

4.2 FCC Section 15.247 (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth

SPECIFICATION

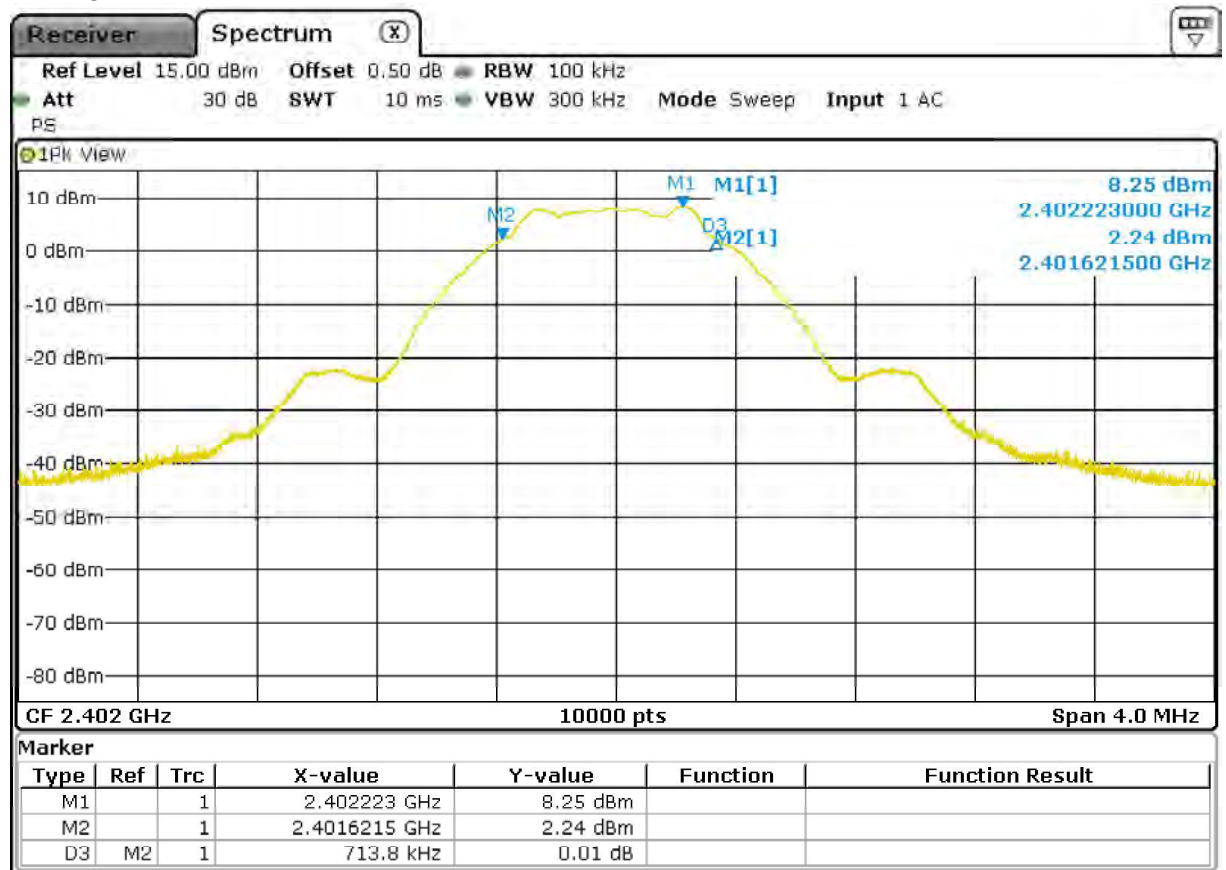
The minimum 6 dB bandwidth shall be at least 500 kHz for systems using digital modulation techniques operating in the 2400 - 2483.5 MHz band.

RESULTS

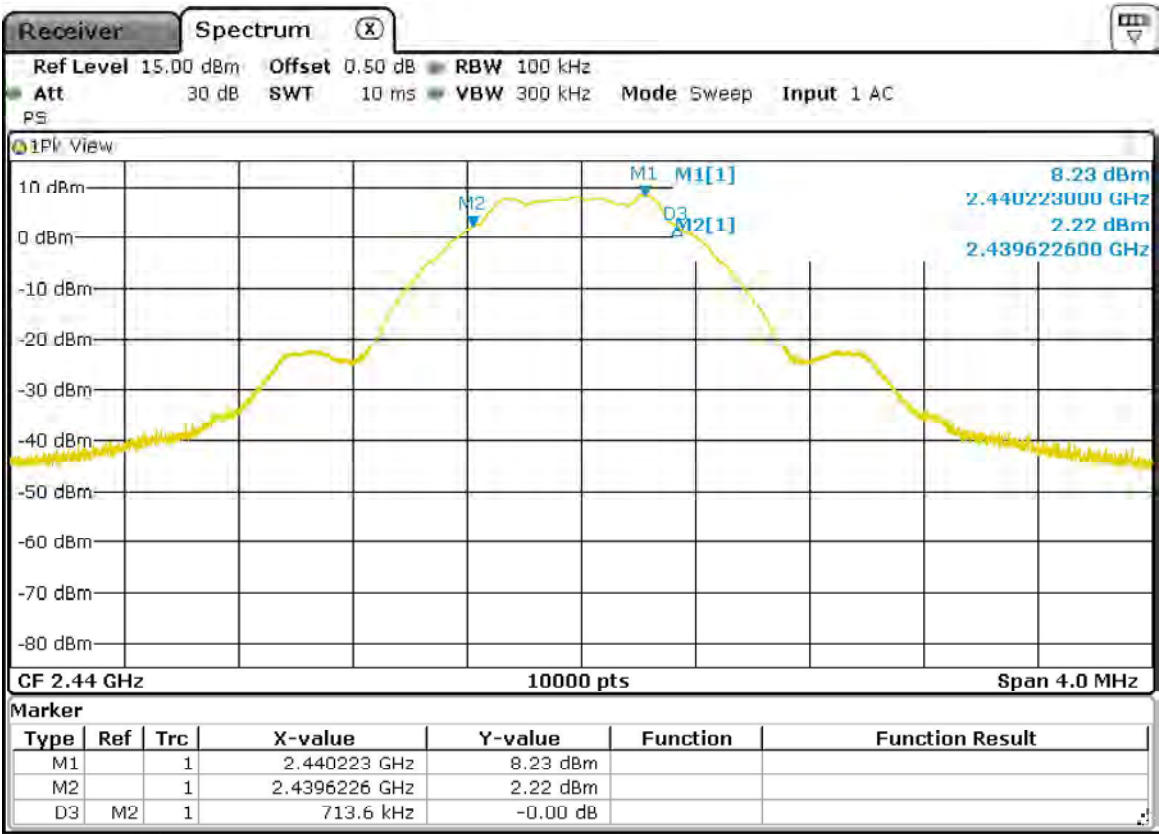
TLF20 4160 3.6 RWLB 277-400V WC3 QB SP:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Bandwidth (kHz)	713.8	713.6	711.6

