Test Report Serial Number:	**45461647 R2.0**
Test Report Date:	**3 February 2021**
Project Number:	**1524**

EMC Test Report - New Certification

Applicant:

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

FCC ID:	IC Registration Number
IPH-04120	**1792A-04120**
Product Model Number / HVIN	Product Marketing Name / PMN
A04120, B04120	**A04120, B04120**

In Accordance With:

CFR Title 47, Part 15 Subpart C (§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

Table of Contents

Table of Plots

Table of Tables

Table of Figures

1.0 DOCUMENT CONTROL

Revision History				
Samples Tested By:	Art Voss, P.Eng.	**Date(s) of Evaluation:**		26 Nov, 2020 - 4 Jan, 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	Initial Draft Release	n/a	Art Voss	27 January 2021
2.0	Added Power Line Conducted Emissions	13.0	Art Voss	3 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-04120**
	ISED ID: **1792A-04120**
Device Model(s) / HVIN:	A04120, B04210
Test Sample Serial No.:	3326988634 - Conducted, 3326988670 - OTA/SAR
Device Type:	Extremity Worn Digital Transceiver
FCC Equipment Class:	NFC - Low Power Communication Device Transmitter (DXX)
ISED Equipment Class:	BlueTooth LE - Low Power Device (2400-2483.5MHz)
Transmit Frequency Range:	BLE: 2402-2480MHz
Manuf. Max. Rated Output Power:	BLE - Low Power Communication Device Transmitter (DXX): 4dBm
Antenna Type and Gain:	0dBi Max*, PCB "F"
Modulation:	BLE: GMSK
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: A04120 is an extremity worn digital transceiver device consisting of a 2.5mW BlueTooth Low Energy (BLE) transceiver.

Requirement:

The transceivers of this *equipment* are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C, ISED: RSS-Gen, RSS-210. As per FCC 47 CFR §2.1093 and Health Canada Safety Code 6, an RF Exposure (SAR) evaluation is required for this *Equipment*. Due to its low power, 2.5mW, it is exempt from SAR or MPE examination.

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	Duty Cycle and Transmission Duration	ANSI C63.10-2013 KDB 558074 D01v05	§15.35(c)	n/a	26 Nov 2020	n/a
8.0	Occupied Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§2.1049	RSS-Gen (6.7)	4 Jan 2021	Pass
9.0	Field Strength (Fundamental)	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(a)(e)	RSS-Gen (6.12) RSS-210 (B.10)	26 Nov 2020	Pass
10.0	20dB BW/Band Edge	ANSI C63.10-2013 KDB 558074 D01v05	§15.225(a)(c)	RSS-Gen (6.12) RSS-210 (B.10)	4 Jan 2021	Pass
11.0	Restricted Bands	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	RSS-Gen (8.10)	26 Nov 2020	Pass
12.0	Radiated Rx Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	RSS-Gen (8.10)	26 Nov 2020	Pass
13.0	Power Line Conducted Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§15.107 §15.209	ICES-003 (6.1)	3 Feb 2021	Pass

Test Station Day Log

Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
26 Nov 2020	5.0	73	102.6	**OATS**	**7,9,11,12**
4 Jan 2021	23.0	16	103.9	**EMC**	**8,10**
3 Feb 2021	20.2	15	102.4	**LISN**	**13**

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.
3 February 2021
Date

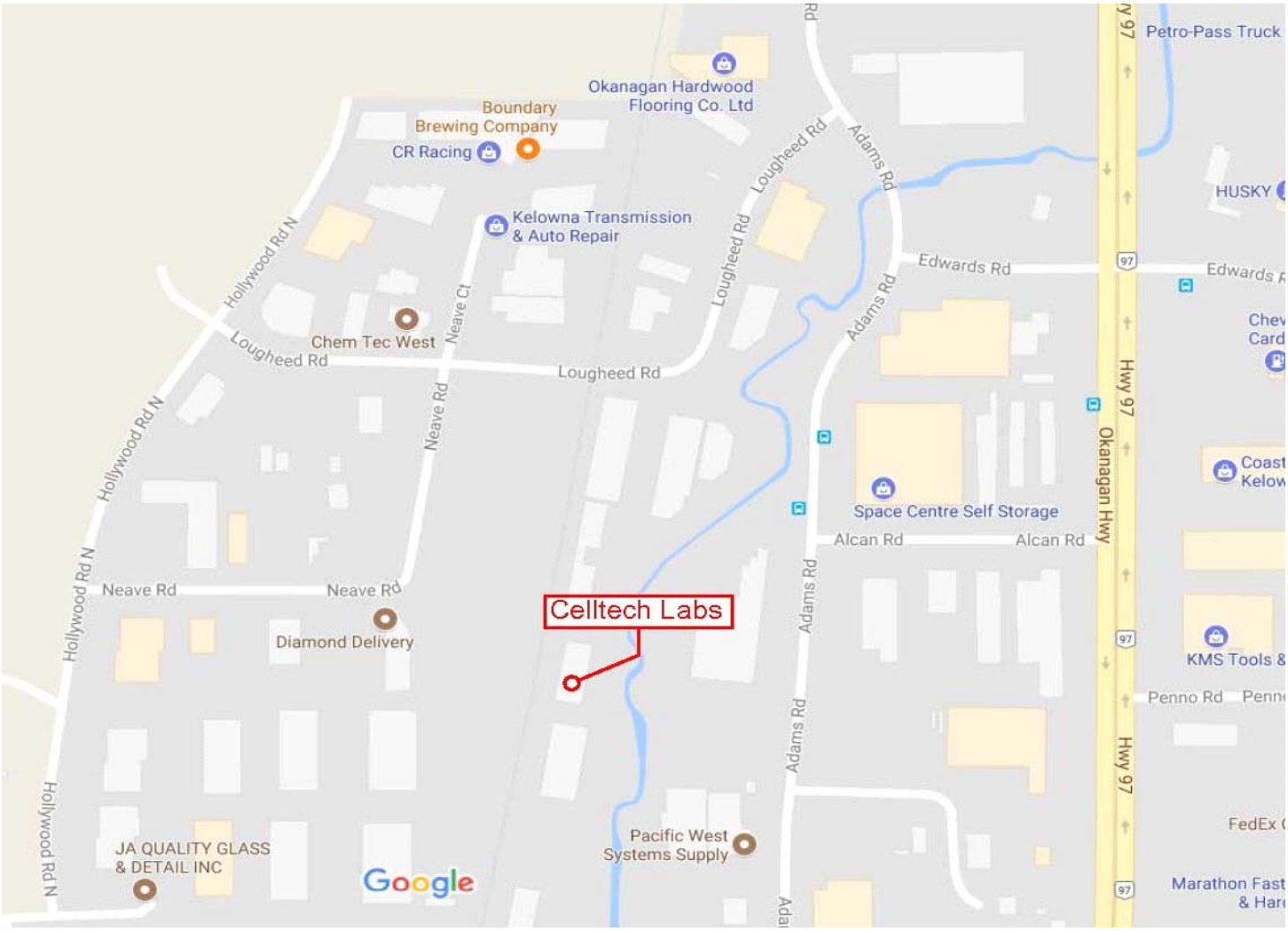
5.0 NORMATIVE REFERENCES

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: Subpart B:	Code of Federal Regulations Telecommunication Radio Frequency Devices Unintentional Radiators
CFR Title 47: Part 15: Subpart B:	Code of Federal Regulations Telecommunication Radio Frequency Devices Unintensional 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-210 Issue 10: Dec 2019, Amend Apr 2020	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification Licence-Exempt Radio Apparatus: Category 1 Equipment and Licensed-Exempt Local Area Network (LE_LAN) Devices
Industry Canada Spectrum Management & Telecommunications Policy ICES-003 Issue 6:	Information Technology Equipment (Including Digital Apparatus) - Limits and Methods of Measurement

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 DUTY CYCLE EVALUATION

Test Procedure	
Normative Reference	**KDB 558074 (6.0), ANSI C63.10 (11.6)**

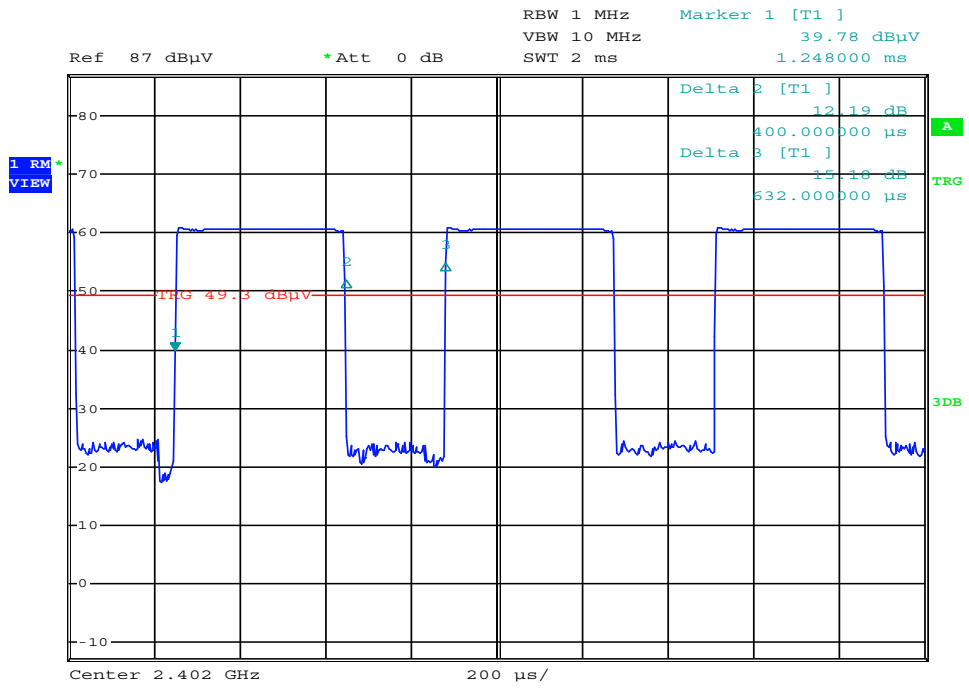
Limits	
KDB 558074 (6.0) C63.10 (11.6)	**6.0 Duty cycle, transmission duration and maximum power control level** b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal. 1) Set the center frequency of the instrument to the center frequency of the transmission. 2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. 3) Set detector = peak or average. 4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.
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 Zero Span and Positive Trigger. The output power of the DUT was set to the manufacturer's highest output power setting at the Mid frequency channel as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle. The variation in Duty Cycle was determined to be less than +/- 2%.

Plot 7.1 – Duty Cycle Measurement

Transmit Duty Cycle (Transmitter On-Time)



Date: 26.NOV.2020 12:09:32

Channel Frequency:	Modulation:	Mode:
2402.00 MHz	**GFSK**	**ANT**

Measured Duty Cycle:
75 %

Table 7.1 - Summary of Duty Cycle Evaluation

Transmit Duty Cycle Results			
Frequency (MHz)	**Mode**	**Modulation**	**Measured Duty Cycle Cycle (%)**
2402	BLE	GMSK	75.000

The variation of the transmit duty cycle was less than 2%

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.

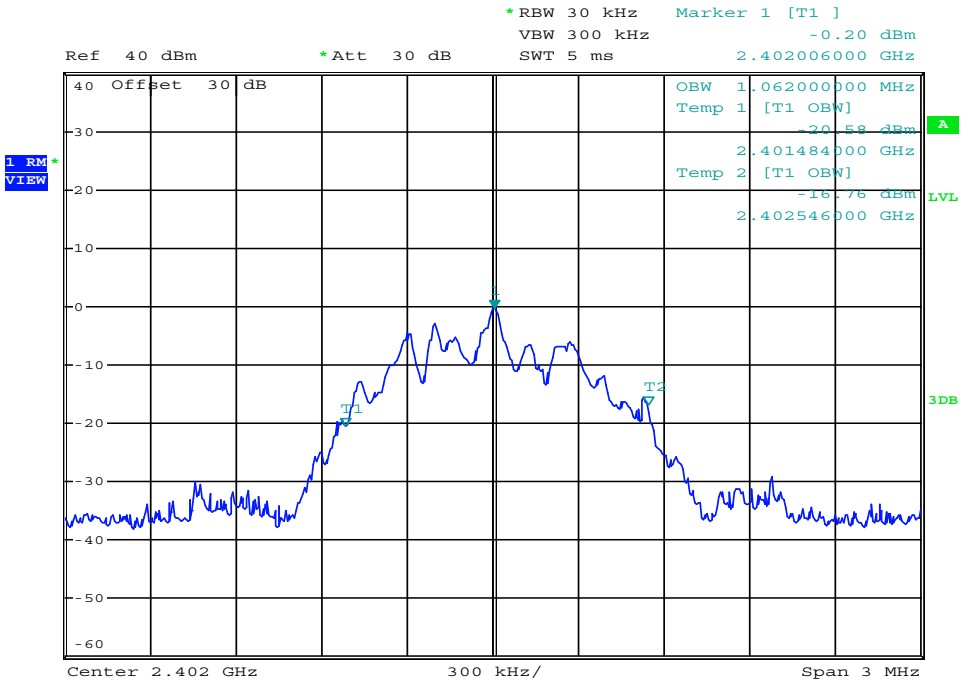
Test Setup	Appendix A - Figure A.1

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.

Plot 8.1 – Occupied Bandwidth – 2402MHz

Occupied Bandwidth

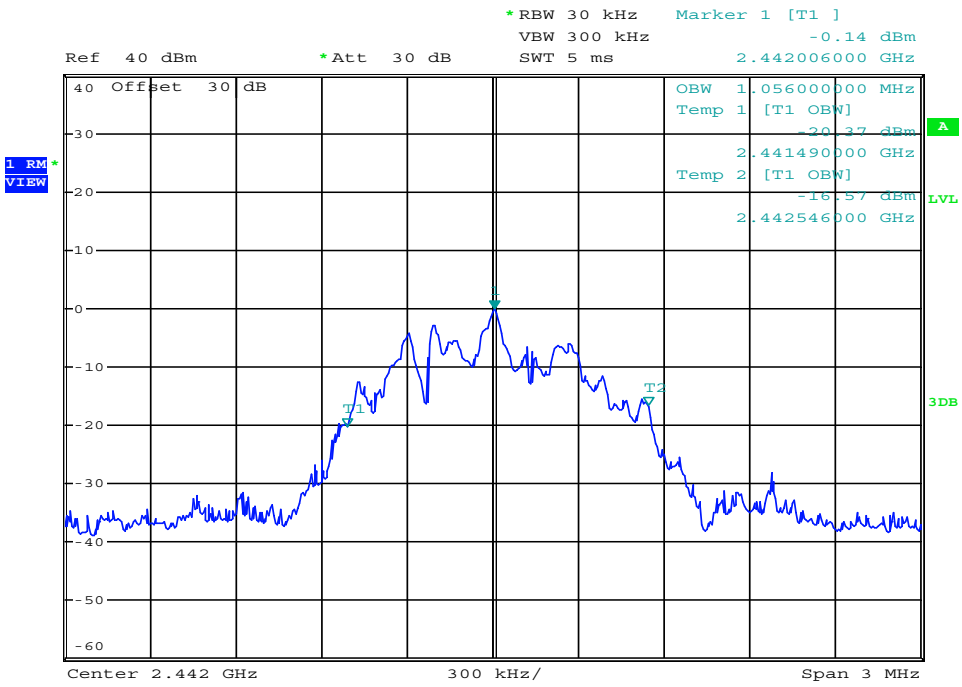


Date: 4.JAN.2021 15:10:23

Channel Frequency:	DUT Modulation:	Measured Occupied Bandwidth:
2402.00 MHz	**GFSK**	**1.062** MHz

Plot 8.2 – Occupied Bandwidth – 2442MHz

Occupied Bandwidth

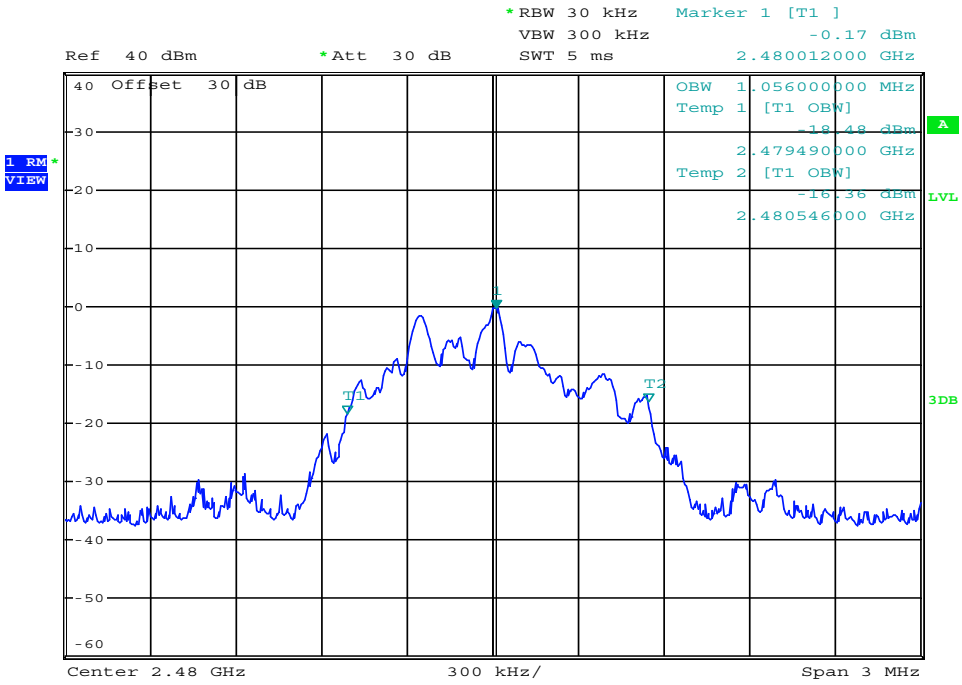


Date: 4.JAN.2021 15:11:22

Channel Frequency:	DUT Modulation:	Measured Occupied Bandwidth:
2442.00 MHz	**GFSK**	**1.056** MHz

Plot 8.3 – Occupied Bandwidth – 2480MHz

Occupied Bandwidth



Date: 4.JAN.2021 15:09:36

Channel Frequency:	DUT Modulation:	Measured Occupied Bandwidth:
2480.00 MHz	**GFSK**	**1.056** MHz

Table 8.1 - Summary of Occupied Bandwidth Measurements

Occupied Bandwidth Measurement Results (DXX)						
Frequency (MHz)	Modulation	Mode	Measured Occupied Bandwidth (MHz)	Minimum Authorized Bandwidth (MHz)	Margin (MHz)	Emission Designator
2402	GMSK	BLE	1.062	0.5	0.562	1M06F1D
2442	GMSK	BLE	1.056		0.556	1M06F1D
2480	GMSK	BLE	1.056		0.556	1M06F1D
						Complies

Margin = Measured BW - Minimum Authorized BW

9.0 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.

