













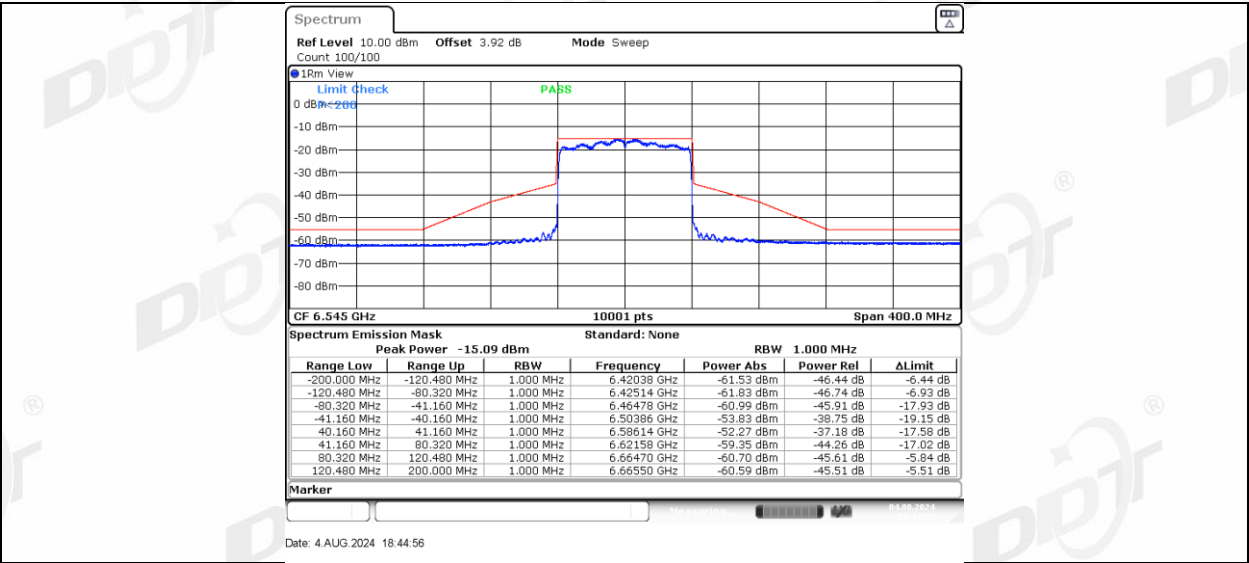




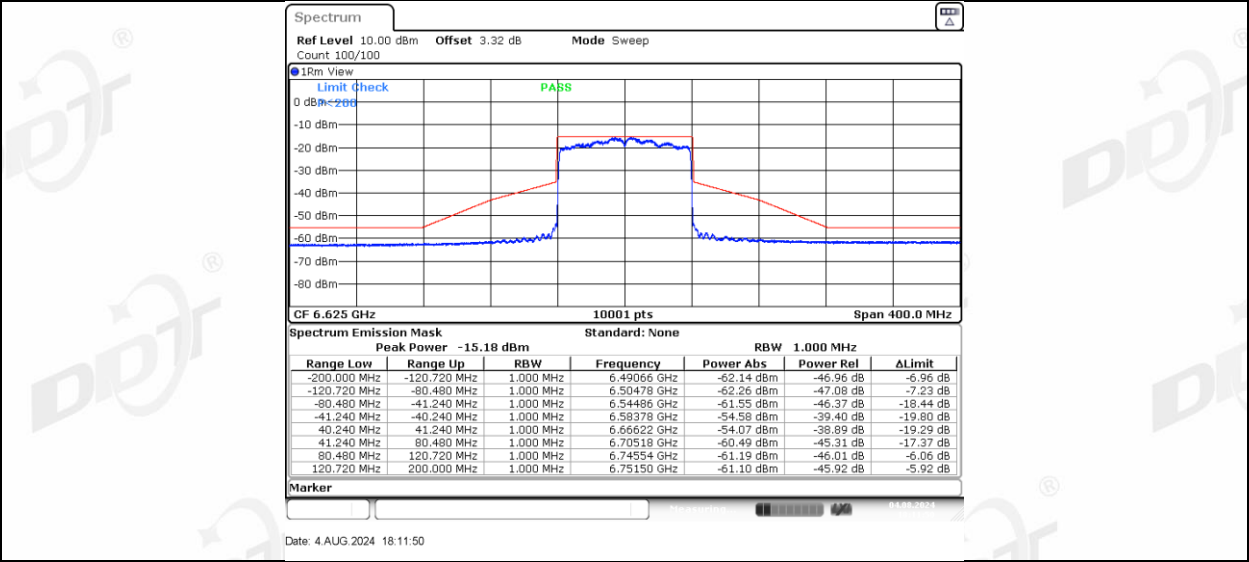




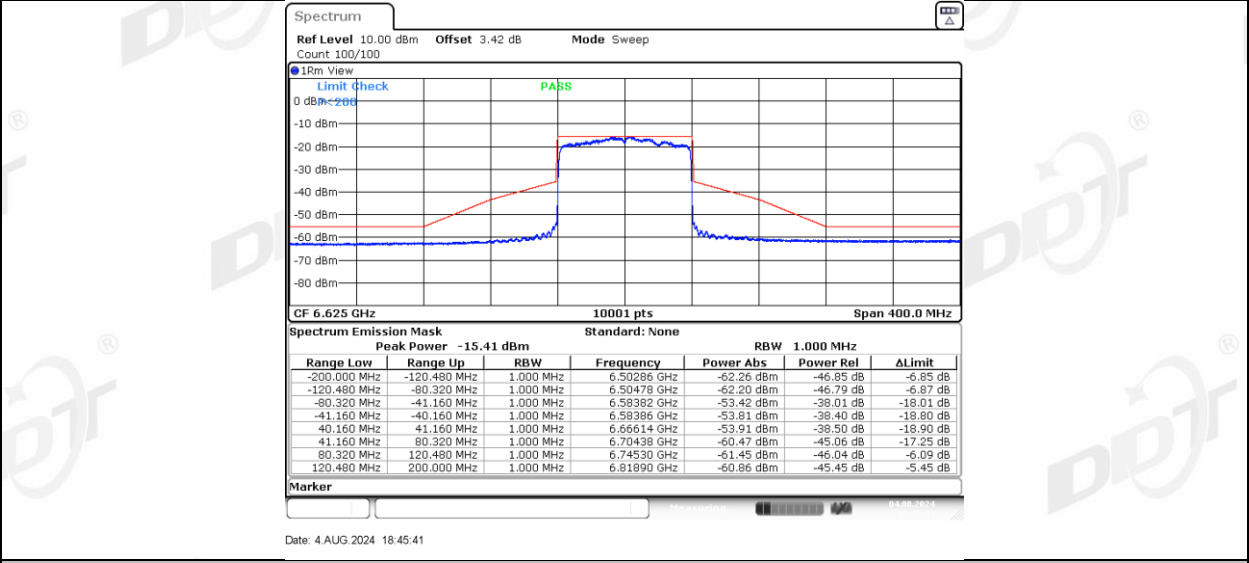




11AX80MIMO Ant-1_6625



11AX80MIMO Ant-3_6625

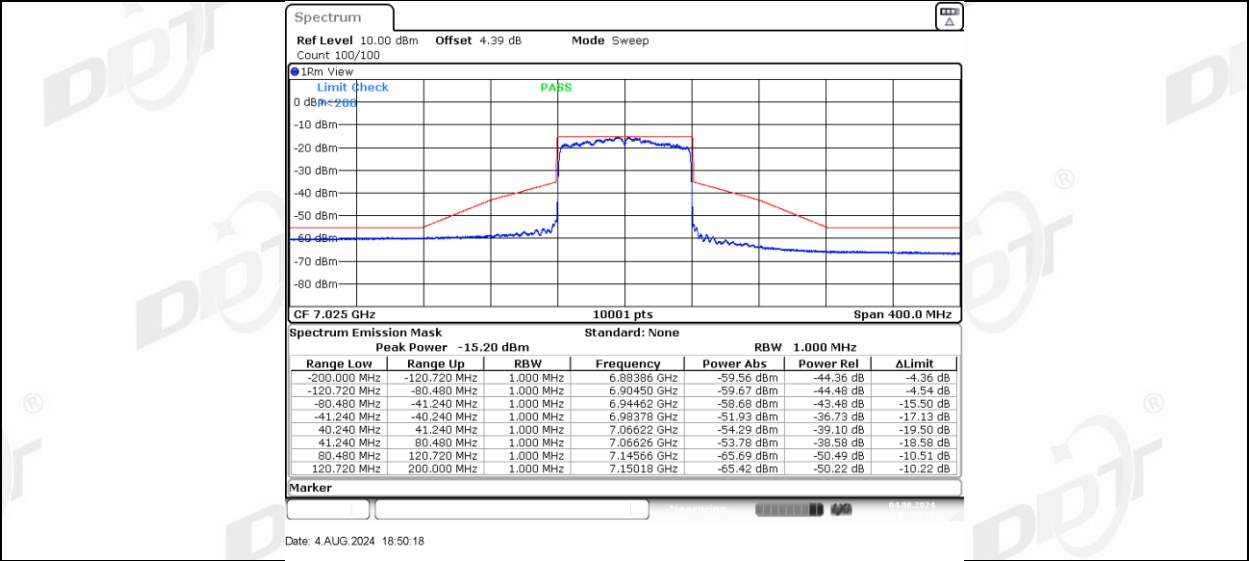


11AX80MIMO Ant-1_6705



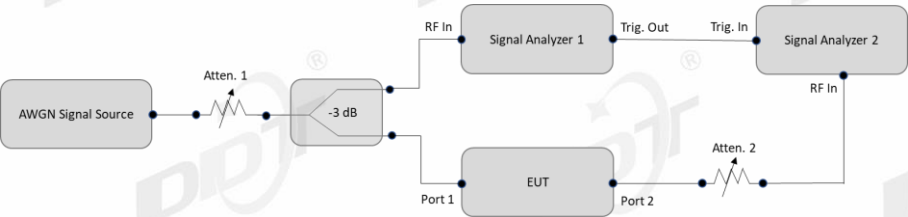






10. Contention Based Protocol

10.1. Block diagram of test setup



10.2. Limits

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) are required to use technologies that include a contention-based protocol to avoid co-channel interference with incumbent devices sharing the band. To ensure incumbent co-channel operations are detected in a technology-agnostic manner, unlicensed devices are required to detect co-channel radio frequency energy (energy detect) and avoid simultaneous transmission.

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel (in which incumbent signal is transmitted) and stay off the incumbent channel as long as

detected radio frequency power is equal to or greater than the threshold (-62 dBm)¹. The -55.01 dBm (or lower) threshold is referenced to a 6.99 dBi antenna gain.

To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, low-power indoor devices must detect co-channel energy with 90% or greater certainty.

