FCC Measurement/Technical Report on

Air Lynx

FCC ID: 2A289EN4001

Test Report Reference: MDE_ATOS_2001_FCC_01_REV01

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

Deutsche
Akkreditierungsstelle
D-PL-12140-01-01
D-PL-12140-01-02
D-PL-12140-01-03

Table of Contents

Applied Standards and Test Summary

1.1 APPLIED STANDARDS

Type of Authorization
Certification for a cellular base station.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 27, (10-1-20 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 27; Miscellaneous Wireless Communications Services
Subpart P – Technical standards

§ 27.1507 – Power and duty cycle limits
§ 27.1509 – Emission limits
§ 27.54 – Frequency stability

The tests were selected and performed with reference to:

- FCC Public Notice 971168 applying "Measurement guidance for certification of licensed digital transmitters" 971168 D01 v03r01, 2018-04-09
- ANSI C63.26: 2015

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.

1.2 FCC-IC CORRELATION TABLE

FCC Part 27

Measurement	FCC reference
RF Output Power	§ 2.1046 § 27.1507
Peak to Average-Ratio	§ 27.1507
Emission and Occupied bandwidth	§ 2.1049
Spurious Emission at Antenna Terminals	§ 2.1051 § 27.1509
Band Edge Compliance	§ 2.1051 § 27.1509
Frequency stability	§ 2.1055 § 27.54
Field strength of spurious radiation	§ 2.1053 § 27.1509

1.3 MEASUREMENT SUMMARY / SIGNATURES

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 2.1046 § 27.1507**

RF Output Power

The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
LTE eFDD8 64QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 64QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 256QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
LTE eFDD8 256QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 256QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 1024QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
LTE eFDD8 1024QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 1024QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB2 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-11-02	Passed	---
CAT-M1 eFDD8 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
CAT-M1 eFDD8 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 2.1055 § 27.54**

Frequency stability

The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-09-01	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-09-01	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-09-01	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 2.1051 § 27.1509**

Spurious emissions at antenna terminals
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 256QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 1024QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB2 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 2.1053 § 27.1509**

Field strength of spurious radiation
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 27.1056 § 2.1049**

Emission and occupied bandwidth
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 64QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 64QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 256QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 256QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 256QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 1024QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 1024QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
LTE eFDD8 1024QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB2 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---
CAT-M1 eFDD8 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 27.1056 § 2.1049**

Emission and occupied bandwidth
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
CAT-M1 eFDD8 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-16	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 2.1051 § 27.1509**

Band edge compliance
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 64QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 64QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 256QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 256QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 256QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 1024QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 1024QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
LTE eFDD8 1024QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB2 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
CAT-M1 eFDD8 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---
CAT-M1 eFDD8 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-24	Passed	---

47 CFR CHAPTER I FCC PART 27 Subpart P **§ 27.1507 §2.1051**

Peak to Average Ratio
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 64QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 64QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 64QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 256QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 256QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 256QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 1024QAM MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---

47 CFR CHAPTER I FCC PART 27 § 27.1507 §2.1051
Subpart P

Peak to Average Ratio
The measurement was performed according to ANSI C63.26: 2015 **Final Result**

OP-Mode Technology, Radio Technology, Operating Frequency, ChBW, Ressource Blocks, Measurement method	Setup	Date	FCC	IC
LTE eFDD8 1024QAM SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
LTE eFDD8 1024QAM SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB2 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB12 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
CAT-M1 eFDD8 MIMO, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
CAT-M1 eFDD8 SISO ANT 1, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---
CAT-M1 eFDD8 SISO ANT 2, mid ch., 3 MHz, cond.	S01_AA01	2021-08-26	Passed	---

N/A: Not applicable
N/P: Not performed

2 REVISION HISTORY

Report version control			
Version	**Release date**	**Change Description**	**Version validity**
initial	2021-10-06	--	invalid
REV01	2021-11-02	• on page 6 reference for "Emission and occupied bandwidth" changed • on page 7 reference for "Peak to Average Ratio" changed • output power for MIMO re-measured page 16	valid

COMMENT: -

(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik

(responsible for testing and report)
B.Sc. Jens Dörwald

7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

3 ADMINISTRATIVE DATA

3.1 TESTING LABORATORY

Company Name:	7layers GmbH
Address:	Borsigstr. 11 40880 Ratingen Germany

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no:	DAkkS D-PL-12140-01-01| D-PL-12140-01-02 | D-PL-12140-01-03
FCC Designation Number:	DE0015
FCC Test Firm Registration:	929146
ISED CAB Identifier	DE0007; ISED#: 3699A
Responsible for accreditation scope:	Dipl.-Ing. Marco Kullik
Report Template Version:	2019-12-22

3.2 PROJECT DATA

Responsible for testing and report:	B.Sc. Jens Dörwald
Employees who performed the tests:	documented internally at 7Layers
Date of Report:	2021-11-02
Testing Period:	2021-08-20 to 2021-11-02

3.3 APPLICANT DATA

Company Name:	ATOS
Address:	1 AVENUE DE L´ATLANTIQUE 91940 LES ULIS FRANCE
Contact Person:	Mr. Emmanuel Wensink

3.4 MANUFACTURER DATA

Company Name: Address:	please see Applicant Data
Contact Person:	

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Cellular Basestation
Product name	Air Lynx
Type	-
Declared EUT data by the supplier	
Power Supply Type	DC
General product description	The EUT is a base station for band 8 (downlink). It supports LTE, LTE CAT-M1 and NB-IoT in SISO and MIMO.
Nominal Voltage / Frequency	-48 V / DC

4.2 EUT MAIN COMPONENTS

Sample Name	**Sample Code**	**Description**
EUT A	DE1460000aa01	radiated & conducted sample
Sample Parameter	**Value**	
Serial No.	AL1512000031	
HW Version	version 1.2	
SW Version	L20063-1.0.27.6822 + L2009-2.7.4.7247	
Comment	-	

NOTE:The short description is used to simplify the identification of the EUT in this test report.

4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Device	**Details (Manufacturer, Type Model, OUT Code)**	**Description**
-	-	-

4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless Auxiliary Equipment can influence the test results.

Device	**Details (Manufacturer, Type Model, HW, SW, S/N)**	**Description**
Power Supply	Eltek, CTOS0201.xxx + 241122.105, -, -, -	

4.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	**Combination of EUTs**	**Description and Rationale**
S01_AA01	EUT A	radiated & conducted sample

4.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

4.6.1 TEST CHANNELS

FCC Part 27

E-UTRA eFDD 8	LOW	MID	HIGH
Channel	-	3580	-
Frequency [MHz]	-	938.0	-

4.7 PRODUCT LABELLING

4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 RF OUTPUT POWER

Standard **FCC PART 27 Subpart P**

The test was performed according to:
ANSI C63.26: 2015

5.1.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable RF Output power test case per § 2.1046 and RSS-GEN 6.12. The limit and the requirements come from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setup according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart P – Technical standards

§ 27.1507 - Effective radiated power limits for 900 MHz broadband systems.

(c) Power measurement. Measurement of 900 MHz broadband base transmitter and repeater ERP must be made using an average power measurement technique. Power measurements for base transmitters and repeaters must be made in accordance with either of the following:

(1) A Commission-approved average power technique (see FCC Laboratory's Knowledge Database); or

(2) For purposes of this section, peak transmit power must be measured over an interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Test Protocol

Ambient temperature: 24 °C
Relative humidity: 38 %

SISO

Radio Technology	Channel	Band-width [MHz]	Peak cond. Power (dBm)	Average cond. Power (dBm)	RMS cond. Power (dBm)	FCC EIRP Limit (W/ MHz)	Max. Antenna Gain FCC (dBi)
LTE eFDD8 64QAM SISO ANT 1	mid	3	49.77	40.32	41.43	400	14.57
LTE eFDD8 64QAM SISO ANT 2	mid	3	49.45	40.03	41.13	400	14.87
LTE eFDD8 256QAM SISO ANT 1	mid	3	49.4	39.42	40.55	400	15.45
LTE eFDD8 256QAM SISO ANT 2	mid	3	49.42	40.06	41.15	400	14.85
LTE eFDD8 1024QAM SISO ANT 1	mid	3	49.76	40.28	41.38	400	14.62
LTE eFDD8 1024QAM SISO ANT 2	mid	3	49.43	40.05	41.17	400	14.83
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1	mid	3	49.68	40.01	41.13	400	14.87
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2	mid	3	49.27	39.59	40.74	400	15.26
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1	mid	3	49.69	40.35	41.46	400	14.54
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2	mid	3	49.39	40.03	41.13	400	14.87
CAT-M1 eFDD8 SISO ANT 1	mid	3	49.77	40.02	41.16	400	14.84
CAT-M1 eFDD8 SISO ANT 2	mid	3	49.33	39.66	40.79	400	15.21

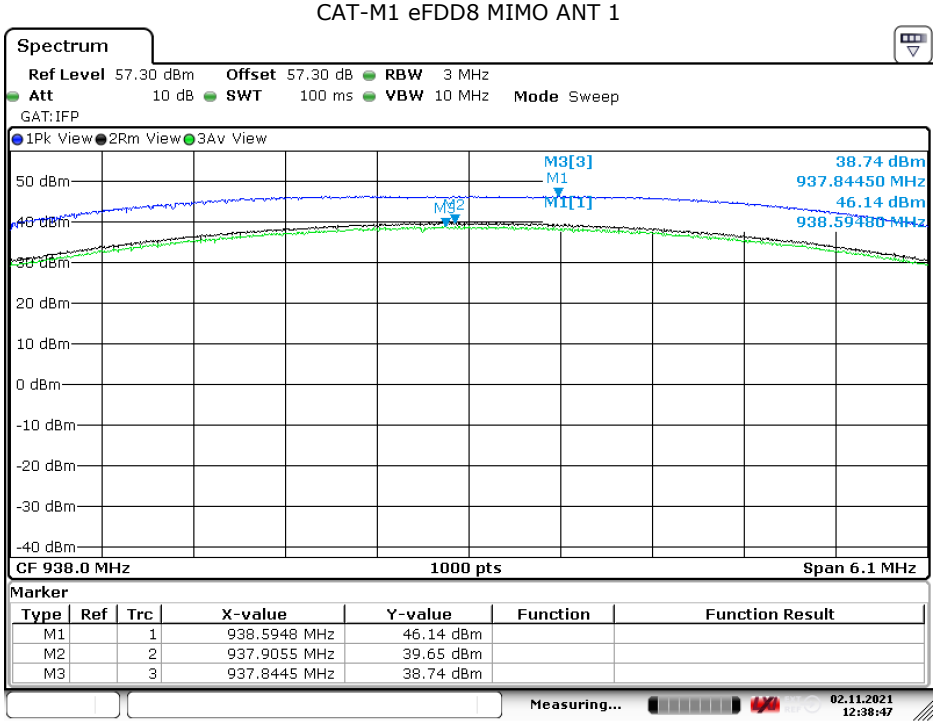
MIMO

Radio Technology	Channel	Band-width [MHz]	Ant 1 RMS cond. Power (dBm)	Ant 2 RMS cond. Power (dBm)	MIMO (lin. Sum of ANT1 + ANT 2) RMS cond. Power (dBm)	FCC EIRP Limit (W/ MHz)	Max. Antenna Gain FCC (dBi)
LTE eFDD8 64QAM MIMO	mid	3	39.5	39.6	42.56	400	11.29
LTE eFDD8 256QAM MIMO	mid	3	39.5	39.61	42.57	400	11.28
LTE eFDD8 1024QAM MIMO	mid	3	39.48	39.75	42.63	400	11.22
CAT-M1 eFDD8 MIMO	mid	3	39.65	39.87	42.77	400	11.08
NB-IoT eFDD8 QPSK PRB12 MIMO	mid	3	39.47	39.7	42.60	400	11.25
NB-IoT eFDD8 QPSK PRB2 MIMO	mid	3	39.51	39.56	42.55	400	11.30

Remark: Please see next sub-clause for the measurement plot.

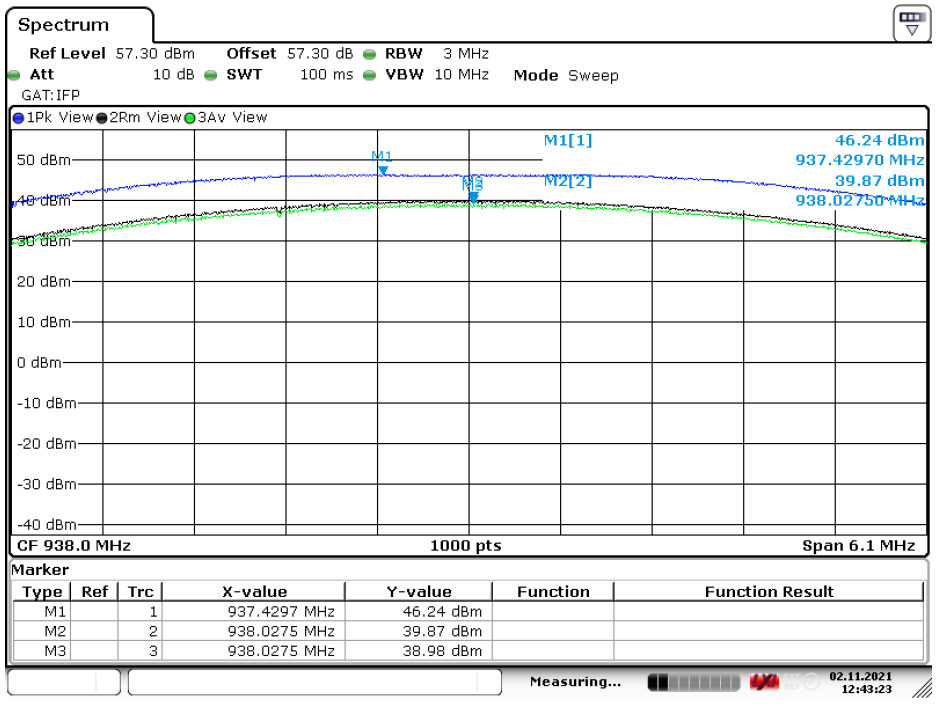
5.1.3 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

CAT-M1 eFDD8 MIMO ANT 1



Date: 2.NOV.2021 12:38:47

CAT-M1 eFDD8 MIMO ANT 2



Date: 2.NOV.2021 12:43:23

5.1.4 TEST EQUIPMENT USED

- Radio Lab

5.2 FREQUENCY STABILITY

Standard **FCC PART 27 Subpart C**

The test was performed according to:
ANSI C63.26: 2015

5.2.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable frequency stability test case per § 2.1055 and RSS-GEN 6.11. The limit and the requirements come from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setup according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring / stimulus path is known for each measured frequency and are considered.

5.2.2 TEST REQUIREMENTS / LIMITS

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§ 27.54 - Frequency stability

All Bands

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

5.2.3 TEST PROTOCOL

LTE eFDD8 64QAM MIMO

Temp °C	Duraion min.	Lower Frequency	Upper Frequency	Lower Limit	Upper Limit	Margin to Lower Limit	Margin to Upper Limit	Verdict 1	Verdict 2
-30	0	936.5239	939.4501	936.5	939.5	0.0239	0.0499	Passed	Passed
-30	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
-30	10	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
-20	0	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
-20	5	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
-20	10	936.5239	939.4761	936.5	939.5	0.0239	0.0239	Passed	Passed
-10	0	936.5326	939.4588	936.5	939.5	0.0326	0.0412	Passed	Passed
-10	5	936.5062	939.4935	936.5	939.5	0.0062	0.0065	Passed	Passed
-10	10	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
0	0	936.5152	939.4761	936.5	939.5	0.0152	0.0239	Passed	Passed
0	5	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
0	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
10	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
10	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
10	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
20	0	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
20	5	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
20	10	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
30	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
30	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
30	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
40	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
40	5	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
40	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
50	0	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
50	5	936.5152	939.4935	936.5	939.5	0.0152	0.0065	Passed	Passed
50	10	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed

CAT-M1 eFDD8 MIMO

Temp °C	Duraion min.	Lower Frequency	Upper Frequency	Lower Limit	Upper Limit	Margin to Lower Limit	Margin to Upper Limit	Verdict 1	Verdict 2
-30	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
-30	5	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
-30	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
-20	0	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
-20	5	936.5412	939.4501	936.5	939.5	0.0412	0.0499	Passed	Passed
-20	10	936.5412	939.4588	936.5	939.5	0.0412	0.0412	Passed	Passed
-10	0	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
-10	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
-10	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
0	0	936.5239	939.4674	936.5	939.5	0.0239	0.0326	Passed	Passed
0	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
0	10	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
10	0	936.5065	939.4674	936.5	939.5	0.0065	0.0326	Passed	Passed
10	5	936.5152	939.4935	936.5	939.5	0.0152	0.0065	Passed	Passed
10	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
20	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
20	5	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
20	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
30	0	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
30	5	936.5152	939.4935	936.5	939.5	0.0152	0.0065	Passed	Passed
30	10	936.5239	939.4677	936.5	939.5	0.0239	0.03226	Passed	Passed
40	0	936.5065	939.4674	936.5	939.5	0.0065	0.0326	Passed	Passed
40	5	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
40	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
50	0	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
50	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
50	10	936.5065	939.4674	936.5	939.5	0.0065	0.0326	Passed	Passed

NB-IoT eFDD8 QPSK PRB12 MIMO

Temp °C	Duraion min.	Lower Frequency	Upper Frequency	Lower Limit	Upper Limit	Margin to Lower Limit	Margin to Upper Limit	Verdict 1	Verdict 2
-30	0	936.5152	939.4761	936.5	939.5	0.0152	0.0239	Passed	Passed
-30	5	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
-30	10	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
-20	0	936.5139	939.4848	936.5	939.5	0.0139	0.0152	Passed	Passed
-20	5	936.5152	939.4761	936.5	939.5	0.0152	0.0239	Passed	Passed
-20	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
-10	0	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
-10	5	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
-10	10	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
0	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
0	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
0	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
10	0	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
10	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
10	10	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
20	0	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
20	5	936.5152	939.4848	936.5	939.5	0.0152	0.0152	Passed	Passed
20	10	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
30	0	936.5065	939.4761	936.5	939.5	0.0065	0.0239	Passed	Passed
30	5	936.5065	939.4935	936.5	939.5	0.0065	0.0065	Passed	Passed
30	10	936.5065	939.4925	936.5	939.5	0.0065	0.0075	Passed	Passed
40	0	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
40	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
40	10	936.5152	936.4848	936.5	939.5	0.0152	3.0152	Passed	Passed
50	0	936.5152	939.4674	936.5	939.5	0.0152	0.0326	Passed	Passed
50	5	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed
50	10	936.5065	939.4848	936.5	939.5	0.0065	0.0152	Passed	Passed

5.2.4 TEST EQUIPMENT USED

- Radio Lab

5.3 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard **FCC PART 27 Subpart P**

The test was performed according to:
ANSI C63.26: 2015

5.3.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission test case per § 2.1051 and RSS-GEN 6.13. The limit comes from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setup according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

5.3.2 TEST REQUIREMENTS / LIMITS

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart P – Technical standards

§27.1509 – Emission limits

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least 50 + 10 log (P) dB.

(c) Compliance with the provisions of paragraphs (a) and (b) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the licensee's band, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.3.3 TEST PROTOCOL

Ambient temperature: 24 °C
Relative humidity: 38 %

Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
LTE eFDD8 64QAM MIMO	RMS	MAXH	30	936.46	-29.29	9.29	-20
LTE eFDD8 64QAM MIMO	RMS	MAXH	30	939.5	-30.44	10.44	-20
LTE eFDD8 64QAM MIMO	PEAK	MAXH	100	1875	-26.64	6.64	-20

Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
LTE eFDD8 256QAM MIMO	RMS	MAXH	30	936.5	-29.42	9.42	-20
LTE eFDD8 256QAM MIMO	RMS	MAXH	30	939.5	-30.82	10.82	-20
LTE eFDD8 256QAM MIMO	PEAK	MAXH	100	1875	-27.62	7.62	-20

Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
LTE eFDD8 1024QAM MIMO	RMS	MAXH	30	936.49	-28.64	8.64	-20
LTE eFDD8 1024QAM MIMO	RMS	MAXH	30	939.5	-28.31	8.31	-20
LTE eFDD8 1024QAM MIMO	PEAK	MAXH	100	1877	-26.87	6.87	-20

Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
NB-IoT eFDD8 QPSK PRB2 MIMO	RMS	MAXH	30	936.50	-30.48	10.48	-20
NB-IoT eFDD8 QPSK PRB2 MIMO	RMS	MAXH	30	939.51	-30.02	10.02	-20
NB-IoT eFDD8 QPSK PRB2 MIMO	PEAK	MAXH	100	1875.00	-29.62	9.62	-20

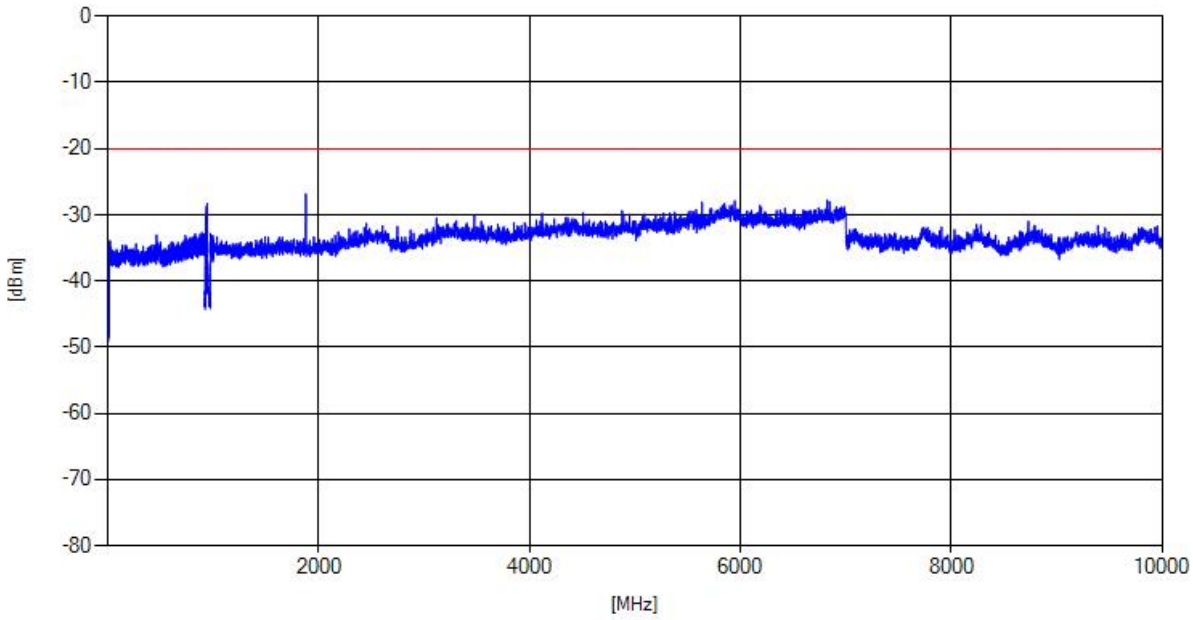
Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
NB-IoT eFDD8 QPSK PRB12 MIMO	RMS	MAXH	30	936.50	-30.13	10.13	-20
NB-IoT eFDD8 QPSK PRB12 MIMO	RMS	MAXH	30	939.50	-30.72	10.72	-20
NB-IoT eFDD8 QPSK PRB12 MIMO	PEAK	MAXH	100	1877.00	-22.72	2.72	-20

Radio Technology	detector	trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
CAT-M1 eFDD8 MIMO	RMS	MAXH	30	936.47	-22.94	2.94	-20
CAT-M1 eFDD8 MIMO	RMS	MAXH	30	939.60	-26.69	6.69	-20
CAT-M1 eFDD8 MIMO	PEAK	MAXH	100	2532.26	-27.14	7.14	-20
CAT-M1 eFDD8 MIMO	RMS	MAXH	100	2814.63	-33.4	13.4	-20

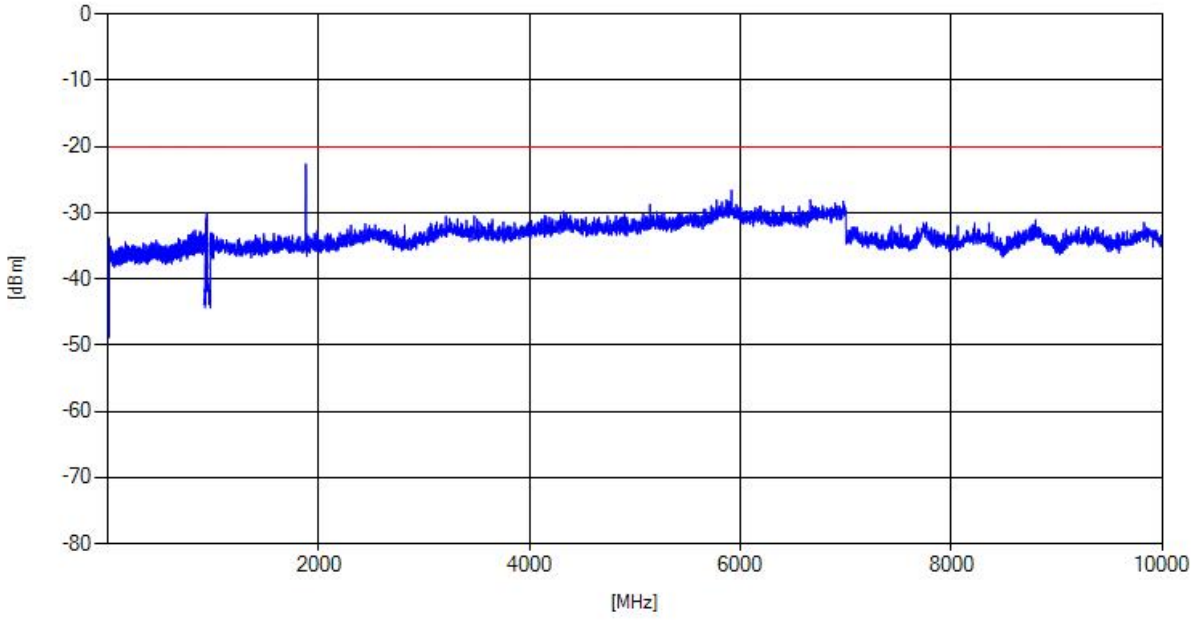
Remark: Please see next sub-clause for the measurement plot.

