

11.8 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to single channel mode and the transmit channel is channel 00 for the lower restricted band and channel 78 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Span	Lower Band: 2370 – 2400 MHz Upper Band: 2480 – 2500 MHz
Trace mode	Max hold
Test setup	See sub clause 6.2 – A
Measurement uncertainty	See sub clause 8

Limits:

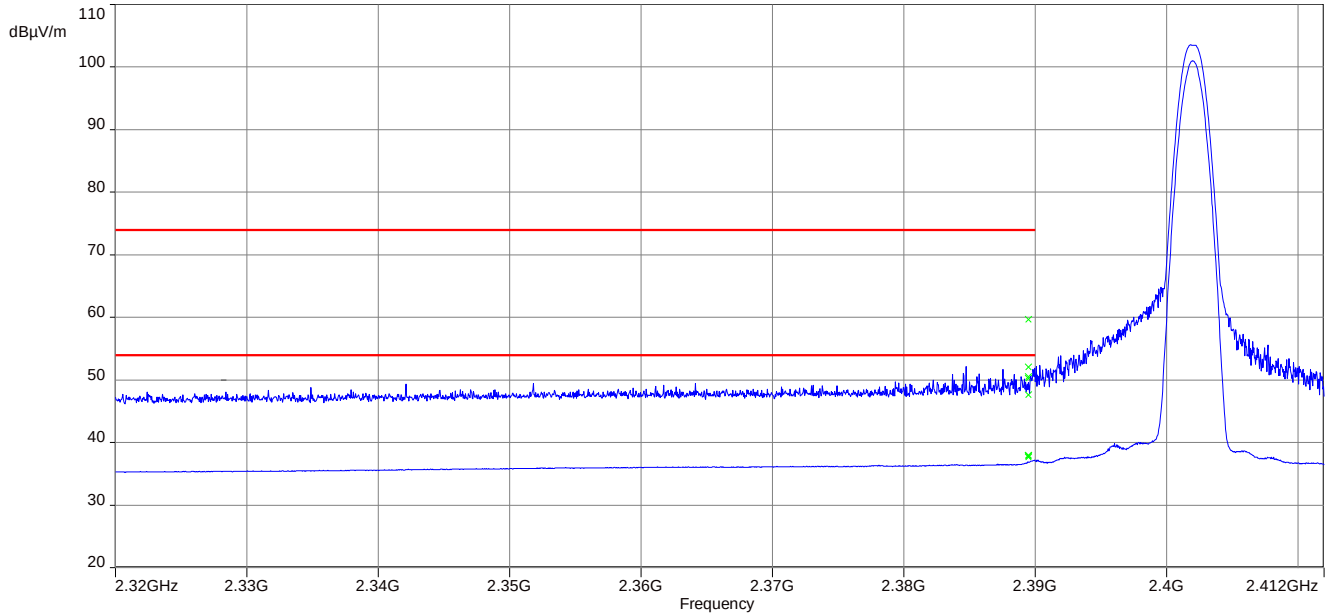
FCC	IC
Band edge compliance radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).	
54 dBµV/m AVG 74 dBµV/m Peak	

Results: ANT100P001B24553 antenna

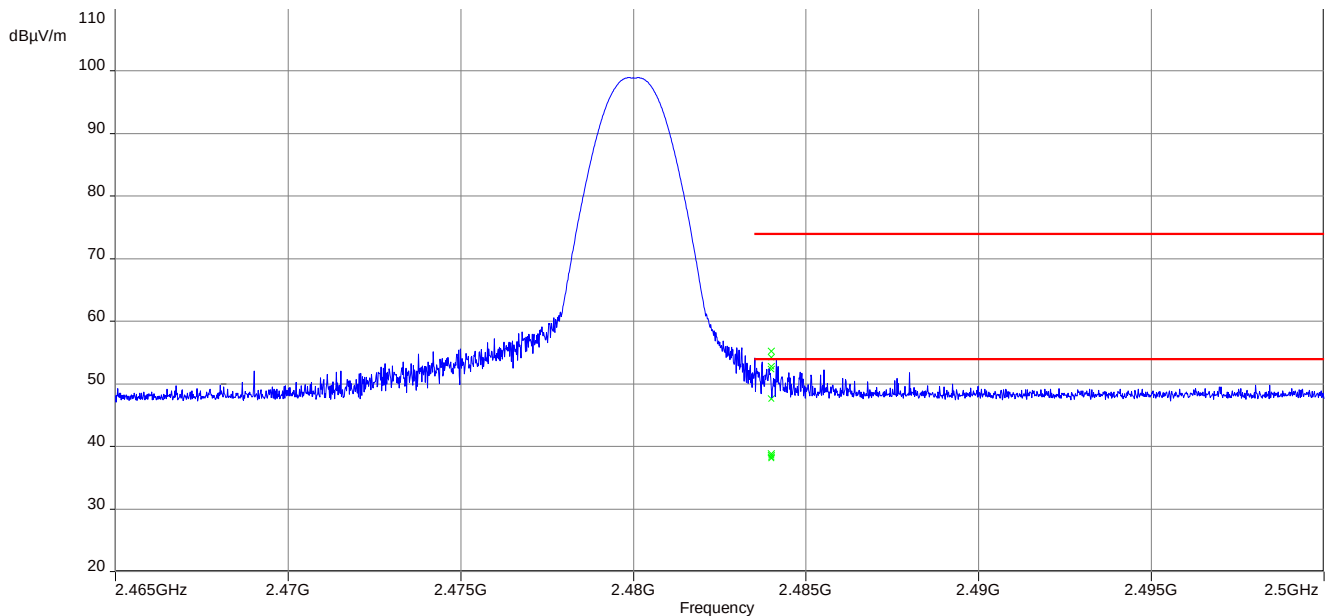
Scenario Modulation	Band edge compliance radiated [dBµV/m]		
	GFSK	Pi/4 DQPSK	8DPSK
Lower restricted band	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP
Upper restricted band	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP

Plots: ANT-X100P001B24553 antenna

Plot 1: Lower band edge, GFSK modulation, vertical & horizontal polarization

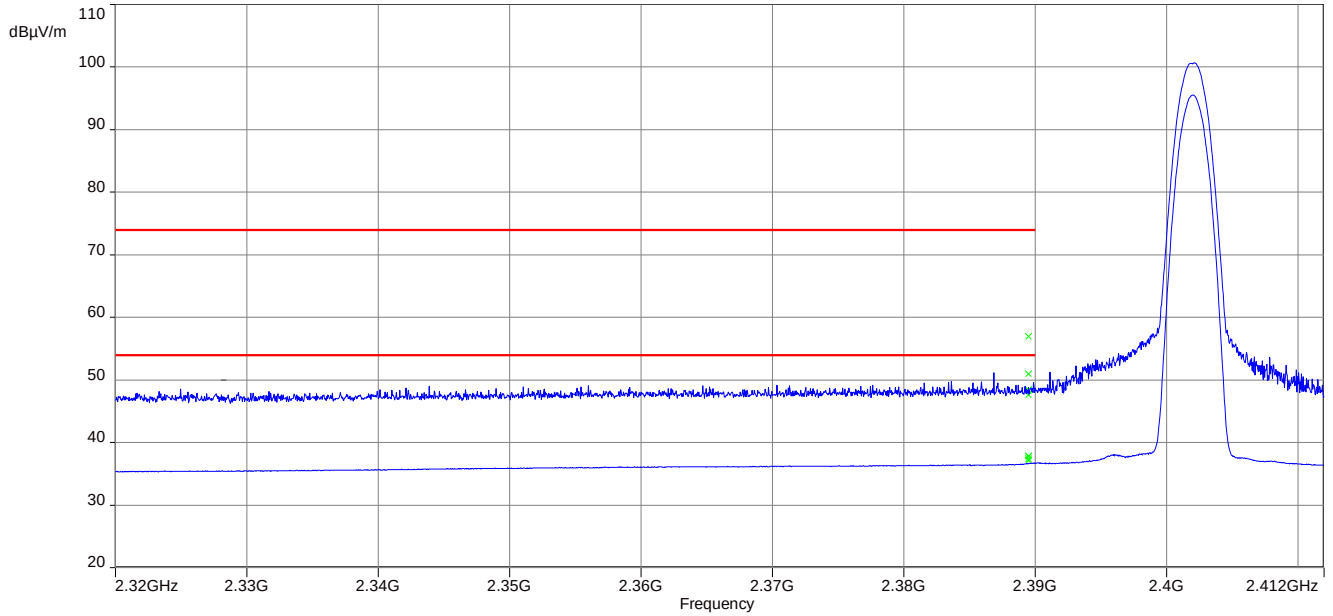


Plot 2: Upper band edge, GFSK modulation, vertical & horizontal polarization

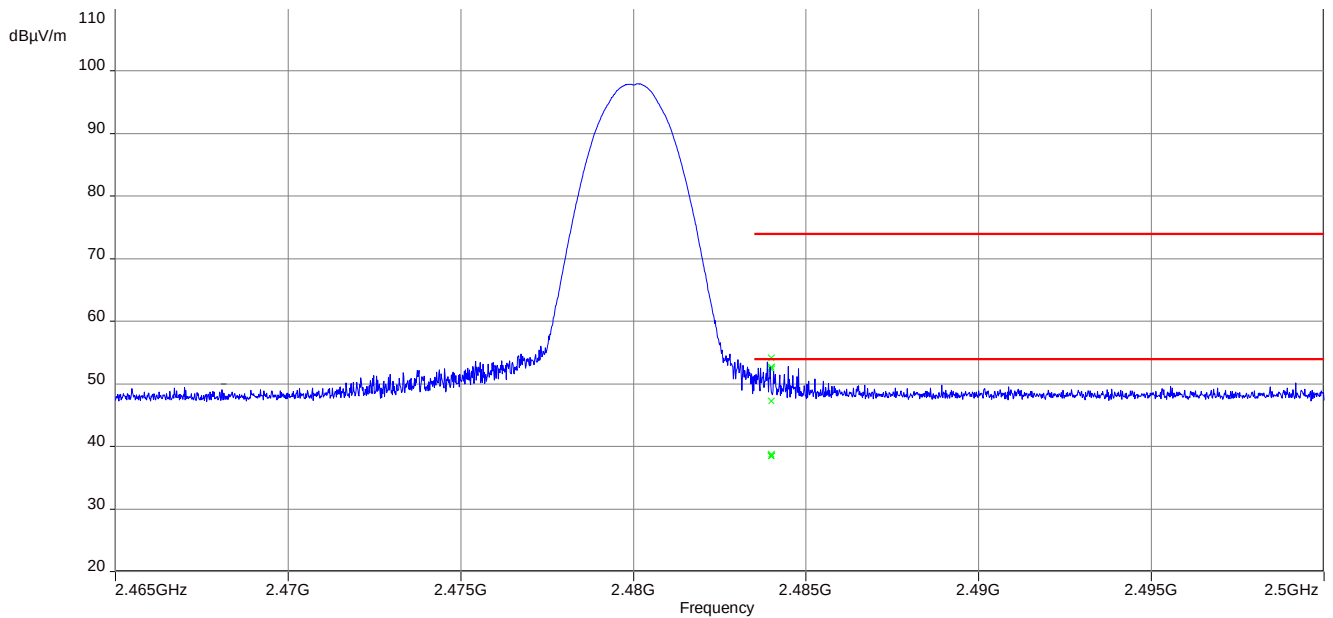


Calculated average value:	Detected band edge peak value:	55.5 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	25.4 dBμV/m @ 3m

Plot 3: Lower band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization

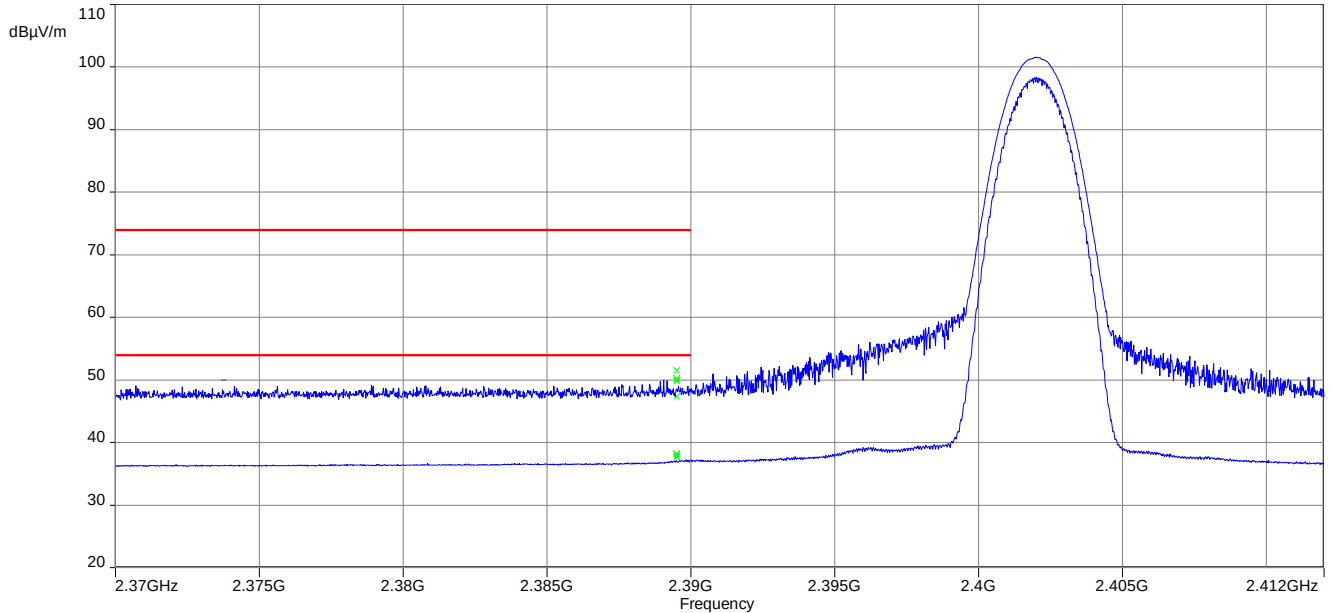


Plot 4: Upper band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization

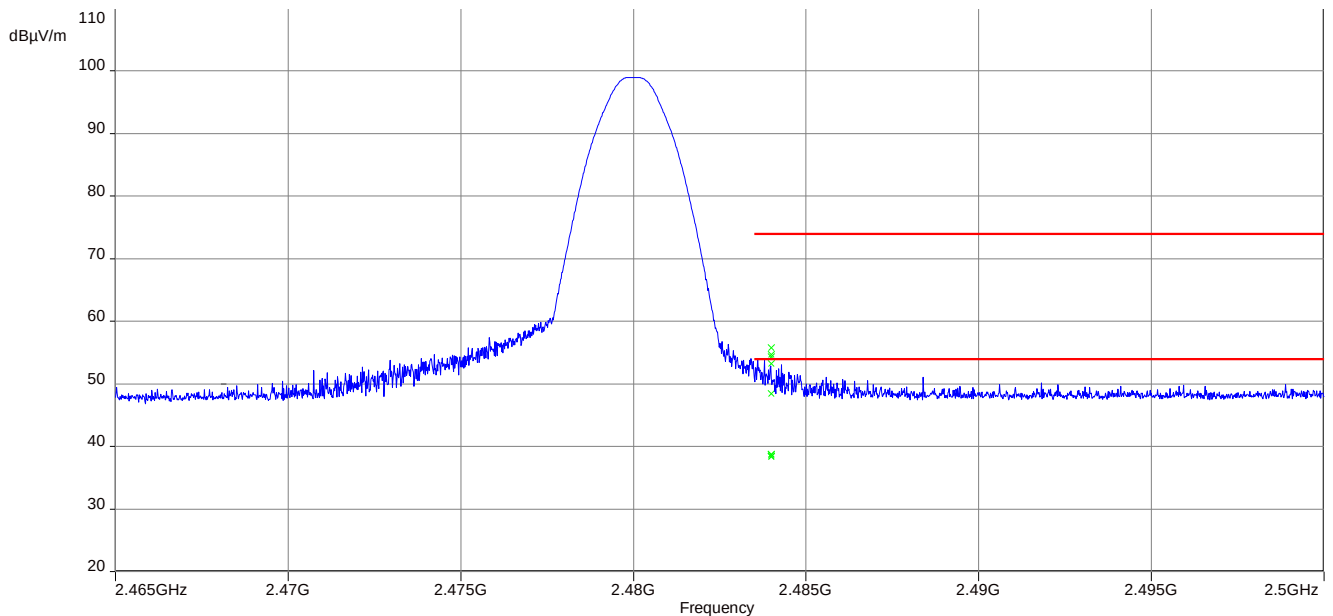


Calculated average value:	Detected band edge peak value:	54.3 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	24.2 dBμV/m @ 3m

Plot 5: Lower band edge, 8 DPSK modulation, vertical & horizontal polarization



Plot 6: Upper band edge, 8 DPSK modulation, vertical & horizontal polarization



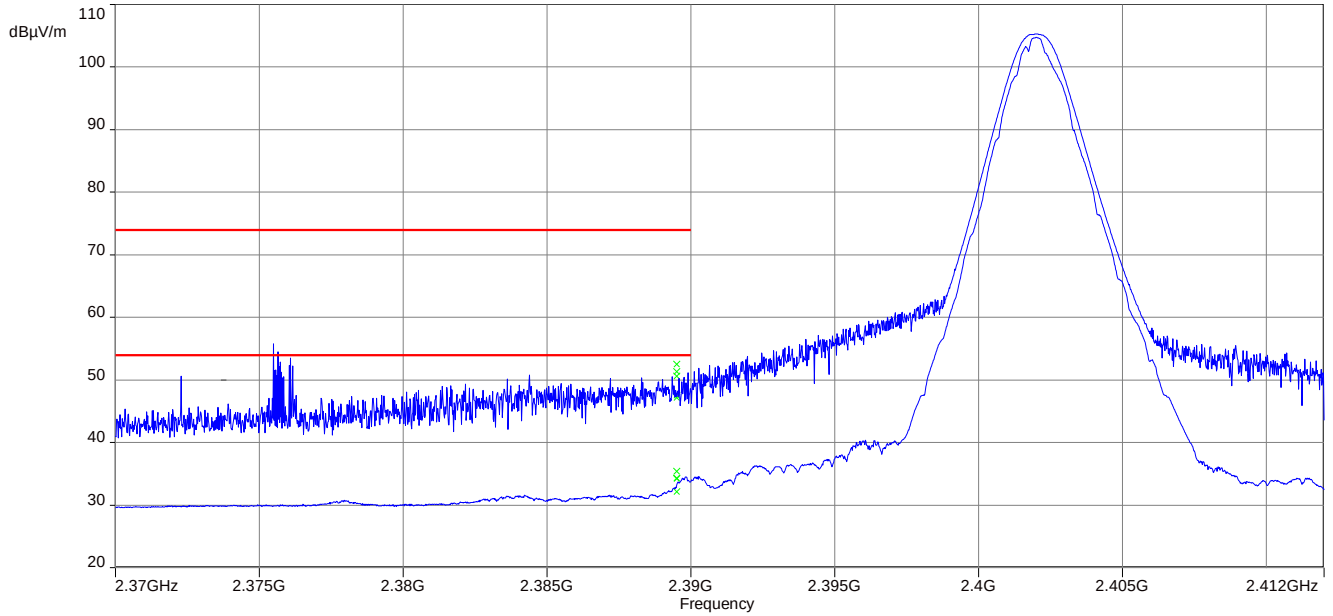
Calculated average value:	Detected band edge peak value:	56.0 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	25.9 dBμV/m @ 3m

Results: ANT-DB1-RAF-xxx antenna

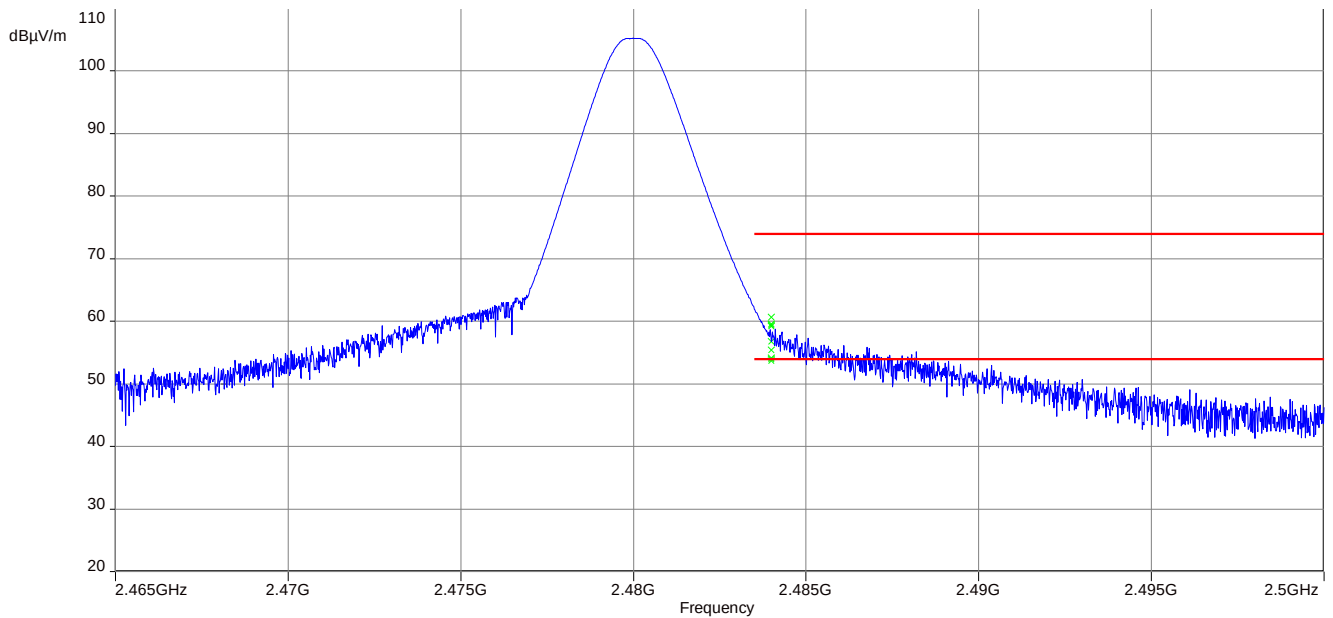
Scenario	Band edge compliance radiated [dBµV/m]		
Modulation	GFSK	Pi/4 DQPSK	8DPSK
Lower restricted band	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP
Upper restricted band	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP	< 54 AVG / < 74 PP

Plots: ANT-DB1-RAF-xxx antenna

Plot 1: Lower band edge, GFSK modulation, vertical & horizontal polarization

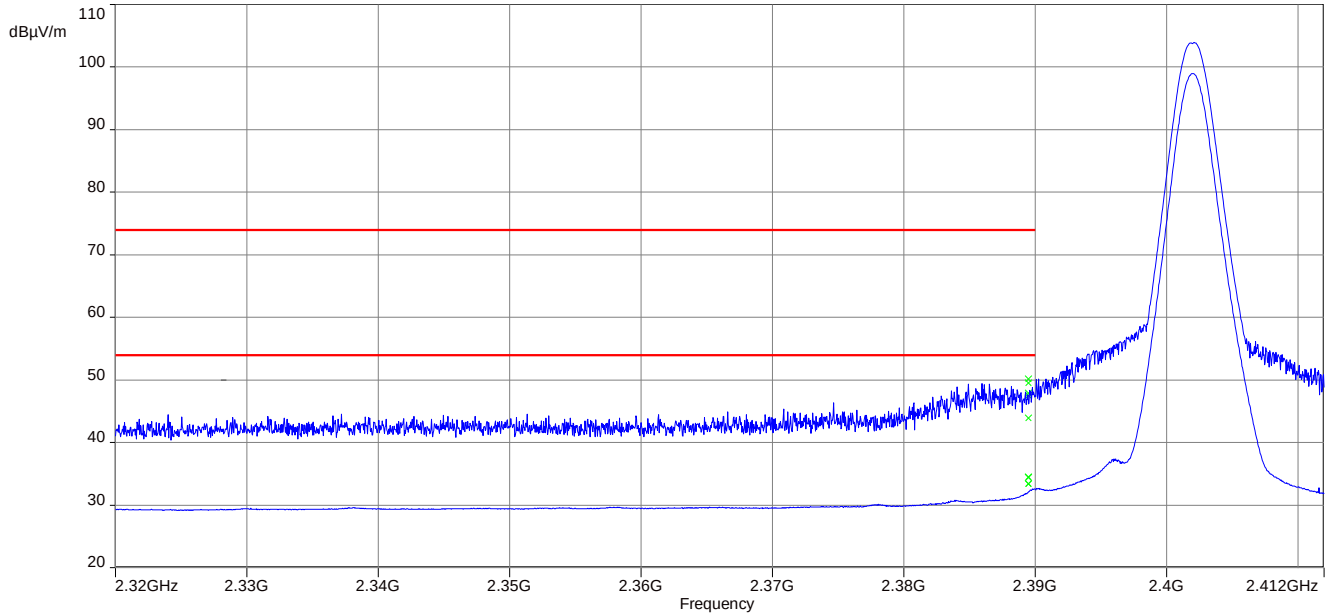


Plot 2: Upper band edge, GFSK modulation, vertical & horizontal polarization

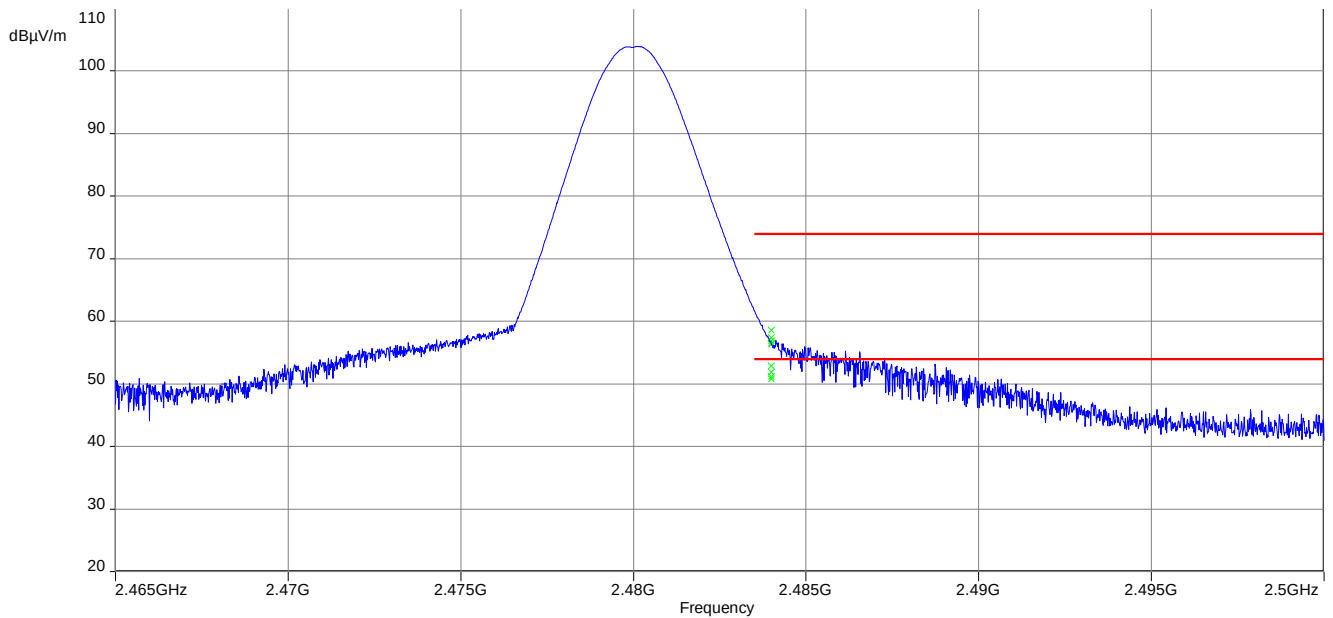


Calculated average value:	Detected band edge peak value:	61.1 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	31.0 dBμV/m @ 3m

Plot 3: Lower band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization

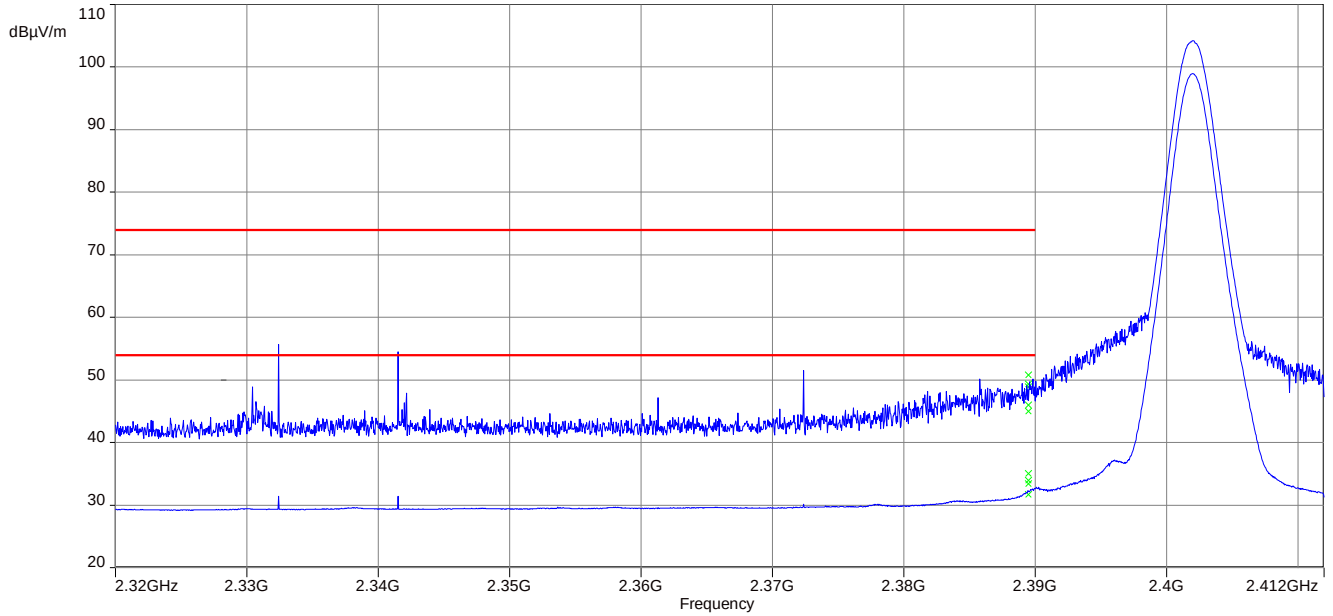


Plot 4: Upper band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization

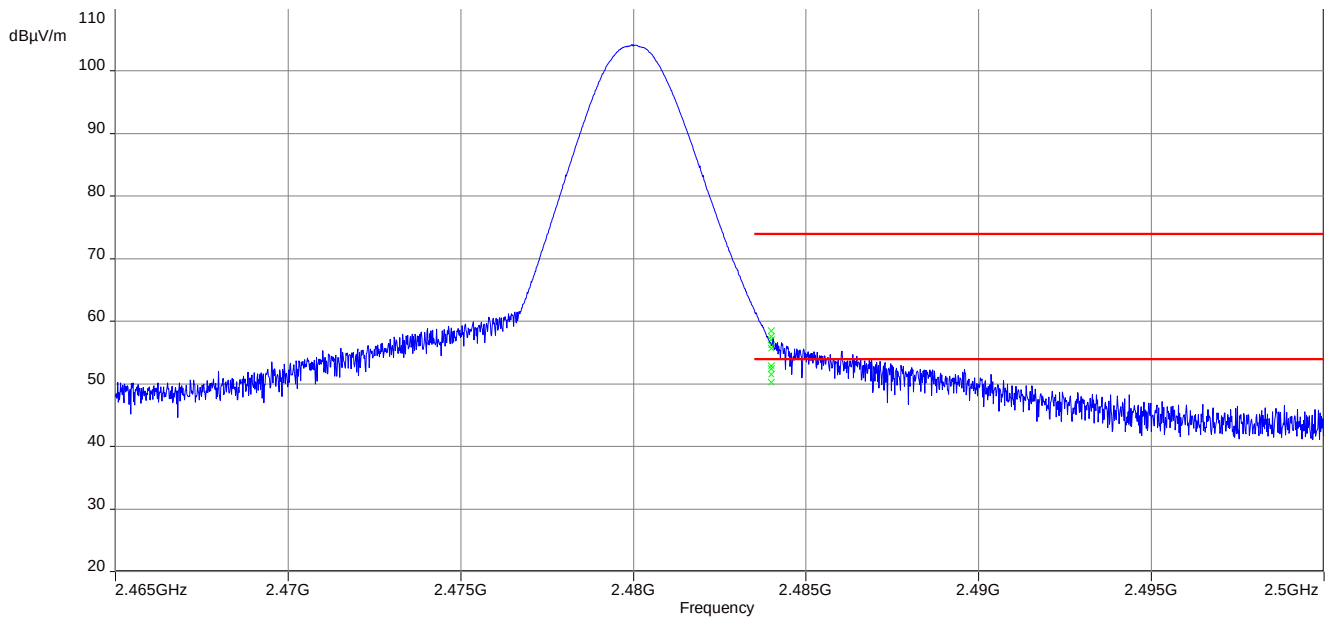


Calculated average value:	Detected band edge peak value:	58.1 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	28.0 dBμV/m @ 3m

Plot 5: Lower band edge, 8 DPSK modulation, vertical & horizontal polarization



Plot 6: Upper band edge, 8 DPSK modulation, vertical & horizontal polarization



Calculated average value:	Detected band edge peak value:	58.7 dBμV/m @ 3m
	Duty cycle correction factor:	-30.1 dB (See chapter 11.12)
	Calculated band edge average value:	28.6 dBμV/m @ 3m

11.9 Spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is repeated for all modulations.

Measurement parameters	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	9 kHz to 25 GHz
Trace mode	Max hold
Test setup	See sub clause 6.5 – A
Measurement uncertainty	See sub clause 8

Limits:

FCC	IC
TX spurious emissions conducted	
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. Attenuation below the general limits specified in Section 15.209(a) is not required	

Results: UFL port

TX spurious emissions conducted					
GFSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		5.6	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		4.9	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		5.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Results: UFL port

TX spurious emissions conducted					
Pi/4-DQPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		2.6	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		1.9	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		2.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Results: UFL port

TX spurious emissions conducted					
8DPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		2.5	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		1.8	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		2.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Results: MMCX port

TX spurious emissions conducted					
GFSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		3.9	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		4.6	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		4.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Results: MMCX port

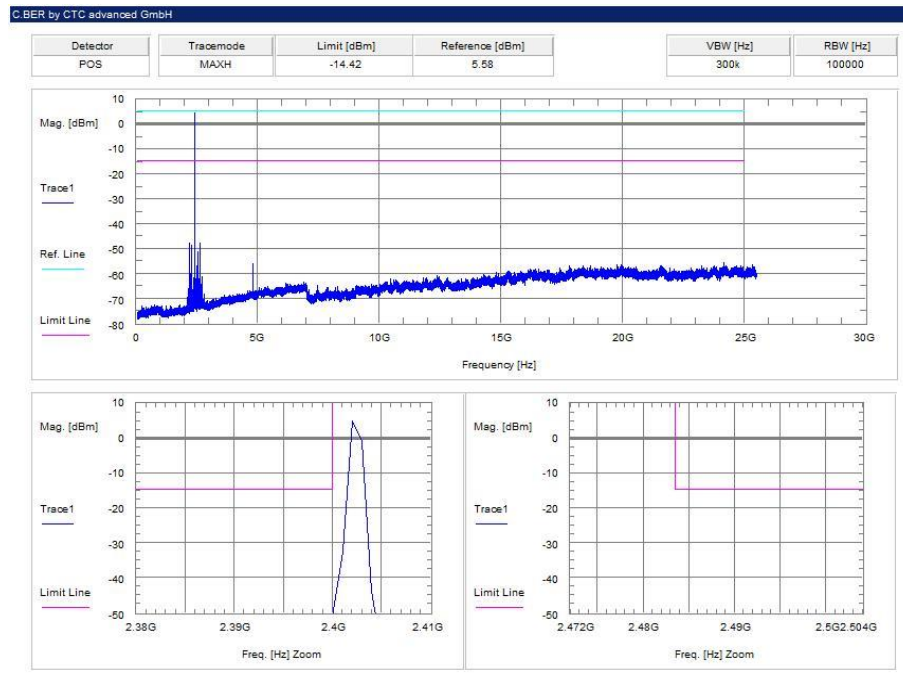
TX spurious emissions conducted					
Pi/4-DQPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		1.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		1.8	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		1.3	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Results: MMCX port

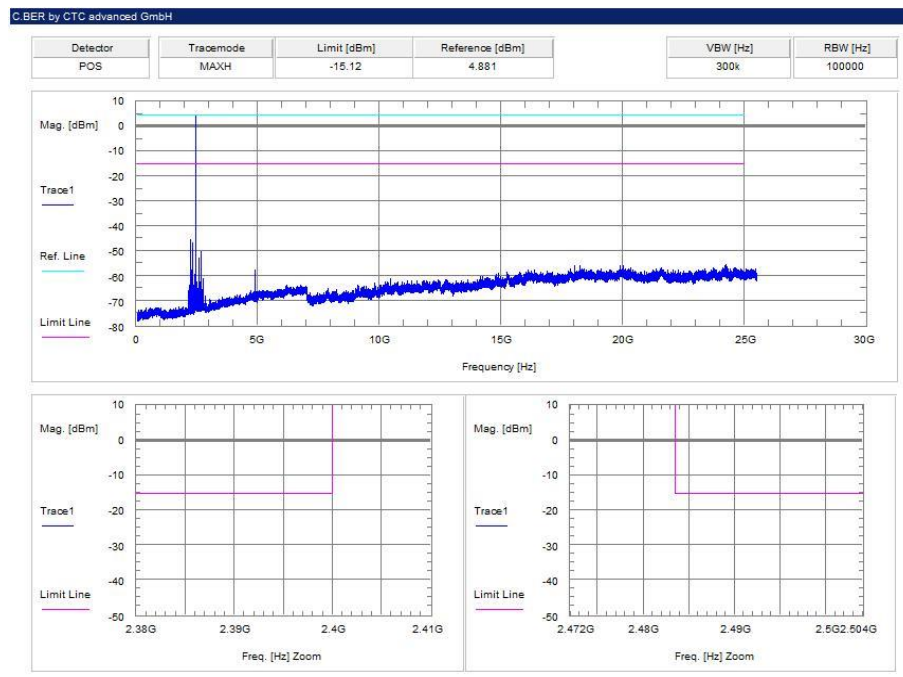
TX spurious emissions conducted					
8DPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		1.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2441		1.8	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant
2480		1.4	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		compliant

Plots: UFL port

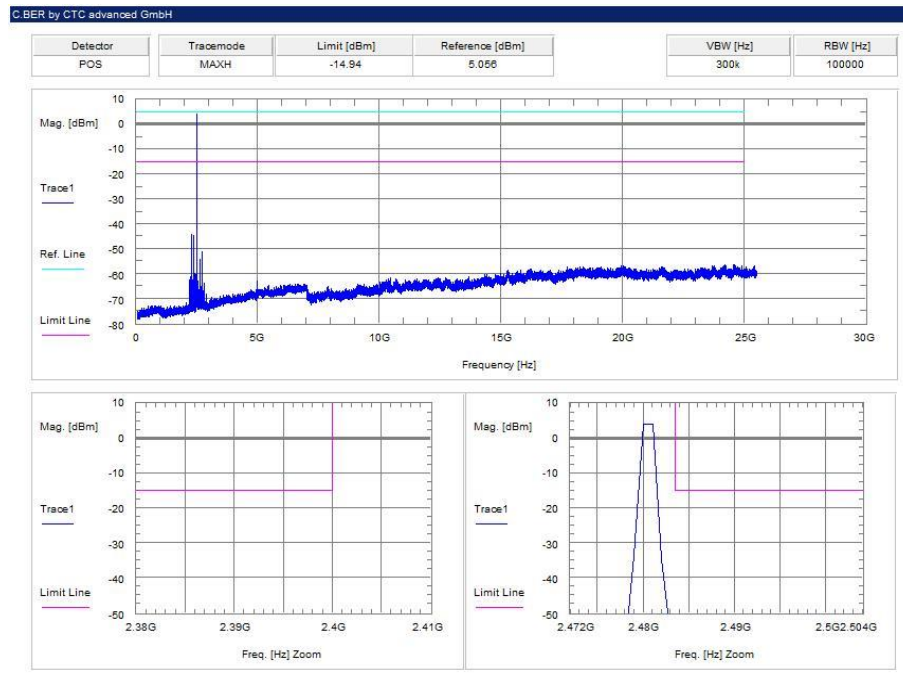
Plot 1: lowest channel – 2402 MHz, GFSK modulation



