

RF EXPOSURE REPORT FCC

APPLICANT

Safetrust Inc

MODEL NAME

SA220

FCC ID

2ANI5SA220

REPORT NUMBER

HA210720-SFT-002-R04

TEST REPORT

Date of Issue
March 31, 2022

Test Site
Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

Applicant	Safetrust Inc
Applicant Address	8116 Mill Creek Rd, Fremont, CA 94539, U.S.A.
FCC ID	2ANI5SA220
Model Name	SA220
EUT Type	SABRE Module V4
FCC Classification	Digital Transmission System (DTS) Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s)	Part 1 (§1.1310 / §1.1307), Part 2 (§2.1091)
Test Procedure	KDB 447498 D01 v06

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was in accordance with the procedures specified in §2.947. The results in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

Tested By



Yongsoo Park

Test Engineer

Reviewed By



Sunwoo Kim

Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA210720-SFT-002-R04	March 31, 2021	Initial Issue

TABLE OF CONTENTS

1. EUT DESCRIPTION	4
2. INTRODUCTION.....	5
2.1. RF Exposure Exemptions for Single Source.....	5
2.2. RF Exposure Exemptions for Simultaneous Transmission	6
3. RESULT	7
3.1. MPE Calculation	7
3.2. SUMMARY OF RESULTS	8

1. EUT DESCRIPTION

Model	SA220	
EUT Type	SABRE Module V4	
RF Specification	WIFI 5 GHz (U-NII 3) : 802.11a/n(HT20/40)/ ac(VHT20/40/80) Bluetooth LE MCU (1Mbps) : nRF52832 Bluetooth LE MESH (1Mbps) : nRF52832 Bluetooth LE RX (1Mbps) : nRF52811	
Transmitter Chain	WIFI 5 GHz : SISO Bluetooth LE : SISO (BLE MCU and BLE MESH transmit simultaneously)	
Exemption Analysis	<input type="checkbox"/>	1-mW Test Exemptions
	<input checked="" type="checkbox"/>	SAR-Based Test Exemptions
	<input type="checkbox"/>	MPE-Based Test Exemptions
Antenna Specification	WIFI 5 GHz	6.2 dBi (Peak Gain)
	BLE 1M (MCU)	2.0 dBi (Peak Gain)
	BLE 1M (MESH)	2.0 dBi (Peak Gain)
Operating Environment	Indoor and outdoor	
Operating Temperature	-20 °C ~ 50 °C	

2. INTRODUCTION

2.1. RF Exposure Exemptions for Single Source

(A) 1-mW Blanket Exemption

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz - 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

(B) SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz - 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions. Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold (P_{th}).

$$P_{th}(mW) = ERP_{20cm} \left(\frac{d}{20} \right)^x, \text{ where } d \leq 20 \text{ cm}$$

$$P_{th}(mW) = ERP_{20cm}, \text{ where } 20 \text{ cm} < d \leq 40 \text{ cm}$$

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right)$$

$$ERP_{20cm}(mW) = 2040 f, \text{ where } 0.3 \text{ GHz} \leq f(\text{GHz}) < 1.5 \text{ GHz}$$

$$ERP_{20cm}(mW) = 3060, \text{ where } 1.5 \text{ GHz} \leq f(\text{GHz}) \leq 6 \text{ GHz}$$

(C) MPE-Based Exemption

MPE-based exemption is provided in the table 1, § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz - 100 GHz. The table 1 applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power.

RF Source Frequency f_L (MHz) – f_H (MHz)	Minimum Distance $\lambda/2\pi (f_L) - \lambda/2\pi (f_H)$	Threshold ERP (ERP_{th})
0.3 – 1.34	150 m – 35.6 m	1,920 R ²
1.34 – 30	35.6 m – 1.6 m	3,450 R ² / f^2
30 – 300	1.6 m – 159 mm	3.83 R ²
300 – 1,500	159 mm – 31.8 mm	0.0128 R ² f
1,500 – 100,000	31.8 mm – 0.5 mm	19.2 R ²

Table 1. § 1.1307(b)(3)(i)(C) – Single RF Source Subject to Routine Environmental Evaluation

2.2. RF Exposure Exemptions for Simultaneous Transmission

(A) 1-mW Blanket Exemption

Per § 1.1307(b)(3)(ii)(A), the 1-mW exemption may be also applied to simultaneous transmission conditions, within the same host device, according one of the following criteria:

- When maximum available power each individual transmitting antenna within the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm.
- When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period.

This exemption cannot be combined with other options (B) or (C).

(B) SAR-Based Exemptions and MPE-Based Exemptions

As described in § 1.1307(b)(3)(ii)(B) and covers the situations where both SAR-based and MPE-based exemption may be considered for test exemption in fixed, mobile, or portable device exposure conditions. For these cases, a device with multiple RF sources transmitting simultaneously will be considered an RF exempt device if the condition of the following formula is satisfied :

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

3. RESULT

3.1. MPE Calculation

Bluetooth LE MCU				
Frequency (MHz)	2.402 – 2.480	GHz		
Separation Distance (d)	20	cm		
P _{th}	3060	mW		
Max Conducted Output Power	1.0	dBm	1.26	mW
Antenna Gain	2.0	dBi	1.58	-
EIRP	3.00	dBm	2.00	mW
ERP (P)	0.85	dBm	1.22	mW
P / P _{th} Ratio	0.00040	at 20 cm separation distance		

Bluetooth LE MESH				
Frequency (MHz)	2.402 – 2.480	GHz		
Separation Distance (d)	20	cm		
P _{th}	3060	mW		
Max Conducted Output Power	1.0	dBm	1.26	mW
Antenna Gain	2.0	dBi	1.58	-
EIRP	3.00	dBm	2.00	mW
ERP (P)	0.85	dBm	1.22	mW
P / P _{th} Ratio	0.00040	at 20 cm separation distance		

WIFI 5.8 GHz				
Frequency (MHz)	5.745 – 5.825	GHz		
Separation Distance (d)	20	cm		
P _{th}	3060	mW		
Max Conducted Output Power	10.0	dBm	10.00	mW
Antenna Gain	6.2	dBi	4.17	-
EIRP	16.20	dBm	41.69	mW
ERP (P)	14.05	dBm	25.41	mW
P / P _{th} Ratio	0.00910	at 20 cm separation distance		

Note :

1. Maximum conducted output power including tune-up tolerance

3.2. SUMMARY OF RESULTS

Mode	Frequency Range (MHz)	Threshold (P_{th}) (mW)	ERP (P) (mW)	P / P_{th} Ratio
BLE 1M (MCU)	2402 – 2480	3060	1.22	0.00040
BLE 1M (MESH)	2402 – 2480	3060	1.22	0.00040
WIFI 5 GHz	5745 – 5825	3060	25.41	0.00830

Both BLE (MCU) and BLE (MESH) transmit simultaneously, but not with WIFI 5 GHz, which is used for firmware update. Therefore, the worst-case RF exposure is at WIFI 5 GHz transmitting mode.

Sample Calculation

RF Exposure (WIFI 5GHz) at 20cm distance = $P / P_{th} = 25.41 / 3060 = \mathbf{0.00830} < 1.0$

END OF TEST REPORT