

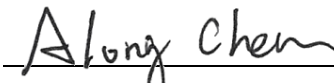
FCC Co-Location Test Report

FCC ID : IPH-04780
Equipment : IVI Unit
Model No. : TGWW
Brand Name : GARMIN
Applicant : Garmin International, Inc.
Address : 1200 E. 151st Street Olathe, KS 66062 United States
Standard : 47 CFR FCC Part 15.247
47 CFR FCC Part 15.407
Received Date : Dec. 25, 2023
Tested Date : Dec. 25 ~ Dec. 29, 2023

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

Approved by:



Along Chen / Assistant Manager



Gary Chang / Manager

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Appendix A. Unwanted Emissions Into Restricted Frequency Bands

Release Record

Report No.	Version	Description	Issued Date
FR3D1301CO	Rev. 01	Initial issue	Jan. 25, 2024

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.407(b) 15.209	Radiated Emissions	[dBuV/m at 3m]: 42.55MHz 33.55 (Margin -6.45dB) - PK	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

WLAN	
Operating Frequency	802.11b/g/n: 2412 MHz ~ 2462 MHz 802.11a/n/ac: 5745 ~ 5825 MHz
Modulation Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n/ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
BT	
Operating Frequency	2402 MHz ~ 2480 MHz
Modulation Type	Bluetooth BR(1Mbps): GFSK Bluetooth EDR (2Mbps): $\pi/4$ -DQPSK Bluetooth EDR (3Mbps): 8-DPSK

1.1.2 Antenna Details

For WiFi

Ant. No.	Brand	Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)	
					2400~2483.5	5725~5850
1	HARADA	39215	RHCP	R-SMA	0.3	-0.3
2	HARADA	39216	RHCP	R-SMA	1.2	0.8

For BT1

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	HARADA	39213	RHCP	R-SMA	3.6

For BT2

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	HARADA	39212	RHCP	R-SMA	3.8

For BT combo

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	HARADA	39215	RHCP	R-SMA	0.3

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc
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1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	Dec. 25, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 03, 2023	Mar. 02, 2024
Spectrum Analyzer	R&S	FSV40	101498	Nov. 23, 2023	Nov. 22, 2024
Loop Antenna	R&S	HFH2-Z2	100330	Oct. 31, 2023	Oct. 30, 2024
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 31, 2023	Jul. 30, 2024
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Nov. 27, 2023	Nov. 26, 2024
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 30, 2023	Oct. 29, 2024
Preamplifier	EMC	EMC02325	980225	Jun. 28, 2023	Jun. 27, 2024
Preamplifier	EMC	EMC118A45SE	980898	Jul. 14, 2023	Jul. 13, 2024
Preamplifier	EMC	EMC184045SE	980903	Jul. 17, 2023	Jul. 16, 2024
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 03, 2023	Oct. 02, 2024
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 03, 2023	Oct. 02, 2024
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 03, 2023	Oct. 02, 2024
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 03, 2023	Oct. 02, 2024
RF Cable	EMC	EMC104-35M-35M- 8000	210920	Oct. 03, 2023	Oct. 02, 2024
RF Cable	EMC	EMC104-35M-35M- 3000	210922	Oct. 03, 2023	Oct. 02, 2024
Attenuator	Pasternack	PE7005-10	10-1	Oct. 05, 2023	Oct. 04, 2024
HIGHPASS FILTER 3.1-18G	WHK	WHK3.1/18G-10SS	39	Oct. 05, 2023	Oct. 04, 2024
HIGHPASS FILTER 7.5-18G	STI	STI15-9722	STI-HP7.5G-A	Oct. 05, 2023	Oct. 04, 2024
Measurement Software	Sporton	SENSE-EMI	V5.10.8	NA	NA

Note: Calibration Interval of instruments listed above is one year.

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Dec. 29, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101910	Apr. 14, 2023	Apr. 13, 2024
Power Meter	Anritsu	ML2495A	1241002	Nov. 21, 2023	Nov. 20, 2024
Power Sensor	Anritsu	MA2411B	1207366	Nov. 21, 2023	Nov. 20, 2024
Attenuator	Pasternack	PE7005-10	10-2	Oct. 05, 2023	Oct. 04, 2024
Wireless connectivity tester	R&S	CMW270	100856	Nov. 14, 2023	Nov. 13, 2024
Bluetooth Tester	R&S	CBT	100959	Jan. 06, 2023	Jan. 05, 2024
Note: Calibration Interval of instruments listed above is one year.					

1.3 Test Standards

47 CFR FCC Part 15.247
47 CFR FCC Part 15.407
ANSI C63.10-2013

1.4 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
FCC KDB 412172 D01 Determining ERP and EIRP v01r01
FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

1.5 Deviation from Test Standard and Measurement Procedure

None

1.6 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$)).

Measurement Uncertainty	
Parameters	Uncertainty
Unwanted Emission \leq 1GHz	± 3.41 dB
Unwanted Emission $>$ 1GHz	± 4.59 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	03CH01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode
Unwanted Emissions	Mode 1: 2.4G 11B CH11 2462MHz + BT1 EDR GFSK CH39 2441MHz + BT2 EDR GFSK CH0 2402MHz Mode 2: 5G 11A CH165 5825MHz + ComboBT EDR GFSK CH78 2480MHz + BT1 EDR GFSK CH39 2441MHz + BT2 EDR GFSK CH0 2402MHz
Conducted Emissions	M03: 5G 11A CH165 5825MHz + ComboBT EDR GFSK CH78 2480MHz
Note: Conducted emission is only for transmission simultaneously and share a common antenna.	

3 Transmitter Test Results

3.1 Unwanted Emissions into Restricted Frequency Bands

3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

Un-restricted band emissions above 1GHz Limit	
Operating Band	Limit
5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.25 - 5.35 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.47 - 5.725 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.725 - 5.850 GHz	All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

3.1.2 Test Procedures

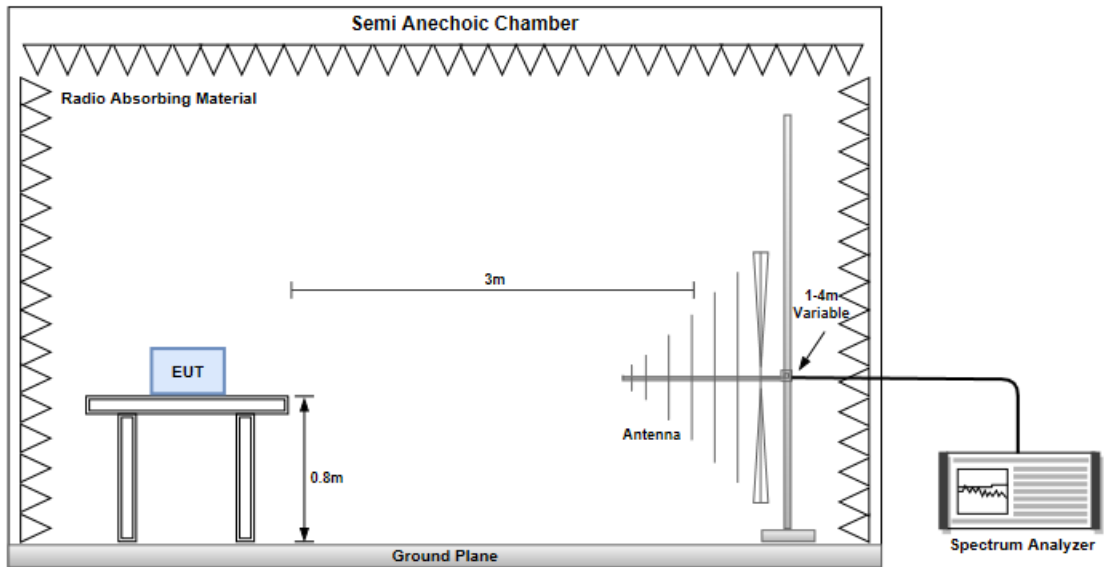
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 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.

