

RF Exposure Report

(Part 0: SAR Char Evaluation)

FCC ID : UZ7TC78A1
Equipment : Touch Computer
Brand Name : Zebra
Model Name : TC78A1
Applicant : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : FCC 47 CFR Part 2 (2.1093)

We, SPORTON INTERNATIONAL INC., 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., the test report shall not be reproduced except in full.



Approved by: Cona Huang / Deputy Manager



Sporton International Inc.

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History of this test report

Report No.	Version	Description	Issued Date
FA271554C	01	Initial issue of report	Oct. 25, 2022

1. Introduction

The FCC 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 FCC RF exposure limit over a defined time window, for SAR (transmit frequency $\leq 6\text{GHz}$) 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 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 uncertainties.
SAR char	P_{limit} for all the technologies/bands for all applicable DSI

Test Lab Information

Test Firm Name	Sporton International Inc.
Test Firm Information	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Firm Registration Number for FCC	553509
FCC Designation No.	TW1190
Test Engineers	Steven Chang, Aaron Chen
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2. Product Description

Product Feature & Specification	
Equipment Name	Touch Computer
FCC ID	UZ7TC78A1
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 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 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n12 : 699 MHz ~ 716 MHz 5G NR n13 : 777 MHz ~ 787 MHz 5G NR n14 : 788 MHz ~ 798 MHz 5G NR n25 : 1850 MHz ~ 1915 MHz 5G NR n26 : 814 MHz ~ 849 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n48 : 3550 MHz ~ 3700 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n71 : 663 MHz ~ 698 MHz 5G NR n77: 3700 MHz ~ 3980 MHz, 3450MHz ~ 3550MHz 5G NR n78: 3700 MHz ~ 3800 MHz, 3450MHz ~ 3650MHz WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3 GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6 GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz WLAN 6E: 5925 MHz ~ 6425 MHz, 6425 MHz ~ 6525 MHz, 6525 MHz ~ 6875 MHz, 6875 MHz ~ 7125 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz RFID : 13.56 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160 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>

The detail SAR design target relate to each exposure conditions pls refer to operation description

