



Test report No:
 NIE: 62862RRF.001

Partial Test report
REFERENCE STANDARD:
USA FCC Part 27
CANADA ISED RSS-139

(*) 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 IC RSS-139 Issue 3, Jul. 2015. 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

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

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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.

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		
	<i>Digital Connector 20 pins for power and serial interface</i>		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.001	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-139 PARAGRAPH		
Requirement – Test case	Verdict	Remark
Clause 27.50 / RSS-139 Clause 6.5.: RF output power	P	
Clause 2.1047 / RSS-139 Clause 6.2.: Modulation characteristics	N/M	(1)
Clause 27.54 / RSS-139 Clause 6.4: Frequency stability	N/M	(1)
Clause 2.1049: Occupied Bandwidth	N/M	(1)
Clause 27.53 / RSS-139 Clause 6.6: Spurious emissions at antenna terminals	N/M	(1)
Clause 27.53 / RSS-139 Clause 6.6: Radiated emissions	P	
<u>Supplementary information and remarks:</u>		
(1) Test not request.		

Appendix A: Test results for FCC Part 27 / RSS-139

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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 4)

	Channel (Frequency. MHz)			
	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	19975 (1712.5)	20000 (1715.0)	20025 (1717.5)	20050 (1720.0)
Middle	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)
Highest	20375 (1752.5)	20350 (1750.0)	20325 (1747.5)	20300 (1745.0)

Note: the EUT does not support transmission in BW = 1.4 MHz and BW = 3 MHz.

RF Output Power

SPECIFICATION

FCC §27.50 (d) (4) & (5). RSS-139 Clause 6.5.

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 1 watt EIRP (30 dBm). 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.

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).

LTE. BAND 4.

Preliminary measurements determined the narrow band = 1 and nominal bandwidth of 15 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)
15	20025	1717.5	QPSK	1	0	21,9
			16-QAM	6	0	21,99
	20175	1732.5	QPSK	1	0	22,01
			16-QAM	5	0	21,9
	20325	1747.5	QPSK	1	0	22,13
			16-QAM	6	0	22,11
			1	0	22,16	
			5	0	21,99	
			QPSK	1	0	21,99
			16-QAM	6	0	21,95
			1	0	21,99	
			5	0	21,85	

LTE BAND 4.

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	22.01	0	22.01	19.86
Middle	22.16	0	22.16	20.01
Highest	21.99	0	21.99	19.84
Measurement uncertainty (dB)	<±1.11			

Verdict: PASS

Radiated emissions

SPECIFICATION

LTE BAND 4. FCC §27.53 (h). RSS-139 Clause 6.6.

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. P in watts.

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

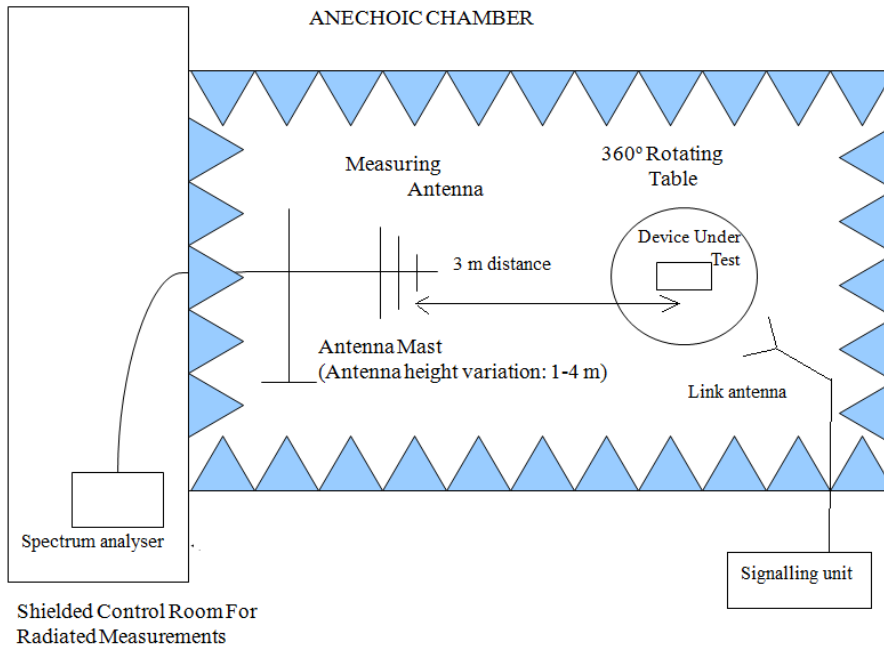
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

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.

