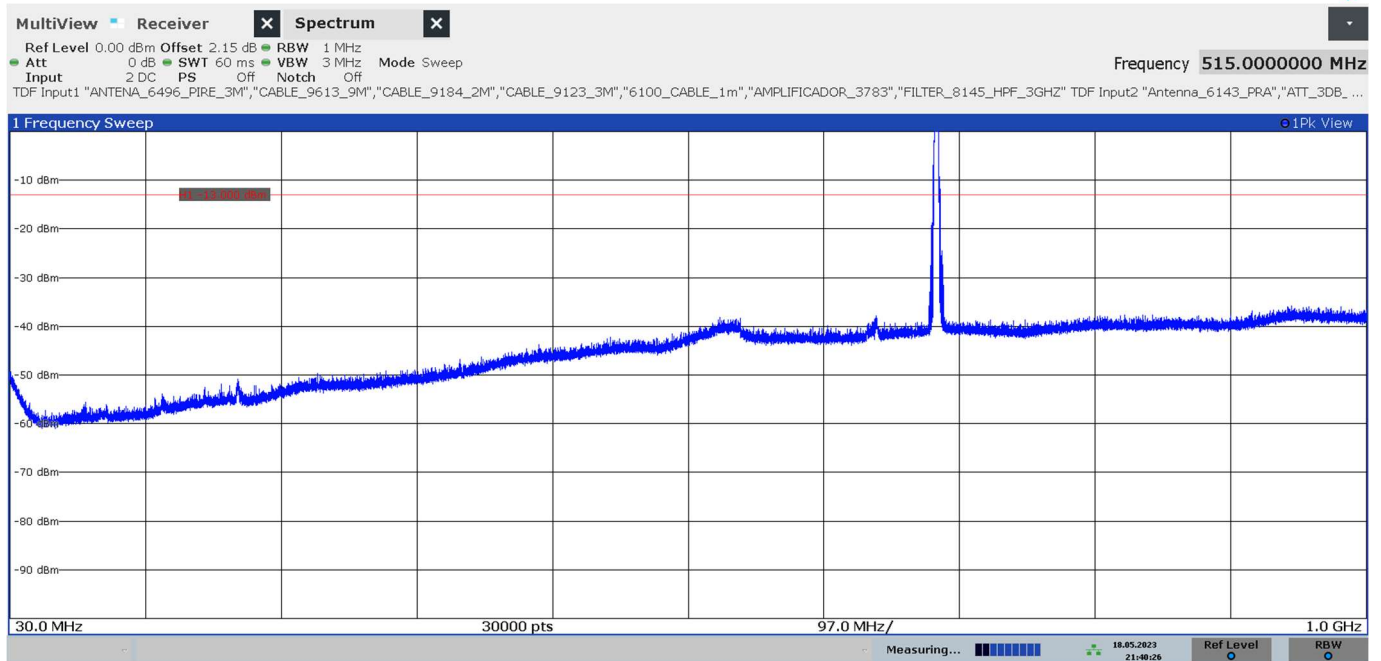


- HIGH CHANNEL:

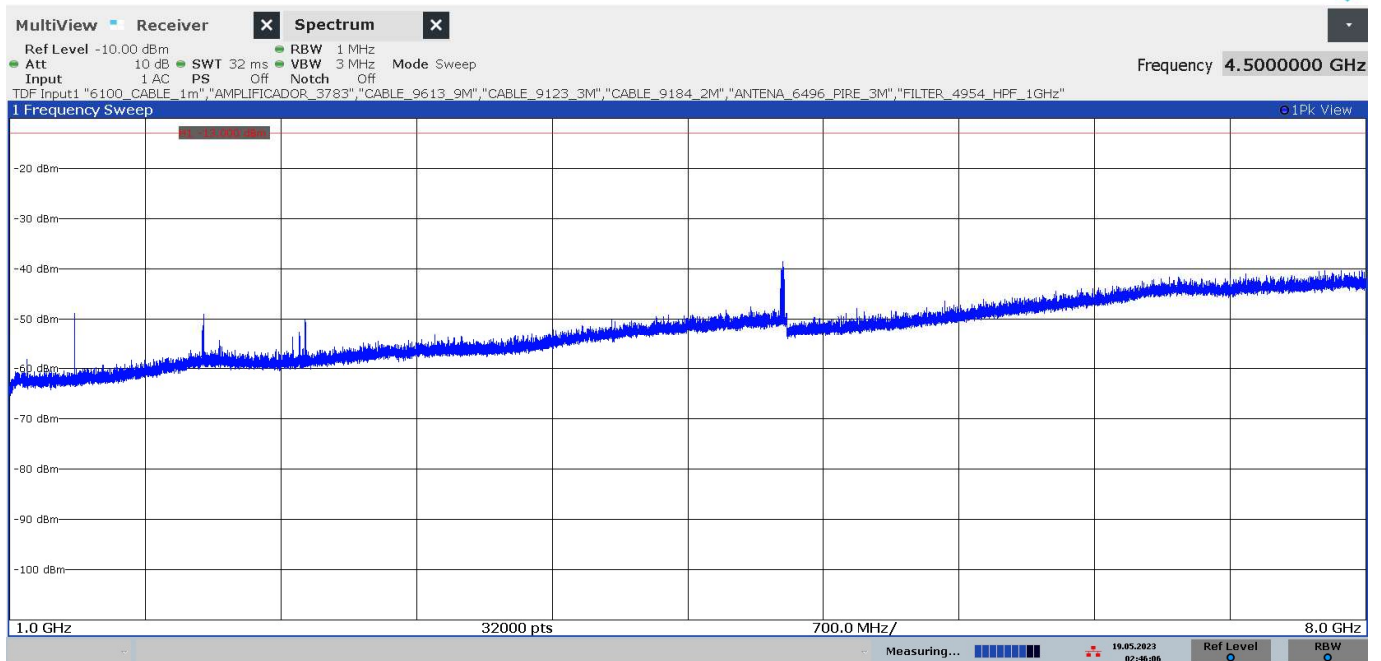


21:40:26 18.05.2023

The peak above the limit is the carrier frequency.

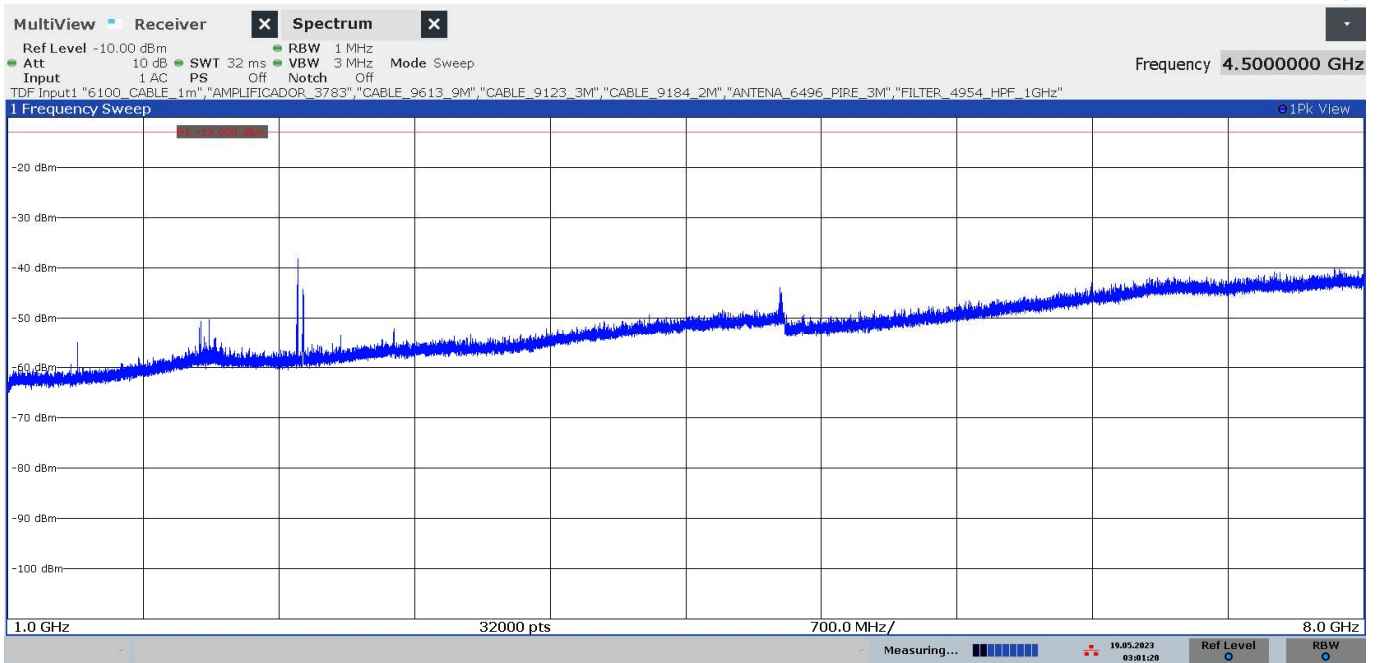
FREQUENCY RANGE 1 - 8 GHz (worst-case):

