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DATE: 18 April 2019

I.T.L. (PRODUCT TESTING) LTD.

FCC/IC Radio Test Report

for

Pointer Telocation

Equipment under test:

Asset Tracking Device

Cello Track Power XT LTE C1 NA \ GC9773013
Cellotrack XT LTE C1 NA \ GC9773014*

*See customer declaration on page 6

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

ISRAEL TESTING LABORATORIES
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Measurement/Technical Report for

Pointer Telocation

Asset Tracking Device

Cello Track Power XT LTE C1 NA \ GC9773013

FCC ID: 2AG69CTPW
IC: 9975A-CTPW

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	FCC: (DTS) Digital Transmission System IC: Spread Spectrum Digital Device (2400-2483.5)
Limits used:	47CFR15 Section 15.247 RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, April 2018

Measurement procedure used is KDB 558074 D01 v03r05 and ANSI C63.10:2013 and RSS Gen, Issue 5

Application for Certification
prepared by:
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ITL (Product Testing) Ltd.
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Israel
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Applicant for this device:
(different from "prepared by")
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Rosh Haain
Israel
Tel: +972 73 2622320
E-mail: Igorr@pointer.com

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1. General Information

1.1 *Administrative Information*

Manufacturer:	Pointer Telocation
Manufacturer's Address:	14 Hamelacha, PO Box 11473 Roash Haain, Israel Tel: +972 73 2622320
Manufacturer's Representative:	Igor Rogov
Equipment Under Test (E.U.T):	Asset Tracking Device
Equipment PMN:	Cello Track Power XT LTE C1 NA: **GC9773013** Cellotrack XT LTE C1 NA: **GC9773014*** (see customer declaration on following page)
Equipment Serial No.:	2310283
Equipment HVIN:	3013; 3014
Date of Receipt of E.U.T:	February 03, 2019
Start of Test:	February 03, 2019
End of Test:	February 04, 2019
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, April 2018

POINTER

Date: 26/03/2019

DECLARATION

I HEREBY DECLARE ARE AS FOLLOW:

Cellotrack Power XT LTE C1 NA \ GC9773013

IS A FULL CONFIGURATION MODEL.

OTHER MODEL WHICH INCLUDE

Cellotrack XT LTE C1 NA \ GC9773014

DIFFER FROM THE Cellotrack Power XT LTE C1 NA \ GC9773013 **ONLY BY:**

1. DC\DC circuit and peripherals components.
2. Battery charger and peripherals components.
3. Main power harness and PCB connector.
4. Cellular Antenna flange.

While in Cellotrack Power XT LTE C1 NA \ GC9773013 all component assembled in Cellotrack XT LTE C1 NA \ GC9773014 they omitted. For Both products PCB is exactly the same all other components are the same (GPS, Cellular modem, BLE ,CPU and Protection circuit etc)

Please relate to them all (from an EMC/radio point of view) as the same product.

Thank you,
Igor Rogov
VP R&D Pointer Telocation

IGOR ROGOV
01-04-2019
VP R&D

1.2 *List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Innovation, Science and Economic Development Canada (ISED) CAB identifier: IL1002.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 *Product Description*

The CelloTrack product line is designed for advanced asset tracking and remote monitoring, featuring enhanced functionality with full fleet management capabilities, robustness and ease of installation, suitable for a wide variety of asset management applications.
The CelloTrack product line is available in two variants – a standalone version and a power version, which includes extended battery life and the ability to connect external sensors via two configurable GPIOs. Models are suitable for 2G, 3G and 4G (LTE) cellular communication technologies.

Working voltage(nominal)	3.7VDC Rechargeable battery operated (Lithium)
Mode of operation	Transceiver
Modulations	GFSK
Assigned Frequency Range	2400.0-2483.5MHz
Operating Frequency Range	2402.0-2480.0MHz
Transmit power(conducted)	~4.0dBm
Antenna Gain	+1.88dBi (chip antenna)
Modulation BW	2MHz
Bit rate (Mbit/s)	1,2,3

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r05 and ANSI C63.10: 2013, RSS Gen, Issue 5.
Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 *Test Facility*

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 *Measurement Uncertainty*

Conducted Emission
Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.44 dB

Radiated Emission
Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:

30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

2. System Test Configuration

2.1 *Justification*

1. The E.U.T contains an IEEE 802.15.1 standard (BLE) transceiver.
2. The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz).
3. Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through a 30dB external attenuator.
4. The E.U.T has 2 working voltage type options: rechargeable battery and non- rechargeable battery. Evaluation tests were performed with the E.U.T using rechargeable battery type as the "worst case".
5. For intermodulation testing, the E.U.T. was transmitting simultaneously at maximum power at the following frequencies:
   For BLE: 2402.0 MHz
   For 3G cellular: 1910.0 MHz
6. Final radiated emission tests were performed after exploratory emission screening was performed in 3 orthogonal polarities to determine the "worst case" radiation. See screening results below which indicate the "worst case" was the X axis.

Orientation	Frequency	2nd Harmonic	3rd Harmonic	Band Edge
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2402.0	44.8	**46.9**	54.3
	2440.0	44.5	**47.1**	-
	2480.0	44.7	**47.3**	63.2
Y axis	2402.0	44.6	46.5	54.4
	2440.0	44.5	47.0	-
	2480.0	44.5	47.3	63.0
Z axis	2402.0	44.8	46.7	54.0
	2440.0	44.2	46.9	-
	2480.0	44.7	47.1	63.2

Figure 1. Screening Results BLE mode

2.2 *EUT Exercise Software*

No special exercise software was used.

2.3 *Special Accessories*

No special accessories was used

2.4 *Equipment Modifications*

No modifications were necessary in order to achieve compliance.

