Test Report Serial Number:	**45461690 R6.0**
Test Report Date:	**15 February 2022**
Project Number:	**1557**

EMC Test Report - New Certification

Applicant:

Garmin International Inc.
1200 East 151 St
Olathe, KS, 66062
USA

FCC ID:	IC Registration Number
IPH-04247	**1792A-04247**
Product Model Number / HVIN	Product Marketing Name / PMN
A04247	**A04247**

In Accordance With:

CFR Title 47, Part 15 Subpart C (§15.247), Part 15 Subpart B

Digital Transmission System (DTS)

RSS-Gen, RSS-247 Issue 2

Digital Transmissions Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Approved By:

Ben Hewson, President
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Canada

Test Lab Certificate: 2470.01 **IC Registration 3874A-1** **FCC Registration: CA3874**

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1.0 DOCUMENT CONTROL

Revision History				
Samples Tested By:	Art Voss, P.Eng.	**Date(s) of Evaluation:**		1 Oct - 1 Dec, 2021
Report Prepared By:	Art Voss, P.Eng.	**Report Reviewed By:**		Ben Hewson
Report Revision	**Description of Revision**	**Revised Section**	**Revised By**	**Revision Date**
0.1	Draft Release	n/a	Art Voss	4 December, 2022
1.0	Initial Release	n/a	Art Voss	25 January, 2022
2.0	Revised Plot Headings	16.0	Art Voss	2 February, 2022
3.0	Revised Scope	3.0	Art Voss	3 February, 2022
4.0	Added DSS Equipment Class	Cover	Art Voss	9 February, 2022
5.0	Revised BLE Info	7-14	Art Voss	14 February, 2022
6.0	Revised Appendices	D-H	Art Voss	15 February, 2022
	Revised Filing from DSS to DTS	n/a		

2.0 CLIENT AND DUT INFORMATION

Client Information		
Applicant Name	**Garmin International Inc.**	
Applicant Address	1200 East 151 St	
	Olathe, KS, 66062	
	USA	
DUT Information		
Device Identifier(s):	**FCC ID:**	**IPH-04247**
	ISED ID:	**1792A-04247**
Device Model(s) / HVIN:	A04247	
Device Marketing Name / PMN:	A04247	
Test Sample Serial No.:	Conducted: 3383564979, 3383564988 OTA: 3383564975, 3383565083	
Device Type:	Radar Device	
FCC Equipment Class:	Digital Transmission System (DTS)	
ISED Equipment Class:	Wireless Local Area Network Device	
Transmit Frequency Range:	WiFi (DTS): 2412-2462MHz	
	BLE/ANT: 2402-2480MHz	
	Radar: 24.0236GHz - 24.2176GHz	
Manuf. Max. Rated Output Power:	WiFi - Digital Transmission System (DTS): 6.42dBm	
	ANT - Low Power Communication Device Transmitter (DXX): 6.51dBm	
	BLE - Digital Transmission System (DTS): 1.56dBm	
	Radar: -11dBm EIRP	
Antenna Type and Gain:*	BLE/WiFi: -0.4dBi, ANT: -0.5dBi, Radar: 10.5dBi	
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7	
Modulation:	BLE: GMSK	
Modulation:	ANT: GFSK	
DUT Power Source:	3.8VDC Rechargeable Li-Ion	
DUT Dimensions [LxWxH]	L x W x H: 105mm x 40mm x 38mm	
Deviation(s) from standard/procedure:	None	
Modification of DUT:	None	

* Information on antenna gain provided by applicant.

3.0 SCOPE

Preface:

This Certification Report was prepared on behalf of:

Garmin International Inc.

,(the '*Applicant*"), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and ,unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Device:

The Garmin Model/HVIN: A04247 is a radar device consisting of a WiFi, BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and 24GHz radar transmitters/transceivers. The BLE and WiFi transceivers share the same antenna and cannot simultaneously transmit.

Requirement:

The transceivers of this *equipment* are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C, ISED: RSS-Gen, RSS-210 and RSS-247. As per FCC 47 CFR §2.1093 and Health Canada Safety Code 6, an RF Exposure (SAR) evaluation is required for this *Equipment* and the results of the RF Exposure (SAR) evaluation appear in a separate report.

Application:

This is an application for a New Certification.

Scope:

The scope of this investigation is limited to the evaluation and reporting of the wanted and spurious emissions in accordance with the rule parts cited in Normative References section of this report.

4.0 TEST SUMMARY

TEST SUMMARY						
Section	**Description of Test**	**Procedure Reference**	**Applicable Rule Part(s) FCC**	**Applicable Rule Part(s) ISED**	**Test Date**	**Result**
7.0	Duty Cycle and Transmission Duration	ANSI C63.10-2013 KDB 558074 D01v05	n/a	n/a	26 May 2021	n/a
8.0	Occupied Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§2.1049	RSS-Gen (6.7)	26, 29 May 2021	Pass
9.0	DTS Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§15.247(a)(2)	RSS-Gen (6.7) RSS-247 (5.2)(a)	26, 29 May 2021	Pass
10.0	Conducted Power (Fundamental)	ANSI C63.10-2013 KDB 558074 D01v05	§2.1046 §15.247(b)(3)	RSS-Gen (6.12) RSS-247 (5.4)(d)	26, 29 May 2021	Pass
11.0	Power Spectral Density	ANSI C63.10-2013 KDB 558074 D01v05	§15.247(e)	RSS-247 (5.2)(b)	26, 29 May 2021	Pass
12.0	Conducted Tx Spurious Emissions Band Edge	ANSI C63.10-2013 KDB 558074 D01v05	§2.1051 §15.247(d)	RSS-Gen (6.13) RSS-247 (5.5)	30 May 2021	Pass
13.0	Conducted Tx Spurious Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§2.1051 §15.247(d)	RSS-Gen (6.13) RSS-247 (5.5)	30 May 2021	Pass
14.0	Radiated Tx Spurious Emissions And Restricted Band	ANSI C63.4-2014 KDB 558074 D01v05	§15.109 §15.247(d)	RSS-Gen (6.13)	2, 3 June 2021	Pass
15.0	Radiated Rx Spurious Emissions	ANSI C63.4-2014 KDB 558074 D01v05	§15.109	RSS-Gen (7.4) ICES-003(6.2)	2, 3 June 2021	Pass
16.0	Power Line Conducted Emissions	ANSI C63.4-2014	§15.107	ICES-003(6.1)	7 June 2021	Pass

Test Station Day Log					
Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
1 Oct 2021	22.8	15	102.6	**LISN**	**16**
16 Nov 2021	23.5	15	102.8	**EMC**	**10**
17 Nov 2021	21.0	17	103.2	**EMC**	**8, 9, 11**
18 Nov 2021	22.9	17	101.9	**EMC**	**8, 9**
21 Nov 2021	23.0	16	102.9	**EMC**	**11, 12, 13**
29 Nov 2021	10.0	90	102.2	**OATS**	**14, 15**
1 Dec 2021	24.1	18	101.1	**EMC**	**7**

EMC - EMC Test Bench
OATS - Open Area Test Site
LISN - LISN Test Area
IMM - Immunity Test Area
SAC - Semi-Anechoic Chamber
TC - Temperature Chamber
ESD - ESD Test Bench
RI - Radiated Immunity Chamber

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.

Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.

4 December 2022
Date

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. F. VOSS
31327

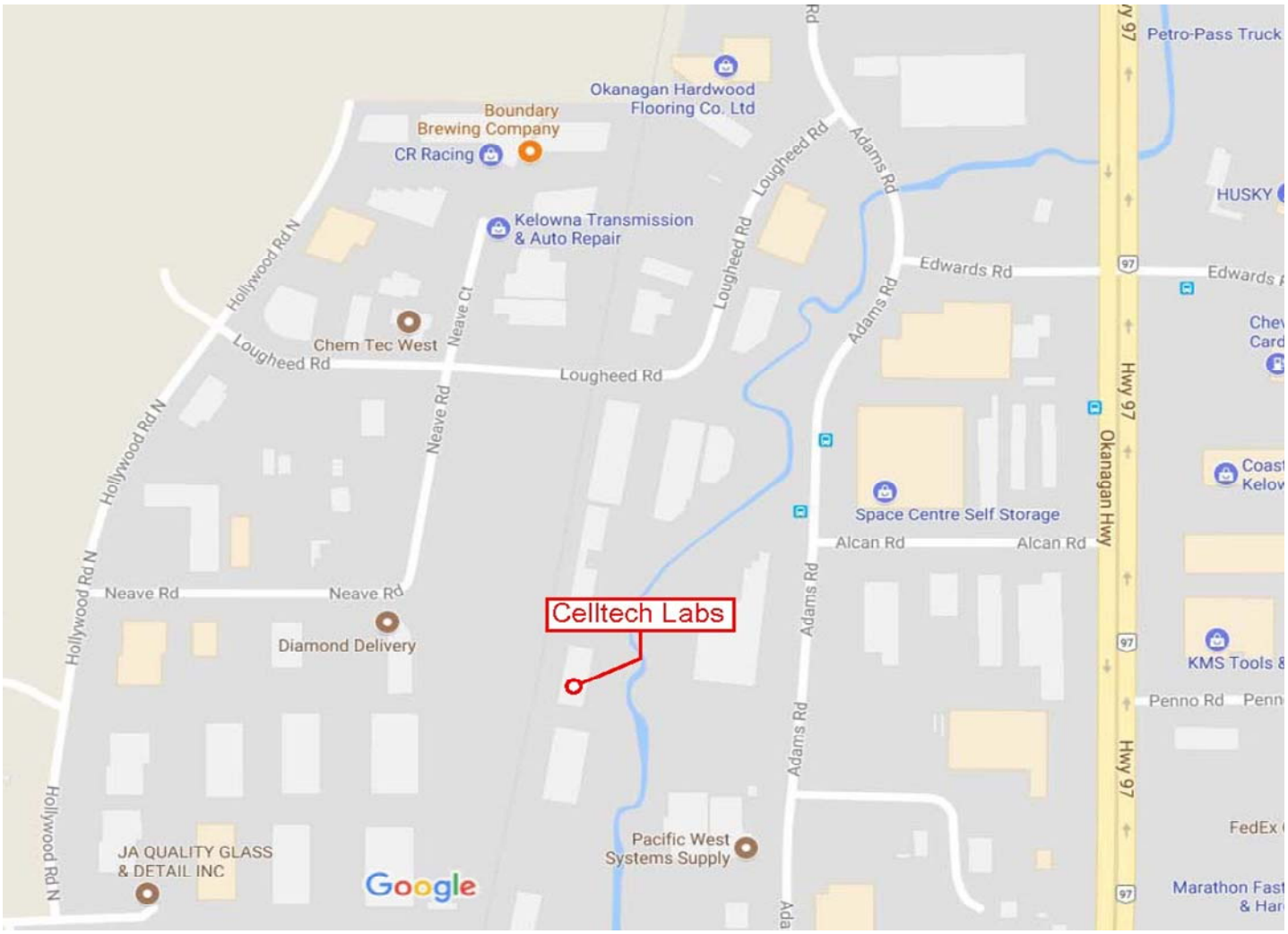
5.0 NORMATIVE REFERENCES

Normative References	
ISO/IEC 17025:2017	General requirements for the competence of testing and calibration laboratories
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
CFR Title 47: Part 2:	Code of Federal Regulations Telecommunication Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR Title 47: Part 15: Sub Part C (15.247)	Code of Federal Regulations Telecommunication Radio Frequency Devices Intentional Radiators
CFR Title 47: Part 15: Subpart B:	Code of Federal Regulations Telecommunication Radio Frequency Devices Unintentional Radiators
FCC KDB 558074 D01v05r02	OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247
ISED RSS-Gen Issue 5: Amendment 1: March 2019	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification General Requirements and Information for the Certification of Radiocommunication Equipment
ISED RSS-247 Issue 2: February 2017	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licensed-Exempt Local Area Network (LE_LAN) Devices

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Innovation, Science and Economic Development Canada under Test Site File Number ISED 3874A. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 DUTY CYCLE AND TRANSMISSION DURATION

See Appendix D for Measurement Plots

Table 7.1 – Summary Duty Cycle Measurement - WiFi

Duty Cycle Measurement Results: WiFi						
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured Duty Cycle [DC_{Meas}] (dBm)	Scale* Factor [CF] (dB)
802.11b	11	2462.00	CCK	1	95.9	0.18
802.11b	11	2462.00	CCK	2	92.4	0.34
802.11b	11	2462.00	DSSS	5.5	83.4	0.79
802.11b	13	2472.00	DSSS	1	95.8	0.19
802.11g	11	2462.00	OFDM	6	96.3	0.16
802.11g	11	2462.00	OFDM	9	94.6	0.24
802.11g	11	2462.00	OFDM	12	88.2	0.55
802.11g	13	2472.00	OFDM	6	96.4	0.16
802.11n	11	2462.00	MCS0	6.5	87.6	0.57
802.11n	13	2472.00	MCS0	6.5	87.6	0.57

*Scale Factor (Correction Factor) [CF] = 10Log(1/[DC_{Meas}])

Table 7.2 – Summary Duty Cycle Measurement - BLE

Duty Cycle Measurement Results: BLE						
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured Duty Cycle [DC_{Meas}] (dBm)	Scale* Factor [CF] (dB)
802.15	18	2442.00	GMSK	-	60.8	2.16

*Scale Factor (Correction Factor) [CF] = 10Log(1/[DC_{Meas}])

8.0 OCCUPIED BANDWIDTH

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2.1), ANSI C63.10 (6.9.3)

General Procedure	
KDB 558074 (8.3.2.1)	**8.3.2.1 General** Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth.
C63.10 (6.9.3)	**6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure** The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth: a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW. b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement. c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2. d) Step a) through step c) might require iteration to adjust within the specified range. e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used. f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

Test Setup	Appendix A - Figure A.1

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above using the 99% Occupied Bandwidth function. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle. The 99% Occupied Bandwidth was measured and recorded and used for the basis for measuring the Conducted Output Power (See Section 10.0) and Power Spectral Density (See Section 11.0).

See Appendix E for Measurement Plots

Table 8.1 – Summary of Occupied Bandwidth Measurements, WiFi

Occupied Bandwidth Results: WiFi						
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured Occupied Bandwidth (MHz)	Emission Designator
802.11b	6	2437.00	CCK	1	13.2	13M2G1D
				2	13.2	13M2G1D
			DSSS	5.5	13.2	13M2G1D
				11	13.2	13M2G1D
802.11g			OFDM	6	16.8	16M8G1D
				9	16.8	16M8G1D
				12	16.7	16M7G1D
				24	16.8	16M8G1D
				24	16.6	16M6G1D
802.11n			MCS0	6.5	16.6	16M6G1D
			MCS4	39	17.8	17M8G1D
			MCS7	65	17.8	17M8G1D
					Result:	Complies

Table 8.2 – Summary of Occupied Bandwidth Measurements, BLE

Occupied Bandwidth Results: BLE						
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured Occupied Bandwidth (MHz)	Emission Designator
802.15	2	2402.00	GMSK	-	1.05	1M04G1D
	18	2442.00		-	1.04	1M04G1D
	39	2480.00		-	1.05	1M04G1D
					Result:	Complies

9.0 DTS BANDWIDTH

Test Procedure	
Normative Reference	FCC 47 CFR §2.1049, §15.247(a)(2), RSS-Gen (6.7), RSS-247 (5.2)(a),
	KDB 558074 (8.2), ANSI C63.10 (11.8.2)

Limits	
47 CFR §15.247(a)(2)	(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions: (2) 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.
RSS-247 (5.2)(a)	5.2 Digital transmission systems DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400 - 2483.5 MHz: a) The minimum 6 dB bandwidth shall be 500 kHz.
KDB 558074 (8.2) C63.10 (11.8.2)	**8.2 Option 2** The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 X RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
Test Setup	**Appendix A Figure A.1**

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as above using the Automatic 6dB Cursor Bandwidth measurement. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle.

See Appendix E for Measurement Plots

Table 9.1 – Summary of 6dB DTS Bandwidth Measurements, WiFi

6dB (DTS) Bandwidth Results: WiFi					
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured DTS Bandwidth (MHz)
802.11b	6	2437.00	CCK	1	8.5
802.11b	6	2437.00	DSSS	5.5	6.4
802.11g	6	2437.00	OFDM	6	16.6
802.11n	6	2437.00	MCS0	6.5	17.8
Result:					Complies

Table 9.2 – Summary of 6dB DTS Bandwidth Measurements, BLE

6dB (DTS) Bandwidth Results: BLE					
Mode	Channel Number	Frequency (MHz)	Modulation	Data Rate (Mbps)	Measured DTS Bandwidth (MHz)
BLE	2	2402.00	GMSK	1	712.0
	18	2442.00			704.0
	39	2480.00			708.0
Result:					Complies

10.0 ANTENNA PORT CONDUCTED POWER

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d),
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.2)

Limits	
47 CFR §15.247(b)(3)	(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.
RSS-247 (5.4)(d)	**5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.)** Devices shall comply with the following requirements, where applicable: d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

See Appendix F for Measurement Plots

Table 10.1 – Summary of Conducted Power Measurements, WiFi

Conducted Power Measurement Results: 802.11										
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Transmit Duty Cycle [DC] (%)	Duty Cycle Correction [CF] (1) (dB)	Measured Power [P_{Meas}] (dBm)	Corrected Power [P_{Corr}] (2) (dBm)	Conducted Limit [P_{Lim}] (dBm)	Conducted Margin (3) (dB)
802.11b	1	2412	CCK	1	95.9	0.18	5.14	5.32	30	24.7
	2	2417		1	95.9	0.18	5.21	5.39	30	24.6
	3	2422		1	95.9	0.18	5.23	5.41	30	24.6
	6	2437		1	95.9	0.18	5.42	5.60	30	24.4
	10	2457		1	95.9	0.18	5.49	5.67	30	24.3
	11	2462		1	95.9	0.18	5.51	5.69	30	24.3
	11	2462	DSSS	5.5	83.4	0.79	3.20	3.99	30	26.0
	11	2462		11	83.4	0.79	4.37	5.16	30	24.8
802.11g	11	2462	OFDM	6	96.3	0.16	6.19	6.35	30	23.6
	11	2462		9	94.6	0.24	6.04	6.28	30	23.7
	11	2462		12	88.2	0.55	5.54	6.09	30	23.9
	11	2462		24	88.2	0.55	4.82	5.37	30	24.6
	11	2462		54	88.2	0.55	3.66	4.21	30	25.8
802.11n	11	2462	MCS0	6.5	87.6	0.57	5.30	5.87	30	24.1
	11	2462	MCS4	36	87.6	0.57	3.08	3.65	30	26.3
	11	2462	MCS7	65	87.6	0.57	2.50	3.07	30	26.9
									Result:	Complies

(1) Correction Factor [CF] = 10Log(1/[DC])

(2) Corrected Power [P_{Corr}] = P_{Meas} + CF

(3) Conducted Margin = P_{Limit} - P_{Corr}

See Appendix F for Measurement Plots

Table 10.2 – Summary of Conducted Power Measurements, BLE

Conducted Power Measurement Results: 802.15 (BLE)										
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Transmit Duty Cycle [DC] (%)	Duty Cycle Correction [CF] (1) (dB)	Measured Power [P_{Meas}] (dBm)	Corrected Power [P_{Corr}] (2) (dBm)	Conducted Limit [P_{Lim}] (dBm)	Conducted Margin (3) (dB)
BLE	2	2402	GMSK	-	60.8	2.16	-1.46	0.70	30	29.3
	18	2442			60.8	2.16	-0.98	1.18	30	28.8
	39	2480			60.8	2.16	-0.93	1.23	30	28.8
	18	2442			60.8	2.16	-0.60	1.56	30	28.4
	39	2480			60.8	2.16	-0.74	1.42	30	28.6
									Result:	Complies

(1) Correction Factor [CF] = 10Log(1/[DC])

(2) Corrected Power [P_{Corr}] = P_{Meas} + CF

(3) Conducted Margin = P_{Limit} - P_{Corr}

11.0 POWER SPECTRAL DENSITY

Test Procedure	
Normative Reference	FCC 47 CFR §15.247(e), RSS-247 (5.2)(b),
	KDB 558074 (10.3), ANSI C63.10 (11.10.3)

Limits	
47 CFR §15.247(e)	(e) 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
RSS-247 (5.2)(b)	b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).
KDB 558074 (10.3) C63.10 (11.10.3)	**Method AVGPSD-1** (trace averaging with EUT transmitting at full power throughout each sweep) This procedure may be used when the maximum (average) conducted output power was used to demonstrate compliance to the output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has an RMS power averaging detector, it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously (duty cycle ≥ 98 %); otherwise sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter off time is to be considered). a) Set instrument center frequency to DTS channel center frequency. b) Set span to at least 1.5 X OBW. c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz. . d) Set VBW ≥ 3 X RBW. e) Detector = RMS f) Ensure that the number of measurement points in the sweep ≥ 2 X span/RBW. g) Sweep time = auto couple. h) Employ trace averaging (RMS) mode over a minimum of 100 traces. i) Use the peak marker function to determine the maximum amplitude level. j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).
Test Setup	**Appendix A Figure A.1**

Measurement Procedure
The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above. Number of Sweep Points ≥ 2 X Span / RBW = 2 X (1.5MHz / 3kHz) = 1000, the SA was configured for 1001 Points. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle. The Power Spectral Density was measured and recorded.

See Appendix F for Power Density Measurement Plots

Table 11.1 – Summary of Power Spectral Density Measurements, WiFi

Power Spectral Density Measurement Results: WiFi										
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured PSD [PSD_{Meas}] (dBm)	Transmit Duty Cycle [DC] (%)	Duty Cycle Correction [CF] (1) (dB)	Corrected PSD [PSD_{Corr}] (2) (dBm)	PSD Limit [PSD_{Lim}] (dBm)	Margin (3) (dB)
802.11b	11	2462	CCK	1.0	-8.090	95.9	0.18	-7.91	10	17.9
802.11g	11	2462	OFDM	6.0	-10.860	92.4	0.34	-10.52	10	20.5
802.11n	11	2462	MCS0	6.5	-10.860	87.6	0.57	-10.29	10	20.3
									Result:	Complies

(1) Duty Cycle Correction Factor [CF] = 10Log(1/[DC])

(2) Corrected PSD [PSDCorr] = [PSDMeas] + [CF]

(3) Margin = [PSD_{Limit}] - [PSD_{Corr}]

See Appendix F for Power Density Measurement Plots

Table 11.2 – Summary of Power Spectral Density Measurements, BLE

Power Spectral Density Measurement Results: BLE										
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured PSD [PSD_{Meas}] (dBm)	Transmit Duty Cycle [DC] (%)	Duty Cycle Correction [CF] (1) (dB)	Corrected PSD [PSD_{Corr}] (2) (dBm)	PSD Limit [PSD_{Lim}] (dBm)	Margin (3) (dB)
BLE	2	2402	GMSK	-	-13.910	60.8	2.16	-11.75	8	19.7
BLE	18	2442	GMSK	-	-14.190	60.8	2.16	-12.03	8	20.0
BLE	39	2480	GMSK	-	-11.920	60.8	2.16	-9.76	8	17.8
									Result:	Complies

(1) Duty Cycle Correction Factor [CF] = 10Log(1/[DC])

(2) Corrected PSD [PSDCorr] = [PSDMeas] + [CF]

(3) Margin = [PSD_{Limit}] - [PSD_{Corr}]

12.0 CONDUCTED SPURIOUS EMISSIONS -BAND EDGE

Test Procedure	
Normative Reference	FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5),
	KDB 558074 (11.3), ANSI C63.10 (11.11.3)

Limits	
47 CFR §15.247(d)	(d) 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.
RSS-247 (5.5)	**5.5 Unwanted emissions** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required. d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.
KDB 558074 (11.3) C63.10 (11.11.3)	**11.1 General** The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions: b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc). **11.2 Reference level measurement** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 X *DTS bandwidth.* c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 X RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference

See Appendix G for Measurement Plots

Table 12.1 – Summary of Spurious Emission Measurements – Band Edge, WiFi

Band Edge Measurement Results: 802.11									
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Emission Power [P_{Em}] (dBm)	Fundamental Power [P_{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
802.11g	1	2412.00	OFDM	6	-58.12	-3.50	54.62	30	24.6
	11	2462.00			-61.57		58.07		28.1
							Result:		Complies

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]
Margin = Attenuation - Limit
* Information regarding antenna gain provided by applicant

Table 12.2 – Summary of Spurious Emission Measurements – Band Edge, BLE

Band Edge Measurement Results: BLE									
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Emission Power [P_{Em}] (dBm)	Fundamental Power [P_{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
BLE	2	2402.00	GMSK	1	-59.02	0.70	59.72	30	29.7
	39	2480.00			-59.18		59.88		29.9
							Result:		Complies

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]
Margin = Attenuation - Limit
* Information regarding antenna gain provided by applicant

13.0 CONDUCTED SPURIOUS EMISSIONS

Test Procedure	
Normative Reference	FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5), KDB 558074 (11.3), ANSI C63.10 (11.11.3)

Limits	
47 CFR §15.247(d)	(d) 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.
RSS-247 (5.5)	**5.5 Unwanted emissions** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required. d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.
KDB 558074 (11.3) C63.10 (11.11.3)	**11.1 General** The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions: b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc). **11.2 Reference level measurement** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 X *DTS bandwidth.* c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 X RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference

See Appendix G for Measurement Plots

Table 13.1 – Summary of Conducted Spurious Emissions, WiFi

Spurious Domain Emissions: WiFi								
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Emission Frequency (MHz)	Measured Emission [P_{Meas}] (dBm)	Emission Limit [P_{Lim}] (dBm)	Margin
802.11g	1	2412	OFDM	6.0	ND	ND	30	n/a
						Result:	Complies	

ND: No Emissions Detected

Table 13.2 – Summary of Conducted Spurious Emissions, BLE

Spurious Domain Emissions: BLE								
Mode	Channel Number	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Emission Frequency (MHz)	Measured Emission [P_{Meas}] (dBm)	Emission Limit [P_{Lim}] (dBm)	Margin
BLE	18	2442	GMSK	1.0	ND	ND	30	n/a
						Result:	Complies	

ND: No Emissions Detected

14.0 RADIATED TX SPURIOUS EMISSIONS, RESTRICTED BAND

Test Procedure	
Normative Reference	FCC 47 CFR §2.1051, §15.247(d), §15.205(a), §15.205(c), §15.209(a)
	KDB 558074 (8.6), ANSI C63.10 (11.12)

Limits

47 CFR §15.247(d)

(d) 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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)).

47 CFR §15.209(a)

§15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)
0.009 - 0.490	2400/F (kHz) @300m
0.490 - 1.705	24000/F (kHz) @30m
1.705 - 30	30 @ 30m
30 - 88	100 @3m
88 - 216	150 @3m
216 - 960	200 @3m
Above 960	500 @3m

See Appendix H Radiated Tx Spurious Measurement Plots

Table 14.1 – Summary of Radiated Simultaneous Tx Spurious Emissions, WiFi + ANT + Radar

Summary of Radiated Simultaneous Tx Emissions WiFi + ANT + Radar									
Measured Frequency Range (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E_{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L_C] (dB)	Amplifier Gain [G_A] (dB)	Corrected Emission [E_{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)
30-1000MHz	Horizontal	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	46.0	n/a
30-1000MHz	Vertical	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	43.5	n/a
1 - 3GHz	Horizontal	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	n/a
1 - 3GHz	Vertical	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	n/a
3-13GHz	Horizontal	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	n/a
3-13GHz	Vertical	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	n/a
13-18GHz	Horizontal	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	n/a
13-18GHz	Vertical	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	n/a
18-22GHz	Horizontal	ND	ND (1)	43.05	18.83	0.00 (3)	ND	54.0	n/a
18-22GHz	Vertical	ND	ND (1)	43.05	18.83	0.00 (3)	ND	54.0	n/a
22 -25GHz	Horizontal	ND	ND (1)	42.96	21.86	0.00 (3)	ND	54.0	n/a
22-25GHz	Vertical	ND	ND (1)	42.96	21.86	0.00 (3)	ND	54.0	n/a
							Results:	**Complies**	

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit
(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
(3) External Amplier not used

$E_{Corr} = E_{Meas} + ACF + L_C - G_A$

See Appendix H Radiated Tx Spurious Measurement Plots

Table 14.2 – Summary of Radiated Simultaneous Tx Spurious Emissions, BLE + ANT + Radar

Summary of Radiated Simultaneous Tx Emissions BLE + ANT + Radar									
Measured Frequency Range (MHz)	Antenna Polarization	Emission Frequency	Measured Emission [E_{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L_C] (dB)	Amplifier Gain [G_A] (dB)	Corrected Emission [E_{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)
30-1000MHz	Horizontal	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	46.0	n/a
30-1000MHz	Vertical	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	43.5	n/a
1 - 3GHz	Horizontal	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	n/a
1 - 3GHz	Vertical	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	n/a
3-13GHz	Horizontal	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	n/a
3-13GHz	Vertical	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	n/a
13-18GHz	Horizontal	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	n/a
13-18GHz	Vertical	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	n/a
18-22GHz	Horizontal	ND	ND (1)	43.05	18.83	0.00 (3)	ND	54.0	n/a
18-22GHz	Vertical	ND	ND (1)	43.05	18.83	0.00 (3)	ND	54.0	n/a
22 -25GHz	Horizontal	ND	ND (1)	42.96	21.86	0.00 (3)	ND	54.0	n/a
22-25GHz	Vertical	ND	ND (1)	42.96	21.86	0.00 (3)	ND	54.0	n/a
							Results:	**Complies**	

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit
(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
(3) External Amplier not used

$E_{Corr} = E_{Meas} + ACF + L_C - G_A$

15.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure	
Normative Reference	**FCC 47 CFR §15.109, ICES-003(6.2)** **ANSI C63.4:2014**

Limits	
47 CFR §15.109	(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values: 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m
ICES-003(6.2.1)	6.2.1 - Radiated Emissions Limits Below 1 GHz Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres. 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m

Test Setup	Appendix A Figure A.2

Measurement Procedure
The DUT was set up as per ANSI C63.4:2014. Emissions were scanned between 30MHz and 1000MHz. The turntable was rotated 360 degrees and the antenna was elevated to 4m to optimize the measured emissions.

See Appendix H Radiated Rx Spurious Measurement Plots

Table 15.1 – Summary of Radiated Rx Spurious Emissions

Measurement Results				
Frequency Range	**Antenna Polarization**	**Measured Emission [E_{Meas}] (dBm)**	**Limit e.r.p./e.r.i.p. [A_L] (dBuV/m)**	**Margin (dB)**
30-1000MHz	Horizontal	ND	-	**n/a**
1 - 18GHz		ND	-	**n/a**
30-1000MHz	Vertical	ND	-	**n/a**
1 - 18GHz		ND	-	**n/a**
		Results:	**Complies**	

ND: No emissions detected above ambient or within 20dB of the limit

16.0 POWER LINE CONDUCTED EMISSIONS

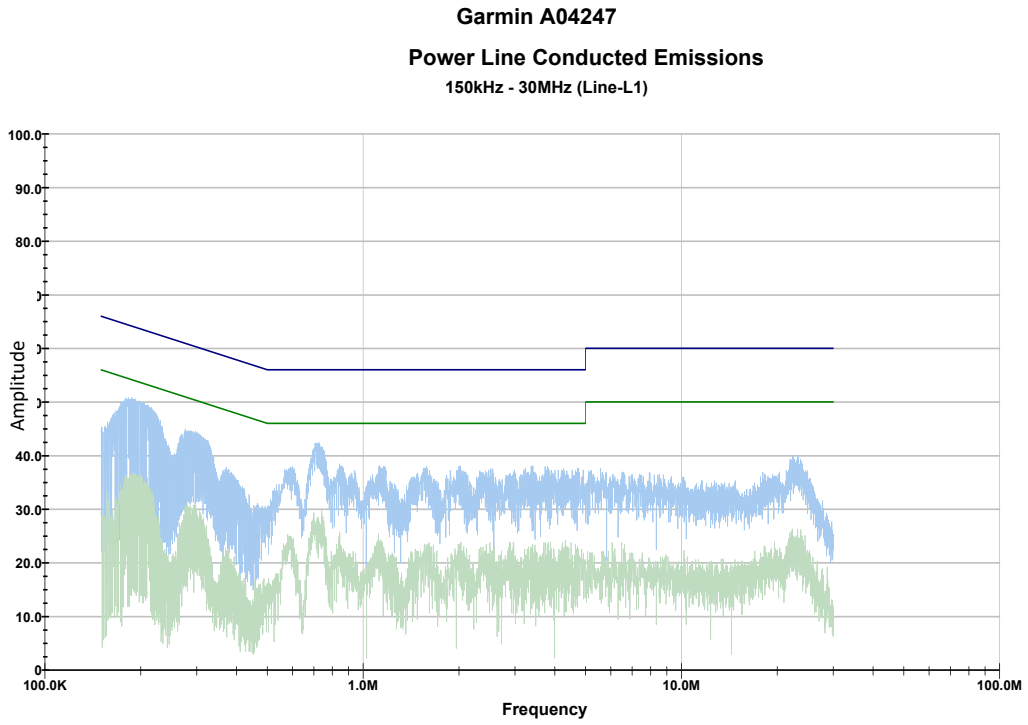
Test Procedure	
Normative Reference	**FCC 47 CFR §15.107, ICES-003(6.1)** **ANSI C63.4-2014**

Limits	
47 CFR §15.107	(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logrithm of the frequency 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average
ICES-003(6.1)	6.1 - AC Power Line Conducted Emissions Limits Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 2. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logrithm of the 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average

Test Setup	**Appendix A** **Figure A.7**

Plot 16.1 – Power Line Conducted Emissions, Line 1

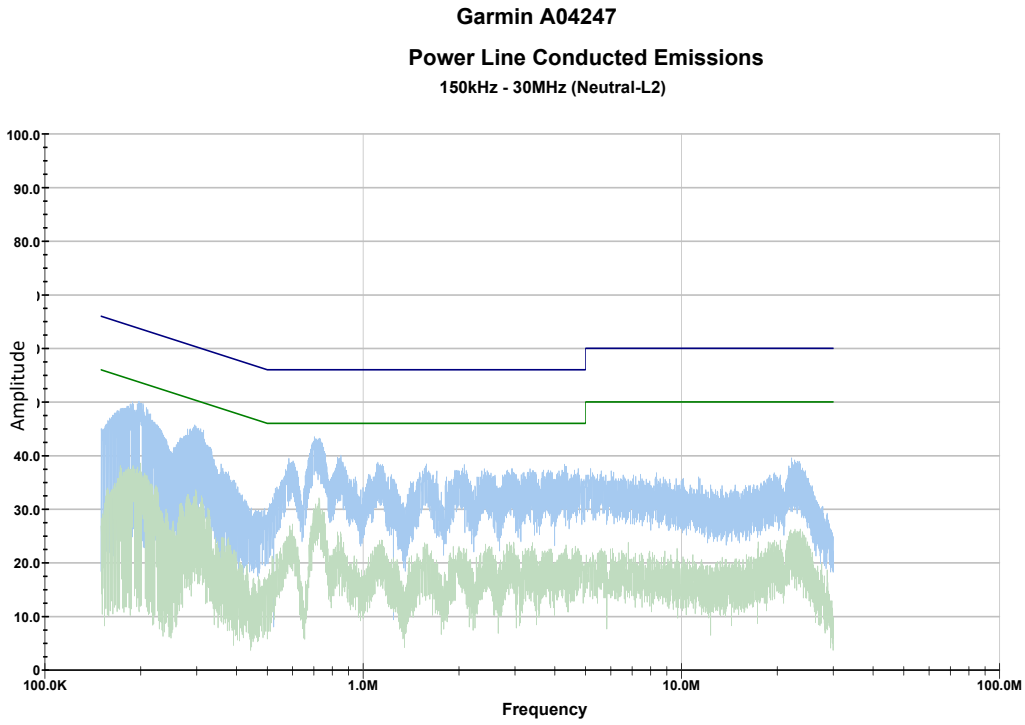
Power Line Conducted Emissions - L1



Green Limit:	Green Trace:	Frequency Range:
Quasi Peak	**Peak**	**0.15 - 30** MHz
Blue Limit:	Blue Trace:	Measured Emission:
Average	**RMS**	

Plot 16.2 – Power Line Conducted Emissions, Line 2

Power Line Conducted Emissions - L2



Blue Limit: **Quasi Peak**	Blue Trace: **Peak**	Frequency Range: **0.15 - 30** MHz
Green Limit: **Average**	Green Trace: **RMS**	Measured Emission:

Table 16.1 – Summary of Power Line Conducted Emissions – L1

Summary of Power Line Conducted Tx Emissions											
Measured Frequency Range (MHz)	Channel Frequency (MHz)	LISN Port	Emission Frequency [f_{Emm}]	Measured Emission [E_{Meas}] (dBuV)	Detector*	Insertion Loss [L_{LISN}] (dB)	Cable Loss [L_C] (dB)	Amplifier Gain [G_A] (dB)	Corrected Emission [E_{Corr}] (dBuV)	Limit (dBuV)	Margin (dB)
150kHz - 30MHz	2442.0	L1	658.90 kHz	45.95	Peak	0.40	0.25	0.00 (3)	46.6 (2)	56.0	**9.4**
			1.38 MHz	38.16		0.30	0.26		38.7 (2)	56.0	**17.3**
			10.74 MHz	44.73		0.30	0.26		45.3 (2)	60.0	**14.7**
			11.15 MHz	44.32		0.30	0.27		44.9 (2)	60.0	**15.1**
			663.10 kHz	38.71	Average	0.40	0.25		39.4 (2)	46.0	**6.6**
			1.40 MHz	28.66		0.30	0.26		29.2 (2)	46.0	**16.8**
			10.83 MHz	32.83		0.30	0.26		33.4 (2)	50.0	**16.6**
			11.10 MHz	33.42		0.30	0.27		34.0 (2)	50.0	**16.0**
									Results:	**Complies**	

* In accordance with FCC §15.35 and ANSI C63.4, a Peak detector may be used to demonstrate compliance to Quasi-Peak limits provided the Resolution Bandwidth (RBW) is equal to or greater than Quasi-Peak bandwidth. The Detector RBW employed was ≥ 9kHz.
(2) LISN Insertion Loss, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
(3) External Amplier not used
$E_{Corr} = E_{Meas} + L_{LISN} + L_C - G_A$
Class B QP Limit = 56 - 20Log (f_{Emm}/500) for f_{Emm} = 150kHz to 500kHz
Class B Avg Limit = 46 - 20Log (f_{Emm}/500) for f_{Emm} = 150kHz to 500kHz
Class A QP Limit = 79dBuV for f_{Emm} = 150kHz to 500kHz
Class A Avg Limit = 66dBuV for f_{Emm} = 150kHz to 500kHz
Margin = Limit - E_{corr}

Table 16.1 – Summary of Power Line Conducted Emissions – L2

Summary of Power Line Conducted Tx Emissions											
Measured Frequency Range (MHz)	Channel Frequency (MHz)	LISN Port	Emission Frequency [f_{Emm}]	Measured Emission [E_{Meas}] (dBuV)	Detector*	Insertion Loss [L_{LISN}] (dB)	Cable Loss [L_C] (dB)	Amplifier Gain [G_A] (dB)	Corrected Emission [E_{Corr}] (dBuV)	Limit (dBuV)	Margin (dB)
150kHz - 30MHz	2442.0	L2	652.80 kHz	45.18	Peak	0.40	0.25	0.00 (3)	45.8 (2)	56.0	**10.2**
			1.38 MHz	37.06		0.30	0.26		37.6 (2)	56.0	**18.4**
			10.72 MHz	45.03		0.30	0.26		45.6 (2)	60.0	**14.4**
			11.26 MHz	43.42		0.30	0.27		44.0 (2)	60.0	**16.0**
			662.04 kHz	38.99	Average	0.40	0.25		39.6 (2)	46.0	**6.4**
			1.38 MHz	28.56		0.30	0.26		29.1 (2)	46.0	**16.9**
			10.75 MHz	32.43		0.30	0.26		33.0 (2)	50.0	**17.0**
			11.06 MHz	34.02		0.30	0.27		34.6 (2)	50.0	**15.4**
									Results:	**Complies**	

* In accordance with FCC §15.35 and ANSI C63.4, a Peak detector may be used to demonstrate compliance to Quasi-Peak limits provided the Resolution Bandwidth (RBW) is equal to or greater than Quasi-Peak bandwidth. The Detector RBW employed was ≥ 9kHz.
(2) LISN Insertion Loss, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
(3) External Amplier not used
$E_{Corr} = E_{Meas} + L_{LISN} + L_C - G_A$
Class B QP Limit = 56 - 20Log (f_{Emm}/500) for f_{Emm} = 150kHz to 500kHz
Class B Avg Limit = 46 - 20Log (f_{Emm}/500) for f_{Emm} = 150kHz to 500kHz
Class A QP Limit = 79dBuV for f_{Emm} = 150kHz to 500kHz
Class A Avg Limit = 66dBuV for f_{Emm} = 150kHz to 500kHz
Margin = Limit - E_{corr}

APPENDIX A – TEST SETUP DRAWINGS

Table A.1 – Conducted Measurement Setup

Equipment List				
Asset Number	**Manufacturer**	**Model Number**	**Serial Number**	**Description**
00241	R&S	FSU40	100500	Spectrum Analyzer
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable

Figure A.1 – Test Setup – Conducted Measurements

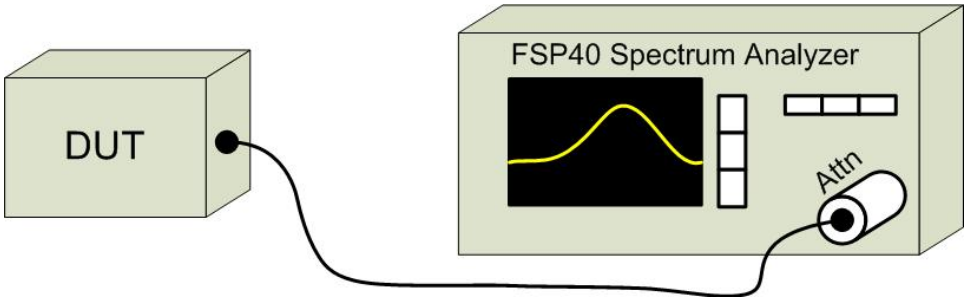


Table A.2 – Radiated Emissions Measurement Equipment

Equipment List				
Asset Number	**Manufacturer**	**Model Number**	**Serial Number**	**Description**
00050	Chase	CBL-6111A	1607	Bilog Antenna
00034	ETS	3115	6267	Double Ridged Guide Horn
00035	ETS	3115	6276	Double Ridged Guide Horn
00085	EMCO	6502	9203-2724	Loop Antenna
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00162	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00166	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00333	HP	85685A	3010A01095	RF Preselector
00049	HP	85650A	2043A00162	Quasi-peak Adapter
00051	HP	8566B	2747A05510	Spectrum Analyzer
00241	R&S	FSU40	100500	Spectrum Analyzer
00265	Miteq	JS32-00104000-58-5P	1939850	Microwave L/N Amplifier
00071	EMCO	2090	9912-1484	Multi-Device Controller
00072	EMCO	2075	0001-2277	Mini-mast
00073	EMCO	2080	0002-1002	Turn Table
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable
00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable
00275	TMS	LMR400	n/a	25m Cable
00278	TILE	34G3	n/a	TILE Test Software

Figure A.2 – Test Setup Radiated Measurements 9kHzMHz – 30MHz

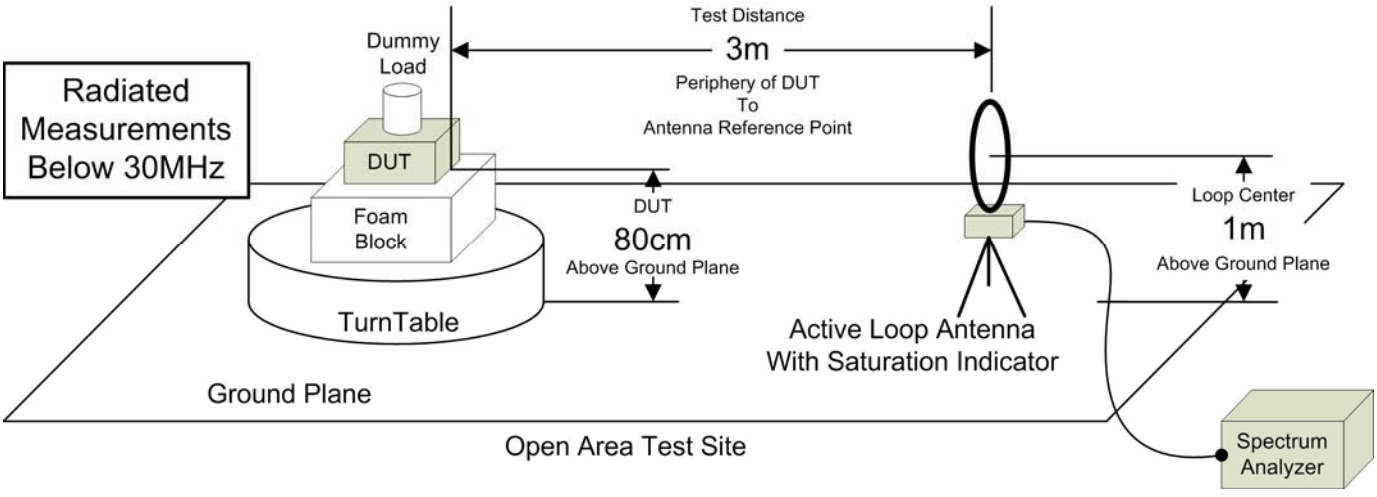


Figure A.3 – Test Setup Radiated Measurements 30MHz – 1GHz

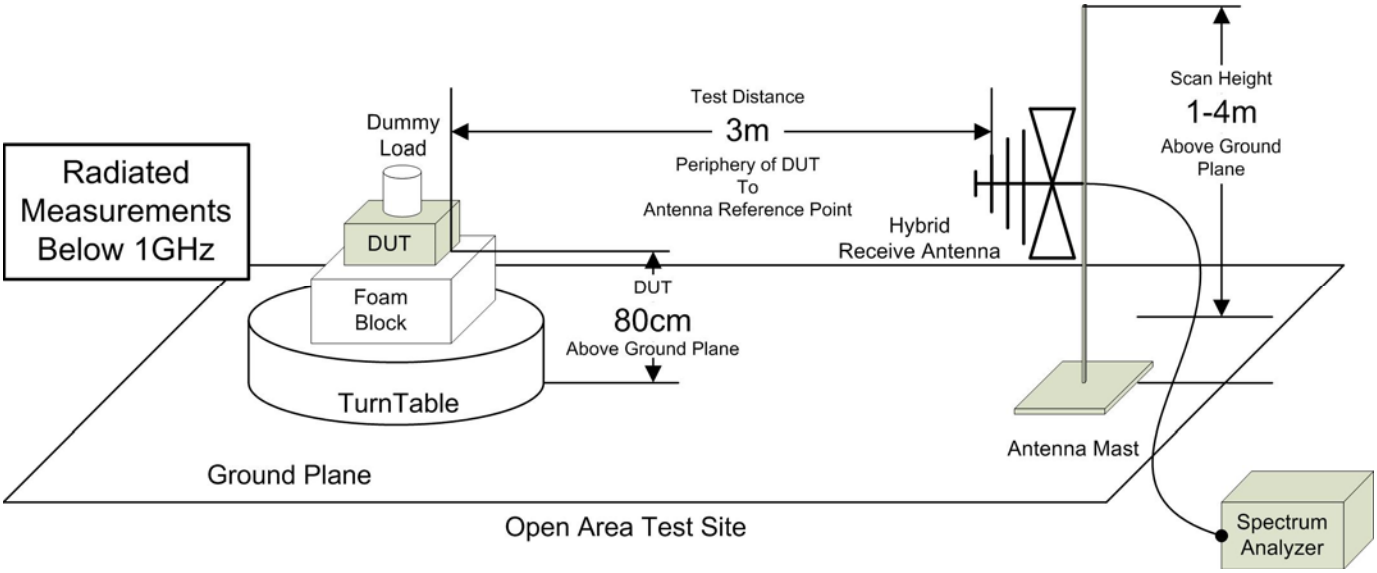


Figure A.4 – Test Setup Radiated Measurements 30MHz – 1GHz, Signal Substitution

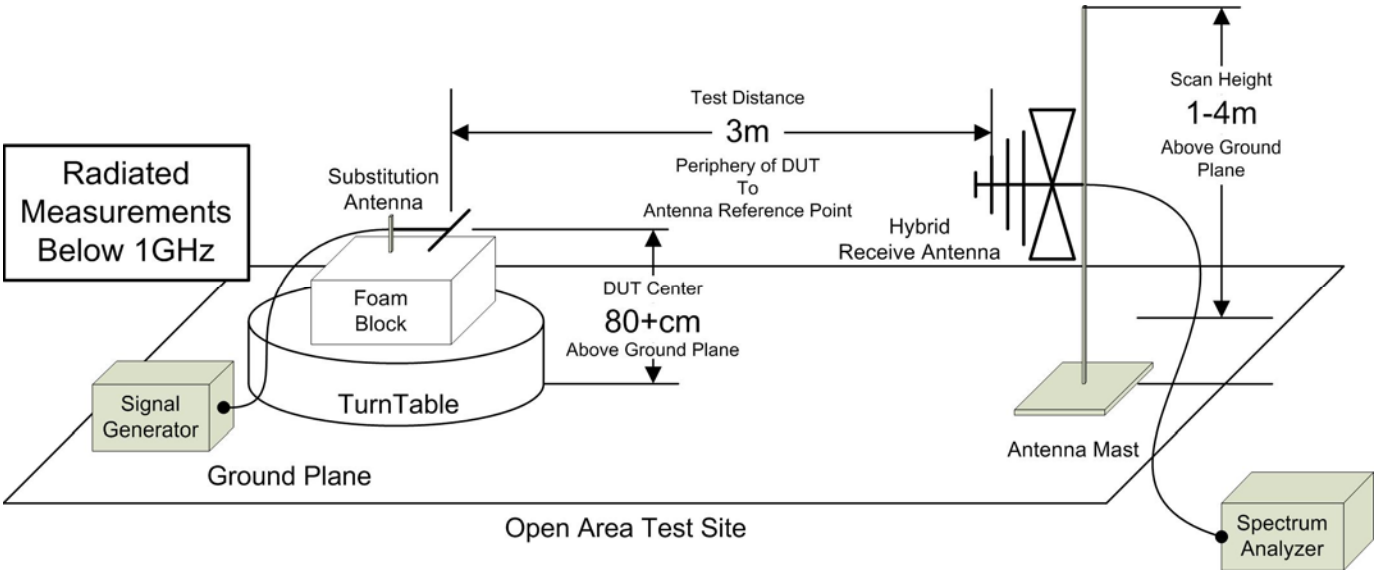


Figure A.5 – Test Setup Radiated Measurements 1 – 18GHz,

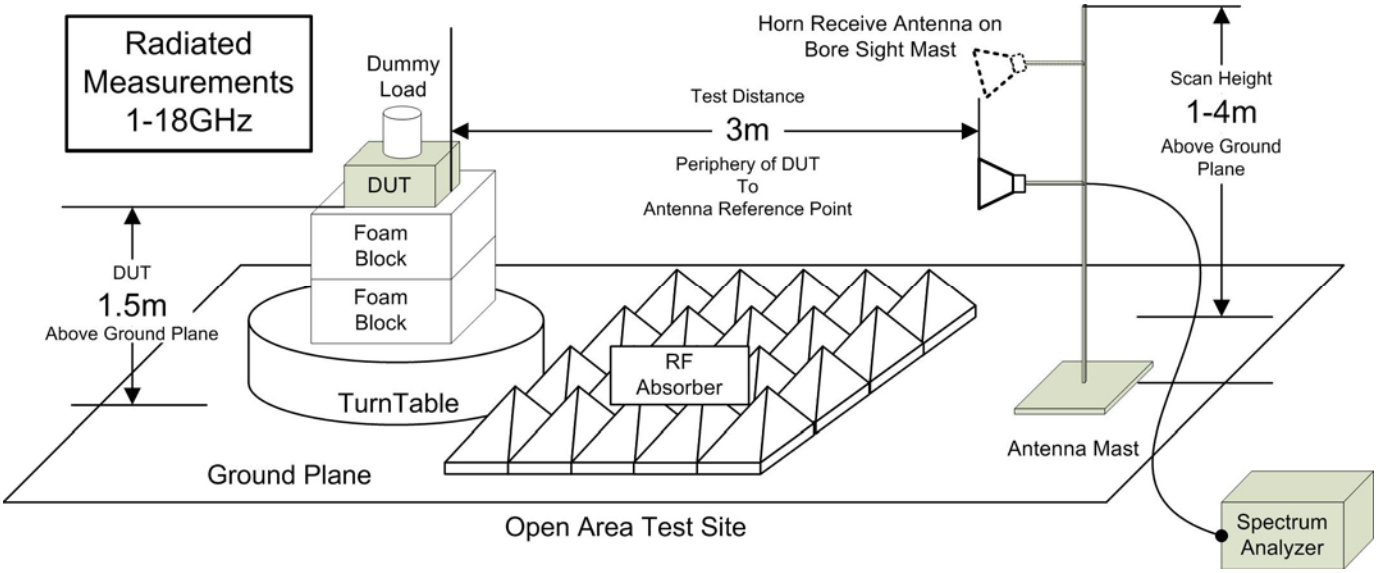


Figure A.6 – Test Setup Radiated Measurements 18 – 26.5GHz,

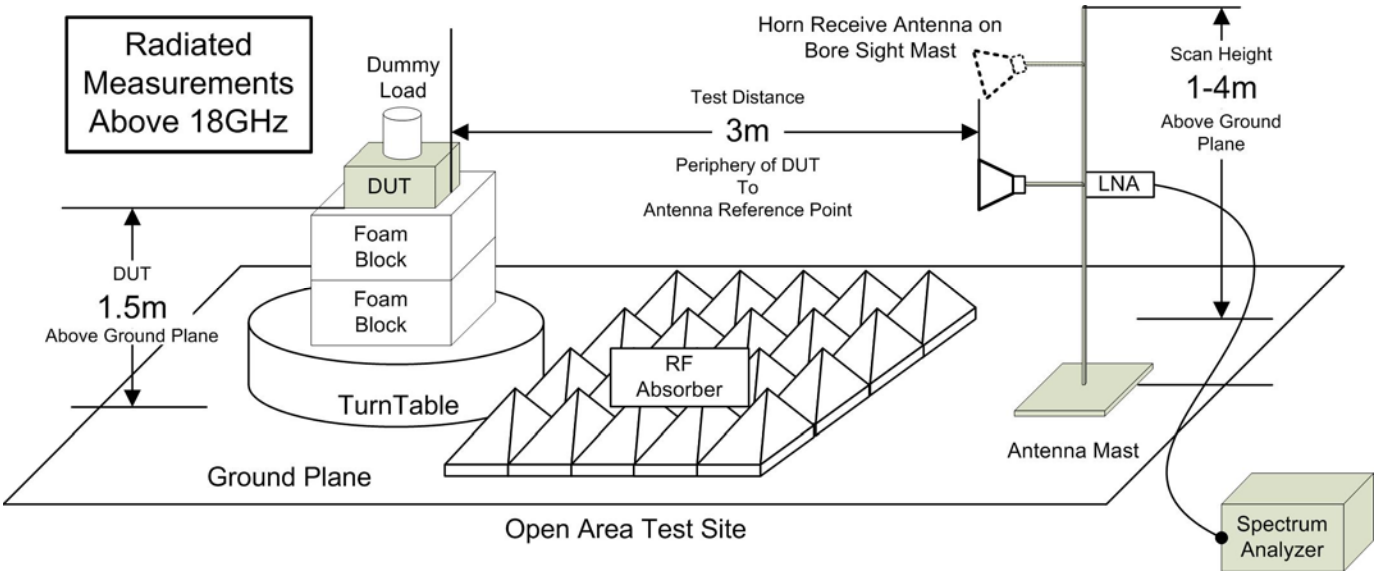


Table A.3 – Setup – Conducted Emissions Equipment List

Equipment List				
Asset Number	**Manufacturer**	**Model Number**	**Serial Number**	**Description**
00333	HP	85685A	3010A01095	RF Preselector
00049	HP	85650A	2043A00162	Quasi-peak Adapter
00051	HP	8566B	2747A05510	Spectrum Analyzer
00223	HP	8901A	3749A07154	Modulation Analyzer
00257	Com-Power	LI-215A	191934	LISN
00276	TMS	LMR400	n/a	4m Cable

