

Test report No:
 NIE: 62862RRF.002

Partial Test report
REFERENCE STANDARD:
USA FCC Part 27
CANADA RSS-130

| | |
|---|---|
| (*) Identification of item tested | Monarch Go-GPS LTE IoT device embedding a Cat-M B4/13 modem with antenna + a GPS chipset with antenna |
| (*) Trademark | SEQUANS Communications |
| (*) Model and /or type reference | Monarch Go-GPS |
| Other identification of the product | HW Version: Monarch Go-GPS REV3 SW Version: SR1.2.0.0-LTE-10400 FCC ID: 2AAGMGMQGOA IC: 12732A-GMQGOA |
| (*) Features | LTE Cat-M Band 4 and Band 3 GPS/GNSS |
| Applicant | SEQUANS COMMUNICATIONS Portes de la Défense 15-55, Boulevard Charles de Gaulle 92700 Colombes. France. |
| Test method requested, standard | USA FCC Part 27 (10-1-18 Edition). CANADA RSS-130 Issue 2, Feb. 2019. ANSI C63.26-2015. ANSI/TIA-603-E: 2016. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018 |
| Approved by (name / position & signature) | Rafael López EMC LAB Manager |
| Date of issue | 2019-12-10 |
| Report template No | FDT08_22 (*) "Data provided by the client" |

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory competent to carry out the tests described in this report.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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1. This report is only referred to the item that has undergone the test.
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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a Monarch Go-GPS, a LTE IoT device embedding a Cat-M B4/13 modem with antenna + a GPS chipset with antenna.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: the client.

Sample S/01 is composed of the following elements:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|------------|-------------------|----------------|------------------|-------------------|
| 62862/005 | Monarch Go device | Monarch Go-GPS | GNE1908210003002 | 2019-10-18 |
| 62862/006 | USB Cable | --- | --- | 2019-10-18 |

1. Sample S/01 has undergone the following test(s): All tests indicated in Appendix A.

Test sample description

| | | | | | | |
|---|--|--------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|
| Ports..... : | Port name and description | Cable | | | | |
| | | Specified length [m] | Attached during test | Shielded | | |
| | Digital Connector 20 pins for power and serial interface | 2 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | N/A | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | N/A | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Supplementary information to the ports..... : | Not provided data | | | | | |
| Rated power supply | Voltage and Frequency | Reference poles | | | | |
| | | L1 | L2 | L3 | N | PE |
| | <input type="checkbox"/> AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input type="checkbox"/> AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input checked="" type="checkbox"/> DC: 3.1Vdc to 4.5Vdc | | | | | |
| Rated Power | 2W | | | | | |
| Clock frequencies..... : | 32.768 kHz, 26 MHz, 38.4 MHz, 104 MHz | | | | | |
| Other parameters | Not provided data | | | | | |
| Software version | GM01Q-GO-GPS_SR1.2.0.0 | | | | | |
| Hardware version | A2 | | | | | |
| Dimensions in cm (W x H x D) | 35 x 14.5 x 50 mm | | | | | |
| Mounting position | <input type="checkbox"/> | Table top equipment | | | | |
| | <input type="checkbox"/> | Wall/Ceiling mounted equipment | | | | |
| | <input type="checkbox"/> | Floor standing equipment | | | | |
| | <input type="checkbox"/> | Hand-held equipment | | | | |
| | <input checked="" type="checkbox"/> | Other: Asset Tracker | | | | |

| | | | |
|---|--|-----------|--------------|
| Modules/parts.....: | Module/parts of test item | Type | Manufacturer |
| | Monarch Go device | LTE+GPS | Sequans |
| Accessories (not part of the test item) | Description | Type | Manufacturer |
| | Interface board from Monarch Go to USB connector | Host card | Sequans |
| | | | |
| | | | |
| Documents as provided by the applicant | Description | File name | Issue date |
| | Not provided data | | |
| | | | |
| | | | |

Identification of the client

SEQUANS COMMUNICATIONS
 Portes de la Défense.
 15-55, Boulevard Charles de Gaulle
 92700 Colombes. France

Testing period and place

| | |
|---------------|--|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start) | 2019-10-24 |
| Date (finish) | 2019-10-28 |

Document history

| Report number | Date | Description |
|---------------|------------|---------------|
| 62862RRF.002 | 2019-12-10 | First release |

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|-------------------|------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |

In the semianechoic chamber, the following limits were not exceeded during the test.

| | |
|-------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

| | |
|-------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 35 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |

Remarks and comments

The tests have been performed by the technical personnel: José Alberto Aranda and Nicolás Salguero.

Used instrumentation:

Conducted Measurements

| | Last Cal. date | Cal. due date |
|---|----------------|---------------|
| 1. Universal Radio communication Tester R&S CMW50 | 2019/02 | 2020/02 |
| 2. DC Power Supply Keysight Technologies U8002A | --- | --- |
| 3. Digital multimeter FLUKE 179 | 2019/06 | 2020/06 |

Radiated Measurements

| | Last Cal. date | Cal. due date |
|--|----------------|---------------|
| 1. Semianechoic Absorber Lined Chamber ETS FACT3 200STP | N.A. | N.A. |
| 2. Spectrum analyser Rohde & Schwarz FSW50 | 2018/02 | 2020/02 |
| 4. Biconical/Log Antenna ETS LINDGREN 3142E | 2017/04 | 2020/04 |
| 5. RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M | 2019/04 | 2020/04 |
| 6. Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D | 2016/11 | 2019/11 |
| 7. DC Power Supply Keysight Technologies U8002A | --- | --- |
| 8. Digital multimeter FLUKE 179 | 2019/06 | 2020/06 |

Testing verdicts

| | |
|------------------|-----|
| Not applicable : | N/A |
| Pass : | P |
| Fail : | F |
| Not measured : | N/M |

Summary

| FCC PART 27 / RSS-130 PARAGRAPH | | |
|---|---------|--------|
| Requirement – Test case | Verdict | Remark |
| Clause 27.50 / RSS-130 Clause 4.4.: RF output power | P | |
| Clause 2.1047 / RSS-130 Clause 4.1.: Modulation characteristics | N/M | (1) |
| Clause 27.54 / RSS-130 Clause 4.3.: Frequency stability | N/M | (1) |
| Clause 2.1049: Occupied Bandwidth | N/M | (1) |
| Clause 27.53 / RSS-130 Clause 4.6.: Spurious emissions at antenna terminals | N/M | (1) |
| Clause 27.53 / RSS-130 Clause 4.6.: Radiated emissions | P | |
| <u>Supplementary information and remarks:</u> | | |
| (1) Test not request. | | |

Appendix A: Test results for FCC Part 27 / RSS-130

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TEST CONDITIONS

Power supply (V):

Vnominal = 4.5 Vdc

Vmax = N/A

Vmin = N/A

The subscripts nom, min and max indicate voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = Integral antenna.

Declared Gain for antenna = 0 dBi.

TEST FREQUENCIES:

LTE. QPSK AND 16QAM MODULATION (BAND 13)

| | Channel (Frequency, MHz) | |
|---------|--------------------------|---------------|
| | BW = 5 MHz | BW = 10 MHz |
| Lowest | 23205 (779.5) | N/A |
| Middle | 23230 (782.0) | 23230 (782.0) |
| Highest | 23255 (784.5) | N/A |

RF Output Power

SPECIFICATION

FCC §27.50 (b) (9).

Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP.

RSS-130 Clause 4.4.

The e.i.r.p. shall not exceed 50 watts (46.99 dBm) for mobile equipment or for outdoor fixed subscriber equipment nor shall it exceed 5 watts (36.99 dBm) for portable equipment or for indoor fixed subscriber equipment.

METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

$$E.R.P. = E.I.R.P. - 2.15 \text{ dB}$$

The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Conducted average power.



RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED).

BAND 13.

Preliminary measurements determined the narrow band = 1 and nominal bandwidth of 5 MHz as the worst case. The results in the next tables shows the results for this configuration.

Narrow band = 1

| BANDWIDTH (MHz) | CHANNEL | FREQUENCY (MHz) | MODULATION | RB SIZE | RB OFFSET | AVERAGE POWER (dBm) |
|-----------------|---------|-----------------|------------|---------|-----------|---------------------|
| 5 | 23205 | 779.5 | QPSK | 1 6 | 0 0 | 22,98 21,98 |
| | | | 16-QAM | 1 5 | 0 0 | 23,03 20,97 |
| | 23255 | 784.5 | QPSK | 1 6 | 0 0 | 22,96 21,92 |
| | | | 16-QAM | 1 5 | 0 0 | 22,83 20,91 |

| Channel | Measured maximum average power (dBm) at antenna port | Maximum declared antenna gain (dBi) | Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm) | Maximum effective radiated power E.R.P. (dBm) |
|------------------------------|--|-------------------------------------|--|---|
| Lowest | 23.03 | 0 | 23.03 | 20.88 |
| Highest | 22.96 | 0 | 22.96 | 20.81 |
| Measurement uncertainty (dB) | <±1.11 | | | |

Verdict: PASS

Radiated emissions

SPECIFICATION

LTE BAND 13.

FCC §27.53 (c) & (f).

On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW (-50 dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

RSS-130 Clause 4.6.

The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB.

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

The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW (-40 dBm) /MHz for wideband signal and -80 dBW (-50 dBm) for discrete emission with bandwidth less than 700 Hz.

At P_o transmitting power, the specified minimum attenuation becomes $43+10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm.}$$

At P_o transmitting power, the specified minimum attenuation becomes $65+10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [65 + 10 \log (P_o \text{ in mwatts}) - 30] = -35 \text{ dBm.}$$

METHOD

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

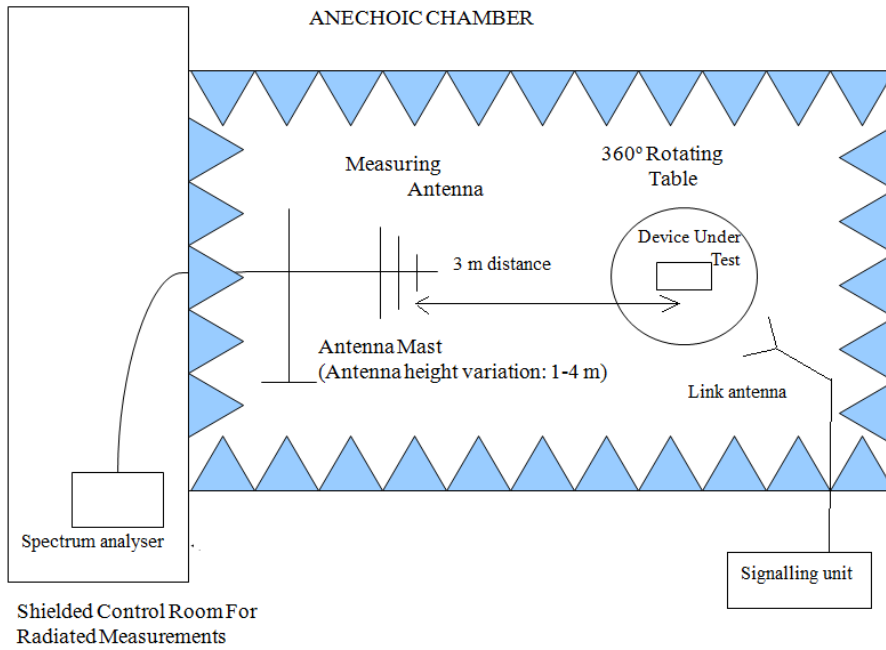
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

