certification requirements

The following are the certification requirements applicable to TAS implementations.

8.1. Laboratory accreditation

All testing performed to demonstrate compliance of a radio apparatus with the requirements set forth in RSS-102, including its referenced and accepted normative standards and test procedures, shall be carried out by an ISED recognized testing laboratory.

It is critical that all device-specific evaluation parameters used for compliance evaluations are assessed by an ISED recognized test laboratory including, but not limited to, the following

- Factors and methods used to determine applicable exposure conditions and operational modes

- Proximity or other sensors used for power reduction
- Output power
- Dynamic antenna tuning
- SAR evaluations

All the TAS validations set forth in section 6.2 shall be also be performed by an ISED recognized testing laboratory. In addition, the laboratory shall demonstrate that they have been properly trained and qualified to carry out validations on specific TAS implementations.

For proprietary test procedures and validation protocols that have been accepted by ISED, the recognized test laboratory shall demonstrate that they have been approved by the TAS algorithm developer to assess their technology. An approval letter from the TAS algorithm developer shall be provided part of the certification filing. A TAS algorithm developer's in-house test laboratory is not required to submit an approval letter.

8.2. Modular approval

Provided the requirements in RSP-100 are met, the applicant may obtain modular approval (MA) for a TAS-enabled module intended for installation in a host product. As per Section 8.2 of RSP-100, modular approvals are not applicable for small, portable, handheld and wearable devices with an overall diagonal dimension of less than 20 cm.

Where modular approval is permitted:

- Conducted TAS validation method should be performed at the module level using output power measurements.
- The appropriate validation method should be performed on representative hosts.

As an alternative, dynamic validation would be performed at the host level.

In situations where dynamic validation is mandatory at the host level, each portable host shall be evaluated via C4PC. ISED shall be notified, and an updated RF exposure technical brief shall be provided.

8.2.1. Requirements for the module

The module manufacturer shall validate the full range of parameters which could be implemented by the host manufacturer.

Module validations shall be performed in accordance with Section 6.2; however, with sufficient rationale ISED may consider exclusions based on host specific implementations and associated limitations on the operating states and applicable exposure conditions may be considered. An inquiry with ISED is required.

When validations are not carried out on the module, or when the range of TAS parameters implemented within the host fall outside the scope of validations carried out on the module, the requirements in section 8.2.3 apply.

8.2.2. Module integration manual

Where the module integration will be performed by the host manufacturer, the module manufacturer shall provide a detailed module integration manual with specific instructions regarding how to configure all of the control and operating parameters that are accessible by the host product for power control.

When the module is only approved for use by the module manufacturer, or specific host manufacturers with whom the module manufacturer will directly engage, the module integration manual may be simplified. In the certification filing, detailed information, including all key configurable parameters, shall be included in the operational description.

8.2.3. Requirements for the host

The host manufacturer shall ensure that the implementation meets all the validation criteria set out in Section 6.2. Any parameters that are not validated at the module level shall be validated at the host level. If the host uses parameters outside of those validated by the module manufacturer, additional testing will be required for proper validation and certification.

8.3. Information to provide to ISED

In addition to the reporting requirements in RSS-102, both Annex A: TAS validation criteria checklist and Annex B: Information to be included in the certification filing shall be provided with the certification filing package sent to ISED.

If nerve stimulation and/or power density measurements are also required to assess the full compliance of the DUT, the reporting requirements shall include the items set forth in other applicable IEC standard(s), including any additional reporting requirements identified in Annex E of RSS-102, SPR-002 and SPR-003.

<Link for SPR-003 will be added when ready>

9. Future Considerations

ISED will be updating the guidance in SPR-004 to consider TAS implementations for WLAN (802.11) and TAS implemented at the proximity sensor level.

ISED is analyzing how device-based time-averaging can be implemented to manage compliance with other RF exposure requirements, such as power density above 6 GHz.

As TAS technologies enable a more representative assessment of the SAR levels a user may be exposed to during normal day-to-day use, ISED is considering revising the separation distance in compliance assessment procedures of wireless devices. Further guidance will be provided on this matter.

If you have any questions or require additional guidance, please contact ISED via the following web page: General Inquiry form.

