



Section 7
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FCC 47 CFR Part 22, Subpart H, FCC 47 CFR Part 24, Subpart E, FCC 47 CFR Part 27, Subpart C, FCC 47 CFR Part 90, Subpart S, ISED RSS -119 Issue 12, ISED RSS -130 Issue 2, ISED RSS -132 Issue 4, ISED RSS -133 Issue 6, ISED RSS -139 Issue 4, ISED RSS -199 Issue 4

Test data, Bandwidth, continued

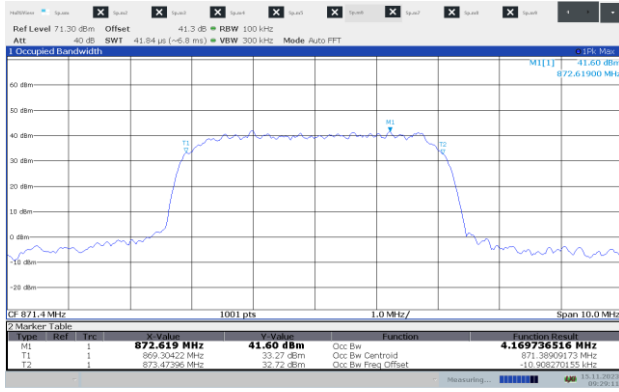


Figure 7.1-246: OBW, WCDMA, B 05, CH 4357

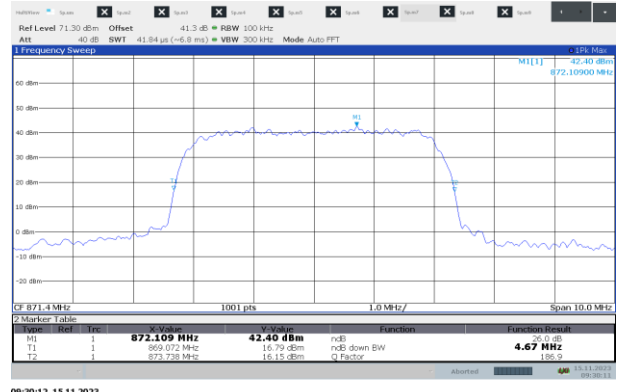


Figure 7.1-247: EBW, WCDMA, B 05, CH 4357

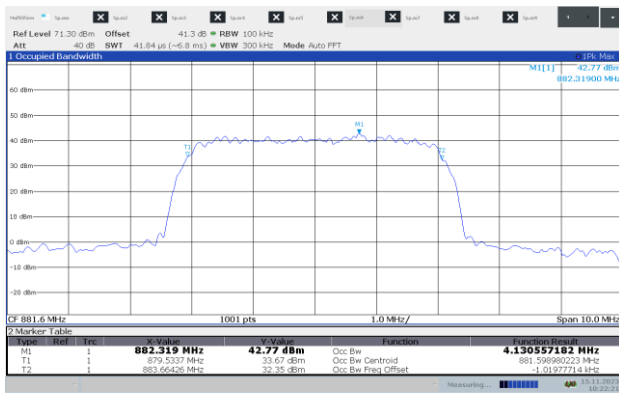


Figure 7.1-248: OBW, WCDMA, B 05, CH 4408

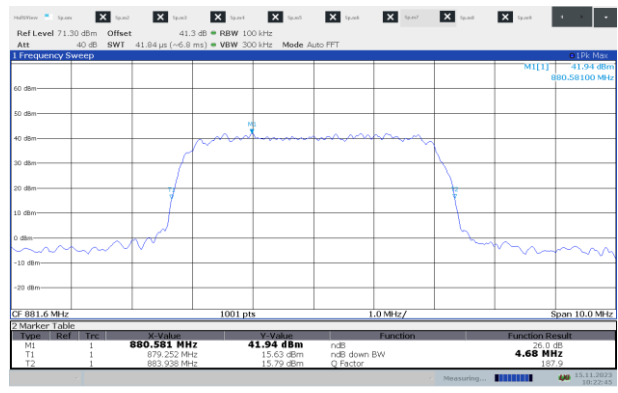


Figure 7.1-249: EBW, WCDMA, B 05, CH 4408

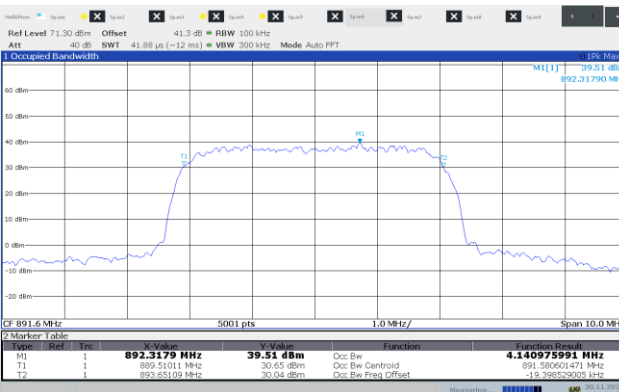


Figure 7.1-250: OBW, WCDMA, B 05, CH 4458



Figure 7.1-251: EBW, WCDMA, B 05, CH 4458

Test data, Bandwidth, continued

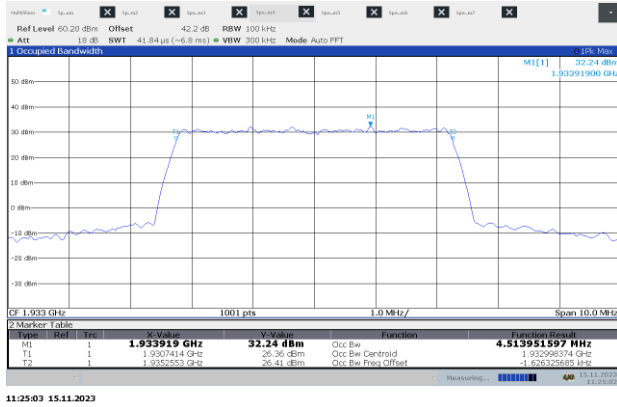


Figure 7.1-252: OBW, LTE, B 02, CH 630

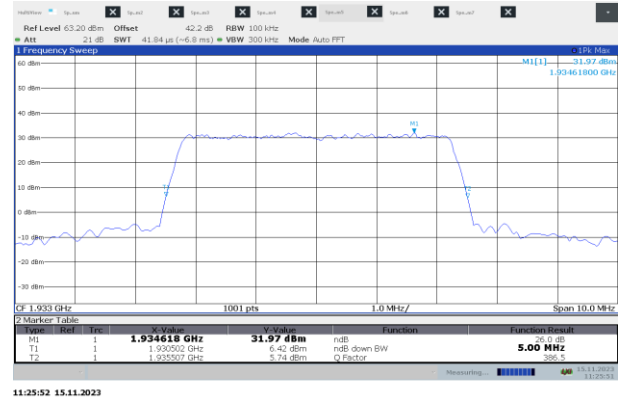


Figure 7.1-253: EBW, LTE, B 02, CH 630

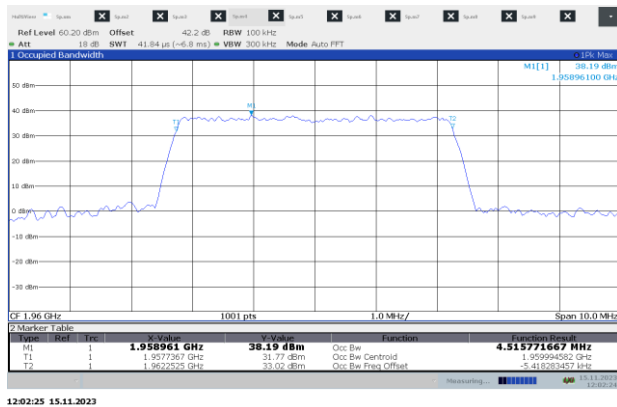


Figure 7.1-254: OBW, LTE, B 02, CH 900

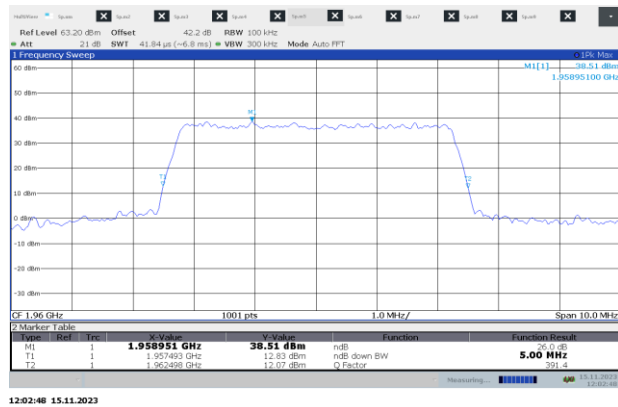


Figure 7.1-255: EBW, LTE, B 02, CH 900

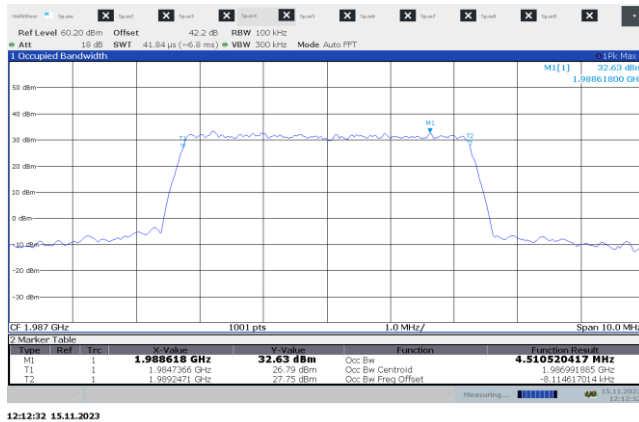


Figure 7.1-256: OBW, LTE, B 02, CH 1170

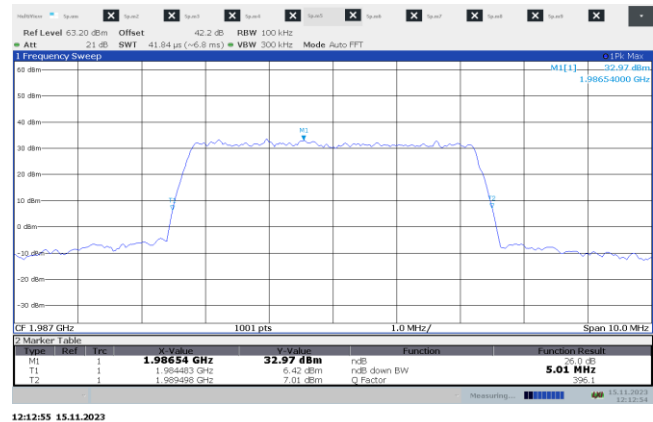


Figure 7.1-257 : EBW, LTE, B 02, CH 1170

Test data, Bandwidth, continued

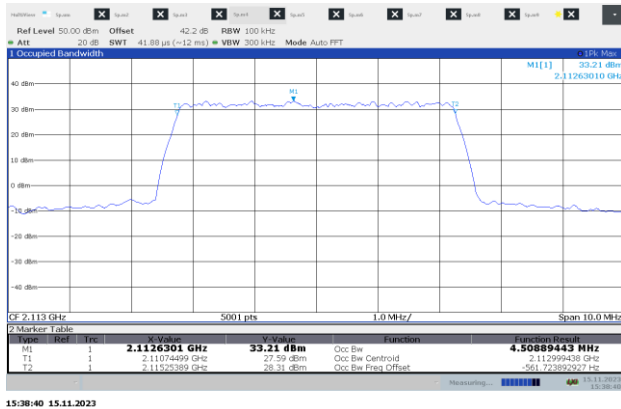


Figure 7.1-258: OBW, LTE, B 04, CH 1980

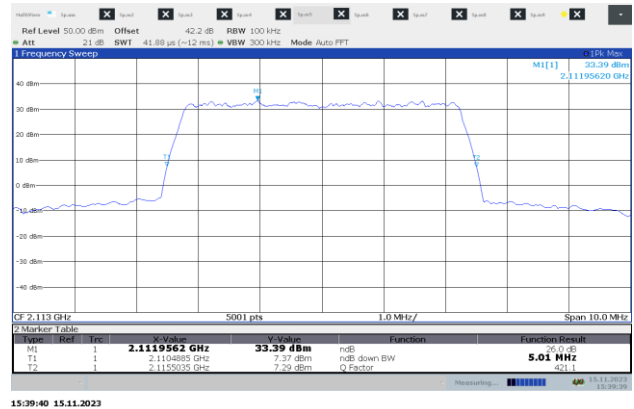


Figure 7.1-259: EBW, LTE, B 04, CH 1980

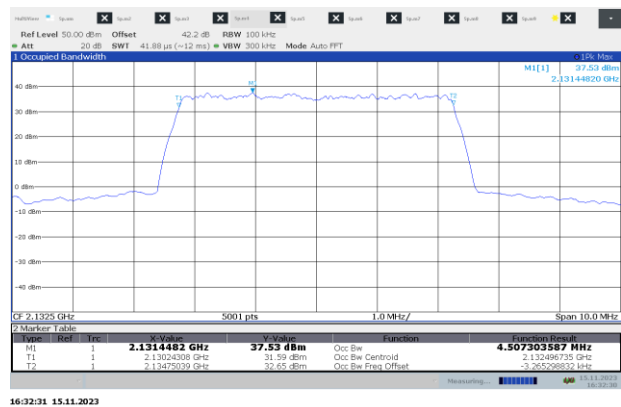


Figure 7.1-260: OBW, LTE, B 04, CH 2175

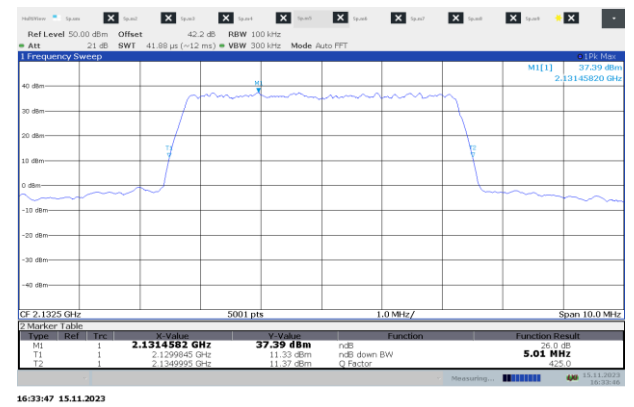


Figure 7.1-261 : EBW, LTE, B 04, CH 2175

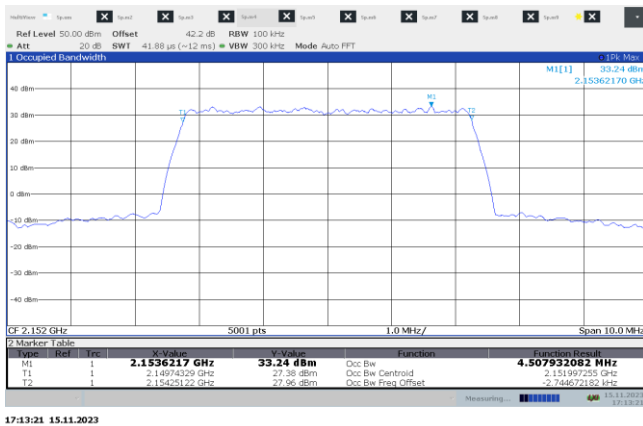


Figure 7.1-262: OBW, LTE, B 04, CH 2370

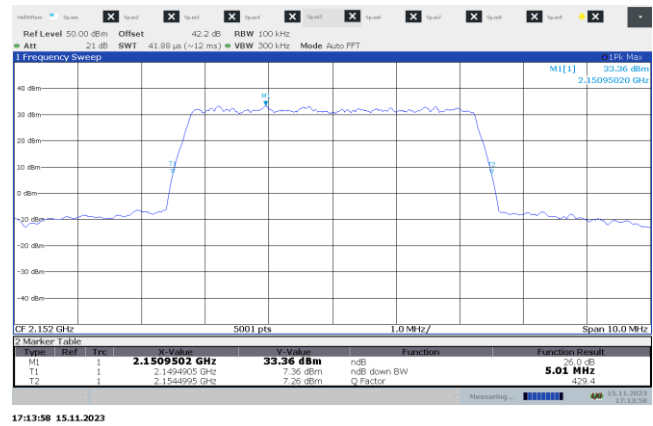


Figure 7.1-263 : EBW, LTE, B 04, CH 2370

Test data, Bandwidth, continued

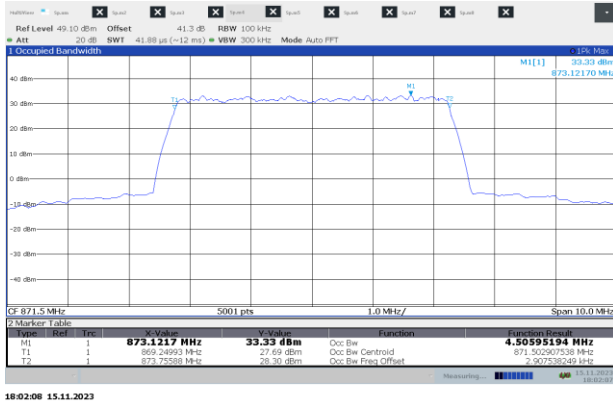


Figure 7.1-264: OBW, LTE, B 05, CH 2425



Figure 7.1-265 : EBW, LTE, B 05, CH 2425



Figure 7.1-266: OBW, LTE, B 05, CH 2525

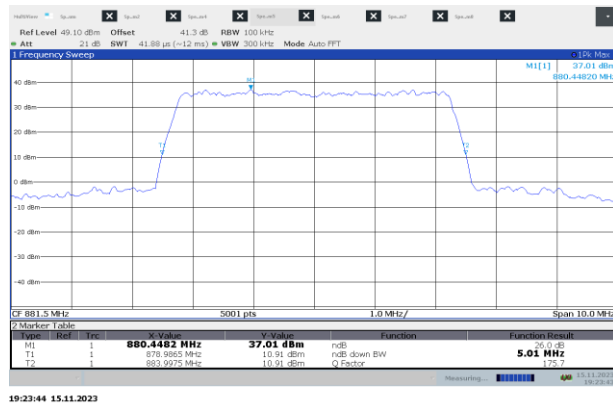


Figure 7.1-267 : EBW, LTE, B 05, CH 2525

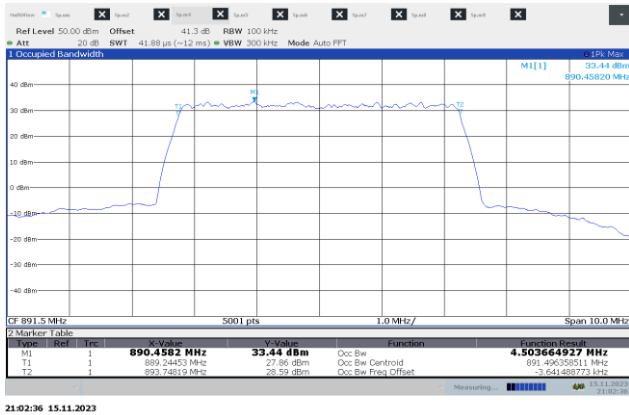


Figure 7.1-268: OBW, LTE, B 05, CH 2625

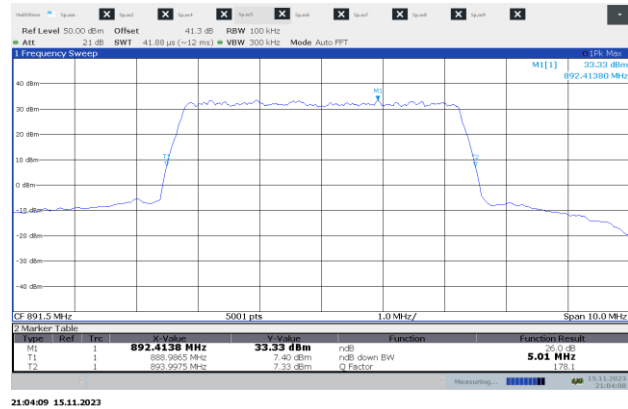


Figure 7.1-269 : EBW, LTE, B 05, CH 2625



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Test data, Bandwidth, continued

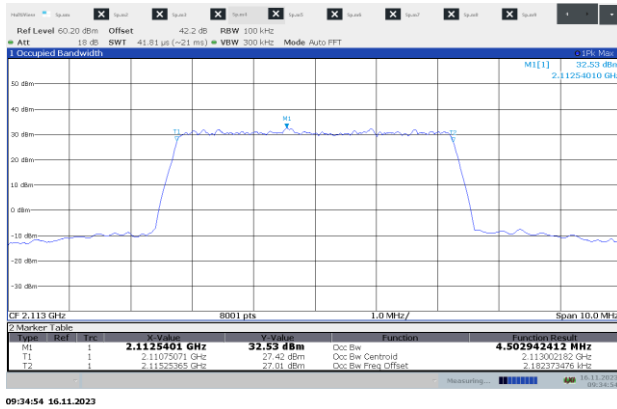


Figure 7.1-270: OBW, LTE, B 10, CH 4180

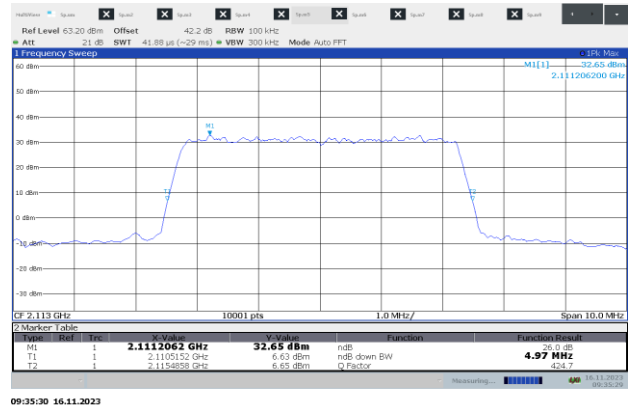


Figure 7.1-271 : EBW, LTE, B 10, CH 4180

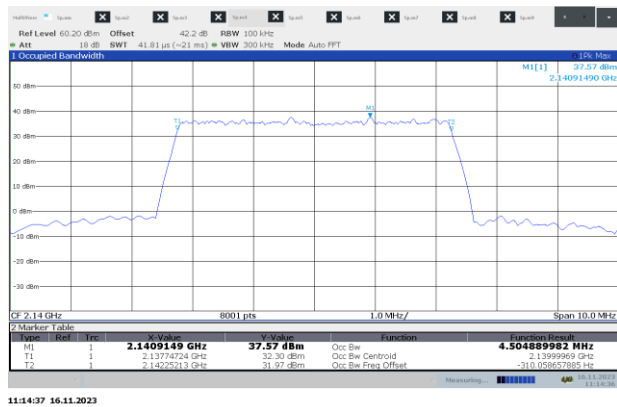


Figure 7.1-272: OBW, LTE, B 10, CH 4450

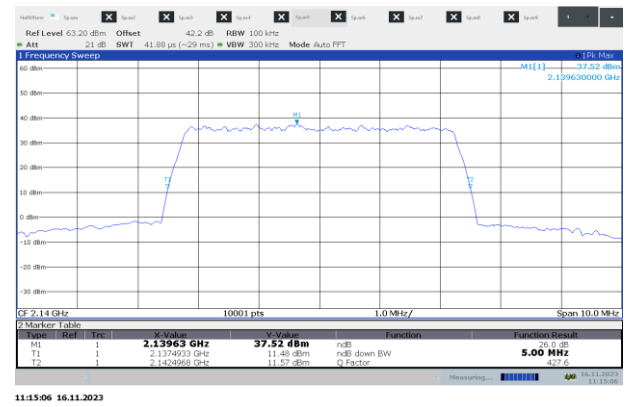


Figure 7.1-273 : EBW, LTE, B 10, CH 4450

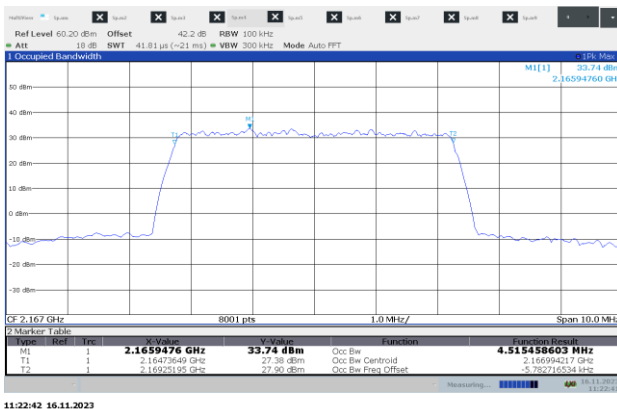


Figure 7.1-274: OBW, LTE, B 10, CH 4720

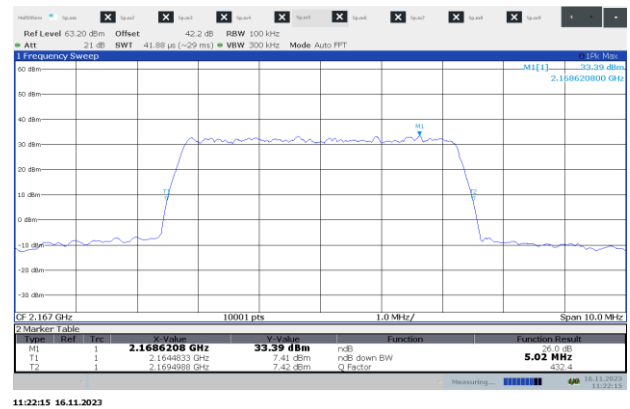


Figure 7.1-275 : EBW, LTE, B 10, CH 4720

Test data, Bandwidth, continued

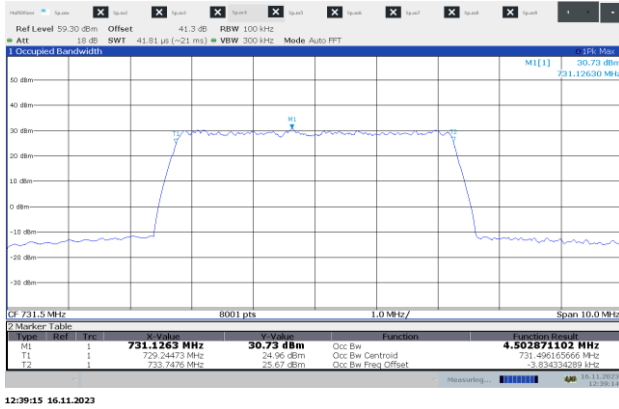


Figure 7.1-276: OBW, LTE, B 12, CH 5035

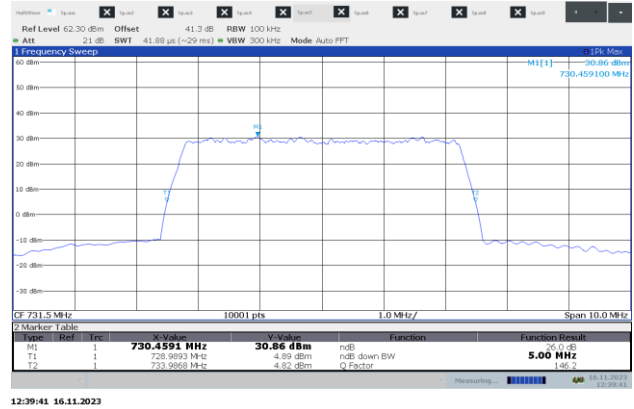


Figure 7.1-277 : EBW, LTE, B 12, CH 5035

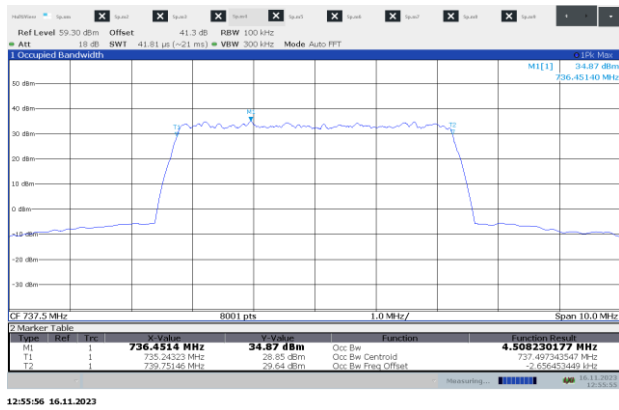


Figure 7.1-278: OBW, LTE, B 12, CH 5095

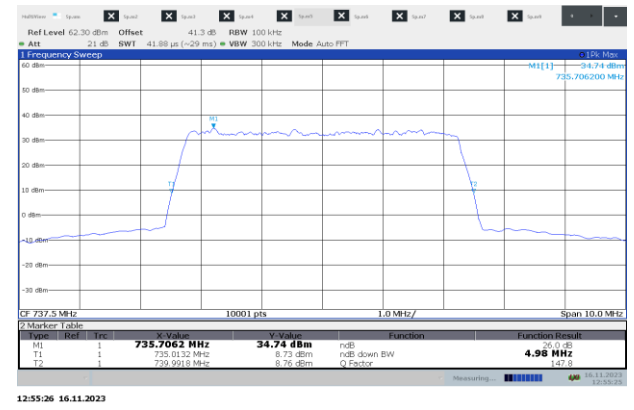


Figure 7.1-279 : EBW, LTE, B 12, CH 5095

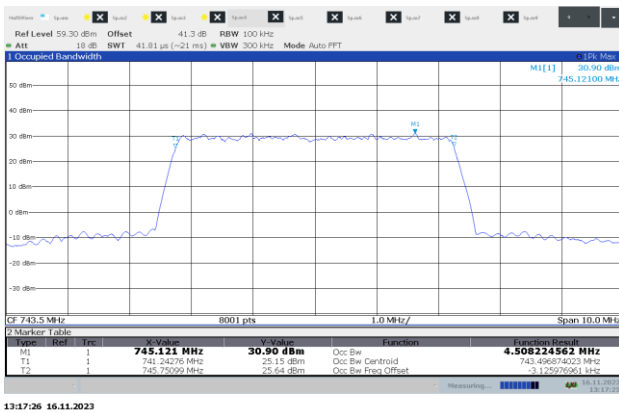


Figure 7.1-280: OBW, LTE, B 12, CH 5155

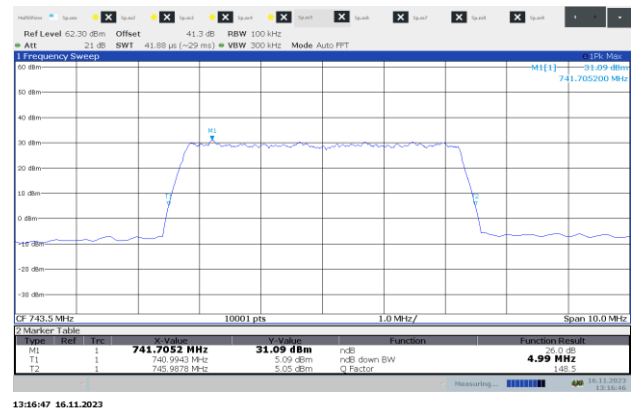


Figure 7.1-281 : EBW, LTE, B 12, CH 5155

Test data, Bandwidth, continued

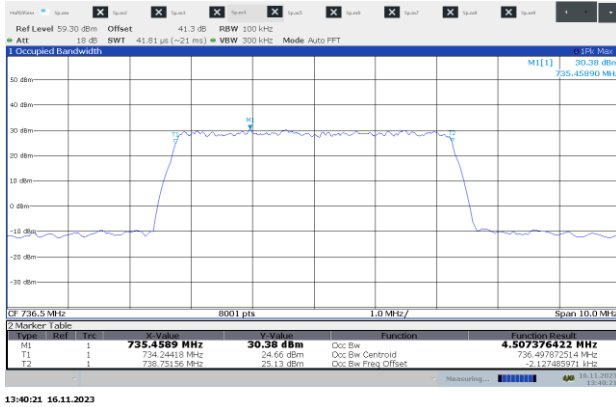


Figure 7.1-282: OBW, LTE, B 17, CH 5755

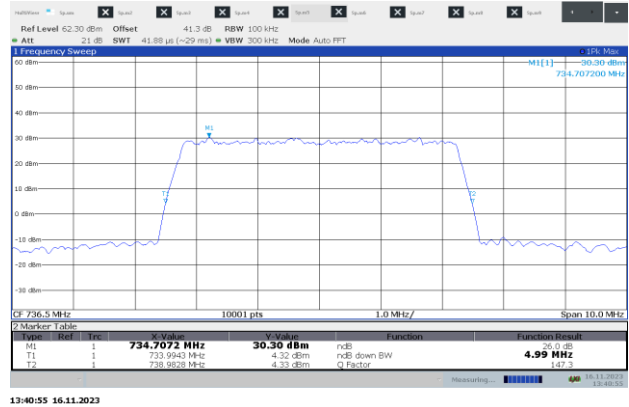


Figure 7.1-283 : EBW, LTE, B 17, CH 5755

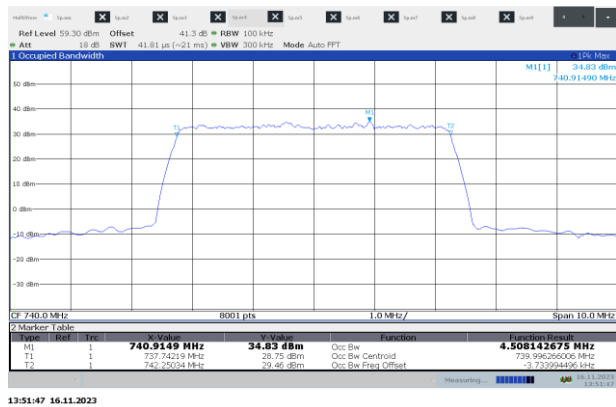


Figure 7.1-284: OBW, LTE, B 17, CH 5790

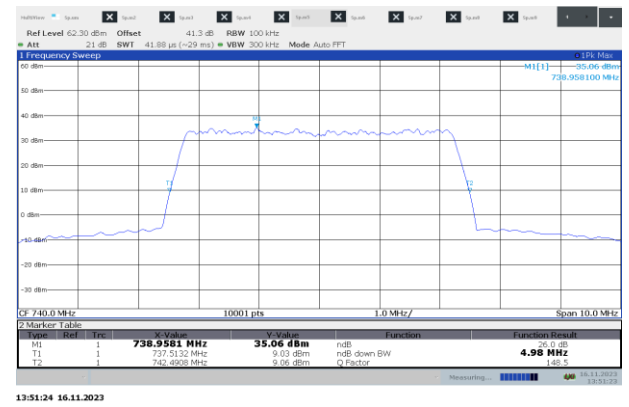


Figure 7.1-285 : EBW, LTE, B 17, CH 5790

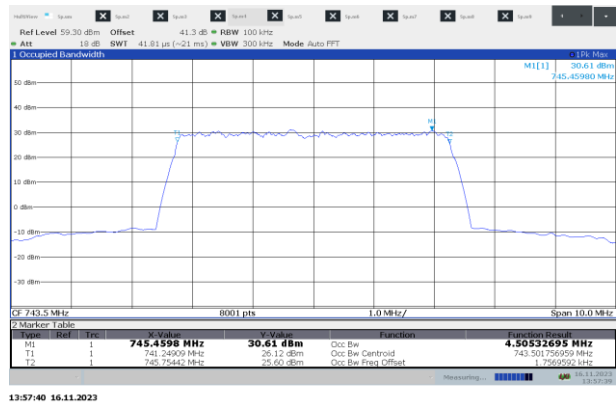


Figure 7.1-286: OBW, LTE, B 17, CH 5825



Figure 7.1-287 : EBW, LTE, B 17, CH 5825



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Test data, Bandwidth, continued