10.3. Test procedure

Table 1. Criteria to determine number of times detection threshold test may be performed

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leq BW_{Inc}$	Once	Tune incumbent and EUT transmissions ($f_{c1} = f_{c2}$)
$BW_{Inc} < BW_{EUT} \leq 2BW_{Inc}$	Once	Incumbent transmission is contained within BW_{EUT}
$2BW_{Inc} < BW_{EUT} \leq 4BW_{Inc}$	Twice. Incumbent transmission is contained within BW_{EUT}	Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel
$BW_{EUT} > 4BW_{Inc}$	Three times	Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel

1. Configure the EUT to transmit with a constant duty cycle.
2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
3. Set the signal analyzer center frequency to the nominal EUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT. Connect the output port of the EUT to the signal analyzer 2, as shown in Figure 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
4. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
5. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
6. Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in Figure 2.
7. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
8. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
9. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
10. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

10.4. Test Result

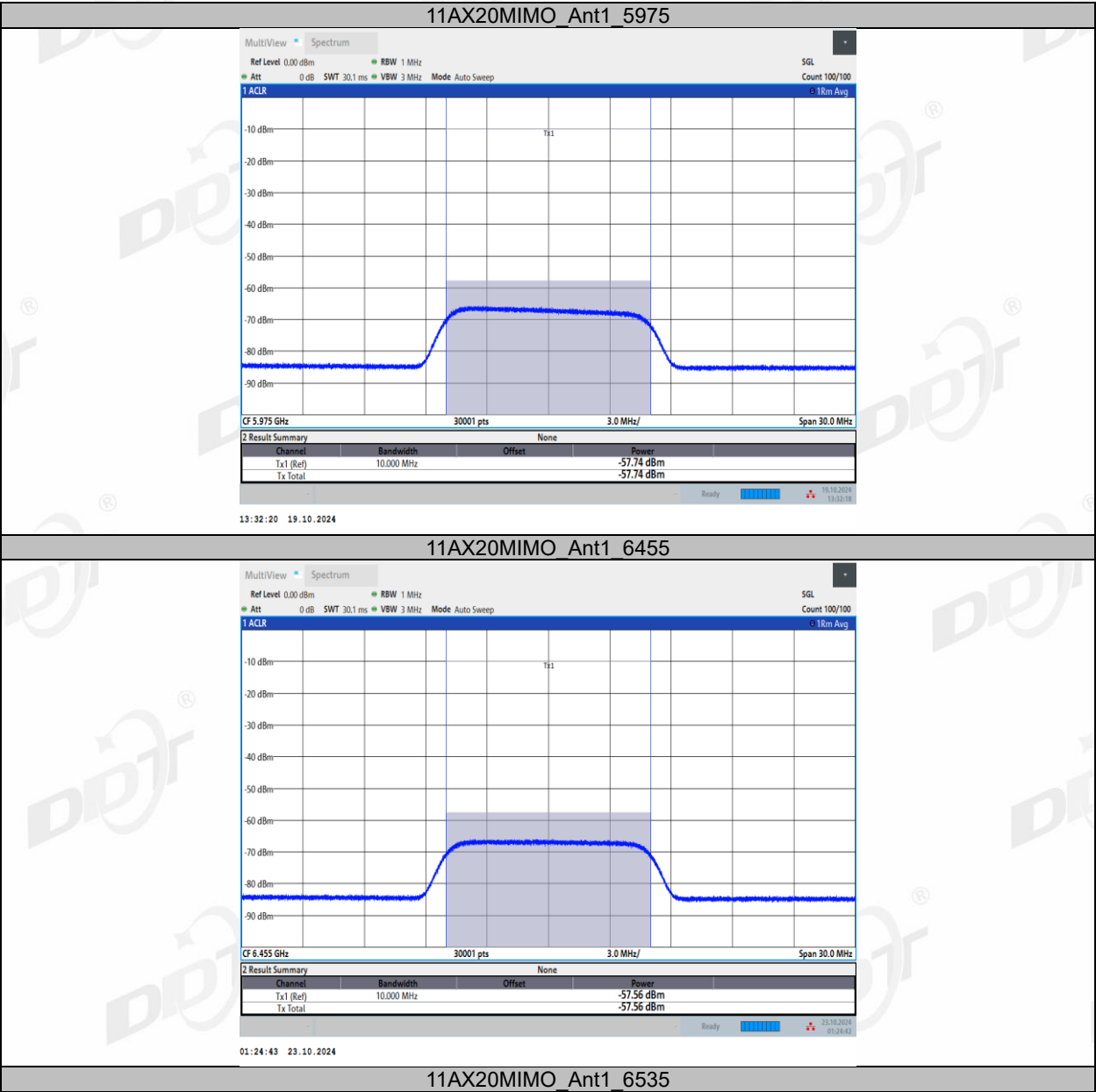
Test Mode	Frequency [MHz]	Frequency [MHz]	Result [dBm]	Limit[dBm]	Verdict
11AX20MIMO	5975	5975	-57.74	-62	PASS
	6455	6455	-57.56	-62	PASS
	6535	6535	-57.59	-62	PASS
	6935	6935	-57.69	-62	PASS
11AX80MIMO	5985	5950	-57.71	-62	PASS
		5985	-57.51	-62	PASS
		6020	-57.56	-62	PASS
	6465	6430	-57.68	-62	PASS
		6465	-57.62	-62	PASS
		6500	-57.5	-62	PASS
	6625	6590	-57.55	-62	PASS
		6625	-57.61	-62	PASS
		6660	-57.54	-62	PASS
	6865	6830	-57.62	-62	PASS
		6865	-57.54	-62	PASS
		6900	-57.53	-62	PASS

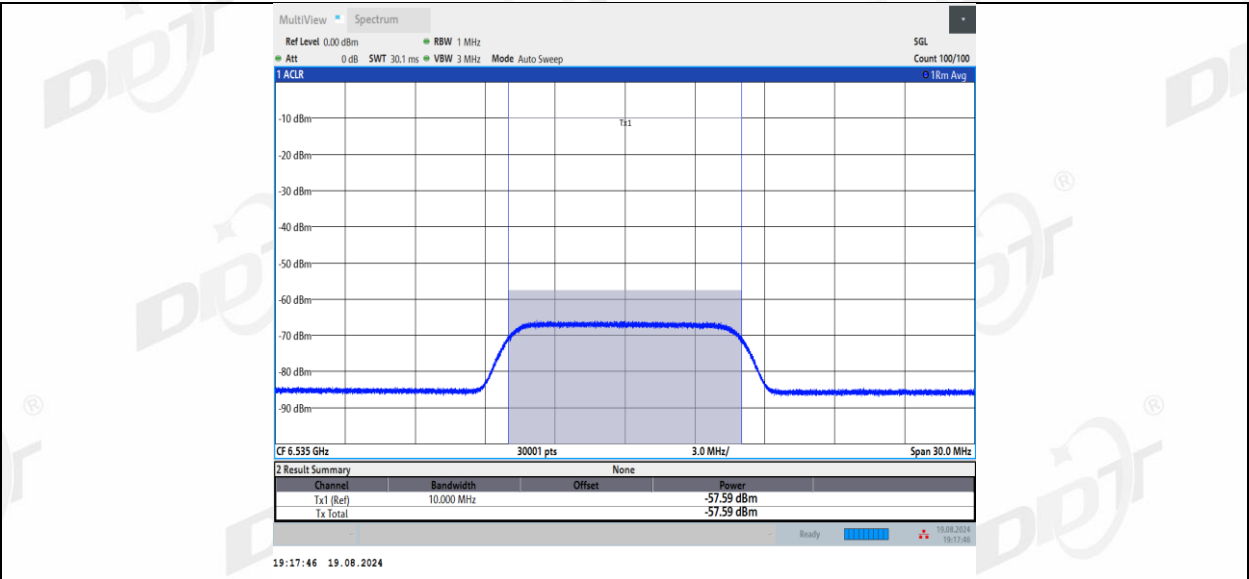
Note: Adjusted Power= Injected AWGN Power - Antenna Gain + Path Loss

Test Mode	Ch.	Interference Frequency [MHz]		Status	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Rate [%]	Limit [%]	Verdict
20 MHz	5955	Center	5955	OFF	0	1	1	1	1	1	1	1	1	1	90	90	PASS
		Center	5955	Minimal	---	---	---	---	---	---	---	---	---	---	40	---	---
		Center	5955	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	5975	Center	5975	OFF	1	1	1	1	1	1	0	1	1	1	90	90	PASS
		Center	5975	Minimal	---	---	---	---	---	---	---	---	---	---	50	---	---
		Center	5975	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6435	Center	6435	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Center	6435	Minimal	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6435	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6455	Center	6455	OFF	1	1	1	1	1	1	0	1	1	1	90	90	PASS
		Center	6455	Minimal	---	---	---	---	---	---	---	---	---	---	10	---	---
		Center	6455	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6535	Center	6535	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Center	6535	Minimal	---	---	---	---	---	---	---	---	---	---	30	---	---
		Center	6535	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6895	Center	6895	OFF	1	1	1	1	1	1	0	1	1	1	90	90	PASS
		Center	6895	Minimal	---	---	---	---	---	---	---	---	---	---	20	---	---
		Center	6895	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6935	Center	6935	OFF	1	0	1	1	1	1	1	1	1	1	90	90	PASS
		Center	6935	Minimal	---	---	---	---	---	---	---	---	---	---	10	---	---
		Center	6935	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
80 MHz	5985	Low	5950	OFF	0	1	1	1	1	1	1	1	1	1	90	90	PASS
		Low	5950	Minimal	---	---	---	---	---	---	---	---	---	---	60	---	---
		Low	5950	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	5985	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Center	5985	Minimal	---	---	---	---	---	---	---	---	---	---	50	---	---
		Center	5985	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		High	6020	OFF	1	1	0	1	1	1	1	1	1	1	90	90	PASS
		High	6020	Minimal	---	---	---	---	---	---	---	---	---	---	30	---	---
		High	6020	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6465	Low	6430	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Low	6430	Minimal	---	---	---	---	---	---	---	---	---	---	60	---	---
		Low	6430	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6465	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Center	6465	Minimal	---	---	---	---	---	---	---	---	---	---	10	---	---
		Center	6465	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		High	6500	OFF	1	0	1	1	1	1	1	1	1	1	90	90	PASS
		High	6500	Minimal	---	---	---	---	---	---	---	---	---	---	10	---	---
		High	6500	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6625	Low	6590	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Low	6590	Minimal	---	---	---	---	---	---	---	---	---	---	20	---	---
		Low	6590	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6625	OFF	1	1	1	0	1	1	1	1	1	1	90	90	PASS
		Center	6625	Minimal	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6625	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		High	6660	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		High	6660	Minimal	---	---	---	---	---	---	---	---	---	---	20	---	---
		High	6660	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
	6865	Low	6830	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		Low	6830	Minimal	---	---	---	---	---	---	---	---	---	---	30	---	---
		Low	6830	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6865	OFF	1	1	1	1	1	1	0	1	1	1	90	90	PASS
		Center	6865	Minimal	---	---	---	---	---	---	---	---	---	---	0	---	---
		Center	6865	ON	---	---	---	---	---	---	---	---	---	---	0	---	---
		High	6900	OFF	1	1	1	1	1	1	1	1	1	1	100	90	PASS
		High	6900	Minimal	---	---	---	---	---	---	---	---	---	---	50	---	---
		High	6900	ON	---	---	---	---	---	---	---	---	---	---	0	---	---