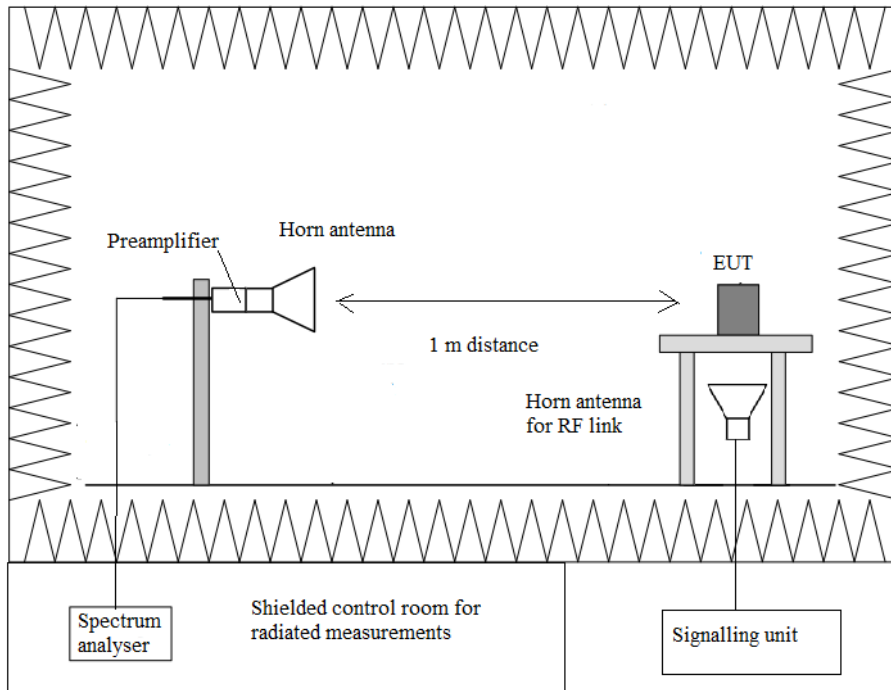
Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method in accordance with the ANSI/TIA-603-E: 2016.

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

LTE QPSK AND 16QAM MODULATION. Band 13. BW = 5 MHz and 10 MHz.

A preliminary scan determined the QPSK 5 MHz bandwidth, Narrow band =1, RB = 1, as the worst case.

The following tables and plots show the results for this configuration.

1. CHANNEL: LOWEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1559 MHz-1610 MHz. RBW = 1 MHz

Substitution method data

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|---|----------------------------------|
| 1563.6198 | -34.95 | H | -54.14 | 0.79 | 8.31 | -46.62 |

No discrete signals were detected. Only wideband signals were detected.

2. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1559 MHz-1610 MHz. RBW = 1 MHz

Substitution method data

| Frequency (MHz) | Instrument reading (dBm) | Polarization | (1) Generator output (dBm) | (2) Cable loss (dB) | (3) Substitution antenna gain Gi (respect to isotropic radiator) (dB) | E.I.R.P. (dBm) = (1) – (2) + (3) |
|-----------------|--------------------------|--------------|----------------------------|---------------------|---|----------------------------------|
| 1564.9033 | -33.67 | H | -52.86 | 0.79 | 8.32 | -45.33 |
| 1573.1636 | -34.01 | H | -53.21 | 0.79 | 8.35 | -45.65 |

