



Report No. 355489-01

## Test Report

<b>Product</b>	RFID Encoder
<b>Name and address of the applicant</b>	ASSA ABLOY Global Solutions Norway AS Postboks 340, Anolitveien 1-3 1402 Ski, Norway
<b>Name and address of the manufacturer</b>	ASSA ABLOY Global Solutions Norway AS Postboks 340, Anolitveien 1-3 1402 Ski, Norway
<b>Model</b>	ENC4010C1
<b>Rating</b>	5Vdc/300mA or 100 – 240Vac,50/60Hz, 12000mA adapter or PoE
<b>Trademark</b>	ASSA ABLOY
<b>Serial number</b>	1929 HA 00001-000050
<b>Additional information</b>	Radio Frequency Identification (RFID) -13.56MHz.
<b>Tested according to</b>	<b>FCC Part 15.225</b> Low Power Transmitter <b>13.110 - 14.010 MHz Band</b> <b>Industry Canada RSS-210, Issue 9</b> Low Power Licence-Exempt Radiocommunications Devices
<b>Order number</b>	355489
<b>Tested in period</b>	2019.08.27 - 2019.09.02
<b>Issue date</b>	2020.01.23
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	  An accredited technical test executed under the Norwegian accreditation scheme
	
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## 1 INFORMATION

### 1.1 Test Item

<b>Name :</b>	ASSA ABLOY
<b>FCC ID :</b>	Y7V-ENC4010C1
<b>Industry Canada ID :</b>	9514A-ENC4010C1
<b>Model/version :</b>	ENC4010C1
<b>Serial number :</b>	1929 HA 00001-000050
<b>Hardware identity and/or version:</b>	P000932992-001-001 A
<b>Software identity and/or version :</b>	signed-encoder-emc-app-v0.3.1
<b>Operating frequency:</b>	13.56MHz
<b>Assigned Frequency Band :</b>	13.110-14.010 MHz
<b>Tunable Bands :</b>	None
<b>Number of Channels :</b>	1
<b>Operating Modes :</b>	TX/RX
<b>Type of Modulation :</b>	ASK
<b>User Frequency Adjustment :</b>	None
<b>Type of Power Supply :</b>	5Vdc
<b>Antenna Connector :</b>	Integral loop antenna
<b>Antenna Diversity Supported :</b>	None
<b>Desktop Charger :</b>	None

#### Description of Test Item

Encoder 4010C1 is a desktop RFID card encoder with network interface and LCD screen. It features Power over Ethernet support as well as 5Vdc supply. It is intended for indoor usage, normally in a hotel reception.

## 1.2 Test Environment

### 1.2.1 *Normal test condition*

Temperature: 20 - 24 °C

Relative humidity: 20 - 50 %

Normal test voltage: 5.0Vdc

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

G. Suhanthakumar

## 1.4 Test Equipment

See list of test equipment in clause 5.



## 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, paragraph 15.225, RSS-GEN Issue 5 and Industry Canada RSS-210 Issue 9.

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

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

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

New Submission

Production Unit

Class II Permissive Change

Pre-production Unit

**DXX** 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)	N/A	Complies <sup>1</sup>
Antenna Requirement	15.203	6.8 (RSS-Gen)	NA <sup>2</sup>
Power-line Conducted Emission	15.207(a)(c)	7.2/.8.8 (RSS-Gen)	Complies <sup>1</sup>
99% Occupied Bandwidth	N/A	6.7 (RSS-GEN)	-
Fundamental Field strength	15.225(a)	B.6(a) (RSS-210)	Complies
Band Emissions	15.225(b)(c)	B.6(b)(c) (RSS-210)	Complies
Spurious Emissions (Radiated)	15.225 (d) 15.209	B.6(d) (RSS-210) 7.3/8.9/8.10 (RSS-GEN)	Complies
Frequency stability	15.225(e)	B.6 (RSS-210) B.6.11 (a) (RSS-Gen)	Complies

<sup>1</sup> EUT is operated by DC power. (via AC/DC adapter or directly from external DC power)

<sup>2</sup> Integral loop antenna

RSS Gen issue 5 covers section 6,7 and 8

RSS 210 issue 9 covers section B.6

## Revision history

Revision #	Date	Order #	Comment	Sign
00	2020.01. 23	355489	First version	GNS

## 2.3 Description of modification for Modification Filing

Not applicable.

## 2.4 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

## 2.5 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.

## 2.6 Comments

And the output level is set to maximum in the software.

The radiated measurements are tested on three axis.

All measurements were done with the EUT powered with 5VDC voltage. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

Following ports were populated during spurious emission measurements:

- DC, PoE and USB -C(service port only)

## 2.7 Family List Rational

Not Applicable.

### 3 TEST RESULTS

#### 3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)(c)

ISED Canada RSS-GEN Issue 5, Clause 7.2/8.8

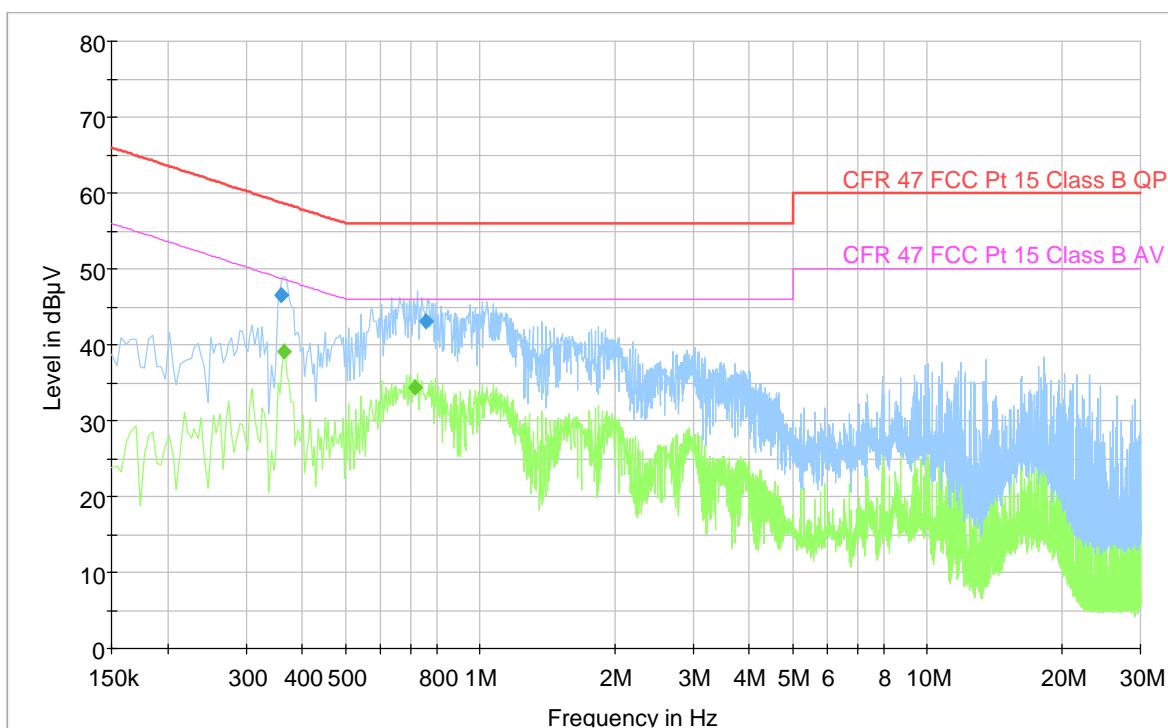
Measurement procedure: ANSI C63.4-2014 using 50  $\mu$ H/50 ohms LISN.

Test Results: Complies

Measurement Data: See attached plots.

Highest measured value (L1 and N): All spurious emissions are well below the PK

Full Spectrum



RFID loop antenna was replaced with a suitable dummy load.

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.360	46.49	---	58.73	12.23	1000	9	L1	OFF
0.364	---	39.09	48.64	9.55	1000	9	L1	OFF
0.716	---	34.37	46.00	11.63	1000	9	L1	OFF
0.760	43.01	---	56.00	12.99	1000	9	L1	OFF

Measured with AC/DC adapter 120Vac/60Hz, Model: CMP S008ACM00120

### 3.2 99% Occupied Bandwidth

ISED Canada RSS-GEN Issue 5, Clause 6.7

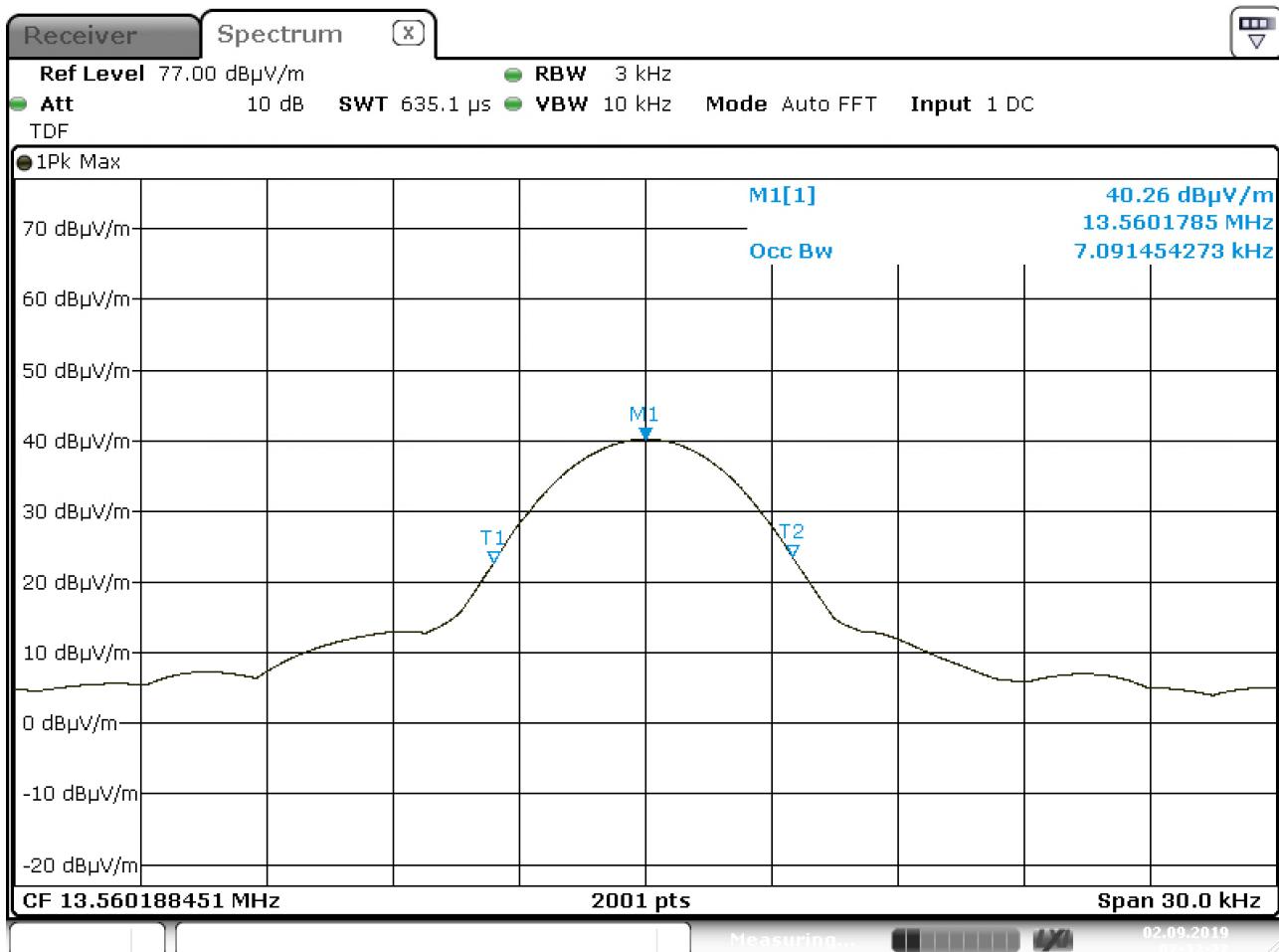
**Test Results: Complies**

**Measurement Data:**

99% BW (kHz)
13.56MHz
7.1

**Requirements:**

For information only



Date: 2.SEP.2019 07:33:28

13.56MHz – 99% BW– 7.1kHz

### 3.3 Fundamental Field Strength

FCC 15.225 (a) / B.6 (a)

ISED Canada RSS-210 Issue 9, B.6(a)

**Test Results: Complies**

**Measurement data:**

**Maximum field strength**

RF channel	Measured PK value (dB $\mu$ V/m) @ 10m	Distance Correction factor for Limit dB	Converted Limit @10m (dB $\mu$ V/m)
13.56MHz	40.90	9.5	93.5

The limit line given in the graph is corrected to 10m distance.

