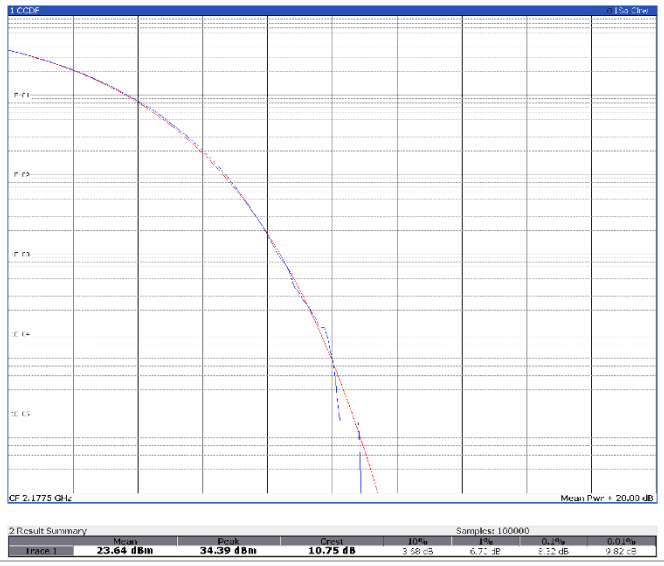
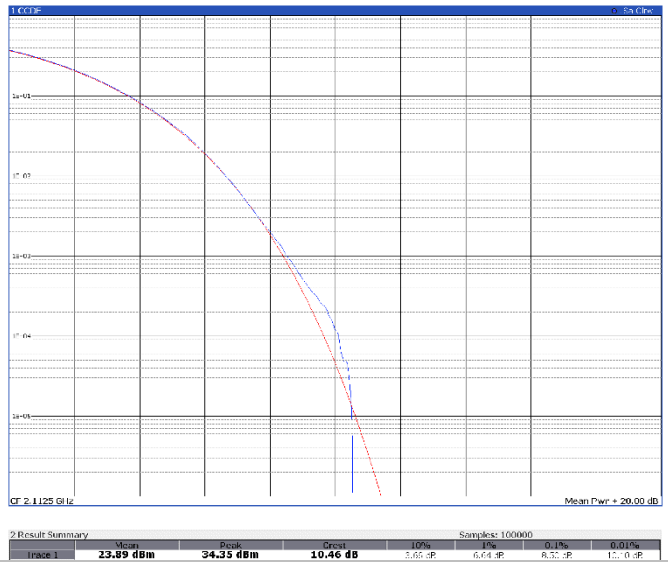
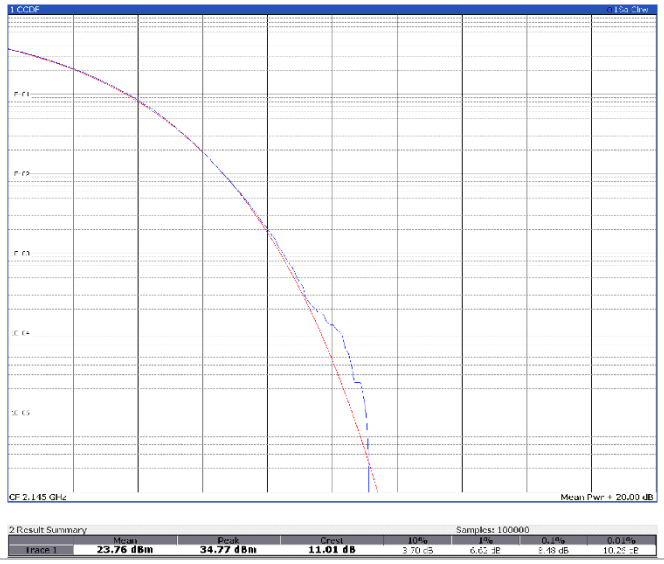
TM3p1a, 5 MHz, high channel