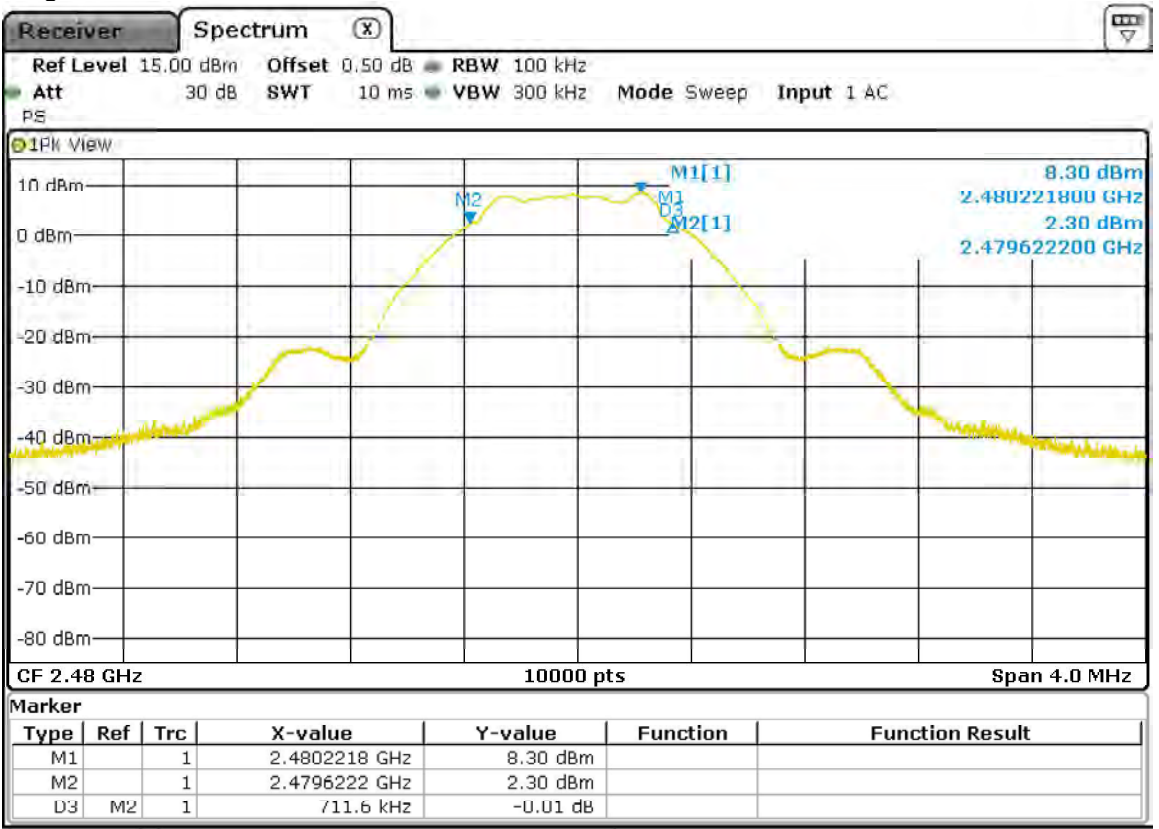
- Low Channel:



- Middle Channel:



- High Channel:



Verdict: PASS

4.3 FCC Section 15.247 (b) / RSS-247 Clause 5.4 (d) Maximum Output Power and Antenna Gain

SPECIFICATION

The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt for systems using digital modulation in the 2400 - 2483.5 MHz band.

The e.i.r.p shall not exceed 4 W (36dBm) (Canada).

RESULTS

The maximum peak conducted output power was measured using the method according to point 8.3.1.1 of Guidance for Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v05r02 dated 02/04/2019.