- LOW CHANNEL:



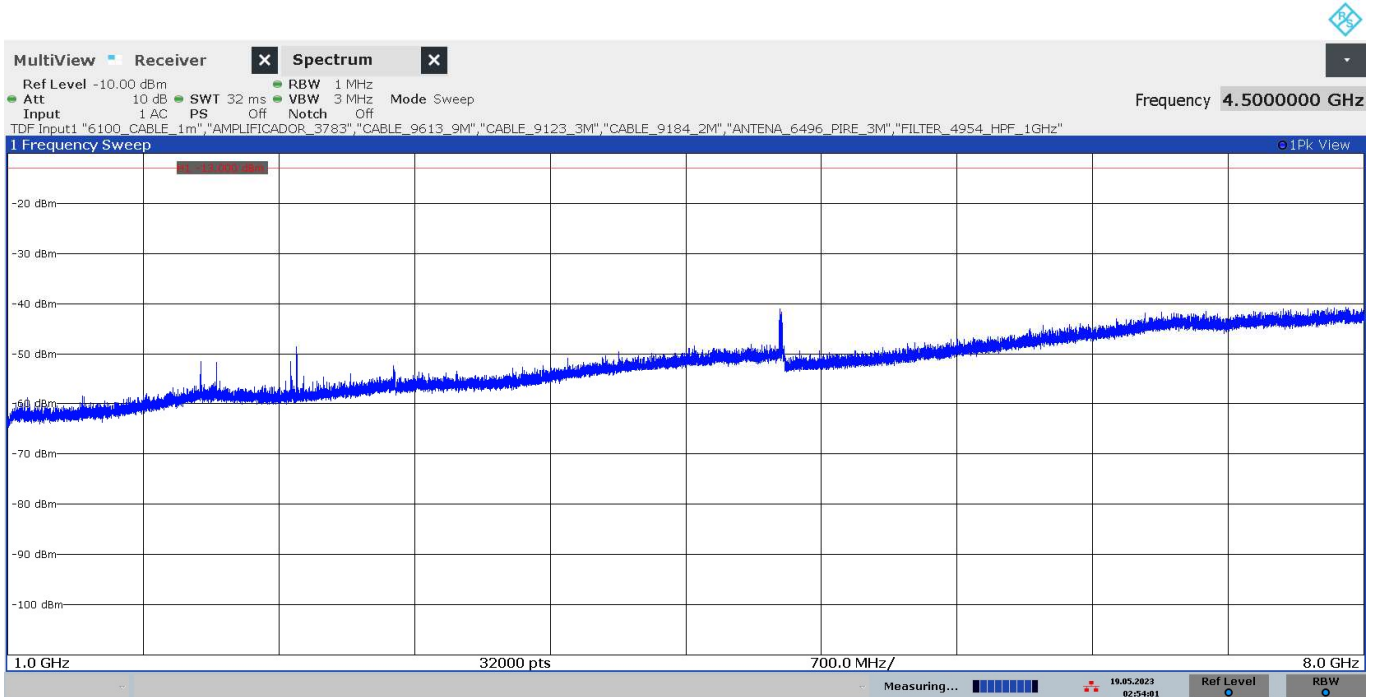
02:46:07 19.05.2023

- MIDDLE CHANNEL:



03:01:20 19.05.2023

- HIGH CHANNEL:



02:54:01 19.05.2023

### **LTE Cat-M1 Band 85:**

A preliminary scan determined the 16QAM modulation, BW=10 MHz, RB=1, Offset=2, Narrow Band=0 as the worst case. The next results are for this worst-case configuration.

#### **- LOW CHANNEL:**

##### **Frequency range 30 MHz - 1 GHz:**

No spurious frequencies at less than 20 dB below the limit.

##### **Frequency range 1 - 8 GHz:**

No spurious frequencies at less than 20 dB below the limit.

#### **- MIDDLE CHANNEL:**

##### **Frequency range 30 MHz - 1 GHz:**

No spurious frequencies at less than 20 dB below the limit.

##### **Frequency range 1 - 8 GHz:**

No spurious frequencies at less than 20 dB below the limit.

#### **- HIGH CHANNEL:**

##### **Frequency range 30 MHz - 1 GHz:**

No spurious frequencies at less than 20 dB below the limit.

##### **Frequency range 1 - 8 GHz:**

No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB) <  $\pm 5.35$  for  $f < 1$  GHz  
<  $\pm 4.32$  for  $f \geq 1$  GHz up to 8 GHz

