

FCC Measurement/Technical Report on Treon Gateway 2

FCC ID: 2AR86GW12

Contains:

U-blox Sara-R422	FCC ID: XPYUBX20VA01	(cellular)
U-blox Sara-R422	IC: 8595A-UBX20VA01	(cellular)
U-blox Nina B301	FCC ID: XPYNINAB30	(BLE/Wirepas mesh)
U-blox Lily-W131	FCC ID: XPYLILYW1	(WiFi)

Test Report Reference: MDE_KIWA_2309_FCC_01

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

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

7layers GmbH
Borsigstraße 11
40880 Ratingen, Germany
T +49 (0) 2102 749 0
F +49 (0) 2102 749 350

Geschäftsführer/
Managing Directors:
Sebastian Doose
Bernhard Retka

Registergericht/registered:
Düsseldorf HRB 75554
USt-Id.-Nr./VAT-No. DE203159652
Steuer-Nr./TAX-No. 147/5869/0385

a Bureau Veritas
Group Company

www.7layers.com

Table of Contents

1	Applied Standards and Test Summary	3
1.1	Applied Standards	3
1.2	FCC-IC Correlation Table	4
1.3	Measurement Summary	5
2	Revision History / Signatures	6
3	Administrative Data	7
3.1	Testing Laboratory	7
3.2	Project Data	7
3.3	Applicant Data	7
3.4	Manufacturer Data	8
4	Test object Data	9
4.1	General EUT Description	9
4.2	EUT Main components	9
4.3	Ancillary Equipment	10
4.4	Auxiliary Equipment	10
4.5	EUT Setups	10
4.6	Operating Modes / Test Channels	11
4.7	Product labelling	11
5	Test Results	12
5.1	Field strength of spurious radiation	12
6	Test Equipment	29
6.1	Test Equipment Hardware	29
6.2	Test Equipment Software	31
7	Antenna Factors, Cable Loss and Sample Calculations	32
7.1	LISN R&S ESH3-Z5 (150 kHz – 30 MHz)	32
7.2	Antenna R&S HFH2-Z2 (9 kHz – 30 MHz)	33
7.3	Antenna R&S HL562 (30 MHz – 1 GHz)	34
7.4	Antenna R&S HF907 (1 GHz – 18 GHz)	35
7.5	Antenna EMCO 3160-09 (18 GHz – 26.5 GHz)	36
7.6	Antenna EMCO 3160-10 (26.5 GHz – 40 GHz)	37
8	Measurement Uncertainties	38
9	Photo Report	39

1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization

Certification for an Industrial Signal Booster.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 22, 24,27 and 90 (10-1-22 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 C – Technical standards

§ 27.50 – Power and duty cycle limits

§ 27.53 – 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

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for Cellular Mobile Devices from FCC and ISED Canada

Measurement	FCC reference	ISED reference
RF Output Power	§ 2.1046 § 27.50	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.12 RSS-130 Issue 2, 4.6.2/4.6.3 RSS-139 Issue 4, 5.5 RSS-199 Issue 4, 5.5
Peak to Average-Ratio	§ 27.50	RSS-130 Issue 2: 4.6.1 RSS 139 Issue 4: 5.5 RSS-199 Issue 4, 5.5
Emission and Occupied bandwidth	§ 2.1049	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.7
Spurious Emission at Antenna Terminals	§ 2.1051 § 27.53	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.13 RSS-130 Issue 2: 4.7.1/4.7.2 RSS-139 Issue 4, 5.6 RSS-199 Issue 4, 5.6
Band Edge Compliance	§ 2.1051 § 27.53	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.13 RSS-130 Issue 2: 4.7.1/4.7.2 RSS-139 Issue 4, 5.6 RSS-199 Issue 4, 5.6
Frequency stability	§ 2.1055 § 27.54	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.11 RSS-130 Issue 2: 4.5 RSS-139 Issue 4: 5.4 RSS-199 Issue 4, 5.4
Field strength of spurious radiation	§ 2.1053 § 27.53	RSS-GEN Issue 5 & AMD 1 & AMD 2, 6.13 RSS-130 Issue 2: 4.7.1/4.7.2 RSS-139 Issue 4: 5.6 RSS-199 Issue 4, 5.6

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 27 Subpart C

§ 2.1053 § 27.53

Field strength of spurious radiation

The measurement was performed according to ANSI C63.26: 2015; 5.5.2.3.1

Final Result

OP-Mode	Setup	Date	FCC	IC
Technology, Radio Technology, Operating channel, ChBW, Ressource Blocks, frequency range, Measurement method				
CAT-M1, eFDD 12 QPSK, high, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AB01	2024-03-04	Passed	Passed
CAT-M1, eFDD 12 QPSK, mid, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AB01	2024-03-04	Passed	Passed
CAT-M1, eFDD 12 QPSK, low, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AB01	2024-03-04	Passed	Passed
CAT-M1, eFDD 12 QPSK, high, 5 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-03-28	Passed	Passed
CAT-M1, eFDD 12 QPSK, mid, 5 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-03-28	Passed	Passed
CAT-M1, eFDD 12 QPSK, low, 5 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-03-28	Passed	Passed
CAT-M1, eFDD 13 QPSK, high, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AC01	2024-03-22	Passed	Passed
CAT-M1, eFDD 13 QPSK, mid, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AC01	2024-03-22	Passed	Passed
CAT-M1, eFDD 13 QPSK, low, 1.4 MHz, 1, 1 GHz -10 GHz, radiated	S01_AC01	2024-03-22	Passed	Passed
CAT-M1, eFDD 13 QPSK, high, 1.4 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-04-08	Passed	Passed
CAT-M1, eFDD 13 QPSK, mid, 1.4 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-03-22	Passed	Passed
CAT-M1, eFDD 13 QPSK, low, 1.4 MHz, 1, 30 MHz - 1 GHz, radiated	S01_AB01	2024-04-08	Passed	Passed

2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2024-05-16	--	valid
--	--	--	--

COMMENT: -

According to the customer the EUT is including following modules:

- Contains =

U-blox Sara-R422 FCC ID: XPYUBX20VA01

(cellular)

U-blox Sara-R422 IC: 8595A-UBX20VA01

(cellular)

U-blox Nina B301 FCC ID: XPYNINAB30

(BLE/Wirepas mesh)

U-blox Lily-W131 FCC ID: XPYLILYW1

(WiFi)



(responsible for accreditation scope)
Daniel Gall



(responsible for testing and report)
Mohamed Fraïtat



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| -02 | -03
FCC Designation Number: DE0015
FCC Test Firm Registration: 929146
ISED CAB Identifier DE0007; ISED#: 3699A

Responsible for accreditation scope: Daniel Gall
Report Template Version: 2022-12-29

3.2 PROJECT DATA

Responsible for testing and report: Mohamed Fraitat
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2024-05-16
Testing Period: 2024-03-04 to 2024-04-08

3.3 APPLICANT DATA

Company Name: Treon Oy
Address: Visiokatu3,
33720, Tampere
Finland
Contact Person: Janne Julkunen

3.4 MANUFACTURER DATA

Company Name: please see Applicant Data

Address:

Contact Person:

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Treon Gateway 2 collects, processes, and transmits data from sensors to any cloud backend over a wide range of wired and wireless connectivity.
Product name	Treon Gateway 2
Type	-
Declared EUT data by the supplier	
General product description	The EUT is supporting Cellular LTE Band 12 and 13 and Bluetooth Low energy.
Voltage Level	120 V / 60 Hz
Voltage Type	AC

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT B	DE1429008ab01	radiated sample
Sample Parameter	Value	
Serial No.	f13b0fea	
HW Version	B5.1	
SW Version	V7	
Comment		

Sample Name	Sample Code	Description
EUT C	DE1429008ac01	radiated sample
Sample Parameter	Value	
Serial No.	61ed4e44	
HW Version	B5.1	
SW Version	V7	
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
AUX1	-, -, -, -, -,	Protective enclosure

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_AB01	EUT B	Setup for Radiated measurement
S01_AC01	EUT C + AUX1	Setup for Radiated measurement

4.6 OPERATING MODES / TEST CHANNELS

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

CAT-M1 eFDD 12		LOW	MID	HIGH	LOW	MID	HIGH
	Cell BW [MHz]	1.4	1.4	1.4	5	5	5
	CH no.	23017	23095	23173	23035	23095	23155
	f [MHz]	699.7	707.5	715.3	701.5	707.5	713.5

CAT-M1 eFDD 13		LOW	MID	HIGH
	Cell BW [MHz]	5	5	5
	CH no.	23205	23230	23255
	f [MHz]	779.5	782.0	784.5

4.7 RODUCT 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 FIELD STRENGTH OF SPURIOUS RADIATION

Standard **FCC PART 27 Subpart C**

The test was performed according to:

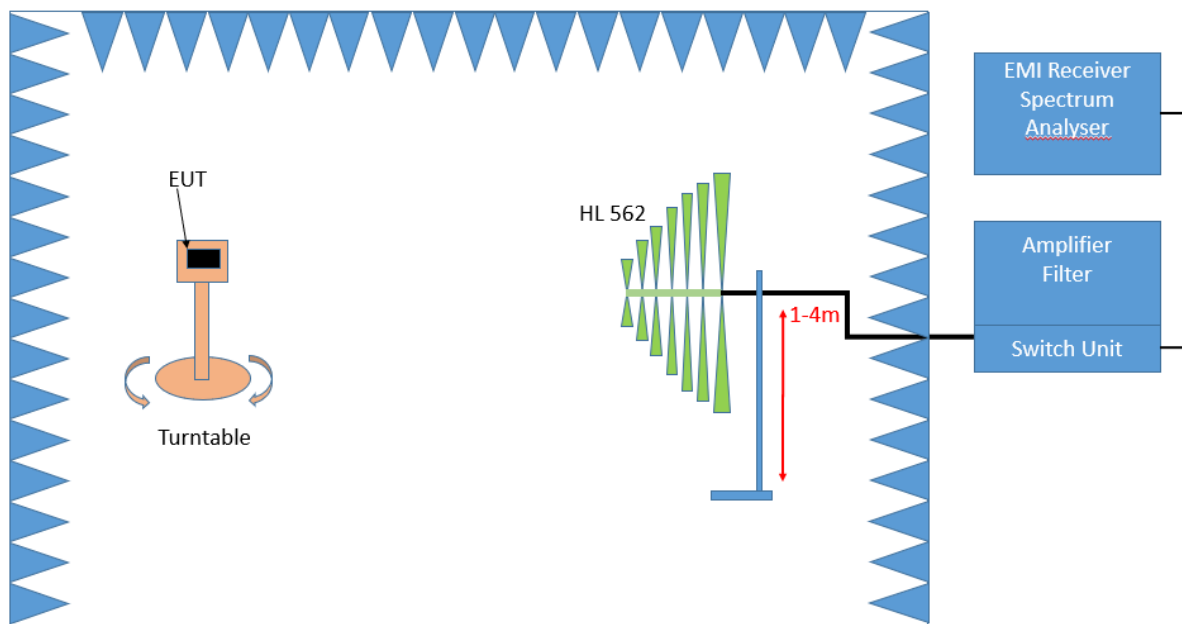
ANSI C63.26: 2015; 5.5.2.3.1

5.1.1 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.

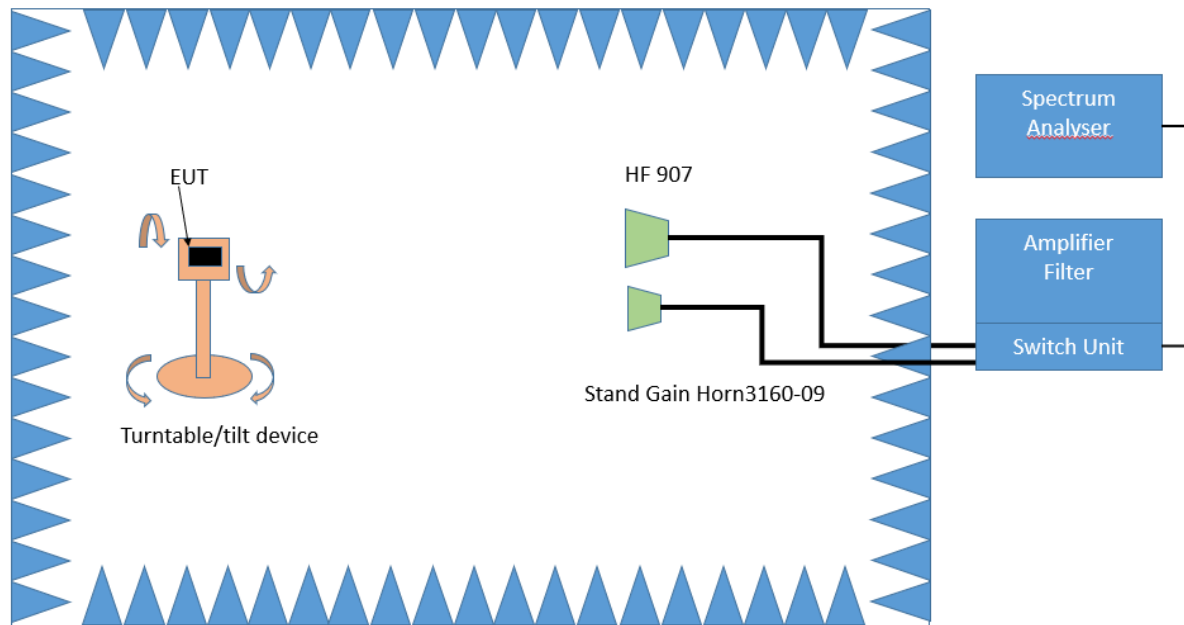
The EUT was connected to the test setup according to the following diagram:

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: 1 MHz
- VBW: 3 MHz
- Sweep time: coupled
- Turntable angle range: –180° to 90°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 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 $\pm 45^\circ$ around this value. 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 by ± 100 cm around the antenna height determined. 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: 1 MHz
- VBW: 1 MHz
- Sweep time: 100 ms
- Turntable angle range: $\pm 45^\circ$ around the determined value
- Height variation range: ± 100 cm around the determined value
- 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: 1MHz
- VBW: 1 MHz
- 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 90° .

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 90°
- Turntable step size: 90°
- 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 in step 2 is omitted. Instead of this, a maximum search with a step size $\pm 45^\circ$ for the elevation axis is performed.

The turn table azimuth will slowly vary by $\pm 22.5^\circ$.

The elevation angle will slowly vary by $\pm 45^\circ$

EMI receiver settings (for all steps):

- Detector: Peak,
- RBW: 1 MHz
- VBW: 3 MHz
- Sweep time: 100 ms

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

5.1.2 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 C – Technical standards****§27.53 – Emission limits****Band 4:**

(h) *AWS emission limits—(1) General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

RSS-139; 6.6 Transmitter Unwanted Emissions

Equipment shall comply with the limits in (i) and (ii) below.

- i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.
- ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

5.1.3 TEST PROTOCOL

Ambient temperature: 23-24 °C
 Air Pressure: 1005-1011 hPa
 Humidity: 38-40 %

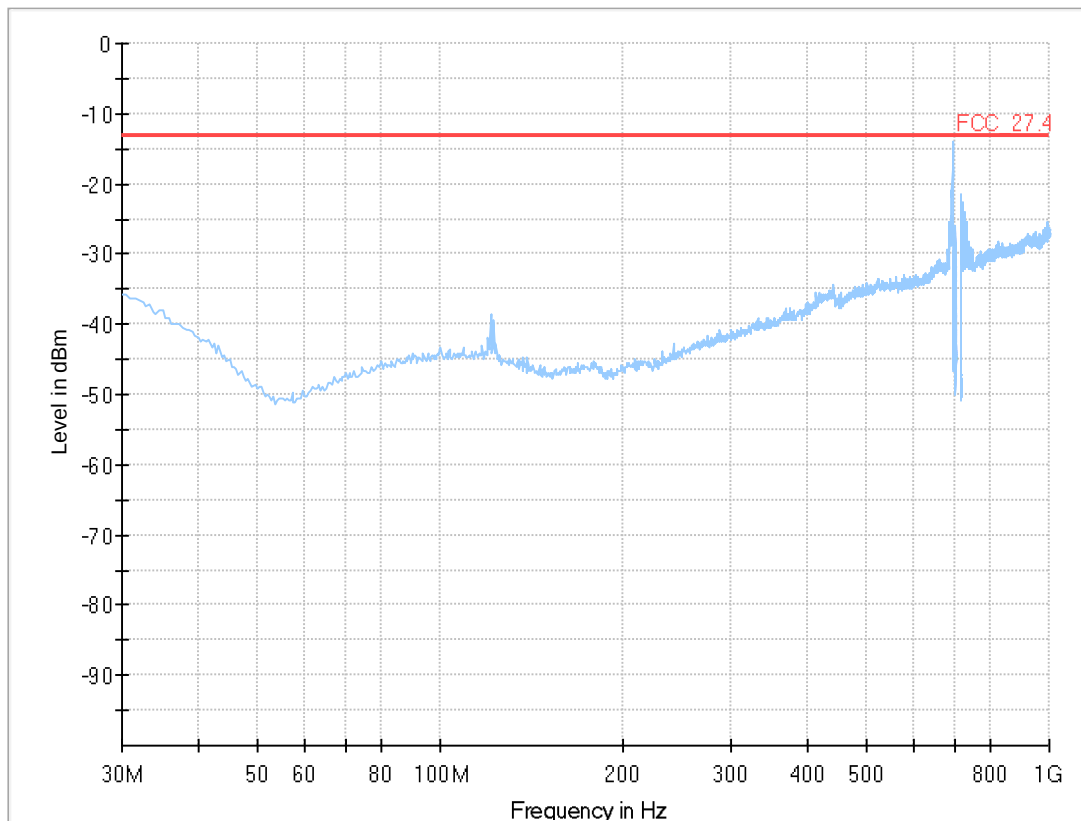
Radio Technology	Channel	Spurious Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
LTE eFDD12	Low	1397.9	-48.4	RMS	1000	-13	35.4
LTE eFDD12	Low	2100.1	-36.5	RMS	1000	-13	23.5
LTE eFDD12	Low	2800.4	-61.6	RMS	1000	-13	48.6
LTE eFDD12	Low	3501.2	-48.3	RMS	1000	-13	35.3
LTE eFDD12	Mid	697.5	-58.2	RMS	100	-13	45.2
LTE eFDD12	Mid	716.7	-57.2	RMS	100	-13	44.2
LTE eFDD12	Mid	1414.3	-46.2	RMS	1000	-13	33.2
LTE eFDD12	Mid	2120.7	-32.0	RMS	1000	-13	19.0
LTE eFDD12	Mid	3534.8	-39.4	RMS	1000	-13	26.4
LTE eFDD12	high	718.1	-57.5	RMS	100	-13	44.5
LTE eFDD12	high	1429.23	-51.5	RMS	1000	-13	38.5
LTE eFDD12	high	2144.5	-31.0	RMS	1000	-13	18.0
LTE eFDD12	high	3574.1	-44.1	RMS	1000	-13	31.1

Radio Technology	Channel	Spurious Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
LTE eFDD13	Low	774.4	-56.8	RMS	100	-13	21.8
LTE eFDD13	Low	774.9	-56.7	RMS	100	-13	21.7
LTE eFDD13	Low	1554.0	-60.6	RMS	1000	-13	47.6
LTE eFDD13	Low	2411.7	-68.1	RMS	1000	-13	55.1
LTE eFDD13	Mid	787.1	-46.9	RMS	100	-13	33.9
LTE eFDD13	Mid	1560.0	-59.4	RMS	100	-13	19.4
LTE eFDD13	High	787.1	-40.7	RMS	100	-13	27.7
LTE eFDD13	High	793.1	-56.1	RMS	100	-35	21.1
LTE eFDD13	High	1564.7	-62.9	RMS	1000	-40	22.9
LTE eFDD13	High	4854.7	-60.0	RMS	1000	-13	47.0

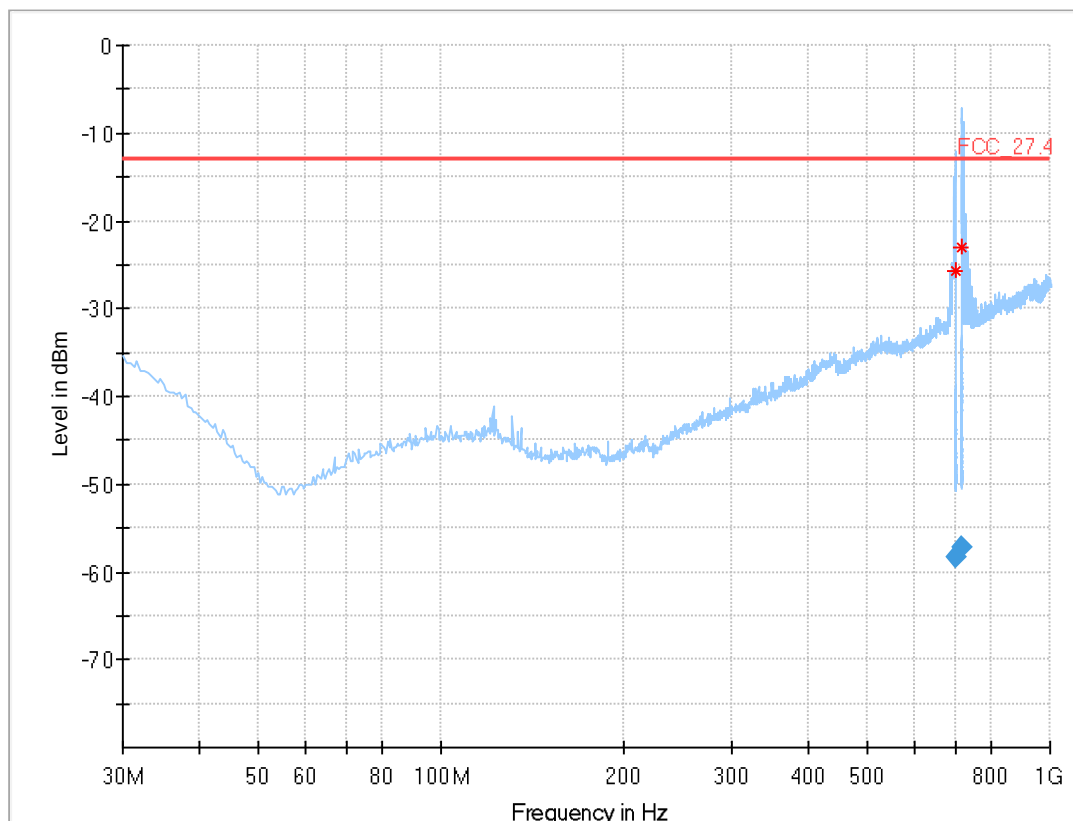
Remark: Please see next sub-clause for the measurement plot.

5.1.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Technology = LTE eFDD12, Channel BW= 5 MHz, Channel = low,
Frequency range = 30 MHz – 1GHz



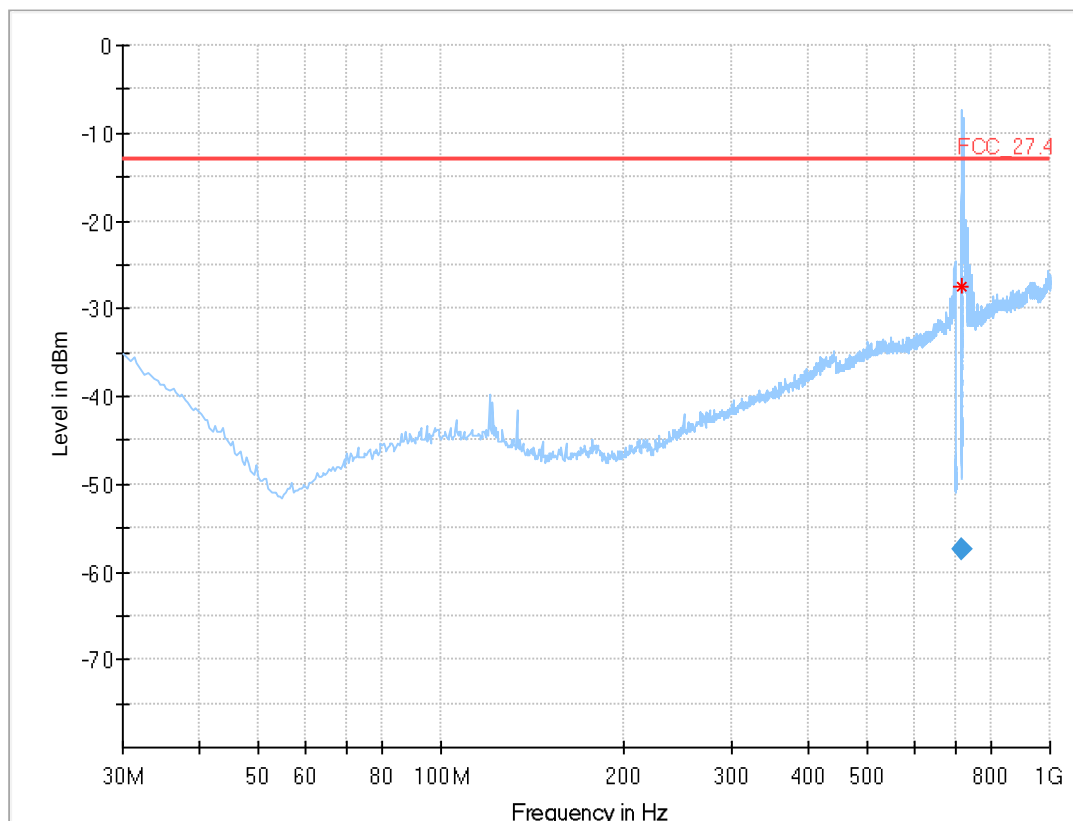
Technology = LTE eFDD12, Channel BW= 5 MHz, Channel = mid,
 Frequency range = 30 MHz – 1GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB)
697.482563	-58.23	-13.00	45.23	1000.0	100.000	122.0	H	-105.0	-73.1
716.667800	-57.25	-13.00	44.25	1000.0	100.000	100.0	V	164.0	-72.6

