

Test report

317749-4TRFWL

Date of issue: November 22, 2016

Applicant:

Digital Security Controls a div. of Tyco Safety Products Canada Ltd.

Product:

Self-Contained Wireless Security System

Model:

WS900-29

FCC ID:

F5316WS90029

IC Registration number:

160A-WS90029

Specifications:

FCC 47 CFR Part 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

RSS-210 Issue 8, December 2010, Annex 2.9

Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency band for any application

Test location

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Website	www.nemko.com
Site number	FCC test site registration number: 176392, IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Andrey Adelberg, Senior Wireless/EMC Specialist David Duchesne, Senior EMC/Wireless Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Review date	November 22, 2016
Reviewer signature	

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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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Digital Security Controls a div. of Tyco Safety Products Ltd.
Address	3301 Langstaff Road, Concord, ON, Canada, L4K 4L2

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.249	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.
RSS-210 Issue 8, December 2010, Annex 2.9	Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz

1.3 Test methods

ANSI C63.10 v2013	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 performed against all relevant requirements of the test standard except as noted in section 1.5 below. 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

The product was assessed under Nemko project 309365-4. Only radiated spurious emissions tests were performed. EUT is being assessed for Class 2 permissive change.

1.6 Test report revision history

Table 1.6-1: Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Notes: None

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Table 2.1-1: FCC part 15 Subpart C test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not tested
§15.31(e)	Variation of power source	Pass ¹
§15.203	Antenna requirement	Pass ²
§15.215(c)	20 dB bandwidth	Not tested

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
² The antenna is located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Table 2.2-1: FCC part 15 Subpart C, §15.249 test results

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	Not applicable
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: None

2.3 IC RSS-GEN, Issue 4, test results

Table 2.3-1: RSS GEN test results

Part	Test description	Verdict
6.6	Occupied bandwidth	Not tested
7.1.2	Receiver radiated emission limits	Not applicable
7.1.3	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not tested

Notes: ¹ According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.4 IC RSS-210, Issue 8, test results

Table 2.4-1: RSS 210 test results

Part	Test description	Verdict
§A2.9a	Radiated emissions not in restricted bands	Pass
§A2.9b	Spurious emissions (except harmonics)	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	November 1, 2016
Nemko sample ID number	133-002226

3.2 EUT information

Product name	Self-Contained Wireless Security System
Model	WS900-29
Model variant	N/A
Serial number	None

3.3 Technical information

All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-210 Annex 2.9 Issue 8, December 2010
Frequency band (MHz)	902–928
Frequency Min (MHz)	908.4
Frequency Max (MHz)	908.4
RF power Max (W), Conducted	N/A
Field strength, Units @ distance	89.08 dBμV/m at 3 m
Data from Project 309365-4	
Measured BW (kHz) (99%)	407.05
Data from Project 309365-4	
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	2FSK
Emission classification	F1D
Transmitter spurious, Units @ distance	37.60 dBμV/m Quasi-Peak @ 3 m at 33.92 MHz
Power requirements	12 V _{DC} (Powered via external AC-DC adapter 90–264 V _{AC} 47–63 Hz) and via 7.5 V _{DC} battery
Hardware and software details	HW: UA707 Rev. 03, SW: Ver 1.0
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. Antenna gain is 1.0 dBi

3.4 Product description and theory of operation

The EUT (WS900-29) is a Wireless Alarm System panel that contains three RF interfaces: Wi-Fi, PowerG and Z-wave. This report covers only the Home Automation Z-Wave Protocol interface.

3.5 EUT exercise details

The EUT was supplied in 8 different configurations: 1) Low channel - conducted, 2) Mid channel - conducted, 3) High channel - conducted, 4) Hopping – conducted and 5) Low channel - radiated, 6) Mid channel - radiated, 7) High channel - radiated, 8) Hopping – radiated. All variants were set to continuous transmit state.

3.6 EUT setup diagram

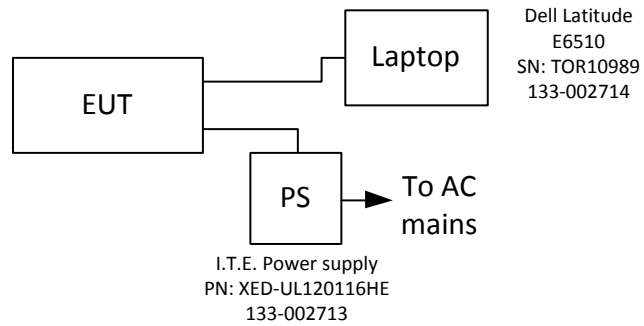


Figure 3.6-1: Setup diagram

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.

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

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78

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.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Dec. 01/16
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
AC Power source	Chenwa	2700M-10k	FA002716	—	VOU
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 28/17
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 26/17
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	April 26/17

Notes: NCR – No Calibration Required, VOU – Verify On Use

Section 8. Testing data

8.1 FCC 15.249(a) RSS 210 A2.9(a) Field strength of fundamental and harmonics outside restricted bands

8.1.1 Definitions and limits

FCC:

The field strength of emissions from intentional radiators shall comply with the following table. Field strength limits are specified at a distance of 3 meters.

IC:

The field strength measured at 3 metres shall not exceed the limits in the following table.

Table 8.1-1: Field strength limits

Fundamental frequencies, MHz	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBμV/m	μV/m	dBμV/m
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24000–24250	250	108	2500	68

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. The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902–928 MHz, which is based on measurements using a CISPR quasi-peak detector.

8.1.2 Test summary

Verdict	Pass				
Test date	November 1, 2016	Test engineer	David Duchesne		
Temperature	24 °C	Relative humidity	35 %	Air pressure	1010. mbar

8.1.3 Notes

- The spectrum was searched from 30 MHz to 10th harmonic of fundamental frequency.
- Radiated measurements were performed at a distance of 3 m.

8.1.4 Setup details

Spectrum analyzer settings for frequencies below 1000 MHz:

Detector mode	Quasi-Peak
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Trace mode	Max Hold

Spectrum analyzer settings for peak measurements at the frequencies above 1000 MHz:

Detector mode	Peak
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Trace mode	Max Hold

Spectrum analyzer settings for average measurements at the frequencies above 1000 MHz:

Detector mode	Peak
Resolution bandwidth	1 MHz
Video bandwidth	10 Hz
Trace mode	Max Hold

Section 8

Test name

Specification

Testing data

FCC 15.249(a) RSS 210 A2.9(a) Field strength of fundamental and harmonics outside restricted bands

FCC Part 15 Subpart C and RSS-210 Annex A2



8.1.4 Test data

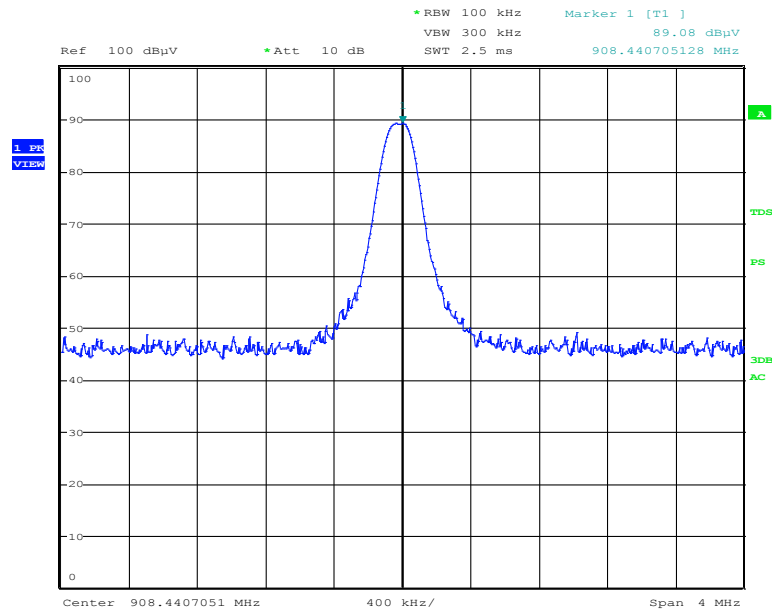


Figure 8.1-1: Field strength of fundamental

Table 8.1-2: Radiated field strength of fundamental and harmonics measurement results

Frequency, MHz	Quasi-peak field strength ¹ , dBμV/m	Quasi-peak field strength limit, dBμV/m	Margin, dB
908.4	89.08	94.00	4.96

Table 8.1-3: Radiated field strength of harmonics measurement results

Frequency, MHz	Peak field strength ¹ , dBμV/m	Peak field strength limit, dBμV/m	Margin, dB	Average field strength, dBμV/m	Average field strength limit, dBμV/m	Average margin, dB
2725.5	40.56	74.00	33.73	34.66	54.00	19.34
4542.5	41.48	74.00	32.77	36.77	54.00	17.23
6358.8	52.67	74.00	21.33	50.69	54.00	3.31

Notes: ¹ Peak field strength (dBμV/m) = Spectrum analyzer value (dBμV) + transducer factors (dB)
Transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

8.2 FCC 15.249(d) Spurious emissions (except for harmonics)

8.2.1 Definitions and limits

FCC

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

IC

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Table 8.2-1: 15.209 and RSS-Gen emissions field strength limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
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 8.2-2: IC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677–5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Notes: Certain frequency bands listed in table above and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.2-3: 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			

8.2.2 Test summary

Verdict	Pass				
Test date	November 1, 2016	Test engineer	David Duchesne		
Temperature	24 °C	Relative humidity	35 %	Air pressure	1010. mbar

8.2.3 Notes

- The spectrum was searched from 30 kHz to 10th harmonic of the fundamental frequency.
- Radiated measurements were performed at a distance of 3 m.

8.2.4 Setup details

Spectrum analyzer settings for frequencies below 1000 MHz:

Detector mode	Peak or Quasi-Peak
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Trace mode	Max Hold

Spectrum analyzer settings for peak measurements at the frequencies above 1000 MHz:

Detector mode	Peak
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Trace mode	Max Hold

Spectrum analyzer settings for average measurements at the frequencies above 1000 MHz:

Detector mode	Peak
Resolution bandwidth	1 MHz
Video bandwidth	10 Hz
Trace mode	Max Hold

8.2.5 Test data

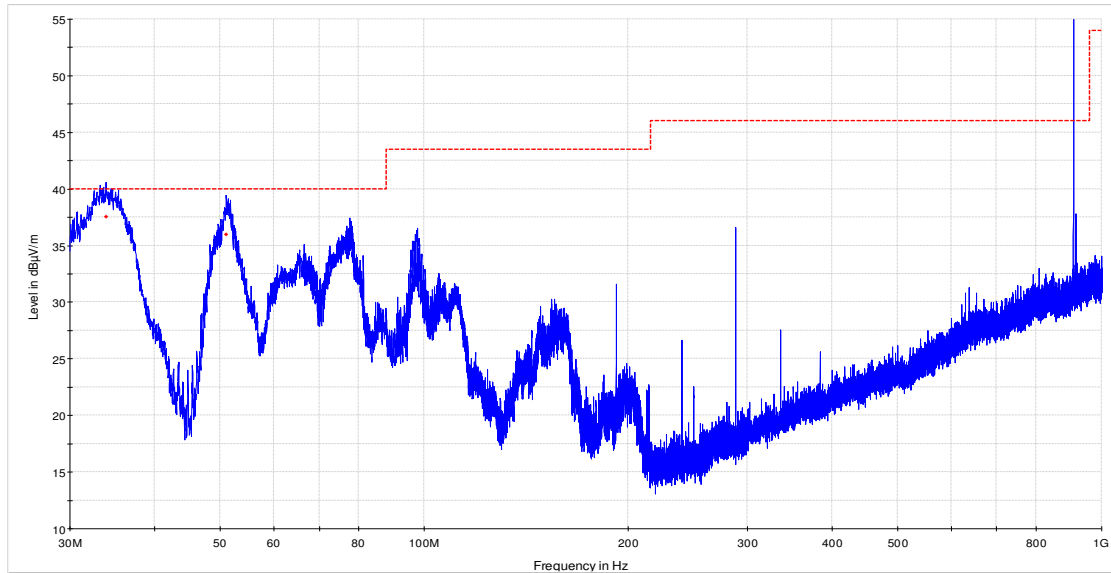


Figure 8.2-1: Field strength of spurious emissions below 1000 MHz

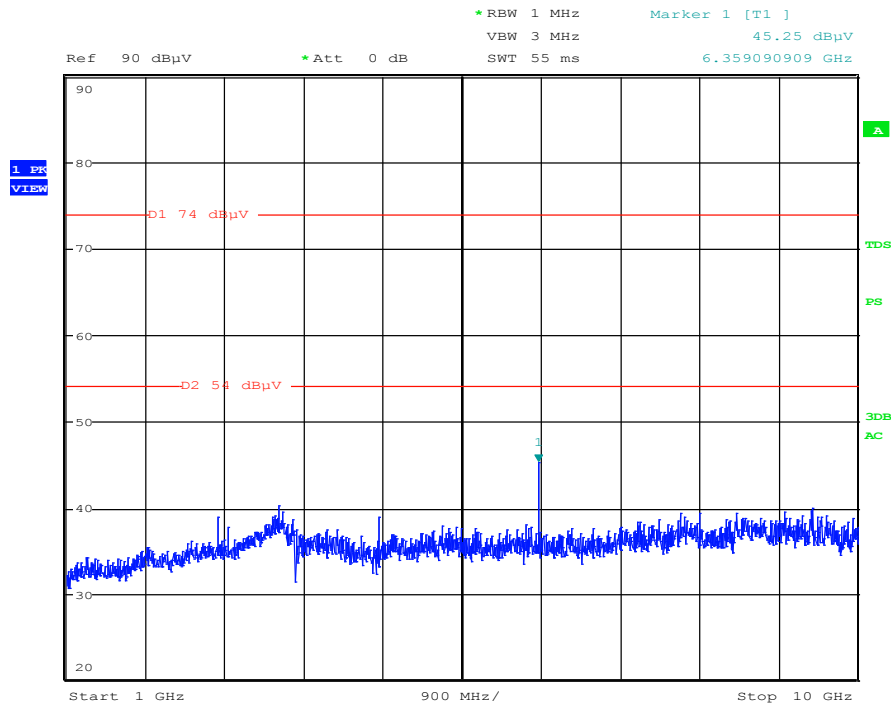


Figure 8.2-2: Field strength of spurious emissions above 1000 MHz

Table 8.2-4: Radiated field strength of spurious emissions measurement results

Frequency, MHz	Quasi-peak field strength ¹ , dBμV/m	Quasi Peak field strength limit, dBμV/m	Margin, dB
33.92	37.60	40.00	2.40
51.04	36.00	40.00	4.00

Table 8.2-5: Radiated band edge emissions measurement results

Frequency, MHz	Attenuation below carrier, dBc	Minimum limit, dBc	Margin, dB
902	52.63	50.00	2.63
928	53.17	50.00	3.17

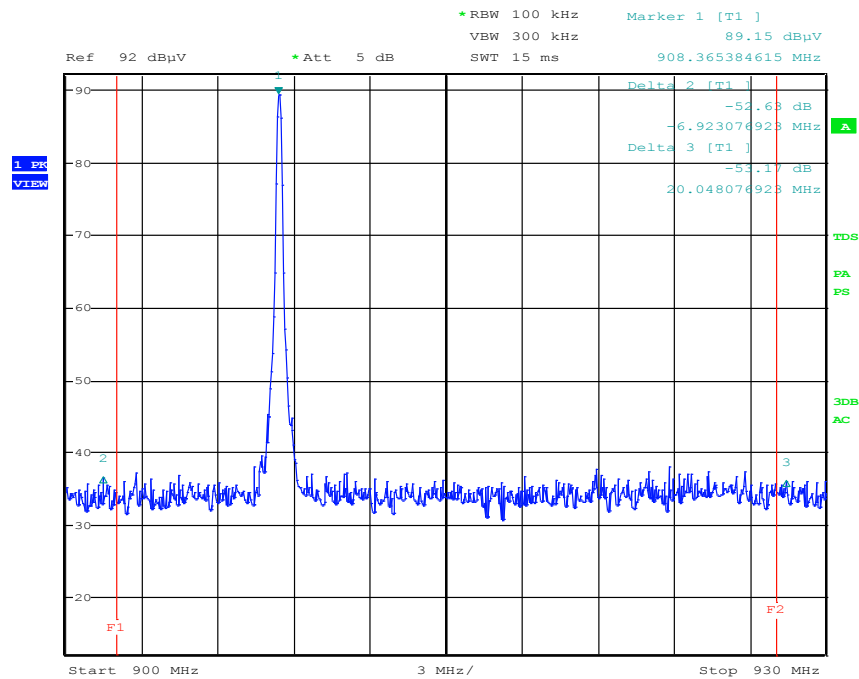
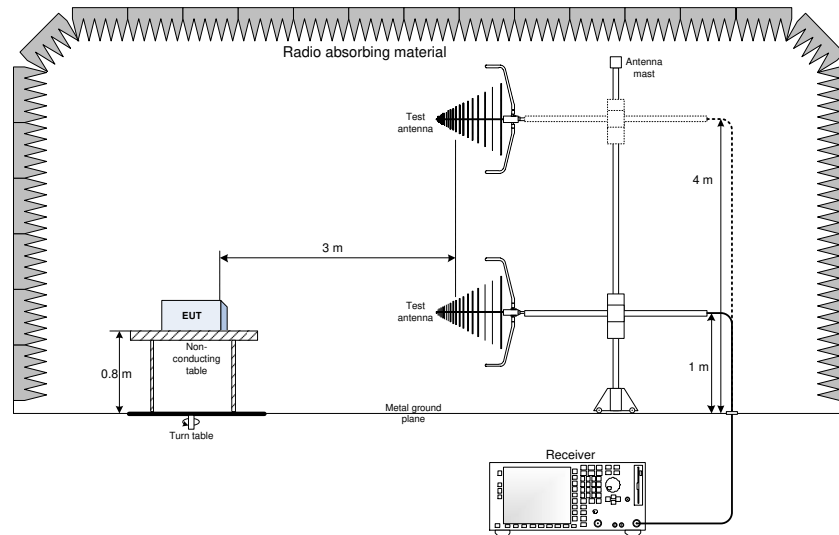


Figure 8.2-3: Radiated band edge emissions

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz

