



# **RF Exposure Evaluation Report**

FCC 47 CFR § 2.1091

for

**Audio Device** 

Model Name.: NH10

Prepared for:

inMusic Brands, Inc.
200 Scenic View Drive, Cumberland, RI 02864 United States

Prepared by

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Issue Date: September 23, 2022

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# **Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	September 23, 2022	Initial Issue	ALL	Angel Cheng



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#### 1 Attestation of Test Results

Applicant Name	inMusic Brands, Inc.
Model Name	NH10
Applicable Standards	FCC 47 CFR § 2.1091 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	December 07, 2021

Compliance Certification Services Inc., tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainy. All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved & Released By:

Sky Zhou

Asst. Section Manager

Compliance Certification Services Inc.



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## 2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1091, the following FCC Published RF exposure <a href="KDB">KDB</a> procedures:

- o 447498 D04 Interim General RF Exposure Guidance v01
- 865664 D02 RF Exposure Reporting v01r02



# 3 Device Under Test (DUT) Information

3.1 **DUT Description** 

	Product	Audio Device				
Trade Name Numark						
Model No. NH10						
Model Discrepancy N/A		N/A				
Hardware Version INM-PCB-NH10-RearPanel		INM-PCB-NH10-RearPanel				
	Software Version	N/A				
	Sample Stage	Identical prototype				

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3.2 Wireless Technologies

	⊠ Bluetooth 5.0: 2402MHz-2480MHz								
	802.11b/g, 802.11n HT20: 2412MHz ~ 2462 MHz								
	802.11n HT40/ac (VHT40)/ax (HE40): 2422MHz ~ 2452MHz								
	☐ 802.11a/n HT20: 5180MHz								
			745MHz ~ 5825MHz						
			745MHz ~ 5825MHz						
	☐ 802.11ax HE20: 5180MHz -								
	5500MHz ~ 5720 MHz / 5745MHz ~ 5825MHz 802.11n HT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz /								
Frequency bands									
Troquency Banas			5MHz ~ 5795MHz						
	☐ 802.11ac VHT 40: 5190MH;								
			5755MHz ~ 5795MHz						
	☐ 802.11ax HE40: 5190MHz -								
			55MHz ~ 5795MHz						
	☐ 802.11ac VHT80: 5210MHz		530MHz ~ 5690 MHz /						
	5775MHz		2000 1411 /						
	☐ 802.11ax HE80: 5210MHz /	5290MHZ / 553	30MHZ ~ 5690 MHZ /						
	5775MHz								
	Others								
Exposure	Occupational/Controlled exposure (S = 5mW/cm2)								
classification	General Population/Uncontrolled exposure								
	(S=1mW/cm2)								
	(0)								
	,								
Antonna	WLAN ANTENNA								
Antenna Specification	WLAN ANTENNA	4 60 dBi (Num	eric gain: 2.88). Worst						
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	WLAN ANTENNA	4.60 dBi (Num	eric gain: 2.88) Worst						
	WLAN ANTENNA  2.4GHz: Direction Gain:	4.60 dBi (Num	eric gain: 2.88) Worst						
	WLAN ANTENNA	4.60 dBi (Num	eric gain: 2.88) Worst						
	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  EEE 802.11b Mode:	4.60 dBi (Num	eric gain: 2.88) Worst						
	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz		(36.898 mW) (14.859 mW)						
	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  EEE 802.11b Mode:	15.67 dBm	(36.898 mW)						
Specification	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  EEE 802.11b Mode:  IEEE 802.11g Mode:	15.67 dBm 11.72 dBm	(36.898 mW) (14.859 mW)						
Specification  Maximum	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  EEE 802.11b Mode:  IEEE 802.11g Mode:	15.67 dBm 11.72 dBm	(36.898 mW) (14.859 mW)						
Specification  Maximum Measurement	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  IEEE 802.11b Mode: IEEE 802.11g Mode: IEEE 802.11n HT 20 Mode:	15.67 dBm 11.72 dBm	(36.898 mW) (14.859 mW)						
Specification  Maximum Measurement	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  IEEE 802.11b Mode: IEEE 802.11g Mode: IEEE 802.11n HT 20 Mode: Bluetooth	15.67 dBm 11.72 dBm 10.83 dBm	(36.898 mW) (14.859 mW) (12.106 mW)						
Specification  Maximum Measurement	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  IEEE 802.11b Mode: IEEE 802.11g Mode: IEEE 802.11n HT 20 Mode: Bluetooth Bluetooth 4.0	15.67 dBm 11.72 dBm 10.83 dBm	(36.898 mW) (14.859 mW) (12.106 mW)						
Specification  Maximum Measurement	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  IEEE 802.11b Mode: IEEE 802.11g Mode: IEEE 802.11n HT 20 Mode: Bluetooth Bluetooth 4.0	15.67 dBm 11.72 dBm 10.83 dBm	(36.898 mW) (14.859 mW) (12.106 mW)						
Specification  Maximum  Measurement	WLAN ANTENNA  2.4GHz: Direction Gain:  2.4GHz  IEEE 802.11b Mode: IEEE 802.11g Mode: IEEE 802.11n HT 20 Mode: Bluetooth Bluetooth 4.0	15.67 dBm 11.72 dBm 10.83 dBm	(36.898 mW) (14.859 mW) (12.106 mW)						



