

RF Exposure Report

(Part 0: SAR Char Evaluation)

APPLICANT : Zebra Technologies Corporation
EQUIPMENT : Touch computer
BRAND NAME : Zebra
MODEL NAME : TC15BK
FCC ID : UZ7TC15BK
STANDARD : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang / Supervisor

Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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History of this test report

Report No.	Version	Description	Issued Date
FA212805A	01	Initial issue of report	Apr. 01, 2022



1. Introduction

The RF exposure limit is defined based on time-averaged RF exposure. The product implements Qualcomm Smart Transmit feature which controls the instantaneous transmitting power for WWAN transmitter to ensure the product in compliance with RF exposure limit over a defined time window, for SAR (transmit frequency \leq 6GHz) and power density (transmit frequency $>$ 6GHz) to control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is compliant to the regulation requirement. Cannot operate without SAR characterization at the device level, beforehand.

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

Terminologies in this report

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



2. Product Description

Product Feature & Specification	
Equipment Name	Touch computer
Brand Name	Zebra
Model Name	TC15BK
FCC ID	UZ7TC15BK
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 42: 3450 MHz ~ 3550MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5: 824 MHz ~ 849 MHz 5G NR n7: 2500 MHz ~ 2570 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2450 MHz ~ 2690 MHz 5G NR n66: 1710 MHz ~ 1780 MHz 5G NR n77: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz 5G NR n78: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is not supported) LTE: QPSK, 16QAM, 64QAM 5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC: ASK

3. SAR Characterization

SAR char must be generated to cover all radio configurations and usage scenarios that the wireless device supports for operating at 6 GHz or below. It will then be used as input for Smart Transmit to control and manage RF exposure for $f < 6$ GHz.

3.1 SAR design target and uncertainty

<SAR design target and uncertainty>:

	Uncertainty dB (k=2)
Total uncertainty	1.5

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

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

SAR design Target :

FCC SAR	Measure Distance	Standalone SAR (W/kg)	Simultaneous SAR (W/kg) For WWAN + WLAN Or BT
			WWAN 2/3/4/5G All Tx Ant
Body Worn (1g)	15 mm	0.95	0.95
Hotspot (1g)	10 mm	NA	0.75
Head (1g)	touch&tilt 15deg	0.95	0.95
Extremity (10g)	0 mm	2.50	2.50



3.2 SAR Char Table

SAR char must be generated to cover all radio configurations and usage scenarios that the wireless device supports for operating at 6 GHz or below. It will then be used as input for Smart Transmit to control and manage RF exposure for $f < 6$ GHz.

<P_{limit} for supported technologies and bands (P_{limit} in EFS file)>

Band	Antenna	Head DSI 3	Hotspot DSI 2	Body Worn & Extremity DSI 1	P _{max} *
GPRS850(2 Tx slots)	Ant 0	29.8	27.5	28.5	24.5
GSM1900(2 Tx slots)	Ant 0	29.6	18.8	20.3	21.5
WCDMA II	Ant 0	29.0	18.9	20.9	23.0
WCDMA IV	Ant 0	25.8	21.8	23.5	23.0
WCDMA V	Ant 0	27.6	25.6	29.0	23.0
LTE Band 2	Ant 0	29.0	18.3	20.7	23.0
LTE Band 4	Ant 0	25.6	21.6	23.8	23.0
LTE Band 5	Ant 0	27.9	26.0	29.1	23.0
LTE Band 7	Ant 2	17.2	19.4	22.3	23.0
LTE Band 38	Ant 2	17.5	19.7	21.0	21.0
LTE Band 41	Ant 2	17.5	19.7	21.0	21.0
LTE Band 42	Ant 3	27.4	23.4	29.1	21.0
5G NR n2	Ant 0	29.3	17.6	19.4	23.0
5G NR n5	Ant 0	27.4	25.6	28.4	23.0
5G NR n7	Ant 2	17.1	20.4	21.5	23.0
5G NR n66	Ant 0	25.7	21.9	27.0	23.0
5G NR n38(41)	Ant 2	18.0	19.7	21.5	23.0
5G NR n41-PC2	Ant 2	18.0	19.7	21.5	26.0
5G NR n77	Ant 3	25.5	23.3	26.5	23.0
5G NR n78	Ant 3	26.4	22.7	23.0	23.0
5G NR n78-PC2	Ant 3	26.4	22.7	23.0	26.0
5G NR n41	Ant 1	34.0	25.8	37.1	20.0
5G NR n41	Ant 4	22.8	21.4	25.1	20.0
5G NR n41	Ant 6	25.6	24.5	27.4	20.0
5G NR n77	Ant 1	28.0	21.8	25.0	19.0
5G NR n77	Ant 4	21.2	20.3	27.3	19.0
5G NR n77	Ant 5	24.7	23.7	27.5	19.0
5G NR n78	Ant 1	27.8	20.6	23.4	20.0
5G NR n78	Ant 4	20.5	20.6	25.9	20.0
5G NR n78	Ant 5	24.5	22.8	27.4	20.0

Note: 1) *P_{max} is used for RF tune up procedure. The maximum allowed output power is equal to P_{max} + device uncertainty.

2) All P_{limit} power levels entered in the Table correspond to average power levels after accounting for duty cycle in the case TDD modulation schemes (for e.g., GSM & LTE TDD).

3) The max allowed output power is the P_{limit} + device uncertainty, and if P_{limit} is higher than P_{max}, the device output power will be P_{max} instead.

4) 5G NR n41 ant 1, ant 4 and ant 6, 5G NR n77/ n78 ant 1, ant 4 and ant 5 support SRS (Sounding Reference Signal) functionality.

5) The following table is duty cycle and factor used for calculating time average power.

GSM/FDD/TDD	Duty Cycle	Time average calculation factor(dB)
GSM 1TX	12.50%	-9.0
GSM 2TX	25%	-6.0
GSM 3TX	37.50%	-4.3
GSM 4TX	50%	-3.0
FDD LTE	100%	0.0
TDD LTE	63.30%	-2.0
TDD HPUE	43.30%	-3.6
NR FDD/TDD	100%	0.0