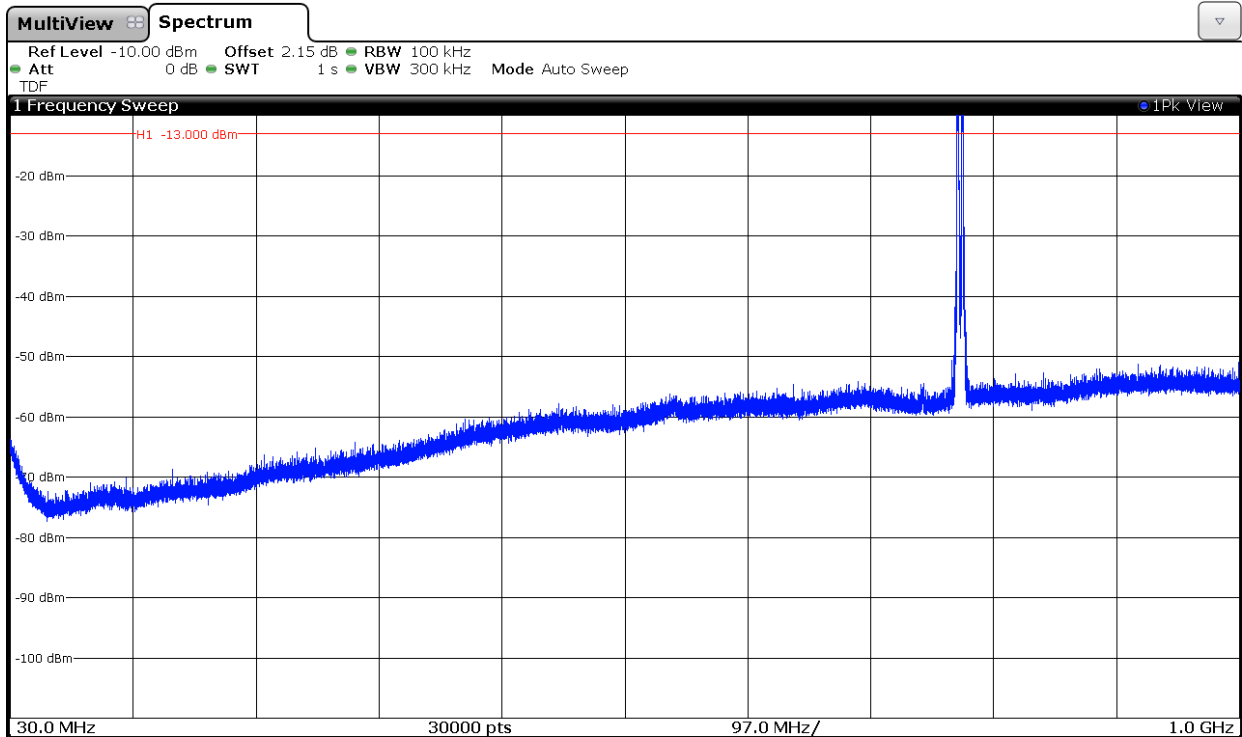
No discrete signals were detected. Only wideband signals were detected.

