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Test report NEX328084-4TRFWL

328084-4TRFWL

Date of issue: April 15, 2019

Applicant:
Commscope

Product:
ION-E

Model:
UAP

Variants
UAP-X, UAP-N25, UAP-XN25

FCC ID:
BCR-IONEUAP

ISED certification number:
2237D-IONEUAP

Specifications:
FCC Part 90, RSS-131 Issue 3, RSS-119 Issue 12

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 test site registration number: 175281, IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Kevin Rose, Wireless/EMC Specialist
Reviewed by	Russell Grant, Senior Technical Assessor
Date	April 15, 2019
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	CommScope
Address	620 N. Greenfield Pwky.
City	Garner
Province/State	NC
Postal/Zip code	27529
Country	USA

1.2 Test specifications

FCC Part 90	PRIVATE LAND MOBILE RADIO SERVICES
KDB 935210 D05 Indus Booster Basic Meas v01r02	MEASUREMENTS GUIDANCE FOR INDUSTRIAL AND NON-CONSUMER SIGNAL BOOSTER, REPEATER, AND AMPLIFIER DEVICES
RSS-131 issue 3	Zone Enhancers
RSS-119 issue 12	Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz

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

Noise figure could not be tested according to test plan. EUT amplifier output will not engage when supplied driven by 28 V_{DC} noise source only. As such there is no observed change in amplitude when noise is applied to EUT input

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 90, RSS-131 Issue 3, RSS-119 Issue 12

Part	Test description	Verdict
KDB 935210 D05 4.2	Measuring AGC threshold	Reported[1]
KDB 935210 D05 4.3	Out-of-band-rejection	Pass
FCC 90.210(i)(j), FCC 90.219(e)(4), RSS-131 6.6(1)(2), RSS119-5.8.7, RSS119-5.8.8, KDB 935210 D05 4.4,	Input-versus-output signal comparison	Pass
FCC 90.635(a), FCC 90.219(e)(1), RSS-131 6.2, RSS-119 5.4, KDB 935210 D05 4.5	Input/output power and amplifier/booster gain	Pass
FCC 90.219(e)(2), RSS-131 6.4, KDB 935210 D05 4.6	Noise figure measurements	Not Tested[1]
FCC 90.219(e)(3), RSS-131 6.5, KDB 935210 D05 4.7.2	Out-of-band/out-of-block emissions conducted measurements	Pass
FCC 90.210(i)(j), RSS-131 6.6(2), RSS-119 5.8.7, RSS-119 5.8.8, KDB 935210 D05 4.7.3	EUT spurious emissions conducted measurements	Pass
FCC 90.213, RSS-119 5.3, KDB 935210 D05 4.8	Frequency stability measurements	N/A[2]
FCC 90.210(i)(j), RSS-131 6.6(2), RSS-119 5.8.7, RSS-119 5.8.8, KDB 935210 D05 4.9	Spurious emissions radiated measurements	Pass

Notes:

[1]EUT amplifier output will not engage when supplied driven by 28 VDC noise source only. As such there is no observed change in amplitude when noise is applied to EUT input

[2]The signal booster does not alter the input signal in any way

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	October 26, 2018
Nemko sample ID number	1

3.2 EUT information

Product name	ION-E
Model	UAP
Serial number	None

3.3 Technical information

Operating band	DL: 935-940 MHz
Modulation type/ Emission designator	8K10F1E, 8K10F1D 7K60FXE, 7K60FXD 11K0F3E, 11K2F1D, 9K20F1D
Power requirements	120 Vac 60 Hz
Gain	20 dB
Antenna information	External Antenna is not provided EUT used a 50 Ω termination.

3.4 Product description and theory of operation

20 dB gain in DL repeater

3.5 EUT exercise details

The EUT was controlled software GUI.

3.6 EUT setup diagram

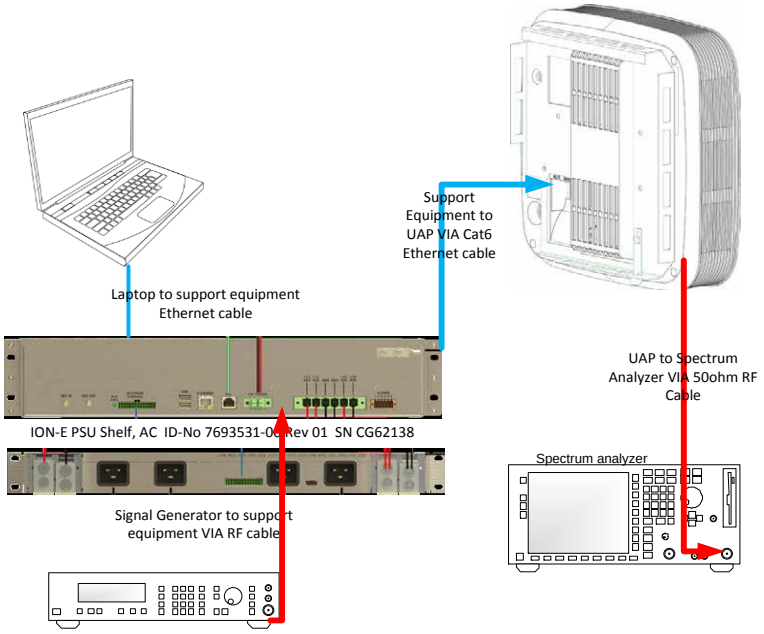


Figure 3.6-1: Setup diagram

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Serial no.	Asset no.	Cal./Ver. cycle	Next cal./ver.
3 m EMI test chamber	TDK	SAC-3		FA003012	1 year	Aug. 22/19
Flush mount turntable	SUNAR	FM2022		FA003006	—	NCR
Controller	SUNAR	SC110V	050118-1	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	042418-5	FA003007	—	NCR
AC Power source	Chroma			FA003020	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	101367	FA002969	1 year	Jan. 30/19
Spectrum analyzer	Rohde & Schwarz	FSW43	104437	FA002971	1 year	Mar. 16/19
Horn antenna (1–18 GHz)	ETS-Lindgren	3117	00052793	FA002911	1 year	Aug. 16/19
Preamp (1–18 GHz)	ETS-Lindgren	124334	00224880	FA002956	1 year	Sept 18/19
Bilog antenna (30–2000 MHz)	SUNAR	JB1	A053018-1	FA003009	1 year	Sept. 6/19

Note: NCR - no calibration required,

Section 8. Testing data

8.1 KDB 935210 D05 4.2, Measuring AGC threshold

8.1.1 Definitions and limits

The AGC threshold is the input power at which a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output power.

8.1.2 Test summary

Test date	October 26, 2018	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1003 mbar
Verdict	Pass	Relative humidity	33 %

8.1.3 Observations, settings and special notes

Test receiver settings:

Detector mode	RMS (for average), Peak (for peak)
Resolution bandwidth	20 kHz
Integration bandwidth	>OBW
Video bandwidth	>RBW
Trace mode	Power Average (for average), Max Hold (for peak)
Measurement time	Auto

8.1.4 Test data

Table 8.1-1: AGC Threshold

Modulation	Frequency, MHz	RF input power AVG, dBm
CW	937.5	1.87

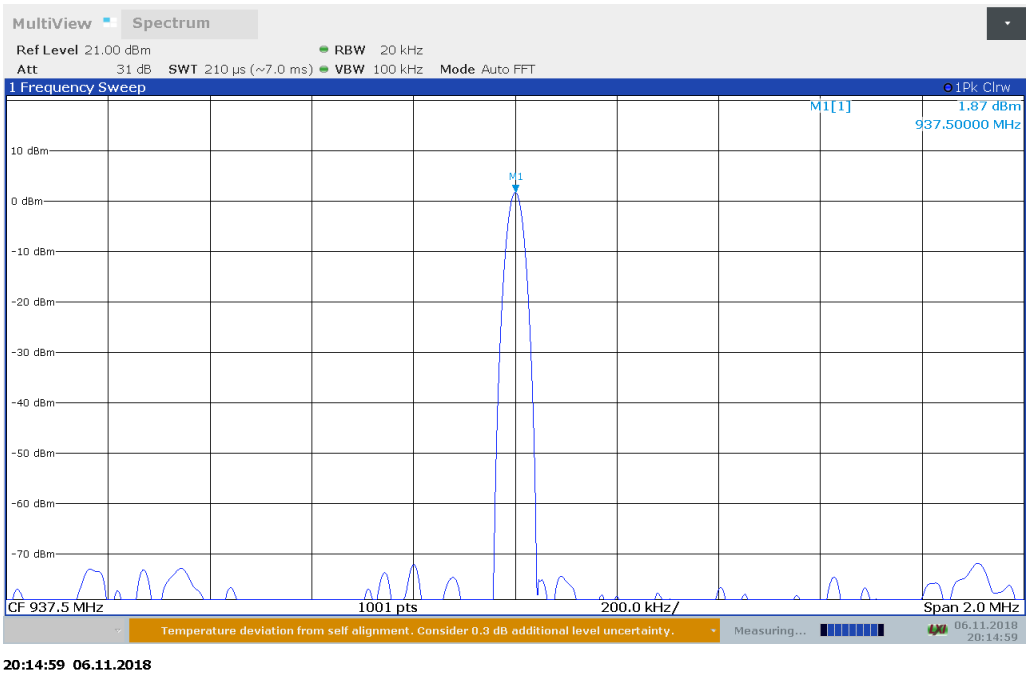


Figure 8.1-1: *AGC +1 dB 937.5 MHz input power*

8.2 KDB 935210 D05 4.3, Out-of-band-rejection

8.2.1 Definitions and limits

The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

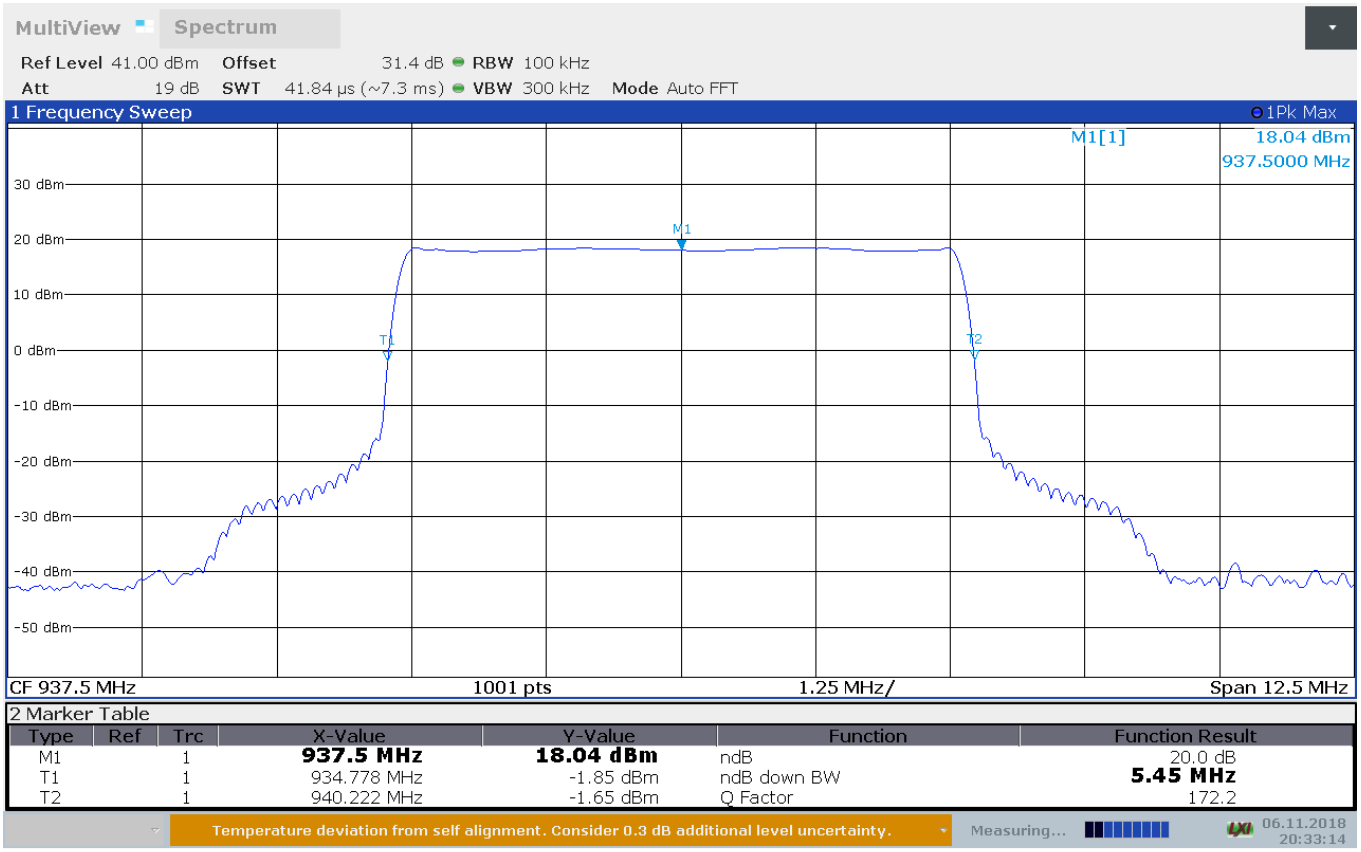
8.2.2 Test summary

Test date	October 26, 2018	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	42 %

8.2.3 Observations, settings and special notes

Frequency range	30 MHz to 10th harmonic
Detector mode	Peak
Resolution bandwidth sweep	100 kHz (below 1 GHz), 1000 kHz (above 1 GHz)
Video bandwidth	>RBW
Trace mode	Max Hold
Measurement time	Auto

8.2.4 Test data



20:33:14 06.11.2018

Figure 8.2-1: *Passband*

8.3 FCC 90.210(i)(j), FCC 90.219(e)(4), RSS-131 6.6(1)(2), RSS-119 5.8.7, RSS-119 5.8.8, KDB 935210 D05 4.4, Input-versus-output signal comparison

8.3.1 Definitions and limits

The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

A 26 dB bandwidth measurement shall be performed on the input signal and the output signal; alternatively, the 99% OBW can be measured and used. See KDB Publication 971168 [R8] for more information on measuring OBW

8.3.2 Test summary

Test date	October 29, 2018	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1001 mbar
Verdict	Pass	Relative humidity	32 %

8.3.3 Observations, settings and special notes

Receiver settings were:

Frequency range	250% of OBW
Detector mode	Peak
Resolution bandwidth	1 % to 5 % of the anticipated OBW
Video bandwidth	>RBW
Trace mode	Max Hold

8.3.4 Test data

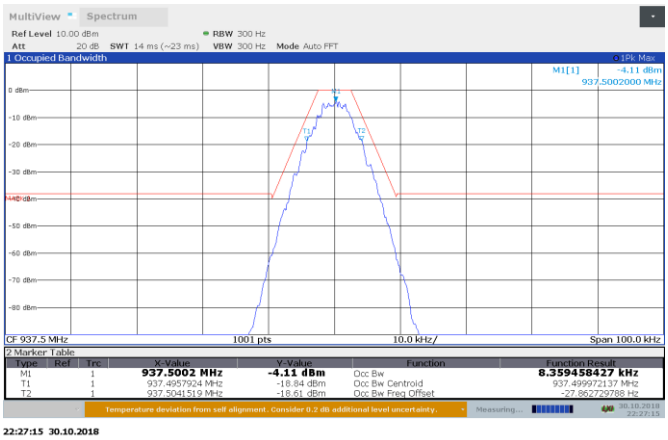


Figure 8.3-1: *8K10F1D AGC-0.5 dB 937.5 MHz input 99% BW Emission Mask J*

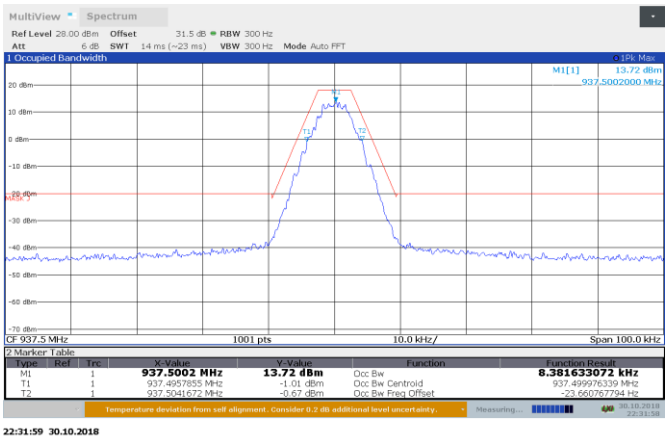


Figure 8.3-2: *8K10F1D AGC-0.5 dB 937.5 MHz output 99% BW Emission Mask J*

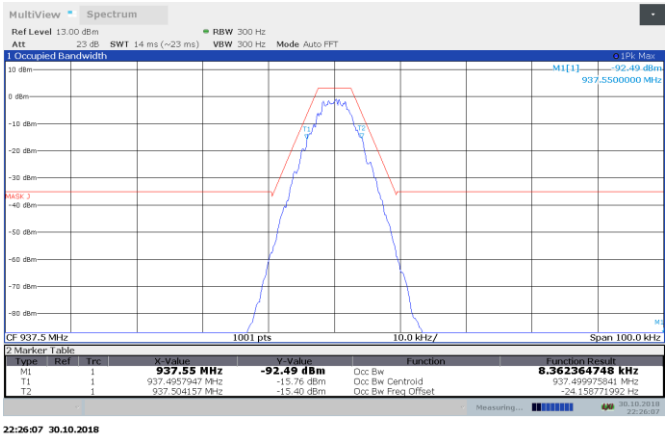


Figure 8.3-3: *8K10F1D AGC +3 dB 937.5 MHz input 99% BW Emission Mask J*

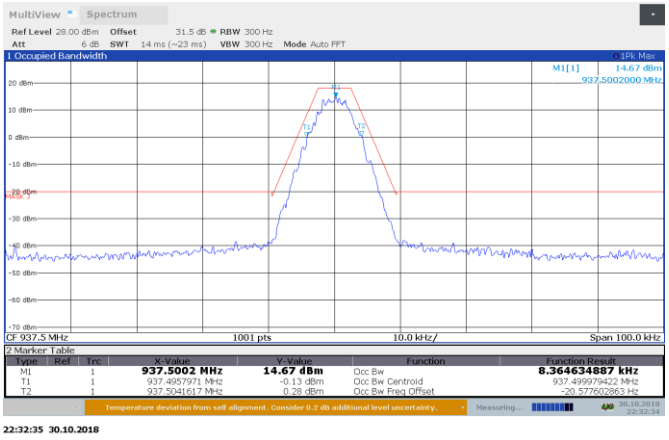


Figure 8.3-4: *8K10F1D AGC +3 dB 937.5 MHz output 99% BW Emission Mask J*

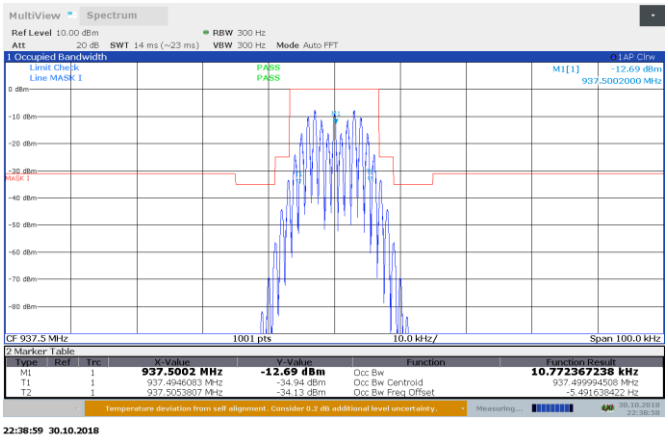


Figure 8.3-5: *11K0F3E AGC-0.5 dB 937.5 MHz input 99% BW Emission Mask I*

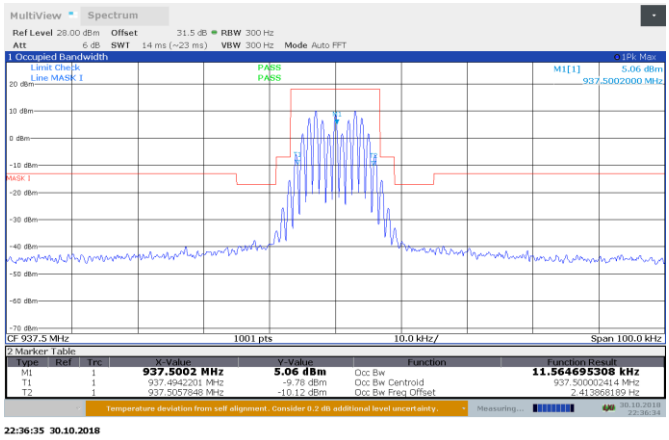


Figure 8.3-6: *11K0F3E AGC-0.5 dB 937.5 MHz output 99% BW Emission Mask I*

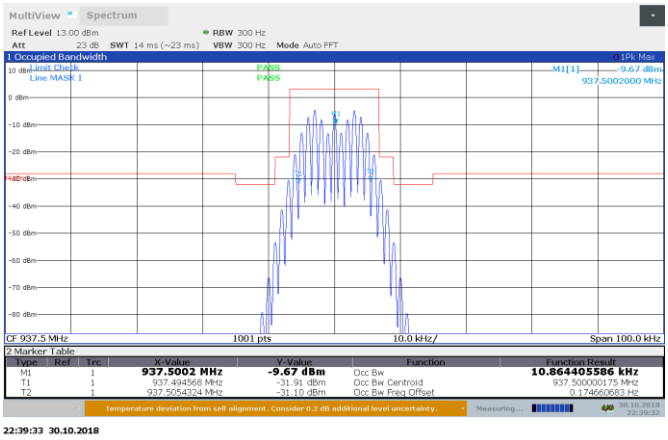


Figure 8.3-7: *11K0F3E AGC +3 dB 937.5 MHz input 99% BW Emission Mask I*

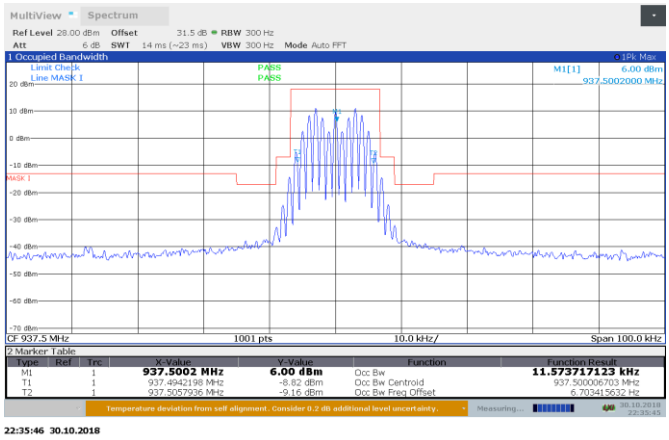


Figure 8.3-8: *11K0F3E AGC+3 dB 937.5 MHz output 99% BW Emission Mask I*

8.4 FCC 90.635(a), FCC 90.219(e)(1), RSS-131 6.2, RSS-119 5.4, KDB 935210 D05 4.5, Input/output power and amplifier/booster gain

8.4.1 Definitions and limits

FCC 90.635(a) 1000 W ERP
FCC 90.219(e)(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.
RSS-131 6.2 The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used (as specified in RSS-119) and shall be within ± 1.0 dB of the zone enhancer manufacturer's rated output power.
RSS-119 5.4 The output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.
RSS-119 5.4 Table 2 – Transmitter Output Power, 896-901/935-940 MHz, Base/Fixed Equipment, 110 W

8.4.2 Test summary

Test date	October 29, 2018	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1001 mbar
Verdict	Pass	Relative humidity	32 %

8.4.3 Observations, settings and special notes

The 99% occupied bandwidth was used.

Spectrum analyzer settings:

Detector mode	RMS (for average), Peak (for peak)
Resolution bandwidth	100 kHz
Integration bandwidth	>OBW
Video bandwidth	>RBW
Trace mode	Power Average (for average), Max Hold (for peak)
Measurement time	Auto

Table 8.4-1: Output power results

Frequency, MHz	RF output power Peak, dBm
937.5	18.51

8.4.1 Test data

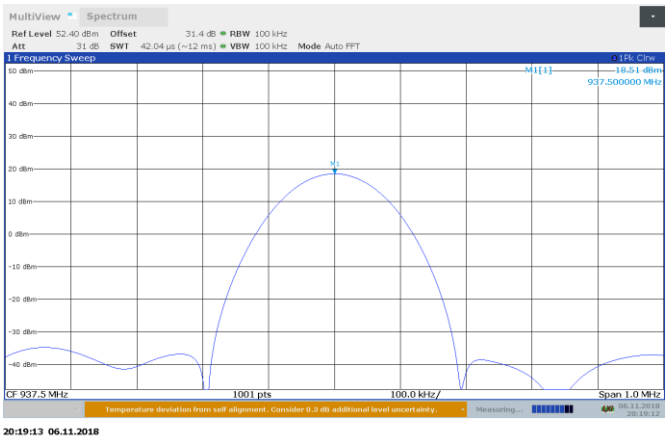


Figure 8.4-1: *AGC-0.5 dB 937.5 MHz output power*

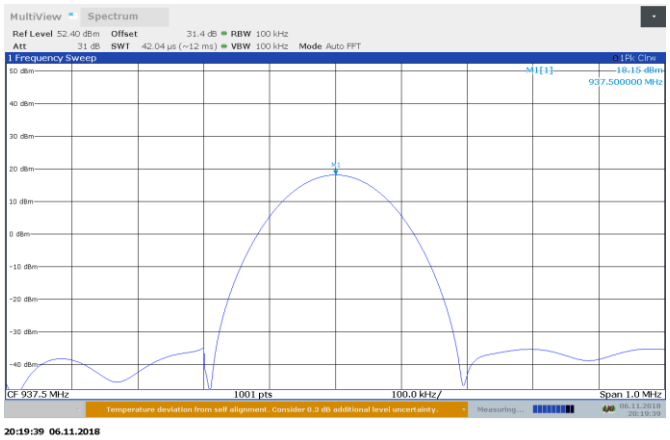


Figure 8.4-2: *AGC+3 dB 937.5 MHz output power*

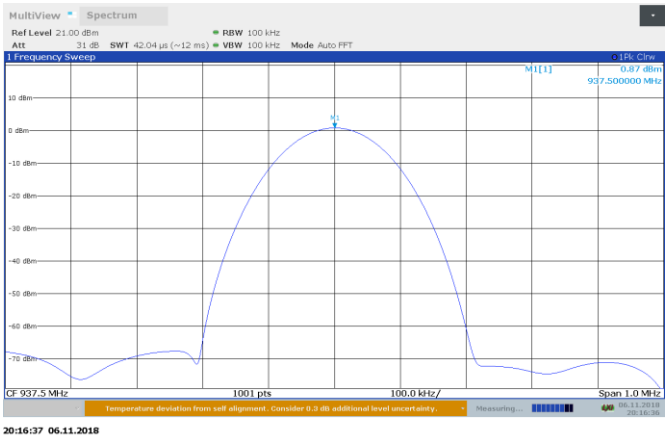


Figure 8.4-3: *AGC-0.5 dB 937.5 MHz input power*

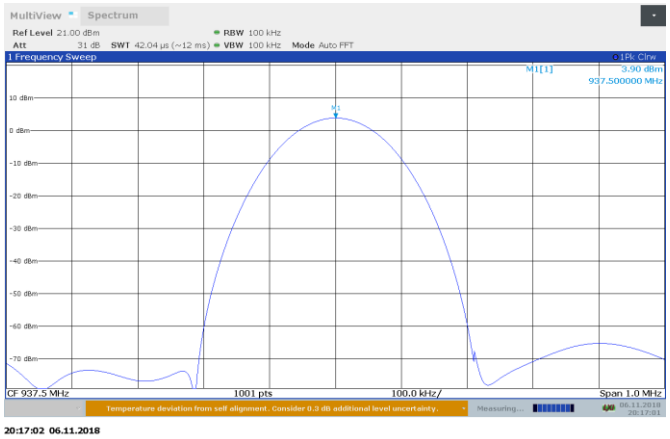


Figure 8.4-4: *AGC+3 dB 937.5 MHz input power*

8.5 FCC 90.219(e)(3), RSS-131 6.5, KDB 935210 D05 4.7.2, Out-of-band/out-of-block emissions conducted measurements

8.5.1 Definitions and limits

FCC 90.219(e)(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.
RSS-131 6.5 The spurious emissions of a zone enhancer shall not exceed −13 dBm in any 100 kHz measurement bandwidth.

8.5.2 Test summary

Test date	October 29, 2018	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1001 mbar
Verdict	Pass	Relative humidity	32 %

8.5.3 Observations, settings and special notes

Test receiver settings:

Detector mode	RMS
Resolution bandwidth	3 kHz
Integration bandwidth	>OBW
Video bandwidth	>RBW
Trace mode	Power Average (100 sweeps)
Measurement time	Auto

8.5.4 Test data

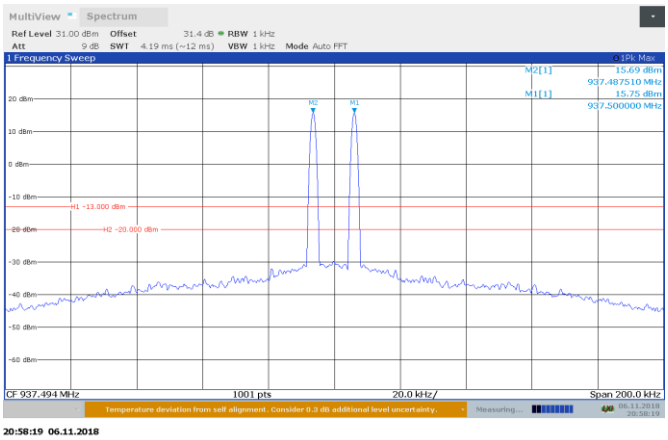


Figure 8.5-1: *937.4875 and 937.5 MHz AGC + 0.5 Out-of-block*

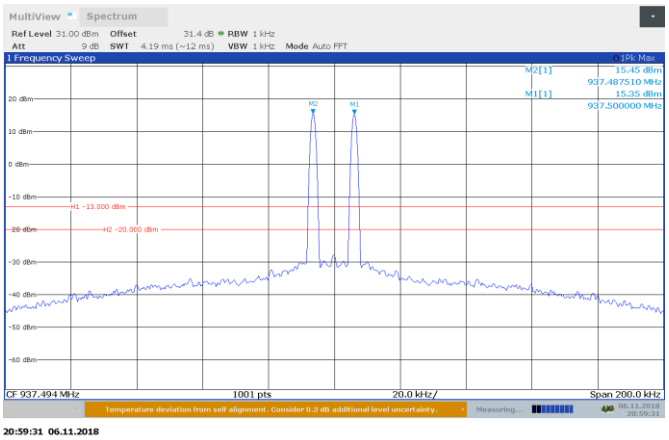


Figure 8.5-2: *937.4875 and 937.5 MHz AGC + 3dB Out-of-block*

8.6 FCC 90.210(i)(j), RSS-131 6.6(2), RSS-119 5.8.7, RSS-119 5.8.8, KDB 935210 D05 4.7.3, EUT spurious emissions conducted

FCC 90.210(i) Emission Mask I. For transmitters that are equipped with an audio low pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows: (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency of more than 15 kHz: At least 43 + 10 log (P) dB, or 70 dB, whichever is the lesser attenuation.
FCC 90.210(j) Emission Mask J. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows: (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 9.5 kHz: At least 157 log (fd/5.3) dB, or 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
RSS-131 6.6(2) the retransmitted signals shall meet the unwanted emission limits in the RSS that applies to the equipment with which the zone enhancer is to be used.
RSS-119 5.8.7 Emission Mask I, Displacement Frequency, fd (kHz), fd > 15, Minimum Attenuation (dB), Whichever is the lesser: 70 or 43 + 10 log10(p)
RSS-119 5.8.8 Emission Mask J for Transmitters not Equipped With an Audio Low-Pass Filter, Displacement Frequency, fd (kHz), fd > 9.5, Minimum Attenuation (dB), Whichever is the lesser: 70 or 157 log10(fd/5.3) or 50 + 10 log10(p)

8.6.1 Test summary

Test date	June 27, 2018	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	42 %

8.6.2 Observations, settings and special notes

Frequency range	30 MHz to 10th harmonic
Detector mode	Peak
Resolution bandwidth sweep	100 kHz (below 1 GHz), 1000 kHz (above 1 GHz)
Video bandwidth	>RBW
Trace mode	Max Hold
Measurement time	Auto

8.6.3 Test data

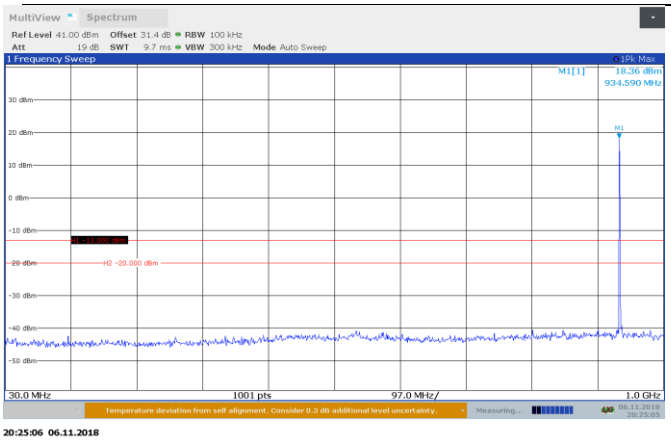


Figure 8.6-1: *935.0125 MHz 30-1000 MHz conducted emission*

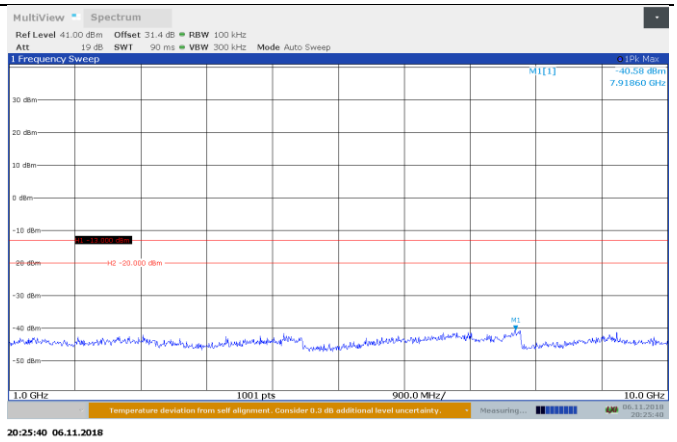


Figure 8.6-2: *935.0125 MHz 1-10 GHz conducted emission*

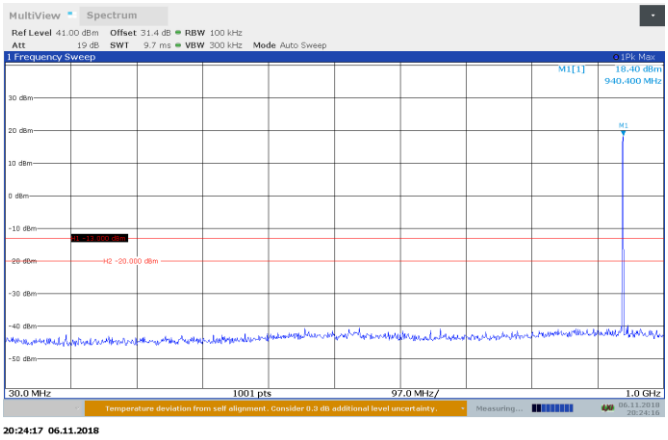


Figure 8.6-3: *939.9875 MHz 30-1000 MHz conducted emission*

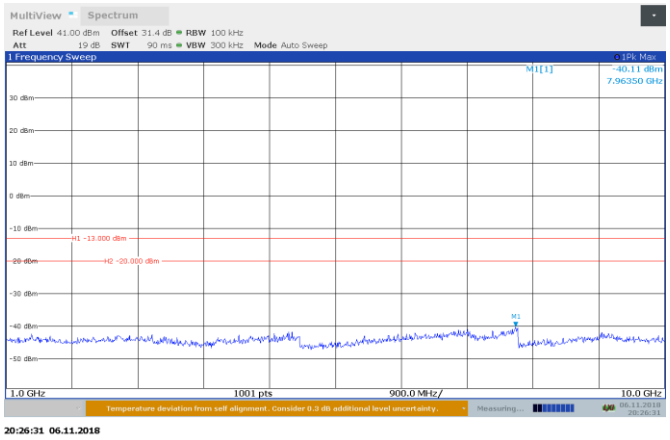


Figure 8.6-4: *939.9875 MHz 1-10 GHz conducted emission*

8.7 FCC 90.210(i)(j), RSS-131 6.6(2), RSS-119 5.8.7, RSS-119 5.8.8, KDB 935210 D05 4.9, Spurious emissions radiated measurements

8.7.1 Definitions and limits

FCC 90.210(i) Emission Mask I. For transmitters that are equipped with an audio low pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows: (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency of more than 15 kHz: At least 43 + 10 log (P) dB, or 70 dB, whichever is the lesser attenuation.
FCC 90.210(j) Emission Mask J. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows: (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 9.5 kHz: At least 157 log (fd/5.3) dB, or 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
RSS-131 6.6(2) the retransmitted signals shall meet the unwanted emission limits in the RSS that applies to the equipment with which the zone enhancer is to be used.
RSS-119 5.8.7 Emission Mask I, Displacement Frequency, fd (kHz), fd > 15, Minimum Attenuation (dB), Whichever is the lesser: 70 or 43 + 10 log10(p)
RSS-119 5.8.8 Emission Mask J for Transmitters not Equipped With an Audio Low-Pass Filter, Displacement Frequency, fd (kHz), fd > 9.5, Minimum Attenuation (dB), Whichever is the lesser: 70 or 157 log10(fd/5.3) or 50 + 10 log10(p)

8.7.2 Test summary

Test date	June 27, 2018	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1000 mbar
Verdict	Pass	Relative humidity	42 %

8.7.3 Observations, settings and special notes

Worst case examples are provided. No emssions within 20 dB of the limit were detected.

Receiver settings were:

Frequency range	30 MHz to 10th harmonic
Detector mode	Peak
Resolution bandwidth	100 kHz (below 1 GHz), 1000 kHz (above 1 GHz)
Video bandwidth	>RBW
Trace mode	Max Hold

8.7.4 Test data

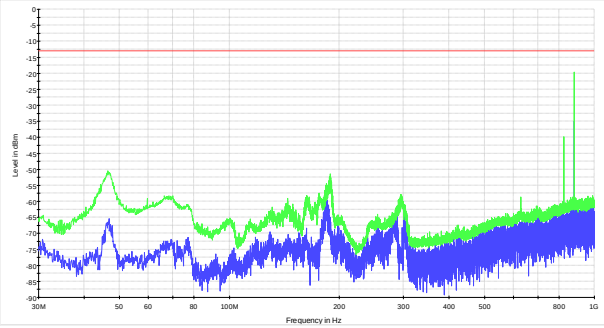


Figure 8.7-1: *30 MHz to 1 GHz Radiated*

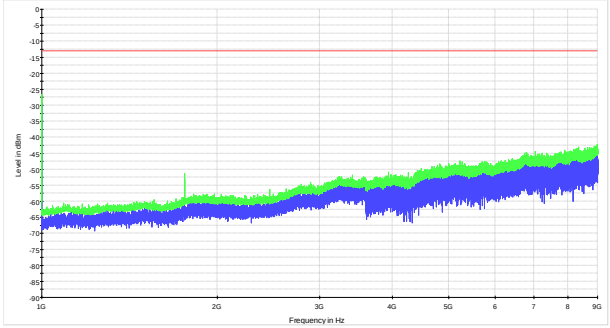
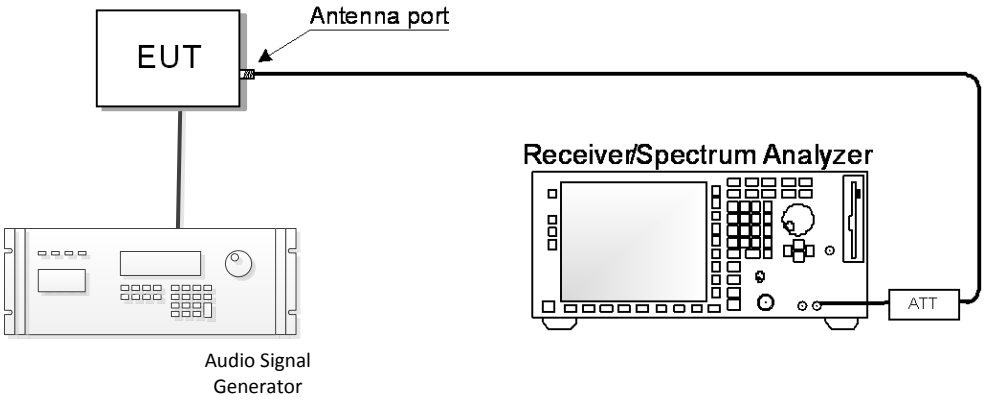


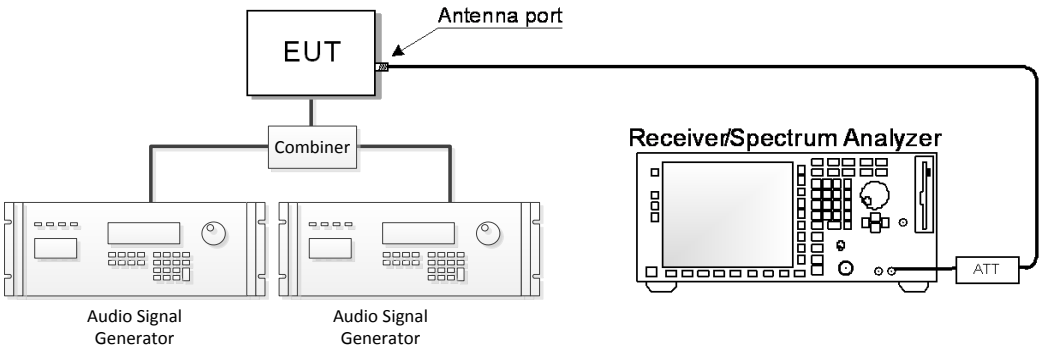
Figure 8.7-2: *1GHz to 9 GHz Radiated*

Section 9. Block diagrams of test set-ups

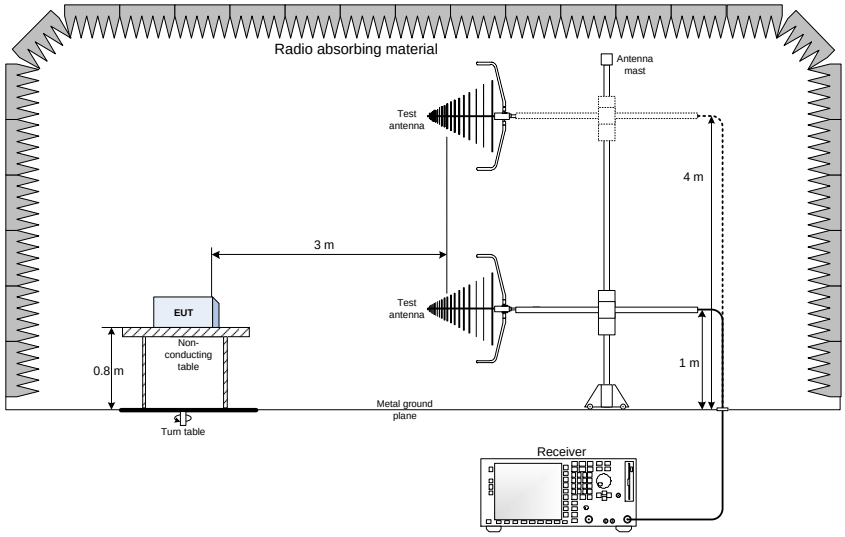
9.1 Measuring AGC threshold, Out-of-band-rejection, Input-versus-output signal comparison, Input/output power and amplifier/booster gain, EUT spurious emissions conducted measurements



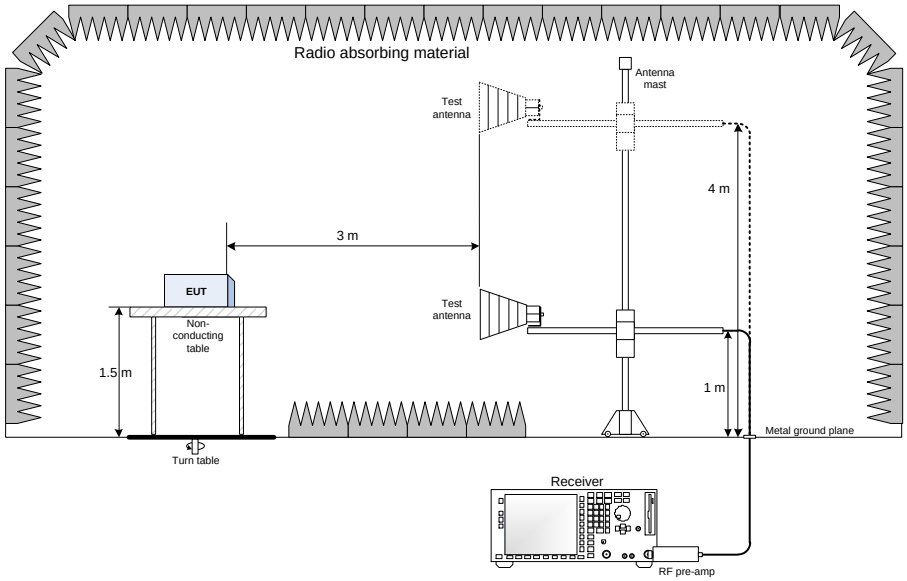
9.2 Out-of-band/out-of-block emissions conducted measurements



9.3 Spurious emissions radiated measurements



Below 1 GHz



Above 1 GHz