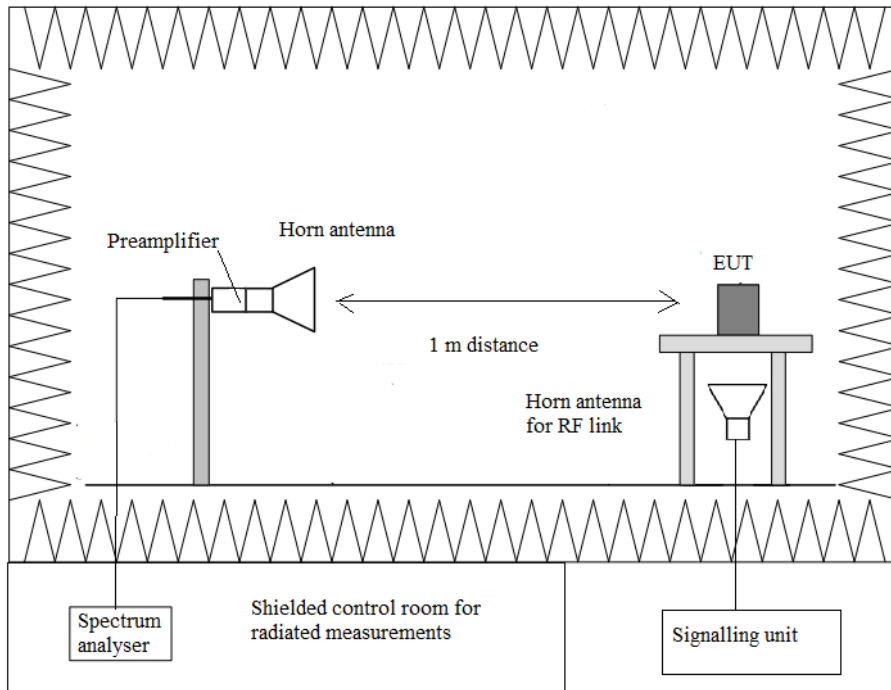
Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method in accordance with the ANSI/TIA-603-E: 2016.

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

LTE QPSK AND 16QAM MODULATION. Band 4. BW = 5 MHz. 10 MHz. 15 MHz and 20 MHz.

A preliminary scan determined the 16QAM 15 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-18 GHz.

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)
5172.75	-24.39	V	-36.31	3.17	11.97	-27.51

2. CHANNEL: MIDDLE

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-18 GHz.

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)
5218.25	-26.50	V	-38.43	3.20	12.07	-29.56

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

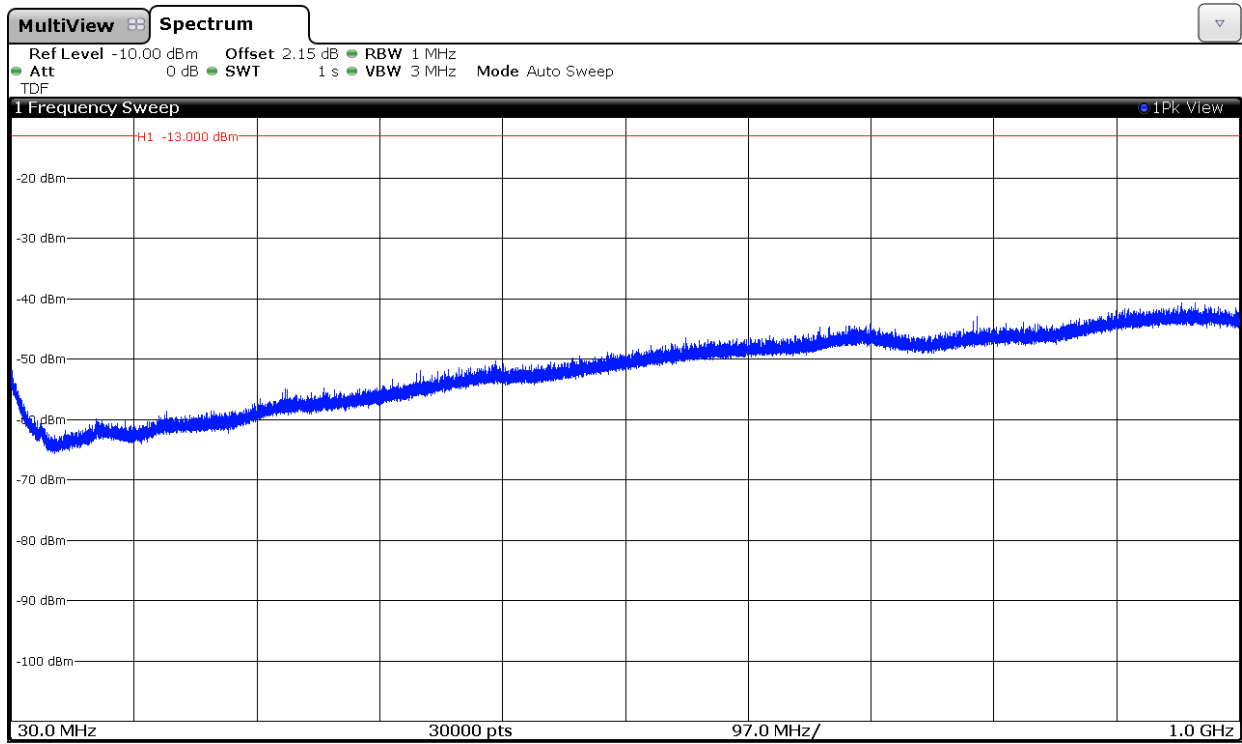
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-18 GHz.

