RF-EXPOSURE REPORT

FCC 47 CFR Part 2.1091
ISED RSS-102

Maximum permissible exposure

Report Reference No	G0M-2002-8805-TFC091MP-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Laird Connectivity Inc
Address	50 South Main Street 44308 Akron, OH United States of America
Test Specification	According to FCC/ISED rules
Standard	FCC 47 CFR 2.1091 ISED RSS-102
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	915MHz LoRaWAN Gateway incl Wi-Fi, Ethernet & LTE - Indoor and IP67 variants
Model(s)	RG191+LTE Series
Additional Model(s)	None
Brand Name(s)	Laird Connectivity
Hardware Version(s)	v750.03.224
Software Version(s)	v93.9.5.1
FCC-ID	SQG-RG191NALTE
IC	3147A-RG191NALTE
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 °C - 30 °C	
Test Lab Humidity	25 % - 55 %	
Date of receipt of test item	2020-06-18 (sample ID 29796) 2020-08-12 (sample ID 30742)	
Report:		
Compiled by	Toralf Jahn	
Tested by (+ signature) (Responsible for Test)	Toralf Jahn	
Approved by (+ signature) (Head of Lab)	Christian Weber	
Date of Issue	2020-09-09	
Total number of pages	31	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2020-09-09	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EIRP	Equivalent Isotropic Radiated Power
EUT	Equipment Under Test
MPE	Maximum Permissible Exposure

REPORT INDEX

1 Equipment (Test Item) Under Test

Description	915MHz LoRaWAN Gateway incl Wi-Fi, Ethernet & LTE - Indoor and IP67 variants
Model	RG191+LTE Series
Additional Model(s)	None
Brand Name(s)	Laird Connectivity
Serial Number(s)	Sample ID 29796 and 30742
Hardware Version(s)	v750.03.224
Software Version(s)	v93.9.5.1
PMN	RG191+LTE Series
HVIN	RG191+LTE
FVIN	v93.9.5.1
HMN	N/A
FCC-ID	SQG-RG191NALTE
IC	3147A-RG191NALTE
Equipment type	End Product
Environment	General public

1.1 Reference Documents

Document Type	Document No.	Issued by	Date
LORA module test report	# 317134 A	Laird Technologies, Inc.	2017-06-23
IEEE 802.11 b/g/n module test report	FR631002AC Rev. 02	International Certification Corp.	2016-05-03
IEEE 802.11 a/n module test report	FR631002AN	International Certification Corp.	2016-05-03
LTE module test report	R1805A0250-R1 R1805A0250-R2 R1805A0250-R3	TA Technology (Shanghai) Co., Ltd.	2018-07-12.
LORA test report	G0M-2002-8805-TFC247DT-V01	Eurofins Product Service GmbH	2020-09-03
IEEE 802.11 b/g/n test report	G0M-2002-8805-TFC247WF-V01	Eurofins Product Service GmbH	2020-09-03
IEEE 802.11 a/n test report	G0M-2002-8805-TFC407WF-V01	Eurofins Product Service GmbH	2020-09-03
LTE test report	G0M-2002-8805-TFCMOCORSE-V02	Eurofins Product Service GmbH	2020-08-27

1.2 Power density radiation sources

Mode	Operating Frequency [MHz]	Maximum conducted power [dBm]	Maximum radiated power [dBm EIRP]	Maximum duty cycle [%]	Maximum antenna gain [dBi]	Maximum antenna diameter [cm]
LORA	923.3	27.7	29.7	100	2	20
IEEE 802.11 (2.4 GHz)	2437	25.96	28.06	100	2.1	14
IEEE 802.11 (U-NII-1)	5180	21.68	24.08	100	2.4	14
IEEE 802.11 (U-NII-2A)	5270	21.81	24.41	100	2.6	14
IEEE 802.11 (U-NII-2C)	5590	21.94	25.34	100	3.4	14
IEEE 802.11 (U-NII-3)	5785	21.47	24.87	100	3.4	14
LTE FDD2	1880.0	25.7*	27.9	100	2.2	22
LTE FDD4	1732.5	25.7*	27.9	100	2.2	22
LTE FDD5	836.0	25.7*	27.9	100	2.2	22
LTE FDD12	707.5	25.7*	27.9	100	2.2	22
LTE FDD13	782	25.7*	27.9	100	2.2	22
Comment: * Maximum power permitted by specific radio technology standard.						

1.3 Field strength radiation sources

None

1.4 Concurrent Sources

Concurrent operating conditions
LORA + IEEE 802.11 (2.4 GHz)
LORA + IEEE 802.11 (U-NII-1)
LORA + IEEE 802.11 (U-NII-2A)
LORA + IEEE 802.11 (U-NII-2C)
LORA + IEEE 802.11 (U-NII-3)
LORA + LTE FDD2
LORA + LTE FDD4
LORA + LTE FDD5
LORA + LTE FDD12
LORA + LTE FDD13
Comment:

2 Result Summary

FCC MPE Evaluation - Single radiation sources					
Product Standard Reference	**Requirement**	**Reference Method**	**Mode**	**Distance [m]**	**Verdict**
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	IEEE 802.11 (2.4 GHz)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	IEEE 802.11 (U-NII-1)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	IEEE 802.11 (U-NII-2A)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	IEEE 802.11 (U-NII-2C)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	IEEE 802.11 (U-NII-3)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LTE FDD2	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LTE FDD4	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LTE FDD5	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LTE FDD12	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LTE FDD13	0.20	PASS
Comment:					

ISED MPE Evaluation - Single radiation sources					
Product Standard Reference	**Requirement**	**Reference Method**	**Mode**	**Distance [m]**	**Verdict**
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	IEEE 802.11 (2.4 GHz)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	IEEE 802.11 (U-NII-1)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	IEEE 802.11 (U-NII-2A)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	IEEE 802.11 (U-NII-2C)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	IEEE 802.11 (U-NII-3)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LTE FDD2	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LTE FDD4	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LTE FDD5	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LTE FDD12	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LTE FDD13	0.20	PASS
Comment:					

FCC MPE Evaluation - Multi-transmitter sources					
Product Standard Reference	**Requirement**	**Reference Method**	**Mode**	**Distance [m]**	**Verdict**
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + IEEE 802.11 (2.4 GHz)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + IEEE 802.11 (U-NII-1)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + IEEE 802.11 (U-NII-2A)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + IEEE 802.11 (U-NII-2C)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + IEEE 802.11 (U-NII-3)	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + LTE FDD2	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + LTE FDD4	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + LTE FDD5	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + LTE FDD12	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	LORA + LTE FDD13	0.20	PASS
Comment:					

ISED MPE Evaluation - Multi-transmitter sources					
Product Standard Reference	**Requirement**	**Reference Method**	**Mode**	**Distance [m]**	**Verdict**
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + IEEE 802.11 (2.4 GHz)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + IEEE 802.11 (U-NII-1)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + IEEE 802.11 (U-NII-2A)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + IEEE 802.11 (U-NII-2C)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + IEEE 802.11 (U-NII-3)	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + LTE FDD2	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + LTE FDD4	0.20	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + LTE FDD5	**0.22**	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + LTE FDD12	**0.22**	PASS
ISED RSS-102	Maximum permissible exposure	ISED RSS-102	LORA + LTE FDD13	**0.22**	PASS
Comment:					

3 RF-Exposure classification

RF-Exposure Categories	
Fixed	A fixed device is defined as a device physically secured at one fixed location and cannot be easily re-located.
Mobile	A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.
Portable	A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

RF-Exposure Categories	
Occupational / Controlled	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 an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
General population / Uncontrolled	Exposures apply in situations in which the general public may be exposed, or in which persons that 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.

4 RF-Exposure limits

FCC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	**Electric field strength [V/M]**	**Magnetic field strength [A/M]**	**Power density [W/m²]**	**Averaging time [min]**
0.3 – 1.34	614	1.63	1000	30
1.34 – 30	824/f	2.19/f	$1800/f^2$	30
30 – 300	27.5	0.073	2	30
300 – 1500	-	-	f/150	30
1500 – 100000	-	-	10.0	30

FCC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	**Electric field strength [V/M]**	**Magnetic field strength [A/M]**	**Power density [W/m²]**	**Averaging time [min]**
0.3 – 3.0	614	1.63	1000	6
3.0 – 30	1842/f	4.89/f	$9000/f^2$	6
30 – 300	61.4	0.163	10.0	6
300 – 1500	-	-	f/30	6
1500 – 100000	-	-	50	6

