

NCC RF Test Report (175K)

Report No.: NCC_RF_SL19072403-MED-078_175K Rev_1.0

Model No.: TM90

Test Date: 05/14/2018 to 05/18/2018

Issued Date: 10/19/2020

Applicant: 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

ISED Test Site Number: 4842D



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Release Control Record

Issue No.	Description	Date Issued
NCC_RF_SL19072403-MED-078_175K	Original Release	07/17/2020
NCC_RF_SL19072403-MED-078_175K Rev_1.0	Standard version update	10/19/2020

1 Certificate of Conformity

Product: Communicator

Brand: Medtronic

Model No.: TM90

Applicant: Medtronic Inc.

Test Date: 10/22/2018

Standards: LP0002: 2020
ANSI C63.10: 2013

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.

Prepared by : Deon, **Date:** 10/19/2020
Deon Dai / Test Engineer

Approved by : Shuo, **Date:** 10/19/2020
Shuo Zhang / Engineer Review

2 Summary of Test Results

LP0002: 2020			
NCC Clause	Test Item	Result	Remarks
3.2	Antenna Requirement	PASS	Antenna type is integral (The antenna is Permanently attached)
3.6	Radiated emissions and field strength	PASS	Meet the requirement

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
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Communicator
Brand	Medtronic
Test Model	TM90
Power Supply Rating	3.7 Vdc from Battery, and 5.0Vdc USB charge
Modulation	OOK burst
Operating Frequency	175kHz
Number of Channel	1
Antenna Type	Integral loop antenna/External antenna
Antenna Gain	0 dBi
Antenna Connector	NA
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.
2. When EUT be operated at $\pm 10\%$ from the normal supply voltage, the supply voltage of RF part was varied within $\pm 1\%$. All test cases were done under the normal supply voltage.

3.2 Description of Test Modes

1 channel is provided to this EUT:

Channel	Frequency (kHz)
0	175

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	X	√	X	X	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 APCM: Antenna Port Conducted 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 (Below 1GHz):

- ☒ 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
0	0	OOK burst

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Cipher Chu

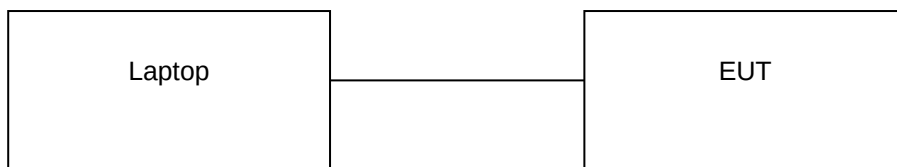
3.3 Description of Support Units

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.	Remarks
A	Laptop	Dell	LATITUDE E6220	N/A	-

Note: The core(s) is (are) originally attached to the cable(s).

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:

LP0002 : 2020
ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission

Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges

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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer	N9030B	MY51440112	08/20/2018	08/20/2019
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2018	08/12/2019
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2018	08/25/2019
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2018	08/28/2019
Pre-Amp (30MHz~40GHz)	LPA-6-30	11140711	02/10/2018	02/10/2019

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 9kHz 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:

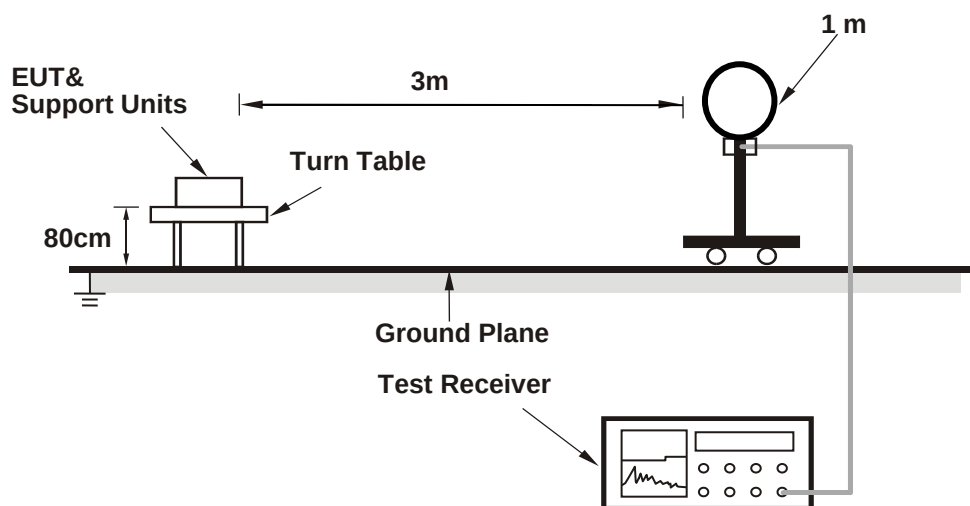
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) 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

