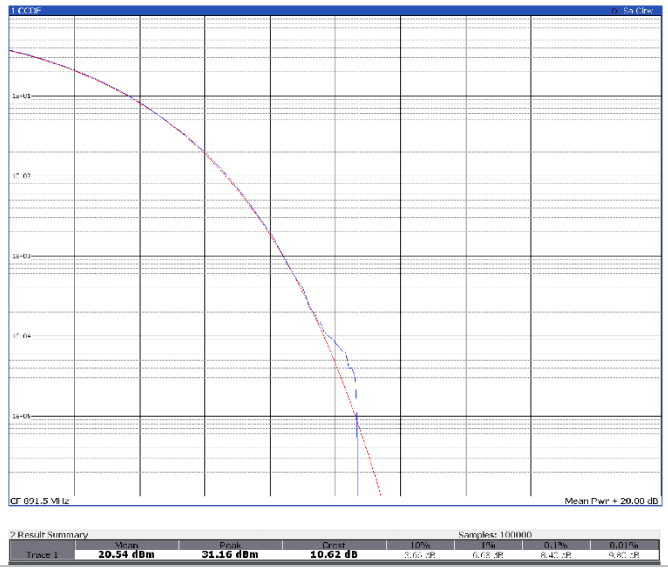
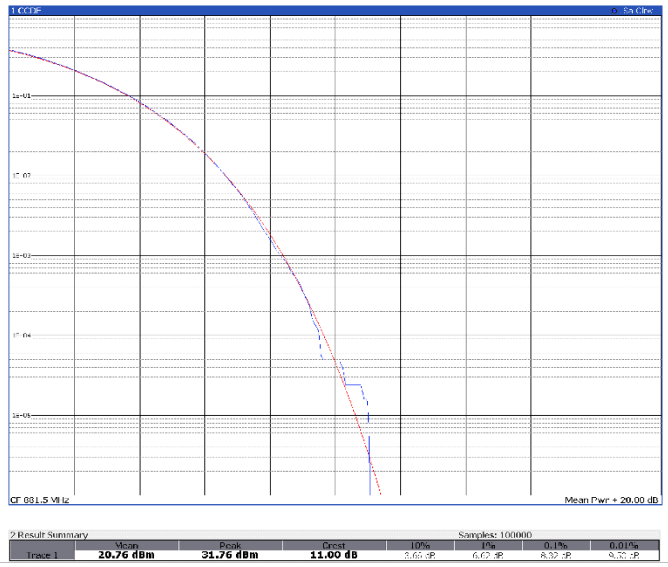
TM3p1, 5 MHz, mid channel

TM3p1, 5 MHz, high channel

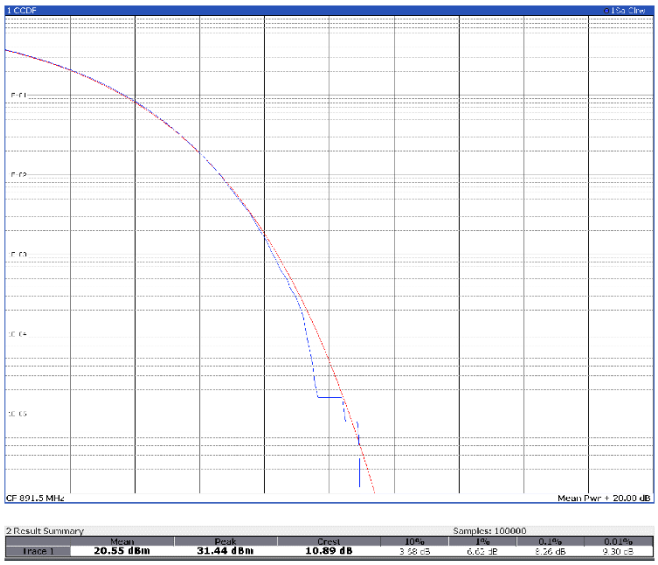


TM3p1a, 5 MHz, low channel

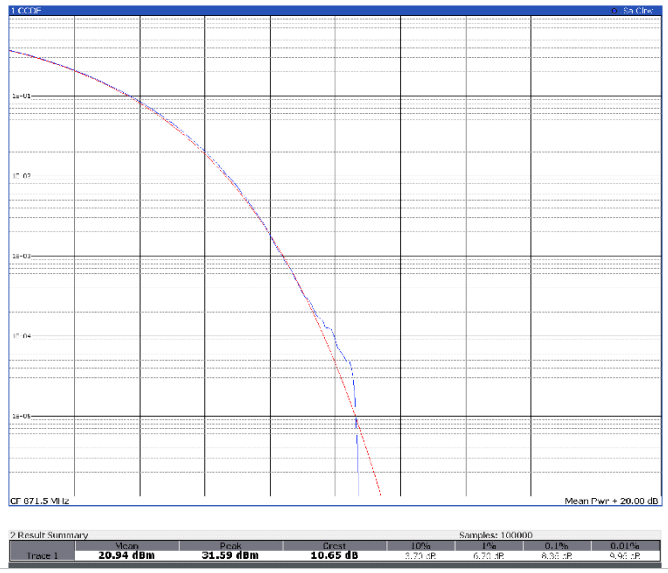
TM3p1a, 5 MHz, mid channel



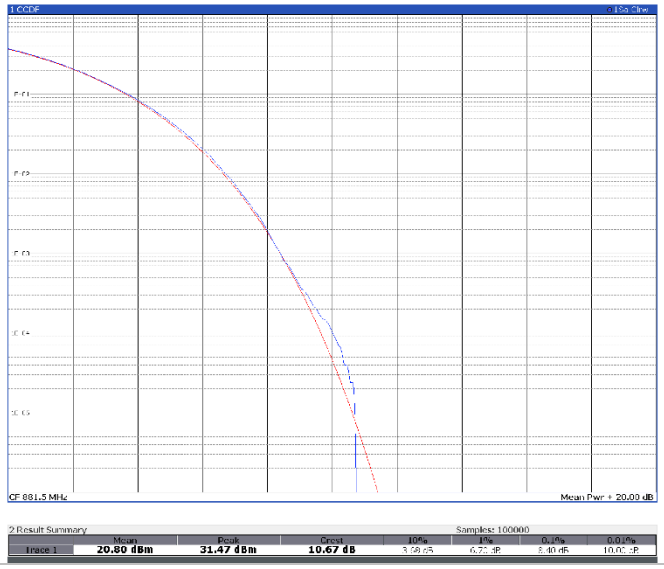
TM3p1a, 5 MHz, high channel



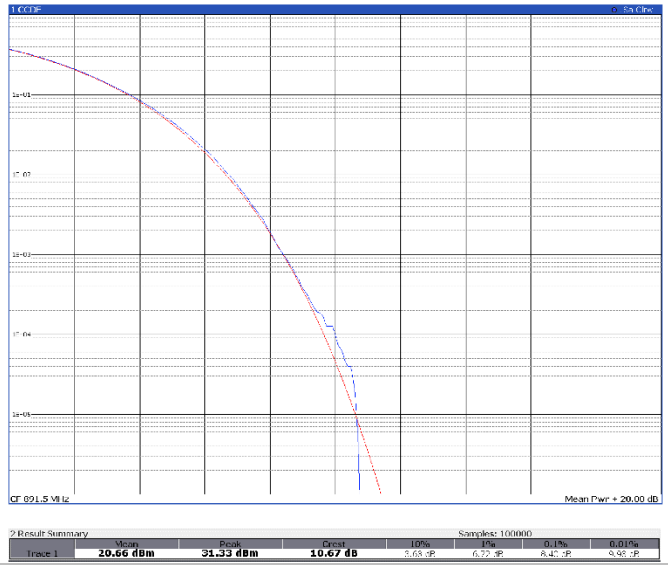
TM3p3, 5 MHz, low channel



TM3p3, 5 MHz, mid channel

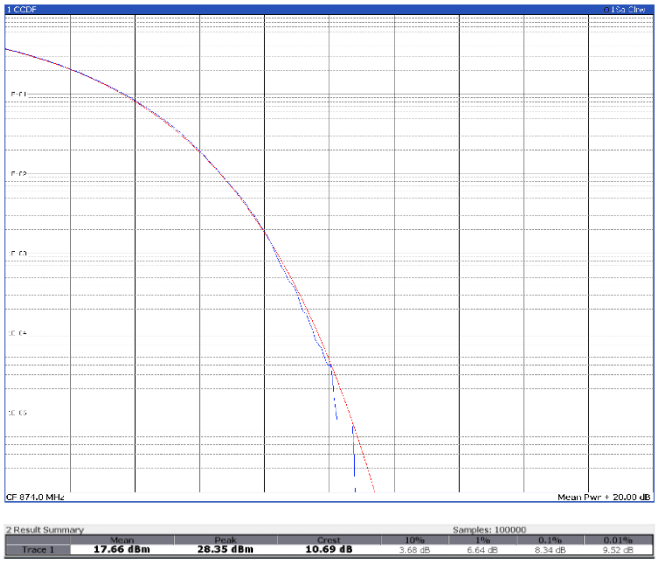


TM3p3, 5 MHz, high channel

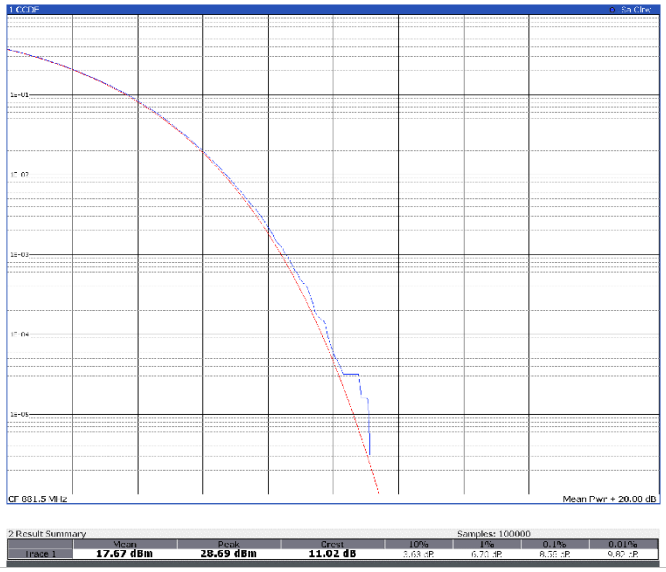


Band B5	10 MHz

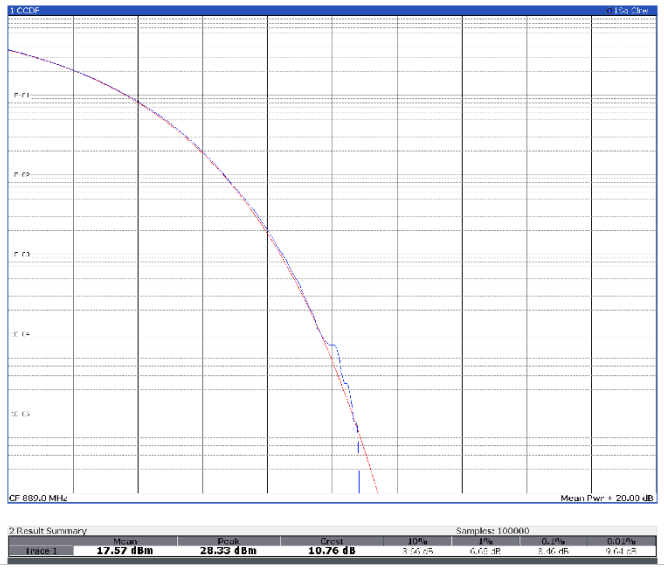
TM1.1, 10 MHz, low channel



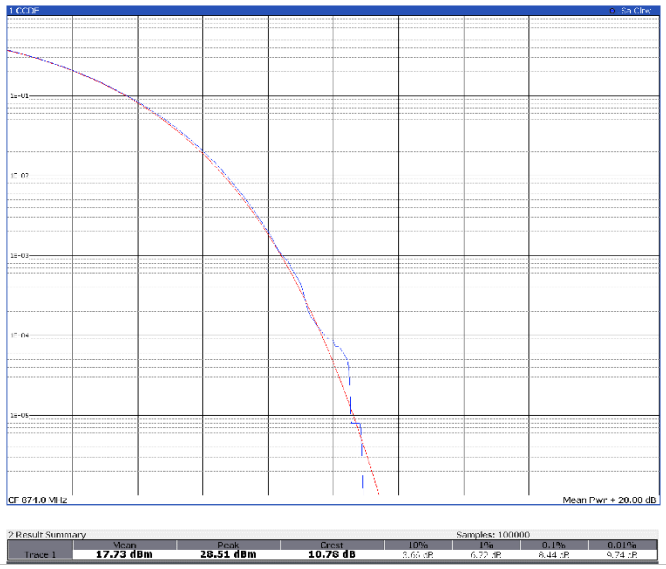
TM1.1, 10 MHz, mid channel



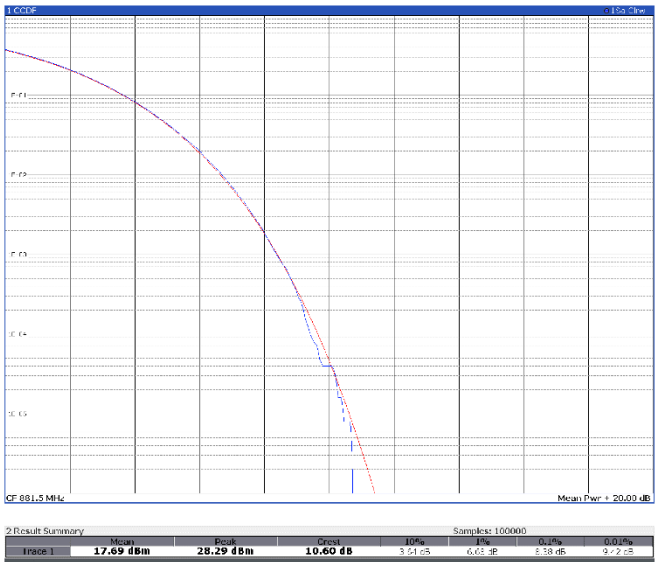
TM1.1, 10 MHz, high channel



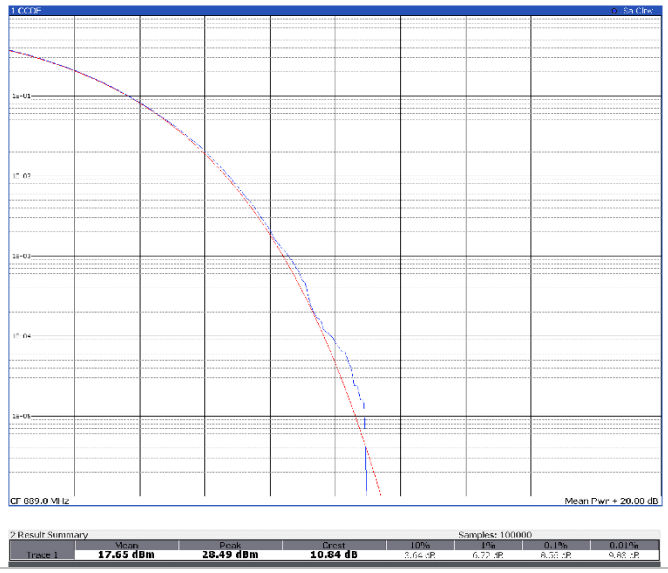
TM3p1, 10 MHz, low channel



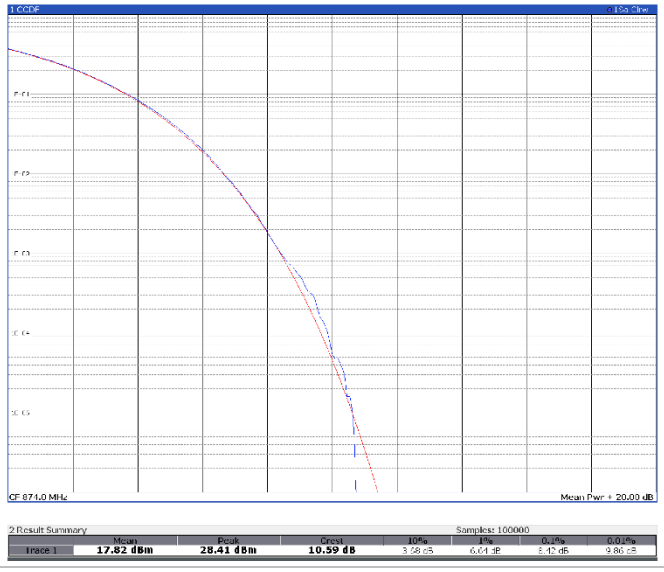
TM3p1, 10 MHz, mid channel



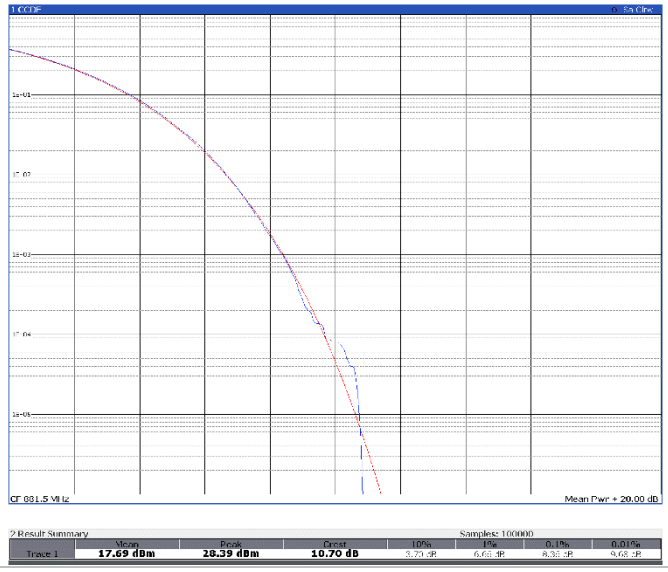
TM3p1, 10 MHz, high channel



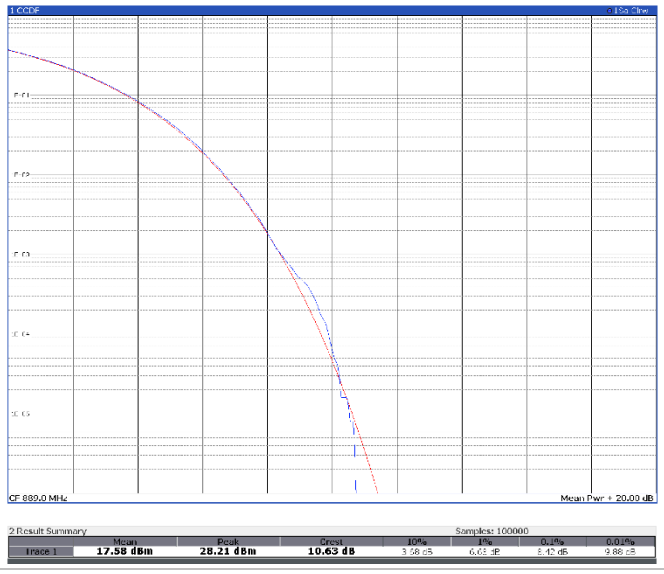
TM3p1a, 10 MHz, low channel



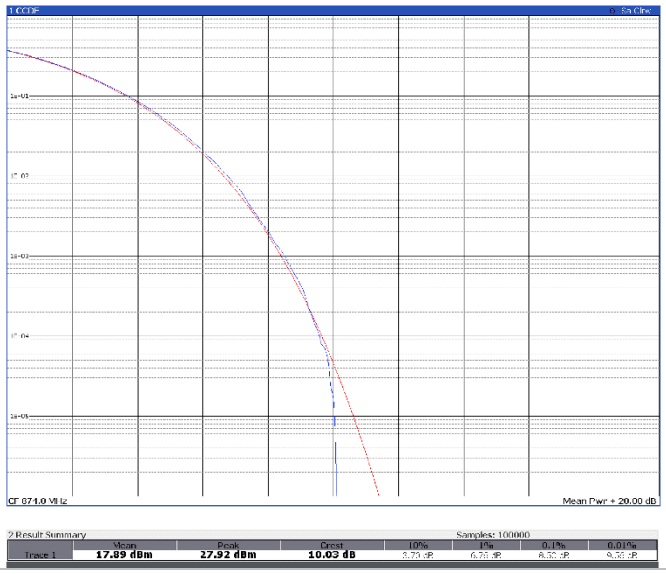
TM3p1a, 10 MHz, mid channel



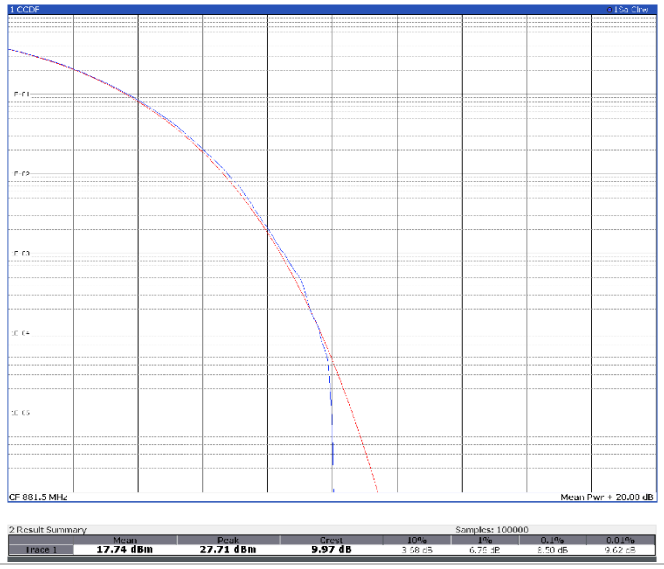
TM3p1a, 10 MHz, high channel



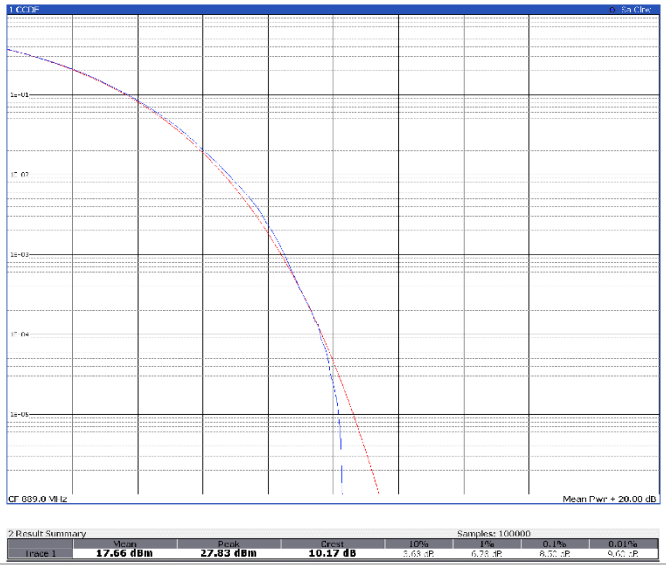
TM3p3, 10 MHz, low channel



TM3p3, 10 MHz, mid channel



TM3p3, 10 MHz, high channel



8.6 FCC 22.917 Emission limitations for cellular equipment.

8.6.1 Definitions and limits

(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.

8.6.2 Test summary

Test start date	October 22, 2024	Temperature	21 °C
Test end date	October 25, 2024	Air pressure	1005 mbar
Test engineer	O. Frau	Relative humidity	64%
Verdict	Pass		

8.6.3 Observations, settings and special notes

EUT setup configuration	Table top
Test facility	3 m Semi anechoic chamber
Measuring distance	3m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Peak and CAverage final measurement)

Spectrum analyzer settings (conducted test):

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Frequency span	Sufficient for making an accurate measurement
Detector mode	RMS
Trace mode	Max Hold

This test was realized in two parts: one with a conducted setup and another one with a radiated setup.

The conducted test was made on one port at time, transmitting at max power and with the other one loaded with 50 Ω loads. For capturing the signal with the equipment, it was divided in two ranges, using a transducer factor to compensate the losses caused by a cable and attenuator used to protect the test equipment. The first range was measured from 30 MHz to 1 GHz where the fundamental signal is visible; the second range was selected from 1 GHz to 10 GHz. The evaluation was made using the three channels and all the modulations (TM1.1, TM3p1, TM3p1a, and TM3p3).

A 30 dB attenuator was placed between the EUT and spectrum analyzer and compensated for as a reference level offset. Additionally, to correct for MIMO consideration, an additional offset of 10Log (2) = -3.01 dB was included to compensate for 2 correlated antennas output.

For band edge tests, in the 1 MHz region immediately outside of the authorized band, a resolution bandwidth of approximately 1 – 5 % of the 26 dB bandwidth measured was used.

The radiated test was made transmitting to max power too with the two ports terminated with 50 Ω loads. The scans were made from 30 MHz to 10 GHz considering all the channels but only the bandwidth and modulation with the highest power was showed.

Based on equation 43 + 10 log10 (P) dB, the general emission limit is -13 dBm (conducted and radiated test) or the equivalent at 3m is 82.23 dBµV/m above 1 GHz and 84.38 dBµV/m below 1 GHz.

