Test report

REP015384-10TRFEMC

Date of issue: December 13, 2023

Applicant:

Alarm.com, Inc.

Product:

PoE Video Doorbell

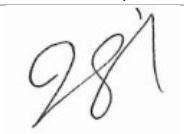
Model:	Variant(s):
ADC-VDB755P	N/A

Specifications:

- FCC 47 CFR Part 15.207 and 15.209

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 214630; Designation Number: US3165
ISED Test Site	2040B

Tested by	Lan Sayasane, EMC Test Engineer
Reviewed by	James Cunningham, EMC/WL Manager
Review date	December 13, 2023
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15.207 and 15.209	Conducted limits Radiated emissions; general requirements

1.2 Exclusions

None.

1.3 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s).

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See “Section 2 Summary of test results” for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Issue Date	Details of changes made to test report
REP015384-10TRFEMC	December 13, 2023	Original report issued

Section 2 Summary of test results

2.1 Sample information

Receipt date	August 7, 2023
Nemko sample ID number	REP015384

2.2 Testing period

Test start date	August 8, 2023
Test end date	September 7, 2023

2.3 Emissions test results

Table 2.3-1: *FCC 47 CFR Part 15.207 and 15.209 results*

Standard	Clause	Test description	Verdict
FCC 47 CFR Part 15, Subpart C	§15.209	Radiated emissions; general requirements	Pass
FCC 47 CFR Part 15, Subpart C	§15.207	Conducted limits	Pass [1]

Notes: [1] The EUT is powered via PoE 48 V DC

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Applicant

Company name	Alarm.com, Inc.
Address	8281 Greensboro Drive Suite 100
City	Tysons
State	Virginia
Postal/Zip code	22102
Country	United States

3.3 Manufacturer

Company name	Alarm.com, Inc.
Address	8281 Greensboro Drive Suite 100
City	Tysons
State	Virginia
Postal/Zip code	22102
Country	United States

3.4 EUT information

Product name	PoE Video Doorbell
Model	ADC-VDB755P
Variant(s)	N/A
Serial number	883A9DE9F094
Part number	N/A
Power requirements	48VDC Power over Ethernet
Description/theory of operation	VDB755P video doorbell for use in residential and commercial spaces; video doorbell for person detection, door control, and surveillance.
Operational frequencies	13.56 MHz, 2.4 GHz, 24 GHz
Software details	No software
Multiple transmitter details	1. NFC transmitter operating at 13.56 MHz 2. Bluetooth Low Energy transmitter operating in 2400 – 2483.5 MHz band 3. Radar operating in 24.00 to 24.25 GHz

3.5 EUT exercise and monitoring details

EUT description of the methods used to exercise the EUT and all relevant ports:

- The EUT was operated with NFC transmitter, Bluetooth Low energy transmitter and radar transmitter operational and transmitting at maximum output power.

EUT setup/configuration rationale:

- The EUT setup in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end user.
- The type and construction of cables used in the measurement set-up were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
  - None
- The EUT was setup in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local ancillary equipment and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
  - None

3.6 EUT setup details

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
N/A				

Table 3.6-2: *EUT interface ports*

Description	Qty.
Ethernet	1

Table 3.6-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop PC				
PoE injector	POE-48i	N/A	112013870D	N/A
Router				

Table 3.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
Ethernet	EUT	PoE injector	1
Ethernet	PoE injector	Router	1
Ethernet	Laptop	Router	

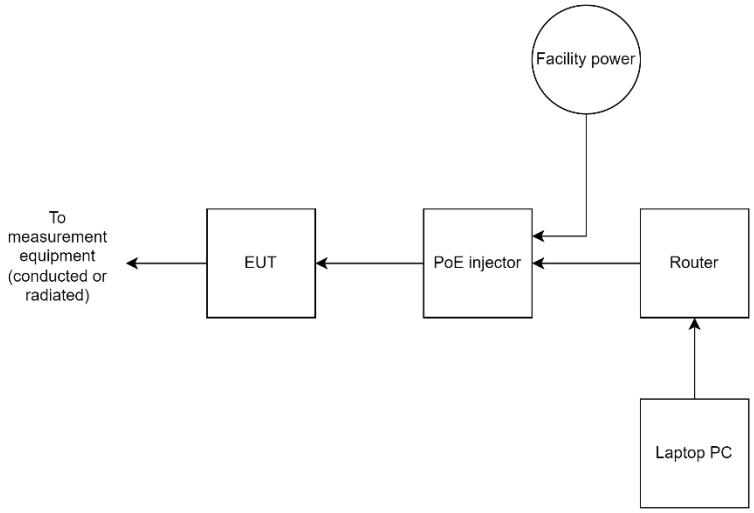


Figure 3.6-1: Test setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		**U_{cispr} dB**	**U_{lab} dB**
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

V-AMN: V type artificial mains network
AAN: Asymmetric artificial network
CP: Current probe
CVP: Capacitive voltage probe
SAC: Semi-anechoic chamber
FAR: Fully anechoic room

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Test Equipment List*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rohde & Schwarz	ESU26	E1353	1 year	14-Nov-2024
System controller	Sunol Sciences	SC104V	E1129	NCR	NCR
Bilog Antenna (30-1000MHz)	Schaffner-Chase	CBL 6111D	1763	2 years	01-Apr-2024
DRG Horn (medium)	ETS-Lindgren	3117-PA	E1160	1 year	13-Feb-2024
Standard Gain Horn Antenna	Eravant	SAZ-2410-42-S1	EW107	1 year	22-Nov-2023
EMI Test Receiver	Rohde & Schwarz	ESU40	E1121	1 year	08-23-2024
System controller	Sunol Sciences	SC104V	E1191	NCR	NCR
Active Loop H Field Antenna	EMCO - HP	6502	E1267	2 years	08-02-2025
Bilog Antenna (30-1000MHz)	Schaffner-Chase	CBL 6111D	1763	2 years	04-01-2024
EMI Test Receiver	Rohde & Schwarz	ESCI 7	E1026	1 year	03-22-2024
Two Line V-Network	Rohde & Schwarz	ENV216	E1019	1 year	10-03-2024
Transient Limiter (10 dB pad)	Hewlett Packard	11947A	681	NCR	NCR

Notes: NCR: no calibration required
VBU: verify before use

7.2 Test software list

Table 7.2-1: *Test Software*

Manufacturer	Details
Rohde & Schwarz	EMC 32 V10.60.10 (AC conducted emissions)
Rohde & Schwarz	EMC 32 V10.60.15 (radiated emissions)

Section 8 Testing data

8.1 Radiated emissions

8.1.1 References and limits

- FCC 47 CFR Part 15, Subpart B: §15.209
- Test method: ANSI C63.4-2014

Table 8.1-1: *FCC §15.209 – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Table 8.1-2: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.1.2 Test summary

Verdict	Pass		
Test date	November 21, 2023	Temperature	18 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1005 mbar
Test location	☐ 10m semi anechoic chamber ☒ 3m semi anechoic chamber ☐ Other:	Relative humidity	58 %

8.1.3 Notes

The spectral plots within this section have been corrected with all relevant transducer factors.

All transmitters (NFC, BLE and radar) where operational at maximum output power.