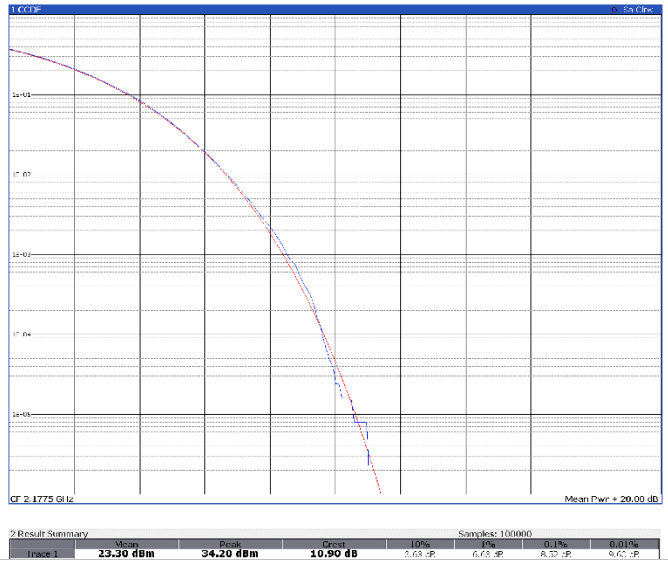
TM3p3, 5 MHz, low channel



TM3p3, 5 MHz, mid channel

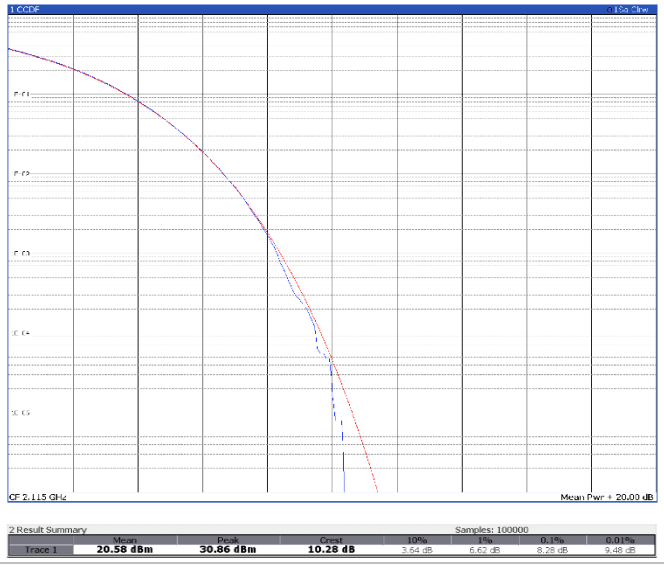


TM3p3, 5 MHz, high channel

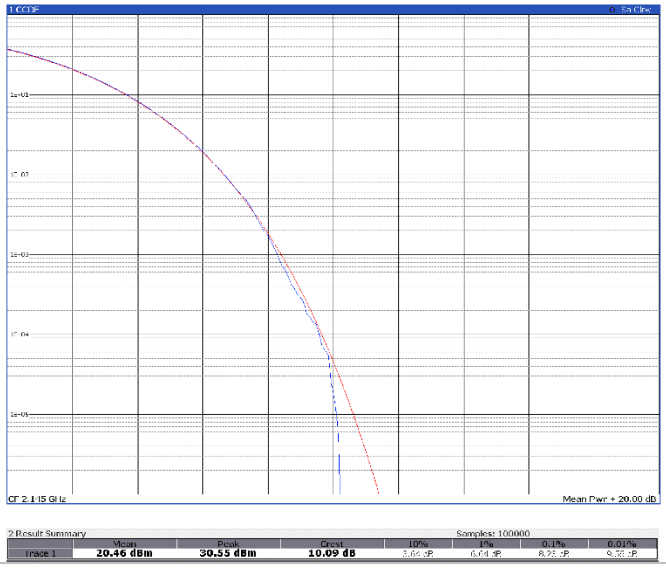


Band n66 | **10 MHz**

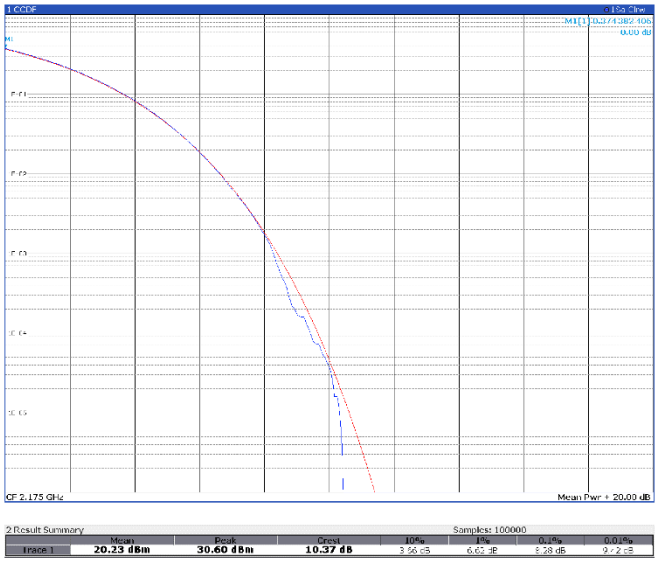
T TM1.1, 10 MHz, low channel



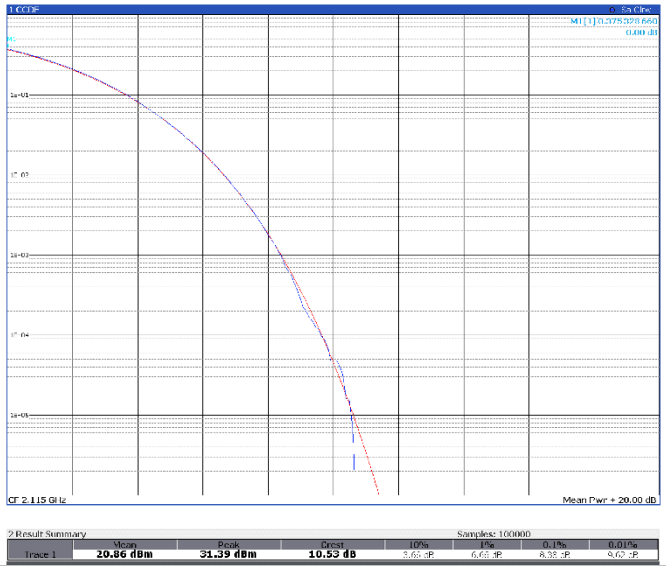
TM1.1, 10 MHz, mid channel



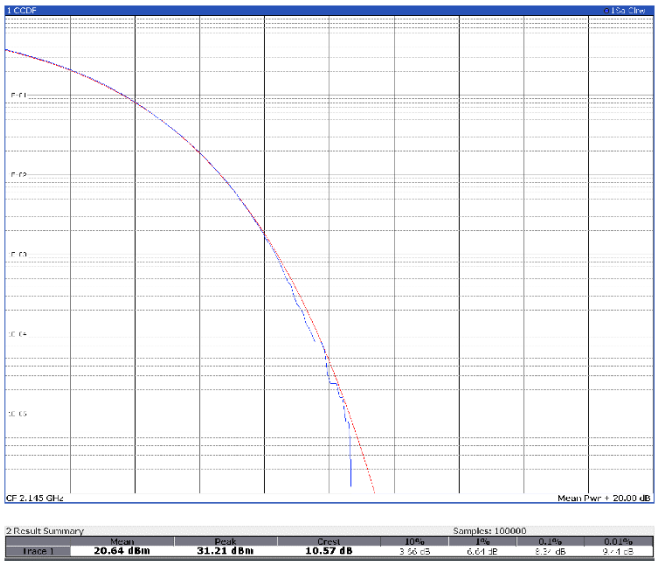
TM1.1, 10 MHz, high channel



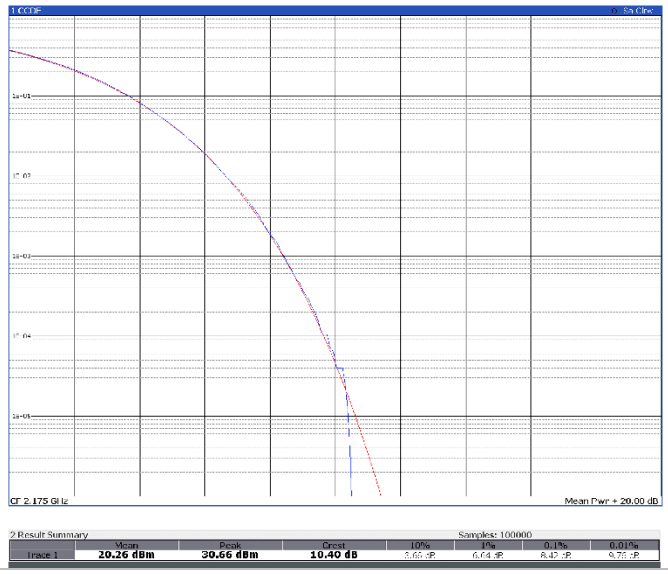
TM3p1, 10 MHz, low channel



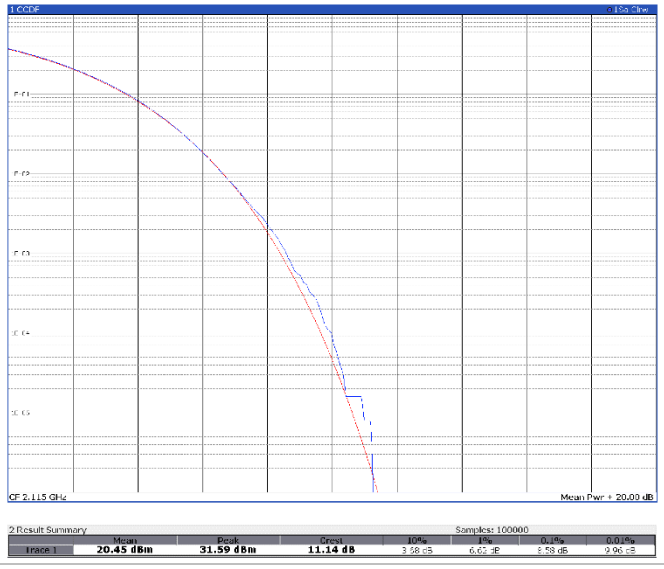
TM3p1, 10 MHz, mid channel



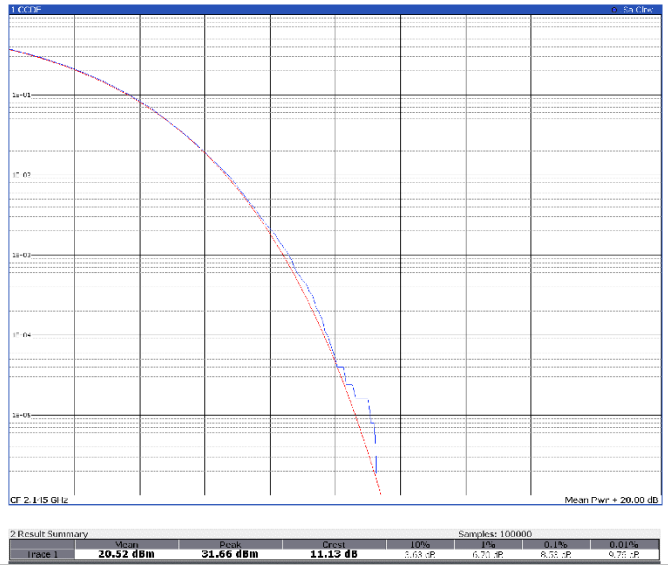
TM3p1, 10 MHz, high channel



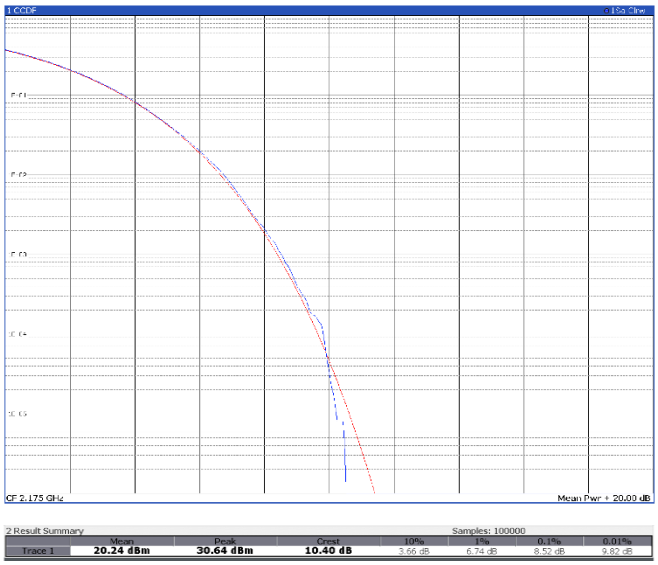
TM3p1a, 10 MHz, low channel



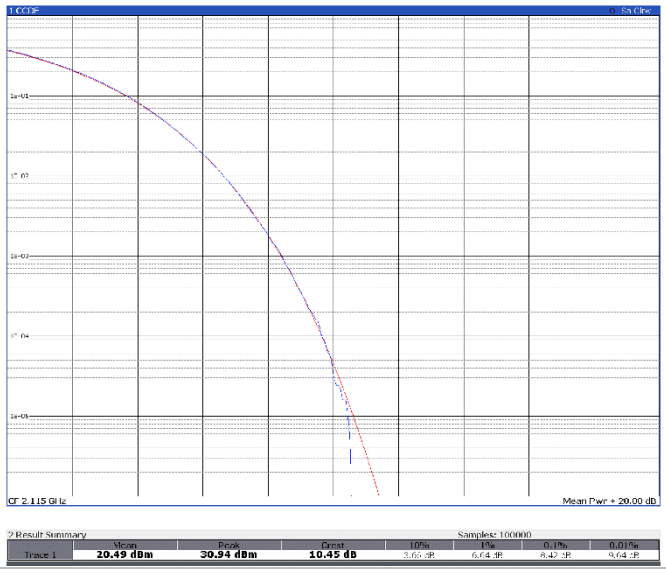
TM3p1a, 10 MHz, mid channel



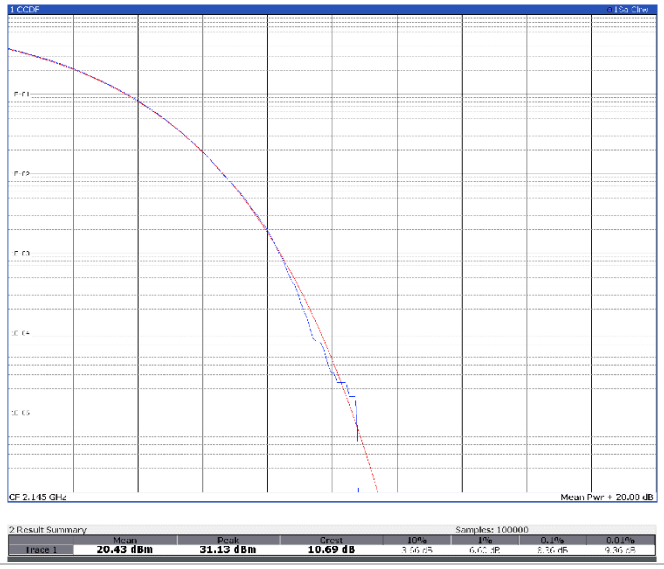
TM3p1a, 10 MHz, high channel



TM3p3, 10 MHz, low channel



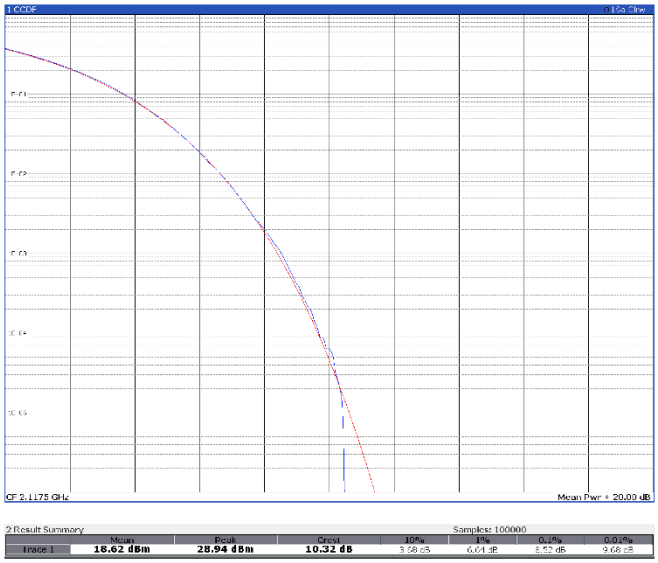
TM3p3, 10 MHz, mid channel



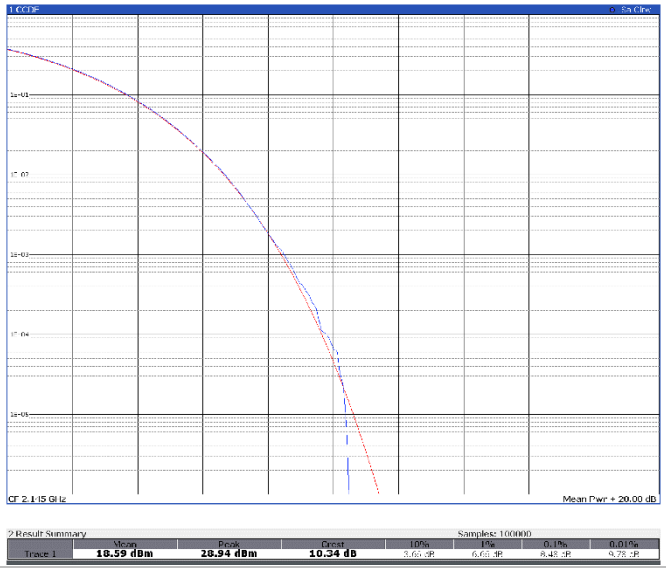
TM3p3, 10 MHz, high channel

Band n66 | **15 MHz**

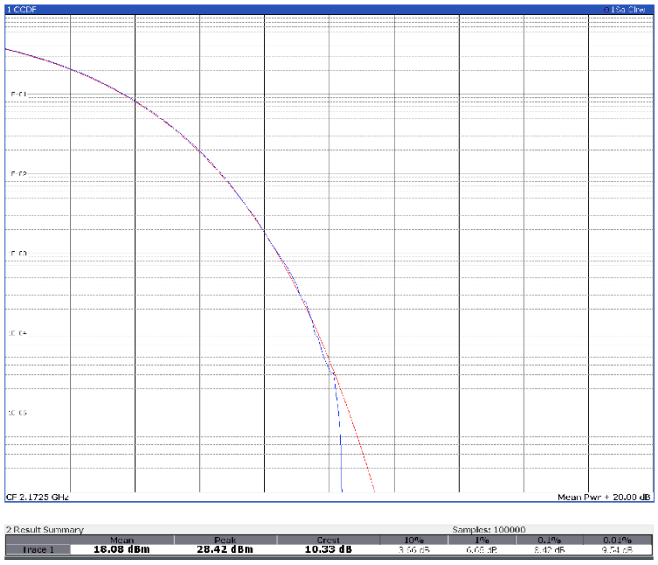
TM1.1, 15 MHz, low channel



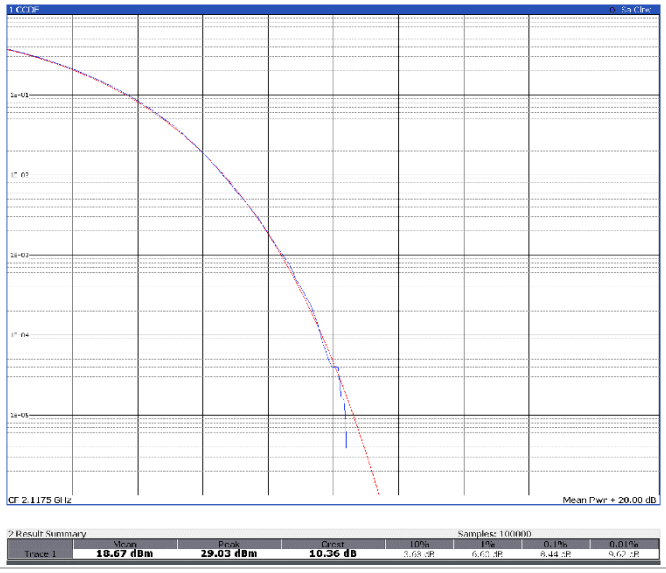
TM1.1, 15 MHz, mid channel



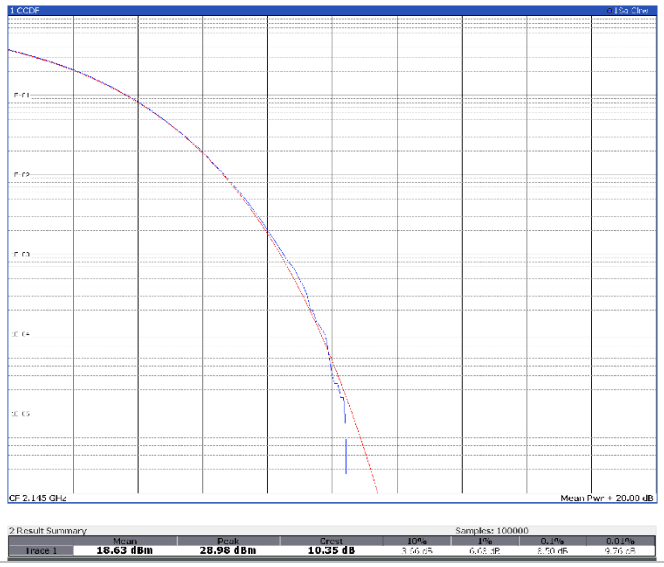
TM1.1, 15 MHz, high channel



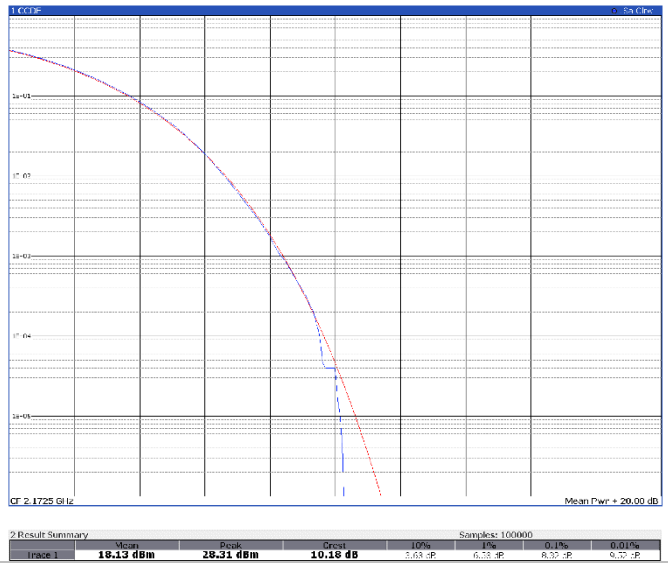
TM3p1, 15 MHz, low channel



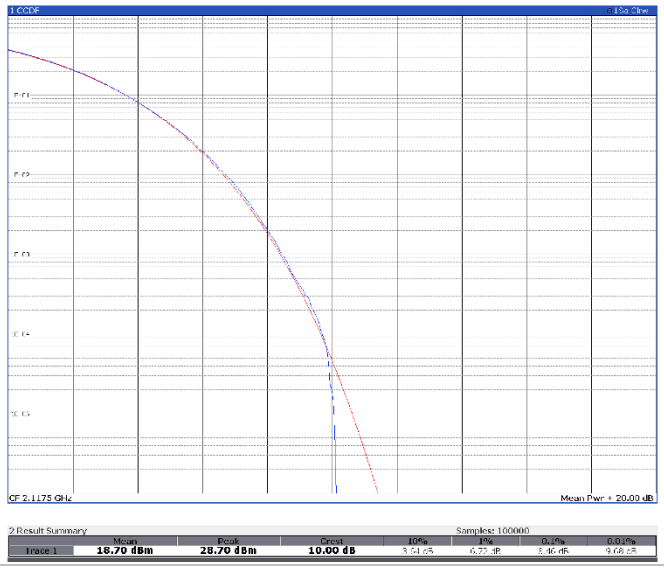
TM3p1, 15 MHz, mid channel



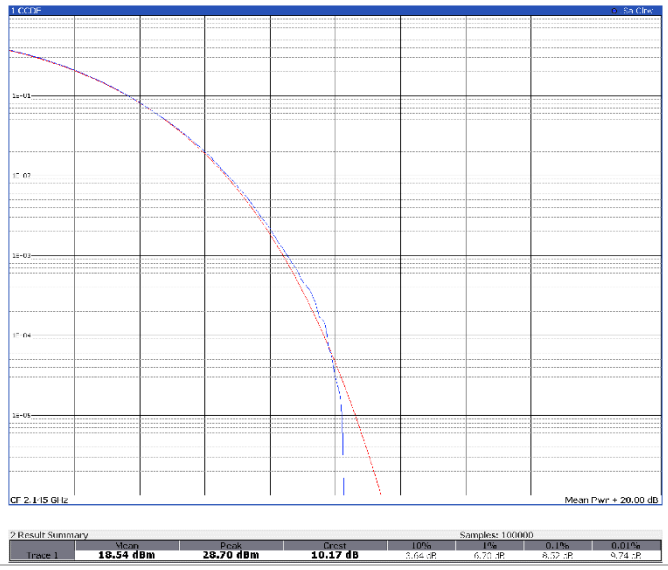
TM3p1, 15 MHz, high channel



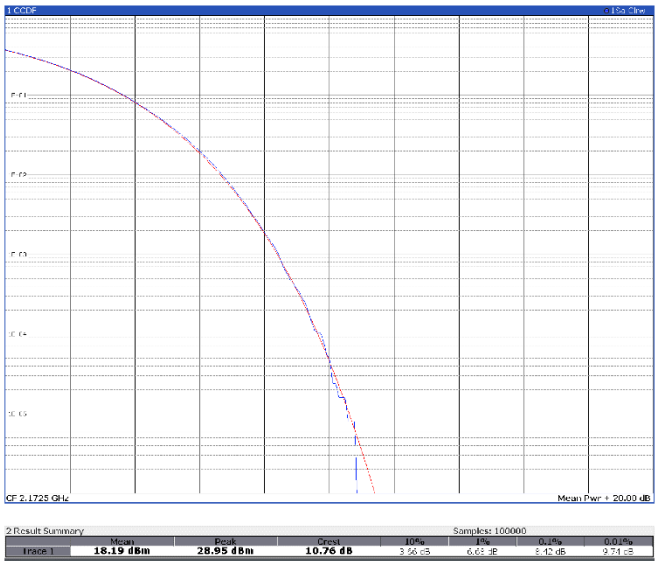
TM3p1a, 15 MHz, low channel



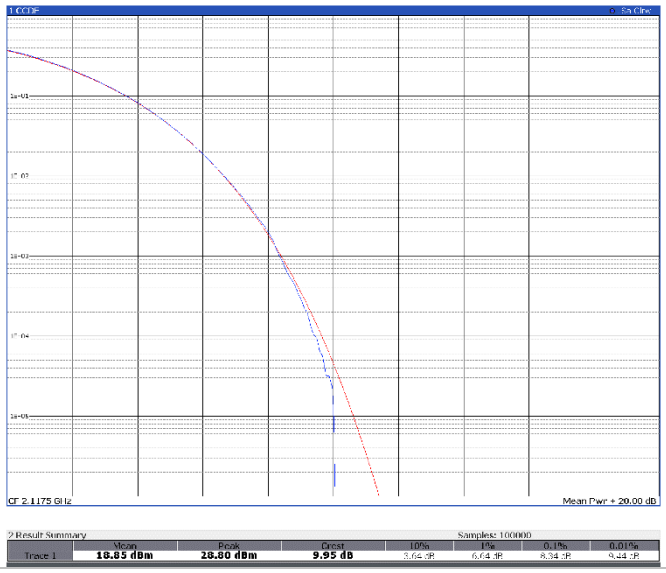
TM3p1a, 15 MHz, mid channel



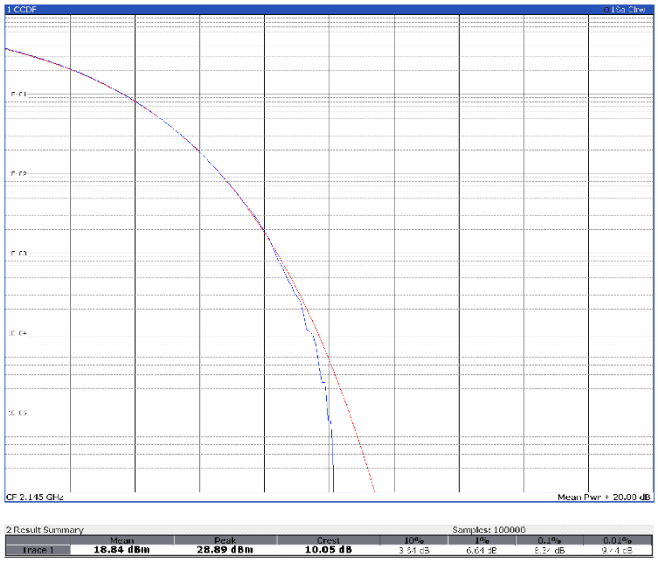
TM3p1a, 15 MHz, high channel



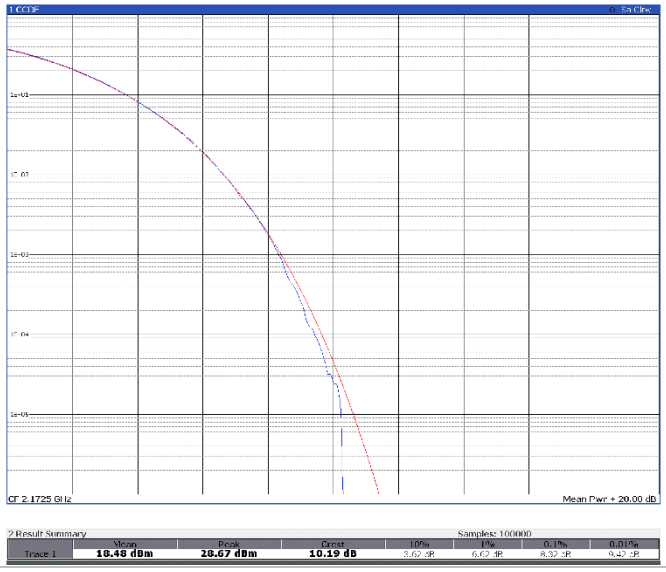
TM3p3, 15 MHz, low channel



TM3p3, 15 MHz, mid channel

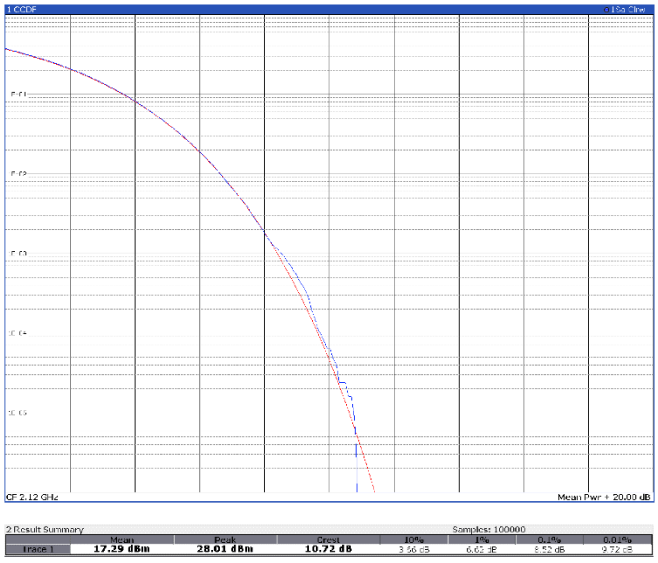


TM3p3, 15 MHz, high channel

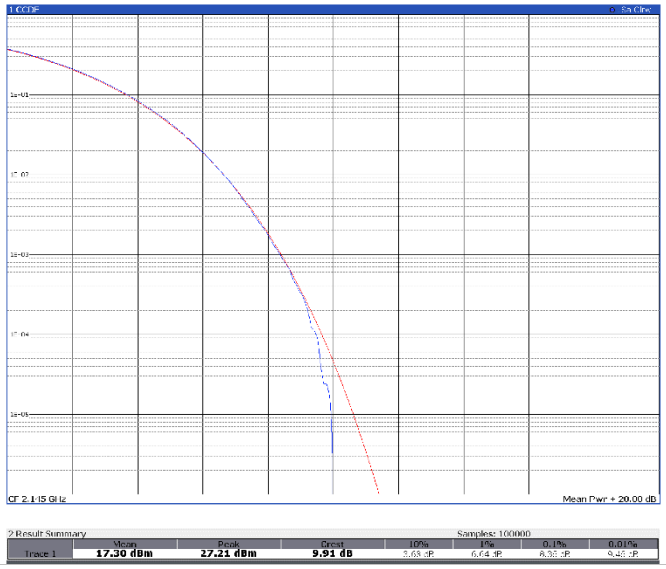


Band n66 | **20 MHz**

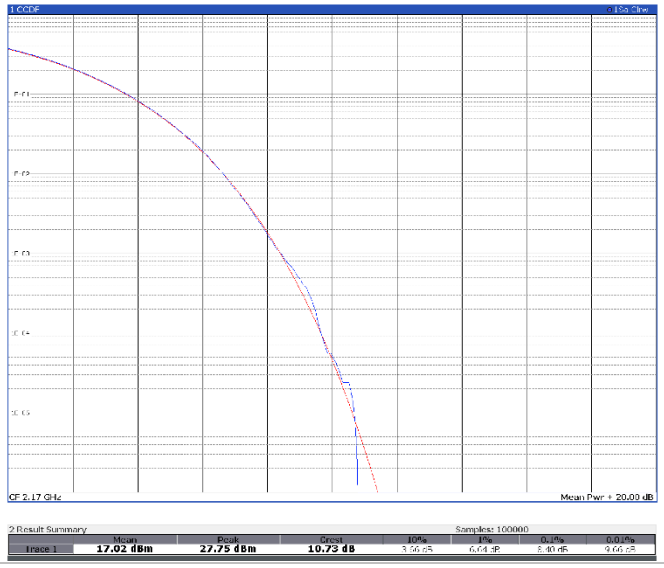
TM1.1, 20 MHz, low channel



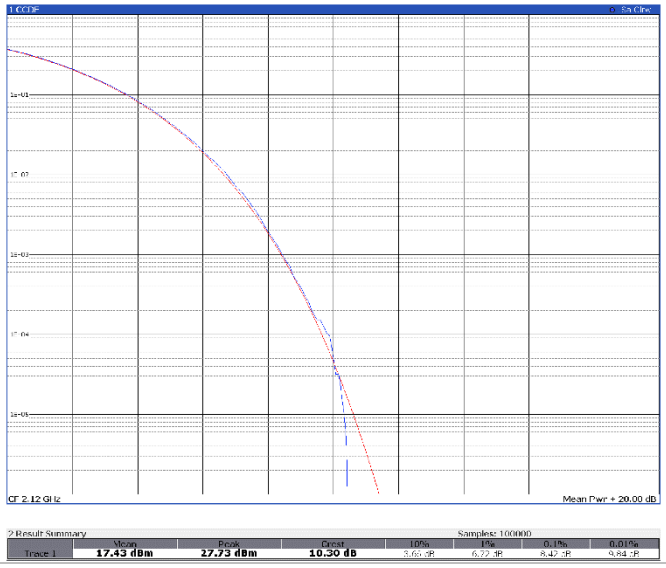
TM1.1, 20 MHz, mid channel



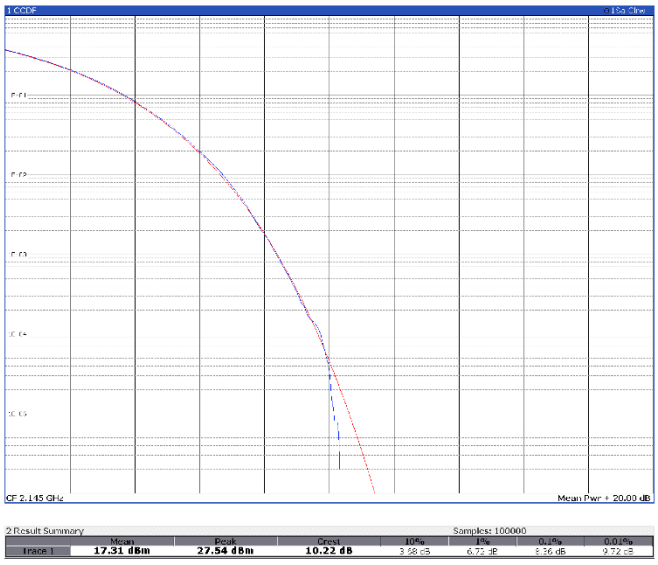
TM1.1, 20 MHz, high channel



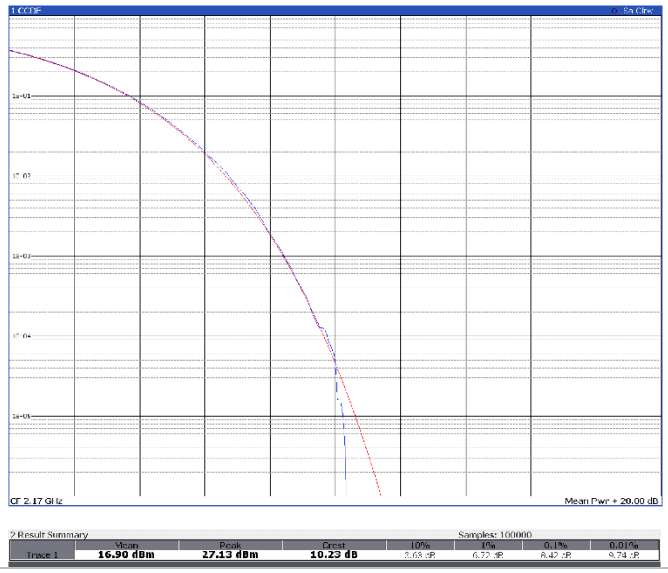
TM3p1, 20 MHz, low channel



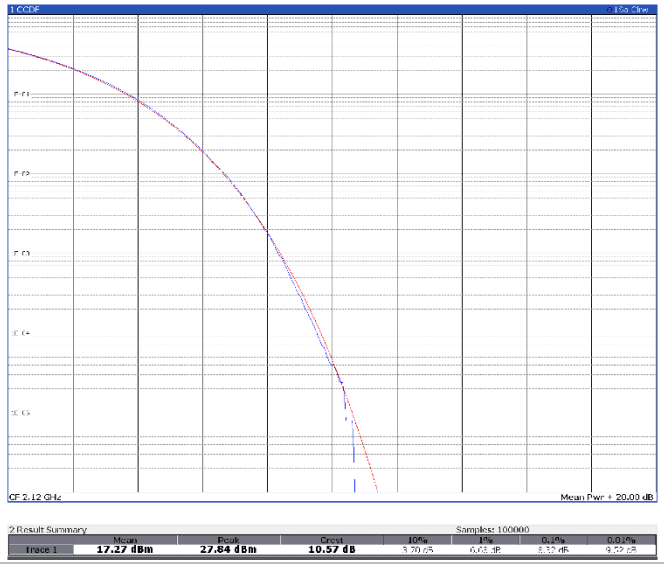
TM3p1, 20 MHz, mid channel



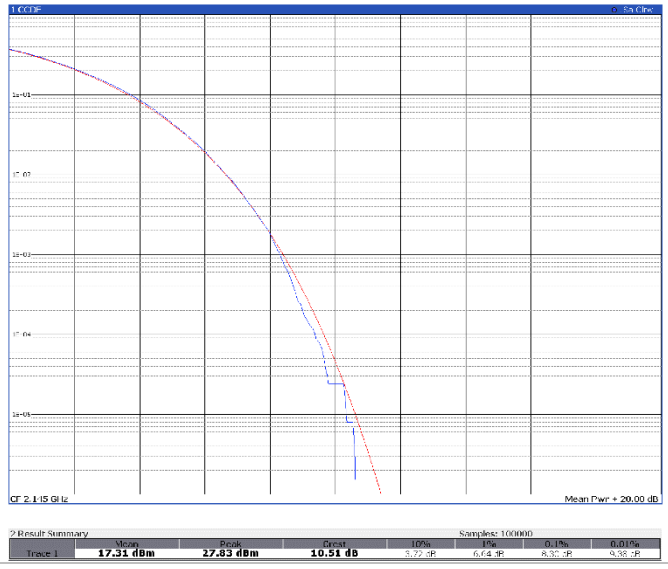
TM3p1, 20 MHz, high channel



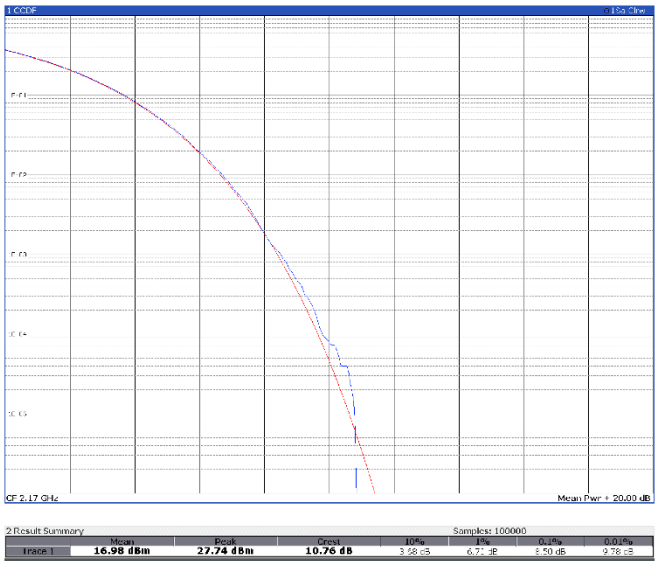
TM3p1a, 20 MHz, low channel



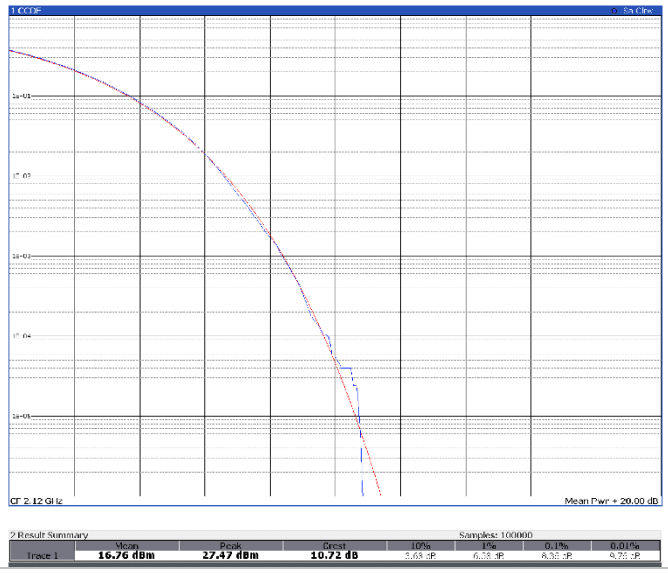
TM3p1a, 20 MHz, mid channel



TM3p1a, 20 MHz, high channel

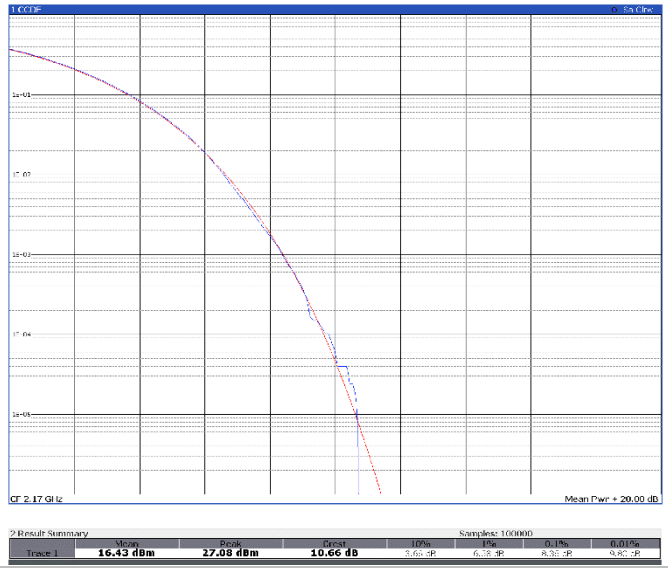


TM3p3, 20 MHz, low channel



TM3p3, 20 MHz, mid channel

TM3p3, 20 MHz, high channel



8.6 FCC 27.53(h)(1)-(2) Emission Limits

8.6.1 Definitions and limits

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:

(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

§ 27.1134

I Protection of Federal operations in the 2200-2290 MHz band

(1) Click to open paragraph tools Default emission limits. Except as provided in paragraph I(2) of this section, the following default out-of-band emissions limits shall apply for AWS-4 operations in the 2180-2200 MHz band.

(i) For these AWS-4 operations, the power of any emissions on all frequencies between 2200 and 2290 MHz shall not exceed an EIRP of −100.6 dBW/4 kHz.

8.6.2 Test summary

Test start date	October 10, 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; the second range was selected from 3 GHz to 25 GHz where the fundamental signal is visible. 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 25 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.

Based on equation 70 + 10 log10 (P) dB, the additional emission limit of 27.53(h)(2)(iii), (iv) and (v) is -40 dBm (conducted and radiated test) or the equivalent at 3m is 55.23 dBµV/m above 1 GHz and 57.38 dBµV/m below 1 GHz.

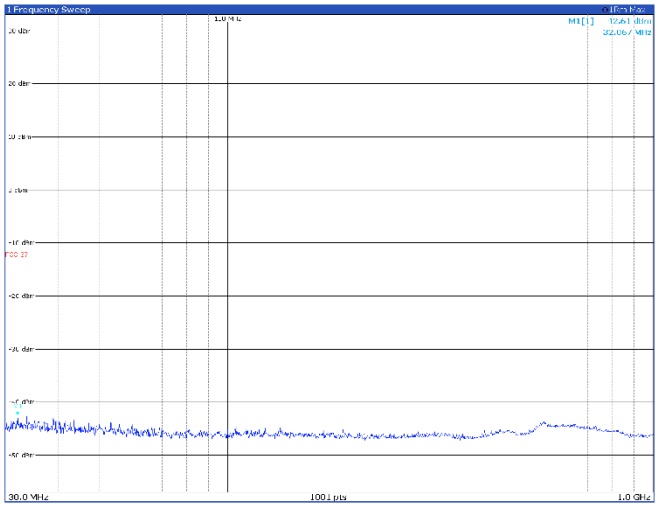
8.6.4 Test equipment used

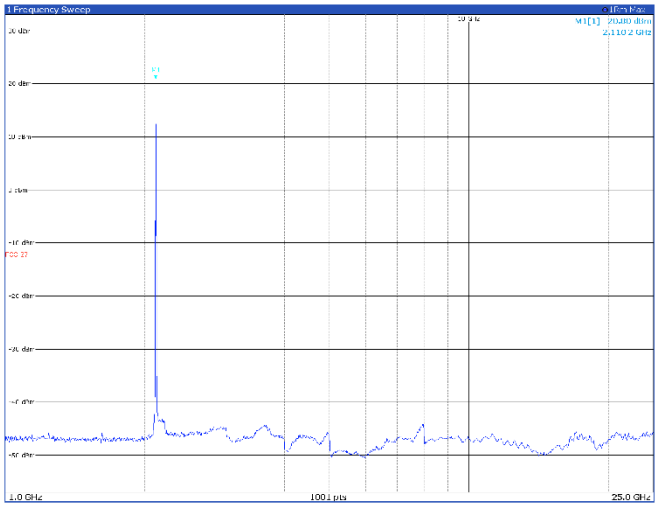
Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
EMI Receiver	Rohde & Schwarz	ESW44	101620
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397
Antenna Trilog 25MHz – 8GHz	Schwarzbeck Mess-Elektronik	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 n66 – conducted emissions Antenna port 1	5 MHz

