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FCC LISTED, REGISTRATION NUMBER: 720267

IC LISTED REGISTRATION NUMBER IC 4621A-2

Test report No:

NIE: 50339RRF.001

Test report
REFERENCE STANDARD:
USA FCC Part 27
CANADA IC RSS-139, RSS-130

Identification of item tested.....:	LTE MODULE
Trademark .....:	TELIT
Model and /or type reference.....:	LE910-SVL
Other identification of the product .....:	FCC ID: RI7LE910SVL IC: 5131A-LE910SVL
Final HW version .....:	0.0
Final SW version .....:	20.00.032
Features.....:	---
Manufacturer.....:	TELIT COMMUNICATIONS SPA Viale Stazione di Prosecco 5/B, 34010 Sgonico (TS). ITALY
Test method requested, standard.....:	USA FCC Part 27 10-1-15 Edition. CANADA IC RSS-139 Issue 3, Jul. 2015. CANADA IC RSS-130 Issue 1, Oct. 2013. Measurement Guidance 971168 D01 v02r02 for certification of Licensed Digital Transmitters. ANSI/TIA-603-D (2010). ANSI C63.26 (2015).
Summary.....:	IN COMPLIANCE
Approved by (name / position & signature) .....:	A. Llamas RF Lab. Manager Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2016.10.03 11:58:56 +02'00'
Date of issue .....:	2016-10-03
Report template No.....:	FDT08_18

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Competences and guarantees

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjuction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-2.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the AT4 wireless internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
50339/001	LTE module	LE910-SVL	IMEI: 35365007999	2016-07-13
46047B/14	Antenna	---	---	2015-05-12
46047B/18	Antenna	---	---	2015-05-12

1. Sample S/01 has undergone the test(s).

   All radiated tests indicated in appendix A.

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
50339/001	LTE module	LE910-SVL	IMEI: 35365007999	2016-07-13

1. Sample S/02 has undergone the test(s).

   All conducted tests indicated in appendix A.

Test sample description

The test sample consists of a wireless LTE Module.

Identification of the client

TELIT COMMUNICATIONS SPA

Viale Stazione di Prosecco 5/B, 34010 Sgonico (TS). ITALY

Testing period

The performed test started on 2016-07-13 and finished on 2016-08-01.

The tests have been performed at AT4 wireless.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

In the semianechoic chamber the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

1: Used instrumentation.

Conducted Measurements

		Last Cal. date	Cal. due date
1.	Spectrum analyser Agilent PSA E4440A	2015/10	2017/10
2.	Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
3.	Vector signal analyzer Rohde & Schwarz FSQ8	2016/06	2018/06
4.	Climatic chamber HERAEUS VM 07/100	2016/03	2018/03
5.	DC power supply R&S NGPE 40/40	2014/11	2017/11
6.	Universal Radio communication Tester R&S CMW500	2014/07	2017/07

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2014/03	2017/03
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2013/11	2016/11
5.	Horn antenna 0.8-18 GHz Rohde & Schwarz R&S HF907 (Link antenna)	N.A.	N.A.
6.	EMI Test Receiver Rohde & Schwarz ESU 40	2016/03	2018/03
7.	Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
8.	RF pre-amplifier 10 MHz-6 GHz SCHWARZBECK BBV9743	2016/04	2017/04
9.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2016/02	2018/02
10.	Universal Radio communication Tester R&S CMW500	2014/07	2017/07

Testing verdicts

Not applicable ..... :	N/A
Pass ..... :	P
Fail ..... :	F
Not measured ..... :	N/M

FCC PART 27/IC RSS-139/IC RSS-130/ PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 27.50 / RSS-139 Clause 6.5. / RSS-130 Clause 4.4.: RF output power		P		
Clause 2.1047 / RSS-139 Clause 6.2. / RSS-130 Clause 4.1.: Modulation characteristics		P		
Clause 27.54 / RSS-139 Clause 6.4. / RSS-130 Clause 4.3.: Frequency stability		P		
Clause 2.1049: Occupied Bandwidth		P		
Clause 27.53 / RSS-139 Clause 6.6. / RSS-130 Clause 4.6.: Spurious emissions at antenna terminals		P		
Clause 27.53 / RSS-139 Clause 6.6. / RSS-130 Clause 4.6.: Radiated emissions		P		

Appendix A – Test result for FCC Part 27/IC RSS-139/IC RSS-130

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TEST RESULTS FOR FCC PART 27 AND IC RSS-139/RSS-130

TEST CONDITIONS

Power supply (V):

V_{nom} = 3.80 Vdc

V_{max} = 4.37 Vdc

V_{min} = 3.23 Vdc

The subscripts nom, min and max indicate voltage test conditions (nominal, minimum and maximum respectively)

Type of power supply = DC Voltage from external power supply.

Type of antenna = External connectable antenna

TEST FREQUENCIES:

LTE. QPSK AND 16QAM MODULATION (BAND IV)

	Channel (Frequency, MHz)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	19957 (1710.7)	19965 (1711.5)	19975 (1712.5)	20000 (1715.0)	20025 (1717.5)	20050 (1720.0)
Middle	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)
Highest	20393 (1754.3)	20385 (1753.5)	20375 (1752.5)	20350 (1750.0)	20325 (1747.5)	20300 (1745.0)

LTE. QPSK AND 16QAM MODULATION (BAND XIII)

	Channel (Frequency, MHz)	
	BW = 5 MHz	BW = 10 MHz
Lowest	23205 (779.5)	N/A
Middle	23230 (782.0)	23230 (782.0)
Highest	23255 (784.5)	N/A

RF Output Power (conducted and E.I.R.P.)

SPECIFICATION

FCC §2.1046 and §27.50. RSS-139 Clause 6.5.

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 1 watt EIRP (30 dBm). 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.

The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP (44.77 dBm).

RSS-130 Clause 4.4.

The e.i.r.p. shall not exceed 50 watts (46.99 dBm) for mobile equipment or for outdoor fixed subscriber equipment nor shall it exceed 5 watts (36.99 dBm) for portable equipment or for indoor fixed subscriber equipment.

The peak-to-average power ratio (PAPR) of the transmission shall not exceed 13 dB.

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 R&S CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

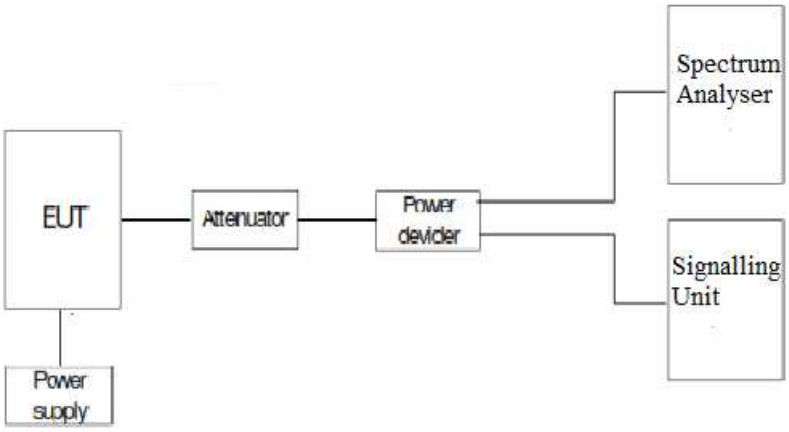
The maximum effective radiated power e.r.p. or the equivalent isotropically radiated power e.i.r.p. are calculated by adding the declared maximum antenna gain (dBd or dBi respectively).

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 EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The measurement is performed for the highest power levels measured.

TEST SETUP

Conducted average power.

Peak-to-average power ratio (PAPR)



RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED).

LTE. BAND IV.

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
1.4	Low 19957	1710.7	QPSK	1	0	22.243	
				1	2	22.116	
				1	5	22.056	
				3	0	22.096	
				3	1	22.184	
				3	2	22.080	
				6	0	21.078	4.70
			16-QAM	1	0	21.356	
				1	2	21.331	
				1	5	21.298	
				3	0	22.141	
				3	1	21.212	
				3	2	21.247	
				6	0	20.165	5.50
	Middle 20175	1732.5	QPSK	1	0	22.192	
				1	2	22.189	
				1	5	22.183	
				3	0	22.237	
				3	1	22.219	
				3	2	22.266	
				6	0	21.081	4.47
			16-QAM	1	0	21.375	
				1	2	21.362	
				1	5	21.514	
				3	0	21.118	
				3	1	21.087	
				3	2	21.226	
				6	0	20.161	5.32
	High 20393	1754.3	QPSK	1	0	22.272	
				1	2	22.299	
				1	5	22.319	
				3	0	22.245	
				3	1	22.328	
				3	2	22.310	
				6	0	21.214	4.10
			16-QAM	1	0	21.685	
				1	2	21.433	
				1	5	21.356	
				3	0	21.352	
				3	1	21.436	
				3	2	21.439	
				6	0	20.248	4.97

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
3	Low 19965	1711.5	QPSK	1	0	22.136	5.19
				1	7	22.185	
				1	14	22.185	
				8	0	21.069	
				8	4	21.021	
				8	7	21.037	
				15	0	21.037	
			16-QAM	1	0	21.396	5.93
				1	7	21.424	
				1	14	21.308	
				8	0	20.240	
				8	4	20.113	
				8	7	20.106	
				15	0	20.187	
	Middle 20175	1732.5	QPSK	1	0	22.172	5.00
				1	7	22.302	
				1	14	22.145	
				8	0	21.159	
				8	4	21.168	
				8	7	21.128	
				15	0	21.179	
			16-QAM	1	0	21.581	5.75
				1	7	21.527	
				1	14	21.545	
				8	0	20.356	
				8	4	20.307	
				8	7	20.333	
				15	0	20.189	
	High 20385	1753.5	QPSK	1	0	22.376	4.73
				1	7	22.291	
				1	14	22.204	
				8	0	21.233	
				8	4	21.283	
				8	7	21.293	
				15	0	21.180	
			16-QAM	1	0	21.491	5.54
				1	7	21.571	
				1	14	21.586	
				8	0	20.36	
				8	4	20.409	
				8	7	20.337	
				15	0	20.290	

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
5	Low 19975	1712.5	QPSK	1	0	22.257	
				1	12	22.250	
				1	24	22.123	
				12	0	21.130	
				12	6	21.124	
				12	11	21.139	
				25	0	21.083	5.03
			16-QAM	1	0	21.604	
				1	12	21.504	
				1	24	21.296	
				12	0	20.233	
				12	6	20.120	
				12	11	20.271	
				25	0	20.151	5.80
	Middle 20175	1732.5	QPSK	1	0	22.196	
				1	12	22.092	
				1	24	22.086	
				12	0	21.174	
				12	6	21.228	
				12	11	21.220	
				25	0	21.184	4.86
			16-QAM	1	0	21.367	
				1	12	21.714	
				1	24	21.246	
				12	0	20.305	
				12	6	20.238	
				12	11	20.283	
				25	0	20.212	5.66
	High 20375	1752.5	QPSK	1	0	22.373	
				1	12	22.247	
				1	24	22.119	
				12	0	21.344	
				12	6	21.243	
				12	11	21.278	
				25	0	21.347	4.57
			16-QAM	1	0	21.696	
				1	12	21.610	
				1	24	21.614	
				12	0	20.308	
				12	6	20.399	
				12	11	20.354	
				25	0	20.317	5.30

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
10	Low 20000	1715	QPSK	1	0	22.372	5.00
				1	24	22.209	
				1	49	22.130	
				25	0	21.193	
				25	12	21.152	
				25	24	21.036	
				50	0	21.095	
			16-QAM	1	0	21.607	5.77
				1	24	21.041	
				1	49	21.149	
				25	0	20.186	
				25	12	20.128	
				25	24	20.072	
				50	0	20.142	
	Middle 20175	1732.5	QPSK	1	0	22.403	4.97
				1	24	22.224	
				1	49	22.329	
				25	0	21.254	
				25	12	21.195	
				25	24	21.217	
				50	0	21.229	
			16-QAM	1	0	21.758	5.75
				1	24	21.443	
				1	49	21.556	
				25	0	20.340	
				25	12	20.245	
				25	24	20.230	
				50	0	20.269	
	High 20350	1750	QPSK	1	0	22.568	4.60
				1	24	22.316	
				1	49	22.277	
				25	0	21.354	
				25	12	21.238	
				25	24	21.245	
				50	0	21.295	
			16-QAM	1	0	21.785	5.43
				1	24	21.572	
				1	49	21.569	
				25	0	20.443	
				25	12	20.400	
				25	24	20.361	
				50	0	20.370	

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
15	Low 20025	1717.5	QPSK	1	0	22.665	4.97
				1	37	22.180	
				1	74	22.279	
				36	0	21.260	
				36	18	21.093	
				36	37	21.108	
				75	0	21.181	
			16-QAM	1	0	21.693	5.59
				1	37	21.373	
				1	74	21.465	
				36	0	20.312	
				36	18	20.107	
				36	37	20.123	
				75	0	20.197	
	Middle 20175	1732.5	QPSK	1	0	22.657	4.87
				1	37	22.273	
				1	74	22.454	
				36	0	21.329	
				36	18	21.207	
				36	37	21.255	
				75	0	21.257	
			16-QAM	1	0	21.724	5.58
				1	37	21.564	
				1	74	21.563	
				36	0	20.390	
				36	18	20.230	
				36	37	20.276	
				75	0	20.312	
	High 20325	1747.5	QPSK	1	0	22.703	4.50
				1	37	22.432	
				1	74	22.302	
				36	0	21.489	
				36	18	21.346	
				36	37	21.295	
				75	0	21.357	
			16-QAM	1	0	22.888	5.22
				1	37	21.649	
				1	74	21.534	
				36	0	20.516	
				36	18	20.360	
				36	37	20.362	
				75	0	20.413	

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
20	Low 20050	1720	QPSK	1	0	22.393	4.97
				1	49	21.924	
				1	99	22.004	
				50	0	21.291	
				50	24	21.063	
				50	49	21.068	
				100	0	21.190	
			16-QAM	1	0	21.670	5.71
				1	49	21.309	
				1	99	21.361	
				50	0	20.329	
				50	24	20.060	
				50	49	20.104	
				100	0	20.190	
	Middle 20175	1732.5	QPSK	1	0	22.302	4.89
				1	49	22.041	
				1	99	22.080	
				50	0	21.301	
				50	24	21.092	
				50	49	21.157	
				100	0	21.244	
			16-QAM	1	0	21.548	5.67
				1	49	21.237	
				1	99	21.304	
				50	0	20.352	
				50	24	20.162	
				50	49	20.211	
				100	0	20.282	
	High 20300	1745	QPSK	1	0	22.551	4.71
				1	49	22.127	
				1	99	22.125	
				50	0	21.470	
				50	24	21.255	
				50	49	21.265	
				100	0	21.374	
			16-QAM	1	0	21.795	5.51
				1	49	21.390	
				1	99	21.346	
				50	0	20.498	
				50	24	20.269	
				50	49	20.384	
				100	0	20.398	

LTE. BAND XIII.