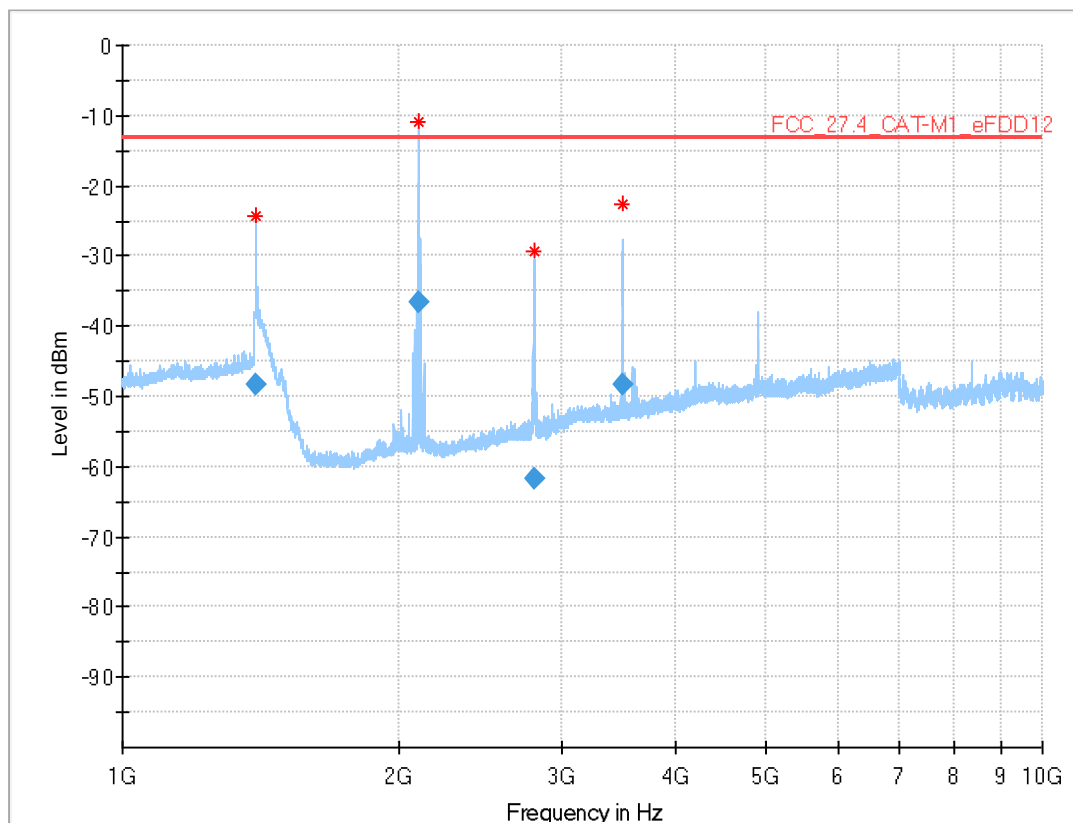
Technology = LTE eFDD12, Channel BW= 5 MHz, Channel = high,
 Frequency range = 30 MHz – 1GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB)
718.100000	-57.49	-13.00	44.49	1000.0	100.000	235.0	V	0.0	-72.5

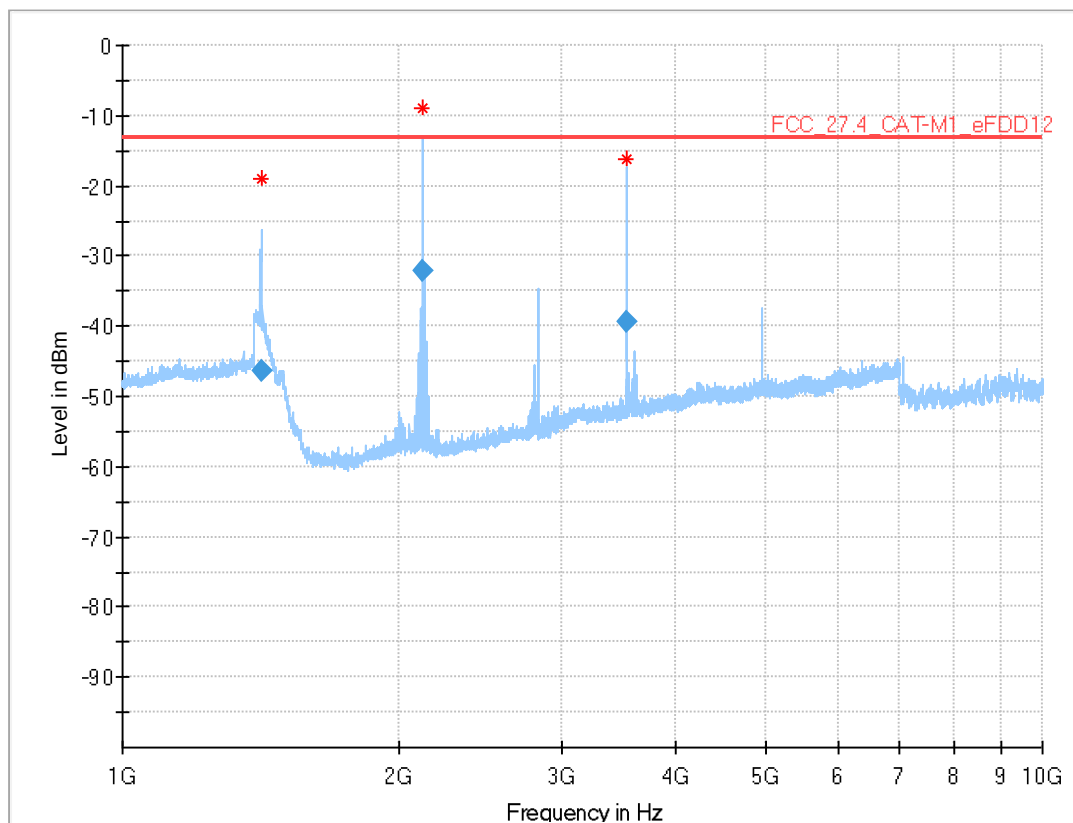
Technology = LTE eFDD12, Channel BW= 1.4 MHz, Channel = low,
Frequency range = 1 GHz – 10 GHz



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Elevation	Corr. (dB)
1397.948	-48.4	-13.00	35.45	1000.0	1000.000	150.0	H	-56.0	-16.0	-82.3
2100.133	-36.5	-13.00	23.51	1000.0	1000.000	150.0	V	-194.0	94.0	-101.1
2800.448	-61.6	-13.00	48.64	1000.0	1000.000	150.0	V	91.0	97.0	-98.0
3501.230	-48.3	-13.00	35.31	1000.0	1000.000	150.0	V	104.0	110.0	-95.2