2.5 *Configuration of Tested System*

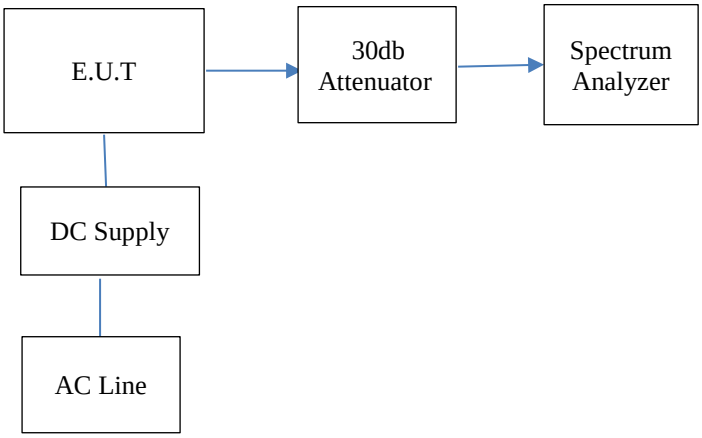

Figure 2. Configuration of Tested System Conducted

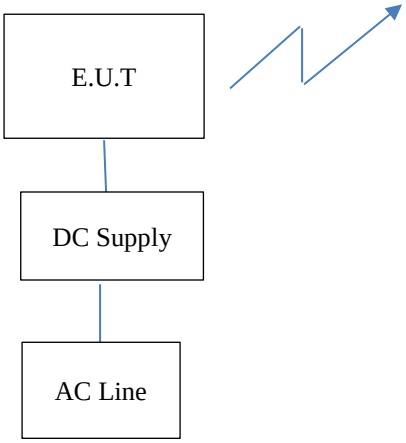

Figure 3. Configuration of Tested System Radiated

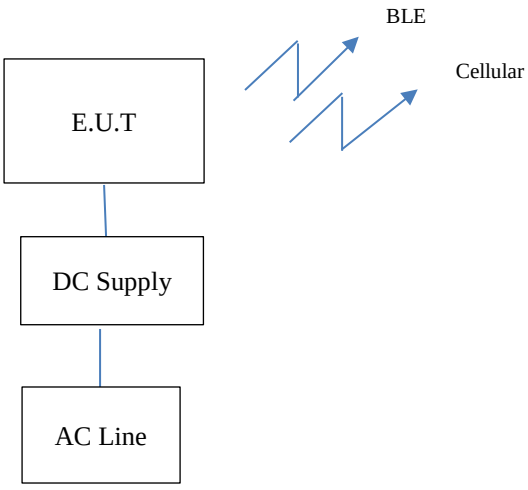

Figure 4. Configuration of Tested System Radiated - Intermodulation

3. Conducted & Radiated Measurement Test Set-Up Photos

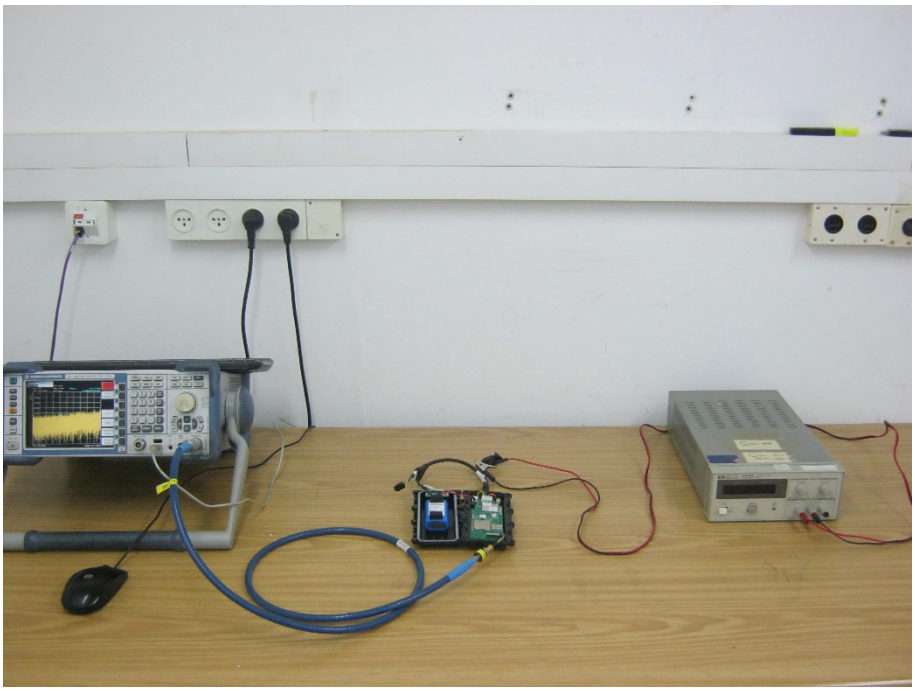

Figure 5. Conducted Emission Test

Figure 6. Radiated Emission Test, 0.009-30MHz

Figure 7. Radiated Emission Test, 30-200MHz

Figure 8. Radiated Emission Test, 200-1000MHz

Figure 9. Radiated Emission Test, 1-18GHz and Intermodulated Radiated Emission Test

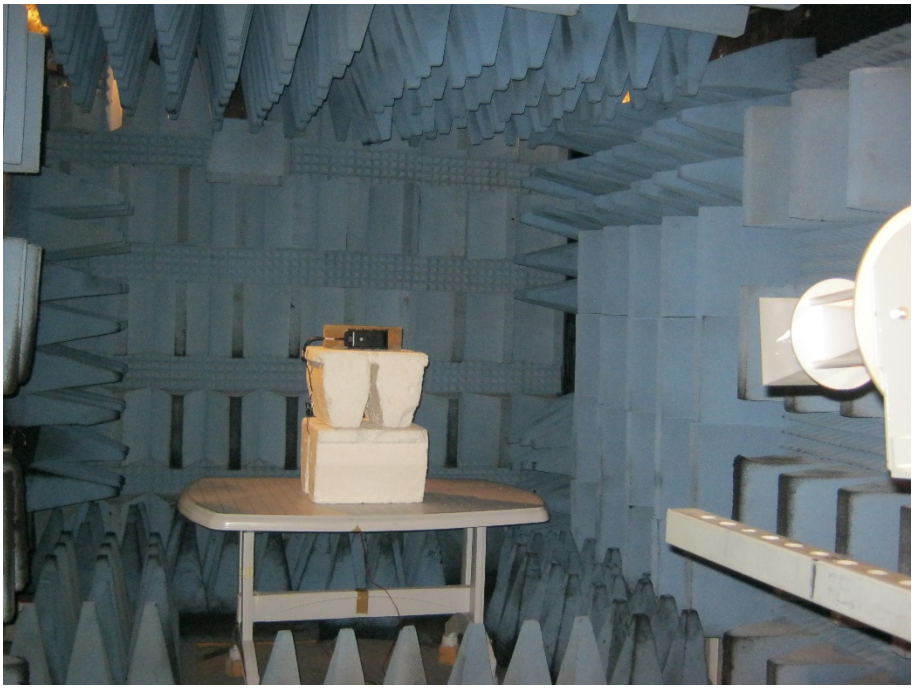

Figure 10. Radiated Emission Test, 18-26.5GHz

4. 6 dB Minimum Bandwidth

4.1 *Test Specification*

FCC Part 15, Subpart C, Section 247(a)(2)

RSS 247, Issue 2, Section 5.2(a)

4.2 *Test Procedure*

(Temperature (25°C)/ Humidity (48%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss=30.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.
The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

4.3 *Test Limit*

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.4 *Test Results*

Protocol Type	Operation Frequency (MHz)	Reading (kHz)	Limit (kHz)
BLE	2402.0	689.0	>500.0
	2440.0	689.0	>500.0
	2480.0	68.0	>500.0

Figure 11 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 12* to *Figure 14.*

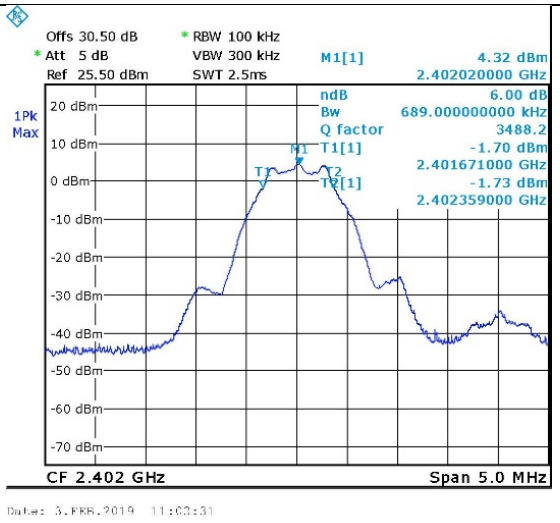

Figure 12. 2402.0 MHz, BLE

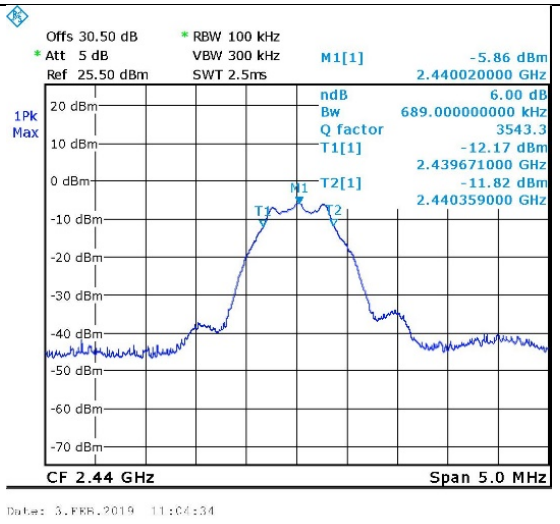

Figure 13. 2440.0 MHz, BLE

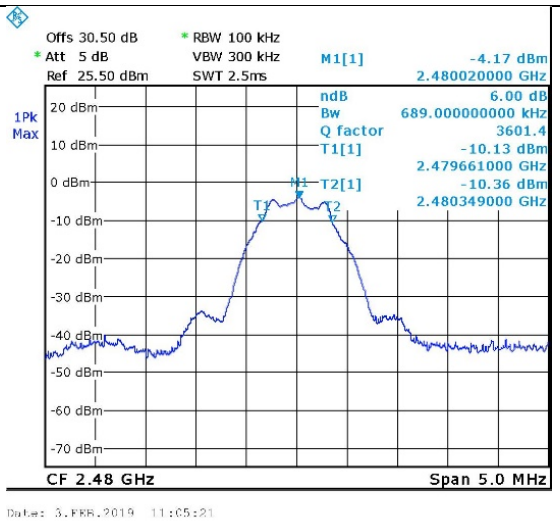

Figure 14. 2480.0 MHz, BLE

4.5 *Test Equipment Used; 6dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 15 Test Equipment Used

5. Maximum Conducted Output Power

5.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(b)(3)

RSS 247, Issue 2, Section 5.4(d)

5.2 *Test Procedure*

(Temperature (25°C)/ Humidity (48%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss=30.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

5.3 *Test Limit*

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.4 *Test Results*

Protocol Type	Operation Frequency	Power	Power	Limit	Margin
	(MHz)	(dBm)	(mW)	(mW)	(mW)
BLE	2402.0	4.9	3.09	1000.0	-996.91
	2440.0	4.7	2.95	1000.0	-997.05
	2480.0	4.4	2.75	1000.0	-997.25

