

NORTHWEST EMC

Etherios Design Solutions

ConnectCore i.MX6 WiFi/Bluetooth

FCC 2.1091:2015

Report # ETHE0018.8



NVLAP Lab Code: 200881-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America. This Report may only be duplicated in its entirety

CERTIFICATE OF EVALUATION



Last Date of Test: February 3, 2015
Etherios Design Solutions
Model: ConnectCore i.MX6 WiFi/Bluetooth

Radio Equipment Testing

Standards

Specification	Method
FCC 2.1091:2015	KDB 447498 D01 General RF Exposure Guidance v05r02

Results

Method Clause	Test Description	Applied	Results	Comments
7.1	Maximum Permissible Exposure	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Donald Facteau, IT Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFTA – Recognized by OFTA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

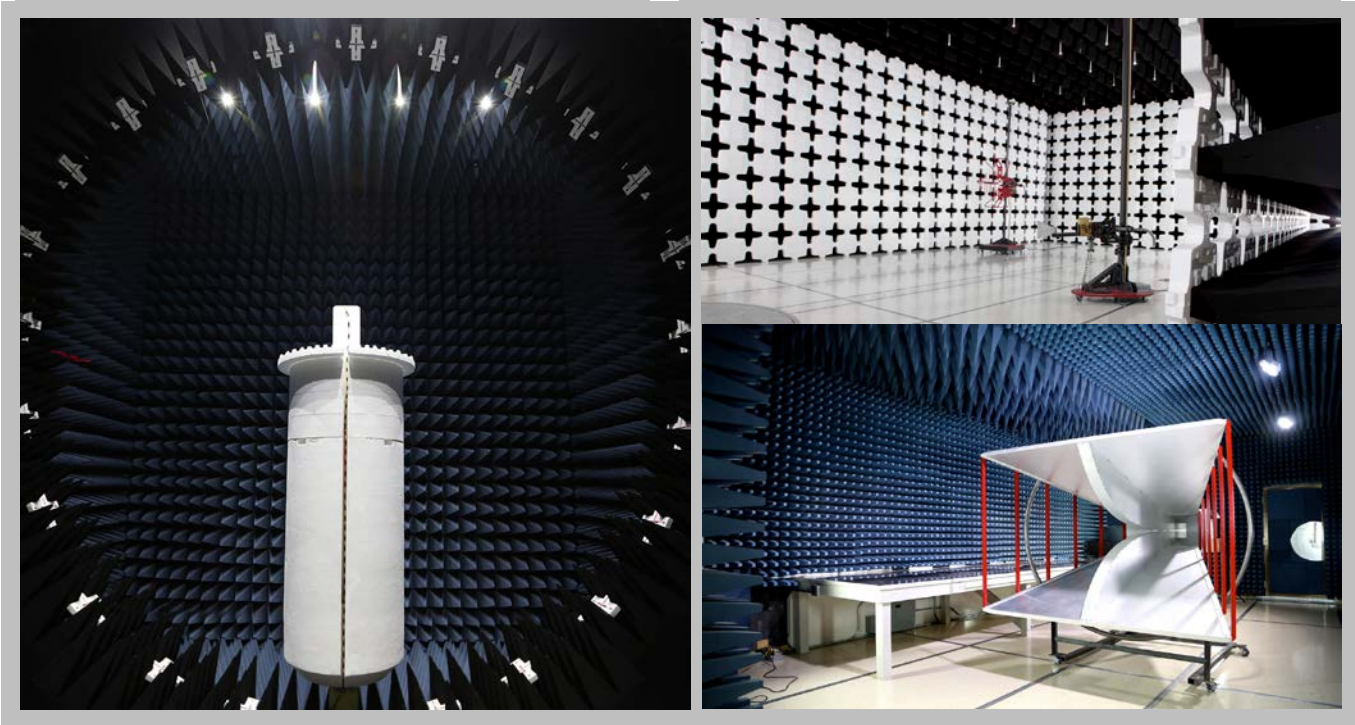
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FACILITIES



California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 9801 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Industry Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Etherios Design Solutions
Address:	110 N 5th Street Suite 400
City, State, Zip:	Minneapolis, MN 55413
Test Requested By:	Moshe Peri
Model:	ConnectCore i.MX6 WiFi/Bluetooth
Evaluation Date:	February 3, 2015

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The EUT is an 802.11abgn SISO and Bluetooth 4.0 radio module with an Quad core I.MX6 processor. The device operates as a Wi-Fi client device and has no radar detection and no ad-hoc capability.

Testing Objective:

To demonstrate compliance with FCC requirements for RF exposure for 2.1091 mobile devices.

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

OVERVIEW

Human exposure to RF emissions from mobile devices (47 CFR §2.1091) may be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and/or power density, as appropriate, since exposures are assumed to occur at distances of 20 cm or more from persons. ANSI C95.1-1992 specifies a minimum separation distance of 20 cm for performing reliable field measurements to determine adherence to MPE limits. If the minimum separation distance between a transmitter and nearby persons is more than 20 cm under normal operating conditions, compliance with MPE limits may be determined at such distance from the transmitter. When applicable, operation instructions and prominent warning labels may be used to alert the exposed persons to maintain a specified distance from the transmitter or to limit their exposure durations and usage conditions to ensure compliance. If the use of warning labels on a transmitter is not effective or desirable, the alternative of performing SAR evaluation with the device at its closest range to persons under normal operating conditions may be used. The field strength and power density limits adopted by the FCC are based on whole-body averaged exposure and the assumption of RF field levels relate most accurately to estimating whole-body averaged SAR. This means some local values of exposures exceeding the stated field strength and power density limits may not necessarily imply non-compliance if the spatial average of spatially averaged RF fields over the exposed portions of a person's body does not exceed the limits.

COMPLIANCE WITH 2.1091

*“Mobile devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, parts 24, 25, 26 and 27 of this chapter, part 80 of this chapter (ship earth stations devices only) and part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more. Unlicensed personal communications service devices, unlicensed millimeter wave devices and unlicensed NII devices authorized under §§15.253, 15.255, and 15.257, and subparts D and E of part 15 of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their ERP is 3 watts or more or if they meet the definition of a portable device as specified in §2.1093(b) requiring evaluation under the provisions of that section. **All other mobile and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in §§1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of mobile and unlicensed transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application.**”*

The EUT will only be used with a separation distance of 20 centimeters or greater between the antenna and the body of the user or nearby persons and can therefore be considered a mobile transmitter per 47 CFR 2.1091(b). Per 47 CFR 1.1310, the EUT meets the General Population / Uncontrolled exposure limits listed in Table 1.

COMPLIANCE WITH FCC KDB 447498 D01 General RF Exposure Guidance v05r02

The EUT is an 802.11abgn SISO and Bluetooth 4.0 radio module which utilizes an Atheros AR6233 system-in-package (SIP). All radios operate through the same, single installed antenna but the 2.4 GHz band and 5 GHz band can operate simultaneously through a diplexer. The 2.4 GHz WLAN and Bluetooth radio operate through a switch and cannot transmit simultaneously.

The product was tested for certification for three separate antenna options. The product will only be used with one antenna at a time. Testing was done separately for each band with the highest gain antenna for that band. The data below includes only the highest gain antenna for each band.

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

"KDB 447498 D01 General RF Exposure Guidance v05r02" provides the procedures, requirements, and authorization policies for mobile and portable devices. Section 7.2 best fits the exposure condition described in this report. Since these mobile devices are categorically excluded from routine evaluation; simple calculations may be used to estimate the power density to demonstrate compliance with 47 CFR 1.1310 requirements. The attached estimate shows MPE limits are met for simultaneous transmission at a 20 cm boundary.

FCC LIMITS FOR MPE

Limits for General Population /Uncontrolled Exposure: 47 CFR 1.1310

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
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 - 100000			1	30

f = frequency in MHz

* = Plane-wave equivalent power density

METHOD OF EVALUATION

The exposure level for the radio is evaluated at a 20 cm distance from the radio's transmitting antenna using the general equation:

$$S = \frac{P * G}{4 * \pi * R^2}$$

Where: S = power density (mW/cm²)

P = power input to the antenna (mW)

G = numeric power gain relative to an isotropic radiator

R = distance to the center of the radiation of the antenna ((20 cm = limit for MPE estimates)

P*G = EIRP

Solving for S, the maximum power density 20 cm from the transmitting antenna is determined. This level is then compared to the applicable limit for that transmit frequency. This is called the "MPE Ratio" The MPE ratios for each co-located radio are summed. If the sum is less than or equal to one, then the device is excluded from testing and is deemed compliant.

The standalone MPE and summed MPE ratios are summarized in the following table:

MAXIMUM PERMISSIBLE EXPOSURE (MPE)



EUT:	ConnectCore i.MX6 WiFi/Bluetooth	Work Order:	ETHE0018	
Serial Number:	00409D 7C03CD	Date:	02/03/2015	
Customer:	Etherios Design Solutions	Temperature (°C):	N/A	
Attendees:	None	Rel. Humidity (%):	N/A	
Customer Project:	None	Bar. Pres. (mb):	N/A	
	Power:	N/A	Job Site:	N/A

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1091:2015	KDB 447498 D01 General RF Exposure Guidance v05r02

COMMENTS

See Product Description

DEVIATIONS FROM TEST STANDARD

None

MPE Estimates for Individual Devices

Radio	Antenna Type	Antenna Manufacturer	Antenna Model (Highest Gain option for each band)	Transmit Frequency (MHz)	Max Peak Conducted Output Power (mW)	Duty Cycle	Duty Cycle Corrected Output Power (mW)	Antenna Gain (dBi)	Minimum Antenna Cable Loss (dB)	Power Density @ 20 cm (mW/cm ²)	General Population Exposure Limit from 1.1310 (mW/cm ²)	Ratio of Power Density to the Exposure Limit
Bluetooth	Omni	Yageo	ANTX100P001B24003	2402	13.23	1	13.23	4.4	0	0.007	1.0	0.00725
802.11bgn	Omni	Yageo	ANTX100P001B24003	2412	25.01	1	25.01	4.4	0	0.014	1.0	0.01370
802.11an	Magnetic Dipole	Ethertronics	1001932	5180	24.44	1	24.44	5.0	0	0.015	1.0	0.01538
				5260	22.00	1	22.00	5.0	0	0.014	1.0	0.01384
				5700	28.55	1	28.55	5.0	0	0.018	1.0	0.01796
				5825	114.41	1	114.41	5.0	0	0.072	1.0	0.07198

Worst Case Co-located Exposure Conditions

Per KDB 447498 D01v05r02 Section 7.2, the Sum of Worst Case Power Ratios cannot exceed 1.0

802.11bgn Worst Case Ratio of Power Density to the Exposure Limit	802.11an Worst Case Ratio of Power Density to the Exposure Limit	Sum of Worst Case Ratios (Power Density to the Exposure Limit)	FCC Limit for Sum of Worst Case Ratios
0.01370	0.07198	0.08568	1.0

PASS