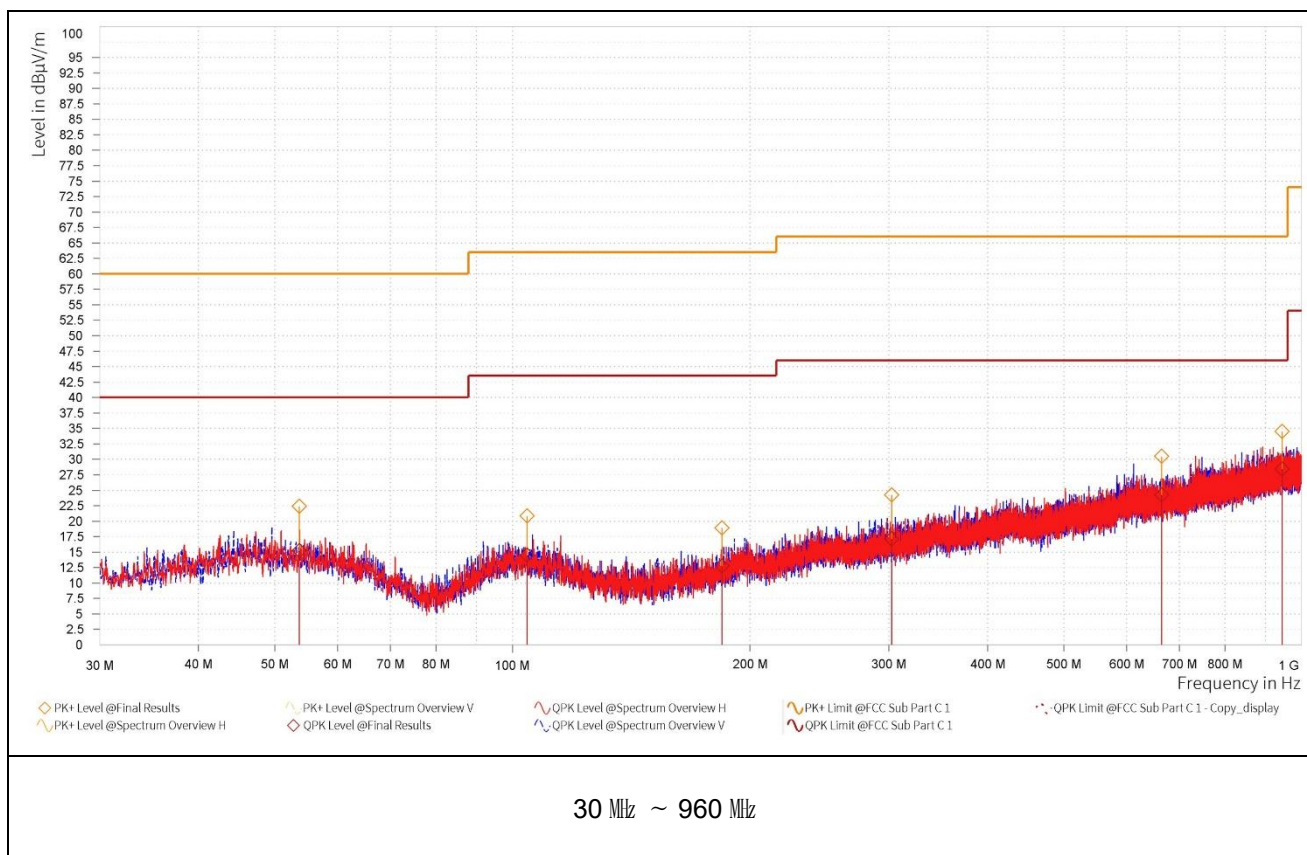




2.4.3. Radiated Spurious Emission above 960 MHz

All emissions tested both horizontal and vertical. The following table shows the highest levels of radiated emissions on the worst polarization.

Frequency (MHz)	Reading (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)		Margin (dB)	
								FCC	IC	FCC	IC
978.24	27.28	H	28.30	-34.85	20.73	-110.82	-90.09	-75.30		14.79	
1 037.82	33.91	H	24.25	-37.77	20.39	-110.82	-90.43	-75.30		15.13	
*1 176.39	4.64	H	25.05	-37.37	-7.68	-110.82	-118.50	-85.30		33.20	
*1 565.12	4.18	H	25.26	-35.92	-6.48	-110.82	-117.30	-85.30		32.00	
1 612.66	32.38	H	25.48	-36.02	21.84	-110.82	-88.98	-63.30	-70.00	25.68	18.98
2 476.20	31.03	H	28.36	-34.19	25.20	-110.82	-85.62	-61.30	-70.00	24.32	15.62
3 201.20	29.56	H	30.50	-32.90	27.16	-110.82	-83.66	-41.30	-70.00	42.36	13.66
4 769.89	25.95	H	32.58	-29.64	28.89	-110.82	-81.93	-41.30		40.63	
16 691.68	22.74	H	41.68	-18.87	45.55	-110.82	-65.27	-61.30		3.97	
Above 16 700.00	Not detected	-	-	-	-	-	-	-		-	

Remark;

1. $E \text{ (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Amp (dB)} + \text{Cable Loss (dB)}$.
2. $E.I.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8$; where D is the measurement distance in meters.
3. $CF \text{ (dB)} (E.I.R.P.) = 20 \log D - 104.8$
4. All the emissions above 960 MHz were measured at a 0.5 meter test distance.
5. “*” means the GPS band.
6. Measurement In frequency 1 162 MHz ~ 1 240 MHz and 1 559 MHz ~ 1 610 MHz, RBW is set to 1 kHz.
7. According to § 15.31(o), Emission levels are not reported much lower than the limits by over 20 dB.
8. AF = Antenna Factor, AMP = Amplifier, CL = Cable Loss.
9. Spurious emission measurements were performed in the mode with the worst-case output power.

- Test plots

960 MHz ~ 1 000 MHz



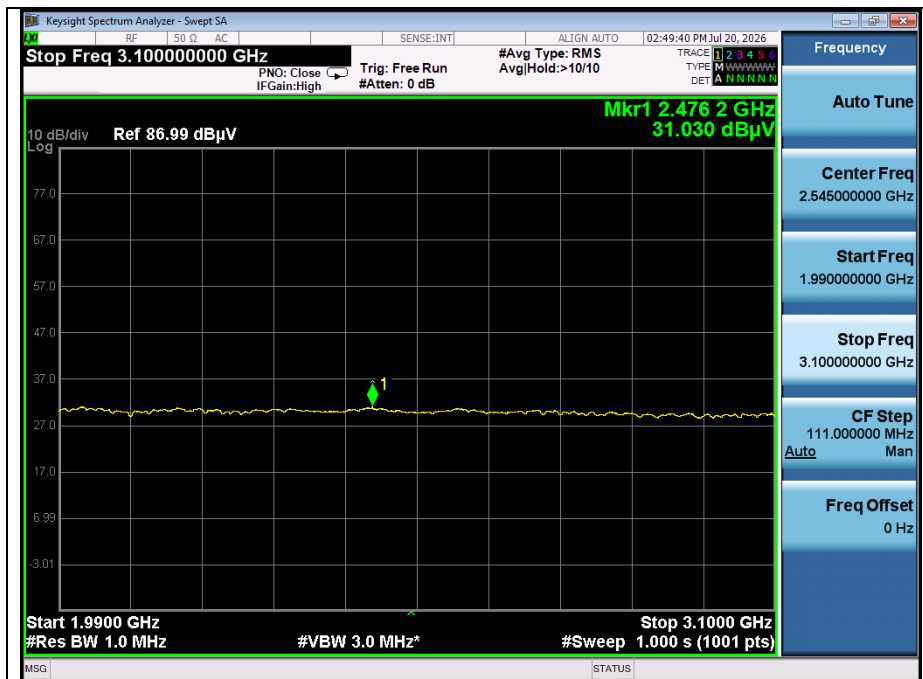
1 000 MHz ~ 1 610 MHz



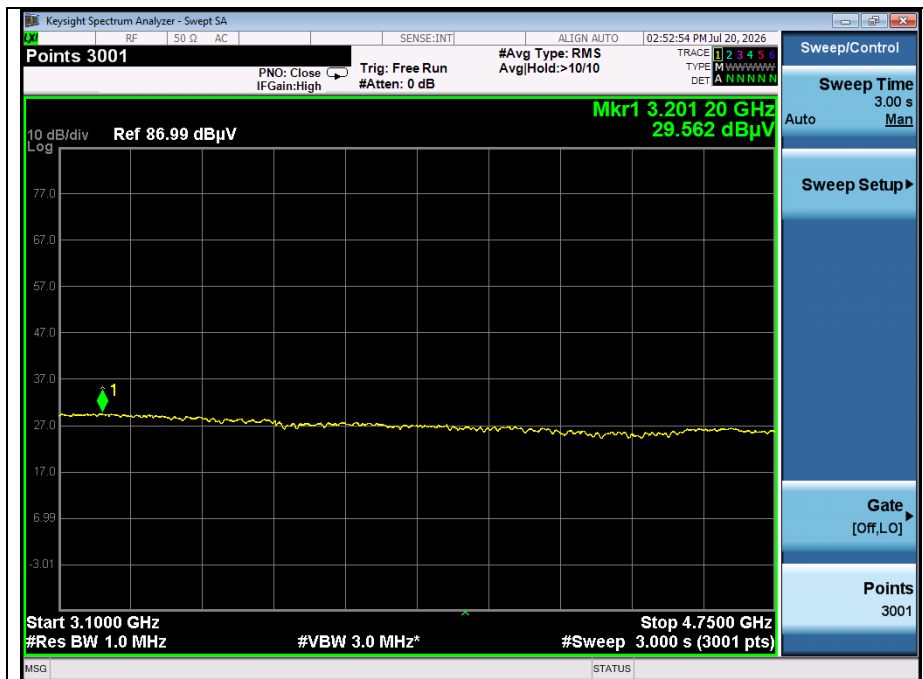
1 610 MHz ~ 1 990 MHz



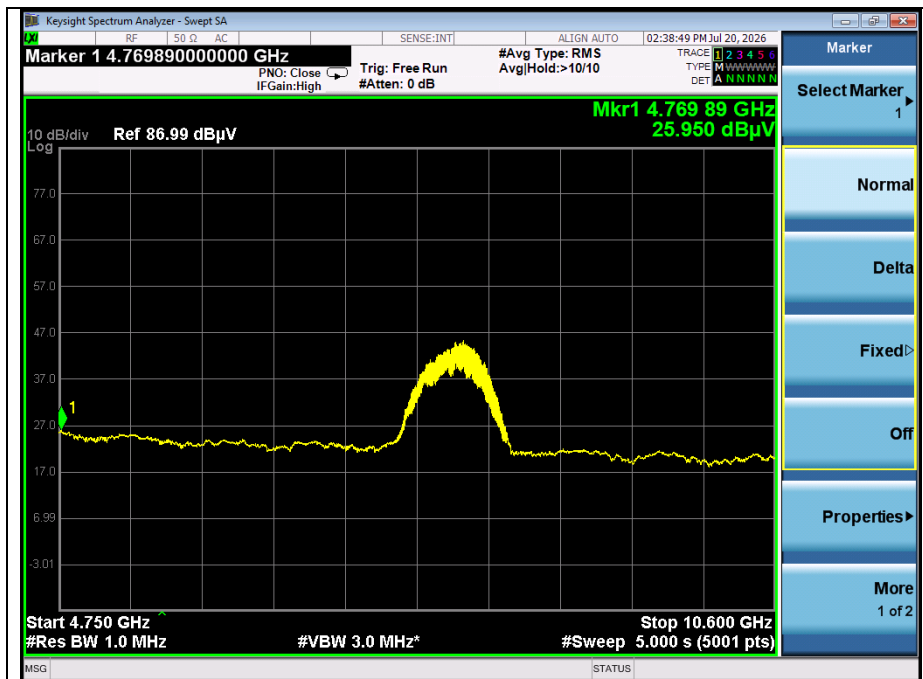
1 990 MHz ~ 3 100 MHz



3 100 MHz ~ 4 750 MHz



4 750 MHz ~ 10 600 MHz

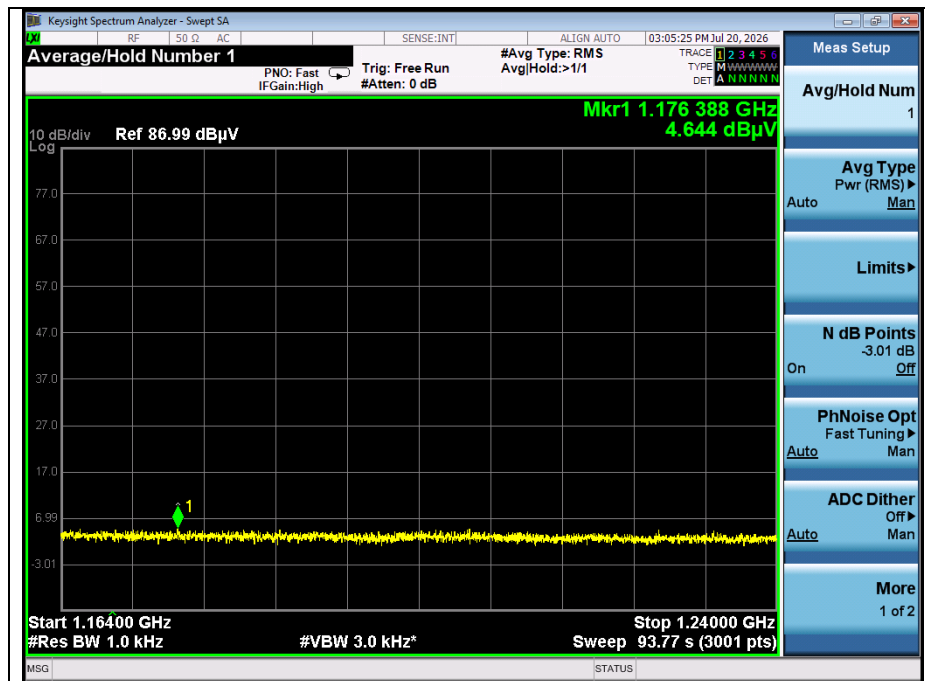


10 600 MHz ~ 18 000 MHz

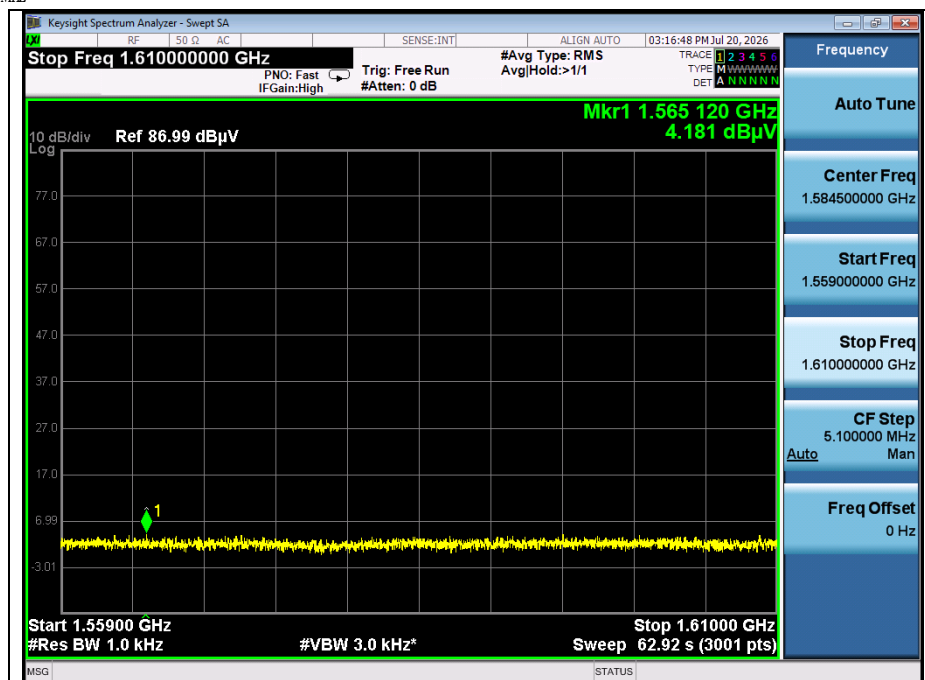


- GPS Band

1 164 - 1 240 MHz

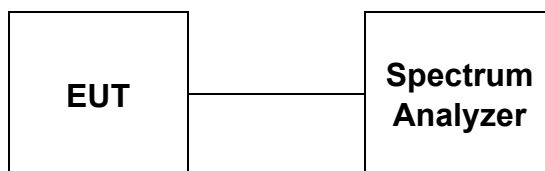


1 559 - 1 610 MHz



3. 10 dB Bandwidth

3.1. Test Setup



3.2. Limit

3.2.1. FCC

According to §15.503(a), for the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.

According to §15.519(b), the UWB bandwidth of a device operating under the provisions of this section must be contained between 3 100 MHz and 10,600 MHz.

According to §15.521(e), The frequency at which the highest radiated emission occurs, f_m , must be contained within the UWB bandwidth.

3.2.2. IC

According to 2 of RSS-220 Issue 1, a UWB device is an intentional radiator that has either a -10 dB bandwidth of at least 500 MHz or a -10 dB fractional bandwidth greater than 0.2. There are eight distinct subclasses of UWB device.

3.3. Test Procedure

10 dB Bandwidth

The test follows section 10.1 of ANSI C63.10-2020 for FCC and ANSI C63.10-2020+Cor.1-2023+C63.10a-2024 + Errata to C63.10a-2024 for ISSED.

The frequency at which the maximum power level is measured with the peak detector is designated f_M . The peak power measurements shall be made using a spectrum analyzer or EMI receiver with a 1 MHz resolution bandwidth and a video bandwidth of 1 MHz or greater. The instrument shall be set to peak detection using the maximum-hold trace mode. The outermost 1 MHz segments above and below f_M , where the peak power falls by 10 dB relative to the level at f_M , are designated as f_H and f_L , respectively:

a) For the lowest frequency bound f_L , the emission is searched from a frequency lower than f_M that has, by inspection, a peak power much lower than 10 dB less than the power at f_M and increased toward f_M until the peak power indicates 10 dB less than the power at f_M . The frequency of that segment is recorded.

b) This process is repeated for the highest frequency bound f_H , beginning at a frequency higher than f_M that has, by inspection, a peak power much lower than 10 dB below the power at f_M . The frequency of that segment is recorded.

c) The two recorded frequencies represent the highest (f_H) and lowest (f_L) bounds of the UWB transmission, and the -10 dB bandwidth (B_{-10}) is defined as $(f_H - f_L)$. The center frequency (f_c) is calculated from $(f_H + f_L) / 2$.

3.4. Test Result

Ambient temperature : (23 ± 1) °C

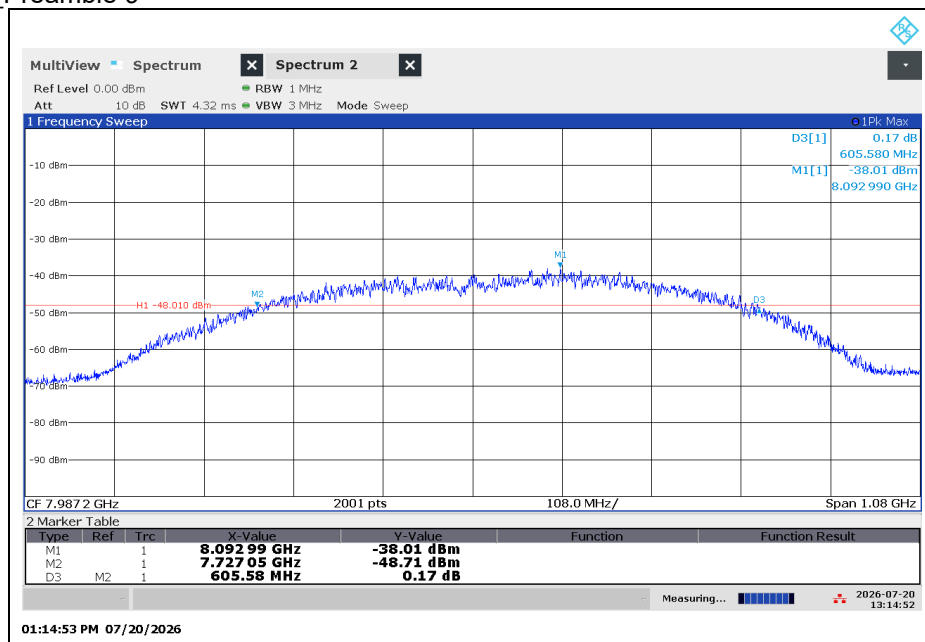
Relative humidity : 47 %

Channel	Configure	Packet length	Preamble	f _M (MHz)	f _L (MHz)	f _H (MHz)	f _C (MHz)	10 dB BW (MHz)	Minimum BW (MHz)
9	SP0	4	9	8 092.99	7 727.05	8 332.63	8 029.84	605.58	500
			10	7 995.84	7 729.75	8 321.83	8 025.79	592.08	
			11	8 102.16	7 703.84	8 331.01	8 017.43	627.17	
			12	8 108.64	7 730.29	8 330.47	8 030.38	600.18	
		20	9	7 999.61	7 721.65	8 331.55	8 026.60	609.90	
			10	7 987.74	7 730.29	8 332.09	8 031.19	601.80	
			11	8 101.08	7 717.33	8 333.16	8 025.25	615.83	
			12	7 987.20	7 704.38	8 342.34	8 023.36	637.96	
	SP3	-	9	8 081.11	7 705.46	8 331.01	8 018.24	625.55	
			10	8 081.11	7 705.46	8 331.01	8 018.24	625.55	
			11	8 080.57	7 705.46	8 331.01	8 018.24	625.55	
			12	8 080.57	7 705.46	8 331.01	8 018.24	625.55	

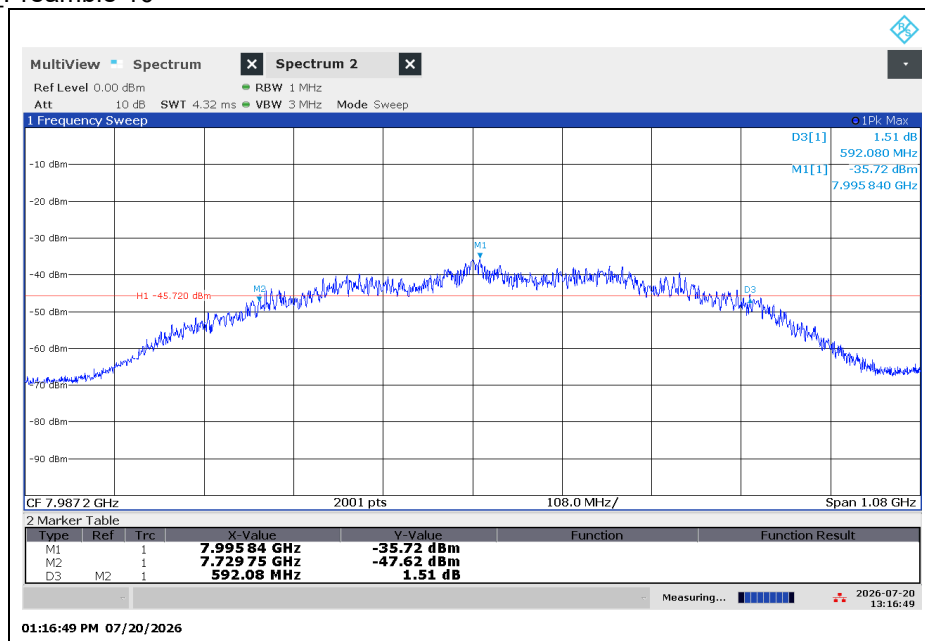
- Test plot

10 dB Bandwidth

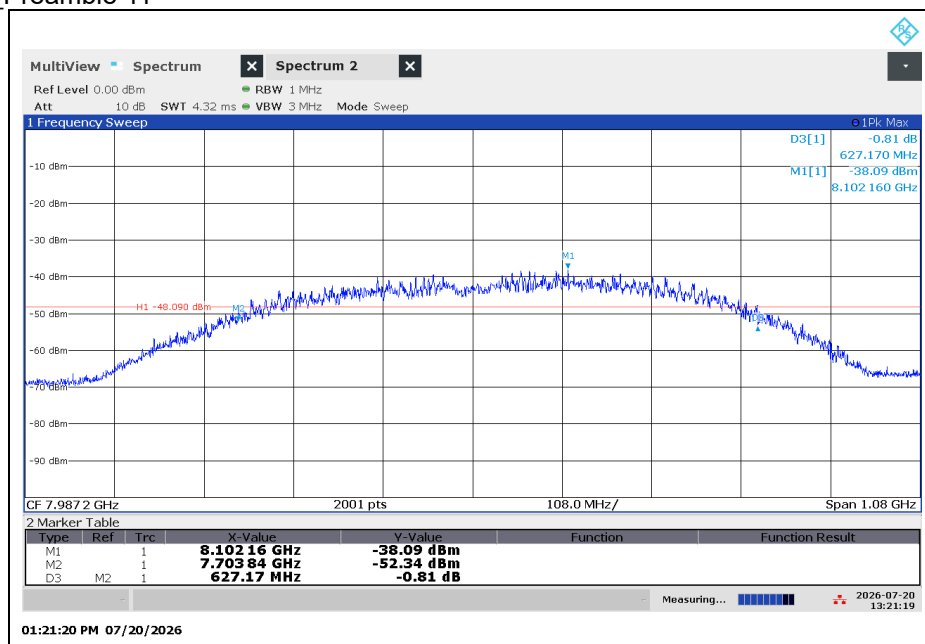
SP0_BPRF 4_Preamble 9



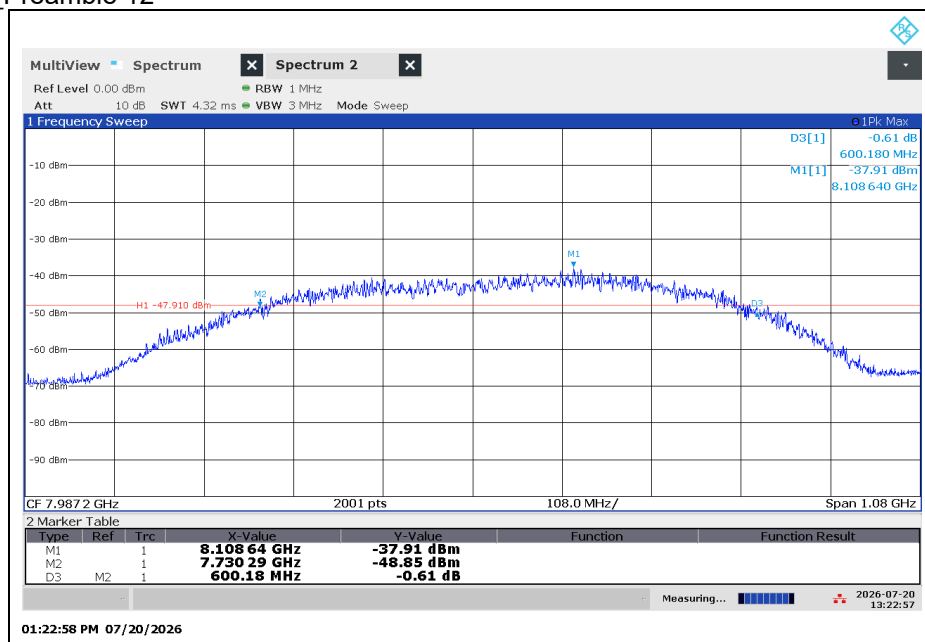
SP0_BPRF 4_Preamble 10



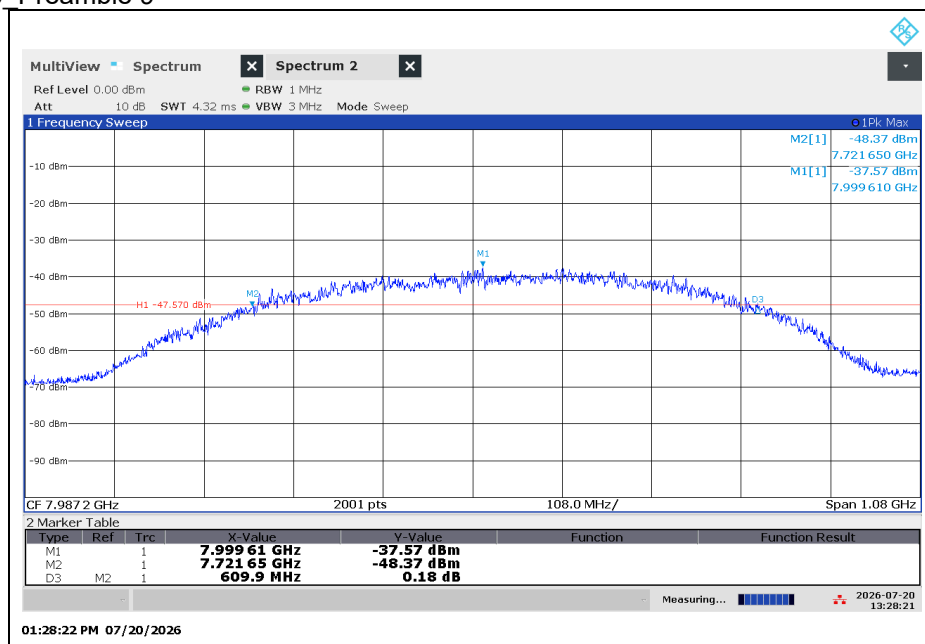
SP0_BPRF 4_Preamble 11



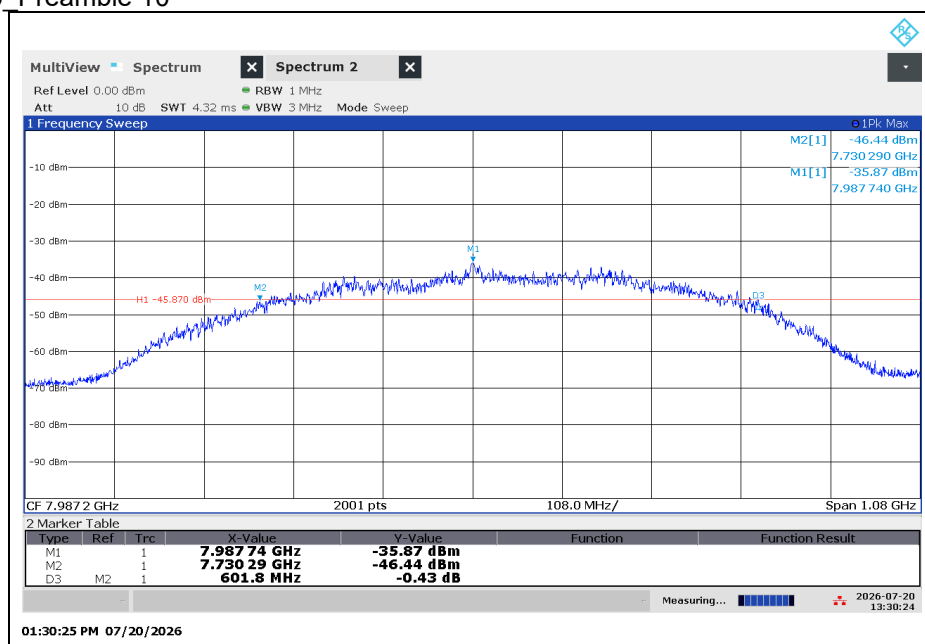
SP0_BPRF 4_Preamble 12



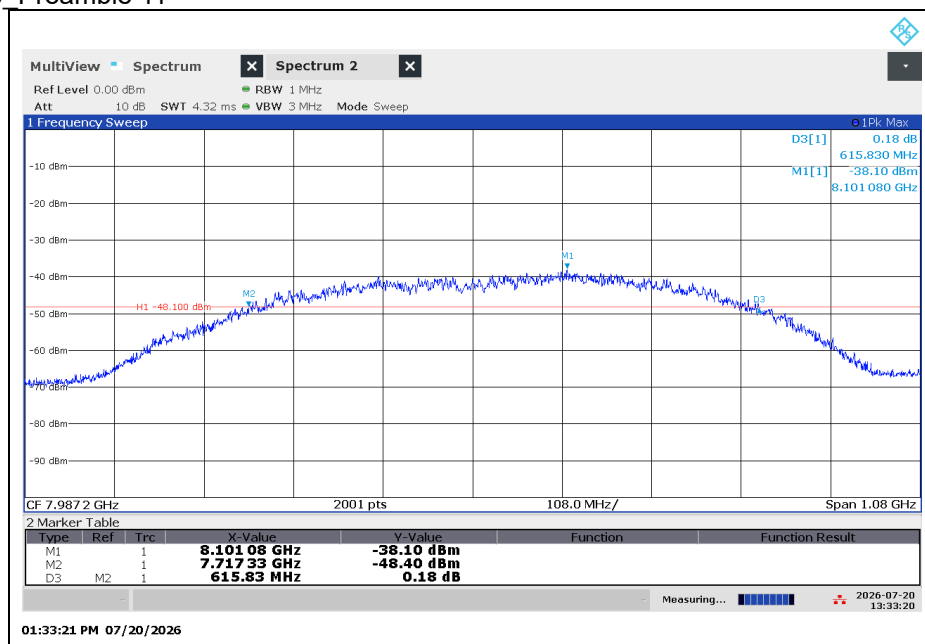
SP0_BPRF 20_Preamble 9



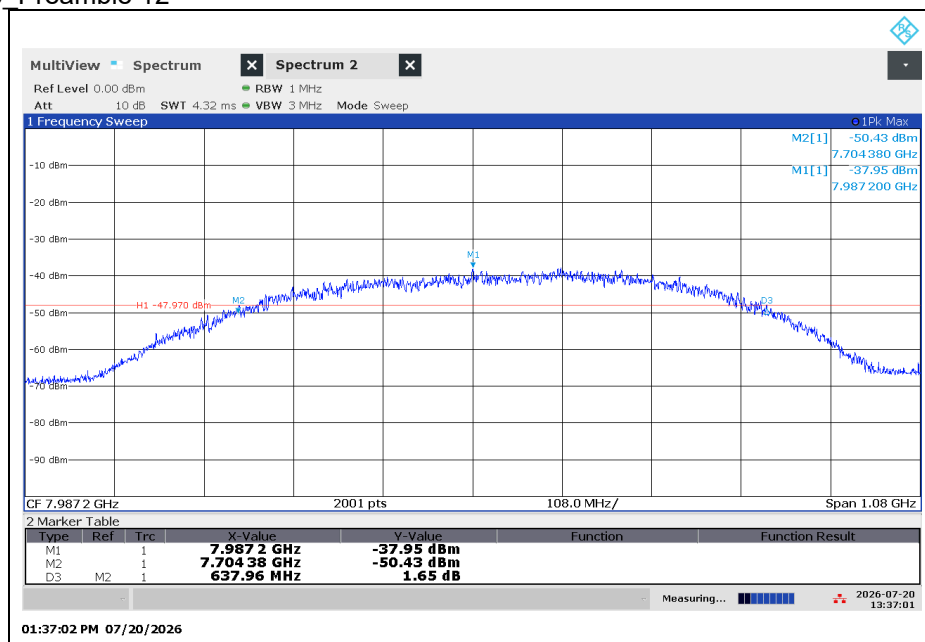
SP0_BPRF 20_Preamble 10



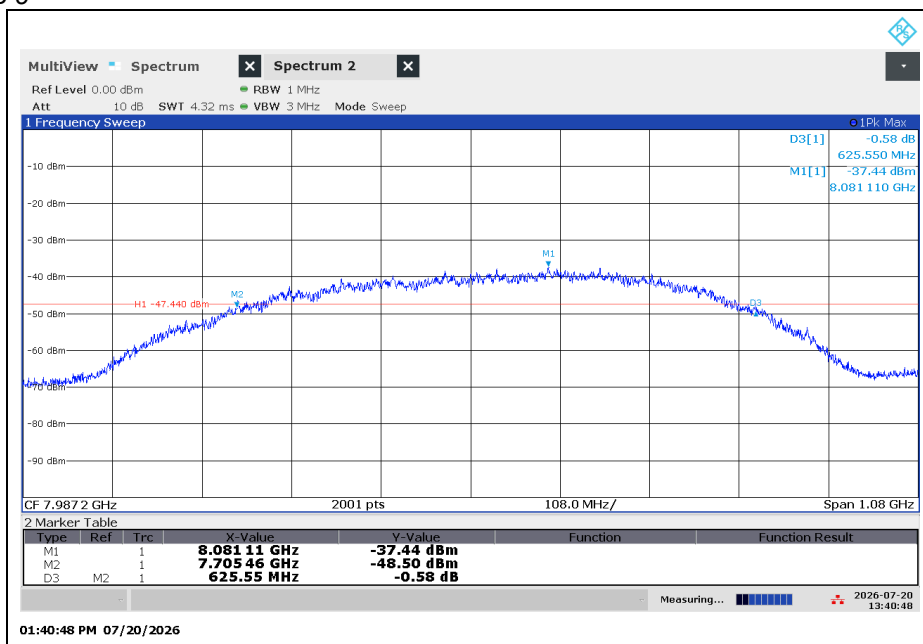
SP0_BPRF 20_Preamble 11



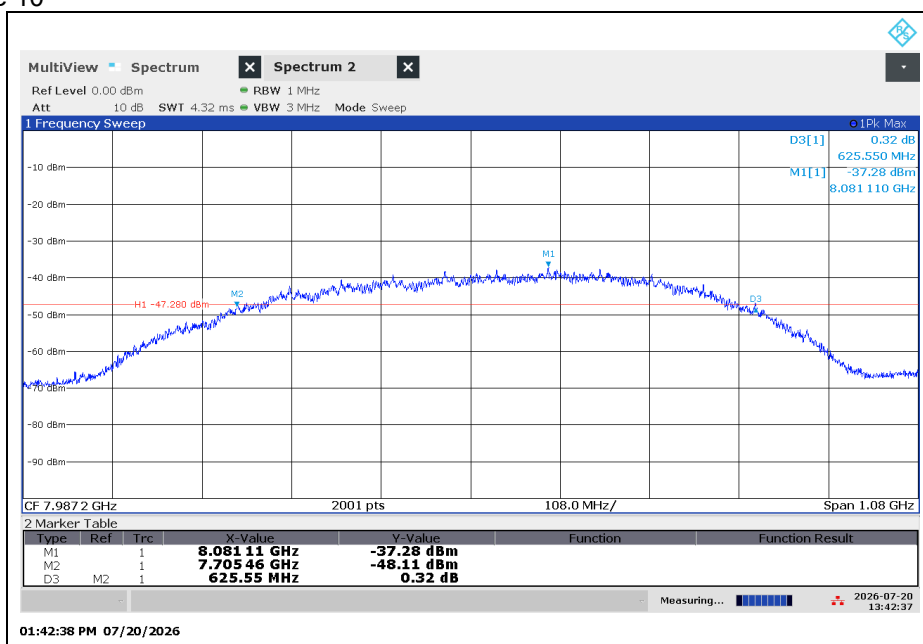
SP0_BPRF 20_Preamble 12



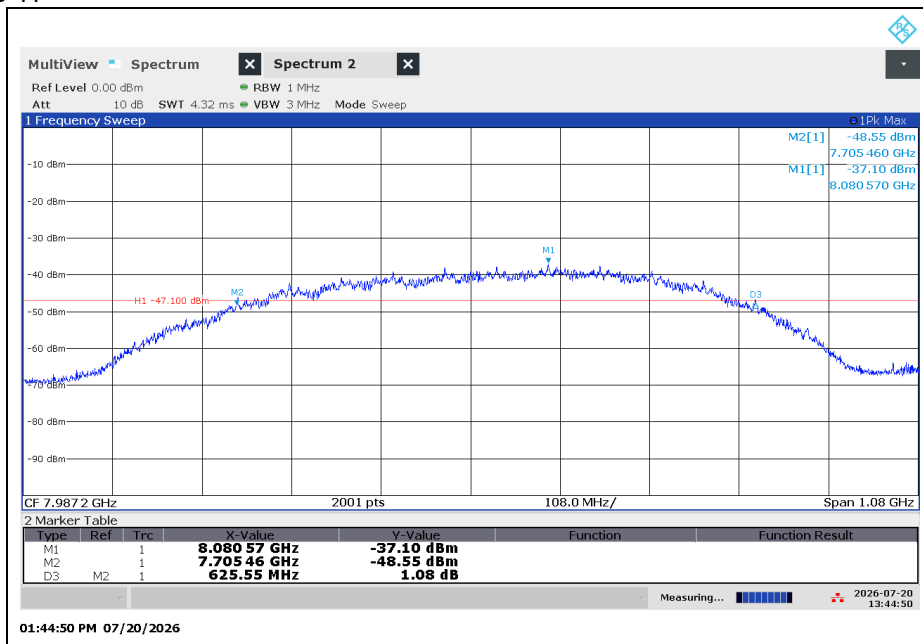
SP3_Preamble 9



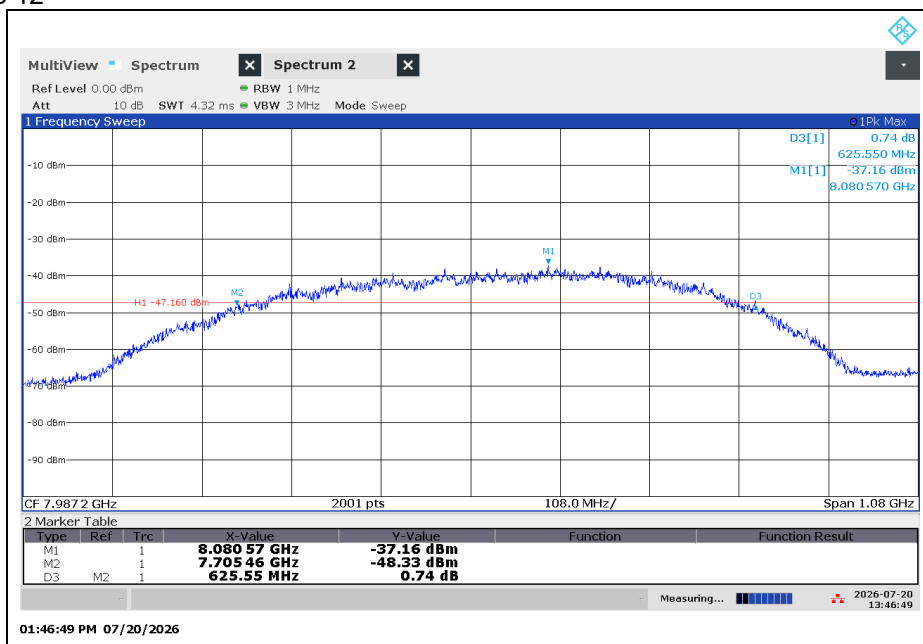
SP3_Preamble 10



SP3_Preamble 11

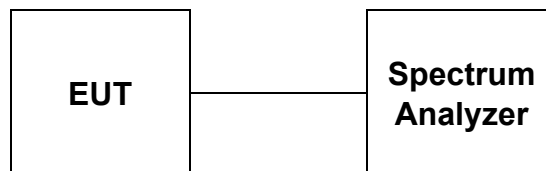


SP3_Preamble 12



4. 99 % Bandwidth

4.1. Test Setup



4.2. Limit

Limit: Not Applicable

4.3. Test Procedure

99 % Bandwidth

The test follows section 6.9.3 of ANSI C63.10-2020 for FCC and ANSI C63.10-2020+Cor.1-2023+C63.10a-2024 + Errata to C63.10a-2024 for ISED.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW without going below the values in 6.9.1 and video bandwidth (VBW) shall be at least three times RBW, unless otherwise specified by the applicable requirement.
 - 1) When measuring OBW for UWB, the VBW shall be set to three times the RBW or the maximum available VBW of the measuring instrument.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $10 \log (\text{OBW}/\text{RBW})$ below the reference level. Specific guidance is given in 4.1.6.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- h) The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

4.4. Test Result

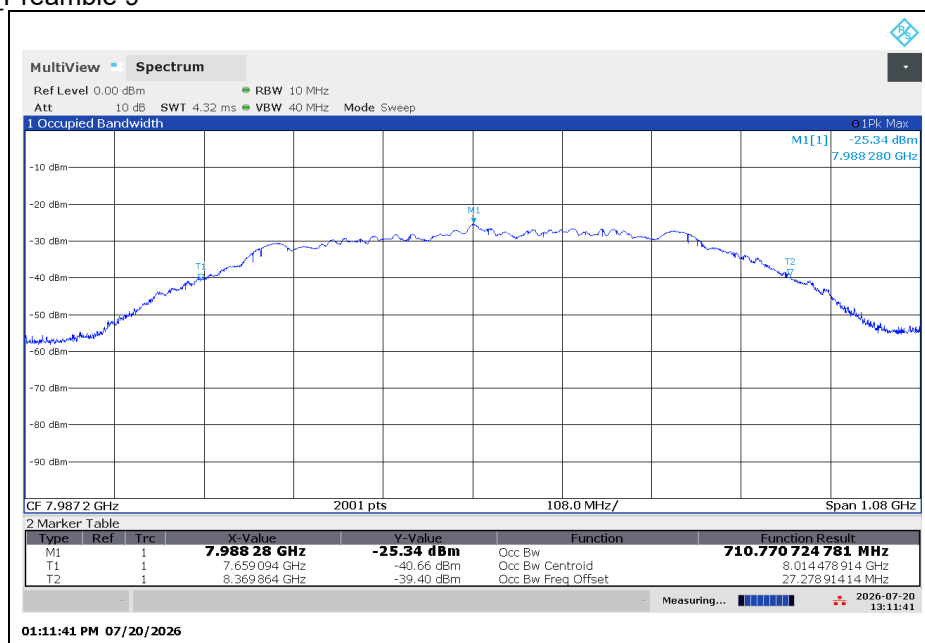
Ambient temperature : (23 ± 1) °C

Relative humidity : 47 %

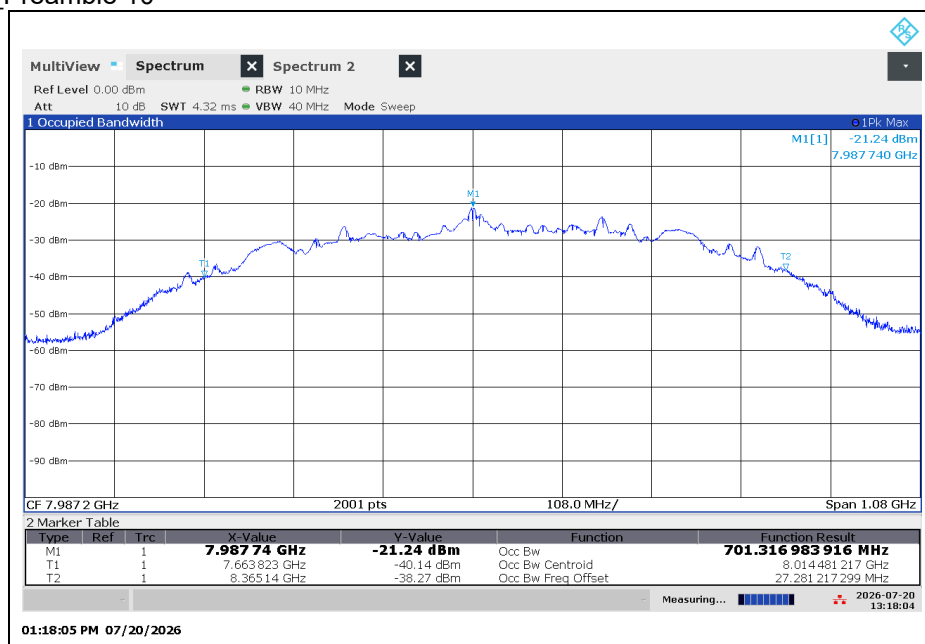
Channel	Configure	Packet length	Preamble	Frequency (MHz)	99 % Bandwidth (MHz)
9	SP0	4	9	7 987.20	710.77
			10	7 987.20	701.32
			11	7 987.20	709.63
			12	7 987.20	711.68
		20	9	7 987.20	709.43
			10	7 987.20	701.10
			11	7 987.20	710.47
			12	7 987.20	711.34
	SP3	-	9	7 987.20	730.62
			10	7 987.20	731.57
			11	7 987.20	733.01
			12	7 987.20	731.05

- Test plot

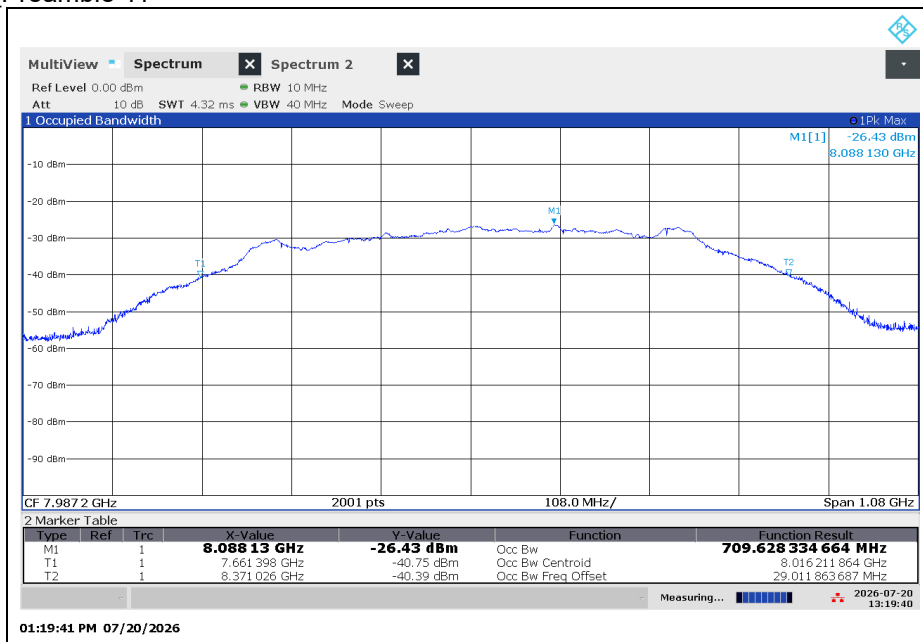
SP0_BPRF 4_Preamble 9



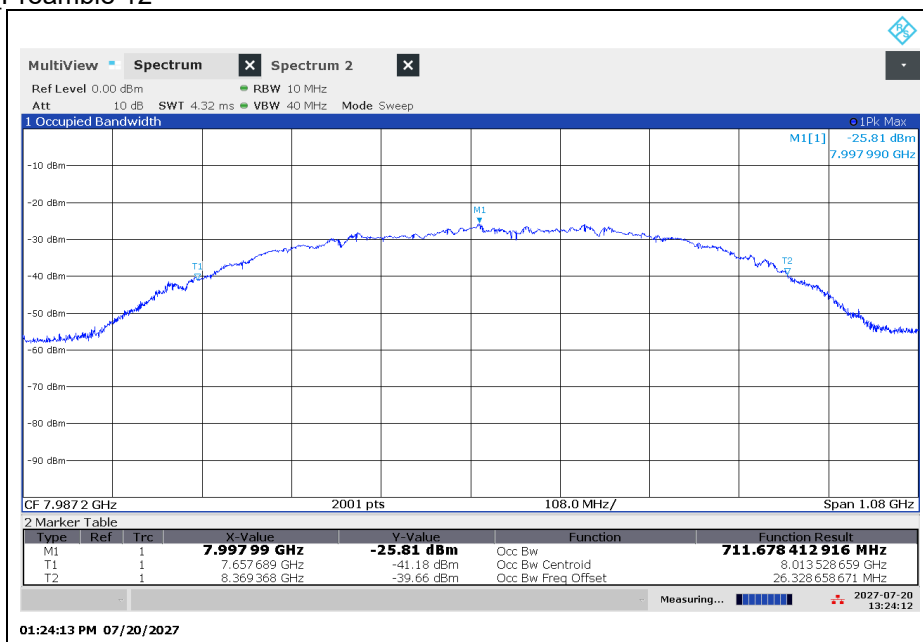
SP0_BPRF 4_Preamble 10



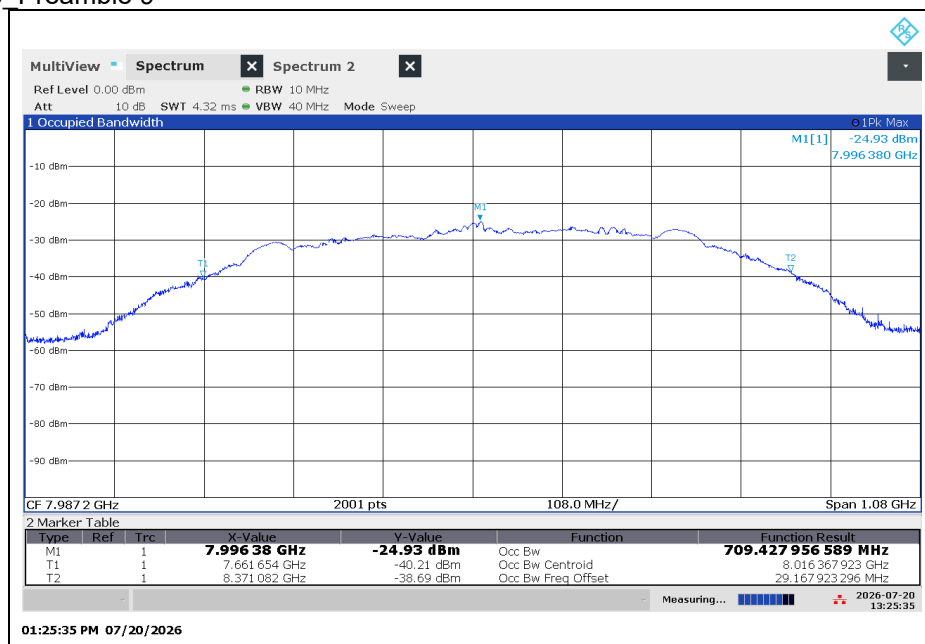
SP0_BPRF 4_Preamble 11



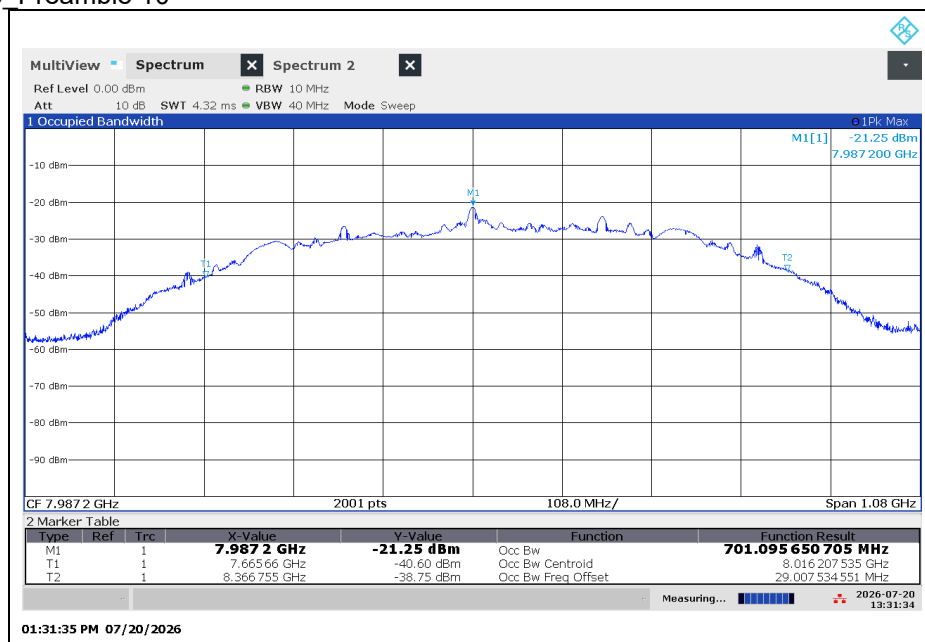
SP0_BPRF 4_Preamble 12



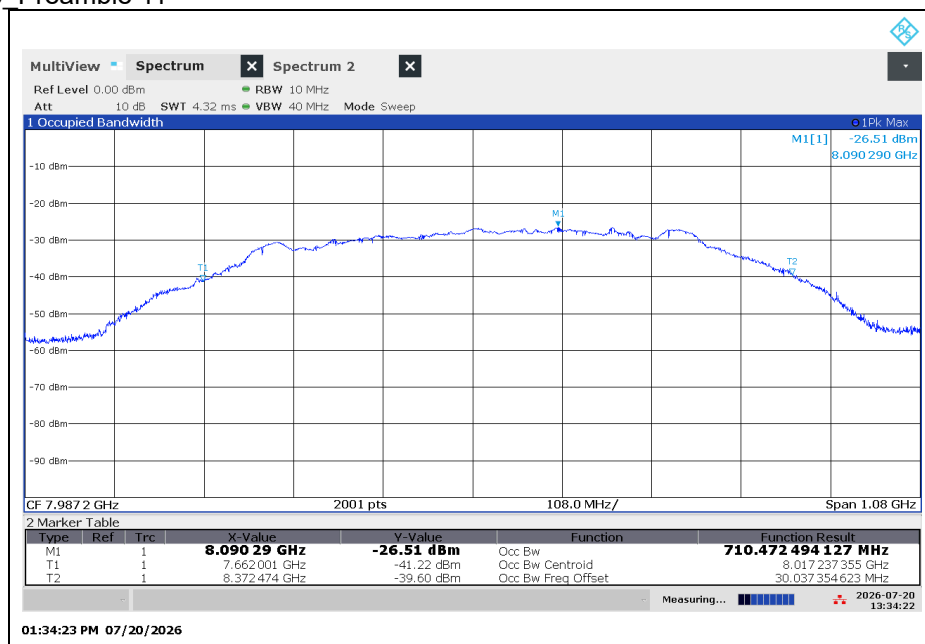
SP0_BPRF 20_Preamble 9



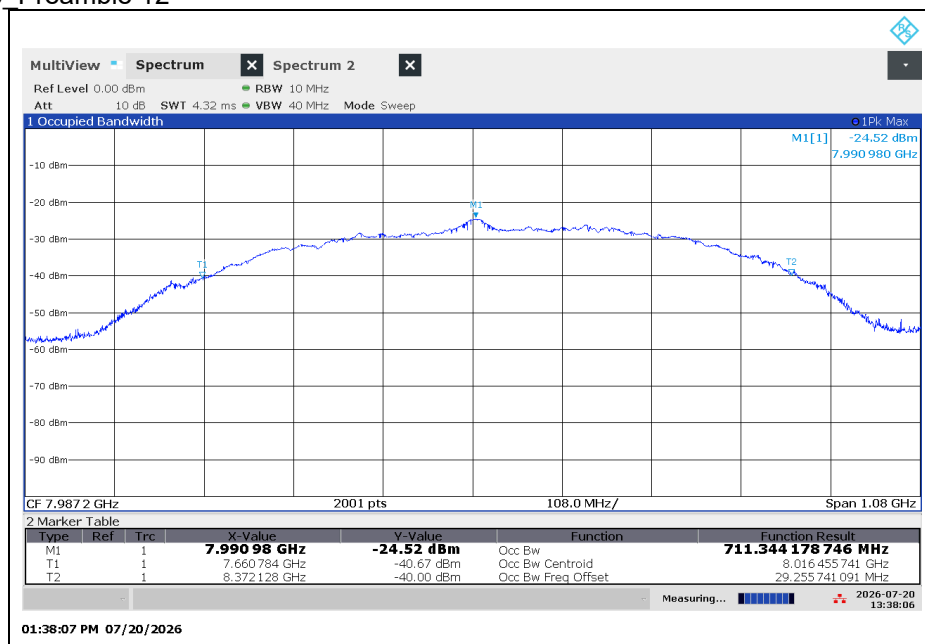
SP0_BPRF 20_Preamble 10



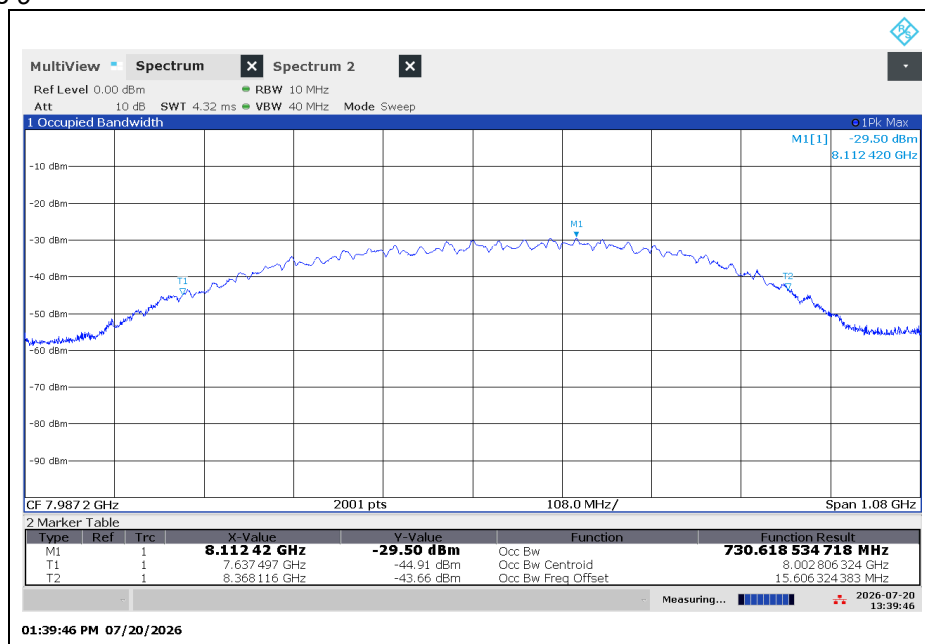
SP0_BPRF 20_Preamble 11



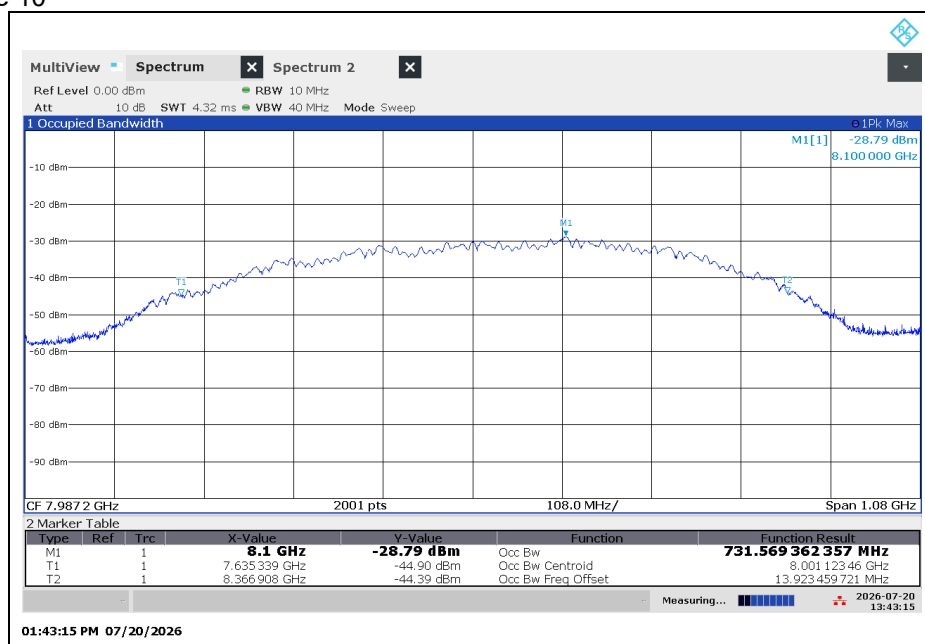
SP0_BPRF 20_Preamble 12



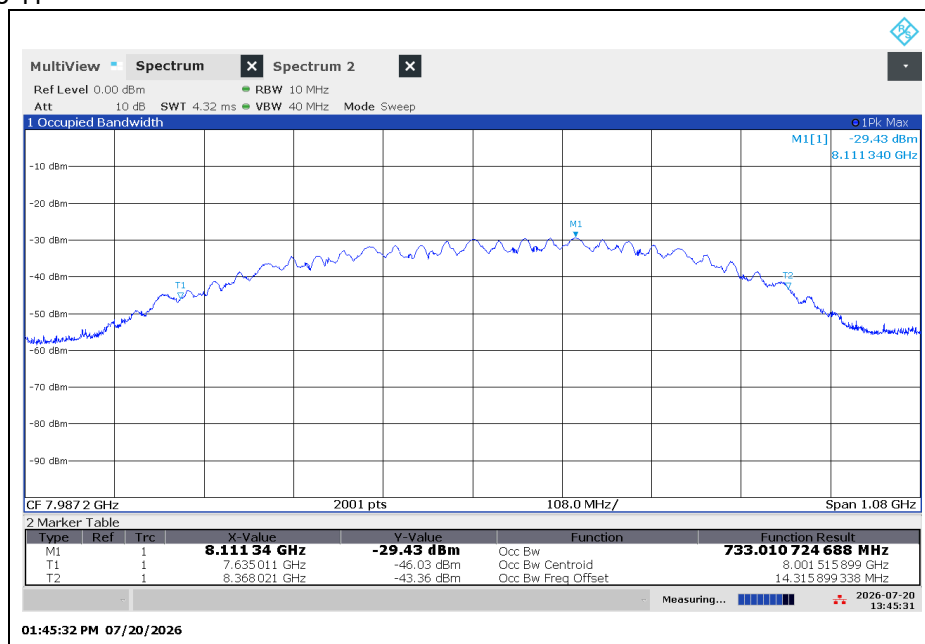
SP3_Preamble 9



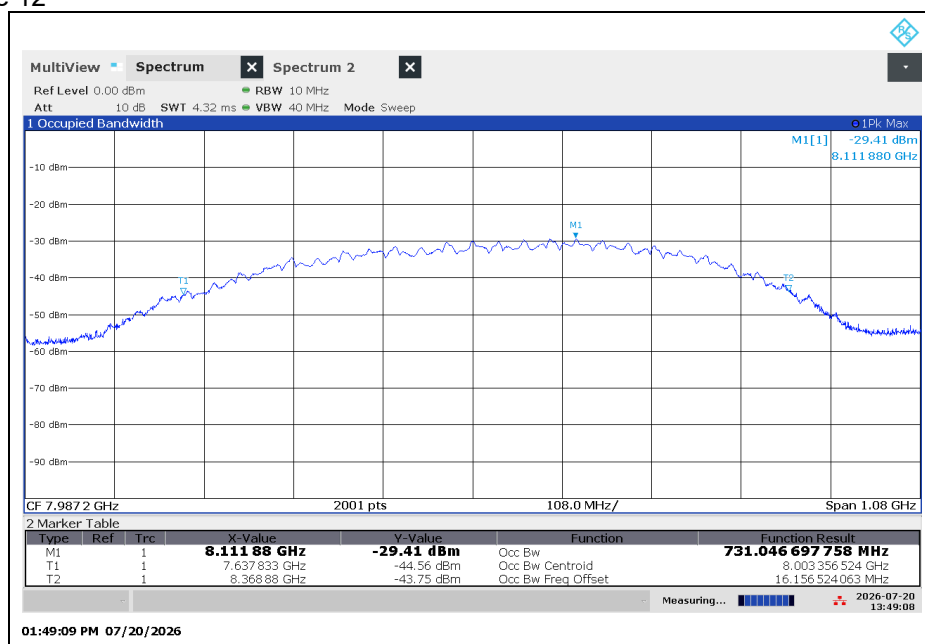
SP3_Preamble 10



SP3_Preamble 11

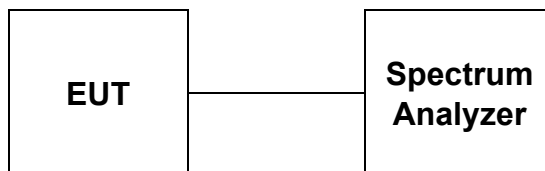


SP3_Preamble 12



5. Cease Transmission Time

5.1. Test Setup



5.2. Limit

5.2.1. FCC

According to §15.519(a)(1), a UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

5.2.2. IC

According to 5.3.1(b) of RSS-220 Issue 1, the device is to transmit only when it is sending information to an associated receiver. The device shall cease transmission of information within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received.

An acknowledgment of reception must continue to be received by the UWB device at least every 10 seconds or the UWB device shall cease transmitting any information other than periodic signals used for the establishment or re-establishment of a communication link with an associated receiver.

5.3. Test Procedure

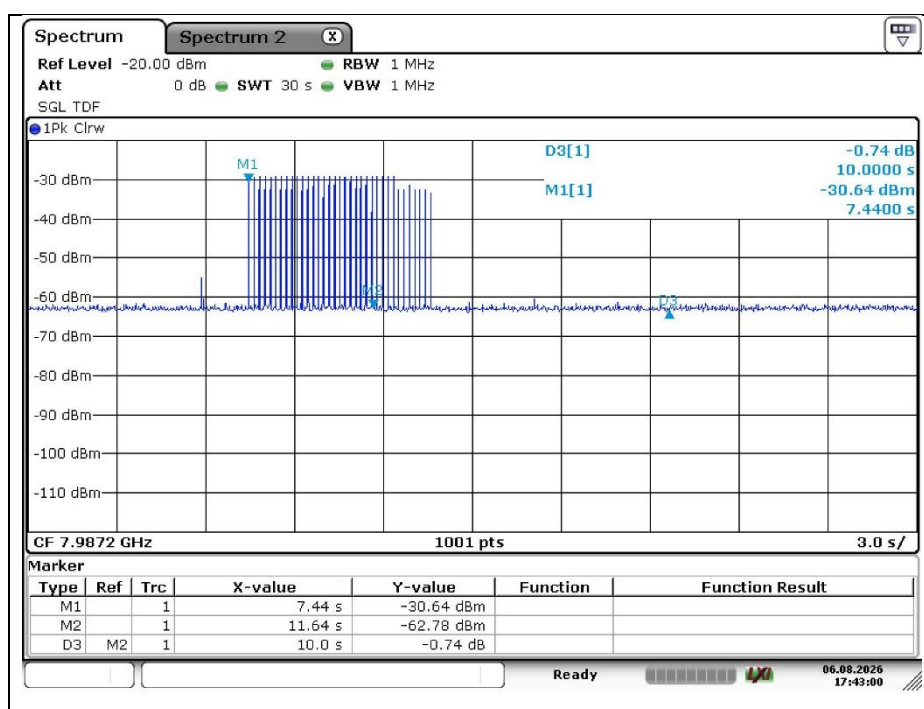
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 1 MHz, VBW = 3 MHz, Span = 0 Hz.

5.4. Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 %

Frequency (MHz)	Limit (sec)	Remark
7 987.2	10	Pass

- Test plot



Remark;

Marker 1 : EUT and smart phone are linked.
Marker 2 : EUT ends UWB link.
Marker 2Δ3 : 10s after EUT ends UWB link.

6. Antenna Requirement

6.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.519 (a)(2), the use of antennas mounted on outdoor structures, e.g., antenna mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

6.2. Antenna Connected Construction

Antenna used in this product is LDS Pattern Antenna with gain of 1.99 dB i.

- End of the Test Report -