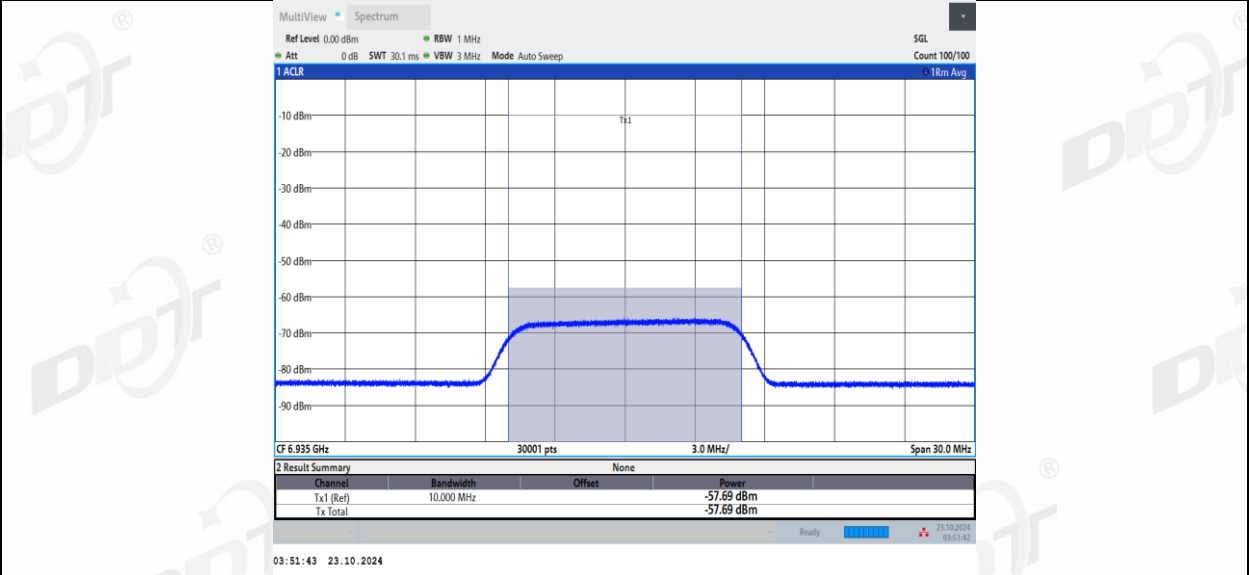
Note: CBP Detection Trials (1=Detection, 0=No Detection).

