

4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

For operations in the 698-787 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

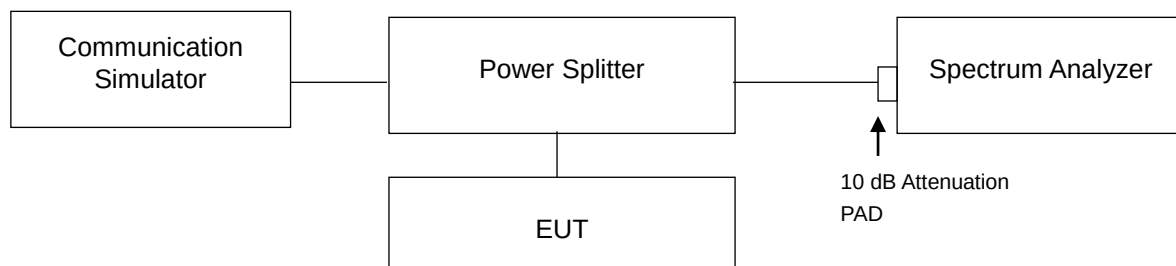
However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

On all frequencies between 763-775 MHz and 793-805 MHz, by a factor no less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

For operations in the 1710–1755 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

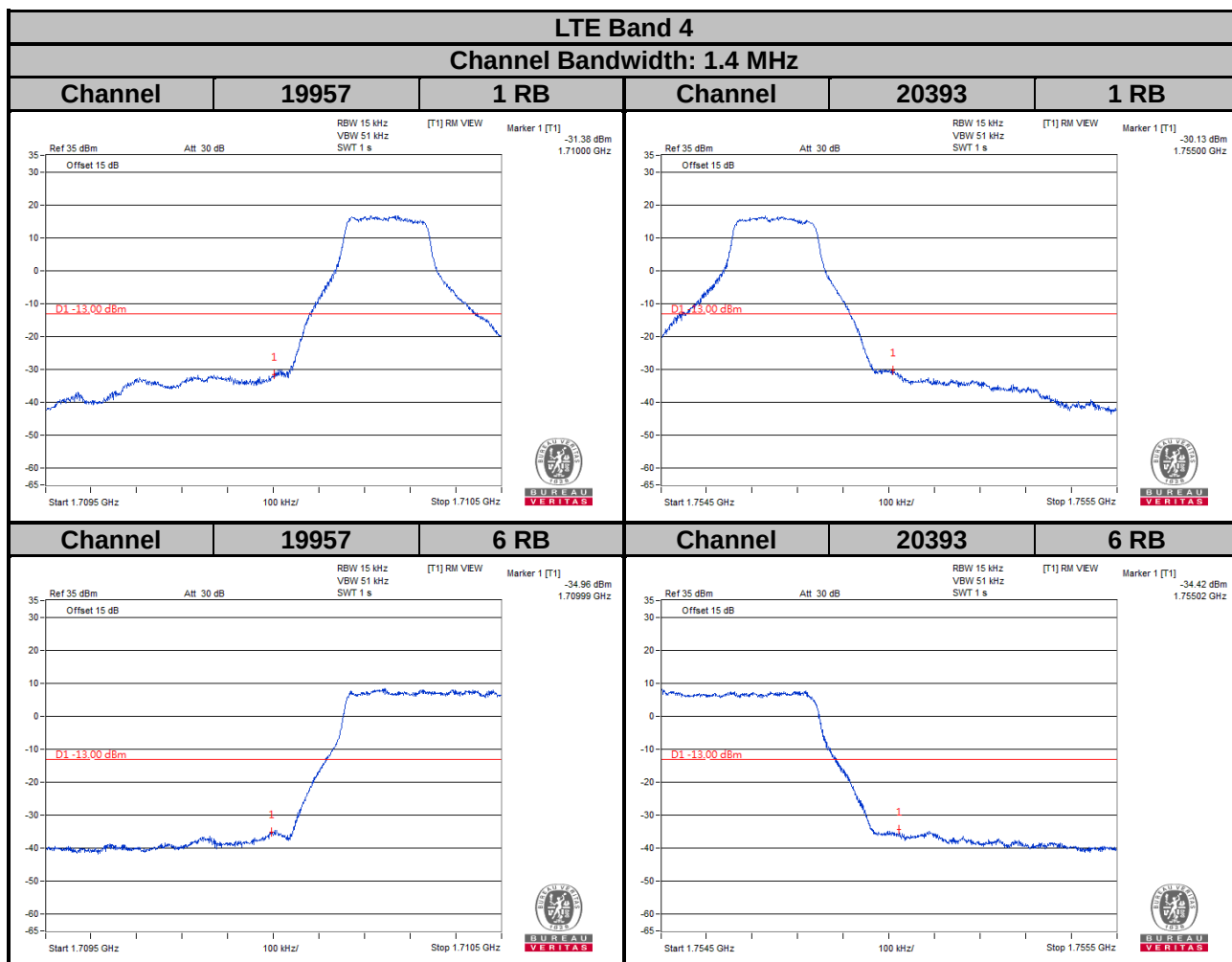
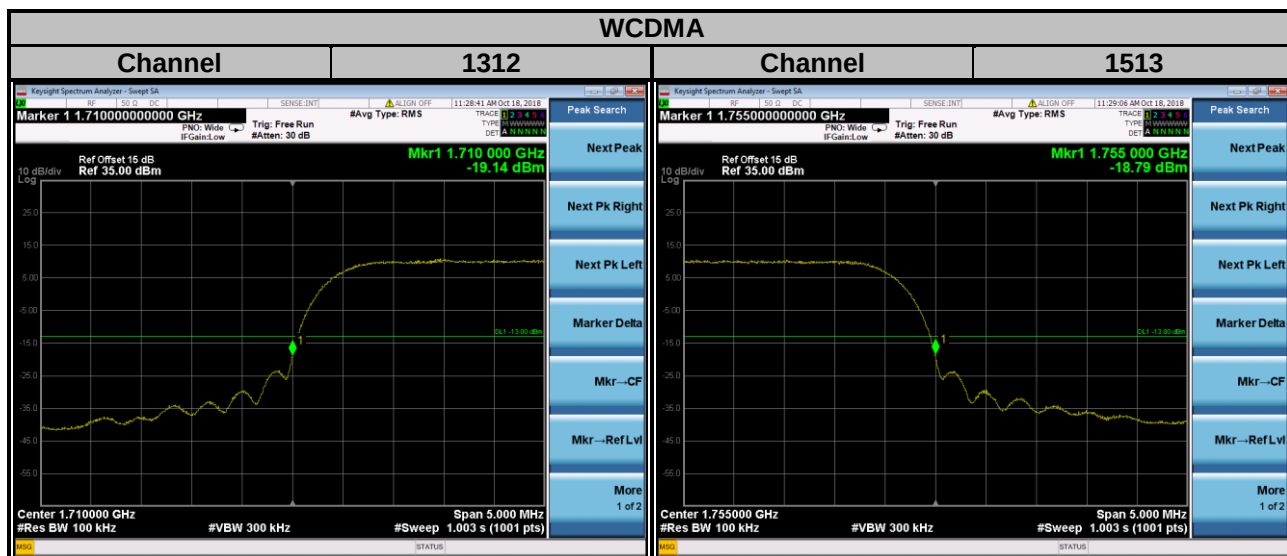
4.5.2 Test Setup

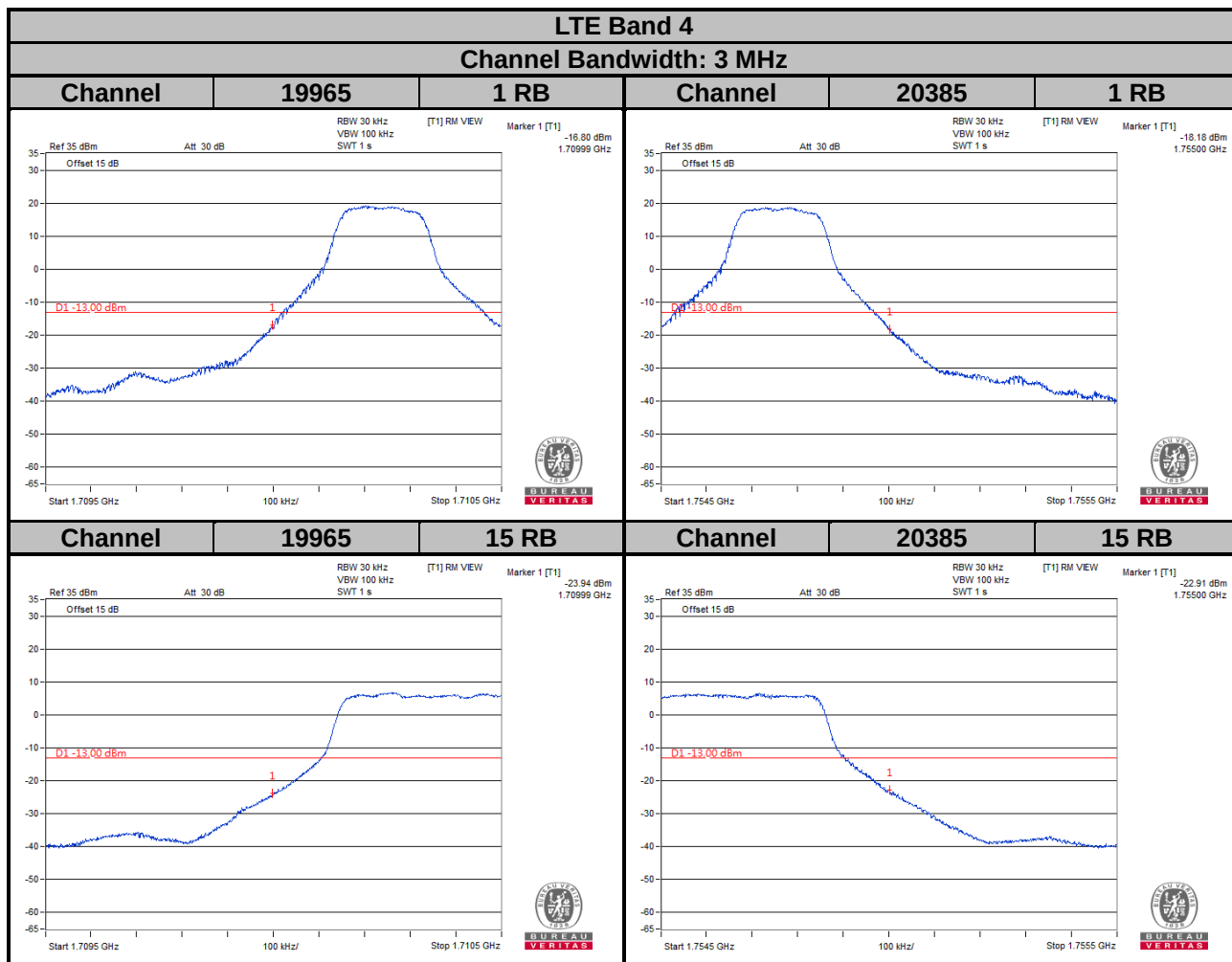


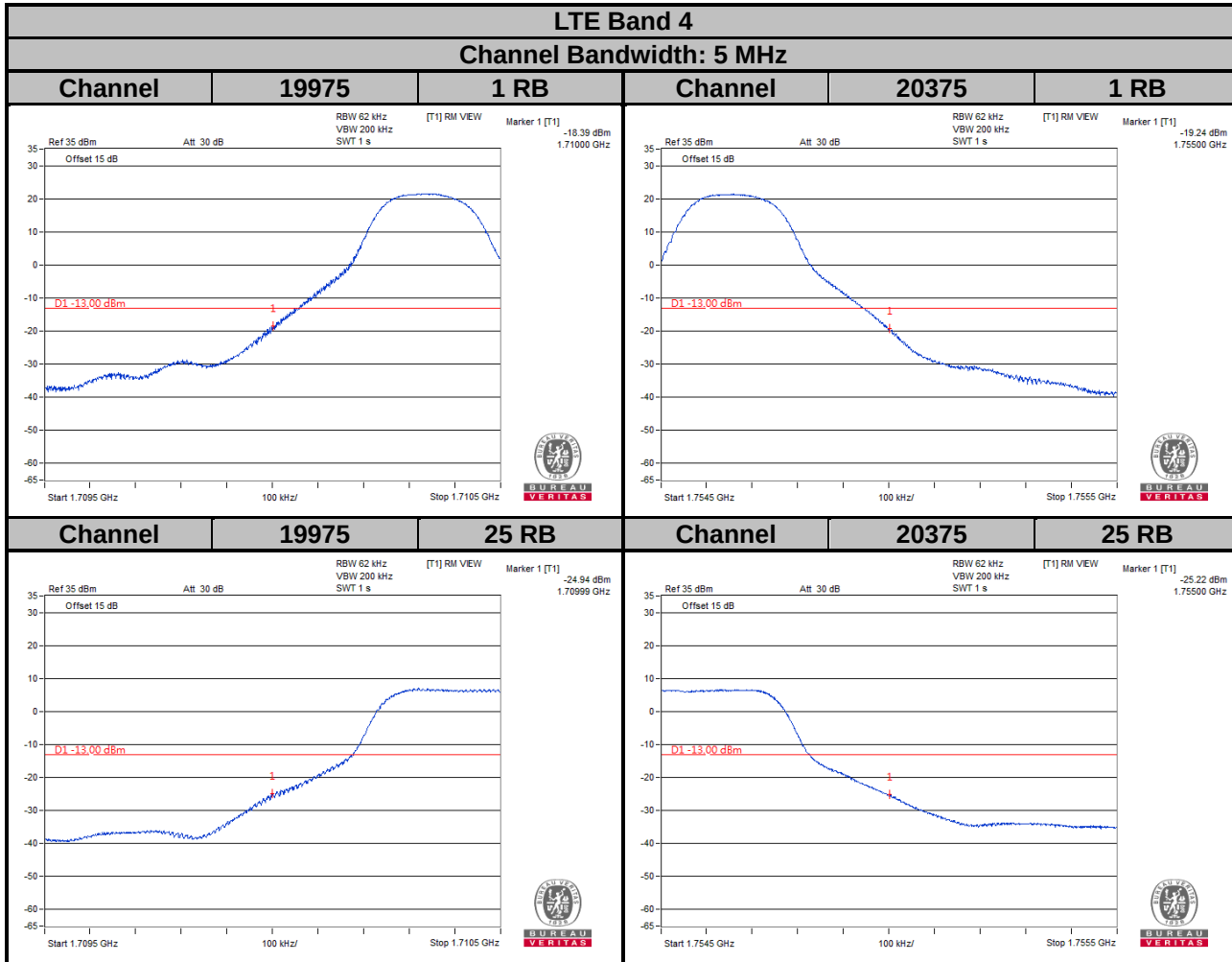
4.5.3 Test Procedures

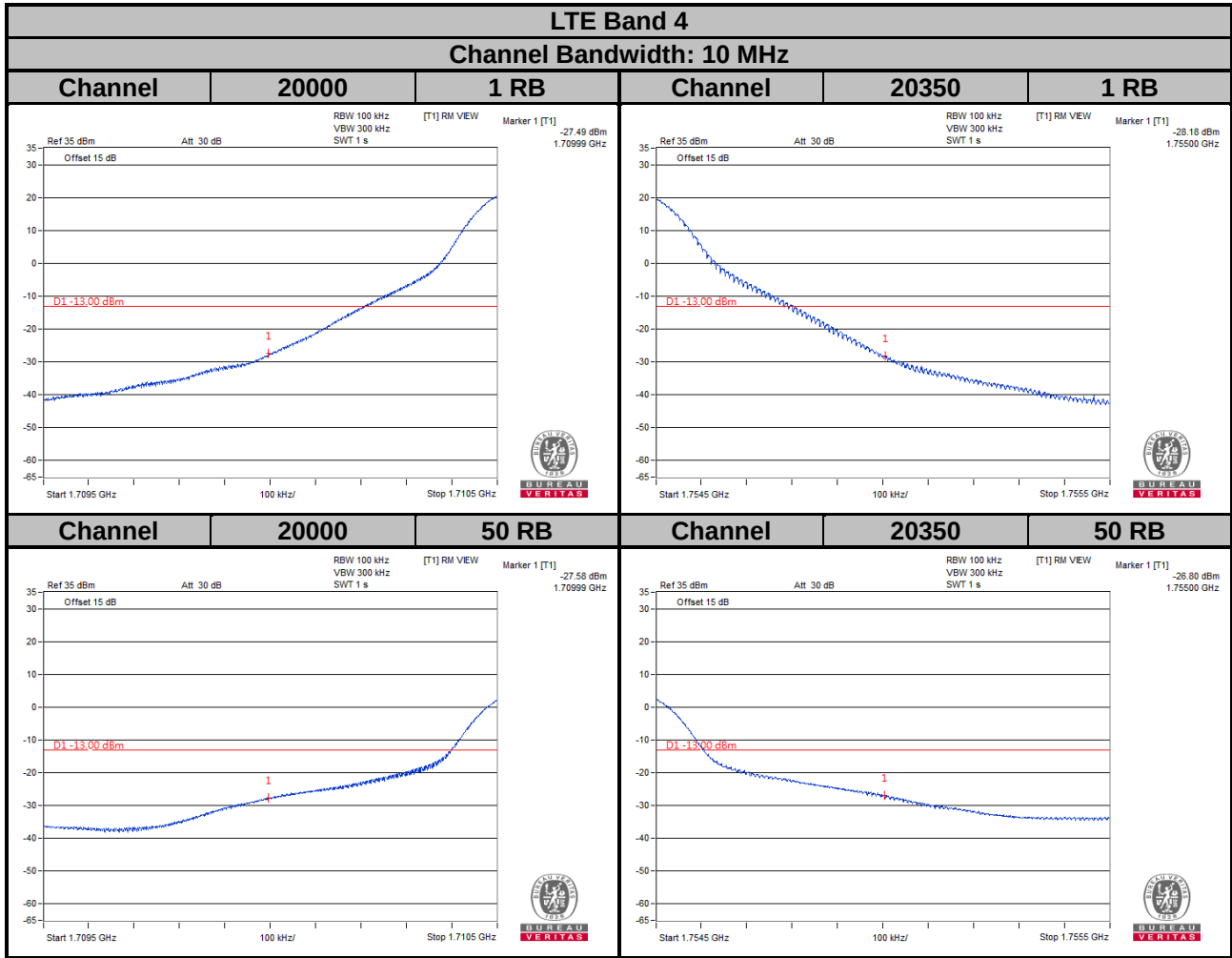
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 15 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 3 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 62 kHz and VB of the spectrum is 200 kHz (LTE Bandwidth 5 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 10 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 150 kHz and VB of the spectrum is 470 kHz (LTE Bandwidth 15 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 200 kHz and VB of the spectrum is 1 MHz (LTE Bandwidth 20 MHz).
- Record the max. trace plot into the test report.

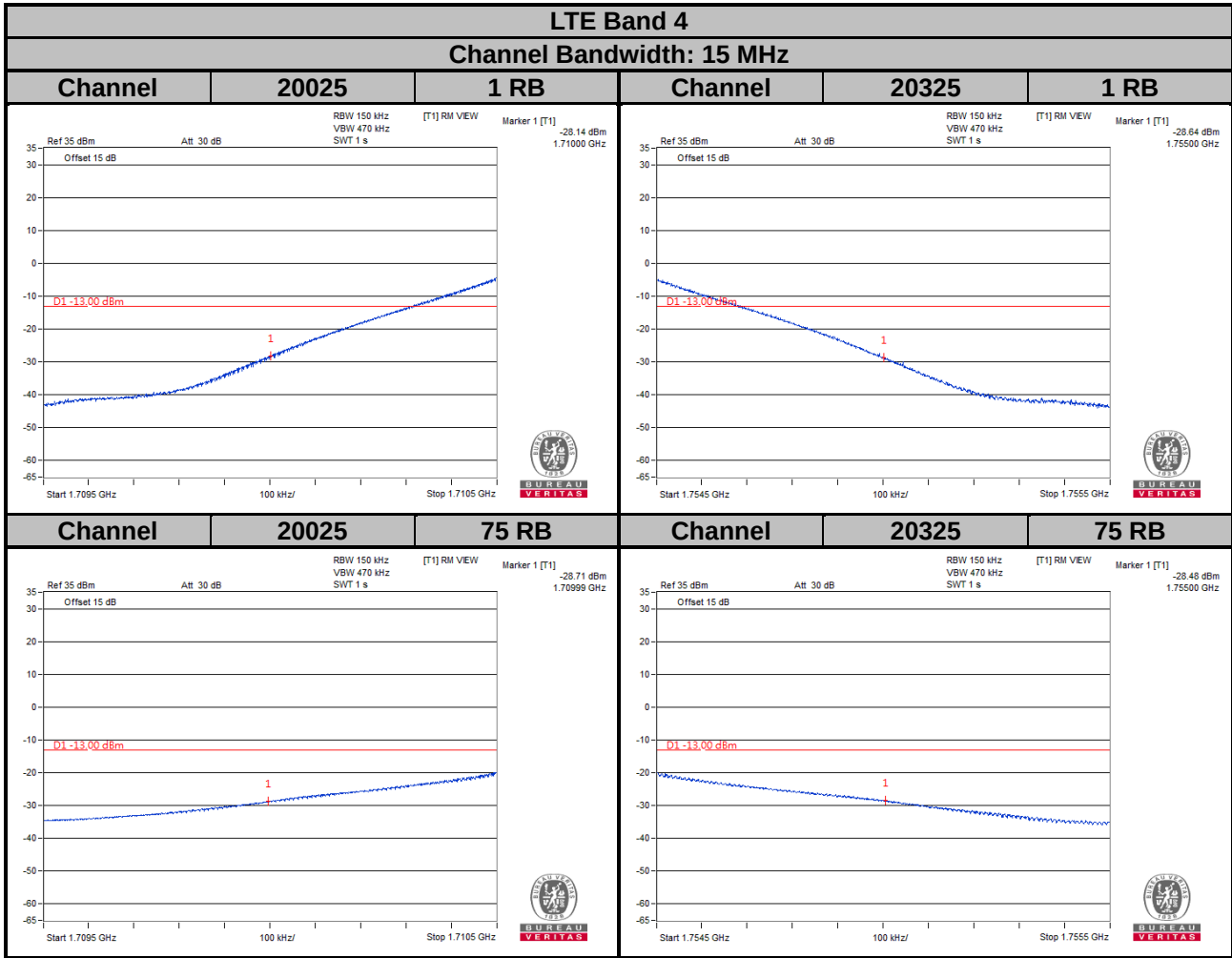
4.5.4 Test Results

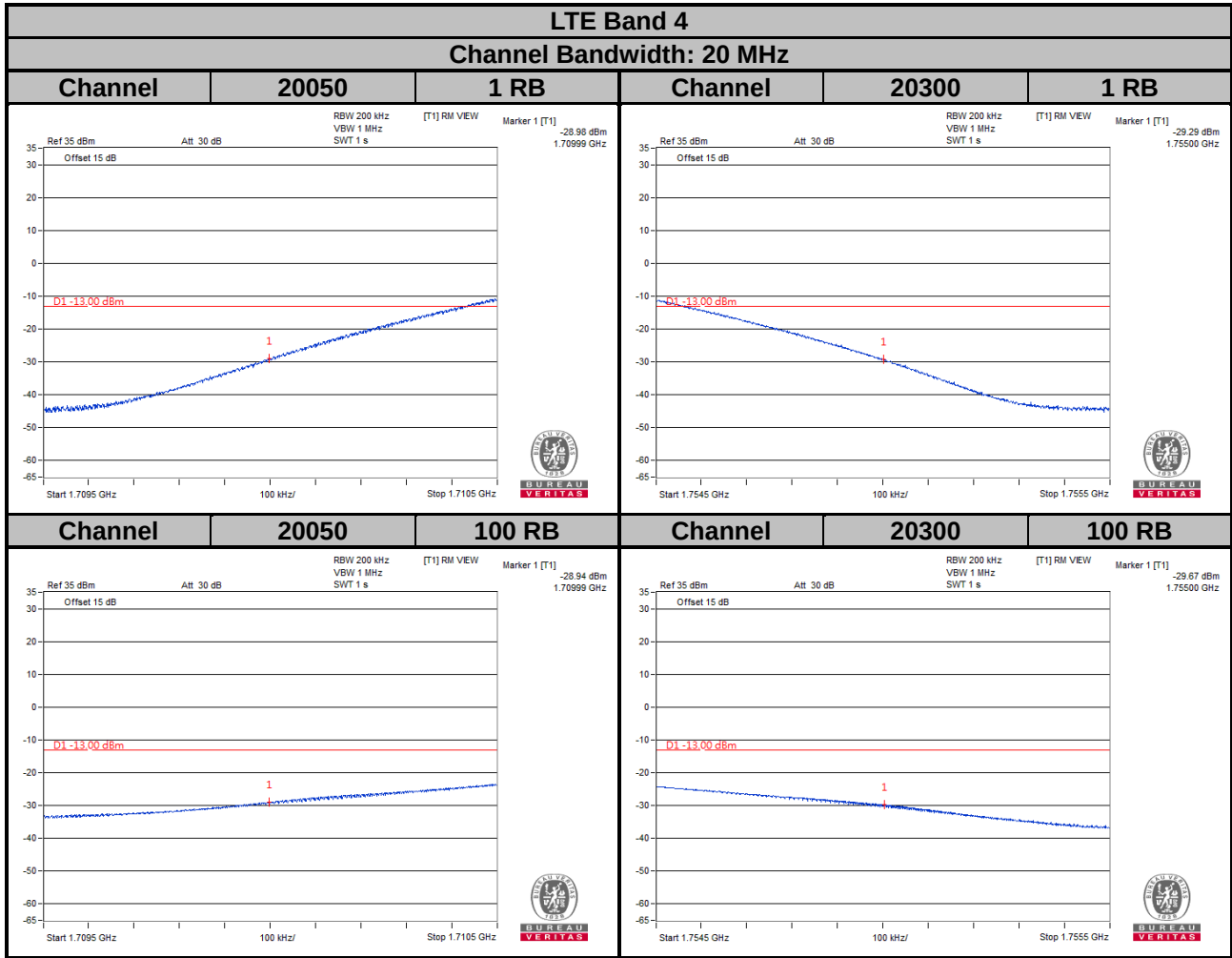






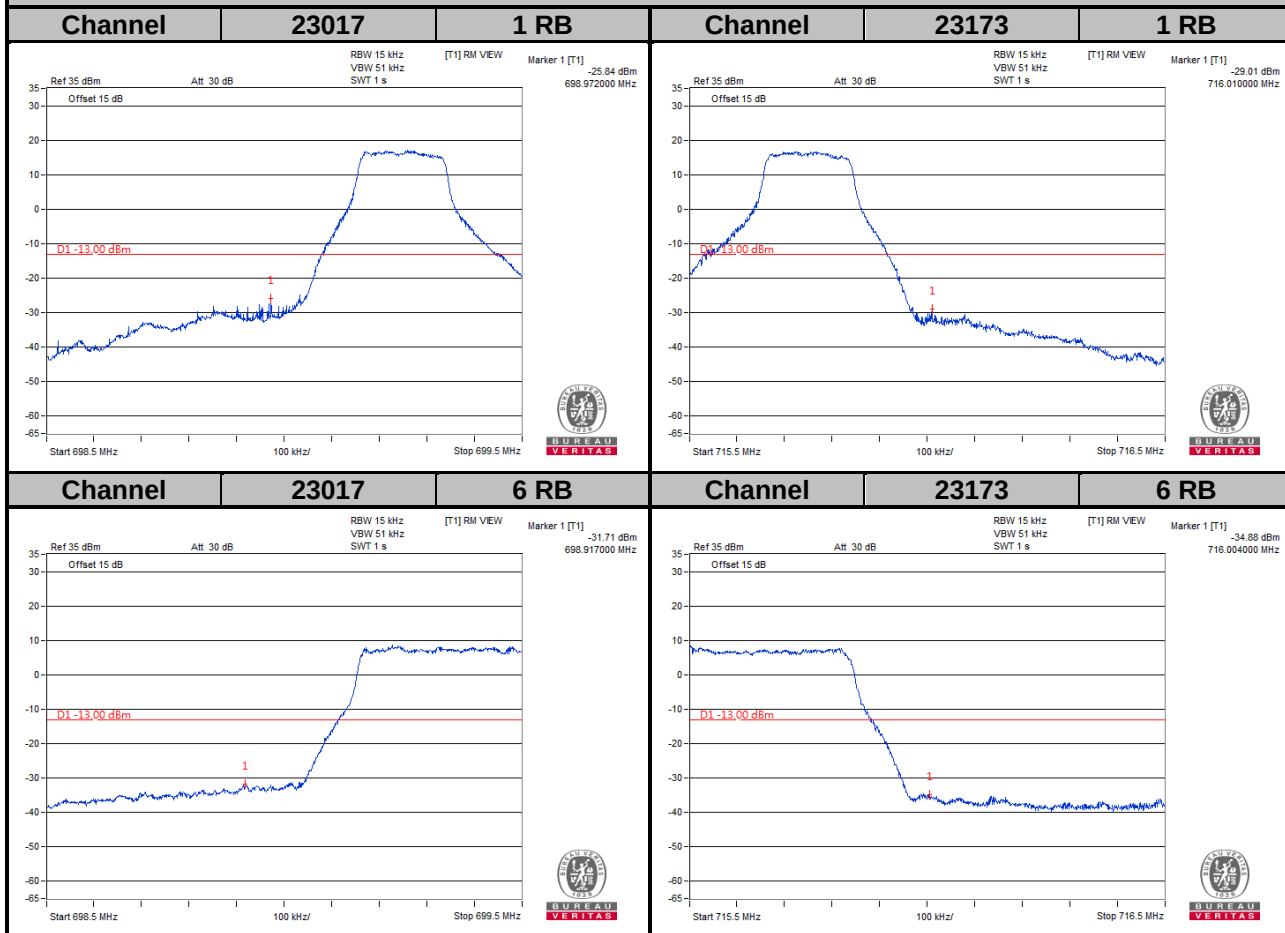


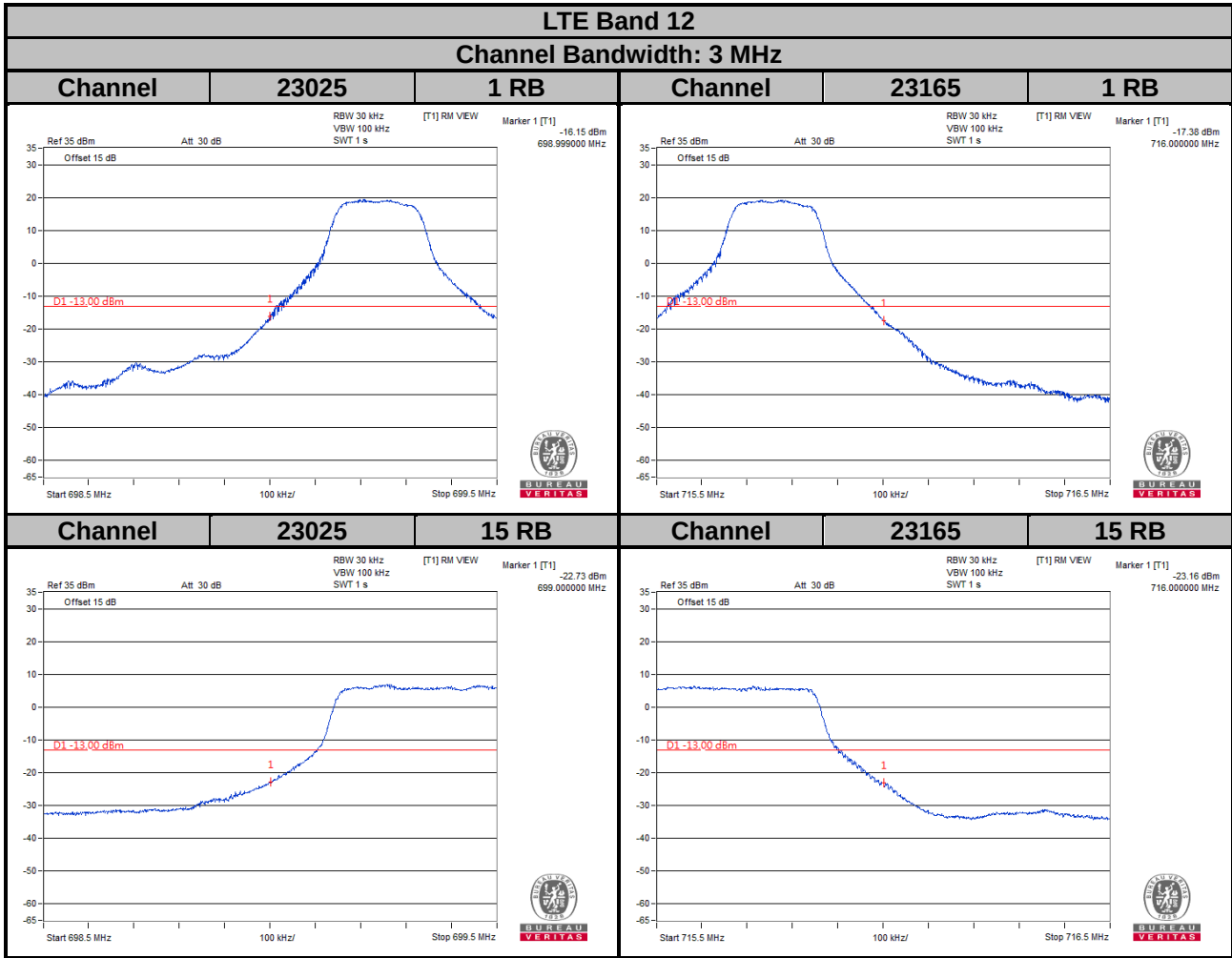




LTE Band 12

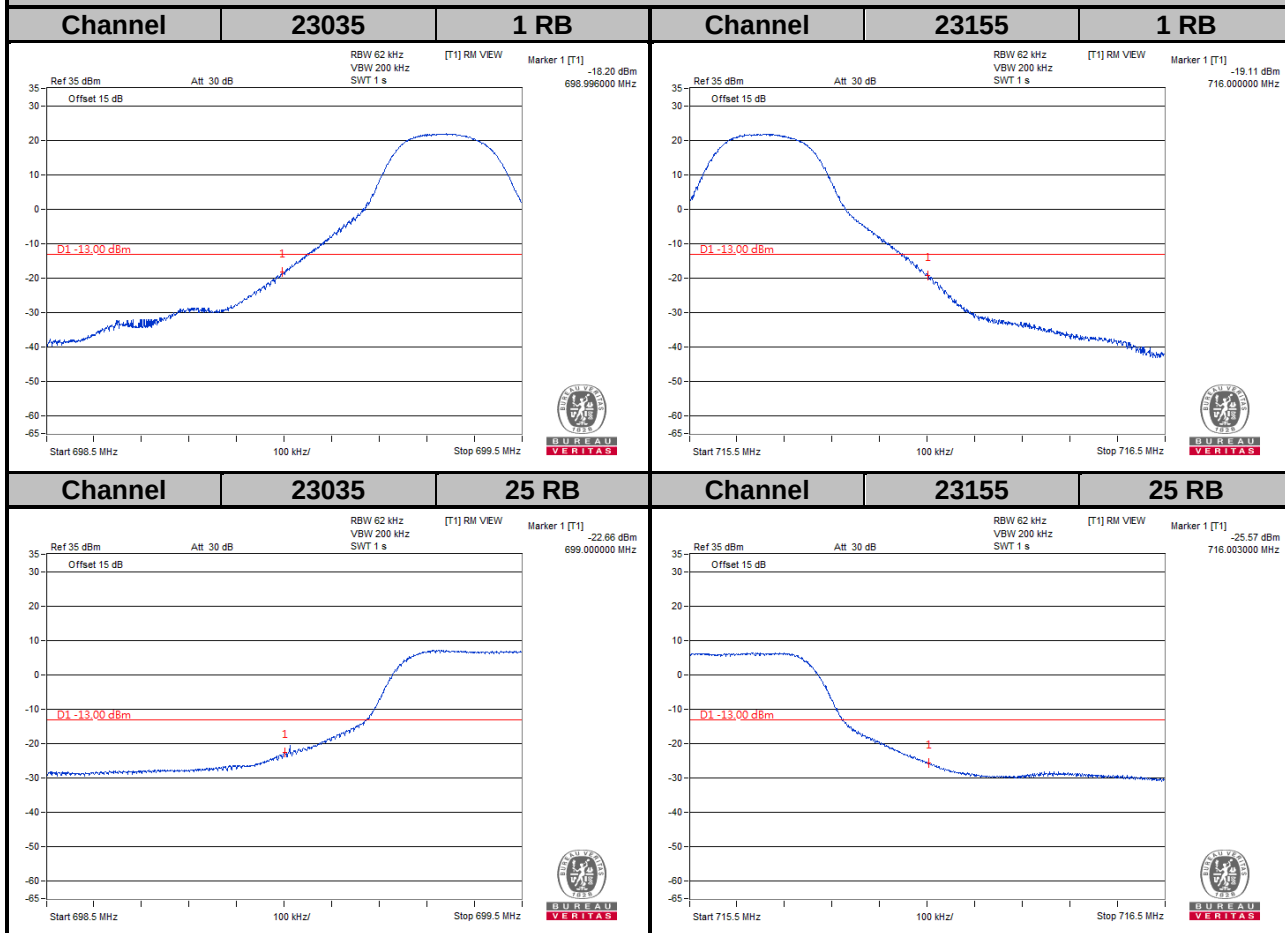
Channel Bandwidth: 1.4 MHz

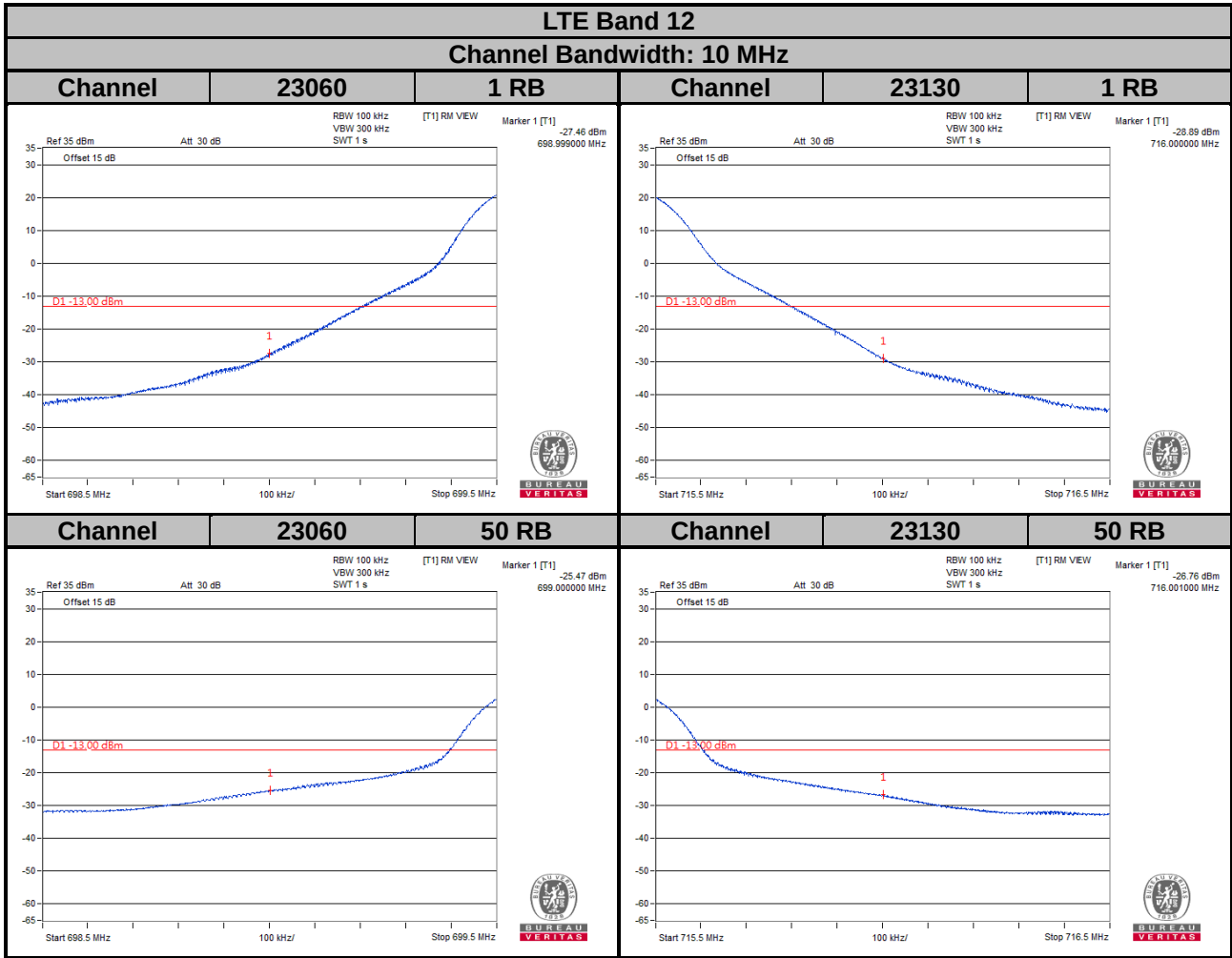


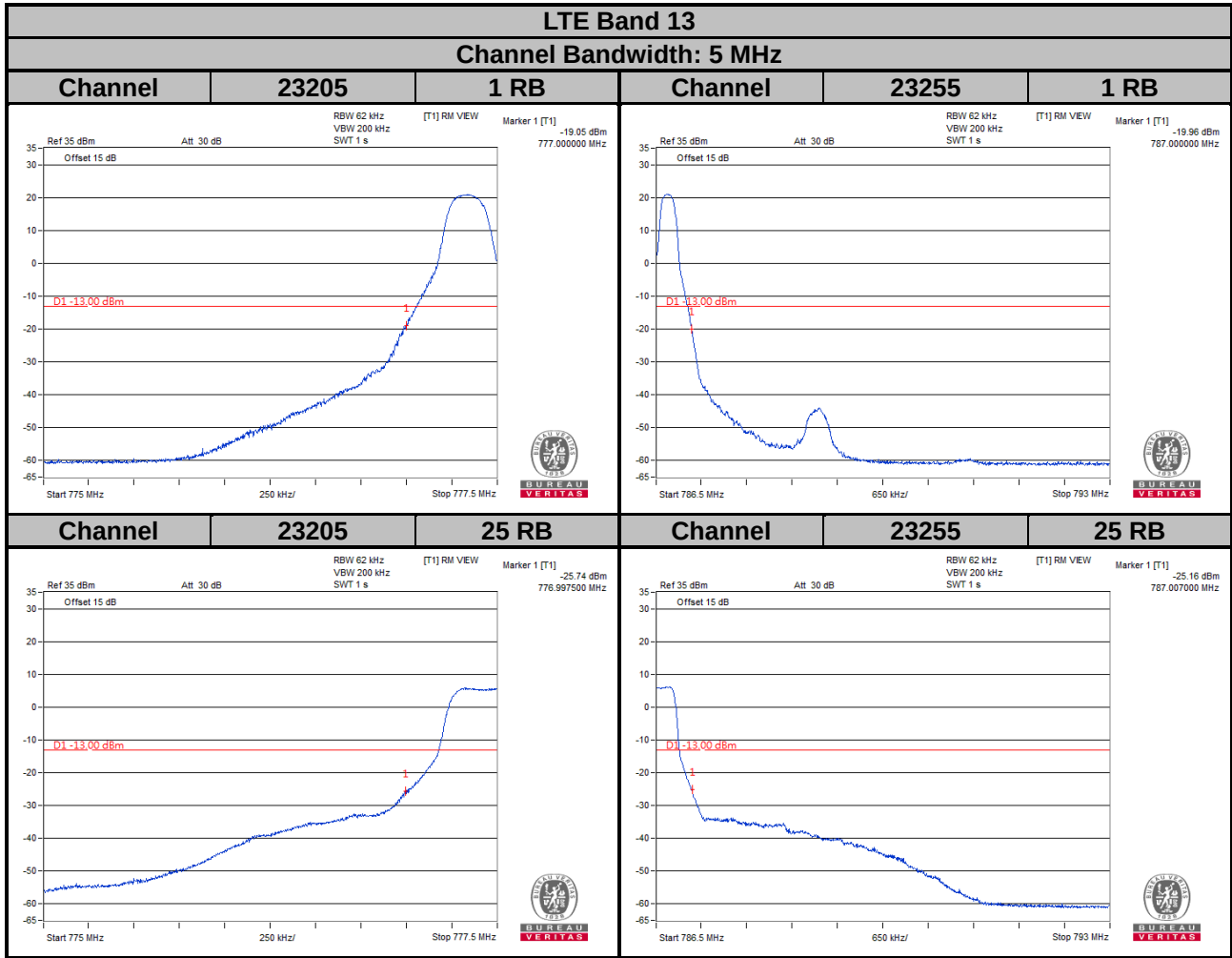


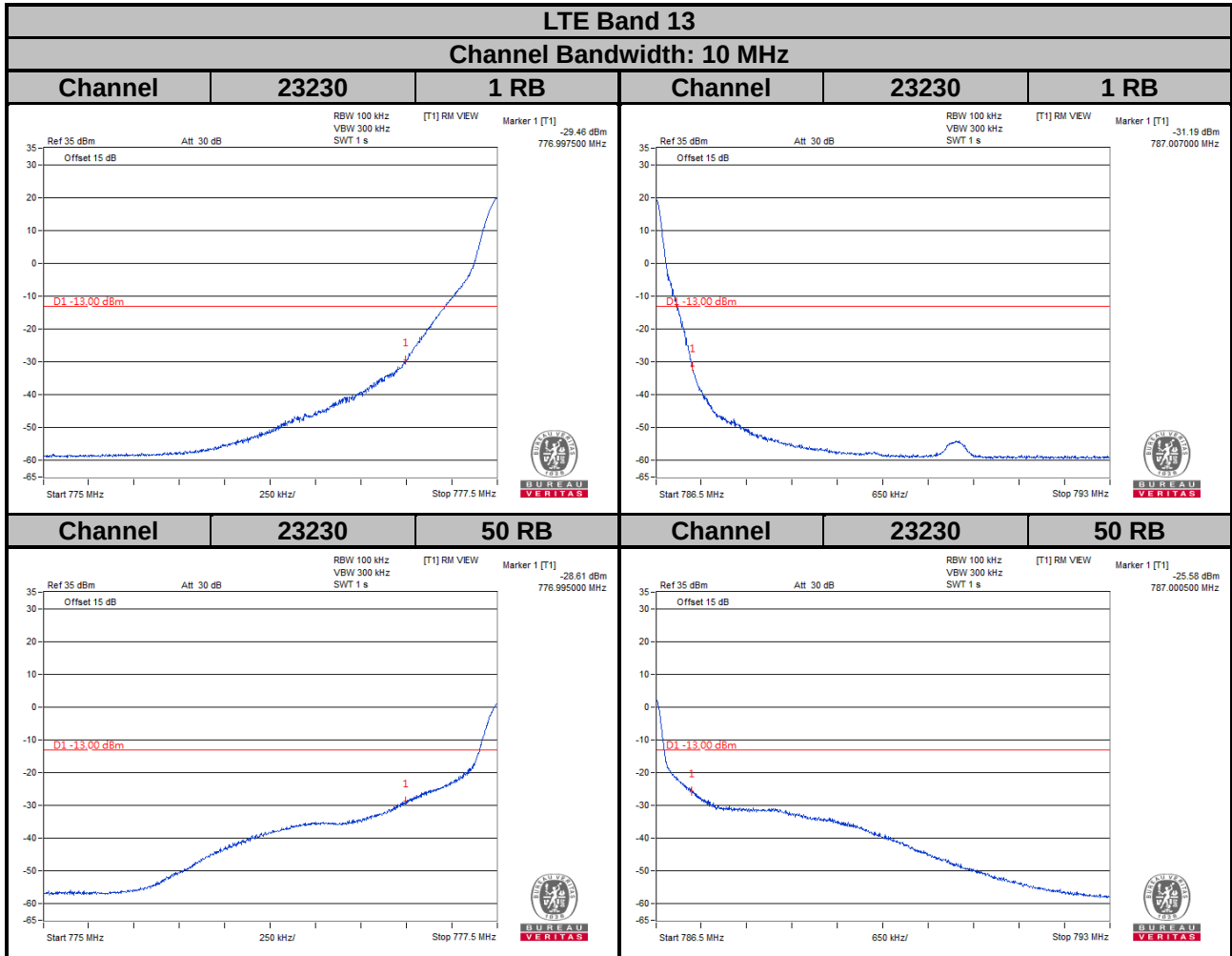
LTE Band 12

Channel Bandwidth: 5 MHz



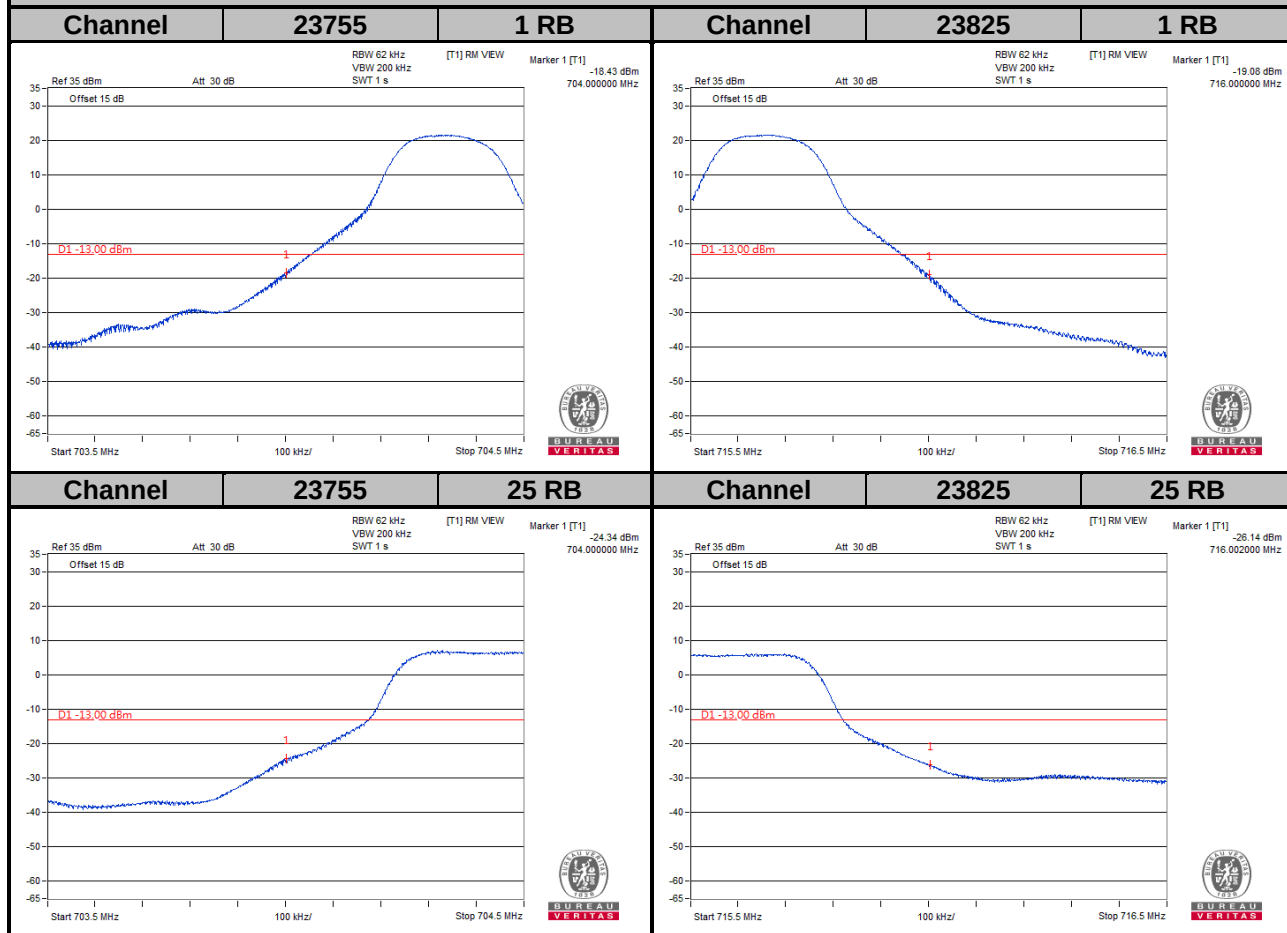


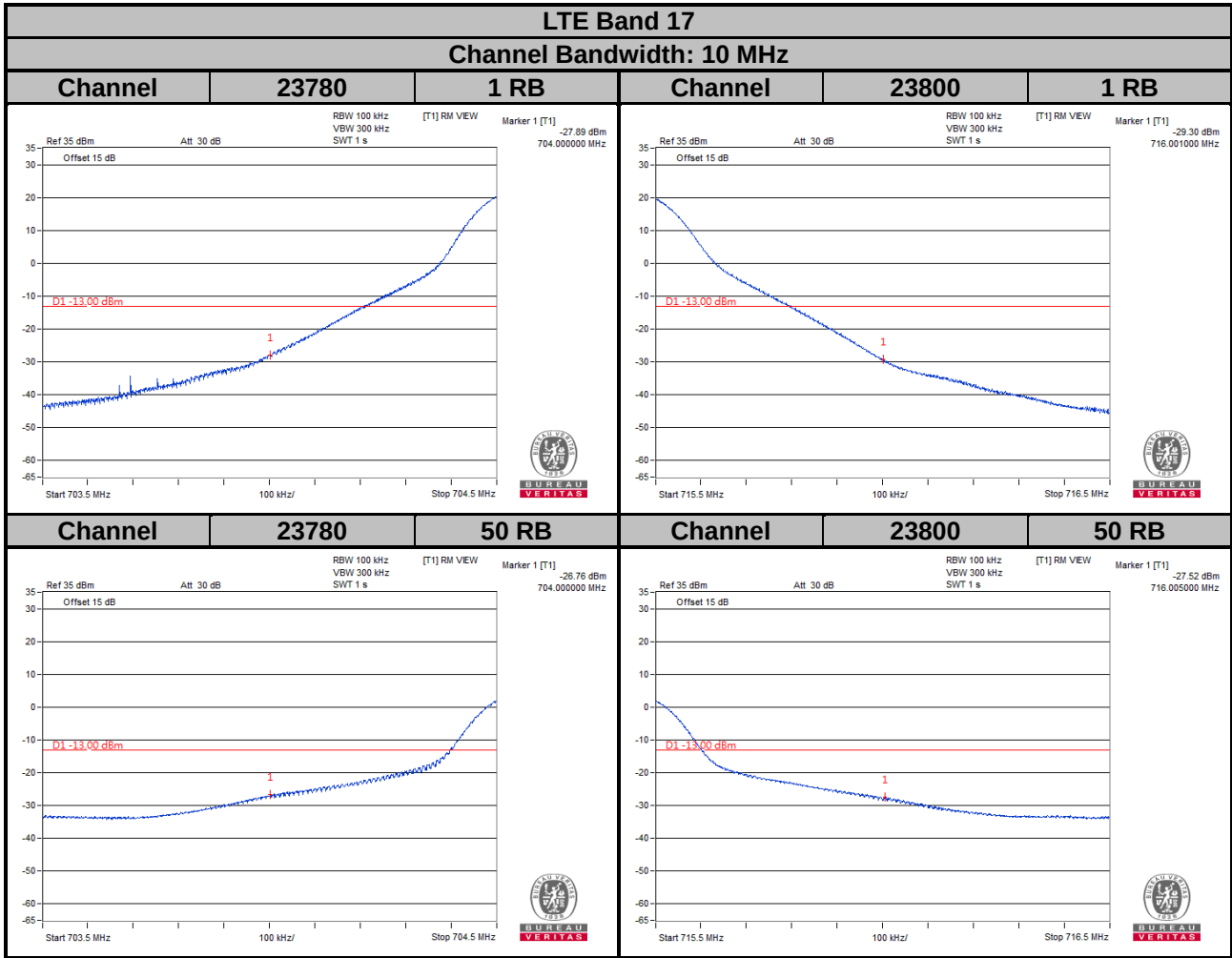




LTE Band 17

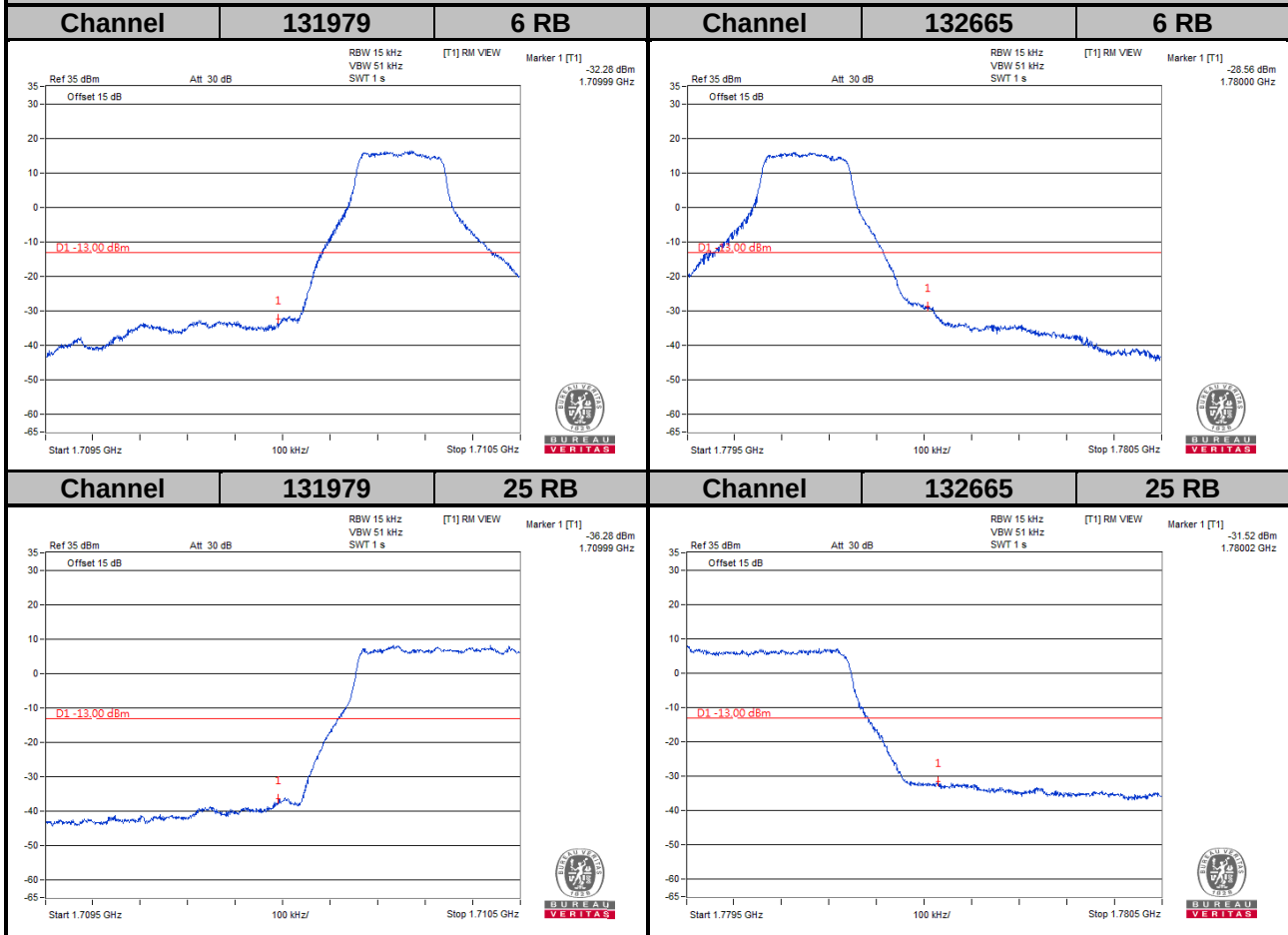
Channel Bandwidth: 5 MHz

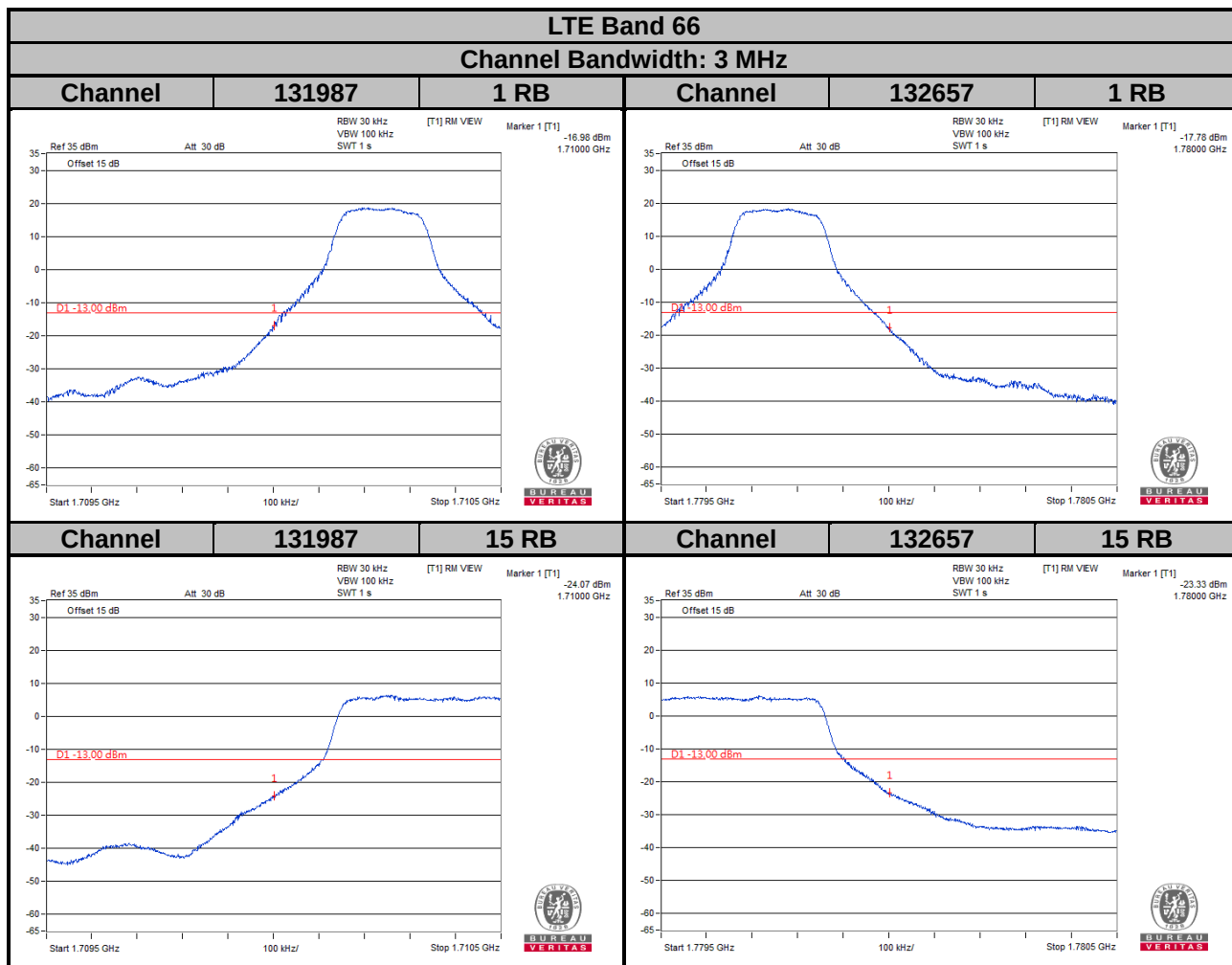




LTE Band 66

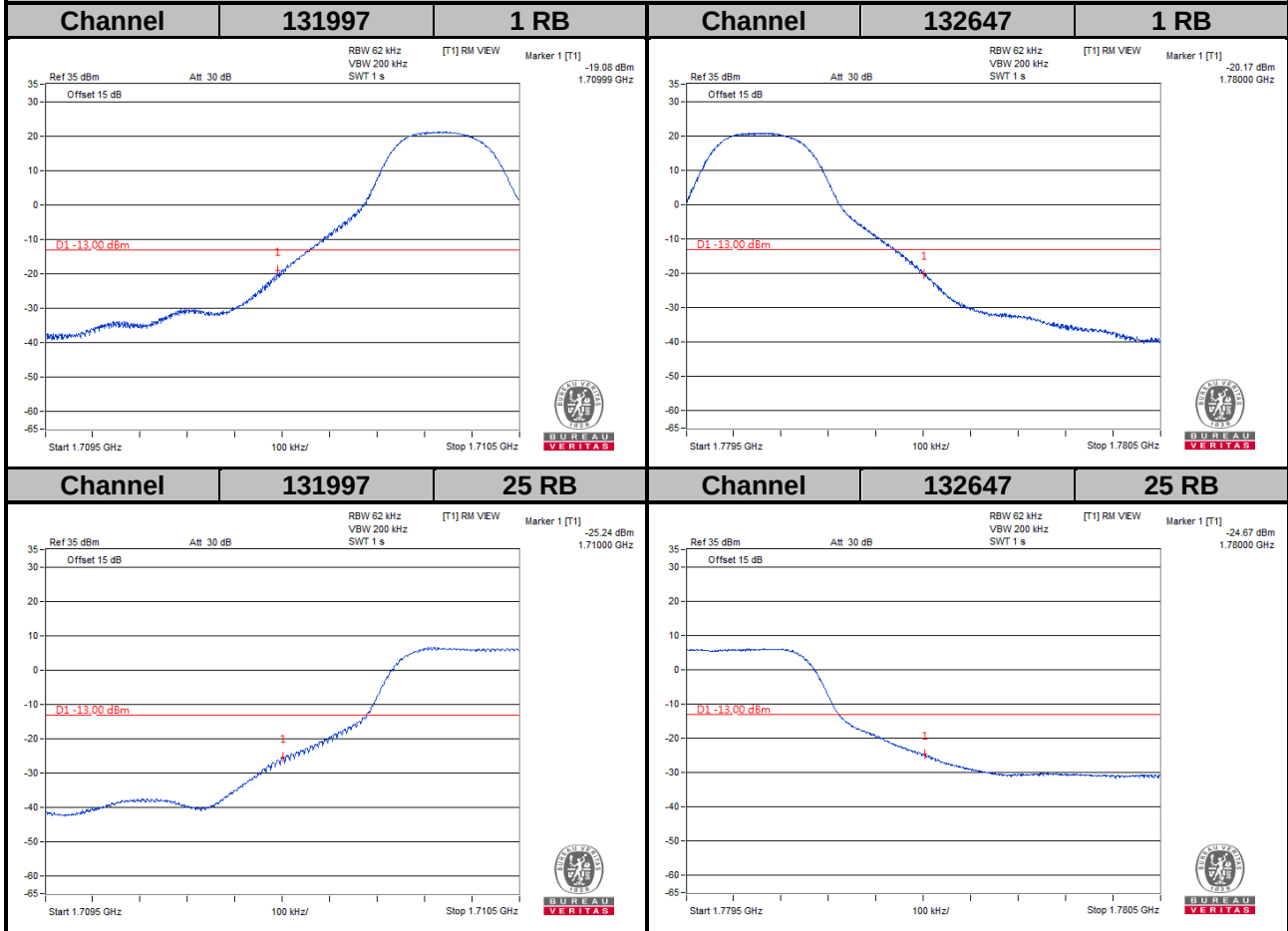
Channel Bandwidth: 1.4 MHz

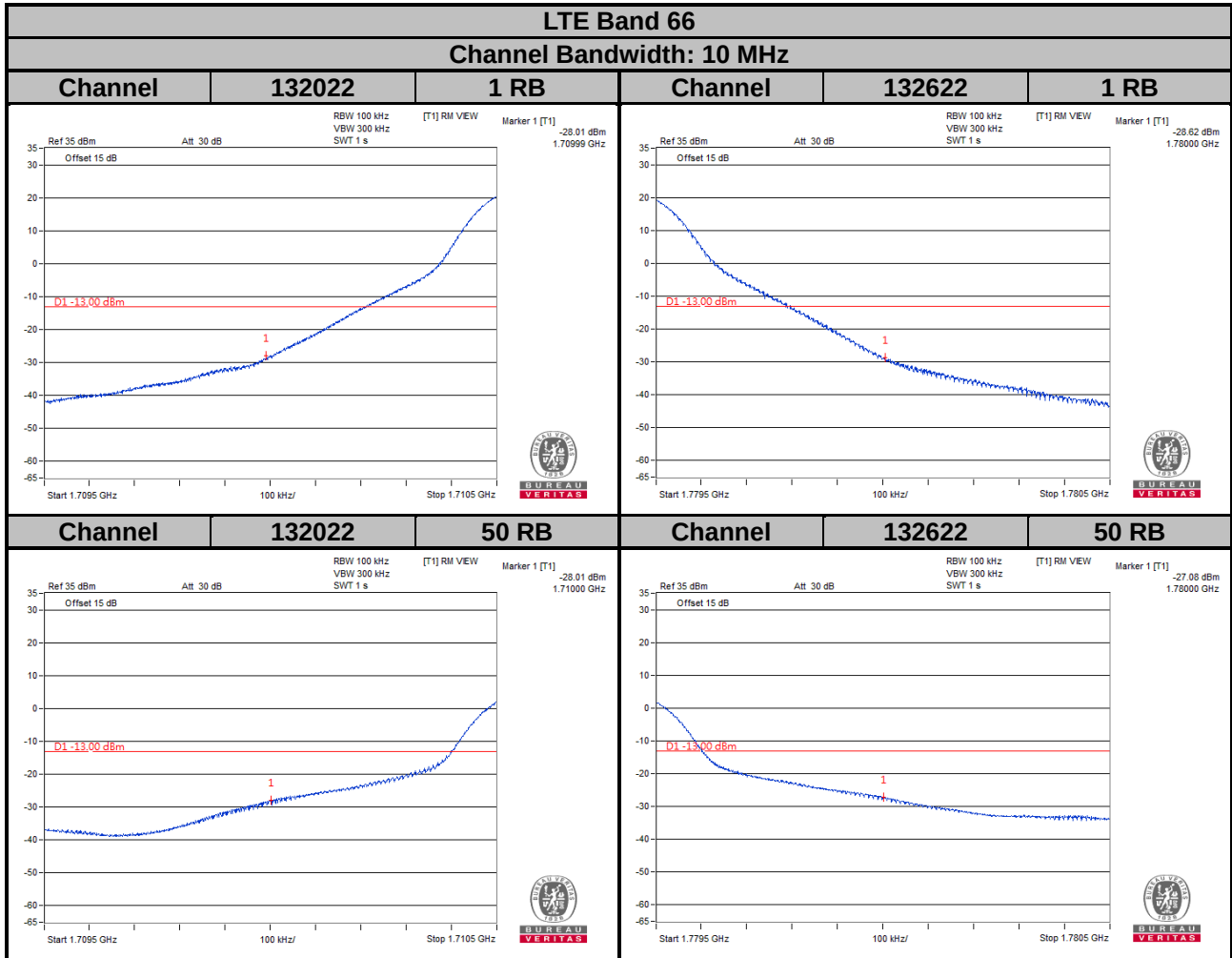


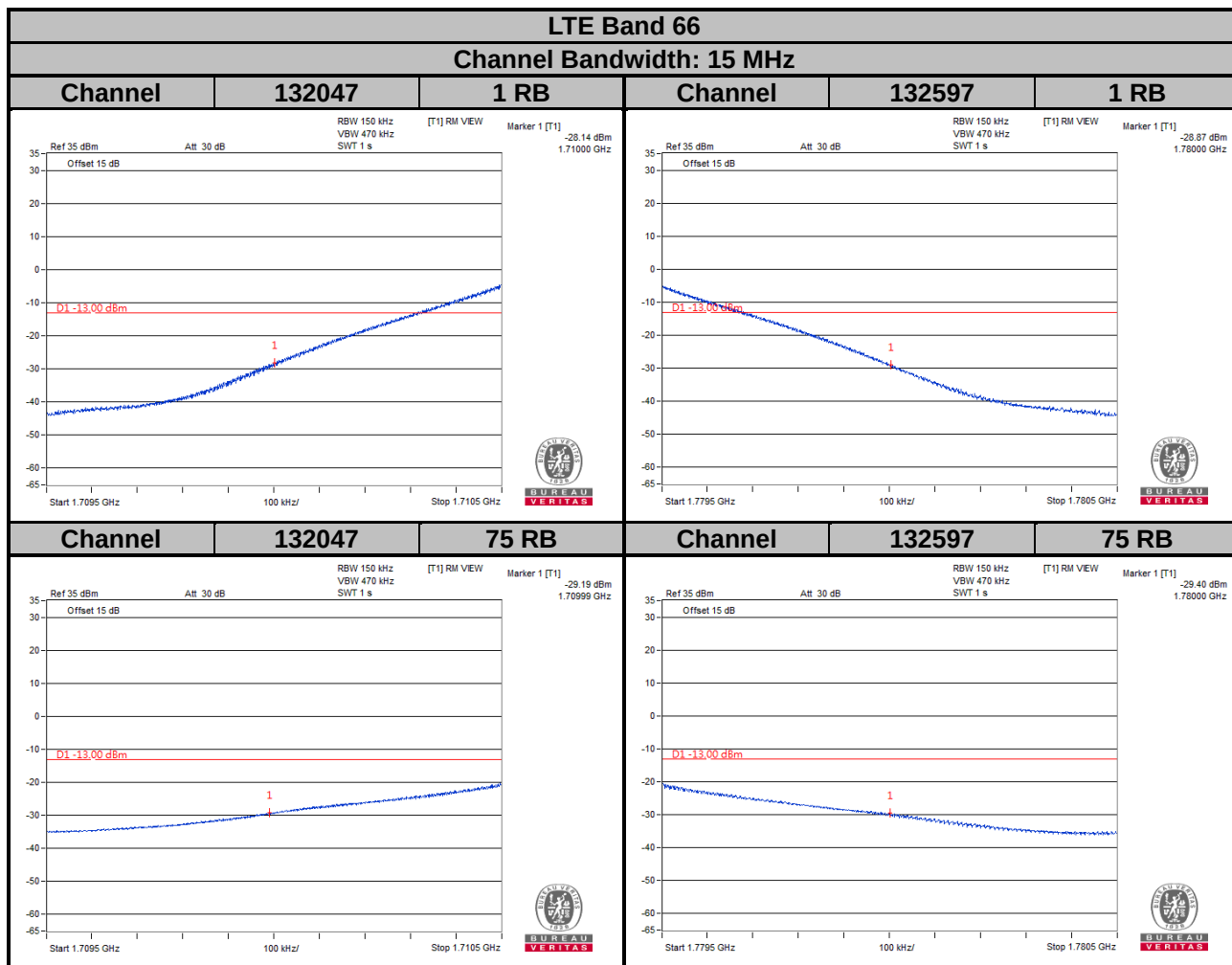


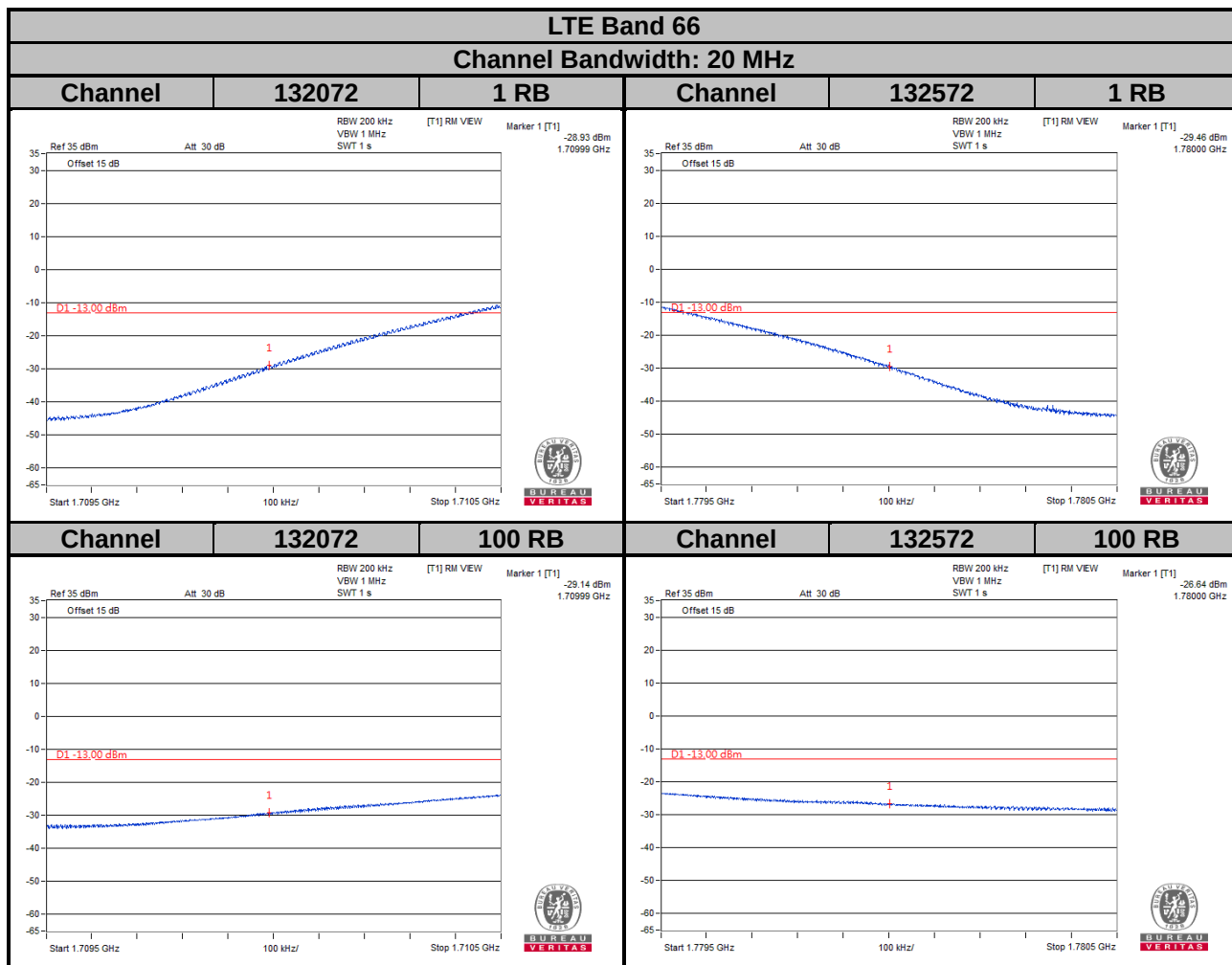
LTE Band 66

Channel Bandwidth: 5 MHz

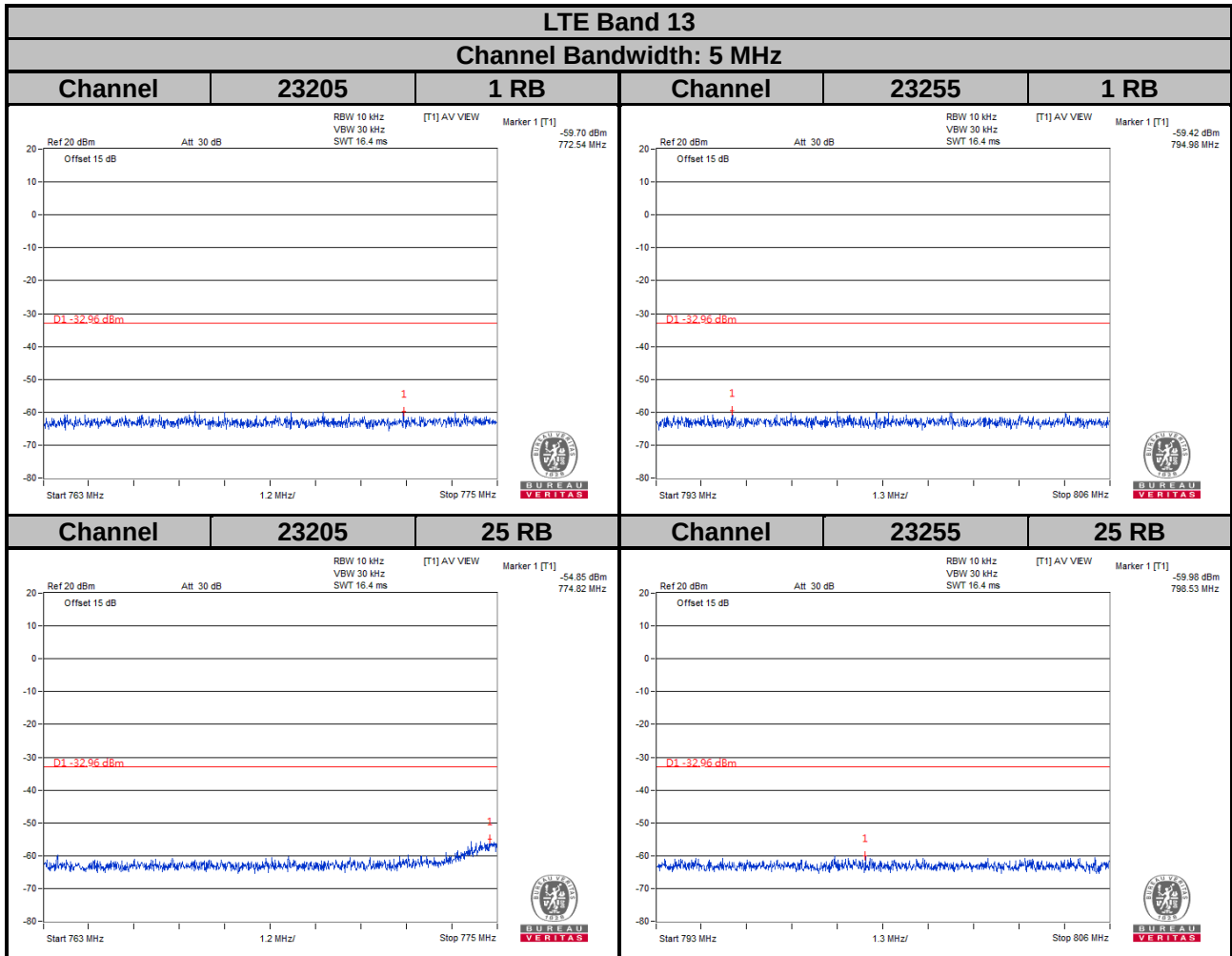








Emission Mask



For the 763 - 775 MHz and 793 - 805 MHz band, the FCC limit is $65 + 10\log(P[\text{watt}])$ in a 6.25 kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance. By using a 10 kHz bandwidth on the spectrum analyzer.

$$10\log(10\text{kHz}/6.25\text{kHz}) = 2.04 \text{ dB}$$

$$\text{Limit line} = -35 \text{ dBm} + 2.04 \text{ dB} = -32.96 \text{ dBm}$$



For the 763 - 775 MHz and 793 - 805 MHz band, the FCC limit is $65 + 10\log(P[\text{watt}])$ in a 6.25 kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance. By using a 10 kHz bandwidth on the spectrum analyzer.

$$10\log(10\text{kHz}/6.25\text{kHz}) = 2.04 \text{ dB}$$

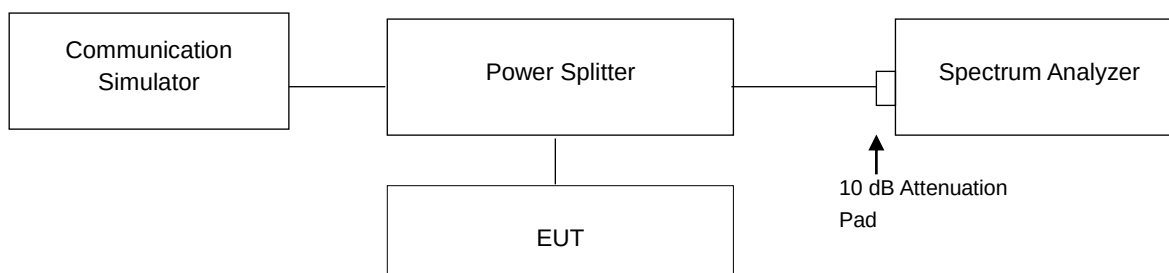
$$\text{Limit line} = -35 \text{ dBm} + 2.04 \text{ dB} = -32.96 \text{ dBm}$$

4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.6.2 Test Setup

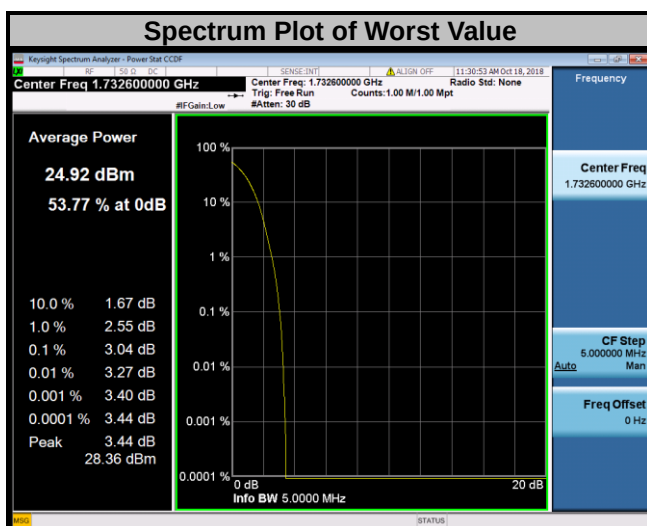


4.6.3 Test Procedures

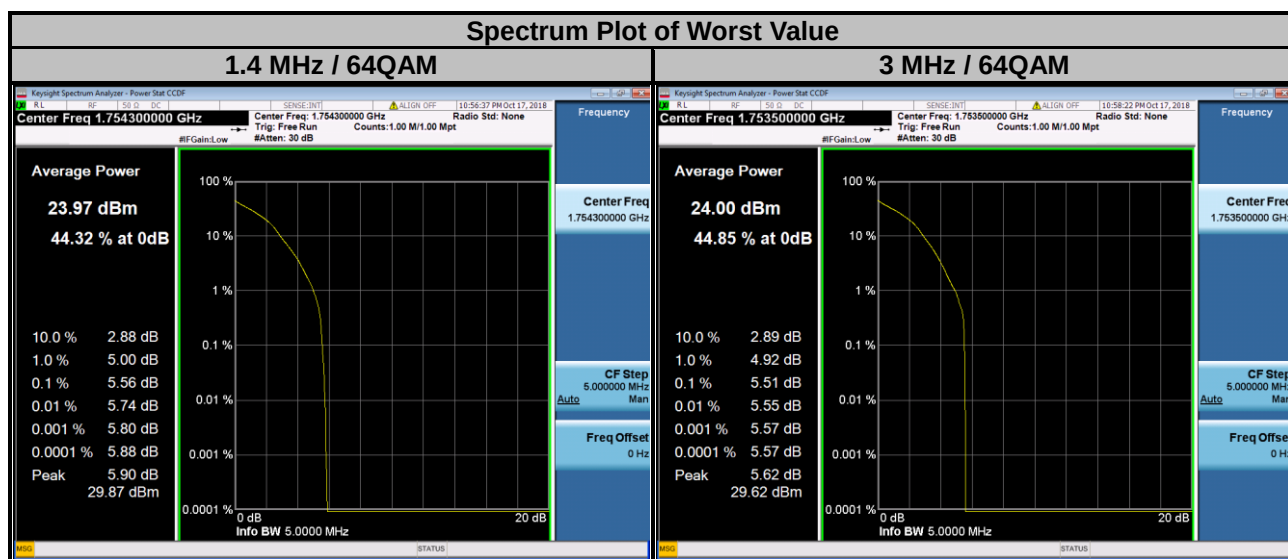
1. Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.6.4 Test Results

WCDMA		
Channel	Frequency (MHz)	Peak to Average Ratio (dB)
1312	1712.4	3.03
1413	1732.6	3.04
1513	1752.6	3.03



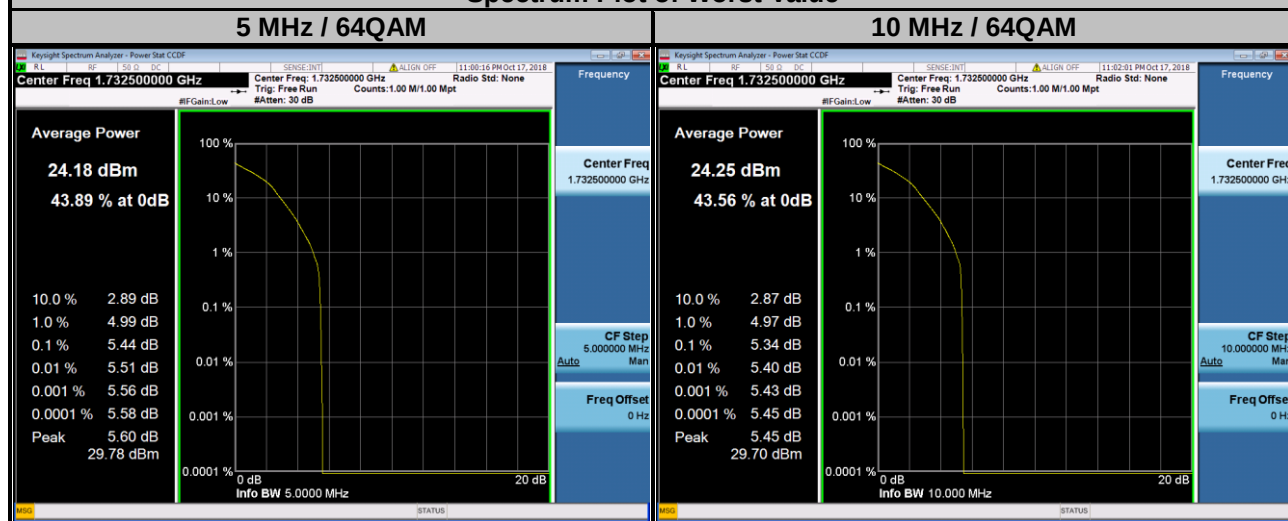
LTE Band 4									
Channel Bandwidth: 1.4 MHz					Channel Bandwidth: 3 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
19957	1710.7	3.86	5.02	5.08	19965	1711.5	3.69	4.92	4.96
20175	1732.5	3.83	5.55	5.54	20175	1732.5	3.59	5.34	5.42
20393	1754.3	3.85	5.53	5.56	20385	1753.5	3.64	5.39	5.51



LTE Band 4

Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
19975	1712.5	3.60	4.91	4.97	20000	1715.0	3.56	4.87	4.93
20175	1732.5	3.57	5.38	5.44	20175	1732.5	3.52	5.28	5.34
20375	1752.5	3.60	5.29	5.39	20350	1750.0	3.52	4.87	5.11

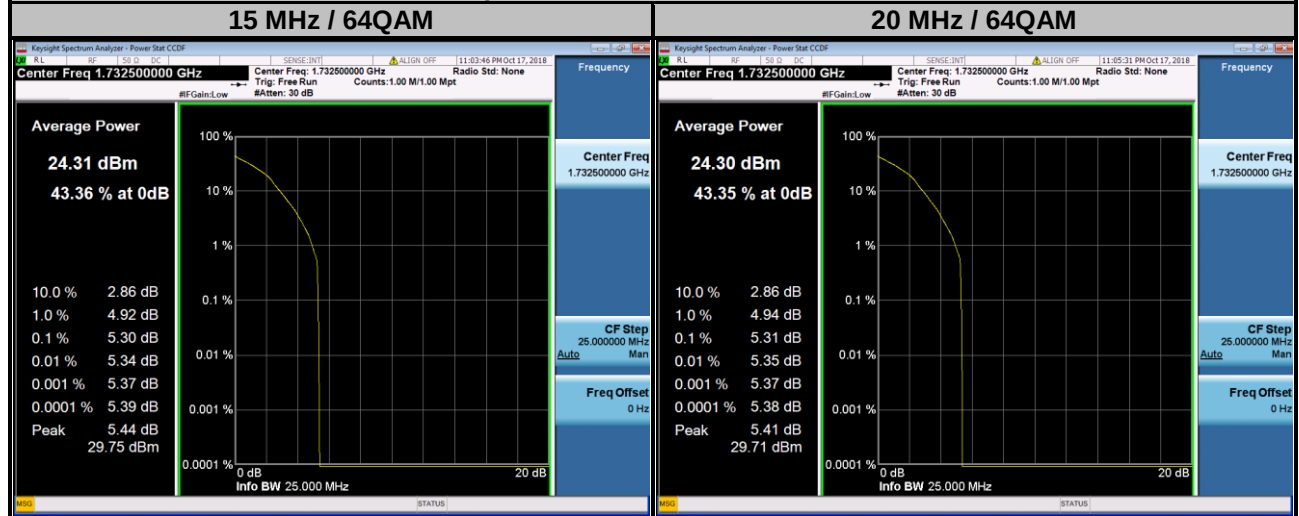
Spectrum Plot of Worst Value



LTE Band 4

Channel Bandwidth: 15 MHz					Channel Bandwidth: 20 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
20025	1717.5	3.49	4.81	4.91	20050	1720.0	3.53	4.75	4.94
20175	1732.5	3.51	5.25	5.30	20175	1732.5	3.47	5.29	5.31
20325	1747.5	3.48	5.23	5.26	20300	1745.0	3.51	5.28	5.30

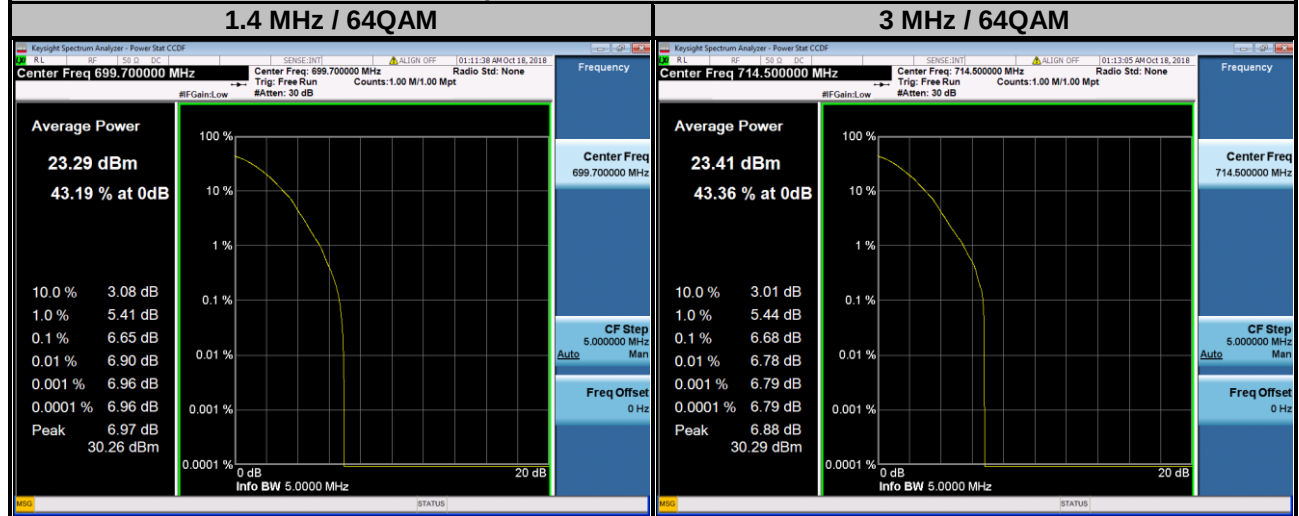
Spectrum Plot of Worst Value



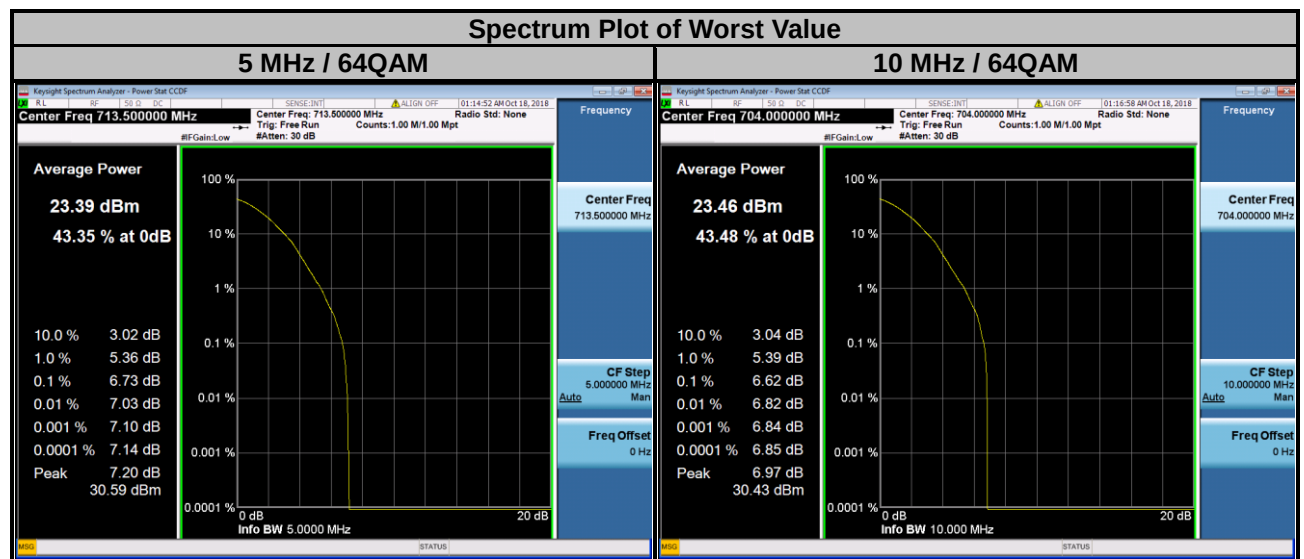
LTE Band 12

Channel Bandwidth: 1.4 MHz					Channel Bandwidth: 3 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
23017	699.7	3.80	5.41	6.65	23025	700.5	3.59	5.29	6.66
23095	707.5	3.82	5.22	6.32	23095	707.5	3.58	5.00	6.22
23173	715.3	3.80	4.62	5.88	23165	714.5	3.57	5.27	6.68

Spectrum Plot of Worst Value



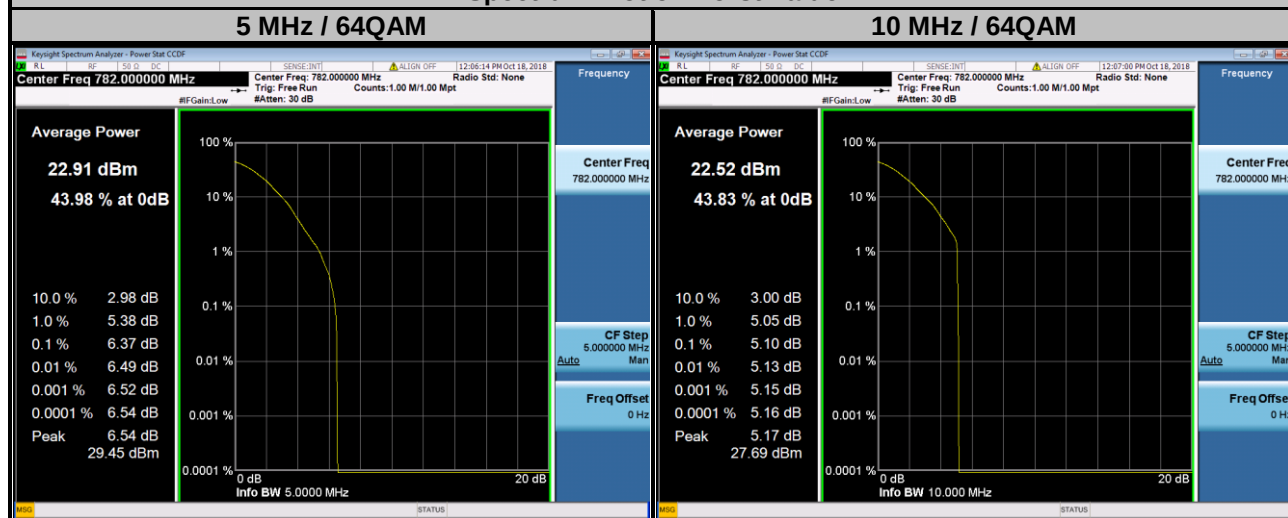
LTE Band 12									
Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
23035	701.5	3.65	5.40	6.64	23060	704.0	3.53	5.20	6.62
23095	707.5	3.59	5.05	6.16	23095	707.5	3.52	5.14	6.31
23155	713.5	3.60	5.29	6.73	23130	711.0	3.52	5.12	6.26



LTE Band 13

Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
23205	779.5	3.31	4.09	5.09	23230	782.0	3.28	4.05	5.10
23230	782.0	3.57	5.24	6.37					
23255	784.5	3.27	4.01	4.97					

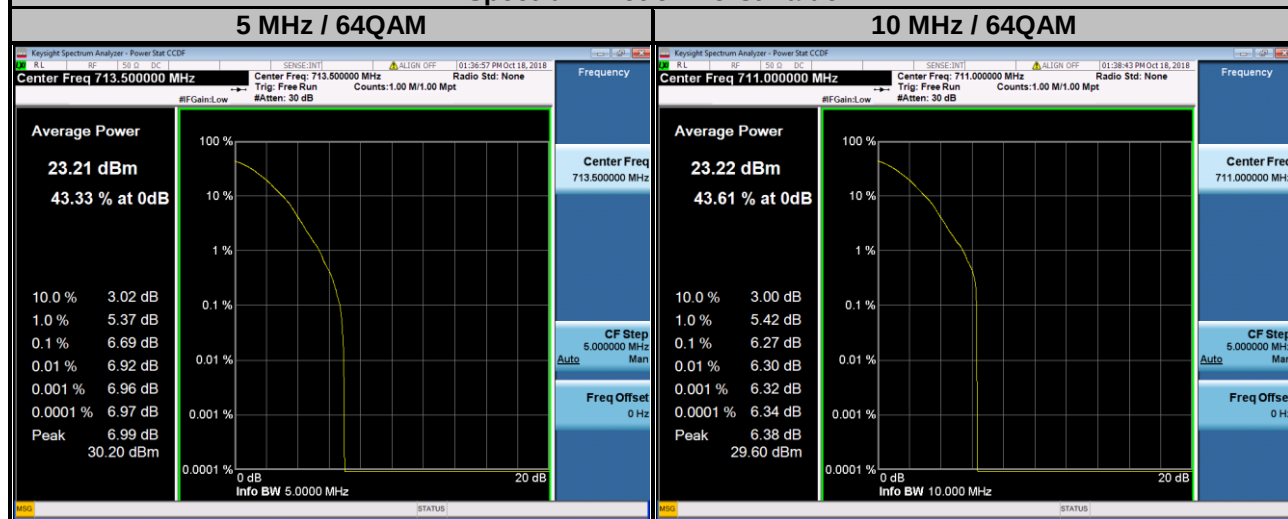
Spectrum Plot of Worst Value



LTE Band 17

Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
23755	706.5	3.59	5.14	6.24	23780	709.0	3.52	5.09	6.20
23790	710.0	3.60	5.28	6.39	23790	710.0	3.53	5.13	6.23
23825	713.5	3.55	5.29	6.69	23800	711.0	3.52	5.12	6.27

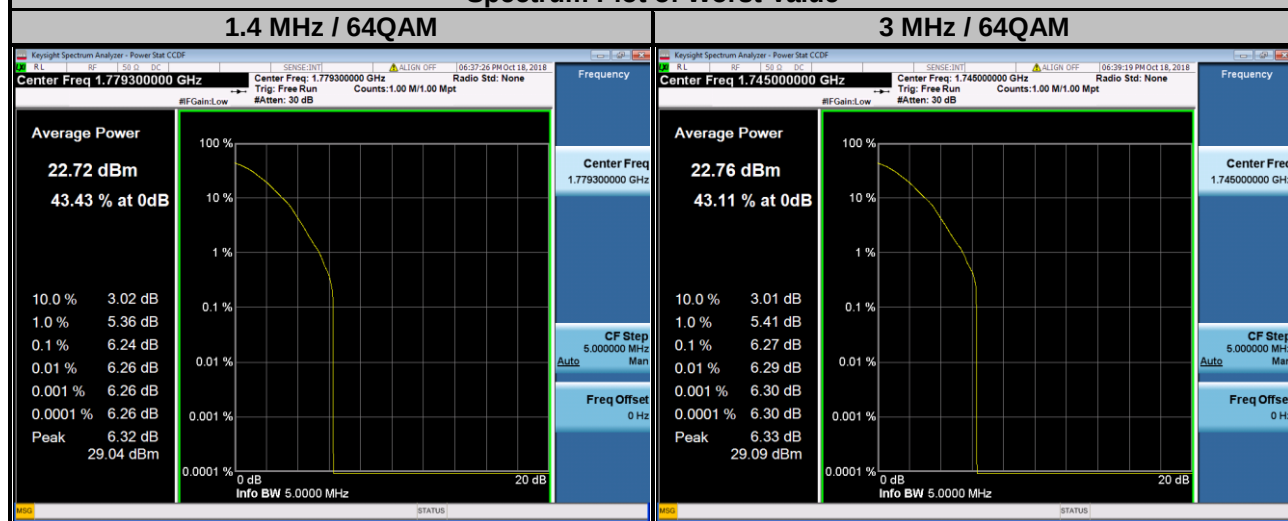
Spectrum Plot of Worst Value



LTE Band 66

Channel Bandwidth: 1.4 MHz					Channel Bandwidth: 3 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
131979	1710.7	3.82	4.85	5.89	131987	1711.5	3.59	4.88	5.92
132322	1745.0	3.81	5.06	6.21	132322	1745.0	3.59	5.16	6.27
132665	1779.3	3.78	5.26	6.24	132657	1778.5	3.55	4.89	5.94

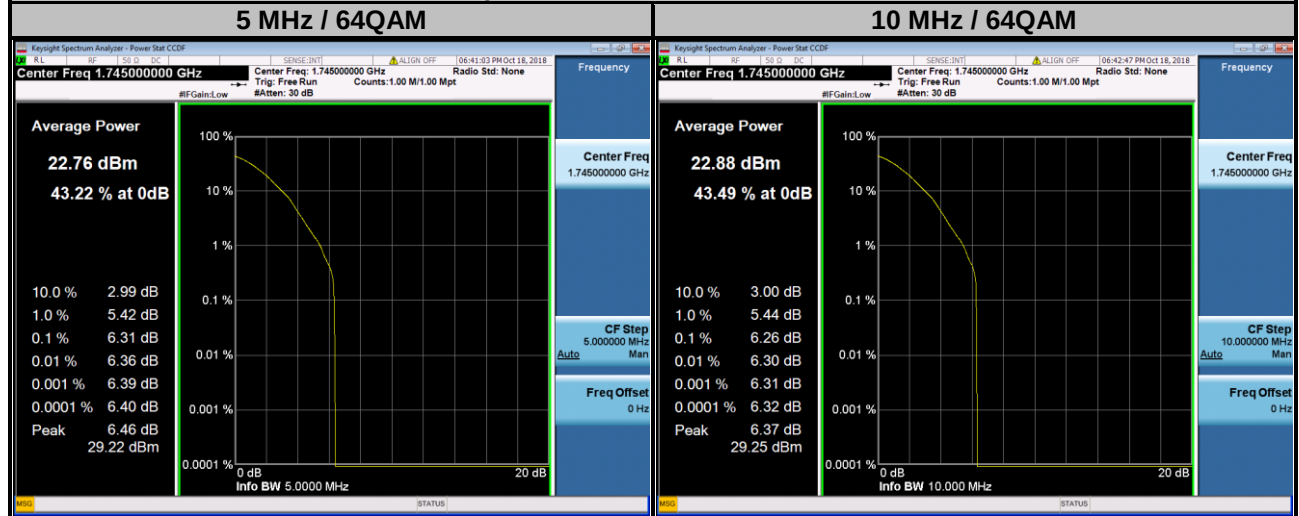
Spectrum Plot of Worst Value



LTE Band 66

Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
131997	1712.5	3.58	4.93	6.05	132022	1715.0	3.50	4.68	5.88
132322	1745.0	3.58	5.20	6.31	132322	1745.0	3.55	5.09	6.26
132647	1777.5	3.56	4.64	5.74	132622	1775.0	3.51	4.54	5.76

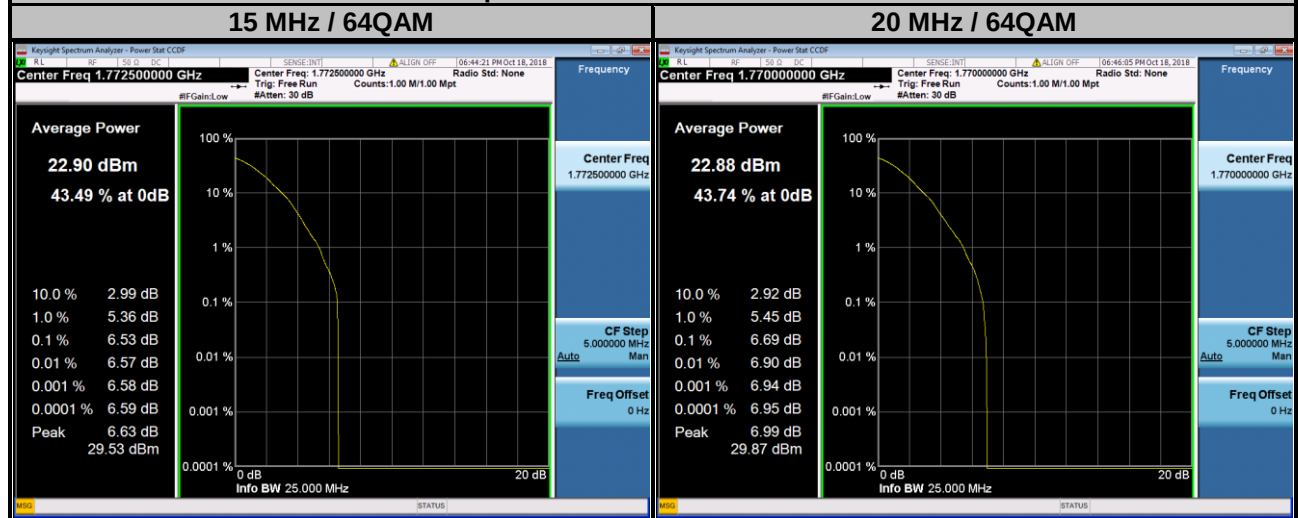
Spectrum Plot of Worst Value



LTE Band 66

Channel Bandwidth: 15 MHz					Channel Bandwidth: 20 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
132047	1717.5	3.46	4.59	5.76	132072	1720.0	3.47	4.71	5.71
132322	1745.0	3.46	5.15	6.36	132322	1745.0	3.49	5.21	6.46
132597	1772.5	3.47	5.11	6.53	132572	1770.0	3.45	5.19	6.69

Spectrum Plot of Worst Value

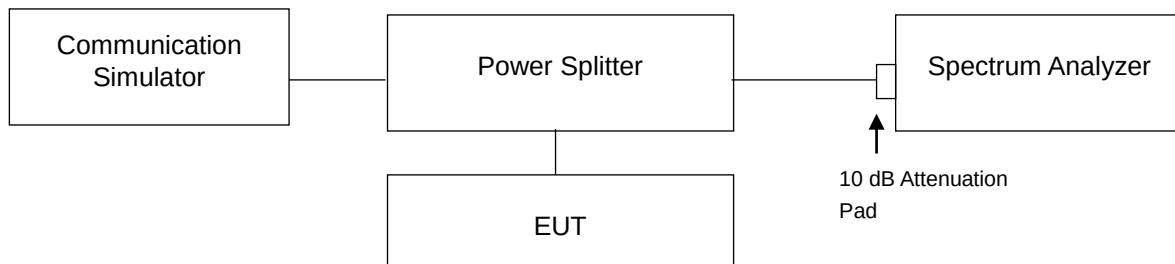


4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB. The limit of emission is equal to -13 dBm.

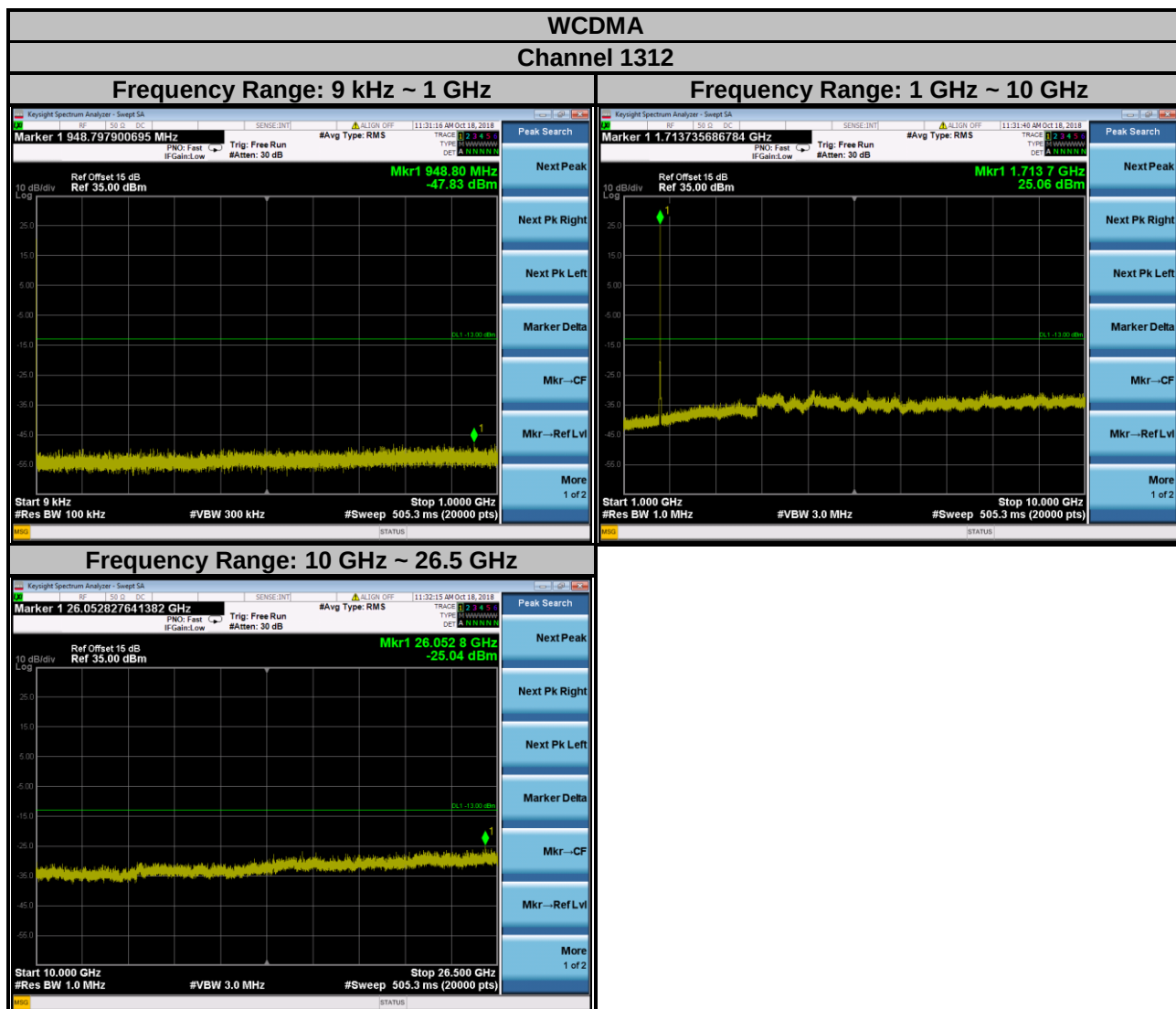
4.7.2 Test Setup



4.7.3 Test Procedure

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 100 kHz and VBW = 300 kHz is used for conducted emission measurement.
- Measuring frequency range is from 1 GHz to 10 GHz / 26.5 GHz / 27 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz is used for conducted emission measurement.

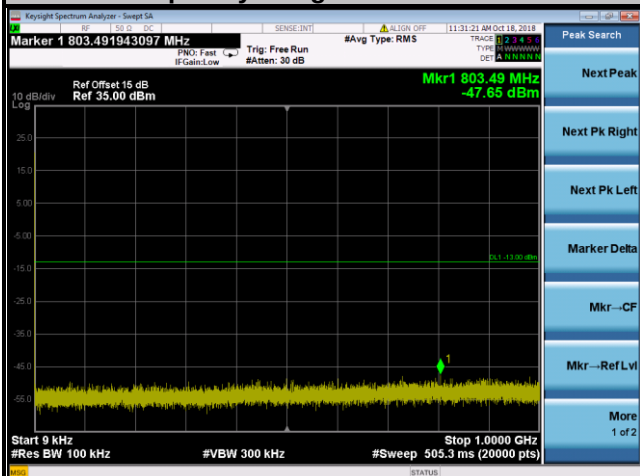
4.7.4 Test Results



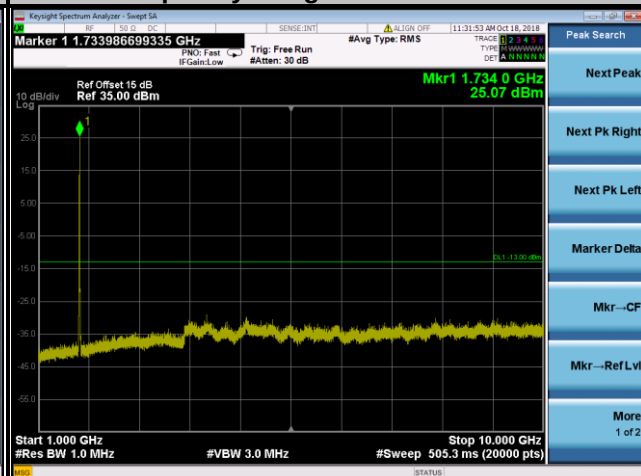
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

WCDMA Channel 1413

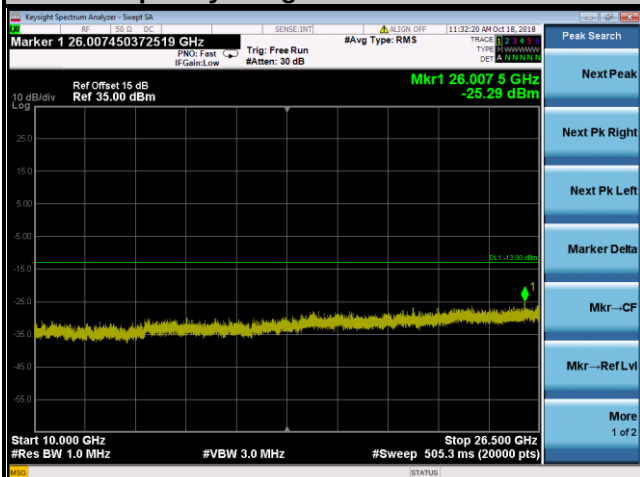
Frequency Range: 9 kHz ~ 1 GHz



Frequency Range: 1 GHz ~ 10 GHz



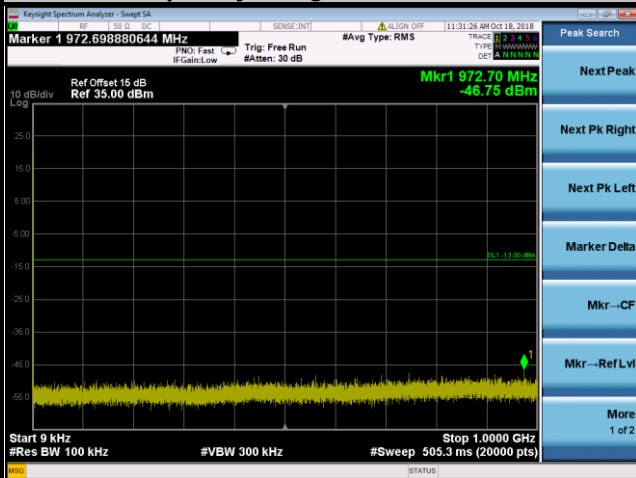
Frequency Range: 10 GHz ~ 26.5 GHz



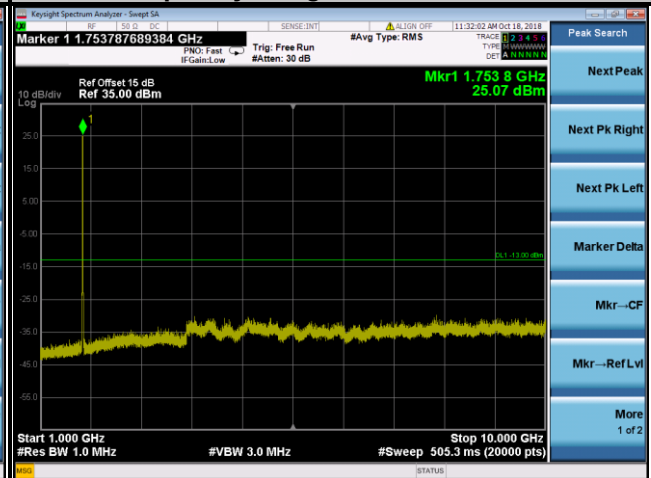
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

WCDMA Channel 1513

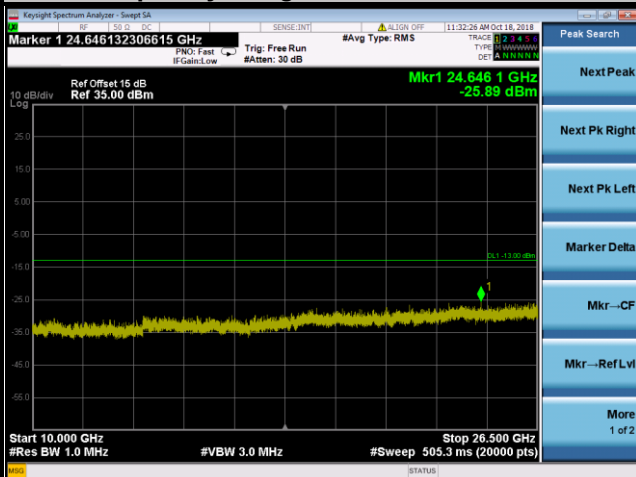
Frequency Range: 9 kHz ~ 1 GHz



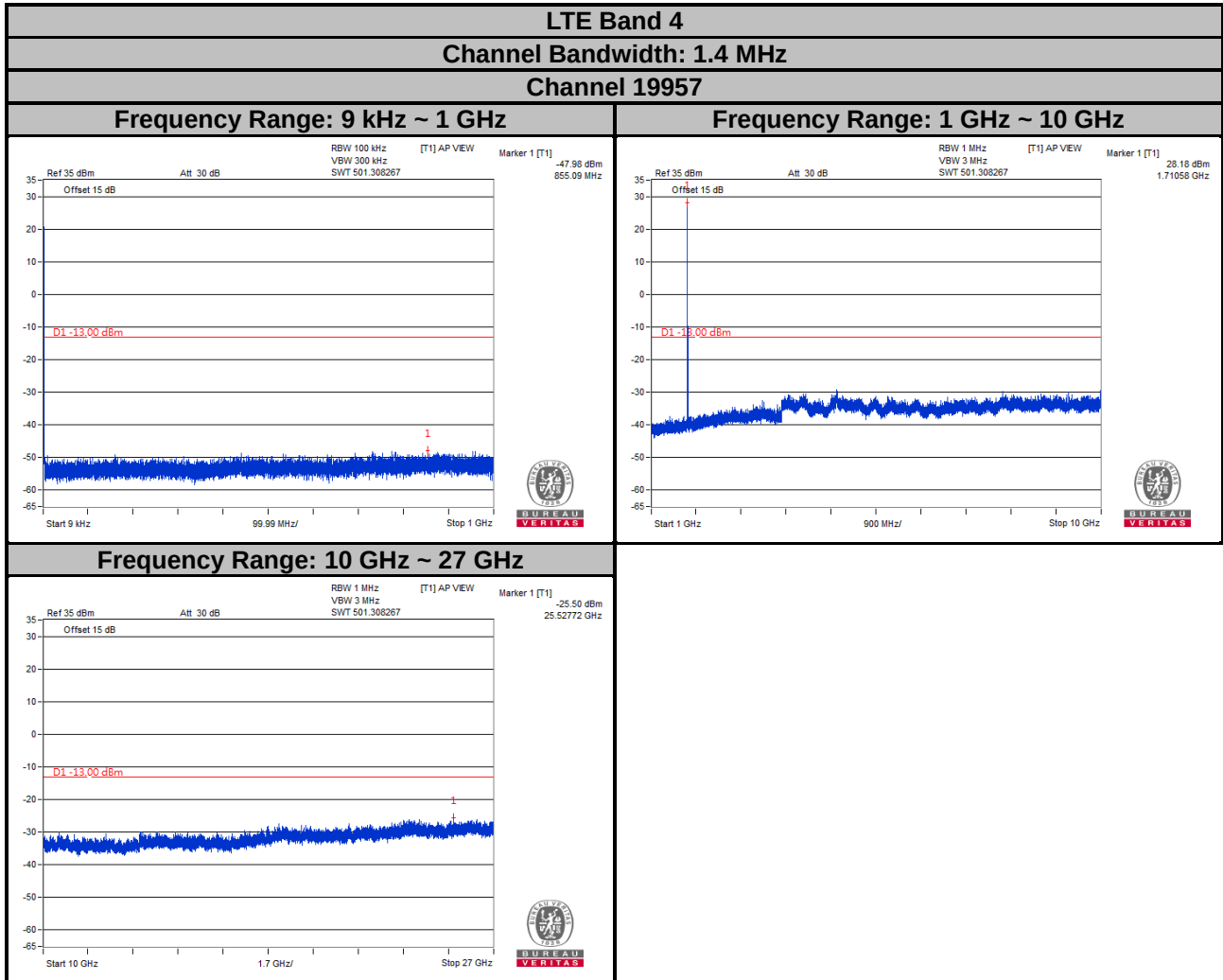
Frequency Range: 1 GHz ~ 10 GHz



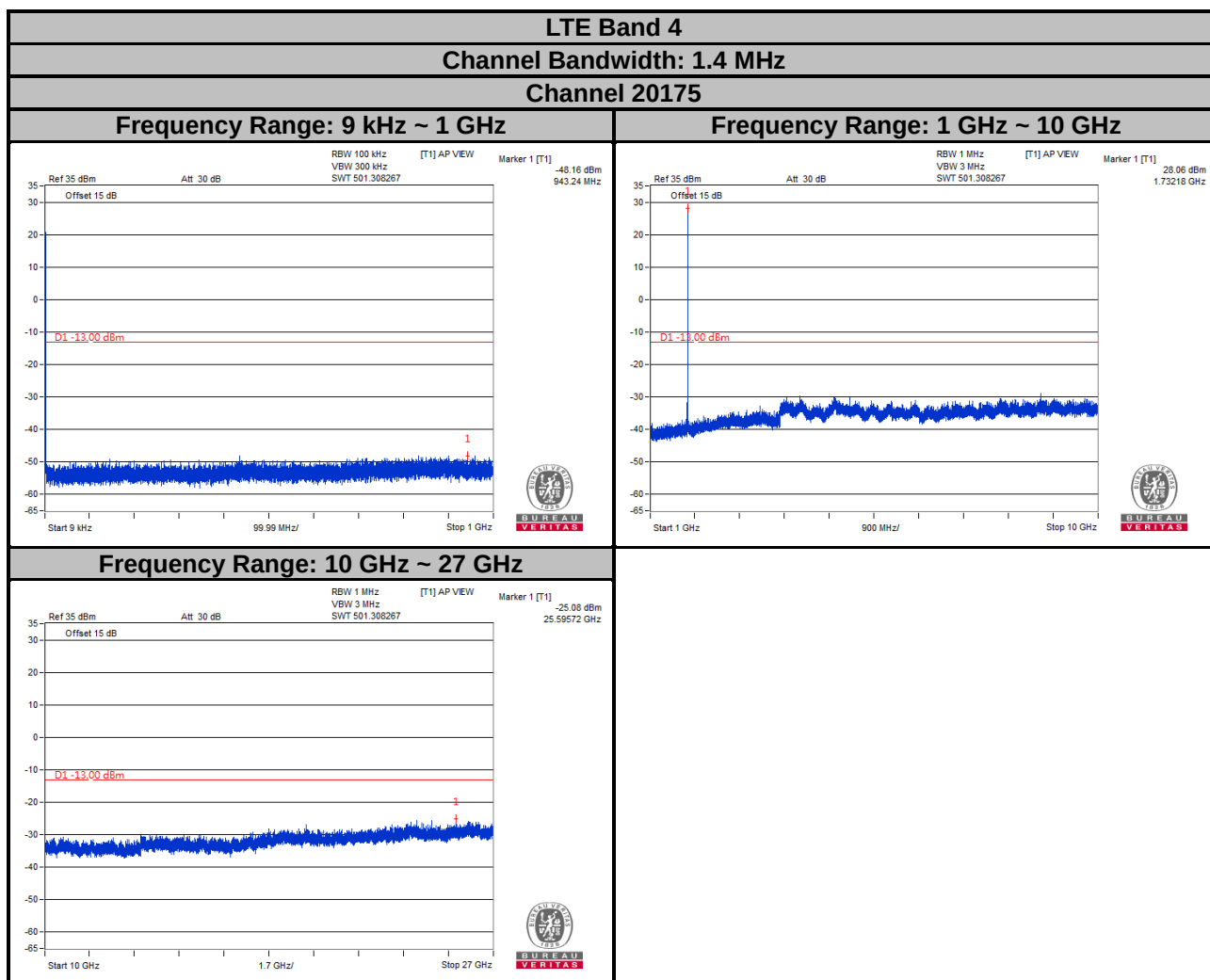
Frequency Range: 10 GHz ~ 26.5 GHz



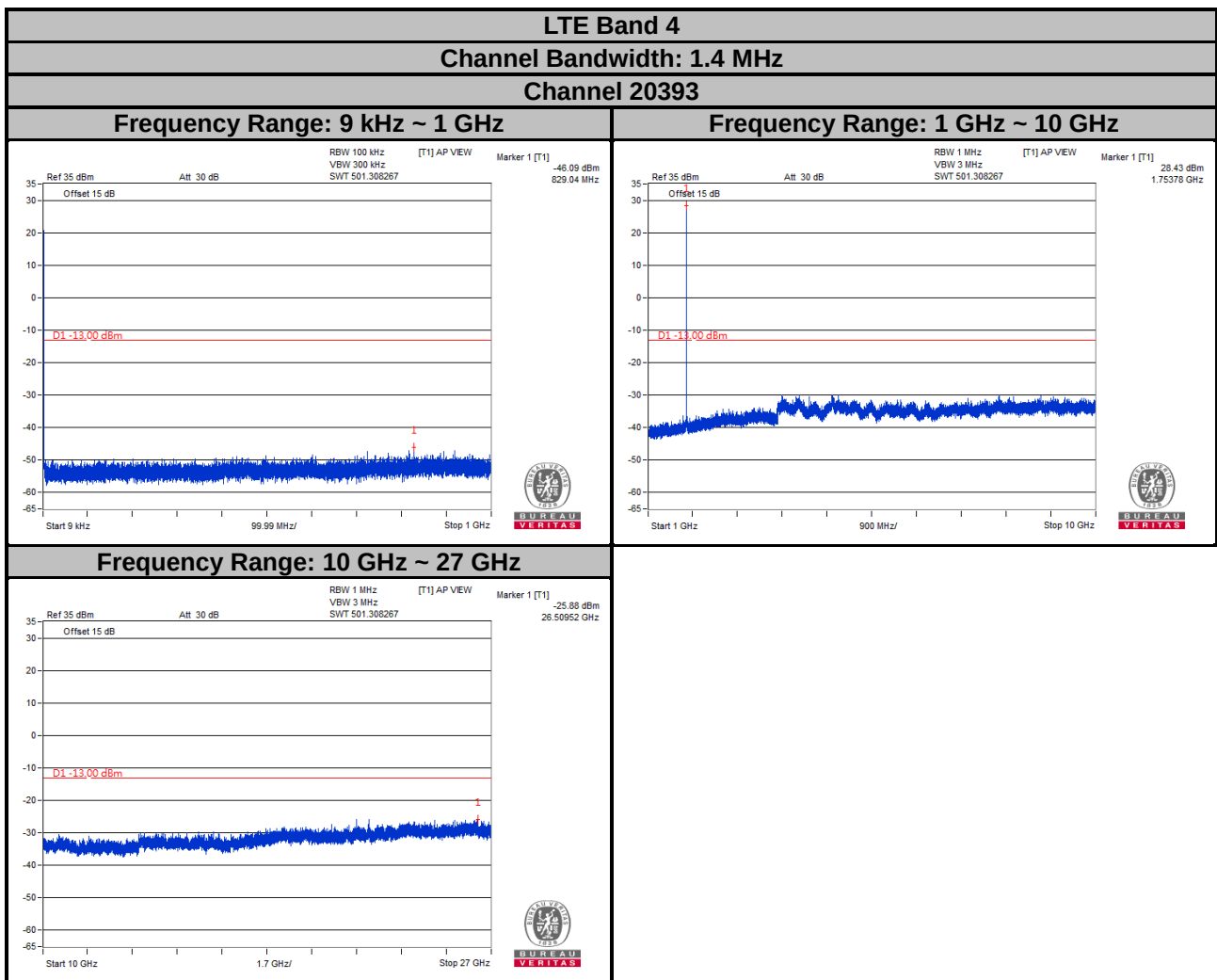
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



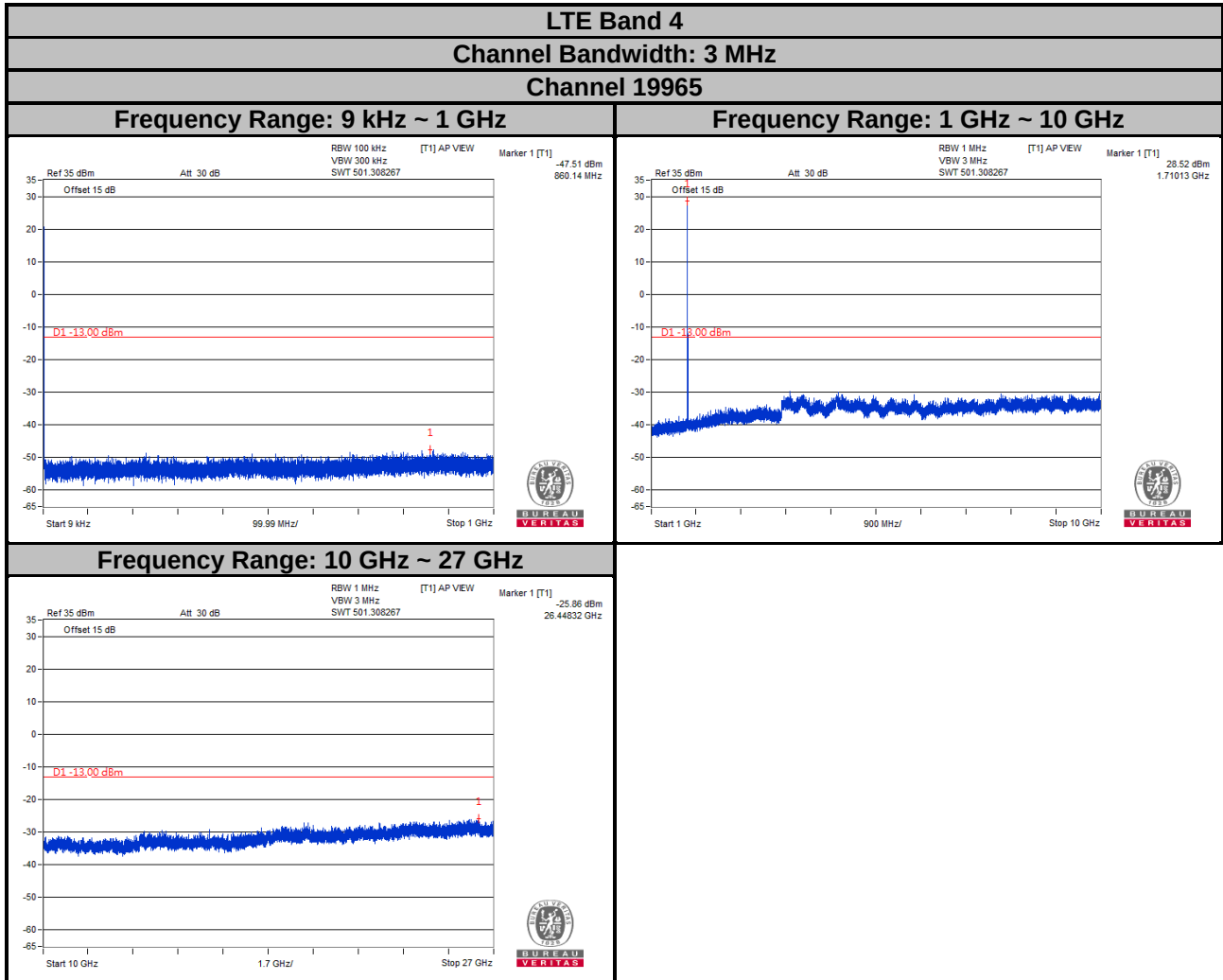
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



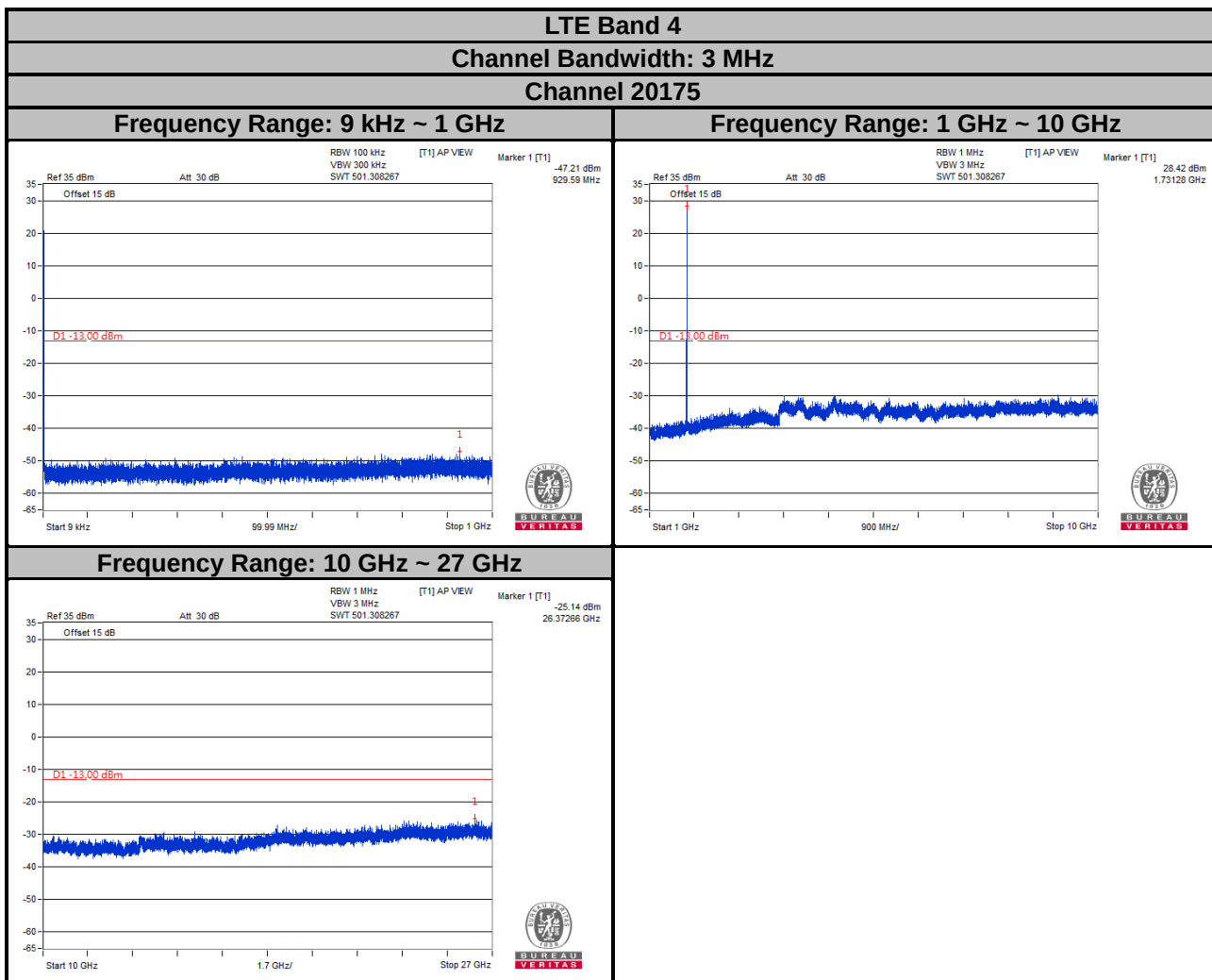
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



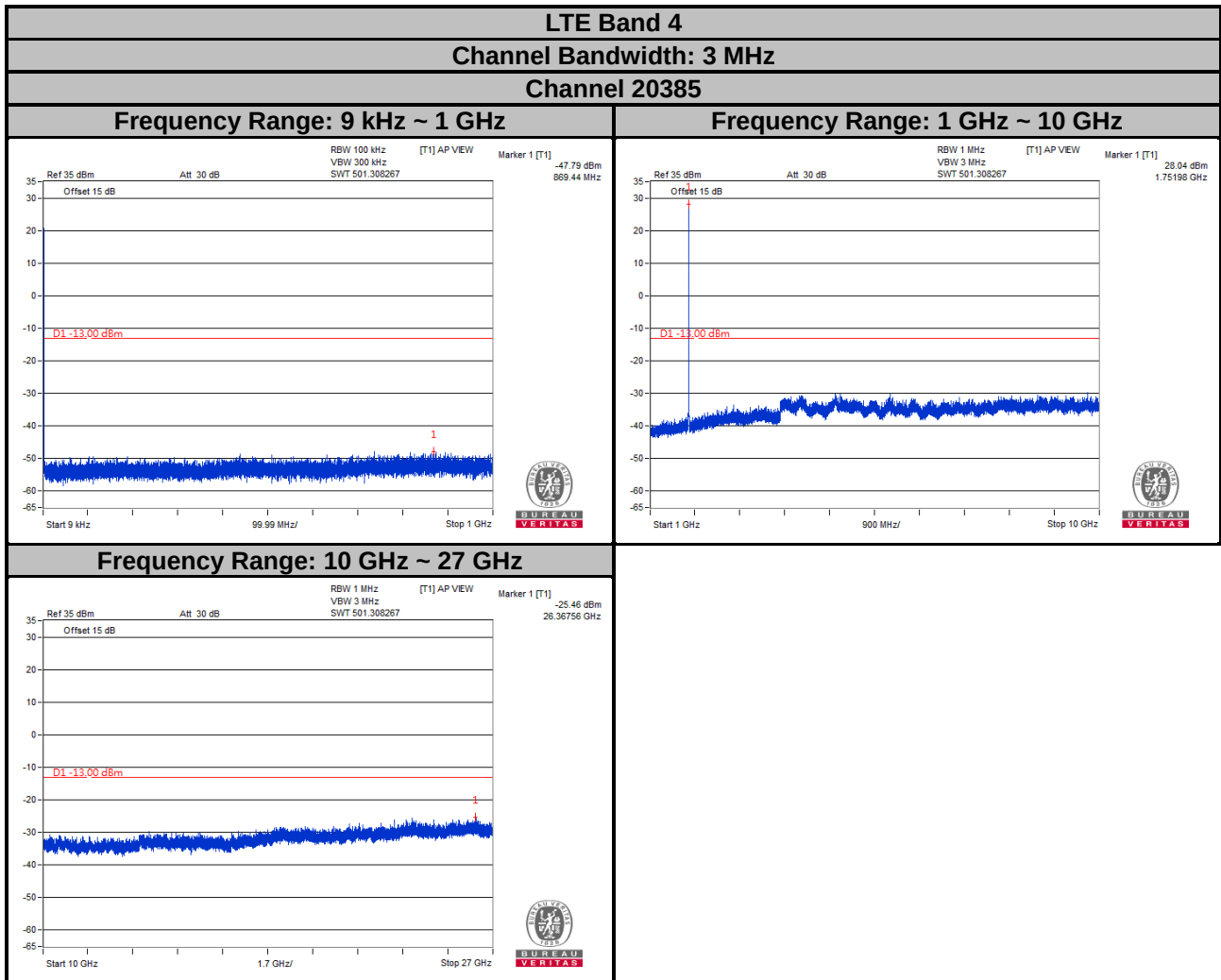
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



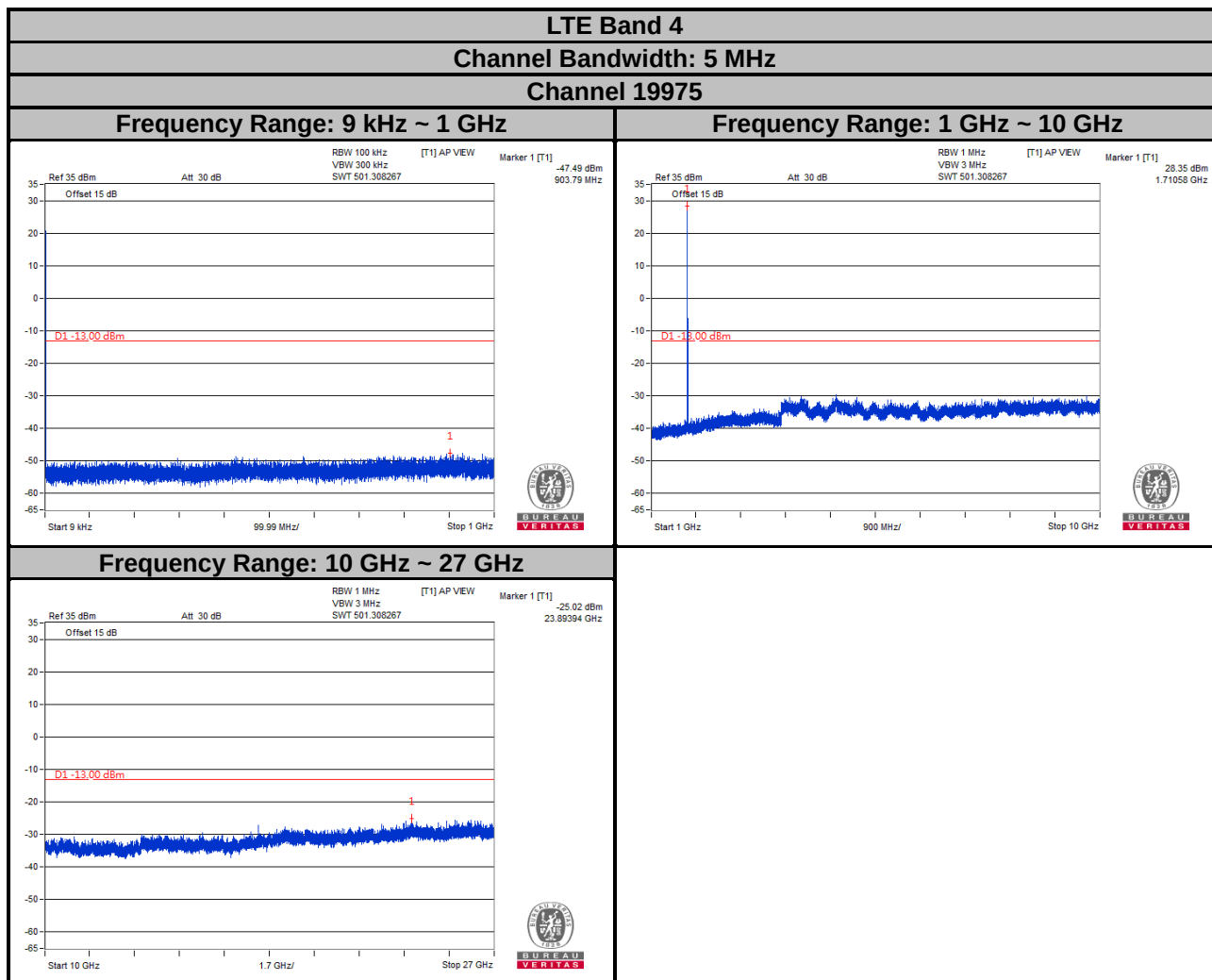
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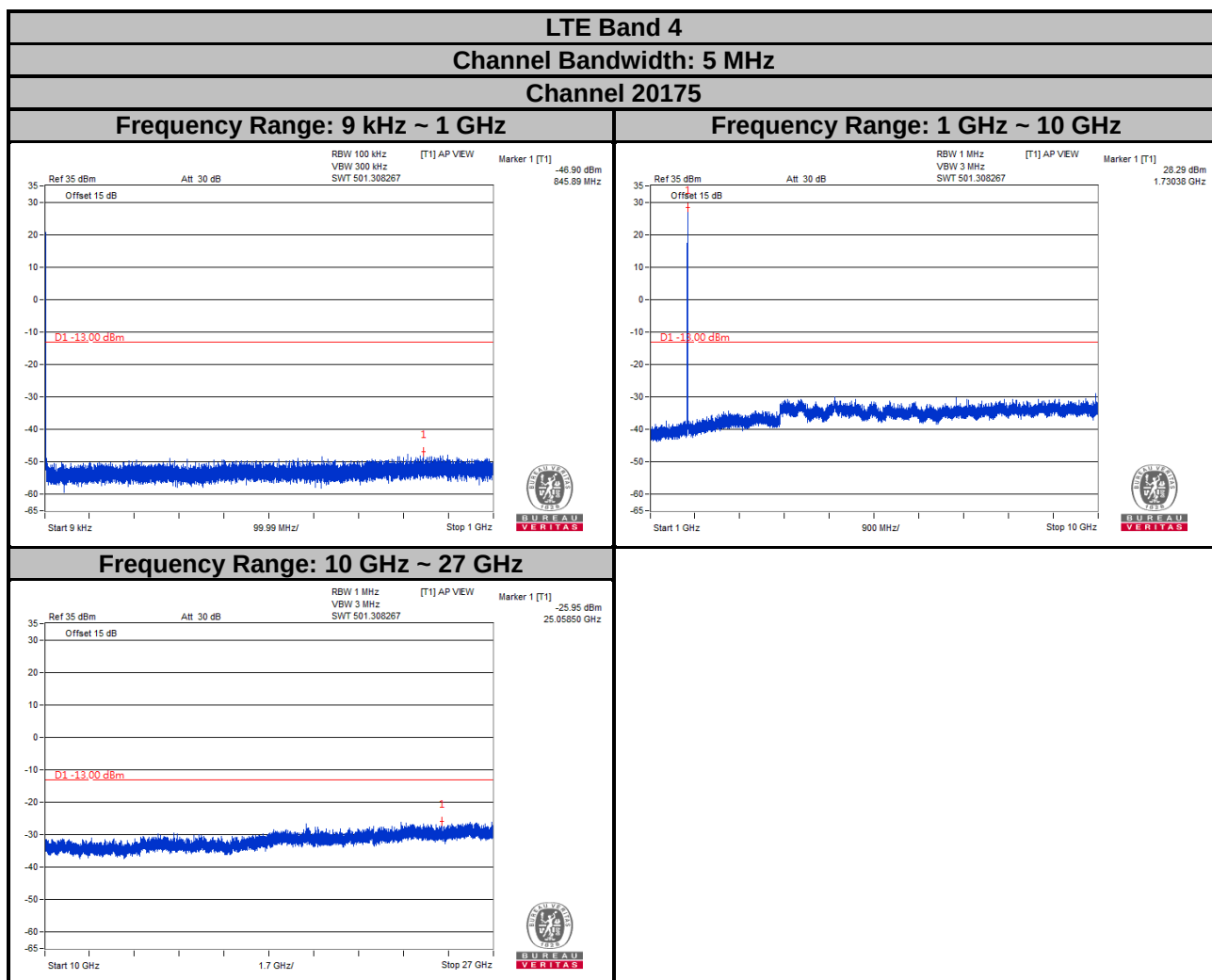
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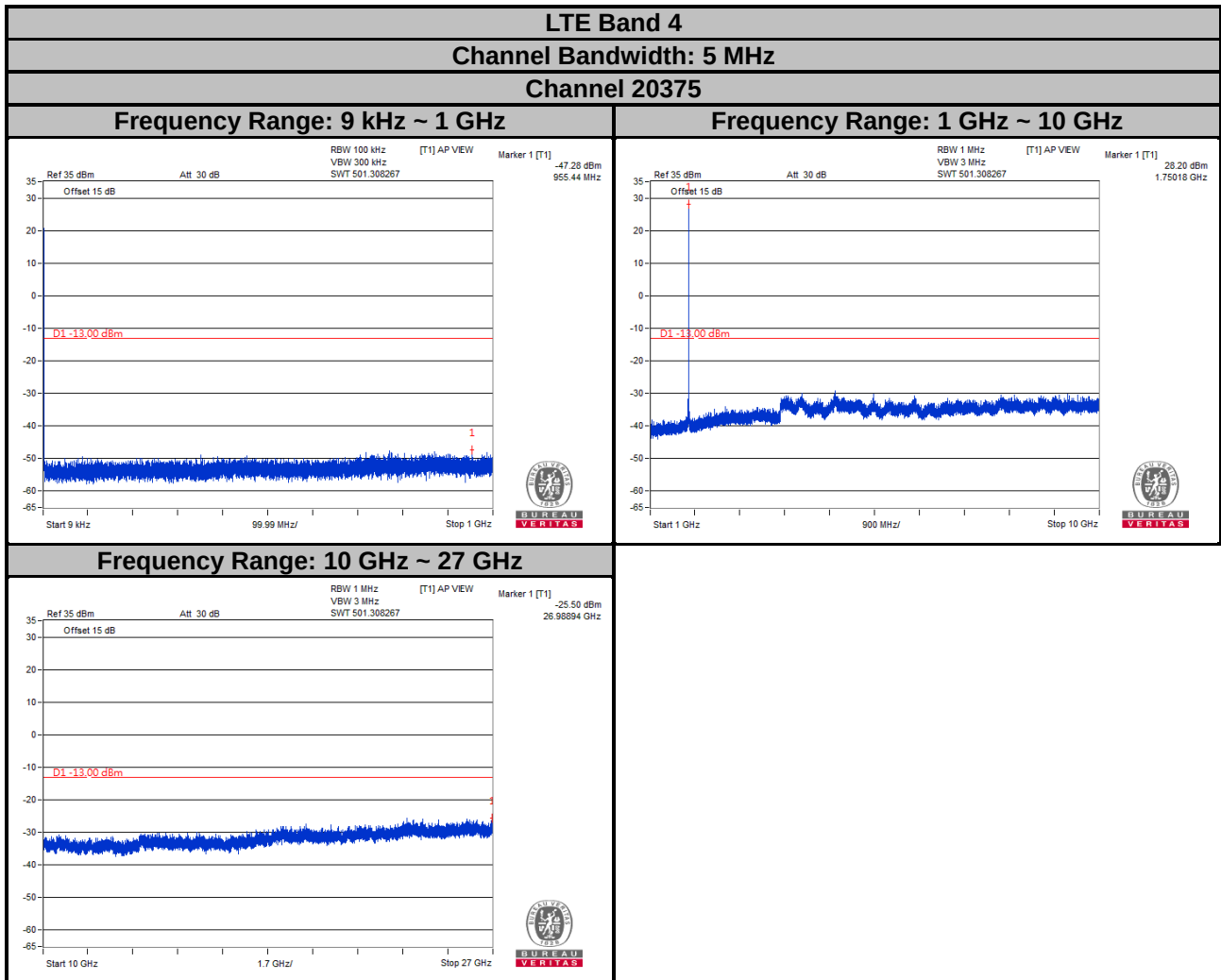
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



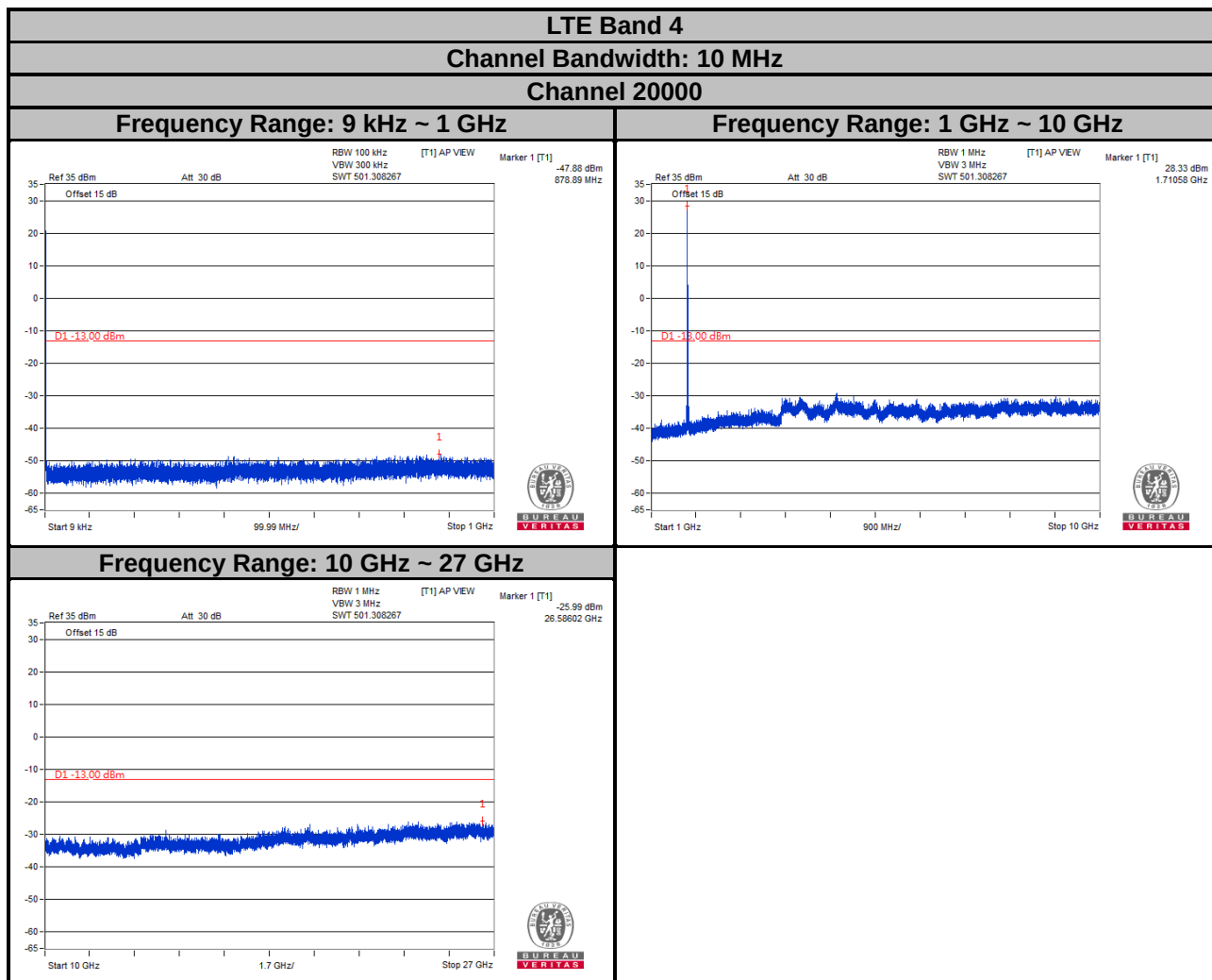
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



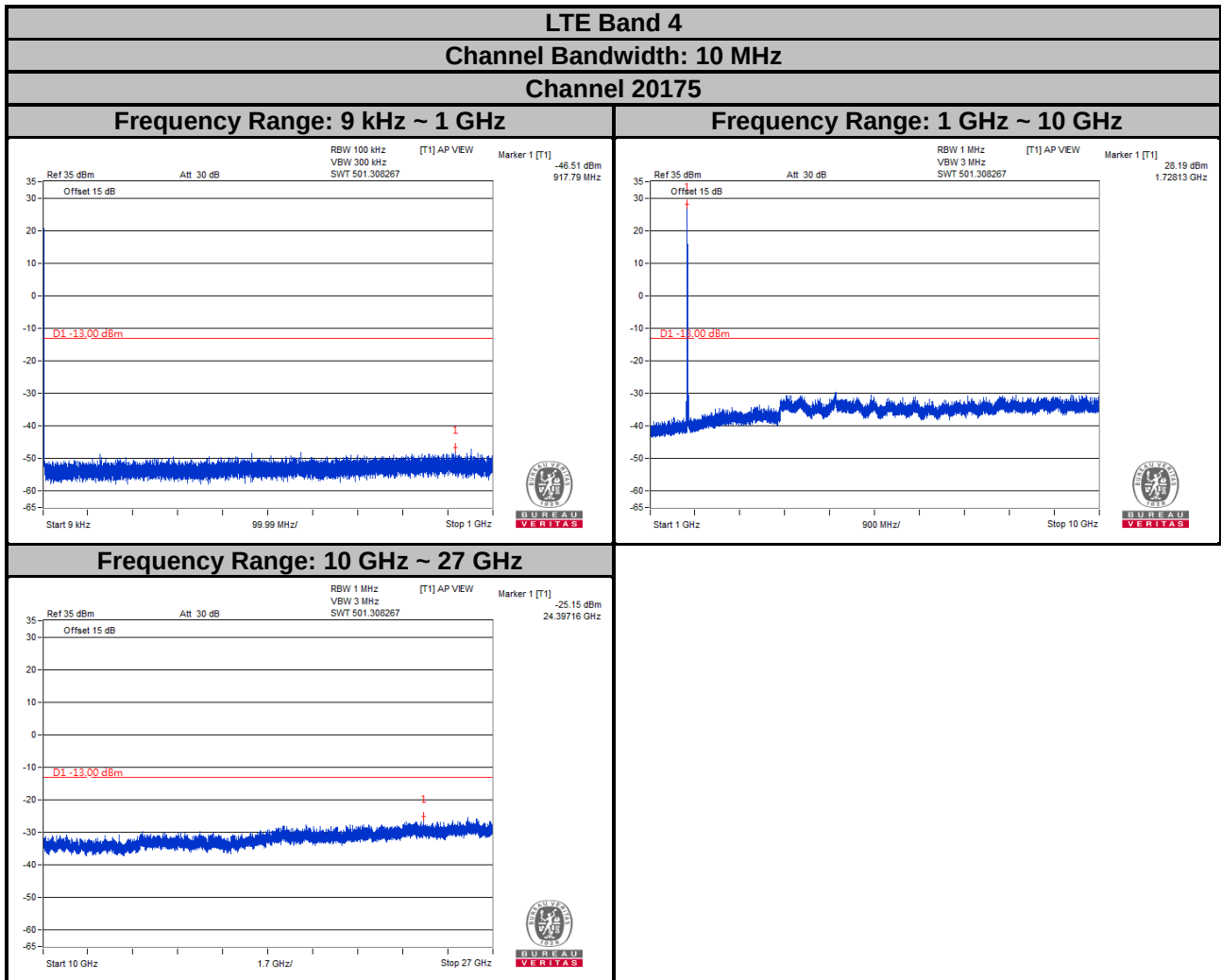
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



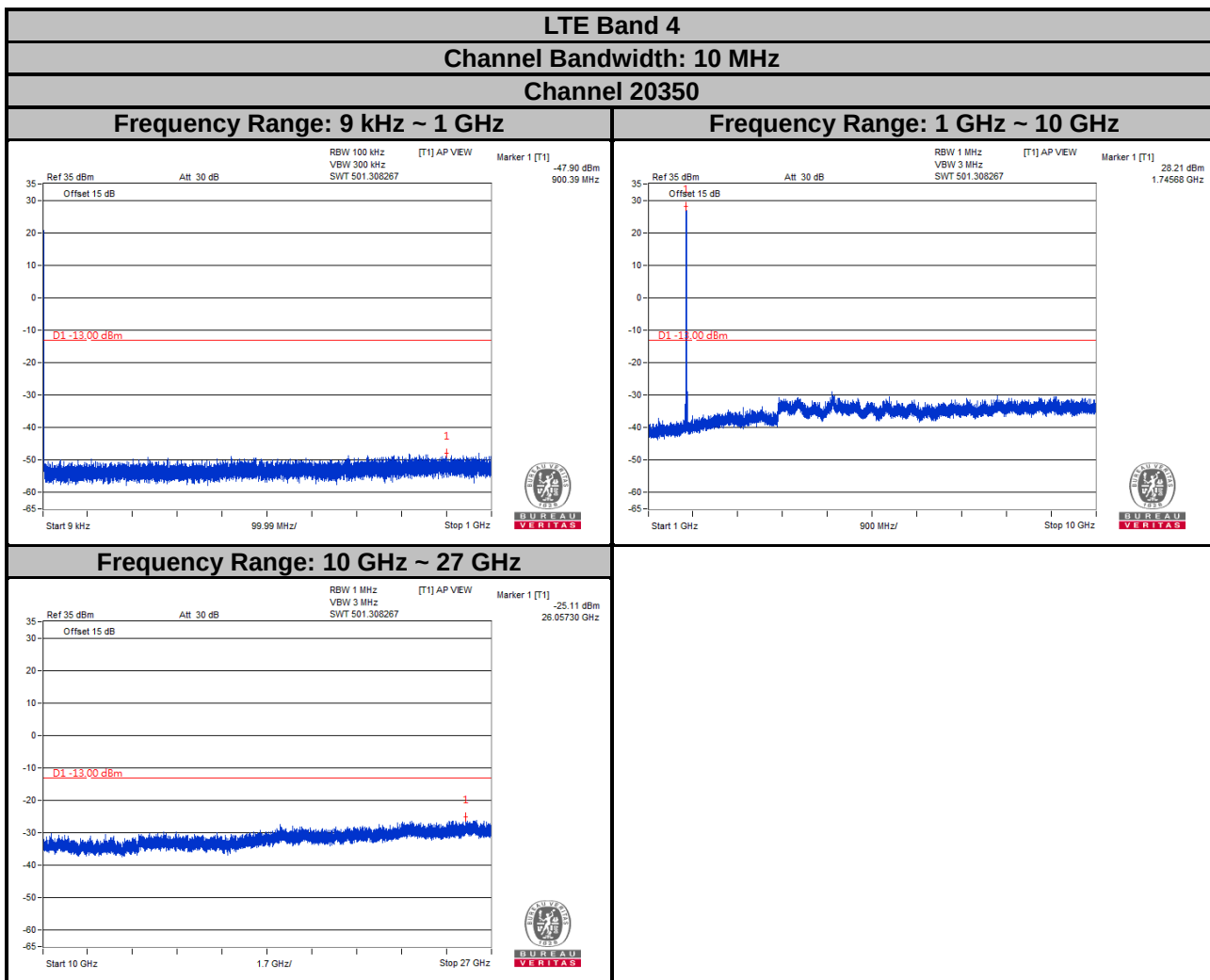
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



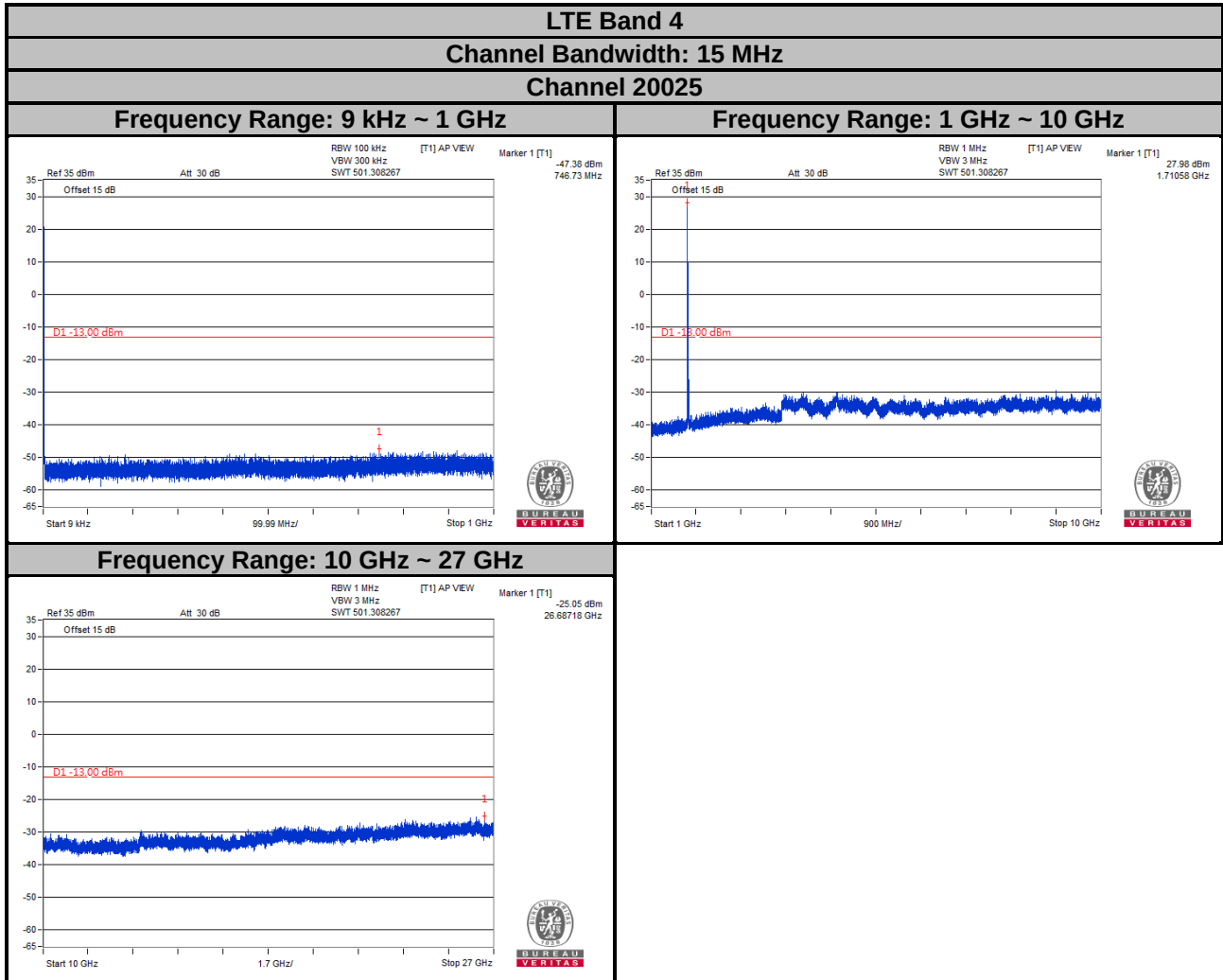
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



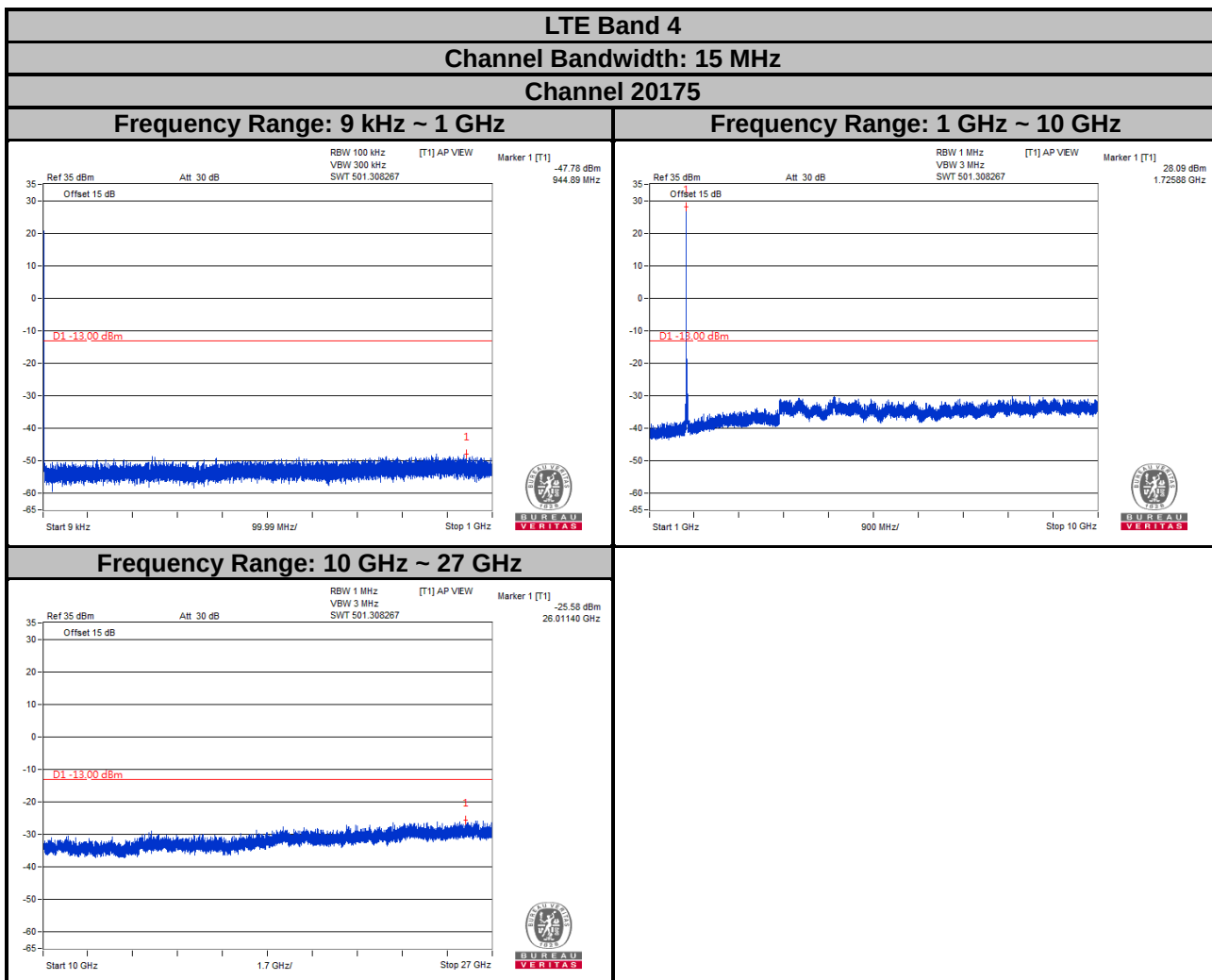
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



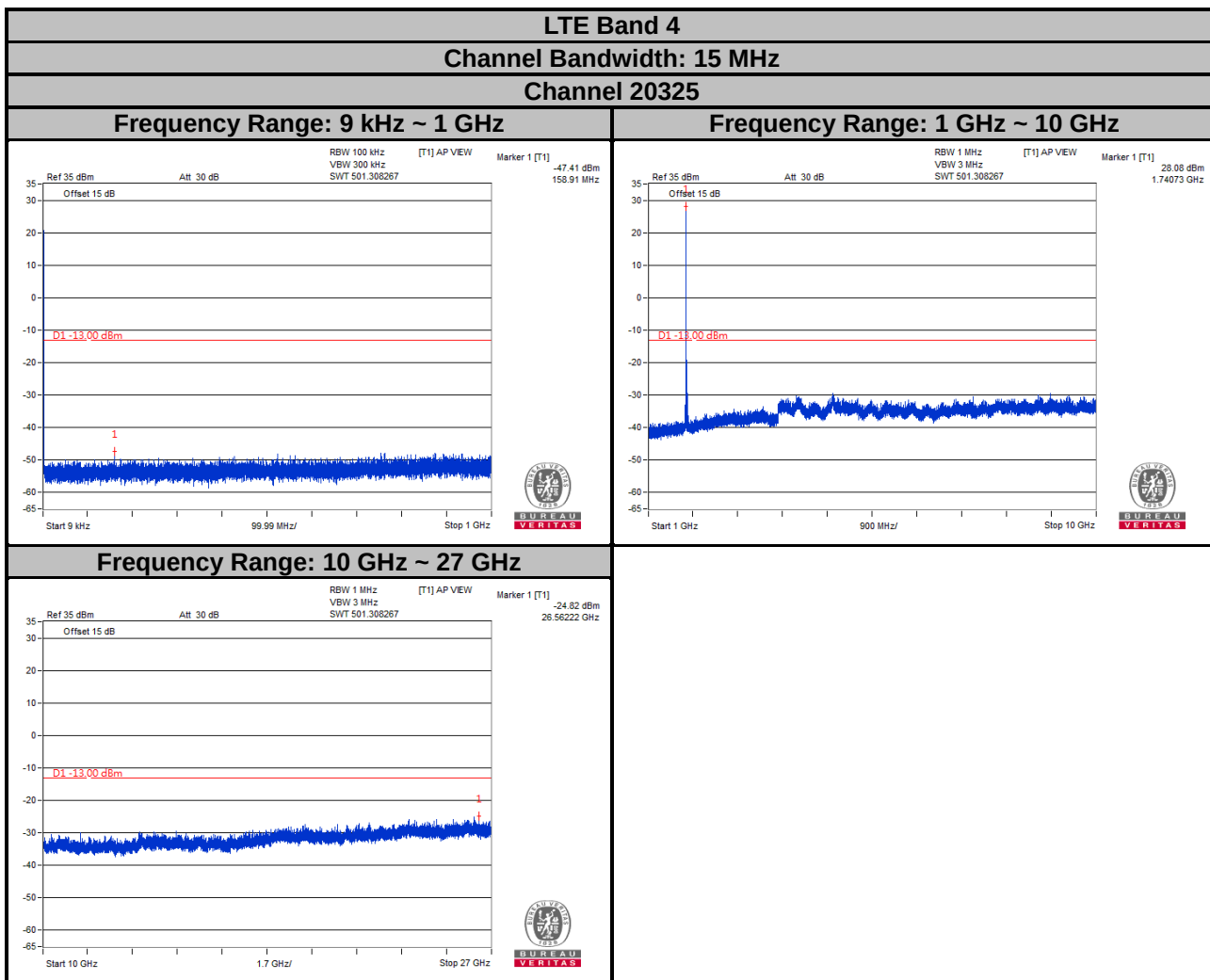
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



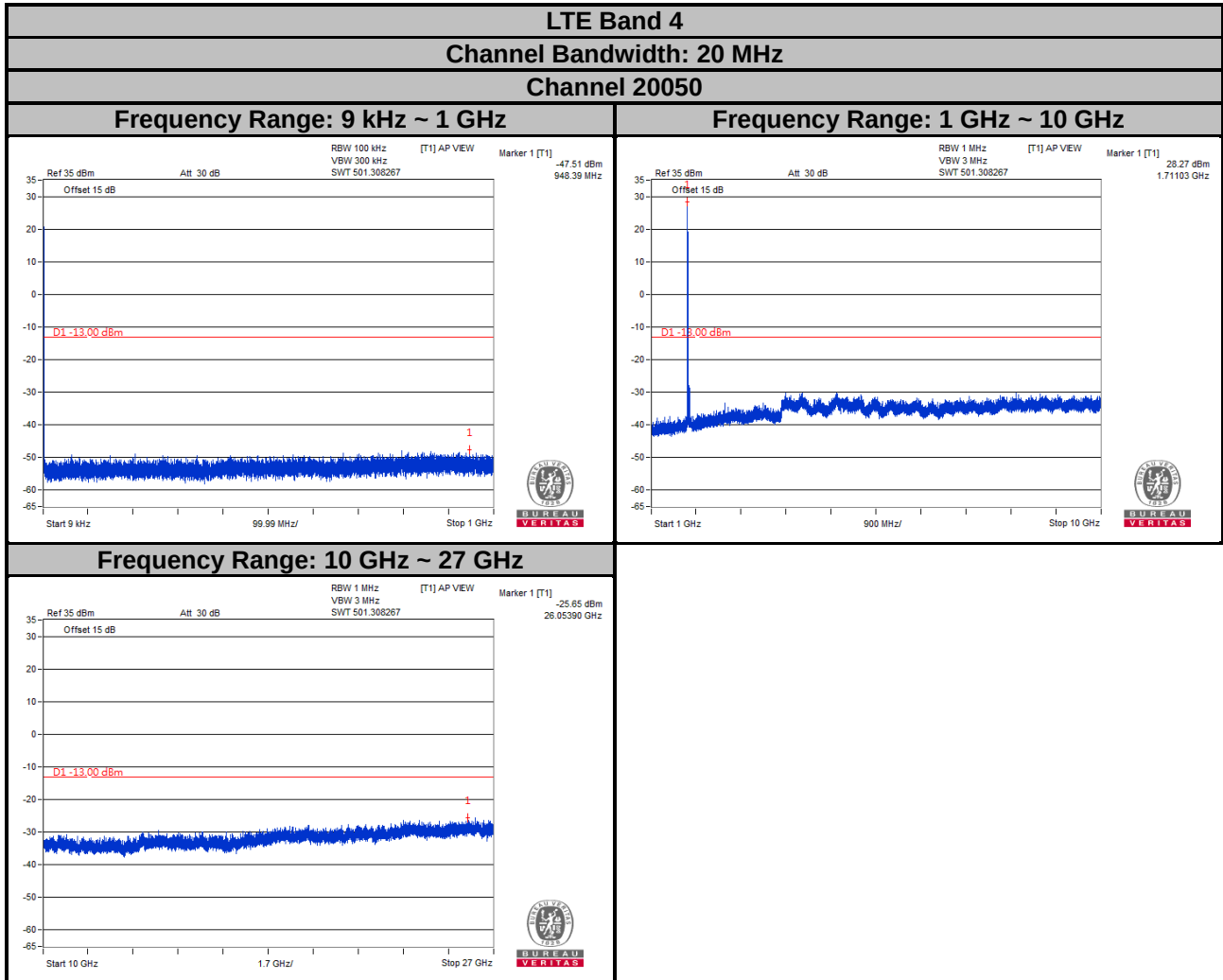
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



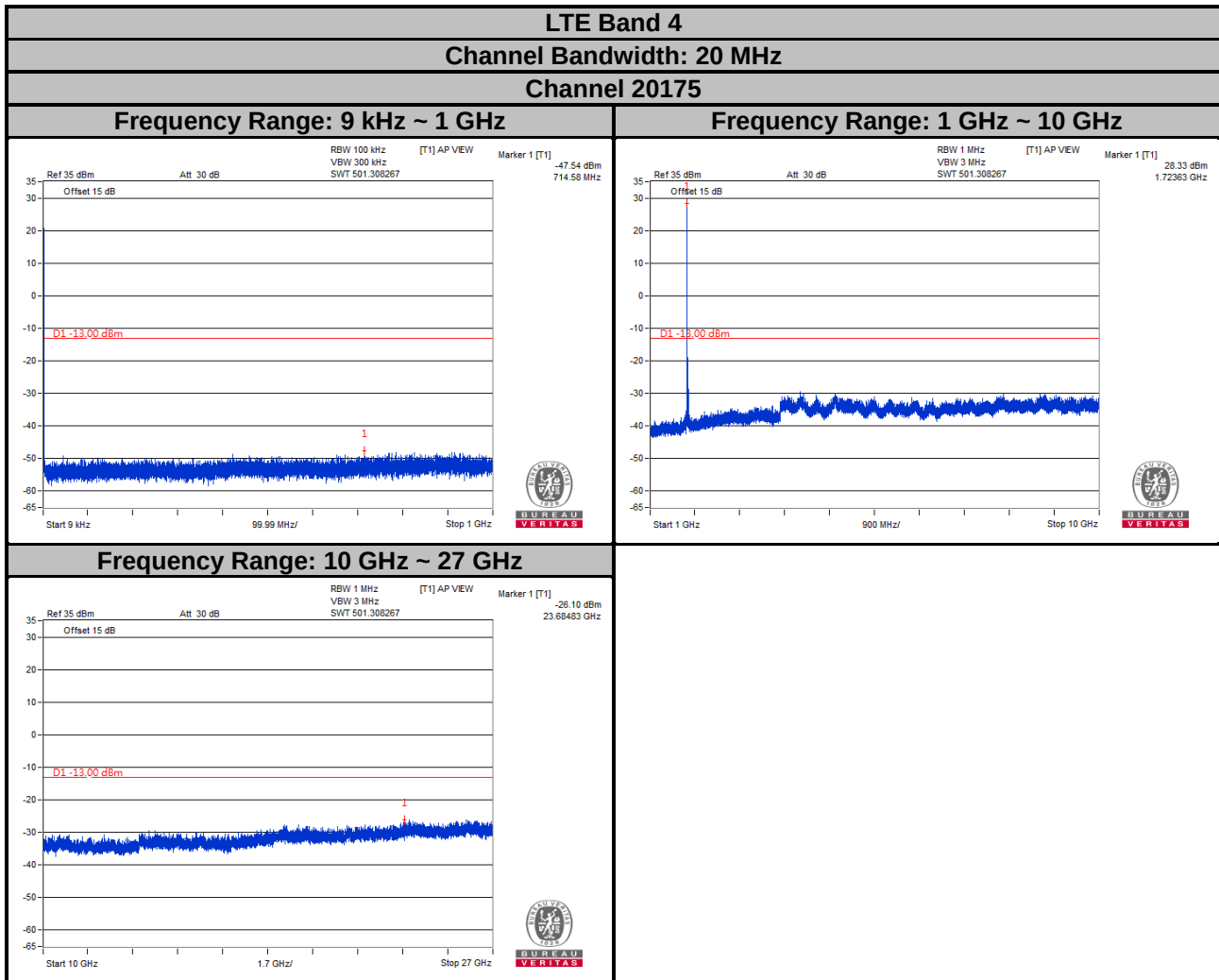
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



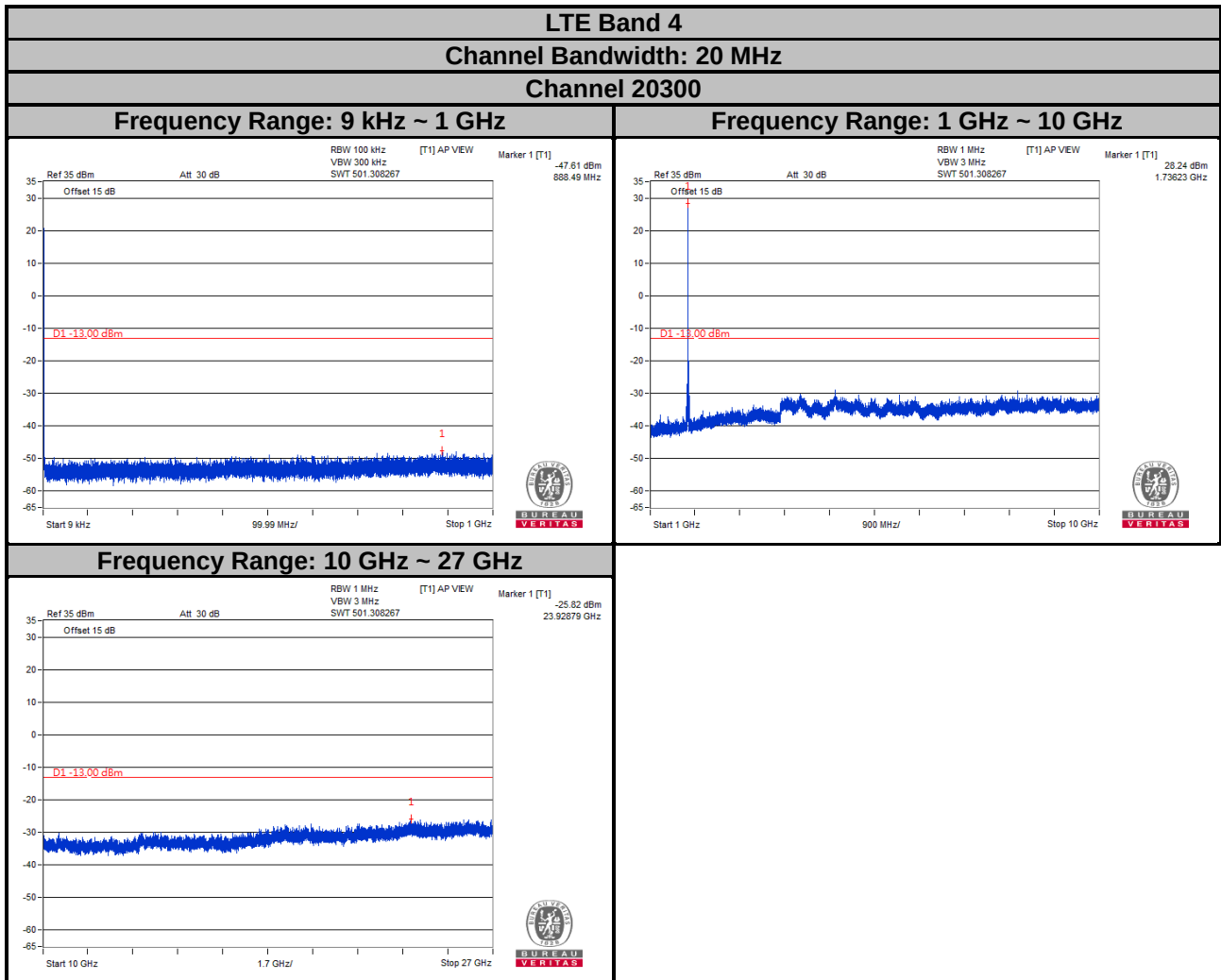
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



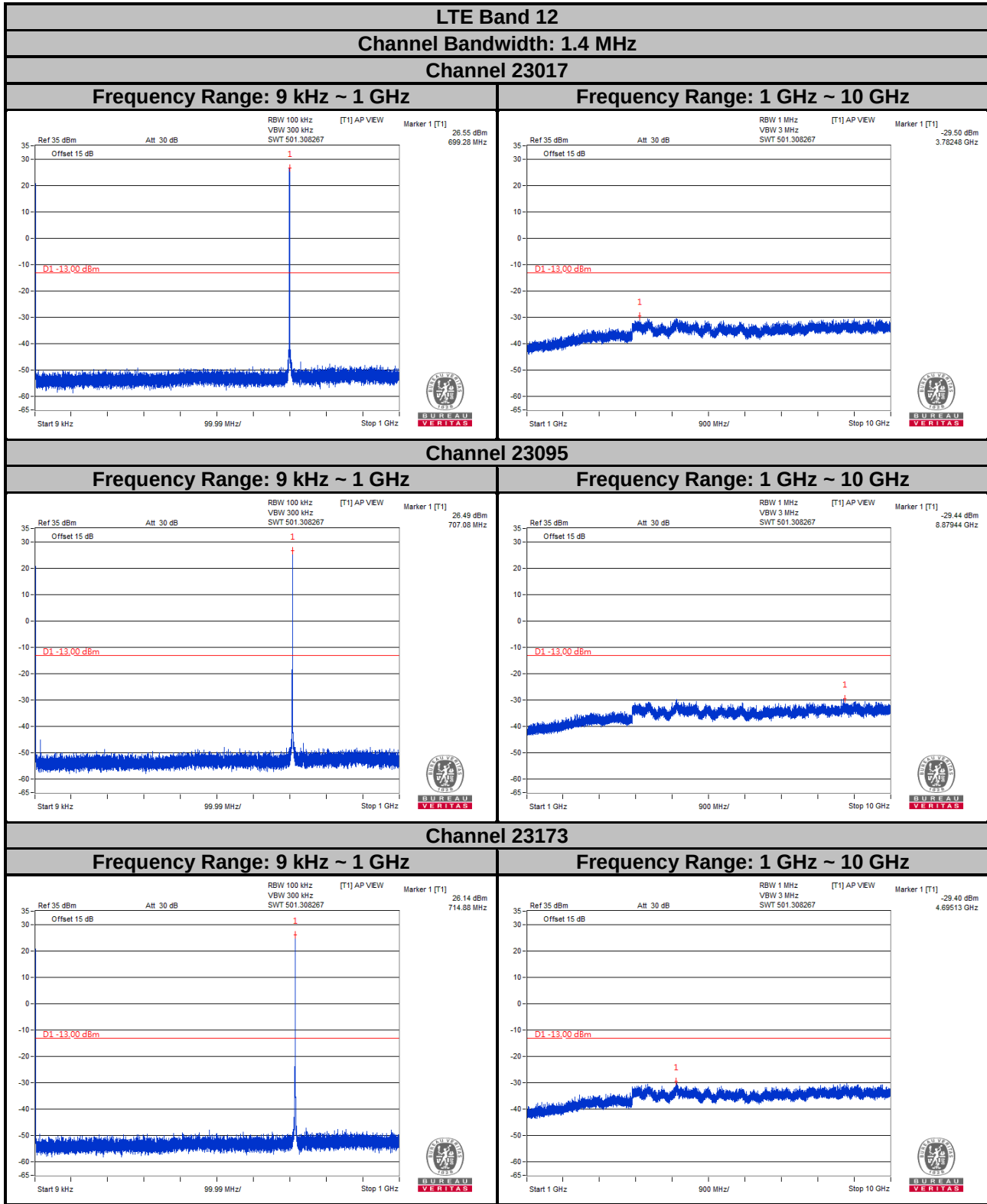
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



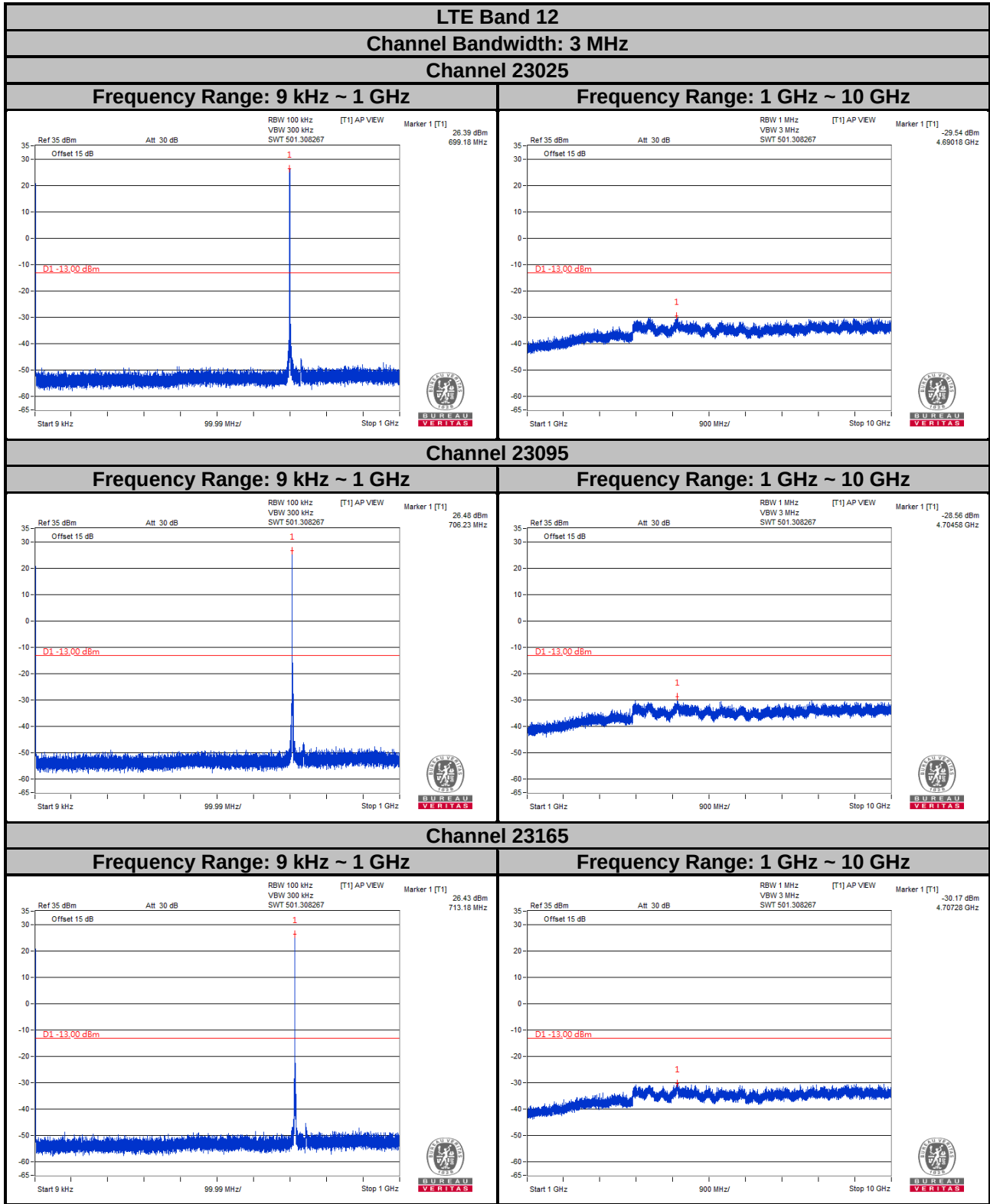
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



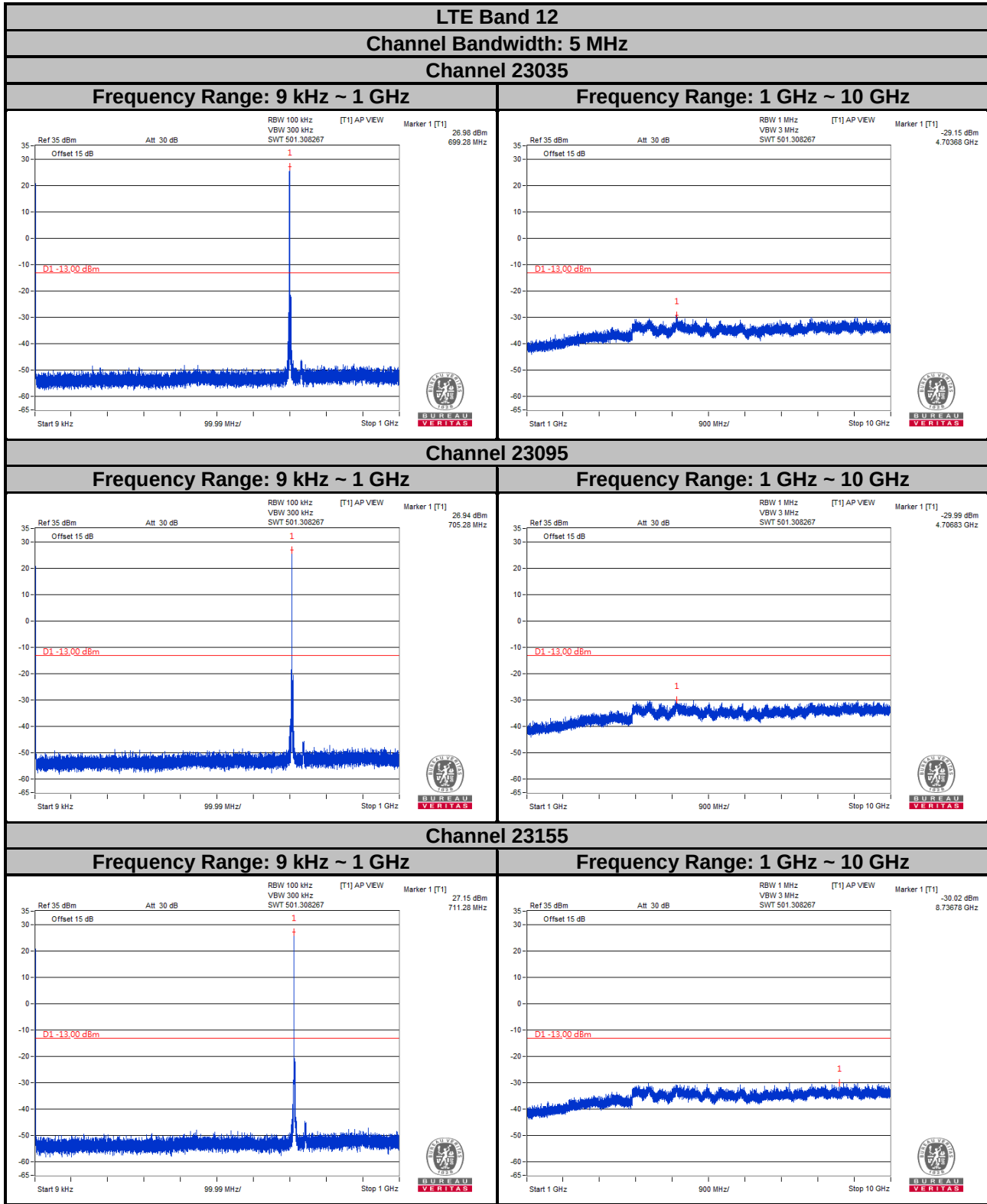
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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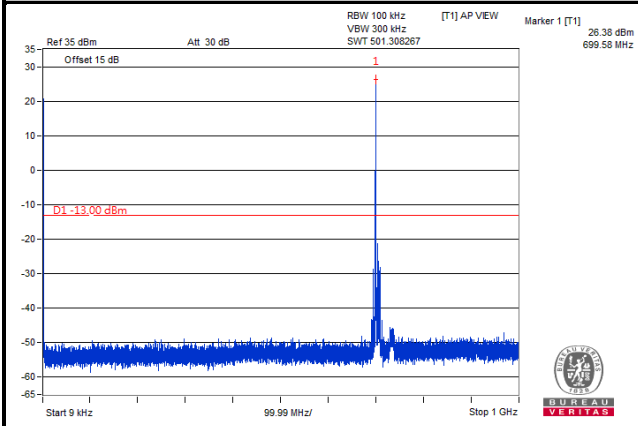
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 12

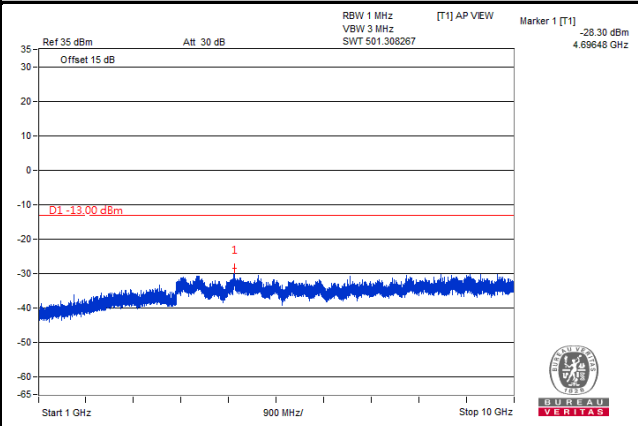
Channel Bandwidth: 10 MHz

Channel 23060

Frequency Range: 9 kHz ~ 1 GHz

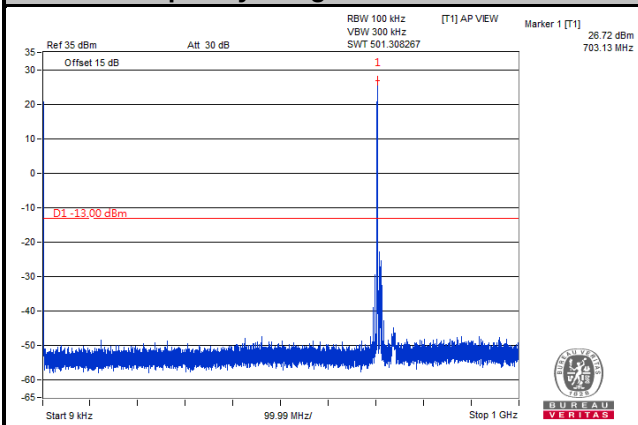


Frequency Range: 1 GHz ~ 10 GHz

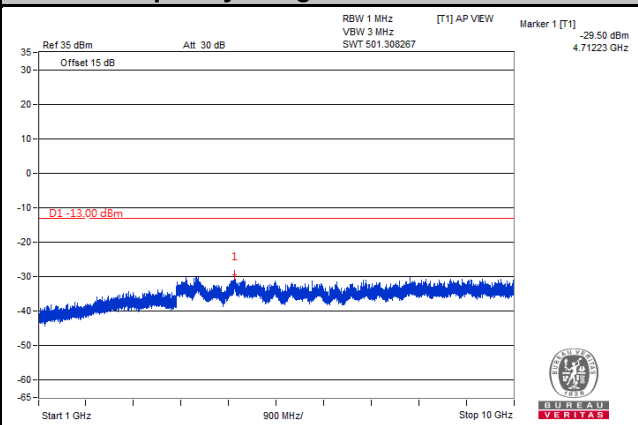


Channel 23095

Frequency Range: 9 kHz ~ 1 GHz

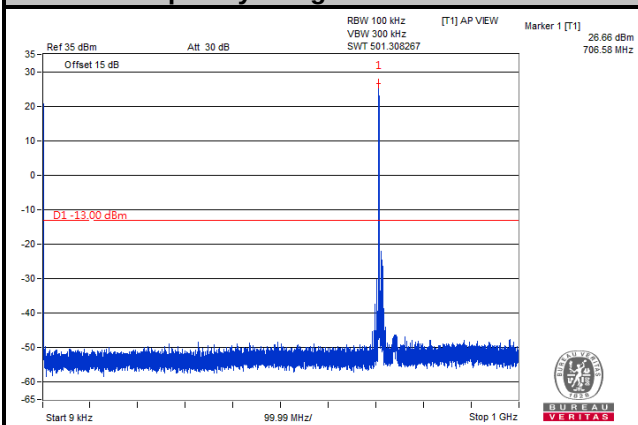


Frequency Range: 1 GHz ~ 10 GHz

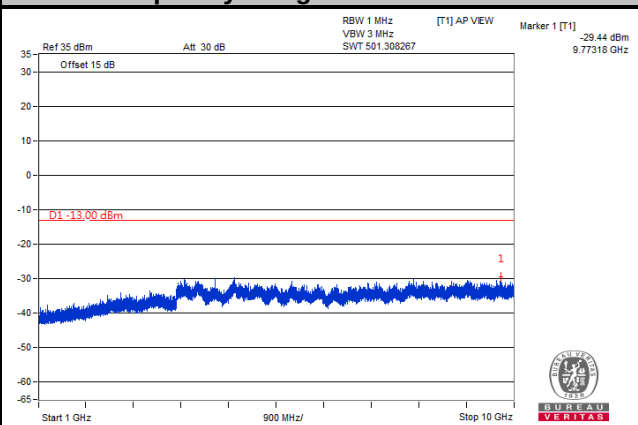


Channel 23130

Frequency Range: 9 kHz ~ 1 GHz



Frequency Range: 1 GHz ~ 10 GHz



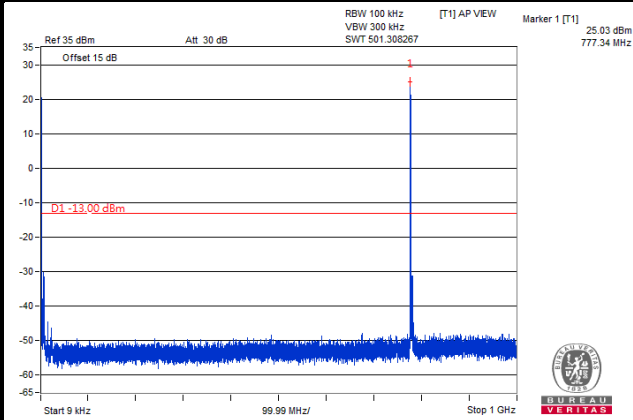
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 13

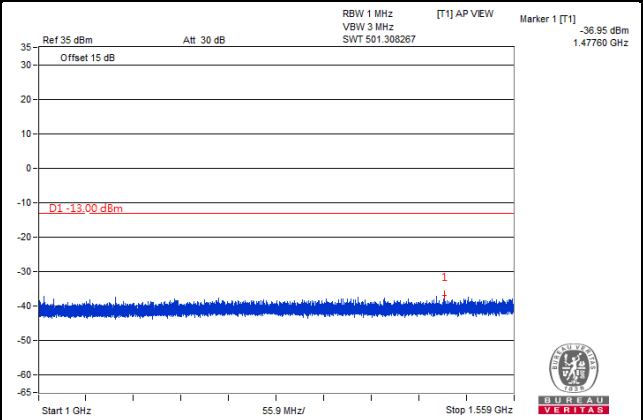
Channel Bandwidth: 5 MHz

Channel 23205

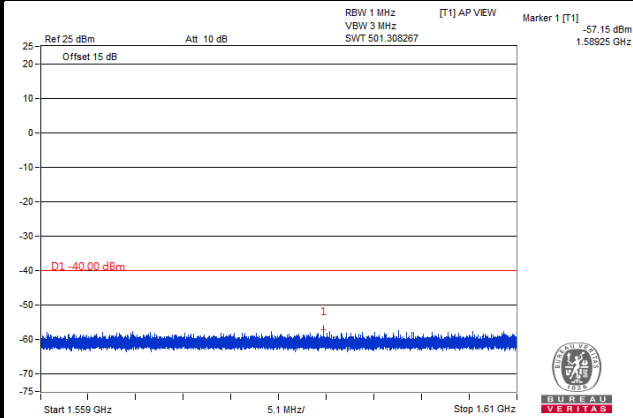
Frequency Range: 9 kHz ~ 1 GHz



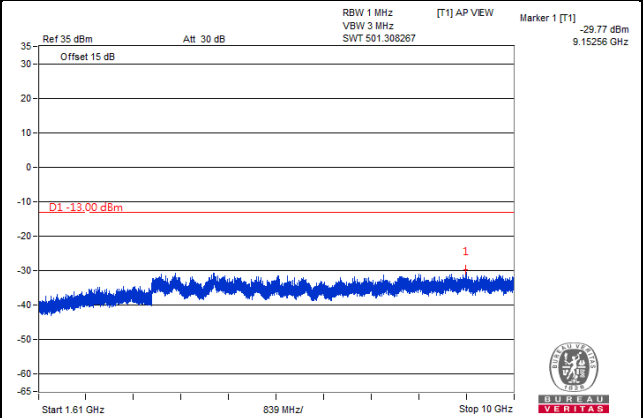
Frequency Range: 1 GHz ~ 1.559 GHz



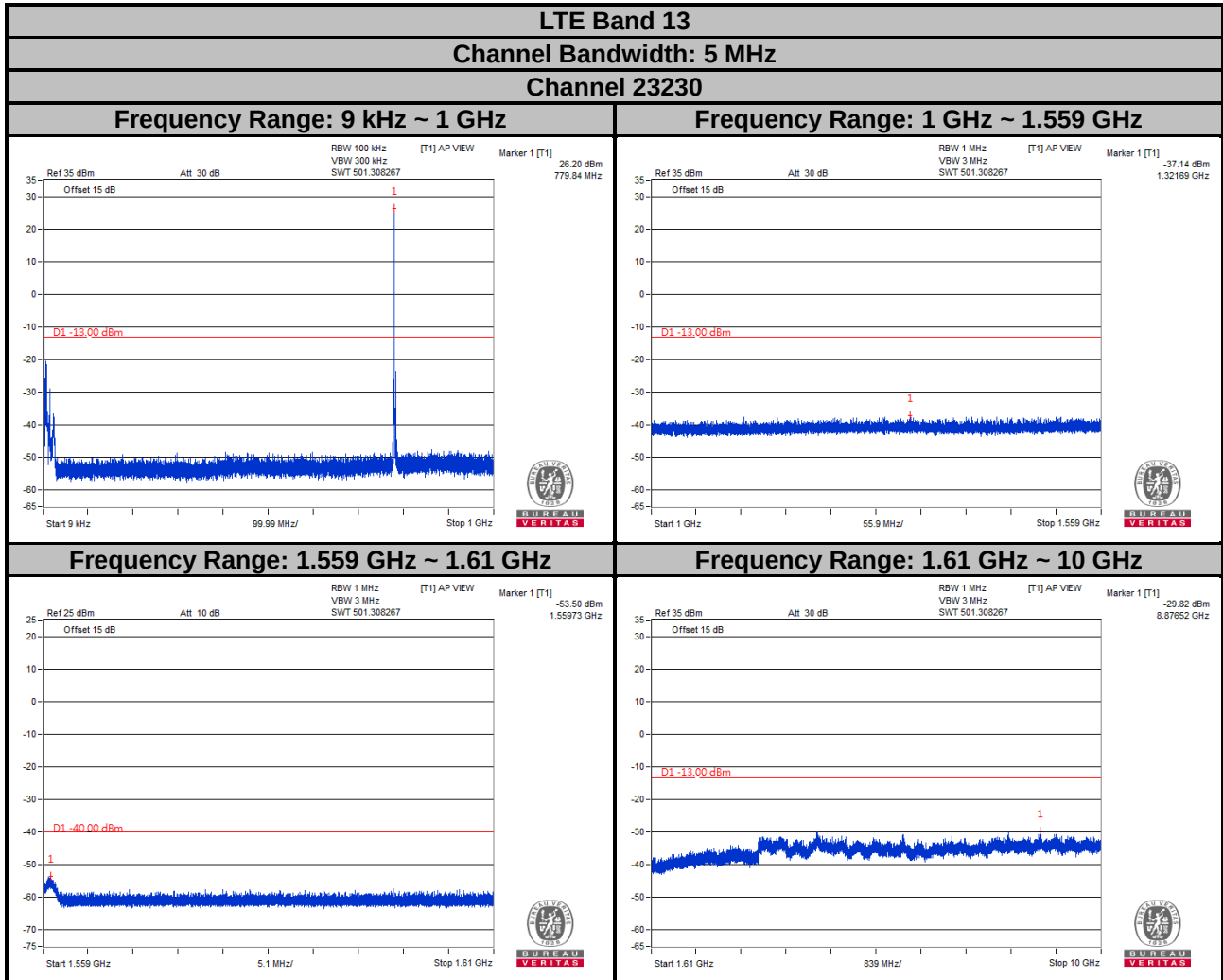
Frequency Range: 1.559 GHz ~ 1.61 GHz



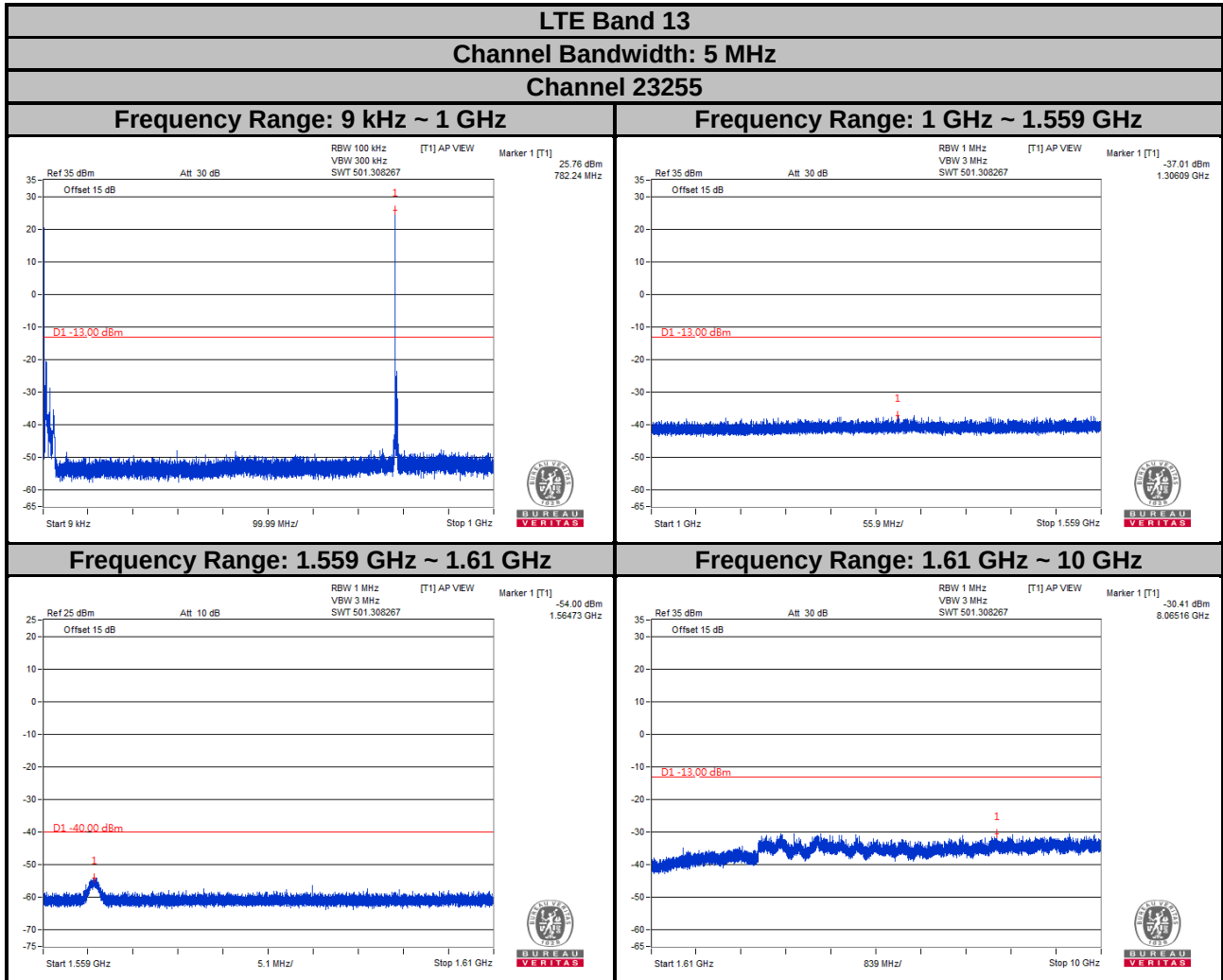
Frequency Range: 1.61 GHz ~ 10 GHz



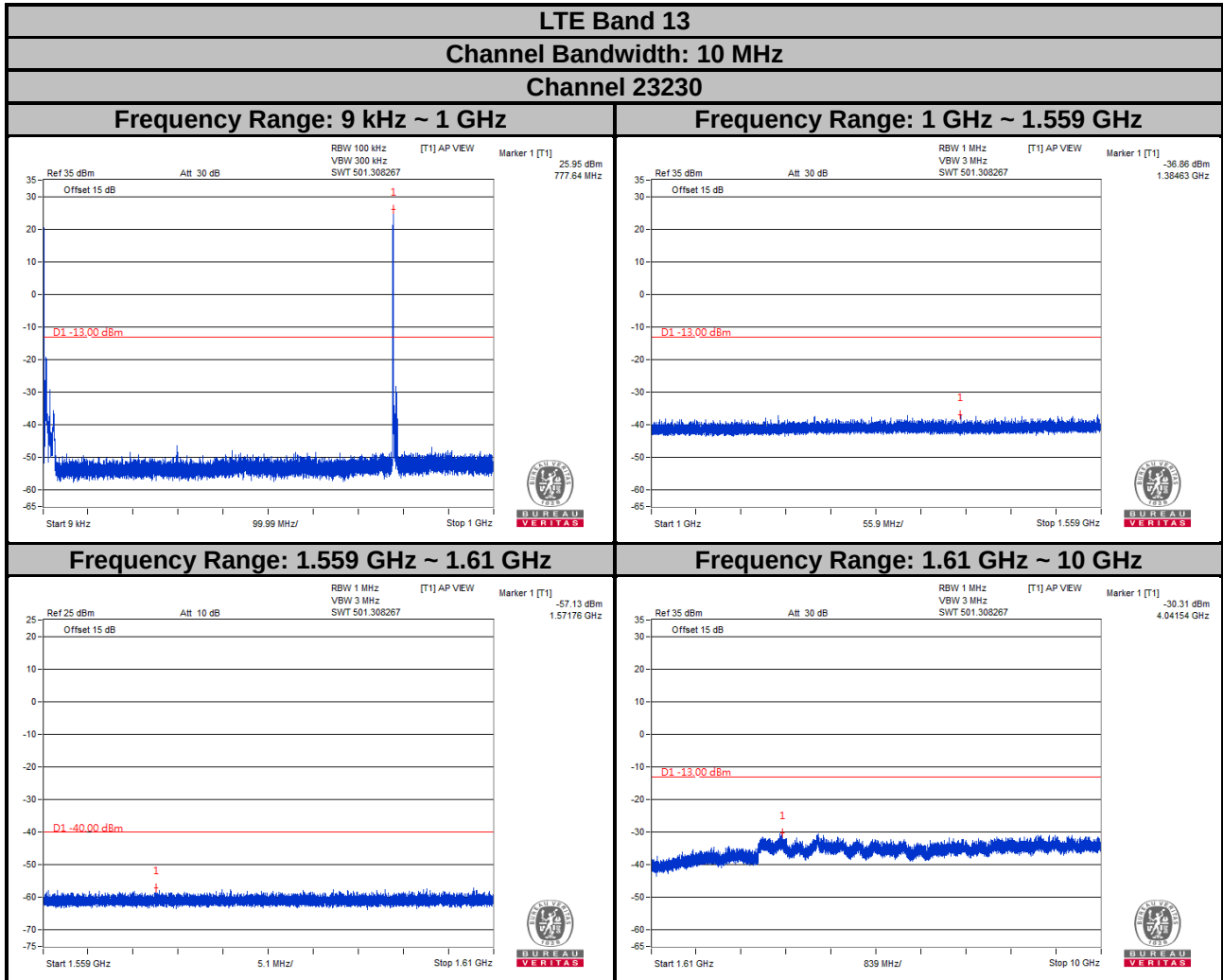
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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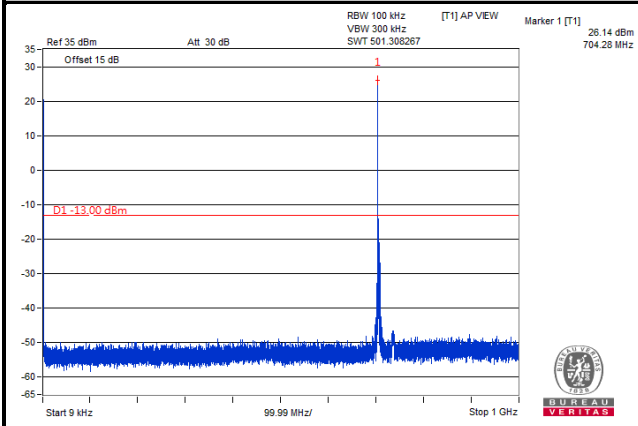
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 17

