

Test report

299588-2R1TRFWL

Date of issue: March 3, 2016

Applicant:

ORBCOMM License Corp.

Product:

OG-ISAT

Model:

L900-300

FCC ID:

XGS-OGI100

IC Registration number:

11881A-OGI100

Specifications:

◆ **FCC 47 CFR Part 25**


Satellite communications

◆ **RSS-170, Issue 3, July 9, 2015**

Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

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	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Date	March 3, 2016
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

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Test methods.....	4
1.4 Statement of compliance	4
1.5 Exclusions.....	4
1.6 Test report revision history	4
Section 2. Summary of test results	5
2.1 FCC Part 25 test results	5
2.2 IC RSS-GEN, Issue 4 test results	5
2.3 IC RSS-170, Issue 3 test results	5
Section 3. Equipment under test (EUT) details	6
3.1 Sample information.....	6
3.2 EUT information	6
3.3 Technical information	6
3.4 Product description and theory of operation	6
3.5 EUT exercise details.....	6
3.6 EUT setup diagram	7
Section 4. Engineering considerations	8
4.1 Modifications incorporated in the EUT.....	8
4.2 Technical judgment	8
4.3 Deviations from laboratory tests procedures	8
Section 5. Test conditions	9
5.1 Atmospheric conditions	9
5.2 Power supply range.....	9
Section 6. Measurement uncertainty	10
6.1 Uncertainty of measurement	10
Section 7. Test equipment	11
7.1 Test equipment list.....	11
Section 8. Testing data	12
8.1 FCC 2.1049 and RSS-Gen 6.6 Occupied bandwidth.....	12
8.2 FCC 25.204 and RSS-170 5.3.2 Transmitter e.i.r.p. for mobile earth stations	14
8.3 FCC 25.202(f) and RSS-170 5.4 Field strength of spurious emissions	16
8.4 FCC 25.202(d) and RSS-170 5.2 Frequency tolerance, Earth stations	21
8.5 FCC 25.216 and RSS-170 5.4.3.2 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service	22
Section 9. Block diagrams of test set-ups	25
9.1 Radiated emissions set-up for frequencies below 1 GHz.....	25
9.2 Radiated emissions set-up for frequencies above 1 GHz.....	26
9.3 Conducted emissions set-up	26

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	ORBCOMM License Corp.
Address	395 West Passaic Street, Suite 325
City	Rochelle Park
Province/State	NJ
Postal/Zip code	07662
Country	United States

1.2 Test specifications

FCC 47 CFR Part 25	Satellite communications
RSS-170, Issue 3, July 9, 2015	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

1.3 Test methods

273109 D01 Equip Auth Guide Part 25 TXReceiver v02r02 (2011)	Equipment Authorization Guidance for Part 25 Transceivers
---	---

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
R1TRF	Model name, product name, FCC ID and IC ID were updated

Section 2. Summary of test results

2.1 FCC Part 25 test results

Part	Test description	Verdict
25.204	Power limit	Pass
2.1046	Occupied bandwidth	Pass
25.202(f)	Spurious emissions at the antenna terminal	Pass
25.202(f)	Field strength of spurious emissions	Pass
25.202(d)	Frequency tolerance, earth stations	Pass
25.216	Limits for emissions from mobile earth stations for protection of aeronautical radionavigation satellite service	Pass

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 Antennas are located within the enclosure of EUT and not user accessible.

2.2 IC RSS-GEN, Issue 4 test results

Part	Test description	Verdict
6.6	Occupied bandwidth	Pass
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 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 a battery operated device intended to be installed in a vehicle.

2.3 IC RSS-170, Issue 3 test results

Part	Test description	Verdict
5.1	Frequency bands	Pass
5.2	Frequency stability	Pass
5.3.1	Transmitter e.i.r.p. for ATC equipment	Not applicable
5.3.2	Transmitter e.i.r.p. for mobile earth stations (MESHs)	Pass
5.4.1.1	Transmitter unwanted emissions for ATC Base Station Equipment within 1525–1559 MHz band	Not applicable
5.4.1.2	Transmitter unwanted emissions for ATC Base Station Equipment within 2000–2020 MHz and 2180–2200 MHz bands	Not applicable
5.4.1.3	Transmitter unwanted emissions for ATC Base Station Equipment within 2483.5–2500 MHz band	Not applicable
5.4.2.1	Transmitter unwanted emissions for ATC Mobile Equipment within 1610–1626.5 MHz band	Not applicable
5.4.2.2	Transmitter unwanted emissions for ATC Mobile Equipment within 1626.5–1660.5 MHz band	Pass
5.4.2.3	Transmitter unwanted emissions for ATC Mobile Equipment within 2000–2020 MHz band	Not applicable
5.4.3.1	Transmitter unwanted emissions for MESHs in all frequency bands	Pass
5.4.3.2	Additional unwanted emission limits for MESHs to protect radionavigation-satellite service	Pass
5.5	Carrier-off state emissions	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	December 7, 2015
Nemko sample ID number	133-001748 and 133-001749

3.2 EUT information

Product name	OG-ISAT
Model	L900-300
Serial number	15090076 (sample with Helix antenna) and 15090074 (sample with Patch antenna)

3.3 Technical information

Applicant IC company number	11881A
IC UPN number	OGI100
All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-170, Issue 3, July 9, 2015
Frequency band	1626.5–1660.5 MHz
Frequency Min (MHz)	1626.501
Frequency Max (MHz)	1660.499
RF power Max (W)	1.866 (32.71 dBm)
Field strength, Units @ distance	N/A
Measured BW (kHz) (99 %)	1.362
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	OQPSK
Emission classification (F1D, G1D, D1D)	G1D
Transmitter spurious, Units @ distance	-30.17 dBm at 3253 MHz @ 3 m
Power requirements	5–15 V _{DC}
Antenna information	Patch antenna with 4.5 dBi gain. Quadrifilar Helix antenna with 2.5 dBi gain. The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.
Stated EIRP	Inmarsat's requirement: 7 dBW (37 dBm)

3.4 Product description and theory of operation

The EUT is a low data rate land mobile satellite earth station (LMES) that operates in microwave L-band (1.5/1.6 GHz) and it is designed to be used within Inmarsat global satellite network for asset tracking and management systems.

3.5 EUT exercise details

EUT was controlled by TeraTerm Pro session from Laptop.

3.6 EUT setup diagram

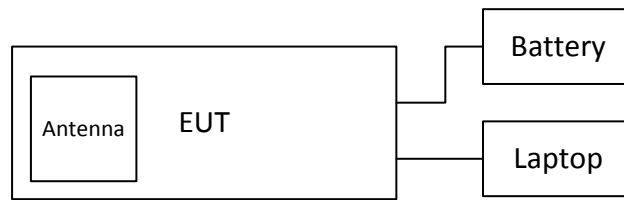


Figure 3.6-1: Setup diagram

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
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	Dec. 01/16
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
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Mar. 27/16
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
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR

Note: NCR - no calibration required

Section 8. Testing data

8.1 FCC 2.1049 and RSS-Gen 6.6 Occupied bandwidth

8.1.1 Definitions and limits

FCC:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

IC:

The emission bandwidth (\times dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated \times dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least $3\times$ the resolution bandwidth.

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

Test date	December 15, 2015	Temperature	24 °C
Test engineer	Andrey Adelberg	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	32 %

8.1.3 Observations, settings and special notes

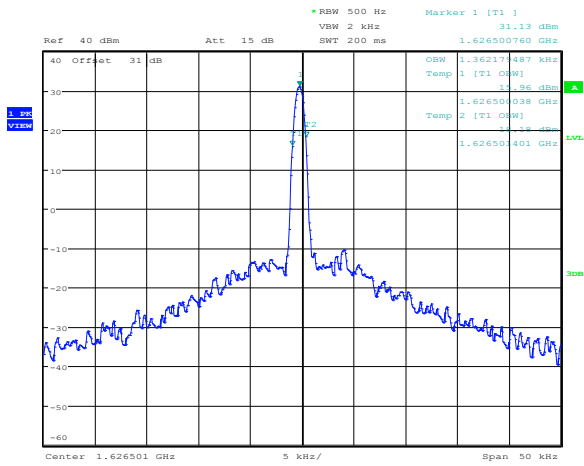
Spectrum analyser settings:

Resolution bandwidth:	$\geq 1\%$ of span
Video bandwidth:	$\geq 3 \times$ RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

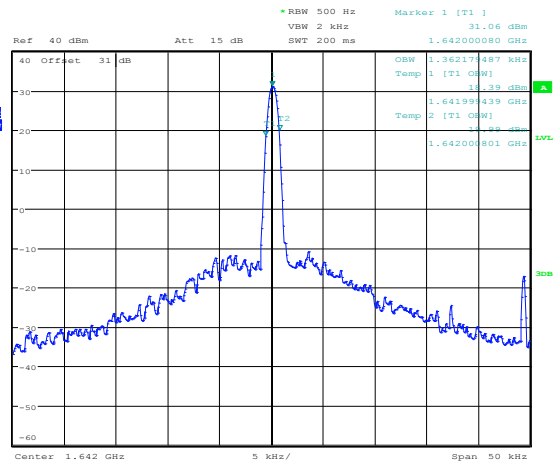
Table 8.1-1: 99 % bandwidth results

Frequency, MHz	99 % occupied bandwidth, kHz
1626.501	1.362
1642.000	1.362
1660.499	1.362



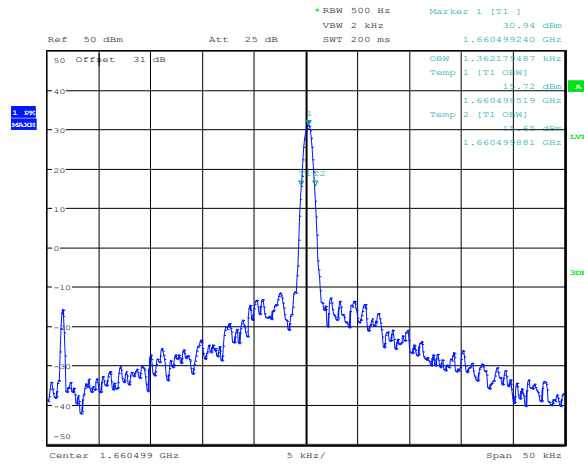
Date: 15.DEC.2015 10:04:43

Figure 8.1-1: 99 % bandwidth on low channel



Date: 15.DEC.2015 10:05:31

Figure 8.1-2: 99 % bandwidth on mid channel



Date: 15.DEC.2015 10:06:28

Figure 8.1-3: 99 % bandwidth on high channel

8.2 FCC 25.204 and RSS-170 5.3.2 Transmitter e.i.r.p. for mobile earth stations

8.2.1 Definitions and limits

FCC:

- (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) below:
 +40 dBW (70 dBm) in any 4 kHz band for $\Theta \leq 0^\circ$
 +40 + 3 Θ dBW in any 4 kHz band for $0^\circ < \Theta \leq 5^\circ$
 where Θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.
- (b) In bands shared coequally with terrestrial radiocommunication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands above 15 GHz shall not exceed the following limits except as provided for in paragraph (c) below:
 +64 dBW (94 dBm) in any 1 MHz band for $\Theta \leq 0^\circ$
 +64 + 3 Θ dBW in any 1 MHz band for $0^\circ < \Theta \leq 5^\circ$
 where Θ is as defined in paragraph (a) above.
- (c) For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.
- (d) Notwithstanding the e.i.r.p. and e.i.r.p. density limits specified in the station authorization, each earth station transmission shall be conducted at the lowest power level that will provide the required signal quality as indicated in the application and further amended by coordination agreements.

IC:

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

8.2.2 Test summary

Test date	December 7, 2015	Temperature	22 °C
Test engineer	Andrey Adelberg	Air pressure	1006 mbar
Verdict	Pass	Relative humidity	32 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

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



8.2.4 Test data

Table 8.2-1: EIRP measurement result for Patch antenna

Frequency, MHz	Output power, dBm	Antenna gain, dBi	Tested EIRP, dBm	Stated EIRP, dBm	Maximum permissible EIRP, dBm	Margin, dB
1626.501	32.65	4.50	37.15	37.00	39.00	1.85
1642.000	31.48	4.50	35.98	37.00	39.00	3.02
1660.449	32.71	4.50	37.21	37.00	39.00	1.79

Note: Margin = Maximum permissible EIRP – Tested EIRP

Table 8.2-2: EIRP measurement result for Helix antenna

Frequency, MHz	Output power, dBm	Antenna gain, dBi	Tested EIRP, dBm	Stated EIRP, dBm	Maximum permissible EIRP, dBm	Margin, dB
1626.501	32.65	2.50	35.15	37.00	39.00	3.85
1642.000	31.48	2.50	33.98	37.00	39.00	5.02
1660.449	32.71	2.50	35.21	37.00	39.00	3.79

Note: Margin = Maximum permissible EIRP – Tested EIRP

8.3 FCC 25.202(f) and RSS-170 5.4 Field strength of spurious emissions

8.3.1 Definitions and limits

FCC:

(f) Emission limitations. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;
- (2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
- (3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts (-13 dBm fixed);
- (4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

IC:

The transmitter unwanted emissions shall be measured with the carrier frequency set at both the highest and lowest channels in which the equipment is designed to operate.

The e.i.r.p. density of unwanted and carrier-off emissions in this section shall be averaged over any 2 ms active transmission using a root-mean-square detector with a resolution bandwidth of 1 MHz for broadband emissions and a resolution bandwidth of 1 kHz for discrete emissions, unless stated otherwise.

5.4.3 Mobile Earth Stations

5.4.3.1 Mobile Earth Stations in All Frequency Bands

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- (1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth;
- (2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth;
- (3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth.

5.4.4 Carrier-off State Emissions

Mobile equipment with transmitting frequencies between 1 GHz and 3 GHz shall have the e.i.r.p. density of carrier-off state emissions in the band 1559–1610 MHz not exceed -80 dBW/MHz.

8.3.2 Test summary

Test date	December 15, 2015	Temperature	24 °C
Test engineer	Andrey Adelberg	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	32 %

8.3.3 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.

Spectrum analyser settings mask measurements:

Resolution bandwidth	500 Hz
Video bandwidth	5 kHz
Detector mode	RMS
Trace mode	Averaging

Spectrum analyser settings for radiated spurious emissions measurements:

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

Emission mask shifts:

Authorized bandwidth (occupied bandwidth) is 2 kHz.

- 50% is 1 kHz shift
- 100% is 2 kHz shift
- 250% is 5 kHz shift

8.3.4 Test data

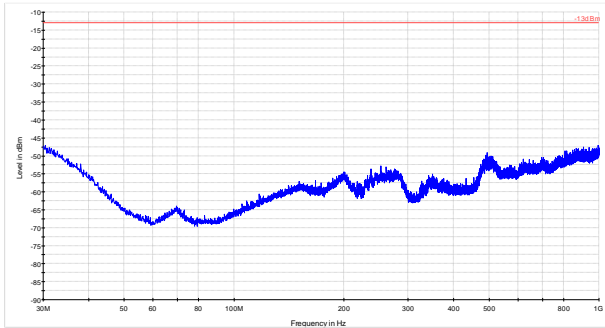


Figure 8.3-1: Spurious emissions below 1 GHz, Patch antenna

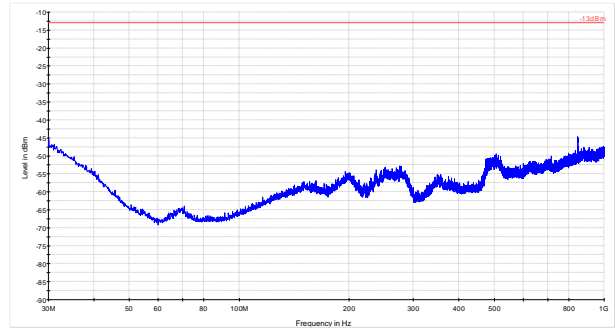


Figure 8.3-2: Spurious emissions below 1 GHz, Helix antenna

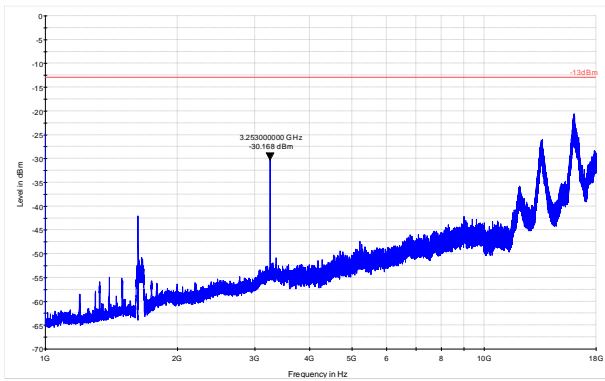


Figure 8.3-3: Spurious emissions above 1 GHz, Patch antenna, low channel

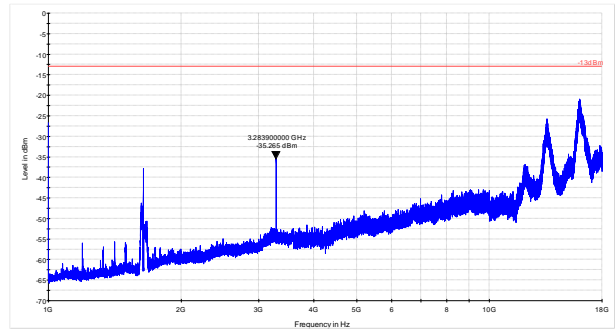


Figure 8.3-4: Spurious emissions above 1 GHz, Patch antenna, mid channel

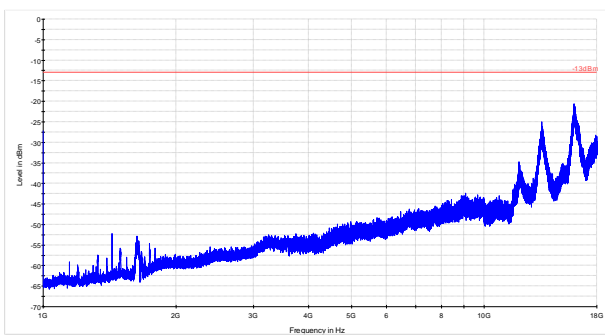


Figure 8.3-5: Spurious emissions above 1 GHz, Patch antenna, high channel

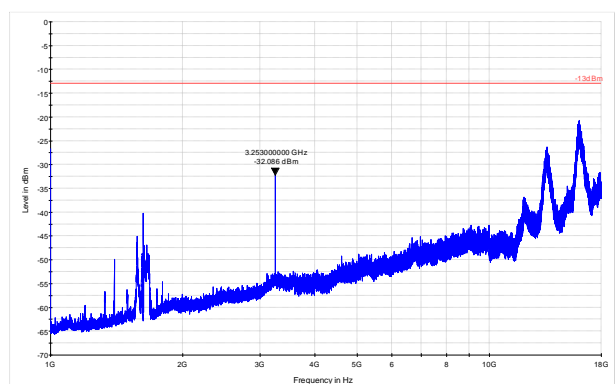


Figure 8.3-6: Spurious emissions above 1 GHz, Helix antenna, low channel

Section 8
Test name
Specification

Testing data
 FCC 25.202(f) and RSS-170 5.4 Field strength of spurious emissions
 FCC Part 25 and RSS-170, Issue 3

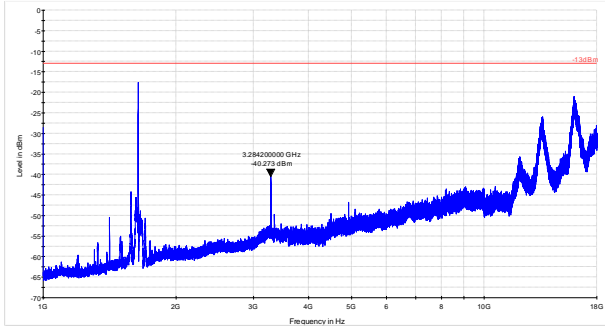


Figure 8.3-7: Spurious emissions above 1 GHz, Helix antenna, mid channel

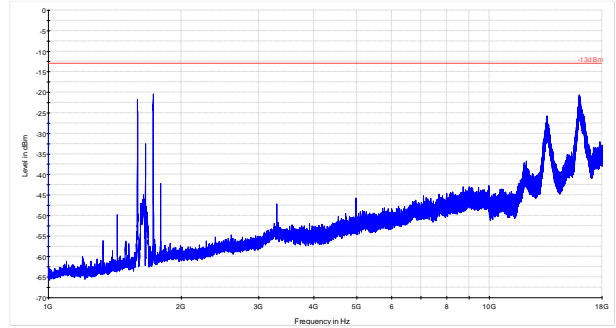
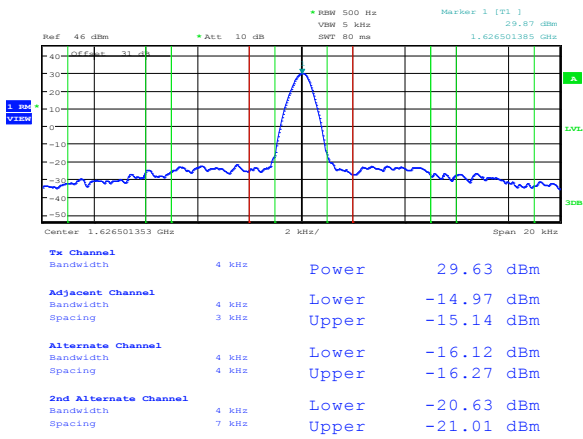
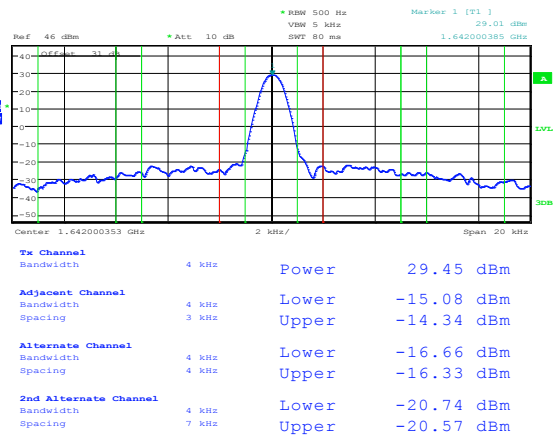


Figure 8.3-8: Spurious emissions above 1 GHz, Helix antenna, high channel



Date: 15.DEC.2015 11:15:27

Figure 8.3-9: Emissions Mask, low channel

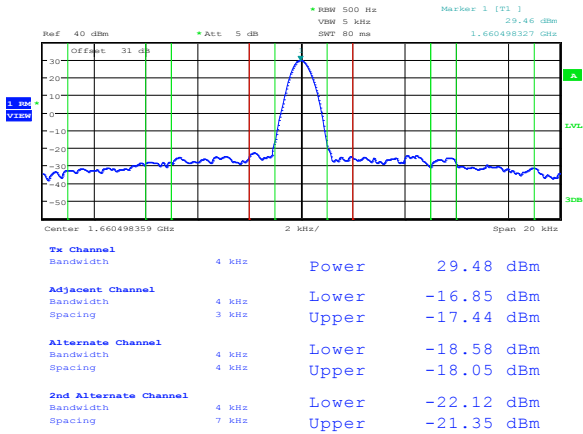


Date: 15.DEC.2015 11:16:36

Figure 8.3-10: Emissions Mask, mid channel

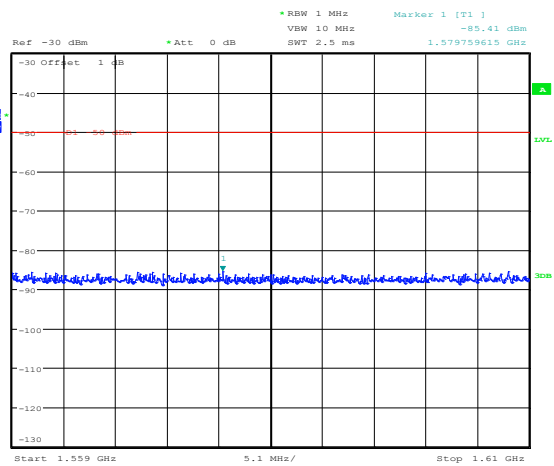
Section 8
Test name
Specification

Testing data
 FCC 25.202(f) and RSS-170 5.4 Field strength of spurious emissions
 FCC Part 25 and RSS-170, Issue 3



Date: 15.DEC.2015 12:14:04

Figure 8.3-11: Emissions Mask, high channel



Date: 15.DEC.2015 10:51:33

Figure 8.3-12: Carrier-off state

Table 8.3-1: Emission mask measurement results for frequencies below 250% of authorized BW

Channel	Frequency shift, kHz	Attenuation, dB	Minimum limit, dB	Margin, dB
Low	1 to 2	44.77	25.00	19.77
Low	-1 to -2	44.60	25.00	19.60
Low	2 to 5	45.90	35.00	10.90
Low	-2 to -5	45.75	35.00	10.75
Mid	1 to 2	43.79	25.00	18.79
Mid	-1 to -2	44.53	25.00	19.53
Mid	2 to 5	45.78	35.00	10.78
Mid	-2 to -5	46.11	35.00	11.11
High	1 to 2	46.90	25.00	21.90
High	-1 to -2	46.31	25.00	21.31
High	2 to 5	47.51	35.00	12.51
High	-2 to -5	48.04	35.00	13.04

Note: authorized/occupied bandwidth is 2 kHz.

Table 8.3-2: Emission mask measurement results beyond 250% of authorized BW

Channel	Frequency shift, kHz	Level, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
Low	5	-21.01	4.50	-16.51	-13.00	3.51
Low	-5	-20.63	4.50	-16.13	-13.00	3.13
Mid	5	-20.57	4.50	-16.07	-13.00	3.07
Mid	-5	-20.74	4.50	-16.24	-13.00	3.24
High	5	-21.35	4.50	-16.85	-13.00	3.85
High	-5	-22.12	4.50	-17.62	-13.00	4.62

Note: EUT comes with two different antennas. Highest antenna gain (4.5 dBi) was used in the calculation of EIRP as a worst-case scenario.

8.4 FCC 25.202(d) and RSS-170 5.2 Frequency tolerance, Earth stations

8.4.1 Definitions and limits

FCC:

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent (± 10 ppm) of the reference frequency.

§2.1055 Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30°C to $+50^{\circ}\text{C}$ for all equipment except that specified in paragraphs (a)(2) and (3) of this section

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10°C through the range.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

IC:

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than ± 10 ppm.

8.4.2 Test summary

Test date	December 15, 2015	Temperature	24 °C
Test engineer	Andrey Adelberg	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	32 %

8.4.3 Test data

Table 8.4-1: 20 dB bandwidth measurement result

Test conditions	Frequency, Hz	Offset, ppm	Limit, \pm ppm	Margin, ppm
+50 °C, Nominal	1642000696	0.27517142	10	9.7248286
+40 °C, Nominal	1642000507	0.15999351	10	9.8400065
+30 °C, Nominal	1642000536	0.17769562	10	9.8223044
+20 °C, +15 %	1642000574	0.20111684	10	9.7988832
+20 °C, Nominal	1642000244		Reference	
+20 °C, -15 %	1642000100	-0.08770043	10	9.9122996
+10 °C, Nominal	1642000365	0.07373487	10	9.9262651
0 °C, Nominal	1642000280	0.0220229	10	9.9779771
-10 °C, Nominal	1642000413	0.10274861	10	9.8972514
-20 °C, Nominal	1641999985	-0.15770837	10	9.8422916
-30 °C, Nominal	1642000087	-0.09540043	10	9.9045996

Note: Offset was calculated as per the following formula: $\frac{F_{\text{Measured}} - F_{\text{reference}}}{F_{\text{reference}}} \times 10^6$

8.5 FCC 25.216 and RSS-170 5.4.3.2 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service

8.5.1 Definitions and limits

FCC:

(c) The e.i.r.p. density of emissions from mobile earth stations with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz (-40 dBm/MHz), averaged over any 2 millisecond active transmission interval, in the band 1559–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW (-50 dBm), averaged over any 2 millisecond active transmission interval, in the 1559–1605 MHz band.

(f) Mobile earth stations with assigned uplink frequencies in the 1610–1660.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band to an extent determined by linear interpolation from -70 dBW/MHz (-40 dBm/MHz) at 1605 MHz to -10 dBW/MHz (20 dBm/MHz) at 1610 MHz.

IC:
 Mobile earth stations with transmitting frequencies between 1626.5 and 1660.5 MHz shall have the e.i.r.p. density of unwanted emissions in the band 1605–1610 MHz, averaged over any 2 ms active transmission interval, not exceed the following limits:

- (1) -70 dBW/MHz (-40 dBm/MHz) at 1605 MHz, linearly interpolated to -46 dBW/MHz (-16 dBm/MHz) at 1610 MHz, for broadband emissions; and
- (2) -80 dBW/kHz (-50 dBm/kHz) at 1605 MHz, linearly interpolated to -56 dBW/kHz (-26 dBm/kHz) at 1610 MHz, for discrete emissions.

8.5.2 Test summary

Test date	December 10, 2015	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	32 %

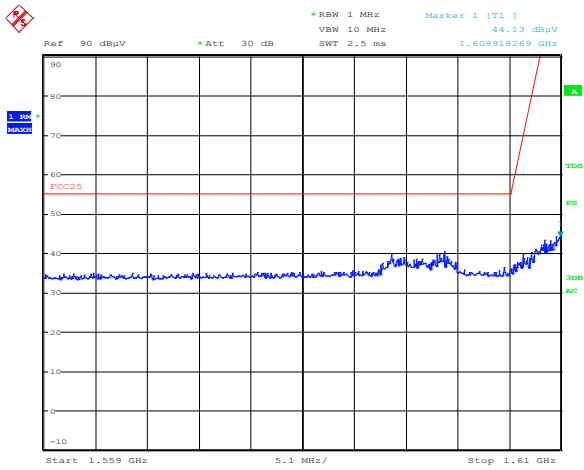
8.5.3 Observations, settings and special notes

The testing was performed radiated therefore the trace is in field strength measurement units. In order to comply with power limits, substitution factor of 95.23 dB was applied to the limit line, converting it to field strength at 3 m distance equivalent limit. Since all the field strength measured levels were more than 10 dB below the FS equivalent limit line, no actual power testing was performed.

Spectrum analyser settings:

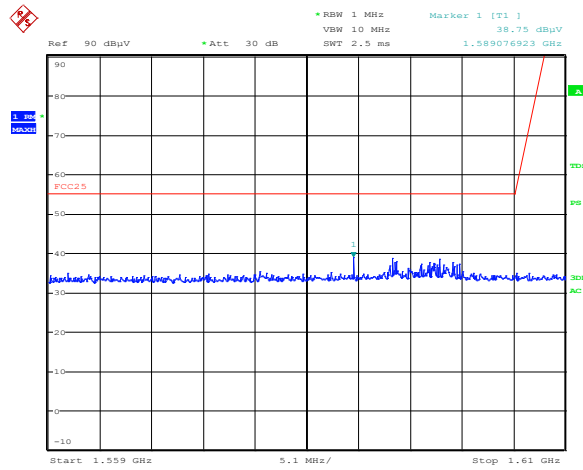
Resolution bandwidth	1 MHz
Video bandwidth	10 MHz
Detector mode	RMS
Trace mode	Max-hold

8.5.4 Test data



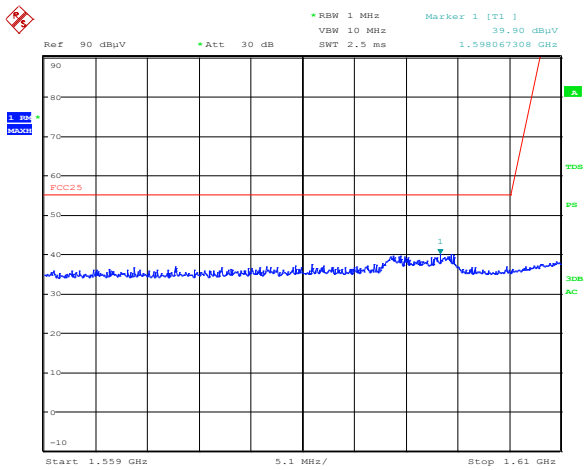
Date: 11.DEC.2015 13:56:58

Figure 8.5-1: Emissions within 1559–1605 MHz, Patch antenna, low channel



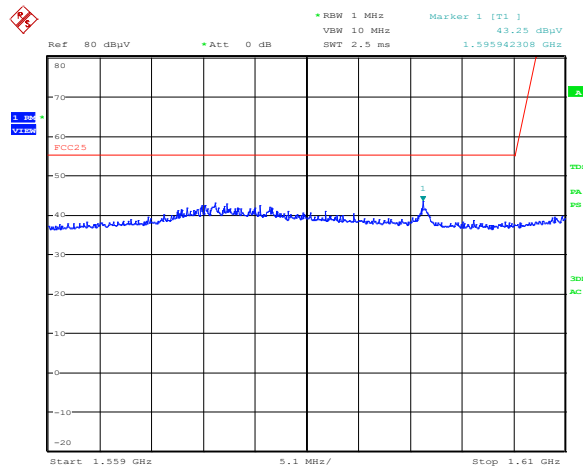
Date: 11.DEC.2015 13:58:13

Figure 8.5-2: Emissions within 1559–1605 MHz, Patch antenna, mid channel



Date: 11.DEC.2015 14:00:16

Figure 8.5-3: Emissions within 1559–1605 MHz, Patch antenna, high channel

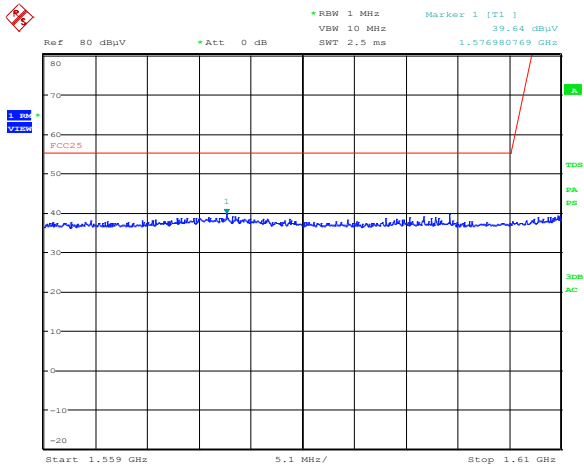


Date: 10.DEC.2015 13:27:56

Figure 8.5-4: Emissions within 1559–1605 MHz, Helix antenna, low channel

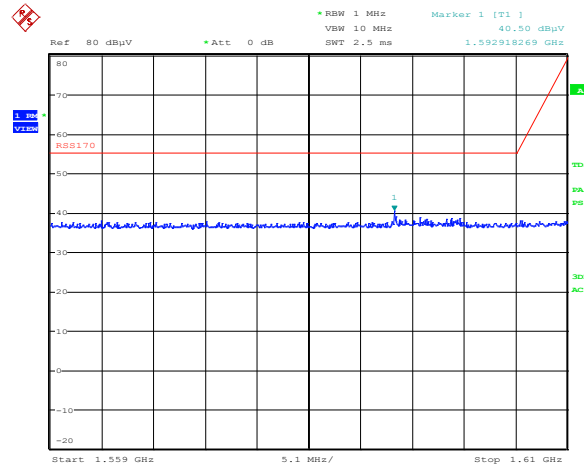
Section 8
Test name
Specification

Testing data
FCC 25.216 and RSS-170 5.4.3.2 Limits on emissions from mobile earth stations for protection of
aeronautical radionavigation-satellite service
FCC Part 25 and RSS-170, Issue 3



Date: 10.DEC.2015 13:30:09

Figure 8.5-5: Emissions within 1559–1605 MHz, Helix antenna, mid channel

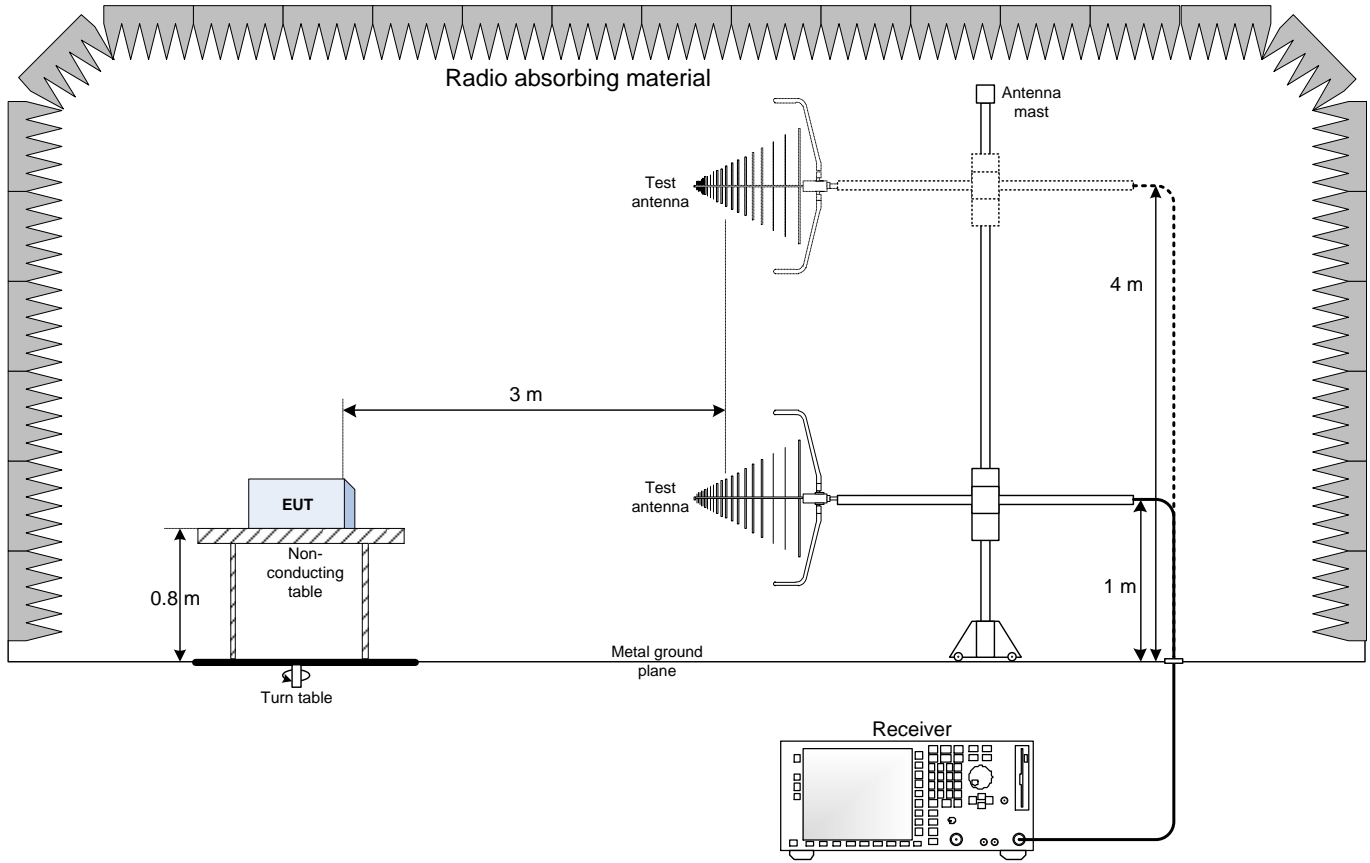


Date: 10.DEC.2015 13:32:47

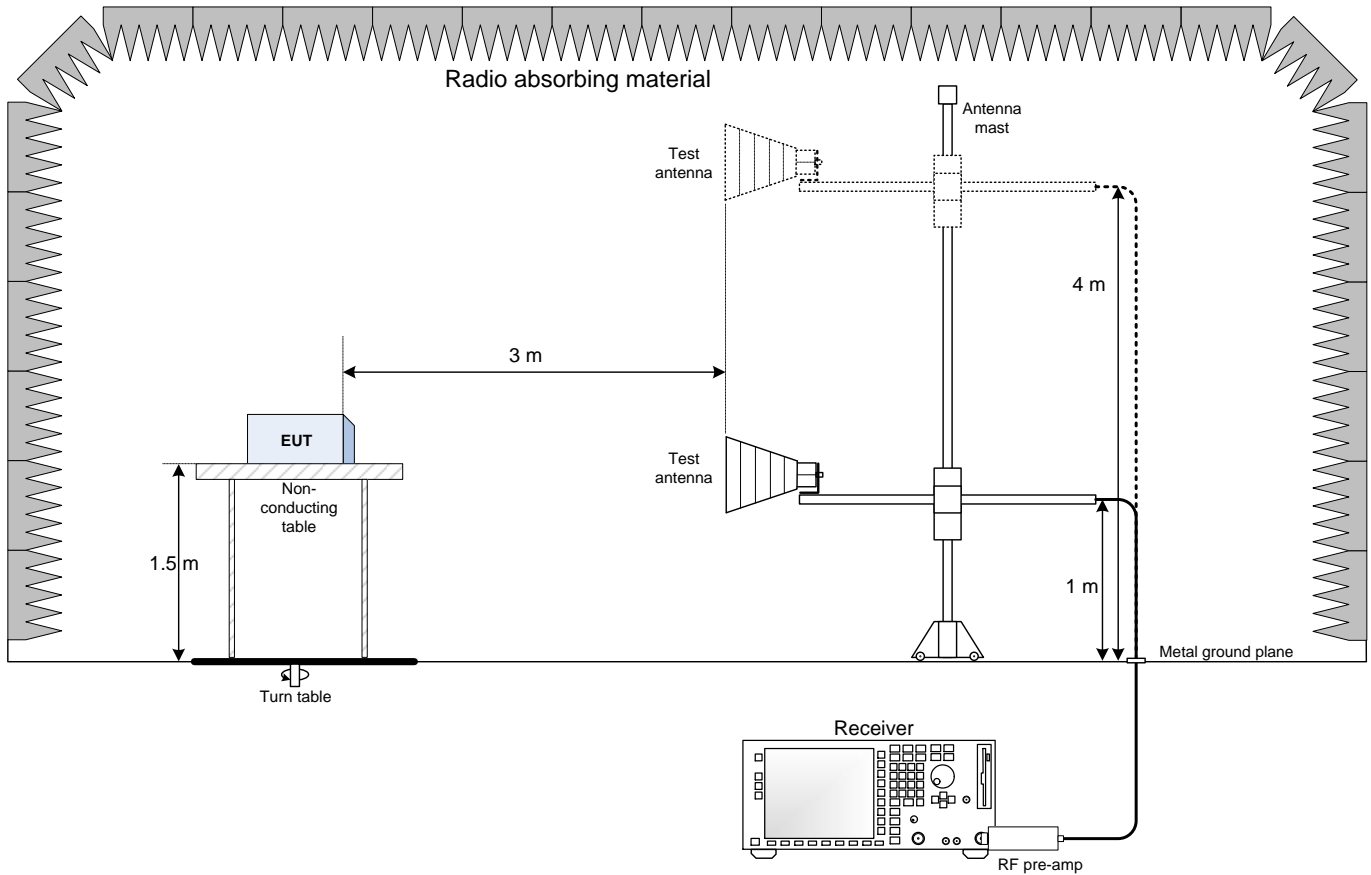
Figure 8.5-6: Emissions within 1559–1605 MHz, Helix antenna, high channel

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



9.3 Conducted emissions set-up