Pulse train period during reading card reading mode (duty cycle: 1.36%)

Radiated measurements are performed at 10 m distance.

Detachable antenna?

Yes  No

If detachable, is the antenna connector non-standard?

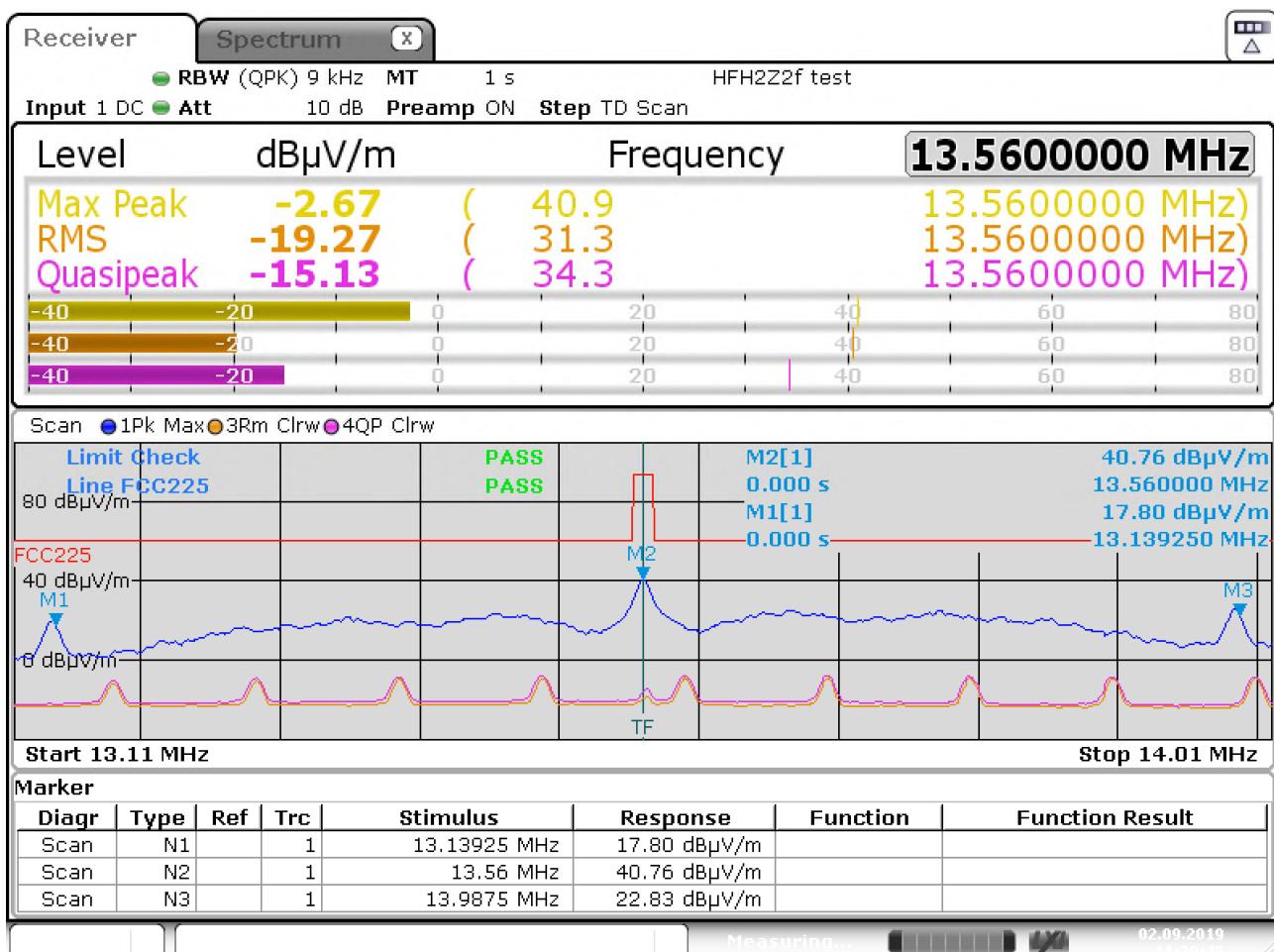
Yes  No

Integral loop antenna

#### Requirements:

The maximum field strength within band 13.553 – 13.567MHz at 30 meters shall be  $\leq$  84.0 dB $\mu$ V/m (at 10 meters  $\leq$  93.5 dB $\mu$ V/m)

- (b) 334 microvolts/m (50.5 dB $\mu$ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz. (at 10 meters  $\leq$  89.5 dB $\mu$ V/m)
- (c) 106 microvolts/m (40.5 dB $\mu$ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz. (at 10 meters  $\leq$  50 dB $\mu$ V/m)



Field strength – 13.56MHz

### 3.4 Spurious emissions (radiated)

FCC 15.209 / 15.225 (b,c,d)

ISED Canad RSS-210 Issue 9, B.6(d) and RSS-Gen 7.3/8.9/8.10

**Test Results: Complies**

**Measurement Data:**

**Radiated Emissions with loop antenna, 9kHz – 30MHz**

measured at a distance of 10m.

**Measured with Peak Detector:**

Frequency	Dist. corr. factor	Measured Field strength, Peak @ 10m	Duty cycle corr. factor	Calculated Field strength, Average @ 30m	Limit @ 300m	Margin
kHz	dB	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
/	/	/	/	/	/	> 30

The limit line given in the graph is corrected to 10m distance.

The maximum is observed in longitudinal polarization

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

**Duty Cycle Correction Factor Calculation:**

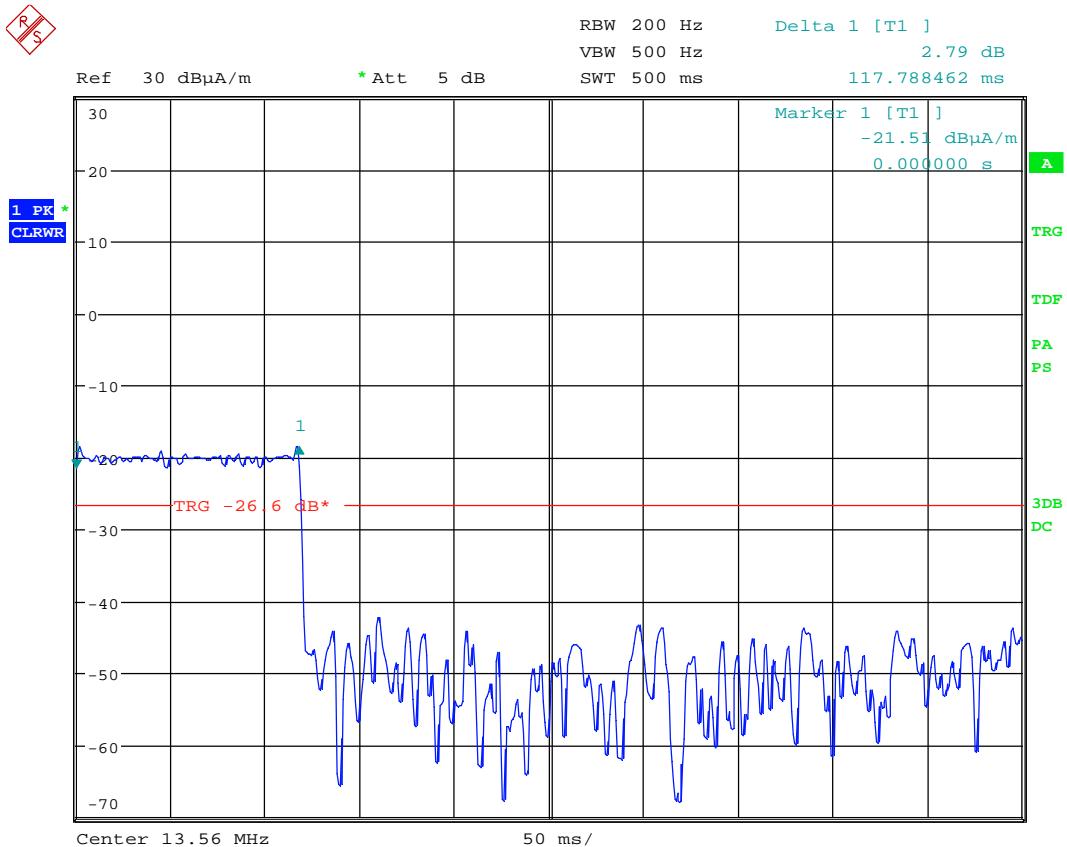
RF duty cycle: Calculation according to RF burst Para 15.35 (c)

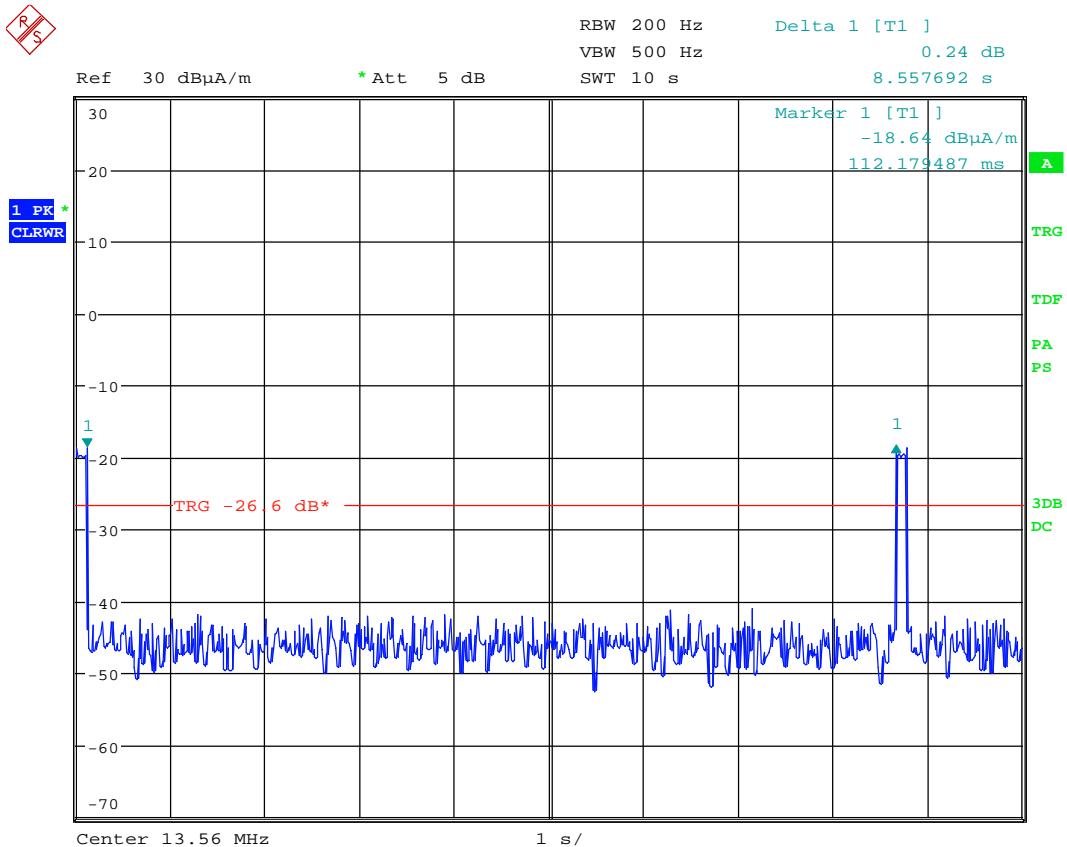
minimum DC Correction factor =  $-20 \times \log((0.11778) / (8.56+0.1178)) = -37.3 \text{ dB}$

**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.





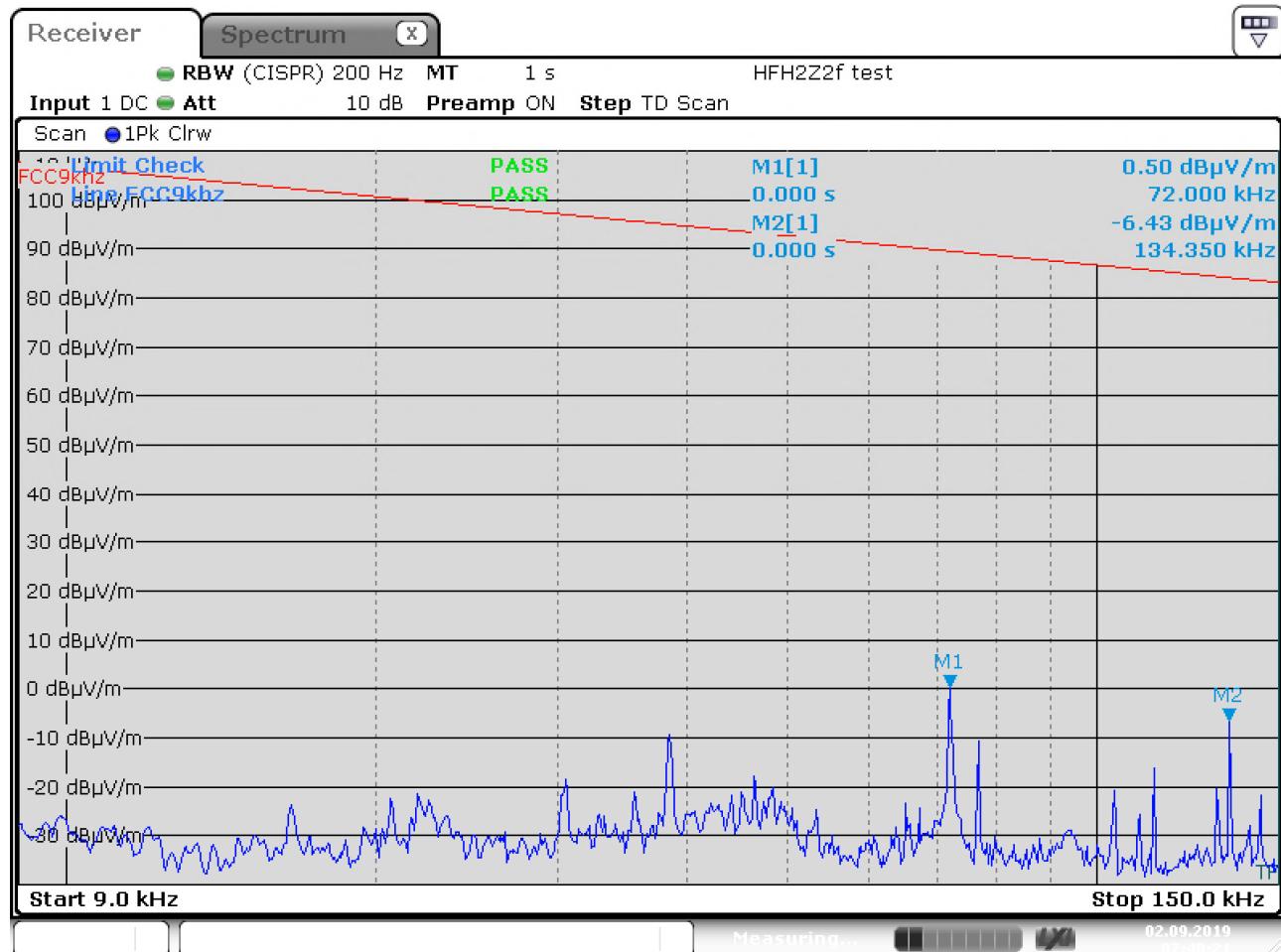
Date: 26.AUG.2019 07:38:03

OFF time

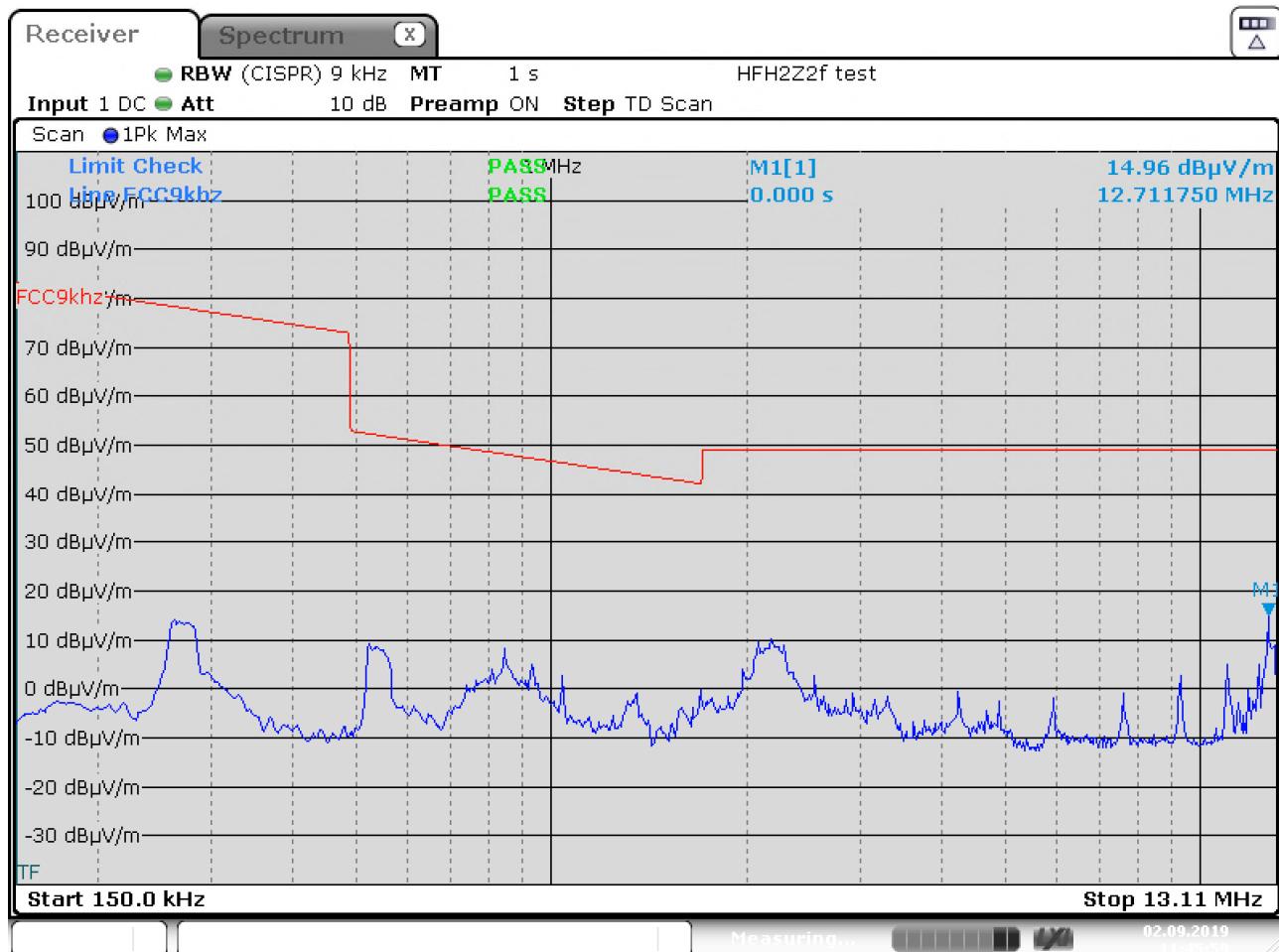
**Radiated emissions 9kHz – 30 MHz.**

Detector: Peak

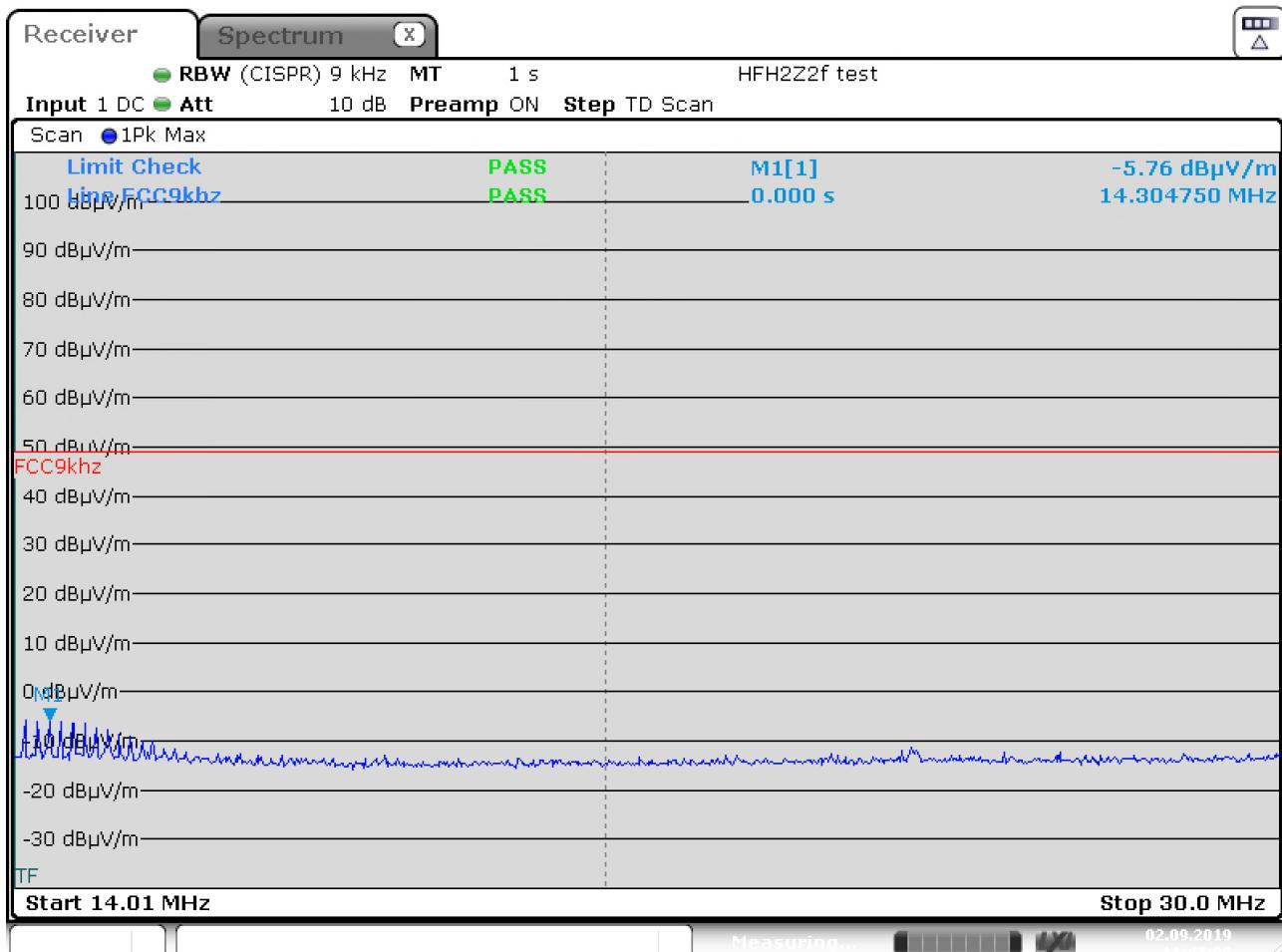
Measuring distance 10 m. The limit is corrected to 10m distance.



**Radiated spurious emissions, 9kHz – 150kHz, PK scan**



Radiated spurious emissions, 150kHz - 13.11MHz, PK scan



Radiated spurious emissions, 14.01Hz - 30MHz, PK scan

**Radiated emissions 30 – 1000 MHz.**

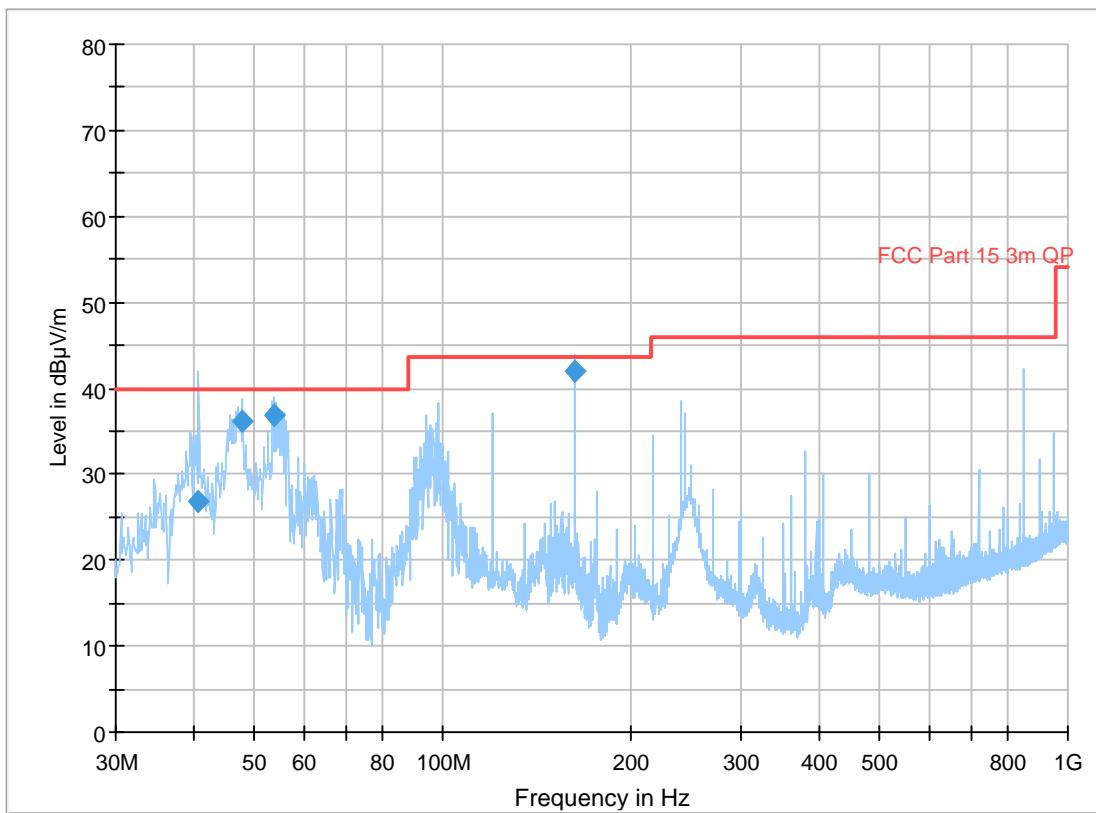
Detector: QP

Measuring distance 3 m.

The graph shows peak scan and highest values.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40.471450	26.86	40.00	13.14	1000.0	120.000	120.0	V	20.0
47.798350	36.12	40.00	3.88	1000.0	120.000	102.0	V	0.0
53.570200	36.79	40.00	3.21	1000.0	120.000	105.0	V	256.0
162.721750	41.96	43.50	1.54	1000.0	120.000	215.0	H	254.0

Full Spectrum



30 - 100MHz (PK scan)

### 3.5 Transmitter Frequency Stability

FCC 15.225(e)

ISED Canada RSS-210 Issue 9, B.6 and RSS-Gen B.6.11 (a)

**Test Results: Complies**

**Measurement Data:**

Temperature	Given Frequency (MHz)	Measured value (MHz)	Deviation (%)
+50 ° C	13.56	13.56013945	0.00029
+40 ° C	13.56	13.56016145	0.00013
+30 ° C	13.56	13.56018070	0.00001
+20 ° C	13.56	13.56017945	<b>Reference</b>
+10 ° C	13.56	13.56016145	0.00119
+0 ° C	13.56	13.56094450	0.00695
-10 ° C	13.56	13.56022345	0.00164
-20 ° C	13.56	13.56024245	0.00178

Supply voltage: 5.0Vdc

**Requirement:**

(e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  ( $\pm 100\%$ ) 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		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
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.

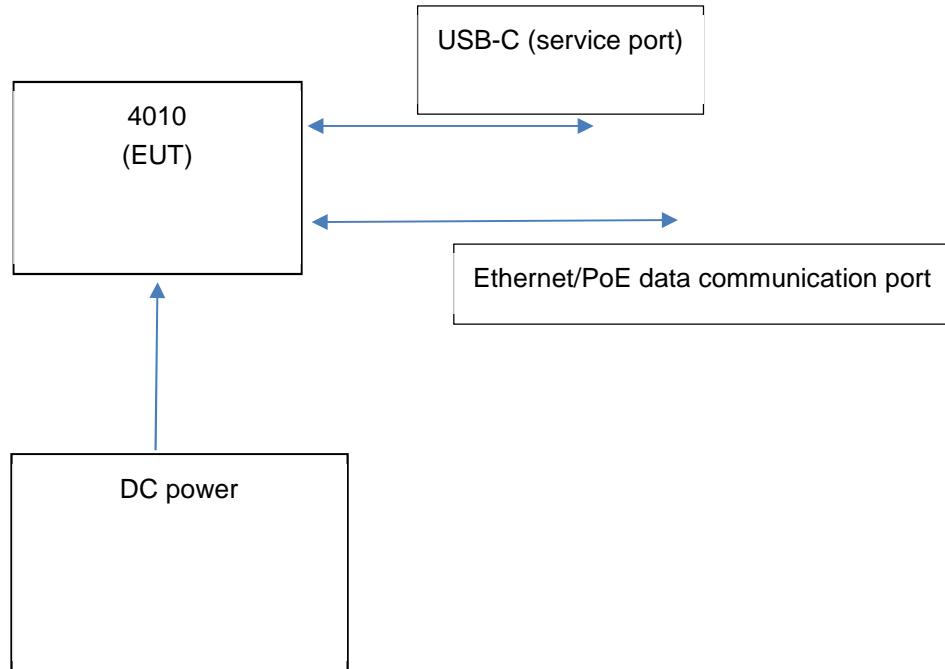
No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1.	ESU40	EMI Receiver	Rohde & Schwarz	LR1639	2019.01	2020.01
2.	FSW43	Spectrum analyser	Rohde & Schwarz	LR1690	2019.01	2020.01
3.	HFH2-Z2	Active Loop antenna	Rohde & Schwarz	LR1660	2016.11	2019.11
4.	3117-PA	Antenna horn	EMCO	LR 1717	2017.05	2020.05
5.	3115	Antenna horn	EMCO	LR 1330	2016.10	2020.10
6.	ARJB1	Bi-log Hybrid Antenna	Sunol	LR 1734	2018.05	2020.05
7.	4768-10	Attenuator	Narda	LR 1356	Cal b4 use	
8.	310N	Pre-amplifier	Sonoma	LR 1686	2019.07	2020.07
9.	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2019.07	2020.07
10.	ESR	Spectrum analyser	R & S	LR 1675	2019.01	2020.01
11.	Model 45	Multimeter	Fluke	LT 5218	2018.11	2020.11
12.	TY80	Climatic chamber Temp	ACS	LR 1083	2019.03	2020.03.
13.	A 10-B	Rubidium	Quartzlock	LR 1386	2017.02	2020.02
14.	FA210A1010003030	Microwave cable	Rosenberger	LR1566	Cal b4 use	
15.	CPX400S	Power Supply	TTi	LR1713	Cal b4 use	
16.	HFH2-Z4	Antenna Inductive Probe	R & S	LR 1100	Cal b4 use	
17.	6812B	AC Power source	Agilent	LR 1515	2019.03	2021.03

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers
2	Rohde & Schwarz	RScommander	1.9.2	Software Tool for R&S Instruments
3	Rohde & Schwarz	EMC 32	10.40.10	Radiated Emission test software

## 6 System set up

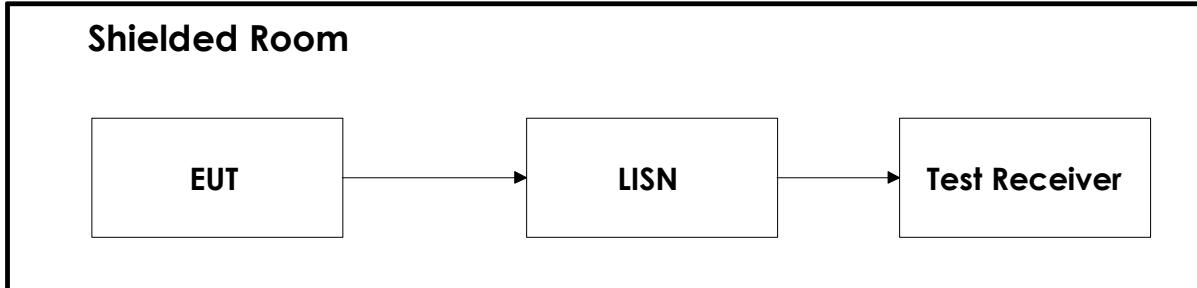
### 6.1 System set up for radiated measurements



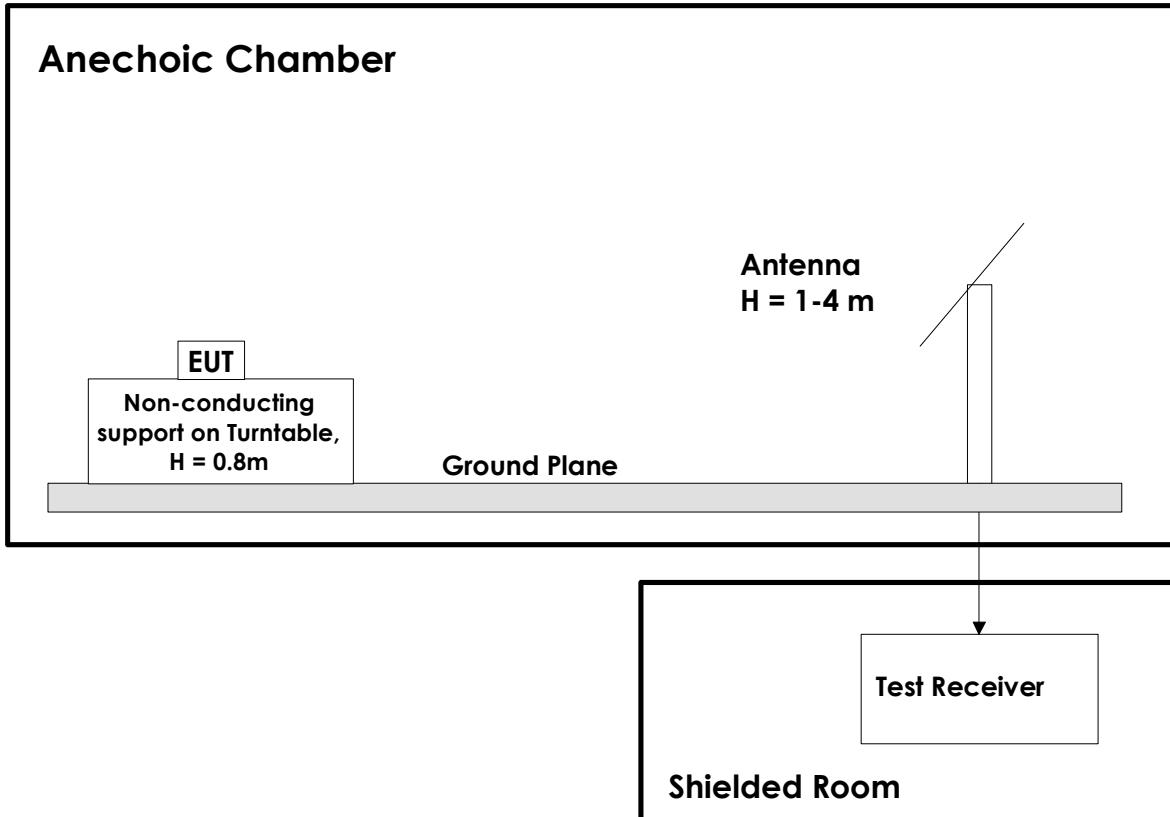
Test equipment: 1,3,4,5,6,8

## 7 BLOCK DIAGRAM

### 7.1 Power Line Conducted Emission



### 7.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.