8.1.4 Setup details

Port under test	Enclosure port
EUT power input during test	48 V DC (PoE)
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:
Measuring distance	☐ 10m ☐ 3m ☐ Other:
Antenna height variation	1 – 4 m
Turn table position	0 – 360°
Measurement details	Preview measurements were performed with the receiver in continuous scan or sweep mode. Emissions detected within 6 dB or above limit (minimum of 6 frequencies) were maximized by rotating the EUT and adjusting the antenna height and polarization. At the position of maximum emission, the signal was measured with the appropriate detector against the corresponding limit and recorded as the final measurement.

Receiver settings; 9 kHz to 30 MHz:

Resolution bandwidth	200 Hz from 9 – 150 kHz 9 kHz from 150 kHz – 30 MHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Measurement time	– 100 ms (Peak preview measurement) – 15000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies 30 MHz to 1 GHz:

Resolution bandwidth	120 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Detector mode	Peak (Preview measurement) Peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Peak and Average final measurement)

8.1.5 Test data

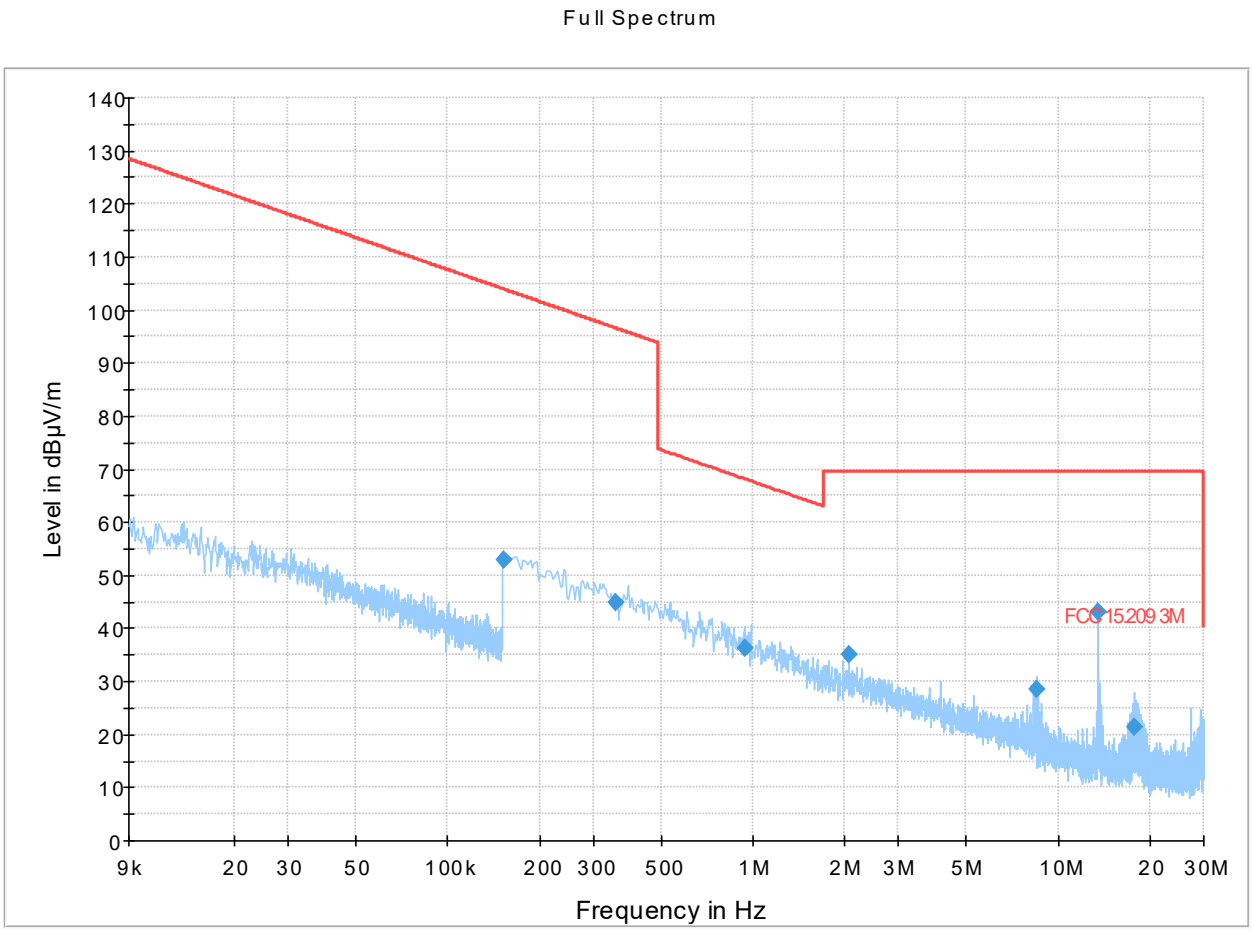


Figure 8.1-1: *Radiated emissions spectral plot (9 kHz - 30 MHz), 0 degrees*

Table 8.1-3*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.152000	52.79	103.96	51.17	15000.0	9.000	H	257.0	10.9
0.353800	45.01	96.63	51.61	15000.0	9.000	H	25.0	10.6
0.944800	36.15	68.11	31.96	15000.0	9.000	H	266.0	10.8
2.063400	35.18	69.50	34.32	15000.0	9.000	H	0.0	10.9
8.523925	28.65	69.50	40.85	15000.0	9.000	H	70.0	11.1
13.560605	Fundamental NFC emission							
17.824140	21.43	69.50	48.07	15000.0	9.000	H	32.0	11.1

