VERIFICATION TEST REPORT

Report Number. : 14233306-E1V1

Applicant	:	BENTLY NEVADA LLC 1631 BENTLY PARKWAY SOUTH MINDEN NV, 89423 U.S.A.
Model	:	109M2380, 109M2390
Brand	:	Bently Nevada LLC
FCC ID	:	Contains: XPYNINAB31
IC ID	:	Contains: 8595A-NINAB31
EUT Description	:	Data Collector with BLE radio
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5 + A1+ A2 KDB 996369 D04 v02

Date Of Issue:
May 11, 2022

Prepared by:
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ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/11/2022	Initial Issue	---

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BENTLY NEVADA LLC
1631 BENTLY PARKWAY SOUTH
MINDEN NV, 89423 U.S.A.

EUT DESCRIPTION: Data Collector with BLE Radio

MODEL: 109M2380, 109M2390

SERIAL NUMBER: 101255

DATE TESTED: April 15 & April 27, 2022

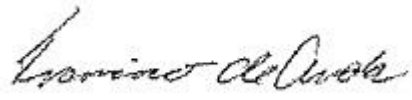
APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C(Only partial of radiated test)	Complies
ISED RSS-247 Issue 2 (Only partial of radiated test)	Complies
ISED RSS-GEN Issue 5 + A1 + A2 (Only partial of radiated test)	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



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2. TEST SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Partial testing performed. Pass	RSE testing only.

3. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification was performed on device for radiated harmonic spurious. The EUT has been verified through appropriate spot checks to demonstrate compliance for this device as shown in this report.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with

- FCC CFR 47 Part 2
- FCC CFR 47 Part 15
- KDB 558074 D01 15.247 Meas Guidance v05
- KDB 414788 D01 Radiated Test Site v01r01
- KDB 996369 D04 Module Integration Guide v02
- ANSI C63.10-2013
- RSS-GEN Issue 5 + A1 + A2
- RSS-247 Issue 2

5. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	550739
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	550739

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6. DECISION RULES AND MEASUREMENT UNCERTAINTY

6.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

6.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{Lab}
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB

Uncertainty figures are valid to a confidence level of 95%.

6.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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7. EQUIPMENT UNDER TEST

7.1. EUT DESCRIPTION

The EUT is an intrinsically safe portable data analyzer solutions designed to monitor machinery conditions in hazardous environments and uses a certified BLE radio to communicate with a wireless, industrial handheld device. The BLE supports 1Mbps and 2Mbps only. Certified BLE module FCC ID: XPYNINAB31, IC : 8595A-NINAB31. IEEE 802.15.4 zigbee radio is disabled and not used by EUT host.

7.2. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna gain(s) and type, as provided by the manufacturer, are as follows:

The EUT utilizes an integrated PCB trace antenna for BLE, with a maximum gain as 3 dBi.

7.3. MODEL DIFFERENCES

Model: 109M2380 and Model: 109M2390 are electronically identical. Only difference is color and model 109M2380 contains potting that is non conductive and has the same permitivity as air. Tested model was 109M2380.

7.4. SOFTWARE AND FIRMWARE

The EUT firmware and version installed during testing was
SW:21.2.347
FW: 21.2.95
Nina B316 FW: 4.0.0-003

The test utility software used during testing was T-Rex Utility Software ver. 3.5.8104.34647

7.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 30MHz, below 1GHz, above 1GHz, and above 18GHz were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, it was determined that orientation X(flatbed) was worst-case orientation for BLE; therefore, all BLE radiated testing was performed with the EUT in X(flatbed) orientation.

This report only covers 9kHz to 26 GHz radiated spurious emisisons testing on 1Mbps for verification of certified module integration into the end product.