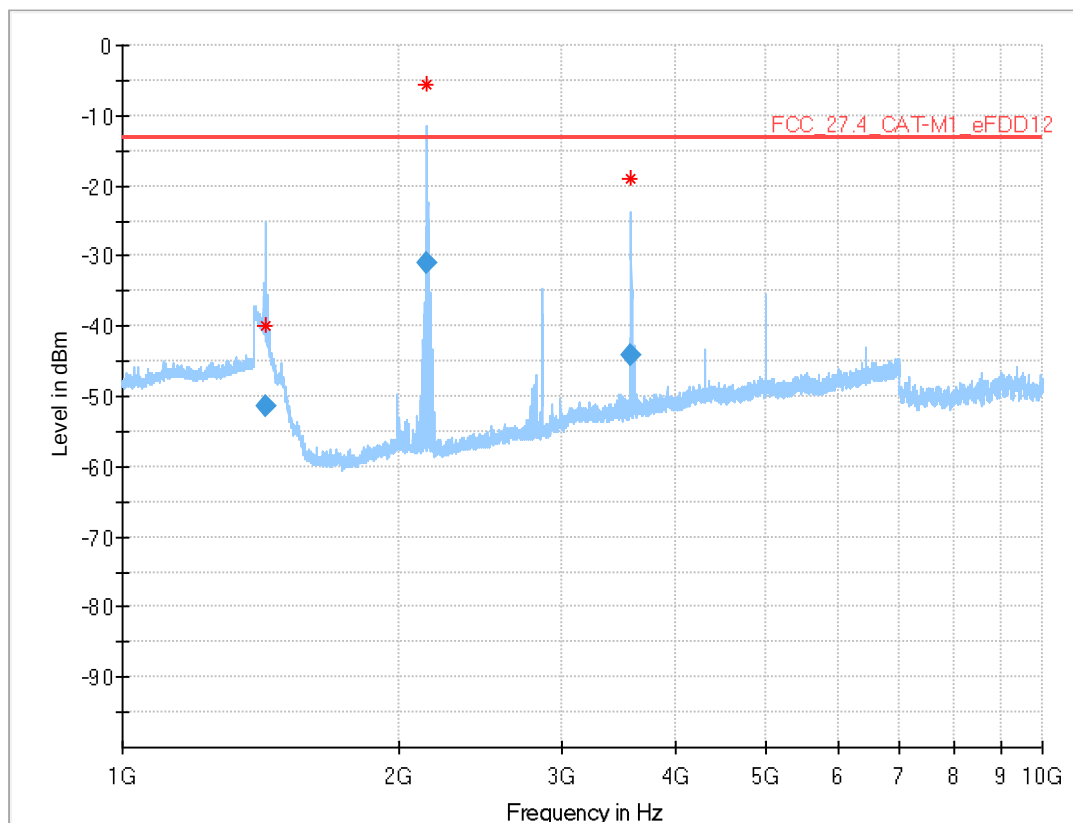
Technology = LTE eFDD12, Channel BW= 1.4 MHz, Channel = mid,
 Frequency range = 1 GHz – 10 GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (h)	Height (t)	Pol	Azimuth (h)	Elevation (n)	Corr. (dB)
1414.310	-46.2	-13.00	33.25	1000.0	1000.000	150.0	H	-164.0	72.0	-82.2
2120.703	-32.0	-13.00	18.98	1000.0	1000.000	150.0	V	65.0	72.0	-100.7
3534.890	-39.4	-13.00	26.37	1000.0	1000.000	150.0	V	107.0	92.0	-95.8

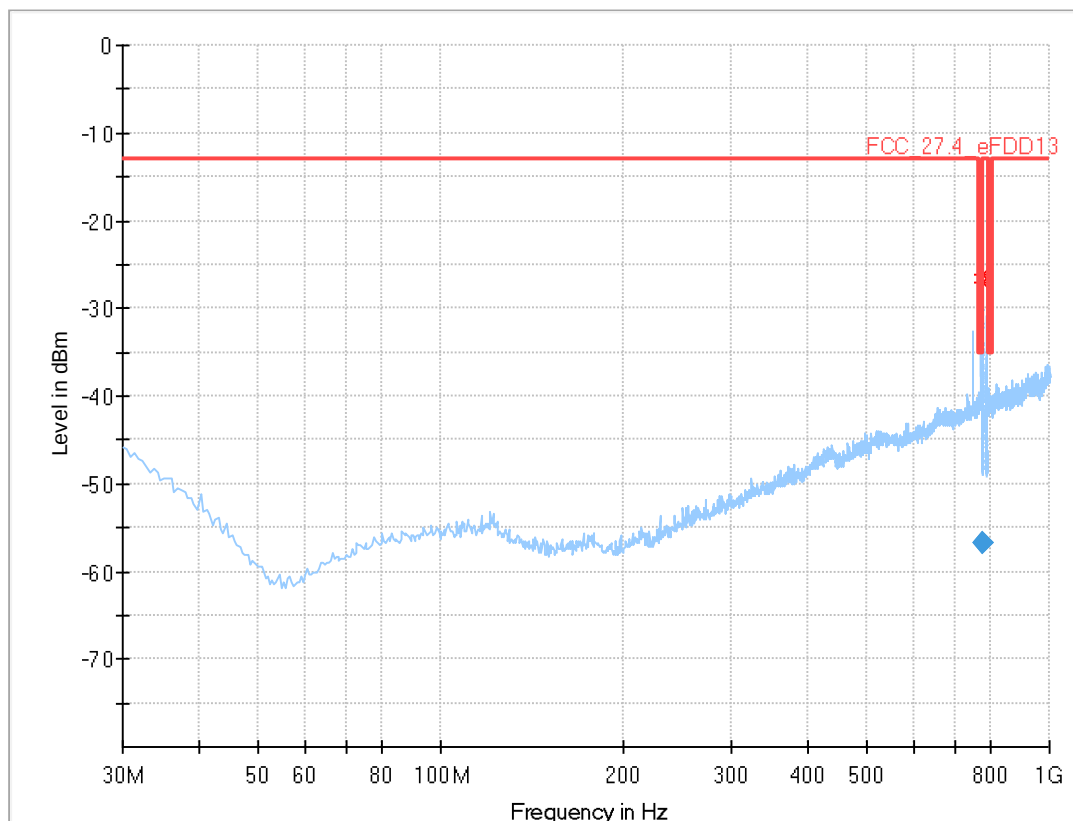
Technology = LTE eFDD12, Channel BW= 1.4 MHz, Channel = high,
Frequency range = 1 GHz – 10 GHz



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (MHz)	Height (dBm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1429.270	-51.5	-13.00	38.47	1000.0	1000.000	150.0	V	-97.0	48.0	-82.7
2144.545	-31.0	-13.00	18.02	1000.0	1000.000	150.0	V	-22.0	77.0	-100.5
3574.160	-44.1	-13.00	31.08	1000.0	1000.000	150.0	H	-43.0	38.0	-95.2

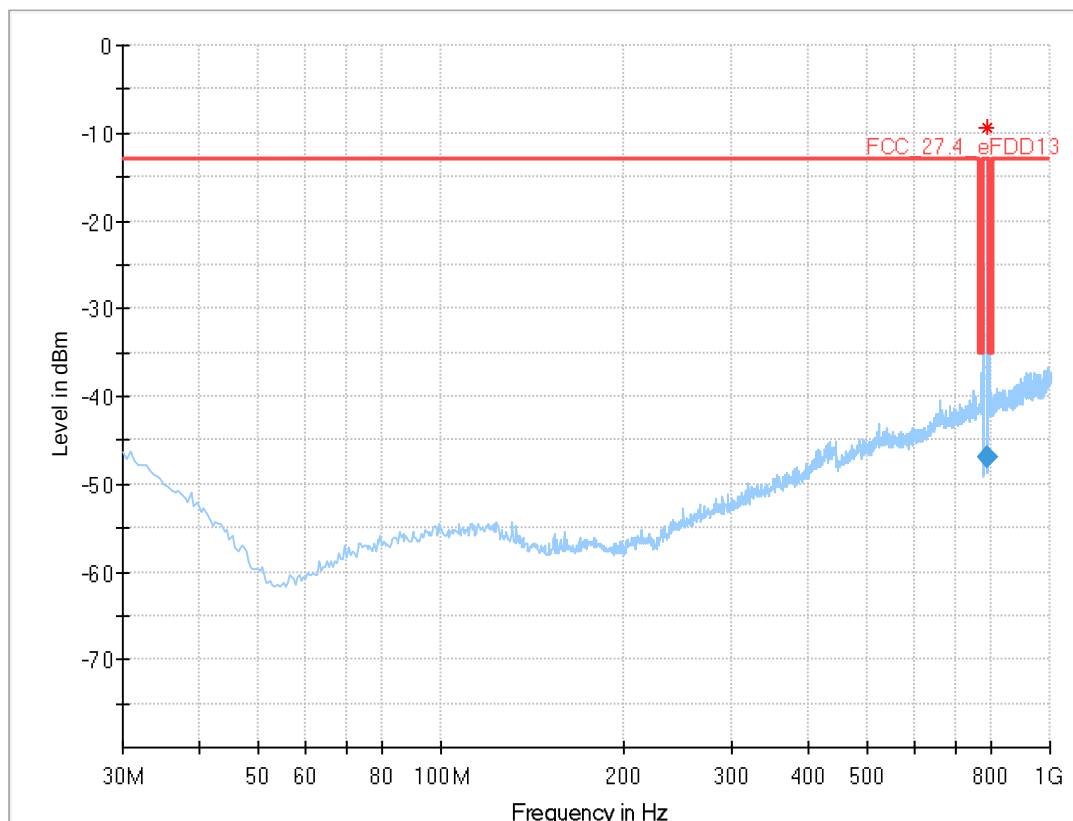
Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = low,
 Frequency range = 30 MHz – 1GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB)
774.434438	-56.86	-35.00	21.86	1000.0	100.000	111.0	H	-25.0	-71.8
774.957333	-56.69	-35.00	21.69	1000.0	100.000	114.0	H	-90.0	-71.8