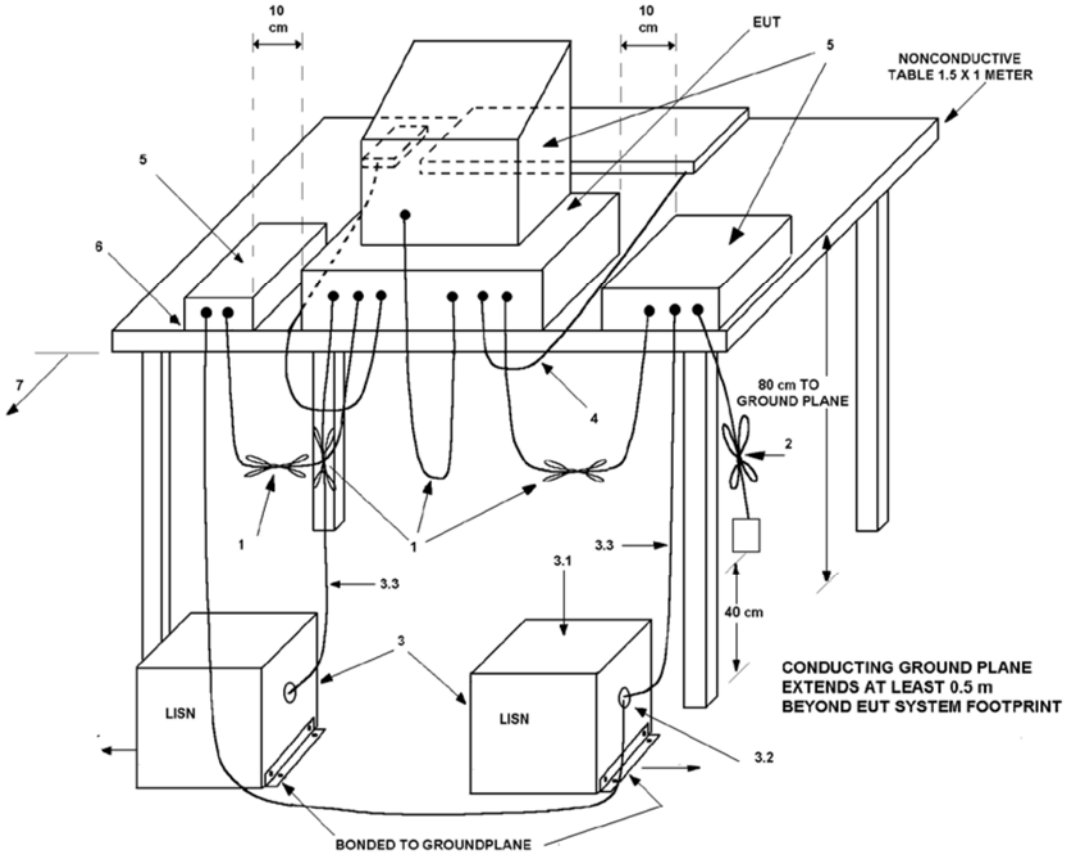


Figure A.7 – Test Setup – Line Conducted Emissions Measurements

APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List							
Asset Number	Manufacturer	Model Number	Serial Number	Description	Last Calibrated	Calibration Interval	Calibration Due
00050	Chase	CBL-6111A	1607	Bilog Antenna	3 Jan 2019	Triennial	3 Jan 2022
00034	ETS	3115	6267	Double Ridged Guide Horn	26 Nov 2018	Triennial	26 Nov 2021
00035	ETS	3115	6276	Double Ridged Guide Horn	22 Mar 2019	Triennial	21 Mar 2022
00085	EMCO	6502	9203-2724	Loop Antenna	11 Jun 2019	Triennial	11 Jun 2022
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz	NCR	n/a	NCR
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz	NCR	n/a	NCR
00345	HP	11970U	2332A00174	Harmonic Mixer 40-60GHz	COU	n/a	COU
00346	Dorado	GH-19		Standard Gain Horn 40-60GHz	NCR	n/a	NCR
00347	HP	11970V	2521A01347	Harmonic Mixer 50-75GHz	COU	n/a	COU
00348	Dorado	GH-15	99005	Standard Gain Horn 50-75GHz	NCR	n/a	NCR
00349	HP	11970W	2521A01604	Harmonic Mixer 75-110GHz	COU	n/a	COU
00350	Dorado	GH-10	99001	Standard Gain Horn 75-110GHz	NCR	n/a	NCR
00333	HP	85685A	3010A01095	RF Preselector	23 Jun 2020	Triennial	30 Jun 2023
00049	HP	85650A	2043A00162	Quasi-peak Adapter	23 Jun 2020	Triennial	23 Jun 2023
00051	HP	8566B	2747A05510	Spectrum Analyzer	23 Jun 2020	Triennial	23 Jun 2023
00241	R&S	FSU40	100500	Spectrum Analyzer	10 Aug 2021	Triennial	10 Aug 2024
00257	Com-Power	LI-215A	191934	LISN	27 Dec 2021	Triennial	27 Dec 2024
00071	EMCO	2090	9912-1484	Multi-Device Controller	n/a	n/a	n/a
00072	EMCO	2075	0001-2277	Mini-mast	n/a	n/a	n/a
00073	EMCO	2080	0002-1002	Turn Table	n/a	n/a	n/a
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable	COU	n/a	COU
00264	Koaxis	KP10-7.00M-TD	264	7m Armoured Cable	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a	NCR

NCR: No Calibration Required
COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

CISPR 16-4 Measurement Uncertainty (U_{LAB})	
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence interval using a coverage factor of k=2	
Radiated Emissions 30MHz - 200MHz	
U_{LAB} = 5.14dB U_{CISPR} = 6.3dB	
Radiated Emissions 200MHz - 1000MHz	
U_{LAB} = 5.90dB U_{CISPR} = 6.3dB	
Radiated Emissions 1GHz - 6GHz	
U_{LAB} = 4.80dB U_{CISPR} = 5.2dB	
Radiated Emissions 6GHz - 18GHz	
U_{LAB} = 5.1dB U_{CISPR} = 5.5dB	
Power Line Conducted Emissions 9kHz to 150kHz	
U_{LAB} = 2.96dB U_{CISPR} = 3.8dB	
Power Line Conducted Emissions 150kHz to 30MHz	
U_{LAB} = 3.12dB U_{CISPR} = 3.4dB	
If the calculated uncertainty U_{lab} is **less** than U_{CISPR} then:	
1	Compliance is deemed to occur if **NO** measured disturbance exceeds the disturbance limit
2	Non-Compliance is deemed to occur if **ANY** measured disturbance **EXCEEDS** the disturbance limit
If the calculated uncertainty U_{lab} is **greater** than U_{CISPR} then:	
3	Compliance is deemed to occur if **NO** measured disturbance, increased by (U_{lab} - U_{CISPR}), exceeds the disturbance limit
4	Non-Compliance is deemed to occur if **ANY** measured disturbance, increased by (U_{lab} - U_{CISPR}), **EXCEEDS** the disturbance limit

Other Measurement Uncertainties (U_{LAB})
RF Conducted Emissions 9kHz - 40GHz
U_{LAB} = 1.0dB U_{CISPR} = n/a
Frequency/Bandwidth 9kHz - 40GHz
U_{LAB} = 0.1ppm U_{CISPR} = n/a
Temperature
U_{LAB} = 1^{O}C U_{CISPR} = n/a

END OF REPORT

APPENDIX D – DUTY CYCLE PLOTS

APPENDIX E – OCCUPIED / DTS BANDWIDTH MEASUREMENT PLOTS

APPENDIX F – CONDUCTED POWER / PSD MEASUREMENT PLOTS

APPENDIX G – CONDUCTED SPURIOUS EMISSIONS MEASUREMENT PLOTS

APPENDIX H – RADIATED TX AND RX MEASUREMENT PLOTS

