

3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.3.2 Test Procedures

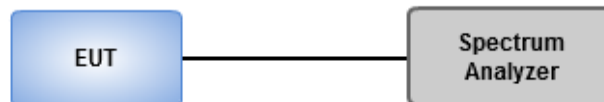
Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

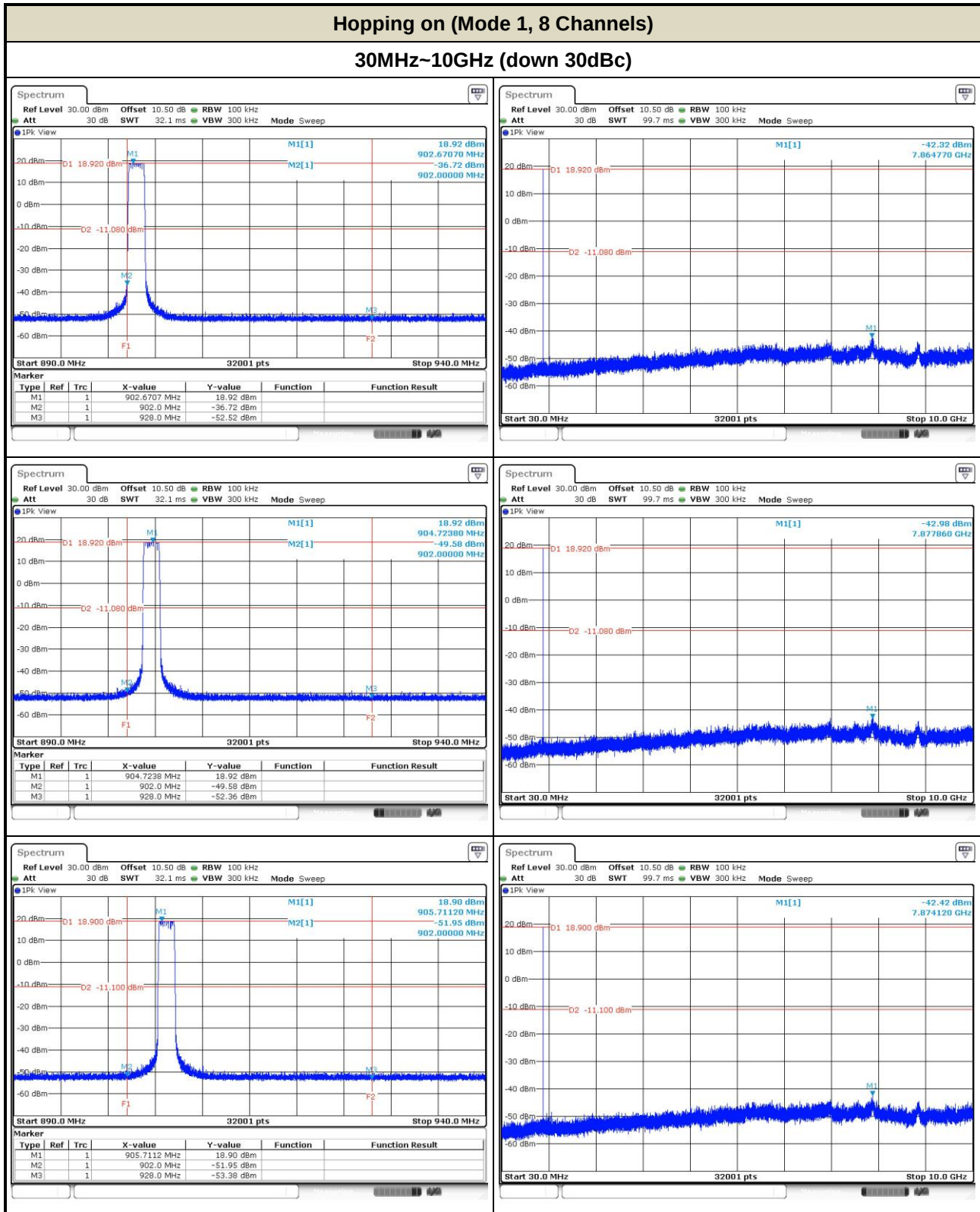
Unwanted Emissions Level Measurement

1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

3.3.3 Test Setup

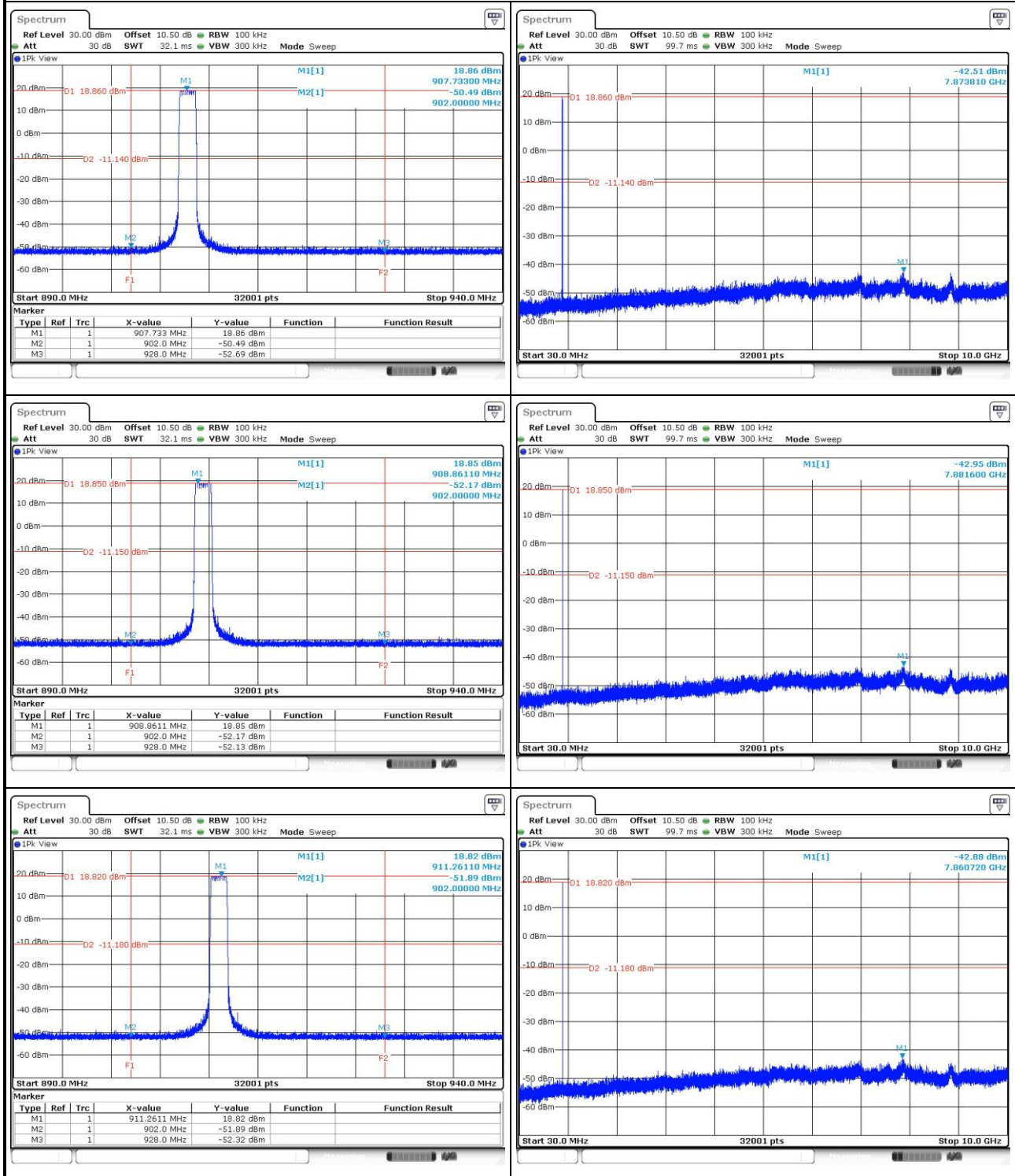


3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands



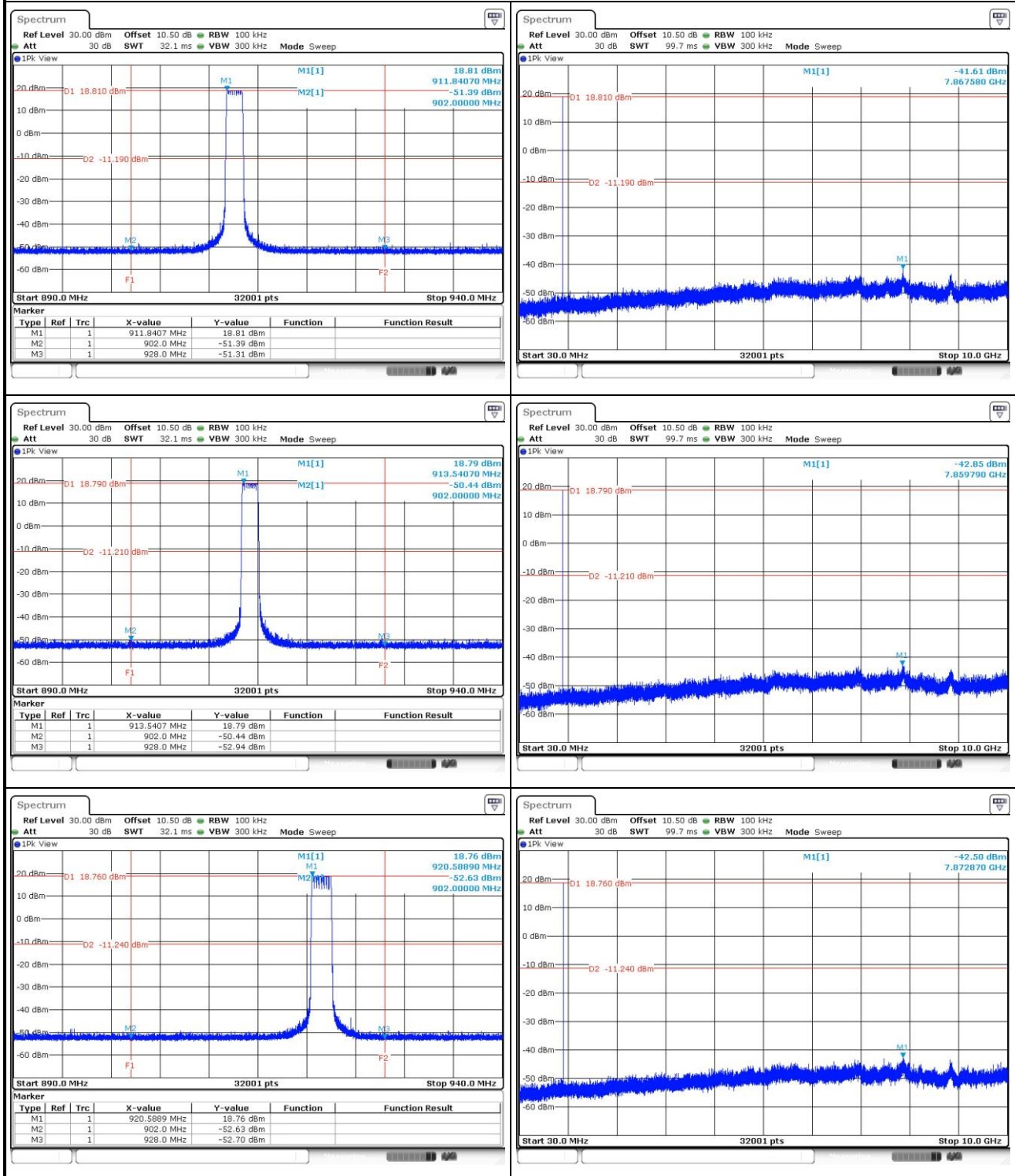
Hopping on (Mode 1, 8 Channels)

30MHz~10GHz (down 30dBc)



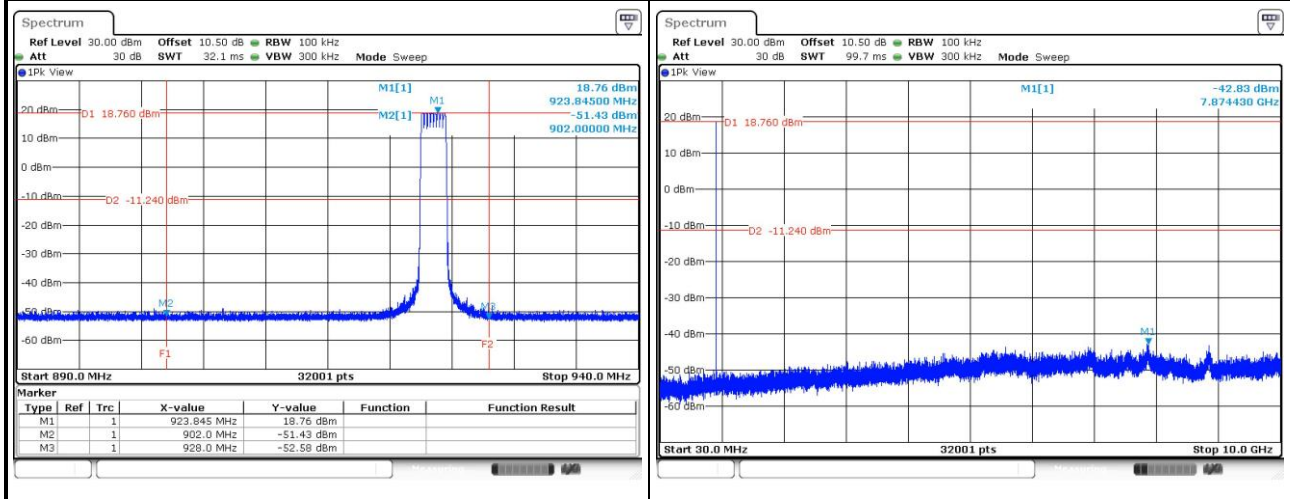
Hopping on (Mode 1, 8 Channels)

30MHz~10GHz (down 30dBc)



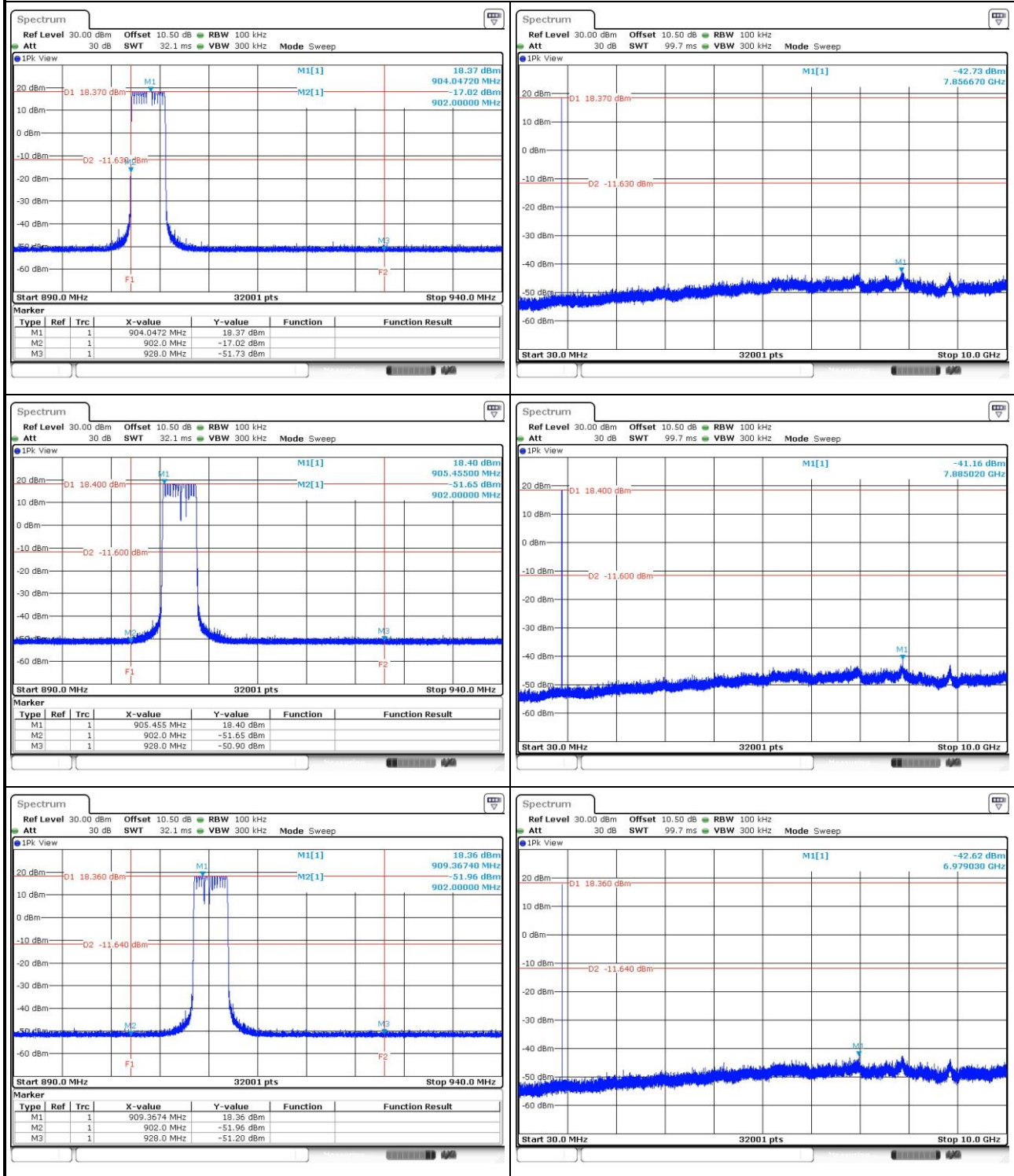
Hopping on (Mode 1, 8 Channels)

30MHz~10GHz (down 30dBc)



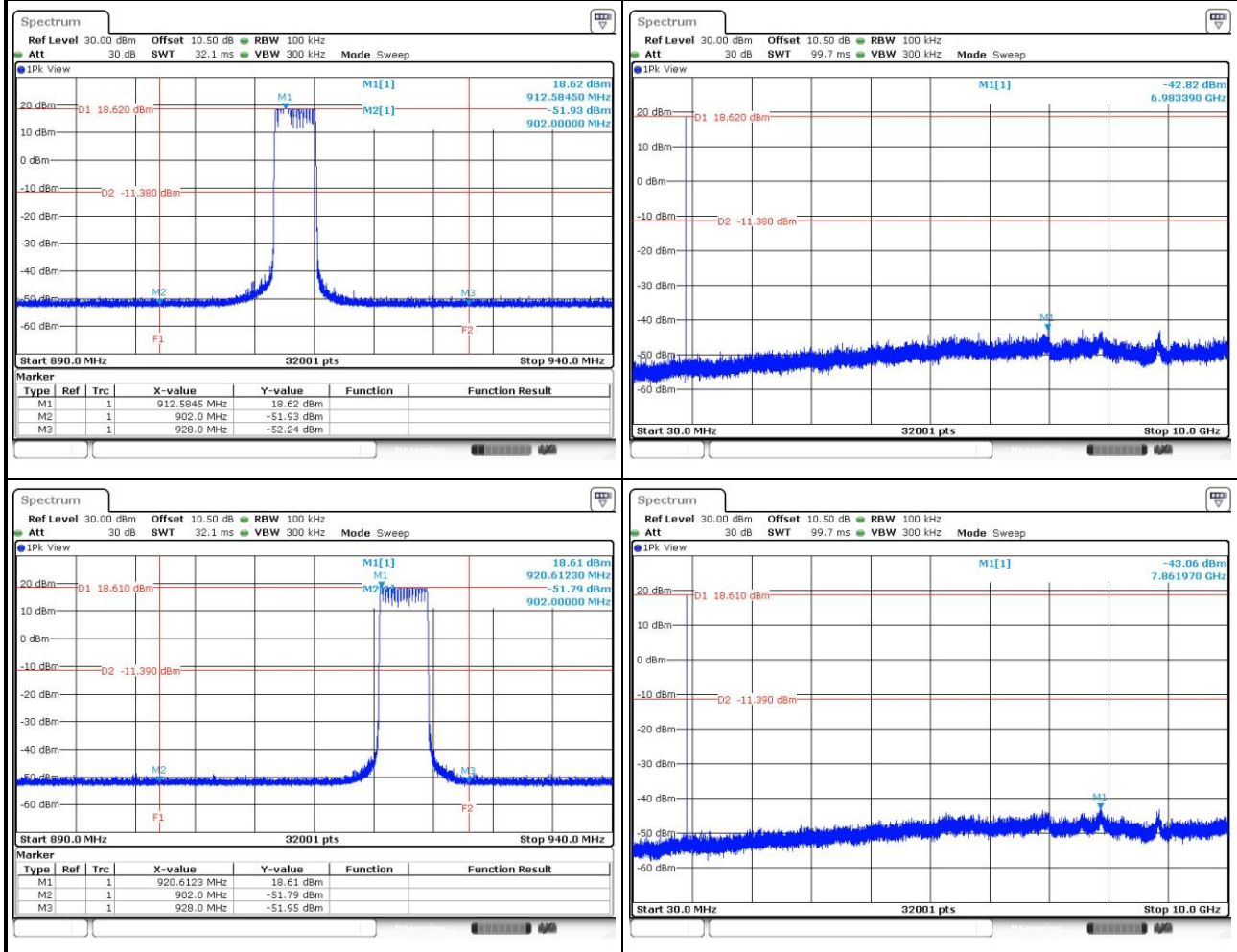
Hopping on (Mode 2, 16 Channels)

30MHz~10GHz (down 30dBc)



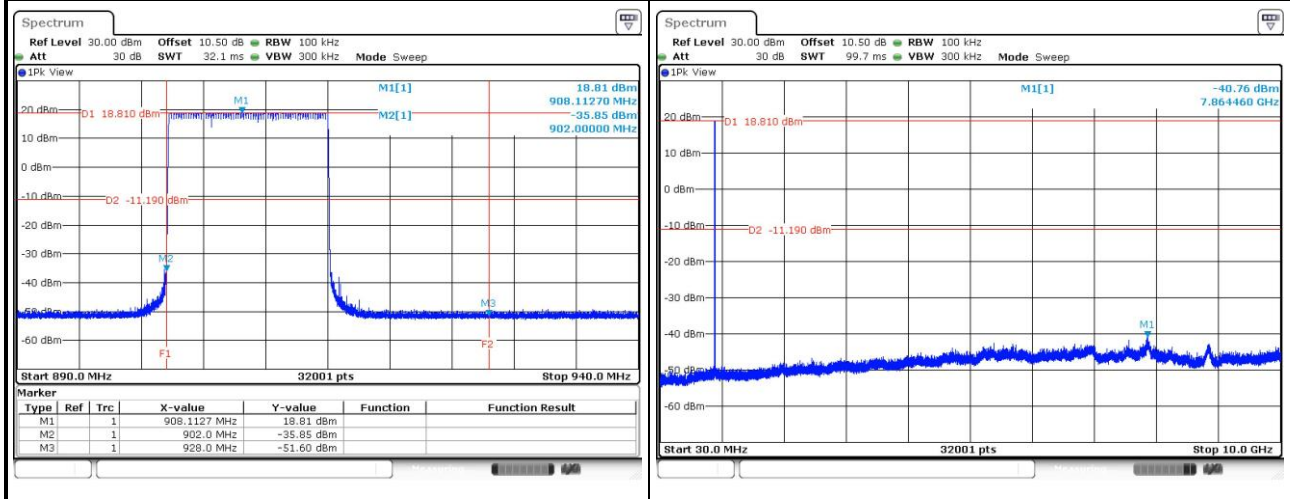
Hopping on (Mode 2, 16 Channels)

30MHz~10GHz (down 30dBc)



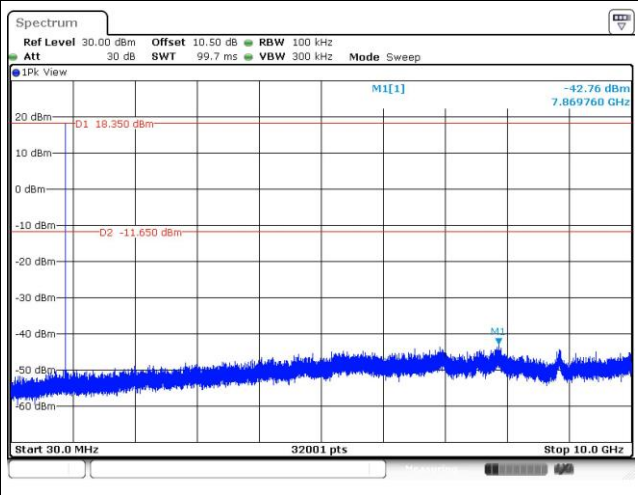
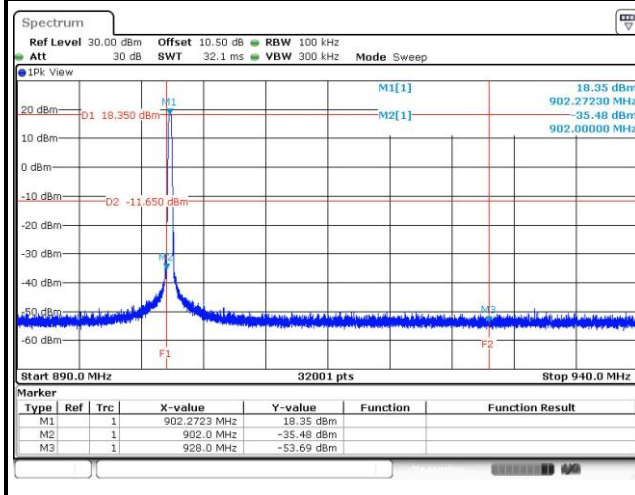
Hopping on (Mode 3, 64 Channels)

30MHz~10GHz (down 30dBc)

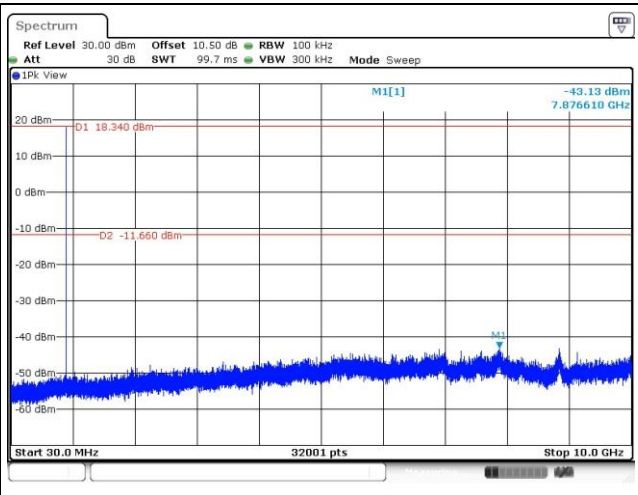
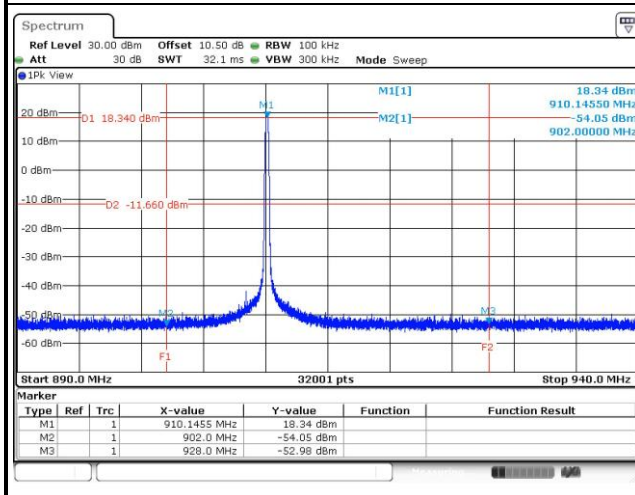


Hopping off (Low / Middle / High channel)

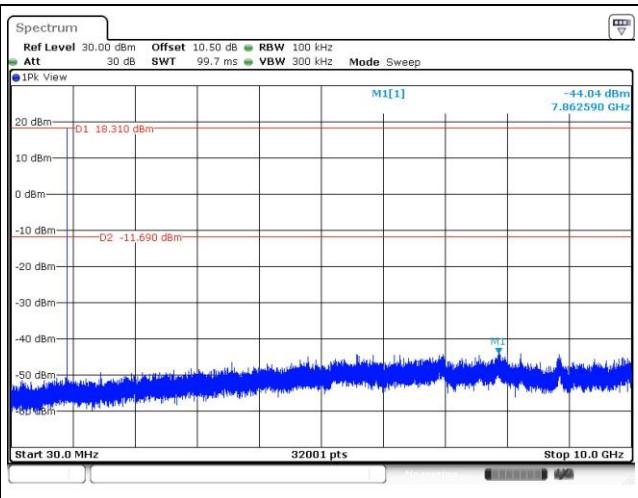
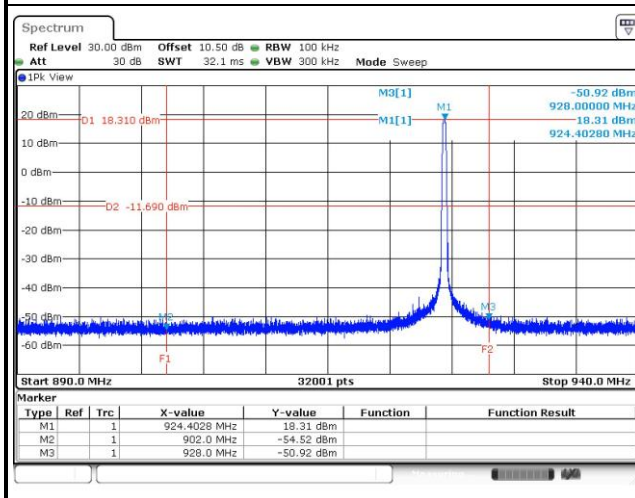
TX Freq 902.3MHz / 30MHz~10GHz (down 30dBc)



TX Freq 910.1MHz / 30MHz~10GHz (down 30dBc)



TX Freq 924.375MHz / 30MHz~10GHz (down 30dBc)



3.4 Conducted Output Power

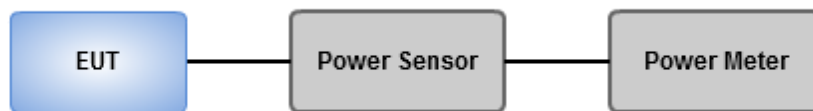
3.4.1 Limit of Conducted Output Power

- ☒ 1 Watt, systems employing at least 50 hopping channels;
- ☐ 0.25 Watt, for systems employing less than 50 hopping channels, but at least 25 hopping channels,

3.4.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power sensor and meter is 50MHz
2. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.4.3 Test Setup



3.4.4 Test Result of Conducted Output Power

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (dBm)
CSS / 9	902.3	79.07	18.98	28
CSS / 9	910.1	78.34	18.94	28
CSS / 9	924.375	78.16	18.93	28

Note: The maximum antenna gain 8dBi is higher than 6dBi, so the limit shall be reduced to 30 dBm - (8dBi - 6dBi) = 28 dBm

3.5 Number of Hopping Frequency

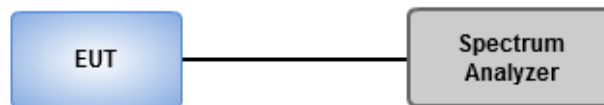
3.5.1 Limit of Number of Hopping Frequency

Number of Hopping Frequencies Limit for Frequency Hopping Systems	
☒	902-928 MHz Band:
☐	$N \geq 50$, 20 dB bandwidth of the hopping channel is less than 250 kHz
☐	$N \geq 25$, 20 dB bandwidth of the hopping channel is 250 kHz or greater
☒	Hybrid mode, No minimum number of hopping channels associated with hybrid system.
N: Number of Hopping Frequencies	

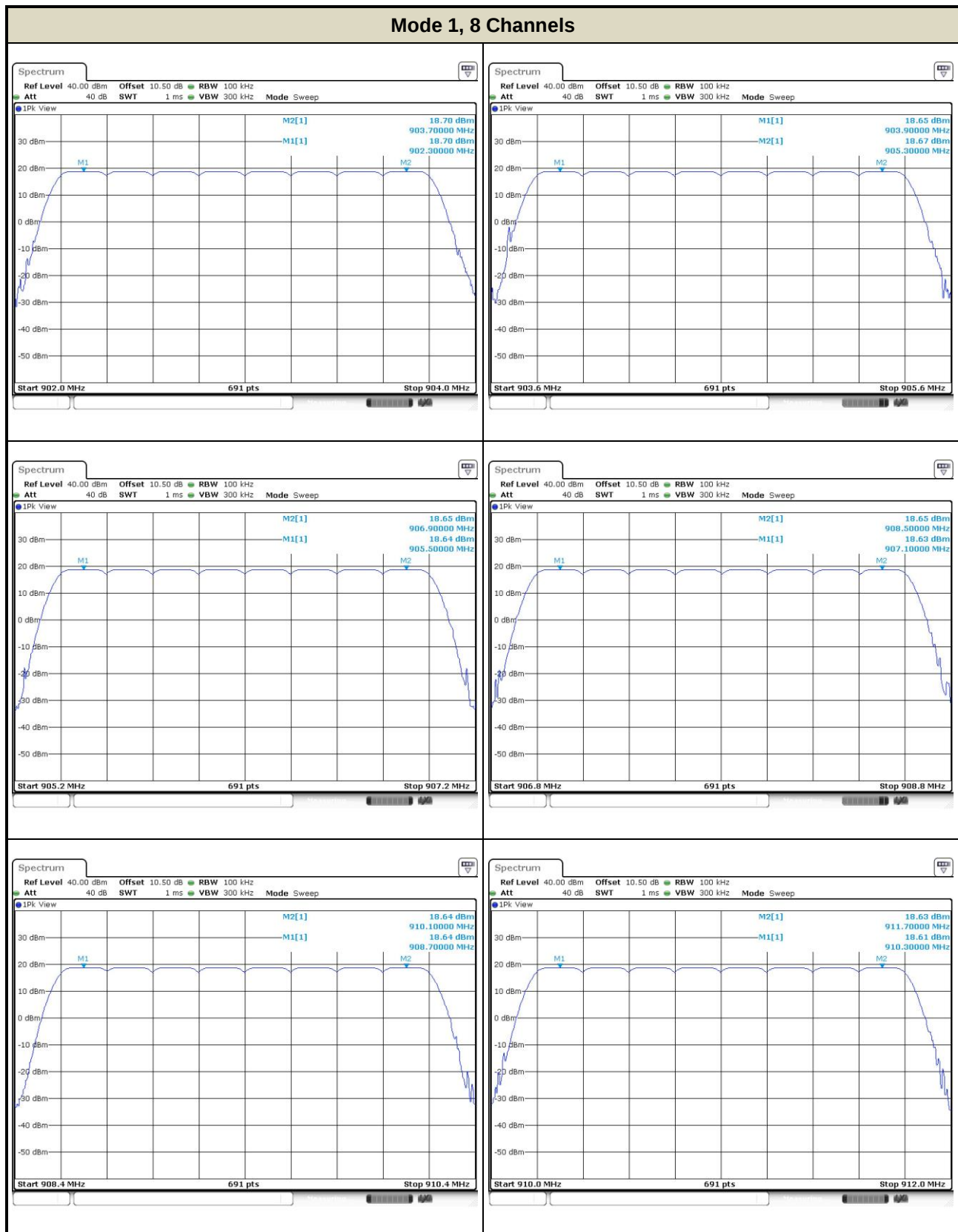
3.5.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2. Allow trace to stabilize.

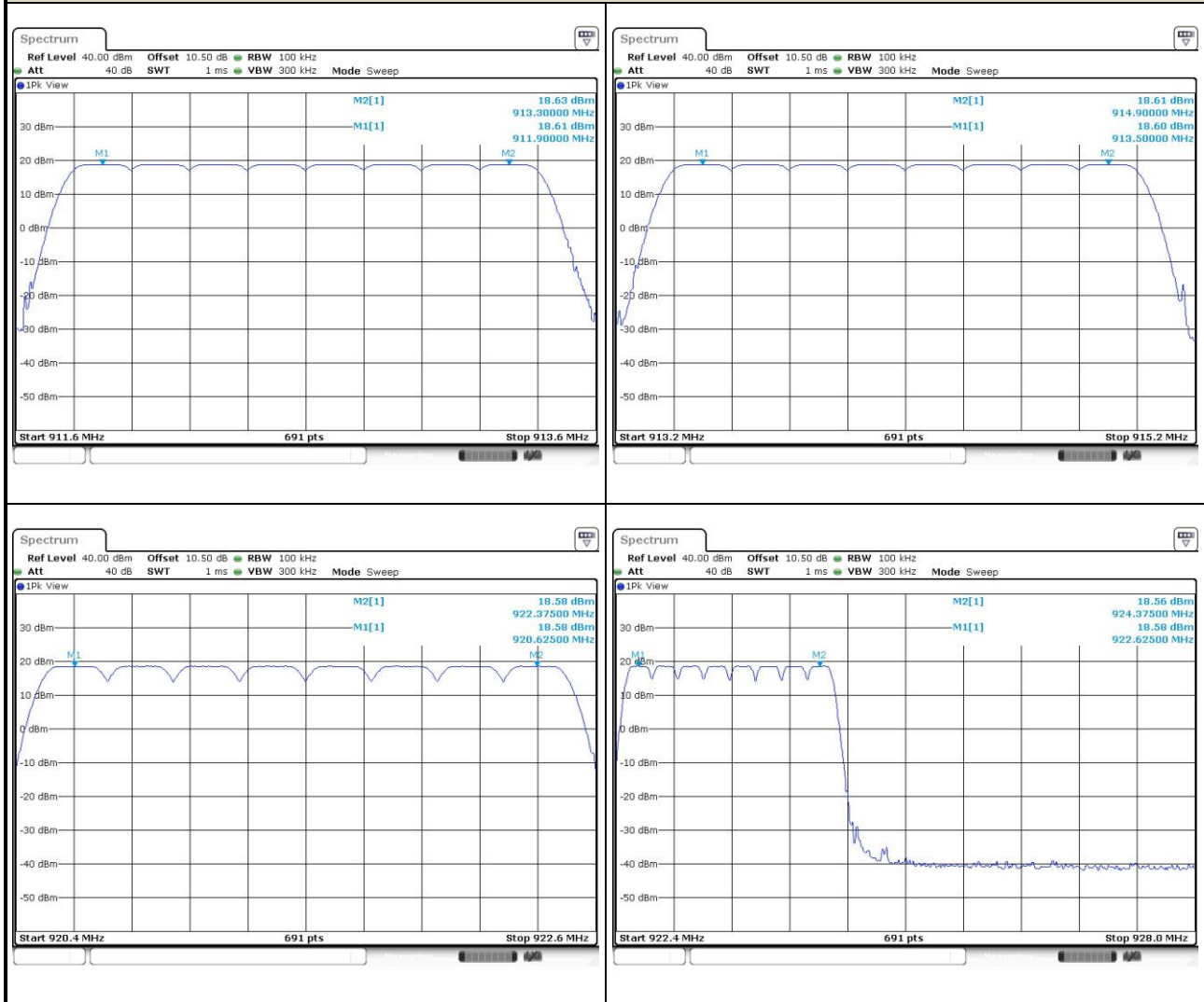
3.5.3 Test Setup



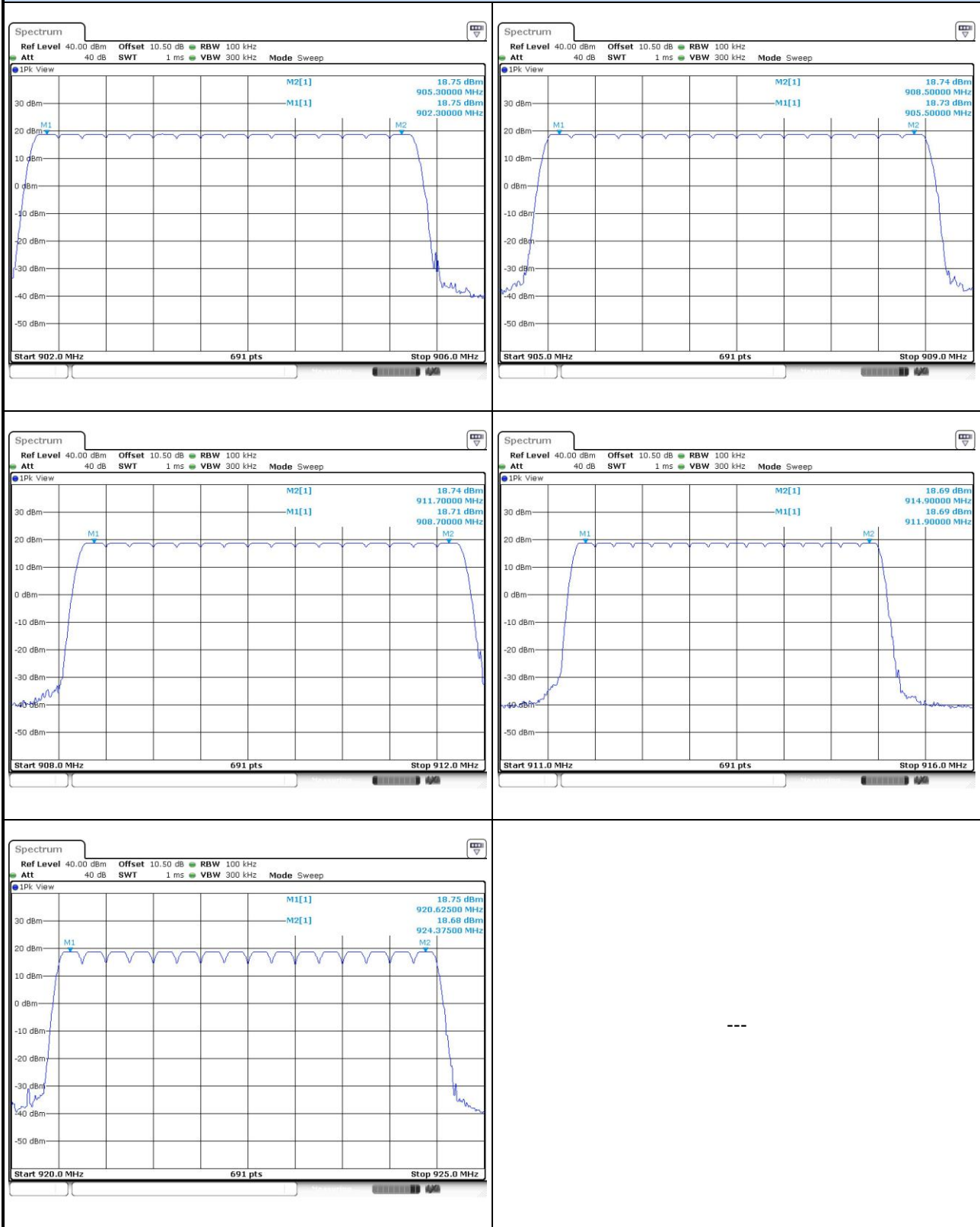
3.5.4 Test Result of Number of Hopping Frequency