ISED Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	**Electric field strength [V/M]**	**Magnetic field strength [A/M]**	**Power density [W/m²]**	**Averaging time [min]**
0.003 – 10	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	$58.07/f^{05}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	$3.142 \cdot f^{0.3417}$	$0.008335 \cdot f^{0.3417}$	$0.02619 \cdot f^{0.6834}$	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	$616000/f^{1.2}$
150000 – 300000	$0.158 \cdot f^{0.5}$	$4.21 \cdot 10^{-4} \cdot f^{0.5}$	$6.67 \cdot 10^{-5} \cdot f$	$616000/f^{1.2}$

ISED Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	**Electric field strength [V/M]**	**Magnetic field strength [A/M]**	**Power density [W/m²]**	**Averaging time [min]**
0.003 – 10	170	180	-	Instantaneous
0.1 – 10	-	1.6/f	-	6
1.1 – 10	$193/f^{0.5}$	-	-	6
10 – 20	61.4	0.163	10	6
20 – 48	$129.8/f^{05}$	$0.3444/f^{0.25}$	$44.72/f^{0.5}$	6
48 – 300	49.33	0.1309	6.455	6
300 – 6000	$15.60 \cdot f^{0.25}$	$0.04138 \cdot f^{0.25}$	$0.6455 \cdot f^{0.5}$	6
6000 – 15000	137	0.364	50	6
15000 – 150000	137	0.364	50	$616000/f^{1.2}$
150000 – 300000	$0.354 \cdot f^{0.5}$	$9.40 \cdot 10^{-4} \cdot f^{0.5}$	$3.33 \cdot 10^{-4} \cdot f$	$616000/f^{1.2}$

5 RF-Exposure Evaluation

Evaluation Relations

$$\lambda[m] = \frac{c\left[\frac{m}{s}\right]}{f[Hz]} \; ; \; R_{FF}[m] \geq \frac{2 \cdot D[m]^2}{\lambda[m]}$$

$$S[W/m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2} \; ; \; R[m] = \sqrt{\frac{P_{E.I.R.P.}[W]}{4\pi S[W/m^2]}}$$

$$DCC\ [dB] = 10 \cdot Log_{10}\left(\frac{DC[\%]}{100}\right)$$

$$\sum_{i=1}^{N} \frac{S_i\left[\frac{W}{m^2}\right]}{S_{Li}\left[\frac{W}{m^2}\right]} + \sum_{j=1}^{M} \left(\frac{E_j\left[\frac{V}{m}\right]}{E_{Lj}\left[\frac{V}{m}\right]}\right)^2 + \sum_{k=1}^{O} \left(\frac{H_k\left[\frac{A}{m}\right]}{H_{Lk}\left[\frac{A}{m}\right]}\right)^2 < 1$$

Evaluation Procedure

Standalone operation evaluation:

For each radio and frequency band the worst case transmission mode with the highest peak conducted or radiated power is evaluated at the frequency that results in the most restrictive rf-exposure limit. From the peak power values, antenna gains and duty cycles taken from the reference documents, the source average radiated power values are calculated. From the average radiated power the power densities at antenna far-field distance is calculated. The distance from the radiation source for compliance power density is calculated. If the separation distance is lower than the far-field distance, the far-field distance is given as compliance separation distance because the plane wave power density assessment is only valid in the far-field of the radiation source.

For radiation sources for which the average electric and magnetic fields are measured using field probes, the measured field strength values are compared to the reference limits. For those sources no calculations are performed. Compliance with the reference values is determined with the near field measurements.

Concurrent operation evaluation:

First the evaluation distance is set to an appropriate value. For all radiation sources for which power densities are calculated, the power densities at the evaluation distance are calculated and for all other sources the electric or magnetic field strengths are measured using field probes. Finally the ratios of the power densities and/or field strength values and the corresponding limits are calculated and summed and the sum is compared to the maximum of 1.

6 Single Source Evaluation Results - FCC

LORA	
Transmission Mode	
Transmission Frequency (f) [MHz]	923.3
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.20
Transmission wavelength (λ) [m]	0.32
Antenna far-field distance (R_{FF}) [m]	0.25
Source average power	
Peak radiated power (PR) [dBm EIRP]	29.7
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	29.70
Power density	
Compliance power density limit [W/m^2]	6.155
Power density (S) @ Antenna far-field distance [W/m^2]	1.225
Power density (S) @ 0.20 m [W/m^2]	1.857
Power density ratio @ 0.20 m	0.30
Distance for compliance power density (S=SL) [m]	0.110
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (2.4 GHz)	
Transmission Mode	
Transmission Frequency (f) [MHz]	2437
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.12
Antenna far-field distance (R_{FF}) [m]	0.32
Source average power	
Peak radiated power (PR) [dBm EIRP]	28.06
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	28.06
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.502
Power density (S) @ 0.20 m [W/m^2]	1.273
Power density ratio @ 0.20 m	0.13
Distance for compliance power density (S=SL) [m]	0.071
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-1)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5180
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.06
Antenna far-field distance (R_{FF}) [m]	0.68
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.08
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.08
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.044
Power density (S) @ 0.20 m [W/m^2]	0.509
Power density ratio @ 0.20 m	0.05
Distance for compliance power density (S=SL) [m]	0.045
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-2A)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5270
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.06
Antenna far-field distance (R_{FF}) [m]	0.69
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.41
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.41
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.046
Power density (S) @ 0.20 m [W/m^2]	0.549
Power density ratio @ 0.20 m	0.05
Distance for compliance power density (S=SL) [m]	0.047
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-2C)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5590
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.05
Antenna far-field distance (R_{FF}) [m]	0.73
Source average power	
Peak radiated power (PR) [dBm EIRP]	25.34
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	25.34
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.051
Power density (S) @ 0.20 m [W/m^2]	0.680
Power density ratio @ 0.20 m	0.07
Distance for compliance power density (S=SL) [m]	0.052
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-3)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5785
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.05
Antenna far-field distance (R_{FF}) [m]	0.76
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.87
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.87
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.043
Power density (S) @ 0.20 m [W/m^2]	0.611
Power density ratio @ 0.20 m	0.06
Distance for compliance power density (S=SL) [m]	0.049
Compliance	
Verdict	PASS
Comment:	

LTE FDD2	
Transmission Mode	
Transmission Frequency (f) [MHz]	1880.0
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.16
Antenna far-field distance (R_{FF}) [m]	0.61
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.133
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.12
Distance for compliance power density (S=SL) [m]	0.070
Compliance	
Verdict	PASS
Comment:	

LTE FDD4	
Transmission Mode	
Transmission Frequency (f) [MHz]	1732.5
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.17
Antenna far-field distance (R_{FF}) [m]	0.56
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	10.000
Power density (S) @ Antenna far-field distance [W/m^2]	0.157
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.12
Distance for compliance power density (S=SL) [m]	0.070
Compliance	
Verdict	PASS
Comment:	

LTE FDD5	
Transmission Mode	
Transmission Frequency (f) [MHz]	836.0
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.36
Antenna far-field distance (R_{FF}) [m]	0.27
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	5.573
Power density (S) @ Antenna far-field distance [W/m^2]	0.674
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.22
Distance for compliance power density (S=SL) [m]	0.094
Compliance	
Verdict	PASS
Comment:	

LTE FDD12	
Transmission Mode	
Transmission Frequency (f) [MHz]	707.5
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.42
Antenna far-field distance (R_{FF}) [m]	0.23
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	4.717
Power density (S) @ Antenna far-field distance [W/m^2]	0.942
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.26
Distance for compliance power density (S=SL) [m]	0.102
Compliance	
Verdict	PASS
Comment:	

LTE FDD13	
Transmission Mode	
Transmission Frequency (f) [MHz]	782
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.38
Antenna far-field distance (R_{FF}) [m]	0.25
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	5.213
Power density (S) @ Antenna far-field distance [W/m^2]	0.771
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.24
Distance for compliance power density (S=SL) [m]	0.097
Compliance	
Verdict	PASS
Comment:	