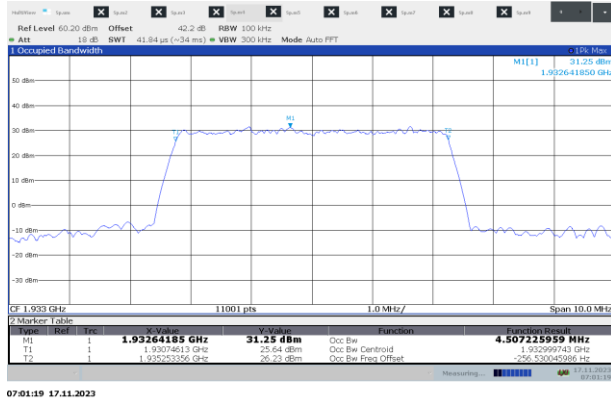


Figure 7.1-288: OBW, LTE, B 25, CH 8070

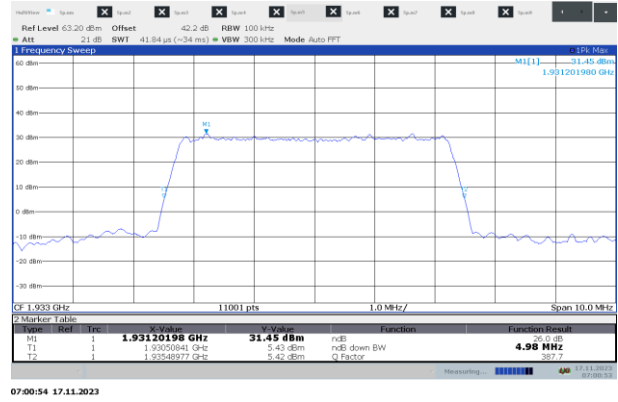


Figure 7.1-289 : EBW, LTE, B 25, CH 8070

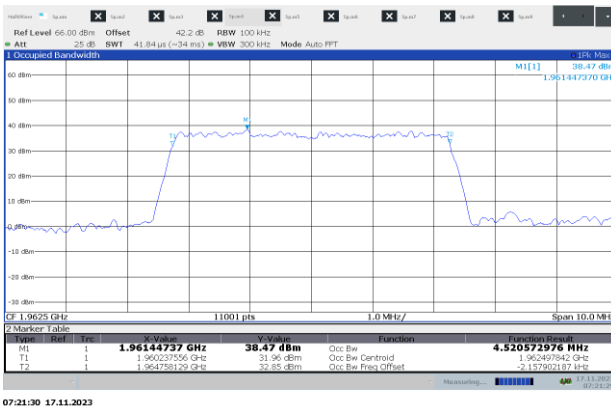


Figure 7.1-290: OBW, LTE, B 25, CH 8365

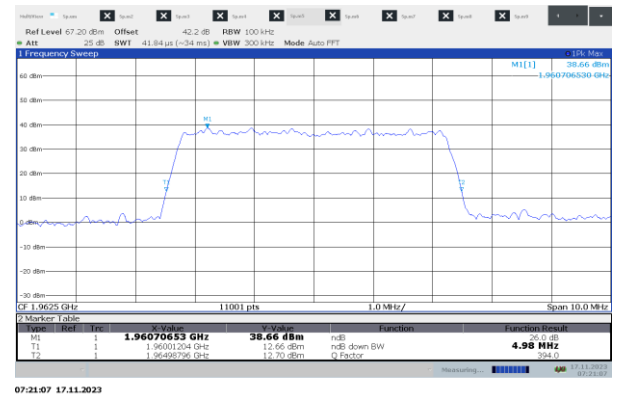


Figure 7.1-291 : EBW, LTE, B 25, CH 8365

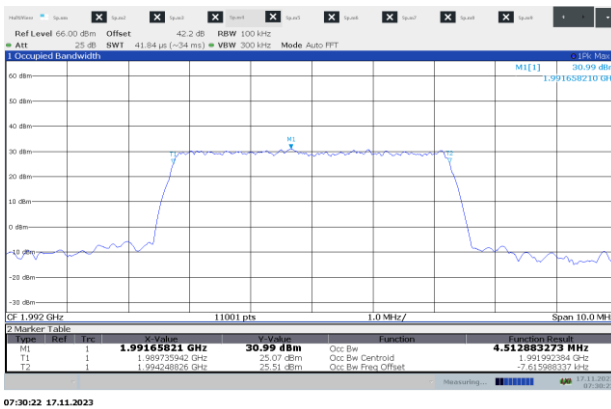


Figure 7.1-292: OBW, LTE, B 25, CH 8660

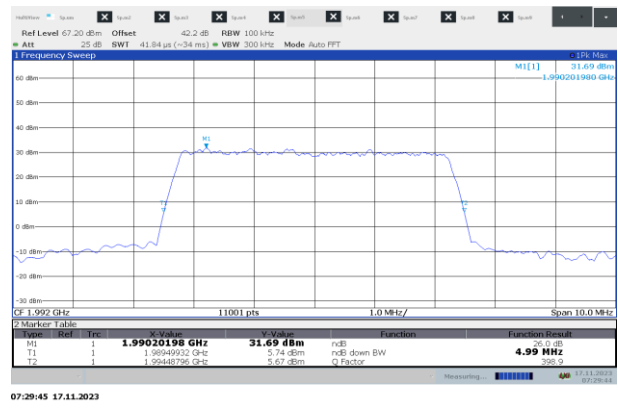


Figure 7.1-293 : EBW, LTE, B 25, CH 8660

Test data, Bandwidth, continued

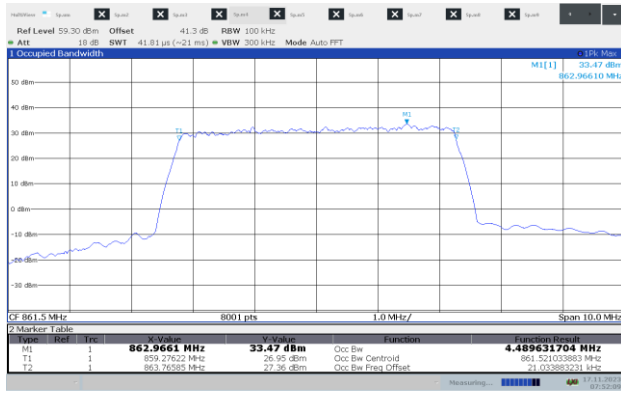


Figure 7.1-294: OBW, LTE, B 26_1, CH 8715

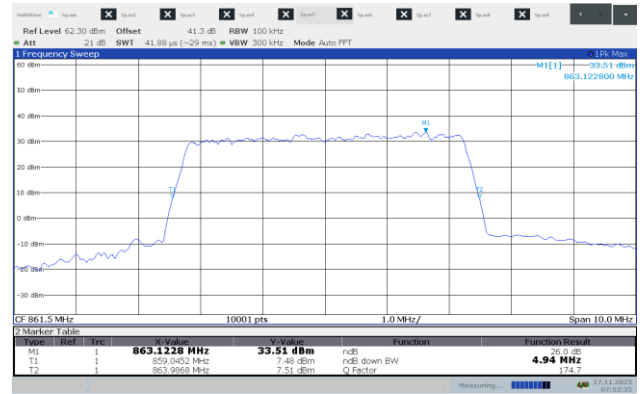


Figure 7.1-295 : EBW, LTE, B 26_1, CH 8715

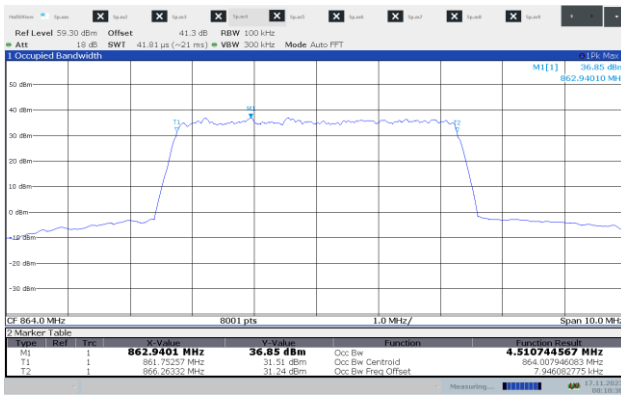


Figure 7.1-296: OBW, LTE, B 26_1, CH 8740

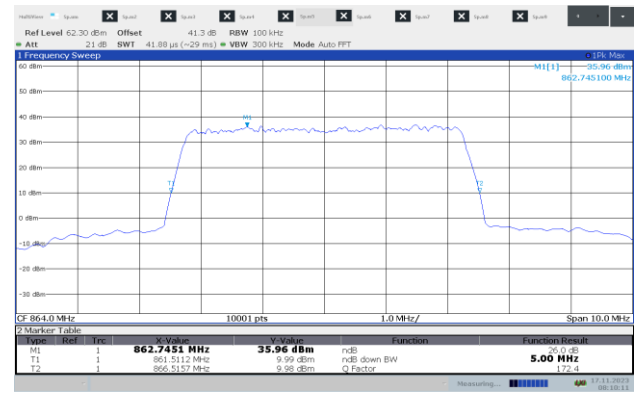


Figure 7.1-297 : EBW, LTE, B 26_1, CH 8740

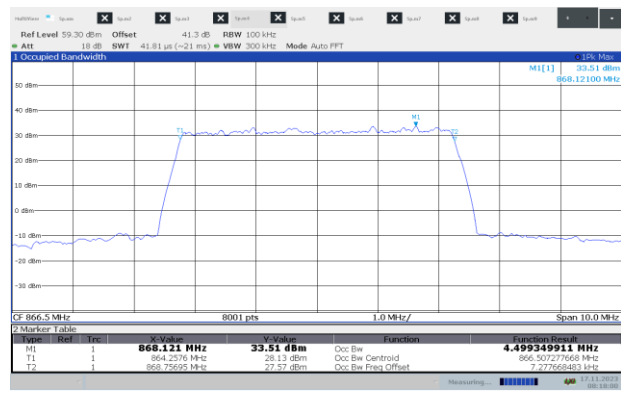


Figure 7.1-298: OBW, LTE, B 26_1, CH 8765

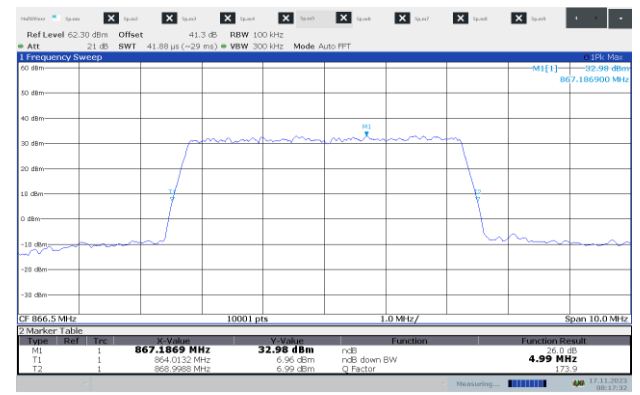


Figure 7.1-299 : EBW, LTE, B 26_1, CH 8765

Test data, Bandwidth, continued

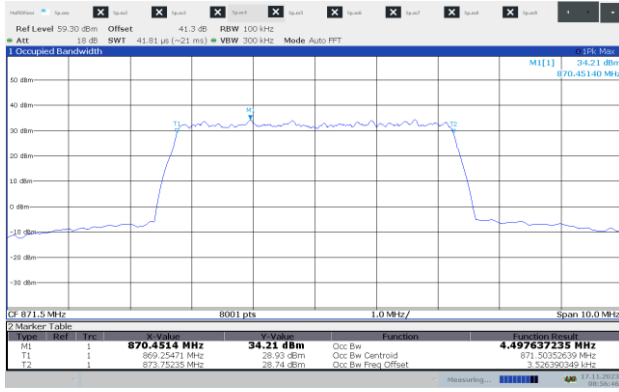


Figure 7.1-300: OBW, LTE, B 26_2, CH 8815

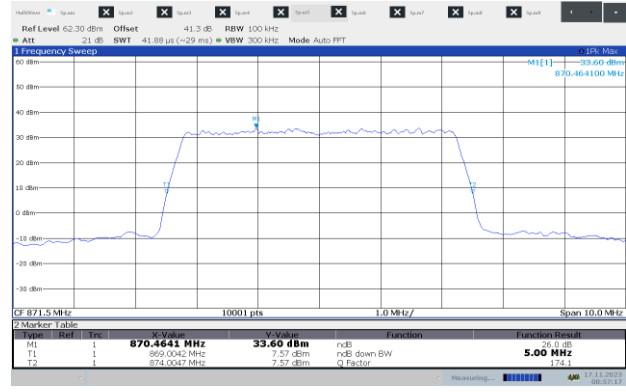


Figure 7.1-301 : EBW, LTE, B 26_2, CH 8815

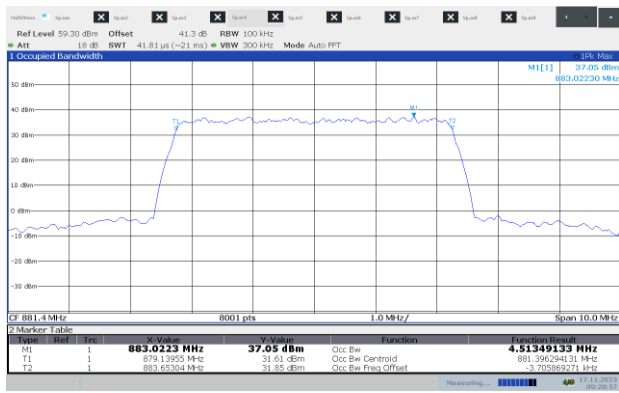


Figure 7.1-302: OBW, LTE, B 26_2, CH 8914

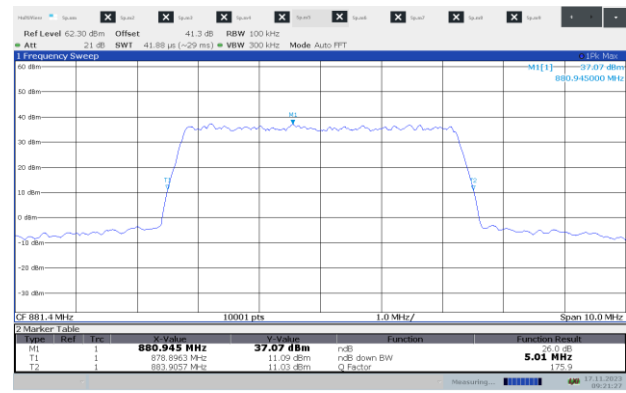


Figure 7.1-303 : EBW, LTE, B 26_2, CH 8914

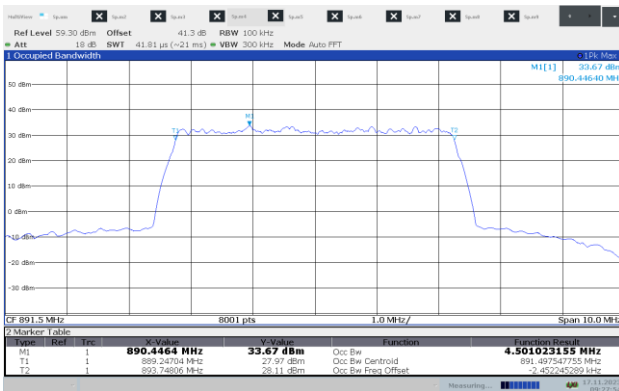


Figure 7.1-304: OBW, LTE, B 26_2, CH 9015

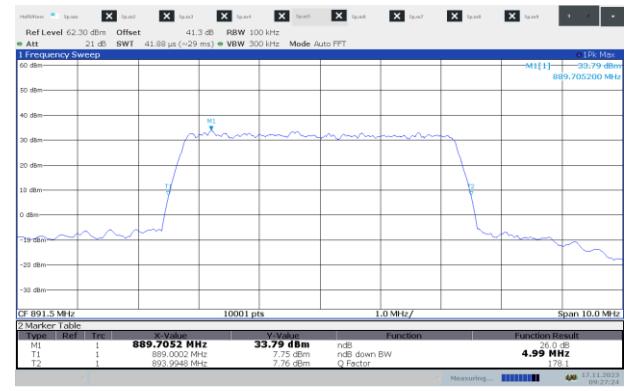


Figure 7.1-305 : EBW, LTE, B 26_2, CH 9015

Test data, Bandwidth, continued

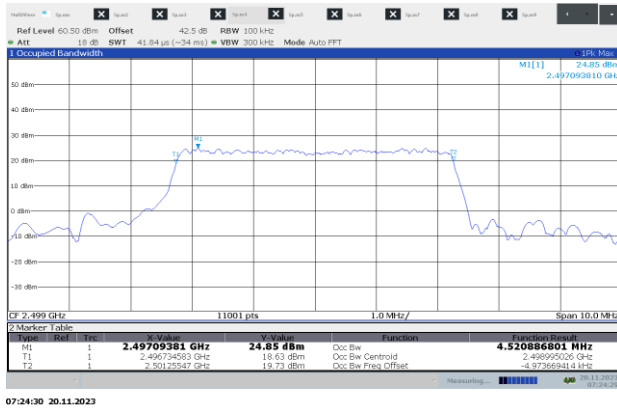


Figure 7.1-306: OBW, LTE, B 41, CH 39680



Figure 7.1-307 : EBW, LTE, B 41, CH 39680

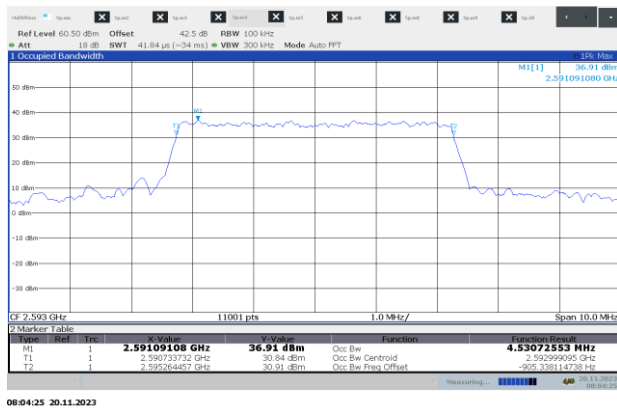


Figure 7.1-308: OBW, LTE, B 41, CH 40620

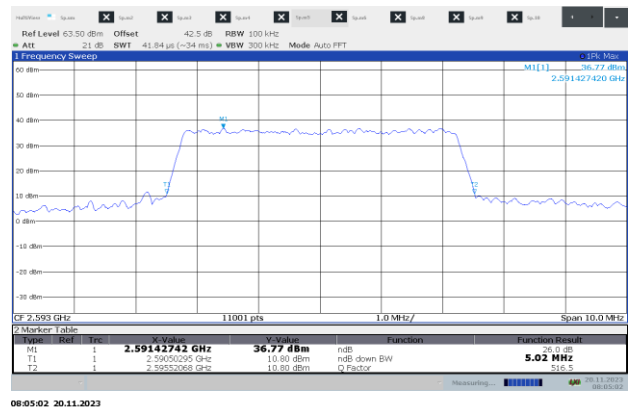


Figure 7.1-309 : EBW, LTE, B 41, CH 40620

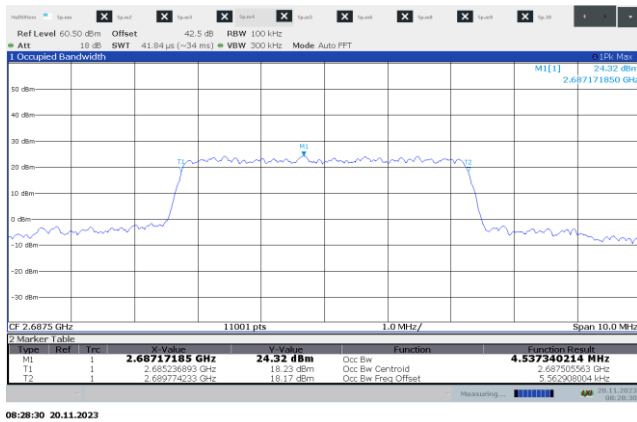


Figure 7.1-310: OBW, LTE, B 41, CH 41565

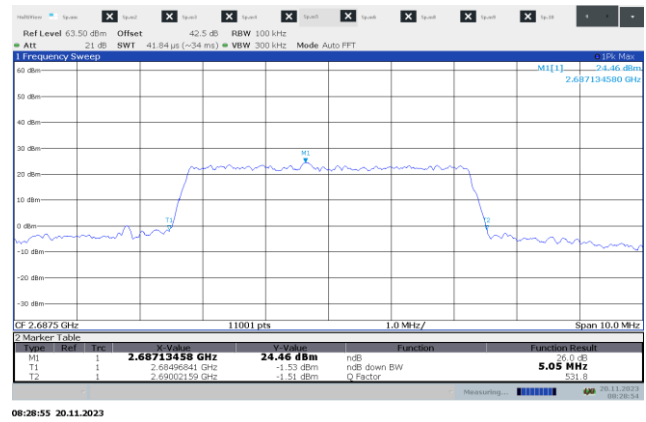


Figure 7.1-311 : EBW, LTE, B 41, CH 41565

Test data, Bandwidth, continued

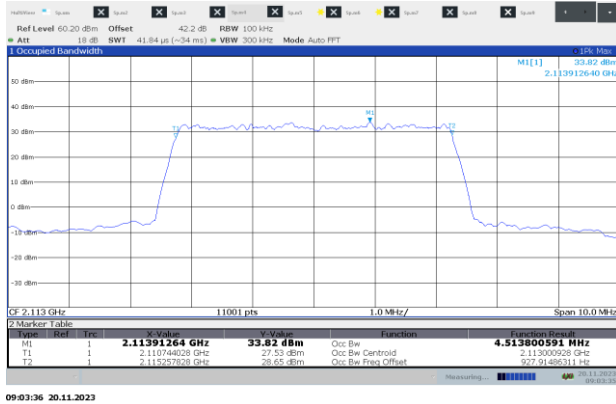


Figure 7.1-312: OBW, LTE, B 66, CH 66466

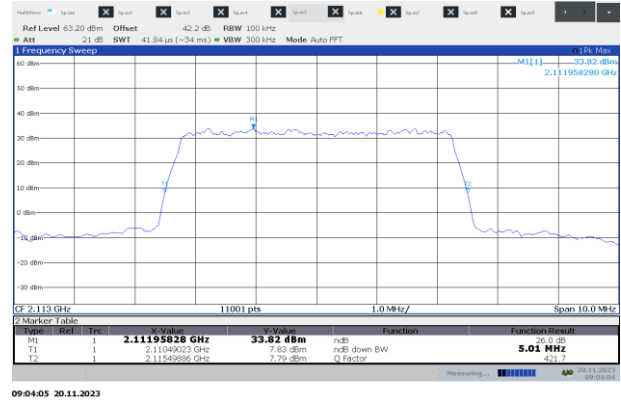


Figure 7.1-313 : EBW, LTE, B 66, CH 66466

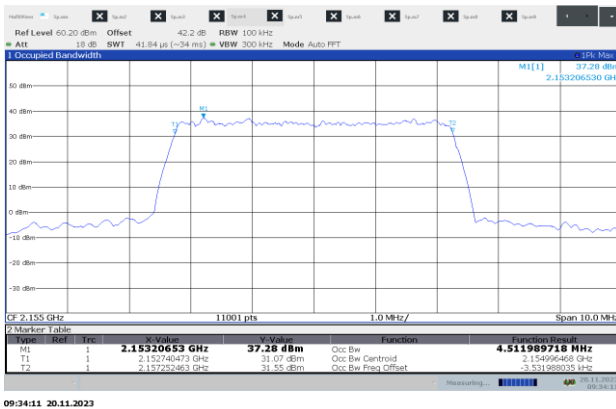


Figure 7.1-314: OBW, LTE, B 66, CH 66886

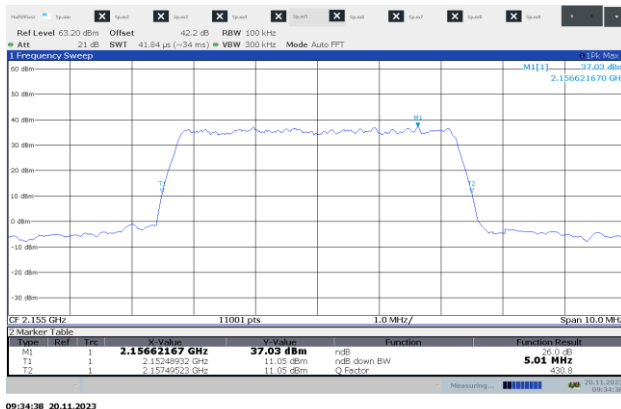


Figure 7.1-315 : EBW, LTE, B 66, CH 66886

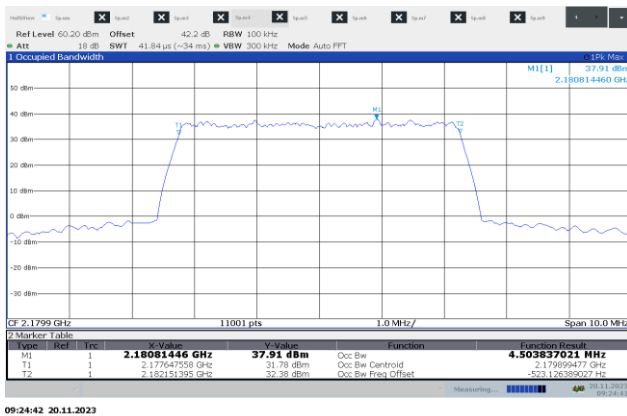


Figure 7.1-316: OBW, LTE, B 66, CH 67135

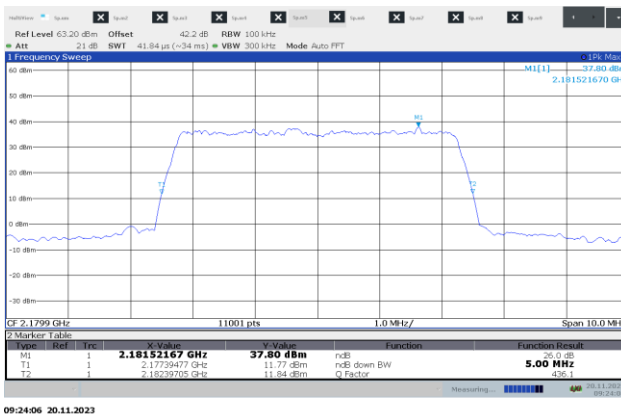


Figure 7.1-317 : EBW, LTE, B 66, CH 67135

7.2 Band edges and Spurious emissions

References, definitions and limits

FCC §22.917:

- (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.