Figure 16 Maximum Peak Power Output

JUDGEMENT: Passed by 996.91 mW

For additional information see *Figure 17* to *Figure 19.*

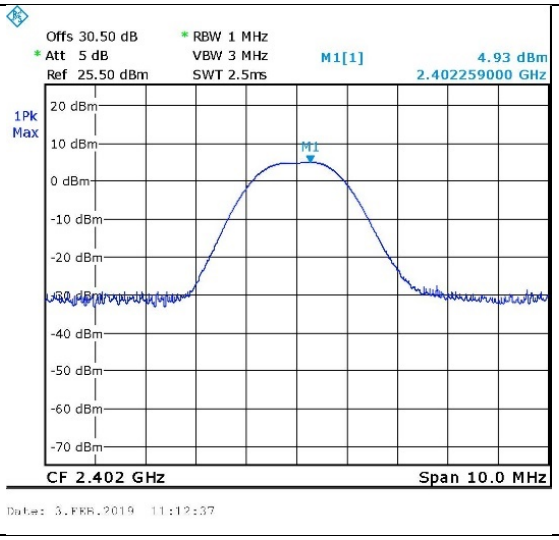

Figure 17. 2402.0 MHz, BLE

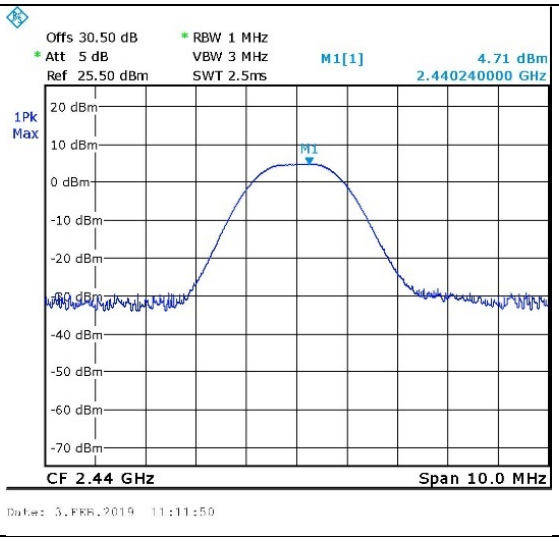

Figure 18. 2440.0 MHz, BLE

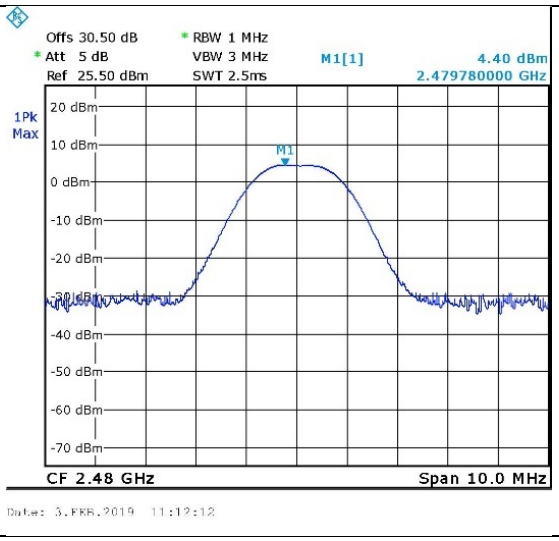

Figure 19. 2480.0 MHz, BLE

5.5 *Test Equipment Used; Maximum Peak Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 20 Test Equipment Used

6. Band Edge Spectrum

6.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)

RSS 247, Issue 2, Section 5.5

6.2 *Test Procedure*

(Temperature (25°C)/ Humidity (48%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=30.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW was set to 100 kHz.

6.3 *Test Limit*

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.

6.4 *Test Results*

Protocol Type	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Limit (dBm)	Margin (dB)
BLE	2402.0	2400.0	-44.5	-15.5	-29.0
	2480.0	2483.5	-44.7	-16.0	-28.7

Figure 21 Band Edge Spectrum

JUDGEMENT: Passed by 28.7 dB

For additional information see *Figure 22* and *Figure 23.*

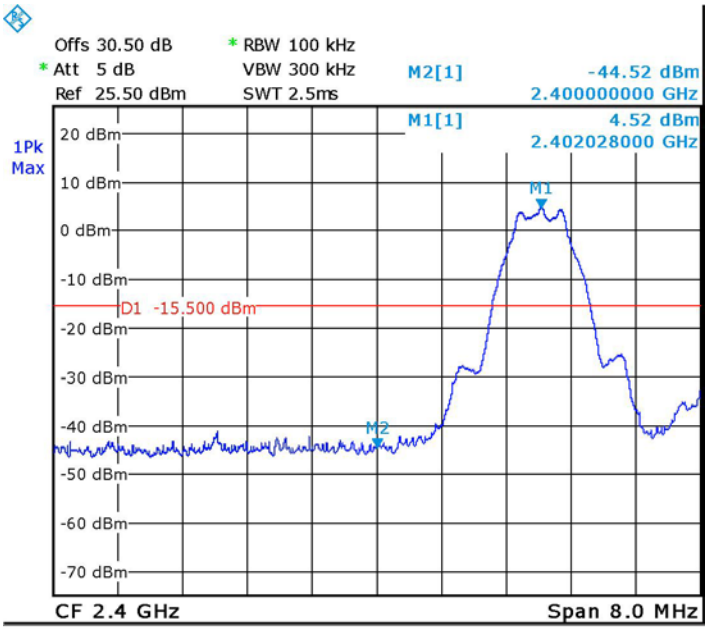

Figure 22 Band Edge Low, BLE

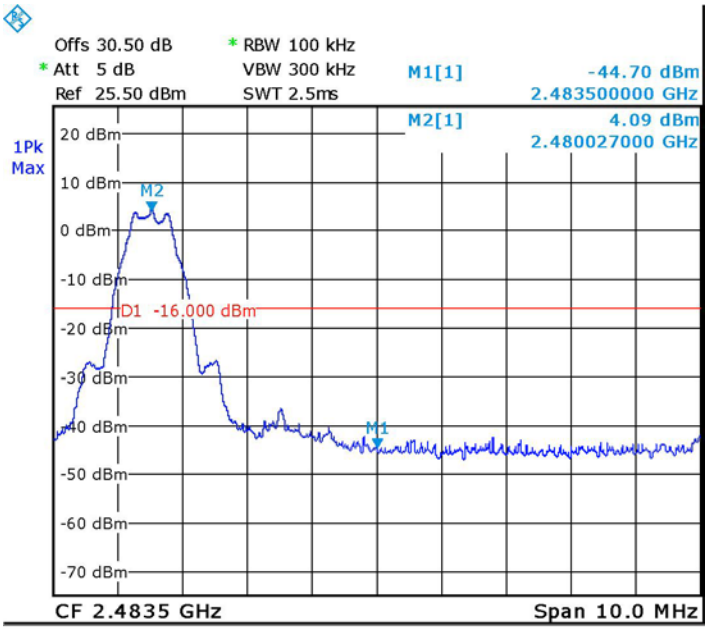

Figure 23 Band Edge High, BLE

6.5 *Test Equipment Used; Band Edge*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 24 Test Equipment Used

7. Transmitted Power Density

7.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(e)

RSS 247, Issue 2, Section 5.2(b)

7.2 *Test Procedure*

(Temperature (25°C)/ Humidity (53%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 30.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum analyzer was set to 3 kHz RBW.

