

FCC IC RF Test Report Report No.: FCC_IC_RF_SL21011803-MED-004_Rev2.0 Models: 97800 FCC ID: LF597800 IC: 3408D-97800 Received Date: 06/24/2021 Test Date: 06/25/2021 Issued Date: 9/8/2022 Applicant name: Medtronic, Inc. Address: 710 Medtronic Parkway N.E., Minneapolis, MN 55432 Manufacturer: Medtronic, Inc. Address: 710 Medtronic Parkway N.E., Minneapolis, MN 55432 Issued By: Bureau Veritas Consumer Products Services, Inc. Lab Address: 775 Montague Expressway, Milpitas, CA 95035 FCC Registration / 540430 **Designation Number:** ISED# / CAB identifier: 4842D



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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL21011803-MED-004	Initial Release	06/30/2021
FCC_IC_RF_SL21011803-MED-004_Rev1.0	Updated section 4.1.7	8/17/2022
FCC_IC_RF_SL21011803-MED-004_Rev2.0	Updated remark 5 on pg 13 and added remark 5 to pg 15.	9/8/2022



Sample Status: Engineering sample Applicant: Medtronic, Inc. Test Date: 06/25/2021 Standards: 47 CFR FCC Part 15, Subpart C (Section 15.207/15.209) ANSI C63.10:2013 RSS Gen Issue 5, March 2019 RSS-210 Issue 10 December 2019 The above equipment has been tested by Bureau Veritas Consumer Products Services, Inc., Milpitas Branch, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report. Dem **Date:** 06/30/2021 Prepared by : Deon Dai / Test Engineer Gary Chou **Date:** 06/30/2021 Approved by : Gary Chou / Engineer Reviewer Page No. 4 / 21 Report No.: FCC_IC_RF_SL21011803-MED-004_Rev2.0 Report Format Version: 6.1.1

Certificate of Conformity

Test Model: 97800

Brand: Medtronic

Product: Ultra Low Power Active Medical Implant (ULP-AMI)

1



2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (15.207/15.209)						
	, RSS G	en Issue 5				
FCC IC Clause	Test Item	Result	Remarks			
15.207 RSS Gen 8.8	AC Power Conducted Emission	N/A	Work with battery			
RSS Gen	Occupied Bandwidth	Pass	Referency Only			
15.209 RSS Gen	Transmitter Radiated Emission	Pass	Meet the requirement of limit.			
15.203 RSS Gen	Antenna Requirement	Pass	The EUT uses an Integral internal Antenna to permanently attach to the device.			

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB

2.2 Modification Record

There were no modifications required for compliance.



3 General Information

3.1 General Description of EUT

Product	Ultra Low Power Active Medical Implant (ULP-AMI)
Brand	Medtronic
Test Model	97800
Series Model	N/A
Model Difference	N/A
Status of EUT	Engineering sample
Power Supply Rating	Battery
Modulation Type	OOK burst, less then 1% duty cycle.
Operating Frequency	175kHz
Number of Channel	1
Antenna Type	Integral internal antenna
Antenna Gain	None

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.



3.2 Description of Test Modes

3.2.1	1 channel is provided to this EUT		
	Channel	Freq. (MHz)	
	1	0.175	
3.2.2	Test Mode Applicability and Tested Cha	annel Detail	
EUT	APPLICABLE TO		

	CONFIGURE					DESCRIPTION		
	MODE			PLC	FS	EB	DESCRIPTION	
	А		\checkmark	-	-	\checkmark	Power from battery	
	В		-	Power from USB via laptop				
۷	Where RE: Radiated Emission PLC: Power Line (onducted Emission					
FS: Frequency Stability EB: 20dB Bandy		: 20dB Bandwid	th measurement					

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**. **NOTE:** "-" means no effect.

