



Test report No:
NIE: 64759RRF.003

Partial Test Report

USA FCC 15.31(h), 27, 15.209, 15.247

CANADA RSS-130, RSS-139, RSS-Gen, RSS-247

(*) Identification of item tested	LTE IoT device embedding a Cat-M B4/13 modem with antenna + a GPS chipset with antenna + a Bluetooth Low Energy antenna
(*) Trademark	SEQUANS Communications
(*) Model and /or type reference	Monarch Go GPS BLE
Other identification of the product	HW version: Monarch Go GPS BLE A3 SW version: SR1.2.0.0-GPS-BLE FCC ID: 2AAGMGMQGOB IC: 12732A-GMQGOB
(*) Features	LTE Cat-M Band 4 and Band 13, GPS/GNSS, Bluetooth Low Energy
Applicant	SEQUANS COMMUNICATIONS Portes de la Défense, 15-55, Boulevard Charles de Gaulle, 92700 Colombes, France
Test method requested, standard	USA FCC Part 15.31(h) (10-1-19 Edition): Measurement standard. USA FCC Part 27 (10-1-19 Edition): Miscellaneous Wireless Communications Services. USA FCC Part 15.209 (10-1-19 Edition): Radiated emission limits; general requirements. USA FCC Part 15.247 (10-1-19 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. CANADA RSS-130 Issue 2, Feb. 2019. CANADA RSS-139 Issue 3, Jul. 2015. CANADA RSS-Gen Issue 5, March 2019. CANADA RSS-247 Issue 2, Feb. 2017. -Transmitter out of band radiated emissions with simultaneous transmissions. Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018. ANSI C63.26-2015.

Approved by (name / position & signature)	ANSI/TIA-603-E: 2016.	
	Rafael López EMC Consumer & RF Lab. Manager	 RAFAEL LÓPEZ MARTÍN 2020.07.17 08:48:21 +02'00'
Date of issue	2020-07-15	
Report template No	FDT08_22 (*) "Data provided by the client"	

Index

Competences and guarantees4

General conditions4

Uncertainty4

Data provided by the client.....4

Usage of samples5

Test sample description5

Identification of the client.....7

Testing period and place.....7

Document history7

Environmental conditions7

Remarks and comments8

Testing verdicts.....9

Summary9

Appendix A: Test results FCC 27 / RSS-130, RSS-13910

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

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 S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. 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 S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. 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 of the model Monarch Go GPS BLE is a LTE IoT device embedding a Cat-M B4/13 modem with antenna + a GPS chipset with antenna + a Bluetooth Low Energy 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 N°	Description	Model	Serial N°	Date of reception
64759/001	LTE IoT device	Monarch Go GPS BLE	--	2020-05-26

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

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
			☒	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
	Supplementary information to the ports..... :						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 3.1V to 4.5V					
	DC:						
Rated Power	2W						
Clock frequencies.....	32.768 kHz, 26 MHz, 32MHz, 38.4 MHz, 104 MHz						
Other parameters							

Software version	SR1.2.0.0-GPS-BLE		
Hardware version	Monarch Go GPS BLE A3		
Dimensions in cm (W x H x D)	35 x 14.5 x 50 mm		
Mounting position	☐	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☒	Other: Asset tracker	
Modules/parts.....	Module/parts of test item		Type
	Monarch Go device		LTE GPS BLE
Accessories (not part of the test item)	Description		Type
	Interface board from Monarch Go to USB connector		Host card
Documents as provided by the applicant	Description		File name

⁽³⁾ Only for Medical Equipment

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)	2020-06-10
Date (finish)	2020-06-11

Document history

Report number	Date	Description
64759RRF.003	2020-07-15	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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Remarks and comments

The tests have been performed by the technical personnel: Cristina Calle, Miguel Manuel López, José Gabriel Pendón.

Used instrumentation:

Radiated Measurements

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/04	2023/04
4.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
5.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/04	2021/04
6.	DC Power Supply, 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N.A.	N.A.
7.	Digital Multimeter FLUKE 175	2019/10	2020/10
8.	Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
9.	Broadband Horn Antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
10.	RF Pre-amplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2020/05	2021/05
11.	Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
12.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2019/09	2021/09

Testing verdicts

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

Summary

FCC 15, FCC 27 / RSS-130, RSS-139, RSS-Gen, RSS-247 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 15.31 (h), FCC 27.53, FCC 15.209 (a), FCC 15.247 (d) / RSS-130 4.6, RSS-139 6.6, RSS-Gen 8.9, RSS-247 5.5. Emission limitations radiated (Transmitter)	P	(1)
<u>Supplementary information and remarks:</u> (1) Only Co-location radiated spurious emission test was requested.		

Appendix A: Test results FCC 27 / RSS-130, RSS-139

INDEX

TEST CONDITIONS12

Radiated emissions.....14

TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 5 Vdc

Type of Power Supply: USB.

ANTENNA:

Type of Bluetooth LE Antenna: Internal.