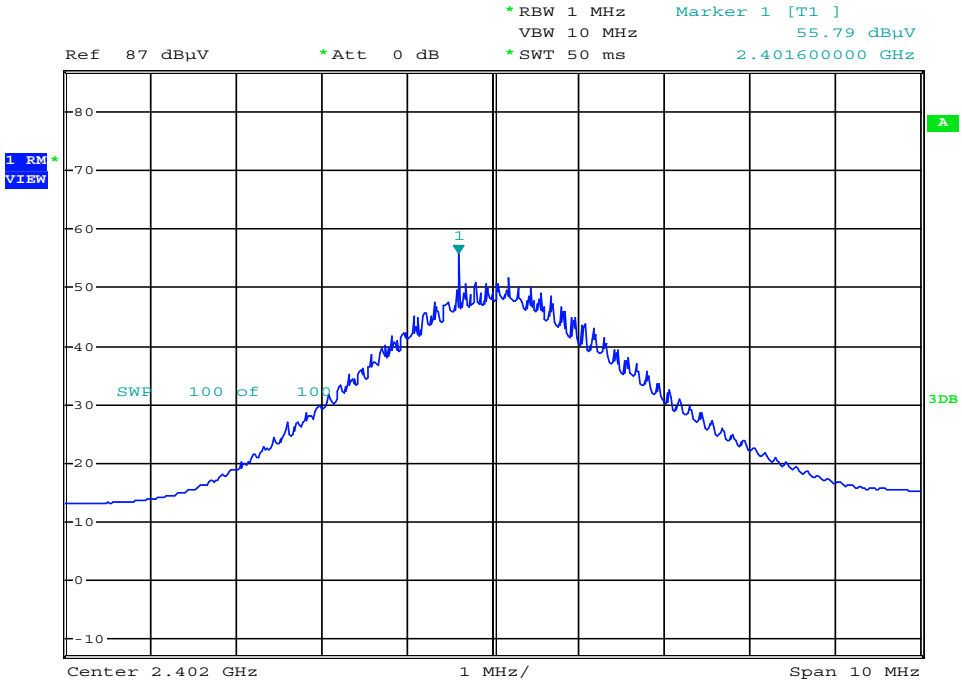
Test Setup	**Appendix A** **Figure A.2**

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.

Plot 9.1 – Field Strength – 2402MHz, RMS, Horizontal

Field Strength (Average)

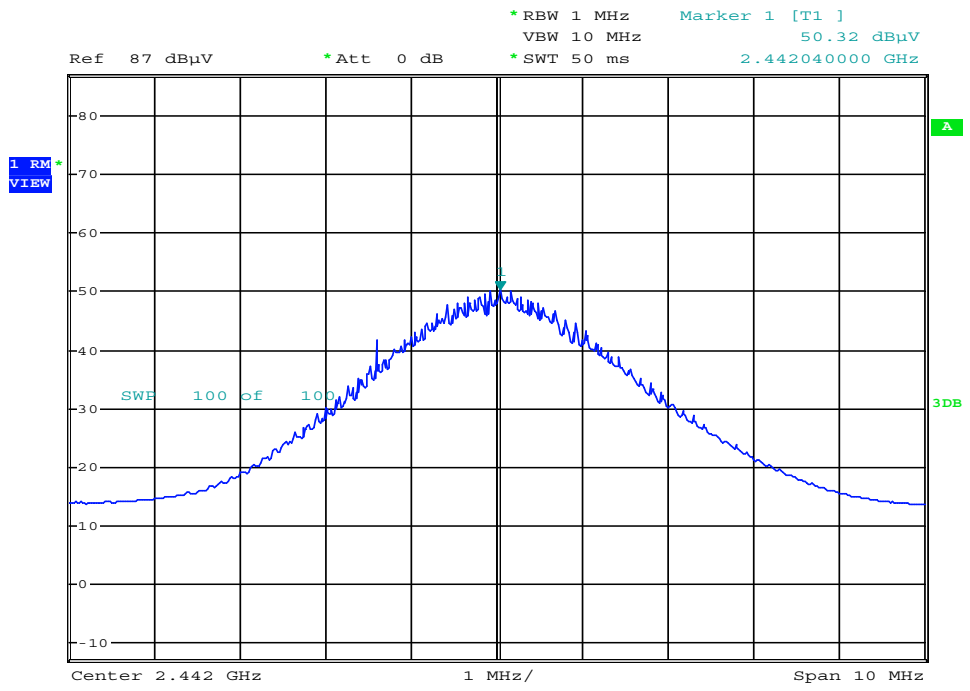


Date: 26.NOV.2020 12:26:07

Channel Frequency:	Detector:	Antenna Polarization:
2402.00 MHz	**RMS**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**55.79** dBuV

Plot 9.2 – Field Strength – 2442MHz, RMS, Horizontal

Field Strength (Average)

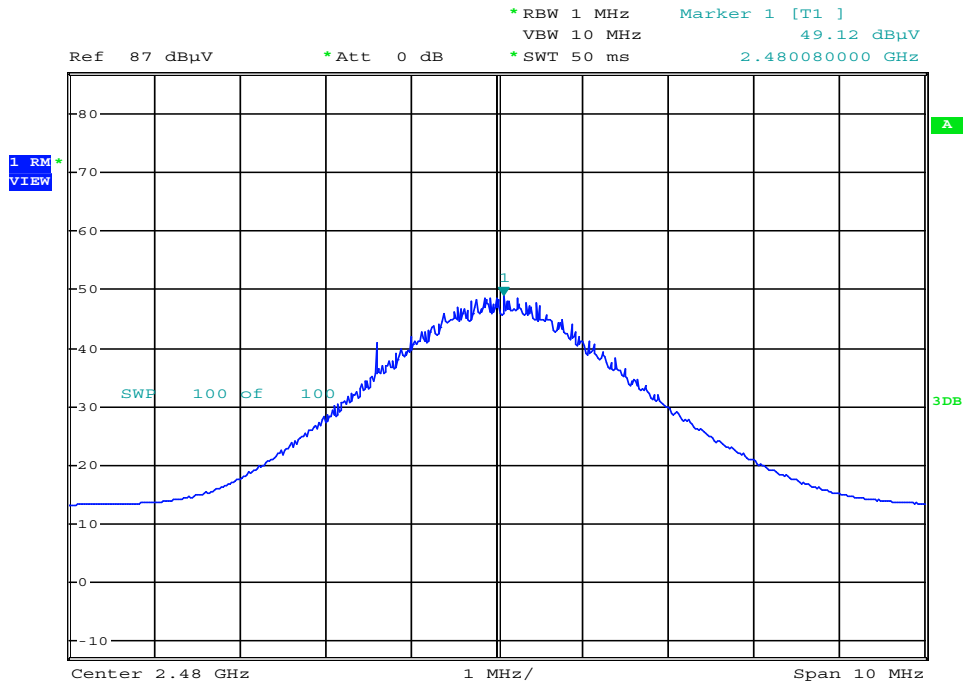


Date: 26.NOV.2020 12:28:46

Channel Frequency:	Detector:	Antenna Polarization:
2442.00 MHz	**RMS**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**50.32** dBuV

Plot 9.3 – Field Strength – 2480MHz, RMS, Horizontal

Field Strength (Average)

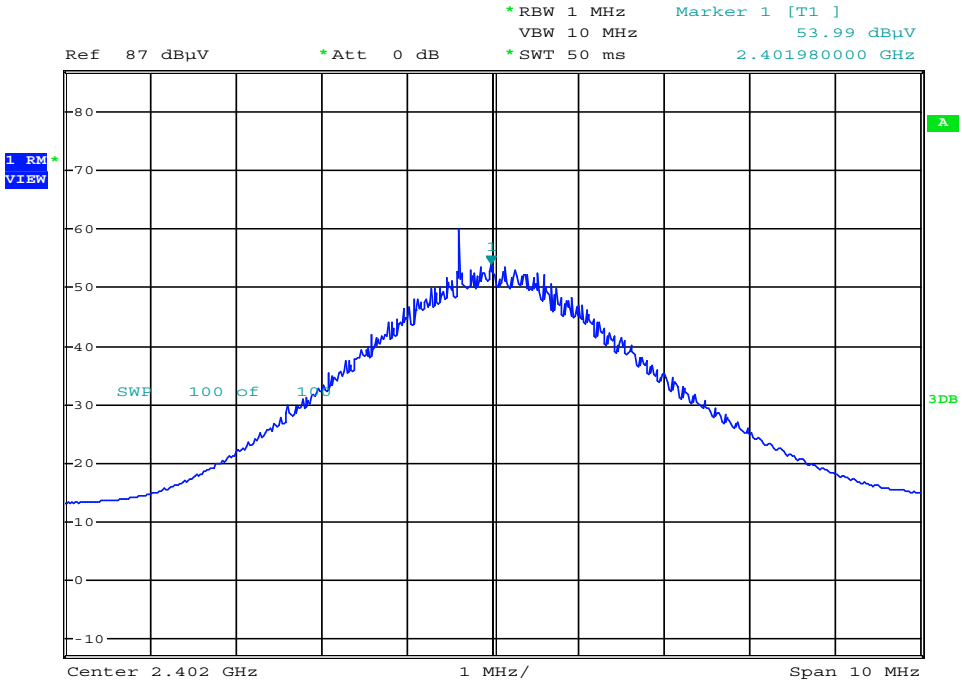


Date: 26.NOV.2020 12:40:54

Channel Frequency:	Detector:	Antenna Polarization:
2480.00 MHz	**RMS**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**49.12** dBuV

Plot 9.4 – Field Strength – 2402MHz, RMS, Vertical

Field Strength (Average)

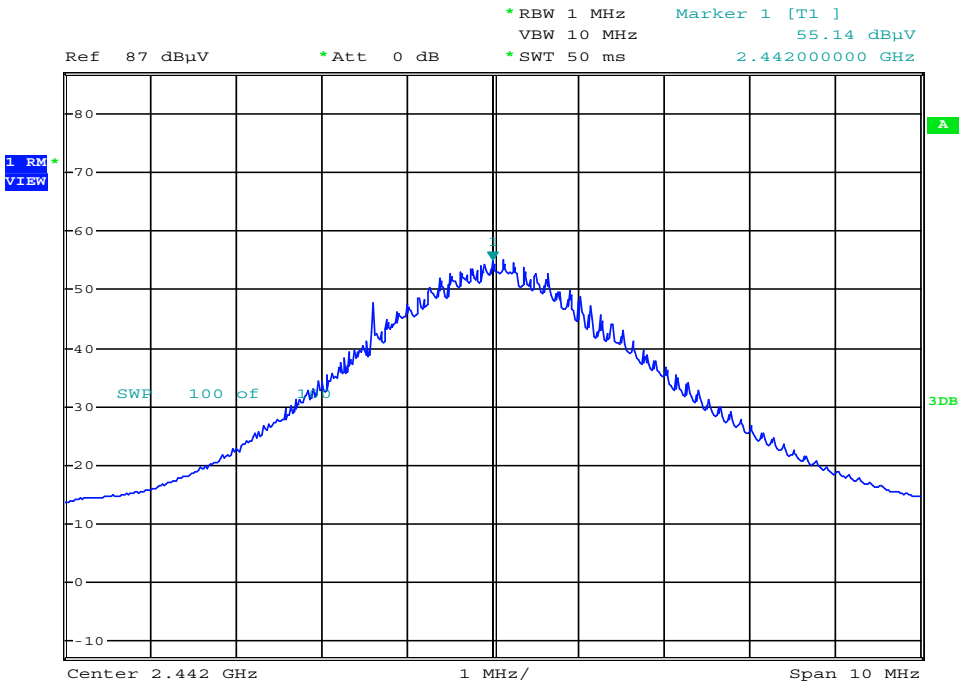


Date: 26.NOV.2020 12:47:47

Channel Frequency:	Detector:	Antenna Polarization:
2402.00 MHz	**RMS**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**53.99** dBuV

Plot 9.5 – Field Strength – 2442MHz, RMS, Vertical

Field Strength (Average)

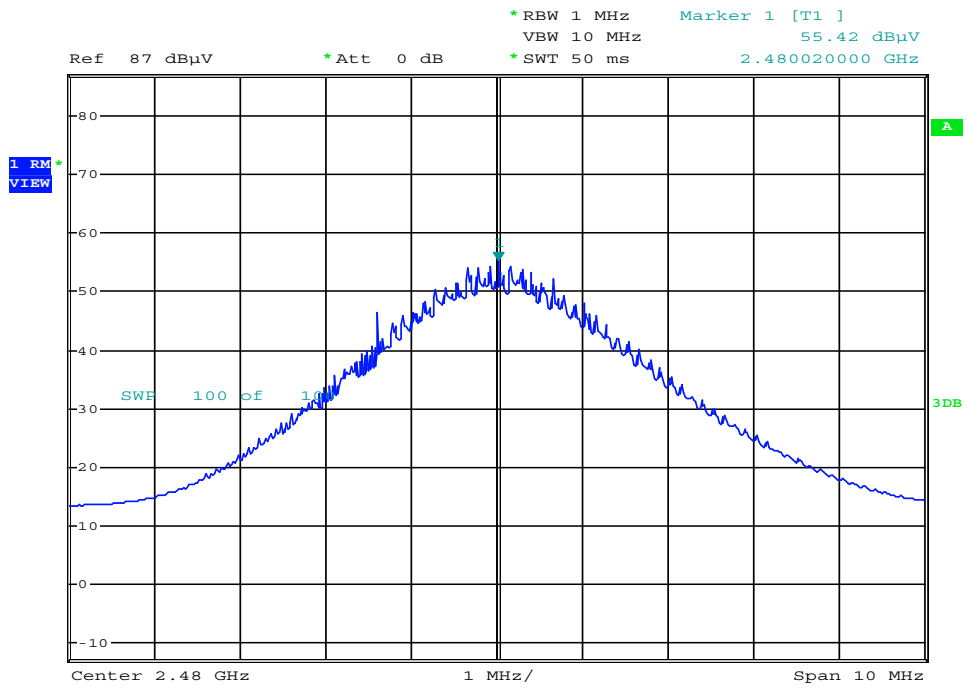


Date: 26.NOV.2020 12:52:58

Channel Frequency:	Detector:	Antenna Polarization:
2442.00 MHz	**RMS**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**55.14** dBuV

Plot 9.6 – Field Strength – 2480MHz, RMS, Vertical

Field Strength (Average)