Radiated Emission Test:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
А	1	1	OOK

Power Line Conducted Emission Test:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	OOK

Frequency Stability:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
А	1	1	ООК

Test Condition:

APPLICABLE TO ENVIRONMENTAL CONDITIONS		INPUT POWER	TESTED BY	
RE	25deg. C, 65%RH	5Vdc	Deon Dai	
EB	25deg. C, 65%RH	5Vdc	Deon Dai	



3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
Α.	Communicator	Medtronic	TM90	NPA11462N	LF5TM90	Provided by Customer
В.	Mobile Phone	Sunsang	Galaxy J3	-	-	Provided by Customer

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	-	-	-	-	-	-

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.207) 47 CFR FCC Part 15, Subpart C (Section 15.209) ANSI C63.10:2013 RSS Gen Issue 5, March 2019 RSS-210 Issue 10 December 2019

All test items have been performed and recorded as per the above standards.



4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

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

NOTE:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Distance extrapolation factor = 40 log (specific distance / test distance)

Limit Line (dBuV/m) = 20 log Emission level (uV/m) + Distance extrapolation factor

- 3. The emission limits shown in the above table are based on measurements employing a CISPR quasipeak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
- 4. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Test Receiver Keysight	ESW 44	1328.4100K- 101662-MH	08/30/2020	08/30/2021
Passive Loop Antenna (9k-30MHz)	6512	49120	11/25/2019	11/25/2021
Preamplifier RF Bay, Inc.	LNA-150	12170607	06/18/2021	06/18/2022



4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasipeak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported.

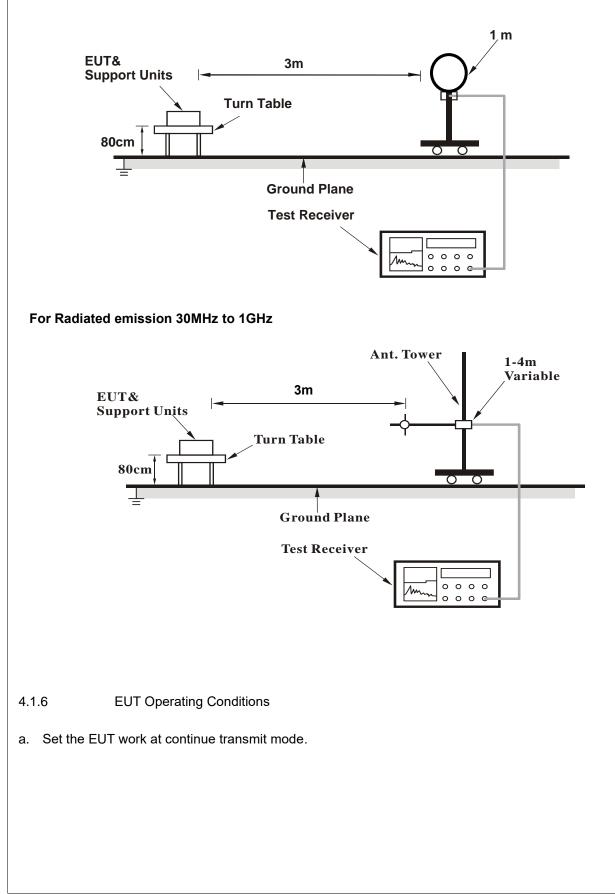
4.1.4 Deviation from Test Standard

No deviation.



4.1.5 Test Setup

For Radiated emission below 30MHz





4.1.7 Test Results

Radiated Emissions (9 kHz~30 MHz)

EUT Test Condition		Measurement Detail		
Frequency	175KHz	Frequency Range	9 kHz~30 MHz	
Input Power	Battery	Detector Function	Quasi-Peak (Average)	

	Antenna Polarity & Test Distance: Loop Antenna 0 degree At 3m									
No.	Frequency (MHz)	Polarization (0/90)	Reading QP(AV) [dB(uV)]	Factor [dB(1/m)]	Level QP(AV) [dB(uV/m)]	Limit QP (AV) dB(uV/m)	Margin QP(AV) [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	0.127	0	13.8	29.3	43.1	105.5	-62.4	100	0.1	Pass
2	0.136	0	13.4	28.8	42.2	105	-62.8	100	0	Pass
3	0.175	0	54.8	27.1	81.9	102.7	-20.8	100	321	Pass
4	0.528	0	11.1	18	29.1	73.1	-44	100	357	Pass
5	3.807	0	10.8	3.5	14.3	69.5	-55.2	100	261	Pass
6	8.772	0	10.7	2.4	13.1	69.5	-56.4	100	351	Pass

REMARKS:

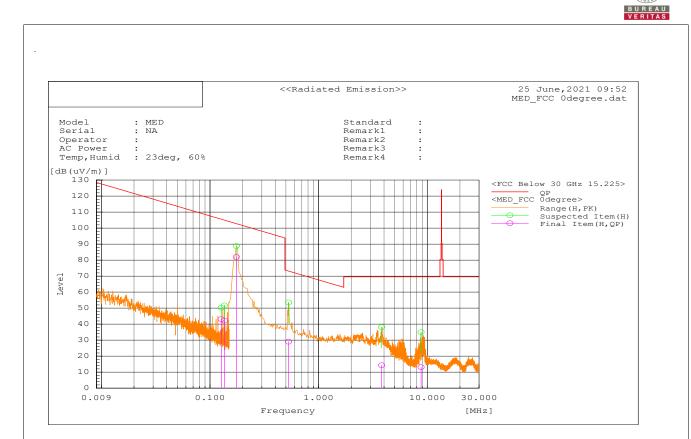
1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).

2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)

3. Margin value = Emission level – Limit value.

4. Here the frequency bands 9-90 kHz and 110-490 kHz are use average detector.

5. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency 11 KHz resulted in a level of 62.6 dBuV/m, which is equivalent to 62.6 -51.5 = 11.1 dBuA/m, which has the same margin, 64.2 dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.





EUT Test Condition		Measurement Detail		
Frequency	175KHz	Frequency Range	9 kHz~30 MHz	
Input Power	Battery	Detector Function	Quasi-Peak (Average)	

	Antenna Polarity & Test Distance: Loop Antenna 0 degree At 3m									
No.	Frequency (MHz)	Polarization (0/90)	Reading QP(AV) [dB(uV)]	Factor [dB(1/m)]	Level QP(AV) [dB(uV/m)]	Limit QP (AV) dB(uV/m)	Margin QP(AV) [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	0.011	90	11.2	51.4	62.6	126.8	-64.2	100	4.2	Pass
2	0.021	90	12.5	46.7	59.2	121.2	-62	100	0	Pass
3	0.528	90	11.1	18	29.1	73.1	-44	100	189	Pass
4	3.667	90	9.4	3.7	13.1	69.5	-56.4	100	189	Pass
5	8.413	90	8.1	2.5	10.6	69.5	-58.9	100	3.2	Pass
6	0.175	90	13.3	27.1	40.4	102.7	-62.3	100	0	Pass

REMARKS:

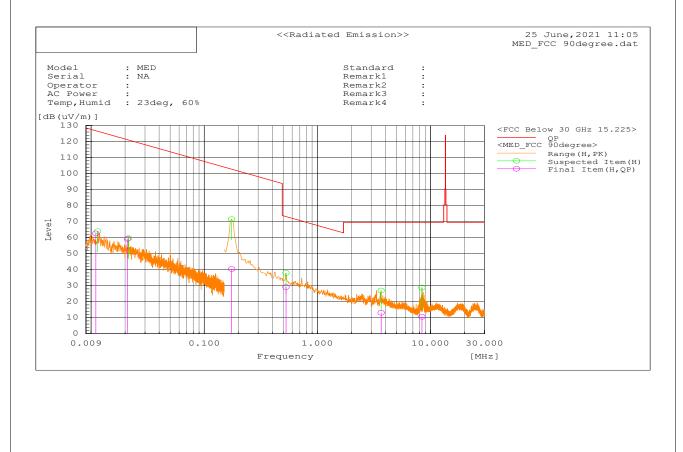
1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).

2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)

3. Margin value = Emission level – Limit value.

4. Here the frequency bands 9-90 kHz and 110-490 kHz are use average detector.

5. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency 11 KHz resulted in a level of 62.6 dBuV/m, which is equivalent to 62.6 -51.5 = 11.1 dBuA/m, which has the same margin, 64.2 dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.





4.2 Occupied Bandwidth

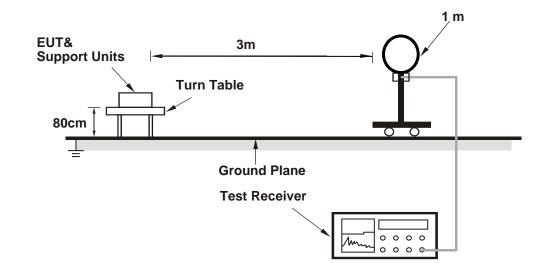
4.2.1 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer Keysight	N9010A	MY51440112	10/23/2020	10/23/2021
Passive Loop Antenna (9k-30MHz)	6512	49120	11/25/2019	11/25/2021

4.2.2 Test Procedures

- a. Set resolution bandwidth (RBW) = 9 kHz
- b. Set the video bandwidth $(VBW) \ge 3 \times RBW$, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the 20dB bandwidth (IC: 99% emission bandwidth)

4.2.3 Test Setup



4.2.4 EUT Operating Conditions

a. Set the EUT work at continue transmit mode.



4.2.5 Test Results

Frequency (KHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)	
175	47.46	58.185	

Test Plots:

Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 10 dB Corrections: Off Freq Ref: Int (S)	Gate: Off	Center Freq: 175.000 kHz Avg Hold:>10/10 Radio Std: None	Trace Type Clear / Write	Trace Control
raph v				Trace Average	
ale/Div 10.0 dB g	Ref Value 10.0	00 dBm		Max Hold	
0				Min Hold	
0				Restart Max Hold	
.0					
.0 nter 175 kHz es BW 9.1000 kHz	#Video BW 30.	000 kHz	Span 100 kHz Sweep Time 1.20 ms (1001 pts		
letrics V					
Occupied Bandwidth 58.185	5 kHz	Total Power	-3.37 dBm		
Transmit Freg Error	3.319 kHz	% of OBW Power			
Tranonii trog Enor	47.46 kHz	x dB	-20.00 dB		

Note: This measurement was taken using the Radiated method. No attenuators and filters were used for the measurement.



4.3 Conducted Emission Measurement

4.3.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)				
Frequency (MI12)	Quasi-peak	Average			
0.15 - 0.5	66 - 56	56 - 46			
0.50 - 5.0	56	46			
5.0 - 30.0	60	50			

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.3.2 Test Instruments

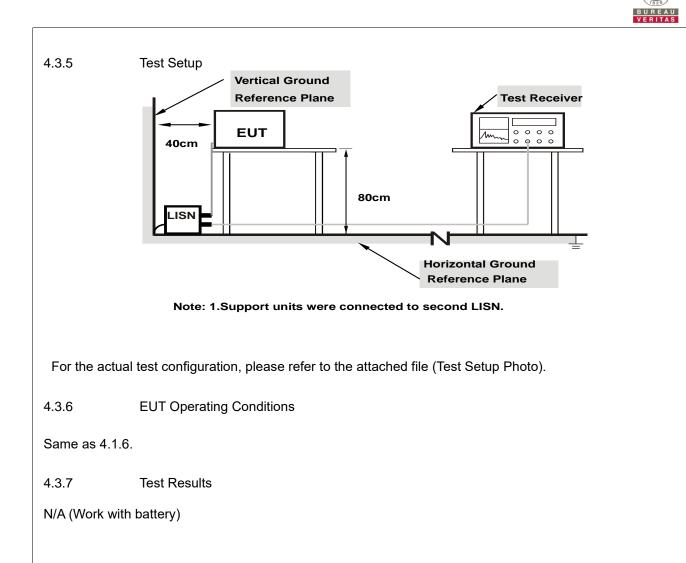
Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	01/29/2021	01/29/2022
Transient Limiter ELECTRO-METRICS	EM-7600-5	106	01/29/2021	01/29/2022
LISN EMCO	3816/2NM	214372	01/29/2021	01/29/2022

4.3.3 Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit 20dB) was not recorded.
- **NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.3.4 Deviation from Test Standard

No deviation.





5 Pictures of Test Arrangements

Please see setup photo file.



Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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