

Test report No:
NIE: 73396RAN.016A1

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091; FCC 47 CFR Part 2.1093; FCC 47 CFR Part 1.1307; FCC 47 CFR Part 1.1310

(*) Identification of item under evaluation	TETRA portable radio
(*) Trademark	Sepura
(*) Model and /or type reference	SC2028
(*) Other identification of the product	FCC ID: XX6SC2028M IC: 8739A-SC2028M HW version: PLX-2516515-01 H/w mod state 11 SW version: 1810 002 07367
(*) Features	TETRA (806-870MHz) , BT, BLE, GNSS, 802.11 b,g,n (20 MHz, 2.4 GHz)
(*) Manufacturer	Sepura Limited 9000 Cambridge Research Park, Waterbeach, Cambridge CB25 9TL, UK
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. FCC 47 CFR Part 2.1093. Radiofrequency radiation exposure evaluation: portable devices. FCC 47 CFR Part 1.1307: Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared. FCC 47 CFR Part 1.1310: Radiofrequency radiation exposure limits.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager
Date of issue	2023-11-23
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Index

Competences and guarantees3

General conditions3

Data provided by the client.....3

Identification of the client.....3

Document history3

Appendix A: FCC RF Exposure assessment result4

 General description of the device under evaluation5

 Evaluation Results.....6

Appendix B: FCC RF Exposure information8

 RF Exposure determination of exemption.....9

 RF Exposure evaluation 11

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Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item under evaluation", "Trademark", "Model and/or type reference", "General description of the device", "Other identification of the product").
2. Maximum output power, maximum antenna gains and use distance information
3. The device under evaluation consists of a hand-held portable radio with TETRA, Bluetooth, Wi-Fi and GNSS radios capability.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

Sepura Limited

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Document history

Report number	Date	Description
73396RAN.016	2023-09-01	First release
73396RAN.016A1	2023-11-23	Second release. The name of one antenna has been updated. This modification test report cancels and replaces the test report 73396RAN.016.

Appendix A: FCC RF Exposure assessment result

General description of the device under evaluation

The device under evaluation consists of a hand-held portable radio with TETRA, Bluetooth, Wi-Fi and GNSS radios capability.

According to the manufacturer two different exposure conditions could be possible used depending of the TETRA antennas used during the normal use.

- When TETRA antenna model “350-00005” is used, the separation distance between the radiating structures of the device and nearby users will be greater than 20 cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used for this exposure condition.
- When TETRA antenna model “300-00498” is used, the separation distance between the radiating structures of the device and nearby users will be greater than 0cm. In order to perform the assessment a conservative evaluation distance of 0 cm has been used for this exposure condition.

As stated into the following test reports:

- Bluetooth values corresponding to conducted output power have been measured and stated into element test report num. TRA-059918-45-01B.
- Bluetooth Low Energy values corresponding to conducted output power have been measured and stated into element test report num. TRA-059918-45-02B.
- 802.11 b/g/n values corresponding to conducted output power have been measured and stated into DEKRA Testing and Certification (Suzhou) Co., Ltd. test report num. 2320054R-RF-US-P06V01.
- TETRA values corresponding to conducted output power have been measured and stated into TÜV SÜD Ltd. test report num. 75957666-02 Issue 01.
- TETRA 300-00498 (SPR-03072) antenna gain is stated into dB Technology (Cambridge) Ltd. test report num. R001234_V00.
- TETRA Duty cycle value are stated into DEKRA Testing and Certification, S.A.U. SAR test report num. 73396RAN.001A1.

TETRA “350-00005” and Bluetooth/Bluetooth Low Energy/802.11 b/g/n antenna gains declared by the manufacturer are stated in 350-00005/SPR-09613 datasheet and Sepura SC20 Bluetooth-WiFi Antenna Data V2.0.

The equipment specifications declared by the manufacturer for each supported technology and band are:

Antenna	Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Time Averaged Conducted Power (dBm)	Antenna peak gain (dBi)	Maximum Averaged E.R.P (dBm)	Maximum Averaged E.R.P (mW)	Maximum Averaged E.I.R.P (dBm)	Maximum Averaged E.I.R.P (mW)
Internal	802.11b/g/n	2.4 GHz	2412 - 2484	17.43	100.00	17.43	2.50	17.78	59.98	19.93	98.40
Internal	Bluetooth	2.4 GHz	2400-2483.5	7.45	100.00	7.45	2.50	7.80	6.03	9.95	9.89
Internal	BTLE	2.4 GHz	2402 - 2480	5.55	100.00	5.55	2.50	5.90	3.89	8.05	6.38
300-00498	TETRA	806-870 MHz	806 - 870	35.18	25.00	29.16	1.05	28.06	639.65	30.21	1049.40
350-00005	TETRA	806-870 MHz	806 - 870	35.18	25.00	29.16	5.00	32.01	1588.33	34.16	2605.79

Table 1: Equipment specifications

Evaluation Results for portable exposure condition

RF Exposure Exemption evaluation:

Antenna	Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Distance (cm)	Time Averaged Conducted Power (mW)	Maximum Averaged E.R.P (mW)	§ 1.1307(b)(3).i.(B) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
Internal	802.11b/g/n	2.4 GHz	2412 - 2484	0.50	N/A	59.98	2.71	*SAR needed
Internal	Bluetooth	2.4 GHz	2400 - 2483.5	0.50	N/A	6.03	2.71	*SAR needed
Internal	BTLE	2.4 GHz	2402 - 2480	0.50	N/A	3.89	2.72	*SAR needed
300-00498	TETRA	806-870 MHz	806 - 870	0.50	824.02	N/A	9.72	*SAR needed

Table 2: FCC Exemption Evaluation Results

*SAR measurements and simultaneous transmission evaluation have been performed and are stated into DEKRA Testing and Certification, S.A.U. SAR test report num. 73396RAN.001A1.

Evaluation Results for mobile exposure condition

RF Exposure Exemption evaluation:

Antenna	Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Distance (cm)	Maximum Averaged E.R.P (mW)	§ 1.1307(b)(3).i.(B) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
Internal	802.11b/g/n	2.4 GHz	2412 - 2484	20.00	59.98	3060.00	Pass
Internal	Bluetooth	2.4 GHz	2400 - 2483.5	20.00	6.03	3060.00	Pass
Internal	BTLE	2.4 GHz	2402 - 2480	20.00	3.89	3060.00	Pass
350-00005	TETRA	806-870 MHz	806 - 870	20.00	1588.33	1644.24	Pass

Table 3: FCC Exemption Evaluation Results

The computed value(s) are below the exemption limit(s), so these modes meet the requirements stated in FCC 47 CFR Part 1.1307.

Simultaneous transmission assessment:

The device under evaluation is able to transmit simultaneously using 802.11 b/g/n, Bluetooth and TETRA transmitters, therefore the most conservative approach for the evaluation of the simultaneous transmission will be:

Simultaneous technologies and modes	Result (Σ of Pout/Pmax ratios)	Verdict ($\Sigma \leq 1$)
802.11 b/g/n + Bluetooth 2.4 GHz + TETRA 806-870 MHz (350-00005 Antenna)	0.99	Pass

Table 4: Simultaneous Transmission assessment

Appendix B: FCC RF Exposure information

RF Exposure determination of exemption

According to FCC 47 CFR §1.1307 (b)(3) Determination of exemption:

(i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2), a single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

TABLE 1 TO §1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ² .
1.34-30	3,450 R ² /f ² .
30-300	3.83 R ² .
300-1,500	0.0128 R ² f.
1,500-100,000	19.2R ² .

(ii) For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

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

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for Pth, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (Pth) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERPj = the ERP of fixed, mobile, or portable RF source j.

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$ according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluated,k = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limit,k = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.

RF Exposure evaluation

Limits for Maximum Permissible Exposure (MPE) for RF sources are defined in FCC 47 CFR “§1.1310 Radiation Exposure limits, paragraph (e)”:

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T = transmitter time-averaged output power (including Duty Cycle and tune-up tolerance, if applicable)

G_T = gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable