



CERTIFICATION TEST REPORT

PART 15.247C

Class II Permissive Change
To add an antenna to the
Wi2WI, Inc. Wifi and BT Combo Module
FCC ID: U9R-W2CBW0015

AS USED BY THE
Thuraya WLAN Satellite Terminal
Model: 9105
Model Names: IP Voyager, and Orion IP

PREPARED FOR:

Hughes Network Systems
9605 Scranton Road Suite 500
San Diego, CA 92121

Prepared on: November 27, 2013
Report Number: 2013 11246221 FCC
Project Number: Q10250268-R8
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<i>Nemko USA, Inc.</i>		2210 Faraday Avenue, Suite 150, Carlsbad, CA 92008 Phone (760) 444-3500 Fax (760) 444-3005	
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DOCUMENT HISTORY

REVISION	DATE	COMMENTS
-	November 27, 2013	Prepared By: Alan Laudani
-	November 27, 2013	Initial Release: Alan Laudani

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4 (2003) "Methods and Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz":

- o The unit described in this report was received at Nemko USA, Inc.'s facilities on October 29, 2013.
- o Testing was performed on the unit described in this report on October 29, 2013 to November 27, 2013
- o The Test Results reported herein apply only to the Unit actually tested, and to substantially identical Units.
- o This report does not imply the endorsement of the Federal Communications Commission (FCC), Industry Canada, NVLAP or any other government agency.

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CERTIFICATION

Nemko USA, Inc., an independent Electromagnetic Compatibility (EMC) Test Laboratory, produced this Test Report and performed the Radio Frequency Interference (RFI) testing and data evaluation contained herein.

Nemko USA, Inc.'s measurement facility is currently registered with the United States Federal Communications Commission (FCC) in accordance with the provisions of 47 United States Code (CFR) Part 2, Subpart I, Section 2.948(a). A current description of Nemko USA, Inc.'s measurement facility is on file with the FCC. Nemko USA Inc. has additionally satisfied the FCC that it complies with the requirements set forth in 47 CFR Part 2, Subpart I, Section 2.948(d) regarding the accreditation of EMC laboratories.

The RFI testing, test data collection and test data evaluation were accomplished in accordance with the ANSI C63.4-2003 Standard, and in accordance with the applicable sections of the FCC rules (47 CFR Parts 2 and 15). The testing was also accomplished in accordance with Industry Canada's ICES-003 standard for unintentional radiating device per EMCAB-3, Issue 3 (May 1998). The administrative summary of this test report provides a description of the test sample.

I hereby certify that the test data, test data evaluation, and equipment configurations used to compile this test report are a true and accurate representation of the test sample's radio frequency interference characteristics as of the test date(s), and, for the design of the test sample.



Senior RF/EMC Engineer

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1. ADMINISTRATIVE DATA AND TEST SUMMARY

1.1. Administrative Data

CLIENT: Hughes Network Systems
9605 Scranton Road Suite 500
San Diego, CA 92121

CONTACT: Dave Couchman
E-Mail: Dave.couchman@hughes.com

DATE (S) OF TEST: October 29, 2013 to November 27, 2013

EQUIPMENT UNDER TEST (EUT): Thuraya WLAN Satellite Terminal
Wi2Wi, Inc. Wifi and BT Combo Module
Antenna: HG2403RD-RSF, 3 dBi

MODEL: 9105

SERIAL NUMBER: REGULATORY #2

CONDITION UPON RECEIPT: Suitable for Test

TEST SPECIFICATION: FCC CFR 47:Part 15.247C. Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

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2. Test Summary

This section contains the following:

FCC Part 15 Subpart C:

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant

Y Yes: Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

Part 15C	Test Description	Required	Result
15.207 (a)	Conducted Emission Limit	NA	
15.215(c)	20 dB Bandwidth	NA*	
15.247(a)(2)	Minimum 6dB RF Bandwidth	NA*	
15.247(b)(3)	Peak Output Power	NA*	
15.247(d)	Band-edge Compliance of RF Conducted Emissions	NA*	
15.247 (d)	Spurious RF Conducted Emissions	NA*	
15.247 (d)	Spurious Radiated Emissions	Y	Pass
15.247(e)	Power Spectral Density for Digitally Modulated Devices	NA*	

*Not applicable as the new antenna would not be a factor for compliance.

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3. SYSTEM CONFIGURATION

3.1. Description and Method of Exercising the EUT

The 9105 is a Thuraya WLAN Satellite Terminal. The 9105 comprises a FCC Part 25 Transmitter in the frequency range 1626.5 MHz to 1660.5 MHz and a FCC Part 15.247 in the frequency range of 2412 to 2462 MHz. An Ethernet connection allows for frequency changes during RF testing. The radios continue to transmit without the Ethernet connection and to be used for network connection in normal operation.