7.3 *Test Limit*

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.4 *Test Results*

Protocol Type	Operation Frequency (MHz)	PSD Reading (dBm)	Limit (dBm)	Margin (dB)
BLE	2402.0	-11.0	8.0	-19.0
	2440.0	-11.5	8.0	-19.5
	2480.0	-11.4	8.0	-19.4

Figure 25 Test Results

JUDGEMENT: Passed by 19.0dB

For additional information see *Figure 26* to *Figure 28.*

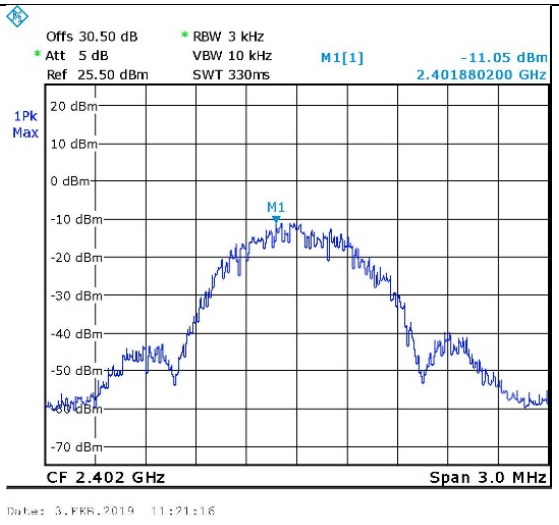

Figure 26. 2402.0 MHz, BLE

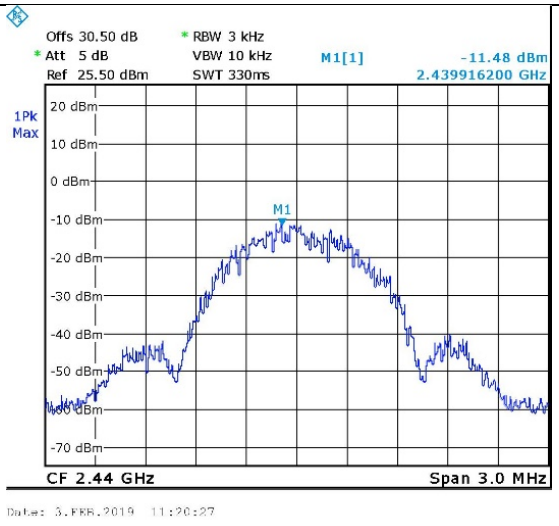

Figure 27. 2440.0 MHz, BLE

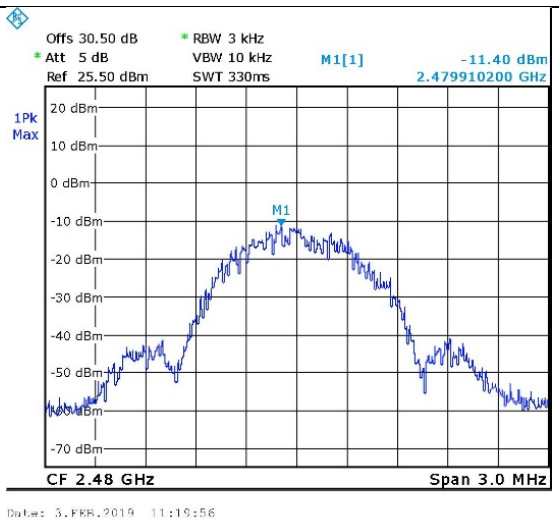

Figure 28. 2480.0 MHz, BLE

7.5 *Test Equipment Used; Transmitted Power Density*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 29 Test Equipment Used

8. Occupied Bandwidth

8.1 *Test Specification*

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2014, Section 6.6

8.2 *Test Procedure*

(Temperature (25°C)/ Humidity (53%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 30.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% to 5% of the OBW. The span was set to ~ 3 times the OBW.
99% occupied bandwidth function was set on.

8.3 *Test Limit*

N/A

8.4 *Test Results*

Protocol Type	Operation Frequency (MHz)	Reading (MHz)
BLE	2402.0	1.02
	2440.0	1.02
	2480.0	1.03

Figure 30. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 31* to *Figure 33.*

Occupied Bandwidth

E.U.T Description	Asset Tracking Device
Model Number	Cello Track Power XT LTE C1 NA \ GC9773013
Part Number:	2310283

