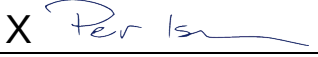


Prüfbericht-Nr.: Test report no.:	60424291-002	Auftrags-Nr.: Order no.:	23870459 030	Seite 1 von 28 Page 1 of 28	
Kunden-Referenz-Nr.: Client reference no.:	1288973	Auftragsdatum: Order date:	2020.05.08		
Auftraggeber: Client:	Axis Communications AB				
Prüfgegenstand: Test item:	OSDP card reader				
Bezeichnung / Typ-Nr.: Identification / Type no.:	AXIS A4020-E / FCC ID PNB-AXISA4020-E				
Auftrags-Inhalt: Order content:	Accredited testing according to FCC 47 CFR Part 15C				
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:	2020.10.30				
Prüfmuster-Nr.: Test sample no.:	See section 2.3				
Prüfzeitraum: Testing period:	2020.11.02 – 2020.11.13				
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: 2021.08.10 Date:	Signed by: Niall Forrester		Datum: 2021.08.10 Date:	Signed by: Per Isacson	
Stellung / Position:	Senior Technical Expert		Stellung / Position:	Lab Manager	
Sonstiges / Other:	The device contains a certified NFC radio module with FCC ID: 2AQPZ-NFC2F				
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	5 = mangelhaft N/T = nicht getestet
* 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 = 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 History60424291-00260424291-002

REVISION	DATE	REMARKS	AUTHOR
001	2021.02.17	First release	Niall Forrester
002	2021.08.10	Added module information and remark in section 3.7	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15.225 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	
15.209 & 15.225 (a,b,c,d)	Radiated Emissions (Intentional Radiators)	YES	4.2	PASS	
15.215 (c)	20 dB bandwidth	YES	4.3	N.P.	Using certified module*
15.225 (e)	Frequency Tolerance	YES	4.4	N.P.	Using certified module*

* See section 2.1 for details

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 / +46709615637

2. PRODUCT INFORMATION

2.1 General Description

Model name:	AXIS A4020-E
Manufacturer:	AXIS
Model number / Marketing name:	AXIS A4020-E
FCC ID:	PNB-AXISA4020-E
Description:	OSDP card reader
Ancillary Equipment:	See section 2.7

The device contains a certified NFC radio module with FCC ID: 2AQPZ-NFC2F

2.2 Device Characteristics

Type of Power Supply	DC
Nominal Supply Voltage	12V
Supply Voltage Range	12-24V
Operating Temperature Range	-30°C - 65°C
Operating Air Humidity Range	10% – 100% relative humidity (non-condensing)
Highest Internal Frequency Source	80 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A002938353-001	Standard sample HW: 2090916 R3.9 FW: Alpha	Radiated Emissions
1	A002938353-002	Standard sample HW: 2090916 R3.9 FW: Alpha	Conducted Emissions

2.4 Wireless Technologies and Bands Supported by the EUT

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

2.6 Wireless Technology Details

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

2.7 Ancillary Equipment

ID	Description	Manufacturer / Model	Hardware & Software Versions
A002938353-004	Power Over Ethernet Injector	Axis T8133	-
A002938353-005	STP Ethernet Cable	-	-
A002938353-006	RJ45 Power & Signalling Cable	-	-
A002938353-007	Door Controller	Axis A1601	-
A002938353-016	STP Ethernet Cable	-	-

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)

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

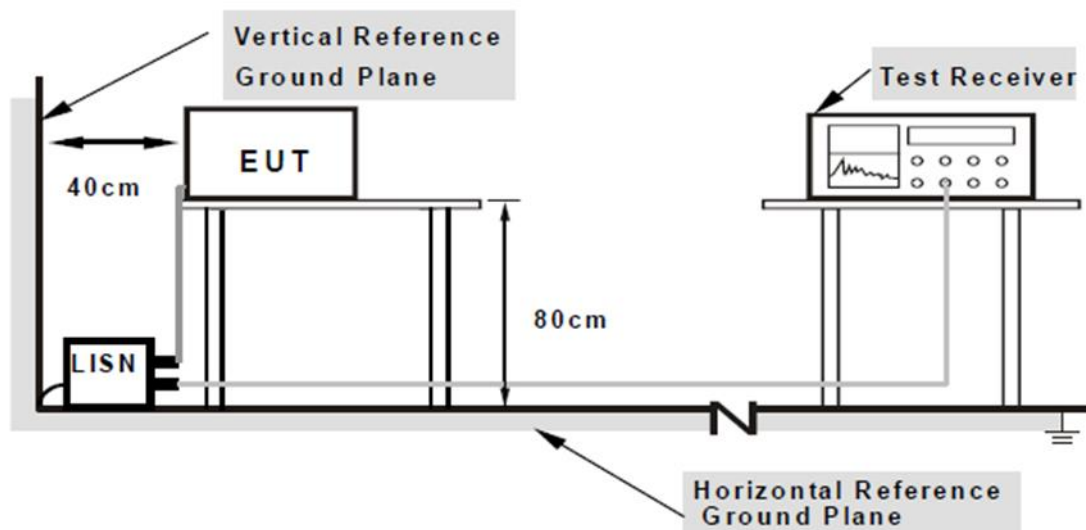
FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	Conducted Emissions
15.209 & 15.225 (a,b,c,d)	Radiated Emissions (Intentional Radiators)	SAC5
15.215 (c)	20 dB bandwidth	Conducted Radio
15.225 (e)	Frequency Tolerance	Conducted Radio

3.4.3 Test Equipment Setup – Conducted Radio

N/A

3.4.4 Test Equipment Setup – Conducted Emissions

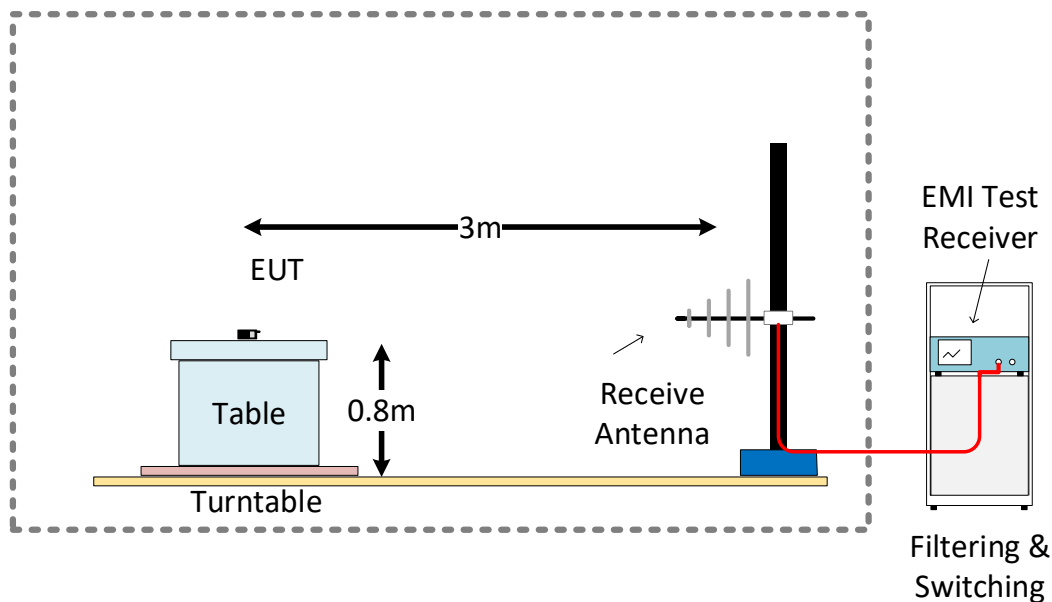
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide 50Ω/ 50μH of coupling impedance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



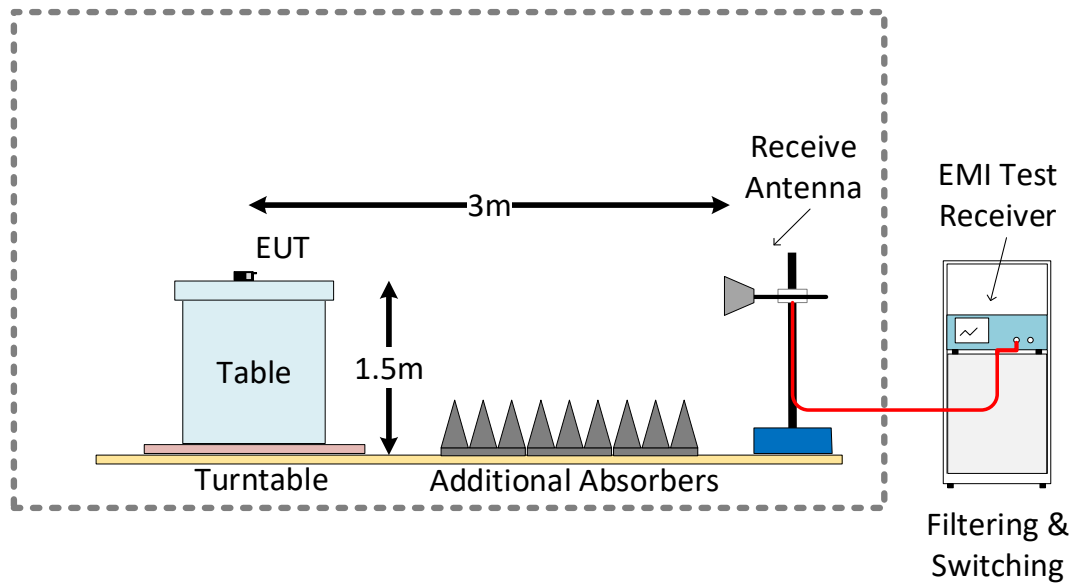
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions)

- 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.

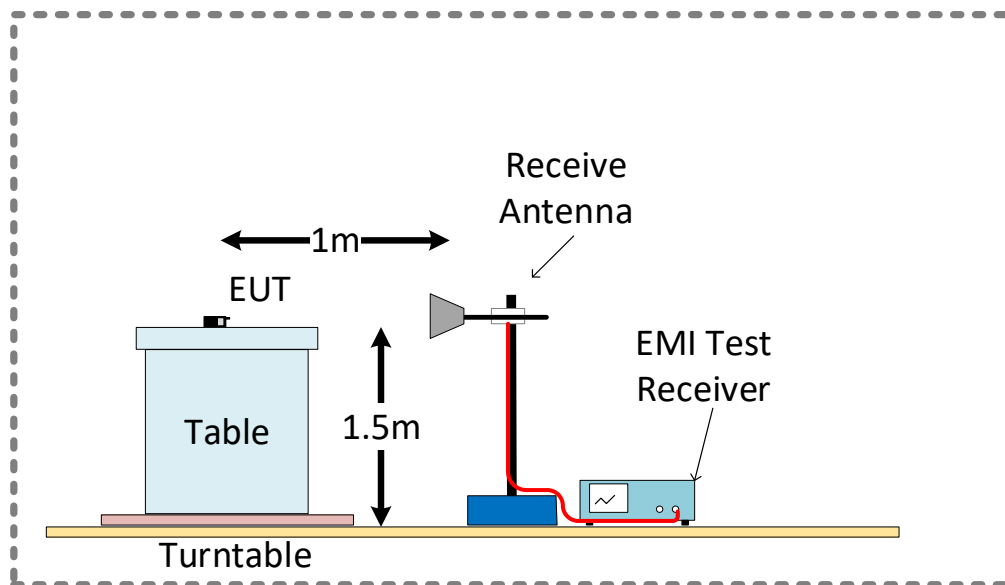
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz

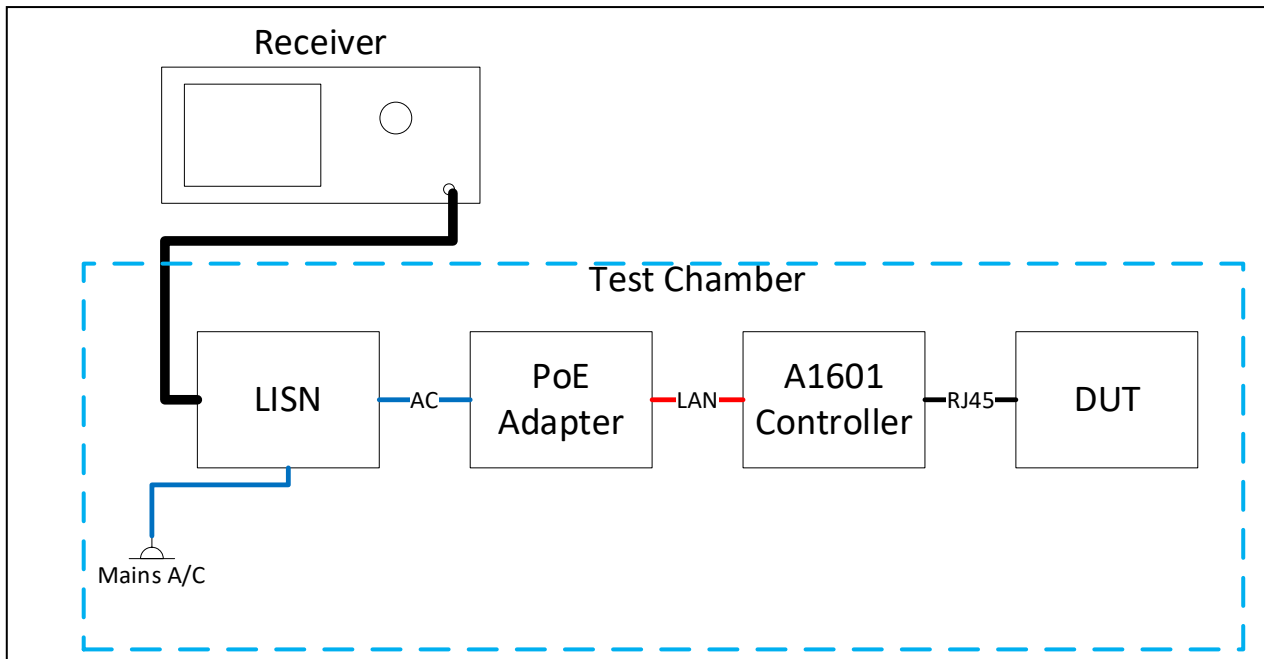


SAC 5 Test Setup Configuration 18GHz – 40GHz

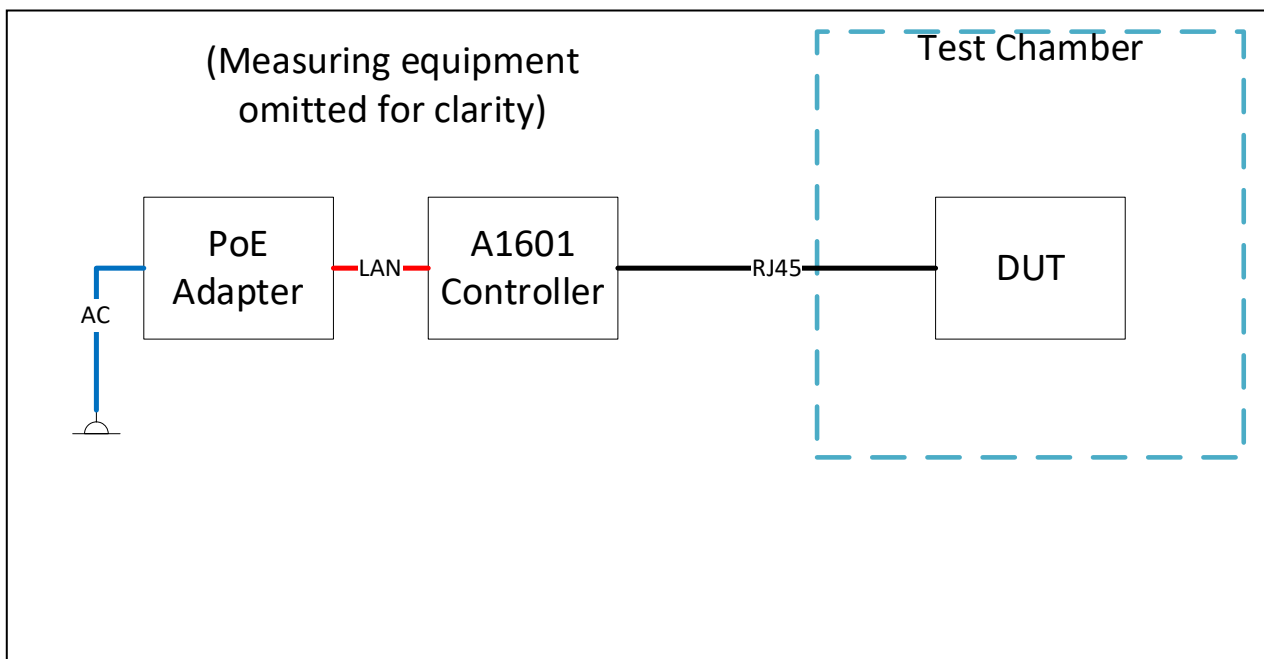


3.5 EUT Configuration During Test

Conducted Emissions Testing: Block Diagram



Radiated Emissions Testing: Block Diagram



3.6 EUT Operation Modes

Operation mode	Description
Continuous Tx	The device is continuously transmitting

3.7 Deviations from the Test Standard

The device contains a certified NFC module and hence a limited set of tests has been performed.

3.8 Environmental Conditions

3.8.1 Environmental Conditions – Conducted Emissions System

Date	Time	Temperature (°C)	Relative Humidity (%)
2020.11.13	08:20	21.9	38

Environmental Conditions Log – Conducted Emissions

3.8.2 Environmental Conditions – SAC5 (Radiated Emissions)

Environmental Conditions Log – SAC5

Date	Time	Temperature (°C)	Relative Humidity (%)
2020.11.02	07:46	18.4	59

4. TEST RESULTS

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

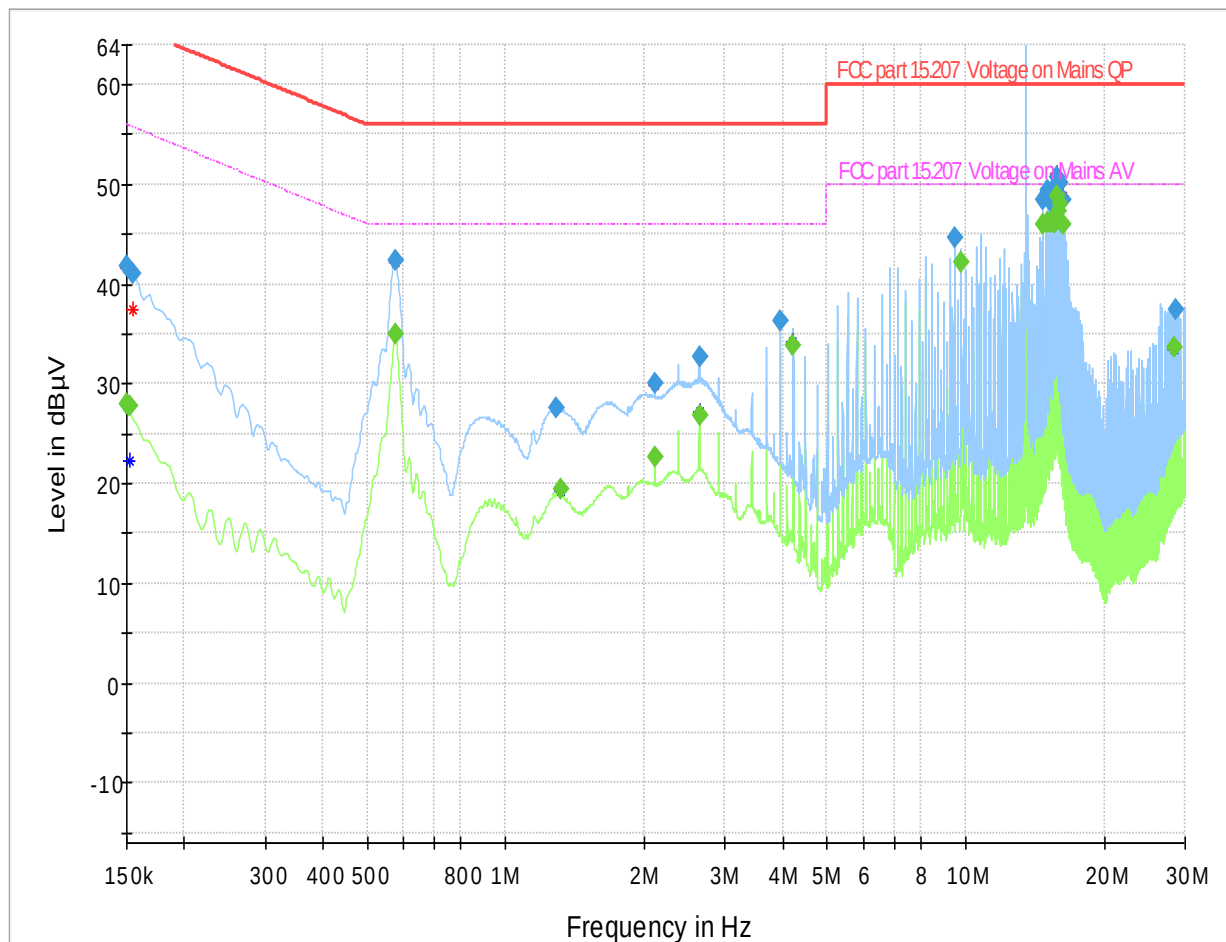
4.1.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Fariborz Abasi	2020.11.13	
EUT and Ancillary Equipment IDs	A002938353-002	A002938353-004 A002938353-006 A002938353-007 A002938353-016	
EUT Operation Mode(s)	Continuous Tx		
EUT Wireless Configuration(s)	13.56MHz RFID		
EUT Hardware Configuration(s)	Power via PoE		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line	13.56MHz RFID	150 kHz – 30 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	13.56MHz 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	A002938353-002	
Ancillary Equipment	A002938353-004: POE A002938353-006: RJ45 Cable A002938353-007: A1601 Controller A002938353-016: STP Ethernet cable	
Test Engineer	Fariborz Abasi	Date: 2020-11-13



- Preview Result 2-CAV
- Preview Result 1-QPK
- * Critical_Freqs CAV
- * Critical_Freqs QPK
- FCC part 15.207 Voltage on Mains QP
- - - FCC part 15.207 Voltage on Mains AV
- ◆ Final_Result QPK
- ◆ Final_Result CAV

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	27.99	56.00	28.01	1000.0	9.000	L1	ON	9.7
0.150000	41.73	---	66.00	24.27	1000.0	9.000	N	ON	9.7
0.152250	---	27.77	55.88	28.10	1000.0	9.000	L1	ON	9.7
0.154500	41.03	---	65.75	24.72	1000.0	9.000	N	ON	9.7
0.575250	---	35.08	46.00	10.92	1000.0	9.000	L1	ON	9.6
0.575250	42.32	---	56.00	13.68	1000.0	9.000	L1	ON	9.6
1.290750	27.51	---	56.00	28.49	1000.0	9.000	N	ON	9.7
1.317750	---	19.39	46.00	26.61	1000.0	9.000	N	ON	9.7
2.109750	---	22.61	46.00	23.39	1000.0	9.000	N	ON	9.7
2.109750	29.98	---	56.00	26.02	1000.0	9.000	N	ON	9.7
2.638500	32.76	---	56.00	23.24	1000.0	9.000	N	ON	9.8
2.638500	---	26.86	46.00	19.14	1000.0	9.000	N	ON	9.8
3.957000	36.25	---	56.00	19.75	1000.0	9.000	L1	ON	9.8
4.220250	---	33.88	46.00	12.12	1000.0	9.000	L1	ON	9.8
9.496500	44.66	---	60.00	15.34	1000.0	9.000	N	ON	9.9
9.759750	---	42.27	50.00	7.73	1000.0	9.000	N	ON	9.9
13.560000	70.31	---	60.00	-10.31	1000.0	9.000	L1	ON	9.9
13.560000	---	66.62	50.00	-16.62	1000.0	9.000	N	ON	9.9
14.770500	48.44	---	60.00	11.56	1000.0	9.000	L1	ON	9.9
14.770500	---	45.93	50.00	4.07	1000.0	9.000	N	ON	10.0
15.033750	---	46.24	50.00	3.76	1000.0	9.000	L1	ON	9.9
15.033750	49.36	---	60.00	10.64	1000.0	9.000	L1	ON	9.9
15.297000	---	46.20	50.00	3.80	1000.0	9.000	N	ON	10.0
15.299250	48.19	---	60.00	11.81	1000.0	9.000	L1	ON	9.9
15.560250	---	46.12	50.00	3.88	1000.0	9.000	L1	ON	9.9
15.560250	49.34	---	60.00	10.66	1000.0	9.000	L1	ON	9.9
15.693000	---	46.13	50.00	3.87	1000.0	9.000	N	ON	10.0
15.695250	49.81	---	60.00	10.19	1000.0	9.000	L1	ON	9.9
15.825750	---	48.77	50.00	1.23	1000.0	9.000	N	ON	10.0
15.825750	50.76	---	60.00	9.24	1000.0	9.000	L1	ON	9.9
15.956250	---	47.27	50.00	2.73	1000.0	9.000	N	ON	10.0
15.958500	50.06	---	60.00	9.94	1000.0	9.000	L1	ON	9.9
16.089000	---	48.15	50.00	1.85	1000.0	9.000	N	ON	10.0
16.089000	50.09	---	60.00	9.91	1000.0	9.000	L1	ON	9.9
16.221750	---	45.92	50.00	4.08	1000.0	9.000	N	ON	10.0
16.221750	48.44	---	60.00	11.56	1000.0	9.000	L1	ON	9.9
28.353750	---	33.66	50.00	16.34	1000.0	9.000	N	ON	10.1
28.619250	37.44	---	60.00	22.56	1000.0	9.000	N	ON	10.1

4.2 Test Results – Radiated Emissions (Intentional Transmitter)

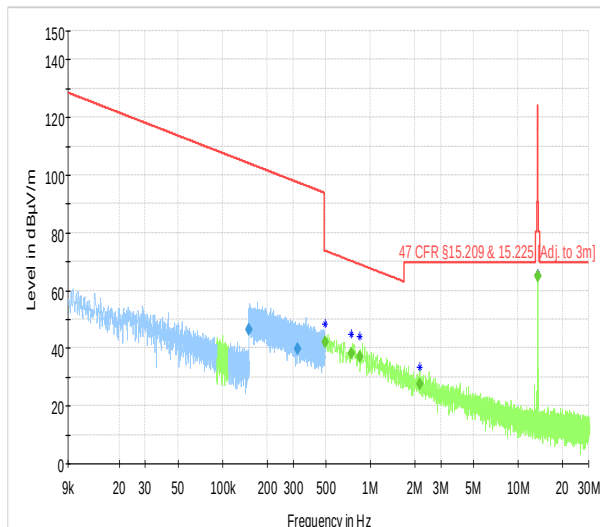
4.2.1 Radiated Emissions (Intentional) – Test Summary

Test Specification		FCC 47 CFR 15.209 (Part 15 Subpart C)	
Test Engineer & Date		Joel Efraimsson Niall Forrester	2020.11.02
EUT and Ancillary Equipment IDs		A002938353-001	A002938353-004 A002938353-005 A002938353-006 A002938353-007
EUT Operation Mode(s)		Continuous Tx	
EUT Wireless Configuration(s)		13.56MHz RFID	
EUT Hardware Configuration(s)		Power via controller / Lab power supply	
Overall Result		PASS	
Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	13.56MHz RFID	9 kHz – 30 MHz	PASS
Radiated Emissions	13.56MHz RFID	30 MHz – 1 GHz	PASS
Radiated Emissions	13.56MHz RFID	1 GHz – 18 GHz	PASS

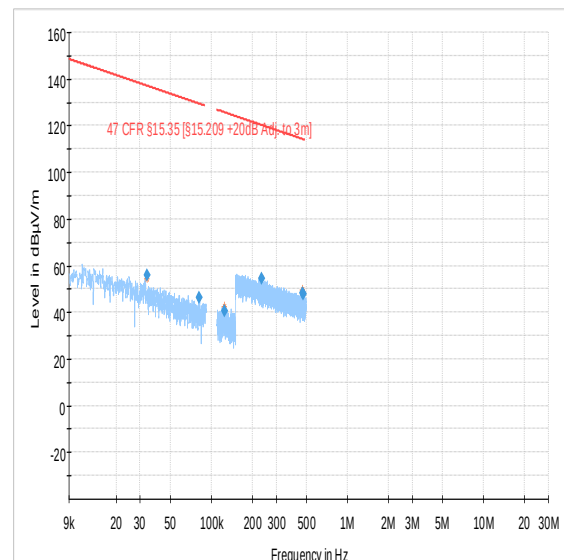
4.2.2 Radiated Emissions (Intentional) – Test Details

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	A002938353-001	
Ancillary Equipment	A002938353-004, A002938353-005, A002938353-006, A002938353-007	
Test Engineer	Joel Efraimsson	Date: 2020.11.02
Chamber details	Chamber: SAC 5	



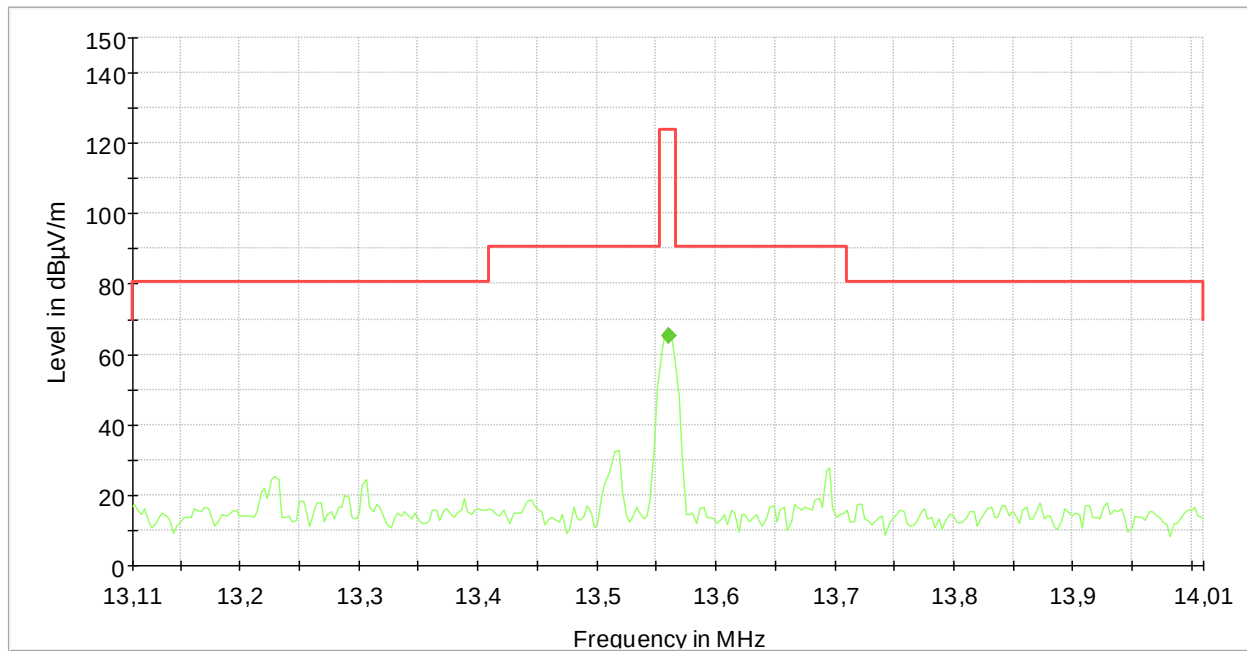
Preview Result 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 & 15.225 (Adj. to 3m)
 Final_Result QPK
 Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG



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)
0.150732	46.60	---	---	104.04	57.44	1000.0	9.000	100.0	H	-26.0
0.322955	39.88	---	---	97.42	57.54	1000.0	9.000	100.0	H	101.0
0.495524	---	42.17	---	73.70	31.54	1000.0	9.000	100.0	H	-45.0
0.742403	---	38.25	---	70.19	31.94	1000.0	9.000	100.0	H	75.0
0.847544	---	37.10	---	69.04	31.94	1000.0	9.000	100.0	H	76.0
2.161416	---	27.40	---	69.54	42.14	1000.0	9.000	100.0	H	11.0
13.560051	---	65.10	---	124.00	58.89	1000.0	9.000	100.0	H	76.0
0.033558	---	---	55.83	137.09	81.25	1000.0	0.200	100.0	H	-27.0
0.080892	---	---	46.44	129.45	83.00	1000.0	0.200	100.0	H	49.0
0.124269	---	---	40.68	125.72	85.04	1000.0	0.200	100.0	H	215.0
0.233961	---	---	54.35	120.22	65.87	1000.0	9.000	100.0	H	313.0
0.470337	---	---	48.06	114.16	66.09	1000.0	9.000	100.0	H	75.0
0.474653	---	---	47.90	114.08	66.17	1000.0	9.000	100.0	H	139.0

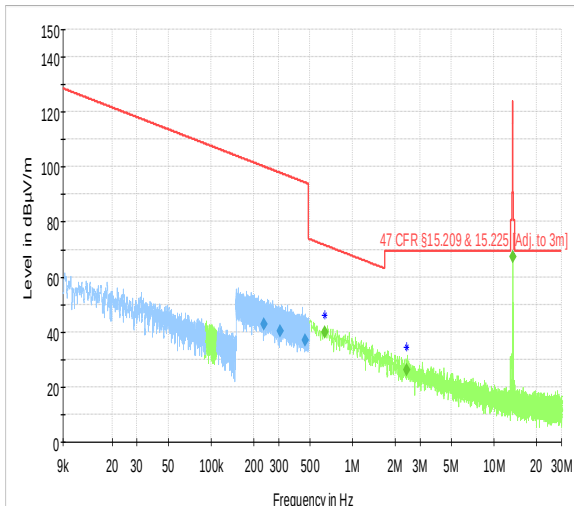
NFC 9kHz – 30MHz –Parallel to Axis (Detail 13.11MHz – 14.01MHz)



- | | | | |
|---|--------------------------------------|---|----------------------|
|  | 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) |

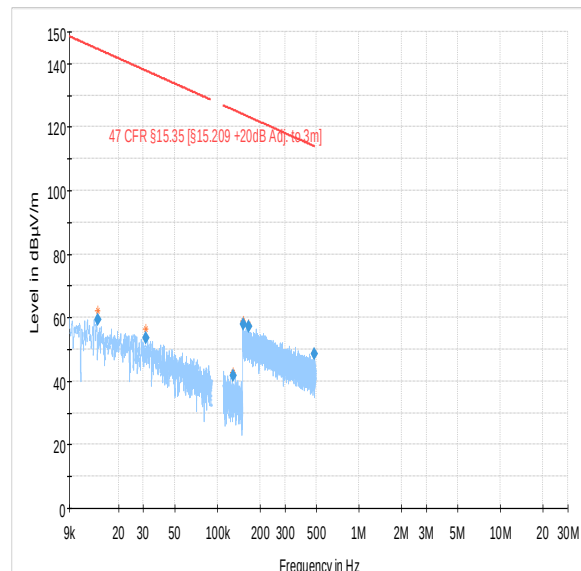
NFC 9kHz – 30MHz –Perpendicular to Axis

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	A002938353-001	
Ancillary Equipment	A002938353-004, A002938353-005, A002938353-006, A002938353-007	
Test Engineer	Joel Efraimsson	Date: 2020.11.02
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)

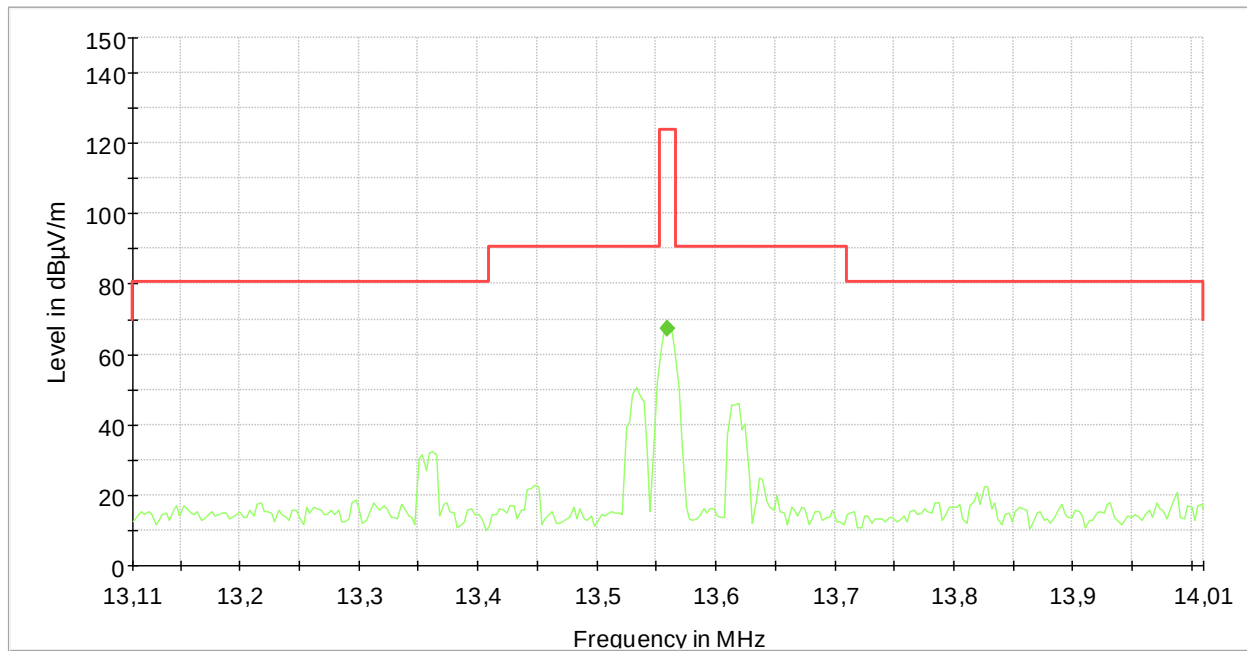
Preview Result 1-AVG
 Critical_Freqs AVG
 Final_Result AVG
 MaxPeak-PK+ (Single)
 Average-AVG (Single)



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)
0.236735	42.83	---	---	100.12	57.29	1000.0	9.000	100.0	H	-26.0
0.307410	40.27	---	---	97.85	57.58	1000.0	9.000	100.0	H	204.0
0.461064	36.92	---	---	94.33	57.41	1000.0	9.000	100.0	H	49.0
0.634157	---	39.69	---	71.56	31.87	1000.0	9.000	100.0	H	154.0
2.410441	---	26.37	---	69.54	43.17	1000.0	9.000	100.0	H	77.0
13.559997	---	67.41	---	124.00	56.59	1000.0	9.000	100.0	H	-14.0
0.014301	---	---	59.33	144.50	85.17	1000.0	0.200	100.0	H	306.0
0.031071	---	---	53.70	137.76	84.06	1000.0	0.200	100.0	H	-15.0
0.128443	---	---	41.55	125.43	83.88	1000.0	0.200	100.0	H	35.0
0.152079	---	---	58.00	123.96	65.96	1000.0	9.000	100.0	H	306.0
0.165887	---	---	57.27	123.21	65.94	1000.0	9.000	100.0	H	215.0
0.485653	---	---	48.56	113.88	65.32	1000.0	9.000	100.0	H	165.0

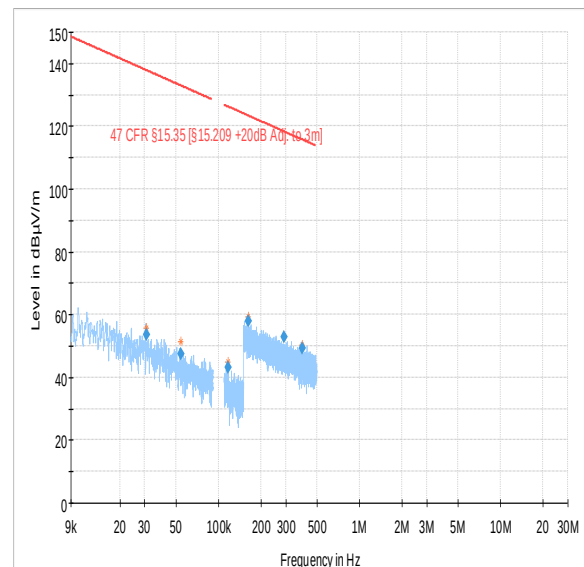
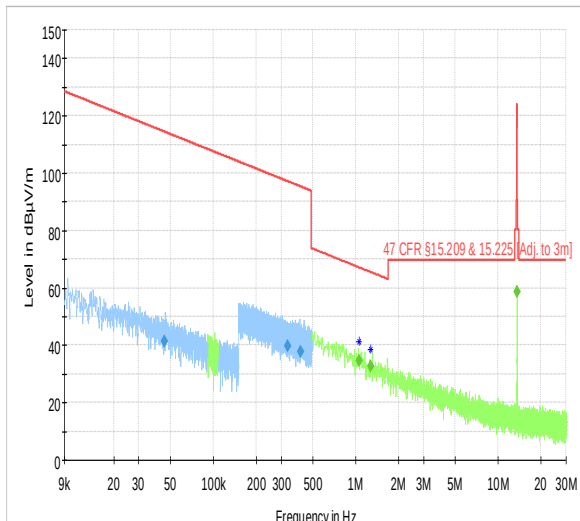
NFC 9kHz – 30MHz –Perpendicular to Axis (Detail 13.11MHz – 14.01MHz)



- | | | | |
|---|--------------------------------------|---|----------------------|
|  | 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) |

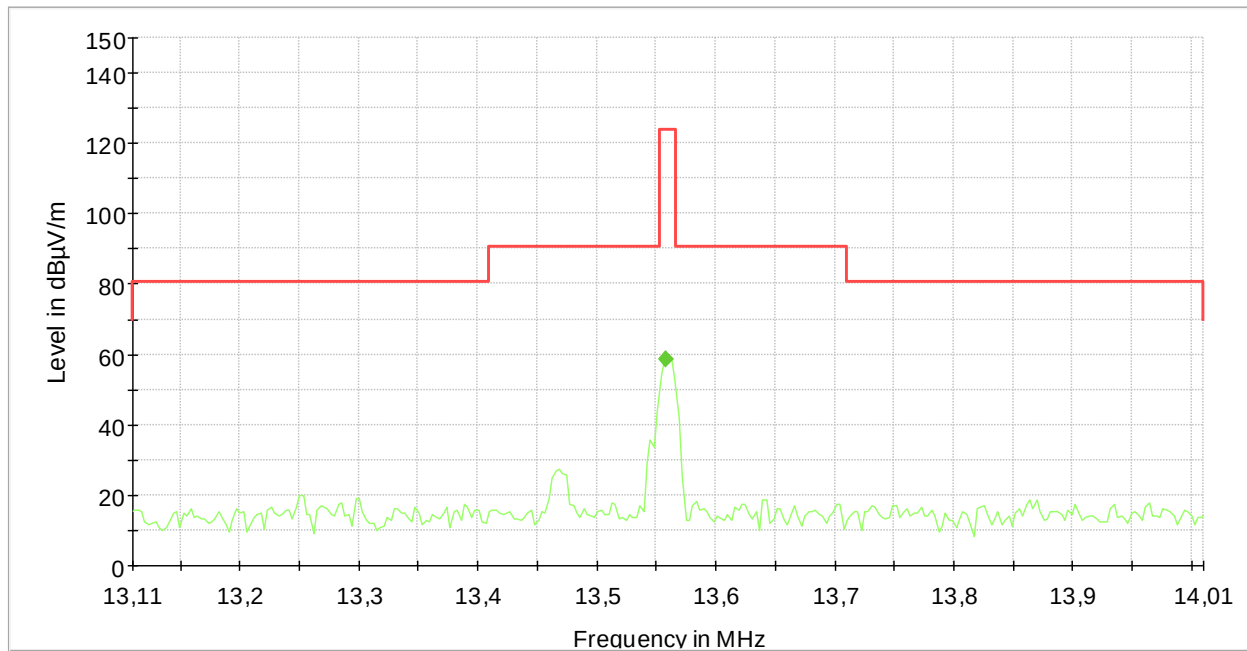
NFC 9kHz – 30MHz –Parallel to Floor

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	A002938353-001	
Ancillary Equipment	A002938353-004, A002938353-005, A002938353-006, A002938353-007	
Test Engineer	Joel Efraimsson	Date: 2020.11.02
Chamber details	Chamber: SAC 5	



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)
0.045155	41.23	---	---	114.51	73.28	1000.0	0.200	100.0	H	225.0
0.333827	39.61	---	---	97.13	57.52	1000.0	9.000	100.0	H	244.0
0.408692	37.89	---	---	95.38	57.48	1000.0	9.000	100.0	H	181.0
1.057640	---	34.66	---	67.12	32.46	1000.0	9.000	100.0	H	281.0
1.269275	---	32.86	---	65.53	32.67	1000.0	9.000	100.0	H	128.0
13.558737	---	58.47	---	124.00	65.53	1000.0	9.000	100.0	H	166.0
0.030978	---	---	53.57	137.78	84.21	1000.0	0.200	100.0	H	124.0
0.053972	---	---	47.53	132.96	85.43	1000.0	0.200	100.0	H	112.0
0.116313	---	---	43.17	126.29	83.13	1000.0	0.200	100.0	H	304.0
0.163048	---	---	57.90	123.36	65.46	1000.0	9.000	100.0	H	49.0
0.291283	---	---	53.05	118.32	65.27	1000.0	9.000	100.0	H	204.0
0.392958	---	---	49.28	115.72	66.44	1000.0	9.000	100.0	H	181.0

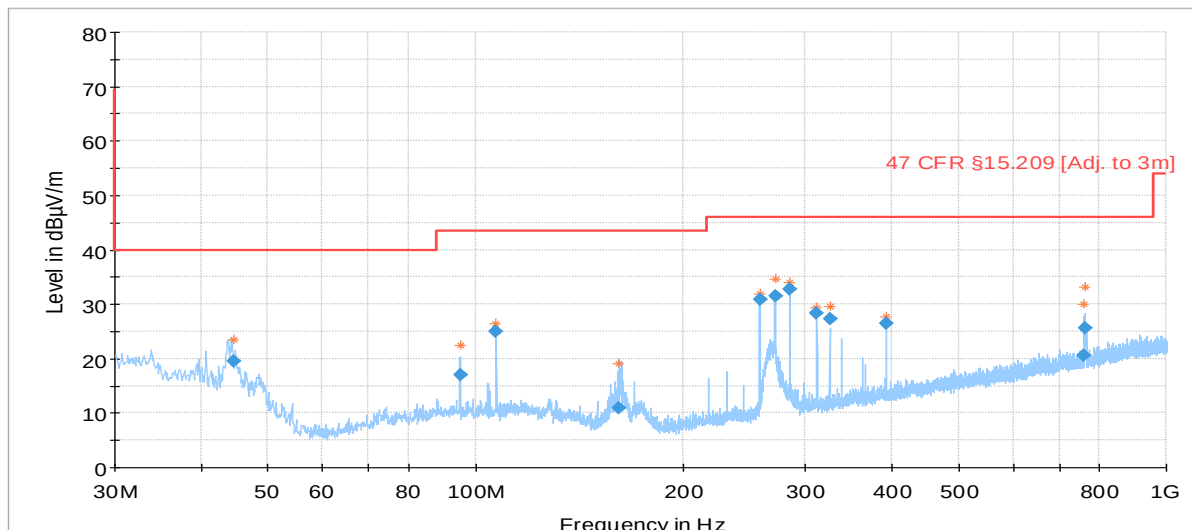
NFC 9kHz – 30MHz –Parallel to Floor (Detail 13.11MHz – 14.01MHz)



- | | | | |
|---|--------------------------------------|---|----------------------|
|  | 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	A002938353-001	
Ancillary Equipment	A002938353-004, A002938353-005, A002938353-006, A002938353-007	
Test Engineer	Niall Forrester	Date: 2020.11.02
Chamber details	Chamber: SAC 5	



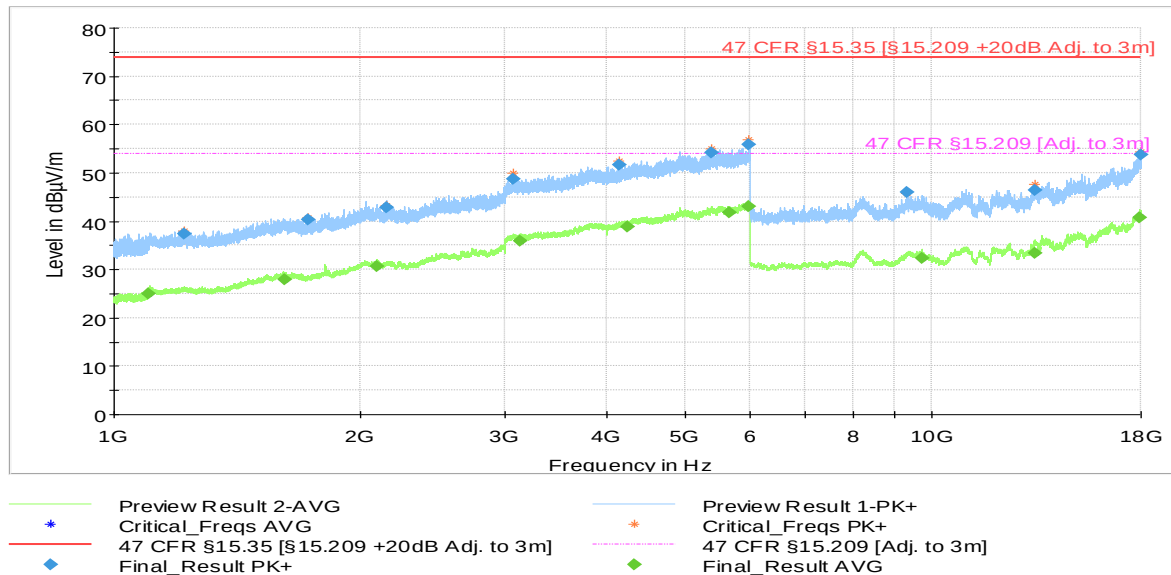
— Preview Result 2-AVG
* Critical_Freqs AVG
— 47 CFR §15.209 [Adj. to 3m]
◆ Final_Result AVG

— 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)
44.540160	19.63	40.00	20.37	1000.0	120.000	100.0	V	68.0
94.863720	16.93	43.52	26.59	1000.0	120.000	100.0	V	112.0
106.999120	24.95	43.52	18.57	1000.0	120.000	100.0	V	334.0
161.302040	10.84	43.52	32.68	1000.0	120.000	175.0	H	-22.0
257.639160	30.81	46.02	15.21	1000.0	120.000	171.0	V	68.0
271.193400	31.60	46.02	14.42	1000.0	120.000	100.0	H	-22.0
284.760160	32.79	46.02	13.23	1000.0	120.000	100.0	H	116.0
311.887880	28.28	46.02	17.74	1000.0	120.000	100.0	H	310.0
325.457920	27.22	46.02	18.80	1000.0	120.000	100.0	H	-22.0
393.250840	26.36	46.02	19.66	1000.0	120.000	100.0	H	-4.0
760.396920	20.65	46.02	25.37	1000.0	120.000	100.0	H	130.0
762.683240	25.58	46.02	20.44	1000.0	120.000	175.0	V	26.0

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	A002938353-001	
Ancillary Equipment	A002938353-004, A002938353-005, A002938353-006, A002938353-007	
Test Engineer	Niall Forrester	Date: 2020.11.02
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)
1101.484042	---	24.92	53.98	29.06	1000.0	1000.000	125.0	H	143.0
1217.649000	37.43	---	73.98	36.55	1000.0	1000.000	188.0	V	112.0
1617.331000	---	27.99	53.98	25.99	1000.0	1000.000	175.0	H	280.0
1726.341000	40.22	---	73.98	33.76	1000.0	1000.000	169.0	V	68.0
2099.456000	---	30.62	53.98	23.36	1000.0	1000.000	177.0	H	116.0
2151.176000	42.83	---	73.98	31.15	1000.0	1000.000	210.0	V	248.0
3078.427000	48.78	---	73.98	25.20	1000.0	1000.000	175.0	H	158.0
3139.275000	---	35.87	53.98	18.11	1000.0	1000.000	125.0	V	-18.0
4140.265000	51.72	---	73.98	22.26	1000.0	1000.000	127.0	H	200.0
4235.379000	---	38.79	53.98	15.19	1000.0	1000.000	169.0	H	202.0
5374.889000	54.07	---	73.98	19.90	1000.0	1000.000	210.0	V	131.0
5641.517000	---	41.88	53.98	12.10	1000.0	1000.000	175.0	V	116.0
5974.383000	55.77	---	73.98	18.21	1000.0	1000.000	125.0	H	202.0
5975.698000	---	42.99	53.98	10.99	1000.0	1000.000	137.0	H	290.0
9319.644000	45.88	---	73.98	28.10	1000.0	1000.000	125.0	H	130.0
9705.857000	---	32.41	53.98	21.57	1000.0	1000.000	125.0	V	85.0
13345.222000	46.40	---	73.98	27.58	1000.0	1000.000	210.0	V	175.0
13346.546000	---	33.35	53.98	20.63	1000.0	1000.000	175.0	V	8.0
17964.349000	---	40.83	53.98	13.15	1000.0	1000.000	175.0	H	175.0
17985.440000	53.67	---	73.98	20.31	1000.0	1000.000	147.0	V	292.0

4.3 Test Results – 20dB Bandwidth

4.3.1 20dB Bandwidth – Test Summary

Test not performed. The device uses a certified module for NFC

4.4 Test Results – Frequency Tolerance

4.4.1 Frequency Tolerance – Test Summary

Test not performed. The device uses a certified module for NFC

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – Conducted RF System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSU26	100308 2704108	2020-07-14	2021-07-14
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	ENV216	101090 2704076	2020.07.16	2021.07.16
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674 2704016	2020.07.17	2021.07.17

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	2020.07.17	2021.07.17
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988 2823181	2019.07.23	2021.07.23
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678 2823164	2019.07.15	2021.07.15
Control Device	Maturo	NCD	NCD/393/2372.01	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	2020.08.04	2021.08.04
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	2020.08.04	2021.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333 2761265	2020.08.04	2021.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335 2761266	2020.08.04	2021.08.04
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	2020.08.04	2021.08.04
Humidity Temperature Probe	Lufft	OPUS 20	1236.0118.0802.033 2771042	2020.07.31	2022.07.31

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
Conducted Radio	N/A	-
Conducted Emissions System	EMC 32	V10.60.10
SAC 5	EMC 32	V10.60.10

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

For photographs see Appendix 1