Maximum Declared Gain for Bluetooth LE: +1 dBi

Maximum Declared Gain for CELLULAR:

HIGH Bands	GAIN	TYPE OF ANTENNA
LTE Cat-M1 Band 4	0 dBi	Internal (PIF)
LTE Cat-M1 Band 13	0 dBi	Internal (PIF)

TEST FREQUENCIES:

CELLULAR LTE Cat-M1 (Bands 4, 13)		
Band:	LTE Cat-M1 Band 4	
Frequency Range:	1710 – 1755 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Middle: 20175	1732.5 MHz (BW 15 MHz, RB Size 1, RB Offset 0, QPSK)
Band:	LTE Cat-M1 Band 13	
Frequency Range:	777 – 787 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Low: 23230	782 MHz (BW 5 MHz, RB Size 1, RB Offset 0, QPSK)

Bluetooth LE		
Mode:	GFSK	
Channel Spacing:	1 MHz	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	High: 39	2480

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v05r02 dated April 2, 2019.

The EUT was tested in the following operating mode:

- Continuous transmission with a modulated carrier at maximum power in all required channels selecting the supported data rates/modulations types.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

The following configurations were selected based on preliminary testing that identified those corresponding to the worst cases:

Selected Transmission Modes for each Radio:

The following configurations were selected based on preliminary testing that identified those corresponding to the worst cases:

* Cellular LTE Cat-M1: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in Cellular LTE Cat-M1 Band 4 / Middle Channel configuration and in Cellular LTE Cat-M1 Band 13 / Low Channel configuration as these channels were found to transmit higher EIRP than all the other LTE Cat-M1 channels.

* Bluetooth Low Energy: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in Bluetooth Low Energy / GFSK mode configuration.

TESTED SIMULTANEOUS TRANSMISSION MODES:

* **Co-location mode Cellular LTE Cat-M1 Band 4, Bluetooth Low Energy**, with the EUT configured to simultaneously transmit two signals at maximum output power, Cellular LTE Cat-M1 Band 4 / Middle Channel and Bluetooth Low Energy / GFSK.

* **Co-location mode Cellular LTE Cat-M1 Band 13, Bluetooth Low Energy**, with the EUT configured to simultaneously transmit two signals at maximum output power, Cellular LTE Cat-M1 Band 13 / Low Channel and Bluetooth Low Energy / GFSK.

Radiated emissions

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

LTE Cat-M1 Band 4. FCC §2.1053 & §27.53 (h) / RSS-139 Issue 3 6.6.

FCC §27.53 (h):

(h) 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 MHz, 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 Issue 3 6.6:

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.

LTE Cat-M1 Band 4 MEASUREMENT LIMIT:

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

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

LTE Cat-M1 Band 13. FCC §2.1053 & §27.53 (c) (2) (4) & (f) / RSS-130 Issue 2 4.7.

FCC §27.53 (c) (2) (4) & (f):

(c) (2) 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.

(c) (4) 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.

(f) 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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

RSS-130 Issue 2 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.

LTE Cat-M1 Band 13 MEASUREMENT LIMIT:

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

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

METHOD:

The measurement was performed with the EUT inside an anechoic chamber.

The spectrum was scanned from 9 kHz to at least the 10th harmonic of the highest frequency of the co-located radios till 26 GHz.

The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna.

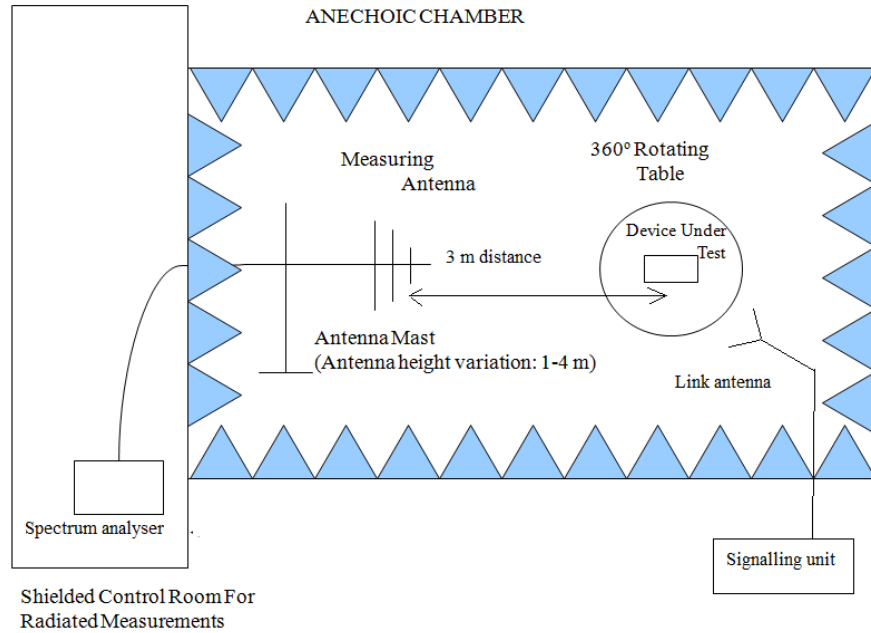
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

