RADIO TEST REPORT

No. 2019067STO-306

RF Performance

EQUIPMENT UNDER TEST

Equipment:	Gateway
Type/Model:	Gateway for Tork EasyCube™ LTE-M (802.15.4 version) TENA SmartCare Gateway (Bluetooth Low Energy version)
Manufacturer:	Essity Hygiene and Health AB
Tested by request of:	Essity Hygiene and Health AB

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the selected requirements according to the following standards:

47 CFR Part 15: Subpart C: Intentional radiators. Section 15.247

RSS-GEN Issue 5 Amendment 1 (2019): General requirements of compliance of radio apparatus (2019)

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

For details, see clause 2 – 4.

Note: Only transmitter spurious emission in the frequency range 1 – 26 GHz has been tested by request of the client.

Date of issue: October 15, 2020

Tested by: Robert Hietala

Approved by: Björn Utermöhl

Revision History

Test report number	Date	Description	Changes
2019067STO-302	July 10, 2020	First release	--
2019067STO-306	October 15, 2020	Second release	Updated clauses 2.2, 3.2 and 4.

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1 CLIENT INFORMATION

The EUT has been tested by request of

Company	Essity Hygiene and Health AB Mölndals Bro 2 Mölndal 405 03 Göteborg Sweden
Name of contact	Rickard Holmersson Phone +46 31 746 06 63

2 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	Gateway
Type/Model:	Gateway for Tork EasyCube™ LTE-M (802.15.4 version) TENA SmartCare Gateway (Bluetooth Low Energy version)
Brand name:	Essity Hygiene and Health AB
Serial number:	No visible serial
Manufacturer:	Essity Hygiene and Health AB
Transmitter frequency range:	2402 – 2480 MHz (Bluetooth Low Energy) 2405 – 2480 MHz (802.15.4) 1710 – 1980 MHz (LTE Cat M1) 703 – 915 MHz (LTE Cat M1) 1710 – 1980 MHz (LTE Cat NB1) 703 – 915 MHz (LTE Cat NB1)
Receiver frequency range:	2402 – 2480 MHz (Bluetooth Low Energy) 2405 – 2480 MHz (802.15.4) 1805 – 2170 MHz (LTE Cat M1) 729 – 960 MHz (LTE Cat M1) 1805 – 2170 MHz (LTE Cat NB1) 729 – 960 MHz (LTE Cat NB1)
Number of channels/bands:	40 (Bluetooth Low Energy) 16 (802.15.4) 13 (LTE Cat M1) 13 (LTE Cat NB1)
Antenna:	☒ Internal antenna ☐ External antenna
Antenna connector:	☒ None, internal antenna ☐ Yes
Antenna gain:	See section 2.1.1
Type of modulation:	GFSK (Bluetooth Low Energy) O-QPSK (802.15.4) QPSK, 16QAM (LTE Cat M1) QPSK, 16QAM (LTE Cat NB1)
Temperature range:	☐ Category I (General): -20°C to +55°C ☐ Category II (Portable equipment): -10°C to +55°C ☐ Category III (Equipment for normal indoor use): +5°C to +35°C ☒ Other: +15°C to +45°C
Transmitter standby mode supported:	☒ Yes ☐ No

2.1.1 Antenna information

Antenna	Manufacturer	Type/model	Gain [dBi]	Connector
Antenna 1	--	--	0	PCB mounted
Antenna 2	--	--	0	PCB mounted

2.2 Additional information about the EUT

The EUT is a new revision of a gateway that employs a Bluetooth Low Energy 1 Mbit and an 802.15.4 radio, which have previously been tested for full compliance in Intertek Test Report No. 1910014STO-002, Ed. 3.

This new revision of the gateway employs new PCB antennas for the Bluetooth Low Energy and 802.15.4 radios.

The EUT also employs an LTE (Cat M1 and Cat NB1) and GSM (900/1800) module, Sierra Wireless AirPrime WP7702.

The Bluetooth Low Energy and 802.15.4 radio cannot transmit simultaneously. Either one of the Bluetooth Low Energy or 802.15.4 can transmit simultaneously as either the LTE or the GSM radio.

This test report covers transmitter spurious emission in the frequency range 1 – 26 GHz for Bluetooth low Energy and 802.15.4.

In the frequency range 1 – 13 GHz test results have been presented for both antennas. In the frequency range 13 – 26 GHz test results for the worst-case antenna have been presented.

The EUT consists of the following units:

Unit	Type	Serial number	Comment
Unit 1	Gateway	No visible serial	Uses antenna 1
Unit 2	Gateway	No visible serial	Uses antenna 2

During the tests the EUT supported following software:

Software	Version	Comment
IoT Certification Card	--	Used to program Bluetooth Low Energy and 802.15.4.

2.3 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type/Model	Manufacturer	Part number
AC/DC adapter	GTM46101-1005USB	GlobTek Inc	WR9QA2000USBNMEDR6W

2.4 Test signals and operating modes

Continuous signal with GFSK modulation (Bluetooth Low Energy).

Continuous signal with O-QPSK modulation (802.15.4).

The following settings were used for the Sierra Wireless AirPrime WP7702 LTE Cat M1 / LTE Cat NB1 module:

Technique	Modulation	UL subcarrier spacing [kHz]	Subcarriers
LTE Cat NB-IoT 1	QPSK	15	1

Technique	Modulation	Cell bandwidth [MHz]	Resource blocks
LTE Cat M1	QPSK	10	6 uplink / 6 downlink

3 TEST SPECIFICATIONS

3.1 Standards

Requirements:

47 CFR Part 15 (2015): Subpart C: Intentional radiators. Section 15.247

RSS-GEN Issue 5 Amendment 1 (2019): General requirements of compliance of radio apparatus.

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test methods:
ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.2 Additions, deviations and exclusions from standards and accreditation

By request of the client only transmitter spurious emission in the frequency range 1 – 26 GHz have been tested for Bluetooth Low Energy and 802.15.4.

No other additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB
Torshamnsgatan 43
Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G
Intertek Semko AB is an ISED recognized wireless testing laboratory with CAB identifier SE0003.

Measurement chambers:

Measurement Chamber	Type of chamber	IC Site filing #
Radiohallen	Fully anechoic 3 m	2042G-4

4 TEST SUMMARY

The results in this report apply only to sample tested:

Requirement	Description	Result
FCC §15.203 **RSS-GEN 8.3** **FCC §15.247 (b)(4)** **RSS-247 5.4(4), 5.4(5)**	**Antenna** The EUT has integrated non detachable antenna which can't be remove without breaking the EUT. The antenna gain is less than 6 dBi	**PASS**
FCC Part 15.205 **RSS-GEN 8.10**	**Restricted bands of operations** The transmit frequency, including fundamental components of modulation, of license-exempt radio apparatus shall not fall within the restricted frequency bands listed in CFR 47 §15.205 and in RSS-GEN section 8.10 EUT operates in unrestricted 2400 – 2483.5 MHz frequency band.	**PASS**
FCC §15.207(a), 15.107 **RSS-GEN 8.8 table 3**	**Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port** The margin to the limit was at least 18.3 dB at 165 kHz.	**PASS[1]**
FCC §15.247 (d), 15.209(a) **RSS-GEN 8.9** **RSS-247 5.5**	**Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz** The EUT complies with the limits. The margin to the limit was at least 10 dB.	**PASS[1]**
FCC §15.247(d), 15.209(a) **RSS-GEN 8.9** **RSS-247 5.5**	**Radiated emission of electromagnetic fields in the frequency range above 1 GHz** The EUT complies with the limits. The margin to the limit was at least 1.4 dB at 3465.0 MHz. See clause 5.5.	**PASS**
FCC §15.247(a)(2) **RSS-GEN 6.7** **RSS-247 5.2(1)**	**Occupied bandwidth** The EUT complies with the limit. The margin to the limit was at least 232.7 kHz.	**PASS[1]**
FCC §15.247(b) **RSS-247 5.4(4)**	**Conducted output power** The EUT complies with the limit. The margin to the limit was at least 24.5 dB at 2440 MHz.	**PASS[1]**
FCC §15.247(e) **RSS-247 5.2(2)**	**Peak power spectral density** The EUT complies with the limit. The margin to the limit was at least 13.1 dB at 2440 MHz.	**PASS[1]**
FCC §15.247(d) **RSS-247 5.5**	**Conducted Band edge** The EUT complies with the limit. The margin to the limit was at least 8.3 dB at 2484 MHz.	**PASS[1]**

NA = Not applicable
NT = Not tested

[1] Refer to Intertek Test Report No. 1910014STO-002, Ed. 3

5 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 1 GHZ TO 26 GHZ

Date of test:	2020-05-27	**Test location:**	Radiohallen
EUT Serial:	No visible serial	**Ambient temp:**	22 °C
Tested by:	Robert Hietala	**Relative humidity:**	32 %
Test result:	Pass	**Margin:**	1.4 dB

5.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013.

The EUT was set up in order to emit maximum disturbances.

The EUT was placed on an insulating support 1.5 m above the turntable which is part of the reference ground plane.

Overview sweeps were performed with the measurement receiver in max-hold mode with peak and average detector activated.

5.2 Test conditions

Test set-up:	**1 GHz – 26.5 GHz**		
Test receiver set-up:			
Preview test:	Peak	RBW 1 MHz	VBW 3 MHz
	Average	RBW 1 MHz	VBW 3 MHz
Final test:	Peak	RBW 1 MHz	VBW 3 MHz
	Average	RBW 1 MHz	VBW 3 MHz
EUT height above ground plane:	1.5 m		
Measuring distance:	3 m		
Measuring angle:	0 – 359°		
Antenna			
Height above ground plane:	1.5 m		
Polarisation:	Vertical and Horizontal		
Type:	Horn		
Antenna tilt:	The EUT is rotated around its axis as described in ANSI C63.10 (2013) clause 6.6.5.		

5.3 Requirements

Within restricted bands:
Reference: CFR 47 §15.209, RSS-Gen section 8.9

Field strength of emissions must comply with limits shown in table below

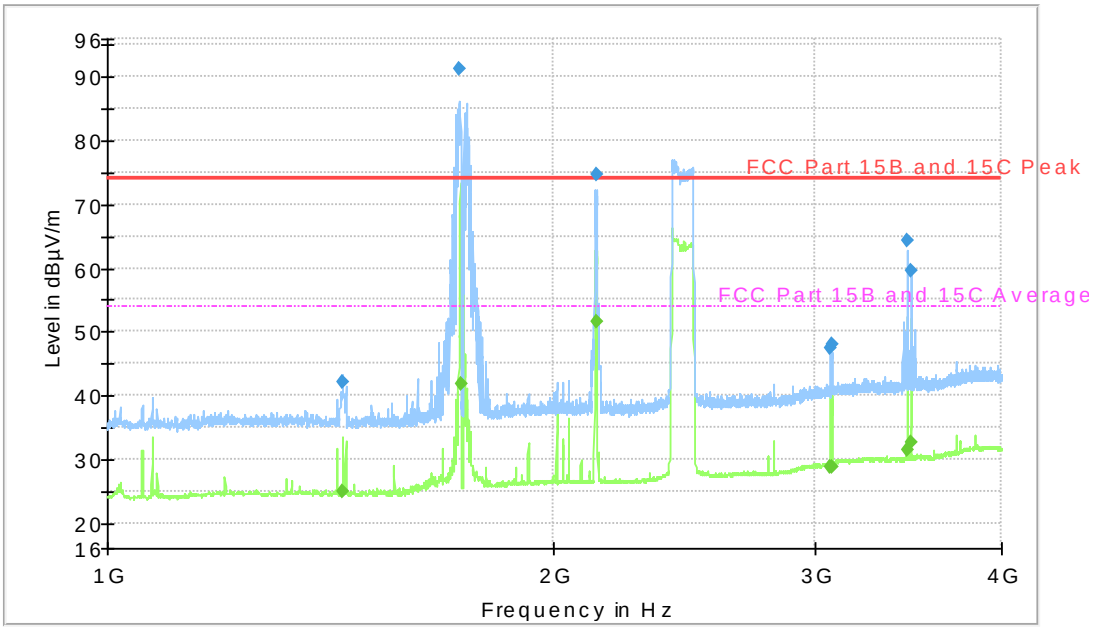
Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Field strength at 10 m (dBµV/m)	Detector (dBµV/m)
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	43.5 / 63.5	Average / Peak

The values for 10 m measuring distance are calculated by subtracting 10.5 dB from the 3 m limit.
(i.e. an extrapolation factor of 20 dB/decade according to CFR 47 §15.31(f)(1))

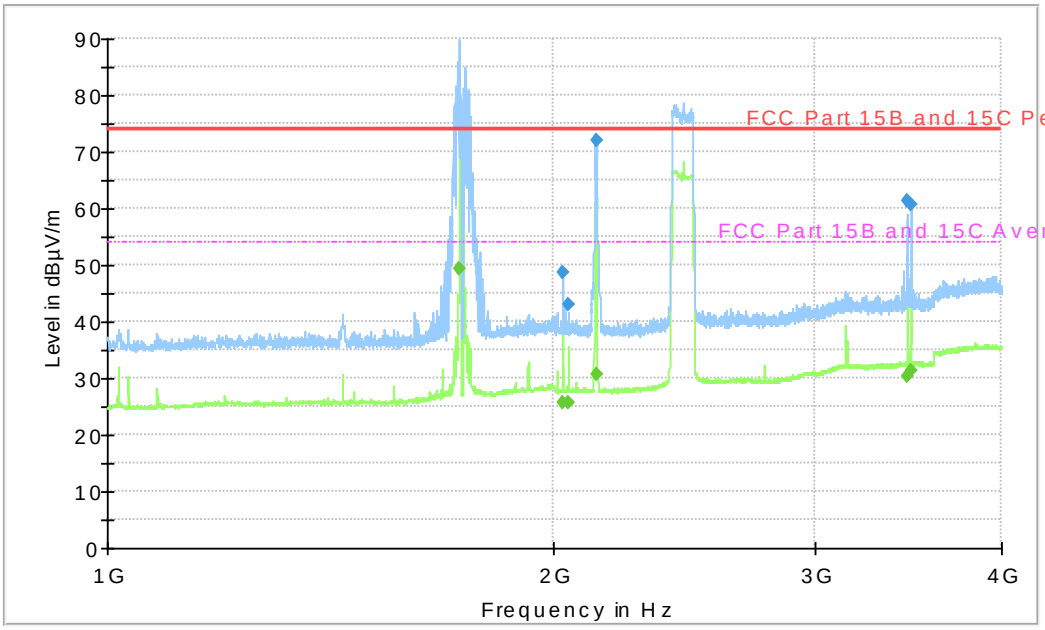
Outside the restricted bands:
Reference: CFR 47 §15.247(d), RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

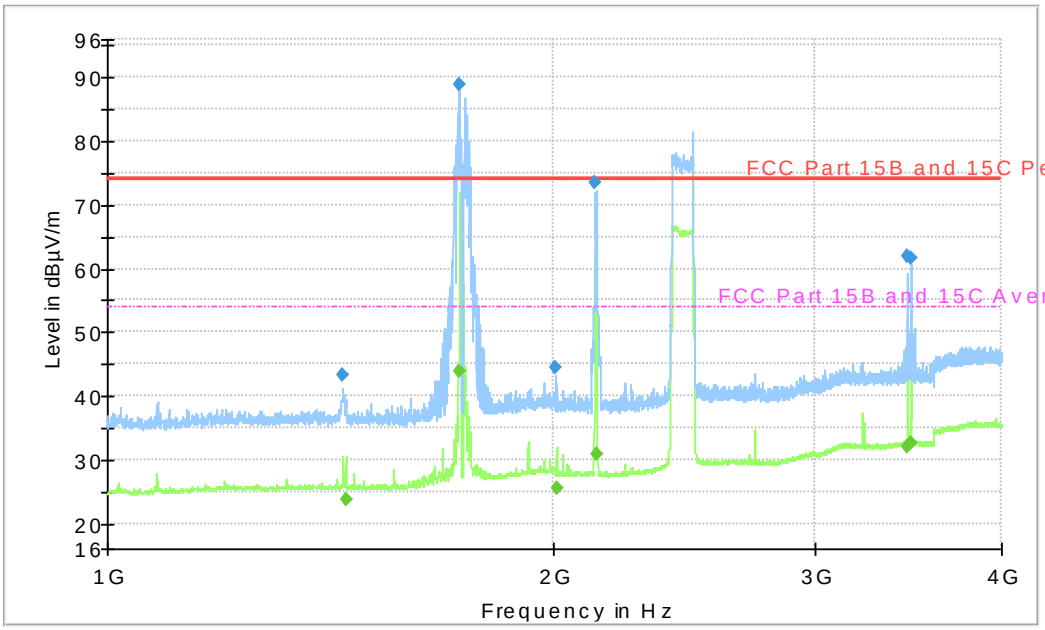
5.4 Test results 1 GHz – 13 GHz, TX mode, Bluetooth Low Energy, antenna 1



Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel, carriers are attenuated by band reject filters. LTE Cat M1 Band 4.



Diagram, Peak overview sweep, 1 – 4 GHz at 3 m distance. TX mid channel, carriers are attenuated by band reject filters. LTE Cat NB1 band 4.



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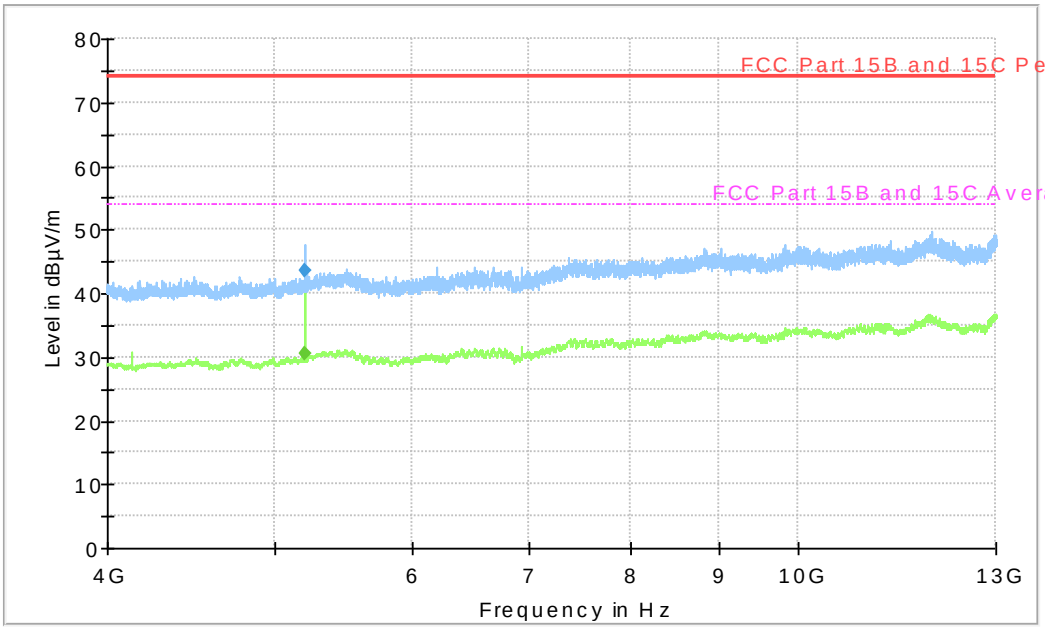
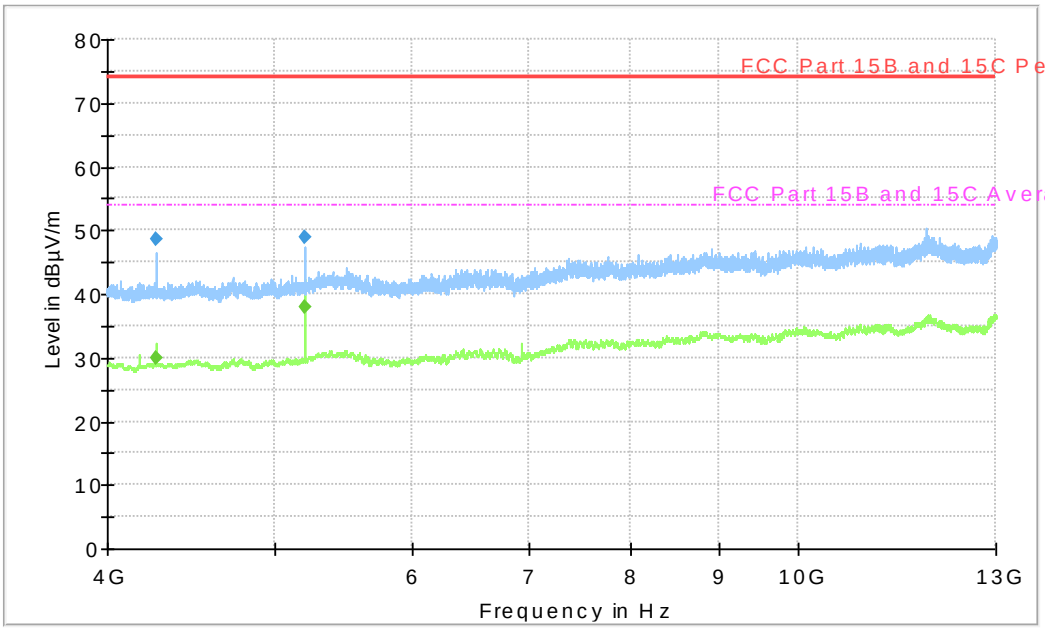


Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX low channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat NB1 band 4.



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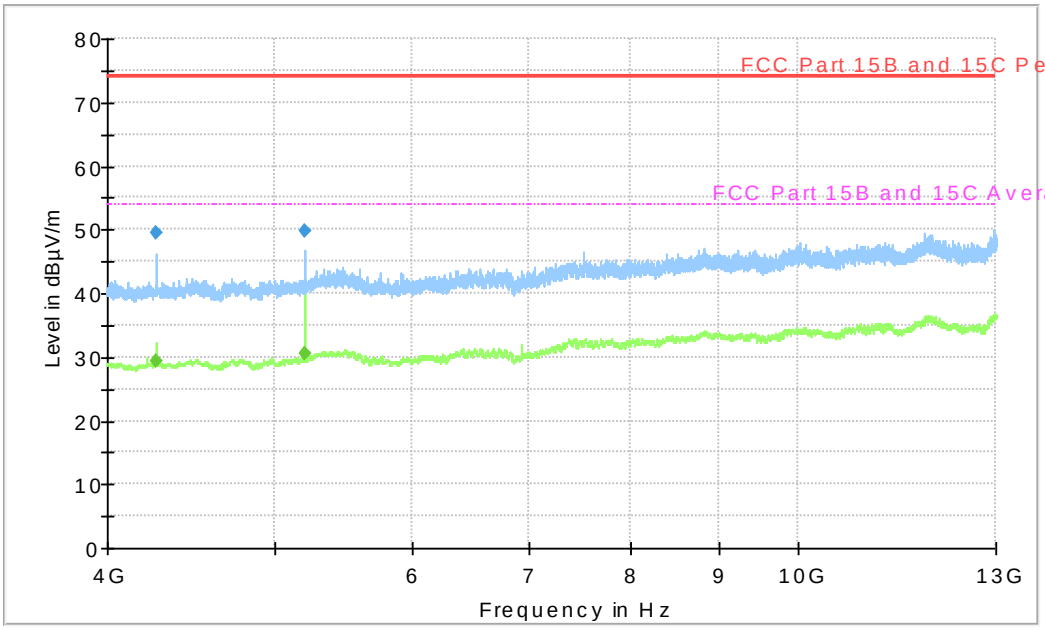


Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX high channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat NB1 band 4.

Measurement results, Peak, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.5	42.0	74.0	H	32.0	--
1725.0	91.3	74.0	V	--	LTE Cat M1 band 4 uplink
2135.0	74.6	74.0	V	--	LTE Cat M1 band 4 downlink
3067.0	47.5	74.0	H	26.5	--
3076.0	48.0	74.0	H	26.0	--
3457.5	64.3	74.0	V	9.7	--
3474.0	59.5	74.0	H	14.5	--
5197.0	43.6	74.0	H	30.4	--

Measurement results, Average, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.0	24.8	54.0	V	29.2	--
1728.5	41.9	54.0	V	--	LTE Cat M1 band 4 uplink
2135.0	51.5	54.0	V	--	LTE Cat M1 band 4 downlink
3067.5	28.6	54.0	V	25.4	--
3076.0	28.7	54.0	V	25.3	--
3457.5	31.5	54.0	V	22.5	--
3474.0	32.5	54.0	V	21.5	--
5197.0	30.5	54.0	H	23.5	--

Measurement results, Peak, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1726.5	92.8	74.0	H	--	LTE Cat NB1 band 4 uplink
2026.5	48.6	74.0	H	25.4	--
2045.0	43.1	74.0	H	30.9	--
2134.0	72.0	74.0	V	--	LTE Cat NB1 band 4 downlink
3458.0	61.5	74.0	V	12.5	--
3474.0	60.8	74.0	V	13.2	--
4265.0	48.5	74.0	V	25.5	--
5197.0	48.8	74.0	V	25.2	--

Measurement results, Average, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1728.0	49.2	54.0	H	--	LTE Cat NB1 band 4 uplink
2026.5	25.7	54.0	H	28.3	--
2044.5	25.7	54.0	H	28.3	--
2135.0	30.8	54.0	H	--	LTE Cat NB1 band 4 downlink
3457.5	30.2	54.0	H	23.8	--
3474.0	31.2	54.0	H	22.8	--
4265.0	29.8	54.0	V	24.2	--
5197.0	38.0	54.0	V	16.0	--

Measurement results, Peak, TX high channel

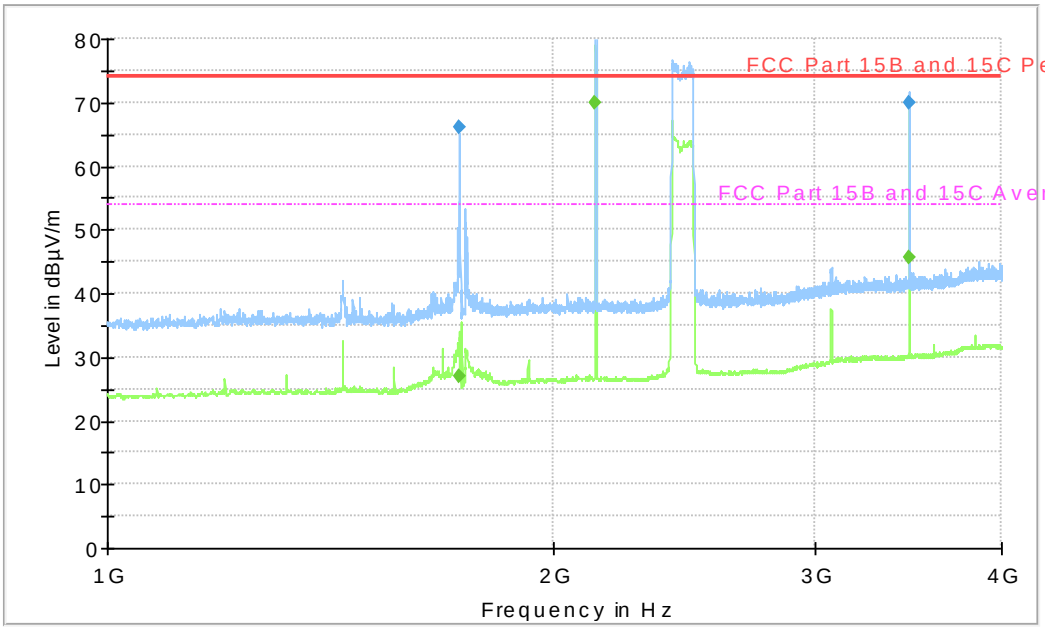
Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.0	43.4	74.0	H	30.6	--
1726.0	88.9	74.0	H		LTE Cat M1 band 4 uplink
2005.5	44.3	74.0	H	29.7	--
2128.5	73.5	74.0	V	--	LTE Cat M1 band 4 downlink
3457.5	62.0	74.0	V	12.0	--
3474.0	61.6	74.0	V	12.4	--
4264.0	49.6	74.0	V	24.4	--
5197.0	49.8	74.0	H	24.2	--

Measurement results, Average, TX high channel

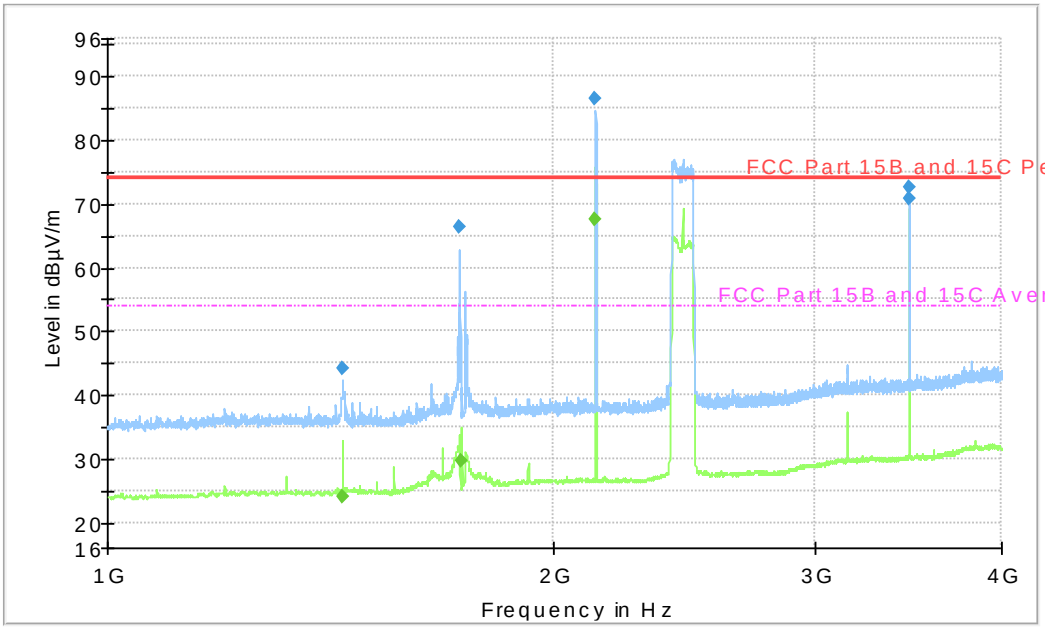
Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	
1447.5	23.8	54.0	H	30.2	--
1728.0	44.0	54.0	H	--	LTE Cat M1 band 4 uplink
2006.0	25.6	54.0	H	28.4	--
2135.0	30.8	54.0	H	--	LTE Cat M1 band 4 downlink
3457.5	31.9	54.0	H	22.1	--
3474.0	32.7	54.0	H	21.3	--
4264.5	29.5	54.0	V	24.5	--
5197.0	30.5	54.0	V	23.5	--

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

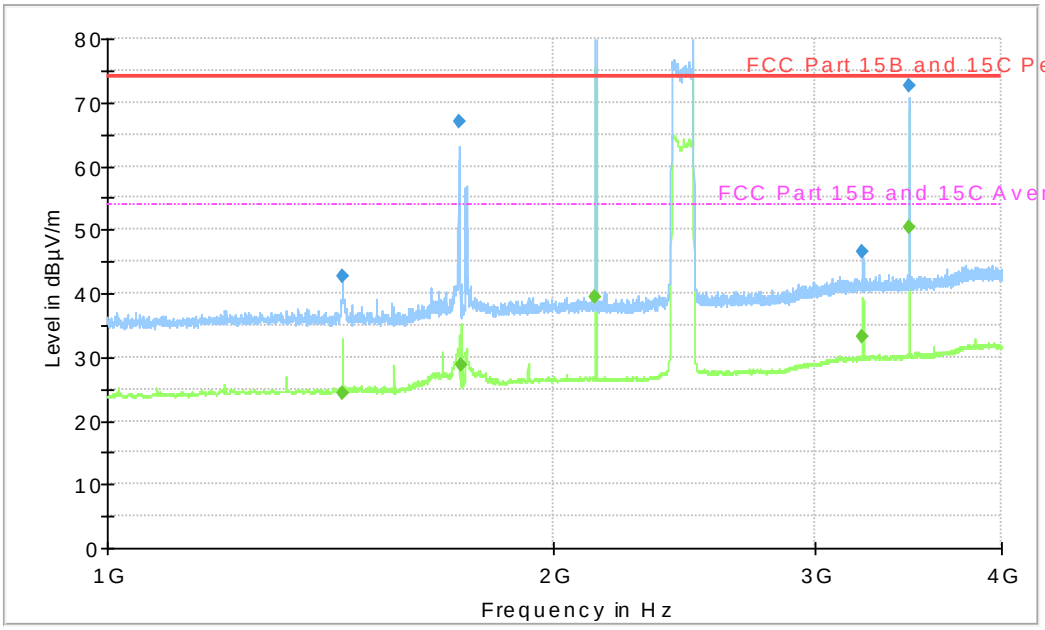
5.5 Test results 1 GHz – 26 GHz, TX mode, Bluetooth Low Energy, antenna 2



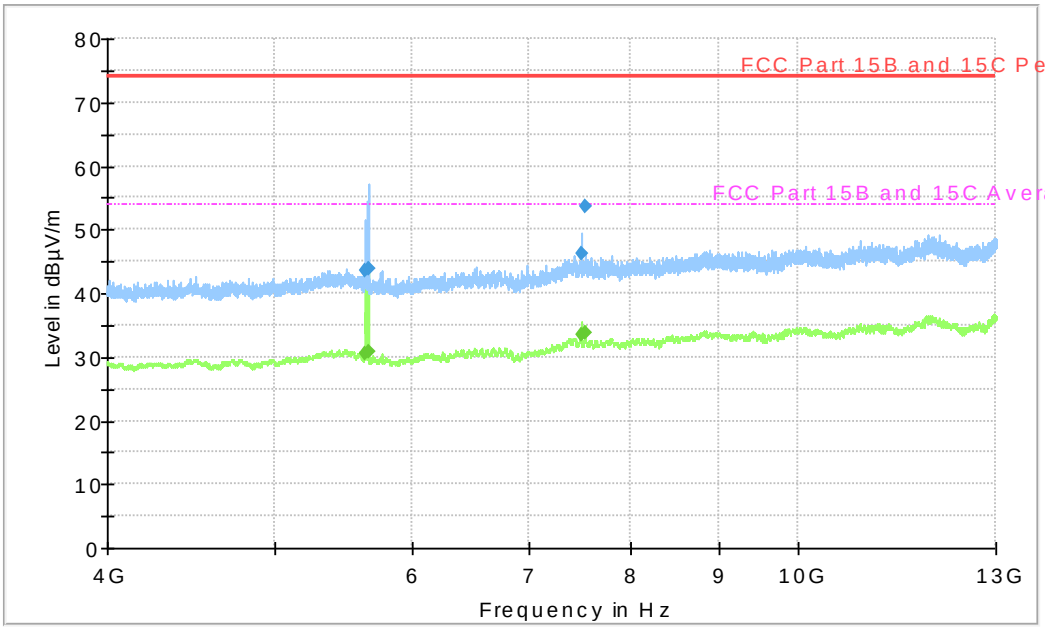
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



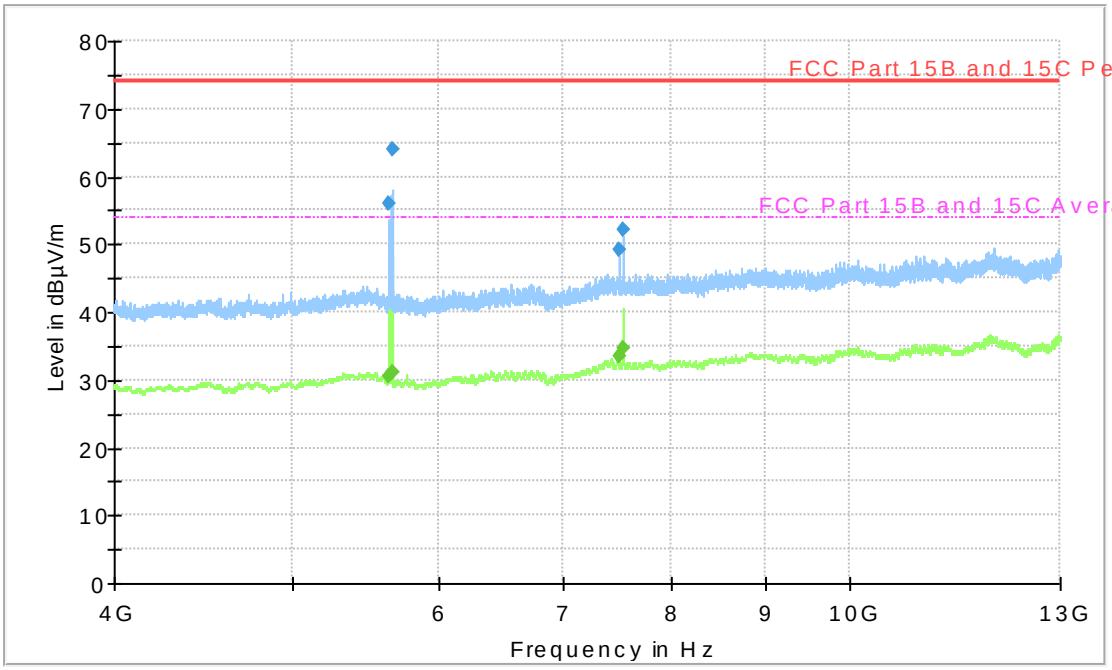
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX mid channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX low channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 2.



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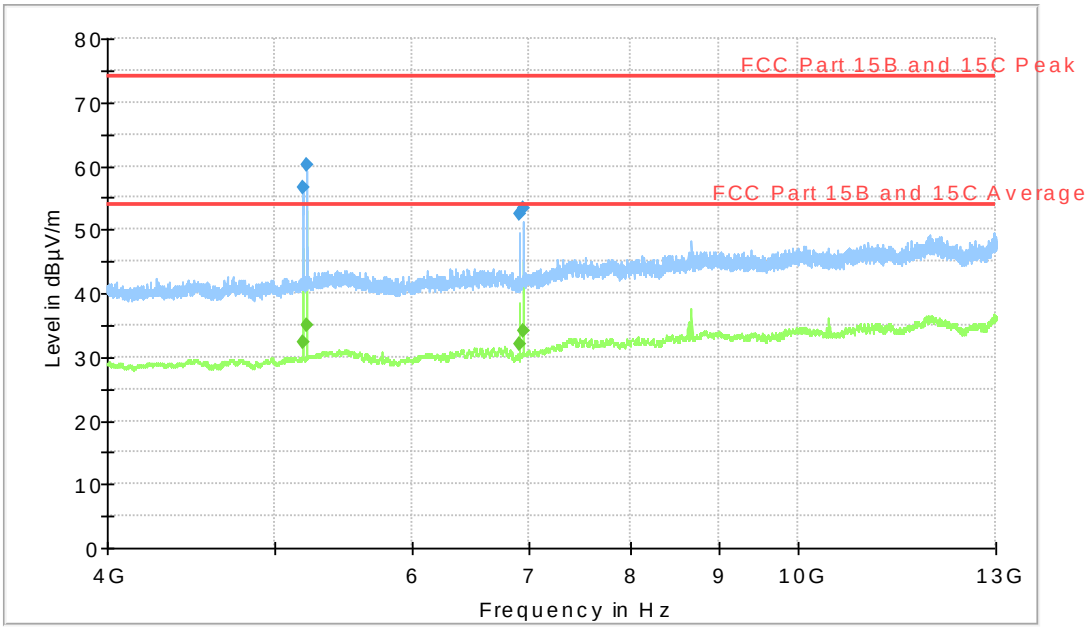

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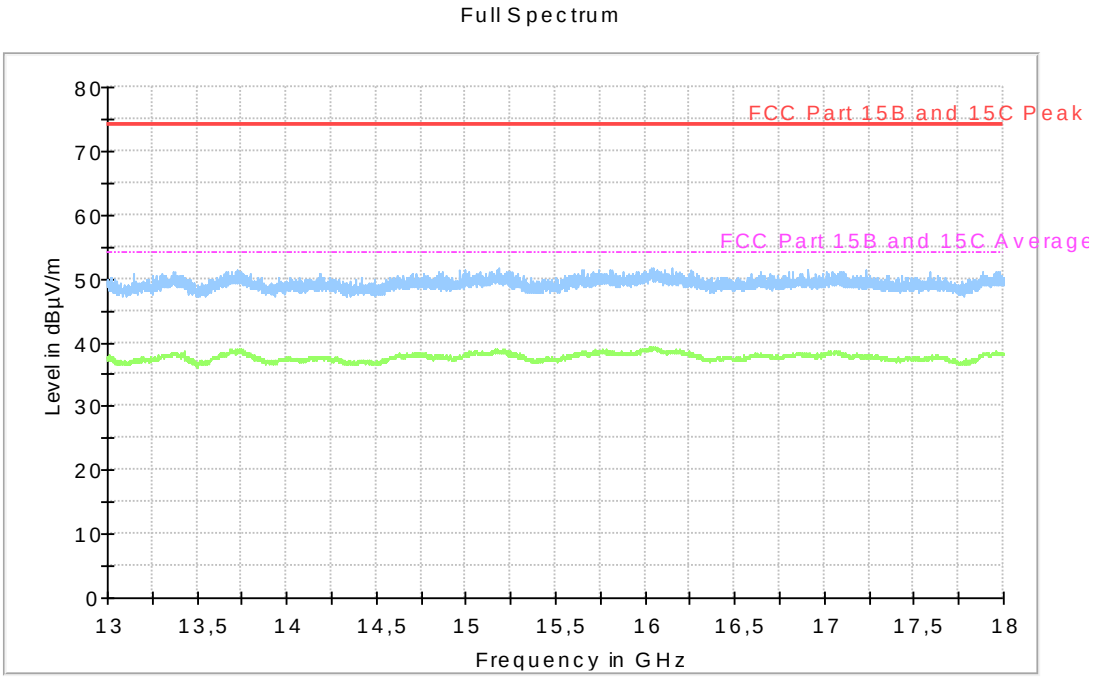
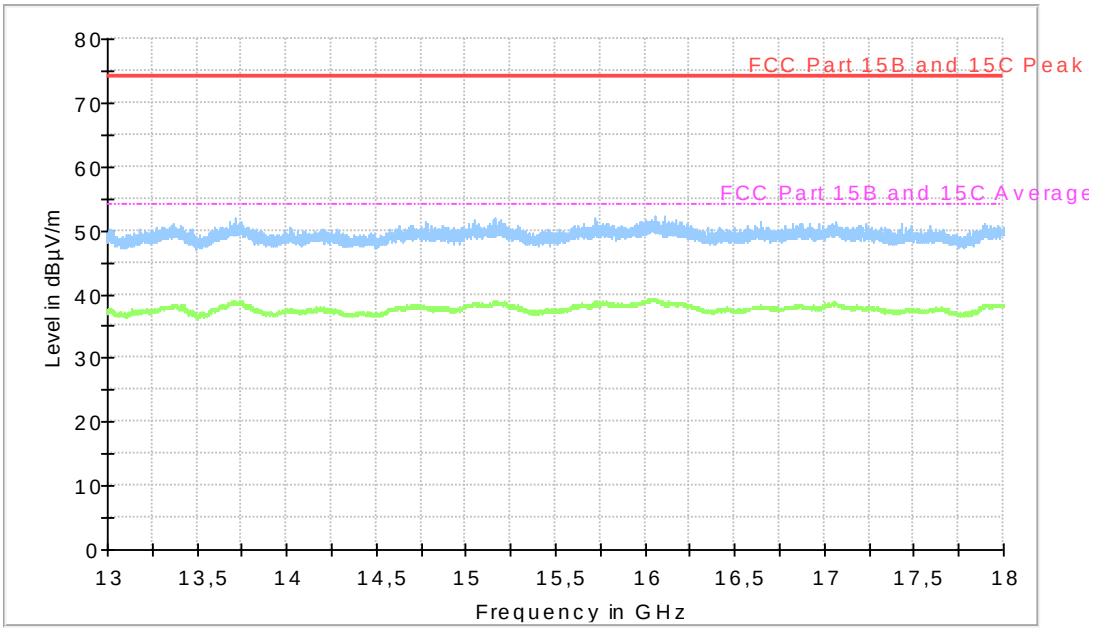
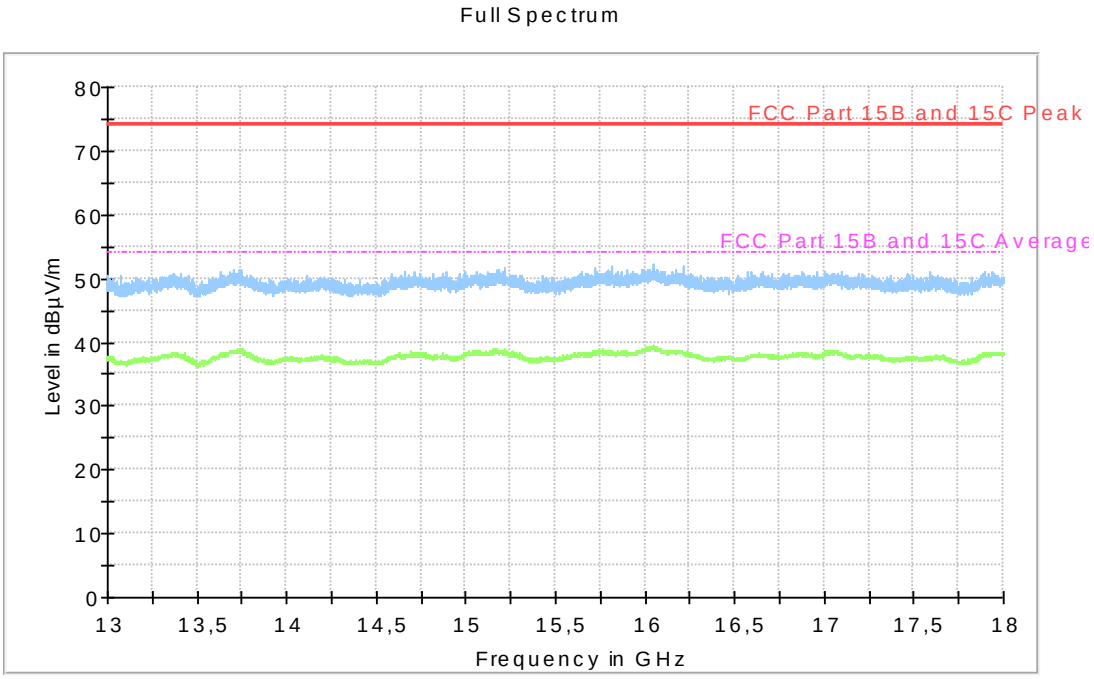


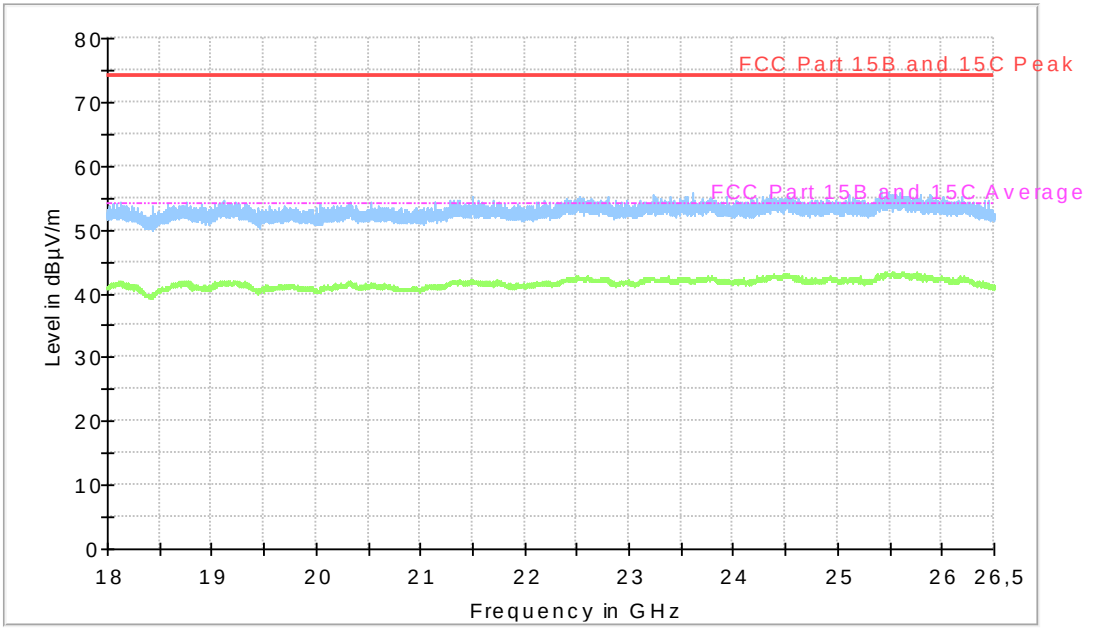
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel. LTE Cat M1 band 4.



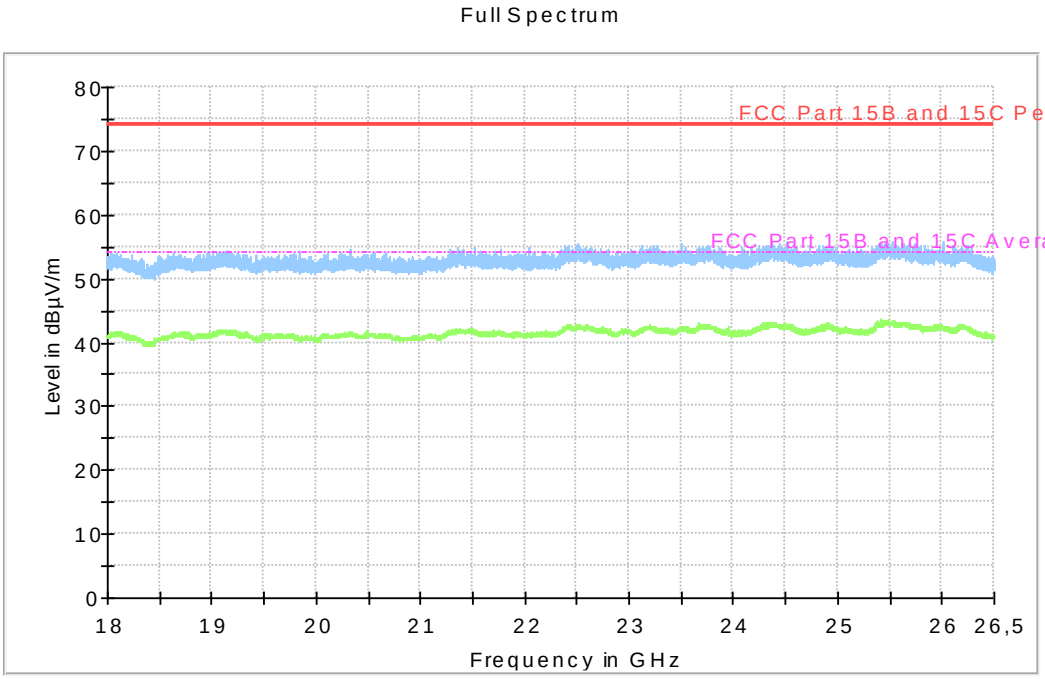
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX mid channel. LTE Cat M1 band 4.