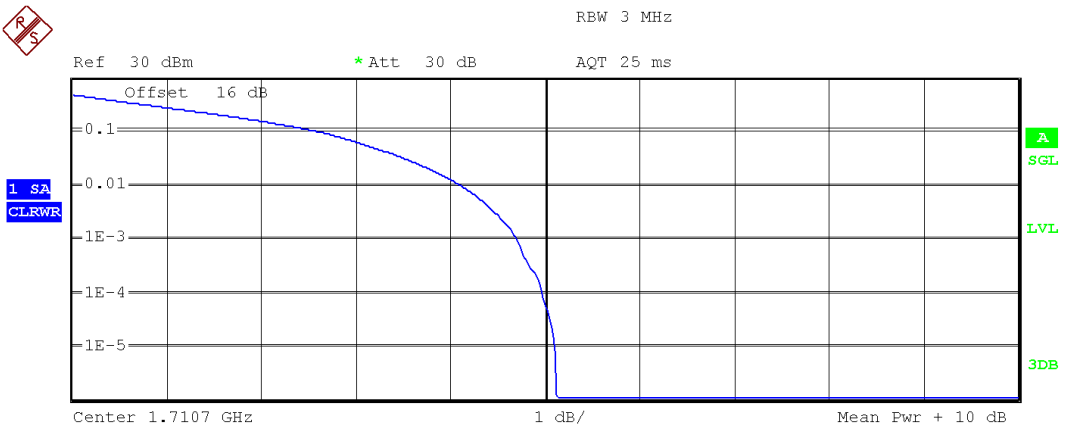
BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
5	Low 23205	779.5 MHz	QPSK	1	0	22.315	5.54
				1	12	22.212	
				1	24	22.175	
				12	0	21.650	
				12	6	21.125	
				12	11	21.165	
				25	0	21.212	
			16-QAM	1	0	21.500	6.23
				1	12	21.486	
				1	24	21.313	
				12	0	20.215	
				12	6	20.154	
				12	11	20.244	
				25	0	20.121	
	Middle 23230	782 MHz	QPSK	1	0	22.20	5.63
				1	12	22.263	
				1	24	22.173	
				12	0	21.25	
				12	6	21.237	
				12	11	21.231	
				25	0	21.237	
			16-QAM	1	0	21.460	6.31
				1	12	21.507	
				1	24	21.414	
				12	0	20.394	
				12	6	20.355	
				12	11	20.374	
				25	0	20.341	
	High 23254	784.5 MHz	QPSK	1	0	22.295	5.54
				1	12	22.194	
				1	24	22.184	
				12	0	21.645	
				12	6	21.325	
				12	11	21.120	
				25	0	21.203	
			16-QAM	1	0	21.452	6.36
				1	12	21.153	
				1	24	21.298	
				12	0	20.195	
				12	6	20.142	
				12	11	20.514	
				25	0	20.095	

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
10	Middle 23230	782 MHz	QPSK	1	0	21.926	5.61
				1	24	22.155	
				1	49	21.611	
				25	0	21.310	
				25	12	21.381	
				25	24	21.270	
				50	0	21.292	
			16-QAM	1	0	21.207	6.38
				1	24	21.398	
				1	49	20.859	
				25	0	20.435	
				25	12	20.386	
				25	24	20.391	
				50	0	20.384	

PEAK-TO-AVERAGE POWER RATIO (PAPR).

LTE. BAND IV.

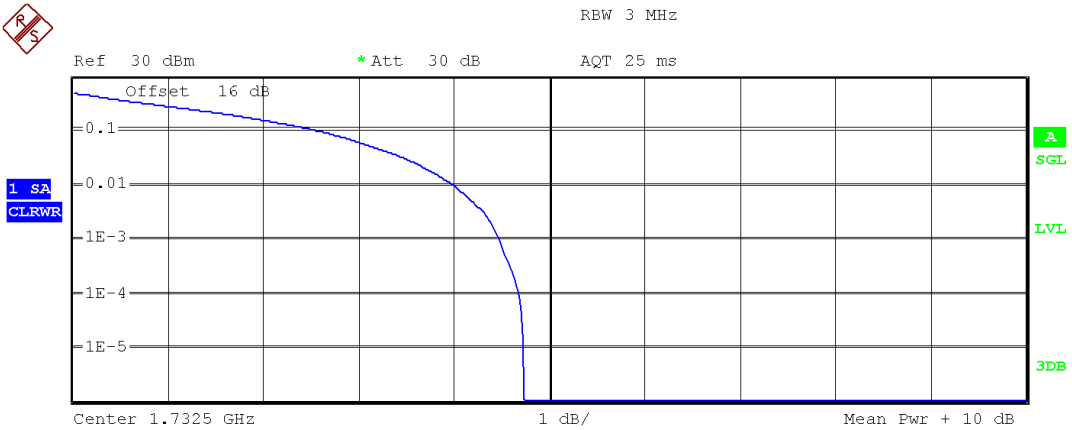
Bandwidth = 1.4 MHz. Modulation QPSK. RB Size: 6. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.20 dBm
Peak	26.32 dBm
Crest	5.12 dB
10 %	2.61 dB
1 %	4.10 dB
.1 %	4.70 dB
.01 %	4.97 dB

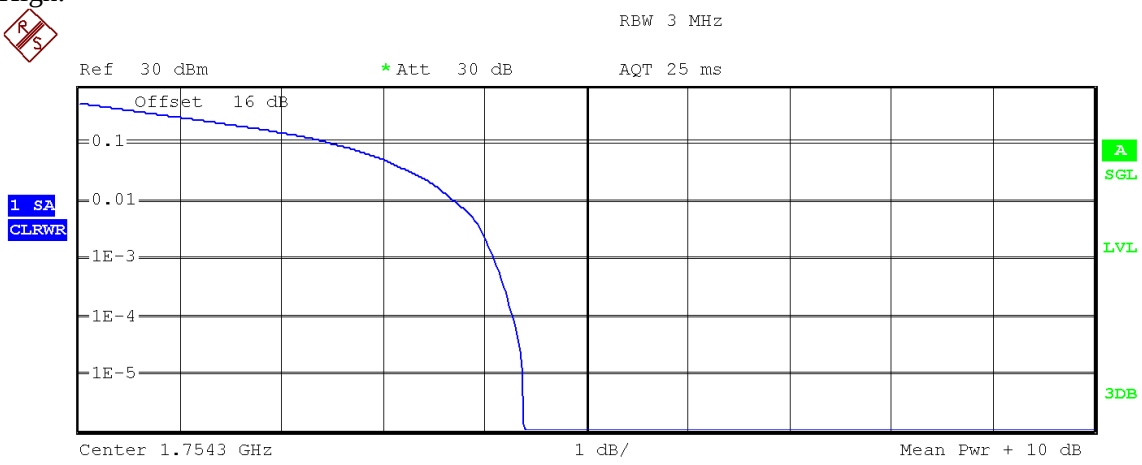
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.31 dBm
Peak	26.04 dBm
Crest	4.73 dB
10 %	2.58 dB
1 %	3.99 dB
.1 %	4.47 dB
.01 %	4.68 dB

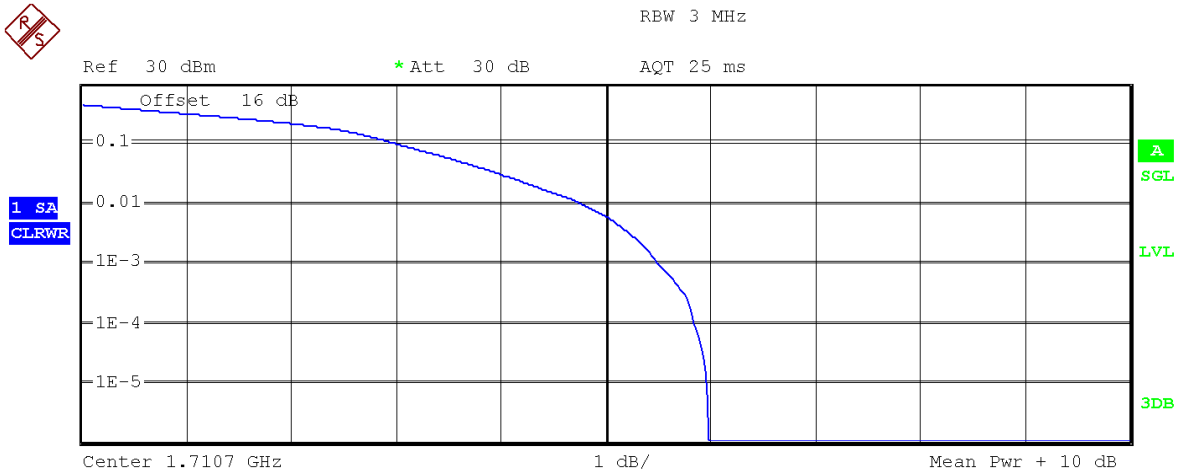
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.37 dBm
Peak	25.76 dBm
Crest	4.39 dB
10 %	2.52 dB
1 %	3.70 dB
.1 %	4.10 dB
.01 %	4.28 dB

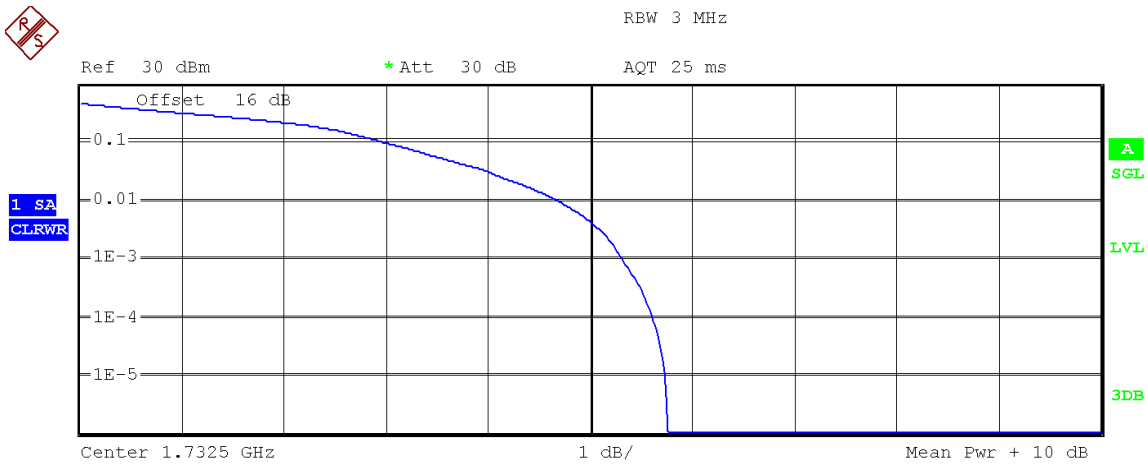
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.27 dBm
Peak	26.25 dBm
Crest	5.98 dB
10 %	3.01 dB
1 %	4.78 dB
.1 %	5.50 dB
.01 %	5.85 dB

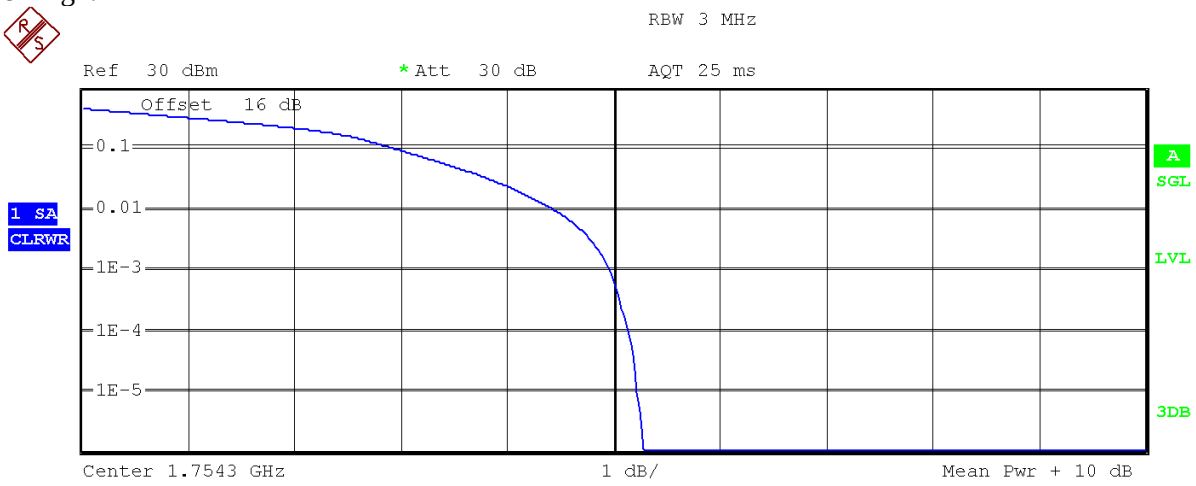
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.36 dBm
Peak	26.11 dBm
Crest	5.75 dB
10 %	3.00 dB
1 %	4.68 dB
.1 %	5.32 dB
.01 %	5.61 dB

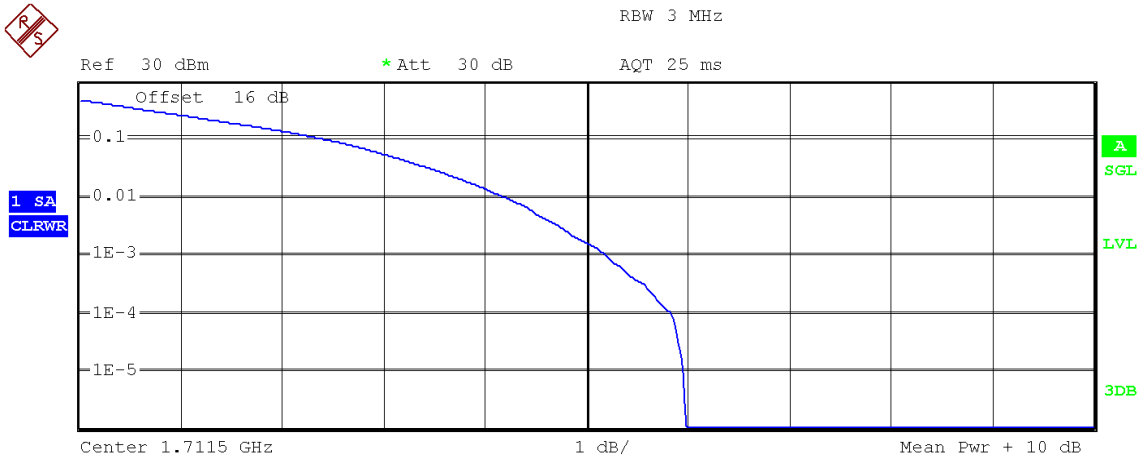
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.48 dBm
Peak	25.76 dBm
Crest	5.28 dB
10 %	2.95 dB
1 %	4.44 dB
.1 %	4.97 dB
.01 %	5.14 dB

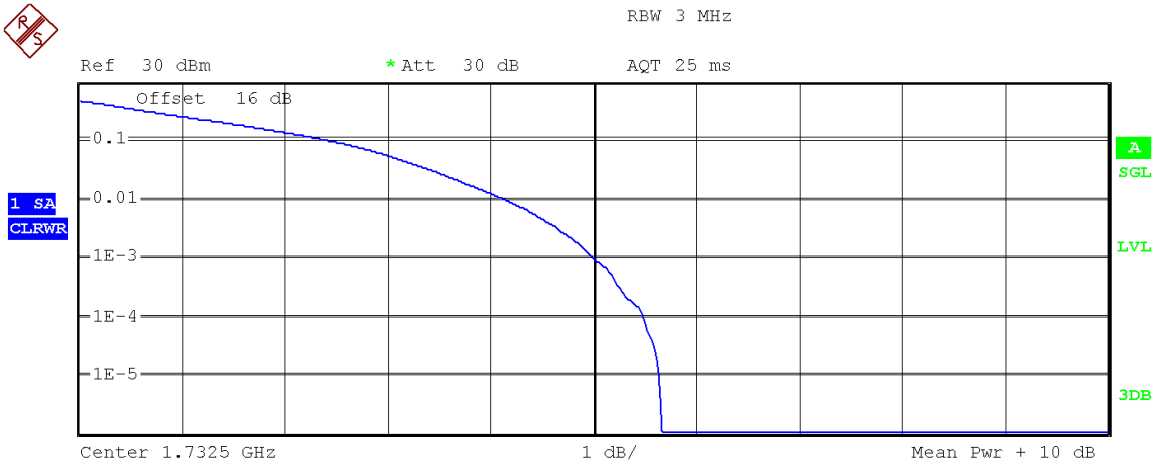
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.19 dBm
Peak	27.17 dBm
Crest	5.97 dB
10 %	2.44 dB
1 %	4.20 dB
.1 %	5.19 dB
.01 %	5.83 dB

