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SAR EXCLUSION DOCUMENT

Document 75943624-10 Issue 02

CE4 Commander 1 (declared variant: CE4 Commander 2)
13.56 MHz Transmitter:

FCC Standalone SAR Test Exclusion Considerations (KDB 447498 D01) Section 4.3.1 c)

<100 MHz – Separation Distance ≤50 mm or Separation Distance >50 mm and <200 mm

The 1g head or body SAR test exclusion thresholds for <100 MHz are determined by the following steps:

Step a) Threshold result from Formula in Section 4.3.1 a);

[(max power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1g SAR.

- $f_{(GHz)}$ 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
- When the maximum test separation distance is < 5 mm, a distance of 5 mm is applied.

Step b) requires formula to be re-arranged to give power allowed at numeric threshold at 50 mm test separation distance and Step c) requires $f_{(GHz)}$ to be set to 100 MHz (0.1 GHz) giving:

Step a) Power threshold = (3 * 50) / ($\sqrt{0.1}$) = 474.3 mW

Step b) Threshold result from Formula in Section 4.3.1 b) 1);

{[Power allowed at numeric threshold for 50 mm {Formula Step A})] + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW

- f_{MHz} is the RF channel transmit frequency in MHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison

Power threshold = 474.3 mW + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW

Step c) requires $f_{(MHz)}$ to be set to 100 MHz giving:

Step b) Power threshold = 474.3 mW + [(test separation distance – 50 mm)·(100)/150)] mW

Approved by ..... **Date** 03 February 2022

Matthew Russell
Authorised Signatory

Step c) 1) Threshold result from Formula in Section 4.3.1 c) 1); >50 mm and <200 mm

Threshold result from Formula in Section 4.3.1 b) 1) is multiplied by [1+log(100/f_{MHz})]

Power threshold = [474.3 mW + (test separation distance – 50 mm)· (100)/150)] * [1+log(100/f_{MHz})] mW

- f_{MHz} is the RF channel transmit frequency in MHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison

Step c) 2) Threshold result from Formula in Section 4.3.1 c) 2); ≤50 mm

Threshold result from the formula in 4.3.1 c) 1) above for >50 mm and <200 mm for 50 mm and 100 MHz is multiplied by 0.5.

Power threshold = [474.3 mW + (50 mm – 50 mm)· (100)/150)] * [1+log(100/f_{MHz})] * 0.5 mW

Which simplifies to:

Power threshold = 474.3 mW * [1+log(100/f_{MHz})] * 0.5 mW

- f_{MHz} is the RF channel transmit frequency in MHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison

SAR Exclusion Result (1 g Head or Body)

Frequency (MHz)	Maximum Power (Tune up Value) * (mW)	Test Separation Distance (mm)	SAR Exclusion Power Threshold Section 4.3.1 c) (mW)	SAR Test Exclusion (Yes/No)
13.56	4	199	1071	Yes

*Tune-up value is the maximum declared conducted output power of the device.

The SAR exclusion threshold has been evaluated using the formula described above from information supplied by the manufacturer below. Based on the calculation above, the EUT is categorically excluded from SAR testing

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Manufacturer's Declaration of Product information (extract):

Product Description:	Free standing blast controller
Model number:	Commander 1 (declared variant: Commander 2)

Antenna length (cm):	4.5	Centimetres (cm)
Frequency range:		
Bottom frequency:		MHz
Middle frequency:	13.56	MHz
Top frequency:		MHz

Maximum power (input to the antenna including a tolerance):	0.00398	W
Antenna gain (or maximum gain allowed):	0	dBi

Or

Field Strength Measurement		dBµA/M
Measurement Distance		cm

Separation distance from antenna to the user/bystander:	20	cm
Transmitter Duty Cycle:		%

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Manufacturer's Declared Variant(s)

Declared Variant: CE4 Commander DS600

Classification:	System/Product:	Document Ref:	Revision:
Restricted	DigiShot 600	TGN-00106	1
	Document Type: TGN-Tech General	Current Author: Morgan Lombard	
detnet	Title: Changes between DigiShot 600 Commander and CE4 Commander.	Original Author: Morgan Lombard	
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1 INTRODUCTION

1.1 Objective

This document describes the differences between the standard CE4 Commander and the DigiShot Commander. Note that from a branding perspective, the system will be branded as 'DigiShot' not 'DigiShot 600' – the latter name being used internally in DetNet to distinguish between the new and old systems.

1.2 Reference Documents

- URS-00111 : DigiShot 600

2 CHANGES

2.1 Hardware Changes

The number of Channels have been reduced to from 4 IOM to 2 IOM.

Table 1 - Hardware differences

	CE4 Commander	DigiShot Commander
Channels	4	2 *

* Channel 3 and 4 will be used on DigiShot.

2.2 Mechanical changes

- Main enclosure colour changed from Pantone Yellow 1235C to Pantone Orange 21C. Base material remains PA 66. Other elements remain the same.
- Top two IOM, bezels, spring-loaded wire terminals, associated gaskets and fastening hardware removed.
- The DigiShot UI Faceplate lacks the holes for the above bezels and spring-loaded wire terminals. A Matt Polycarbonate product label is placed over this area.
- Same packaging will be used as the CE4 Commander, at roughly the same weight (14Kg). Packaging tests are conducted to the nearest Kg so the difference in weight from the lack of two IOM is negligible.
- Fitted with an improved UI front plate and sealing.

APPROVER	APPROVER SIGNATURE	SIGNATURE DATE	ISSUE DATE
Abrie Liebenberg	X Signed by: AJLieb 20200403	2020/10/20	2020/10/20

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Figure 1: CE4 Commander UI vs. DigiShot Commander UI

Figure 2: DigiShot System packaging uses existing CE4 Commander Packaging.

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2.3 Firmware Changes

The Base is only allowed to connect to one Bench by default. A ticket option can be used to change the number of benches to two. The Bench only allows 300 detonators per channel. The Bench is limited to two channels. The Bench only works with DigiShot detonators.

Table 2 - Firmware differences

	CE4 Commander	DigiShot Commander
Benches	10	1 (2)
Channels	4	2
Detonators per Channel	400	300
Detonator Product	DigiShot+, IntelliShot	DigiShot

3 REVISION HISTORY

Revision 1: New document