



Report No. 389668-01

FCC TEST REPORT / IC TEST REPORT

Product	MosaiQ 125		
Name and address of the applicant	Quotient Suisse SA Business Park Terre Bonne Route de Crassier 13 1262 Eysins, Switzerland		
Name and address of the manufacturer	Quotient Suisse SA Business Park Terre Bonne Route de Crassier 13 1262 Eysins, Switzerland		
Model	REF: 126001		
Rating	100 – 240V		
Trademark	Quotient Suisse SA		
Serial number	5290000126		
Additional information	Radio Frequency Identification (RFID) -13.56MHz.		
Tested according to	FCC Part 15.225 Low Power Transmitter 13.110 - 14.010 MHz Band Industry Canada RSS-210, Issue 10 Low Power Licence-Exempt Radiocommunications Devices		
Order number	389668		
Tested in period	2020-02-03 – 2020-02-04		
Issue date	2020-06-09		
Name and address of the testing laboratory	Nemko GmbH & Co. KG Reetzstraße 58 D-76327 Pfinztal Tel.: + 49 (0) 7240 – 63 - 0 Fax: + 49 (0) 7240 – 63 – 11	 Bundesnetzagentur BNetzA: CAB-17/21-17	FCC No: 973501 IC OATS: 10921A
 Prepared by [F. Hupbauer]  Approved by [Dipl.-Ing. P. Lukas]			

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CONTENTS

1	TEST INFORMATION	3
1.1	Test item	3
1.2	Normal test condition	4
1.3	Test Engineer(s)	4
1.4	Description of modification for Modification Filing	4
1.5	Family List Rational	4
1.6	Antenna Requirement	4
1.7	Worst-Case Configuration and Mode	4
1.8	Comments	4
2	TEST REPORT SUMMARY	5
2.1	General	5
2.2	Test summary	6
3	TEST RESULTS	7
3.1	Power Line Conducted Emissions	7
3.2	99 % Occupied Bandwidth	9
3.3	Fundamental Field Strength	12
3.4	Spurious emissions (radiated)	15
3.5	Transmitter Frequency Stability	21
4	Measurement Uncertainty	22
5	LIST OF TEST EQUIPMENT	23
6	BLOCK DIAGRAM	24
6.1	Test site radiated emission	24

1 TEST INFORMATION

1.1 Test item

Name :	MosaiQ 125
Model/version :	REF: 126001
FCC ID:	2AWE5 MosaiQ 125
Serial number :	5290000126
Software identity and/or version :	02.03 9891 00 COP firmware 1.300.1906.21001 User Software 1.2.1904.18001 Service Software For all firmware versions and article numbers see file: Uniload_5290_Checkscript.txt
Frequency Range :	13.553-13.567 MHz
Number of Channels :	1
Operating Modes :	Transmitter
Type of Modulation :	ASK
User Frequency Adjustment :	None
Maximum field strength @ 3m:	52.88 dBµV/m
Type of Power Supply :	Entire unit: 100 – 240V / 50 – 60Hz RFID Module: 24V DC
Antenna Connector :	Integral loop antenna
Number of antennas:	Module 1: 5 identical antennas Module 2: 8 identical antennas Module 3: 8 identical antennas
Antenna Diversity Supported :	None
Desktop Charger :	None

Description of test item

The MosaiQ is a fully automated, floor standing analyzer system for in-vitro diagnostic use. It performs blood type detection and disease testing.

The device contains three RFID modules for identifying samples and containers.

Module 1 Loading tower: It can control five identical antennas to ensure that a tag is detected.

Module 2 DDCA: It can control eight identical antennas to detected different containers.

Module 3 Buffer reconstitution module: It can control eight identical antennas to detected different containers.

Module 1 and module 3 have the same design, they only contain a different number of antennas.

The EUT is a class A device.

Class A digital device:

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

1.2 Normal test condition

Temperature: 19 - 22 °C
Relative humidity: 38 - 45 %
Normal test voltage: 120V / 60Hz

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frederic Hupbauer

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

The modules were set to continuous operation and the maximum output level was set in the software.

For every module the antenna with the highest output with and without tag was tested.

The radiated measurements are tested on three axes.

The worst-case-scenario is reported.

1.8 Comments

The radiated measurements are tested on three axis.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15.225 and Industry Canada RSS-210, Issue 10 and RSS-GEN, Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic shielded room ($f < 1$ GHz) and a fully-anechoic shielded room ($f > 1$ GHz) at a measuring distance of 3m.

A description of the test facility is on file with the FCC and Industry Canada.

Test setup photo document: 389668-01TRFFCC Annex – Test set-up photos

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DXT Equipment Code

☐ Family Listing



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test summary

Name of test	FCC Part 15 reference	RSS-210 Issue 9 & RSS-GEN Issue 5	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	N/A ¹
Power-line Conducted Emission	15.207(a)	8.8 (RSS-GEN)	Complies
Occupied Bandwidth	N/A	6.7 (RSS-GEN)	-
Fundamental Field strength	15.225(a)	B.6(a)	Complies
Band Emissions	15.225(b)(c)	B.6(b)(c)	Complies
Spurious Emissions (Radiated)	15.225 (d) 15.209	B.6(d) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies
Frequency stability	15.225(e)	B.6	Complies

¹ Integral loop antenna

RSS Gen issue 5 covers section 7 & 6

RSS 210 issue 10 covers section B.6

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Para. No.: 8.8

Test Performed By: F. Hupbauer

Date of Test: 2020-02-04

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

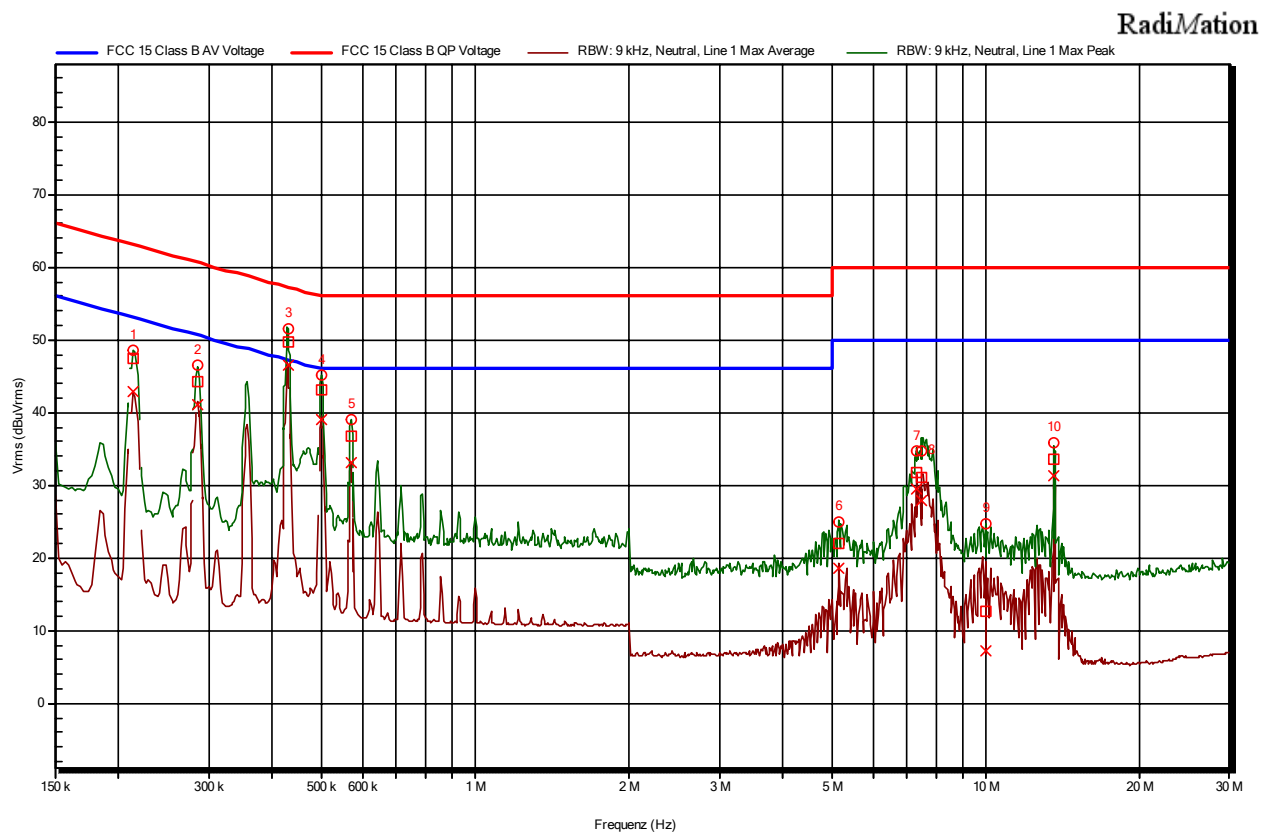
Test Results: Complies.