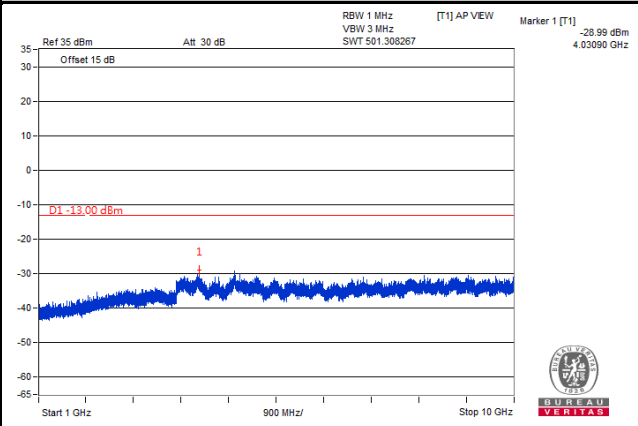
Channel Bandwidth: 5 MHz

Channel 23755

Frequency Range: 9 kHz ~ 1 GHz

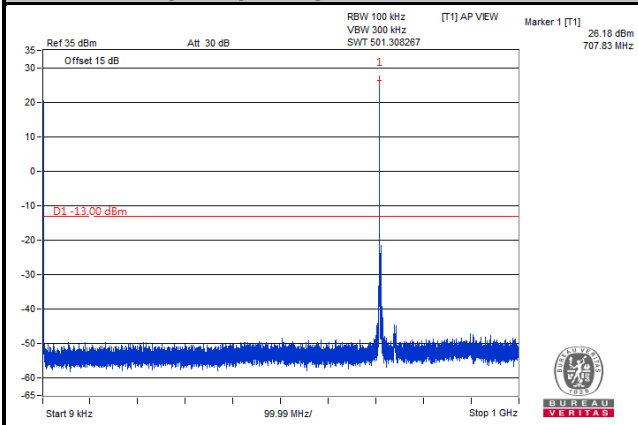


Frequency Range: 1 GHz ~ 10 GHz

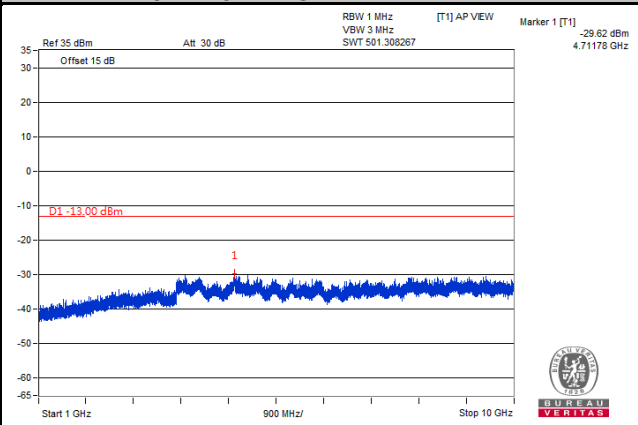


Channel 23790

Frequency Range: 9 kHz ~ 1 GHz

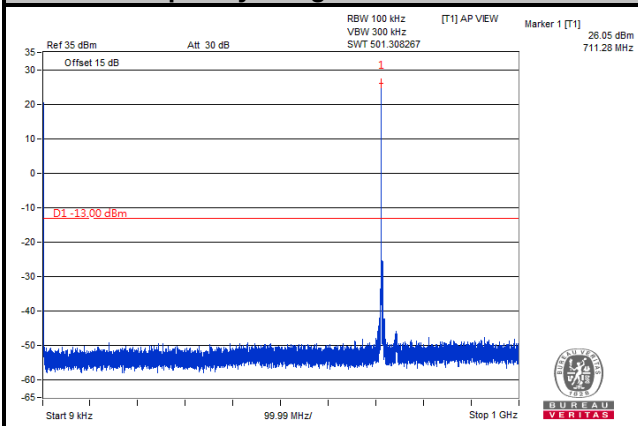


Frequency Range: 1 GHz ~ 10 GHz

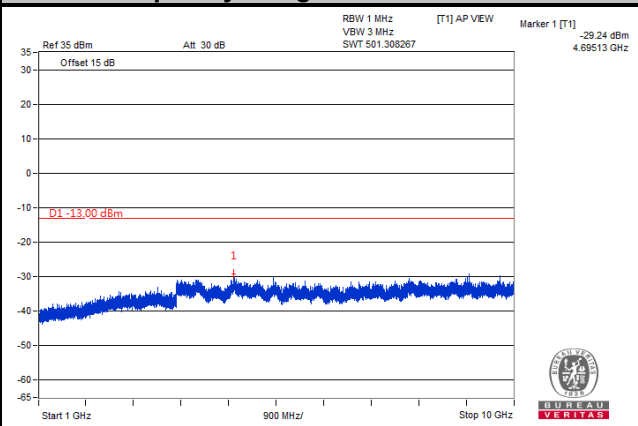


Channel 23825

Frequency Range: 9 kHz ~ 1 GHz



Frequency Range: 1 GHz ~ 10 GHz



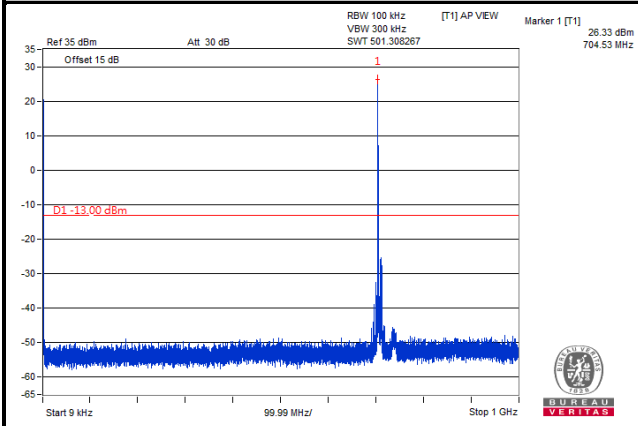
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 17

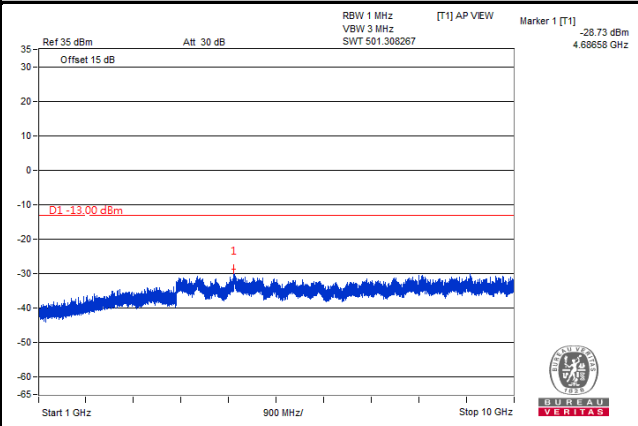
Channel Bandwidth: 10 MHz

Channel 23780

Frequency Range: 9 kHz ~ 1 GHz

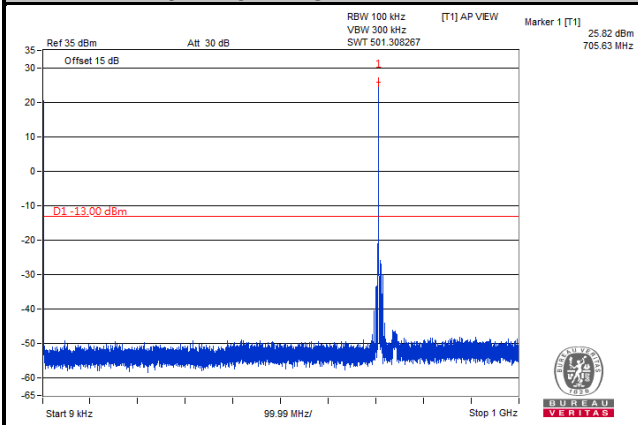


Frequency Range: 1 GHz ~ 10 GHz

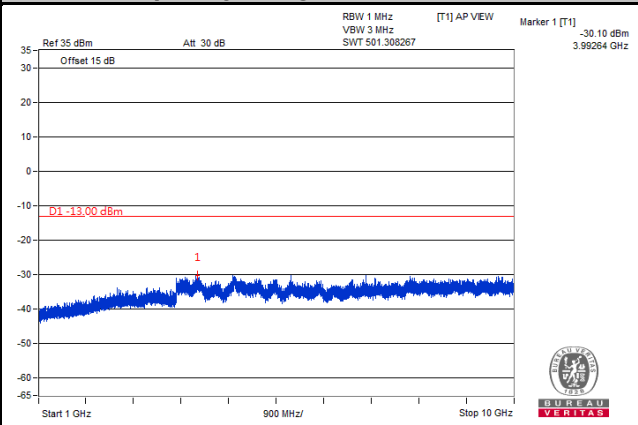


Channel 23790

Frequency Range: 9 kHz ~ 1 GHz

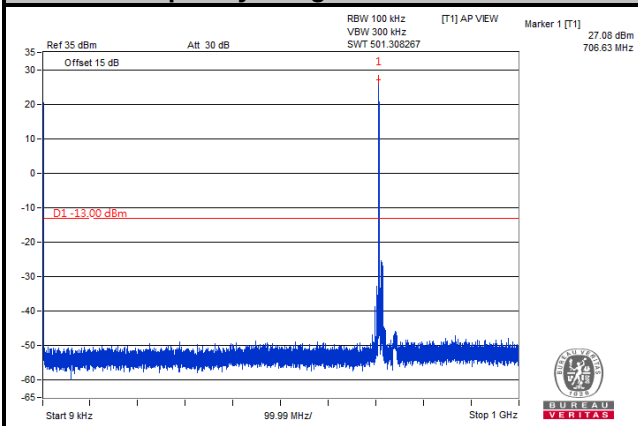


Frequency Range: 1 GHz ~ 10 GHz

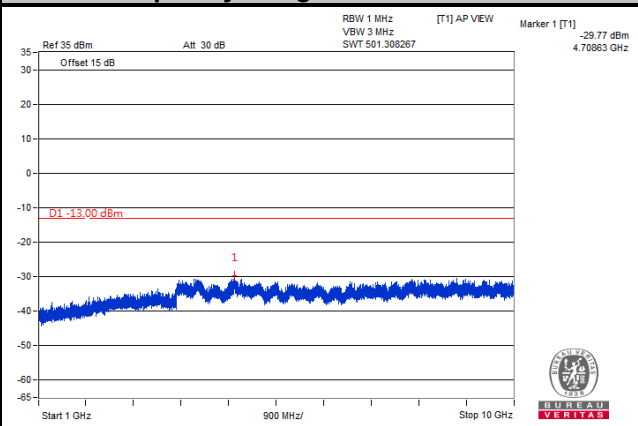


Channel 23800

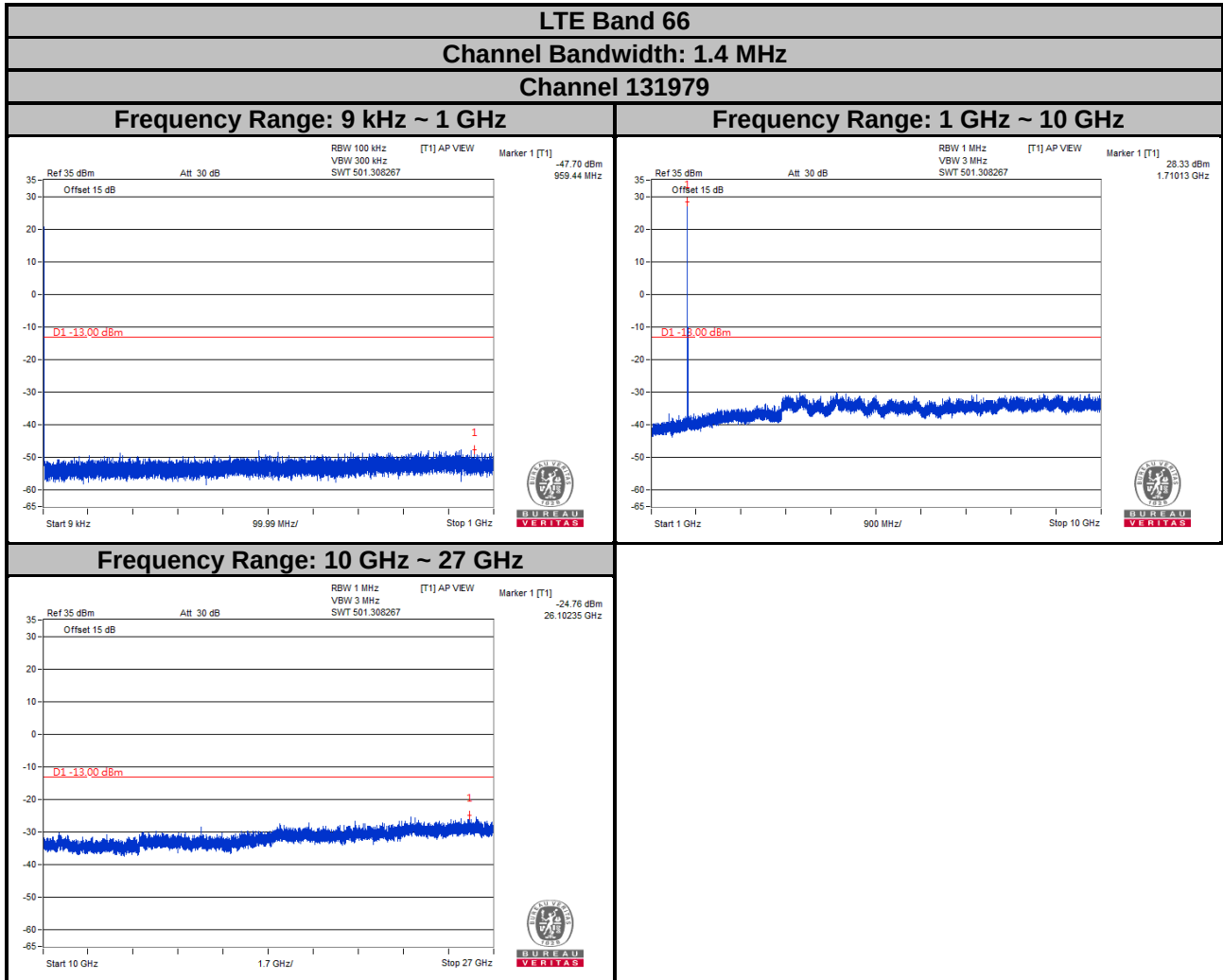
Frequency Range: 9 kHz ~ 1 GHz



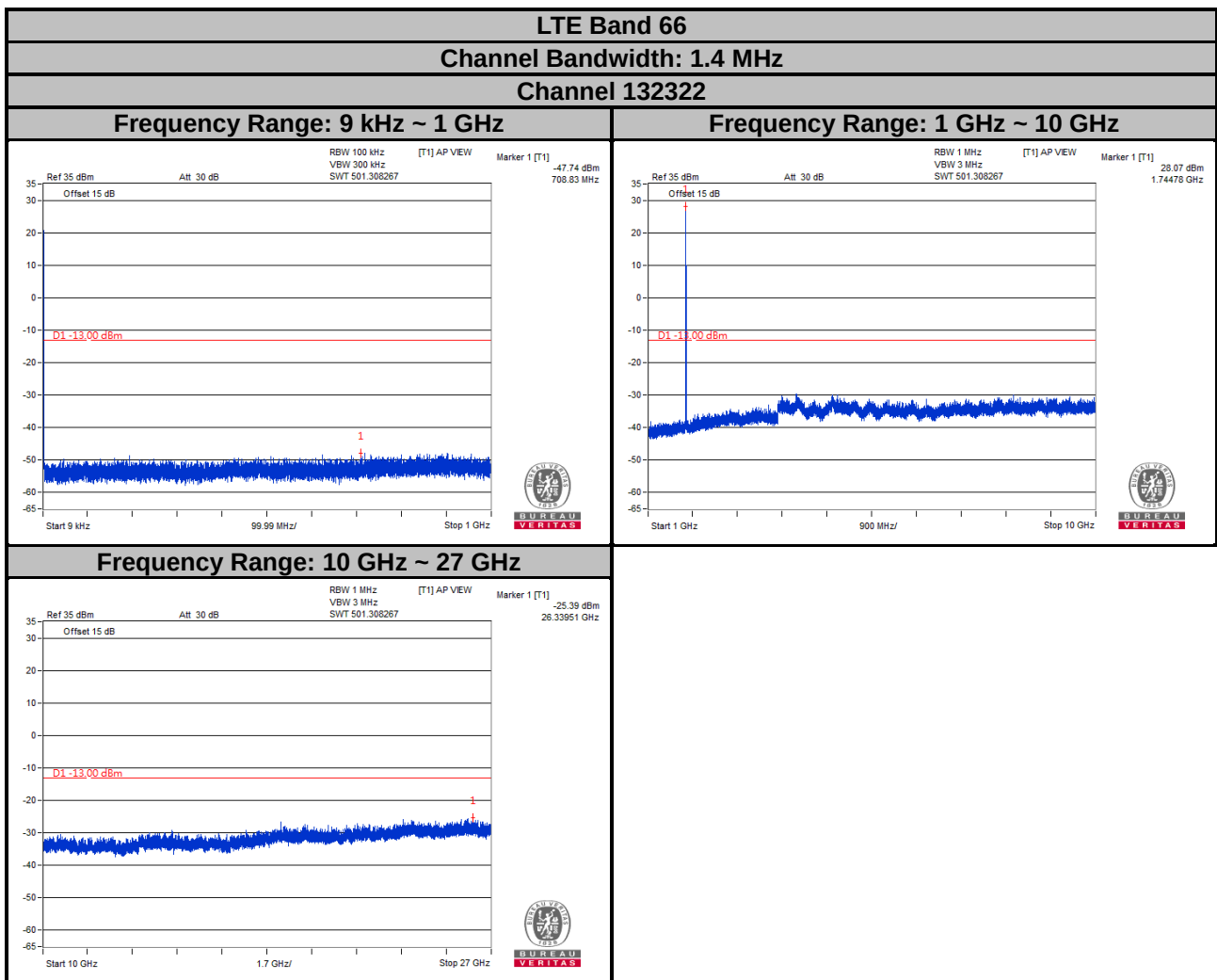
Frequency Range: 1 GHz ~ 10 GHz



Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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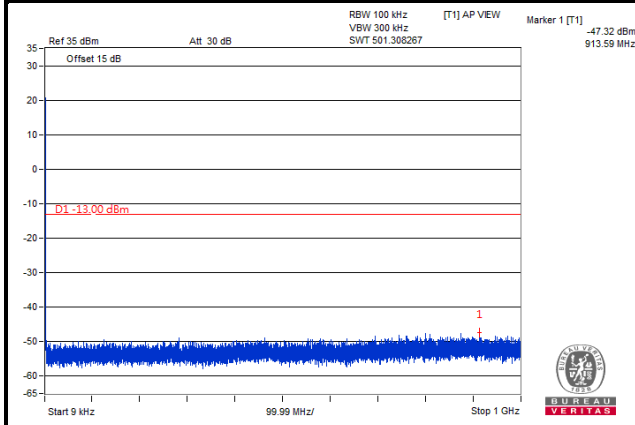
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 66

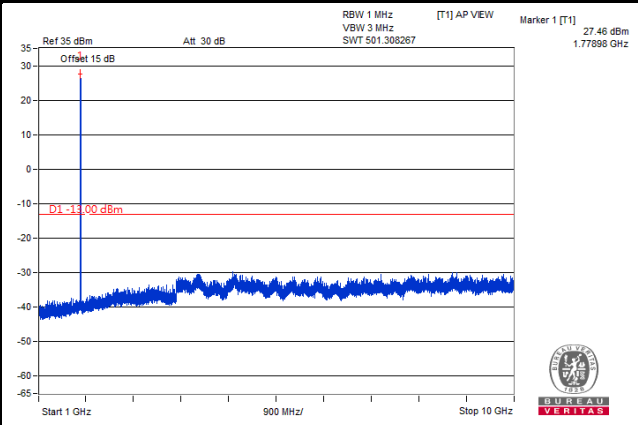
Channel Bandwidth: 1.4 MHz

Channel 132665

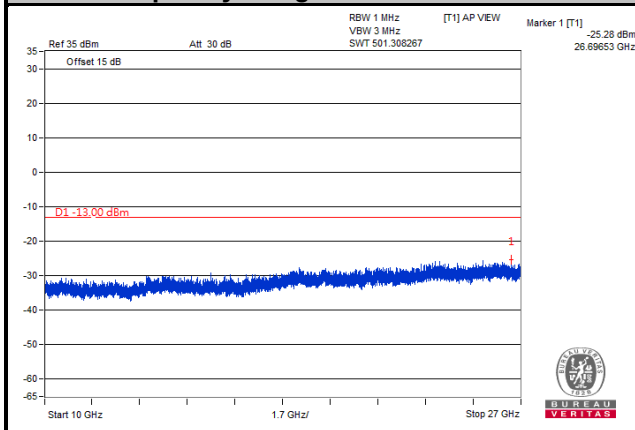
Frequency Range: 9 kHz ~ 1 GHz



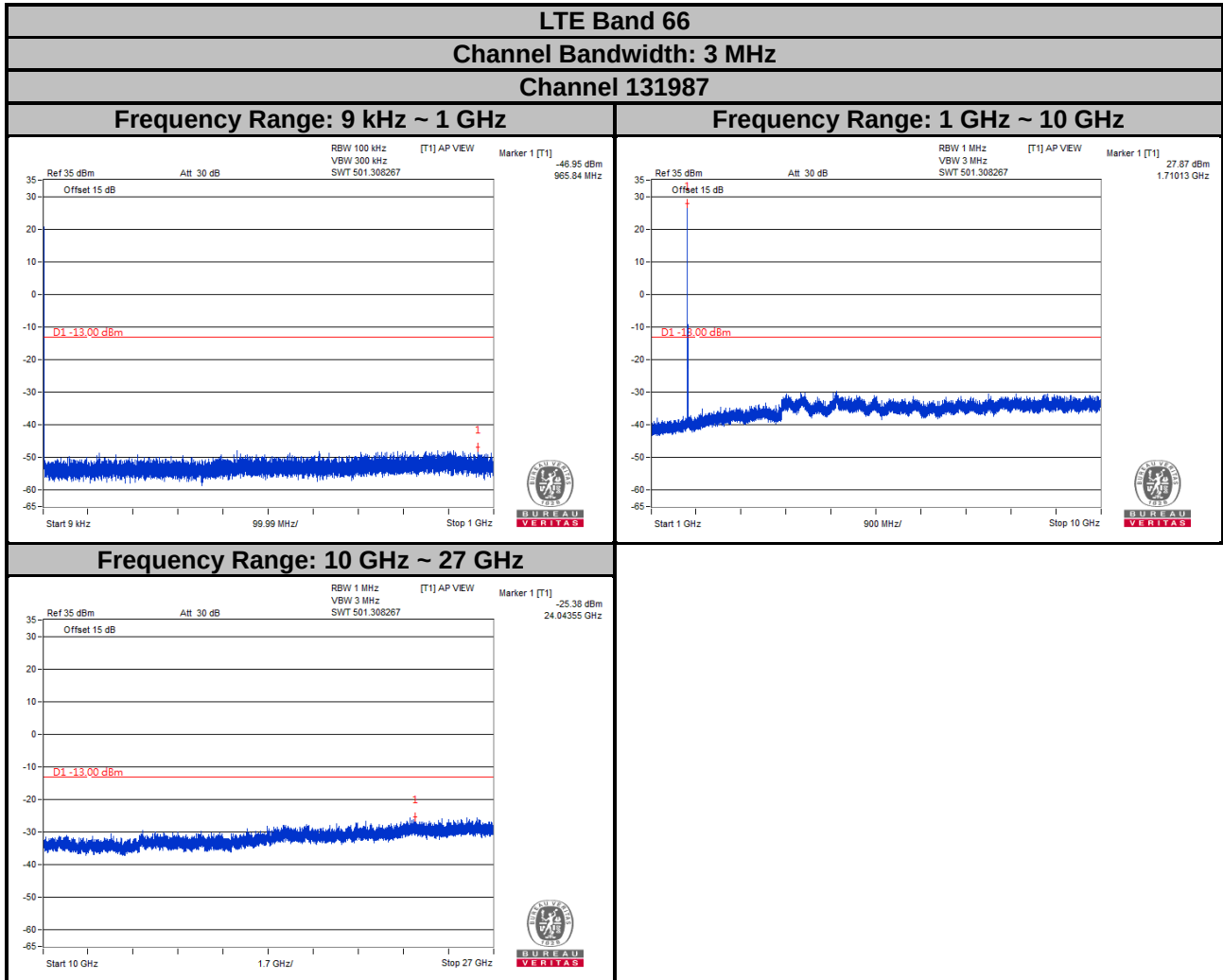
Frequency Range: 1 GHz ~ 10 GHz



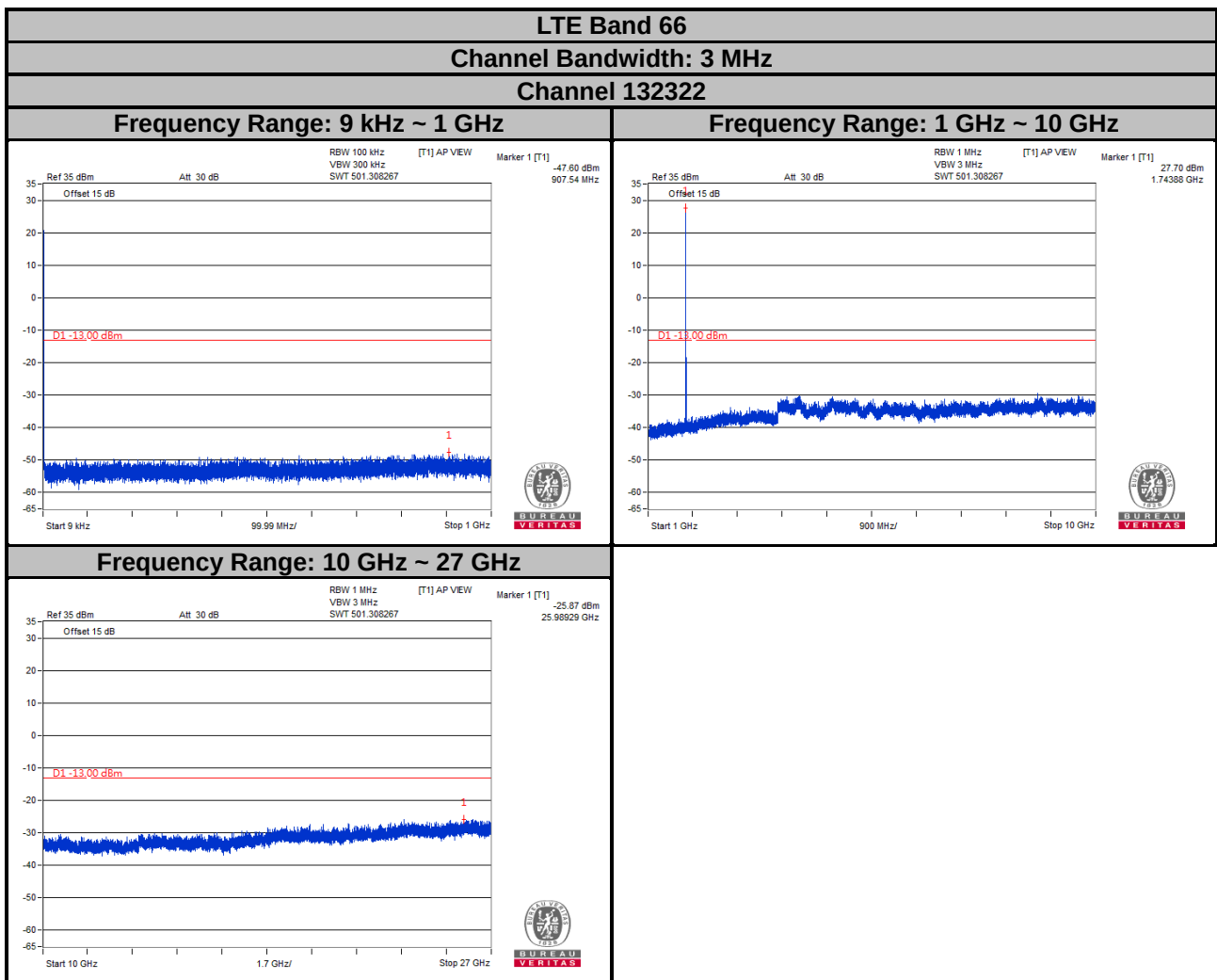
Frequency Range: 10 GHz ~ 27 GHz



Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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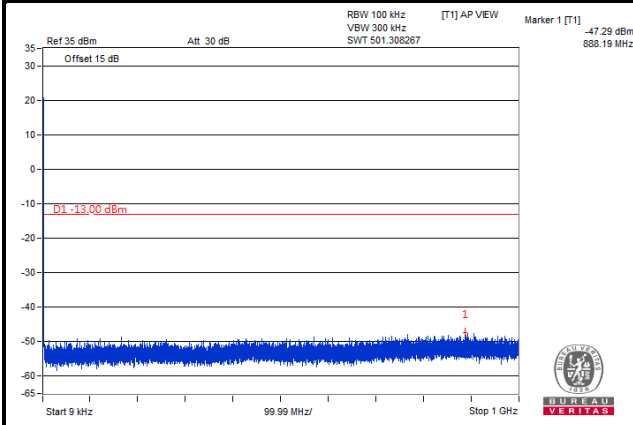
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 66

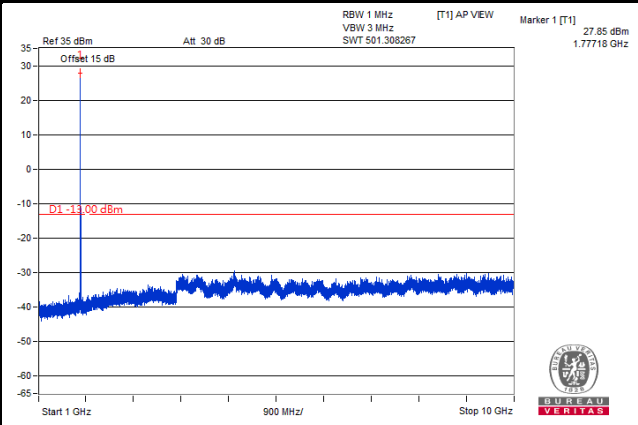
Channel Bandwidth: 3 MHz

Channel 132657

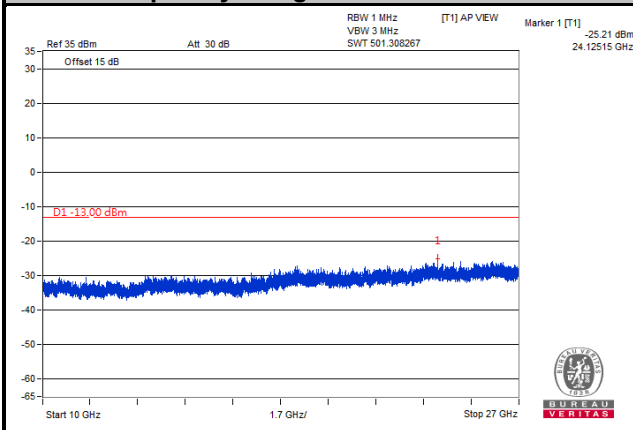
Frequency Range: 9 kHz ~ 1 GHz



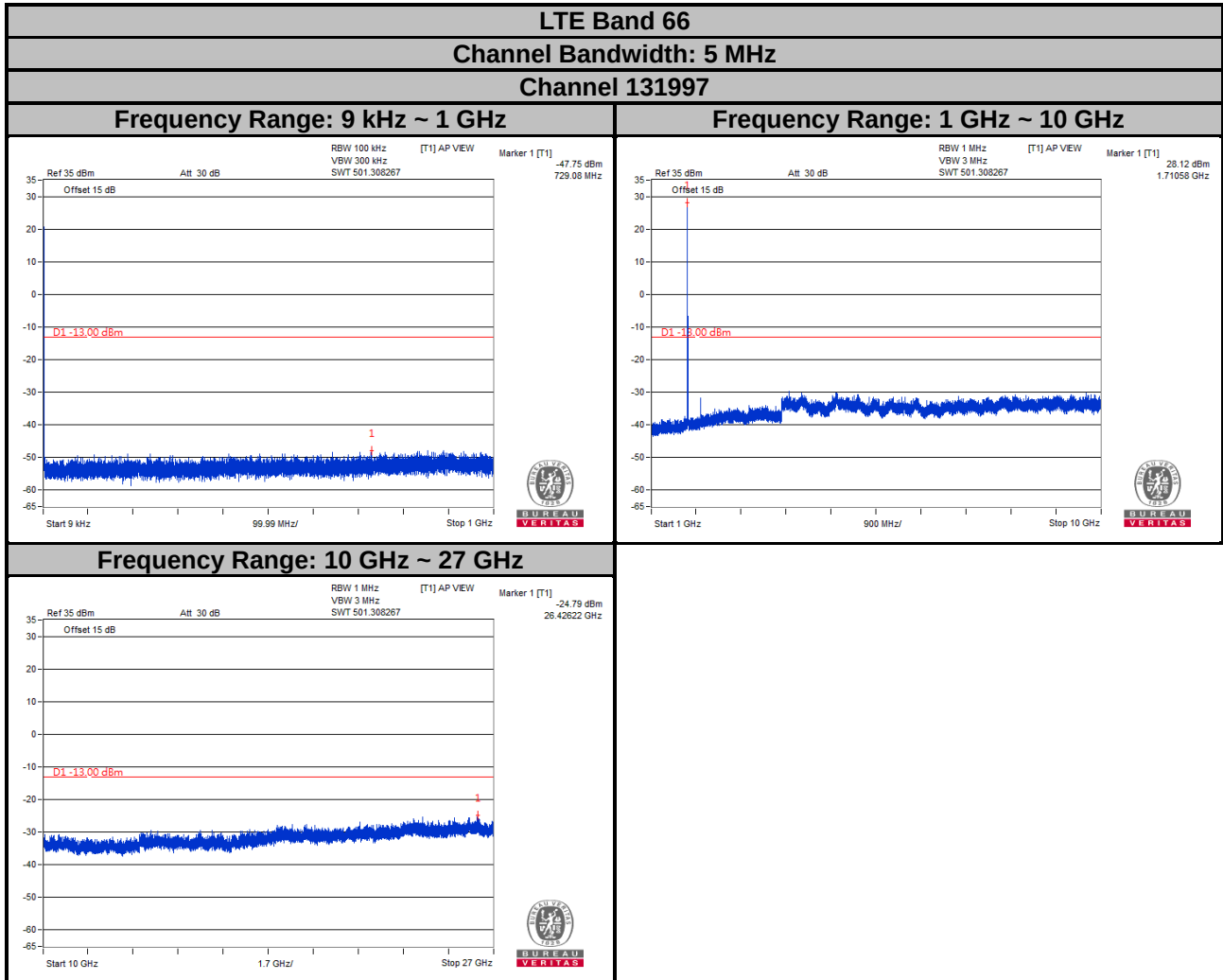
Frequency Range: 1 GHz ~ 10 GHz



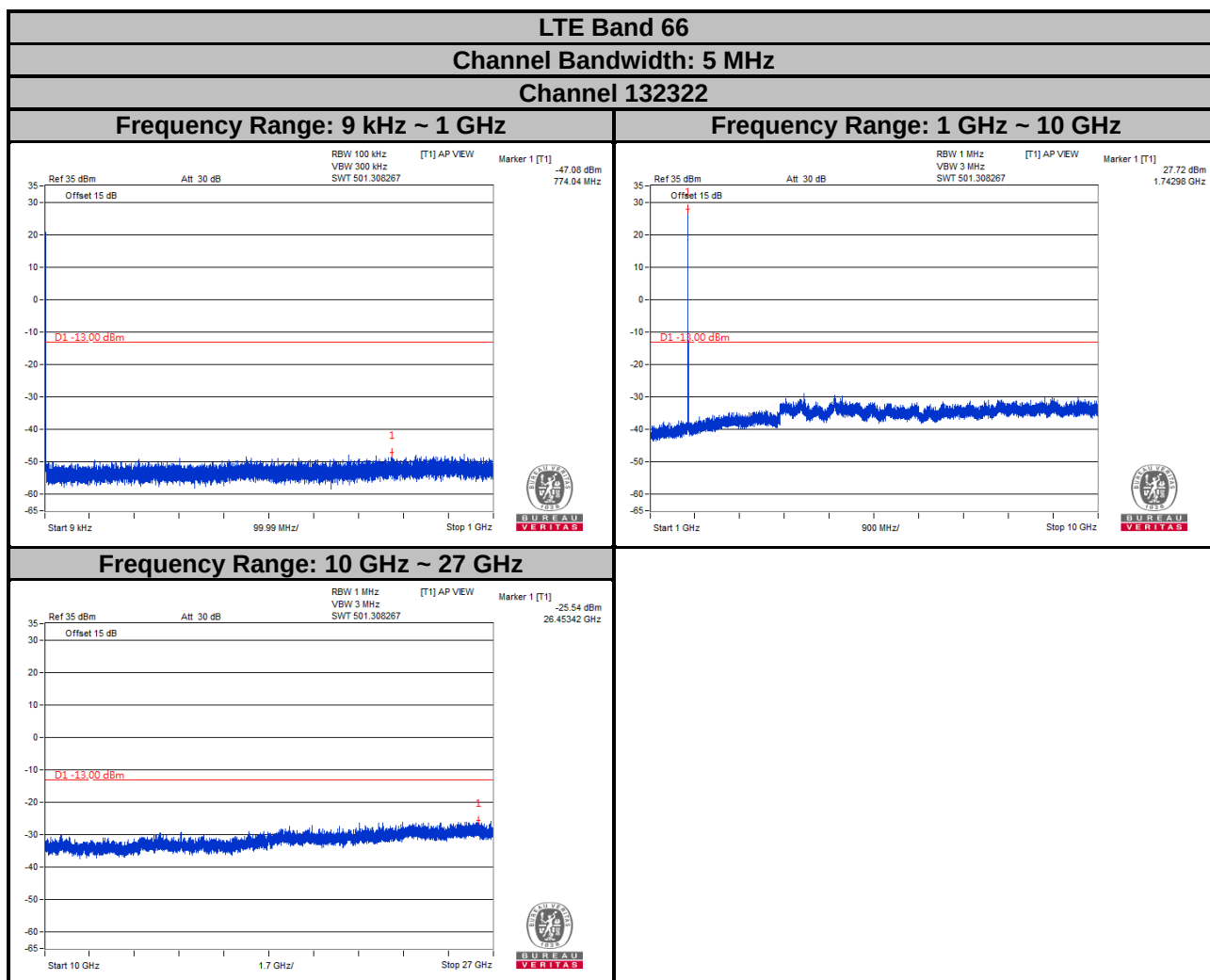
Frequency Range: 10 GHz ~ 27 GHz



Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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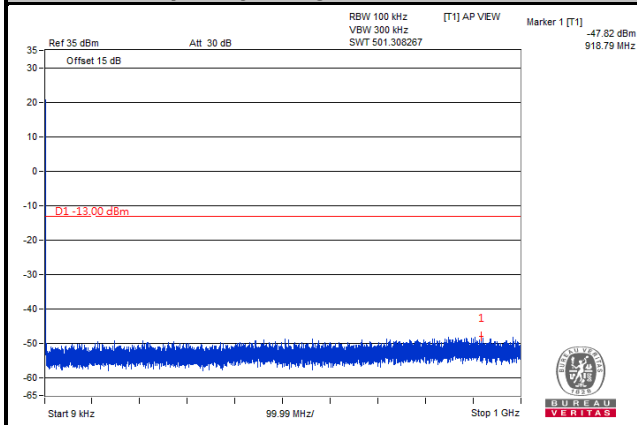
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 66