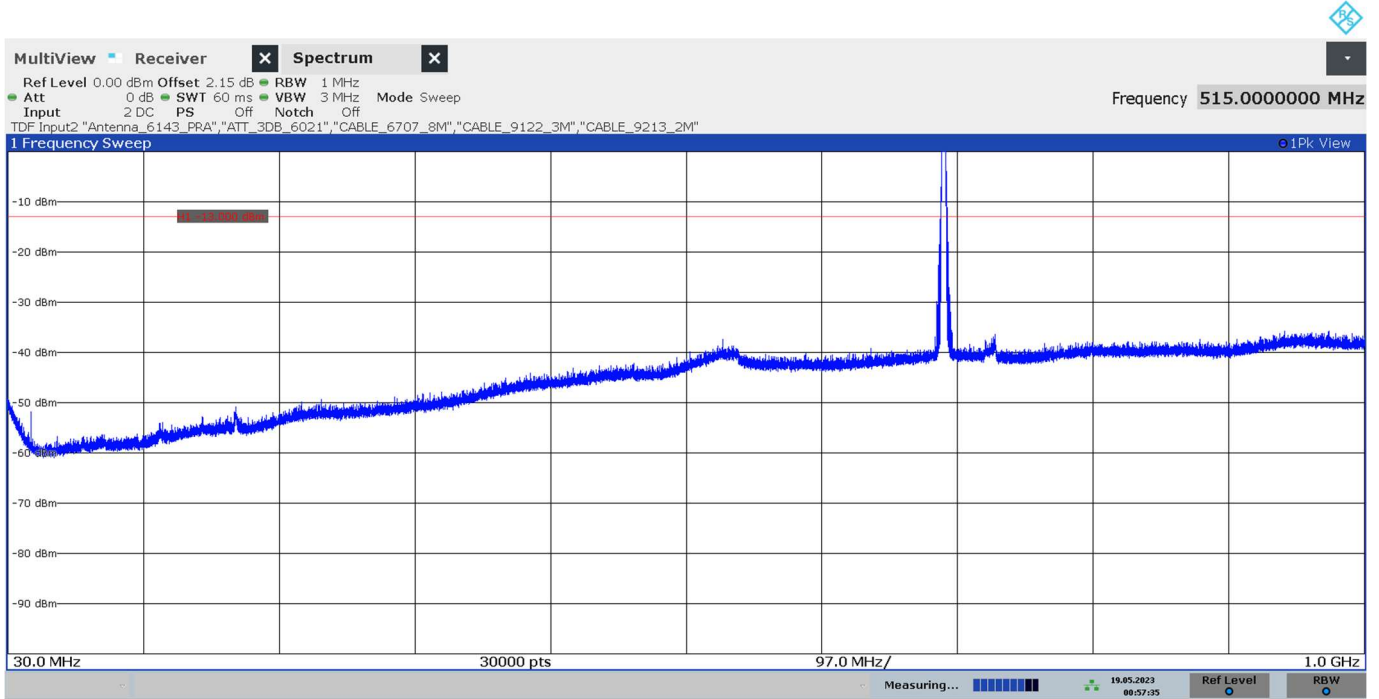
### **Verdict**

Pass

### LTE Cat-M1 Band 85:

### FREQUENCY RANGE 30 MHz - 1 GHz:

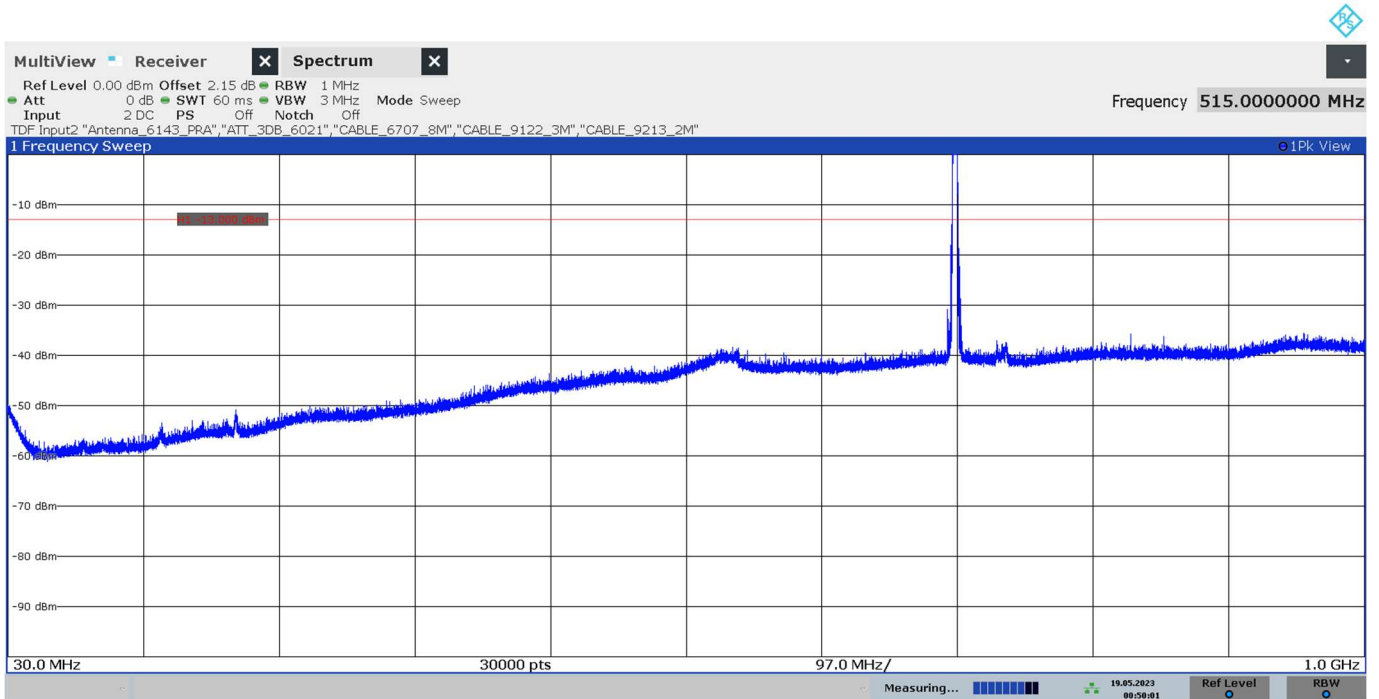
#### - LOW CHANNEL:



00:57:36 19.05.2023

The peak above the limit is the LTE Cat-M1 Band 85 carrier frequency.

#### - HIGH CHANNEL:

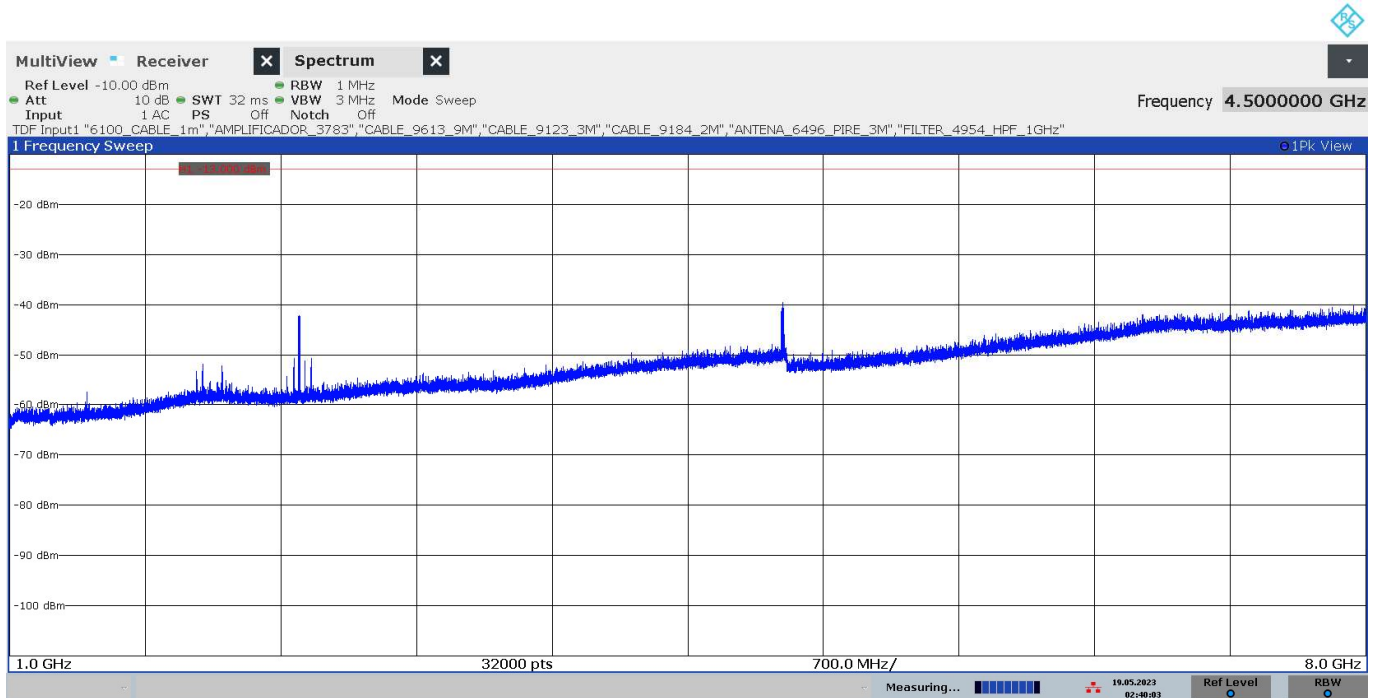


00:50:01 19.05.2023

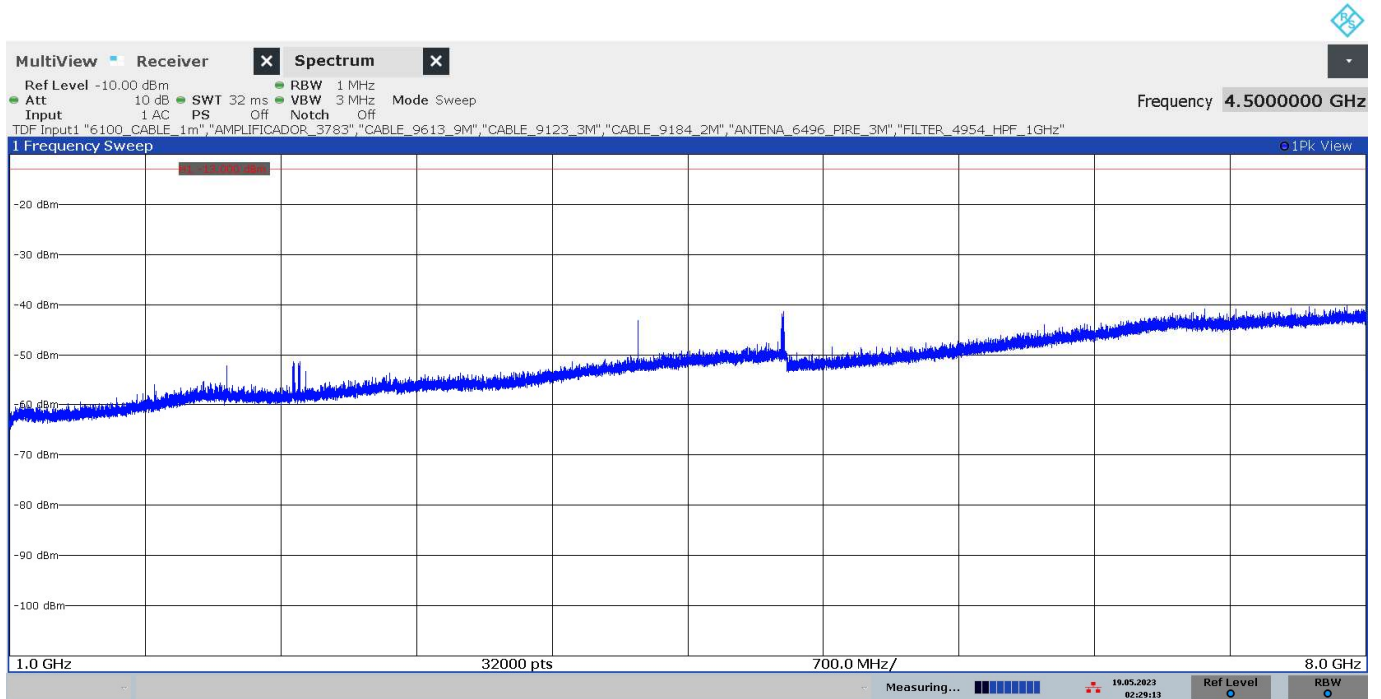
The peak above the limit is the LTE Cat-M1 Band 85 carrier frequency.

### FREQUENCY RANGE 1 GHz - 8 GHz

- LOW CHANNEL:



- HIGH CHANNEL:



## Appendix B: Test results for FCC 27 / RSS-130, RSS-139: LTE Cat NB1 Bands 4, 8, 12, 13, 66, 71, 85

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## TEST CONDITIONS

(\*): Data provided by the Applicant.

### POWER SUPPLY (\*):

Vnormal: 5 Vdc.

Vmin 3 Vdc

Vmax 5.5Vdc

Type of Power Supply: Internal DC.

### ANTENNA (\*):

Low Bands	Gain (dBi)	Type
LTE 8	+2.70	SMD
LTE 12	+1.56	SMD
LTE 13	+1.56	SMD
LTE 17	+1.56	SMD
LTE 71	+1.56	SMD
LTE 85	+1.56	SMD
High Bands	Gain (dBi)	Type
LTE 4	+3.0	SMD
LTE 66	+3.0	SMD

### TEST FREQUENCIES:

LTE Cat NB1 Band 4. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel. Number (Frequency, MHz)		
Low	Middle	High
19952 (1710.2)*	20300 (1745)	20398 (1754.8)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB1 Band 4 is completely included in LTE Cat NB1 Band 66, so the channels of LTE Cat NB1 Band 66 were tested to give conformity to the assigned block.

LTE Cat NB1 Band 8. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel (Frequency, MHz)		
Low	Middle	High
21628 (897.80)*	21640 (899)	21652 (900.20)*
*The outermost channel which is in compliance with Block edge testing.		



LTE Cat NB1 Band 12. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel. Number (Frequency, MHz)		
Low	Middle	High
23012 (699.20)*	23090 (707)	23179 (715.8)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB1 Band 12 is completely included in LTE Cat NB1 Band 85, so the channels of LTE Cat NB1 Band 85 were tested to give conformity to the assigned block.

LTE Cat NB1 Band 13. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel (Frequency, MHz)		
Low	Middle	High
23182 (777.20)*	23230 (782)	23278 (786.80)*
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB1 Band 17. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel. Number (Frequency, MHz)		
Low	Middle	High
23732 (704.20)*	23790 (710)	23848 (715.80)*
*The outermost channel which is in compliance with Block edge testing.		

NOTE: LTE Cat NB1 Band 17 is completely included in LTE Cat NB1 Band 85, so the channels of LTE Cat NB1 Band 85 were tested to give conformity to the assigned block.

LTE Cat NB1 Band 66. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel (Frequency, MHz)		
Low	Middle	High
131974 (1710.2)	132322 (1745)	132670 (1779.8)
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB1 Band 71. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel (Frequency, MHz)		
Low	Middle	High
133124 (663.2)*	133297 (680.5)	133470 (697.8)*
*The outermost channel which is in compliance with Block edge testing.		

LTE Cat NB1 Band 85. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel (Frequency, MHz)		
Low	Middle	High
134004 (698.2)*	134092 (707)	134181 (715.8)*
*The outermost channel which is in compliance with Block edge testing.		

## RF Output Power

### Limits

#### 1. LTE Cat NB1 Band 8. FCC §27.1507 (a) & (d).

FCC §27.1507 (a) & (d):

(a) *Maximum ERP.* The power limits specified in this section are applicable to operations in areas more than 110 km (68.4 miles) from the U.S./Mexico border and 140 km (87 miles) from the U.S./Canada border.

(3) *Mobile, control and auxiliary test stations.* Mobile, control and auxiliary test stations must not exceed 10 watts ERP.

(4) *Portable stations.* Portable stations must not exceed 3 watts ERP.

(d) *PAR limit.* The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

#### 2. LTE Cat NB1 Band 13. FCC §27.50 (b) (10) / RSS-130 Clause 4.6.

FCC §27.50 (b) (10):

Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

RSS-130 Clause 4.6:

##### 4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the High PAPR during periods of continuous transmission.

##### 4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

#### 3. LTE Cat NB1 Band 66. FCC §27.50 (d) / RSS-139 Clause 6.5.

FCC §27.50 (d):

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(5) 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.

RSS-139 Clause 6.5:

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the High PAPR during periods of continuous transmission.

#### 4. LTE Cat NB1 Band 71 & LTE Cat NB1 Band 85. FCC §27.50 (c) (10) / RSS-130 Clause 4.6.

##### FCC §27.50 (c) (10):

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

##### RSS-130 Clause 4.6:

###### 4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the High PAPR during periods of continuous transmission.

###### 4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

### **Method**

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The peak-to-average power ratio (PAPR) is measured using an attenuator, power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

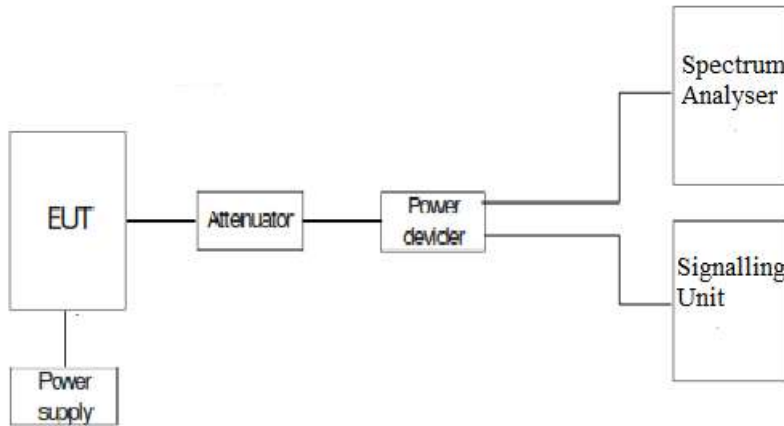
$$E.R.P. = E.I.R.P. - 2.15 \text{ dB}$$

**Test Setup**

3. CONDUCTED AVERAGE POWER:



4. PEAK-TO-AVERAGE POWER RATIO (PAPR) and Conducted Average power:



## Results

### 1. CONDUCTED AVERAGE POWER

LTE Cat NB1 Band 8:

Worst-case of RF Power is Low Channel, Pi/2-BPSK, BW=15 kHz, Tone Number=1, Tone Offset=0, MSC/TBS=0.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MCS / TBS	AVERAGE POWER (dBm)
Low 21628	897.8 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.81
				1	47	0	22.80
			15 kHz	1	0	0	23.55
				1	11	0	23.45
		Pi/4-QPSK	3.75 kHz	1	0	3	22.83
				1	47	3	22.81
			15 kHz	1	0	3	23.45
				1	11	3	23.45
		QPSK	15 kHz	3	0	5	23.23
				3	9	5	23.27
				6	0	5	22.22
				6	6	5	22.57
			12	0	5	21.32	
High 21652	900.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.01
				1	47	0	22.86
			15 kHz	1	0	0	22.91
				1	11	0	22.95
		Pi/4-QPSK	3.75 kHz	1	0	3	22.96
				1	47	3	22.90
			15 kHz	1	0	3	23.47
				1	11	3	23.45
		QPSK	15 kHz	3	0	5	23.22
				3	9	5	23.26
				6	0	5	22.14
				6	6	5	22.46
			12	0	5	21.42	

MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG (dBm)	RAD. POWER AVG ERP (dBm)
LOW	23.55	+2.70	26.25	24.10
MIDDLE				
HIGH	23.47	+2.70	26.17	24.02
MAX:	23.55		26.25	

LTE Cat NB1 Band 13:

Worst-case of RF Power is Low Channel, Pi/2-BPSK, BW=15 kHz, Tone Number=1, Tone Offset=0, MSC/TBS=0.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MCS / TBS	AVERAGE POWER (dBm)
Low 23182	777.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.08
				1	47	0	23.09
			15 kHz	1	0	0	23.16
				1	11	0	23.00
		Pi/4-QPSK	3.75 kHz	1	0	3	23.11
				1	47	3	23.05
			15 kHz	1	0	3	22.95
				1	11	3	22.96
		QPSK	15 kHz	3	0	5	22.59
				3	9	5	22.65
				6	0	5	21.88
				6	6	5	21.90
			12	0	5	20.83	
Middle 23230	782 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.96
				1	47	0	23.02
			15 kHz	1	0	0	22.95
				1	11	0	22.95
		Pi/4-QPSK	3.75 kHz	1	0	3	23.01
				1	47	3	23.00
			15 kHz	1	0	3	22.85
				1	11	3	22.82
		QPSK	15 kHz	3	0	5	22.58
				3	9	5	22.56
				6	0	5	21.86
				6	6	5	21.80
			12	0	5	20.75	
High 23277	786.8 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.99
				1	47	0	22.99
			15 kHz	1	0	0	22.95
				1	11	0	22.90
		Pi/4-QPSK	3.75 kHz	1	0	3	22.98
				1	47	3	22.92
			15 kHz	1	0	3	22.83
				1	11	3	22.80
		QPSK	15 kHz	3	0	5	22.55
				3	9	5	22.50
				6	0	5	21.83
				6	6	5	21.75
			12	0	5	20.79	

MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG (dBm)	RAD. POWER AVG ERP (dBm)
LOW	23.16	+1.56	24.72	22.57
MIDDLE	23.02	+1.56	24.58	22.43
HIGH	22.99	+1.56	24.55	22.40
MAX:	23.16		24.72	

LTE Cat NB1 Band 66:

Worst-case of RF Power is Low Channel, Pi/2-BPSK, BW=3.75 kHz, Tone Number=1, Tone Offset=0, MSC/TBS=0.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MSC / TBS	AVERAGE POWER (dBm)		
Low 131974	1710.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.00		
				1	47	0	22.78		
			15 kHz	1	0	0	22.92		
				1	11	0	22.79		
		Pi/4-QPSK	3.75 kHz	1	0	3	22.88		
				1	47	3	22.91		
			15 kHz	1	0	3	22.95		
				1	11	3	22.94		
		QPSK	15 kHz	3	0	5	22.59		
				3	9	5	22.64		
				6	0	5	21.92		
				6	6	5	21.81		
				12	0	5	20.80		
		Middle 132322	1745 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22.87
						1	47	0	22.81
15 kHz	1				0	0	22.80		
	1				11	0	22.81		
Pi/4-QPSK	3.75 kHz			1	0	3	22.85		
				1	47	3	22.75		
	15 kHz			1	0	3	22.79		
				1	11	3	22.72		
QPSK	15 kHz			3	0	5	22.55		
				3	9	5	22.59		
				6	0	5	21.74		
				6	6	5	21.67		
				12	0	5	20.75		
High 132669	1779.8 MHz			Pi/2-BPSK	3.75 kHz	1	0	0	22.67
						1	47	0	22.66
		15 kHz	1		0	0	22.58		
			1		11	0	22.63		
		Pi/4-QPSK	3.75 kHz	1	0	3	22.64		
				1	47	3	22.58		
			15 kHz	1	0	3	22.56		
				1	11	3	22.53		
		QPSK	15 kHz	3	0	5	22.35		
				3	9	5	22.37		
				6	0	5	21.60		
				6	6	5	21.57		
				12	0	5	20.53		

MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG (dBm)	RAD. POWER AVG ERP (dBm)
LOW	23.00	+3.00	26.00	23.85
MIDDLE	22.87	+3.00	25.87	23.72
HIGH	22.67	+3.00	25.67	23.52
MAX:	23.00		26	



LTE Cat NB1 Band 71:

Worst-case of RF Power is High Channel, Pi/2-BPSK, BW=15 kHz, Tone Number=1, Tone Offset=11, MSC/TBS=0.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MSC / TBS	AVERAGE POWER (dBm)	
Low 133124	663.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.08	
				1	47	0	23.07	
			15 kHz	1	0	0	23.14	
				1	11	0	23.00	
			Pi/4-QPSK	3.75 kHz	1	0	3	23.11
					1	47	3	23.08
		15 kHz		1	0	3	23.06	
			1	11	3	22.90		
		QPSK	15 kHz	3	0	5	22.51	
				3	9	5	22.53	
				6	0	5	21.81	
				6	6	5	21.73	
				12	0	5	20.80	
				12	0	5	20.80	
		Middle 133297	680.5 MHz	Pi/2-BPSK	3.75 kHz	1	0	0
1	47					0	23.09	
15 kHz	1				0	0	23.01	
	1				11	0	23.03	
Pi/4-QPSK	3.75 kHz				1	0	3	23.10
					1	47	3	23.05
	15 kHz			1	0	3	22.89	
1				11	3	22.84		
QPSK	15 kHz			3	0	5	22.53	
				3	9	5	22.53	
				6	0	5	21.71	
				6	6	5	21.69	
				12	0	5	20.73	
				12	0	5	20.73	
High 133469	697.8 MHz			Pi/2-BPSK	3.75 kHz	1	0	0
		1	47			0	23.22	
		15 kHz	1		0	0	23.23	
			1		11	0	23.30	
		Pi/4-QPSK	3.75 kHz		1	0	3	23.30
					1	47	3	23.13
			15 kHz	1	0	3	23.09	
		1		11	3	23.03		
		QPSK	15 kHz	3	0	5	22.61	
				3	9	5	22.63	
				6	0	5	21.79	
				6	6	5	21.80	
				12	0	5	20.81	
				12	0	5	20.81	

MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG (dBm)	RAD. POWER AVG ERP (dBm)
LOW	23.14	+1.56	24.70	22.55
MIDDLE	23.10	+1.56	24.66	22.51
HIGH	23.30	+1.56	24.86	22.71
MAX:	23.30		24.86	

LTE Cat NB1 Band 85:

Worst-case of RF Power is High Channel, Pi/2-BPSK, BW=3.75 kHz, Tone Number=1, Tone Offset=47, MSC/TBS=0.

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MSC / TBS	AVERAGE POWER (dBm)		
Low 134004	698.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.17		
				1	47	0	22.99		
			15 kHz	1	0	0	23.07		
				1	11	0	23.01		
		Pi/4-QPSK	3.75 kHz	1	0	3	23.08		
				1	47	3	22.98		
			15 kHz	1	0	3	22.85		
				1	11	3	22.84		
		QPSK	15 kHz	3	0	5	22.53		
				3	9	5	22.47		
				6	0	5	21.77		
				6	6	5	21.76		
				12	0	5	20.78		
		Middle 134092	707 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	23.12
						1	47	0	23.00
15 kHz	1				0	0	23.06		
	1				11	0	23.04		
Pi/4-QPSK	3.75 kHz			1	0	3	22.99		
				1	47	3	23.05		
	15 kHz			1	0	3	22.93		
				1	11	3	22.88		
QPSK	15 kHz			3	0	5	22.43		
				3	9	5	22.42		
				6	0	5	21.71		
				6	6	5	21.63		
				12	0	5	20.66		
High 134178	715.8 MHz			Pi/2-BPSK	3.75 kHz	1	0	0	23.12
						1	47	0	23.22
		15 kHz	1		0	0	23.07		
			1		11	0	23.18		
		Pi/4-QPSK	3.75 kHz	1	0	3	23.04		
				1	47	3	23.03		
			15 kHz	1	0	3	22.92		
				1	11	3	22.87		
		QPSK	15 kHz	3	0	5	22.60		
				3	9	5	22.58		
				6	0	5	21.81		
				6	6	5	21.80		
				12	0	5	20.80		

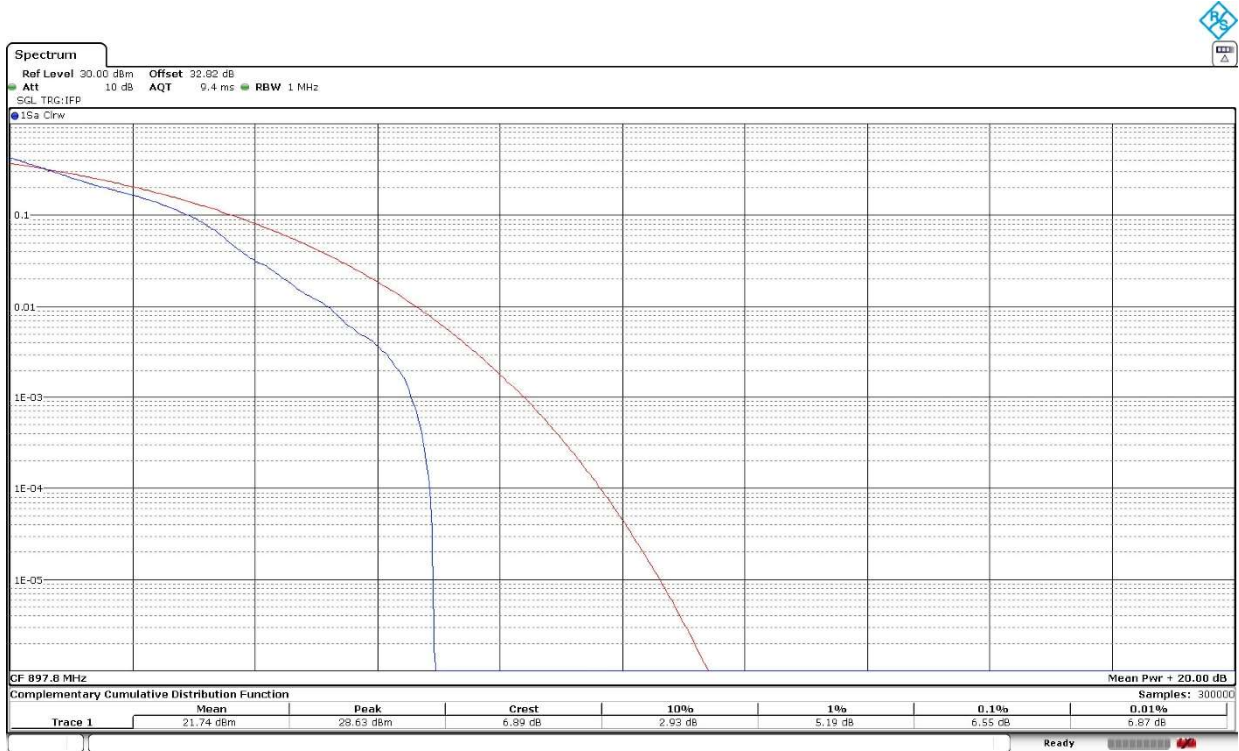
MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG (dBm)	RAD. POWER AVG ERP (dBm)
LOW	23.17	+1.56	24.73	22.58
MIDDLE	23.12	+1.56	24.68	22.53
HIGH	23.22	+1.56	24.78	22.63
MAX:	23.22		24.78	

