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1 Introduction

This document is provided to Sierra Wireless distributors and clients. To request a new application/technical note, contact your regional Sierra Wireless Product Marketing Manager.

2 Glossary

Term	Definition
CW	Continuous Waveform
DRI	Device Range Index
DSI	Device State Index (Value corresponding to a specific usage scenario)
EFS	Qualcomm Embedded Files System (Latest version — EFS2)
FCC	Federal Communications Commission (FCC ST certification is the American standard smart transmit certification)
FTM	Factory Test Mode
HPUE	High Power User Equipment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISED	Innovation, Science, Economic Development Canada
MCC	Mobile Country Code
Module	Sierra Wireless EM91 series module
MTPL	Maximum Tx Power Limit — The module's maximum (non-configurable) Tx power. Tx power will be limited to this value if the requested Tx power is higher.
PD	Power Density (W/m ²)
Plimit	Power Limit — The maximum power, in dBm, at which a given radio configuration reaches the SAR design target. The SAR design target is predetermined for the specific device and will be less than the regulatory SAR limit after accounting for all design-related tolerances.
QTI	Qualcomm Technologies, Inc.
RAT	Radio Access Technology
RF	Radio Frequency

Term	Definition
ROW	Rest of World (ROW ST certification is the European standard smart transmit certification)
SAR	Specific Absorption Rate (W/kg)
SIB1	System Information Block #1
ST	Smart Transmit
Sub-6	3G/4G/5G-Sub6 Technology
ULCA	Uplink Carrier Aggregation
Wireless device	Host platform (i.e., chassis in which a module is installed)

3 Scope

This document describes Qualcomm (QTI) Smart Transmit (ST), the ST certification workflow, and how to use the ST feature and associated tools to comply with SAR regulations.

Note: In this document,

- EM919x refers to 5G-Sub6-capable EM91 series modules (EM9190, EM9191).
- EM91 refers to the full EM91 module series (EM919x, EM7690).

Note: ST is supported on EM919x (3G/4G/5G-Sub6) and EM7690 (3G/4G).

Important: Instructions in this document are specifically for EM91 modules. To use ST with EM92 modules, refer to [6] EM929x Smart Transmit (Doc# 2174327).

4 ST Overview

EM91 series modules introduce QTI's advanced ST feature for regulatory compliance, which replaces the legacy SAR backoff feature used in earlier Sierra Wireless modules.¹

Note: If transitioning from a SAR backoff-oriented process to ST, refer to [5] Transition Guide — SAR Backoff to Smart Transmit (Doc# 2174315) for a suggested transition path.

1. Legacy SAR backoff via non-volatile memory items (and related AT commands, e.g., !SARBACKOFF) is no longer supported.

4.1 ST Exposure Methods

ST supports two exposure methods for managing a wireless device's target output power (P_{limit}), which is the output power requirement for SAR regulatory compliance:

- Time-averaged exposure — ST controls the wireless device's Tx power for all supported RAT / band combinations by dynamically adjusting instantaneous Tx power to achieve a target average power over a period of time (i.e., the "averaging window").

Note that:

- Average output power never exceeds the P_{limit} .
- Instantaneous output power can exceed the P_{limit} and the wireless device's SAR design target (regulatory average SAR power limit), but the wireless device will cap the output power at its maximum transmit power limit (MTPL).

Time-averaging allows the wireless device to maintain SAR regulatory compliance, while also achieving good user experience and network performance.

- Force Peak exposure — Instantaneous output power never exceeds the P_{limit} . (Note: This is the default exposure method used for a given band when ST has not been configured to use a specific exposure method for that band.)

The ST exposure method, time-averaging window and SAR regulatory limit used for any given RAT / band combination are region-dependent and carrier-dependent.

Figure 1 displays the difference between the exposure methods. (For additional ST details, refer to [7] *Qualcomm Smart Transmit Feature for SDX55 (80-PM475-8_L)*.)

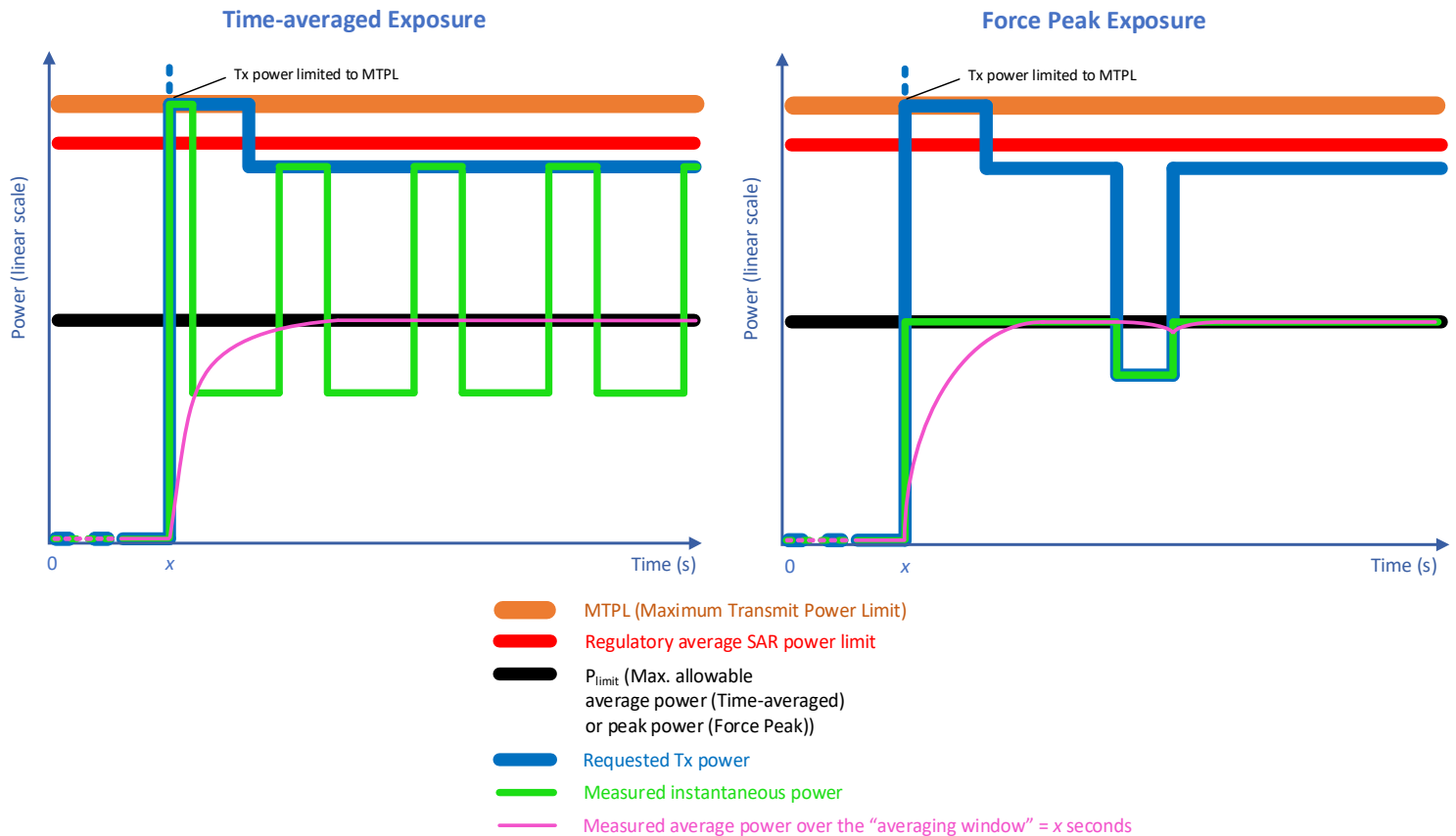


Figure 1: ST Exposure Methods (Idealized) Comparison — Time-averaged vs. Force Peak

4.2 ST Customization by Region and Mobile Country Code (MCC)

To configure a wireless device to use ST, Sierra Wireless provides radio transmitter SAR (rtsar) configuration template files that the OEM must populate with P_{limit} values for all of the device's exposure conditions, and with the regional MCCs that use those limits:

- `rtsar_sub6_fcc.xlsx` — For use in regions subject to FCC regulation.
- `rtsar_sub6_row.xlsx` — For use in the other (non-FCC) regions in the 'ROW' (Rest of World).

Migration Note: ST for EM92 uses only one template file for both FCC and ROW.

After the OEM populates the rtsar configuration template files, Sierra Wireless converts them to a pair of EFS files packaged in a single .cwe file. The OEM must load the .cwe package onto the module as a normal firmware download (e.g., using FDT, Sierra Wireless' module firmware download tool). ST settings automatically take effect on the next restart if ST initialization is successful.

