

Test report

349566TRFWL

Date of issue: 2018-03-16

Applicant:

Zadi Spa

Via Carlo Marx, 138 – 41012 Carpi (MO) – Italy

Product:

E-Lock System

Model:

EL0343

FCC ID:

VFZKLGZADI03

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C**

Intentional radiators

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The test report merely corresponds to the tested sample.

The phase of sampling / collection of equipment under test is carried out by the customer.

Test location

Company name:	Nemko Spa
Address:	Via del Carroccio, 4
City:	Biassono
Province:	MB
Postal code:	20853
Country:	Italy
Site number:	FCC test site registration number: 682159

Tested by (name, function and signature)	P. Barbieri	(project handler)	
Approved by (name, function and signature)	D. Guarnone	(verifier)	
Date	2018-03-16		

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Test methods.....	4
1.4 Statement of compliance	4
1.5 Exclusions	4
1.6 Test report revision history	4
Section 2. Summary of test results	5
2.1 FCC Part 15 Subpart C, general requirements test results	5
Section 3. Equipment under test (EUT) details	6
3.1 Sample information.....	6
3.2 EUT information	6
3.3 Technical information	6
3.4 Product description and theory of operation	6
3.5 EUT exercise details.....	6
3.6 EUT setup diagram	7
3.7 EUT sub assemblies	7
Section 4. Engineering considerations	8
4.1 Modifications incorporated in the EUT.....	8
4.2 Technical judgment	8
4.3 Deviations from laboratory tests procedures	8
Section 5. Test conditions	9
5.1 Atmospheric conditions	9
5.2 Power supply range.....	9
Section 6. Measurement uncertainty	10
6.1 Uncertainty of measurement	10
Section 7. Test equipment	11
7.1 Test equipment list.....	11
Section 8. Testing data	12
8.1 FCC 15.209(a) Radiated emissions limits	12
Section 9. Block diagrams of test set-ups	17
9.1 Radiated emissions set-up.....	17
Section 10. Photos	18
10.1 Photo documentation of the test set-up	18
10.2 EUT photos	19

Section 1. Report summary

1.1 Applicant and manufacturer

Company name:	Zadi Spa
Address:	Via Carlo Marx, 138
City:	Carpi
Province/State:	MO
Postal/Zip code:	41012
Country:	Italy

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C	Intentional radiators
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1.3 Test methods

ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
349566TRFWL	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.31(e)	Variation of power source	Pass ¹
§15.203	Antenna requirement	Pass ²
§15.209	Radiated emission limits; general requirements.	Pass

Notes: ¹ Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed. EUT nominal voltage: 13.5 V DC.

² The Antennas are located within the enclosure of EUT and not user accessible.

The EUT is for vehicular use and it's supplied only by the battery so part §15.207(a) is not applicable.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	2018-03-13
Nemko sample ID number	349586-1/2

3.2 EUT information

Product name	E-Lock System
Model	EL0343
Model variant	--
Serial number	041036

3.3 Technical information

Operating band	None
Operating frequency	134.2 kHz
Modulation type	FSK
Occupied bandwidth (99 %)	10 kHz
Emission designator	10K0F1D
Power requirements	49.1 dB μ V/m
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The E-Lock steering lock switch is a mechatronic device in which there is the steering locking function, realized in mechanically traditional way by the rotation of a key lock cylinder, together with the immobilizer function made electronically by a special integrated unit.

3.5 EUT exercise details

The EUT has been modified to transmit in continues mode. Normally the 134.2 kHz carrier is activate only by the rotation of the key lock cylinder (by a passive key)

3.6 EUT setup diagram

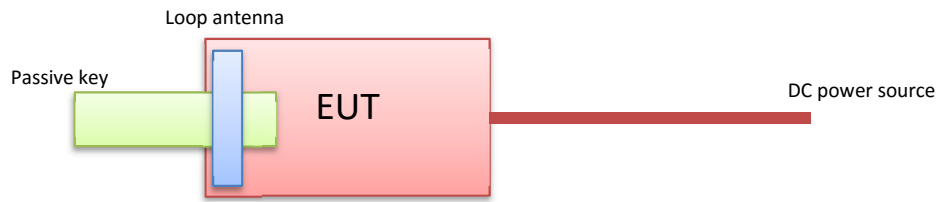


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model	Serial number
E-lock system	Zadi Spa	EL0343	041036

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

Test equipment used for the monitoring of the environmental conditions

Equipment	Manufacturer	Model no.	Asset no.
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Thermohygrometer data loggers	Testo	175-H2	38203337/703
Barometer	MSR	MSR145B	330080

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

EUT	Type	Test	Range and Setup features	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001MHz ÷ 18 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	1MHz ÷ 18 GHz With power meter	1.6 dB	(1)
			1MHz ÷ 18 GHz With spectrum/receiver	3.0 dB	(1)
		Adjacent channel power	1MHz ÷ 18 GHz	1.6 dB	(1)
		Conducted spurious emissions	1MHz ÷ 18 GHz	4.2 dB	(1)
		Intermodulation attenuation	1MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
	Hopping Frequency Separation	0.01MHz ÷ 18 GHz	1%	(1)	
	Occupied Channel Bandwidth	0.01MHz ÷ 18 GHz	2%	(1)	
	Modulation Bandwidth	0.01MHz ÷ 18 GHz	2%	(1)	
Receiver	Radiated	Radiated spurious emissions	30MHz ÷ 18 GHz	6.0 dB	(1)
		Effective radiated power transmitter	30MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	1MHz ÷ 18 GHz	4.2 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %.

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	R&S	ESW44	100202	2017-04	2018-04
Trilog Broadband Antenna 25 ÷ 8000 MHz	Schwarzbeck	VULB 9162	9162-025	2017-07	2018-07
Loop antenna	R&S	HFH2-Z2	831247/011	2017-10	2020-10
Turn-table	R&S	HCT	835 803/03	NCR	NCR
Antenna mast	R&S	HCM	836 529/05	NCR	NCR
Controller	R&S	HCC	836 620/7	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2016-10	2018-10
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.209(a) Radiated emissions limits

8.1.1 Definitions and limits

- (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the Table 8.1-1 below.
- (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
- (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Table 8.1-1: FCC §15.209– Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	μV/m	dBμV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Table 8.1-2: FCC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.1.2 Test summary

Test date:	2018-03-15	Temperature:	22 °C
Test engineer:	P. Barbieri	Air pressure:	1004 mbar
Verdict:	Pass	Relative humidity:	45 %

8.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.

EUT was set to transmit with 100 % duty cycle.

Radiated measurements were performed at a distance of 10 m for frequency below 30 MHz and at a distance of 3 m for frequency above 30 MHz.

Receiver settings for frequencies below 30 MHz:

Detector mode	Quasi-Peak
Resolution bandwidth	9 kHz
Measurement time	1000 ms

Receiver settings for frequencies above 30 MHz:

Detector mode	Quasi-Peak
Resolution bandwidth	120 kHz
Measurement time	1000 ms

8.1.4 Test data

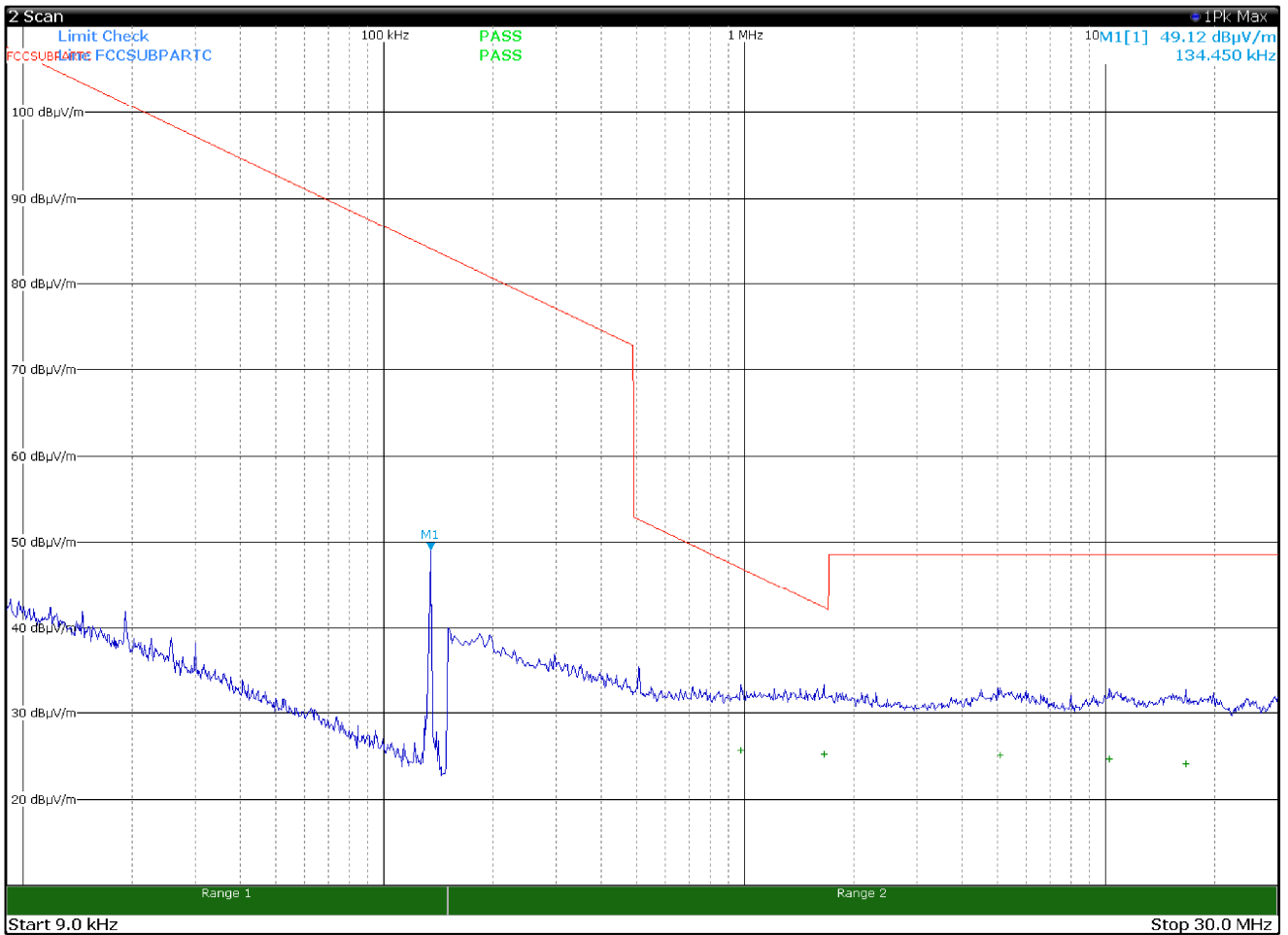


Figure 8.1-1: Field strength of spurious emissions below 30 MHz

Table 8.1-3: Quasi-Peak spurious emissions results below 30 MHz

Frequency, MHz	Q-Peak result, dBµV/m	Meas. Time, ms	Bandwidth, kHz	Margin, dB	Limit, dBµV/m
0.1344	48.3	1000	9	-36.7	85.0
0.9735	25.7	1000	9	-21.2	46.9
1.6598	25.3	1000	9	-17.1	42.4
5.1045	25.2	1000	9	-23.3	48.5
10.2615	24.8	1000	9	-23.7	48.5

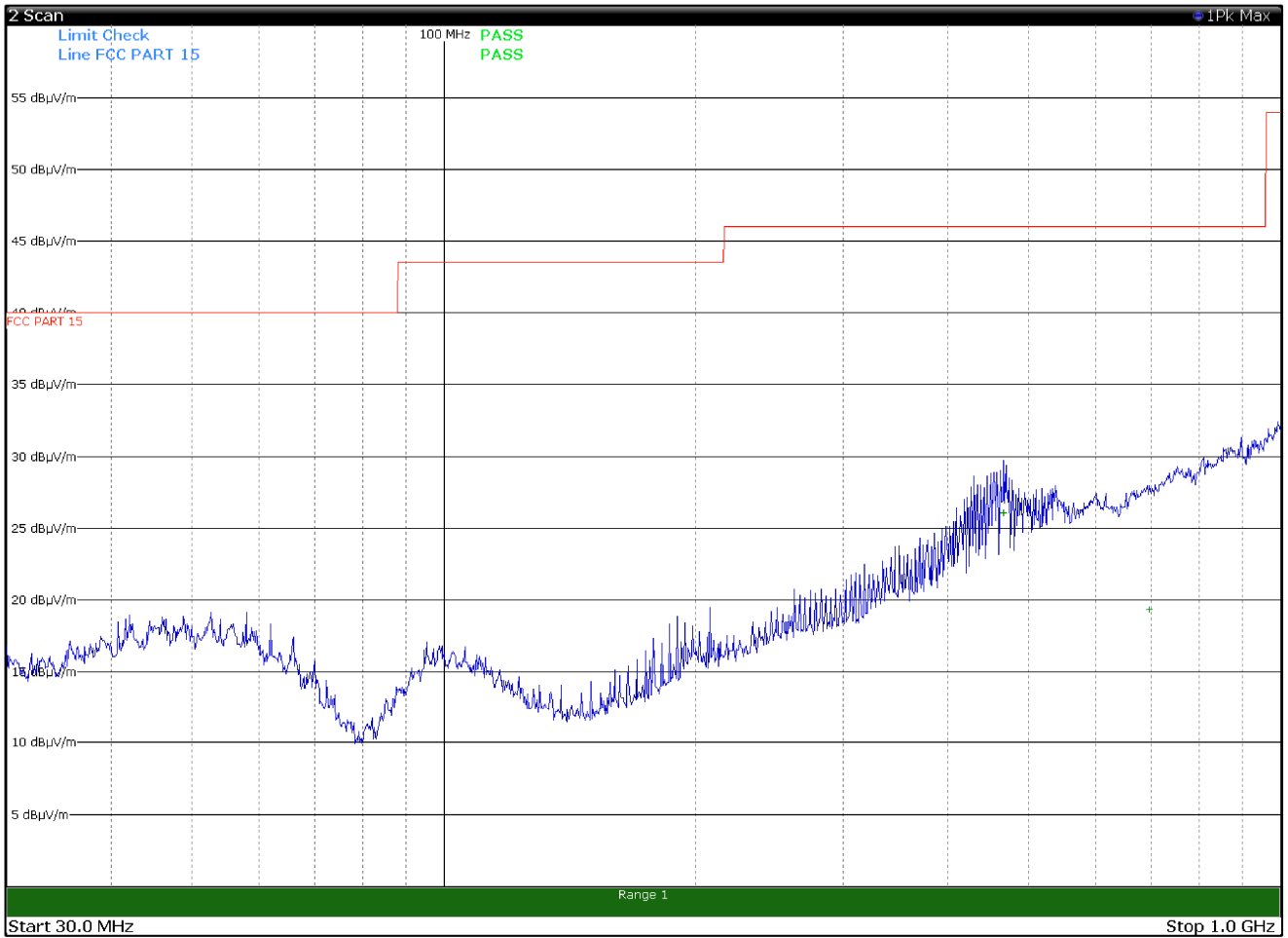


Figure 8.1-2: Field strength of spurious emissions above 30 MHz – Antenna in horizontal polarization

Table 8.1-4: Quasi-Peak spurious emissions results above 30 MHz with antenna in horizontal polarization

Frequency, MHz	Q-Peak result, dBµV/m	Meas. Time, ms	Bandwidth, kHz	Margin, dB	Limit, dBµV/m
466.0200	26.1	1000	120	-19.9	46.0
697.1100	19.3	1000	120	-26.7	46.0

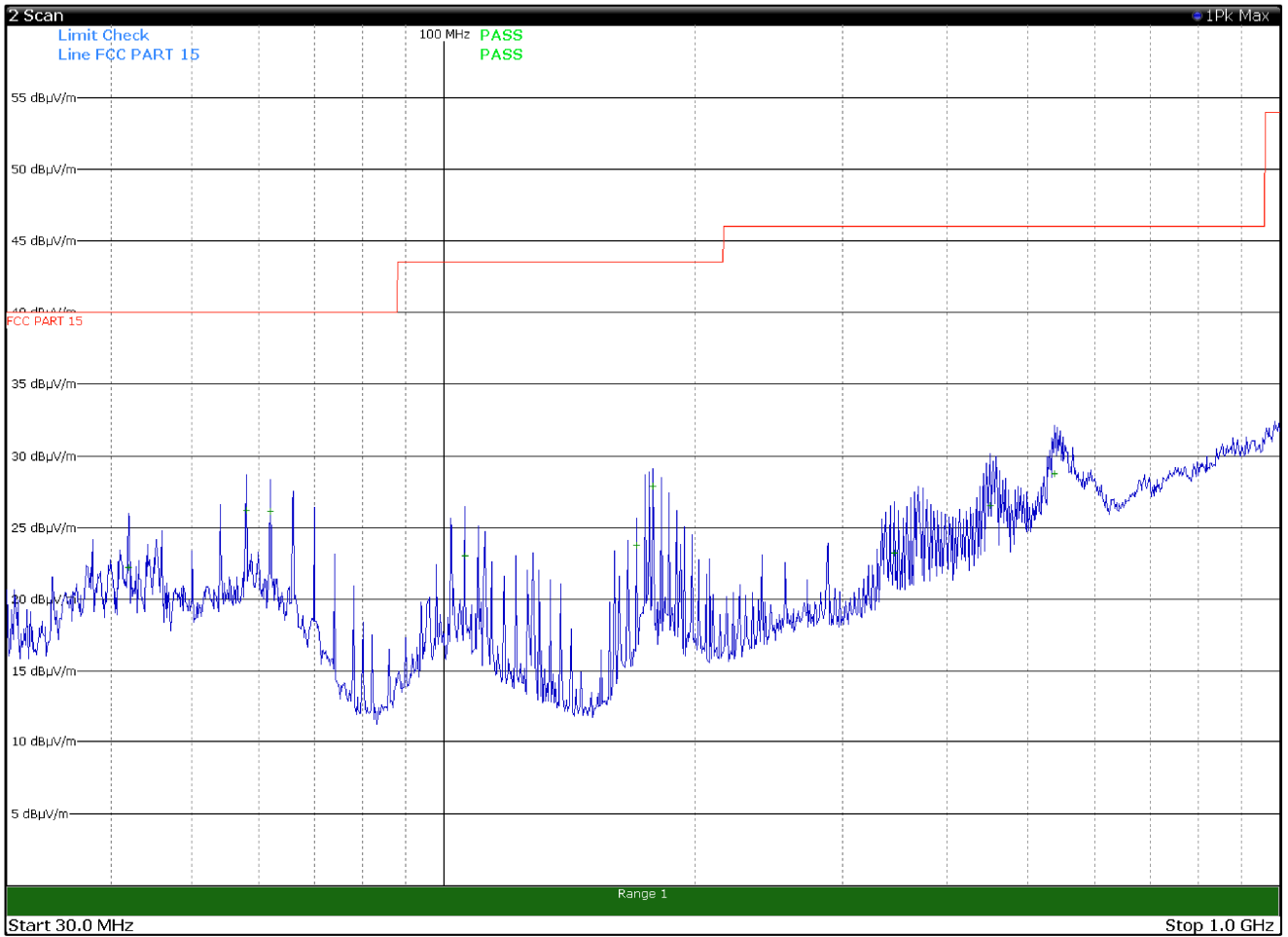


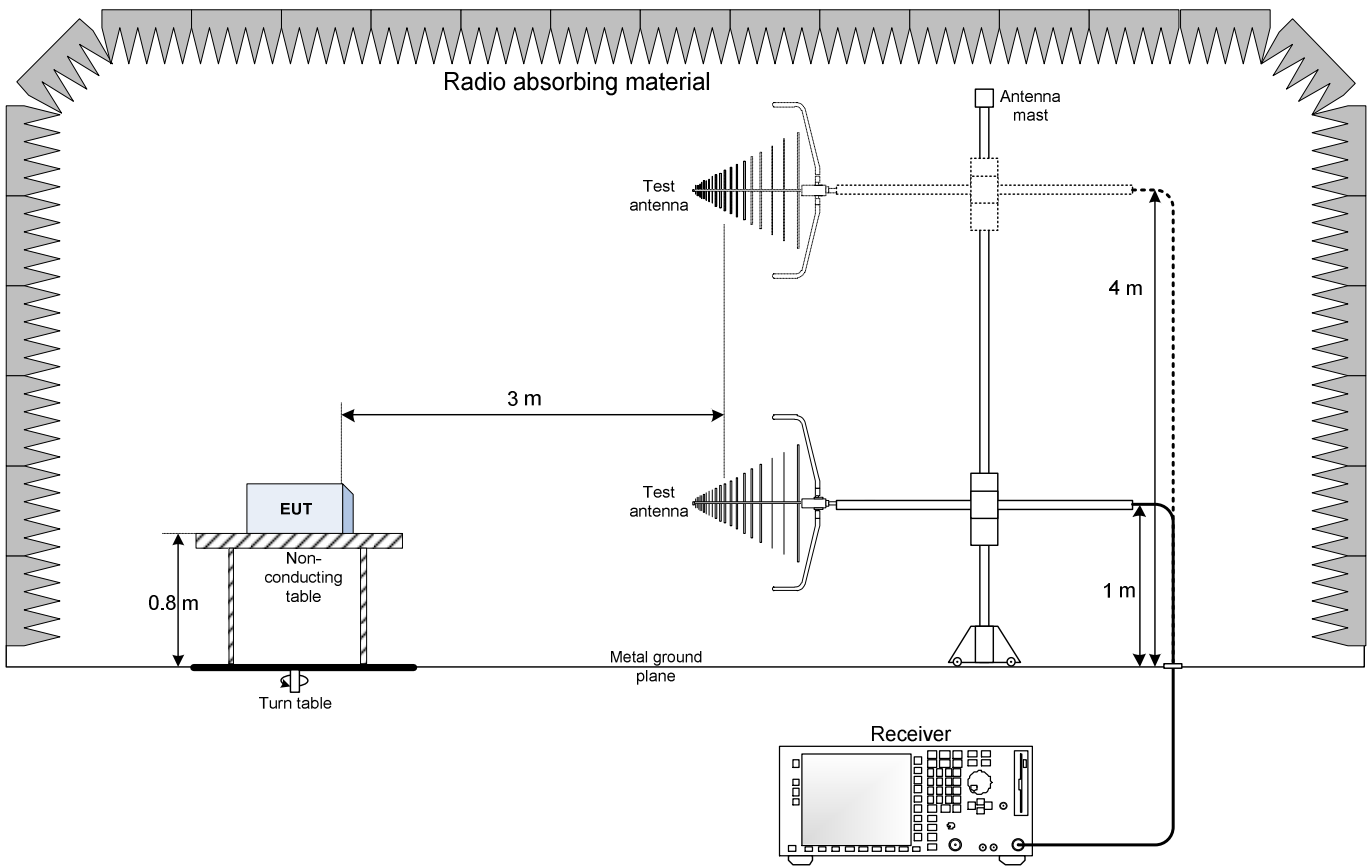
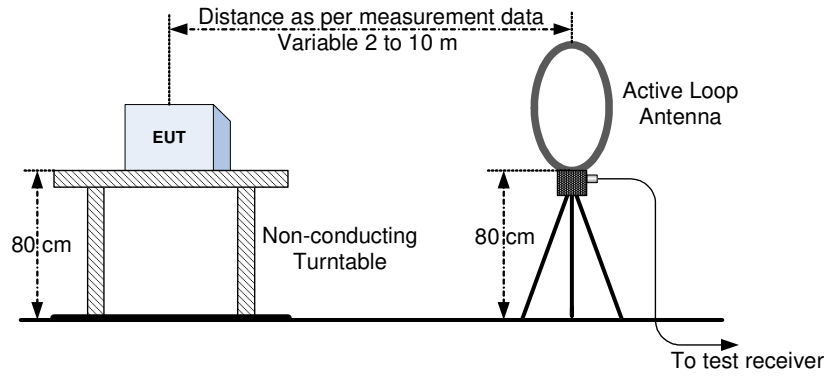
Figure 8.1-3: Field strength of spurious emissions above 30 MHz – Antenna in vertical polarization

Table 8.1-5: Quasi-Peak spurious emissions results above 30 MHz with antenna in horizontal polarization

Frequency, MHz	Q-Peak result, dBµV/m	Meas. Time, ms	Bandwidth, kHz	Margin, dB	Limit, dBµV/m
42.0000	22.3	1000	120	-17.7	40.0
57.9900	26.2	1000	120	-13.8	40.0
62.0100	26.2	1000	120	-13.8	40.0
105.9900	23.1	1000	120	-20.4	43.5
170.0100	23.8	1000	120	-19.7	43.5
177.9900	27.9	1000	120	-15.6	43.5
346.0200	23.3	1000	120	-22.7	46.0
450.0000	26.6	1000	120	-19.4	46.0
537.9900	28.8	1000	120	-17.2	46.0

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



Section 10. Photos

10.1 Photo documentation of the test set-up



