

# Test report

**407658-5TRFWL**

Date of issue: 2020-11-04

Applicant:

**Gimasi SA**

**Piazzale Roncàa, 4 – 6850 Mendrisio – Switzerland**

Product:

**TheNODE**

Model:

**THE NODE**

Variants:

**TheNODE IO, TheNODE LCD**

FCC ID:

**2AXU7-THENODE**

IC:

**26592-THENODE**

Specifications:

◆ **FCC 47 CFR Part 27 Subpart C**

MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES – Technical Standards

◆ **RSS-130, Issue 2 (February 2019)**

Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz

◆ **RSS-139, Issue 3 (July 2015)**

Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz

◆ **RSS Gen, Issue 5 (April 2018), Amendment 1 (March 2019)**

General Requirements for Compliance of Radio Apparatus

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*The test report merely corresponds to the tested sample.*

*The phase of sampling / collection of equipment under test is carried out by the customer.*

#### Test location

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Province	MB
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Registration number:	FCC: 682159; IC: 9109A

Date of issue: 2020-04-11

Tested by  
(name, function and signature)

P. Barbieri

(project handler) Signature:



Reviewed by  
(name, function and signature)

D. Guarnone

(verifier) Signature:



#### Limits of responsibility

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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Spa ISO/IEC 17025 accreditation.

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## Section 1. Report summary

### 1.1 Applicant and manufacturer

Company name	Gimasi SA
Address	Piazzale Roncàa, 4
City	Mendrisio
State	Switzerland
Postal/Zip code	6850

### 1.2 Test specifications

FCC 47 CFR Part 27 Subpart C	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES – Technical Standards
RSS-130, Issue 2 (February 2019)	Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
RSS-139, Issue 3 (July 2015)	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz
RSS Gen, Issue 5 (April 2018), Amendment 1 (March 2019)	General Requirements for Compliance of Radio Apparatus

### 1.3 Test methods

ANSI C63.26 v2015 KDB 971168 D01 v03r01	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services Power Meas License Digital Systems
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### 1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

### 1.5 Exclusions

None

### 1.6 Test report revision history

Revision #	Details of changes made to test report
407658-5TRFWL	Original report issued

## Section 2. Summary of test results

### 2.1 FCC Part 27C

RSS-130, Issue 2 (February 2019)

RSS-139, Issue 3 (July 2015)

RSS Gen, Issue 5 (April 2018), Amendment 1 (March 2019)

Part	Test method	Test description	Verdict
27.50 (c)(10) 27.50 (d)(4) RSS-130, §4.6 RSS-139, §6.5	ANSI C63.26 § 5 KDB 971168 D01 v03r01 § 5.8	Effective Isotropic Radiated Power	Pass
27.53 (g) 2.1053(h) RSS-130, §4.7 RSS-139, §6.6 RSS Gen	ANSI C63.26 § 5 KDB 971168 D01 v03r01 § 7	Radiated Spurious Emission	Pass

## Section 3. Equipment under test (EUT) details

### 3.1 Sample information

Receipt date	2020-10-22
Nemko sample ID number	4076580003

### 3.2 EUT information

Product name	TheNODE
Model	TheNODE
Model variant	TheNODE IO, TheNODE LCD
Serial number	864475040481649

### 3.3 Technical information

Frequency band	LTE Band 4	LTE Band 12
Frequency Min (MHz)	TX: 1710 / RX: 2110	TX: 699 / RX: 729
Frequency Max (MHz)	TX: 1755 / RX: 2150	TX: 716 / RX: 746
RF power EIRP (dBm)	22.8	21.0
Type of modulation	QPSK	QPSK
Transmitter spurious, Units @ distance	-36.7 dBm @ 3 m	-22.3 dBm @ 3m
Power requirements	7 to 48 V DC	
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.  Antenna type: Antenova SR4L034L with 3.5 dBi gain for LTE Band 4 and 0.4 dBi gain for LTE Band 12.	

### 3.4 Product description and theory of operation

The EUT is designed for tracking applications. It is available with 2G/NB1/M1 communication, GNSS module and accelerometer/gyroscope for wakeup and movement detection, as well as the standard temperature sensor. The EUT comes with a 1.17" 184x38 Monochrome LCD display and an RGB led. On the display working information and configuration data can be displayed. The power subsystem is based on a DC power port with a rechargeable 3350mAh battery.

The EUT use the Quectel BG95-M3 radio module separately approved.

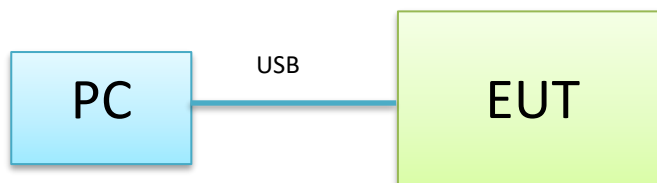
### 3.5 EUT exercise details

TX mode forced by AT commands as following:

```
AT+QRFTESTMODE=1
AT+QRFTEST="LTE BAND12",23095,"ON",100,1
AT+QRFTEST="LTE BAND4",20175,"ON",100,1
```

### 3.6 EUT setup diagram

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### 3.7 EUT sub assemblies

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Description	Brand name	Model/Part number	Serial number
Radio module	Quectel	BG95-M3	--

## **Section 4. Engineering considerations**

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### **4.1 Modifications incorporated in the EUT**

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

### **4.2 Technical judgment**

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None

### **4.3 Deviations from laboratory tests procedures**

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No deviations were made from laboratory procedures.



## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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In the laboratory, the following ambient conditions are respected for each test reported below:

Temperature	18 – 33 °C
Relative humidity	25 – 70 %
Air pressure	860 – 1060 mbar

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	01/2019	01/2021
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	01/2019	01/2021
Barometer	Castle	GPB 3300	072015	12/2019	12/2020

### 5.2 Power supply range

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

## Section 6. Measurement uncertainty

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### 6.1 Uncertainty of measurement

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The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
			0.009 MHz ÷ 18 GHz	3.0 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95 %

## Section 7. Test equipment

### 7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	08/2020	08/2021
EMI receiver (2 Hz ÷ 44 GHz)	Rohde & Schwarz	ESW44	101620	09/2020	09/2021
Spectrum Analyzer (2 Hz ÷ 43 GHz)	Rohde & Schwarz	FSW43	101767	07/2020	07/2021
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	07/2018	07/2021
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	09/2018	09/2021
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137	07/2020	07/2021
Horn antenna (4 ÷ 40 GHz)	RFSpin	DRH40	061106A40	04/2020	04/2023
Preamplifier (18 ÷ 40 GHz)	Sage	STB-1834034030-KFKF-L1	18490-01	03/2020	03/2021
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	09/2019	09/2021
Shielded room	Siemens	10m control room	1947	NCR	NCR

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

## Section 8. Testing data

### 8.1 FCC 27.50 – Effective Isotropic Radiated Power

RSS-130, Issue 2 (February 2019), §4.6 - Transmitter output power and effective radiated power (e.i.r.p.)

RSS-139, Issue 3 (July 2015), §6.5 - Transmitter Output Power

#### 8.1.1 Definitions and limits

##### 27.50(c)

(10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

##### 27.50(d)

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

#### RSS-130, Issue 2 (February 2019), §4.6

4.6.2 Frequency bands 617-652 MHz and 663-698 MHz

The e.i.r.p. shall not exceed 3 watts for mobile equipment, fixed subscriber equipment and portable equipment. For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the equivalent isotropically radiated power (e.i.r.p.) limits.

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.i.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.i.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment. For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

#### RSS-139, Issue 3 (July 2015), §6.5

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt. Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110-2180 MHz.

#### 8.1.2 Test summary

Test date	From 2020-10-30 to 2020-11-02	Temperature	23 °C
Test engineer	P. Barbieri	Air pressure	55 %
Verdict	Pass	Relative humidity	1000 hPa

#### 8.1.3 Observations, settings and special notes

Measurement performed with antenna eight from 1 to 4 m at 3 m distance from the EUT with a rotation of 360 °.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	≥ OBW
Video bandwidth:	≥ 3 x RBW
Detector mode:	RMS
Trace mode:	Power average

#### 8.1.4 Test data

Mode	Channel	Frequency (MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Margin (dB)
LTE Band 4	20175	1732.5	Horizontal	22.8	30.0	-7.2
LTE Band 12	23095	707.5	Horizontal	21.0	34.7	-13.7

## 8.2 FCC 27.50 – Radiated Spurious Emission

RSS-130, Issue 2 (February 2019), §4.7 - Transmitter unwanted emissions

RSS-139, Issue 3 (July 2015), §6.6 - Transmitter Unwanted Emissions

RSS Gen, Issue 5 (April 2018), Amendment 1 (March 2019)

### 8.2.1 Definitions and limits

#### 27.50 (g)

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

#### 27.50 (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.

#### FCC §2.1053 Measurements required: Field strength of spurious radiation.

- (a) 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. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

#### RSS-130, Issue 2 (February 2019), §4.7

##### 4.7.1 General unwanted emissions limits

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least  $43 + 10 \log_{10} p$  (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

##### 4.7.2 Additional unwanted emissions limits

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

$76 + 10 \log_{10} p$  (watts), dB, for base and fixed equipment and

$65 + 10 \log_{10} p$  (watts), dB, for mobile and portable equipment

the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

#### RSS-139, Issue 3 (July 2015), §6.6

In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, Footnote2 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.

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.

### 8.2.2 Test summary

Test date	From 2020-10-30 to 2020-11-02	Temperature	23 °C
Test engineer	P. Barbieri	Air pressure	55 %
Verdict	Pass	Relative humidity	1000 hPar

### 8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic. Radiated measurements were performed at a distance of 3 m. The spurious emissions limit is -13 dBm

Spectrum analyser settings for radiated measurements below 1 GHz:

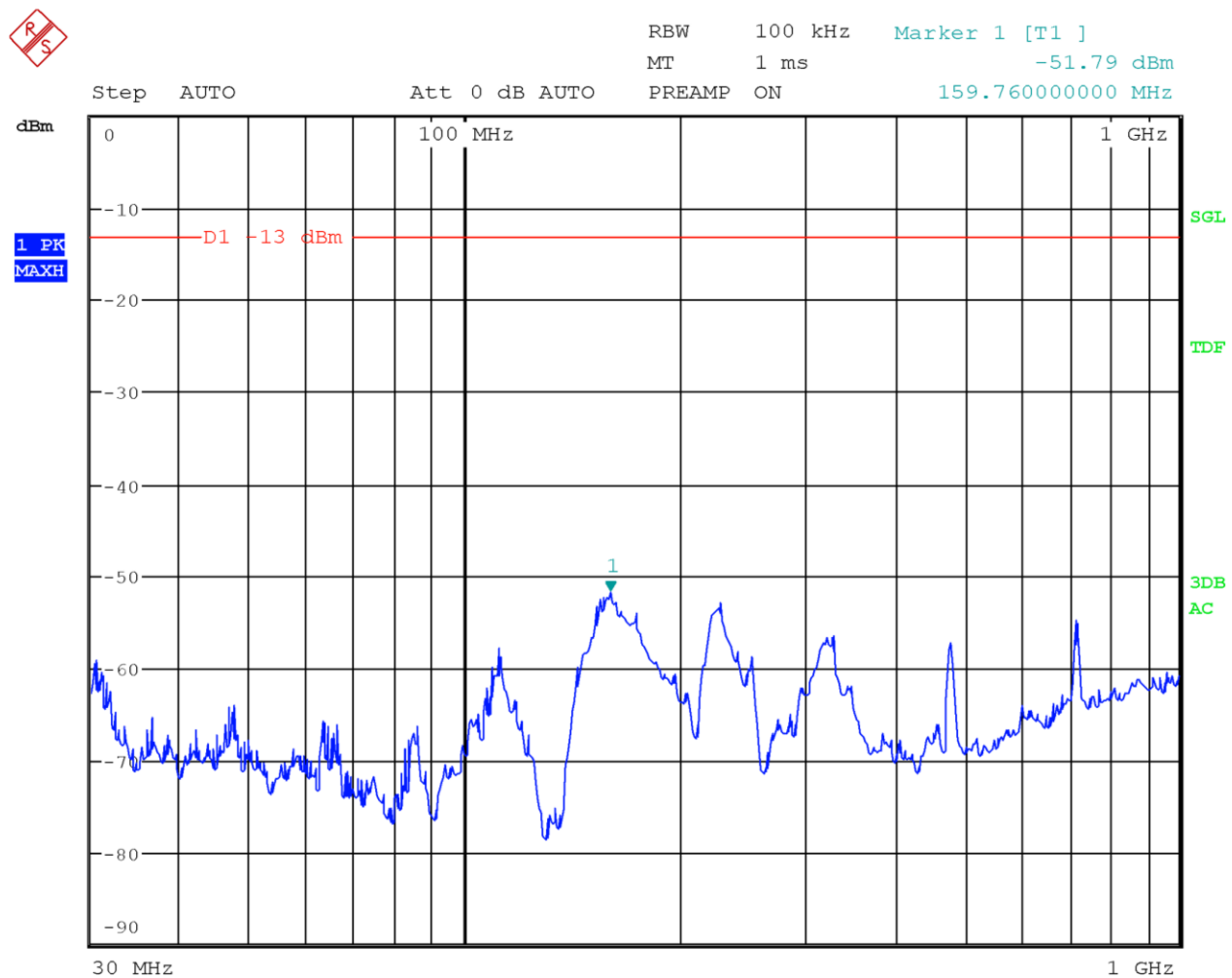
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for radiated measurements below 1 GHz:

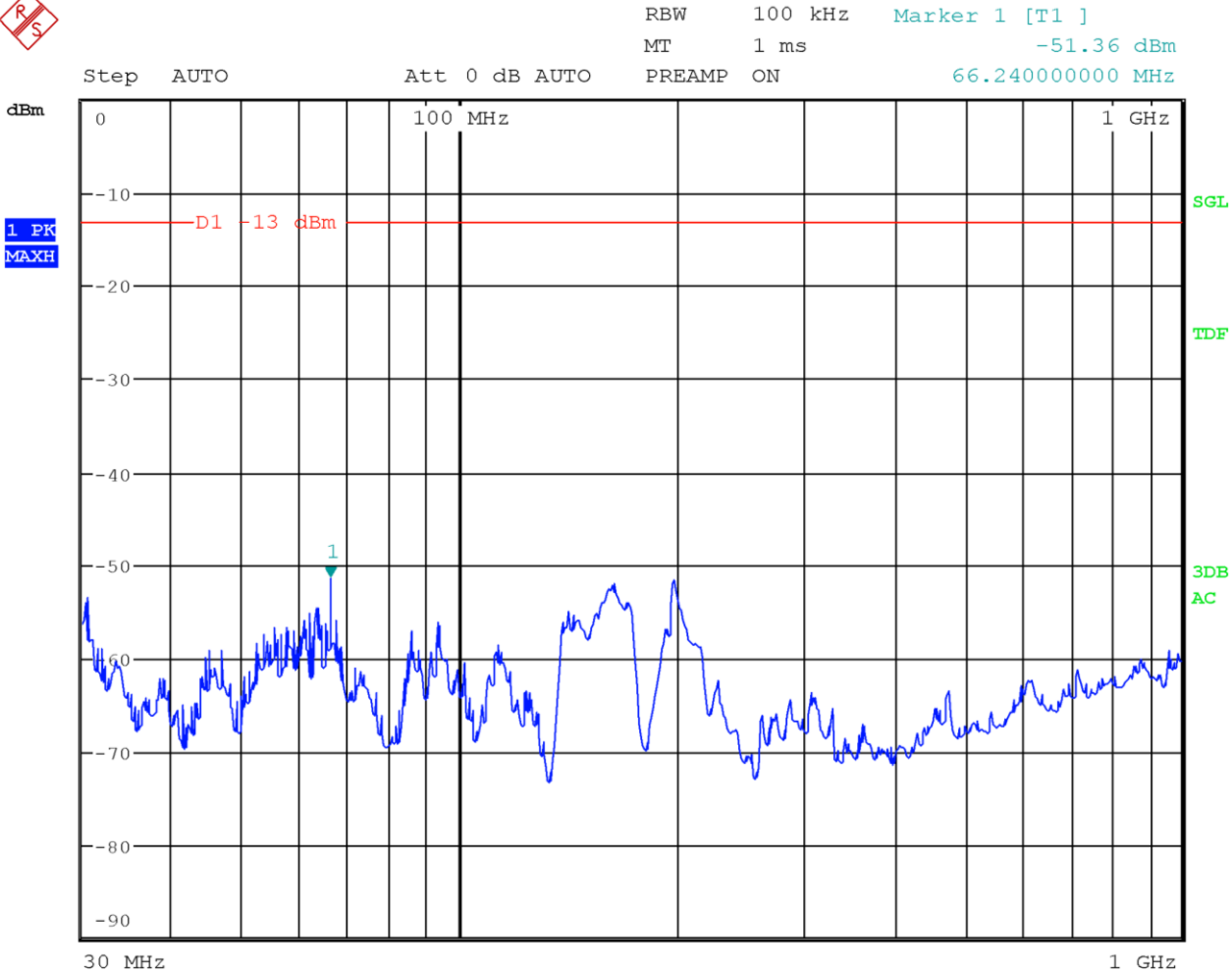
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Final measurement, if any, has been performed in power averaging mode

8.2.4 Test data

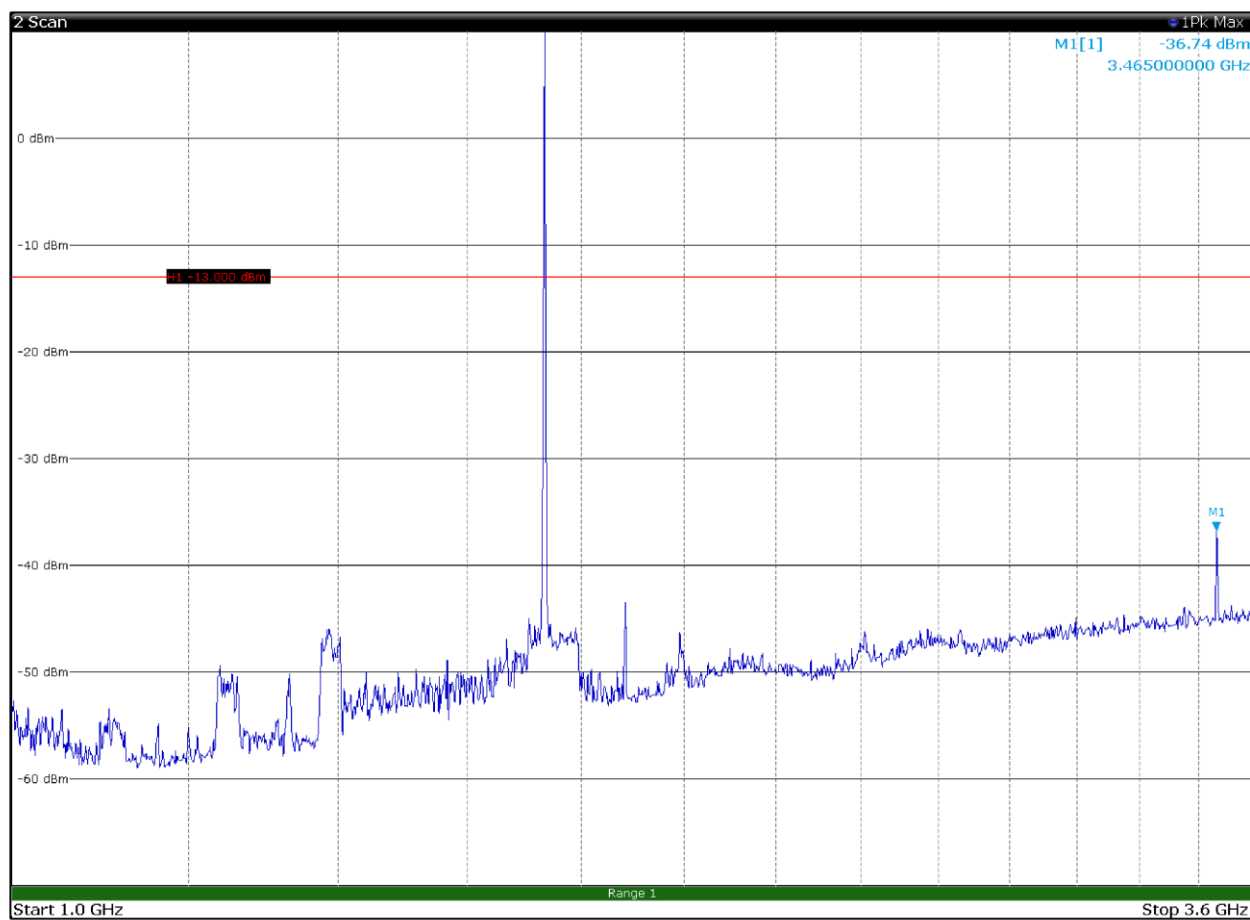


LTE Band 4 – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



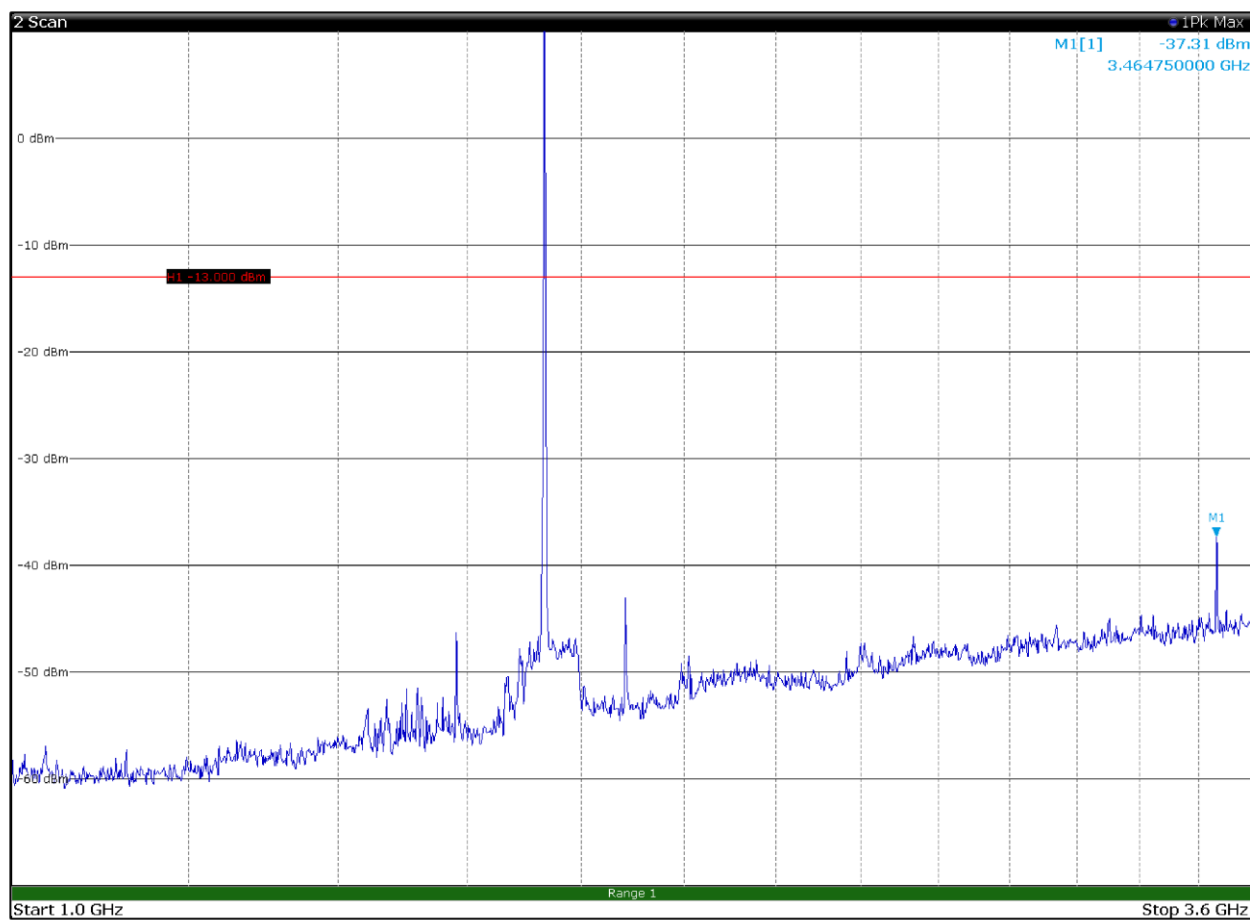
LTE Band 4 – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization





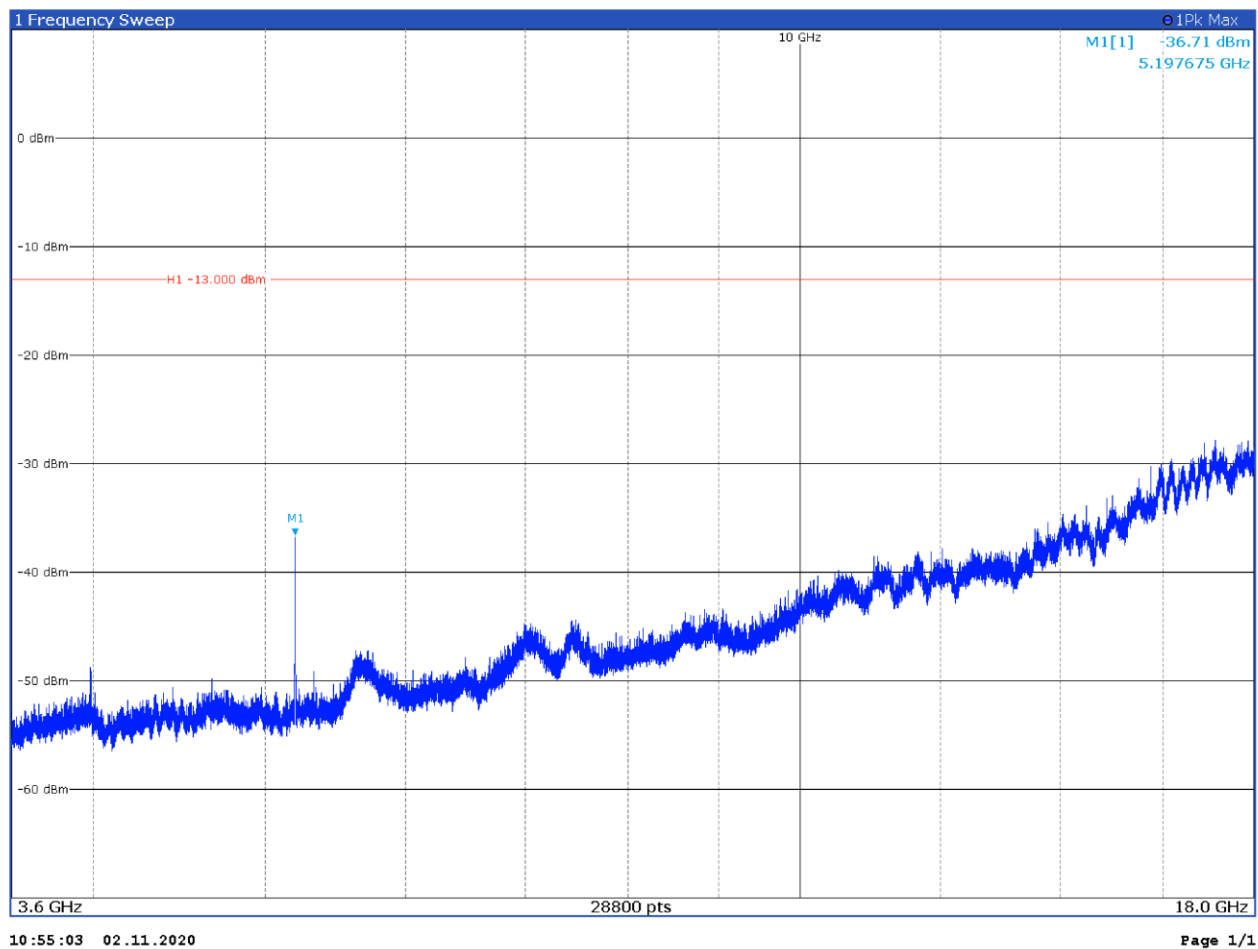
LTE Band 4 – Frequency range 1 GHz to 3.6 GHz with antenna in horizontal polarization