For details, see [6.2 Evaluate SAR Exposure Scenarios, Assign DSIs, Specify SAR_design_target Values \(Task#3\)](#) and [6.4 Populate ST rtsar Configuration Template Files \(Task #6\)](#).

5 ST Certification Workflow

The ST certification process involves the OEM, third-party labs (with SAR measurement and ST testing capabilities), and Sierra Wireless. (Note—Sierra Wireless does not recommend any specific third party labs.)

[Figure 2](#) and [Table 1](#) outline the ST certification procedure and brief descriptions of the actions taken for each task by the OEM, third-party lab or Sierra Wireless, and detailed descriptions of the OEM's tasks are included in [6 OEM Actions in the ST Certification Workflow](#).

Note: [Figure 2](#) illustrates the workflow, and [Table 1](#) adds additional context.

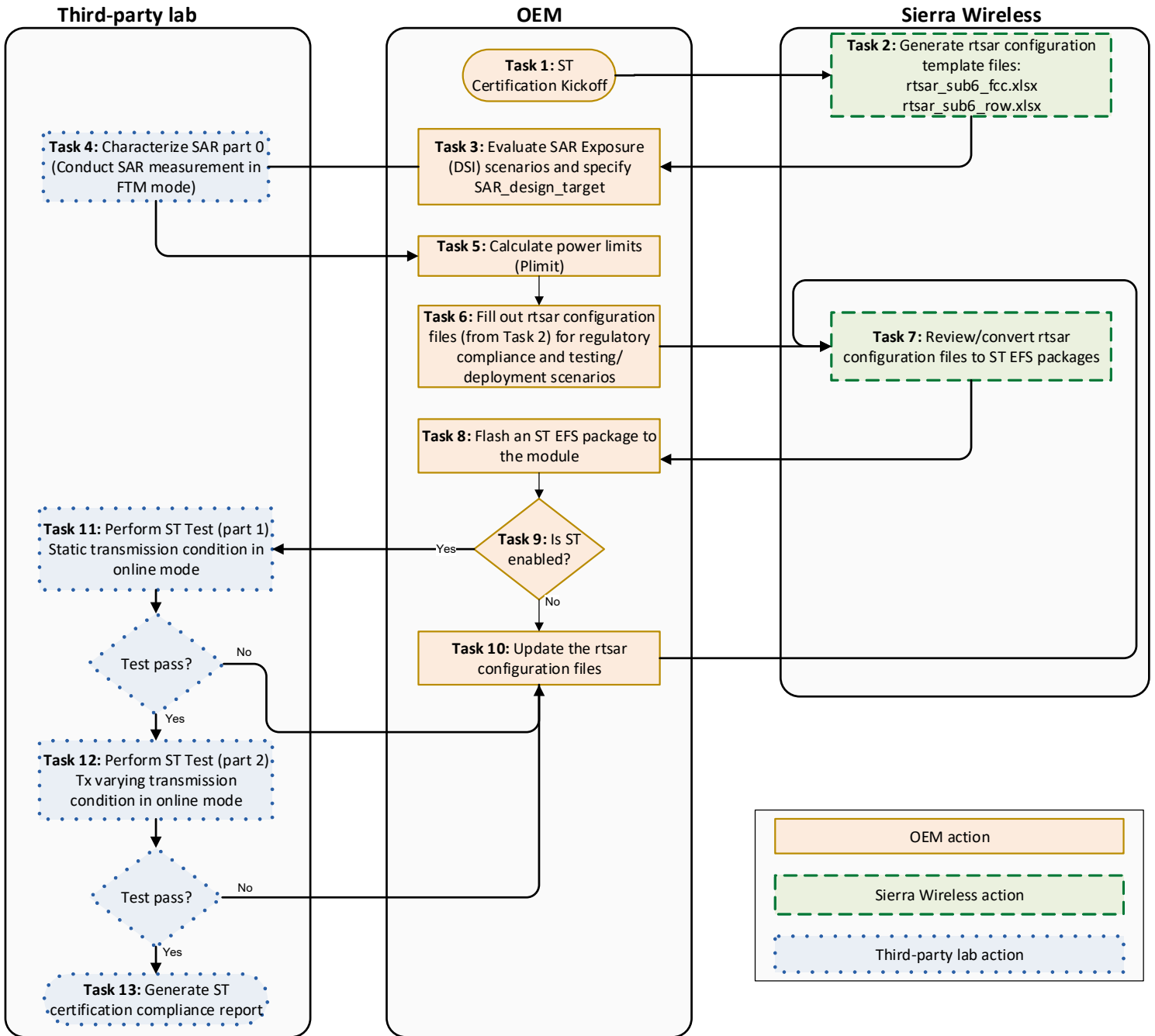


Figure 2: ST Certification Workflow for EM91 modules

Table 1: ST Certification Workflow Actions — Inputs and Outputs

Task	Action	Responsible Party	Input	Action / Output
#1	ST certification kickoff (Section 6.1)	OEM	—	OEM requests ST rtsar configuration template files from Sierra Wireless and provides the following information: <ul style="list-style-type: none"> ▪ Firmware version that will be used for ST certification
#2	Generate rtsar configuration template files	Sierra Wireless	#1 output	Sierra Wireless produces and sends two rtsar configuration template files to the OEM: <ul style="list-style-type: none"> ▪ rtsar_sub6_fcc.xlsx ▪ rtsar_sub6_row.xlsx
#3	Evaluate SAR exposure scenarios, assign DSI values, and specify SAR_design_target values (Section 6.2)	OEM	#2 output	OEM determines their SAR exposure scenarios, assigns DSI index values to the scenarios, calculates SAR_design_target values, and provides the details to the lab.
#4	Characterize SAR part 0 — Conduct SAR measurement in FTM mode	Third-party Lab	DSI scenarios	Lab measures max power and SAR values for every antenna/RAT/band/DSI combination, and provides a report to the OEM.
#5	Calculate power limit (Section 6.3)	OEM	#4 output	OEM calculates power limit values for every antenna/RAT/band/DSI combination.
#6	Fill out rtsar configuration template files with reserve margins 0 and 30 (Section 6.4)	OEM	#5 output	OEM completes two copies of each of the rtsar configuration template files with required details for regulator compliance testing in one copy and required details for development testing and commercial field deployments in the other copy). OEM returns the following completed rtsar configuration files to Sierra Wireless. (Note — Suggested filenames are shown below.) <ul style="list-style-type: none"> ▪ Files used for regulatory compliance lab testing: <ul style="list-style-type: none"> • rtsar_sub6_fcc_margin0.xlsx • rtsar_sub6_row_margin0.xlsx ▪ Files used for development testing and commercial field deployments: <ul style="list-style-type: none"> • rtsar_sub6_fcc_margin30.xlsx • rtsar_sub6_row_margin30.xlsx
#7	Verify and convert the OEM's completed rtsar configuration files to signed ST EFS packages	Sierra Wireless	#6 output or #10 output	Sierra Wireless uses the OEM's completed rtsar configuration files to prepare ST EFS packages (.cwe files) and sends them to the OEM. <ul style="list-style-type: none"> ▪ Regulatory compliance ST EFS package for: <ul style="list-style-type: none"> • FCC with margin 0 • ROW with margin 0 ▪ Testing/Deployment ST EFS package for: <ul style="list-style-type: none"> • FCC with margin 30 • ROW with margin 30
#8	Flash the ST EFS package to the module (Section 6.5)	OEM	#7 output	OEM installs the appropriate ST EFS package on the module — either the regulatory compliance package, or the testing/deployment package.

Table 1: ST Certification Workflow Actions — Inputs and Outputs (Continued)

Task	Action	Responsible Party	Input	Action / Output
#9	Verify that ST is enabled (Section 6.6)	OEM	#8 output	OEM verifies that ST is enabled: <ul style="list-style-type: none"> If enabled, continue to Task #11. If not enabled, go to Task #10.
#10	Review the submitted rtsar configuration files for valid MCCs, DSIs, and P_{limit} values. Update the rtsar configuration files accordingly. (Section 6.7)	OEM	#9 test failure or #11 test failure or #12 test failure	OEM corrects the rtsar configuration files and resends them to Sierra Wireless with the same names that were used in Task #6.
#11	Flash the ST regulatory compliance EFS package (FCC and ROW) with reserve margin 0 to device. Perform ST Test (part 1) in static transmission condition in online mode	Third-party Lab	#9 output	Lab performs static transmission testing — reserve margin 0 files (for testing only, not used in the field) are loaded, time averaging is disabled for all bands, and the device is forced to operate in peak exposure mode: <ul style="list-style-type: none"> If the test passes, continue to Task #12. If the test fails, go back to Task #10.
#12	Flash the ST testing/ deployment EFS package (FCC and ROW) with reserve margin 30 to device Perform ST Test (part 2) in Tx varying transmission condition in online mode Perform testing for field use — ST Test (part 2) in Tx varying transmission condition in online mode	Third-party Lab	#11 test passes	Lab performs varying transmission testing — reserve margin 30 files (for use in the field) are loaded, and time averaging is enabled per the configuration in the template files: <ul style="list-style-type: none"> If the test passes, continue to Task #13. If the test fails, go back to Task #10.
#13	Generate an ST certification compliance report	Third-party Lab	#12 test passes	Lab produces an ST certification compliance report and sends to the OEM.