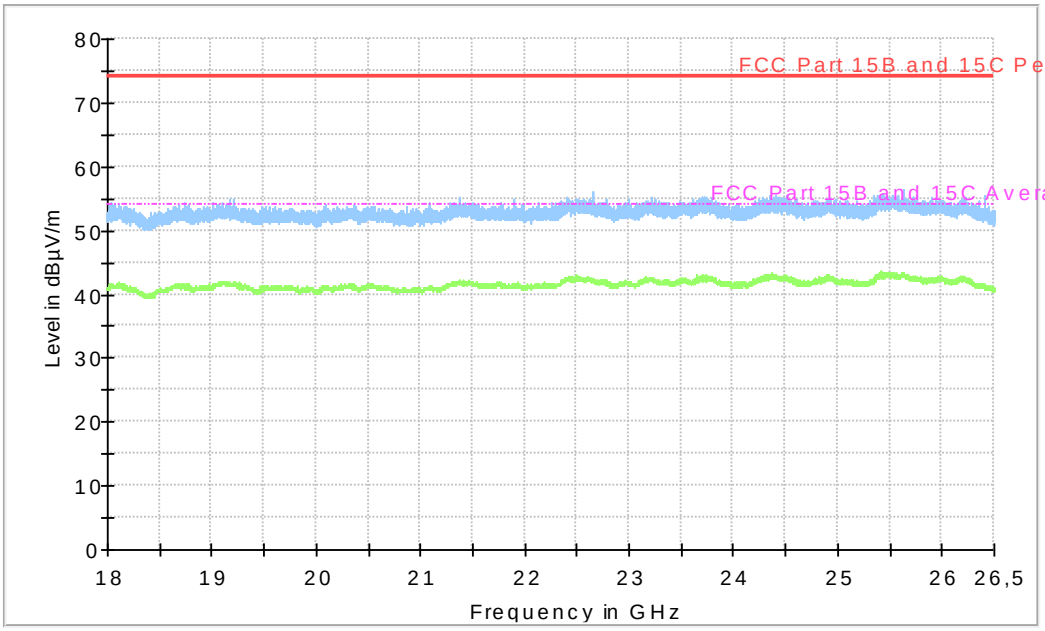
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX high channel. LTE Cat M1 band 4.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX low channel. LTE Cat M1 band 4.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX mid channel. LTE Cat M1 band 4.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX high channel. LTE Cat M1 band 4.

Measurement results, Peak, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1726.0	65.9	74.0	H	--	LTE Cat NB1 band 4 uplink
2132.5	89.3	74.0	V	--	LTE Cat NB1 band 4 downlink
3465.5	69.8	74.0	H	4.2	--
5628.5	43.5	74.0	V	30.5	--
5653.5	44.0	74.0	H	30.0	--
7504.5	46.1	74.0	H	27.9	--
7537.0	53.6	74.0	H	20.4	--

Measurement results, Average, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1726.0	27.1	54.0	V	--	LTE Cat NB1 band 4 uplink
2132.5	69.9	54.0	V	--	LTE Cat NB1 band 4 downlink
3465.0	45.8	54.0	V	8.2	--
5628.5	30.4	54.0	H	23.6	--
5653.0	30.7	54.0	H	23.3	--
7404.5	33.4	54.0	H	20.6	--
7537.5	33.7	54.0	H	20.3	--

Measurement results, Peak, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.0	44.2	74.0	H	29.8	--
1726.0	66.3	74.0	H	--	LTE Cat NB1 band 4 uplink
2132.5	86.6	74.0	V	--	LTE Cat NB1 band 4 downlink
3464.5	70.7	74.0	H	3.3	--
3465.0	72.6	74.0	H	1.4	--
5629.0	55.9	74.0	H	18.1	--
5653.0	64.0	74.0	H	10.0	--
7505.0	49.2	74.0	H	24.8	--
7538.0	52.1	74.0	V	21.9	--

Measurement results, Average, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1439.5	24.1	54.0	V	29.9	--
1732.5	29.5	54.0	V	--	LTE Cat NB1 band 4 uplink
2132.5	67.4	54.0	V	--	LTE Cat NB1 band 4 downlink
5628.0	30.5	54.0	V	23.5	--
5653.0	31.1	54.0	V	22.9	--
7505.0	33.6	54.0	V	20.4	--
7537.5	34.6	54.0	V	19.4	--

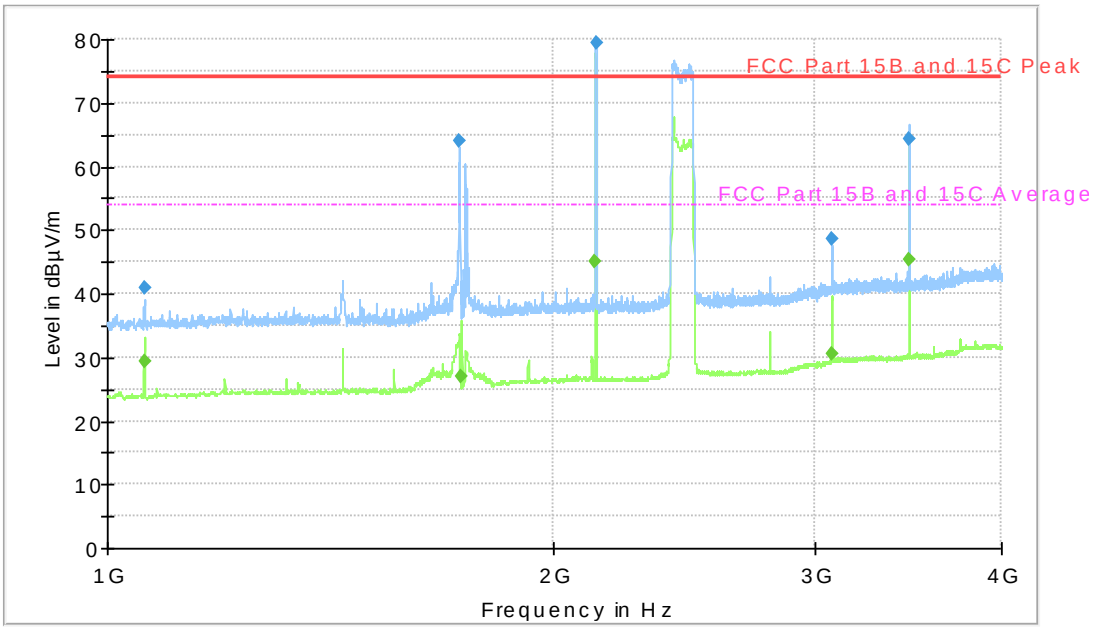
Measurement results, Peak, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1439.5	42.8	74.0	H	31.2	--
1726.0	67.1	74.0	H	--	LTE Cat NB1 band 4 uplink
2132.0	84.0	74.0	V	--	LTE Cat NB1 band 4 downlink
3227.5	46.5	74.0	H	27.5	--
3465.0	72.5	74.0	H	1.5	--
5187.0	56.7	74.0	V	17.3	--
5210.5	60.1	74.0	H	13.9	--
6916.5	52.4	74.0	H	21.6	--
6947.5	53.4	74.0	V	20.6	--

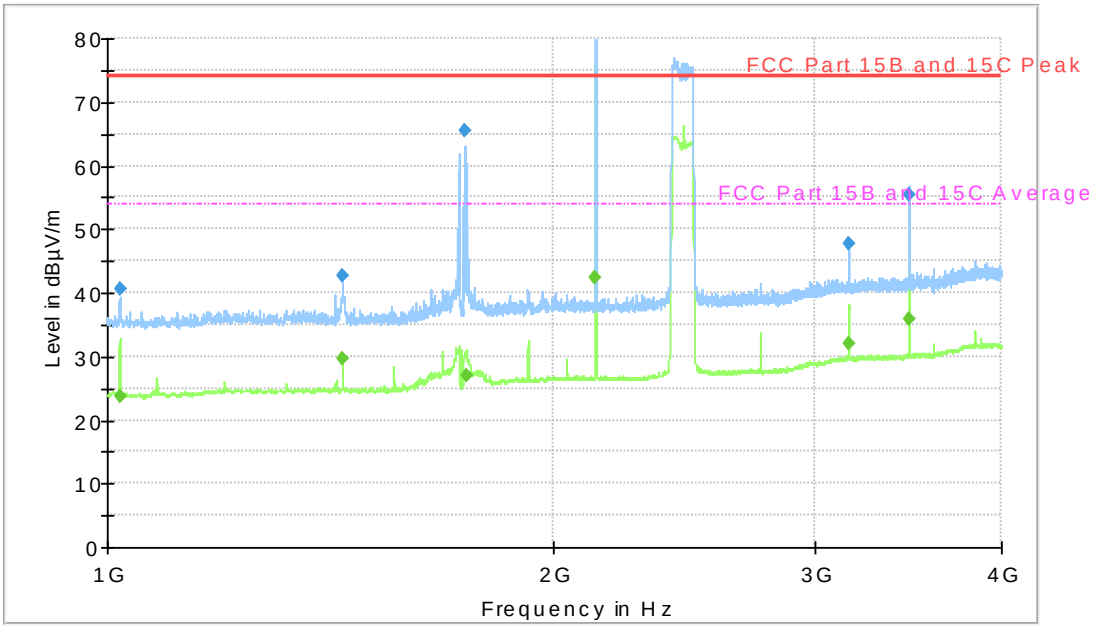
Measurement results, Average, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	
1440.0	24.4	54.0	H	29.6	--
1732.0	28.8	54.0	H	--	LTE Cat NB1 band 4 uplink
2132.5	39.5	54.0	H	--	LTE Cat NB1 band 4 downlink
3227.5	33.2	54.0	H	20.8	--
3465.0	50.4	54.0	H	3.6	--
5186.0	32.4	54.0	V	21.6	--
5210.5	34.9	54.0	V	19.1	--
6915.5	32.0	54.0	V	22.0	--
6947.5	34.0	54.0	V	20.0	--

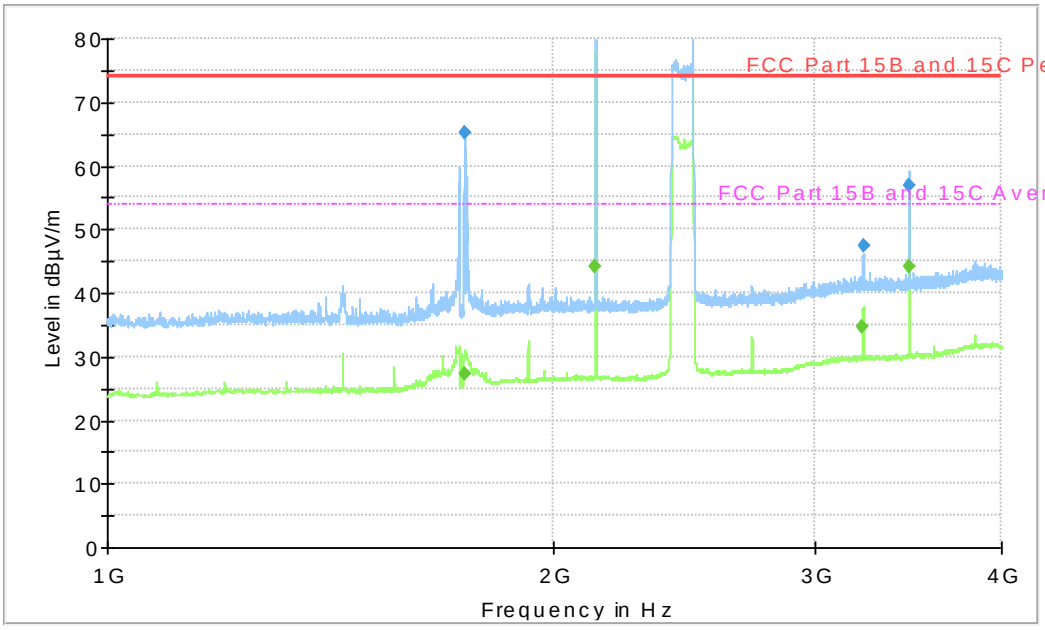
5.6 Test results 1 GHz – 13 GHz, TX mode, 802.15.4, antenna 1



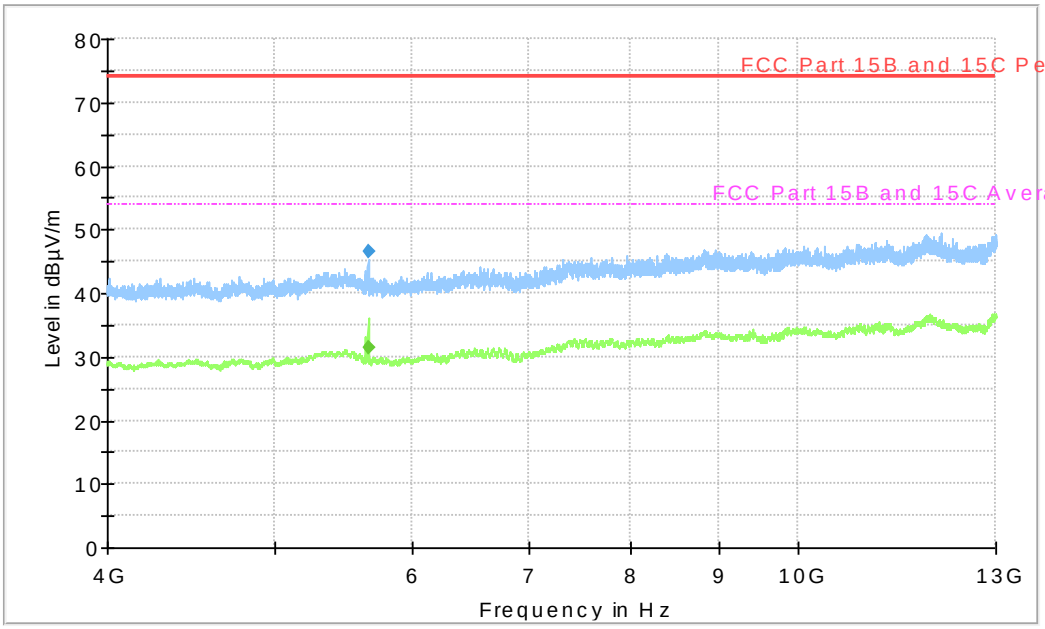
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



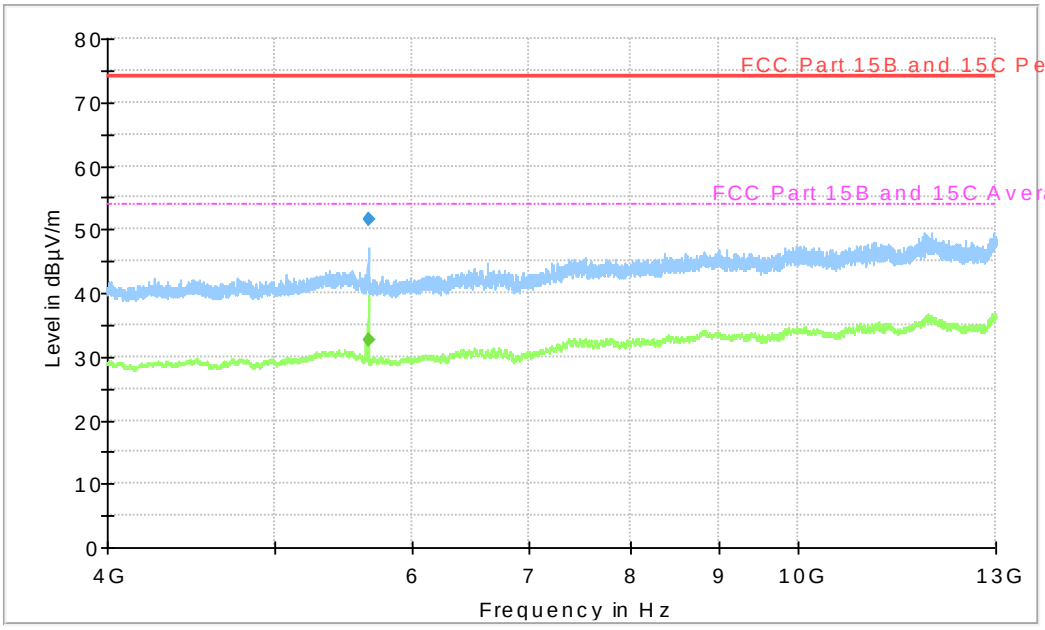
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX middle channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



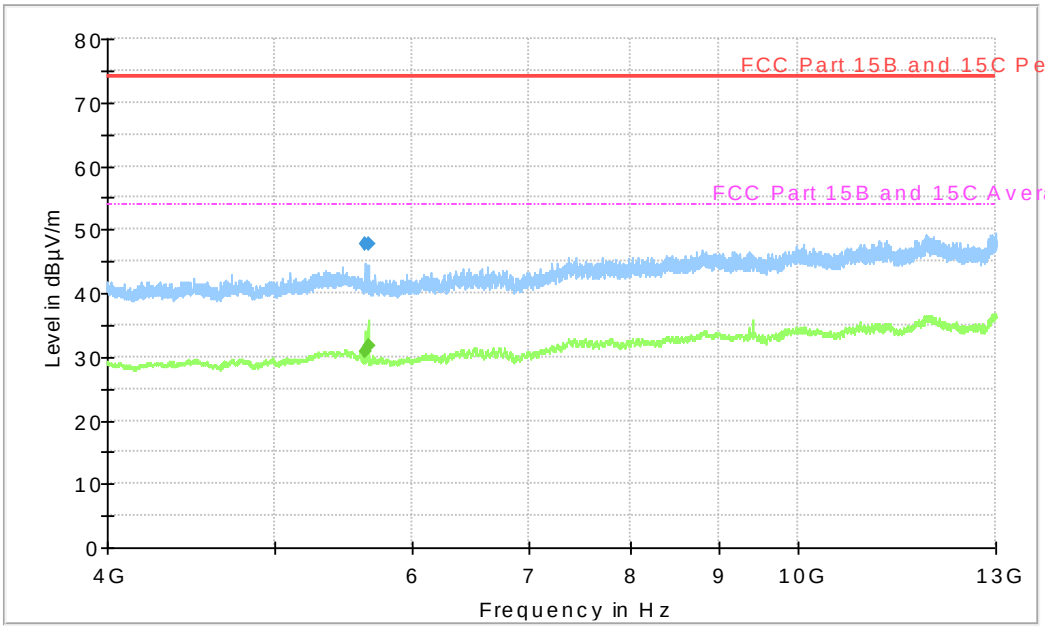
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 4.



Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX low channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 2.



Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX middle channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 2.



Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX high channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 2.

Measurement results, Peak, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1059.5	41.0	74.0	H	33.0	--
1725.5	64.0	74.0	H	--	LTE Cat NB1 band 4 uplink
2133.5	79.4	74.0	V	--	LTE Cat NB1 band 4 downlink
3078.5	48.5	74.0	H	25.5	--
3465.5	64.2	74.0	V	9.8	--
5653.0	46.6	74.0	H	27.4	--

Measurement results, Average, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1060.0	29.3	54.0	H	24.7	--
1732.0	26.9	54.0	H	--	LTE Cat NB1 band 4 uplink
2132.5	45.0	54.0	H	--	LTE Cat NB1 band 4 downlink
3078.0	30.6	54.0	H	23.4	--
3465.0	45.2	54.0	H	8.8	--
5653.0	31.4	54.0	H	22.6	--

Measurement results, Peak, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1020.0	40.6	74.0	H	33.4	--
1440.5	42.8	74.0	H	31.2	--
1740.0	65.6	74.0	H	--	LTE Cat NB1 band 4 uplink
2132.0	83.9	74.0	V	--	LTE Cat NB1 band 4 downlink
3457.0	47.7	74.0	H	26.3	--
3465.5	55.4	74.0	V	18.6	--
5653.5	51.6	74.0	H	22.4	--

Measurement results, Average, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1019.5	23.7	54.0	H	30.3	--
1440.0	29.7	54.0	H	24.3	--
1744.5	27.0	54.0	H	--	LTE Cat NB1 band 4 uplink
2135.5	42.3	54.0	H	--	LTE Cat NB1 band 4 downlink
3457.5	32.1	54.0	H	21.9	--
3465.0	35.7	54.0	H	18.3	--
5653.5	32.6	54.0	H	21.4	--

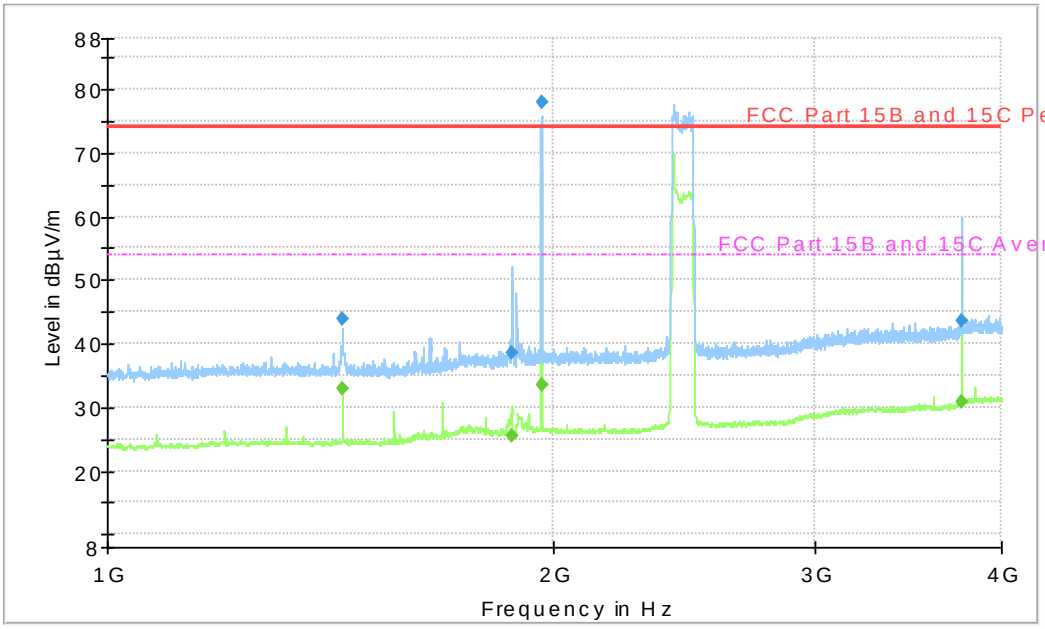
Measurement results, Peak, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1739.5	65.3	74.0	H	--	LTE Cat NB1 band 4 uplink
2132.0	86.1	74.0	V	--	LTE Cat NB1 band 4 downlink
3229.0	47.4	74.0	H	26.6	--
3465.5	56.9	74.0	V	17.1	--
5628.5	47.7	74.0	H	26.3	--
5653.0	47.7	74.0	H	26.3	--

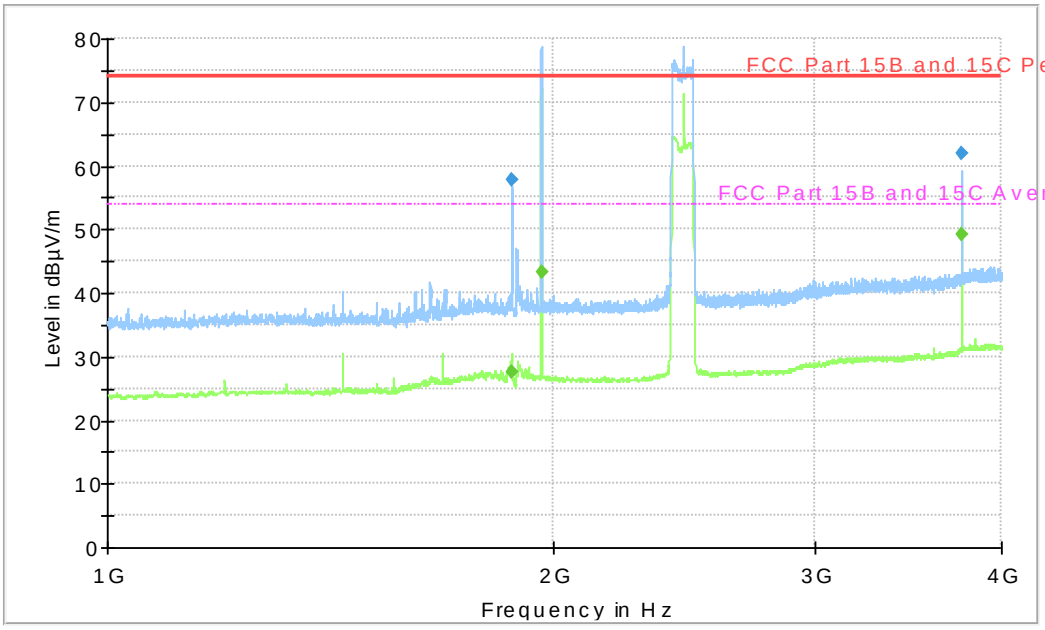
Measurement results, Average, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	
1739.5	27.3	54.0	H	--	LTE Cat NB1 band 4 uplink
2132.5	44.2	54.0	H	--	LTE Cat NB1 band 4 downlink
3227.0	34.7	54.0	H	19.3	--
3465.0	44.3	54.0	H	9.7	--
5628.5	30.7	54.0	H	26.3	--
5653.0	31.6	54.0	H	22.4	--

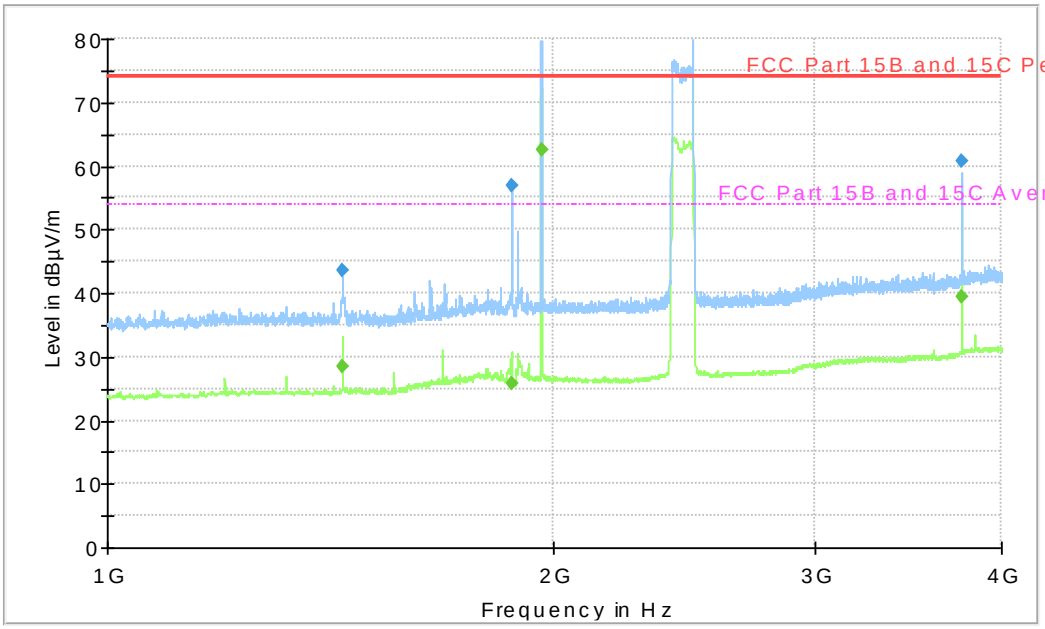
5.7 Test results 1 GHz – 26 GHz, TX mode, 802.15.4, antenna 2