Measurement Data: See attached graph.

Input voltage to EUT: 120V/60Hz

Highest measured value (L1 and N):

Diagram



Final measurements QP with Quasi-Peak-Detector

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	LISN
1	0,213000 MHz	47,41 dBuVrms	63,09 dBuVrms	-15,68 dB	Line 1
2	0,285000 MHz	44,27 dBuVrms	60,67 dBuVrms	-16,40 dB	Neutral
3	0,429000 MHz	49,62 dBuVrms	57,27 dBuVrms	-7,65 dB	Neutral
4	0,498750 MHz	43,10 dBuVrms	56,02 dBuVrms	-12,92 dB	Neutral
5	0,570750 MHz	36,68 dBuVrms	56,00 dBuVrms	-19,32 dB	Line 1
6	5,136000 MHz	22,01 dBuVrms	60,00 dBuVrms	-37,99 dB	Line 1
7	7,289250 MHz	31,80 dBuVrms	60,00 dBuVrms	-28,20 dB	Line 1
8	7,458000 MHz	31,07 dBuVrms	60,00 dBuVrms	-28,93 dB	Neutral
9	10,007250 MHz	12,57 dBuVrms	60,00 dBuVrms	-47,43 dB	Neutral
10	13,562250 MHz	33,66 dBuVrms	60,00 dBuVrms	-26,34 dB	Neutral

Final measurements AV with Average-Detector

Peak Number	Frequency	Average	Average Limit	Average Difference	LISN
1	0,213000 MHz	42,86 dBuVrms	53,09 dBuVrms	-10,22 dB	Line 1
2	0,285000 MHz	41,02 dBuVrms	50,67 dBuVrms	-9,65 dB	Neutral
3	0,429000 MHz	46,58 dBuVrms	47,27 dBuVrms	-0,69 dB	Neutral
4	0,498750 MHz	39,03 dBuVrms	46,02 dBuVrms	-6,99 dB	Neutral
5	0,570750 MHz	33,06 dBuVrms	46,00 dBuVrms	-12,94 dB	Line 1
6	5,136000 MHz	18,53 dBuVrms	50,00 dBuVrms	-31,47 dB	Line 1
7	7,289250 MHz	29,40 dBuVrms	50,00 dBuVrms	-20,60 dB	Line 1
8	7,458000 MHz	27,87 dBuVrms	50,00 dBuVrms	-22,13 dB	Neutral
9	10,007250 MHz	7,25 dBuVrms	50,00 dBuVrms	-42,75 dB	Neutral
10	13,562250 MHz	31,26 dBuVrms	50,00 dBuVrms	-18,74 dB	Neutral

3.2 99 % Occupied Bandwidth

Para. No.: 6.7 RSS-Gen

Test Performed By: F. Hupbauer

Date of Test: 2020-02-03

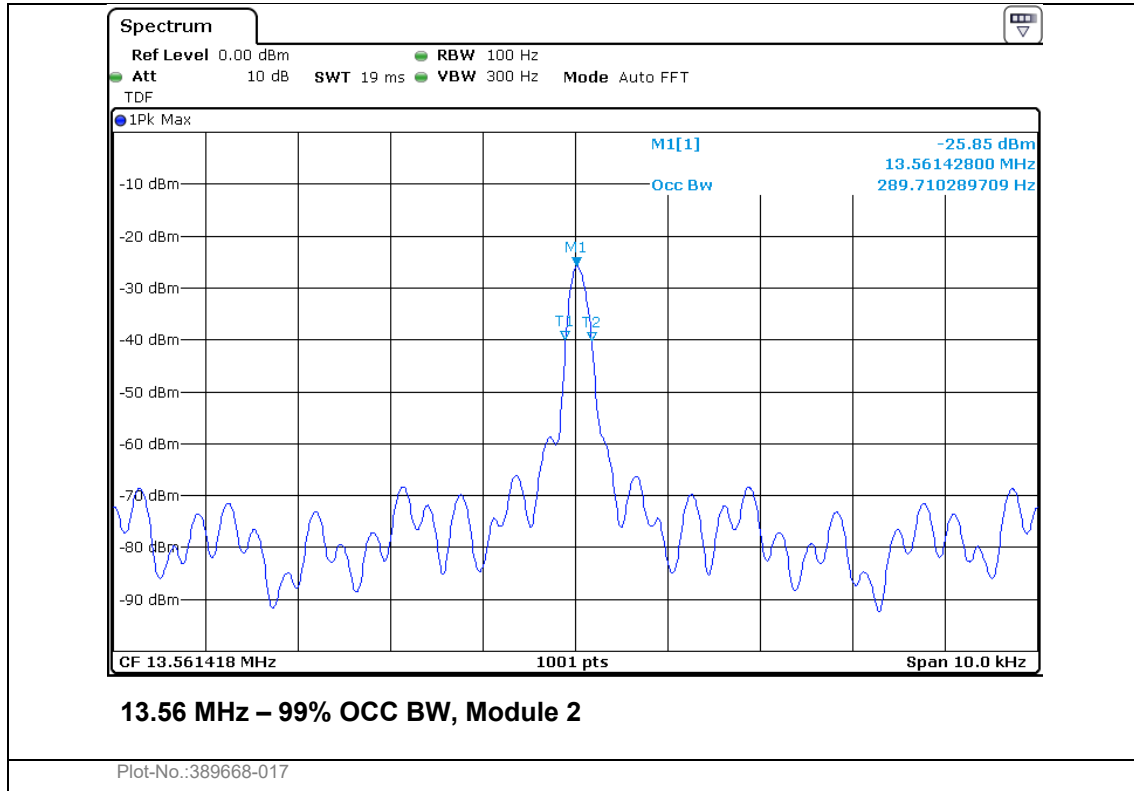
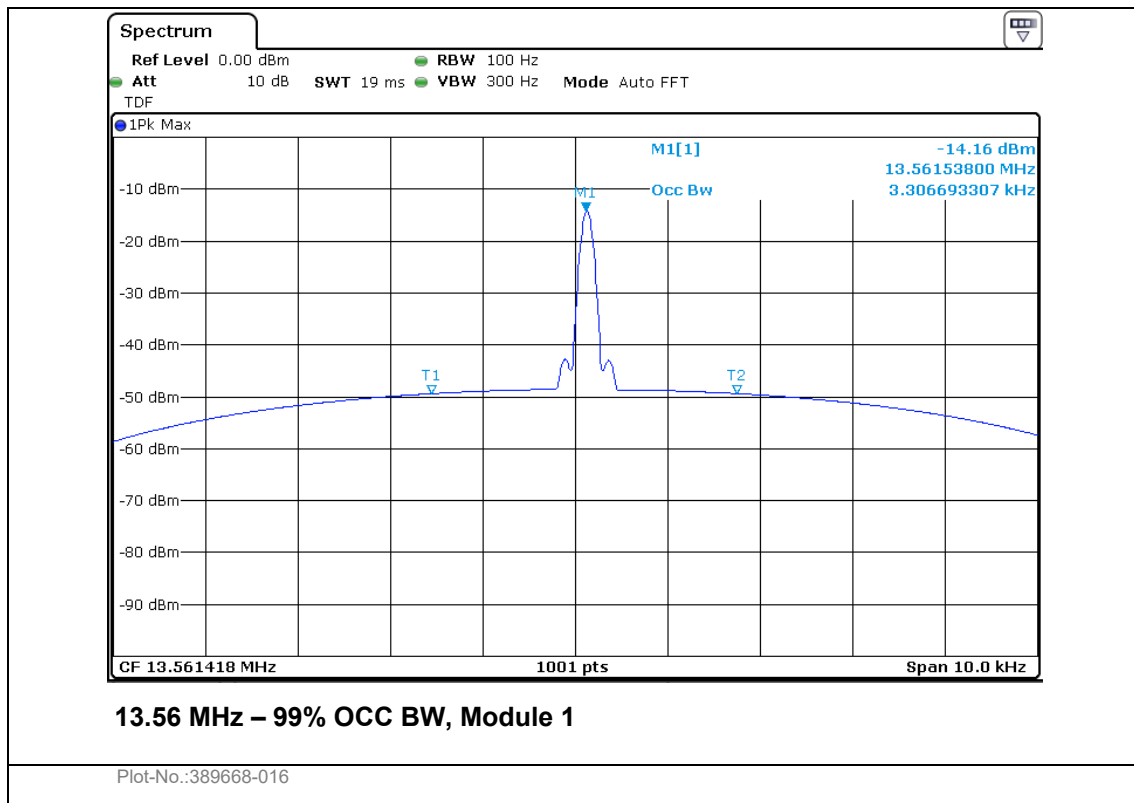
Test Results: Complies

