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Test report

317749-6TRFWL

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, §15.209
  Radiated emission limits; general requirements.
- RSS-GEN, Issue 4, November 2015, Section 8.9
  Transmitter Emission Limits for Licence-Exempt Radio Apparatus

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

Table of contents

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, §15.209	Radiated emission limits; general requirements.
RSS-GEN, Issue 4, November 2015, Section 8.9	Transmitter Emission Limits for Licence-Exempt Radio Apparatus

1.3 Test methods

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 309365-6. 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

Section 2. Summary of test results

2.1 FCC Part 15 Subpart test results

Table 2.1-1: *FCC 47 CFR Part 15 Subpart C, §15.209, test results*

Part	Test description	Verdict
§15.209 (a)	Emissions from an intentional radiator	Pass[1]

Notes: [1]The EUT was verified for compliance with multiple transmitters enabled.

2.2 IC RSS-GEN, Issue 4, test results

Table 2.2-1: *RSS-GEN, Issue 4, November 2015, Section 8.9, test results*

Section	Test description	Verdict
8.9	Transmitter Emission Limits for Licence-Exempt Radio Apparatus	Pass[1]

Notes: [1]The EUT was verified for compliance with multiple transmitters enabled.

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
Serial number	None

3.3 Technical information

All used IC test site(s) Reg. number	2040A-4
WIFI Transmitter	
Frequency band (MHz)	2400–2483.5
Frequency Min (MHz)	2412 (for 802.11b, 802.11g and 802.11n HT20) 2422 (for 802.11n HT40)
Frequency Max (MHz)	2462(for 802.11b, 802.11g and 802.11n HT20) 2452 (for 802.11n HT40)
Type of modulation	802.11b/g/n HT20 and HT40
Power G Transmitter	
Frequency band (MHz)	902–928
Frequency Min (MHz)	912.750
Frequency Max (MHz)	919.106
Type of modulation	FHSS - FSK
Z Wave Transmitter	
Frequency band (MHz)	902–928
Frequency Min (MHz)	908.4
Frequency Max (MHz)	908.4
Type of modulation	2FSK

3.4 Product description and theory of operation

The Wireless alarm system has support for 128 wireless zones. It monitors the wireless initiating devices and activates the integrated siren when an alarm occurs and also provides communication of the alarm event over the integrated Wi-Fi interface. The control unit is also capable to communicate with Z-Wave compatible home automation devices. The security portion can be armed and disarmed via the integrated keypad. Trouble/alarm/signal strength status is indicated on the front panel using LED's.

3.5 EUT exercise details

EUT was connected to a laptop via Ethernet connector. A putty application was running on the computer that controlled the transmitter parameters. Client provided a modified sample with a direct connection to the antenna port for conducted measurements at the antenna ports.

3.6 EUT setup diagram

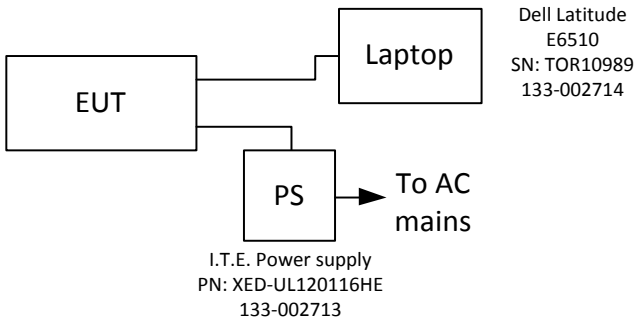


Figure 3.6-1: *Setup diagram*

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
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.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/17
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Dec. 01/16
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
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	Apr.15/17
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	April 26/17
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Notch filter 2400–2483 MHz	Microwave Circuits	2400–2483 MHz	FA001940	—	VOU

Notes: None

Table 7.1-2: *test software*

Test description	Manufacturer of Software	Details
Radiated emissions – Ottawa	Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

Notes: None

Section 8. Testing data

8.1 Radiated spurious emissions

8.1.1 Definitions and limits

FCC §15.209 (a):

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following ***Table 8.1 – 1****:*

RSS-GEN, Section 8.9:

Except when the requirements applicable to a given device state otherwise, emissions from licence‑exempt transmitters shall comply with the field strength limits shown in ***Table 8.1 – 1***:. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 8.1-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions µV/m	Field strength of emissions dBµV/m	Measurement distance, 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

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 the 25 GHz. No emissions were discovered above 18 GHz.
- EUT was set to transmit with 100 % duty cycle.
- Test mode: All transmitters transmitting at the same time (WI-Fi (Mid channel), Power G (Low Channel) and Z-Wave)

8.1.4 Setup details

EUT setup configuration	Table top
Test facility	3 m Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turn table position	0–360°

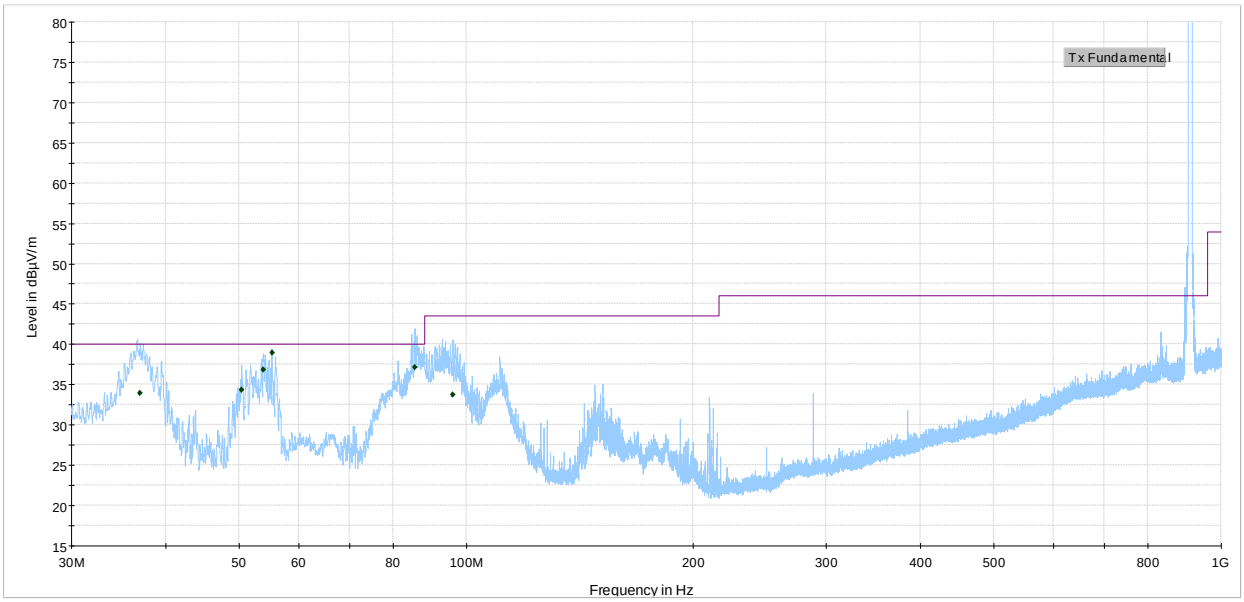
Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 160 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 100 ms (Peak and CAverage final measurement) Special note: Average field strength = Peak field strength + DCCF (which is −26 dB) for Harmonics for Power G transmitter.

8.1.5 Test data



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-1: *Radiated spurious emissions spectral plot – 30 to 1000 MHz*

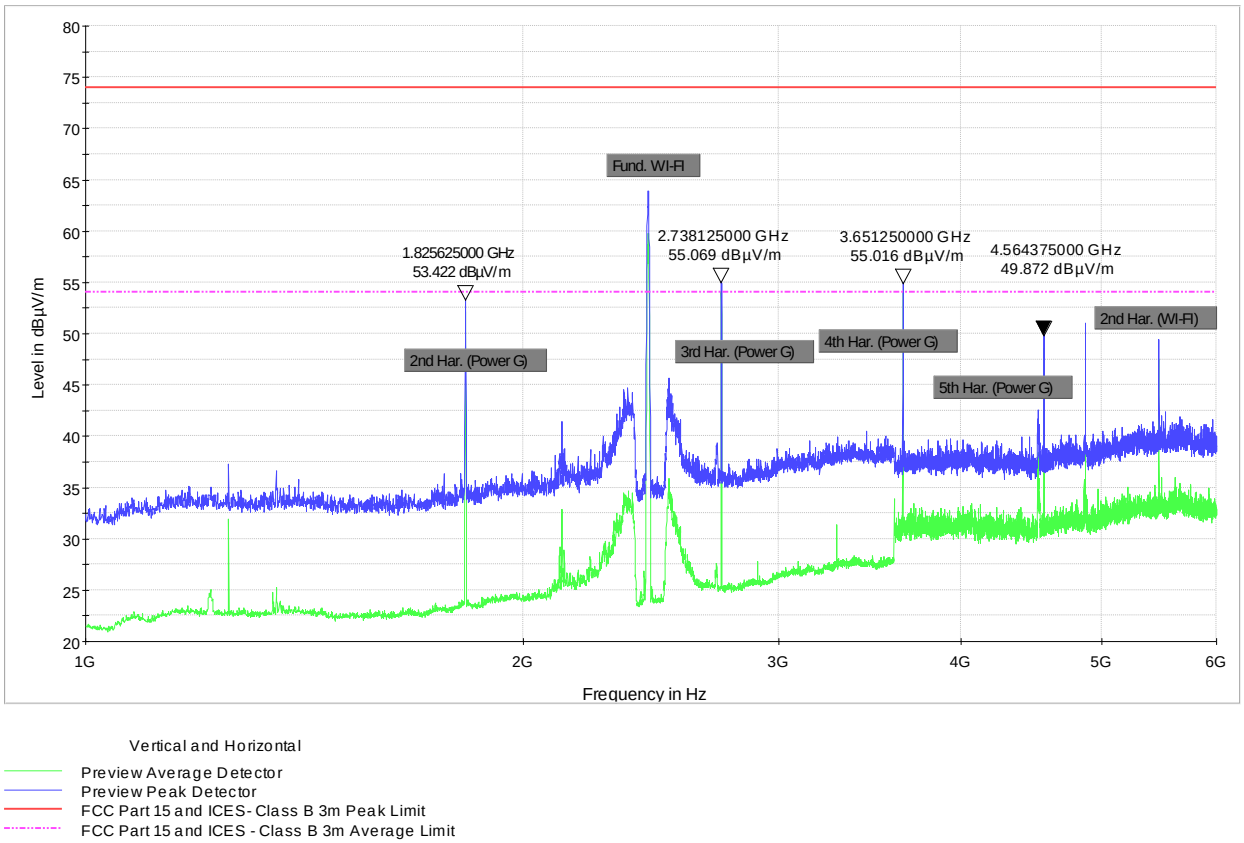
Table 8.1-2: *Radiated spurious emissions (Quasi-Peak) results*

Frequency (MHz)	Quasi-Peak field strength [1 and 4] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor [2] (dB)
36.96	33.94	40.00	6.06	160	120	107.1	V	311.0	18.40
50.43	34.31	40.00	5.69	160	120	123.2	V	54.0	9.80
53.82	36.85	40.00	3.15	160	120	113.4	V	188.0	9.00
55.29	38.93	40.00	1.07	160	120	122.6	V	356.0	8.90
85.50	37.15	40.00	2.85	160	120	109.3	V	30.0	9.30
96.00	33.71	43.50	9.79	160	120	103.2	V	328.0	10.80

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] An inverse proportionality factor of 20 dB per decade (20 log (10/3) = 10.5 dB) has been used to normalize the specification limit to a measurement distance of 3 meters to determine compliance.
[4] The maximum measured value observed over a period of 15 seconds was recorded.

Sample calculation: 38.93 dBµV/m (field strength) = 30.03 dBµV (receiver reading) + 8.90 dB (Correction factor)

8.1.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-2: *Radiated spurious emissions spectral plot – 1 to 6 GHz*

8.1.5 Test data, continued

Table 8.1-3: *Radiated spurious emissions above 1 GHz for Power G transmitter results*

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
1825.62	53.42	74.00	20.58	27.42	54.00	26.58
2738.12	55.07	74.00	18.93	29.07	54.00	24.93
3651.25	55.02	74.00	18.98	29.02	54.00	24.98

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)

Duty cycle/average factor calculations for POWER G transmitter

§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.

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

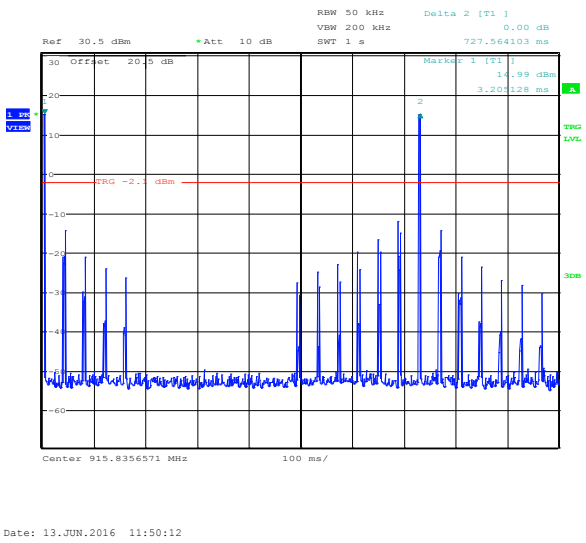


Figure 8.1-3: *Transmission pulse repetition*

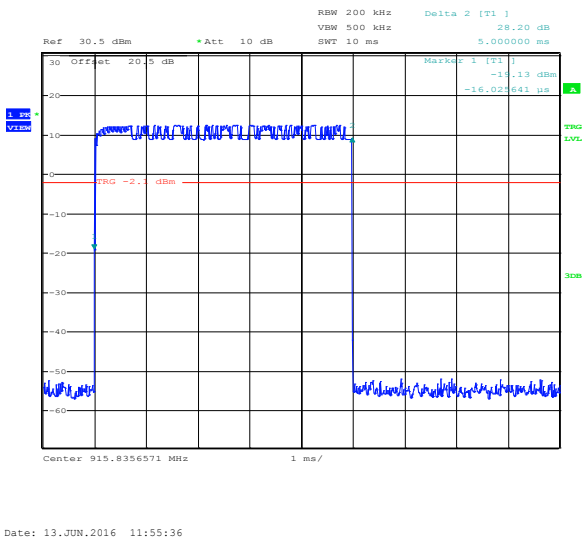
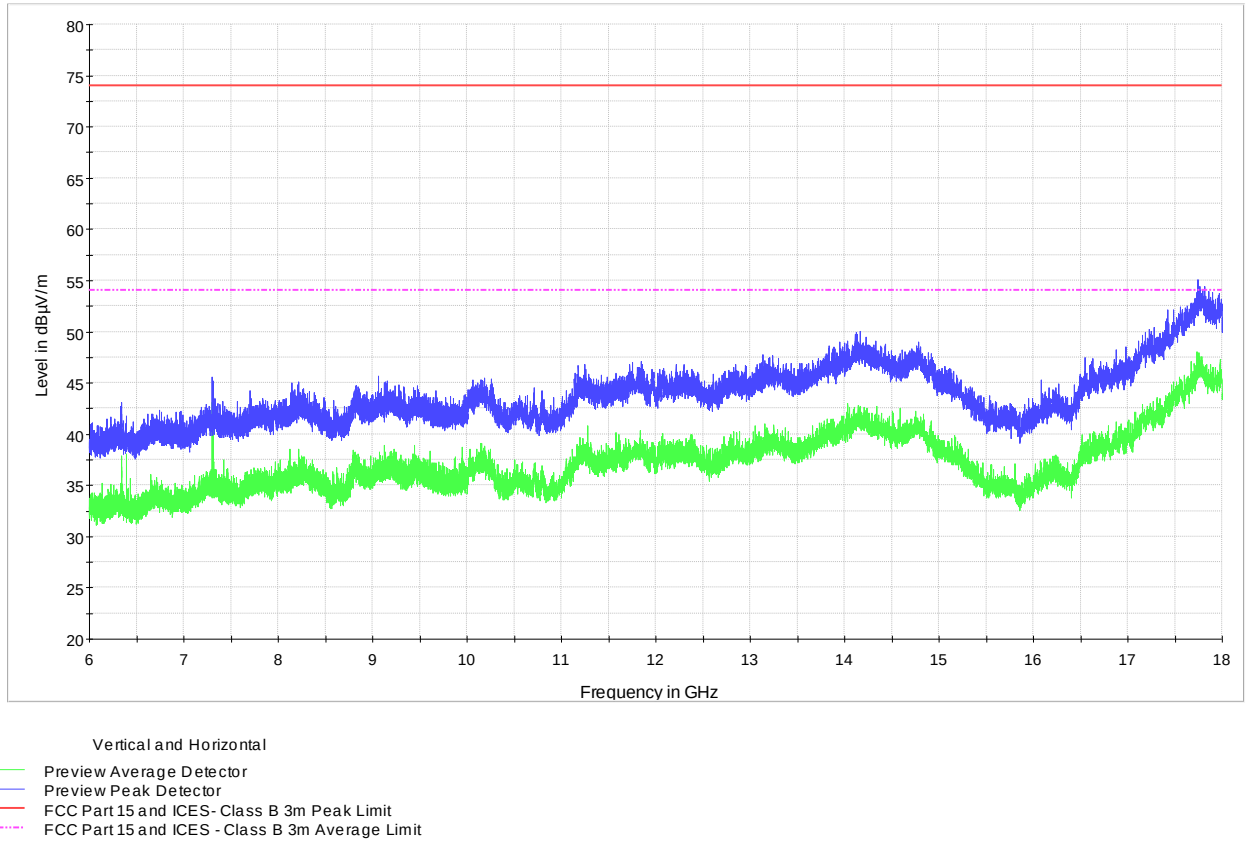


Figure 8.1-4: *Transmitter pulse width*

Duty cycle correction factor:

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

8.1.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-5: *Radiated spurious emissions spectral plot – 6 to 18 GHz*

8.1.6 Setup photos

Figure 8.1-1: *Radiated spurious emissions setup photo – 30 to 1000 MHz*

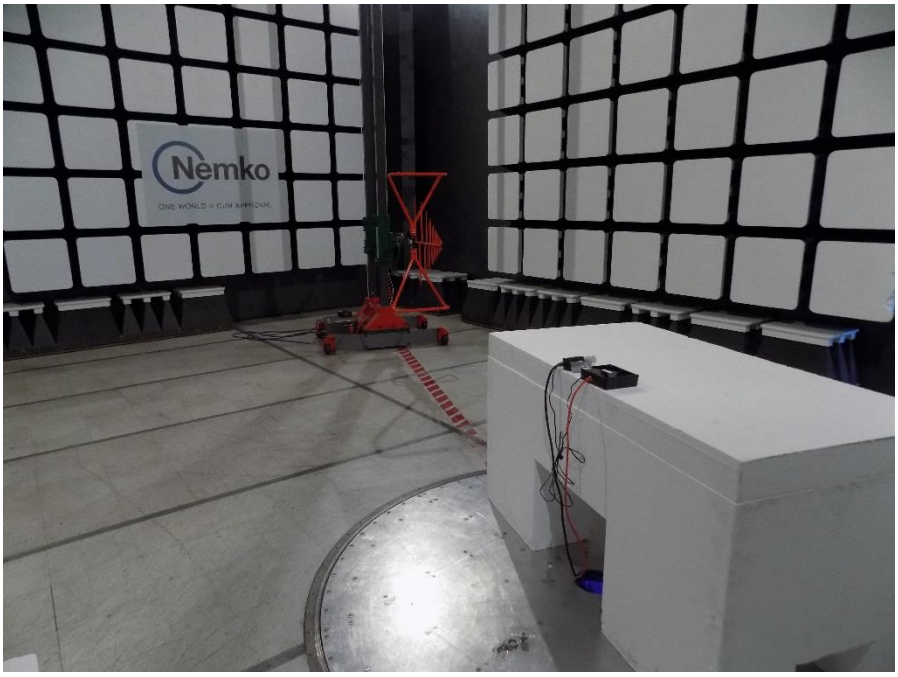


Figure 8.1-2: *Radiated spurious emissions setup photo – 30 to 1000 MHz*

8.1.6 Setup photos, continued

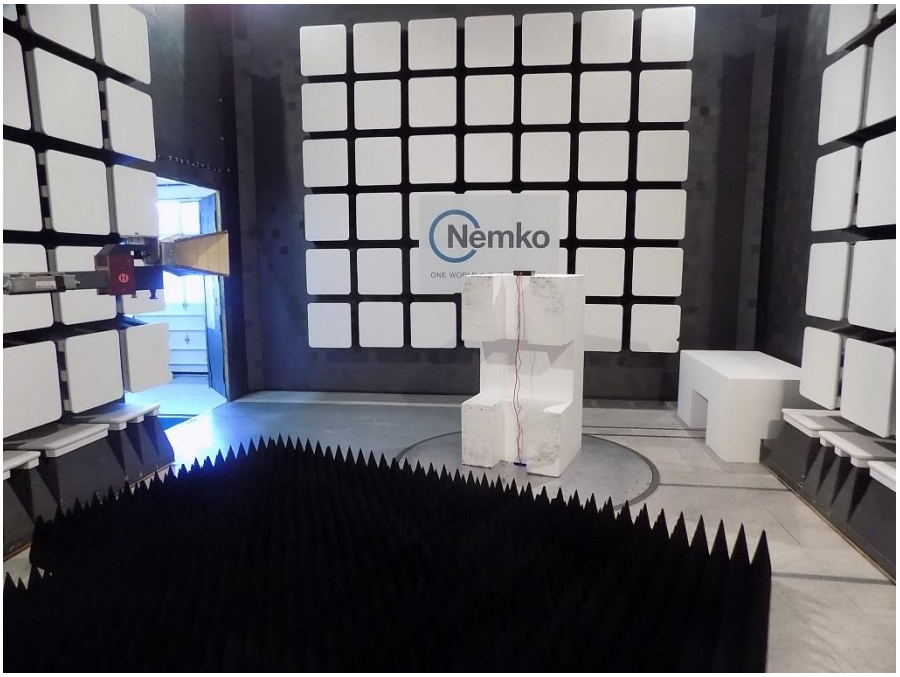


Figure 8.1-3: *Radiated spurious emissions setup photo – above 1 GHz*

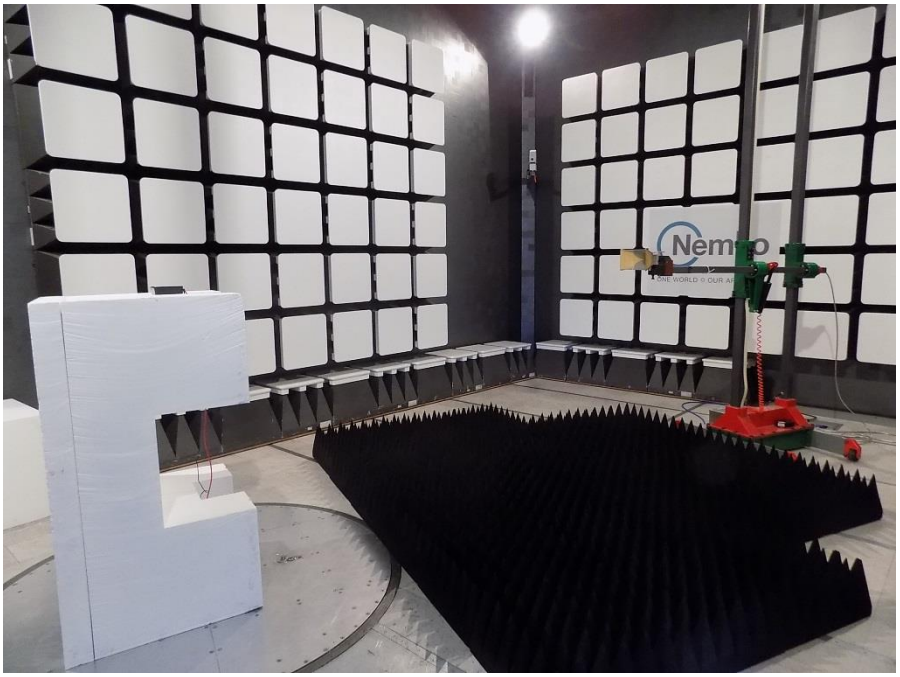
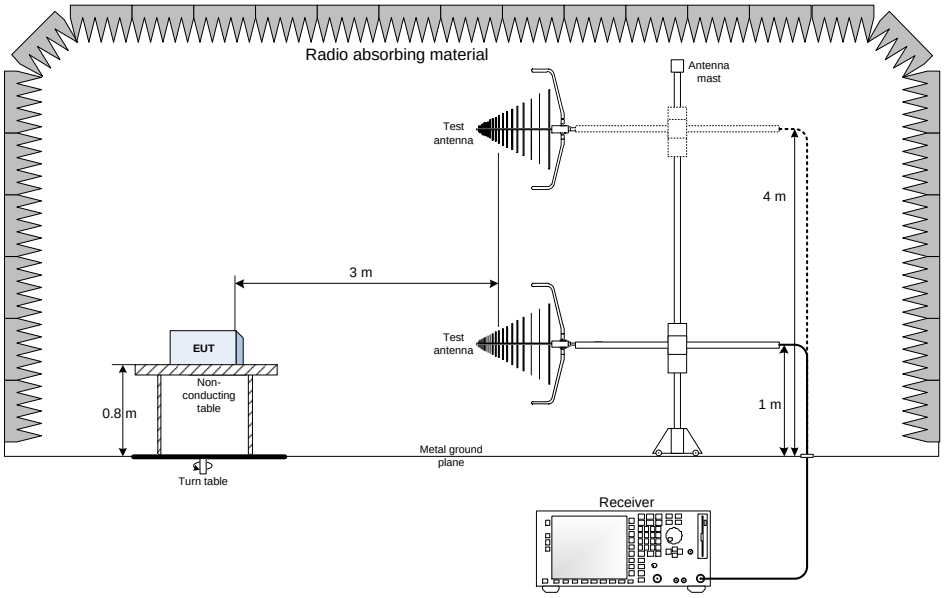


Figure 8.1-4: *Radiated spurious emissions setup photo – above 1 GHz*

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