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7.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
EUT AC/DC Adapter	Shenzhen FuJia Appliance Co.Ltd	FJ-SW1203000D	ADAP0607	DoC
Support Laptop	HP	Zbook 15 G3	CND72924PJ	PD98260NGW
Laptop AC/Adapter Adapter	HP	TPN-DA03	WFDBH0CAR436YA	DoC
Sensor	Wilcoxon research	780A-D2	11818 11920 12638	DoC
Sensor	Wilcoxon research	780A-IS	10288	DoC

I/O CABLES						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC (3-prong)	Un-shielded	1	AC Mains to DC Power Adapter
2	DC	1	3-pin	Un-shielded	1.7	DC to Supportt laptop
3	USB-A to Micro USB	1	USB Type A	Shielded	3	Support Laptop to EUT
4	AC	1	AC (3-prong)	Un-shielded	1.8	AC Mains to DC Power Adapter
5	DC	1	3-pin	Un-shielded	1	EUT to AC Mains
6	Lemo Connector	1	Lemo	Shielded	1m to 2.8m	EUT to sensor
7	Lemo Connector	1	Lemo	Shielded	0.2	EUT to Lemo Splitter
8	Lemo Connector	3	Lemo	Shielded	1m to 2.6m	Lemo Splitter to sensors

TEST SETUP

A test laptop is used to program the EUT during radiated tests. Test software exercised the radio card. For radiated emissions, EUT was powered by battery and charging with AC/DC adapter.

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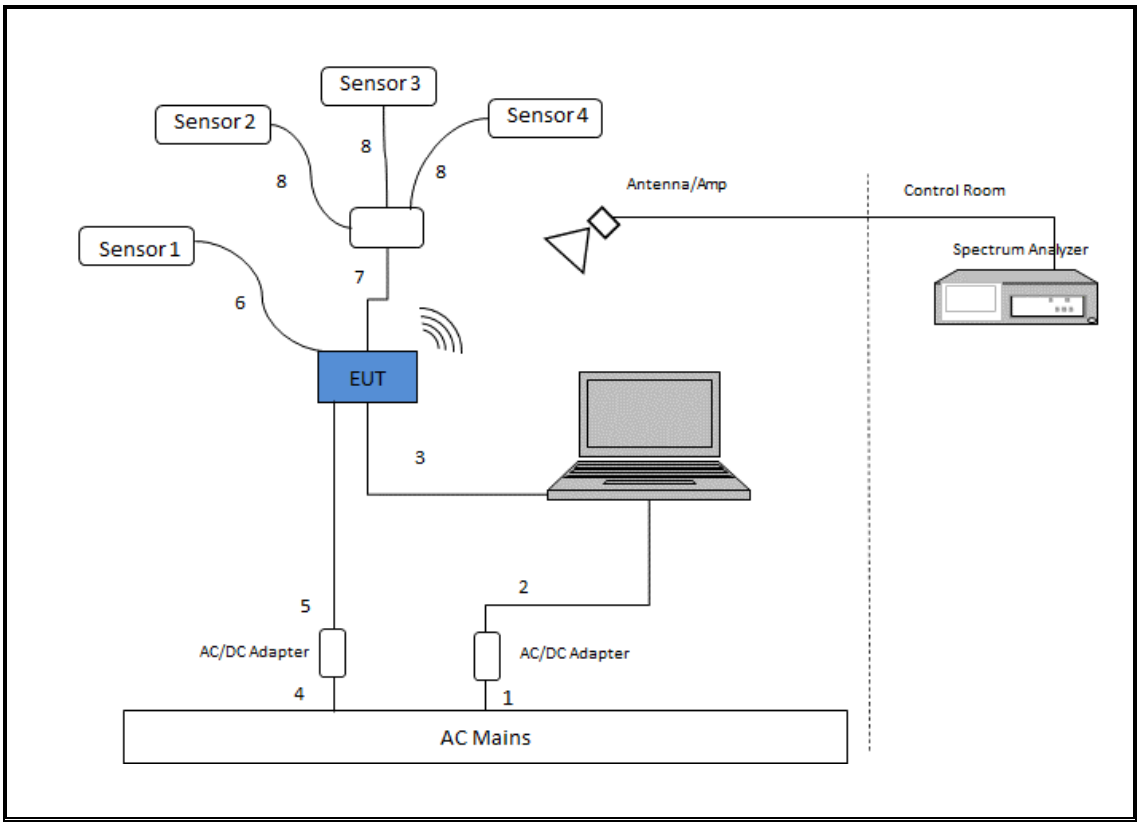
SETUP DIAGRAMS



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8. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6.