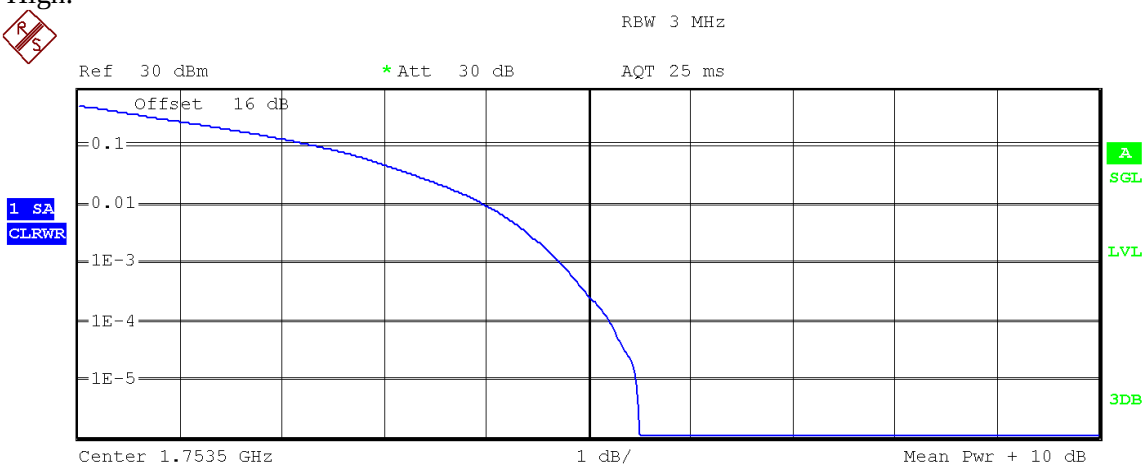
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.30 dBm
Peak	26.96 dBm
Crest	5.66 dB
10 %	2.45 dB
1 %	4.13 dB
.1 %	5.00 dB
.01 %	5.50 dB

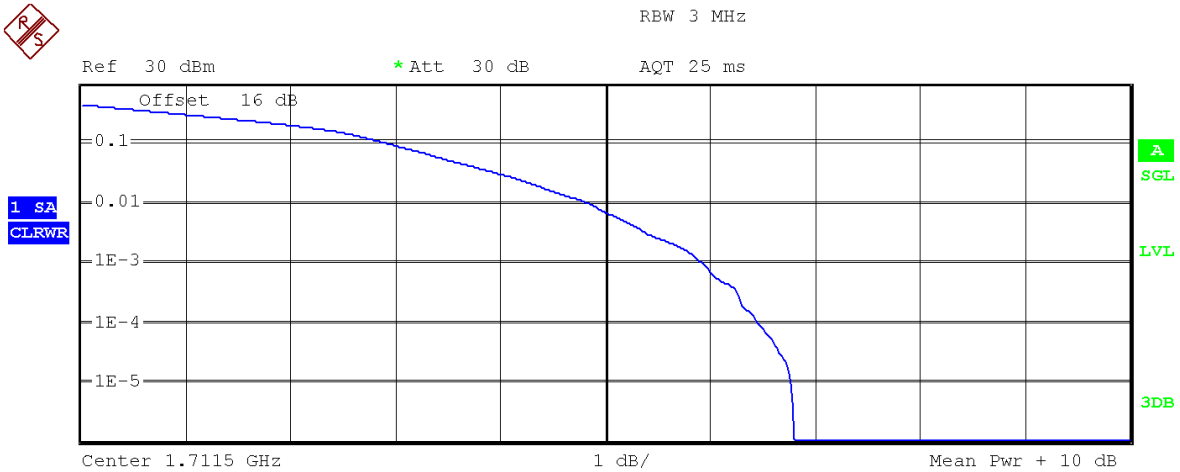
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.39 dBm
Peak	26.89 dBm
Crest	5.50 dB
10 %	2.36 dB
1 %	3.99 dB
.1 %	4.73 dB
.01 %	5.21 dB

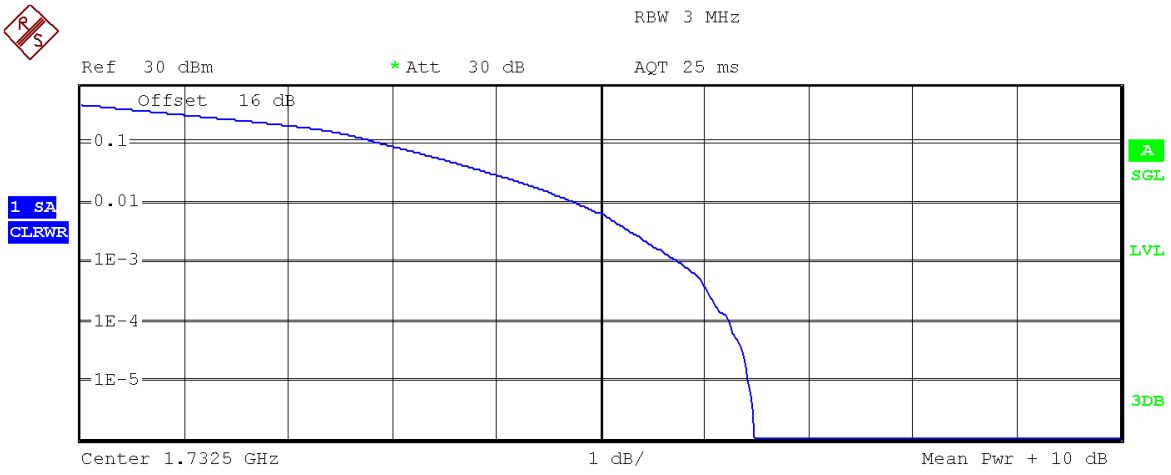
Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.23 dBm
Peak	27.03 dBm
Crest	6.80 dB
10 %	2.93 dB
1 %	4.84 dB
.1 %	5.93 dB
.01 %	6.46 dB

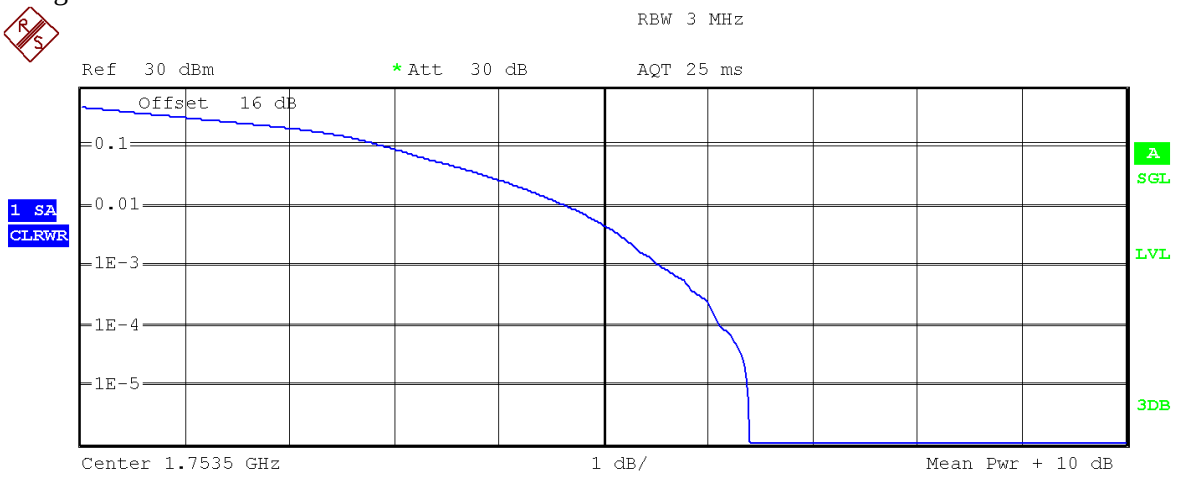
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.33 dBm
Peak	26.82 dBm
Crest	6.49 dB
10 %	2.92 dB
1 %	4.76 dB
.1 %	5.75 dB
.01 %	6.25 dB

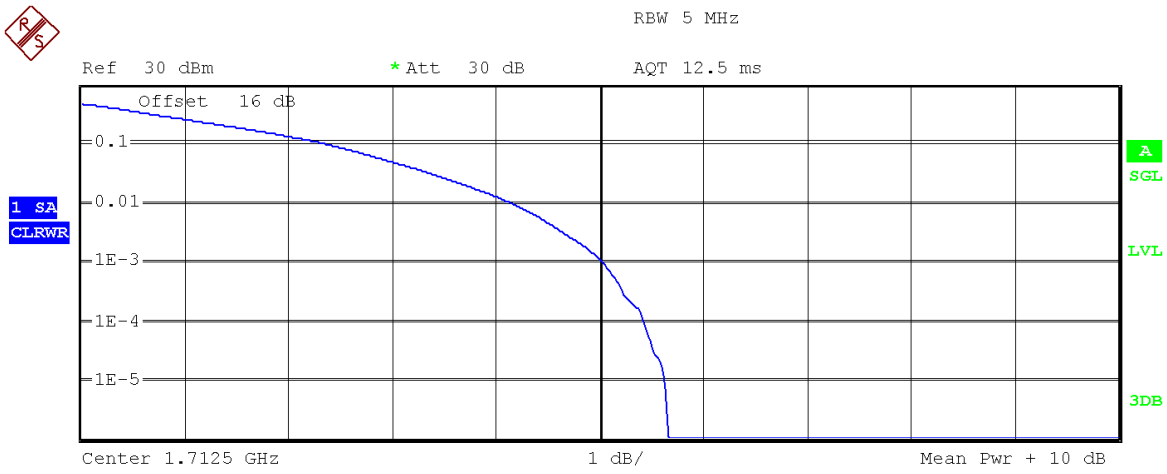
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.42 dBm
Peak	26.82 dBm
Crest	6.40 dB
10 %	2.92 dB
1 %	4.66 dB
.1 %	5.54 dB
.01 %	6.12 dB

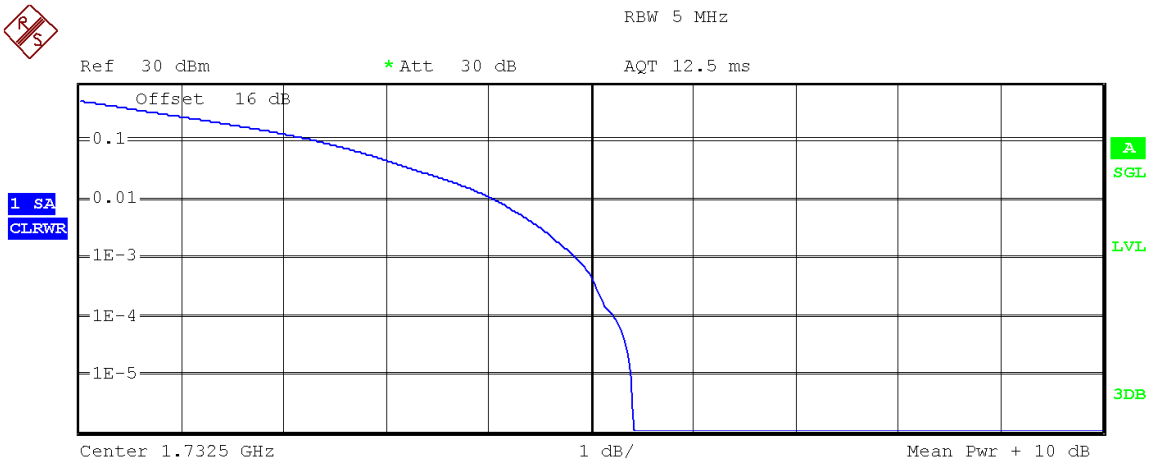
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.16 dBm
Peak	26.82 dBm
Crest	5.66 dB
10 %	2.39 dB
1 %	4.15 dB
.1 %	5.03 dB
.01 %	5.43 dB

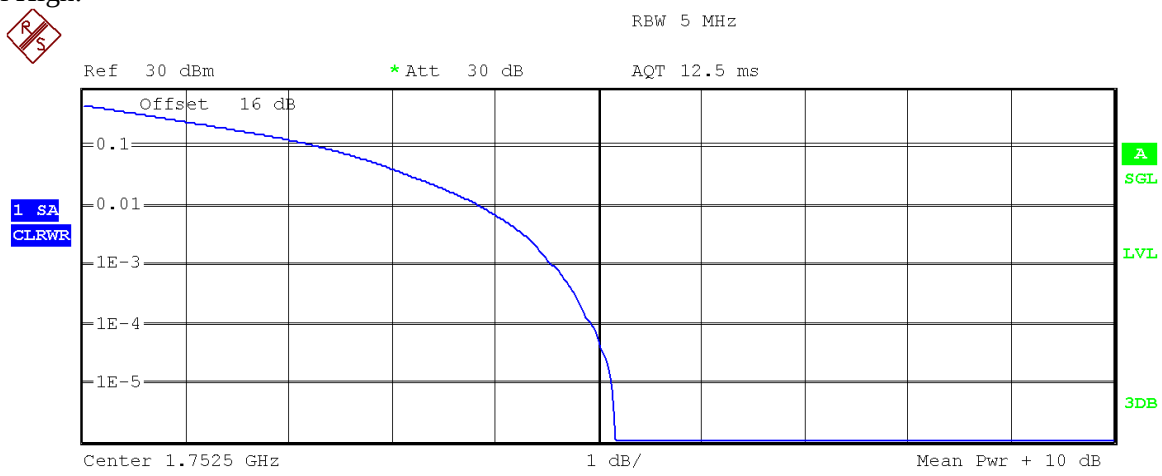
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.33 dBm
Peak	26.75 dBm
Crest	5.41 dB
10 %	2.36 dB
1 %	4.07 dB
.1 %	4.86 dB
.01 %	5.22 dB

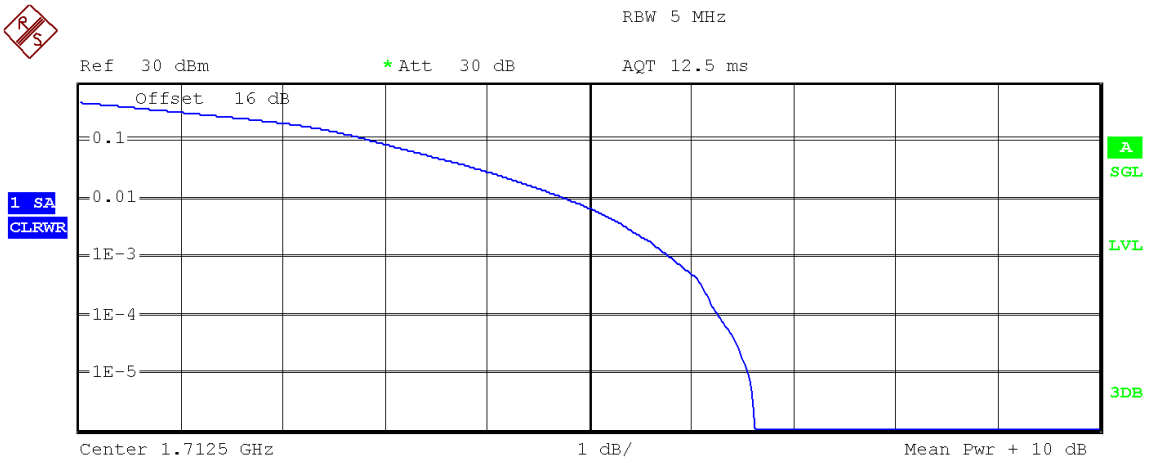
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.37 dBm
Peak	26.53 dBm
Crest	5.16 dB
10 %	2.32 dB
1 %	3.86 dB
.1 %	4.57 dB
.01 %	4.94 dB

