CERTIFICATION TEST REPORT

Report Number. : 11686683-E4V3

Applicant	:	DIGI INTERNATIONAL INC. 11001 BREN RD. E MINNETONKA, MN 55343, U.S.A.
Model	:	SMARTGATEWAY
FCC ID	:	MCQ-SMARTGTW01
IC	:	1846A-SMARTGTW01
EUT Description	:	DIGI SMART GATEWAY
Test Standard(s)	:	FCC Part 1 Subpart I FCC Part 2 Subpart J INDUSTRY CANADA RSS 102 ISSUE 5

Date Of Issue:
May 12, 2017

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	04/28/17	Initial Issue	D. Coronia
V2	05/11/17	Updated Section 6 (removed DFS channel)	D. Coronia
V3	05/12/17	Updated Section 6 (Added LTE band)	D. Coronia

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: DIGI WIRELESS DESIGN SERVICES INC.
11001 BREN RD. E
MINNETONKA, MN 55343, U.S.A.

EUT DESCRIPTION: DIGI SMART GATEWAY

MODEL: SMARTGATEWAY

SERIAL NUMBER: F000025 (CONDUCTED), F000026 (RADIATED)

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Pass
INDUSTRY CANADA RSS 102 ISSUE 5	Pass

UL Verification Services Inc. calculated the RF Exposure of the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations of these calculations. The results show that the equipment is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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Calculated By:

KIYA KEDIDA
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2. TEST METHODOLOGY

All calculations were made in accordance with FCC OET Bulletin 65 Edition 97-01 and IC Safety Code 6.

3. REFERENCES

All measurements were made as documented in test report UL Verification Services Inc. Document 11686683-E1V1 FCCIC Report BLE WLAN & 11686683-E2V1 FCCIC DTS WLAN for operation in the 2.4 GHz band and UL Verification Services Inc. Document 11686683-E3V2 FCCIC Report UNII WLAN for operation in the 5 GHz bands, and FCC ID: RI7LE910NA and IC ID: 5131A-LE910NA for Cellular band (GSM & WCDMA).

Output power, Duty cycle and Antenna gain data is excerpted from the applicable test reports.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

5. MAXIMUM PERMISSIBLE RF EXPOSURE

5.1. FCC RULES

§1.1310 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 §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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 Exposure				
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
300-1,500			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	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Notes:

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

5.2. IC RULES

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Dentisty (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

5.3. EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

Total EIRP = (EIRP1) + (EIRP2) + ... + (EIRPn)

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

MIMO AND COLOCATED TRANSMITTERS

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply:

The Power Density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as
(Power Density of chain or transmitter) / (Limit applicable to that chain or transmitter).

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

5.4. LIMITS AND IC EXEMPTION

VARIABLE LIMITS

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency:

824 MHz / 1500 = 0.55 mW/cm^2 (FCC)
S = 0.02619 $f^{0.6834}$ W/m^2 (IC).

FIXED LIMITS

For operation in the PCS band, the 2.4 GHz band and the 5 GHz bands:

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2
From IC Safety Code 6, Section 4 Table 4 Column 4, S = 0.02619 $f^{0.6834}$ W/m^2

INDUSTRY CANADA EXEMPTION

RSS-102 Clause 2.5.2 RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. 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 e.i.r.p. of the device is equal to or less than 4.49/f0.5 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 e.i.r.p. 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 e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

6. RF EXPOSURE RESULTS

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

Single Chain and non-colocated transmitters										
Band	**Mode**	**Separation Distance (cm)**	**Output Power (dBm)**	**Antenna Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC Power Density (mW/cm^2)**	**IC Power Density (W/m^2)**	**FCC Limit (mW/cm^2)**	**IC Limit (W/m^2)**
706.5-713.5 MHz	LTE B17	20	25.0	-0.28	100.0	296.5	0.0590	0.590	0.47	4.7
709-711 MHz	LTE B17	20	25.0	-0.28	100.0	296.5	0.0590	0.590	0.47	4.7
826.5-846.5 MHz	LTE B5	20	25.0	-1.11	100.0	244.9	0.0487	0.487	0.55	5.5
829-844 MHz	LTE B5	20	25.0	-1.11	100.0	244.9	0.0487	0.487	0.55	5.5
1712.5-1752.5 MHz	LTE B4	20	25.0	-1.74	100.0	211.8	0.0422	0.422	1.00	10.0
1715.0-1750.0 MHz	LTE B4	20	25.0	-1.74	100.0	211.8	0.0422	0.422	1.00	10.0
1720.0-1745.0 MHz	LTE B4	20	25.0	-1.74	100.0	211.8	0.0422	0.422	1.00	10.0
1852.5-1907.5 MHz	LTE B2	20	25.0	-1.48	100.0	224.9	0.0448	0.448	1.00	10.0
1855.0-1905.0 MHz	LTE B2	20	25.0	-1.48	100.0	224.9	0.0448	0.448	1.00	10.0
1860.0-1900.0 MHz	LTE B2	20	25.0	-1.48	100.0	224.9	0.0448	0.448	1.00	10.0
824.2-848.2 MHz	GSM	20	33.50	-1.11	25.0	433.5	0.0863	0.863	0.55	5.5
1850.2-1909.8 MHz	GSM	20	30.50	-1.48	25.0	199.5	0.0397	0.397	1.00	10.0
826.5-846.6 MHz	WCDMA	20	20.00	-1.11	100.0	77.4	0.0154	0.154	0.55	5.5
1852.4-1907.6 MHz	WCDMA	20	25.00	-1.18	100.0	241.0	0.0480	0.480	1.00	10.0
2.4 GHz	BLE	20	4.53	-1.50	90.1	1.8	0.0004	0.004	1.00	10.0
2.4 GHz	WLAN	20	16.50	-1.45	97.2	31.1	0.0062	0.062	1.00	10.0
5 GHz	WLAN	20	16.00	-0.92	98.3	31.7	0.0063	0.063	1.00	10.0

Remarks:

1) Maximum conducted output power (per tune-up or target power)
2) 2.4GHz 802.11g is the worst mode, and 5GHz (5.2GHz) 802.11a is the worst mode. Other operation modes are being covered by presented output power data.

SIMULTANEOUS MULTIPLE BAND RESULTS

Multiple chain or colocated transmitters									
Band	**Mode**	**Separation Distance (cm)**	**Output Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC Power Density (mW/cm^2)**	**IC Power Density (W/m^2)**
706.5-713.5 MHz	LTE B17		25.00	-0.28	24.72	25.0	74.1		
709-711 MHz	LTE B17		25.00	-0.28	24.72	25.0	74.1		
826.5-846.5 MHz	LTE B5		25.00	-1.11	23.89	25.0	61.2		
829-844 MHz	LTE B5		25.00	-1.11	23.89	25.0	61.2		
1712.5-1752.5 MHz	LTE B4		25.00	-1.74	23.26	25.0	53.0		
1715.0-1750.0 MHz	LTE B4		25.00	-1.74	23.26	25.0	53.0		
1720.0-1745.0 MHz	LTE B4		25.00	-1.74	23.26	25.0	53.0		
1852.5-1907.5 MHz	LTE B2		25.00	-1.48	23.52	25.0	56.2		
1855.0-1905.0 MHz	LTE B2		25.00	-1.48	23.52	25.0	56.2		
1860.0-1900.0 MHz	LTE B2		25.00	-1.48	23.52	25.0	56.2		
824.2-848.2 MHz	GSM		33.50	-1.11	32.39	25.0	433.5		
1850.2-1909.8 MHz	GSM		30.50	-1.48	29.02	25.0	199.5		
826.4-846.6 MHz	WCDMA		20.00	-1.11	18.89	100.0	77.4		
1852.4-1907.6 MHz	WCDMA		25.00	-1.48	23.52	100.0	224.9		
2.4 GHz	BLE		4.53	-1.50	3.03	90.1	1.8		
2.4 GHz	WLAN		16.50	-1.45	15.05	97.2	31.1		
5 GHz	WLAN		16.00	-0.92	15.08	98.3	31.7		
Combined		20					1231.2	0.245	2.45

Notes:

1) For MPE the new KDB 447498 requires the calculations to use the maximum rated power; that power should be declared by the manufacturer, and should not be lower than the measured power. If the power has a tolerance then we also need to check that the measured power is within the tolerance.

2) The manufacturer configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level measured.

3) The output power in the tables above is the maximum power per chain among various channels and various modes within the specific band.

4) The antenna gain in the tables above is the maximum antenna gain among various channels within the specified band.

(MIMO and/or Colocated transmitters with different Power Density limits among bands)

Worse-case among all bands

Multiple chain or colocated transmitters

Band	(GHz)	0.8	2.4
Mode		GSM	WLAN
Transmitter		Cell	
Separation Distance	(cm)	20	20
Output Power	(dBm)	33.5	16.5
Antenna Gain	(dBi)	-1.1	-1.5
Duty Cycle	(%)	25	97
Source Based EIRP	(mW)	433.5	31.1
FCC Power Density	(mW/cm^2)	0.09	0.01
FCC Power Density Limit	(mW/cm^2)	0.55	1.0
IC Power Density	(W/m^2)	0.863	0.062
IC Power Density Limit	(W/m^2)	5.5	10
Fraction of Limit	(%)	15.7	0.6
Sum of Fractions (%)	16.4		

END OF REPORT