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Full Spectrum

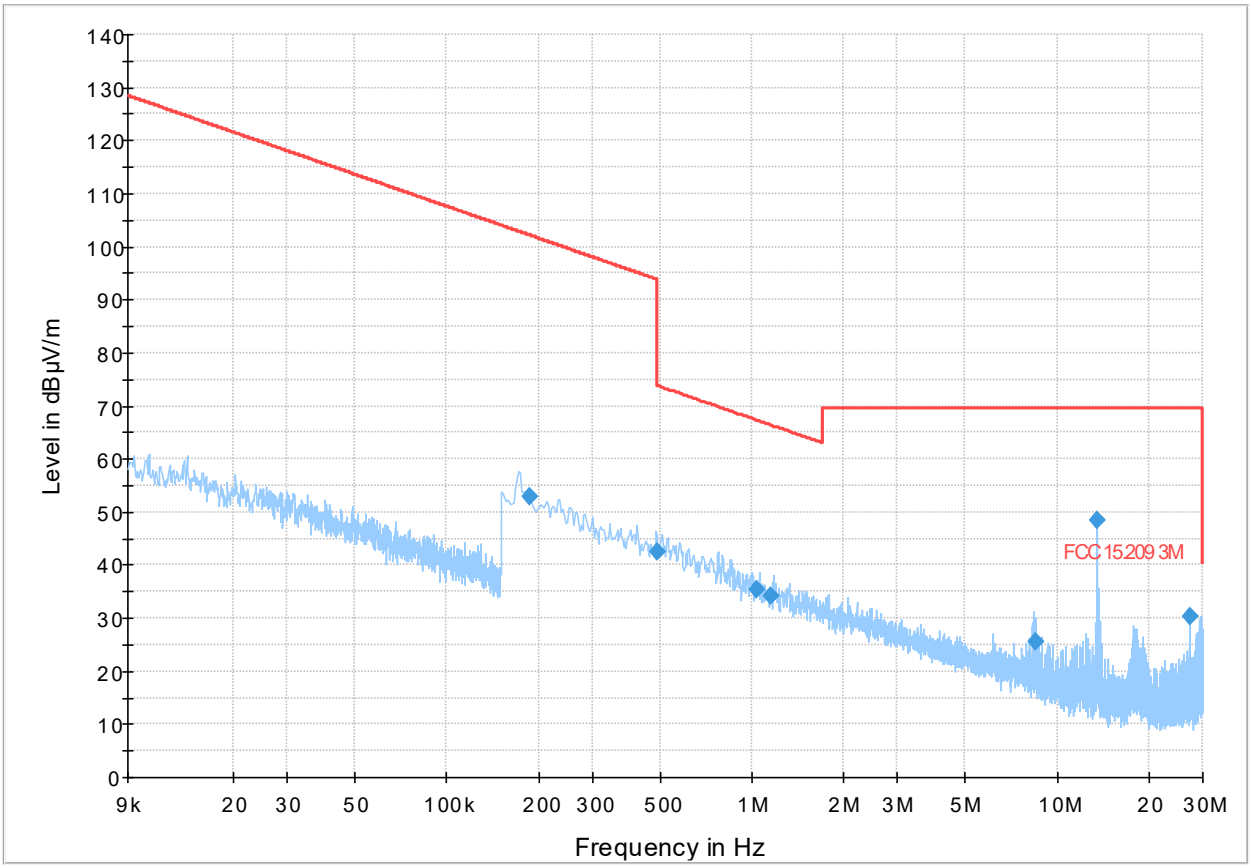


Figure 8.1-2: *Radiated emissions spectral plot (9 kHz - 30 MHz), 90 degrees*

Table 8.1-4*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.186000	52.86	102.21	49.35	15000.0	9.000	H	140.0	10.8
0.489200	42.55	93.81	51.27	15000.0	9.000	H	271.0	10.7
1.032440	35.39	67.35	31.96	15000.0	9.000	H	64.0	11.0
1.154825	34.30	66.38	32.07	15000.0	9.000	H	314.0	11.0
8.456315	25.54	69.50	43.96	15000.0	9.000	H	96.0	11.1
13.560605				Fundamental NFC emission				
27.120475	30.45	69.50	39.05	15000.0	9.000	H	142.0	9.5

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Full Spectrum

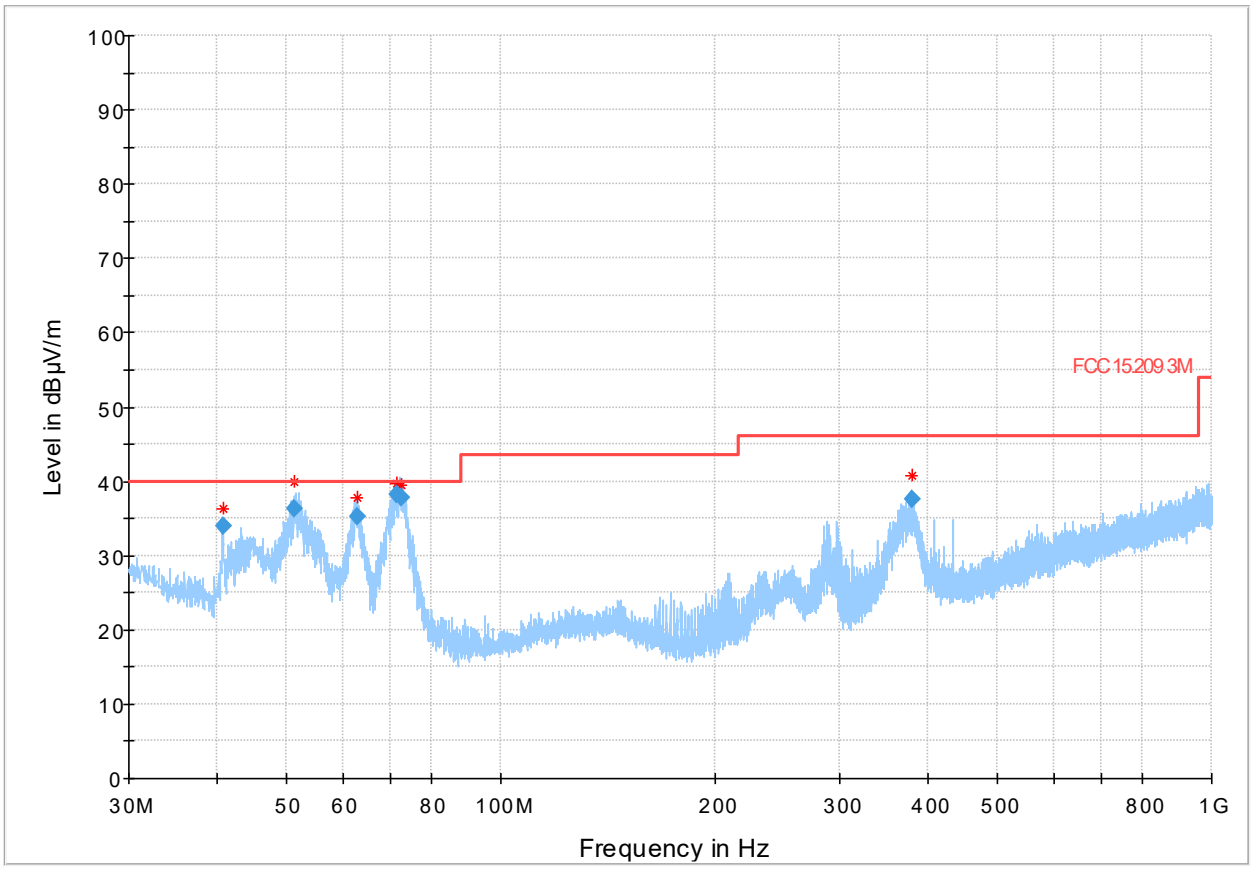


Figure 8.1-3: *Radiated emissions spectral plot (30 MHz - 1 GHz)*

Table 8.1-5*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.690000	33.87	40.00	6.13	5000.0	120.000	98.0	V	0.0	20.7
51.383000	36.26	40.00	3.74	5000.0	120.000	98.0	V	106.0	15.2
62.814500	35.14	40.00	4.86	5000.0	120.000	107.0	V	219.0	12.6
71.602500	38.27	40.00	1.73	5000.0	120.000	128.0	V	353.0	13.7
72.501000	37.82	40.00	2.18	5000.0	120.000	107.0	V	333.0	13.9
379.665000	37.62	46.00	8.38	5000.0	120.000	102.0	V	0.0	24.2