FCC §24.238:

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

- (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.

FCC §27.53:

- (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 $43 + 10 \log_{10}(P)$ 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.

FCC §90.691:

- (a) (2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS-119, Clause 5.8.9.2:

On any frequency outside of the ranges specified in the ACP tables 13 to 16, the power of any emission shall be attenuated below the mean output power P (dBW) by at least $43 + 10 \log_{10}(p)$, measured in a 100 kHz bandwidth for frequencies less than or equal to 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

RSS-130, Clause 4.7.1:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

RSS-132, Clause 5.5:

Equipment shall meet the unwanted emission limits specified below:

- i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated below the transmitter output power P (dBW) by at least $43 + 10 \log(p)$ dB.
- ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated below the transmitter output power P (dBW) by at least $43 + 10 \log(p)$ dB. If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1:

Equipment shall comply with the limits in (i) and (ii) below.

- i. In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10}(p)$ (watts).
- ii. After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10}(p)$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

References, definitions and limits, continued

RSS-139, Clause 5.6:

Unwanted emissions shall be measured in terms of average values.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors) of the unwanted emissions outside the frequency block or frequency block group shall not exceed the below limits.

Offset from the edge of the frequency block or frequency block group	Unwanted emission limits
1 MHz	-13 dBm/(1% of OBW)
>1 MHz	-13 dBm/MHz

RSS-199, Clause 5.6:

Unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 MHz band immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for fixed stations, base stations, and fixed subscriber equipment, and 2% for subscriber equipment other than fixed subscriber equipment. Beyond this 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in the tables below.

Table 4: Unwanted emission limits for fixed station, base station and fixed subscriber equipment	
Offset from the edge of the frequency block or frequency block group (MHz)	Unwanted emission limits
≤ 1	-13 dBm/(1% of OBW)
> 1	-13 dBm/MHz

Test summary

Verdict	Pass		
Test date	November 20, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	974 mbar
Test location	Cambridge	Relative humidity	33 %

Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.3 method.
- Spurious emissions tests and band edges were performed at RF antenna connector and a radiated cabinet spurious emission was performed with the antenna ports terminated with 50Ω termination.

Spectrum analyser settings for out of band emissions:

Resolution bandwidth:	1 MHz (Signals greater than 1 GHz) 100 kHz (Signals below 1 GHz)
Video bandwidth:	> RBW
Detector mode:	RMS
Trace mode:	Averaging

Spectrum analyser settings for spurious emissions in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block:

Resolution bandwidth:	At least 1% of EBW
Video bandwidth:	> RBW
Detector mode:	RMS
Trace mode:	Averaging