5.1 Materials List

Table 2 describes the materials that OEMs require to engage in ST certification.

Table 2: Materials List

Tool or Test Equipment	Owner / Brand	Required for Task #	Remark
Callbox	CMW500, Anritsu MT8000A, or equivalent	#9 — Verify that ST is enabled	Populate template file with MCC 001.

6 OEM Actions in the ST Certification Workflow

This section describes actions the OEM must take for OEM-specific tasks in the ST certification workflow (Section 5).

Note — Actions performed by Sierra Wireless or third-party labs are summarized in [Table 1](#).

6.1 ST Certification Kickoff (Task #1)

To begin the ST certification workflow for a wireless device, the OEM must:

1. Determine where the wireless device will be used:
 - Regions subject to FCC regulation (i.e., U.S.A.) — FCC ST certification is required for FCC SAR compliance.
 - Rest of World — ROW ST certification is required for ICNIRP SAR compliance.
2. Contact your Sierra Wireless customer support representative to request ST rtsar configuration template files for the wireless device. Be prepared to:
 - a. Indicate the firmware version that will be used for ST certification.

Based on the information you provide, Sierra Wireless performs Task #2 and provides the following files to the OEM (both are required, even if the wireless device will be used in only one region):

- rtsar_sub6_fcc.xlsx
- rtsar_sub6_row.xlsx

6.2 Evaluate SAR Exposure Scenarios, Assign DSIs, Specify SAR_design_target Values (Task#3)

The OEM's wireless device must be SAR-characterized for all supported bands and Tx antenna paths. SAR characterization is evaluated at each surface of the wireless device for each SAR exposure scenario ("DSI scenario") — for example, body, hotspot, extremity, etc.¹

To prepare for SAR characterization, the OEM must:

1. As described in [6.2.1 Define DSI Scenarios](#), identify all exposure scenarios that apply to the wireless device, assign unique Device State Index (DSI) values to each scenario, and calculate the worst-case RF exposure values for each scenario — 1gSAR for FCC, and 10gSAR for ROW.
(Note — The OEM will populate the rtsar configuration template files with these DSI values and related details.)
2. Calculate SAR design target values for both regulatory regions (FCC, ROW) — see [6.2.2 Specify FCC/ROW SAR Design Target Values](#).
3. Provide the exposure scenario details and the SAR design target values ($SAR_{\text{design_target_FCC}}$, $SAR_{\text{design_target_ROW}}$) to the lab — the lab performs Task #4 and provides a SAR characterization report to the OEM.

1. SAR characterization reference materials: [10] *SAR Evaluation Procedures for Portable Devices With Wireless Router Capabilities (941225 D06 Hot Spot SAR v02r01)*, [9] *RF Exposure Compliance with Smart Transmit (Sub-6) (80-PM669-8 Rev.A) section 3 Part 0: SAR Characterization*

6.2.1 Define DSI Scenarios

- Identify all SAR exposure scenarios that apply to the wireless device and assign unique DSI values to each scenario:
 - If the device does not support any sensors or other SAR detection mechanisms, use DSI value 255 (as a Head scenario) to indicate there is only one exposure scenario (and that scenario is not distinguished).
 - Otherwise, assign unique DSI values from 0 (default) to 19 (maximum) to each exposure scenario — Note that only one Head SAR exposure scenario is needed.
(If the device is configured for use in Canada, corresponding DSI values from 50 to 69 are also supported.)

Note: For example, the hypothetical wireless device described in this procedure (e.g., Figure 3, Worst Case 1gSAR Determination Based on SAR Scenario Detection Scheme, on page 10) has three defined exposure scenarios: head, body, and hotspot.

- Determine the worst-case RF exposure values for each DSI (1gSAR values for FCC, 10gSAR values for ROW).
The example shown in Figure 3 represents a wireless device with three exposure scenarios — head, body, and hotspot. (Note: Examples shown in this document (unless otherwise indicated) refer to 1gSAR values (FCC).)

Number of scenarios distinguished ^a	Worst-case 1gSAR
All scenarios distinguished — The wireless device has proximity sensors or other SAR scenario detection mechanisms for each exposure scenario.	Worst-case 1gSAR for each DSI (individual exposure scenario) is that DSI's SAR value. <ul style="list-style-type: none"> Worst-case 1gSAR[DSI_{head}] = SAR_{head} Worst-case 1gSAR[DSI_{body}] = SAR_{body} Worst-case 1gSAR[DSI_{hotspot}] = SAR_{hotspot}
No scenarios distinguished — The wireless device has no proximity sensors or other SAR scenario detection mechanisms.	All DSIs (individual exposure scenarios) have the same worst-case 1gSAR — the maximum of the 1gSAR values for all exposure scenarios. <ul style="list-style-type: none"> Worst-case 1gSAR = max {SAR_{head}, SAR_{body}, SAR_{hotspot}}
Some (not all) scenarios distinguished — The wireless device has proximity sensors or other SAR scenario detection mechanisms for some (but not all) exposure scenarios.	Worst-case 1gSAR for each DSI (individual exposure scenario) depends on whether it is distinguished or not distinguished: <ul style="list-style-type: none"> DSI is Distinguished? — Worst-case 1gSAR is the DSI's SAR. (DSI=yes) DSI is not Distinguished? — Worst-case 1gSAR is the maximum of the 1gSAR values for all non-distinguished exposure scenarios. (DSI=no)

- a. 'Distinguished' scenarios are specific exposure scenarios that can be identified by the wireless device using proximity sensors or other SAR scenario detection mechanisms.

ST works with a single exposure scenario (DSI) at any time, using the power limit value (P_{limit}) recorded for the DSI/RAT/Band/Antenna combination, which is derived from the worst-case 1gSAR value associated with the current DSI (see 6.3 Calculate Power Limits (Task #5)).

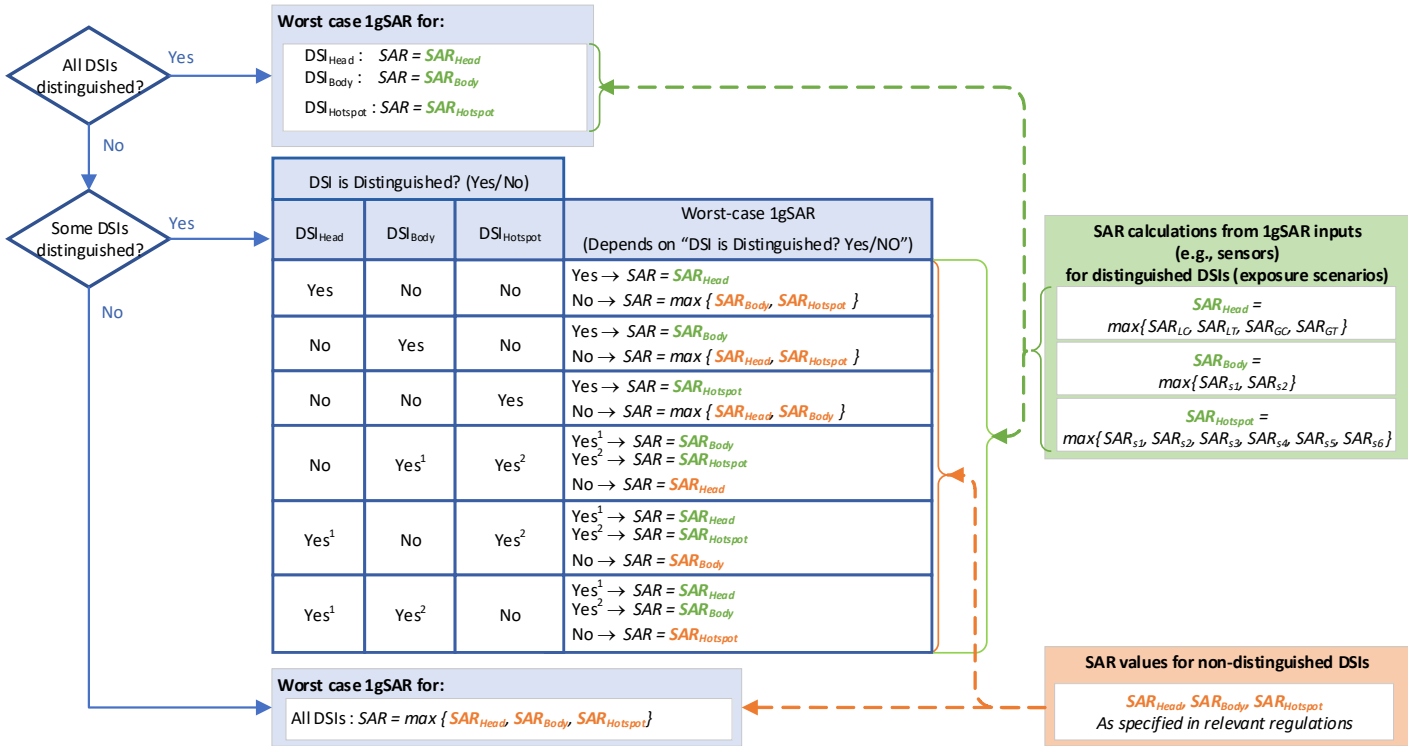


Figure 3: Worst Case 1gSAR Determination Based on SAR Scenario Detection Scheme

6.2.2 Specify FCC /ROW SAR Design Target Values

To enable the lab to perform SAR characterization, SAR design target values must be calculated for both regulatory regions — FCC (1gSAR limit) and ROW (10gSAR limit).