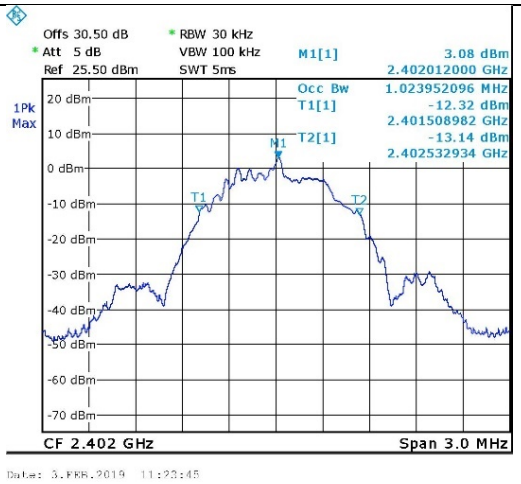

Figure 31. 2402.0 MHz, BLE

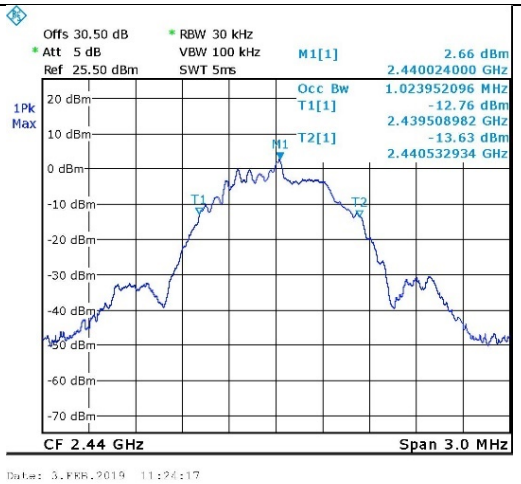

Figure 32. 2440.0 MHz, BLE

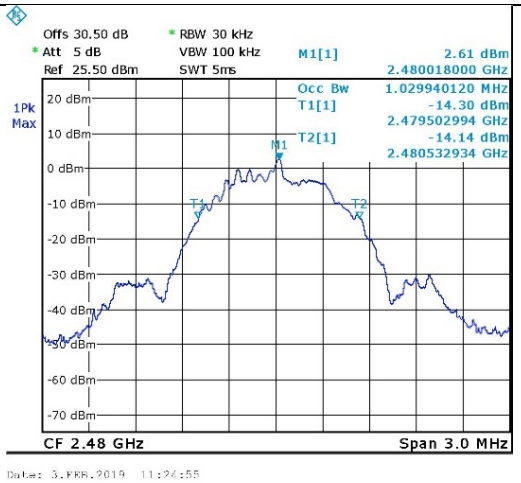

Figure 33. 2480.0 MHz, BLE

8.5 *Test Equipment Used; Occupied Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 34 Test Equipment Used

9. Emissions in Non-Restricted Frequency Bands

9.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)

RSS 247, Issue 2, Section 5.5

9.2 *Test Procedure*

(Temperature (25°C)/ Humidity (53%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (max total loss=34.0 dB).
Special attention was taken to prevent Spectrum Analyzer RF input overload.
RBW was set to 100kHz, detector set to max peak and trace to “max hold”.

9.3 *Test Limit*

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.

9.4 *Test Results*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) specification.

For additional information see *Figure 35* to *Figure 37*.

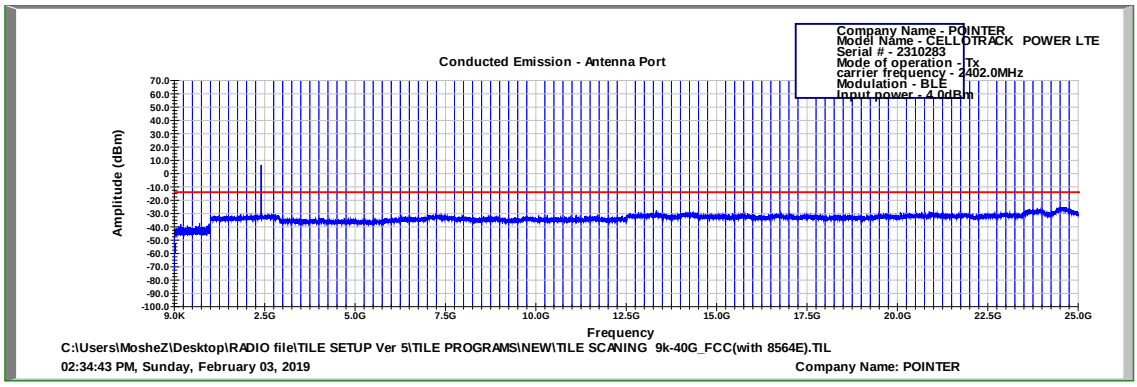

Figure 35 2402.0 MHz, BLE

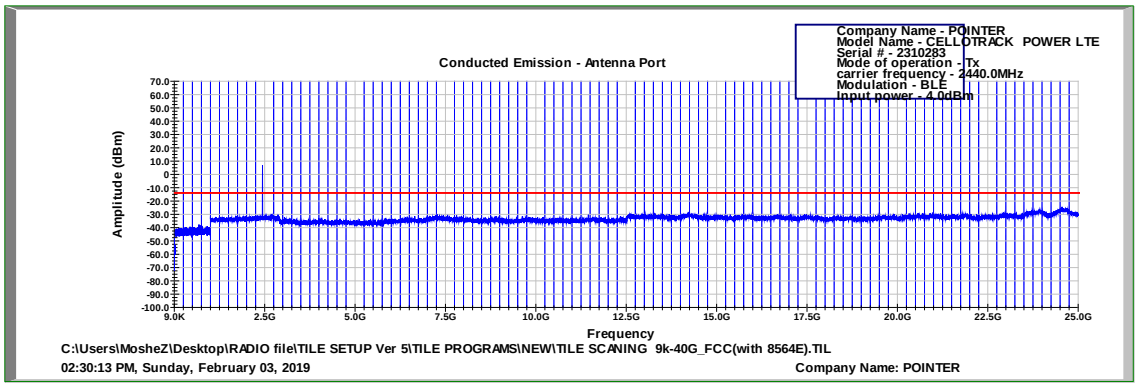

Figure 36 2440.0 MHz, BLE

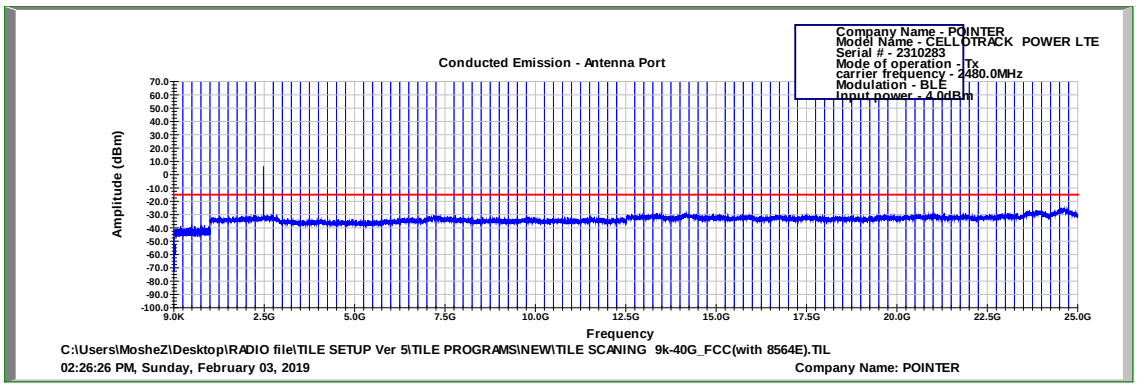

Figure 37 2480.0 MHz, BLE

Note: All peaks in plots are the fundamental transmission frequency.

9.5 *Test Instrumentation Used, Emission in Non Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2018	February 28, 2019
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 38 Test Equipment Used

10. Emissions in Restricted Frequency Bands

10.1 *Test Specification*

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

RSS 247, Issue 2, Section 3.3

RSS Gen, Issue 5, Section 8.10

10.2 *Test Procedure*

(Temperature (23°C)/ Humidity (55%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009-30MHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The frequency range 0.009MHz-30MHz was scanned.

For measurements between 30-1000MHz:
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

For measurements between 1GHz-25GHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The frequency range 1GHz -25GHz was scanned.

The highest radiation is described in the tables below.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

10.3 *FCC Test Limit*

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)	Field Strength* (dBµV/m)	Field Strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak 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. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 39 Table of Limits

10.4 *IC Test Limit*

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Magnetic Field strength (microampere/meter)	Measurement distance (meters)	Magnetic Field strength (dBµA/m)	Magnetic Field strength * (dBµA/m)@3m
0.009-0.490	6.37/F(kHz)	300	-3.0-(-37.7)	77.0-42.2
0.490-1.705	63.7/F(kHz)	30	-17.7-(-28.5)	22.3-11.4
1.705-30.0	0.08	30	-21.9	18.0
Frequency (MHz)	**Field strength (microvolts/meter)**	**Measurement distance (meters)**	**Field strength (dBµV/m)**	**Field strength * (dBµV/m)@3m**
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak 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. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

10.5 *Test Results*

JUDGEMENT: Passed by 0.2 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 11.4dB at the frequency of 2390.0 MHz, horizontal polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 0.2dB at the frequency of 2483.5 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 40.*

Radiated Emission

E.U.T Description	Asset Tracking Device
Type	Cello Track Power XT LTE C1 NA \ GC9773013
Serial Number:	2310283

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS 247, Issue 2, Section 3.3; RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical
Frequency Range: 9kHz to 25.0 GHz
Protocol Type: BLE
Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
2402.0	2390.0	V	52.9	74.0	-21.1	41.9	54.0	-12.1
	2390.0	H	53.9	74.0	-20.1	42.6	54.0	-11.4
	4804.0	V	44.4	74.0	-29.6	-	54.0	-
	4804.0	H	45.2	74.0	-28.8	-	54.0	-
2440.0	4880.0	V	44.5	74.0	-29.5	-	54.0	-
	4880.0	H	45.7	74.0	-28.3	-	54.0	-
	7320.0	V	46.7	74.0	-27.3	-	54.0	-
	7320.0	H	46.9	74.0	-27.1	-	54.0	-
2480.0	4960.0	V	44.8	74.0	-29.2	-	54.0	-
	4960.0	H	44.9	74.0	-29.1	-	54.0	-
	2483.5	V	63.6	74.0	-10.4	53.5	54.0	-0.5
	2483.5	H	63.9	74.0	-10.1	53.8	54.0	-0.2

Figure 40. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

10.6 *Test Instrumentation Used; Emissions in Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 19, 2019
EMI Receiver	HP	8542E	3906A00276	February 19, 2018	February 19, 2019
RF Filter Section	HP	85420E	3705A00248	February 19, 2018	February 19, 2019
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 20, 2018	February 20, 2019
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2017	October 19, 2019
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Log Periodic Antenna	EMCO	3146	9505-4081	May 31, 2018	May 31, 2019
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31, 2021
Horn Antenna	ARA	SWH-28	1007	December 31, 2017	December 31, 2020
MicroWave System Amplifier	HP	83006A	3104A00589	December 24, 2018	December 31, 2019
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4-02001800-50-8P	-	December 24, 2018	December 31, 2019
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	December 24, 2018	December 31, 2019
RF Cable Oats	EIM	RG214-11N(X2)		August 13, 2018	August 31, 2019
Filter Band Pass 4-20 GHz	Meuro	MFL040120H50	902252	December 24, 2018	December 31, 2019
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 41 Test Equipment Used

11. Intermodulation Radiated

11.1 *Test Procedure*

(Temperature (24°C)/ Humidity (49%RH))

The test method was based on ANSI/TIA-603-D: 2010, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -5.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:

P_d(dBm) = P_g(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dBd)

P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

A Peak detector was used for this test.

The table below describe only results with the highest radiation.

11.2 *Test Limit*

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10* log (P) dB, yielding –13dBm.

11.3 *Test Results*

JUDGEMENT: Passed

Intermodulation Radiated Results

Freq.	Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	ERP Level	Limit	Margin
(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
926.0	V	47.0	-54.4	0.5	5.0	-49.9	-13.0	-36.9
	H	47.1	-53.0	0.5	5.0	-48.5	-13.0	-35.5
1418.0	V	48.6	-51.4	0.5	4.9	-47.0	-13.0	-34.0
	H	48.1	-51.0	0.5	4.9	-46.6	-13.0	-33.6
2894.0	V	54.7	-49.6	1.0	7.9	-42.7	-13.0	-29.7
	H	55.2	-49.5	1.0	7.9	-42.6	-13.0	-29.6
3386.0	V	53.0	-51.6	1.0	7.9	-44.7	-13.0	-31.7
	H	53.2	-51.5	1.0	7.9	-44.6	-13.0	-31.6
3878.0	V	56.5	-49.0	1.0	7.4	-42.6	-13.0	-29.6
	H	56.3	-49.0	1.0	7.4	-42.6	-13.0	-29.6
4370.0	V	56.2	-49.0	1.0	7.4	-42.6	-13.0	-29.6
	H	56.5	-49.0	1.0	7.4	-42.6	-13.0	-29.6