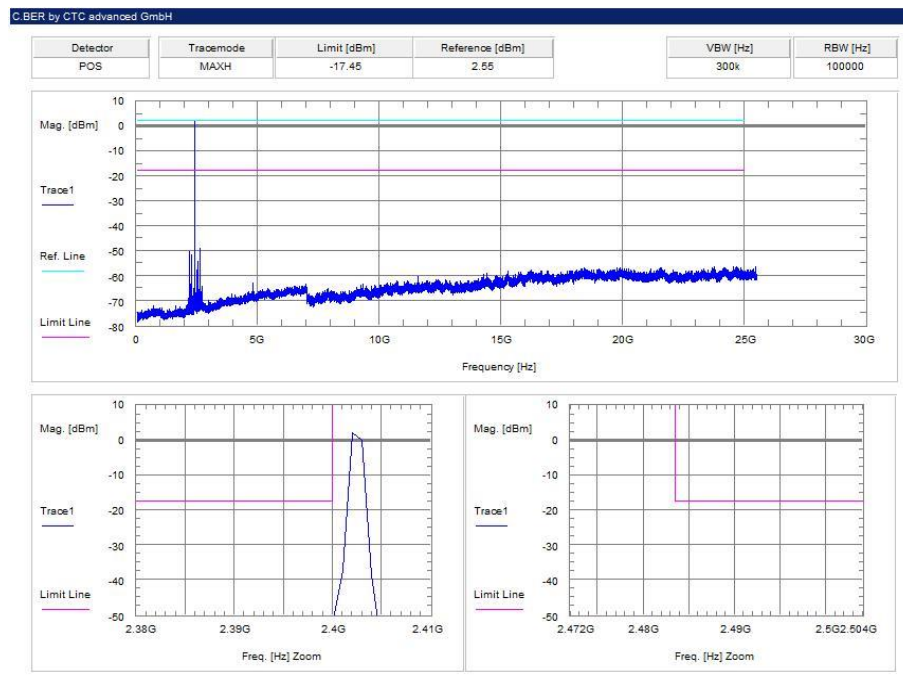
Plot 2: middle channel – 2441 MHz, GFSK modulation



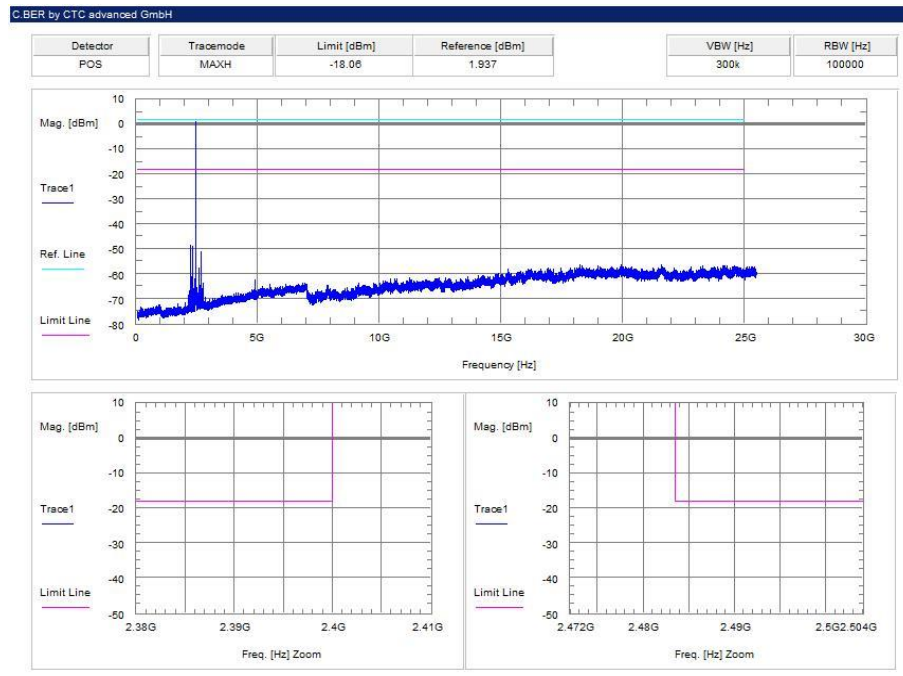
Plot 3: highest channel – 2480 MHz, GFSK modulation



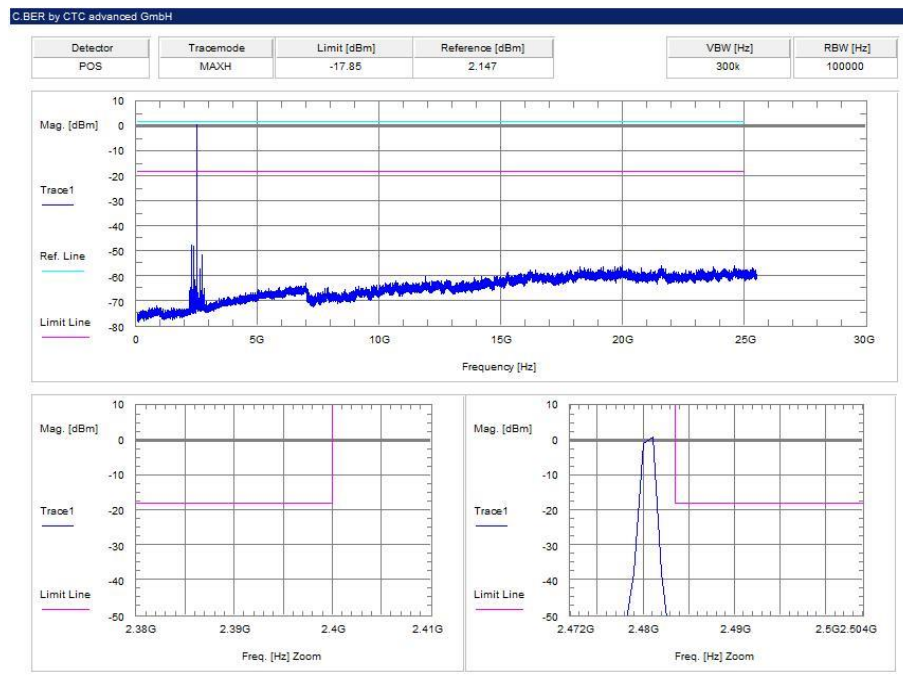
Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation



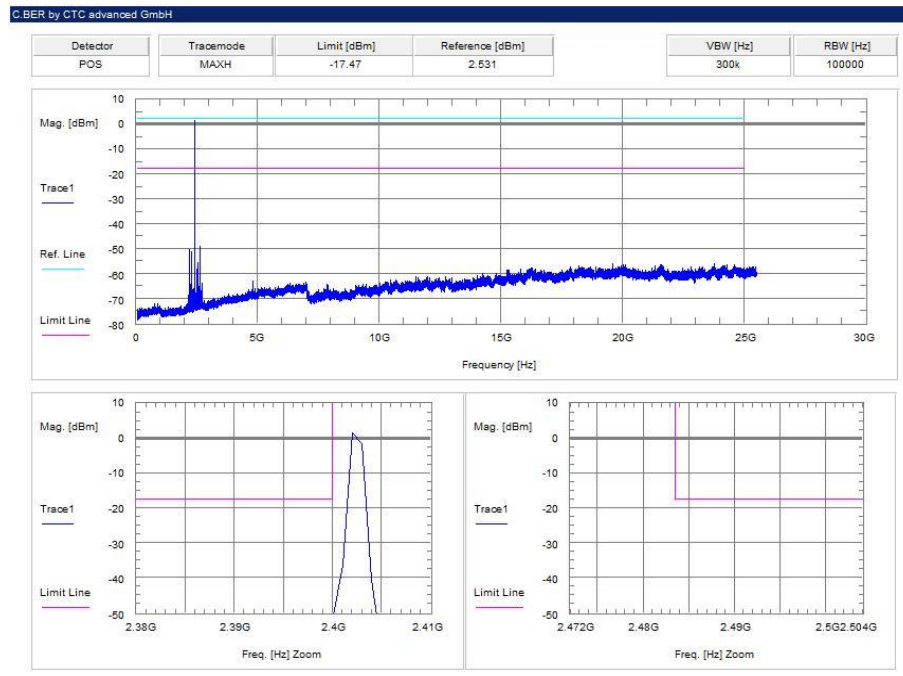
Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation



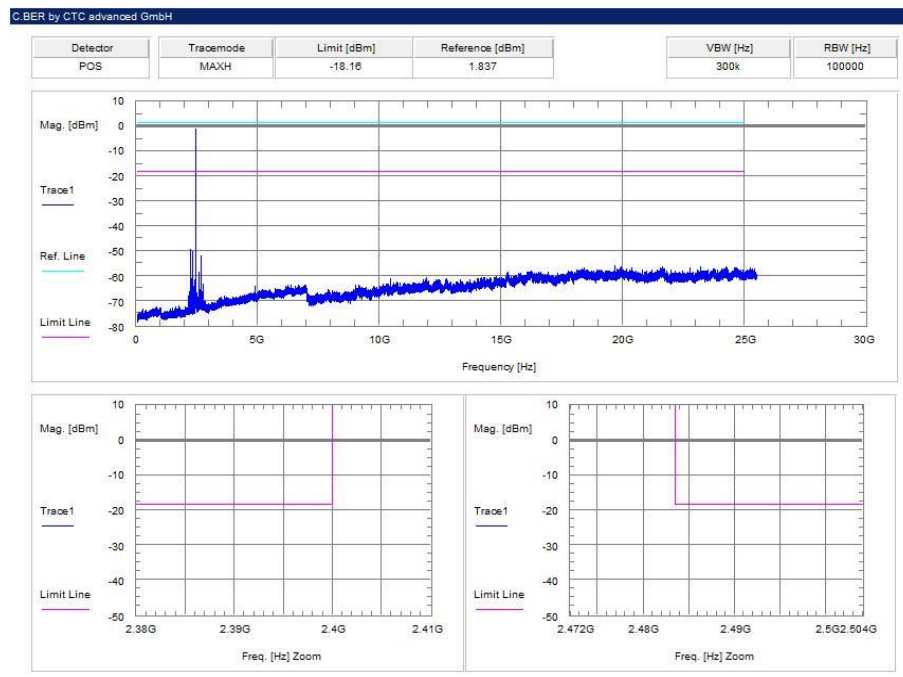
Plot 6: highest channel – 2480 MHz, Pi / DQPSK modulation



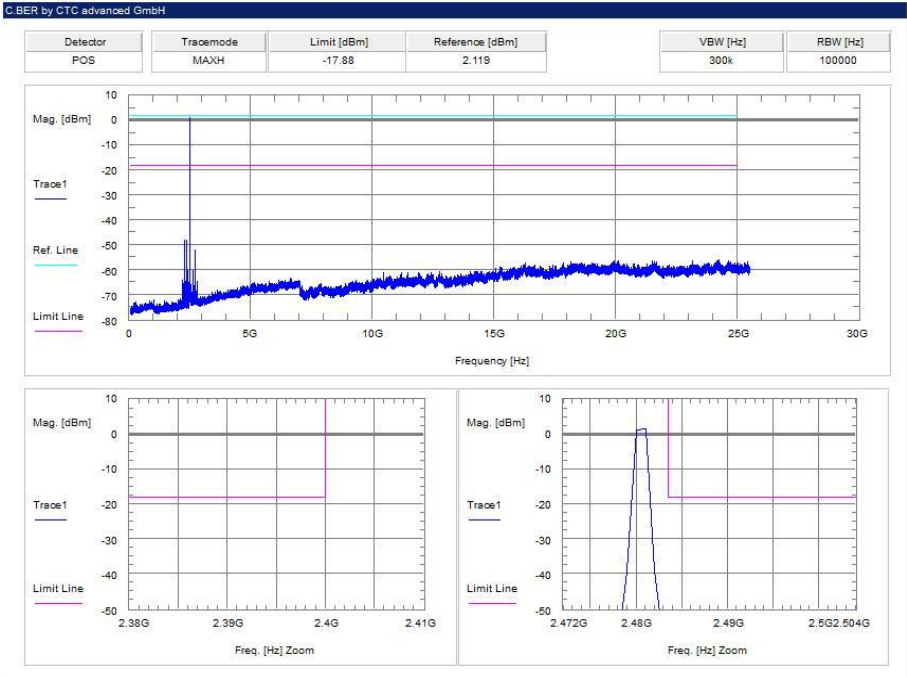
Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation



Plot 8: middle channel – 2441 MHz, 8 DPSK modulation

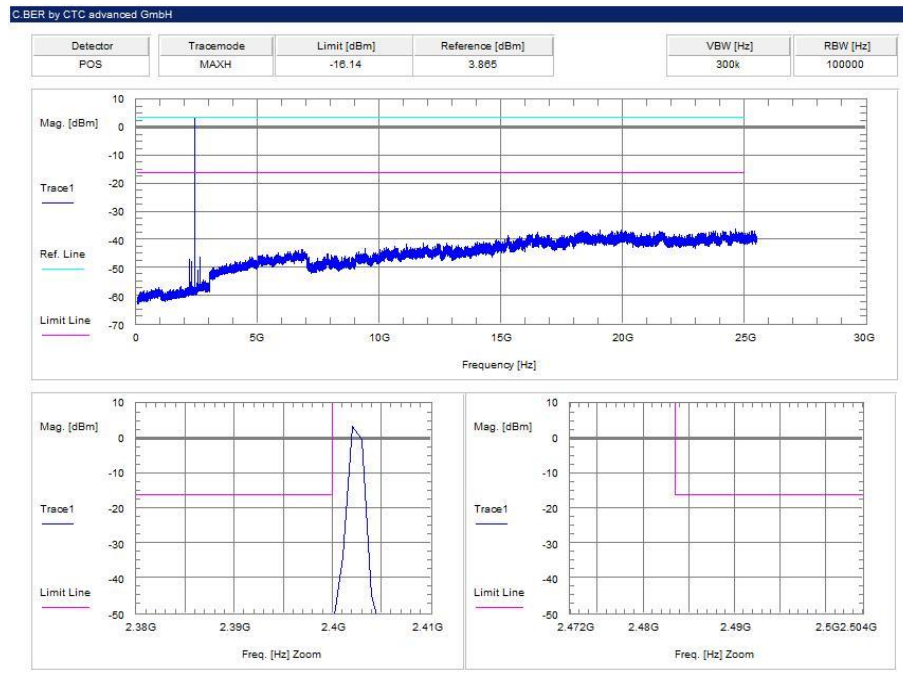


Plot 9: highest channel – 2480 MHz, 8 DPSK modulation

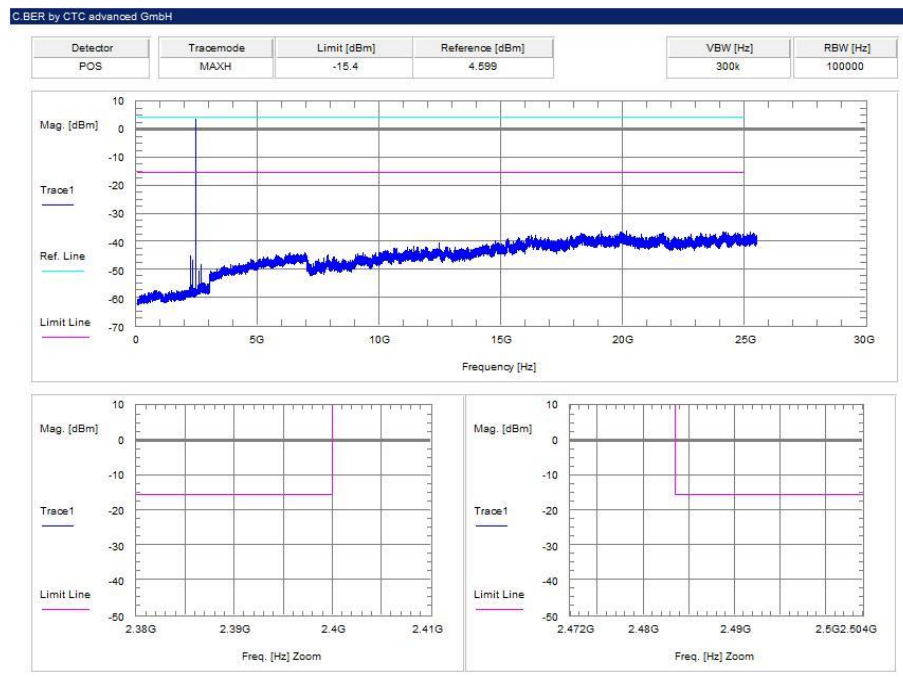


Plots: MMCX port

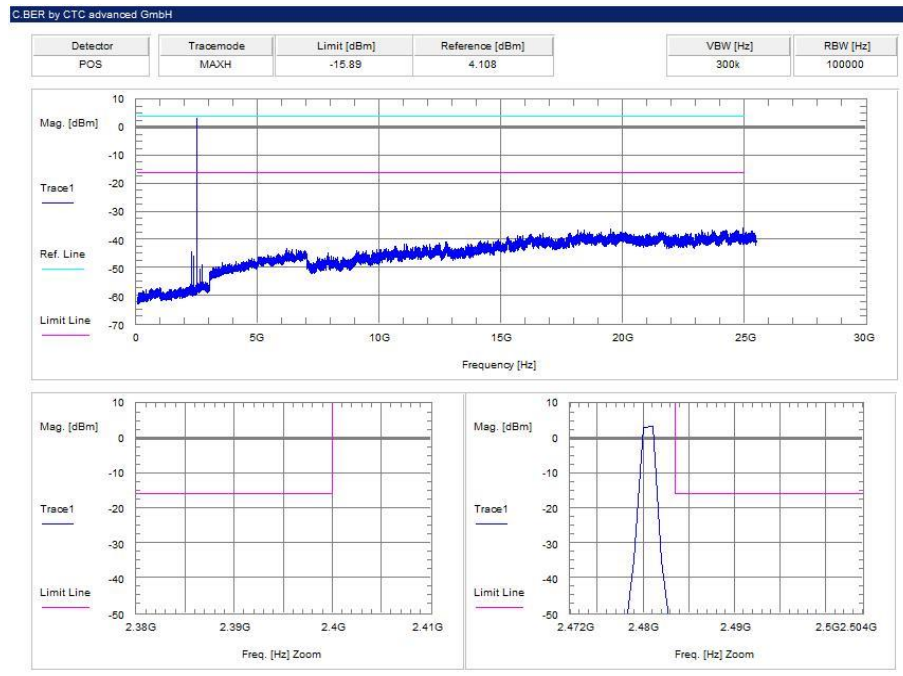
Plot 1: lowest channel – 2402 MHz, GFSK modulation



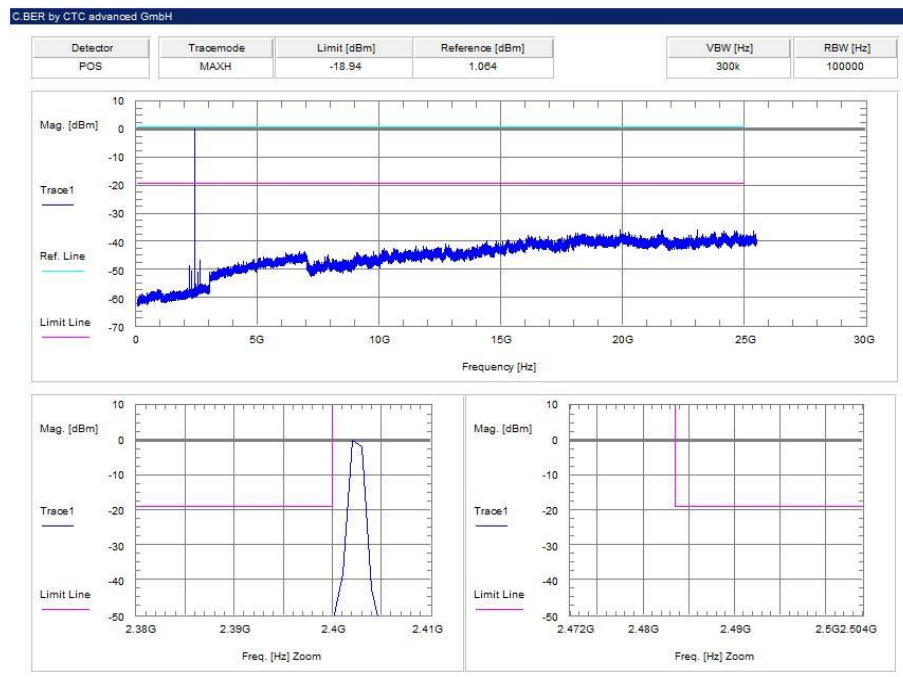
Plot 2: middle channel – 2441 MHz, GFSK modulation



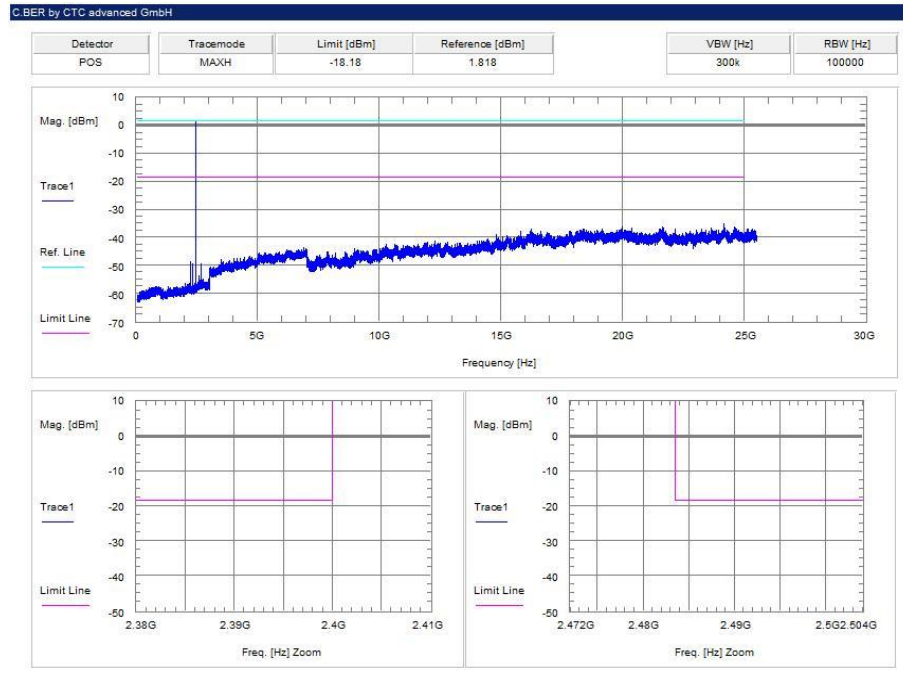
Plot 3: highest channel – 2480 MHz, GFSK modulation



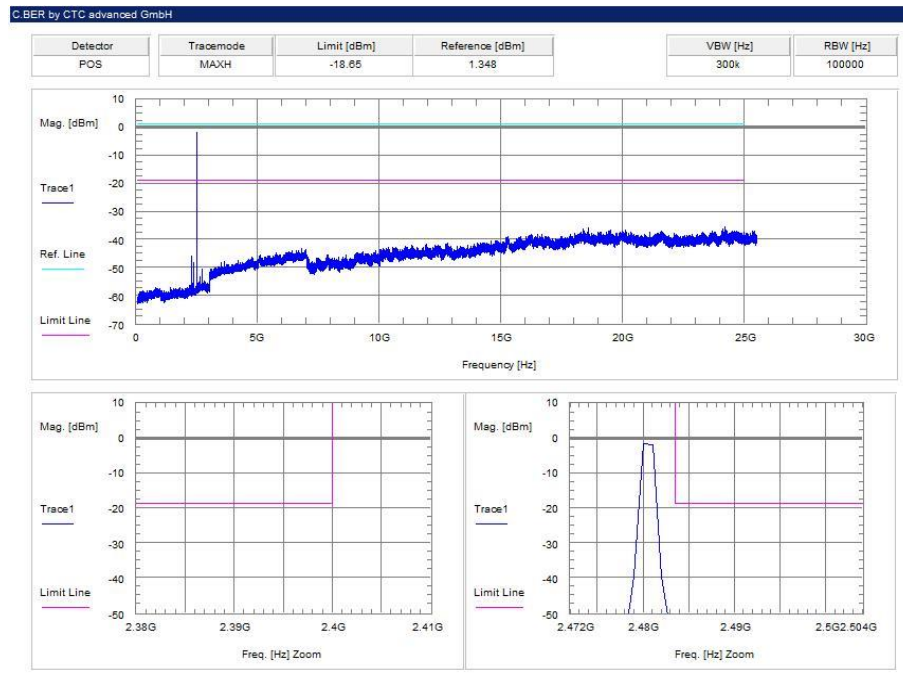
Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation



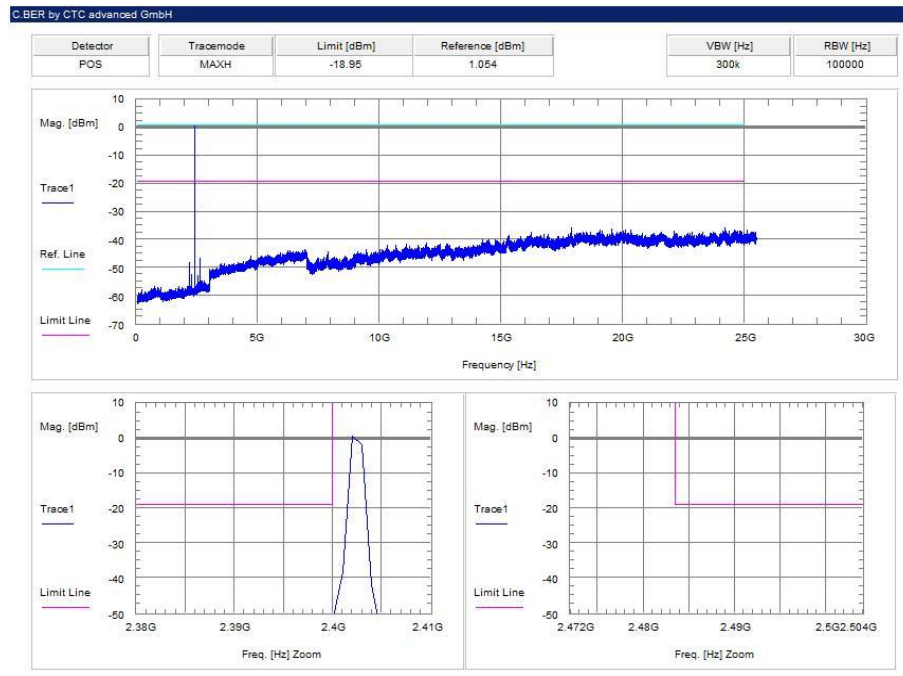
Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation



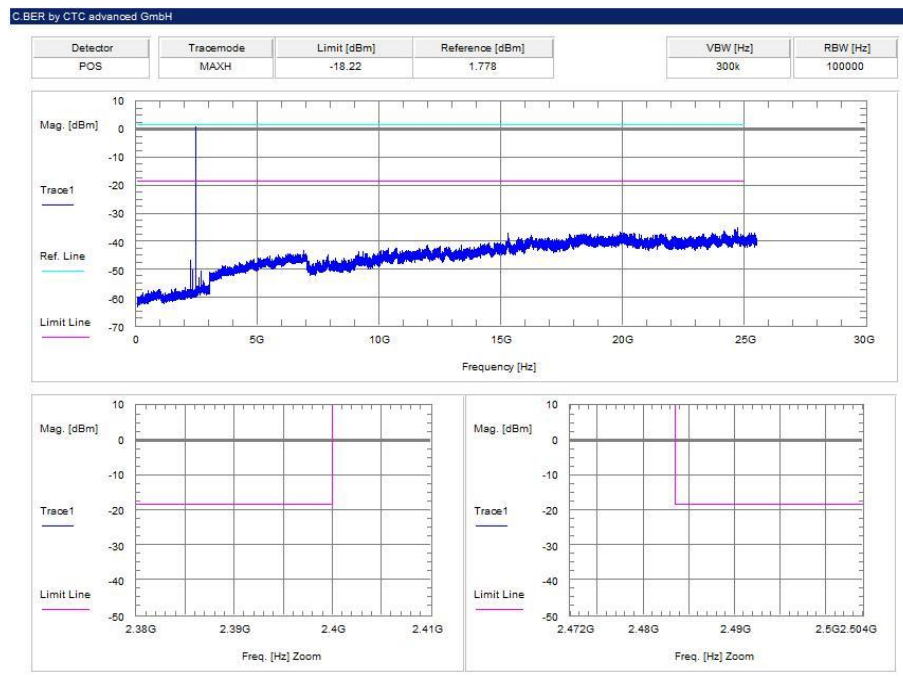
Plot 6: highest channel – 2480 MHz, Pi / DQPSK modulation



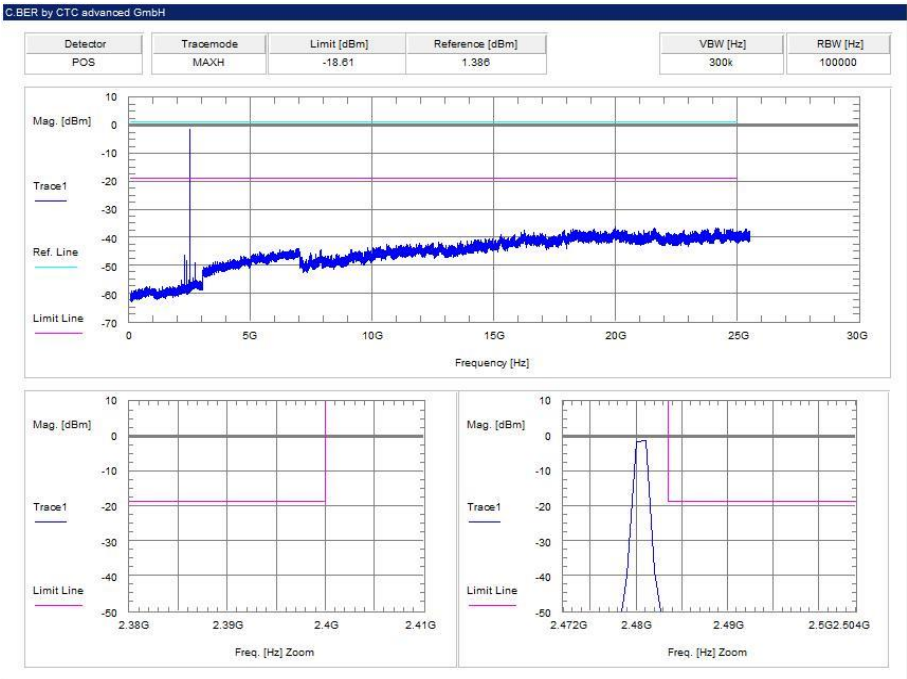
Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation



Plot 8: middle channel – 2441 MHz, 8 DPSK modulation



Plot 9: highest channel – 2480 MHz, 8 DPSK modulation



11.10 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channels are 00; 39 and 78. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

Measurement parameters	
Detector	Peak / Quasi peak
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max hold
Test setup	See sub clause 6.2 – B
Measurement uncertainty	See sub clause 8

Limits:

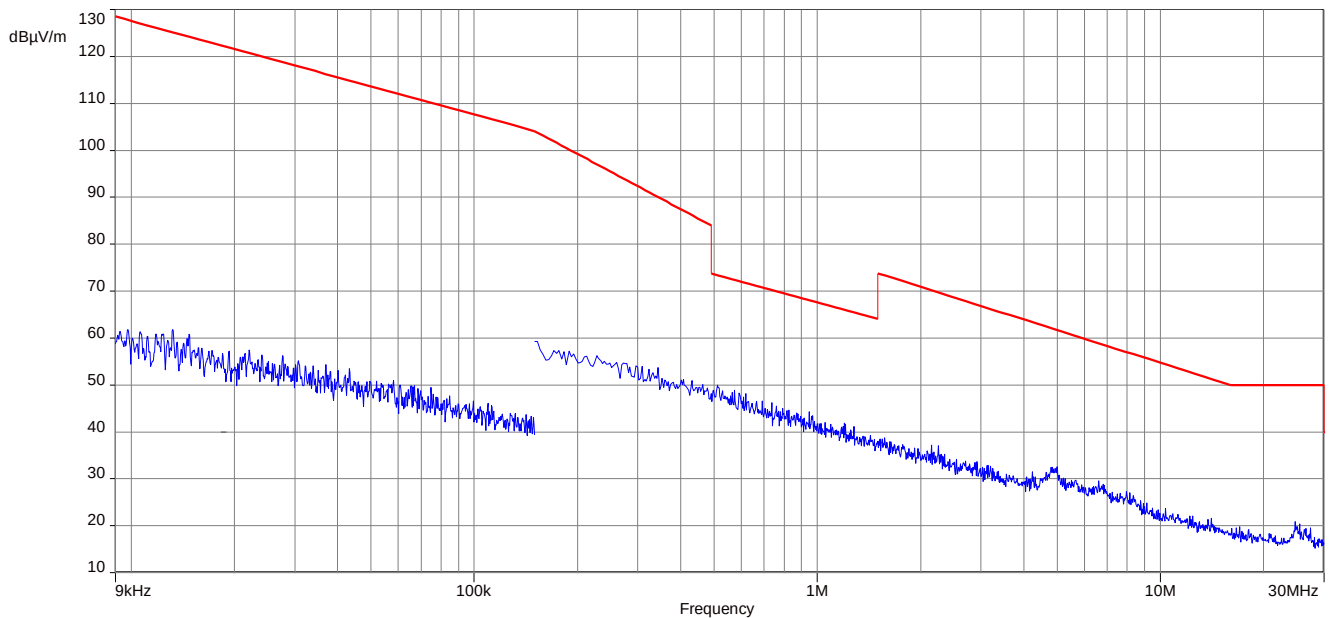
FCC		IC
TX spurious emissions radiated below 30 MHz		
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results: ANT-X100P001B 24553 antenna

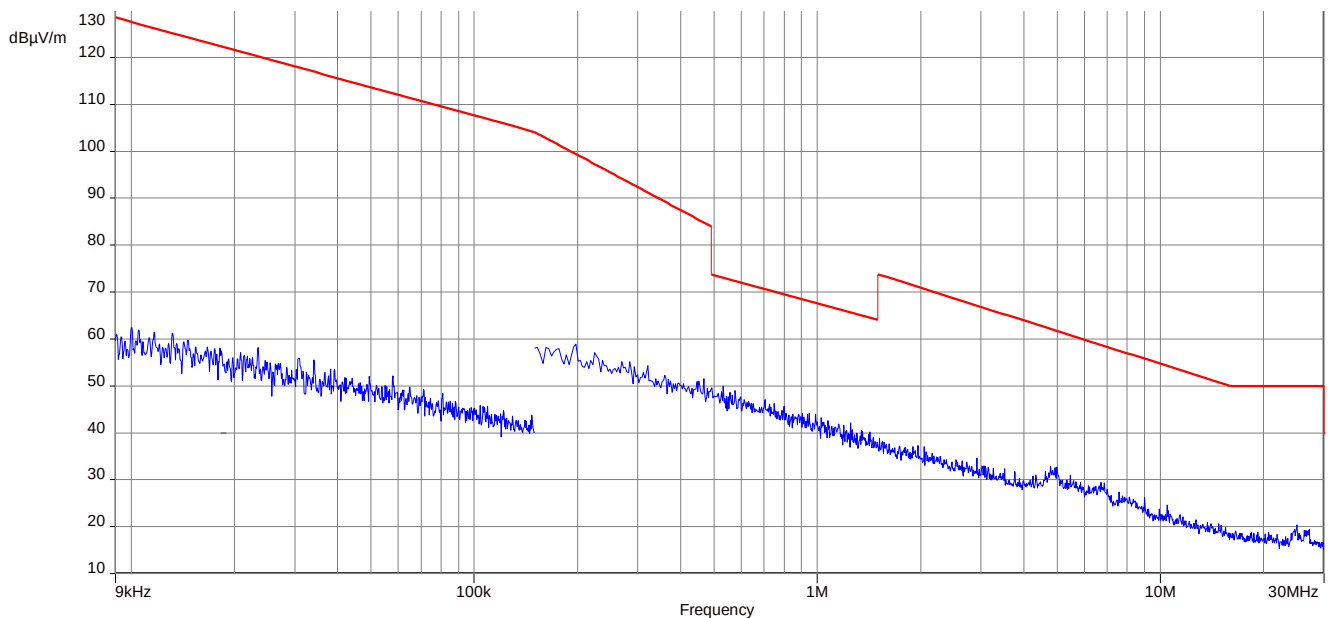
TX spurious emissions radiated below 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
All detected emissions are more than 20 dB below the limit.		

Plots: ANT-X100P001B24553 antenna

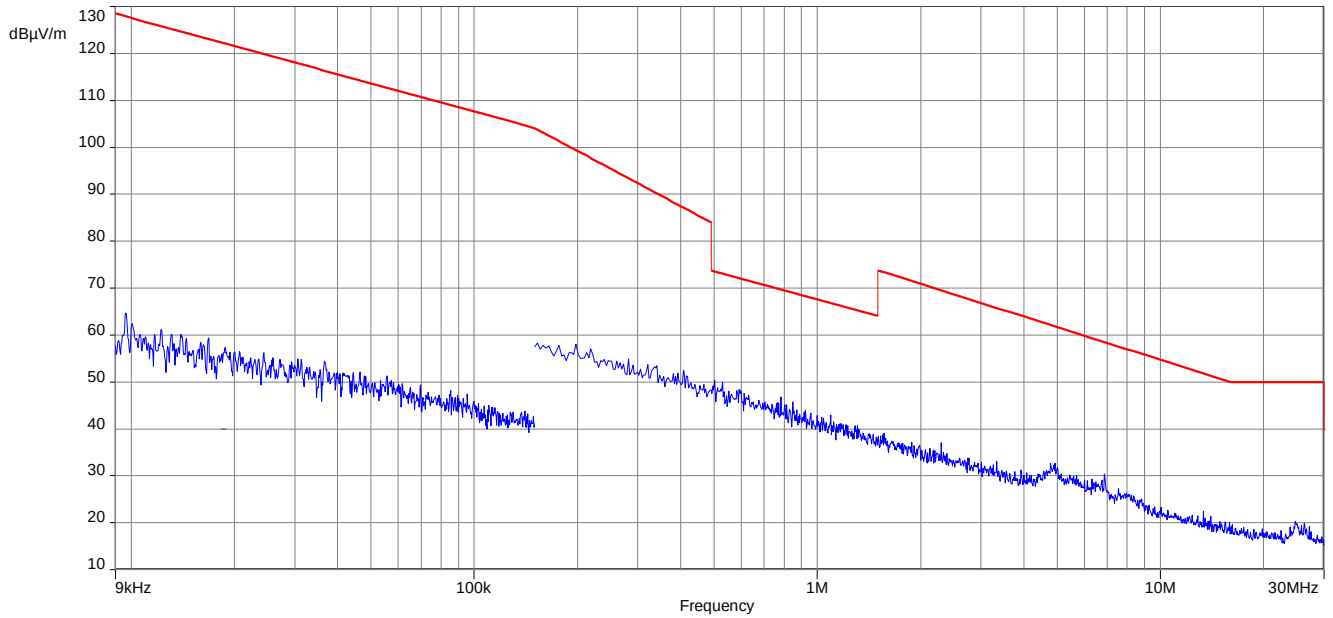
Plot 1: 9 kHz to 30 MHz, channel 00, transmit mode



Plot 2: 9 kHz to 30 MHz, channel 39, transmit mode



Plot 3: 9 kHz to 30 MHz, channel 78, transmit mode

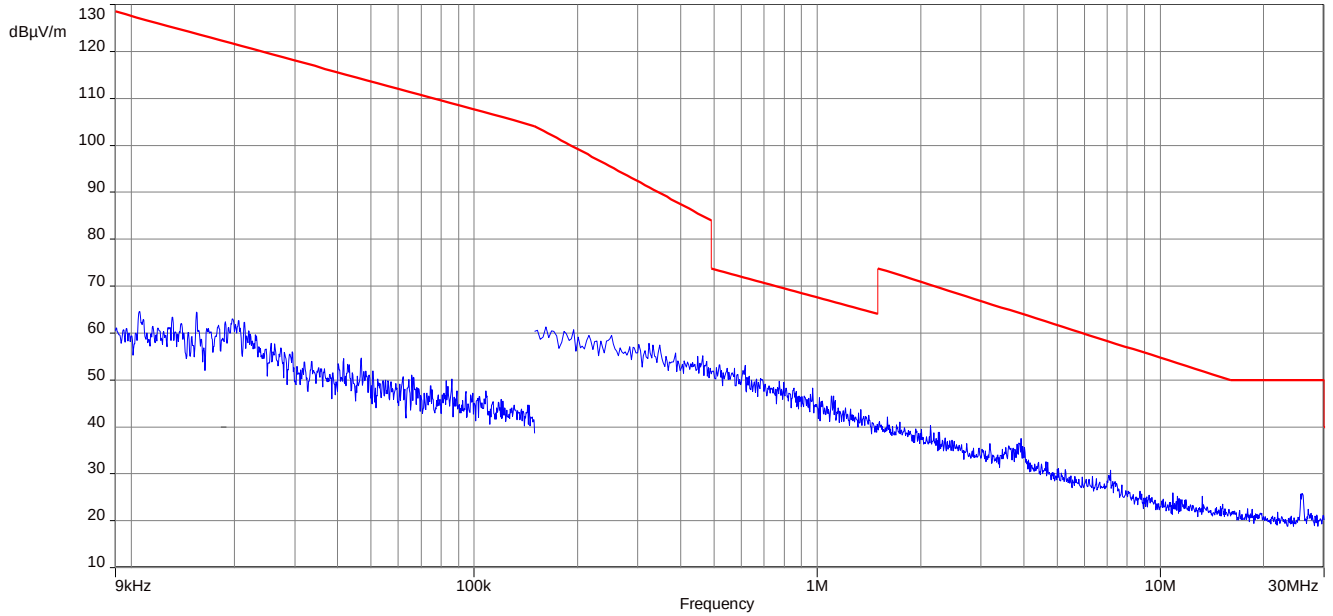


Results: ANT-DB1-RAF-xxx antenna

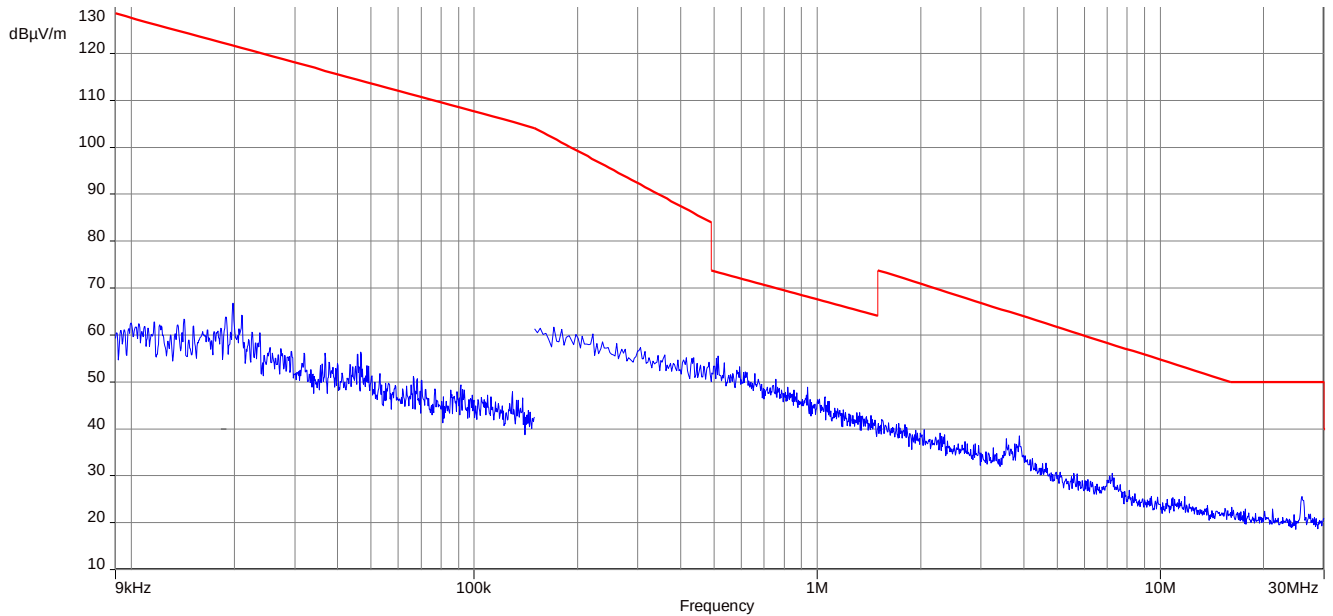
TX spurious emissions radiated below 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
All detected emissions are more than 20 dB below the limit.		

Plots: ANT-DB1-RAF-xxx antenna

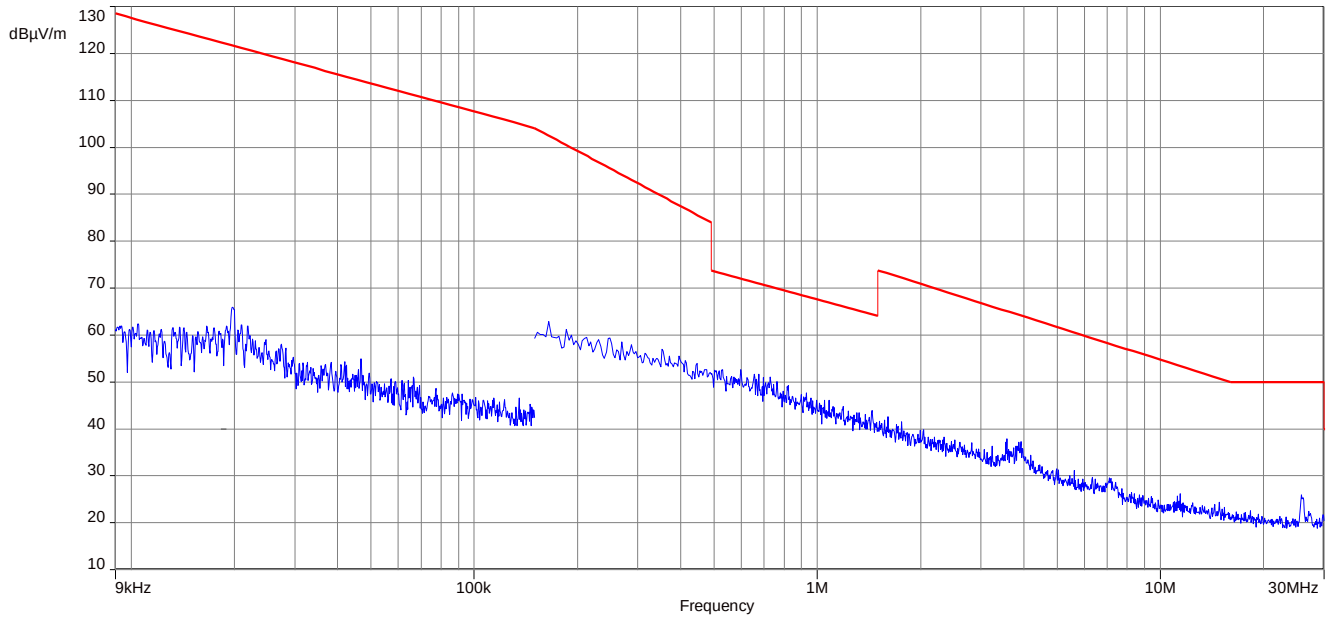
Plot 1: 9 kHz to 30 MHz, channel 00, transmit mode



Plot 2: 9 kHz to 30 MHz, channel 39, transmit mode



Plot 3: 9 kHz to 30 MHz, channel 78, transmit mode



11.11 Spurious emissions radiated 30 MHz to 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	☒ GFSK ☐ Pi/4 DQPSK ☐ 8DPSK
Test setup	See sub clause 6.1 – A
Measurement uncertainty	See sub clause 8

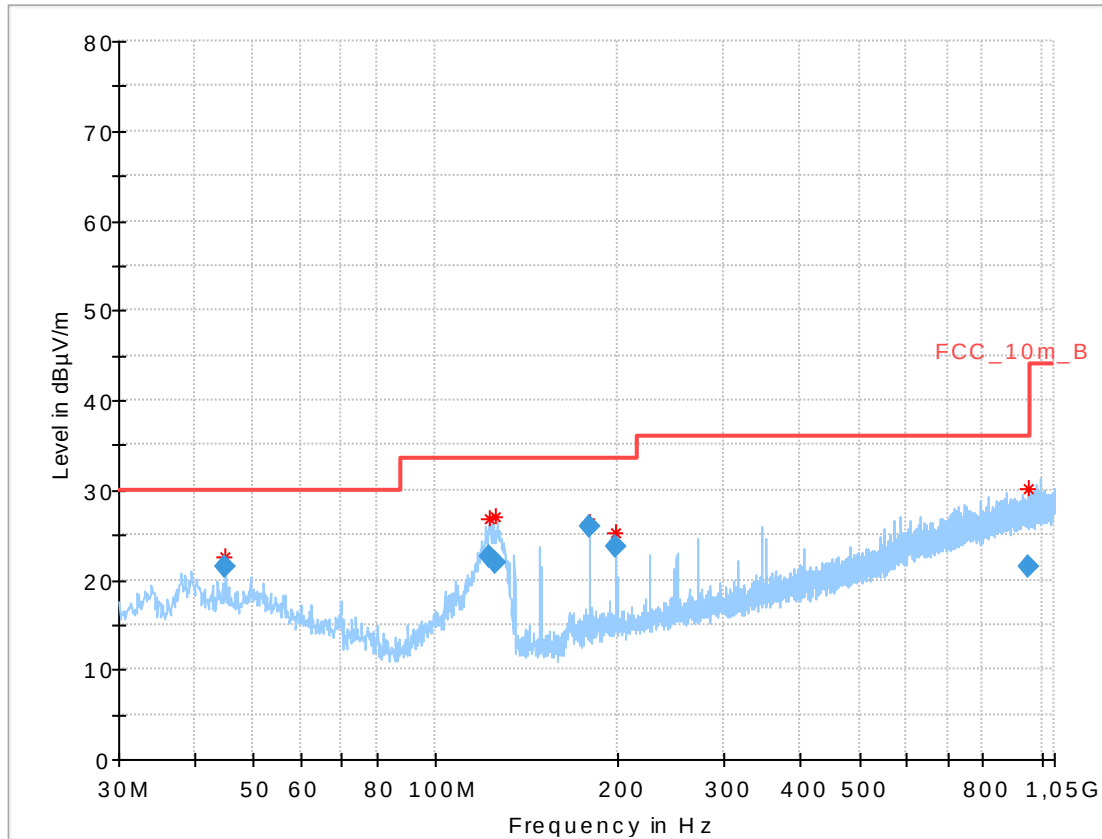
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC		IC
TX spurious emissions radiated		
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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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)).		
§15.209		
Frequency (MHz)	Field strength (dBμV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

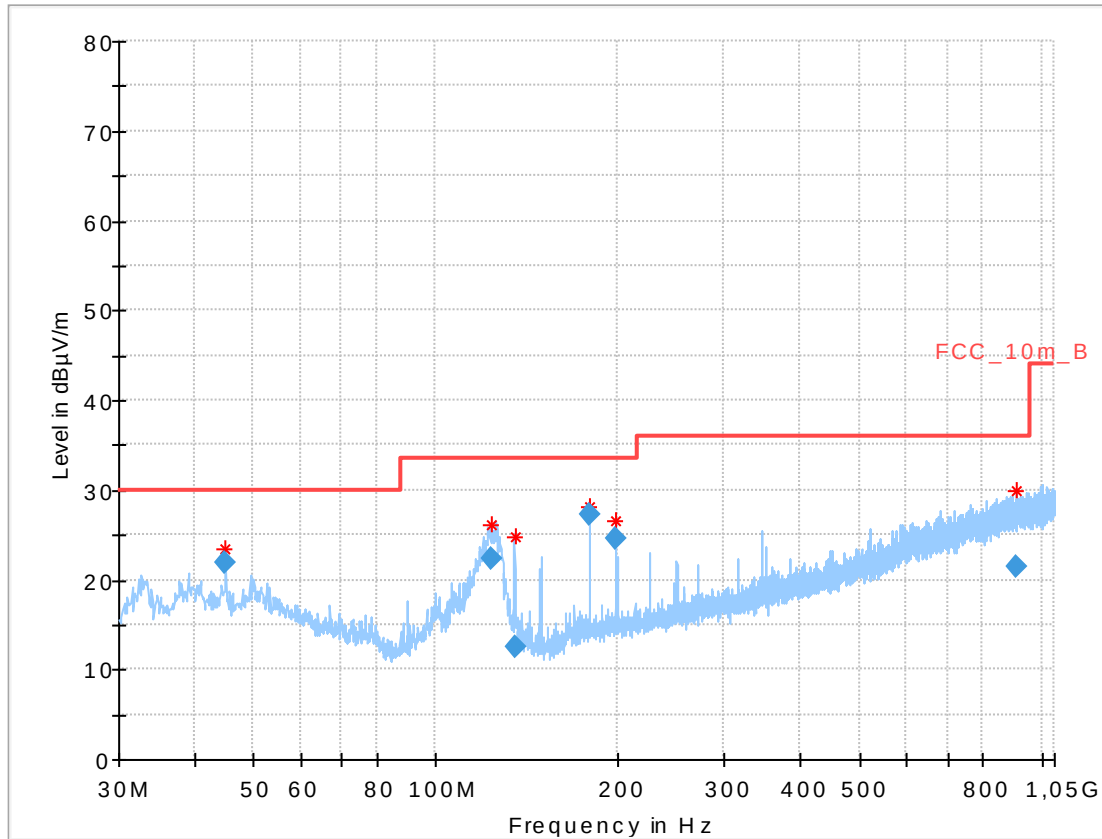
Plots: Transmit mode, ANT100P001B24553 antenna

Plot 1: 30 MHz to 1 GHz, TX mode, channel 00, vertical & horizontal polarization

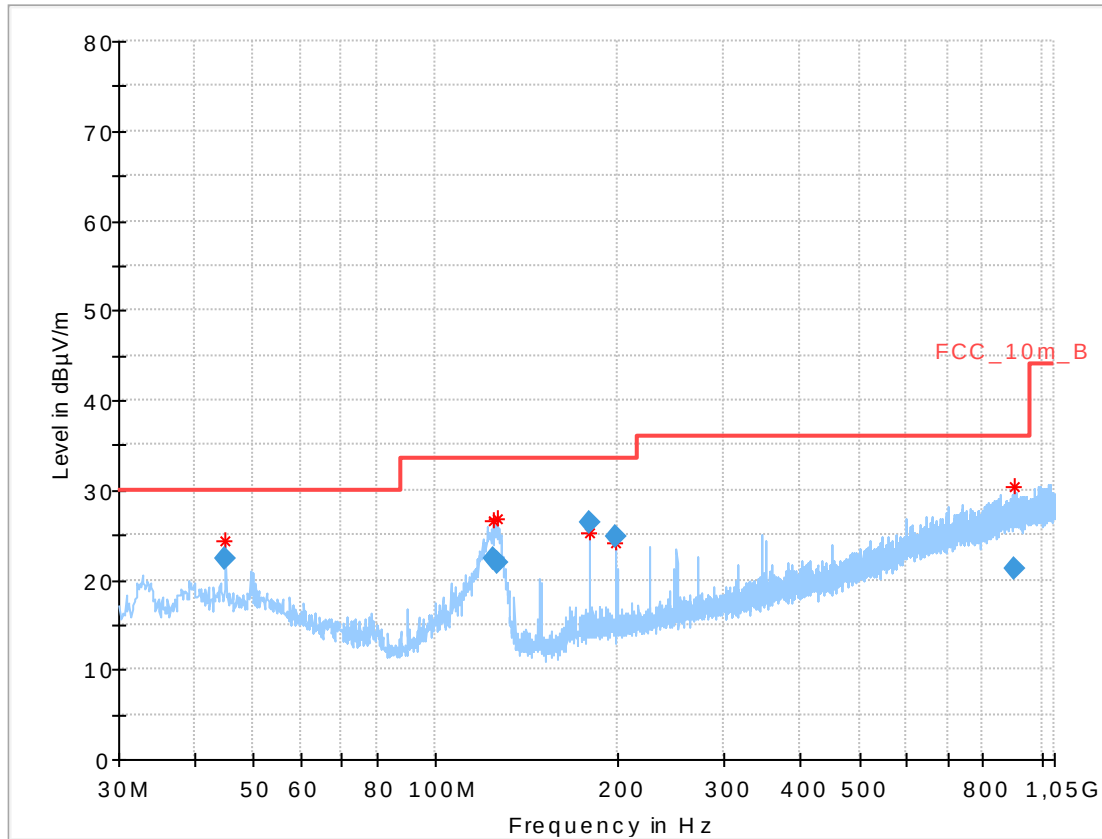


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.012600	21.47	30.00	8.53	1000.0	120.000	98.0	V	115.0	13.6
122.895600	22.48	33.50	11.02	1000.0	120.000	100.0	V	32.0	10.1
125.816100	21.90	33.50	11.60	1000.0	120.000	101.0	V	0.0	9.8
179.991600	26.03	33.50	7.47	1000.0	120.000	98.0	V	39.0	10.9
198.004350	23.61	33.50	9.89	1000.0	120.000	98.0	V	287.0	11.8
950.499150	21.40	36.00	14.60	1000.0	120.000	101.0	H	232.0	24.3

Plot 2: 30 MHz to 1 GHz, TX mode, channel 39, vertical & horizontal polarization**Final results:**

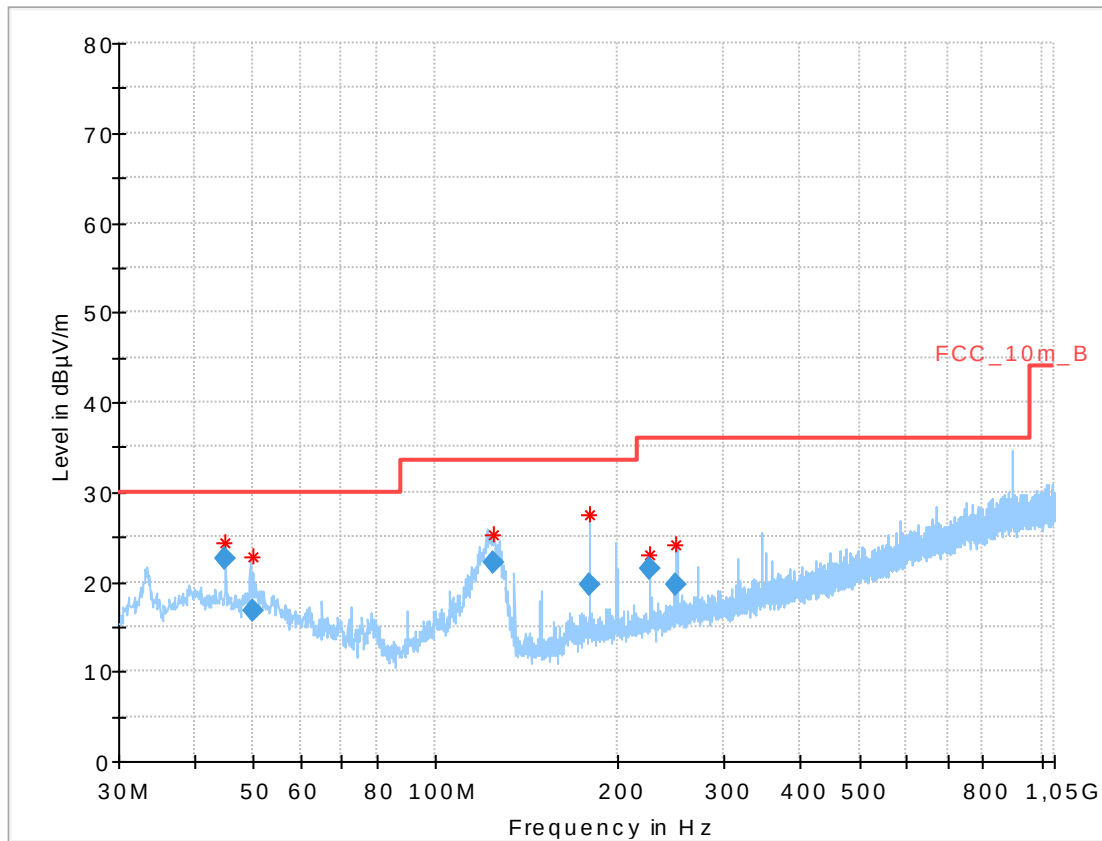
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.982900	21.89	30.00	8.11	1000.0	120.000	98.0	V	314.0	13.6
123.666750	22.41	33.50	11.09	1000.0	120.000	101.0	V	53.0	10.0
134.990250	12.61	33.50	20.89	1000.0	120.000	101.0	V	60.0	9.2
179.993550	27.28	33.50	6.22	1000.0	120.000	98.0	V	327.0	10.9
197.994450	24.59	33.50	8.91	1000.0	120.000	98.0	V	181.0	11.8
908.574000	21.35	36.00	14.65	1000.0	120.000	98.0	V	314.0	24.2

Plot 3: 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization**Final results:**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.984250	22.27	30.00	7.73	1000.0	120.000	98.0	V	322.0	13.6
124.624650	22.24	33.50	11.26	1000.0	120.000	101.0	V	39.0	9.9
126.219150	21.92	33.50	11.58	1000.0	120.000	101.0	V	113.0	9.8
179.968650	26.46	33.50	7.04	1000.0	120.000	98.0	V	329.0	10.9
197.990400	24.70	33.50	8.80	1000.0	120.000	98.0	V	225.0	11.8
900.919650	21.25	36.00	14.75	1000.0	120.000	185.0	H	113.0	24.2

Plots: Receiver mode, ANT100P001B24553 antenna

Plot 1: 30 MHz to 1 GHz, RX / idle – mode, vertical & horizontal polarization

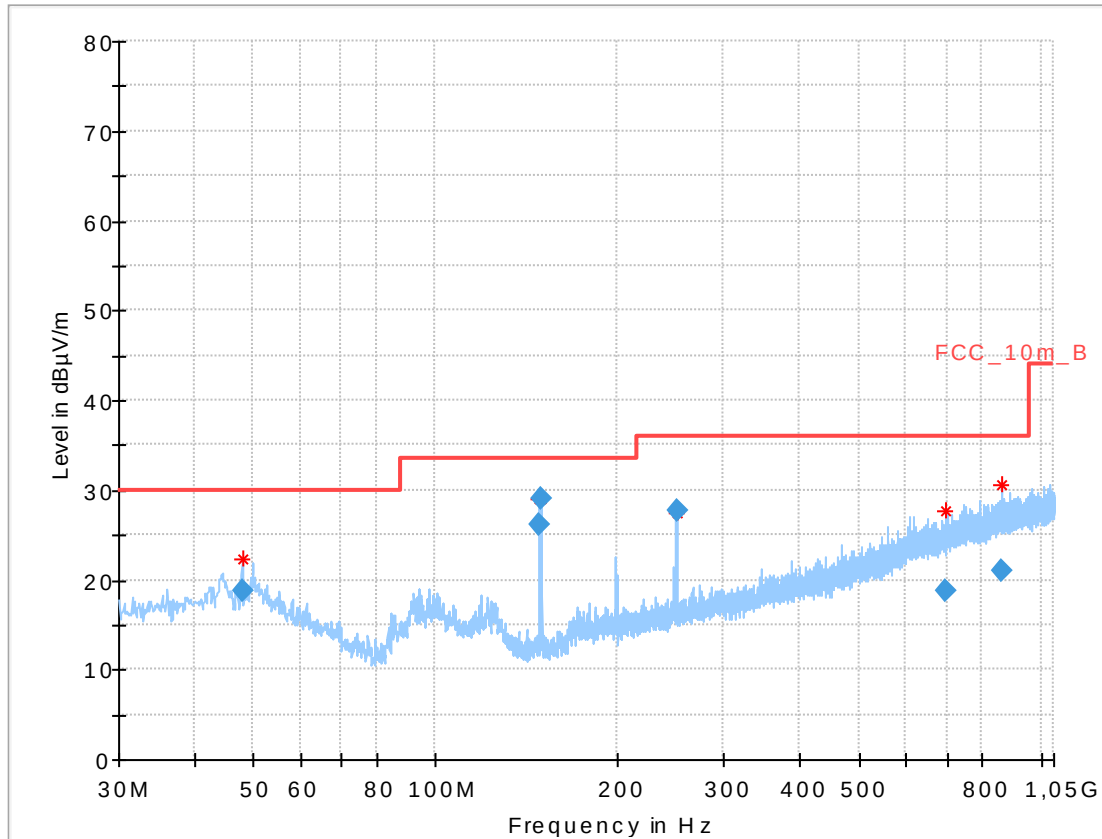


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.985150	22.50	30.00	7.50	1000.0	120.000	98.0	V	339.0	13.6
50.001900	16.79	30.00	13.21	1000.0	120.000	98.0	V	314.0	13.7
124.561050	22.15	33.50	11.35	1000.0	120.000	101.0	V	81.0	9.9
179.981400	19.68	33.50	13.82	1000.0	120.000	185.0	V	254.0	10.9
225.012600	21.50	36.00	14.50	1000.0	120.000	98.0	V	353.0	12.7
249.983550	19.65	36.00	16.35	1000.0	120.000	98.0	V	160.0	13.4

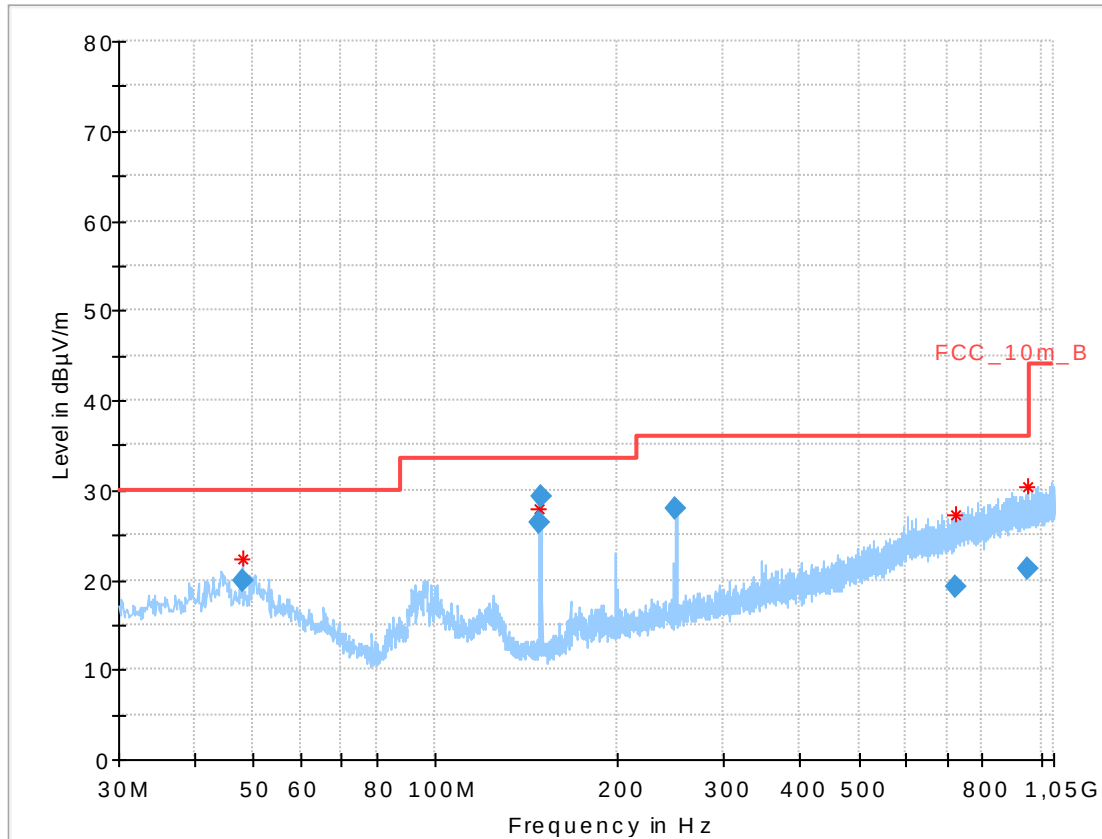
Plots: Transmit mode, ANT-DB1-RAF-xxx antenna

Plot 1: 30 MHz to 1 GHz, TX mode, channel 00, vertical & horizontal polarization

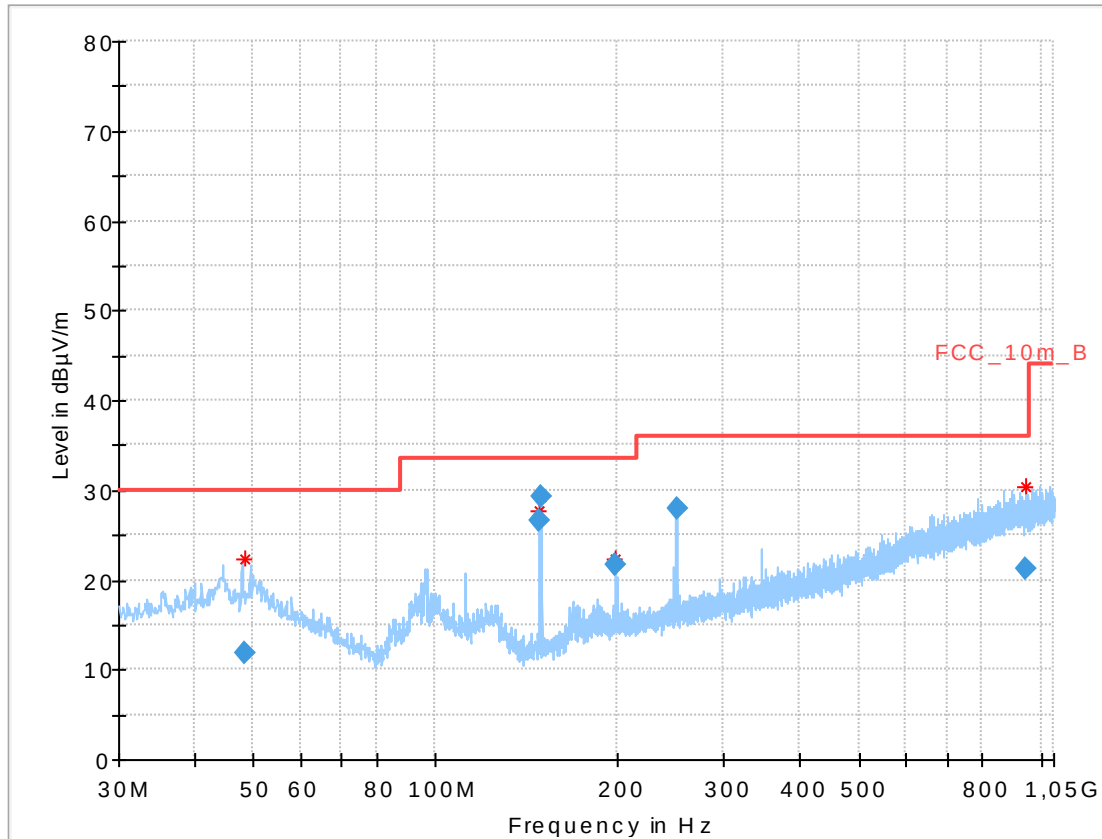


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.992050	18.88	30.00	11.12	1000.0	120.000	101.0	V	41.0	13.7
148.493850	26.11	33.50	7.39	1000.0	120.000	98.0	V	133.0	9.2
150.008250	29.03	33.50	4.47	1000.0	120.000	98.0	V	85.0	9.3
250.001700	27.61	36.00	8.39	1000.0	120.000	101.0	V	353.0	13.4
697.480050	18.68	36.00	17.32	1000.0	120.000	185.0	V	259.0	21.5
863.391900	20.93	36.00	15.07	1000.0	120.000	98.0	V	167.0	23.7

Plot 2: 30 MHz to 1 GHz, TX mode, channel 39, vertical & horizontal polarization**Final results:**

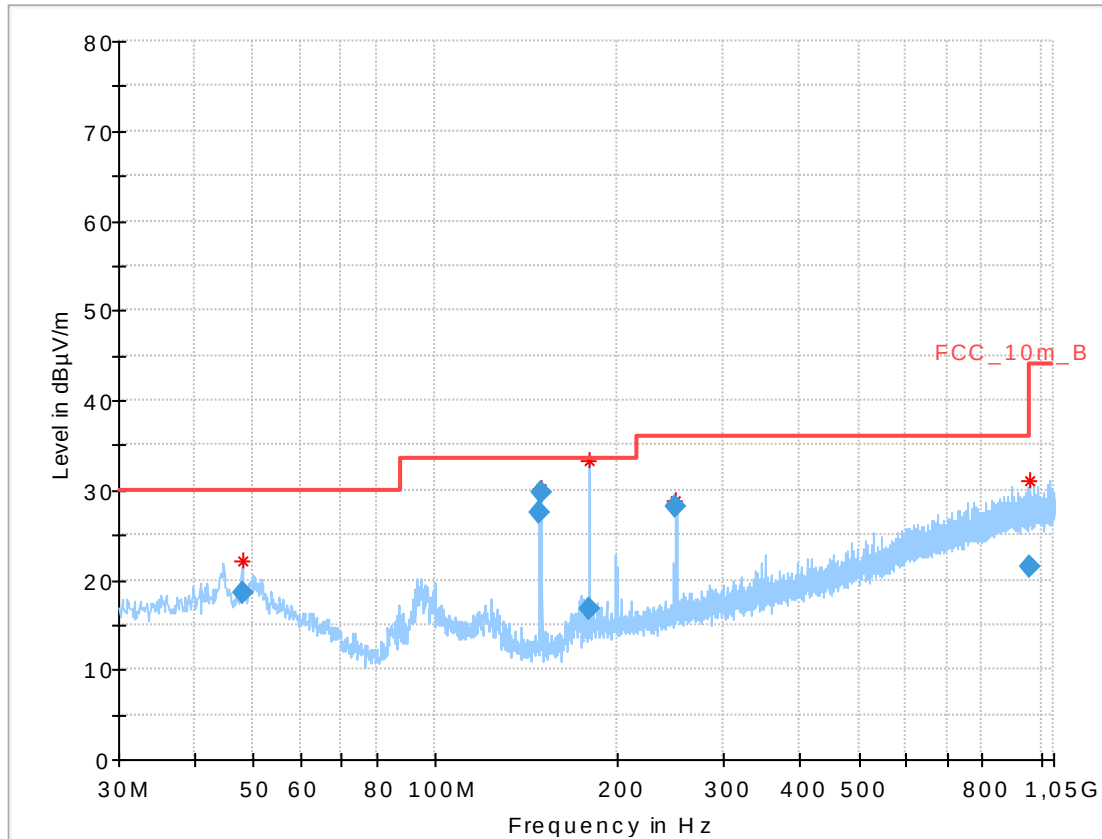
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
48.005400	20.00	30.00	10.00	1000.0	120.000	98.0	V	155.0	13.7
148.509150	26.33	33.50	7.17	1000.0	120.000	98.0	V	232.0	9.2
150.002700	29.24	33.50	4.26	1000.0	120.000	98.0	V	89.0	9.3
249.999600	27.88	36.00	8.12	1000.0	120.000	98.0	V	353.0	13.4
721.858950	19.13	36.00	16.87	1000.0	120.000	100.0	V	335.0	22.1
954.029100	21.30	36.00	14.70	1000.0	120.000	185.0	V	96.0	24.4

Plot 3: 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization**Final results:**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
48.366000	11.85	30.00	18.15	1000.0	120.000	178.0	V	341.0	13.7
148.497750	26.62	33.50	6.88	1000.0	120.000	98.0	V	264.0	9.2
150.000600	29.27	33.50	4.23	1000.0	120.000	98.0	V	113.0	9.3
198.002250	21.67	33.50	11.83	1000.0	120.000	98.0	V	207.0	11.8
250.000950	27.90	36.00	8.10	1000.0	120.000	98.0	V	352.0	13.4
947.296350	21.27	36.00	14.73	1000.0	120.000	185.0	H	134.0	24.3

Plots: Receiver mode, ANT-DB1-RAF-xxx antenna

Plot 1: 30 MHz to 1 GHz, RX / idle – mode, vertical & horizontal polarization



Final results:

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.978700	18.63	30.00	11.37	1000.0	120.000	178.0	V	149.0	13.7
148.498200	27.47	33.50	6.03	1000.0	120.000	98.0	V	254.0	9.2
150.001200	29.72	33.50	3.78	1000.0	120.000	98.0	V	281.0	9.3
180.170700	16.76	33.50	16.74	1000.0	120.000	185.0	V	338.0	10.9
249.997500	28.06	36.00	7.94	1000.0	120.000	98.0	V	353.0	13.4
955.076700	21.39	36.00	14.61	1000.0	120.000	185.0	H	166.0	24.4

11.12 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 26 GHz
Trace mode	Max hold
Measured modulation	☒ GFSK ☐ Pi/4 DQPSK ☐ 8DPSK
Test setup	See sub clause 6.2 – A See sub clause 6.3 – A
Measurement uncertainty	See sub clause 8

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC		IC	
TX spurious emissions radiated			
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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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)).			
§15.209			
Frequency (MHz)	Field strength (dBµV/m)		Measurement distance
Above 960	54.0		3

Results: Transmitter mode, ANT-X100P001B24553 antenna

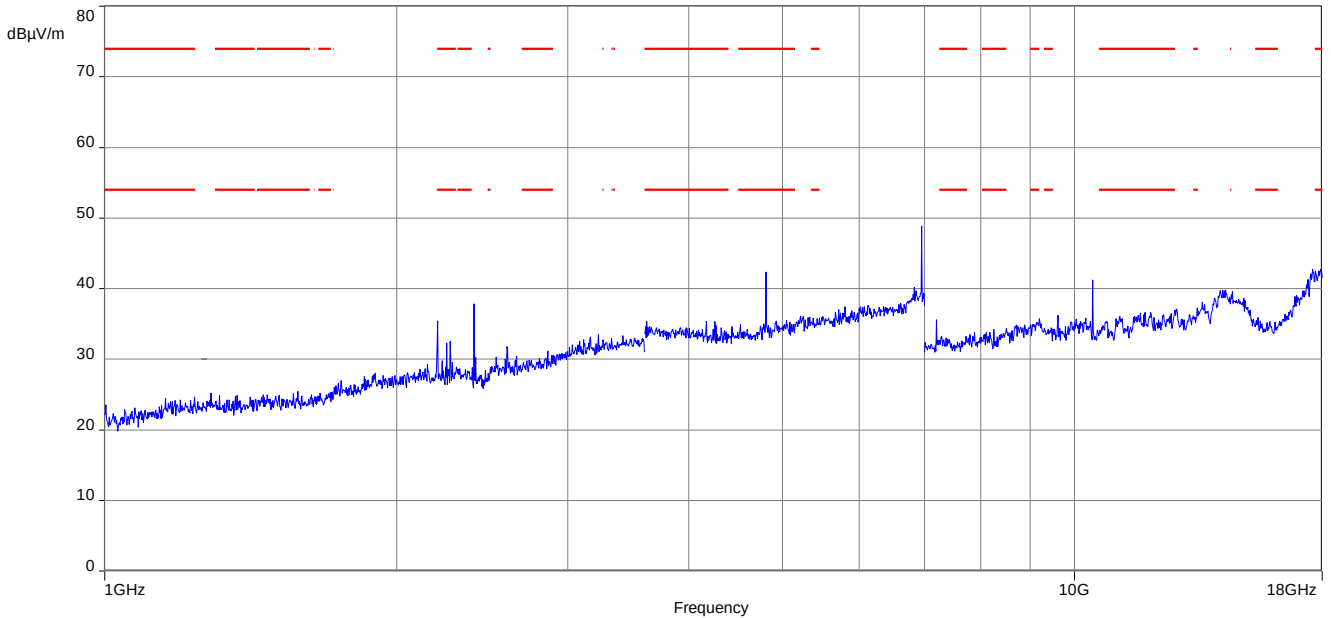
TX spurious emissions radiated [dBµV/m]								
2402 MHz			2441 MHz			2480 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.								
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: Receiver mode, ANT-X100P001B24553 antenna

RX spurious emissions radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		
-/-	Peak	-/-
	AVG	-/-

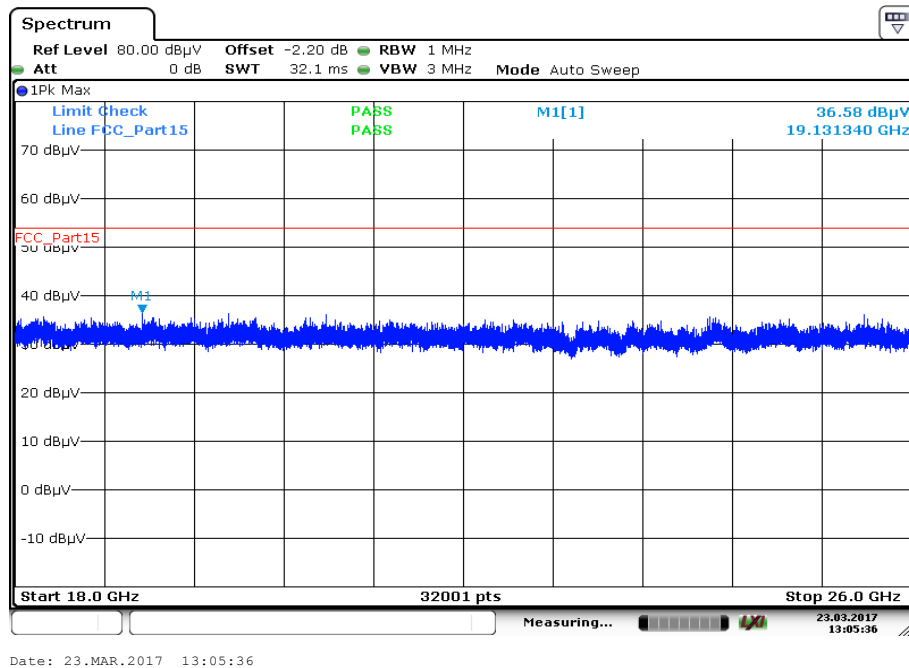
Plots: Transmitter mode, ANT100P001B24553 antenna

Plot 1: 1 GHz to 18 GHz, TX mode, channel 00, vertical & horizontal polarization

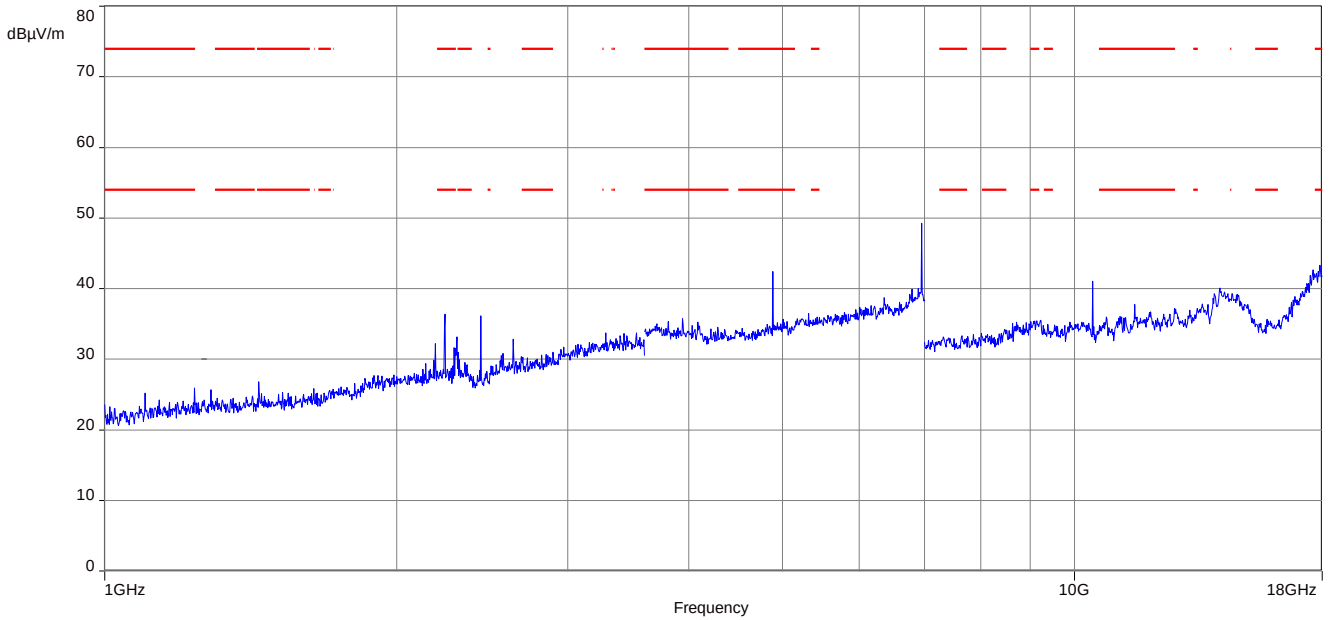


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization

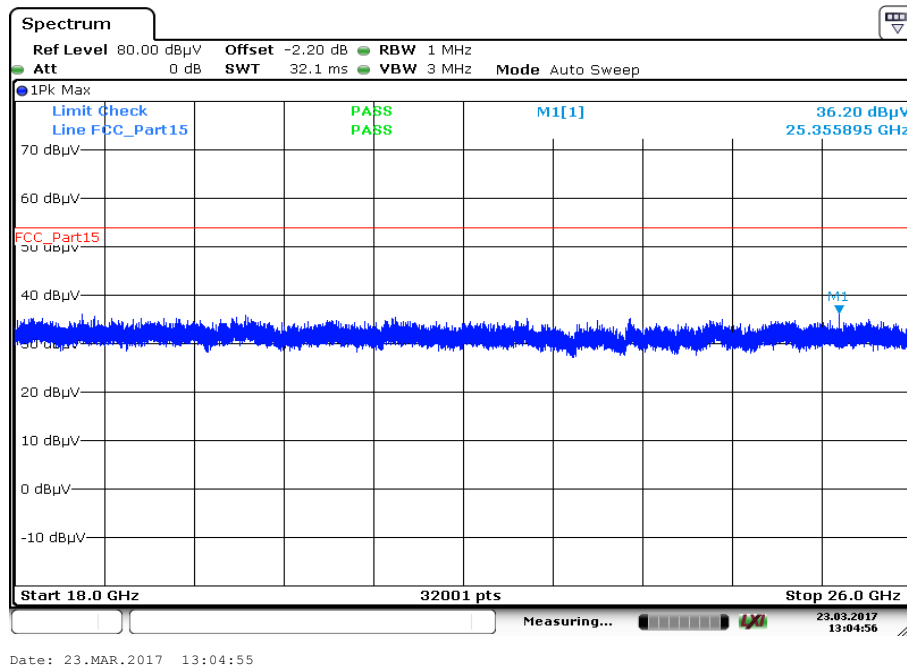


Plot 3: 1 GHz to 18 GHz, TX mode, channel 39, vertical & horizontal polarization

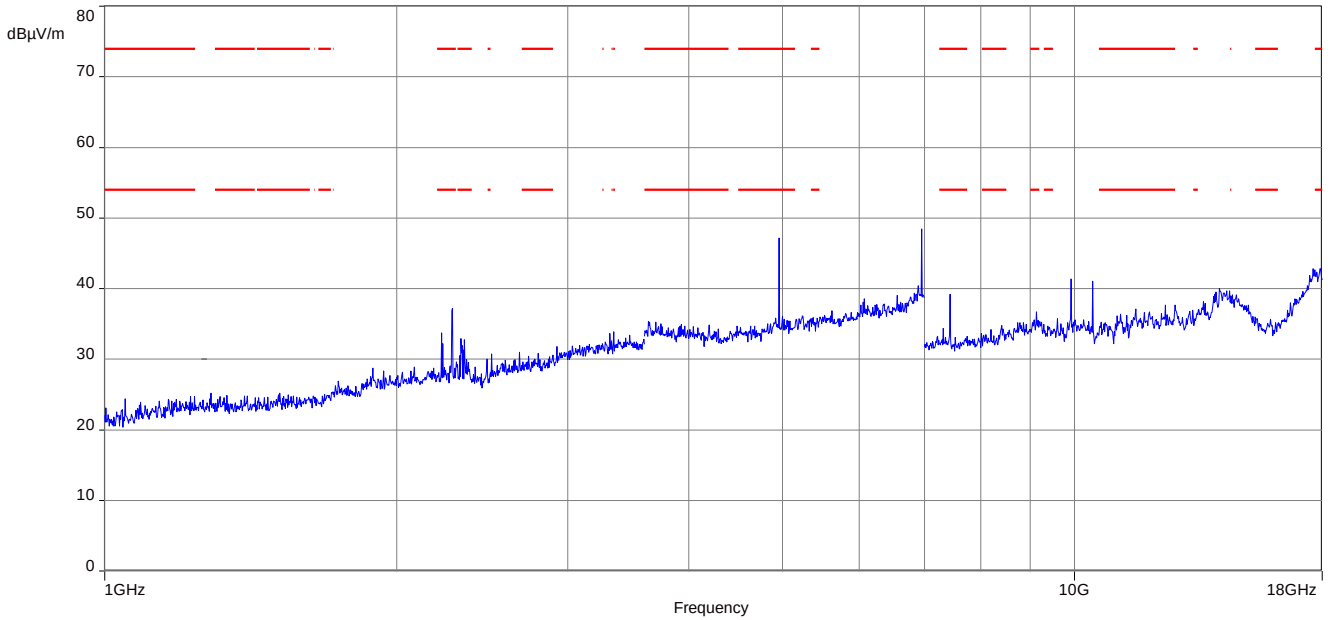


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization

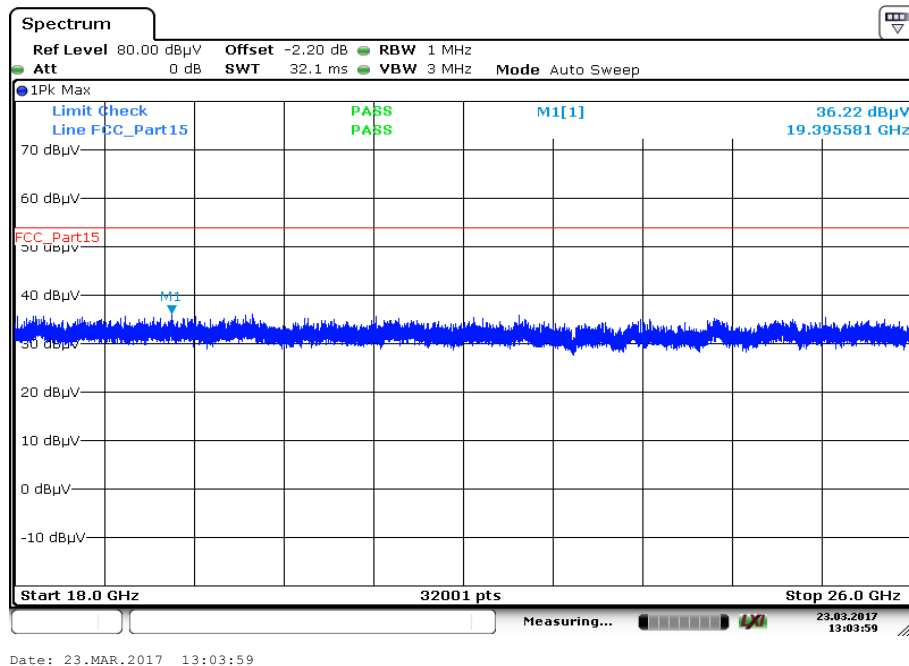


Plot 5: 1 GHz to 18 GHz, TX mode, channel 78, vertical & horizontal polarization



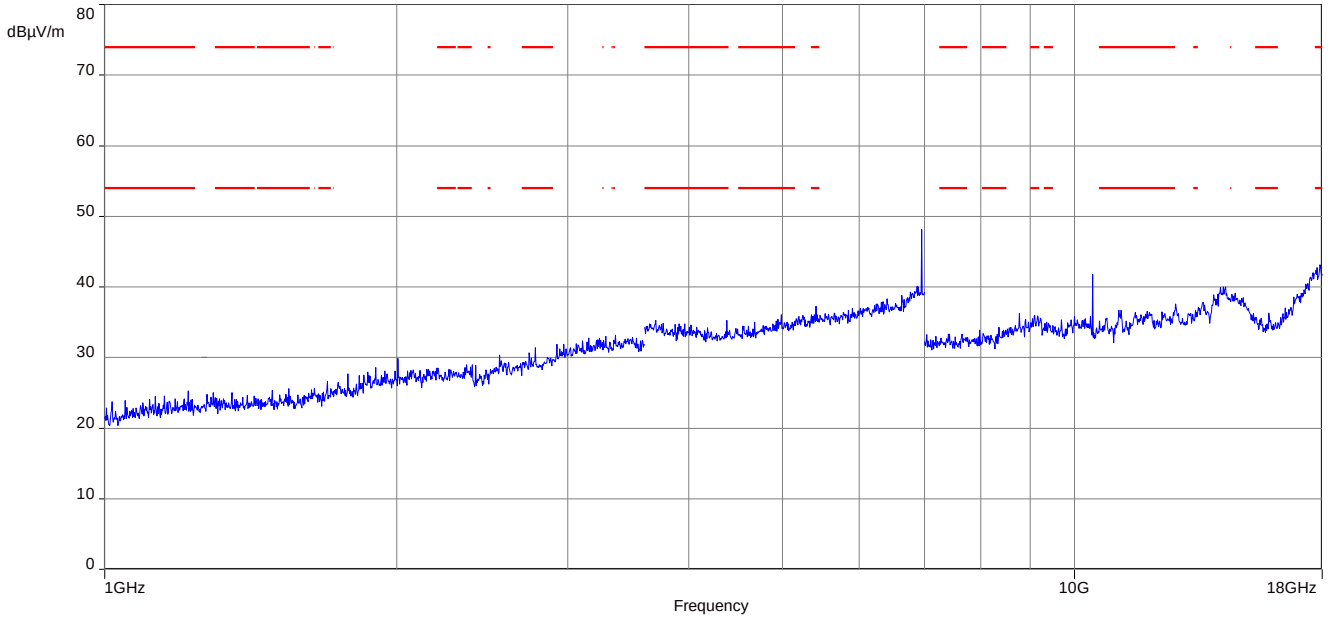
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: 18 GHz to 26 GHz, TX mode, channel 78, vertical & horizontal polarization

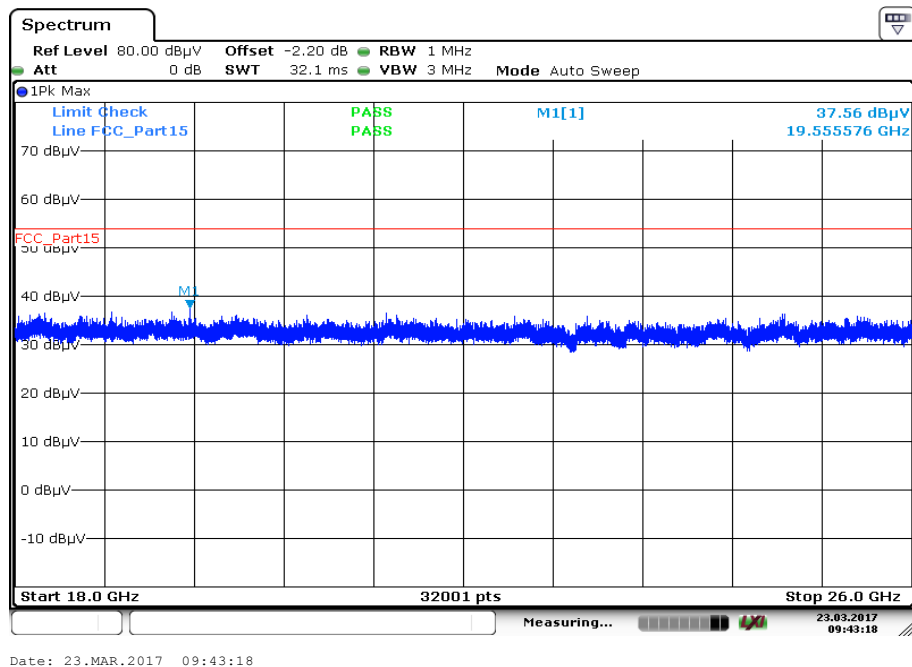


Plots: Receiver mode, ANT100P001B24553 antenna

Plot 1: 1 GHz to 18 GHz, RX mode, vertical & horizontal polarization



Plot 2: 18 GHz to 26 GHz, RX mode, vertical & horizontal polarization



Results: Transmitter mode, ANT-DB1-RAF-xxx antenna

TX spurious emissions radiated [dBµV/m]								
2402 MHz			2441 MHz			2480 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
	Peak		7323	Peak	52.6	7439	Peak	49.4
	AVG			AVG	22.5*		AVG	19.3*
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

*) Average emission adjusting factor:

$$F = 20 * \log (\text{dwell time} / 100 \text{ ms})$$

The dwell time of the longest possible Bluetooth transmission (DH5-packet) is 3.125 ms.

In a period of 100 ms, we have a maximum of 1 transmission and that implies a correction factor for spurious measurement emissions:

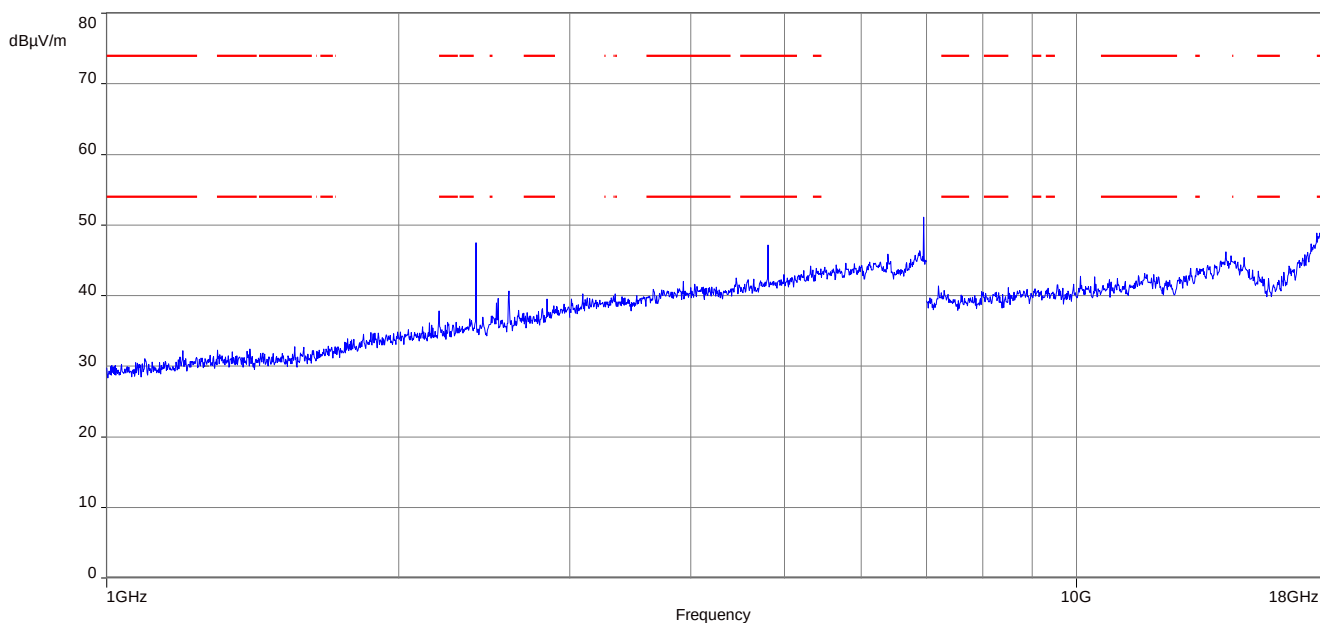
$$F = 20 * \log (1 * 3.125 / 100) = -30.1 \text{ dB}$$

Results: Receiver mode, ANT-DB1-RAF-xxx antenna

RX spurious emissions radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		
-/-	Peak	-/-
	AVG	-/-

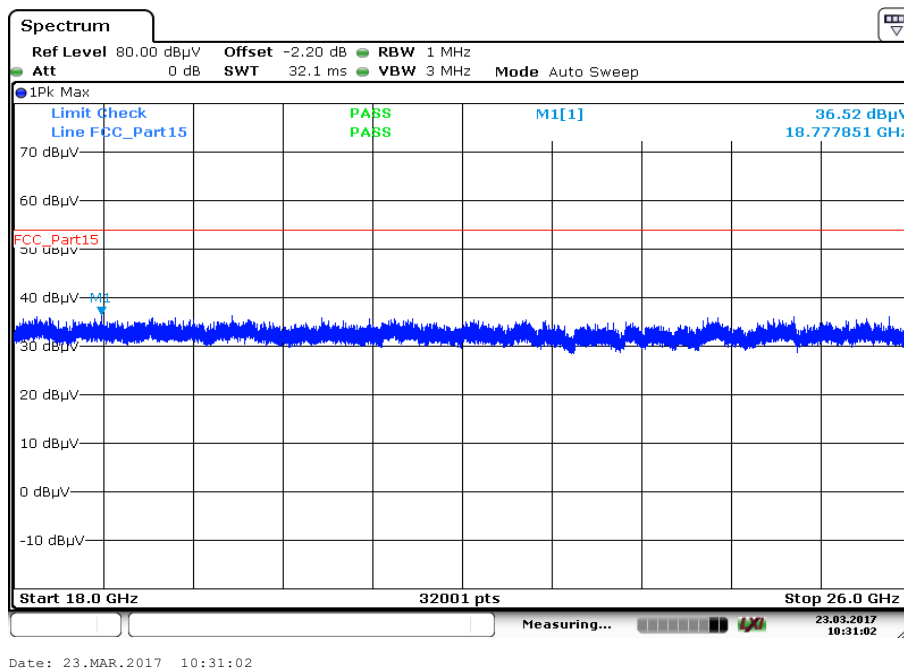
Plots: Transmitter mode, ANT-DB1-RAF-xxx antenna