To calculate SAR design target values:

- Use (e.1) to calculate the wireless device's total uncertainty from the EM91 module uncertainty and the wireless device's base uncertainty:

$$Uncertainty_{total} = Uncertainty_{device} + Uncertainty_{module} \quad (e.1)$$

where:

- $Uncertainty_{module} = 1.5\text{dB}$ (EM91 module uncertainty)
- $Uncertainty_{device} = (\text{TBD by OEM})\text{ dB}$ (Base device uncertainty due to TxAGC uncertainties and device variance)

- Use (e.2) as described in the following substeps to calculate SAR_{design_target} values for FCC and ROW from region-specific SAR regulatory limits and the device's total uncertainty:

$$SAR_{design_target_<Region>} < SAR_{regulatory_limit_<Region>} \times 10^{\frac{-Uncertainty_{total}}{10}} \quad (e.2)$$

where:

- $SAR_{regulatory_limit_FCC} = 1.6\text{ W/kg per 1g}$ (FCC/ISED regulatory limit)
- $SAR_{regulatory_limit_ROW} = 2\text{ W/kg per 10g}$ (ROW regulatory limit)

For example:

- a. Calculate the FCC SAR design target value, assuming $Uncertainty_{total} = 1.5$ dB, and round down to 1 decimal place:

$$SAR_{design_target_FCC} < SAR_{regulatory_limit_FCC} \times 10^{\frac{-Uncertainty_{total}}{10}}$$

$$SAR_{design_target_FCC} < 1.6 \times 10^{\frac{-1.5}{10}}$$

$$SAR_{design_target_FCC} < 1.1 \text{ W/kg per 1g (rounded down from 1.133)}$$

- b. Calculate the ROW SAR design target value, assuming $Uncertainty_{total} = 1.5$ dB, and round down to 1 decimal place:

$$SAR_{design_target_ROW} < SAR_{regulatory_limit_ROW} \times 10^{\frac{-Uncertainty_{total}}{10}}$$

$$SAR_{design_target_ROW} < 2 \times 10^{\frac{-1.5}{10}}$$

$$SAR_{design_target_ROW} < 1.4 \text{ W/kg per 10g (rounded down from 1.416)}$$

- c. If the wireless device supports additional concurrent WLAN technologies that are not supported by ST (e.g., Bluetooth, Wi-Fi), reduce the calculated $SAR_{design_target_FCC}$ and $SAR_{design_target_ROW}$ values to account for the additional RF exposure.

$$SAR_{design_target_FCC} = SAR_{design_Target_FCC} - additionalRFexposure$$

$$SAR_{design_target_ROW} = SAR_{design_Target_ROW} - additionalRFexposure$$

3. If FCC and/or ROW certification is required for the wireless device, use (e.3) to calculate region-specific SAR design target extremity value(s) from the corresponding region-specific SAR regulatory limit for extremities and the device's total uncertainty:

$$SAR_{design_target_extremity_<region>} = \frac{SAR_{design_target_<region>}}{SAR_{regulatory_limit_<region>}} \times SAR_{regulatory_limit_extremity_<region>} \quad (e.3)$$

where:

- $SAR_{regulatory_limit_extremity_FCC} = 4$ W/kg per 10g (FCC/ISED regulatory limit (extremity))
- $SAR_{regulatory_limit_extremity_ROW} = 4$ W/kg per 10g (ROW regulatory limit (extremity))

For example, using the $SAR_{design_target_FCC}$ and $SAR_{design_target_ROW}$ values calculated in [step 2](#):

- a. Calculate $SAR_{design_target_extremity_FCC}$:

$$SAR_{design_target_extremity_FCC} = \frac{SAR_{design_target_FCC}}{SAR_{regulatory_limit_FCC}} \times SAR_{regulatory_limit_extremity_FCC}$$

$$SAR_{design_target_extremity_FCC} = \frac{1.1}{1.6} \times 4$$

$$SAR_{design_target_extremity_FCC} = 2.75 \text{ W/kg per 10g}$$

- b. Calculate $SAR_{design_target_extremity_ROW}$:

$$SAR_{design_target_extremity_ROW} = \frac{SAR_{design_target_ROW}}{SAR_{regulatory_limit_ROW}} \times SAR_{regulatory_limit_extremity_ROW}$$

$$SAR_{design_target_extremity_ROW} = \frac{1.4}{2.0} \times 4$$

$$SAR_{design_target_extremity_ROW} = 2.8 \text{ W/kg per 10g}$$

6.3 Calculate Power Limits (Task #5)

The SAR characterization report provided by the third-party lab (Task #4) should include measured power and measured SAR values for each DSI, at the maximum Tx power limit (MTPL) for each band/antenna path/device position/channel combination.

Note: If all of the following conditions are satisfied, HPUE (power class 2) is supported on HPUE-capable LTE bands (e.g., B41), otherwise power class 3 will be used:

- TDD UL/DL frame configuration 1–5 is in use.
- Inter-band ULCA is not activated (HPUE band intra-contiguous ULCA is allowed).
- MTPL in SIB1 is > +23 dBm.

Typical MTPL values are +23 dBm for non-HPUE LTE bands and +25 dBm for HPUE LTE bands. For band-specific MTPL values, refer to the Conducted Maximum Tx (Transmit) Power Tolerances table in [1] EM919X/EM7690 Product Technical Specification (Doc# 41113174).

The OEM must use the lab report's measured power and measured SAR values to calculate power limit (P_{limit}) values for each DSI/band/antenna path combination at each device position and channel (low, middle, high).

To calculate the P_{limit} values for a specific DSI/band/antenna path combination:

1. Use (e.4) or (e.5) to calculate the P_{limit} values for each position/channel combination (see [6.3.1 Power Limit Calculation Example](#)):

- Firmware version SWIX55C_03.14.10.04 or newer:

$$P_{limit} = MeasuredPower + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right) \quad (e.4)$$

- Firmware version older than SWIX55C_03.14.10.04:

$$P_{limit} = MeasuredPower + 10 \times \log(DutyCycle) + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right) \quad (e.5)$$

where:

- *MeasuredPower* — Refer to the lab report.
- *MeasuredSAR* — Refer to the lab report.
- $SAR_{design_target\ <region>}$ — Worst-case 1gSAR for the DSI as determined in [6.2.1 Define DSI Scenarios](#).
- *DutyCycle* — Ratio of Tx transmission duration to total test duration. For example:
 - For a TDD band with a 50% duty cycle:

$$P_{limit} = Measured\ Power + 10 \times \log(DutyCycle) + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right)$$

$$P_{limit} = Measured\ Power + 10 \times \log(0.50) + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right)$$

$$P_{limit} = Measured\ Power - 3.01 + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right)$$

- For FDD bands, since transmission is conducted statically, the Duty Cycle is always 1 (i.e., 100%), so $10 \times \log(DutyCycle)$ reduces to 0:

$$P_{limit} = Measured\ Power + 10 \times \log(DutyCycle) + 10 \times \log\left(\frac{SAR_{design_target\ <region>}}{Measured\ SAR}\right)$$

$$P_{limit} = \text{Measured Power} + 10 \times \log(1.0) + 10 \times \log\left(\frac{SAR_{design\ target\ <region>}}{\text{Measured SAR}}\right)$$

$$P_{limit} = \text{Measured Power} + 0 + 10 \times \log\left(\frac{SAR_{design\ target\ <region>}}{\text{Measured SAR}}\right)$$

- After calculating the P_{limit} values, enter the minimum P_{limit} value as the Tx power at Design Target for the DSI/band/antenna path combination in the rtsar configuration template files.