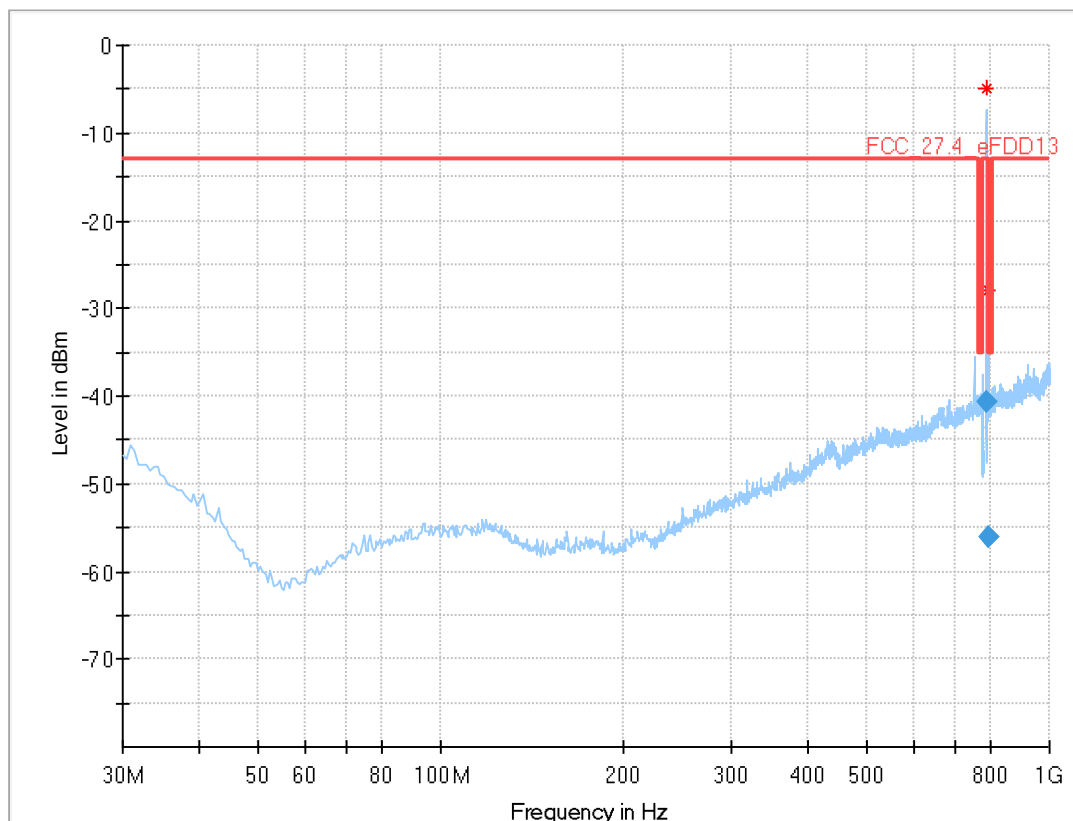
Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = mid,
 Frequency range = 30 MHz – 1GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (MHz)	Height	Pol	Azimuth	Corr. (dB)
787.100000	-46.97	-13.00	33.97	1000.0	100.000	194.0	H	-74.0	-71.6

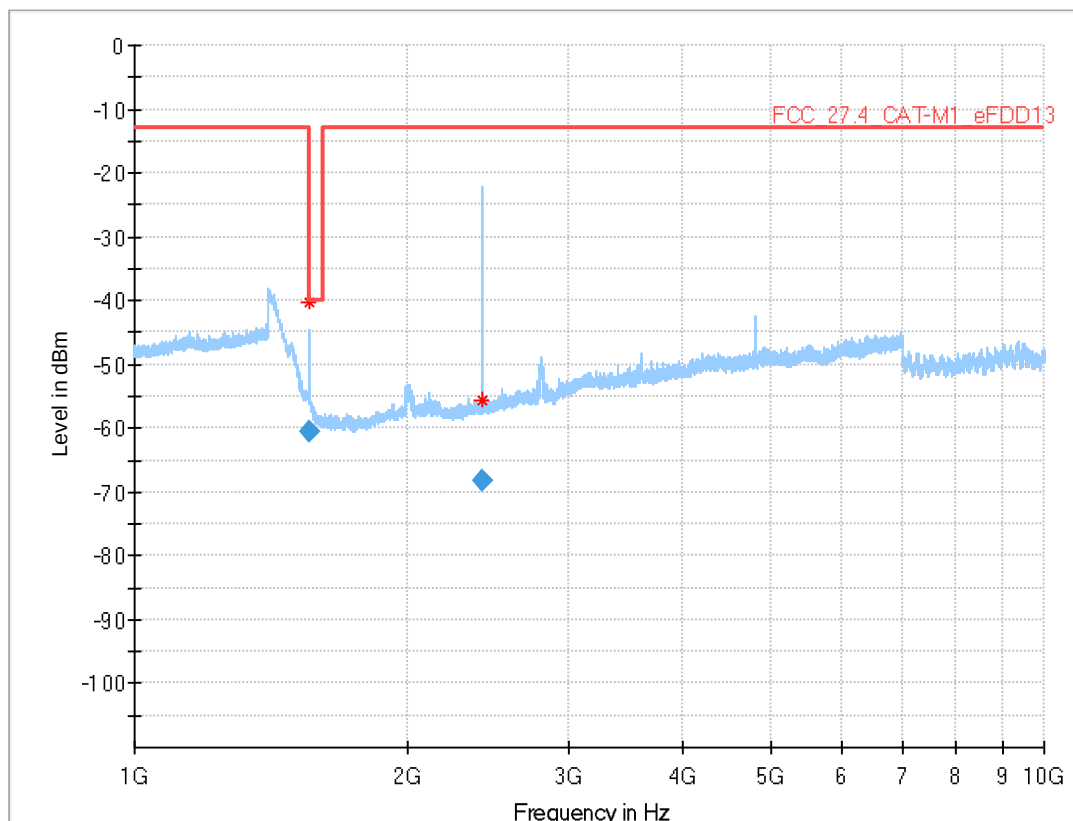
Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = high,
Frequency range = 30 MHz – 1GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (h)	Height	Pol	Azimuth (h)	Corr. (dB)
787.116675	-40.72	-13.00	27.72	1000.0	100.000	103.0	H	-21.0	-71.6
793.150000	-56.06	-35.00	21.06	1000.0	100.000	100.0	H	-23.0	-71.4