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

9. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	200784	2023/01/12	2022/01/12
RF Filter Box, 1-18GHz	UL	N/A	PRE0211790	2022/06/15	2021/06/15
Antenna, BroadBand Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	173997	2023/01/18	2022/01/18
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	170650	2022/07/20	2021/07/20
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T449	2022/04/22	2021/04/22
Amplifier 18-26.5GHz, +5Vdc, 60dB min	AMPLICAL	AMP18G26.5-60	215705	2023/02/26	2022/02/26
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169935	2023/02/19	2022/02/19
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	191429	2023/02/20	2022/02/20
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO-METRICS	EM-6872	PRE0179468	2022/06/08	2021/06/08
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO-METRICS	EM-6871	PRE0179466	2022/06/08	2021/06/08

TEST SOFTWARE LIST			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver. 9.5 07 Jul 2020

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10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from above 1GHz, below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site (OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst-case test result.

NOTE: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example, the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to Y – 51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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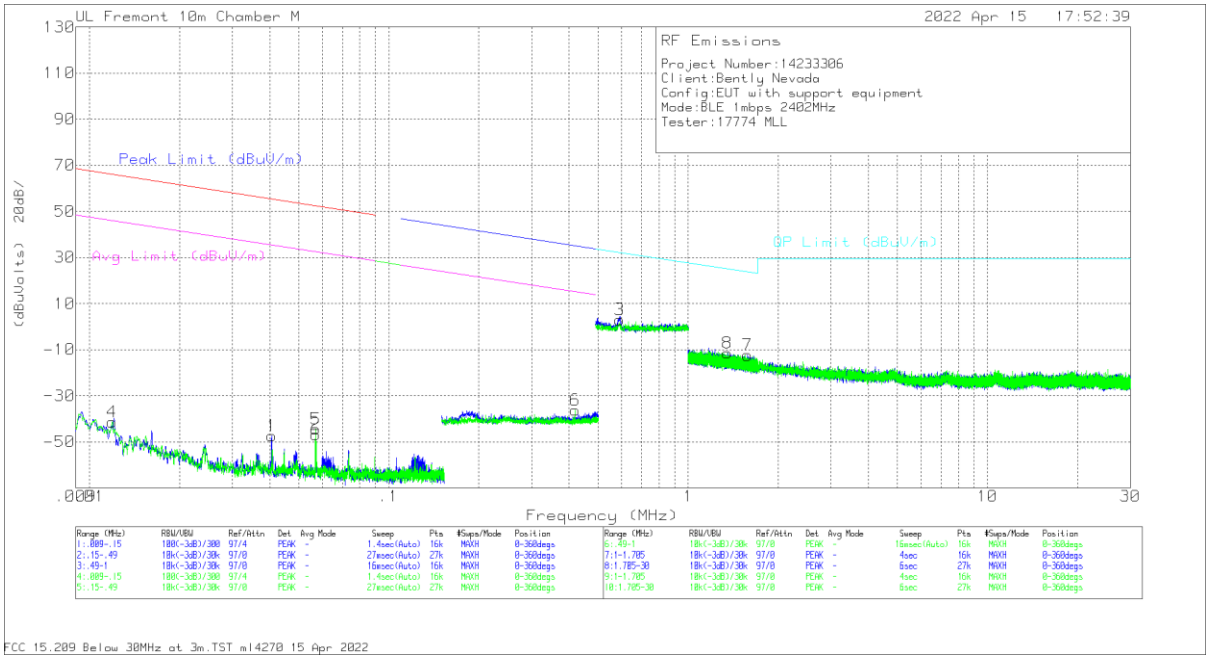
10.1. TRANSMITTER BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.0406	6.03	Pk	57.2	-30.5	-80	-47.27	55.41	-102.68	35.41	-82.68	0-360
2	.057	7.41	Pk	56.5	-30.6	-80	-46.69	52.47	-99.16	32.47	-79.16	0-360
4	.0119	8.03	Pk	60.1	-29.4	-80	-41.27	66.06	-107.33	46.06	-87.33	0-360
5	.057	9.75	Pk	56.5	-30.6	-80	-44.35	52.47	-96.82	32.47	-76.82	0-360
6	.4187	18.17	Pk	56.2	-30.5	-80	-36.13	35.17	-71.3	15.17	-51.3	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.591	17.41	Pk	56.2	-30.5	-40	3.11	32.18	-29.07	0-360
7	1.5752	14.32	Pk	43.7	-30.4	-40	-12.38	23.69	-36.07	0-360
8	1.3516	14.1	Pk	44.9	-30.4	-40	-11.4	25.01	-36.41	0-360

Pk - Peak detector

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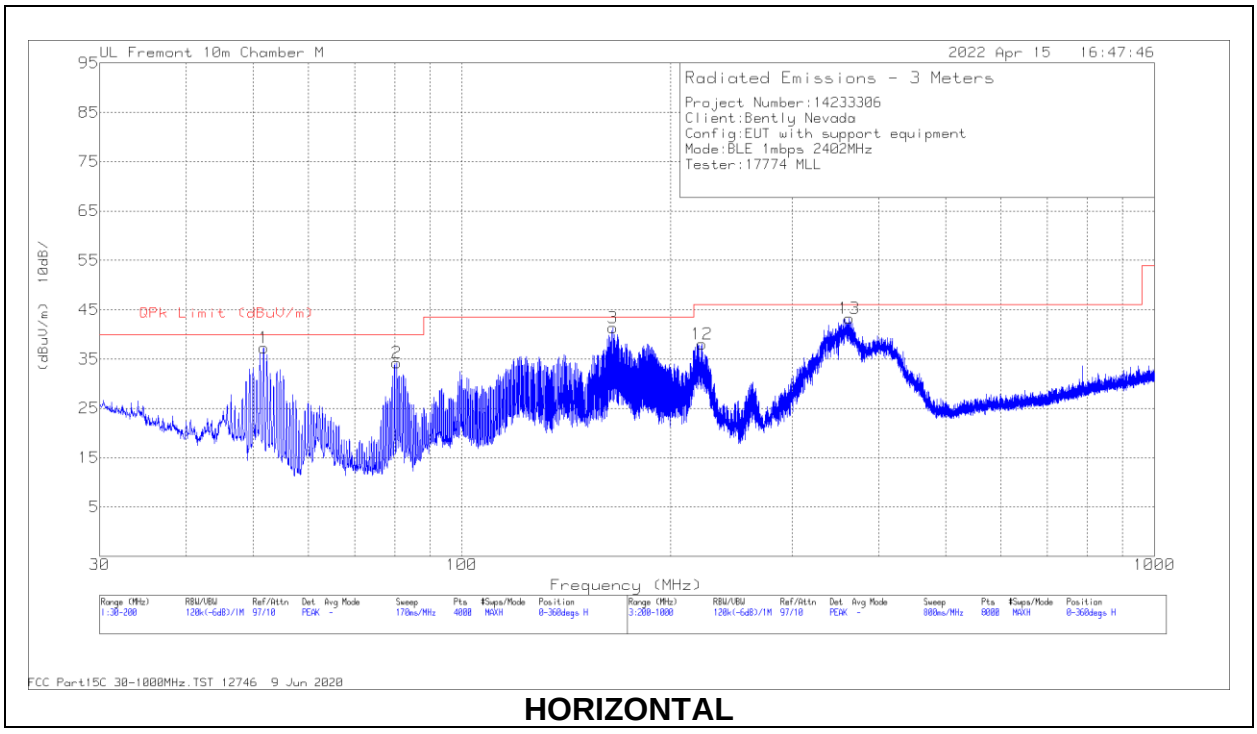
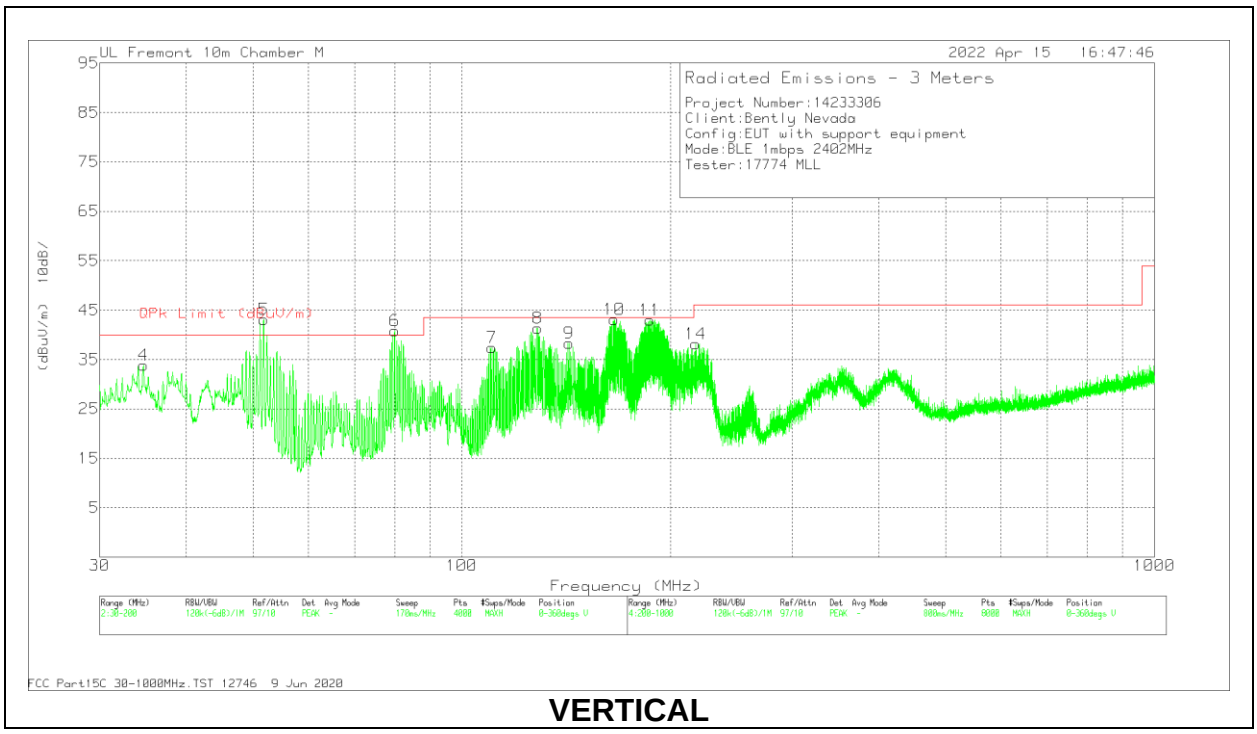
10.2. TRANSMITTER BELOW 1 GHz

HARMONICS AND SPURIOUS EMISSIONS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	173997 AF (dB/m)	Chamber M 10-meter Amp_cable f	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	51.7169	44.77	Qp	14	-29.9	28.87	40	-11.13	187	394	H
2	80.5427	44.52	Qp	13.7	-29.5	28.72	40	-11.28	306	232	H
3	165.181	49.53	Qp	18.2	-28.9	38.83	43.52	-4.69	87	207	H
4	34.6762	39.46	Pk	24.5	-30.1	33.86	40	-6.14	0-360	100	V
5	51.7279	53.75	Qp	14	-29.9	37.85	40	-2.15	338	94	V
6	79.9399	50.85	Qp	13.8	-29.5	35.15	40	-4.85	264	135	V
7	110.516	48.08	Pk	18.7	-29.4	37.38	43.52	-6.14	0-360	100	V
8	128.721	45.71	Qp	19.9	-29.2	36.41	43.52	-7.11	199	96	V
9	142.821	44.09	Qp	19.1	-29.1	34.09	43.52	-9.43	138	94	V
10	165.757	51.62	Qp	18.1	-28.9	40.82	43.52	-2.7	220	94	V
11	186.938	51.46	Qp	17.5	-28.9	40.06	43.52	-3.46	260	94	V
12	222.103	49.39	Pk	17.4	-28.7	38.09	46.02	-7.93	0-360	100	H
13	362.702	47.51	Qp	21.4	-28.1	40.81	46.02	-5.21	260	94	H
14	217.402	49.7	Pk	17.2	-28.7	38.2	46.02	-7.82	0-360	97	V

Pk - Peak detector
Qp - Quasi-Peak detector

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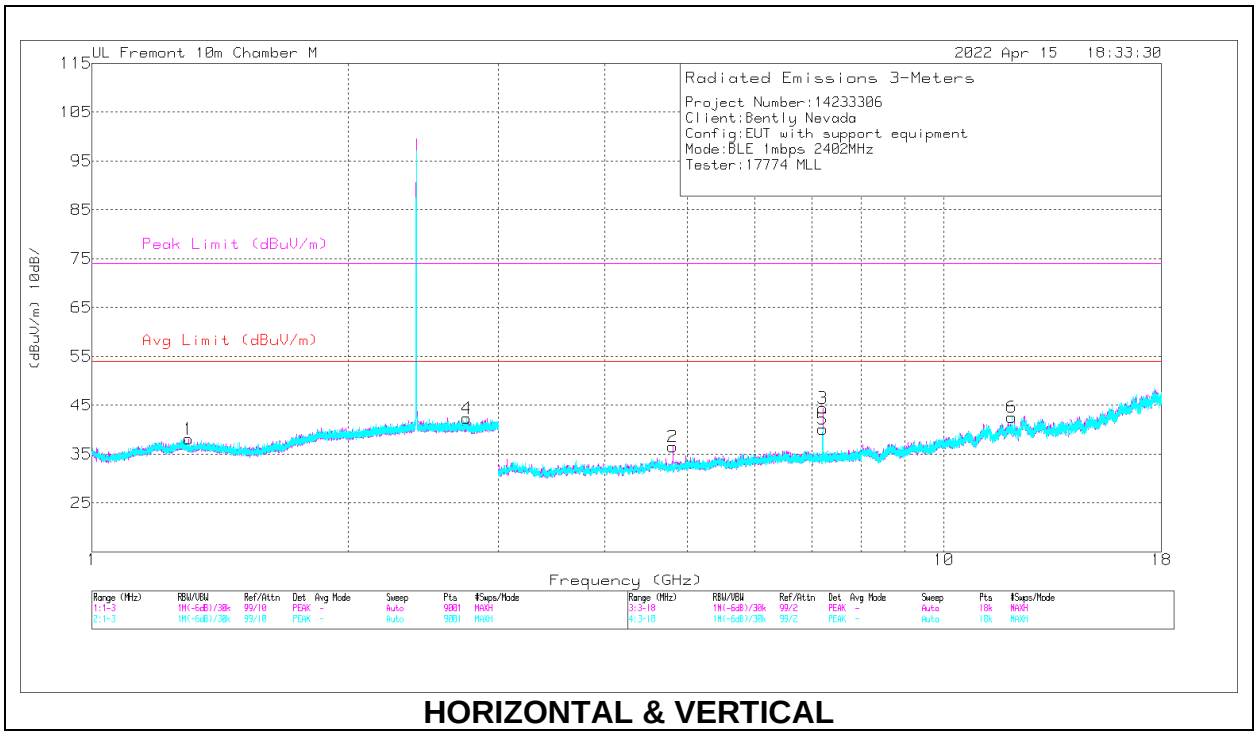
10.3. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS



HORIZONTAL & VERTICAL

RADIATED EMISSIONS

Range 1: Horizontal 1 - 3GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200784 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.298903	54	PK2	28.7	-36.3	0	46.4	-	-	74	-27.6	159	124	H
	* 1.299802	42.48	MAv1	28.6	-36.3	2.4	37.18	54	-16.82	-	-	159	124	H

Range 2: Vertical 1 - 3GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200784 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 2.75057	52.25	PK2	32.1	-33.3	0	51.05	-	-	74	-22.95	73	103	V
	* 2.752224	40.46	MAv1	32.1	-33.3	2.4	41.66	54	-12.34	-	-	73	103	V

Range 3: Horizontal 3 - 18GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200784 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 4.804967	50.28	PK2	34.1	-40.1	0	44.28	-	-	74	-29.72	336	215	H
	* 4.805031	39.08	MAv1	34.1	-40.1	2.4	35.48	54	-18.52	-	-	336	215	H
3	7.207514	54	PK2	35.7	-38	0	51.7	-	-	-	-	6	223	H
	7.207306	44.62	MAv1	35.7	-38	2.4	44.72	-	-	-	-	6	223	H

Range 4: Vertical 3 - 18GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200784 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	7.20467	51.45	PK2	35.7	-38	0	49.15	-	-	-	-	135	124	V
	7.20467	41.29	MAv1	35.7	-38	2.4	41.39	-	-	-	-	135	124	V
6	* 12.012521	47.72	PK2	38.8	-33	0	53.52	-	-	74	-20.48	29	197	V
	* 12.012417	36.9	MAv1	38.8	-33	2.4	45.1	54	-8.9	-	-	29	197	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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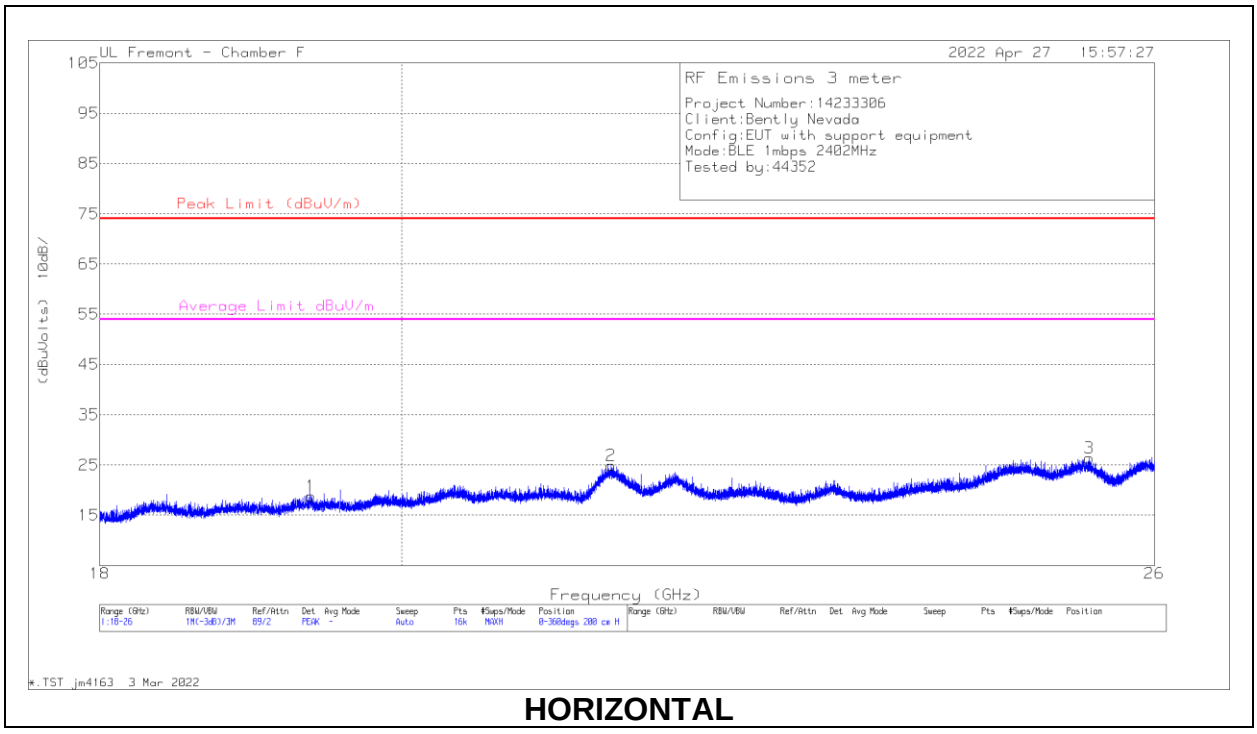
