

Prüfbericht-Nr.: Test report no.:	SE23ZOJM-003	Auftrags-Nr.: Order no.:	0290100214	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: Client reference no.:	2458172	Auftragsdatum: Order date:	2022.09.29	
Auftraggeber: Client:	Nomono AS			
Prüfgegenstand: Test item:	Central hub of recording device			
Bezeichnung / Typ-Nr.: Identification / Type no.:	Space Recorder / FCC ID: 2A9CX-REC1			
Auftrags-Inhalt: Order content:	Accredited Testing			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15B with parts 15.107 & 15.109 ANSI C63.4: 2014			
Wareneingangsdatum: Date of sample receipt:	2022.11.09			
Prüfmuster-Nr.: Test sample no.:	See section 2.3			
Prüfzeitraum: Testing period:	2023.02.27 – 2023.03.02			
Ort der Prüfung: Place of testing:	Lund, Sweden			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland Sweden			
Prüfergebnis*: Test result*:	Pass			
überprüft von: reviewed by:			genehmigt von: authorized by:	
Datum: 2023.05.17 Date:	Signed by: Niall Forrester		Datum: 2023.05.17 Date:	Signed by: Hakan Ahlberg
Stellung / Position:	Senior Technical Expert		Stellung / Position:	Lab Manager
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet 5 = poor N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts.</i>				

Revision History

REVISION	DATE	REMARKS	AUTHOR
001	2023.04.14	First release	Niall Forrester
002	2023.04.21	Corrected error in wireless frequencies	Niall Forrester
003	2023.05.17	Updated module text	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15B no JBP Template version 1.3			

Summary of Test Results

FCC 47 CFR Rule Part	Test Description	Applicability	Report Section	RESULT	REMARKS
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	YES	4.1	PASS	
15.109	Radiated Emissions (Unintentional Radiators)	YES	4.2	PASS	

Possible test case verdicts:

- | | |
|--|-----------------------|
| - Test case does not apply to the test object: | N/A |
| - Test object complies with the requirement: | PASS or COMPLIANT |
| - Test object does not meet the requirement: | FAIL or NOT COMPLIANT |
| - Test case not performed on the test object: | N.P. |

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1. GENERAL INFORMATION

1.1 Test Site

Test Facility:	TÜV Rheinland Sweden AB
Address:	Mobilvägen 10
	223 62 Lund
	Sweden
Swedac Registration Number:	10325
FCC Test Firm Registration Number:	517458
ISED Test Site Registration Number:	24753

1.2 Client Information

Company Name:	Nomono AS
Address:	Strandveien 43
	7067 Trondheim
	Norway
Contact Person:	Kristine Snyder / Sindre Georgsen
Contact e-Mail / Telephone	compliance@nomono.co +47 40 44 00 40 / +47 93 42 48 42

2. PRODUCT INFORMATION

2.1 General Description

Model name:	Space Recorder
Manufacturer:	Nomono
Model number / Marketing name:	Space Recorder
FCC ID:	2A9CX-REC1
Description:	Central hub of recording device
Ancillary Equipment:	See section 2.7

The device incorporates five separate radio transmitters:

A “Main” module for WLAN 2.4 GHz 802.11 b/g/n, WLAN 5GHz 802.11 a/n/ac and Bluetooth Low Energy. This module uses its own SMT antenna

4 x “Microphone” modules (labelled “Tx0” “Tx3” below) for communicating with a wireless microphone via Bluetooth Low Energy. Each of these modules is connected to its own PCB antenna

2.2 Device Characteristics

Device Class for 47 CFR Part 15 B	Class B
Type of Power Supply	Internal battery Charging via dedicated charging base or Charging via USB C (No dedicated AC/DC adapter supplied with device)
Nominal Supply Voltage	3.6V DC (Battery) 5.0V DC (From charging base) 5.0V DC (USB)
Supply Voltage Range	2.75V – 4.2V (Battery) 4.9V – 5.1V (From charging base) 5.0V – 12.0V DC (USB)
Operating Temperature Range	0 to 45 °C
Operating Air Humidity Range	-
Highest Internal Frequency Source	5825 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A003421467-001	Standard Sample Hardware: 830-00002 rev. 4 Firmware: nRF radio: v0.8.0 CPU: v0.6.1	All Tests

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
WLAN 802.11b/g/n (Main)	2.4 GHz	2412 MHz - 2462 MHz	N/A
WLAN 802.11a/n/ac (Main)	5 GHz	5180 MHz – 5825 MHz	N/A
Bluetooth Low Energy (Main)	2.4 GHz	2402 MHz - 2480 MHz	N/A
Bluetooth Low Energy (Microphone Tx0)	2.4 GHz	2402 MHz - 2480 MHz	N/A
Bluetooth Low Energy (Microphone Tx1)	2.4 GHz	2402 MHz - 2480 MHz	N/A
Bluetooth Low Energy (Microphone Tx2)	2.4 GHz	2402 MHz - 2480 MHz	N/A
Bluetooth Low Energy (Microphone Tx3)	2.4 GHz	2402 MHz - 2480 MHz	N/A

(Note that other parts of the recording system contain additional wireless transmitters have been tested separately)

2.5 Antenna Information

Technology	Band	Number of Antennas	Antenna Type(s)	Gain (dBi)
WLAN 802.11b/g/n (Main) & Bluetooth Low Energy (Main)	2.4 GHz	1	SMT Chip Antenna	4.20
WLAN 802.11a/n/ac (Main)	5 GHz	1	SMT Chip Antenna	4.50
Bluetooth Low Energy (Microphone Tx0)	2.4 GHz	1	PCB Antenna	2.05
Bluetooth Low Energy (Microphone Tx1)	2.4 GHz	1	PCB Antenna	1.99
Bluetooth Low Energy (Microphone Tx2)	2.4 GHz	1	PCB Antenna	2.58
Bluetooth Low Energy (Microphone Tx3)	2.4 GHz	1	PCB Antenna	1.16

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
WLAN 802.11b/g/n (Main)	2.4 GHz	CCK, BPSK, QPSK, 16-QAM, 64-QAM	As per 802.11 Spec	As per 802.11 Spec	N/A
WLAN 802.11a/n/ac (Main)	5 GHz	CCK, BPSK, QPSK, 16-QAM, 64-QAM	As per 802.11 Spec	As per 802.11 Spec	N/A
Bluetooth Low Energy (Main)	2.4 GHz	GFSK	40	2 MHz	N/A
Bluetooth Low Energy (Microphone Tx0)	2.4 GHz	GFSK	40	2 MHz	N/A
Bluetooth Low Energy (Microphone Tx1)	2.4 GHz	GFSK	40	2 MHz	N/A
Bluetooth Low Energy (Microphone Tx2)	2.4 GHz	GFSK	40	2 MHz	N/A
Bluetooth Low Energy (Microphone Tx3)	2.4 GHz	GFSK	40	2 MHz	N/A

2.7 Ancillary Equipment

ID	Description	Manufacturer / Model	Hardware & Software Versions
A003414830-001	Charging Base	Nomono Charging Case	HW: 830-00009 rev. 1 FW: v0.3.4
A003419822-002	Wireless Microphone	Nomono Stellar Mic	HW: 830-00005 rev. 3 FW: v0.6.13
A003419822-003	Wireless Microphone	Nomono Stellar Mic	HW: 830-00005 rev. 3 FW: v0.6.13
A003419822-004	Wireless Microphone	Nomono Stellar Mic	HW: 830-00005 rev. 3 FW: v0.6.13
A003419822-005	Wireless Microphone	Nomono Stellar Mic	HW: 830-00005 rev. 3 FW: v0.6.13
A003389898-003	USB Charger	Samsung EP-T4510	HW: 13.08.2022 FW: N/A

2.8 EUT Diagrams

N/A

3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 15.107	-	Conducted limits
FCC 47 CFR 15.109	-	Radiated emission limits

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

3.3 Limits

FCC 47 CFR Rule Part	Test Description	Limit Reference (FCC 47 CFR Reference)
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	15.107 (a) for Class B Devices
15.109	Radiated Emissions (Unintentional Radiators)	15.109 (a) for Class B Devices *See Note 1

Interpretation of the measurement results has been performed in accordance with ANSI C63.4 section 10.2.8.2

Compliance with the requirements has been based on the results of the measurements compared to the specified limits, not taking into account measurement instrumentation uncertainty.