7 Single Source Evaluation Results - ISED

LORA	
Transmission Mode	
Transmission Frequency (f) [MHz]	923.3
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.20
Transmission wavelength (λ) [m]	0.32
Antenna far-field distance (R_{FF}) [m]	0.25
Source average power	
Peak radiated power (PR) [dBm EIRP]	29.7
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	29.70
Power density	
Compliance power density limit [W/m^2]	2.784
Power density (S) @ Antenna far-field distance [W/m^2]	1.225
Power density (S) @ 0.20 m [W/m^2]	1.857
Power density ratio @ 0.20 m	0.67
Distance for compliance power density (S=SL) [m]	0.163
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (2.4 GHz)	
Transmission Mode	
Transmission Frequency (f) [MHz]	2437
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.12
Antenna far-field distance (R_{FF}) [m]	0.32
Source average power	
Peak radiated power (PR) [dBm EIRP]	28.06
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	28.06
Power density	
Compliance power density limit [W/m^2]	5.404
Power density (S) @ Antenna far-field distance [W/m^2]	0.502
Power density (S) @ 0.20 m [W/m^2]	1.273
Power density ratio @ 0.20 m	0.24
Distance for compliance power density (S=SL) [m]	0.097
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-1)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5180
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.06
Antenna far-field distance (R_{FF}) [m]	0.68
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.08
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.08
Power density	
Compliance power density limit [W/m^2]	9.047
Power density (S) @ Antenna far-field distance [W/m^2]	0.044
Power density (S) @ 0.20 m [W/m^2]	0.509
Power density ratio @ 0.20 m	0.06
Distance for compliance power density (S=SL) [m]	0.047
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-2A)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5270
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.06
Antenna far-field distance (R_{FF}) [m]	0.69
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.41
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.41
Power density	
Compliance power density limit [W/m^2]	9.154
Power density (S) @ Antenna far-field distance [W/m^2]	0.046
Power density (S) @ 0.20 m [W/m^2]	0.549
Power density ratio @ 0.20 m	0.06
Distance for compliance power density (S=SL) [m]	0.049
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-2C)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5590
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.05
Antenna far-field distance (R_{FF}) [m]	0.73
Source average power	
Peak radiated power (PR) [dBm EIRP]	25.34
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	25.34
Power density	
Compliance power density limit [W/m^2]	9.531
Power density (S) @ Antenna far-field distance [W/m^2]	0.051
Power density (S) @ 0.20 m [W/m^2]	0.680
Power density ratio @ 0.20 m	0.07
Distance for compliance power density (S=SL) [m]	0.053
Compliance	
Verdict	PASS
Comment:	

IEEE 802.11 (U-NII-3)	
Transmission Mode	
Transmission Frequency (f) [MHz]	5785
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.14
Transmission wavelength (λ) [m]	0.05
Antenna far-field distance (R_{FF}) [m]	0.76
Source average power	
Peak radiated power (PR) [dBm EIRP]	24.87
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	24.87
Power density	
Compliance power density limit [W/m^2]	9.756
Power density (S) @ Antenna far-field distance [W/m^2]	0.043
Power density (S) @ 0.20 m [W/m^2]	0.611
Power density ratio @ 0.20 m	0.06
Distance for compliance power density (S=SL) [m]	0.050
Compliance	
Verdict	PASS
Comment:	

LTE FDD2	
Transmission Mode	
Transmission Frequency (f) [MHz]	1880.0
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.16
Antenna far-field distance (R_{FF}) [m]	0.61
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	4.526
Power density (S) @ Antenna far-field distance [W/m^2]	0.133
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.27
Distance for compliance power density (S=SL) [m]	0.104
Compliance	
Verdict	PASS
Comment:	

LTE FDD4	
Transmission Mode	
Transmission Frequency (f) [MHz]	1732.5
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.17
Antenna far-field distance (R_{FF}) [m]	0.56
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	4.280
Power density (S) @ Antenna far-field distance [W/m^2]	0.157
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.29
Distance for compliance power density (S=SL) [m]	0.107
Compliance	
Verdict	PASS
Comment:	

LTE FDD5	
Transmission Mode	
Transmission Frequency (f) [MHz]	836.0
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.36
Antenna far-field distance (R_{FF}) [m]	0.27
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	2.601
Power density (S) @ Antenna far-field distance [W/m^2]	0.674
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.47
Distance for compliance power density (S=SL) [m]	0.137
Compliance	
Verdict	PASS
Comment:	

LTE FDD12	
Transmission Mode	
Transmission Frequency (f) [MHz]	707.5
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.42
Antenna far-field distance (R_{FF}) [m]	0.23
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	2.321
Power density (S) @ Antenna far-field distance [W/m^2]	0.942
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.53
Distance for compliance power density (S=SL) [m]	0.145
Compliance	
Verdict	PASS
Comment:	

LTE FDD13	
Transmission Mode	
Transmission Frequency (f) [MHz]	782
Antenna far-field distance	
Maximum antenna diameter (D) [m]	0.22
Transmission wavelength (λ) [m]	0.38
Antenna far-field distance (R_{FF}) [m]	0.25
Source average power	
Peak radiated power (PR) [dBm EIRP]	27.9
Maximum transmission duty cycle (DC)	1.00
Duty cycle correction (DCC) [dB]	0.00
Average radiated power (PRAVG) [dBm EIRP]	27.90
Power density	
Compliance power density limit [W/m^2]	2.485
Power density (S) @ Antenna far-field distance [W/m^2]	0.771
Power density (S) @ 0.20 m [W/m^2]	1.227
Power density ratio @ 0.20 m	0.49
Distance for compliance power density (S=SL) [m]	0.141
Compliance	
Verdict	PASS
Comment:	

8 Concurrent Evaluation Results - FCC

LORA + IEEE 802.11 (2.4 GHz)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
IEEE 802.11 (2.4 GHz)	0.13
Sum of MPE Ratios	
Sum	0.43
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-1)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
IEEE 802.11 (U-NII-1)	0.05
Sum of MPE Ratios	
Sum	0.35
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-2A)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
IEEE 802.11 (U-NII-2A)	0.05
Sum of MPE Ratios	
Sum	0.35
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-2C)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
IEEE 802.11 (U-NII-2C)	0.07
Sum of MPE Ratios	
Sum	0.37
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-3)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
IEEE 802.11 (U-NII-3)	0.06
Sum of MPE Ratios	
Sum	0.36
Compliance	
Verdict	PASS

LORA + LTE FDD2	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
LTE FDD2	0.12
Sum of MPE Ratios	
Sum	0.42
Compliance	
Verdict	PASS

LORA + LTE FDD4	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
LTE FDD4	0.12
Sum of MPE Ratios	
Sum	0.42
Compliance	
Verdict	PASS

LORA + LTE FDD5	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
LTE FDD5	0.22
Sum of MPE Ratios	
Sum	0.52
Compliance	
Verdict	PASS

LORA + LTE FDD12	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
LTE FDD12	0.26
Sum of MPE Ratios	
Sum	0.56
Compliance	
Verdict	PASS

LORA + LTE FDD13	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.30
LTE FDD13	0.24
Sum of MPE Ratios	
Sum	0.54
Compliance	
Verdict	PASS

9 Concurrent Evaluation Results - ISED

LORA + IEEE 802.11 (2.4 GHz)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
IEEE 802.11 (2.4 GHz)	0.24
Sum of MPE Ratios	
Sum	0.91
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-1)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
IEEE 802.11 (U-NII-1)	0.06
Sum of MPE Ratios	
Sum	0.73
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-2A)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
IEEE 802.11 (U-NII-2A)	0.06
Sum of MPE Ratios	
Sum	0.73
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-2C)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
IEEE 802.11 (U-NII-2C)	0.07
Sum of MPE Ratios	
Sum	0.74
Compliance	
Verdict	PASS

LORA + IEEE 802.11 (U-NII-3)	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
IEEE 802.11 (U-NII-3)	0.06
Sum of MPE Ratios	
Sum	0.73
Compliance	
Verdict	PASS

LORA + LTE FDD2	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
LTE FDD2	0.27
Sum of MPE Ratios	
Sum	0.94
Compliance	
Verdict	PASS

LORA + LTE FDD4	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
LORA	0.67
LTE FDD4	0.29
Sum of MPE Ratios	
Sum	0.96
Compliance	
Verdict	PASS

LORA + LTE FDD5	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.22
Maximum MPE Ratios	
LORA	0.55
LTE FDD5	0.39
Sum of MPE Ratios	
Sum	0.94
Compliance	
Verdict	PASS

LORA + LTE FDD12	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.22
Maximum MPE Ratios	
LORA	0.55
LTE FDD12	0.44
Sum of MPE Ratios	
Sum	0.99
Compliance	
Verdict	PASS

LORA + LTE FDD13	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.22
Maximum MPE Ratios	
LORA	0.55
LTE FDD13	0.41
Sum of MPE Ratios	
Sum	0.96
Compliance	
Verdict	PASS