Band	Antenna	Device Uncertainty (dB)	WLAN OFF		WLAN ON		
			Head	Body-Worn /Product Specific	Head	Hotspot	Body-Worn /Product Specific
GSM850(4 Tx slots)	4	1.00	0.365	0.794	0.318	0.560	0.794
GSM1900(4 Tx slots)	4	1.00	0.318	0.794	0.318	0.596	0.794
WCDMA II	2	1.00	0.318	0.794	0.318	0.720	0.794
WCDMA IV	2	1.00	0.318	0.794	0.318	0.596	0.794
WCDMA V	4	1.00	0.318	0.812	0.318	0.560	0.794
LTE B2/25	2	1.00	0.680	0.794	0.680	0.596	0.794
LTE B2/25	4	1.00	0.318	0.871	0.318	0.596	0.794
LTE B4/66	2	1.00	0.680	0.935	0.680	0.596	0.935
LTE B4/66	4	1.00	0.318	2.600	0.318	0.935	2.540
LTE B5/26	4	1.00	0.400	0.794	0.318	0.560	0.794
LTE B7	6	1.00	0.391	0.935	0.318	0.715	0.935
LTE B12/B17	0	1.00	0.318	0.794	0.318	0.596	0.794
LTE B13	0	1.00	0.318	0.794	0.318	0.596	0.794
LTE B14	0	1.00	0.318	0.794	0.318	0.596	0.794
LTE B71	0	1.00	0.318	0.794	0.318	0.560	0.794
LTE B38 (PC3)	6	1.00	0.318	0.794	0.318	0.715	0.794
LTE B41 (PC3)	6	1.00	0.318	0.794	0.318	0.715	0.794
LTE B41 (PC2)	6	1.00	0.318	0.794	0.318	0.715	0.794
LTE B48	11	1.00	0.318	0.955	0.318	0.715	0.794
LTE B48	12	1.00	1.000	0.794	0.794	0.874	0.794
FR1 n2/n25	2	1.00	0.318	0.794	0.318	0.720	0.794
FR1 n2/n25	4	1.00	0.318	0.977	0.318	0.596	0.794
FR1 n5/n26	4	1.00	0.341	0.794	0.318	0.560	0.794
FR1 n7	6	1.00	0.400	0.935	0.318	0.560	0.935
FR1 n12	0	1.00	0.318	0.794	0.318	0.596	0.794
FR1 n13	0	1.00	0.318	0.794	0.318	0.596	0.794
FR1 n14	0	1.00	0.318	0.794	0.318	0.596	0.794
FR1 n38 (PC3)	6	1.00	0.318	0.794	0.318	0.715	0.794
FR1 n41 (PC3)	6	1.00	0.318	0.794	0.318	0.715	0.794
FR1 n41 (PC2)	6	1.00	0.318	0.891	0.318	0.715	0.794
FR1 n41_SRS (PC3)	12	1.00	0.955	0.935	0.794	0.720	0.935
FR1 n41_SRS (PC2)	12	1.00	0.955	0.935	0.794	0.720	0.935
FR1 n41_SRS (PC3)	1	1.00	0.460	0.935	0.318	0.560	0.935
FR1 n41_SRS (PC2)	1	1.00	0.460	0.935	0.318	0.560	0.935
FR1 n41_SRS (PC3)	7	1.00	0.460	0.794	0.318	0.715	0.794
FR1 n41_SRS (PC2)	7	1.00	0.460	0.794	0.318	0.715	0.794
FR1 n48 (PC3)	11	1.00	0.318	2.380	0.318	0.715	2.220
FR1 n48 (PC3)	12	1.00	0.955	0.933	0.794	0.874	0.794
FR1 n66	2	1.00	0.794	0.935	0.794	0.596	0.935
FR1 n66	4	1.00	0.318	0.794	0.318	0.935	0.794
FR1 n71	0	1.00	0.318	0.715	0.318	0.596	0.715
FR1 n77/78 (PC2)	12	1.00	0.712	0.794	0.680	0.874	0.794
FR1 n77/78 (PC3)	12	1.00	0.680	0.794	0.680	0.874	0.794
FR1 n77/78 (PC2)	11	1.00	0.365	2.930	0.318	0.480	2.220
FR1 n77/78 (PC3)	11	1.00	0.365	2.930	0.318	0.480	2.220
FR1 n77/78_SRS (PC3)	5	1.00	0.374	0.808	0.318	0.935	0.720
FR1 n77/78_SRS (PC3)	3	1.00	0.763	0.794	0.680	0.720	0.794

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

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

3.2 SAR Char Table

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

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

**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 & NR TDD).

The max allowed output power is the P_{limit} + 1dB device uncertainty, and if P_{limit} is higher than P_{max}, the device output power will be P_{max} instead.