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW \geq DTS bandwidth" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

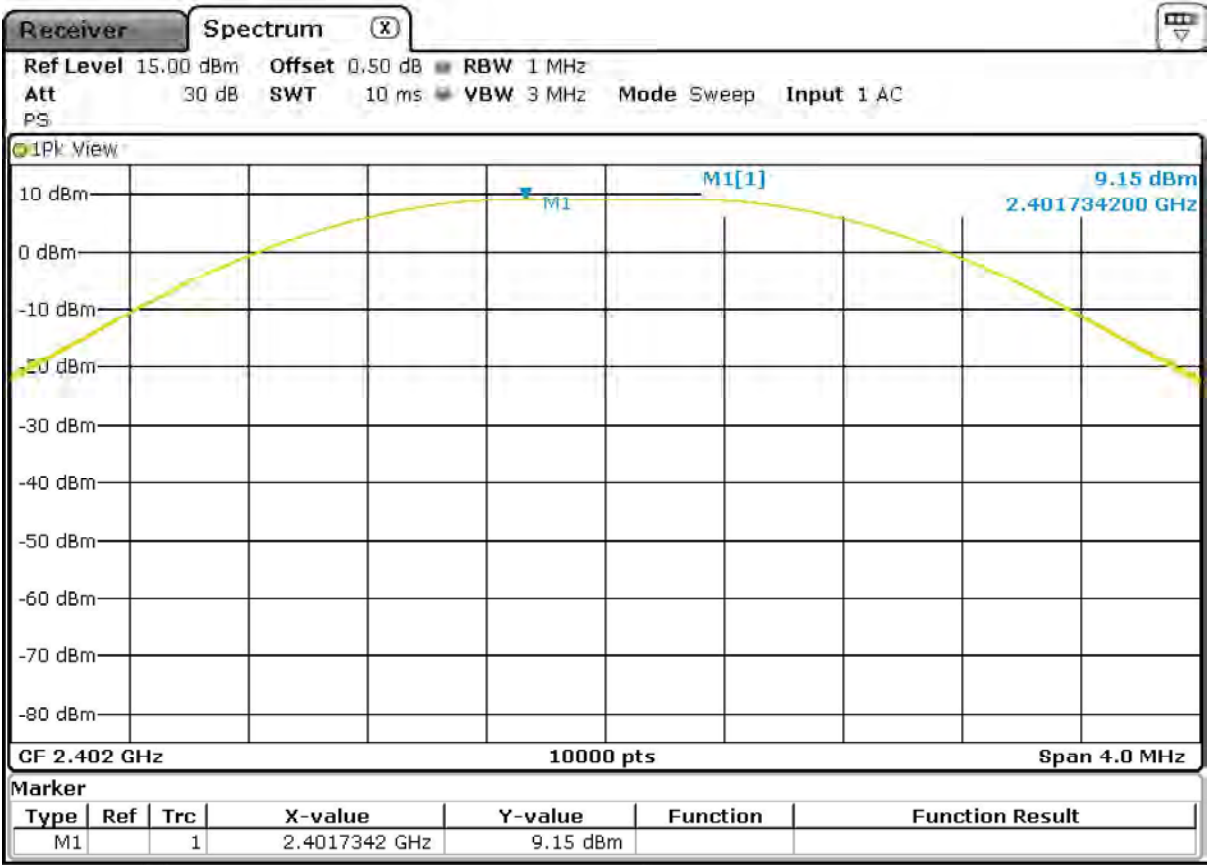
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Maximum Declared Antenna Gain: -6 dBi

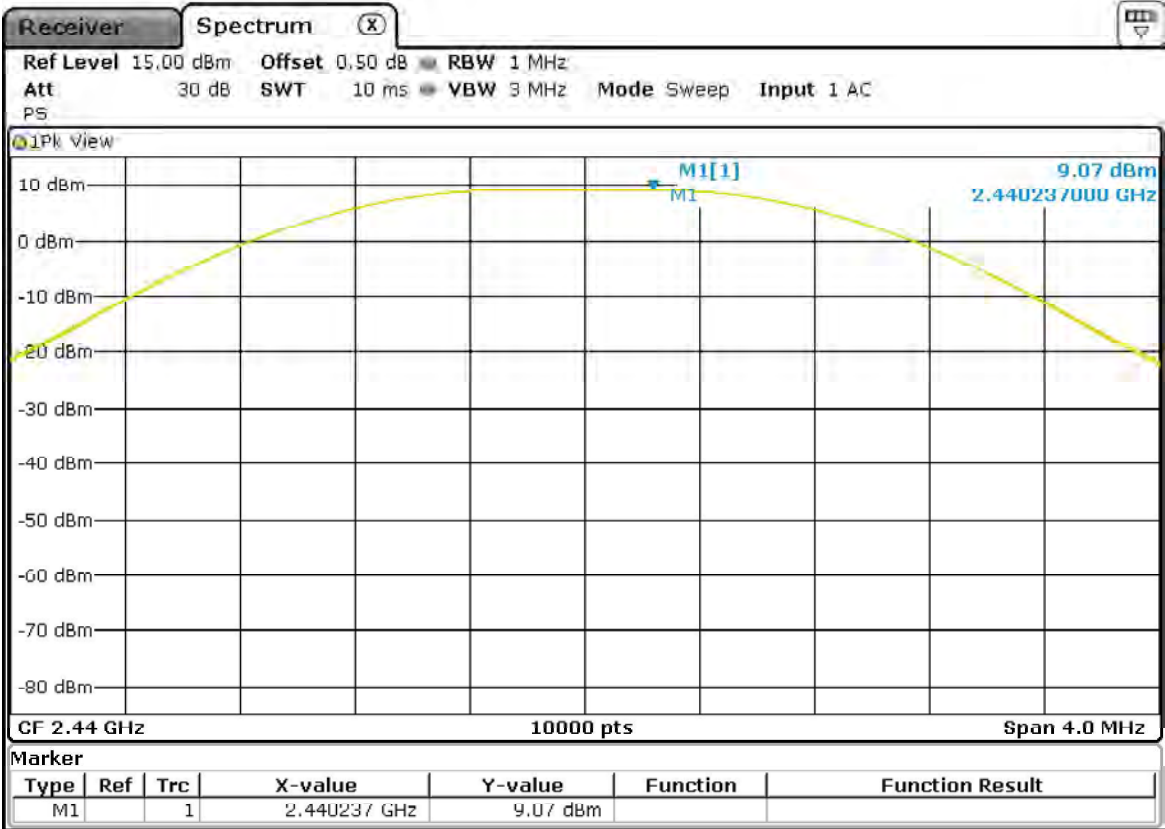
TLF20 4160 3.6 RWLB 277-400V WC3 QB SP:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Peak Output Power (dBm)	9.15	9.07	9.16
Maximum EIRP Power (dBm)	3.15	3.07	3.16