Figure 42 Intermodulation Radiated Results

11.4 *Test Instrumentation Used; Radiated Measurements Intermodulation*

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	85422E	3906A00276	February 19, 2018	February 28, 2019
RF Filter Section	HP	85420E	3705A00248	February 19, 2018	February 28, 2019
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 28, 2019
Spectrum Analyzer	HP	8593EM	3536A00120ADI	February 20, 2018	February 28, 2019
Antenna Biconical	EMCO	3110B	9912-3337	May 31, 2018	May 31, 2019
Antenna Log Periodic	EMCO	3146	9505-4081	May 31, 2018	May 31, 2019
Horn Antenna 1G-18G	ETS	3115	29845	May 31, 2018	May 31, 2021
Signal Generator	WILTRON	6747B	278007	February 20, 2018	February 20, 2019
Signal Generator	HP	8648C	3623A04126	February 19, 2018	February 28, 2019
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	-	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 43 Test Equipment Used

12. Antenna Gain/Information

The antenna gain is +1.88 dBi, chip

13. R.F Exposure/Safety

The typical placement of the E.U.T. is on wall mounted. The typical distance between the E.U.T. and the user is at least 20cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on 47CFR1 Section 1.1307(b)(1) and RSS 102 Issue 5, Table 4 Requirements

(a) FCC Limit at 2402 MHz is: $1\frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

(b) ISED Limit: 300-6000MHz = $0.02619f^{0.6834}$ W/m^2=
$0.02619 \times 2402^{0.6834} = 0.02619 \times 204.31 = 5.35$ W/m^2 = 0.535 mW/cm^2

(c) The power density produced by the E.U.T. is:

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t = Conducted Transmitted Power 4.9 dBm = 3.09 mW

G_t = Antenna Gain 1.88 dBi = 1.54 numeric

R = Distance From Transmitter 20 cm

(d) The peak power density produced by the E.U.T. is:

$S = 3.09*1.54/4\pi(20)^2 = 9.47 \times 10^{-4}$ mW/cm^2

(e) This is below the FCC/ISED limit.

14. APPENDIX A - CORRECTION FACTORS

14.1 *Correction factors for RF OATS Cable 35m ITL #1911*

Frequency (MHz)	Ref&cable loss (dBm)	Ref loss (dBm)	Cable loss (dB)
1.00	0.7	0.2	0.5
10.00	1.3	0.3	1
20.00	1.7	0.3	1.34
30.00	2.0	0.5	1.5
50.00	2.3	0.5	1.83
100.00	3.0	0.3	2.67
150.00	3.7	0.5	3.17
200.00	4.3	0.5	3.83
250.00	4.5	0.3	4.17
300.00	5.0	0.5	4.5
350.00	5.7	0.5	5.17
400.00	6.0	0.5	5.5
450.00	6.5	0.7	5.83
500.00	6.8	0.5	6.33
550.00	7.2	0.5	6.67
600.00	7.5	0.7	6.83
650.00	7.7	0.5	7.17
700.00	8.3	0.7	7.66
750.00	8.5	0.7	7.83
800.00	8.8	0.7	8.16
850.00	9.0	0.5	8.5
900.00	9.5	0.7	8.83
950.00	9.7	0.8	8.84
1000.00	9.7	0.7	9

14.2 *Correction factor for RF cable for Anechoic Chamber*

ITL #1840

Frequency (GHz)	loss Result (dB)
0.5	-1.0
1.0	-1.4
1.5	-1.7
2.0	-2.0
2.5	-2.3
3.0	-2.6
3.5	-2.8
4.0	-3.1
4.5	-3.3
5.0	-3.6
5.5	-3.7
6.0	-4.0
6.5	-4.4
7.0	-4.7
7.5	-4.8
8.0	-5.0
8.5	-5.1
9.0	-5.6
9.5	-5.8
10.0	-6.0
10.5	-6.2
11.0	-6.2
11.5	-6.0
12.0	-6.0
12.5	-6.1
13.0	-6.3
13.5	-6.5
14.0	-6.7
14.5	-7.0
15.0	-7.3
15.5	-7.5
16.0	-7.6
16.5	-8.0
17.0	-8.0
17.5	-8.1
18.0	-8.2
18.5	-8.2
19.0	-8.3
19.5	-8.6
20.0	-8.5

NOTES:

1. *The cable is manufactured by Commscope*
2. *The cable type is 0623 WBC-400, serial # G020132 and 10m long*

14.3 *Correction factors for Active Loop Antenna*

Model 6502 S/N 9506-2950

ITL # 1075:

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8

14.4 *Correction factors for biconical antenna*

ITL #1356
Model: EMCO 3110B
Serial No.: 9912-3337

Frequency [MHz]	ITL 1356 AF [dB/m]
30	14.77
35	13.46
40	12.57
45	11.62
50	10.87
60	9.19
70	9.52
80	9.55
90	9.27
100	10.20
120	11.18
140	12.02
160	12.62
180	13.44
200	14.82

14.5 *Correction factors for log periodic antenna*

ITL # 1349
Model:EMCO 3146
Serial No.: 9505-4081

Frequency [MHz]	ITL 1349 AF [dB/m]
200	11.31
250	11.85
300	14.47
400	15.12
500	17.69
600	18.45
700	20.52
800	20.77
900	21.97
1000	23.21

14.6 *Correction factors for Double –Ridged Waveguide Horn ANTENNA*

Model: 3115
Serial number:29845
3 meter range; ITL # 1352

FREQUENCY (GHz)	AFE (dB/m)	FREQUENCY (GHz)	AFE (dB/m)
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5

14.7 *Correction factors for Horn Antenna Model: SWH-28*

CALIBRATION DATA

3 m distance

Frequency, MHz	Measured antenna factor, dB/m [1]
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.