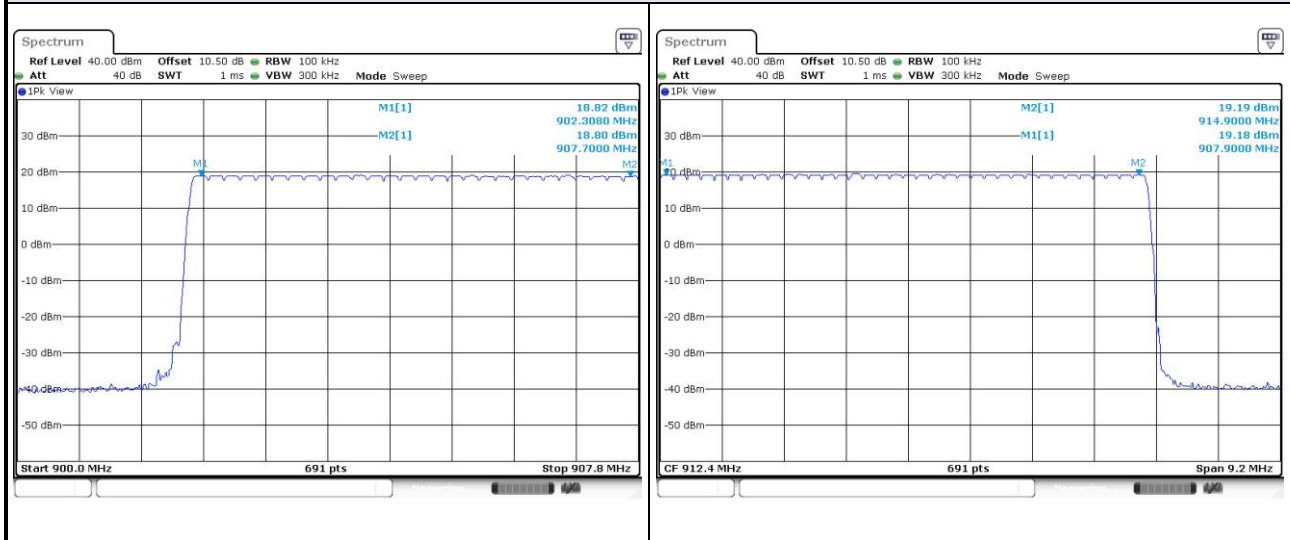
Mode 1, 8 Channels



Mode 2, 16 Channels



Mode 3, 64 Channels



3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

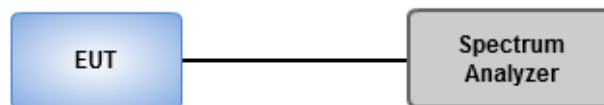
20dB Bandwidth

1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2. Allow trace to stabilize.
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

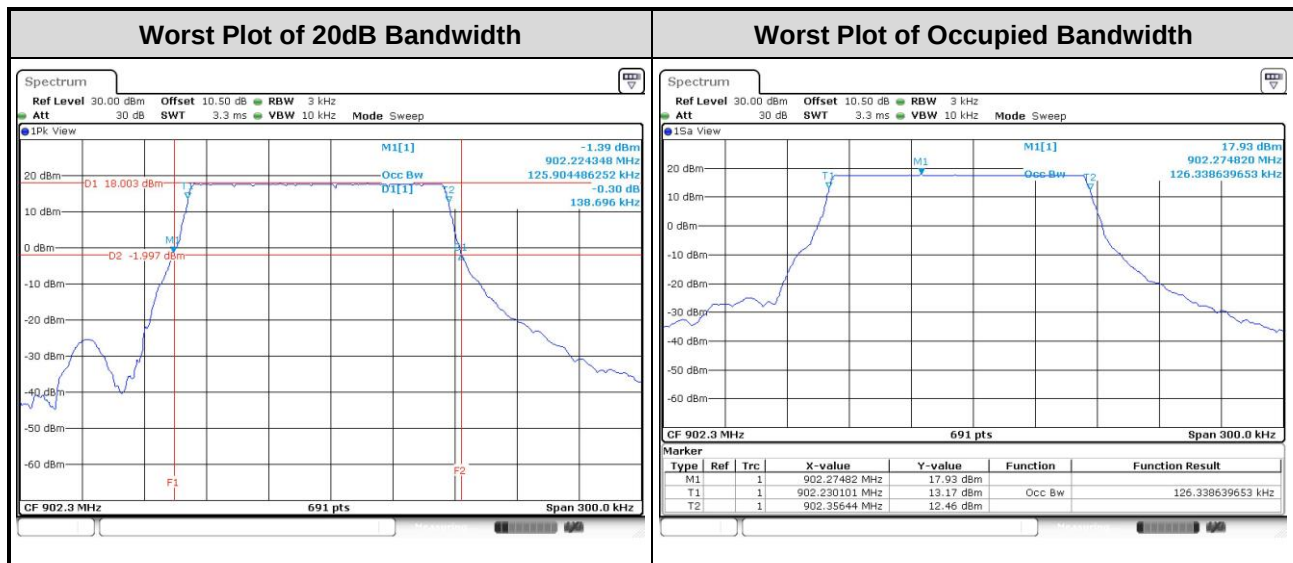
1. Set RBW=3kHz, VBW=10kHz, Sweep time = Auto, Detector=Sample, Trace max hold
2. Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.6.2 Test Setup



3.6.3 Test result of 20dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
CSS / 9	902.3	0.139	0.126
CSS / 9	910.1	0.137	0.125
CSS / 9	914.9	0.137	0.126
CSS / 9	920.625	0.138	0.126
CSS / 9	924.375	0.138	0.125



3.7 Channel Separation

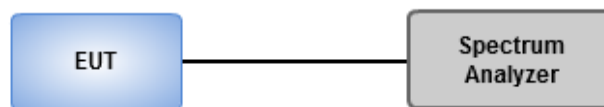
3.7.1 Limit of Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

3.7.2 Test Procedures

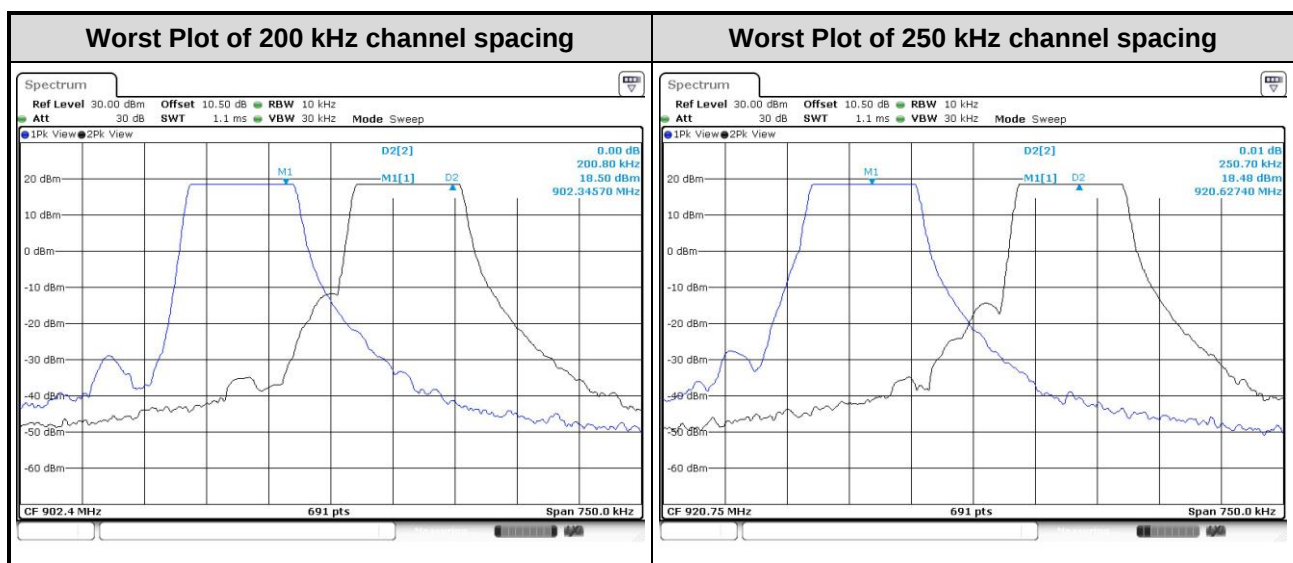
1. Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2. Allow trace to stabilize.
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.7.3 Test Setup



3.7.4 Test result of Channel Separation

Modulation / SF	Freq. (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Pass/Fail
CSS / 9	902.3	0.2008	0.139	Pass
CSS / 9	910.1	0.2008	0.137	Pass
CSS / 9	914.9	0.2008	0.137	Pass
CSS / 9	920.625	0.2507	0.138	Pass
CSS / 9	924.375	0.2507	0.138	Pass



3.8 Number of Dwell Time

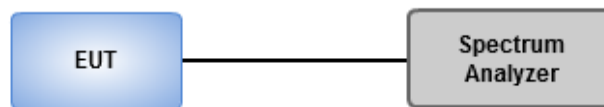
3.8.1 Limit of Dwell time

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems	
☒	902-928 MHz Band:
☐	≤ 0.4 second within a 20 second period, 20 dB bandwidth of the hopping channel is less than 250 kHz
☐	≤ 0.4 second within a 10 second period, 20 dB bandwidth of the hopping channel is 250 kHz or greater
☒	Hybrid mode ,an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

3.8.2 Test Procedures

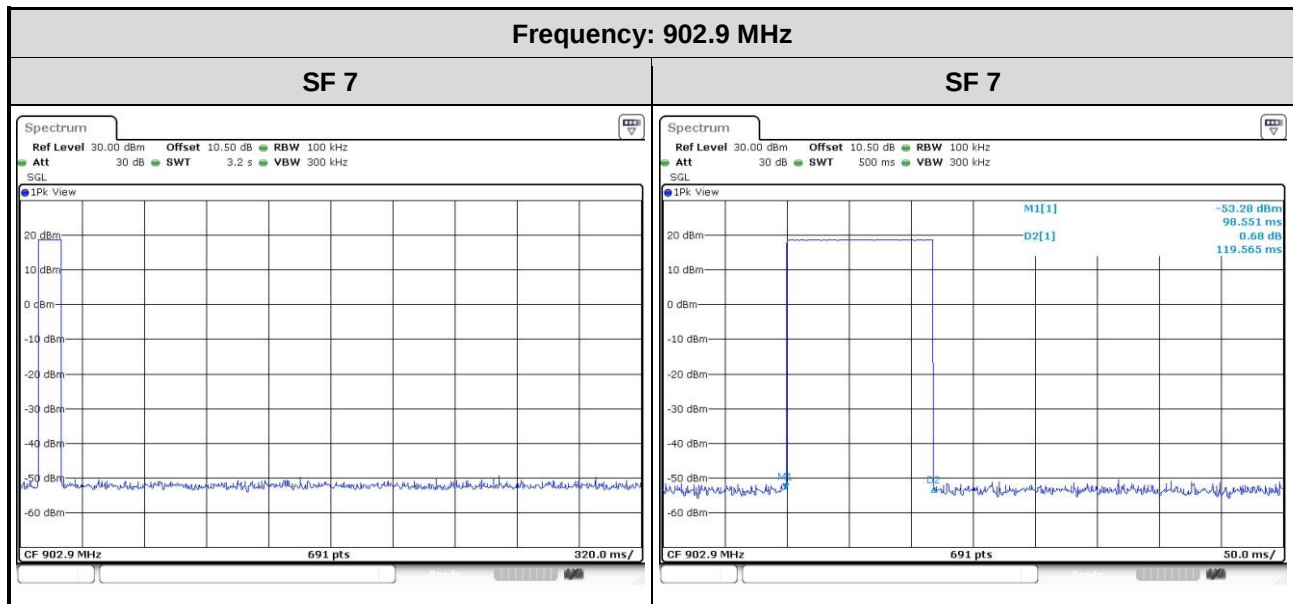
1. Set RBW=100kHz, VBW=300kHz, Sweep time=6.4s / 500ms, Detector=Peak, Span=0Hz, Trace max hold.
2. Measure and record the burst on time.

3.8.3 Test Setup



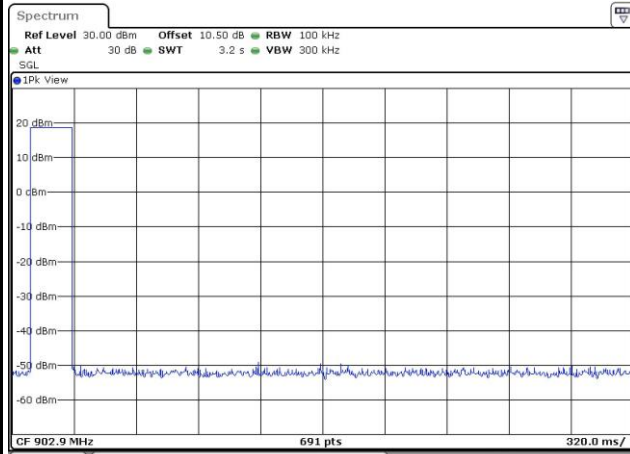
3.8.4 Test Result of Dwell Time

Mode 1, 8 Channels					
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 3.2s (8 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	902.9	0.119565	1	0.120	0.4
CSS / 8	902.9	0.217391	1	0.217	0.4
CSS / 9	902.9	0.392754	1	0.393	0.4
CSS / 10	902.9	0.372464	1	0.372	0.4
CSS / 9	904.5	0.393478	1	0.393	0.4
CSS / 9	906.1	0.392754	1	0.393	0.4
CSS / 9	907.7	0.392029	1	0.392	0.4
CSS / 9	909.3	0.392754	1	0.393	0.4
CSS / 9	910.9	0.392029	1	0.392	0.4
CSS / 9	912.5	0.392029	1	0.392	0.4
CSS / 9	914.1	0.392029	1	0.392	0.4
CSS / 9	921.375	0.392029	1	0.392	0.4
CSS / 9	923.375	0.392754	1	0.393	0.4

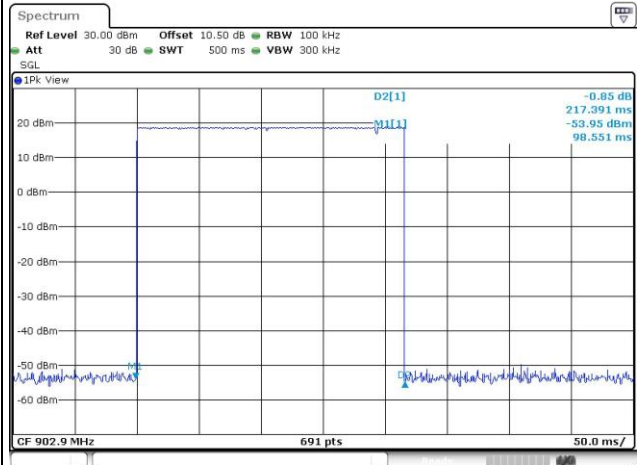


Frequency: 902.9 MHz

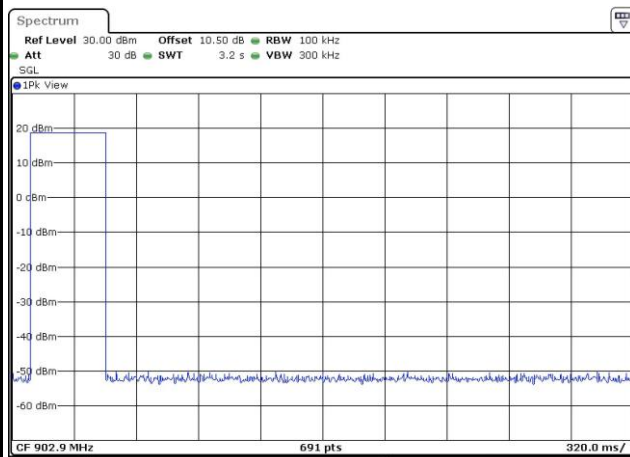
SF 8



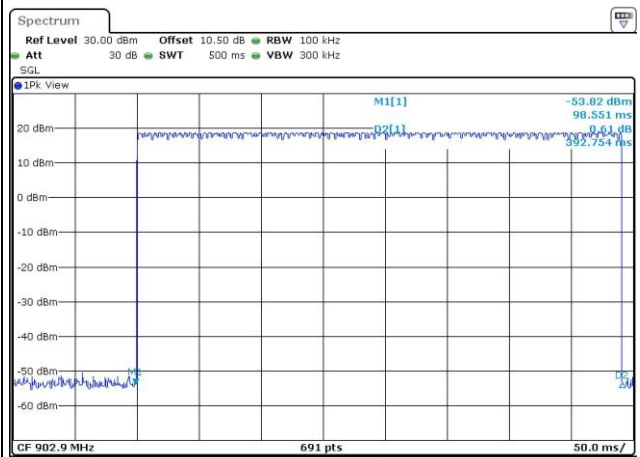
SF 8



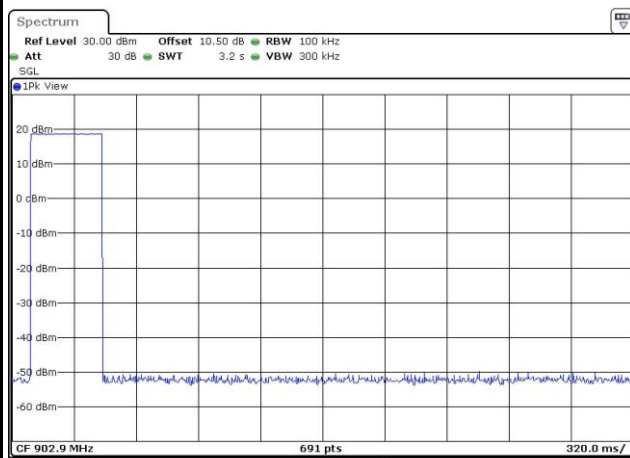
SF 9



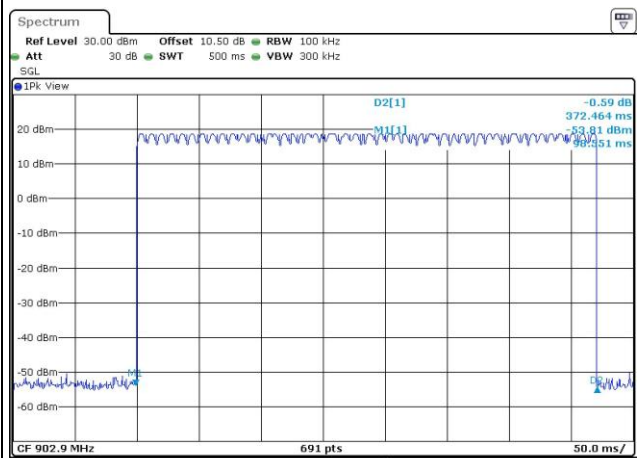
SF 9



SF 10



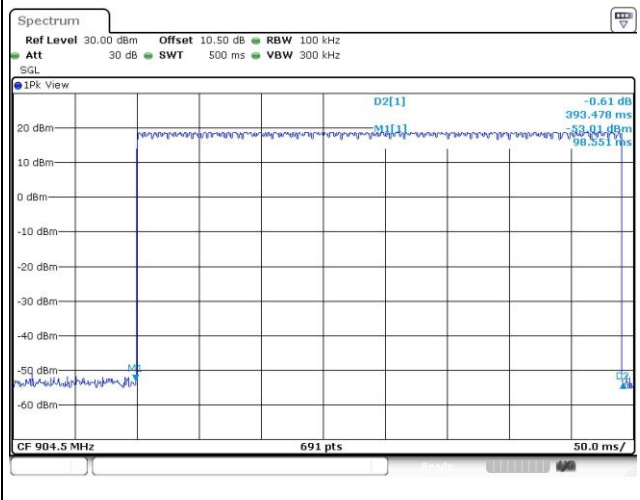
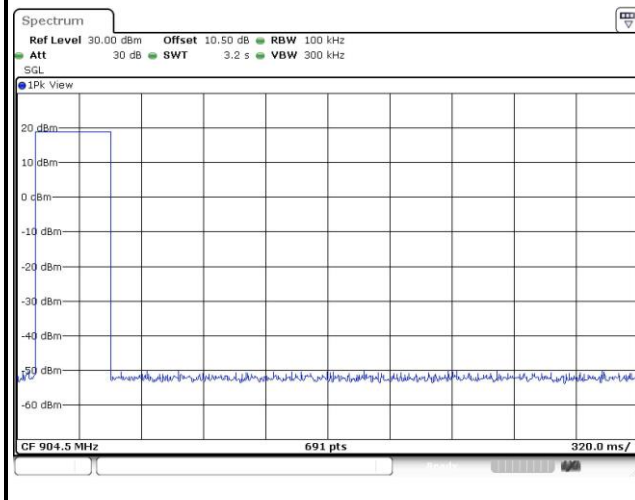
SF 10



Frequency: 904.5 MHz

SF 9

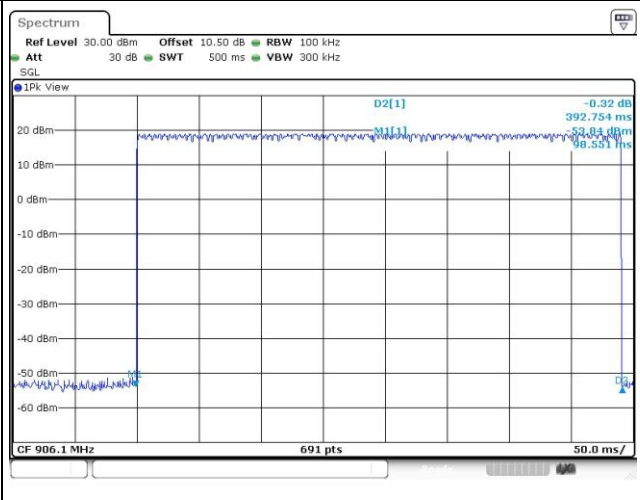
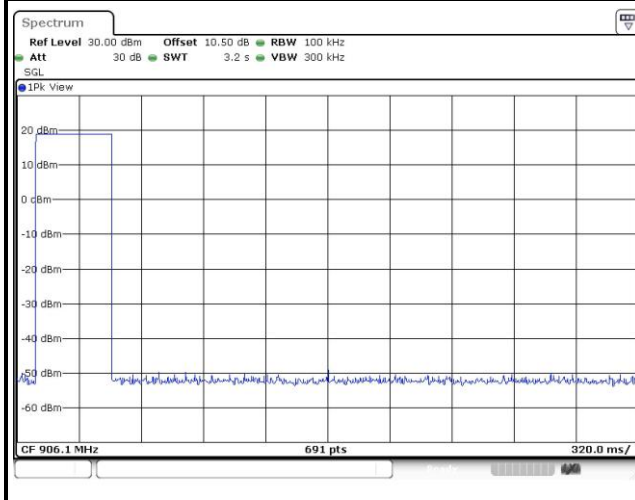
SF 9



Frequency: 906.1 MHz

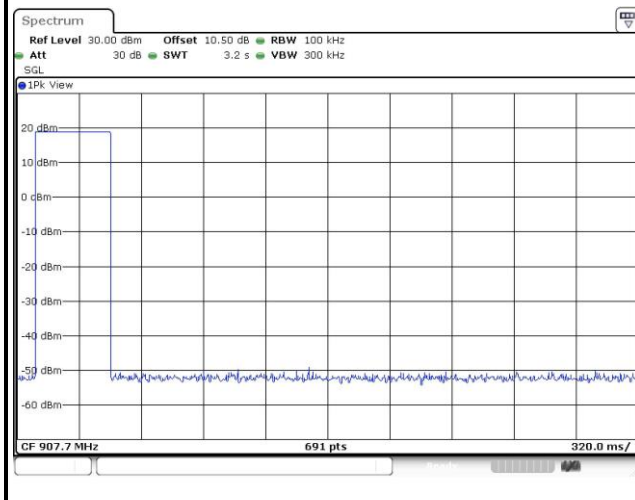
SF 9

SF 9

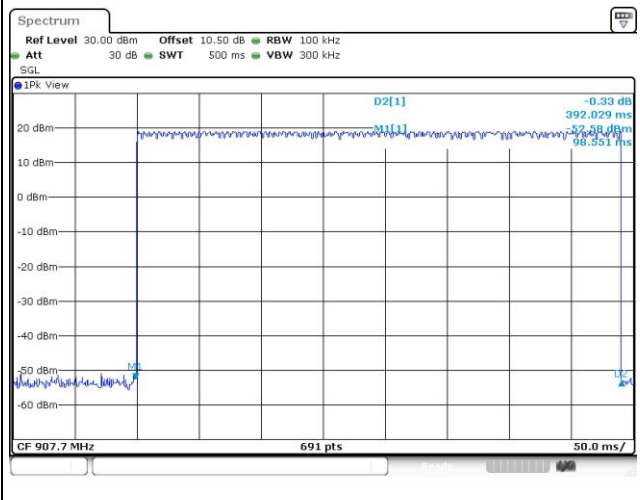


Frequency: 907.7 MHz

SF 9

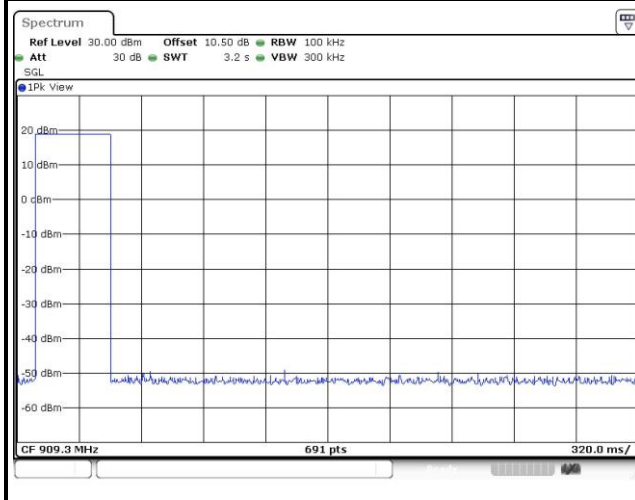


SF 9

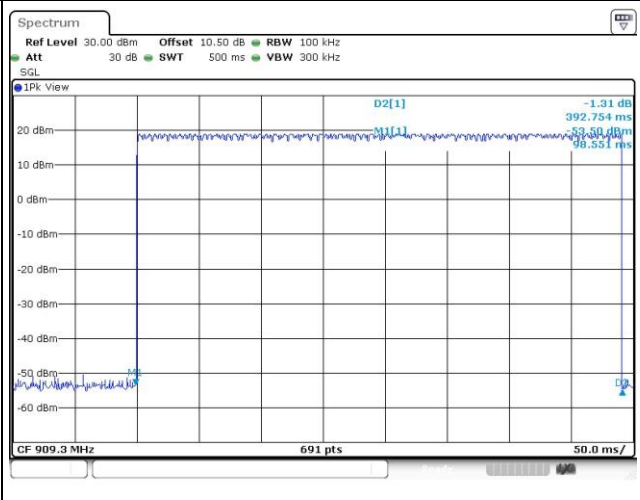


Frequency: 909.3 MHz

SF 9

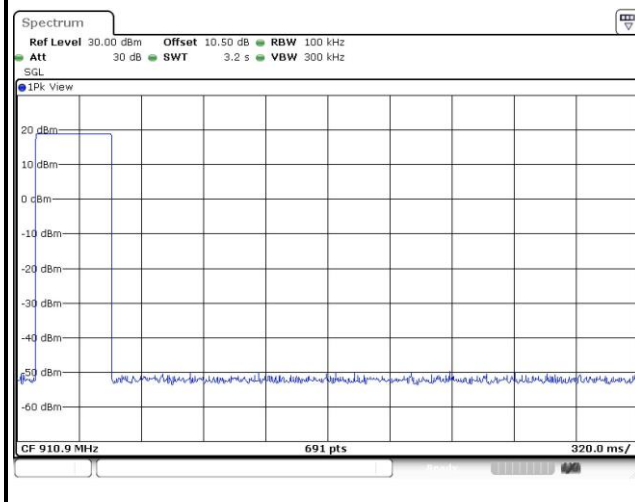


SF 9

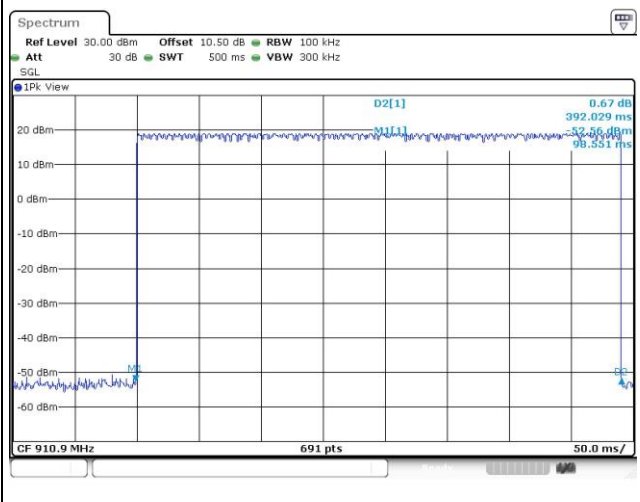


Frequency: 910.9 MHz

SF 9

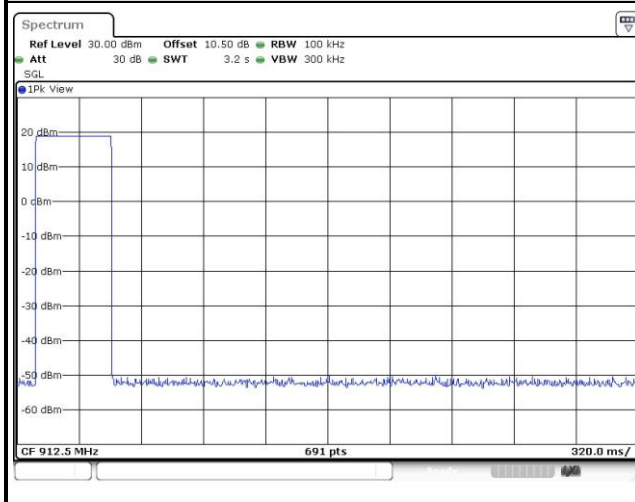


SF 9

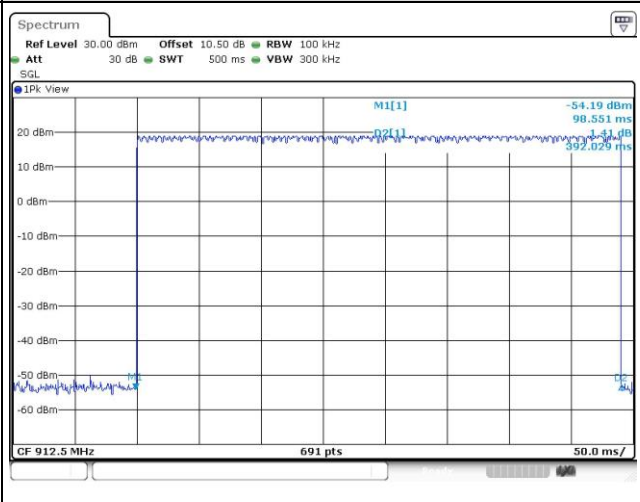


Frequency: 912.5 MHz

SF 9

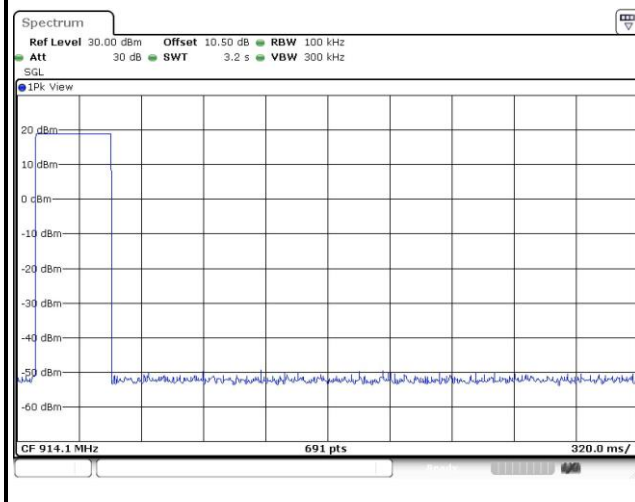


SF 9

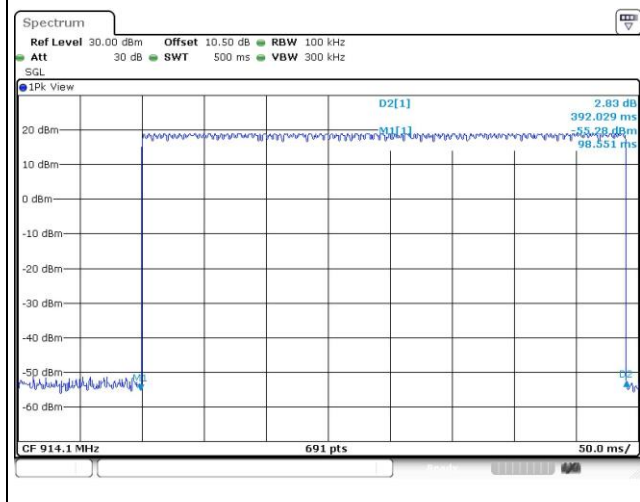


Frequency: 914.1 MHz

SF 9

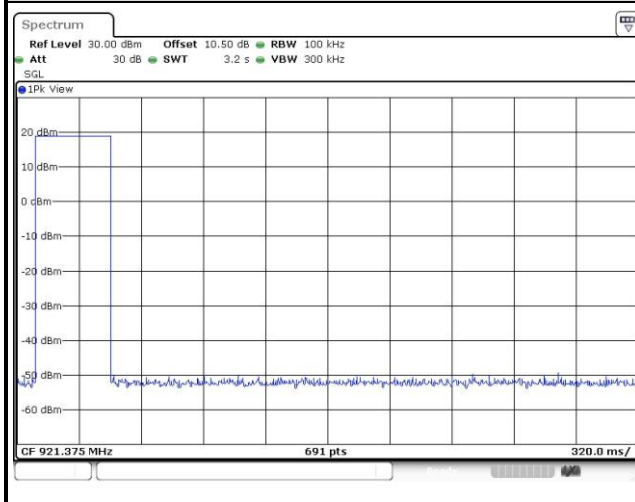


SF 9

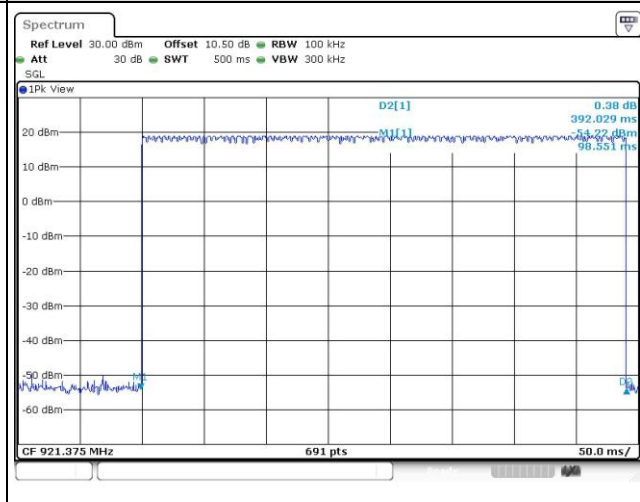


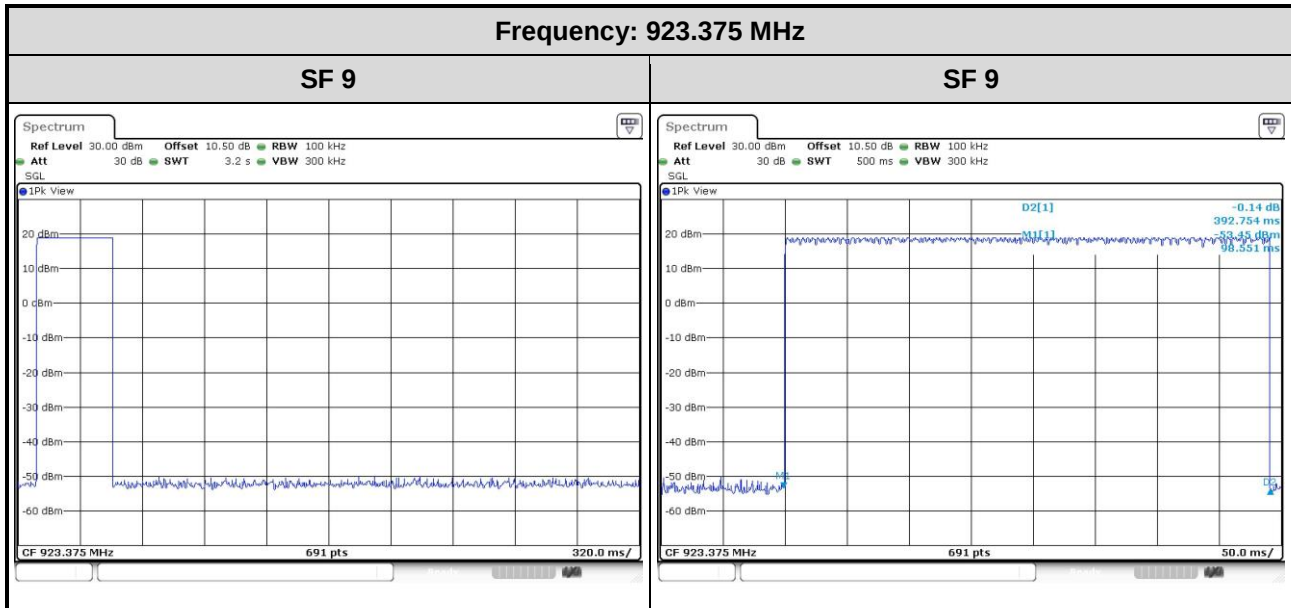
Frequency: 921.375 MHz

SF 9

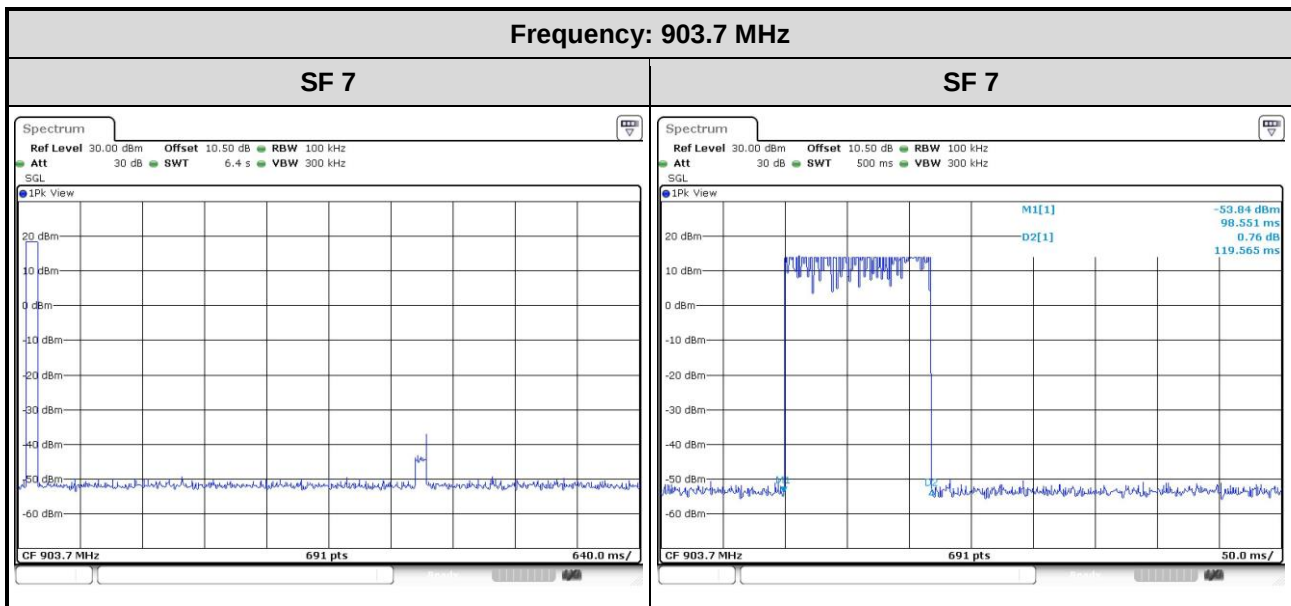


SF 9



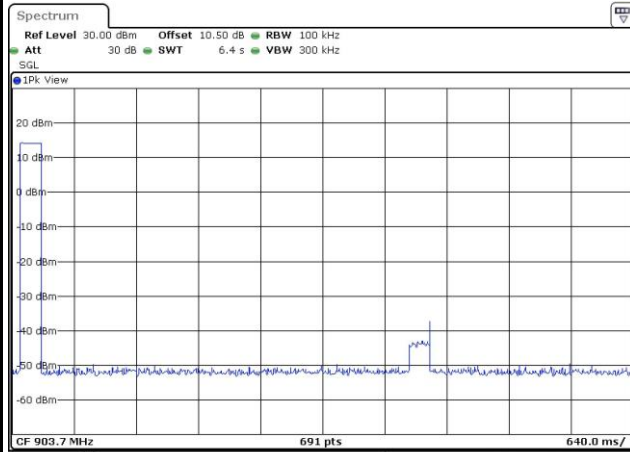


Mode 2, 16 Channels					
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 6.4s (16 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	903.7	0.119565	1	0.120	0.4
CSS / 8	903.7	0.217391	1	0.217	0.4
CSS / 9	903.7	0.392029	1	0.392	0.4
CSS / 10	903.7	0.373188	1	0.373	0.4
CSS / 9	906.9	0.392754	1	0.393	0.4
CSS / 9	910.1	0.392754	1	0.393	0.4
CSS / 9	913.3	0.392754	1	0.393	0.4
CSS / 9	922.375	0.392754	1	0.393	0.4

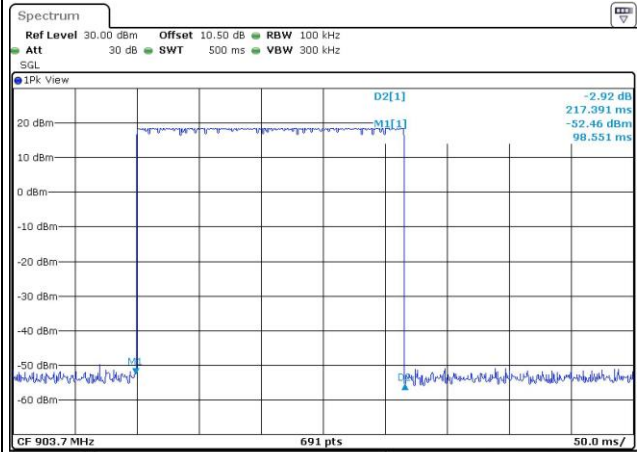


Frequency: 903.7 MHz

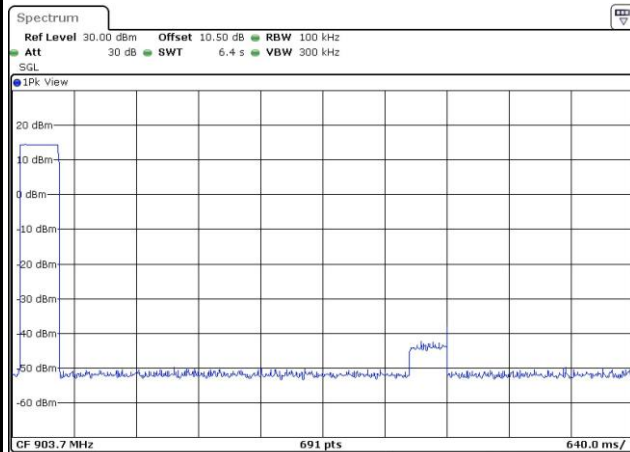
SF 8



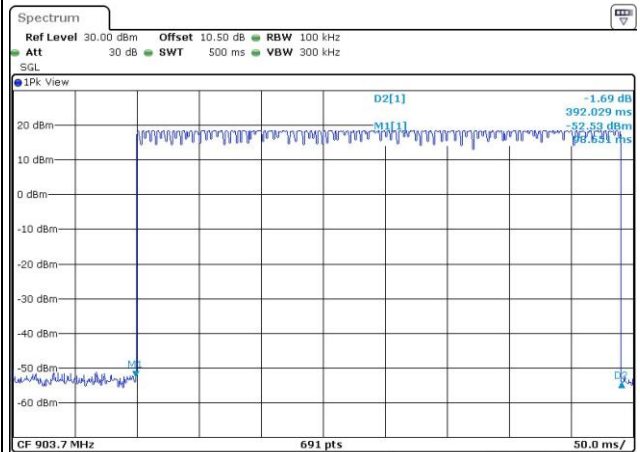
SF 8



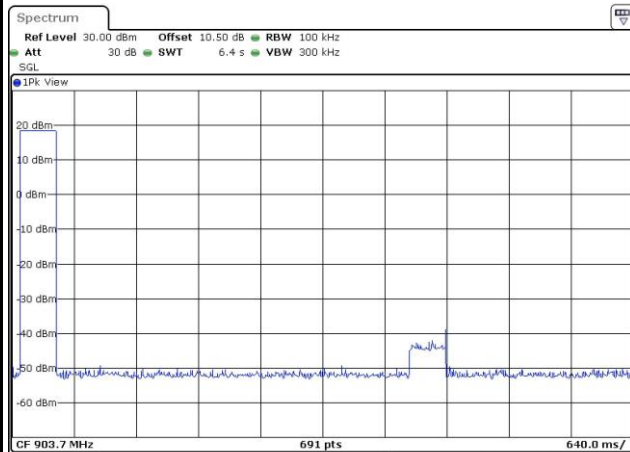
SF 9



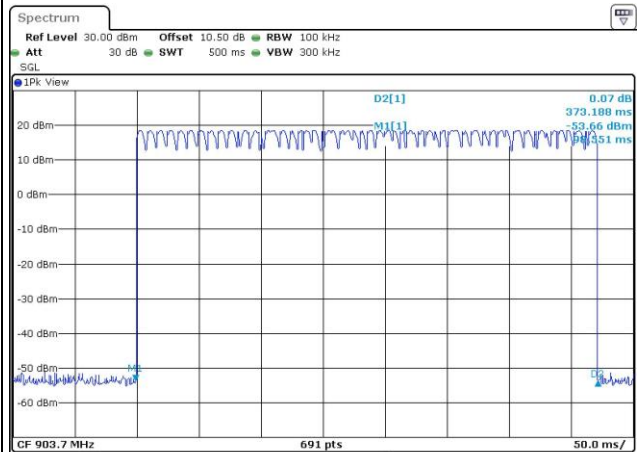
SF 9



SF 10



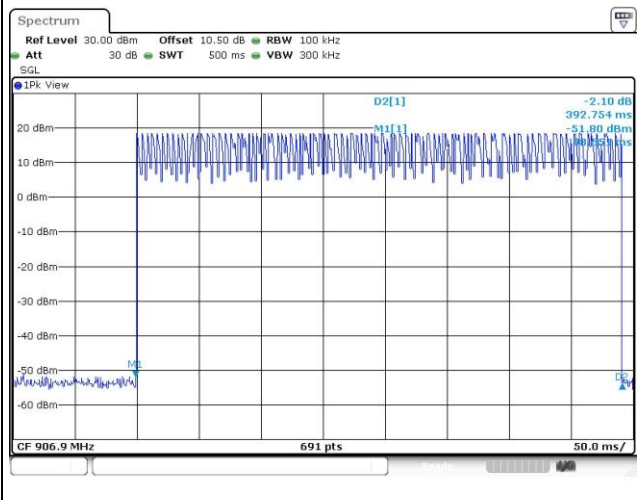
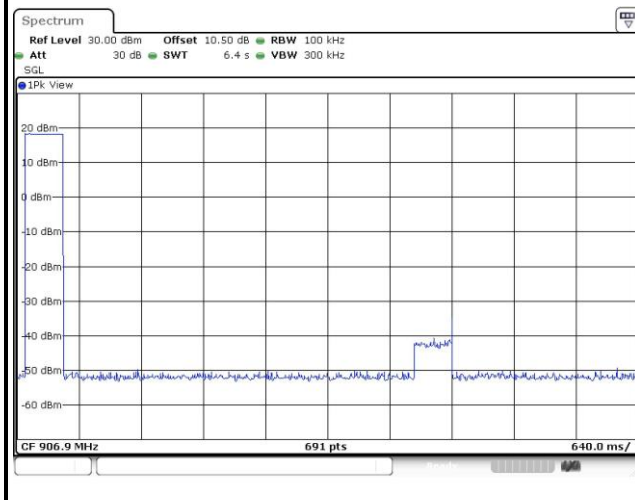
SF 10



Frequency: 906.9 MHz

SF 9

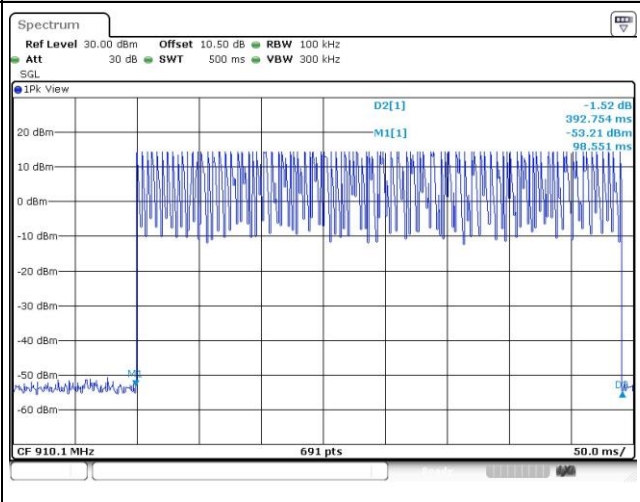
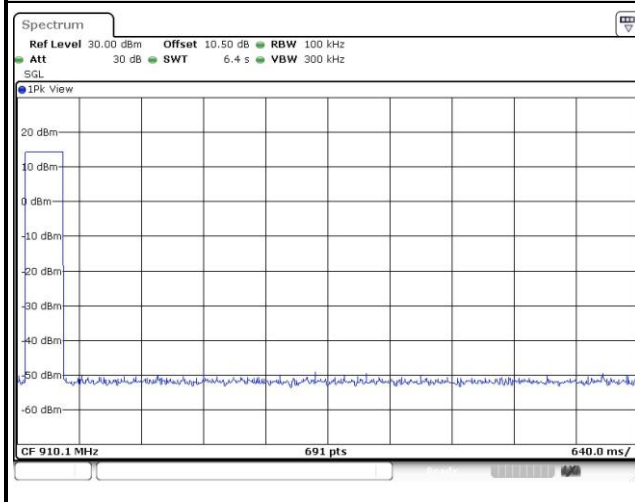
SF 9



Frequency: 910.1 MHz

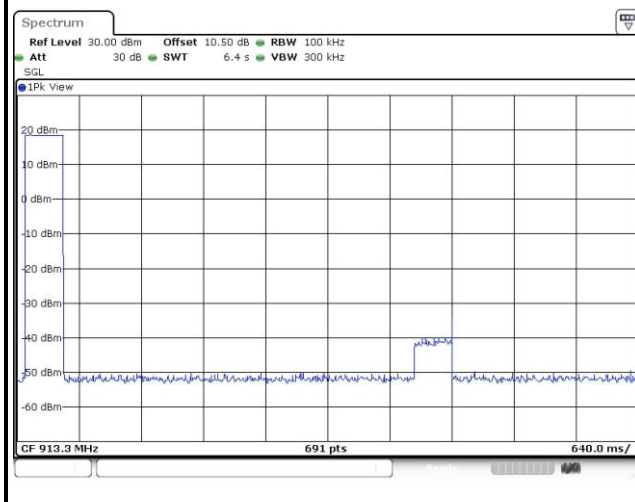
SF 9

SF 9

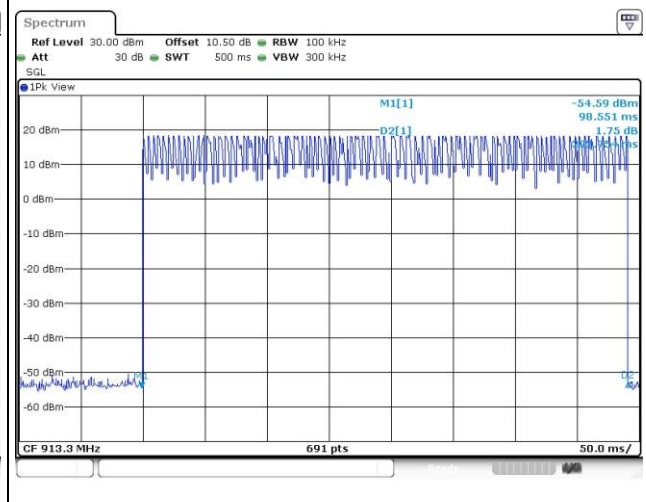


Frequency: 913.3 MHz

SF 9

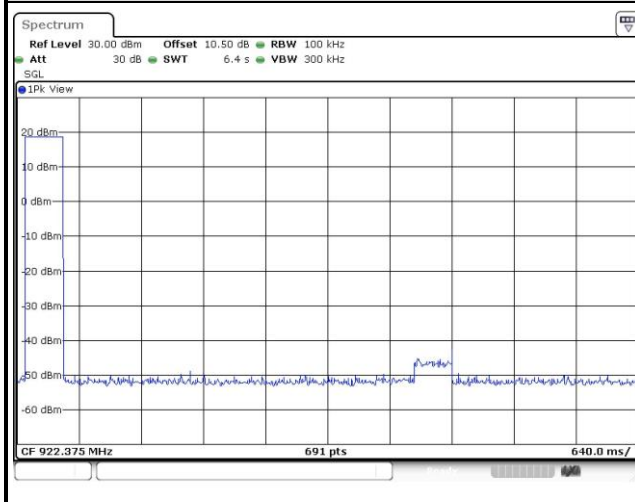


SF 9

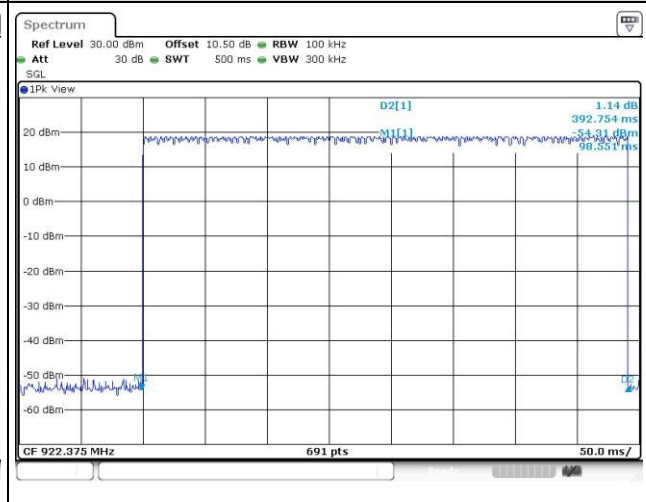


Frequency: 922.375 MHz

SF 9



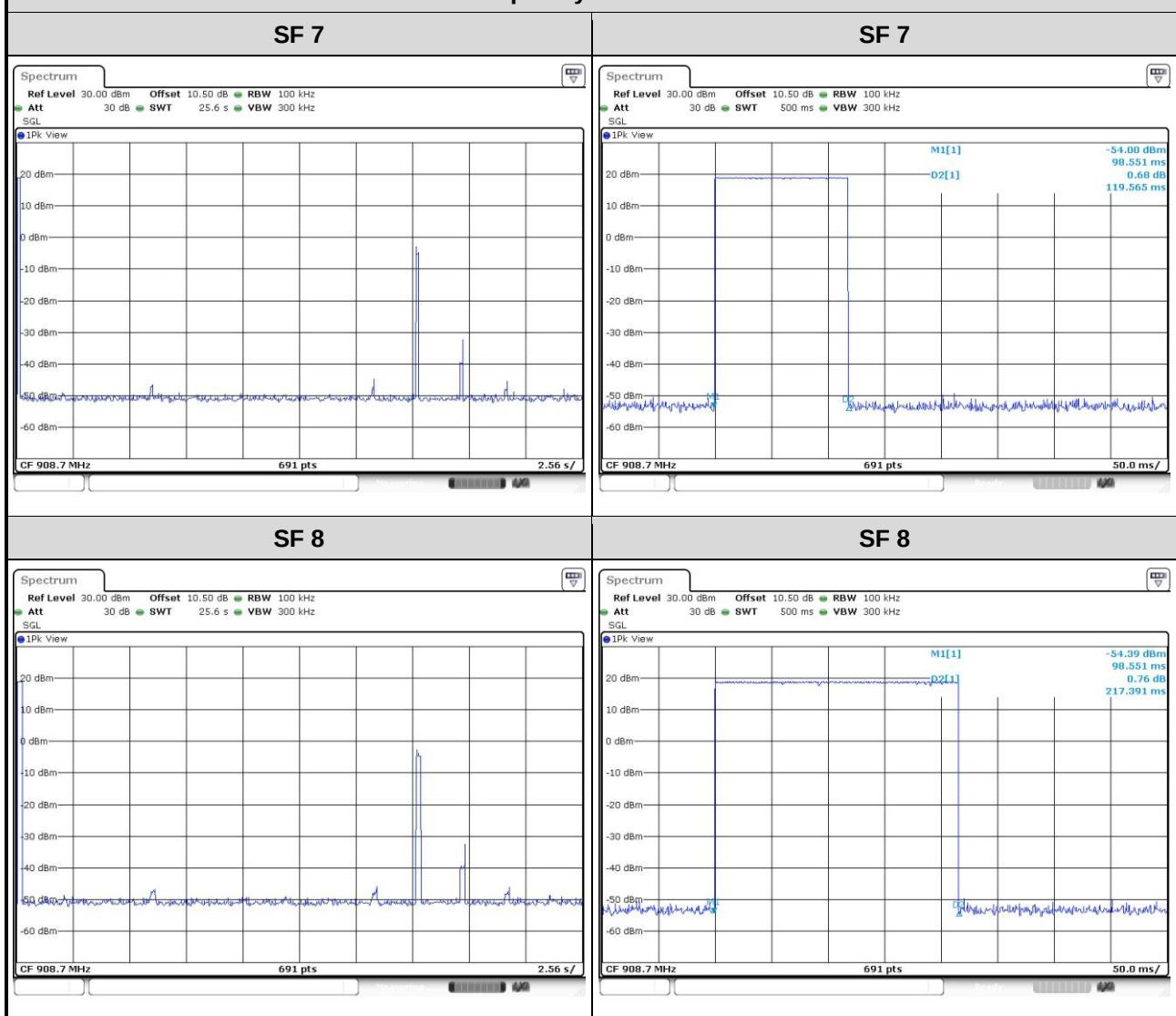
SF 9



Mode 3, 64 Channels

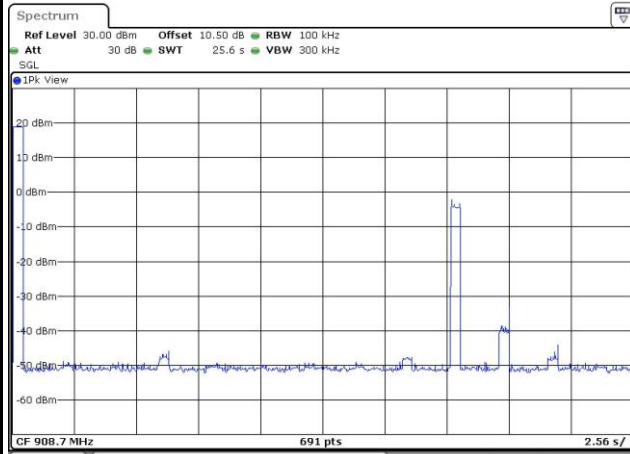
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 25.6s (64 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	908.7	0.119565	1	0.120	0.4
CSS / 8	908.7	0.217391	1	0.217	0.4
CSS / 9	908.7	0.392029	1	0.392	0.4
CSS / 10	908.7	0.373188	1	0.373	0.4

Frequency: 908.7 MHz

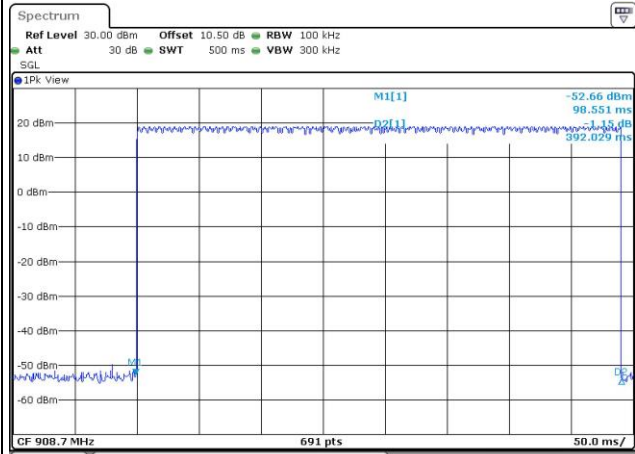


Frequency: 908.7 MHz

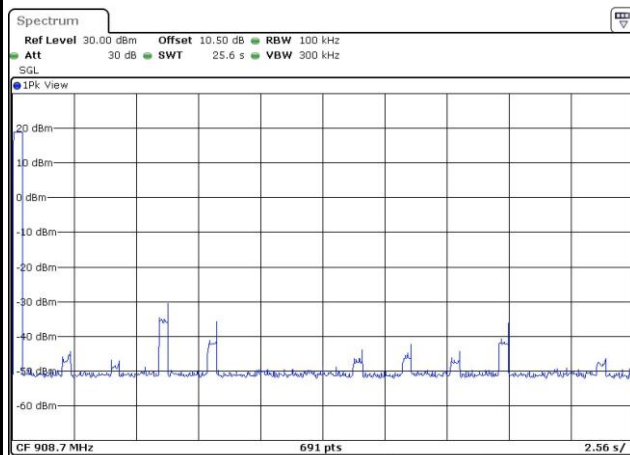
SF 9



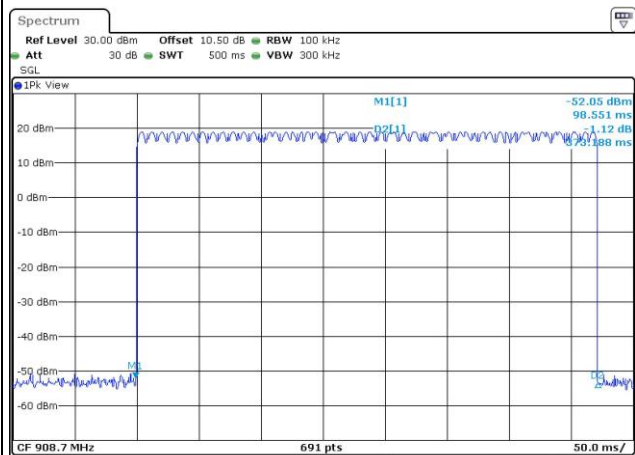
SF 9



SF 10



SF 10



3.9 Power Spectral Density

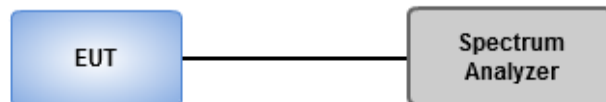
3.9.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band. This item is for Hybrid mode.

3.9.2 Test Procedures

- ☐ Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
 1. Set the RBW = 3kHz, VBW = 10kHz.
 2. Detector = Peak, Sweep time = auto couple.
 3. Trace mode = max hold, allow trace to fully stabilize.
 4. Use the peak marker function to determine the maximum amplitude level.
- ☒ Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.
 1. Set the RBW = 3kHz, VBW = 10 kHz.
 2. Detector = RMS, Sweep time = auto couple.
 3. Employ trace averaging (RMS) mode over a minimum of 100 traces
 4. Use the peak marker function to determine the maximum amplitude level.

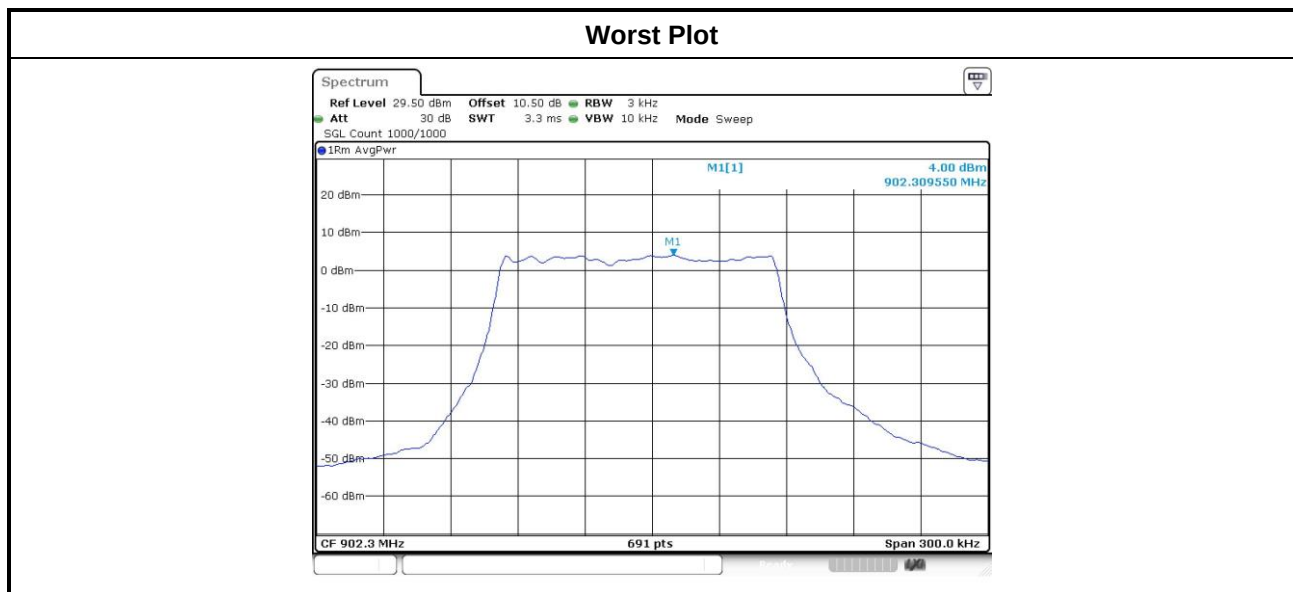
3.9.3 Test Setup



3.9.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 9	902.3	4.00	6.00
CSS / 9	910.1	3.83	6.00
CSS / 9	924.375	3.96	6.00

Note: The maximum antenna gain 8dBi is higher than 6dBi, so the limit shall be reduced to 8 dBm - (8dBi - 6dBi) = 6 dBm.



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan,
R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd
St., Kwei Shan Hsiang, Tao Yuan
Hsien 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan Hsiang, Tao Yuan
Hsien 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==