



RF Exposure Evaluation Report

APPLICANT : Nauto Corporation
EQUIPMENT : Nauto 2
BRAND NAME : Nauto 2
MODEL NAME : Nauto 2
MARKETING NAME : Nauto 2
FCC ID : 2AKJ5-N2
STANDARD : 47 CFR Part 2.1091

We, Sporton International (KunShan) INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of Sporton International (KunShan) INC., the test report shall not be reproduced except in full.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA6D2204	Rev. 01	Initial issue of report	May 03, 2017

**1. Administration Data****1.1. Testing Laboratory**

Testing Laboratory	
Test Site	Sporton International (KunShan) INC.
Test Site Location	No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958

Applicant	
Company Name	Nauto Corporation
Address	380 Portage Avenue Palo Alto, CA 94306

Manufacturer	
Company Name	Qisda Corporation
Address	18 Jihu Road. Neihu, Taipei 114, Taiwan

**2. Description of Equipment Under Test (EUT)**

Product Feature & Specification	
EUT Type	Nauto 2
Brand Name	Nauto 2
Model Name	Nauto 2
Marketing Name	Nauto 2
FCC ID	2AKJ5-N2
IMEI Code	014711000030623
Wireless Technology and Frequency Range	WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink is not supported) LTE: QPSK, 16QAM 802.11b/g/n HT20/HT40 Bluetooth v3.0+EDR, Bluetooth v4.0 LE
Antenna Type	WWAN: PIFA Antenna WLAN: Monopole Antenna Bluetooth: Monopole Antenna
HW Version	DVT01
SW Version	2.006
EUT Stage	Production Unit

Note: The device has no voice function.

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

**3. Maximum RF average output power among production units****<WCDMA>**

Band		WCDMA Band II	WCDMA Band V
Mode		Tune-up	
3GPP Rel 99	RMC 12.2Kbps	25.00	24.50
3GPP Rel 6	HSDPA Subtest-1	24.50	24.00
3GPP Rel 6	HSDPA Subtest-2	24.50	24.00
3GPP Rel 6	HSDPA Subtest-3	24.00	23.50
3GPP Rel 6	HSDPA Subtest-4	24.00	23.50
3GPP Rel 7	DC-HSDPA Subtest-1	24.00	24.00
3GPP Rel 7	DC-HSDPA Subtest-2	24.00	24.00
3GPP Rel 7	DC-HSDPA Subtest-3	24.00	24.00
3GPP Rel 7	DC-HSDPA Subtest-4	24.00	24.00
3GPP Rel 6	HSUPA Subtest-1	24.00	23.50
3GPP Rel 6	HSUPA Subtest-2	22.00	21.50
3GPP Rel 6	HSUPA Subtest-3	23.00	22.50
3GPP Rel 6	HSUPA Subtest-4	22.00	21.50
3GPP Rel 6	HSUPA Subtest-5	24.00	23.50

**<LTE>**

LTE Band 17				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00

LTE Band 5				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00
QPSK	3	≤ 4	0	24.00
QPSK	3	> 4	0-1	23.00
16QAM	3	≤ 4	0-1	23.00
16QAM	3	> 4	0-2	22.00
QPSK	1.4	≤ 5	0	24.00
QPSK	1.4	> 5	0-1	23.00
16QAM	1.4	≤ 5	0-1	23.00
16QAM	1.4	> 5	0-2	22.00



LTE Band 4				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	20	≤ 18	0	24.00
QPSK	20	> 18	0-1	23.00
16QAM	20	≤ 18	0-1	23.00
16QAM	20	> 18	0-2	22.00
QPSK	15	≤ 16	0	24.00
QPSK	15	> 16	0-1	23.00
16QAM	15	≤ 16	0-1	23.00
16QAM	15	> 16	0-2	22.00
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00
QPSK	3	≤ 4	0	24.00
QPSK	3	> 4	0-1	23.00
16QAM	3	≤ 4	0-1	23.00
16QAM	3	> 4	0-2	22.00
QPSK	1.4	≤ 5	0	24.00
QPSK	1.4	> 5	0-1	23.00
16QAM	1.4	≤ 5	0-1	23.00
16QAM	1.4	> 5	0-2	22.00