## 2. PEAK-TO-AVERAGE POWER RATIO (PAPR)

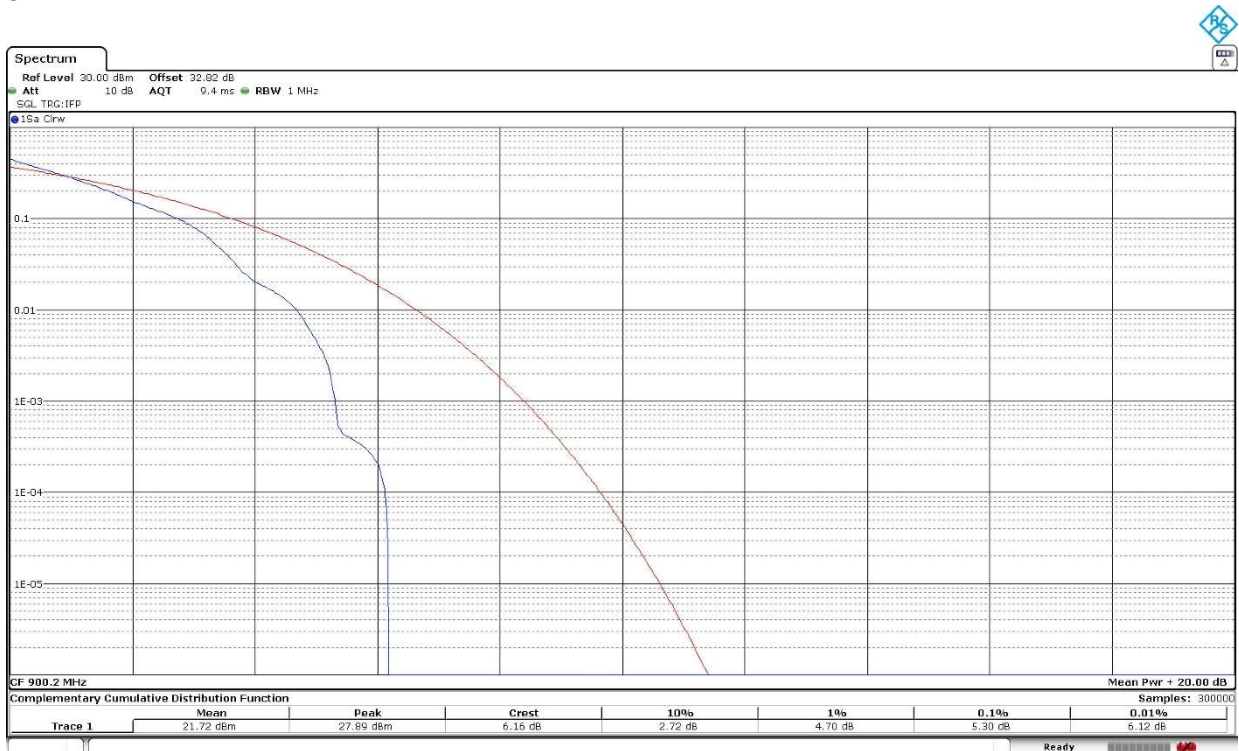
### LTE Cat NB1 Band 8:

Worst-case of PAPR is Low Channel, QPSK, BW=15 kHz, Tone Number=6, Tone Offset=6, MSC/TBS=5.

Low Channel:



High Channel:



QPSK	Low	High
PAPR (dB)	6.55	5.30

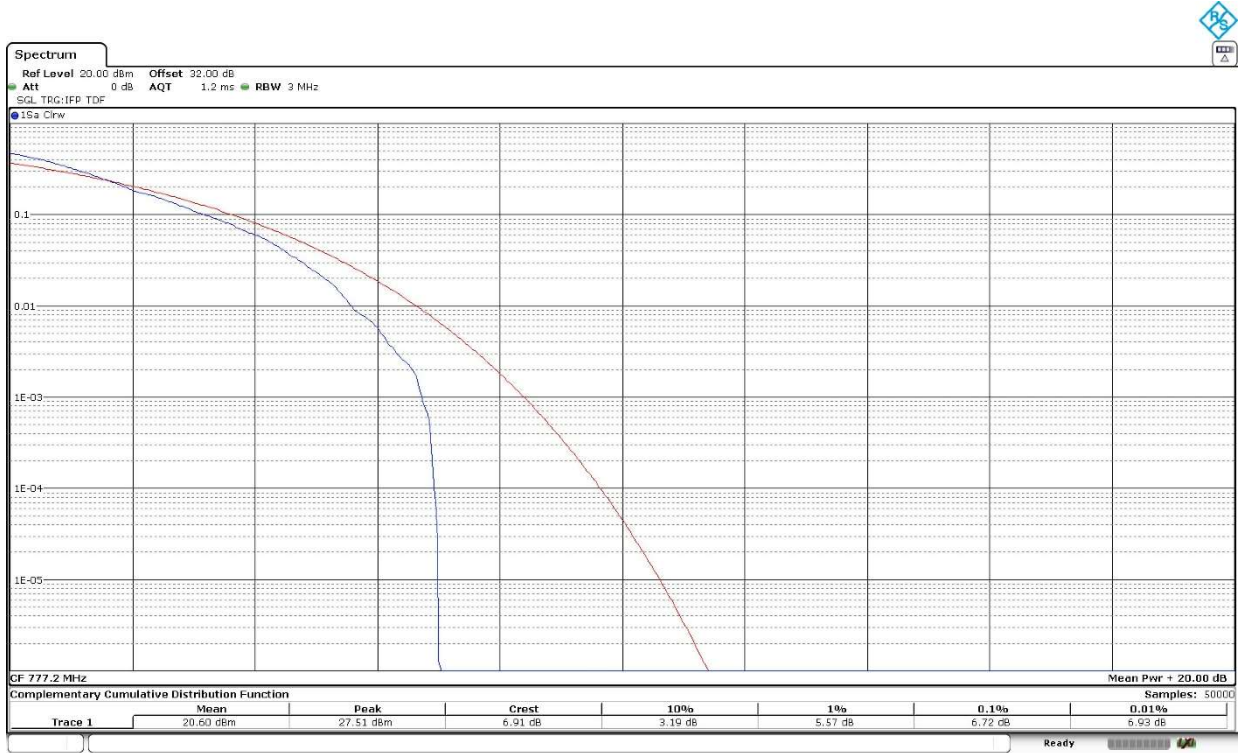
**Verdict**

Pass

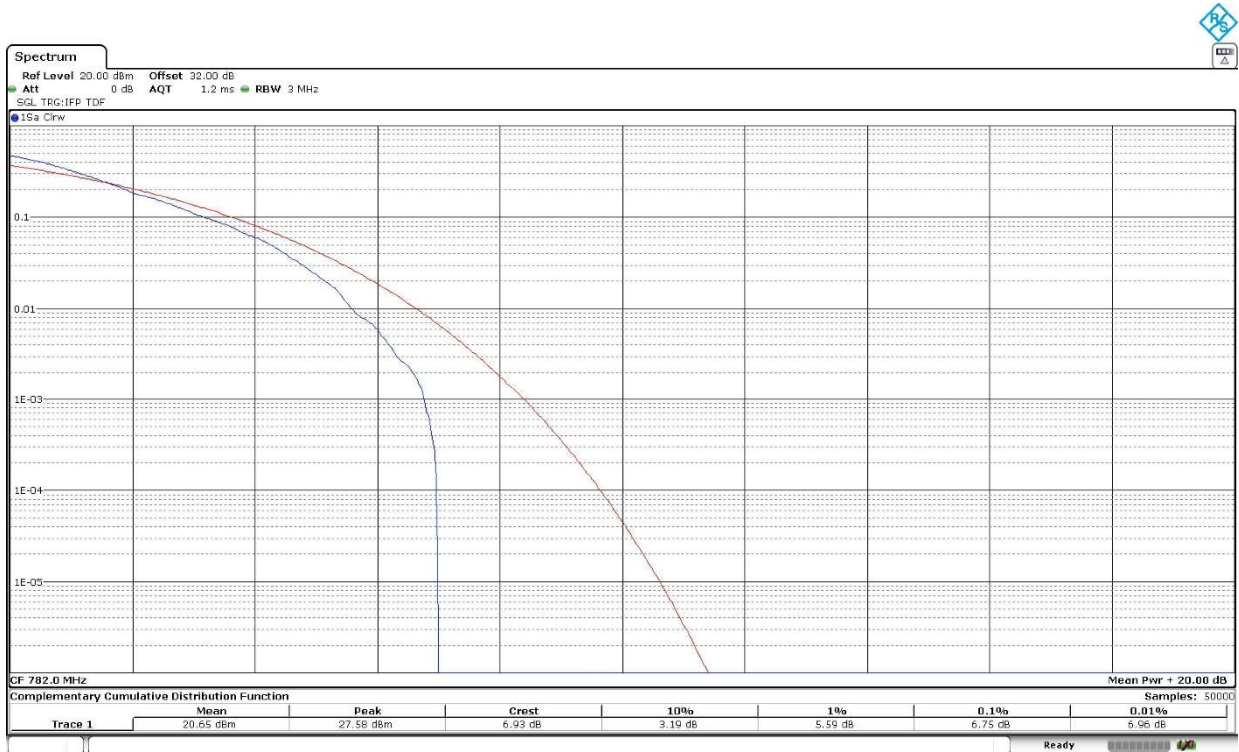
LTE Cat NB1 Band 13:

Worst-case of PAPR is Middle Channel, QPSK, BW=15 kHz, Tone Number=12, Tone Offset=0, MSC/TBS=5.

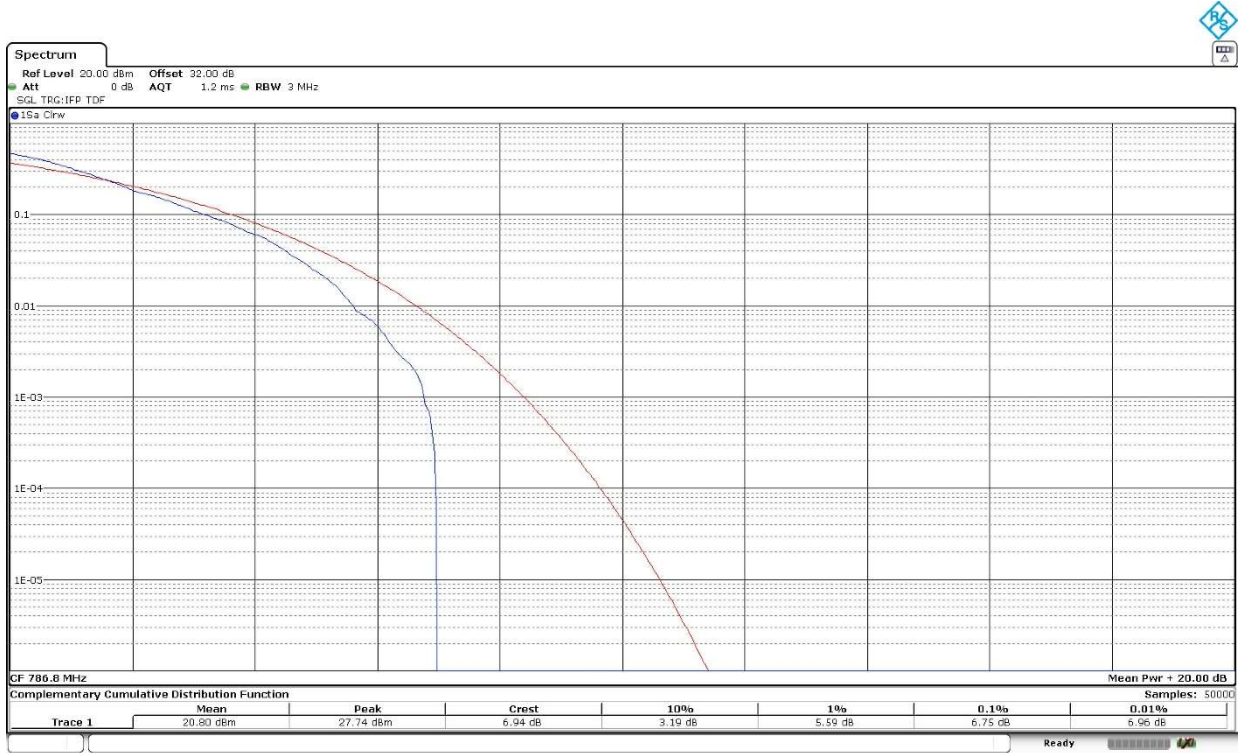
Low Channel:



Middle Channel:



High Channel:



QPSK	Low	Middle	High
PAPR (dB)	6.72	6.75	6.75

**Verdict**

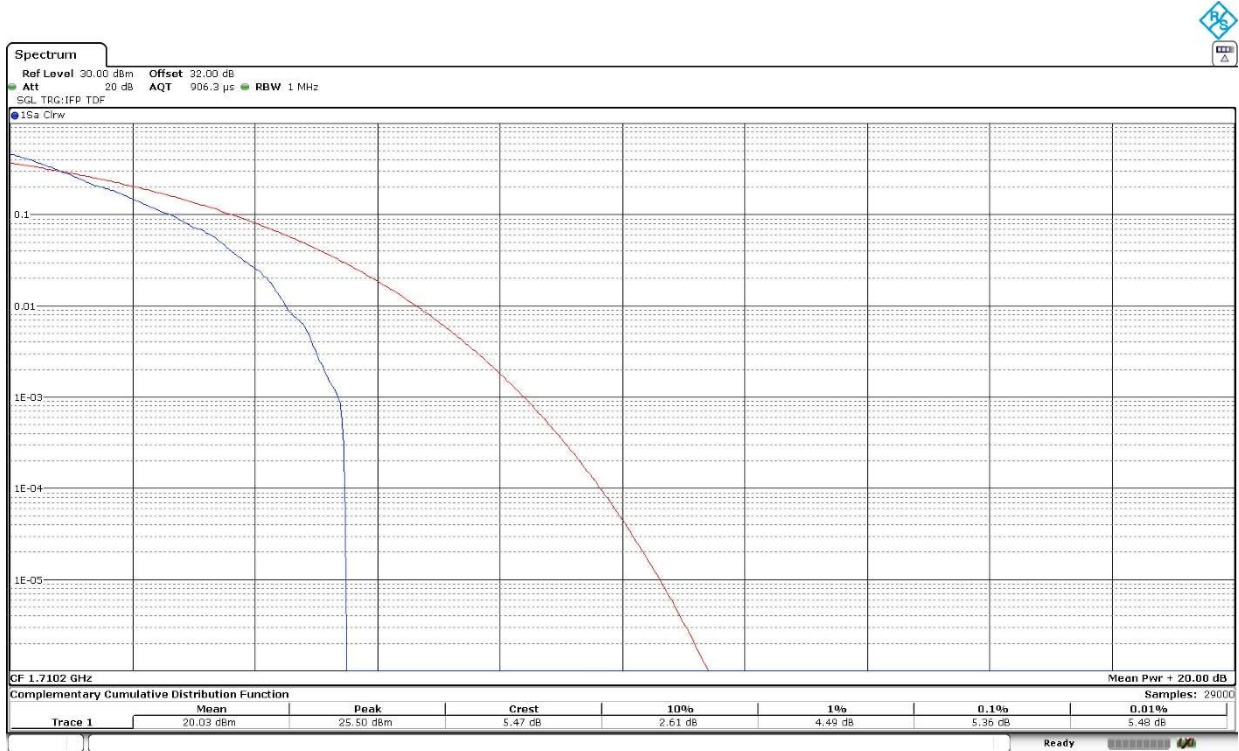
Pass



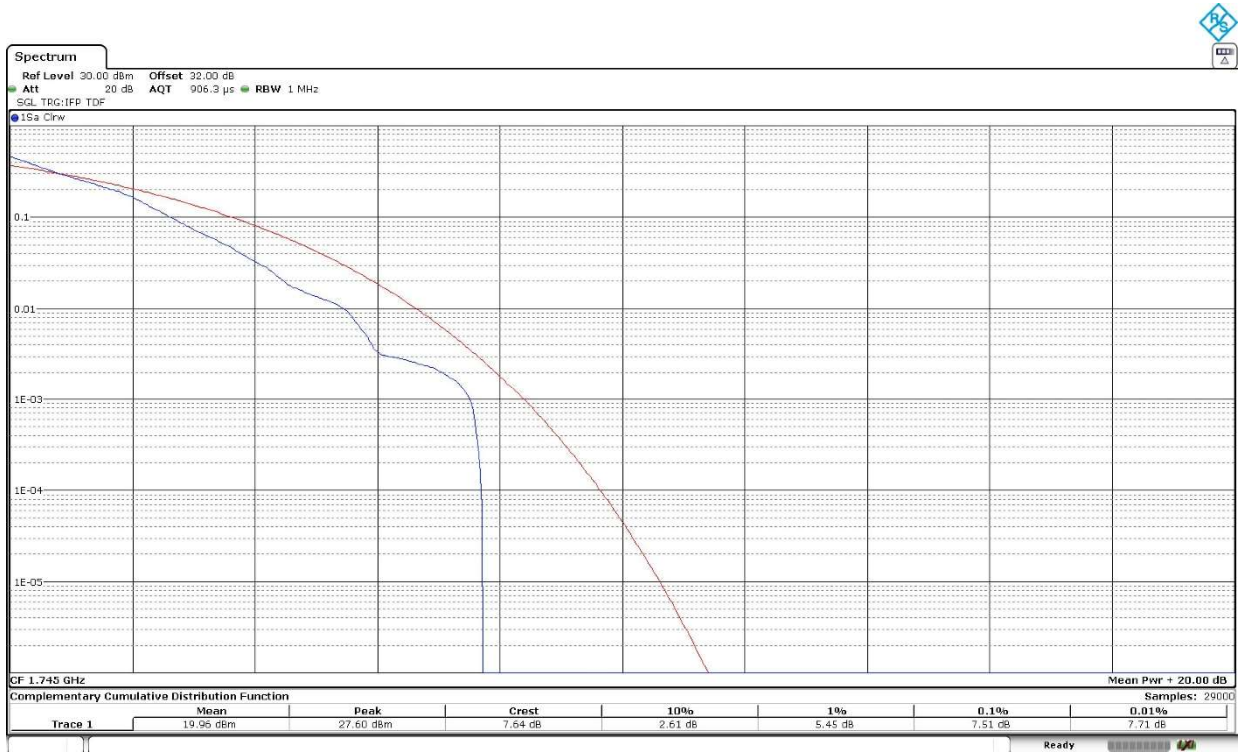
LTE Cat NB1 Band 66:

Worst-case of PAPR is Middle Channel, QPSK, BW=15 kHz, Tone Number=12, Tone Offset=0, MSC/TBS=5.

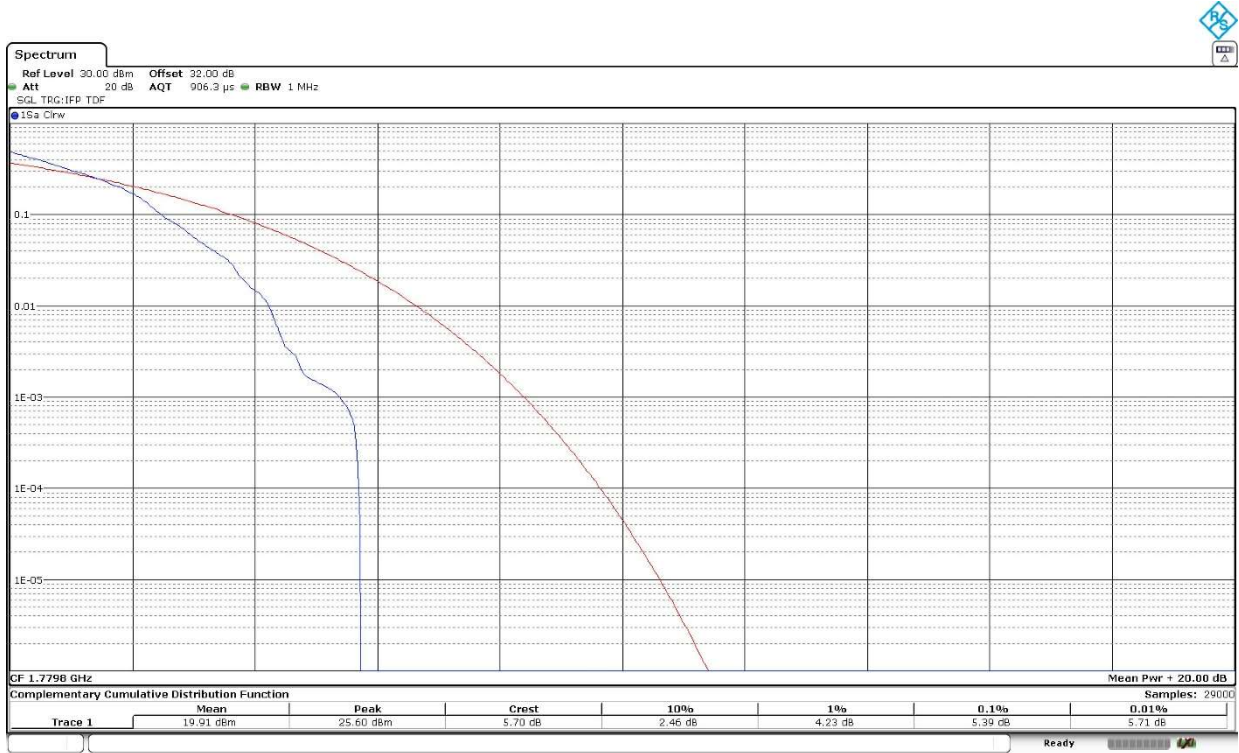
Low Channel:



Middle Channel:



High Channel:



QPSK	Low	Middle	High
PAPR (dB)	5.36	7.51	5.39

**Verdict**

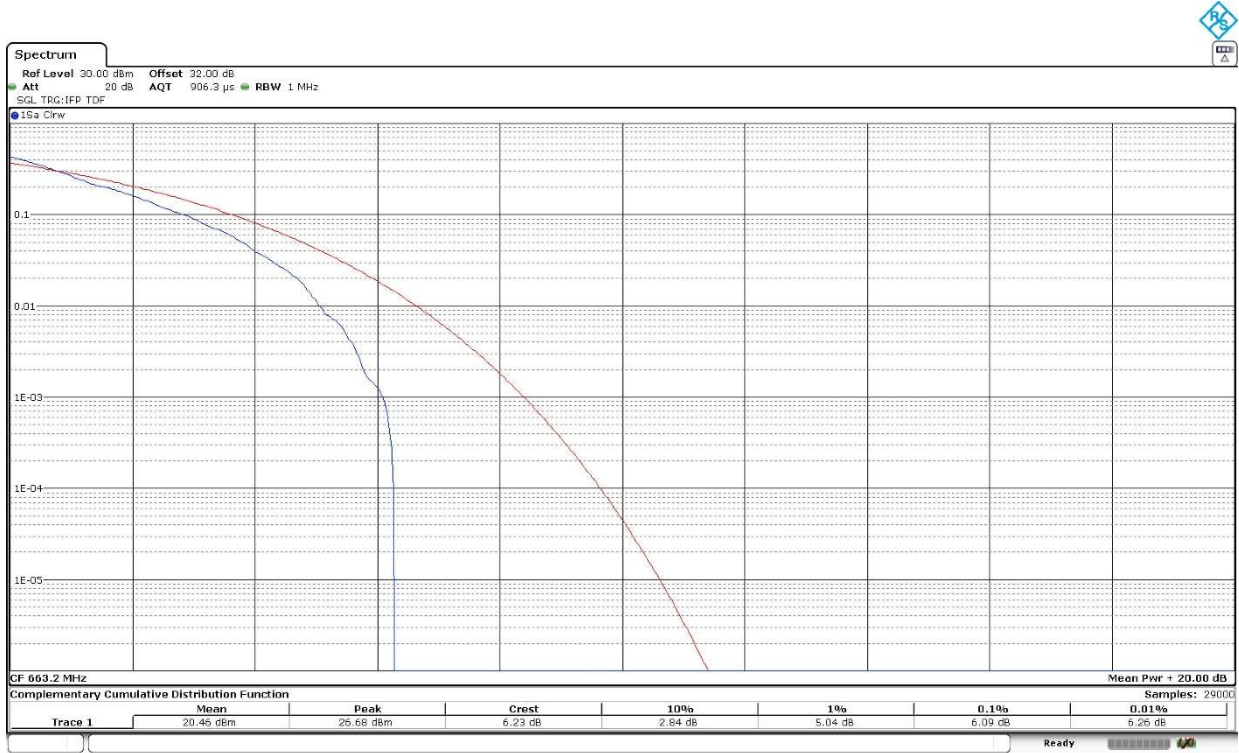
Pass



LTE Cat NB1 Band 71:

Worst-case of PAPR is Middle Channel, QPSK, BW=15 kHz, Tone Number=12, Tone Offset=0, MSC/TBS=5.

Low Channel:



Middle Channel:

