

6.2 Occupied bandwidth

Test Date (yy-mm-dd): 2017-05-16 to 2017-07-11

Test environment: Normal

Ambient Temp 24.1°C~26.1°C, Humid 46%~51%, Atmospheric Pressure 101kpa

Power supply: AC 120V 50/60Hz

Test Method: FCC part 2. 1049& KDB 935210 D05 Indus Booster Basic Meas v01r01

Test Requirement: FCC part 90.219(a)

6.2.1 Limit

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in table 2.

Table 2 Occupied bandwidth limits

Assigned frequency (MHz)	Modulation envelope reference points or X% power)	Maximum allowed bandwidth
700MHz Band(LTE) Downlink: 758~768 Uplink:788~798	26dBc or 99%	10MHz
700MHz Band Downlink: 769~775 Uplink:799~805	26dBc or 99%	75kHz
800MHz Band Downlink: 851~869 Uplink:806~824	26dBc or 99%	75kHz

NOTE:

1. RF channels to be tested for single-carrier: Low, Mid and High frequency.
2. Modulation types are C4FM, Tetra , Analog FM and LTE.
3. Modulation envelope reference points are provided in terms of attenuation below the modulated carrier.

6.2.2 Test configuration

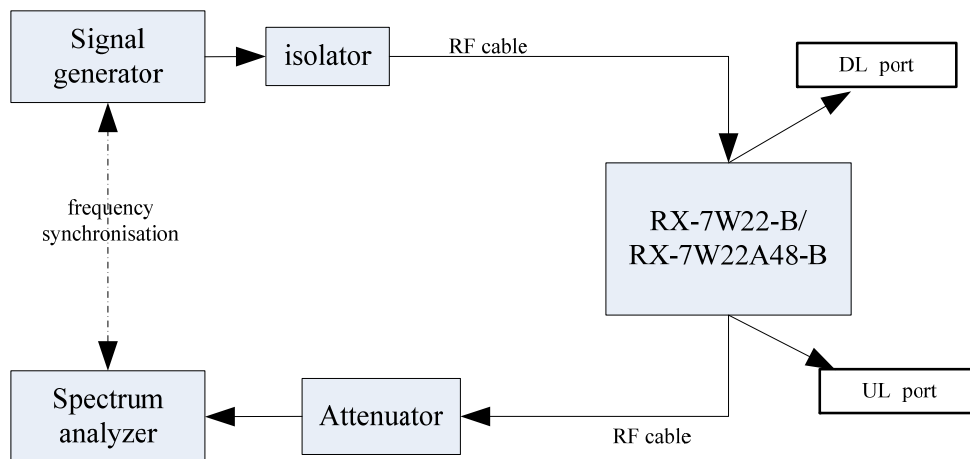


Figure 3: Occupied bandwidth arrangement for Downlink

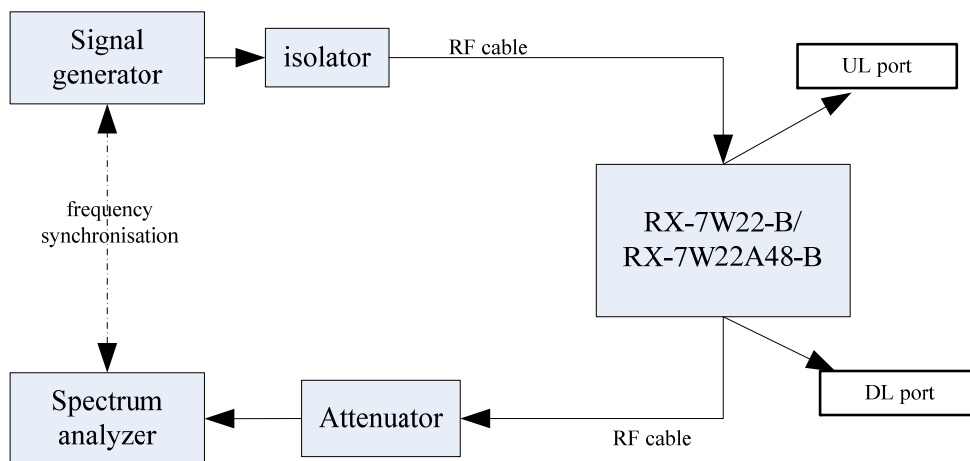


Figure 4: Occupied bandwidth arrangement for Uplink

6.2.3 Test procedures

- (1) Connect the device as illustrated Figure 3 and Figure 4, when the output power is over the maximum value of the Spectrum Analyzer, add the attenuator to avoid destroying.
- (2) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation.
- (3) Configure the signal level to be just below the ALC threshold and maximum gain.
- (4) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- (5) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between 2 times to 5 times the OBW.
- (6) The nominal RBW shall be 100 Hz for 12.5kHz channel and 300 Hz for 25kHz channel and 100kHz for LTE.

- (7) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level.
- (8) Set spectrum analyzer detection mode to peak, and trace mode to max hold.
- (9) Allow the trace to fully stabilize.
- (10) Confirm that the signal is contained within the appropriate emissions mask.
- (11) Use the marker function to determine the maximum emission level and record the associated frequency as f_0 .
- (12) Capture the emissions mask plot for inclusion in the test report (output signal spectra).
- (13) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 [R8] (input signal spectra).
- (14) Compare the spectral plot of the output signal (determined in step 11), to the input signal (determined in step 1) to affirm they are similar (in passband and roll off characteristic features and relative spectral locations).
- (15) Repeat steps (4) to (16) with the input signal amplitude set 3 dB above the AGC threshold;
- (16) Repeat steps (2) to (17) for all authorized operational bands and emissions types.
- (17) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report, and note any observed dissimilarities.
- (18) Repeat RF channels to be tested for single-carrier: Low and High frequency.

6.2.4 Test Results

6.2.4.1 700MHz Band

6.2.4.1.1 Modulation signal: LTE

Resolution Bandwidth:	100 kHz
Video Bandwidth:	1MHz
Detector mode:	Peak hold
Trace mode:	Maximum hold
Modulation envelope reference points	20dBc
Configuration:	Single Band
Operating frequency range:	Downlink: 758MHz~768MHz Uplink:788MHz~798MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(MHz)	Output Occupied BW (MHz)	Max.Limit (MHz)	Result
Downlink transmit mode					
763.00	-57.20	9.262	9.262	10.00	pass
	-54.20	9.262	9.233	10.00	pass
Uplink transmit mode					
793.00	-63.30	9.262	9.262	10.00	pass
	-60.30	9.262	9.262	10.00	pass

6.2.4.1.2 Modulation signal: C4FM

Resolution Bandwidth:	100 Hz
Video Bandwidth:	300 Hz
Detector mode:	Peak hold
Trace mode:	Maximum hold
Modulation envelope reference points	20dBc
Configuration:	Single Band
Symbol Rate:	4.8ksps
Operating frequency range:	Downlink: 769MHz~775MHz Uplink:799MHz~805MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
769.00625	-56.50	9.55	9.55	75.00	pass

	-53.50	9.55	9.55	75.00	pass
772.00625	-57.50	9.55	9.55	75.00	pass
	-54.50	9.55	9.55	75.00	pass
774.99375	-57.00	9.55	9.55	75.00	pass
	-54.00	9.55	9.55	75.00	pass
Uplink transmit mode					
799.00625	-62.80	9.55	9.55	75.00	pass
	-59.80	9.55	9.55	75.00	pass
802.00625	-63.00	9.55	9.55	75.00	pass
	-60.00	9.55	9.55	75.00	pass
804.99375	-63.20	9.55	9.55	75.00	pass
	-60.20	9.55	9.55	75.00	pass

6.2.4.1.3 Modulation signal: Tetra

Resolution Bandwidth:	300 Hz
Video Bandwidth:	1 kHz
Detector mode:	Peak hold
Trace mode:	Maximum hold
Modulation envelope reference points	20dBc
Configuration:	Single Band
Symbol Rate:	18ksps
Operating frequency range:	Downlink: 769MHz~775MHz Uplink: 799MHz~805MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
769.0125	-56.90	23.44	23.44	75.00	pass
	-53.90	23.44	23.44	75.00	pass
772.0125	-57.20	23.44	23.44	75.00	pass
	-54.20	23.44	23.44	75.00	pass

774.9875	-57.10	23.44	23.44	75.00	pass
	-54.10	23.44	23.44	75.00	pass
Uplink transmit mode					
799.0125	-62.60	23.44	23.44	75.00	pass
	-59.60	23.44	23.44	75.00	pass
802.0125	-62.70	23.44	23.44	75.00	pass
	-59.70	23.44	23.44	75.00	pass
804.9875	-62.90	23.44	23.44	75.00	pass
	-59.90	23.44	23.44	75.00	pass

6.2.4.1.4 Modulation signal: Analog FM(10kHz/1kHz)

Resolution Bandwidth:	300 Hz
Video Bandwidth:	1 kHz
Detector mode:	Peak hold
Trace mode:	Maximum hold
Modulation envelope reference points	Occupied BW 99% power
Configuration:	Single Band
Symbol Rate:	1ksps
Frequency Dev:	10kHz
Operating frequency range:	Downlink: 769MHz~775MHz Uplink:799MHz~805MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
769.0125	-56.80	22.14	22.14	75.00	pass
	-53.80	22.14	22.14	75.00	pass
772.0125	-57.20	22.14	22.14	75.00	pass
	-54.20	22.14	22.00	75.00	pass
774.9875	-57.10	22.14	22.14	75.00	pass
	-54.10	22.14	22.14	75.00	pass

Uplink transmit mode					
799.0125	-62.90	22.14	22.14	75.00	pass
	-59.90	22.14	22.14	75.00	pass
802.0125	-62.90	22.14	22.14	75.00	pass
	-59.90	22.14	22.14	75.00	pass
804.9875	-63.20	22.14	22.14	75.00	pass
	-60.20	22.14	22.14	75.00	pass

6.2.4.2 800MHz Band

6.2.4.2.1 Modulation signal: C4FM

Resolution Bandwidth:	100 Hz
Video Bandwidth:	300 Hz
Detector mode:	Peak hold
Trace mode:	Maximum hold
Modulation envelope reference points	20dBc
Configuration:	Single Band
Symbol Rate:	4.8ksps
Operating frequency range:	Downlink: 851MHz~862MHz Uplink:806MHz~817MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
856.50625	-56.20	8.10	8.10	75.00	pass
	-53.20	8.10	8.10	75.00	pass
Uplink transmit mode					
811.50625	-61.90	8.10	8.03	75.00	pass
	-58.90	8.10	8.10	75.00	pass

6.2.4.2.2 Modulation signal: Tetra

Resolution Bandwidth:	300 Hz
Video Bandwidth:	1 kHz

Detector mode: Peak hold
 Trace mode: Maximum hold
 Modulation envelope reference points: 20dBc
 Configuration: Single Band
 Symbol Rate: 18ksps
 Operating frequency range: Downlink: 851MHz~862MHz
 Uplink: 806MHz~817MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
856.5125	-56.70	20.98	20.84	75.00	pass
	-53.70	20.98	20.98	75.00	pass
Uplink transmit mode					
811.5125	-62.00	20.98	20.98	75.00	pass
	-59.00	20.98	20.98	75.00	pass

6.2.4.2.3 Modulation signal: Analog FM(10kHz/1kHz)

Resolution Bandwidth: 300 Hz
 Video Bandwidth: 1 kHz
 Detector mode: Peak hold
 Trace mode: Maximum hold
 Modulation envelope reference points: Occupied BW 99% power
 Configuration: Single Band
 Symbol Rate: 1ksps
 Frequency Dev: 10kHz
 Operating frequency range: Downlink: 851MHz~862MHz
 Uplink: 806MHz~817MHz

Carrier frequency (MHz)	Input power (dBm)	Input Occupied BW(kHz)	Output Occupied BW (kHz)	Max.Limit (kHz)	Result
Downlink transmit mode					
856.5125	-56.60	22.14	22.00	75.00	pass
	-53.60	22.14	22.00	75.00	pass
Uplink transmit mode					

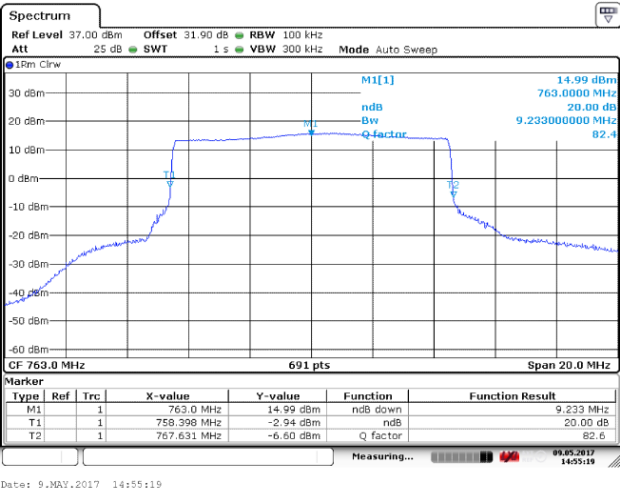
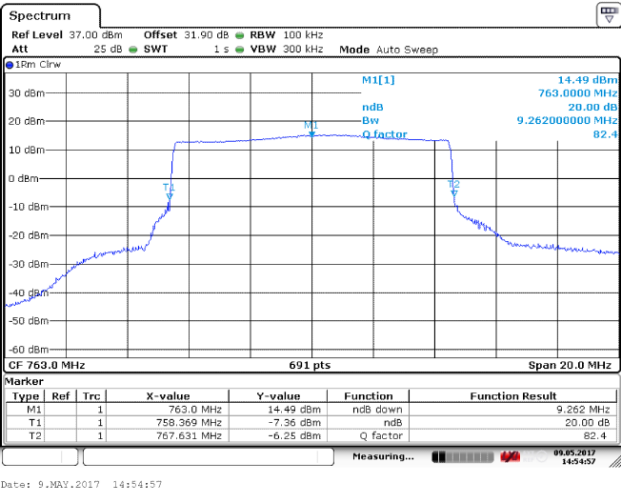
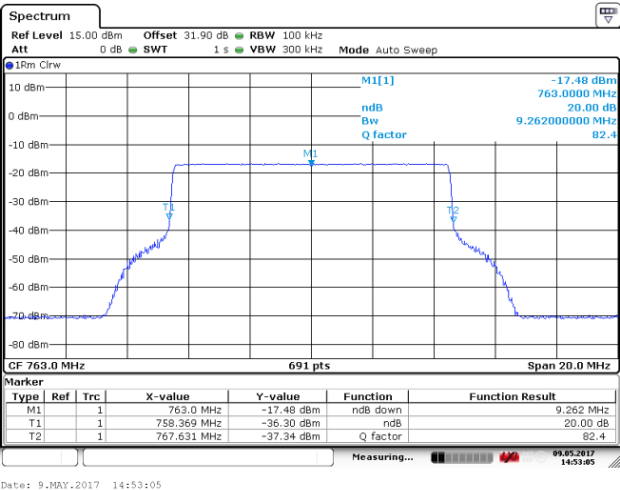
811.5125	-62.00	22.14	22.00	75.00	pass
	-59.00	22.14	22.00	75.00	pass

6.2.5 Test screenshot

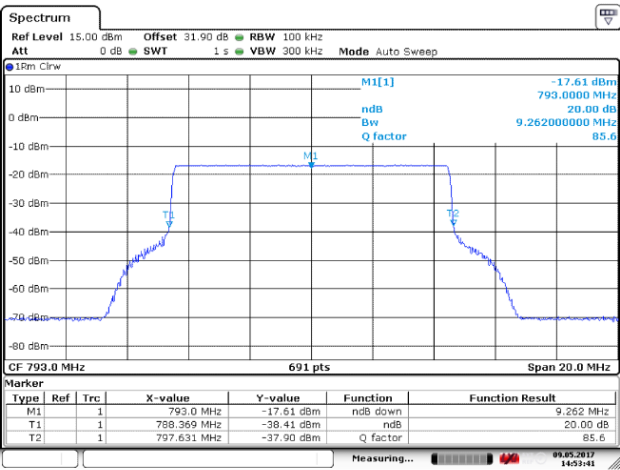
6.2.5.1 700MHz Band

6.2.5.1.1 Modulation signal: LTE

(1) Downlink

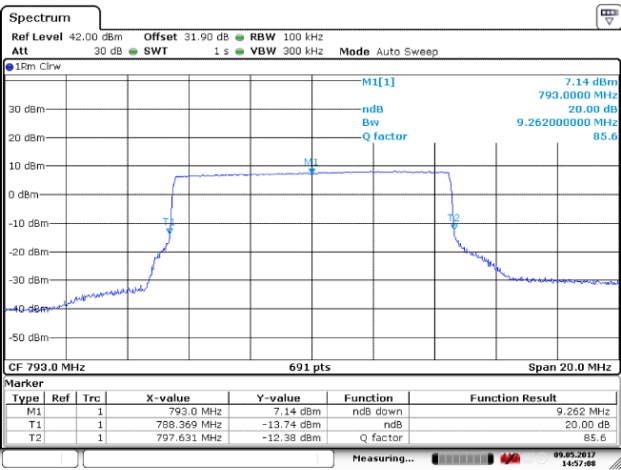


(2) Uplink



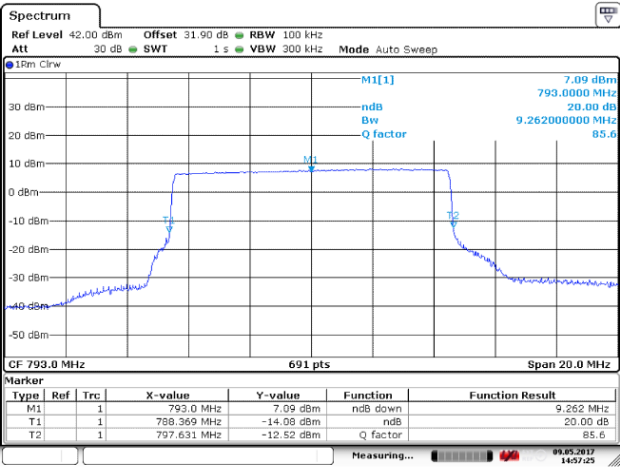
Date: 9.MAY.2017 14:53:41

Frequency: 793.0MHz, Input occupied BW



Date: 9.MAY.2017 14:57:09

Frequency: 793.0MHz,, Output occupied BW(ALC)

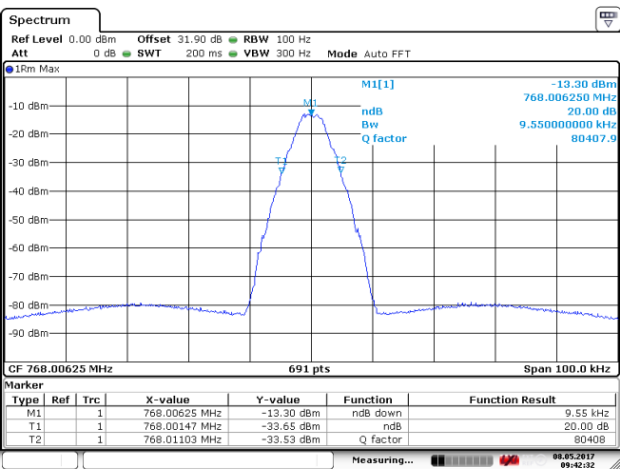


Date: 9.MAY.2017 14:57:25

Frequency: 793.0MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)

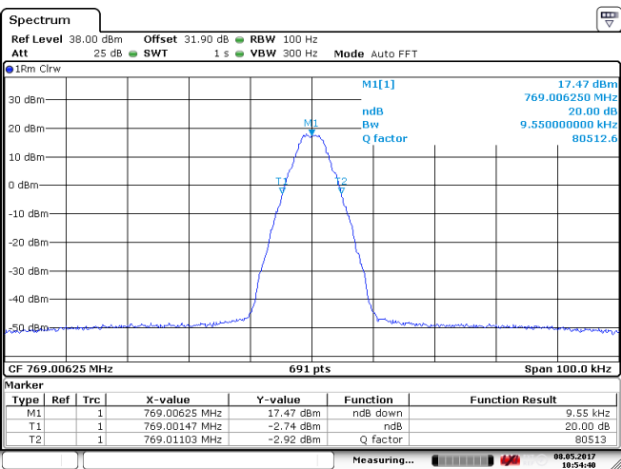
6.2.5.1.2 Modulation signal: C4FM

(1) Downlink



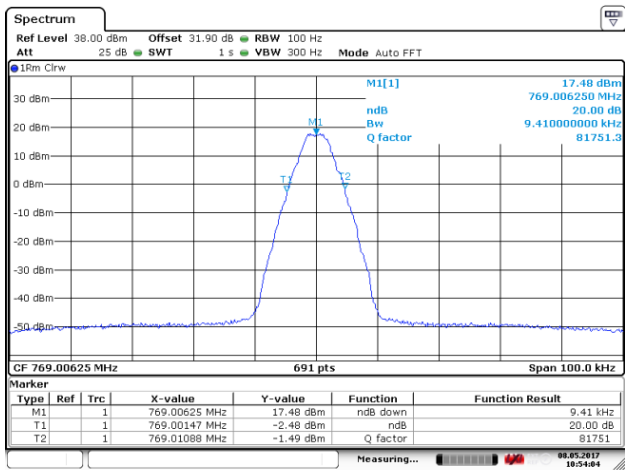
Date: 8.MAY.2017 09:42:32

Low Frequency: 769.00625MHz, Input occupied BW

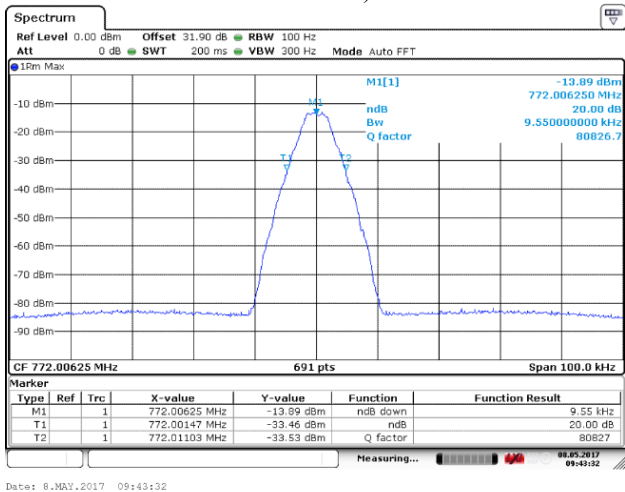


Date: 8.MAY.2017 10:54:39

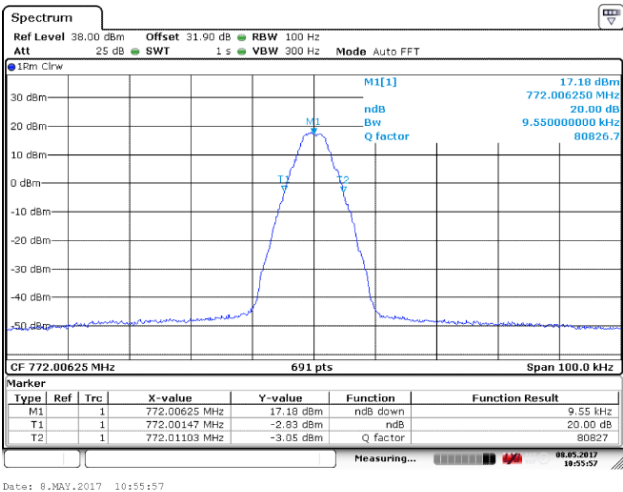
Low Frequency: 769.00625MHz, Output occupied BW(ALC)



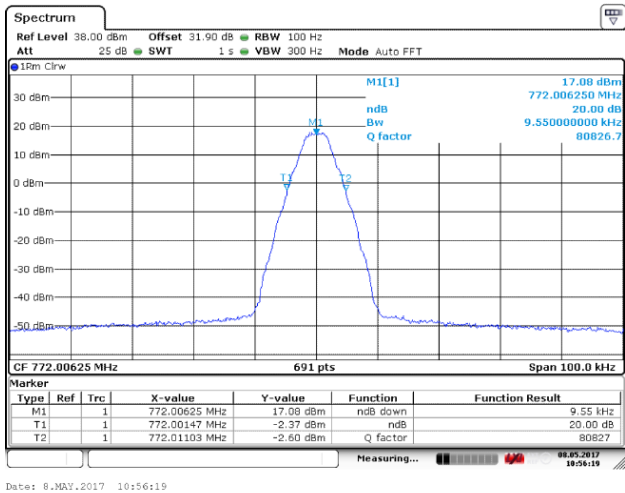
Low Frequency: 769.00625MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



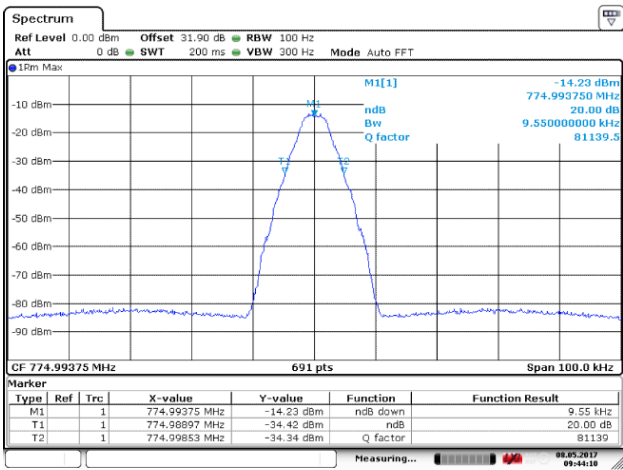
Mid Frequency: 772.00625MHz, Input occupied BW



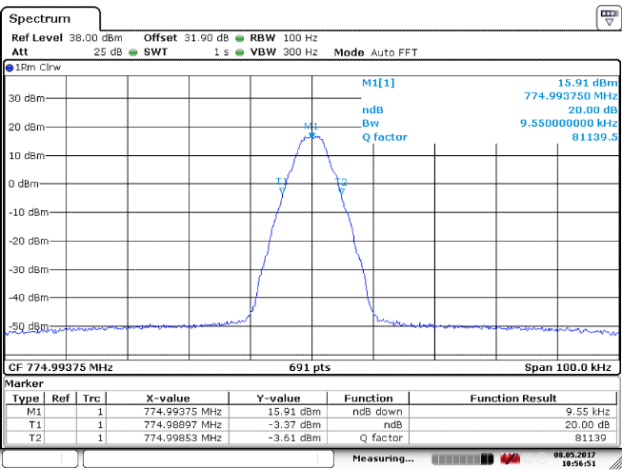
Mid Frequency: 772.00625MHz, Output occupied BW(ALC)



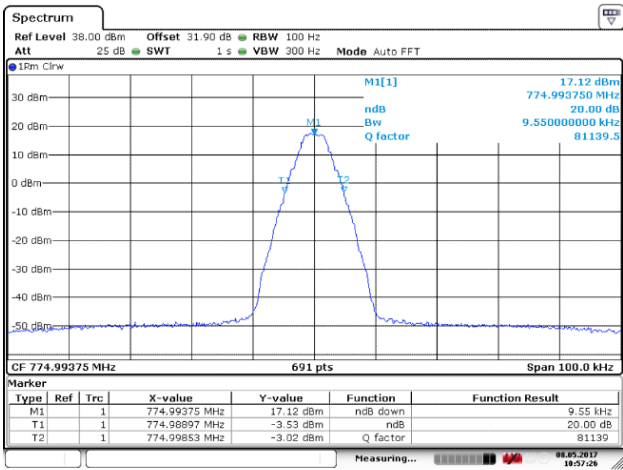
Mid Frequency: 772.00625MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



High Frequency: 774.99375MHz, Input occupied BW

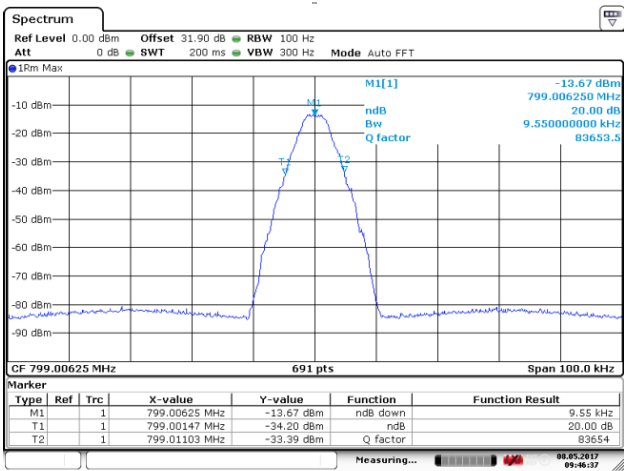


High Frequency: 774.99375MHz, Output occupied BW(ALC)

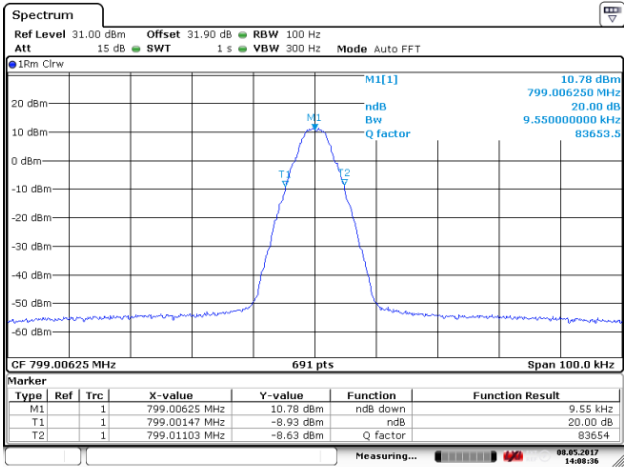


High Frequency: 774.99375MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)

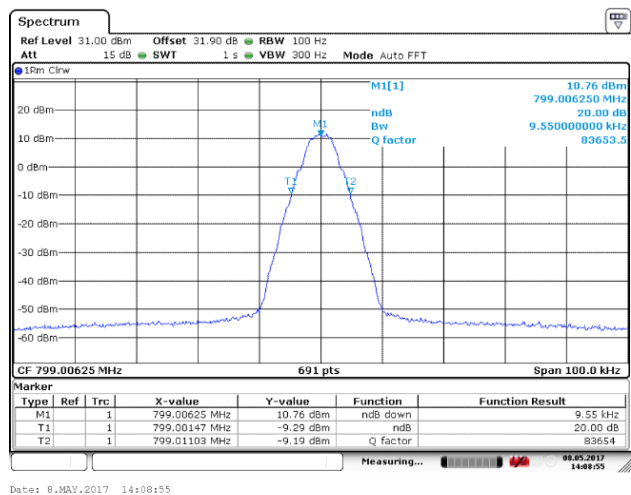
(2) Uplink



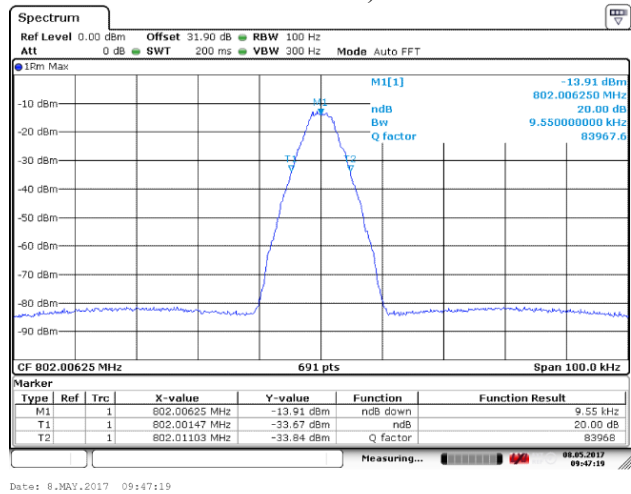
Low Frequency: 799.00625MHz, Input occupied BW



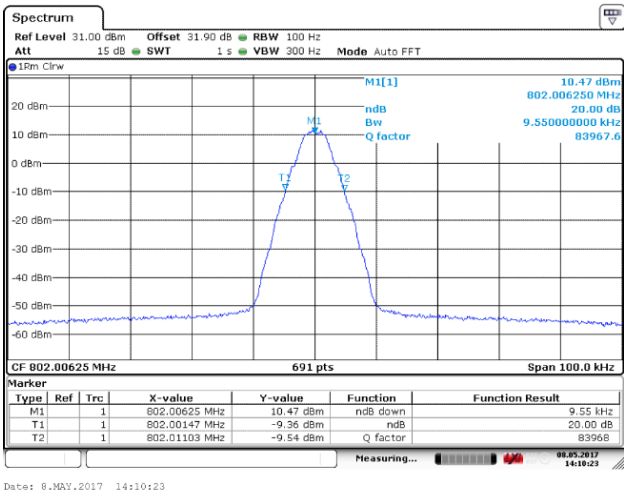
Low Frequency: 799.00625MHz, Output occupied BW(ALC)



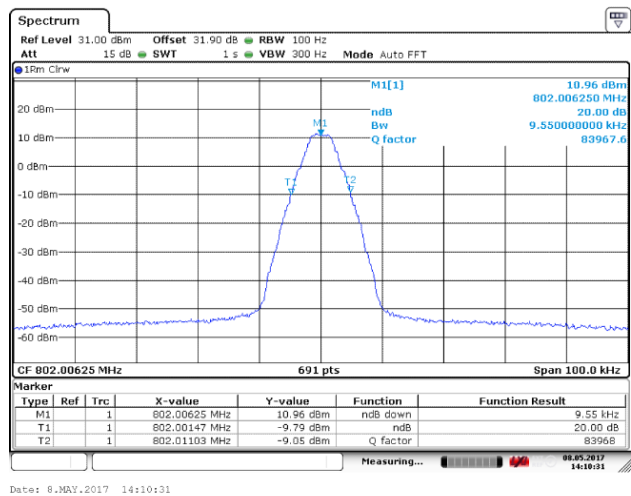
Low Frequency: 799.00625MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



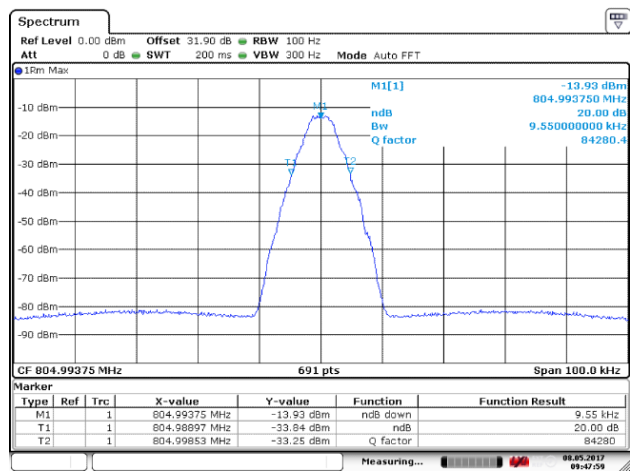
Mid Frequency: 802.00625MHz, Input occupied BW



