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Test report

317749-2TRFWL

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 Subpart C, §15.247

  Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

- RSS-247, Issue 1, May 2015, Section 5

  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	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.

Copyright notification

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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 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz
RSS-247, Issue 1, May 2015, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

DA 00-705 Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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 309365-2. 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]

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, §15.247 test results*

Part	Test description	Verdict
§15.215(c)	20 dB bandwidth	Not tested
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not tested
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Not applicable
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not tested
§15.247(b)(3,4)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not tested
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Not applicable
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Notes: None

2.3 IC RSS-GEN, Issue 4, test results

Table 2.3-1: *RSS GEN test results*

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Not applicable[1]
7.1.3	Receiver conducted emission limits	Not applicable[1]
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not tested
6.6	Occupied bandwidth	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-247, Issue 1, test results

Table 2.4-1: *RSS 247 test results*

Part	Test description	Verdict
5.1	Frequency Hopping Systems (FHSs)	
5.1 (1)	Bandwidth of a frequency hopping channel	Not tested
5.1 (2)	Minimum channel spacing for frequency hopping systems	Not tested
5.1 (3)	Frequency hopping systems operating in the 902–928 MHz band	Not tested
5.1 (4)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.1 (5)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
5.2	Digital Transmission Systems (DTSs)	
5.2 (1)	Minimum 6 dB bandwidth	Not applicable
5.2 (2)	Maximum power spectral density	Not applicable
5.3	Hybrid Systems	
5.3 (1)	Digital modulation turned off	Not applicable
5.3 (2)	Frequency hopping turned off	Not applicable
5.4	Transmitter output power and e.i.r.p. requirements	
5.4 (1)	Frequency hopping systems operating in the 902–928 MHz band	Not tested
5.4 (2)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.4 (3)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
5.4 (4)	Systems employing digital modulation techniques	Not applicable
5.4 (5)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
5.4 (6)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
5.5	Out-of-band emissions	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-247 Issue 1, May 2015
Frequency band (MHz)	902–928
Frequency Min (MHz)	912.750
Frequency Max (MHz)	919.106
RF power Max (W), Conducted ***Data from Project 309365-2***	0.032 (15 dBm)
Field strength, Units @ distance	N/A
Measured BW (kHz) (99%) ***Data from Project 309365-2***	87.34
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	FHSS - FSK
Number of hopping channels	50
Emission classification	F1D
Transmitter spurious, Units @ distance	60.22 dBµV/m Peak and 34.22 dBµV/m Average @ 3 m @ 2747.5 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 test report covers only the Proprietary Security RF protocol (PowerG) transmitter.

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

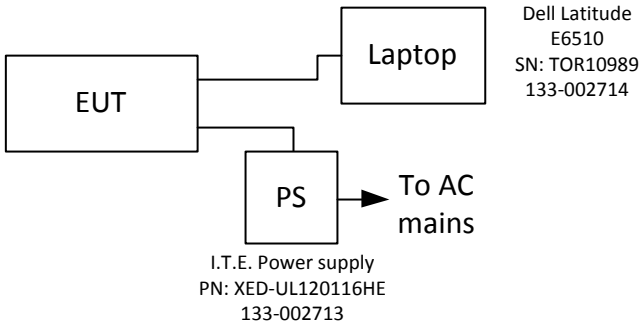


Figure 3.6-1: *Setup diagram*

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 ±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
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
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Mar. 08/17

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

Section 8. Testing data

8.1 FCC 15.247(d) and RSS-247 5.5 Spurious (out-of-band) emissions

8.1.1 Definitions and limits

FCC §15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247, Clause 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Table 8.1-1: *FCC §15.209 and RSS-Gen – 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: *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 8.1-2 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

8.1.1 Definitions and limits, continued

Table 8.1-3: *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			

8.1.2 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

- Only radiated emissions were performed.
- The spectrum was searched from 30 MHz to the 10th harmonic.
- EUT was set to transmit with 100 % duty cycle.
- Spurious emissions limit for frequencies outside restricted bands is −20 dBc/100 kHz

8.1.4 Setup details

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

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

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

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

8.1.5 Test data

Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

$$Duty\,cycle\,/\,average\,factor = 20 \times \log_{10}\left(\frac{Tx_{100ms}}{100\,ms}\right)$$

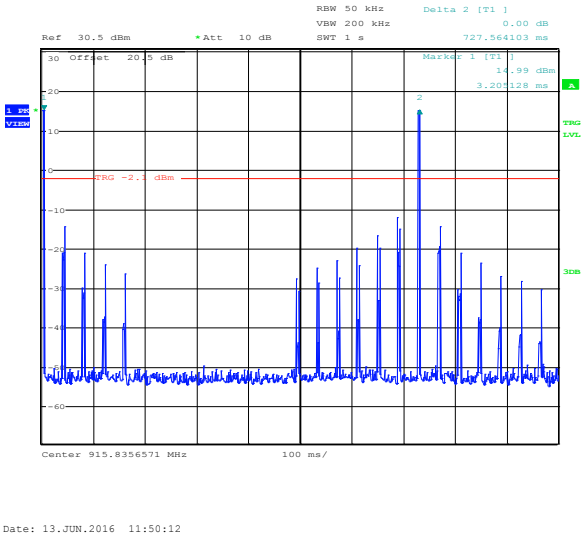


Figure 8.1-1: *Transmission pulse repetition*

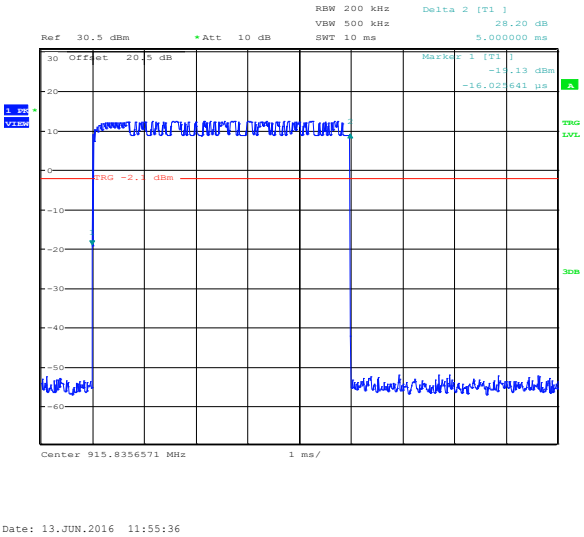


Figure 8.1-2: *Transmitter pulse width*

Duty cycle correction factor:

$$20 \times \text{Log}_{10}\,(5 \div 100) = -26\ \text{dB}$$

8.1.5 Test data, continued

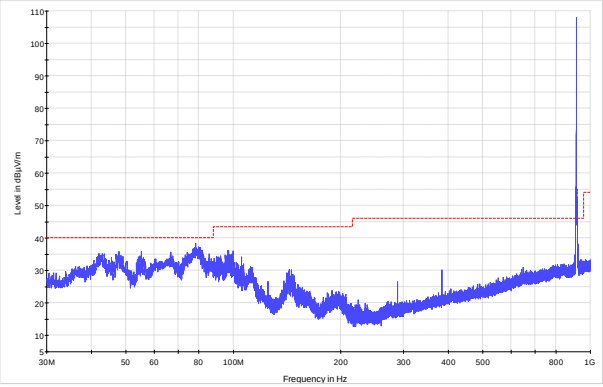


Figure 8.1-3: *Radiated spurious emissions below 1 GHz, low channel*

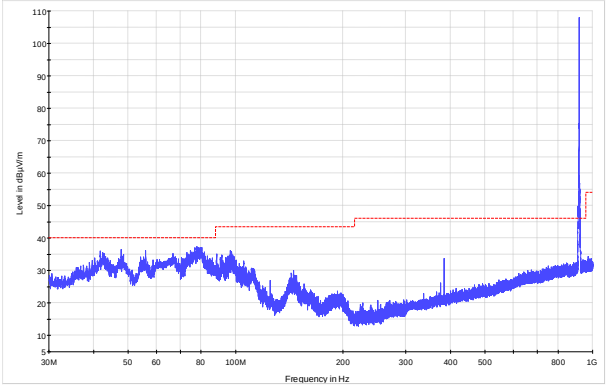


Figure 8.1-4: *Radiated spurious emissions below 1 GHz, mid channel*

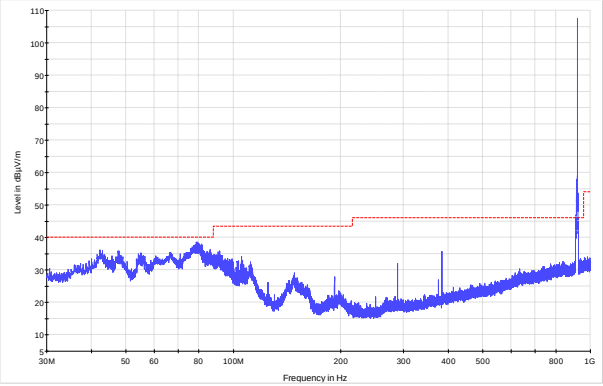


Figure 8.1-5: *Radiated spurious emissions below 1 GHz, high channel*

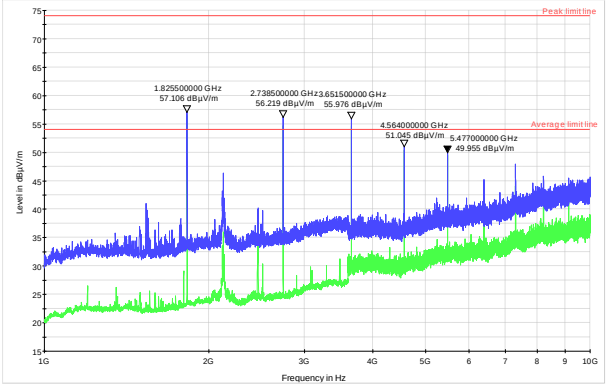


Figure 8.1-6: *Radiated spurious emissions above 1 GHz, low channel*

8.1.5 Test data, continued

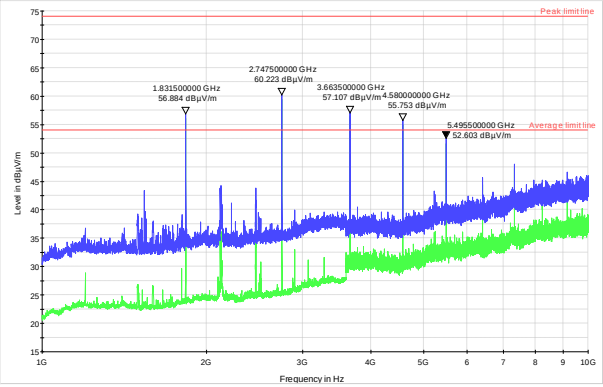


Figure 8.1-7: *Radiated spurious emissions above 1 GHz, mid channel*

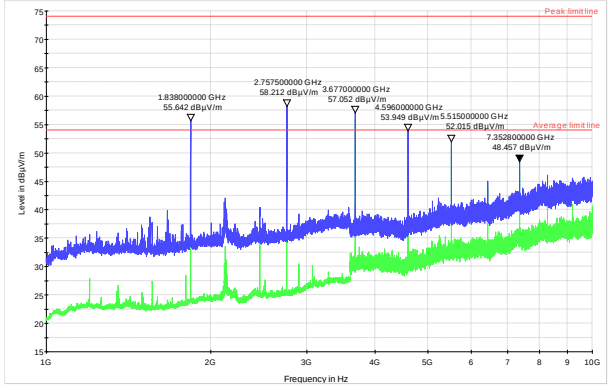


Figure 8.1-8: *Radiated spurious emissions above 1 GHz, high channel*

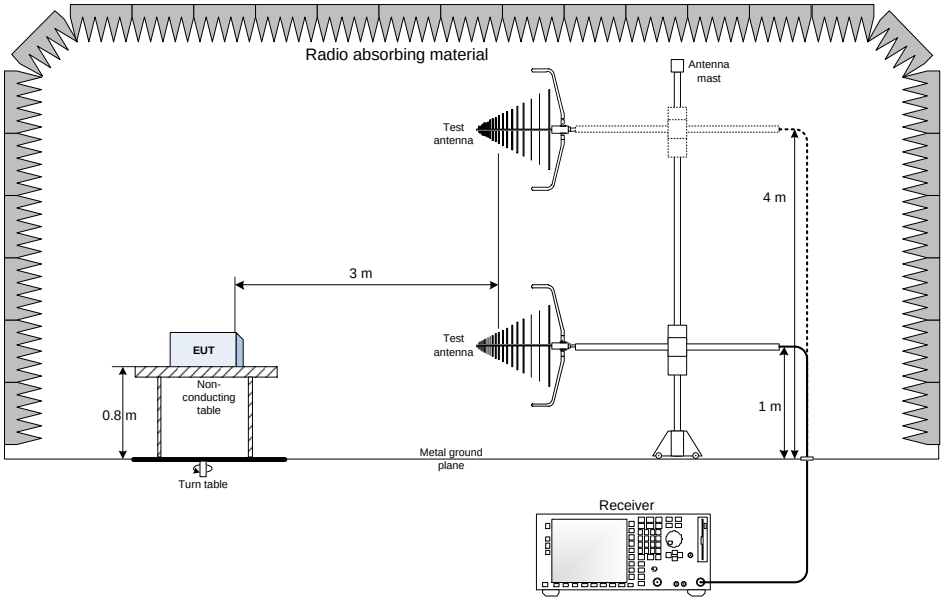
Table 8.1-4: *Radiated field strength measurement results*

Channel	Frequency, MHz	Peak field strength[1], dBµV/m	Peak field strength limit, dBµV/m	Peak margin, dB	Average field strength[2], dBµV/m	Average field strength limit, dBµV/m	Average margin, dB
Low	1825.5	57.11	74.00	16.89	31.11	54.00	22.89
Low	2738.5	56.22	74.00	17.78	30.22	54.00	23.78
Low	3651.5	55.98	74.00	18.02	29.98	54.00	24.02
Low	4564.0	51.05	74.00	22.95	25.05	54.00	28.95
Low	5477.0	49.96	74.00	24.04	23.96	54.00	30.04
Mid	1831.5	56.88	74.00	17.12	30.88	54.00	23.12
Mid	2747.5	60.22	74.00	13.78	34.22	54.00	19.78
Mid	3663.5	57.11	74.00	16.89	31.11	54.00	22.89
Mid	4580.0	55.75	74.00	18.25	29.75	54.00	24.25
Mid	5495.5	52.60	74.00	21.40	26.60	54.00	27.40
High	1838.0	55.64	74.00	18.36	29.64	54.00	24.36
High	2757.5	58.21	74.00	15.79	32.21	54.00	21.79
High	3677.0	57.05	74.00	16.95	31.05	54.00	22.95
High	4596.0	53.95	74.00	20.05	27.95	54.00	26.05
High	5515.0	52.02	74.00	21.98	26.02	54.00	27.98
High	7352.8	48.46	74.00	25.54	22.46	54.00	31.54

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.
[2] Average field strength = Peak field strength + DCCF (which is −26 dB)

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