10.5. Test Graphs

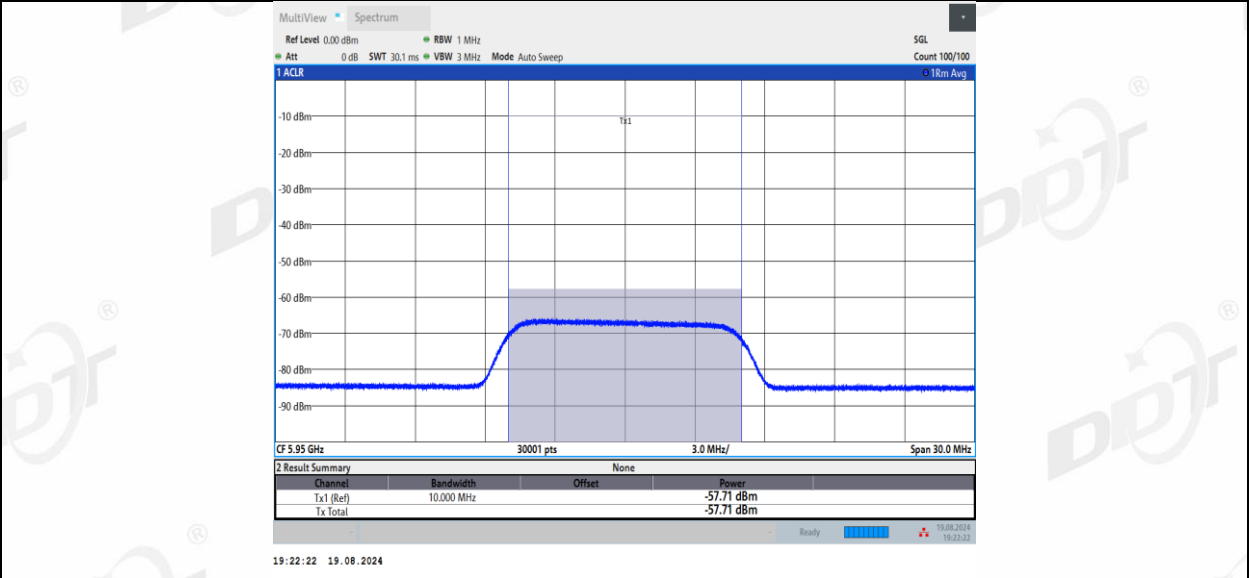




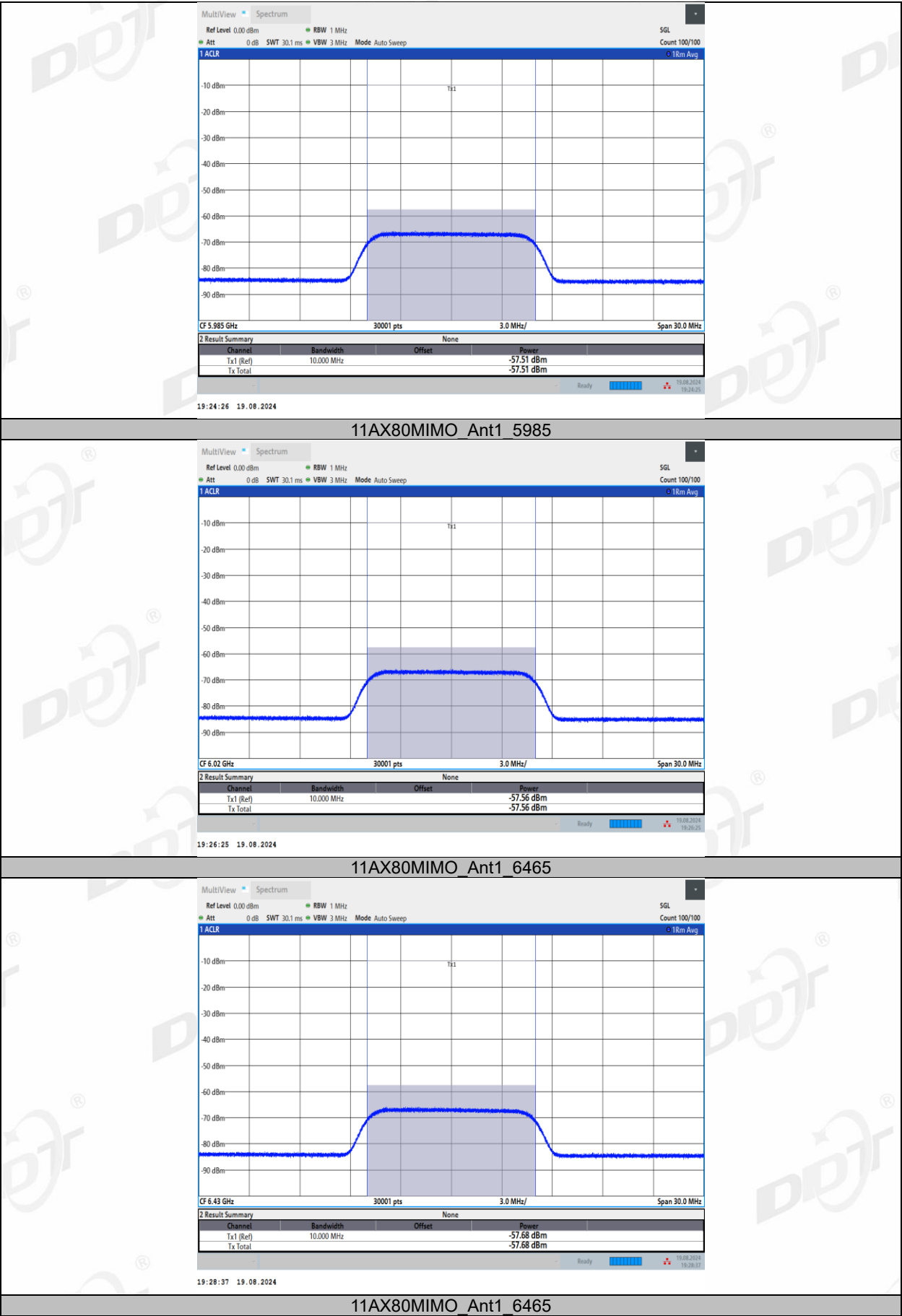
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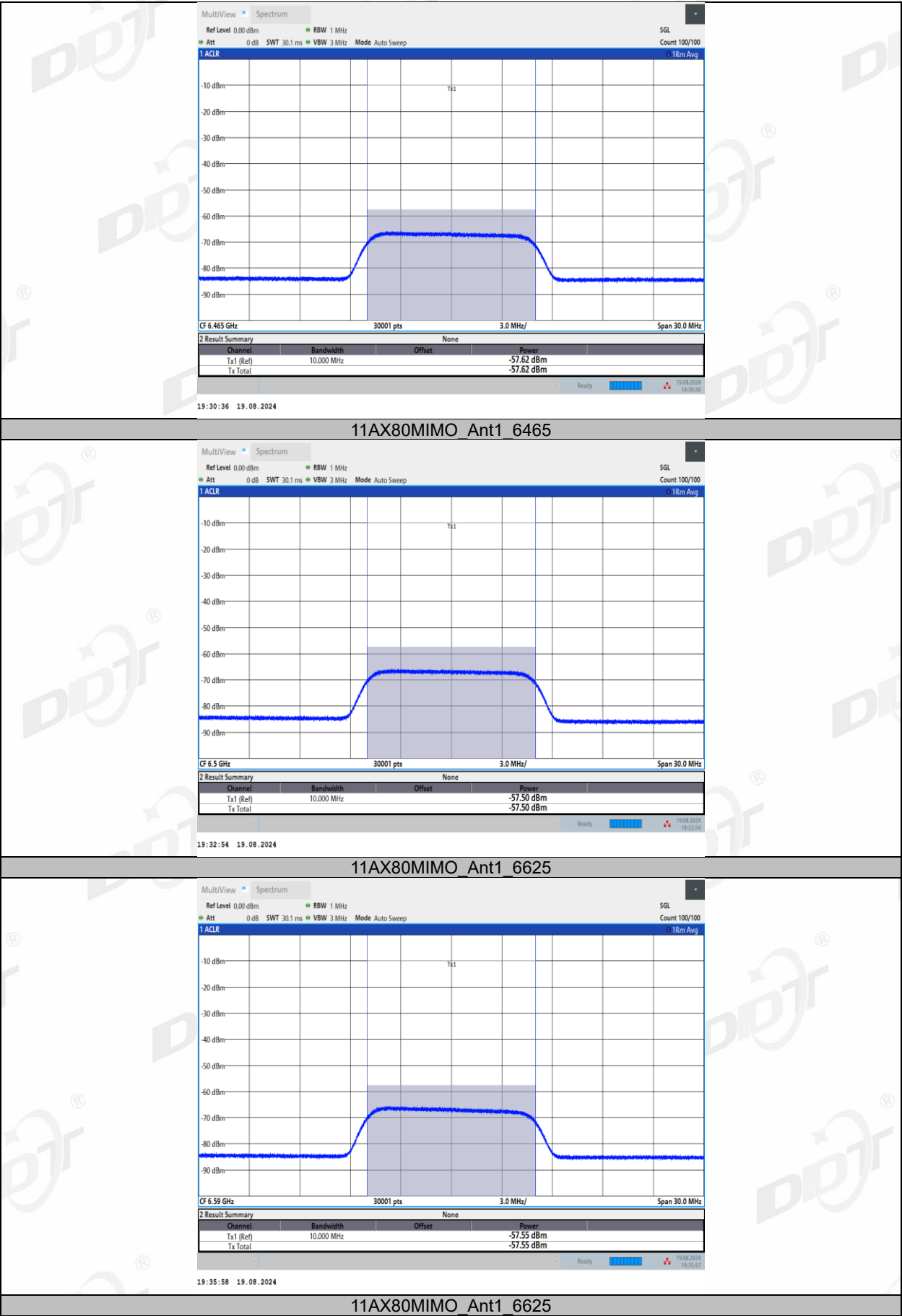