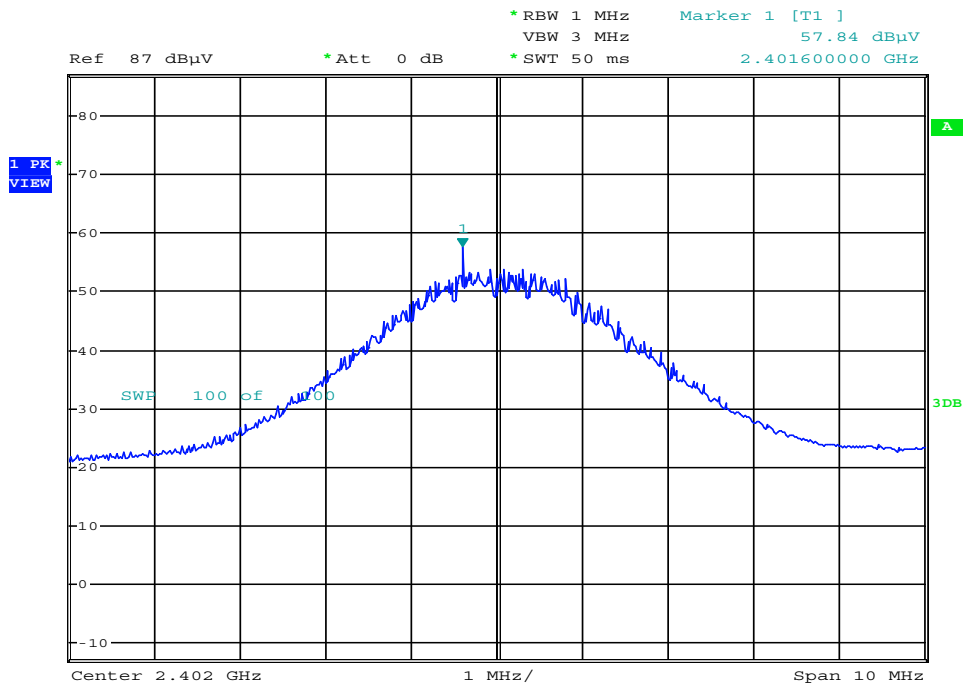


Date: 26.NOV.2020 12:42:48

Channel Frequency:	Detector:	Antenna Polarization:
2480.00 MHz	**RMS**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**55.42** dBuV

Plot 9.7 – Field Strength – 2402MHz, Peak, Horizontal

Field Strength (Peak)

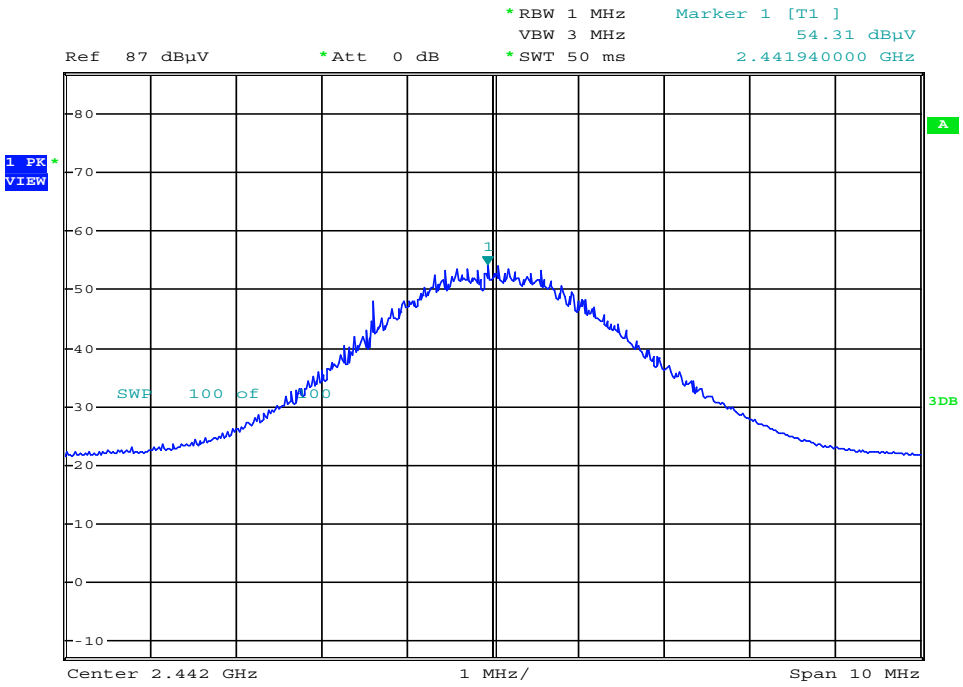


Date: 26.NOV.2020 12:49:50

Channel Frequency:	Detector:	Antenna Polarization:
2402.00 MHz	**Peak**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**57.84** dBuV

Plot 9.8 – Field Strength – 2442MHz, Peak, Horizontal

Field Strength (Peak)

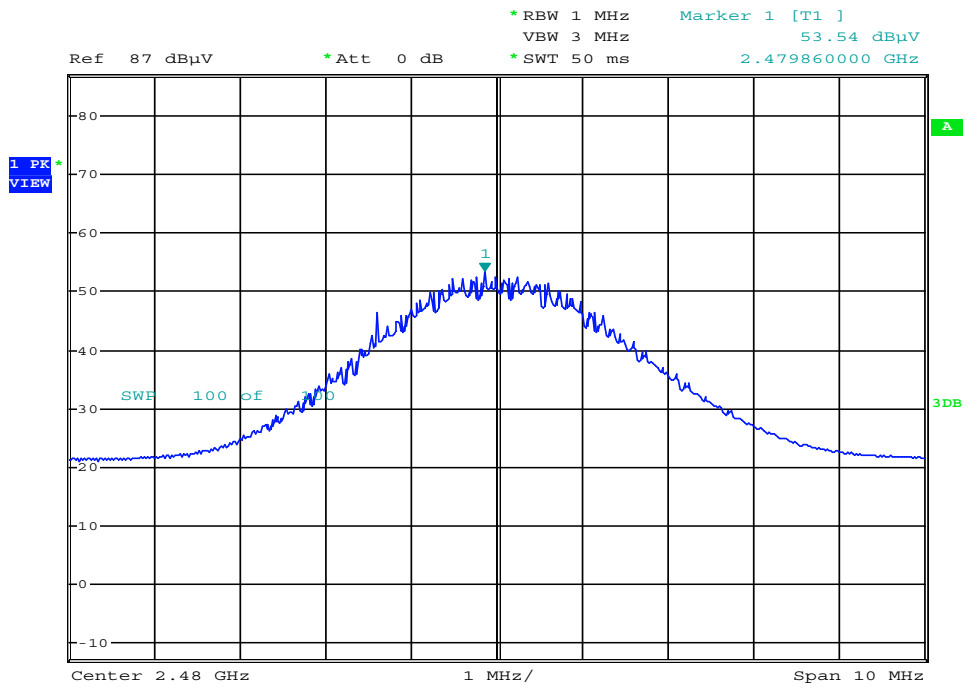


Date: 26.NOV.2020 12:37:37

Channel Frequency:	Detector:	Antenna Polarization:
2442.00 MHz	**Peak**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**54.31** dBuV

Plot 9.9 – Field Strength – 2480MHz, Peak, Horizontal

Field Strength (Peak)

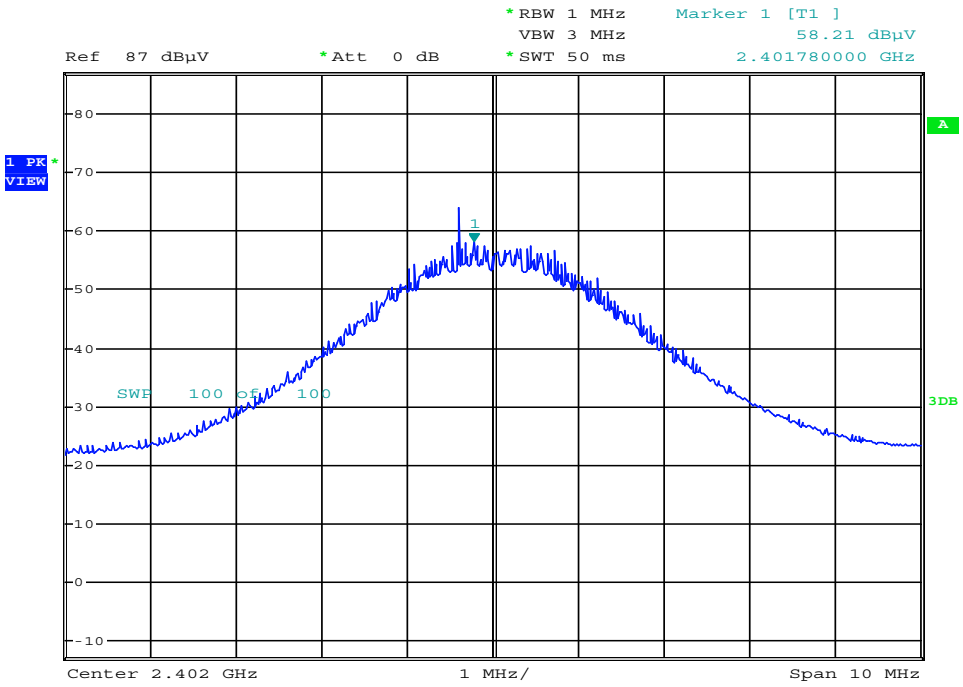


Date: 26.NOV.2020 12:40:08

Channel Frequency:	Detector:	Antenna Polarization:
2480.00 MHz	**Peak**	**Horizontal**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**53.54** dBuV

Plot 9.10 – Field Strength – 2402MHz, Peak, Vertical

Field Strength (Peak)

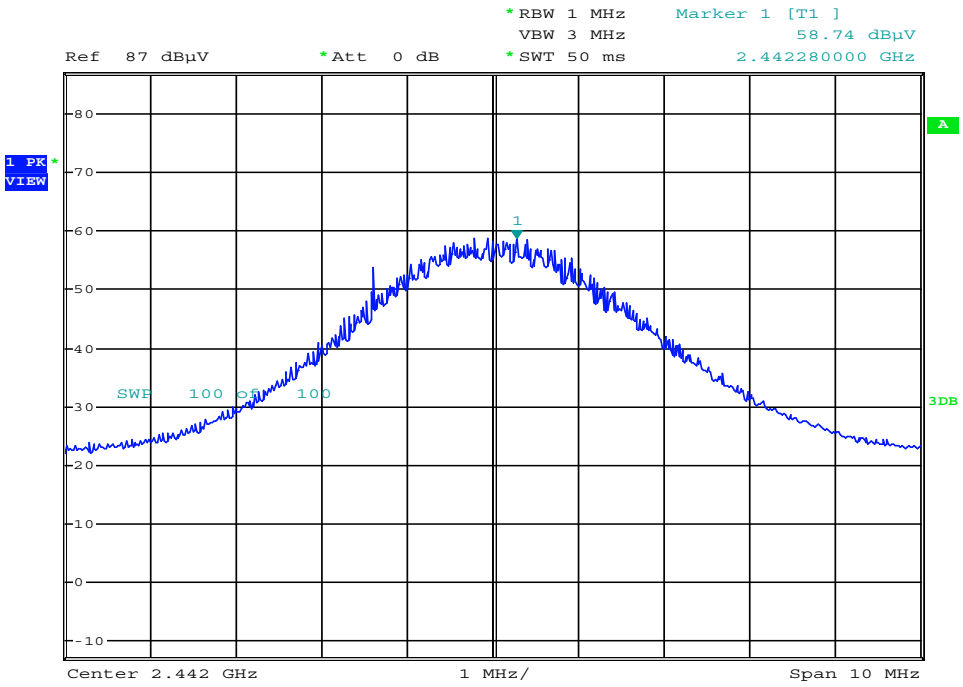


Date: 26.NOV.2020 12:46:18

Channel Frequency:	Detector:	Antenna Polarization:
2402.00 MHz	**Peak**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**58.21** dBuV

Plot 9.11 – Field Strength – 2442MHz, Peak, Vertical

Field Strength (Peak)

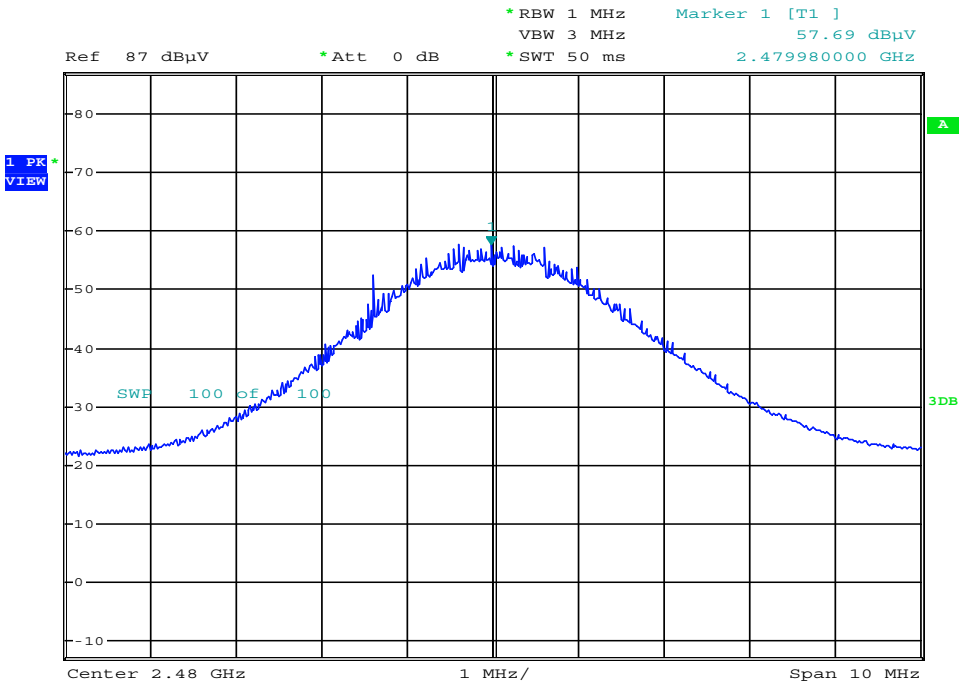


Date: 26.NOV.2020 12:52:24

Channel Frequency:	Detector:	Antenna Polarization:
2442.00 MHz	**Peak**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**58.74** dBuV

Plot 9.12 – Field Strength – 2480MHz, Peak, Vertical

Field Strength (Peak)



Date: 26.NOV.2020 12:43:31

Channel Frequency:	Detector:	Antenna Polarization:
2480.00 MHz	**Peak**	**Vertical**
Modulation Setting:	**Protocol:**	**Measured Field Strength:**
GMSK	**BLE**	**57.69** dBuV

Table 9.1 - Summary of Field Strength Measurements

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	55.79	4.6	28.3	88.69	94.0	**5.3**
2442.0					50.32			83.22		**10.8**
2480.0					49.12			82.02		**12.0**
2402.0				Vertical	53.99			86.89		**7.1**
2442.0					55.14			88.04		**6.0**
2480.0					55.42			88.32		**5.7**
2402.0	BLE	GMSK	Peak	Horizontal	57.84	4.6	28.3	90.74	114.0	**23.3**
2442.0					54.31			87.21		**26.8**
2480.0					53.54			86.44		**27.6**
2402.0				Vertical	58.21			91.11		**22.9**
2442.0					58.74			91.64		**22.4**
2480.0					57.69			90.59		**23.4**
								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).

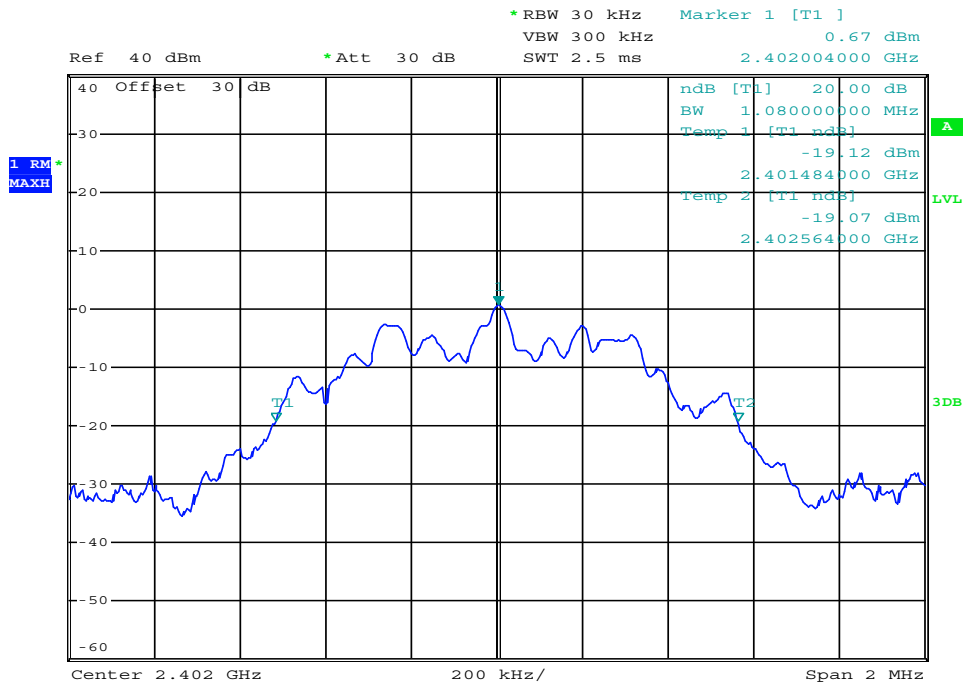
Test Setup	Appendix A Figure A.1

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.

Plot 10.1 – 20dB Bandwidth, 2402MHz

20dB Bandwidth

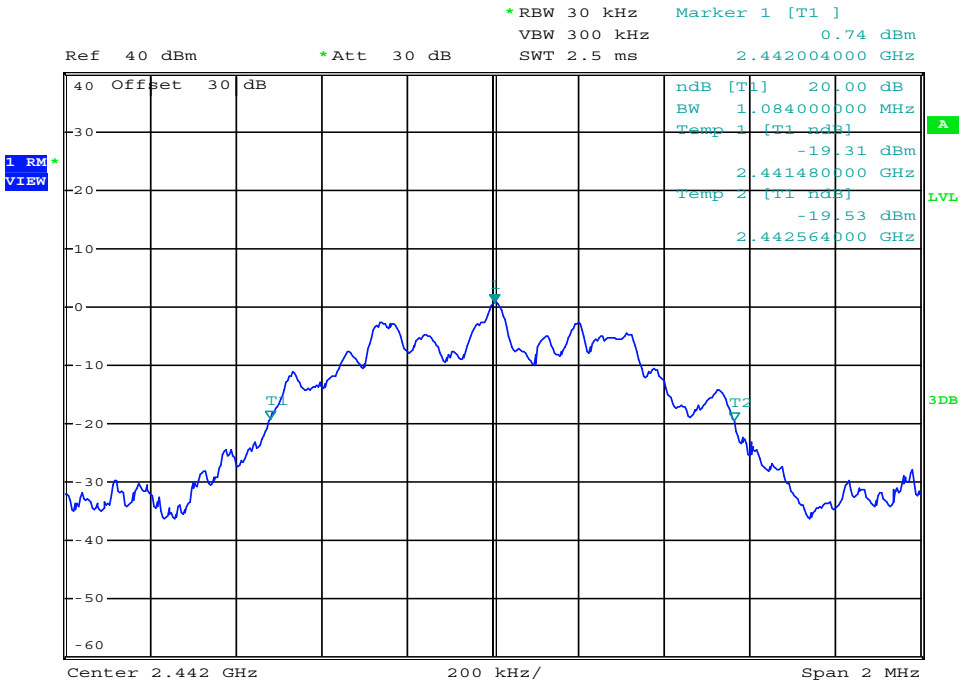


Date: 4.JAN.2021 15:54:30

Channel Frequency:		
2402.00 MHz		
DUT Modulation:	Mode:	Measured 20dB Bandwidth:
GMSK	**BLE**	**1.080** MHz

Plot 10.2 – 20dB Bandwidth, 2442MHz

20dB Bandwidth

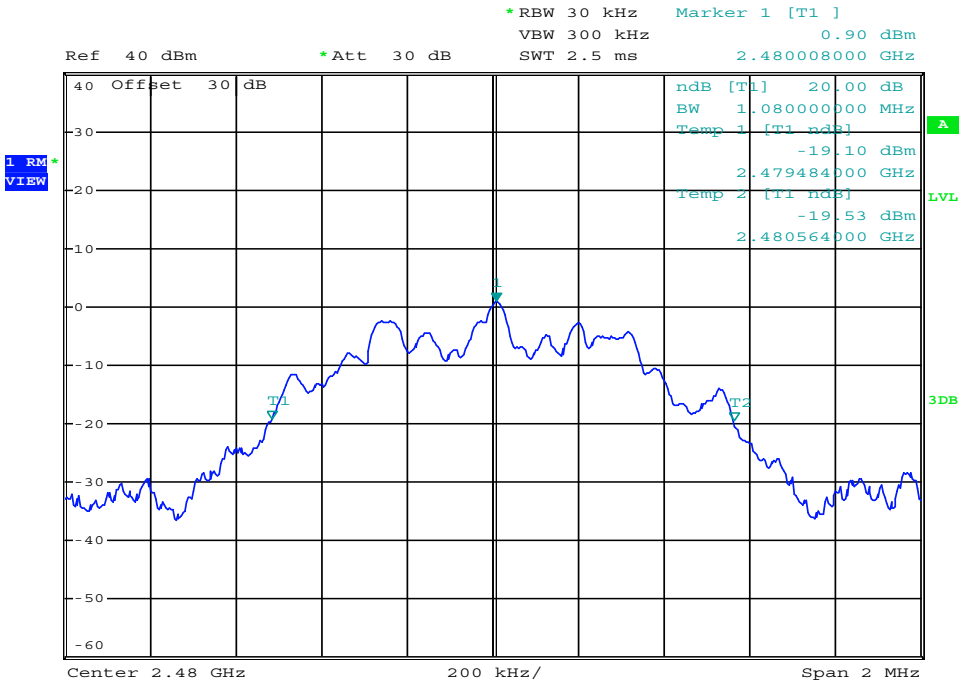


Date: 4.JAN.2021 15:57:02

Channel Frequency:		
2442.00 MHz		
DUT Modulation:	Mode:	Measured 20dB Bandwidth:
GMSK	**BLE**	**1.084** MHz

Plot 10.3 – 20dB Bandwidth, 2480MHz

20dB Bandwidth



Date: 4.JAN.2021 15:55:49

Channel Frequency:		
2480.00 MHz		
DUT Modulation:	Mode:	Measured 20dB Bandwidth:
GMSK	**BLE**	**1.080** MHz

Table 10.1 - Summary of 20dB BW Measurements

20dB BW Bandwidth Measurement Results (DXX)			
Frequency (MHz)	Modulation	Mode	Measured 20dB Bandwidth (MHz)
2402	GMSK	BLE	1.080
2442	GMSK	BLE	1.084
2480	GMSK	BLE	1.080
		Result:	Complies

Compliance to §15.215(c):

Largest Measured 20dB BW < 1.084MHz, 50% BW < 0.542MHz

LBE = 2402MHz - 0.542MHz = 2401.458MHz > 2400MHz

UBE = 2480 + 0.542MHz = 2480.542MHz < 2483.5MHz

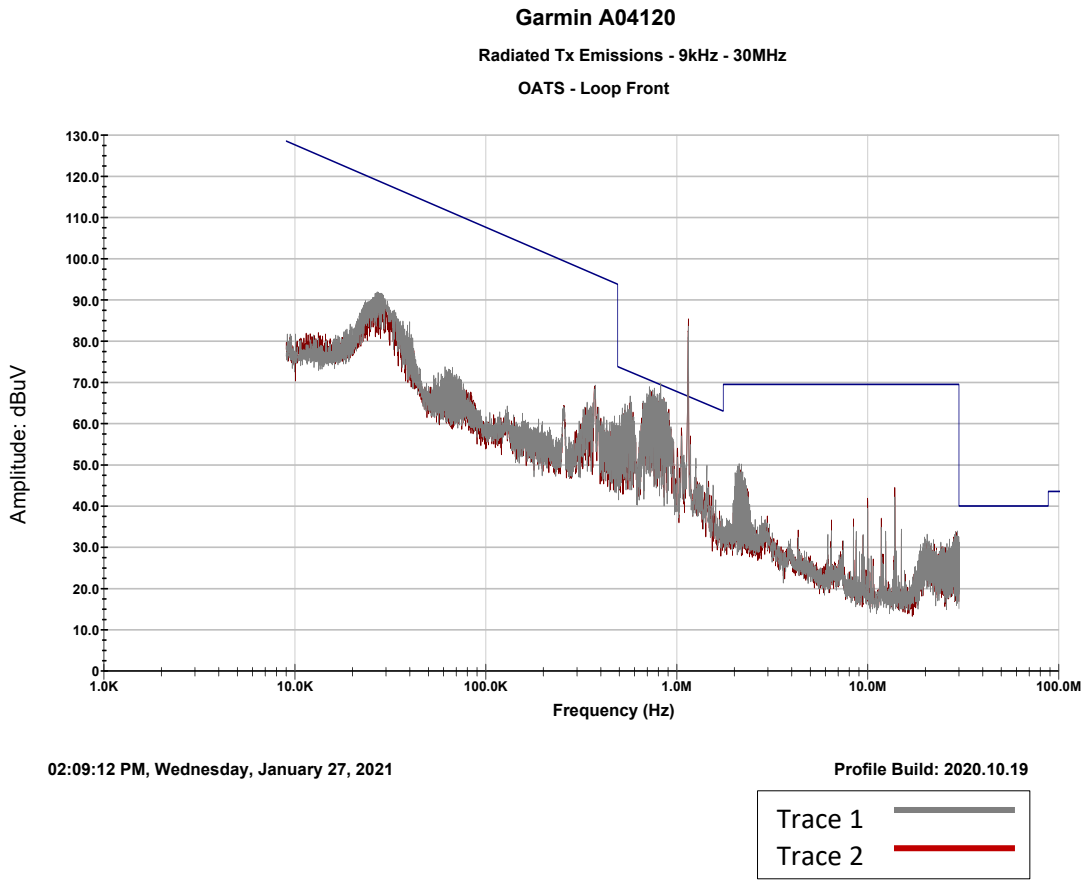
11.0 RADIATED SPURIOUS EMISSIONS – RESTRICTED BANDS

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

Plot 11.1 – Radiated Tx, Restricted Band, 9kHz – 30MHz, Front

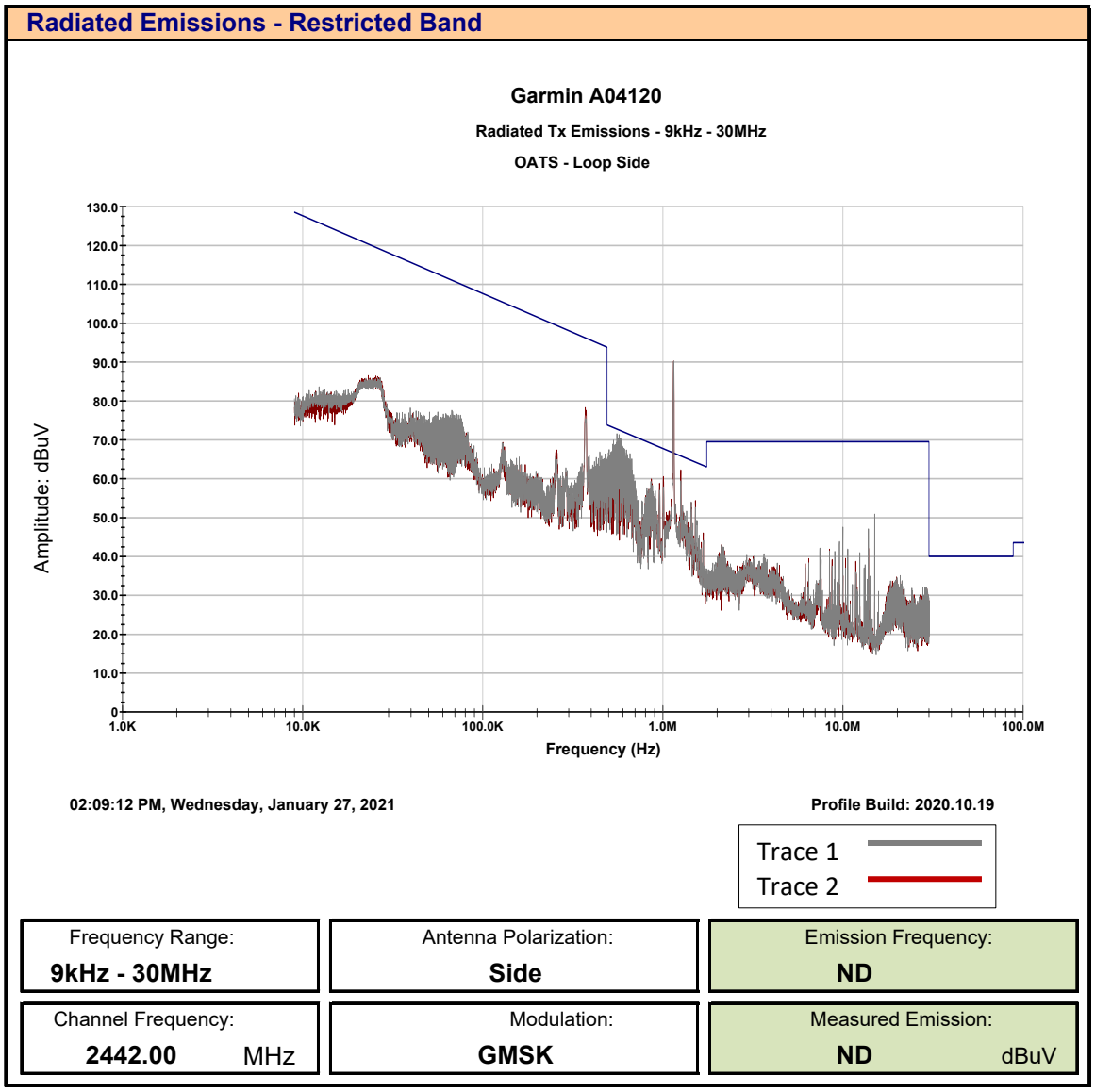
Radiated Emissions - Restricted Band



Frequency Range:	Antenna Polarization:	Emission Frequency:
9kHz - 30MHz	**Front**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Trace 1: Ambient
Trace 2: Ambient + DUT

Plot 11.2 – Radiated Tx, Restricted Band, 9kHz – 30MHz, Side

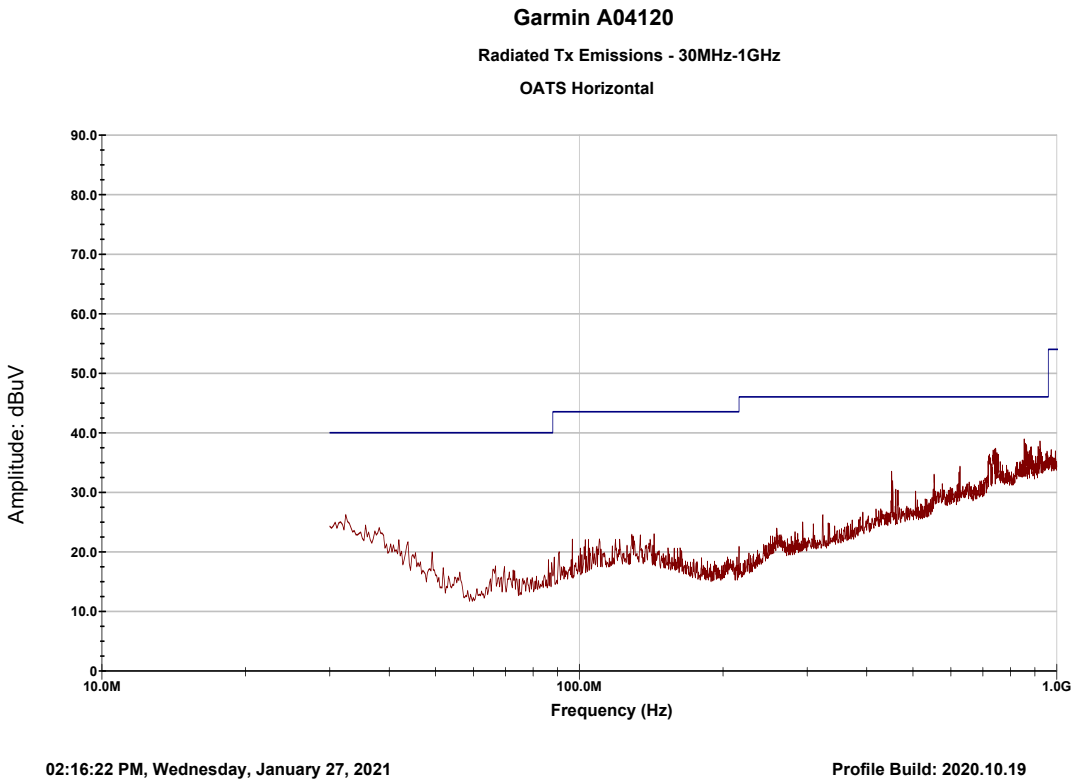


Trace 1: Ambient

Trace 2: Ambient + DUT

Plot 11.3 – Radiated Tx, Restricted Band, 30 - 1000MHz, Horizontal

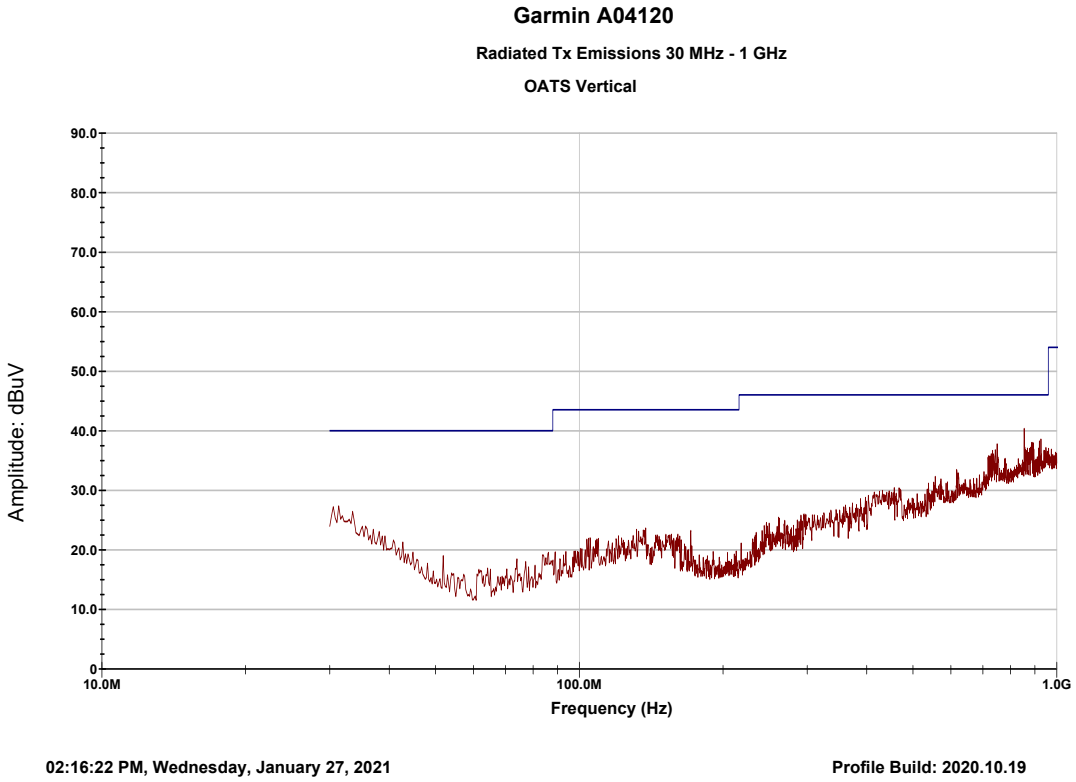
Radiated Emissions - Restricted Band



Frequency Range:	Antenna Polarization:	Emission Frequency:
30-1000MHz	**Horizontal**	**ND**
Channel Frequency:	Modulation:	Measured Emission:
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.4 – Radiated Tx, Restricted Band, 30 - 1000MHz, Vertical

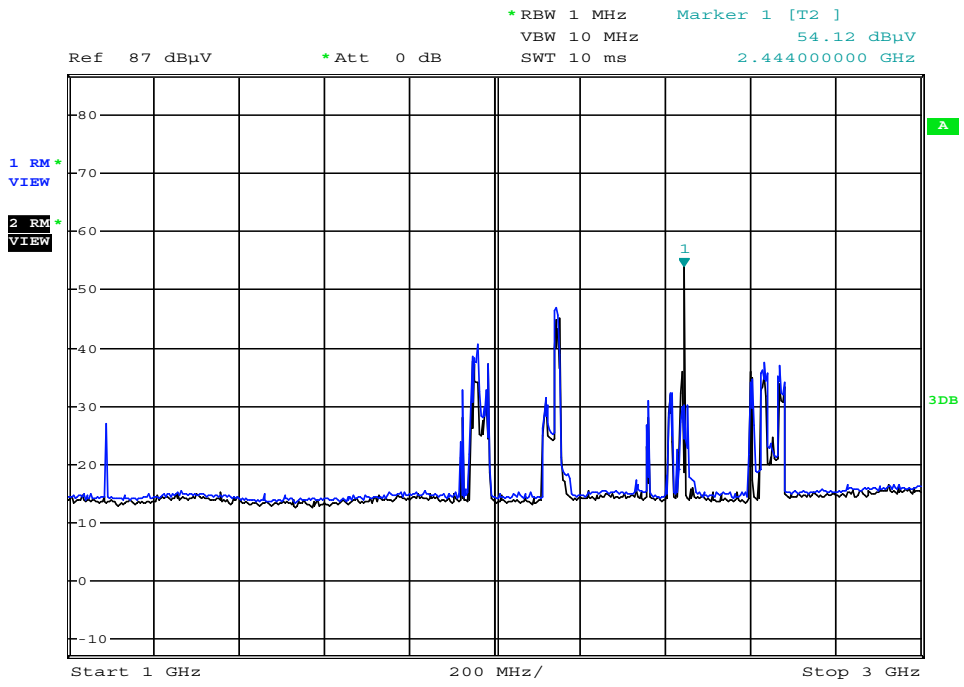
Radiated Emissions - Restricted Band



Frequency Range:	Antenna Polarization:	Emission Frequency:
30-1000MHz	**Vertical**	**ND**
Channel Frequency:	Modulation:	Measured Emission:
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.5 – Radiated Tx, Restricted Band, 1 – 3 GHz, Horizontal

Radiated Emissions - Restricted Band



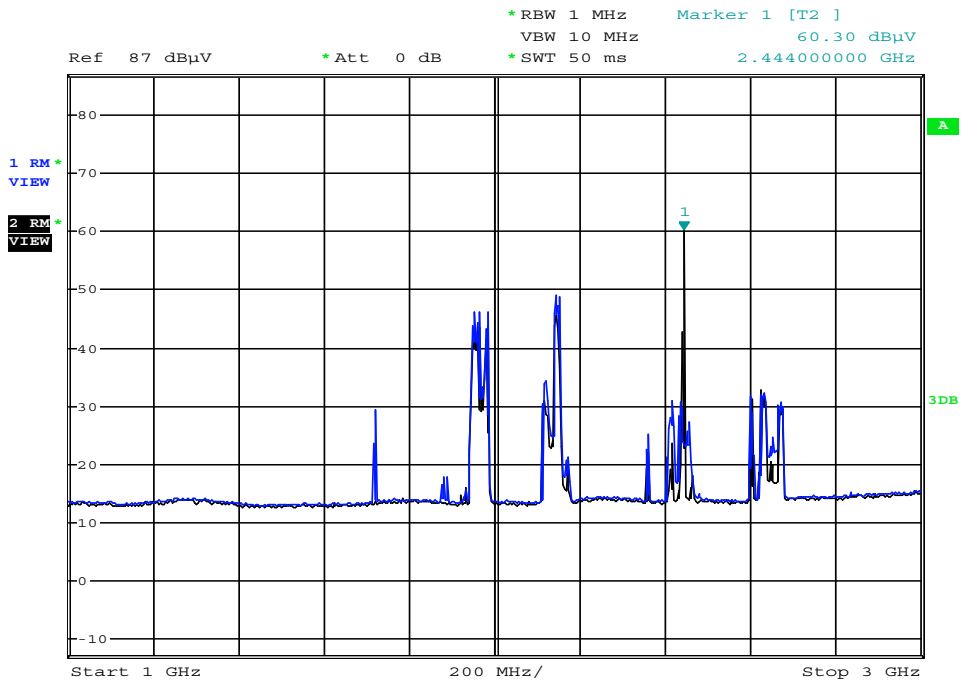
Date: 26.NOV.2020 13:05:48

Frequency Range:	Antenna Polarization:	Emission Frequency:
1 - 3GHz	**Horizontal**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Trace 1: Ambient
Trace 2: Ambient + DUT
Marker 1: Fundamental

Plot 11.6 – Radiated Tx, Restricted Band, 1 – 3 GHz, Vertical

Radiated Emissions - Restricted Band



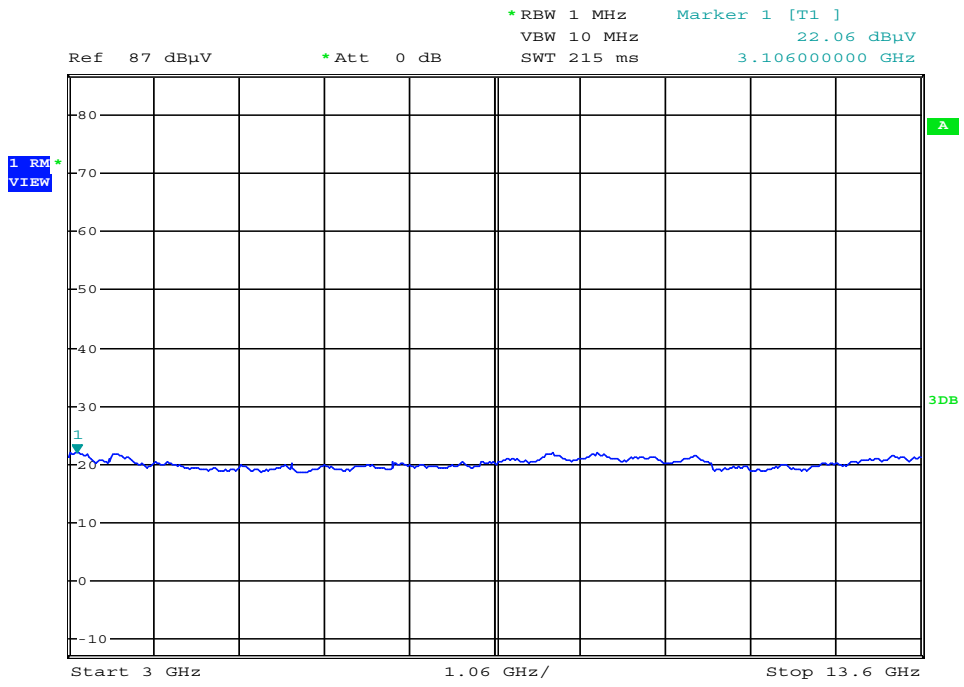
Date: 26.NOV.2020 12:58:05

Frequency Range:	Antenna Polarization:	Emission Frequency:
1 - 3GHz	**Vertical**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Trace 1: Ambient
Trace 2: Ambient + DUT
Marker 1: Fundamental

Plot 11.7 – Radiated Tx, Restricted Band, 3 – 13 GHz, Horizontal

Radiated Emissions - Restricted Band

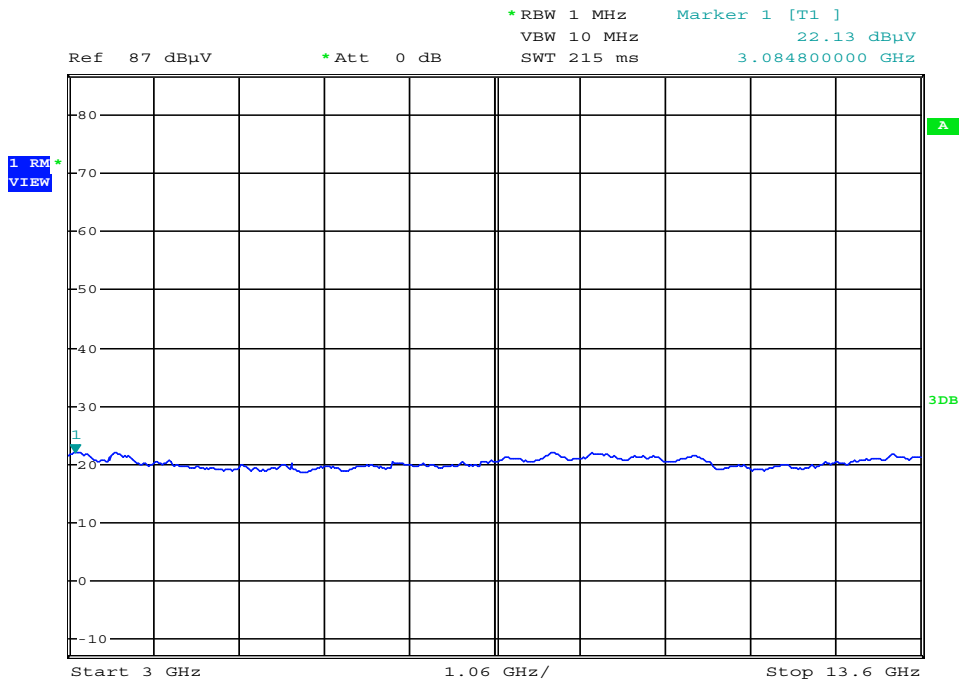


Date: 26.NOV.2020 13:06:20

Frequency Range:	Antenna Polarization:	Emission Frequency:
3-13GHz	**Horizontal**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.8 – Radiated Tx, Restricted Band, 3 – 13 GHz, Vertical

Radiated Emissions - Restricted Band

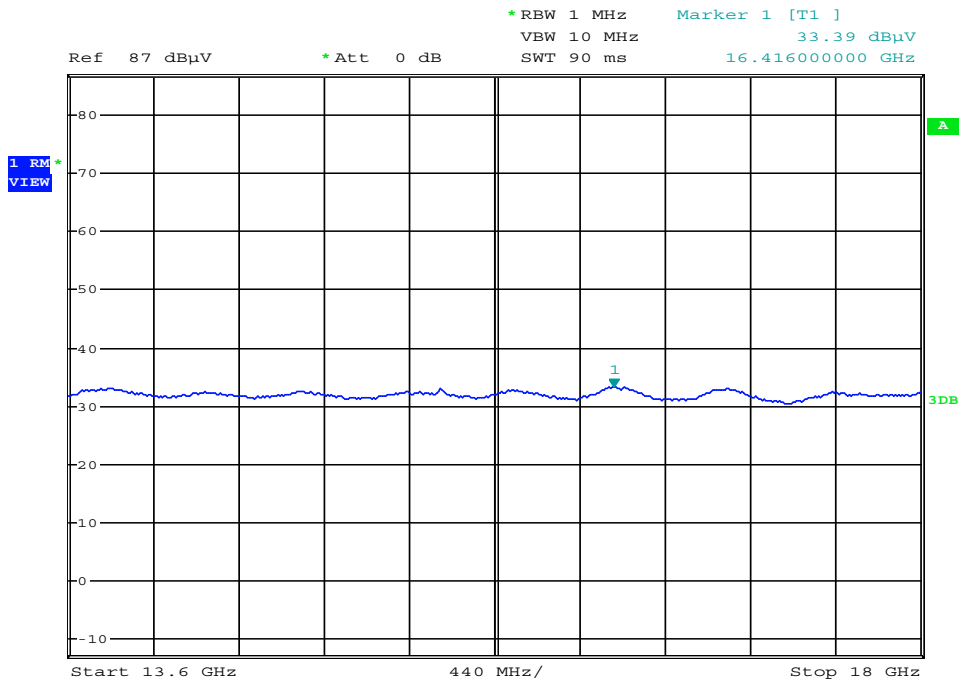


Date: 26.NOV.2020 12:59:28

Frequency Range:	Antenna Polarization:	Emission Frequency:
3-13GHz	**Vertical**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.9 – Radiated Tx, Restricted Band, 13 – 18 GHz, Horizontal

Radiated Emissions - Restricted Band

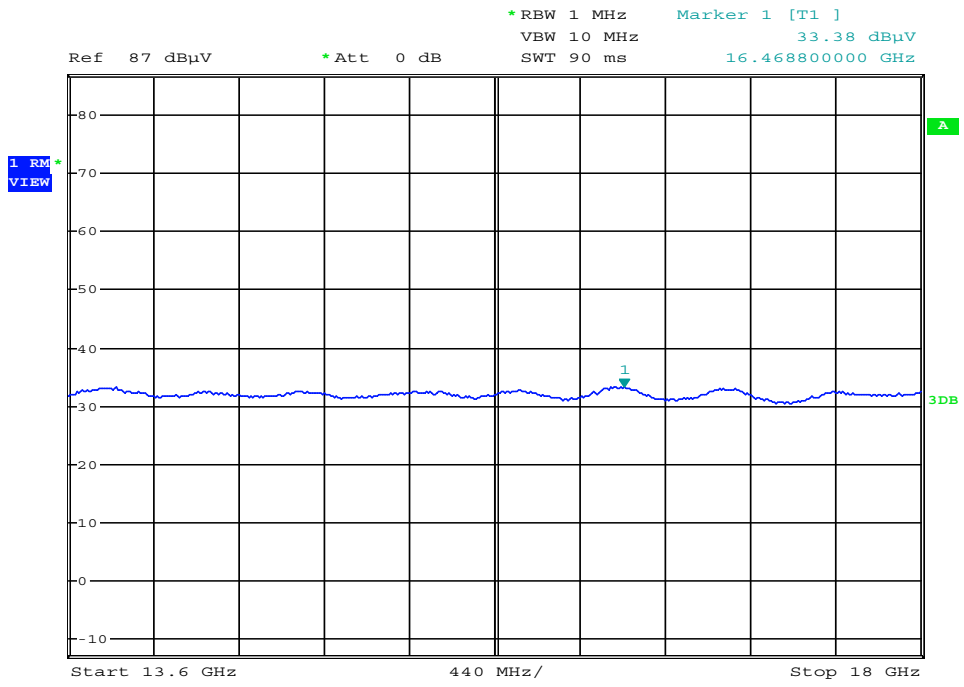


Date: 26.NOV.2020 13:07:06

Frequency Range:	Antenna Polarization:	Emission Frequency:
13-18GHz	**Horizontal**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.10 – Radiated Tx, Restricted Band, 13 – 18 GHz, Vertical

Radiated Emissions - Restricted Band

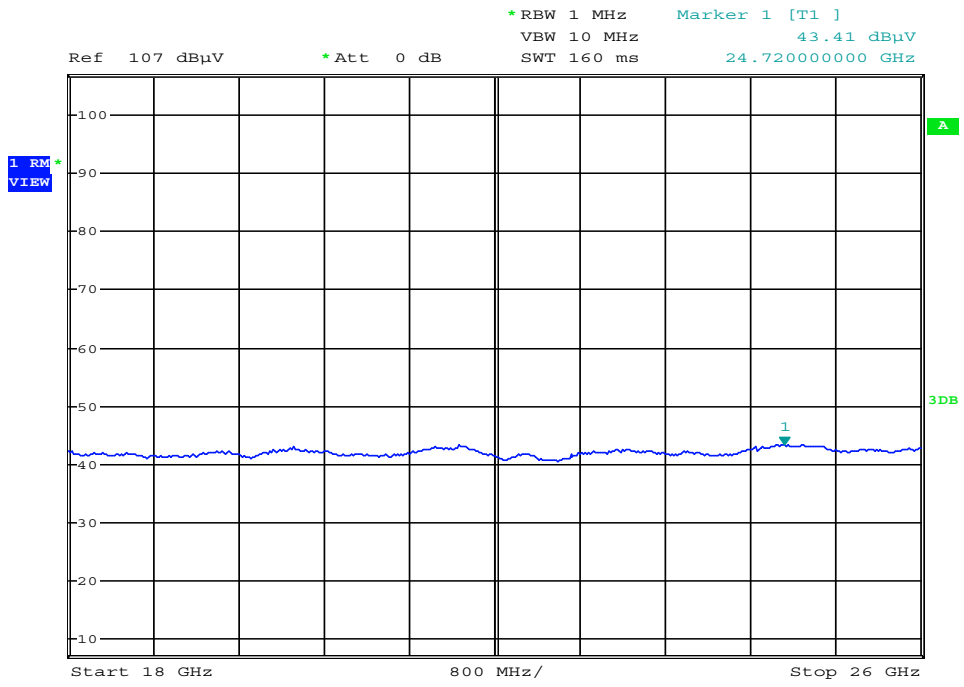


Date: 26.NOV.2020 13:00:14

Frequency Range:	Antenna Polarization:	Emission Frequency:
13-18GHz	**Vertical**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.11 – Radiated Tx, Restricted Band, 18 – 26 GHz, Horizontal

Radiated Emissions - Restricted Band

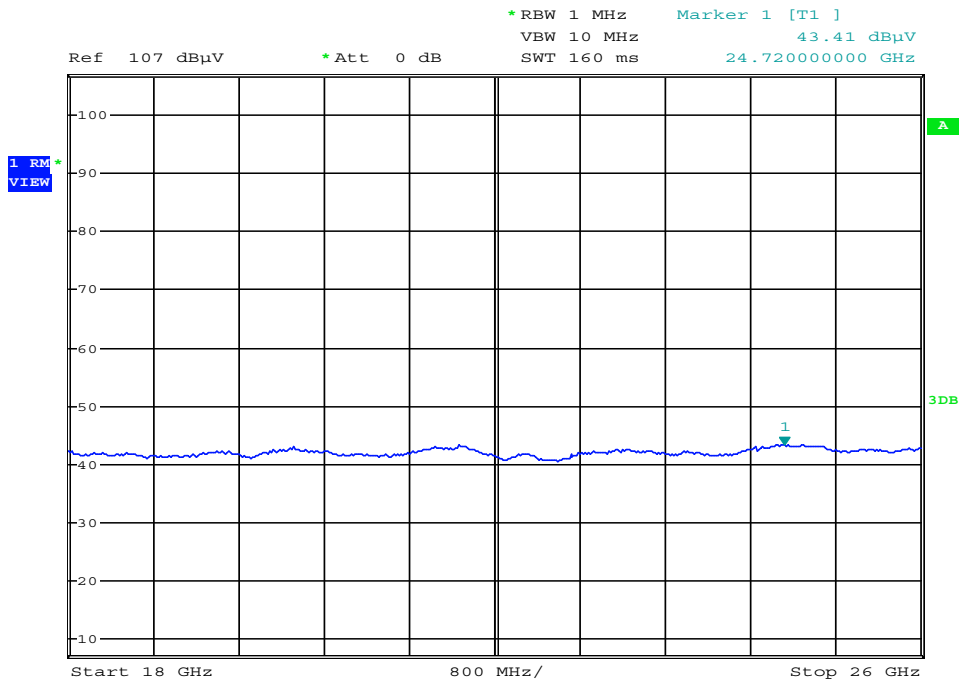


Date: 26.NOV.2020 14:25:16

Frequency Range:	Antenna Polarization:	Emission Frequency:
18-26GHz	**Horizontal**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

Plot 11.12 – Radiated Tx, Restricted Band, 18 – 26 GHz, Vertical

Radiated Emissions - Restricted Band



Date: 26.NOV.2020 14:25:16

Frequency Range:	Antenna Polarization:	Emission Frequency:
18-26GHz	**Horizontal**	**ND**
Channel Frequency:	**Modulation:**	**Measured Emission:**
2442.00 MHz	**GMSK**	**ND** dBuV

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

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	ND	ND	0.00	0.00	0.00 (3)	ND (2)	46.0	**n/a**
30-1000MHz	2442.0	Vertical	ND	ND	0.00	0.00	0.00 (3)	ND (2)	46.0	**n/a**
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

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

12.0 RADIATED RX SPURIOUS EMISSIONS

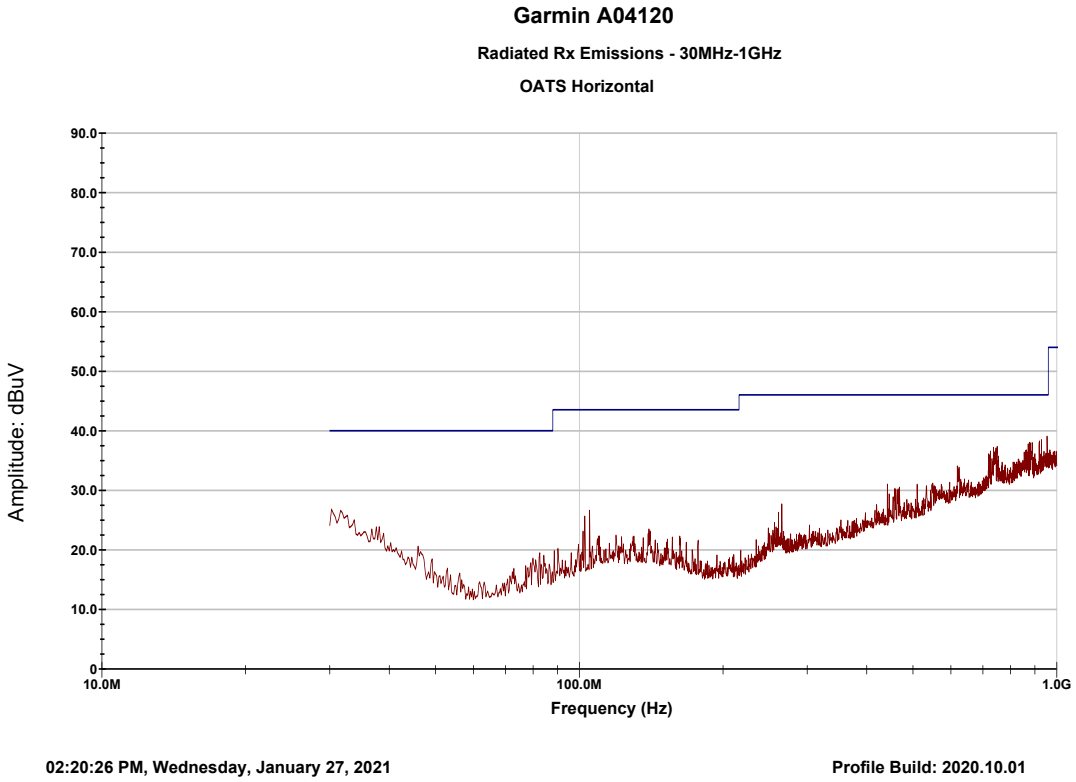
Test Procedure	
Normative Reference	FCC 47 CFR §2.1046
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

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.

Plot 12.1 – Radiated Rx, Restricted Band, 30 - 1000MHz, Horizontal

Radiated Rx Emissions

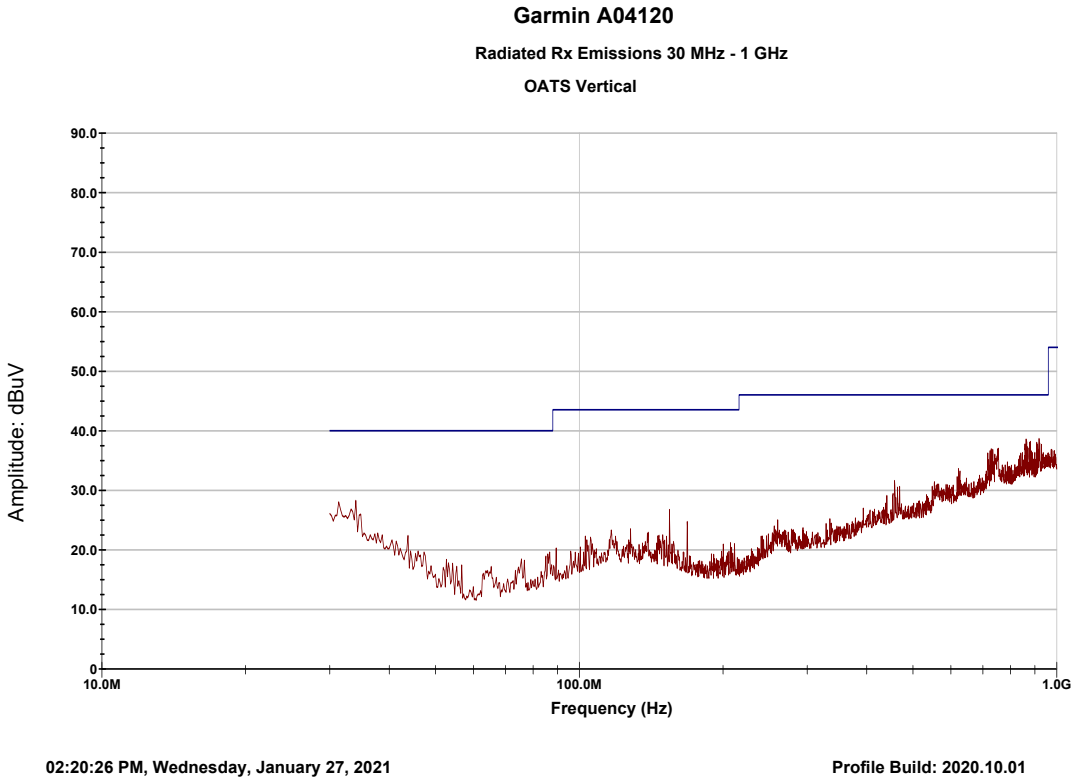


Frequency Range:	Antenna Polarization:	Emission Frequency:
30-1000MHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Plot 12.2– Radiated Rx, Restricted Band, 30 - 1000MHz, Vertical

Radiated Rx Emissions

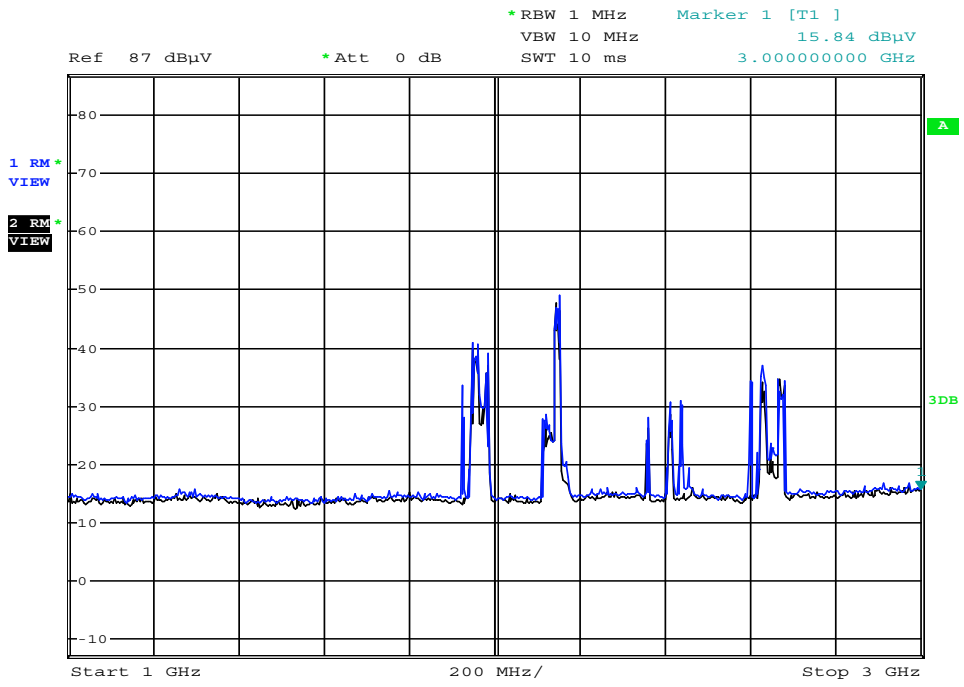


Frequency Range:	Antenna Polarization:	Emission Frequency:
30-1000MHz	**Vertical**	**ND**

Measured Emission: **ND** dBuV

Plot 12.3 – Radiated Rx, Restricted Band, 1 – 3 GHz, Horizontal

Radiated Rx Emissions



Date: 26.NOV.2020 13:24:29

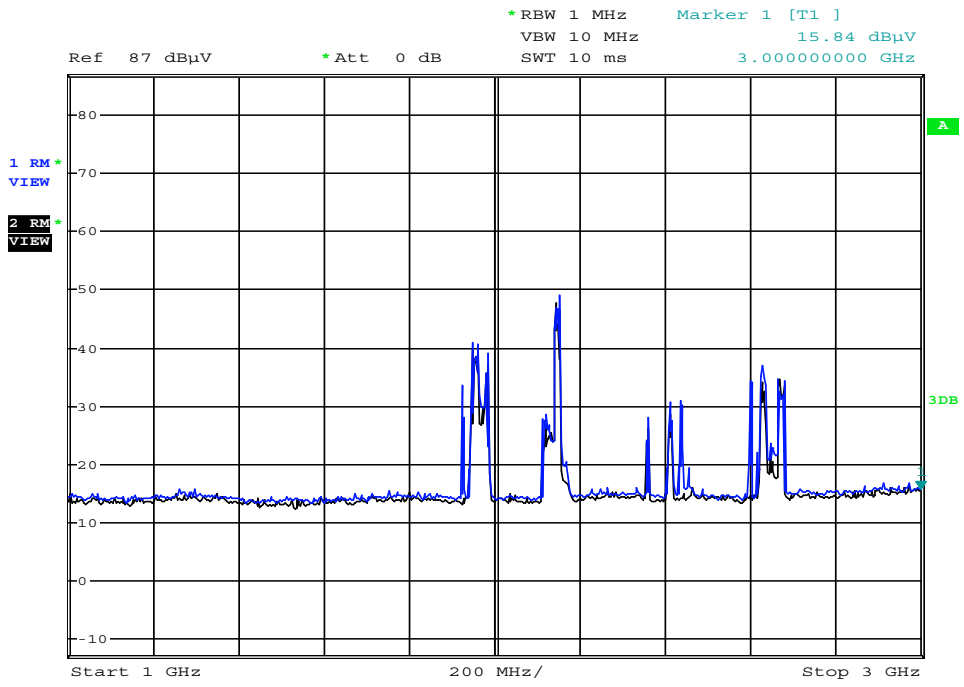
Frequency Range:	Antenna Polarization:	Emission Frequency:
1 - 3GHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Trace 1: Ambient

Plot 12.4 – Radiated Rx, Restricted Band, 1 – 3 GHz, Vertical

Radiated Rx Emissions



Date: 26.NOV.2020 13:24:29

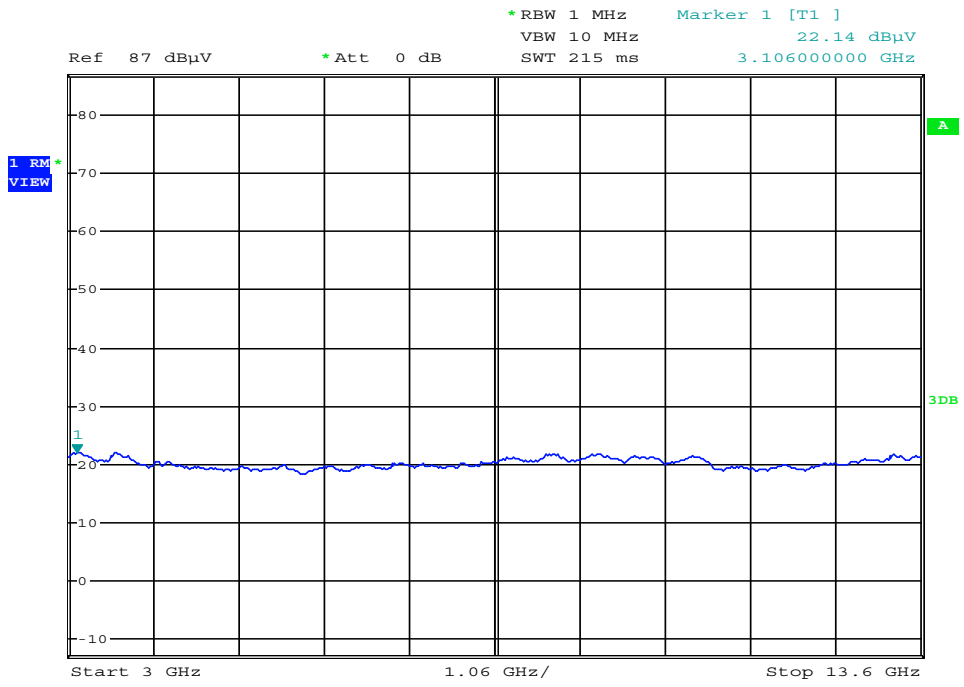
Frequency Range:	Antenna Polarization:	Emission Frequency:
1 - 3GHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Trace 1: Ambient

Plot 12.5 – Radiated Rx, Restricted Band, 3 – 13 GHz, Horizontal

Radiated Rx Emissions



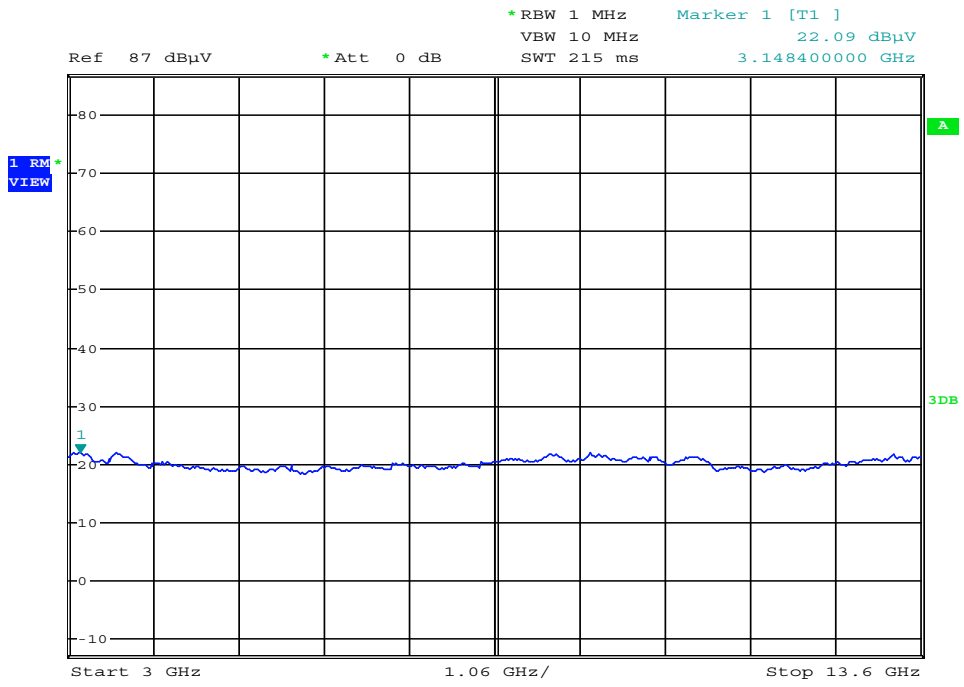
Date: 26.NOV.2020 13:23:30

Frequency Range:	Antenna Polarization:	Emission Frequency:
3-13GHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Plot 12.6 – Radiated Rx, Restricted Band, 3 – 13 GHz, Vertical

Radiated Rx Emissions



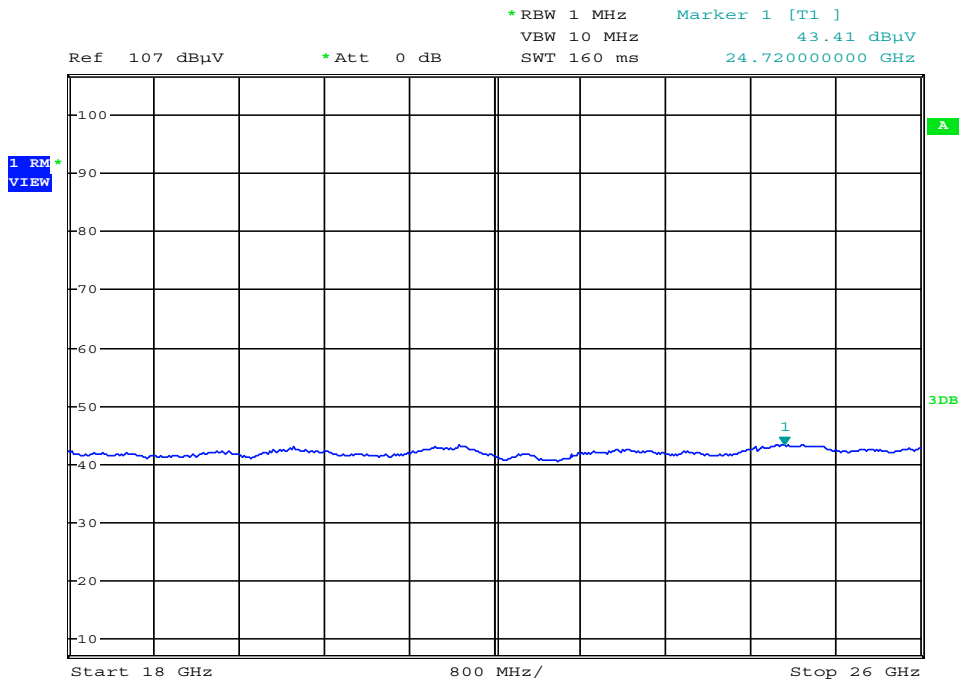
Date: 26.NOV.2020 13:27:23

Frequency Range:	Antenna Polarization:	Emission Frequency:
3-13GHz	**Vertical**	**ND**

Measured Emission:	
ND	dBuV

Plot 12.7 – Radiated Rx, Restricted Band, 13 – 18 GHz, Horizontal

Radiated Rx Emissions



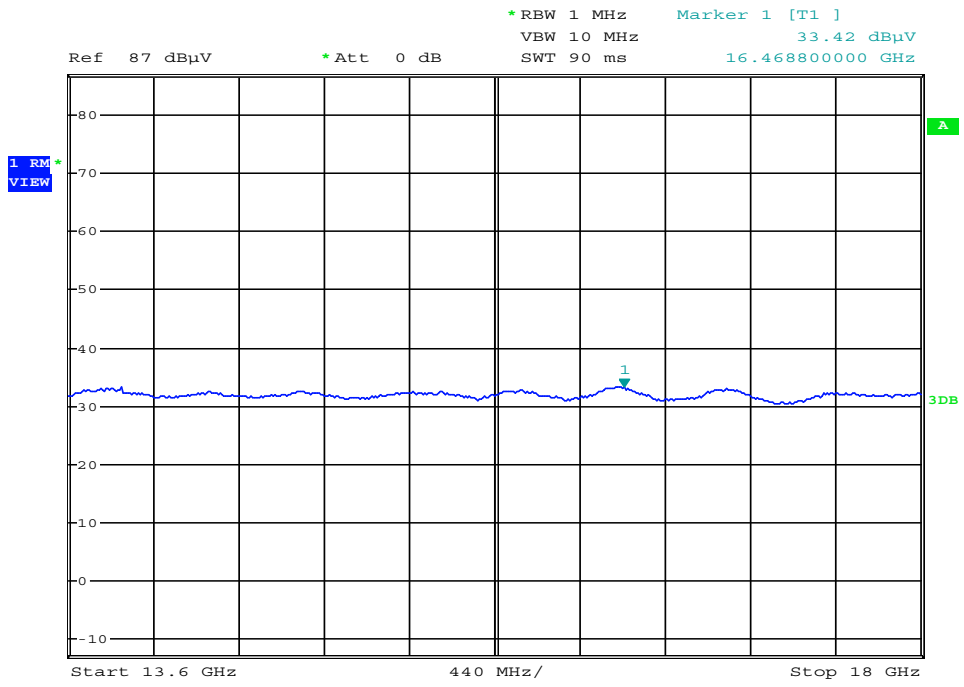
Date: 26.NOV.2020 14:25:16

Frequency Range:	Antenna Polarization:	Emission Frequency:
13-18GHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Plot 12.8 – Radiated Rx, Restricted Band, 13 – 18 GHz, Vertical

Radiated Rx Emissions



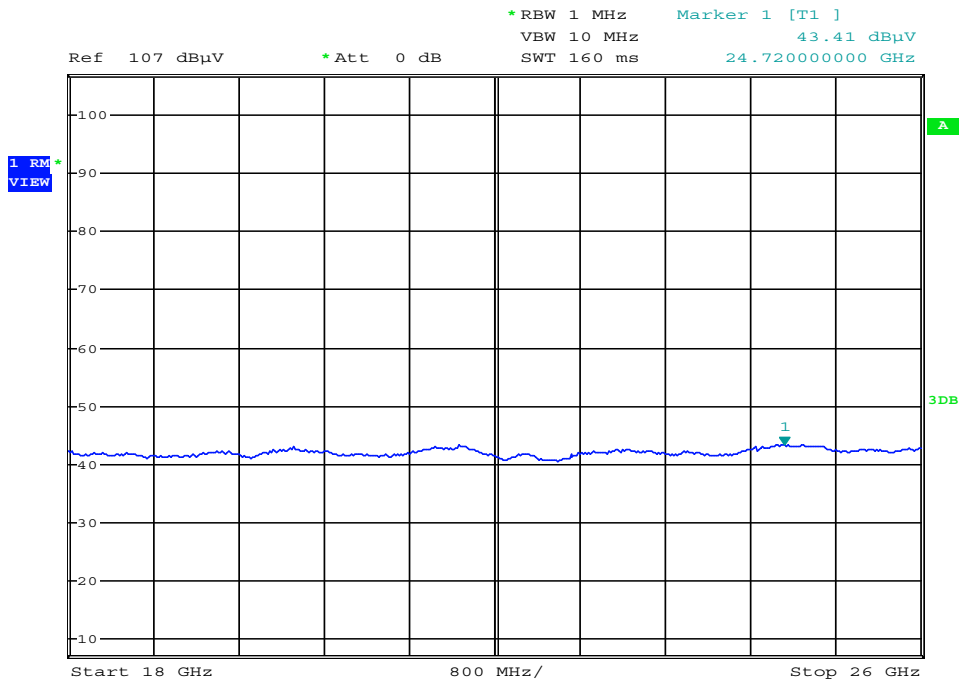
Date: 26.NOV.2020 13:27:51

Frequency Range:	Antenna Polarization:	Emission Frequency:
13-18GHz	**Vertical**	**ND**

Measured Emission:	
ND	dBuV

Plot 12.9 – Radiated Rx, Restricted Band, 18 – 26 GHz, Horizontal

Radiated Rx Emissions



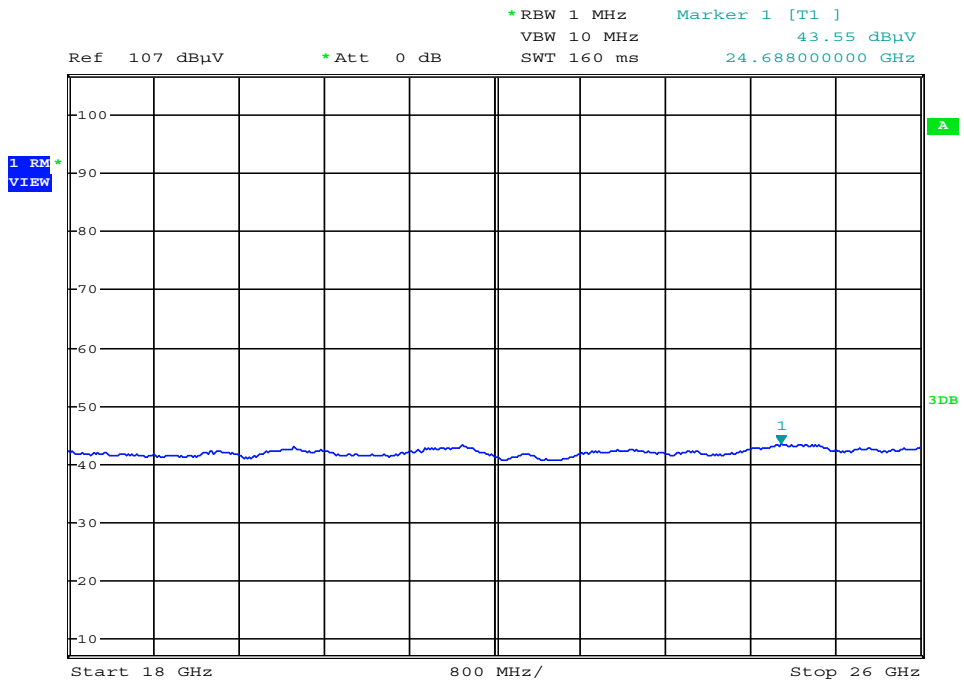
Date: 26.NOV.2020 14:25:16

Frequency Range:	Antenna Polarization:	Emission Frequency:
18-26GHz	**Horizontal**	**ND**

Measured Emission: **ND** dBuV

Plot 12.10 – Radiated Rx, Restricted Band, 18 – 26 GHz, Vertical

Radiated Rx Emissions



Date: 26.NOV.2020 14:28:55

Frequency Range:	Antenna Polarization:	Emission Frequency:
18-26GHz	**Vertical**	**ND**

Measured Emission: **ND** dBuV

Table 12.1 – Summary of Radiated Rx Emissions

Summary of Radiated Rx Emissions										
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)
30-1000MHz	2442.0	Horizontal	ND	ND	0.00	0.00	0.00 (3)	ND (2)	46.0	n/a
30-1000MHz	2442.0	Vertical	ND	ND	0.00	0.00	0.00 (3)	ND (2)	46.0	n/a
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

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

13.0 – POWER LINE CONDUCTED EMISSIONS

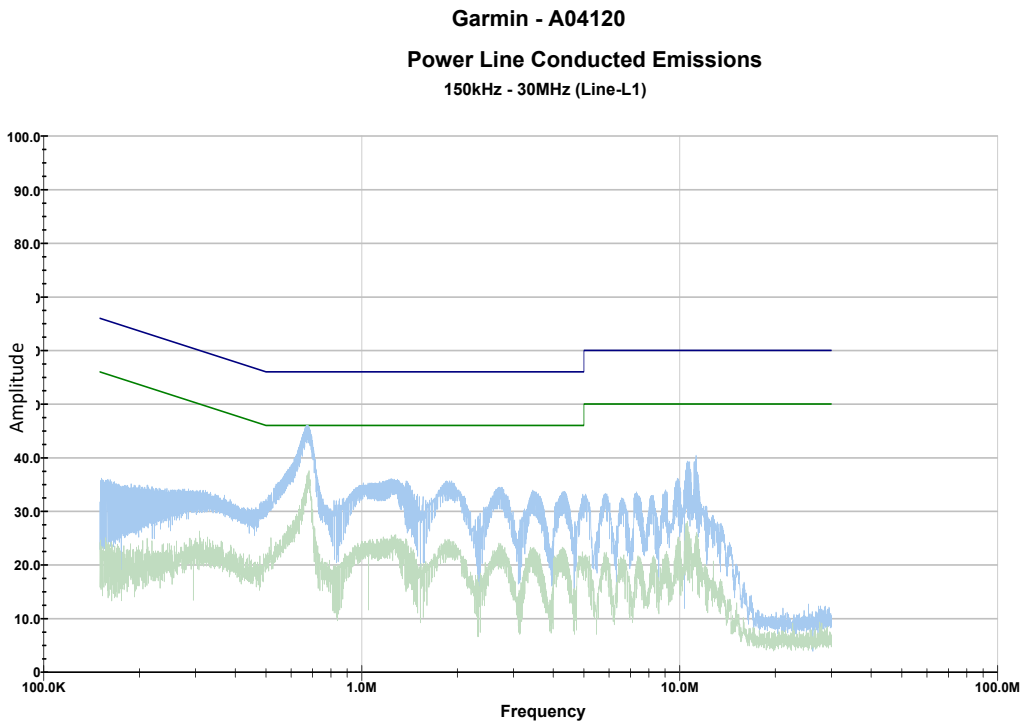
Test Procedure	
Normative Reference	**FCC 47 CFR §15.107, ICES-003(6.1)** **ANSI C63.4-2014**