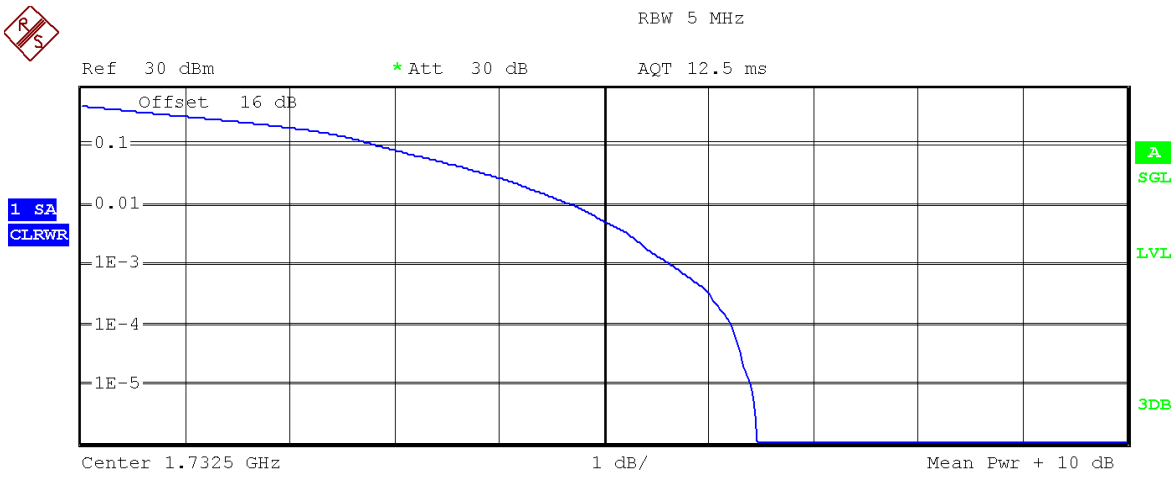
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.19 dBm
Peak	26.82 dBm
Crest	6.63 dB
10 %	2.88 dB
1 %	4.78 dB
.1 %	5.80 dB
.01 %	6.27 dB

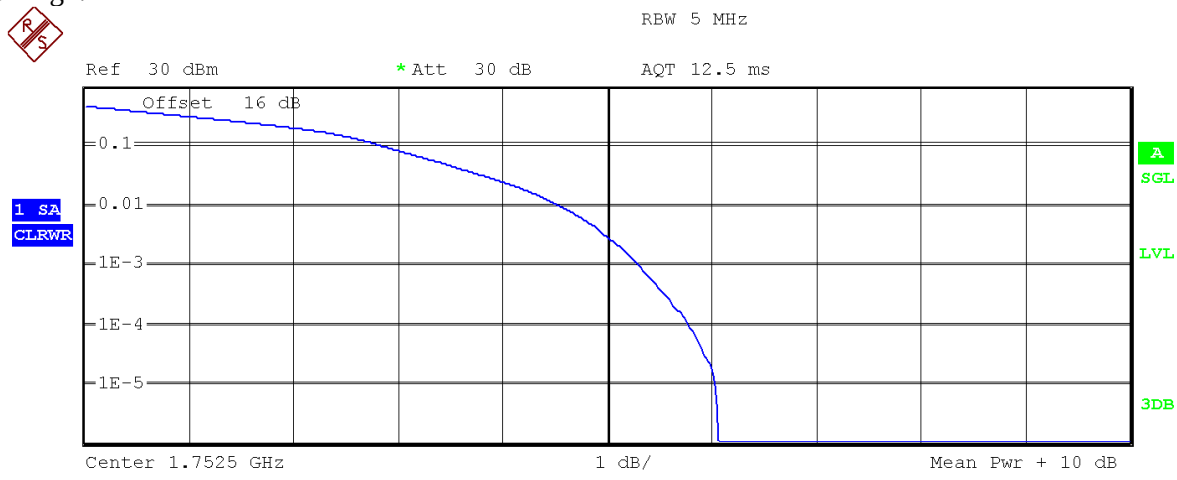
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.35 dBm
Peak	26.82 dBm
Crest	6.47 dB
10 %	2.85 dB
1 %	4.71 dB
.1 %	5.66 dB
.01 %	6.22 dB

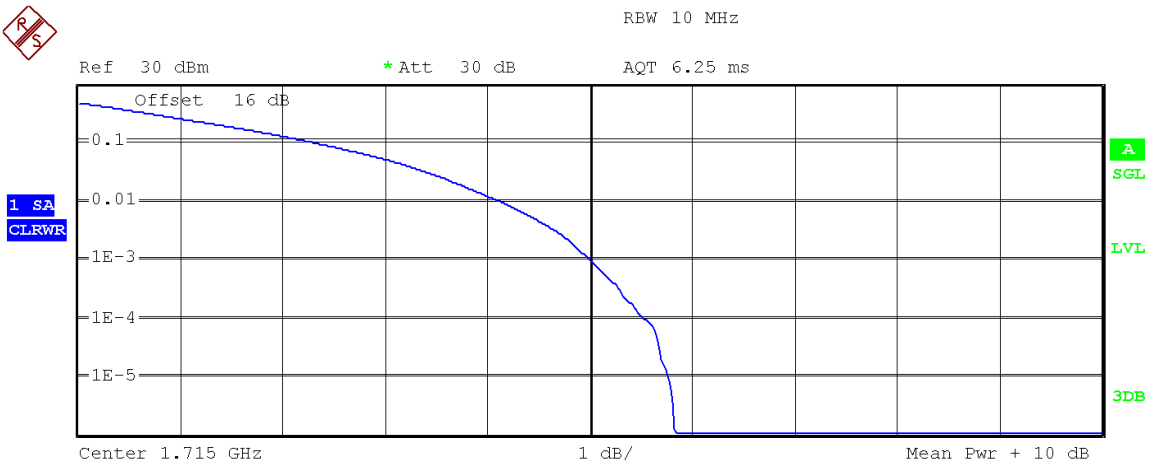
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.40 dBm
Peak	26.46 dBm
Crest	6.06 dB
10 %	2.87 dB
1 %	4.54 dB
.1 %	5.30 dB
.01 %	5.79 dB

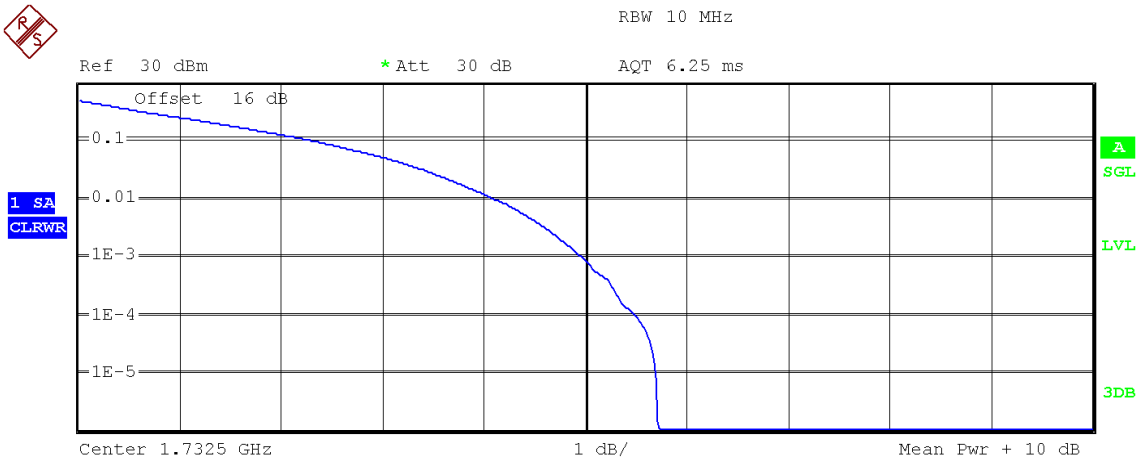
Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.33 dBm
Peak	27.16 dBm
Crest	5.83 dB
10 %	2.31 dB
1 %	4.12 dB
.1 %	5.00 dB
.01 %	5.53 dB

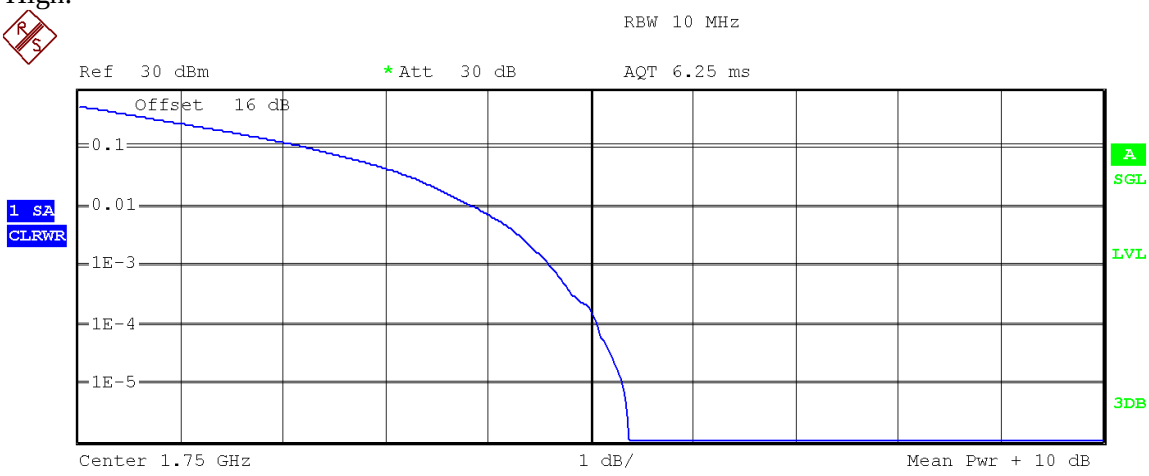
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.49 dBm
Peak	27.21 dBm
Crest	5.72 dB
10 %	2.32 dB
1 %	4.10 dB
.1 %	4.97 dB
.01 %	5.50 dB

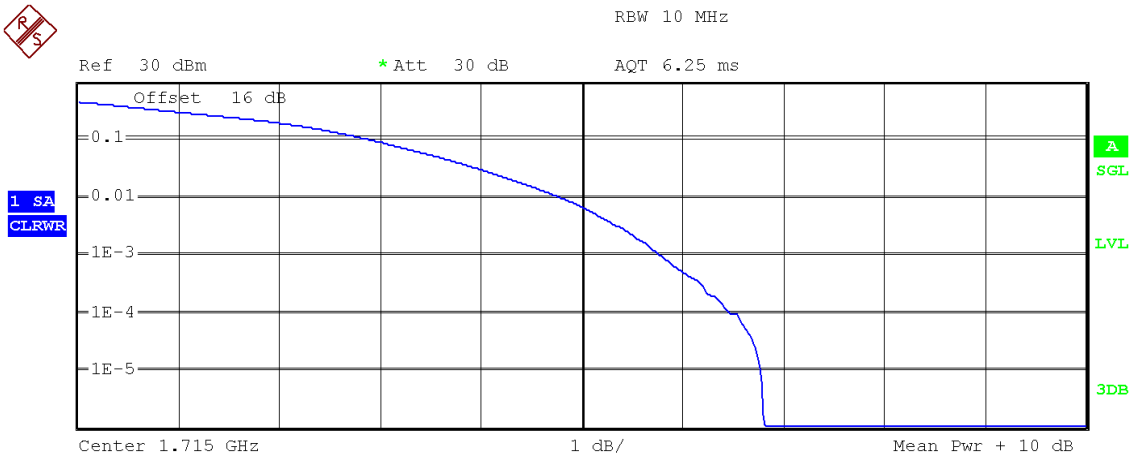
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.57 dBm
Peak	26.95 dBm
Crest	5.38 dB
10 %	2.24 dB
1 %	3.86 dB
.1 %	4.60 dB
.01 %	5.06 dB

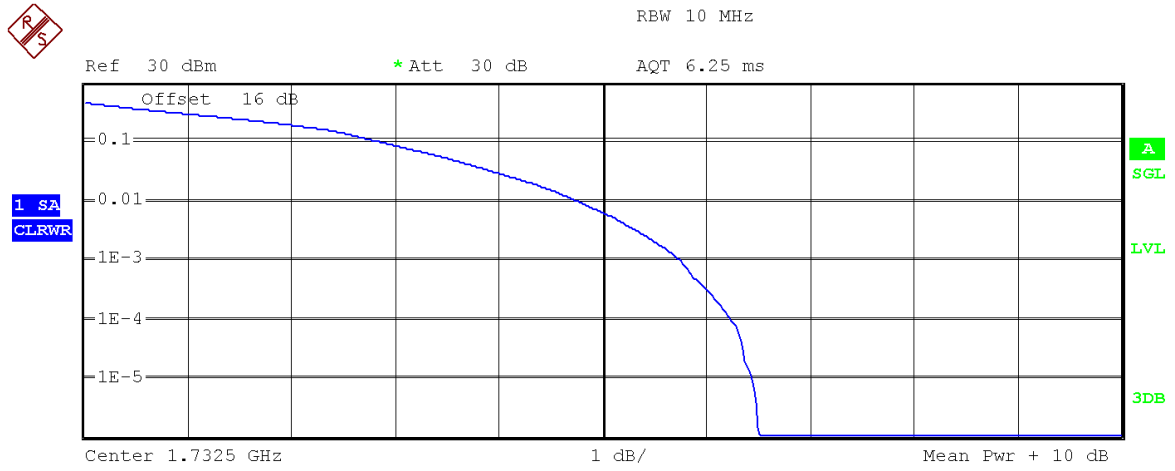
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.35 dBm
Peak	27.16 dBm
Crest	6.81 dB
10 %	2.92 dB
1 %	4.79 dB
.1 %	5.77 dB
.01 %	6.47 dB

