

Test report

328084-3TRFWL

Date of issue: April 12, 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 24D, RSS-131 Issue 3, RSS-134 Issue 2

Test location

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City	Ottawa
Province	Ontario
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Country	Canada
Telephone	+1 613 737 9680
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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 12, 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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	CommScope
Address	620 N. Greenfield Pwky.
City	Hickory
Province/State	NC
Postal/Zip code	27529
Country	USA

1.2 Test specifications

FCC Part 24D	PERSONAL COMMUNICATIONS SERVICES, Narrowband PCS
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-134 Issue 2	900 MHz Narrowband Personal Communication Service

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 24D, RSS-131 Issue 3, RSS-134 Issue 2

Part	Test description	Verdict
KDB 935210 D05 3.2	Measuring AGC threshold level	Reported
RSS-131 5.2.1, KDB 935210 D05 3.3	Out-of-band-rejection	Pass
FCC 24.133(a), RSS-131 5.2.2, RSS-134 4.4, KDB 935210 D05 3.4	Input-versus-output signal comparison	Pass
FCC 24.132, RSS-131 5.2.3, RSS-134 4.3, KDB 935210 D05 3.5	Mean output power and amplifier/booster gain	Pass
FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.6.2	Out-of-band/out-of-block emissions conducted measurements	Pass
FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.6.3	Spurious emissions conducted measurements	Pass
FCC 24.135, RSS-131 5.2.4, RSS-134 4.5, 935210 D05 3.7	Frequency stability measurements	N/A ¹
FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.8	Spurious emissions radiated measurements	Pass

Notes: ¹The 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: 940-941 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

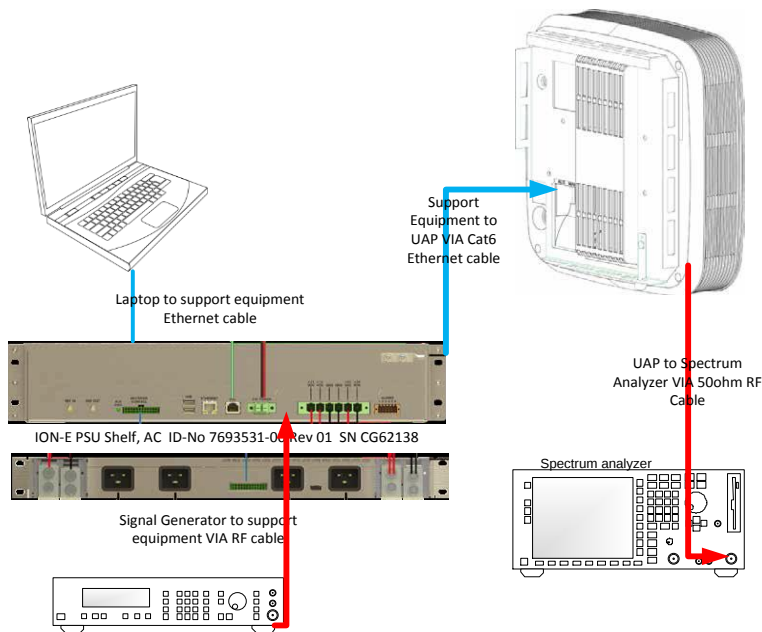


Figure 3.6-1: Setup diagram



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 $\pm 5\%$, 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

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	June 1/19
Spectrum analyzer	Rohde & Schwarz	FSW43	104437	FA002971	1 year	June 1/19
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
Vector Signal Generator	Rohde & Schwarz	SMW200A	101857	FA002970	1 year	June 1/19

