

Prüfbericht-Nr.: Test report no.:	60500217-001	Auftrags-Nr.: Order no.:	23870622 030	Seite 1 von 44 Page 1 of 44
Kunden-Referenz-Nr.: Client reference no.:	2384582	Auftragsdatum: Order date:	2021.10.20	
Auftraggeber: Client:	Raytelligence AB			
Prüfgegenstand: Test item:	Radar Sensor			
Bezeichnung / Typ-Nr.: Identification / Type no.:	Eazense / FCC ID: 2A3XO-A01			
Auftrags-Inhalt: Order content:	Accredited testing			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15.255 with parts 15.207, 15.209 & 15.215 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2021.10.20			
Prüfmuster-Nr.: Test sample no.:	See section 2.3			
Prüfzeitraum: Testing period:	2021.11.16 – 2022.01.14			
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: 2022.01.28 Date:	Datum: 2022.01.28 Date:			
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 History60500217-00160500217-001

REVISION	DATE	REMARKS	AUTHOR
001	2022.01.28	First release	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15.255 Template version 1.0			

Summary of Test Results

FCC 47 CFR Rule Part	Test Description	Applicability	Report Section	RESULT	REMARKS
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	YES	4.1	PASS	
15.215 (c)	Emission Bandwidth	YES	4.2	PASS	
15.255 (c)(1-3) & (e)	Peak Conducted Output Power and e.i.r.p	YES	4.3	PASS	
15.209 & 15.255 (d)	Spurious Emissions (Intentional Radiators)	YES	4.5	PASS	
15.255 (f)	Frequency Tolerance	YES	4.6	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:	Raytelligence AB
Address:	Olofdalsvägen 40
	30241 Halmstad
	Sweden
Contact Person:	Emil Nilsson
Contact e-Mail / Telephone	emil.nilsson@raytelligence.com +46 730797744

2. PRODUCT INFORMATION

2.1 General Description

Model name:	Eazense
Manufacturer:	Raytelligence AB
Model number / Marketing name:	Eazense
FCC ID:	2A3XO-A01
Description:	“Radar sensor eazense is a cost-effective, non-intrusive sensor providing 24-hour monitoring of activity”
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Type of Power Supply	Power over Ethernet
Nominal Supply Voltage	48V DC PoE (115V AC input to PoE Switch adapter)
Supply Voltage Range	37V – 57V DC PoE (100V – 240V AC input to PoE Switch adapter)
Operating Temperature Range	10°C - 40°C
Operating Air Humidity Range	20% - 80% RH
Highest Internal Frequency Source	63.00 GHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A003152562-006	Standard Sample	All tests

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
Radar	57–71 GHz	60.75 GHz – 63.00 GHz	YES

*This statement refers only to this report. Other wireless technologies may be covered by other reports.

2.5 Antenna Information

Technology	Band	Number of Antennas	Antenna Type(s)	Gain
Radar	57–71 GHz	1	Patch Antenna Array	7 dBi

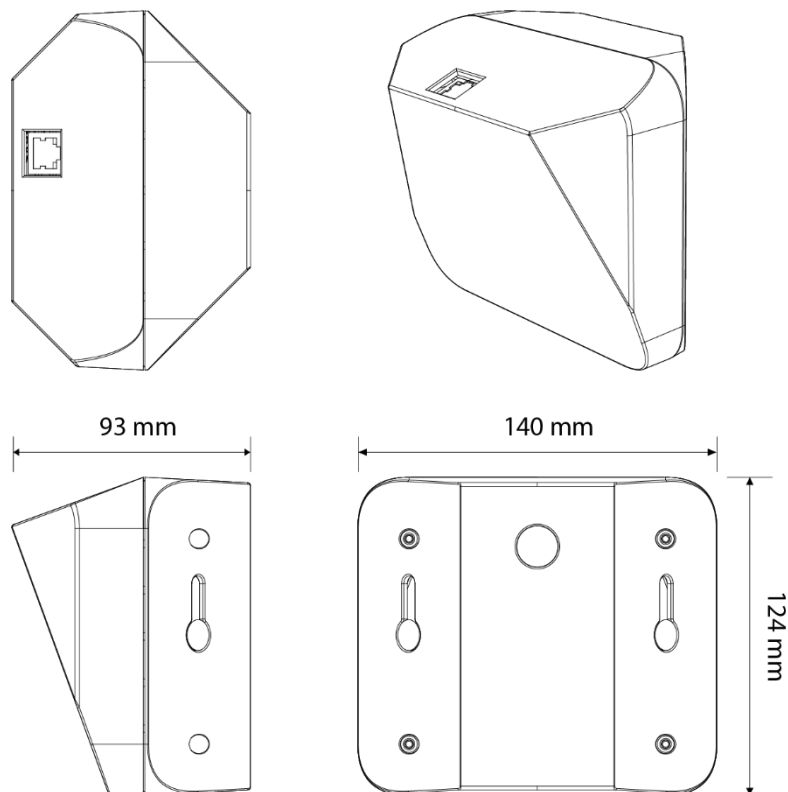
2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	Frequency Hopping	Transmitter Type
Radar	57–71 GHz	FMCW	NO	Field Disturbance Sensor

2.7 Ancillary Equipment

ID	Description	Manufacturer / Model	Hardware & Software Versions
A003152562-007	PoE Switch With AC/DC adapter	D-Link DGS-100P	N/A

2.8 EUT Diagrams



3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 15.255	-	Operation within the band 57-71 GHz
FCC 47 CFR 15.207	-	Conducted limits
FCC 47 CFR 15.209	-	Radiated emission limits; general requirements
FCC 47 CFR 15.215	-	Additional provisions to the general radiated emission limitations

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.3 Limits

FCC 47 CFR Rule Part	Test Description	Limit Reference (FCC 47 CFR Reference)
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	15.207 (a)
15.215 (c)	Emission Bandwidth	15.215 (c)
15.255 (c)(1-3) & (e)	Peak Conducted Output Power and e.i.r.p	15.255 (c)(1-3) 15.255 (e)(1)
15.209 & 15.255 (d)	Spurious Emissions (Intentional Radiators)	15.209 (a) & 15.255 (d) (3&4) *See Note 1
15.255 (f)	Frequency Tolerance	15.255 (f)

Interpretation of the measurement results has been performed in accordance with ANSI C63.10 section 1.3

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 & 15.209 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:

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

Radiated Emissions limits in 47 CFR 15.255 (d)(3) are presented in pW/cm^2 . Measurements on the test system are made in $\text{dB}\mu\text{V/m}$. To convert between these, the following adjustment is used:

$$\text{New Limit} = 10 \log \left(\frac{\text{Original Limit}}{10^4} \right) + 115.8$$

Example: from 15.255 (d)(3) the limit for 40GHz – 200GHz is 90 pW/cm^2 at 3m. This gives:

$$\text{New Limit} = 10 \log \left(\frac{90}{10^4} \right) + 115.8 = 85.34\text{dB}\mu\text{V/m at 3m}$$

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

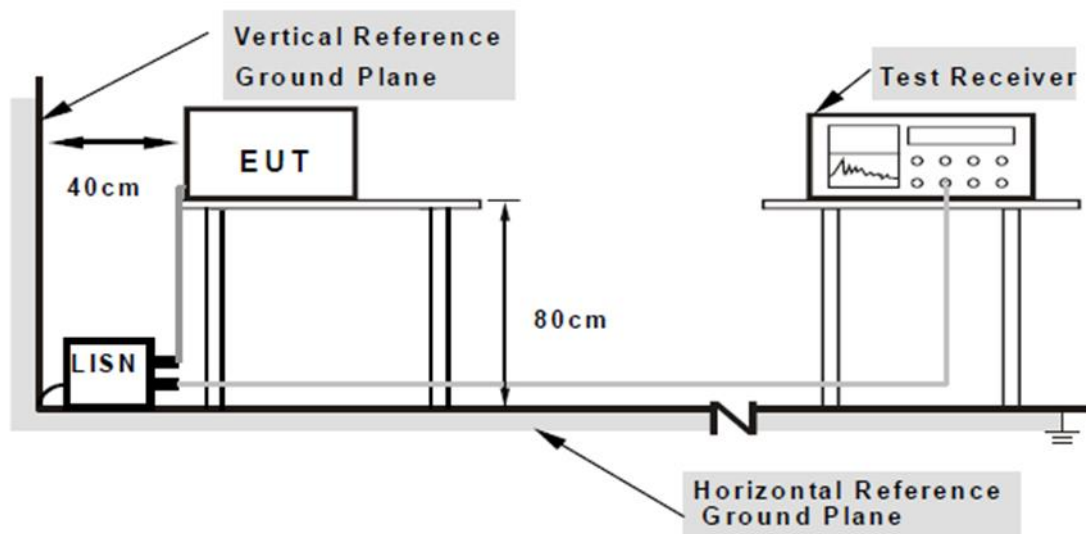
FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	Conducted Emissions
15.215 (c)	Emission Bandwidth	Radiated RF
15.255 (c)(1-3) & (e)	Peak Conducted Output Power and e.i.r.p	Radiated RF
15.209 & 15.255 (d)	Spurious Emissions (Intentional Radiators)	SAC5
15.255 (f)	Frequency Tolerance	Radiated RF

3.4.3 Test Equipment Setup – Radiated RF

- Radiated RF tests were run with a subset of the equipment used for the SAC5 system. In this case, no controller PC or software (EMC32) was used, and measurement values and graphs were extracted directly from the measuring receiver
- In the case of the frequency stability tests, the device under test was placed inside a climate chamber to allow for control of the temperature. An aperture in the side of this chamber, filled with a foam bung, allowed for measurements to be made with the measuring antenna outside of the chamber. temperatures were monitored using a calibrated thermometer.

3.4.4 Test Equipment Setup – Conducted Emissions

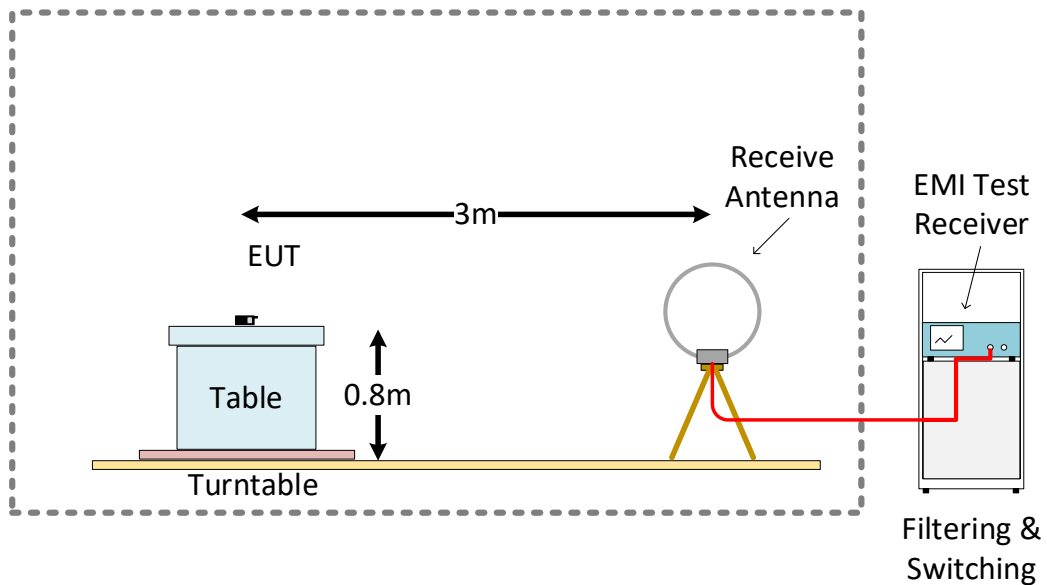
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide $50\Omega/50\mu\text{H}$ of coupling 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.