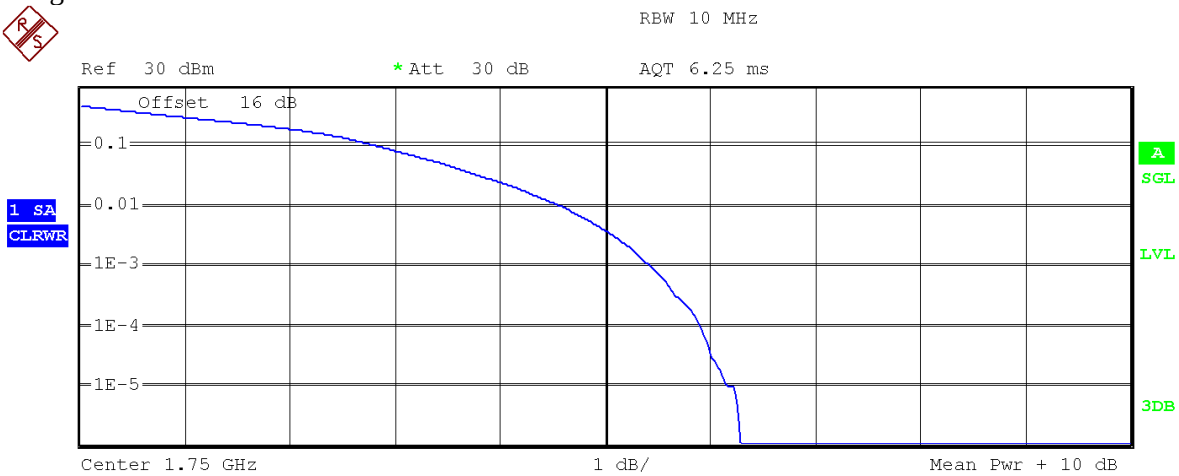
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.49 dBm
Peak	27.00 dBm
Crest	6.51 dB
10 %	2.87 dB
1 %	4.76 dB
.1 %	5.75 dB
.01 %	6.23 dB

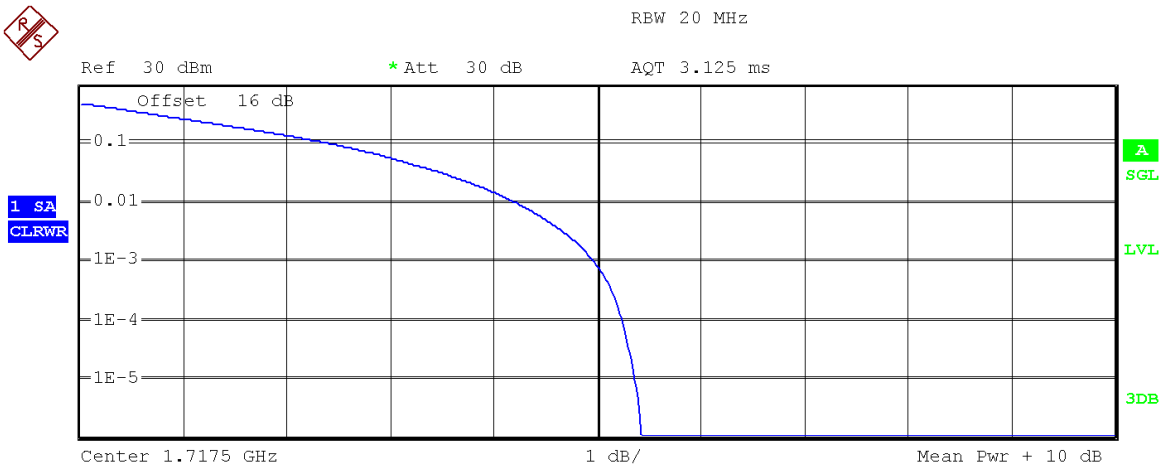
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.59 dBm
Peak	26.88 dBm
Crest	6.29 dB
10 %	2.84 dB
1 %	4.58 dB
.1 %	5.43 dB
.01 %	5.91 dB

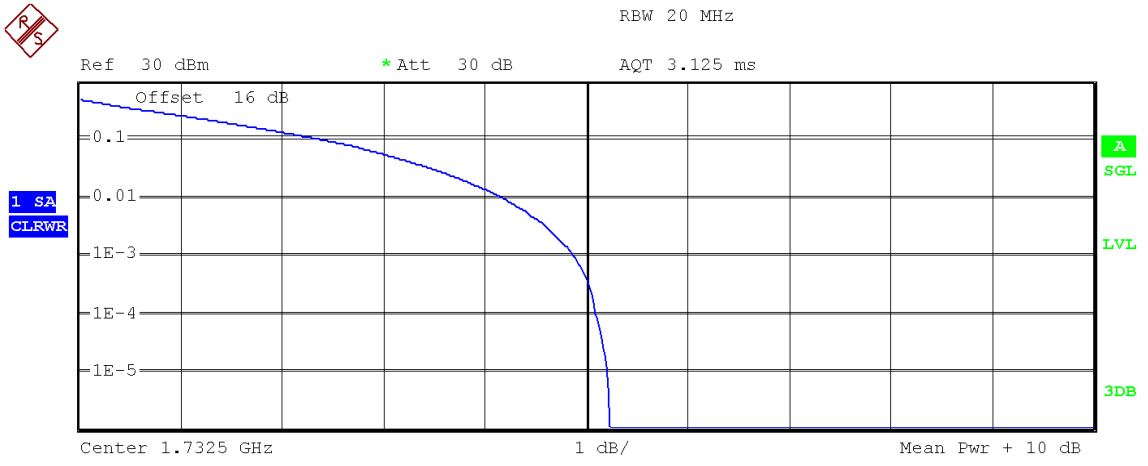
Bandwidth = 15 MHz. Modulation QPSK. RB Size: 75. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.36 dBm
Peak	26.79 dBm
Crest	5.43 dB
10 %	2.44 dB
1 %	4.21 dB
.1 %	4.97 dB
.01 %	5.24 dB

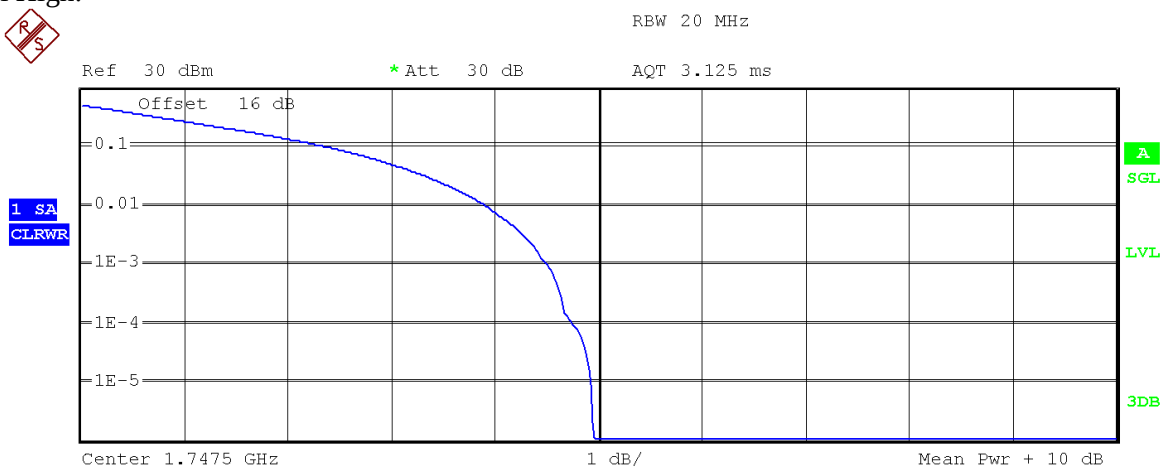
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.48 dBm
Peak	26.70 dBm
Crest	5.23 dB
10 %	2.40 dB
1 %	4.17 dB
.1 %	4.87 dB
.01 %	5.10 dB

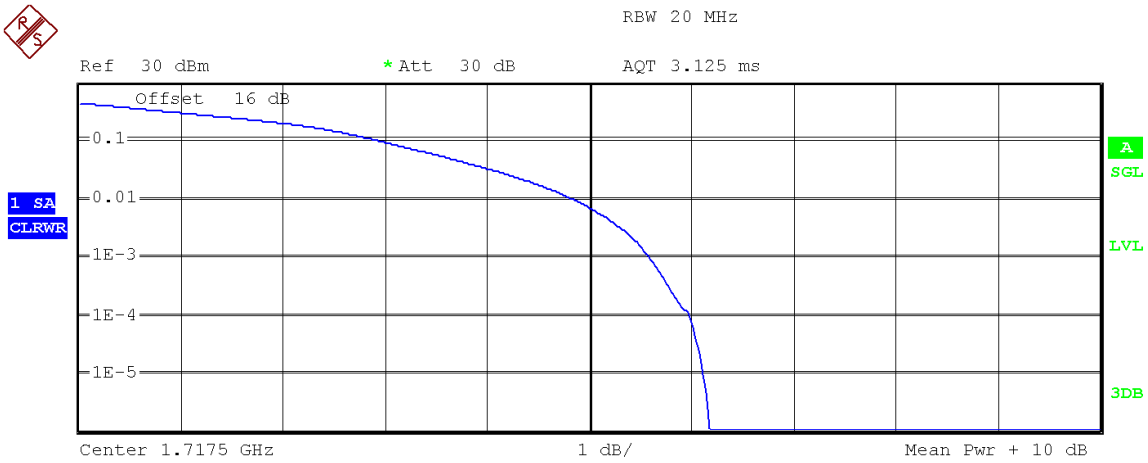
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.56 dBm
Peak	26.51 dBm
Crest	4.95 dB
10 %	2.37 dB
1 %	3.91 dB
.1 %	4.50 dB
.01 %	4.74 dB

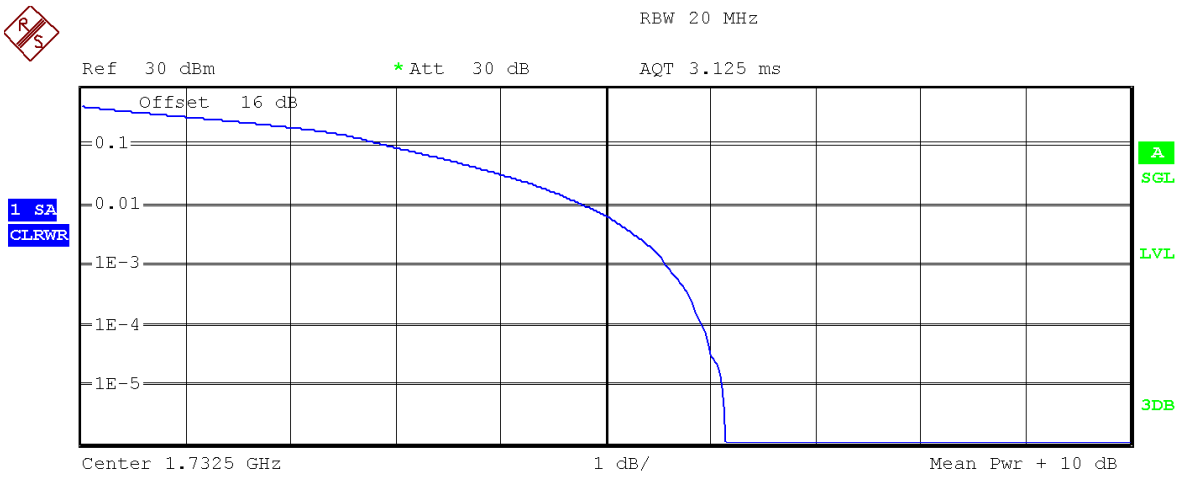
Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.40 dBm
Peak	26.58 dBm
Crest	6.18 dB
10 %	2.95 dB
1 %	4.84 dB
.1 %	5.59 dB
.01 %	5.98 dB

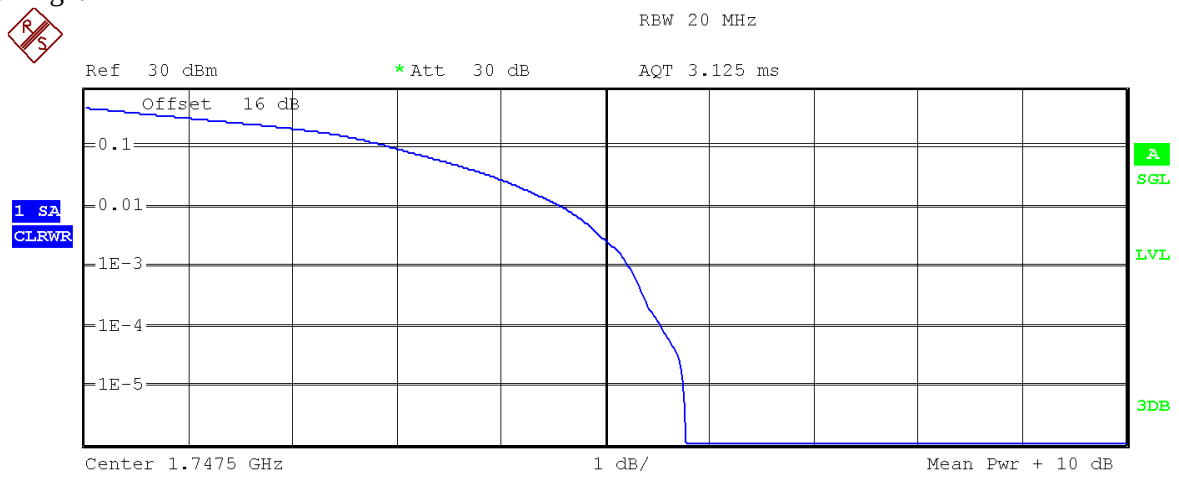
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.49 dBm
Peak	26.63 dBm
Crest	6.14 dB
10 %	2.95 dB
1 %	4.81 dB
.1 %	5.58 dB
.01 %	5.93 dB

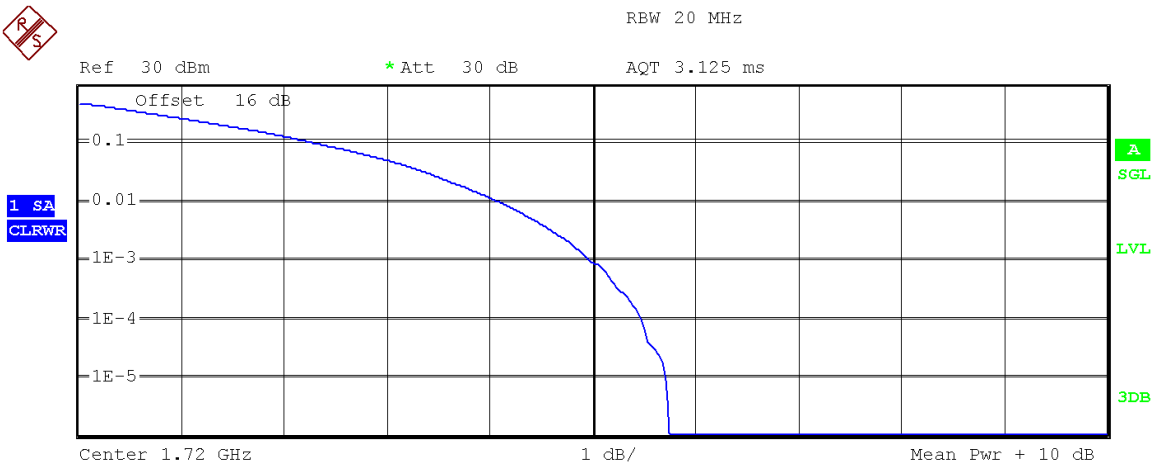
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.60 dBm
Peak	26.37 dBm
Crest	5.77 dB
10 %	2.96 dB
1 %	4.58 dB
.1 %	5.22 dB
.01 %	5.54 dB

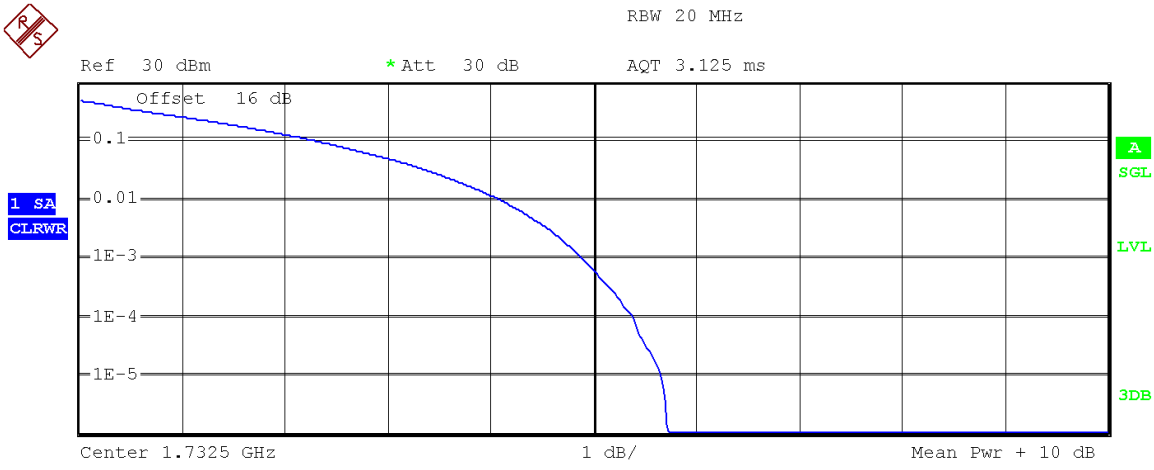
Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.39 dBm
Peak	27.13 dBm
Crest	5.74 dB
10 %	2.31 dB
1 %	4.09 dB
.1 %	4.97 dB
.01 %	5.48 dB

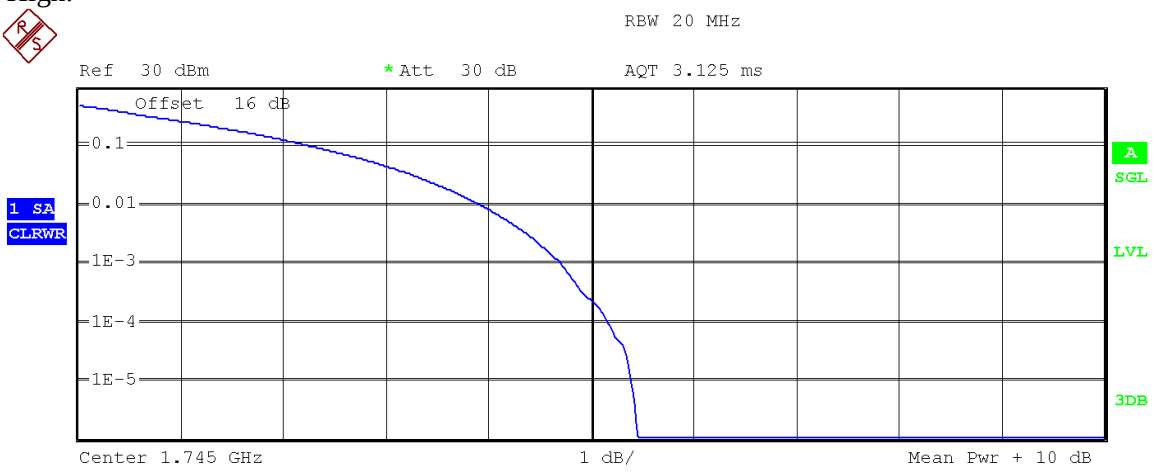
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.48 dBm
Peak	27.20 dBm
Crest	5.72 dB
10 %	2.32 dB
1 %	4.10 dB
.1 %	4.89 dB
.01 %	5.38 dB

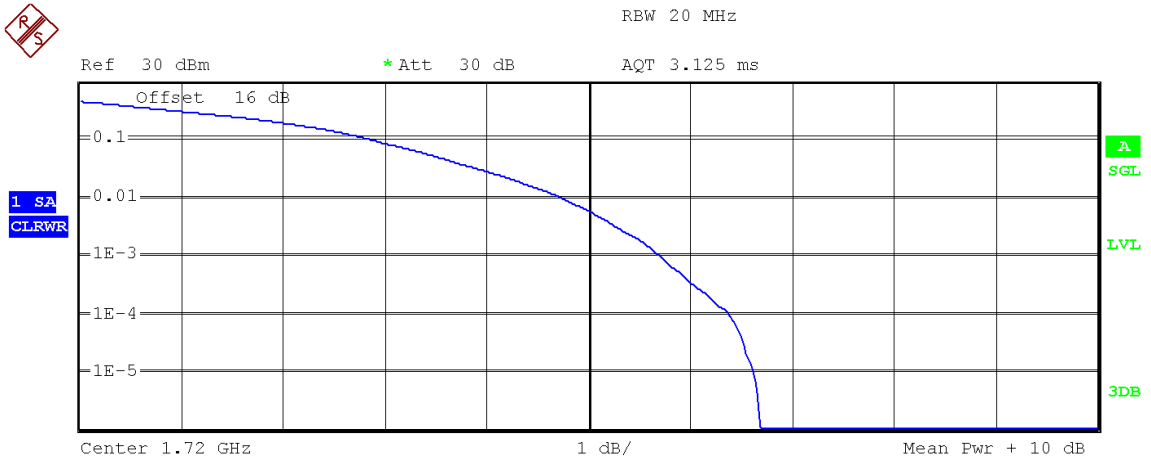
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.55 dBm
Peak	27.00 dBm
Crest	5.45 dB
10 %	2.28 dB
1 %	3.93 dB
.1 %	4.71 dB
.01 %	5.16 dB

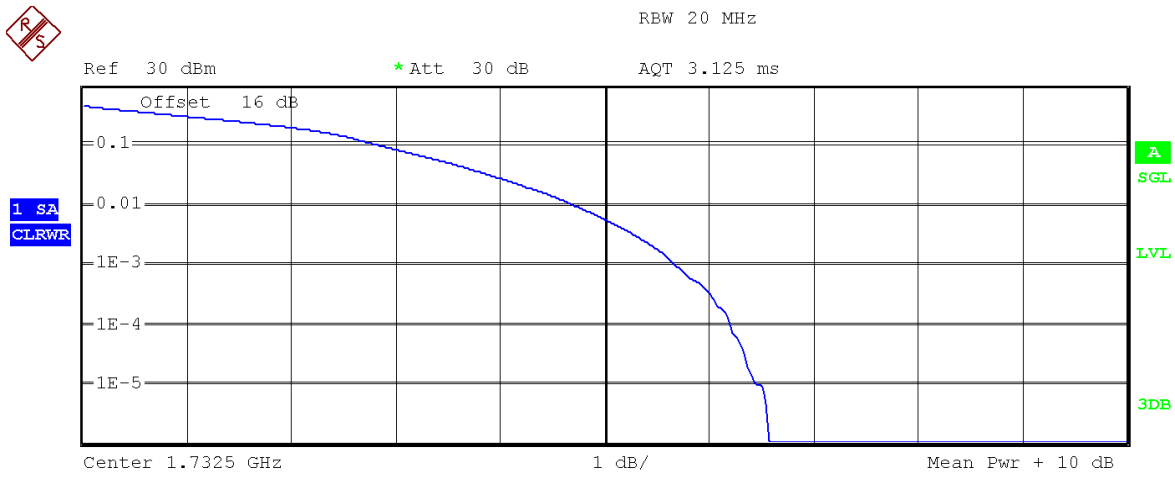
Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.37 dBm
Peak	27.06 dBm
Crest	6.69 dB
10 %	2.87 dB
1 %	4.73 dB
.1 %	5.71 dB
.01 %	6.38 dB

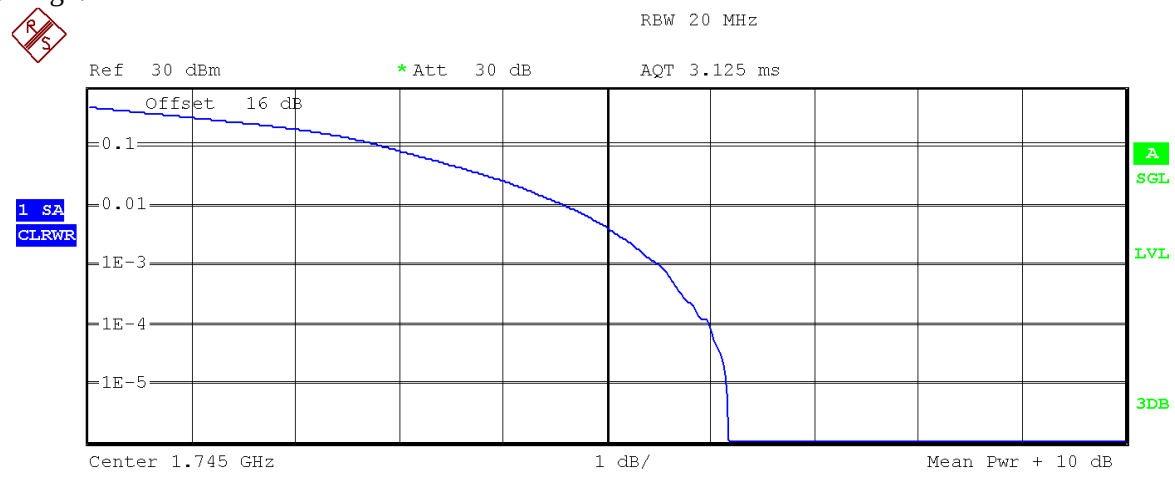
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.48 dBm
Peak	27.06 dBm
Crest	6.58 dB
10 %	2.87 dB
1 %	4.71 dB
.1 %	5.67 dB
.01 %	6.20 dB

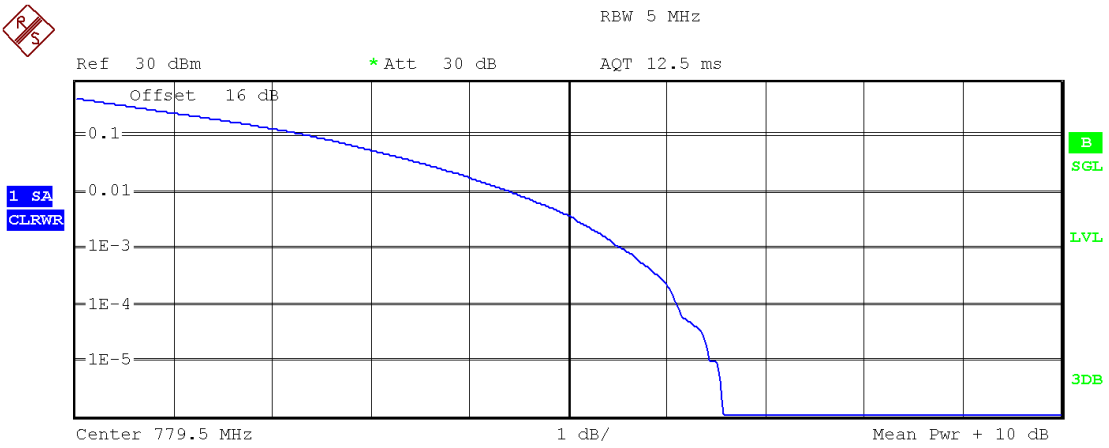
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.54 dBm
Peak	26.72 dBm
Crest	6.18 dB
10 %	2.87 dB
1 %	4.62 dB
.1 %	5.51 dB
.01 %	5.99 dB

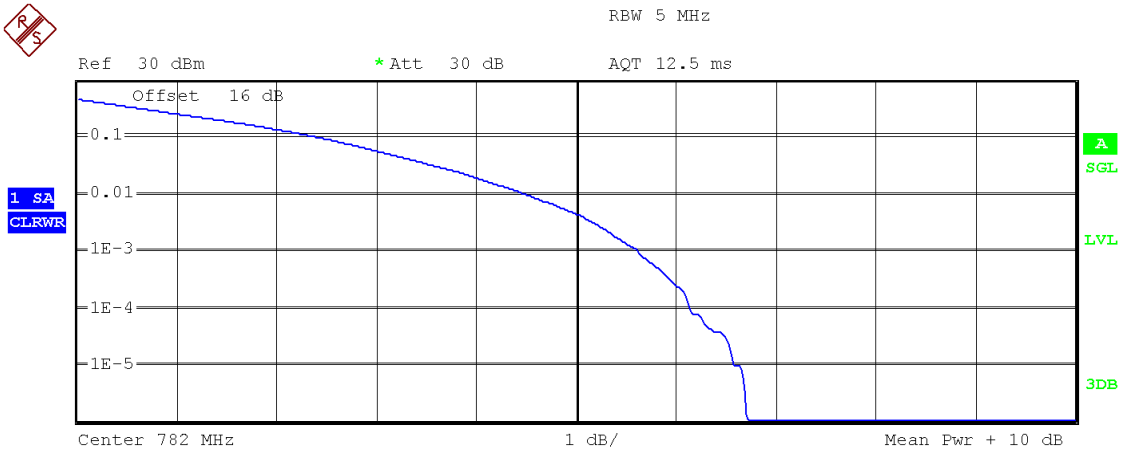
LTE. BAND XIII.
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.42 dBm
Peak	28.00 dBm
Crest	6.57 dB
10 %	2.42 dB
1 %	4.44 dB
.1 %	5.54 dB
.01 %	6.11 dB

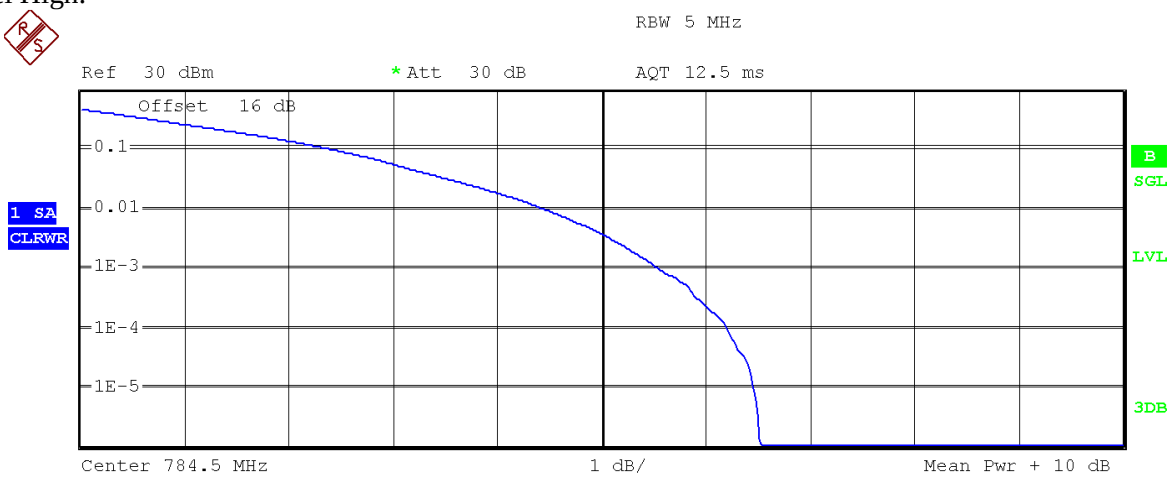
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.57 dBm
Peak	28.28 dBm
Crest	6.71 dB
10 %	2.42 dB
1 %	4.49 dB
.1 %	5.63 dB
.01 %	6.15 dB