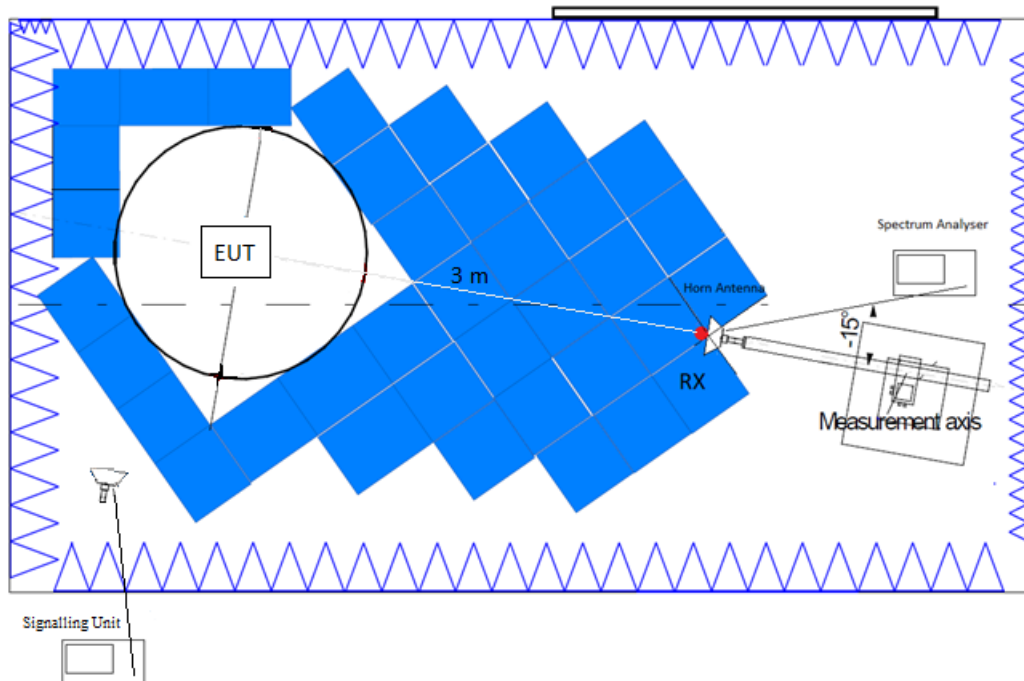
These measurements have been performed in order to check the impact of the Co-Location of all radio interfaces (that can be transmitting simultaneously).

TEST SETUP:

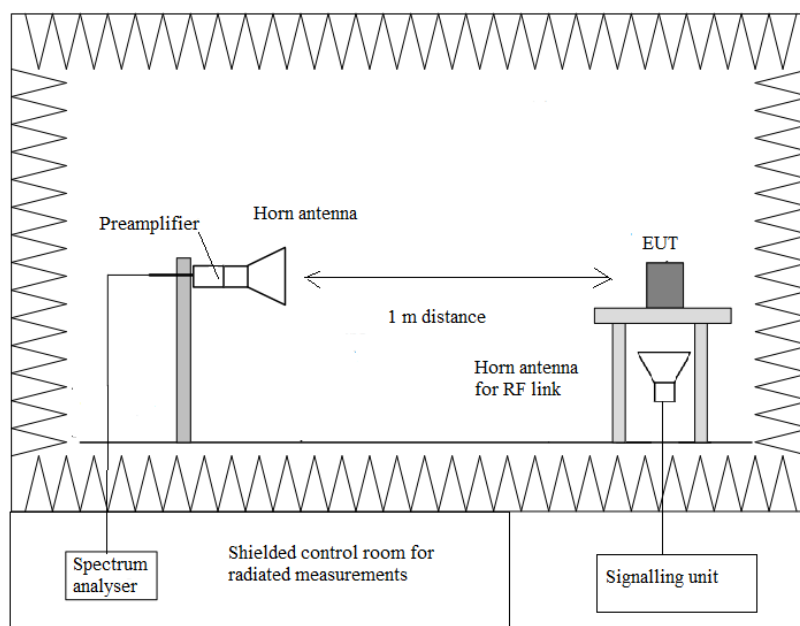
Radiated measurements below 1 GHz.



Radiated measurements between 1 GHz and 18 GHz.



Radiated measurements above 18 GHz.



RESULTS:

- **Co-location mode Cellular LTE Cat-M1 Band 4, Bluetooth Low Energy.**

QPSK & 16QAM:

A preliminary scan determined the QPSK modulation in the Middle Channel as the worst case.

LTE Cat-M1 Band 4:	Middle Channel (1732.5 MHz). QPSK.
Bluetooth Low Energy:	High Channel (2480 MHz). GFSK.

LIMIT: The spurious frequencies were measured at 3 meter. The limit of the test is determined by:

Frequency Range	Detector	Limit at 3m (dBμV/m)
30 MHz to 20 GHz	Peak	$43 + 10 \log (P) \text{ dB} = -13 \text{ dBm} \rightarrow 82.23 \text{ dB}\mu\text{V/m}$
20 GHz to 26 GHz	Peak	74 dBμV/m
	Average	54 dBμV/m (*)

(*) Radiated emissions which fall in the restricted bands, as defined in §15.205(a).