5.3.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

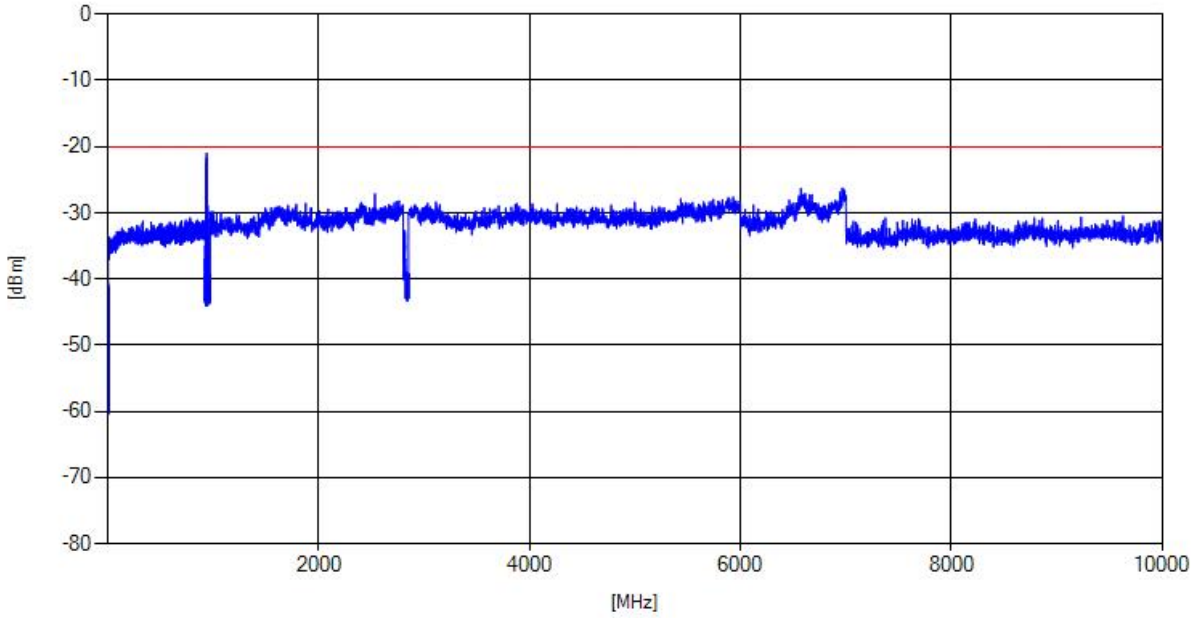
LTE eFDD8 1024QAM MIMO



NB-IoT eFDD8 QPSK PRB12 MIMO



CAT-M1 eFDD8 MIMO



5.3.5 TEST EQUIPMENT USED

- Radio Lab

5.4 FIELD STRENGTH OF SPURIOUS RADIATION

Standard **FCC PART 27 Subpart P**

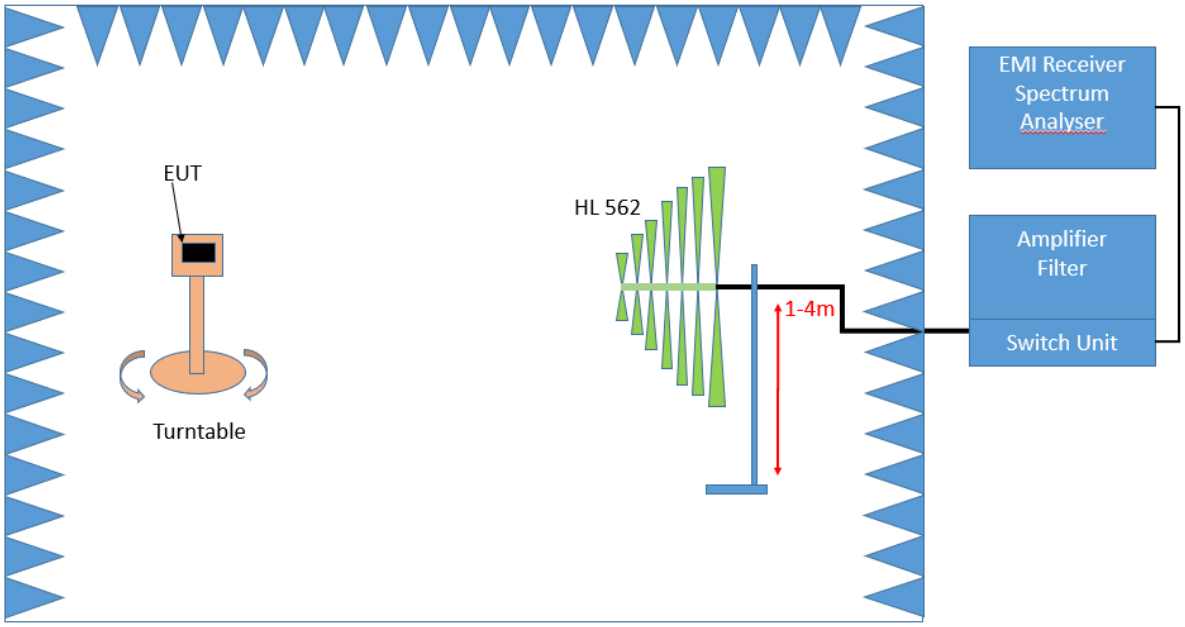
The test was performed according to:
ANSI C63.26: 2015

5.4.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable radiated spurious emission measurements per § 2.1053 and RSS-GEN 6.13. The limit and requirements come from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

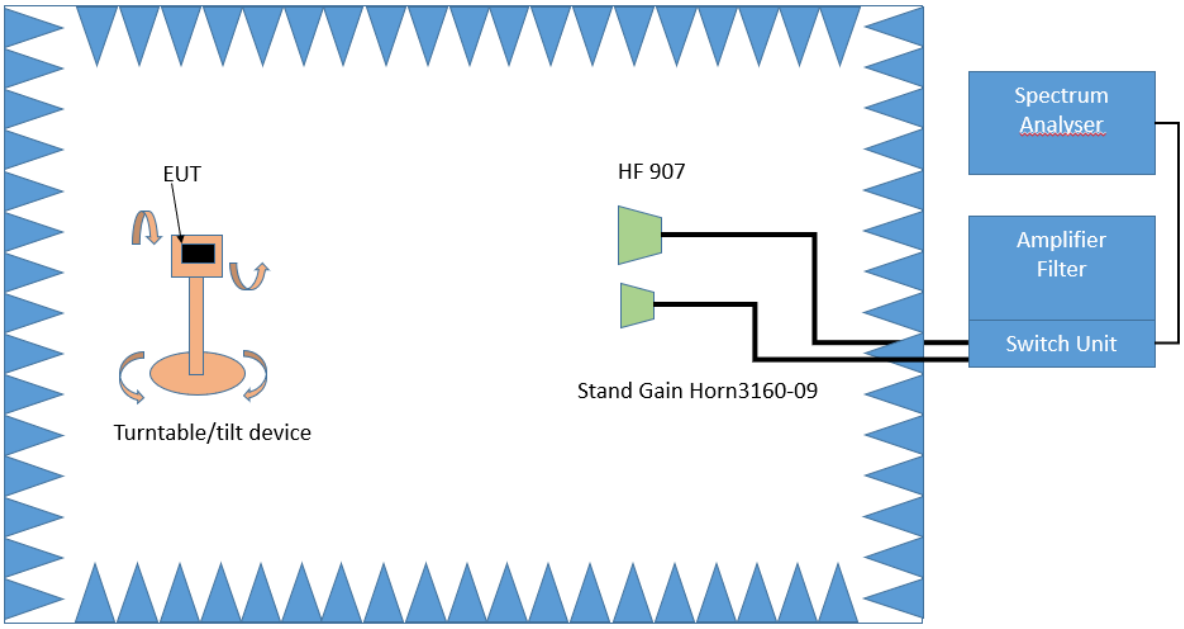
The EUT was connected to the test setup according to the following diagram:

Frequency Range: 30 MHz – 1 GHz:



Test Setup; Spurious Emission Radiated (SAC), 30 MHz- 1GHz

Frequency Range: 1 GHz – 26.5 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

The test set-up was made in accordance to the general provisions of ANSI C63.26 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered from a DC power source.

1. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 3 m
- Detector: Peak
- RBW: 100 kHz
- VBW: 300 kHz
- Sweep time: coupled
- Turntable angle range: –180° to 90°
- Turntable step size: 90°
- Height variation range: 1 – 4 m
- Height variation step size: 1.5 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by 360°. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be

recorded and adjusted. In this position, the antenna height will also slowly vary from 1 – 4 m. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak
- Measured frequencies: in step 1 determined frequencies
- RBW: 100 kHz
- VBW: 300 kHz
- Sweep time: coupled
- Turntable angle range: 360°
- Height variation range: 1 – 4 m
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with RMS detector
With the settings determined in step 3, the final measurement will be performed:
EMI receiver settings for step 4:
- Detector: RMQ
- Measured frequencies: in step 1 determined frequencies
- RBW: 100 kHz
- VBW: 300 kHz
- Sweep time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz
The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
Step 1:
The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.
All steps were performed with one height (1.5 m) of the receiving antenna only.
The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 45 °.
The turn table step size (azimuth angle) for the preliminary measurement is 45 °.
- Antenna distance: 3 m
- Detector: Peak
- RBW: 1 MHz
- VBW: 3 MHz
- Sweep time: coupled
- Turntable angle range: –180° to 135°
- Turntable step size: 45°
- Polarisation: Horizontal + Vertical

Step 2:
Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.
The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
EMI receiver settings (for all steps):
- Detector: Peak,
- RBW: 1 MHz
- VBW: 3 MHz
- Sweep time: coupled

Step 3:
Spectrum analyser settings for step 3:
- Detector: RMS
- Measured frequencies: in step 1 determined frequencies
- RBW: 1 MHz
- VBW: 3 MHz
- Sweep Time: 1 s

5.4.2 TEST REQUIREMENTS / LIMITS

FCC Part 2.1053; Measurement required: Field strength of spurious radiation:

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate.

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart P – Technical standards

§27.1509 – Emission limits

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least 50 + 10 log (P) dB.