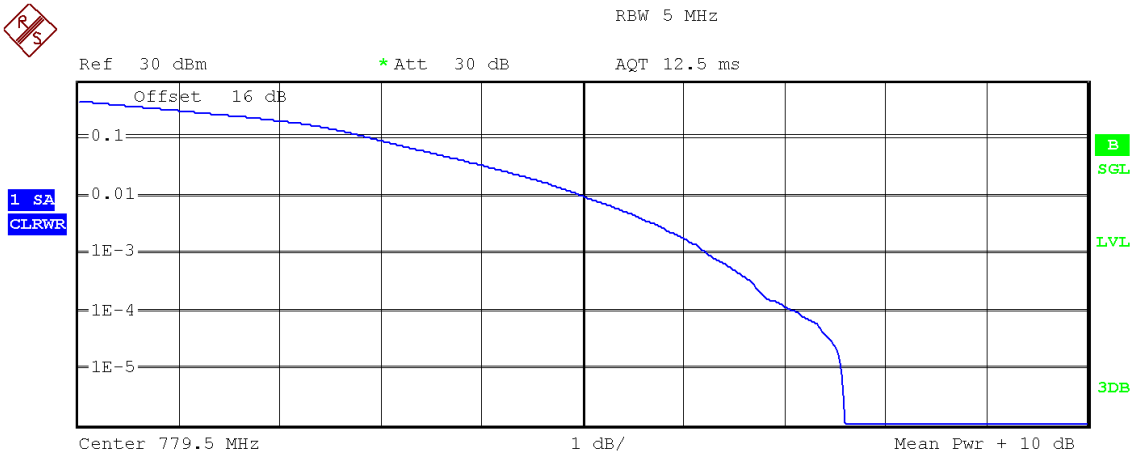
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	21.48 dBm
Peak	28.00 dBm
Crest	6.52 dB
10 %	2.42 dB
1 %	4.46 dB
.1 %	5.54 dB
.01 %	6.20 dB

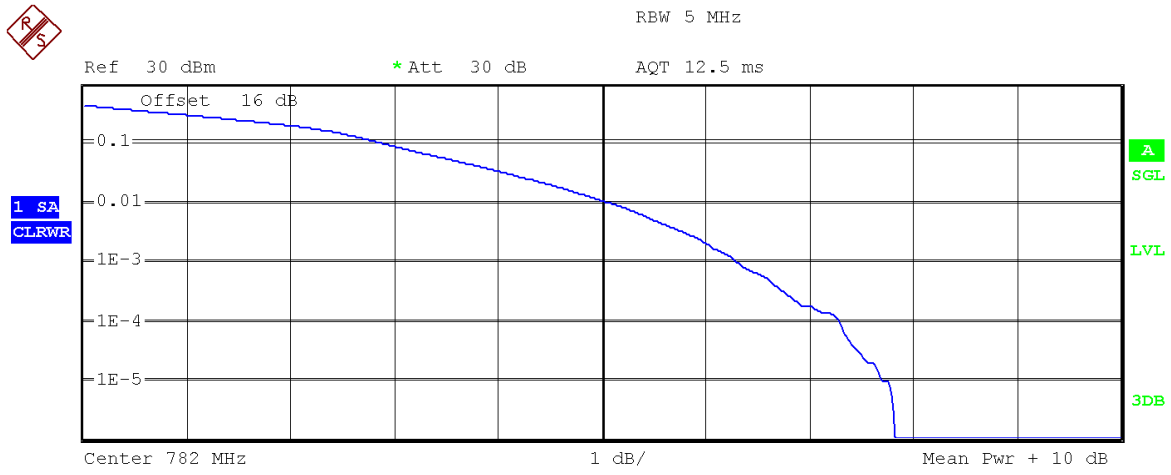
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.54 dBm
Peak	28.14 dBm
Crest	7.60 dB
10 %	2.92 dB
1 %	5.00 dB
.1 %	6.23 dB
.01 %	7.12 dB

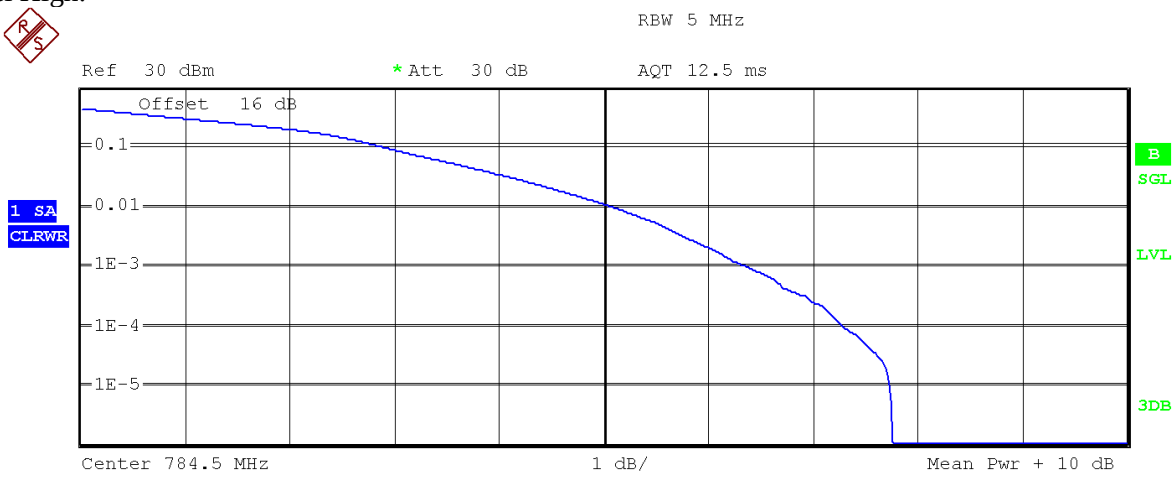
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.66 dBm
Peak	28.49 dBm
Crest	7.83 dB
10 %	2.92 dB
1 %	5.08 dB
.1 %	6.31 dB
.01 %	7.29 dB

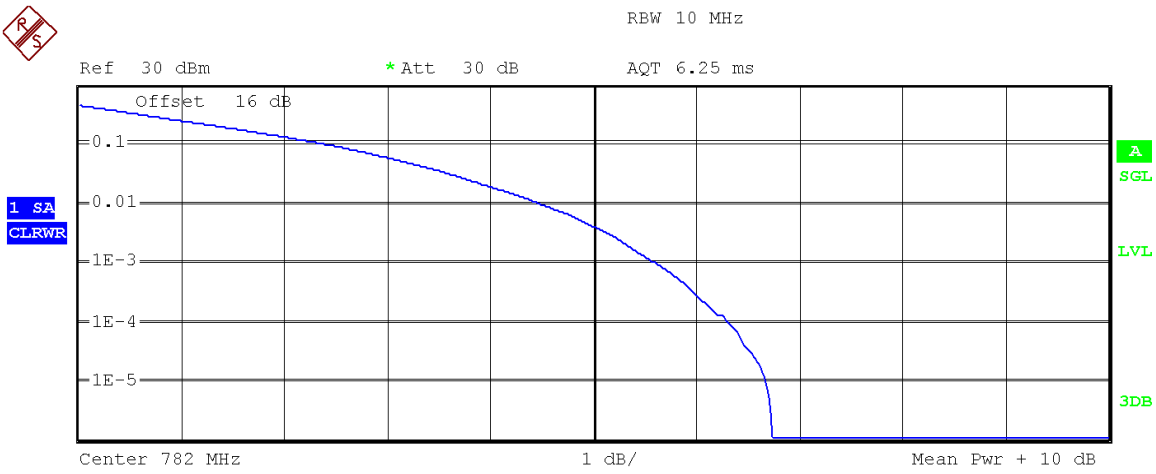
Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.59 dBm
Peak	28.35 dBm
Crest	7.76 dB
10 %	2.90 dB
1 %	5.10 dB
.1 %	6.36 dB
.01 %	7.28 dB

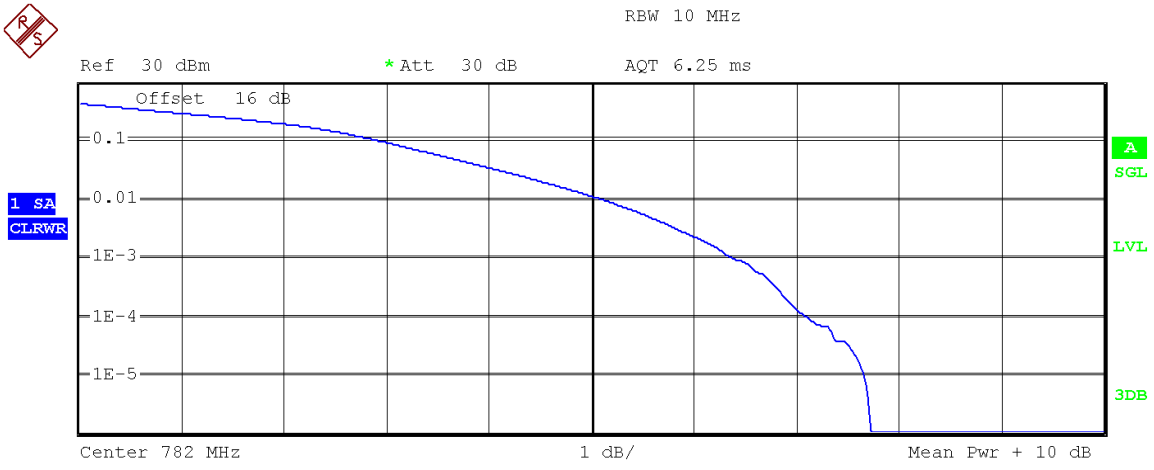
Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.75 dBm
Peak	28.49 dBm
Crest	6.74 dB
10 %	2.42 dB
1 %	4.49 dB
.1 %	5.61 dB
.01 %	6.31 dB

Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.83 dBm
Peak	28.56 dBm
Crest	7.73 dB
10 %	2.95 dB
1 %	5.13 dB
.1 %	6.38 dB
.01 %	7.10 dB

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 1.4 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.24	22.27	22.33
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.38	24.41	24.47
Peak-to-average ratio (PAR) (dB)	5.50	5.32	4.97
Measurement uncertainty (dB)	<±1.11		

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 3 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.19	22.30	22.38
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.33	24.44	24.52
Peak-to-average ratio (PAR) (dB)	5.93	5.75	5.54
Measurement uncertainty (dB)	<±1.11		

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 5 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.26	22.20	22.37
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.40	24.34	24.51
Peak-to-average ratio (PAR) (dB)	5.80	5.66	5.30
Measurement uncertainty (dB)	±1.11		

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 10 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.37	22.40	22.57
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.51	24.54	24.71
Peak-to-average ratio (PAR) (dB)	5.77	5.75	5.43
Measurement uncertainty (dB)	±1.11		

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 15 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.67	22.66	22.89
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.81	24.80	25.03
Peak-to-average ratio (PAR) (dB)	5.59	5.58	5.22
Measurement uncertainty (dB)	±1.11		

LTE QPSK AND 16QAM MODULATION. BAND IV. Bandwidth = 20 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.39	22.30	22.55
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.53	24.44	24.69
Peak-to-average ratio (PAR) (dB)	5.71	5.67	5.51
Measurement uncertainty (dB)	<±1.11		

LTE QPSK AND 16QAM MODULATION. BAND XIII. Bandwidth = 5 MHz

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.14	2.14	2.14
Measured maximum average power (dBm) at antenna port	22.32	22.26	22.30
Maximum effective isotropic radiated average power E.I.R.P. (dBm)	24.46	24.40	24.44
Maximum effective radiated average power E.R.P. (dBm)	22.31	22.25	22.29
Peak-to-average ratio (PAR) (dB)	6.23	6.31	6.36
Measurement uncertainty (dB)	<±1.11		

LTE QPSK AND 16QAM MODULATION. BAND XIII. Bandwidth = 10 MHz

Channel	Middle
Maximum declared antenna gain (dBi)	2.14
Measured maximum average power (dBm) at antenna port	22.16
Maximum effective isotropic radiated average power E.I.R.P. (dBm)	24.30
Maximum effective radiated average power E.R.P. (dBm)	22.15
Peak-to-average ratio (PAR) (dB)	6.38
Measurement uncertainty (dB)	<±1.11

Verdict: PASS

Modulation Characteristics

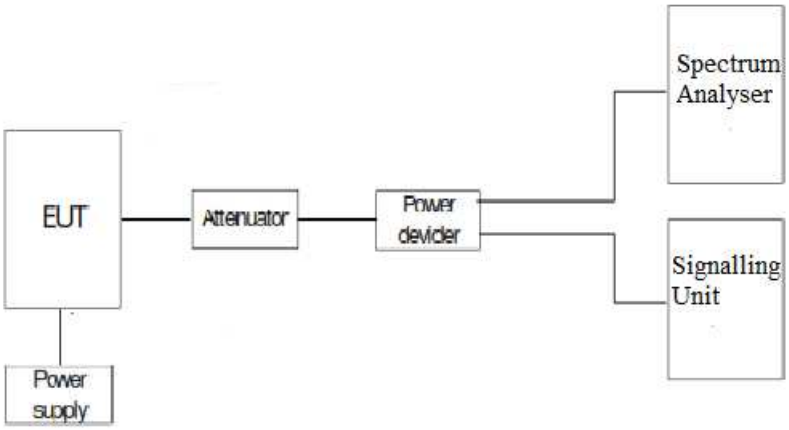
SPECIFICATION

FCC §2.1047.
RSS-139. Clause 6.2. RSS-130. Clause 4.1. The devices shall employ digital modulation techniques.

METHOD

For LTE the EUT operates with QPSK and 16QAM modulation modes in which the information is digitised and coded into a bit stream. The RF transmission is multiplexed using *Orthogonal Frequency Division Multiplexing (OFDM)* using different possible arrangement of subcarriers (Resource Blocks RB).