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

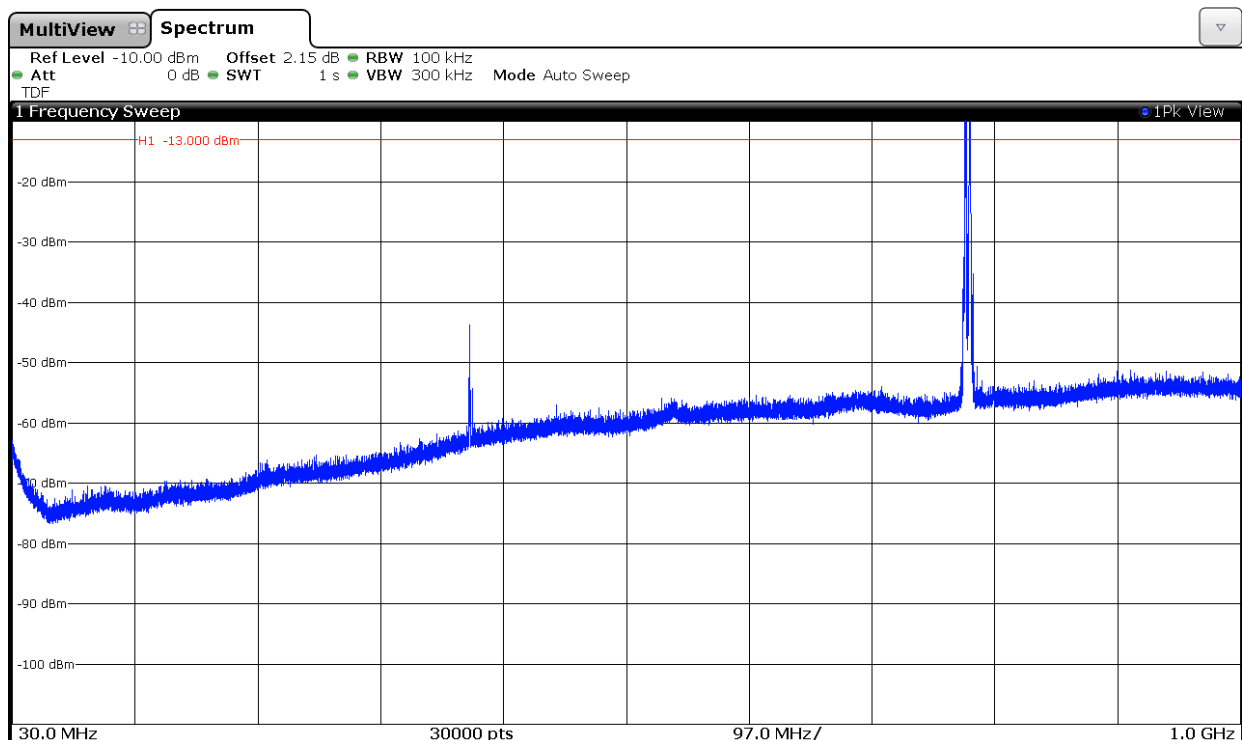
LTE Band 13

CHANNEL: LOWEST



Note: The peak above the limit is the carrier frequency.