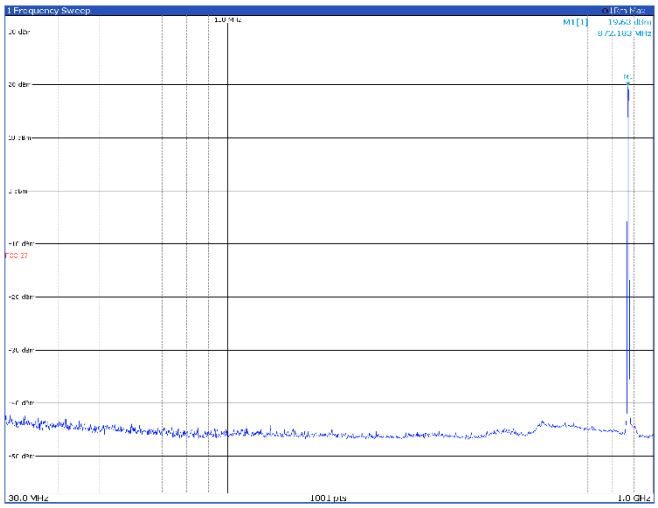
8.6.4 Test equipment used

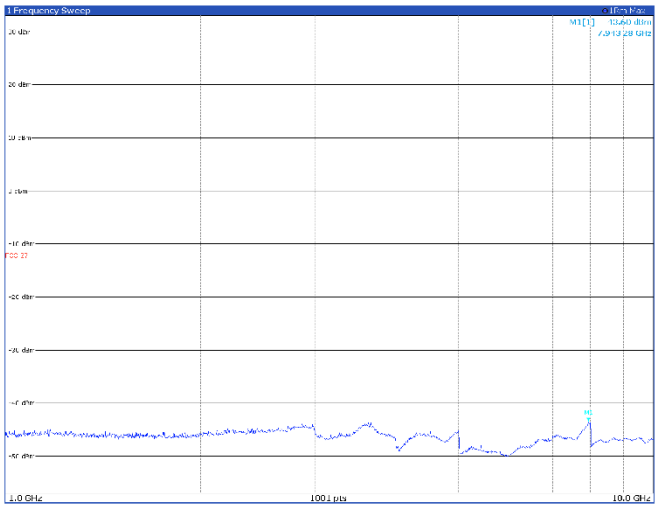
Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
EMI Receiver	Rohde & Schwarz	ESW44	101620
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397
Antenna Trilog 25MHz - 8GHz	Schwarzbeck Mess-Elektronik	VULB9162	9162-025
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152
Double Ridge Horn Antenna	RFSpin	DRH40	061106A40
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121
Broadband Bench Top Amplifier	Sage	STB-1834034030-KFKF-L1	18490-01
Controller	Maturo	FCU3.0	10041
Tilt antenna mast	Maturo	TAM4.0-E	10042
Turntable	Maturo	TT4.0-5T	2.527

8.6.5 Test data

Band B5 – conducted emissions Antenna port 1	5 MHz

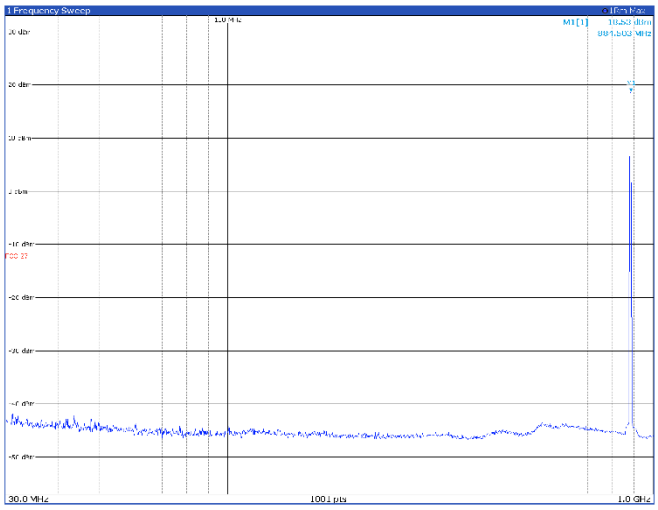
TM1.1, 5 MHz, low channel

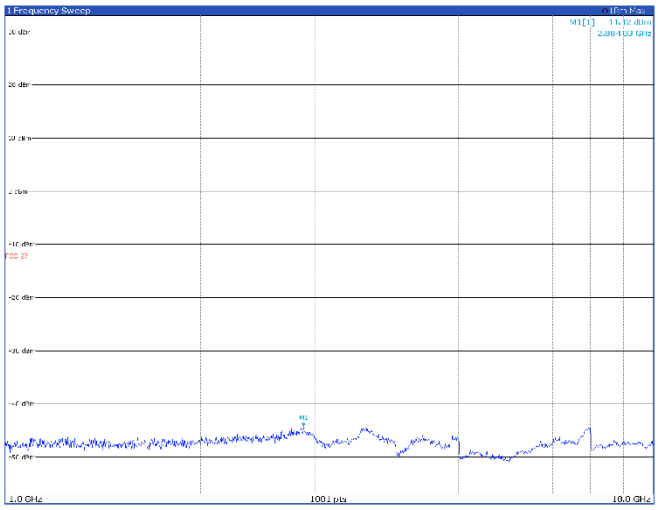




Limit exceeded by the carrier

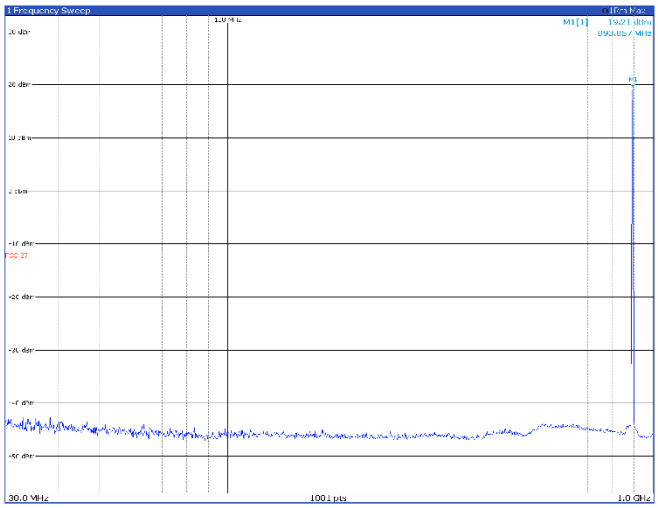
TM1.1, 5 MHz, mid channel

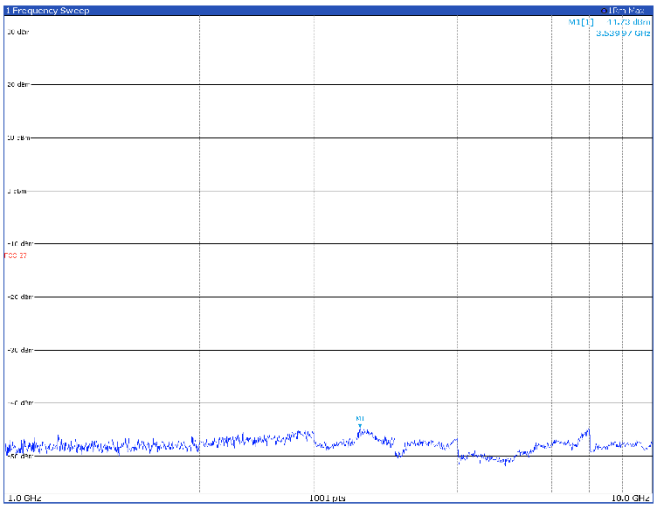




Limit exceeded by the carrier

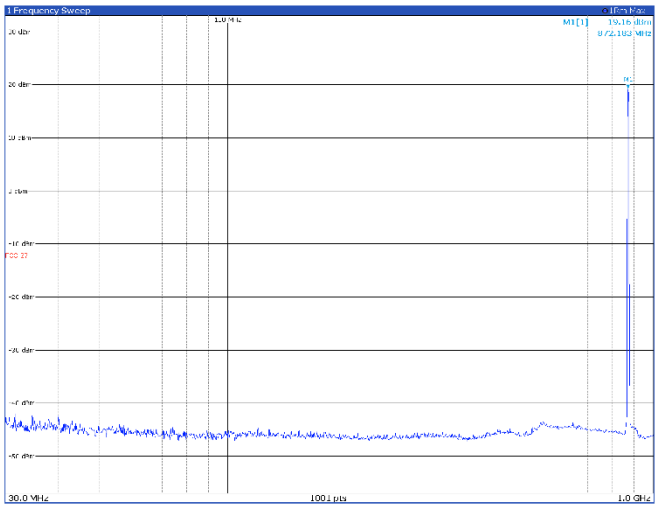
TM1.1, 5 MHz, high channel

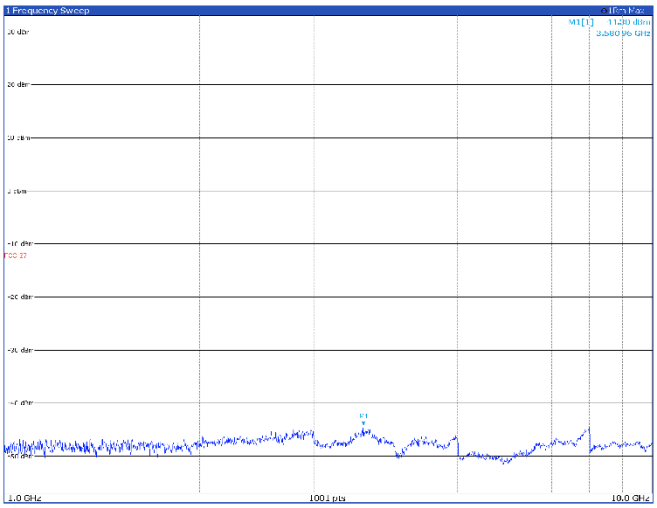




Limit exceeded by the carrier

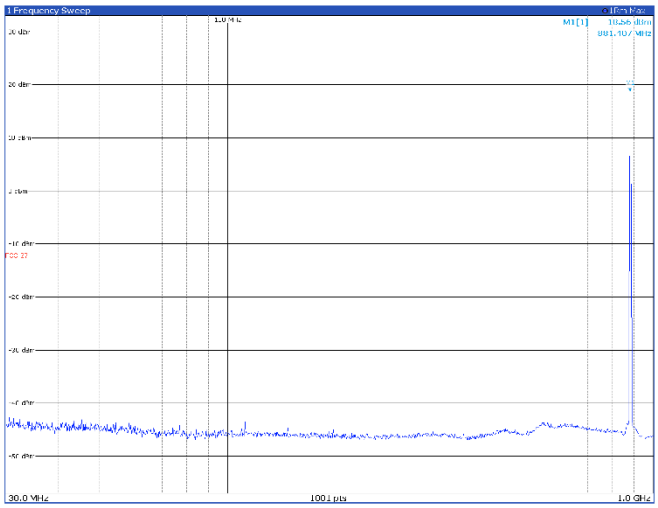
TM3p1, 5 MHz, low channel

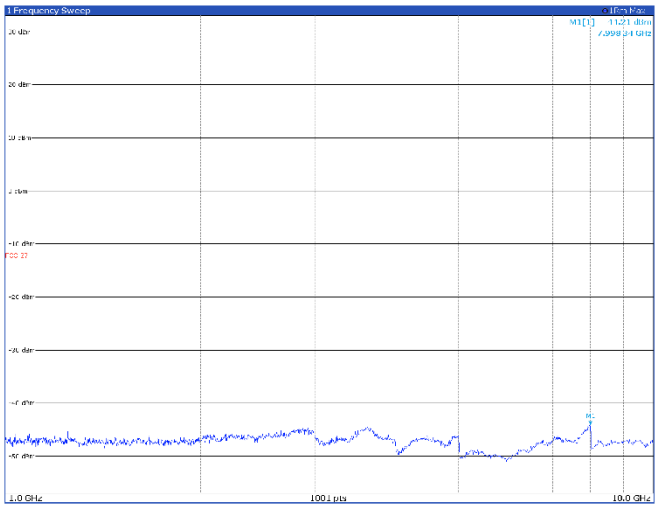




Limit exceeded by the carrier

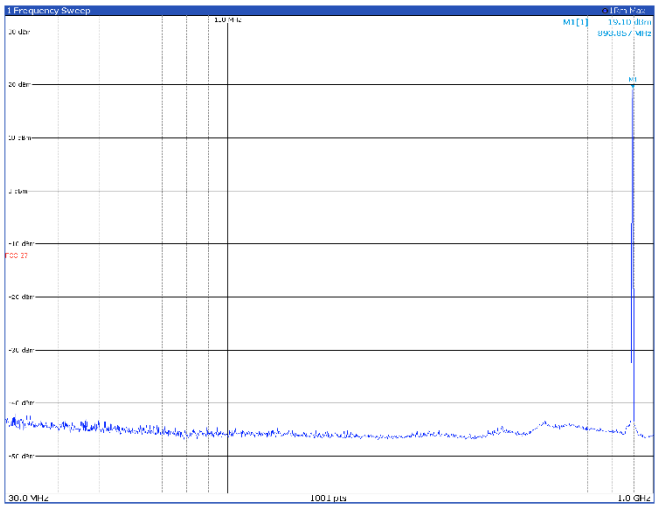
TM3p1, 5 MHz, mid channel

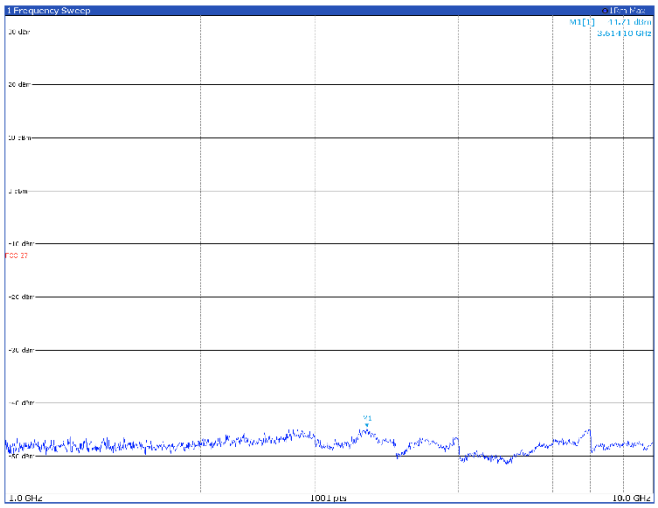




Limit exceeded by the carrier

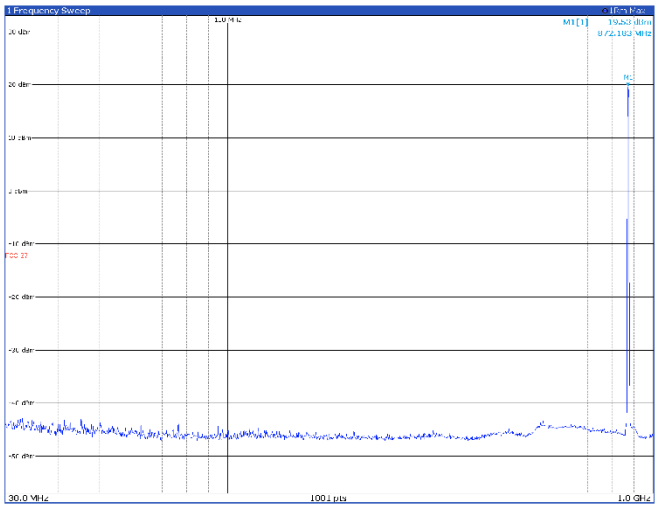
TM3p1, 5 MHz, high channel

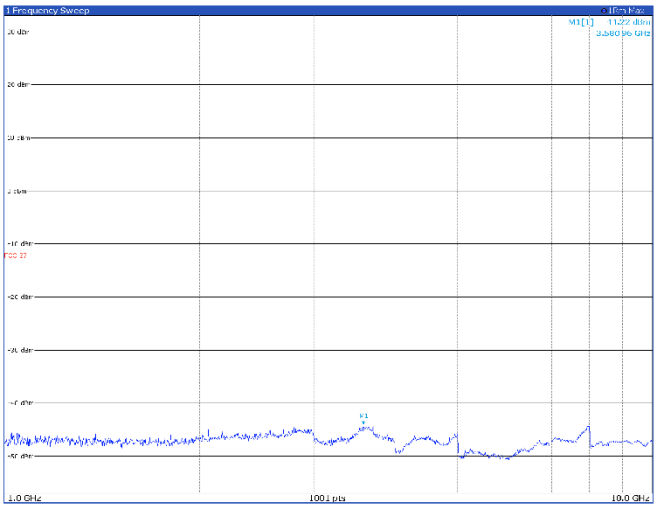




Limit exceeded by the carrier

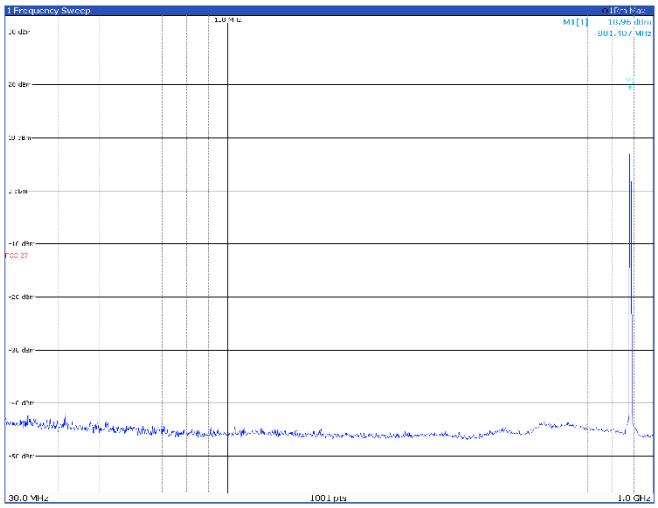
TM3p1a, 5 MHz, low channel

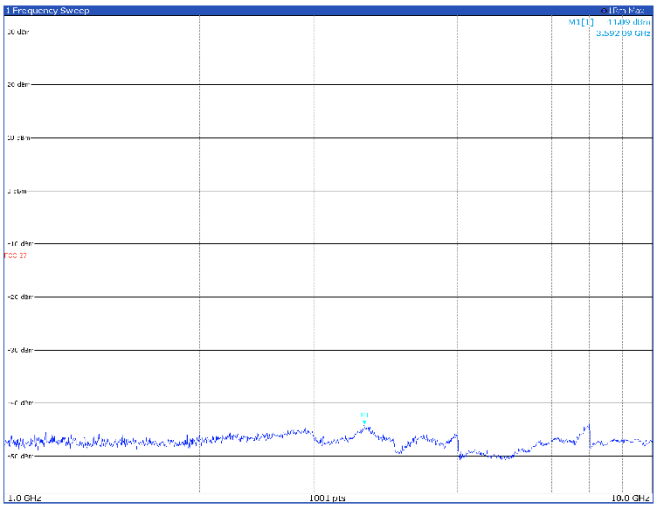




Limit exceeded by the carrier

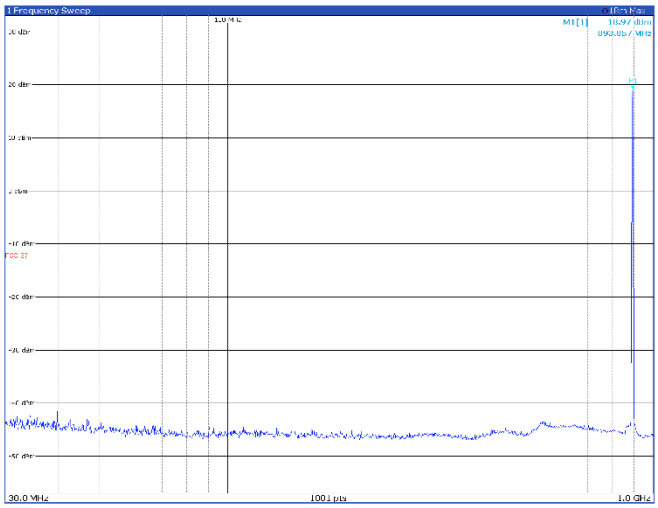
TM3p1a, 5 MHz, mid channel

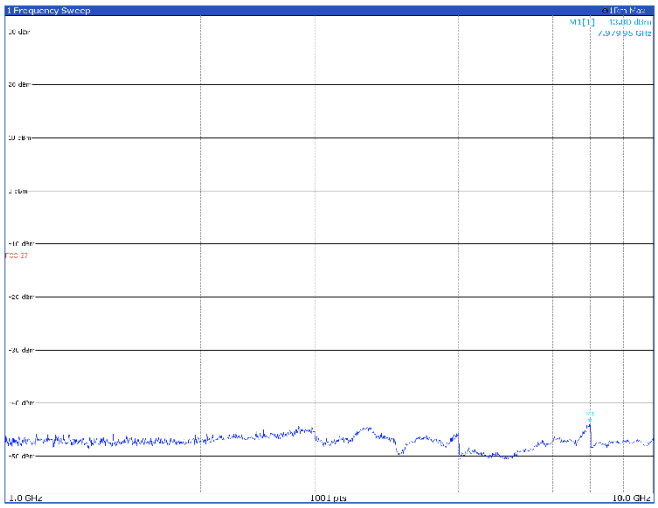




Limit exceeded by the carrier

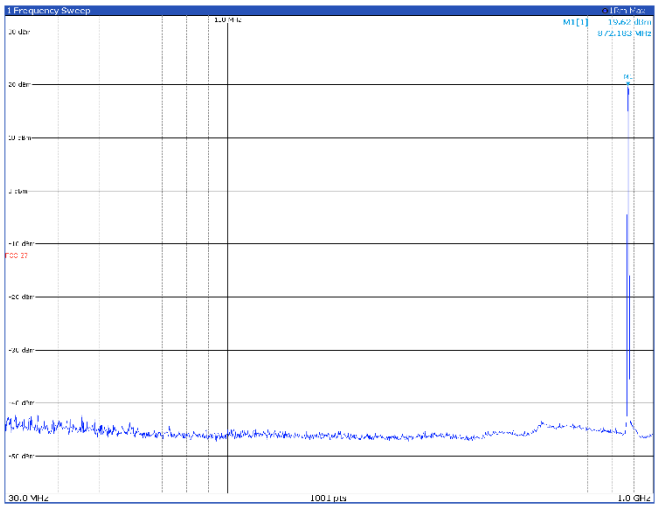
TM3p1a, 5 MHz, high channel

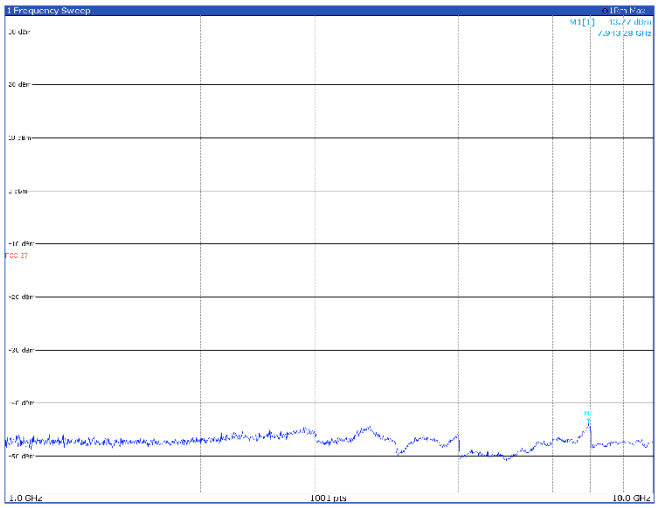




Limit exceeded by the carrier

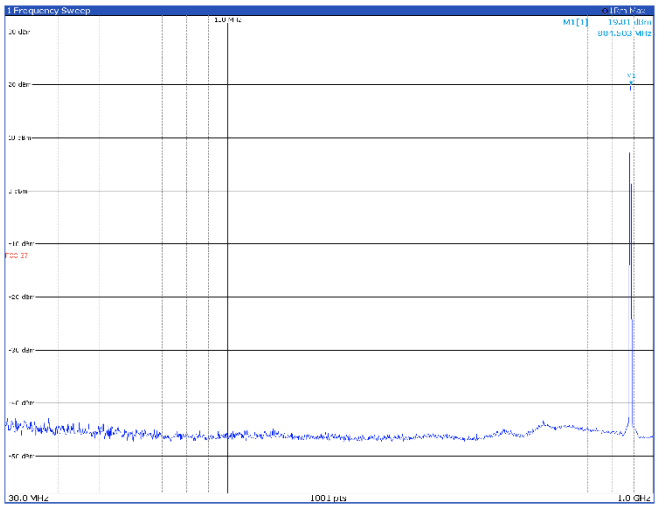
TM3p3, 5 MHz, low channel

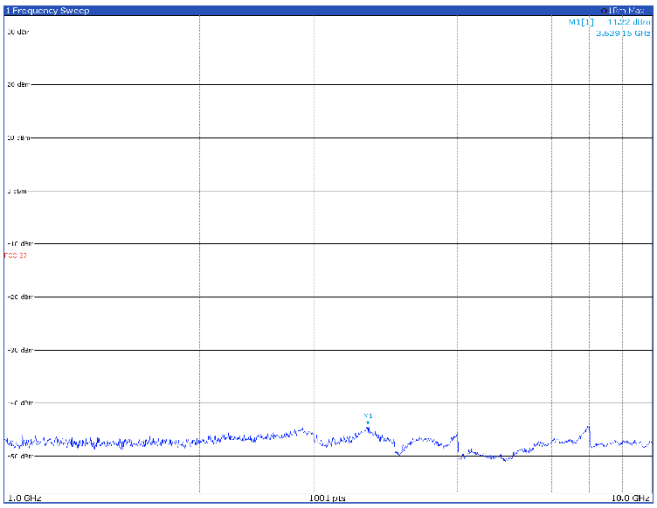




Limit exceeded by the carrier

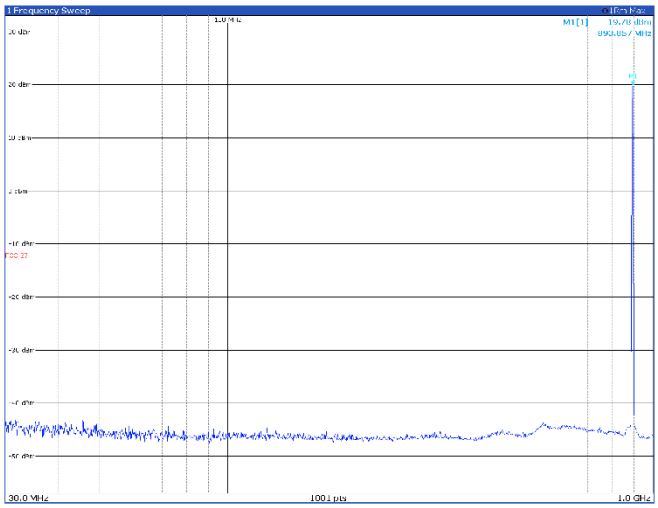
TM3p3, 5 MHz, mid channel

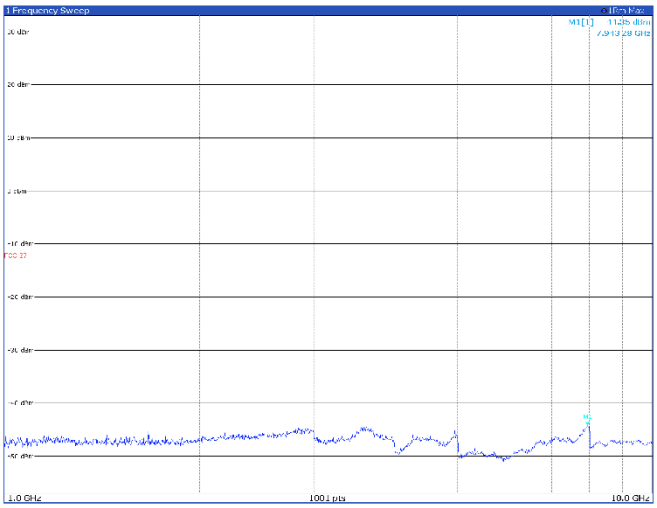




Limit exceeded by the carrier

TM3p3, 5 MHz, high channel

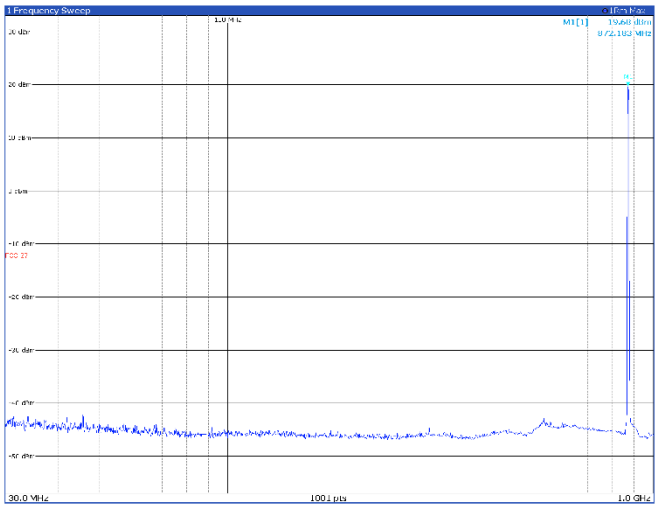


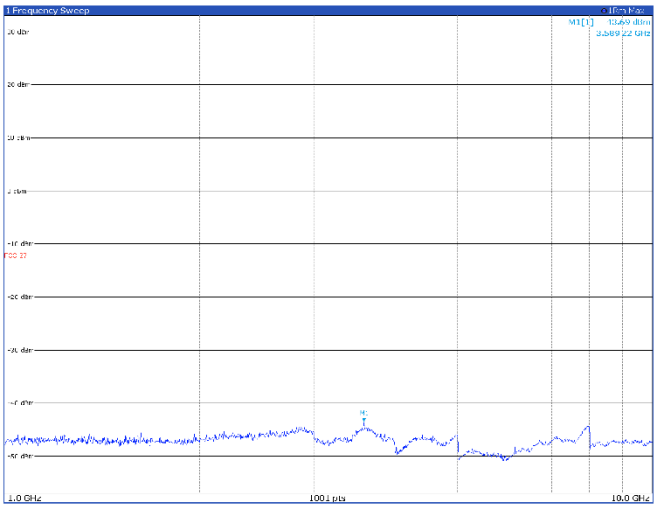


Limit exceeded by the carrier

Band B5 – conducted emissions Antenna port 2 **5 MHz**

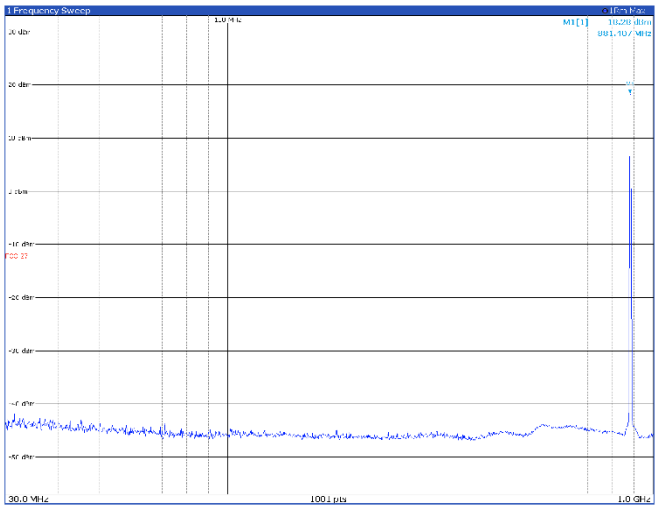
TM1.1, 5 MHz, low channel

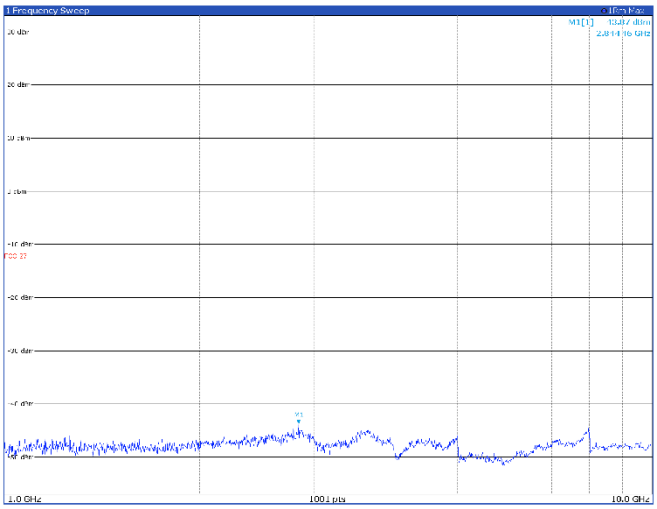




Limit exceeded by the carrier

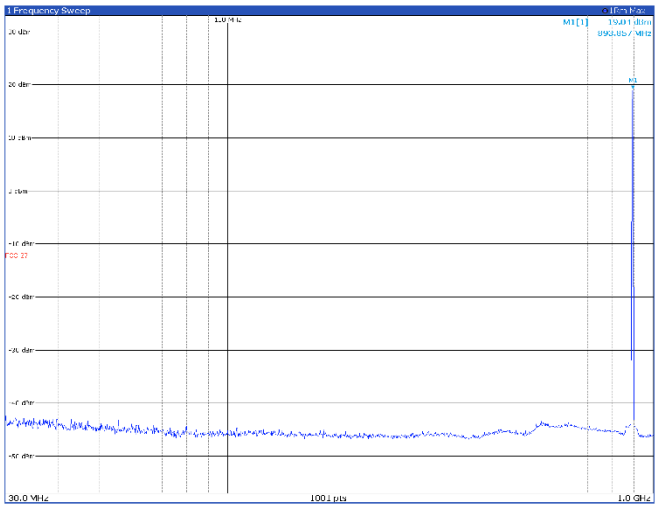
TM1.1, 5 MHz, mid channel

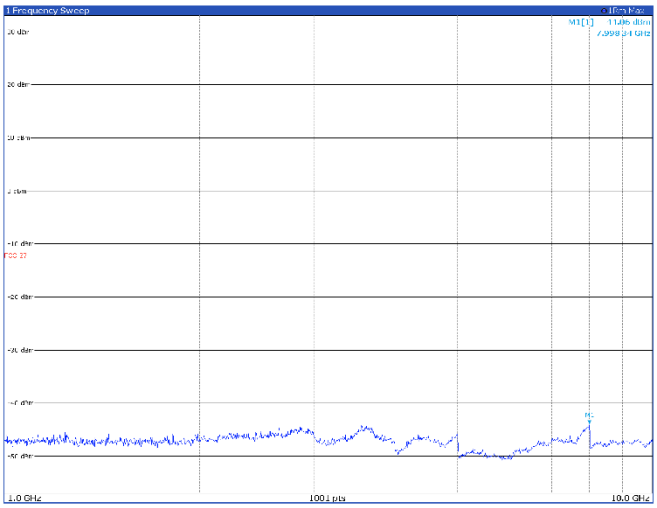




Limit exceeded by the carrier

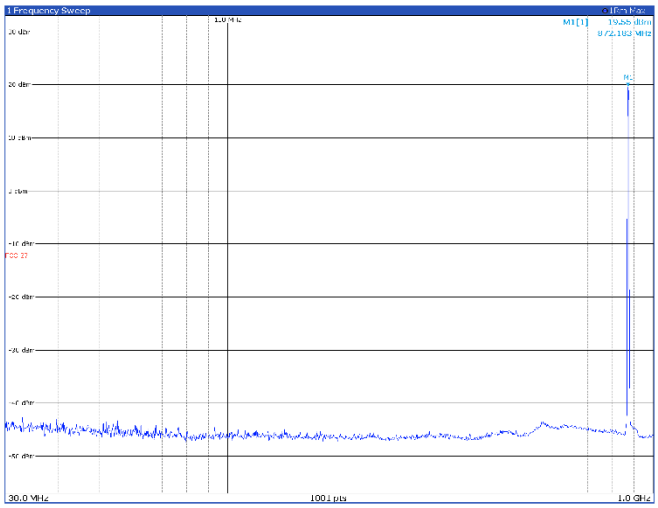
TM1.1, 5 MHz, high channel

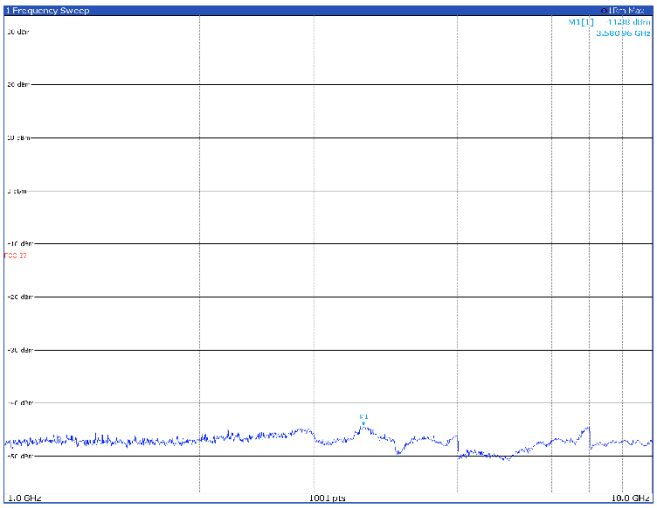




Limit exceeded by the carrier

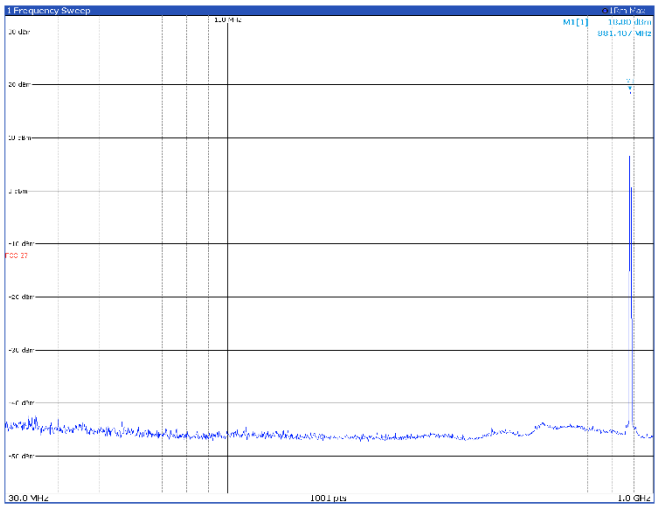
TM3p1, 5 MHz, low channel

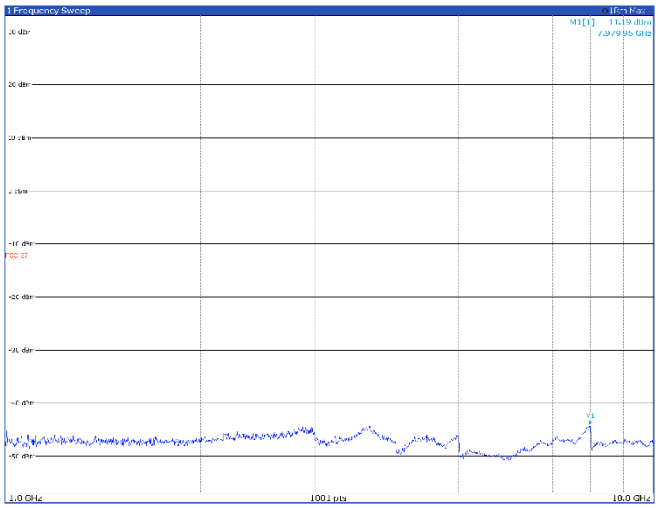




Limit exceeded by the carrier

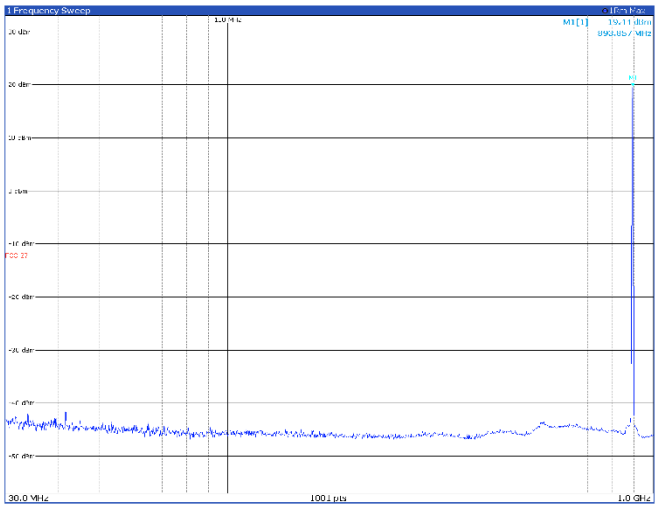
TM3p1, 5 MHz, mid channel

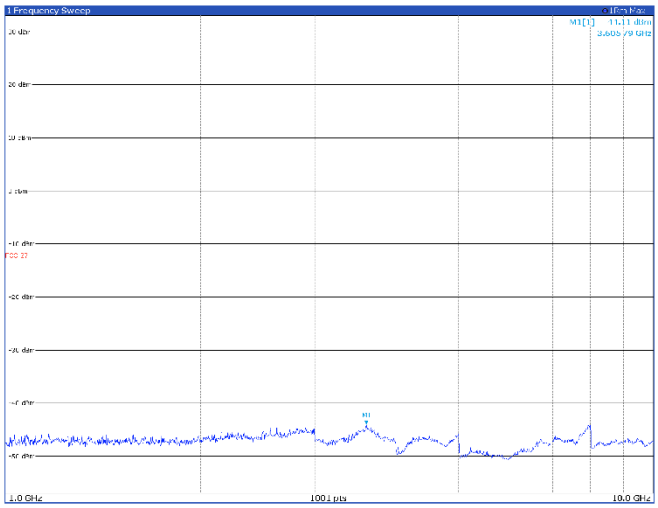




Limit exceeded by the carrier

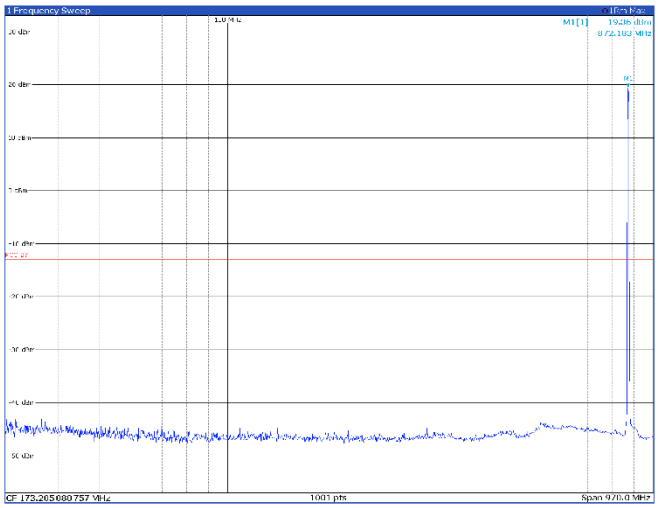
TM3p1, 5 MHz, high channel

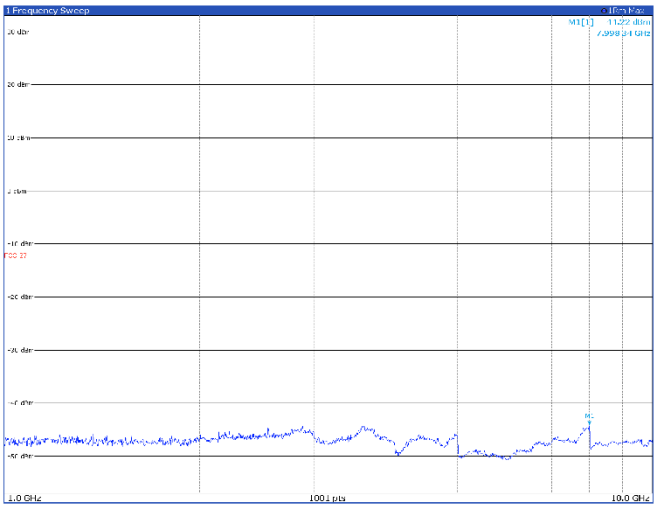




Limit exceeded by the carrier

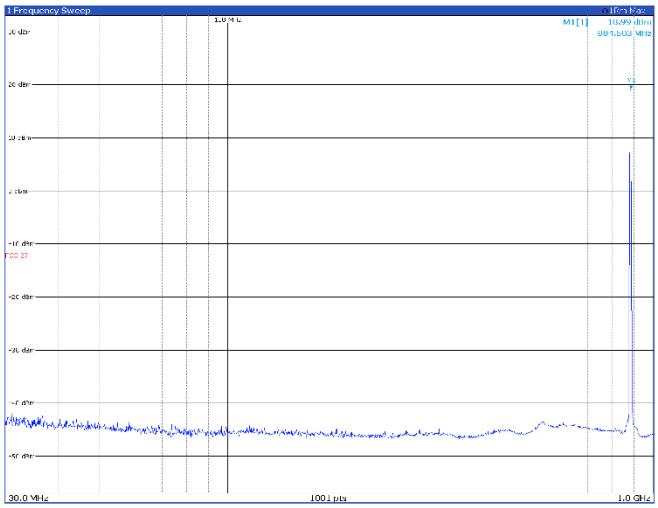
TM3p1a, 5 MHz, low channel

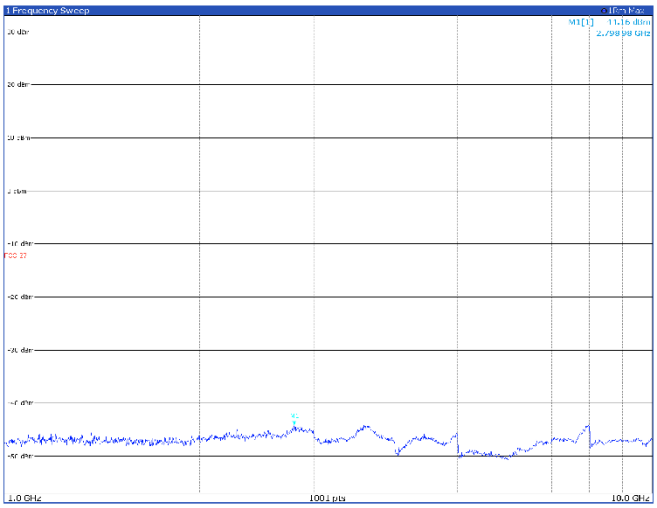




Limit exceeded by the carrier

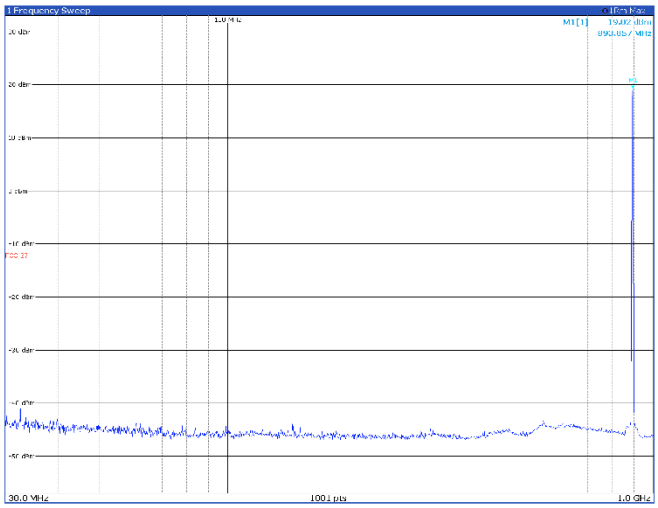
TM3p1a, 5 MHz, mid channel

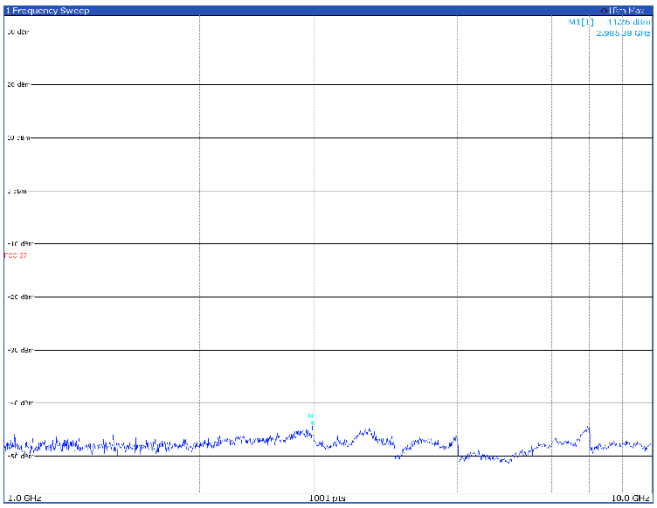




Limit exceeded by the carrier

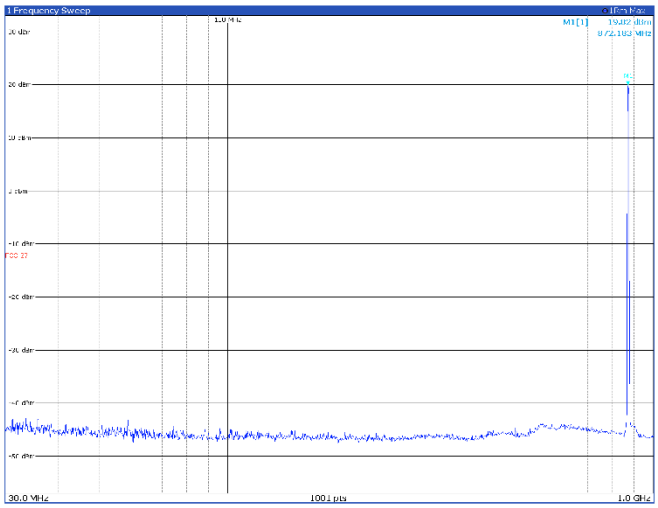
TM3p1a, 5 MHz, high channel

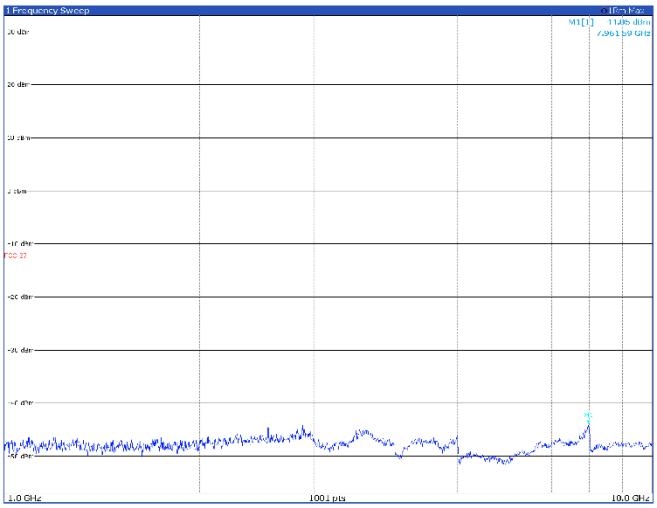




Limit exceeded by the carrier

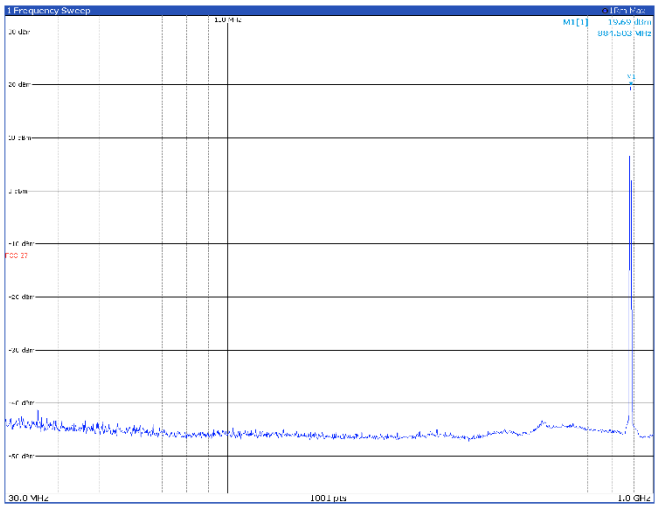
TM3p3, 5 MHz, low channel

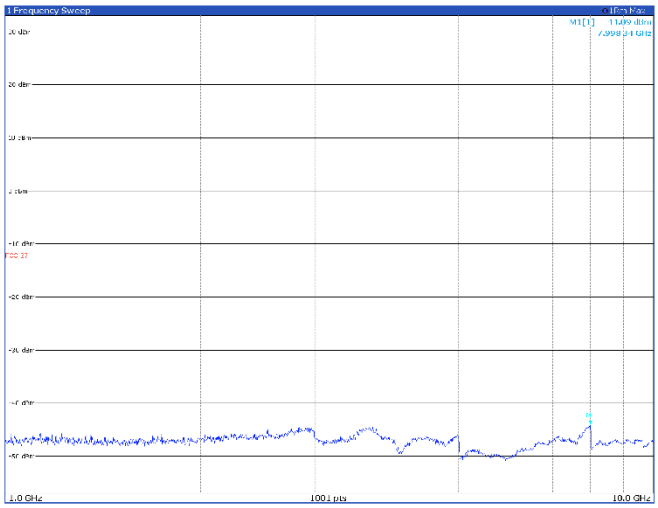




Limit exceeded by the carrier

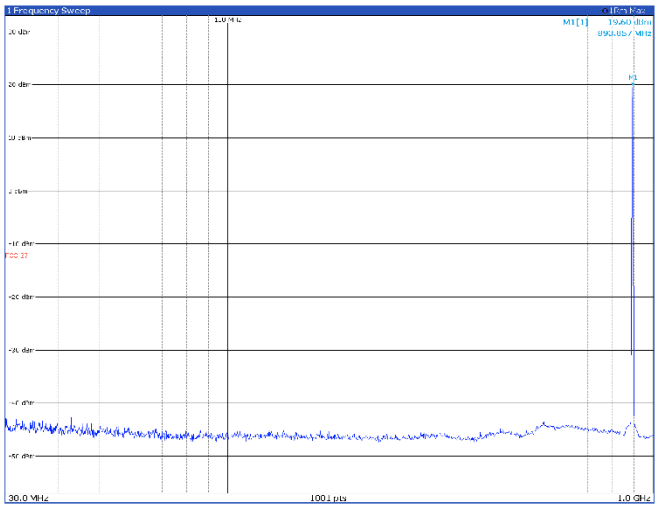
TM3p3, 5 MHz, mid channel

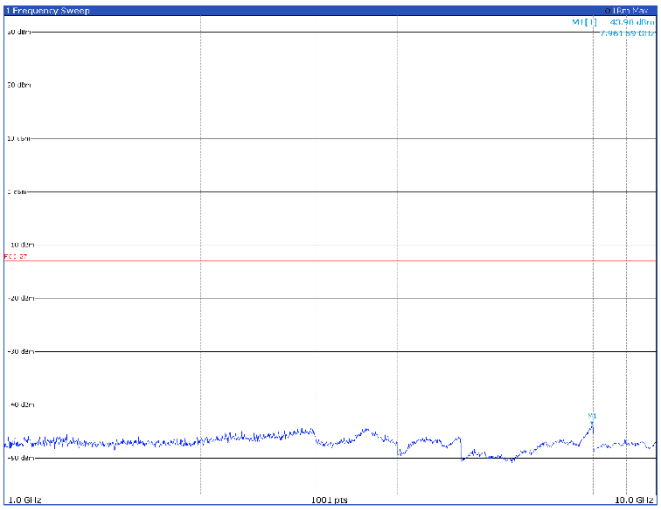




Limit exceeded by the carrier

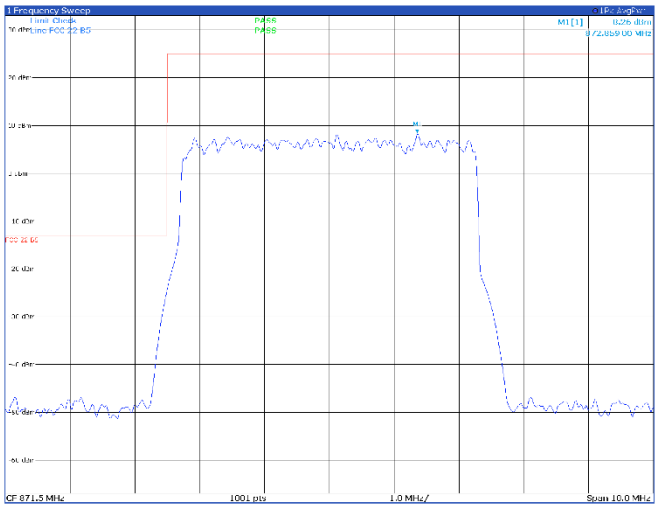
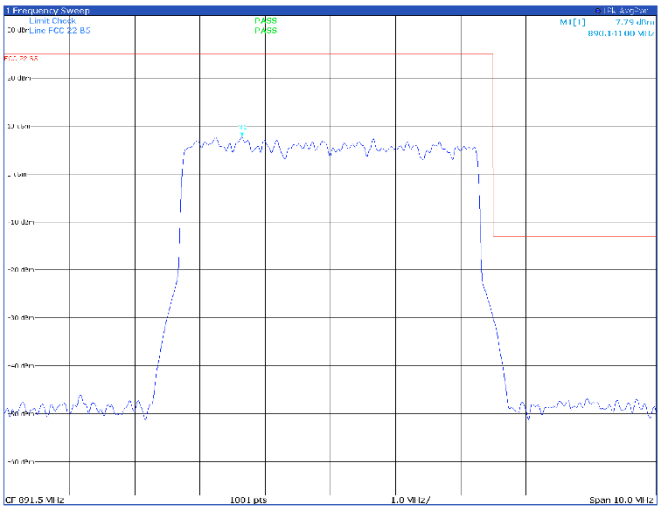
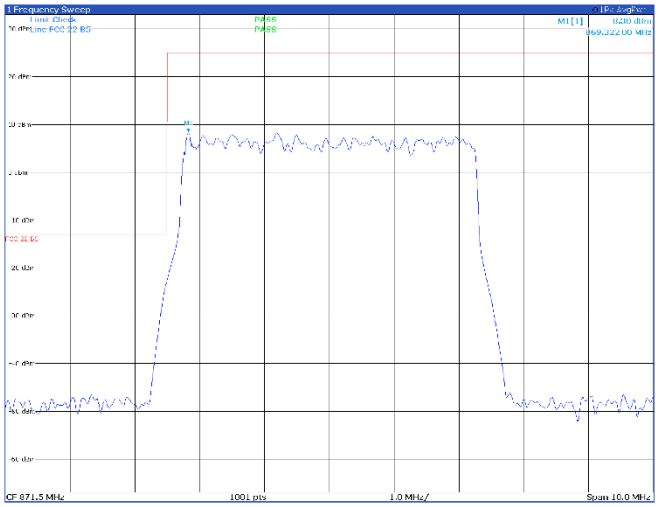
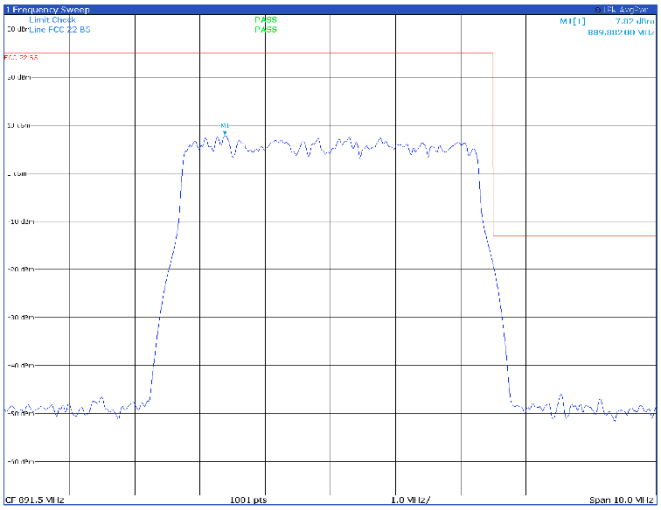
TM3p3, 5 MHz, high channel

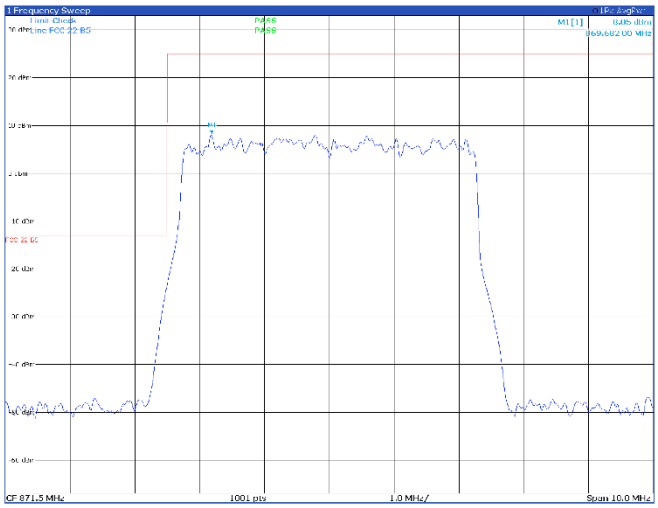
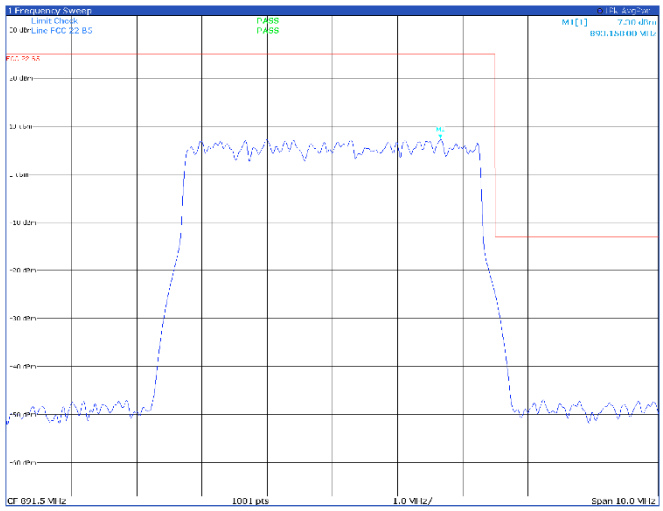
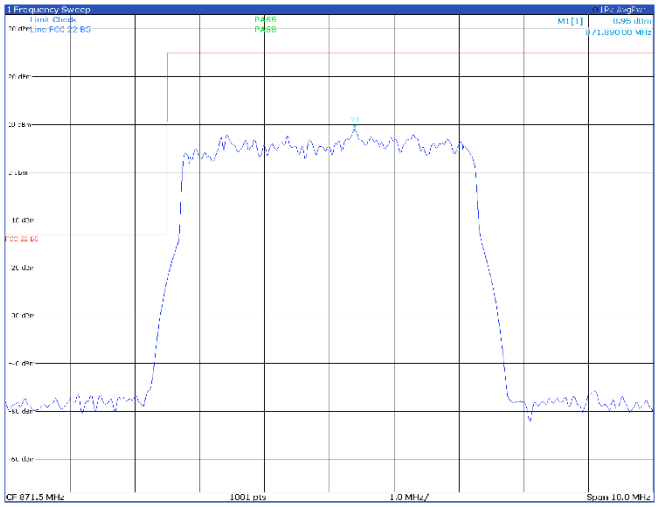
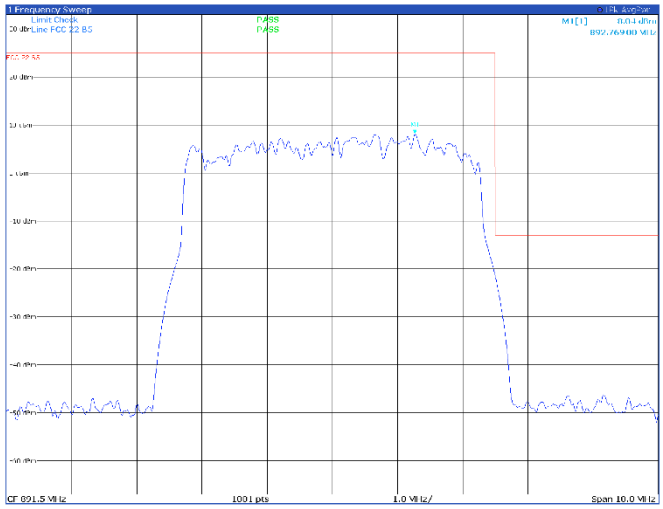




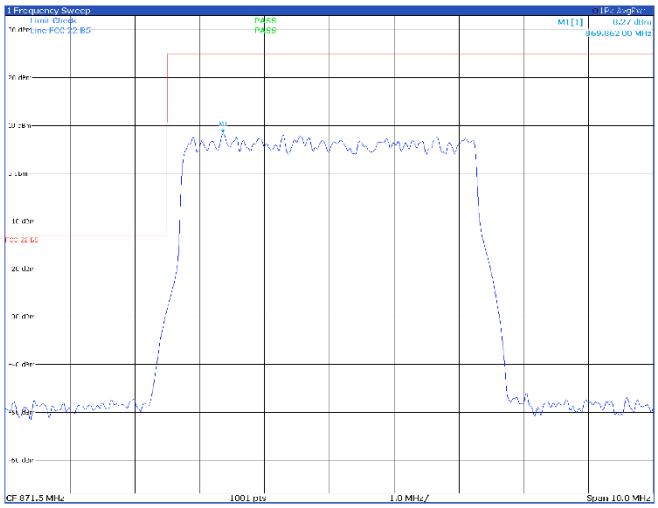
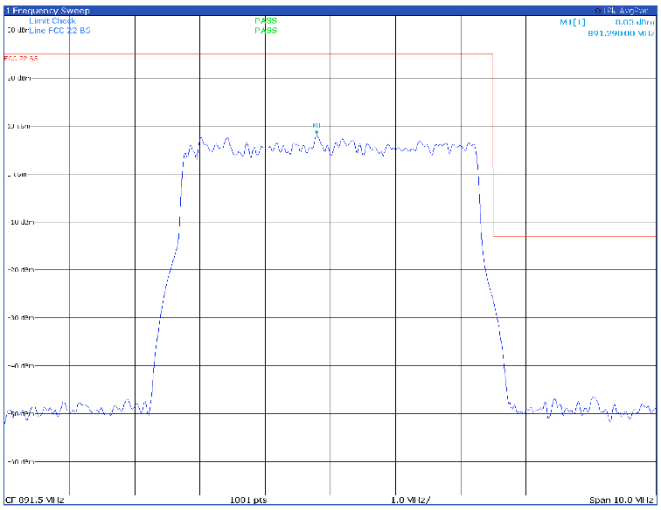
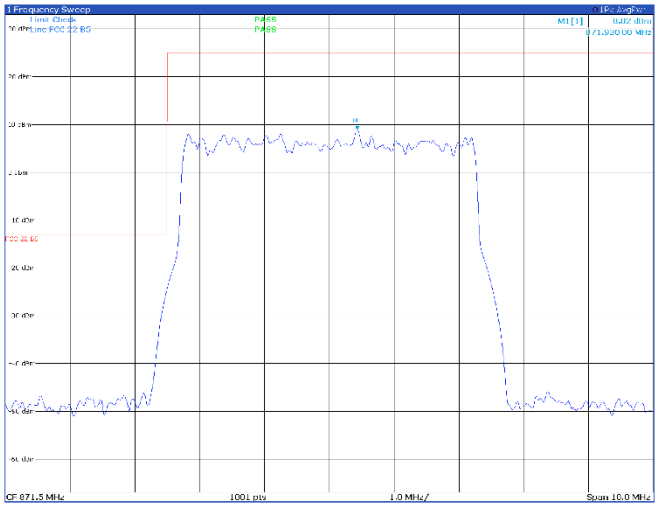
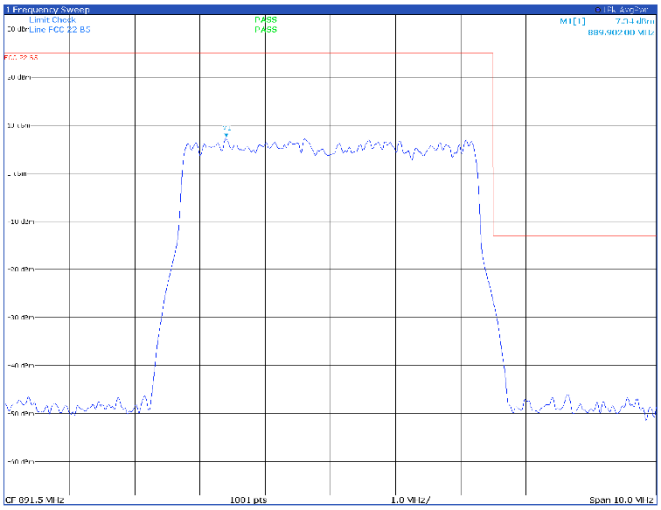
Limit exceeded by the carrier

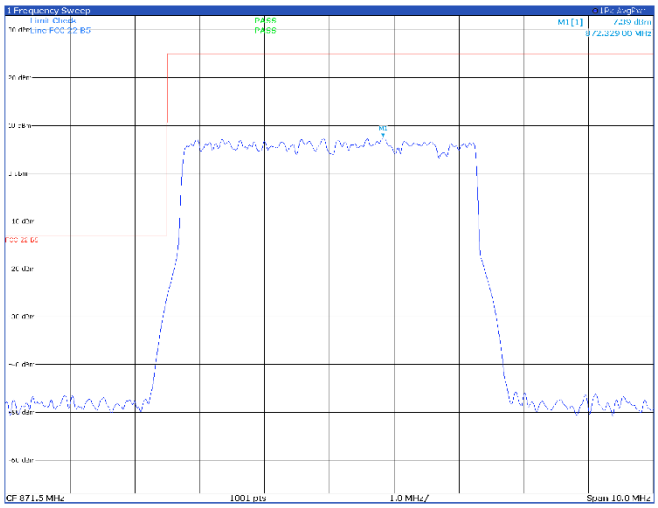
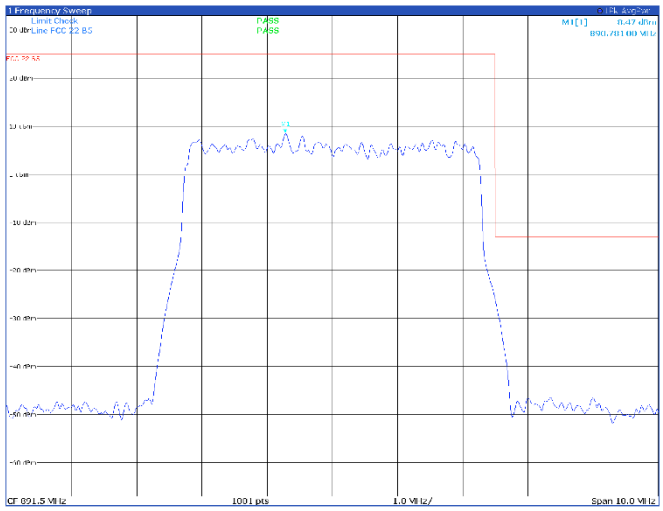
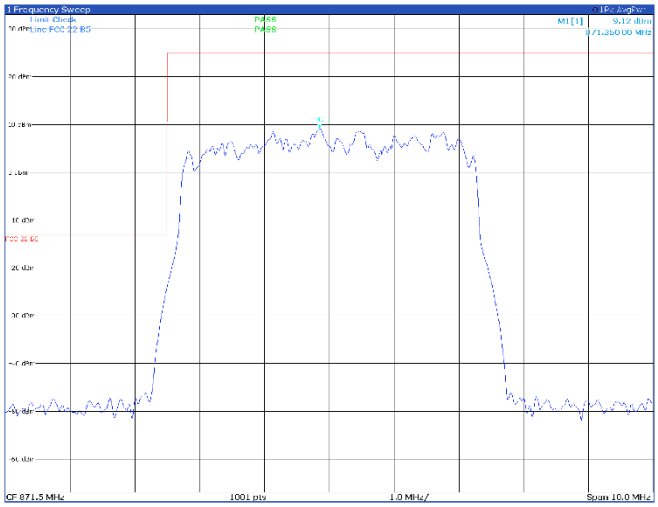
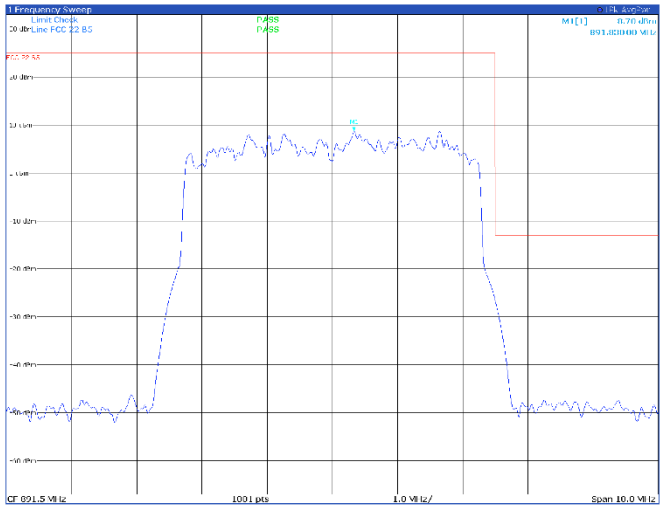
Band B5 – band edge Antenna port 1 **5 MHz**

TM1.1, 5 MHz, low channel	TM1.1, 5 MHz, high channel
	
TM3p1, 5 MHz, low channel	**TM3p1, 5 MHz, high channel**
	

TM3p1a, 5 MHz, low channel	TM3p1a, 5 MHz, high channel
	
TM3p3, 5 MHz, low channel	**TM3p3, 5 MHz, high channel**
	

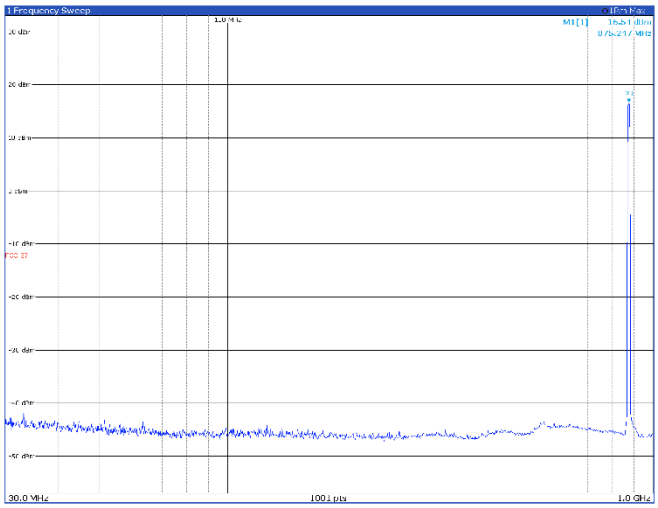
Band B5 – band edge Antenna port 2 **5 MHz**

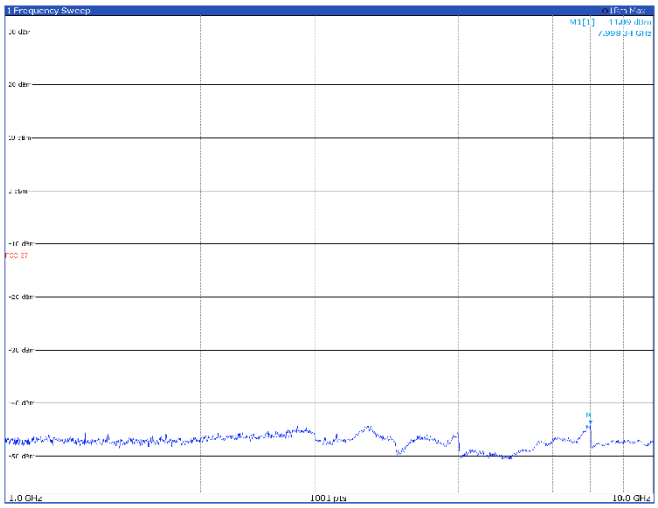
TM1.1, 5 MHz, low channel	TM1.1, 5 MHz, high channel
	
TM3p1, 5 MHz, low channel	**TM3p1, 5 MHz, high channel**
	

TM3p1a, 5 MHz, low channel	TM3p1a, 5 MHz, high channel
	
TM3p3, 5 MHz, low channel	**TM3p3, 5 MHz, high channel**
	

Band B5 – conducted emissions Antenna port 1 **10 MHz**

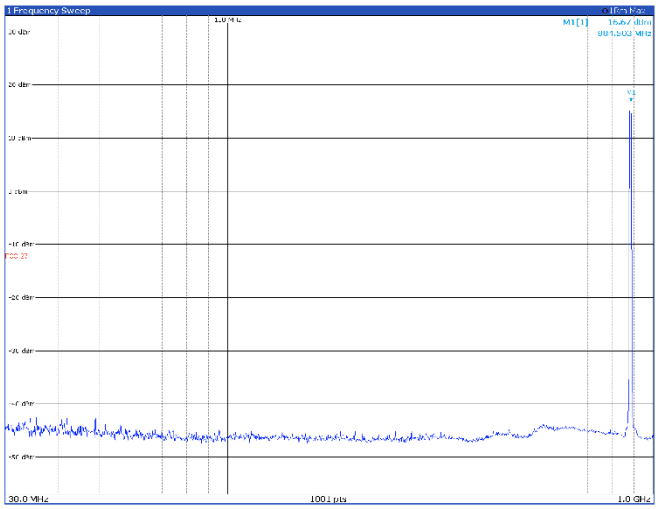
TM1.1, 10 MHz, low channel

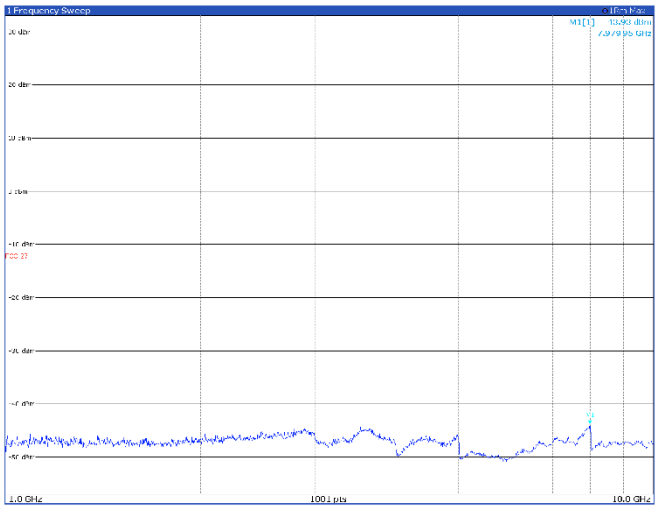




Limit exceeded by the carrier

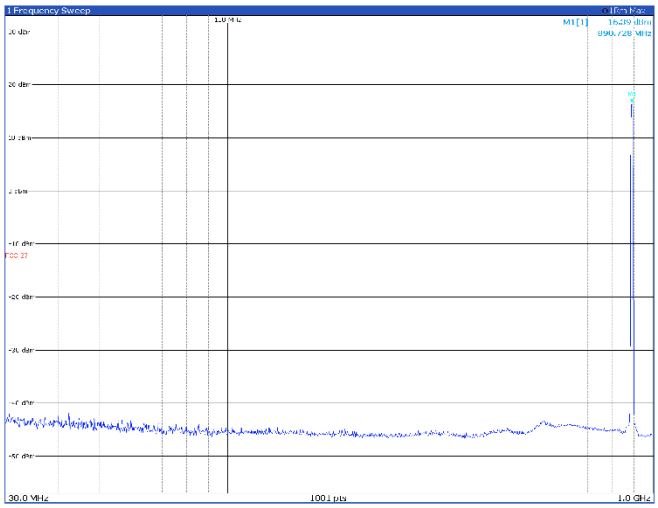
TM1.1, 10 MHz, mid channel

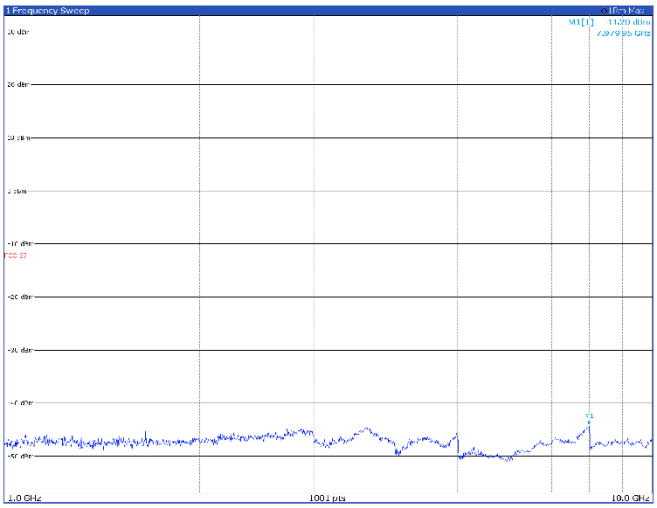




Limit exceeded by the carrier

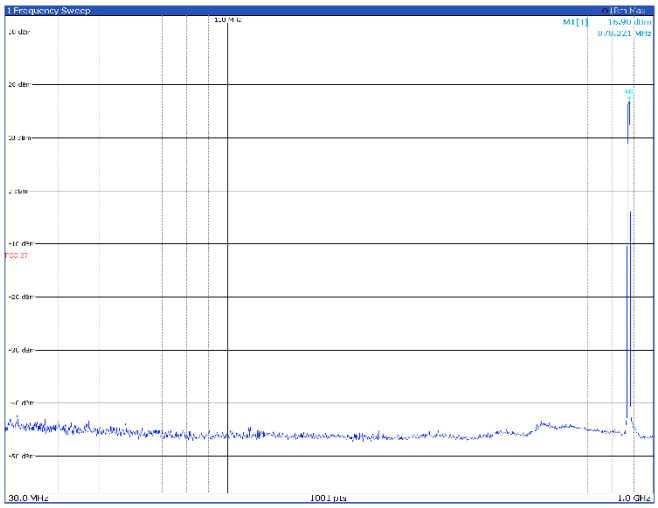
TM1.1, 10 MHz, high channel

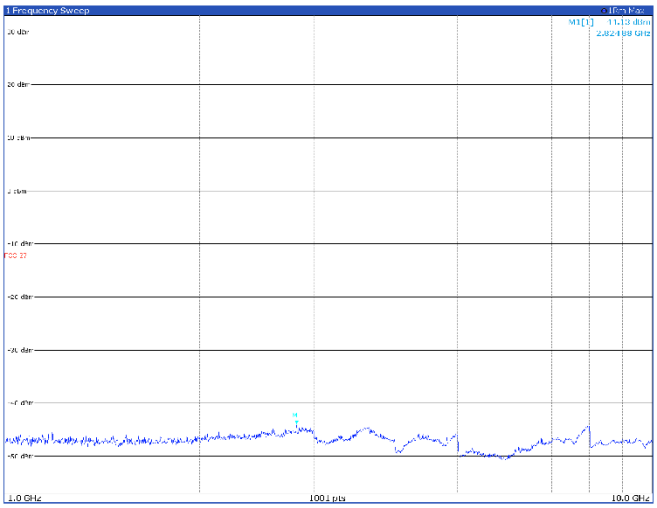




Limit exceeded by the carrier

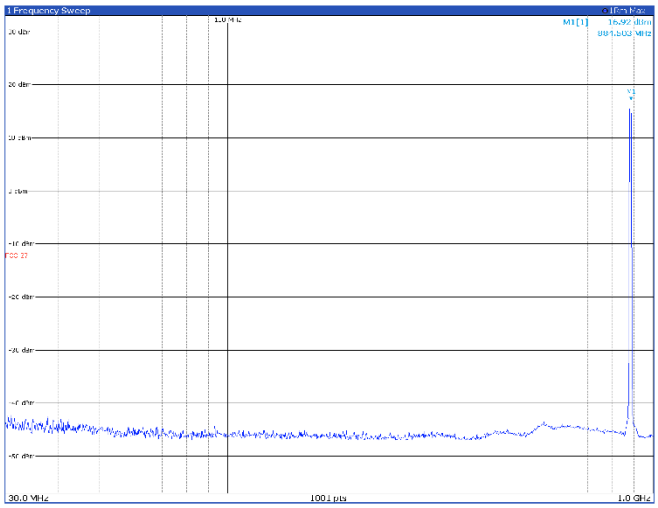
TM3p1, 10 MHz, low channel

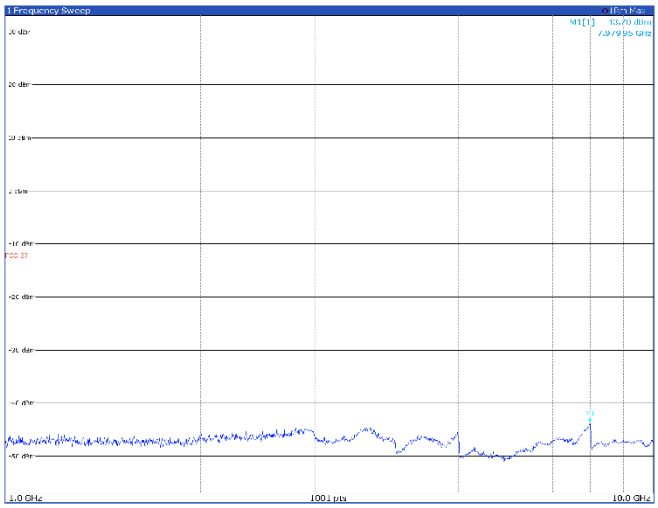




Limit exceeded by the carrier

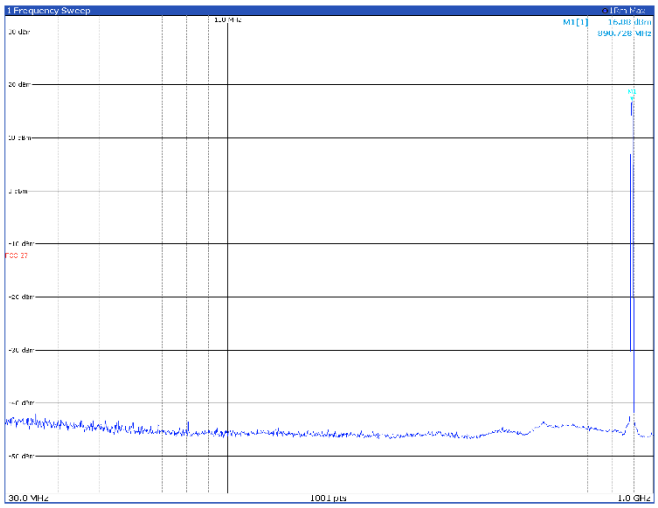
TM3p1, 10 MHz, mid channel

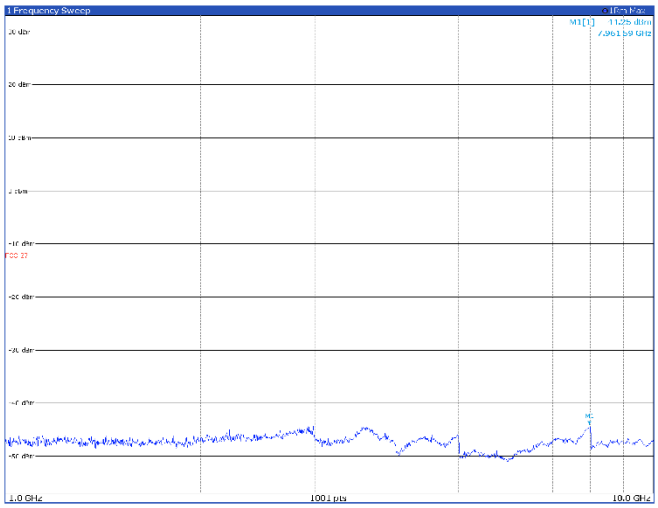




Limit exceeded by the carrier

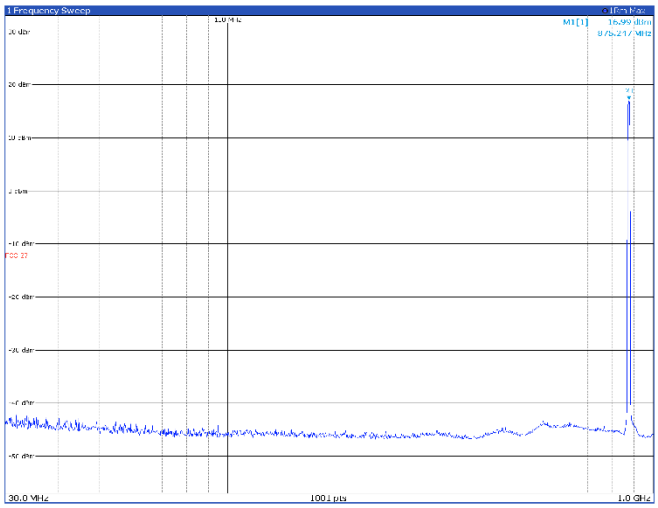
TM3p1, 10 MHz, high channel

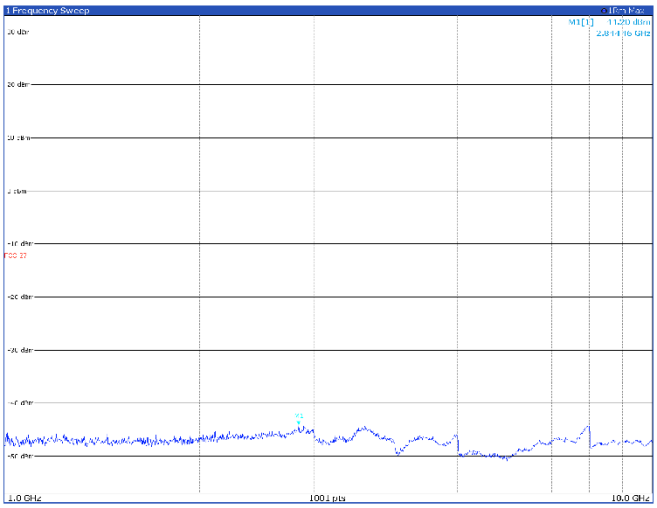




Limit exceeded by the carrier

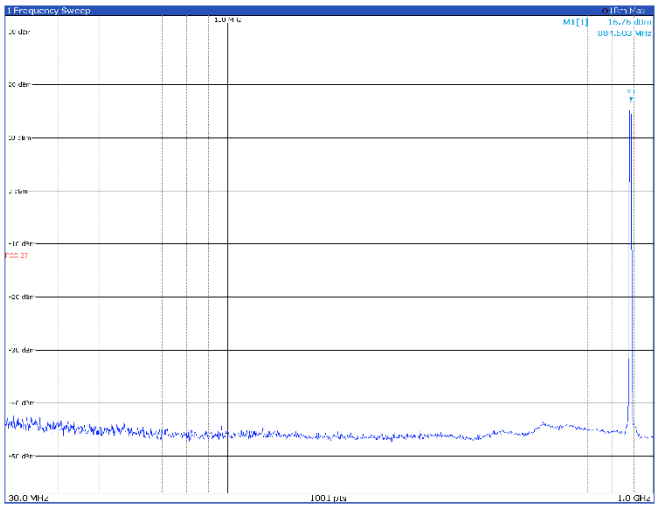
TM3p1a, 10 MHz, low channel

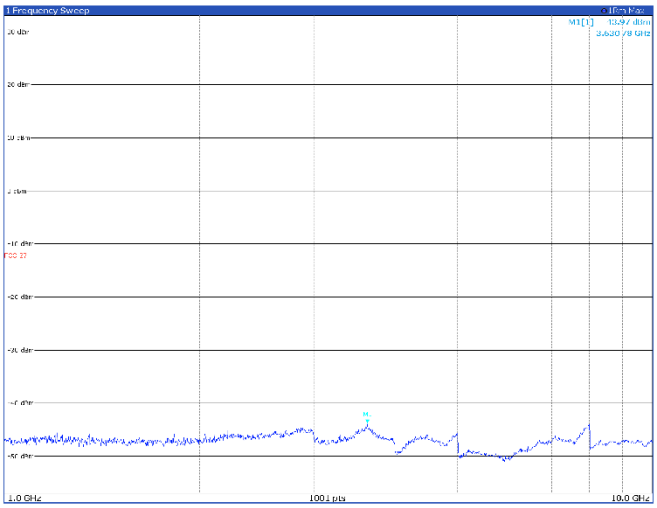




Limit exceeded by the carrier

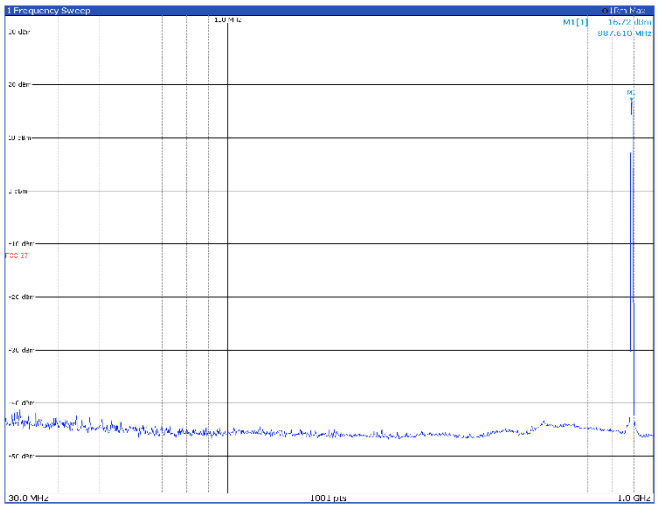
TM3p1a, 10 MHz, mid channel

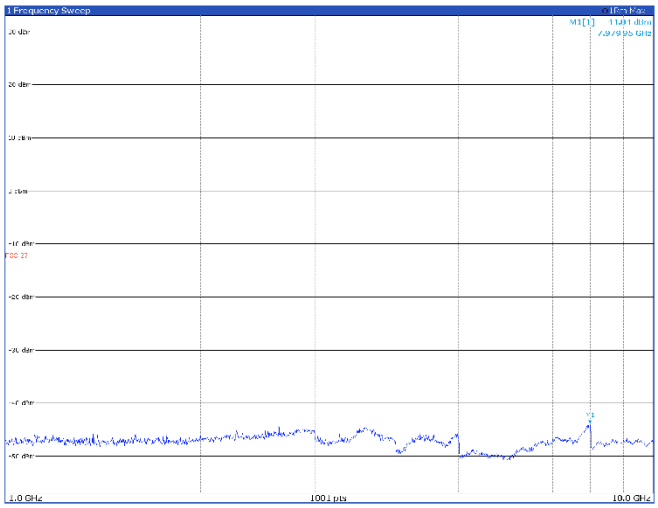




Limit exceeded by the carrier

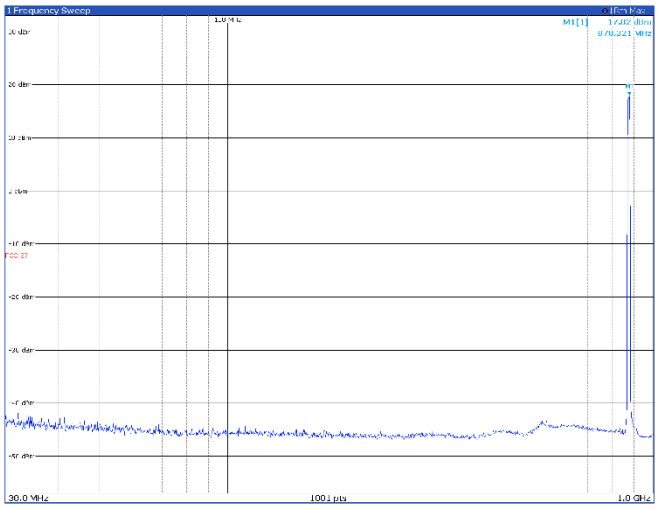
TM3p1a, 10 MHz, high channel

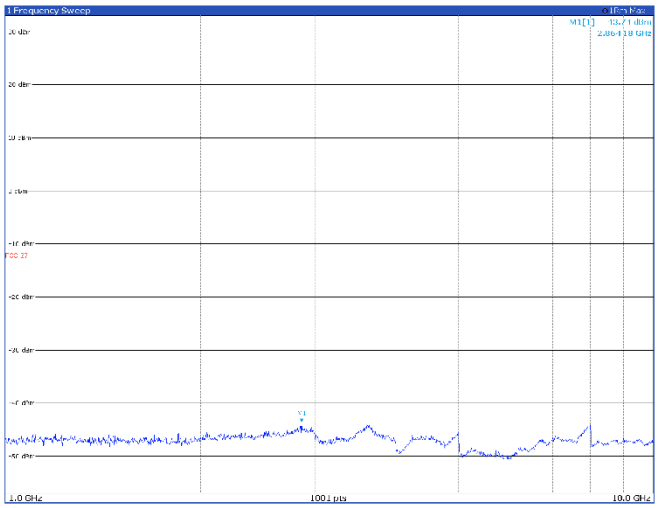




Limit exceeded by the carrier

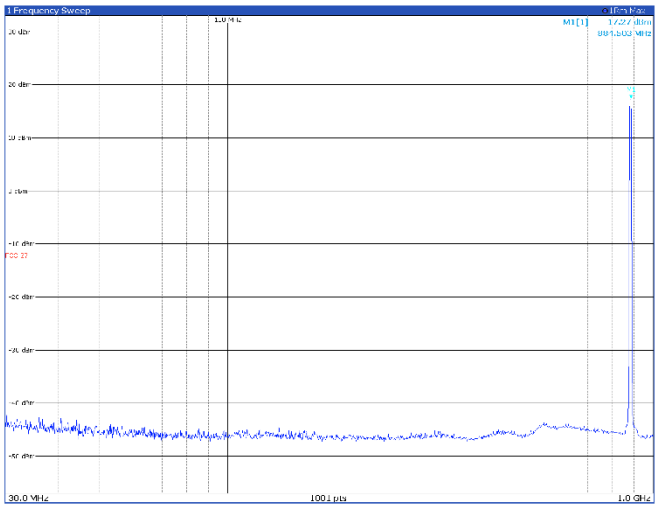
TM3p3, 10 MHz, low channel

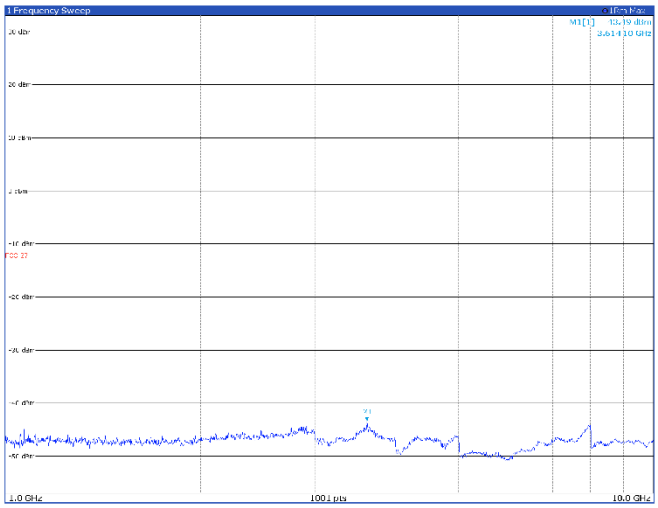




Limit exceeded by the carrier

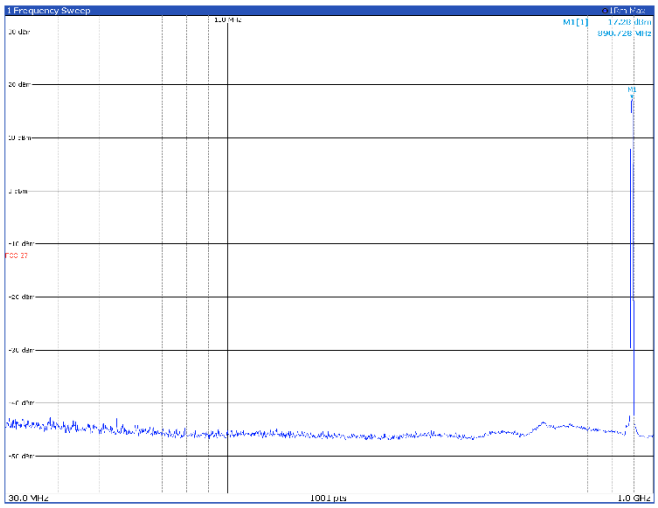
TM3p3, 10 MHz, mid channel

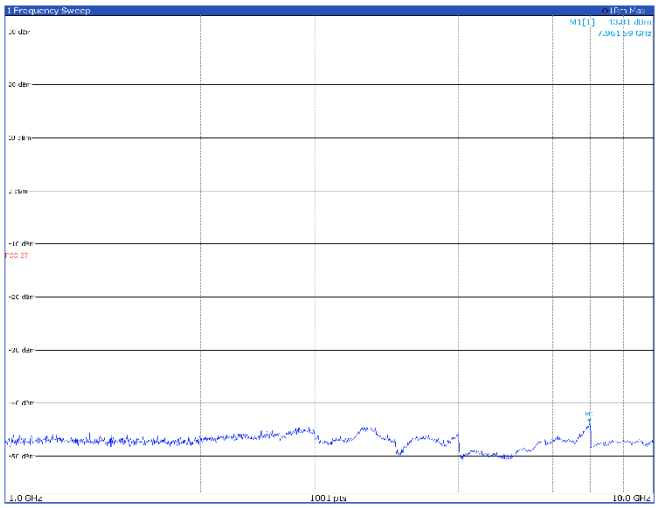




Limit exceeded by the carrier

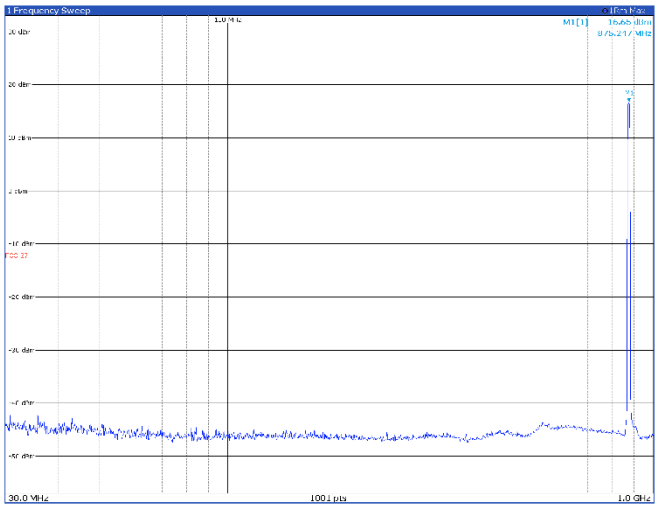
TM3p3, 10 MHz, high channel

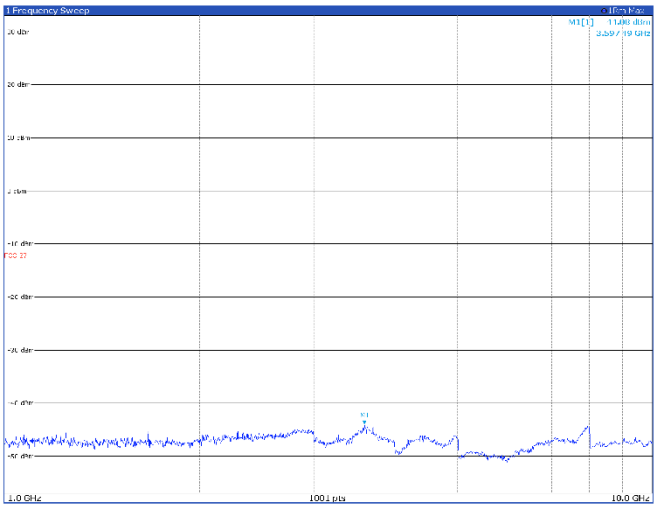




Limit exceeded by the carrier

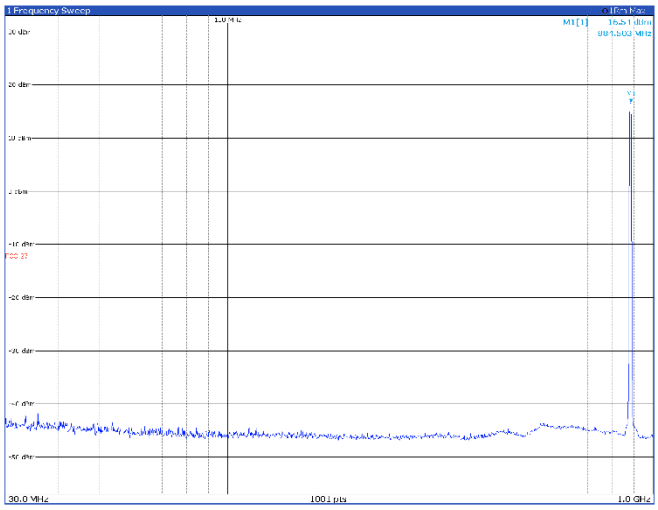
TM1.1, 10 MHz, low channel

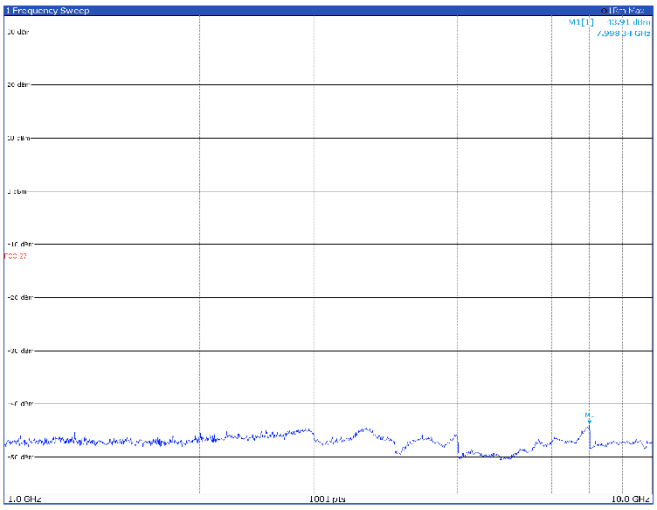




Limit exceeded by the carrier

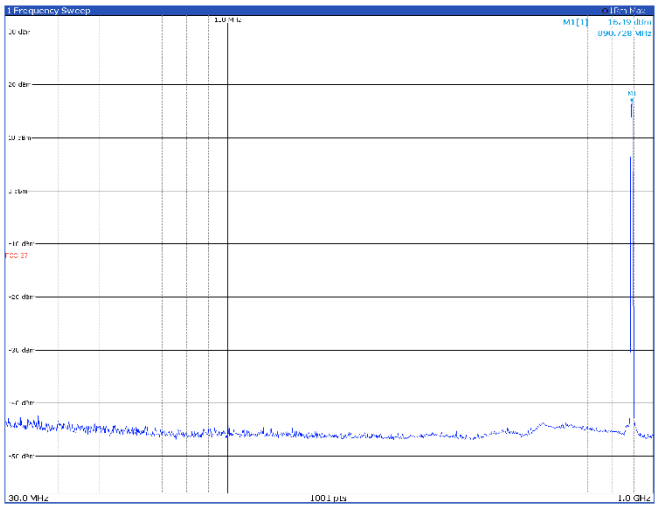
TM1.1, 10 MHz, mid channel

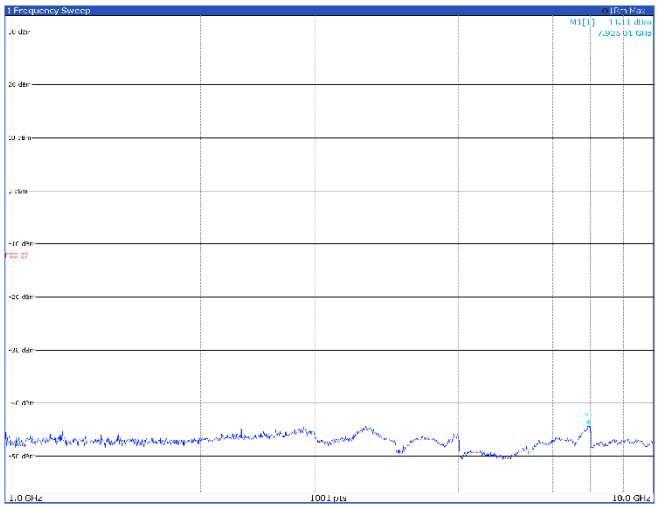




Limit exceeded by the carrier

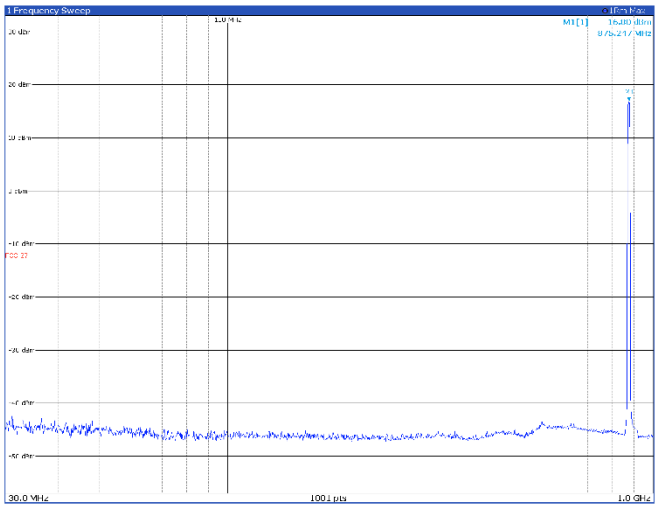
TM1.1, 10 MHz, high channel

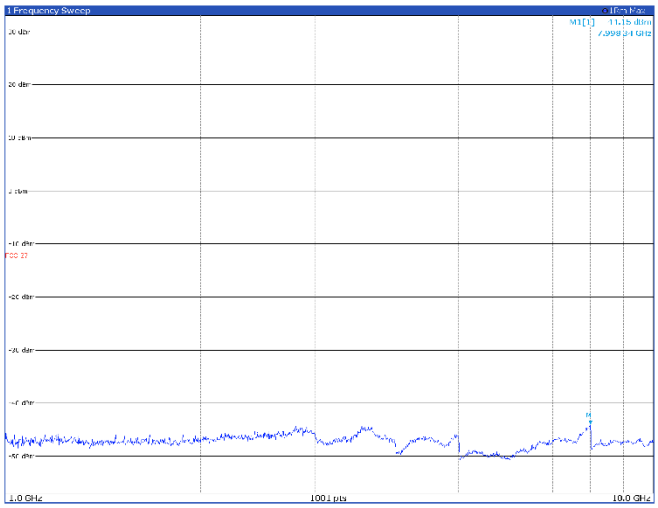




Limit exceeded by the carrier

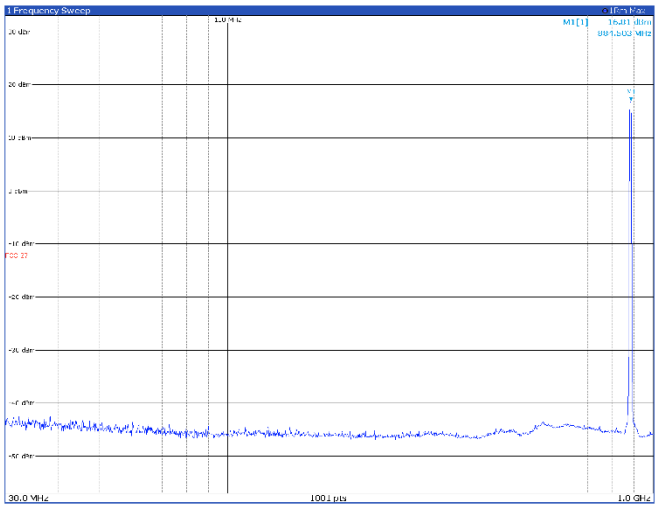
TM3p1, 10 MHz, low channel

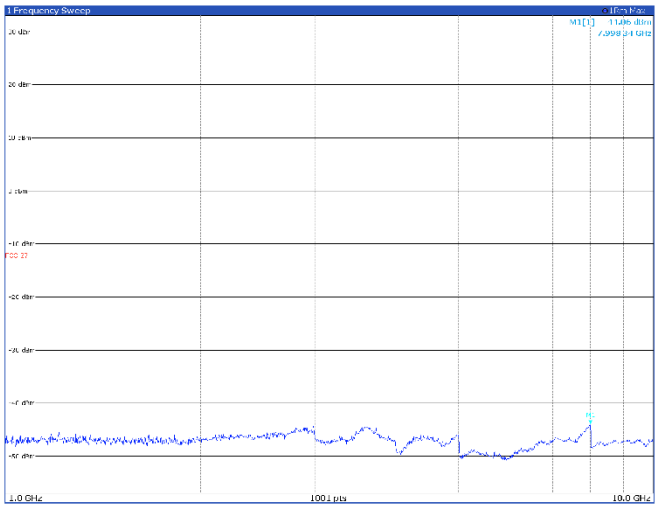




Limit exceeded by the carrier

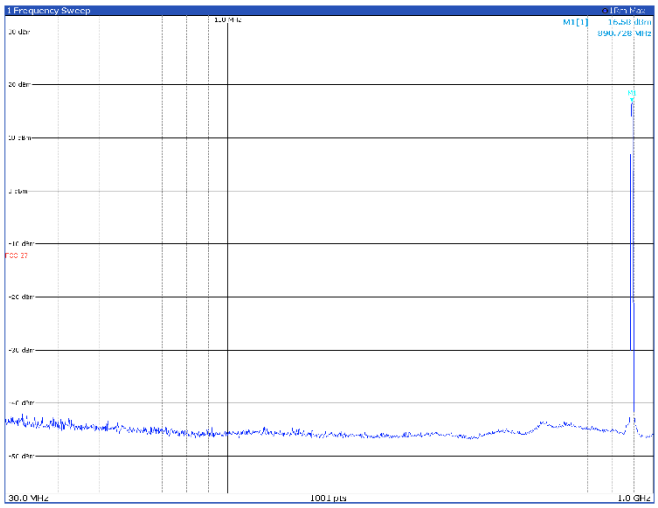
TM3p1, 10 MHz, mid channel

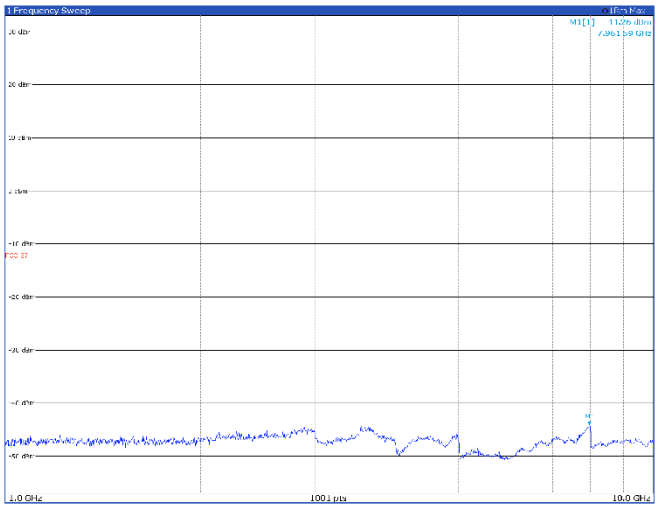




Limit exceeded by the carrier

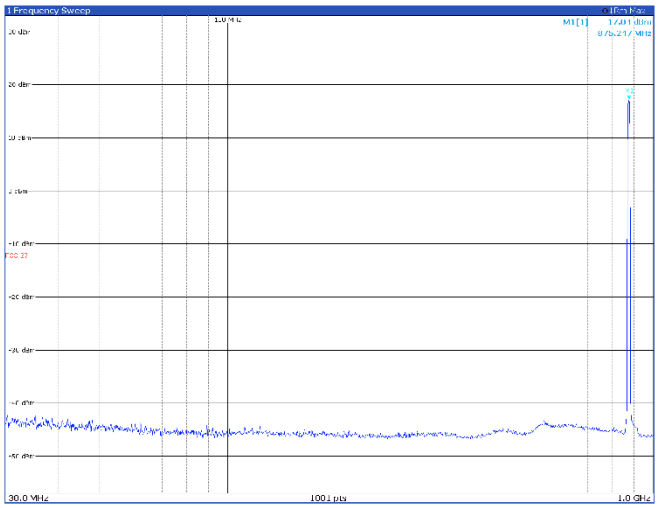
TM3p1, 10 MHz, high channel

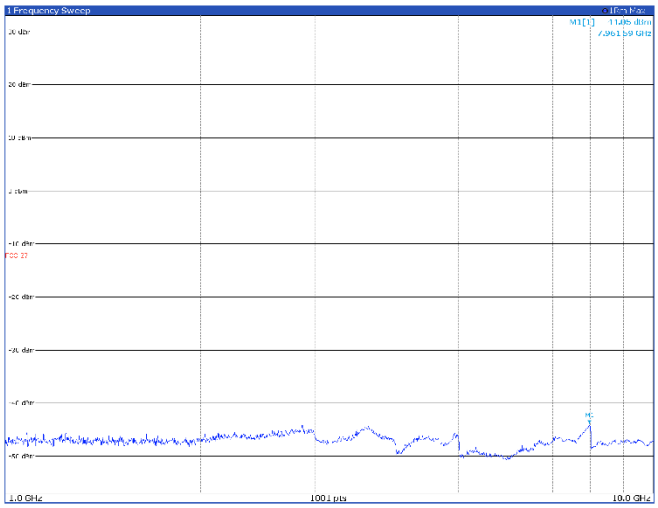




Limit exceeded by the carrier

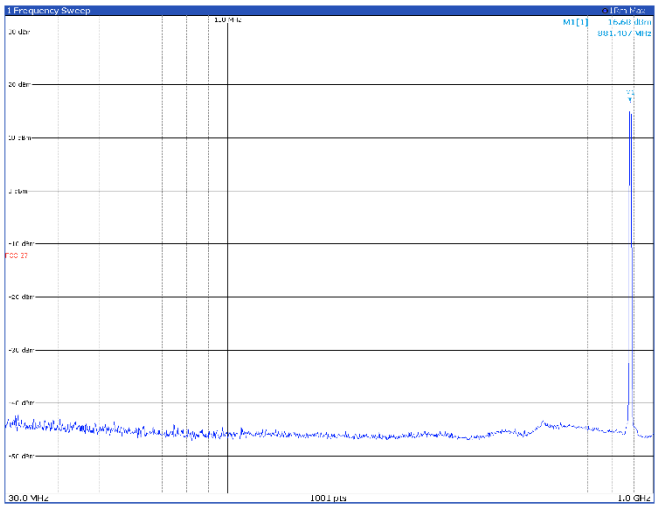
TM3p1a, 10 MHz, low channel

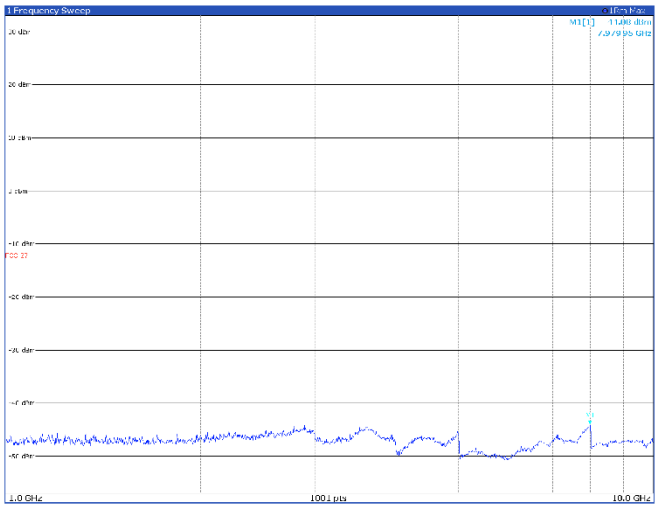




Limit exceeded by the carrier

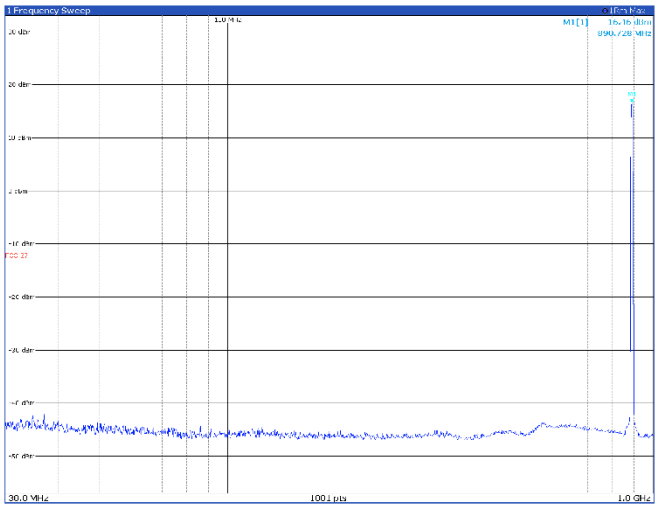
TM3p1a, 10 MHz, mid channel

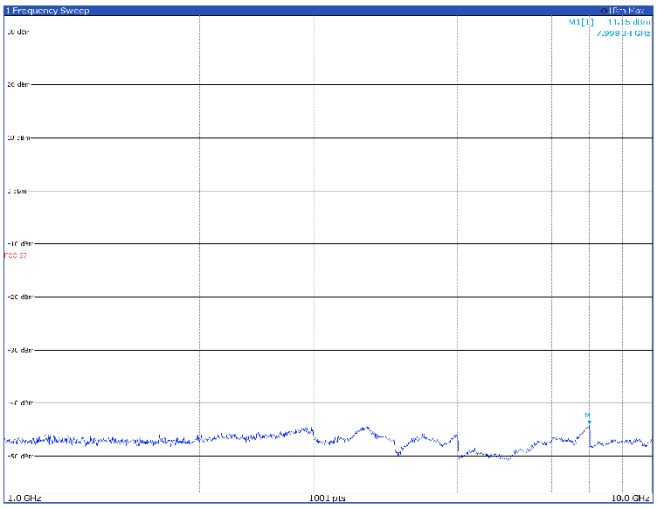




Limit exceeded by the carrier

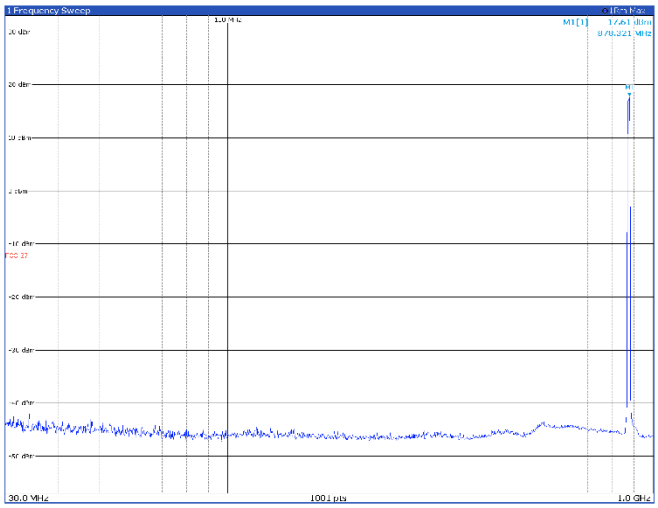
TM3p1a, 10 MHz, high channel

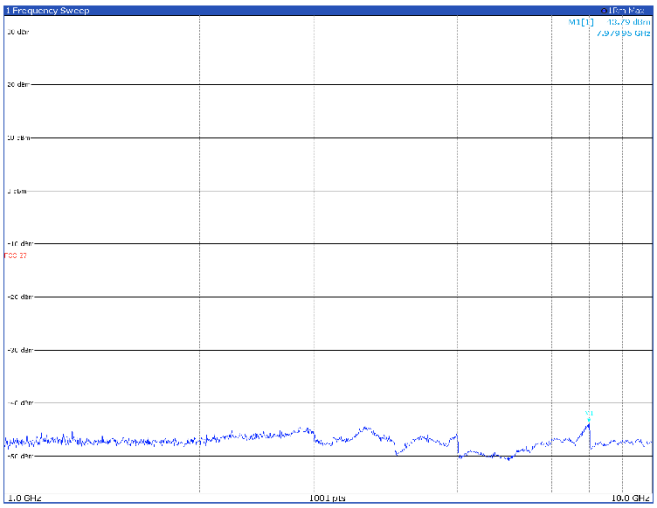




Limit exceeded by the carrier

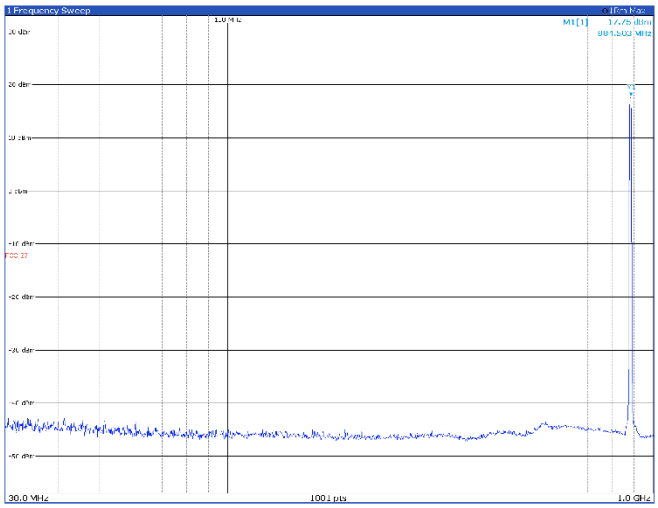
TM3p3, 10 MHz, low channel

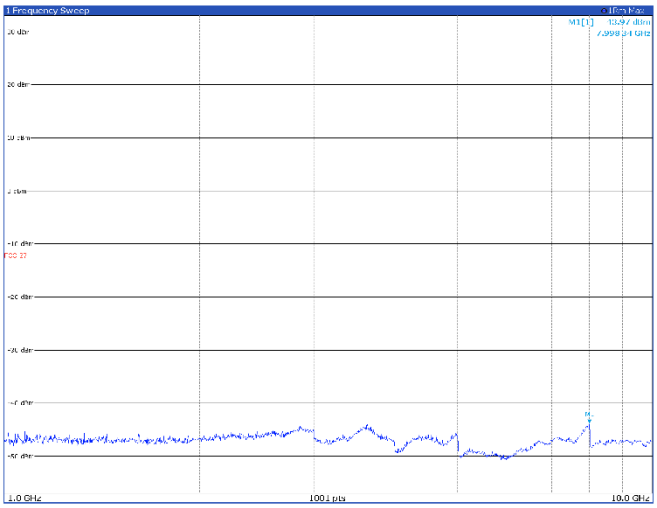




Limit exceeded by the carrier

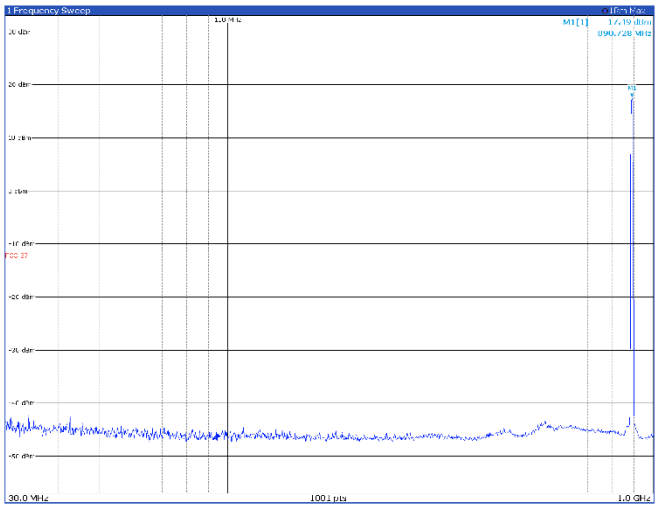
TM3p3, 10 MHz, mid channel

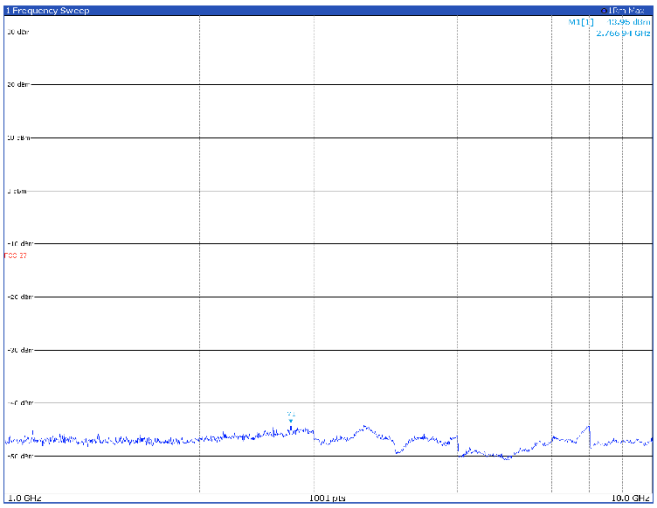




Limit exceeded by the carrier

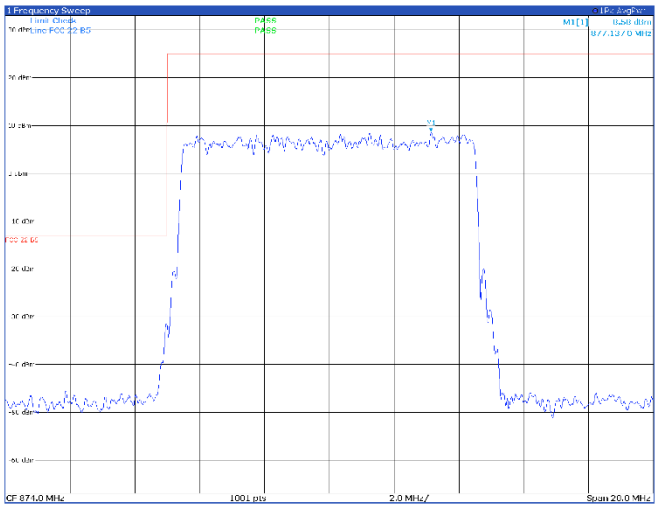
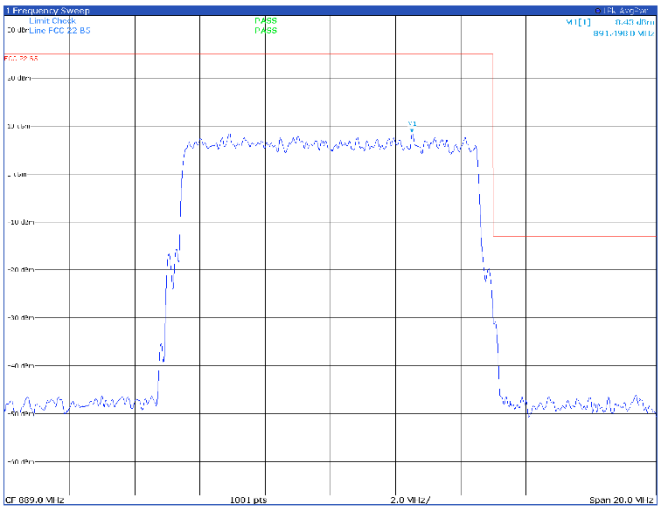
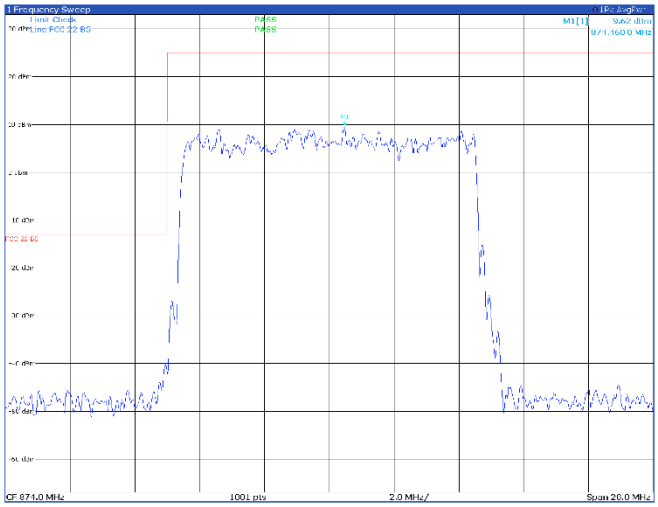
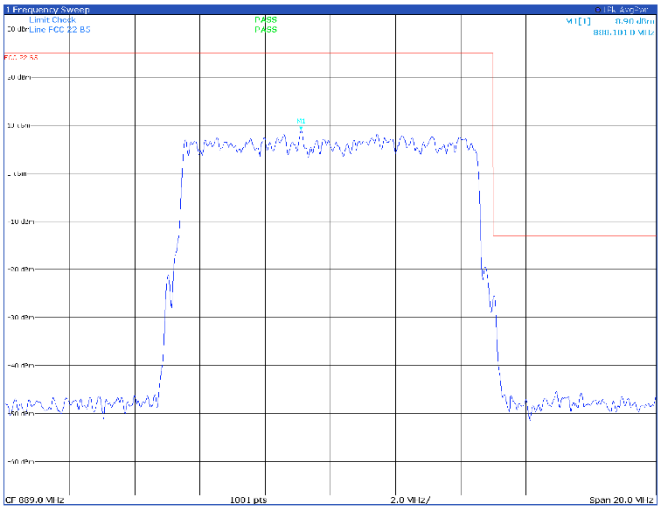
TM3p3, 10 MHz, high channel

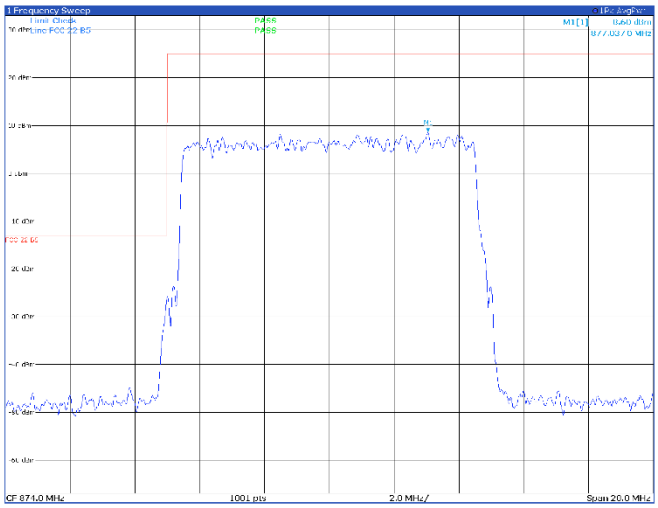
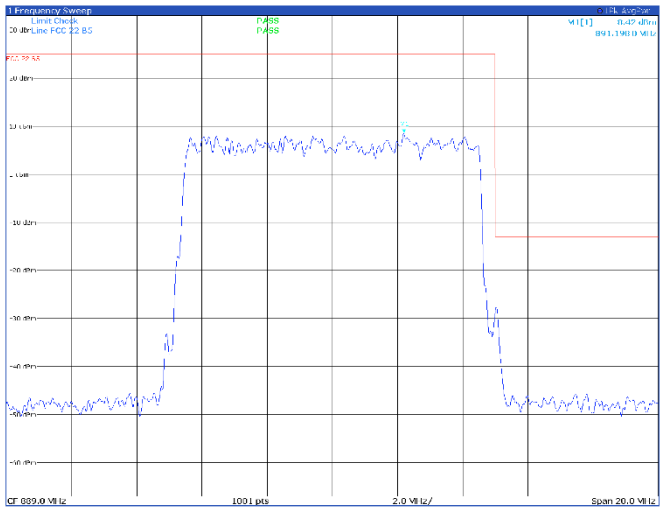
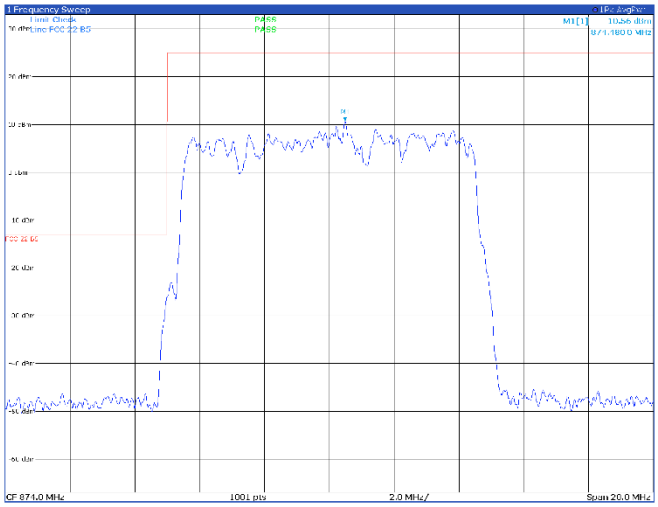
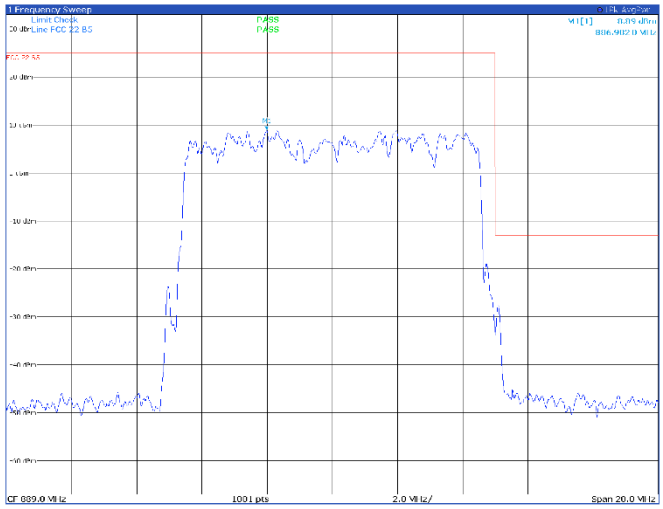




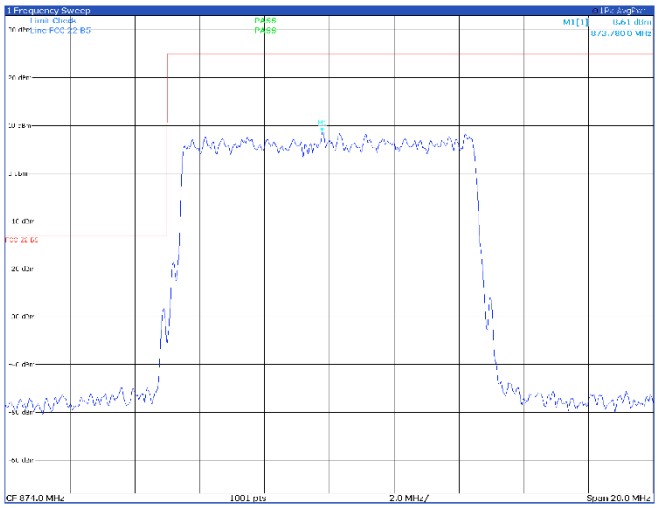
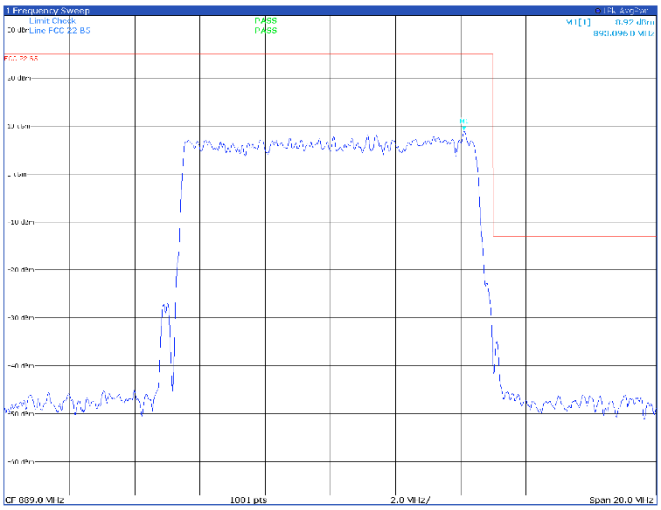
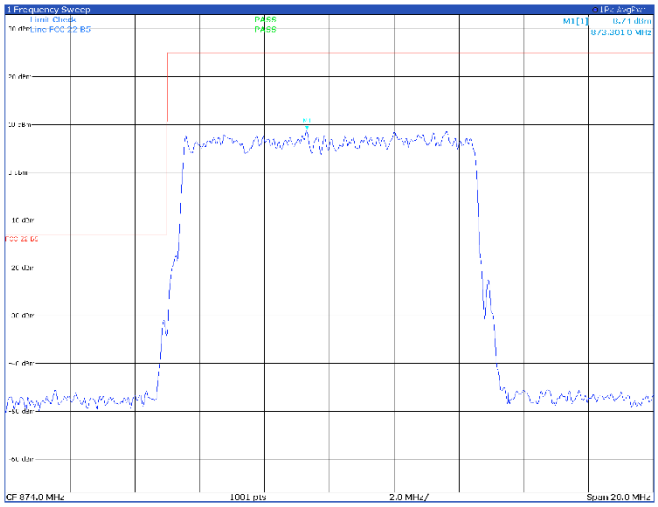
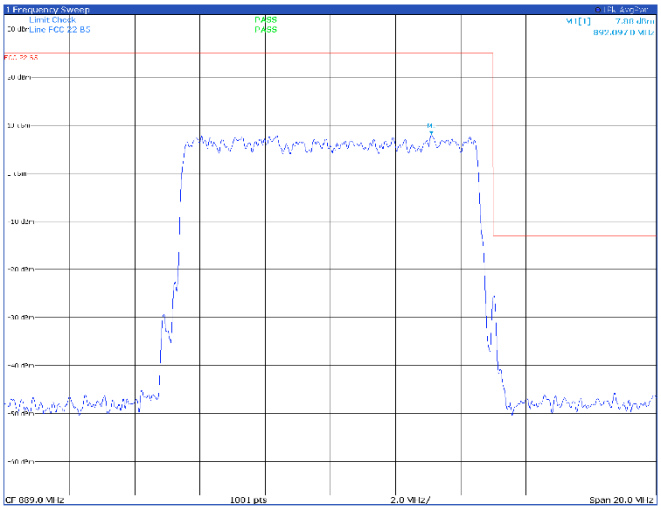
Limit exceeded by the carrier

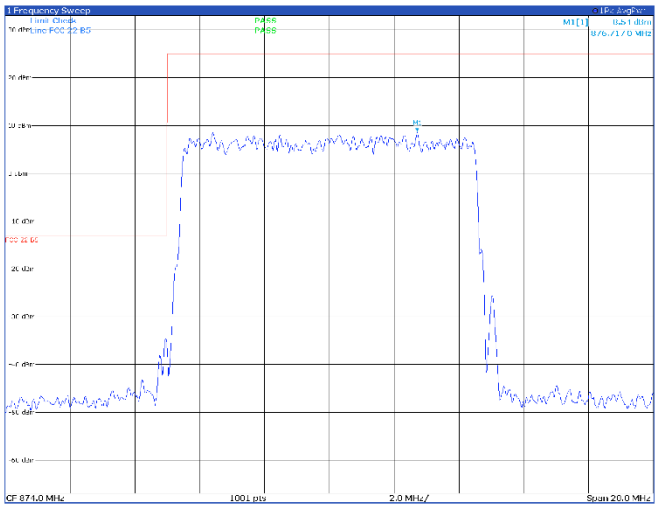
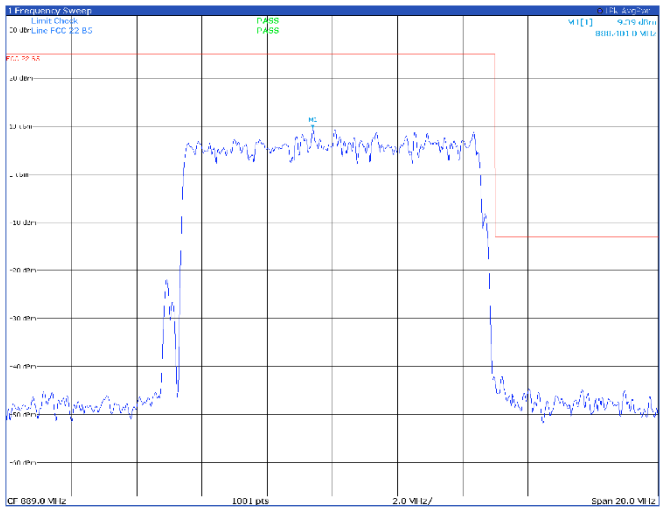
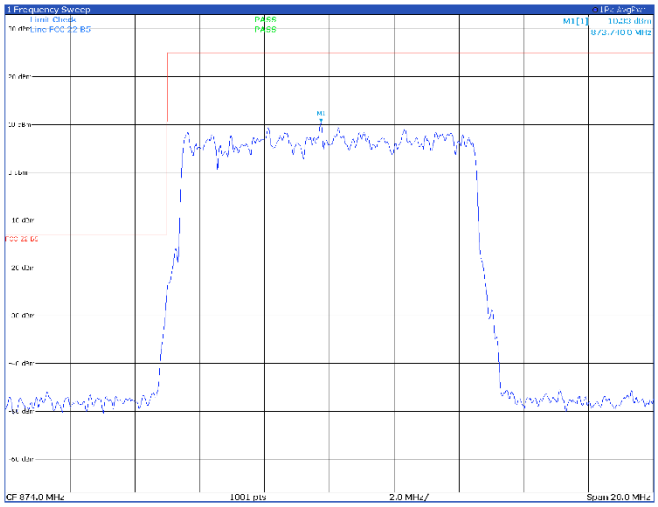
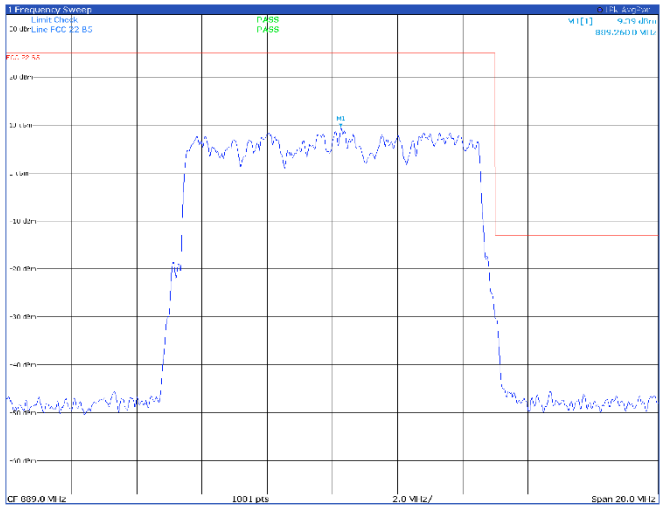
Band B5 – band edge Antenna port 1 **10 MHz**

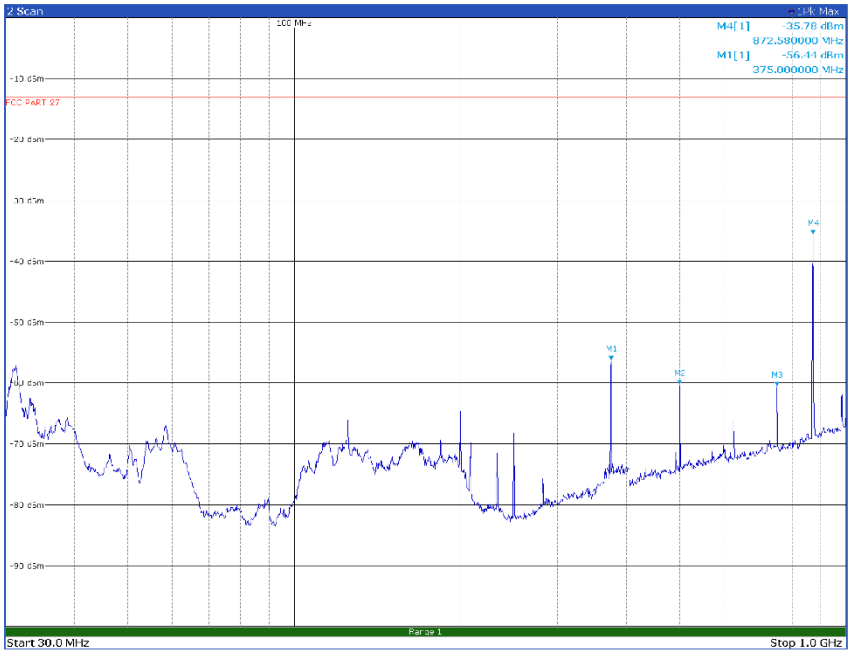
TM1.1, 10 MHz, low channel	TM1.1, 10 MHz, high channel
	
TM3p1, 10 MHz, low channel	**TM3p1, 10 MHz, high channel**
	

TM3p1a, 10 MHz, low channel	TM3p1a, 10 MHz, high channel
	
TM3p3, 10 MHz, low channel	**TM3p3, 10 MHz, high channel**
	

Band B5 – band edge Antenna port 2 **10 MHz**

TM1.1, 10 MHz, low channel	TM1.1, 10 MHz, high channel
	
TM3p1, 10 MHz, low channel	**TM3p1, 10 MHz, high channel**
	

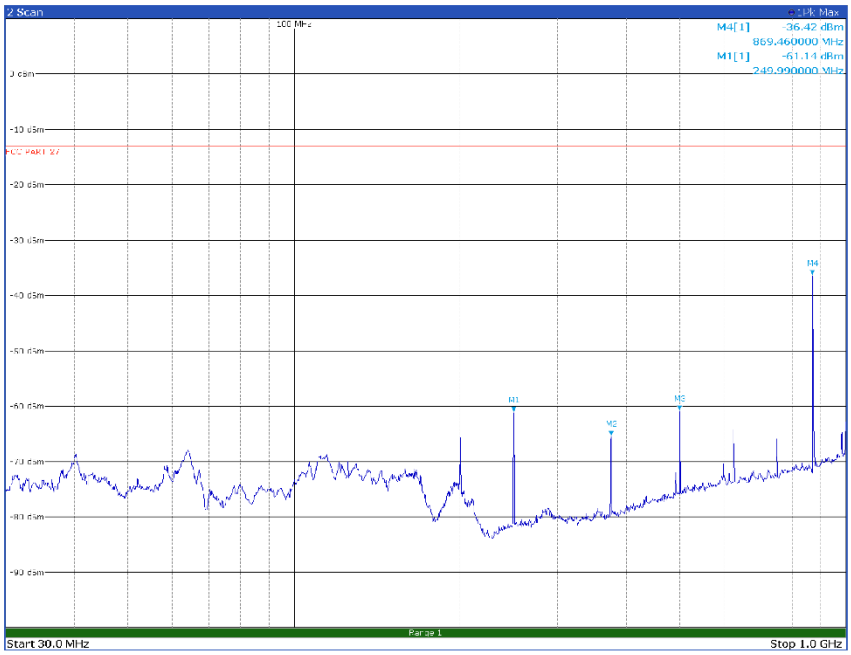
TM3p1a, 10 MHz, low channel	TM3p1a, 10 MHz, high channel
	
TM3p3, 10 MHz, low channel	**TM3p3, 10 MHz, high channel**
	



3 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	375.0 MHz	-56.44 dBm
Scan	M2		1	500.01 MHz	-60.44 dBm
Scan	M3		1	750.0 MHz	-60.74 dBm
Scan	M4		1	872.58 MHz	-35.78 dBm

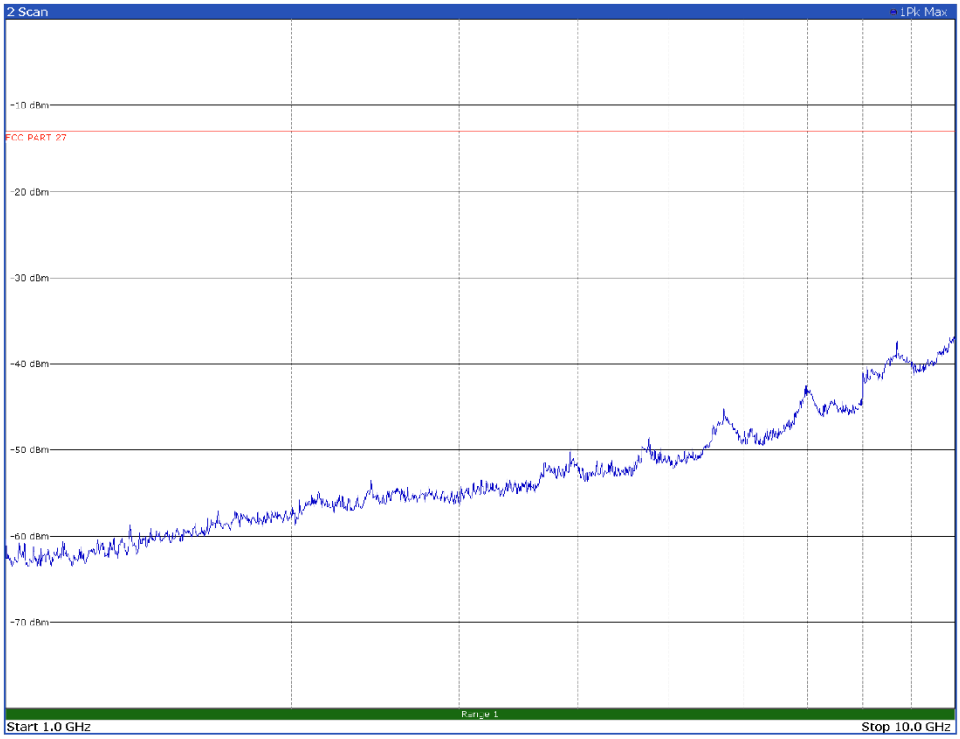
Radiated emissions spectral plot (30 MHz - 1 GHz), vertical polarization, low channel, TM3p1A modulation



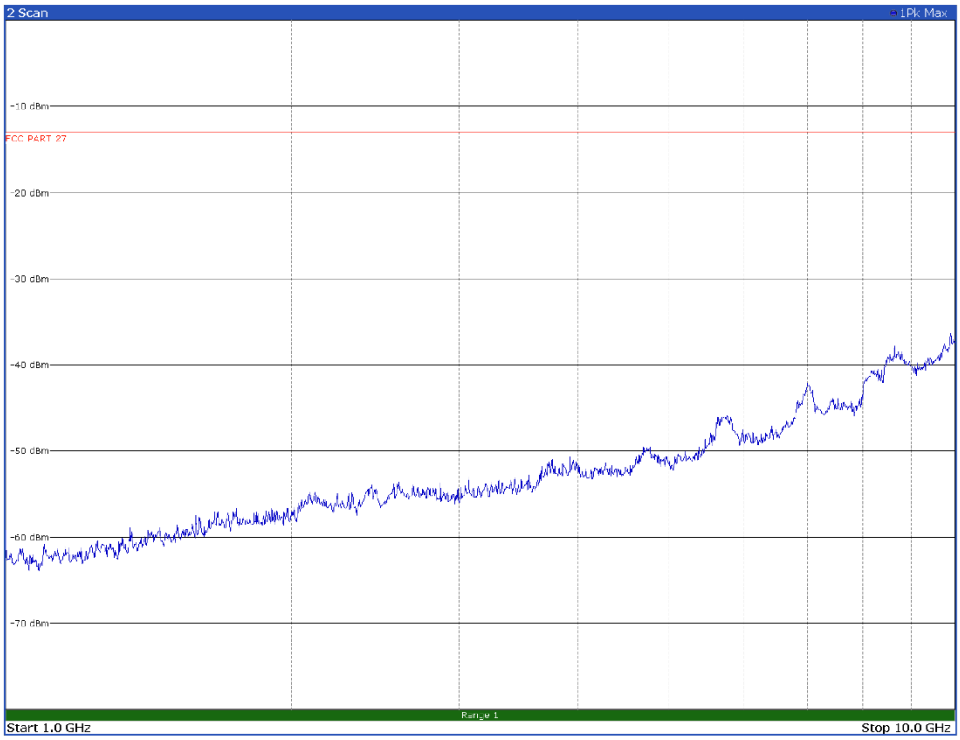
3 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	249.99 MHz	-61.14 dBm
Scan	M2		1	375.0 MHz	-65.44 dBm
Scan	M3		1	500.01 MHz	-60.9 dBm
Scan	M4		1	869.46 MHz	-36.42 dBm

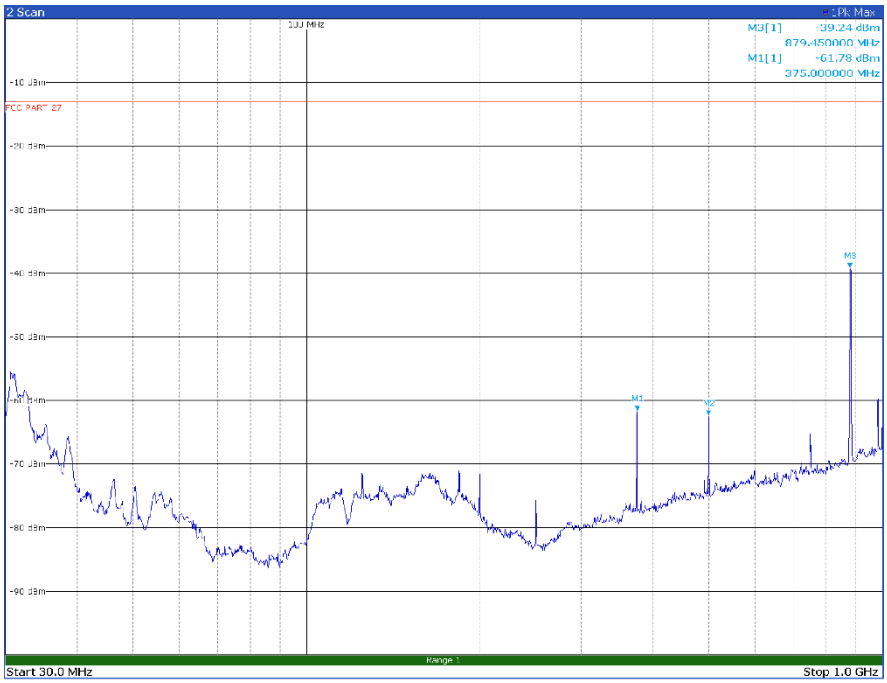
Radiated emissions spectral plot (30 MHz - 1 GHz), horizontal polarization, low channel, TM3p1a modulation



Radiated emissions spectral plot (1 GHz - 10 GHz), vertical polarization, low channel, TM3p1a modulation



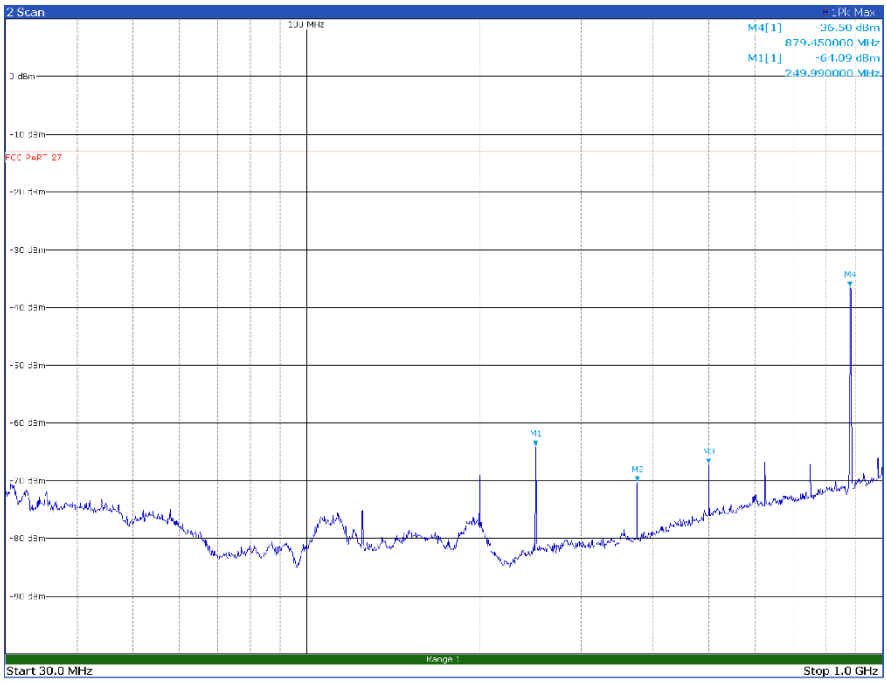
Radiated emissions spectral plot (1 GHz - 10 GHz), horizontal polarization, low channel, TM3p1a modulation



3 Marker Table

Wnd	Type	Rel	Trc	X-value	Y-value
Scan	M1		1	375.0 MHz	-61.78 dBm
Scan	M2		1	500.01 MHz	-62.46 dBm
Scan	M3		1	879.45 MHz	-39.24 dBm

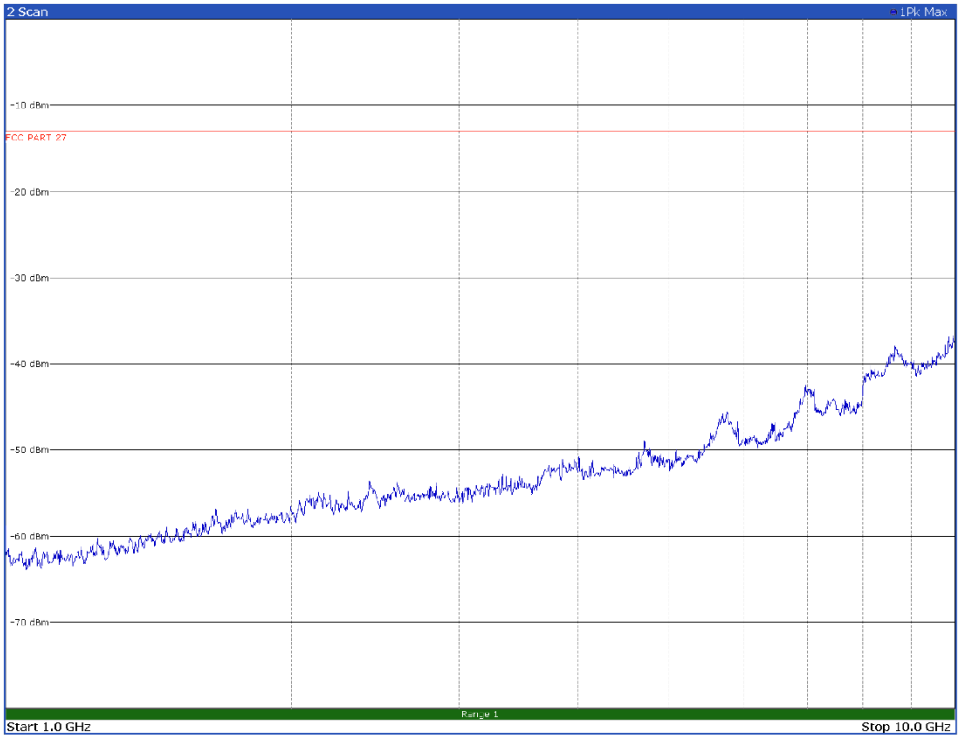
Radiated emissions spectral plot (30 MHz - 1 GHz), vertical polarization, mid channel, TM3p1a modulation



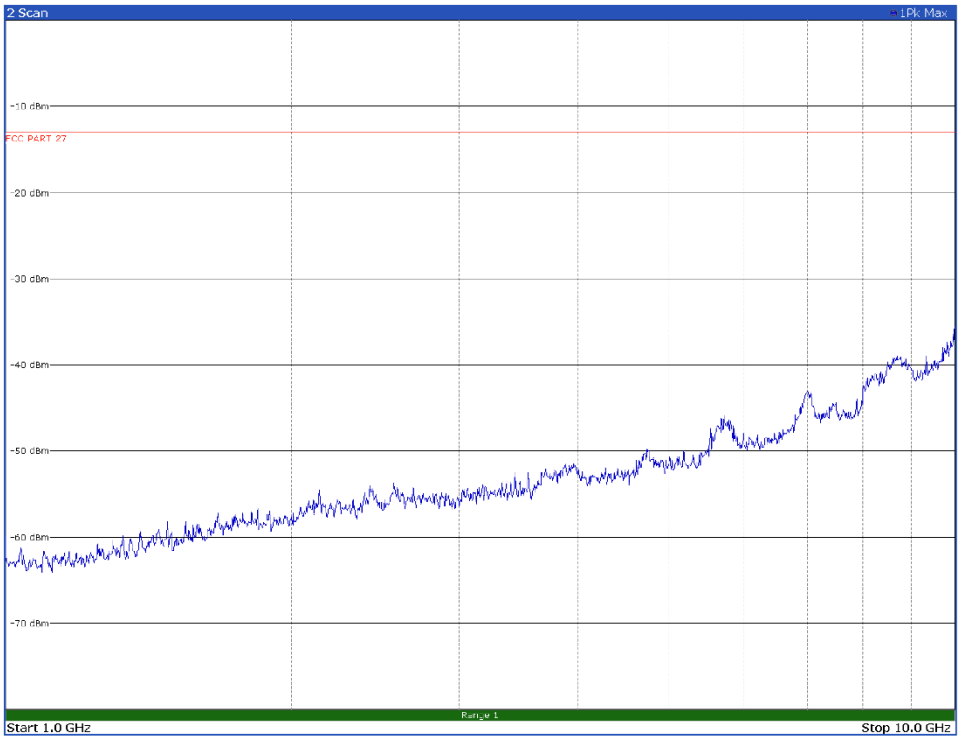
3 Marker Table

Wnd	Type	Rel	Trc	X-value	Y-value
Scan	M1		1	249.99 MHz	-64.09 dBm
Scan	M2		1	375.0 MHz	-70.28 dBm
Scan	M3		1	500.01 MHz	-67.22 dBm
Scan	M4		1	879.45 MHz	-36.5 dBm

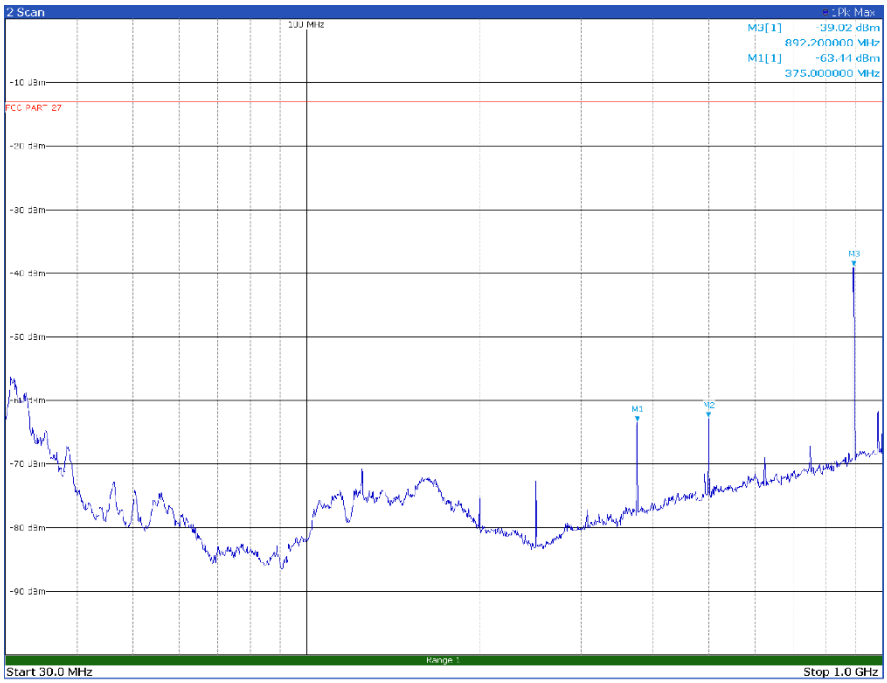
Radiated emissions spectral plot (30 MHz - 1 GHz), horizontal polarization, mid channel, TM3p1a modulation



Radiated emissions spectral plot (1 GHz - 10 GHz), vertical polarization, mid channel, TM3p1a modulation



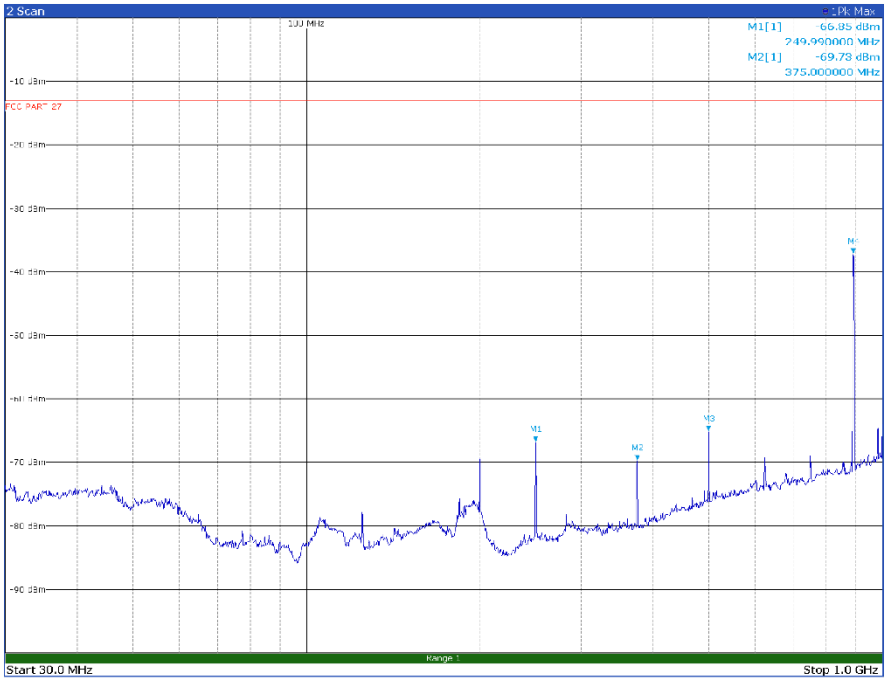
Radiated emissions spectral plot (1 GHz - 10 GHz), horizontal polarization, mid channel, TM3p1a modulation



3 Marker Table

Wnd	Type	Rel	Trc	X-value	Y-value
Scan	M1		1	375.0 MHz	-63.44 dBm
Scan	M2		1	500.01 MHz	-62.78 dBm
Scan	M3		1	892.2 MHz	-39.02 dBm

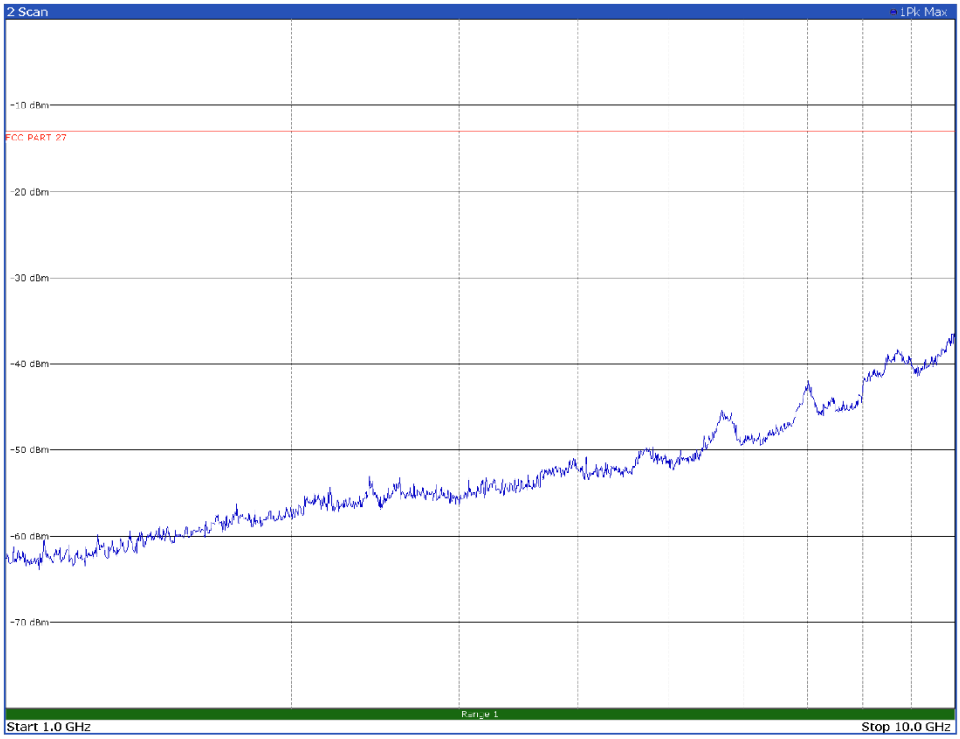
Radiated emissions spectral plot (30 MHz - 1GHz), vertical polarization, high channel, TM3p1a modulation



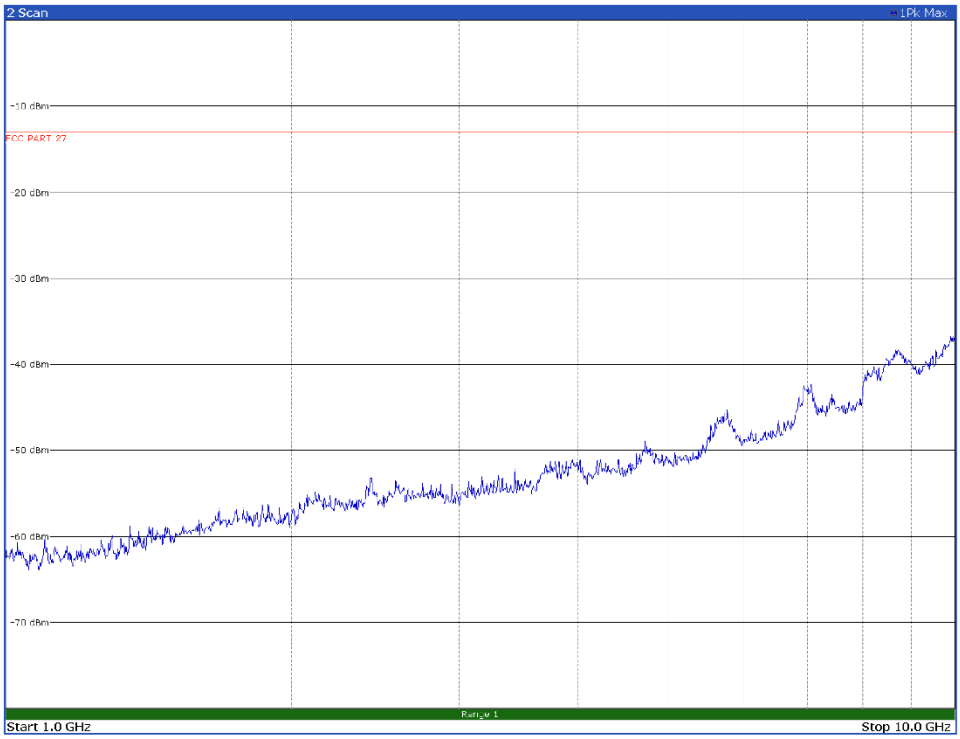
3 Marker Table

Wnd	Type	Rel	Trc	X-value	Y-value
Scan	M1		1	249.99 MHz	-66.85 dBm
Scan	M2		1	375.0 MHz	-69.73 dBm
Scan	M3		1	500.01 MHz	-65.2 dBm
Scan	M4		1	889.47 MHz	-37.24 dBm

Radiated emissions spectral plot (30 MHz - 1GHz), horizontal polarization, high channel, TM3p1a modulation



Radiated emissions spectral plot (1 GHz - 10 GHz), vertical polarization, high channel, TM3p1a modulation



Radiated emissions spectral plot (1 GHz - 10 GHz), horizontal polarization, high channel, TM3p1a modulation

8.7 FCC 22.917 Frequency Stability

8.7.1 Definitions and limits

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

8.7.2 Test summary

Test date	October 21, 2024	Temperature	21 °C
Test engineer	O. Frau	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	64%

8.7.3 Observations, settings and special notes

The EUT was configured to continuously transmit an un-modulated continuous wave signal. The frequency measurement was performed using the marker-signal count functionality of the spectrum analyzer. The only requirement from Part 24 is that the carrier stays within the allocated band.

8.7.4 Test data

Band B5:

*Table **Errore. Per applicare Heading 2 al testo da visualizzare in questo punto, utilizzare la scheda Home.**-1: Frequency stability results, band B5*

Test conditions	Frequency, Hz	Drift, Hz	Drift, ppm
+50 °C, Nominal	881500329.0	565.0	0.64
+40 °C, Nominal	881499920.0	156.0	0.18
+30 °C, Nominal	881499819.0	55.0	0.06
+20 °C, +15%	881499767.0	3.0	0.00
+20 °C, Nominal	881499764.0	Reference	Reference
+20 °C, -15%	881499765.0	1.0	0.00
+10 °C, Nominal	881500039.0	275.0	0.31
0 °C, Nominal	881499722.0	-42.0	-0.05
-10 °C, Nominal	881499736.0	-28.0	-0.03
-20 °C, Nominal	881500336.0	572.0	0.65
-30 °C, Nominal	881500487.0	723.0	0.82

Section 9. Block diagrams of test setups

9.1 Conducted emissions set-up

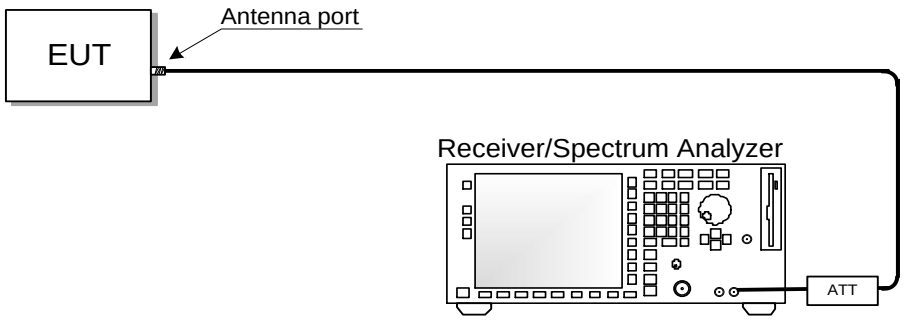


Figure 9.1-1: Conducted setup

9.2 Radiated emissions set-up

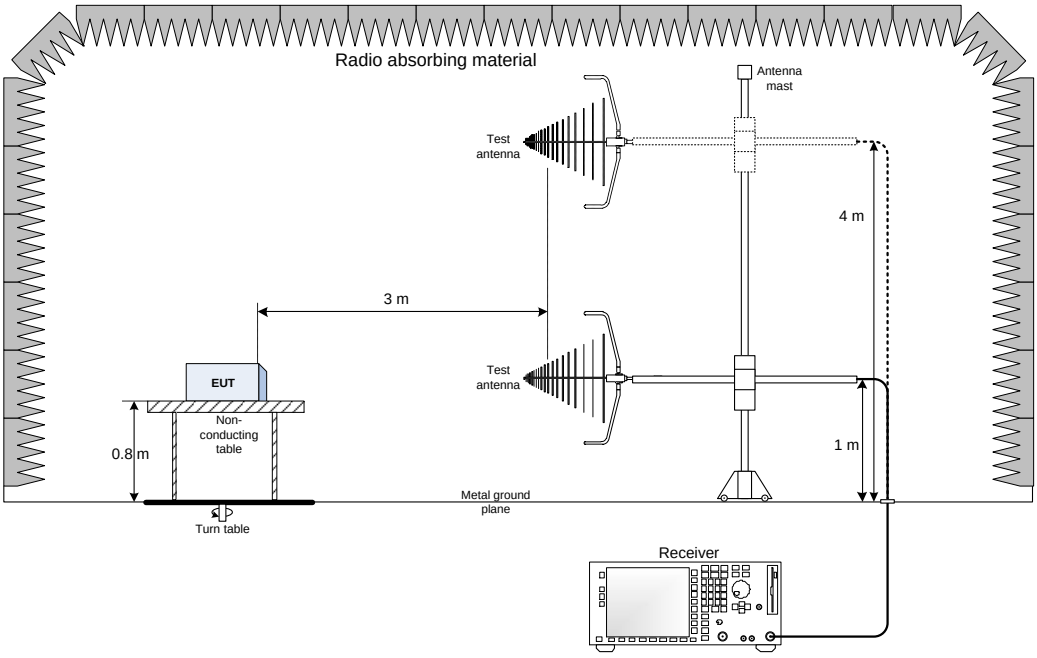


Figure 9.2-1: Below 1 GHz setup

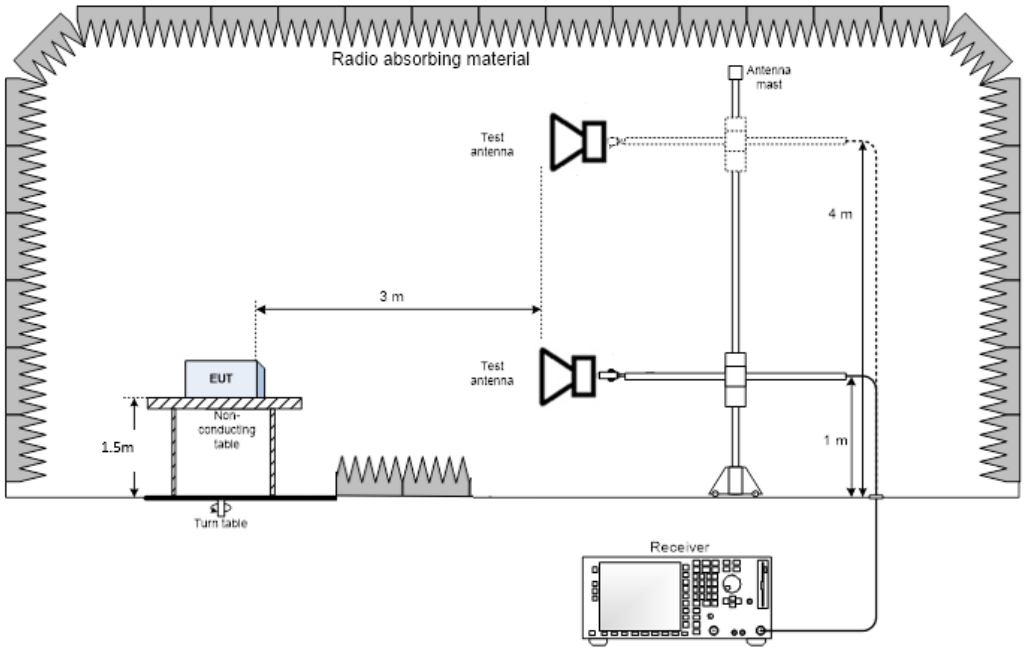


Figure 9.2-2: Above 1GHz setup

End of Report