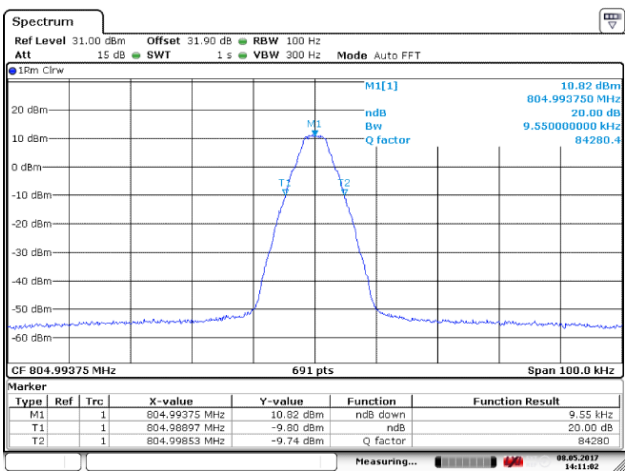
Mid Frequency: 802.00625MHz, Output occupied BW(ALC)



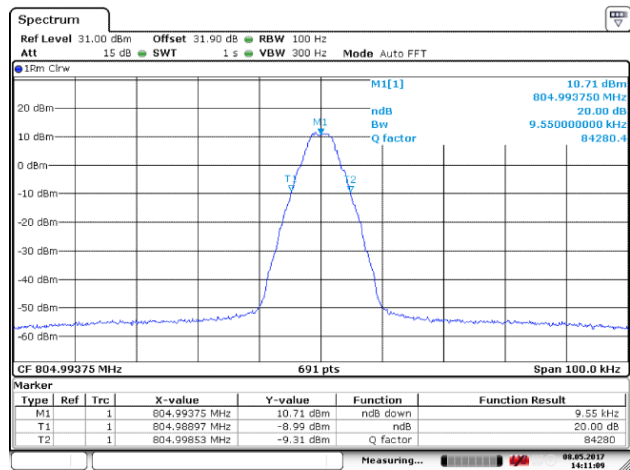
Mid Frequency: 802.00625MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



High Frequency: 804.99375MHz, Input occupied BW



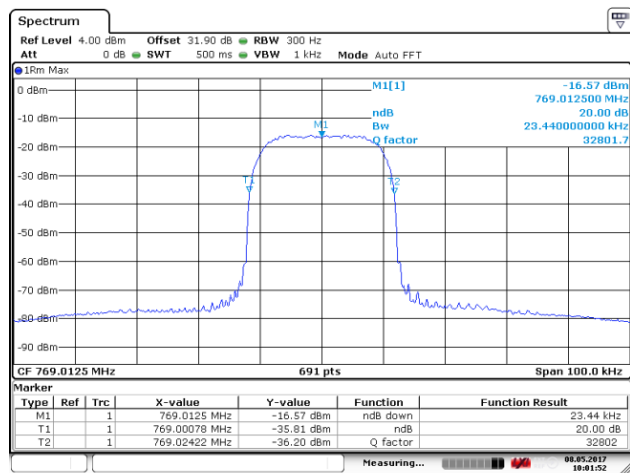
High Frequency: 804.99375MHz, Output occupied BW(ALC)



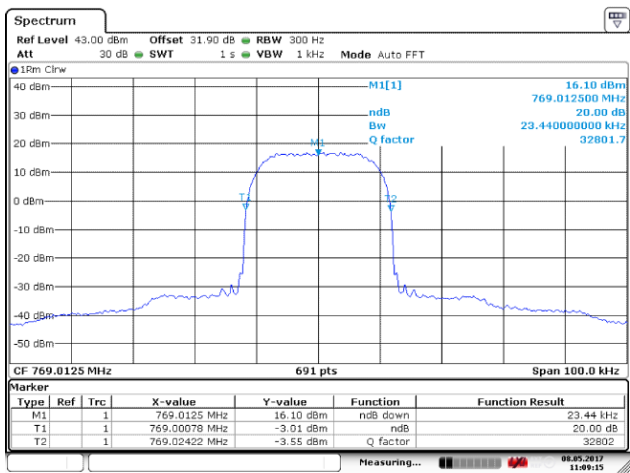
High Frequency: 804.99375MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)

6.2.5.1.3 Modulation signal: Tetra

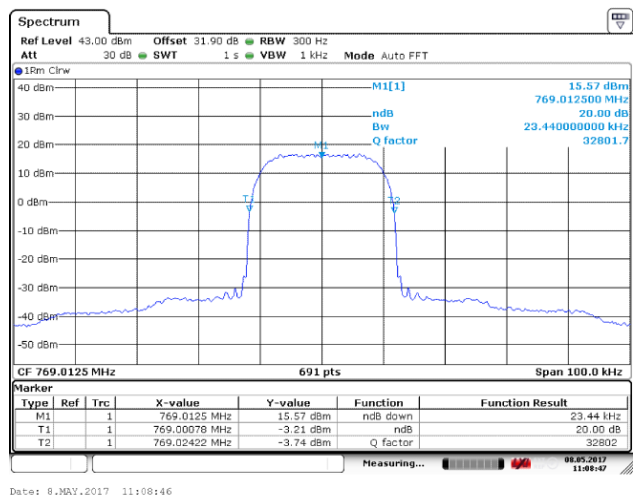
(1) Downlink



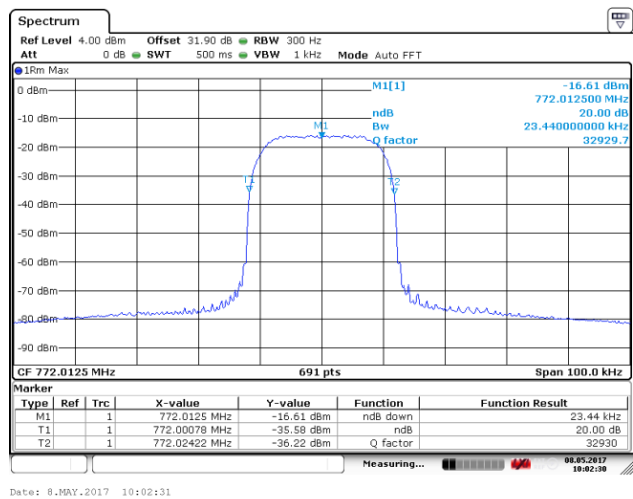
Low Frequency: 769.0125MHz, Input occupied BW



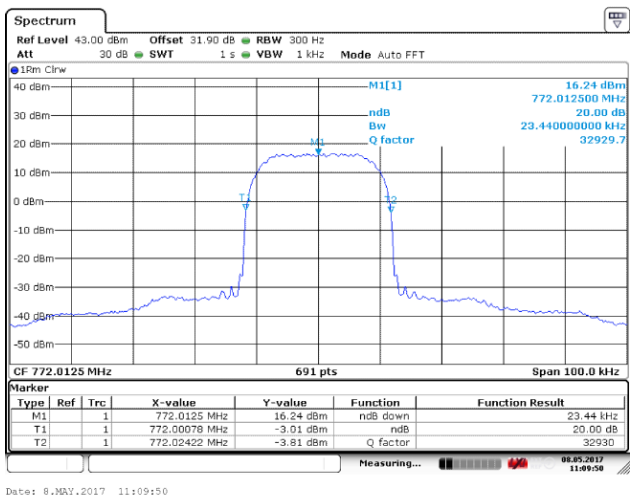
Low Frequency: 769.0125MHz, Output occupied BW(ALC)



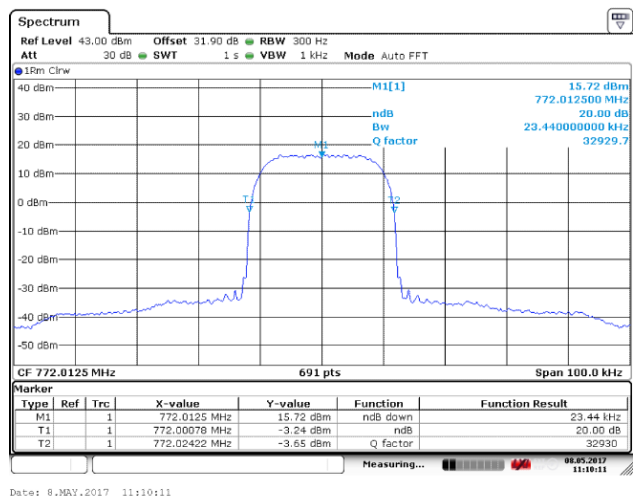
Low Frequency: 769.0125MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



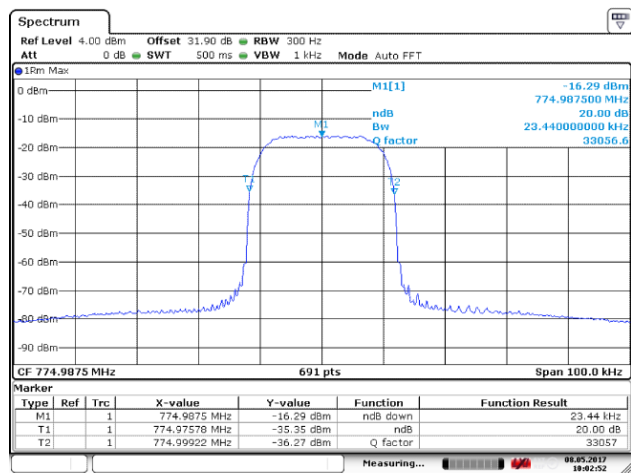
Mid Frequency: 772.0125MHz, Input occupied BW



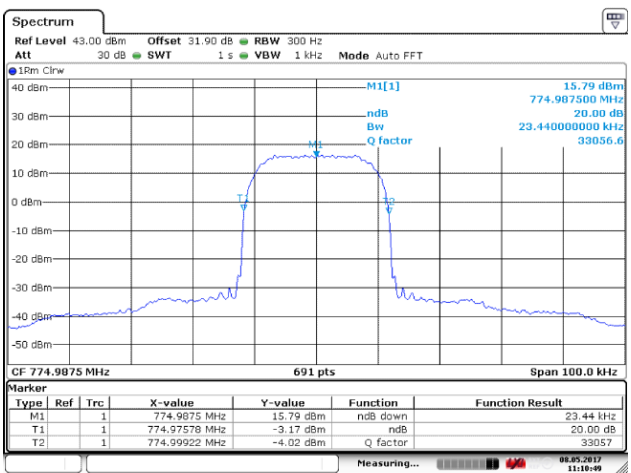
Mid Frequency: 772.0125MHz, Output occupied BW(ALC)



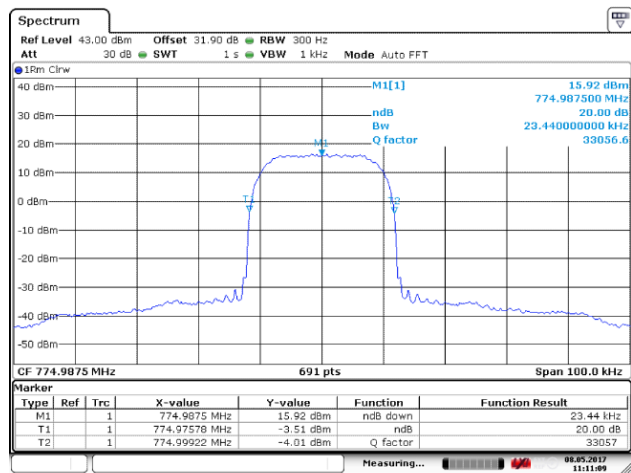
Mid Frequency: 772.0125MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)



