Radio Frequency Exposure Evaluation Report

FOR:
Crane Payment Innovations

Model Name:
AIO2210-US101

Product Description:
ALIO Note is a card reader bezel that incorporates mag stripe, contact, and contactless card reader capabilities in support of unattended cashless sales. It is mechanically mounted on a bill acceptor during normal use further enhancing payment capability at the POS. It utilizes 4g CAT M (Telit module ME910G1WW) cellular radio, NFC (13.56 MHz) to read cards, and BLE (QUALCOMM CSR1010) to support diagnostic capability.

FCC ID: QP8ALIONOTEVZ

Applied Rules and Standards:
CFR 47 Part 2 (2.1093),
FCC KDB 447498 D01 General RF Exposure Guidance v06

Report number: EMC_MEIGR-011-21001_FCC_SAR_EX

DATE: 2021-06-01

A2LA Accredited

***CETECOM* Inc.**
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Contents

1. Assessment

The following device was evaluated against the limits for general population uncontrolled exposure specified in CFR 47 Part 2.1093 according to SAR evaluation exclusion requirements specified in FCC regulation as listed in KDB 447498.

The device meets the requirements for SAR exclusion as stipulated by the above given FCC rules.

Company	Description	Model #
Crane Payment Innovations	ALIO Note is a card reader bezel that incorporates mag stripe, contact, and contactless card reader capabilities in support of unattended cashless sales. It is mechanically mounted on a bill acceptor during normal use further enhancing payment capability at the POS. It utilizes 4g CAT M (Telit module ME910G1WW) cellular radio, NFC (13.56 MHz) to read cards, and BLE (QUALCOMM QualCom CSR1010) to support diagnostic capability.	AIO2210-US101

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2021-06-01	Compliance	Kevin Wang (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2021-06-01	Compliance	Yuchan Lu (Test Engineer)	Yuchan Lu Digitally signed by: Yuchan Lu DN: CN = Yuchan Lu email = Yuchan.Lu@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2021.06.01 11:59:55 -07'00'

2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Lab Manager:	Kevin Wang
Responsible Project Leader:	Rami Saman

2.2. Identification of the Client / Manufacturer

Client's Name:	Crane Payment Innovations
Street Address:	3222 Phoenixville Pike, Suite 200
City/Zip Code	Malvern, PA 19355
Country	USA

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3. Equipment under Assessment

Model No	AIO2210-US101
HW Version	G1
SW Version	5.X
FCC-ID	QP8ALIONOTEVZ
Product Description	ALIO Note is a card reader bezel that incorporates mag stripe, contact, and contactless card reader capabilities in support of unattended cashless sales. It is mechanically mounted on a bill acceptor during normal use further enhancing payment capability at the POS. It utilizes 4g CAT M (Telit module ME910G1WW) cellular radio, NFC (13.56 MHz) to read cards, and BLE (QUALCOMM CSR1010) to support diagnostic capability.
Device Category	☐ Fixed Installation ☐ Mobile ■ Portable ☐ Mixed Mobile and Portable
Frequency Range / number of channels	CAT-M1 LTE Band 4: 1710.7 – 1754.3 MHz; CAT-M1 LTE Band 13: 779.5 – 784.5 MHz; BT LE: 2402(ch 0) – 2480(ch 39), 40 channels
Type(s) of Modulation	LTE Bands: QPSK Modulation Bluetooth version 4.0: GFSK modulation
Modes of Operation / Declared Output power	CAT-M1 LTE Band 4: 23.86 dBm; CAT-M1 LTE Band 13: 23.04 dBm; BT LE: 9.4 dBm
Max. declared antenna gain	LTE: Taoglas antenna PT# FXUB65 • LTE Band 4/13 = 2 dBi Peak • BTLE: pcb strip line antenna, 1.8 dBi
Minimum distance of antenna or radiating parts to user	20 mm
Power Supply/ Rated Operating Voltage Range	Vmin: 20 VDC/ Vnom: 24 VDC / Vmax: 42 VDC
Operating Temperature Range	Low -15ºC, Nominal 25ºC, High 60ºC
Other Radios included in the device	NFC
Co-located Transmitters / Antennas	■Yes ☐No
Sample Revision	☐Prototype ■ Production ☐ Pre-Production
Exposure Category	☐ Occupational/ Controlled ■ General Population/ Uncontrolled

4. FCC Exemption Limits for Routine Evaluation

4.1. FCC SAR test exclusions per KDB 447498

KDB 447498 D01 General RF Exposure Guidance v06 Section: 4.3.1.
Standalone SAR test exclusion considerations states

4) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, 30 where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds.*

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	*SAR Test Exclusion Threshold* (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

5. Stand-alone Transmission SAR Exclusion Evaluation

5.1. Justification for using the 20 mm Distance

The devise intends to be used on human body. The conservative distance of 20 mm is an estimate of how close a human body can be to the device in its typical application.