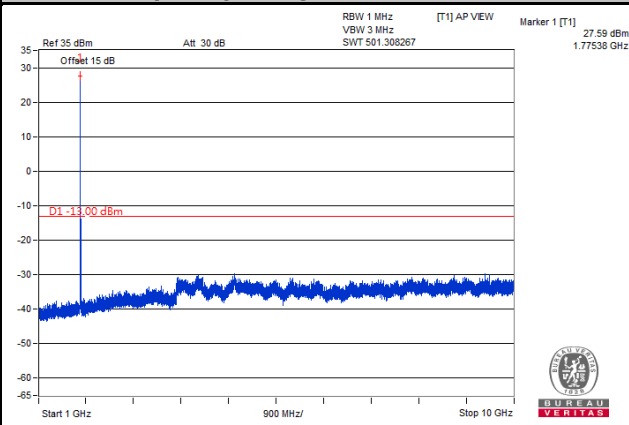
Channel Bandwidth: 5 MHz

Channel 132647

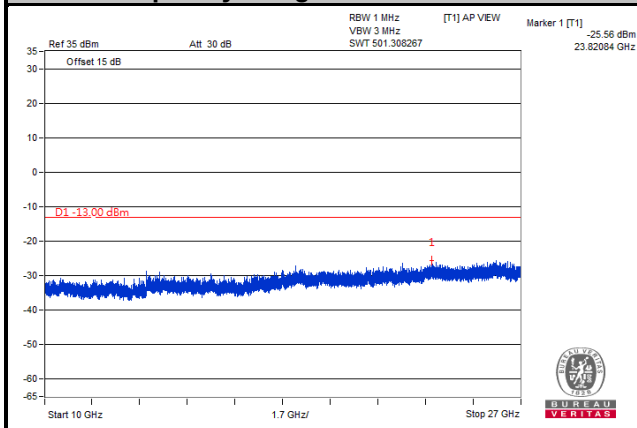
Frequency Range: 9 kHz ~ 1 GHz



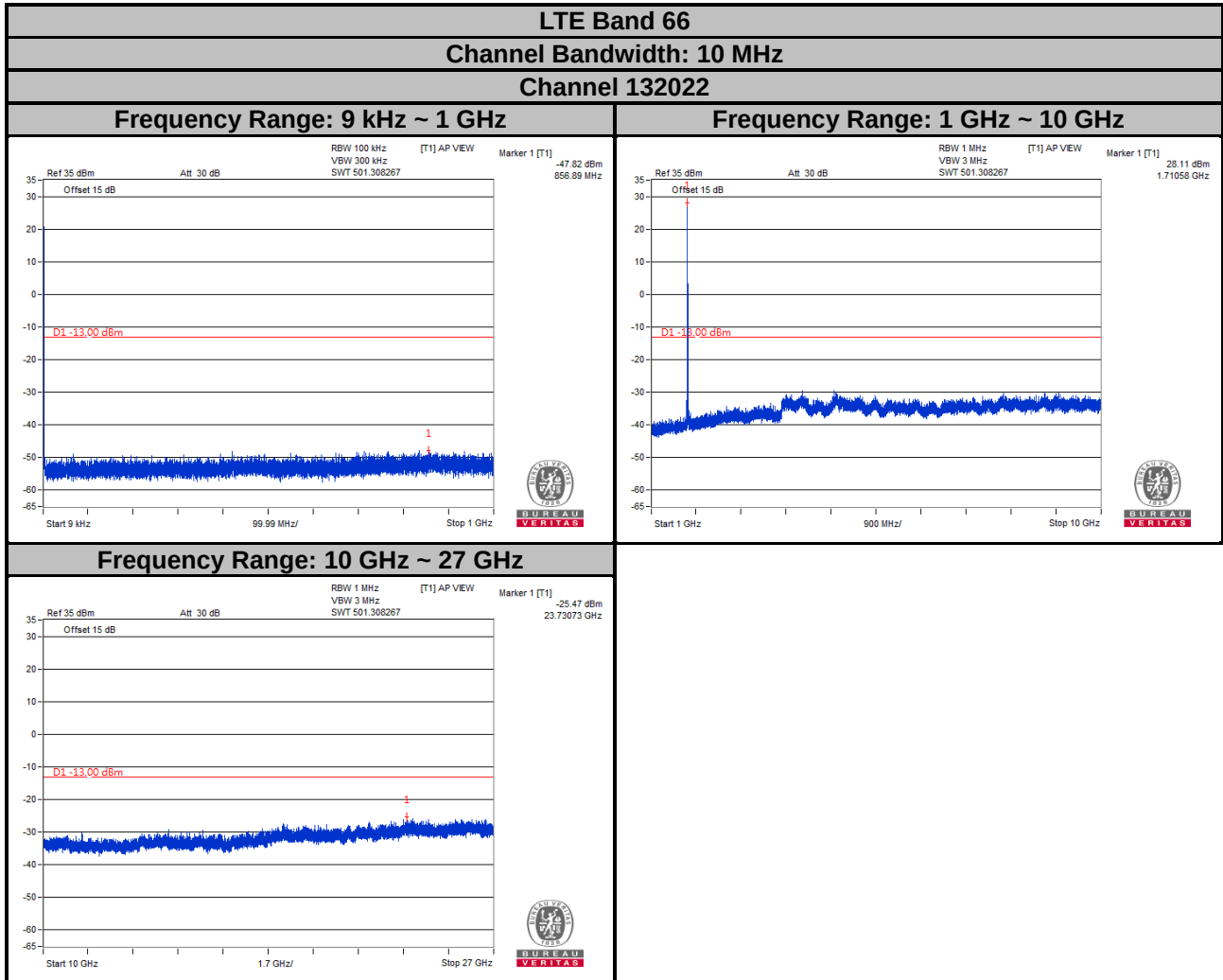
Frequency Range: 1 GHz ~ 10 GHz



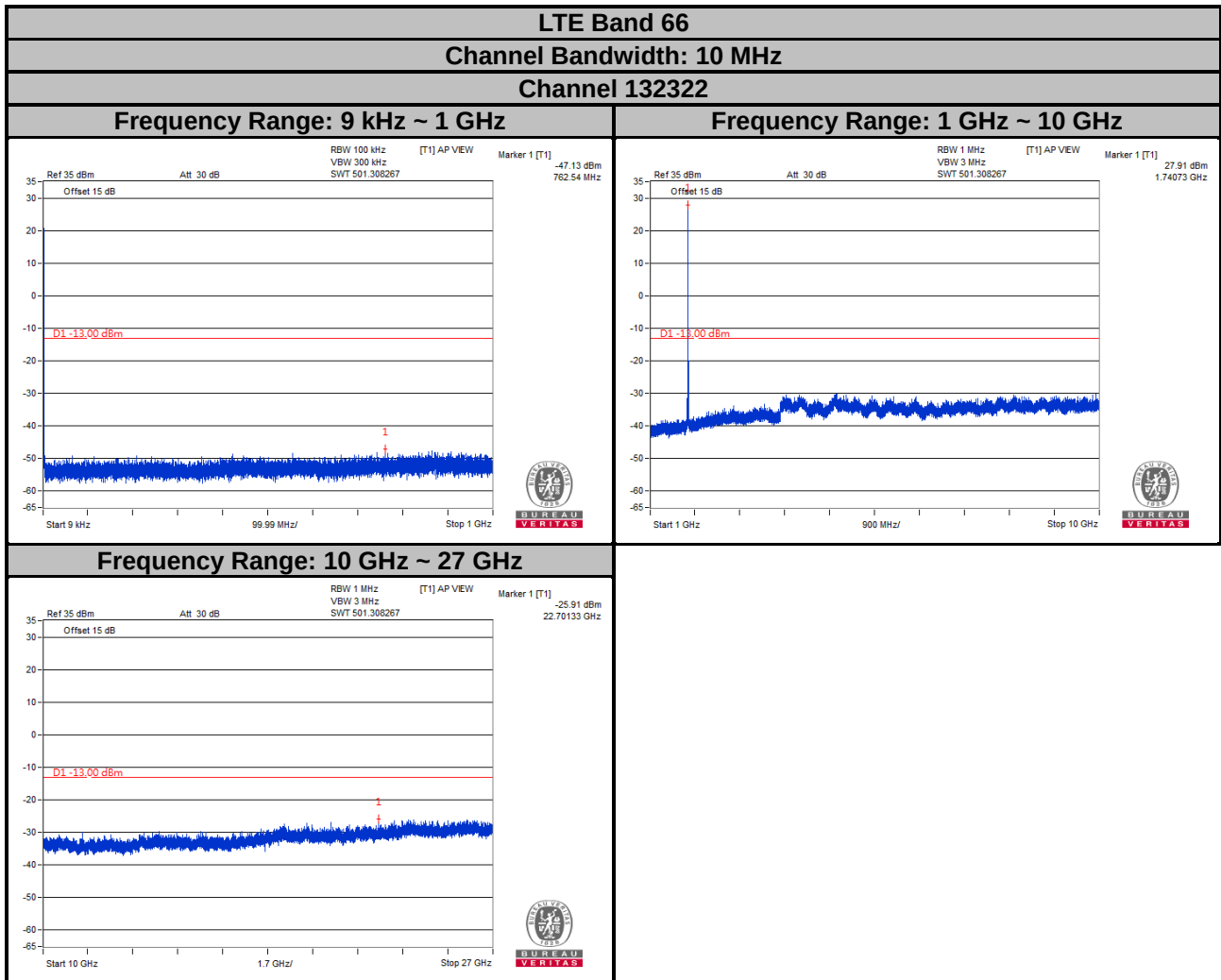
Frequency Range: 10 GHz ~ 27 GHz



Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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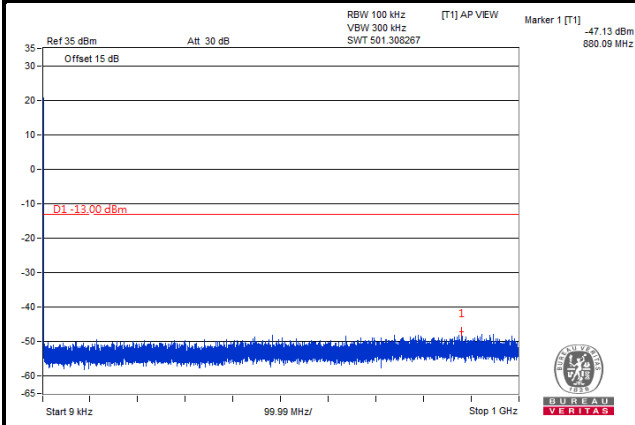
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 66

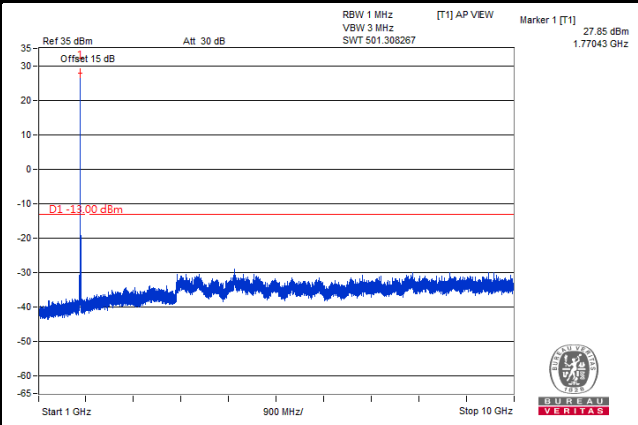
Channel Bandwidth: 10 MHz

Channel 132622

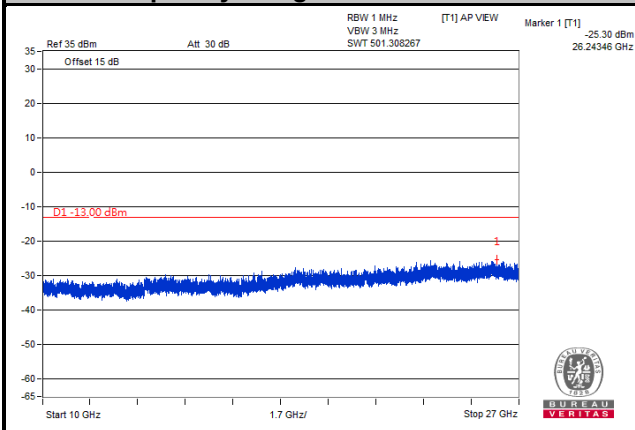
Frequency Range: 9 kHz ~ 1 GHz



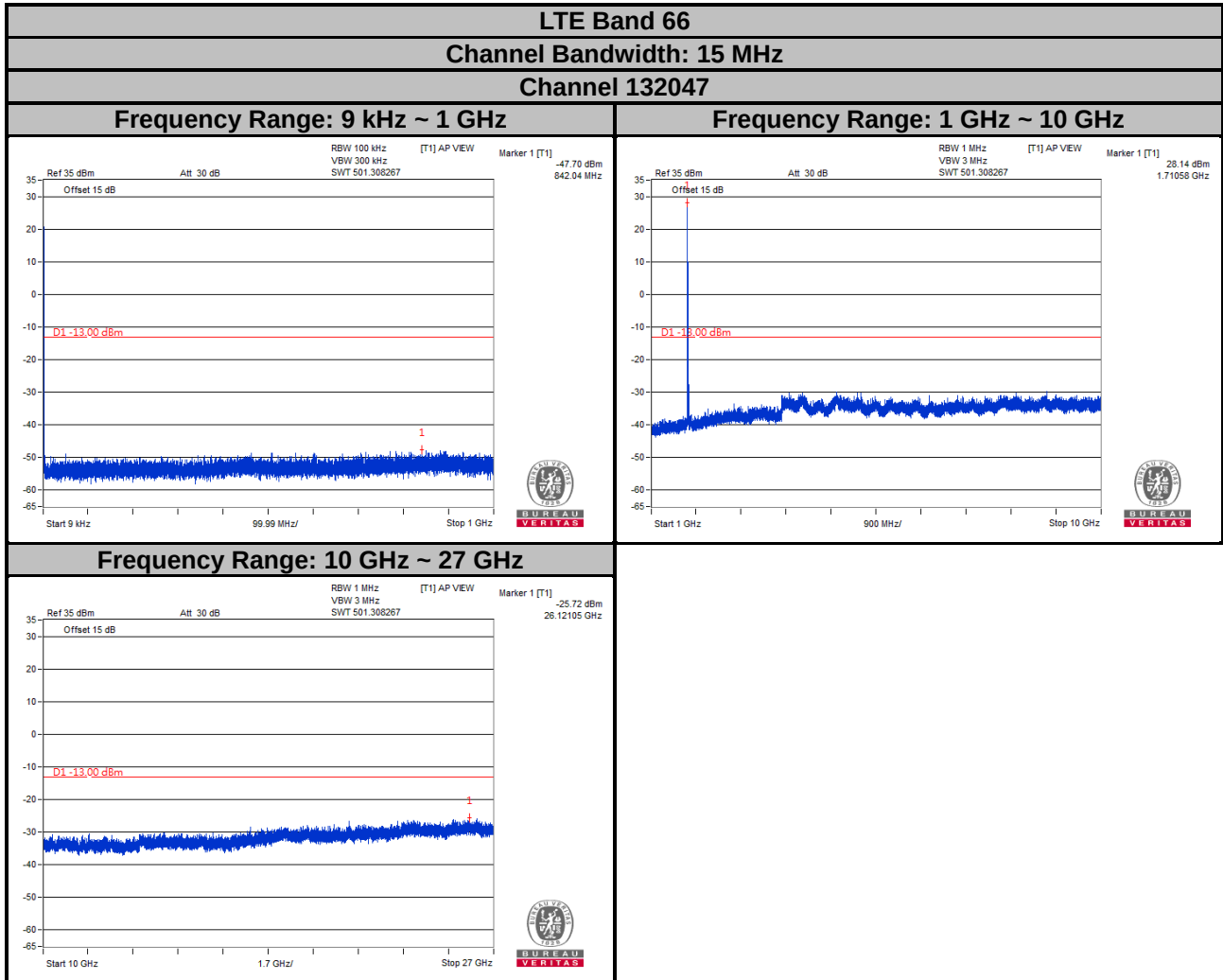
Frequency Range: 1 GHz ~ 10 GHz



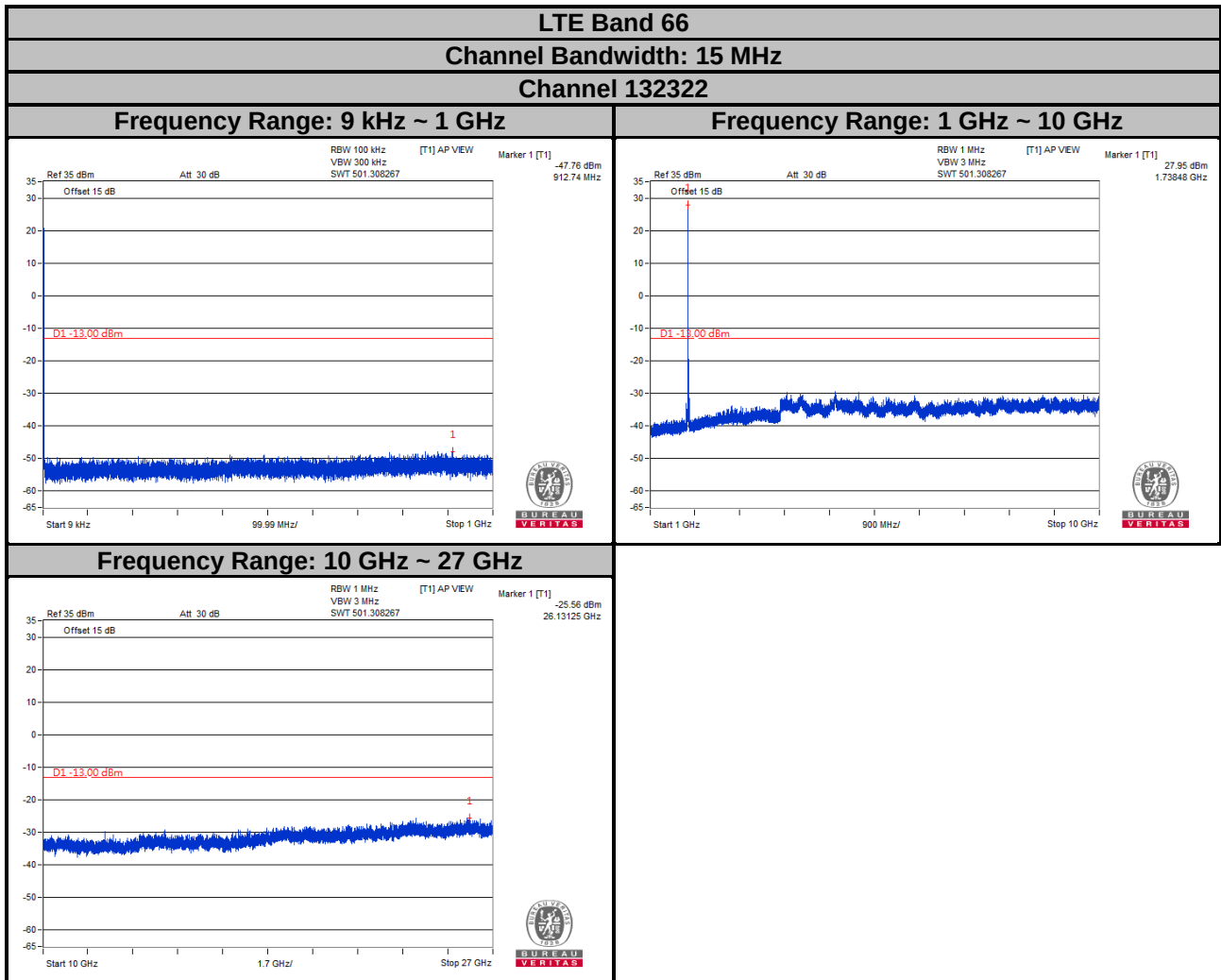
Frequency Range: 10 GHz ~ 27 GHz



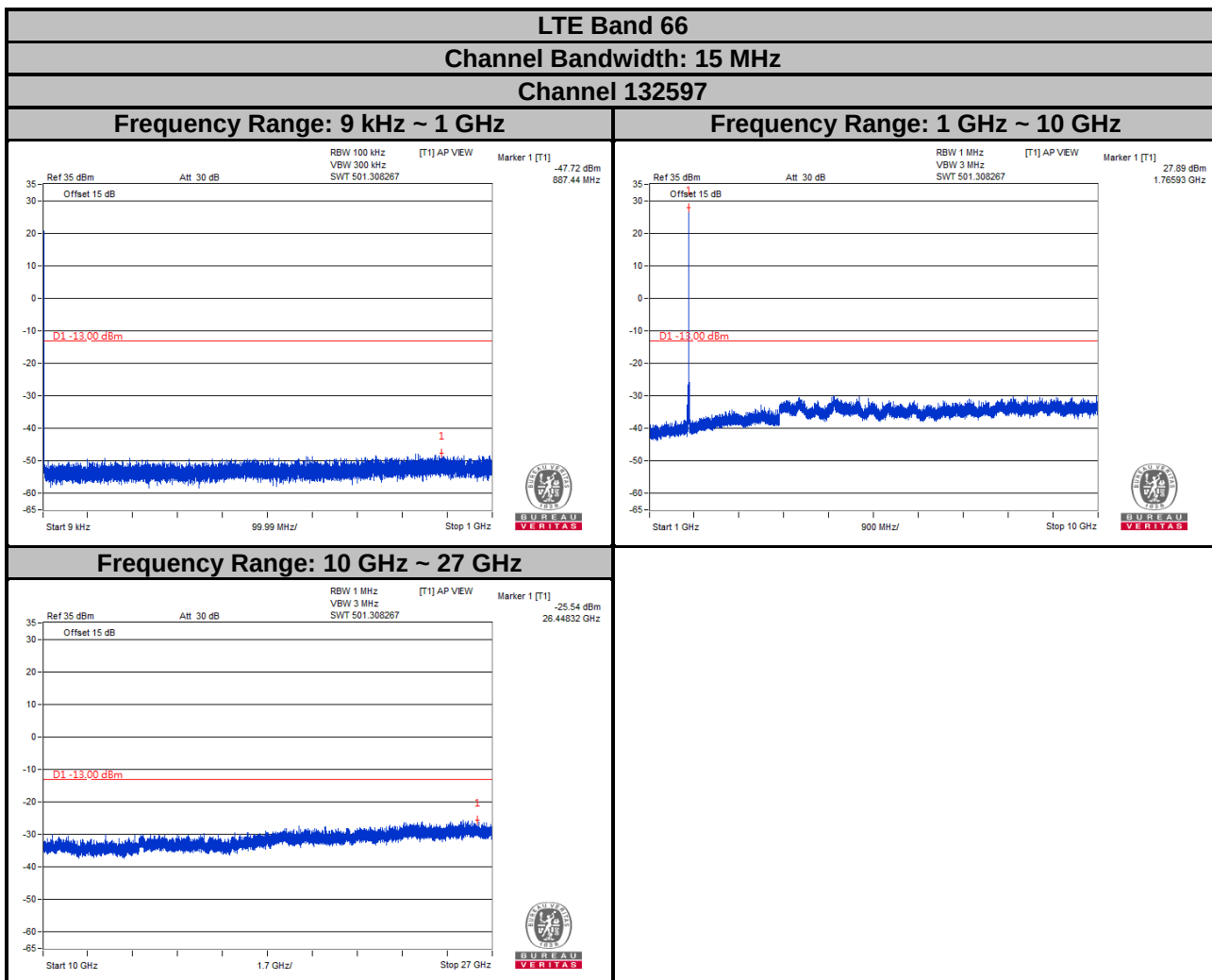
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



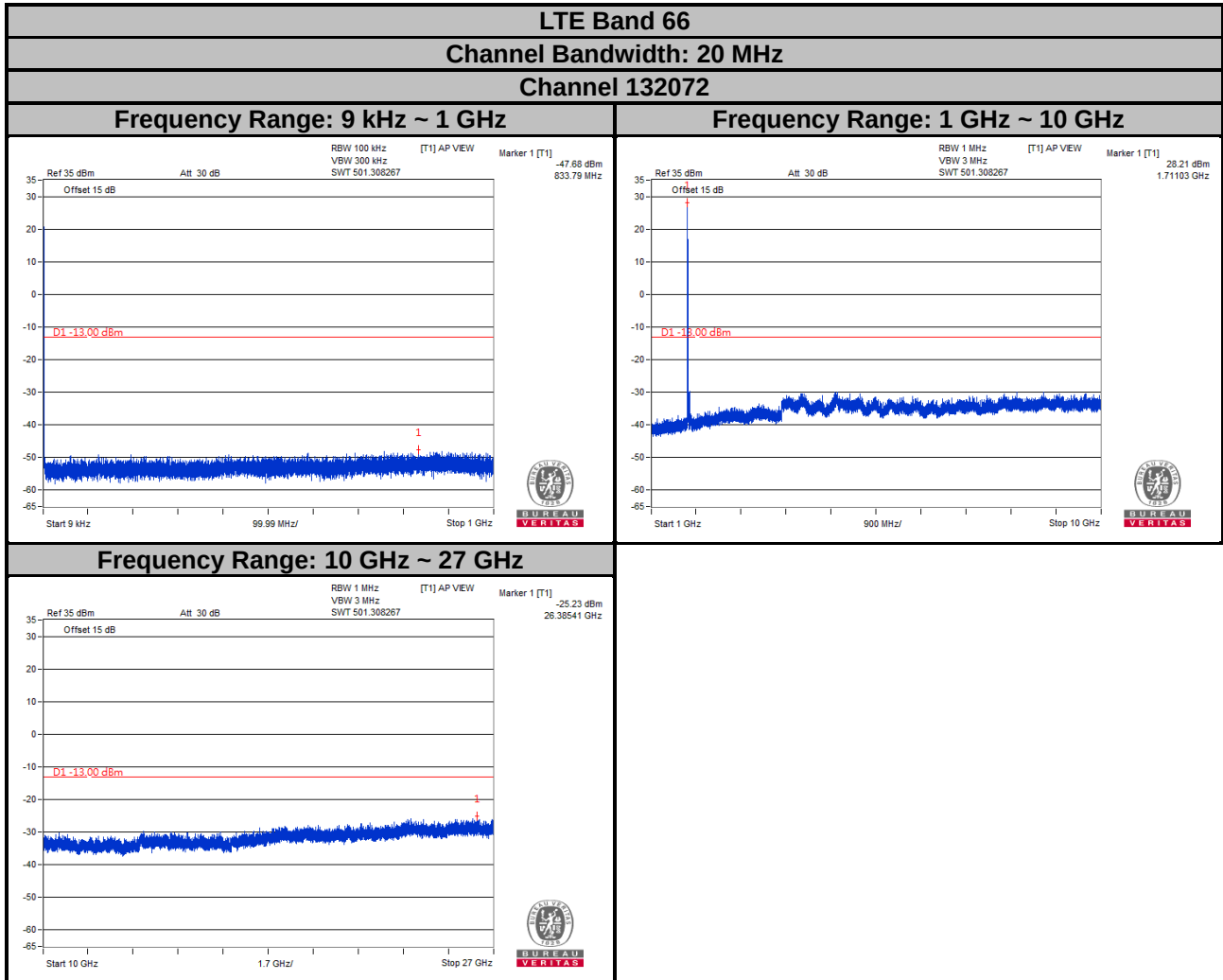
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



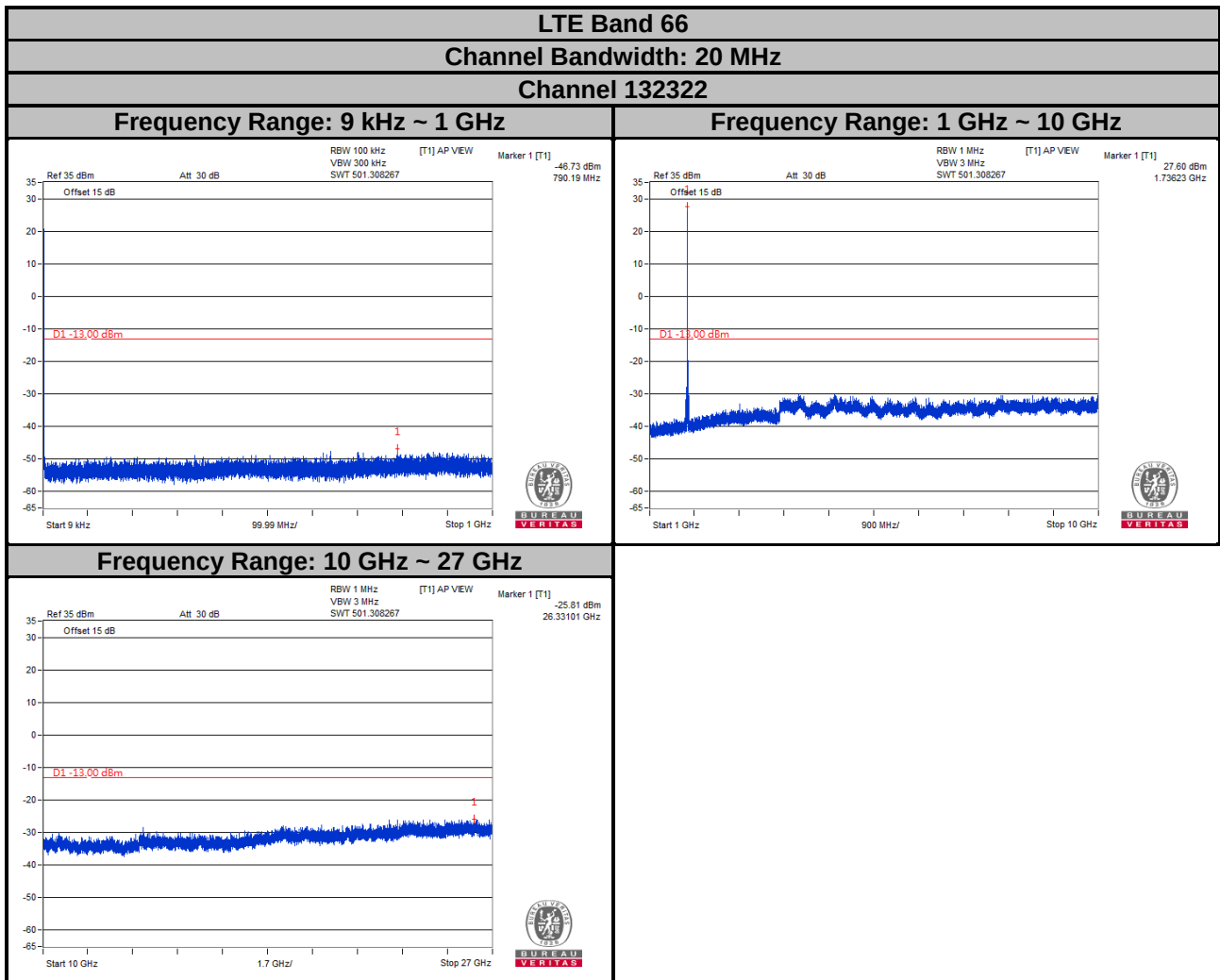
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



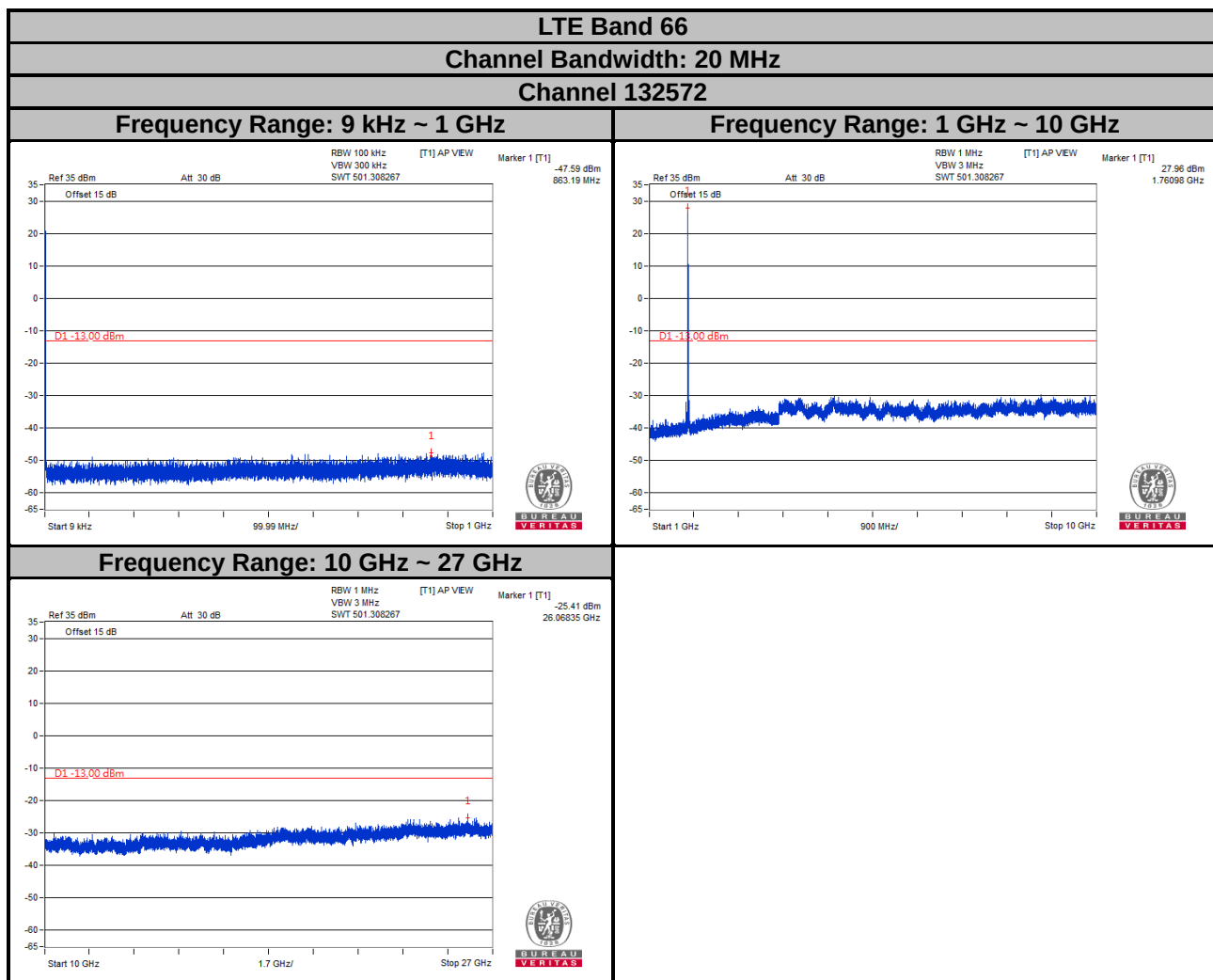
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