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

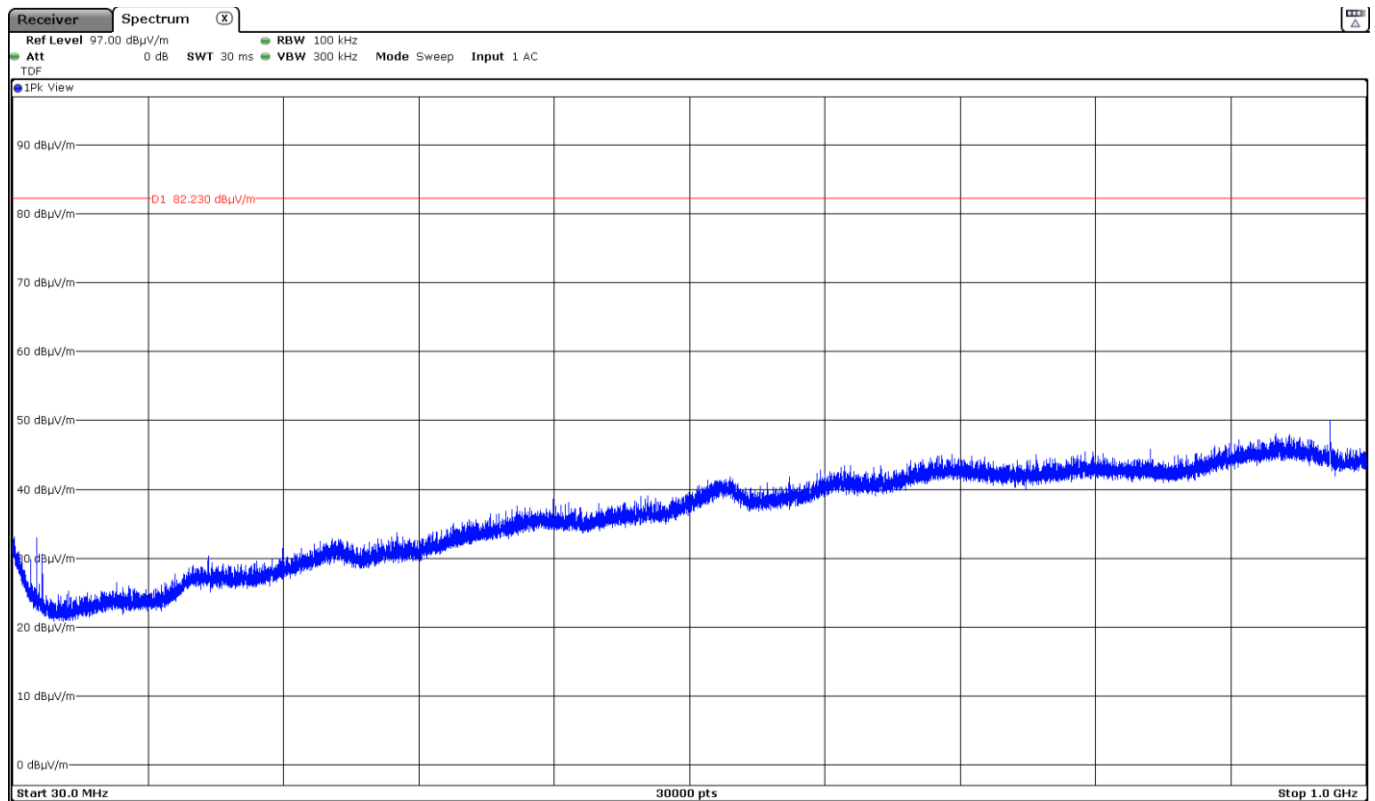
Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	E (dBμV/m)	Limit (dBμV/m)	Polarization	Measurement Uncertainty (dB)
3.22003	Peak	66.05	82.23	H	<± 4.98
5.18097	Peak	68.29	82.23	H	<± 4.98
5.21737	Peak	66.05	82.23	H	<± 4.98

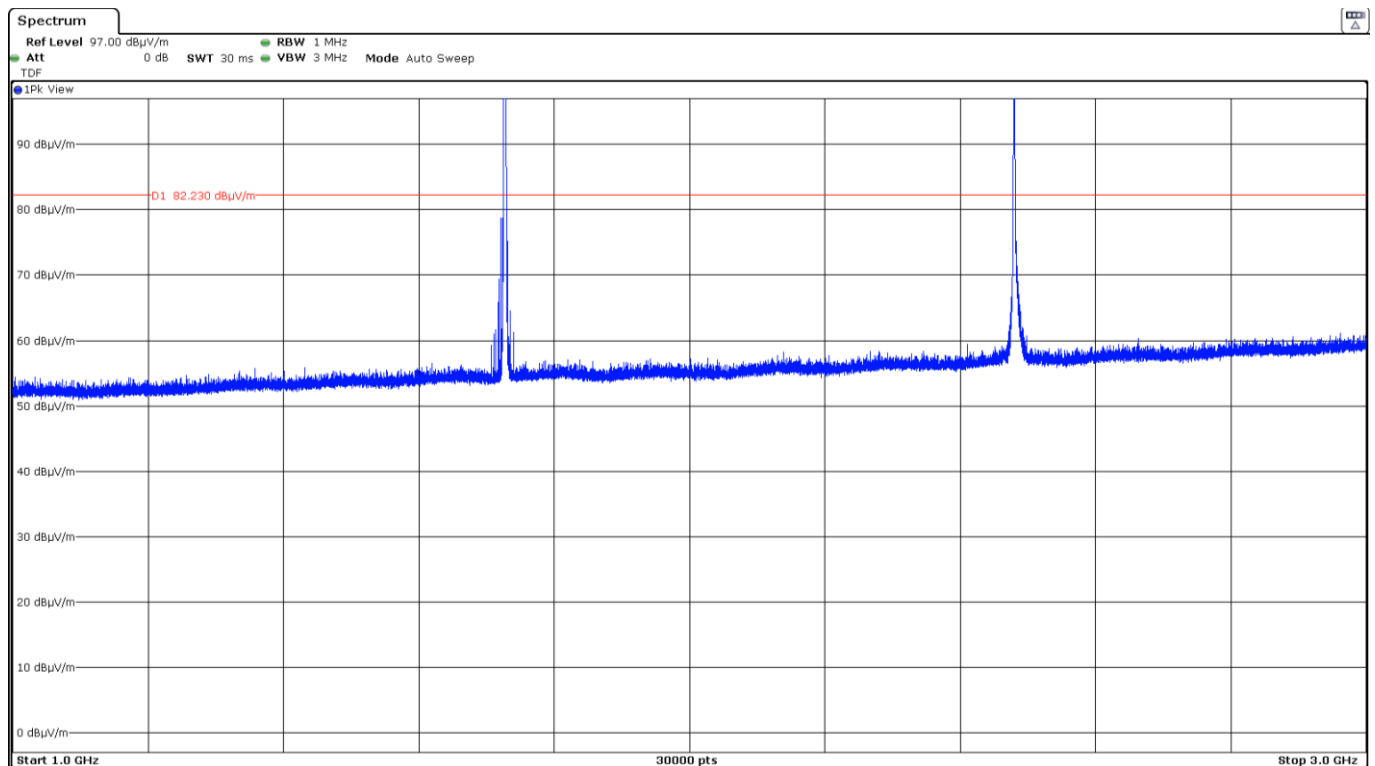
Measurement uncertainty (dB)	f < 1 GHz, <± 4.65 f ≥ 1 GHz up to 17 GHz, <± 4.98 f ≥ 17 GHz up to 26 GHz, <± 5.08
------------------------------	---