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Maximum tune up power

2.4GHz		
IEEE 802.11b Mode:	16.50 dBm	(44.668 mW)
IEEE 802.11g Mode:	12.50 dBm	(17.783 mW)
IEEE 802.11n HT 20 Mode:	11.50 dBm	(14.125 mW)
Bluetooth		
Bluetooth 4.0	4.50 dBm	(2.818 mW)
Bluetooth 5.0	4.50 dBm	(2.818 mW)

#### Notes:

- 1. For more details, please refer to the User's manual of the EUT.
- Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- 3. The tune up power referred the AVG power of the test report TMTN2202000188NR for RF Exposure assessment purpose.



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## 4 Maximum Permissible Exposure

## 4.1 Limits for Maximum Permissible Exposure (MPE)

**Table 1 - Limits for Maximum Permissible Exposure (MPE)** 

Frequency range (MHz)	· · · · · · · · · · · · · · · · · · ·		Power density (mW/cm²)	Averaging time (minutes)					
(A) Limits for Occupational/Controlled Exposure									
0.3-3.0	614	1.63	* 100	6					
3.0-30	1842/f	4.89/f	* 900/f <sup>2</sup>	6					
30-300	61.4	0.163	1.0	6					
300-1,500			f/300	6					
1,500-100,000			5	6					
	(B) Limits for General Population/Uncontrolled Exposure								
0.3-1.34	614	1.63	* 100	30					
1.34-30	824/f	2.19/f	* 180/f <sup>2</sup>	30					
30-300	27.5	0.073	0.2	30					
300-1,500			f/1500	30					
<u>1,500-100,000</u>			1.0	30					



### 4.2 MPE Calculation Method

## <u>Calculation</u>

Given

$$E = \frac{\sqrt{30 \times P \times G}}{d} \& S = \frac{E^2}{377}$$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

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$$S = \frac{30 \times P \times G}{377d^2}$$

Changing to units of mW and cm, using:

$$P(mW) = P(W) / 1000 \text{ and}$$

$$d(cm) = d(m) / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$
 Equation 1

Where

d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm<sup>2</sup>

If, Substituting the MPE safe distance using d = 20 cm into Equation 1:

S = 0.000199 X P X G



#### 4.3 MPE EXEMPTION

- (A) The available maximum time-averaged power is no more than 1 mW
- (B) The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). *Pth* is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \ cm} (d/20 \ \text{cm})^x & d \le 20 \ \text{cm} \\ ERP_{20 \ cm} & 20 \ \text{cm} < d \le 40 \ \text{cm} \end{cases}$$

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Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20~cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

(C) Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of  $\lambda/4$  or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Single RF Sources Subject to Routine Environmental Evaluation					
Threshold ERP (watts)					
1,920 R².					
3,450 R <sup>2</sup> /f <sup>2</sup> .					
3.83 R <sup>2</sup> .					
0.0128 R <sup>2</sup> f.					
19.2R <sup>2</sup> .					



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#### 4.4 Multiple RF sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^{a} \frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$



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# 5 MPE Exemption Option B

### WIFI 2.4GHz

Mode	Frequency (MHz)	R(m)	Max Tune- up EIRP(dBm)	Max Tune- up ERP(dBm)	Max Tune- up ERP(mW)	ERP Threshold(mW)	MPE Exemption	
IEEE 802.11b	2462.00	0.2	21.10	18.95	78.524	3060	Complies	
IEEE 802.11g	2462.00	0.2	17.10	14.95	31.261	3060	Complies	
IEEE 802.11n HT 20	2462.00	0.2	16.10	13.95	24.831	3060	Complies	

#### **Bluetooth**

Mode	Frequency (MHz)	R(m)	Max Tune- up EIRP(dBm)	Max Tune- up ERP(dBm)	Max Tune- up ERP(mW)	ERP Threshold(mW)	MPE Exemption
Bluetooth 4.0	2480.00	0.2	9.10	6.95	4.955	3060	Complies
Bluetooth 5.0	2480.00	0.2	9.10	6.95	4.955	3060	Complies



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## 6 Simultaneous Transmission Analysis

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^{a} \frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \le 1$$

N/A



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### 7 Facilities

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)

#### **END OF REPORT**