Limit exceeded by the carrier

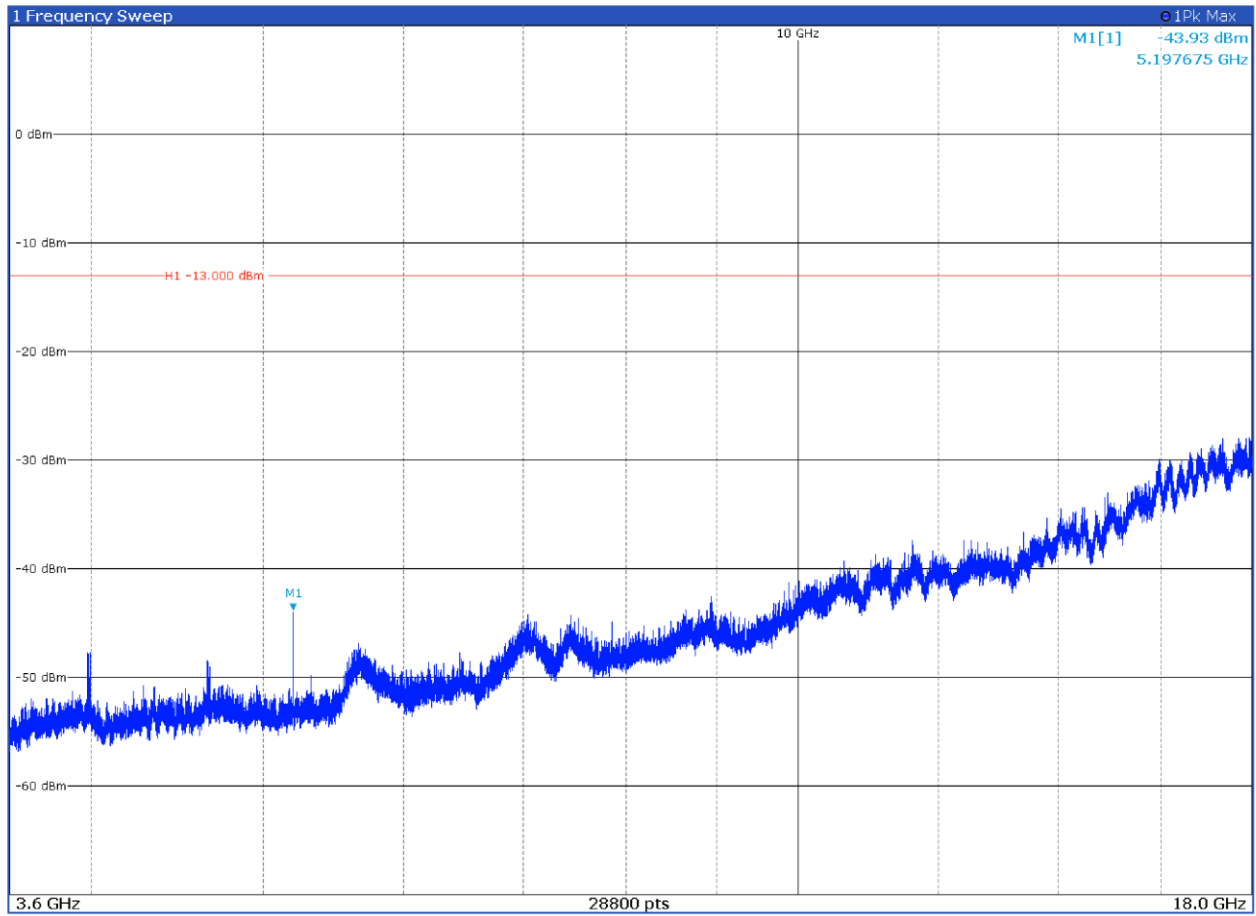


LTE Band 4 – Frequency range 1 GHz to 3.6 GHz with antenna in vertical polarization

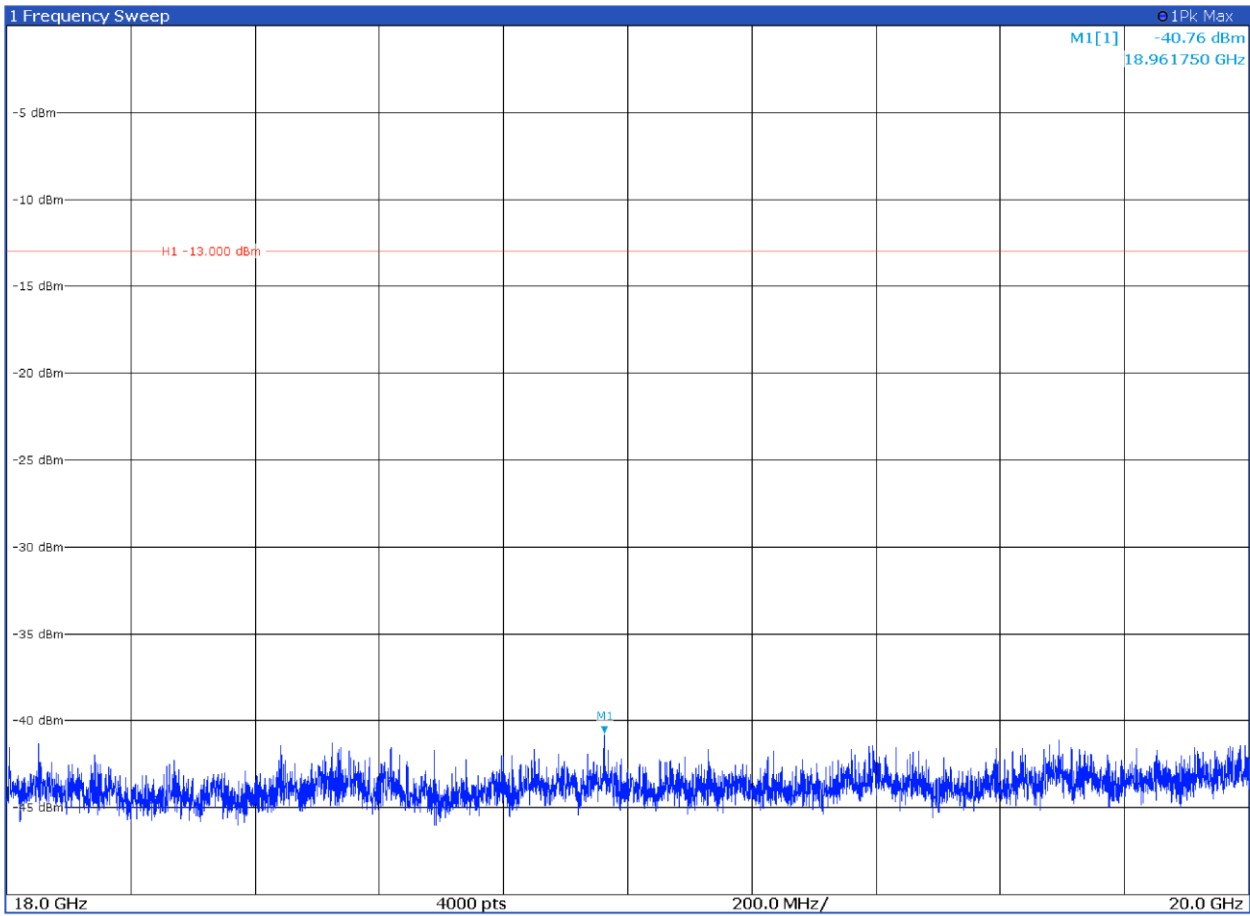
Limit exceeded by the carrier



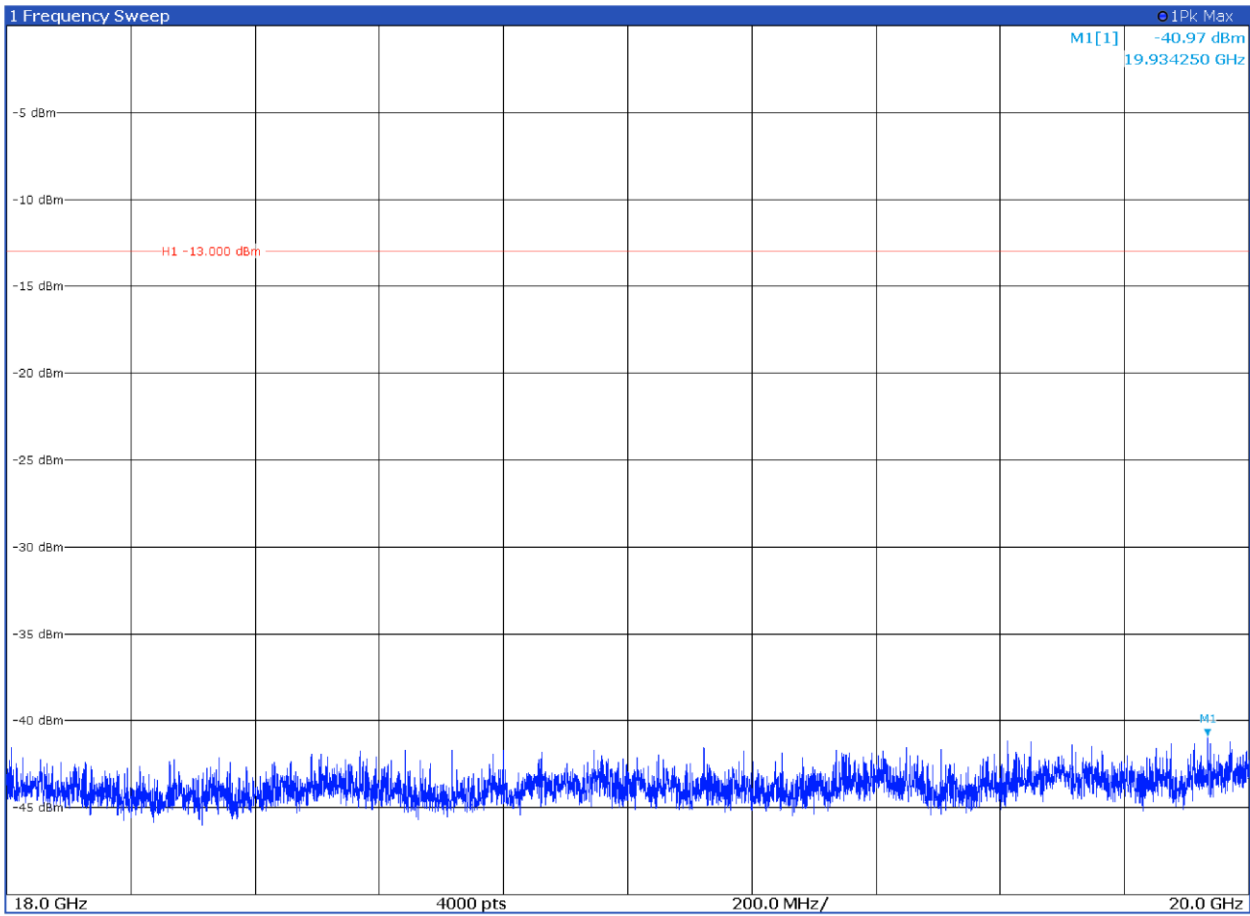
LTE Band 4 – Frequency range 3.6 GHz to 18 GHz with antenna in horizontal polarization