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)
3482.25	-20.35	H	-36.58	2.50	11.83	-27.25
5223.25	-21.30	V	-33.24	3.20	12.08	-24.36

FREQUENCY RANGE 30 MHz-1000 MHz.

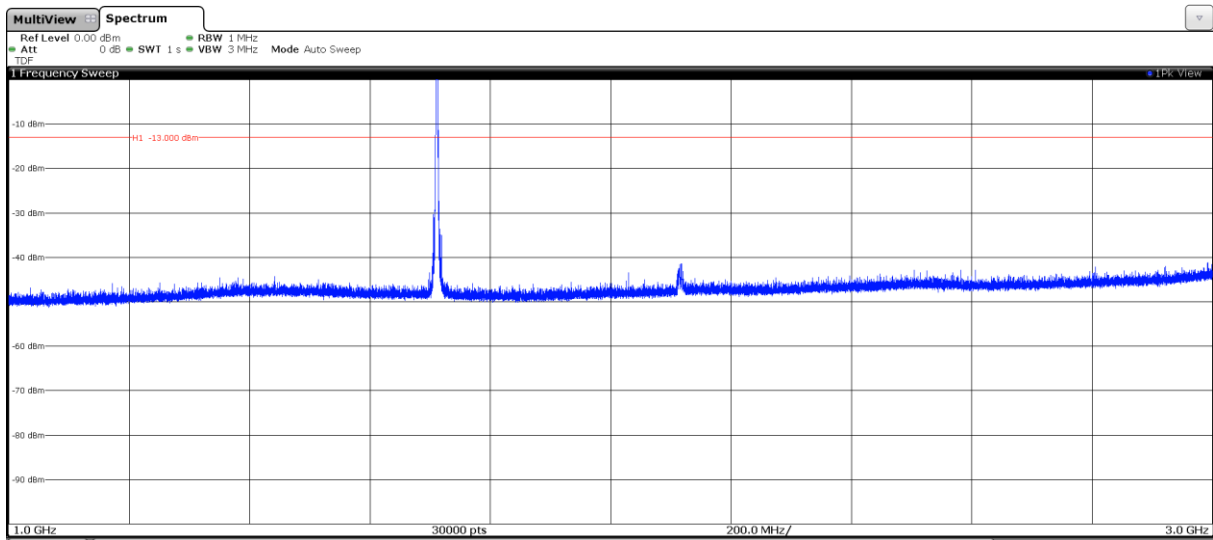
LTE Band 4



(This plot is valid for all three channels)