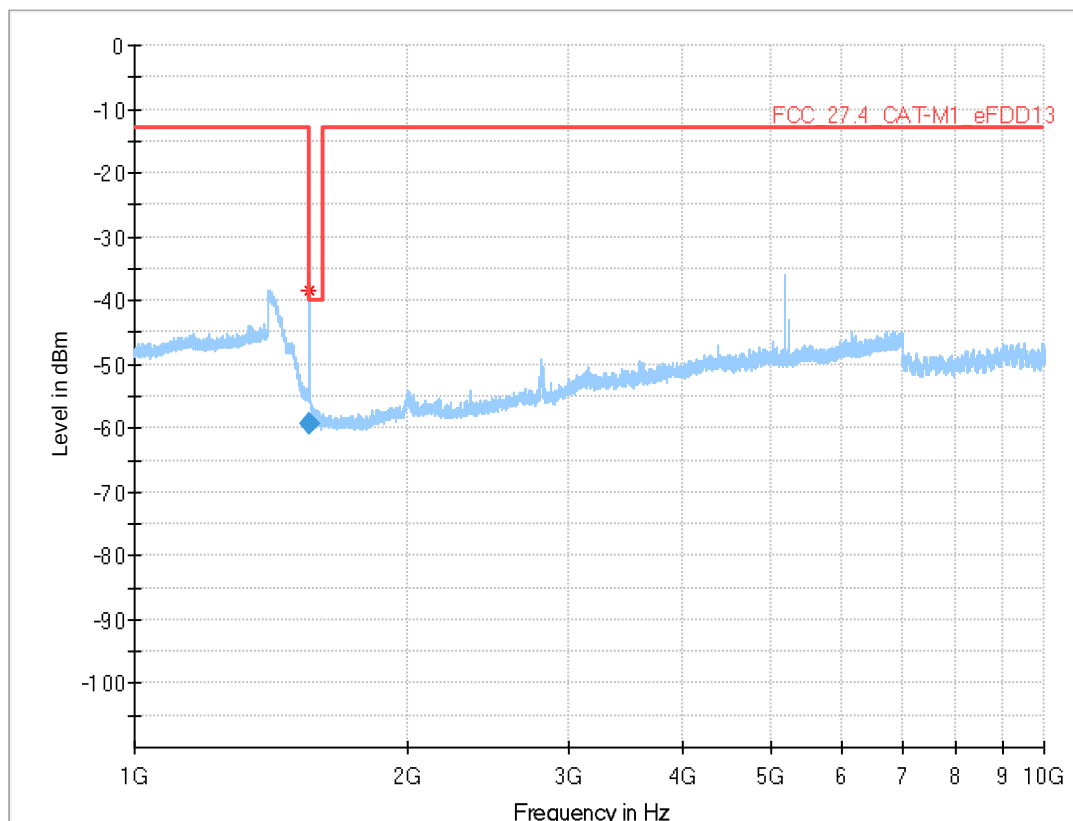
Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = low,
 Frequency range = 1 GHz – 10 GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (Hz)	Height	Pol	Azimuth	Elevation	Corr. (dB)
1554.000	-60.6	-13.00	47.56	1000.0	1000.000	150.0	H	134.0	18.0	-97.5
2411.733	-68.1	-13.00	55.08	1000.0	1000.000	150.0	H	-71.0	110.0	-100.4

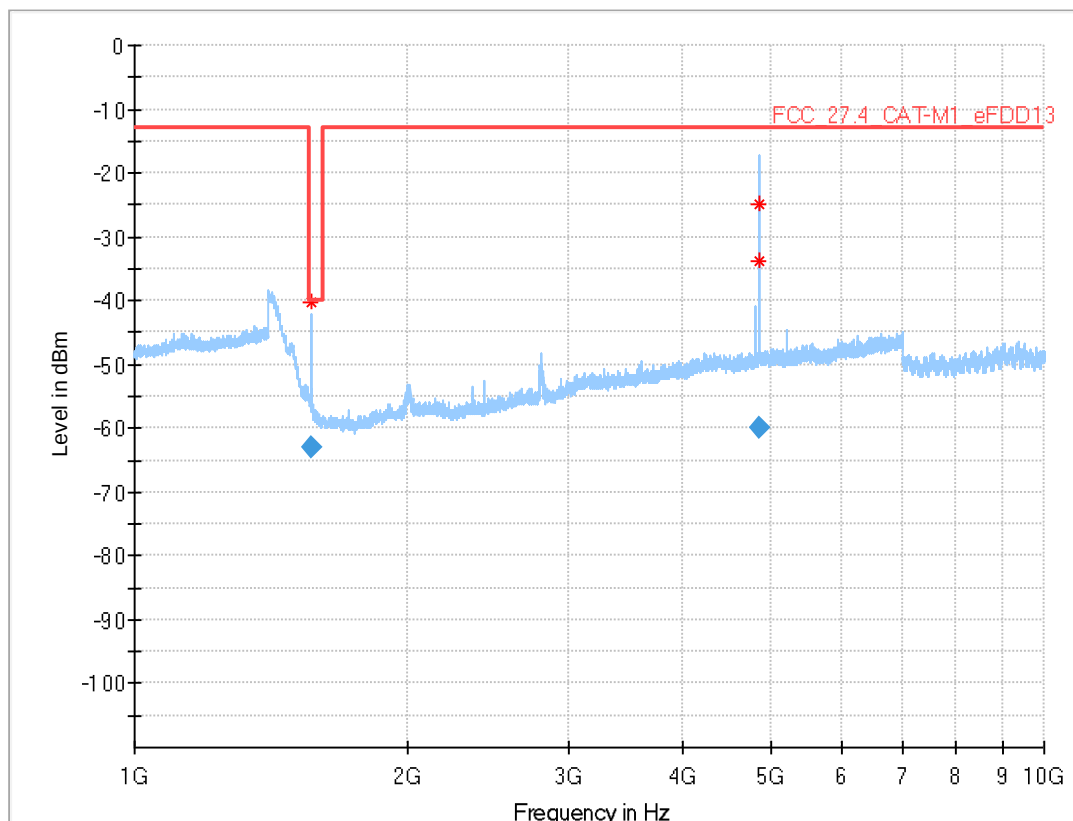
Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = mid,
 Frequency range = 1 GHz – 10 GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (MHz)	Height (m)	Pol	Azimuth (°)	Elevation (°)	Corr. (dB)
1560.067	-59.4	-40.00	19.43	1000.0	1000.000	150.0	H	128.0	11.0	-98.2

Technology = LTE eFDD13, Channel BW= 5 MHz, Channel = high,
 Frequency range = 1 GHz – 10 GHz



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (h)	Height	Pol	Azimuth (h)	Elevation (n)	Corr. (dB)
1564.733	-62.9	-40.00	22.93	1000.0	1000.000	150.0	H	18.0	45.0	-99.1
4854.733	-60.0	-13.00	46.98	1000.0	1000.000	150.0	V	16.0	99.0	-91.0

5.1.5 TEST EQUIPMENT USED

- Radiated Emissions FAR
- Radiated Emissions SAC up to 1 GHz

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

- 1 Radiated Emissions FAR
Radiated Emissions in a fully anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A	N/A
1.2	5HC2700/12750-1.5-KK	High Pass Filter	Trilithic	9942012	N/A	N/A
1.3	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-	N/A	N/A
1.4	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	N/A	N/A
1.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2022-06	2024-06
1.6	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A	N/A
1.7	FSW43	Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	103779	2022-11	2024-11
1.8	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
1.9	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
1.10	4HC1600/12750-1.5-KK	High Pass Filter	Trilithic	9942011	N/A	N/A
1.11	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
1.12	HL 562 ULTRALOG	Biconical-log-per Antenna (30 MHz - 3 GHz)	Rohde & Schwarz GmbH & Co. KG	100609	2022-06	2025-06
1.13	VLFX-650+	Low Pass Filter DC650 MHz	Mini-Circuits	15542	N/A	N/A
1.14	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008	N/A	N/A
1.15	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	N/A	N/A
1.16	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
1.17	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-	N/A	N/A
1.18	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
1.19	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2021-09	2024-09
1.20	CMW500	Callbox OIL-RE, SUW	Rohde & Schwarz GmbH & Co. KG	155999-Ei	2023-01	2026-01

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.21	CMU 200	"CMU2" Universal Radio Communica tion Tester	Rohde & Schwarz GmbH & Co. KG	837983/052	2021-11	2024-11

- 1 Radiated Emissions SAC up to 1 GHz
 Radiated emission tests up to 1 GHz in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
1.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufth Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.3	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101424	2023-01	2025-01
1.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
1.5	HL 562 ULTRALOG	Biconical-log- per antenna (30 MHz - 3 GHz) with HL 562E biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003	2021-09	2024-09
1.6	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
1.7	Opus10 THI (8152.00)	T/H Logger 10	Lufth Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
1.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
1.9	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
1.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2024-10
1.11	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/1192 0513	N/A	N/A

The calibration interval is the time interval between "Last Calibration" and "Calibration Due"

6.2 TEST EQUIPMENT SOFTWARE

Semi-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
INNCO Mast Controller	1.02.62
MATURO Mast Controller	12.19
MATURO Turn-Table Controller	30.10
Fully-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
MATURO Turn-Unit Cotrolller	11.10
MATURO Mast Controller	12.10
MATURO Turntable Controller	12.11
Conducted AC Emissions:	
Software	Version
EMC32 Measurement Software	10.60.20

7 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.

7.1 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

$$U_{\text{LISN}} (\text{dB } \mu\text{V}) = U (\text{dB } \mu\text{V}) + \text{Corr. (dB)}$$

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.