Note:

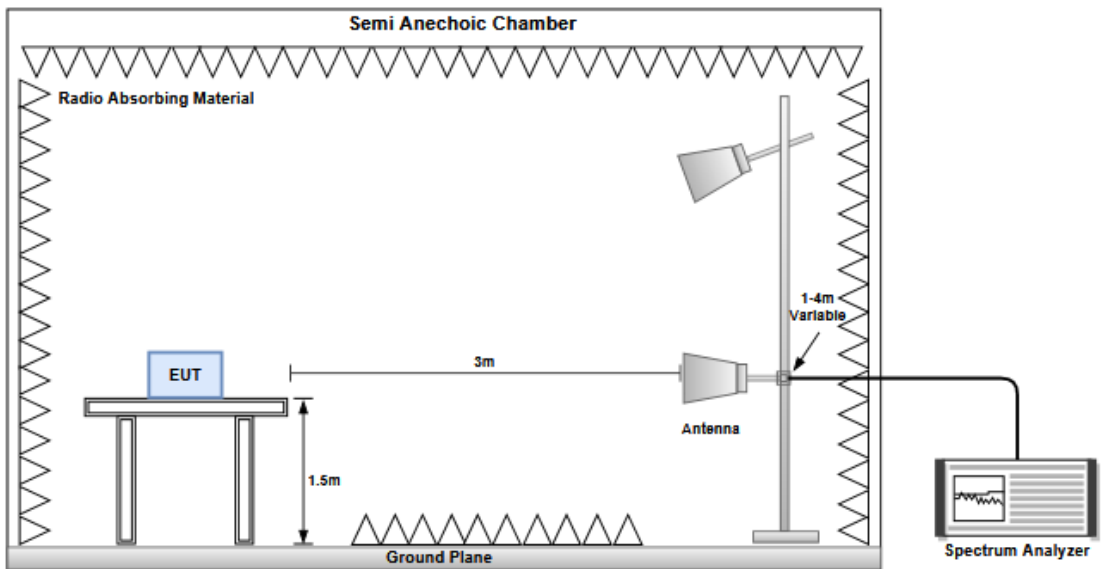
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

3.1.3 Test Setup

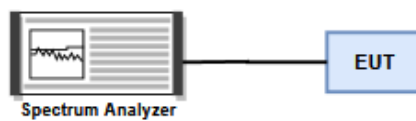
Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



Transmitter Conducted Unwanted Emissions (30MHz~40GHz)



3.1.4 Test Results

Ambient Condition	24°C / 63%	Tested By	Sean Yu / Brad Wu
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Ambient Condition	22°C / 63%	Tested By	Roger Lu
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Refer to Appendix A.

4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No.30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan
(R.O.C.)

Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)
No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666

Fax: 886-3-318-0345

Email: ICC_Service@icertifi.com.tw

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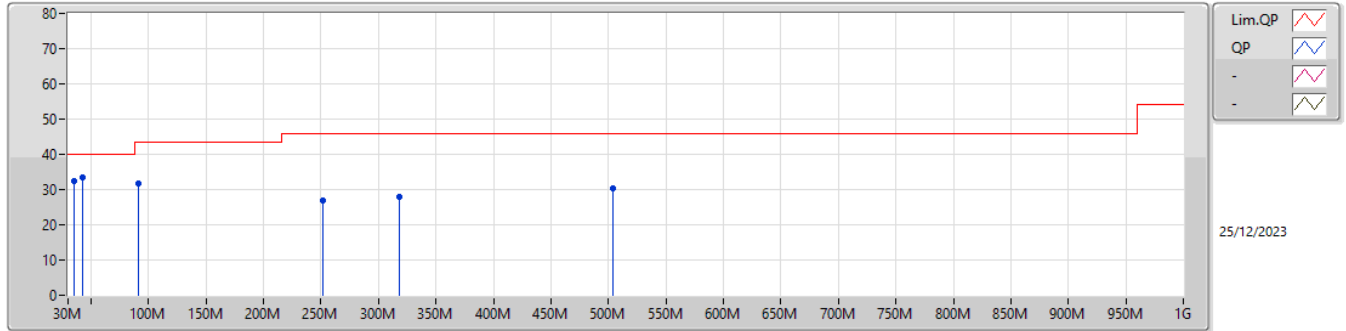


Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	PK	42.61M	33.47	40.00	-6.53	Vertical
Mode 2	Pass	PK	42.55M	33.55	40.00	-6.45	Vertical



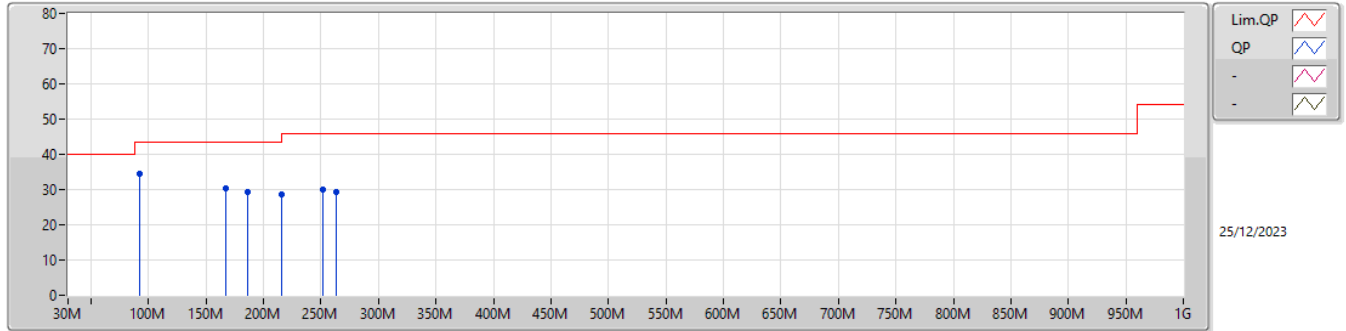
Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	34.85M	32.32	40.00	-7.68	-9.48	3	Vertical	-	-	-	41.80	17.98	0.54	28.00
PK	42.61M	33.47	40.00	-6.53	-8.39	3	Vertical	-	-	-	41.86	19.06	0.59	28.04
PK	91.11M	31.57	43.50	-11.93	-14.42	3	Vertical	-	-	-	45.99	13.01	0.90	28.33
PK	252.13M	27.00	46.00	-19.00	-9.90	3	Vertical	-	-	-	36.90	17.04	1.49	28.43
PK	318.09M	27.78	46.00	-18.22	-7.45	3	Vertical	-	-	-	35.23	19.26	1.69	28.40
PK	504.33M	30.29	46.00	-15.71	-2.89	3	Vertical	-	-	-	33.18	23.17	2.18	28.24



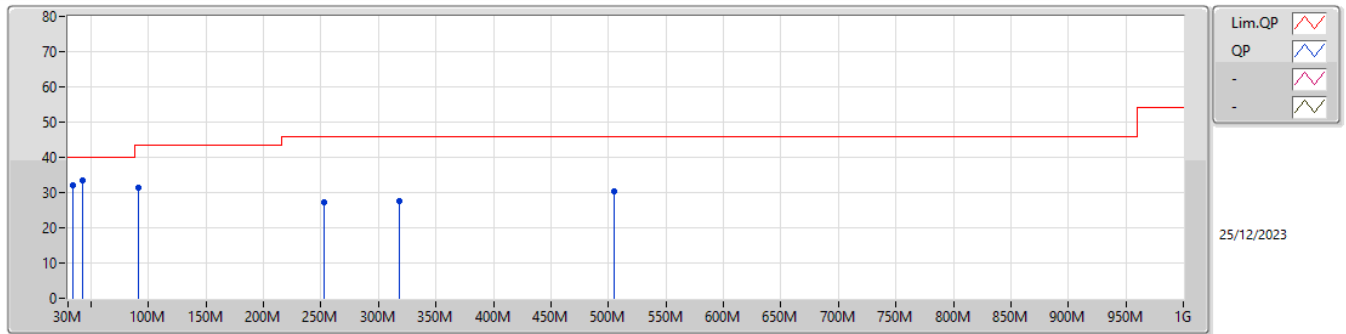
Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	92.08M	34.59	43.50	-8.91	-14.31	3	Horizontal	-	-	-	48.90	13.12	0.90	28.33
PK	167.74M	30.43	43.50	-13.07	-9.11	3	Horizontal	-	-	-	39.54	18.10	1.21	28.42
PK	186.17M	29.36	43.50	-14.14	-10.94	3	Horizontal	-	-	-	40.30	16.20	1.29	28.43
PK	216.24M	28.75	46.00	-17.25	-11.94	3	Horizontal	-	-	-	40.69	15.12	1.38	28.44
PK	252.13M	29.95	46.00	-16.05	-9.90	3	Horizontal	-	-	-	39.85	17.04	1.49	28.43
PK	263.77M	29.45	46.00	-16.55	-9.35	3	Horizontal	-	-	-	38.80	17.55	1.53	28.43