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

Section 8. Testing data

8.1 KDB 935210 D05 3.2, 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	940.5	0.05

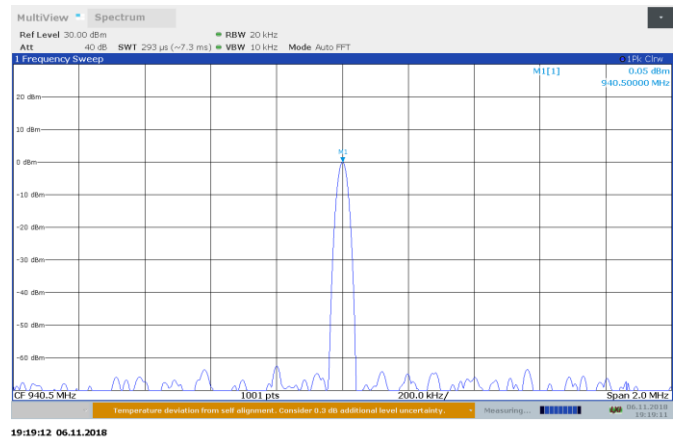


Figure 8.1-1: AGC +1 dB 940.5 MHz input power

8.2 RSS-131 5.2.1, KDB 935210 D05 3.3, 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.

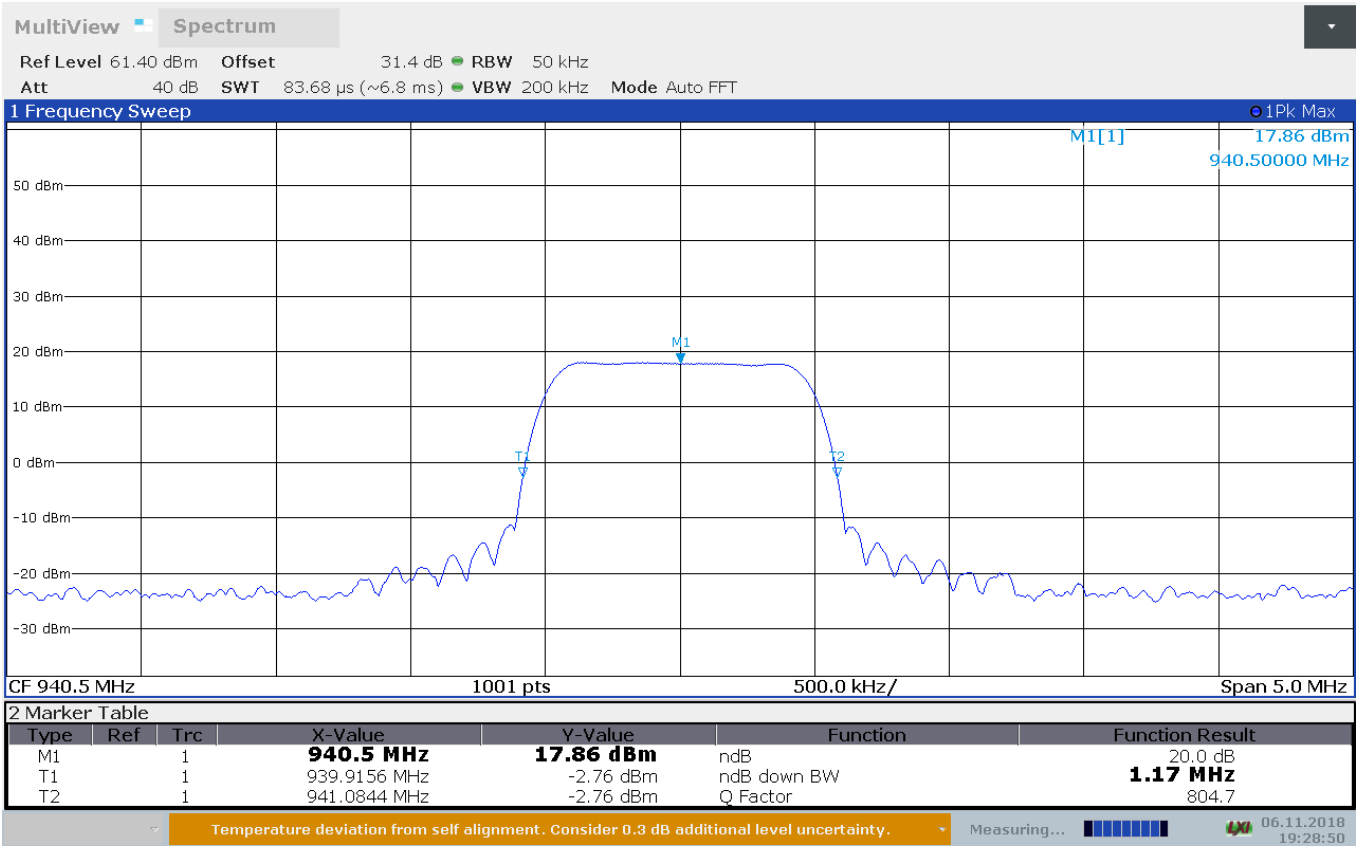
8.2.2 Test summary

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 10 th 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



19:28:50 06.11.2018

Figure 8.2-1: Passband

8.3 FCC 24.133(a), RSS-131 5.2.2, RSS-134 4.4, KDB 935210 D05 3.4, 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.