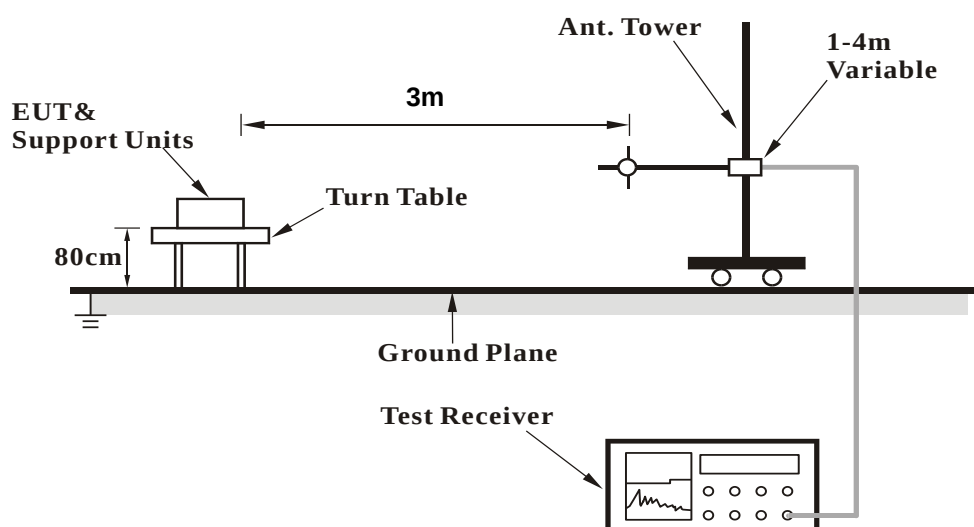
No deviation.

4.1.5 Test Setup

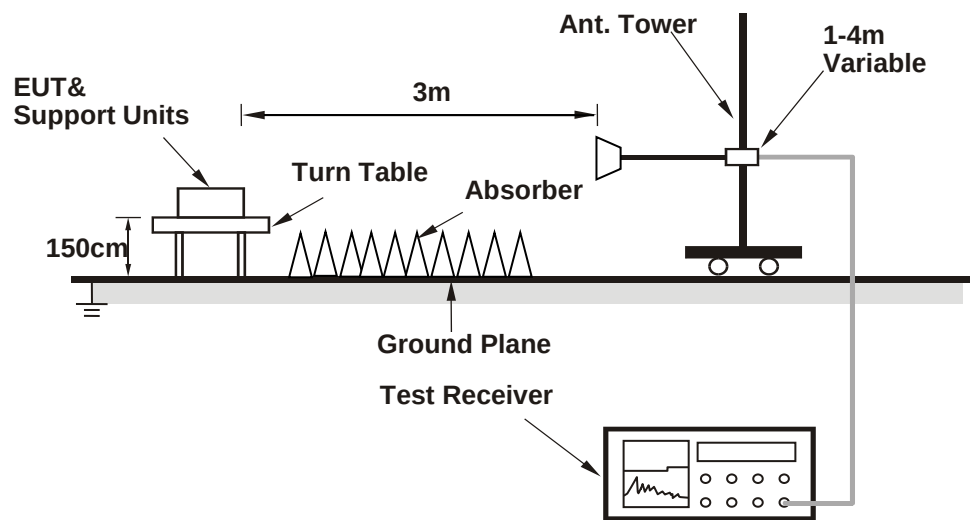
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

- Connected the EUT with the Notebook Computer which is placed on remote site.
- Controlling software has been activated to set the EUT on specific status.