LTE Band 2				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	20	≤ 18	0	24.00
QPSK	20	> 18	0-1	23.00
16QAM	20	≤ 18	0-1	23.00
16QAM	20	> 18	0-2	22.00
QPSK	15	≤ 16	0	24.00
QPSK	15	> 16	0-1	23.00
16QAM	15	≤ 16	0-1	23.00
16QAM	15	> 16	0-2	22.00
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00
QPSK	3	≤ 4	0	24.00
QPSK	3	> 4	0-1	23.00
16QAM	3	≤ 4	0-1	23.00
16QAM	3	> 4	0-2	22.00
QPSK	1.4	≤ 5	0	24.00
QPSK	1.4	> 5	0-1	23.00
16QAM	1.4	≤ 5	0-1	23.00
16QAM	1.4	> 5	0-2	22.00

<Bluetooth>

Mode	Maximum Average Power (dBm)
Bluetooth v2.0+EDR	4.00

Mode	Maximum Average Power (dBm)
Bluetooth v4.0 LE	0

<2.4GHz WLAN>

Mode		Maximum Average Power (dBm)
2.4GHz WLAN	802.11 b	16.50
	802.11 g	14.00
	802.11 n	14.00

The table below summarized necessary items addressed in KDB 941225 D05 v02.

Summarized necessary items addressed in KDB 941225 D05 v02r05								
FCC ID	2AKJ5-N2							
Equipment Name	Nauto 2							
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz							
Channel Bandwidth	LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 17: 5MHz, 10MHz							
Uplink modulations used	QPSK and 16QAM							
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3							
	Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
		1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)							
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.							
LTE Release Version	R9, Cat 1							
CA Support	Not Supported							



Transmission (H, M, L) channel numbers and frequencies in each LTE band												
LTE Band 2												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900
LTE Band 4												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745
LTE Band 5												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829				
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5				
H	20643	848.3	20635	847.5	20625	846.5	20600	844				
LTE Band 17												
	Bandwidth 5 MHz					Bandwidth 10 MHz						
	Channel #		Freq.(MHz)			Channel #		Freq. (MHz)				
L	23755		706.5			23780		709				
M	23790		710			23790		710				
H	23825		713.5			23800		711				



4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			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 ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
WCDMA Band V	826.4	0.1	24.50	24.60	0.288	288.403	0.057	0.551	0.104
WCDMA Band II	1852.4	1.9	25.00	26.90	0.490	489.779	0.097	1.000	0.097
LTE Band 17	706.5	-4.8	24.00	19.20	0.083	83.176	0.017	0.471	0.035
LTE Band 5	824.7	0.1	24.00	24.10	0.257	257.040	0.051	0.550	0.093
LTE Band 4	1710.7	1.9	24.00	25.90	0.389	389.045	0.077	1.000	0.077
LTE Band 2	1850.7	1.9	24.00	25.90	0.389	389.045	0.077	1.000	0.077
Bluetooth	2402.0	3.6	4.00	7.60	0.006	5.754	0.001	1.000	0.001
WLAN	2412.0	3.6	16.50	20.10	0.102	102.329	0.020	1.000	0.020

Note: For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band

**5.2. Collocated Power Density Calculation**

Mode	Frequency	Maximum EIRP (dBm)	Calculated Power Density (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit	WCDMA Band V Power Density / Limit	Σ (Power Density / Limit) of WWAN+ Bluetooth/ WWAN+ WLAN
Bluetooth	2402MHz ~2480MHz	7.60	0.001	1.0	0.001	0.104	0.105
WLAN	2412MHz ~2462MHz	20.10	0.020	1.0	0.020		0.124

Note:

1. For collocation analysis, WCDMA Band V is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + Bluetooth, WWAN + WLAN.
3. Bluetooth and WLAN share the same antenna, and cannot transmit simultaneously.

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.