The model 9105 supports both Land Mobile and Marine satellite tracking antennas. For Land Mobile use, the system is named IP Voyager, and for Marine use it is named Orion IP. The antennas share the same antenna element design with the marine antenna having more robust drives for sea duty satellite tracking.

The 9105 is a variant of the previously tested 9450, with changes to the ASIC and FPGA chips, the power supply and the RF components being the same, therefore complete testing of the EMC tests do not need to be repeated. During EMC immunity testing the program PING and RF continuous transmit for the two bands verified the function was not interrupted. Results for the 9450 were noted for the omitted tests.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

3.2. System Components and Power Cables

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
EUT - Thuraya WLAN Satellite Terminal	Hughes Network Systems Model: 9105 Serial #: Regulatory #2	3 wire, shielded 20 AWG
Support -Laptop computer	Toshiba Model: Portage 7000CT Serial #: 14083-J37765	1.5m, unshielded, 12 VDC coaxial
Laptop – AC Adapter	Toshiba Model: PA2450U Serial #: 2058923	1.5m, unshielded, 18 AWG, 2-wire, IEC connector
Support—Laptop Mouse	Compaq Model: M-S34 Serial #: F13590M5BHK4EBQ	NA
Support – Ethernet Router	Dell Model: Power Connect 2324 Serial #: 907898349891853	1.5m, unshielded, 12 VDC coaxial

3.3. Device Interconnection and I/O Cables

Connection	I/O Cable
EUT Ethernet to Laptop	3m, CAT5, 5m, unshielded cable
EUT Ethernet to Load	(3) 2.5 m, CAT5 cables
Antenna to EUT	Coax, 50 ohm—see test configuration diagram

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3.4. Technical Specifications of the EUT

Manufacturer:	Hughes Network Systems
Operating Frequency:	2412 MHz to 2462 MHz in the 2400-2483.5 MHz Band
Rated Power:	0.020 W
Modulation:	Digital: 802.11 b/g/n
Number of Operating Frequencies:	11
Antenna Type:	HG2403RD-RSF, 3 dBi
Antenna Connector:	Reverse SMA
Power Source:	12 and/or 24 VDC

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4. DESCRIPTION OF TEST SITE AND ENVIRONMENT

4.1. Description of Test Site

The test site is located at 2210 Faraday Ave., Suite 150, Carlsbad, CA 92008. Radiated emissions measurements are performed in the 10 meter Semi-Anechoic chamber, which conforms to the volumetric normalized site attenuation (VNSA) for three and ten-meter measurements. The chamber also conforms to the SVSWR compliance requirements for 1-18 GHz measurements. The VNSA and SVSWR meet the technical requirements, as set, in the CISPR 16 and ANSI C63.4 documents. Facility test areas for conducted emissions and immunity testing also meet the construction and characteristics, as required by CISPR 16 and ANSI C63.4 documents.

Emissions measurements are performed using TILE software. Version 4.0.A.7 for radiated and version 3.4.K.24 for conducted.

4.2. Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedures.

4.3. Design Modifications for Compliance

No design modifications were needed for compliance

4.4. Record Of Technical Judgments

No technical judgments were made during the assessment.

4.5. EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.6. Test Deleted

No Tests were deleted from this assessment.

4.7. Additional Observations

There were no additional observations made during this assessment.

4.8. Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	17 – 22 °C
Humidity range	:	29 - 50%
Pressure range	:	87 - 105 kPa
Power supply range	:	120VAC 60Hz (±15%)