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

Frequency MHz	AF HFH-Z2) dB (1/m)	Corr. dB	cable loss 1 (inside chamber) dB	cable loss 2 (outside chamber) dB	cable loss 3 (switch unit) dB	cable loss 4 (to receiver) dB	distance corr. (-40 dB/ decade) dB	d _{Limit} (meas. distance (limit) m	d _{used} (meas. distance (used) 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values

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

($d_{\text{Limit}} = 3 \text{ m}$)

Frequency	AF R&S HL562	Corr.
MHz	dB (1/m)	dB
30	18.6	0.6
50	6.0	0.9
100	9.7	1.2
150	7.9	1.6
200	7.6	1.9
250	9.5	2.1
300	11.0	2.3
350	12.4	2.6
400	13.6	2.9
450	14.7	3.1
500	15.6	3.2
550	16.3	3.5
600	17.2	3.5
650	18.1	3.6
700	18.5	3.6
750	19.1	4.1
800	19.6	4.1
850	20.1	4.4
900	20.8	4.7
950	21.1	4.8
1000	21.6	4.9

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))
dB	dB	dB	dB	dB	m	m
0.29	0.04	0.23	0.02	0.0	3	3
0.39	0.09	0.32	0.08	0.0	3	3
0.56	0.14	0.47	0.08	0.0	3	3
0.73	0.20	0.59	0.12	0.0	3	3
0.84	0.21	0.70	0.11	0.0	3	3
0.98	0.24	0.80	0.13	0.0	3	3
1.04	0.26	0.89	0.15	0.0	3	3
1.18	0.31	0.96	0.13	0.0	3	3
1.28	0.35	1.03	0.19	0.0	3	3
1.39	0.38	1.11	0.22	0.0	3	3
1.44	0.39	1.20	0.19	0.0	3	3
1.55	0.46	1.24	0.23	0.0	3	3
1.59	0.43	1.29	0.23	0.0	3	3
1.67	0.34	1.35	0.22	0.0	3	3
1.67	0.42	1.41	0.15	0.0	3	3
1.87	0.54	1.46	0.25	0.0	3	3
1.90	0.46	1.51	0.25	0.0	3	3
1.99	0.60	1.56	0.27	0.0	3	3
2.14	0.60	1.63	0.29	0.0	3	3
2.22	0.60	1.66	0.33	0.0	3	3
2.23	0.61	1.71	0.30	0.0	3	3

($d_{\text{Limit}} = 10 \text{ m}$)

30	18.6	-9.9
50	6.0	-9.6
100	9.7	-9.2
150	7.9	-8.8
200	7.6	-8.6
250	9.5	-8.3
300	11.0	-8.1
350	12.4	-7.9
400	13.6	-7.6
450	14.7	-7.4
500	15.6	-7.2
550	16.3	-7.0
600	17.2	-6.9
650	18.1	-6.9
700	18.5	-6.8
750	19.1	-6.3
800	19.6	-6.3
850	20.1	-6.0
900	20.8	-5.8
950	21.1	-5.6
1000	21.6	-5.6

0.29	0.04	0.23	0.02	-10.5	10	3
0.39	0.09	0.32	0.08	-10.5	10	3
0.56	0.14	0.47	0.08	-10.5	10	3
0.73	0.20	0.59	0.12	-10.5	10	3
0.84	0.21	0.70	0.11	-10.5	10	3
0.98	0.24	0.80	0.13	-10.5	10	3
1.04	0.26	0.89	0.15	-10.5	10	3
1.18	0.31	0.96	0.13	-10.5	10	3
1.28	0.35	1.03	0.19	-10.5	10	3
1.39	0.38	1.11	0.22	-10.5	10	3
1.44	0.39	1.20	0.19	-10.5	10	3
1.55	0.46	1.24	0.23	-10.5	10	3
1.59	0.43	1.29	0.23	-10.5	10	3
1.67	0.34	1.35	0.22	-10.5	10	3
1.67	0.42	1.41	0.15	-10.5	10	3
1.87	0.54	1.46	0.25	-10.5	10	3
1.90	0.46	1.51	0.25	-10.5	10	3
1.99	0.60	1.56	0.27	-10.5	10	3
2.14	0.60	1.63	0.29	-10.5	10	3
2.22	0.60	1.66	0.33	-10.5	10	3
2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + \text{AF (dB 1/m)} + \text{Corr. (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.

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

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
1000	24.4	-19.4
2000	28.5	-17.4
3000	31.0	-16.1
4000	33.1	-14.7
5000	34.4	-13.7
6000	34.7	-12.7
7000	35.6	-11.0

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)		
dB	dB	dB	dB		
0.99	0.31	-21.51	0.79		
1.44	0.44	-20.63	1.38		
1.87	0.53	-19.85	1.33		
2.41	0.67	-19.13	1.31		
2.78	0.86	-18.71	1.40		
2.74	0.90	-17.83	1.47		
2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
3000	31.0	-23.4
4000	33.1	-23.3
5000	34.4	-21.7
6000	34.7	-21.2
7000	35.6	-19.8

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
dB	dB	dB	dB	dB	
0.47	1.87	0.53	-27.58	1.33	
0.56	2.41	0.67	-28.23	1.31	
0.61	2.78	0.86	-27.35	1.40	
0.58	2.74	0.90	-26.89	1.47	
0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
7000	35.6	-57.3
8000	36.3	-56.3
9000	37.1	-55.3
10000	37.5	-56.2
11000	37.5	-55.3
12000	37.6	-53.7
13000	38.2	-53.5
14000	39.9	-56.3
15000	40.9	-54.1
16000	41.3	-54.1
17000	42.8	-54.4
18000	44.2	-54.7

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)
dB	dB	dB	dB	dB	dB
0.56	1.28	-62.72	2.66	0.94	1.46
0.69	0.71	-61.49	2.84	1.00	1.53
0.68	0.65	-60.80	3.06	1.09	1.60
0.70	0.54	-61.91	3.28	1.20	1.67
0.80	0.61	-61.40	3.43	1.27	1.70
0.84	0.42	-59.70	3.53	1.26	1.73
0.83	0.44	-59.81	3.75	1.32	1.83
0.91	0.53	-63.03	3.91	1.40	1.77
0.98	0.54	-61.05	4.02	1.44	1.83
1.23	0.49	-61.51	4.17	1.51	1.85
1.36	0.76	-62.36	4.34	1.53	2.00
1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + \text{Corr. (dB)}$

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.

7.5 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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.

7.6 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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 = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

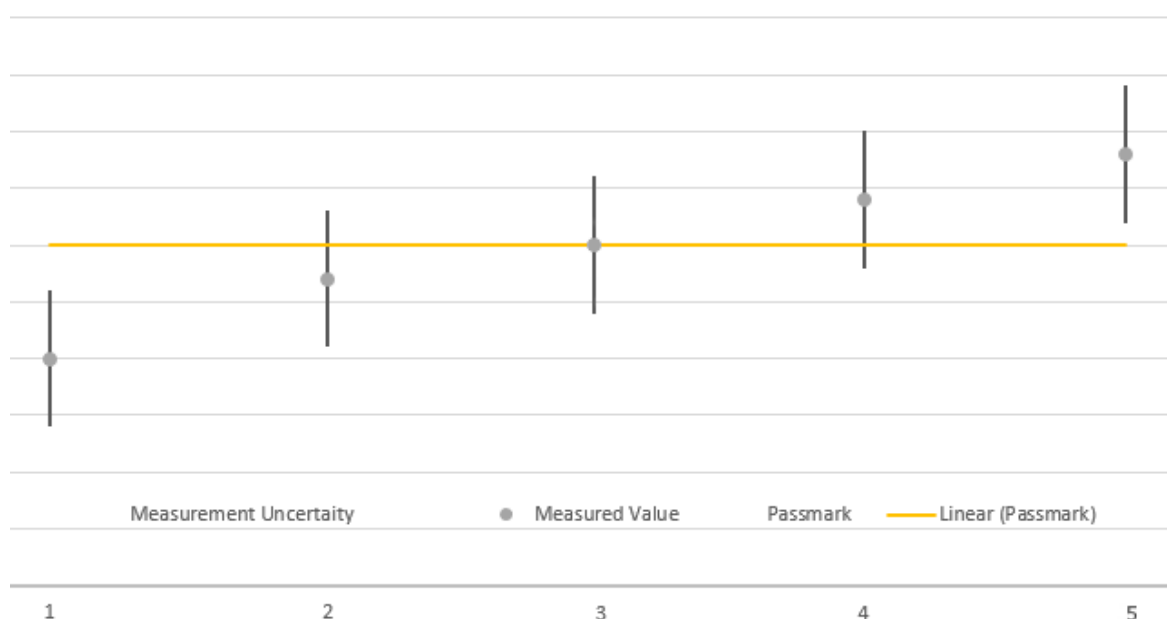
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

8 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	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	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.

9 PHOTO REPORT

Please see separate photo report.