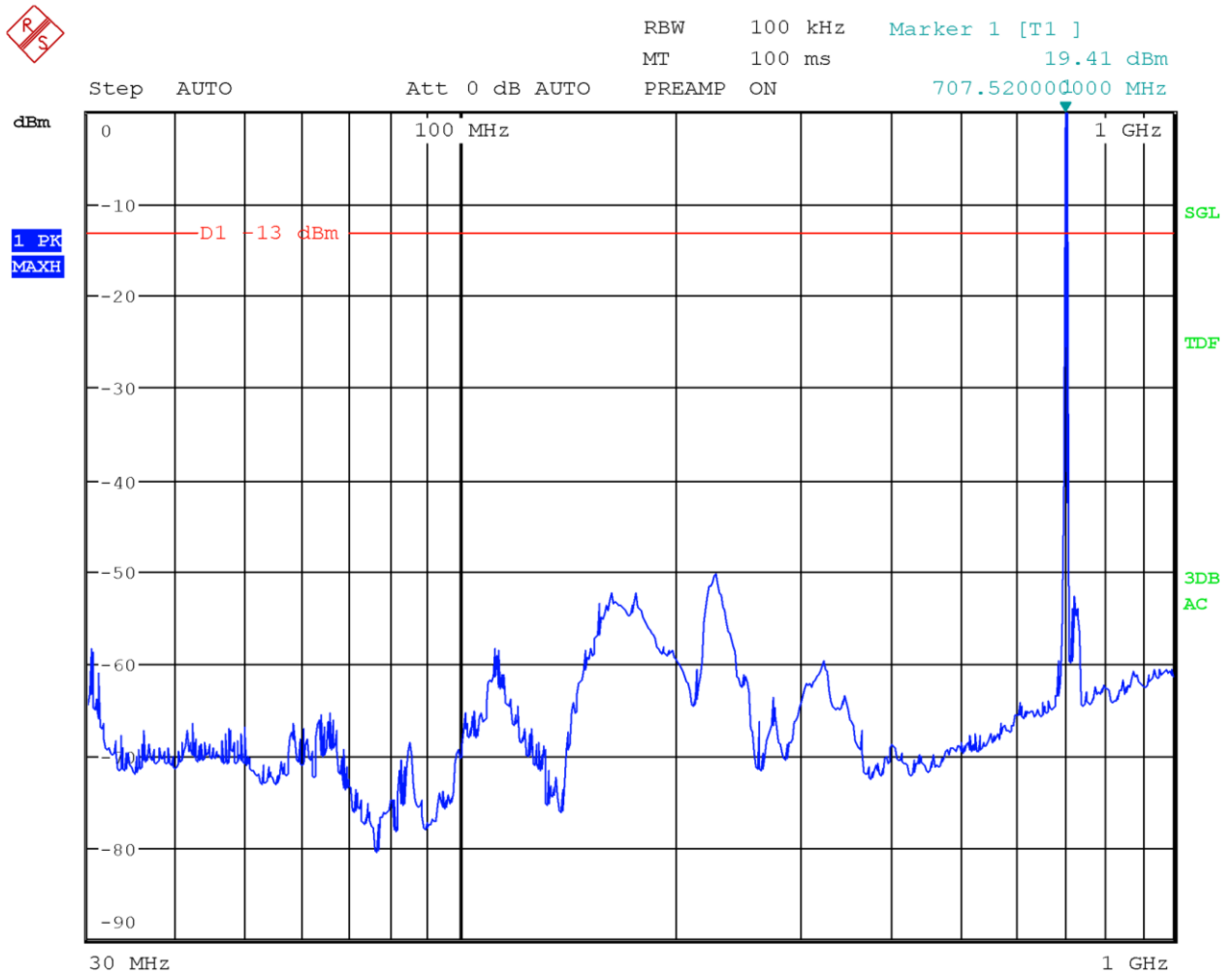
LTE Band 4 – Frequency range 3.6 GHz to 18 GHz with antenna in vertical polarization



LTE Band 4 – Frequency range 18 GHz to 20 GHz with antenna in horizontal polarization

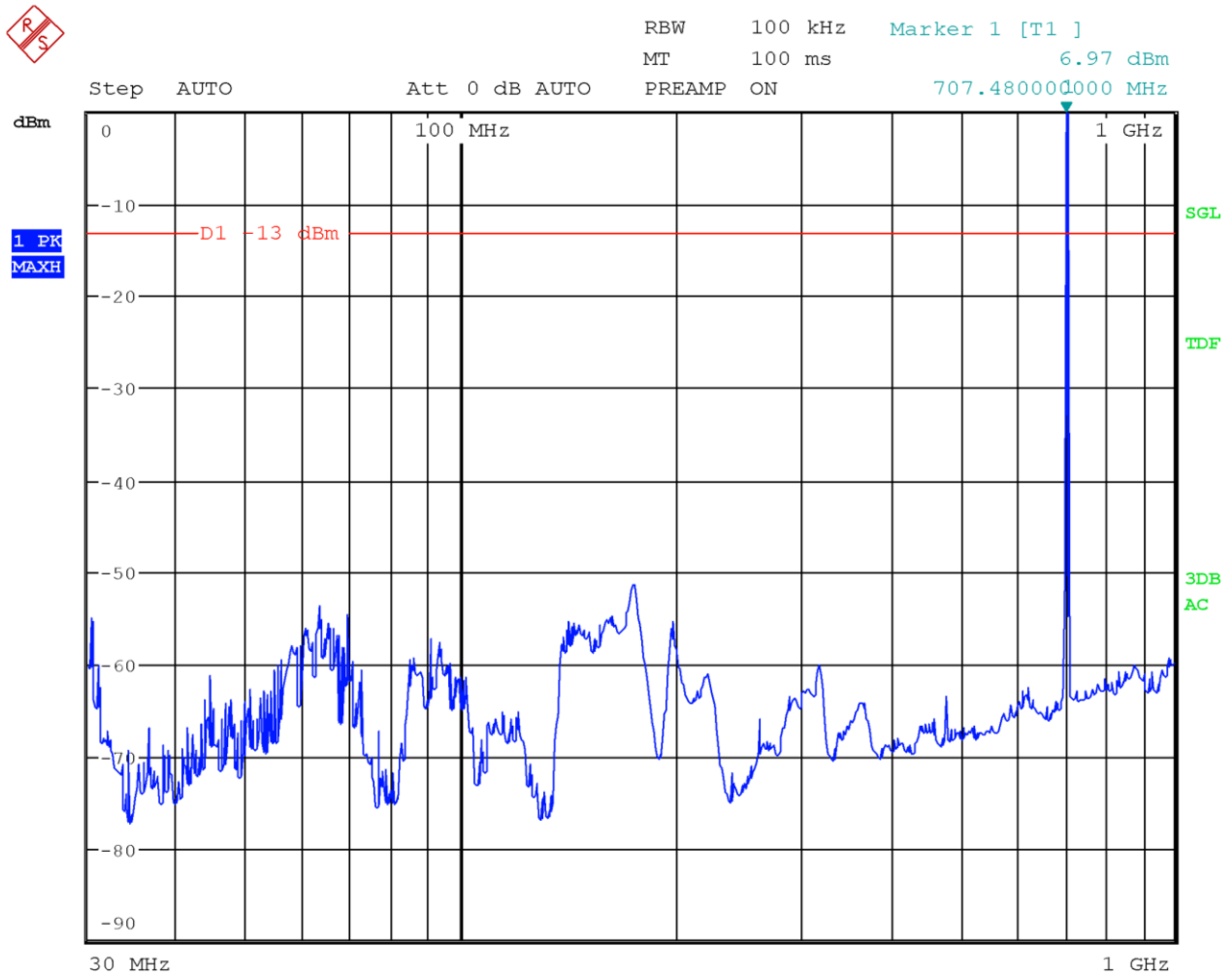


LTE Band 4 – Frequency range 18 GHz to 20 GHz with antenna in vertical polarization



LTE Band 12 – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization

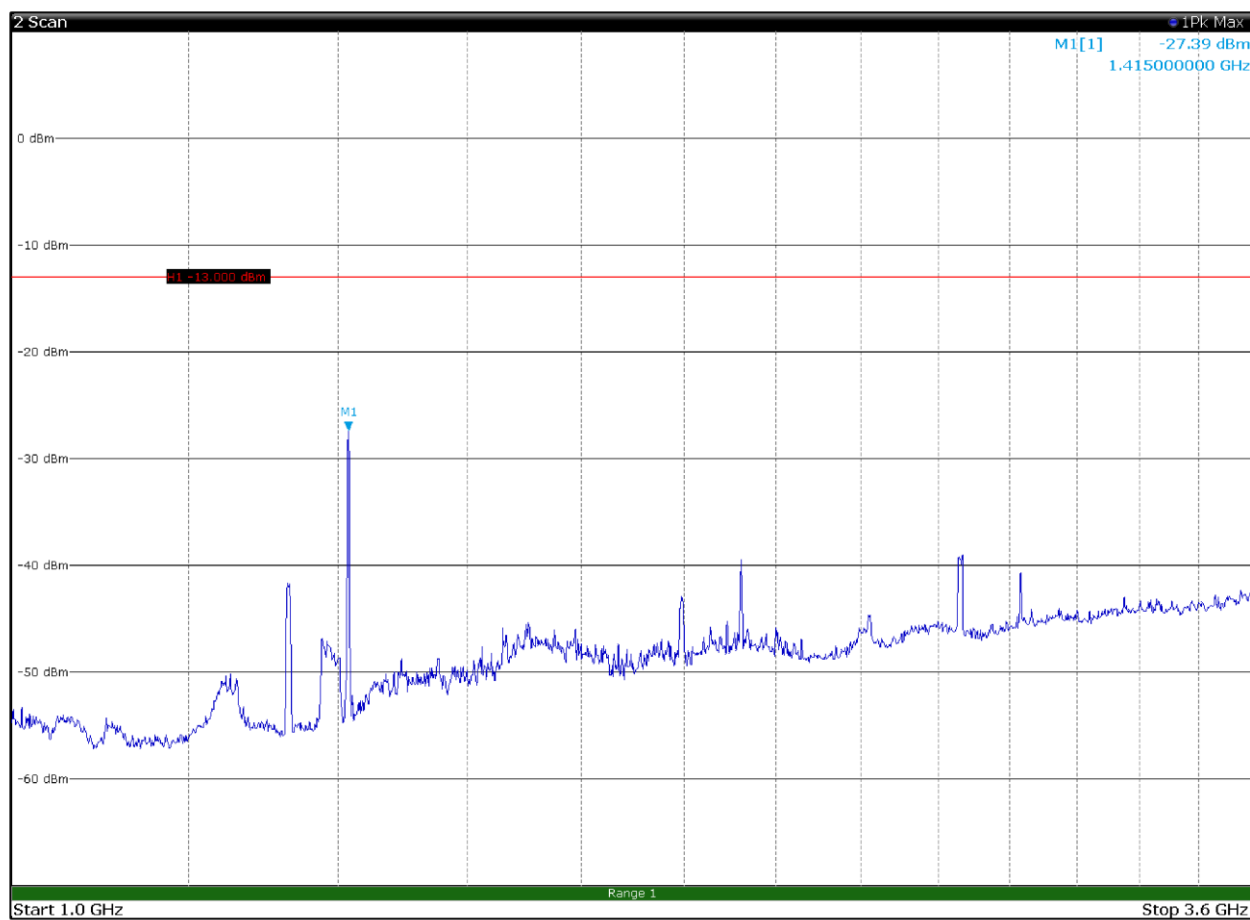
Limit exceeded by the carrier



LTE Band 12 – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization

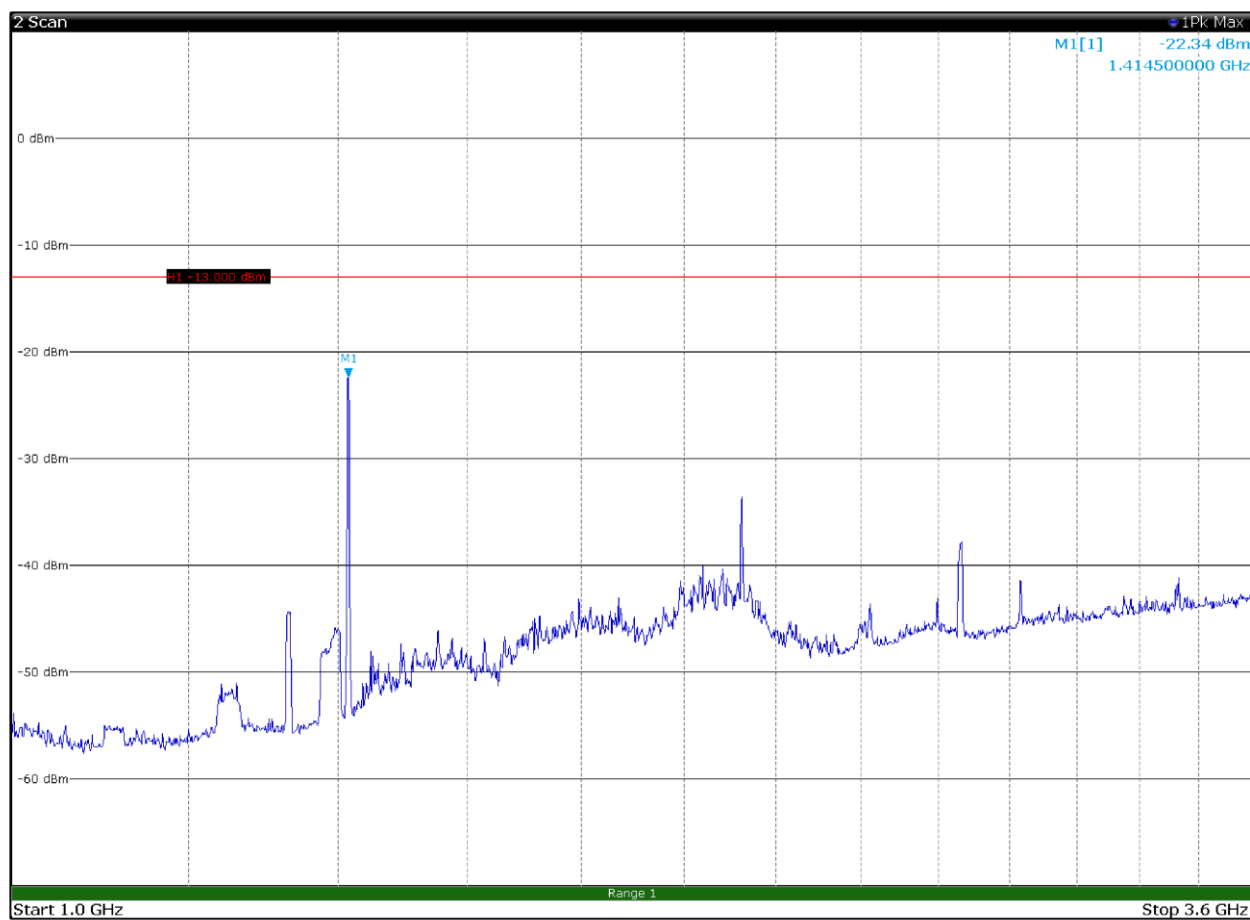
Limit exceeded by the carrier





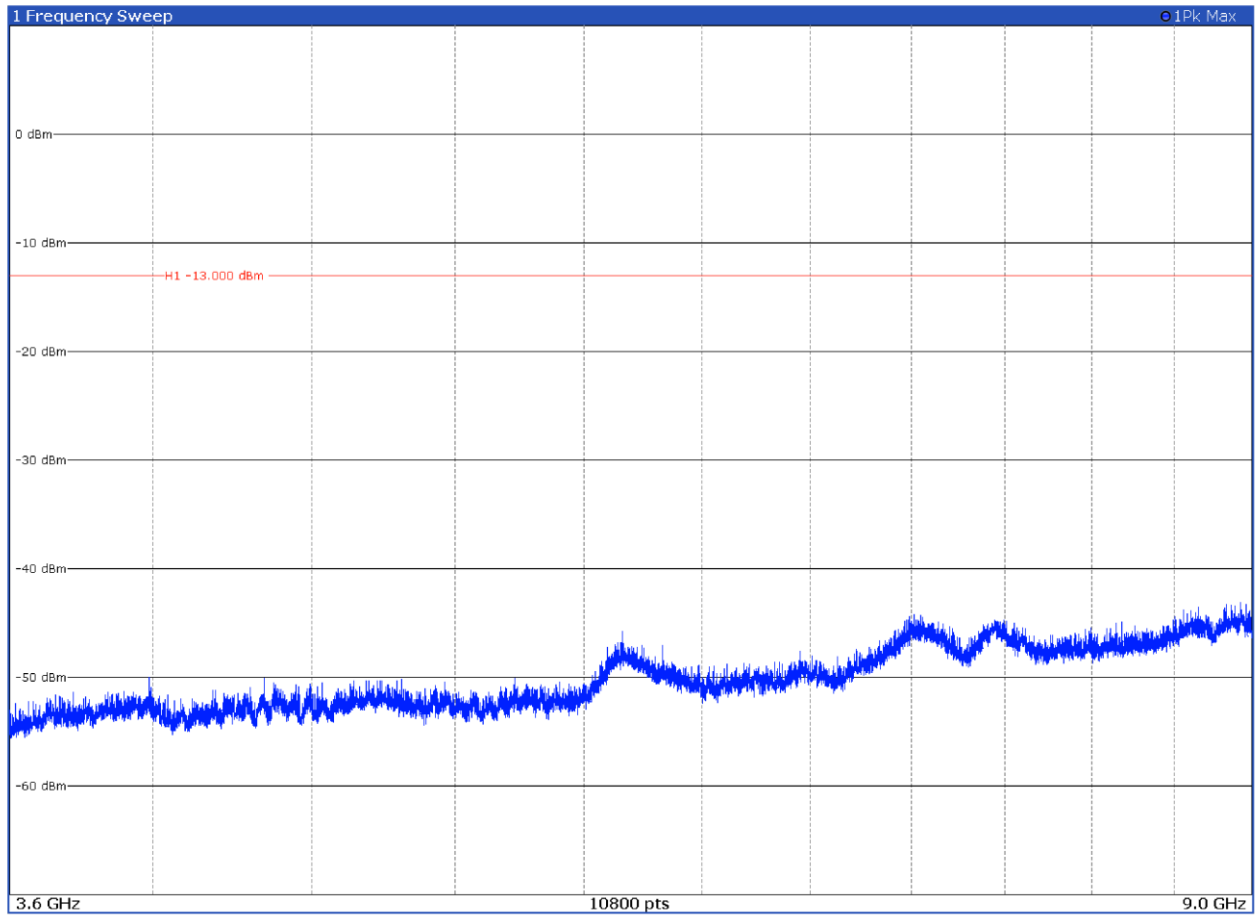
LTE Band 12 – Frequency range 1 GHz to 3.6 GHz with antenna in horizontal polarization

