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Diehl Metering GmbH

TEST REPORT

SCOPE OF WORK

FCC PART 15B / ICES-003 ISSUE 6 – IZAR OH BT 2

REPORT NUMBER

103477146LEX-001.1

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EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103477146LEX-001.1

Project Number: G103477146

Report Issue Date: 6/5/2018

Model(s) Tested: IZAR OH BT 2

Standards: Title 47 CFR Part 15 Subpart B
ICES-003 Issue 6

Tested by:
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Client:
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Report prepared by



Brian Lackey, Project Engineer

Report reviewed by



Bryan Taylor, Team Leader

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

| Section | Test full name | Result |
|---------|---|--------|
| 6 | Radiated Emissions (ANSI C63.4: 2014) | Pass |
| 7 | Conducted Emissions (ANSI C63.4: 2014) | Pass |



3 Client Information

This product was tested at the request of the following:

| Client Information | |
|------------------------------|--|
| Client Name: | Diehl Metering GmbH |
| Address: | Industriestr. 13 91522 Ansbach Germany |
| Contact: | Heiko Hitz |
| Telephone: | +49 981 1806-613 |
| Email: | Heiko.hitz@diehl.com |
| Manufacturer Information | |
| Manufacturer Name: | Diehl Metering GmbH |
| Manufacturer Address: | Industriestr. 13 91522 Ansbach Germany |



4 Description of Equipment under Test and Variant Models

| Equipment Under Test | |
|---|--------------|
| Product Name | IZAR OH BT 2 |
| Model Number | 3094452 |
| Serial Number | 00802543B240 |
| Receive Date | 5/14/2018 |
| Test Start Date | 5/14/2018 |
| Test End Date | 5/25/2018 |
| Device Received Condition | Good |
| Test Sample Type | Production |
| Rated Voltage | Battery |
| Rated Current | - |
| Rated Frequency | - |
| Number of Phases | 1 |
| Software Used By EUT | NA |
| Description of Equipment Under Test (provided by client) | |
| The IZAR OPTO HEAD BT 2 (IZAR OH BT 2) is an optical reading head that can be connected to static or mobile computers via a Bluetooth interface. Laptops or PCs can be retrofitted with this interface if necessary using a Bluetooth USB adapter. | |
| The optical interface offers the two standards IrDA and ZVEI, which means all Diehl Metering Group meters with an optical interface can be read and configured. The IZAR OH BT 2 is switched between ZVEI and IrDA by Diehl Metering programs either automatically or must be set in the software according to the interface of the meter to be read. | |
| The IZAR OH BT 2 is equipped with a lithium ion battery for approx. 14 hours of continuous operation. Charging a completely flat battery takes about 3.5 hours. | |
| The operating statuses are indicated by four coloured LEDs. An on/off switch is built into the device for easy operation. The IZAR OH BT also has a metal ring to fasten a carrying strap. | |

4.1 Variant Models:

There were no variant models covered by this evaluation.



5 System Setup and Method

5.1 Method:

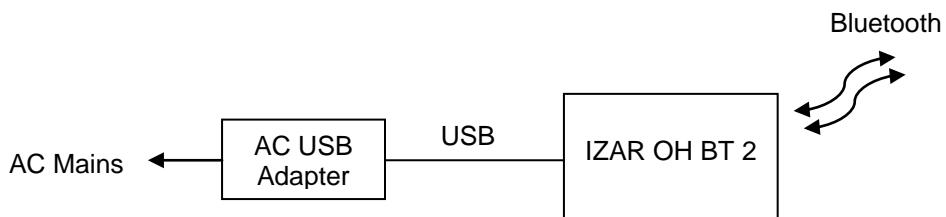
Configuration as required by ANSI C63.4: 2014

| No. | Descriptions of EUT Exercising |
|-----|--------------------------------|
| 1 | Unit powered, radios idle |

| Cables | | | | | |
|--------|---------------|------------|-----------|----------|-------------|
| ID | Description | Length (m) | Shielding | Ferrites | Termination |
| 1 | USB A-micro B | 1 | No | No | USB |

| Support Equipment | | | |
|-------------------|--------------|---------------|---------------|
| Description | Manufacturer | Model Number | Serial Number |
| AC Power Adapter | Phihong | PSM03A-050Q-3 | PH12047385 |

5.2 EUT Block Diagram:





5.3 EUT Photo (Front):



Note: Sample shown has additional SPI connector for testing purposes and is not included in normal configuration



5.4 EUT Photo (Back):



Note: Sample shown has additional SPI connector for testing purposes and is not included in normal configuration



6 Radiated Emissions

6.1 Method

Tests are performed in accordance with ANSI C63.4: 2014

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | Ucispr |
|-------------------------|-----------------|----------------------------|--------|
| Radiated Emissions, 10m | 30-1000 MHz | 3.9dB | 6.3 dB |
| Radiated Emissions, 3m | 30-1000 MHz | 4.0dB | 6.3 dB |
| Radiated Emissions, 3m | 1-6 GHz | 4.7dB | 5.2 dB |
| Radiated Emissions, 3m | 6-15 GHz | 4.7dB | 5.5 dB |
| Radiated Emissions, 3m | 15-18 GHz | 4.7dB | 5.5 dB |
| Radiated Emissions, 3m | 18-40 GHz | 4.7dB | 5.5 dB |

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.



6.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 $\text{dB}\mu\text{V}$ is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V}/\text{m}$$

To convert from $\text{dB}\mu\text{V}$ to μV or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in } \text{dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V}/\text{m} / 20)} = 39.8 \mu\text{V}/\text{m}$$



6.3 Test Equipment Used:

| Description | Asset | Manufacturer | Model | Cal Date | Cal Due |
|------------------------------------|-------|----------------|-------------|-----------------------|-----------------------|
| EMI Test Receiver | 3900 | Rohde&Schwarz | ESU40 | 9/20/2017 | 9/20/2018 |
| Bilog Antenna | 3133 | ETS Lindgren | 3142C | 4/6/2017 | 10/6/2018 |
| Horn Antenna | 3780 | ETS Lindgren | 3117 | 6/1/2017 | 6/1/2018 |
| System Controller | 4096 | ETS Lindgren | 2090 | Verify at Time of Use | Verify at Time of Use |
| System Controller | 3957 | Sunol Sciences | SC99V | Verify at Time of Use | Verify at Time of Use |
| 3m Cable Antenna→Preamp | 3074 | | | 11/29/2017 | 11/29/2018 |
| 3m Cable Preamplifier | 3918 | TS-PR18 | 122005 | 11/29/2017 | 11/29/2018 |
| 3m Cable Preamp→Chamber | 2588 | | | 11/29/2017 | 11/29/2018 |
| 3m Cable Chamber→Control Room | 2593 | | | 11/29/2017 | 11/29/2018 |
| 3m Cable Control Room→Receiver | 2592 | | | 11/29/2017 | 11/29/2018 |
| 10m Cable Antenna→Preamp | 3339 | | | 11/29/2017 | 11/29/2018 |
| 10m Cable Preamplifier | 7019 | ZX60-3018G-S+ | SUU63801252 | 11/29/2017 | 11/29/2018 |
| 10m Cable Preamp→Chamber | 3172 | | | 11/29/2017 | 11/29/2018 |
| 10m Cable Chamber→Control Room | 2590 | | | 11/29/2017 | 11/29/2018 |
| 10m Cable Control Room→Receiver | 2589 | | | 11/29/2017 | 11/29/2018 |

6.4 Software Utilized:

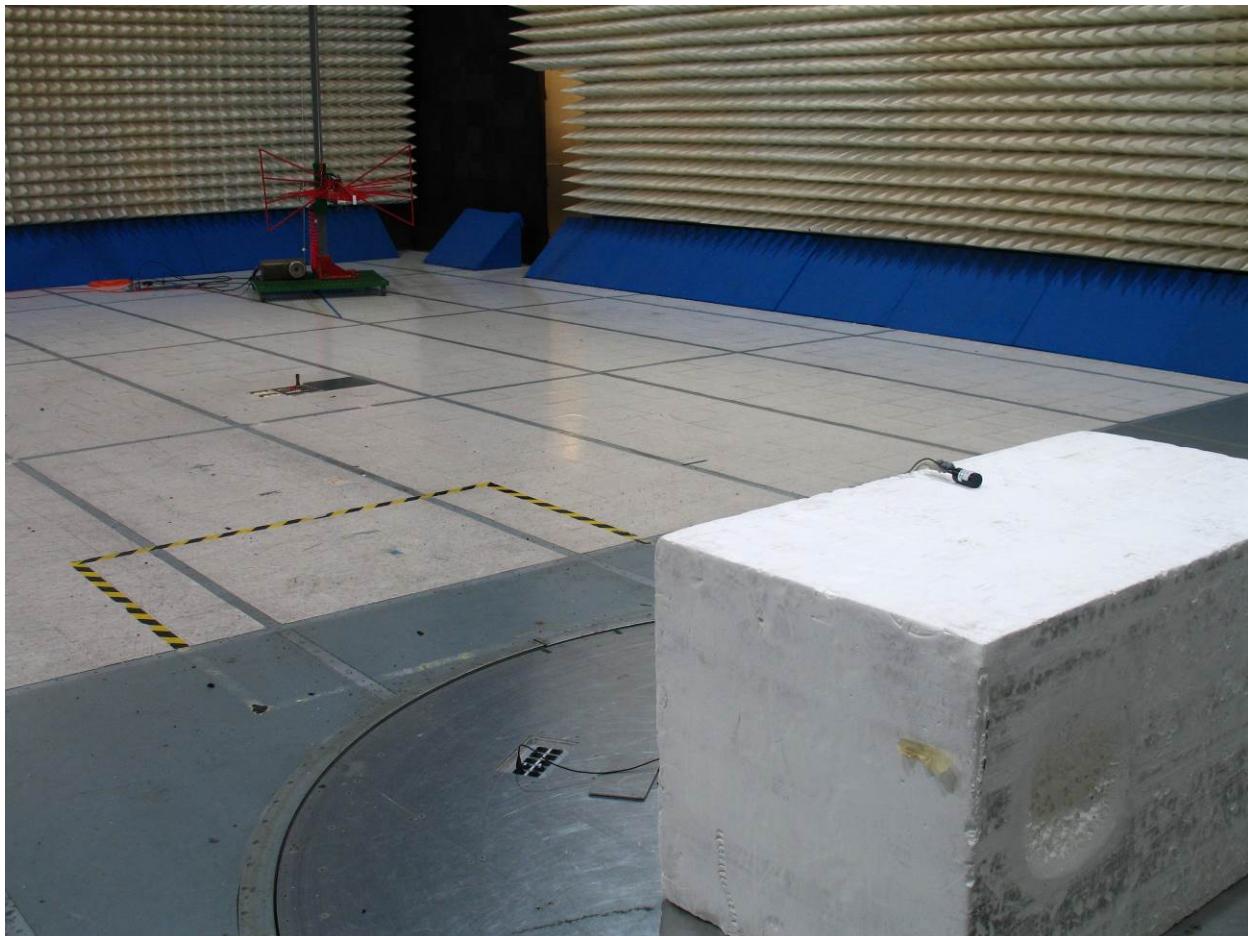
| Name | Manufacturer | Version |
|-------|-----------------|-----------------|
| EMC32 | Rohde & Schwarz | Version 9.15.02 |

6.5 Results:

The sample tested was found to Comply.

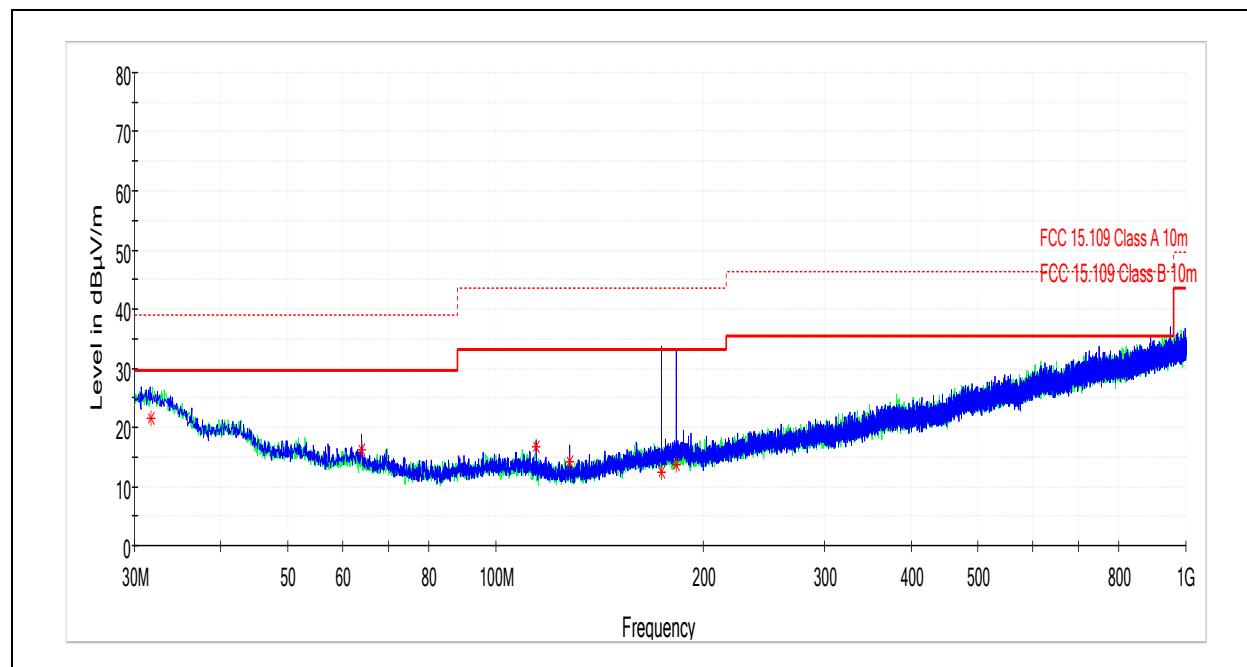


6.6 Setup Photographs: Radiated Emissions, 30MHz – 1GHz





6.7 Plots/Data: Radiated Emissions, 30MHz – 1GHz

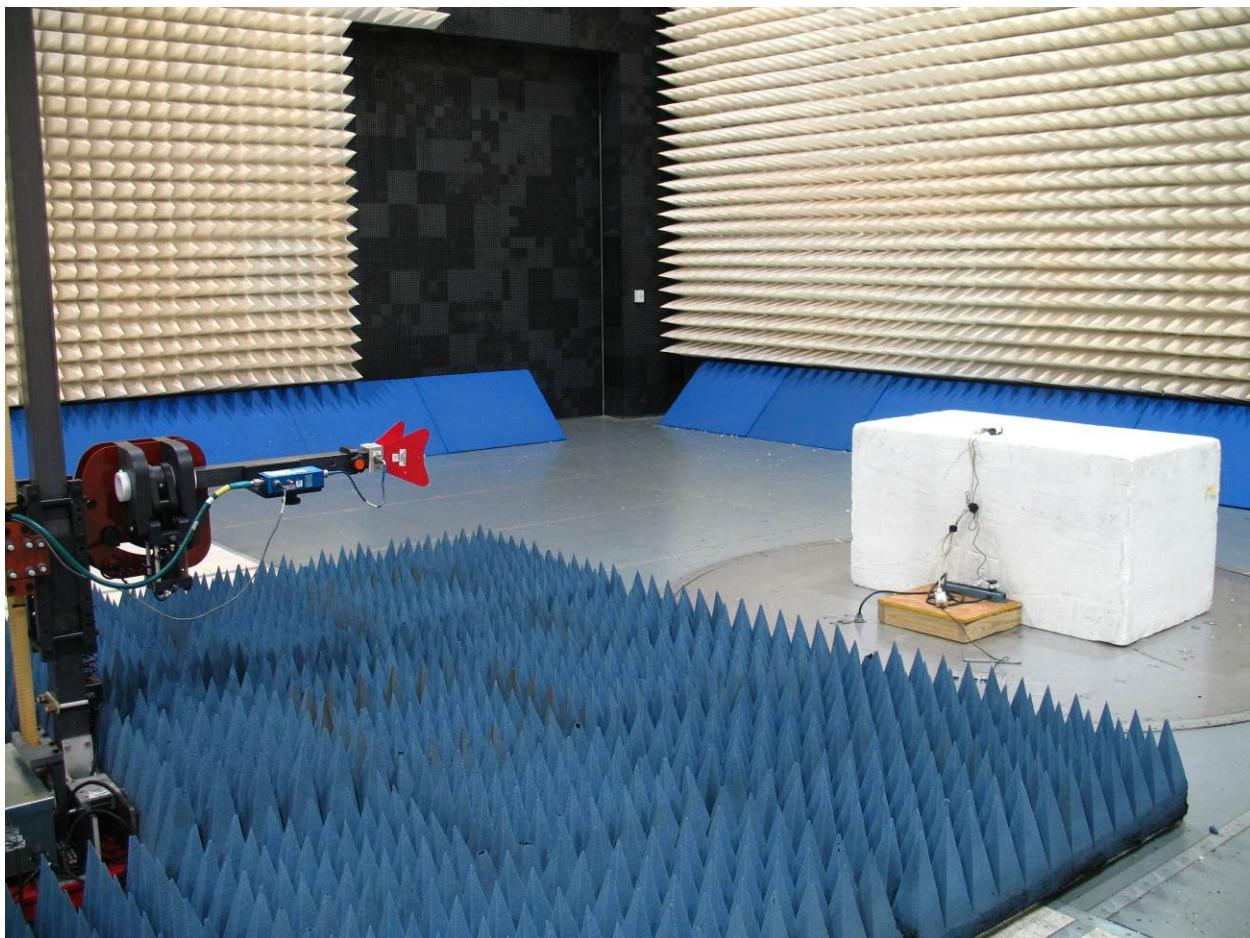


| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-------------|-----|---------------|------------|
| 31.678222 | 21.58 | 29.00 | 7.42 | 120.000 | 400.3 | H | 102.0 | 0.2 |
| 64.024000 | 16.30 | 29.00 | 12.70 | 120.000 | 176.8 | V | 136.0 | -8.5 |
| 114.545778 | 16.67 | 33.50 | 16.83 | 120.000 | 357.7 | V | 147.0 | -8.0 |
| 127.968000 | 14.13 | 33.50 | 19.37 | 120.000 | 100.2 | V | 263.0 | -8.3 |
| 173.696444 | 12.35 | 33.50 | 21.15 | 120.000 | 100.4 | V | 35.0 | -4.9 |
| 182.711889 | 13.78 | 33.50 | 19.72 | 120.000 | 104.5 | V | 145.0 | -4.5 |

| | | | |
|---|---------------------|-----------------------|-----------|
| Test Personnel: | B. Lackey | Test Date: | 5/16/2018 |
| Supervising/Reviewing Engineer: (Where Applicable) | NA | Limit Applied: | Class B |
| Product Standard: | FCC Part 15B | Ambient Temperature: | 25.3C |
| Input Voltage: | ICES-003 Issue 6 | Relative Humidity: | 44.2% |
| Pretest Verification w / Ambient Signals or BB Source: | 120V/60Hz to 5V USB | Atmospheric Pressure: | 982.0mbar |

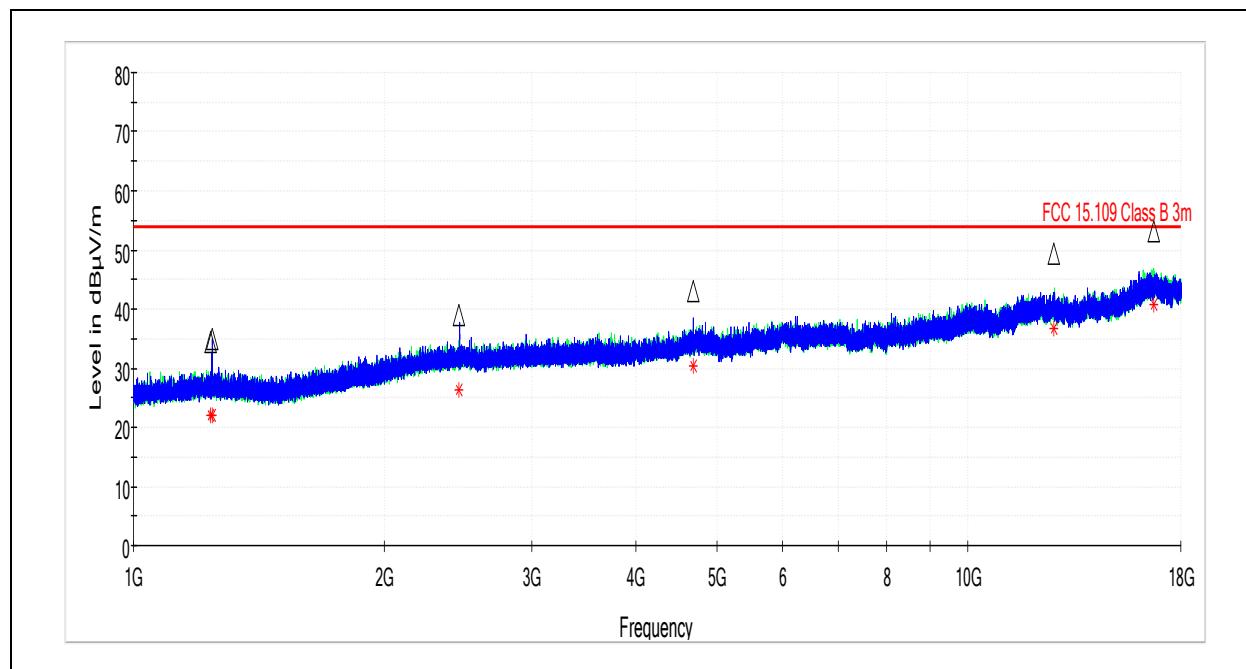
Deviations, Additions, or Exclusions: None

6.8 Setup Photographs: Radiated Emissions, 1GHz – 18GHz





6.9 Plots/Data: Radiated Emissions, 1GHz – 18GHz



Peak

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----------------|-------------|-----|---------------|------------|
| 1236.823500 | 34.55 | 74.00 | 39.45 | 1000.000 | 184.0 | V | 220.0 | -1.1 |
| 1242.417000 | 34.96 | 74.00 | 39.04 | 1000.000 | 300.0 | V | 237.0 | -1.0 |
| 2454.443000 | 39.08 | 74.00 | 34.92 | 1000.000 | 300.0 | V | 183.0 | 3.9 |
| 4682.581000 | 42.98 | 74.00 | 31.02 | 1000.000 | 300.0 | V | 5.0 | 8.4 |
| 12690.958500 | 49.29 | 74.00 | 24.71 | 1000.000 | 400.0 | H | 95.0 | 16.9 |
| 16717.426500 | 53.08 | 74.00 | 20.92 | 1000.000 | 170.0 | H | 247.0 | 21.8 |

Average

| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----------------|-------------|-----|---------------|------------|
| 1236.823500 | 21.96 | 54.00 | 32.04 | 1000.000 | 184.0 | V | 220.0 | -1.1 |
| 1242.417000 | 22.02 | 54.00 | 31.98 | 1000.000 | 300.0 | V | 237.0 | -1.0 |
| 2454.443000 | 26.45 | 54.00 | 27.55 | 1000.000 | 300.0 | V | 183.0 | 3.9 |
| 4682.581000 | 30.45 | 54.00 | 23.55 | 1000.000 | 300.0 | V | 5.0 | 8.4 |
| 12690.958500 | 36.64 | 54.00 | 17.36 | 1000.000 | 400.0 | H | 95.0 | 16.9 |
| 16717.426500 | 40.67 | 54.00 | 13.33 | 1000.000 | 170.0 | H | 247.0 | 21.8 |

Test Personnel: B. Lackey
Supervising/Reviewing Engineer: _____
(Where Applicable) NA
Product Standard: FCC Part 15B
Input Voltage: 120V/60Hz to 5V USB
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 5/16/2018
Limit Applied: Class B
Ambient Temperature: 25.3C
Relative Humidity: 44.2%
Atmospheric Pressure: 982.0mbar

Deviations, Additions, or Exclusions: None



7 Conducted Emissions

7.1 Method

Tests are performed in accordance with ANSI C63.4: 2014

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | Ucispr |
|-----------------------------|------------------|----------------------------|--------|
| AC Line Conducted Emissions | 150 kHz - 30 MHz | 3.1dB | 3.4dB |
| Telco Port Emissions | 150 kHz - 30 MHz | 3.2dB | 5.0dB |

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

7.2 Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V}/20)} = 285.1 \mu\text{V}/\text{m}$$

**7.3 Test Equipment Used:**

| Description | Asset | Manufacturer | Model | Cal Date | Cal Due |
|-------------------|-------|---------------|-------|-----------|-----------|
| EMI Test Receiver | 2327 | Rohde&Schwarz | ESI26 | 9/20/2017 | 9/20/2018 |
| LISN | 3333 | Teseq | NNB52 | 6/15/2017 | 6/15/2018 |
| COND3 | 7024 | | | 12/1/2017 | 12/1/2018 |

7.4 Software Utilized:

| Name | Manufacturer | Version |
|------|--------------|------------|
| TILE | ETS Lindgren | V7.0.6.545 |

7.5 Results:

The sample tested was found to Comply.

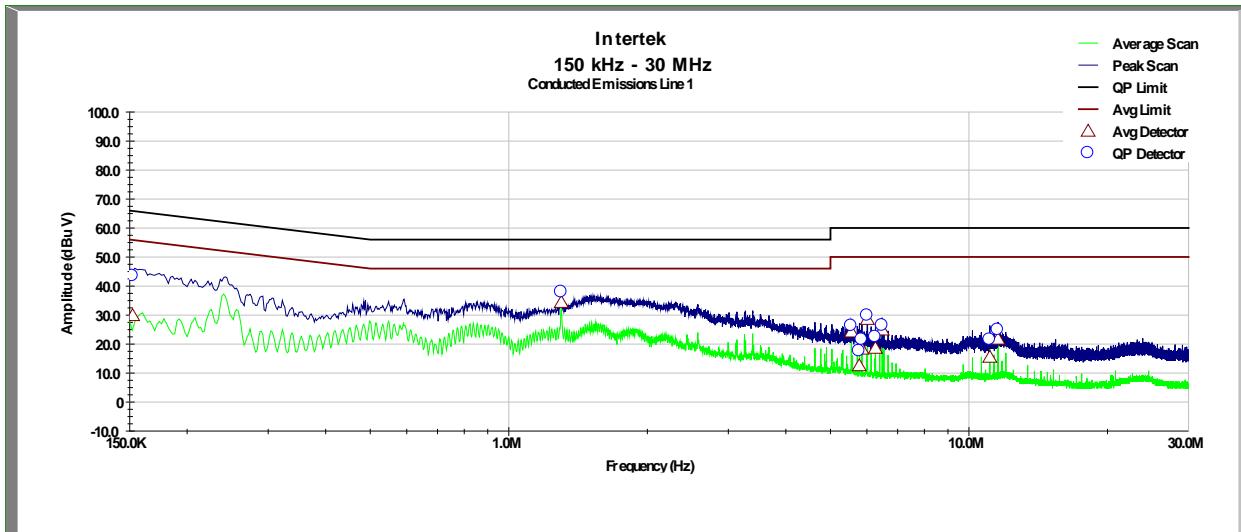


7.6 Setup Photographs: Conducted Emissions





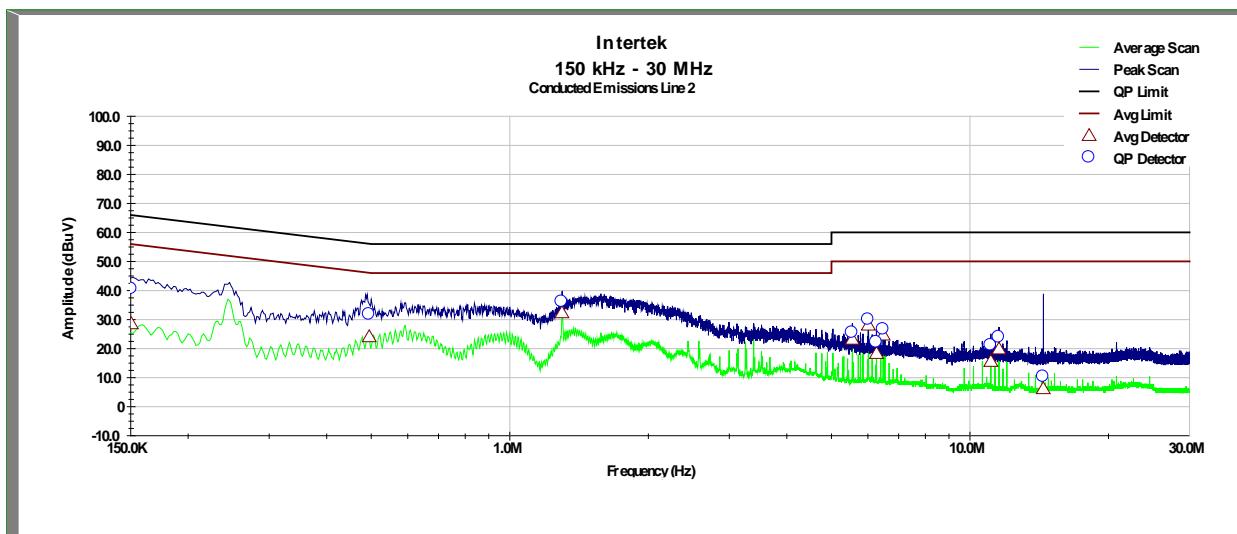
7.7 Plots/Data: Conducted Emissions



Line

| Frequency (MHz) | Quasi-Peak (dBuV) | Quasi-Peak Limit (dBuV) | Quasi-Peak Margin (dB) | Average (dBuV) | Average Limit (dBuV) | Average Margin (dB) |
|-----------------|-------------------|-------------------------|------------------------|----------------|----------------------|---------------------|
| 0.152 | 43.391 | 65.937 | 22.546 | 29.790 | 55.937 | 26.148 |
| 1.300 | 37.873 | 56.000 | 18.839 | 34.339 | 46.000 | 12.372 |
| 5.551 | 26.260 | 60.000 | 29.828 | 24.139 | 50.000 | 21.949 |
| 5.775 | 17.541 | 60.000 | 38.583 | 12.514 | 50.000 | 33.610 |
| 5.853 | 21.450 | 60.000 | 34.686 | 18.222 | 50.000 | 27.914 |
| 6.014 | 29.779 | 60.000 | 26.383 | 28.490 | 50.000 | 17.673 |
| 6.263 | 22.364 | 60.000 | 33.838 | 18.512 | 50.000 | 27.690 |
| 6.477 | 26.348 | 60.000 | 29.888 | 24.821 | 50.000 | 21.415 |
| 11.099 | 21.460 | 60.000 | 35.515 | 15.419 | 50.000 | 31.557 |
| 11.564 | 24.855 | 60.000 | 32.195 | 21.688 | 50.000 | 25.362 |

Line



Neutral

| Frequency (MHz) | Quasi-Peak (dBuV) | Quasi-Peak Limit (dBuV) | Quasi-Peak Margin (dB) | Average (dBuV) | Average Limit (dBuV) | Average Margin (dB) |
|-----------------|-------------------|-------------------------|------------------------|----------------|----------------------|---------------------|
| 0.150 | 40.536 | 65.986 | 25.450 | 28.545 | 55.986 | 27.441 |
| 0.495 | 31.699 | 56.146 | 24.447 | 24.072 | 46.146 | 22.074 |
| 1.298 | 36.074 | 56.000 | 20.636 | 32.339 | 46.000 | 14.370 |
| 5.549 | 25.425 | 60.000 | 30.663 | 23.231 | 50.000 | 22.857 |
| 6.015 | 29.923 | 60.000 | 26.240 | 28.084 | 50.000 | 18.079 |
| 6.265 | 22.136 | 60.000 | 34.067 | 18.319 | 50.000 | 27.883 |
| 6.478 | 26.559 | 60.000 | 29.677 | 24.657 | 50.000 | 21.580 |
| 11.099 | 21.075 | 60.000 | 35.901 | 15.586 | 50.000 | 31.389 |
| 11.562 | 23.870 | 60.000 | 33.180 | 19.870 | 50.000 | 27.180 |
| 14.432 | 10.300 | 60.000 | 47.209 | 6.187 | 50.000 | 41.322 |

Neutral

Test Personnel: B. Lackey
Supervising/Reviewing Engineer: _____
(Where Applicable) NA
Product Standard: FCC Part 15B
Input Voltage: ICES-003 Issue 6
Pretest Verification w / Ambient Signals or BB Source: 120V/60Hz to 5V USB
Atmospheric Pressure: Yes

Test Date: 5/25/2018
Limit Applied: Class B
Ambient Temperature: 22.6C
Relative Humidity: 54.6%
Atmospheric Pressure: 982.0mbar

Deviations, Additions, or Exclusions: None



8 Revision History

| Revision Level | Date | Report Number | Prepared By | Reviewed By | Notes |
|----------------|-----------|--------------------|-------------|-------------|---|
| 0 | 5/31/2018 | 103477146LEX-001 | BZ | BCT | Original Issue |
| 1 | 6/5/2018 | 103477146LEX-001.1 | BZ | BCT | Updated model number and contact information. |
| | | | | | |
| | | | | | |
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| | | | | | |