Nemko GmbH & Co. KG
Reetzstraße 58
D-76327 Pfinztal
Tel.: + 49 (0) 7240 – 63 - 0
Fax: + 49 (0) 7240 – 63 - 11

DAkkS Deutsche Akkreditierungsstelle
D-PL-18175-01-01
D-PL-18175-01-02
D-PL-18175-01-03
D-PL-18175-01-04

Report No. 345369-01-002

FCC TEST REPORT / IC TEST REPORT

Product	Lock Controller / RFID module
Name and address of the applicant	ASSA ABLOY Hospitality AS Anolitveien 1-3, 1400 Ski, Norway
Name and address of the manufacturer	Same as above
Model	LCU6351C1
Rating	4.5Vdc
Trademark	ASSA ABLOY
Serial number	-
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 9** Low Power Licence-Exempt Radiocommunications Devices
Order number	345369-01-002
Tested in period	2018-03-14 - 2018-03-15
Issue date	2018-08-30
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-1

Prepared by [Dipl.-Ing. M. Korny]	Approved by [Dipl.-Ing. P. Lukas]

Template version: B

CONTENTS

1 TEST INFORMATION

1.1 Test item

Name :	ASSA ABLOY
Model/version :	LCU6351C1
FCC ID:	Y7V-LCU6351C1
IC ID:	9514A-LCU6351C1
Serial number :	/
Hardware identity and/or version:	LCU6351 (P000702908-001-001 A)
Software identity and/or version :	V11.16, test mode
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:	67.63 dBμV/m (Radiated)
Type of Power Supply :	Primary batteries (AA) 3x 1.5Vdc(4.5Vdc)
Antenna Connector :	Integral loop antenna
Number of antennas:	1
Antenna Diversity Supported :	None
Desktop Charger :	None

Description of test item

The RFID transceiver is controlled by the microcontroller inside the LCU6351.
The RFID transceiver will communicate with an RFID card, if the card is held in front of the RFID antenna.
The RFID antenna is a flexible print located on the outside of the plastic housing of the LCU6351.

The LCU6351 contains both an RFID and a BLE transceiver. These two transceivers will never transmit simultaneously.

Theory of Operation

The RFID transceiver module supports several RFID standards, ISO 14443-A, ISO 14443-B and ISO 15693, working on 13.56MHz. On a higher level it supports MIFARE communication and encryption.
The transceiver's oscillator is controlled by a 27.12MHz crystal.

1.2 Normal test condition

Temperature:	20 - 26 °C
Relative humidity:	35 - 55 %
Normal test voltage:	4.5Vdc (Primary battries 3x 1.5Vdc)

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Markus Korny

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

Radiated Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.8 Comments

The radiated measurements are tested on three axis.
Fully charged primary batteries are used.

All ports were populated during spurious emission measurements.

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 9 and RSS-GEN, Issue 5.

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

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-production Unit

DXT Equipment Code ☐ Family Listing

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 [1]
Antenna Requirement	15.203	6.8 (RSS-GEN)	N/A [2]
Power-line Conducted Emission	15.207(c)	8.8 (RSS-GEN)	N/A [1]
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] EUT is battery powered.

[2] Integral loop antenna

RSS Gen issue 5 covers section 7 & 6

RSS 210 issue 9 covers section B.6

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Comments

And the output level is set to maximum in the software.
The radiated measurements are tested on three axes.
Two fully charged primary batteries are used.
All ports were populated during spurious emission measurements.

2.5 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 99 % Occupied Bandwidth

Para. No.: 6.7 RSS-Gen

Test Performed By: Markus Korny	Date of Test: 2018-03-14

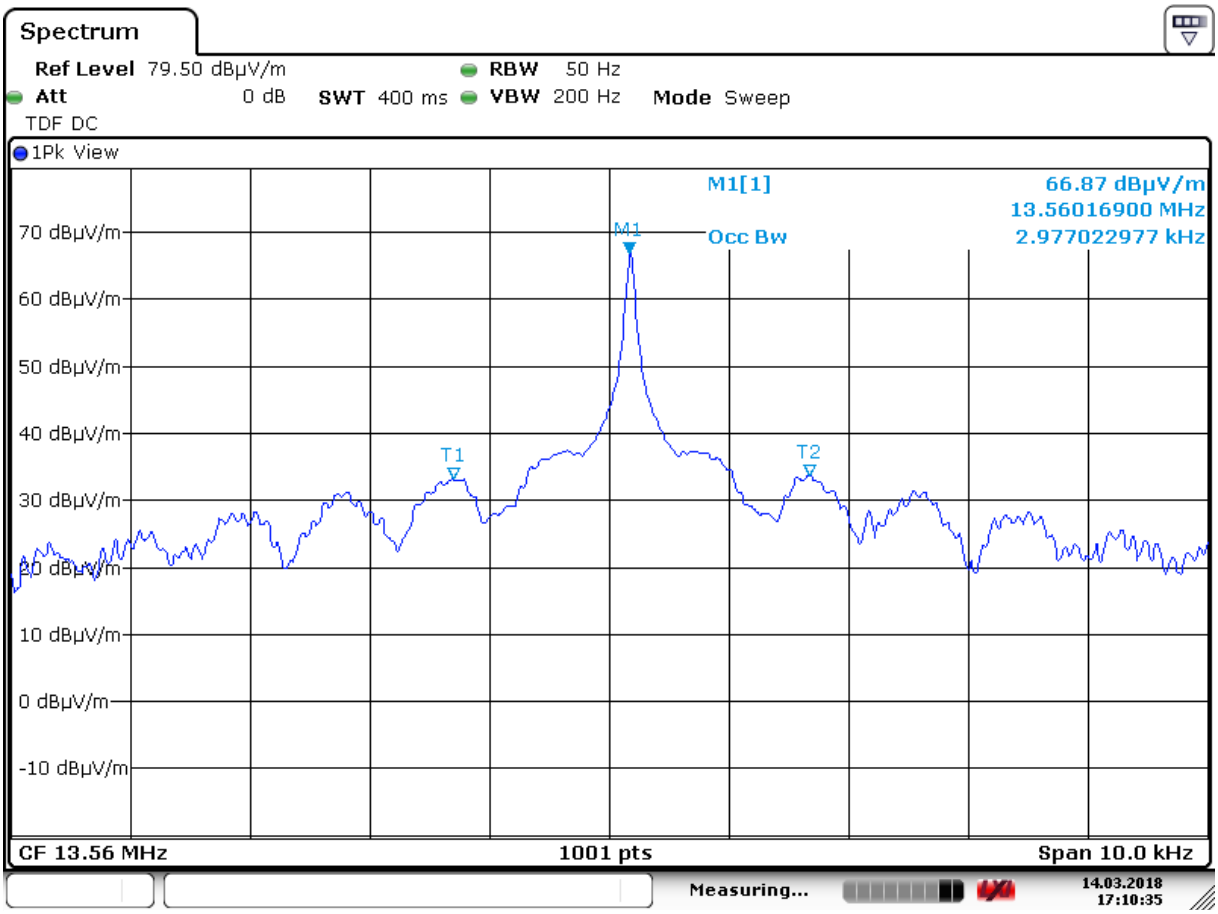
Test Results: Complies

Measurement Data:

99% BW (kHz)
13.56MHz
2.98

Requirements:

For information only



Date: 14.MAR.2018 17:10:36

13.56 MHz – 99% OCC BW

3.2 Fundemental Field Strength

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

Test Performed By: Markus Korny	**Date of Test: 2018-03-14**

Test Results: Complies

Measurement data:
Maximum field strength

RF channel	Measured PK value (dBµV/m) @ 3m	Distance Correction factor dB	Converted Limit @3m (dBµV/m)
13.56MHz	67.63	-40.0	124.0

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

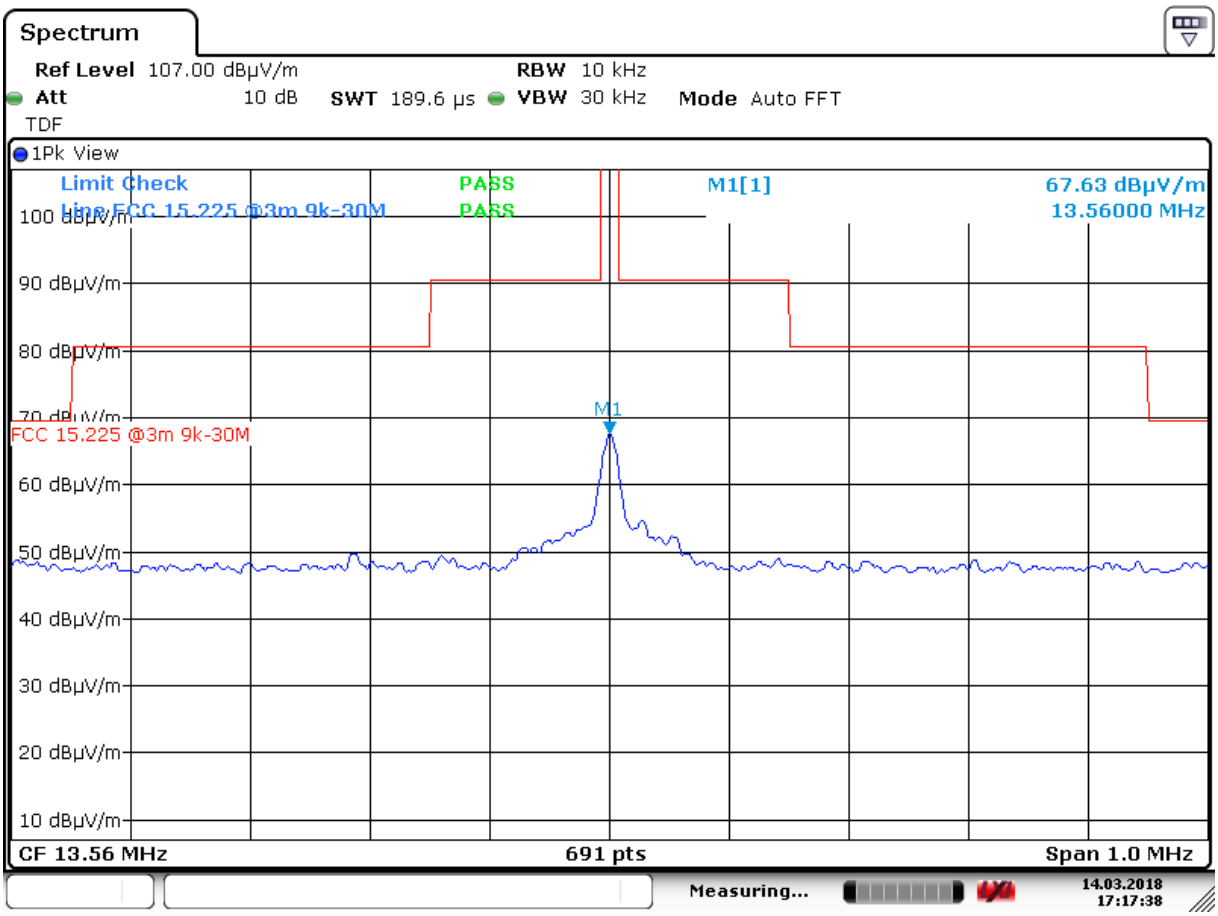
Radiated measurements are performed at 3 m distance.

Detachable antenna?	☐ Yes	☒ No
If detachable, is the antenna connector non-standard?	☐ Yes	☐ No
Integral loop antenna		

New batteries were used.

Requirements:
The maximum field strength within band 13.553 – 13.567MHz at 30 meters shall be ≤ 84.0 dBµV/m (at 3 meters ≤ 124.0 dBµV/m)

(b) 334 microvolts/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz. (at 3 meters ≤ 90.5 dBµV/m)
(c) 106 microvolts/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz. (at 3 meters ≤ 80.5 dBµV/m)



Date: 14.MAR.2018 17:17:39

Field strength at radial polarization – 13.56MHz

3.3 Spurious emissions (radiated)

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

Test Performed By: Markus Korny	**Date of Test: 2018-03-14**

Test Results: Complies
Measurement Data:

Radiated Emissions with loop antenna, 9kHz – 30MHz
measured at a distance of 3 m.

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	dBµV/m	dB	dBµV/m	dBµV/m	dB
99.472	80	78.02 *)	/	-1.98	27.65	29.63

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

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

The maximum is observed in radial polarization.
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

Duty Cycle Correction Factor Calculation:
RF duty cycle: Calculation according to RF burst Para 15.35 (c)
minimum DC Correction factor = 20 x log((73.6 ms) / 250.4 ms) = -10.6 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

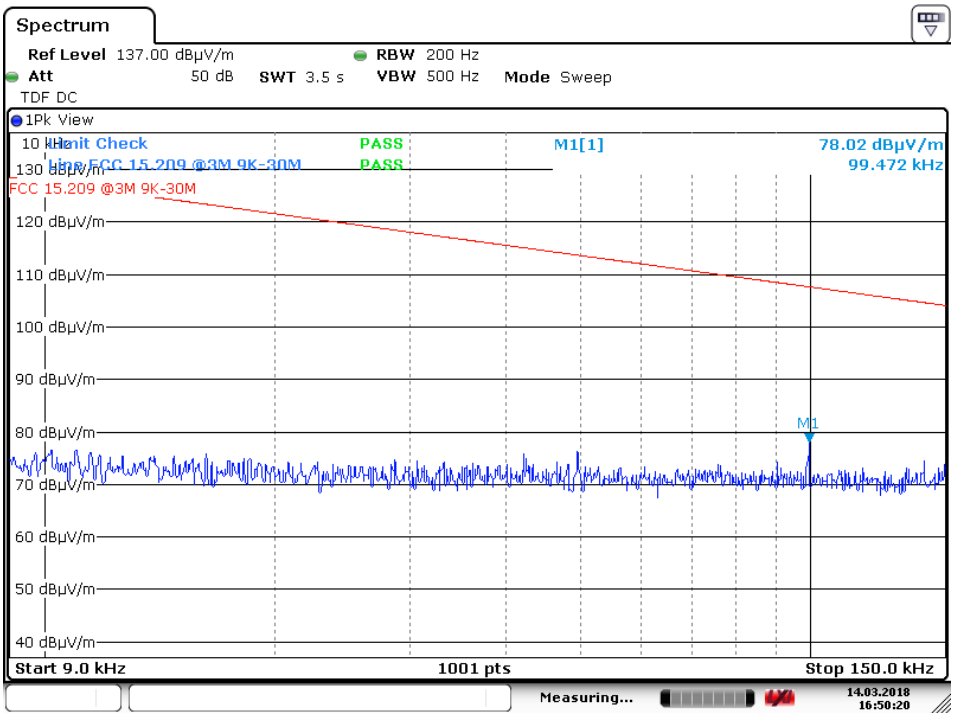
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	**Quasi Peak (µV/m)**	**Quasi Peak (dBµV/m)**
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Radiated emissions 9kHz – 30 MHz.

Measuring distance 3 m, measured with Peak detector.

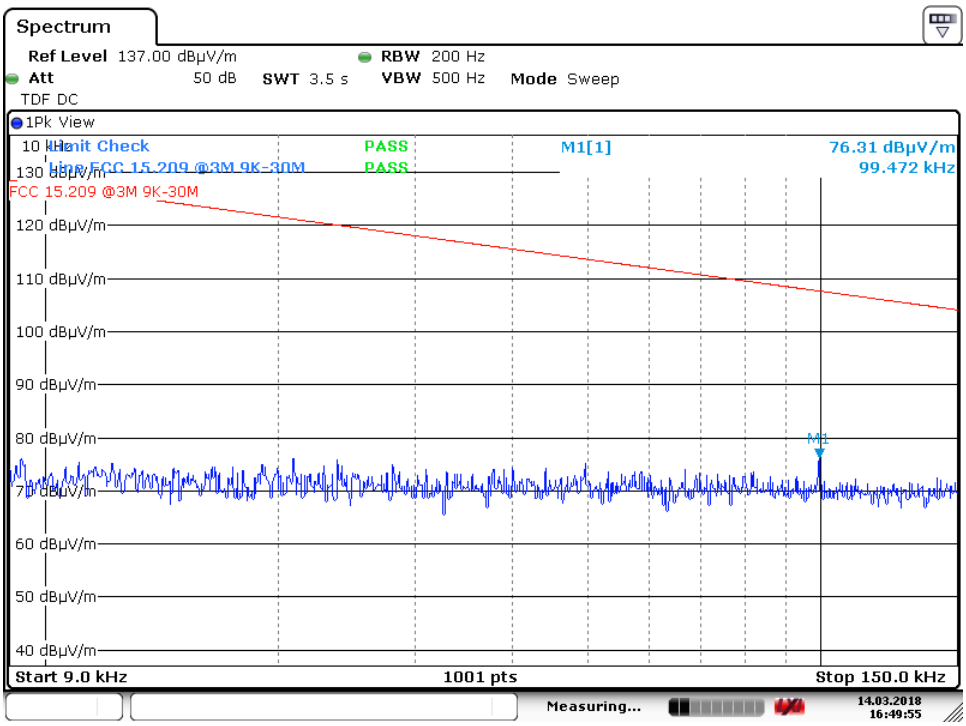
No component detected, see attached graph.

Limit is converted to 3 m using 40 dB/decade according to 15.31 (f) (2).



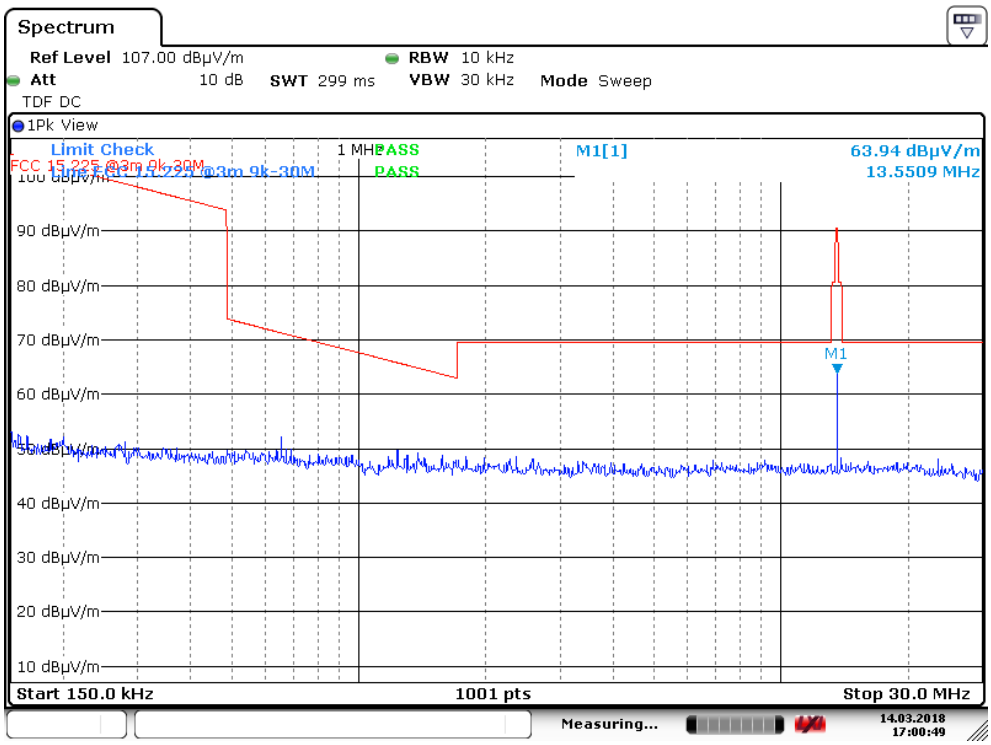
Date: 14.MAR.2018 16:50:21

Radiated Emissions, 9 kHz – 150 kHz @3m, longitudinal polarization



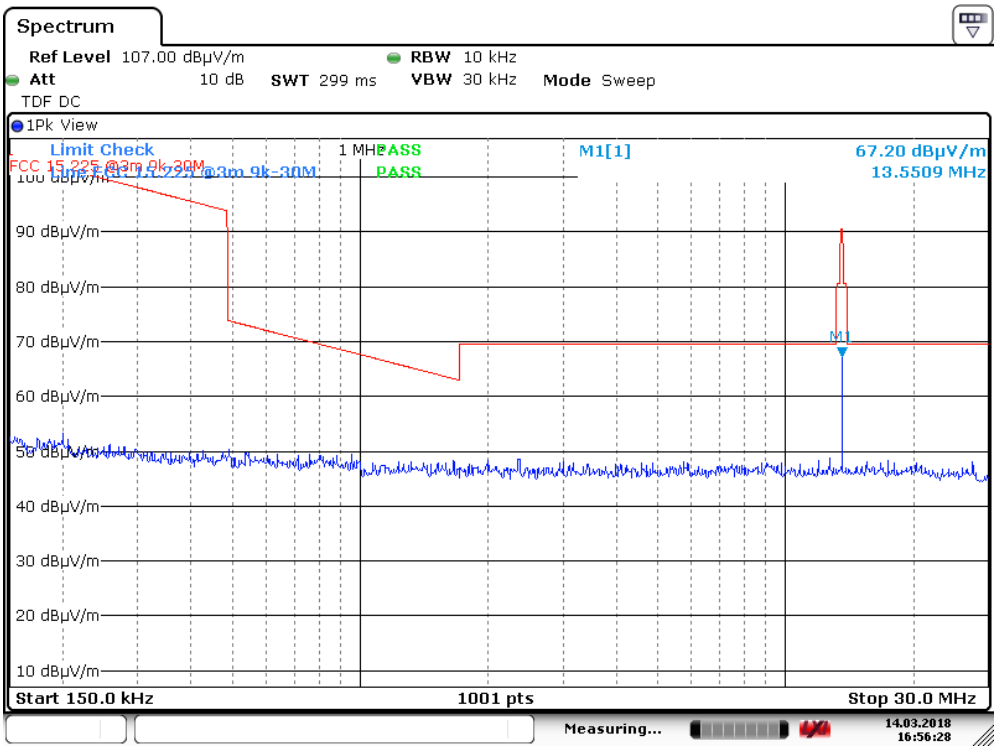
Date: 14.MAR.2018 16:49:55

Radiated Emissions, 9 kHz – 150 kHz @3m, radial polarization



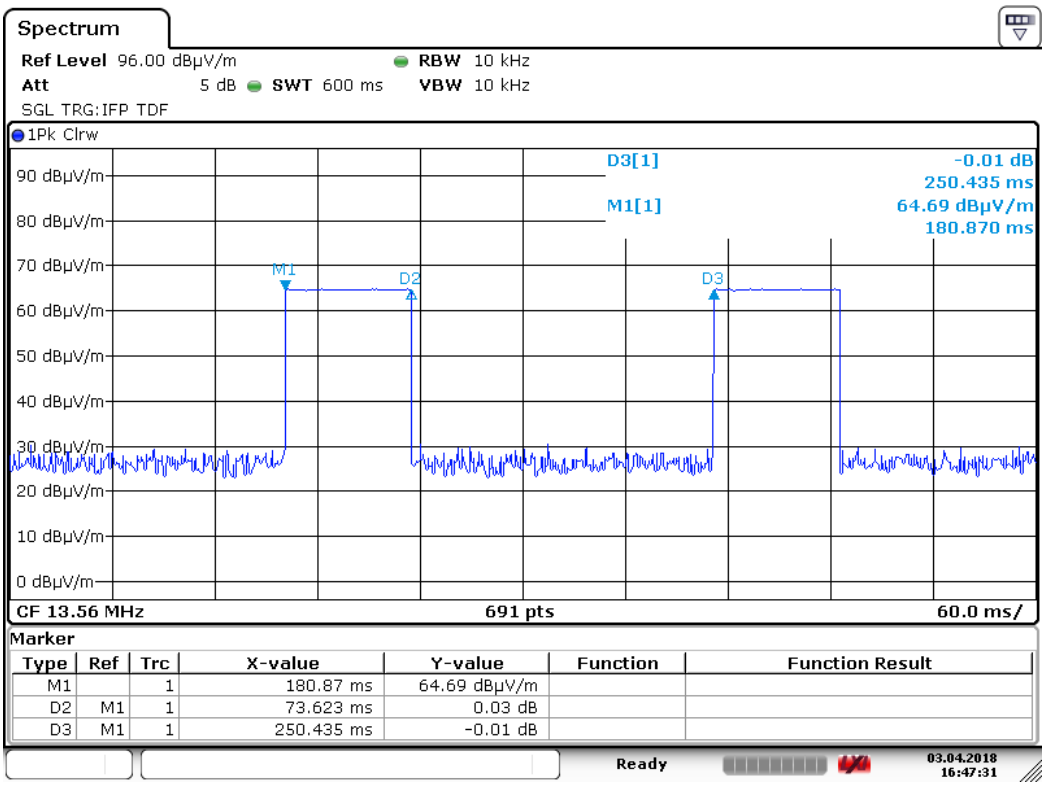
Date: 14.MAR.2018 17:00:50

Radiated Emissions, 150 kHz - 30MHz @3m, longitudinal polarization



Date: 14.MAR.2018 16:56:29

Radiated Emissions, 150 kHz - 30MHz @3m, radial polarization



Date: 3.APR.2018 16:47:31

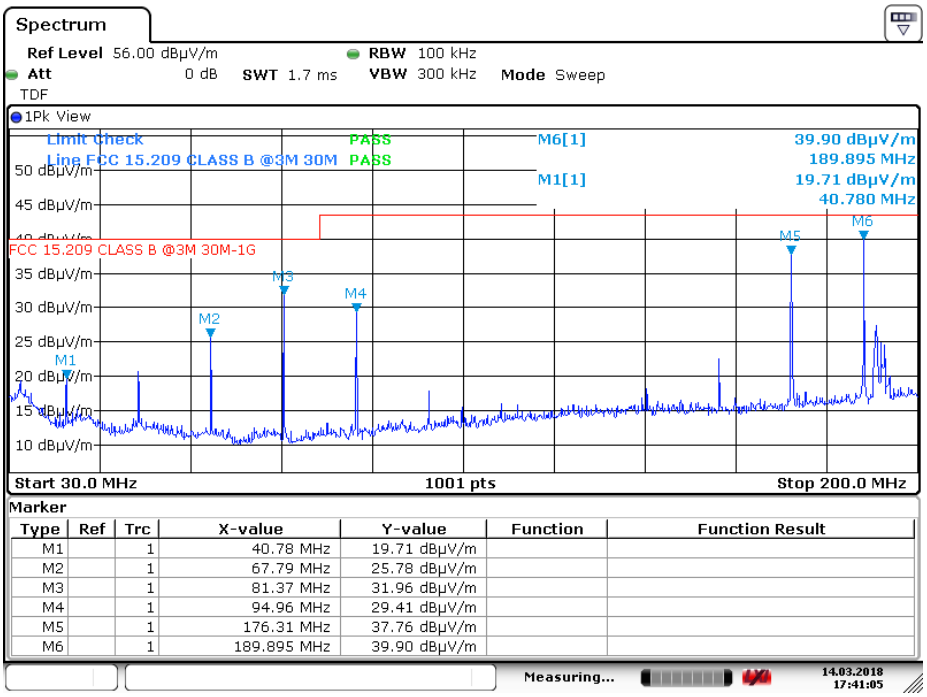
13.56 MHz – Duty Cycle

Radiated emissions 30 – 1000 MHz.

Detector: Peak

Measuring distance 3 m.

The graph shows peak scan and highest values.



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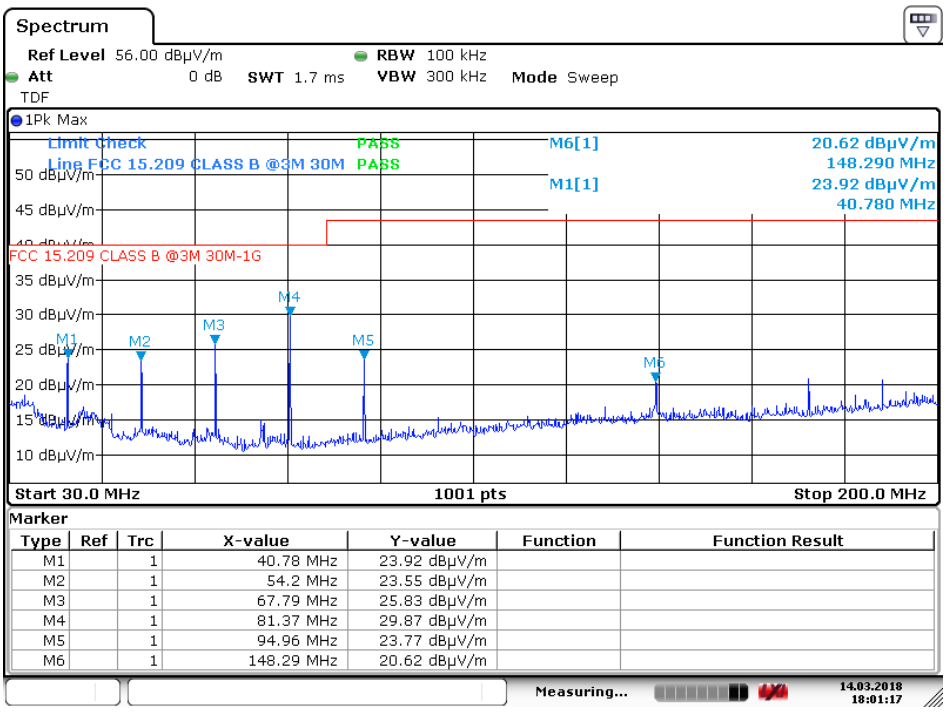
Radiated Emissions, 30 – 200 MHz, HP, @3m, PK scan



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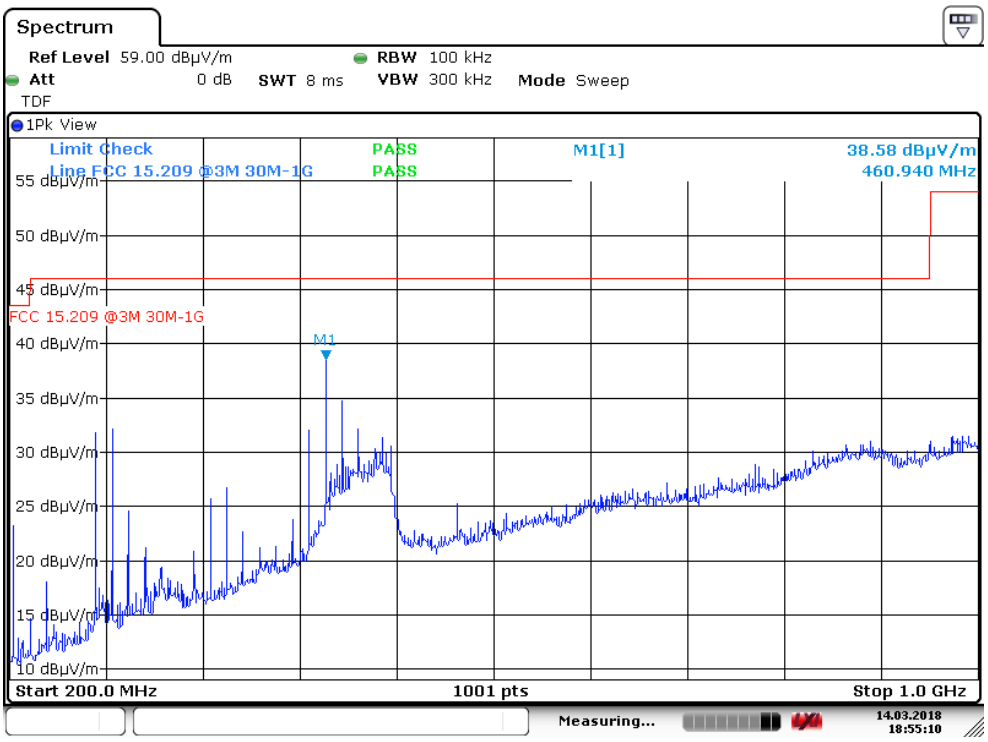
Radiated Emissions, 30 – 200 MHz, VP, @3m, PK scan



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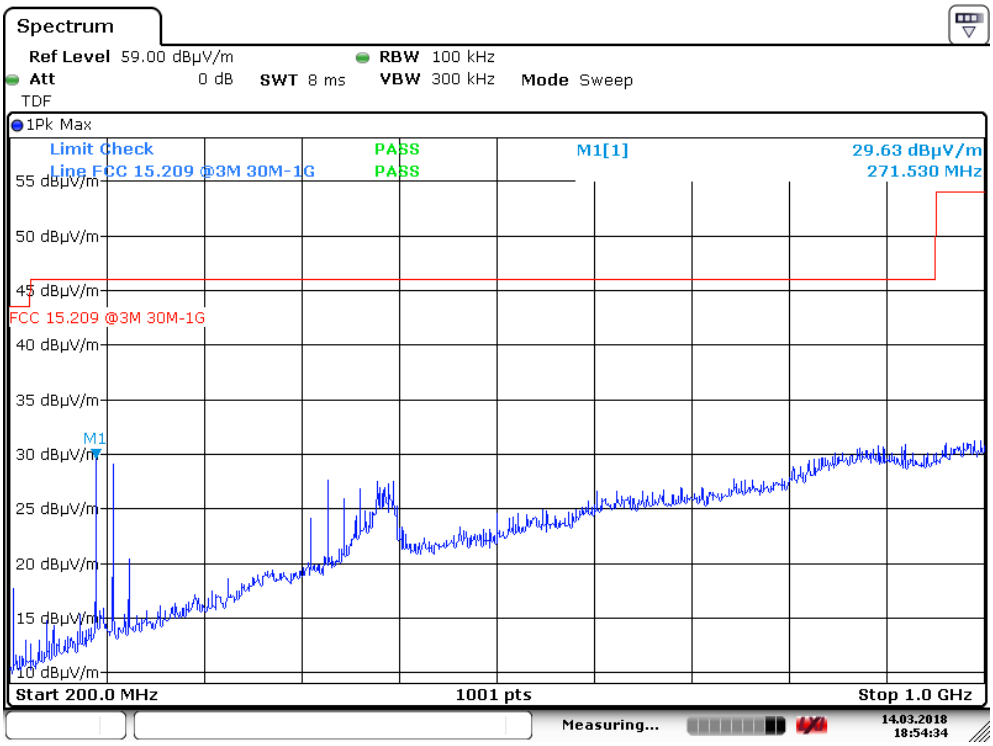
Radiated Emissions, 200 – 1000 MHz, HP, @3m, PK scan



Date: 14.MAR.2018 18:54:35

Radiated Emissions, 200 – 1000 MHz, VP, @3m, PK scan

3.4 Transmitter Frequency Stability

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

Test Performed By: Markus Korny	**Date of Test: 2018-03-15**

Measurement Data:

Temperature	Given Frequency (MHz)	Measured value (MHz)	Deviation (%)
+50 ° C	13.56	13.5601189	-0.00065
+40 ° C	13.56	13.5601399	-0.00049
+30 ° C	13.56	13.5601818	-0.00018
+20 ° C	13.56	13.5602068	**0.00000**
+10 ° C	13.56	13.5602368	0.00022
+0 ° C	13.56	13.5602418	0.00026
-10 ° C	13.56	13.5602388	0.00024
-20 ° C	13.56	13.5601848	-0.00016
-30 ° C	13.56	13.5601049	-0.00075

Supply voltage:4.5Vdc (fully charged battery)

Requirement:

(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage.

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

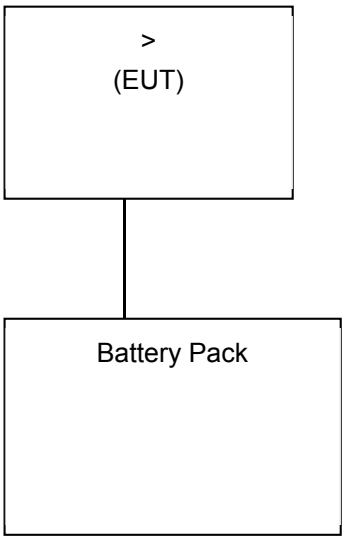
5 LIST OF TEST EQUIPMENT

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.

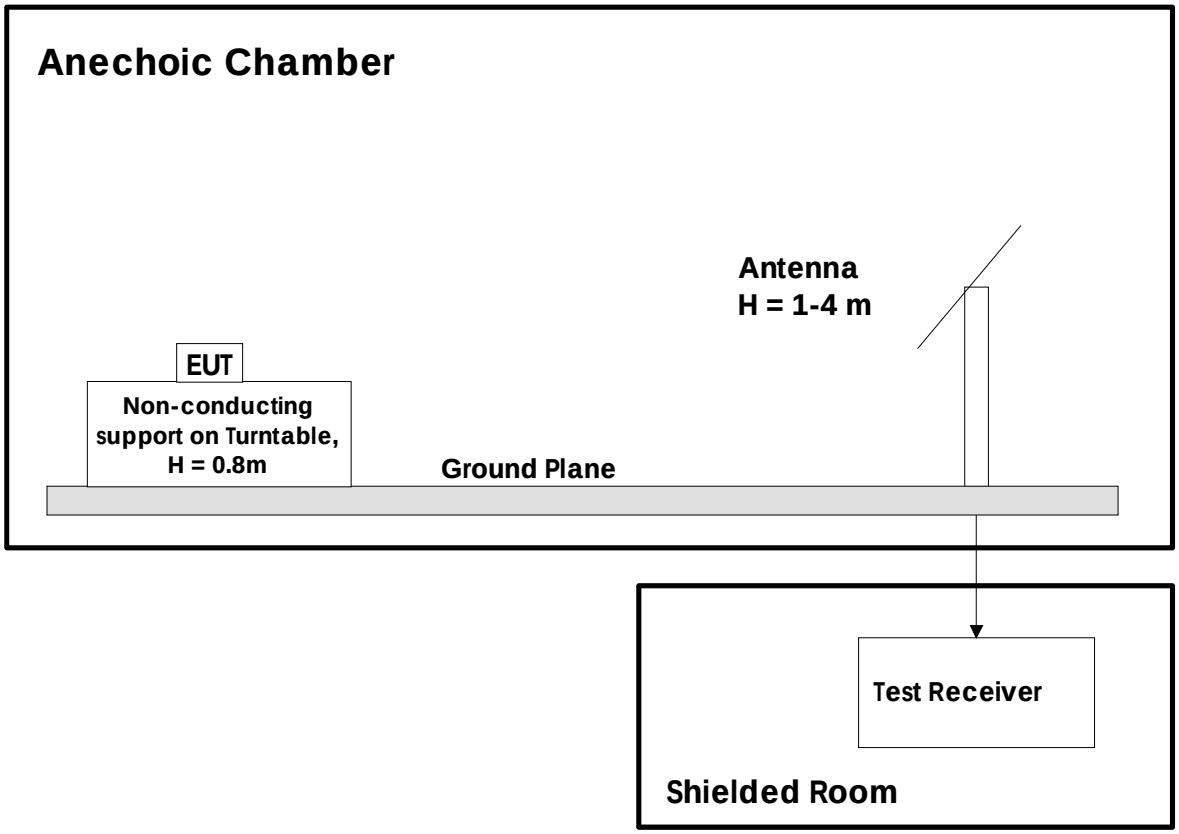
Ref No	*Instrument/ ancillary*	*Manufacturer*	*Type of instrument/ ancillary*	*Cal. Date*	*Cal. Due*
1-0039	Loop antenna	Rohde & Schwarz	HFH2-Z2	2017-09	2018-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	2015-08	2018-08
1-0055	LopPer antenna	Rohde & Schwarz	HL223	2015-08	2018-08
1-0080	Turntable	H. Deisel	DS 420	--	--
1-0256	Horn antenna	Schwarzbeck Mess-Elektronik	BBHA 9120	--	--
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	2017-06	2020-06
1-0364	Antenna cable 2	Kabelwerk Eupen	RF/Cord CMS / RG 214-N/7	2016-09	2019-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	2017-09	2018-09
1-0611	Signal analyzer	Rohde & Schwarz	FSV 40	2017-09	2018-09
1-0614	Log.-per. antenna	Schwarzbeck Mess-Elektronik	STLP 9148 Stacked Log.-Per. Antenne	2016-11	2019-11
1-0615	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV-9718 Broadband Preamplifier	2017-09	2018-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	2016-09	2019-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	2016-09	2019-09
1-0781	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV 9721	2017-09	2018-09
1-0782	Antenna cable	Huber & Suhner	FB142A	2015-07	2018-07
1-0789	High Pass Filter	Mini Circuits	VHF-1320+ 1700-3800 MHz	2016-09	2019-09
1-0790	High Pass Filter	Mini Circuits	VHF-3100+ 3400-9900MHz	2016-09	2019-09
1-0791	High Pass Filter	Mini Circuits	VHF-740+ 900-2200MHz	2016-09	2019-09
1-0870	10 dB Attenuator	Mini Circuits	BW-N10W5+	2016-09	2019-09
1-0924	Cable 1m	---	SMA	2016-09	2019-09
1-0925	Cable 1m	---	SMA	2016-09	2019-09
1-0926	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0927	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0964	Climate chamber	WEISS-TECHNIK	WK3 1000/70	2017-11	2018-11
1-0966	RF power meter	DARE	RPR3006W	2017-07	2018-07

6 BLOCK DIAGRAM

6.1 System set up for radiated measurements



6.2 Test site radiated emission



Revision history

Version	Date	Comment	Sign
02	2018-08-30	Background noise explanation in chapter 3.3 added.	mk
01	2018-08-10	RSS-Gen issue 4 replaced by issue 5, some writing errors corrected	mk
00	2018-04-03	First version	mk