Test data

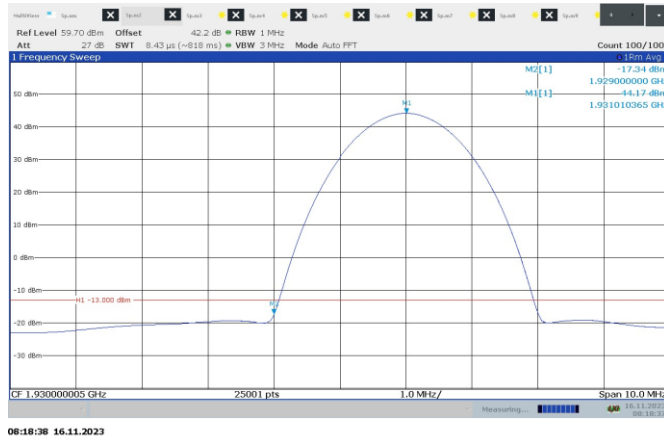


Figure 7.2-1: Conducted band edge, GSM, B 02, CH 516

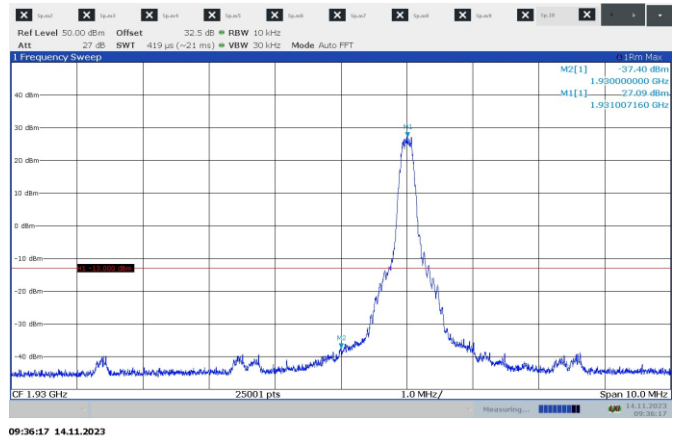


Figure 7.2-2: Conducted band edge (RBW 1% of EBW), GSM, B 02, CH 516

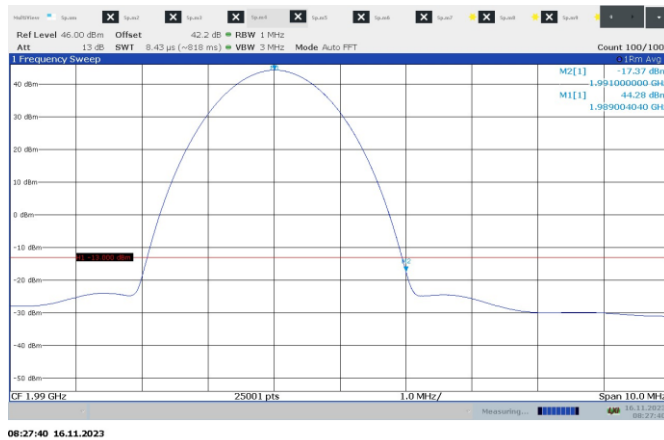


Figure 7.2-3: Conducted band edge, GSM, B 02, CH 806

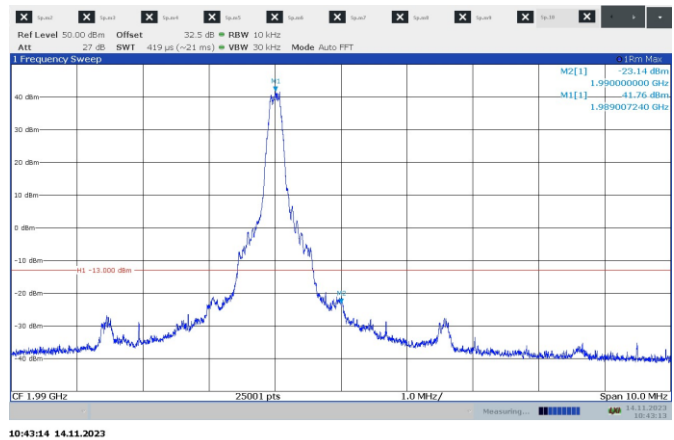


Figure 7.2-4: Conducted band edge (RBW 1% of EBW), GSM, B 02, CH 806

Test data, Band edges, continued

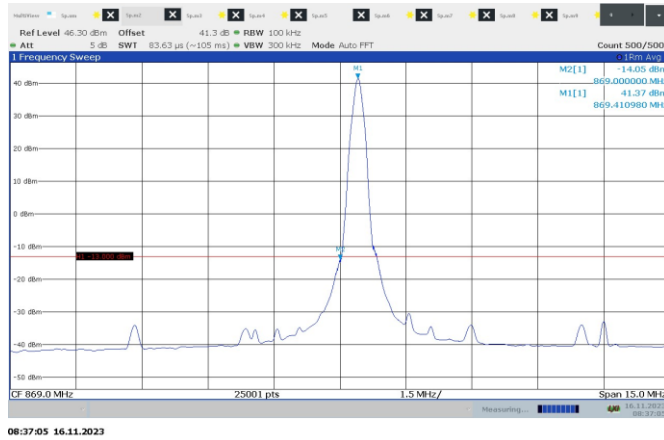


Figure 7.2-5: Conducted band edge, GSM, B 05, CH 129

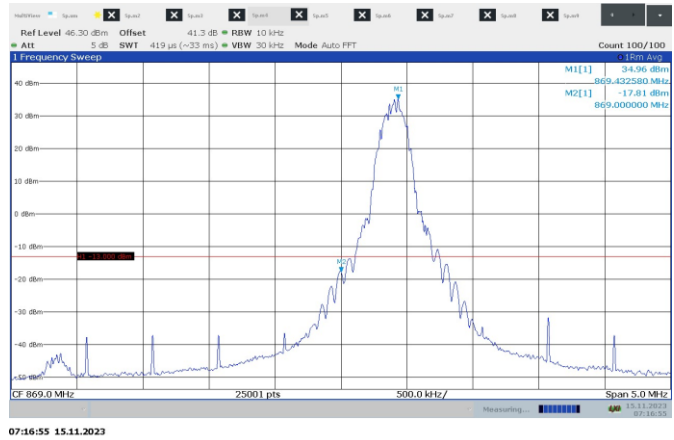


Figure 7.2-6: Conducted band edge (RBW 1% of EBW), GSM, B 05, CH 129

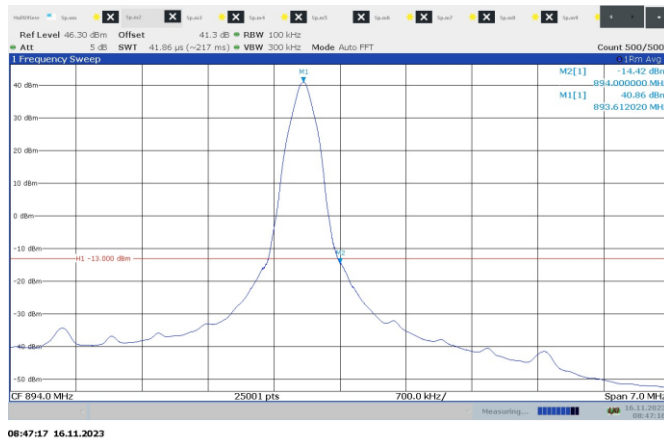


Figure 7.2-7: Conducted band edge, GSM, B 05, CH 250

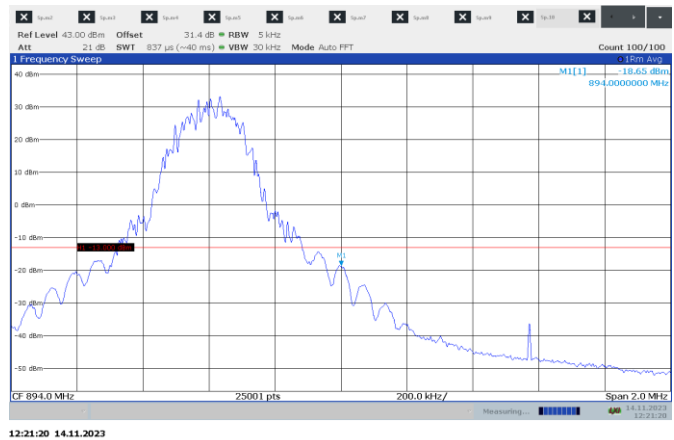


Figure 7.2-8: Conducted band edge (RBW 1% of EBW), GSM, B 05, CH 250

Test data, Band edges, continued

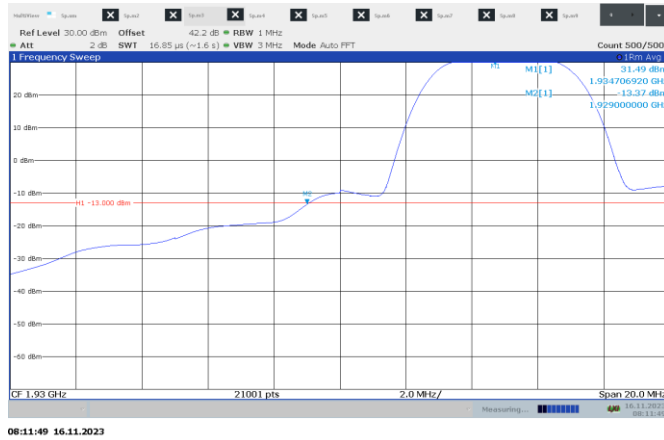


Figure 7.2-9: Conducted band edge, WCDMA, B 02, CH 9675

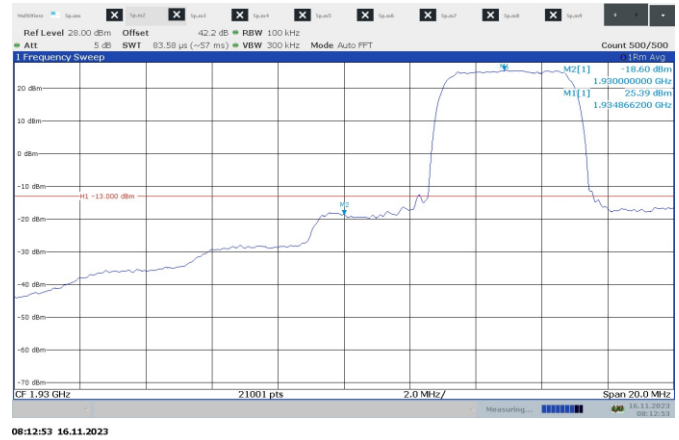


Figure 7.2-10: Conducted band edge (RBW 1% of EBW), WCDMA, B 02, CH 9675

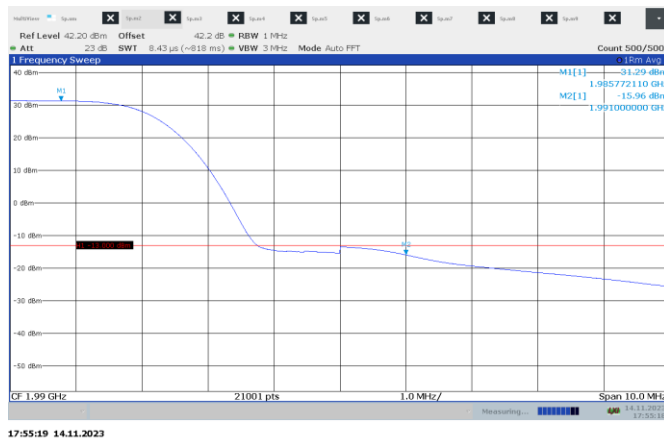


Figure 7.2-11: Conducted band edge, WCDMA, B 02, CH 9925

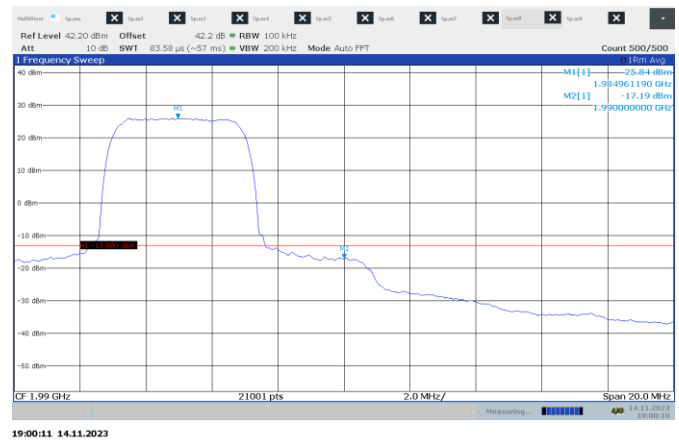


Figure 7.2-12: Conducted band edge (RBW 1% of EBW), WCDMA, B 02, CH 9925

Test data, Band edges, continued

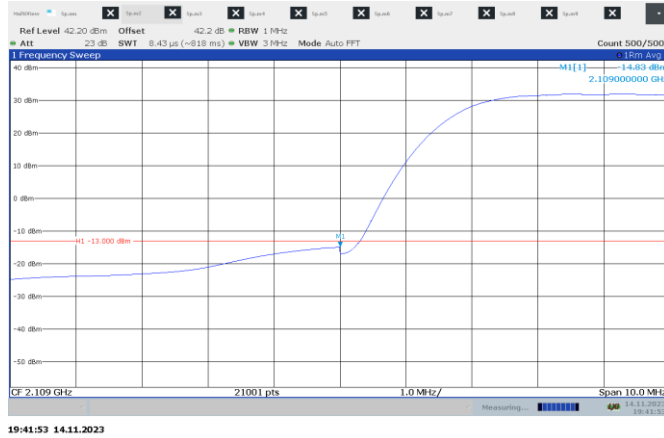


Figure 7.2-13: Conducted band edge, WCDMA, B 04, CH 1540

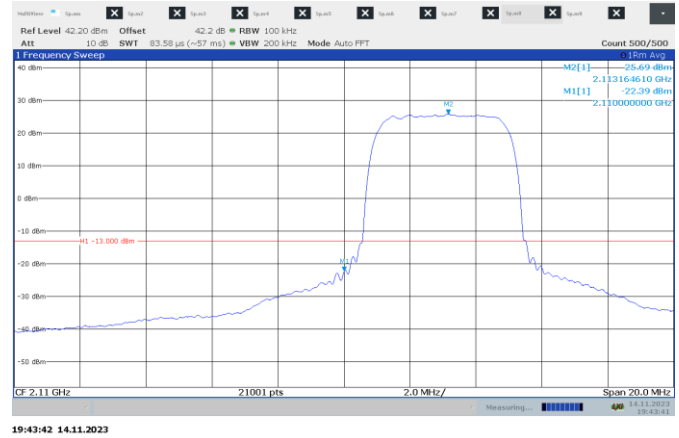


Figure 7.2-14: Conducted band edge (RBW 1% of EBW), WCDMA, B 04, CH 1540

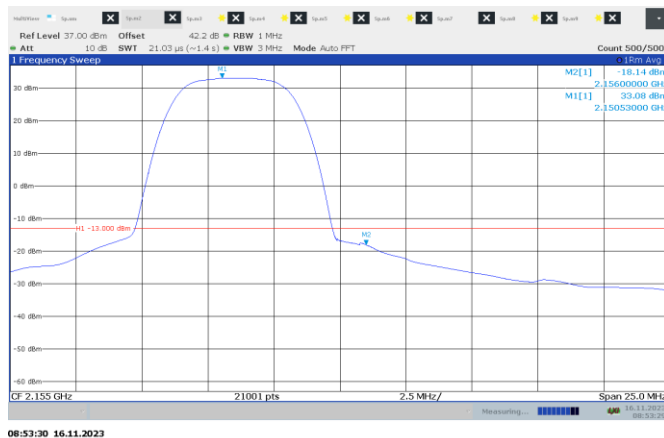


Figure 7.2-15: Conducted band edge, WCDMA, B 04, CH 1730

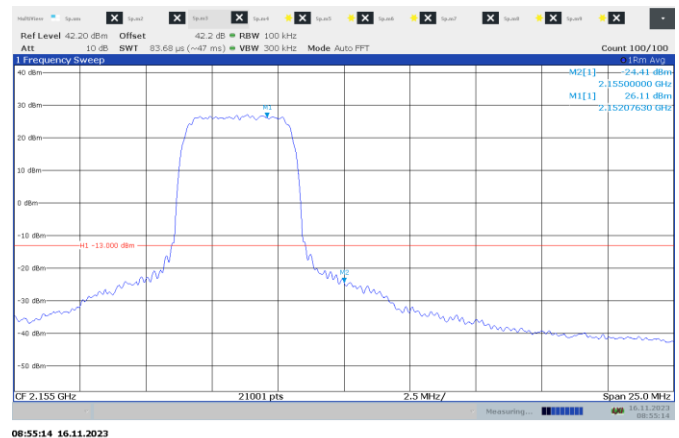


