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Test report

332152-3TRFWL

Date of issue: July 7, 2017

Applicant:

Fortin Systèmes Électroniques

Product:

Keyfob

Model:

FTX84

FCC ID: 2ACKU-R1W02FM

IC Registration number: 12084A-R1W02FM

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.231

  Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

- RSS-210, Issue 9, August 2016, Annex A.1

  Momentarily operated devices

Test location

Company name	Nemko Canada Inc.
Address	292 Labrosse Avenue
City	Pointe-Claire
Province	QC
Postal code	H9R 5L8
Country	Canada
Telephone	+1 514 694 2684
Facsimile	+1 514 694 3528
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: CA2041; IC: 2040G-5 (3 m semi anechoic chamber)

Tested by	Yong Huang, Wireless/EMC Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Date	July 7, 2017
Signature of reviewer	

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	Fortin Systèmes Électroniques
Address	9855, rue Colbert
City	Anjou
Province/State	Québec
Postal/Zip code	H1J 1Z9
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.231	Periodic operation in the band 40.66–40.70 MHz and above 70 MHz
RSS-210, Issue 9, August 2016, Annex A.1	Momentarily operated devices

1.3 Test methods

ANSI C63.10 v 2013	American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices

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
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.31(e)	Variation of power source	See Notes [1]
§15.203	Antenna requirement	See Notes [2]
§15.231(a)	Conditions for intentional radiators to comply with periodic operation	Pass
§15.231(b)	Field strength of emissions	Pass
§15.231(c)	Emission bandwidth	Pass
§15.231(d)	Requirements for devices operating within 40.66–40.70 MHz band	Not applicable [4]
§15.231(e)	Conditions for intentional radiators to comply with periodic operation	Not applicable [5]

Notes: [1] Fundamental field strength was measured with a fresh battery.
[2] The EUT is equipped with an integral antenna.
[3] The EUT is battery powered.
[4] The EUT does not operate in the frequency range of 40.66–40.70 MHz.
[5] The EUT complies with requirement 15.231 (a).

2.2 IC RSS-GEN, Issue 4 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 applicable [2]

Notes: [1] The EUT does not contain a receiver.
[2] The EUT is battery powered.

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.

2.3 IC RSS-210, Issue 9 test results

Part	Test description	Verdict
A.1.1	Types of momentary signals	Pass
A.1.2	Field strength of emissions	Pass
A.1.3	Bandwidth of momentary signals	Pass
A.1.4	Reduced Field Strengths	Not applicable[1]

Notes: [1] The EUT complies with requirement RSS-210 A1.1.2.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	May 25, 2017
Nemko sample ID number	Item#2

3.2 EUT information

Product name	Keyfob
Model	FTX84
Model variant	None
Serial number	None

3.3 Technical information

Applicant IC company number	12084A
IC UPN number	R1W02FM
All used IC test site(s) Reg. number	2040G-5
RSS number and Issue number	RSS-210 Annex A.1, Issue 9, August 2016
Frequency Min (MHz)	433.925
Frequency Max (MHz)	433.925
RF power Min (W)	N/A
RF power Max (W)	N/A
Field strength, Units @ distance	91.8 dBµV/m, Peak field strength @ 3 m, 72.8 dBµV/m, Average field strength @ 3 m
Measured BW (kHz) (99 %)	81.7
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	2FSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ distance	35.9 dBµV/m (Avg) at 5640.0 MHz, @ 3 m
Power requirements	Internally powered by two 3V button battery CR2016
Antenna information	The EUT uses a non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The product is an aftermarket remote starter keyfob. When the costumer press the remote button, the remote sends through radio frequency a unique message that is received by the remote starter that will execute the command in the costumer vehicle.

3.5 EUT exercise details

EUT was configured and operated by client on site. During transmitter testing, the unit was set to transmit continuously.

3.6 EUT setup diagram

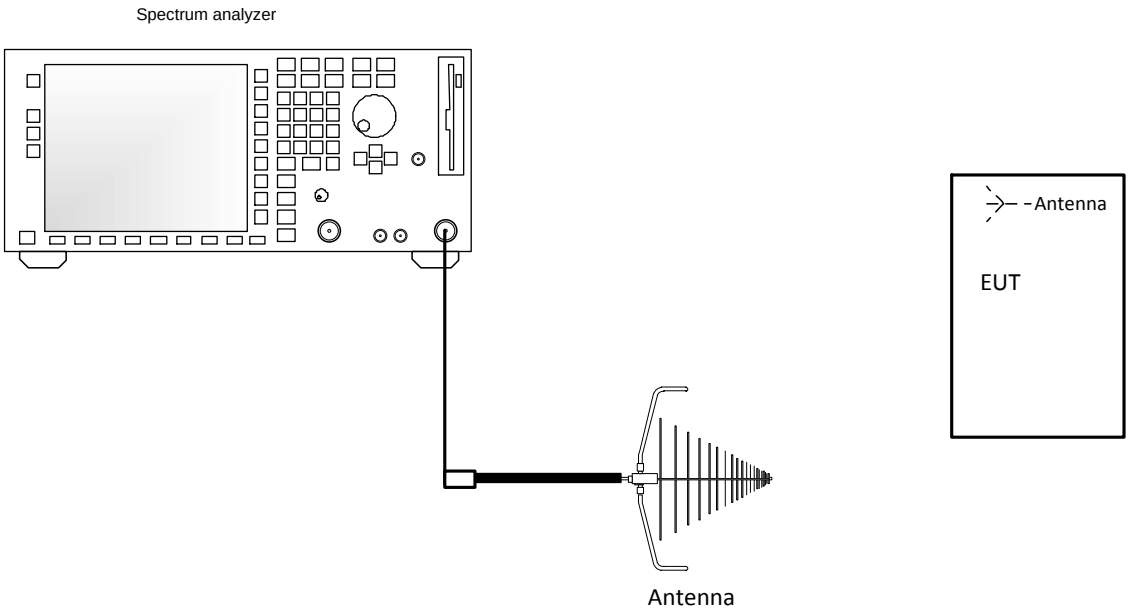


Figure 3.6-1: *Setup diagram*

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

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

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
AC power line conducted emissions	3.55

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	FA002532	2 year	Aug. 25/17
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Oct. 5/17
Horn antenna (1–18 GHz)	EMCO	3115	FA001451	1 year	April 5/18
Pre-amplifier (0.5–18 GHz)	COM-POWER	PAM-118A	FA002561	1 year	May 8/18
50 Ω coax cable	C.C.A.	None	FA002603	—	VOU
50 Ω coax cable	C.C.A.	None	FA002605	—	VOU
50 Ω coax cable	C.C.A.	None	FA002607	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	May 3/18

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

Section 8. Testing data

8.1 FCC 15.231(a) and RSS-210 A.1.1 Conditions for intentional radiators to comply with periodic operation

8.1.1 Definitions and limits

FCC:

(a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

ISED:

Devices shall comply with the following for momentary operation:

(a) A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.

(b) A transmitter that has been activated automatically shall cease transmission within 5 seconds of activation.

(c) Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in Section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

(d) Intentional radiators used for radio control during emergencies involving fire, security of goods (e.g. burglar alarms), and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

8.1.2 Test summary

Test date	June 8, 2017	Temperature	24 °C
Test engineer	Yong Huang	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	40 %

8.1.3 Observations, settings and special notes

None

8.1.4 Test data

1) The EUT is manual triggered. The EUT ceases transmission within 5 s after button is released. (See **Figure 8.1-1** below)
2) The EUT does not generate automatic transmission.
3) The EUT does not generate periodic transmission.
4) The EUT radio is not used for control purposes during emergencies involving fire, security, and safety of life.
5) The EUT does not transmit set-up information.

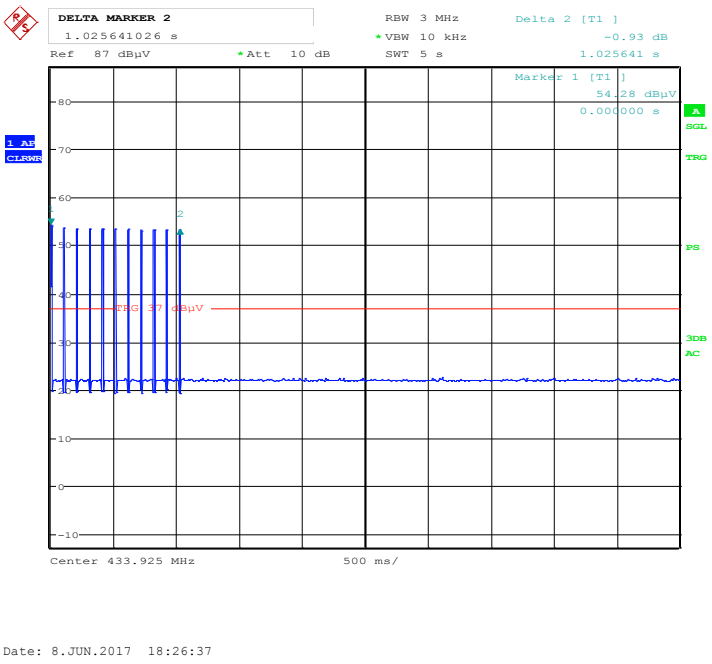


Figure 8.1-1: *Timing measurement*

8.2 FCC 15.231(b) and RSS-210 A.1.2 Field strength of emissions

8.2.1 Definitions and limits

FCC:

(b) In addition to the provisions of §15.205 the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.

1) The field strength limits in the table are specified at a distance of 3 meters. The tighter limits apply at the band edges.
2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.
3) The limits on the field strength of the spurious emissions in the table below are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

ISED:

a. The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits outlined in the table below, based on the average value of the measured emissions. The requirements of the Pulsed Operation section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions.
Alternatively, compliance with the limits in the table below may be demonstrated using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.
b. Unwanted emissions shall be 10 times below the fundamental emissions field strength limits in the table below or comply with the limits specified in RSS-Gen, whichever is less stringent.
c. The field strength limits shown in Table A are based on the fundamental frequency of the intentional radiator. Unwanted emissions shall be attenuated to the limits listed in RSS-Gen or to the limits shown in table below, whichever are less stringent.

Table 8.2-1: *Field strength limits*

Fundamental frequency (MHz)	Field strength of fundamental (µV/m)	Field strength of fundamental (dBµV/m)	Field strength of spurious emissions (µV/m)	Field strength of spurious emissions (dBµV/m)
40.66–40.70[1]	2,250	67	225	47
70–130	1,250	61.9	125	41.9
130–174	1,250 to 3,750*	61.9 to 71.5*	125 to 375*	41.9 to 51.5*
174–260[2]	3,750	71.5	375	51.5
260–470[2]	3,750 to 12,500*	71.5 to 81.9*	375 to 1,250*	51.5 to 61.9*
Above 470	12,500	81.9	1,250	61.9

* Linear interpolations
Note: [1]The levels applicable to FCC only.

* Linear interpolation with frequency F in MHz:
For 130–174 MHz: Field Strength (µV/m) = (56.82 × F) – 6136
For 260–470 MHz: Field Strength (µV/m) = (41.67 × F) – 7083

Frequency bands 225–328.6 MHz and 335.4–399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

Table 8.2-2: *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 8.2-3: *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

Note: Certain frequency bands listed in Table 8.2-3 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 8.2-4: *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

Test date	June 5, 2017 to June 8, 2017	Temperature	24 °C
Test engineer	Yong Huang	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	40 %

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
Radiated measurements were performed at a distance of 3 m.
Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

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

8.2.4 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.

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

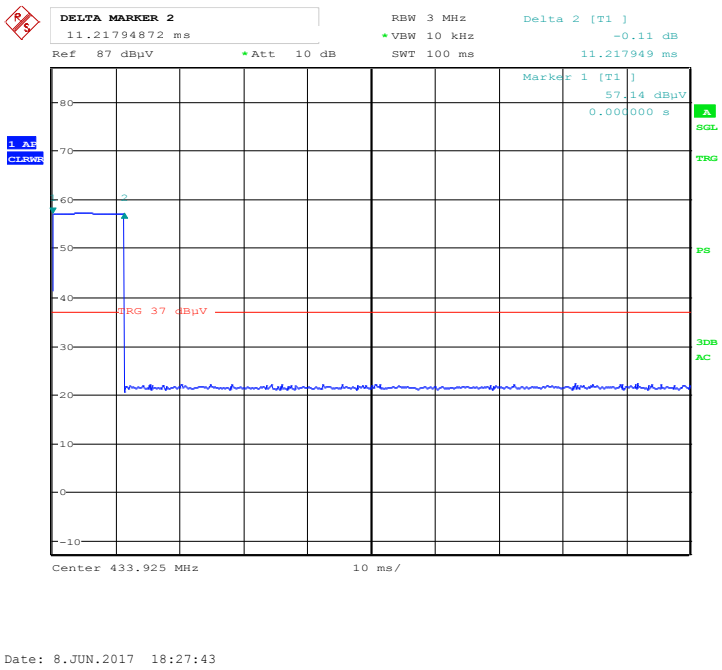


Figure 8.2-1: *Transmission within 100 ms*

Measured Duty cycle:
Total ON time for data train: Tx on time $_{100\ ms}$ = 11.54 ms

Therefor utilized the declared clients Duty cycle.

$$Duty\ \frac{cycle}{average}\ factor = 20\times Log_{10}\left(\frac{Tx_{100\ ms}}{100\ ms}\right) = 20\times Log_{10}\left(\frac{11.22\ ms}{100\ ms}\right) = -19.0\ dB$$

8.2.4 Test data, continued

Table 8.2-5: *Field Strength of Fundamental results*

Freq. (MHz)	Meas. peak field strength[1] (dBµV/m)	Peak field strength limit (dBµV/m)	Peak field strength margin[3] (dB)	Duty cycle correction factor (dB)	Calculated average field strength[2] (dBµV/m)	Average field strength limit (dBµV/m)	Average field strength margin[3] (dB)
433.925	91.8	100.8	9.0	-19.0	72.8	80.8	8.0

Notes: [1] Field strength (dBµV/m) = spectrum analyzer value (dBµV) + correction factor (dB)

Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
Sample calculation: 96.1 dBµV/m (field strength) = 76.2 dBµV (receiver reading) + 19.9 dB (Correction factor)

[2] Calculated average field strength (dBµV/m) = measured Peak field strength (dBµV/m) + Duty cycle correction factor (dB). Duty cycle correction factor as calculated from §15.35 (c)

[3] Margin (dB) = field strength limit − field strength measurement

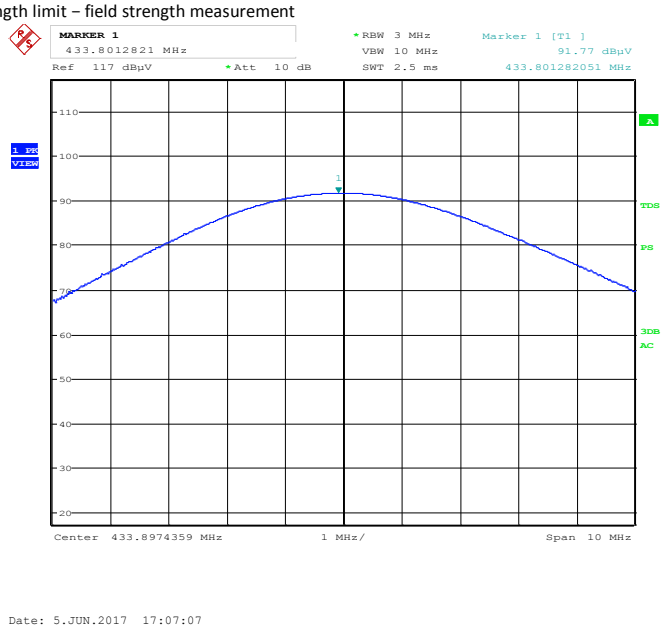


Figure 8.2-2: *Field Strength of Fundamental plot*

Table 8.2-6: *Field Strength of Spurious emissions (Harmonic) results*

Freq. (MHz)	Meas. peak field strength[1] (dBµV/m)	Peak field strength limit (dBµV/m)	Peak field strength margin[3] (dB)	Duty cycle correction factor (dB)	Calculated average field strength[2] (dBµV/m)	Average field strength limit (dBµV/m)	Average field strength margin[3] (dB)
3905	45.7	80.8	35.1	-19	26.7	60.8	34.1
5207	47.9	80.8	32.9	-19	28.9	60.8	31.9
5640	54.9	80.8	25.9	-19	35.9	60.8	24.9

Notes: [1] Field strength (dBµV/m) = spectrum analyzer value (dBµV) + correction factor (dB)

Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
Sample calculation: 59.4 dBµV/m (field strength) = 70.3 dBµV (receiver reading) + (−10.9 dB) (Correction factor)

[2] Calculated average field strength (dBµV/m) = measured Peak field strength (dBµV/m) + Duty cycle correction factor (dB). Duty cycle correction factor as calculated from §15.35 (c)

[3] Margin (dB) = field strength limit − field strength measurement

All other spurious emissions (Harmonics) were greater that 20 dB from limit.

8.2.1 Test data, continued

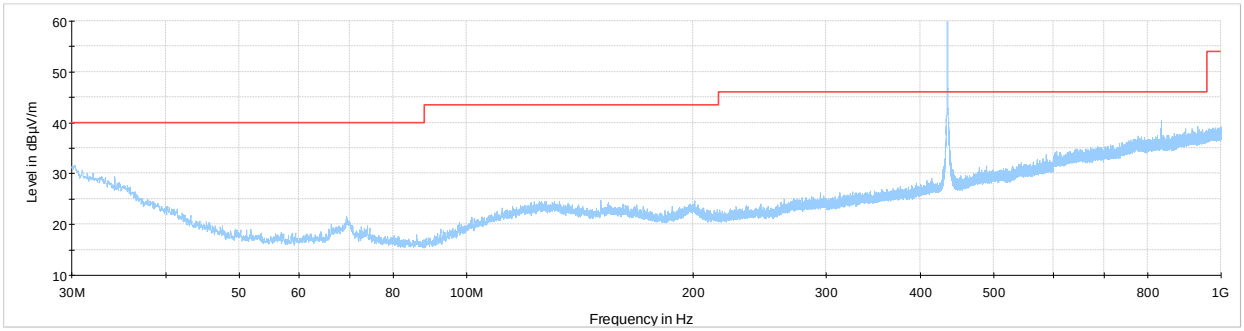


Figure 8.2-3: Spurious emissions below 1 GHz

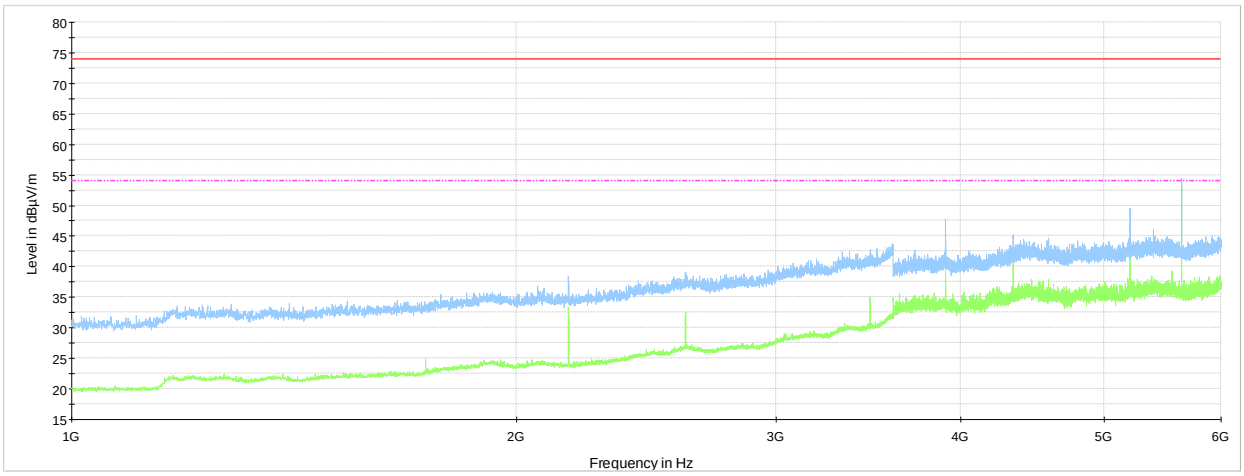


Figure 8.2-4: *Spurious emissions above 1 GHz*

8.3 FCC 15.231(c) and RSS-210 A.1.3 Emission bandwidth of momentary signals

8.3.1 Definitions and limits

FCC:
The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

ISED:
The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

8.3.2 Test summary

Test date	June 8, 2017	Temperature	24 °C
Test engineer	Yong Huang	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	40 %

8.3.3 Observations, settings and special notes

Limit: 0.25 % of 433.925 MHz is 1084.8 kHz
Spectrum analyser settings:

Resolution bandwidth	≥ 1 % of emission bandwidth
Video bandwidth	≥ 3 × RBW
Frequency span	Wider than emission bandwidth
Detector mode	Peak

8.3.4 Test data

Table 8.3-1: *20 dB bandwidth measurement result*

20 dB bandwidth, kHz	Limit, kHz	Margin, kHz
81.7	1084.8	1003.1

Table 8.3-2: *99 % occupied bandwidth measurement result*

99 % occupied bandwidth, kHz	Limit, kHz	Margin, kHz
94.7	1084.8	990.1

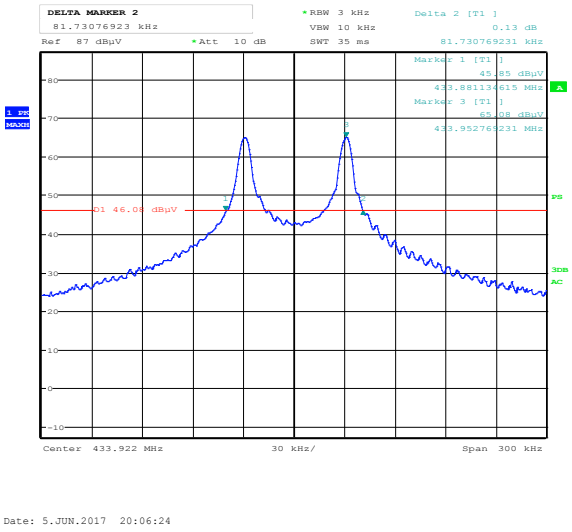


Figure 8.3-1: *20 dB occupied bandwidth*

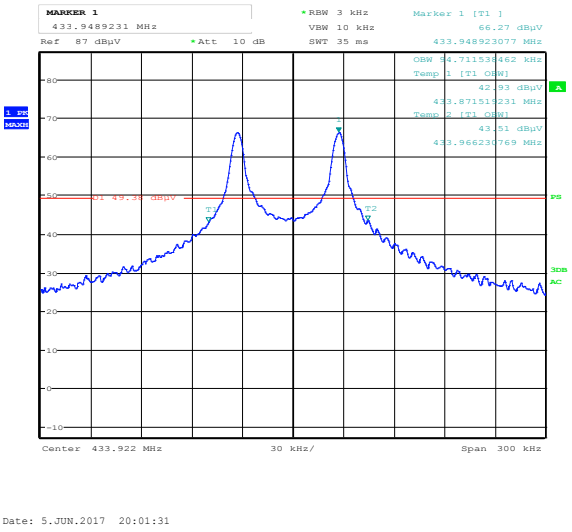
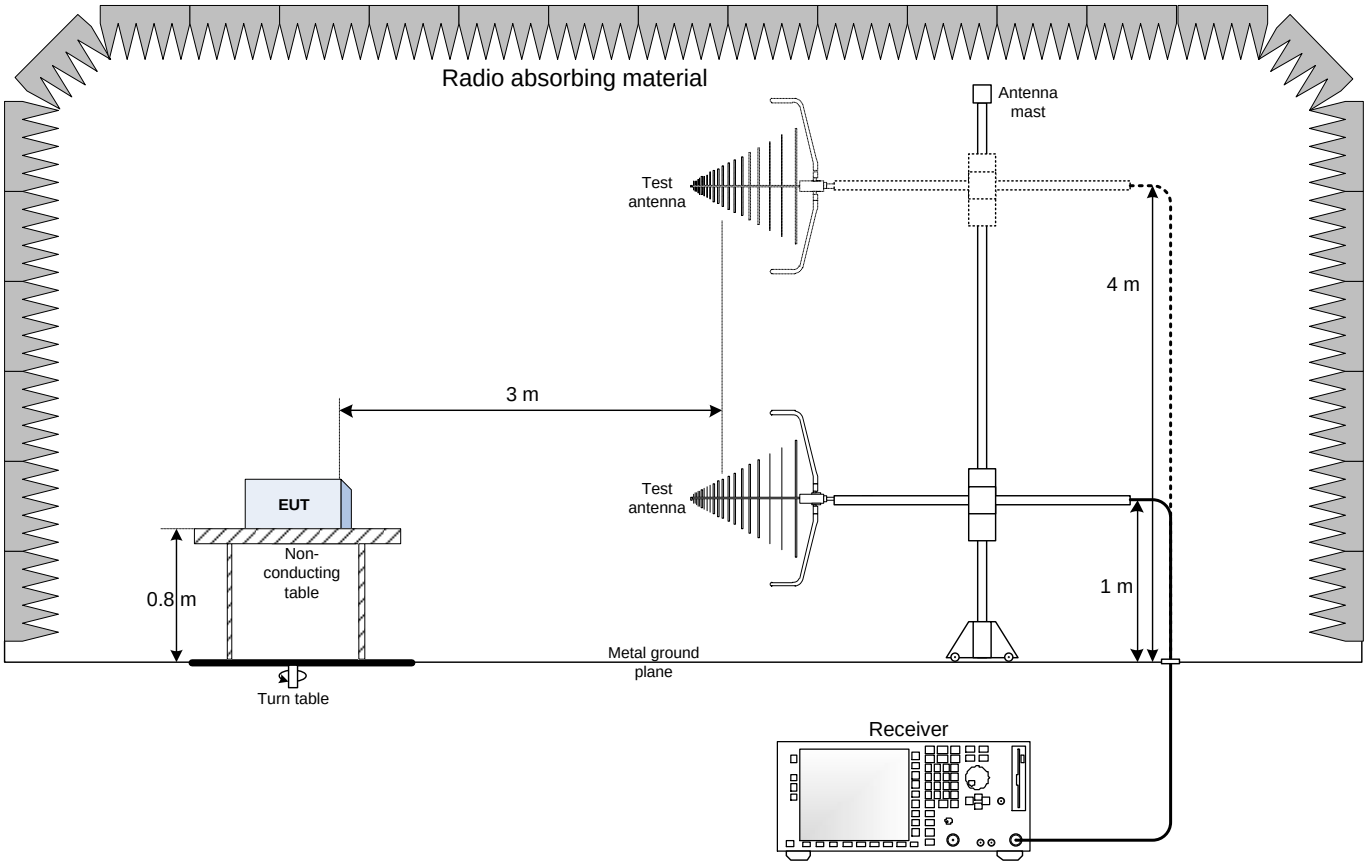


Figure 8.3-2: *99 % occupied bandwidth*

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