High Frequency: 774.9875MHz, Input occupied BW

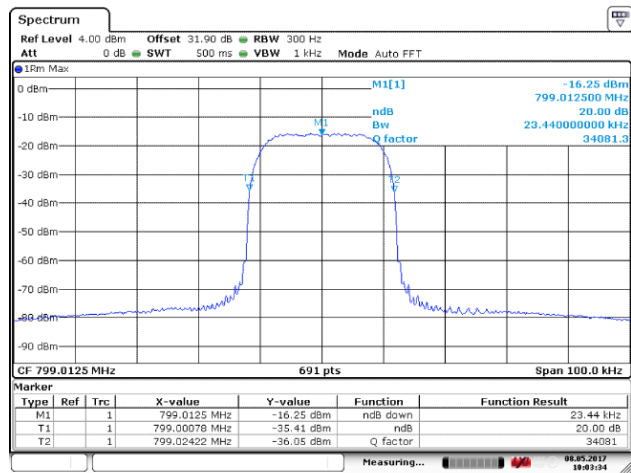


High Frequency: 774.9875MHz, Output occupied BW(ALC)

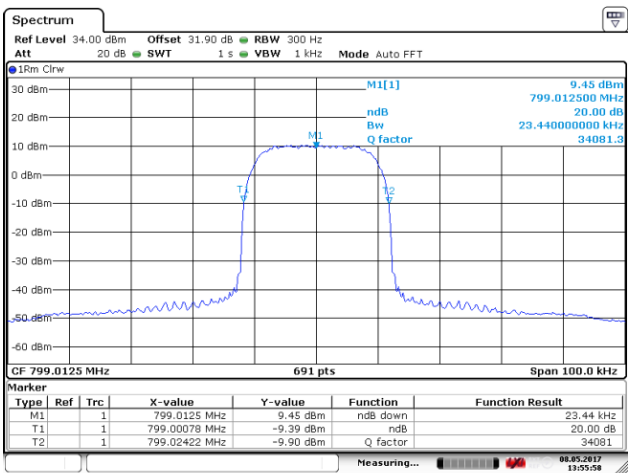


High Frequency: 774.9875MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)

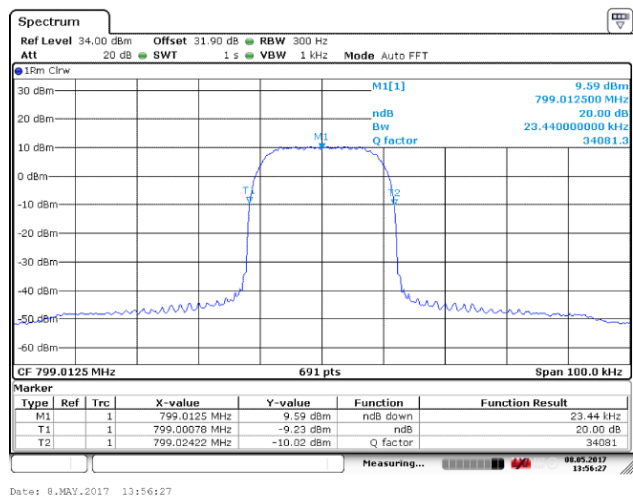
(2) Uplink



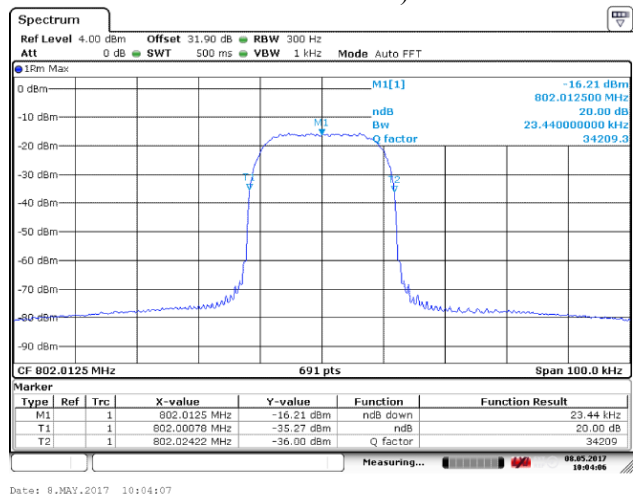
Low Frequency: 799.0125MHz, Input occupied BW



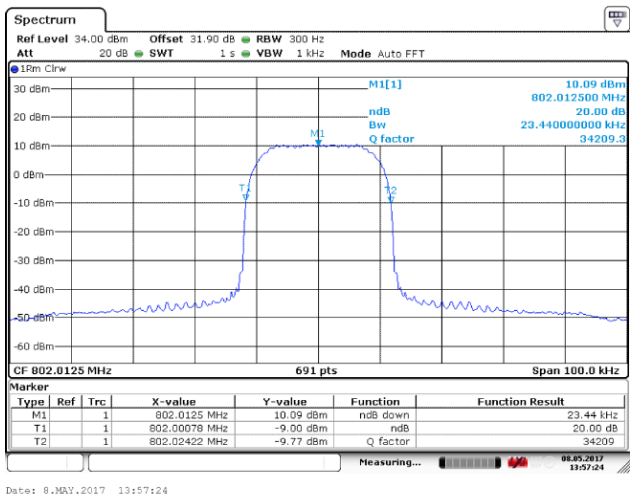
Low Frequency: 799.0125MHz, Output occupied BW(ALC)



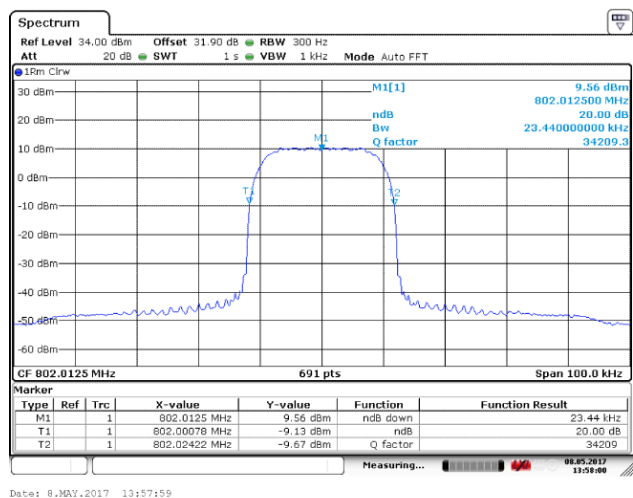
Low Frequency: 799.0125MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)



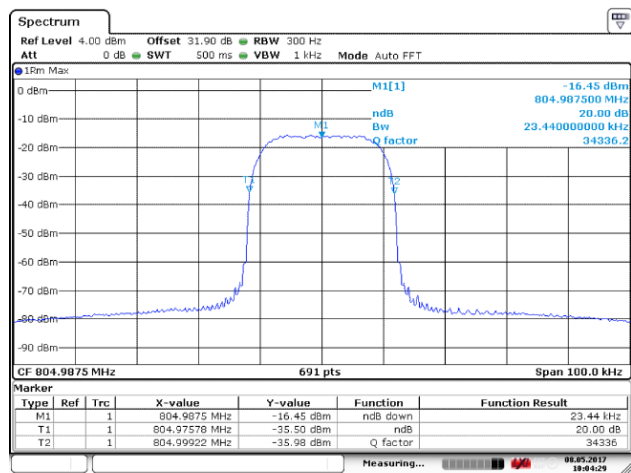
Mid Frequency: 802.0125MHz, Input occupied BW



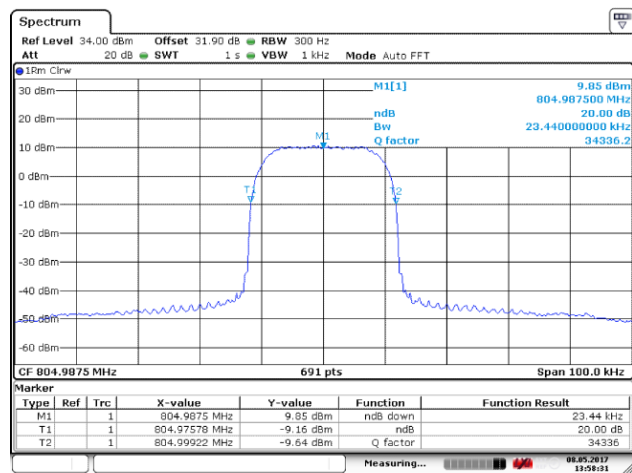
Mid Frequency: 802.0125MHz, Output occupied BW(ALC)



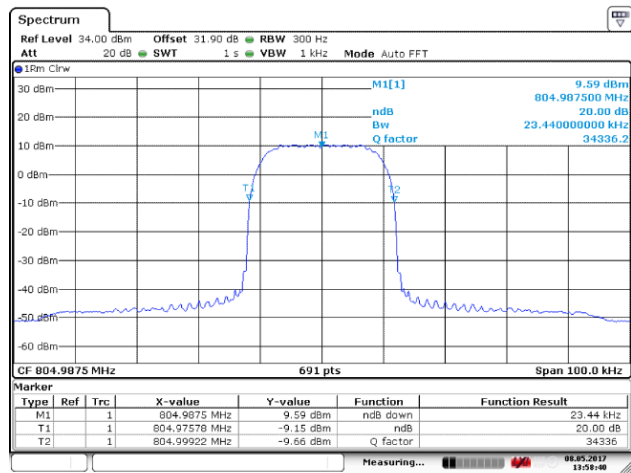
Mid Frequency: 802.0125MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)



High Frequency: 804.9875MHz, Input occupied BW



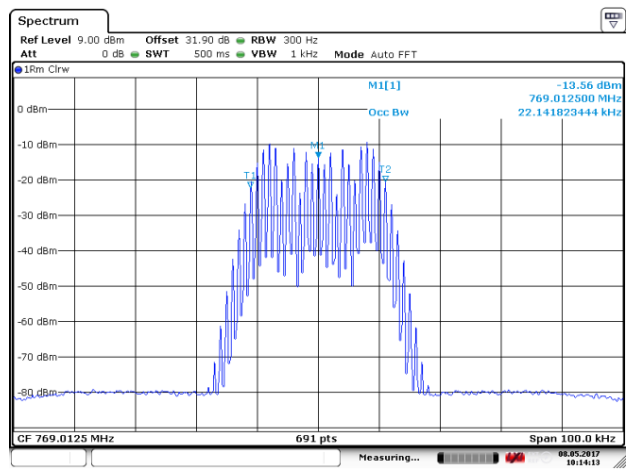
High Frequency: 804.9875MHz, Output occupied BW(ALC)



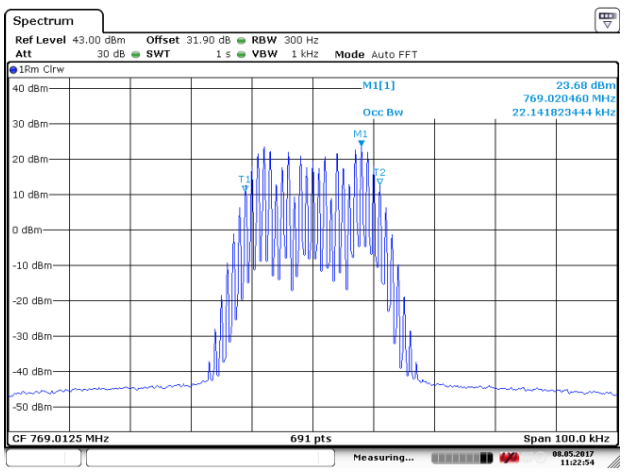
High Frequency: 804.9875MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

6.2.5.1.4 Modulation signal: Analog FM(10kHz/1kHz)

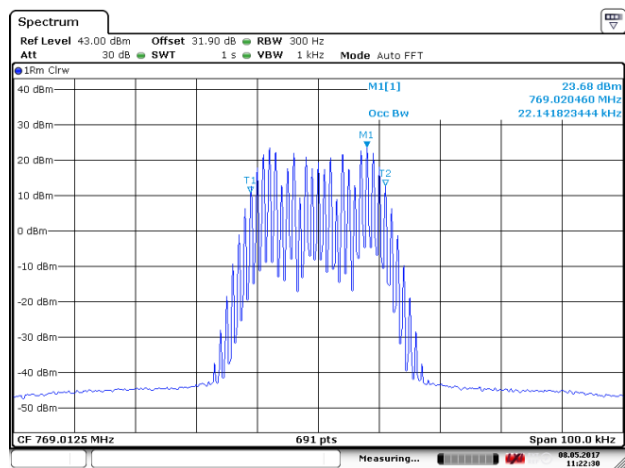
(1) Downlink



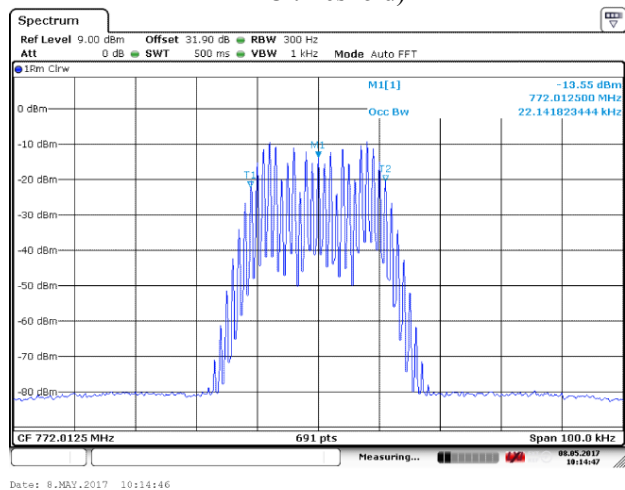
Low Frequency: 769.0125MHz, Input occupied BW



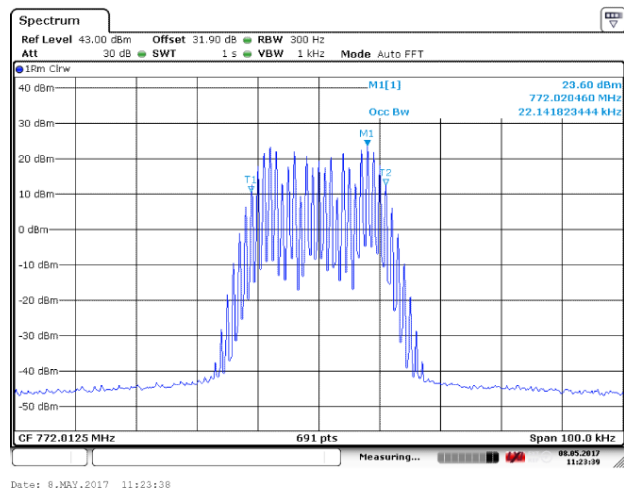
Low Frequency: 769.0125MHz, Output occupied BW(ALC)



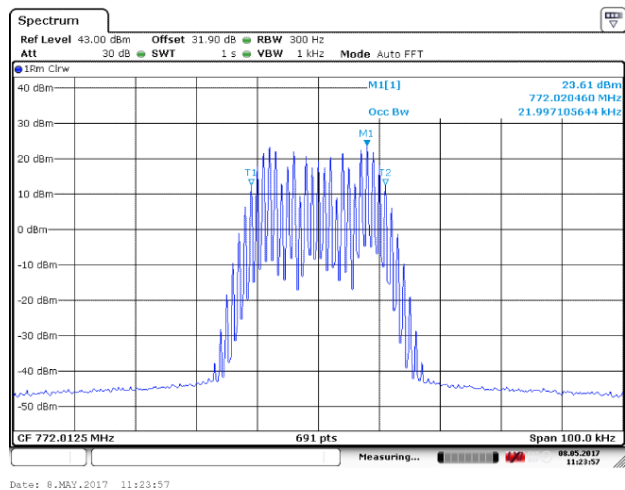
Low Frequency: 769.0125MHz, Output occupied BW
(with the input signal amplitude set 3 dB above the
ALC threshold)



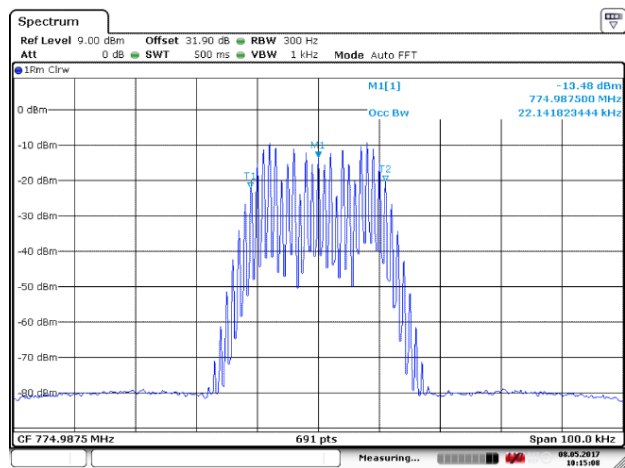
Mid Frequency: 772.0125MHz, Input occupied BW



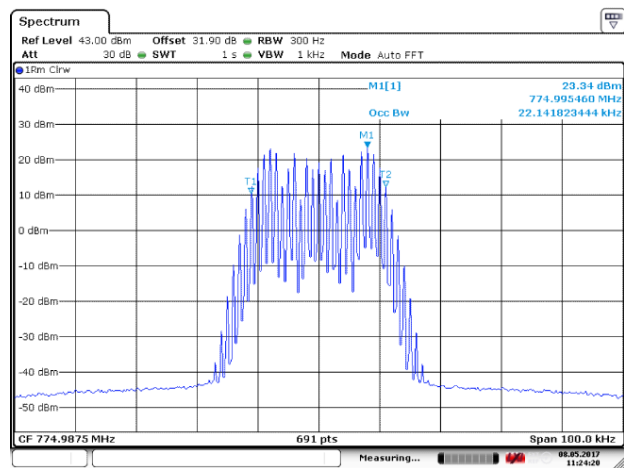
Mid Frequency: 772.0125MHz, Output occupied
BW(ALC)



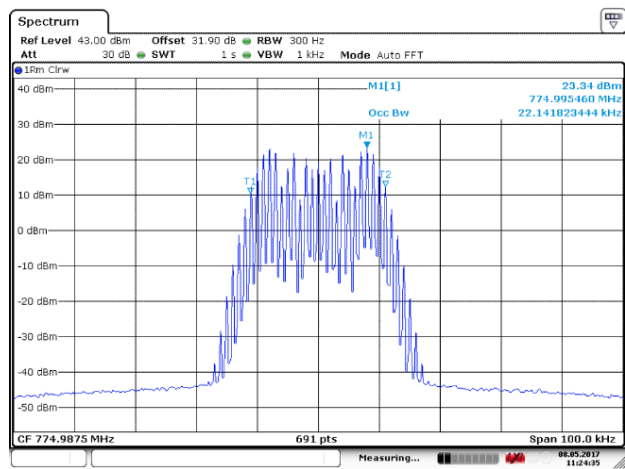
Mid Frequency: 772.0125MHz, Output occupied BW
(with the input signal amplitude set 3 dB above the
ALC threshold)



High Frequency: 774.9875MHz, Input occupied BW

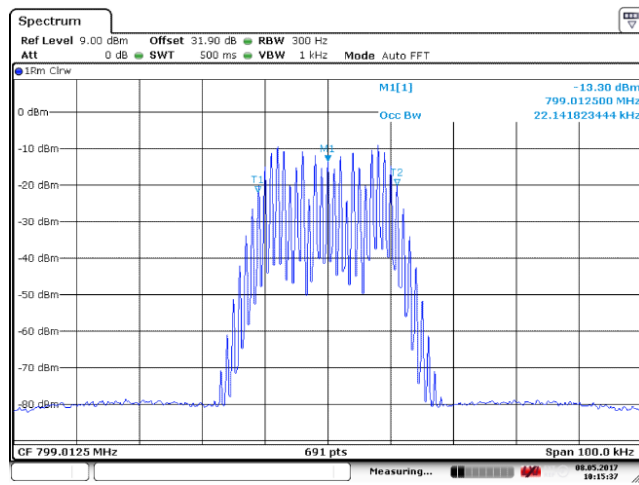


High Frequency: 774.9875MHz, Output occupied BW(ALC)

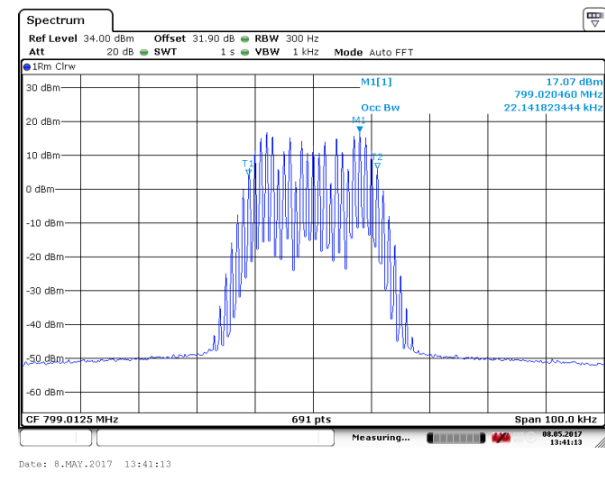


High Frequency: 774.9875MHz, Output occupied BW (with the input signal amplitude set 3 dB above the ALC threshold)

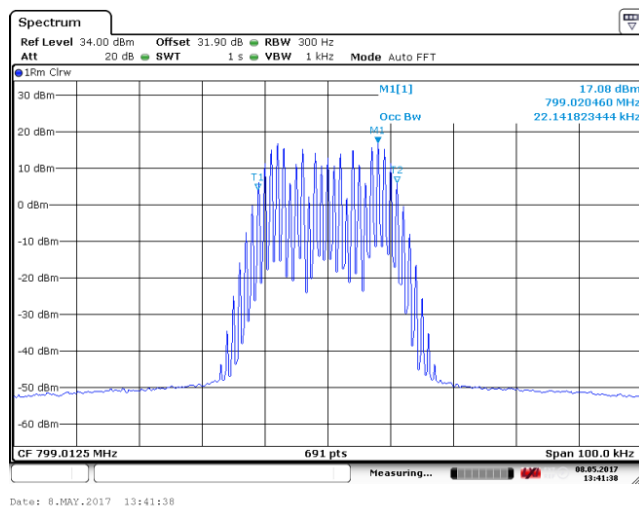
(2) Uplink



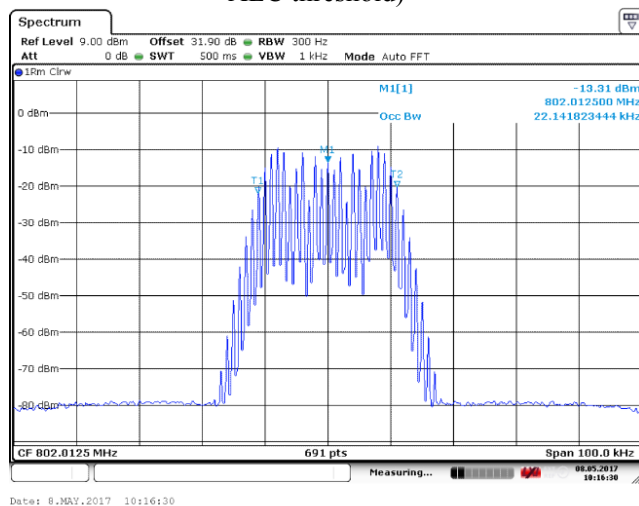
Low Frequency: 799.0125MHz, Input occupied BW