542 **Annex A: TAS validation criteria checklist**

Item	Description (See Section 6.2 for details)	Validated (Yes / No / Not Applicable)	Justification for Omission
Change in requested output power	Validate performance of TAS algorithm when a base station requests different output power levels.		
Antenna diversity	Validate performance of TAS algorithm for antennas with different *Plimit* values.		
Change in operating state	Validate performance of TAS algorithm for different operating states.		
Frequency band hand-off or redirect	Validate performance of TAS algorithm for frequency band hand-offs.		
Technology hand-off	Validate performance of TAS algorithm for technology hand-offs.		
Modulation scheme	Validate performance of TAS algorithm for changes in the modulation scheme.		
Dropped connections	Validate performance of TAS algorithm for dropped calls.		
Control parameters and input variables	Validate performance of TAS algorithm for control parameters and/or input variables such as sensors.		
Timers	Validate performance of TAS algorithm for accuracy and effectiveness of the sampling rate and/or data acquisition used to calculate the time-averaged SAR value.		
Accuracy of TAS implementation	Validate failures in the TAS implementation. Assess tolerances		

and algorithm failure	along with a list of all applicable contributors for hosts and modules.		
Consideration for the proximity sensor(s)	Validate performance of the TAS algorithm when a proximity sensor triggers a change in operating state.		

Annex B: Information to be included in the certification filing

Items in addition to RSS-102 RF technical brief
(1) General Information
a) Test Laboratory information including ISED recognition and accreditation information
b) Evaluation Dates
c) General description of the device including certification related information (i.e. ISED Certification Number, HVIN, PMN, HMN etc.)
d) Brief description of the TAS implementation including the model number (chipset, module etc. if different from the model number of the host device) and TAS version number
(2) Validation test procedure, operating configurations and test conditions
a) Summary of the TAS validation criteria evaluated. A copy of "Annex A: TAS validation criteria checklist" shall be provided
b) Validation measurement procedures description for • Output power; and • Single point SAR
c) Description of all applicable operating states and configurations evaluated for TAS and the selection criteria used to satisfy all test considerations detailed in section 6.2.
d) Detailed description of all key parameters identified in section 6.1, including calculations of SAR Target and *Plimit* value(s).
e) *Plimit* values reported for all operating states selected for validation.
e) Description of the pass / fail criteria established for each validation criteria evaluated.
f) SAR measurement System Check and Dielectric parameters measurement results (when different than those provided in the RSS-102 RF technical brief)
(3) Test results
a) Tabulated summary of the test results including clear determination of the pass / fail criteria established for each evaluation performed.
b) Tabulated summary of Preq and Treq values generated for the pseudo-random test sequence described in 6.2.2, along with plots of Preq versus time.
c) One or more test plots shall be included for each validation criteria to demonstrate that the thresholds established for each mode of operation have been adhered to. For test cases where *Plimit* is constant, the following parameters shall be shown on the plot(s):

1) The rolling time-averaged output power / single point SAR
2) The instantaneous output power / single point SAR
3) The power requested by the base station simulator
4) All applicable reference lines (e.g. *Plimit*, *Pmax*, *Pctrl*, and *Pmin*) including other output power and/or SAR thresholds or reference values defined for each operating state
5) Any other reference and/or measurement values necessary to demonstrate that:
   i. The algorithm is functioning as intended within the pre-defined thresholds, and
   ii. Correlation with the compliance assessment has been clearly established
6) The maximum time-averaged output power or SAR evaluated for each validation criteria

For test cases where *Plimit* is **not** constant, the following parameters shall be shown in the plot(s):

1) The normalized rolling time-averaged output power / single point SAR
2) The normalized instantaneous output power / single point SAR
3) The normalized power requested by the base station simulator
4) All applicable reference lines (e.g. *Plimit*, *Pmax*, *Pctrl*, and *Pmin*) including other output power and/or SAR thresholds or reference values defined for each operating state
5) Any other reference and/or measurement values necessary to demonstrate that:
   i. The algorithm is functioning as intended within the pre-defined thresholds, and
   ii. Correlation with the compliance assessment has been clearly established
6) The maximum normalized rolling time-averaged output power / single-point SAR evaluated for each validation criteria