Plot 1: 1 GHz to 18 GHz, TX mode, channel 00, vertical & horizontal polarization

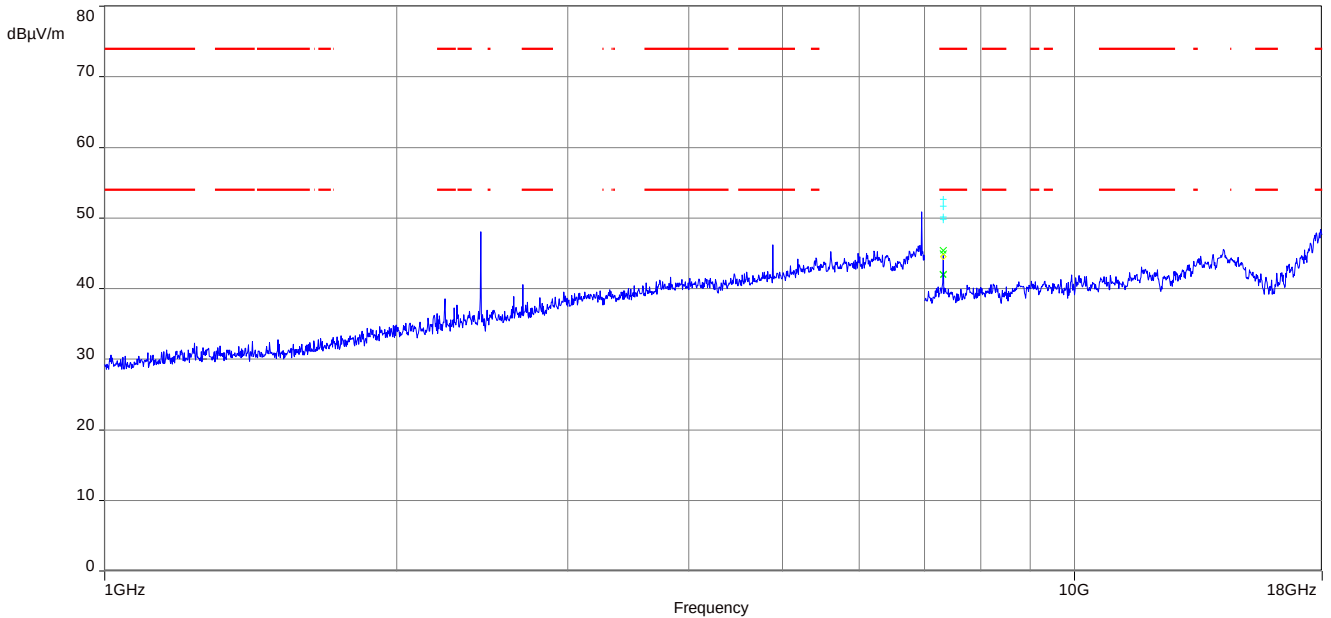


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization

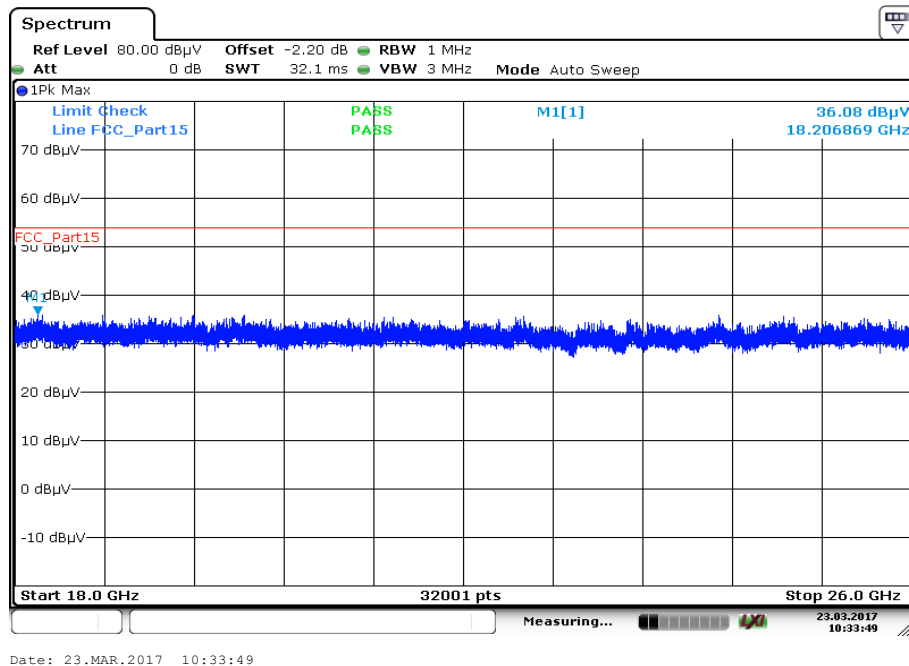


Plot 3: 1 GHz to 18 GHz, TX mode, channel 39, vertical & horizontal polarization

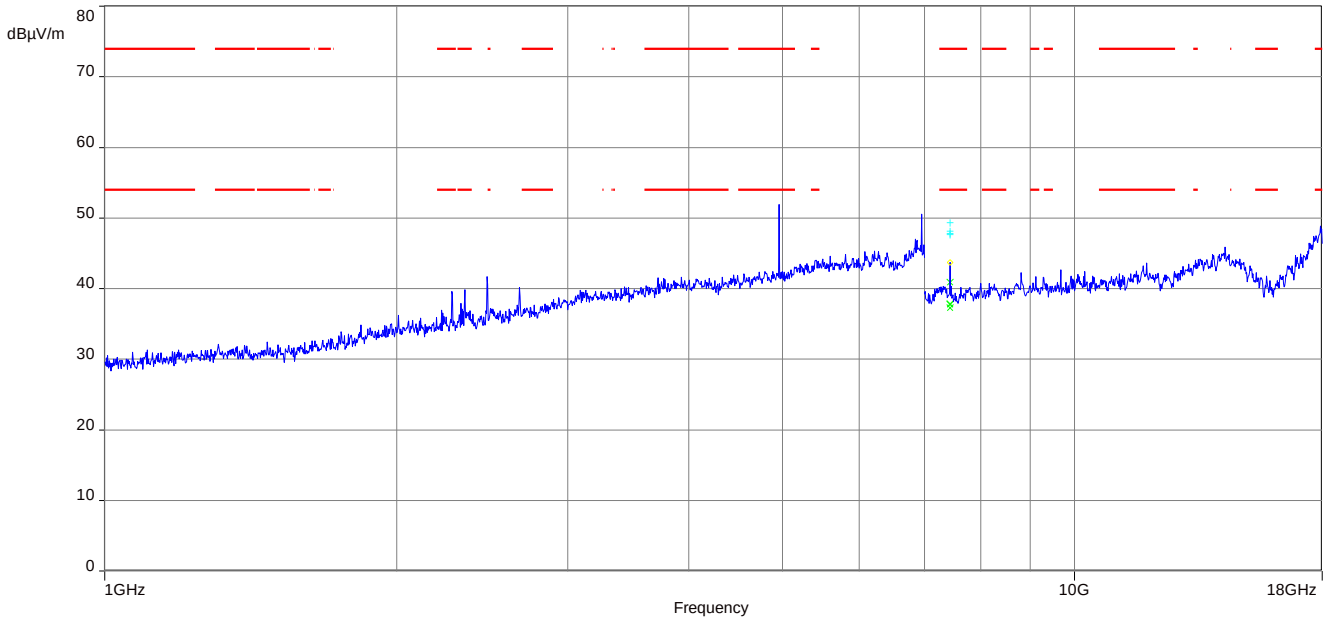


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization

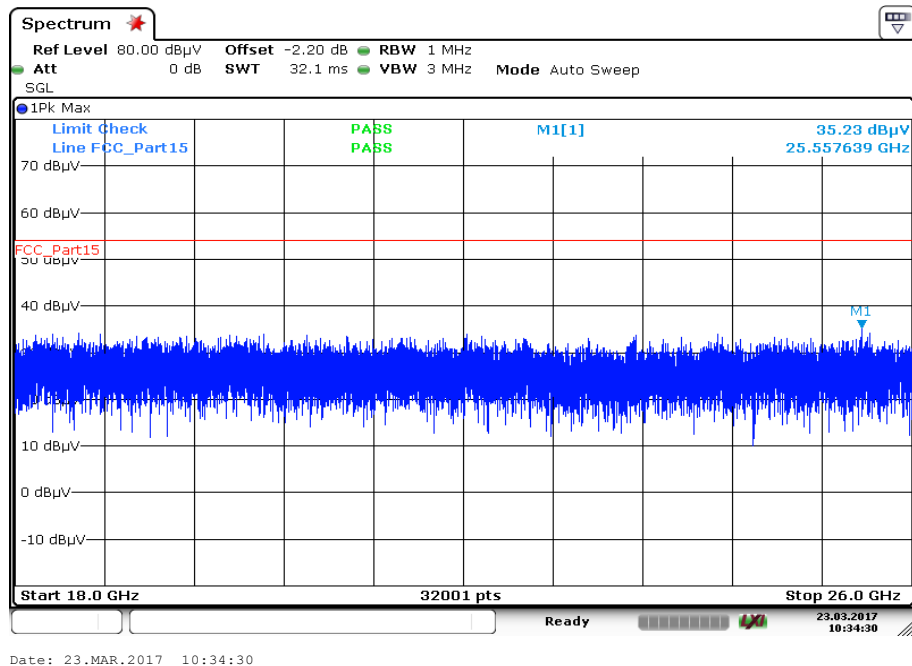


Plot 5: 1 GHz to 18 GHz, TX mode, channel 78, vertical & horizontal polarization



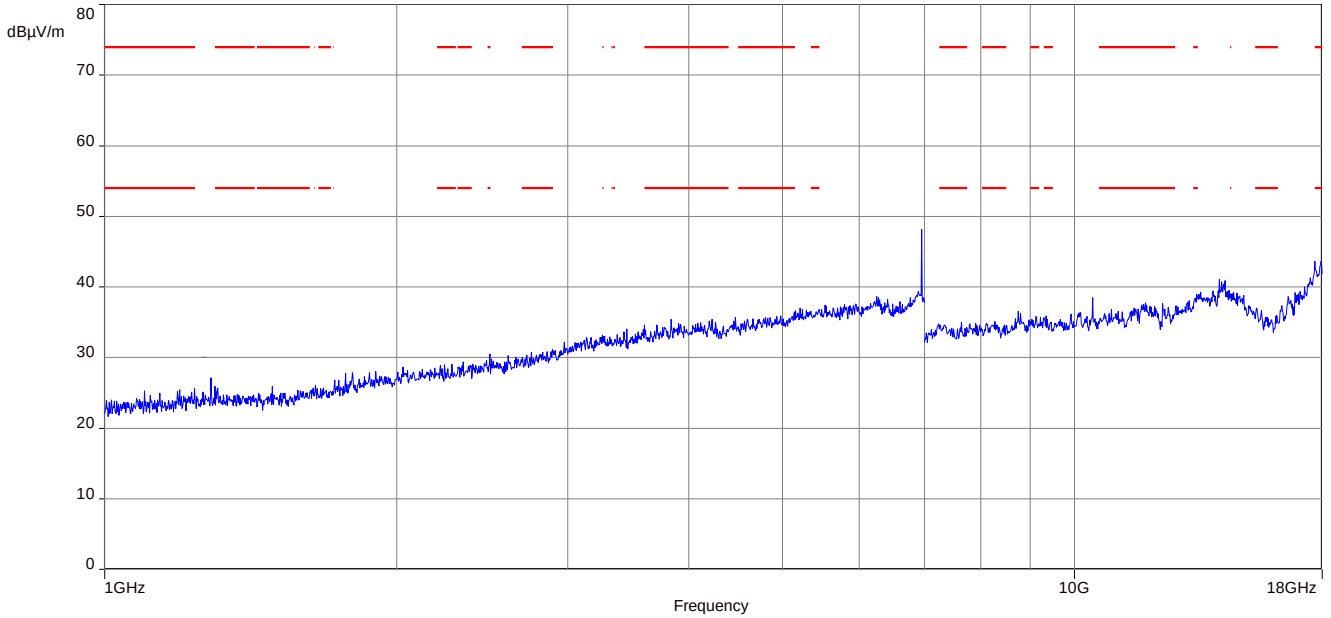
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: 18 GHz to 26 GHz, TX mode, channel 78, vertical & horizontal polarization

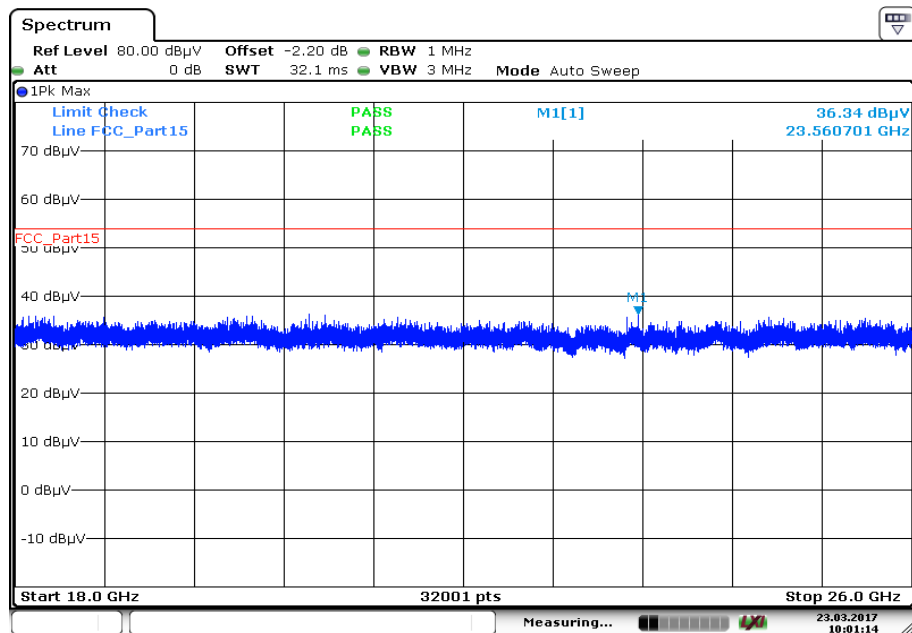


Plots: Receiver mode, ANT-DB1-RAF-xxx antenna

Plot 1: 1 GHz to 18 GHz, RX mode, vertical & horizontal polarization



Plot 2: 18 GHz to 26 GHz, RX mode, vertical & horizontal polarization



Date: 23.MAR.2017 10:01:14

11.13 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channel is channel 39. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 78 will be measured too. The measurement is performed in the mode with the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement parameters	
Detector	Peak - Quasi peak / average
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max hold
Test setup	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

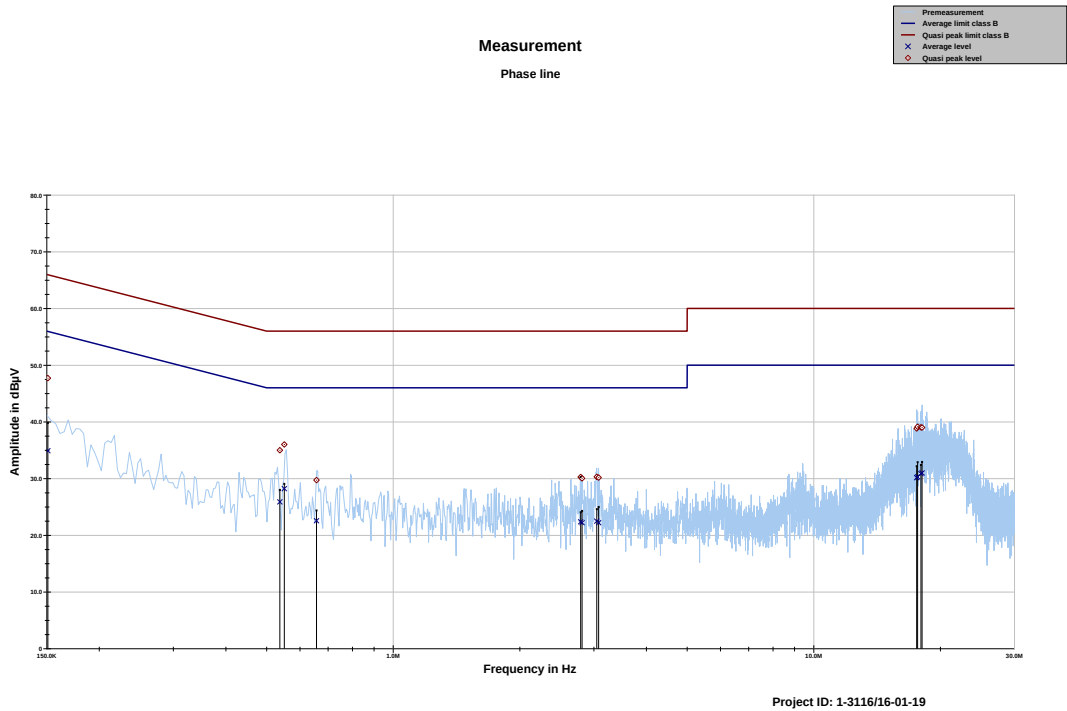
Limits:

FCC		IC
TX spurious emissions conducted < 30 MHz		
Frequency (MHz)	Quasi-peak (dB μ V/m)	Average (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

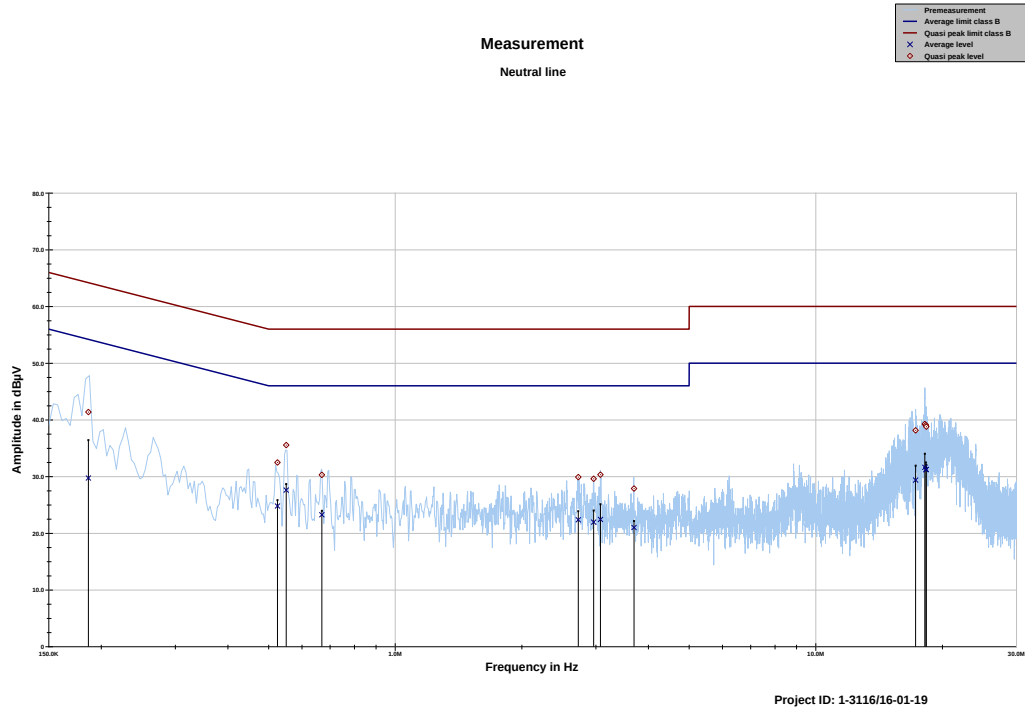
Results:

Spurious emissions conducted < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No emissions detected		

Plots:**Plot 1:** 150 kHz to 30 MHz, phase line**Final results:**

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150995	47.72	18.23	65.945	34.91	21.06	55.972
0.537709	35.00	21.00	56.000	25.88	20.12	46.000
0.550783	36.02	19.98	56.000	28.22	17.78	46.000
0.657092	29.73	26.27	56.000	22.55	23.45	46.000
2.790452	30.27	25.73	56.000	22.38	23.62	46.000
2.812208	30.04	25.96	56.000	22.22	23.78	46.000
3.048334	30.30	25.70	56.000	22.49	23.51	46.000
3.079536	30.17	25.83	56.000	22.22	23.78	46.000
17.570936	38.84	21.16	60.000	30.15	19.85	50.000
17.653312	39.14	20.86	60.000	30.30	19.70	50.000
17.982729	39.03	20.97	60.000	30.86	19.14	50.000
18.091554	39.00	21.00	60.000	31.00	19.00	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.186392	41.38	22.81	64.196	29.74	25.22	54.960
0.524798	32.48	23.52	56.000	24.80	21.20	46.000
0.550735	35.55	20.45	56.000	27.62	18.38	46.000
0.669288	30.31	25.69	56.000	23.26	22.74	46.000
2.724239	29.90	26.10	56.000	22.37	23.63	46.000
2.963404	29.62	26.38	56.000	21.96	24.04	46.000
3.075469	30.34	25.66	56.000	22.44	23.56	46.000
3.696817	27.88	28.12	56.000	21.01	24.99	46.000
17.277084	38.14	21.86	60.000	29.38	20.62	50.000
18.171341	39.26	20.74	60.000	31.64	18.36	50.000
18.276841	39.07	20.93	60.000	31.22	18.78	50.000
18.315658	38.80	21.20	60.000	31.25	18.75	50.000

12 Observations

No observations except those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2017-04-12
A	Reduced to 3 different antennas	2017-05-31

Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number
OBW		Occupied Bandwidth
OC		Operating Channel
OCW		Operating Channel Bandwidth
OOB		Out Of Band

Annex C Accreditation Certificate

first page

last page



Deutsche Akkreditierungsstelle GmbH

Befähigung gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
 Unterzeichnerin der Multilateralen Abkommen
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CTC advanced GmbH
 Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Funk
 Mobilfunk (GSM / DCS) + OTA
 Elektromagnetische Verträglichkeit (EMV)
 Produktsicherheit
 SAR / EMF
 Umwelt
 Smart Card Technology
 Bluetooth®
 Automotive
 Wi-Fi-Services
 Kanadische Anforderungen
 US-Anforderungen
 Akustik
 Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 25.11.2016

Stelle Minister auf der Rückseite

Im Auftrag Dipl.-Ing. Ralf Eigner
 Abteilungsleiter

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
 Spittelmarkt 10
 10117 Berlin

Standort Frankfurt am Main
 Europa-Allee 52
 60327 Frankfurt am Main

Standort Braunschweig
 Bundesallee 100
 38116 Braunschweig

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Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abi. L 218 vom 9. Juli 2008, S. 30). Die DAKKS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
 EA: www.european-accreditation.org
 ILAC: www.ilac.org
 IAF: www.iaf.nu

Note:

The current certificate including annex can be received on request.