

Prüfbericht-Nr.: Test report no.:	60500439-001	Auftrags-Nr.: Order no.:	23870628 030	Seite 1 von 33 Page 1 of 33
Kunden-Referenz-Nr.: Client reference no.:	1288973	Auftragsdatum: Order date:	2021.11.09	
Auftraggeber: Client:	Axis Communications AB			
Prüfgegenstand: Test item:	OSDP Card reader			
Bezeichnung / Typ-Nr.: Identification / Type no.:	FCC ID: PNB-AXISA4120-E			
Auftrags-Inhalt: Order content:	Accredited testing according to FCC Part 15.225			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15.225 with parts 15.207, 15.209 & 15.215 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2022.01.31			
Prüfmuster-Nr.: Test sample no.:	A003159409-004			
Prüfzeitraum: Testing period:	2022.02.04 – 2022.02.17			
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: 2022.04.06 Date:	Datum: 2022.04.06 Date:			
Stellung / Position:	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 History60500439-00160500439-001

REVISION	DATE	REMARKS	AUTHOR
001	2022.03.31	First release	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15.225 Template version 1.1			

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	
15.209 & 15.225 (a,b,c,d)	Radiated Emissions (Intentional Radiators)	YES	4.2	PASS	
15.215 (c)	20 dB bandwidth	YES	4.3	PASS	
15.225 (e)	Frequency Tolerance	YES	4.4	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:	Axis Communications
Address:	Emdalavägen 14
	223 69 Lund
	Sweden
Contact Person:	Alexander Holmström
Contact e-Mail / Telephone	Alexander.holmstrom@axis.com / +46 709 61 56 37

2. PRODUCT INFORMATION

2.1 General Description

Model name:	A4120-E
Manufacturer:	AXIS
Model number / Marketing name:	AXIS A4120-E
FCC ID:	PNB-AXISA4120-E
Description:	OSDP Card reader
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Type of Power Supply	DC
Nominal Supply Voltage	12V DC
Supply Voltage Range	10.8V to 14.4V DC
Operating Temperature Range	-30° to + 65°C
Operating Air Humidity Range	10% - 100% RH (non-condensing)
Highest Internal Frequency Source	80 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A003159409-004	B8A44F3B86F8	All Tests

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
13.56 MHz RFID	HF	13.553 MHz – 13.567 MHz	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
13.56 MHz RFID	HF	1	Loop antenna	N/A

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
13.56 MHz RFID	HF	ASK 100%	1	N/A	N/A
13.56 MHz RFID	HF	ASK 10%	1	N/A	N/A

2.7 Ancillary Equipment

ID	Description	Manufacturer / Model	Hardware & Software Versions
A003159409-002	Control Unit	00408C1888F7	-
A003159409-006	Midspan (PoE)	P90700988A2	PHIHONG

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 15.225	-	Operation within the band 13.110 – 14.010 MHz
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)
15.209 & 15.225 (a,b,c,d)	Radiated Emissions (Intentional Radiators)	15.209 (a) *See Note 1
15.215 (c)	20 dB bandwidth	15.215 (c)
15.225 (e)	Frequency Tolerance	15.225 (e)

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:

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

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

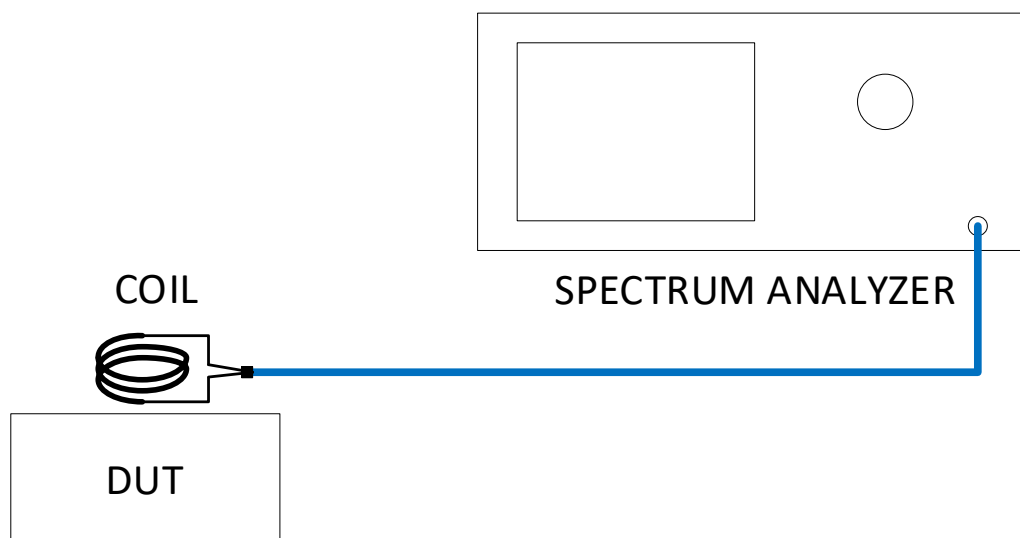
Where different arrangements of equipment were used for different types of measurements, these are tabulated in section 3.4.2 and details of each arrangement are included in subsequent sections

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
15.209 & 15.225 (a,b,c,d)	Radiated Emissions (Intentional Radiators)	SAC5
15.215 (c)	20 dB bandwidth	Conducted Radio
15.225 (e)	Frequency Tolerance	Conducted Radio

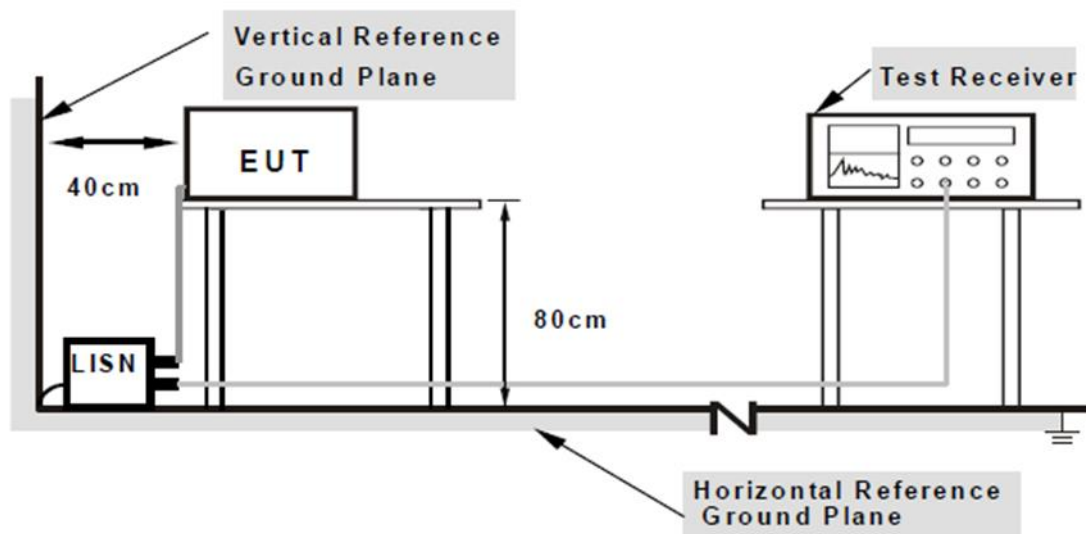
3.4.3 Test Equipment Setup – Conducted Radio

The device under test was connected to the Spectrum Analyzer via a coil antenna placed close to the transmitting NFC coil. The DUT was placed in a temperature chamber where required to control the ambient temperature. Where appropriate, temperature and supply voltage were measure using calibrated equipment.