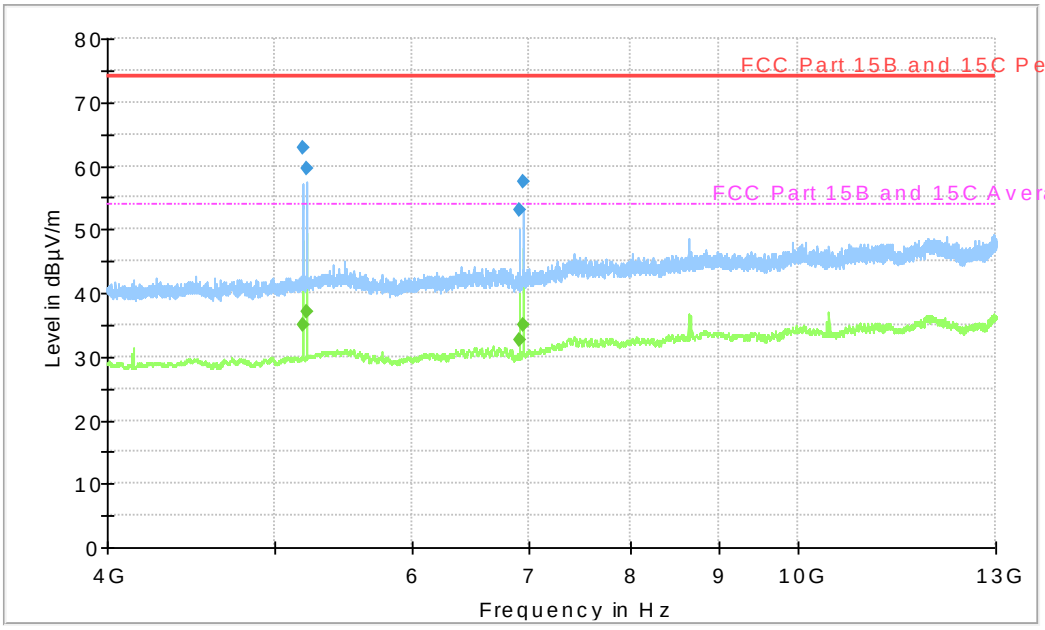
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 2.



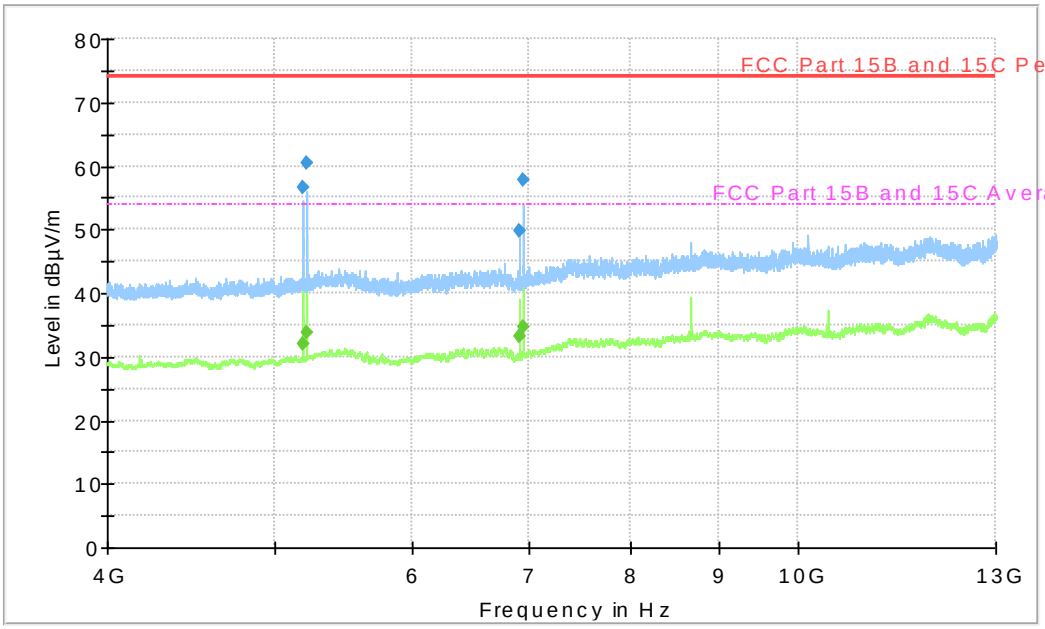
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX mid channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 2.



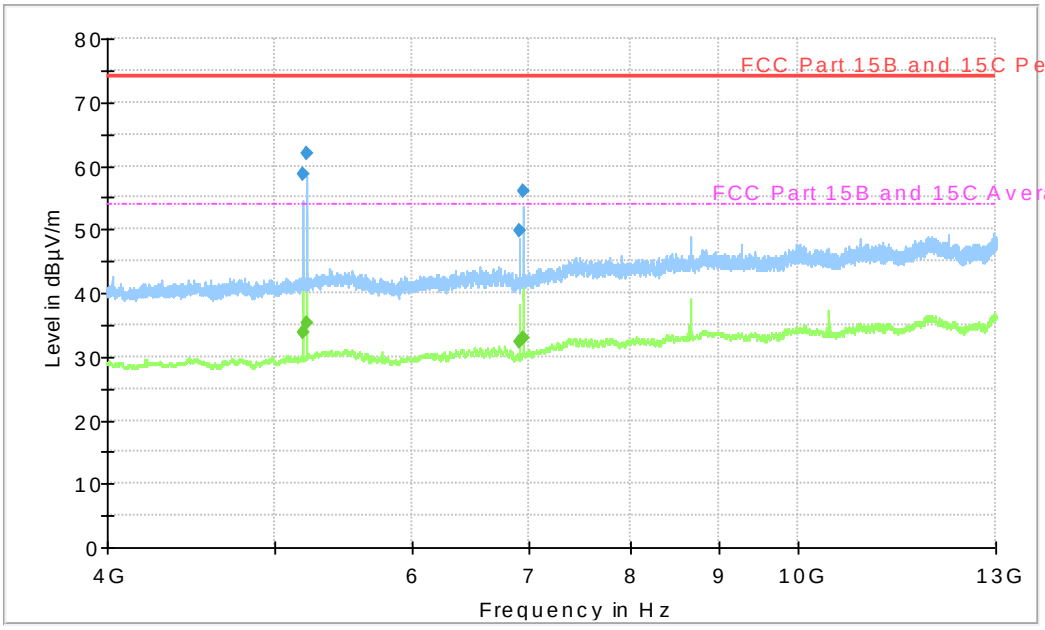
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel, carriers are attenuated by band reject filters. LTE Cat NB1 Band 2.



Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX low channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 4.

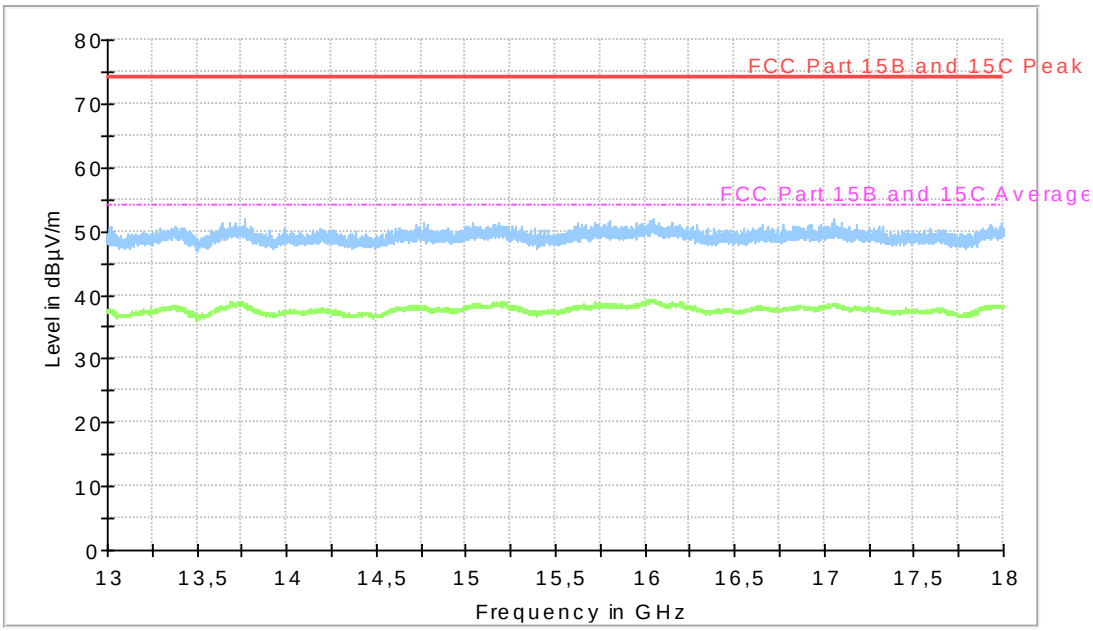


Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX mid channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 4.

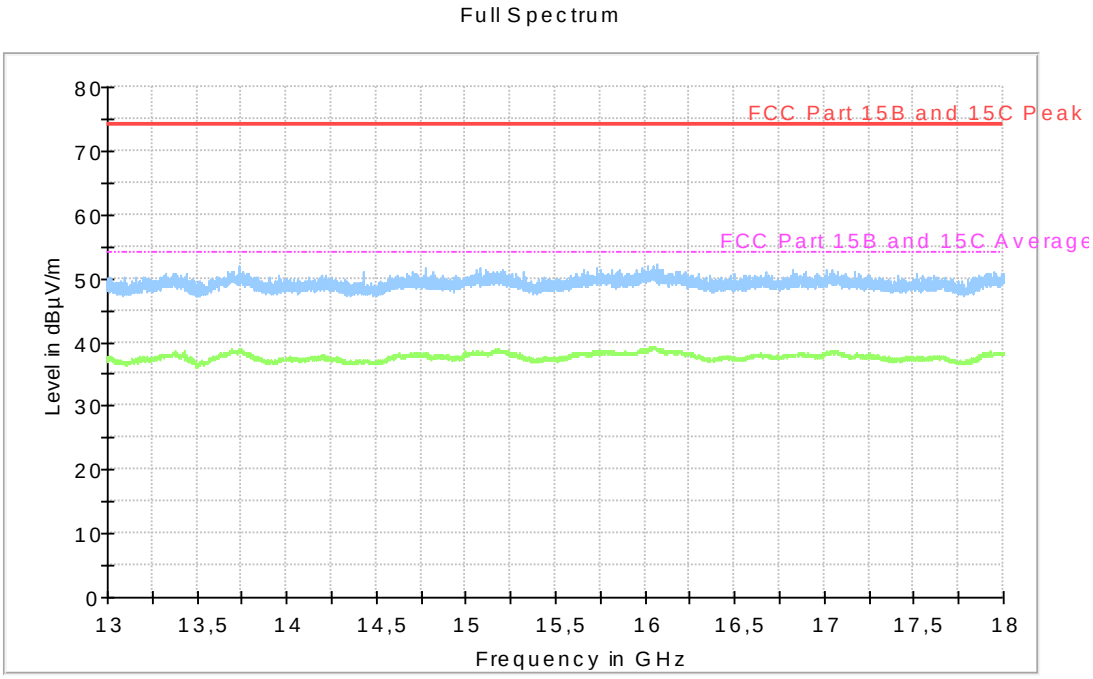


Diagram, Peak overview sweep, 4 – 13 GHz at 3 m distance. TX high channel, emissions below 4 GHz are attenuated by a high-pass filter. LTE Cat M1 band 4.

