

Test report No:

NIE: 66776RRF.001

Partial Test Report

USA FCC 15.31(h), 22, 24, 15.209, 15.247

CANADA RSS-132, RSS-133, RSS-247, RSS-Gen

(*) Identification of item tested	Telematics Control Unit for trucks with TPMS support, GSM, BLE, LF Transmitter and GNSS receiver
(*) Trademark	LDL Technology
(*) Model and /or type reference	19239
Other identification of the product	HW version: 319-158-2090 SW version: 414069191013 FCC ID: T4519239 IC: 6450A-19239 Cell module FCC ID: RI7ME910C1WW Cell module IC: 5131A-ME910C1WW IMEI TAC: 35308109
(*) Features	Bluetooth LE, RF 434, GSM/LTE, GNSS receiver
Applicant	LDL TECHNOLOGY Parc Technologique du Canal, 3 rue Giotto, 31520, Ramonville-Saint-Agne, FRANCE
Test method requested, standard	USA FCC Part 15.31(h) (10-1-19 Edition): Measurement standard. USA FCC Part 22 (10-1-19 Edition): Public Mobile Services. USA FCC Part 24 (10-1-19 Edition): Personal 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. USA FCC Part 15.231 (10-1-19 Edition): Periodic operation in the band 40.66-40.70 MHz and above 70 MHz. CANADA RSS-132 Issue 3, Jan. 2013. CANADA RSS-133 Issue 6 Amendment 1, Jan. 2018. CANADA RSS-Gen Issue 5 (March 2019). CANADA RSS-247 Issue 2 (February 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 C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. ANSI C63.26-2015. ANSI/TIA-603-E: 2016.	
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager	 RAFAEL LÓPEZ MARTÍN 2020.12.23 12:32:43 +01'00'
Date of issue	2020-12-23	
Report template No	FDT08_23 (*) "Data provided by the client"	

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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.

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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 19239 is a system that aims to offer telematic services and the device acts like gateway, receiving and transmitting data

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
64195C/029	Telematics Control Unit	19239	9d99E029	2020-06-01
64195C/020	Harness	--	--	2020-03-25
64195C/013	Metallic mounting bracket	--	--	2020-03-25

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⁾		
		Power and data (RS232) test cable	1	☒	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: nominal 12V/24V (according to vehicle battery)					
☒	DC: tolerated range: 8 to 32V						
Rated Power	12W						
Clock frequencies.....	8MHz, 32 MHz, 32.768 KHz, 16 MHz						
Other parameters							
Software version	414069191013						
Hardware version	319-158-2090						
Dimensions in cm (W x H x D)	18 x 6.5 x 13						
Mounting position	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: attached to provided bracket, mounted on vehicle					
Modules/parts.....	Module/parts of test item		Type	Manufacturer			

	TCU 1.2 4G Autolocation	EUT	LDL Technology
	TCU 1.2 Bracket	Metallic mounting bracket	LDL Technology
Accessories (not part of the test item)	Description	Type	Manufacturer
Documents as provided by the applicant	Description	File name	Issue date

⁽³⁾ Only for Medical Equipment

Identification of the client

LDL TECHNOLOGY
Parc Technologique du Canal, 3 rue Giotto, 31520, Ramonville-Saint-Agne, FRANCE

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-11-20
Date (finish)	2020-11-20

Document history

Report number	Date	Description
66776RRF.001	2020-12-23	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 %

Remarks and comments

The tests have been performed by the technical personnel: Verónica García, Pablo Redondo.

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. Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
6. RF Pre-amplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2020/05	2021/05
7. Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
8. Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
9. Pre-amplifier, G>30 dB, 18-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
10. DC Power Supply Keysight Technologies U8002A	N.A.	N.A.
11. Digital Multimeter FLUKE 175	2020/11	2021/11

Testing verdicts

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

Summary

FCC PART 15 / FCC PART 22 / FCC PART 24 / RSS-247 / RSS-132 / RSS-133 / RSS-Gen PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 15.31(h), FCC 15.209 (a), FCC 15.247 (d) / RSS-Gen 8.9, RSS-247 5.5. FCC 22.917 / RSS-132 5.5 FCC 24.238 / RSS-133 6.5 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 22, 15.247, 15.209 / RSS-132, RSS-247

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 12 Vdc

Type of Power Supply: DC external.

ANTENNA:

Type of Antennas: Internal (SMD).

Maximum Declared Gain for Bluetooth LE: +2.2 dBi

Maximum Declared Gain for CELLULAR:

LOW Bands	GAIN	ANTENNA TYPE
2G Band 850 MHz	+3.5 dBi	Internal (SMD)

TEST FREQUENCIES:

Based on preliminary testing that identified those corresponding to the worst cases (cases with the higher E.I.R.P.):

	CELLULAR 2G	
Band:	2G Band GSM-850	
Frequency Range:	824 – 849 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Low: 128	824.2

	Bluetooth LE	
Mode:	GFSK	
Channel Spacing:	1 MHz	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Low: 37	2402

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.

Selected Transmission Modes for each Radio:

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

* Cellular 2G Band GSM-850: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in:

Cellular 2G Band GSM-850 / Low Channel in GPRS mode configuration.

This channel was found to transmit higher EIRP than all the other 2G channels.

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

TESTED SIMULTANEOUS TRANSMISSION MODES:

* **Co-Location mode 2G Band GSM-850, Bluetooth Low Energy**, with the EUT configured to simultaneously transmit two signals at maximum output power, Cellular 2G Band GSM-850 / Low Channel in GPRS mode and Bluetooth Low Energy / Low Channel in GFSK mode.

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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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
Above 960	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.

1. 2G Band GSM-850. FCC §2.1053 & §22.917 / RSS-132 Clause 5.5.:

FCC §22.917:

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-132 Clause 5.5:

- i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts).
- ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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.

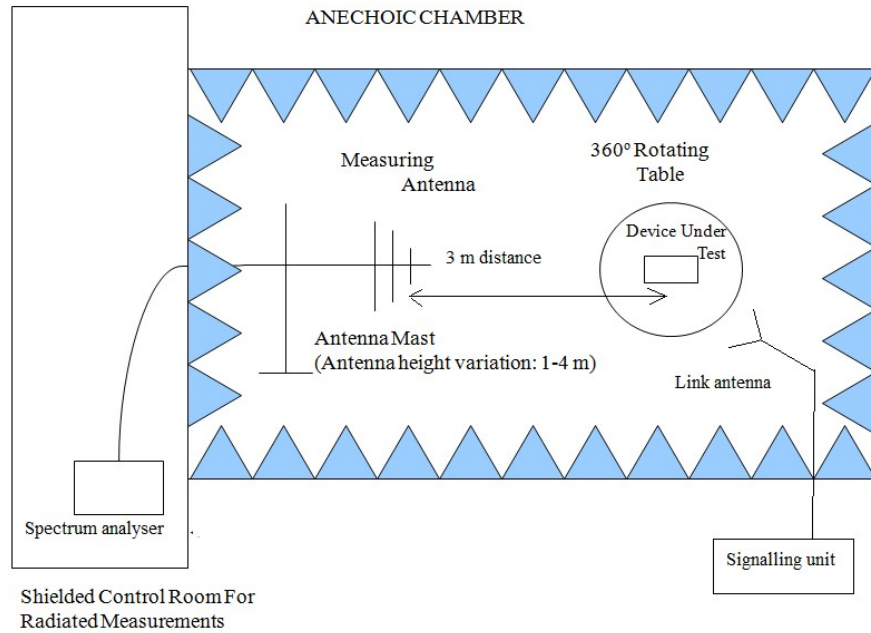
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

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.

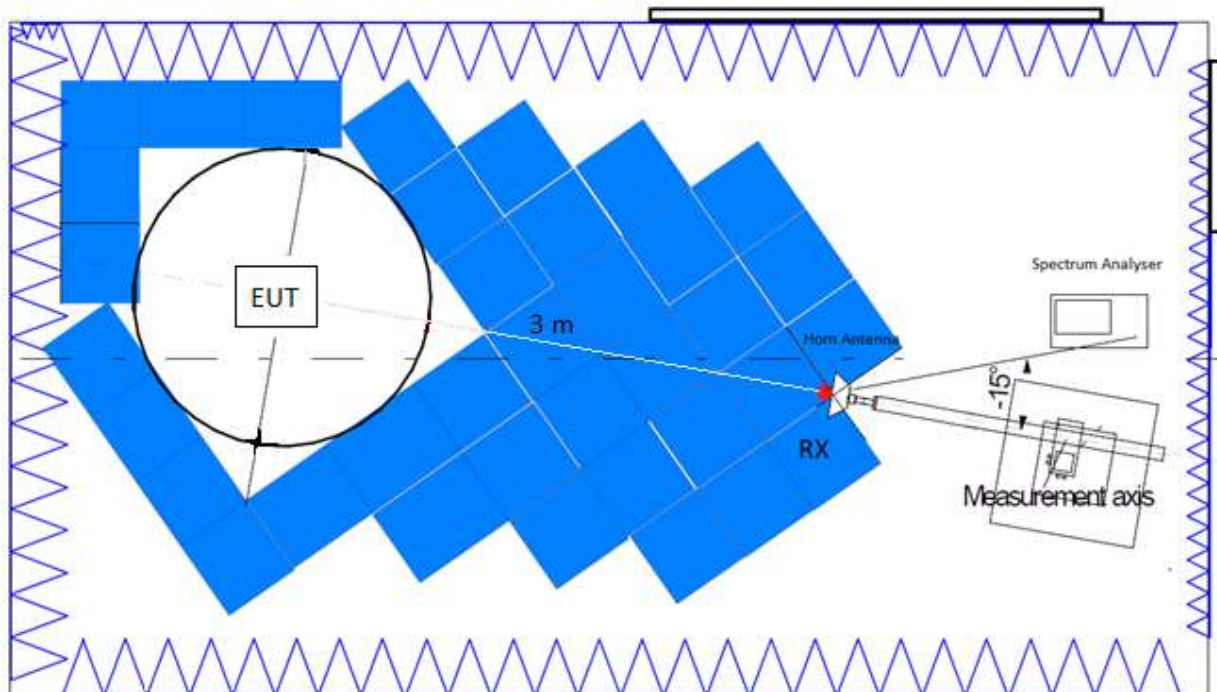
These measurements have been performed in order to check the impact of the Co-Location of all radio interfaces (that can be transmitting simultaneously).

TEST SETUP:

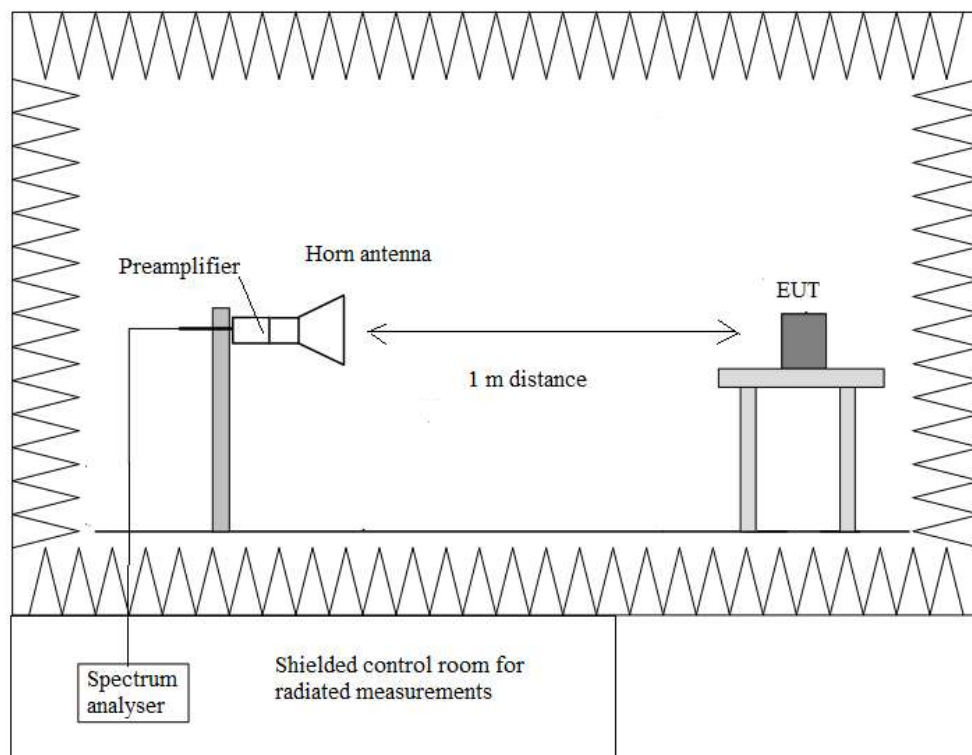
Radiated measurements below 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



RESULTS:

• Co-Location mode 2G Band GSM-850, Bluetooth Low Energy:

GPRS & EDGE:

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

2G Band GSM-850:	Low Channel (824.2 MHz). GPRS.
Bluetooth Low Energy:	Low Channel (2402 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 8.49 GHz	Peak	$43 + 10 \log (P) \text{ dB} = -13 \text{ dBm} \rightarrow 82.23 \text{ dBµV/m}$
8.49 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

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E (dBµV/m)	Polarization	Detector
881.6600	66.76	H	Peak

Frequency range 1 - 26 GHz

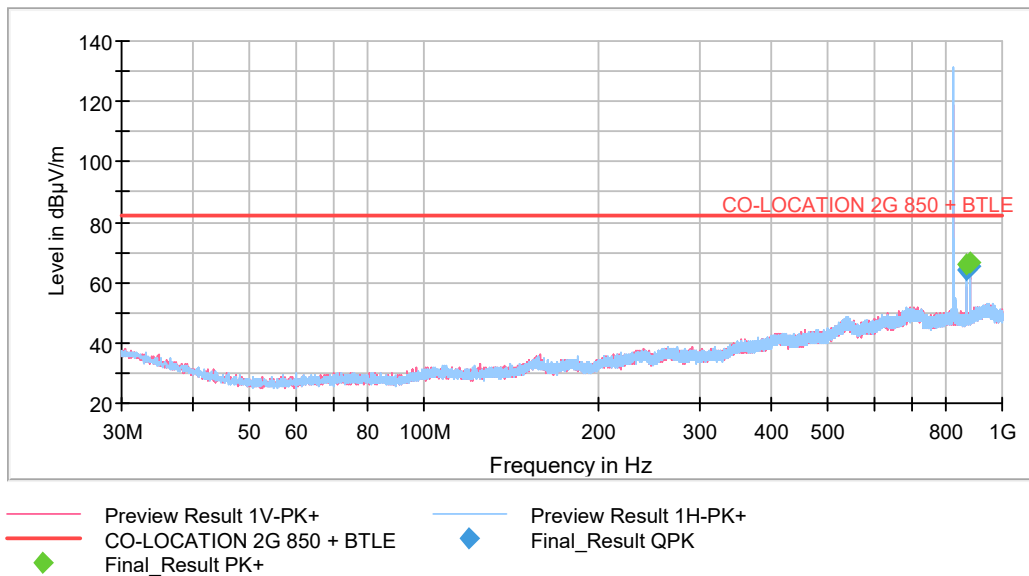
Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	E (dBµV/m)	Polarization	Detector
1.6485	68.78	H	Peak
12.0090	51.74	V	Peak

Measurement uncertainty (dB)	$< \pm 4.68$ for $f < 1 \text{ GHz}$ $< \pm 4.00$ for $f \geq 1 \text{ GHz}$ up to 3 GHz $< \pm 4.99$ for $f \geq 3 \text{ GHz}$ up to 17 GHz $< \pm 5.08$ for $f \geq 17 \text{ GHz}$ up to 26 GHz
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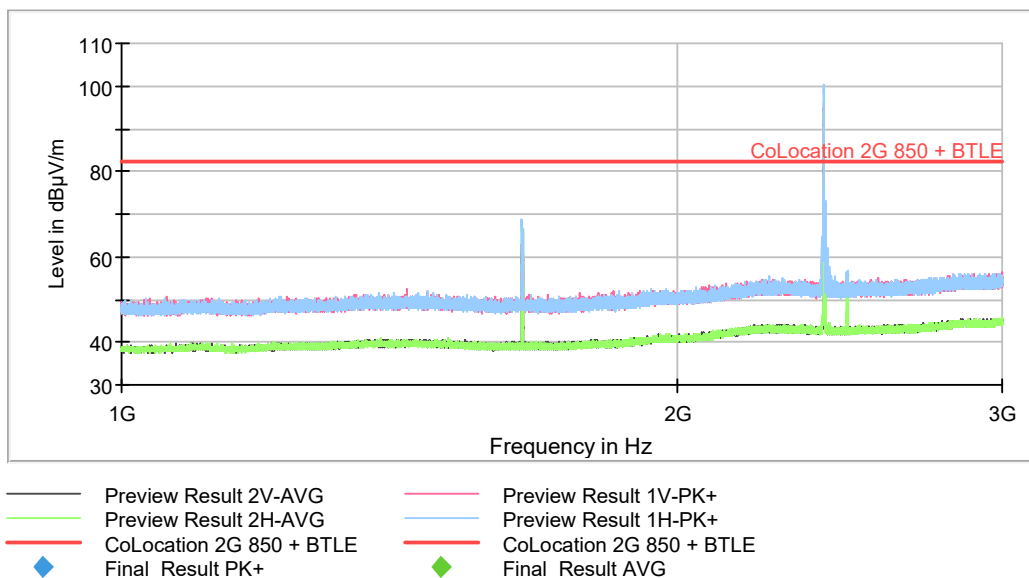
Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz (worst case):



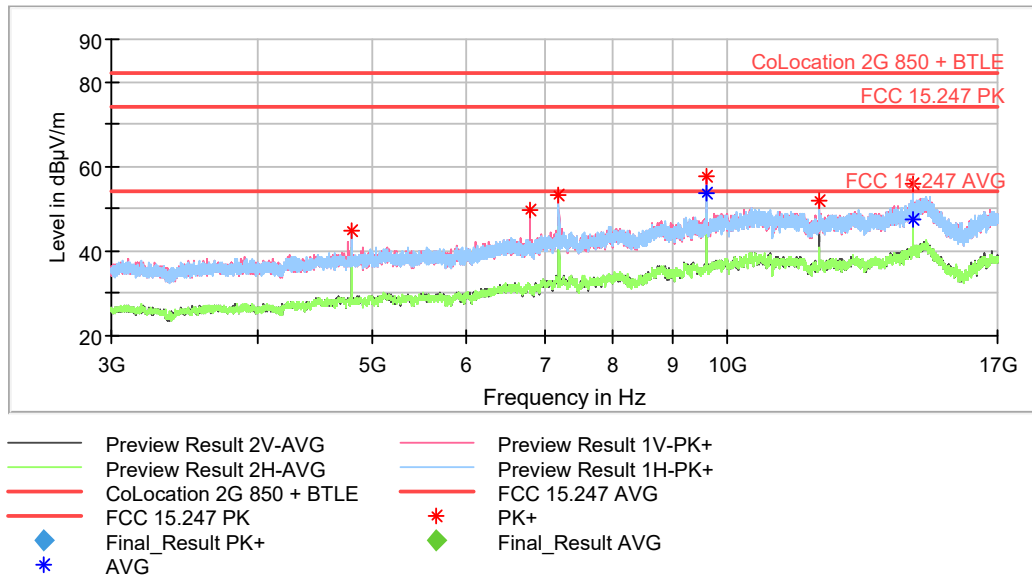
The peak above the limit is the Carrier frequency of the 2G Band GSM-850 (824.2 MHz).
The other peak is the Downlink Carrier frequency 2G Band GSM-850 (869.2 MHz).

FREQUENCY RANGE 1 - 3 GHz (worst case):

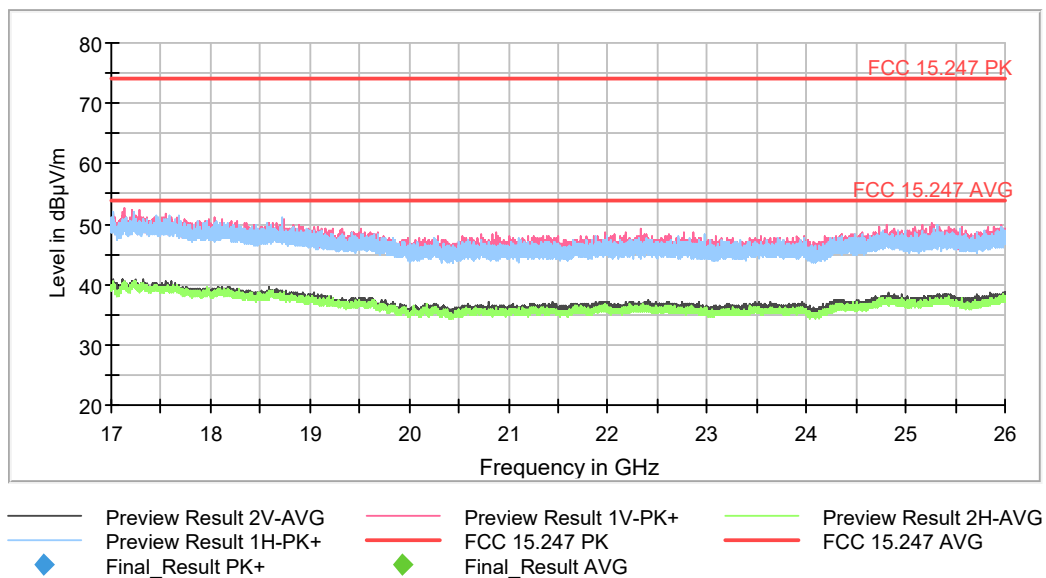


The peak above the limit is the Carrier frequency of the Bluetooth Low Energy.

FREQUENCY RANGE 3 – 17 GHz (worst case):



FREQUENCY RANGE 17 - 26 GHz (worst case):



Appendix B: Test results FCC 24, 15.247, 15.209 / RSS-133, RSS-247

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Radiated emissions	24

TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 12 Vdc
Type of Power Supply: DC External.

ANTENNA:

Type of Antennas: Internal (SMD).
Maximum Declared Gain for Bluetooth LE: +2.2 dBi
Maximum Declared Gain for CELLULAR:

MIDDLE Bands	GAIN	ANTENNA TYPE
2G Band 1900 MHz	+3.5 dBi	Internal (SMD)

TEST FREQUENCIES:

	CELLULAR 2G	
Band:	2G Band PCS-1900	
Frequency Range:	1850 – 1910 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	High: 810	1909.8

	Bluetooth LE	
Mode:	GFSK	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Low: 37	2402

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.

Selected Transmission Modes for each Radio:

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

* Cellular 2G Band PCS-1900: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in PCS-1900 / High Channel in GPRS mode configuration. This channel was found to transmit higher EIRP than all the other LTE channels.

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

TESTED SIMULTANEOUS TRANSMISSION MODES:

* **Co-Location mode 2G Band PCS-1900, Bluetooth Low Energy**, with the EUT configured to simultaneously transmit two signals at maximum output power, Cellular 2G Band PCS-1900 / High Channel in GPRS mode and Bluetooth Low Energy / Low Channel in GFSK mode.

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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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
Above 960	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.

1. 2G Band PCS-1900. FCC §2.1053 & §24.238 / RSS-133 Clause 6.5.

FCC §24.238:

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-133 Clause 6.5:

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

ii. After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10}(P)$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

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.