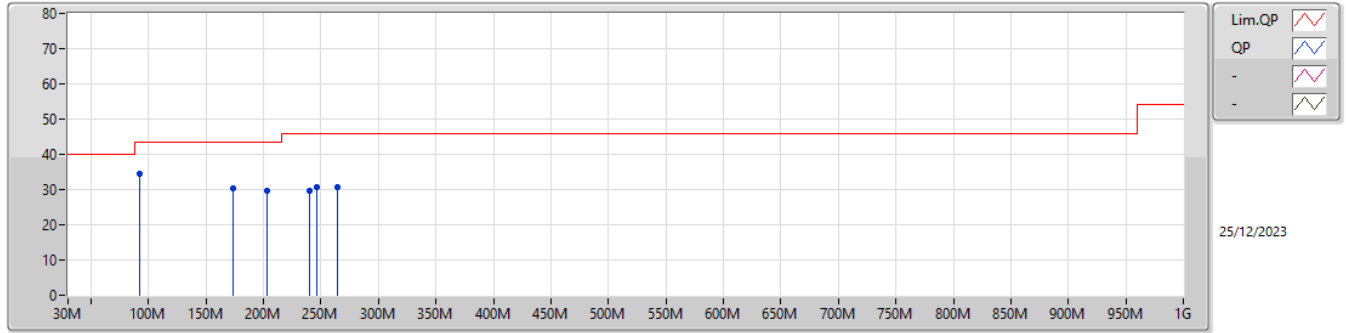
Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	34.61M	32.18	40.00	-7.82	-9.50	3	Vertical	-	-	-	41.68	17.96	0.54	28.00
PK	42.55M	33.55	40.00	-6.45	-8.40	3	Vertical	-	-	-	41.95	19.05	0.59	28.04
PK	91.24M	31.48	43.50	-12.02	-14.41	3	Vertical	-	-	-	45.89	13.02	0.90	28.33
PK	252.27M	27.22	46.00	-18.78	-9.89	3	Vertical	-	-	-	37.11	17.05	1.49	28.43
PK	318.37M	27.56	46.00	-18.44	-7.44	3	Vertical	-	-	-	35.00	19.27	1.69	28.40
PK	504.53M	30.48	46.00	-15.52	-2.88	3	Vertical	-	-	-	33.36	23.18	2.18	28.24



Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	92.21M	34.62	43.50	-8.88	-14.27	3	Horizontal	-	-	-	48.89	13.16	0.90	28.33
PK	173.46M	30.25	43.50	-13.25	-9.63	3	Horizontal	-	-	-	39.88	17.55	1.24	28.42
PK	203.53M	29.77	43.50	-13.73	-11.87	3	Horizontal	-	-	-	41.64	15.23	1.34	28.44
PK	239.88M	29.54	46.00	-16.46	-10.29	3	Horizontal	-	-	-	39.83	16.69	1.45	28.43
PK	246.46M	30.68	46.00	-15.32	-10.03	3	Horizontal	-	-	-	40.71	16.93	1.47	28.43
PK	263.91M	30.55	46.00	-15.45	-9.34	3	Horizontal	-	-	-	39.89	17.56	1.53	28.43