Measurement Uncertainty figures are stated in section 6

Note 1

Radiated Emissions limits in the tables from 47 CFR sections 15.109 are presented in $\mu\text{V/m}$. Measurements on the test system are made in $\text{dB}\mu\text{V/m}$. To convert between these, the following adjustment is used:

$$\text{New Limit} = 20 \log \left(\frac{\text{Original Limit}}{10^6} \right) + 120$$

Example: from 15.209(a) the limit for 30MHz – 88MHz is $100\mu\text{V/m}$ at 3m. This gives:

$$\text{New Limit} = 20 \log \left(\frac{100}{10^6} \right) + 120 = 40\text{dB}\mu\text{V/m at 3m}$$

Additionally, in some cases testing has been performed at distances other than those specified in the tables. When this has occurred, the limits have been adjusted in accordance with the requirements in 47 CFR 15.31, using an extrapolation factor of 40dB/decade at frequencies below 30MHz and 20dB/decade at or above 30MHz

Example: from 15.209(a) the limit for 1.705MHz – 30MHz is $30\mu\text{V/m}$ (=29.54 $\text{dB}\mu\text{V/m}$) at 30m

$$\text{Limit@3m} = \text{Limit@30m} + 40 \log \left(\frac{30}{3} \right) = 29.54 + 40.00 = 69.54 \text{ dB}\mu\text{V/m at 3m}$$

Example: from 15.209(a) the limit for 1GHz – 18GHz is $500\mu\text{V/m}$ (=53.98 $\text{dB}\mu\text{V/m}$) at 3m

$$\text{Limit@1m} = \text{Limit@3m} + 20 \log \left(\frac{3}{1} \right) = 53.98 + 9.54 = 63.52 \text{ dB}\mu\text{V/m at 1m}$$

3.4 Description of Test Methods and Equipment Setup

3.4.1 General Description

Testing was performed in accordance with the various requirements of ANSI C63.4 and ANSI C63.10. Any deviations from the test methods are described in section 3.7

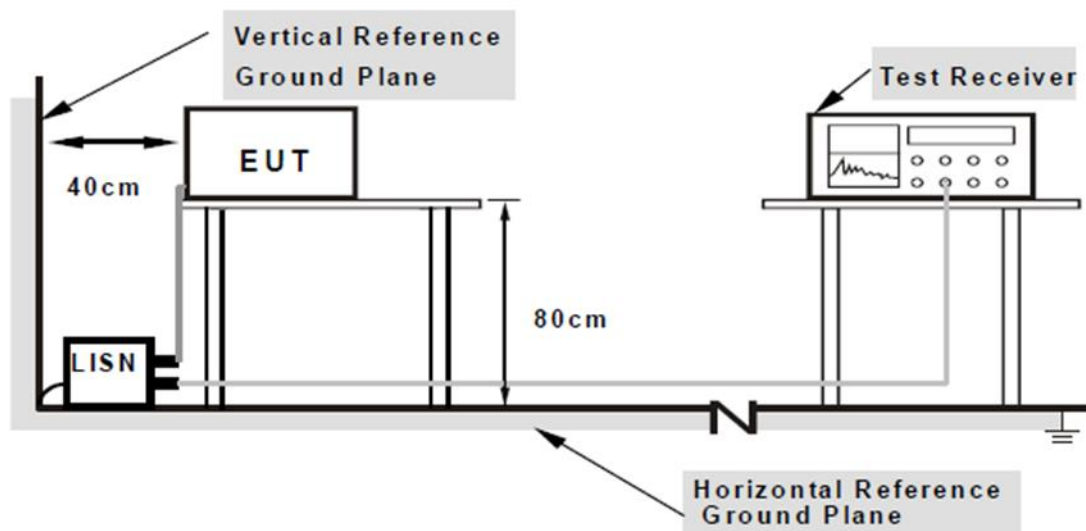
Where different arrangements of equipment were used for different types of measurements, these are tabulated in section 3.4.2 and details of each arrangement are included in subsequent sections

3.4.2 Test Equipment Setup Used by Test Type

FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	Conducted Emissions
15.109	Radiated Emissions (Unintentional Radiators)	SAC5

3.4.3 Test Equipment Setup – Conducted Emissions

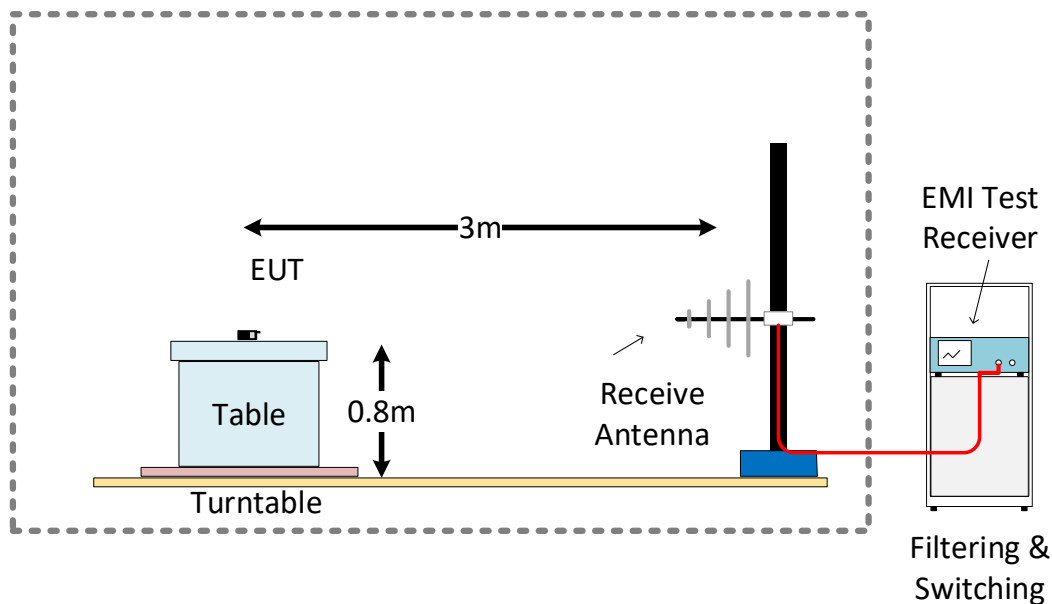
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide 50Ω/ 50μH of coupling impedance for the measuring instrument.
- The lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10 dB under the prescribed limits could not be reported.



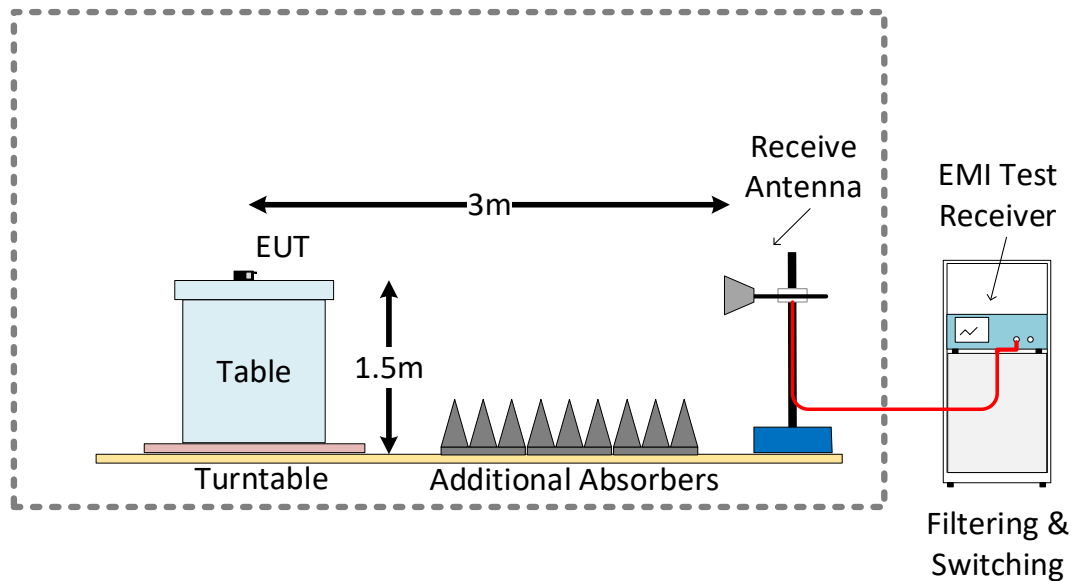
3.4.4 Test Equipment Setup – SAC 5 (Radiated Emissions)

- For frequency range 30MHz-1GHz Log-Periodic Antenna was used. Antenna elevated from 100 cm from floor to 400 cm from floor, and was placed at 3 m from center of turntable in tilted position. The equipment under test (EUT) was placed at the middle of the turntable at 80 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 1GHz-18GHz horn Antenna was used. Antenna elevated from 100 cm from floor to 200 cm from floor, and was placed at 3 m from center of turntable. The equipment under test (EUT) was placed at the middle of the turntable at 150 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 18GHz-40GHz double horn Antenna was used. Antenna's height was adjusted to 150 cm from floor, and 1 m distance to center of turntable. The equipment under test (EUT) was placed at the middle of the turntable on at 150 cm height from floor.
- For all frequency ranges the turntable was rotated 360° for obtaining the maximum emission.

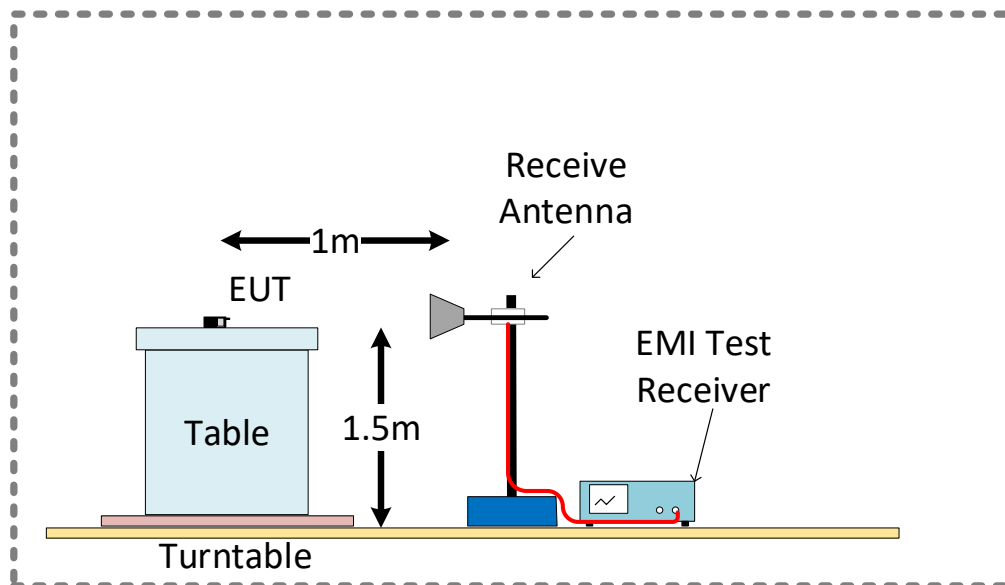
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz

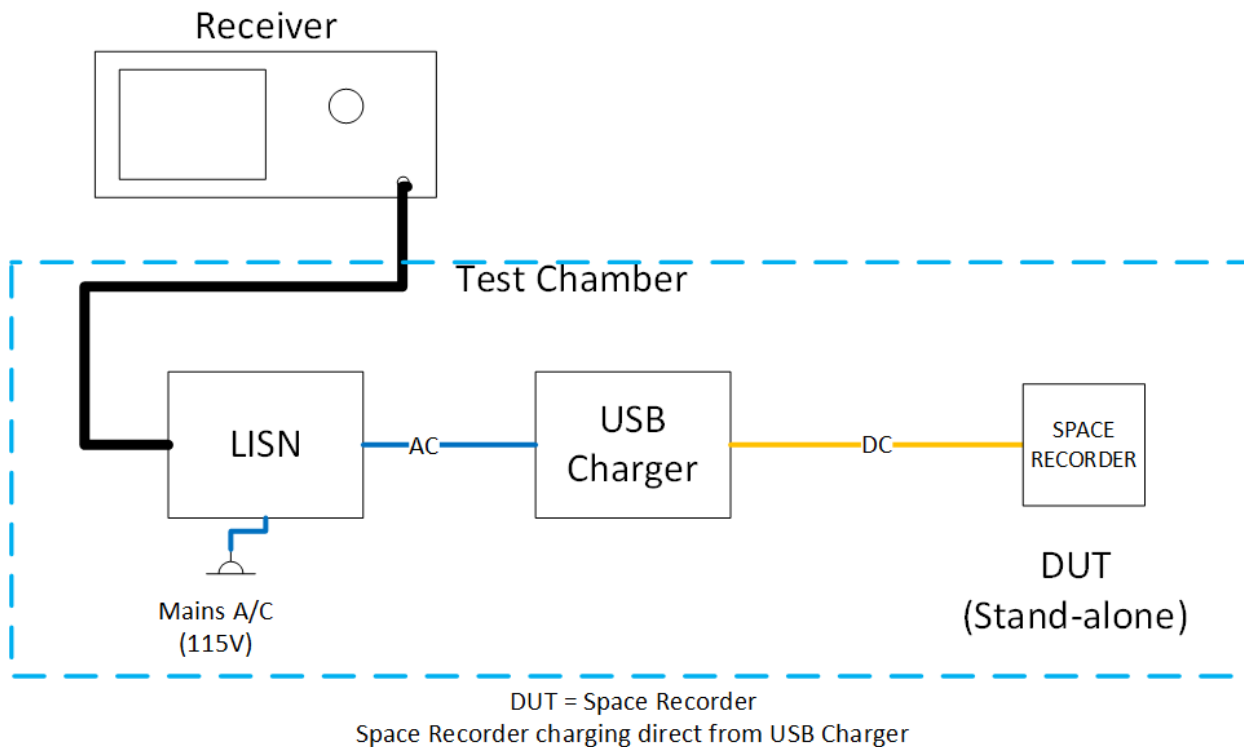


SAC 5 Test Setup Configuration 18GHz – 40GHz

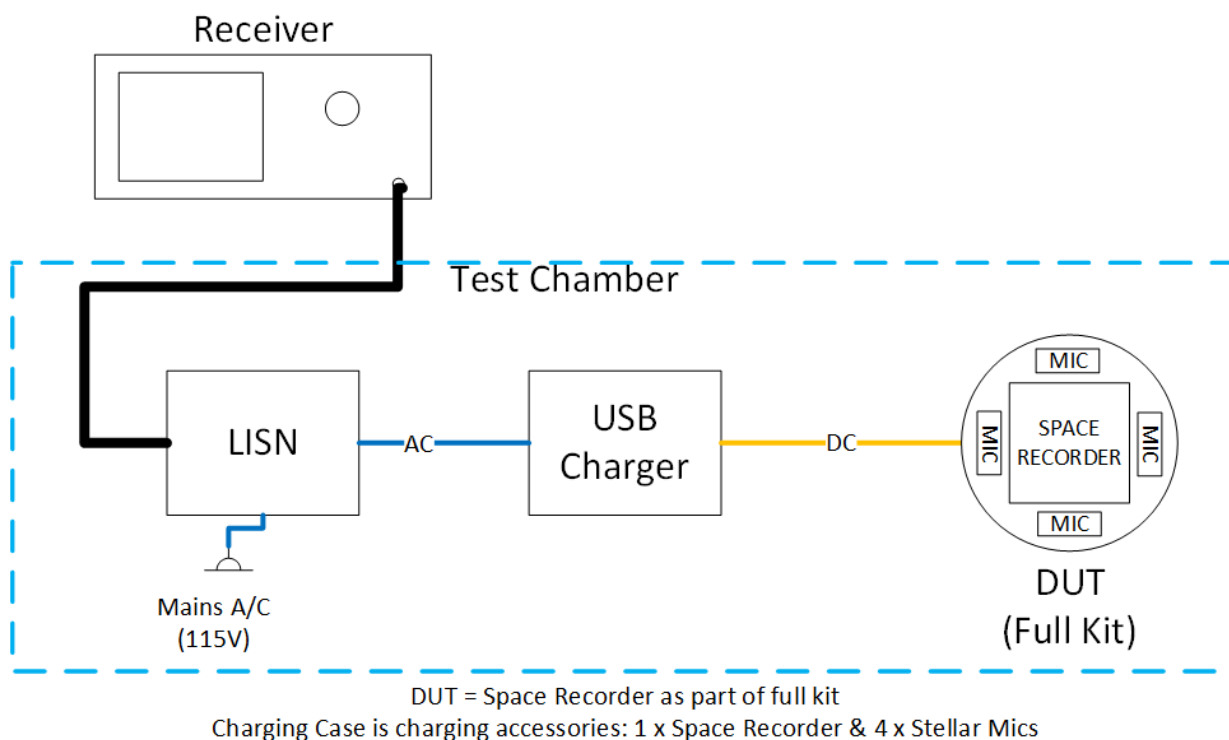


3.5 EUT Configuration During Test

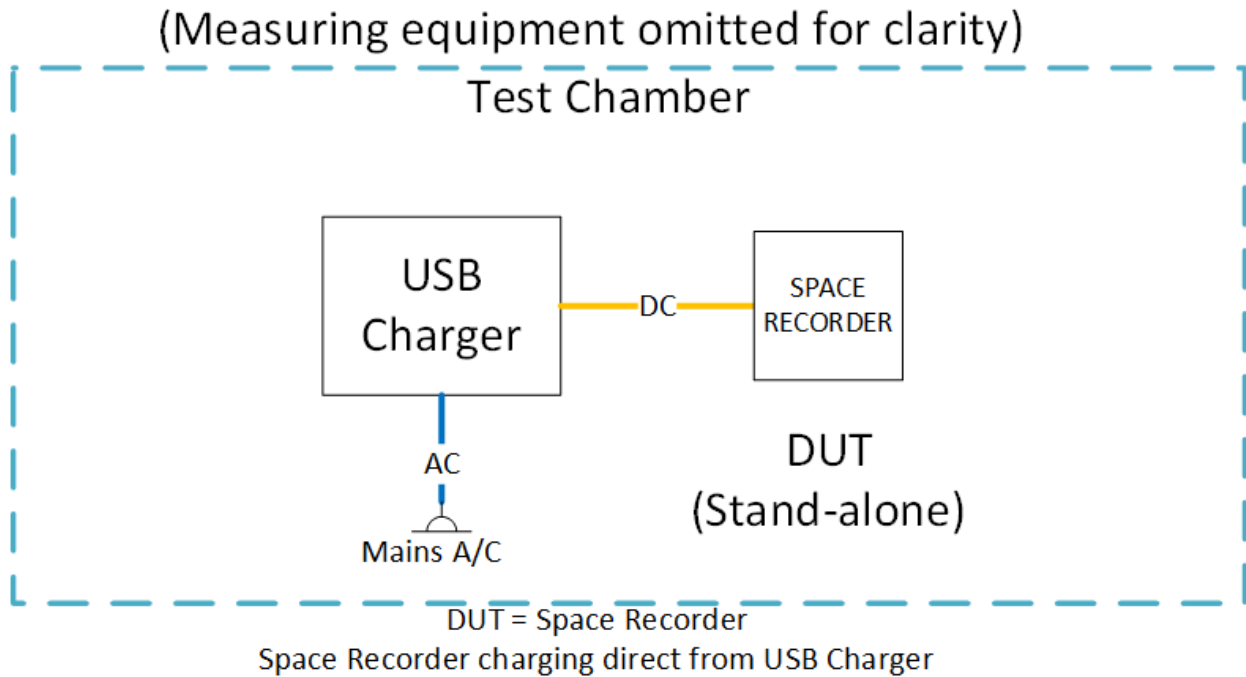
AC Conducted Emissions Testing: Block Diagram (Stand-alone with charging)



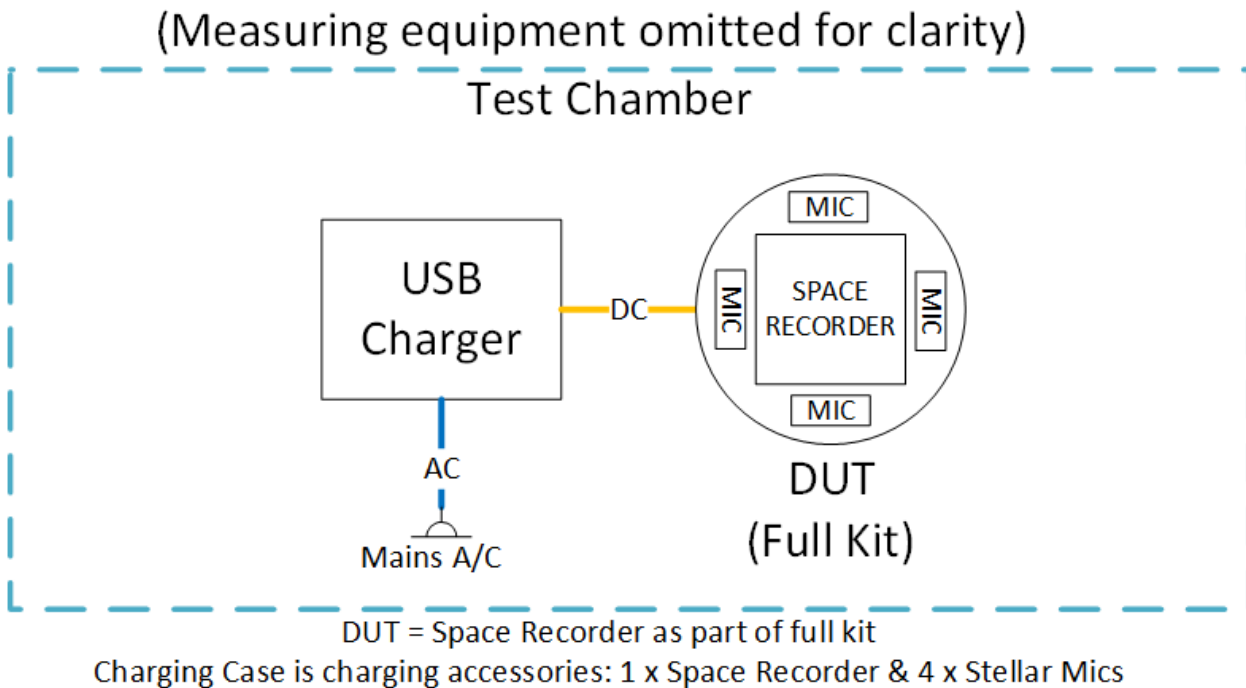
AC Conducted Emissions Testing: Block Diagram (Full Kit with charging)



Radiated Emissions & Radiated RF Testing: Block Diagram (Stand-alone with charging)



Radiated Emissions & Radiated RF Testing: Block Diagram (Full Kit with charging)



3.6 EUT Operation Modes

Operation mode	Description
Rec – Charge – No Tx	Space Recorder only in “stand-alone” configuration. Device charging via USB All radio transmitters (WLAN 2.4/5GHz, all Bluetooth Low Energy) set to receive-only mode
Kit - Charge - No Tx	“Full Kit”: Charging Base with 1 x Space Recorder & 4x Stellar Mic All devices charging via USB connected to Charging Base All radio transmitters (Space Recorder & Stellar Mic) set to receive-only mode

3.7 Deviations from the Test Standard

Note that for “Full Kit” configurations, the device under test, “Space Recorder” was tested together with four “Stellar Mic” devices and a “Charging Case” device, representing the items that are packaged together and can be charged together when placed in the “Charging Case”

3.8 Environmental Conditions

3.8.1 Environmental Conditions – Conducted Emissions System

Date	Time	Temperature (°C)	Relative Humidity (%)
2023.03.02	09:57	22.5	23

3.8.2 Environmental Conditions – SAC5 (Radiated Emissions)

Date	Time	Temperature (°C)	Relative Humidity (%)
2023.02.27	09:15	18.4	30
2023.02.28	07:35	18.7	32
2023.03.01	07:17	18.7	33

4. TEST RESULTS

4.1 Test Results – AC Power Line Conducted Emissions (Unintentional Trans.)

4.1.1 AC Power Line Conducted Emissions (Unintentional) – Test Summary

Test Specification	FCC 47 CFR 15.107 (Part 15 Subpart B)		
Test Engineer & Date	Niall Forrester	2023.03.02	
EUT and Ancillary Equipment IDs	A003421467-001	A003421467-001 A003414830-001 A003419822-002/003/004/005 A003389898-003	
EUT Operation Mode(s)	Rec – Charge – No Tx / Kit - Charge - No Tx		
EUT Wireless Configuration(s)	Receive Only (All radios: No Tx)		
EUT Hardware Configuration(s)	Stand-alone (Space Recorder) / Full Kit		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line 115V / 60Hz Stand-alone	Receive Only	150kHz – 30MHz	PASS
AC Conducted Power Line Emissions – “L1” Line 115V / 60Hz Stand-alone	Receive Only	150kHz – 30MHz	PASS
AC Conducted Power Line Emissions – “N” Line 115V / 60Hz Full Kit	Receive Only	150kHz – 30MHz	PASS
AC Conducted Power Line Emissions – “L1” Line 115V / 60Hz Full Kit	Receive Only	150kHz – 30MHz	PASS

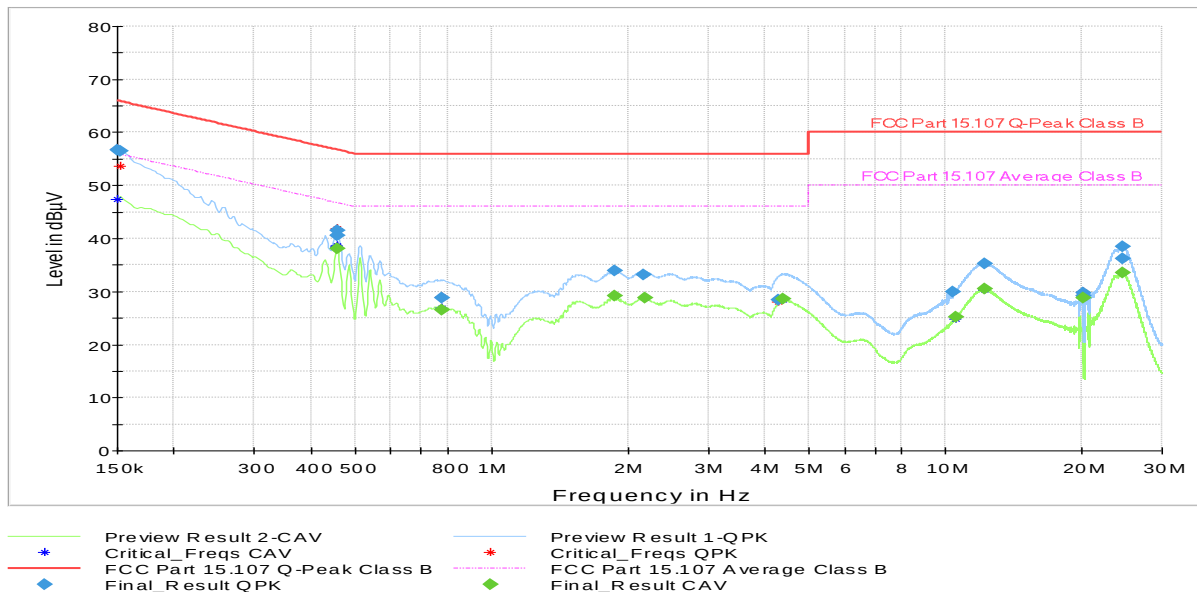
* For detailed measurements, see tables and graphs in sections below

NOTE: As the device may be connected to the AC mains when charging in the dedicated Charging Case, a test was run with the “Full Kit” of devices: the Charging Case, four Stellar Mics and one Space Recorder, with an AC/DC adapter connected to the Charging Case. These results are duplicated in the reports for the Charging Case and the Stellar Mic

Additionally, the Space Recorder device has its own USB charging port which allows connection to AC mains via an AC/DC adapter, and this was tested separately in the “Stand-alone” configuration.

4.1.2 AC Power Line Conducted Emissions (Unintentional) – Test Details: Stand-alone

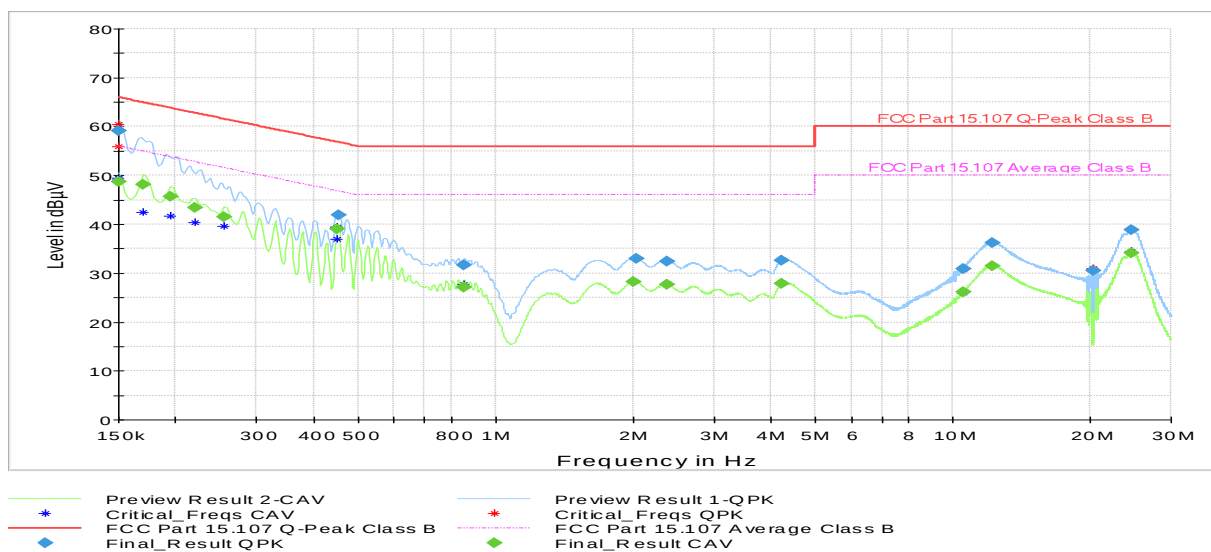
Test mode condition	Conducted Emissions	
Sweep frequency	150 kHz – 30 MHz	
Standard	FCC 47 Part 15.107	
EUT	A003421467-001	
Ancillary Equipment	A003389898-003	
Test Engineer	Niall Forrester	Date: 2023.03.02



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.150000	56.65	---	66.00	9.35	1000.0	9.000	N	ON
0.152250	56.43	---	65.88	9.44	1000.0	9.000	N	ON
0.456000	41.57	---	56.77	15.19	1000.0	9.000	L1	ON
0.458250	40.52	---	56.72	16.20	1000.0	9.000	N	ON
0.458250	---	38.18	46.72	8.54	1000.0	9.000	L1	ON
0.775500	---	26.48	46.00	19.52	1000.0	9.000	L1	ON
0.775500	28.73	---	56.00	27.27	1000.0	9.000	N	ON
1.869000	33.96	---	56.00	22.04	1000.0	9.000	N	ON
1.871250	---	29.17	46.00	16.83	1000.0	9.000	N	ON
2.168250	33.14	---	56.00	22.86	1000.0	9.000	N	ON
2.175000	---	28.86	46.00	17.14	1000.0	9.000	L1	ON
4.285500	28.44	---	56.00	27.56	1000.0	9.000	N	ON
4.382250	---	28.55	46.00	17.45	1000.0	9.000	L1	ON
10.349250	29.87	---	60.00	30.13	1000.0	9.000	N	ON
10.549500	---	25.31	50.00	24.69	1000.0	9.000	N	ON
12.162750	35.21	---	60.00	24.79	1000.0	9.000	N	ON
12.214500	---	30.44	50.00	19.56	1000.0	9.000	N	ON
20.186250	---	28.79	50.00	21.21	1000.0	9.000	N	ON
20.186250	29.75	---	60.00	30.25	1000.0	9.000	N	ON
20.188500	29.11	---	60.00	30.89	1000.0	9.000	N	ON
24.472500	38.41	---	60.00	21.59	1000.0	9.000	N	ON
24.481500	36.22	---	60.00	23.78	1000.0	9.000	L1	ON
24.544500	---	33.52	50.00	16.48	1000.0	9.000	N	ON

4.1.3 AC Power Line Conducted Emissions (Unintentional) – Test Details: Full Kit

Test mode condition	Conducted Emissions	
Sweep frequency	150 kHz – 30 MHz	
Standard	FCC 47 Part 15.107	
EUT	A003421467-001	
Ancillary Equipment	A003414830-001, A003389898-003 A003419822-002/003/004/005	
Test Engineer	Niall Forrester	Date: 2023.03.02



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.150000	59.12	---	66.00	6.88	1000.0	9.000	N	ON
0.150000	---	48.71	56.00	7.29	1000.0	9.000	N	ON
0.170250	---	48.17	54.95	6.78	1000.0	9.000	N	ON
0.195000	---	45.78	53.82	8.05	1000.0	9.000	N	ON
0.219750	---	43.42	52.83	9.41	1000.0	9.000	N	ON
0.255750	---	41.42	51.57	10.14	1000.0	9.000	N	ON
0.451500	---	39.01	46.85	7.83	1000.0	9.000	L1	ON
0.453750	41.96	---	56.81	14.84	1000.0	9.000	L1	ON
0.854250	---	27.04	46.00	18.96	1000.0	9.000	L1	ON
0.854250	31.75	---	56.00	24.25	1000.0	9.000	L1	ON
2.001750	---	28.23	46.00	17.78	1000.0	9.000	L1	ON
2.026500	32.97	---	56.00	23.03	1000.0	9.000	L1	ON
2.366250	---	27.64	46.00	18.36	1000.0	9.000	L1	ON
2.366250	32.48	---	56.00	23.52	1000.0	9.000	L1	ON
4.209000	---	27.95	46.00	18.05	1000.0	9.000	L1	ON
4.231500	32.67	---	56.00	23.33	1000.0	9.000	L1	ON
10.502250	30.91	---	60.00	29.09	1000.0	9.000	N	ON
10.574250	---	26.21	50.00	23.79	1000.0	9.000	N	ON
12.165000	36.20	---	60.00	23.80	1000.0	9.000	N	ON
12.187500	---	31.38	50.00	18.62	1000.0	9.000	N	ON
20.193000	30.54	---	60.00	29.46	1000.0	9.000	N	ON
24.519750	---	34.19	50.00	15.81	1000.0	9.000	N	ON
24.614250	38.89	---	60.00	21.11	1000.0	9.000	N	ON

4.2 Test Results – Radiated Emissions (Unintentional Transmitter)

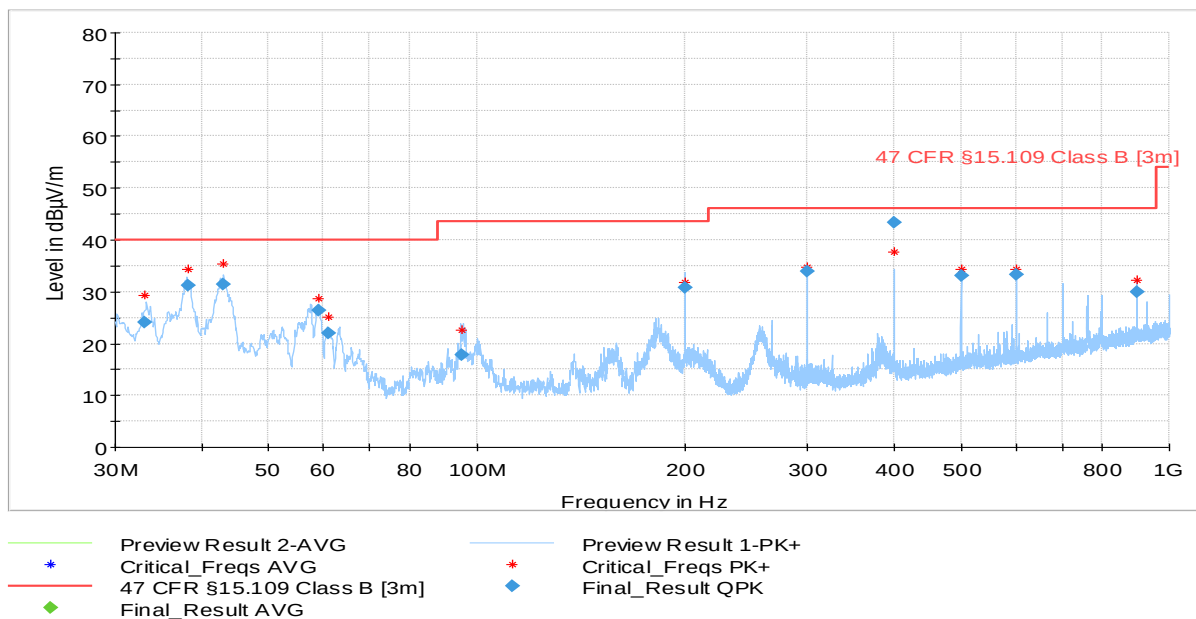
4.2.1 Radiated Emissions (Unintentional) – Test Summary

Test Specification	FCC 47 CFR 15.109 (Part 15 Subpart B)	
Test Engineer & Date	Niall Forrester	2023.02.27 – 2023.03.01
EUT and Ancillary Equipment IDs	A003368431-004	
EUT Operation Mode(s)	Rec – Charge – No Tx / Kit - Charge - No Tx	
EUT Wireless Configuration(s)	Receive Only	
EUT Hardware Configuration(s)	Stand-alone (Space Recorder) / Full Kit	
Overall Result	PASS	
Test Parameter	Frequency Range	Result*
Radiated Emissions - Idle Mode Stand-alone	30 MHz – 1 GHz	PASS
Radiated Emissions - Idle Mode Stand-alone	1 GHz – 18 GHz	PASS
Radiated Emissions - Idle Mode Stand-alone	18 GHz – 40 GHz	PASS
Radiated Emissions - Idle Mode Full Kit	30 MHz – 1 GHz	PASS
Radiated Emissions - Idle Mode Full Kit	1 GHz – 18 GHz	PASS

* For detailed measurements, see tables and graphs in sections below

4.2.2 Radiated Emissions (Unintentional) – Test Details: Stand-alone 30MHz – 1GHz

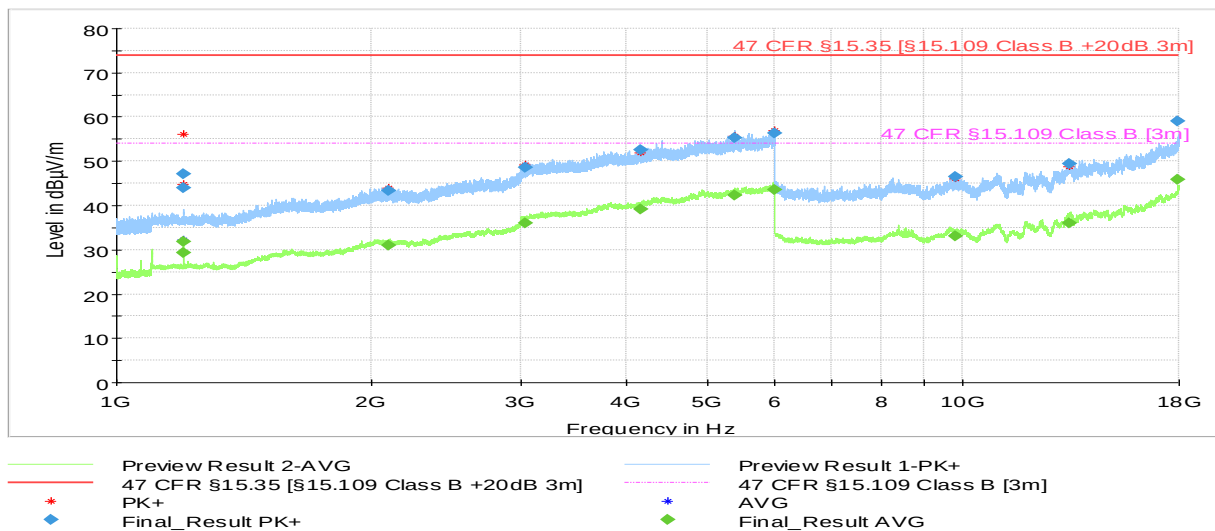
Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003421467-001	
Ancillary Equipment	A003389898-003	
Test Engineer	Niall Forrester	Date: 2023.02.28
Chamber details	Chamber: SAC 5	



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
33.138520	24.06	40.00	15.94	1000.0	120.000	125.0	V	22.0
38.319600	31.22	40.00	8.78	1000.0	120.000	100.0	V	221.0
42.993560	31.44	40.00	8.56	1000.0	120.000	100.0	V	244.0
58.969720	26.32	40.00	13.68	1000.0	120.000	168.0	V	158.0
60.954080	22.02	40.00	17.98	1000.0	120.000	129.0	V	338.0
95.173160	17.78	43.52	25.75	1000.0	120.000	104.0	V	26.0
200.002800	30.78	43.52	12.74	1000.0	120.000	225.0	H	112.0
299.998160	33.89	46.02	12.13	1000.0	120.000	104.0	H	158.0
400.007200	43.37	46.02	2.65	1000.0	120.000	100.0	H	290.0
500.008200	33.12	46.02	12.90	1000.0	120.000	125.0	V	266.0
600.000200	33.37	46.02	12.65	1000.0	120.000	179.0	V	267.0
900.018320	29.90	46.02	16.13	1000.0	120.000	229.0	V	112.0

1GHz – 18GHz

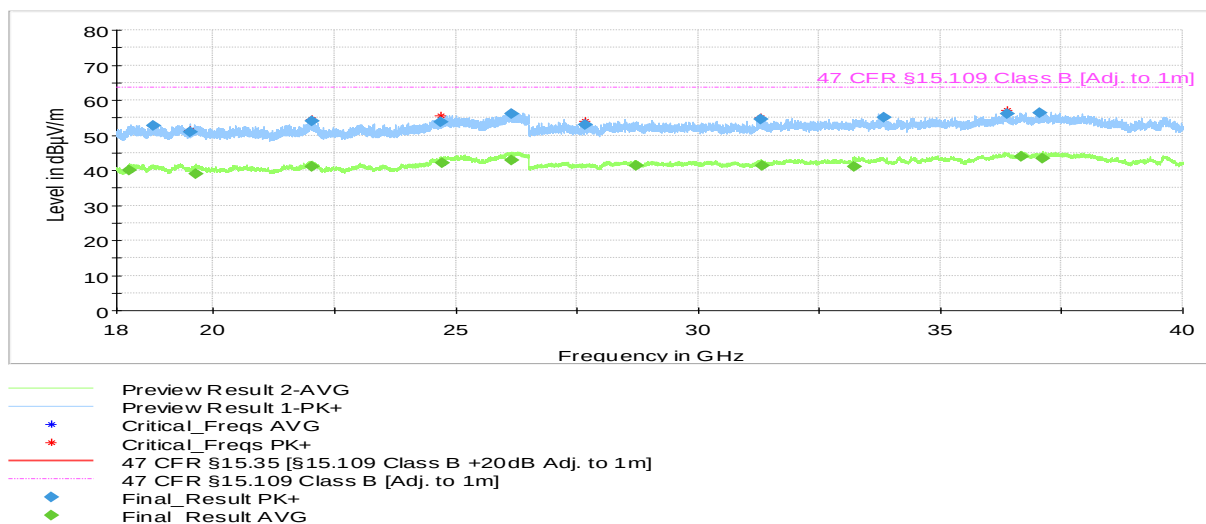
Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003421467-001	
Ancillary Equipment	A003389898-003	
Test Engineer	Niall Forrester	Date: 2023.03.01
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1199.861000	47.21	---	73.98	26.77	1000.0	1000.000	410.0	V	128.0
1199.861000	---	31.84	53.98	22.14	1000.0	1000.000	410.0	V	128.0
1200.253000	---	29.25	53.98	24.73	1000.0	1000.000	135.0	V	-4.0
1200.253000	43.99	---	73.98	29.98	1000.0	1000.000	135.0	V	-4.0
2098.880000	43.39	---	73.98	30.59	1000.0	1000.000	215.0	V	86.0
2098.880000	---	30.93	53.98	23.05	1000.0	1000.000	215.0	V	86.0
3043.622000	---	36.09	53.98	17.89	1000.0	1000.000	285.0	V	218.0
3043.622000	48.57	---	73.98	25.41	1000.0	1000.000	285.0	V	218.0
4166.869000	---	39.27	53.98	14.71	1000.0	1000.000	235.0	H	188.0
4166.869000	52.52	---	73.98	21.46	1000.0	1000.000	235.0	H	188.0
5375.769000	---	42.35	53.98	11.63	1000.0	1000.000	265.0	H	172.0
5375.769000	55.20	---	73.98	18.78	1000.0	1000.000	265.0	H	172.0
5988.734000	56.30	---	73.98	17.68	1000.0	1000.000	315.0	H	266.0
5988.734000	---	43.63	53.98	10.35	1000.0	1000.000	315.0	H	266.0
9784.166000	---	33.07	53.98	20.91	1000.0	1000.000	165.0	V	-8.0
9784.166000	46.40	---	73.98	27.58	1000.0	1000.000	165.0	V	-8.0
13353.868000	49.42	---	73.98	24.56	1000.0	1000.000	100.0	V	-4.0
13353.868000	---	36.07	53.98	17.91	1000.0	1000.000	100.0	V	-4.0
17964.906000	59.02	---	73.98	14.96	1000.0	1000.000	410.0	V	52.0
17964.906000	---	45.93	53.98	8.05	1000.0	1000.000	410.0	V	52.0

18GHz – 40GHz

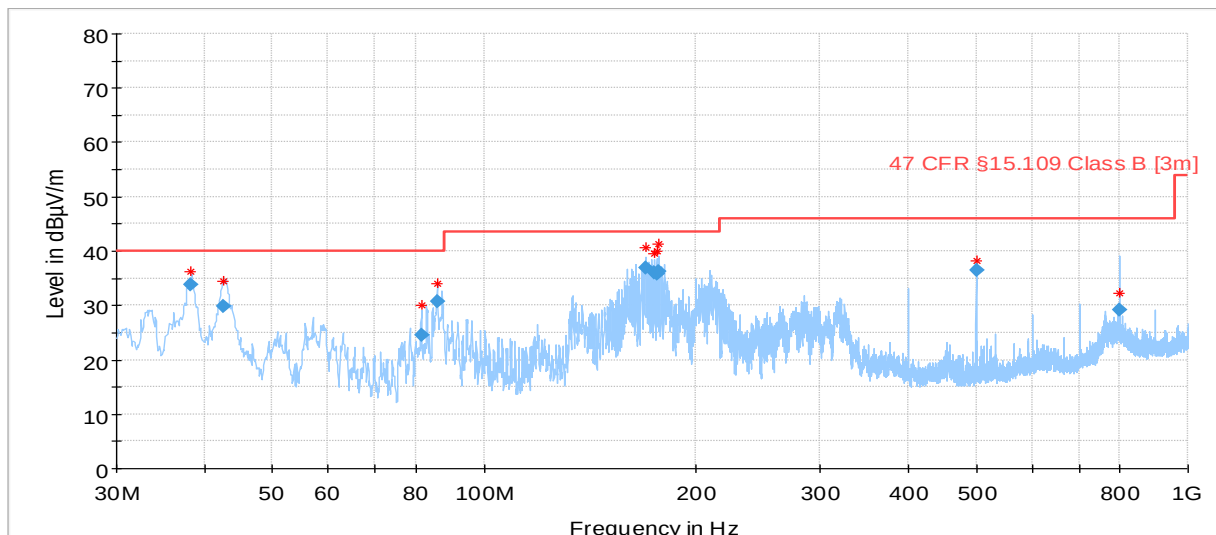
Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003421467-001	
Ancillary Equipment	A003389898-003	
Test Engineer	Niall Forrester	Date: 2023.03.01
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
18261.958000	---	39.91	63.52	23.61	1000.0	1000.000	155.0	H	282.0
18772.463000	52.65	---	83.52	30.87	1000.0	1000.000	155.0	V	112.0
19518.906000	50.89	---	83.52	32.64	1000.0	1000.000	155.0	H	14.0
19643.149000	---	39.08	63.52	24.44	1000.0	1000.000	155.0	V	278.0
22038.792000	53.92	---	83.52	29.61	1000.0	1000.000	155.0	V	82.0
22040.980000	---	41.02	63.52	22.50	1000.0	1000.000	155.0	H	158.0
24699.548000	53.87	---	83.52	29.65	1000.0	1000.000	155.0	H	158.0
24732.305000	---	41.96	63.52	21.57	1000.0	1000.000	155.0	V	-8.0
26148.882000	---	42.79	63.52	20.73	1000.0	1000.000	155.0	V	22.0
26150.727000	56.18	---	83.52	27.34	1000.0	1000.000	155.0	V	98.0
27660.167000	53.04	---	83.52	30.48	1000.0	1000.000	155.0	H	308.0
28711.342000	---	41.28	63.52	22.24	1000.0	1000.000	155.0	V	38.0
31288.891000	54.42	---	83.52	29.10	1000.0	1000.000	155.0	V	262.0
31312.148000	---	41.40	63.52	22.12	1000.0	1000.000	155.0	V	248.0
33232.413000	---	40.91	63.52	22.61	1000.0	1000.000	155.0	V	158.0
33824.050000	55.13	---	83.52	28.39	1000.0	1000.000	155.0	H	278.0
36364.967000	56.16	---	83.52	27.36	1000.0	1000.000	155.0	H	12.0
36670.588000	---	43.80	63.52	19.73	1000.0	1000.000	155.0	V	56.0
37048.745000	56.43	---	83.52	27.09	1000.0	1000.000	155.0	V	56.0
37104.872000	---	43.40	63.52	20.12	1000.0	1000.000	155.0	V	112.0

4.2.3 Radiated Emissions (Unintentional) – Test Details: Full Kit 30MHz – 1GHz

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003421467-001	
Ancillary Equipment	A003414830-001 A003419822-002/003/004/005, A003389898-003	
Test Engineer	Sam Ebadeh	Date: 2023.02.27
Chamber details	Chamber: SAC 5	