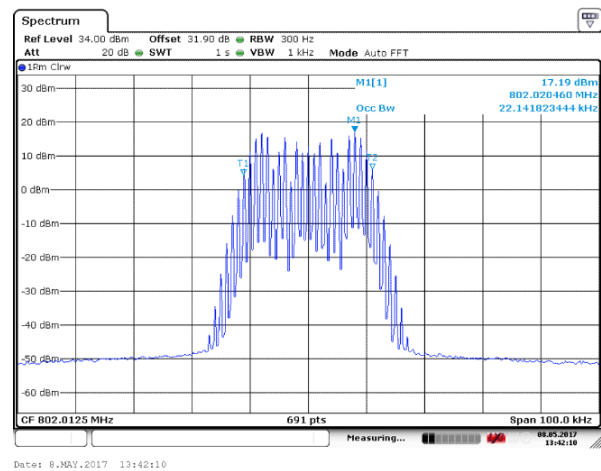
Low Frequency: 799.0125MHz, Output occupied BW(ALC)



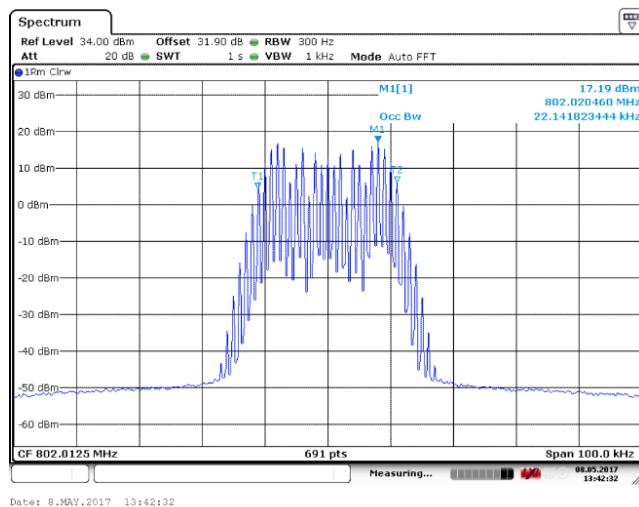
Low Frequency: 799.0125MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)



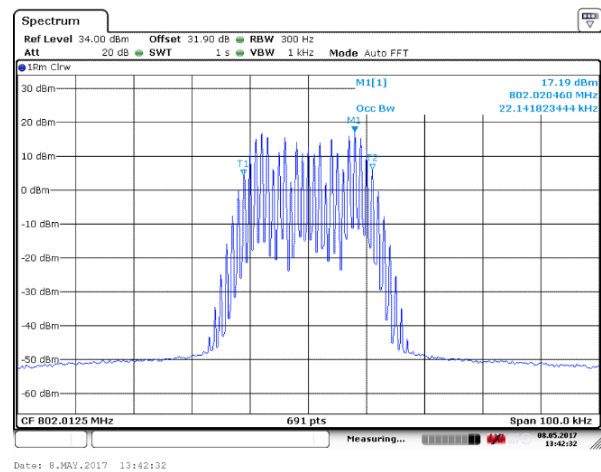
Mid Frequency: 802.0125MHz, Input occupied BW

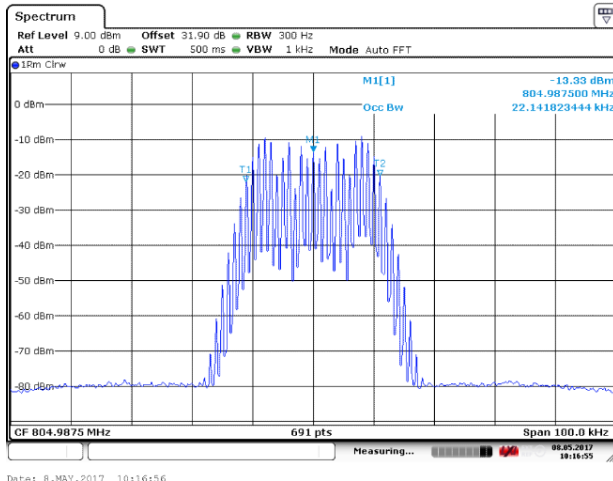


Mid Frequency: 802.0125MHz, Output occupied BW(ALC)

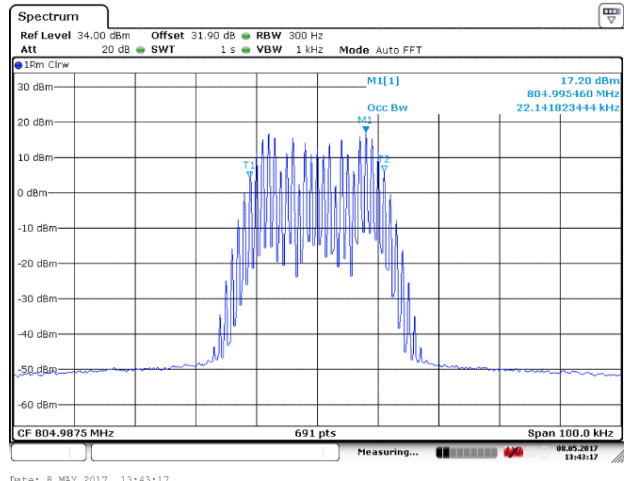


Mid Frequency: 802.0125MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

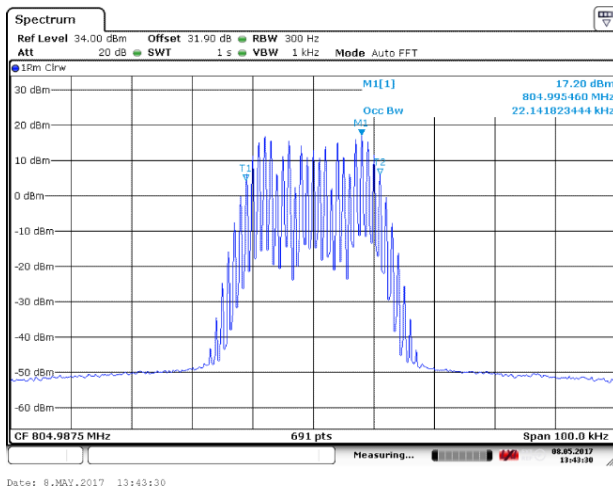




High Frequency: 804.9875MHz, Input occupied BW



High Frequency: 804.9875MHz, Output occupied BW(ALC)

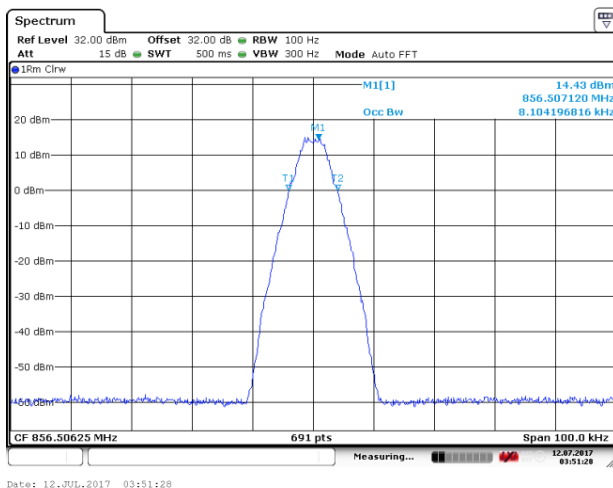


High Frequency: 804.9875MHz, Input occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

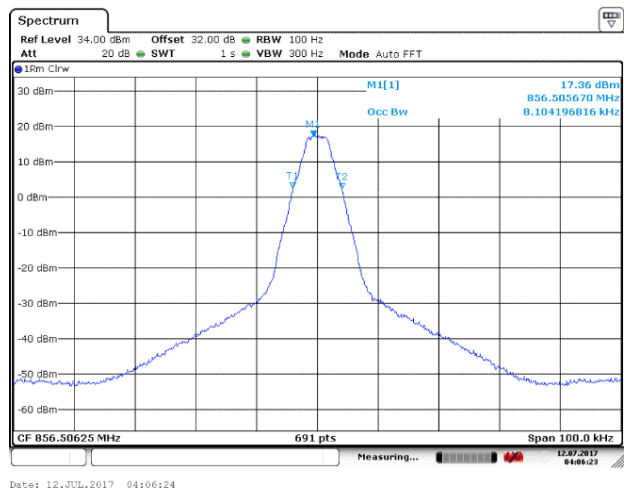
6.2.5.2 800MHz Band

6.2.5.2.1 Modulation signal: C4FM

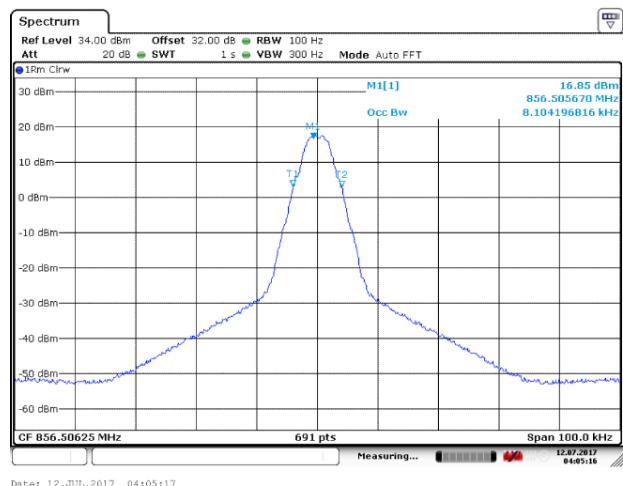
(1) Downlink



Mid Frequency: 856.50625MHz, Input occupied BW

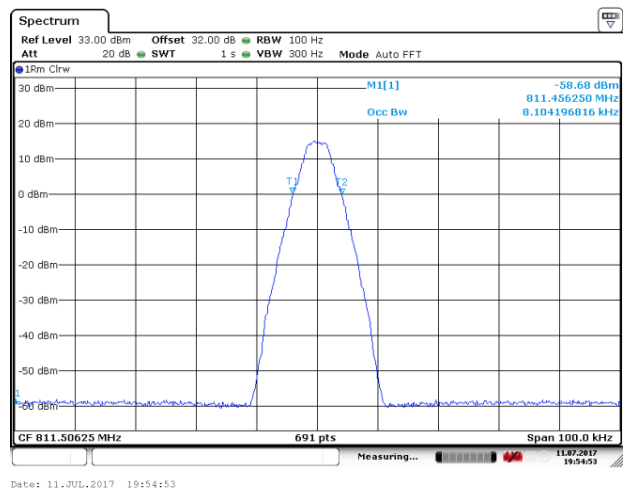


Mid Frequency: 856.50625MHz, Output occupied BW(ALC)