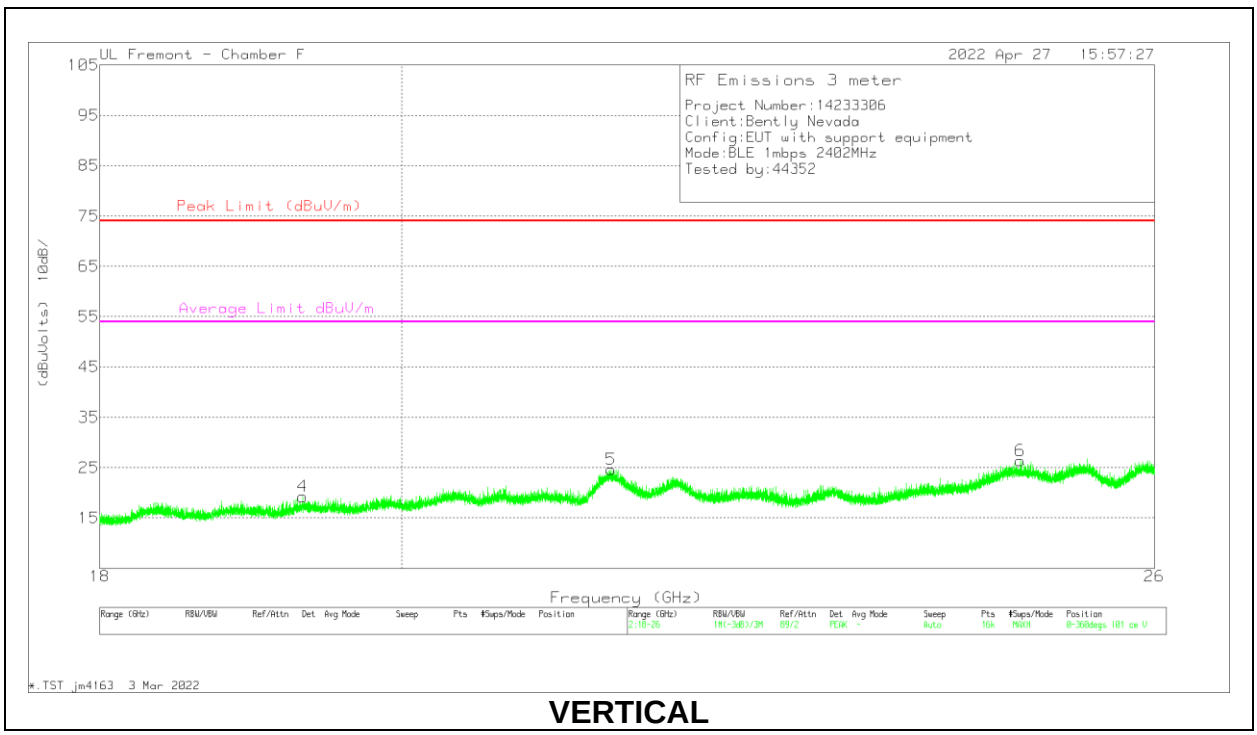
10.4. TRANSMITTER ABOVE 18 GHz

HARMONICS AND SPURIOUS EMISSIONS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	81140 AF (dB/m)	Cables (dB)	215705 Amp Kit (dB)	DC Corr (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 19.377	29.21	Pk	32.6	18	-61	0	18.81	74	-55.19	54	-35.19	0-360	200	H
2	21.513	33.06	Pk	33.1	18.9	-60.2	0	24.86	74	-49.14	54	-29.14	0-360	200	H
3	25.415	32.64	Pk	34.2	20.7	-61.1	0	26.44	74	-47.56	54	-27.56	0-360	200	H
4	* 19.3195	29.53	Pk	32.7	18	-61	0	19.23	74	-54.77	54	-34.77	0-360	200	V
5	21.513	32.9	Pk	33.1	18.9	-60.2	0	24.7	74	-49.3	54	-29.3	0-360	200	V
6	24.813	33.17	Pk	34	20.4	-61.2	0	26.37	74	-47.63	54	-27.63	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

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