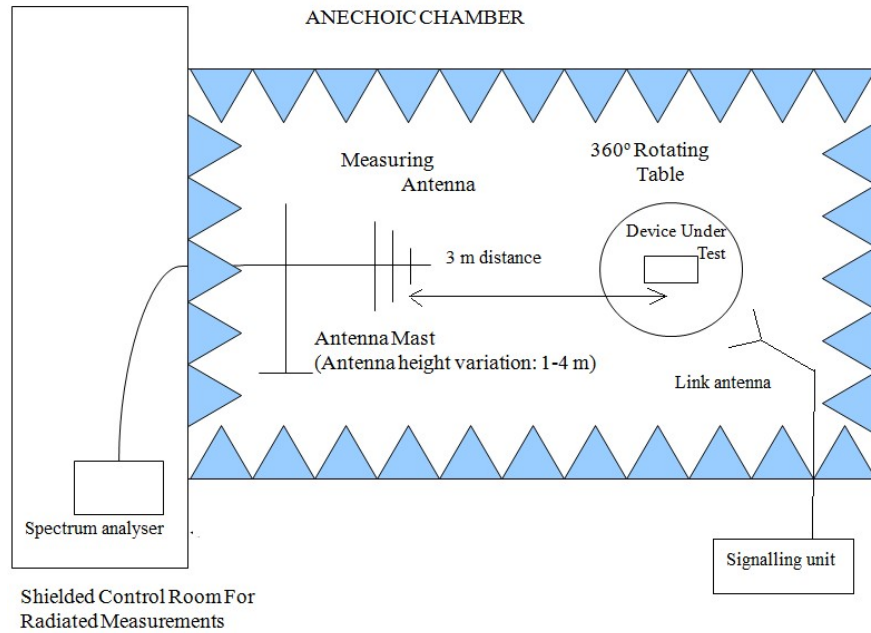
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

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.

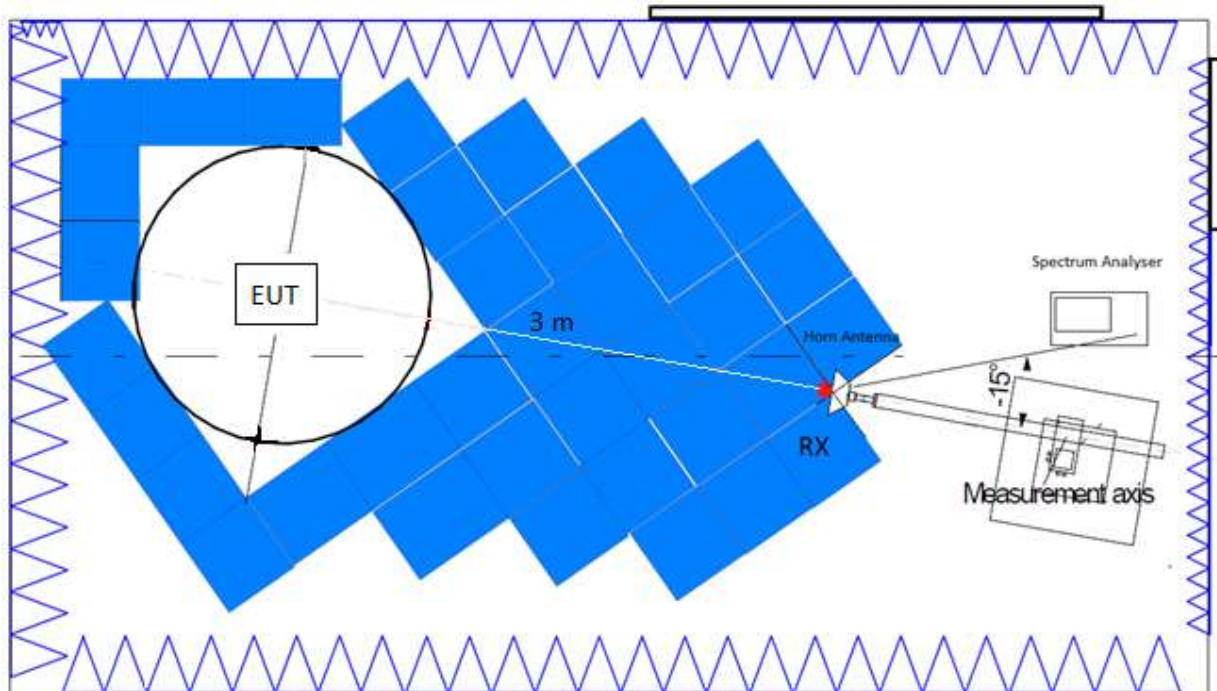
These measurements have been performed in order to check the impact of the Co-Location of all radio interfaces (that can be transmitting simultaneously).

TEST SETUP:

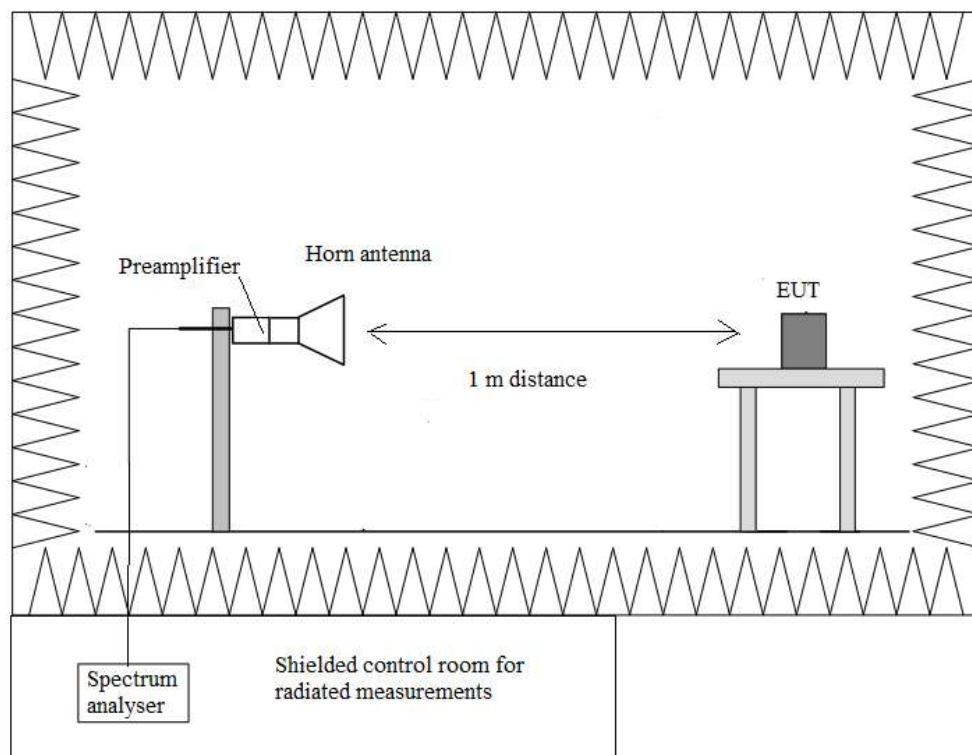
Radiated measurements below 1 GHz.



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



RESULTS:

• Co-Location mode 2G Band PCS-1900, Bluetooth Low Energy:

GPRS & EDGE:

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

2G Band PCS-1900:	High Channel (1909.8 MHz). GPRS.
Bluetooth Low Energy:	Low Channel (2402 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 19.1 GHz	Peak	$43 + 10 \log (P) \text{ dB} = -13 \text{ dBm} \rightarrow 82.23 \text{ dB}\mu\text{V/m}$
19.1 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.