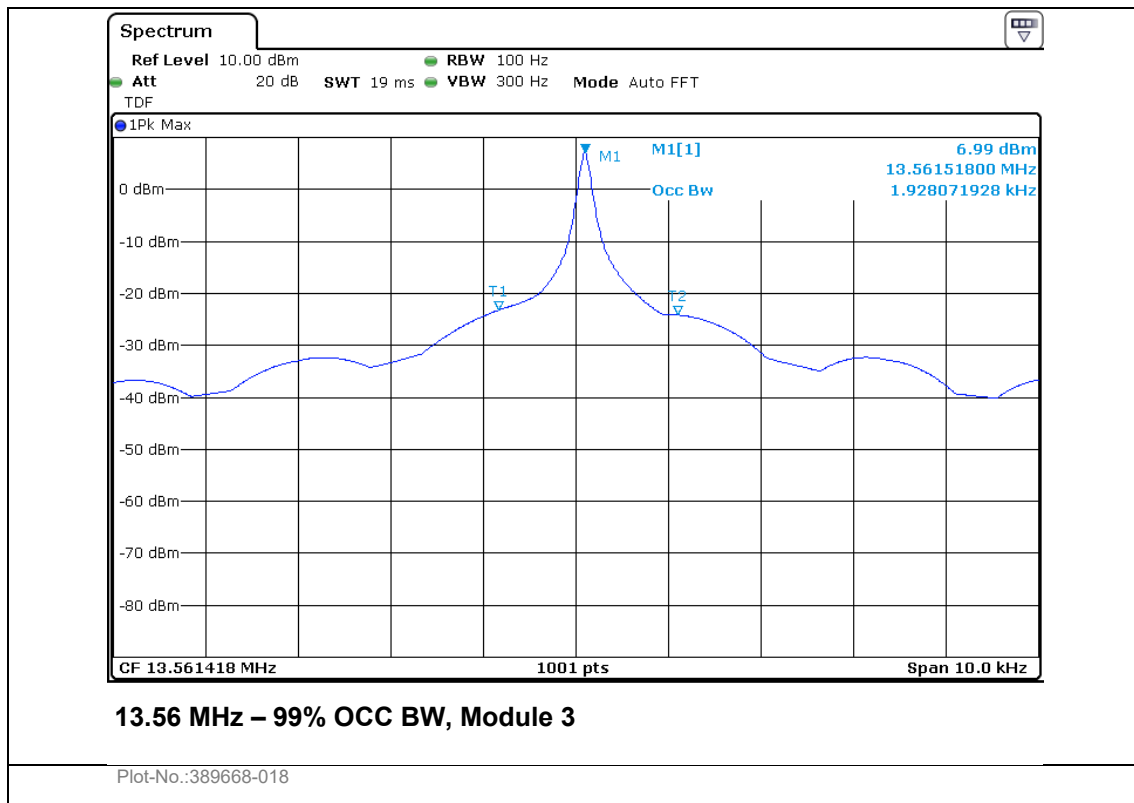
Measurement Data:

99% BW (kHz)	
13.56MHz	
Module 1	3.3 kHz
Module 2	289.7 Hz
Module 3	1.9 kHz

Requirements:

For information only





3.3 Fundamental Field Strength

Para. No.: 15.225 (a) / B.6 (a)

Test Performed By: F. Hupbauer	Date of Test: 2020-02-03
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Test Results: Complies

Measurement data:

Maximum field strength

	RF channel (MHz)	Measured PK value (dB μ V/m) @ 3m	Distance Correction factor (dB)	Converted Limit @3m (dB μ V/m)
Module 1	13.56	45.74	-40.0	124.0
Module 2	13.56	36.11	-40.0	124.0
Module 3	13.56	52.88	-40.0	124.0

The limit line given in the graph is corrected to 3 m distance.

Radiated measurements are performed at 3 m distance.

Detachable antenna?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

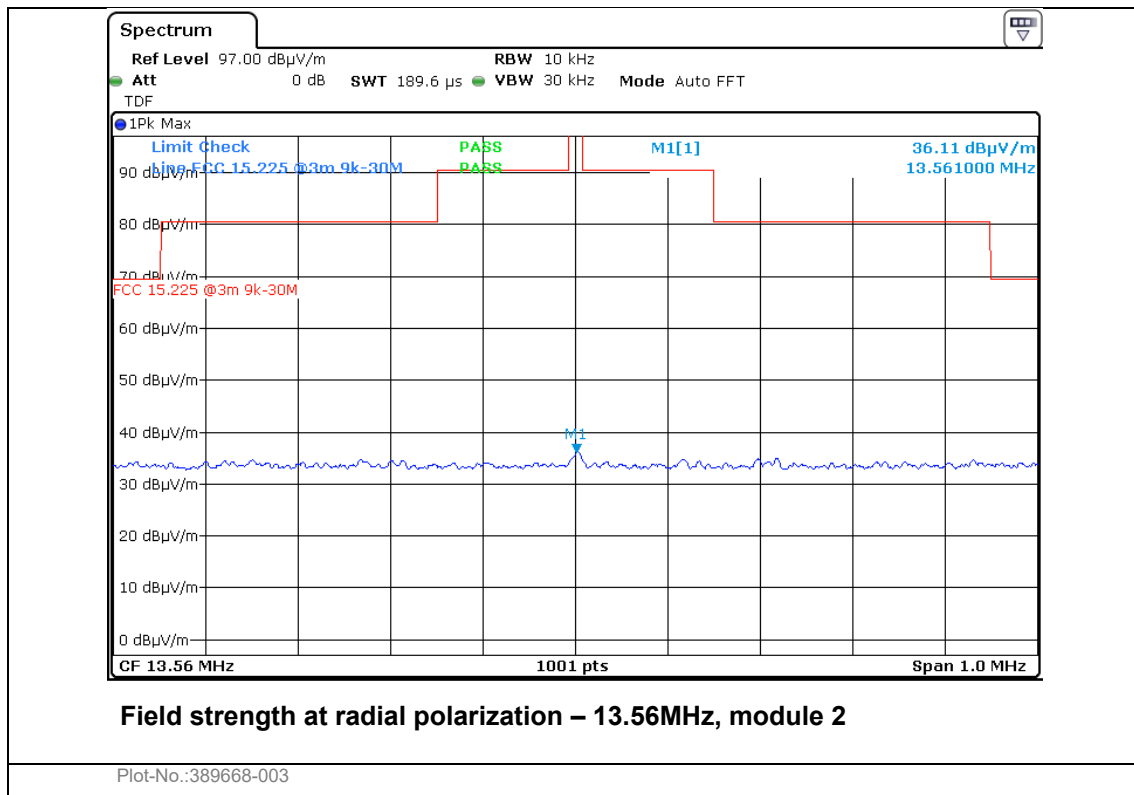
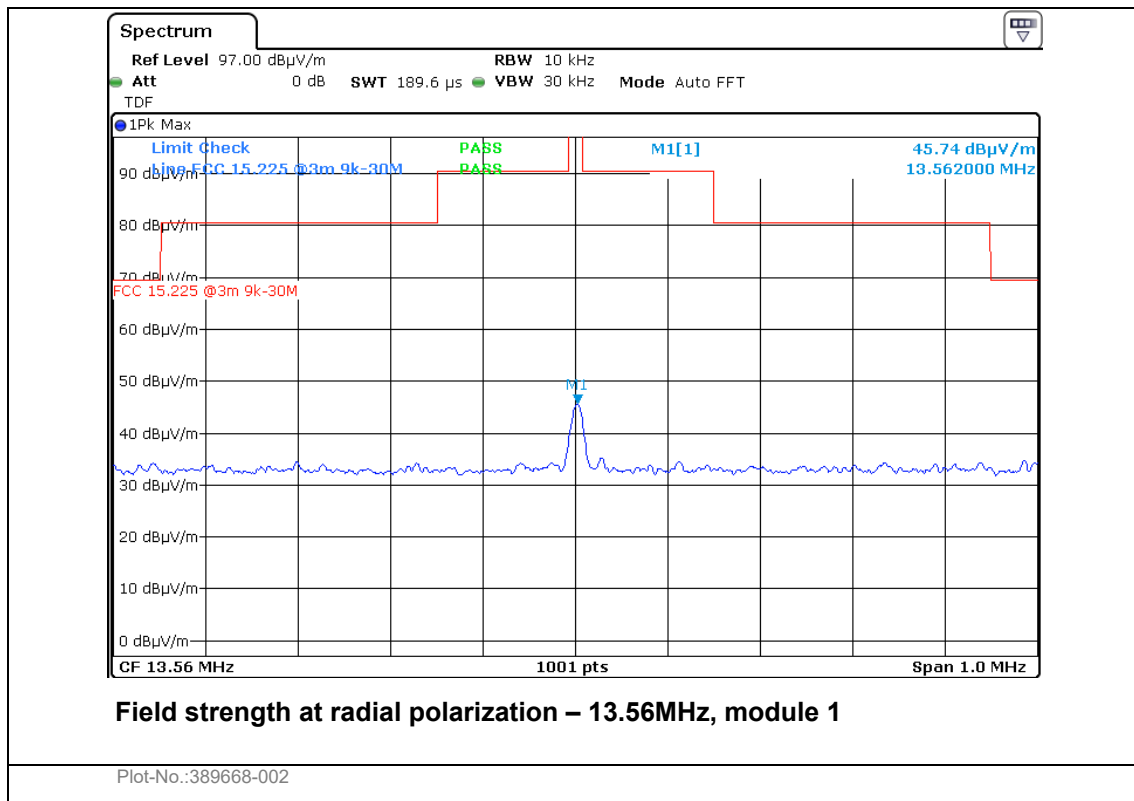
Integral loop antenna