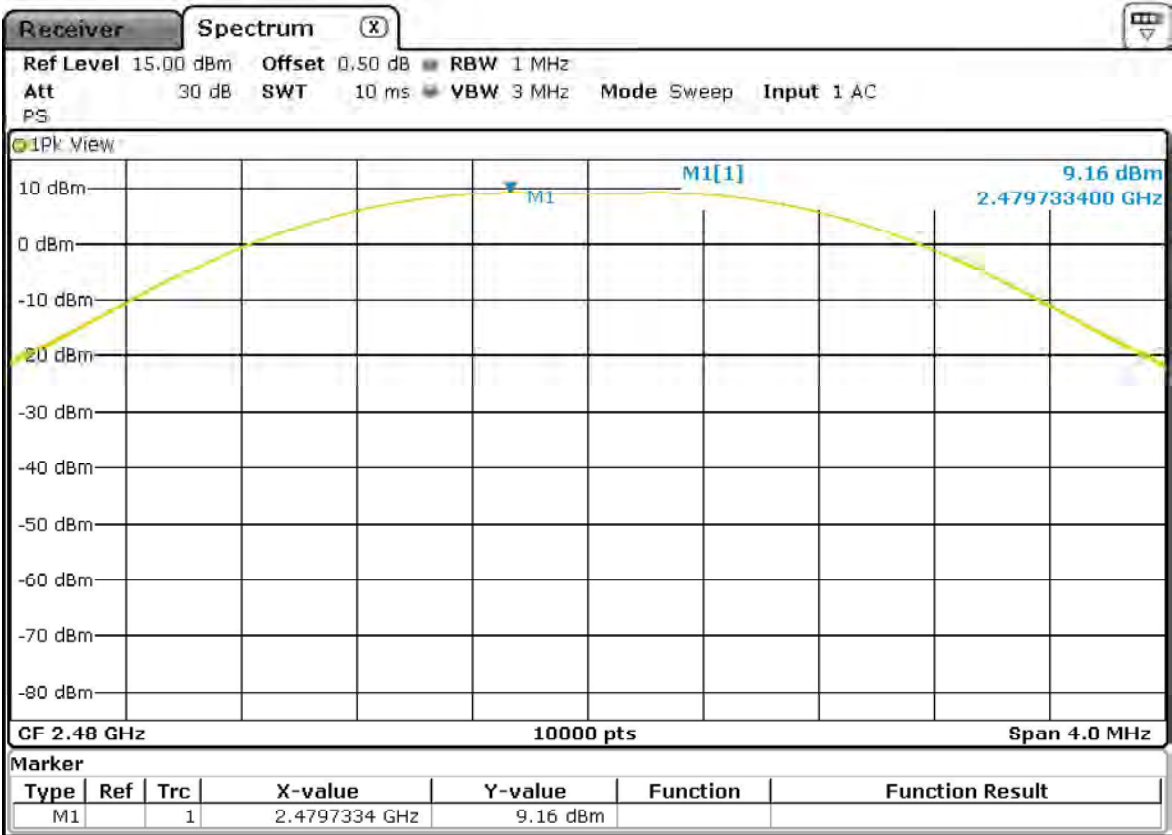
- Low Channel:



- Middle Channel:



- High Channel:



Verdict: PASS

4.4 FCC Section 15.247 (d) / RSS-247 Clause 5.5 Band-edge emissions compliance

SPECIFICATION

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

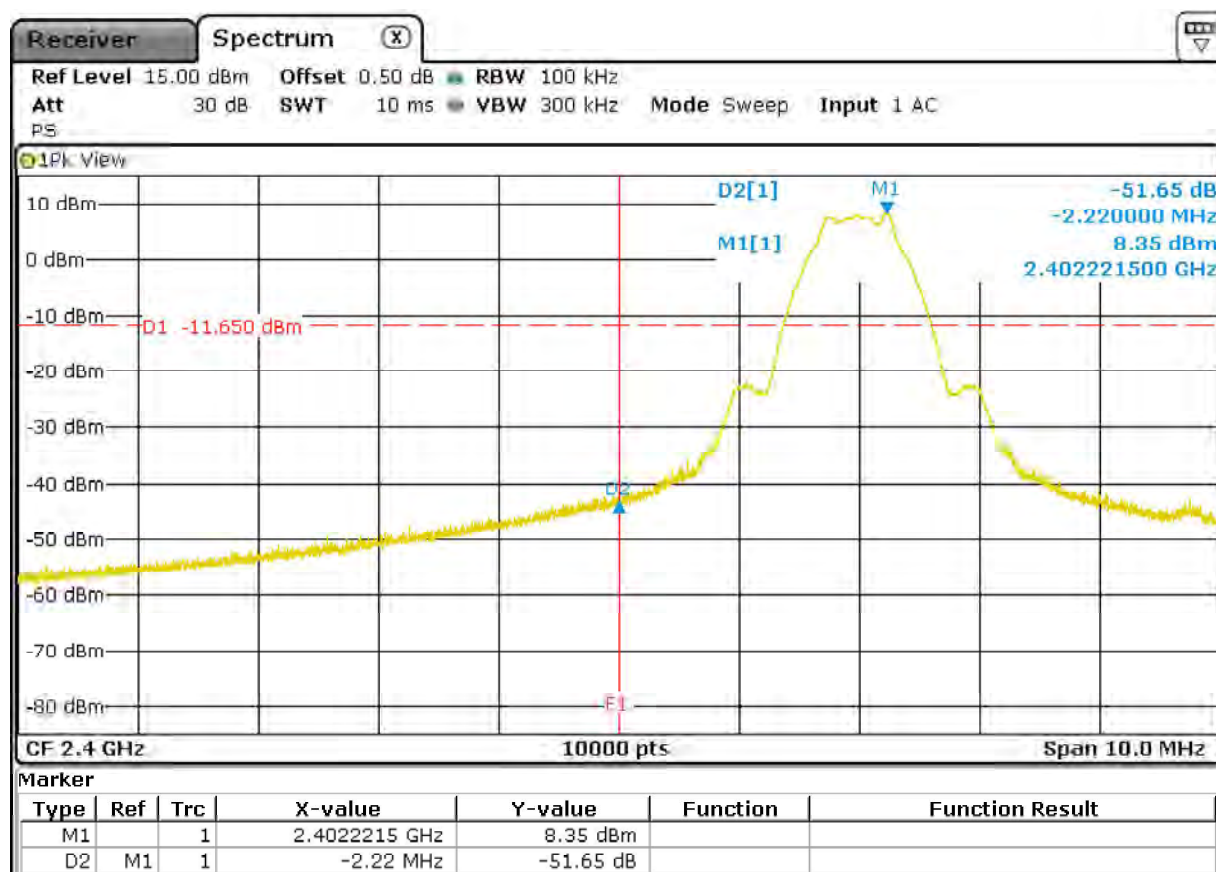
RESULTS

The attenuation of highest emissions at the band-edge is more than 20 dB respect to the highest level of the desired power.

Band-edge emissions compliance:

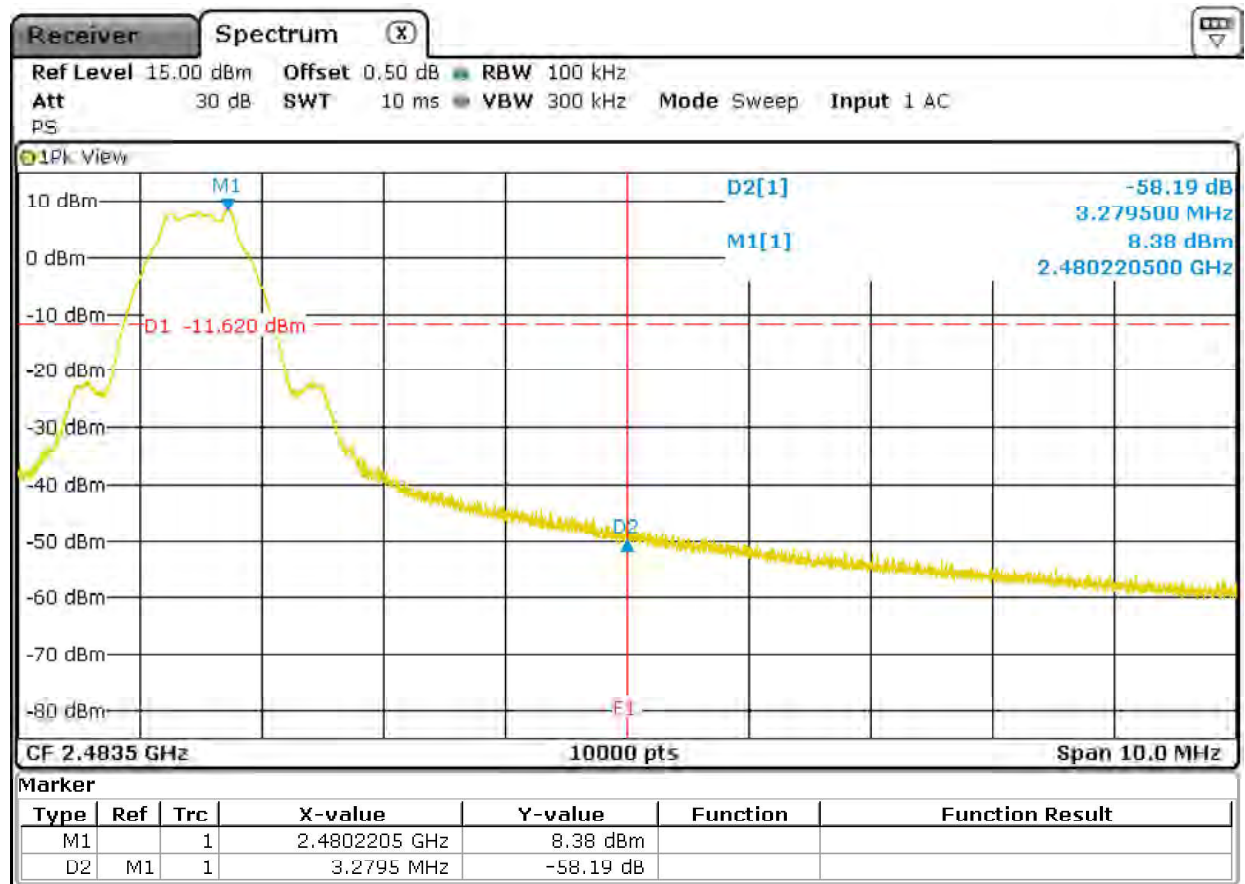
TLF20 4160 3.6 RWLB 277-400V WC3 QB SP:

1. Low Frequency Section. Conducted 2402 MHz



Verdict: PASS

2. High Frequency Section. Conducted 2480 MHz



Verdict: PASS

4.5 FCC Section 15.247 (e) / RSS-247 Clause 5.2 (b) Power Spectral Density

SPECIFICATION

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

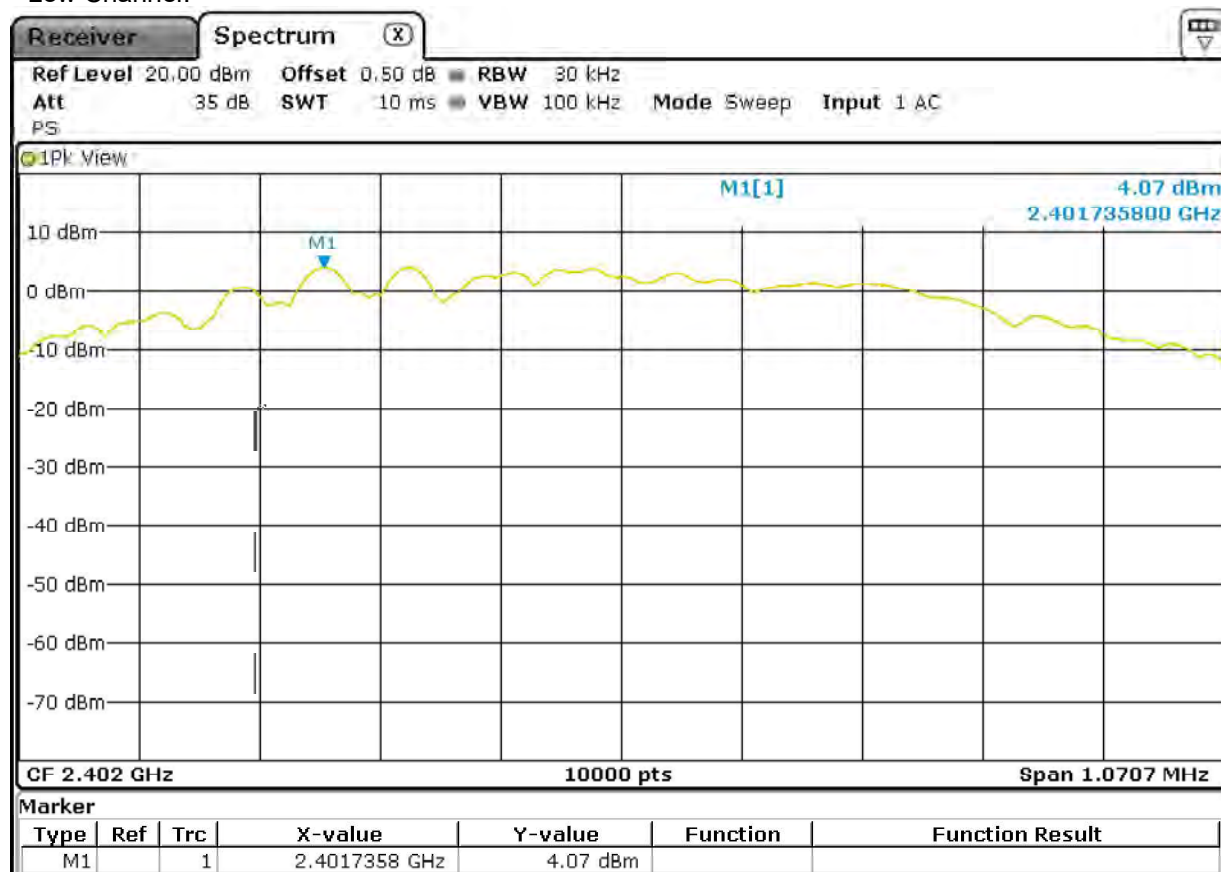
RESULTS

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 8.4. of Guidance for Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v05r02 dated 02/04/2019.

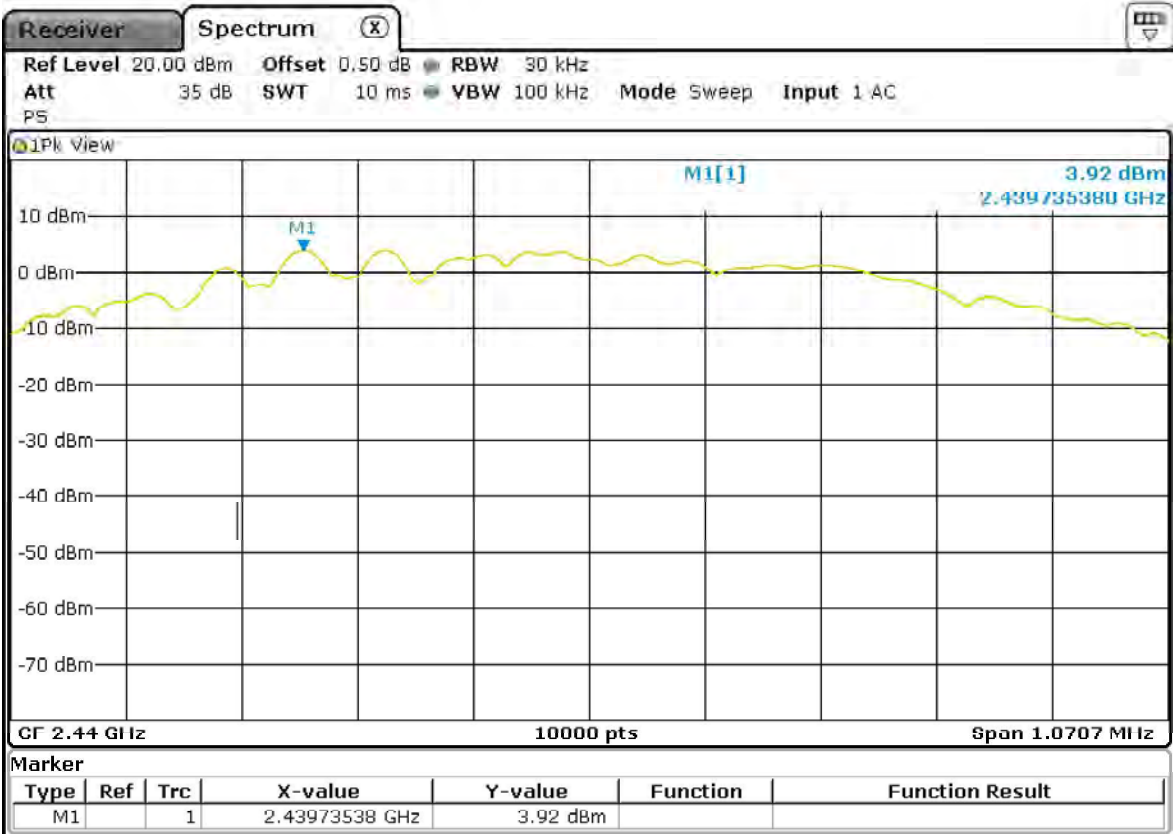
TLF20 4160 3.6 RWLB 277-400V WC3 QB SP:

	Low Channel 2401.7358 MHz	Middle Channel 2439.73538 MHz	High Channel 2479.80853 MHz
Power Spectral Density (dBm)	4.07	3.92	4.22

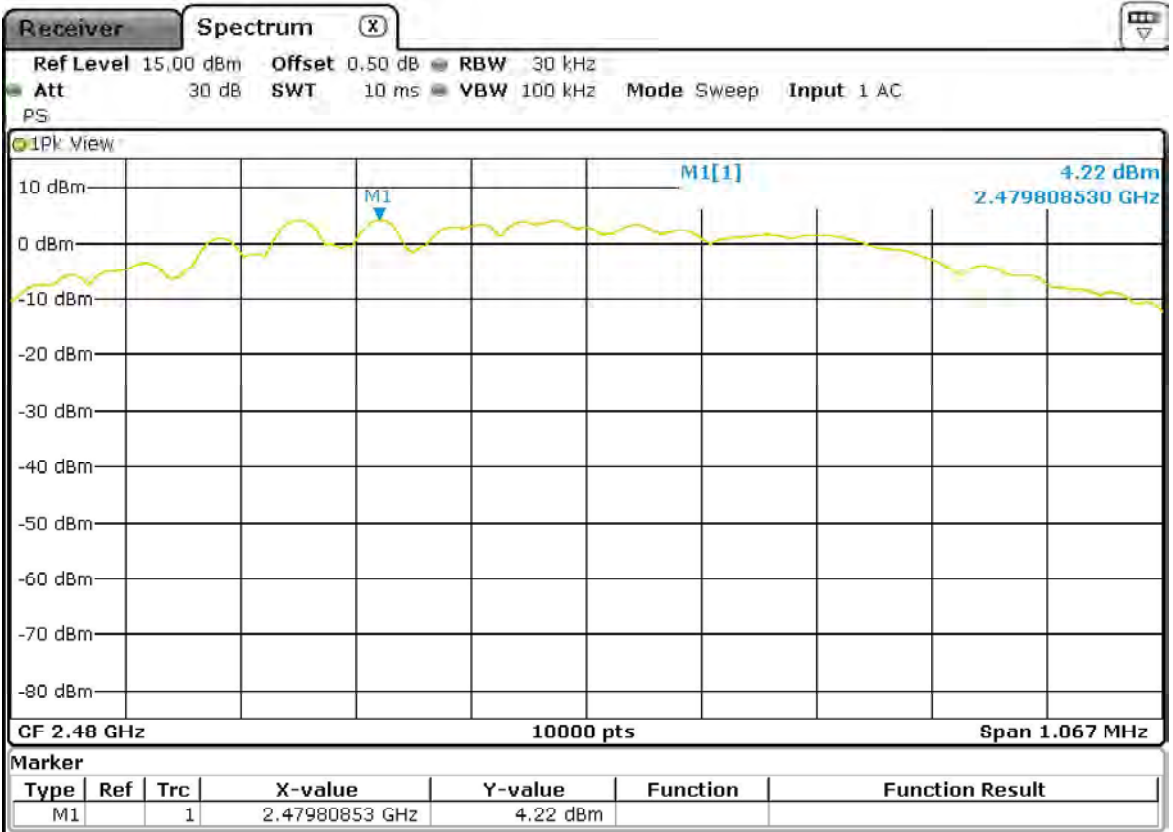
- Low Channel:



- Middle Channel:



- High Channel:



Verdict: PASS

4.6 FCC Section 15.247 (d) / RSS-247 Clause 5.5 Emission Limitations Radiated (Transmitter)

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.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits.

RESULTS

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied (in TILT mode) from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The EUT was set up on a non-conductive platform at a height of 0.8m for measurements below 1 GHz and 1.5m for over 1 GHz

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz – 18 GHz, and at a distance of 1 m for the frequency range 18 – 26 GHz.

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.

4.6.1 TLF20 4160 3.6 RWLB 277-400V WC3 QB SP

Performed measurements

The following configuration(s) and parameter(s) was/were used for testing:

Port under test	Enclosure (with cabling)		
Test method	X	Semi Anechoic Chamber	
		Open Area Test Site (OATS)	
		In-Situ (at user/manufacture premises)	
		GTEM cell	
	Other:	---	
Test set-up	X	Equipment on a table of 80 cm height	
		Equipment on the floor (insulated from the reference ground plane)	
	Other:	The EUT is installed on a support of 1.5 m above the ground plane.	