Migration Note: EM91 calculations are recorded in the rtsar configuration template file in dBm10 units; EM92 calculations are recorded in dBm units.

- Go back to [step 1](#) and repeat this procedure for the next DSI/band/antenna path combination.

6.3.1 Power Limit Calculation Example

The following examples describe power limit calculations for newer firmware (no TDD duty cycle adjustment) and older firmware (including TDD duty cycle adjustment) using the same UE (User Equipment) device.

Example 1 — Firmware version \geq 03.14.10.04

[Table 3](#) presents an excerpt of a lab report prepared for an example UE device that has been FCC SAR-characterized for two positions — front and back.

The OEM uses (e.4) to calculate P_{limit} values for both positions for DSI 3 + LTE Band 48 (TDD band) at low, middle, and high channels.

For example, the first P_{limit} (DSI=3, LTE B48 (TDD band), Ant5, Position=Front, Channel=55290) in this example is 21.6 dBm (rounded down to 1 decimal place), calculated as follows:

$$P_{limit} = \text{MeasuredPower} + 10 \times \log\left(\frac{SAR_{design\ target\ FCC}}{\text{Measured SAR}}\right)$$

$$P_{limit} = 24.55 + 10 \times \log\left(\frac{1.1}{2.13}\right)$$

$$P_{limit} = 21.6 \text{ dB}$$

Table 3: Example — P_{limit} Calculation using Lab-provided SAR Characterization Report

DSI	Mode	RB / RB Offset	Ant#	Position	Channel	Freq (MHz)	Measured Power (dBm)	Measured SAR (W/kg)	SAR _{design_target_FCC} (W/kg)	P _{limit} (dBm) ^a (Power level scaled at SAR _{design_target_FCC})
									1 g	1 g
3	LTE Band 48 (10 MHz) QPSK	1/0	5	Front	55290	3555.0	24.55	2.13	1.1	21.6
				Back						20.6
				Front	55990	3625.0	24.49	2.93		20.2
				Back						19.2
				Front	56690	3695.0	24.50	2.77		20.4
				Back						19.4
Tx power at Design Target for LTE Band 48 for Ant#5 = min(P_{limit} for each combination above) →									19.2	

a. P_{limit} values rounded down to 1 decimal place

Example 2 — Firmware version < 03.14.10.04

Table 4 presents an excerpt of a lab report prepared for an example UE device that has been FCC SAR-characterized for two positions — front and back.

The OEM uses (e.5) to calculate P_{limit} values for both positions for DSI 3 + LTE Band 48 (TDD band) at low, middle, and high channels.

Note: A TDD band is used in this example to show the effect of the duty cycle on the power limit calculation. When an FDD band is used, transmission is conducted statically (Duty Cycle is always 1 (100%), so the (10 × log(DutyCycle)) reduces to 0 (i.e., no effect on the power limit calculation).

For example, the first P_{limit} (DSI=3, LTE B48 (TDD band, 63.34% duty cycle), Ant5, Position=Front, Channel=55290) in this example is 19.6 dBm (rounded down to 1 decimal place), calculated as follows:

$$P_{limit} = MeasuredPower + 10 \times \log(DutyCycle) + 10 \times \log\left(\frac{SAR_{design_target_FCC}}{Measured\ SAR}\right)$$

$$P_{limit} = 24.55 + 10 \times \log(0.6334) + 10 \times \log\left(\frac{1.1}{2.13}\right)$$

$$P_{limit} = 19.6\ db$$

Table 4: Example — P_{limit} Calculation using Lab-provided SAR Characterization Report

DSI	Mode	RB / RB Offset	Ant#	Position	Channel	Freq (MHz)	Measured Power (dBm)	Measured SAR (W/kg)	SAR _{design_target_FCC} (W/kg)	P _{limit} (dBm) ^a (Power level scaled at SAR _{design_target_FCC})
									1 g	1 g
3	LTE Band 48 (10 MHz) QPSK	1/0	5	Front	55290	3555.0	24.55	2.13	1.1	19.6
				Back						18.6
				Front	55990	3625.0	24.49	2.93		18.2
				Back						17.2
				Front	56690	3695.0	24.50	2.77		18.5
				Back						17.4
Tx power at Design Target for LTE Band 48 for Ant#5 = min(P_{limit} for each combination above) →									17.2	

a. P_{limit} values rounded down to 1 decimal place

6.4 Populate ST rtsar Configuration Template Files (Task #6)

The OEM must populate the rtsar configuration template files that were received from Sierra Wireless, then send them back to Sierra Wireless to convert them into ST EFS packages.

Note: The OEM must prepare two sets of these files—one for regulatory certification (with a 0 dB power margin), and one for testing/field deployment of the wireless device (with a 30 dB power margin). As described in 6.4.1 Header tab, these files will be identical except for the reserve_power_margin_db_10 values.

1. Make two copies of each of the rtsar configuration template files (FCC and ROW) using unique names — Sierra Wireless requires the filename to include the power margin value.
That is, after making the copies, you should have:
 - margin0 rtsar configuration files: rtsar_sub6_fcc_margin0.xls and rtsar_sub6_row_margin0.xls — These can be used for regulatory certification.
 - and
 - margin30 rtsar configuration files: rtsar_sub6_fcc_margin30.xls and rtsar_sub6_row_margin30.xls — These can be used for testing/field deployment.
2. In the rtsar_sub6_fcc_margin0.xls and rtsar_sub6_row_margin0.xls files:
 - a. Populate the Header tab (section 6.4.1) — **Important:** Make sure to set the power margin for regulatory certification.
 - b. Populate the mcc_list Tab (section 6.4.2).
 - c. Populate the tech_records tab (section 6.4.3).
3. In both of the margin30 rtsar configuration files:
 - a. Populate the Header tab (section 6.4.1) — **Important:** Make sure to set the power margin for regulatory certification.

Note: The `mcc_list` and `tech_records` tabs do not need to be modified. The same information is used for regulatory certification (`margin0`) and for testing/field deployment (`margin30`).

4. Send the completed files (four files total) to Sierra Wireless.
5. Sierra Wireless performs Task #7 and will contact the OEM to collect information needed to produce ST EFS packages for regulatory compliance and for testing/field deployment.

Use the following commands and save their responses to provide to Sierra when requested:

```

ATI
<response>
OK

AT!SKU?
<response>
OK

AT!RFCID?
<response>
OK

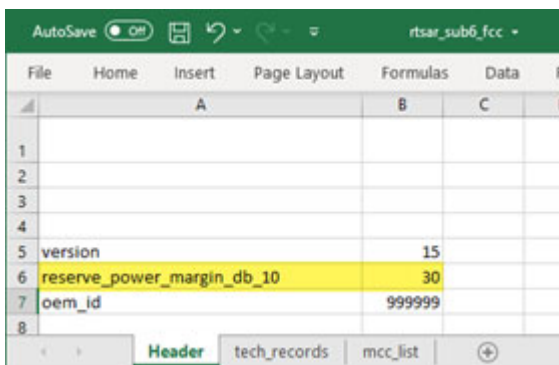
AT!SECBOOTCFG?
<response>
OK
    
```

6. When the packages are ready, Sierra Wireless provides them to the OEM.

6.4.1 Header tab

This tab contains template file identification information and a customizable reserve power margin (uncertainty) value.

Important— Modify only the `reserve_power_margin_db_10` value as described in the procedure below. Do not change any other settings. If any other settings are modified, ST will not work correctly with the design.



	A	B	C
1			
2			
3			
4			
5	version	15	
6	reserve_power_margin_db_10	30	
7	oem_id	999999	
8			

Figure 4: Header Tab Parameters

To populate the Header tab:

1. Update the `reserve_power_margin_db_10` value (in dBm10 units; e.g., 30 = 3.0 dB).

This margin is used to calculate the minimum transmission power (Tx_power_{min}) the wireless device will use for each band in the tech_records tab, based on each band's "Tx_power_at_Design_target" (P_{limit}) value: (i.e., $Tx_power_{min} = P_{limit} - reserve_power_margin_db_10$).