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5. Test Results

5.1. Out-of-band Emissions / Radiated Emissions within Restricted Bands

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

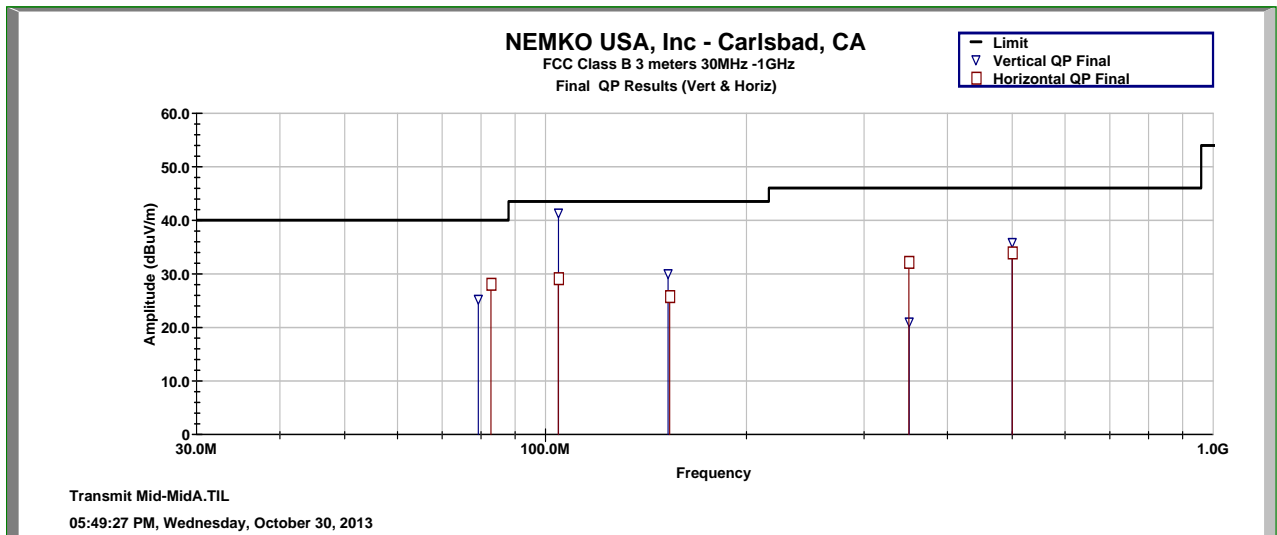
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Sample Number:	9105	Temperature:	21°C
Date:	10/30/2013	Humidity:	44%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	10 m Chamber @ 3m

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Test Results

- The Spectrum was searched from 30MHz to the 10th Harmonic, 25000 MHz.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Radiated Measurements below 1GHz were performed at 3m with a Quasi-Peak detector (RBW 120kHz/VBW 300kHz) while Radiated Peak (RBW 1MHz/VBW 3MHz) and Average (RBW 1MHz/VBW 10Hz) measurements conducted above 1GHz.
- No emissions observed other than the fundamental and digital emissions below 1000 MHz. The fundamental conducted output power was sampled to verify certified output power was reproduced before radiated emissions were measured.
- Emission runs from 30 MHz to 1000 MHz with variations of transmitter channels of the low, mid, and high with the Part 25 transmitter were made, the worst case presented below when transmitting Mid channel WLAN and Mid channel Part 25. A 1000 MHz low pass filter was used to block mixing signals prorogated by the preamplifier. Modulation type, when varied, did not prove a difference in emissions.



Frequency MHz	QP Measured dBuV	Adjustments dB/m	EUT Rotation degrees	Ant. Ht. cm	Ant. Polarity	Final Result dBuV/m	Limit dBuV/m	QP Margin dB
82.818	50.1	-21.9	113	359	H	28.2	40	-11.8
79.285	47.3	-22.0	5	258	V	25.3	40	-14.7
104.503	49.6	-20.4	6	279	H	29.2	43.5	-14.3
104.522	61.8	-20.4	0	117	V	41.4	43.5	-2.1
152.615	47.9	-17.9	290	110	V	30.1	43.5	-13.4
153.372	43.7	-17.9	1	391	H	25.9	43.5	-17.6
350.029	45.7	-13.4	0	120	H	32.3	46	-13.7
350.478	34.5	-13.4	158	151	V	21.1	46	-25.0
499.976	43.5	-9.5	1	109	H	34.0	46	-12.0
500.022	45.4	-9.5	7	198	V	35.9	46	-10.1

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No emissions within 20 dB of the limits found for spurious emissions from 1 GHz to 25 GHz. Modulation type, when varied, did not prove a difference in emissions

Search RBW100 kHz, RBW 300 kHz, peak hold while maximizing by turning the turntable and varying the antenna height. Transmit frequencies excluded.

5.2. Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
111	Antenna, LPA	EMCO	3146	1382	09-Jan-2013	09-Jan-2014
529	Antenna, DRWG	EMCO	3115	2505	31-Oct-2012	31-Oct-2014
901	Preamplifier	Sonoma	310 N	130607	15-Oct-2012	*15-Dec-2013
911	Spectrum Analyzer	Agilent	E4440A	US41421266	15-Oct-2012	*15-Dec-2013
E1029	Preamplifier (20MHz to 18GHz)	A.H. Systems, Inc.	PAM-0118	343	21-Jan-2013	21-Jan-2014
E1046	Biconical Antenna	A.H. Systems Inc.	SAS-540	736	22-Apr-2013	22-Apr-2014
991	Antenna, Horn	EMCO	3160-10	9704-1049	Verified before use	
992	Antenna, Horn	EMCO	3160-09	9705-1079	Verified before use	
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	15-Jul-2013	15-Jul-2015

*extended 60 days

Registration of the OATS are on file with the Federal Communications Commission, under Registration Number 90579.