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1415.000	-27.3	-13.0	-14.3

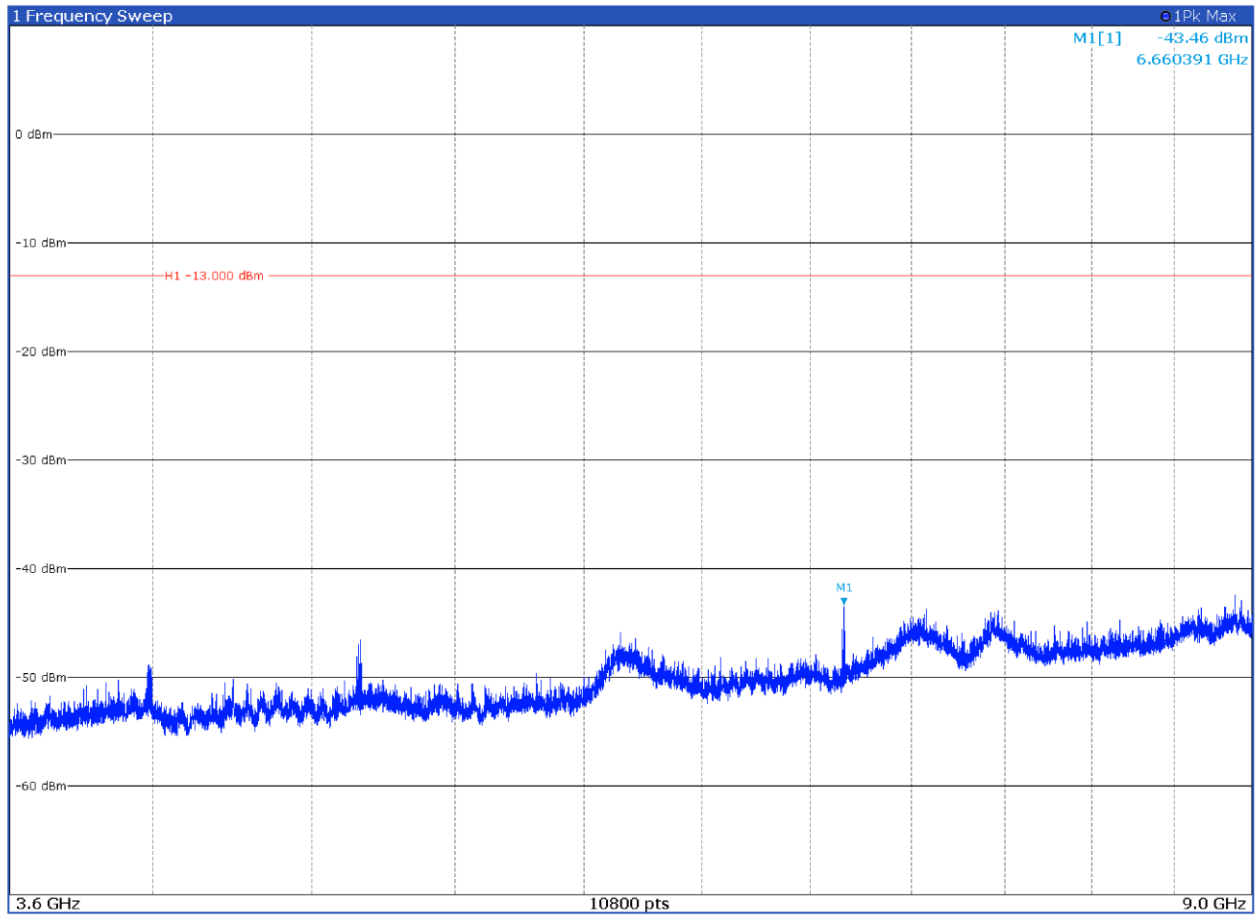


LTE Band 12 – Frequency range 1 GHz to 3.6 GHz with antenna in vertical polarization

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1415.000	-22.3	-13.0	-9.3



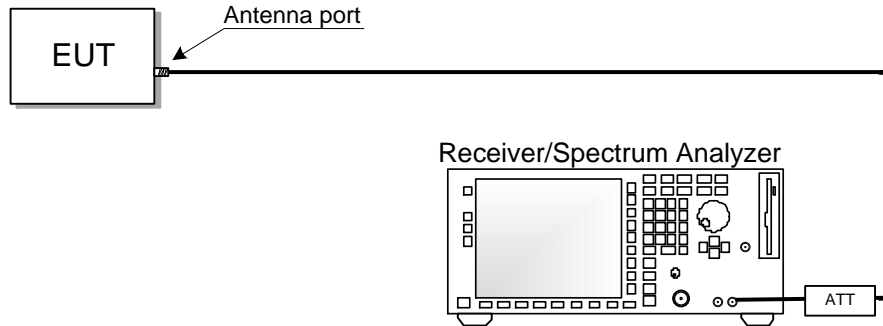
LTE Band 12 – Frequency range 3.6 GHz to 9 GHz with antenna in horizontal polarization



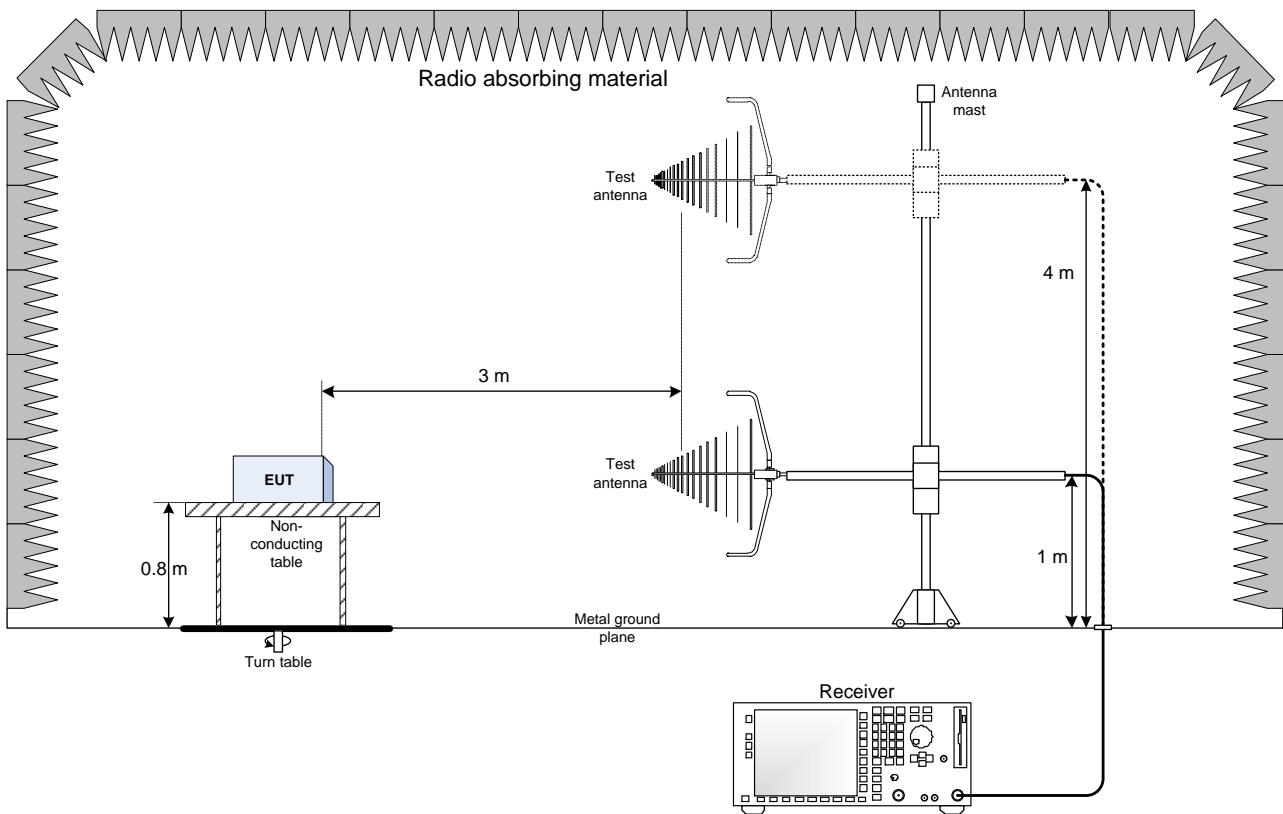
LTE Band 12 – Frequency range 3.6 GHz to 9 GHz with antenna in vertical polarization