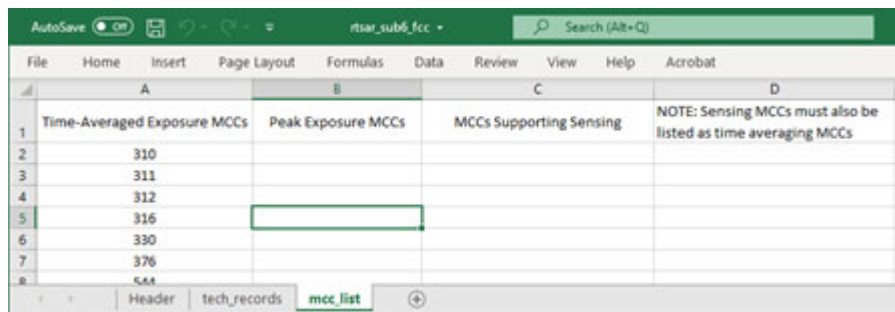
If this copy of the file will be used for:

- Regulatory compliance lab testing—Set the margin to 0 (i.e., the device will use full Tx power).
- Development testing and commercial field deployment—Set the margin to 30. (This is the default value, recommended for testing/field use.)

2. **Do not change** any other settings in the Header tab, unless instructed to do so by Sierra Wireless.

6.4.2 mcc_list Tab

This tab lists the preferred exposure method (Time-averaged or Force Peak) for each specific carrier (network) MCC.



	A	B	C	D
1	Time-Averaged Exposure MCCs	Peak Exposure MCCs	MCCs Supporting Sensing	NOTE: Sensing MCCs must also be listed as time averaging MCCs
2	310			
3	311			
4	312			
5	316			
6	330			
7	376			
8	544			

Figure 5: mcc_list Tab Parameters

Note: MCCs in the Time-Averaged Exposure MCCs list always use the Time-Averaged exposure mode except for specific RAT/band/antenna combinations in the tech_records tab (section 6.4.3). If a RAT/band/antenna combination has its "force peak" value = 1, then Force Peak exposure mode is used regardless of the mcc_list tab preference.

Important:

- FCC rtsar configuration files (e.g. rtsar_sub6_fcc_margin0.xlsx and rtsar_sub6_fcc_margin30.xlsx) must list only FCC MCCs, and ROW rtsar configuration files (e.g., rtsar_sub6_row_margin0.xlsx and rtsar_sub6_row_margin30.xlsx) must list only ROW MCCs.
(Note—Canadian MCCs must be recorded in the ROW template file, not the FCC file.)
- If an MCC is in the FCC rtsar configuration files and in the ROW rtsar configuration files, ST will not work.
- If an MCC is not in the FCC or ROW rtsar configuration files, the FCC P_{limit} values for each RAT/band/antenna combination will be applied using the Force Peak Exposure method.
- Modify only the values described in the procedure below. If any other values are modified, ST will not work correctly with the design.

To populate the mcc_list tab:

1. For each carrier, confirm the exposure method they support and enter their MCC in the corresponding column—"Time-Averaged Exposure MCCs" or "Peak Exposure MCCs" (i.e., force peak).
(As noted above, if an MCC is not listed in either the FCC or the ROW rtsar configuration files, it will use the FCC rtsar file and the Peak Exposure method.)

Note—Table 5 describes country-specific exposure method support as of 27 June 2023. However, it is the OEM's responsibility to confirm carrier exposure support as this information may be out-of-date at any time.

Table 5: Country / Region-specific Exposure Method Support^a

Country / Region	Peak Exposure	Time-averaged Exposure ^b
USA	F	F
Korea	F (TBD)	F, I
Japan	I	I
EU	I	I
China	I (TBD)	I (TBD)
Canada	I	F, I
Australia/NZ	I (TBD)	I
Singapore	I (TBD)	I
Mexico	I (TBD)	I
Brazil	I (TBD)	I
India	F (TBD)	F, I
Taiwan	(TBD)	I

a. Derived from Qualcomm documentation, current as of 27 June 2023.

b. F—FCC; I—ICNIRP (1998)

2. After both template files (FCC and ROW) are populated:

a. **Important**—Add the testing MCC (001) to either the FCC or the ROW template, in the appropriate exposure method column for lab testing. This ensures that the correct exposure method will be used for testing (since most TE use MCC 001).

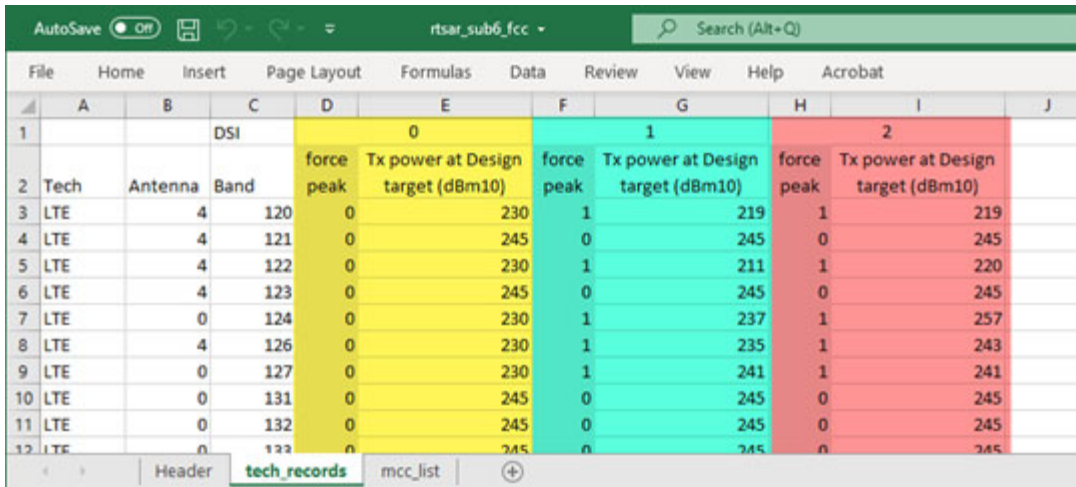
(When the module connects to a registered network or test equipment (TE) callbox, the network / TE-provided MCC is used, not the SIM-provisioned MCC.)

b. Make sure no MCCs appear in both files. (ST will not work if any MCC appears in both files.)

6.4.3 Populate the tech_records tab

This tab lists all RATs/Bands supported by the customer design, and includes DSI details for each supported RAT/Band/Antenna combination.

Note—This tab uses QTI band numbers in the Band field, which correspond to 3GPP band numbers (see [Table 7 on page 26](#)). For example, QTI band 124 is LTE B5; QTI band 196 is 5G-Sub6 band n71, etc.



	A	B	C	0		1		2	
	Tech	Antenna	Band	force peak	Tx power at Design target (dBm10)	force peak	Tx power at Design target (dBm10)	force peak	Tx power at Design target (dBm10)
3	LTE	4	120	0	230	1	219	1	219
4	LTE	4	121	0	245	0	245	0	245
5	LTE	4	122	0	230	1	211	1	220
6	LTE	4	123	0	245	0	245	0	245
7	LTE	0	124	0	230	1	237	1	257
8	LTE	4	126	0	230	1	235	1	243
9	LTE	0	127	0	230	1	241	1	241
10	LTE	0	131	0	245	0	245	0	245
11	LTE	0	132	0	245	0	245	0	245
12	LTE	0	133	0	245	0	245	0	245

Figure 6: tech_records Tab Parameters

Important:

- Do not delete any rows (otherwise the deleted RAT / Band / Antenna path combinations will not work).
If a band must be added or removed, submit a request to Sierra Wireless for review and new ST rtsar template file generation. Note that after passing certification, any changes made to band / antenna path combinations, Tx power at Design target (P_{limit}) values or force peak values voids the certification, and new certification will be required.
- Modify only the values described in the procedure below. If any other values are modified, ST will not work correctly with the design.

To populate the tech_records tab:

- Add force peak and Tx power at Design target column pairs for each DSI scenario distinguished in 6.2.1 Define DSI Scenarios (i.e. a pair for DSI 0, another pair for DSI 1, etc.), as shown in Figure 6.
If no DSI scenarios were distinguished, make sure only one DSI column pair is shown, with the DSI value set to 255.
(In the example shown in Figure 6, DSI 0 (yellow) represents the DSI_{head} scenario, DSI 1 (green) represents the DSI_{body} scenario, and DSI 2 represents the DSI_{hotspot} scenario.)
- If the wireless device will be marketed in Canada, additional DSIs must be set up in the ROW template file, since Canada uses ISED regulatory limits, instead of the ICNIRP limits used by other ROW region countries.
For each distinguished DSI scenario, add Canadian DSI scenarios with index values = DSI_{scenario} + 50. For example, Figure 7 shows a ROW template for a two-scenario device (DSI 0, DSI 2) with corresponding Canadian scenarios (DSI 0+50=50, DSI 2+50=52) shown in red.

	Tech	Antenna	Band	0		2		50		52	
				force peak	r at Design target	force peak	r at Design target	force peak	r at Design target	force peak	at Design target
3	LTE	4	120	1	10		10	1	10		10
4	LTE	4	121		10		10		10		10
5	LTE	4	122		10		10		10		10
6	LTE	4	123		10	1	10		10	1	10
7	LTE	0	124		10		10		10		10
8	LTE	4	126		10		10		10		10
9	LTE	0	127		10		10		10		10
10	LTE	0	131		10		10		10		10
11	LTE	0	132		10		10		10		10

Figure 7: ROW Template File—Canadian DSI Scenario Columns

3. For each RAT/antenna path/band/DSI combination:

- a. In the Tx power at Design target (dBm10) field, enter the maximum P_{limit} value that was calculated for the combination in [6.3 Calculate Power Limits \(Task #5\)](#).

If power backoff is not required, enter 245 to disable it.

- b. In the force peak field, enter the exposure method to use for the combination:

- 1—Always use the Force Peak exposure method, regardless of the mcc_list tab.
- 0—The exposure mode will be selected for each network on which the wireless device operates, based on the MCC tab of the appropriate template (ROW or FCC):
 - MCC is listed in the Time-Averaged Exposure MCCs column—Use the Time-averaged method.
 - MCC is listed in the Peak Exposure MCCs column—Use the Force Peak method.
 - MCC is not listed in either column—Use the Force Peak method with FCC P_{limit} values, regardless of the region where the device is operating (i.e., FCC or ROW).
 - Note—The Force Peak method will be used for voice calls (e.g., WCDMA circuit switched calls).

See [Figure 8](#) for an example of how the exposure method is determined.

EXAMPLE: Exposure method determination for DSI=1, LTE 122 (LTE B3) when MCC = 001

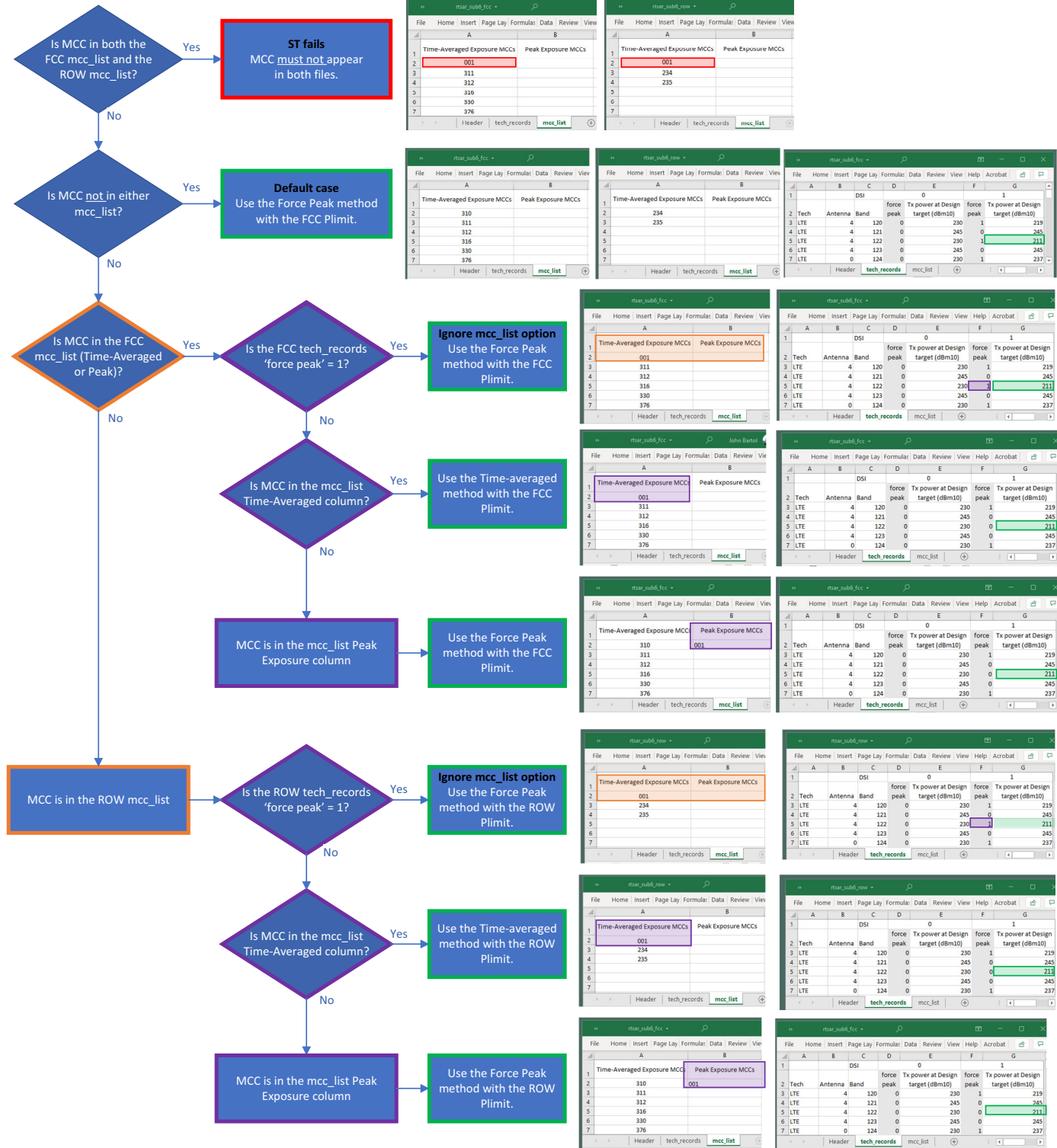


Figure 8: Exposure Method Determination

6.5 Flash ST Package to the Wireless Device (Task #8)

After Sierra Wireless verifies and converts the rtsar files that were prepared in Task #6 and sends them back to the OEM as .cwe packages, the OEM must flash (install) the regulatory or test/deployment package to the wireless device's EM91 module.

To install a package:

1. Use the fdt2 tool:

```
$ fdt2 - rtsar_config.cwe
```

6.6 Verify ST is Enabled (Task #9)

After installing an ST EFS package to the EM91 module, confirm that ST is enabled:

- a. Confirm both the FCC and ROW EFS files have been properly flashed, and determine if the correct ST files have been used: Use the !STEFS command to display the names of the ST files that are currently installed:

AT!STEFS?

```
rtsar_config_fcc    <sha256_file_1>
rtsar_config_row    <sha256_file_2>
rtsar_swi           <sha256_hash_ID>
OK
```

e.g.:

AT!STEFS?

```
rtsar_config_fcc    dee196b43deb60a8c506f8ba9bb650fb66d1d1efa069bc7affcef2676bcfa233
rtsar_config_row    a6b2661ddc34b06a2d8c58106410bc00cf5e5fbba340a212c12bca4126feaf74
rtsar_swi           129d84dc780ec6ab5649e8d43abb97ea145df696c13deb9e3b3c1a420f8be2
OK
```

- b. If the command returned a "File missing" message, the package did not flash successfully — the submitted rtsar files must be revised and resubmitted to Sierra Wireless to receive an updated package. Go to [6.7 Update ST rtsar Template Files \(Task #10\)](#).

Otherwise, continue to the next step.

2. Compare the sha256 checksums returned by !STEFS? to the checksums provided by Sierra Wireless with the ST EFS package. If the checksums do not match, re-attempt the download if possible. If the checksums still do not match, contact your Sierra Wireless customer service representative. Confirm that ST successfully initialized — Use the !STSTATUS command:

AT!STSTATUS?

```
ST_FW_VERSION: <fw_ver>
ST_Config_version: <cfg_ver>
ST_OEM_ID: <oem_id_hex> (<oem_id_dec>)
ST_Current_MCC: <mcc>
ST_Exposure_mode: <exposure_mode>
ST_Sensing_mode: <sensing_mode>
OK
```

If the command returns output as shown above, ST has initialized successfully:

- i. If the <fw_ver> and <cfg_ver> match, continue to [step 3](#).

- ii. Otherwise, contact your Sierra Wireless customer service representative to determine if a newer set of rtsar template files is available and should be used.

Otherwise, if an error message is returned (e.g. "ST unknown status", "ST configuration not present", etc.), ST did not initialize. Go to [6.7 Update ST rtsar Template Files \(Task #10\)](#) to revise the submitted rtsar files and resubmit them to Sierra Wireless to receive an updated package.

3. Manually test that ST is enabled:

- a. Connect the wireless device to a callbox.
- b. Initiate one data call from the callbox.
- c. Set Tx power control to maximum power.
- d. Set a valid DSI state (i.e. one that is listed in the rtsar file)—see [7 How to Select the DSI \(Exposure Scenario\) for Sub-6 ST](#).
- e. Observe the Tx power limit changing with DSI state.

During this test, ensure there is data transmission from the wireless device to the network after the data call has been established. The expected Tx power behavior depends on whether the force peak option for the band and antenna path under test is disabled or enabled:

- Disabled—Tx power is expected to increase and decrease around the expected Tx power at Design Target value.
- Enabled—Tx power should never exceed the Tx power at Design Target value.

6.7 Update ST rtsar Template Files (Task #10)

If [6.6 Verify ST is Enabled \(Task #9\)](#) indicated there was a problem (i.e. ST did not flash successfully or did not initialize successfully), the submitted rtsar configuration file (or a new template from Sierra Wireless, if provided) must be revised and resubmitted to Sierra Wireless to receive an updated package.

The most common errors that will prevent Sierra Wireless from building an ST EFS package and will require corrections to the template file are:

- The FCC EFS file or ROW EFS file is missing from the device
- The same MCC is in both configuration files, or an MCC is in the wrong regional file
- No valid DSI states are populated (255, or 0-19)

To update the ST configuration file(s):

1. Review the files to identify and fix any errors/omissions (based on the requirements described in [6.4 Populate ST rtsar Configuration Template Files \(Task #6\)](#)).
2. Resubmit the corrected configuration files to Sierra Wireless for verification and conversion.

7 How to Select the DSI (Exposure Scenario) for Sub-6 ST

To select the DSI (i.e. to select the exposure scenario) to use for ST, use an appropriate method (AT commands, SDK API, GPIO) as described in this section.

7.1 Set DSI via AT Command

To set the DSI using AT commands:

1. Enable access to password-protected AT commands:

```
AT!ENTERCND=<password> ← The password is factory-configured and can be changed using !SETCND.  
OK                               If the password is not known, contact Sierra Wireless for assistance.
```

2. Disable the DPR GPIO function if it is enabled (note — DPR GPIO is disabled by default):

```
AT!CUSTOM="GPIOsAREENABLE",0  
OK  
  
AT!RESET
```

3. Set the DSI to select a desired exposure scenario (note — this setting does not persist across power cycles):

```
AT!SARSTATE=<dsi_index>  
OK
```

Refer to [4] *EM9 Series AT Command Reference (Doc# 41113480)* for AT command details.

7.2 Set DSI via SDK API

To set the DSI using an SDK API:

1. Disable the DPR GPIO function if it is enabled (note — DPR GPIO is disabled by default):

```
AT!CUSTOM="GPIOsAREENABLE",0  
OK  
  
AT!RESET
```

2. Set the DSI to select a desired exposure scenario (note — this setting does not persist across power cycles) — Use the "pack_sar_SLQSSetRfSarState()" API.

7.3 Set DSI via GPIO

The DPR GPIO (pin 25) can be used to switch exposure scenarios between DSI 0 and DSI 1.

Sierra Wireless suggests using the DPR GPIO to enable SAR back-off (switch the DSI to 1) when an OEM's wireless device's sensor (or other detection mechanism) detects a human body scenario (e.g., head, body, hotspot). Otherwise, if a human body scenario is not detected, use the DPR GPIO to disable SAR back-off (switch the DSI to 0).

Important: *Disabling SAR back-off (switching the DSI to 0 with the DPR GPIO) only works if the OEM updates 'Tx power at SAR design target (dBm10)' for DSI 0 with 245 for every desired antenna/RAT/band combination in the tech_records tab during population of the ST rtsar configuration files.*

To set the DSI with the DPR GPIO:

1. Enable access to password-protected AT commands:

```
AT!ENTERCND=<password> ← The password is factory-configured and can be changed using !SETCND.  
OK                               If the password is not known, contact Sierra Wireless for assistance.
```

2. Enable the DPR GPIO function if it is disabled:

```
AT!CUSTOM="GPIOAREENABLE",1
```

```
OK
```

```
AT!RESET
```

3. Set the DPR pin mode:

```
AT!SARINTGPIOMODE=<0 or 1> ← Note: If using an EM9190 DEV KIT BOARD, use '0'. The dev kit does not correctly detect the DPR pin state if the DPR logic is inverted using '1'.
```

```
OK
```

```
AT!RESET
```

4. Pull DPR GPIO (pin 25) high or low to switch the DSI. The wireless device's EM91 series module's firmware monitors DPR GPIO and adjusts the RF Tx power appropriately, as detailed in [Table 6](#).

Table 6: Dynamic Power Selection of ST DSI

!SARINTGPIOMODE ^a	DPR Internal Pull	DPR Pin	ST State
0 (default)	Pull up	High ^b	No ST enabled or ST enabled with DSI 0
		Low	ST enabled with DSI 1
1	Pull down	Low	No ST enabled or ST enabled with DSI 0
		High	ST enabled with DSI 1

a. !SARINTGPIOMODE=1 inverts the DPR logic.

b. The host can implement an open collector drive for the DPR pin (if a 1.8V-compatible drive is not available).

8 Appendix — 3GPP to QTI Band Number Map

The 'Band' values shown in the rtsar configuration file's tech_records tab are QTI band numbers that map to 3GPP band numbers. The following table lists the bands that EM91 modules can support.

Table 7: 3GPP to QTI Band Number Map

RAT	Band	QTI Band
WCDMA	B1	80
	B2	81
	B3	82
	B4	83
	B5	84 ^a
	B6	85 ^a
	B8	87
	B9	88
	B19	91 ^a

RAT	Band	QTI Band
LTE	B1	120
	B2	121
	B3	122
	B4	123
	B5	124
	B7	126
	B8	127
	B12	131
	B13	132
	B14	133
	B17	136
	B18	137
	B19	138
	B20	139
	B25	144
	B26	145
	B28	147
	B29	148
	B30	149
	B32	151
	B34	153
	B38	157
	B39	158
	B40	159
B41	160	
B42	161	
B43	162	
B46	176	
B48	178	
B66	168	
B71	179	

RAT	Band	QTI Band
5G-Sub6	n1	182
	n2	183
	n3	184
	n5	185
	n7	186
	n8	187
	n12	215
	n20	188
	n25	216
	n28	189
	n38	190
	n40	219
	n41	191
	n48	222
	n66	194
	n71	196
	n77	200
n78	201	
n79	202	

a. WCDMA B5 can be used to test B6 and B19, since B6 and B19 are sub-bands of B5.

9 References

Sierra Wireless

- [1] EM919X/EM7690 Product Technical Specification (Doc# 41113174)
- [2] RF Exposure Compliance Test Report for FCC Equipment Authorization of QRD (80-W2112-4 Rev. YD)
- [3] RF Exposure Compliance with Qualcomm Smart Transmit (mmWave and Sub-6) (80-PM475-10_B)
- [4] EM9 Series AT Command Reference (Doc# 41113480)
- [5] Transition Guide—SAR Backoff to Smart Transmit (Doc# 2174315)
- [6] EM929x Smart Transmit (Doc# 2174327)

Qualcomm Technologies, Inc.

- [7] Qualcomm Smart Transmit Feature for SDX55 (80-PM475-8_L)
- [8] RF Exposure Compliance Test Report for FCC Equipment Authorization of QRD (80-W2112-4 Rev. YD)
- [9] RF Exposure Compliance with Smart Transmit (Sub-6) (80-PM669-8 Rev.A)

FCC

- [10] SAR Evaluation Procedures for Portable Devices With Wireless Router Capabilities (941225 D06 Hot Spot SAR v02r01)

10 Support

For direct clients: contact your Sierra Wireless FAE

For distributor clients: contact your distributor FAE

For distributors: contact your Sierra Wireless FAE

11 Document History

Revision number	Release date	Changes
1	August 21, 2020	Creation

Revision number	Release date	Changes
2	February 2022	Overall update
3	May 2024	<p>Overall update</p> <p>Notable updates:</p> <ul style="list-style-type: none"> ▪ 4.1 ST Exposure Methods (method descriptions, figure) ▪ 5 ST Certification Workflow (figure/ table description wording clarifications) ▪ 6.3 Calculate Power Limits (Task #5) (firmware-dependent TDD duty-cycle correction factor) ▪ 6.3.1 Power Limit Calculation Example (firmware-dependent examples) ▪ 6.4.1 Header tab (procedure wording clarifications) ▪ 6.4.2 mcc_list Tab (updated Table 5: Country/Region-specific Exposure Method Support) ▪ 6.5 Flash ST Package to the Wireless Device (Task #8) (manual test step update) ▪ 6.6 Verify ST is Enabled (Task #9) (updated examples; manual test step update) ▪ 7.3 Set DSI via GPIO (updated description) ▪ 8 Appendix — 3GPP to QTI Band Number Map (B19 clarification)

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Wireless Communications

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. The Semtech product should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Semtech accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Semtech product, or for failure of the Semtech product to transmit or receive such data.

Safety

Do not operate the Semtech product in areas where blasting is in progress, where explosive atmospheres may be present, near medical equipment, near life support equipment, or near any equipment which may be susceptible to any form of radio interference. In such areas, the Semtech product should be powered off.

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Sierra Wireless

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