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz



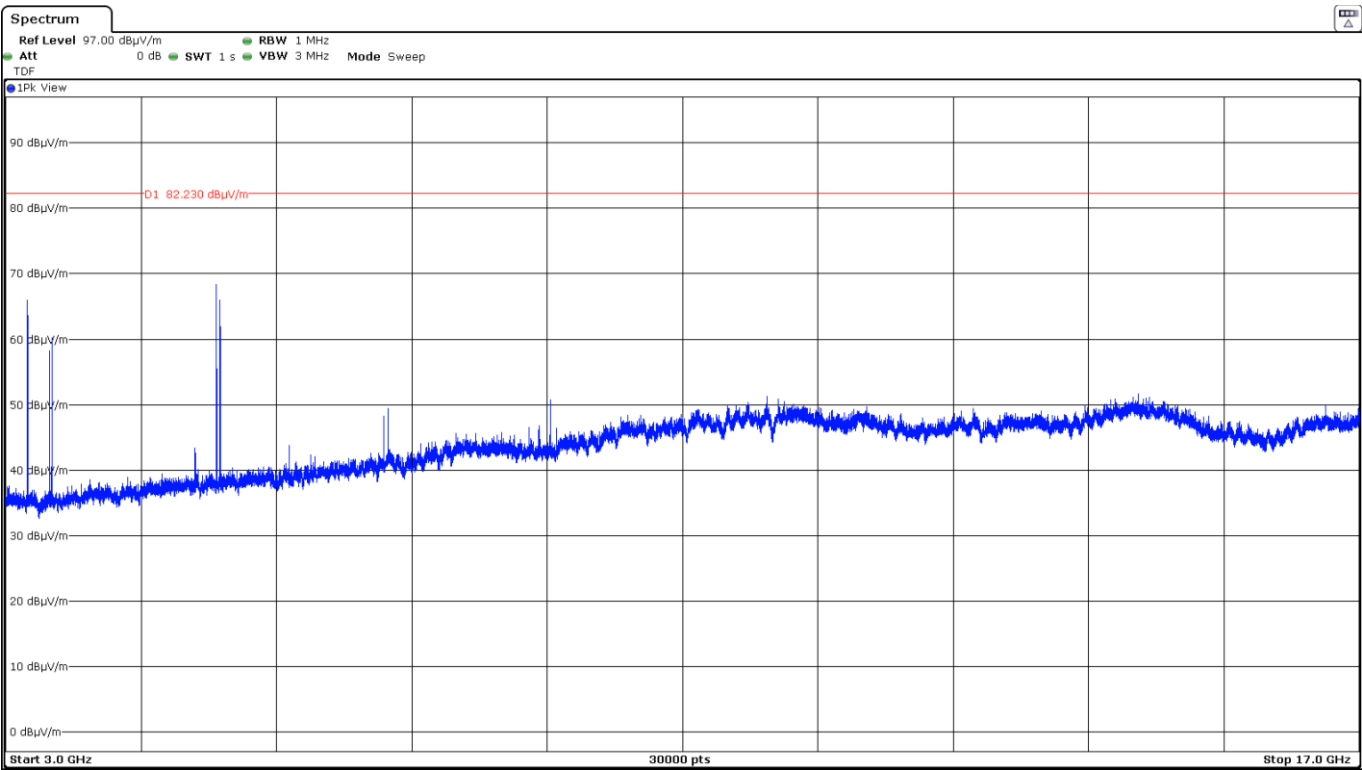
FREQUENCY RANGE 1 – 3 GHz



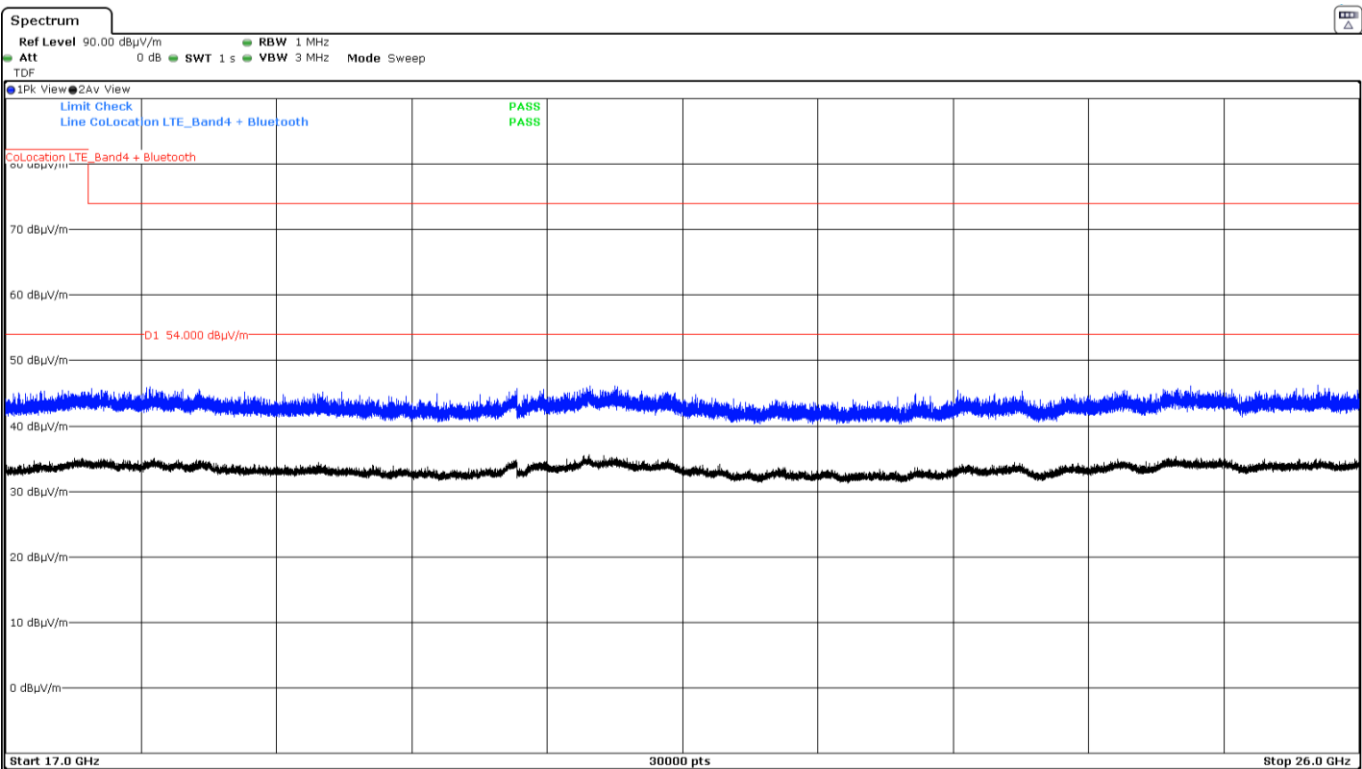
The peak above the limit on the left is the Carrier frequency LTE Cat-M1 Band 4 (1732.5 MHz).

The peak above the limit on the right is the Carrier frequency Bluetooth Low Energy (2480 MHz).

FREQUENCY RANGE 3 – 17 GHz



FREQUENCY RANGE 17 - 26 GHz



- **Co-location mode Cellular LTE Cat-M1 Band 13, Bluetooth Low Energy.**

QPSK & 16QAM:

A preliminary scan determined the QPSK modulation in the Low Channel as the worst case.

LTE Cat-M1 Band 13:	Low Channel (782 MHz). QPSK.
Bluetooth Low Energy:	High Channel (2480 MHz). GFSK.

LIMIT: The spurious frequencies were measured at 3 meter. The limit of the test is determined by:

Frequency Range	Detector	Limit at 3m (dBμV/m)
30 MHz to 8 GHz	Peak	$43 + 10 \log (P) \text{ dB} = -13 \text{ dBm} \rightarrow 82.23 \text{ dB}\mu\text{V/m}$
8 GHz to 26 GHz	Peak	74 dBμV/m
8 GHz to 26 GHz	Average	54 dBμV/m (*)

(*) Radiated emissions which fall in the restricted bands, as defined in §15.205(a).