## Section 9. Block diagrams of test set-ups

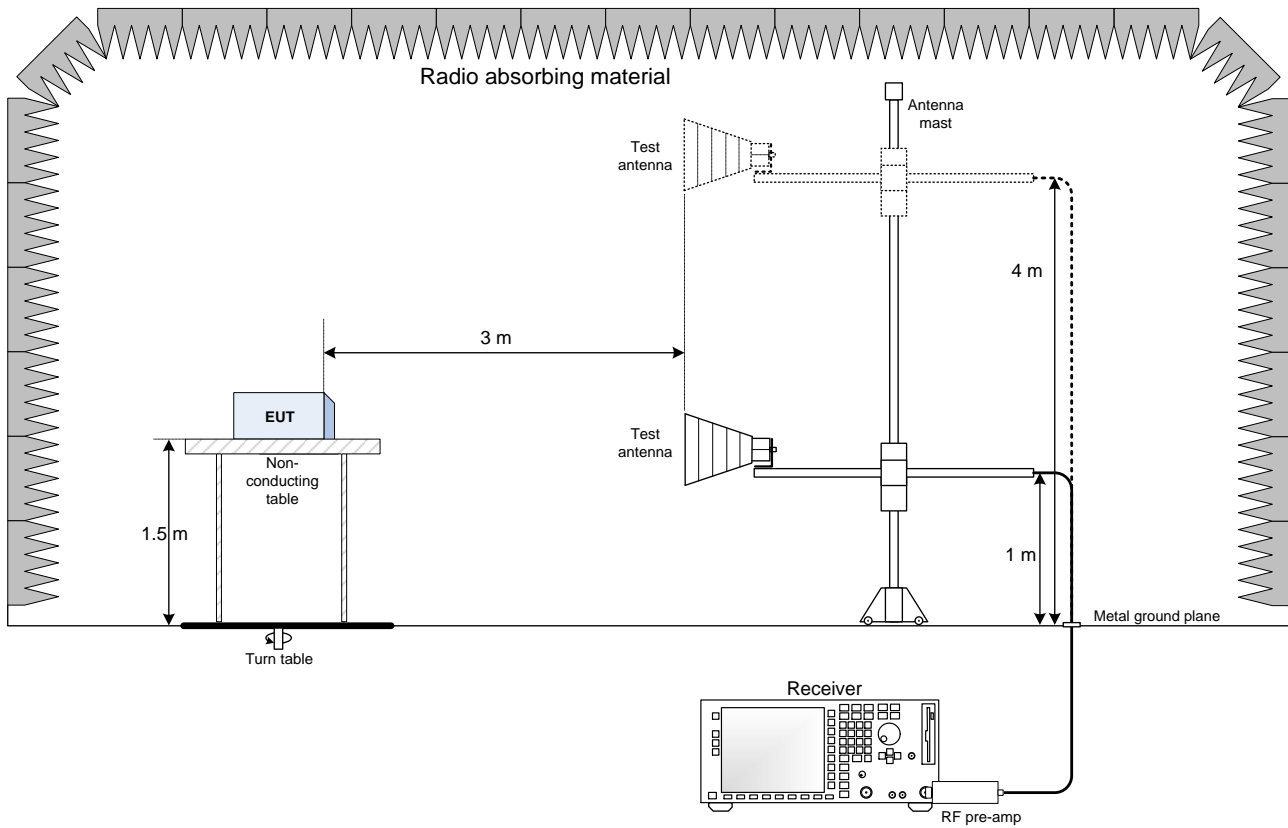
### 9.1 Antenna port set-up



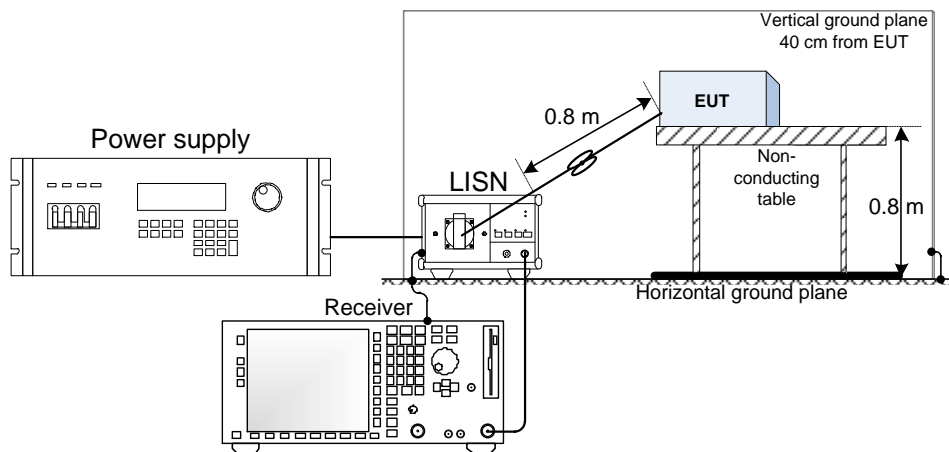
### 9.2 Radiated emissions set-up for frequencies below 1 GHz



### 9.3 Radiated emissions set-up for frequencies above 1 GHz



### 9.4 Conducted emissions set-up

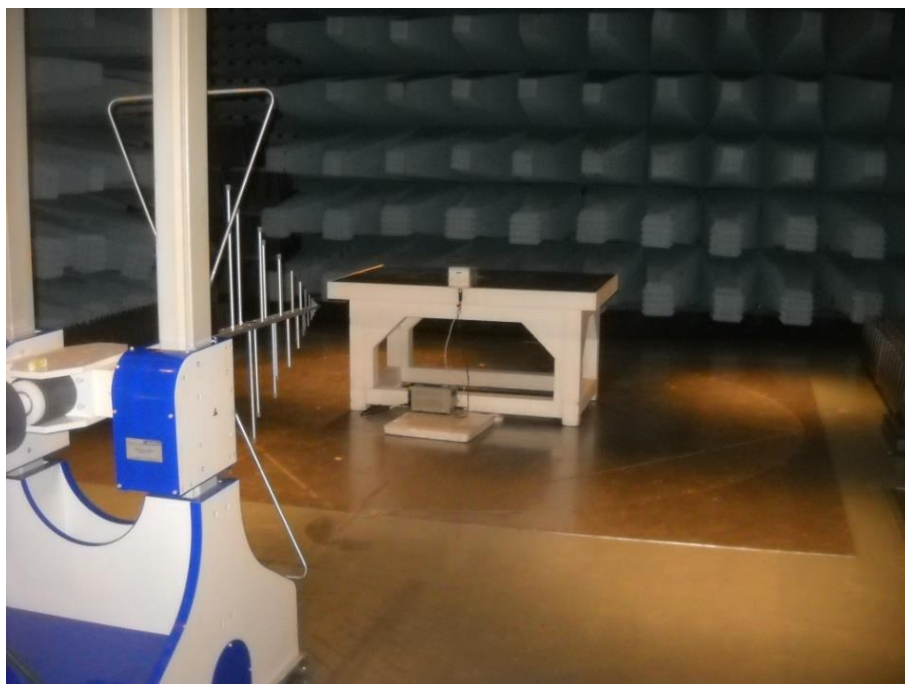


## Section 10. Photos

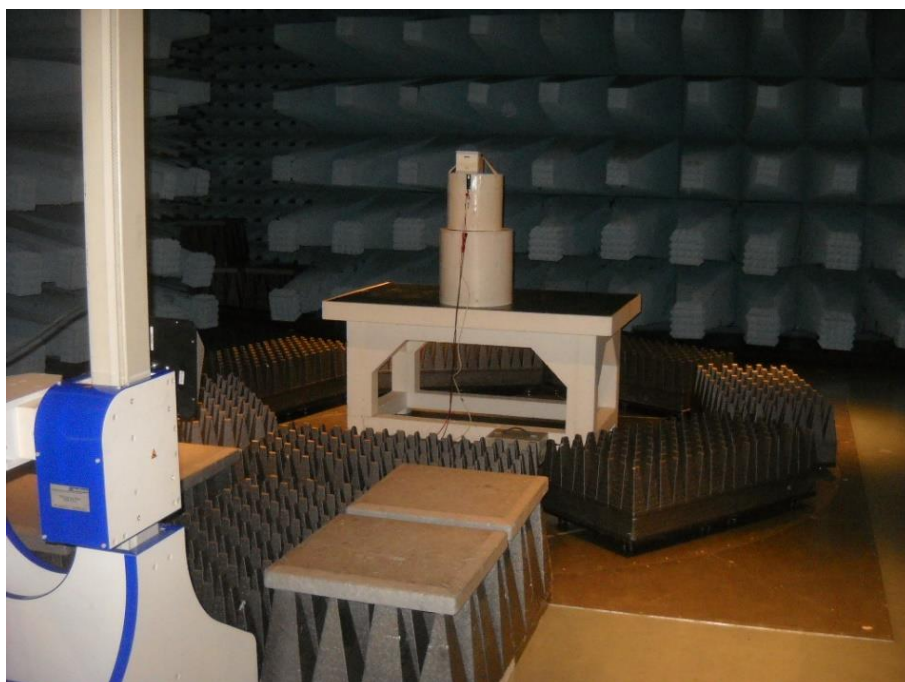
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### 10.1 Photos of the test set-up

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Radiated emission test below 1 GHz



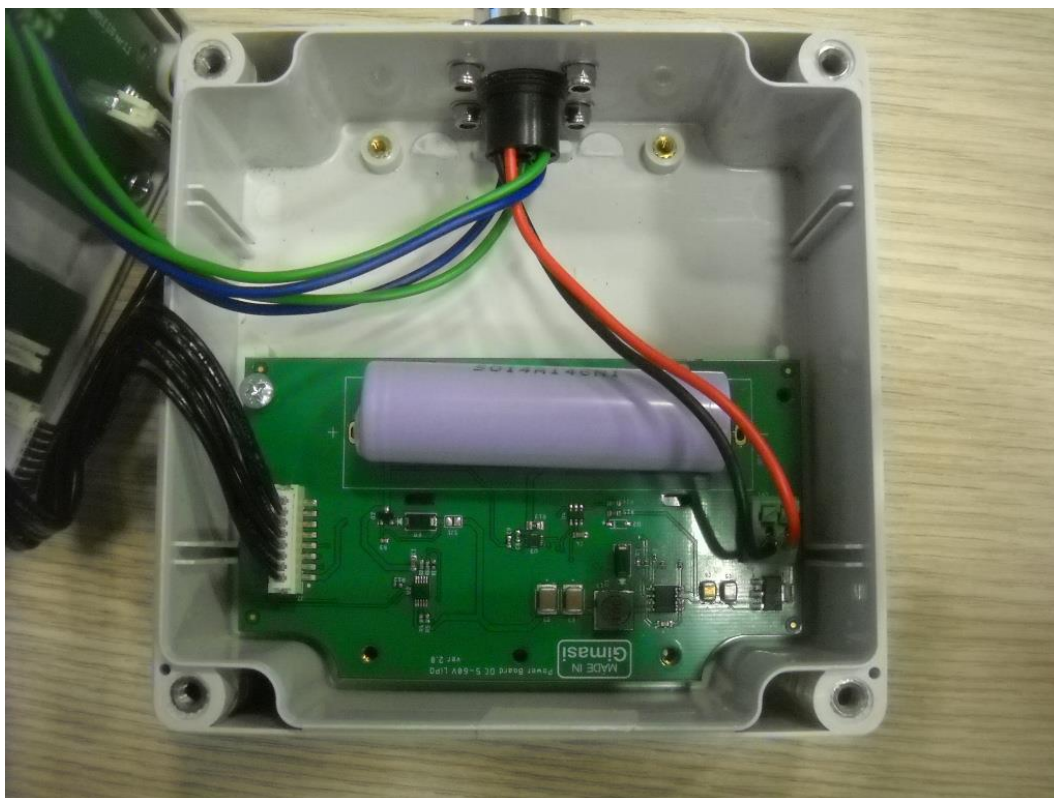
Radiated emission test above 1 GHz

## 10.2 Photos of the EUT

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(End of report)