Band	Config	Antenna	Duty cycle	WLAN OFF		WLAN ON			Pmax
				Head	Body-worn /Product Specific	Head	Hotspot	Body-worn /Product Specific	
				DSI2	DSI1	DSI2	DSI3	DSI1	
GSM850 GPRS 4TX	TX0	4	50.00%	26.5	27.6	25.9	27.3	26.6	26.5
GSM1900 GPRS 4TX	TX0	4	50.00%	32.7	24.5	31.7	23.1	23.5	23.5
WCDMA B2	TX0	2	100.00%	28.1	27	27.1	25.4	26	24.2
WCDMA B4	TX0	2	100.00%	25.3	27.3	24.3	23.5	26.3	24.2
WCDMA B5	TX0	4	100.00%	25.3	24.2	24.3	24.4	24.1	24.2
LTE B25/2	TX0	2	100.00%	27.1	29	26.1	25.9	28	24.2
LTE B25/2	TX1	4	100.00%	28.6	22	27.6	21.3	21.6	23.7
LTE B66/4	TX0	2	100.00%	26.8	27.4	25.8	22.6	26.4	24.2
LTE B66/4	TX1	4	100.00%	32.1	23.7	31.1	22.3	23.6	23.7
LTE B26/5	TX0	4	100.00%	23.7	25.5	22.7	25.2	24.5	24.2
LTE B7	TX0	12	100.00%	23	30.7	21.6	24.3	29.7	23
LTE B7	TX1	6	100.00%	23	24.7	22.1	22.3	23.7	23
LTE B12/17	TX0	0	100.00%	25.8	27.6	24.8	27	26.6	23.7
LTE B13	TX0	0	100.00%	28.4	27.3	27.4	25.9	26.3	23.5
LTE B14	TX0	0	100.00%	26.1	26.4	25.1	26.5	25.4	23.7
LTE B38 PC3	TX1	6	63.30%	21.6	24.9	21.5	20.7	23.9	21.5
LTE B41 PC3	TX1	6	63.30%	21.6	24.9	21.5	20.7	23.9	22
LTE B41 PC2	TX1	6	43.30%	21.6	24.9	21.5	20.7	23.9	22.4
LTE B48	TX0	12	63.30%	27.8	17	26.8	12.9	16.2	19
LTE B48	TX1	11	63.30%	19	24.8	18	18.1	23.8	19
LTE B71	TX0	0	100.00%	25.4	28.3	24.4	27.3	27.3	23.7
FR1 n25/2	TX0	2	100.00%	25.2	29	24.2	26.1	28	24.2
FR1 n25/2	TX1	4	100.00%	31	22.6	30	24.1	21.7	24.2
FR1 n5	TX1	4	100.00%	24.2	27.2	23.9	25.1	26.2	24.2
FR1 n7	TX0	12	100.00%	22.7	28.7	21.7	24.3	27.7	23
FR1 n7	TX1	6	100.00%	22.4	26.3	21.8	22.9	25.3	23
FR1 n12	TX0	0	100.00%	27.4	28.9	26.4	29.8	27.9	23.7
FR1 n13	TX0	0	100.00%	28	25.7	27	26.4	24.7	23.5
FR1 n14	TX0	0	100.00%	29.1	26.6	28.1	27	25.6	23.7
FR1 n38 PC3	TX1	6	100.00%	22.8	26	22.8	22.3	25.5	23.5
FR1 n41 PC3	TX1	6	100.00%	22.8	26	22.8	22.3	25.5	24
FR1 n41 PC2	TX1	6	100.00%	22.8	26	22.8	22.3	25.5	26
FR1 n41 PC3 SRS	TX1	12	100.00%	22.7	29.2	21.9	27.3	28.2	24
FR1 n41 PC2 SRS	TX1	12	100.00%	22.7	29.2	21.9	27.3	28.2	26
FR1 n41 PC3 SRS	TX1	1	100.00%	20.5	28.9	18.9	26.1	27.9	24
FR1 n41 PC2 SRS	TX1	1	100.00%	20.5	28.9	18.9	26.1	27.9	26
FR1 n41 PC3 SRS	TX1	7	100.00%	21.1	32.2	19.5	22.9	31.2	24
FR1 n41 PC2 SRS	TX1	7	100.00%	21.1	32.2	19.5	22.9	31.2	26
FR1 n48	TX0	12	100.00%	30.4	21	29.4	17.5	20.7	21
FR1 n48	TX1	11	100.00%	18	20.8	17.2	17.2	20.1	21
FR1 n66	TX0	2	100.00%	26.2	28.1	25.2	22.7	27.1	24.2
FR1 n66	TX1	4	100.00%	35.8	27	34.8	24.9	26	24.2
FR1 n71	TX0	0	100.00%	24.7	29.4	23.7	26.7	28.4	23.7
FR1 n77/78 (PC2)	TX0	12	100.00%	25.5	18	25.3	14.8	18	25.5
FR1 n77/78 (PC3)	TX0	12	100.00%	25.5	18	25.3	14.8	18	21
FR1 n77/78 (PC2)	TX1	11	100.00%	17.7	19.7	17.1	16.3	18.5	25.5
FR1 n77/78 (PC3)	TX1	11	100.00%	17.7	19.7	17.1	16.3	18.5	21
FR1 n77/78_SRS (PC3)	TX1	5	100.00%	15.7	23.5	15	17.7	23	24
FR1 n77/78_SRS (PC3)	TX1	3	100.00%	20	27.3	19.5	23.4	26.3	22