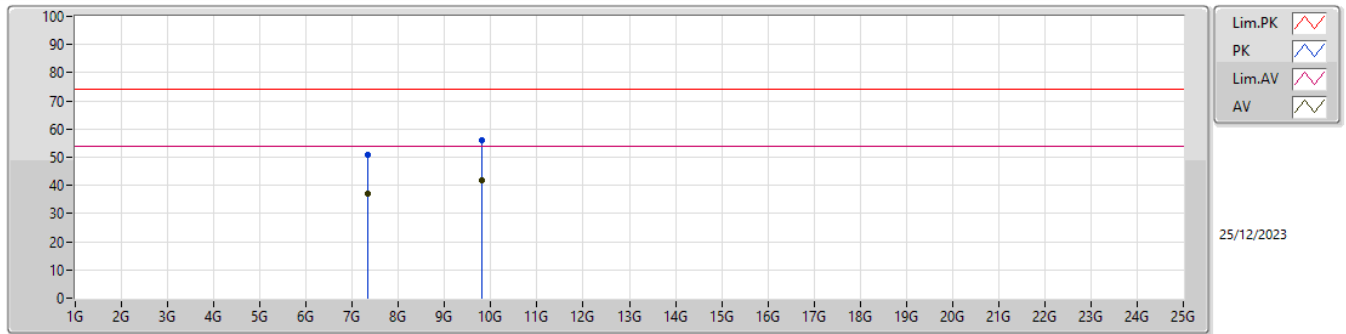


Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	AV	9.806G	41.84	54.00	-12.16	Vertical
Mode 2	Pass	AV	8.227G	37.88	54.00	-16.12	Vertical



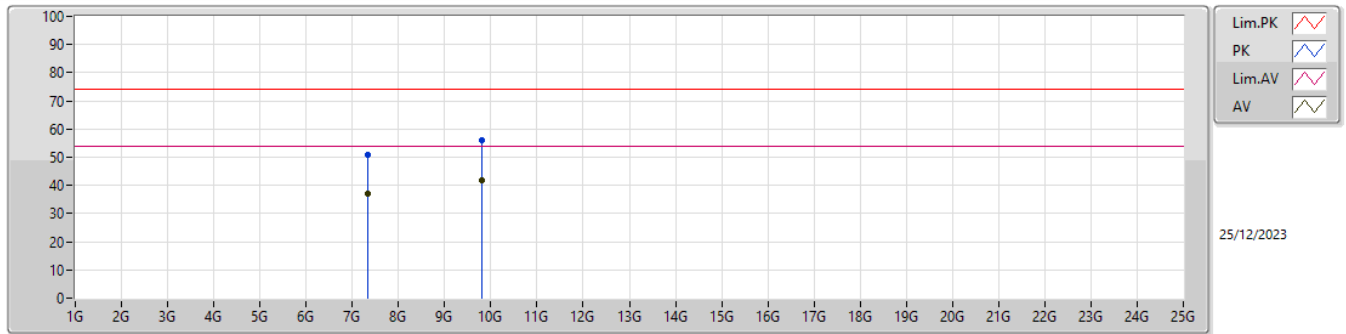
Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	7.326G	50.99	74.00	-23.01	5.12	3	Vertical	206	1.00	-	45.87	36.15	8.44	39.47
AV	7.326G	37.12	54.00	-16.88	5.12	3	Vertical	206	1.00	-	32.00	36.15	8.44	39.47
PK	9.806G	56.07	74.00	-17.93	7.32	3	Vertical	174	1.00	-	48.75	39.32	9.68	41.68
AV	9.806G	41.84	54.00	-12.16	7.32	3	Vertical	174	1.00	-	34.52	39.32	9.68	41.68