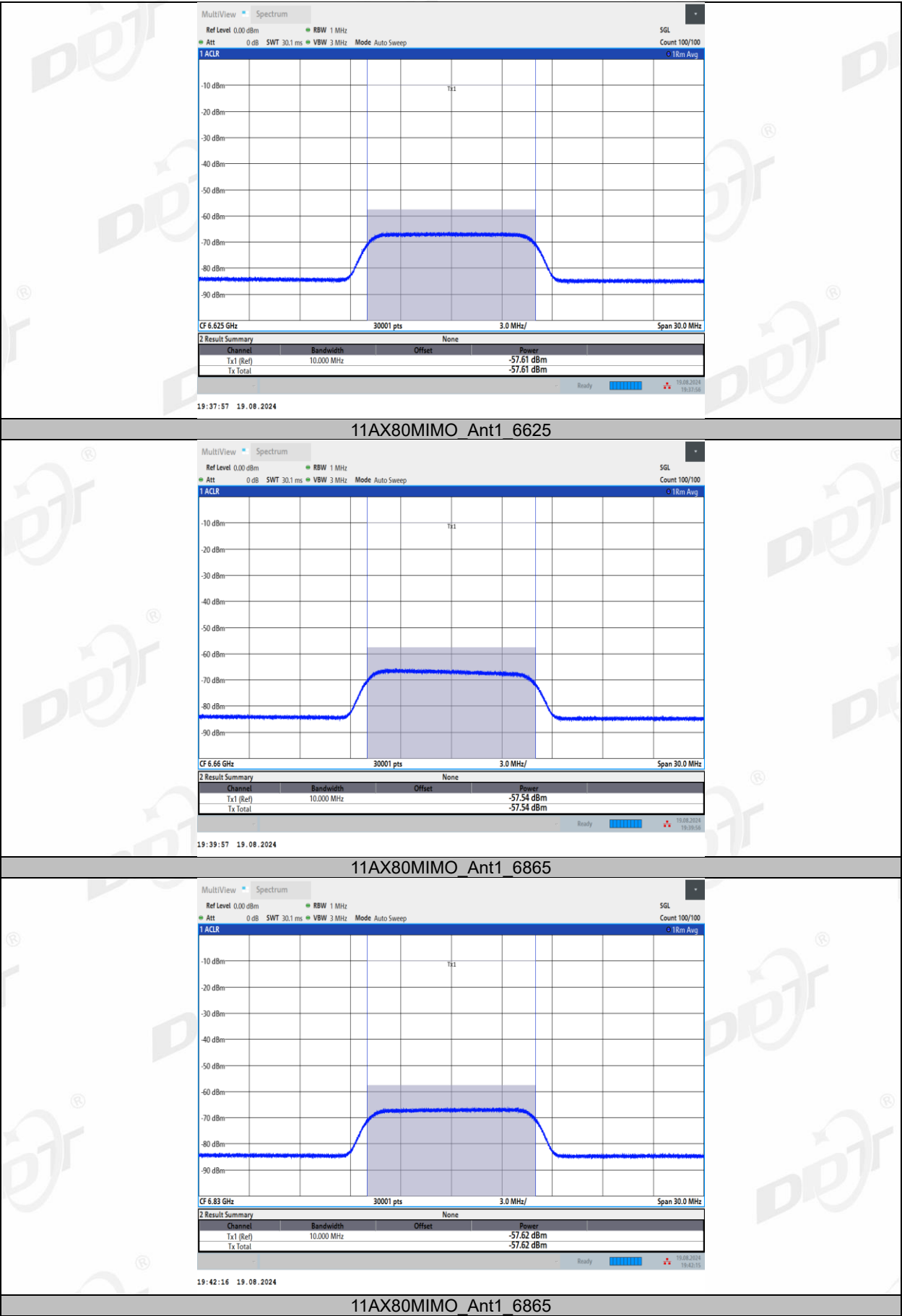
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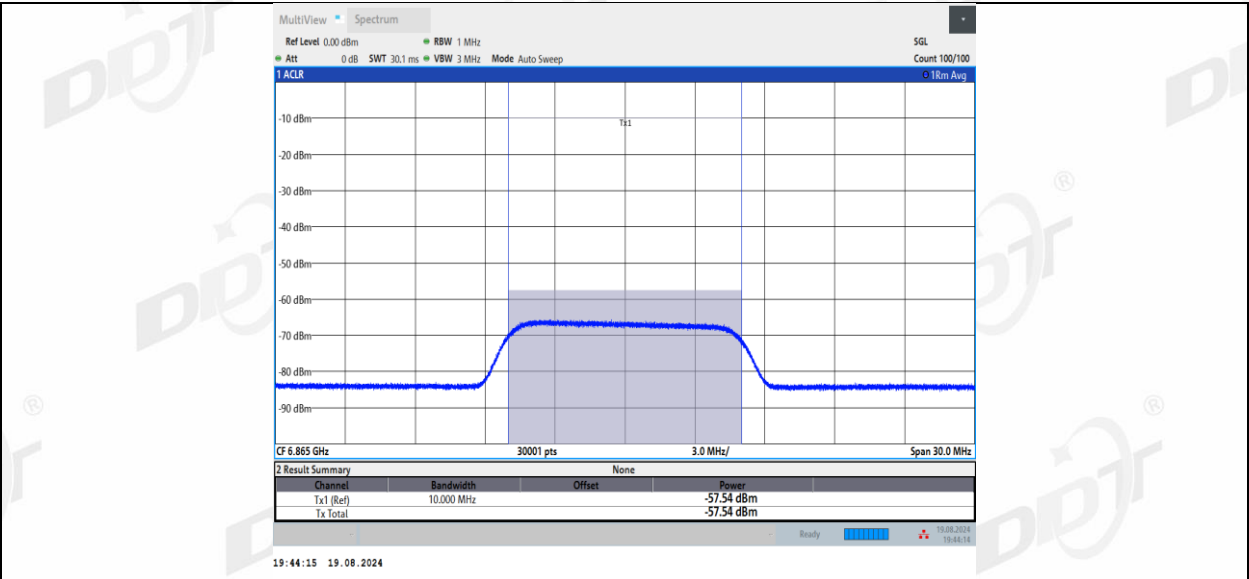