(c) Compliance with the provisions of paragraphs (a) and (b) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the licensee's band, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.4.3 TEST PROTOCOL

Ambient temperature: 24 °C
Relative humidity: 38 %

Radio Technology	detector	Trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
LTE eFDD8 64QAM MIMO	RMS	MAXH	100	1875.7	-44.38	24.38	-20

Radio Technology	detector	Trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
NB-IoT eFDD8 QPSK PRB12 MIMO	RMS	MAXH	100	1876.20	-46.18	26.18	-20

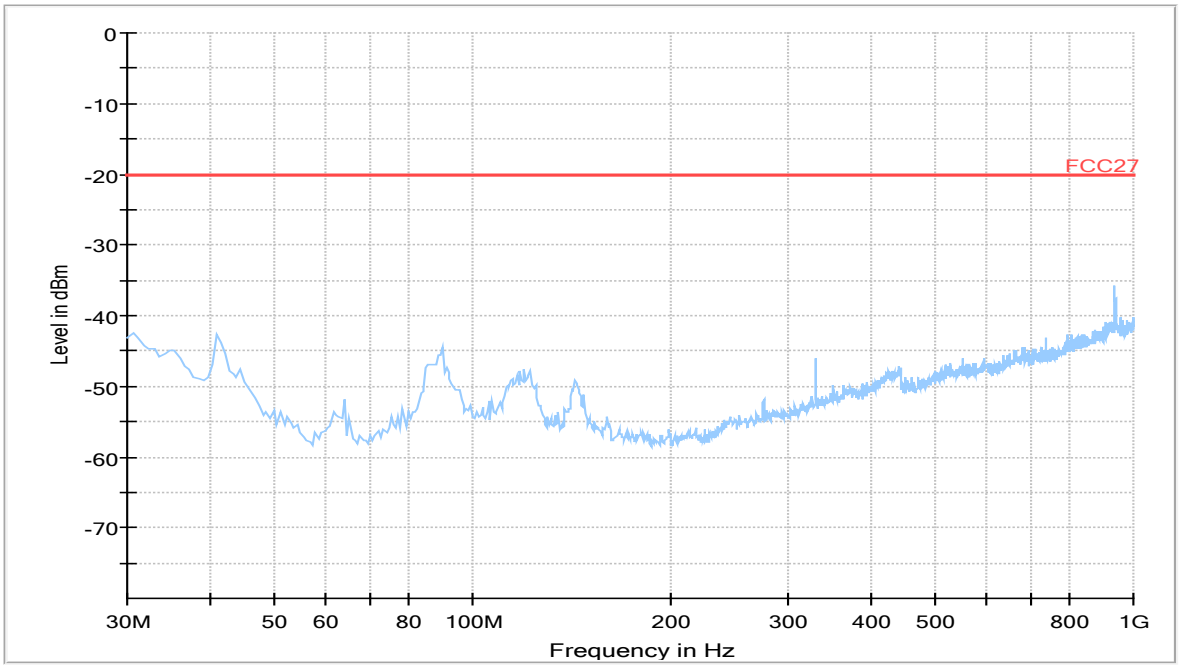
Radio Technology	detector	Trace	RBW [kHz]	Frequency [MHz]	Peak Value [dBm]	Margin to Limit [dB]	Limit [dBm]
CAT-M1 eFDD8 MIMO	RMS	MAXH	100	1875.73	-44.38	24.38	-20

COMMENT:
The measurements were performed with a 50 Ohm Load at the antenna ports.

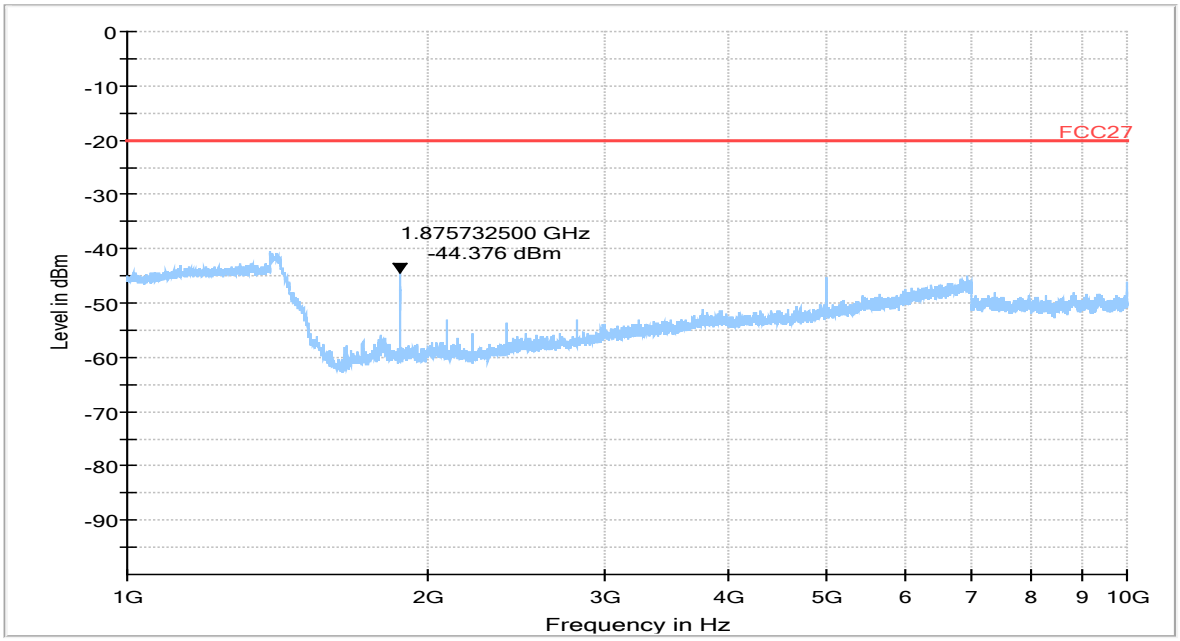
Remark: Please see next sub-clause for the measurement plot.

5.4.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

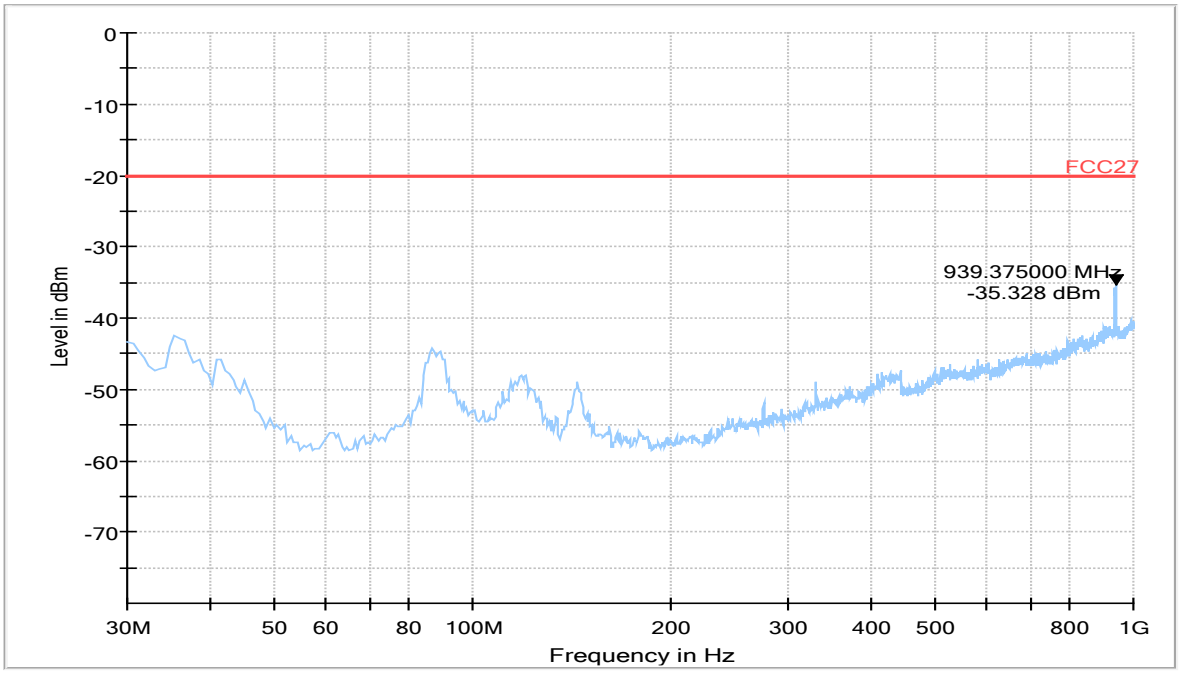
LTE eFDD8 64QAM MIMO
30 MHz – 1 GHz



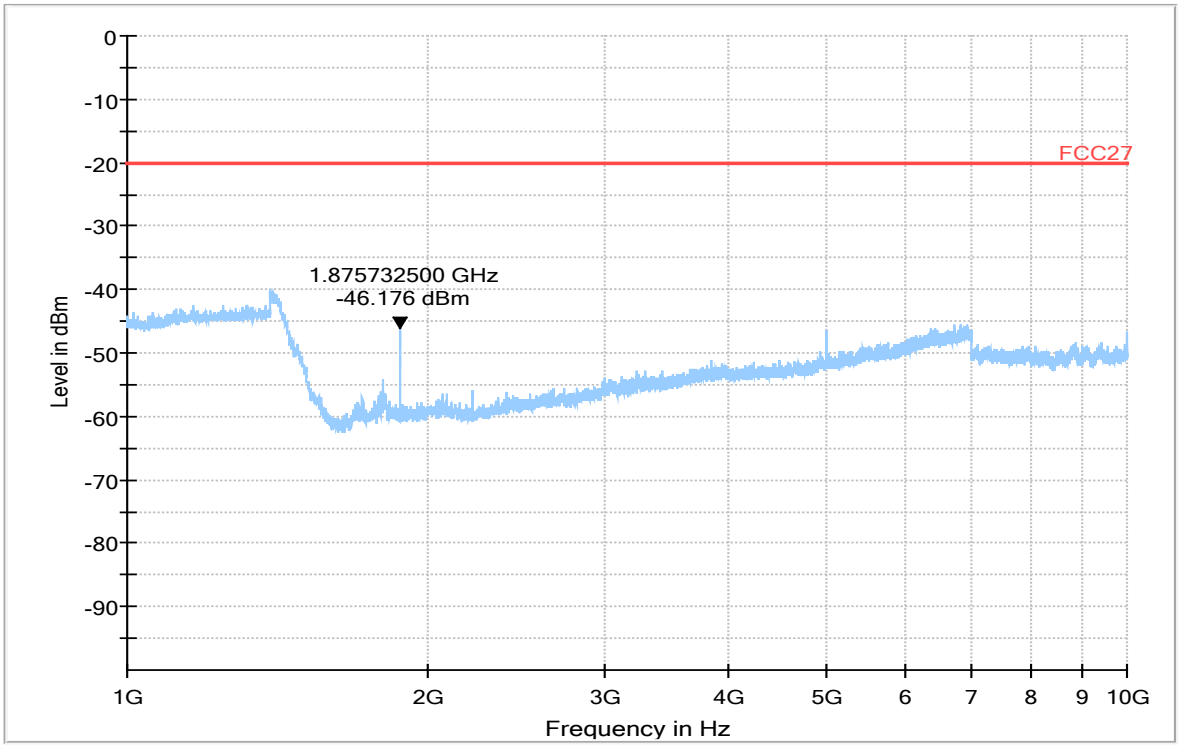
1 GHz – 10 GHz



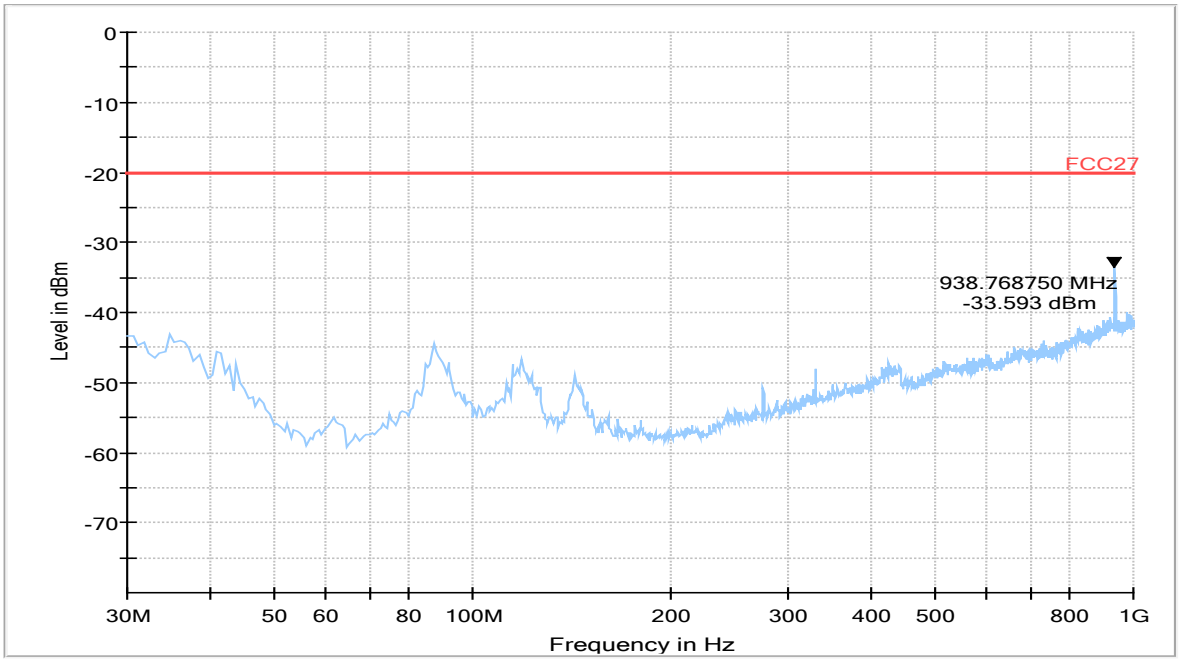
NB-IoT eFDD8 QPSK PRB12 MIMO
30 MHz – 1 GHz