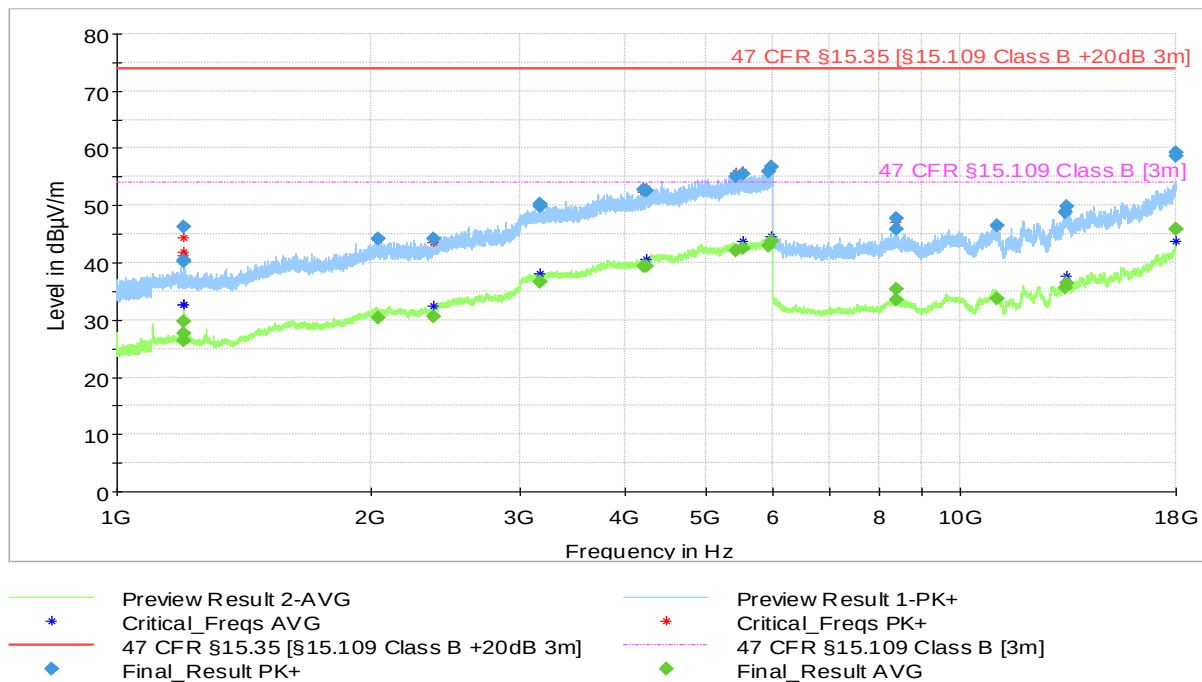


Preview Result 2-AVG	Preview Result 1-PK+
* Critical_Freqs AVG	* Critical_Freqs PK+
47 CFR §15.109 Class B [3m]	◆ Final_Result QPK
◆ Final_Result AVG	× MaxPeak-PK+ (Single)
+ QuasiPeak-QPK (Single)	× Average-AVG (Single)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
38.185160	33.79	40.00	6.21	1000.0	120.000	100.0	V	248.0
42.668080	29.90	40.00	10.10	1000.0	120.000	100.0	V	-18.0
81.380960	24.55	40.00	15.45	1000.0	120.000	225.0	H	22.0
85.903120	30.65	40.00	9.35	1000.0	120.000	225.0	V	68.0
169.970720	36.95	43.52	6.57	1000.0	120.000	179.0	H	87.0
174.346640	36.07	43.52	7.45	1000.0	120.000	225.0	H	87.0
175.766960	35.83	43.52	7.69	1000.0	120.000	175.0	H	87.0
177.215760	36.16	43.52	7.36	1000.0	120.000	225.0	H	72.0
500.006520	36.42	46.02	9.60	1000.0	120.000	100.0	V	158.0
799.993920	29.08	46.02	16.94	1000.0	120.000	129.0	V	158.0

1GHz – 18GHz

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003421467-001	
Ancillary Equipment	A003414830-001 A003419822-002/003/004/005, A003389898-003	
Test Engineer	Niall Forrester	Date: 2023.02.28
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1199.344000	40.23	---	73.98	33.75	1000.0	1000.000	410.0	V	128.0
1199.344000	---	26.39	53.98	27.59	1000.0	1000.000	410.0	V	128.0
1200.187000	---	29.72	53.98	24.26	1000.0	1000.000	189.0	V	132.0
1200.187000	46.34	---	73.98	27.64	1000.0	1000.000	189.0	V	132.0
1200.544000	40.41	---	73.98	33.57	1000.0	1000.000	389.0	V	142.0
1200.544000	---	27.63	53.98	26.35	1000.0	1000.000	389.0	V	142.0
2043.773000	---	30.28	53.98	23.70	1000.0	1000.000	165.0	V	86.0
2043.773000	44.12	---	73.98	29.86	1000.0	1000.000	165.0	V	86.0
2370.540000	---	30.52	53.98	23.46	1000.0	1000.000	104.0	V	-4.0
2370.540000	44.19	---	73.98	29.79	1000.0	1000.000	104.0	V	-4.0
3175.072000	---	36.64	53.98	17.34	1000.0	1000.000	365.0	H	8.0
3175.072000	49.81	---	73.98	24.17	1000.0	1000.000	365.0	H	8.0
3177.170000	---	36.64	53.98	17.34	1000.0	1000.000	289.0	H	218.0
3177.170000	50.25	---	73.98	23.73	1000.0	1000.000	289.0	H	218.0
4210.840000	---	39.28	53.98	14.70	1000.0	1000.000	104.0	V	188.0
4210.840000	52.80	---	73.98	21.17	1000.0	1000.000	104.0	V	188.0
4240.358000	52.58	---	73.98	21.40	1000.0	1000.000	135.0	V	86.0
4240.358000	---	39.45	53.98	14.53	1000.0	1000.000	135.0	V	86.0
5414.342000	55.05	---	73.98	18.93	1000.0	1000.000	215.0	H	232.0
5414.342000	---	42.14	53.98	11.84	1000.0	1000.000	215.0	H	232.0
5530.142000	---	42.57	53.98	11.41	1000.0	1000.000	185.0	H	218.0
5530.142000	55.51	---	73.98	18.47	1000.0	1000.000	185.0	H	218.0
5927.333000	---	42.86	53.98	11.11	1000.0	1000.000	100.0	V	222.0
5927.333000	55.88	---	73.98	18.10	1000.0	1000.000	100.0	V	222.0
5977.604000	---	43.69	53.98	10.29	1000.0	1000.000	100.0	H	262.0
5977.604000	56.74	---	73.98	17.24	1000.0	1000.000	100.0	H	262.0
8399.869000	---	35.33	53.98	18.65	1000.0	1000.000	185.0	V	86.0
8399.869000	47.71	---	73.98	26.27	1000.0	1000.000	185.0	V	86.0
8400.018000	---	33.43	53.98	20.55	1000.0	1000.000	285.0	V	266.0
8400.018000	45.92	---	73.98	28.06	1000.0	1000.000	285.0	V	266.0
11050.953000	---	33.66	53.98	20.32	1000.0	1000.000	285.0	V	176.0
11050.953000	46.51	---	73.98	27.47	1000.0	1000.000	285.0	V	176.0
13313.681000	48.89	---	73.98	25.08	1000.0	1000.000	385.0	H	98.0
13313.681000	---	35.66	53.98	18.32	1000.0	1000.000	385.0	H	98.0
13336.953000	49.95	---	73.98	24.03	1000.0	1000.000	285.0	H	218.0
13336.953000	---	36.42	53.98	17.56	1000.0	1000.000	285.0	H	218.0
17967.705000	58.59	---	73.98	15.39	1000.0	1000.000	365.0	H	232.0
17967.705000	---	45.87	53.98	8.11	1000.0	1000.000	365.0	H	232.0
17995.359000	59.24	---	73.98	14.73	1000.0	1000.000	285.0	V	308.0
17995.359000	---	45.96	53.98	8.02	1000.0	1000.000	285.0	V	308.0

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – Conducted Emissions System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Two-Line V-network	Rohde & Schwarz	ENV216	101090 2704076	2022.07.14	2023.07.14
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674 2704016	2022.08.19	2023.08.19
Humidity Temperature Probe	Lufft	OPUS 20	146.0216.0802.030 2703980	2022.07.27	2024.07.27

5.1.2 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	2022.07.21	2023.07.21
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988 2823181	2021.07.26	2023.07.26
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678 2823164	2021.07.26	2023.07.26
Horn Antenna	ETS Lindgren	UG-596A/U	20898 2814839	2022.07.26	2024.07.26
Horn Antenna – 40 GHz	ETS Lindgren	UG-600A/U	20623 2814834	2022.07.26	2024.07.26
Control Device	Maturo	NCD	NCD/393/2372.01 2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	2022.08.01	2023.08.01
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333 2761265	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335 2761266	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	2022.08.01	2023.08.01
Humidity Temperature Probe	Lufft	OPUS 20	146.0216.0802.030 2703980	2022.07.27	2024.07.27

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
Conducted Emissions System	EMC 32	V10.60.20
SAC 5	EMC 32	V10.60.20

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for Conducted Emissions

Parameter	Uncertainty (Coverage Factor k=2)
Conducted emissions with LISN 150KHz to 30 MHz	2.98 dB

6.2 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)

Parameter	Uncertainty (Coverage Factor k=2)
Field Strength 10 Hz -9 kHz	3.38 dB
Field Strength 9 kHz -30 MHz	3.38 dB
Field Strength 30 MHz -1000 MHz	3.38 dB
Field Strength 1 GHz -18 GHz	4.88 dB
Field Strength 18 GHz - 40 GHz	5.14 dB

7. PHOTOGRAPHS

7.1 Photographs of the EUT

See Appendix 1 for photographs