HEARING AID COMPATIBILITY RF EMISSIONS TEST REPORT

FCC ID	**: RWO-RZ350259**
Equipment	**: Smartphone**
Brand Name	**: RAZER**
Model Name	**: RZ35-0259**
M-Rating	**: M4**
Applicant	**: Razer Inc.** **201 3rd Street, Suite 900, San Francisco, CA 94103, USA**
Manufacturer	**: Razer Inc.** **201 3rd Street, Suite 900, San Francisco, CA 94103, USA**
Standard	**: FCC 47 CFR §20.19** **ANSI C63.19-2011**

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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Cona Huang

Approved by: Cona Huang / Deputy Manager

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
HA871722-03A	Rev. 01	Initial issue of report	Sep. 17, 2018

1. General Information

Product Feature & Specification	
Applicant Name	Razer Inc.
Equipment Name	Smartphone
Brand Name	RAZER
Model Name	RZ35-0259
FCC ID	RWO-RZ350259
HW Version	DVT
SW Version	V1.2xx
EUT Stage	Identical Prototype
Frequency Band	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 14: 790.5 MHz ~ 795.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 26: 814.7 MHz ~ 848.3 MHz LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 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 AMR / RMC 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM, 64QAM 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC:ASK

Reviewed by: Jason Wang
Report Producer: Wan Liu

2. Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test.

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No.: **SAR04-HY**

3. Applied Standards

- FCC CFR47 Part 20.19
- ANSI C63.19-2011
- FCC KDB 285076 D01 HAC Guidance v05
- FCC KDB 285076 D02 T Coil testing v03
- FCC KDB 285076 D03 HAC FAQ v01

4. RF Audio Interference Level

FCC wireless hearing aid compatibility rules ensure that consumers with hearing loss are able to access wireless communications services through a wide selection of handsets without experiencing disabling radio frequency (RF) interference or other technical obstacles.
To define and measure the hearing aid compatibility of handsets, in CFR47 part 20.19 ANSI C63.19 is referenced. A handset is considered hearing aid-compatible for acoustic coupling if it meets a rating of at least M3 under ANSI C63.19, and A handset is considered hearing aid compatible for inductive coupling if it meets a rating of at least T3. According to ANSI C63.19 2011 version, for acoustic coupling, the RF electric field emissions of wireless communication devices should be measured and rated according to the emission level as below.

Emission Categories	E-field emissions	
	<960Mhz	>960Mhz
M1	50 to 55 dB (V/m)	40 to 45 dB (V/m)
M2	45 to 50 dB (V/m)	35 to 40 dB (V/m)
M3	40 to 45 dB (V/m)	30 to 35 dB (V/m)
M4	<40 dB (V/m)	<30 dB (V/m)

Table 5.1 Telephone near-field categories in linear units

5. Air Interface and Operating Mode

Air Interface	Band MHz	Type	C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	EDGE850	VD	Yes	WLAN, BT	SIP calling(1,2) / Google Duo(1)	No
	EDGE1900			WLAN, BT		No
WCDMA	850 HSPA	VD	No(1)	WLAN, BT	SIP calling(1,2) / Google Duo(1)	No
	1750 HSPA			WLAN, BT		No
	1900 HSPA			WLAN, BT		No
LTE (FDD)	Band 2	VD	No(1)	WLAN, BT	SIP calling(1,2) / Google Duo(1)	No
	Band 4			WLAN, BT		No
	Band 5			WLAN, BT		No
	Band 7			WLAN, BT		No
	Band 12			WLAN, BT		No
	Band 13			WLAN, BT		No
	Band 14			WLAN, BT		No
	Band 17			WLAN, BT		No
	Band 26			WLAN, BT		No
	Band 30			WLAN, BT		No
	Band 66			WLAN, BT		No
	Band 71			WLAN, BT		No
LTE (TDD)	Band 38	VD	Yes	WLAN, BT	SIP calling(1,2) / Google Duo(1)	No
	Band 41			WLAN, BT		No
Wi-Fi	2450	VD	No(1)	GSM,CDMA,LTE	VoWiFi(1) / SIP calling(1,2) / Google Duo(1)	No
	5200			GSM,CDMA,LTE		No
	5300			GSM,CDMA,LTE		No
	5500			GSM,CDMA,LTE		No
	5800			GSM,CDMA,LTE		No
BT	2450	DT	No	GSM,CDMA,LTE	NA	No