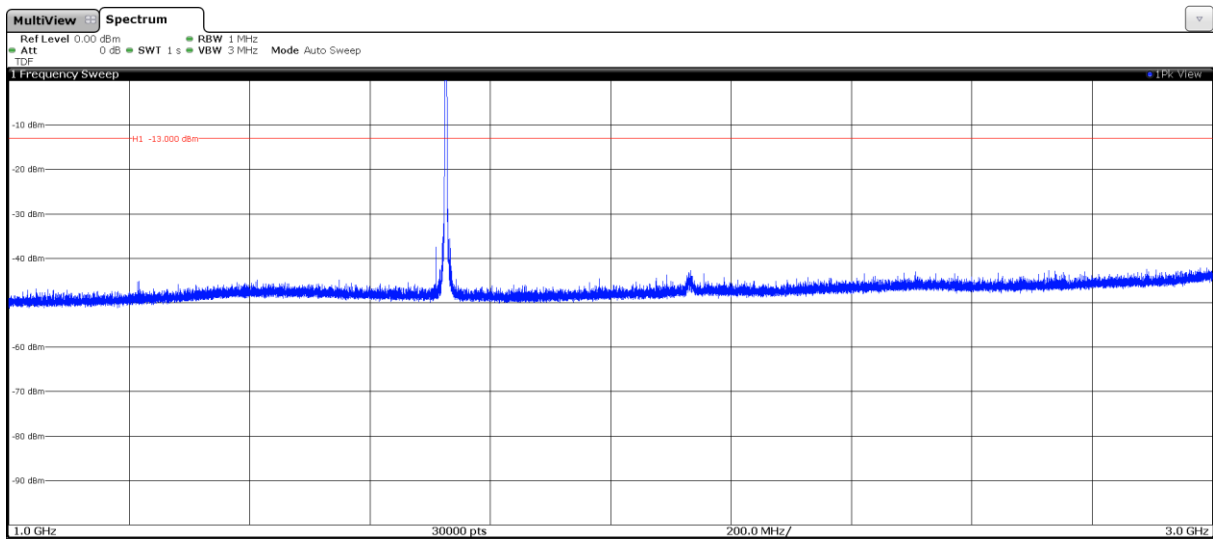
LTE Band 4. Frequency range 1 GHz to 3 GHz

CHANNEL: LOWEST



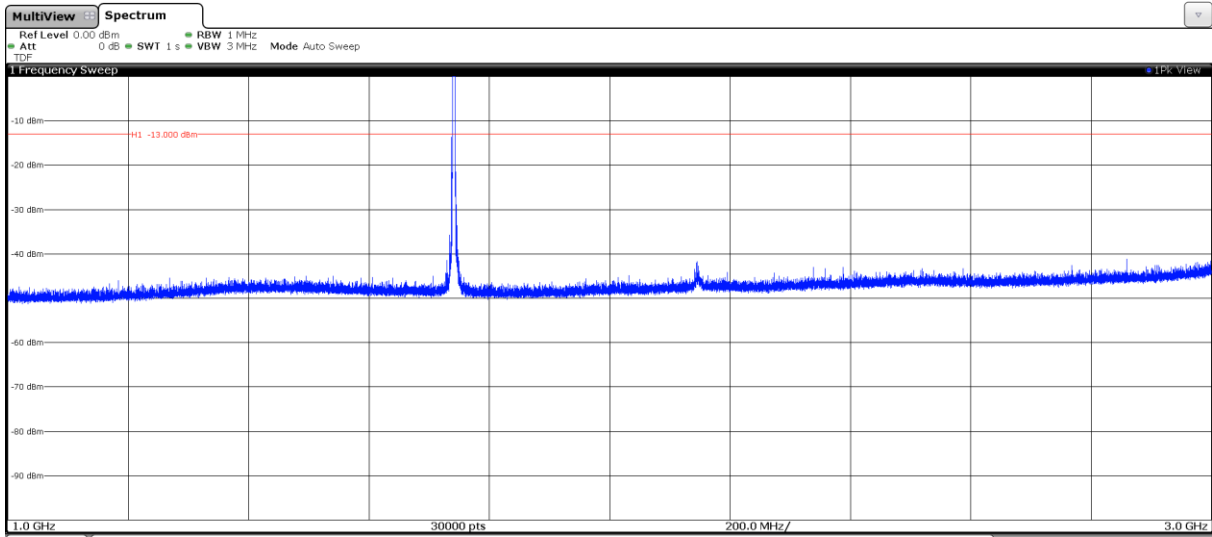
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