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

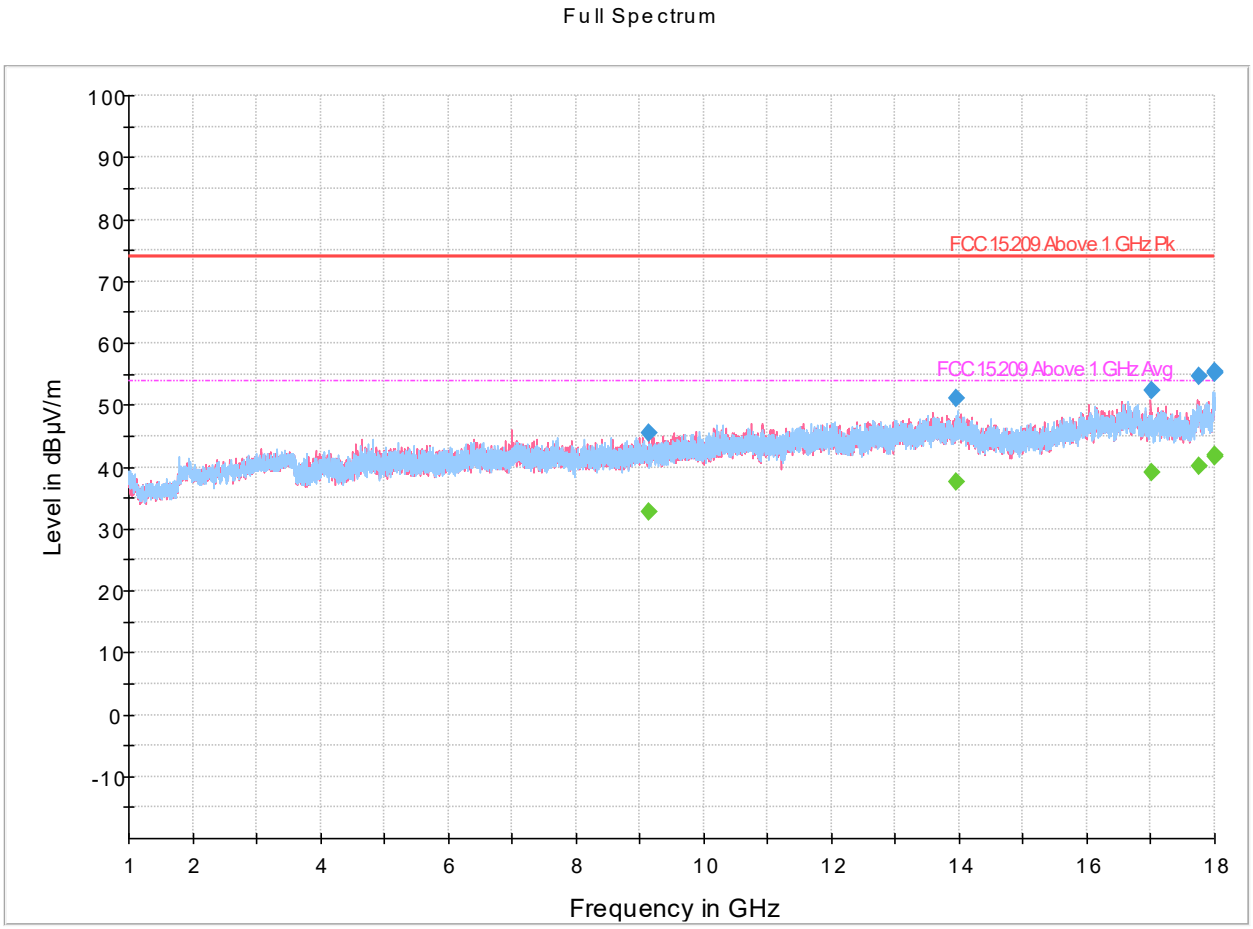


Figure 8.1-4: *Radiated emissions spectral plot (1 GHz - 18 GHz)*

Table 8.1-6*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9148.500000	45.52	---	73.90	28.38	5000.0	1000.000	164.0	V	355.0	5.8
9148.500000	---	32.73	53.90	21.17	5000.0	1000.000	164.0	V	355.0	5.8
13960.900000	51.19	---	73.90	22.71	5000.0	1000.000	315.0	H	290.0	14.6
13960.900000	---	37.69	53.90	16.21	5000.0	1000.000	315.0	H	290.0	14.6
17001.400000	---	39.05	53.90	14.85	5000.0	1000.000	349.0	V	214.0	15.4
17001.400000	52.29	---	73.90	21.61	5000.0	1000.000	349.0	V	214.0	15.4
17744.800000	---	40.19	53.90	13.71	5000.0	1000.000	337.0	V	330.0	17.0
17744.800000	54.75	---	73.90	19.15	5000.0	1000.000	337.0	V	330.0	17.0
17995.000000	55.17	---	73.90	18.73	5000.0	1000.000	344.0	H	340.0	20.1
17995.000000	---	41.74	53.90	12.16	5000.0	1000.000	344.0	H	340.0	20.1
17998.700000	55.34	---	73.90	18.56	5000.0	1000.000	98.0	H	204.0	20.3
17998.700000	---	41.94	53.90	11.96	5000.0	1000.000	98.0	H	204.0	20.3

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.
Fundamental Bluetooth Low Energy transmitter at 2440 MHz suppressed with notch filter.