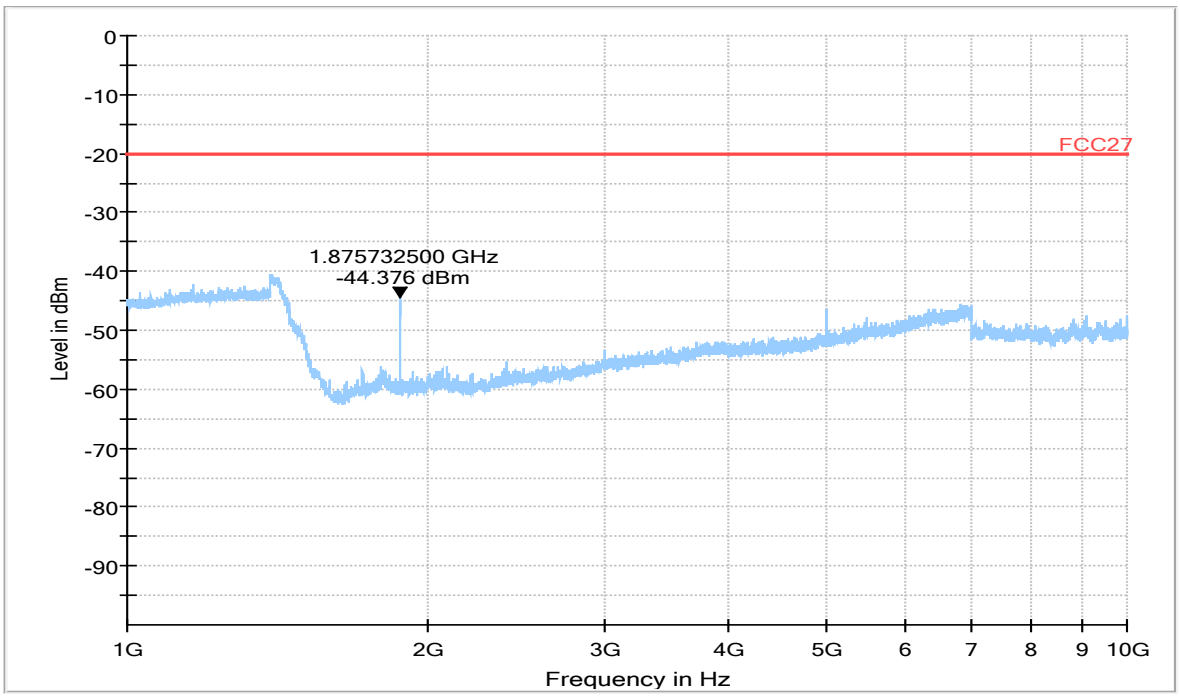
1 GHz – 10 GHz



CAT-M1 eFDD8 MIMO
30 MHz – 1 GHz



1 GHz – 10 GHz



5.4.5 TEST EQUIPMENT USED

- Radiated Emissions

5.5 EMISSION AND OCCUPIED BANDWIDTH

Standard **FCC PART 27 Subpart P**

The test was performed according to:
ANSI C63.26: 2015

5.5.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission test case per FCC §2.1049 and RSS-GEN 6.7. The limit and the requirements come from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setups according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

5.5.2 TEST REQUIREMENTS / LIMITS

FCC Part 2.1049; Occupied Bandwidth:

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 shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

5.5.3 TEST PROTOCOL

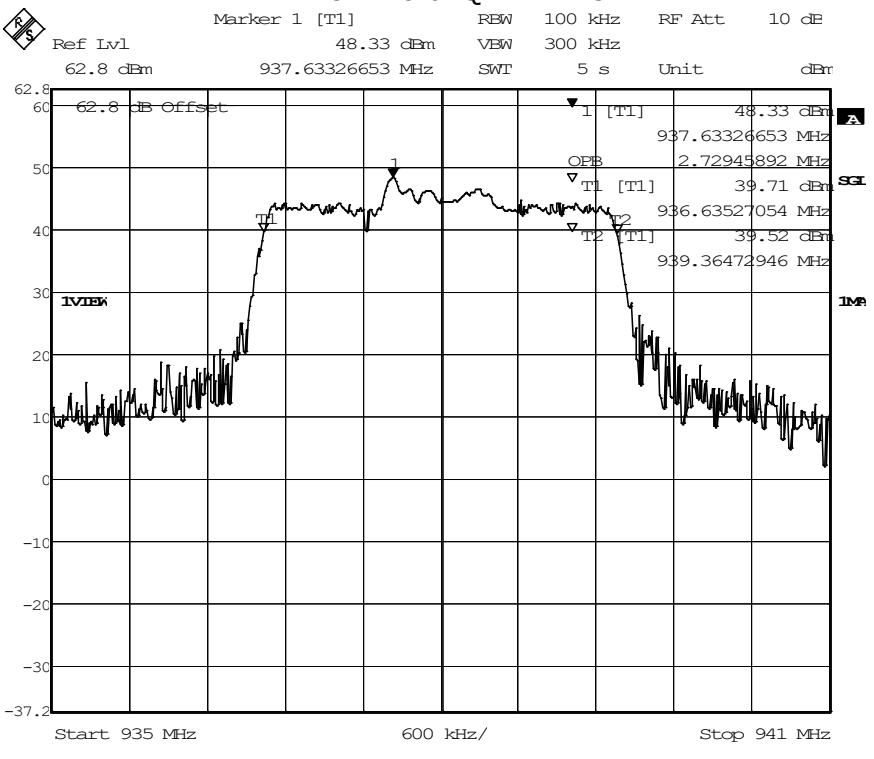
Ambient temperature: 24 °C
Relative humidity: 38 %

Radio Technology	Channel	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
LTE eFDD8 64QAM MIMO	mid	3	3	2729.5
LTE eFDD8 64QAM SISO ANT 1	mid	3	3	2741.5
LTE eFDD8 64QAM SISO ANT 2	mid	3	3	2741.5
LTE eFDD8 256QAM MIMO	mid	3	3	2741.5
LTE eFDD8 256QAM SISO ANT 1	mid	3	3	2753.5
LTE eFDD8 256QAM SISO ANT 2	mid	3	3	2765.5
LTE eFDD8 1024QAM MIMO	mid	3	3	2741.5
LTE eFDD8 1024QAM SISO ANT 1	mid	3	3	2753.5
LTE eFDD8 1024QAM SISO ANT 2	mid	3	3	2753.5
NB-IoT eFDD8 QPSK PRB2 MIMO	mid	3	3	2688.0
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1	mid	3	3	2729.5
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2	mid	3	3	2741.5
NB-IoT eFDD8 QPSK PRB12 MIMO	mid	3	3	2717.4
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1	mid	3	3	2717.4
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2	mid	3	3	2729.5
CAT-M1 eFDD8 MIMO	mid	3	3	2573.1
CAT-M1 eFDD8 SISO ANT 1	mid	3	3	2549.1
CAT-M1 eFDD8 SISO ANT 2	mid	3	3	2537.1

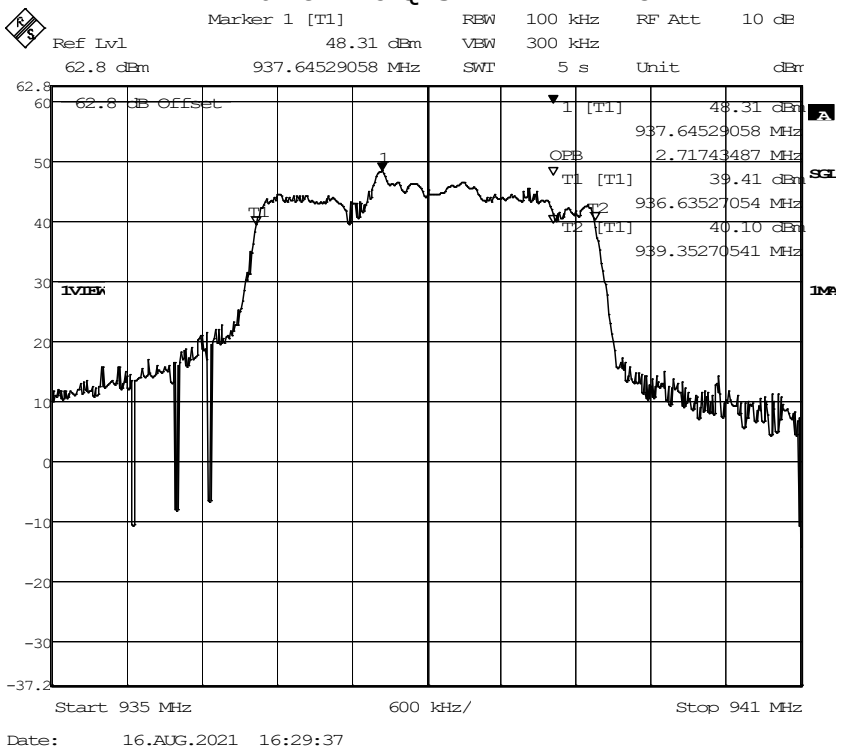
Remark: Please see next sub-clause for the measurement plot.

5.5.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

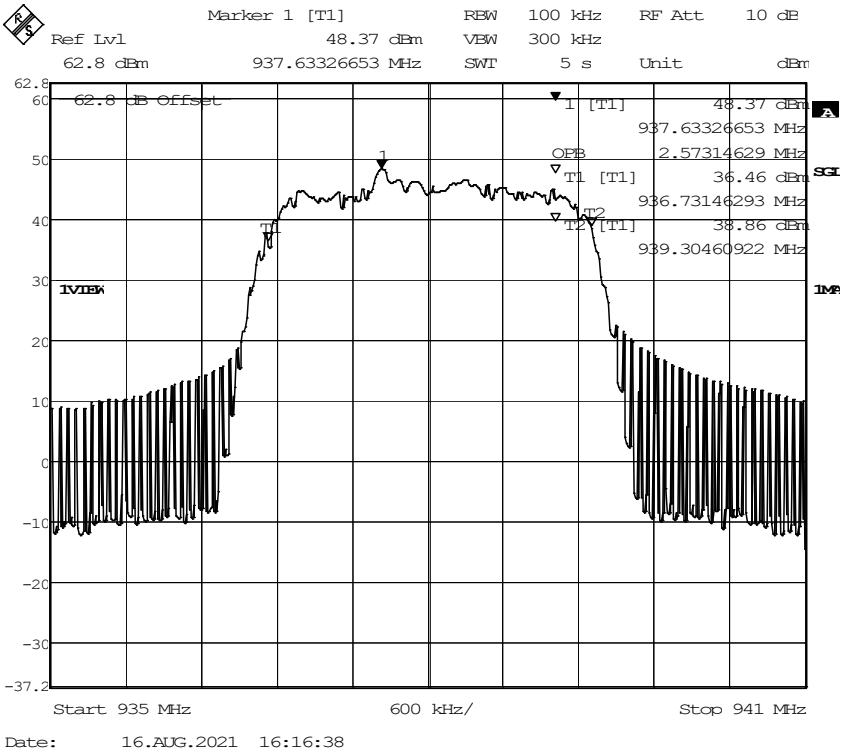
LTE eFDD8 64QAM MIMO



NB-IoT eFDD8 QPSK PRB12 MIMO



CAT-M1 eFDD8 MIMO



5.5.5 TEST EQUIPMENT USED

- Radio Lab

5.6 BAND EDGE COMPLIANCE

Standard **FCC PART 27 Subpart P**

The test was performed according to:
ANSI C63.26: 2015

5.6.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission test case per § 2. 1051 and RSS-GEN 6.13. The limit comes from the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setup according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

5.6.2 TEST REQUIREMENTS / LIMITS

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart P – Technical standards

§27.1509 - Emission limits

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least 43 + 10 log (P) dB.

(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least 50 + 10 log (P) dB.

(c) Compliance with the provisions of paragraphs (a) and (b) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the licensee's band, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.6.3 TEST PROTOCOL

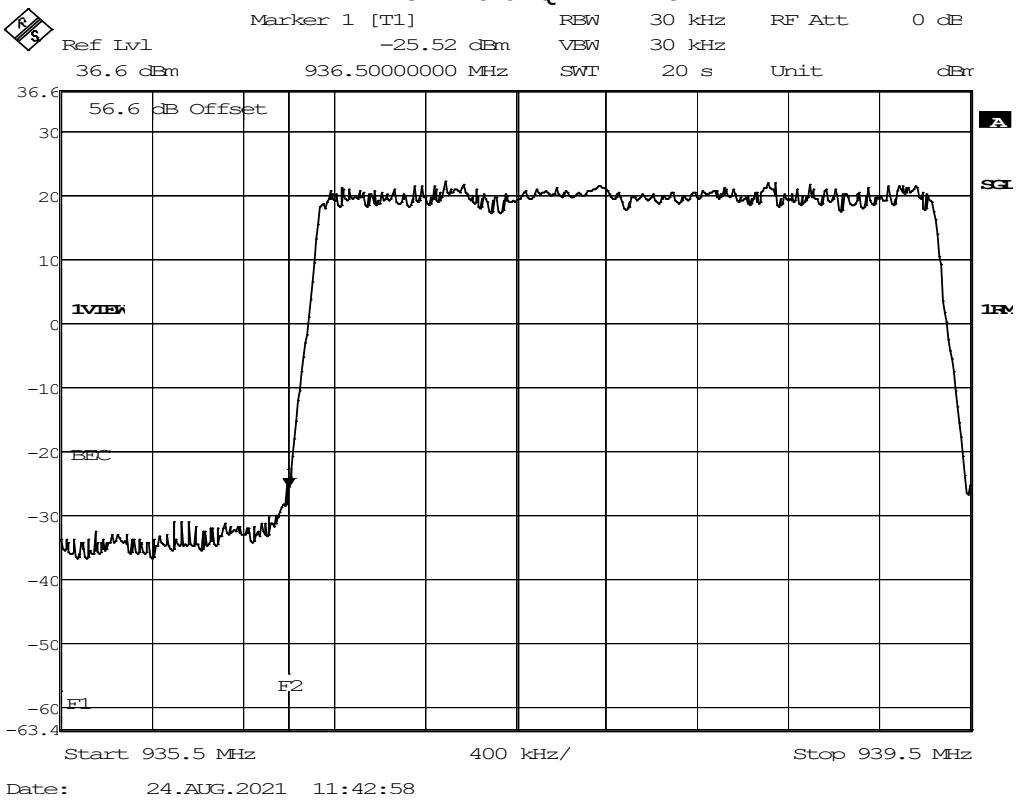
Ambient temperature: 24 °C
Relative humidity: 38 %

Radio Technology	Band Edge	Bandwidth [MHz]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
LTE eFDD8 64QAM MIMO	low	3	-25.52	-20	5.52
LTE eFDD8 64QAM MIMO	high	3	-27.84	-20	7.84
LTE eFDD8 64QAM SISO ANT 1	low	3	-31.93	-20	11.93
LTE eFDD8 64QAM SISO ANT 1	high	3	-34.30	-20	14.30
LTE eFDD8 64QAM SISO ANT 2	low	3	-30.58	-20	10.58
LTE eFDD8 64QAM SISO ANT 2	high	3	-33.81	-20	13.81
LTE eFDD8 256QAM MIMO	low	3	-27.49	-20	7.49
LTE eFDD8 256QAM MIMO	high	3	-32.50	-20	12.50
LTE eFDD8 256QAM SISO ANT 1	low	3	-30.69	-20	10.69
LTE eFDD8 256QAM SISO ANT 1	high	3	-34.70	-20	14.70
LTE eFDD8 256QAM SISO ANT 2	low	3	-31.60	-20	11.60
LTE eFDD8 256QAM SISO ANT 2	high	3	-28.46	-20	8.46
LTE eFDD8 1024QAM MIMO	low	3	-27.65	-20	7.65
LTE eFDD8 1024QAM MIMO	high	3	-31.92	-20	11.92
LTE eFDD8 1024QAM SISO ANT 1	low	3	-30.20	-20	10.20
LTE eFDD8 1024QAM SISO ANT 1	high	3	-35.62	-20	15.62
LTE eFDD8 1024QAM SISO ANT 2	low	3	-27.91	-20	7.91
LTE eFDD8 1024QAM SISO ANT 2	high	3	-29.21	-20	9.21
NB-IoT eFDD8 QPSK PRB2 MIMO	low	3	-28.32	-20	8.32
NB-IoT eFDD8 QPSK PRB2 MIMO	high	3	-29.28	-20	9.28
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1	low	3	-32.55	-20	12.55
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1	high	3	-32.06	-20	12.06
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2	low	3	-31.16	-20	11.16
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2	high	3	-34.18	-20	14.18
NB-IoT eFDD8 QPSK PRB12 MIMO	low	3	-27.31	-20	7.31
NB-IoT eFDD8 QPSK PRB12 MIMO	high	3	-29.69	-20	9.69
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1	low	3	-29.85	-20	9.85
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1	high	3	-35.32	-20	15.32
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2	low	3	-31.53	-20	11.53
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2	high	3	-34.65	-20	14.65
CAT-M1 eFDD8 MIMO	low	3	-30.79	-20	10.79
CAT-M1 eFDD8 MIMO	high	3	-24.77	-20	4.77
CAT-M1 eFDD8 SISO ANT 1	low	3	-25.96	-20	5.96
CAT-M1 eFDD8 SISO ANT 1	high	3	-36.08	-20	16.08
CAT-M1 eFDD8 SISO ANT 2	low	3	-26.69	-20	6.69
CAT-M1 eFDD8 SISO ANT 2	high	3	-25.86	-20	5.86

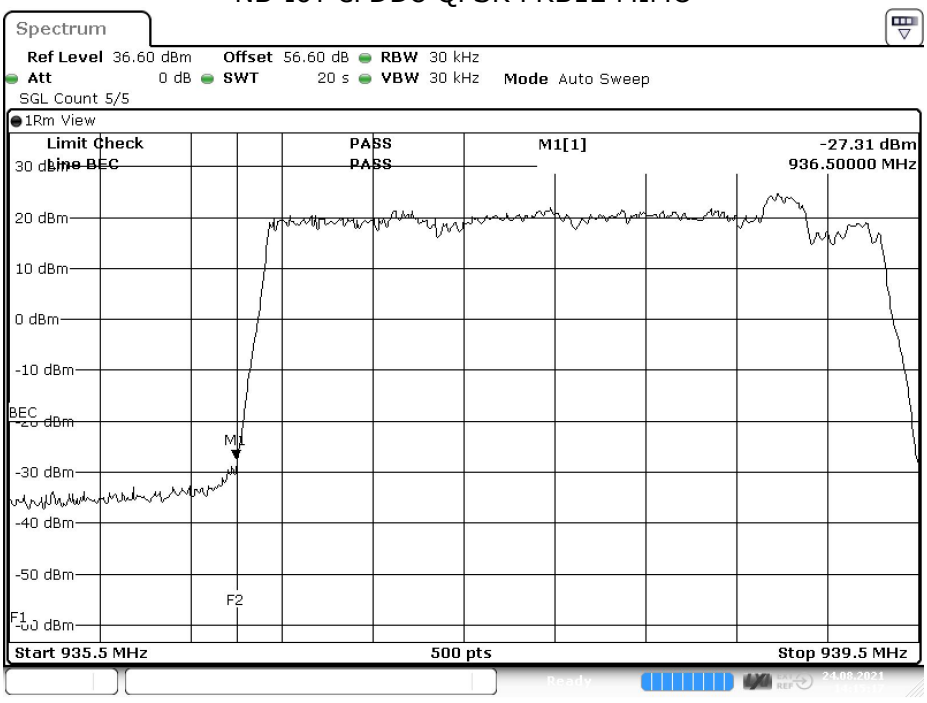
Remark: Please see next sub-clause for the measurement plot.

5.6.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

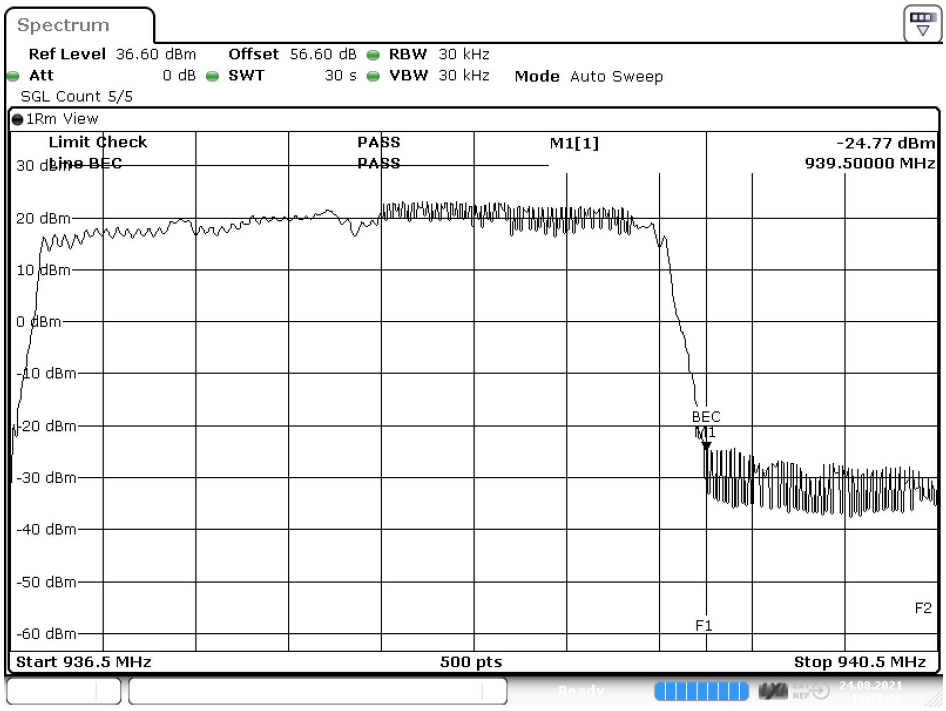
LTE eFDD8 64QAM MIMO



NB-IoT eFDD8 QPSK PRB12 MIMO



CAT-M1 eFDD8 MIMO



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5.6.5 TEST EQUIPMENT USED

- Radio Lab

5.7 PEAK TO AVERAGE RATIO

Standard **FCC PART 27 Subpart P**

The test was performed according to:
ANSI C63.26: 2015

5.7.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance of the EUT to the peak-to-average limits and requirements of the applicable rule part and ISED RSS-Standard for the operating band of the cellular device.

The EUT was connected to the test setup according to the following diagram:

Test Setup FCC Part 22/24/27/90 Cellular

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams. The internal CCDF (complementary cumulative distribution function) of the spectrum analyser is used for this measurement

5.7.2 TEST REQUIREMENTS / LIMITS

FCC Part 27; Miscellaneous Wireless Communication Services

Subpart P – Technical standards

§ 27.1507 - Effective radiated power limits for 900 MHz broadband systems.

(d) *PAR limit.* The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

5.7.3 TEST PROTOCOL

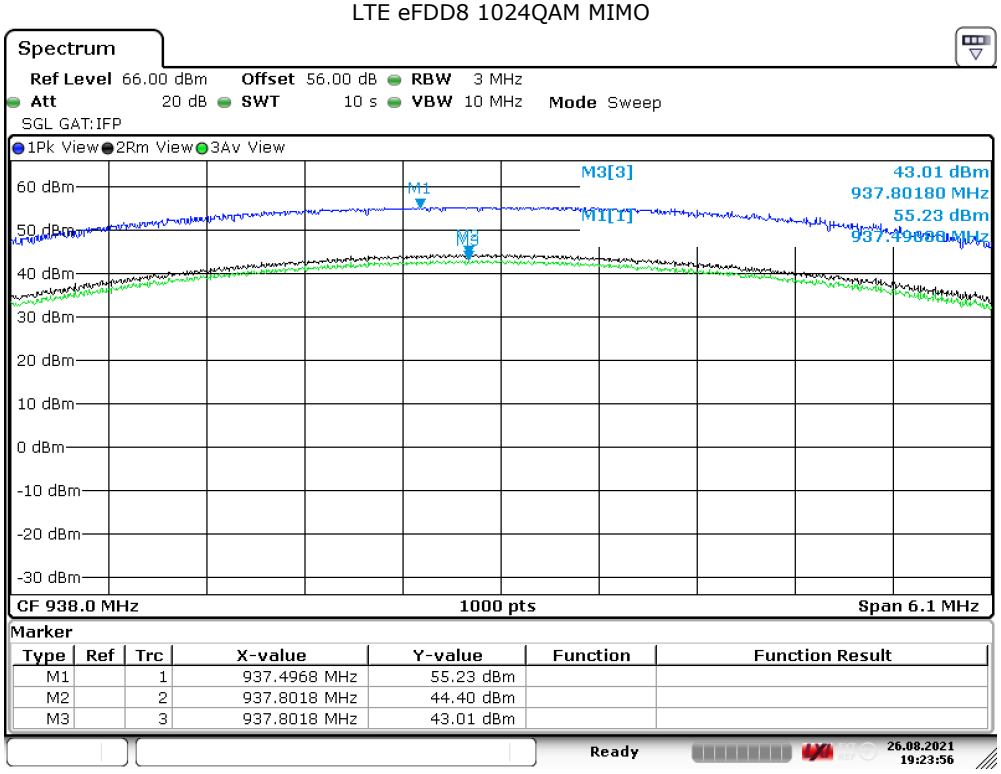
Ambient temperature: 24 °C
Relative humidity: 38 %

Radio Technology	Channel	Bandwidth [MHz]	Peak cond. Power (dBm)	Average cond. Power (dBm)	Limit (dB)	Margin to Limit (dB)
LTE eFDD8 64QAM MIMO	mid	3	55.17	42.88	13	0.71
LTE eFDD8 64QAM SISO ANT 1	mid	3	49.77	40.32	13	3.55
LTE eFDD8 64QAM SISO ANT 2	mid	3	49.45	40.03	13	3.58
LTE eFDD8 256QAM MIMO	mid	3	55.22	42.91	13	0.69
LTE eFDD8 256QAM SISO ANT 1	mid	3	49.4	39.42	13	3.02
LTE eFDD8 256QAM SISO ANT 2	mid	3	49.42	40.06	13	3.64
LTE eFDD8 1024QAM MIMO	mid	3	55.23	43.01	13	0.78
LTE eFDD8 1024QAM SISO ANT 1	mid	3	49.76	40.28	13	3.52
LTE eFDD8 1024QAM SISO ANT 2	mid	3	49.43	40.05	13	3.62
NB-IoT eFDD8 QPSK PRB2 MIMO	mid	3	55.24	42.82	13	0.58
NB-IoT eFDD8 QPSK PRB2 SISO ANT 1	mid	3	49.68	40.01	13	3.33
NB-IoT eFDD8 QPSK PRB2 SISO ANT 2	mid	3	49.27	39.59	13	3.32
NB-IoT eFDD8 QPSK PRB12 MIMO	mid	3	55.31	42.83	13	0.52
NB-IoT eFDD8 QPSK PRB12 SISO ANT 1	mid	3	49.69	40.35	13	3.66
NB-IoT eFDD8 QPSK PRB12 SISO ANT 2	mid	3	49.39	40.03	13	3.64
CAT-M1 eFDD8 MIMO	mid	3	55.06	42.44	13	0.38
CAT-M1 eFDD8 SISO ANT 1	mid	3	49.77	40.02	13	3.25
CAT-M1 eFDD8 SISO ANT 2	mid	3	49.33	39.66	13	3.33

Remark: Please see next sub-clause for the measurement plot.

5.7.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

LTE eFDD8 1024QAM MIMO



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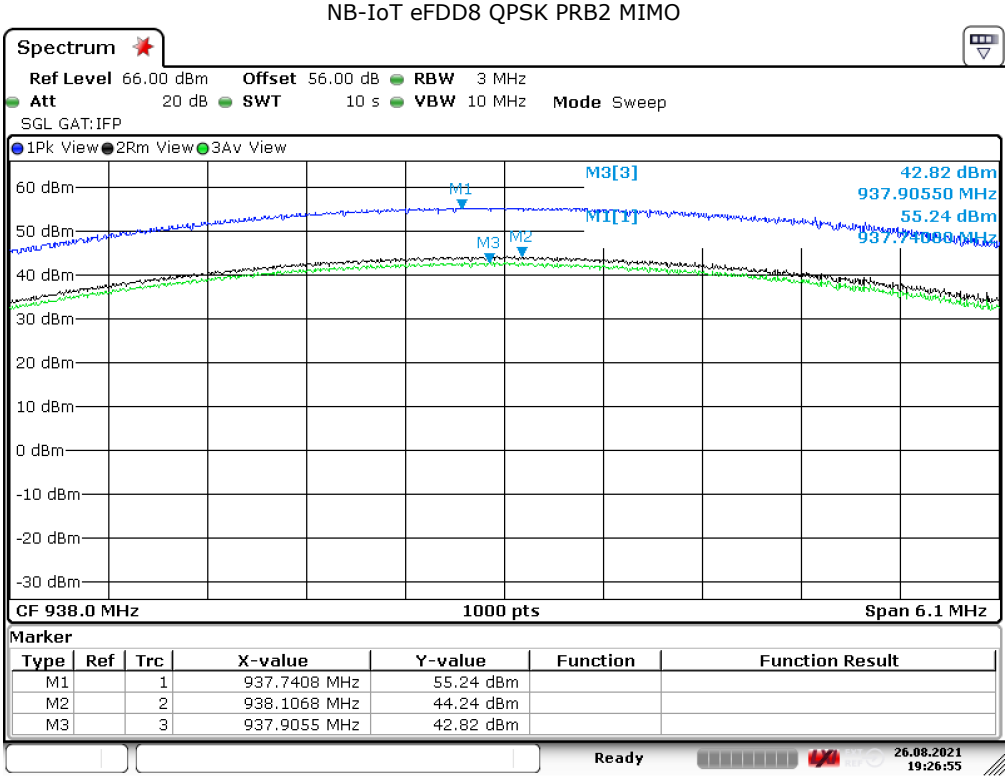
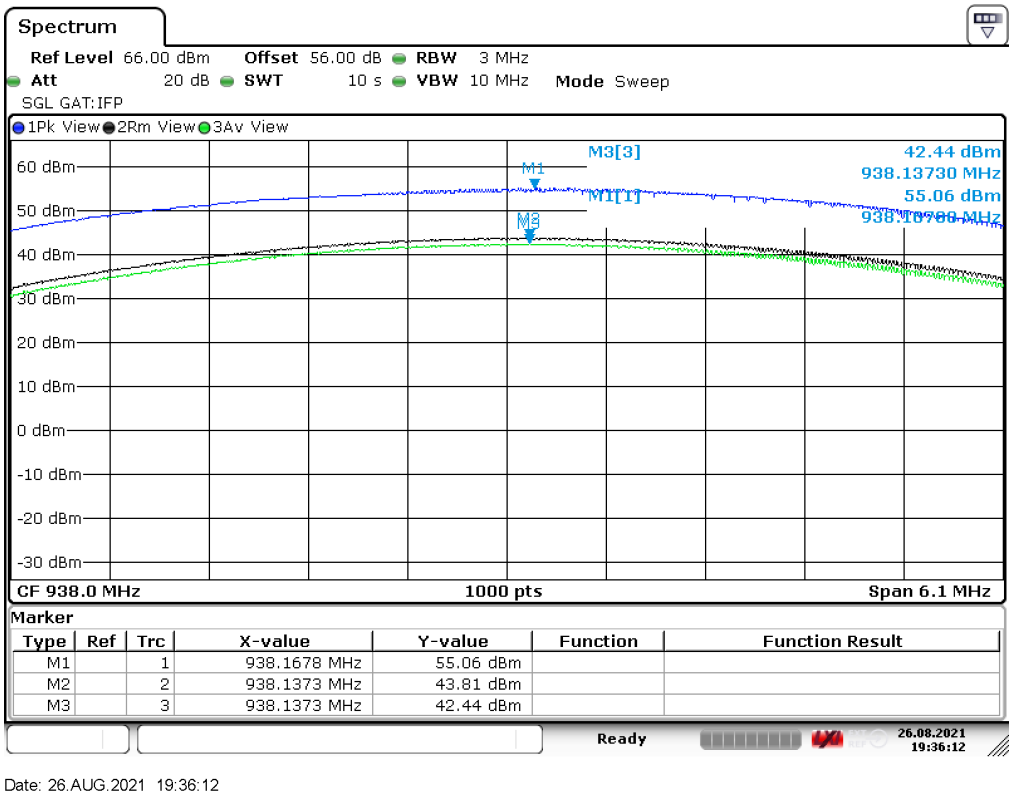
NB-IoT eFDD8 QPSK PRB2 MIMO



Date: 26.AUG.2021 19:26:56

CAT-M1 eFDD8 MIMO



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5.7.5 TEST EQUIPMENT USED

- Radio Lab

Test Equipment

1 Radiated Emissions

Lab to perform radiated emission tests

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2020-11	2021-11
1.2	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515		
1.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2019-12	2021-12
1.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia	none	2021-04	2023-04
1.5	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq			
1.6	5HC2700/12750-1.5-KK	High Pass Filter	Trilithic	9942012		
1.7	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-		
1.8	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	2021-04	2023-04
1.9	HF 906	Double-ridged horn	Rohde & Schwarz	357357/002	2018-09	2021-09
1.10	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2021-06	2023-06
1.11	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069		
1.12	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09		
1.13	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99		
1.14	4HC1600/12750-1.5-KK	High Pass Filter	Trilithic	9942011		
1.15	WRCD1879.8-0.2/40-10EE	Notch Filter Ultra Stable	Wainwright Instruments GmbH	16		
1.16	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368		
1.17	TT 1.5 WI	Turn Table	Maturo GmbH	-		
1.18	HL 562 ULTRALOG	Biconical-log-per Antenna (30 MHz - 3 GHz)	Rohde & Schwarz GmbH & Co. KG	100609	2019-05	2022-05
1.19	HF 906	Double-ridged horn	Rohde & Schwarz	357357/001	2021-08	2024-08
1.20	MA4985-XP-ET	Bore Sight Antenna Mast	innco systems GmbH	none		
1.21	A8455-4	4 Way Power Divider (SMA)		-		

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.22	JUN-AIR Mod. 6-15	Air Compressor	JUN-AIR Deutschland GmbH	612582		
1.23	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
1.24	JS4-00101800-35-5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037		
1.25	AS 620 P	Antenna Mast (pneumatic polarisation)	HD GmbH	620/37		
1.26	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709		
1.27	Innco Systems CO3000	Controller for bore sight mast SAC	innco systems GmbH	CO3000/967/39371016/L		
1.28	HF 907-2	Double-ridged horn	Rohde & Schwarz	102817	2019-04	2022-04
1.29	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
1.30	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324		
1.31	WRCA800/960-0.2/40-6EEK	Tunable Notch Filter	Wainwright Instruments GmbH	20		
1.32	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/11920513		

2 Radio Lab
Conducted Radio Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	1575	Broadband Resistive Power Divider DC to 40 GHz	API Weinschel, Inc.	4070		
2.2	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2020-05	2022-05
2.3	WRD1920/1980-5/22-5EESD	Tunable Band Reject Filter	Wainwright Instruments GmbH	11		
2.4	WRCD1879.8-0.2/40-10EE	Notch Filter Ultra Stable	Wainwright Instruments GmbH	16		
2.5	FSIQ26	Signal Analyser 20 Hz to 26.5 GHz	Rohde & Schwarz GmbH & Co. KG	840061/005	2021-07	2023-07
2.6	Temperature Chamber WT 64/75	Temperature Chamber	Weiss	5922606670010	2020-05	2022-05
2.7	A8455-4	4 Way Power Divider (SMA)		-		
2.8	WRCA800/960-0.2/40-6EEK	Tunable Notch Filter	Wainwright Instruments GmbH	20		

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

6 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

6.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

Frequency		Corr.	LISN insertion loss ESH3-Z5	cable loss (incl. 10 dB atten-uator)
MHz		dB	dB	dB
0.15		10.1	0.1	10.0
5		10.3	0.1	10.2
7		10.5	0.2	10.3
10		10.5	0.2	10.3
12		10.7	0.3	10.4
14		10.7	0.3	10.4
16		10.8	0.4	10.4
18		10.9	0.4	10.5
20		10.9	0.4	10.5
22		11.1	0.5	10.6
24		11.1	0.5	10.6
26		11.2	0.5	10.7
28		11.2	0.5	10.7
30		11.3	0.5	10.8

Sample calculation

U_{LISN} (dB µV) = U (dB µV) + Corr. (dB)
U = Receiver reading
LISN Insertion loss = Voltage Division Factor of LISN
Corr. = sum of single correction factors of used LISN, cables, switch units (if used)
Linear interpolation will be used for frequencies in between the values in the table.

6.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency	AF HFH-Z2)	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-40 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
0.009	20.50	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.01	20.45	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.015	20.37	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.02	20.36	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.025	20.38	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.03	20.32	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.05	20.35	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.08	20.30	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.1	20.20	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.2	20.17	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.3	20.14	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.49	20.12	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.490001	20.12	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.5	20.11	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.8	20.10	-39.6	0.1	0.1	0.1	0.1	-40	30	3
1	20.09	-39.6	0.1	0.1	0.1	0.1	-40	30	3
2	20.08	-39.6	0.1	0.1	0.1	0.1	-40	30	3
3	20.06	-39.6	0.1	0.1	0.1	0.1	-40	30	3
4	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
5	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
6	20.02	-39.5	0.2	0.1	0.1	0.1	-40	30	3
8	19.95	-39.5	0.2	0.1	0.1	0.1	-40	30	3
10	19.83	-39.4	0.2	0.1	0.2	0.1	-40	30	3
12	19.71	-39.4	0.2	0.1	0.2	0.1	-40	30	3
14	19.54	-39.4	0.2	0.1	0.2	0.1	-40	30	3
16	19.53	-39.3	0.3	0.1	0.2	0.1	-40	30	3
18	19.50	-39.3	0.3	0.1	0.2	0.1	-40	30	3
20	19.57	-39.3	0.3	0.1	0.2	0.1	-40	30	3
22	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
24	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
26	19.54	-39.3	0.3	0.1	0.2	0.1	-40	30	3
28	19.46	-39.2	0.3	0.1	0.3	0.1	-40	30	3
30	19.73	-39.1	0.4	0.1	0.3	0.1	-40	30	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -40 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values

6.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

(d_{Limit} = 3 m)

Frequency	AF R&S HL562	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
30	18.6	0.6	0.29	0.04	0.23	0.02	0.0	3	3
50	6.0	0.9	0.39	0.09	0.32	0.08	0.0	3	3
100	9.7	1.2	0.56	0.14	0.47	0.08	0.0	3	3
150	7.9	1.6	0.73	0.20	0.59	0.12	0.0	3	3
200	7.6	1.9	0.84	0.21	0.70	0.11	0.0	3	3
250	9.5	2.1	0.98	0.24	0.80	0.13	0.0	3	3
300	11.0	2.3	1.04	0.26	0.89	0.15	0.0	3	3
350	12.4	2.6	1.18	0.31	0.96	0.13	0.0	3	3
400	13.6	2.9	1.28	0.35	1.03	0.19	0.0	3	3
450	14.7	3.1	1.39	0.38	1.11	0.22	0.0	3	3
500	15.6	3.2	1.44	0.39	1.20	0.19	0.0	3	3
550	16.3	3.5	1.55	0.46	1.24	0.23	0.0	3	3
600	17.2	3.5	1.59	0.43	1.29	0.23	0.0	3	3
650	18.1	3.6	1.67	0.34	1.35	0.22	0.0	3	3
700	18.5	3.6	1.67	0.42	1.41	0.15	0.0	3	3
750	19.1	4.1	1.87	0.54	1.46	0.25	0.0	3	3
800	19.6	4.1	1.90	0.46	1.51	0.25	0.0	3	3
850	20.1	4.4	1.99	0.60	1.56	0.27	0.0	3	3
900	20.8	4.7	2.14	0.60	1.63	0.29	0.0	3	3
950	21.1	4.8	2.22	0.60	1.66	0.33	0.0	3	3
1000	21.6	4.9	2.23	0.61	1.71	0.30	0.0	3	3

(d_{Limit} = 10 m)

30	18.6	-9.9	0.29	0.04	0.23	0.02	-10.5	10	3
50	6.0	-9.6	0.39	0.09	0.32	0.08	-10.5	10	3
100	9.7	-9.2	0.56	0.14	0.47	0.08	-10.5	10	3
150	7.9	-8.8	0.73	0.20	0.59	0.12	-10.5	10	3
200	7.6	-8.6	0.84	0.21	0.70	0.11	-10.5	10	3
250	9.5	-8.3	0.98	0.24	0.80	0.13	-10.5	10	3
300	11.0	-8.1	1.04	0.26	0.89	0.15	-10.5	10	3
350	12.4	-7.9	1.18	0.31	0.96	0.13	-10.5	10	3
400	13.6	-7.6	1.28	0.35	1.03	0.19	-10.5	10	3
450	14.7	-7.4	1.39	0.38	1.11	0.22	-10.5	10	3
500	15.6	-7.2	1.44	0.39	1.20	0.19	-10.5	10	3
550	16.3	-7.0	1.55	0.46	1.24	0.23	-10.5	10	3
600	17.2	-6.9	1.59	0.43	1.29	0.23	-10.5	10	3
650	18.1	-6.9	1.67	0.34	1.35	0.22	-10.5	10	3
700	18.5	-6.8	1.67	0.42	1.41	0.15	-10.5	10	3
750	19.1	-6.3	1.87	0.54	1.46	0.25	-10.5	10	3
800	19.6	-6.3	1.90	0.46	1.51	0.25	-10.5	10	3
850	20.1	-6.0	1.99	0.60	1.56	0.27	-10.5	10	3
900	20.8	-5.8	2.14	0.60	1.63	0.29	-10.5	10	3
950	21.1	-5.6	2.22	0.60	1.66	0.33	-10.5	10	3
1000	21.6	-5.6	2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay + cable inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit, atten-uator & pre-amp)	cable loss 4 (to receiver)		
MHz	dB (1/m)	dB	dB	dB	dB	dB		
1000	24.4	-19.4	0.99	0.31	-21.51	0.79		
2000	28.5	-17.4	1.44	0.44	-20.63	1.38		
3000	31.0	-16.1	1.87	0.53	-19.85	1.33		
4000	33.1	-14.7	2.41	0.67	-19.13	1.31		
5000	34.4	-13.7	2.78	0.86	-18.71	1.40		
6000	34.7	-12.7	2.74	0.90	-17.83	1.47		
7000	35.6	-11.0	2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (inside chamber)	cable loss 3 (outside chamber)	cable loss 4 (switch unit, atten-uator & pre-amp)	cable loss 5 (to receiver)	used for FCC 15.247
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	
3000	31.0	-23.4	0.47	1.87	0.53	-27.58	1.33	
4000	33.1	-23.3	0.56	2.41	0.67	-28.23	1.31	
5000	34.4	-21.7	0.61	2.78	0.86	-27.35	1.40	
6000	34.7	-21.2	0.58	2.74	0.90	-26.89	1.47	
7000	35.6	-19.8	0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (High Pass)	cable loss 3 (pre-amp)	cable loss 4 (inside chamber)	cable loss 5 (outside chamber)	cable loss 6 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	dB
7000	35.6	-57.3	0.56	1.28	-62.72	2.66	0.94	1.46
8000	36.3	-56.3	0.69	0.71	-61.49	2.84	1.00	1.53
9000	37.1	-55.3	0.68	0.65	-60.80	3.06	1.09	1.60
10000	37.5	-56.2	0.70	0.54	-61.91	3.28	1.20	1.67
11000	37.5	-55.3	0.80	0.61	-61.40	3.43	1.27	1.70
12000	37.6	-53.7	0.84	0.42	-59.70	3.53	1.26	1.73
13000	38.2	-53.5	0.83	0.44	-59.81	3.75	1.32	1.83
14000	39.9	-56.3	0.91	0.53	-63.03	3.91	1.40	1.77
15000	40.9	-54.1	0.98	0.54	-61.05	4.02	1.44	1.83
16000	41.3	-54.1	1.23	0.49	-61.51	4.17	1.51	1.85
17000	42.8	-54.4	1.36	0.76	-62.36	4.34	1.53	2.00
18000	44.2	-54.7	1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

Frequency	AF EMCO 3160-09	Corr.	cable loss 1 (inside chamber)	cable loss 2 (pre-amp)	cable loss 3 (inside chamber)	cable loss 4 (switch unit)	cable loss 5 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB
18000	40.2	-23.5	0.72	-35.85	6.20	2.81	2.65
18500	40.2	-23.2	0.69	-35.71	6.46	2.76	2.59
19000	40.2	-22.0	0.76	-35.44	6.69	3.15	2.79
19500	40.3	-21.3	0.74	-35.07	7.04	3.11	2.91
20000	40.3	-20.3	0.72	-34.49	7.30	3.07	3.05
20500	40.3	-19.9	0.78	-34.46	7.48	3.12	3.15
21000	40.3	-19.1	0.87	-34.07	7.61	3.20	3.33
21500	40.3	-19.1	0.90	-33.96	7.47	3.28	3.19
22000	40.3	-18.7	0.89	-33.57	7.34	3.35	3.28
22500	40.4	-19.0	0.87	-33.66	7.06	3.75	2.94
23000	40.4	-19.5	0.88	-33.75	6.92	3.77	2.70
23500	40.4	-19.3	0.90	-33.35	6.99	3.52	2.66
24000	40.4	-19.8	0.88	-33.99	6.88	3.88	2.58
24500	40.4	-19.5	0.91	-33.89	7.01	3.93	2.51
25000	40.4	-19.3	0.88	-33.00	6.72	3.96	2.14
25500	40.5	-20.4	0.89	-34.07	6.90	3.66	2.22
26000	40.5	-21.3	0.86	-35.11	7.02	3.69	2.28
26500	40.5	-21.1	0.90	-35.20	7.15	3.91	2.36

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

6.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

Frequency	AF EMCO 3160-10	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
GHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
26.5	43.4	-11.2	4.4				-9.5	3	1.0
27.0	43.4	-11.2	4.4				-9.5	3	1.0
28.0	43.4	-11.1	4.5				-9.5	3	1.0
29.0	43.5	-11.0	4.6				-9.5	3	1.0
30.0	43.5	-10.9	4.7				-9.5	3	1.0
31.0	43.5	-10.8	4.7				-9.5	3	1.0
32.0	43.5	-10.7	4.8				-9.5	3	1.0
33.0	43.6	-10.7	4.9				-9.5	3	1.0
34.0	43.6	-10.6	5.0				-9.5	3	1.0
35.0	43.6	-10.5	5.1				-9.5	3	1.0
36.0	43.6	-10.4	5.1				-9.5	3	1.0
37.0	43.7	-10.3	5.2				-9.5	3	1.0
38.0	43.7	-10.2	5.3				-9.5	3	1.0
39.0	43.7	-10.2	5.4				-9.5	3	1.0
40.0	43.8	-10.1	5.5				-9.5	3	1.0

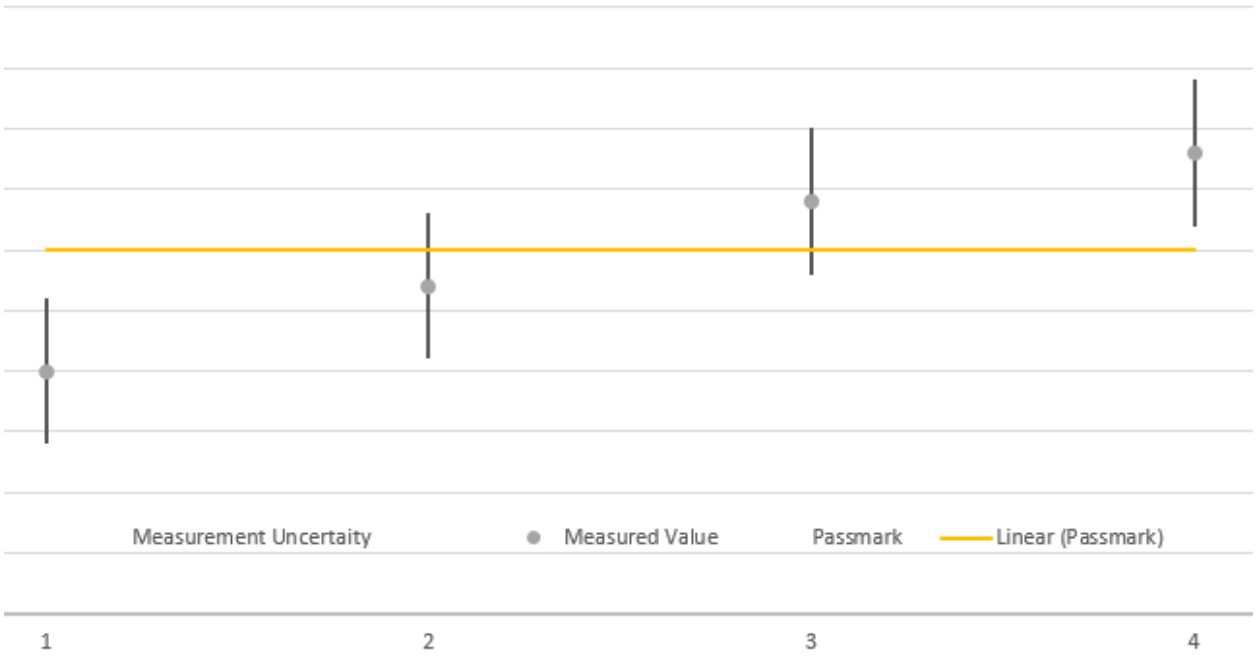
Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

7 MEASUREMENT UNCERTAINTIES

Test Case(s)	Parameter	Uncertainty
- Field strength of spurious radiation	Field Strength	± 5.5 dB
- Emission and Occupied Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
- RF Output Power - Peak to Average Ratio	Power	± 2.2 dB
- Band Edge Compliance - Spurious Emissions at Antenna Terminal	Power Frequency	± 2.2 dB ± 11.2 kHz
- Frequency Stability	Frequency	± 25 Hz

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) k = 1.96. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	above pass mark	within pass mark	Failed
4	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.

8 PHOTO REPORT

Please see separate photo report.