

Report	RF-Exposure Evaluation	HBC
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Dokumenthistorie / Documenthistory

rev	Erstellt am / von: Created by / on:	Geprüft am / von: Approved on / by:	Beschreibung / Description:
00	26.03.2026 / SETS	---	Ersterstellung / First issue
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11			
12			
13			
14			
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File Name:	RF Exposure FCC IC_TC792-TP_rev0.pdf	CONFIDENTIAL	
Drawing Title:	RF-Exposure Evaluation for TC792-TP	Status: Released	Scale: None
Drawing No.:	RF Exposure FCC IC_TC792-TP	Revision: 0	Page 1 of 6

Report	RF-Exposure Evaluation	HBC
--------	------------------------	-----

Inhaltsverzeichnis / Table of contents

Dokumenthistorie / Documenthistory 1

Inhaltsverzeichnis / Table of contents 2

1. Introduction 3

2. EUT 3

 2.1. Reference Documents 3

3. Classification 3

4. FCC RF-Exposure Exemption 4

 4.1. Calculation 4

5. ISED RF-Exposure Exemption 5

6. Result 6



Report	RF-Exposure Evaluation	HBC
--------	------------------------	-----

4. FCC RF-Exposure Exemption

Evaluation in accordance to FCC §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01 chapter 2.1.3 for all RF sources in fixed, mobile, and portable device exposure conditions this exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW). P_{th} is given by Formula:

$P_{th}(mW) = \begin{cases} ERP_{20\text{ cm}}(\frac{d}{20\text{ cm}})^x, & d \leq 20\text{ cm} \\ ERP_{20\text{ cm}}, & 20\text{ cm} < d < 40\text{ cm} \end{cases}$		(4.1)
Where		
$x = -\log_{10}(\frac{60}{ERP_{20\text{ cm}} * \sqrt{f}})$		(4.2)
f is in GHz, d is the separation distance (cm)		
$ERP_{20\text{ cm}}$ is:		
$P_{th}(mW) = ERP_{20\text{ cm}}(mW) = \begin{cases} 2040 * f, & 0.3\text{ GHz} \leq f < 1.5\text{ GHz} \\ 3060, & 1.5\text{ GHz} \leq f < 6\text{ GHz} \end{cases}$		(4.3)

In accordance to KDB 447498 D04 Interim General RF Exposure Guidance v01, chapter 2.1.1: Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

4.1. Calculation

Radiation Source							
Operating Frequency [MHz]	Output power [dBm]	Maximum Antenna Gain [dBi]	Duty Cycle [%]	EIRP [dBm]	ERP [dBm]	ERP Tune-Up Time-Averaged Power [dBm]	ERP Tune-Up Time-Averaged Power [mW]
903,05	28,63	-1,77	27,90	21,32	19,17	20,00	100,00
903,05	28,63	3,72	27,90	26,81	24,66	25,00	316,23
903,05	28,63	1,25	27,90	24,34	22,19	23,00	199,53
903,05	28,63	3,75	27,90	26,84	24,69	25,00	316,23
903,05	28,63	3,15	27,90	26,24	24,09	25,00	316,23

Antenna	Operating Frequency [MHz]	ERP Tune-Up Time-Averaged Power [mW]	Distance [mm]	Exposure Limit [mW]	Margin [mW]	Pass / Fail
Antenna 1	903,05	100,00	105	103,71	-3,71	Pass
Antenna 2	903,05	316,23	135	318,55	-2,32	Pass
Antenna 3	903,05	199,53	122	202,69	-3,16	Pass

Drawing No.: RF Exposure FCC IC_TC792-TP	CONFIDENTIAL	Revision: 0	Page 4 of 6
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Report	RF-Exposure Evaluation	HBC
---------------	-------------------------------	------------

Antenna	Operating Frequency [MHz]	ERP Tune-Up Time-Averaged Power [mW]	Distance [mm]	Exposure Limit [mW]	Margin [mW]	Pass / Fail
Antenna 4	903,05	316,23	135	318,55	-2,32	Pass
Antenna 5	903,05	316,23	135	318,55	-2,32	Pass

5. ISED RF-Exposure Exemption

Evaluation is in accordance to RSS-102 issue 6 chapter 6.6 and shall demonstrate RF exposure compliance. RF Exposure Conditions:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49 * f^{0.5} W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 * 10^{-2} * f^{0.6834} W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

Frequency	Output Power [dBm]	Antenna Gain [dBi]	Duty Cycle [%]	Time-averaged EIRP [dBm]	Time-averaged EIRP [mW]	EIRP-Limit FRL [W]	Pass / Fail
903,05	28,63	-1,77	27,90	21,32	135,40	1,37	Pass
903,05	28,63	3,72	27,90	26,81	479,30	1,37	Pass
903,05	28,63	1,25	27,90	24,34	271,40	1,37	Pass
903,05	28,63	3,75	27,90	26,84	482,62	1,37	Pass
903,05	28,63	3,15	27,90	26,24	420,34	1,37	Pass

In accordance to RSS-102 issue 6 table 5 the power density limit for frequency range 300 MHz – 6000 MHz and the calculated minimum distance will be calculated as follow:

$S_{RL} = 0.02619 * f^{0,6834} \frac{W}{m^2}$		(5.1)
With: $S_{RL} = \frac{P_{AVG}}{4\pi r^2} \Rightarrow r = \sqrt{\frac{P_{AVG}}{4\pi * S_{RL}}} = \sqrt{\frac{P_{AVG}}{4\pi * 0.02619 * f^{0,6834}}}$ P in mW F in MHz R in m		(5.2)

Report	RF-Exposure Evaluation	HBC
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Frequency	Output Power [dBm]	Antenna Gain [dBi]	Duty Cycle [%]	Time-averaged EIRP [dBm]	Time-averaged EIRP [mW]	Distance [mm]	Pass / Fail
903,05	28,63	-1,77	27,90	21,32	135,40	63	Pass
903,05	28,63	3,72	27,90	26,81	479,30	118	Pass
903,05	28,63	1,25	27,90	24,34	271,40	89	Pass
903,05	28,63	3,75	27,90	26,84	482,62	118	Pass
903,05	28,63	3,15	27,90	26,24	420,34	110	Pass

6. Result

In accordance to the applicable FCC Rules, the RSS-102 and circumstances that Innovation Science and Economic Development (ISED) accepts the FCC KDB procedures it has been demonstrate that the limits are met for fixed, mobile and portable applications.