4.1.7 Test Results

BELOW 30MHz WORST-CASE DATA:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	Below 30MHz, 0 degree		

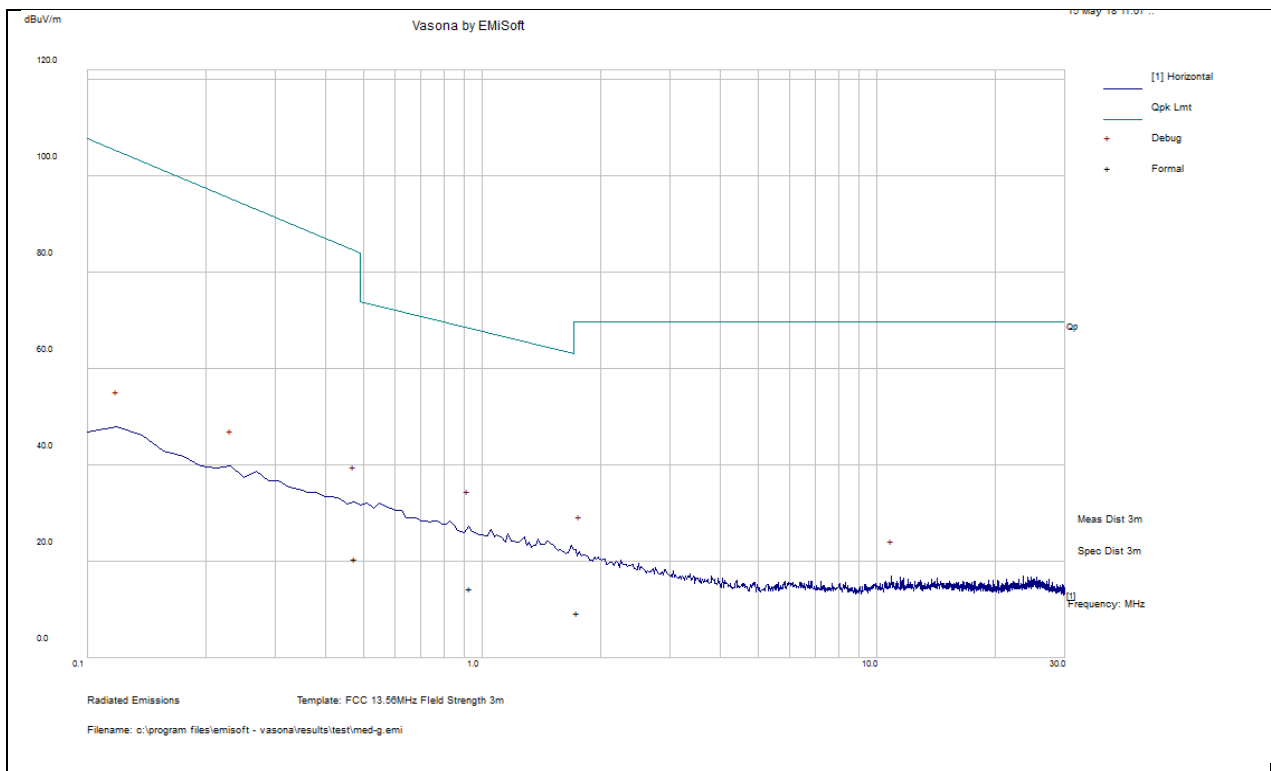
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1.74	0.86	0.48	13.08	14.41	Quasi Max	0	100	15	68.22	-53.81	Pass
0.58	0.65	0.4	8.36	9.41	Quasi Max	0	100	299	69.54	-60.13	Pass
0.48	1.61	0.4	18.62	20.63	Quasi Max	0	100	228	84.2	-63.57	Pass

Fundamental field strength

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
0.175	34.67	0.48	10.12	45.27	Quasi Max	0	100	168	102.74	-57.47	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss(dB) + AF (dB)
2. AF (dB) = Antenna Factor (dB) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

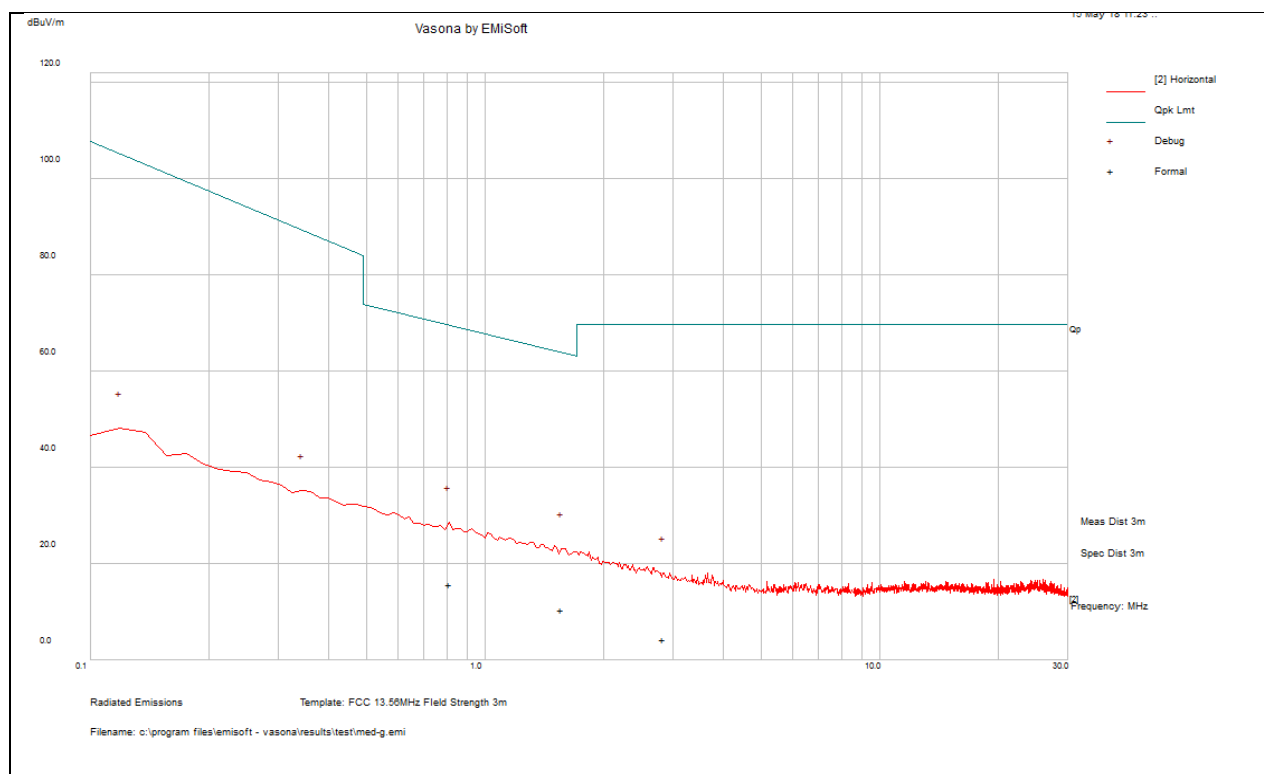


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	Below 30MHz, 90 degree		

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1.58	0.8	0.48	9.11	10.39	Quasi Max	H	99	160	63.71	-53.32	Pass
0.81	0.94	0.4	14.27	15.61	Quasi Max	H	99	225	69.39	-53.78	Pass
2.82	-1.06	0.51	4.85	4.2	Quasi Max	H	99	333	69.54	-65.35	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss(dB) + AF (dB)
2. AF (dB) = Antenna Factor (dB) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

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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