Figure 7.2-16: Conducted band edge (RBW 1% of EBW), WCDMA, B 04, CH 1730

Test data, Band edges, continued

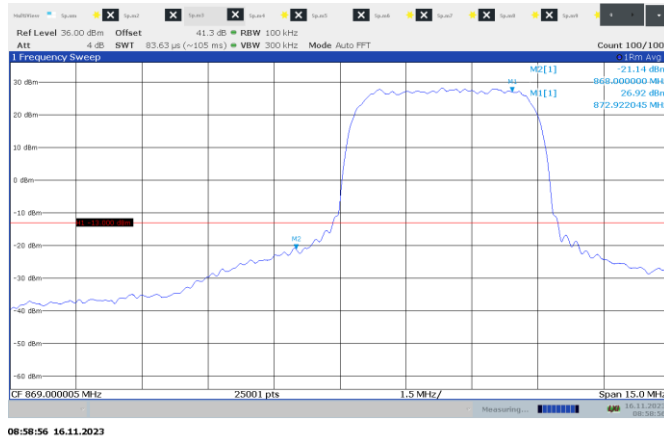


Figure 7.2-17: Conducted band edge, WCDMA, B 05, CH 4357

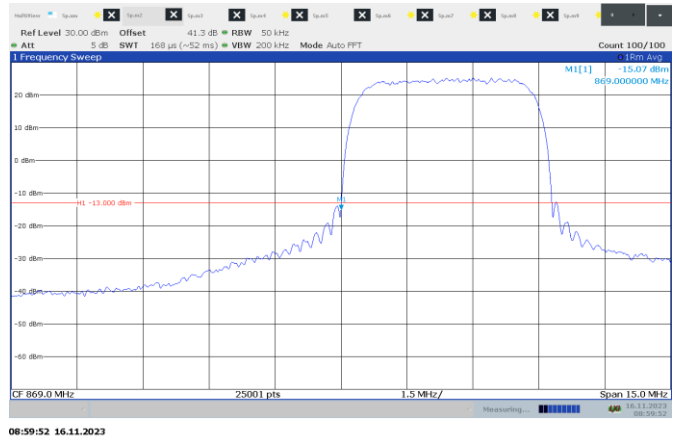


Figure 7.2-18: Conducted band edge (RBW 1% of EBW), WCDMA, B 05, CH 4357

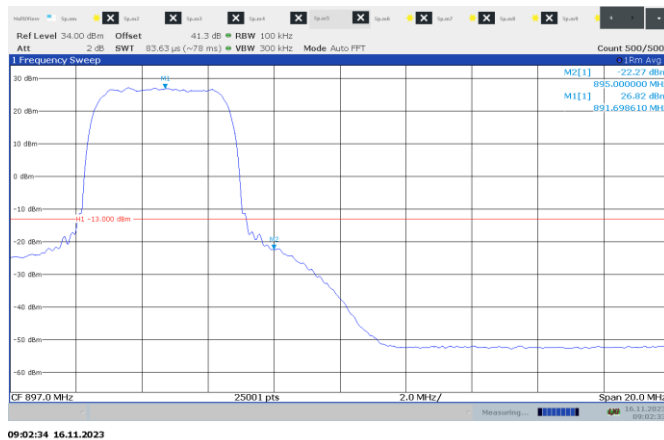


Figure 7.2-19: Conducted band edge, WCDMA, B 05, CH 4458

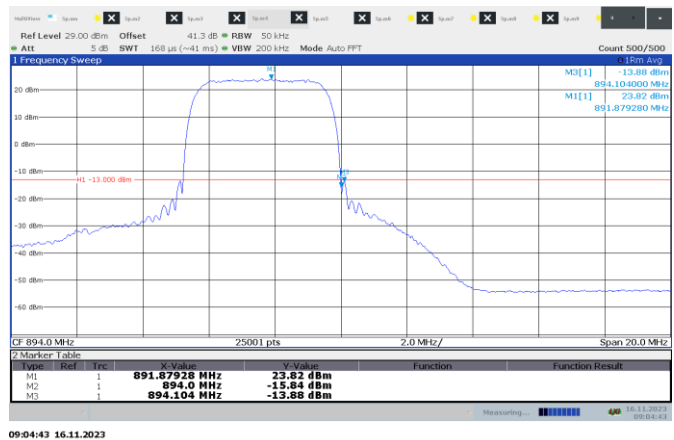


Figure 7.2-20: Conducted band edge (RBW 1% of EBW), WCDMA, B 05, CH 4458

Test data, Band edges, continued



Figure 7.2-21: Conducted band edge, LTE, B 02, CH 630

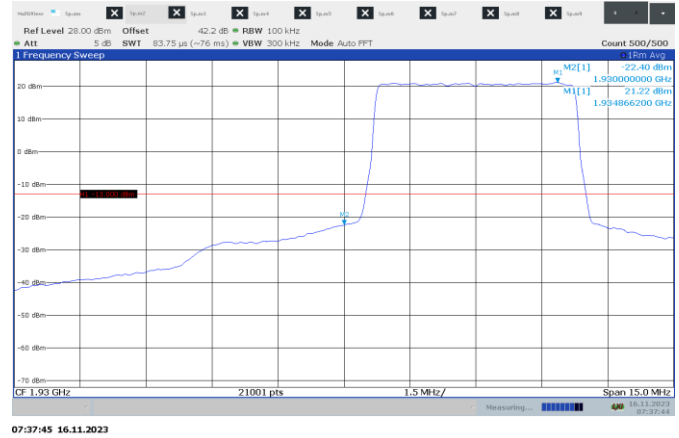


Figure 7.2-22: Conducted band edge (RBW 1% of EBW), LTE, B 02, CH 630

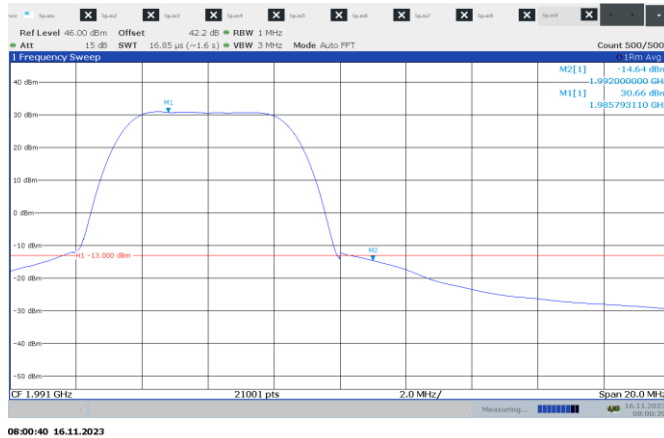


Figure 7.2-23: Conducted band edge, LTE, B 02, CH 1170

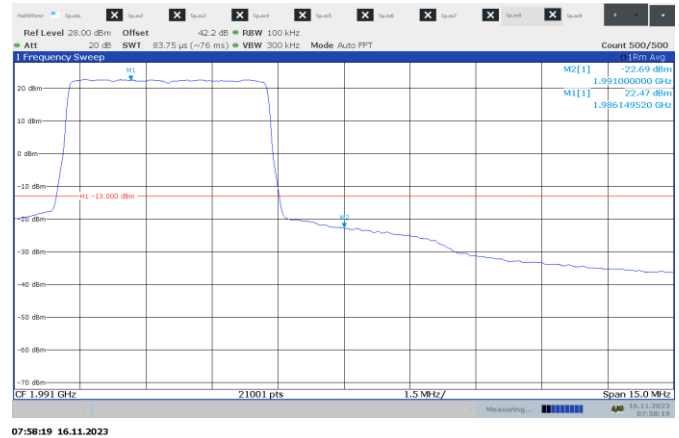


Figure 7.2-24: Conducted band edge (RBW 1% of EBW), LTE, B 02, CH 1170

Test data, Band edges, continued

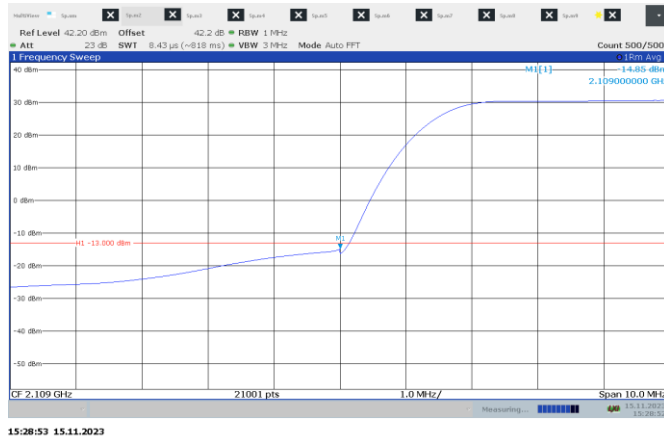


Figure 7.2-25: Conducted band edge, LTE, B 04, CH 1980



Figure 7.2-26: Conducted band edge (RBW 1% of EBW), LTE, B 04, CH 1980

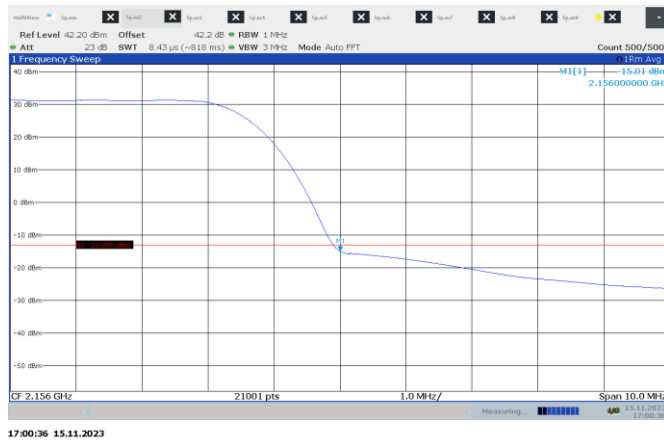


Figure 7.2-27: Conducted band edge, LTE, B 04, CH 2370



Figure 7.2-28 : Conducted band edge (RBW 1% of EBW), LTE, B 04, CH 2370

Test data, Band edges, continued

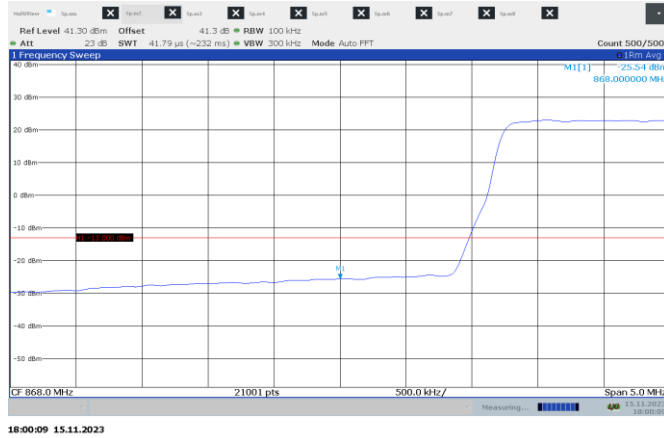


Figure 7.2-29: Conducted band edge, LTE, B 05, CH 2425

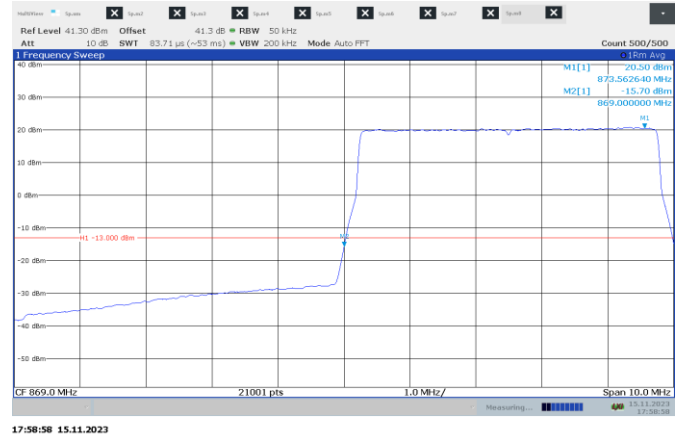


Figure 7.2-30: Conducted band edge (RBW 1% of EBW), LTE, B 05, CH 2425

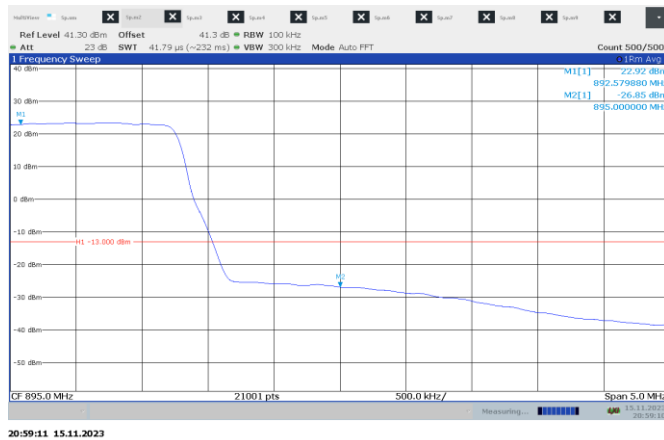


Figure 7.2-31: Conducted band edge, LTE, B 05, CH 2625

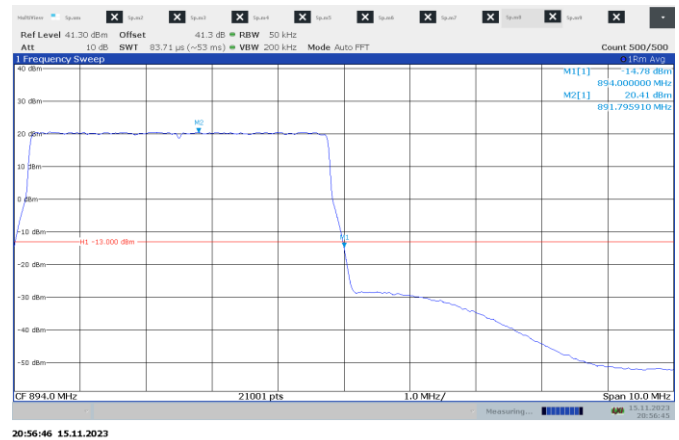


Figure 7.2-32: Conducted band edge (RBW 1% of EBW), LTE, B 05, CH 2625

Test data, Band edges, continued

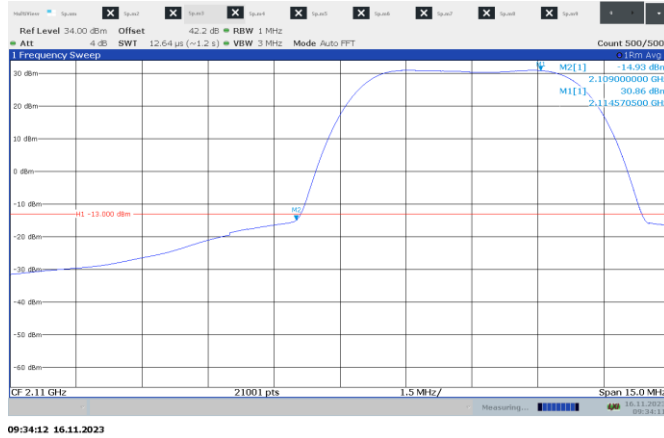


Figure 7.2-33: Conducted band edge, LTE, B 10, CH 4180

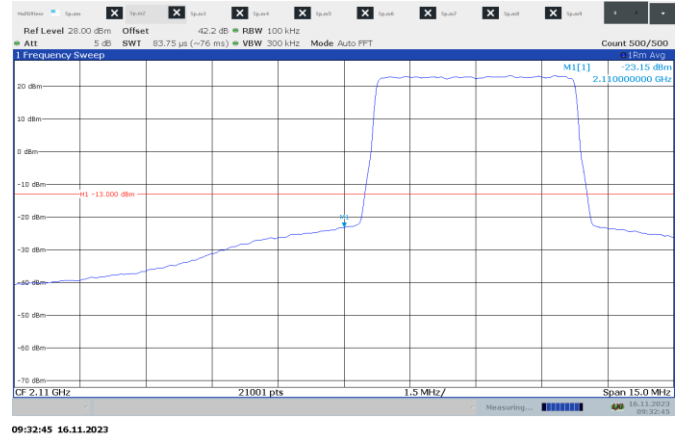


Figure 7.2-34: Conducted band edge (RBW 1% of EBW), LTE, B 10, CH 4180

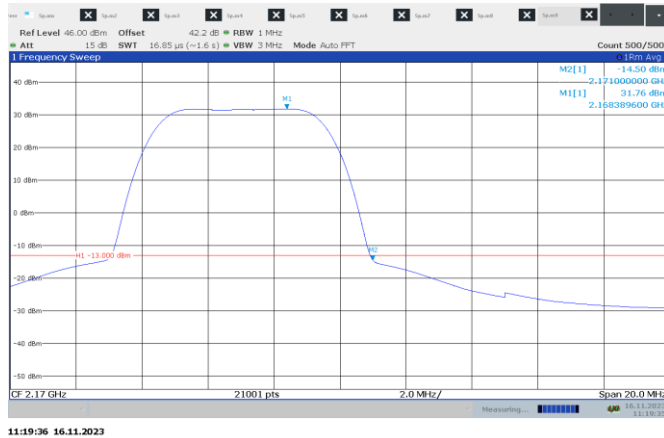


Figure 7.2-35: Conducted band edge, LTE, B 10, CH 4720

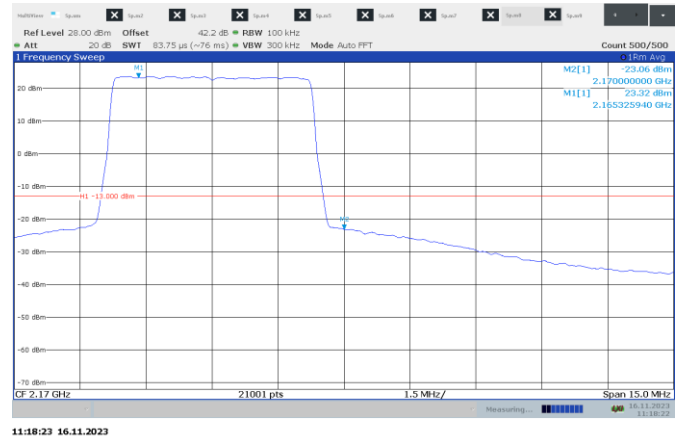


Figure 7.2-36: Conducted band edge (RBW 1% of EBW), LTE, B 10, CH 4720

Test data, Band edges, continued

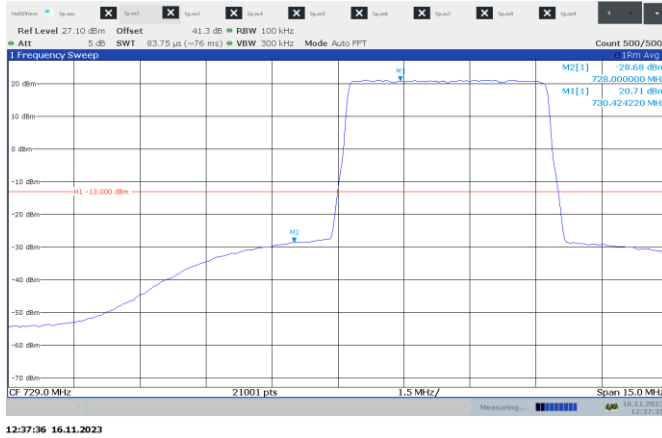


Figure 7.2-37: Conducted band edge, LTE, B 12, CH 5035



Figure 7.2-38 : Conducted band edge (RBW 1% of EBW), LTE, B 12, CH 5035

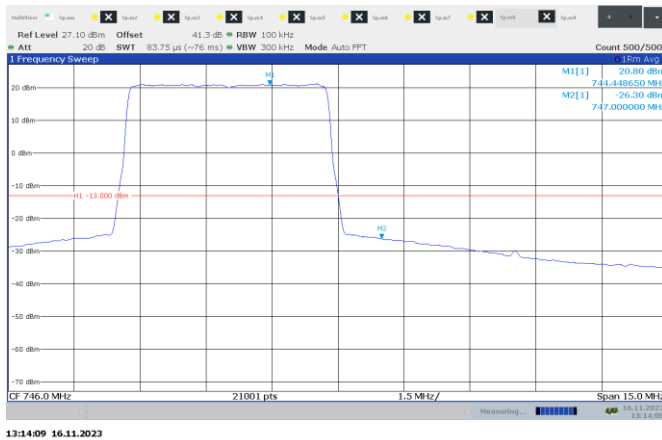


Figure 7.2-39: Conducted band edge, LTE, B 12, CH 5155



Figure 7.2-40 : Conducted band edge (RBW 1% of EBW), LTE, B 12, CH 5155

Test data, Band edges, continued

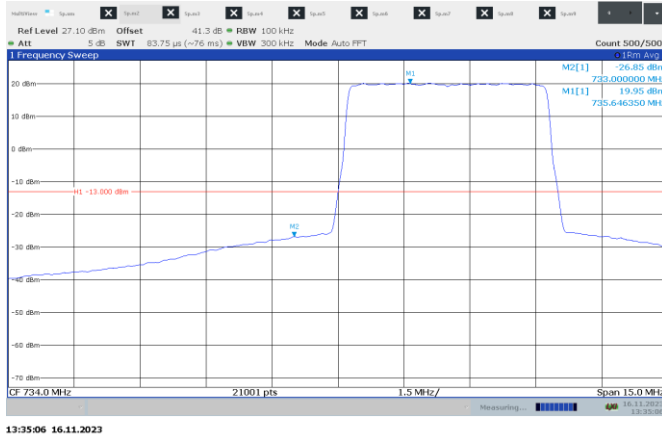


Figure 7.2-41: Conducted band edge, LTE, B 17, CH 5755

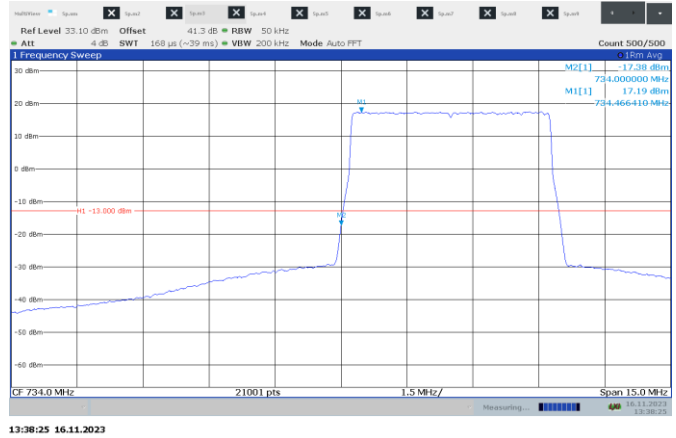


Figure 7.2-42 : Conducted band edge (RBW 1% of EBW), LTE, B 17, CH 5755

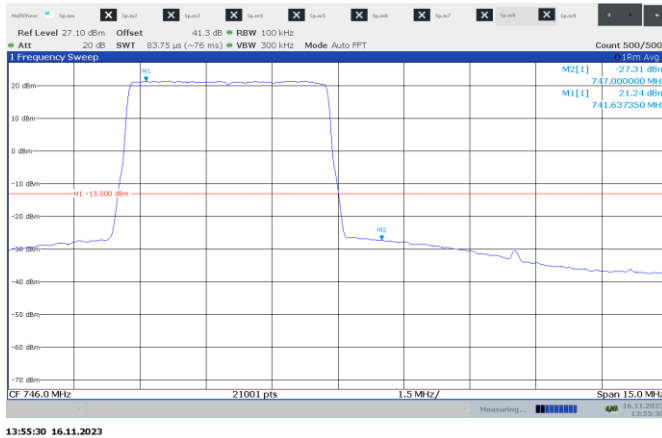


Figure 7.2-43: Conducted band edge, LTE, B 17, CH 5825

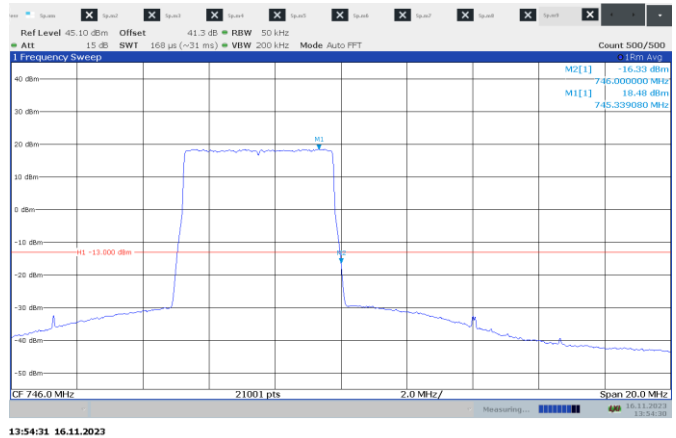


Figure 7.2-44 : Conducted band edge (RBW 1% of EBW), LTE, B 17, CH 5825

Test data, Band edges, continued

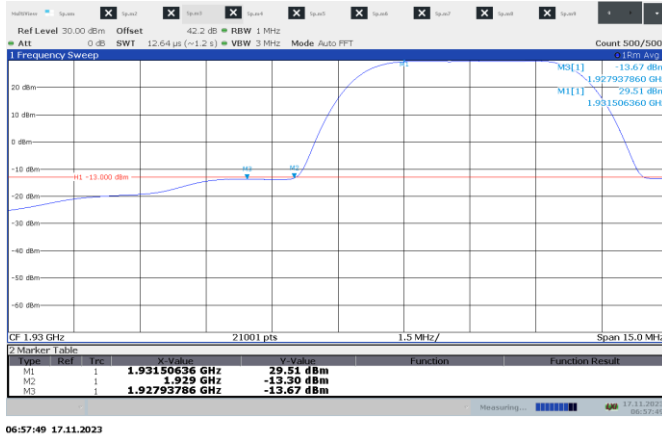


Figure 7.2-45: Conducted band edge, LTE, B 25, CH 8070

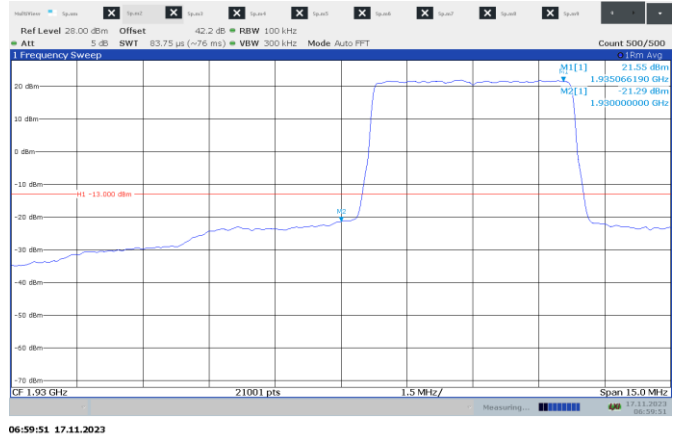


Figure 7.2-46 : Conducted band edge (RBW 1% of EBW), LTE, B 25, CH 8070

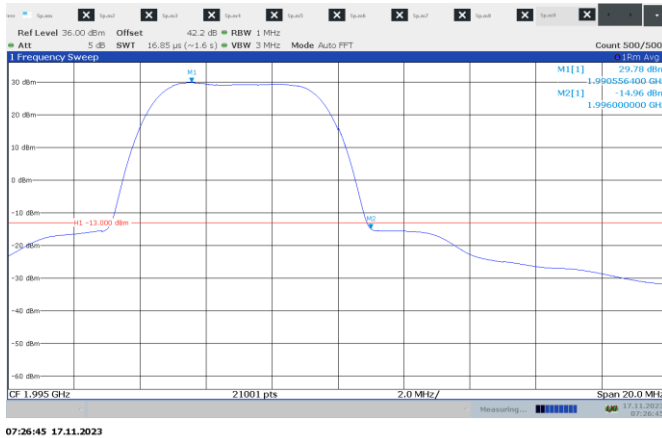


Figure 7.2-47: Conducted band edge, LTE, B 25, CH 8660

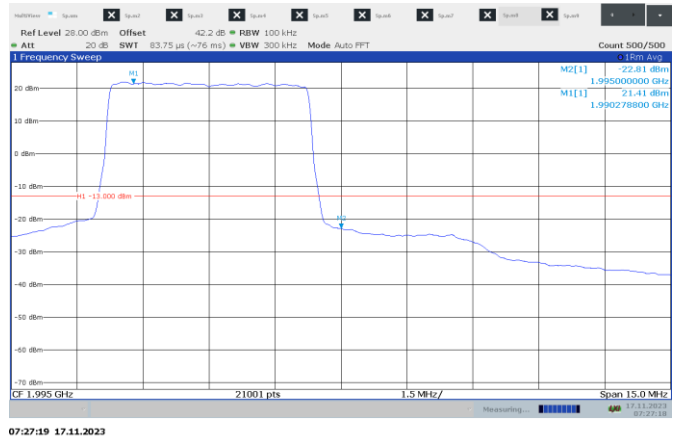


Figure 7.2-48 : Conducted band edge (RBW 1% of EBW), LTE, B 25, CH 8660

Test data, Band edges, continued

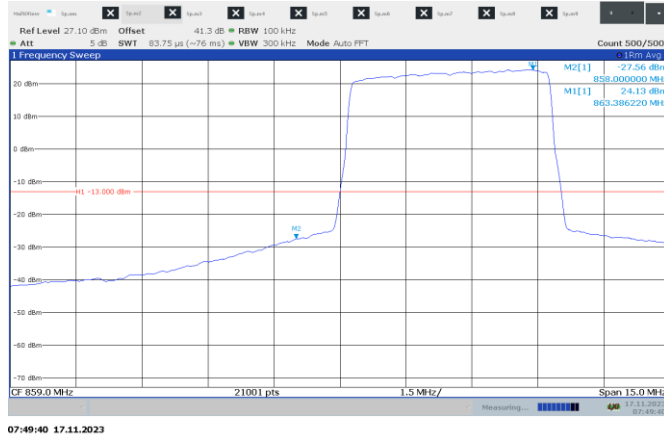


Figure 7.2-49: Conducted band edge, LTE, B 26_1, CH 8715



Figure 7.2-50 : Conducted band edge (RBW 1% of EBW), LTE, B 26_1, CH 8715

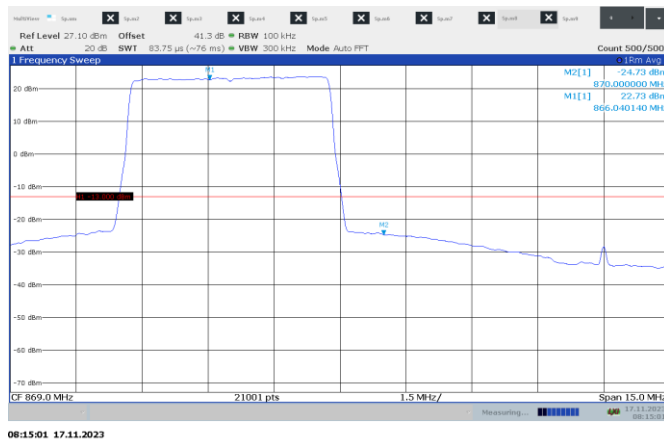


Figure 7.2-51: Conducted band edge, LTE, B 26_1, CH 8765

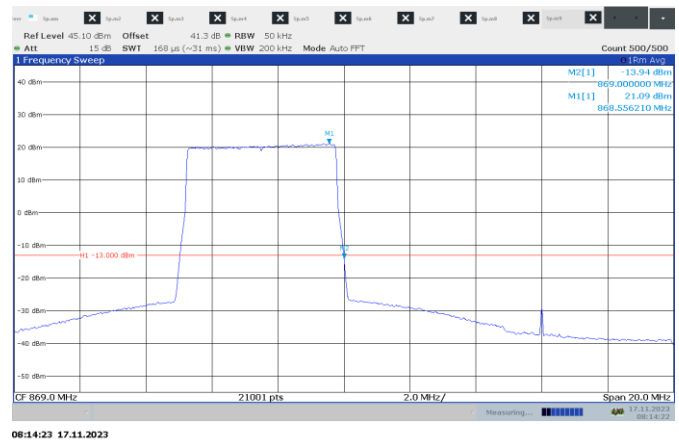


Figure 7.2-52 : Conducted band edge (RBW 1% of EBW), LTE, B 26_1, CH 8765

Test data, Band edges, continued

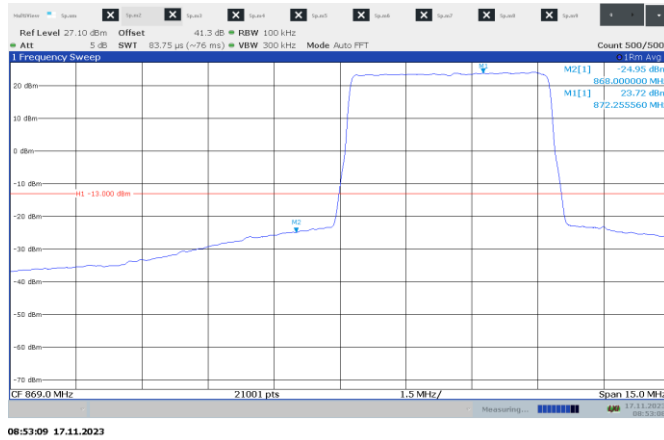


Figure 7.2-53: Conducted band edge, LTE, B 26_2, CH 8815

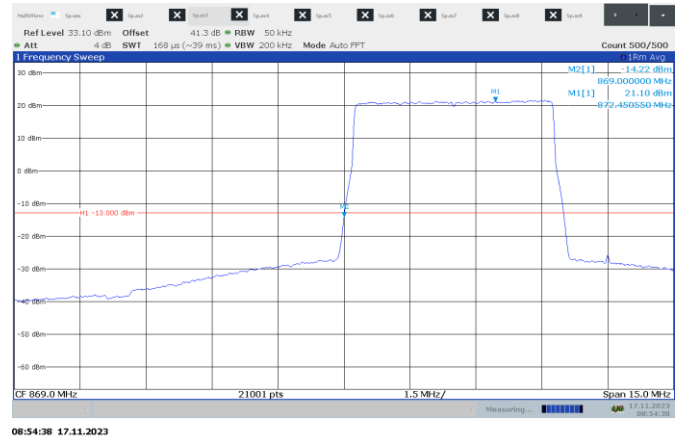


Figure 7.2-54 : Conducted band edge (RBW 1% of EBW), LTE, B 26_2, CH 8815

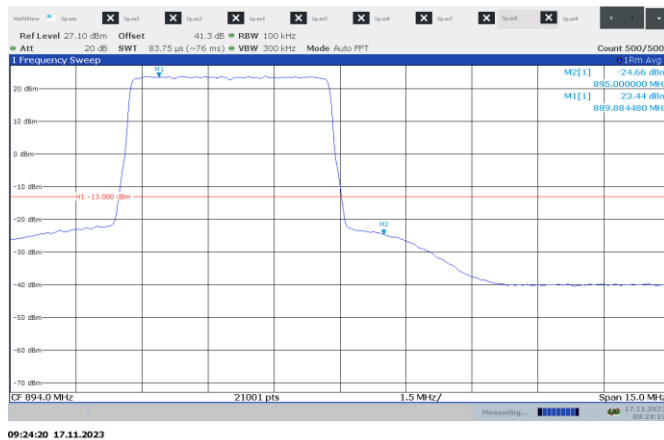


Figure 7.2-55: Conducted band edge, LTE, B 26_2, CH 9015

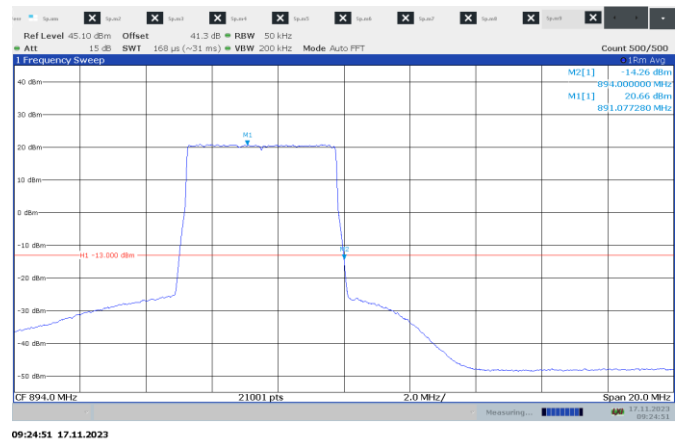


Figure 7.2-56 : Conducted band edge (RBW 1% of EBW), LTE, B 26_2, CH 9015

Test data, Band edges, continued

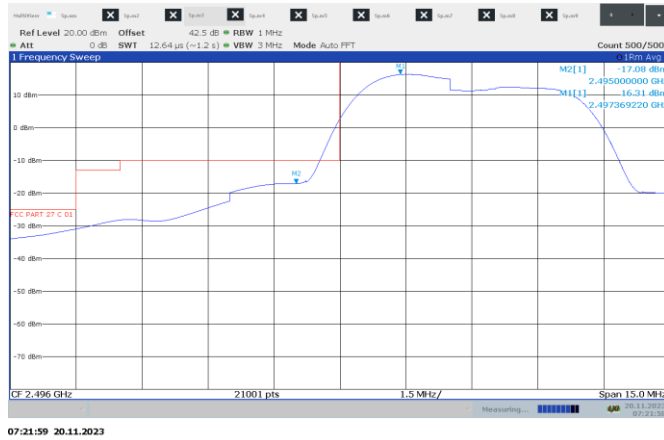


Figure 7.2-57: Conducted band edge, LTE, B 41, CH 39680

Note: plot in figure 7.2-57 is to show compliance 1 MHz away from the authorized bandwidth, the band edge at the authorized band edge is shown in plot in figure 7.2-58 utilizing a reduced RBW as per the standard

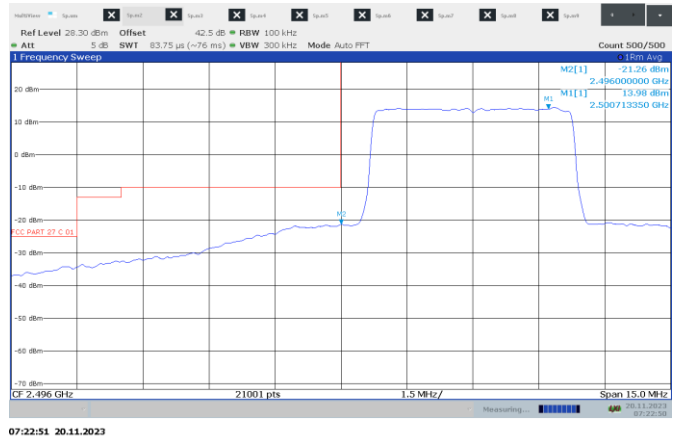


Figure 7.2-58 : Conducted band edge (RBW 1% of EBW), LTE, B 41, CH 39680

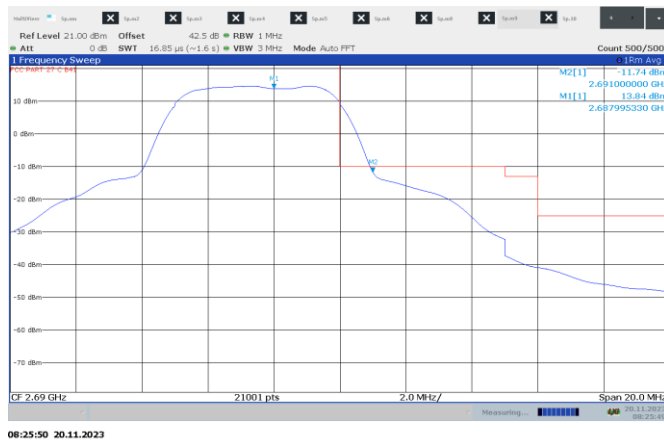


Figure 7.2-59: Conducted band edge, LTE, B 41, CH 41565

Note: plot in figure 7.2-59 is to show compliance 1 MHz away from the authorized bandwidth, the band edge at the authorized band edge is shown in plot in figure 7.2-60 utilizing a reduced RBW as per the standard



Figure 7.2-60 : Conducted band edge (RBW 1% of EBW), LTE, B 41, CH 41565