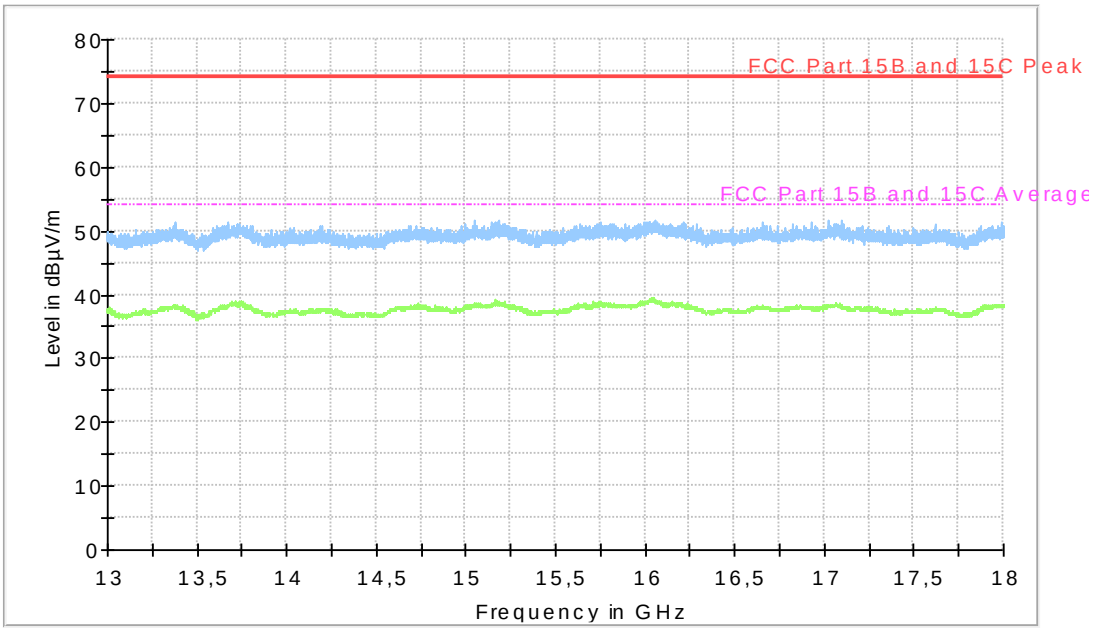
Full Spectrum



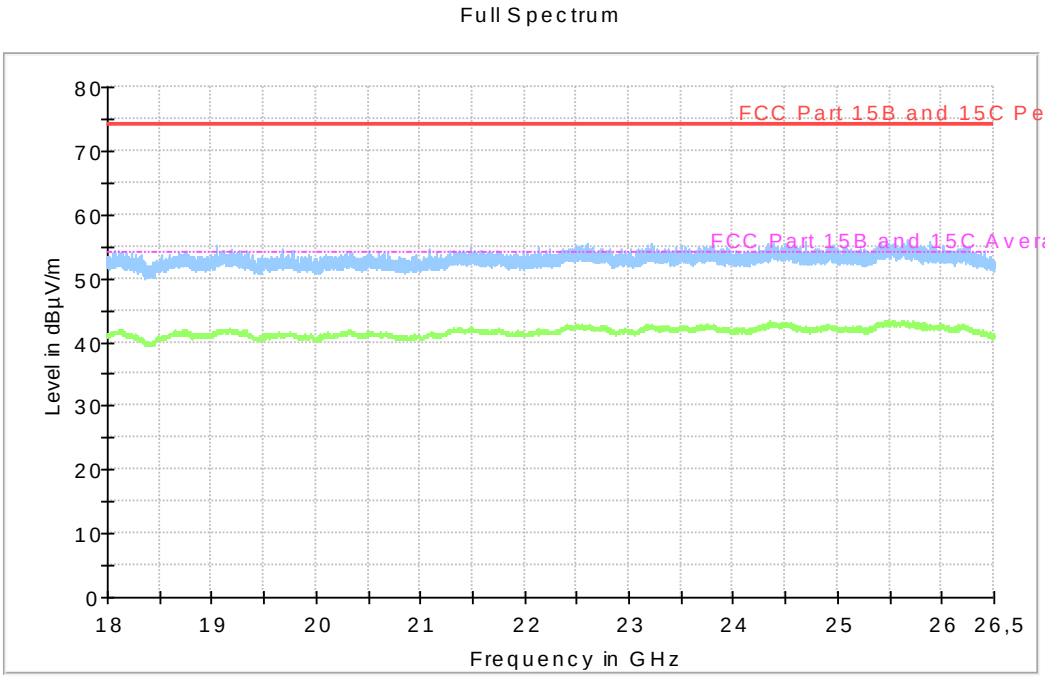
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel. LTE Cat M1 band 2.



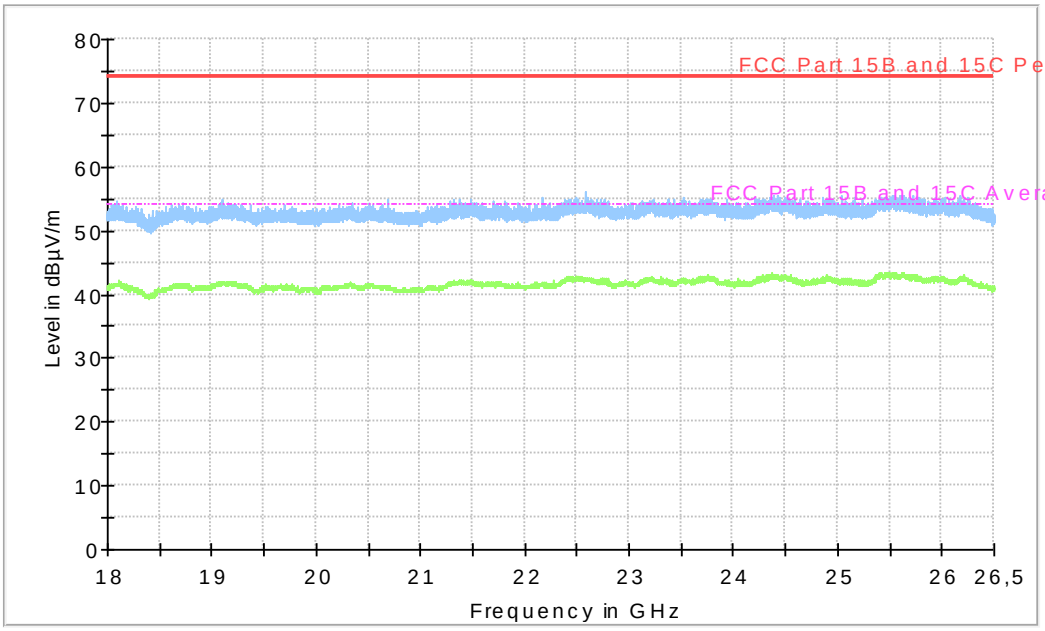
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel. LTE Cat M1 band 2.



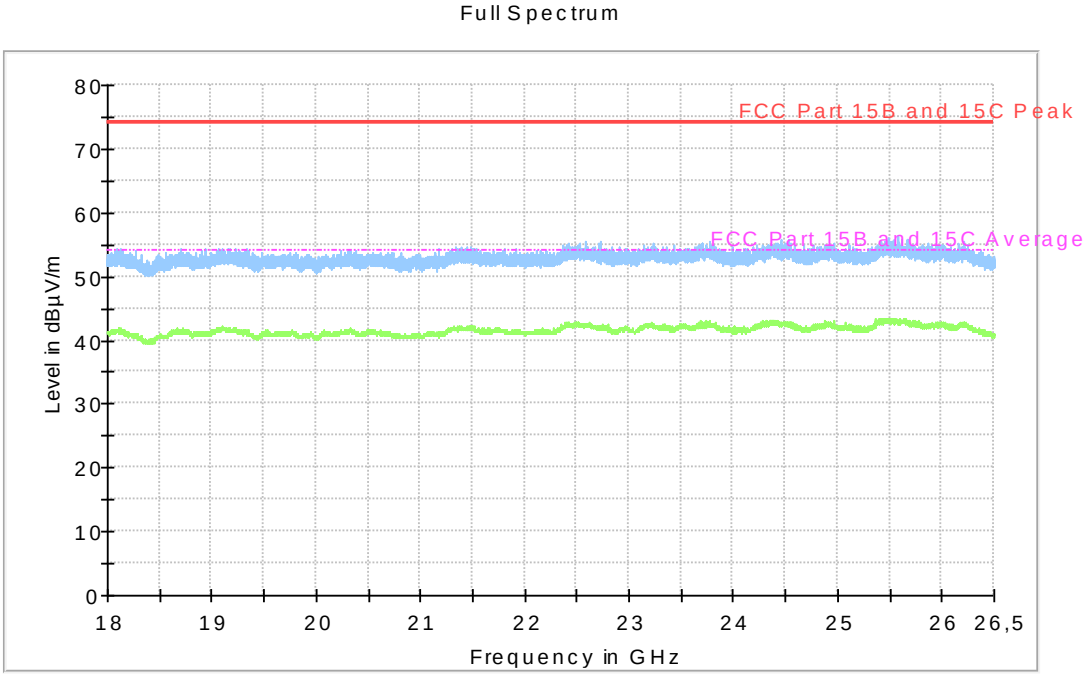
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX high channel. LTE Cat M1 band 2.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX low channel. LTE Cat M1 band 2.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX middle channel. LTE Cat M1 band 2.



Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX high channel. LTE Cat M1 band 2.

Measurement results, Peak, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.5	43.8	74.0	H	30.2	--
1875.0	38.6	74.0	H	--	LTE Cat NB1 band 2 downlink
1960.0	77.9	74.0	V	--	LTE Cat NB1 band 2 uplink
3760.0	43.5	74.0	H	30.5	--
5186.0	62.9	74.0	H	11.1	--
5210.5	59.5	74.0	H	14.5	--
6914.0	53.2	74.0	H	20.8	--
6947.5	57.4	74.0	H	16.6	--

Measurement results, Average, TX low channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1440.0	33.0	54.0	H	11.0	--
1873.0	25.4	54.0	H	--	LTE Cat NB1 band 2 downlink
1960.0	33.5	54.0	H	--	LTE Cat NB1 band 2 uplink
3760.0	30.7	54.0	H	23.3	--
5186.0	35.0	54.0	H	19.0	--
5211.0	36.9	54.0	H	11.1	--
6914.0	32.7	54.0	H	21.3	--
6947.0	35.0	54.0	H	19.0	--

Measurement results, Peak, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1874.0	57.9	74.0	H	--	LTE Cat NB1 band 2 downlink
1960.0	81.7	74.0	V	--	LTE Cat NB1 band 2 uplink
3760.0	61.8	74.0	H	12.2	--
5185.0	56.7	74.0	H	17.3	--
5210.0	60.4	74.0	H	13.6	--
6915.0	49.8	74.0	H	24.2	--
6947.5	57.8	74.0	H	16.2	--

Measurement results, Average, TX middle channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1873.0	27.7	54.0	H	--	LTE Cat NB1 band 2 downlink
1960.0	43.4	54.0	H	--	LTE Cat NB1 band 2 uplink
3760.0	49.3	54.0	H	4.7	--
5185.5	32.0	54.0	H	22.0	--
5210.5	33.8	54.0	H	20.2	--
6915.0	33.2	54.0	H	20.8	--
6947.0	35.5	54.0	H	19.5	--

Measurement results, Peak, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	Comment
1439.5	43.6	74.0	H	30.4	--
1873.0	56.9	74.0	H	--	LTE Cat NB1 band 2 downlink
1960.0	81.9	74.0	V	--	LTE Cat NB1 band 2 uplink
3760.0	60.8	74.0	H	13.2	--
5186.0	58.5	74.0	H	15.5	--
5210.5	61.8	74.0	H	12.2	--
6915.0	49.9	74.0	V	24.1	--
6947.5	55.9	74.0	H	18.1	--

Measurement results, Average, TX high channel

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]	
1440.0	28.3	54.0	V	25.7	--
1873.0	25.6	54.0	V	--	LTE Cat NB1 band 2 downlink
1960.0	62.5	54.0	V	--	LTE Cat NB1 band 2 uplink
3760.0	39.5	54.0	V	14.5	--
5186.0	33.6	54.0	H	20.4	--
5210.5	35.4	54.0	H	18.6	--
6914.5	32.3	54.0	H	21.7	--
6947.0	33.0	54.0	H	21.0	--

6 TEST EQUIPMENT

Radiohallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10.50.40	--	--	--
Receiver	Rohde & Schwarz	ESU 40	12793	June-2019	1 year
Measurement cable	Megaphase	G916-K1K1-79	9462	July-2018	2 years
Measurement cable	Rosenberger	LU7-S020-4000	39146	Dec-2019	1 year
Measurement cable	Midwest Microwave	MCN-KMKM-46-150-CS	9664	July-2019	1 year
Measurement cable	Huber + Suhner	Sucoflex 104	5191	July-2019	1 year
Horn antenna	EMCO	3115	4936	July-2017	3 year
Pre-amplifier	Sangus	00101400-23-10P -6-S ; AFS44-12002400-32-10P -44	12335	June-2019	1 year
Horn antenna	EMCO	3160-08	30099	Sep-2016	3 years
Horn antenna	EMCO	3160-09	30101	Sep-2016	3 years
2,4 GHz band reject filter:	Wainwright Instr. GmbH	WRCGV10-2381-2401-2479-2499-40SS	33938	Oct-2019	1 year
4 GHz high pass filter	K&L MICROWAVE INC	4410-X4500/18000-0/0	5133	Aug-2019	1 year
Communication tester	Rohde & Schwarz	CMW500	34164	--	--
Temperature reader	Vaisala	HM 40	32879	Aug-2019	1 year
Band reject filter	Wainwright Instr. GmbH	WTRCTW10-1700-2500-10-20-40TTK	33570	Oct-2019	1 year

7 MEASUREMENT UNCERTAINTY

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

8 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 2019067STO-303.
Test set up photos are in separate document 2019067STO-304.