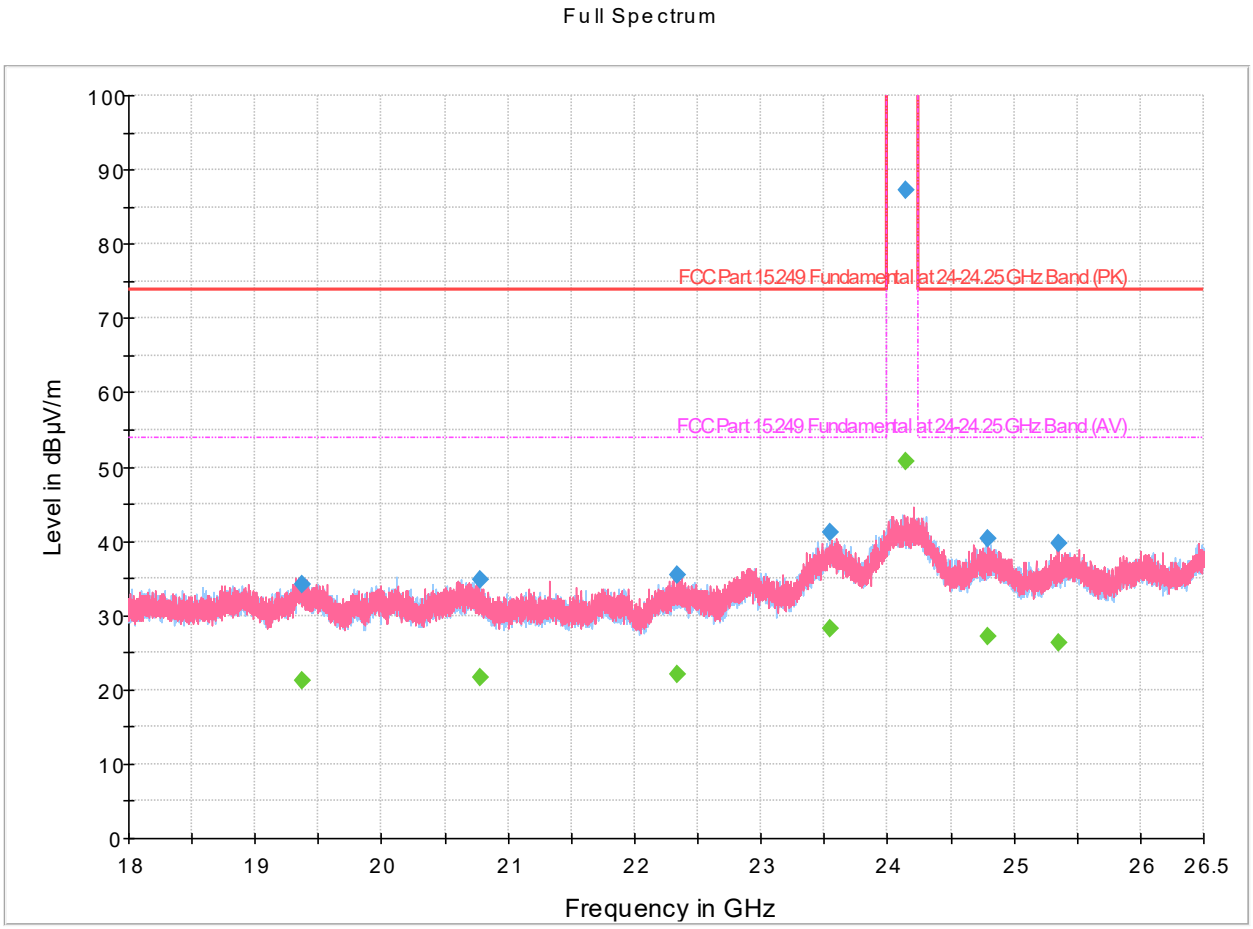


Figure 8.1-5: *Radiated emissions spectral plot (18 GHz - 26.5 GHz)*

Table 8.1-7*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19371.600000	34.23	---	73.90	39.67	5000.0	1000.000	250.0	H	242.0	16.7
19371.600000	---	21.24	53.90	32.66	5000.0	1000.000	250.0	H	242.0	16.7
20784.356250	34.89	---	73.90	39.01	5000.0	1000.000	343.0	H	0.0	17.7
20784.356250	---	21.64	53.90	32.26	5000.0	1000.000	343.0	H	0.0	17.7
22334.956250	---	22.12	53.90	31.78	5000.0	1000.000	259.0	V	0.0	17.6
22334.956250	35.44	---	73.90	38.46	5000.0	1000.000	259.0	V	0.0	17.6
23551.662500	41.24	---	73.90	32.66	5000.0	1000.000	334.0	V	43.0	23.6
23551.662500	---	28.33	53.90	25.57	5000.0	1000.000	334.0	V	43.0	23.6
24145.262500	Fundamental radar emission									
24145.262500	Fundamental radar emission									
24786.793750	---	27.21	53.90	26.69	5000.0	1000.000	190.0	V	328.0	22.3
24786.793750	40.37	---	73.90	33.53	5000.0	1000.000	190.0	V	328.0	22.3
25357.156250	---	26.34	53.90	27.56	5000.0	1000.000	183.0	V	0.0	21.4
25357.156250	39.80	---	73.90	34.10	5000.0	1000.000	183.0	V	0.0	21.4

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Full Spectrum

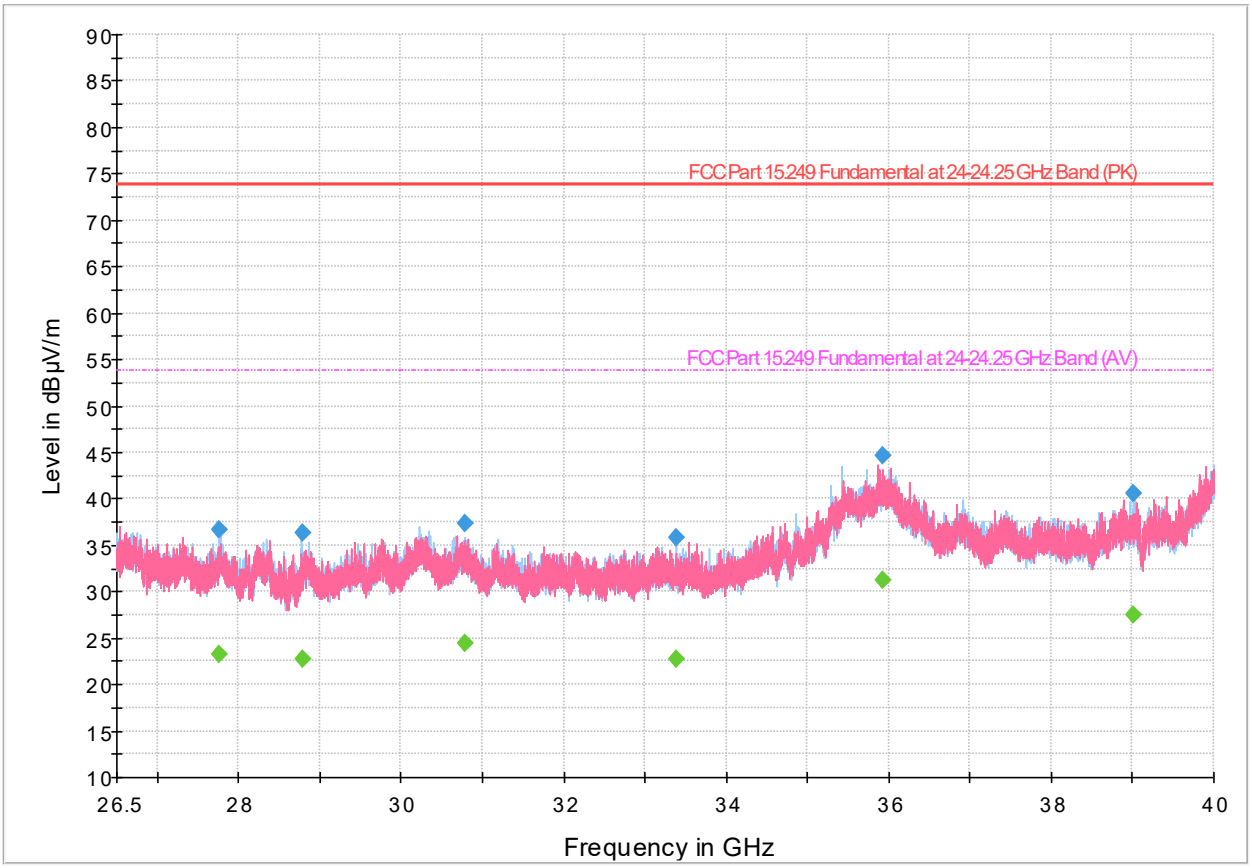


Figure 8.1-6: *Radiated emissions spectral plot (26.5 GHz - 40 GHz)*

Table 8.1-8*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
27768.887500	---	23.28	53.90	30.62	5000.0	1000.000	117.0	H	-1.0	9.6
27768.887500	36.60	---	73.90	37.30	5000.0	1000.000	117.0	H	-1.0	9.6
28785.268750	---	22.72	53.90	31.18	5000.0	1000.000	106.0	H	10.0	10.7
28785.268750	36.40	---	73.90	37.50	5000.0	1000.000	106.0	H	10.0	10.7
30785.856250	37.26	---	73.90	36.64	5000.0	1000.000	175.0	H	3.0	12.2
30785.856250	---	24.36	53.90	29.54	5000.0	1000.000	175.0	H	3.0	12.2
33386.050000	---	22.73	53.90	31.17	5000.0	1000.000	164.0	H	115.0	11.7
33386.050000	35.78	---	73.90	38.12	5000.0	1000.000	164.0	H	115.0	11.7
35929.750000	---	31.19	53.90	22.71	5000.0	1000.000	200.0	V	8.0	20.8
35929.750000	44.62	---	73.90	29.28	5000.0	1000.000	200.0	V	8.0	20.8
39010.581250	40.59	---	73.90	33.31	5000.0	1000.000	125.0	H	228.0	16.8
39010.581250	---	27.49	53.90	26.41	5000.0	1000.000	125.0	H	228.0	16.8