Technology	Sample	Mode / Modulation	Channel / Freq.	Frequency range	Antenna Polar. / axis	P/F	Sup. Info / Remark
BLE	01	OM#01	37 / 2402 MHz	30 – 1000 MHz	H/V	P	(1)
BLE	01	OM#01	17 / 2440 MHz	30 – 1000 MHz	H/V	P	(1)
BLE	01	OM#01	39 / 2480 MHz	30 – 1000 MHz	H/V	P	(1)

26

Supplementary information / Remark:

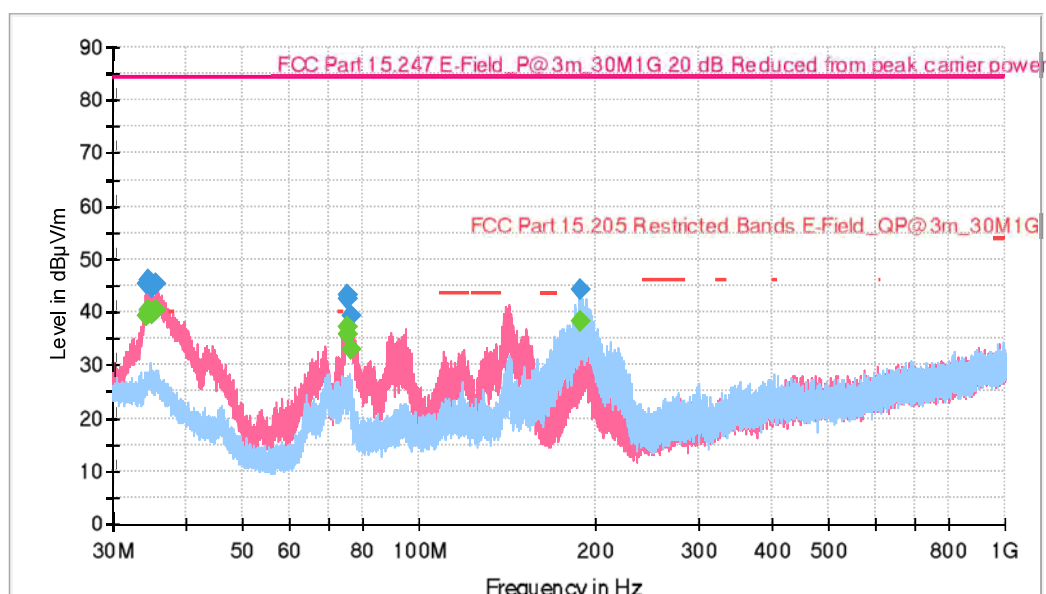
- 1) The spurious frequencies do not depend on the operating channel.

FREQUENCY RANGE 30 MHz – 1 GHz:

Measurement data	<input checked="" type="checkbox"/>	Horizontal	<input checked="" type="checkbox"/>	Vertical
Operating mode / Info		Mode 1 / TX All Channels		

Common Information

EUT/Sample # / OM# : TLF20 4160 3.6 RWLB 277-400V WC3 QB SP / 01
Voltage/Frequency : 277-400 Vac
Port/Terminal under test : Enclosure
Remark/Comment : EUT ON. BLE All Channels



- Preview Result 2V-AVG
- Preview Result 1V-PK+
- Preview Result 2H-AVG
- Preview Result 1H-PK+
- FCC Part 15.205 Restricted Bands E-Field_QP@3m_30M1G
- FCC Part 15.247 E-Field_P@3m_30M1G 20 dB Reduced from peak carrier power
- ◆ Final_Result PK+
- ◆ Final_Result QPK

Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Pol
34.335000	45.37	105.0	V
34.616167	46.00	100.0	V
34.928167	44.82	105.0	V
35.561333	45.46	100.0	V
75.360000	42.60	116.0	V
75.366833	43.17	114.0	V
76.881667	39.47	174.0	V
188.580333	44.41	173.0	H

NOTE: As the spurious frequencies are outside the restricted bands as defined in § 15.205 (a), the maximum peak radiated carrier power was measured at 3 m to be 102.59 dBµV/m, and a new limit line of 20 dB below that value was applied, as stated in § 15.247 (d).

Supplementary information:

- The "Azimuth/Pol/Height" indicates the turn-table azimuth, the antenna polarization and the antenna height where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

Performed measurements

The following configuration(s) and parameter(s) was/were used for testing:

Port under test	Enclosure (with cabling)		
Test method	X	Semi Anechoic Chamber	
		Open Area Test Site (OATS)	
		In-Situ (at user/manufacturer premises)	
		GTEM cell	
		Other:	---
Test set-up		Equipment on a table of 80 cm height	
		Equipment on the floor (insulated from the reference ground plane)	
	X	Other:	The EUT is installed on a support of 1.5 m above the ground plane.

Technology	Sample	Mode / Modulation	Channel / Freq.	Frequency range	Antenna Polar. / axis	P/F	Sup. Info / Remark
BLE	01	OM#1	37 / 2402 MHz	1 – 3 GHz	H/V	P	---
BLE	01	OM#1	17 / 2440 MHz	1 – 3 GHz	H/V	P	---
BLE	01	OM#1	39 / 2480 MHz	1 – 3 GHz	H/V	P	---
BLE	01	OM#1	37 / 2402 MHz	3 – 18 GHz	H/V	P	---
BLE	01	OM#1	17 / 2440 MHz	3 – 18 GHz	H/V	P	---
BLE	01	OM#1	39 / 2480 MHz	3 – 18 GHz	H/V	P	---
BLE	01	OM#1	37 / 2402 MHz	18 – 26 GHz	H/V	P	(1)
BLE	01	OM#1	17 / 2440 MHz	18 – 26 GHz	H/V	P	(1)
BLE	01	OM#1	39 / 2480 MHz	18 – 26 GHz	H/V	P	(1)

Supplementary information / Remark:

- 1) The spurious frequencies do not depend on the operating channel.