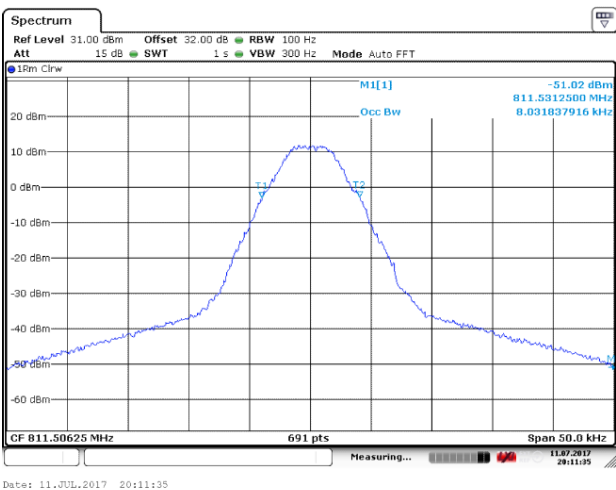


Mid Frequency: 856.50625MHz, Output occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

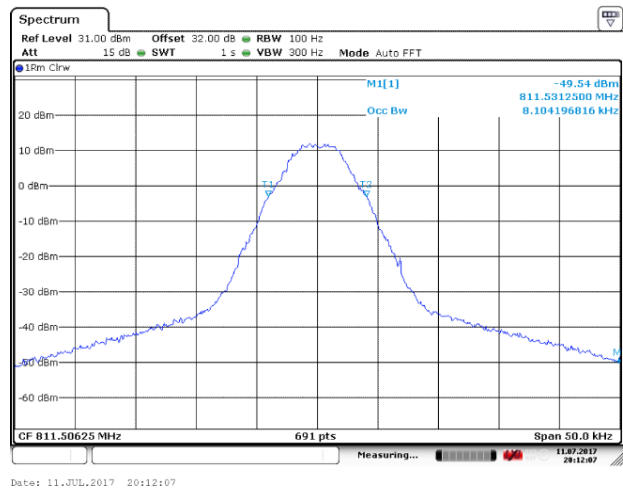
(2) Uplink



Mid Frequency: 811.50625MHz, Input occupied BW



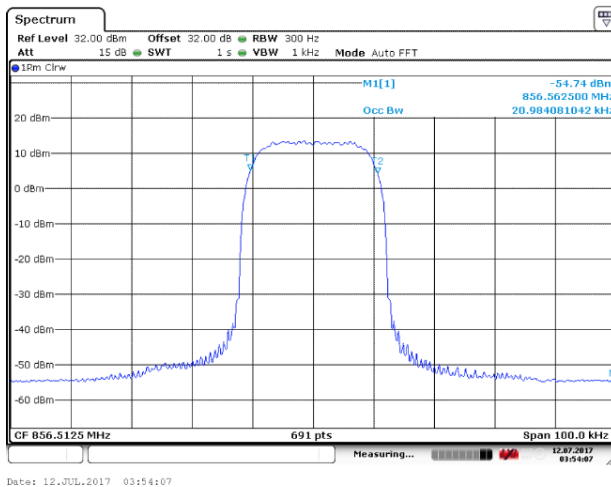
Mid Frequency: 811.50625MHz, Output occupied BW(ALC)



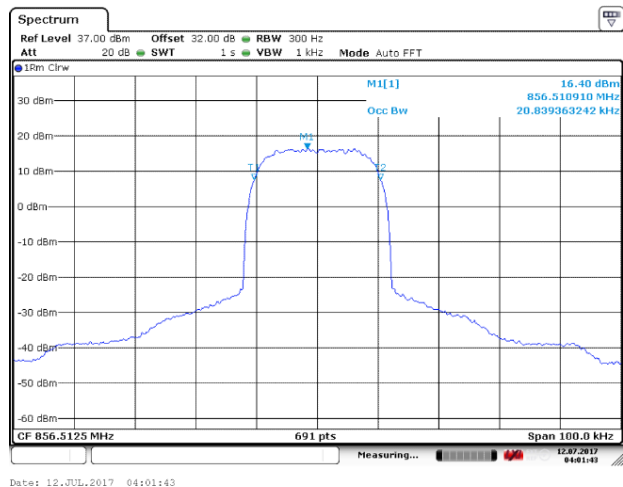
Mid Frequency: 811.50625MHz, Output occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

6.2.5.2.2 Modulation signal: Tetra

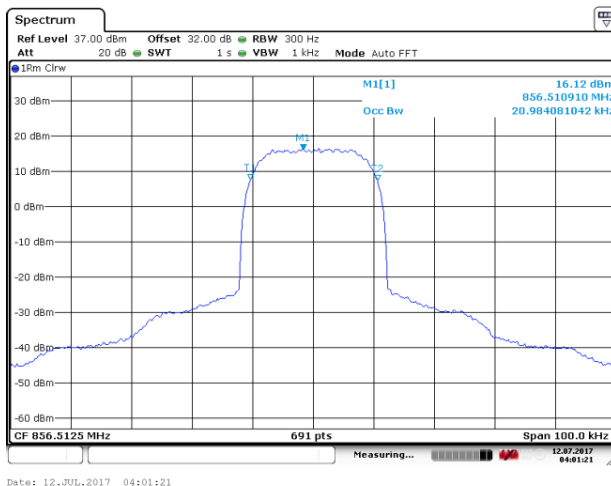
(1) Downlink



Mid Frequency: 856.5125MHz, Input occupied BW

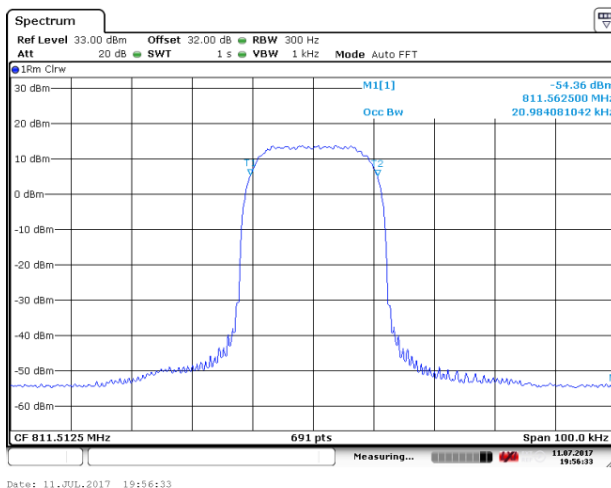


Mid Frequency: 856.5125MHz, Output occupied BW(ALC)

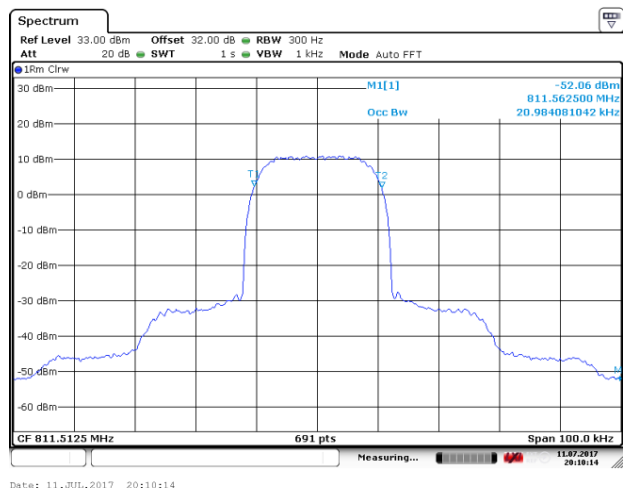


Mid Frequency: 856.5125MHz, Output occupied BW(with the input signal amplitude set 3 dB above the ALC threshold)

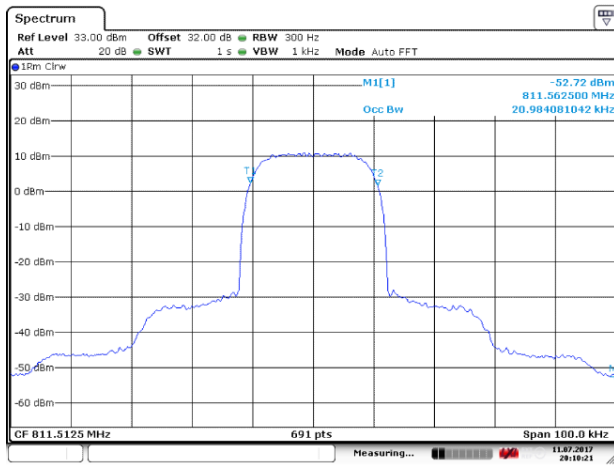
(2) Uplink



Mid Frequency: 811.5125MHz, Input occupied BW



Mid Frequency: 811.5125MHz, Output occupied BW(ALC)

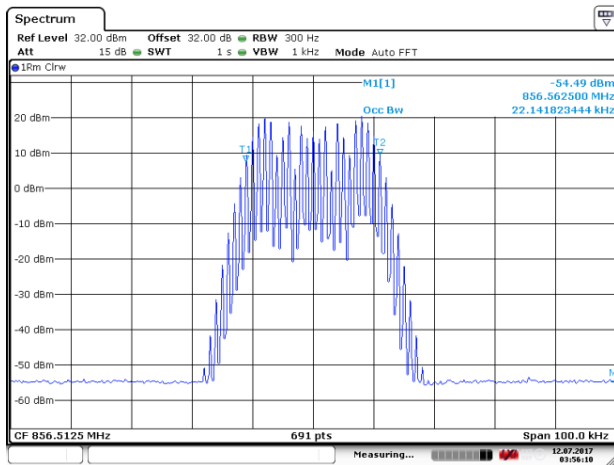


Date: 11.JUL.2017 20:10:21

Mid Frequency: 811.5125MHz, Output occupied
BW(with the input signal amplitude set 3 dB above the
ALC threshold)

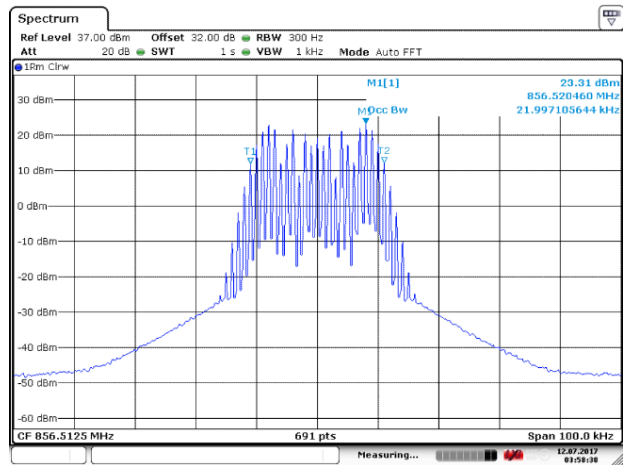
6.2.5.2.3 Modulation signal: Analog FM(10kHz/1kHz)

(1) Downlink



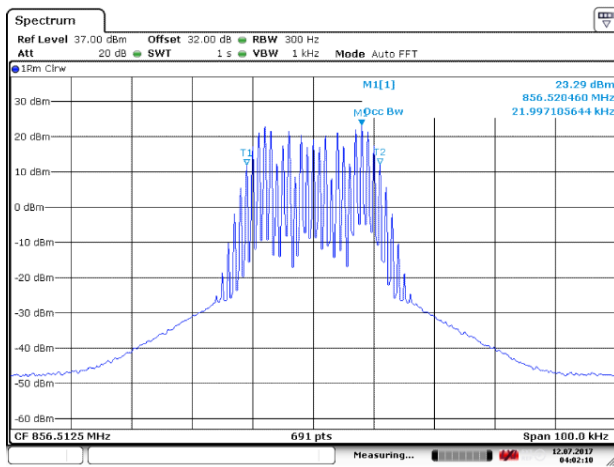
Date: 12.JUL.2017 03:56:10

Mid Frequency: 856.5125MHz, Input occupied BW



Date: 12.JUL.2017 03:58:38

Mid Frequency: 856.5125MHz, Output occupied
BW(ALC)



Date: 12.JUL.2017 04:02:11

Mid Frequency: 856.5125MHz, Output occupied
BW(with the input signal amplitude set 3 dB above the
ALC threshold)