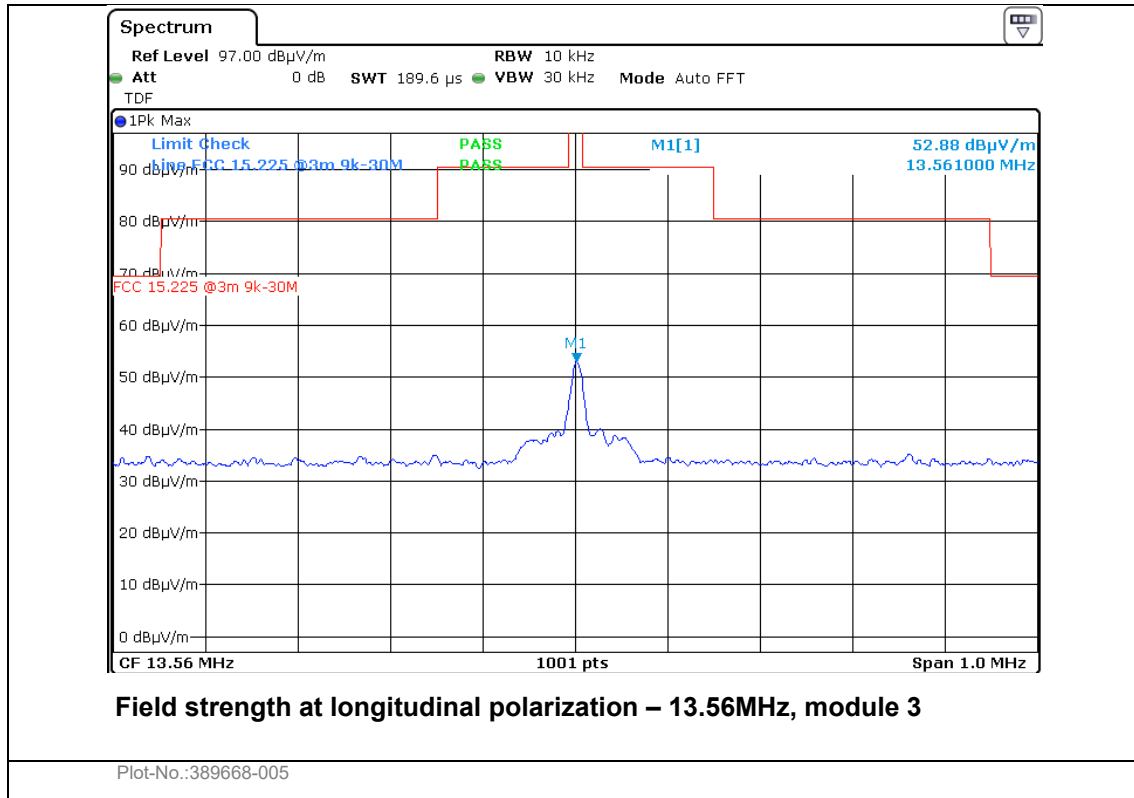
Requirements:

The maximum field strength within band 13.553 – 13.567MHz at 30 meters shall be ≤ 84.0 dB μ V/m (at 3 meters ≤ 124.0 dB μ V/m)

(b) 334 microvolts/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz. (at 3 meters ≤ 90.5 dB μ V/m)

(c) 106 microvolts/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz. (at 3 meters ≤ 80.5 dB μ V/m)





3.4 Spurious emissions (radiated)

Para. No.: 15.209 / 15.225 (b, c, d) / B.6(b, c, d)

Test Performed By: F. Hupbauer	Date of Test: 2020-02-03
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Test Results: Complies

Measurement Data:

Radiated Emissions with loop antenna, 9kHz – 30MHz

measured at a distance of 3 m.

All three modules are operating simultaneously at 13.56 MHz.

Measured with Peak Detector:

Frequency	Dist. corr. factor	Measured Field strength, Peak @ 3m	Duty cycle corr. factor	Calculated Field strength, Peak @ 300m	Limit @ 300m	Margin
kHz	dB	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
11.56	80	59.45 *)	/	-20.55	27.65	48.2

*) The measured value is background noise and not from the EUT.

The maximum is observed in radial polarization.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

The limit line given in the graph is corrected to 3 m distance using 40 dB/decade according to 15.31 (f) (2).

Duty Cycle Correction Factor Calculation:

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

minimum DC Correction factor = $20 \times \log((356.0 \text{ ms}) / 1091 \text{ ms}) = -9.7 \text{ dB}$

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

Requirement:

(d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

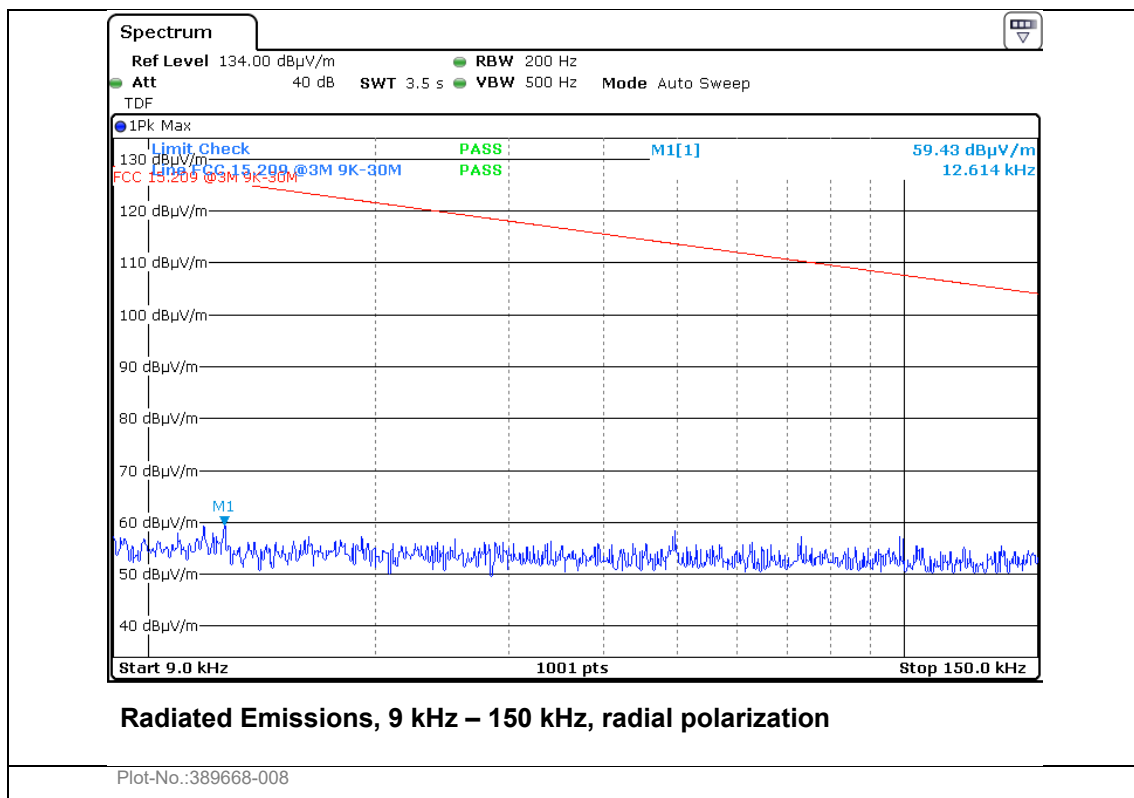
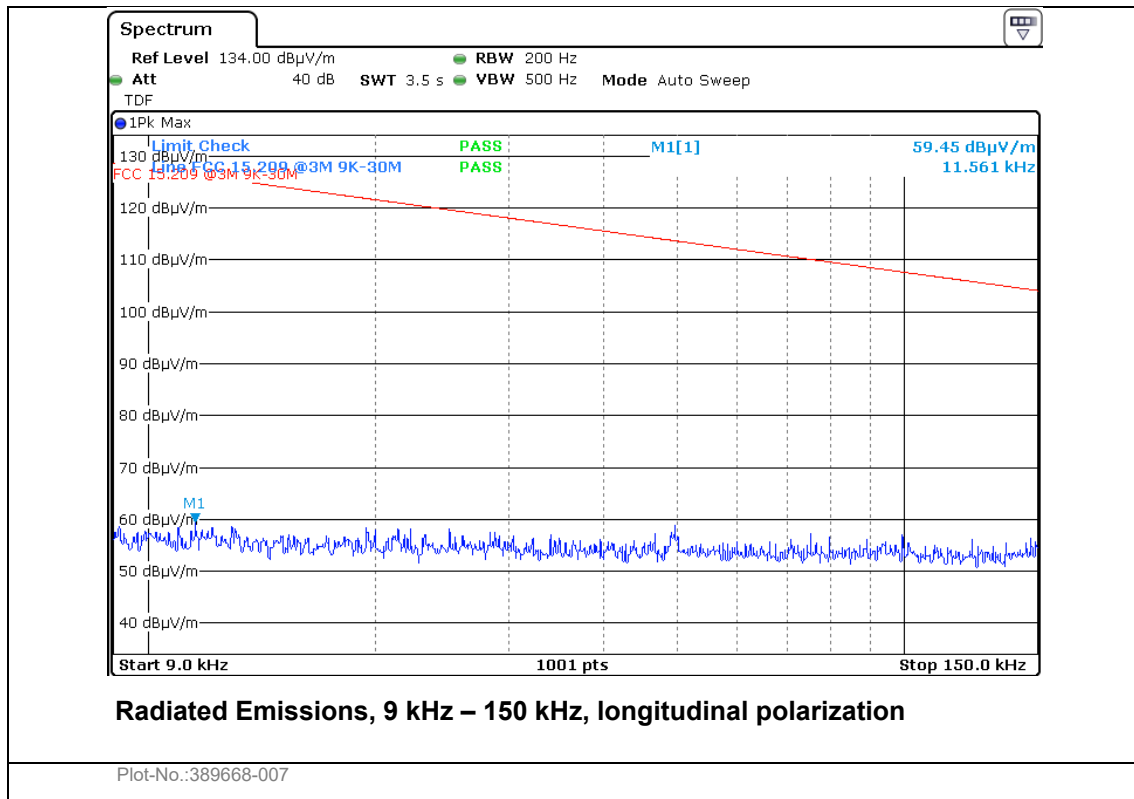
Requirements/Limit according §15.209

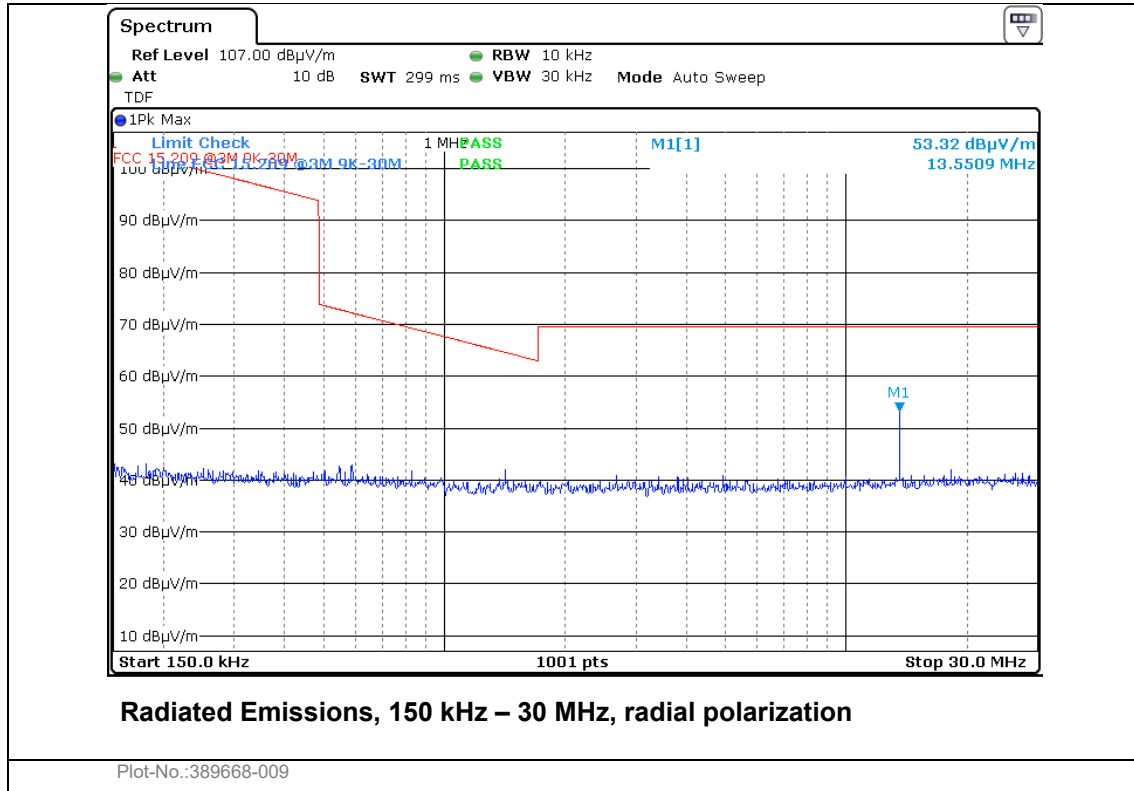
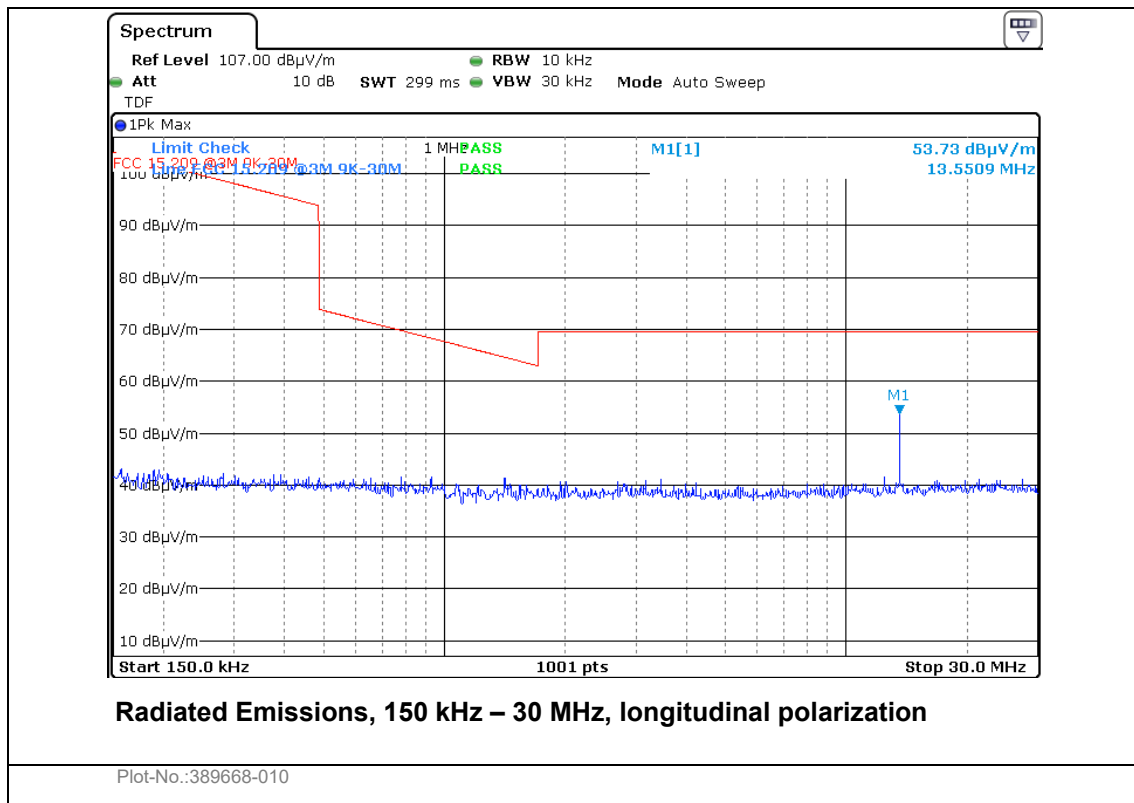
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