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.5

Plot 13.1 Power Line Conducted Emissions – Line 1

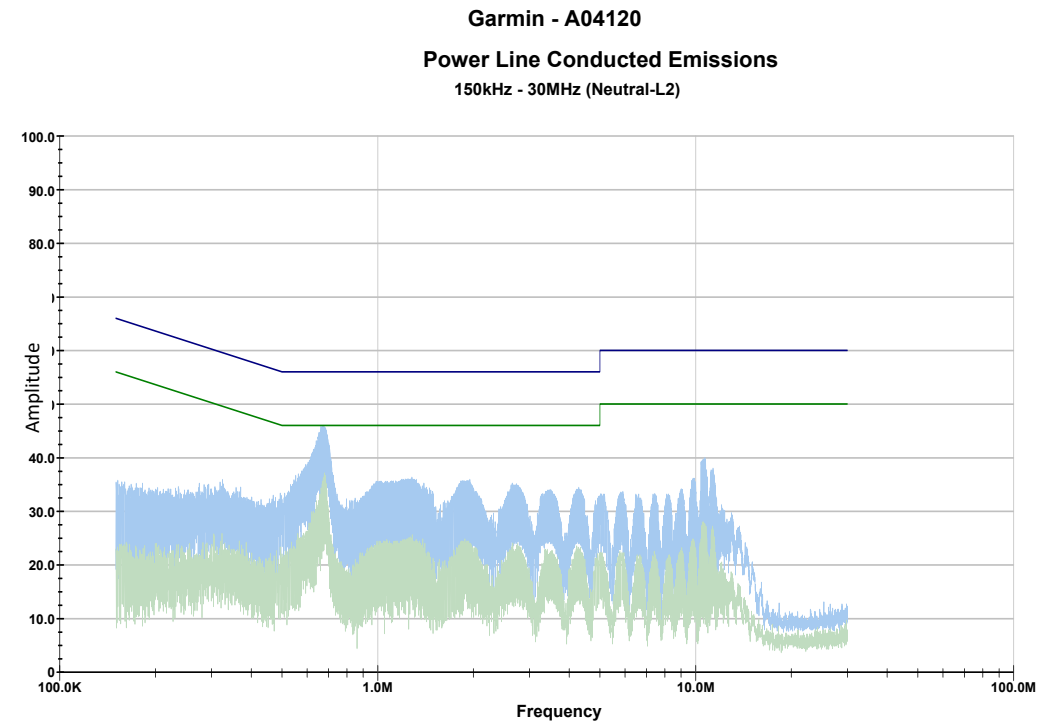
Power Line Conducted Emissions - L1



Green Limit: **Quasi Peak**	Red Trace: **Ambient**	Frequency Range: **0.15 - 30** MHz
Blue Limit: **Average**	Green Trace: **DUT + Ambient**	Measured Emission:

Plot 13.2 Power Line Conducted Emissions – Line 1

Power Line Conducted Emissions - L2



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

Table 13.1 – Summary of Radiated Rx Emissions – Line 1

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	678.40 kHz	45.31	Peak	0.40	0.25	0.00 (3)	46.0 (2)	56.0	**10.0**
			1.92 MHz	35.07		0.30	0.26		35.6 (2)	56.0	**20.4**
			2.68 MHz	33.77		0.30	0.26		34.3 (2)	56.0	**21.7**
			3.45 MHz	33.37		0.30	0.27		33.9 (2)	56.0	**22.1**
			4.28 MHz	32.96		0.30	0.28		33.5 (2)	56.0	**22.5**
			4.95 MHz	32.57		0.30	0.28		33.2 (2)	56.0	**22.9**
			678.40 kHz	36.91	Average	0.40	0.25		37.6 (2)	46.0	**8.4**
			1.92 MHz	24.26		0.30	0.26		24.8 (2)	46.0	**21.2**
			2.68 MHz	23.37		0.30	0.26		23.9 (2)	46.0	**22.1**
			3.45 MHz	22.66		0.30	0.27		23.2 (2)	46.0	**22.8**
			4.28 MHz	22.66		0.30	0.28		23.2 (2)	46.0	**22.8**
			4.95 MHz	21.86		0.30	0.28		22.4 (2)	46.0	**23.6**
									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 13.2 – Summary of Radiated Rx Emissions – Line 2

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	687.70 kHz	44.61	Peak	0.30	0.25	0.00 (3)	45.2 (2)	56.0	**10.8**
			1.94 MHz	34.76		0.60	0.26		35.6 (2)	56.0	**20.4**
			2.64 MHz	34.67		0.30	0.26		35.2 (2)	56.0	**20.8**
			3.52 MHz	32.56		0.30	0.27		33.1 (2)	56.0	**22.9**
			4.28 MHz	33.76		0.40	0.28		34.4 (2)	56.0	**21.6**
			5.12 MHz	32.27		0.60	0.28		33.2 (2)	56.0	**22.9**
			687.70 kHz	36.60	Average	0.30	0.25		37.2 (2)	46.0	**8.9**
			1.94 MHz	26.01		0.60	0.26		26.9 (2)	46.0	**19.1**
			2.64 MHz	23.37		0.30	0.26		23.9 (2)	46.0	**22.1**
			3.52 MHz	23.36		0.30	0.27		23.9 (2)	46.0	**22.1**
			4.28 MHz	24.26		0.30	0.28		24.8 (2)	46.0	**21.2**
			5.12 MHz	23.27		0.40	0.28		24.0 (2)	46.0	**22.1**
									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

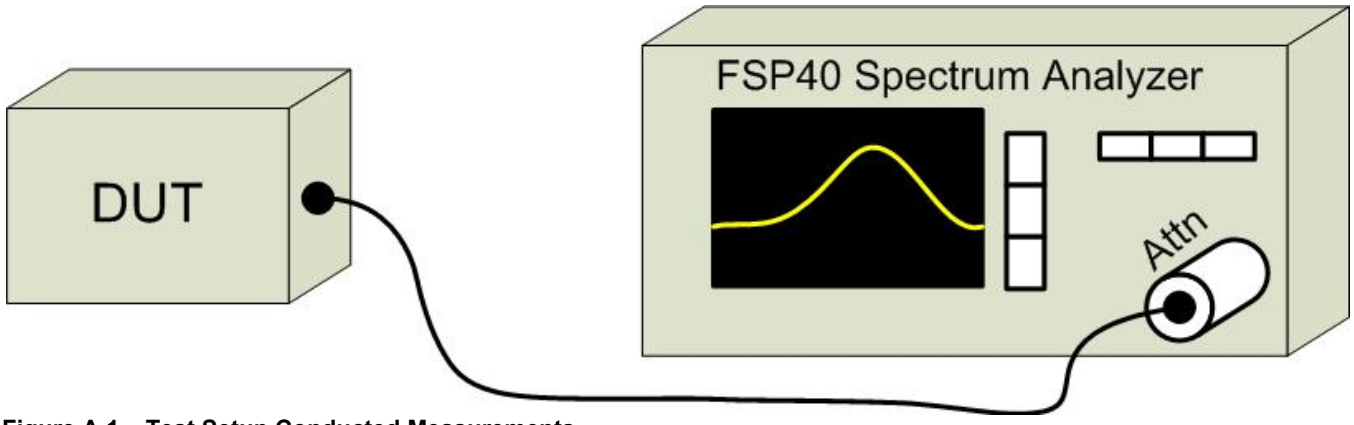


Figure A.1 – Test Setup Conducted Measurements

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
*	00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
*	00047	HP	85685A	2837A00826	RF Preselector
*	00049	HP	85650A	2043A00162	Quasi-peak Adapter
*	00051	HP	8566B	2747A05510	Spectrum Analyzer
*	00241	R&S	FSU40	100500	Spectrum Analyzer
*	00005	HP	8648D	3847A00611	Signal Generator
*	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
*	00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable
*	00264	Koaxis	KP10-7.00M-TD	264	7m Armoured Cable
*	00275	TMS	LMR400	n/a	25m Cable
*	00276	TMS	LMR400	n/a	4m Cable
*	00277	TMS	LMR400	n/a	4m Cable
*	00278	TILE	34G3	n/a	TILE Test Software

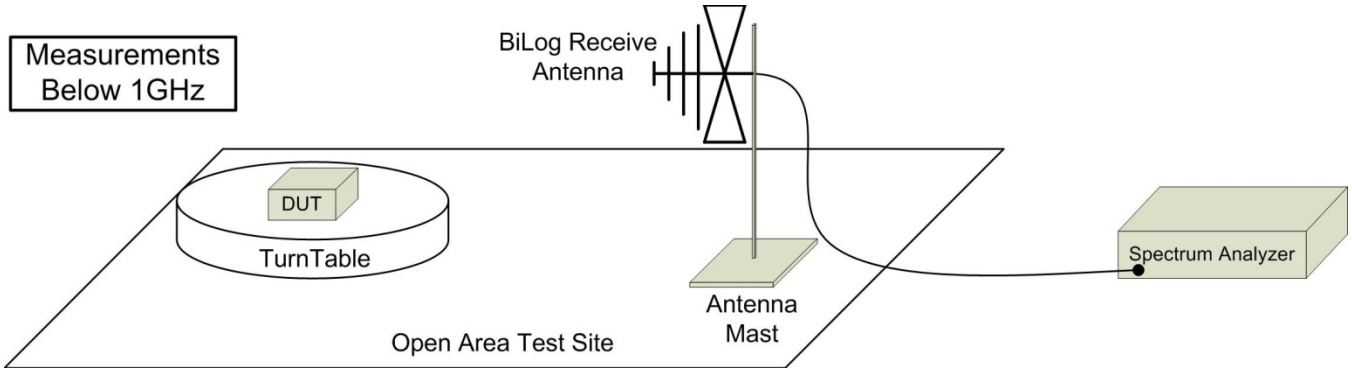


Figure A.2 – Test Setup Radiated Emissions Measurements 30-1000MHz

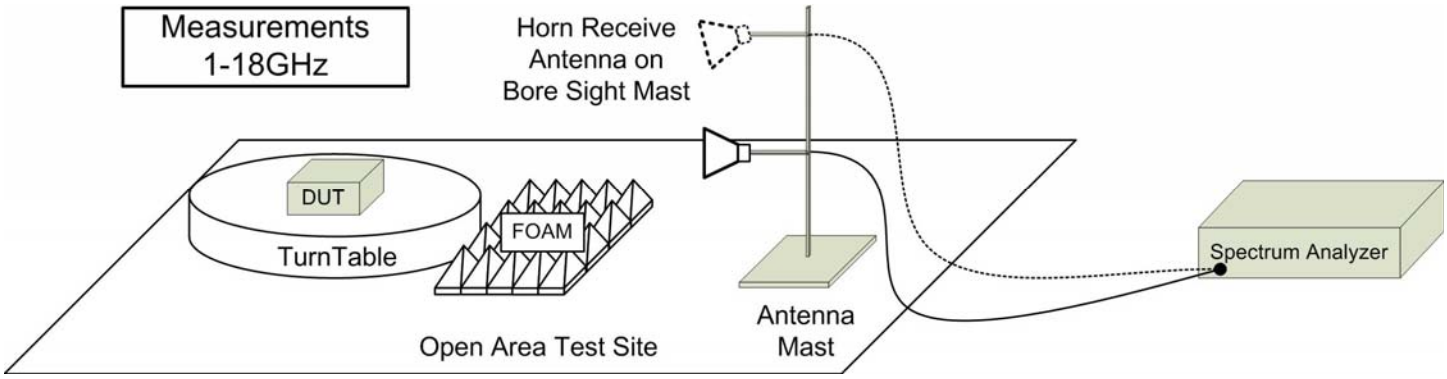


Figure A.3 – Test Setup Radiated Emissions Measurements 1-18GHz

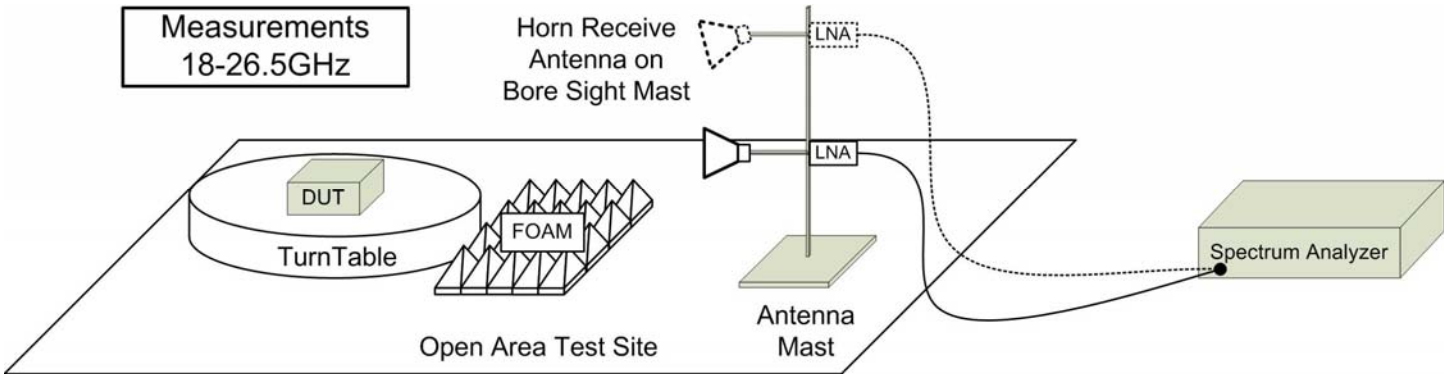


Figure A.4 – Test Setup Radiated Emissions Measurements 18-26.5GHz

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

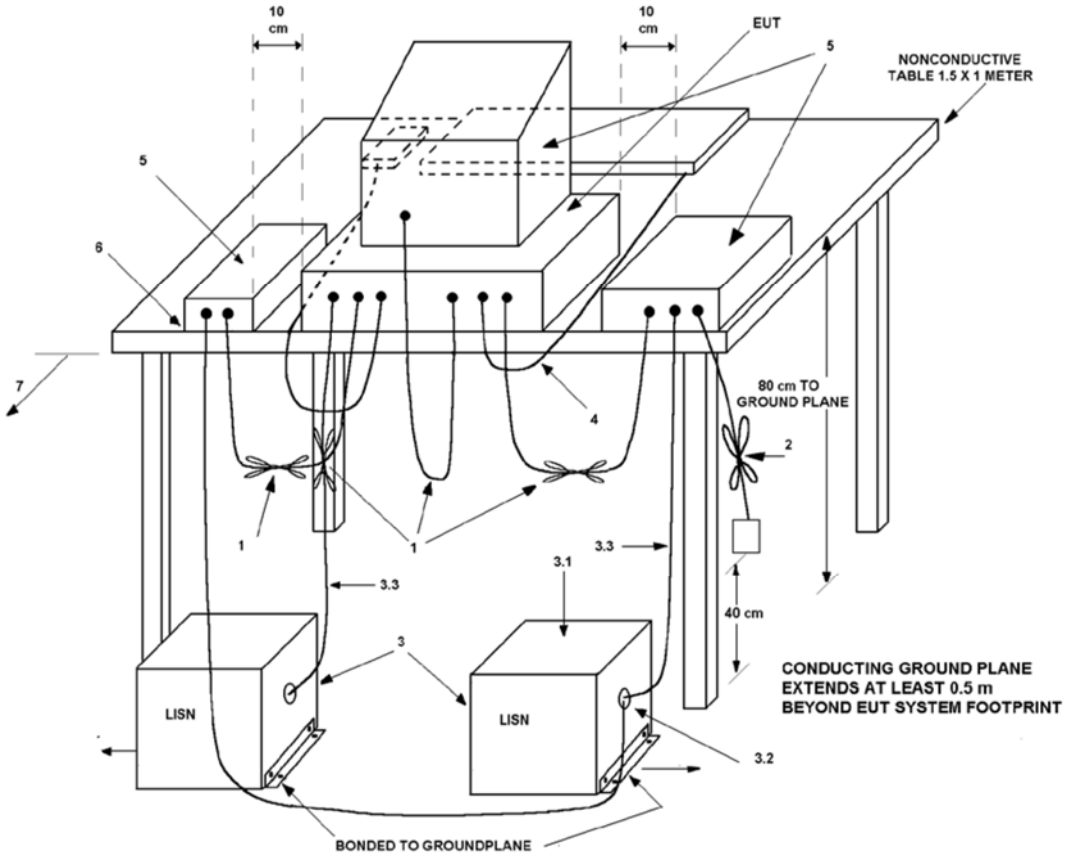


Figure A.5 – Test Setup Conducted Emissions Measurements

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
00162	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
00166	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz	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
00223	HP	8901A	3749A07154	Modulation Analyzer	27 Dec 2017	Triennial	27 Dec 2020
00224	HP	8903B	3729A18691	Audio Analyzer	28 Dec 2017	Triennial	28 Dec 2020
00241	R&S	FSU40	100500	Spectrum Analyzer	15 May 2018	Triennial	15 May 2021
00005	HP	8648D	3847A00611	Signal Generator	23 Jun 2020	Triennial	23 Jun 2023
00257	Com-Power	LI-215A	191934	LISN	5 Jan 2018	Triennial	5 Mar 2021
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
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
00276	TMS	LMR400	n/a	4m Cable	COU	n/a	COU
00277	TMS	LMR400	n/a	4m 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	
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