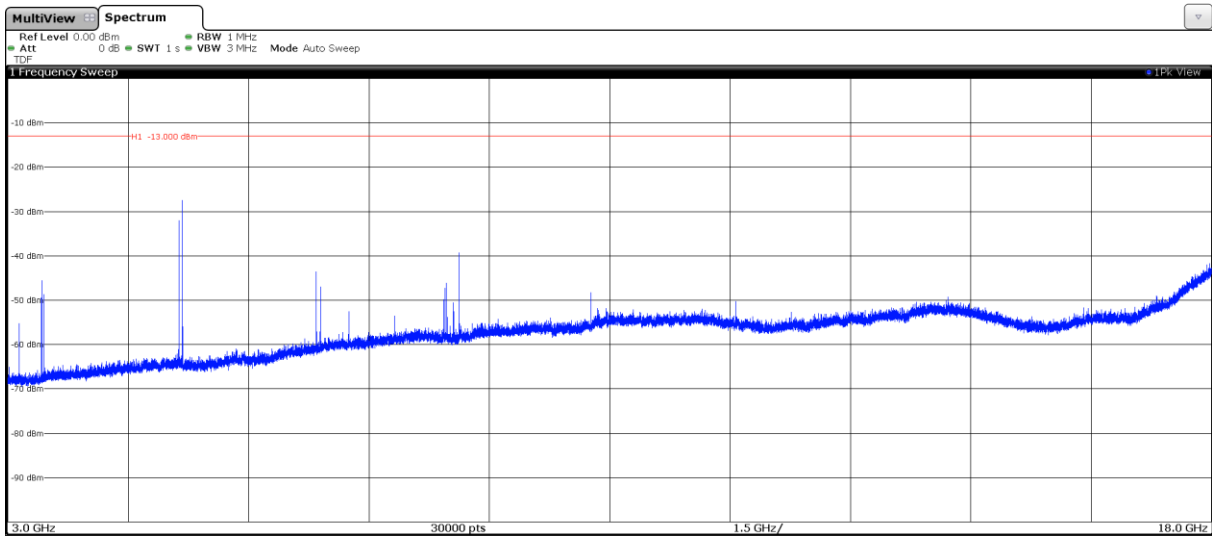
CHANNEL: HIGHEST



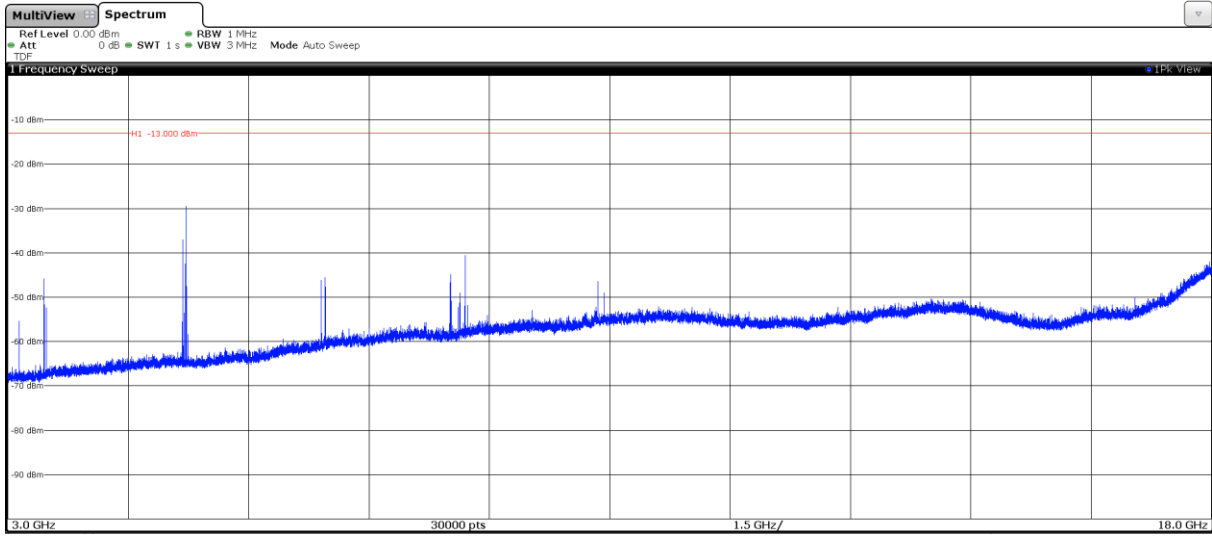
Note: The peak above the limit is the carrier frequency.

LTE Band 4. Frequency range 3 GHz to 18 GHz

CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST