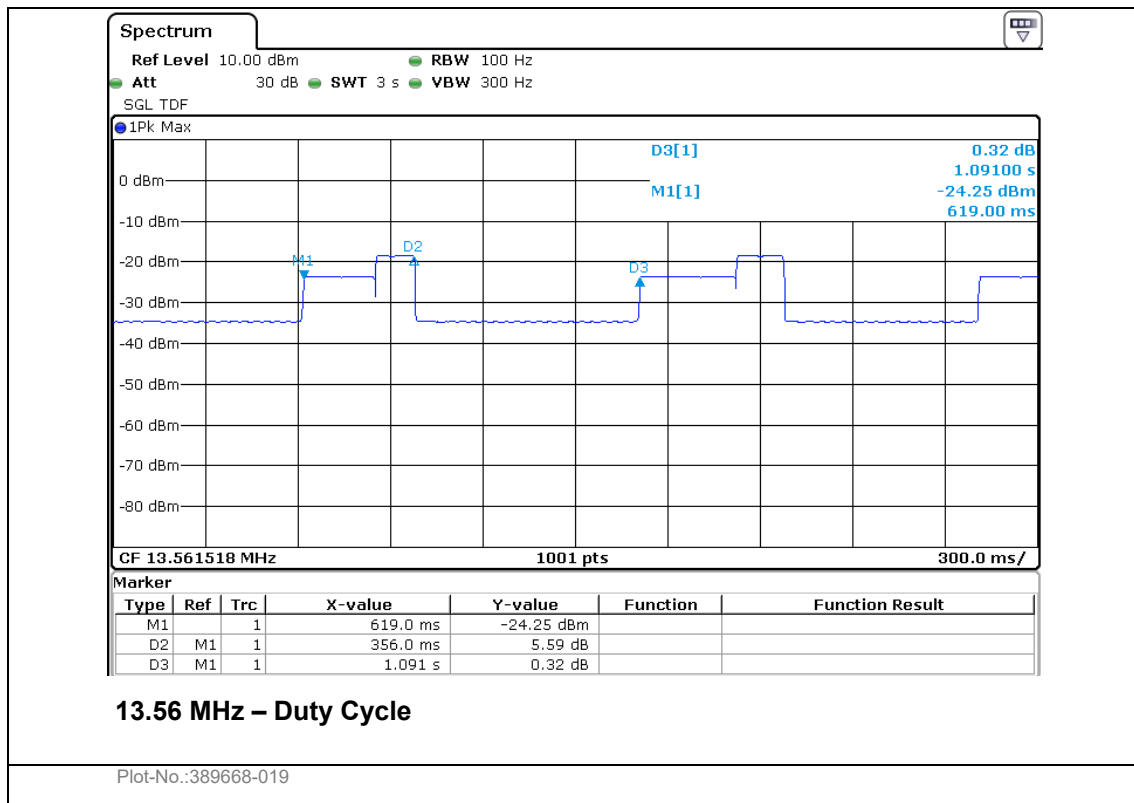
Radiated emissions 9kHz – 30 MHz.

Measuring distance 3 m, measured with Peak detector.

No component detected, see attached graph.



