Test Report 2023-050

Version B
Issued 20 Sep 2023

Project GCL-0306
Model Identifier A04583
Primary Test Standard
CFR 47, FCC Part 15, Subpart B
ICES-003 Issue 7

Garmin Compliance Lab
Garmin International
1200 E 151st Street
Olathe Kansas 66062 USA

Client-supplied Information

FCC ID:	IPH-04583
IC ID:	1792A-04583

See section 6 of this report regarding the presence or absence of accreditation logos or marks on this cover page.

1. Summary

The equipment or product described in section 5 of this report was tested at the Garmin Compliance Lab according to standards listed in section 6. This report focuses on the digital devices that control the transceiver(s). The results are as follows.

Parameter	Description	Key Performance Values [Performance Class]	Result	Data starts at page
Unintentional Radiated Emissions	Radio emissions that this device may generate via its structures and connected cables that are not necessary for its operation and that may affect radio communication [See for example FCC parts 15.109 and 15.209, ICES-003 at 3.2.2, CISPR 32 Annex A.]	3.1 dB of margin to the Class B limit. Tested 30 MHz to 12.5 GHz at a 3m test distance. Appropriate for use in homes, offices, and industrial facilities. [Class B]	PASS	10
Unintentional Conducted Emissions	Radio emissions that this device may generate via its ac power network connections that are not necessary for its operation and that may affect radio communication. [See for example FCC parts 15.107 and 15.207, ICES-003 at 3.2.1, CISPR 32 Annex A.]	15.6 dB of margin to the appropriate limit. Tested 150 kHz to 30 MHz. Appropriate for use in homes, offices, and industrial facilities. [Class B]	PASS	18

NT (Not Tested) means the requirement may or may not be applicable, but the relevant measurement or test was not performed as part of this test project.

N/A (Not Applicable) means the lab judged that the test sample is exempt from the requirement.

Table 1: Summary of results

Report Organization

For convenience of the reader, this report is organized as follows:

1. Summary
2. Test Background
3. Report History and Approval
4. Test Sample Modifications and Special Conditions
5. Description of Equipment Tested
6. Test Standards Applied
7. Measurement Instrumentation Uncertainty
8. Selected Examples of Calculations
9. Environmental Conditions During Test
10. Immunity Performance Criteria

Annex: Test records are provided for each type of test, following the order and page numbering stated in the summary table. Concluding notes appear on the final page of this report.

Due to confidentiality, certain material (such as test setup photographs) has been removed from this report and placed in GCL Test Report 2023-052. That report is treated as a part of this document by way of this reference.

2. Test Background

The testing reported here was performed at the Garmin Compliance Lab, an organization within Garmin International, located at 1200 E 151st St, Olathe Kansas, USA. The contact telephone number is +1.913.397.8200.

The testing was performed on behalf of the Garmin design group, a separate organization located at 1200 E 151st St, Olathe Kansas, USA. Witnesses from the business group included: None.

Test Sample received: appx. 24 Jun 2023
Test Start Date: 30 Jun 2023
Test End Date: 8 Aug 2023

The data in this test report apply only to the specific samples tested.

Upon receipt all test samples were believed to be properly assembled and ready for testing.

3. Report History and Approval

This report was written by David Arnett and initially issued on 30 Aug 2023 as Version A.
Version B, issued 20 Sep 2023, corrected some product description elements in sections 5.1 and 5.2.

Report Technical Review:

David Arnett
Technical Lead EMC Engineer

Report Approval:

Shruti Kohli
Manager Test and Measurement (EMC, Reliability and Calibration)

4. Test Sample Modifications and Special Conditions

The following special conditions or usage attributes were judged during test to be necessary to achieve compliance with one or more of the standards listed in section 6 of this report:
None

The following modifications to the test sample(s) were made, and are judged necessary to achieve compliance with one or more of the standards listed in section 6 of this report:
None

5. Description of the Equipment Tested

5.1 Unique Identification

Product Model	A04583
Serial Numbers Tested	3448629564

This product tested is a short range transceiver for collecting and sharing data.

The client affirmed that the test samples will be representative of production in all relevant aspects.

5.2 Key Parameters

EUT Input Power:	5 Vdc
I/O Ports:	USB
Radio Transceivers:	Bluetooth Low Energy
Radio Receivers:	GNSS (Global Navigation Satellite Systems)
Primary Functions:	Radio reception and transmission
Typical use:	Portable, with varying orientation
Highest internal frequency:	2.484 GHz
Firmware Revision	3.41

5.3 Operating modes

During test, the EUT was operated in one or more of the following modes.

Mode 1: M1 (BleTx1MB). Continuous Bluetooth Low Energy transmissions at 1 Mbps rate

Mode 2: M2 (Ble Link). The test sample is linked to a companion device using Bluetooth Low Energy

Mode 3: M3 (GNSS). GNSS signals are provided and the test sample attempts to determine its location

Mode 4: M4 (BleGnss). A BLE link is established as in M2, and GNSS signals are decoded as in M3

5.4 EUT Arrangement

During test, the EUT components and associated support equipment were selected including the following arrangement sets.

Arrangement 1: A1 (Batt) The test sample operates on internal battery power with no external cables

Arrangement 2: A2 (UsbPwr) The test sample is powered over its USB port from a computer or power supply

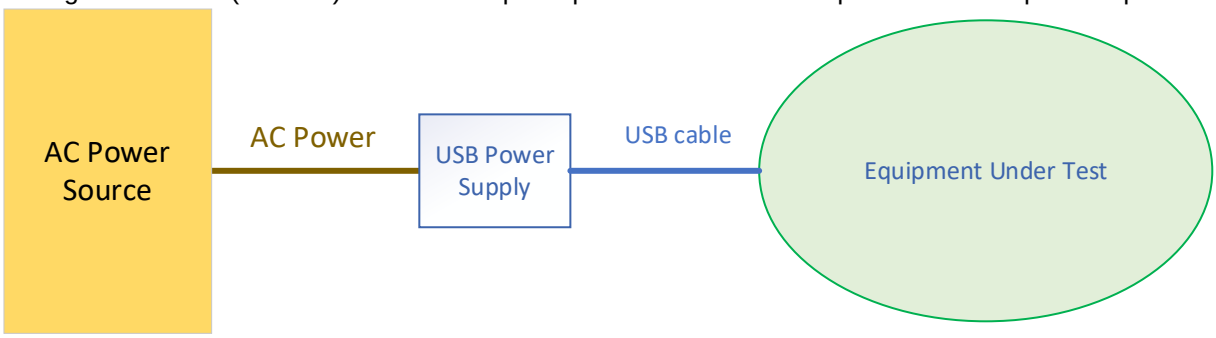
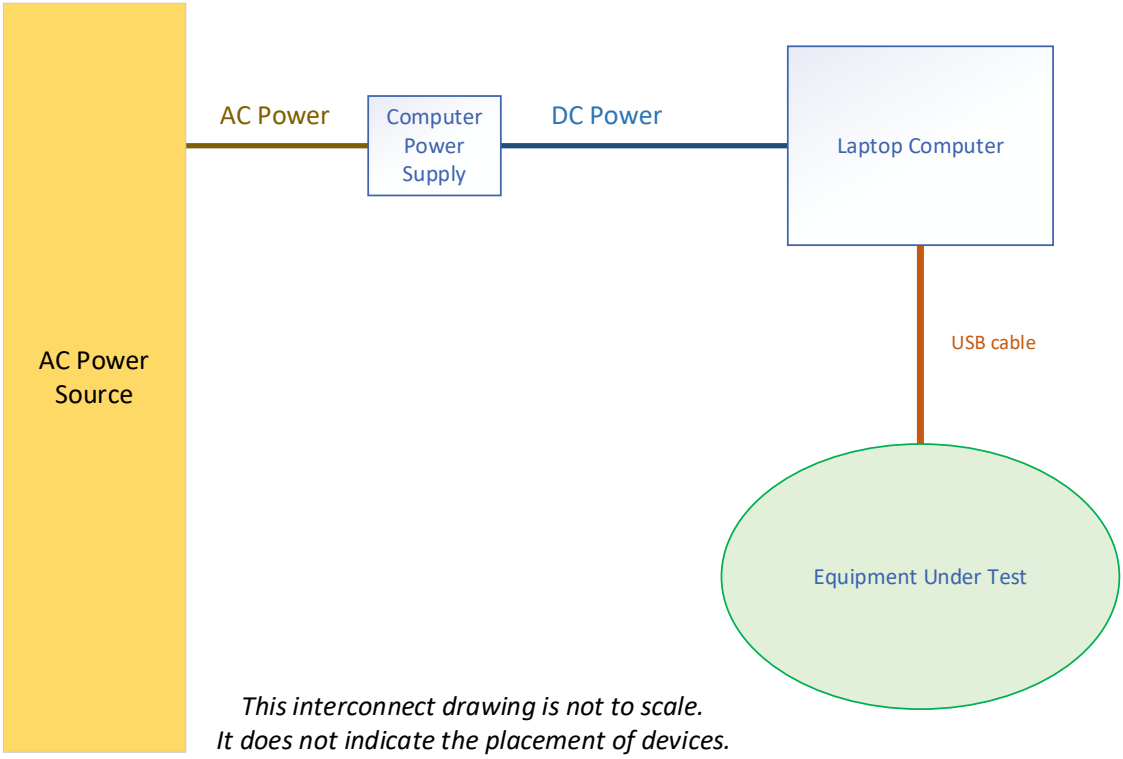


Figure 1: Block diagram of equipment arrangements A2

Arrangement 3: A3 (PC) The test sample is powered and establishes a data link over its USB port



This interconnect drawing is not to scale.
It does not indicate the placement of devices.

Figure 2: Block diagram of equipment arrangements A3

5.5 Associated Equipment (AE) used

Description	Manufacturer	Model	Serial Number
Tablet	Apple	iPad Pro 11inch	DMPZ7582KD6L
Laptop	Dell	Latitude 5410	5VSPFB3
Power Supply	Dell	HA65NM191	0BD-7TC0-A02

Table 2: List of associated equipment that may have been used during test

5.6 Cables used

Description	From	To	Length	EMC Treatment
USB	PC / Power	EUT	56 cm	None

Table 3: List of cables that may have been used during test

6 Test Standards Applied

6.1. Accredited Standards

The following test or measurement standards were applied and are within the scope of the lab's accreditation. All results in this report that cite these standards are presented as Accredited results consistent with ISO/IEC 17025.

CFR 47, FCC Part 15, Subpart B
ANSI C63.4: 2014
ICES-003 Issue 7

6.2. Non-accredited Standards

The following test or measurement standards were applied and are either outside the scope of the lab's accreditation, or were performed in such a way that results are not presented as being fully accredited.

(None)

6.3 Variances

The following variances were applied to standards cited in this section.

Where different test standards cover the same test parameter or phenomenon, and the standards have compatible differences, the stricter of the requirements is typically applied. For example, a consolidated limit may be applied to emission tests selecting the strictest of the limits at each frequency. Likewise, if one standard requires a vertical antenna sweep with boresighting and another does not, swept motion with boresighting will typically be used as it is the more stringent requirement.

6.4 Laboratory Accreditation

The Garmin Compliance Lab, an organization within Garmin International, is registered with the US Federal Communication Commission as US1311. The lab is recognized by the Canada Department of Innovation, Science, and Economic Development (ISED) under CAB identifier US0233.

The Garmin Compliance Lab, an organization within Garmin International, is accredited by A2LA, Certificate No. 6162.01. The presence of the A2LA logo on the cover of this report indicates this is an accredited ISO/IEC 17025 test report. If the logo is absent, this report is not issued as an accredited report. Other marks and symbols adjacent to the A2LA logo are accreditation co-operations of which A2LA is a member under a mutual recognition agreement, and to which the Garmin Compliance Lab has been sublicensed.

7 Measurement Instrumentation Uncertainty

The lab has analyzed the sources of measurement instrumentation uncertainty. The analysis concludes that the actual measurement values cited in this report are accurate within the U_{LAB} intervals shown below with approximately 95% statistical confidence. Where the report shows a judgment that a test sample passes a test against a published limit based on these measured values, that judgment has a statistical confidence of 97.5% or greater. Measurement Instrumentation Uncertainty is one component of over-all measurement uncertainty, and other uncertainty components are not considered as part of this analysis.

The primary benchmark for measurement instrumentation uncertainty (MIU) in an electromagnetic compatibility (EMC) test lab is the set of U_{CISPR} values published in CISPR 16-4-2. In all cases where a U_{CISPR} value is published by CISPR, the analysis shows that U_{LAB} – this lab's estimated MIU – is better than the U_{CISPR} benchmark.

The secondary benchmark for MIU in an EMC lab performing radio transceiver tests is a set of uncertainty limit values published in various ETSI standards. In this report, U_{ETSI} is the most restrictive of the values found in the ETSI EN standards listed in section 5 of this report. The analysis principles are described in the ETSI TR documents listed there. In most cases U_{LAB} is better than the U_{ETSI} benchmark. Where U_{LAB} exceeds the U_{ETSI} benchmark cited here, that entry is preceded by an asterisk. When required by the ETSI EN standards, excess uncertainty will be added to the measurand before comparison to a limit. In an individual test report, staff may re-evaluate that excess uncertainty based on the uncertainty of the method used and the uncertainty limits of the actual ETSI EN standard being applied, and the revised uncertainty values will be shown in the test report.

Some measurement uncertainties analyzed and reported here are not addressed in CISPR 16-4-2 or the ETSI standards, as indicated by the entry 'None.'

Test Type		**U_{LAB}**	**U_{CISPR}**	**U_{ETSI}**
Conducted DC voltage		0.09% + 2 x LSDPV	None	1%
Conducted AC voltage below 500 Hz		1.0% + 3 x LSDPV	None	2%
Conducted Emissions, Mains Voltage		0.10% + 10 mV	None	None
Conducted Emissions, Mains Current		0.10% + 3 mA	None	None
Conducted Emissions, Mains Power		0.15% + 100 mW	None	None
Conducted Emissions, Power Mains, 9 kHz to 150 kHz		1.49 dB	3.8 dB	None
Conducted Emissions, Power Mains, 150 kHz to 30 MHz		1.40 dB	3.4 dB	None
Conducted Emissions, Cat 6 LCL, 150 kHz to 30 MHz		2.80dB	5 dB	None
Conducted Emissions, Cat 5 LCL, 150 kHz to 30 MHz		3.21 dB	5 dB	None
Conducted Emissions, Cat 3 LCL, 150 kHz to 30 MHz		4.24 dB	5 dB	None
Radiated Emissions, below 30 MHz		0.88 dB	None	6 dB
Radiated Emissions, 30 MHz to 1000 MHz		2.77 dB	6.3 dB	6 dB
Radiated Emissions, 1 GHz to 18 GHz		2.60 dB	5.2 & 5.5 dB	6 dB
Radiated Emissions, 18 GHz to 26.5 GHz		2.73 dB	None	6 dB
*Radio Signal Frequency Accuracy		*1.55 x 10^-7	None	1.0 x 10^-7
Radio Signal Occupied Bandwidth		0.95%	None	5%
Radio Power or Power Spectral Density		0.98 dB	None	1 dB
Temperature		0.38 °C	None	1 °C
Barometric Pressure		0.38 kPA	None	None
Relative Humidity		2.85% RH	None	±5% RH
Signal Timing	The greater of these three...	0.63 usec 0.01% of value 0.5 x LSDPV	None	None

Note: *LSDPV stands for the Least Significant Digit Place Value reported. In the value 1470 msec, the least significant digit is the 7. It has a 10 msec place value. The LSDPV is thus 10 msec and the maximum error due to roundoff would be 5 msec. If the time value were reported as 147<u>0</u> msec, the underscore indicates that the 0 is a significant figure and the error due to roundoff would be 0.5 msec. All digits provided to the right of a decimal point radix are significant.*

8 Selected Example Calculations

Certain regulators require samples of the calculations that lead from the raw measurement to the final result for AC Mains conducted and unintended radiated emissions. The assumption is that the lab performs raw measurements, then adds, subtracts, multiplies, or divides based on transducer factors, amplifier gains, and losses in the signal transmission path. In this lab, our CISPR 16 Receiver does not work that way. The calibration factors and losses and gains are provided to the receiver as detailed data files. These factors are applied in the RF measurement path prior to the detector. But as a step in the lab measurement process, staff frequently verify that these factors are applied correctly. They make a measurement with the factors applied inside the receiver, then they disable the factors and remeasure the result manually adding in the various relevant factors.

The transmission loss is measured including the combined losses and gains of preamplifiers, cables, and any band-selective filters. In many cases above 1 GHz it is a negative value, indicating that the preamplifier gain is greater than these other losses.

Here are examples of these calculations. The data in these examples was not taken as part of this project:

8.1 AC Mains conducted emissions at 22 MHz

(Raw measurement) + (AMN factor) + (transmission loss) = Result

(7.145 dBuV) + (9.812 dB) + (0.216 dB) = 17.173 dBuV

8.2 Radiated Emissions at 630 MHz

(Raw measurement) + (Antenna factor) + (transmission loss) = Result

(2.25 dBuV) + (27.80 dB/m) + (2.89 dB) = 32.94 dBuV/m

8.3 Radiated Emissions at 2.7 GHz

(Raw measurement) + (Antenna factor) + (transmission loss) = Result

(43.72 dBuV) + (32.22 dB/m) + (-36.09 dB) = 39.85 dBuV/m

9 Environmental Conditions During Test

Environmental conditions in the test lab were monitored during the test period. Temperature and humidity are controlled by an air handling system. As information to the reader, the conditions were observed at the values or within the ranges noted below. For any tests where environmental conditions are critical to test results and require further constraints or details, the test records in the annex may provide more specific information.

Temperature:	21.4 to 22.9 °C
Relative Humidity:	42.9% to 54.3% (non-condensing)
Barometric Pressure	97.1 to 98.5 kPa

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
Barometer	Traceable	6453	221702700	3-Aug-2022	1-Aug-2024

Table 4: Environmental monitoring device

10 Immunity Performance Criteria

If this report includes immunity tests then results have been categorized as Performance Criteria A, B, C, or D. The standards that the lab applied will define the details for A, B, and C, as well as which criterion is required for each type of test. They will also define the electrical stresses that were applied during each test. In a very general sense the observed criteria noted in this report are as follows:

Criterion A. The stress applied did not alter product operation. This criterion is generally used for ‘continuous’ stresses that can be present for a long time in the places the product will be used, or that can appear often, even though they may come and go over time.

Criterion B. The stress applied altered product operation, but the product self-recovered so that the user would not have to try to figure out how to restore it to full operation. This criterion is generally used for 'transient' stresses that appear briefly and occasionally, but are usually not present in the places the product will be used.

Criterion C. The stress applied altered product operation, but the user could restore it to full operation, for example by power cycling the product. This criterion is generally used for 'transient' stresses that appear briefly and only rarely in the places the product will be used.

Criterion D. This is not an official criterion in the standards, because it would be a failure of the requirements. This indication in a test record means the product was affected in a way that the user might not be able to correct. The effect could include some degree of hardware damage, or it could include loss of program files or data files necessary for operation.

Repeatability is an issue in all EMC immunity work. When the product operation changes unexpectedly during a test, and the change would fail the requirements of the standard, this is an anomaly. The test operator needs to determine whether the anomaly was a result of the applied electrical stress. The investigation is done by repeating the section of the test where the anomaly occurred three times. If the same or a similar anomaly occurs in any of the three repeat trials, it is confirmed as a response to the stress. If not, the anomaly is judged unreproducible and is not considered when judging the A, B, or C observed performance. Since there is usually no ability to confirm a Criterion D anomaly, these are usually treated as Criterion D upon a single occurrence.

Tests that require Criterion B performance will be judged to Pass if criteria A or B is observed. Similarly, tests that require Criterion C performance will be judged to Pass if criteria A, B, or C is observed.

ANNEX

The remainder of this report is an Annex containing individual test data records. These records are the basis for the judgments summarized in section 1 of this report. The Annex ends with a set of concluding notes regarding use of the report.

Test Record
Radiated Emission Test RE03
Project GCL0306

Test Date(s)	30 Jun 2023
Test Personnel	David Kerr
Product Model	A04583
Serial Number tested	3448629564
Operating Mode	M4 (Ble, Gnss, Link)
Arrangement	A1 (Batt)
Input Power	Battery
Test Standards:	FCC Part 15, ANSI C63.4, ICES-003, CISPR 32, EN 55032, AS/NZS CISPR 32 (as noted in Section 6 of the report).
Frequency Range:	30 MHz to 1000 MHz
Pass/Fail Judgment:	**PASS**
Test record created by:	**David A Kerr**
Date of this record:	**03 Jul 2023**

Original record, Version A.

Test Equipment

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
PXE Receiver	Keysight	N9048B	MY59290135	21-Sep-2022	15-Sep-2023
Antenna, Biconilog, 30M-6 GHz	ETS Lindgren	3142E	233201	19-Jul-2022	15-Jul-2024
SAC 3m, below 1 GHz	Frankonia	SAC3	F199004	7-Nov-23	7-Nov-23
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10720	16-Jan-2023	15-Jan-2026
Barometer	Traceable	6453	221702700	3-Aug-2022	1-Aug-2024
Vector Signal Generator	Rohde&Schwarz	SMBV100B	101011	19-Oct-2021	15-Oct-2023

Table RE03.1: Test Equipment Used

Software Used Keysight PXE software A.32.06
RE Signal Maximization Tool v2021Feb25.xlsx
RE 30M to 1G XYZ_orientations_ TemplateV8.xlsm
RE 30M to 1G Data Analysis Template V3 2022May10.xlsx

Test Data

The radiated emission test process began with a preliminary scan at multiple turntable angles, antenna heights, and both antenna polarizations. For test standards that require reorienting the test sample, further preliminary scans were taken in those alternate orientations typically described as X, Y, and Z. Subsequent testing was done using on the orientation(s) producing the highest result relative to the test limit. Where the test standard requires cable manipulation, this was done at one of more likely worst case frequencies selected by the test personnel while observing the receiver display. At each of the frequencies selected for final measurements, the turntable angle, antenna height, and antenna polarization were explored to find the worst-case settings. Final field strength measurements were taken in that set of positions. Full maximization was not performed at frequencies that are noise floor measurements included per the test standard requirements.

At azimuth angle 0° the 'front' reference mark of the turntable is pointed Southward. At 90° the reference mark points West. At -90° it points East. At -7° the turntable reference mark is pointed directly at the antenna. The designation of the X, Y, and Z orientations of the test sample are sample dependent, so these are reported by use of photographs.

The table shows the selected final measurement data between 30 MHz and 1 GHz. It includes at least the six strongest emissions observed relative to the test limit, along with other data points of interest. Where a data point is highlighted is yellow, this is an aid to indicate the data point(s) with the least margin to the test limit. A positive margin value indicates that the emission was below the test limit. The test limit is the Composite FCC/CISPR Class B Limit at 3m.

Frequency (MHz)	Limit (dBuV/m)	Measured (dBuV/m)	Margin (dB)	Azimuth (degree)	Height (mm)	Antenna Polarity
36.210	40.0	25.9	14.1	-52	1276	VERT
222.750	40.0	21.1	18.9	-37	2204	VERT
334.110	46.0	20.9	25.1	11	1497	HORZ
371.250	46.0	24.5	21.5	47	1006	VERT
408.360	46.0	25.5	20.5	-12	1202	VERT
944.700	46.0	33.5	12.5	150	2483	VERT

Table RE03.2: Emission summary

The graph below shows the background spectrum observed during pre-scan, as well as the final data points from the table above.

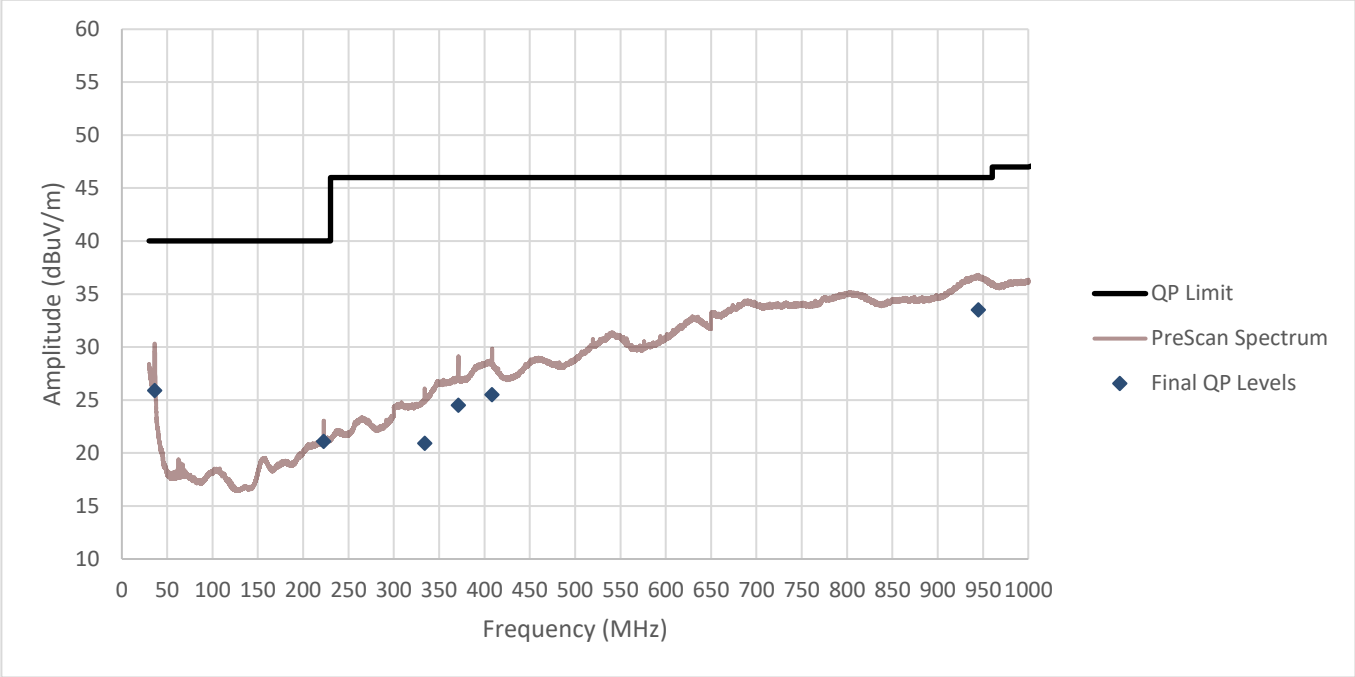


Figure RE03.1: Spectral data

Setup Photographs

The following photographs show the EUT configured and arranged in the manner in which it was measured.

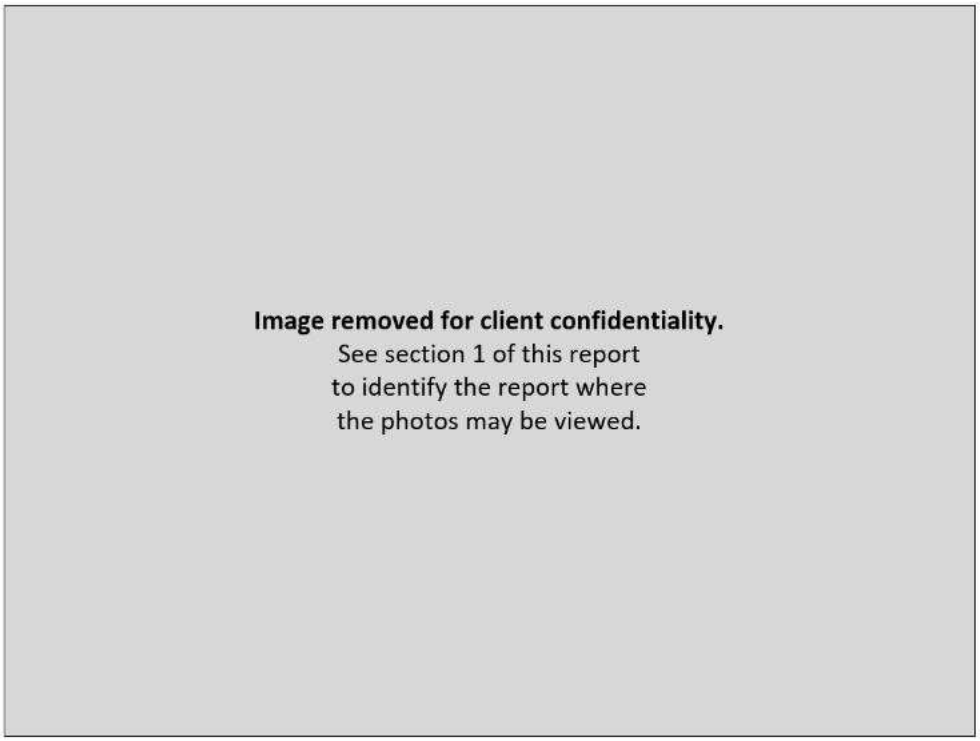


Figure RE03.2: EUT Z orientation test setup, front view

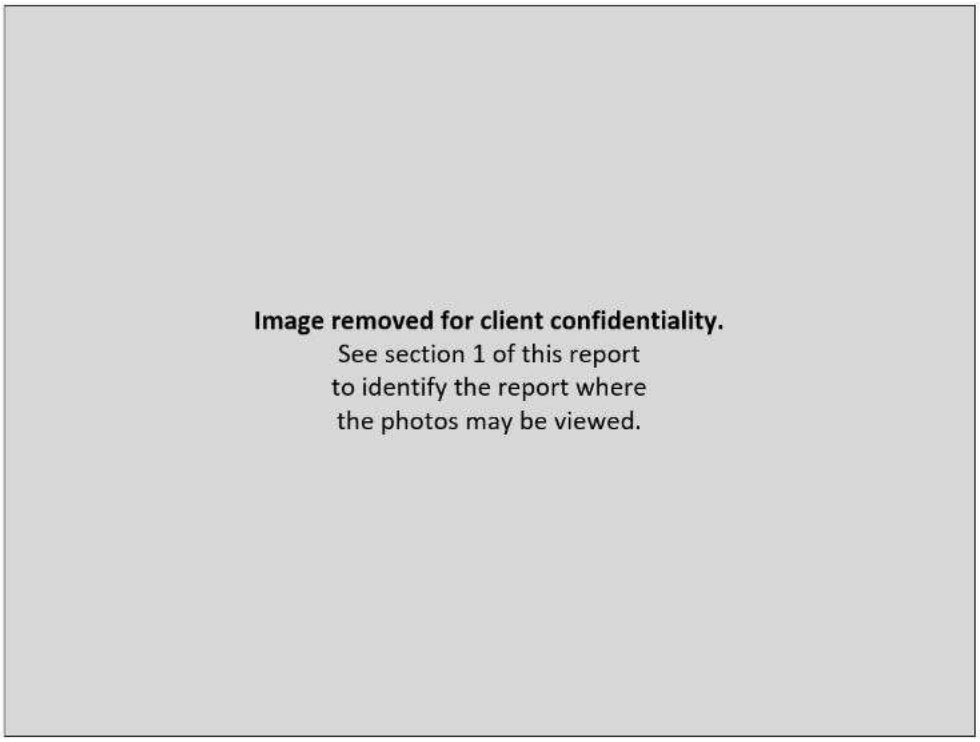


Figure RE03.3: EUT Z orientation test setup, reverse view

This line is the end of the test record.

Test Record
Radiated Emission Test RE04
Project GCL0306

Test Date(s)	01 Jul 2023
Test Personnel	David Kerr
Product Model	A04583
Serial Number tested	3448629564
Operating Mode	M4 (Ble, Gnss linked)
Arrangement	A3 (PC)
Input Power	USB 5 Vdc
Test Standards:	FCC Part 15, ANSI C63.4, ICES-003, CISPR 32, EN 55032, AS/NZS CISPR 32 (as noted in Section 6 of the report).
Frequency Range:	30 MHz to 1000 MHz
Pass/Fail Judgment:	**PASS**
Test record created by:	**David A Kerr**
Date of this record:	**3 Jul 2023**

Original record, Version A.

Test Equipment

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
PXE Receiver	Keysight	N9048B	MY59290135	21-Sep-2022	15-Sep-2023
Antenna, Biconilog, 30M-6 GHz	ETS Lindgren	3142E	233201	19-Jul-2022	15-Jul-2024
SAC 3m, below 1 GHz	Frankonia	SAC3	F199004	7-Nov-23	7-Nov-23
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10720	16-Jan-2023	15-Jan-2026
Barometer	Traceable	6453	221702700	3-Aug-2022	1-Aug-2024
Vector Signal Generator	Rohde&Schwarz	SMBV100B	101011	19-Oct-2021	15-Oct-2023

Table RE4.1: Test Equipment Used

Software Used: Keysight PXE software A.32.06
RE Signal Maximization Tool v2021Feb25.xlsx
RE 30M to 1G XYZ_orientations_ TemplateV8.xlsm
RE 30M to 1G Data Analysis Template V3 2022May10.xlsx

Test Data

The radiated emission test process began with a preliminary scan at multiple turntable angles, antenna heights, and both antenna polarizations. For test standards that require reorienting the test sample, further preliminary scans were taken in those alternate orientations typically described as X, Y, and Z. Subsequent testing was done using on the orientation(s) producing the highest result relative to the test limit. Where the test standard requires cable manipulation, this was done at one of more likely worst case frequencies selected by the test personnel while observing the receiver display. At each of the frequencies selected for final measurements, the turntable angle, antenna height, and antenna polarization were explored to find the worst-case settings. Final field strength measurements were taken in that set of positions. Full maximization was not performed at frequencies that are noise floor measurements included per the test standard requirements.

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Frequency (MHz)	Limit (dBuV/m)	Measured (dBuV/m)	Margin (dB)	Azimuth (degree)	Height (mm)	Antenna Polarity
35.550	40.0	24.9	15.1	-27	1642	VERT
38.910	40.0	23.3	16.7	80	1286	VERT
47.100	40.0	26.1	13.9	70	1000	VERT
114.570	40.0	36.9	3.1	29	1022	VERT
371.250	46.0	23.7	22.3	23	2387	VERT
942.330	46.0	33.4	12.6	18	2617	VERT

Table RE04.2: Emission summary

The graph below shows the background spectrum observed during pre-scan, as well as the final data points from the table above.

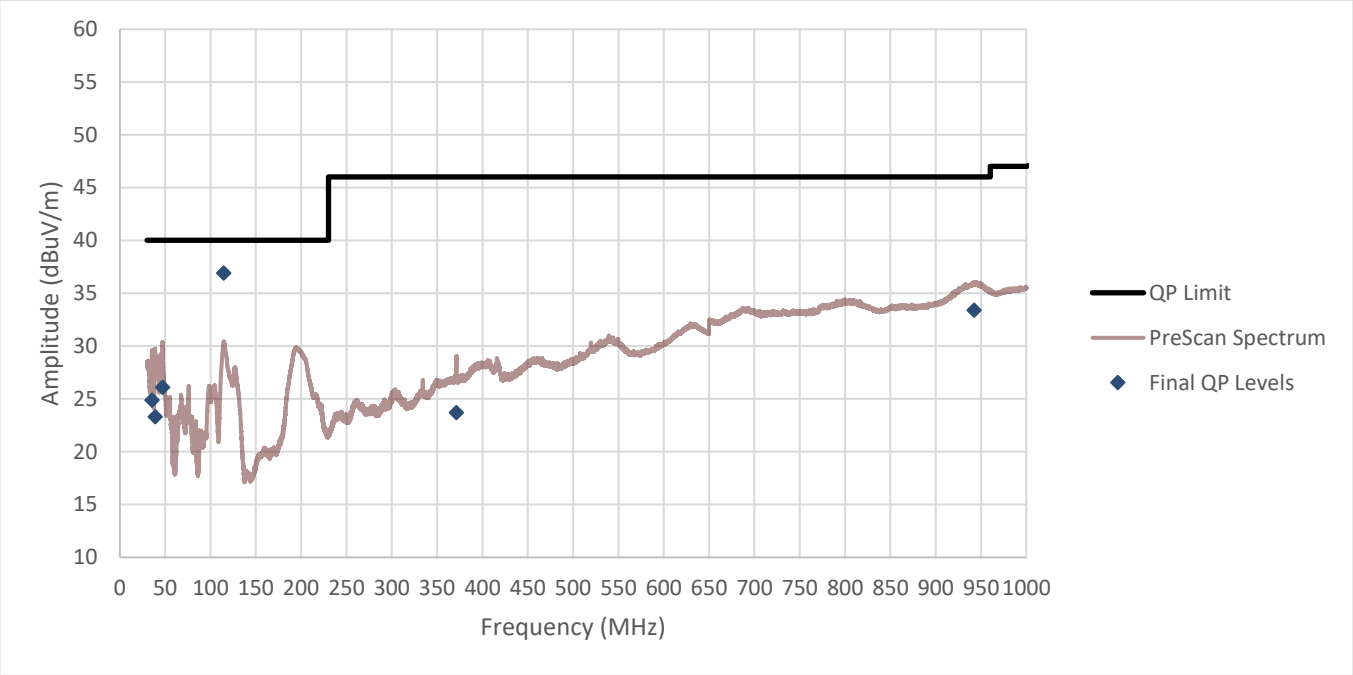

Figure RE04.1: Spectral data

Setup Photographs

The following photographs show the EUT configured and arranged in the manner in which it was measured.

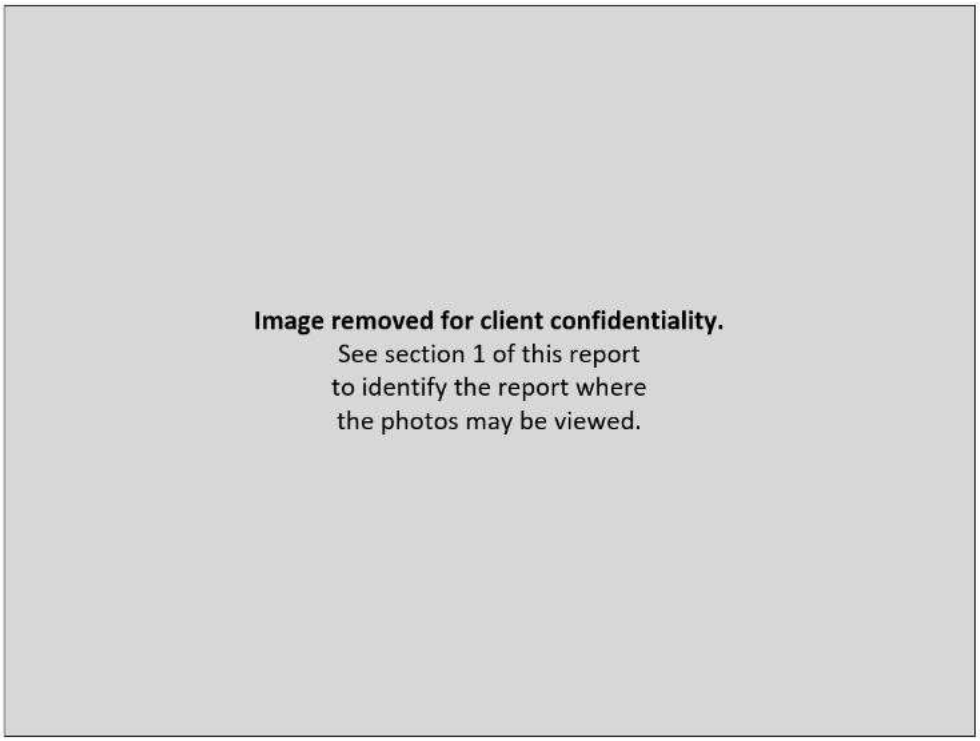

Figure RE04.2: EUT Z orientation test setup, front view

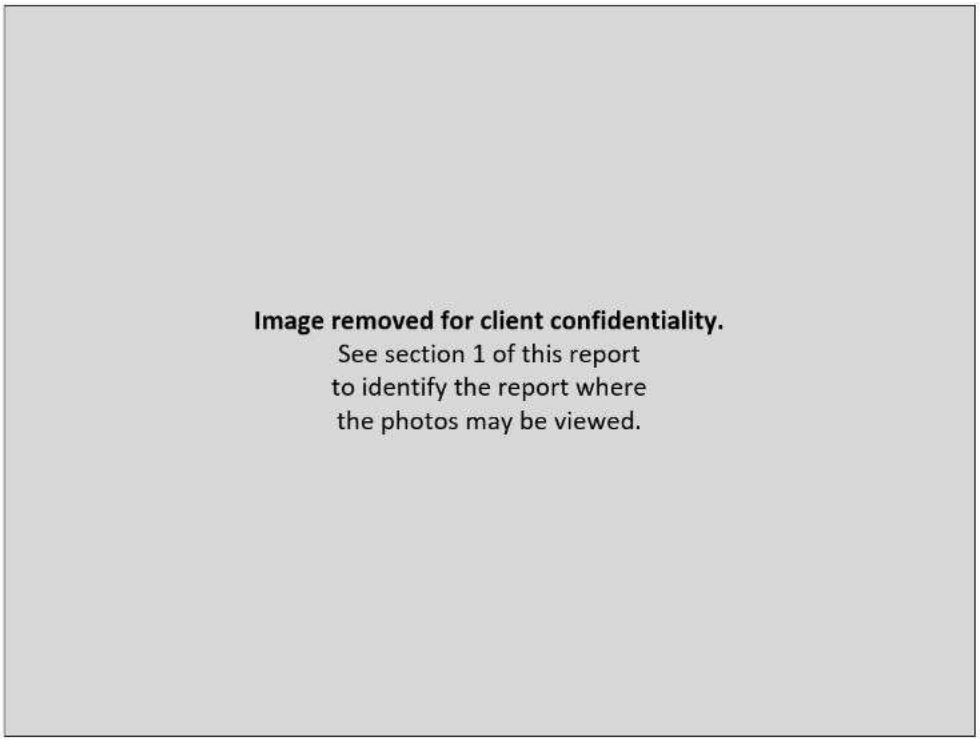

Figure RE04.3: EUT Z orientation test setup, reverse view

This line is the end of the test record.

Test Record
Radiated Emission Test RE02
Project GCL0306

Test Date(s)	11 July 2023
Test Personnel	David Arnett
Product Model	A04583
Serial Number tested	3448629564
Operating Mode	M3 (GNSS)
Arrangement	A3 (PC)
Input Power	USB 5 Vdc
Test Standards:	FCC Part 15, ANSI C63.4, ICES-003, CISPR 32, EN 55032, AS/NZS CISPR 32 (as noted in Section 6 of the report).
Frequency Range:	1000 MHz to 12500 MHz
Pass/Fail Judgment:	**PASS**
Test record created by:	**David Arnett**
Date of this record:	**11 July 2023**

Original record, Version A.

Test Equipment

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
PXE Receiver	Keysight	N9048B	MY59290135	21-Sep-2022	15-Sep-2023
Antenna, Horn, 1-18 GHz	ETS Lindgren	3117	00227596	27-Aug-2021	1-Sep-2023
FSOATS 3m, above 1 GHz	Frankonia	SAC3	F199004	16-Nov-2022	16-Nov-2025
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10720	16-Jan-2023	15-Jan-2026
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10721	15-Aug-2022	15-Aug-2023
Preamplifier, 500 MHz 18 GHz	Com-Power	PAM-118A	18040133	Calibration	Not Required

Table RE02.1: Test Equipment Used

Software Used: Keysight PXE software A.32.06
RE Signal Maximization Tool v2021Feb25.xlsx
RE 1G to 18G Data AnalysisV2 2023June13.xlsx

Test Data

The radiated emission test process began with a preliminary scan at multiple turntable angles, antenna heights, and both antenna polarizations. For test standards that require reorienting the test sample, further preliminary scans were taken in those alternate orientations typically described as X, Y, and Z. Subsequent testing was done using on the orientation(s) producing the highest result relative to the test limit. Where the test standard requires cable manipulation, this was done at one of more likely worst case frequencies selected by the test personnel while observing the receiver display. At each of the frequencies selected for final measurements, the turntable angle, antenna height, and antenna polarization were explored to find the worst-case settings. Final field strength measurements were taken in that set of positions. Full maximization was not performed at frequencies that are noise floor measurements included per the test standard requirements.

At azimuth angle 0° the 'front' reference mark of the turntable is pointed Southward. At 90° the reference mark points West. At -90° it points East. At -7° the turntable reference mark is pointed directly at the antenna. The designation of the X, Y, and Z orientations of the test sample are sample dependent, so these are reported by use of photographs.

The table shows the selected final measurement data between 1 GHz and 12.5 GHz. It includes at least the six strongest emissions observed relative to the test limit, along with other data points of interest. Where a data point is highlighted is yellow, this is an aid to indicate the data point(s) with the least margin to the test limit. A positive margin value indicates that the emission was below the test limit. Where a frequency is highlighted in blue, it indicates that the signal was judged to be noise floor so it was not fully maximized. The test limit is the Composite FCC/CISPR Class B Limit at 3m.

Frequency (MHz)	Avg Limit (dBuV/m)	Pk Limit (dBuV/m)	Avg Level (dBuV/m)	Pk Level (dBuV/m)	Av Margin (dB)	Pk Margin (dB)	Azimuth (degree)	Height (mm)	Polarity ---
1331.250	50.0	70.0	32.0	50.8	18.0	19.2	-2	1577	VERT
1521.750	50.0	70.0	30.1	47.3	19.9	22.7	-10	2487	VERT
3873.000	54.0	74.0	35.3	49.3	18.7	24.7	0	1100	Horiz
8413.500	54.0	74.0	41.7	55.7	12.3	18.3	-90	1100	Vert
8877.000	54.0	74.0	41.4	54.7	12.6	19.3	90	1100	Horiz
12366.750	54.0	74.0	45.9	59.4	8.1	14.6	-180	1100	VERT

Table RE02.2: Emission summary

The graph below shows the background spectrum observed during pre-scan, as well as the final data points from the table above.

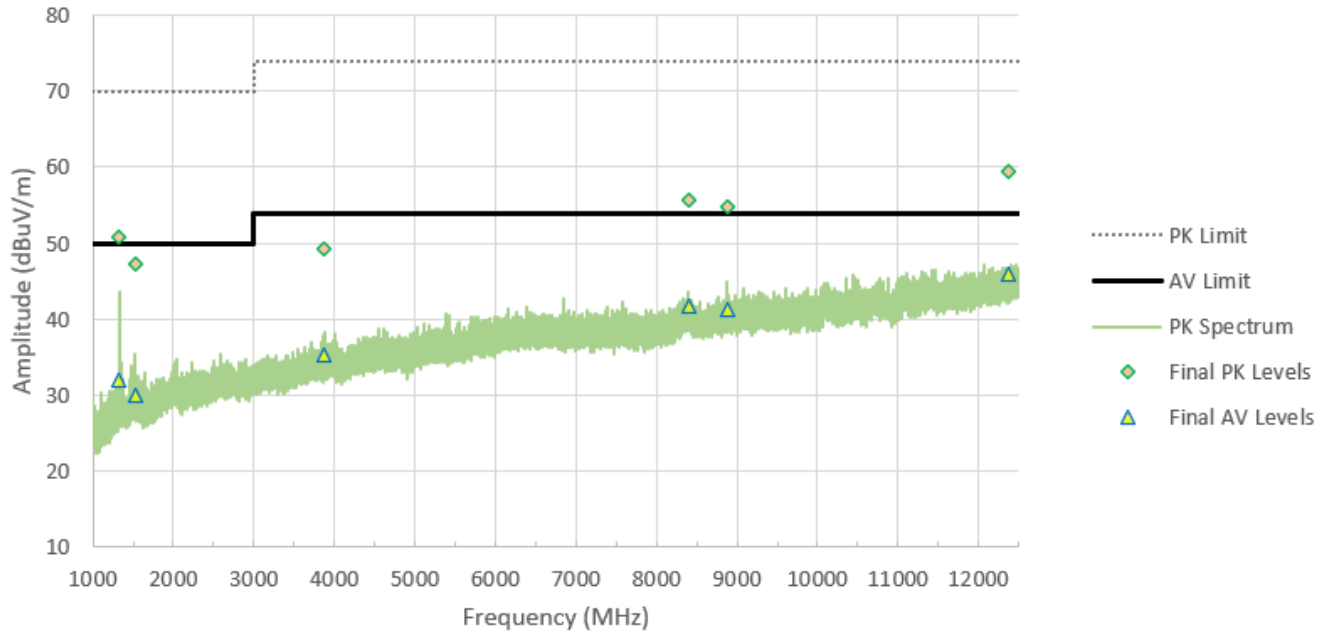

Figure RE02.1: Spectral data

Setup Photographs

The following photographs show the EUT configured and arranged in the manner in which it was measured.

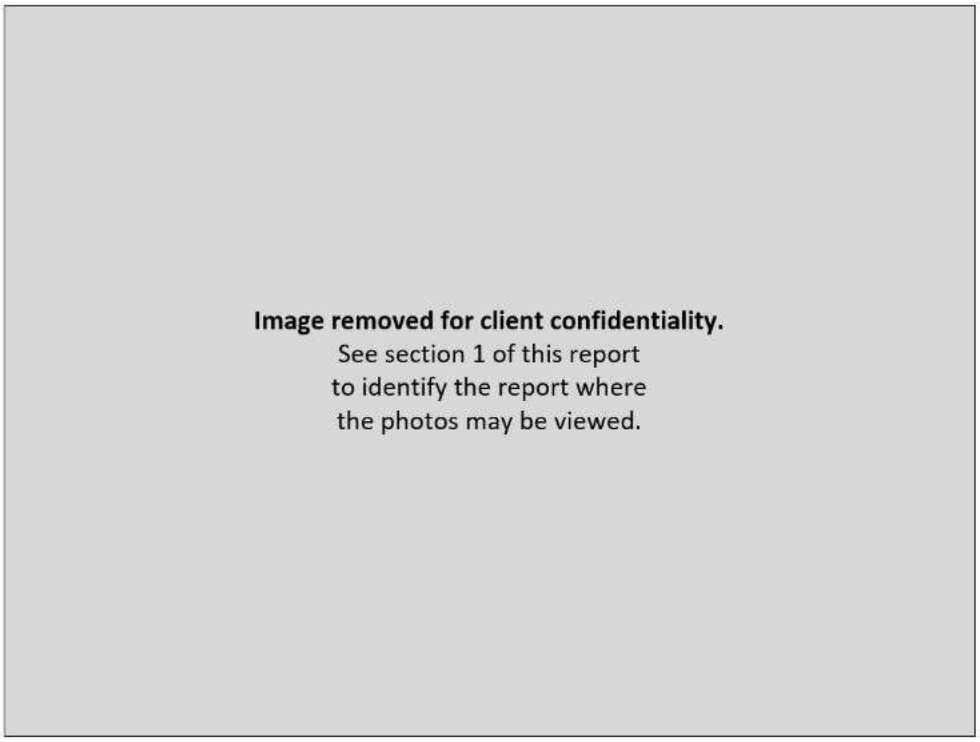

Figure RE02.2: EUT test setup, front view

Figure RE02.3: EUT test setup, reverse view

This line is the end of the test record.

Test Record
Conducted Emissions Mains Test CE01
Project GCL0306

Test Date(s)	8 Aug 2023
Test Personnel	Jim Solum
Product Model	A04583
Serial Number tested	3448629564
Operating Mode	M2 (Ble Link)
Arrangement	A2 (UsbPwr) using the Garmin 362-00096-00 power converter
Input Power	120 Vac 60 Hz
Test Standards:	FCC Part 15, ANSI C63.4, ICES-003, CISPR 32, EN 55032, AS/NZS CISPR 32, (as noted in Section 6 of the report).
Frequency Range:	150 kHz to 30 MHz
Pass/Fail Judgment:	**PASS**

Test record created by: **Jim Solum**
Date of this record: **8 Aug 2023**
Original record, Version A.

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
PXE Receiver 26 GHz	Keysight	N9048B	MY59290135	21-Sep-2022	15-Sep-2023
LISN multiline; 20A 50uH	Com-Power	LIN-120C	20160005	10-Feb-2023	15-Feb-2024
DMM Multimeter	FLUKE	79 III	71740743	5-Apr-2023	1-Apr-2024
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10720	16-Jan-2023	15-Jan-2026

Table CE01.1: Test Equipment Used

Software Used
Keysight PXE software A.32.06; CE Mains 150 to 30M Data Analysis V2 2021Jun10.xlsx

Test Data

The conducted emission test process began with a set of preliminary scans on both power conductors using both Quasi-Peak and Average detectors across the frequency range. Where the test standard requires cable manipulation, one or more likely worst case frequencies selected by the test personnel. Cables were manipulated to find the maximal signal strength while observing the receiver levels at those selected frequencies. At each of the frequencies selected for final measurements, Quasi-peak and Average detector readings were taken on each conductor.

The table shows the selected final measurement data. It includes at least the six strongest emissions observed relative to the limit lines, along with other data points of interest. The yellow highlight indicate the data points with the least margin to the quasi-peak detector limit and the average detector limit. A positive margin value indicates that the emission was below the test limit. The test limit is the Composite FCC/CISPR Class B Limit.

Frequency	QP Limit	AV Limit	L1 QP	L2 QP	L1 AV	L2 AV	QP Margin	AV Margin
(kHz)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
150	66.00	56.00	29.16	28.76	23.76	23.47	36.84	32.24
179	64.52	54.52	30.2	32.9	24.66	23.97	31.62	29.86
200	63.63	53.63	36.55	38.36	28.57	27.39	25.27	25.06
215	63	53	27.28	37.58	22.15	21.97	25.42	30.85
616	56	46	28.96	26.39	24.17	21.31	27.04	21.83
647	56	46	31.43	27.25	26.44	21.9	24.57	19.56
679	56	46	35.94	29.73	30.38	23.81	20.06	15.62
713	56	46	29.95	29.55	26.81	26.44	26.05	19.19
1325	56	46	27.4	25.85	22.27	20.55	28.60	23.73
1361	56	46	27.18	25.92	22.15	20.69	28.82	23.85

Table CE01.2: Emission summary

The graph below shows preliminary scan data as continuous curves. Superimposed are the final measurement data points reported in the table above.

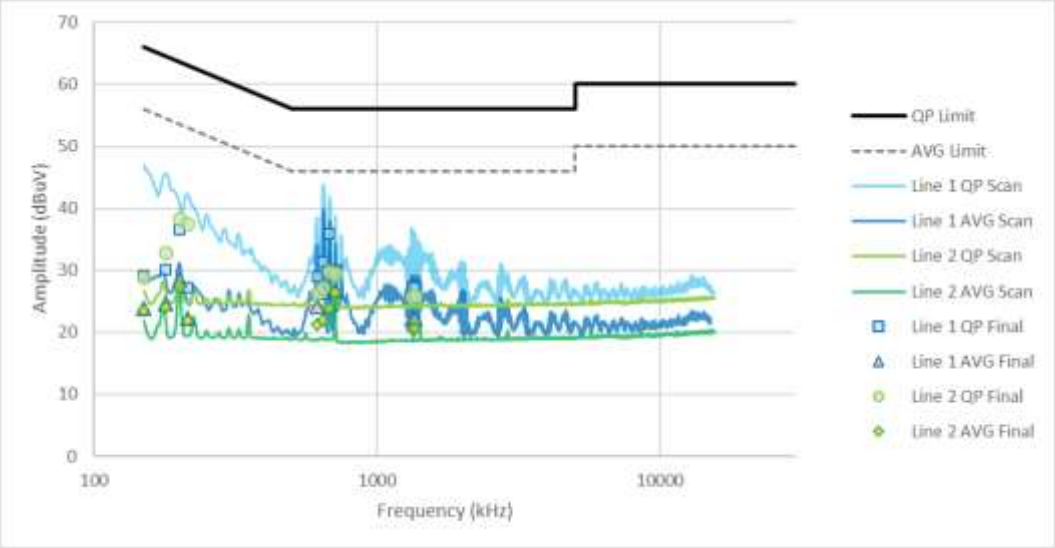

Figure CE01.1: Spectral data

Setup Photographs

The following photographs show the EUT configured and arranged in the manner in which it was measured.

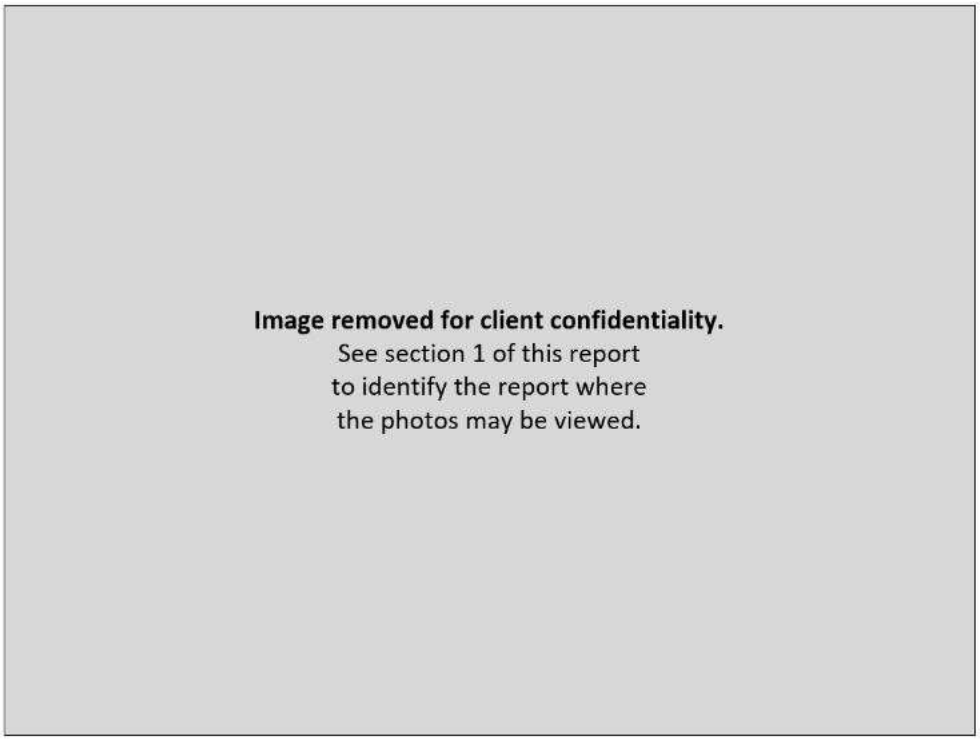

Figure CE01.2: Test setup, front view

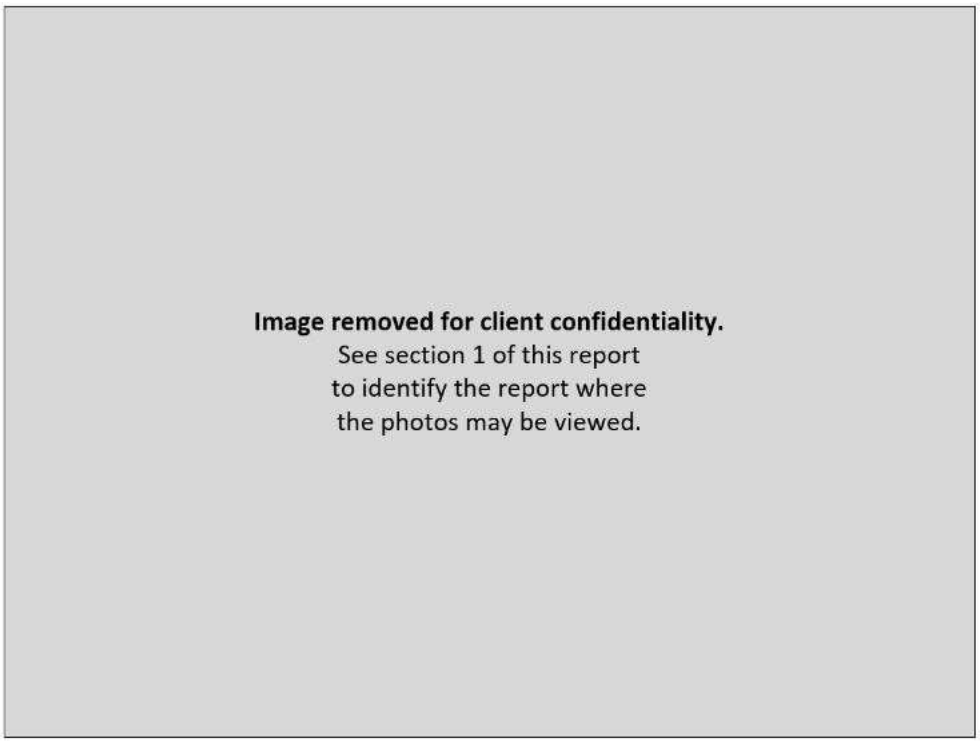

Figure CE01.3: Test setup, side view

This line is the end of the test record.

Test Record
Conducted Emissions Mains Test CE02
Project GCL0306

Test Date(s)	8 Aug 2023
Test Personnel	Jim Solum
Product Model	A04583
Serial Number tested	3448629564
Operating Mode	M2 (Ble Link)
Arrangement	A2 (UsbPwr) using the Garmin 362-00096-00 power converter
Input Power	230 Vac 50 Hz
Test Standards:	FCC Part 15, ANSI C63.4, ICES-003, CISPR 32, EN 55032, AS/NZS CISPR 32, (as noted in Section 6 of the report).
Frequency Range:	150 kHz to 30 MHz
Pass/Fail Judgment:	**PASS**

Test record created by: **Jim Solum**
Date of this record: **9 Aug 2023**
Original record, Version A.

Description	Make	Model #	Serial #	Last Cal/Ver	Next Due
PXE Receiver 26 GHz	Keysight	N9048B	MY59290135	21-Sep-2022	15-Sep-2023
LISN multiline; 20A 50uH	Com-Power	LIN-120C	20160005	10-Feb-2023	15-Feb-2024
AC Power Source and Test System	Pacific Power	ECTS2-140LMX	147440104, 20004,	8-Aug-2022	15-Aug-2023
DMM Multimeter	FLUKE	79 III	71740743	5-Apr-2023	1-Apr-2024
Tape measure, 1" x 33'	Lufkin	PHV1410CMEN	10720	16-Jan-2023	15-Jan-2026

Table CE02.1: Test Equipment Used

Software Used
Keysight PXE software A.33.03 CE Mains150k to 30M Data Analysis V2 2021Jun10.xlsx

Test Data

The conducted emission test process began with a set of preliminary scans on both power conductors using both Quasi-Peak and Average detectors across the frequency range. Where the test standard requires cable manipulation, one or more likely worst case frequencies selected by the test personnel. Cables were manipulated to find the maximal signal strength while observing the receiver levels at those selected frequencies. At each of the frequencies selected for final measurements, Quasi-peak and Average detector readings were taken on each conductor.

The table shows the selected final measurement data. It includes at least the six strongest emissions observed relative to the limit lines, along with other data points of interest. The yellow highlight indicate the data points with the least margin to the quasi-peak detector limit and the average detector limit. A positive margin value indicates that the emission was below the test limit. The test limit is the Composite FCC/CISPR Class B Limit.

Frequency (kHz)	QP Limit (dBuV)	AV Limit (dBuV)	L1 QP (dBuV)	L2 QP (dBuV)	L1 AV (dBuV)	L2 AV (dBuV)	QP Margin (dB)	AV Margin (dB)
150	66.00	56.00	29.28	31.26	24.14	24.61	34.74	31.39
353	58.9	48.9	23.05	19.11	17.16	14.35	35.85	31.74
686	56	46	36.14	29.92	27.66	18.75	19.86	18.34
893	56	46	28.15	20.56	20.04	12.81	27.85	25.96
1424	56	46	20.47	18.62	14.95	13.73	35.53	31.05
2409	56	46	24.92	18.1	17.01	12.29	31.08	28.99
2515	56	46	24.8	18.2	16.76	12.29	31.20	29.24
4045	56	46	22.73	17.3	15.55	11.87	33.27	30.45

Table CExx.2: Emission summary

The graph below shows preliminary scan data as continuous curves. Superimposed are the final measurement data points reported in the table above.

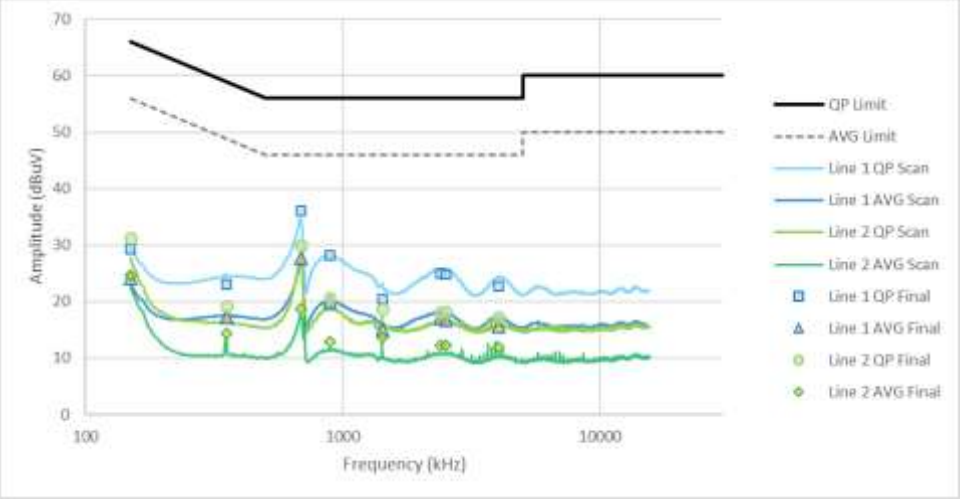

Figure CExx.1: Spectral data

Setup Photographs

The following photographs show the EUT configured and arranged in the manner in which it was measured.

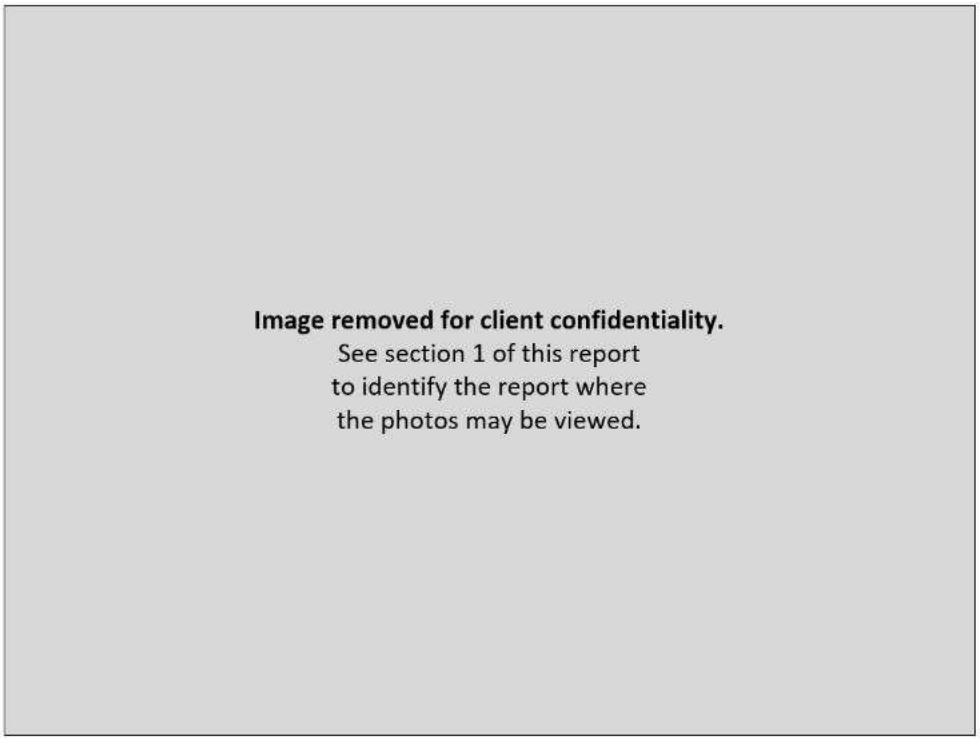

Figure CExx.2: Test setup, front view

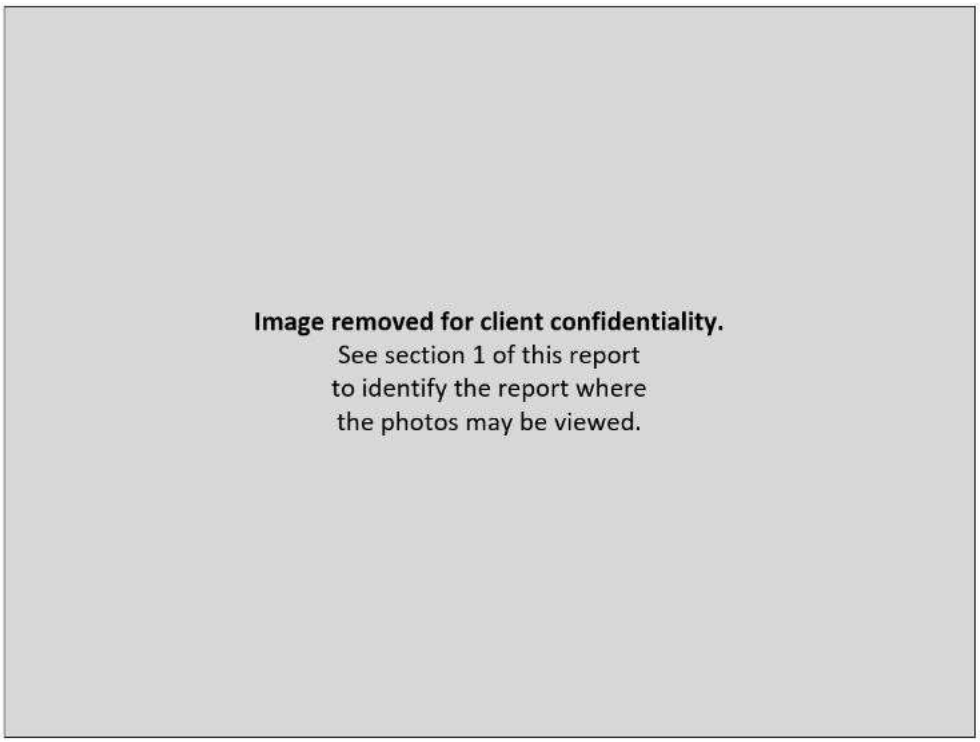

Figure CExx.3: Test setup, side view

This line is the end of the test record.

Concluding Notes

This report stands as an integrated record of the tests performed and must be copied or distributed in its complete form. The reproduction of selected pages or sections separate from the complete report would require specific approval from the manager of the Garmin Compliance Lab.

This is the final page of the report.