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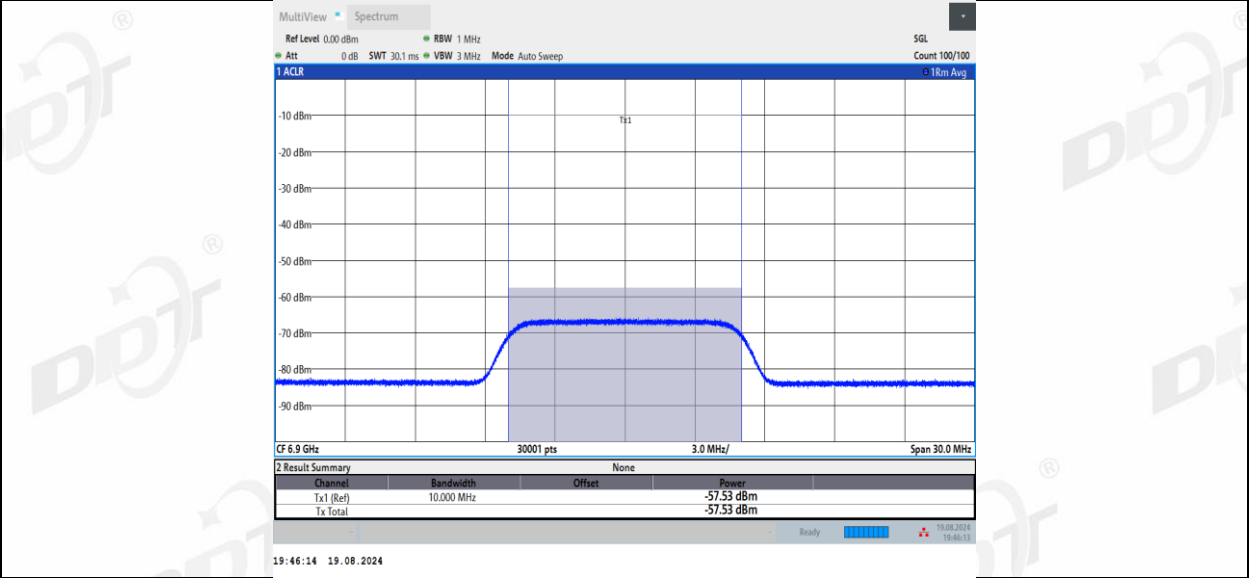








11AX80MIMO Ant1 6865



11AX20MIMO Ant1_5975_Center_5975_OFF