3.4.4 Test Equipment Setup – Conducted Emissions

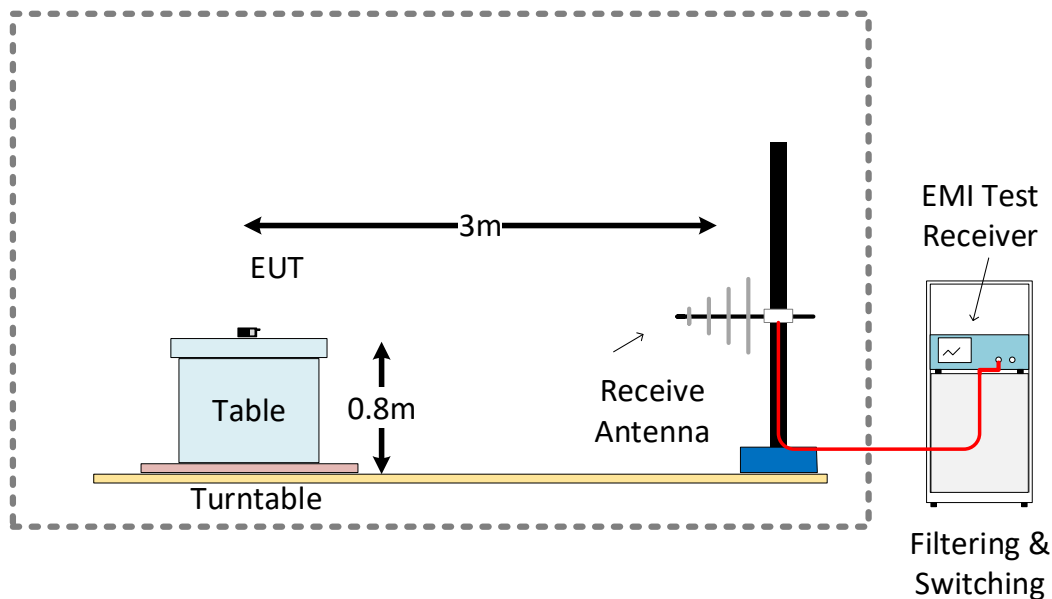
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide 50Ω/ 50μH of coupling impedance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



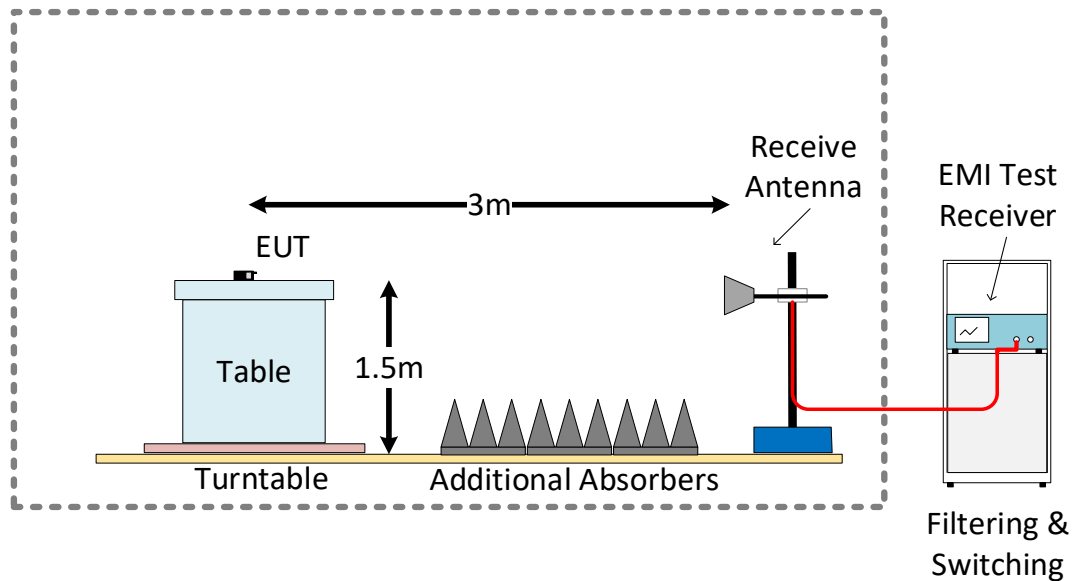
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- 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 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 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

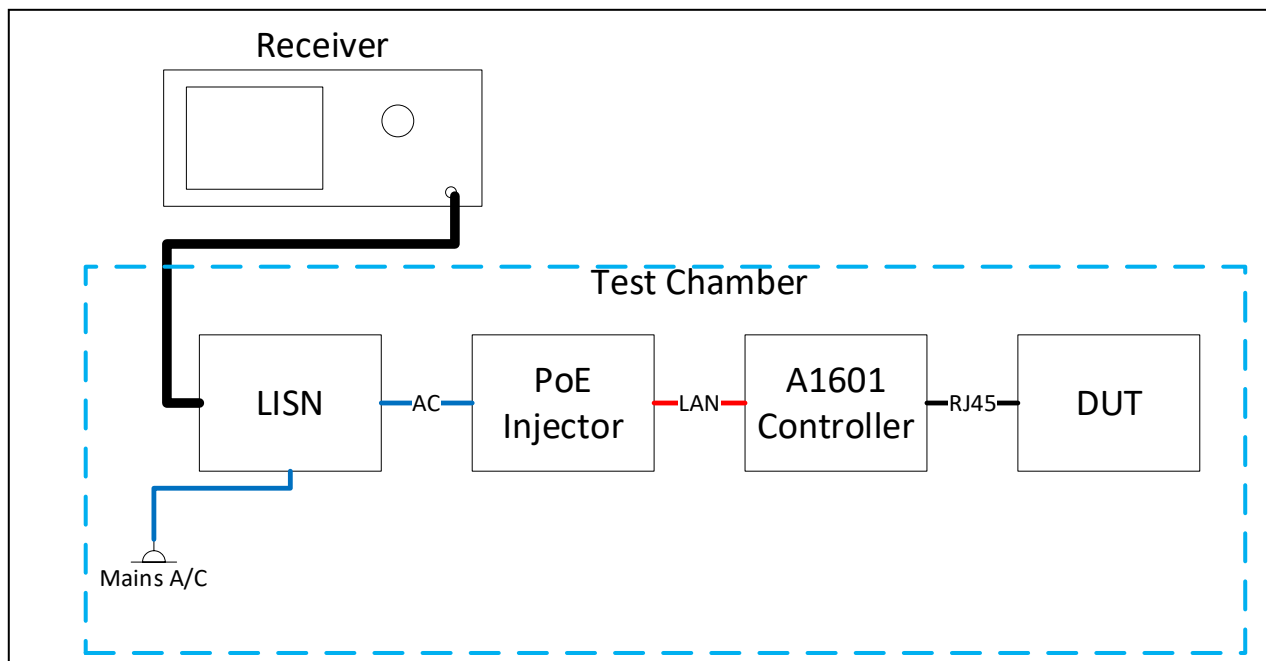


SAC 5 Test Setup Configuration 1GHz – 18GHz

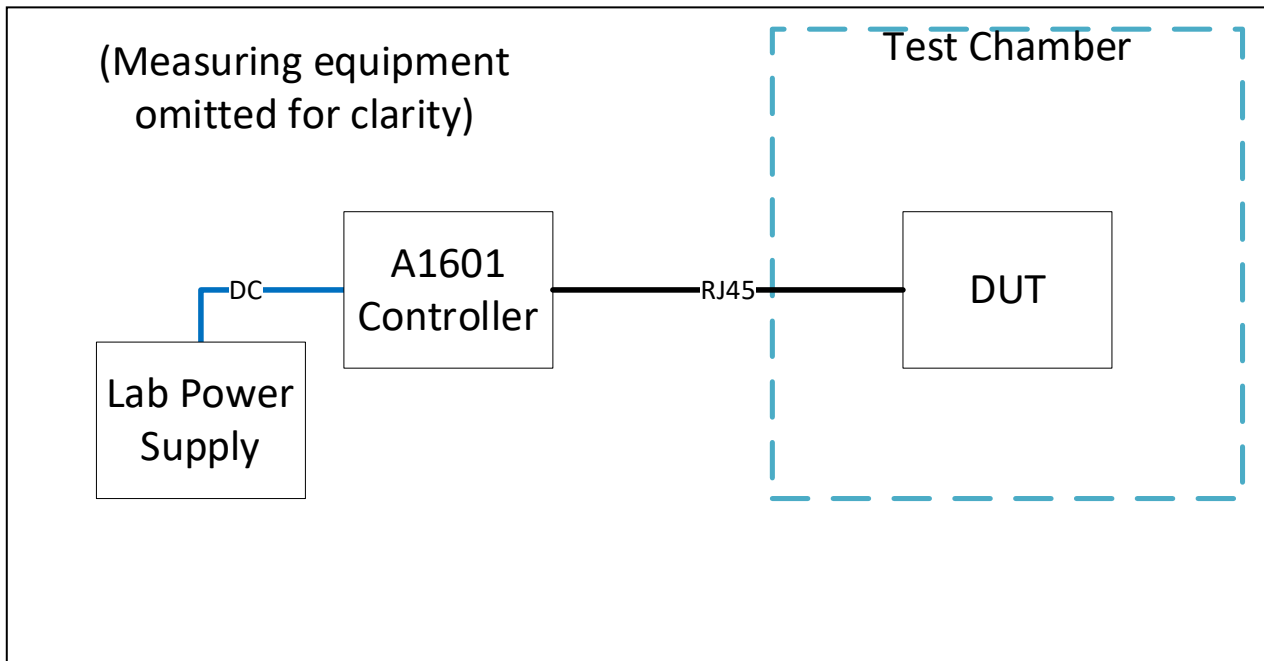


3.5 EUT Configuration During Test

Conducted Emissions Testing: Block Diagram



Radiated Emissions Testing: Block Diagram



3.6 EUT Operation Modes

Operation mode	Description
Idle mode	Device is not actively transmitting
Continuous TX	The device is continuously transmitting

3.7 Deviations from the Test Standard

None

3.8 Environmental Conditions

3.8.1 Environmental Conditions – Conducted Radio

Environmental Conditions Log – Conducted Radio

Date	Time	Temperature (°C)	Relative Humidity (%)
2022.02.16	11:00	18.1	39
2022.02.17	09:15	17.5	35

3.8.2 Environmental Conditions – Conducted Emissions System

Date	Time	Temperature (°C)	Relative Humidity (%)
2022.02.08	10:15	21.9	34

3.8.3 Environmental Conditions – SAC5 (Radiated Emissions)

Date	Time	Temperature (°C)	Relative Humidity (%)
2022.02.04	08:27	18.2	37
2022.02.07	07:52	18.4	36

4. TEST RESULTS

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

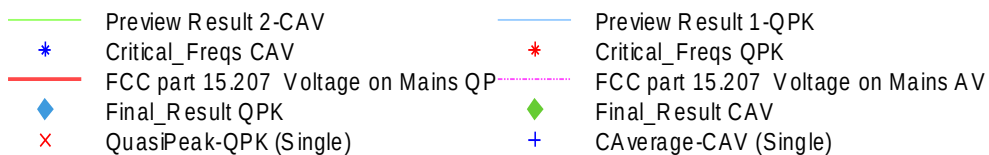
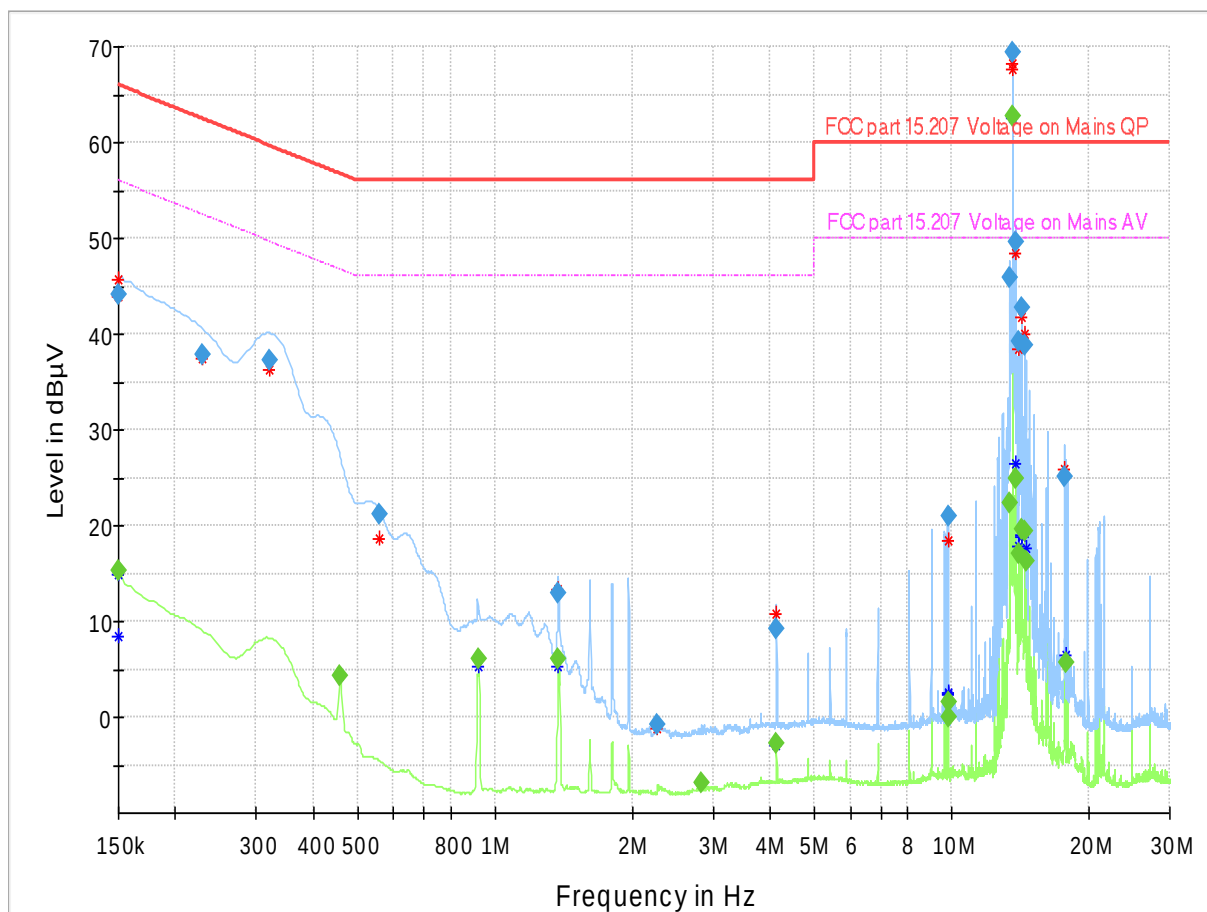
4.1.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Niall Forrester	2022.02.08	
EUT and Ancillary Equipment IDs	A003159409-004	A003159409-002 A003159409-006	
EUT Operation Mode(s)	Continuous TX		
EUT Wireless Configuration(s)	13.56 MHz RFID		
EUT Hardware Configuration(s)	-		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line	13.56 MHz RFID	150 kHz – 30 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	13.56 MHz RFID	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	Conducted Emission	
Test mode condition	13.56MHz RFID Active	
Standard	47 CFR Part 15.207 Class B	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	2022.02.08



NOTE: Peak at 13.56 MHz (caused by RFID transmitter) has been ignored when judging pass/fail verdict

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.150000	---	15.37	56.00	40.63	1000.0	9.000	L1	ON
0.150000	44.02	---	66.00	21.98	1000.0	9.000	N	ON
0.228750	37.89	---	62.50	24.61	1000.0	9.000	N	ON
0.321000	37.35	---	59.68	22.33	1000.0	9.000	N	ON
0.458250	---	4.28	46.72	42.45	1000.0	9.000	N	ON
0.557250	21.25	---	56.00	34.75	1000.0	9.000	N	ON
0.919500	---	6.00	46.00	40.01	1000.0	9.000	L1	ON
1.376250	---	6.12	46.00	39.88	1000.0	9.000	N	ON
1.376250	12.92	---	56.00	43.08	1000.0	9.000	N	ON
2.271750	-0.88	---	56.00	56.88	1000.0	9.000	N	ON
2.841000	---	-6.95	46.00	52.95	1000.0	9.000	L1	ON
4.130250	---	-2.79	46.00	48.79	1000.0	9.000	L1	ON
4.134750	9.17	---	56.00	46.83	1000.0	9.000	N	ON
9.800250	---	1.66	50.00	48.34	1000.0	9.000	N	ON
9.804750	---	0.02	50.00	49.99	1000.0	9.000	N	ON
9.807000	20.92	---	60.00	39.08	1000.0	9.000	N	ON
13.348500	---	22.44	50.00	27.56	1000.0	9.000	L1	ON
13.348500	45.92	---	60.00	14.08	1000.0	9.000	N	ON
13.560000	---	62.83	50.00	-12.83	1000.0	9.000	L1	ON
13.560000	69.32	---	60.00	-9.32	1000.0	9.000	L1	ON
13.771500	49.66	---	60.00	10.34	1000.0	9.000	N	ON
13.771500	---	24.91	50.00	25.09	1000.0	9.000	L1	ON
13.983000	---	17.14	50.00	32.86	1000.0	9.000	L1	ON
13.983000	39.15	---	60.00	20.85	1000.0	9.000	N	ON
14.196750	---	19.59	50.00	30.41	1000.0	9.000	L1	ON
14.196750	42.65	---	60.00	17.35	1000.0	9.000	N	ON
14.408250	---	19.50	50.00	30.50	1000.0	9.000	L1	ON
14.408250	38.87	---	60.00	21.13	1000.0	9.000	N	ON
14.516250	---	16.23	50.00	33.77	1000.0	9.000	L1	ON
17.650500	25.07	---	60.00	34.93	1000.0	9.000	N	ON
17.745000	---	5.64	50.00	44.36	1000.0	9.000	L1	ON

NOTE: Peak at 13.56 MHz (caused by RFID transmitter) has been ignored when judging pass/fail verdict

4.2 Test Results – Radiated Emissions (Intentional Transmitter)

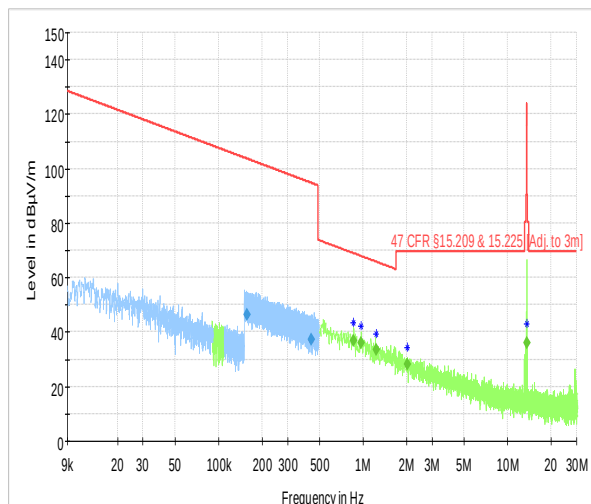
4.2.1 Radiated Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.209 (Part 15 Subpart C)		
Test Engineer & Date	Niall Forrester	2022.02.04 – 2022.02.07	
EUT and Ancillary Equipment IDs	A003159409-004	A003159409-002 A003159409-006	
EUT Operation Mode(s)	Continuous TX		
EUT Wireless Configuration(s)	13.56 MHz RFID		
EUT Hardware Configuration(s)	-		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	13.56 MHz RFID	9 kHz – 30 MHz	PASS
Radiated Emissions	13.56 MHz RFID	30 MHz – 1 GHz	PASS
Radiated Emissions	13.56 MHz RFID	1 GHz – 18 GHz	PASS

4.2.2 Radiated Emissions (Intentional) – Test Details

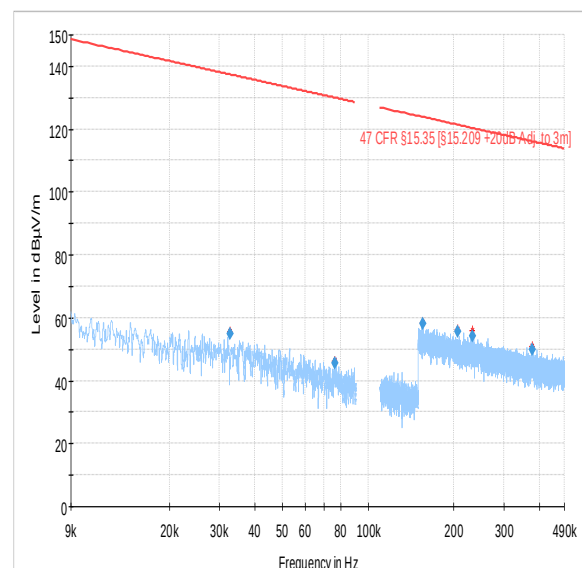
NFC 9kHz – 30MHz –Parallel to Axis

Test mode condition	NFC Continuous Tx	
Antenna orientation	Loop Antenna Parallel to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	Date: 2022.02.04
Chamber details	Chamber: SAC 5	



Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 & 15.225 [Adj. to 3m]
 Final_Result QPK
 QuasiPeak-QPK (Single)

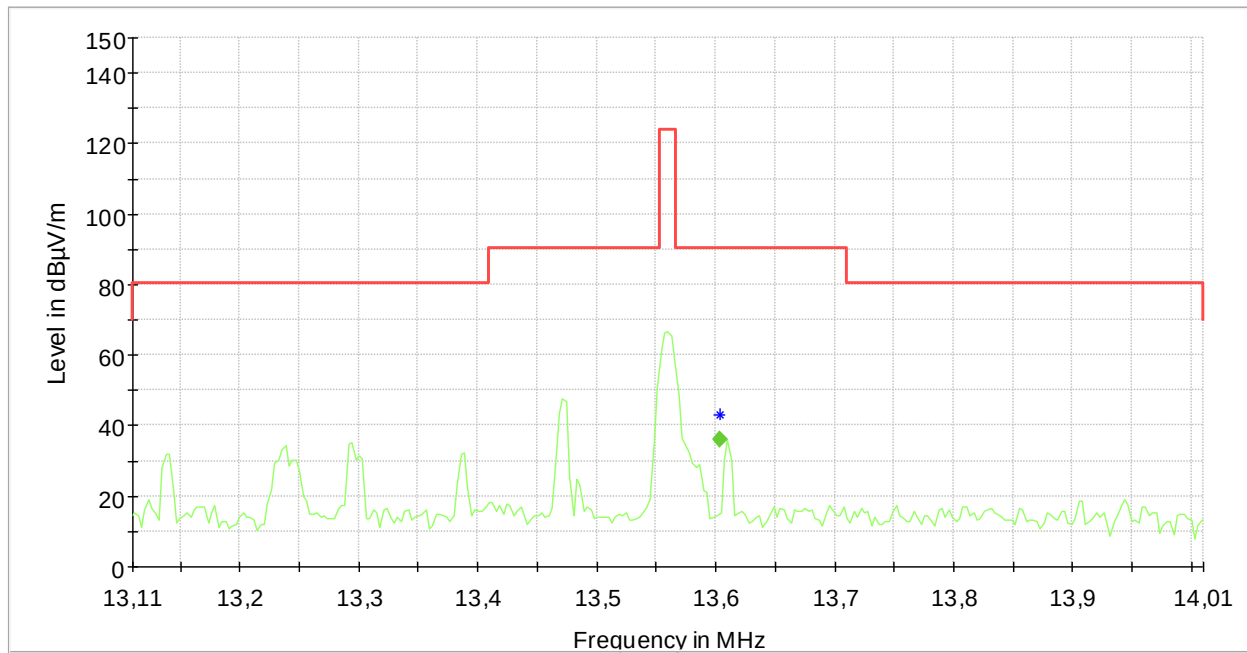
Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG
 MaxPeak-PK+ (Single)
 Average-AVG (Single)



Preview Result 1-PK+
 47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
 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)
0.157409	46.46	---	---	103.66	57.20	1000.0	9.000	100.0	H	308.0
0.438778	37.42	---	---	94.76	57.34	1000.0	9.000	100.0	H	49.0
0.854032	---	36.92	---	68.98	32.06	1000.0	9.000	100.0	H	183.0
0.964327	---	36.10	---	67.92	31.82	1000.0	9.000	100.0	H	315.0
1.230554	---	33.58	---	65.80	32.22	1000.0	9.000	100.0	H	229.0
2.027626	---	28.21	---	69.54	41.33	1000.0	9.000	100.0	H	115.0
13.603746	---	36.18	---	90.48	54.29	1000.0	9.000	100.0	H	273.0
0.032571	---	---	54.89	137.35	82.46	1000.0	0.200	100.0	H	102.0
0.076463	---	---	45.60	129.94	84.33	1000.0	0.200	100.0	H	49.0
0.155290	---	---	58.09	123.78	65.70	1000.0	9.000	100.0	H	306.0
0.206629	---	---	55.79	121.30	65.51	1000.0	9.000	100.0	H	126.0
0.232483	---	---	54.29	120.28	65.99	1000.0	9.000	100.0	H	45.0
0.376564	---	---	49.89	116.09	66.20	1000.0	9.000	100.0	H	216.0

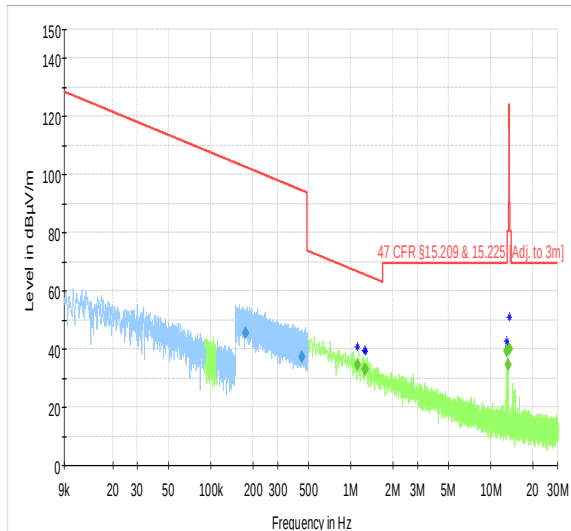
NFC 9kHz – 30MHz –Parallel to Axis (Detail 13.11MHz – 14.01MHz)



- | | | | |
|---|--------------------------------------|---|----------------------|
|  | Preview Result 2-PK+ |  | Preview Result 1-AVG |
|  | Critical_Freqs PK+ |  | Critical_Freqs AVG |
|  | 47 CFR §15.209 & 15.225 [Adj. to 3m] |  | Final_Result AVG |
|  | Final_Result QPK |  | MaxPeak-PK+ (Single) |
|  | QuasiPeak-QPK (Single) |  | Average-AVG (Single) |

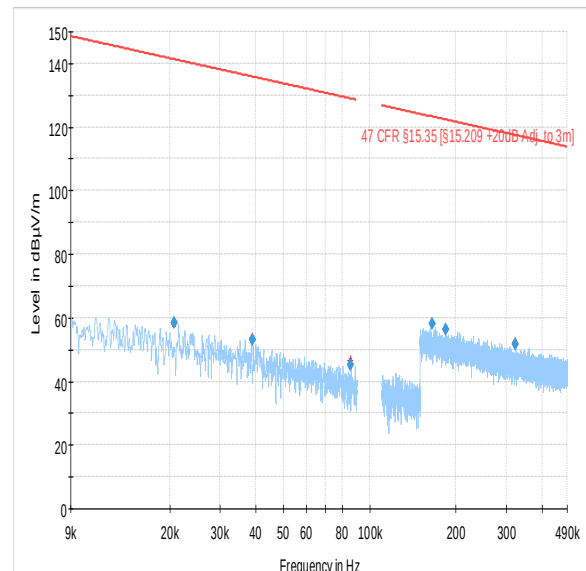
NFC 9kHz – 30MHz –Perpendicular to Axis

Test mode condition	NFC Continuous Tx	
Antenna orientation	Loop Antenna Perpendicular to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	Date: 2022.02.04
Chamber details	Chamber: SAC 5	



Preview Result 2-PK+
Critical_Freqs PK+
47 CFR §15.209 & 15.225 [Adj. to 3m]
Final_Result QPK

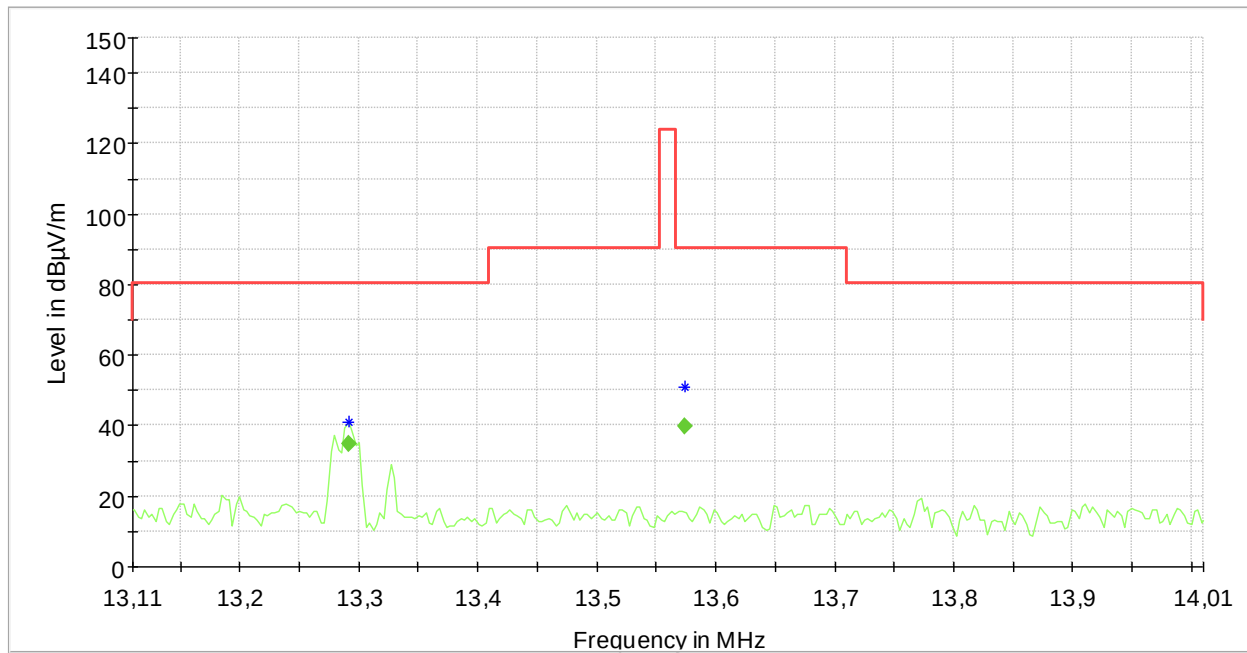
Preview Result 1-AVG
Critical_Freqs AVG
Final_Result AVG



Preview Result 1-PK+
47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
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)
0.178445	45.38	---	---	102.57	57.20	1000.0	9.000	100.0	H	229.0
0.446881	37.20	---	---	94.60	57.40	1000.0	9.000	100.0	H	225.0
1.110752	---	34.51	---	66.69	32.19	1000.0	9.000	100.0	H	-45.0
1.262433	---	33.08	---	65.58	32.50	1000.0	9.000	100.0	H	-45.0
1.277258	---	33.00	---	65.48	32.48	1000.0	9.000	100.0	H	166.0
12.925860	---	39.42	---	69.54	30.12	1000.0	9.000	100.0	H	-2.0
13.291726	---	34.73	---	80.51	45.78	1000.0	9.000	100.0	H	-13.0
0.020643	---	---	58.49	141.31	82.82	1000.0	0.200	100.0	H	166.0
0.038794	---	---	52.95	135.83	82.88	1000.0	0.200	100.0	H	-15.0
0.085492	---	---	45.10	128.97	83.87	1000.0	0.200	100.0	H	135.0
0.164726	---	---	58.20	123.27	65.07	1000.0	9.000	100.0	H	49.0
0.183849	---	---	56.41	122.32	65.90	1000.0	9.000	100.0	H	45.0
0.322054	---	---	51.52	117.45	65.92	1000.0	9.000	100.0	H	77.0

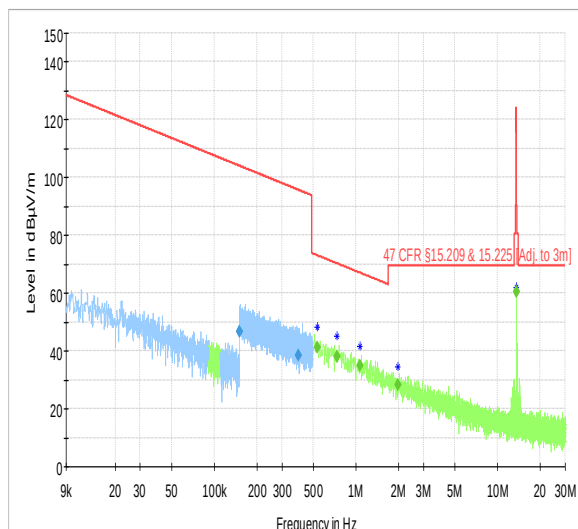
NFC 9kHz – 30MHz –Perpendicular to Axis (Detail 13.11MHz – 14.01MHz)



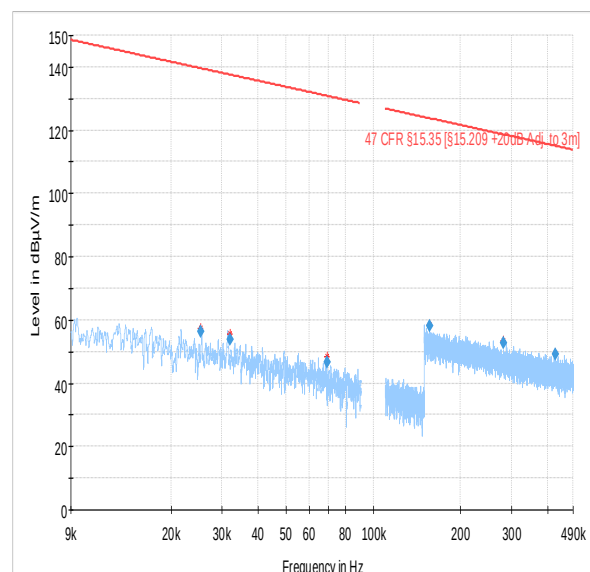
- | | | | |
|---|--------------------------------------|---|----------------------|
|  | Preview Result 2-PK+ |  | Preview Result 1-AVG |
|  | Critical_Freqs PK+ |  | Critical_Freqs AVG |
|  | 47 CFR §15.209 & 15.225 [Adj. to 3m] |  | Final_Result AVG |
|  | Final_Result QPK |  | MaxPeak-PK+ (Single) |
|  | QuasiPeak-QPK (Single) |  | Average-AVG (Single) |

NFC 9kHz – 30MHz –Parallel to Floor

Test mode condition	NFC Continuous Tx	
Antenna orientation	Loop Antenna Parallel to Floor	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	Date: 2022.02.04
Chamber details	Chamber: SAC 5	



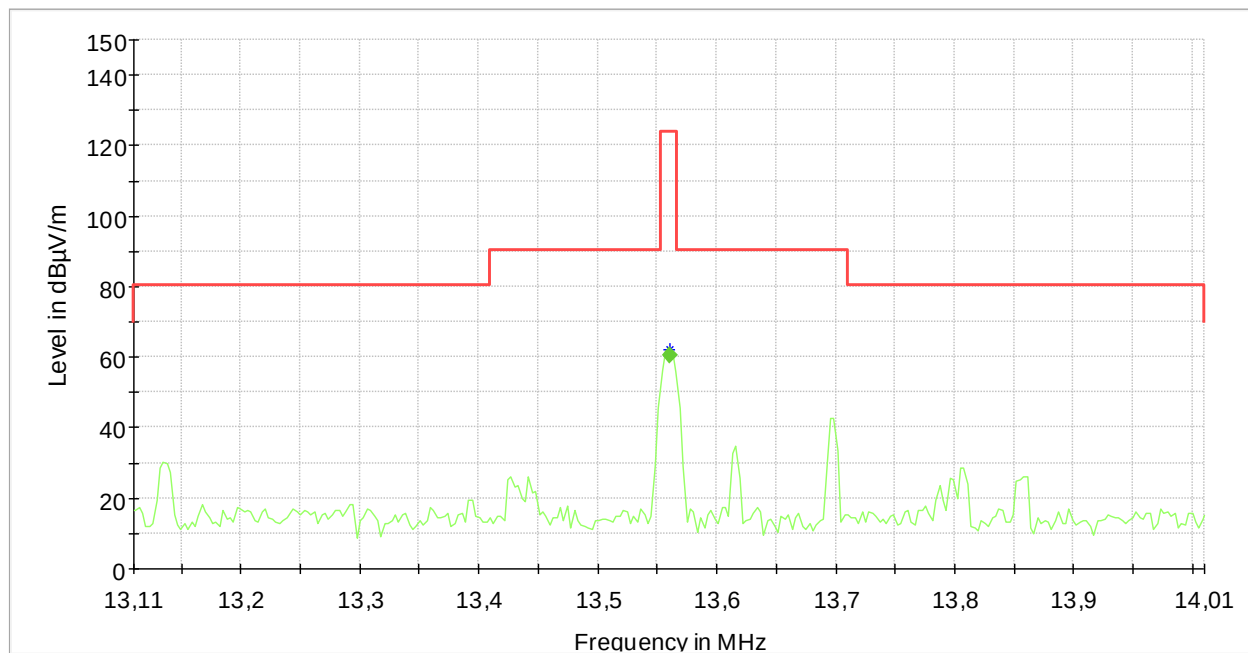
Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 & 15.225 (Adj. to 3m)
 Final_Result QPK
 Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG



Preview Result 1-PK+
 Critical_Freqs PK+
 47 CFR §15.35 (Adj. to 3m)
 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)
0.150359	46.89	---	---	104.06	57.17	1000.0	9.000	100.0	H	135.0
0.390907	38.36	---	---	95.76	57.40	1000.0	9.000	100.0	H	315.0
0.533607	---	41.40	---	73.06	31.66	1000.0	9.000	100.0	H	-13.0
0.736320	---	38.26	---	70.26	32.01	1000.0	9.000	100.0	H	135.0
1.071978	---	34.85	---	67.00	32.15	1000.0	9.000	100.0	H	295.0
1.974123	---	28.37	---	69.54	41.17	1000.0	9.000	100.0	H	88.0
13.560672	---	60.50	---	124.00	63.50	1000.0	9.000	100.0	H	167.0
0.025290	---	---	56.36	139.55	83.19	1000.0	0.200	100.0	H	63.0
0.032013	---	---	53.92	137.50	83.58	1000.0	0.200	100.0	H	139.0
0.069326	---	---	46.50	130.79	84.29	1000.0	0.200	100.0	H	36.0
0.156584	---	---	58.16	123.71	65.55	1000.0	9.000	100.0	H	-2.0
0.281932	---	---	52.76	118.60	65.84	1000.0	9.000	100.0	H	113.0
0.426407	---	---	49.18	115.01	65.83	1000.0	9.000	100.0	H	36.0

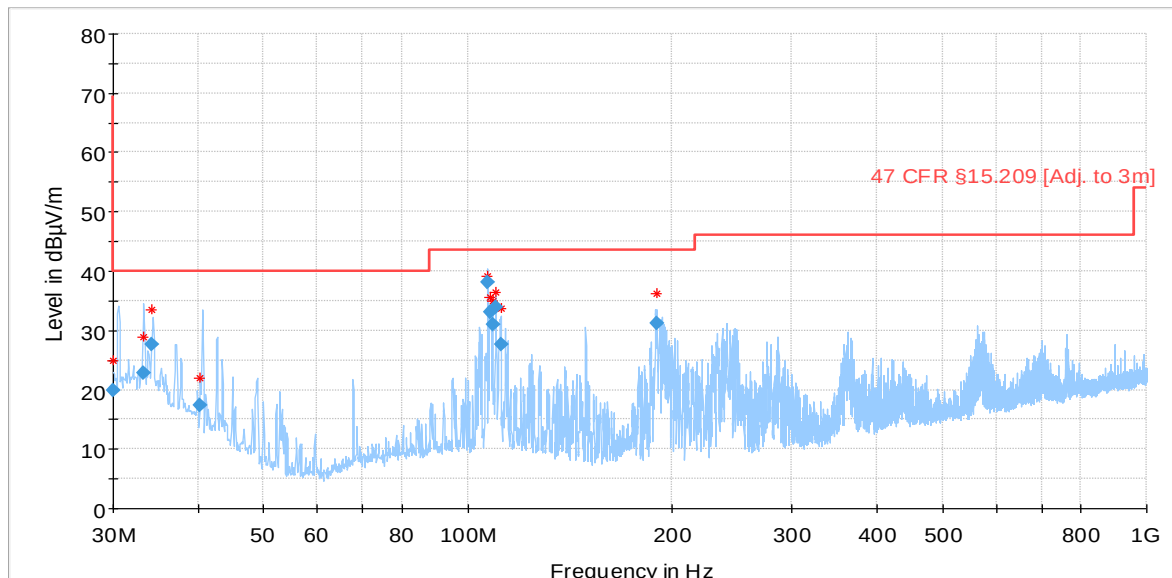
NFC 9kHz – 30MHz –Parallel to Floor (Detail 13.11MHz – 14.01MHz)



- | | | | |
|---|--------------------------------------|---|----------------------|
|  | Preview Result 2-PK+ |  | Preview Result 1-AVG |
|  | Critical_Freqs PK+ |  | Critical_Freqs AVG |
|  | 47 CFR §15.209 & 15.225 [Adj. to 3m] |  | Final_Result AVG |
|  | Final_Result QPK |  | MaxPeak-PK+ (Single) |
|  | QuasiPeak-QPK (Single) |  | Average-AVG (Single) |

NFC 30MHz – 1GHz

Test mode condition	NFC Continuous Tx	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC part 15 subpart C	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	Date: 2022.02.04
Chamber details	Chamber: SAC 5	

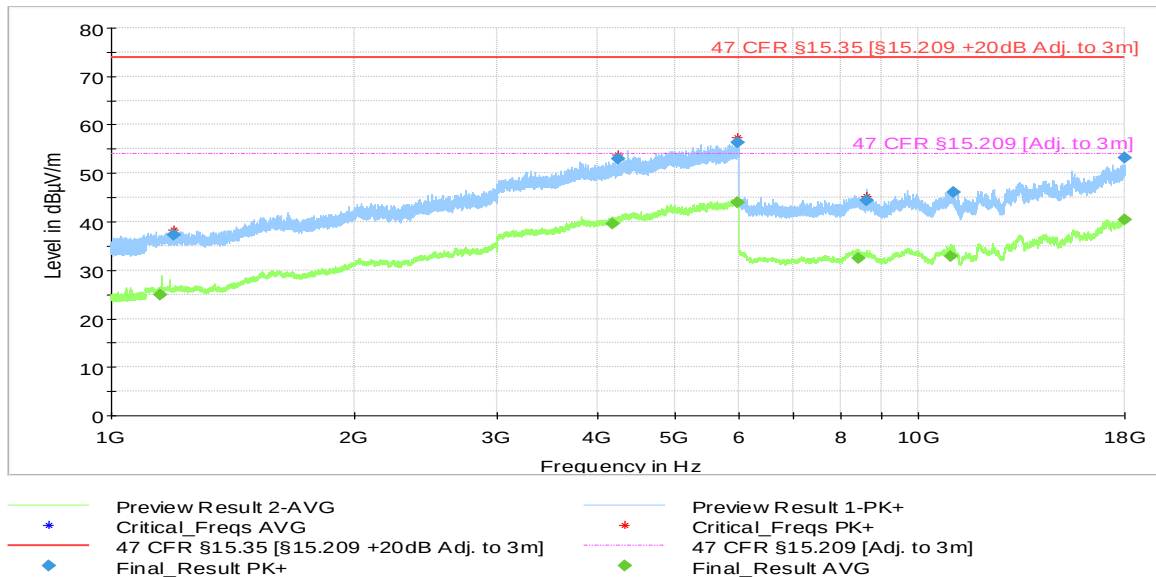


— Preview Result 2-AVG
* Critical_Freqs AVG
— 47 CFR §15.209 [Adj. to 3m]
◆ Final_Result AVG
— Preview Result 1-PK+
* Critical_Freqs PK+
◆ Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.048580	19.80	40.00	20.20	1000.0	120.000	175.0	V	244.0
33.318640	22.91	40.00	17.09	1000.0	120.000	100.0	V	206.0
34.243320	27.68	40.00	12.32	1000.0	120.000	175.0	V	221.0
40.249880	17.42	40.00	22.58	1000.0	120.000	225.0	V	72.0
107.015200	38.03	43.52	5.49	1000.0	120.000	100.0	V	-22.0
107.811520	33.13	43.52	10.40	1000.0	120.000	100.0	V	22.0
108.882920	31.07	43.52	12.45	1000.0	120.000	100.0	V	-22.0
109.944560	34.03	43.52	9.49	1000.0	120.000	100.0	V	311.0
111.761240	27.66	43.52	15.87	1000.0	120.000	175.0	V	116.0
189.862800	31.24	43.52	12.28	1000.0	120.000	275.0	V	-3.0

NFC 1GHz – 18GHz

Test mode condition	NFC Continuous Tx	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC part 15 subpart C	
EUT	A003159409-004	
Ancillary Equipment	A003159409-002, A003159409-006	
Test Engineer	Niall Forrester	Date: 2022.02.07
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)
1149.680000	---	24.94	53.98	29.04	1000.0	1000.000	127.0	V	-22.0
1195.950000	37.24	---	73.98	36.74	1000.0	1000.000	210.0	V	-2.0
4180.384000	---	39.51	53.98	14.46	1000.0	1000.000	210.0	V	68.0
4243.201000	52.99	---	73.98	20.99	1000.0	1000.000	125.0	H	312.0
5970.486000	56.39	---	73.98	17.59	1000.0	1000.000	175.0	H	335.0
5977.886000	---	43.88	53.98	10.10	1000.0	1000.000	125.0	V	-18.0
8408.302000	---	32.38	53.98	21.60	1000.0	1000.000	101.0	V	22.0
8619.084000	44.41	---	73.98	29.57	1000.0	1000.000	125.0	V	-4.0
10952.391000	---	32.82	53.98	21.16	1000.0	1000.000	125.0	H	202.0
11029.713000	46.17	---	73.98	27.81	1000.0	1000.000	126.0	V	112.0
17995.661000	---	40.37	53.98	13.61	1000.0	1000.000	210.0	V	68.0
17997.258000	53.19	---	73.98	20.78	1000.0	1000.000	206.0	V	109.0

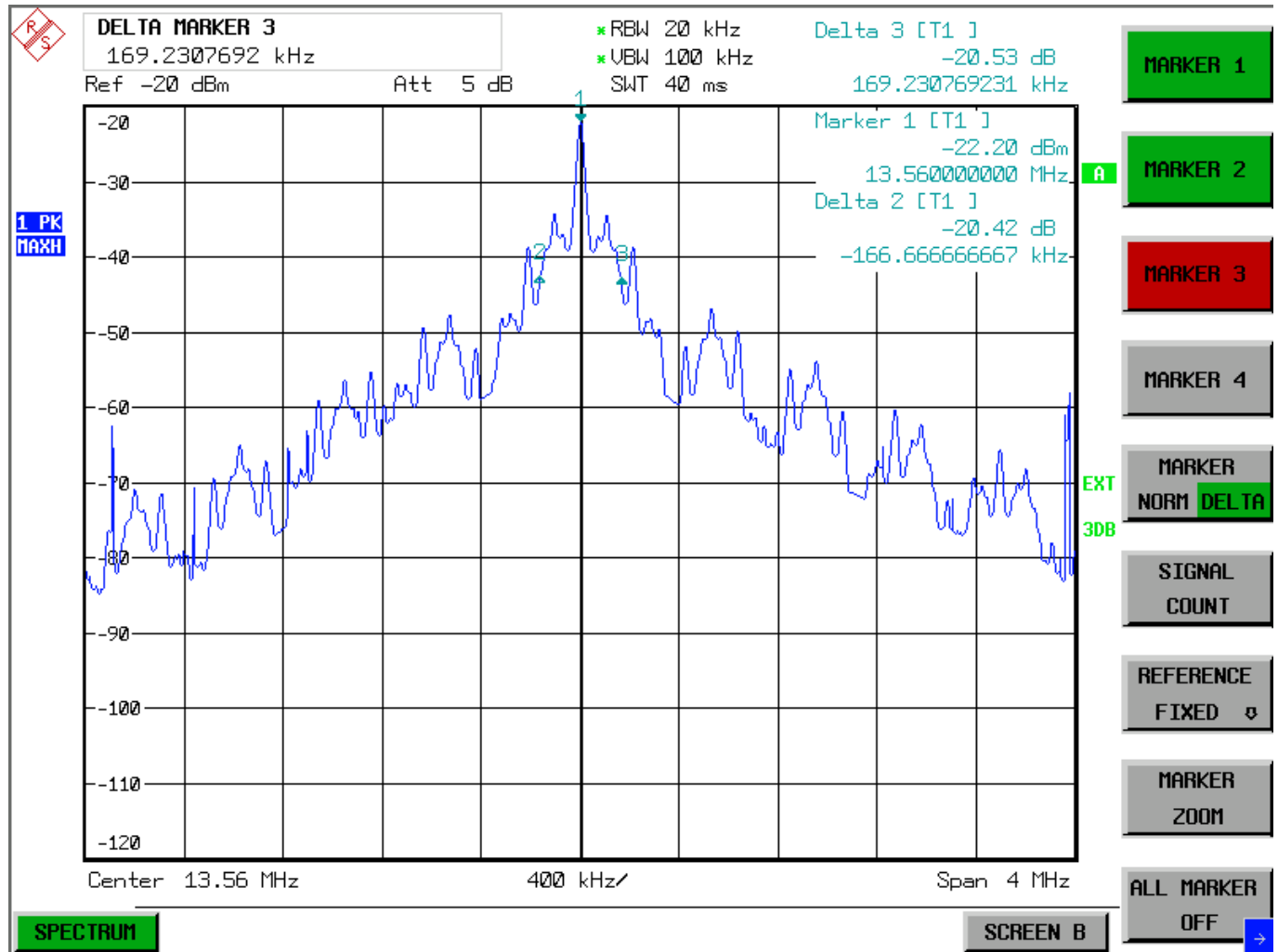
4.3 Test Results – 20dB Bandwidth

4.3.1 20dB Bandwidth – Test Summary

Test Specification		FCC 47 CFR 15.215 (c) (Part 15 Subpart C)		
Test Engineer & Date		Sam Ebadeh	2022.02.16	
EUT and Ancillary Equipment IDs		A003159409-004	A003159409-002 A003159409-006	
EUT Operation Mode(s)		Continuous TX		
EUT Wireless Configuration(s)		13.56 MHz RFID		
EUT Hardware Configuration(s)		-		
Overall Result		PASS		

Test Parameter	Wireless Configuration	Measured Frequency (MHz)	Limit (MHz)	Result
20dB Bandwidth - Lower	13.56 MHz RFID	13.393333	>13.110	PASS
20dB Bandwidth - Upper	13.56 MHz RFID	13.729231	<14.010	PASS

4.3.2 20dB Bandwidth – Test Details



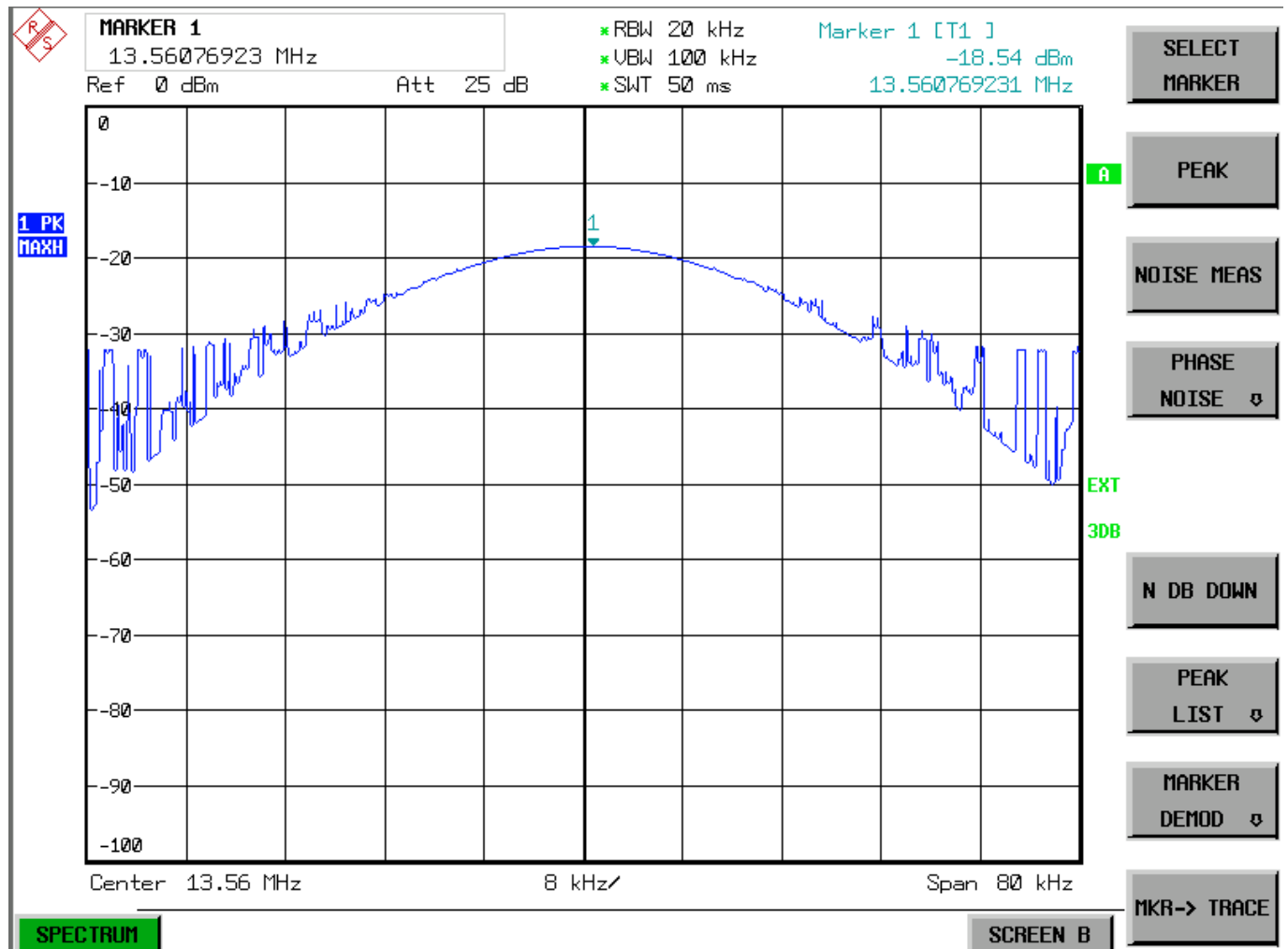
4.4 Test Results – Frequency Tolerance

4.4.1 Frequency Tolerance – Test Summary

Test Specification		FCC 47 CFR 15.225 (e) (Part 15 Subpart C)					
Test Engineer & Date		Sam Ebadeh			2022.02.16 – 2022.02.17		
EUT and Ancillary Equipment IDs		A003159409-004			A003159409-002 A003159409-006		
EUT Operation Mode(s)		Continuous TX					
EUT Wireless Configuration(s)		13.56 MHz RFID					
EUT Hardware Configuration(s)		-					
Overall Result		PASS					
Test Parameter	Wireless Config.	Measured Frequency (MHz)				Limit (MHz)	Result
		Start	2 Min.	5 Min.	10 Min.		
Frequency @ 12.0V -20°C	13.56 MHz RFID	13.560256	13.560256	13.560256	13.560000	13.558644-13.561356	PASS
Frequency @ 12.0V -10°C	13.56 MHz RFID	13.560385	13.560385	13.560385	13.560385	13.558644-13.561356	PASS
Frequency @ 12.0V 0°C	13.56 MHz RFID	13.560513	13.560256	13.560000	13.560769	13.558644-13.561356	PASS
Frequency @ 12.0V 10°C	13.56 MHz RFID	13.560513	13.560256	13.560128	13.560384	13.558644-13.561356	PASS
Frequency @ 10.8V 20°C	13.56 MHz RFID	13.560128	-	-	-	13.558644-13.561356	PASS
Frequency @ 12.0V 20°C	13.56 MHz RFID	13.560513	-	-	-	13.558644-13.561356	PASS
Frequency @ 14.4V 20°C	13.56 MHz RFID	13.560385	-	-	-	13.558644-13.561356	PASS
Frequency @ 12.0V 30°C	13.56 MHz RFID	13.560256	13.560513	13.560513	13.560128	13.558644-13.561356	PASS
Frequency @ 12.0V 40°C	13.56 MHz RFID	13.559872	13.560513	13.560256	13.560128	13.558644-13.561356	PASS
Frequency @ 12.0V 50°C	13.56 MHz RFID	13.560128	13.559744	13.560128	13.560385	13.558644-13.561356	PASS

4.4.2 Frequency Tolerance – Test Details (Worst Case Plot)

NFC: 12.0V, 0°C, 10 minutes



5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – Conducted Radio

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSU26	100308 2704108	2021.07.20	2022.07.20
Temp. & Humidity Logger	Lufft	Opus 20	113.0118.0802.033 2771025	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	2022.07.21
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
Loop Antenna	EMCO	6502	9206-2775 2759035	2021.07.21	2022.07.21
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
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
Conducted Emissions System	EMC 32	V10.60.20
SAC 5	EMC 32	V10.60.20

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for Conducted Radio

Parameter	Uncertainty (Coverage Factor k=2)
20dB Channel Bandwidth & 99% Occupied bandwidth (15.215c)	<5%
Frequency Tolerance (15.225e)	0.33 ppm

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 & 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

See Appendix 1