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

8.1.6 Setup photos

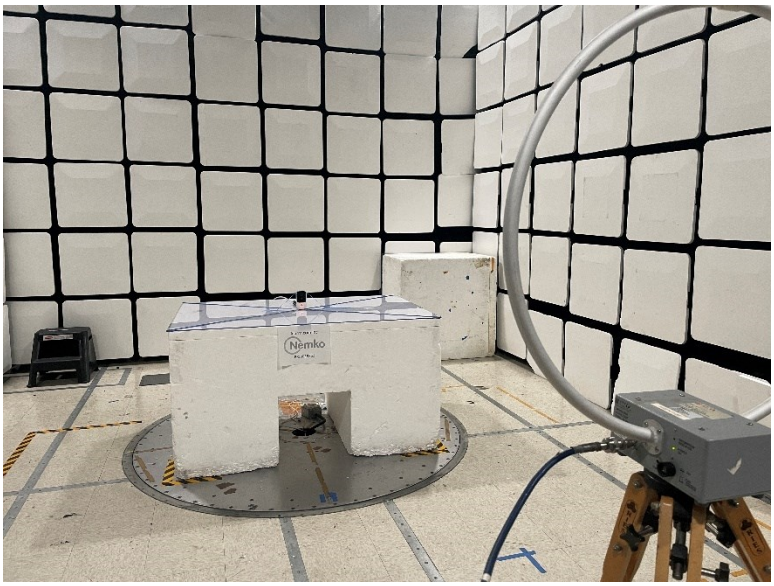


Figure 8.1-7: *Radiated emissions setup photo – below 30 MHz*

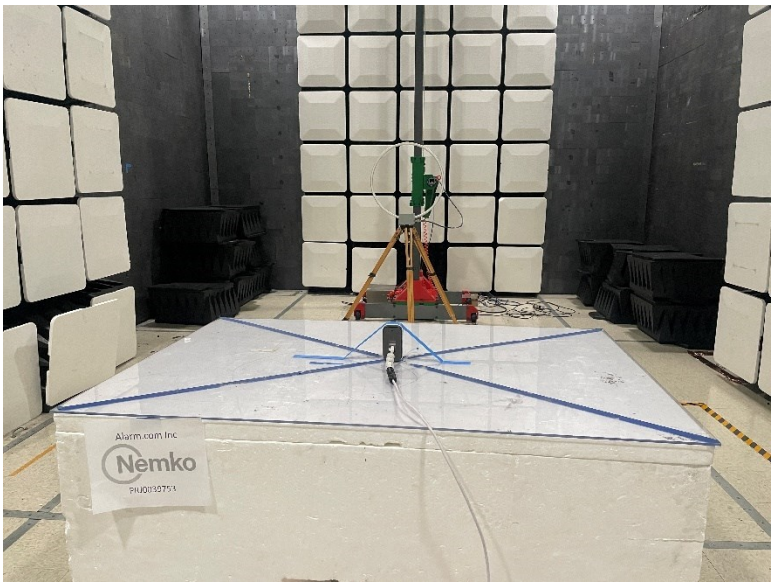


Figure 8.1-8: *Radiated emissions setup photo – below 30 MHz*

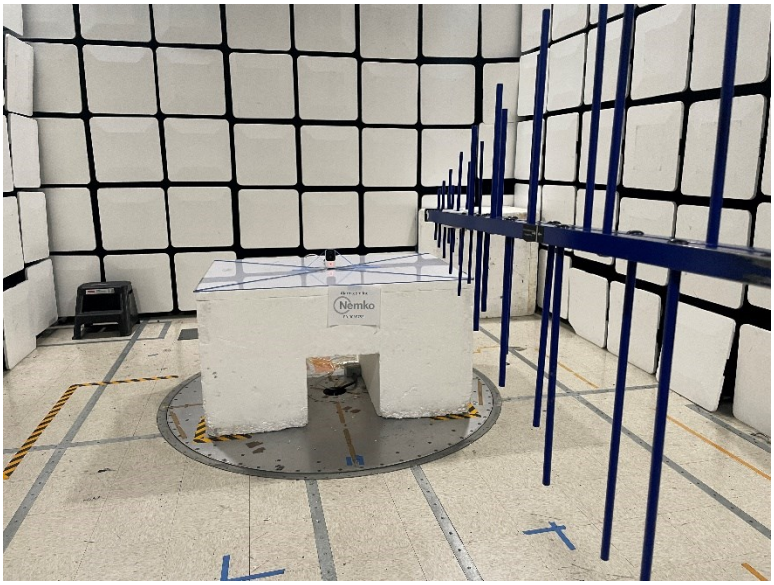


Figure 8.1-9: *Radiated emissions setup photo – 30 MHz to 1 GHz*

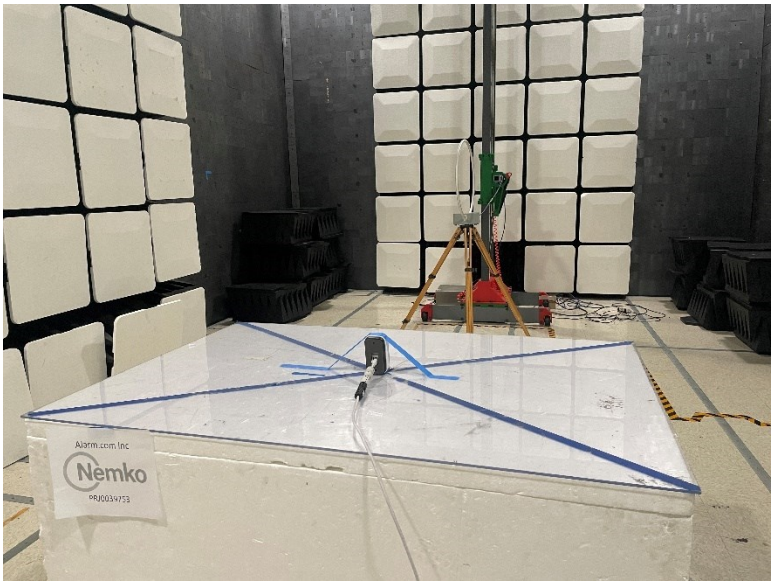


Figure 8.1-10: *Radiated emissions setup photo – 30 MHz to 1 GHz*

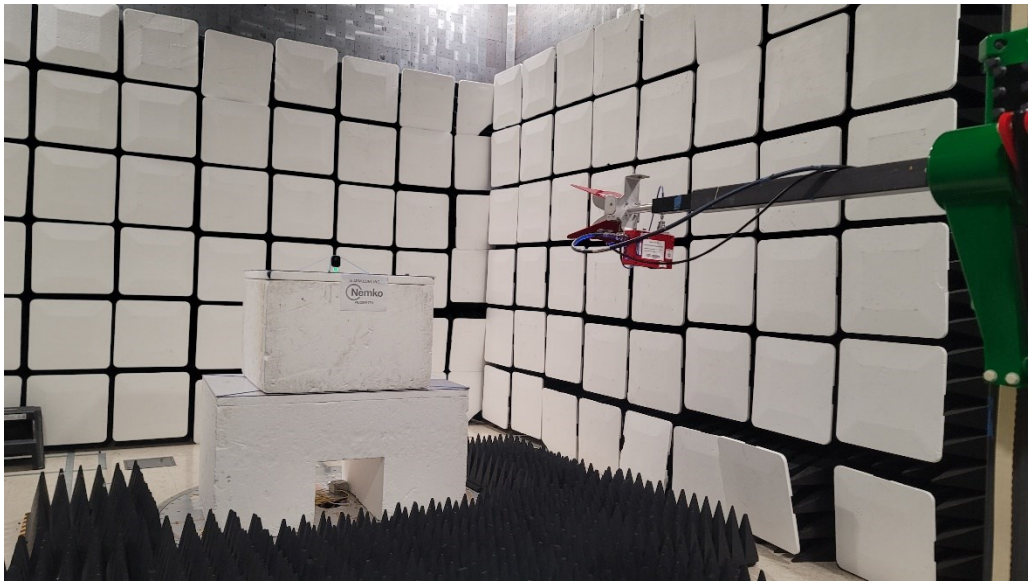


Figure 8.1-11: *Radiated emissions setup photo – above 1 GHz*

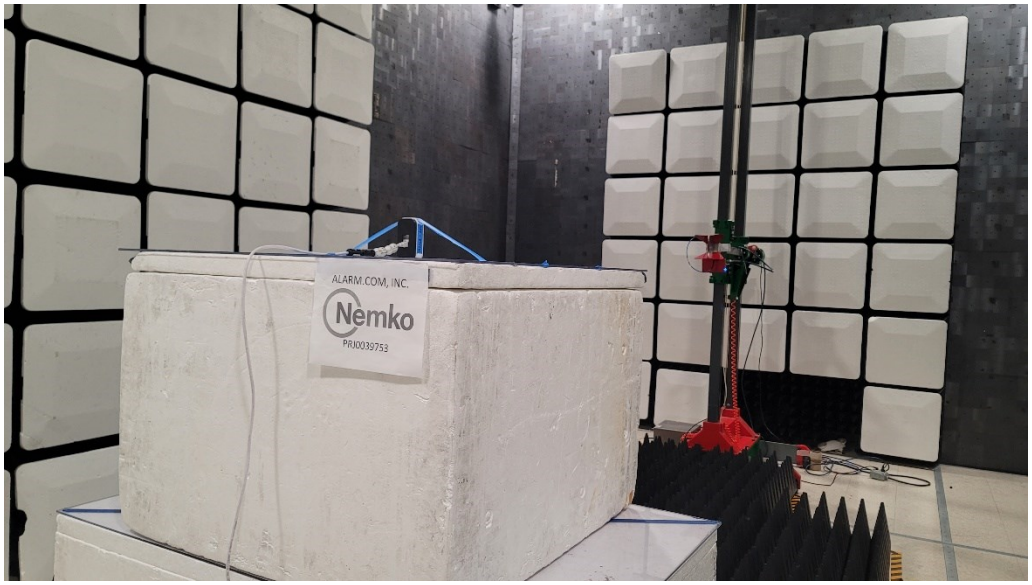


Figure 8.1-12: *Radiated emissions setup photo – above 1 GHz*

8.2 Conducted emissions from AC mains ports

8.2.1 References and limits

- FCC 47 CFR Part 15, Subpart B: §15.207
- Test method: ANSI C63.4-2014

Table 8.2-1: *Conducted emissions limit*

Frequency of emission, MHz	Conducted limit, dBµV	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * Decreases with the logarithm of the frequency.

8.2.2 Test summary

Verdict	Pass		
Test date	November 22, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1006 mbar
Test location	☒ Ground plane ☐ Other:	Relative humidity	57 %

8.2.3 Notes

The spectral plots within this section have been corrected with all relevant transducer factors.

Equipment with a DC power port powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment and tested with a power converter. Where the manufacturer provided the power converter, the supplied converter was used.

All transmitters (NFC, BLE and radar) where operational at maximum output power.

8.2.4 Setup details

Port under test – Coupling device	AC power input – Artificial Mains Network (AMN)
EUT power input during test	48 V DC, PoE (AC power port of PoE injector tested)
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Selected emissions were re-measured with the appropriate detector(s) against the correlating limit(s) and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Detector mode	– Peak and Average (Preview measurement) – Quasi-peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 5000 ms (Quasi-peak and Average final measurement)

8.2.5 Test data

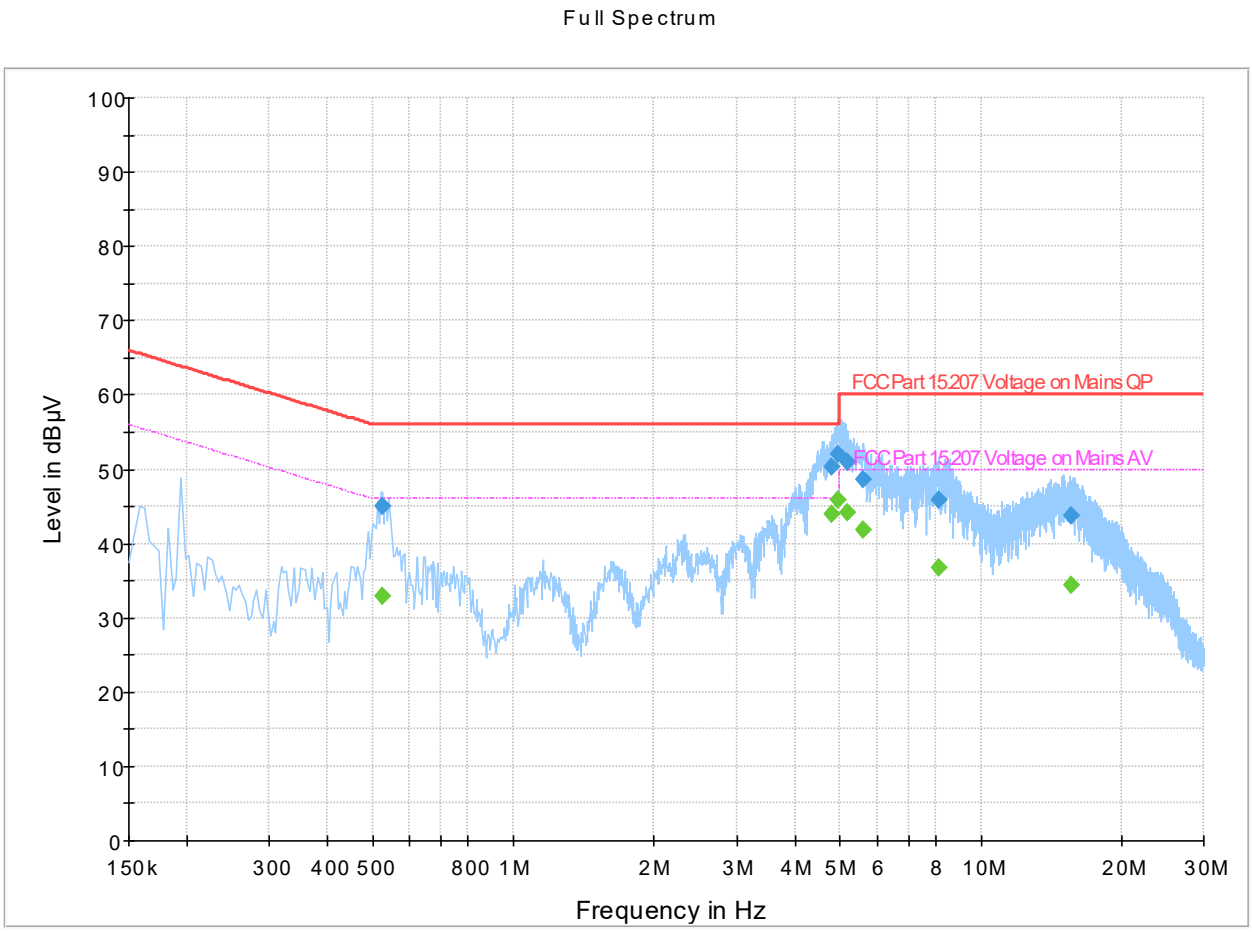


Figure 8.2-1: *Conducted emissions at mains port spectral plot (150 kHz - 30 MHz)*

Table 8.2-2*: Conducted emissions at mains port results*

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.522000	---	32.92	46.00	13.08	5000.0	9.000	L1	GND	19.6
0.522000	45.04	---	56.00	10.96	5000.0	9.000	L1	GND	19.6
4.814000	---	44.01	46.00	1.99	5000.0	9.000	L1	GND	19.6
4.814000	50.30	---	56.00	5.70	5000.0	9.000	L1	GND	19.6
4.954000	---	45.77	46.00	0.23	5000.0	9.000	L1	GND	19.6
4.954000	52.01	---	56.00	3.99	5000.0	9.000	L1	GND	19.6
5.198000	---	44.11	50.00	5.89	5000.0	9.000	L1	GND	19.7
5.198000	50.88	---	60.00	9.12	5000.0	9.000	L1	GND	19.7
5.582000	---	41.91	50.00	8.09	5000.0	9.000	L1	GND	19.7
5.582000	48.67	---	60.00	11.33	5000.0	9.000	L1	GND	19.7
8.122000	---	36.65	50.00	13.35	5000.0	9.000	L1	GND	19.8
8.122000	45.88	---	60.00	14.12	5000.0	9.000	L1	GND	19.8
15.562000	---	34.38	50.00	15.62	5000.0	9.000	L1	GND	20.1
15.562000	43.64	---	60.00	16.36	5000.0	9.000	L1	GND	20.1

Notes:
[1] Result (dBµV) = receiver analyzer value (dBµV) + correction factor (dB).
[2] Correction factors = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

8.2.6 Setup photos

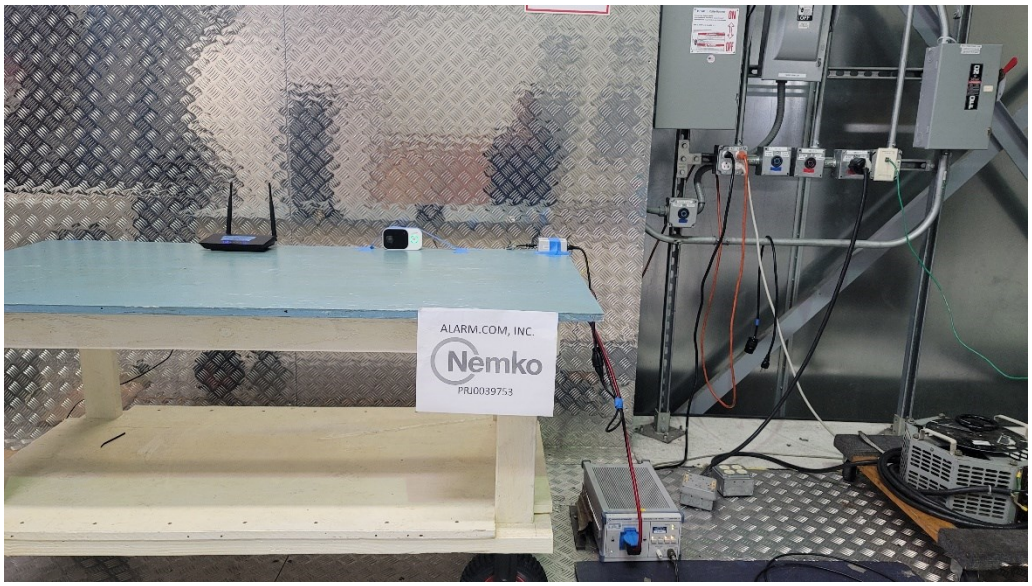


Figure 8.2-2: *Conducted emissions from AC mains ports setup photo*

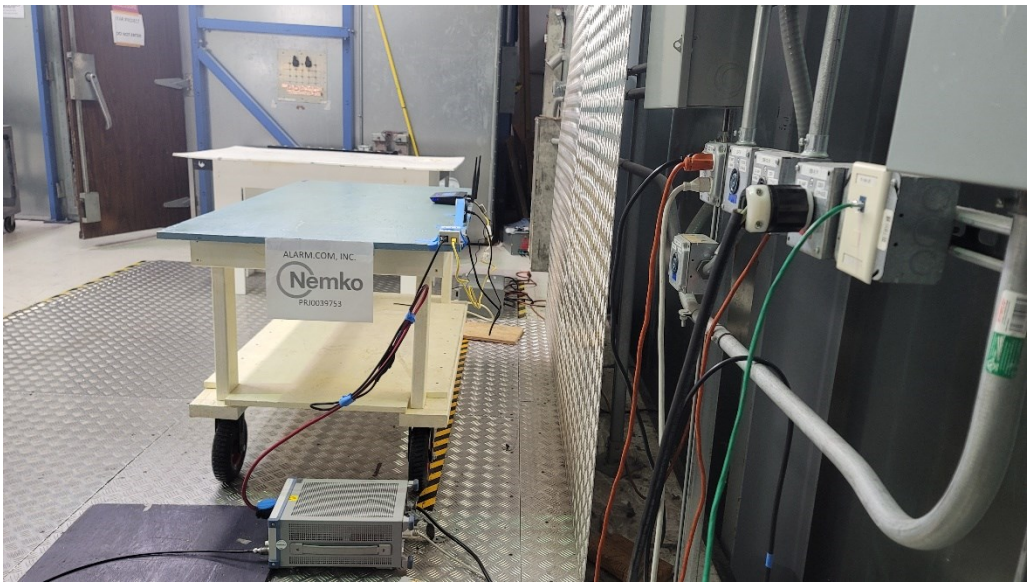


Figure 8.2-3: *Conducted emissions from AC mains ports setup photo*

Section 9 EUT photos

9.1 External photos

Figure 9.1-1: *Front view photo*

Figure 9.1-2: *Rear view photo*

Figure 9.1-3: *Side view photo*

Figure 9.1-4: *Side view photo*

Figure 9.1-5: *Top view photo*

Figure 9.1-6: *Bottom view photo*

End of test report