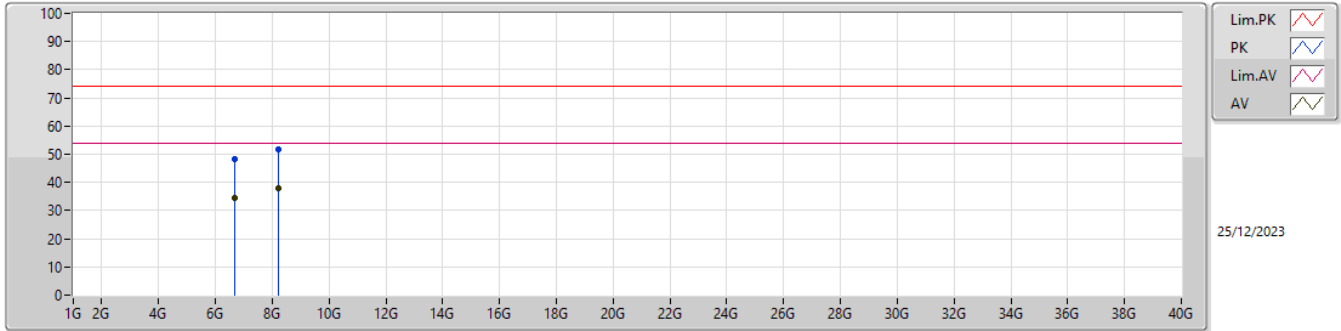
Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	7.326G	50.71	74.00	-23.29	5.12	3	Horizontal	211	1.00	-	45.59	36.15	8.44	39.47
AV	7.326G	36.91	54.00	-17.09	5.12	3	Horizontal	211	1.00	-	31.79	36.15	8.44	39.47
PK	9.806G	55.99	74.00	-18.01	7.32	3	Horizontal	182	1.00	-	48.67	39.32	9.68	41.68
AV	9.806G	41.80	54.00	-12.20	7.32	3	Horizontal	182	1.00	-	34.48	39.32	9.68	41.68



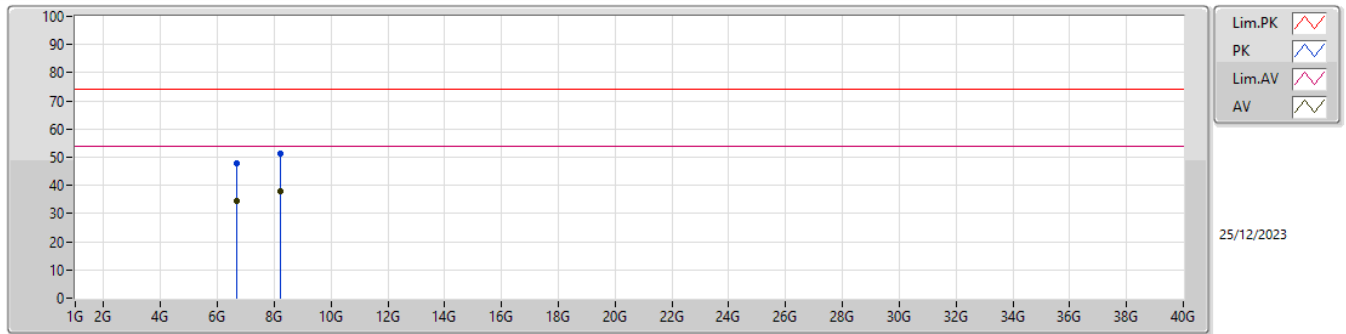
Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	6.69G	48.26	74.00	-25.74	3.10	3	Vertical	294	1.00	-	45.16	34.22	7.78	38.90
AV	6.69G	34.64	54.00	-19.36	3.10	3	Vertical	294	1.00	-	31.54	34.22	7.78	38.90
PK	8.227G	51.66	74.00	-22.34	5.49	3	Vertical	275	1.00	-	46.17	36.69	8.97	40.17
AV	8.227G	37.88	54.00	-16.12	5.49	3	Vertical	275	1.00	-	32.39	36.69	8.97	40.17



Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	6.69G	47.86	74.00	-26.14	3.10	3	Horizontal	231	1.00	-	44.76	34.22	7.78	38.90
AV	6.69G	34.51	54.00	-19.49	3.10	3	Horizontal	231	1.00	-	31.41	34.22	7.78	38.90
PK	8.227G	51.33	74.00	-22.67	5.49	3	Horizontal	119	1.00	-	45.84	36.69	8.97	40.17
AV	8.227G	37.79	54.00	-16.21	5.49	3	Horizontal	119	1.00	-	32.30	36.69	8.97	40.17



Mode: Mode 3

