

INQUIRY FCC SC2028

**< KDB 484596 DATA
REFERENCE >**



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VERSION CONTROL

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1 INTRODUCTION

The product under certification (variant device) is SC2028, with FCC ID: XX6SC2028M and ISED/IC ID 8739A-SC2028M. This is a device with TETRA, BT and Wi-Fi transmitter.

SEPURA Limited has a previous version of this model SC2028 (REFERENCE device) certified under the FCC ID: XX6SC2028 and IC ID 8739A-SC2028 integrating the current Bluetooth and Wi-Fi module (LBEP5CLWTC-631 Type WT), and GNSS module (Ublox M8). However, same antennas, same frequency and software are used to generate the TETRA signal.

We, SEPURA LIMITED, take full responsibility for the fact that the test data as referenced represents valid data for demonstrating compliance for the variants listed in the application.

2 JUSTIFICATIONS

A tetra mobile radio (reference device) is certified for TETRA bands, Bluetooth 2.4GHz, Bluetooth Low energy and Wi-Fi 2.4GHz bands (Part 90, Part 15C).

Due to the availability issues for the current Bluetooth and Wi-Fi module (LBEP5CLWTC-631 Type WT), and GNSS module (Ublox M8), SC2028 has undergone a design change with new BT/Wi-Fi module - LBEE59B1LV-278 Type 1LV and a new GNSS module (Ublox M10). Both variants have the same main PCB, same antennas, same frequency and same software is used to generate the TETRA signal. Related to Hardware the only difference are the modules.

For TETRA only spot checking has been performed.

For Wi-Fi the manufacturer has modified some module output power values, so they performed FULL testing on the new variant. Then, for BT purposes, they have followed the integration and installation module guidelines. So only spot cheking has been done.

For all these reasons, we consider that the variant device can leverage the test results from the reference device just performing the spot checking explained below.

3 ILLUSTRATIONS SIDE BY SIDE

Please refers to document “CON-REP-00393 SC2028 BT-WiFi Internal Photographs Comparison”.

4 SPOT CHECK TEST PLAN

4.1 RADIO FREQUENCY

TETRA

Full testing was performed on the Reference device SC2028 with FCC ID: XX6SC2028:

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 90, FCC 47 CFR Part 2, Industry Canada RSS-119 and ISSED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 90	Part 2	RSS-119	RSS-GEN			
Configuration and Mode: TETRA 809 MHz to 824 MHz - Transmit High capacity battery							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	
2.2	90.209	2.1049	5.5	6.7	Bandwidth Limitations	Pass	
2.3	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.4	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	
2.5	90.221	-	-	-	Adjacent Channel Power	Pass	
2.6	90.207	2.1047	5.2	-	Types of Emissions	Pass	
2.7	90.210	2.1051	5.8	6.13	Radiated Spurious Emissions	Pass	
Configuration and Mode: TETRA 851 MHz to 869 MHz - Transmit High capacity battery							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	
2.2	90.209	2.1049	5.5	6.7	Bandwidth Limitations	Pass	
2.3	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.4	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	
2.5	90.221	-	-	-	Adjacent Channel Power	Pass	
2.6	90.207	2.1047	5.2	-	Types of Emissions	Pass	
2.7	90.210	2.1051	5.8	6.13	Radiated Spurious Emissions	Pass	

Then, partial testing as spot checking has been performed on the Variant device SC2028 with FCC ID: XX6SC2028M:

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 90, ISSED RSS-119 and ISSED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 2	Part 90	RSS-119	RSS-GEN			
Configuration and Mode: TETRA 806 MHz to 824 MHz							
2.1	2.1046	90.205	5.4	6.12	Maximum Conducted Output Power	Pass	
2.2	2.1051	90.210	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.3	2.1053	90.210	5.8	6.13	Radiated Spurious Emissions	Pass	
Configuration and Mode: TETRA 851 MHz to 869 MHz							
2.1	2.1046	90.205	5.4	6.12	Maximum Conducted Output Power	Pass	
2.3	2.1053	90.210	5.8	6.13	Radiated Spurious Emissions	Pass	
2.2	2.1051	90.210	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	

According to KDB 484596 D01 Referencing Test Data v02r01, while being always compliant with the applicable rule part(s) for the test under consideration, spot-check measurements may show a deviation from the reference data no larger than 3 dB, applicable for both field and power quantities.

Comparing the test results in terms of power;

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

806.025 MHz		815.000 MHz		823.975 MHz	
Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
34.51	2.825	34.42	2.767	34.58	2.767

Figure 1 XX6SC2028 Maximum Output Power 806 – 824 MHz

TETRA 806 MHz to 824 MHz

Parameter	806.025 MHz	815.000 MHz	823.975 MHz
Conducted Output Power (dBm)	35.03	35.10	35.18
Manufacturer Declared Power (dBm)	35.0	35.0	35.0
Δ from manufacturer Power (dB)	0.03	0.10	0.18
Antenna Gain (dBd)	-1.05	-1.05	-1.05
ERP (dBm)	33.98	34.05	34.13

Figure 2 XX6SC2028M Maximum Output Power 806 – 824 MHz

$$\text{Difference} = 0.6 \text{ dBm}$$

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

851.025 MHz		860.000 MHz		868.975 MHz	
Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
34.63	2.904	34.41	2.761	34.23	2.649

Figure 3 XX6SC2028 Maximum Output Power 851 - 869 MHz

TETRA 851 MHz to 869 MHz

Parameter	851.025 MHz	860.000 MHz	868.975 MHz
Conducted RMS Output Power (dBm)	34.91	34.84	34.75
Manufacturer Declared Power (dBm)	35.0	35.0	35.0
Δ from manufacturer Power (dB)	-0.09	-0.16	-0.25
Antenna Gain (dBd)	-1.05	-1.05	-1.05
ERP (dBm)	33.86	33.79	33.70

Figure 4 XX6SC2028M Maximum Output Power 851 - 869 MHz

$$\text{Difference} = 0.28 \text{ dBm}$$

In terms of output power, we can check that the deviation is less than 3 dB for all channels tested, so this KDB is satisfactory met.

WLAN 2.4GHz

Full testing has been performed on the Variant device because output power from EUT is modified respecting module's output power. This information can be confirmed by checking test report with ID 2320054R-RF-US-P06V01.

So, no data reference is needed for this functionality.

Bluetooth LE

- Full testing on the integrated module with FCC ID: XX6LBEE59B1LV performing the following test cases:

FCC Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	$\geq 500\text{kHz}$	Conducted	Pass	Section 6.2
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	$\leq 30\text{dBm}$		Pass	Section 6.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	$\leq 8\text{dBm/3kHz}$		Pass	Section 6.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	$\leq 20\text{dBc(Peak)}$		Pass	Section 6.5
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 6.6 & 6.7

- Partial testing as spot checking has been performed on model SC2028 with FCC ID: XX6SC2028M with the following test cases:

Test Method and Description		Requirement Clause 47CFR15	Requirement Clause RSS	Applicable to this equipment	Result / Note
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.247 (d)	247, 3.3	☒	Pass
AC power line conducted emissions		15.207	Gen, 8.8	☐	Note 1
Occupied bandwidth		15.247 (a) (2)	247, 5.2 (a)	☐	Note 1
Conducted carrier power	Peak	15.247 (b) (3)	247, 5.4 (d)	☒	Pass
	Max.			☐	
Out of band emissions		15.247 (d)	247, 5.5	☐	Note 1
Power spectral density		15.247 (e)	247, 5.2 (b)	☐	Note 1
Calculation of duty correction		-	15.35 (c)	☒	N/A

Specific Note:

- Limited testing was performed to check transmitter radiated spurious emissions only on a single channel and mode, as required by the client, to satisfy modular integration requirements of KDB996369 D04 v02 and RSP-100.

For this interface, modular approval approach is followed. In order to confirm that the integration is correct and modular approval KDB is fulfilled, one conducted output power from EUT is measured and compared with worst case of conducted output power from module, and it must be inside a margin of +/- 1.5 dB. Also, Radiated Spurious Emissions test case was performed in order to confirm a correct module integration.

- BLE (DTS), reports ID 1901WSU002-U5 (module) page 19 (top); 74747RRF.003 (EUT), page 17 (bottom)

Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate / Mbps	Channel No.	Freq. (MHz)	Average Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE	1	00	2402	3.56	≤ 30.00	4.46	≤ 36.00	Pass
BLE	1	19	2440	4.51	≤ 30.00	5.41	≤ 36.00	Pass
BLE	1	39	2480	4.69	≤ 30.00	5.59	≤ 36.00	Pass
BLE	2	00	2402	3.48	≤ 30.00	4.38	≤ 36.00	Pass
BLE	2	19	2440	4.44	≤ 30.00	5.34	≤ 36.00	Pass
BLE	2	39	2480	4.63	≤ 30.00	5.53	≤ 36.00	Pass

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Max RF-Output power (dBm)	Max E.I.R.P. (dBm)
2402.00000	Digital Transmission System (DTS)	1	1	1	4.85	7.35
2440.00000	Digital Transmission System (DTS)	1	1	1	4.57	7.07
2480.00000	Digital Transmission System (DTS)	1	1	1	5.21	7.71

Difference = 0.52 dBm

AS the difference is less than 3dBm, we are in compliance with the KDB criteria for data referencing.

Bluetooth EDR

- Full testing on the integrated module with FCC ID: XX6LBEE59B1LV performing the following test cases:

FCC Part Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result
15.247(a)(1)	RSS-247 [5.1]	20dB Bandwidth	N/A	Conducted	PASS
15.247(b)(1)	RSS-247 [5.4(b)]	Peak Transmitter Output Power	<0.125 Watt		PASS
15.247(a)(1)	RSS-247 [5.1]	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		PASS
15.247(a)(1) (iii)	RSS-247 [5.1]	Number of Channels	> 15 Channels		PASS
15.247(a)(1) (iii)	RSS-247 [5.1]	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS
15.247(d)	RSS-247 [5.5]	Band Edge / out-of-Band Emissions	Conducted ≤ 20dBc		PASS
15.205, 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	PASS

- Partial testing as spot checking has been performed on model SC2028 with FCC ID: XX6SC2028M with the following test cases:

Test Method and Description	Requirement Clause 47CFR15	Requirement Clause RSS	Applicable to this equipment	Result / Note
Radiated spurious emissions (restricted bands of operation and cabinet radiation)	15.247(d)	247, 3.3	☒	Pass
AC power line conducted emissions	15.207	Gen, 8.8	☐	Note 1
Carrier frequency separation	15.247 (a) (1)	247, 5.1 (b)	☐	Note 1
Number of hopping channels	15.247 (a) (1) (i), (ii) and (iii)	247, 5.1 (c), (d) and (e)	☐	Note 1
Average time of occupancy	15.247 (a) (1) (i), (ii) and (iii)	247, 5.1 (c), (d) and (e)	☐	Note 1
Maximum peak conducted output power	15.247 (a) (1), (b)(1) and (b)(2)	247, 5.4 (a), (b) and (c)	☒	Pass
20 dB emission bandwidth	15.247 (a) (1) (i) and (ii)	247, 5.1 (a)	☐	Note 1
Out-of-band emissions	15.247(d)	247, 5.5	☐	Note 1
Calculation of duty correction	-	15.35 (c)	☒	N/A

Specific Note:

- Limited testing was performed to check transmitter radiated spurious emissions only on a single channel and mode, as required by the client, to satisfy modular integration requirements of KDB996369 D04 v02 and RSP-100.

For this interface, modular approval approach is followed. In order to confirm that the integration is correct and modular approval KDB is fulfilled, one conducted output power from EUT is measured and compared with worst case of conducted output power from module, and it must be inside a margin of +/- 1.5 dB. Also, Radiated Spurious Emissions test case was performed in order to confirm a correct module integration.

- BT EDR (DSS), reports ID 1901WSU002-U4 (module) page 23 (top); 74747RRF.003 (EUT), page 12 (bottom)

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Result
DH5	00	2402	9.59	≤ 20.97	10.49	≤ 36.0	Pass
DH5	39	2441	9.93	≤ 20.97	10.83	≤ 36.0	Pass
DH5	78	2480	9.50	≤ 20.97	10.40	≤ 36.0	Pass
2DH5	00	2402	7.75	≤ 20.97	8.65	≤ 36.0	Pass
2DH5	39	2441	7.76	≤ 20.97	8.66	≤ 36.0	Pass
2DH5	78	2480	8.05	≤ 20.97	8.95	≤ 36.0	Pass
3DH5	00	2402	8.24	≤ 20.97	9.14	≤ 36.0	Pass
3DH5	39	2441	8.20	≤ 20.97	9.10	≤ 36.0	Pass
3DH5	78	2480	8.45	≤ 20.97	9.35	≤ 36.0	Pass

Modulation: BT (GFSK 1-DH5)

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Peak Power (dBm)	EIRP (dBm)
2402.000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	9.32	11.82
2441.000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	9.73	12.23
2480.000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	8.41	10.91

Difference = 0.2 dBm

AS the difference is less than 3dBm, we are in compliance with the KDB criteria for data referencing.

SAR

For SAR, test report is issued against RSS-102 Issue 5 and it states that Notice 2020-DRS0022 is followed. Requirements from RSS-102-SAR.MEAS and Notice 2020-DRS0022 and they are similar. So, reports should be in compliance with RSS-102-SAR.MEAS too. We have performed FULL testing on model SC2028 where we got a PASS result.

So, no data reference is needed for this functionality.

RF EXPOSURE

RF exposure assessment has been fully repeated for new version model SC2028.

So, no data reference is needed for this functionality.

4.2 EMC

Full testing has been done for new version model SC2028 against FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-21 Edition). So we don't need to leverage any test result from other device.

So, no data reference is needed for this functionality.

ANNEX 1: CROSS REFERENCE TABLE

Reference device	Variant device	Key Differences
FCC XX6SC2028	FCC XX6SC2028M	Due to the availability issues for the current Bluetooth and Wi-Fi module (LBEP5CLWTC-631 Type WT), and GNSS module (Ublox M8), SC2028 has undergone a design change with new BT/Wi-Fi module - LBEE59B1LV-278 Type 1LV and a new GNSS module (Ublox M10).

Rule Part	Test item	Data Reference	Comments
TNB			
FCC 90.205	Maximum Conducted Output Power	N	Full testing for model SC2028 and spot checking for model SC2028M
FCC 90.209	Bandwidth Limitations	Y	Full testing for model SC2028 and data reference for model SC2028M
FCC 90.210	Spurious Emissions at Antenna Terminals	N	Full testing for model SC2028 and spot checking for model SC2028M
FCC 90.210	Frequency stability	Y	Full testing for model SC2028 and data reference for model SC2028M
FCC 90.221	Adjacent Channel Power	Y	Full testing for model SC2028 and data reference for model SC2028M

FCC 90.207	Types of Emissions	Y	Full testing for model SC2028 and data reference for model SC2028M
FCC 90.210	Radiated Spurious Emissions	N	Full testing for model SC2028 and spot checking for model SC2028M
DTS (802.11 b, g, n)			
FCC 15.247 (a)	20 dB Bandwidth	N	Full testing for model SC2028 and for model SC2028M
FCC 15.247 (b)	Maximum output power and antenna gain	N	Full testing for model SC2028 and for model SC2028M
FCC 15.247 (c)	Band-edge emissions compliance (Transmitter)	N	Full testing for model SC2028 and for model SC2028M
FCC 15.247 (d) FCC 15.205 FCC 15.209	Band Edge measurements	N	Full testing for model SC2028 and for model SC2028M
FCC 15.247 (e)	Power spectral density	N	Full testing for model SC2028 and for model SC2028M
FCC 15.247 (d) FCC 15.209	Conducted Spurious Emission	N	Full testing for model SC2028 and for model SC2028M
ANSI C63.10:2013	Duty Cycle	N	Full testing for model SC2028 and for model SC2028M
FCC 15.205 FCC 15.209	AC Power Line Conducted Emission	N	Full testing for model SC2028 and for model SC2028M
FCC 15.203	Antenna Requirements	N	Full testing for model SC2028 and for model SC2028M
DTS (BLUETOOTH LOW ENERGY)			

FCC 15.247 (a)	Occupied Bandwidth	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (b)	Maximum output power and antenna gain	N	Full testing for integrated module and spot checking for model SC2028M
FCC 15.247 (a)	Channel Separation	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (a)	Number of Channels	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (d)	Radiated Spurious Emissions	N	Full testing for integrated module and spot checking for model SC2028M
FCC 15.247 (d)	Out of band Emissions	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.205 FCC 15.209	Field Strength Limits	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.207	AC Conducted Emissions 150kHz – 30MHz	Y	Full testing for integrated module and data reference for model SC2028M
DSS (BLUETOOTH)			
FCC 15.247 (a)	Occupied Bandwidth	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (b)	Maximum output power and antenna gain	N	Full testing for integrated module and spot checking for model SC2028M

FCC 15.247 (a)	Channel Separation	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (a)	Number of Channels	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.247 (d)	Radiated Spurious Emissions	N	Full testing for integrated module and spot checking for model SC2028M
FCC 15.247 (d)	Out of band Emissions	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.205 FCC 15.209	Field Strength Limits	Y	Full testing for integrated module and data reference for model SC2028M
FCC 15.207	AC Conducted Emissions 150kHz – 30MHz	Y	Full testing for integrated module and data reference for model SC2028M

Rule Part	Test item	Data Reference	Comments
FCC 2.1091 FCC 2.1093 FCC 1.1310 FCC 1.1307	RF Exposure Exemption evaluation	N	Full testing for model SC2028 and for model SC2028M
FCC 2.1093	MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)	N	Full testing for model SC2028 and for model SC2028M

Unintentional radiator (EMC) is out of the certification scope.

Rule Part	Test item	Data Reference	Comments
JAB			
FCC 15.107	Conducted emission	N	Full testing for model SC2028 and for model SC2028M
FCC 15.109	Radiated emission	N	Full testing for model SC2028 and for model SC2028M

Acceptance Criteria for all test cases**FCC Part 90 (TNB)**

For the same radiated test conditions, It has been evaluated the value of the carrier, with the difference between the reference and the variant being <3 dB.

FCC Part 15.247 (DTS)

For the same radiated test conditions, It has been taken the considered most critical range of harmonic emission of the carrier and compared the value of the first evaluable harmonic, with the difference between the reference and the variant being <3 dB.

FCC Part 15.247 (DSS)

For the same radiated test conditions, It has been evaluated the value of the carrier, with the difference between the reference and the variant being <3 dB.