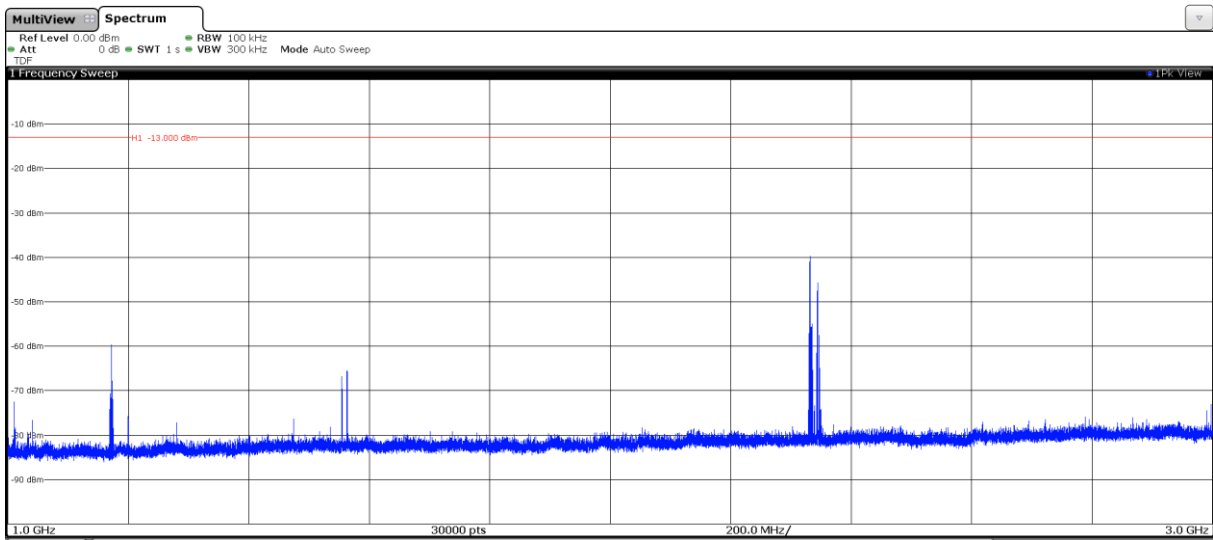
CHANNEL: HIGHEST



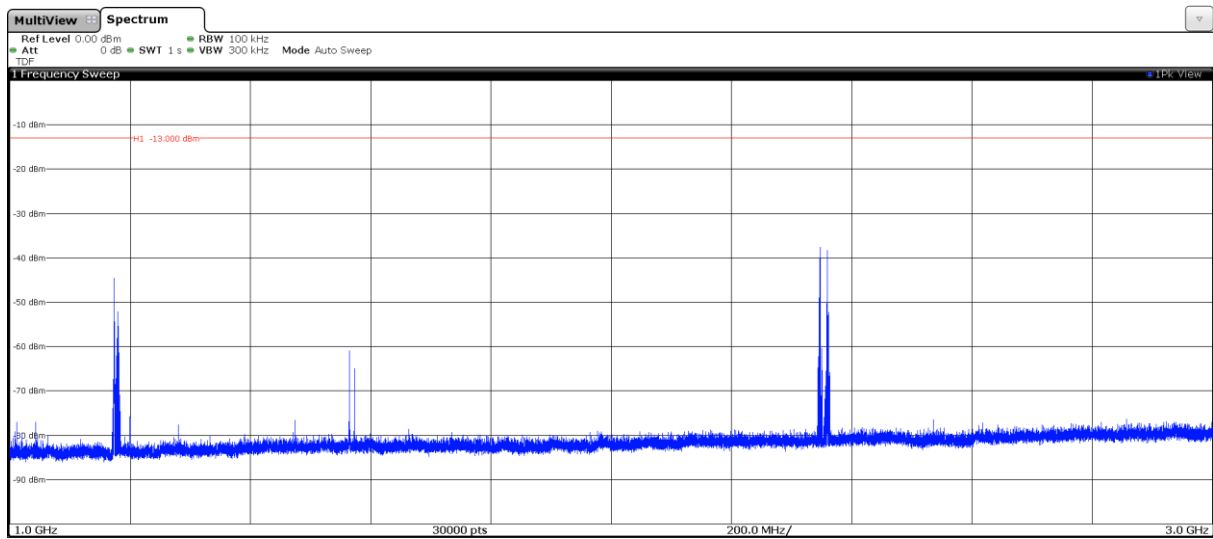
Note: The peak above the limit is the carrier frequency.

LTE Band 13. Frequency range 1 GHz to 3 GHz.

CHANNEL: LOWEST

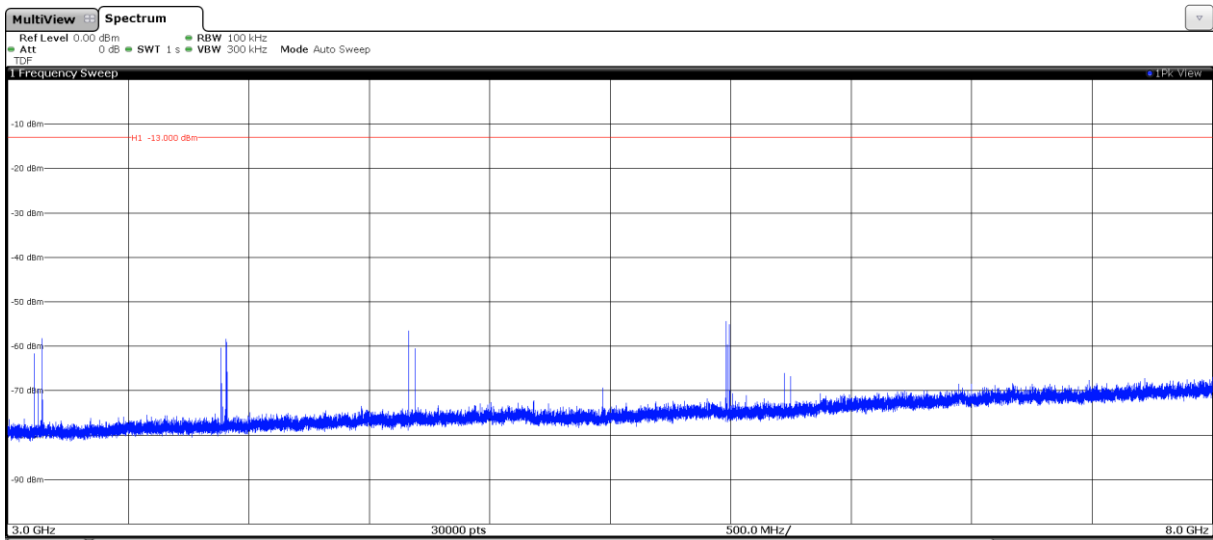


CHANNEL: HIGHEST

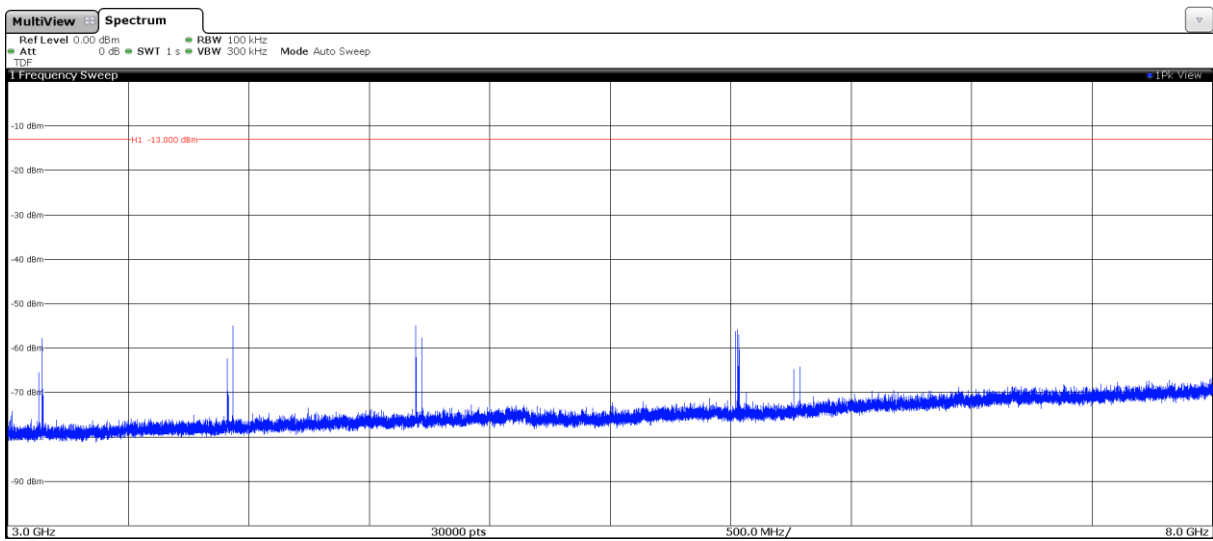


LTE Band 13. Frequency range 3 GHz to 8 GHz.

CHANNEL: LOWEST

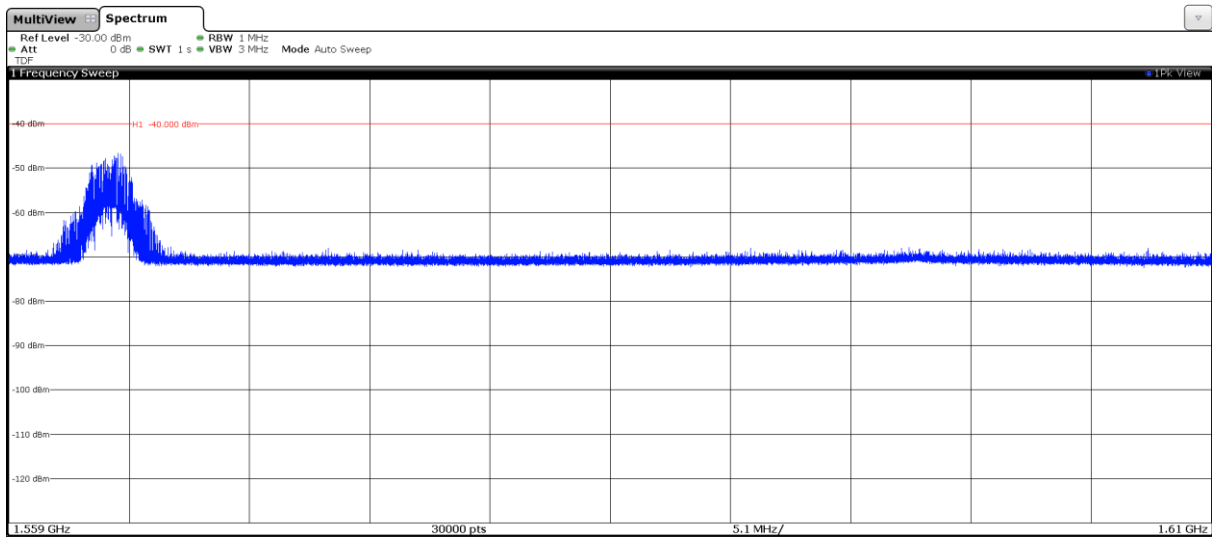


CHANNEL: HIGHEST



LTE Band 13. Frequency range 1559 MHz to 1610 MHz.

CHANNEL: LOWEST



CHANNEL: HIGHEST