Type Transport:
VO= Voice only
DT= Digital Transport only (no voice)
VD= CMRS and IP Voice Service over Digital Transport

Remark:
1. The air interface is exempted from testing by low power exemption that its average antenna input power plus its MIF is ≤17 dBm, and is rated as M4.
2. The SIP calling is android internal auxiliary functions under the dialing program.
3. This is a variant report to add VoWiFi and VoIP evaluation for RZ35-0259.

6. Modulation Interference Factor

The HAC Standard ANSI C63.19-2011 defines a new scaling using the Modulation Interference Factor (MIF). For any specific fixed and repeatable modulated signal, a modulation interference factor (MIF, expressed in dB) may be developed that relates its interference potential to its steady-state rms signal level or average power level. This factor is a function only of the audio-frequency amplitude modulation characteristics of the signal and is the same for field-strength and conducted power measurements. It is important to emphasize that the MIF is valid only for a specific repeatable audio-frequency amplitude modulation characteristic. Any change in modulation characteristic requires determination and application of a new MIF

The Modulation Interference factor (MIF, in dB) is added to the measured average E-field (in dBV/m) and converts it to the RF Audio Interference level (in dBV/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics. Modulations without time slots and low fluctuations at low frequencies have low MIF values, TDMA modulations with narrow transmission and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63.19-2011.

ER3D, EF3D and EU2D E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the indirect measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by PMR calibration in order to not overestimate the field reading. Probe Modulation Response (PMR) calibration linearizes the probe response over its dynamic range for specific modulations which are characterized by their UID and result in an uncertainty specified in the probe calibration certificate. The MIF is characteristic for a given waveform envelope and can be used as a constant conversion factor if the probe has been PMR calibrated.

The evaluation method for the MIF is defined in ANSI C63.19-2011 section D.7. An RMS demodulated RF signal is fed to a spectral filter (similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is scaled to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty. It may alliteratively be determined through analysis and simulation, because it is constant and characteristic for a communication signal. DASY52 uses well-defined signals for PMR calibration. The MIF of these signals has been determined by simulation and it is automatically applied.

The MIF measurement uncertainty is estimated as follows, declared by HAC equipment provider SPEAG, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:

1. 0.2 dB for MIF: -7 to +5 dB
2. 0.5 dB for MIF: -13 to +11 dB
3. 1 dB for MIF: > -20 dB

MIF values applied in this test report were provided by the HAC equipment provider of SPEAG, and the worst values for all air interface are listed below to be determine the Low-power Exemption.

UID	Communication System Name	MIF(dB)
10025	EDGE-FDD (TDMA, 8PSK, TN 0)	3.75
10225	UMTS-FDD (HSPA+)	-20.39
10170	LTE-FDD(SC-FDMA,1RB,20MHz,16-QAM)	-9.76
10172	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	-1.62
10173	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	-1.44
10174	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	-1.54
10061	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02
10077	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	0.12
10427	IEEE 802.11n (HT Greeneld, 150 Mbps, 64-QAM)	-13.44
10069	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	-3.15
10616	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	-5.57

7. Low-power Exemption

<Max Tune-up Limit>

Mode			Average Power (dBm)
GSM	EDGE850		27.0
	EDGE1900		25.0
WCDMA	Band II		21.5
	Band IV		21.0
	Band V		22.5
FDD LTE	Band 2		22.0
	Band 4		22.0
	Band 5		24.0
	Band 7		24.5
	Band 12		24.0
	Band 13		24.0
	Band 14		24.0
	Band 17		24.0
	Band 26		24.0
	Band 30		23.5
	Band 66		22.0
	Band 71		24.0
TDD LTE	Band 38		24.5
	Band 41		25.0
2.4GHz WLAN	ANT1	802.11b	12.5
		802.11g	13.0
		802.11n-HT20	13.0
		802.11n-HT40	13.0
	ANT2	802.11b	13.5
		802.11g	14.0
		802.11n-HT20	14.0
		802.11n-HT40	14.0
5GHz WLAN	ANT1	802.11a	16.0
		802.11n-HT20	15.0
		802.11n-HT40	16.0
		802.11ac-VHT20	14.0
		802.11ac-VHT40	15.0
		802.11ac-VHT80	15.0
	ANT2	802.11a	16.5
		802.11n-HT20	16.0
		802.11n-HT40	16.5
		802.11ac-VHT20	15.0
		802.11ac-VHT40	16.0
		802.11ac-VHT80	16.0

<Low Power Exemption>

Air Interface		Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required
EDGE850		27.0	3.75	30.75	Yes(1)
EDGE1900		25.0	3.75	28.75	Yes(1)
WCDMA - HSPA		22.5	-20.39	2.11	No
LTE - FDD		24.5	-9.76	14.74	No
LTE – TDD	QPSK	25.0	-1.62	23.38	Yes(1)
	16QAM	24.0	-1.44	22.56	Yes(1)
	64QAM	23.0	-1.54	21.46	Yes(1)
2.4GHz WLAN ANT1	802.11b	12.5	-2.02	10.48	No
	802.11g	13.0	0.12	13.12	No
	802.11n-HT20	13.0	-13.44	-0.44	No
	802.11n-HT40	13.0	-13.44	-0.44	No
2.4GHz WLAN ANT2	802.11b	13.5	-2.02	11.48	No
	802.11g	14.0	0.12	14.12	No
	802.11n-HT20	14.0	-13.44	0.56	No
	802.11n-HT40	14.0	-13.44	0.56	No
5GHz WLAN ANT1	802.11a	16.0	-3.15	12.85	No
	802.11n-HT20	15.0	-13.44	1.56	No
	802.11n-HT40	16.0	-13.44	2.56	No
	802.11ac-VHT20	14.0	-5.57	8.43	No
	802.11ac-VHT40	15.0	-5.57	9.43	No
	802.11ac-VHT80	15.0	-5.57	9.43	No
5GHz WLAN ANT2	802.11a	16.5	-3.15	13.35	No
	802.11n-HT20	16.0	-13.44	2.56	No
	802.11n-HT40	16.5	-13.44	3.06	No
	802.11ac-VHT20	15.0	-5.57	9.43	No
	802.11ac-VHT40	16.0	-5.57	10.43	No
	802.11ac-VHT80	16.0	-5.57	10.43	No

General Note:

1. EDGE data modes is not necessary due the GSM Voice mode is the worst case, GSM Voice mode and TDD LTE already evaluation in the Sporton HAC report, FCC ID: RWO-RZ350259, Report No.: HA871722A.
2. According to ANSI C63.19 2011-version, for the air interface technology of a device is exempt from testing when its average antenna input power plus its MIF is ≤17 dBm for any of its operating modes.
3. HAC RF rating is M4 for the air interface which meets the low power exemption.

8. References

[1] ANSI C63.19-2011, “American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”, 27 May 2011.

[2] FCC KDB 285076 D01v05, “Equipment Authorization Guidance for Hearing Aid Compatibility”, Sep 2017

[3] FCC KDB 285076 D02v03, “Guidance for performing T-Coil tests for air interfaces supporting voice over IP (e.g., LTE and WiFi) to support CMRS based telephone services”, Sep 2017

[4] FCC KDB 285076 D03v01, “Hearing aid compatibility frequently asked questions”, Sep 2017

[5] SPEAG DASY System Handbook