SAR EXEMPTION, MPE CALCULATION AND RADIATION EXPOSURE RISK ASSESSMENT CALCULATIONS
Model number: DD16-3A
Product Marketing Name: "Chroma 16+, Chroma 16L"

1   FCC SAR TEST EXCLUSION CALCULATIONS

Based on guidance from KDB 447498

1.1   SAR TEST EXCLUSION CALCULATION

Time averaged conducted power		
Nominal power output	0 dBm	Set by Firmware
Production tolerance	+0.5 dB	IC tolerance over temperature and supply
max conducted power	0.5 dBm (1.12mW)	"Tune up tolerance"
Max theoretical duty cycle in normal operation	0.136%	12ms every 8.8s
Max average conducted power	0.0015 mW	
Rounded up to nearest mW	1 mW	(Clause 4.3.1)

Minimum test Separation Distance	
Minimum 5mm is used. (Clause 4.1.5)	It is conceivable that a user might touch the electronic shelf label display while it is transmitting. Antenna is 3mm from the surface of the display.

Minimum frequency	902.5 MHz
Maximum frequency	927.5 MHz

SAR test exclusion threshold calculation (clause 4.3.1)

*Calculation is Power of channel (mW) / min test separation(mm) * [sqrt freq (GHz)]. (Result rounded to 1 decimal place)*

Min. channel: 1 / 5 * [sqrt 0.9025] = 0.2

Max. channel: 1 / 5 * [sqrt 0.9275] = 0.2

This is below the limits for 1-g SAR (3.0) and 10-g SAR (7.5) and so the product meets the thresholds for SAR test exclusion.

2 MPE CALCULATION AND EXPOSURE RISK

Following guidelines in KDB 447498 D03 supplement C Cross-reference v01

Prediction of MPE limit at a given distance

$$S = \frac{1.64ERP}{4\pi R^2} \quad \text{re-arranged} \quad R = \sqrt{\frac{1.64ERP}{S4\pi}}$$

where:

S = power density
R = distance to the centre of radiation of the antenna
ERP = EUT Maximum power

With the maximum test case 100% duty cycle the MPE calculation result based on radiated field measurements from Hursley-Eurofins EMC test report no. "4590A FR - Final - GL - Displaydata "

Max Result is at 902.5MHz is 84.98 dBuV/m @ 3m (Page 21 of 4590A FR - Final - GL - Displaydata), which is equivalent to 0.058 mW ERP.

Prediction frequency (MHz)	Max ERP (mW)	Power density limit (S) (mW/cm^2)	Distance R cm required to be less than 0.6mW/cm^2
902.5MHz	0.058	0.6	0.11 cm

Exposure risk in normal operation

Although the product is a fixed installation, it is possible, as the product is fixed to the edge of a retail shelf, that a human body could come in contact with the device, but only momentarily. Therefore, normal exposure is momentary.

The maximum theoretical transmitter duty cycle in operation is 12ms every 8.8s, (0.136%), which reduces the average ERP to 79 nW.

In practice, it is impossible to reach the power density limit of 0.6 mW/cm^2 even with 100% duty cycle, because the required distance R=0.11 cm is smaller than the distance from the antenna to the outside surface of the device enclosure.

3 INDUSTRY CANADA RSS-102 exemption requirements

The minimum distance a bystander could be is <5mm if the bystander is touching the product, therefore this product falls under RSS-102 issue 5, section 2.5.1

From RSS-102 issue 5, Section 2.5.1, Table 1 the appropriate exemption limit for the 902.5 to 927.5MHz band of operation is between 7mW and 17mW for <5mm separation distance. (Assumed 7mW for worst case)

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW

From Hursley-Eurofins EMC test report no. "4590A FR - Final - GL - Displaydata":

Max Result (100% duty cycle) at 902.5MHz is 84.98 dBuV/m @ 3m, equivalent to 0.094 mW EIRP (0.058 mW ERP)

Maximum TX power with 100% duty cycle, adjusted for +0.5dB production tolerance:

85.48 dBuV/m @ 3m @ 902.5MHz = 0.106 mW EIRP (0.065 mW ERP)

The maximum theoretical transmitter duty cycle in operation is 12ms every 8.8s, (0.136%), which reduces the maximum EIRP to 144 nW.

This meets the requirement for exemption from routine evaluation.

Date of Assessment: 9th March 2023

Approved by,

Dave Jones

Hardware Engineering Manager

Displaydata Limited,
Unit 12, Headley Park 10,
Headley Road East,
Woodley, Reading,
Berks, RG5 4SW, UK

+44 (0) 118 207 5641

contact@displaydata.com