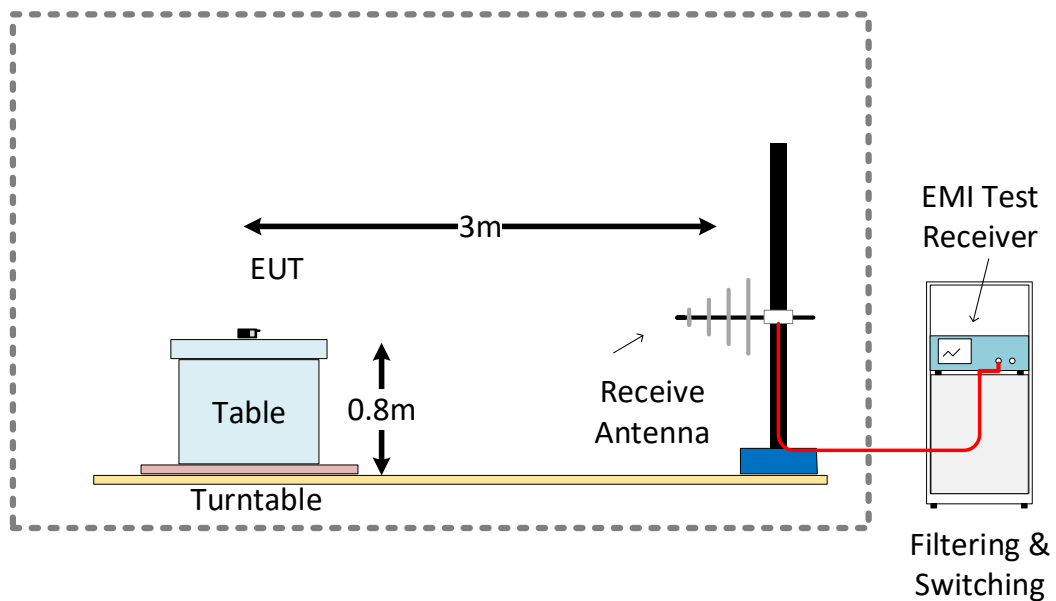
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- For measurements between 9kHz and 30MHz, the device is placed on a table at a height of 80cm from the floor with the radiating structure located above the center of the turntable. A magnetic loop antenna is placed with its reference point at a fixed height of 100cm from the floor and at a distance of 3m from the center of the turntable. The output of the antenna is connected to the external rack to allow for appropriate amplification and filtering where required. Testing is repeated for three different polarisation positions for the loop antenna: 1) Loop of antenna parallel to the axis through antenna and turntable. 2) Loop of antenna perpendicular to the axis through the antenna and turntable. 3) Loop of antenna parallel to the floor. The EUT is rotated using the turntable to determine the position with maximum emissions.
- For measurements between 30MHz and 1GHz, the device is placed on a table at a height of 80cm from the floor with the radiating structure located above the center of the turntable. A bilog antenna is placed with its reference point at a distance of 3m from the center of the turntable. The height of the antenna reference point is varied between 100cm and 400cm above the floor, with the angle continuously adjusted so that the axis of the antenna is oriented towards the EUT. The output of the antenna is connected to the external rack to allow for appropriate amplification and filtering where required. Testing is repeated with the antenna in both horizontal and vertical polarisation positions. The EUT is rotated using the turntable to determine the position with maximum emissions.
- For measurements between 1GHz and 18GHz, the device is placed on a table at a height of 150cm from the floor with the radiating structure located above the center of the turntable. A horn antenna is placed with its reference point at a distance of 3m from the center of the turntable, with absorbers placed on the floor between the EUT and the measurement antenna. A low-noise amplifier and high-pass filter is connected to the output of the antenna for frequencies above 6GHz to improve performance. The output of the antenna or amplifier is connected to the external rack to allow for appropriate amplification and filtering where required. The height of the antenna reference point is varied between 100cm and 200cm above the floor. Testing is repeated with the antenna in both horizontal and vertical polarisation positions. The EUT is rotated using the turntable to determine the position with maximum emissions.
- For measurements between 18GHz and 40GHz, the device is placed on a table at a height of 150cm from the floor with the radiating structure located above the center of the turntable. A mounting with two standard-gain horn antennas with associated low-noise amplifiers is placed so the reference point of the antennas is at a fixed height of 150cm from the floor and at a distance of 1m from the center of the turntable. One antenna is used for measurements between 18GHz and 26GHz, while the second is used between 26GHz and 40GHz. To reduce losses, the measuring instrument is placed close to the antenna mast with the output of the low-noise amplifiers connected directly to its input via a short cable. Absorbers are placed on the floor between the EUT and the measurement antennas. Testing is repeated with the antennas in both horizontal and vertical polarisation positions. The EUT is rotated using the turntable to determine the position with maximum emissions.
- For measurements between 40GHz and 200GHz, the device is placed on a table at a height of 150cm from the floor with the radiating structure located above the center of the turntable. A mounting to hold a standard-gain horn antenna and associated mixer is placed so the reference point of the antenna is at a fixed height of 150cm from the floor and at a fixed distance (see below) from the perimeter of a circle encompassing the device under test. Four separate antennas and mixers are available to cover measurements in the range 40-60GHz, 60-90GHz and 90-140GHz and 140-200GHz. The IF Input and LO Output of the mixer is connected to the measuring instrument which is placed close to the antenna mast. Testing is repeated with the antennas in both horizontal and vertical polarisation positions. The EUT is rotated using the turntable to determine the position with maximum emissions. In addition, where necessary, the signal is maximised manually by tilting the device in the vertical plane while observing the level displayed on the measuring instrument
 - Measurements from 40GHz – 60 GHz performed at a distance of 1m
 - Measurements from 60GHz – 90 GHz performed at a distance of 1m
 - Measurements from 90GHz – 140 GHz performed at a distance of 0.25m
 - Measurements from 140GHz – 200 GHz performed at a distance of 0.25m

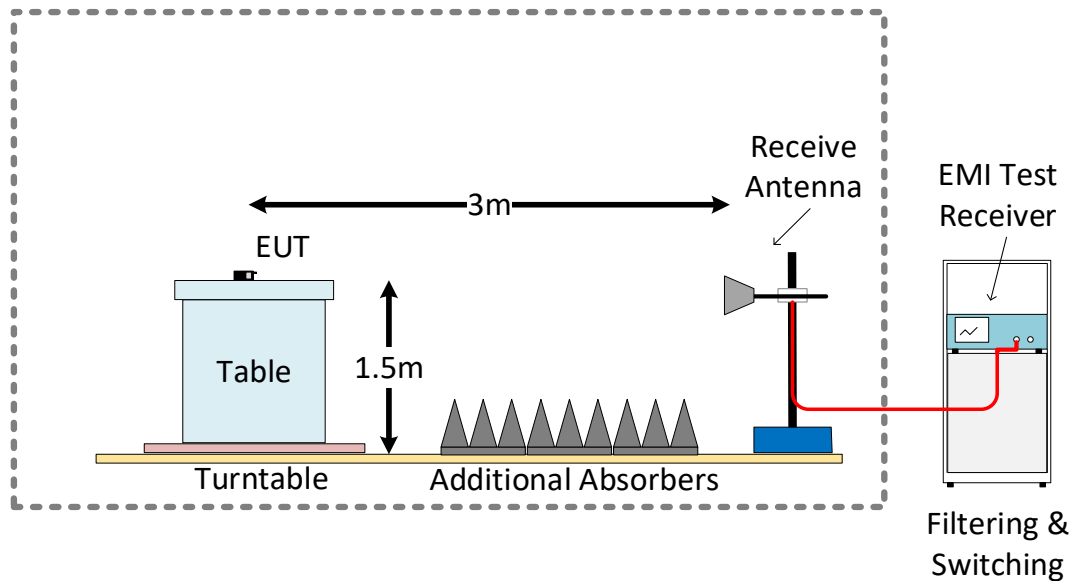
SAC 5 Test Setup Configuration 9kHz – 30MHz



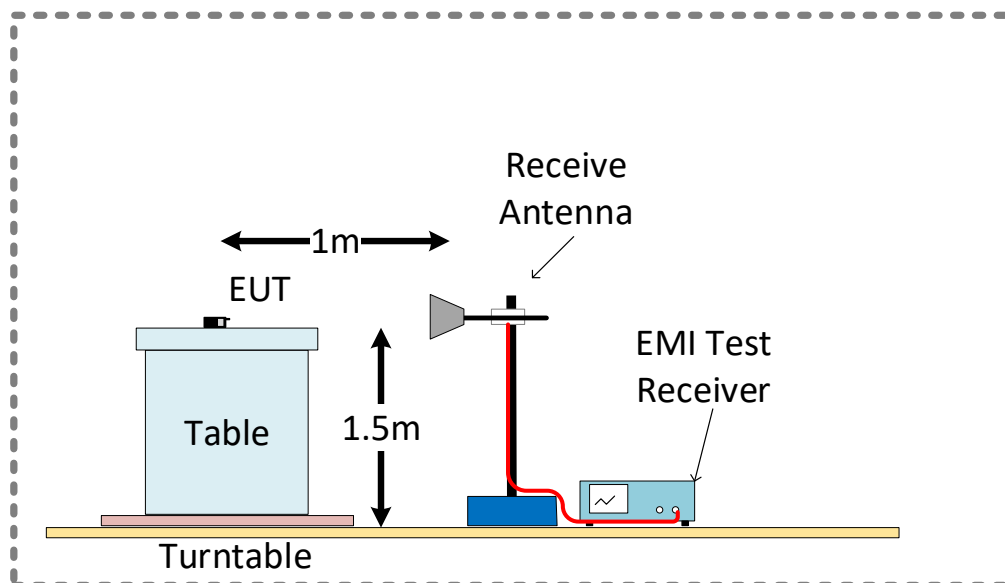
SAC 5 Test Setup Configuration 30MHz – 1GHz



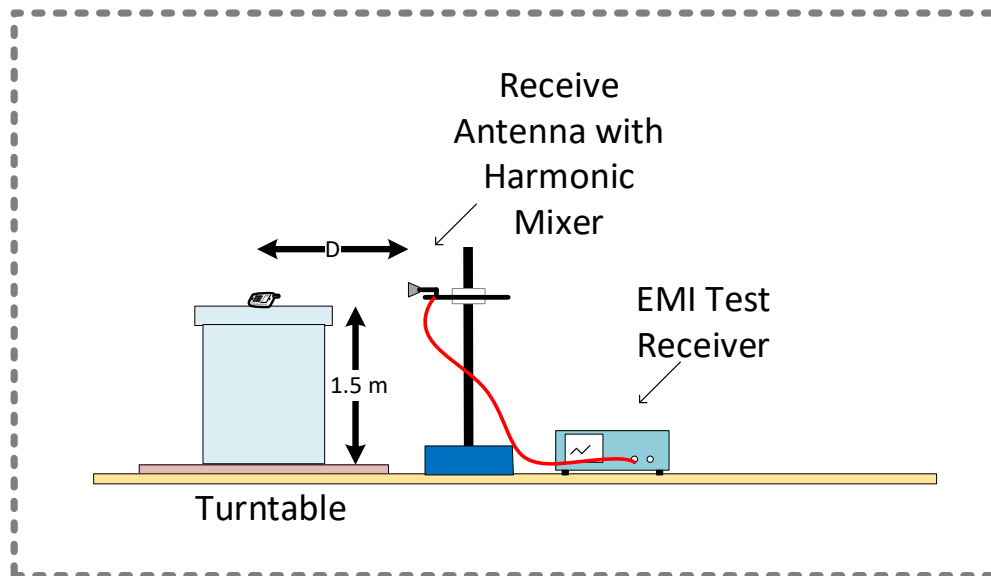
SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz

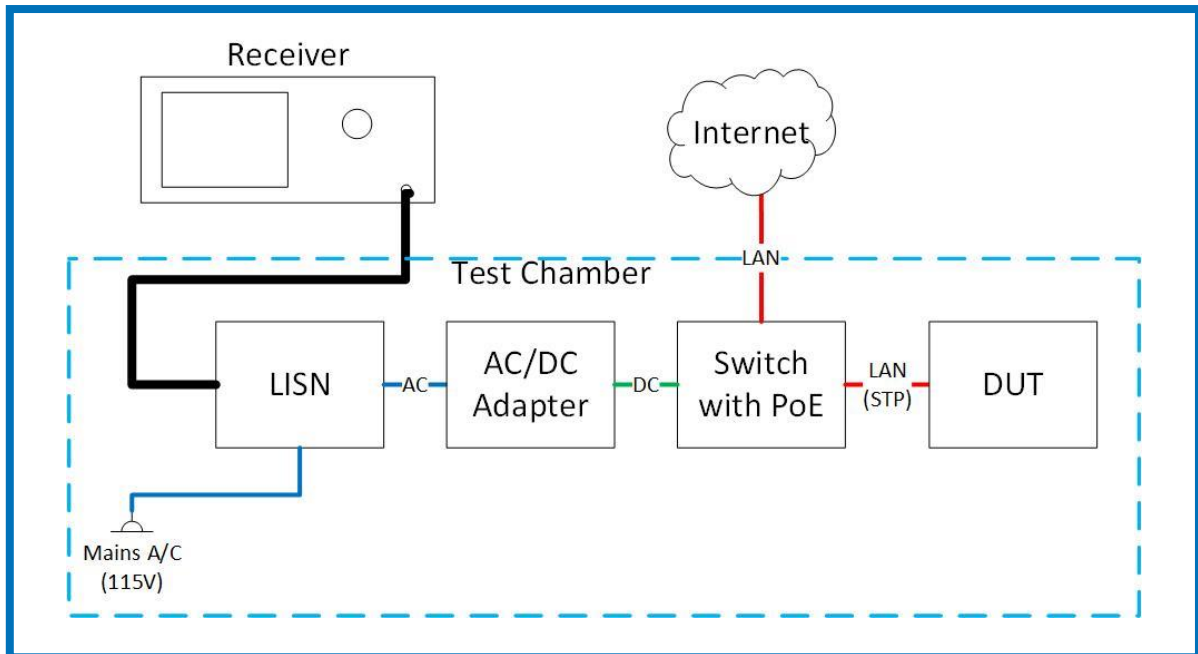


SAC 5 Test Setup Configuration 40GHz – 200GHz

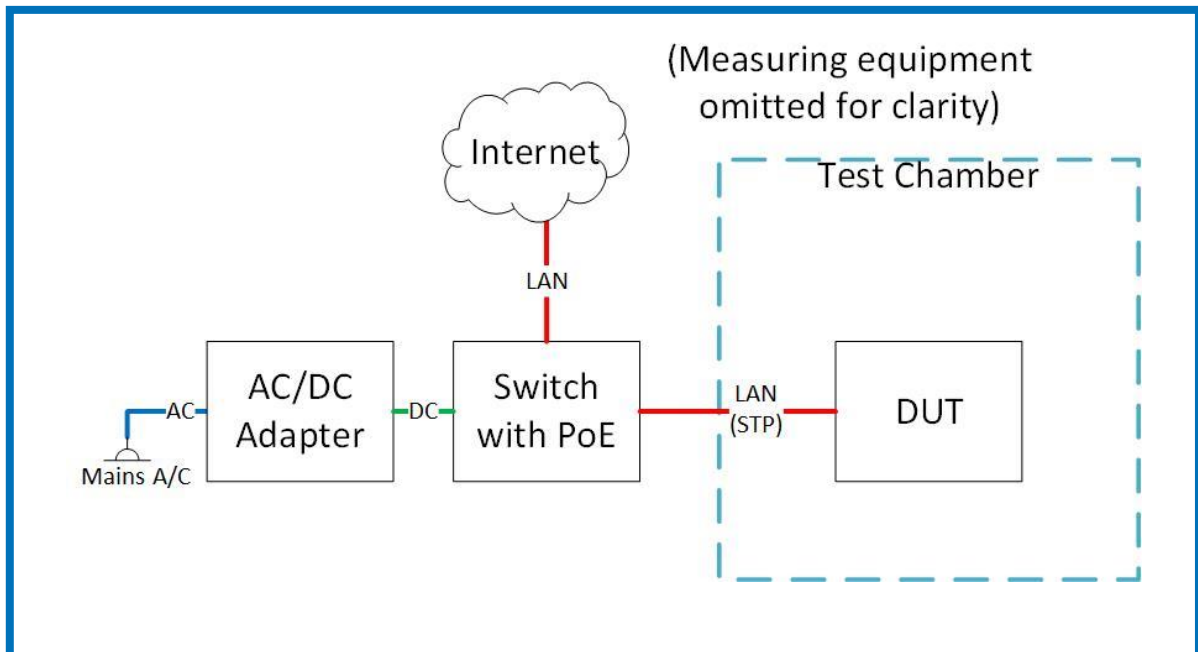


3.5 EUT Configuration During Test

Conducted Emissions Testing: Block Diagram (Power via PoE)



Radiated Emissions & Radiated RF Testing: Block Diagram (Power via PoE)



3.6 EUT Operation Modes

Operation mode	Description
Default	The device is powered and the radar is operating as normal. Power via PoE over an STP LAN cable with a ferrite attached at the DUT

3.7 Deviations from the Test Standard

Note that the device under test was not capable of operation in a fixed 'continuous wave' mode, so all tests were run with the radar transmitter operating in 'chirp' mode. In this mode, a narrow transmission is swept rapidly across the range of frequencies over a short time. A number of chirps are performed followed by a period with no transmission, as below:

Chirp sweep range: 60.75GHz – 63.00GHz
Chirp duration: 41.1µS
Chirp sequence: 288 consecutive chirps (13.85ms) followed by 36.15mS with no transmission

Spurious Emissions:

Due to the nature of the signal, the duration of the tests was increased in order to compensate for the nature of the signal. Where emissions related to the transmitter were expected (i.e. in the transmission band and around the harmonic frequencies), multiple preliminary sweeps were run with max hold enabled on the measuring instrument to decrease the risk of missed transitory signals.

General:

It should be noted that it is not practicable to calibrate the horn antennas used for measurements above 40GHz. In these cases, correction factors for the antennas have been calculated based on standard models

3.8 Environmental Conditions

3.8.1 Environmental Conditions – Radiated RF

Date	Time	Temperature (°C)	Relative Humidity (%)
2021.11.30	12:38	19.2	37
2022.01.14	10:13	18.1	39

3.8.2 Environmental Conditions – Conducted Emissions System

Date	Time	Temperature (°C)	Relative Humidity (%)
2021.12.09	13:30	22.8	32

3.8.3 Environmental Conditions – SAC5 (Radiated Emissions)

Date	Time	Temperature (°C)	Relative Humidity (%)
2021.11.16	08:05	18.5	44
2021.11.22	08:30	18.9	45
2021.11.24	08:28	19.2	43
2021.11.26	09:22	18.6	44
2021.12.01	11:40	18.5	37
2021.12.02	07:48	18.8	37
2021.12.08	15:37	18.3	31
2021.12.09	07:40	18.8	31
2021.12.13	08:36	18.1	37

4. TEST RESULTS

4.1 Test Results – AC Power Line Conducted Emissions (Intentional Transmitter)

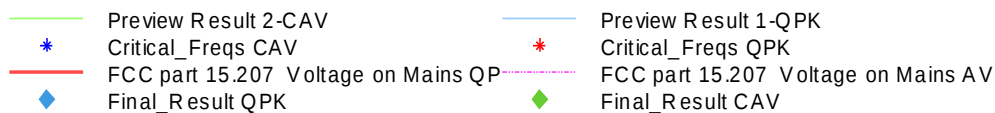
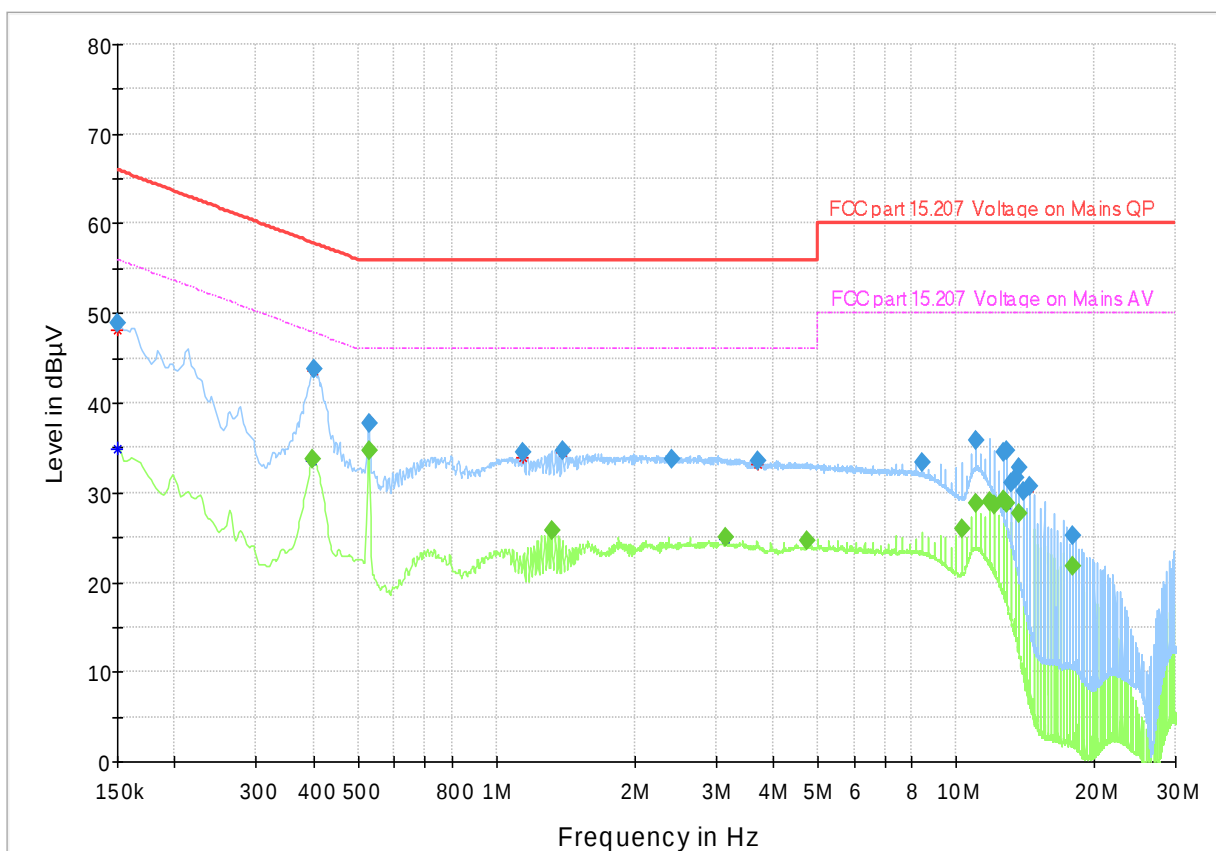
4.1.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Niall Forrester	2021.12.09	
EUT and Ancillary Equipment IDs	A003152562-006	A003152562-007	
EUT Operation Mode(s)	Default		
EUT Wireless Configuration(s)	Chirp Mode		
EUT Hardware Configuration(s)	-		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line	Chirp Mode	150 kHz – 30 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	Chirp Mode	150 kHz – 30 MHz	PASS

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

4.1.2 AC Power Line Conducted Emissions (Intentional) – Test Details

Test mode condition	Conducted Emissions	
Sweep frequency	150 kHz – 30 MHz	
Standard	FCC 47 Part 15.207	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.09



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.150000	48.94	---	66.00	17.06	1000.0	9.000	L1	ON
0.399750	---	33.66	47.86	14.20	1000.0	9.000	L1	ON
0.402000	43.70	---	57.81	14.11	1000.0	9.000	L1	ON
0.528000	---	34.73	46.00	11.27	1000.0	9.000	L1	ON
0.528000	37.73	---	56.00	18.27	1000.0	9.000	L1	ON
1.140000	34.50	---	56.00	21.50	1000.0	9.000	N	ON
1.320000	---	25.73	46.00	20.27	1000.0	9.000	N	ON
1.389750	34.74	---	56.00	21.26	1000.0	9.000	N	ON
2.402250	33.78	---	56.00	22.22	1000.0	9.000	N	ON
3.162750	---	24.95	46.00	21.05	1000.0	9.000	L1	ON
3.700500	33.63	---	56.00	22.37	1000.0	9.000	L1	ON
4.744500	---	24.71	46.00	21.29	1000.0	9.000	L1	ON
8.434500	33.46	---	60.00	26.54	1000.0	9.000	L1	ON
10.279500	---	25.98	50.00	24.02	1000.0	9.000	L1	ON
11.069250	35.92	---	60.00	24.08	1000.0	9.000	N	ON
11.069250	---	28.86	50.00	21.14	1000.0	9.000	N	ON
11.861250	---	29.08	50.00	20.92	1000.0	9.000	N	ON
12.124500	---	28.64	50.00	21.36	1000.0	9.000	L1	ON
12.651000	---	29.12	50.00	20.88	1000.0	9.000	L1	ON
12.651000	34.57	---	60.00	25.43	1000.0	9.000	L1	ON
12.914250	34.64	---	60.00	25.36	1000.0	9.000	L1	ON
12.914250	---	28.81	50.00	21.19	1000.0	9.000	L1	ON
13.177500	31.00	---	60.00	29.00	1000.0	9.000	L1	ON
13.440750	31.66	---	60.00	28.34	1000.0	9.000	L1	ON
13.704000	32.75	---	60.00	27.25	1000.0	9.000	L1	ON
13.706250	---	27.73	50.00	22.27	1000.0	9.000	L1	ON
13.967250	30.18	---	60.00	29.82	1000.0	9.000	L1	ON
14.496000	30.66	---	60.00	29.34	1000.0	9.000	L1	ON
17.922750	---	21.81	50.00	28.19	1000.0	9.000	L1	ON
17.922750	25.12	---	60.00	34.88	1000.0	9.000	N	ON

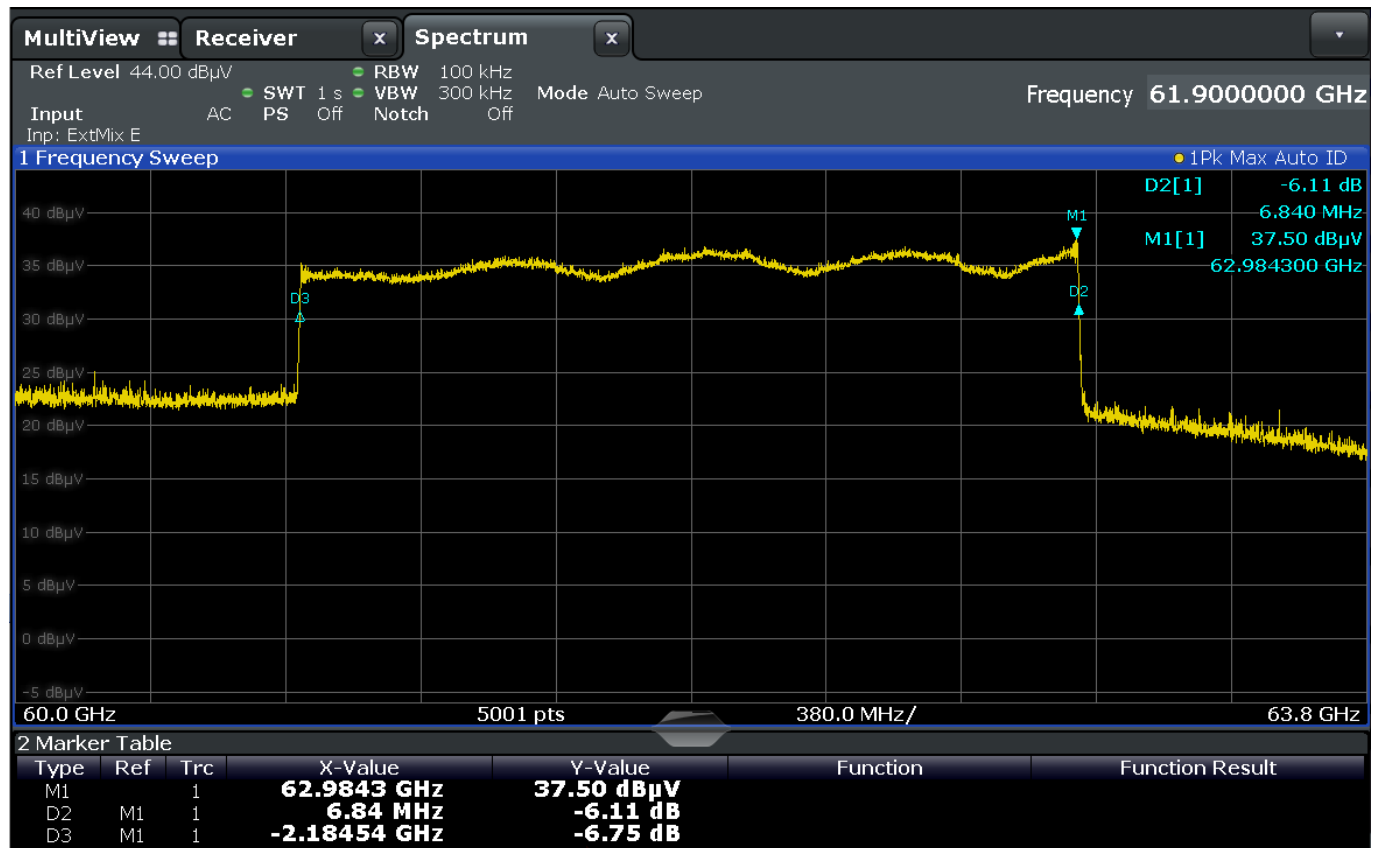
4.2 Test Results – Emission Bandwidth

4.2.1 Emission Bandwidth – Test Summary

Test Specification				FCC 47 CFR 15.215 (c) & 15.255 (e) (Part 15 Subpart C) / ANSI C63.10 sec. 9.3				
Test Engineer & Date				Niall Forrester		2021.11.30		
EUT and Ancillary Equipment IDs				A003152562-006		A003152562-007		
EUT Operation Mode(s)				Default				
EUT Wireless Configuration(s)				Chirp Mode				
EUT Hardware Configuration(s)				-				
Overall Result				PASS				

Test Parameter	Wireless Configuration	Emission Bandwidth (MHz)	BW Limit (MHz)	F _{Low} (GHz)	Limit F _{Low} (GHz)	(GHz)	Limit F _{High} (GHz)	Result
6dB Bandwidth	Chirp Mode	2191.38	-	60.80	>57	62.99	<71	PASS

4.2.2 Emission Bandwidth – Test Details



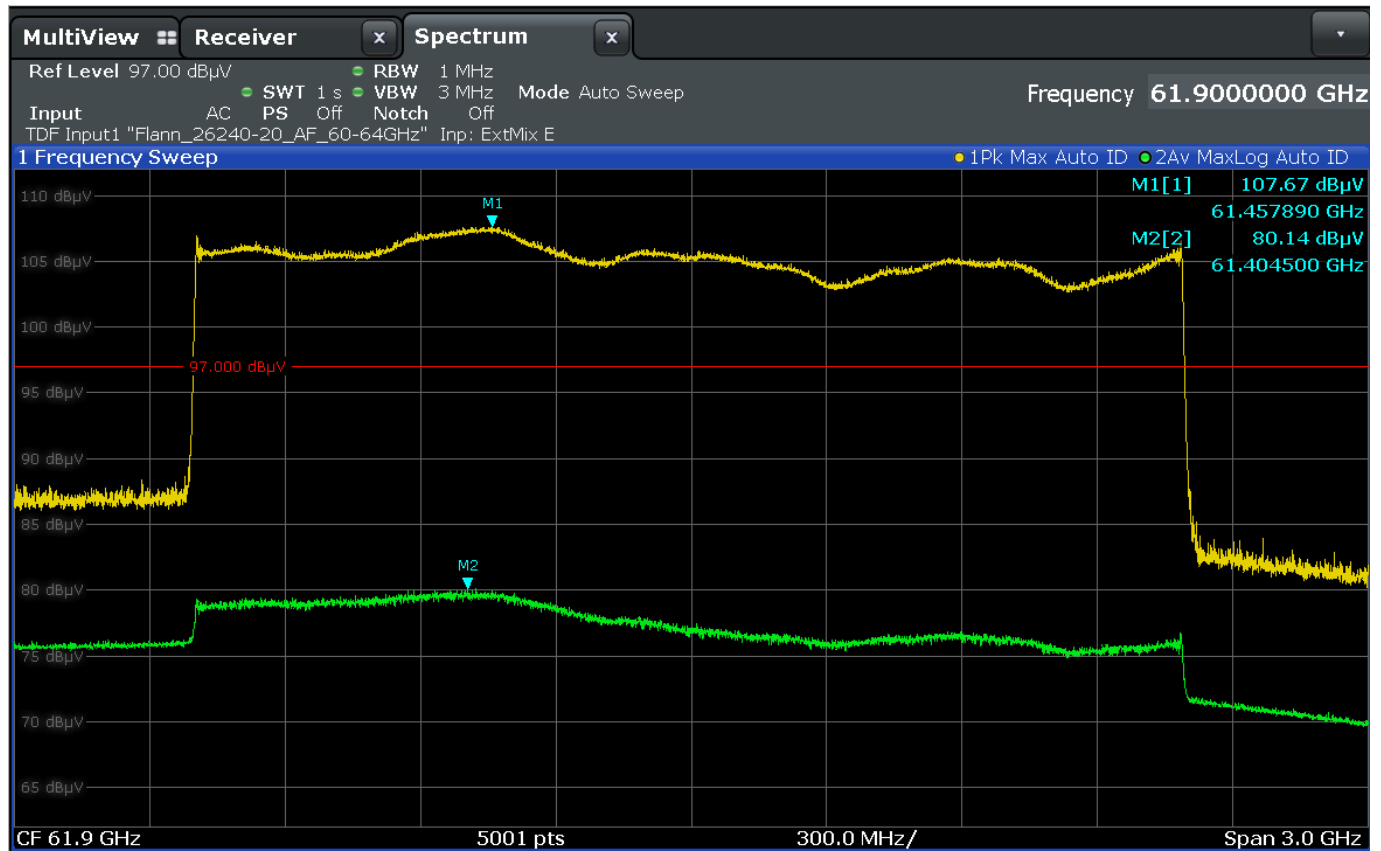
4.3 Test Results – Peak Conducted Power and e.i.r.p.

4.3.1 Peak Conducted Power and e.i.r.p. – Test Summary

Test Specification			FCC 47 CFR 15.255(c)(1-3) FCC 47 CFR 15.255 (e) (Part 15 Subpart C) / ANSI C63.10 sec 9.10			
Test Engineer & Date			Niall Forrester		2021.11.30	
EUT and Ancillary Equipment IDs			A003152562-006		A003152562-007	
EUT Operation Mode(s)			Default			
EUT Wireless Configuration(s)			Chirp Mode			
EUT Hardware Configuration(s)			-			
Overall Result			PASS			

Test Parameter	Wireless Configuration	Power (dBm)	Power (mW)	Limit: Power (dBm)	Additional Limit: Power (mW)	Result
e.i.r.p.	Chirp Mode	-3.05	0.50	10	-	PASS
Peak Conducted Power	Chirp Mode	-10.05	0.10	-10	500	PASS

4.3.2 Peak Conducted Power and e.i.r.p. – Test Details



Measurements using radiated method at 0.5m with compensation for mixer loss.

Maximum field strength = 107.67 dBμV/m

$$e.i.r.p = 107.67 + 20 \log(0.5) - 104.7 = -3.05 \text{ dBm}$$

$$e.i.r.p_{lin} = 10^{[-3.05/10]} = 0.50 \text{ mW}$$

$$Peak \text{ Cond. Pwr.} = e.i.r.p - gain = -3.05 - 7 = -10.05 \text{ dBm}$$

$$Peak \text{ Cond. Pwr.}_{lin} = 10^{[-10.05/10]} = 0.10 \text{ mW}$$

4.4 Test Results –Spurious Emissions (Intentional Transmitter)

4.4.1 Spurious Emissions (Intentional) – Test Summary

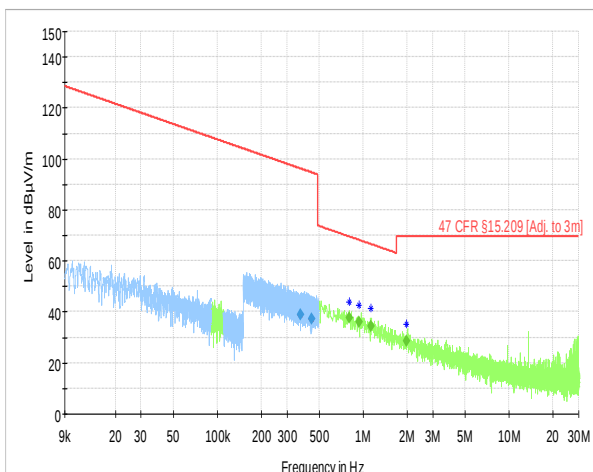
Test Specification		FCC 47 CFR 15.209 (Part 15 Subpart C) FCC 47 CFR 15.255 (d)	
Test Engineer & Date		Niall Forrester	2021.11.16 – 2021.12.13
EUT and Ancillary Equipment IDs		A003152562-006	A003152562-007
EUT Operation Mode(s)		Default	
EUT Wireless Configuration(s)		Chirp Mode	
EUT Hardware Configuration(s)		-	
Overall Result		PASS	

Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	Chirp Mode	9 kHz – 30 MHz	PASS
Radiated Emissions	Chirp Mode	30 MHz – 1 GHz	PASS
Radiated Emissions	Chirp Mode	1 GHz – 18 GHz	PASS
Radiated Emissions	Chirp Mode	18 GHz – 40 GHz	PASS
Radiated Emissions	Chirp Mode	40 GHz – 60 GHz	PASS
Radiated Emissions	Chirp Mode	60 GHz – 90 GHz	PASS
Radiated Emissions	Chirp Mode	90 GHz – 140 GHz	PASS
Radiated Emissions	Chirp Mode	140 GHz – 200 GHz	PASS

4.4.2 Radiated Emissions (Intentional) – Test Details

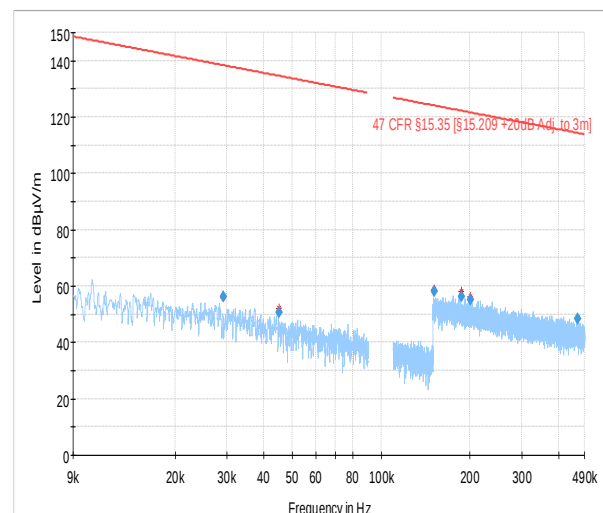
9kHz – 30MHz (Parallel to Axis)

Test mode condition	Default mode	
Antenna orientation	Loop Antenna Parallel to Axis	
Sweep frequency	9 kHz-30 MHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.26
Chamber details	Chamber: SAC 5	



Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 QuasiPeak-QPK (Single)

Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG
 MaxPeak-PK+ (Single)
 Average-AVG (Single)



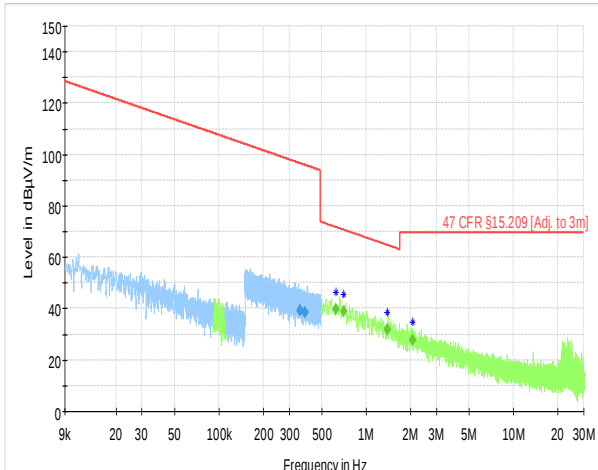
Preview Result 1-PK+
 47 CFR §15.35 (Adj. to 3m)
 MaxPeak-PK+ (Single)

Critical_Freqs PK+
 Final_Result PK+

Frequency (MHz)	Average (dBμV/m)	QuasiPeak (dBμV/m)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.370401	38.81	---	---	96.23	57.42	1000.0	9.000	100.0	H	167.0
0.441877	37.34	---	---	94.70	57.36	1000.0	9.000	100.0	H	128.0
0.806990	---	37.51	---	69.47	31.96	1000.0	9.000	100.0	H	-13.0
0.931792	---	36.22	---	68.22	32.00	1000.0	9.000	100.0	H	257.0
1.127305	---	34.37	---	66.56	32.19	1000.0	9.000	100.0	H	24.0
1.983016	---	28.50	---	69.54	41.04	1000.0	9.000	100.0	H	128.0
0.029120	---	---	56.42	138.32	81.90	1000.0	0.200	100.0	H	243.0
0.044983	---	---	50.58	134.54	83.96	1000.0	0.200	100.0	H	135.0
0.151690	---	---	58.06	123.99	65.93	1000.0	9.000	100.0	H	305.0
0.187562	---	---	56.13	122.14	66.01	1000.0	9.000	100.0	H	-15.0
0.201124	---	---	55.25	121.54	66.28	1000.0	9.000	100.0	H	177.0
0.463274	---	---	48.32	114.29	65.97	1000.0	9.000	100.0	H	-14.0

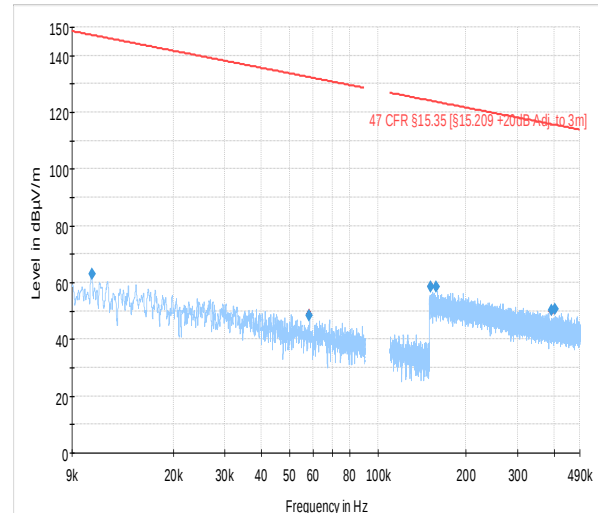
9kHz – 30MHz (Perpendicular to Axis)

Test mode condition	Default mode	
Antenna orientation	Loop Antenna Perpendicular to Axis	
Sweep frequency	9 kHz-30 MHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.26
Chamber details	Chamber: SAC 5	



Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 [Adj. to 3m]
 Final_Result QPK
 QuasiPeak-QPK (Single)

Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG
 MaxPeak-PK+ (Single)
 Average-AVG (Single)



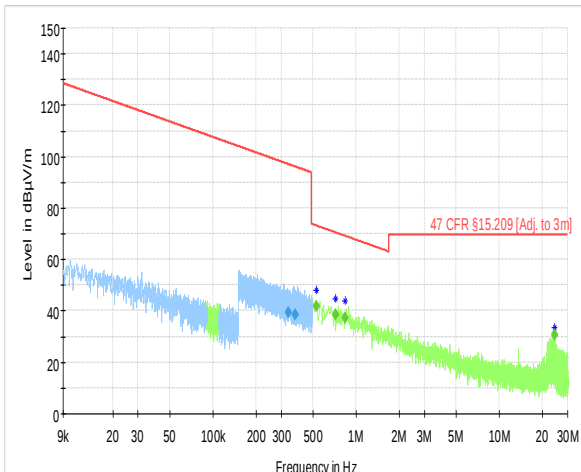
Preview Result 1-PK+
 47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
 MaxPeak-PK+ (Single)

Critical_Freqs PK+
 Final_Result PK+

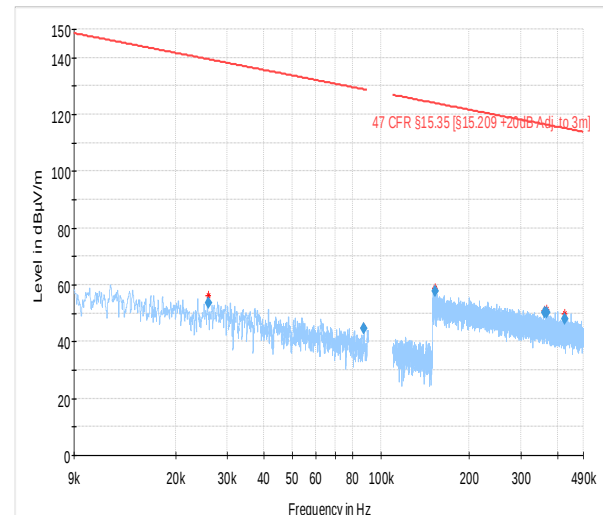
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.357404	39.16	---	---	96.54	57.38	1000.0	9.000	100.0	H	192.0
0.382159	38.46	---	---	95.96	57.50	1000.0	9.000	100.0	H	135.0
0.621207	---	39.92	---	71.74	31.82	1000.0	9.000	100.0	H	64.0
0.699782	---	38.87	---	70.71	31.83	1000.0	9.000	100.0	H	225.0
1.395487	---	31.99	---	64.71	32.72	1000.0	9.000	100.0	H	315.0
2.073860	---	27.92	---	69.54	41.62	1000.0	9.000	100.0	H	102.0
0.010529	---	---	63.03	147.16	84.13	1000.0	0.200	100.0	H	-13.0
0.058219	---	---	48.28	132.30	84.03	1000.0	0.200	100.0	H	256.0
0.151778	---	---	58.45	123.98	65.53	1000.0	9.000	100.0	H	-41.0
0.158285	---	---	58.34	123.62	65.28	1000.0	9.000	100.0	H	292.0
0.392345	---	---	50.12	115.73	65.61	1000.0	9.000	100.0	H	243.0
0.402816	---	---	50.56	115.50	64.95	1000.0	9.000	100.0	H	135.0

9kHz – 30MHz (Parallel to Floor)

Test mode condition	Default mode	
Antenna orientation	Loop Antenna Parallel to Floor	
Sweep frequency	9 kHz-30 MHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.26
Chamber details	Chamber: SAC 5	



Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 QuasiPeak-QPK (Single)

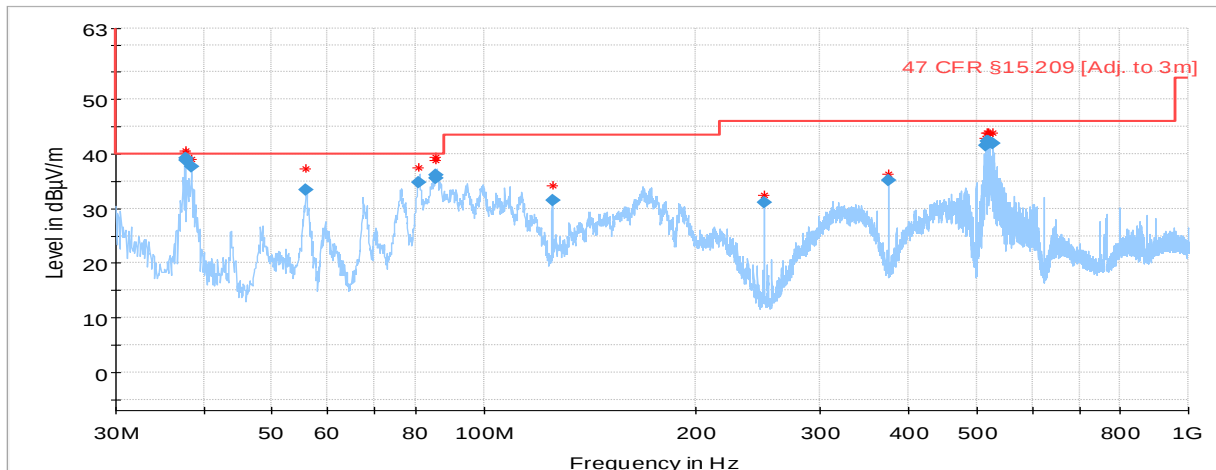


Preview Result 1-PK+
 47 CFR §15.35 (Adj. to 3m)
 MaxPeak-PK+ (Single)

Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.337384	39.56	---	---	97.04	57.48	1000.0	9.000	100.0	H	38.0
0.375057	38.71	---	---	96.12	57.42	1000.0	9.000	100.0	H	167.0
0.526161	---	41.87	---	73.18	31.31	1000.0	9.000	100.0	H	244.0
0.718709	---	38.72	---	70.47	31.75	1000.0	9.000	100.0	H	191.0
0.841937	---	37.13	---	69.10	31.97	1000.0	9.000	100.0	H	102.0
24.232727	---	30.48	---	69.54	39.06	1000.0	9.000	100.0	H	257.0
0.025803	---	---	53.74	139.37	85.63	1000.0	0.200	100.0	H	101.0
0.087196	---	---	44.49	128.79	84.30	1000.0	0.200	100.0	H	139.0
0.153426	---	---	57.71	123.89	66.18	1000.0	9.000	100.0	H	308.0
0.361395	---	---	50.09	116.45	66.35	1000.0	9.000	100.0	H	315.0
0.367463	---	---	50.36	116.30	65.94	1000.0	9.000	100.0	H	45.0
0.423949	---	---	48.14	115.06	66.92	1000.0	9.000	100.0	H	161.0

30MHz – 1GHz

Test mode condition	Default mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.16
Chamber details	Chamber: SAC 5	

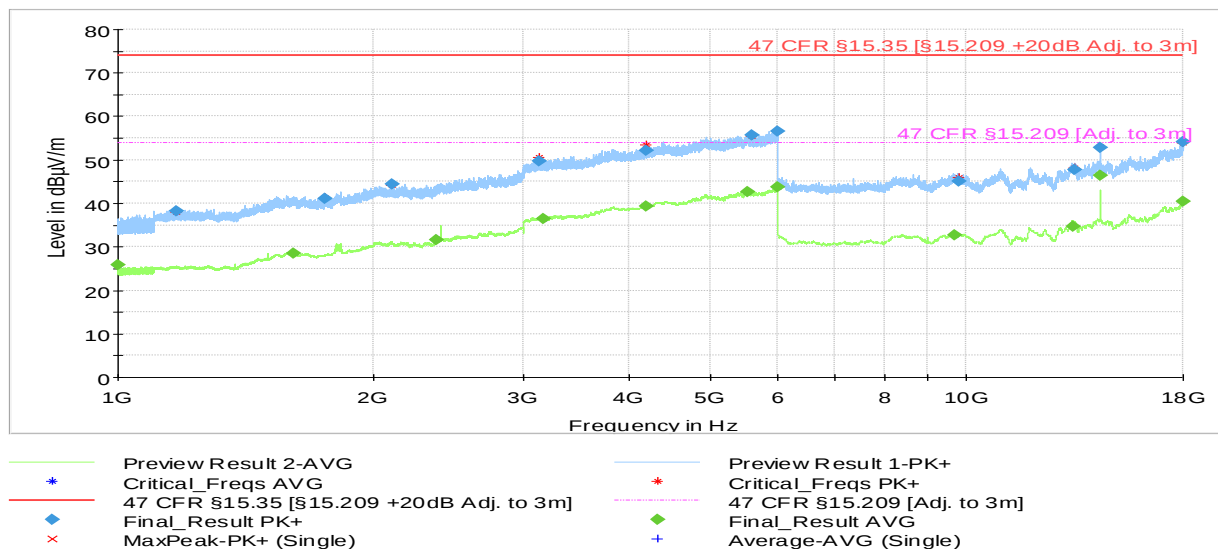


Preview Result 2-AVG	Preview Result 1-PK+
* Critical_Freqs AVG	* Critical_Freqs PK+
47 CFR §15.209 [Adj. to 3m]	Final_Result QPK
◆ Final_Result AVG	× MaxPeak-PK+ (Single)
+ QuasiPeak-QPK (Single)	× Average-AVG (Single)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
37.649640	38.74	40.00	1.26	1000.0	120.000	125.0	V	200.0
37.667920	39.17	40.00	0.83	1000.0	120.000	125.0	V	200.0
38.453880	37.71	40.00	2.29	1000.0	120.000	125.0	V	200.0
55.866320	33.32	40.00	6.68	1000.0	120.000	375.0	V	9.0
80.885600	34.72	40.00	5.28	1000.0	120.000	275.0	H	72.0
85.327800	35.58	40.00	4.42	1000.0	120.000	275.0	H	267.0
85.570600	36.10	40.00	3.90	1000.0	120.000	258.0	H	72.0
124.986640	31.39	43.52	12.13	1000.0	120.000	125.0	V	334.0
249.978800	31.16	46.02	14.86	1000.0	120.000	125.0	H	41.0
374.955520	35.06	46.02	10.96	1000.0	120.000	229.0	V	311.0
516.112840	41.49	46.02	4.53	1000.0	120.000	100.0	V	296.0
518.207480	42.33	46.02	3.69	1000.0	120.000	100.0	V	296.0
520.187000	42.24	46.02	3.78	1000.0	120.000	100.0	V	296.0
523.043320	42.07	46.02	3.95	1000.0	120.000	100.0	V	296.0
526.476480	41.92	46.02	4.10	1000.0	120.000	100.0	V	296.0

1GHz – 18GHz

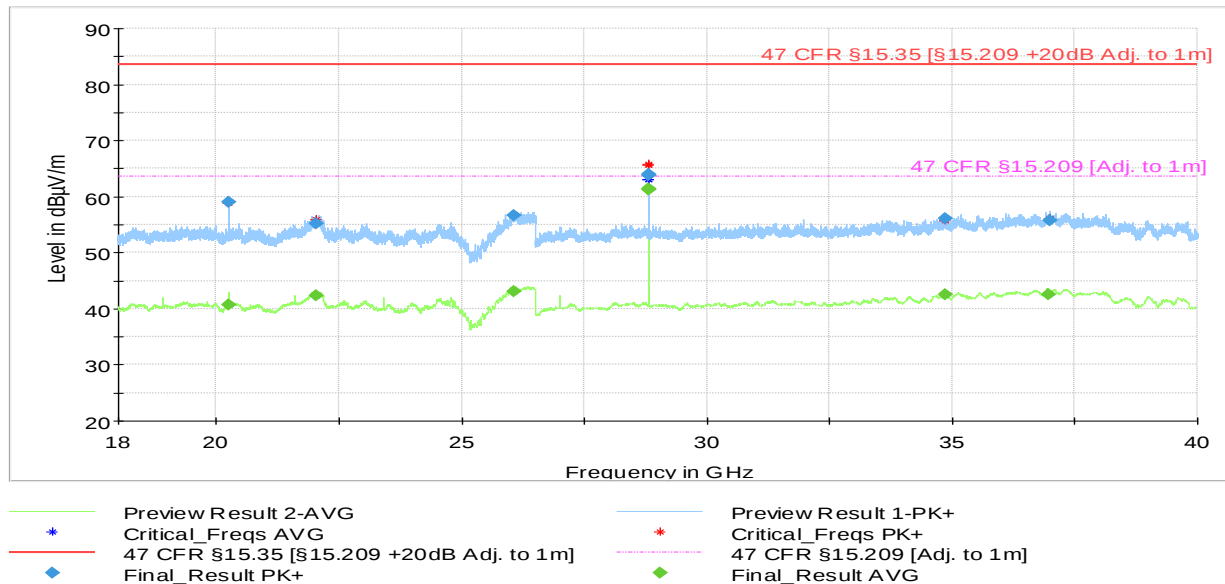
Test mode condition	Default mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.22
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1000.003507	---	25.78	53.98	28.20	1000.0	1000.000	125.0	V	22.0
1170.167000	38.23	---	73.98	35.75	1000.0	1000.000	207.0	V	296.0
1612.899000	---	28.40	53.98	25.58	1000.0	1000.000	210.0	V	-2.0
1755.127000	41.16	---	73.98	32.82	1000.0	1000.000	175.0	V	68.0
2101.327000	44.33	---	73.98	29.65	1000.0	1000.000	175.0	H	132.0
2374.666000	---	31.61	53.98	22.37	1000.0	1000.000	188.0	H	-18.0
3141.741000	49.64	---	73.98	24.34	1000.0	1000.000	121.0	V	202.0
3174.469000	---	36.46	53.98	17.52	1000.0	1000.000	100.0	V	292.0
4193.517000	52.05	---	73.98	21.93	1000.0	1000.000	125.0	H	156.0
4200.940000	---	39.35	53.98	14.63	1000.0	1000.000	125.0	V	10.0
5529.920000	---	42.61	53.98	11.37	1000.0	1000.000	175.0	V	-1.0
5585.687000	55.69	---	73.98	18.29	1000.0	1000.000	121.0	V	68.0
5981.376000	---	43.66	53.98	10.32	1000.0	1000.000	189.0	H	158.0
5986.202000	56.48	---	73.98	17.50	1000.0	1000.000	125.0	V	-18.0
9698.217000	---	32.66	53.98	21.32	1000.0	1000.000	125.0	V	116.0
9799.071000	45.05	---	73.98	28.93	1000.0	1000.000	100.0	V	130.0
13378.344000	---	34.65	53.98	19.33	1000.0	1000.000	175.0	V	200.0
13386.526000	47.83	---	73.98	26.15	1000.0	1000.000	175.0	H	154.0
14399.286000	---	46.32	53.98	7.66	1000.0	1000.000	100.0	H	-3.0
14399.376000	52.75	---	73.98	21.23	1000.0	1000.000	101.0	H	-4.0
17990.214000	---	40.43	53.98	13.55	1000.0	1000.000	100.0	V	-22.0
17997.038000	54.17	---	73.98	19.81	1000.0	1000.000	186.0	V	279.0

18GHz – 40GHz

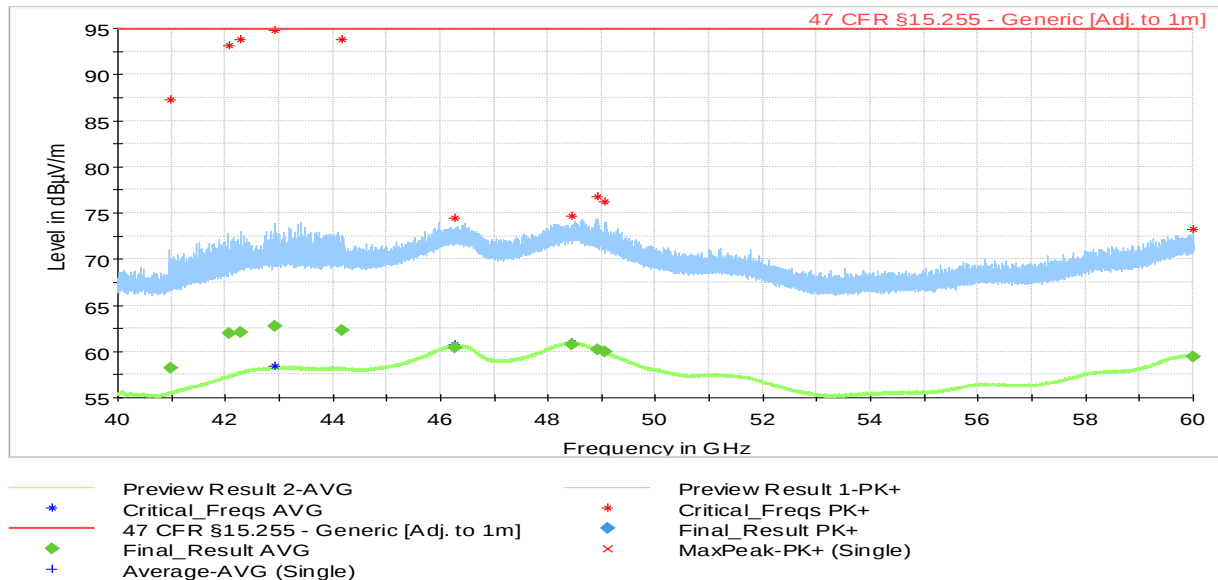
Test mode condition	Default mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.11.24
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
20248.837000	58.97	---	83.52	24.55	1000.0	1000.000	150.0	H	116.0
20248.967000	---	40.66	63.52	22.86	1000.0	1000.000	150.0	H	116.0
22038.142000	55.12	---	83.52	28.40	1000.0	1000.000	150.0	H	188.0
22042.532000	---	42.33	63.52	21.19	1000.0	1000.000	150.0	H	56.0
26069.723000	---	43.01	63.52	20.51	1000.0	1000.000	150.0	V	-8.0
26072.097000	56.64	---	83.52	26.88	1000.0	1000.000	150.0	H	188.0
28798.515000	63.85	---	83.52	19.67	1000.0	1000.000	150.0	V	326.0
28798.549000	---	61.30	63.52	2.22	1000.0	1000.000	150.0	V	326.0
28798.562000	---	61.36	63.52	2.16	1000.0	1000.000	150.0	V	326.0
28798.569000	63.93	---	83.52	19.59	1000.0	1000.000	150.0	V	326.0
34846.542000	---	42.49	63.52	21.03	1000.0	1000.000	150.0	V	22.0
34866.993000	56.17	---	83.52	27.35	1000.0	1000.000	150.0	V	172.0
36948.280000	---	42.53	63.52	20.99	1000.0	1000.000	150.0	V	292.0
36987.621000	55.73	---	83.52	27.79	1000.0	1000.000	150.0	H	186.0

40GHz – 60GHz (Vertical)

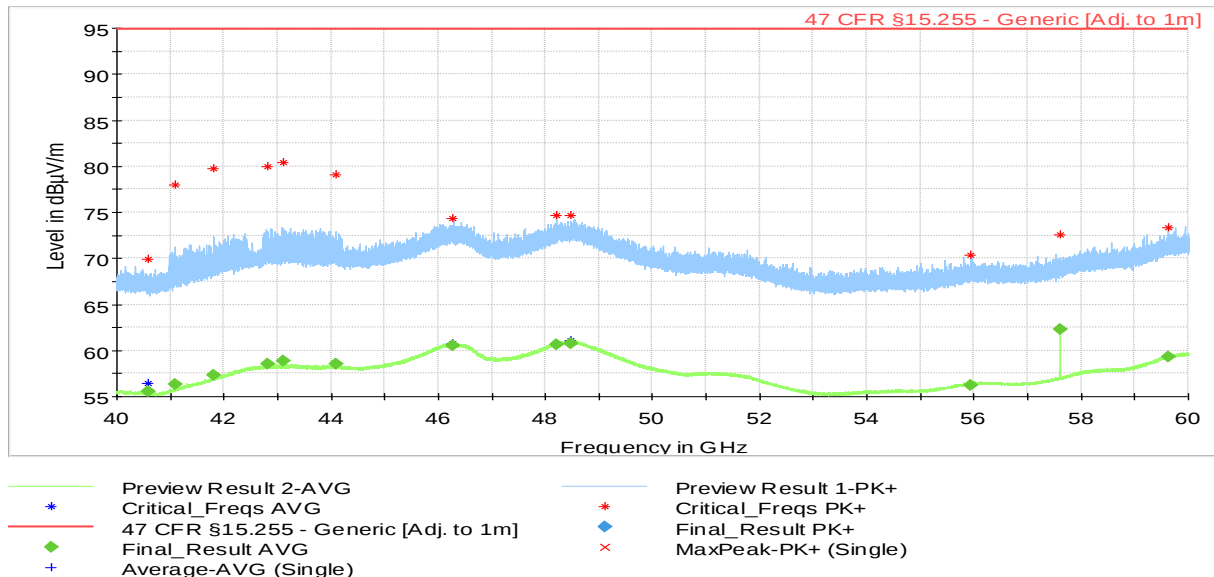
Test mode condition	Default mode	
Antenna orientation	Vertical	
Sweep frequency	40 GHz – 60 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.01
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40971.642273	58.21	94.89	36.68	1000.0	1000.000	162.0	H	15.0
42062.150909	61.99	94.89	32.89	1000.0	1000.000	162.0	H	0.0
42278.928636	62.10	94.89	32.78	1000.0	1000.000	162.0	H	351.0
42924.488181	62.76	94.89	32.12	1000.0	1000.000	162.0	H	12.0
44170.044546	62.25	94.89	32.63	1000.0	1000.000	162.0	H	352.0
46271.833182	60.46	94.89	34.43	1000.0	1000.000	162.0	H	352.0
48450.102728	60.71	94.89	34.18	1000.0	1000.000	162.0	H	194.0
48919.623182	60.20	94.89	34.69	1000.0	1000.000	162.0	H	0.0
49061.619091	59.93	94.89	34.95	1000.0	1000.000	162.0	H	0.0
59989.603182	59.38	94.89	35.51	1000.0	1000.000	162.0	H	191.0

40GHz – 60GHz (Horizontal)

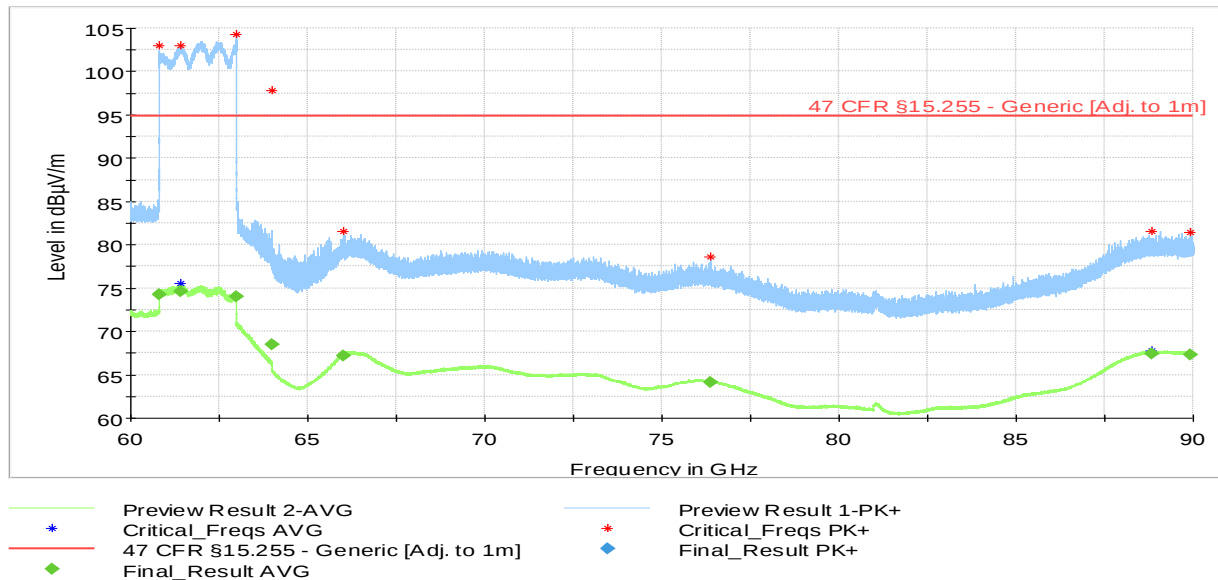
Test mode condition	Default mode	
Antenna orientation	Horizontal	
Sweep frequency	40 GHz – 60 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.02
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40591.251364	55.55	94.89	39.33	1000.0	1000.000	162.0	H	39.0
41077.625000	56.28	94.89	38.61	1000.0	1000.000	162.0	H	338.0
41809.062272	57.32	94.89	37.56	1000.0	1000.000	162.0	H	334.0
42817.311364	58.54	94.89	36.34	1000.0	1000.000	162.0	H	315.0
43094.595455	58.85	94.89	36.04	1000.0	1000.000	162.0	H	338.0
44101.360000	58.49	94.89	36.39	1000.0	1000.000	162.0	H	334.0
46267.066818	60.49	94.89	34.40	1000.0	1000.000	162.0	H	287.0
48204.741818	60.60	94.89	34.28	1000.0	1000.000	162.0	H	186.0
48474.710909	60.76	94.89	34.12	1000.0	1000.000	162.0	H	128.0
55936.617727	56.24	94.89	38.65	1000.0	1000.000	162.0	H	33.0
57596.897273	62.24	94.89	32.65	1000.0	1000.000	162.0	H	61.0
59619.212727	59.27	94.89	35.62	1000.0	1000.000	162.0	H	201.0

60GHz – 90GHz (Vertical)

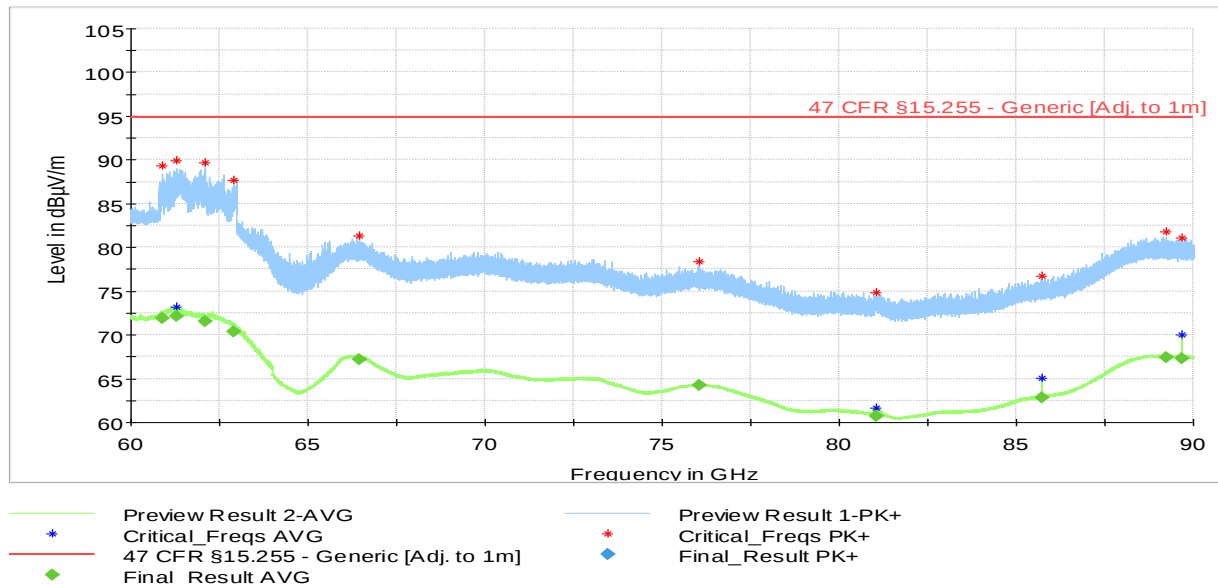
Test mode condition	Default mode	
Antenna orientation	Vertical	
Sweep frequency	60 GHz – 90 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.02
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
60804.390244	74.20	94.89	20.69	1000.0	1000.000	162.0	H	14.0
61395.121951	74.59	94.89	20.29	1000.0	1000.000	162.0	H	16.0
62984.878049	74.02	94.89	20.87	1000.0	1000.000	162.0	H	0.0
63999.512195	68.49	94.89	26.39	1000.0	1000.000	162.0	H	14.0
66019.733333	67.23	94.89	27.65	1000.0	1000.000	162.0	H	44.0
76369.933333	64.10	94.89	30.79	1000.0	1000.000	162.0	H	0.0
88815.692308	67.43	94.89	27.46	1000.0	1000.000	162.0	H	254.0
89923.384615	67.30	94.89	27.59	1000.0	1000.000	162.0	H	337.0

60GHz – 90GHz (Horizontal)

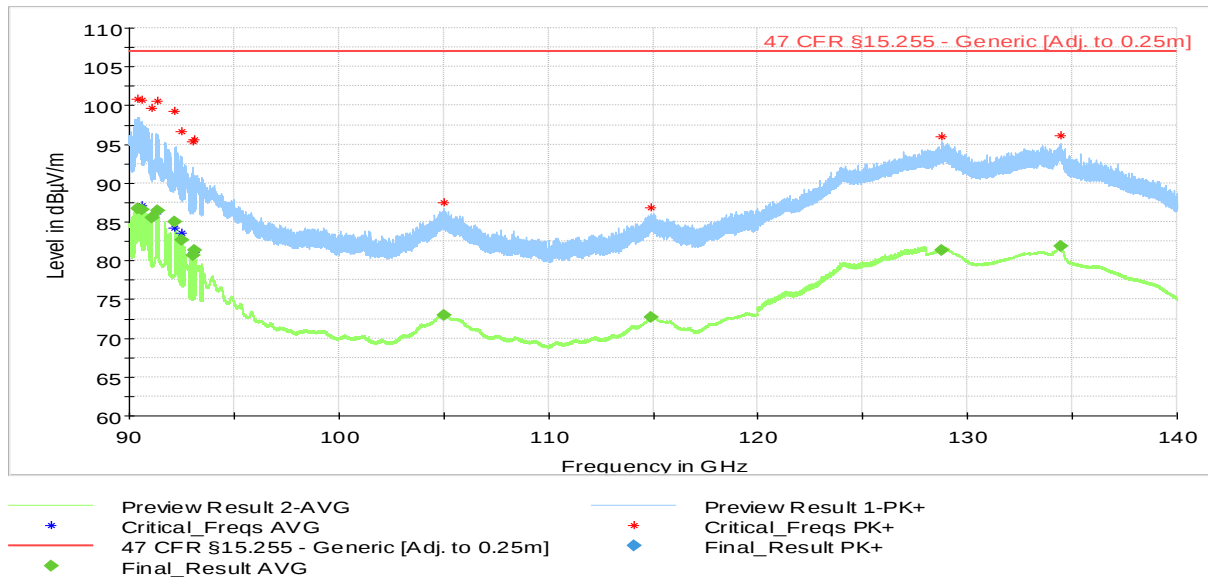
Test mode condition	Default mode	
Antenna orientation	Horizontal	
Sweep frequency	60 GHz – 90 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.02
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
60880.975610	71.89	94.89	22.99	1000.0	1000.000	162.0	H	335.0
61300.975610	72.15	94.89	22.74	1000.0	1000.000	162.0	H	336.0
62089.756098	71.50	94.89	23.38	1000.0	1000.000	162.0	H	336.0
62899.024390	70.42	94.89	24.47	1000.0	1000.000	162.0	H	342.0
66452.333333	67.16	94.89	27.72	1000.0	1000.000	162.0	H	128.0
76033.000000	64.19	94.89	30.69	1000.0	1000.000	162.0	H	334.0
81064.153846	60.74	94.89	34.14	1000.0	1000.000	162.0	H	255.0
85737.230769	62.82	94.89	32.06	1000.0	1000.000	162.0	H	83.0
89235.230769	67.38	94.89	27.50	1000.0	1000.000	162.0	H	50.0
89688.461539	67.27	94.89	27.61	1000.0	1000.000	162.0	H	339.0

90GHz – 140GHz (Vertical)

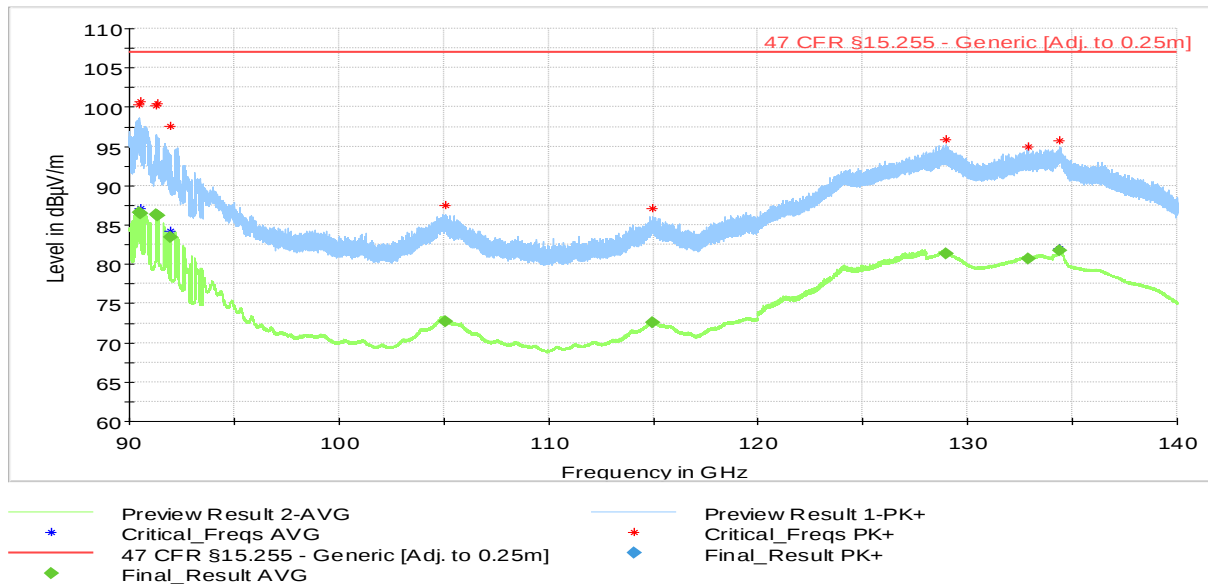
Test mode condition	Default mode	
Antenna orientation	Vertical	
Sweep frequency	90 GHz – 140 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.08
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
90416.818182	86.74	106.93	20.18	1000.0	1000.000	162.0	H	191.0
90594.545455	86.52	106.93	20.40	1000.0	1000.000	162.0	H	71.0
91104.545455	85.52	106.93	21.40	1000.0	1000.000	162.0	H	268.0
91328.636364	86.40	106.93	20.53	1000.0	1000.000	162.0	H	47.0
92171.818182	85.06	106.93	21.87	1000.0	1000.000	162.0	H	57.0
92483.636364	82.58	106.93	24.34	1000.0	1000.000	162.0	H	0.0
93037.727273	80.72	106.93	26.20	1000.0	1000.000	162.0	H	35.0
93085.000000	81.38	106.93	25.54	1000.0	1000.000	162.0	H	222.0
105002.272727	72.94	106.93	33.98	1000.0	1000.000	162.0	H	41.0
114929.545455	72.64	106.93	34.29	1000.0	1000.000	162.0	H	280.0
128762.000000	81.35	106.93	25.58	1000.0	1000.000	162.0	H	249.0
134424.615385	81.86	106.93	25.07	1000.0	1000.000	162.0	H	226.0

90GHz – 140GHz (Horizontal)

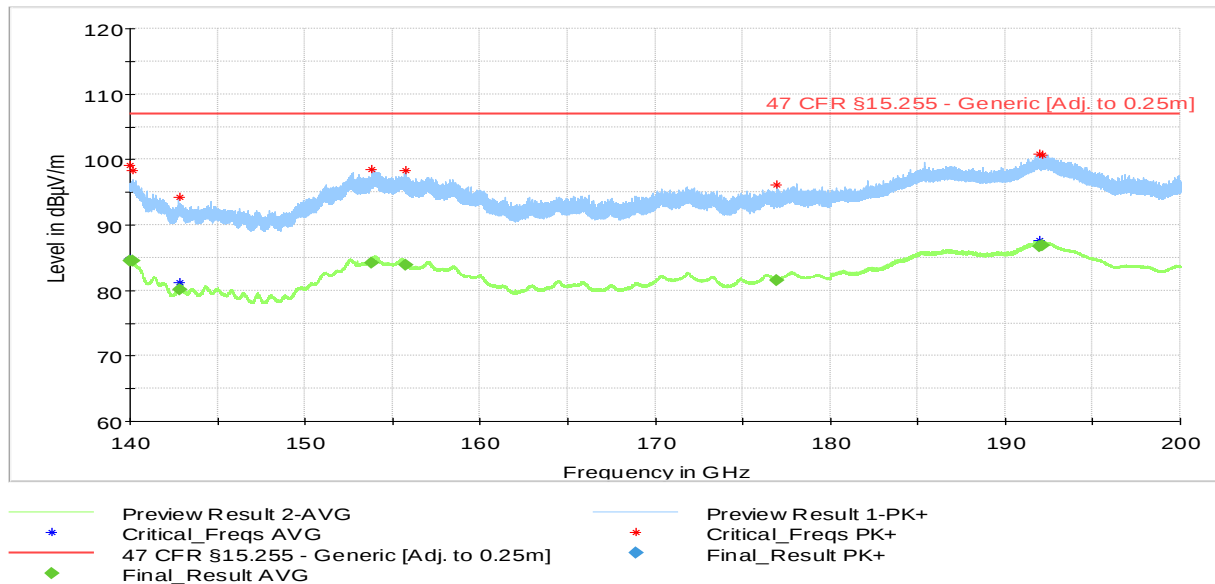
Test mode condition	Default mode	
Antenna orientation	Horizontal	
Sweep frequency	90 GHz – 140 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.09
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
90503.181818	86.52	106.93	20.41	1000.0	1000.000	162.0	H	209.0
90514.545455	86.49	106.93	20.44	1000.0	1000.000	162.0	H	265.0
91318.181818	86.34	106.93	20.59	1000.0	1000.000	162.0	H	263.0
91336.363636	86.18	106.93	20.75	1000.0	1000.000	162.0	H	83.0
91992.727273	83.38	106.93	23.55	1000.0	1000.000	162.0	H	276.0
105102.727273	72.64	106.93	34.28	1000.0	1000.000	162.0	H	92.0
114967.727273	72.61	106.93	34.31	1000.0	1000.000	162.0	H	3.0
128974.769231	81.32	106.93	25.61	1000.0	1000.000	162.0	H	32.0
132914.923077	80.65	106.93	26.27	1000.0	1000.000	162.0	H	330.0
134408.923077	81.73	106.93	25.19	1000.0	1000.000	162.0	H	35.0

140GHz – 200GHz (Vertical)

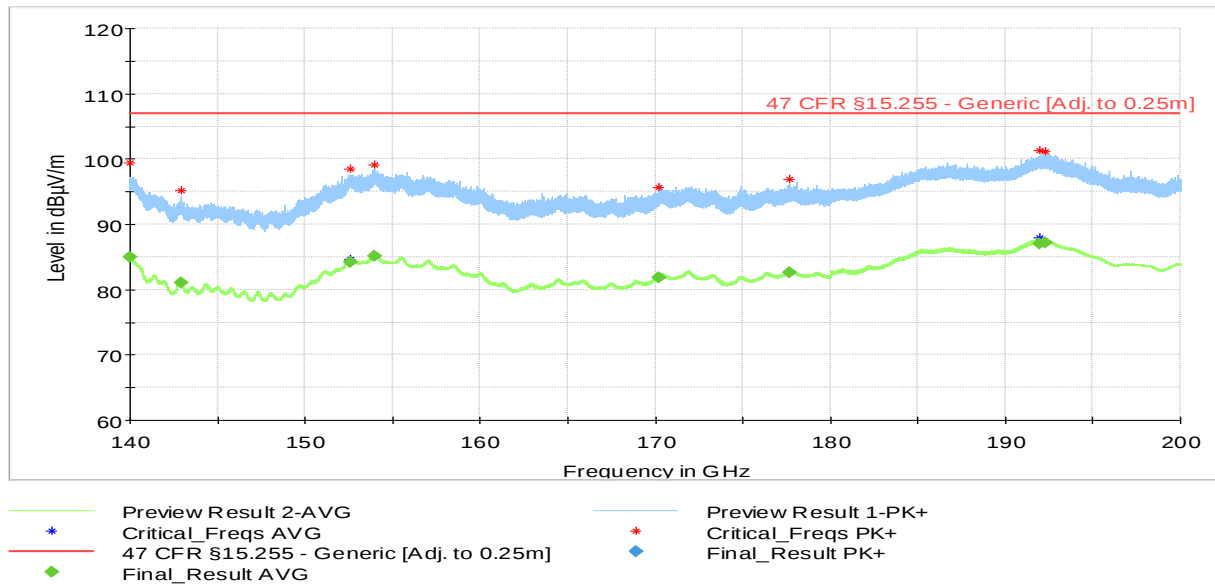
Test mode condition	Default mode	
Antenna orientation	Vertical	
Sweep frequency	140 GHz – 200 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.09
Chamber details	Chamber: SAC 5	



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
140021.363636	84.57	106.93	22.36	1000.0	1000.000	162.0	H	95.0
140141.363636	84.43	106.93	22.49	1000.0	1000.000	162.0	H	211.0
142828.181818	80.15	106.93	26.78	1000.0	1000.000	162.0	H	270.0
153803.636364	84.25	106.93	22.68	1000.0	1000.000	162.0	H	339.0
155715.000000	83.88	106.93	23.05	1000.0	1000.000	162.0	H	98.0
176968.181818	81.44	106.93	25.48	1000.0	1000.000	162.0	H	47.0
191982.000000	86.75	106.93	20.18	1000.0	1000.000	162.0	H	95.0
192099.428572	86.81	106.93	20.12	1000.0	1000.000	162.0	H	306.0

140GHz – 200GHz (Horizontal)

Test mode condition	Default mode	
Antenna orientation	Horizontal	
Sweep frequency	140 GHz – 200 GHz	
Standard	47 CFR FCC Part 15 subpart C	
EUT	A003152562-006	
Ancillary Equipment	A003152562-007	
Test Engineer	Niall Forrester	Date: 2021.12.13
Chamber details	Chamber: SAC 5	



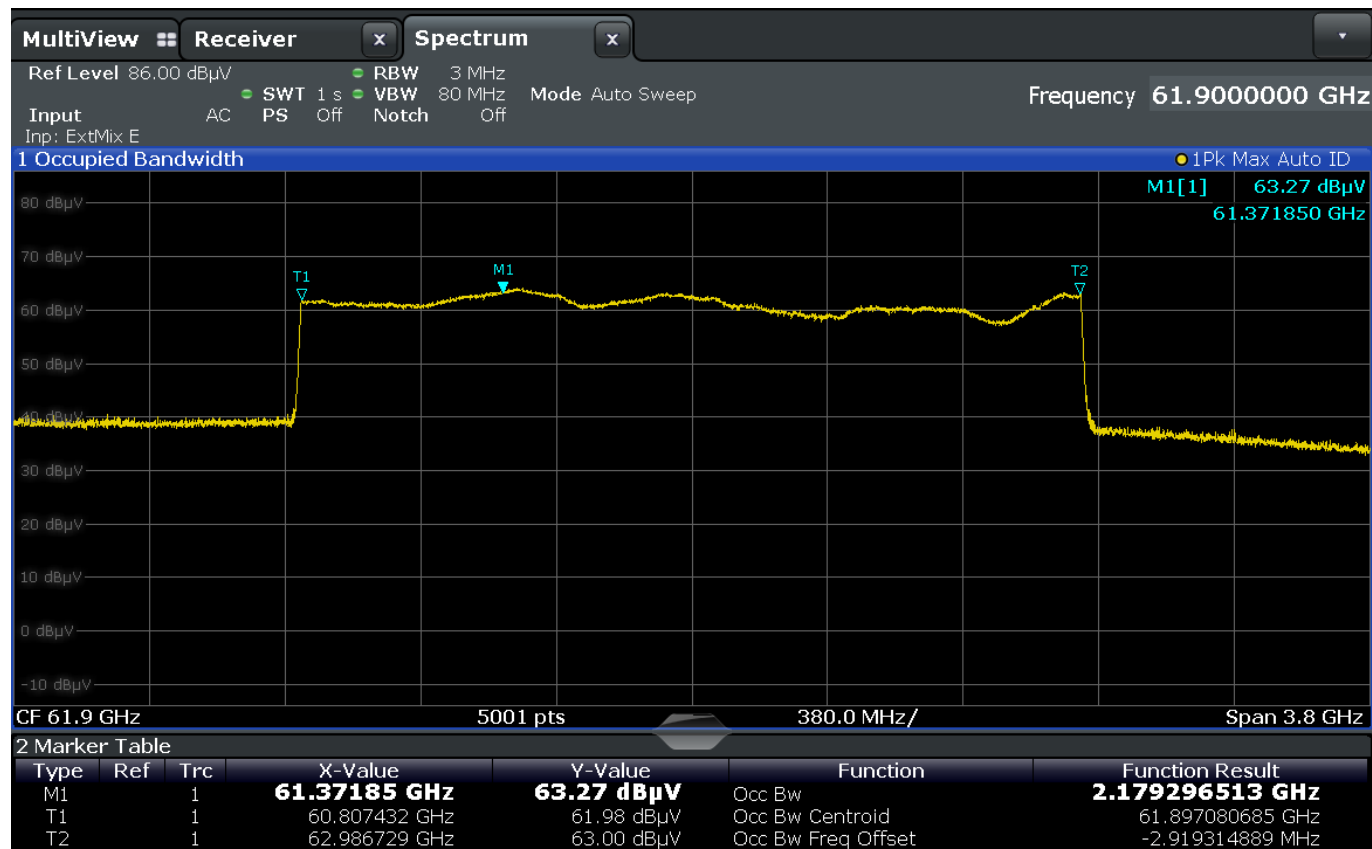
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
140012.727273	85.01	106.93	21.92	1000.0	1000.000	162.0	H	152.0
142916.818182	81.02	106.93	25.91	1000.0	1000.000	162.0	H	29.0
152545.454546	84.26	106.93	22.66	1000.0	1000.000	162.0	H	100.0
153960.000000	85.15	106.93	21.78	1000.0	1000.000	162.0	H	44.0
170179.545455	81.81	106.93	25.12	1000.0	1000.000	162.0	H	349.0
177693.636364	82.54	106.93	24.38	1000.0	1000.000	162.0	H	217.0
191955.692308	87.04	106.93	19.89	1000.0	1000.000	162.0	H	349.0
192325.142857	87.23	106.93	19.69	1000.0	1000.000	162.0	H	176.0

4.5 Test Results – Frequency Tolerance

4.5.1 Frequency Tolerance – Test Summary

Test Specification		FCC 47 CFR 15.255 (f) (Part 15 Subpart C) / ANSI C63.10 sec 9.14				
Test Engineer & Date		Niall Forrester			2022.01.14	
EUT and Ancillary Equipment IDs		A003152562-006			A003152562-007	
EUT Operation Mode(s)		Default				
EUT Wireless Configuration(s)		Chirp Mode				
EUT Hardware Configuration(s)		-				
Overall Result		PASS				
Test Parameter	Wireless Configuration	Measured Frequency (MHz)				Result
		F _{low} GHz	Limit (GHz)	F _{high}	Limit (GHz)	
Frequency @ 48.0V -20C	Chirp Mode	60.809349	>57	62.988399	<71	PASS
Frequency @ 48.0V -10°C	Chirp Mode	60.813061	>57	62.988585	<71	PASS
Frequency @ 48.0V 0°C	Chirp Mode	60.810617	>57	62.986413	<71	PASS
Frequency @ 48.0V 10°C	Chirp Mode	60.810443	>57	62.986212	<71	PASS
Frequency @ 40.5V 20°C	Chirp Mode	60.805395	>57	62.985752	<71	PASS
Frequency @ 48.0V 20°C	Chirp Mode	60.807432	>57	62.986729	<71	PASS
Frequency @ 55.2V 20°C	Chirp Mode	60.805092	>57	62.985205	<71	PASS
Frequency @ 48.0V 30°C	Chirp Mode	60.807706	>57	62.986127	<71	PASS
Frequency @ 48.0V 40C	Chirp Mode	60.805410	>57	62.985736	<71	PASS
Frequency @ 48.0V 50°C	Chirp Mode	60.806589	>57	60.982193	<71	PASS

4.5.2 Frequency Tolerance – Test Details (Example Plot)



5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – Radiated RF

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	2021.07.15	2022.07.15
Harmonic Mixer – 60 GHz to 90 GHz	RPG	FS-Z90	101850 2886130	2021.07.14	2022.07.14
Temperature Chamber	Vötsch	VT4002	58566081940010 2717693	N/A	N/A
Single Input Thermometer	Fluke	Fluke-51-2	41410362WS 2807523	2021.07.21	2022.07.21
Temperature Probe	Fluke	80PK-1	WPL26041802 2807523	2021.07.21	2022.07.21
Humidity Temperature Probe	Lufft	OPUS 20 THI	126.0118.0802.033 2771042	2020.07.31	2022.07.31

5.1.2 Hardware List – Conducted Emissions System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Two Line V-Network	Rohde & Schwarz	ENV 216	101090 2704076	2021.08.03	2022.08.03
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674 2704016	2021.07.09	2022.07.09
RF Probe	Fischer Custom Communication	F-52	22 2902256	2021.07.21	2022.07.22
Temperature & humidity Logger	Lufft	OPUS 20 THI	113.0118.0802.033 2771025	2020.07.31	2022.07.31

5.1.3 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	2021.07.15	2022.07.15
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	2020.07.27	2022.07.27
Horn Antenna	ETS Lindgren	UG-600A/U	20623 2814834	2020.07.27	2022.07.27
Harmonic Mixer – 40 GHz to 60 GHz	RPG	FS-Z60	100981 2916123	2021.07.15	2022.07.15
Harmonic Mixer – 60 GHz to 90 GHz	RPG	FS-Z90	101850 2886130	2021.07.14	2022.07.14
Harmonic Mixer – 90 GHz to 140 GHz	RPG	FS-Z140	101124 2892049	2021.08.03	2022.08.03
Harmonic Mixer – 140 GHz to 220 GHz	RPG	FS-Z220	101036 9001924	2021.07.22	2023.07.22
Control Device	Maturo	NCD	NCD/393/2372.01	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	2021.08.04	2022.08.04
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	2021.08.04	2022.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333 2761265	2021.08.04	2022.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335 2761266	2021.08.04	2022.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	2021.08.04	2022.08.04
Humidity Temperature Probe	Lufft	OPUS 20 THI	126.0118.0802.033 2771042	2020.07.31	2022.07.31

5.2 Software / Firmware Versions

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

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for Radiated RF

Parameter	Uncertainty (Coverage Factor k=2)
Field Strength 60 GHz - 90 GHz	5.43 dB
Frequency 60 GHz – 90 GHz (@100kHz - 30MHz BW, 4GHz Span)	0.027%

6.2 Measurement Uncertainty for Conducted Emissions

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

6.3 Measurement Uncertainty for SAC 5 (Radiated Emissions)

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
Field Strength 40 GHz - 60 GHz	5.43 dB
Field Strength 60 GHz - 90 GHz	5.43 dB
Field Strength 90 GHz - 140 GHz	5.43 dB
Field Strength 140 GHz - 220 GHz	5.43 dB

7. PHOTOGRAPHS

7.1 Photographs of the EUT

For photographs, see Appendix 1