5.2. Justification for use of load based time averaging

The worst case loading for each of the radios was determined from the following information provided by the manufacturer:

EUT Operating Conditions

Co-transmission is only possible with Cellular and BT LE.

5.3. SAR Exclusion Calculation Table

FCC Standalone Transmission SAR Exclusion Calculations								
Band	**d [mm]**	**f [GHz]**	**Max Power + Tune Up [mW]**	**Source Based Duty Cycle**	**Load based duty cycle based on Maximum payload.[2]**	**Effective Time Average Max Power [mW]**	**FCC Limit [1] @ 20 mm [mW]**	**SAR Exclusion applicable (Yes/No)**
LTE Band 4	20	1.755	316.23	1.00	0.074	23.40	45.29	Yes
LTE Band 13	20	0.787	316.23	1.00	0.074	23.40	67.63	Yes
BTLE	20	2.48	8.71	1.00	0.05	0.44	38.10	Yes
NFC	20	0.01356	1400	1.00	0.0132	18.48	424.3	Yes

Note 1: The FCC limit was derived by calculating the maximum output power passing the threshold for 1-g SAR exclusion

Note 2: RRC connection setup in LTE:

The connection setup is not be affected by our transmission control mechanism as there is not user plane data involved here.

MSG1 (RACH preamble) is a maximum 2.3 ms in length.

MSG3 (RRC connection request) is a maximum of 100 bits long. In worst-case resource allocation of 16 bits /ms this will lead to a 7 ms transmission time

MSG5 (RRC connection setup complete) is a maximum of 100 Bytes long. In worst-case resource allocation of 16 bits /ms this will lead to a 50 ms transmission time.

In case the RRC connection is not successful because the MSG5 does not get through, a conservative RRC timeout is defined by ALIO with 800 ms. Only after this timer runs down the UE may attempt another connection requests.

59.3 ms in 800 ms leads to a worst-case duty cycle of **7.4%.**

All above values have been taken from the LTE physical layer standard 3GPP TS 36.213 and the LTE MAC layer standard 3GPP TS 36.321.

Transmission of user plane data over LTE:

1) Transmission speed = 230Kbits/ sec.
2) Max bits user data, transmitted / card authorization:
During card authorization, 13,112 bits are transmitted.
At an allocation, 230k bits/second this takes 0.057 seconds of transmission time.
Duty cycle = **5.7%**

Based on customer declaration, the transmission for NFC:

NFC Duty cycle = NFC Transmit time per vend / Vending cycle time until next Vend Start.

NFC Duty cycle = 500ms / 38 second

NFC Duty cycle = 0.0132 or 1.32%

6. Simultaneous Transmission SAR Exclusion Evaluation

6.1. FCC 1-g Standalone Transmitter Calculation for Simultaneous Transmitter SAR Exclusion

Band	d [mm]	f [GHz]	Max Power + Tune Up [mW]	Source Based Duty Cycle	Load based duty cycle based on Maximum payload.	Effective Time Average Max Power [mW]	FCC 1-g SAR Exclusion calculation [W/kg]
LTE Band 4	20	1.755	316.23	1	0.074	23.40	1.55
LTE Band 13	20	0.787	316.23	1	0.074	23.40	1.04
BTLE	20	2.48	8.71	1	0.05	0.44	0.03

6.2. Simultaneous Transmission FCC 1-g SAR Exclusion calculation

Based on the information provided by the manufacturer there is only one mode of possible simultaneous transmission. The mode was evaluated against the FCC 1-g SAR exclusion threshold in the table below.

Transmission Mode	Simultaneous Transmission FCC 1-g SAR Exclusion calculation [W/kg]	FCC 1-g SAR Exclusion Threshold [W/kg]	SAR Exclusion applicable (Yes/No)
LTE B4 and BLE	0.2112	< 0.4	Yes
LTE B13 and BLE	0.1430	< 0.4	Yes

7. Revision History

Date	Report Name	Changes to report	Report prepared by
2021-06-01	EMC_MEIGR-011-21001_FCC _SAR_EX	Initial version	Yuchan Lu