Test Report Serial Number:	**45461627 R2.0**
Test Report Date:	**16 February 2021**
Project Number:	**1510**

EMC Test Report - New Certification

Applicant:

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

FCC ID:	IC Registration Number
IPH-03948	**1792A-03948**
Product Model Number / HVIN	Product Marketing Name / PMN
A03948	**A03948**

In Accordance With:

CFR Title 47, Part 15 Subpart C (§15.225), (§15.249)

Part 15 Low Power Communication Device Transmitter (DXX)

RSS-Gen, RSS-210 Issue 10

Low Power Transmitter (2400-2483.5MHz)

Approved By:

Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
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:**		18 Nov - 16 Dec, 2020
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	Initial Draft Release	n/a	Art Voss	17 December 2020
0.2	Revised Table 12.3	12.0	Art Voss	21 December 2020
1.0	Initial Release	n/a	Art Voss	10 February 2021
2.0	Added Power Line Conducted Emissions	15.0	Art Voss	16 February 2021

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-03948**
	ISED ID: **1792A-03948**
Device Model(s) / HVIN:	A03948
Test Sample Serial No.:	3326988634 - Conducted, 3326988670 - OTA/SAR
Device Type:	Extremity Worn Digital Transceiver
FCC Equipment Class:	WiFi - Digital Transmission System (DTS)
	BlueTooth - Spread Spectrum Transmitter (DSS)
	BlueTooth LE/ANT - Low Power Communication Device Transmitter (DXX)
	NFC - Low Power Communication Device Transmitter (DXX)
ISED Equipment Class:	WiFi: Wi-Fi Device
	BlueTooth: Spread Spectrum/Digital Device (2400-2483.5MHz)
	BlueTooth LE/ANT - Low Power Device (2400-2483.5MHz)
	NFC - RFID Device
Transmit Frequency Range:	WiFi (DTS): 2412-2462MHz
	BT/BLE/ANT: 2402-2480MHz
	NFC: 13.56MHz
Manuf. Max. Rated Output Power:	WiFi - Digital Transmission System (DTS): 17.52dBm
	BlueTooth - Spread Spectrum Transmitter (DSS): 9.42dBm
	BLE/ANT - Low Power Communication Device Transmitter (DXX): 4dBm
	NFC - Low Power Communication Device Transmitter (DXX): -36dBm
Antenna Type and Gain:	0.6dBi Max*
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7
Modulation:	BT BR: GFSK
Modulation:	BT EDR 2Mb: Pi/4-DQPSK, BT EDR 3Mb: 8-DPSK
Modulation:	BLE: GMSK
Modulation:	ANT: GFSK
Modulation:	NFC:
DUT Power Source:	3VDC Rechargeable Li-Ion
DUT Dimensions [LxWxH]	H x W x D: 50mm x 45mm x 18mm
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

* Information regarding antenna type and 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: A03948 is an extremity worn digital transceiver device consisting of a WiFi, BlueTooth (BT), BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and Near Field Communication (NFC) transceivers. The WiFi and BT/BLE/ANT 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 RESULT SUMMARY

TEST SUMMARY

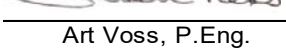
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Applicable Rule Part(s) ISED	Test Date	Result
7.0	Occupied Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§2.1049	RSS-Gen (6.7)	15 Dec 2020	Pass
8.0	Field Strength (Fundamental)	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(a)(e)	RSS-Gen (6.12) RSS-210 (B.10)	23 Nov 2020	Pass
9.0	20dB BW	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(a)(e)	RSS-Gen (6.12) RSS-210 (B.10)	15 Dec 2020	Pass
10.0	Field Strength (NFC)	ANSI C63.10-2013 KDB 558074 D01v05	§15.225(a)	RSS-Gen (6.12) RSS-210 (B.10)	16 Dec 2020	Pass
11.0	Band Edge (NFC)	ANSI C63.10-2013 KDB 558074 D01v05	§15.225(a)(c)	RSS-Gen (6.12) RSS-210 (B.10)	16 Dec 2020	Pass
12.0	Restricted Bands	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	RSS-Gen (8.10)	16 Dec 2020	Pass
13.0	Radiated Rx Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	RSS-Gen (8.10)	23 Nov 2020	Pass
14.0	Frequency Stability	ANSI C63.10-2013 KDB 558074 D01v05	§15.225	RSS-G210 B.6	3 Dec 2020	Pass

Test Station Day Log

Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
23 Nov 2020	2.0	87	101.5	**OATS**	**8, 12, 13**
26 Nov 2020	5.0	73	102.6	**OATS**	**13**
3 Dec 2020	18.0	26	103.1	**TC**	**14**
15 Dec 2020	24.0	15	102.6	**EMC**	**7, 9**
16 Dec 2020	23.0	17	101.8	**EMC**	**11, 12**
16 Dec 2020	4.0	76	102.6	**OATS**	**10**

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.

12 May 2020
Date

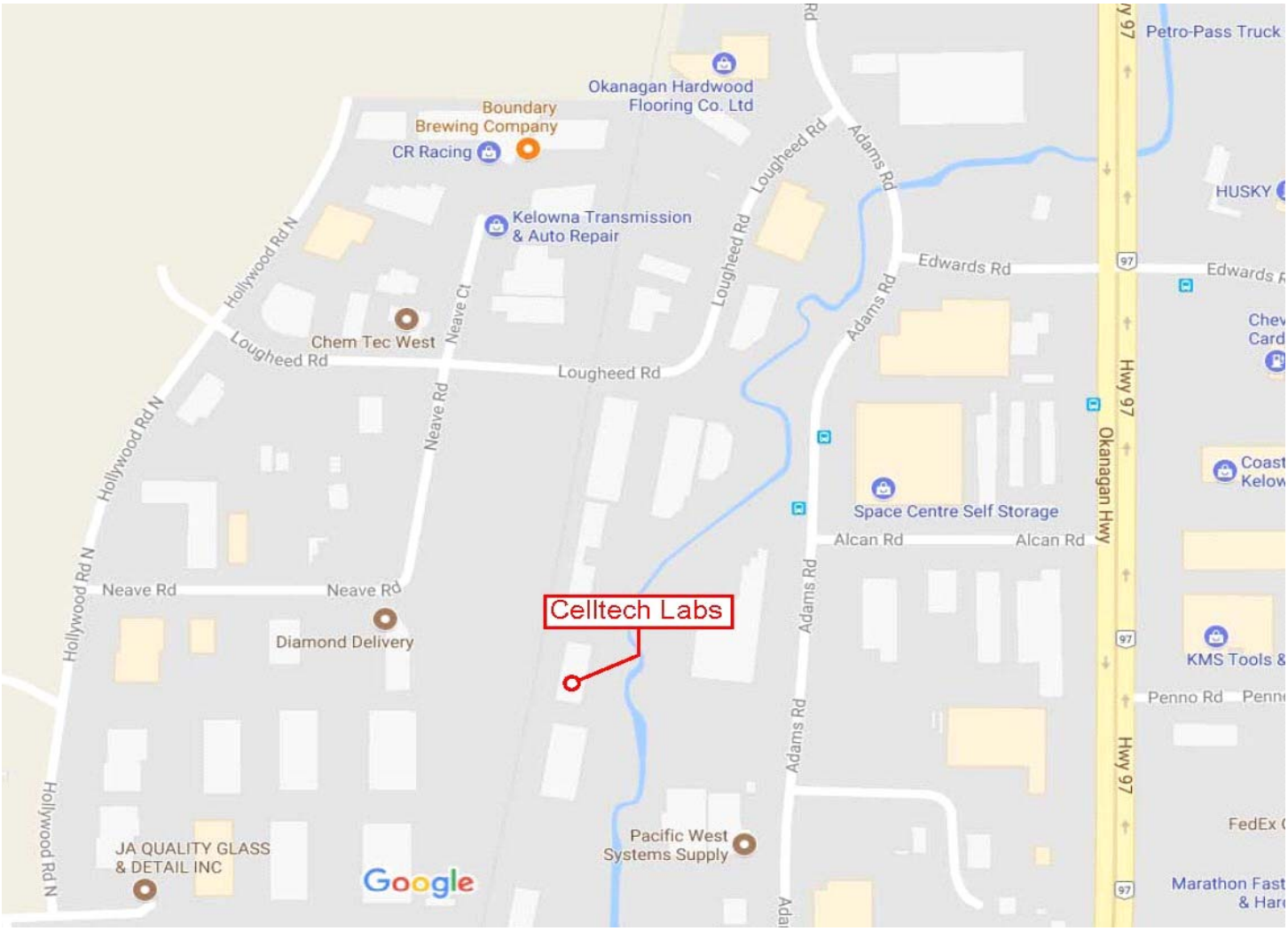
5.0 NORMATIVE REFERENCES

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 (15.249)	Code of Federal Regulations Telecommunication Radio Frequency Devices Intentional Radiators
CFR Title 47: Part 15: Sub Part C (15.225)	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
ISED RSS-Gen Issue 5:	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-210 Issue10:	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification Licence-Exempt Radio Apparatus: Category I Equipment
FCC KDB 558074 D01v05	OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247

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 CA3874A-1 and Industry Canada under Test Site File Number IC 3874A-1. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

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

General Procedure	
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.

Table 7.1 - Summary of Occupied Bandwidth Measurements (DXX)

See Appendix K for measurement plots

Occupied Bandwidth Measurement Results (DXX)						
Frequency (MHz)	Modulation	Mode	Measured Occupied Bandwidth (MHz)	Minimum Authorized Bandwidth (MHz)	Margin (MHz)	Emission Designator
2402	GFSK	BT BR	1.230	0.5	0.730	1M23F1D
2480	GFSK	BT BR	0.996		0.496	996KF1D
2402	GFSK	ANT	0.978		0.478	978KF1D
2480	GFSK	ANT	1.026		0.526	1M03F1D
2402	GMSK	BLE	1.146		0.646	1M15F1D
2480	GMSK	BLE	1.200		0.700	1M20F1D
						Complies

Margin = Measured BW - Minimum Authorized BW

Table 7.2 - Summary of Occupied Bandwidth Measurements (NFC)

See Appendix K for measurement plots

Occupied Bandwidth Measurement Results (NFC)				
Frequency (MHz)	Modulation	Mode	Measured Occupied Bandwidth (Hz)	Emission Designator
13.56	ASK	NFC	670.000	670HK1D
				Complies

8.0 FIELD STRENGTH

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §15.249, RSS-210
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

Limits	
§15.249(a)	**Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.** (a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:
	2400-2483.5MHz, Fundamental Field Strength: 50mV/m, Harmonic: 500uV/m
RSS-210 B.10(a)	**Bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24-24.25 GHz** (a) The field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits in table B2.
	2400-2483.5MHz, Fundamental Field Strength: 50mV/m, Harmonic: 500uV/m

General Procedure	
C63.10 (6.5.4)	**6.5.4 Final radiated emission tests** Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported. Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

Test Setup	Appendix A Figure A.2

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 8.1 - Summary of Field Strength Measurements (ANT)

See Appendix L for Measurement Plots

FCC §15.249(a), RSS-210 Radiated Field Strength										
Frequency (MHz)	**Mode**	**Modulation**	**Detector**	**Antenna Polarization**	**Measured Field Strength [FS_{Meas}] (dBuV @ 3m)**	**Cable Loss [L_C] (dBm)**	**Receive Antenna [ACF] (dB)**	**Corrected Field Strength [FS_{Corr}] (dBuV @3m)**	**Limit (dBuV)**	**Margin (dB)**
2402.0	ANT	GFSK	RMS	Horizontal	52.06	4.6	28.3	84.96	94.0	**9.0**
2442.0					53.68			86.58		**7.4**
2480.0					54.76			87.66		**6.3**
2402.0				Vertical	45.21			78.11		**15.9**
2442.0					46.17			79.07		**14.9**
2480.0					43.80			76.70		**17.3**
2480.0			Peak	Horizontal	55.62			88.52	114.0	**25.5**
2442.0				Vertical	48.65			81.55		**32.5**
								Result:		**Complies**

$FS_{Corr} = FS_{Meas} + ACF + L_C$

Margin = Limit - FS_{Corr}

Table 8.2 - Summary of Field Strength Measurements (BLE)

See Appendix L for Measurement Plots

FCC §15.249(a), RSS-210 Radiated Field Strength										
Frequency (MHz)	**Mode**	**Modulation**	**Detector**	**Antenna Polarization**	**Measured Field Strength [FS_{Meas}] (dBuV @ 3m)**	**Cable Loss [L_C] (dBm)**	**Receive Antenna [ACF] (dB)**	**Corrected Field Strength [FS_{Corr}] (dBuV @3m)**	**Limit (dBuV)**	**Margin (dB)**
2402.0	BLE	GMSK	RMS	Horizontal	51.94	4.6	28.3	84.84	94.0	**9.2**
2442.0					52.82			85.72		**8.3**
2480.0					53.61			86.51		**7.5**
2402.0				Vertical	44.51			77.41		**16.6**
2442.0					44.70			77.60		**16.4**
2480.0					44.66			77.56		**16.4**
2480.0			Peak	Horizontal	53.99			86.89	114.0	**27.1**
2442.0				Vertical	50.09			82.99		**31.0**
								Result:		**Complies**

$FS_{Corr} = FS_{Meas} + ACF + L_C$

Margin = Limit - FS_{Corr}

Table 8.3 - Summary of Field Strength Measurements (BT BR)

See Appendix L for Measurement Plots

FCC §15.249(a), RSS-210 Radiated Field Strength										
Frequency (MHz)	**Mode**	**Modulation**	**Detector**	**Antenna Polarization**	**Measured Field Strength [FS_{Meas}] (dBuV @ 3m)**	**Cable Loss [L_C] (dBm)**	**Receive Antenna [ACF] (dB)**	**Corrected Field Strength [FS_{Corr}] (dBuV @3m)**	**Limit (dBuV)**	**Margin (dB)**
2402.0	BT BR	GFSK	RMS	Horizontal	54.00	4.6	28.3	86.90	94.0	**7.1**
2442.0					54.18			87.08		**6.9**
2480.0					54.37			87.27		**6.7**
2402.0				Vertical	42.04			74.94		**19.1**
2442.0					44.15			77.05		**17.0**
2480.0					40.41			73.31		**20.7**
2442.0			Peak	Horizontal	53.61			86.51	114.0	**27.5**
2442.0				Vertical	48.04			80.94		**33.1**
								Result:		**Complies**

$FS_{Corr} = FS_{Meas} + ACF + L_C$

Margin = Limit - FS_{Corr}

9.0 20DB BW

Test Procedure	
Normative Reference	FCC 47 CFR §2.1051, §15.215
	ANSI C63.10 (6.10.3)

Limits	
§15.215(c)	**Additional provisions to the general radiated emission limitations.** (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

General Procedure	
C63.10 (6.3.10)	**6.10.3 Unlicensed wireless device operational configuration** Set the EUT to operate at 100% duty cycle or equivalent "normal mode of operation."[54] Testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.[55] Testing shall be performed for each frequency with every applicable unlicensed wireless device configuration. If more than one power output level is available, then testing shall be done with the appropriate maximum power output for each antenna combination or modulation, as recorded in the unlicensed wireless device conducted power measurement results. The highest gain of each antenna type shall be used for this test.

[54] For unlicensed wireless devices unable to be configured for 100% duty cycle even in test mode, configure the system for the longest duration duty cycle supported.

[55] Some radios operating, for example, in the 2.4 GHz band, have hardware capability to operate at frequencies outside the band permitted by the regulatory authority. Testing shall only be done at the lowest and highest frequencies within the allowed frequency band (see Annex A for examples of regulatory requirements and frequency ranges).

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. The output power of the DUT was set to the manufacturer's highest output power setting at the Low and High frequency channels as permitted by the device. The unwanted band edge emissions were measured and recorded.

Table 9.1 - Summary of 20dB BW Measurements

See Appendix M for Measurement Plots

20dB BW Bandwidth Measurement Results (DXX)			
Frequency (MHz)	**Modulation**	**Mode**	**Measured 20dB Bandwidth (MHz)**
2402	GFSK	BT BR	1.140
2480	GFSK	BT BR	0.912
2402	GFSK	ANT	0.918
2480	GFSK	ANT	1.026
2402	GMSK	BLE	1.224
2480	GMSK	BLE	1.212
		Result:	**Complies**

Compliance to §15.215(c):
Largest Measured 20dB BW < 1.3MHz, 50% BW < 0.650MHz
LBE = 2402MHz - 0.650MHz = 2401.35MHz > 2400MHz
UBE = 2480 + 0.650MHz = 2480.65MHz < 2483.5MHz

10.0 FIELD STRENGTH - NFC

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §15.225, RSS-210
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

Limits	
§15.225	**Operation within the band 13.110-14.010 MHz.** (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.
RSS-210 B.10(6)	**Band 13.110-14.010 MHz** (a) the field strength of any emission shall not exceed the following limits: (i)15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz (ii)334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and13.567-13.710 MHz (iii)106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and13.710-14.010 MHz (iv)RSS-Gen general field strength limits for frequencies outside the band13.110-14.010 MHz

General Procedure	
C63.10 (6.5.4)	**6.5.4 Final radiated emission tests** Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported. Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

Test Setup	Appendix A Figure A.2

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 10.1 – Summary of Field Strength Measurements (NFC)

See Appendix N for Measurement Plots

FCC §15.225(a), RSS-210 Radiated Field Strength										
Frequency (MHz)	**Mode**	**Modulation**	**Detector**	**Antenna Polarization**	**Measured Field Strength [FS_{Meas}] (dBuV @ 3m)**	**Cable Loss [L_C] (dBm)**	**Receive Antenna [ACF] (dB)**	**Corrected Field Strength [FS_{Corr}] (dBuV @3m)**	**Limit (dBuV)**	**Margin (dB)**
13.56	NFC	ASK	RMS	Front	22.96	0.5	10.65	34.11	124.0	**89.9**
				Side	17.93			29.08		**94.9**
			Peak	Front	23.40			34.55	144.0	**109.5**
				Side	18.84			29.99		**114.0**
								Result:		**Complies**

$FS_{Corr} = FS_{Meas} + ACF + L_C$

Margin = Limit - FS_{Corr}

11.0 EMISSIONS MASK / 20 DB BW - NFC

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046, §15.225, RSS-210
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

Limits	
§15.225	**Operation within the band 13.110-14.010 MHz.** (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.
RSS-210 B.10(6)	**Band 13.110-14.010 MHz** (a) the field strength of any emission shall not exceed the following limits: (i)15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz (ii)334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and13.567-13.710 MHz (iii)106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and13.710-14.010 MHz (iv)RSS-Gen general field strength limits for frequencies outside the band13.110-14.010 MHz

General Procedure	
C63.10 (6.5.4)	**6.5.4 Final radiated emission tests** Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported. Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

Test Setup	Appendix A Figure A.2

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 11.2 – Summary of Band Edge Evaluation (NFC)

See Appendix N for Measurement Plots

20dB BW Bandwidth Measurement Results (NFC)			
Frequency (MHz)	Modulation	Mode	Measured 20dB Bandwidth (Hz)
13.56	ASK	NFC	780.0
		Result:	Complies

Compliance to §15.215(c):
See NFC Emissions Mask Plots

12.0 RADIATED SPURIOUS EMISSIONS – RESTRICTED BANDS

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

Table 12.1 – Summary of Radiated Emissions, Restricted Band (DXX)

See Appendix O for Measurement Plots

Summary of Radiated Tx Emissions (Restricted Band)										
Measured Frequency Range (MHz)	Channel Frequency	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)
9kHz - 30MHz	2442.0	Front	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	**n/a**
9kHz - 30MHz	2442.0	Side	ND	ND (1)	0.00	0.00	0.00 (3)	ND (2)	n/a	**n/a**
30-1000MHz	2442.0	Horizontal	745.2MHz	37.88	0.00	0.00	0.00 (3)	37.88 (2)	46.0	**8.1**
30-1000MHz	2442.0	Vertical	955.9MHz	39.24	0.00	0.00	0.00 (3)	39.24 (2)	46.0	**6.8**
1 - 3GHz	2442.0	Horizontal	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	**n/a**
1 - 3GHz	2442.0	Vertical	ND	ND (1)	27.40	4.58	0.00 (3)	ND	54.0	**n/a**
3-13GHz	2442.0	Horizontal	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	**n/a**
3-13GHz	2442.0	Vertical	ND	ND (1)	36.76	9.86	0.00 (3)	ND	54.0	**n/a**
13-18GHz	2442.0	Horizontal	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	**n/a**
13-18GHz	2442.0	Vertical	ND	ND (1)	38.75	16.54	0.00 (3)	ND	54.0	**n/a**
18-26GHz	2442.0	Horizontal	ND	ND (1)	43.50	21.86	26.00	ND	54.0	**n/a**
18-26GHz	2442.0	Vertical	ND	ND (1)	43.50	21.86	26.00	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

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

Table 12.2 – Summary of Radiated Emissions, Restricted Band (NFC) 9kHz – 1000MHz

See Appendix O for Measurement Plots

Summary of Conducted Tx Emissions (Restricted Band)

Measured Frequency Range (MHz)	Channel Frequency	Emission Frequency	Antenna Gain [G_T]	Measured Emission [P_T] (dBm)	e.r.p. or e.i.r.p. (dB)	Ground Reflection [L_R] (dB)	Conversion dBm to dBuV/m [CF_R] (dB)	Distance Correction [L_D]	Corrected Emission [E_{Corr}] (dBuV/m)
9kHz - 30MHz	13.56	13.56* MHz	-0.15 dBd	-70.57	-70.72	6.0	107.0	9.54	32.7
		487.8 MHz		-73.16	-73.31	4.7	107.0		28.9
		515.0 MHz		-74.91	-75.06	4.7	107.0		27.1
		610.1 MHz		-76.80	-76.95	4.7	107.0		25.2
									Results:

Ground Reflection Factor [CF_R] = 6dB for f < 30MHz, 4.7dB for 30MHz < f < 1000MHz, 0dB for f > 1000MHz

e.r.p. = P_T + G_T - L_C, where P_T = measured emission (dBm), G_T = DUT antenna gain (dBd), L_C = loss between the DUT transmitter and DUT antenna (dB) = 0

e.i.r.p. = P_T + G_T - L_C, where P_T = measured emission (dBm), G_T = DUT antenna gain (dBi), L_C = loss between the DUT transmitter and DUT antenna (dB) = 0

G_T(dBd) = G_T(dBi) - 2.15, e.r.p. = e.i.r.p - 2.15

G_T minimum = 2dBi, -0.15dBd

Distance Correction [L_D] = 20Log(D), where D would have been the measurement distance = 3m

Conversion dBm to dBuV/m [CF] = 107 for e.r.p. and G_T expressed as dBd, 104.85 for e.i.r.p. and G_T expressed as dBi

E_{Corr} = e.r.p - [L_D] + [CF] + [CF_R]

E_{Corr} = e.i.r.p - [L_D] + [CF] + [CF_R]

Margin = Limit - E_{Corr}

* Fundamental

Table 12.3 – Summary of Radiated Emissions, Restricted Band (NFC) > 1000MHz

See Appendix O for Measurement Plots

Summary of Radiated Tx Emissions (Restricted Band)										
Measured Frequency Range (MHz)	Channel Frequency	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)
1 - 3GHz	13.56MHz	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
18-26GHz		Horizontal	ND	ND (1)	43.50	21.86	26.00	ND	54.0	n/a
18-26GHz		Vertical	ND	ND (1)	43.50	21.86	26.00	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

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

13.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure	
Normative Reference	FCC 47 CFR §2.1046
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

General Procedure	
C63.10 (6.5.4)	**6.5.4 Final radiated emission tests** Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported. Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.
Test Setup	**Appendix A Figure A.2**

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 13.1 – Summary of Radiated Rx Emissions

See Appendix P for Measurement Plots

Measurement Results

Frequency Range	Antenna Polarization	Bit Rate (Mbps)	Modulation	Power Setting[1] (dBm)	Transmit Duty Cycle (%)	Measured Emission [E_{Meas}] (dBm)	Worst Case Limit[4] [A_L] (dBuV @ 3m)	Margin (dB)
9kHz - 30MHz	Front	n/a	n/a	n/a	n/a	ND	69.5	n/a
30-1000MHz	Horizontal					ND	40.0	n/a
1 - 3GHz						ND	54.0	n/a
3 - 13.6GHz						ND	54.0	n/a
13.6 - 18GHz						ND	54.0	n/a
9kHz - 30MHz	Side					ND	69.5	n/a
30-1000MHz	Vertical					ND	40.0	n/a
1 - 3GHz						ND	54.0	n/a
3 - 13.6GHz						ND	54.0	n/a
13.6 - 18GHz						ND	54.0	n/a
						Results:	**Complies**	

14.0 FREQUENCY STABILITY (NFC)

Test Conditions	
Normative Reference	**FCC 47 CFR §2.1055, §15.225, RSS-Gen, RSS-210**

Limits	
47 CFR §15.225	(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.
RSS-210 B.6	(b) the carrier frequency stability shall not exceed ±100 ppm

Measurement Procedure

47 CFR §2.1055 Frequency Stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

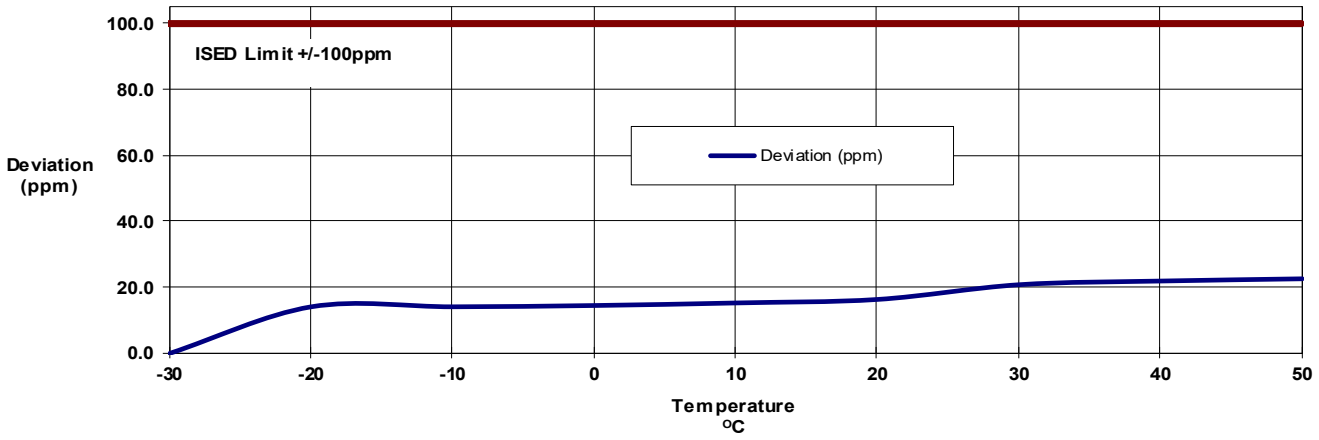
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Test Setup	Appendix A	5

Table 14.1 – Summary of Frequency Stability Measurements

Frequency Stability

Nominal Frequency (MHz):	13.56
Nominal Channel BW (KHz):	CW
Nominal Voltage (VDC):	3
Nominal Temperature (°C):	20



Frequency Stability Measurements (Temperature)

Temp (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Deviation (Hz)	Deviation [Absolute] (ppm)
-20	13.560000	13.560190	190	14.01
-10		13.560190	190	14.01
0		13.560195	195	14.38
10		13.560206	206	15.19
20		13.560220	220	16.22
30		13.560280	280	20.65
40		13.560295	295	21.76
50		13.560304	304	22.42
			Maximum Deviation:	22.42
			Maximum Limit:	100.00
			Result:	Complies

Frequency Stability Measurements (Voltage)

Voltage (VDC)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Deviation (Hz)	Deviation [Absolute] (ppm)
3%	13.560000	13.560220	220	16.22
			Maximum Deviation:	16.22
			Maximum Limit:	100.00
			Result:	Complies

15.0 POWER LINE CONDUCTED EMISSIONS

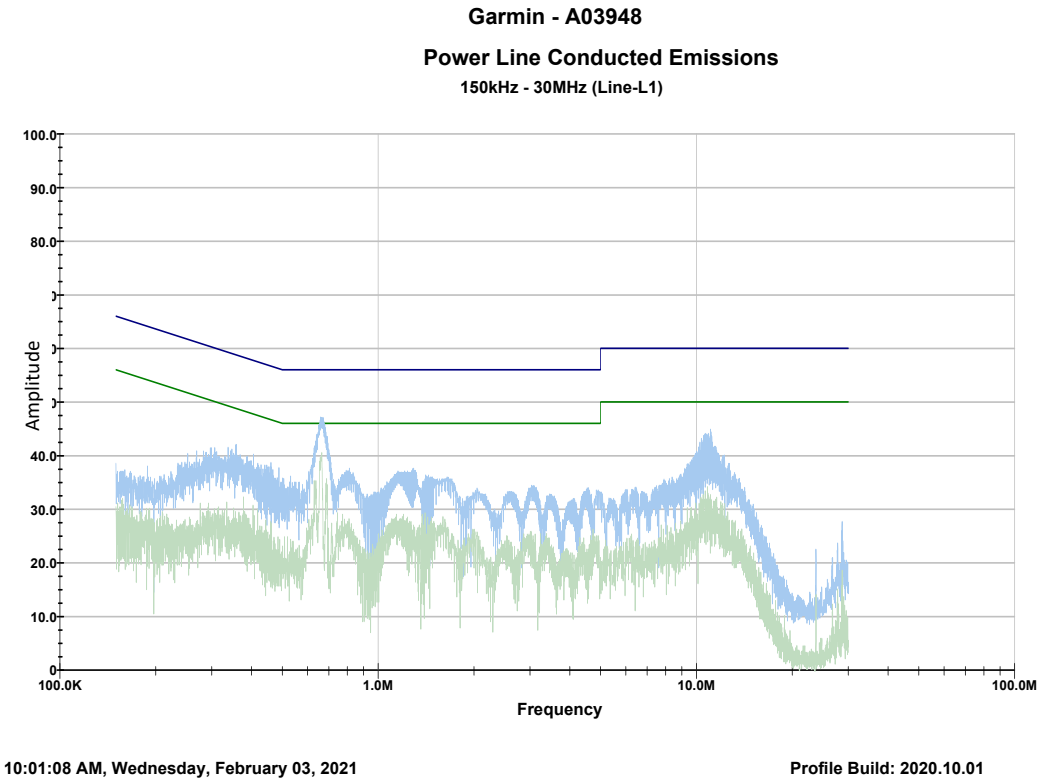
Test Procedure	
Normative Reference	**FCC 47 CFR §15.107, ICES-003(6.1)** **ANSI C63.4-2014**

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 15.1 – Power Line Conducted Emissions, Line 1

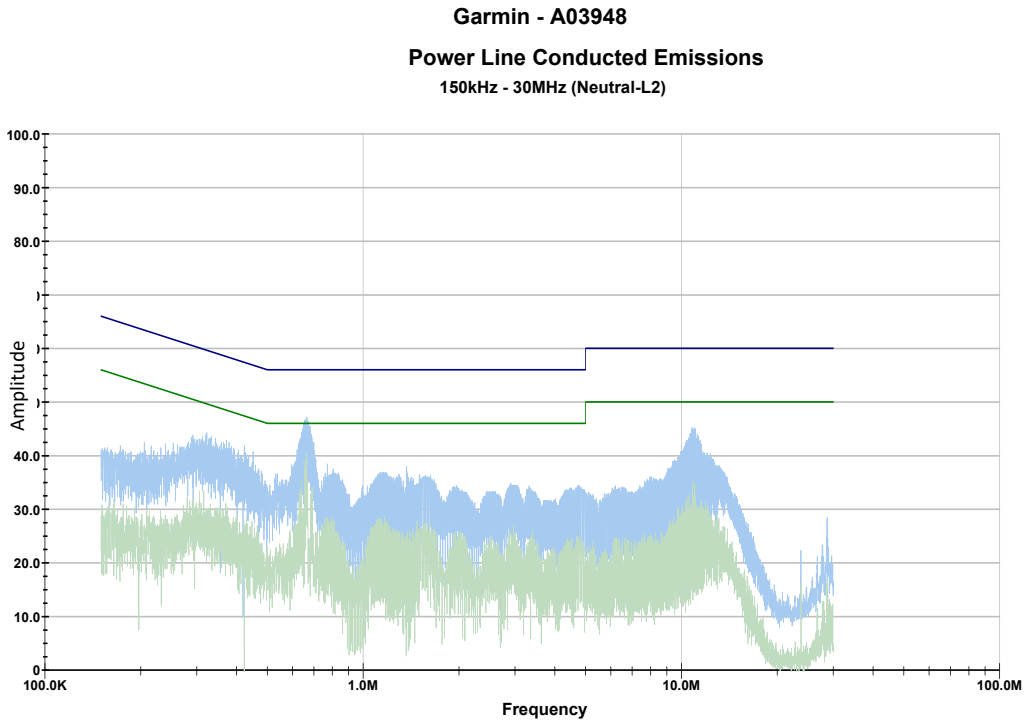
Power Line Conducted Emissions - L1



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

Plot 15.2 – 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 15.1 – Summary of Power Line Conducted Emissions

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 15.1 – Summary of Power Line Conducted Emissions (Cont)

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 AND EQUIPMENT

Table A.1 – Setup - Conducted Measurements Equipment List

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

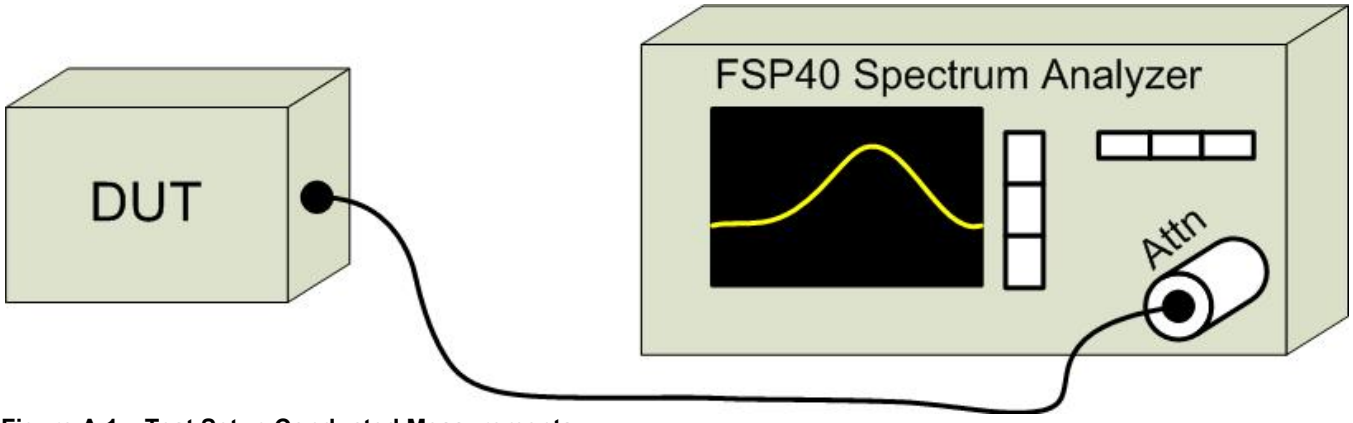


Figure A.1 – Test Setup Conducted Measurements

Table A.2 – Setup - Radiated Emissions Equipment List

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

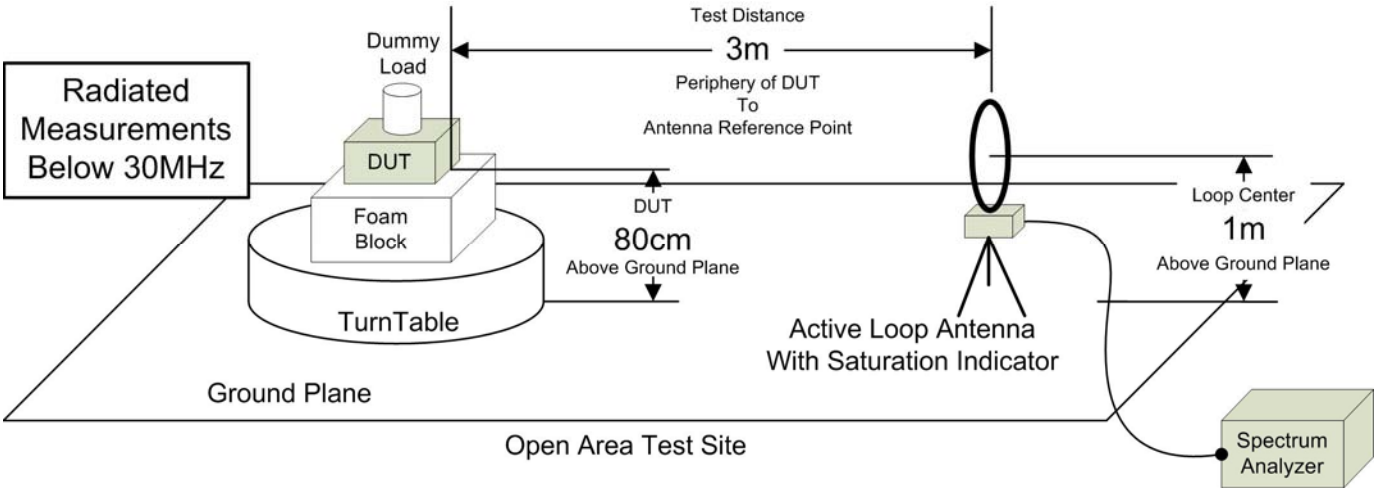


Figure A.2 – Test Setup Radiated Emissions Measurements Below 30MHz

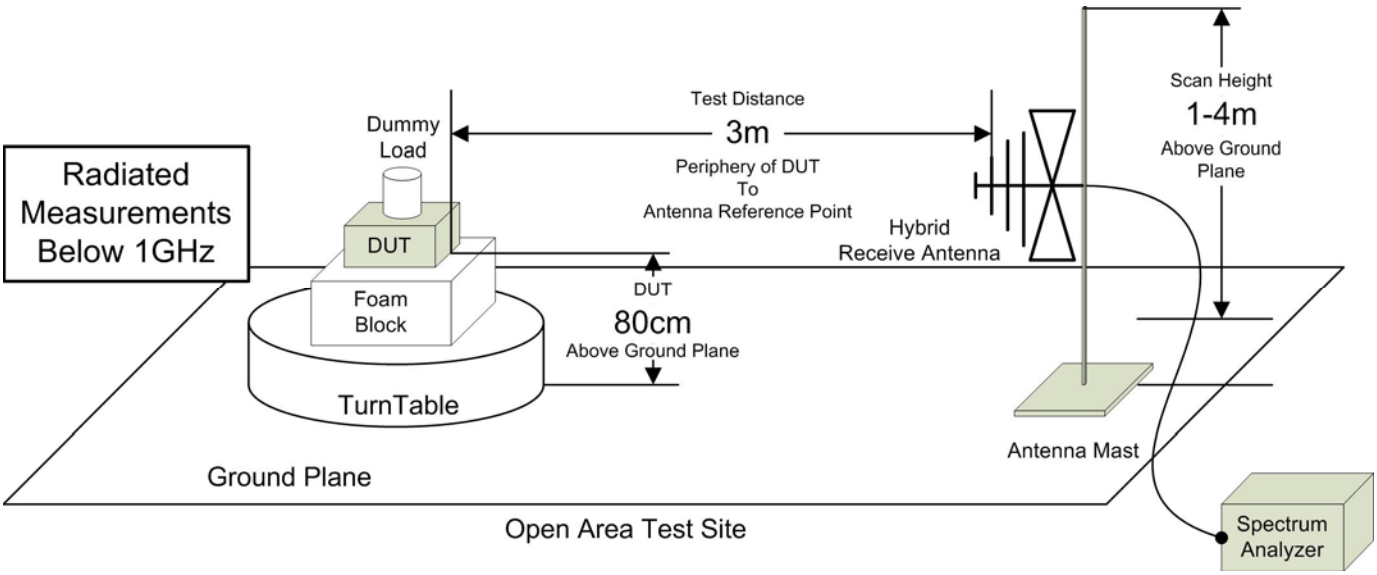


Figure A.3 – Test Setup Radiated Emissions Measurements 30 – 1000MHz

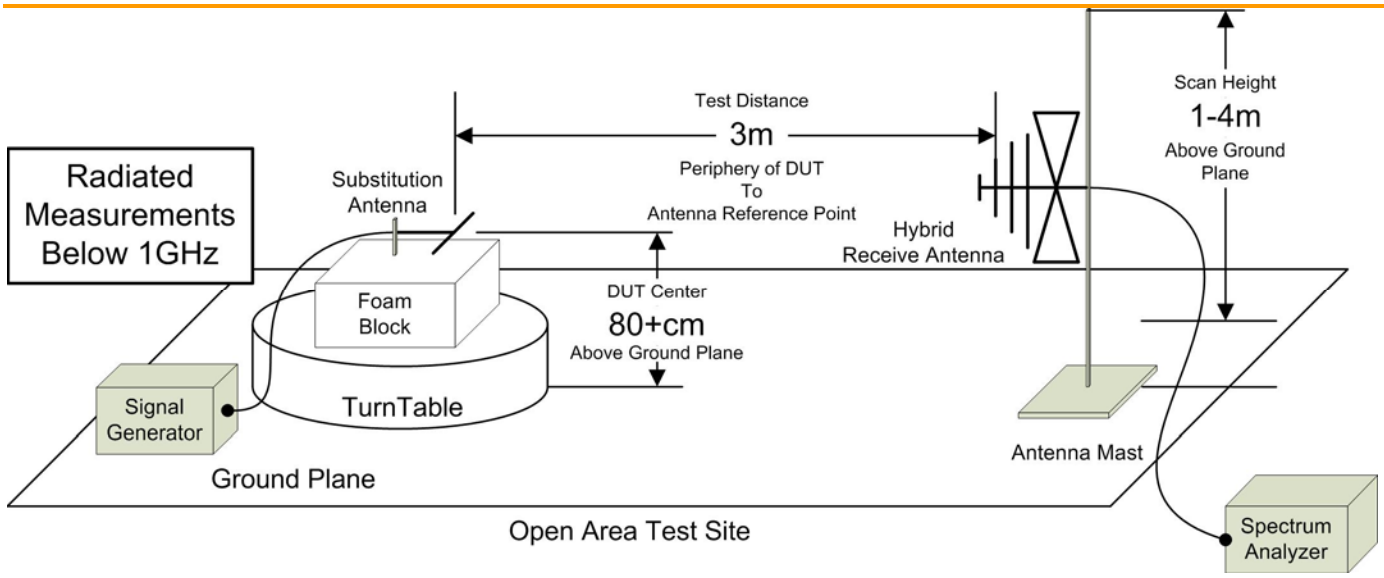


Figure A.4 – Test Setup Radiated Emissions Measurements 30 – 1000MHz Signal Substitution

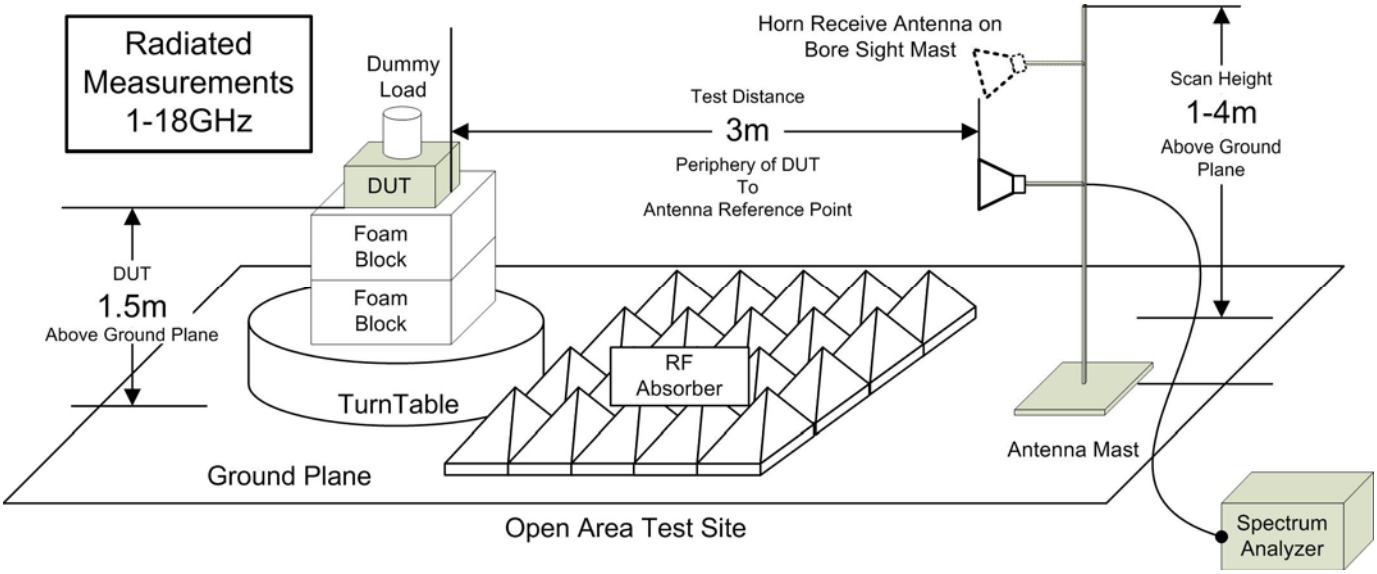


Figure A.5 – Test Setup Radiated Emissions Measurements 1 – 18GHz

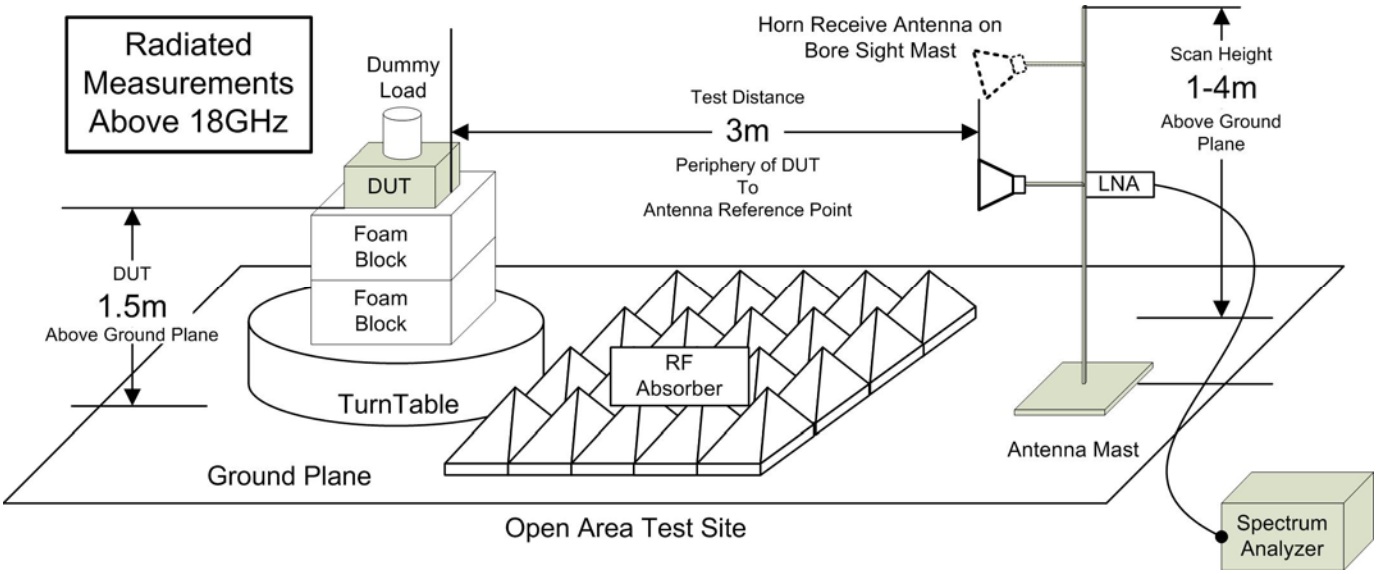


Figure A.6 – Test Setup Radiated Emissions Measurements Above 18 GHz

Table A.3 – Setup – Frequency Stability Equipment List

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00241	R&S	FSU40	100500	Spectrum Analyzer
00081	ESPEC	ECT-2	0510154-B	Environmental Chamber
00234	VWR	61161-378	140320430	Temp/Humidity Meter

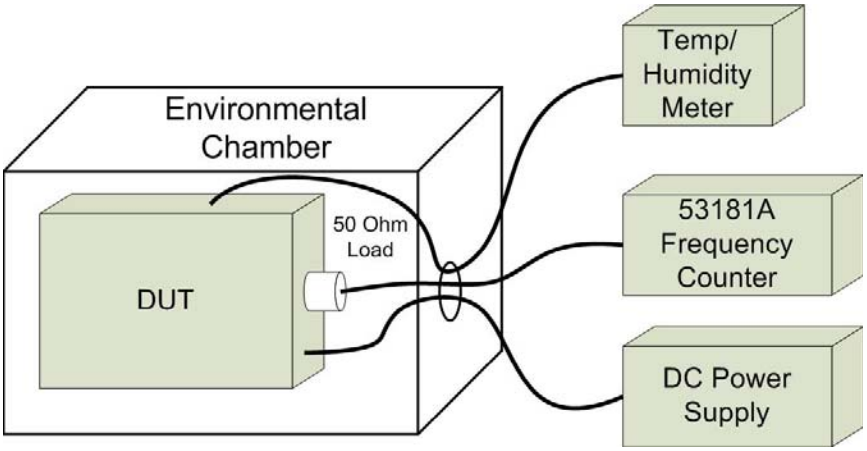


Figure A.7 – Frequency Stability

APPENDIX B – EQUIPMENT LIST AND CALIBRATION

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
00081	ESPEC	ECT-2	0510154-B	Environmental Chamber
00234	VWR	61161-378	140320430	Temp/Humidity Meter
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

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	
30MHz - 200MHz	
U_{LAB} = 5.14dB U_{CISPR} = 6.3dB	
200MHz - 1000MHz	
U_{LAB} = 5.90dB U_{CISPR} = 6.3dB	
1GHz - 6GHz	
U_{LAB} = 4.80dB U_{CISPR} = 5.2dB	
6GHz - 18GHz	
U_{LAB} = 5.1dB U_{CISPR} = 5.5dB	
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

END OF REPORT

APPENDIX K – OCCUPIED BANDWIDTH MEASUREMENT PLOTS

APPENDIX L – FIELD STRENGTH MEASUREMENT PLOTS

APPENDIX M– 20DB BW (DXX) MEASUREMENT PLOTS

APPENDIX N– FIELD STRENGTH/20DB BW (NFC) MEASUREMENT PLOTS

APPENDIX O– RADIATED TX EMISSIONS MEASUREMENT PLOTS

APPENDIX P– RADIATED RX MEASUREMENT PLOTS

