

Test report

297413-1TRFWL

Date of issue: January 28, 2016

Applicant:

ÉlanCité

Product:

Module Radar (field sensor) 24GHz band

Model:

ANTENNA MODULE REV1-3

FCC ID:

2AF46DSPREV1-3

IC Registration number:

20796-DSPREV13

Specifications:

◆ **FCC 47 CFR Part 15.245 Subpart C**

Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz.

◆ **RSS-210 Issue 8, December 2010, Annex 7**

Field Disturbance Sensors Operating in the Bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10.5–10.55 GHz and 24.075–24.175 GHz.

Test location

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

Tested by:	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by:	Kevin Rose, Wireless/EMC Specialist
Date:	January 28, 2016
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 Test specifications

FCC 47 CFR Part 15.245, Subpart C	Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz.
RSS-210, Issue 8, December 2010, Annex 7	Field Disturbance Sensors Operating in the Bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10.5–10.55 GHz and 24.075–24.175 GHz.

1.2 Test methods

ANSI C63.10 v2013	American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
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1.3 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.

1.4 Exclusions

None

1.5 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, general requirements test results

Table 2.1-1: FCC 47 CFR Part 15, Subpart C general requirements results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable ¹
§15.31(e)	Variation of power source	Pass ²
§15.203	Antenna requirement	Pass ³
§15.215(c)	20 dB bandwidth	Pass

Notes: ¹ EUT is not connected directly or indirectly to AC network.
² The fully charged battery was used throughout the assessment.
³ 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 47 CFR Part 15, Subpart C §15.245 results

Part	Test description	Verdict
§15.245(b)	Radiated emissions of fundamental and harmonics	Pass
§15.245(b)(1)	Radiated emissions of harmonics that fall within restricted frequency bands	Pass
§15.245(b)(3)	Radiated spurious emissions except for harmonics	Pass

2.3 IC RSS-GEN, Issue 4, test results

Table 2.3-1: IC RSS-Gen results

Part	Test description	Verdict
6.6	Occupied bandwidth	Pass
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 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 EUT is not connected directly or indirectly to AC network.

2.4 IC RSS-210, Issue 8, test results

Table 2.4-1: IC RSS-210 results

Part	Test description	Verdict
1	Radiated emissions of fundamental and harmonics	Pass
2	Radiated emissions of harmonics that fall within restricted frequency bands	Pass
4	Radiated spurious emissions except for harmonics	Pass

Section 3. Equipment under test (EUT) details

3.1 Applicant and manufacturer

Company name	ÉlanCité
Address	Zone industrielle de la Pentecôte, 12 Route de la Garenne 44700 Orvault France

3.2 Sample information

Receipt date	November 24, 2015
Nemko sample ID number	133-000478 and 133-000479

3.3 EUT information

Product name	Module Radar (field sensor) 24GHz band
Model	ANTENNA MODULE REV1-3
Serial number	E357349

3.4 Technical information

Operating band	24075–24175 MHz
Operating frequency	24135 MHz
Modulation type	Continuous wave
Occupied bandwidth (99 %)	833.33 kHz
Emission designator	N0N
Power requirements	11–15 V _{DC} from car battery
Antenna information	Manufacturer : INNOSENT Type : CW Gain : 15 dBi Model : IPS-146_F The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.5 Product description and theory of operation

Antenna module (EUT) intended to be used for speed measurements of various moving objects. Most appliances are for cars speed measurements. Easily usable with simplified communication protocol.

3.6 EUT exercise details

EUT was energized and the transmission on the desired frequency was verified.

3.7 EUT setup diagram

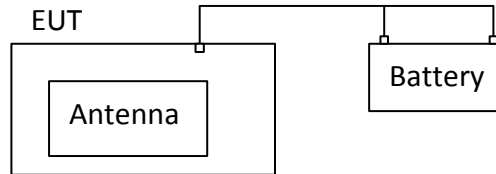


Figure 3.7-1: Setup diagram

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
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	FA002047	1 year	Feb. 25/16
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 12/16
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 01/16
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	Jan. 09/16
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Mar. 27/16
40–60 GHz Standard gain horn	Millitech	U SGH-19	FA002322	—	VOU
60–90 GHz Standard gain horn	Millitech	U SGH-12	FA001524	—	VOU
90–140 GHz Standard gain horn	Millitech	U SGH-08	FA001525	—	VOU

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

Section 8. Testing data

8.1 Clause 15.215(c) and RSS-Gen 6.6 Occupied (Emission) bandwidth

8.1.1 Definitions and limits

FCC
 Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

IC
 When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.1.2 Test summary

Verdict	Pass				
Test date	November 25, 2015	Test engineer	Andrey Adelberg		
Temperature	22 °C	Relative humidity	33 %	Air pressure	1008 mbar

8.1.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	≥1 % of span
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-1: Lower 20 dBc frequency-cross result

Lower 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
24133.75	24075	58.75

Table 8.1-2: Upper 20 dBc frequency-cross result

Upper 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
24134.75	24175	40.25

Table 8.1-3: Bandwidth results

Frequency, MHz	20 dB bandwidth, MHz	99 % occupied bandwidth, MHz
24135	1.025	0.833

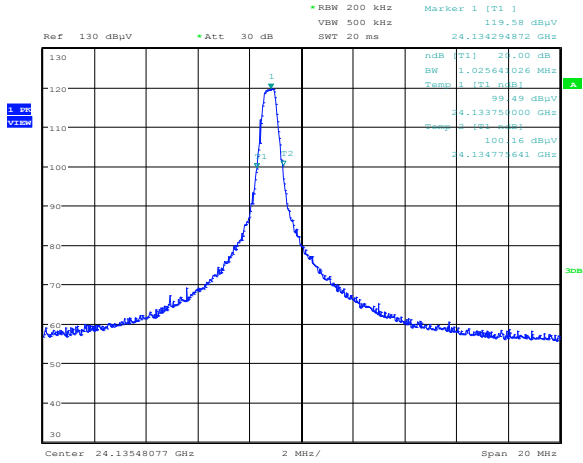


Figure 8.1-1: 20 dB bandwidth

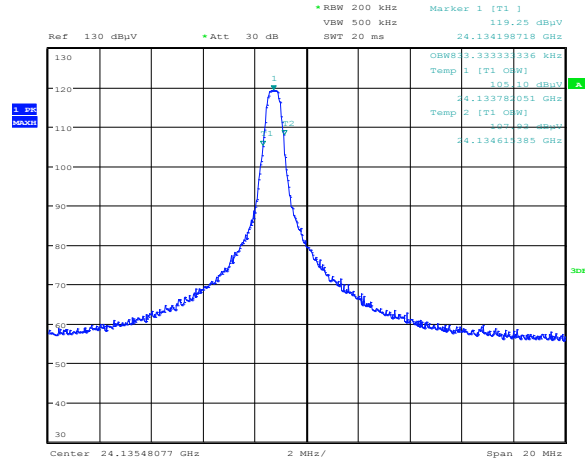


Figure 8.1-2: 99% occupied bandwidth

8.2 FCC 15.245((b)1 and (b) 3) Radiated emission and RSS-210 Annex 7 (1, 2)

8.2.1 Definitions and limits

FCC §15.245:

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with table below.

- (1) Regardless of the limits shown in the table below, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:
 - (i) For the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m (87.96 dBµV/m).
 - (ii) For all other field disturbance sensors, 7.5 mV/m (77.50 dBµV/m).
 - (iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075–24175 MHz band, fully comply with the limits given in §15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).
- (3) 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.

RSS-210 Annex 7:

1. The field strength measured at 3 metres shall not exceed the limits shown in the table below.
2. Additionally, harmonic emissions falling into a restricted band of RSS-Gen and below 17.7 GHz shall meet the general field strength limits of RSS-Gen. Those falling into restricted bands above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 metres:
 - (i) 25 mV/m (87.96 dBµV/m) for the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for devices designed for use only within buildings or for intermittent use, such as to open building doors;
 - (ii) 7.5 mV/m (77.50 dBµV/m) for all other devices.
4. 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 specified in RSS-Gen, whichever is less stringent.

Table 8.2-1: Radiated emission limits

Fundamental frequency MHz	Field strength of fundamental @ 3 m		Field strength of harmonics @ 3 m	
	mV/m	dBµV/m	mV/m	dBµV/m
902–928	500	114	1.6	64
2435–2465	500	114	1.6	64
5785–5815	500	114	1.6	64
10500–10550	2500	127.95	25	87.95
24075–24175	2500	127.95	25	87.95

Notes: The emission limits shown above are based on measurement instrumentation employing an **average detector**. The provisions in §15.35 for limiting peak emissions apply.

Table 8.2-2: 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			

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

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

Table 8.2-4: 15.209 and RSS-Gen emissions field strength limits

Frequency MHz	Field strength of emissions		Measurement distance
	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	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. *F* is in kHz. 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

8.2.2 Test summary

Verdict	Pass				
Test date	November 25, 2015	Test engineer	Andrey Adelberg		
Temperature	23 °C	Relative humidity	32 %	Air pressure	1006 mbar

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 100 GHz.
Radiated measurements for frequencies below 18 GHz were performed at a distance of 3 m. Radiated measurements for frequencies above 18 GHz were performed at a distance of 1 m, and distance correction factor of 9.5 dB $\{20 \times \text{Log}_{10}(3 \text{ m} \div 1 \text{ m})\}$ was applied.

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

Table 8.2-5: Radiated field strength measurement Fundamental results measured at 1 m

Frequency MHz	Peak Field strength dB μ V/m	Average Field strength limit dB μ V/m @ 1 m	Margin dB
24135	119.07	137.45	18.38

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable. Peak field strength measured value complies with average limit line, hence no further average measurement was performed. Distance correction factor of 9.5 dB $\{20 \times \text{Log}_{10}(3 \text{ m} \div 1 \text{ m})\}$ was applied to 3 m limit.

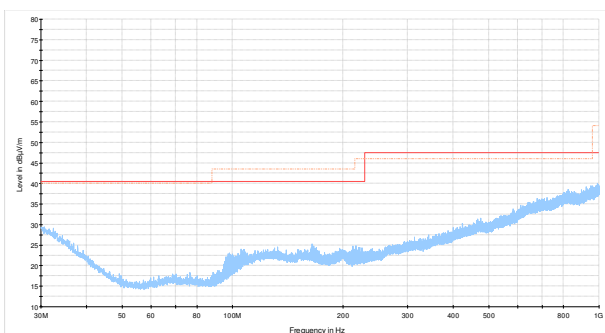


Figure 8.2-1: Radiated spurious emissions within 30–1000 MHz range

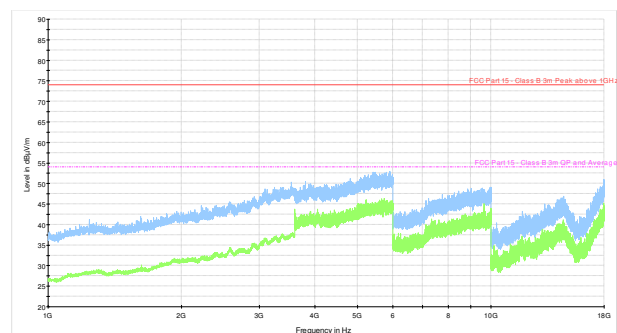


Figure 8.2-2: Radiated spurious emissions within 1–18 GHz range

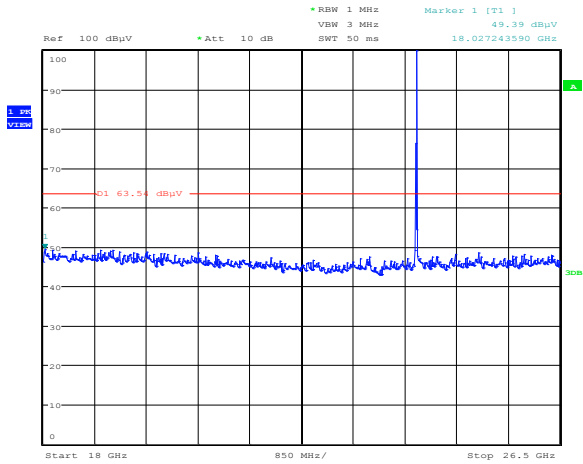


Figure 8.2-3: Radiated spurious emissions within 18–26.5 GHz range

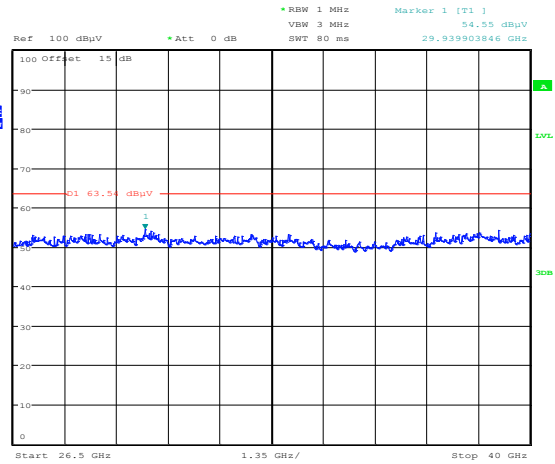


Figure 8.2-4: Radiated spurious emissions within 26.5–40 GHz range

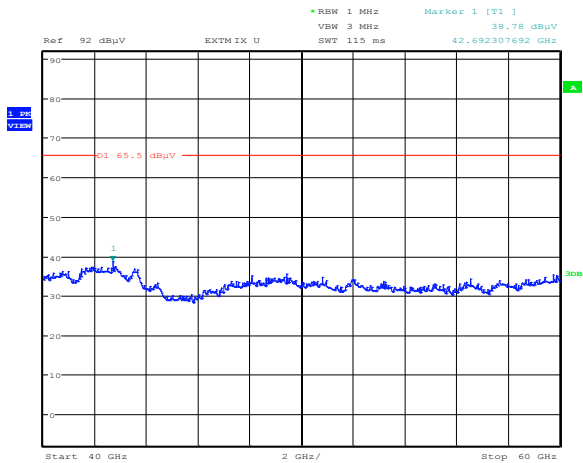


Figure 8.2-5: Radiated spurious emissions within 40–60 GHz range

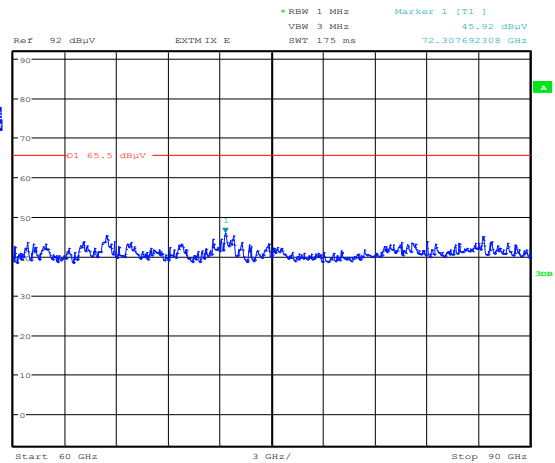


Figure 8.2-6: Radiated spurious emissions within 60–90 GHz range

Section 8
Test name
Specification

Testing data
FCC 15.245 (b)1 and (b) 3 Radiated emission and RSS-210 Annex 7 (1)
FCC Part 15 Subpart C and RSS-210 Issue 8

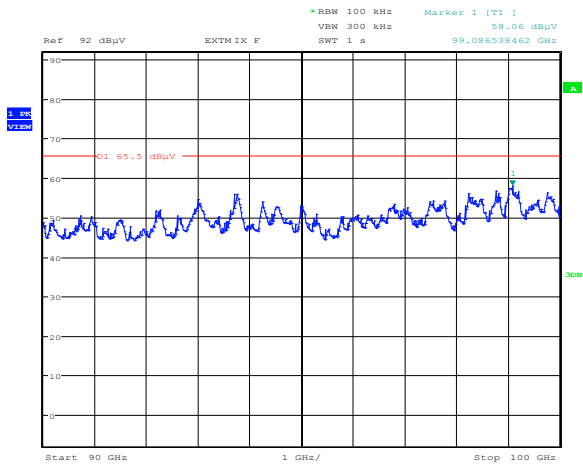


Figure 8.2-7: Radiated spurious emissions within 90–100 GHz range

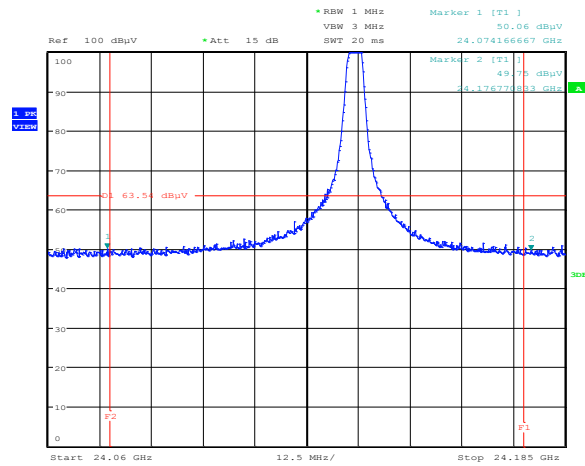


Figure 8.2-8: Radiated spurious emissions at the band edges

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up