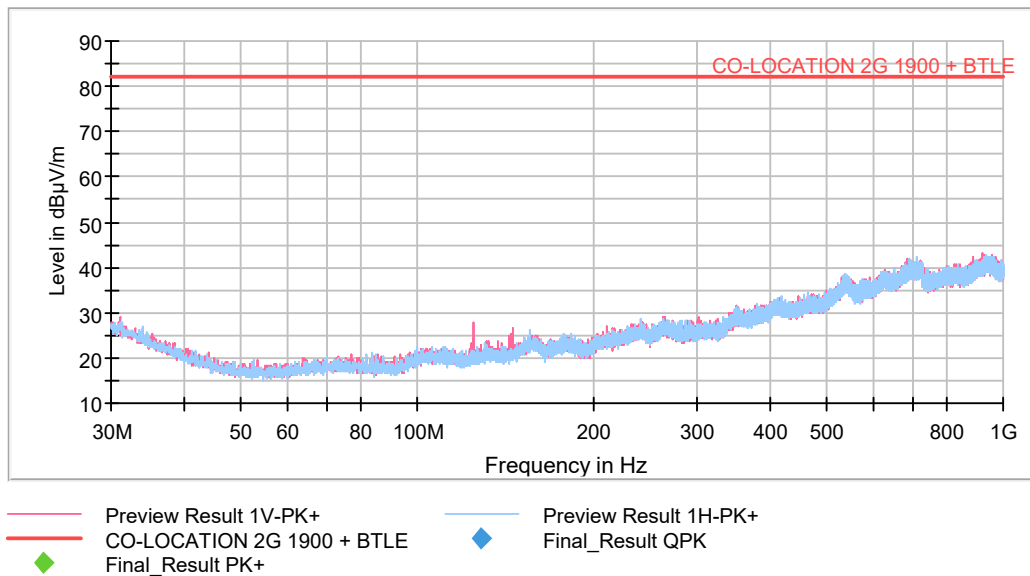
Frequency range 1 – 26 GHz

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

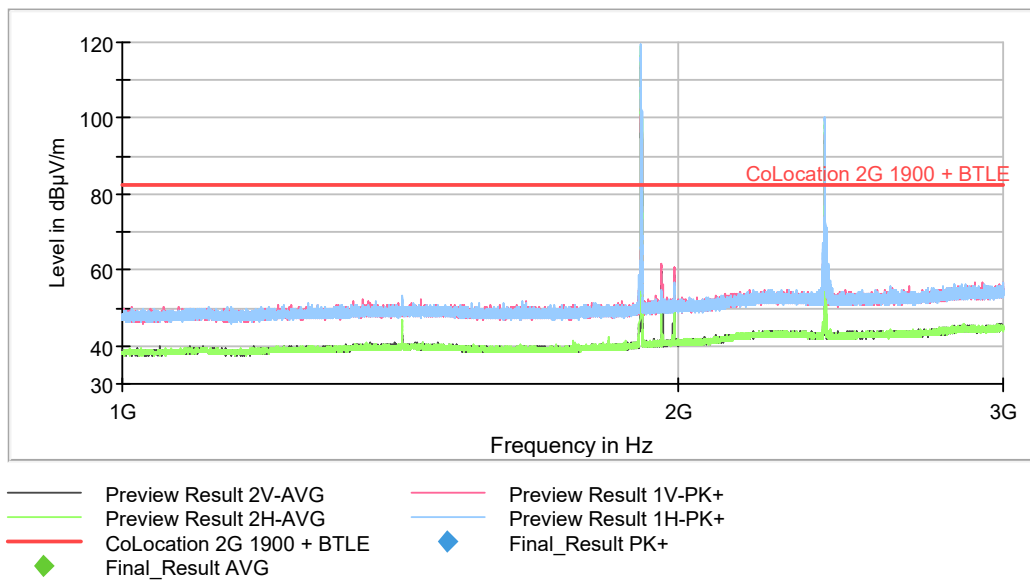
Measurement uncertainty (dB)	$<\pm 4.68$ for $f < 1 \text{ GHz}$ $<\pm 4.00$ for $f \geq 1 \text{ GHz}$ up to 3 GHz $<\pm 4.99$ for $f \geq 3 \text{ GHz}$ up to 17 GHz $<\pm 5.08$ for $f \geq 17 \text{ GHz}$ up to 26 GHz
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Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz (worst case):



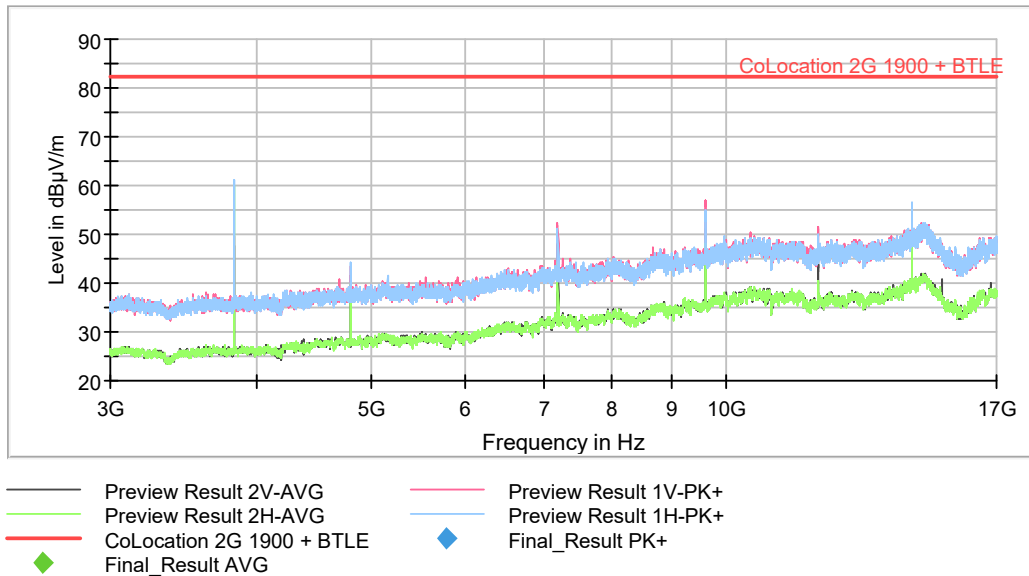
FREQUENCY RANGE 1 – 3 GHz (worst case):



The peak above the limit on the left is the Carrier frequency 2G Band PCS-1900 (1909.8 MHz).

The peak above the limit on the right is the Carrier frequency Bluetooth Low Energy (2402 MHz).

FREQUENCY RANGE 3 – 17 GHz (worst case):



FREQUENCY RANGE 17 - 26 GHz (worst case):