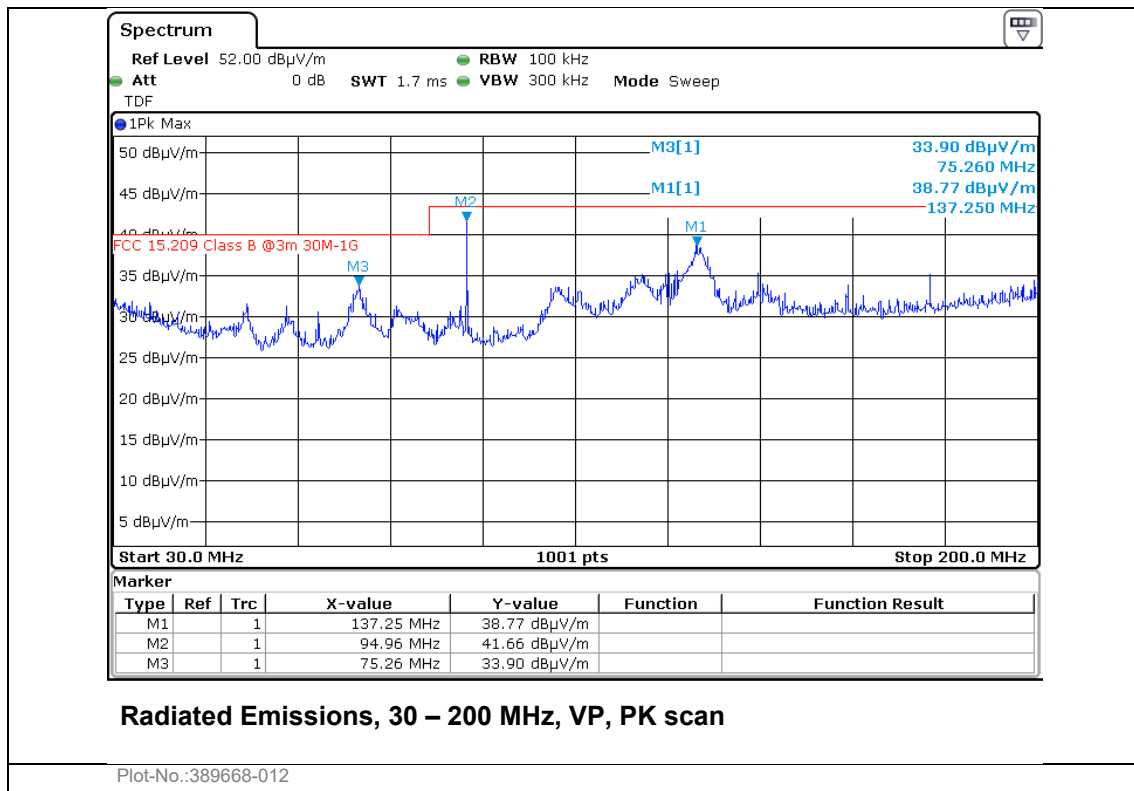
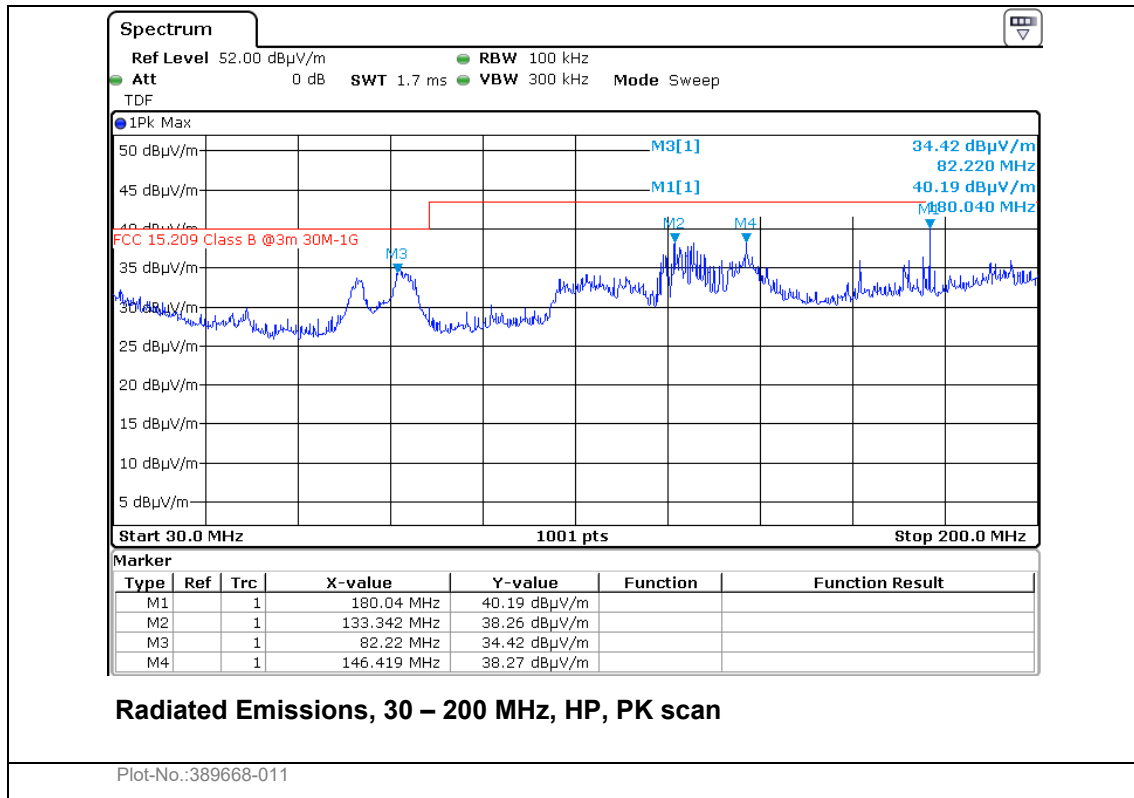




Radiated emissions 30 – 200 MHz.

Measuring distance 3 m. Detector: Peak

The graph shows peak scan and highest values.

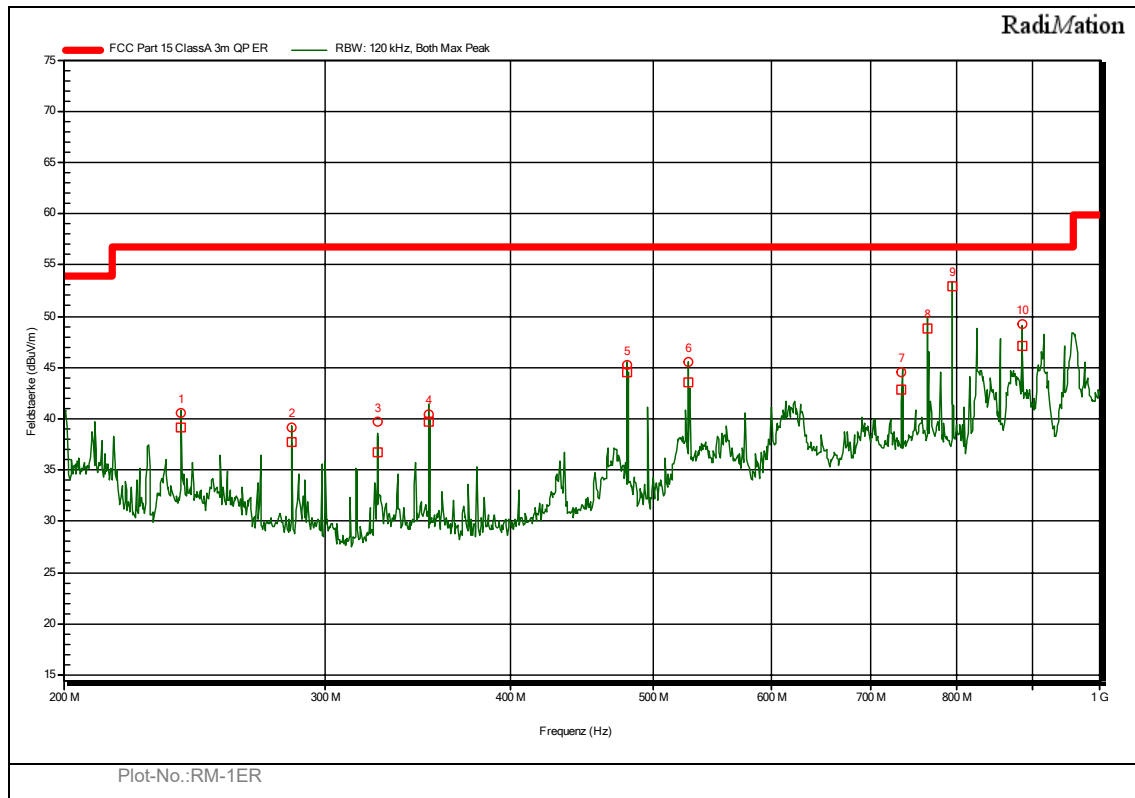


Radiated emissions 200 – 1000 MHz.

Measuring distance 3 m. Detector: Quasi Peak

Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in § 15.109 that are applicable to the incorporated digital device.

The emissions in the range 200-1000 MHz are not caused by the RFID modules but by the main device.
The EUT is a class A device.



Peak No.	Frequency	Quasi-Peak	Quasi-Peak Difference	Polarization	Status
1	240,020 MHz	39,09 dBuV/m	-17,71 dB	Horizontal	Pass
2	285,020 MHz	37,73 dBuV/m	-19,07 dB	Horizontal	Pass
3	325,460 MHz	36,79 dBuV/m	-20,01 dB	Vertical	Pass
4	352,610 MHz	39,75 dBuV/m	-17,05 dB	Vertical	Pass
5	480,020 MHz	44,53 dBuV/m	-12,27 dB	Horizontal	Pass
6	528,020 MHz	43,53 dBuV/m	-13,27 dB	Horizontal	Pass
7	735,020 MHz	42,82 dBuV/m	-13,98 dB	Vertical	Pass
8	765,020 MHz	48,77 dBuV/m	-8,03 dB	Vertical	Pass
9	795,020 MHz	52,98 dBuV/m	-3,82 dB	Vertical	Pass
10	885,020 MHz	47,10 dBuV/m	-9,70 dB	Horizontal	Pass

3.5 Transmitter Frequency Stability

Para. No.: 15.225(e)/B.6

Test Performed By: F. Hupbauer

Date of Test: 2020-02-03

Measurement Data:

Module 1 + 3

Temperature	Module supply voltage	Given Frequency (MHz)	Measured value (MHz)	Deviation (%)
+50 ° C	24Vdc	13.56	13.5617698	0.0018213
+40 ° C	24Vdc	13.56	13.5617718	0.0018361
+30 ° C	24Vdc	13.56	13.5617938	0.0019983
+20 ° C	24Vdc	13.56	13.5615228	0.00000
+20 ° C	27.6Vdc	13.56	13.5618038	0.002072
+20 ° C	20.4Vdc	13.56	13.5618038	0.002072
+10 ° C	24Vdc	13.56	13.5615418	0.0001401
+0 ° C	24Vdc	13.56	13.5615598	0.0002728
-10 ° C	24Vdc	13.56	13.5615618	0.0002876
-20 ° C	24Vdc	13.56	13.5615358	0.0000959

Module 2

Temperature	Module supply voltage	Given Frequency (MHz)	Measured value (MHz)	Deviation (%)
+50 ° C	24Vdc	13.56	13.5614508	-0.002617646
+40 ° C	24Vdc	13.56	13.5614708	-0.002470173
+30 ° C	24Vdc	13.56	13.5614818	-0.002389062
+20 ° C	24Vdc	13.56	13.5618058	0.00000
+20 ° C	27.6Vdc	13.56	13.5615138	-0.0021531
+20 ° C	20.4Vdc	13.56	13.5615138	-0.0021531
+10 ° C	24Vdc	13.56	13.5618318	0.0001917
+0 ° C	24Vdc	13.56	13.5618408	0.0002581
-10 ° C	24Vdc	13.56	13.5615618	-0.00179917
-20 ° C	24Vdc	13.56	13.5618068	0.0000074

Requirement:

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage and for a variation in the supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.8 dB
Power Spectral Density		±0.8 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.8 dB
	> 3.6 GHz	±1.2 dB
Spurious Emissions, Radiated	< 200 MHz	±4.77 dB
	200 MHz - 1 GHz	±5.02 dB
	1 GHz – 18 GHz	±4.94 dB
	> 18 GHz	±5.91 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		±3.58 %
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

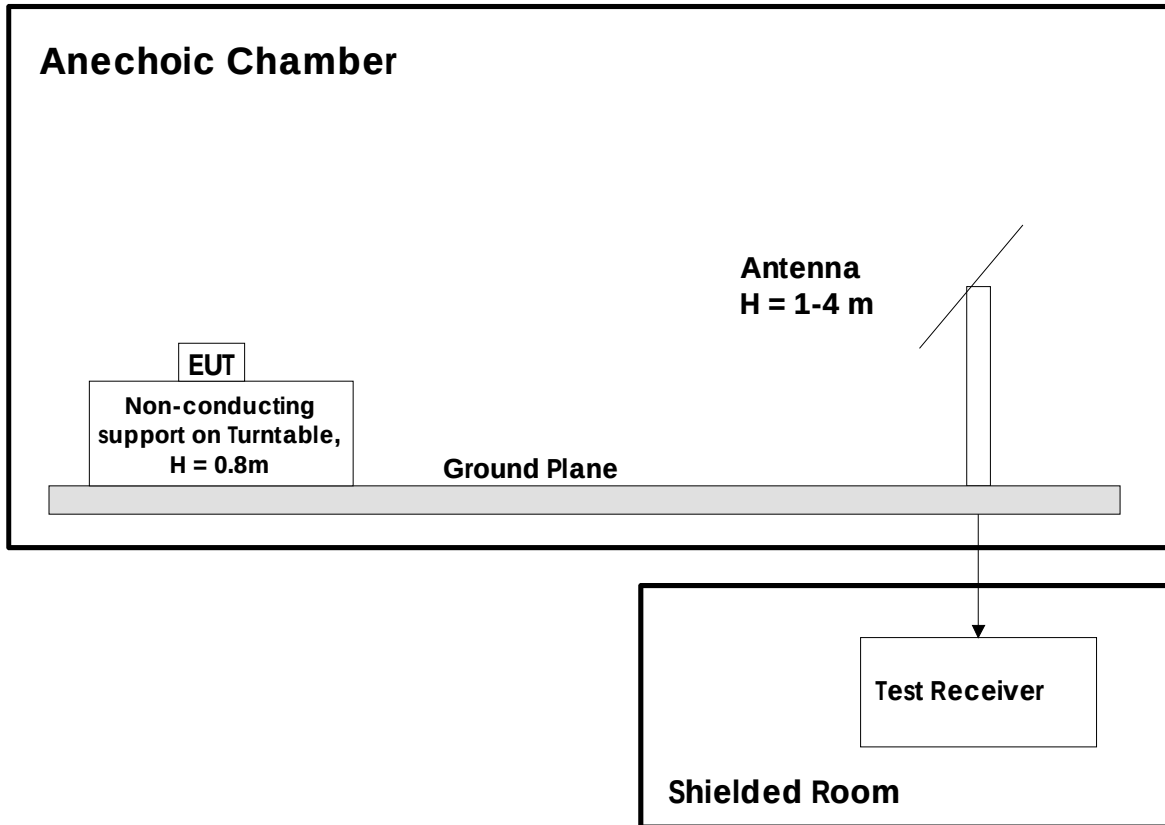
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

Inv.-Nr.	Instrument/ ancillary	Manufacturer	Type	Cal. Date	Cal. Due
1-0037	Artificial mains network, 3ph	Rohde & Schwarz	ESH2-Z5	2019-09	2020-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	2017-07	2020-07
1-0054	Pulse limiter	Rohde & Schwarz	ESH3-Z2	2019-09	2020-09
1-0055	LogPer antenna	Rohde & Schwarz	HL223	2017-07	2020-07
1-0072	Artificial mains network, 1ph	Rohde & Schwarz	ESH3-Z5	2019-09	2020-09
1-0080	Turntable	H. Deisel	DS 420	N / A	N / A
1-0200	Trilog antenna	Schwarzbeck	VULB 9163	2019-02	2022-02
1-0334	Climate chamber	WEISS-TECHNIK	1000SB/+10IU/40DU	2019-11	2020-11
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	2019-12	2022-12
1-0364	Antenna cable 2	Kabelwerk Eupen	CMS / RG 214-N/7	2019-09	2022-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	2019-09	2020-09
1-0611	Spectrum analyzer	Rohde & Schwarz	FSV 40	2019-09	2020-09
1-0614	Log.-per. antenna	Schwarzbeck	STLP 9148	2019-08	2022-08
1-0615	Pre amplifier	Schwarzbeck	BBV-9718	2019-09	2020-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	2019-09	2022-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	2019-09	2022-09
1-0624	EMI-Software Radimation	DARE	Radimation	N / A	N / A
1-0770	Horn antenna	Schwarzbeck	BBHA 9170	2018-06	2021-06
1-0772	Horn antenna	Schwarzbeck	BBHA 9120D	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck	BBV 9721	2019-09	2020-09
1-0782	Antenna cable	Huber & Suhner	FB142A1060002020	2017-10	2020-10
1-0794	Coaxial cable	Rosenberger	FB142A0010002020	2017-10	2020-10
1-0795	Dual Rotary Attenuator	JFW Industries	50DR-125	2019-09	2022-09
1-0806	Controller	Innco	CO 3000	N / A	N / A
1-0807	Antenna mast	Innco	MA-400-XPET	N / A	N / A
1-0871	10 dB Attenuator	mini circuits	BW-N10W5+	2019-09	2022-09
1-0915	Coaxial Directional Coupler	Mini Circuits	ZFDC-20-33-S+	2019-09	2022-09
1-0923	Coaxial cable	-	SMA	2019-09	2022-09
1-0924	Coaxial cable	-	SMA	2019-09	2022-09
1-0925	Coaxial cable	-	SMA	2019-09	2022-09
1-0926	Coaxial cable	HARBOUR	RG316 MIL	2019-09	2022-09
1-0927	Coaxial cable	HARBOUR	RG316 MIL	2019-09	2022-09
1-0994	3 dB Attenuator	mini circuits	BW-N3W5+	2017-10	2020-10
1-0995	6 dB Attenuator	mini circuits	UNAT-6+	2017-09	2021-09

6 BLOCK DIAGRAM

6.1 Test site radiated emission



Revision history

Version	Date	Comment	Sign
00	2020-06-09	First version	fh