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

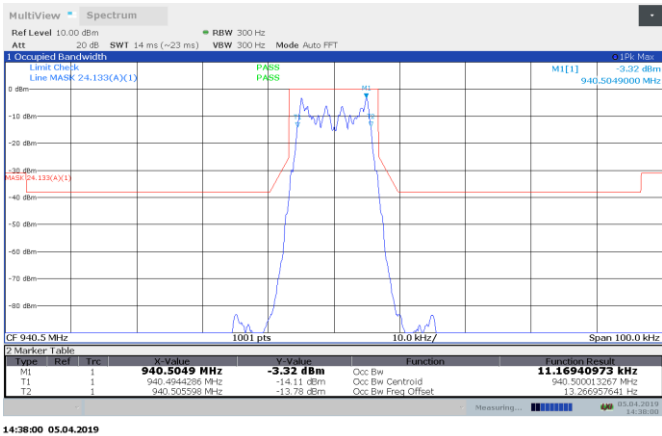


Figure 8.3-1: F1D AGC -0.5 dB 940.5 MHz input 99% BW

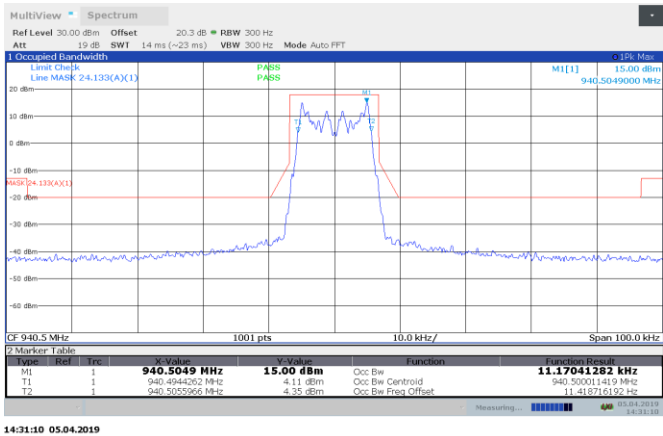


Figure 8.3-2: F1D AGC -0.5 dB 940.5 MHz output 99% BW

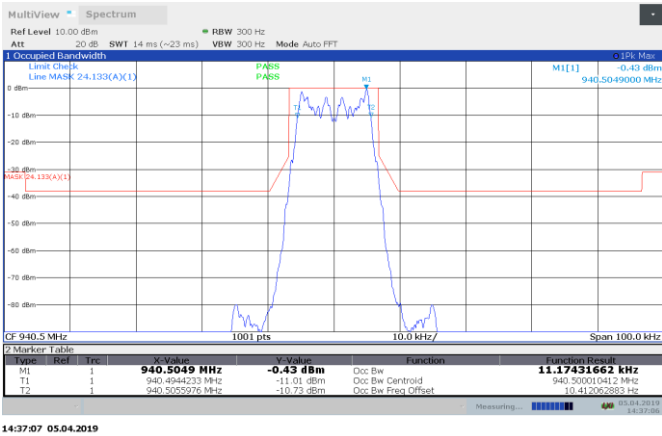


Figure 8.3-3: F1D AGC +3 dB 940.5 MHz input 99% BW

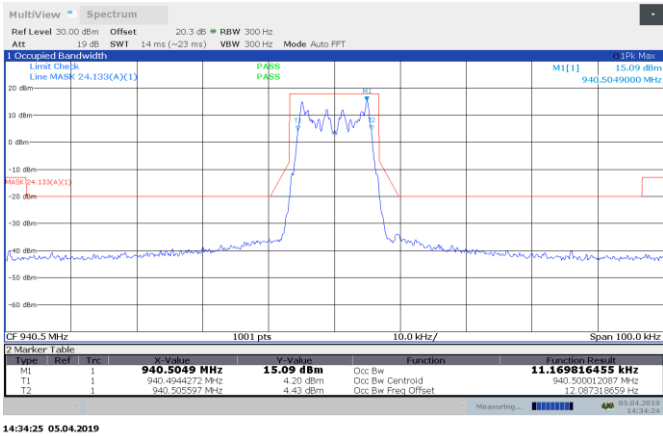


Figure 8.3-4: F1D AGC +3 dB 940.5 MHz output 99% BW

Section 8
Test name
Specification

Testing data
Input-versus-output signal comparison
FCC 24.133(a), RSS-131 5.2.2, RSS-134 4.4, KDB 935210 D05 3.4

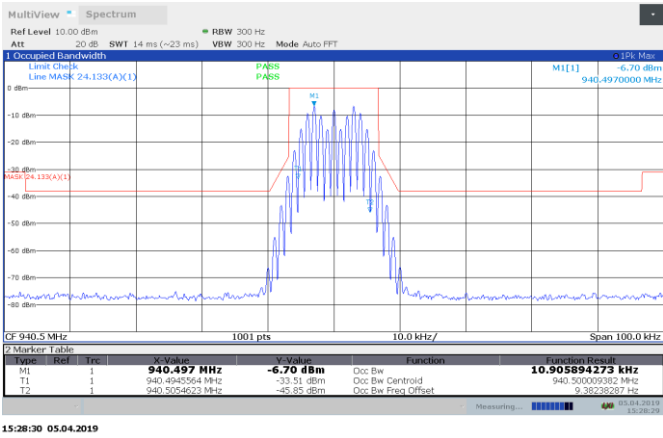


Figure 8.3-5: F3E AGC-0.5 dB 940.5 MHz input 99% BW

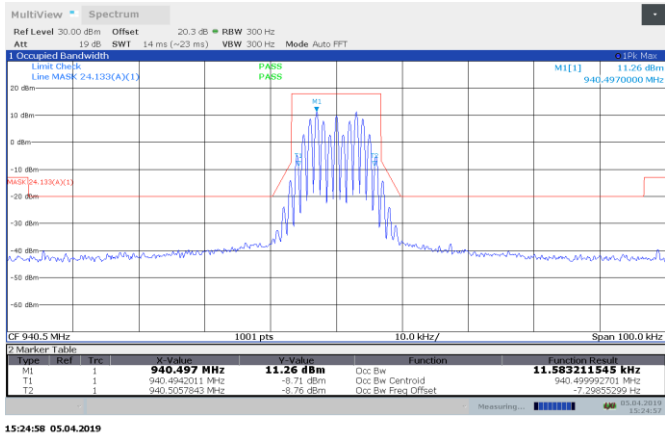


Figure 8.3-6: F3E AGC-0.5 dB 940.5 MHz output 99% BW

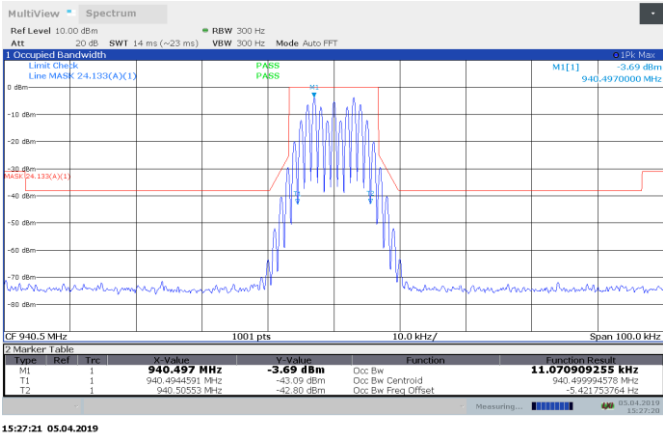


Figure 8.3-7: F3E AGC +3 dB 940.5 MHz input 99% BW

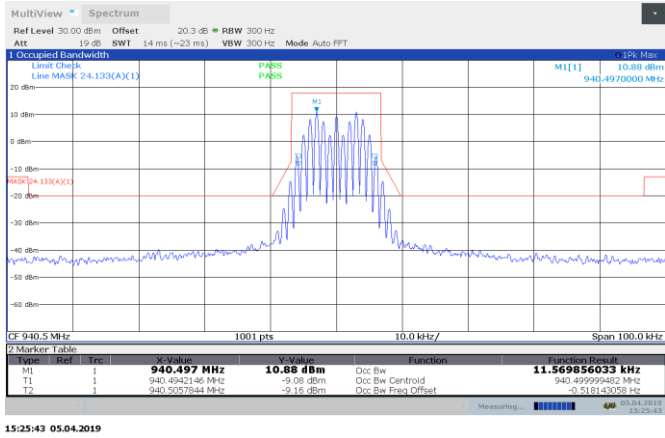


Figure 8.3-8: F3E AGC+3 dB 940.5 MHz output 99% BW

8.4 FCC 24.132, RSS-131 5.2.3, RSS-134 4.3, KDB 935210 D05 3.5, Mean output power and amplifier/booster gain

8.4.1 Definitions and limits

FCC 24.132, 3500 W ERP

RSS-134, 5.2.3 The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

RSS-134 4.3, SRSP-509, 1600 W ERP

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
940.5	18.85

8.4.1 Test data

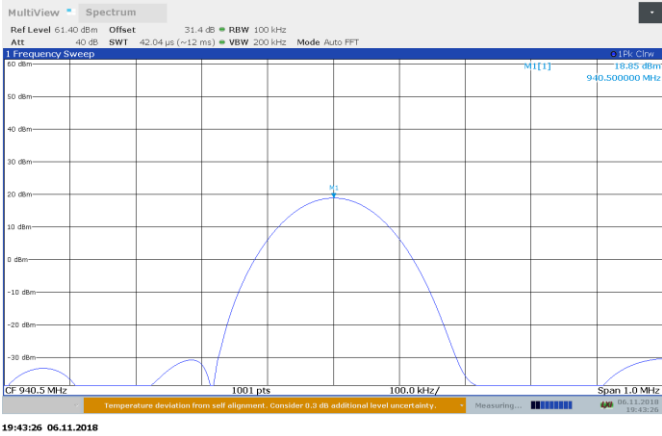


Figure 8.4-1: AGC-0.5 dB 940.5 MHz output power

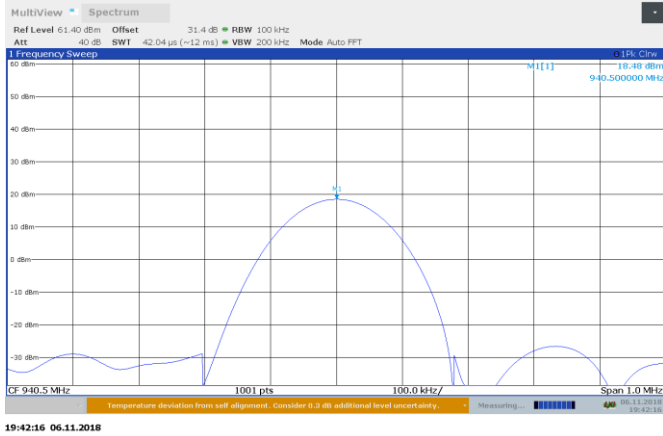


Figure 8.4-2: AGC+3 dB 940.5 MHz output power

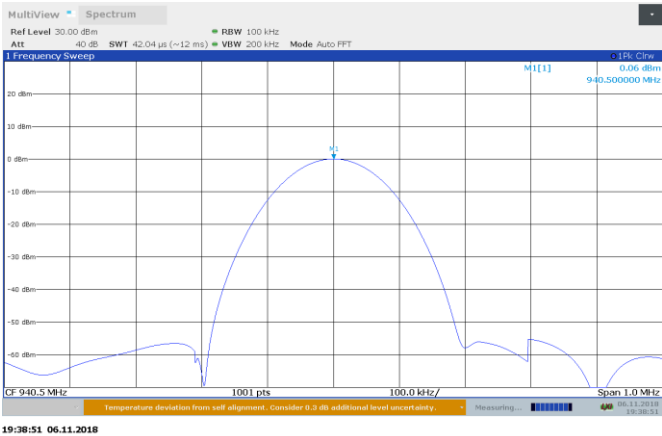


Figure 8.4-3: AGC-0.5 dB 940.5 MHz input power

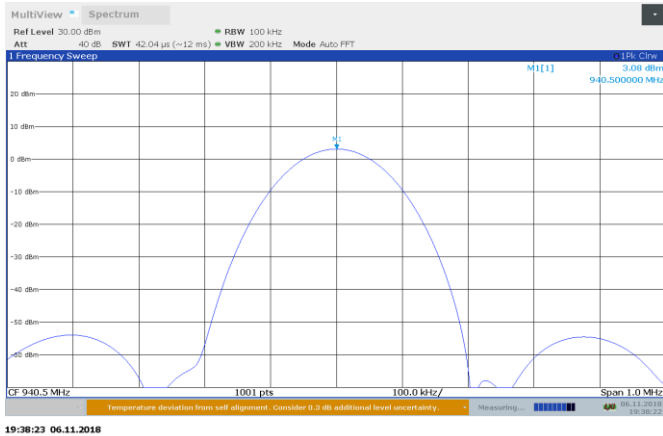


Figure 8.4-4: AGC+3 dB 940.5 MHz input power

8.5 FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.6.2, Out-of-band/out-of-block emissions conducted measurements

8.5.1 Definitions and limits

FCC 24.133(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with §24.132(f), in accordance with the following schedule: (1) For transmitters authorized a bandwidth greater than 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz: at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation. (2) For transmitters authorized a bandwidth of 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 20 kHz: at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation.

RSS-134 4.4, 4.4.1 Minimum Standard for Spacings Exceeding 12.5 kHz (Bandwidth > 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd measured in kHz starts from the edge of the authorized bandwidth): (b) For fd of more than 40 kHz: at least $43 + 10 \log_{10}(P)$ dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution bandwidth. 4.4.2 Minimum Standard for 12.5 kHz Spaced Equipment (Bandwidth = 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd, measured in kHz, starts from the edge of the authorized bandwidth): (b) For fd of more than 20 kHz: at least $43 + 10 \log_{10}(P)$ dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution 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

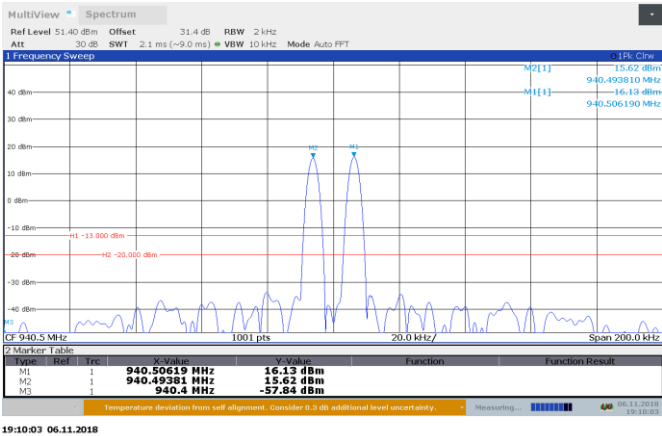


Figure 8.5-1: 940.49375 and 940.50625 MHz AGC - 0.5 Out-of-block

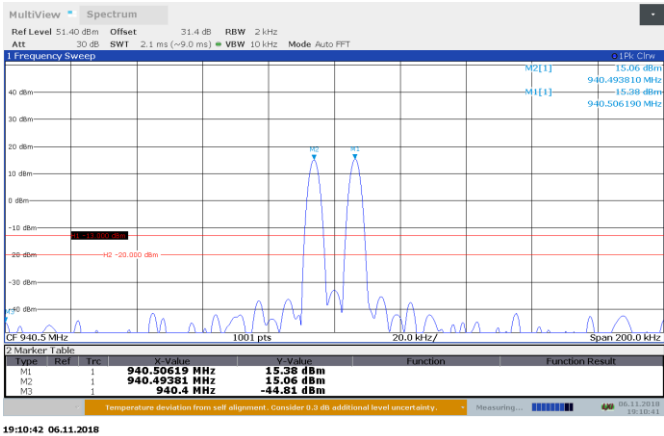


Figure 8.5-2: 940.49375 and 940.50625 MHz AGC + 3dB Out-of-block

8.6 FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.6.3, Spurious emissions conducted measurements

FCC 24.133(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with § 24.132(f), in accordance with the following schedule: (1) For transmitters authorized a bandwidth greater than 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz: at least 43 + 10 Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation. (2) For transmitters authorized a bandwidth of 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 20 kHz: at least 43 + 10 Log 10 (P) decibels or 80 decibels, whichever is the lesser attenuation.

RSS-134 4.4, 4.4.1 Minimum Standard for Spacings Exceeding 12.5 kHz (Bandwidth > 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd measured in kHz starts from the edge of the authorized bandwidth): (b) For fd of more than 40 kHz: at least 43+10 log10 (P) dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution bandwidth. 4.4.2 Minimum Standard for 12.5 kHz Spaced Equipment (Bandwidth = 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd, measured in kHz, starts from the edge of the authorized bandwidth): (b) For fd of more than 20 kHz: at least 43+10 log10 (P) dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution bandwidth.

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 10 th 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

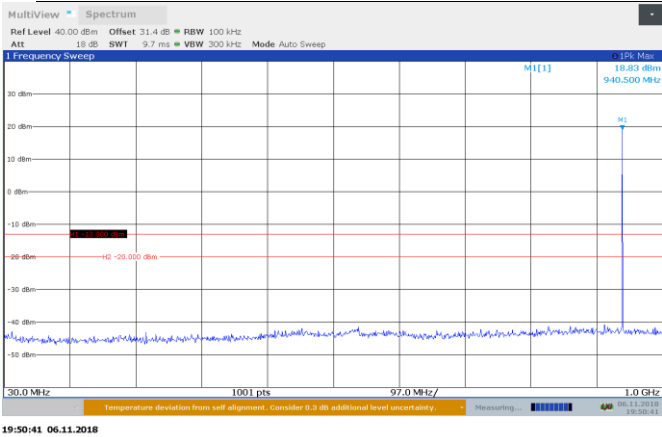


Figure 8.6-1: 940.5 MHz 30-1000 MHz conducted emission

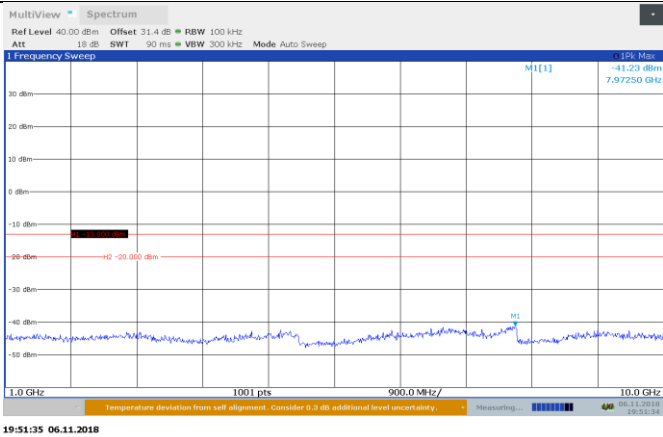


Figure 8.6-2: 940.5 MHz 1-10 GHz conducted emission

8.7 FCC 24.133(a), RSS-134 4.4, KDB 935210 D05 3.8, Spurious emissions radiated measurements

8.7.1 Definitions and limits

FCC 24.133(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with §24.132(f), in accordance with the following schedule: (1) For transmitters authorized a bandwidth greater than 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz: at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation. (2) For transmitters authorized a bandwidth of 10 kHz: (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 20 kHz: at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation.

RSS-134 4.4, 4.4.1 Minimum Standard for Spacings Exceeding 12.5 kHz (Bandwidth > 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd measured in kHz starts from the edge of the authorized bandwidth): (b) For fd of more than 40 kHz: at least $43 + 10 \log_{10}(P)$ dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution bandwidth. 4.4.2 Minimum Standard for 12.5 kHz Spaced Equipment (Bandwidth = 10 kHz) The power of emissions from the transmitter with modulated carrier shall be attenuated below the transmitter power (P) in accordance with the following schedule (where the displacement frequency fd, measured in kHz, starts from the edge of the authorized bandwidth): (b) For fd of more than 20 kHz: at least $43 + 10 \log_{10}(P)$ dB, or 80 dB, whichever is less stringent, using a spectrum analyzer of 30 kHz resolution bandwidth.

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 emissions within 20 dB of the limit were detected.

Receiver settings were:

Frequency range	30 MHz to 10 th 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

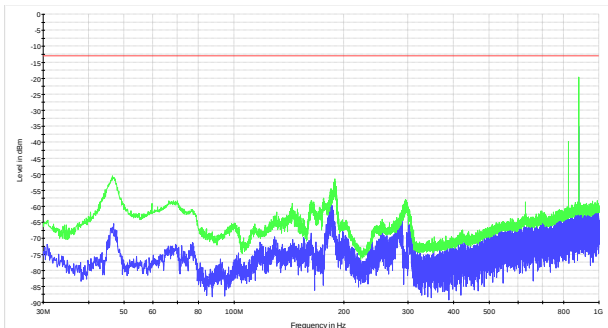


Figure 8.7-1: 30 MHz to 1 GHz Radiated

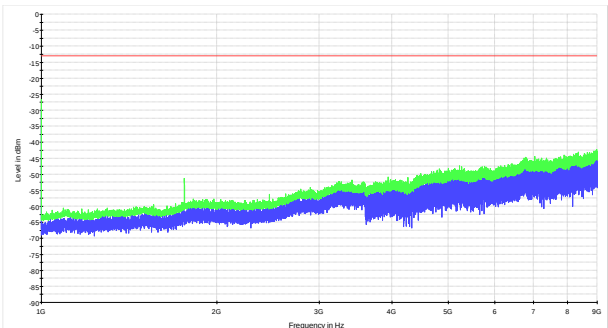


Figure 8.7-2: 1GHz to 9 GHz Radiated

Section 9. Setup Photos

9.1 Set-up

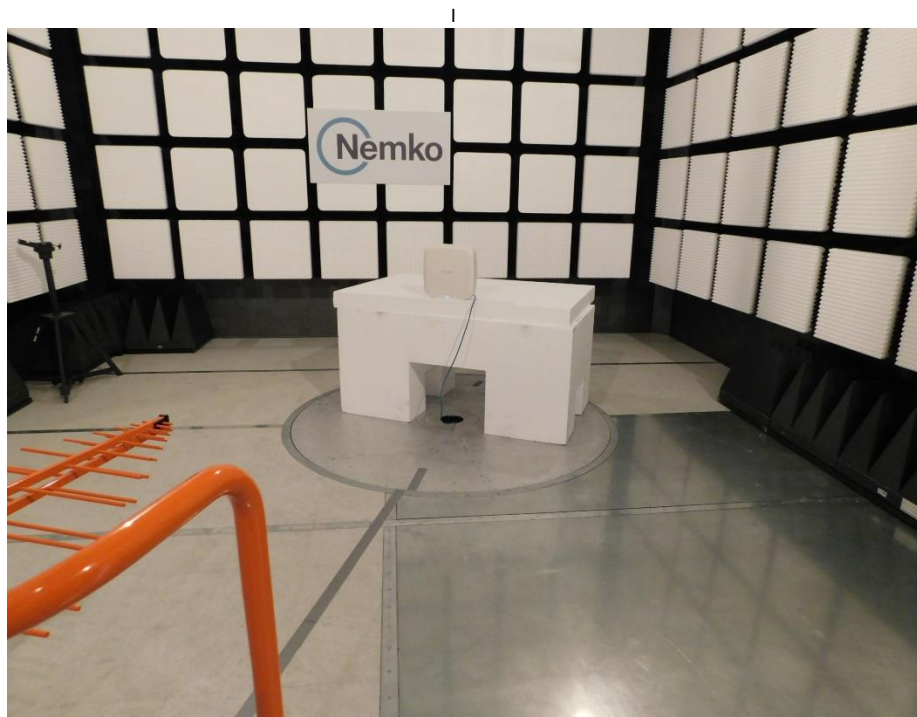


Figure 9.1-1: Radiated setup photo

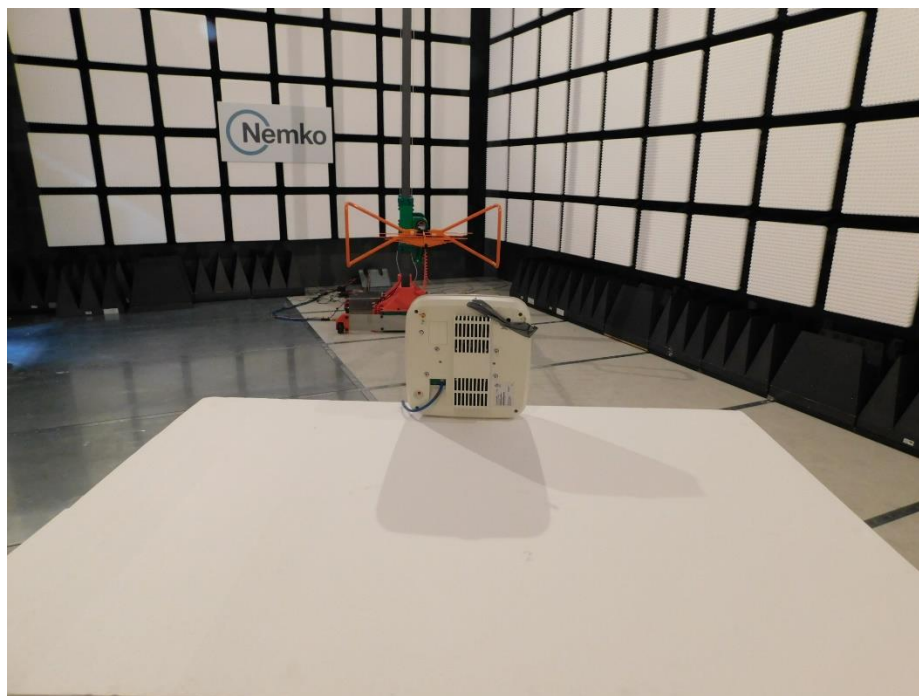
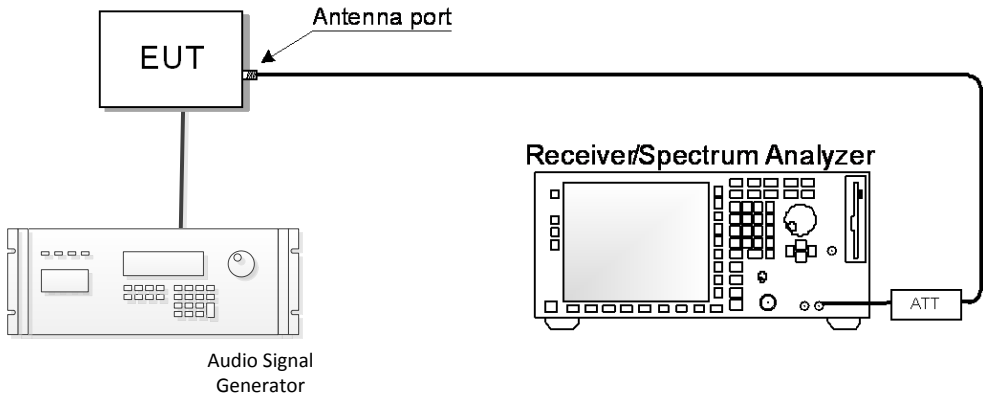


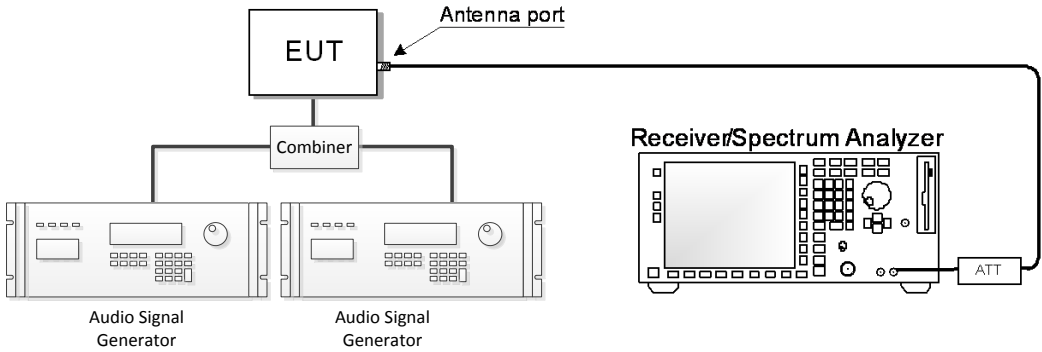
Figure 9.1-2: Radiated setup photo - Back

Section 10. Block diagrams of test set-ups

10.1 Measuring AGC threshold level, Out-of-band-rejection, Input-versus-output signal comparison, Mean output power and amplifier/booster gain, Spurious emissions conducted measurements



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



10.3 Spurious emissions radiated measurements