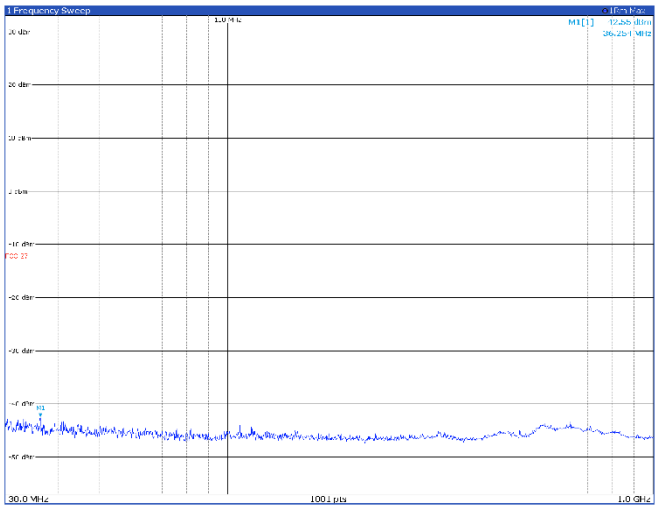
TM1.1, 5 MHz, low channel

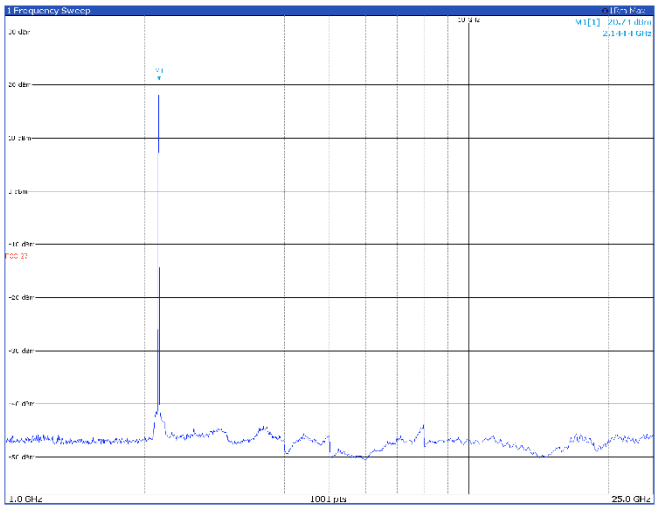




Limit exceeded by the carrier

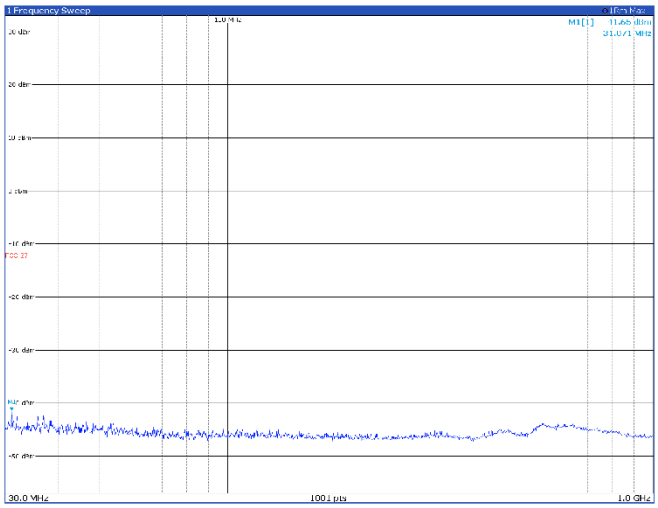
TM1.1, 5 MHz, mid channel

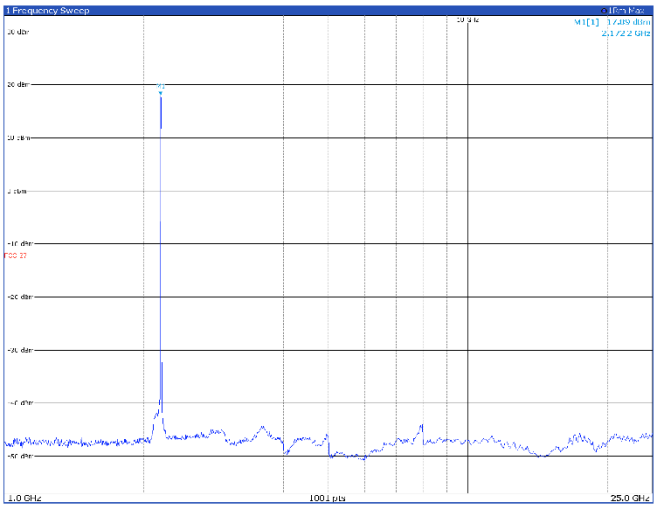




Limit exceeded by the carrier

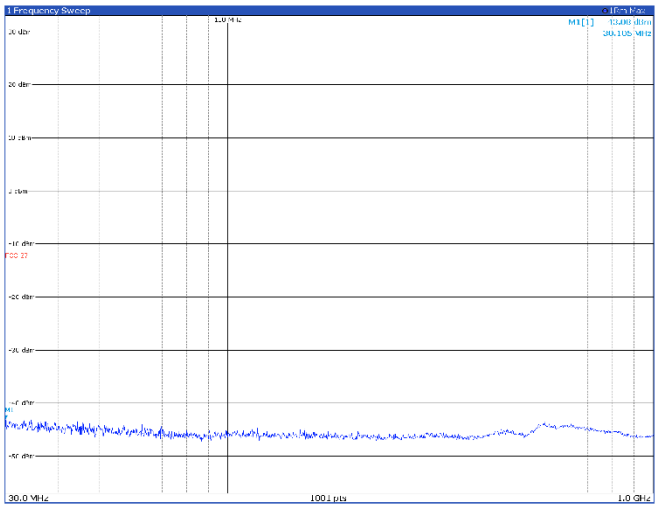
TM1.1, 5 MHz, high channel

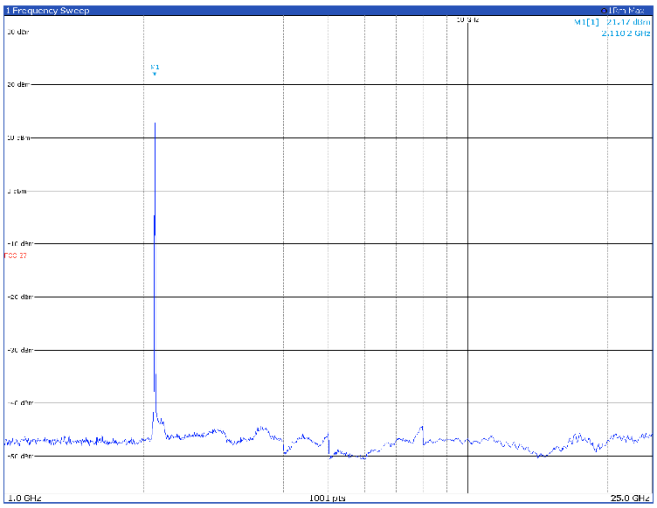




Limit exceeded by the carrier

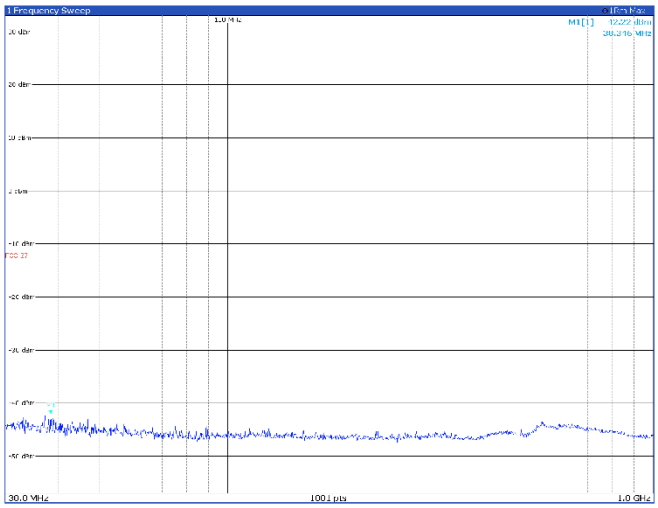
TM3p1, 5 MHz, low channel

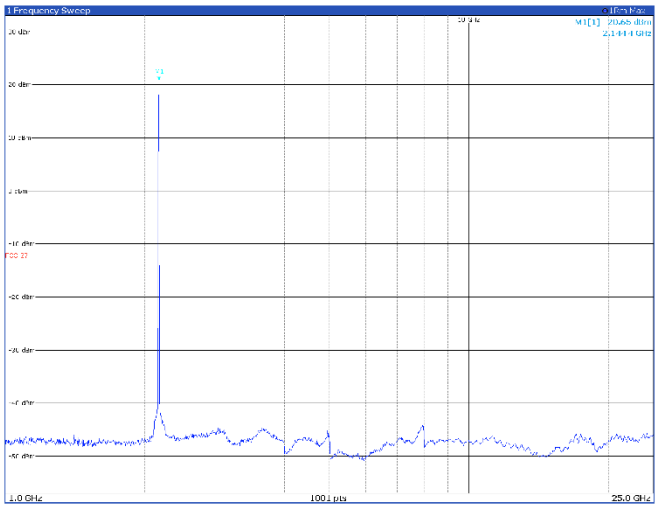




Limit exceeded by the carrier

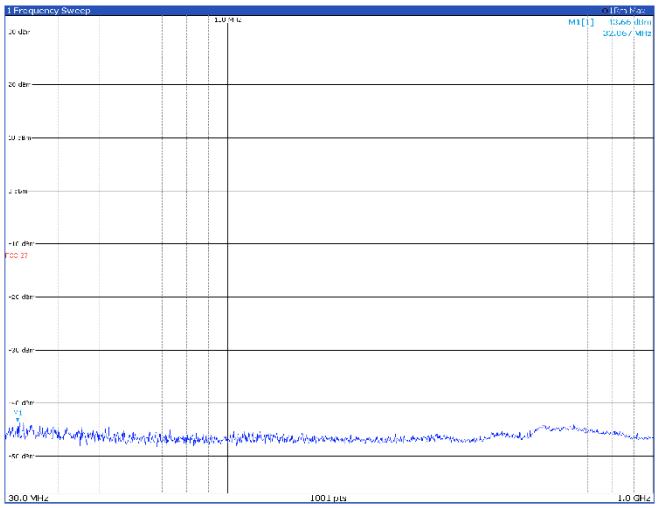
TM3p1, 5 MHz, mid channel

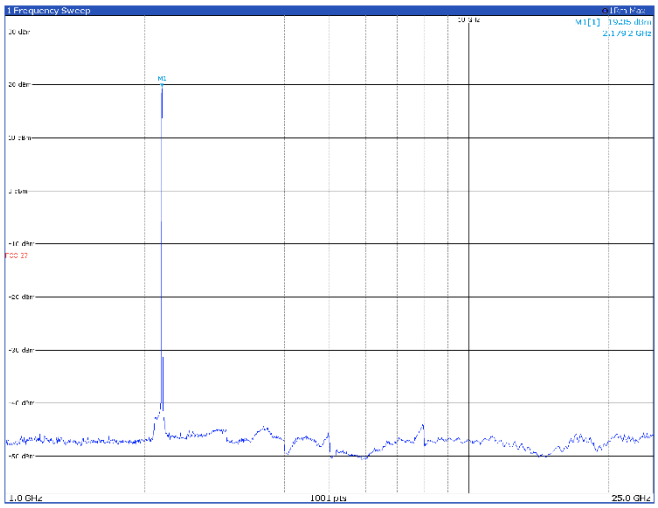




Limit exceeded by the carrier

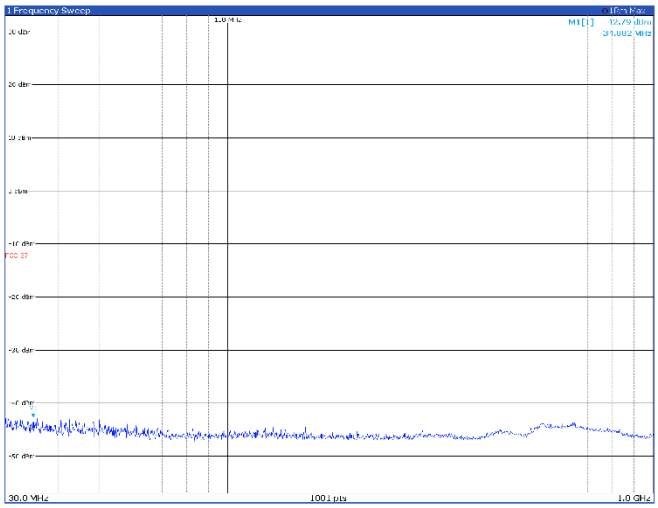
TM3p1, 5 MHz, high channel

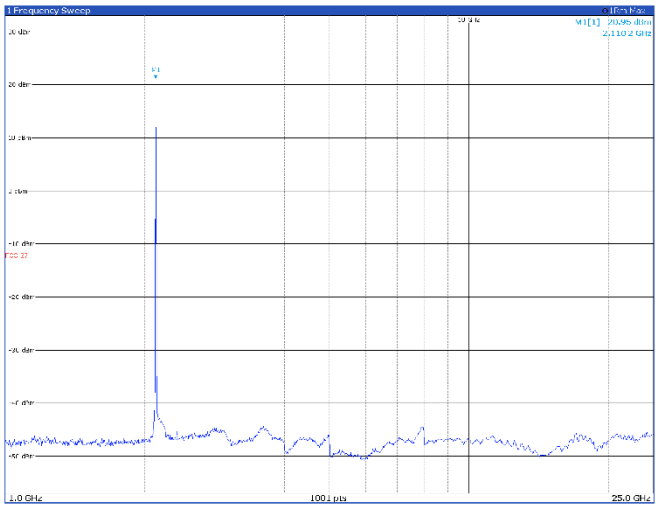




Limit exceeded by the carrier

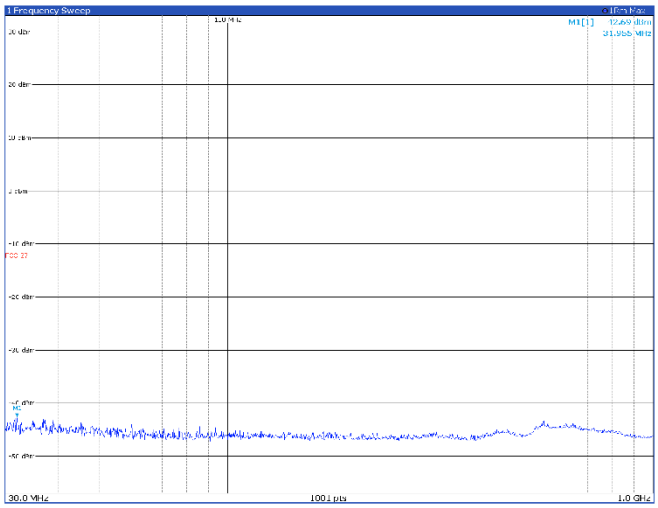
TM3p1a, 5 MHz, low channel

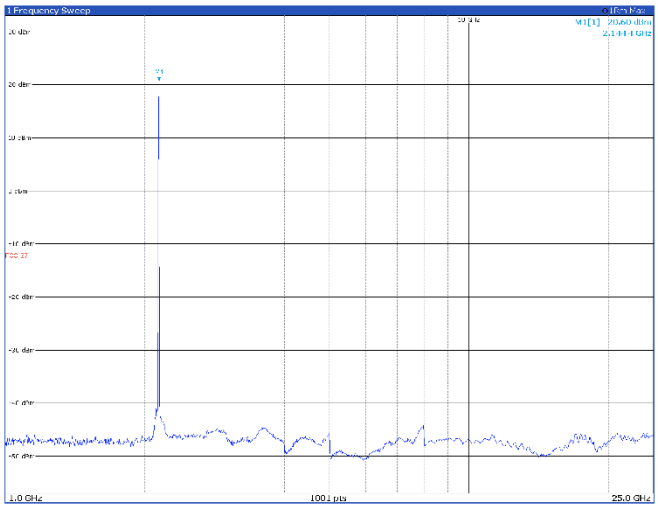




Limit exceeded by the carrier

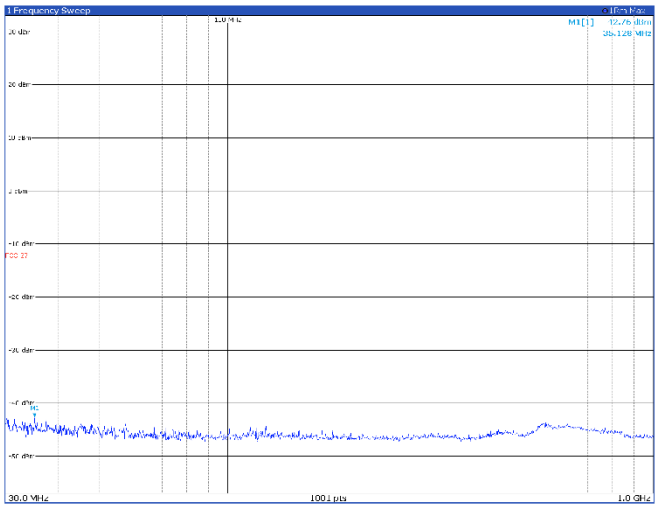
TM3p1a, 5 MHz, mid channel

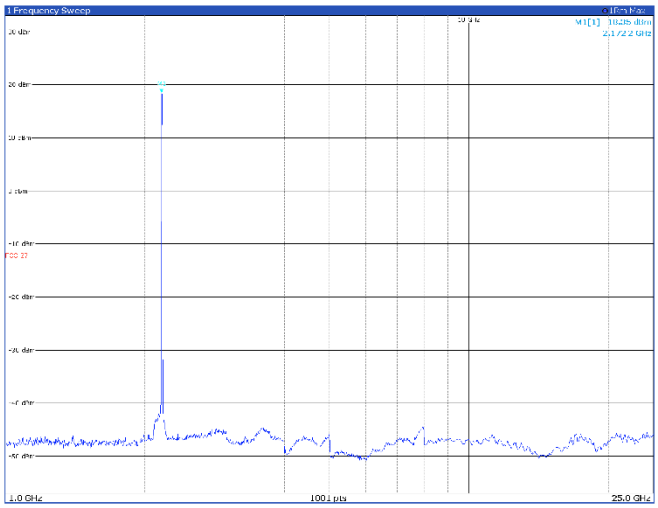




Limit exceeded by the carrier

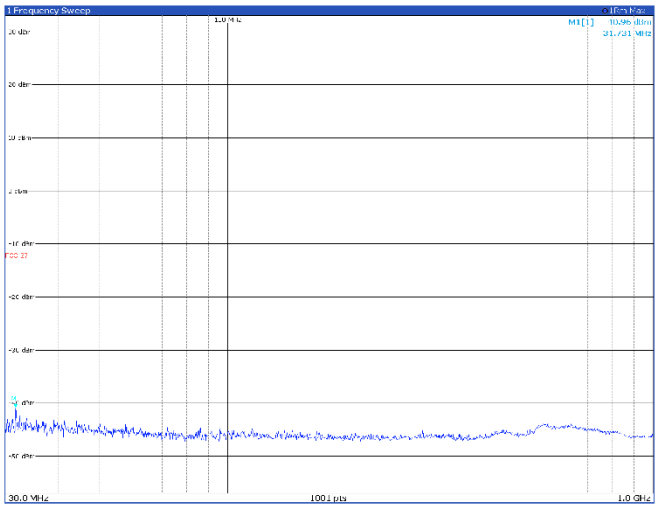
TM3p1a, 5 MHz, high channel

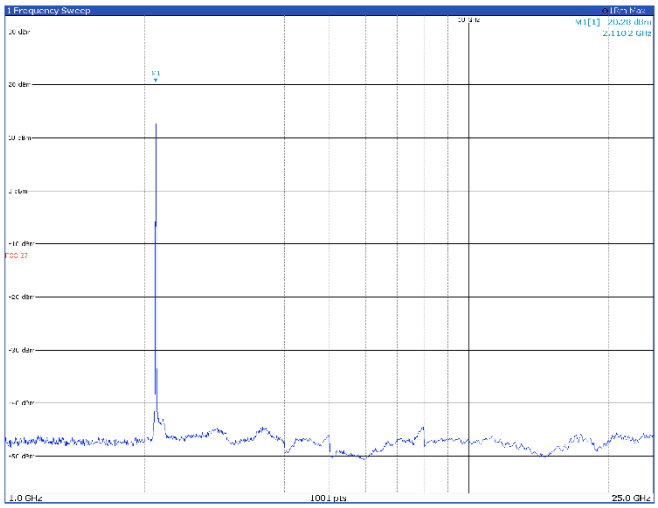




Limit exceeded by the carrier

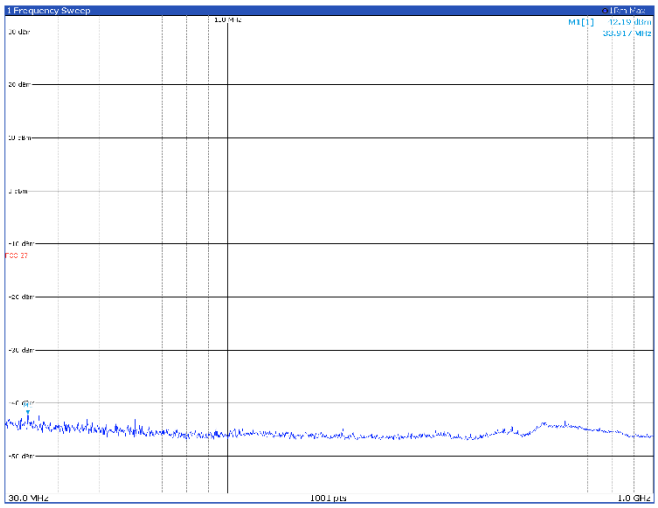
TM3p3, 5 MHz, low channel

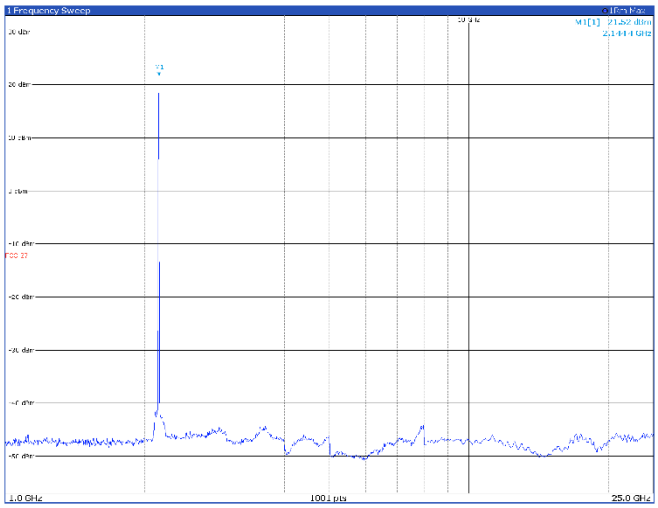




Limit exceeded by the carrier

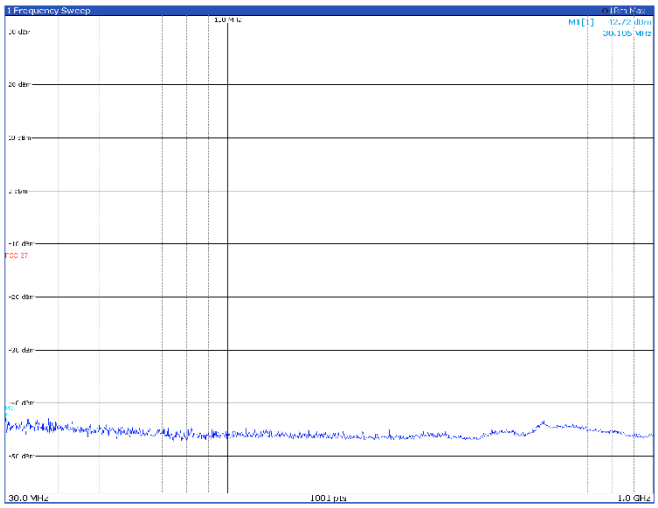
TM3p3, 5 MHz, mid channel

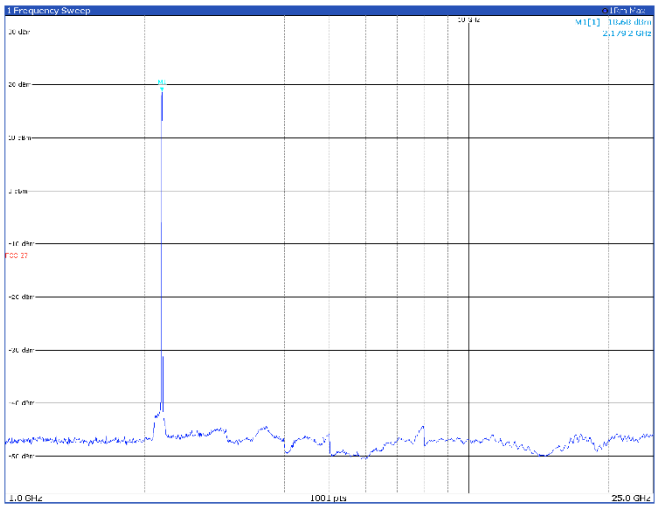




Limit exceeded by the carrier

TM3p3, 5 MHz, high channel

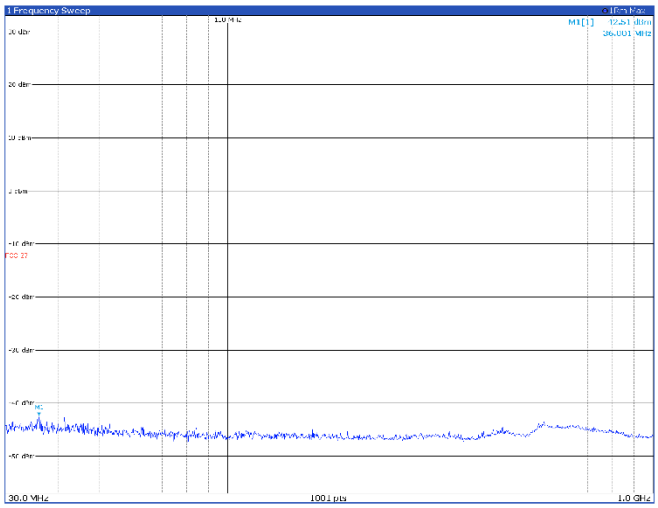


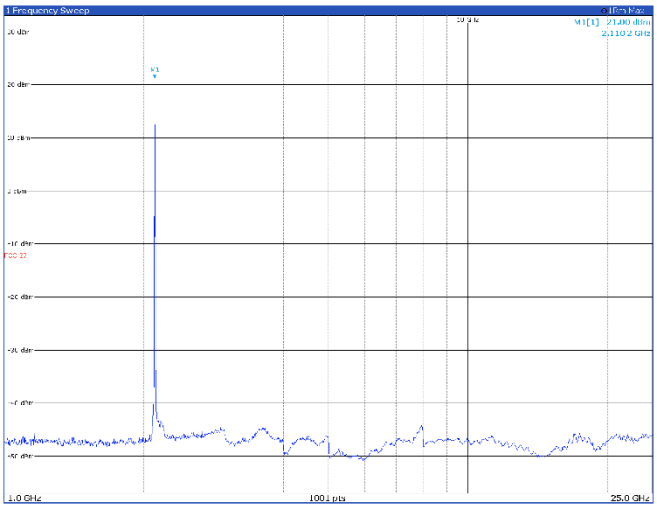


Limit exceeded by the carrier

Band n66 – conducted emissions Antenna port 2 **5 MHz**

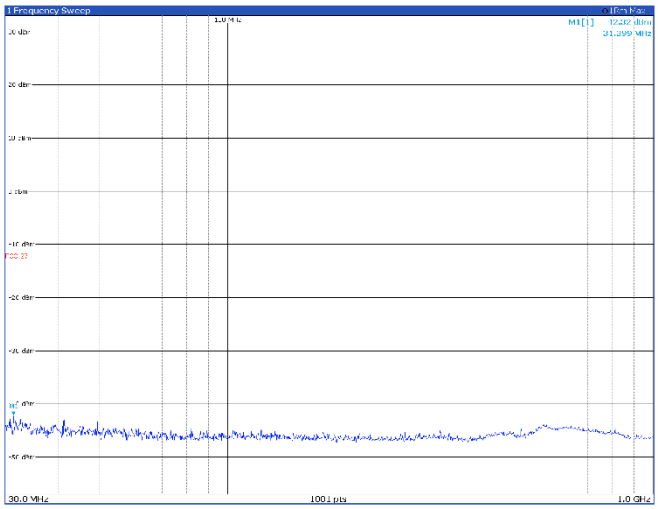
TM1.1, 5 MHz, low channel

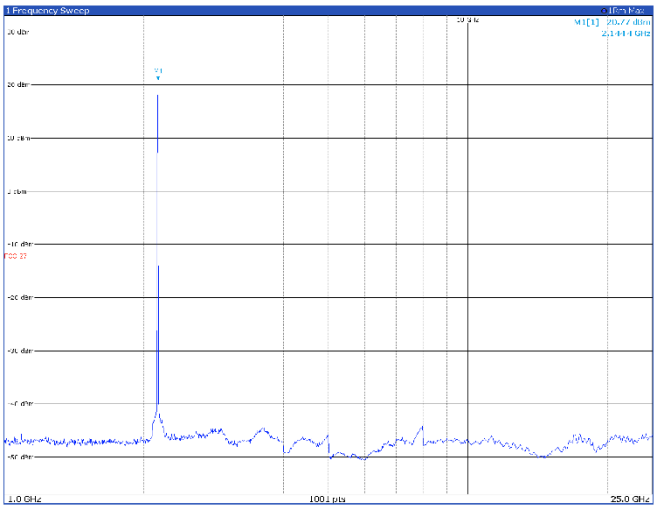




Limit exceeded by the carrier

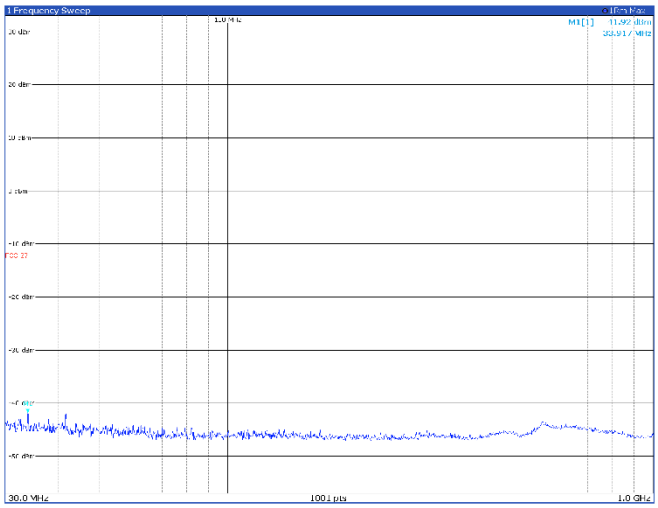
TM1.1, 5 MHz, mid channel

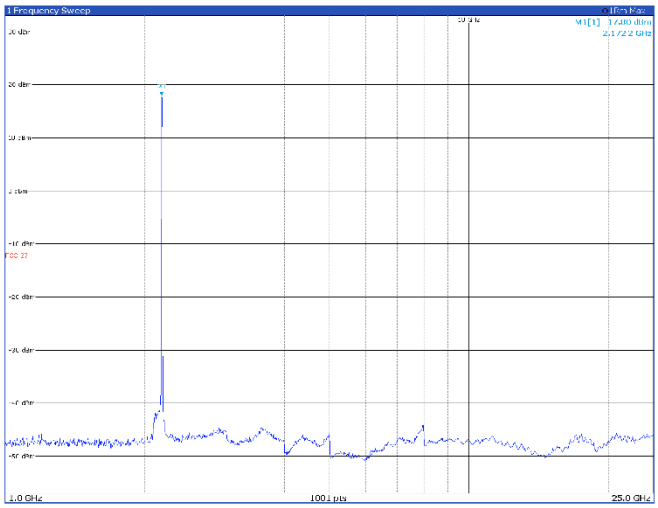




Limit exceeded by the carrier

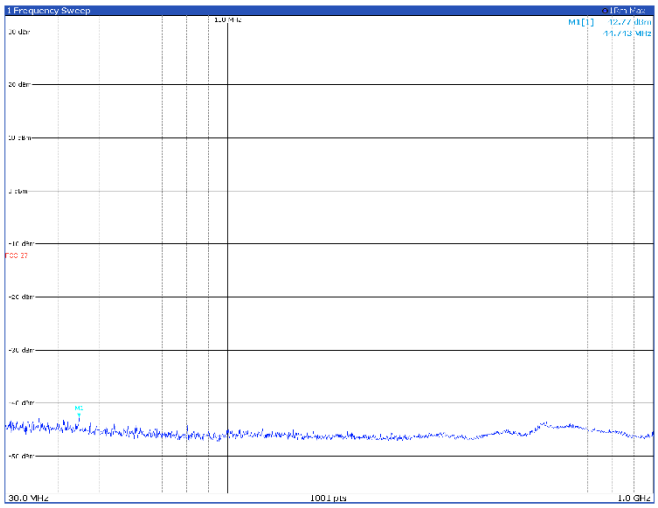
TM1.1, 5 MHz, high channel

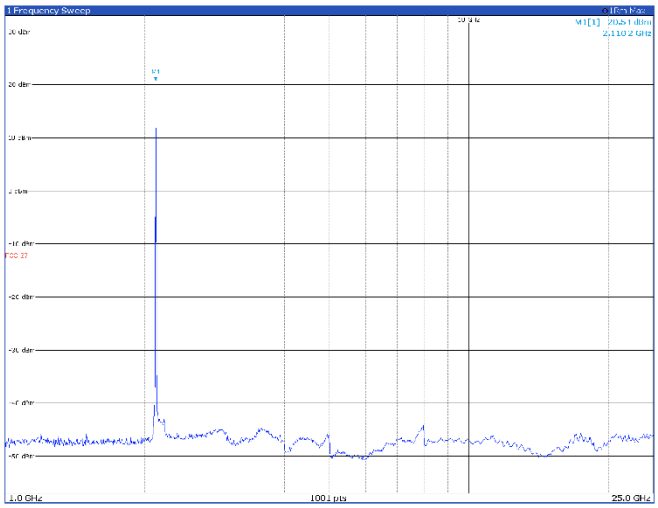




Limit exceeded by the carrier

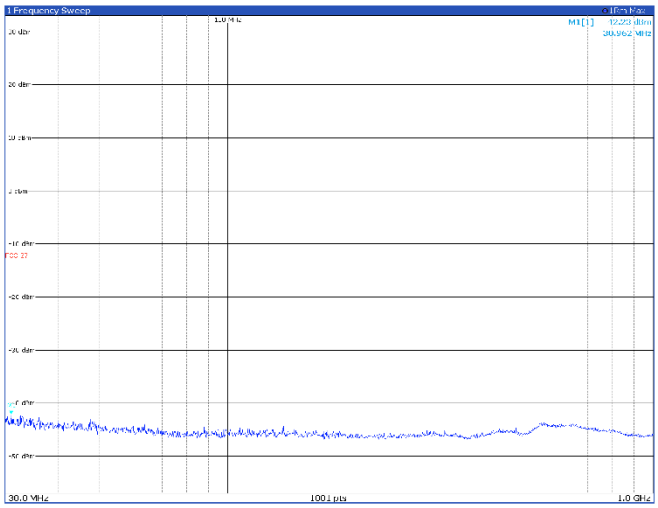
TM3p1, 5 MHz, low channel

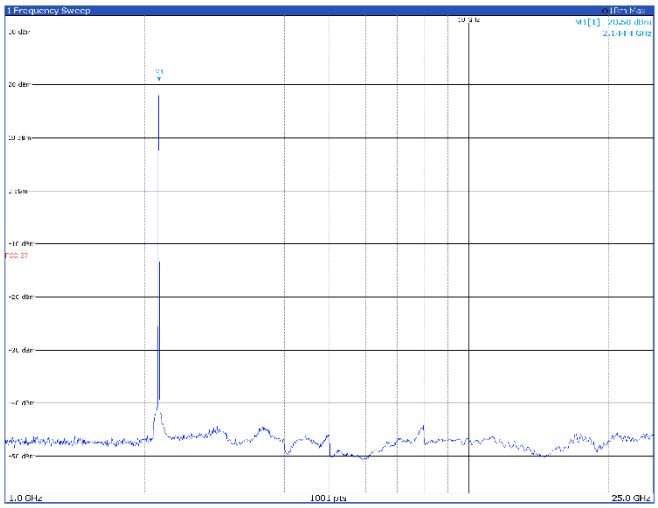




Limit exceeded by the carrier

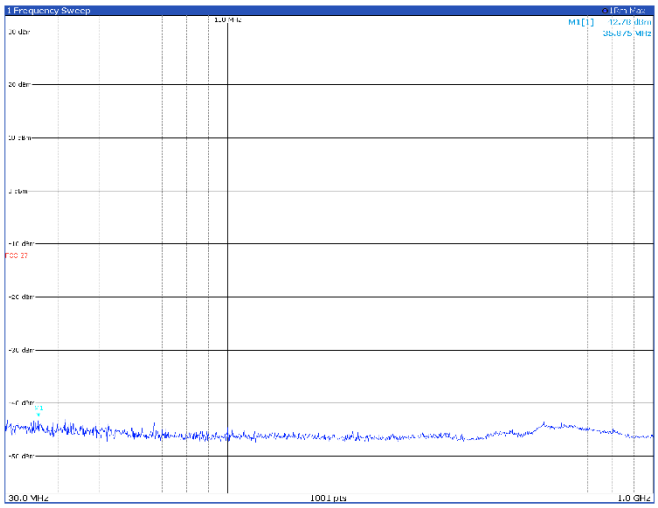
TM3p1, 5 MHz, mid channel

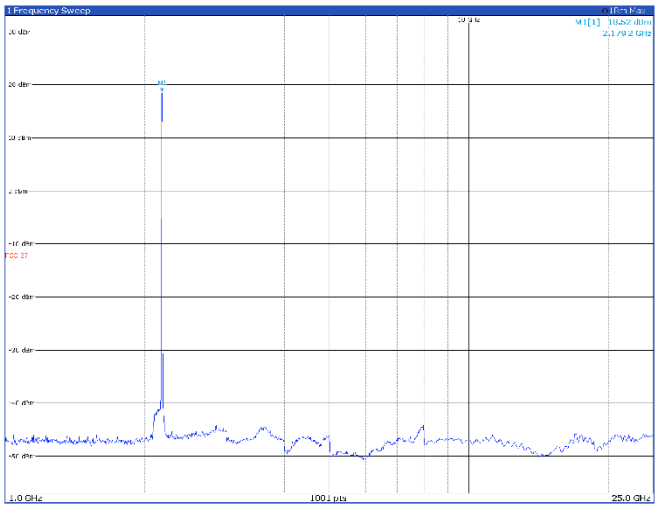




Limit exceeded by the carrier

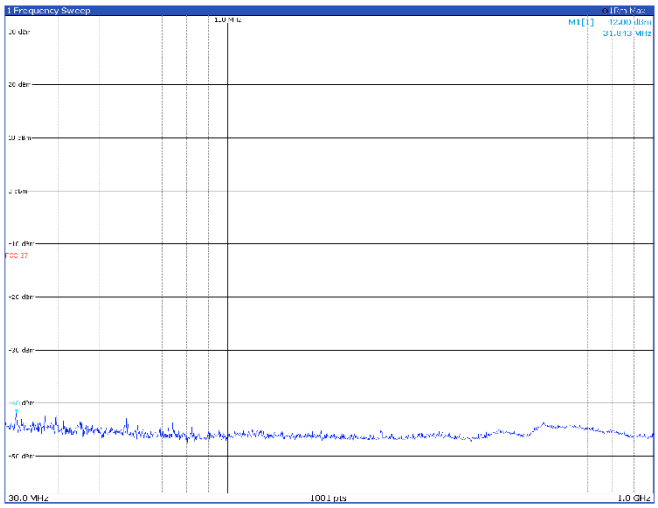
TM3p1, 5 MHz, high channel

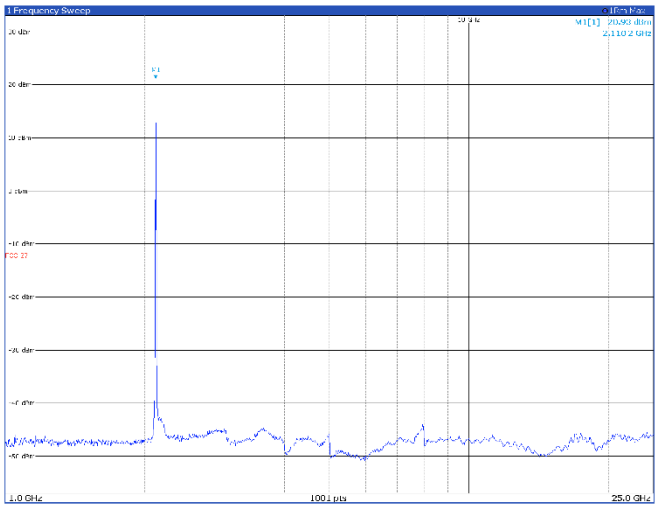




Limit exceeded by the carrier

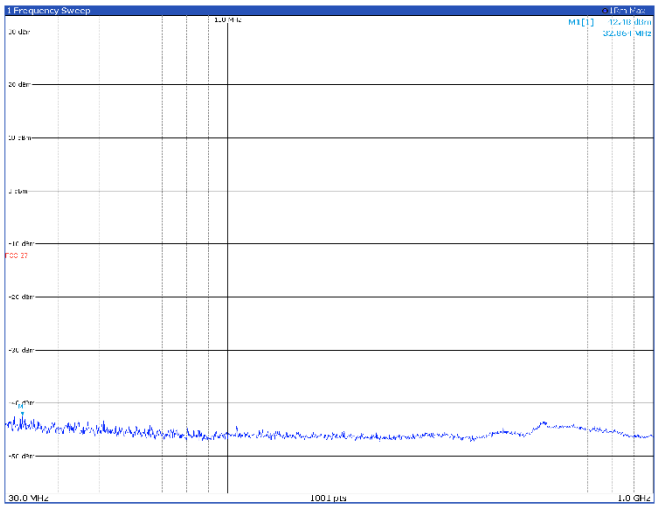
TM3p1a, 5 MHz, low channel

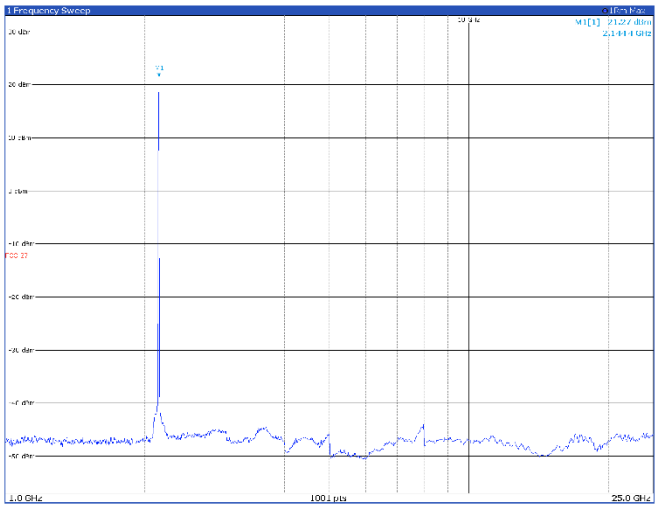




Limit exceeded by the carrier

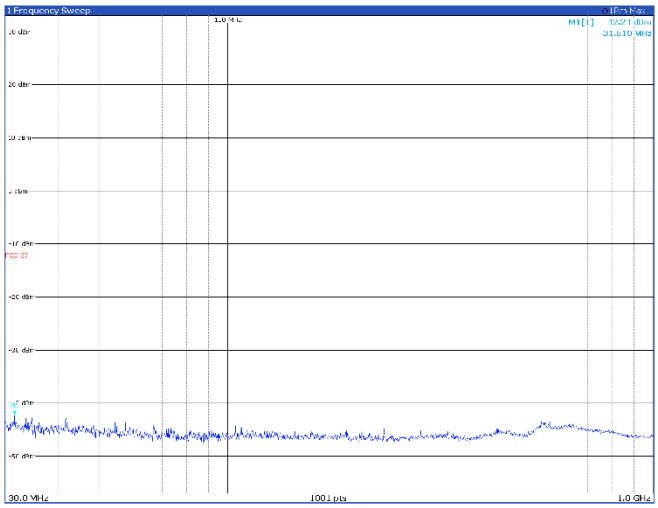
TM3p1a, 5 MHz, mid channel

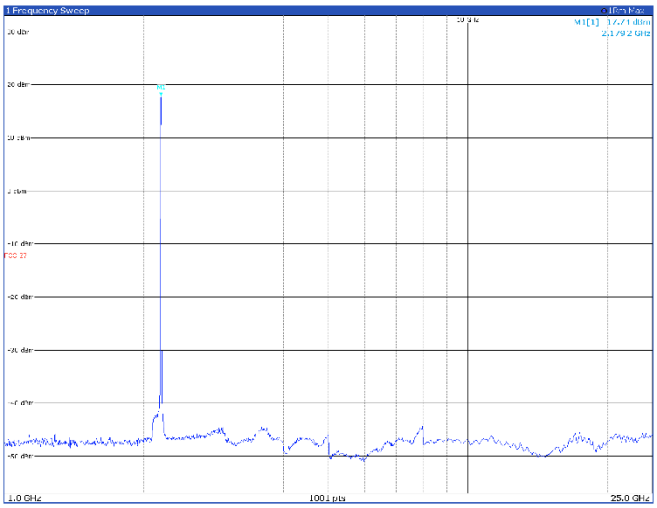




Limit exceeded by the carrier

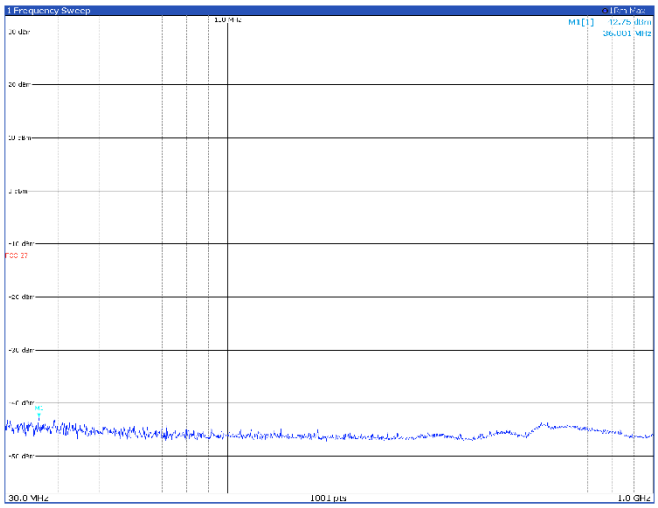
TM3p1a, 5 MHz, high channel

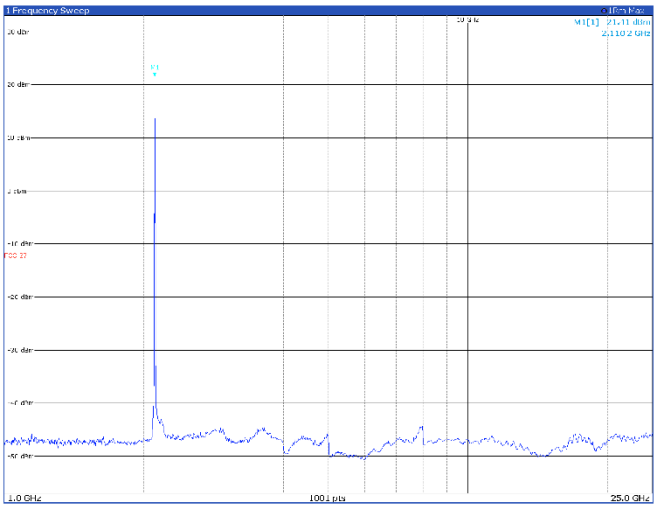




Limit exceeded by the carrier

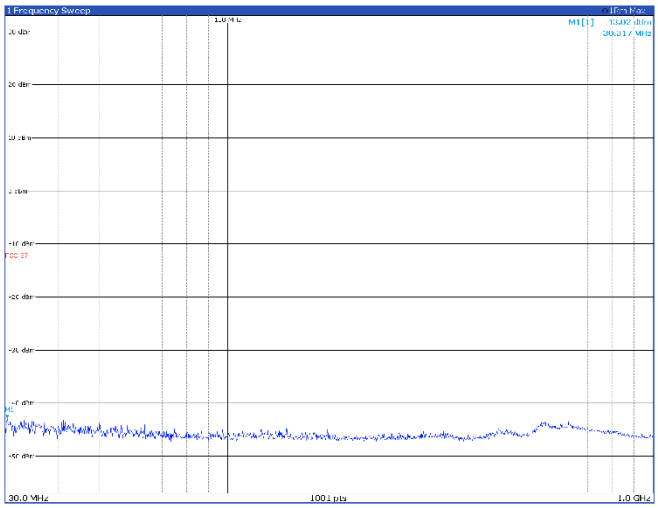
TM3p3, 5 MHz, low channel

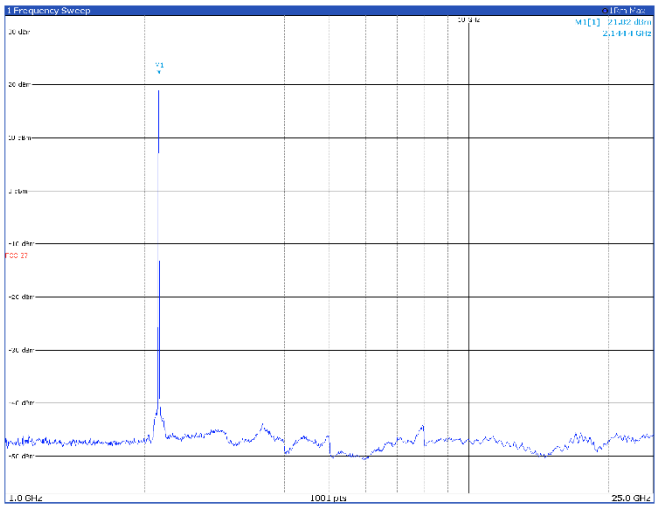




Limit exceeded by the carrier

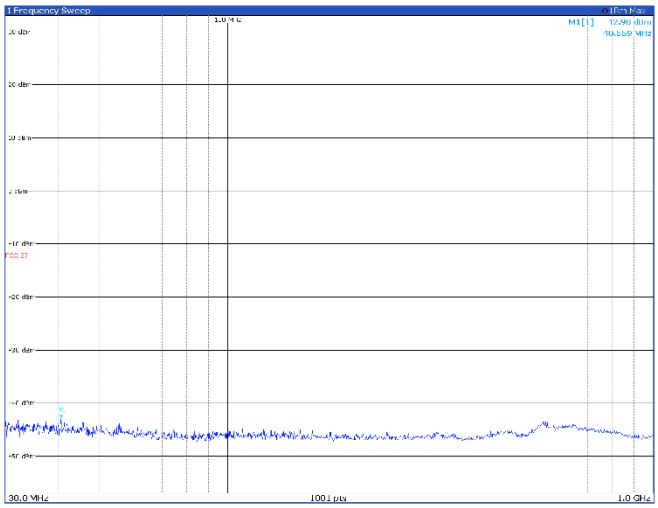
TM3p3, 5 MHz, mid channel

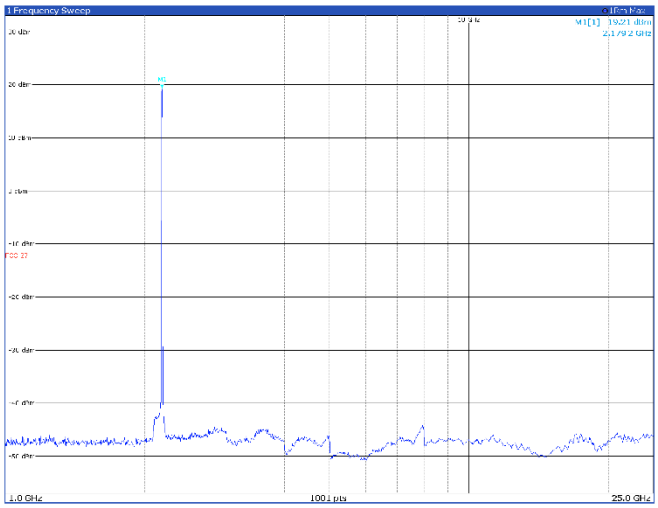




Limit exceeded by the carrier

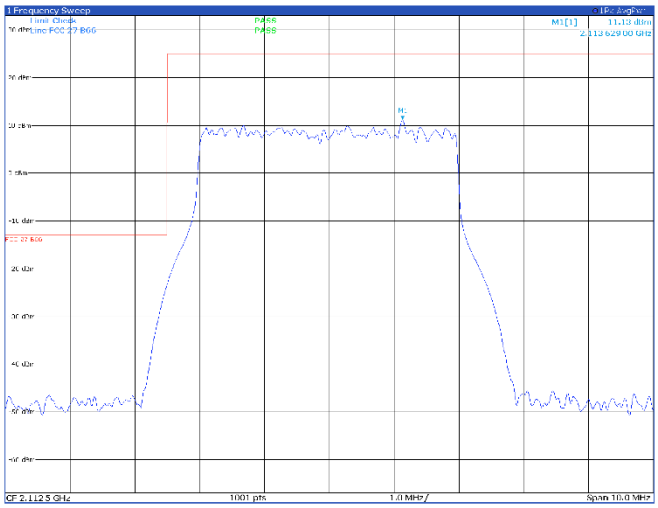
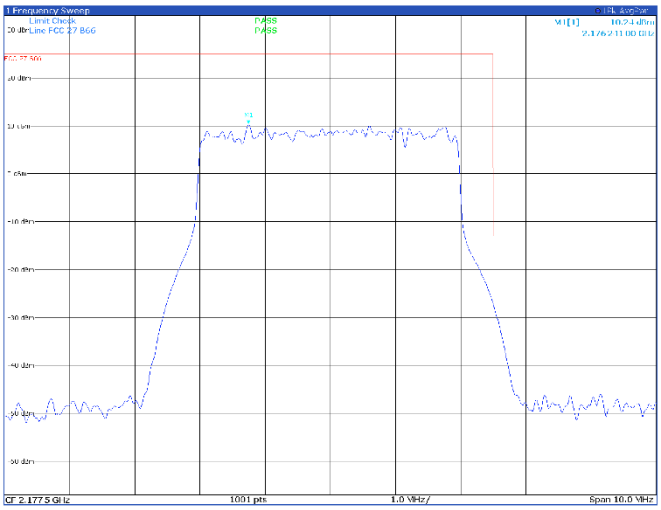
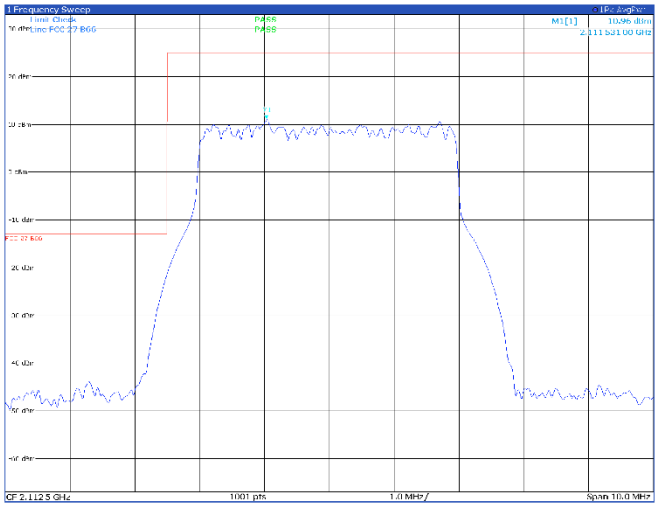
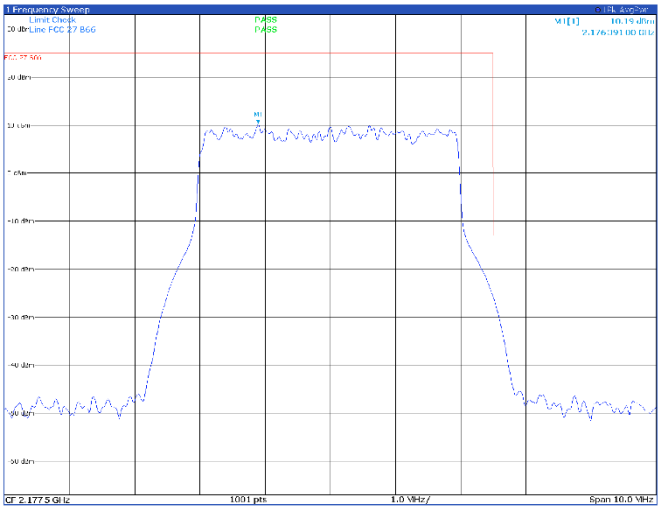
TM3p3, 5 MHz, high channel

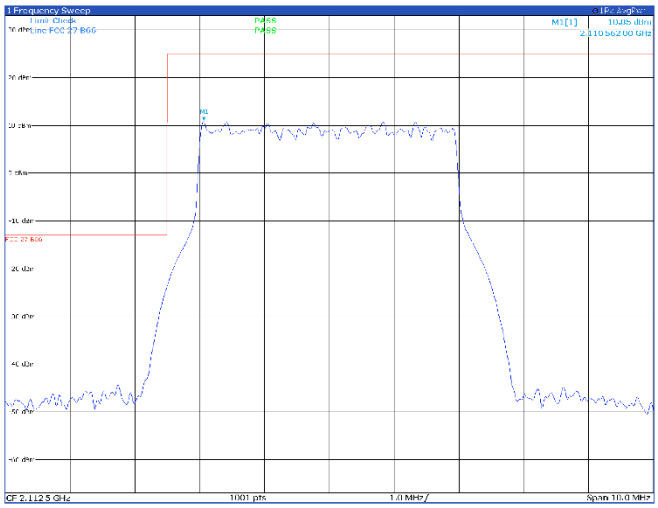
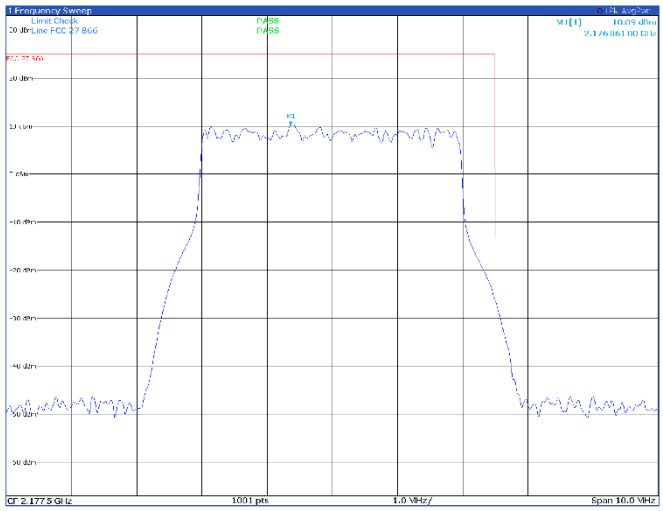
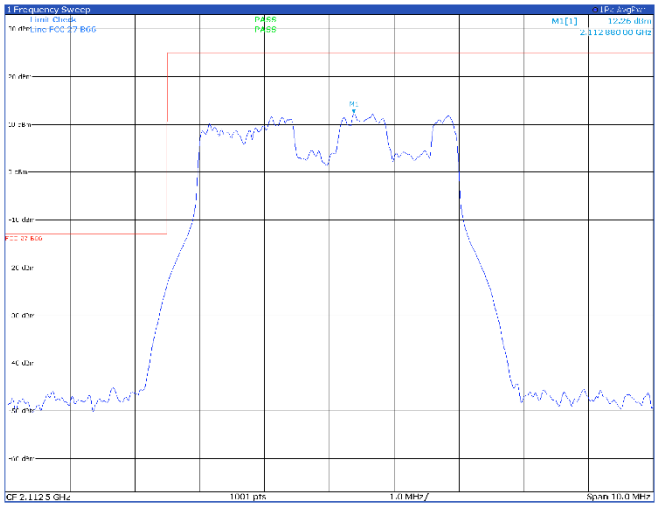
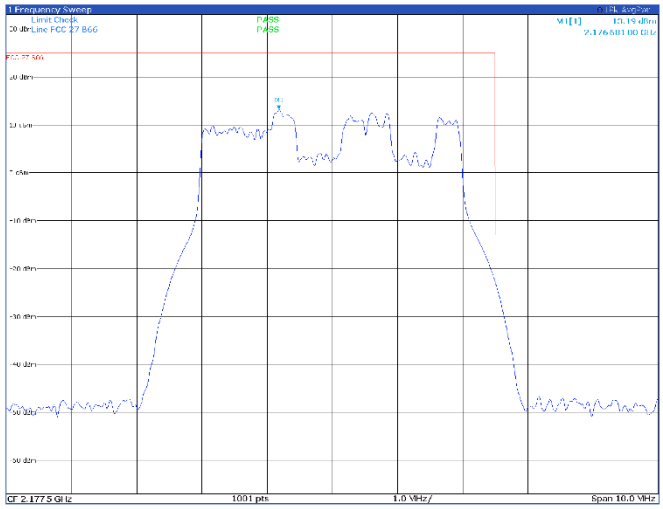




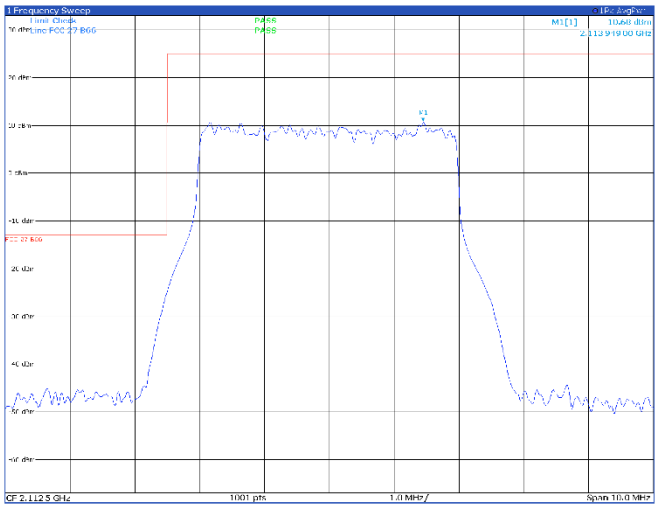
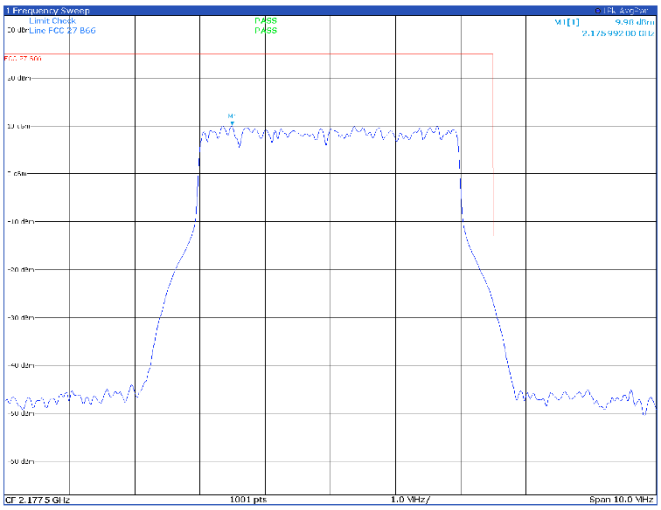
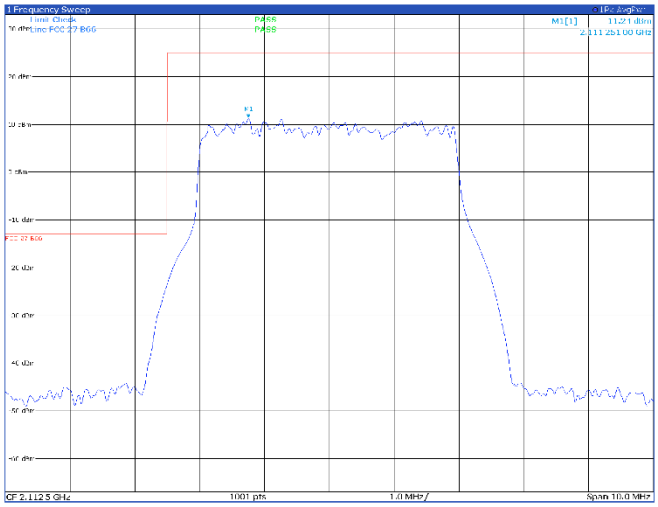
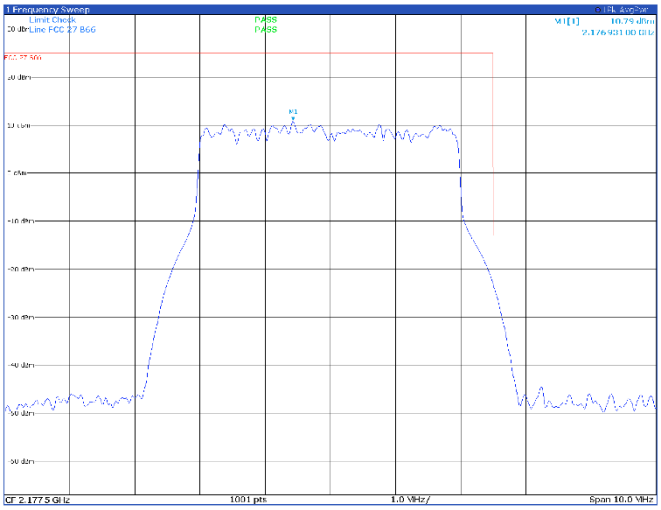
Limit exceeded by the carrier

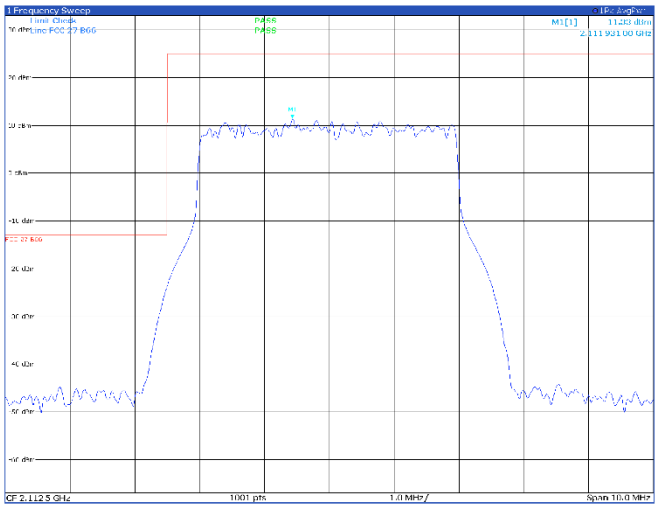
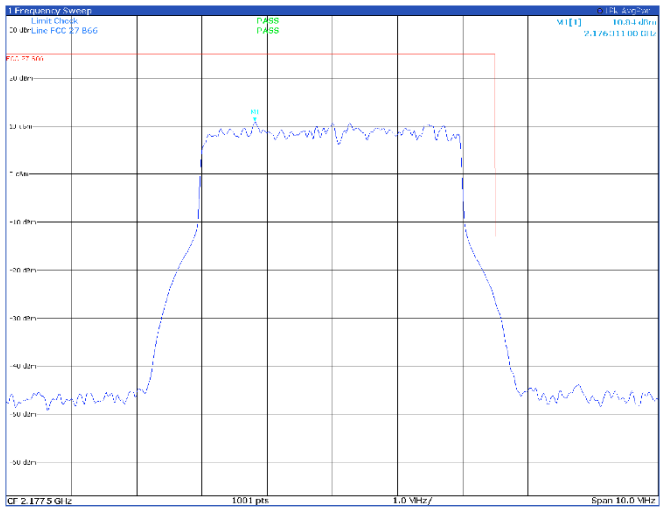
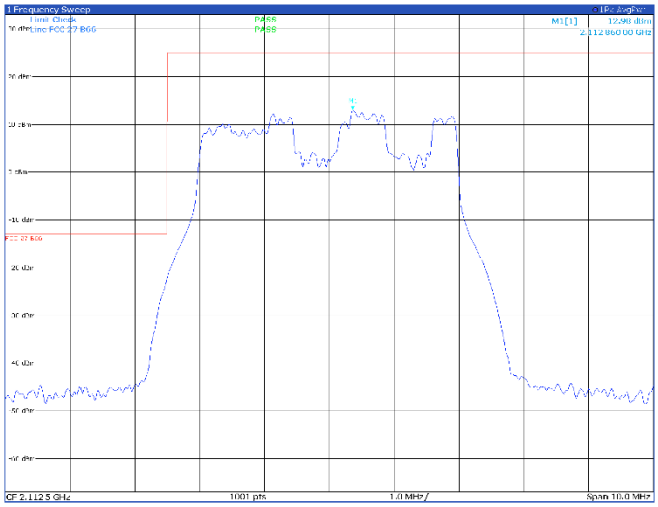
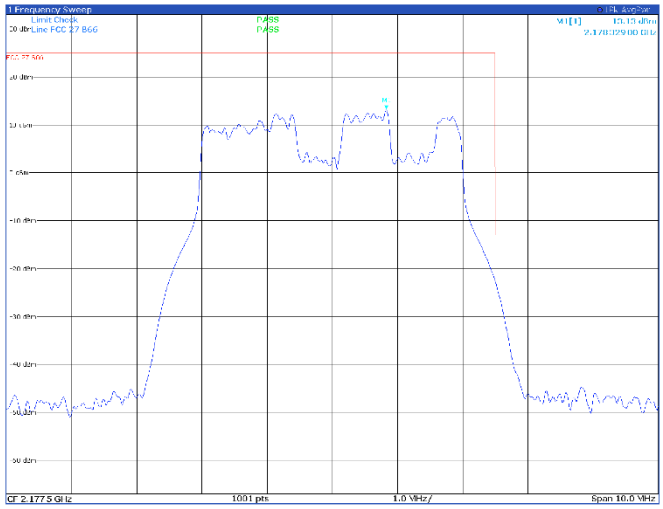
Band n66 – band edge Antenna port 1 **5 MHz**

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**
	

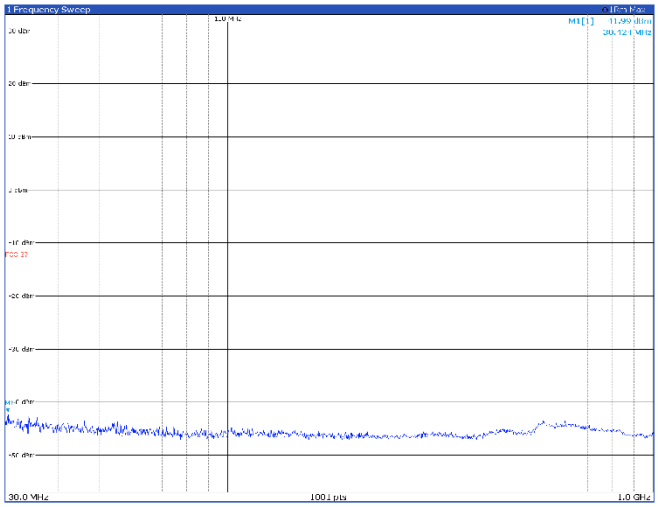
Band n66 – band edge Antenna port 2 **5 MHz**

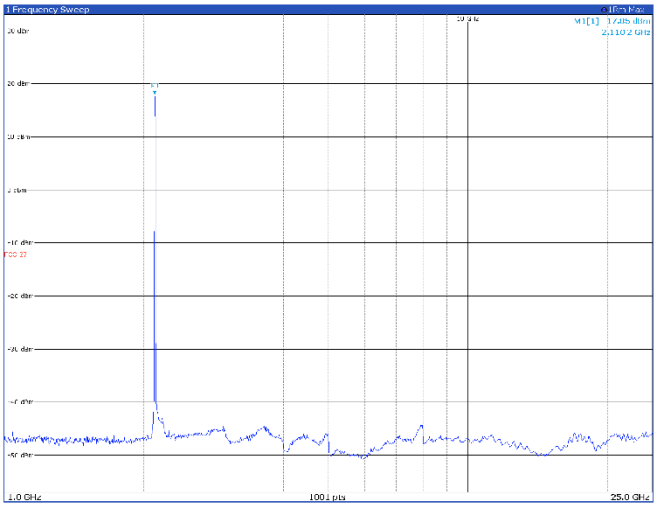
TM1.1, 5 MHz, low channel	TM1.1, 5 MHz, high channel
	
TM3p1, 5 MHz, low channel	**TM3p1, 5 MHz, high channel**
	

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

Band n66 – conducted emissions Antenna port 1 **10 MHz**

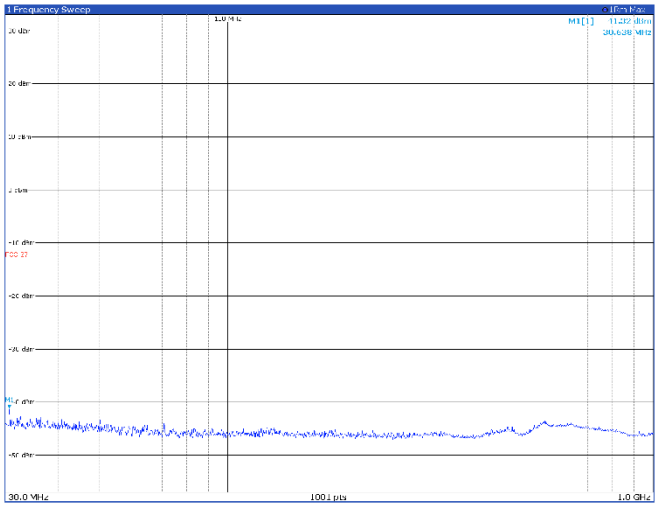
TM1.1, 10 MHz, low channel

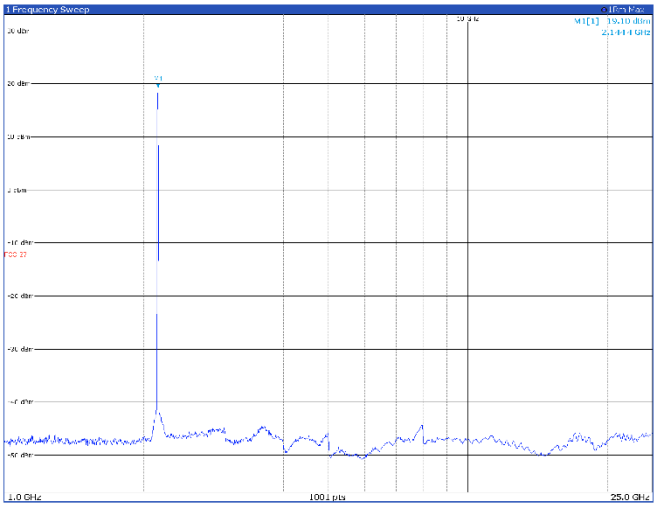




Limit exceeded by the carrier

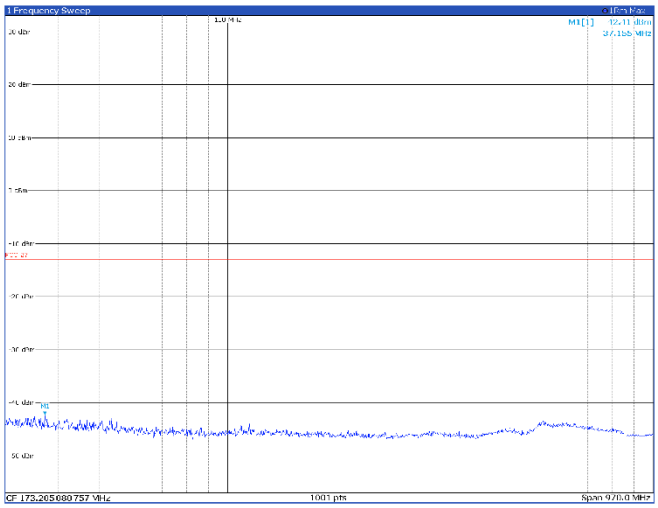
TM1.1, 10 MHz, mid channel

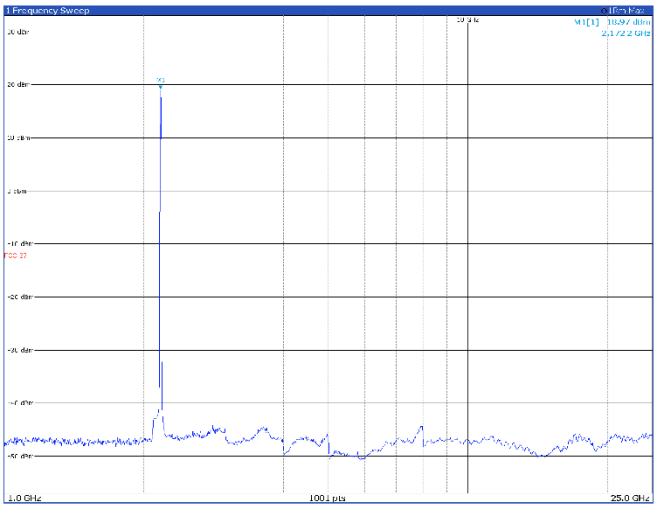




Limit exceeded by the carrier

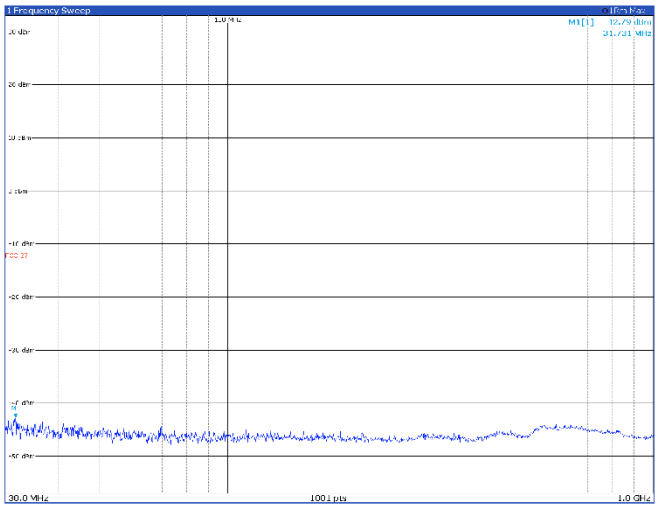
TM1.1, 10 MHz, high channel

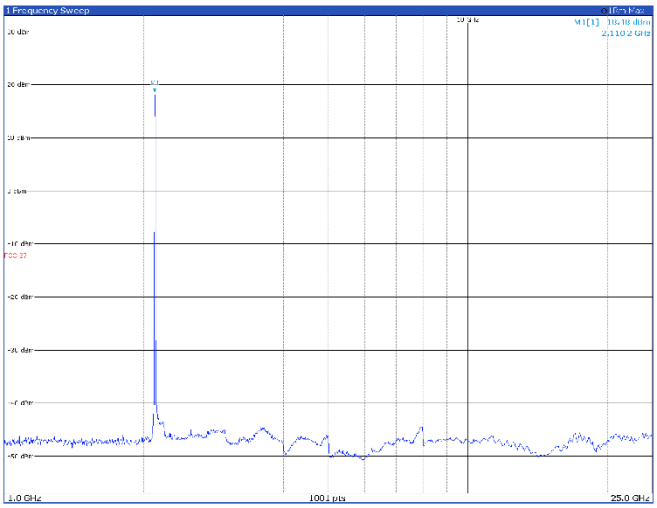




Limit exceeded by the carrier

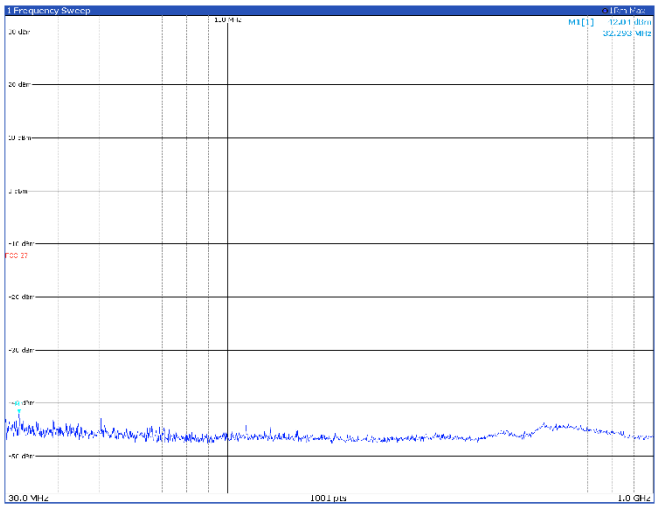
TM3p1, 10 MHz, low channel

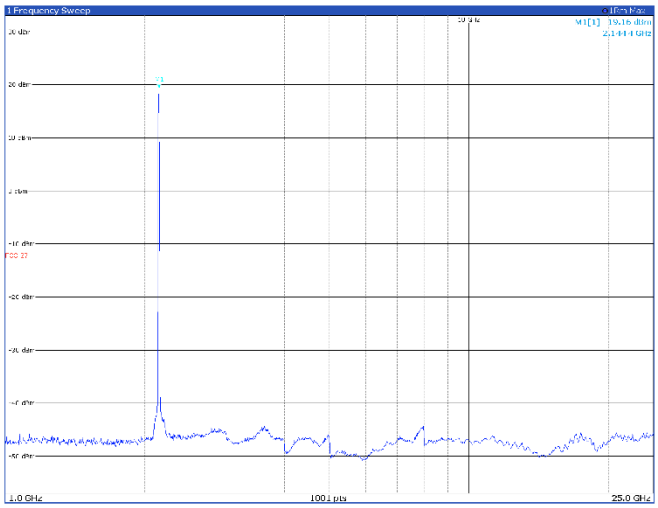




Limit exceeded by the carrier

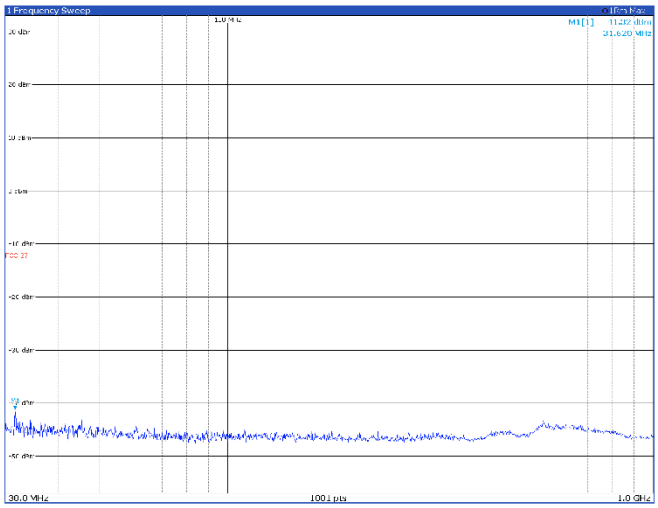
TM3p1, 10 MHz, mid channel

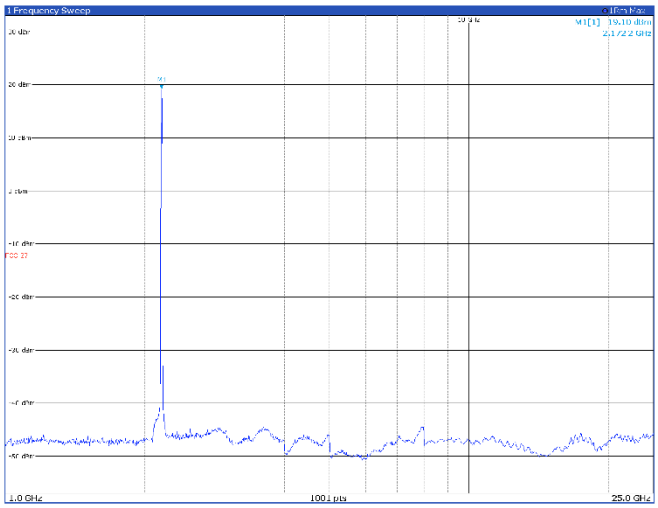




Limit exceeded by the carrier

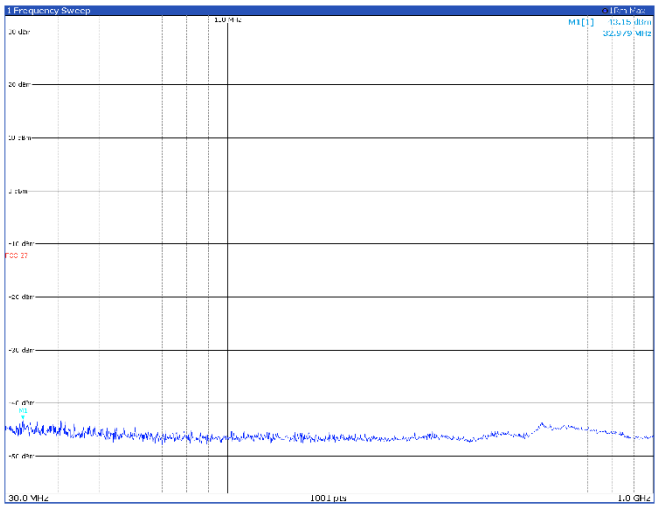
TM3p1, 10 MHz, high channel

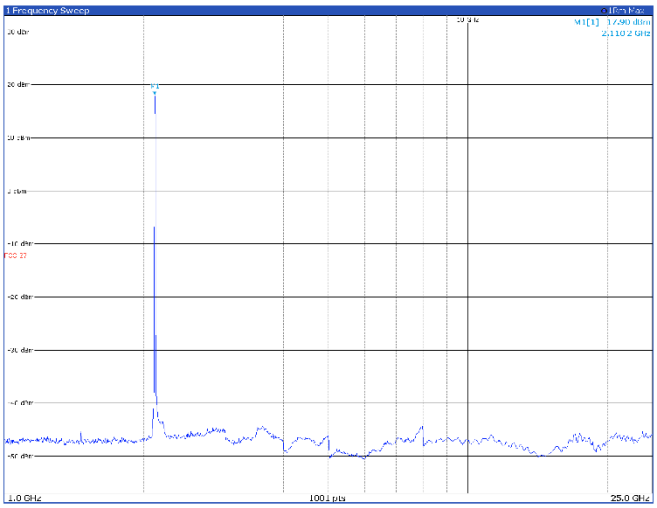




Limit exceeded by the carrier

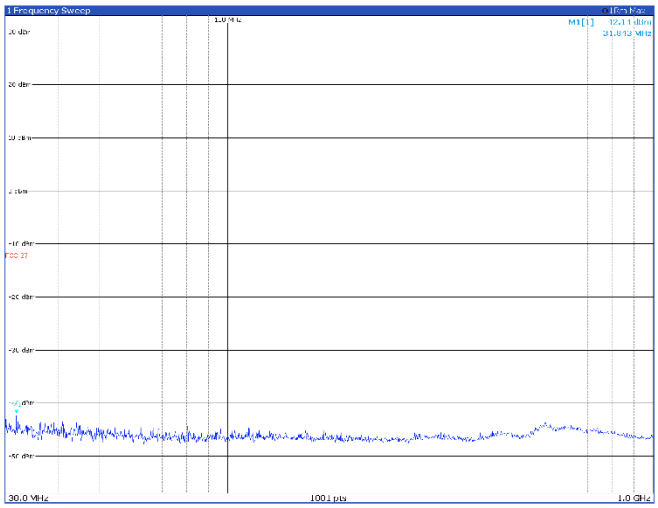
TM3p1a, 10 MHz, low channel

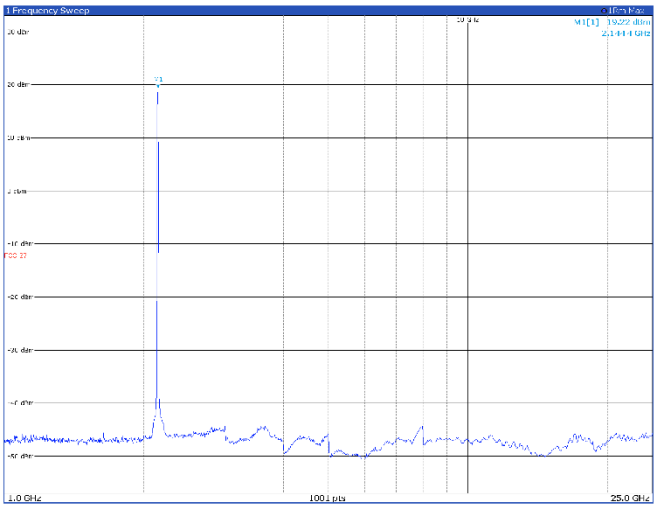




Limit exceeded by the carrier

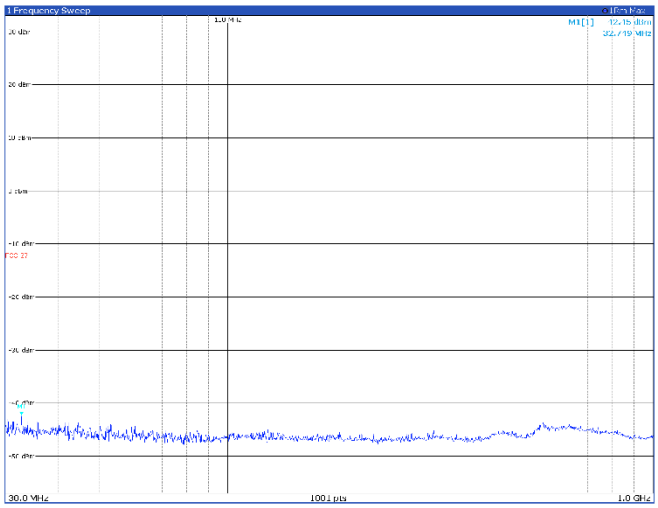
TM3p1a, 10 MHz, mid channel

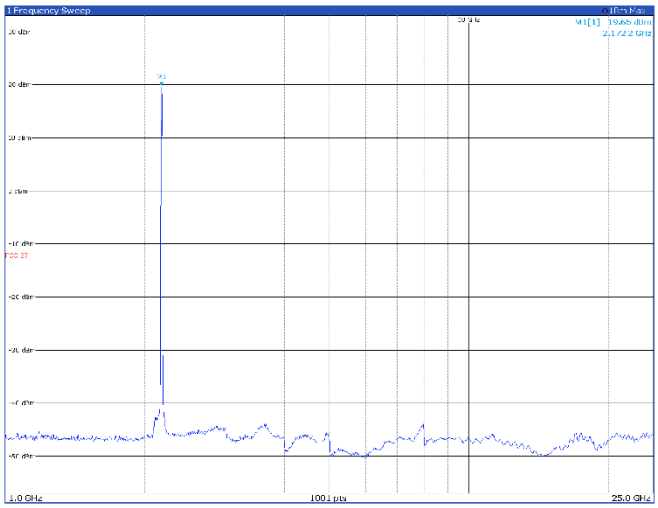




Limit exceeded by the carrier

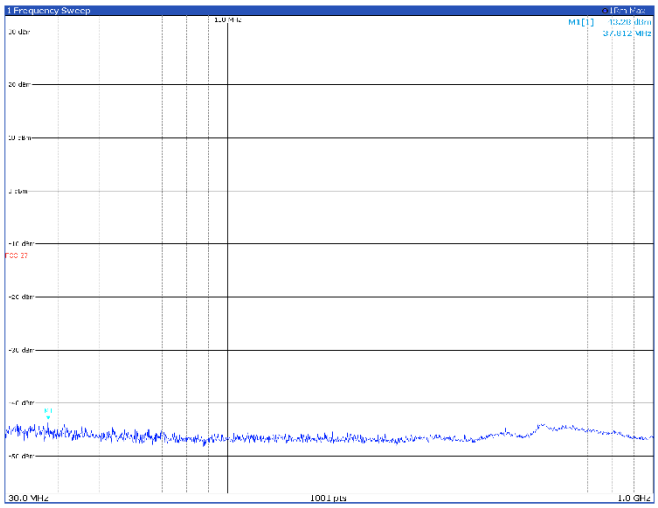
TM3p1a, 10 MHz, high channel

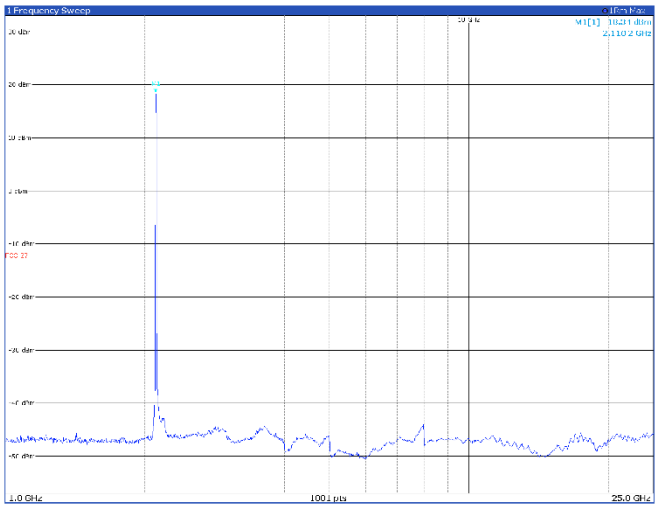




Limit exceeded by the carrier

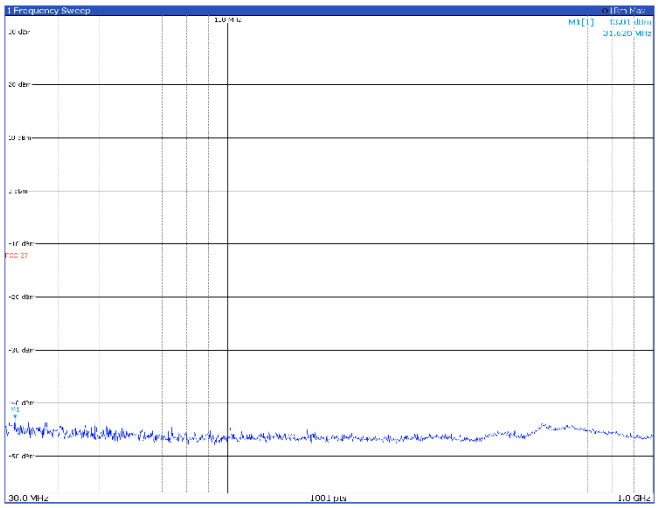
TM3p3, 10 MHz, low channel

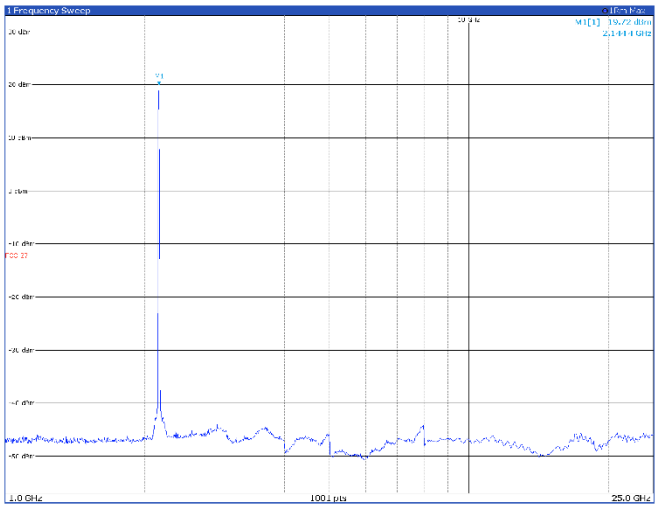




Limit exceeded by the carrier

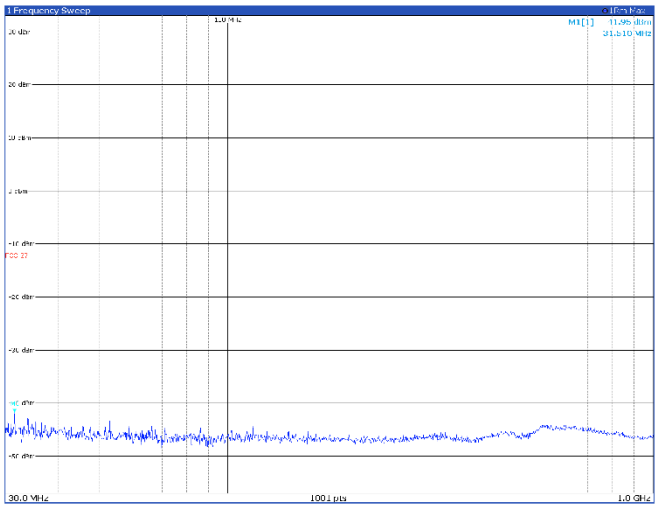
TM3p3, 10 MHz, mid channel

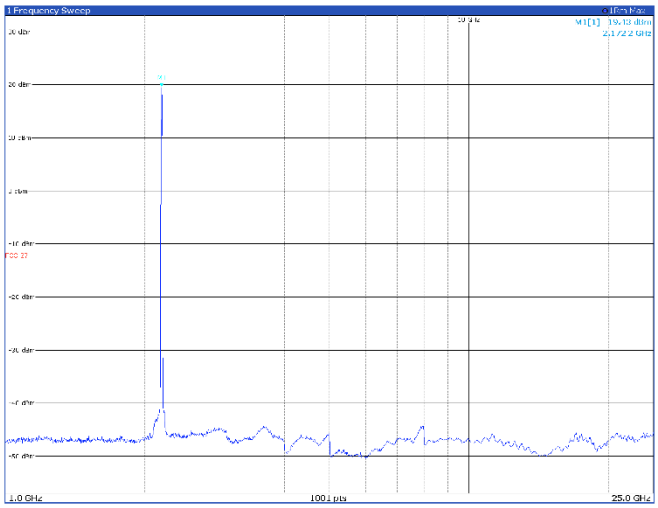




Limit exceeded by the carrier

TM3p3, 10 MHz, high channel

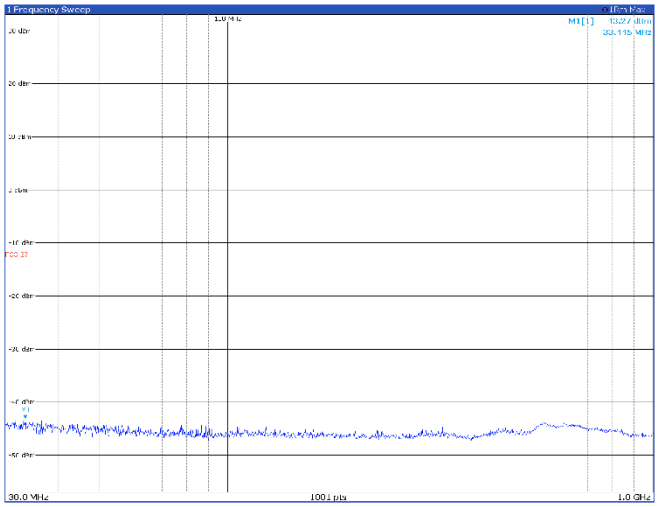


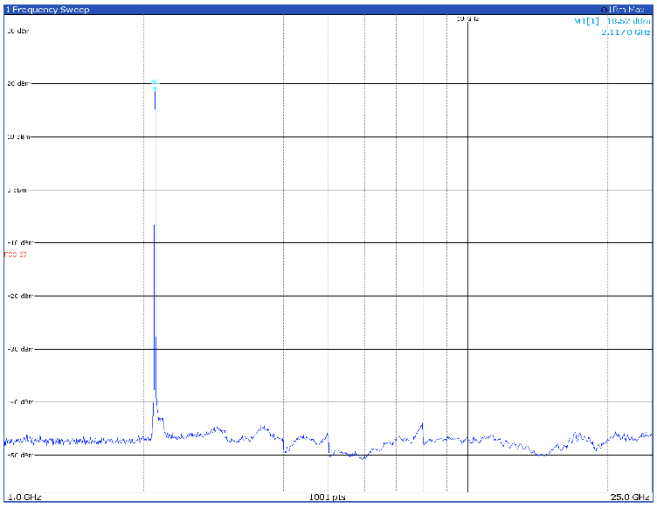


Limit exceeded by the carrier

Band n66 – conducted emissions Antenna port 2 **10 MHz**

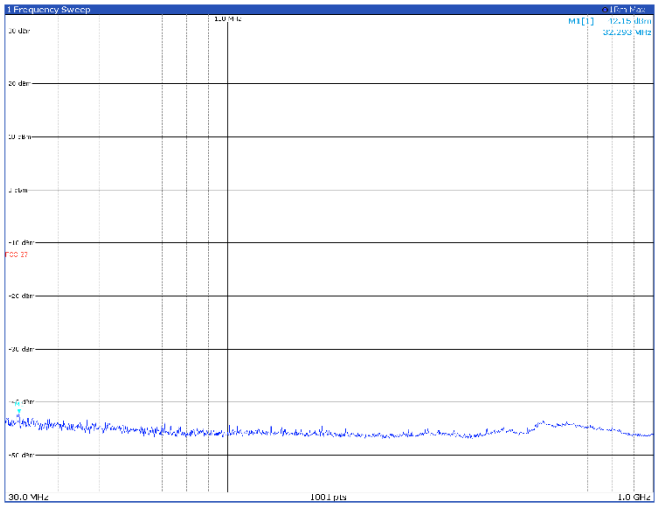
TM1.1, 10 MHz, low channel

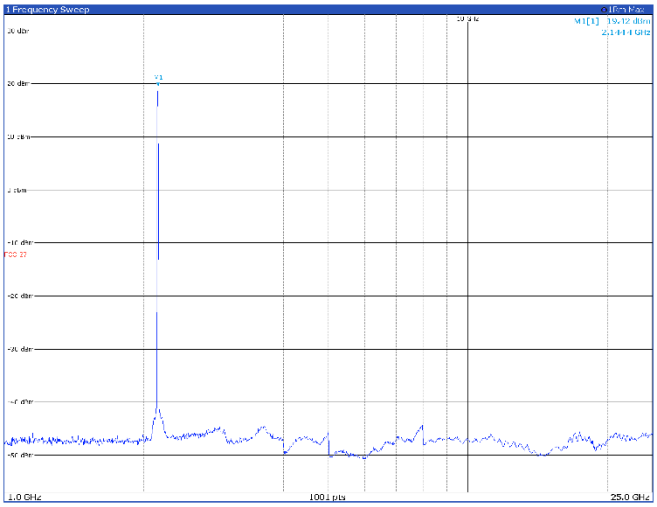




Limit exceeded by the carrier

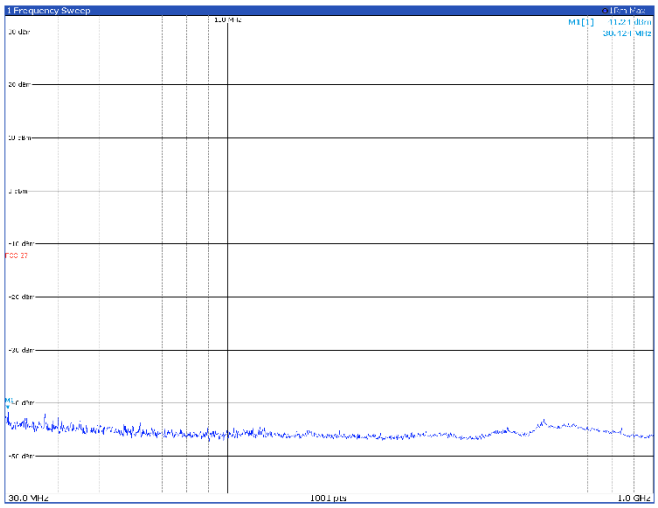
TM1.1, 10 MHz, mid channel

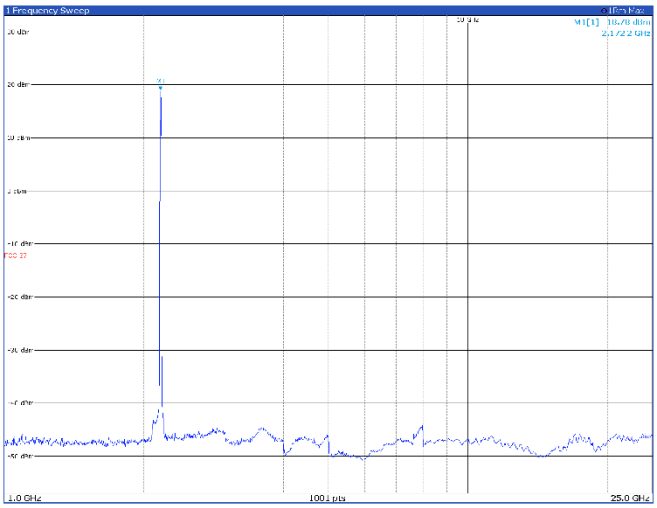




Limit exceeded by the carrier

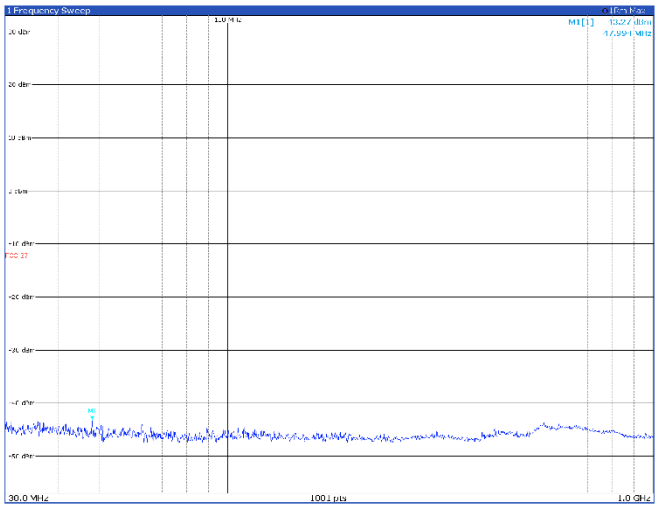
TM1.1, 10 MHz, high channel

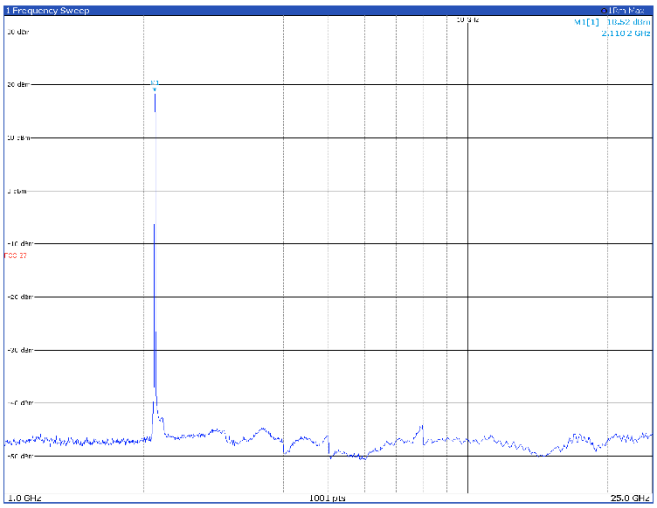




Limit exceeded by the carrier

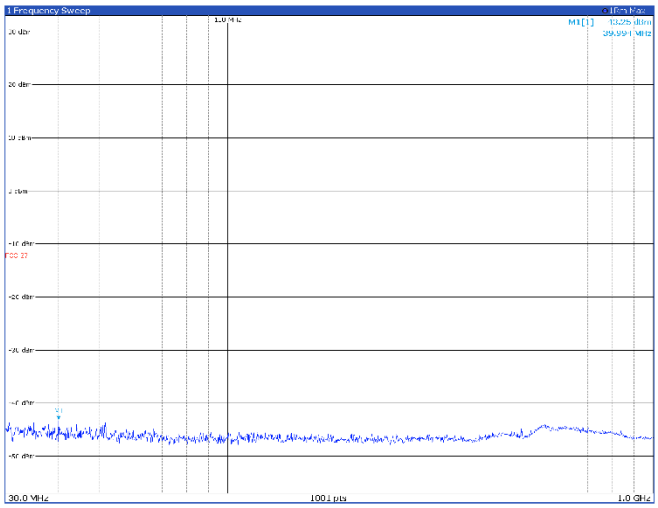
TM3p1, 10 MHz, low channel

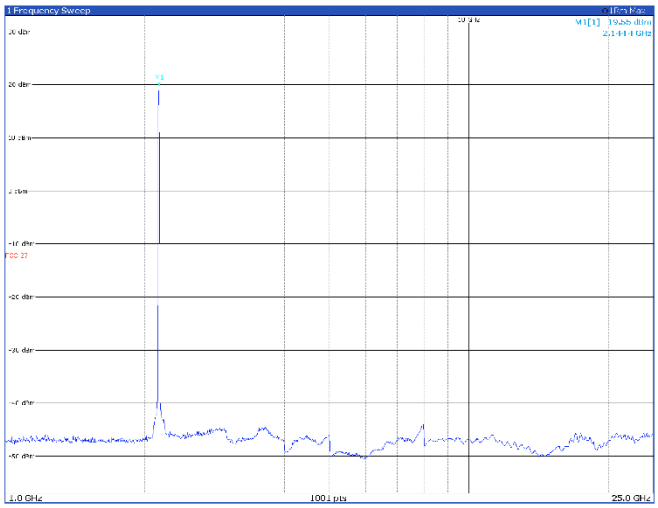




Limit exceeded by the carrier

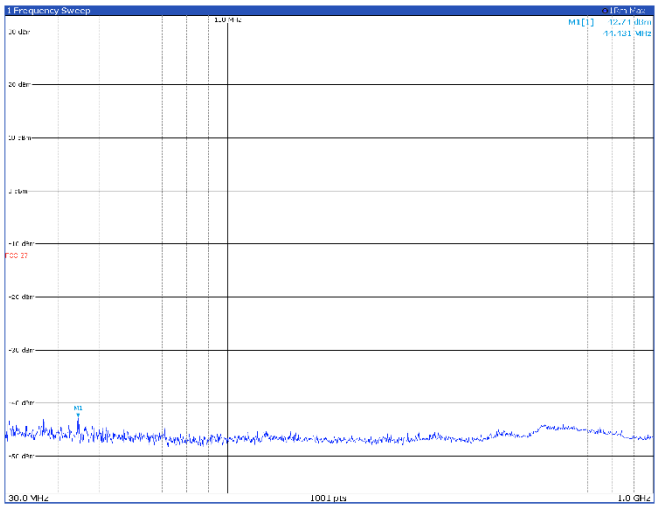
TM3p1, 10 MHz, mid channel

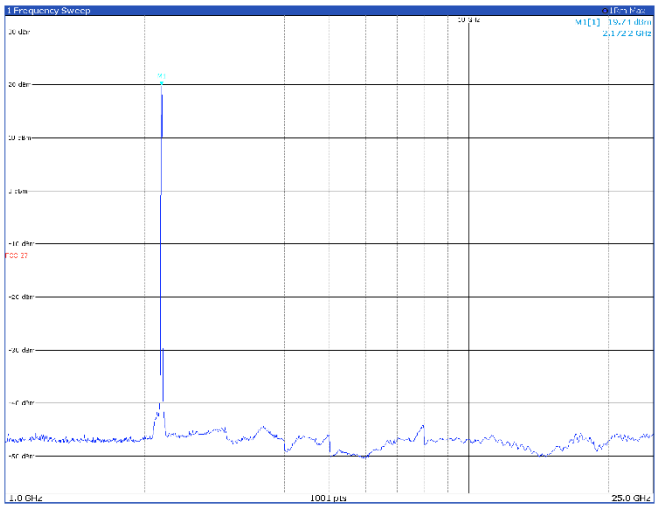




Limit exceeded by the carrier

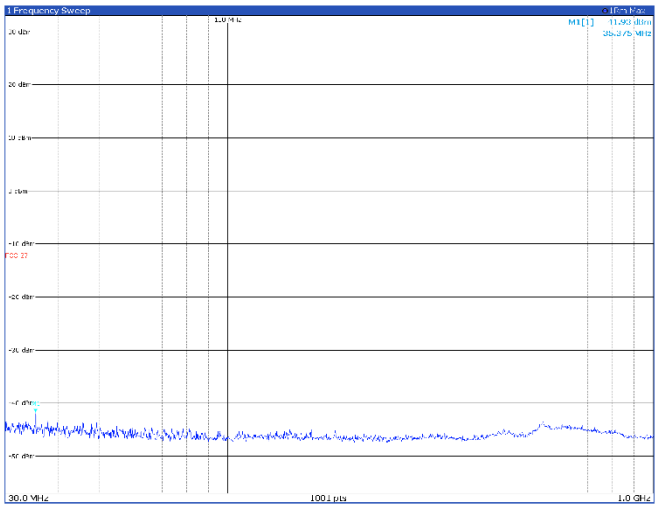
TM3p1, 10 MHz, high channel

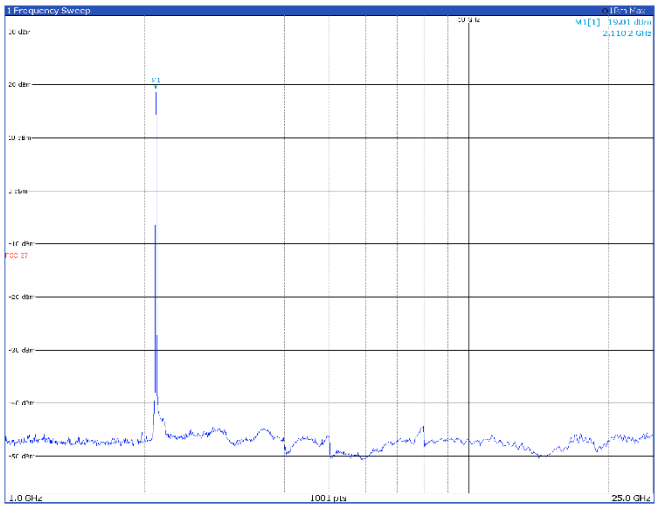




Limit exceeded by the carrier

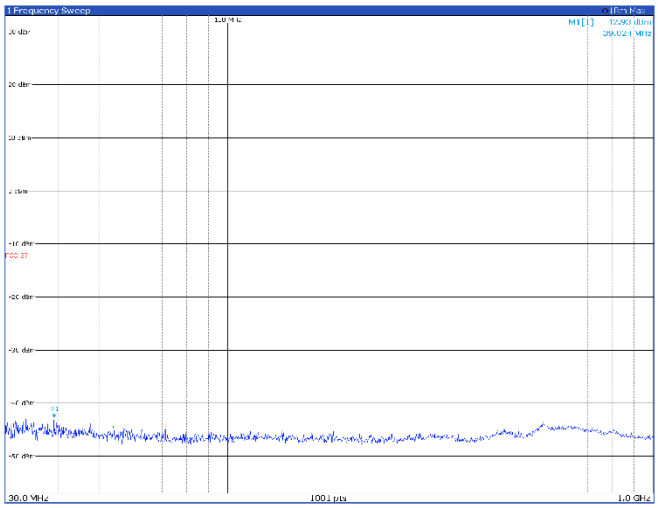
TM3p1a, 10 MHz, low channel

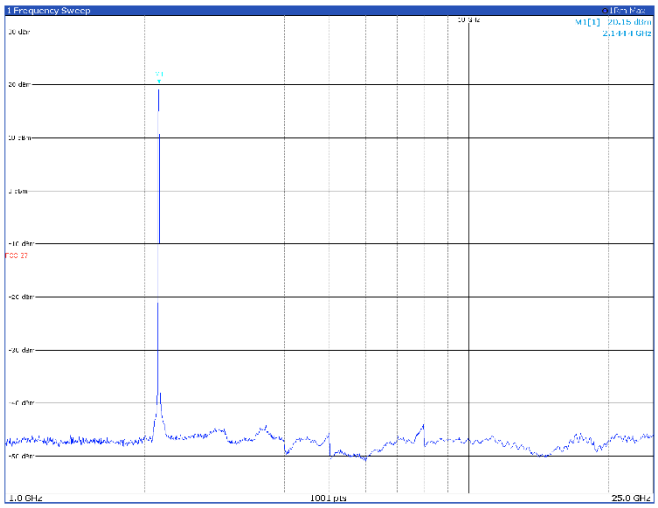




Limit exceeded by the carrier

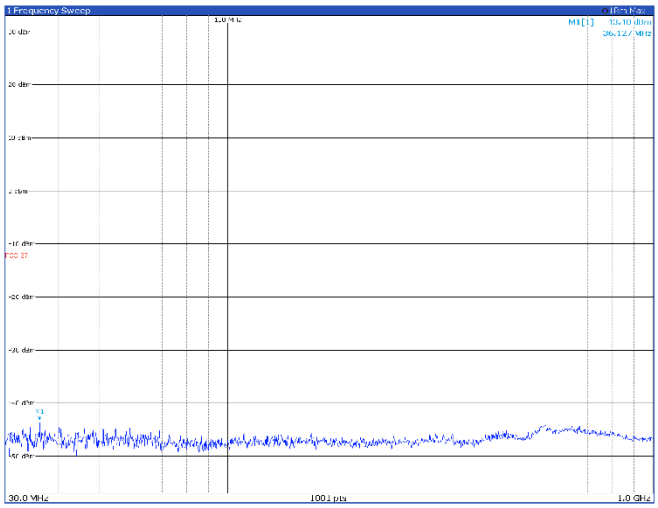
TM3p1a, 10 MHz, mid channel

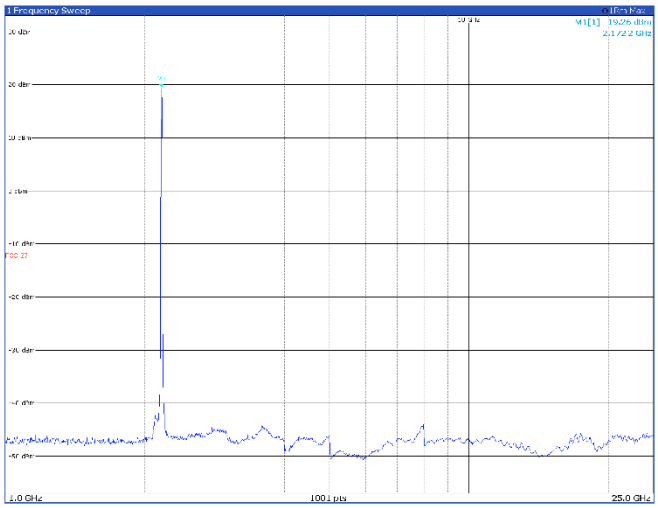




Limit exceeded by the carrier

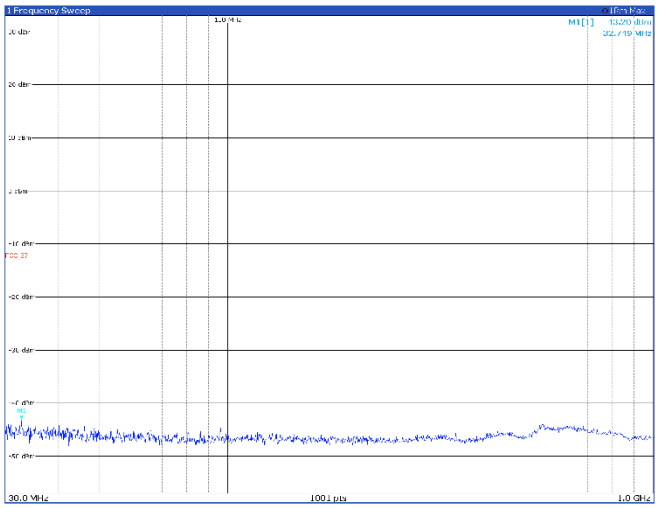
TM3p1a, 10 MHz, high channel

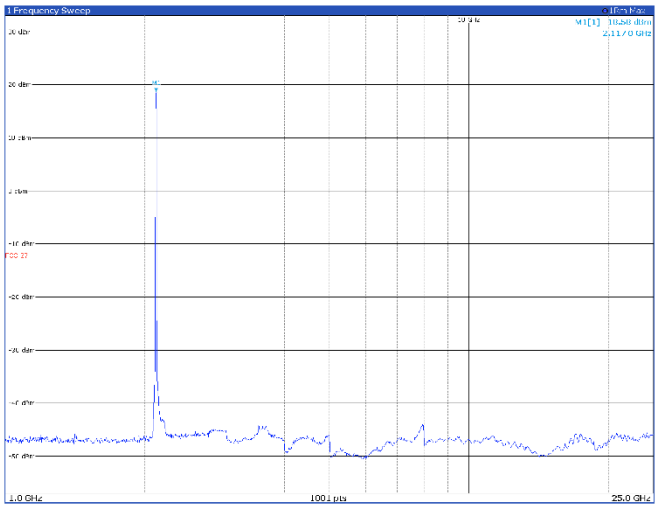




Limit exceeded by the carrier

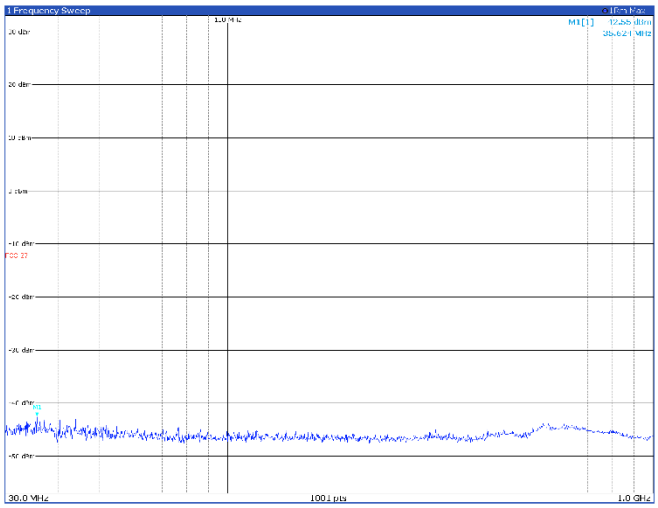
TM3p3, 10 MHz, low channel

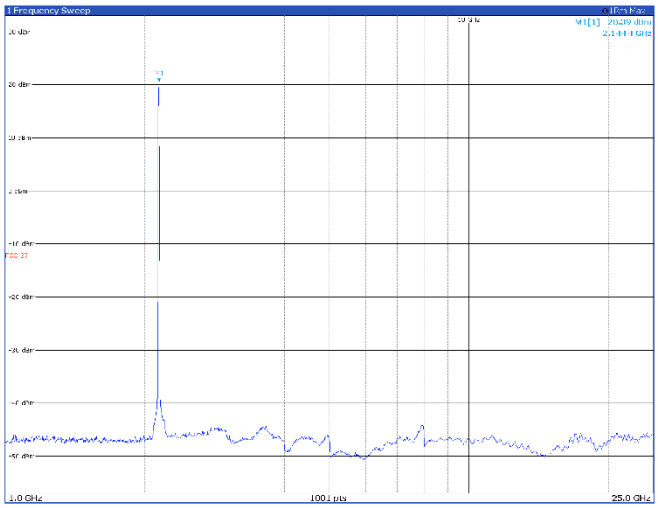




Limit exceeded by the carrier

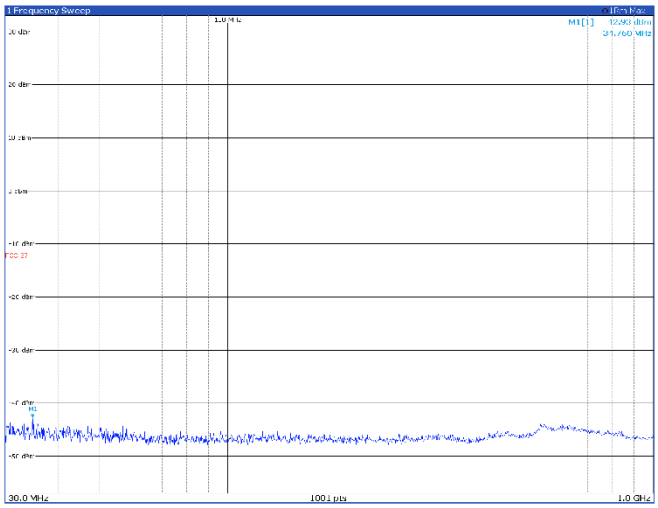
TM3p3, 10 MHz, mid channel

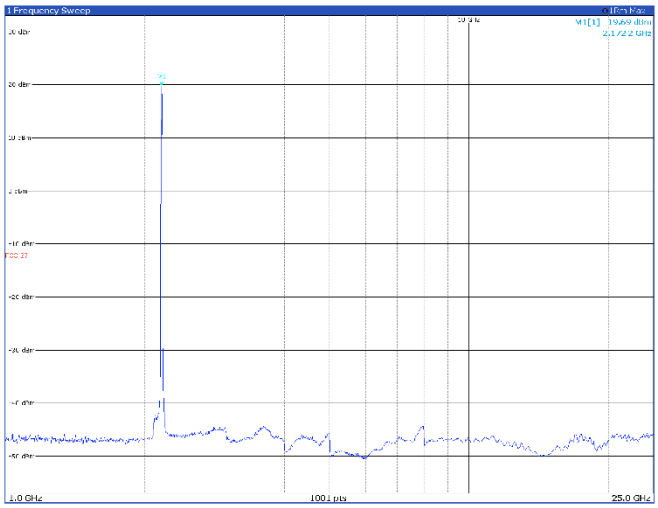




Limit exceeded by the carrier

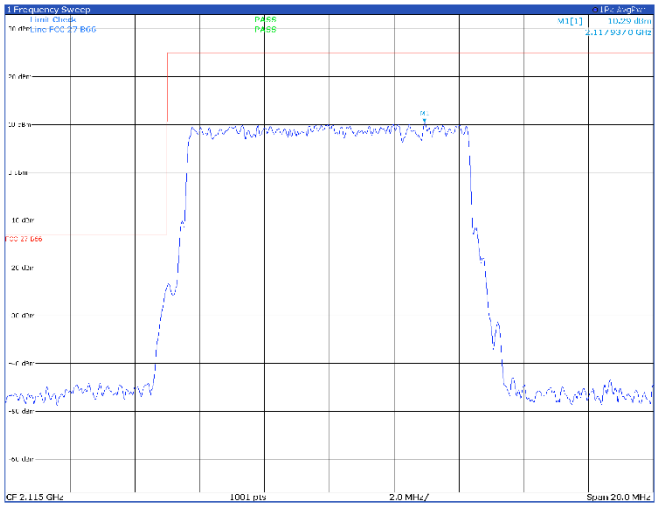
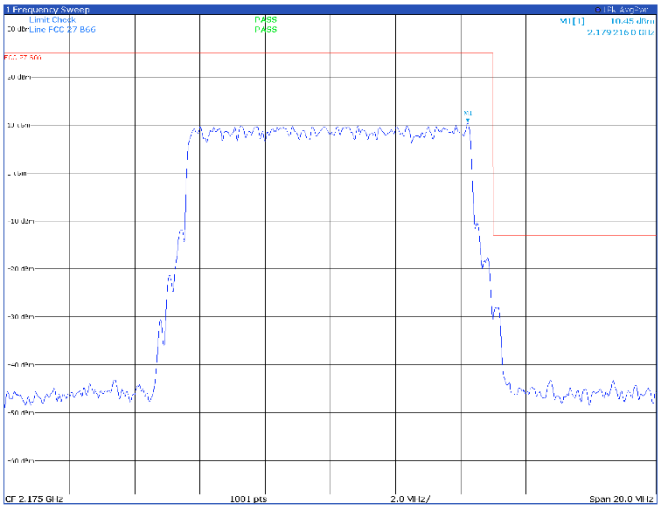
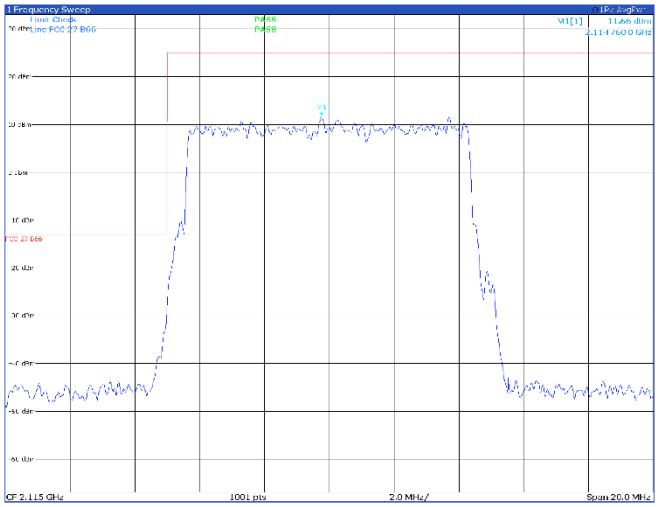
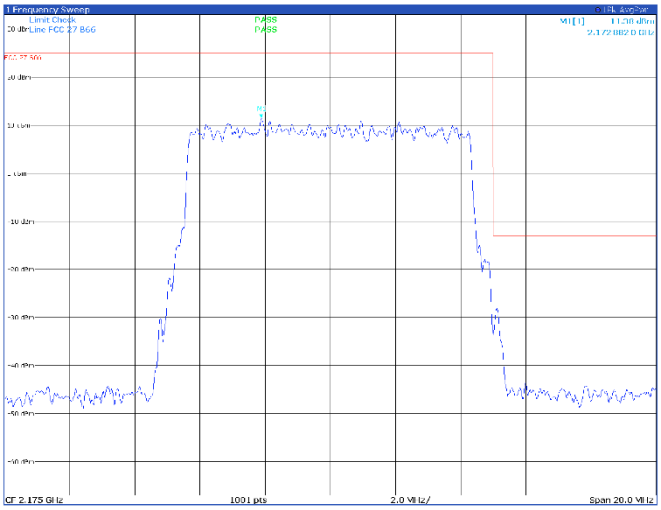
TM3p3, 10 MHz, high channel

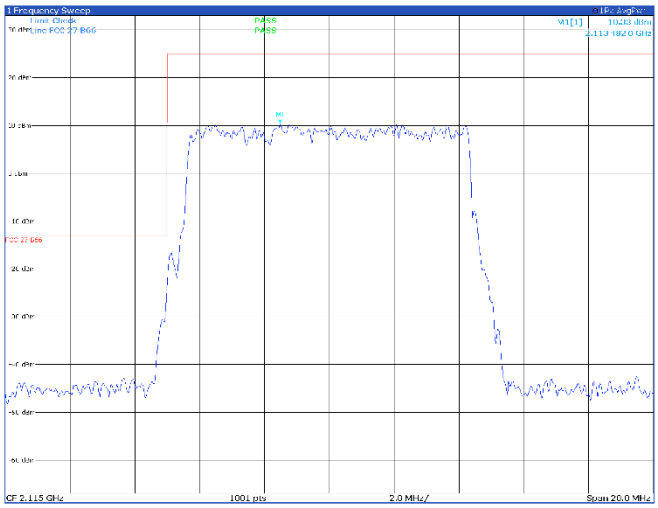
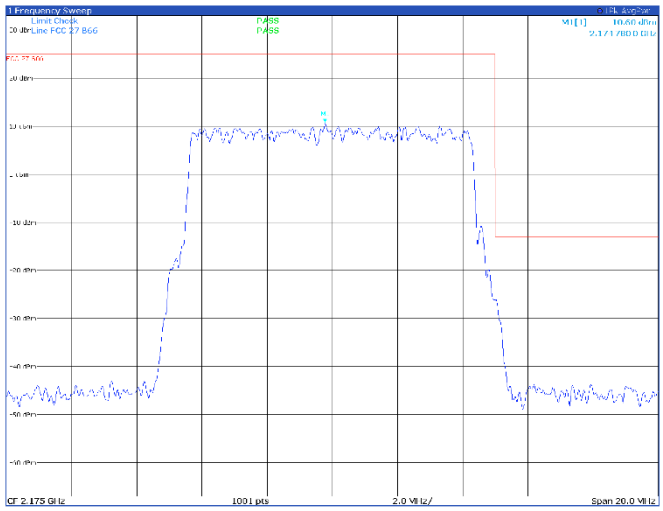
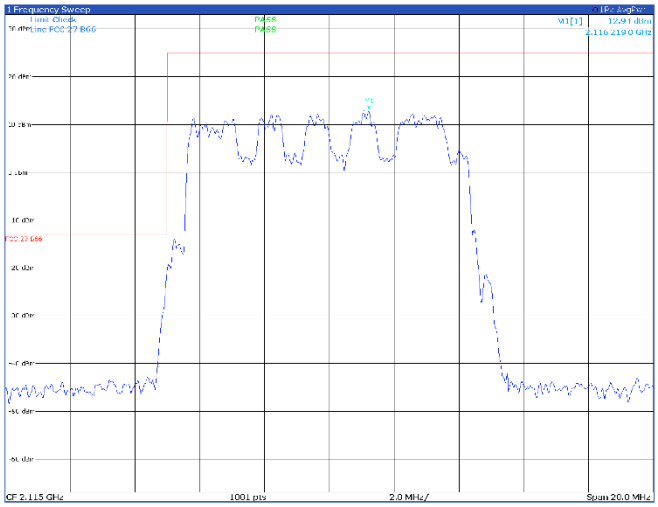
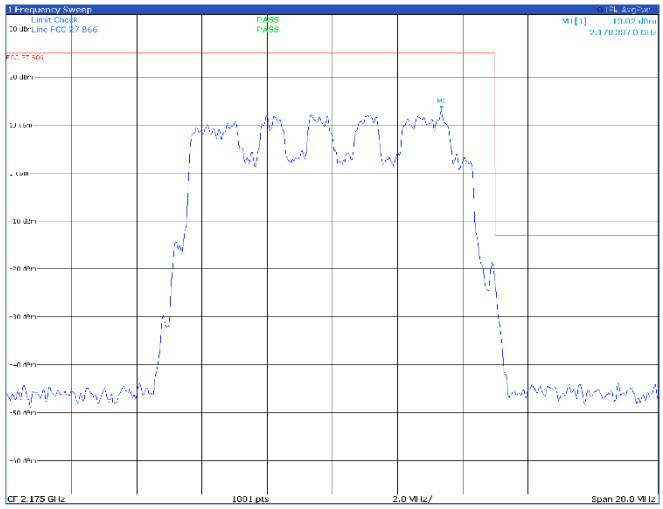




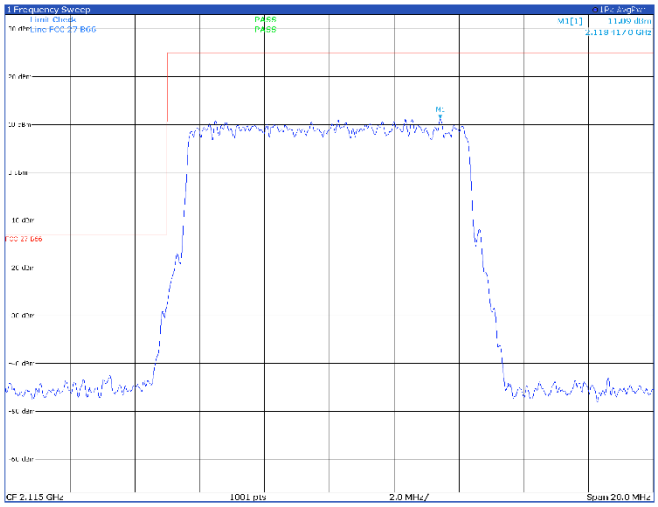
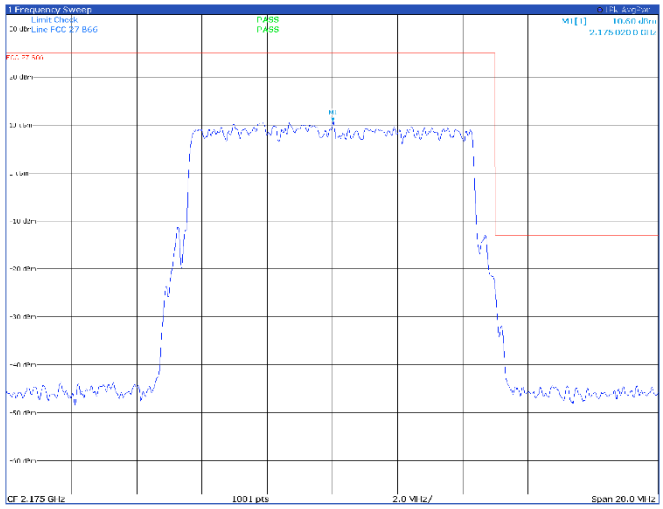
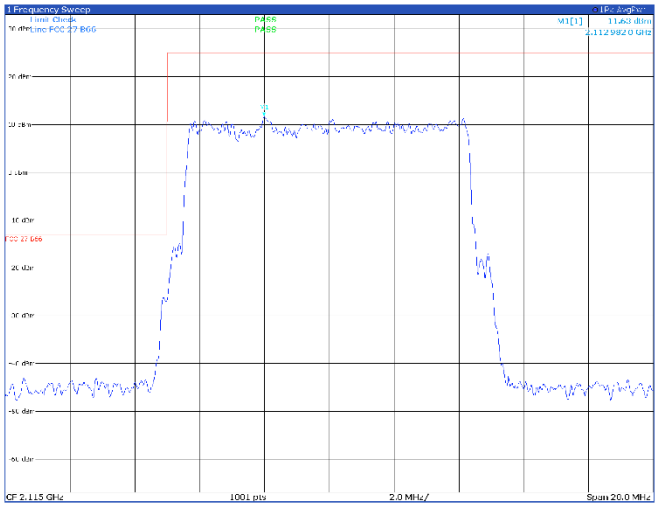
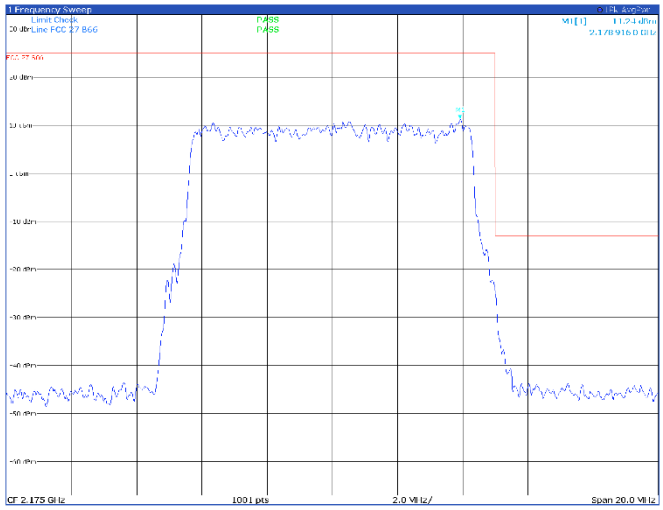
Limit exceeded by the carrier

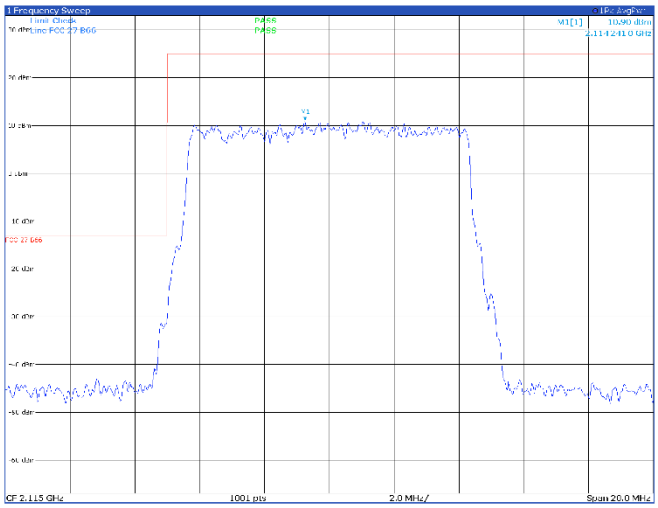
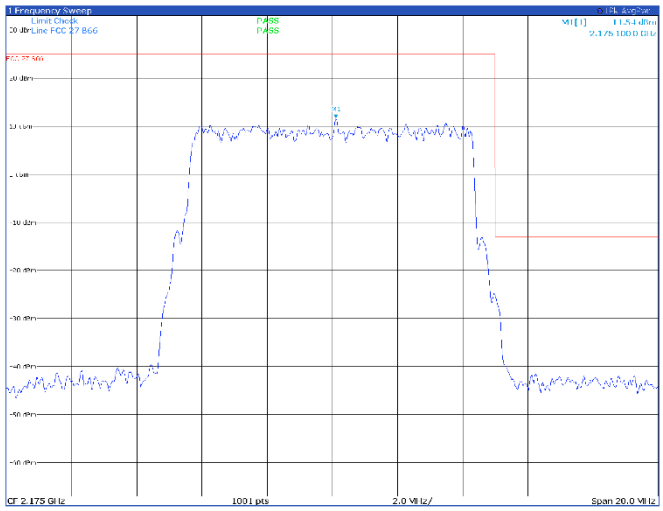
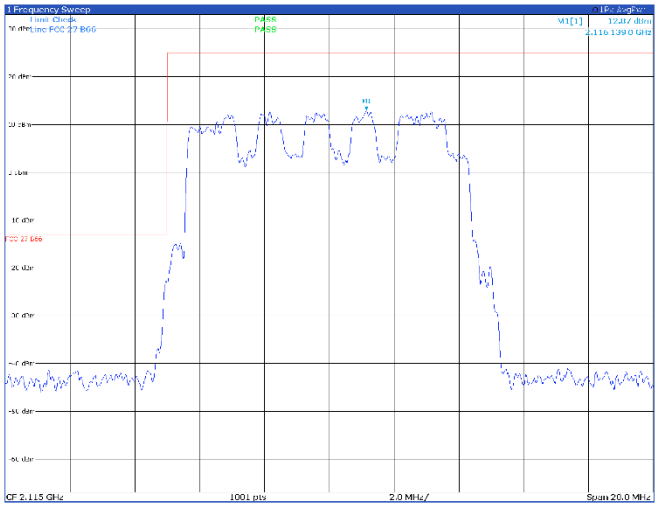
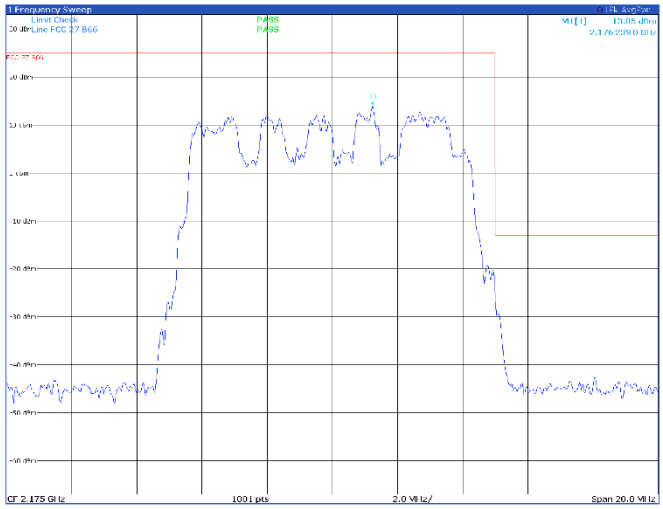
Band n66 – band edge Antenna port 1 **10 MHz**

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**
	

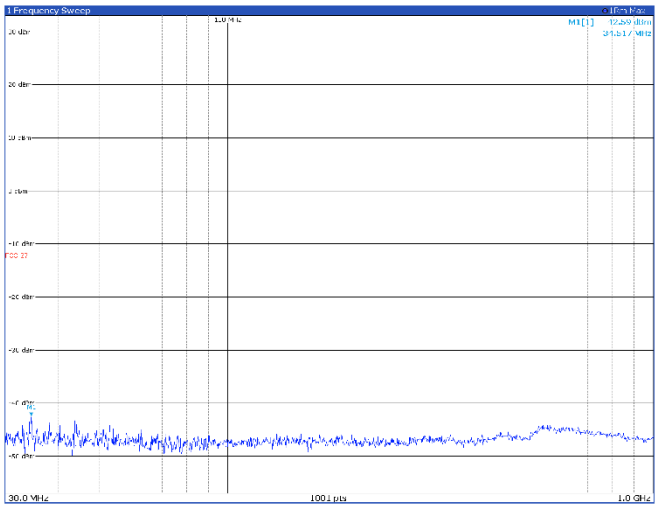
Band n66 – band edge Antenna port 2 **10 MHz**

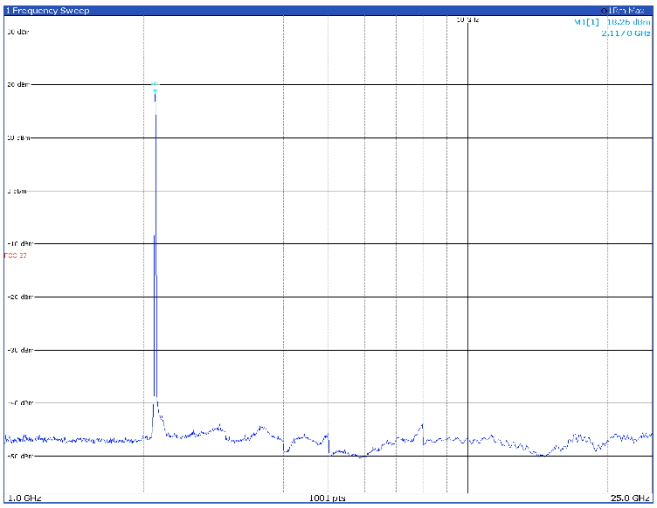
TM1.1, 10 MHz, low channel	TM1.1, 10 MHz, high channel
	
TM3p1, 10 MHz, low channel	**TM3p1, 10 MHz, high channel**
	

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

Band n66 – conducted emissions Antenna port 1 **15 MHz**

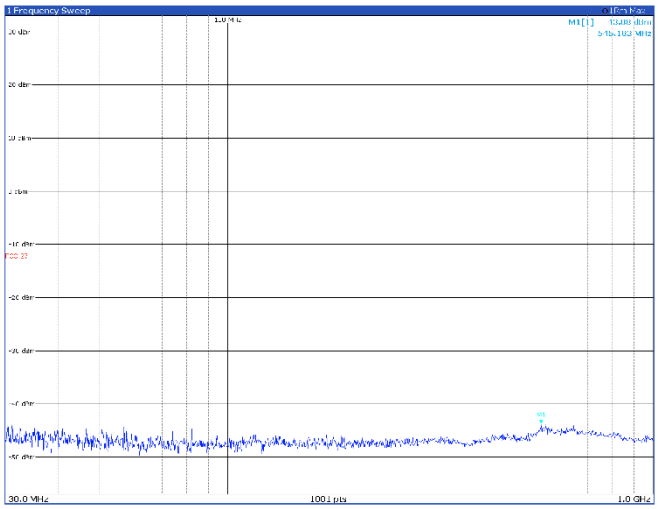
TM1.1, 15 MHz, low channel

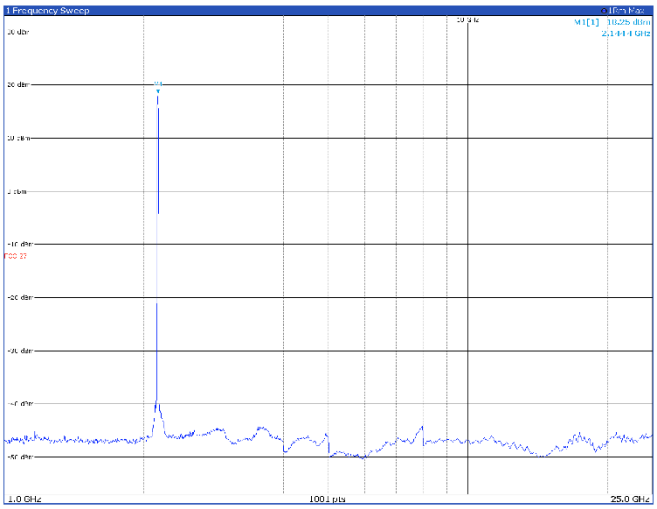




Limit exceeded by the carrier

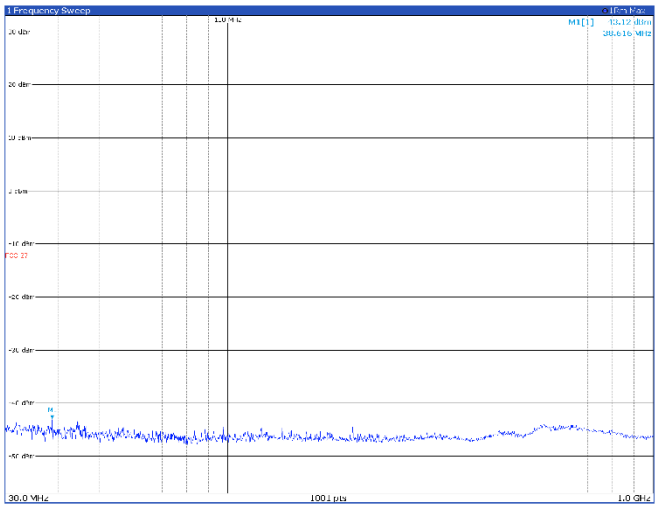
TM1.1, 15 MHz, mid channel

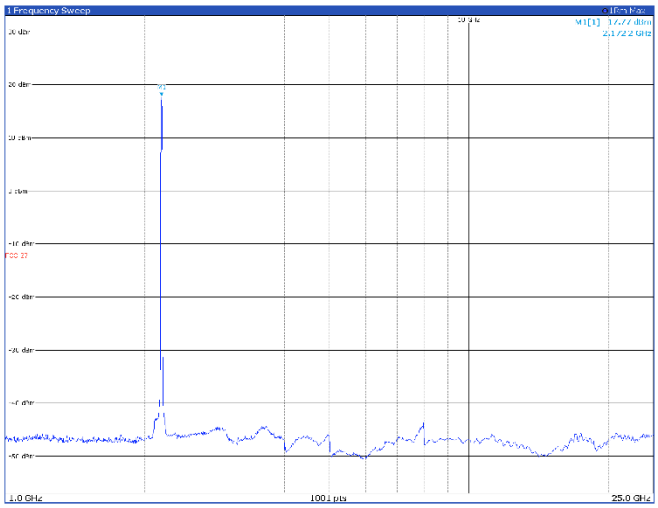




Limit exceeded by the carrier

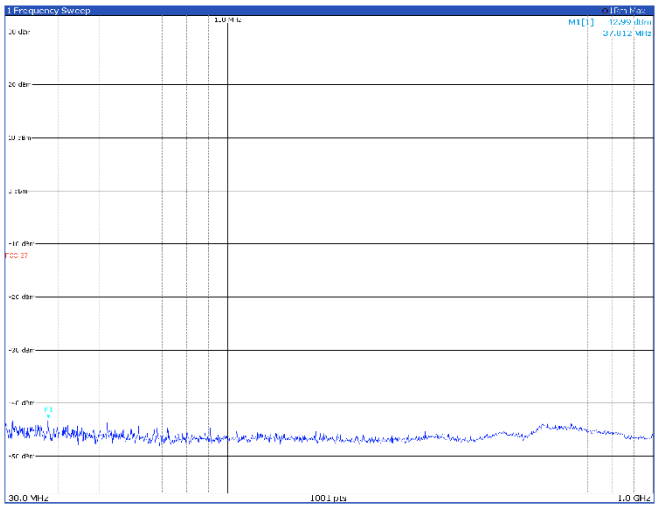
TM1.1, 15 MHz, high channel

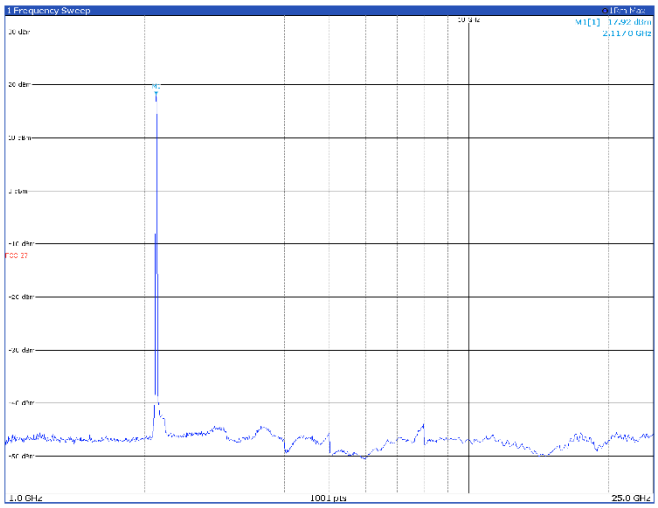




Limit exceeded by the carrier

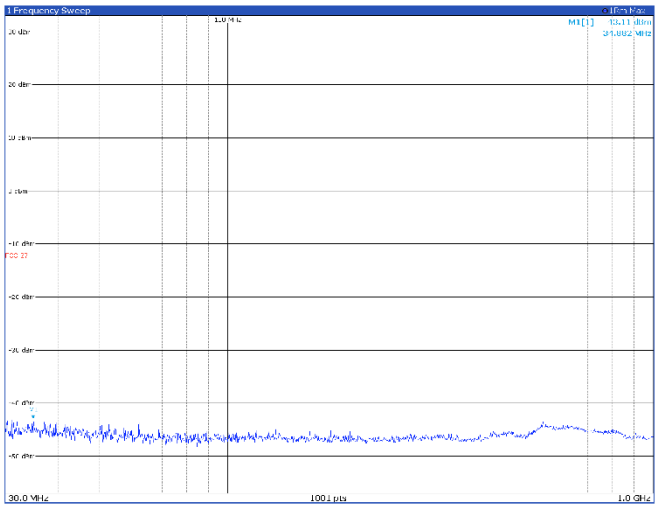
TM3p1, 15 MHz, low channel

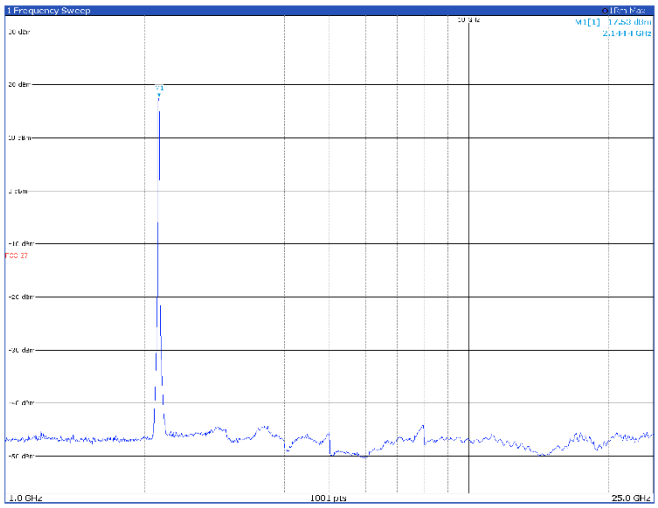




Limit exceeded by the carrier

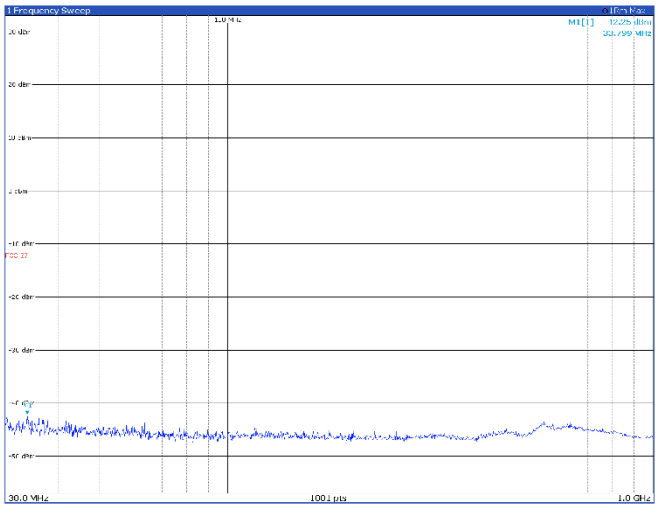
TM3p1, 15 MHz, mid channel

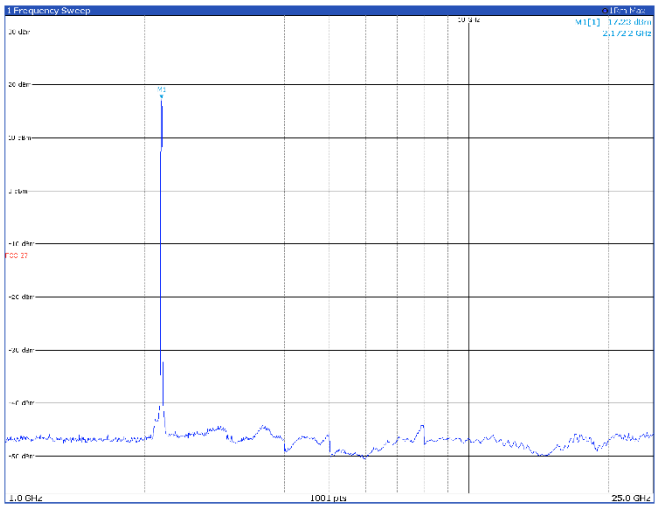




Limit exceeded by the carrier

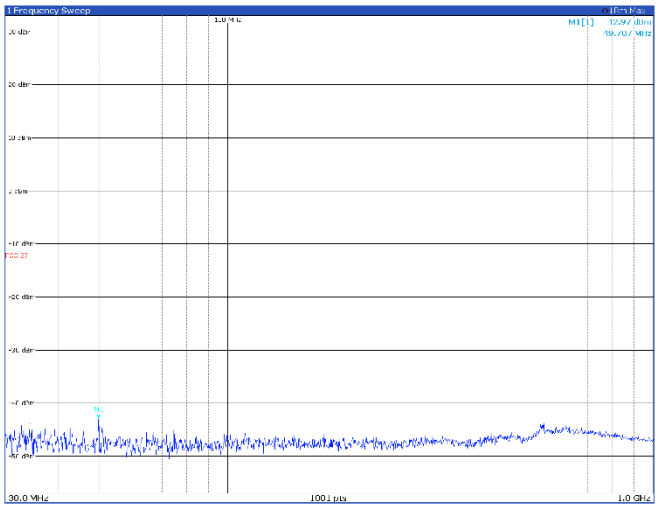
TM3p1, 15 MHz, high channel

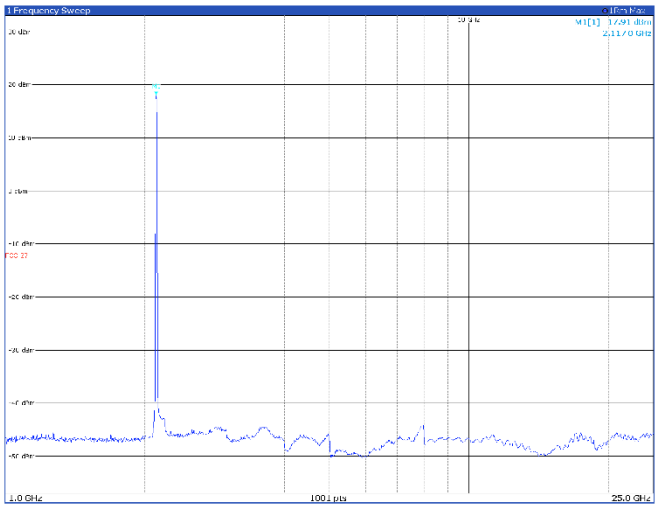




Limit exceeded by the carrier

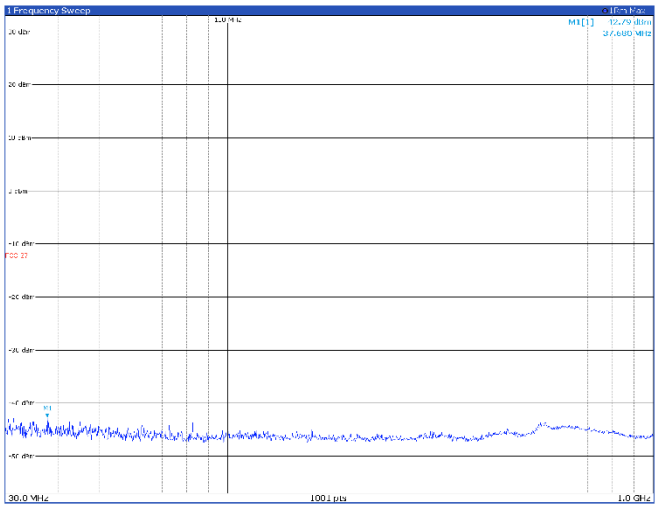
TM3p1a, 15 MHz, low channel

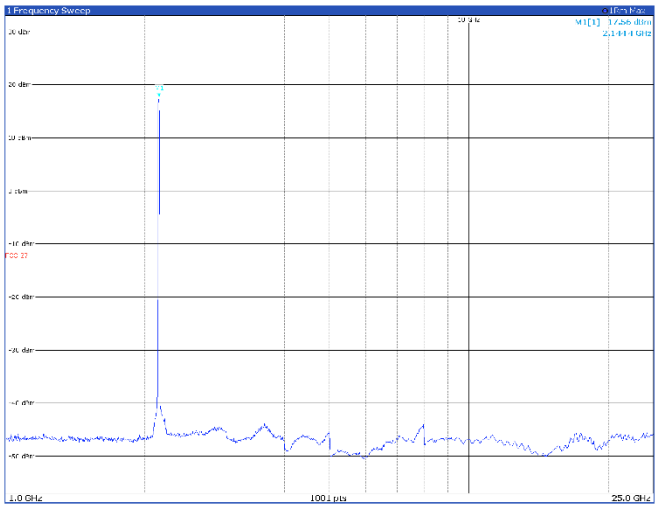




Limit exceeded by the carrier

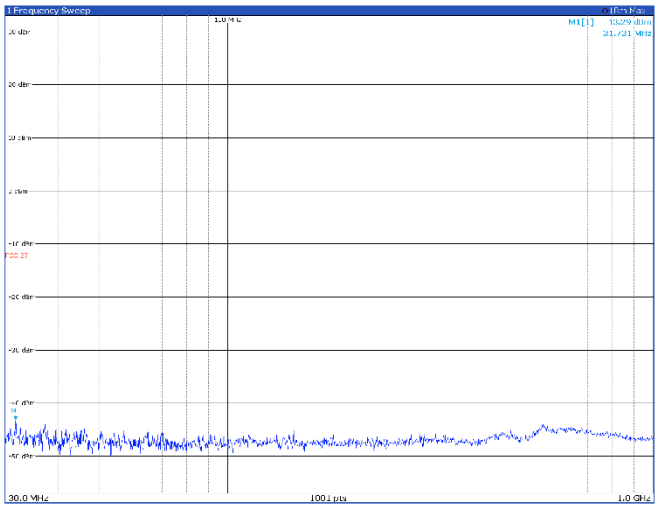
TM3p1a, 15 MHz, mid channel

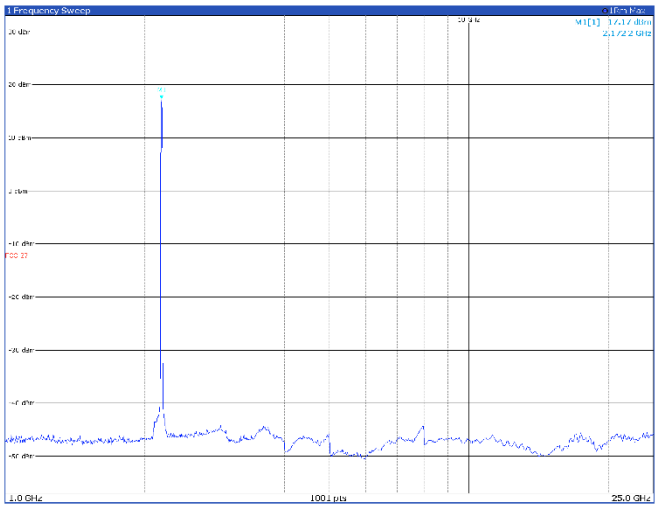




Limit exceeded by the carrier

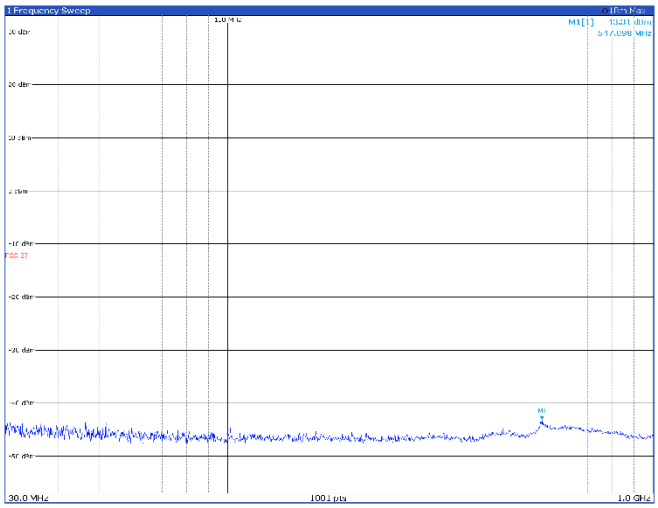
TM3p1a, 15 MHz, high channel

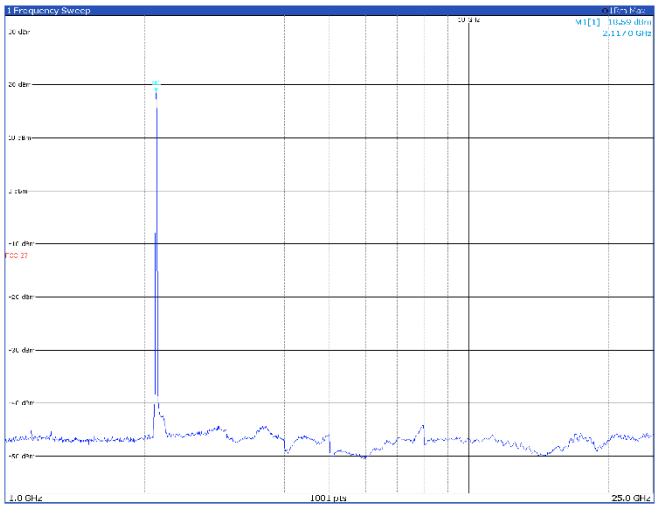




Limit exceeded by the carrier

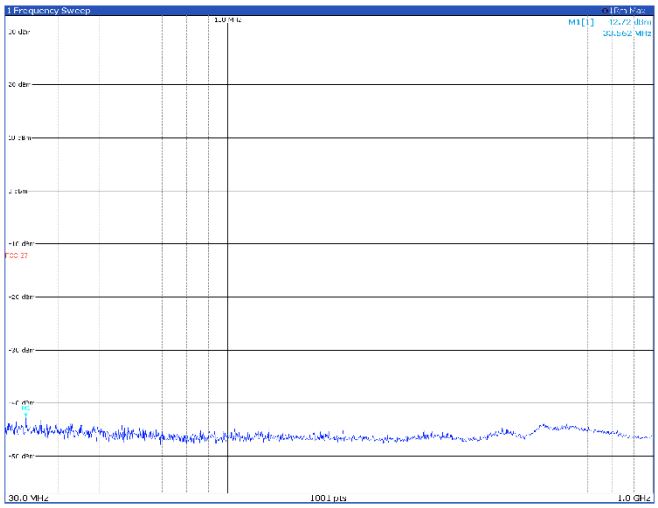
TM3p3, 15 MHz, low channel

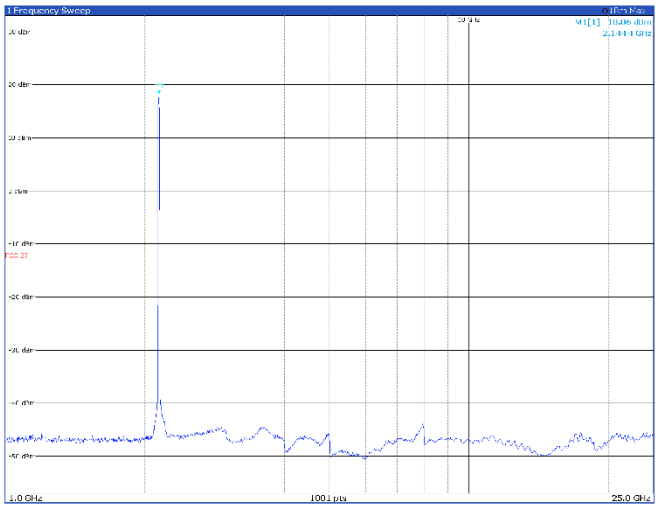




Limit exceeded by the carrier

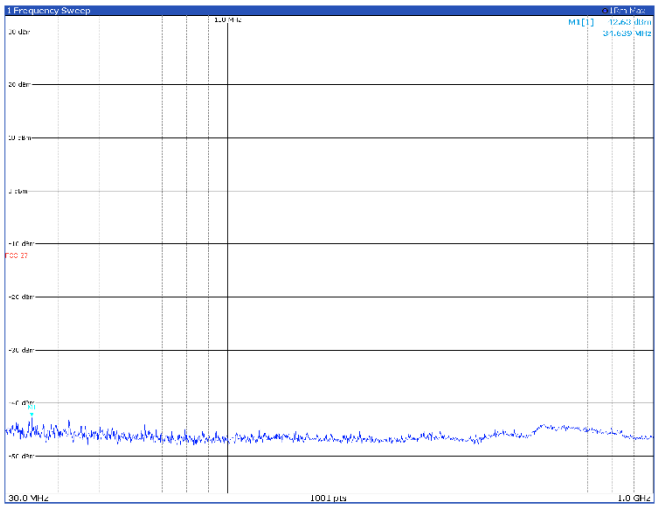
TM3p3, 15 MHz, mid channel

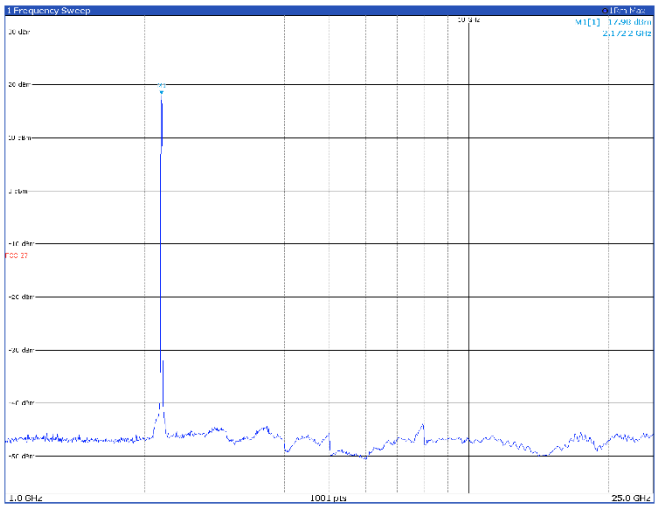




Limit exceeded by the carrier

TM3p3, 15 MHz, high channel

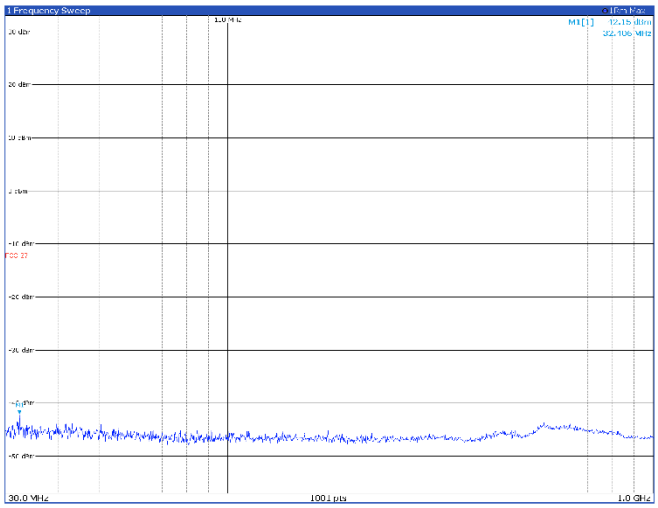


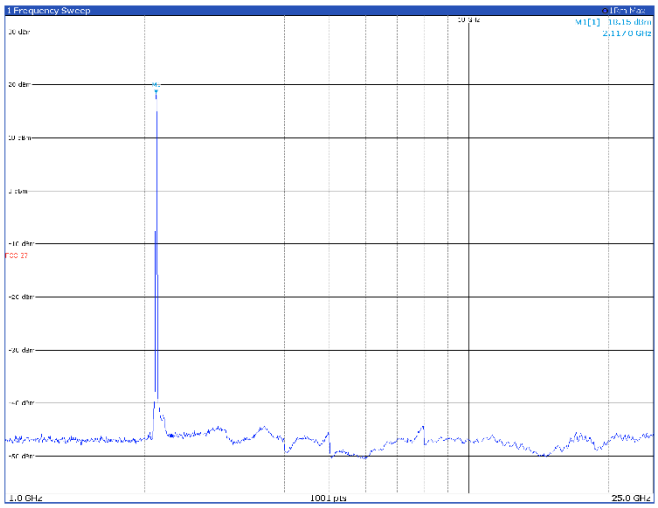


Limit exceeded by the carrier

Band n66 – conducted emissions Antenna port 2 **15 MHz**

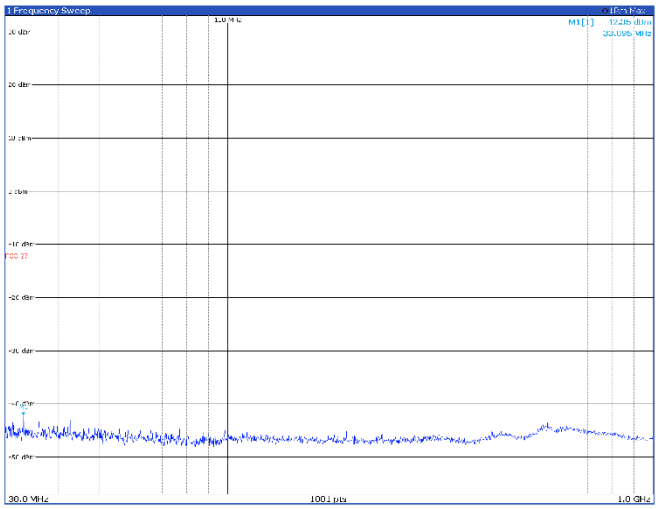
TM1.1, 15 MHz, low channel

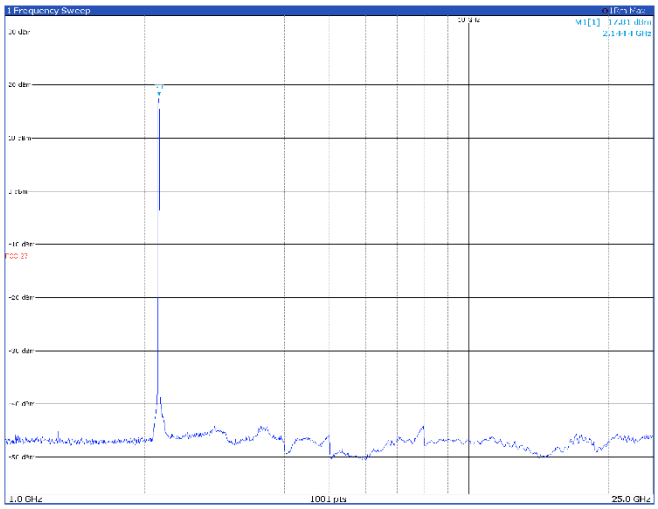




Limit exceeded by the carrier

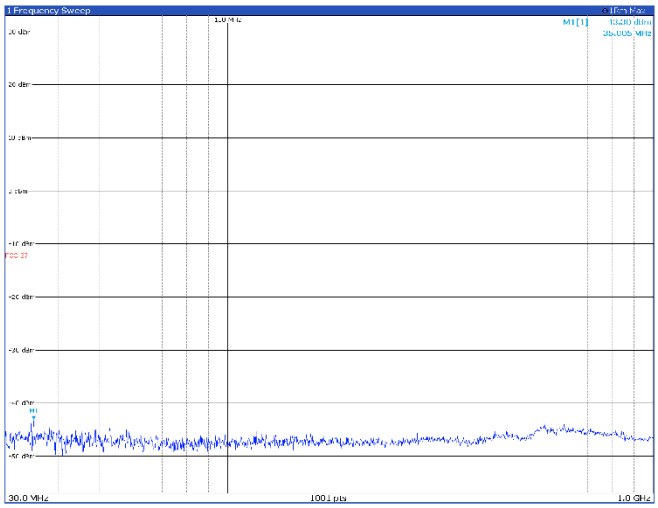
TM1.1, 15 MHz, mid channel

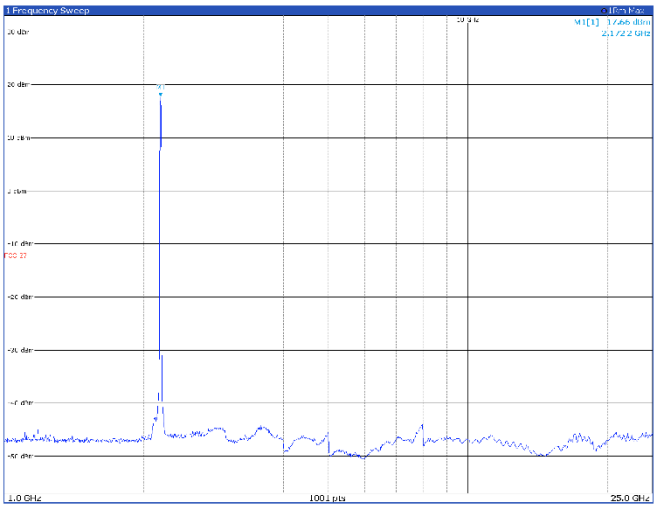




Limit exceeded by the carrier

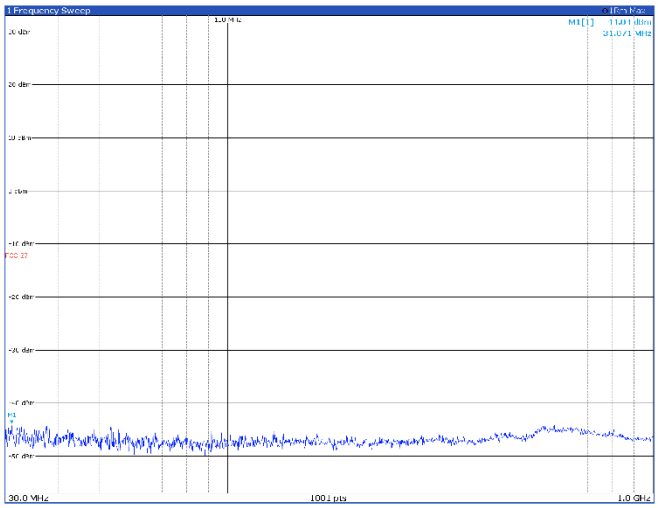
TM1.1, 15 MHz, high channel

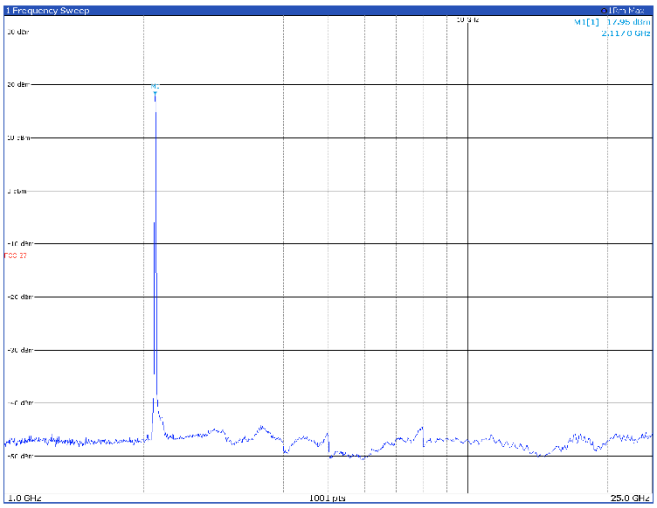




Limit exceeded by the carrier

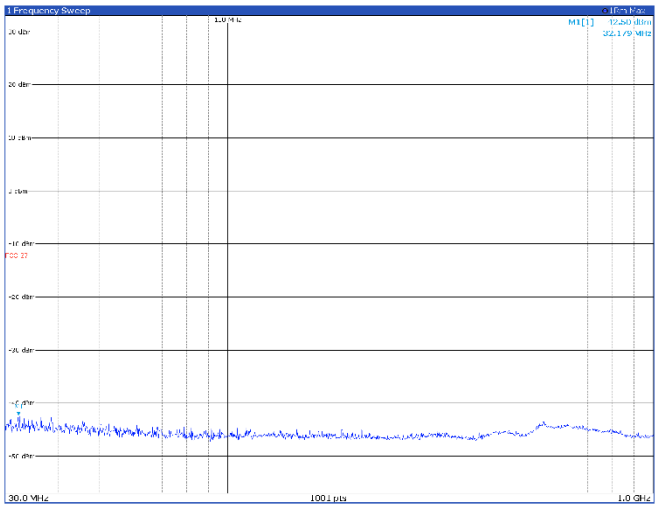
TM3p1, 15 MHz, low channel

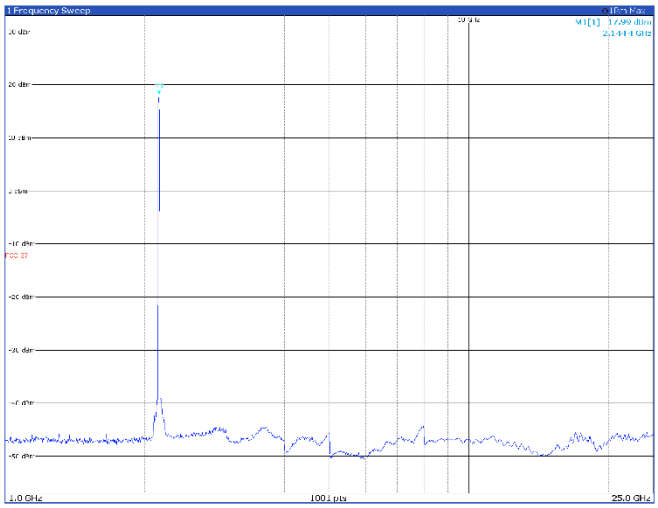




Limit exceeded by the carrier

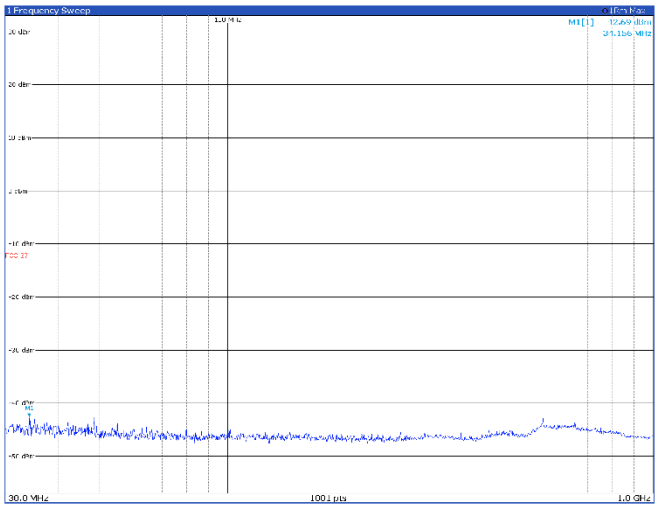
TM3p1, 15 MHz, mid channel

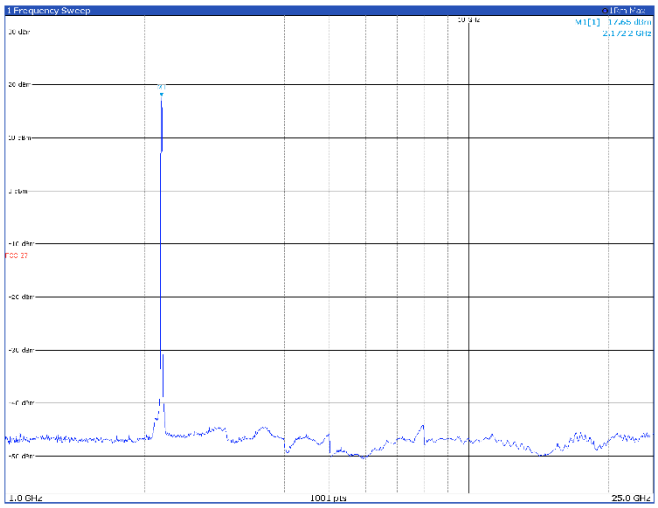




Limit exceeded by the carrier

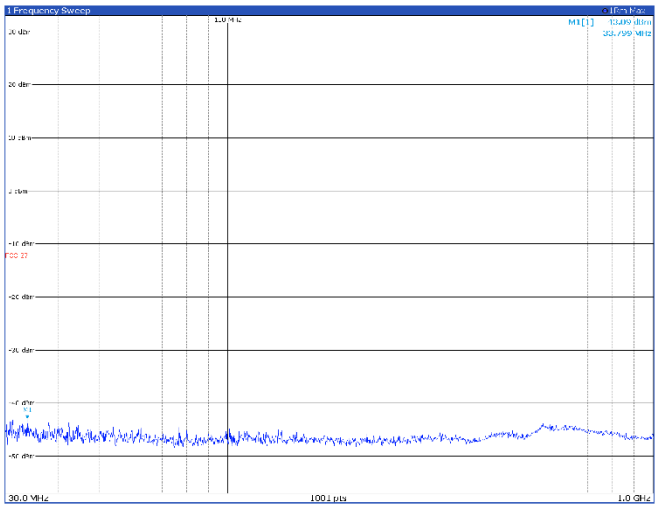
TM3p1, 15 MHz, high channel

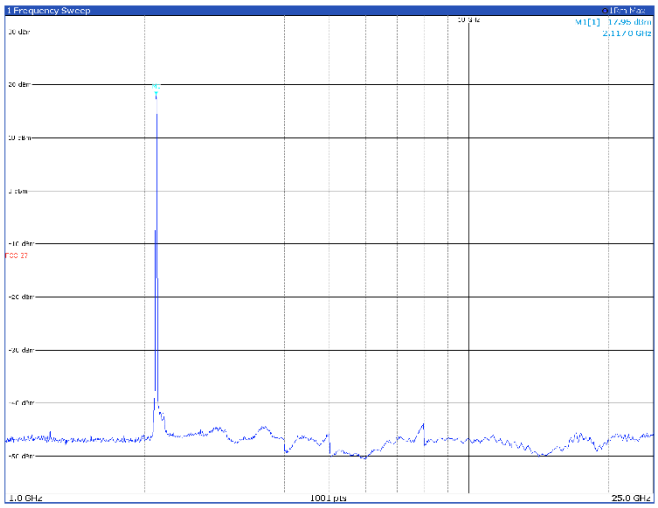




Limit exceeded by the carrier

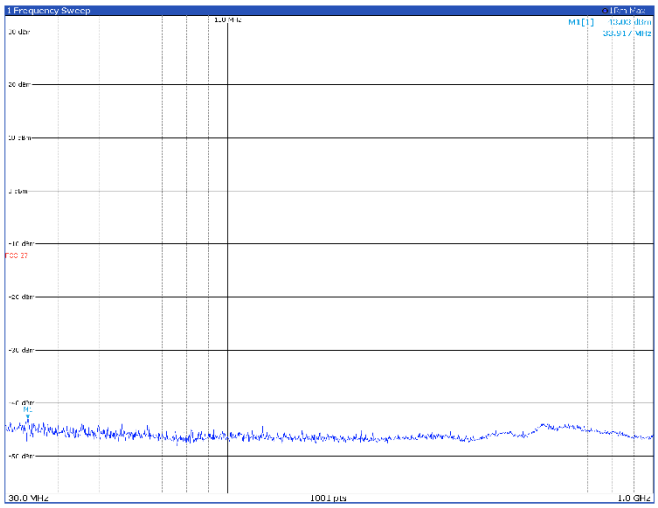
TM3p1a, 15 MHz, low channel

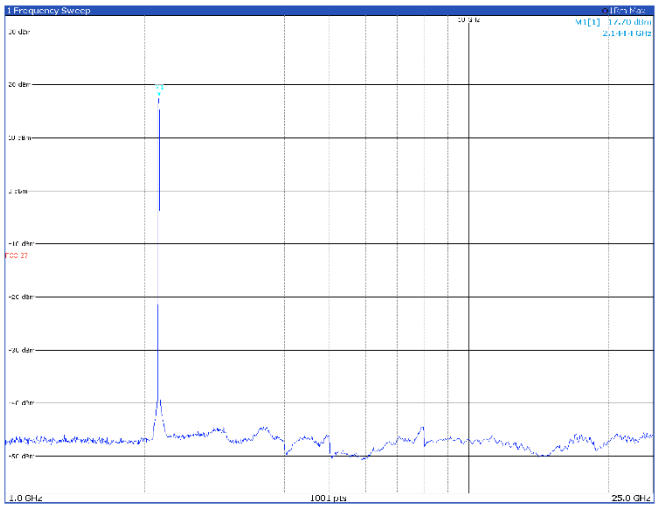




Limit exceeded by the carrier

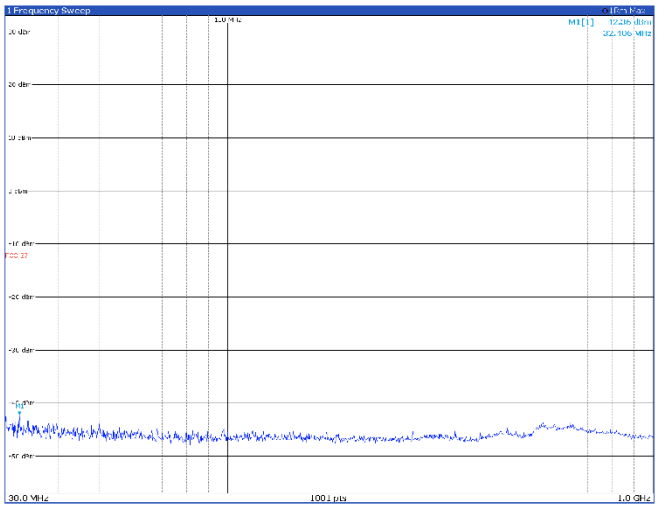
TM3p1a, 15 MHz, mid channel

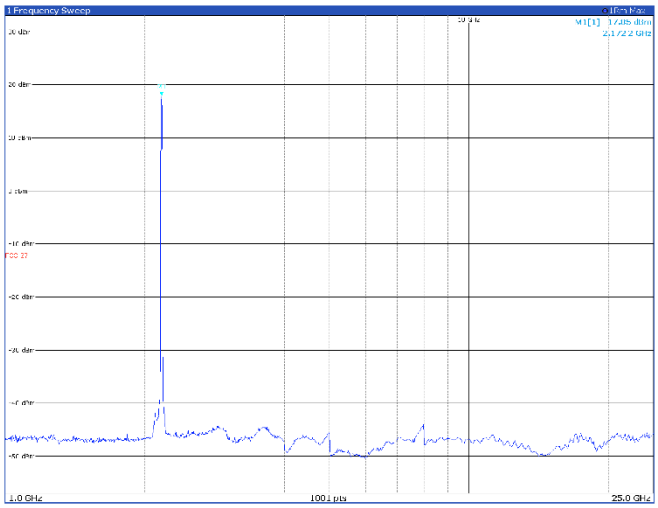




Limit exceeded by the carrier

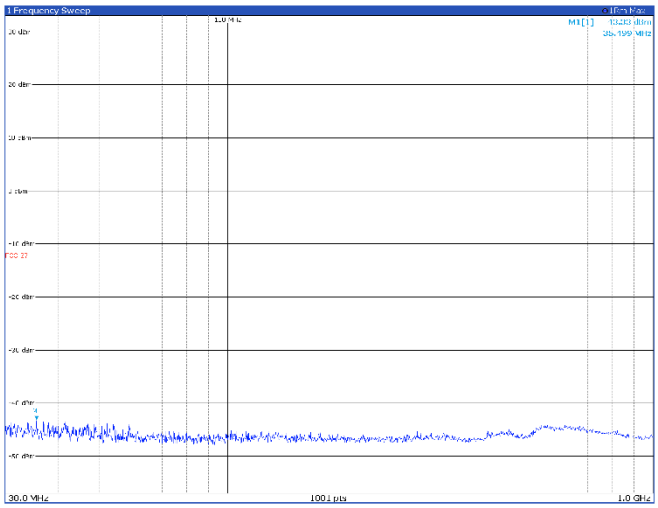
TM3p1a, 15 MHz, high channel

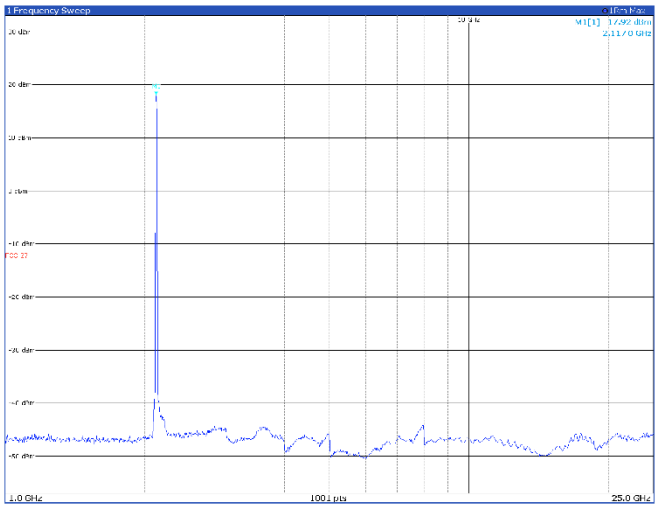




Limit exceeded by the carrier

TM3p3, 15 MHz, low channel





Limit exceeded by the carrier