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 – 26 GHz

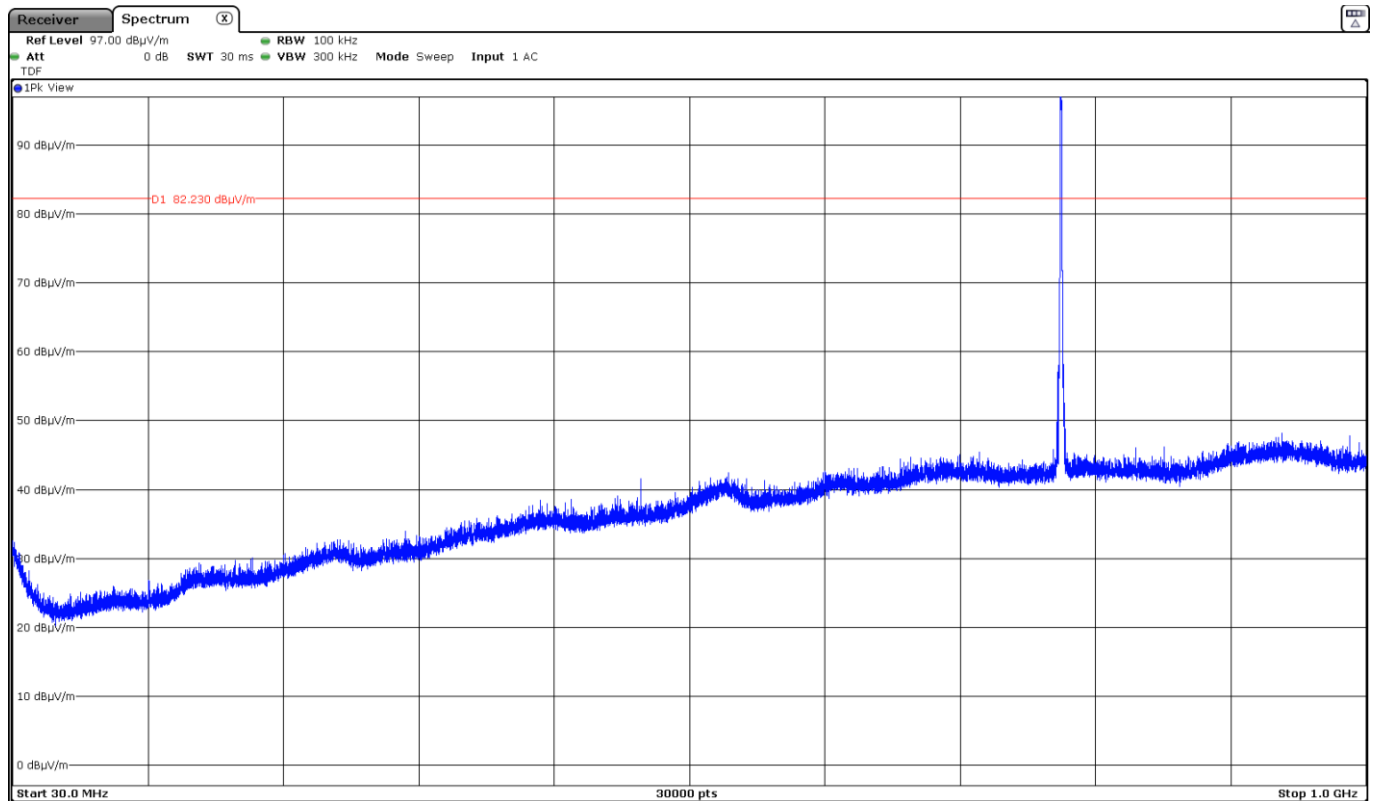
Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	E (dBμV/m)	Limit (dBμV/m)	Polarization	Measurement Uncertainty (dB)
2.343433	Peak	73.39	82.23	V	<± 4.98

Measurement uncertainty (dB)	$f < 1 \text{ GHz}, <\pm 4.65$ $f \geq 1 \text{ GHz up to } 17 \text{ GHz}, <\pm 4.98$ $f \geq 17 \text{ GHz up to } 26 \text{ GHz}, <\pm 5.08$
------------------------------	---

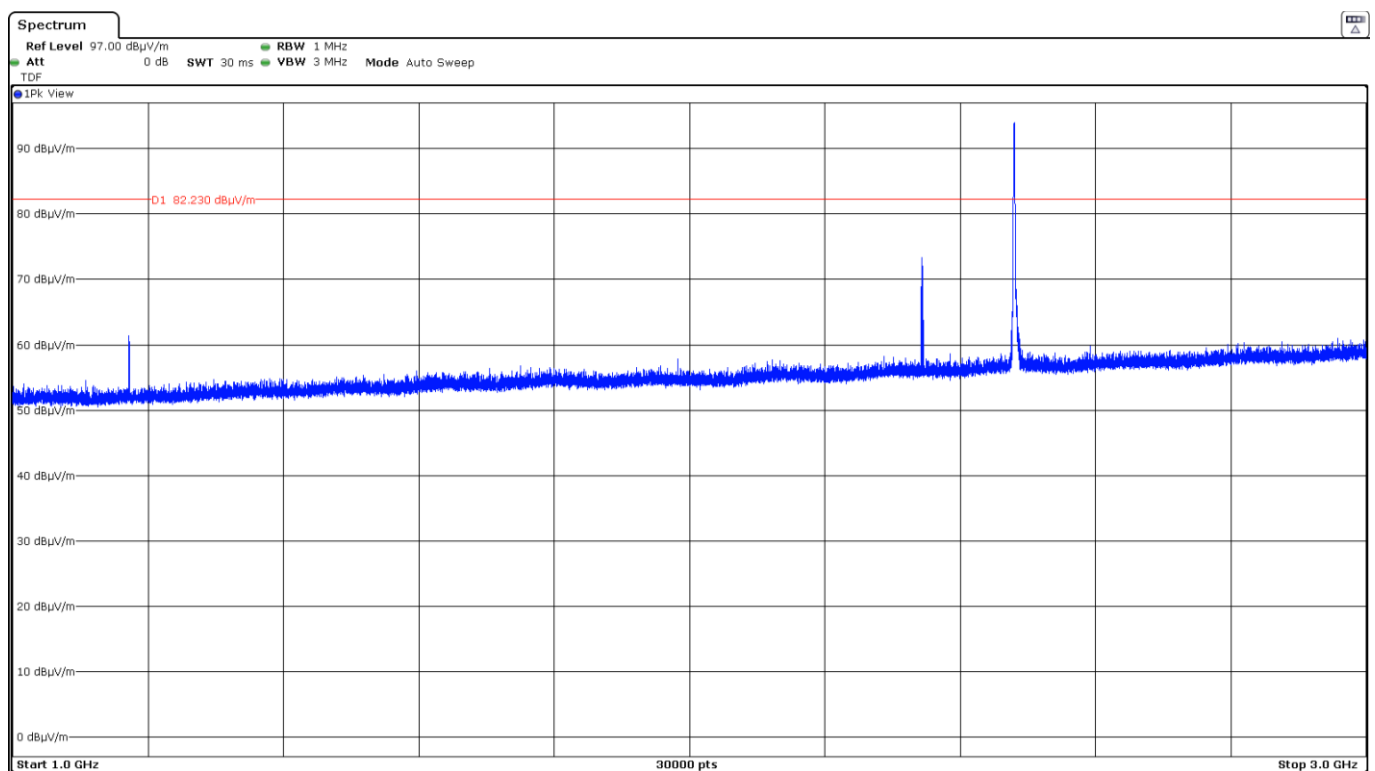
Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz



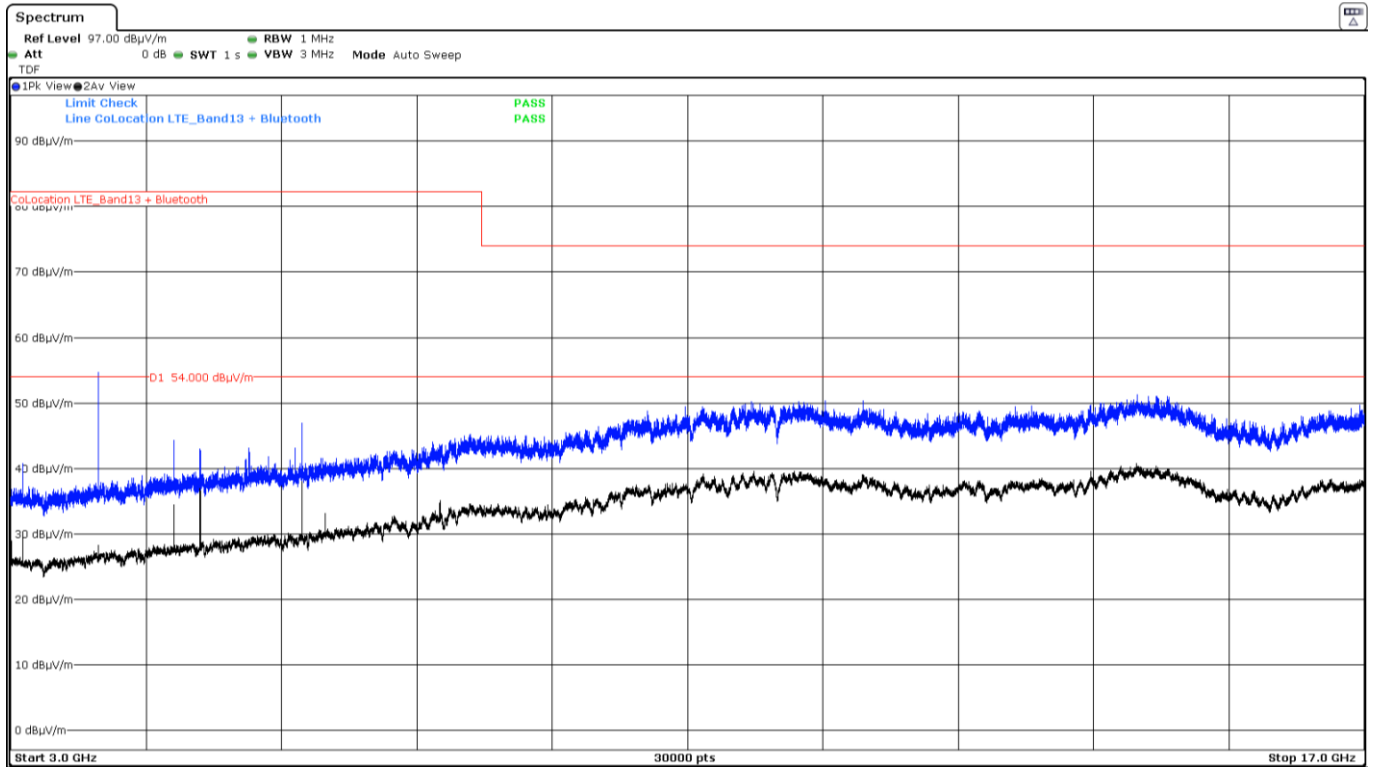
The peak above the limit is the Carrier frequency LTE Cat-M1 Band 13 (782 MHz)

FREQUENCY RANGE 1 – 3 GHz



The peak above the limit is the Carrier frequency Bluetooth Low Energy (2480 MHz).

FREQUENCY RANGE 3 – 17 GHz



FREQUENCY RANGE 17 - 26 GHz