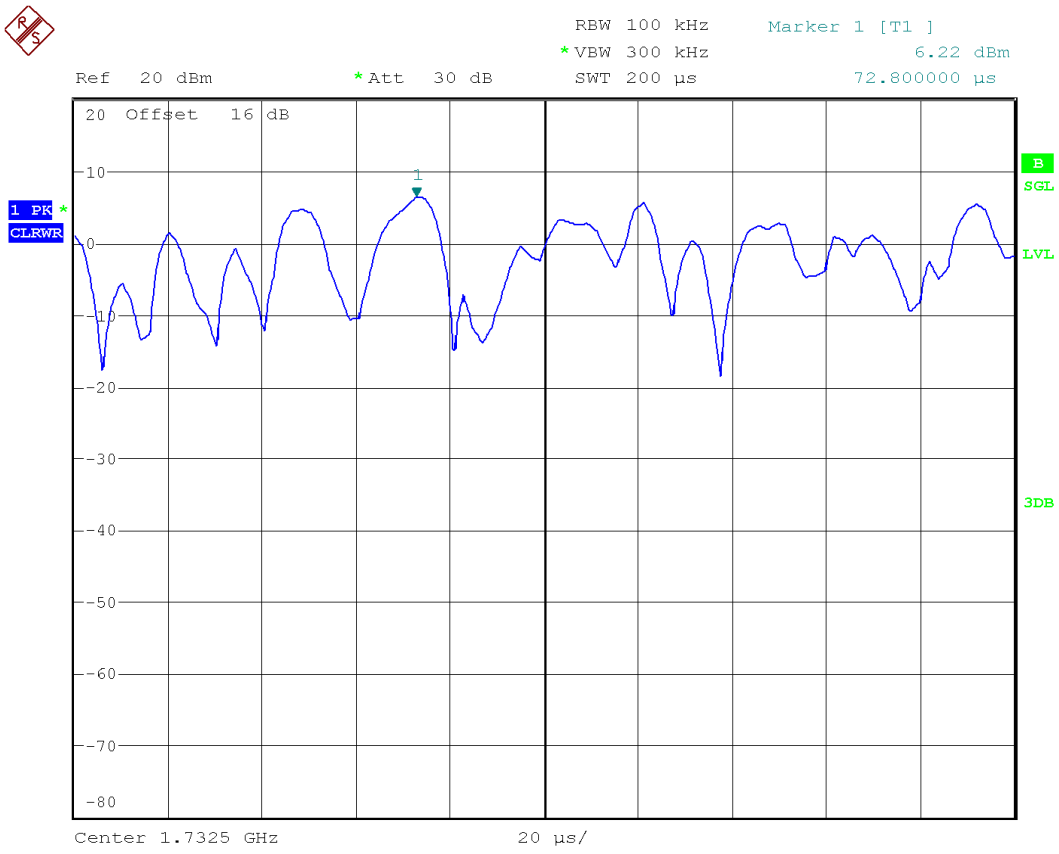
TEST SETUP



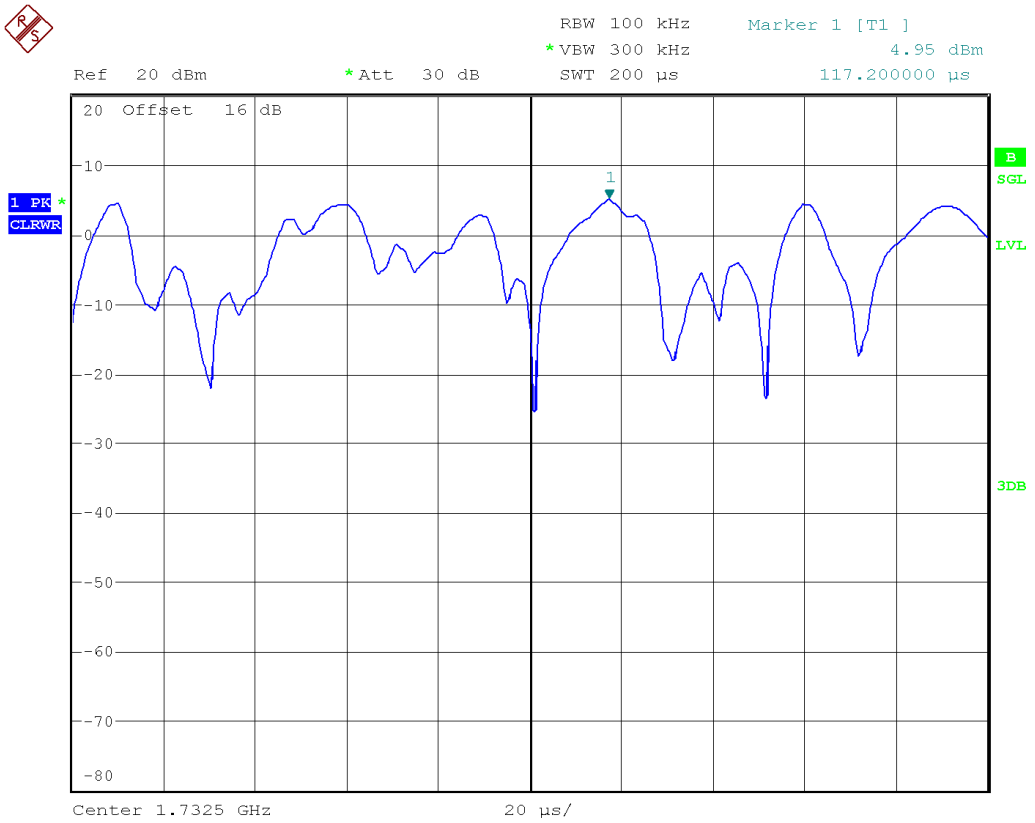
RESULTS

The following plots show the modulation schemes in the EUT.

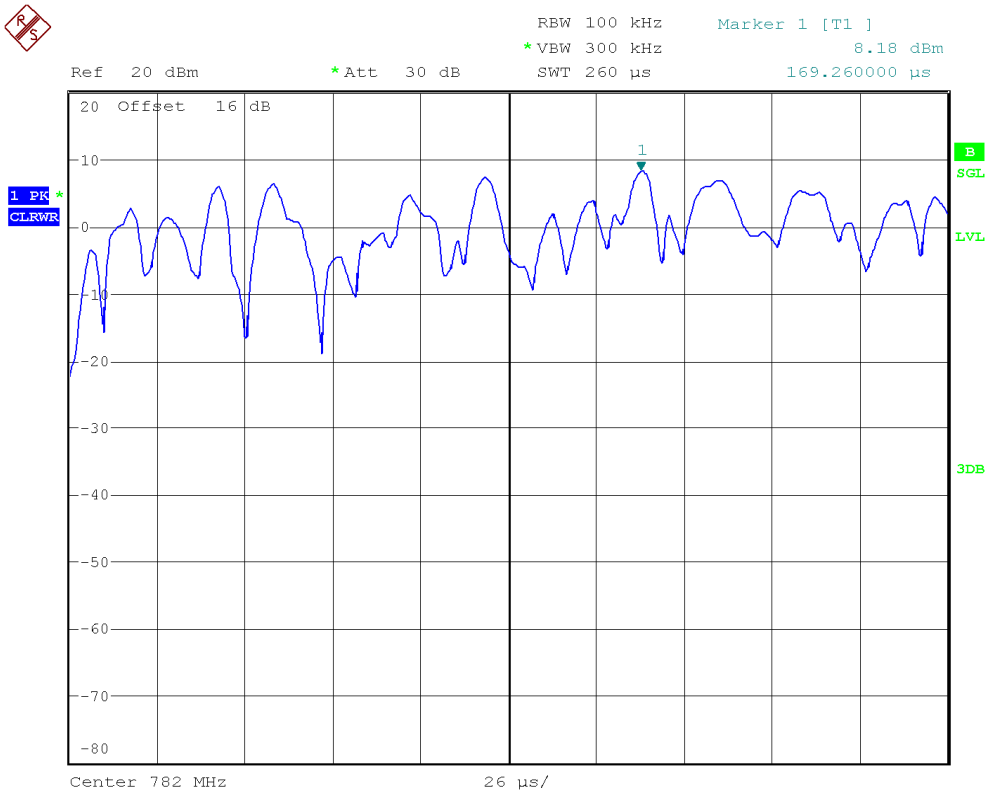
LTE MODULATION. QPSK. Band IV



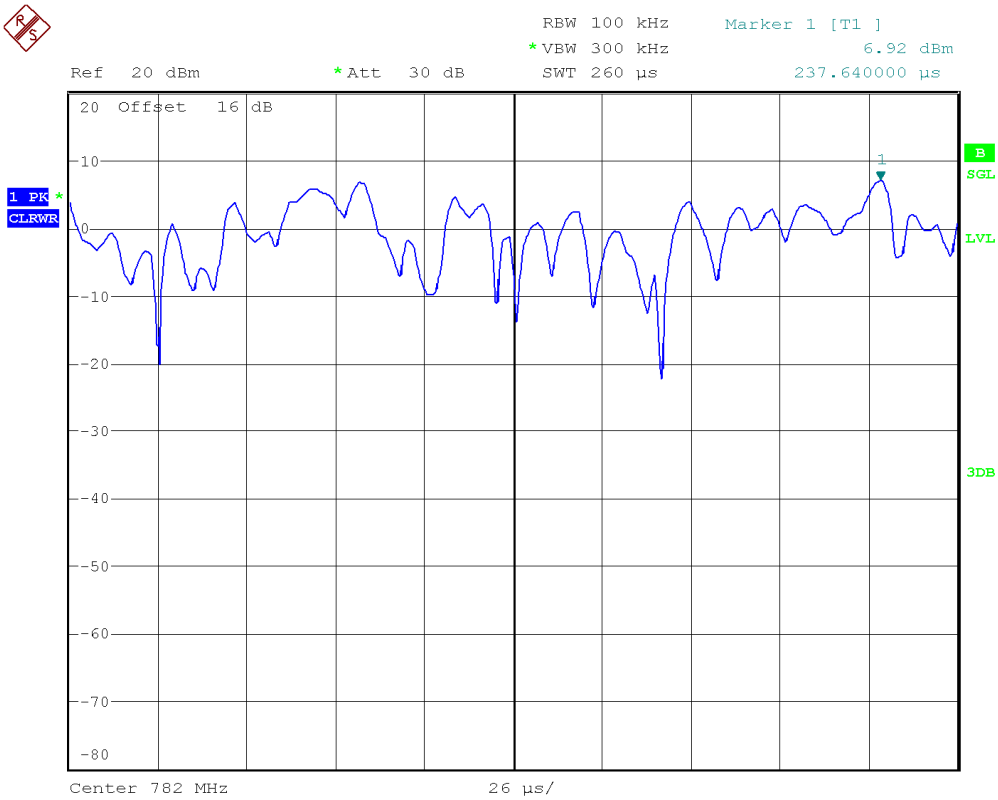
LTE MODULATION. 16QAM. Band IV



LTE MODULATION. QPSK. Band XIII



LTE MODULATION. 16QAM. Band XIII



Frequency Stability

SPECIFICATION

FCC §2.1055 and §27.54.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-139 Clause 6.4.

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations

RSS-130. Clause 4.3.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.

The supply voltage was varied between 85% and 115% of nominal voltage.

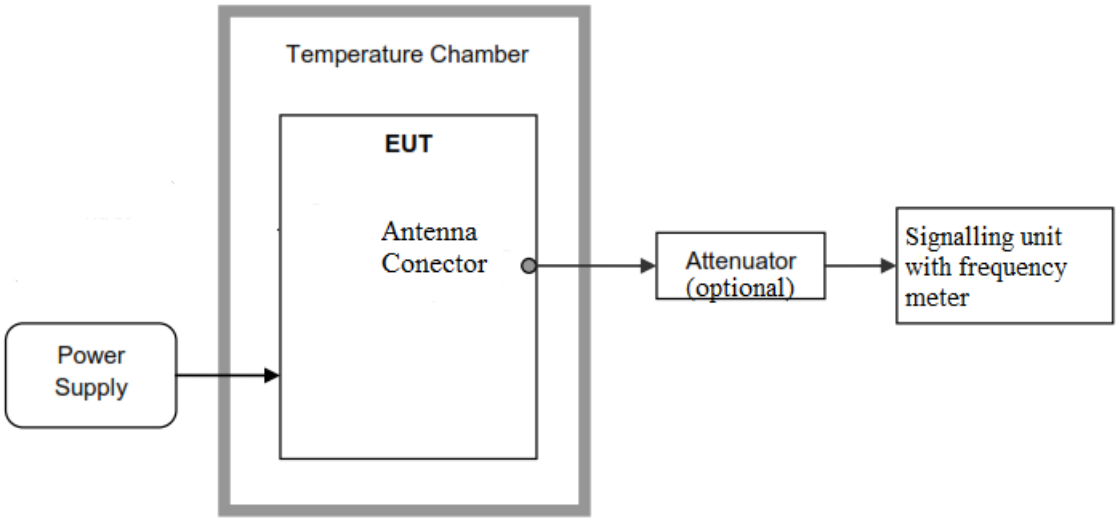
The EUT was set in “call mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.

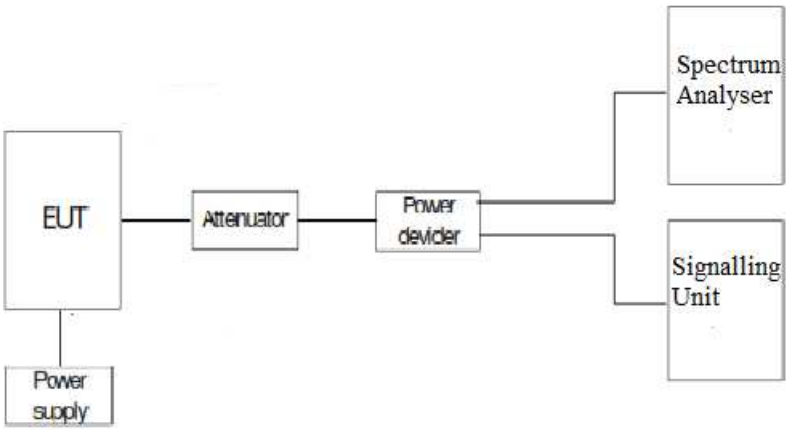
In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as *f*L and *fH* respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of *f*L and *fH* to check that the resulting frequencies remain within the band.
The reference point measurements were made at the RF output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Frequency tolerance.



Reference points *f*L and *fH*.



RESULTS

Frequency stability over temperature variations.
LTE QPSK MODULATION. BW = 1.4 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	5.56	0.003209235	0.000000320924
+40	-14.98	-0.008646465	-0.000000864646
+30	-14.13	-0.008155844	-0.000000815584
+20	-13.99	-0.008075036	-0.000000807504
+10	-11.74	-0.006776335	-0.000000677633
0	13.03	0.007520924	0.000000752092
-10	-10.59	-0.006112554	-0.000000611255
-20	-11.39	-0.006574315	-0.000000657431
-30	-13.89	-0.008017316	-0.000000801732

LTE QPSK MODULATION. BW = 3 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-8.10	-0.004675325	-0.000000467532
+40	-14.53	-0.008386724	-0.000000838672
+30	-12.02	-0.006937951	-0.000000693795
+20	-11.97	-0.006909091	-0.000000690909
+10	-10.49	-0.006054834	-0.000000605483
0	-12.33	-0.007116883	-0.000000711688
-10	-14.12	-0.008150072	-0.000000815007
-20	-15.15	-0.008744589	-0.000000874459
-30	-18.18	-0.010493506	-0.000001049351

LTE QPSK MODULATION. BW = 5 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-9.80	-0.005656566	-0.000000565657
+40	-13.53	-0.007809524	-0.000000780952
+30	-13.83	-0.007982684	-0.000000798268
+20	-11.67	-0.006735931	-0.000000673593
+10	-13.12	-0.007572872	-0.000000757287
0	-12.70	-0.007330447	-0.000000733045
-10	-13.90	-0.008023088	-0.000000802309
-20	-10.60	-0.006118326	-0.000000611833
-30	-13.69	-0.007901876	-0.000000790188

LTE QPSK MODULATION. BW = 10 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-10.41	-0.006008658	-0.000000600866
+40	-13.99	-0.008075036	-0.000000807504
+30	-15.16	-0.008750361	-0.000000875036
+20	-11.17	-0.006447330	-0.000000644733
+10	12.06	0.006961039	0.000000696104
0	-13.48	-0.007780664	-0.000000778066
-10	-12.03	-0.006943723	-0.000000694372
-20	-14.35	-0.008282828	-0.000000828283
-30	-12.82	-0.007399711	-0.000000739971

LTE QPSK MODULATION. BW = 15 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-12.50	-0.007215007	-0.000000721501
+40	10.73	0.006193362	0.000000619336
+30	-10.67	-0.00615873	-0.000000615873
+20	-16.09	-0.009287157	-0.000000928716
+10	10.53	0.006077922	0.000000607792
0	-12.97	-0.007486291	-0.000000748629
-10	9.18	0.005298701	0.000000529870
-20	-10.56	-0.006095238	-0.000000609524
-30	-13.00	-0.007503608	-0.000000750361

LTE QPSK MODULATION. BW = 20 MHz. (Band IV)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-13.63	-0.007867244	-0.000000786724
+40	-11.93	-0.006886003	-0.000000688600
+30	-13.05	-0.007532468	-0.000000753247
+20	-11.59	-0.006689755	-0.000000668975
+10	-12.96	-0.007480519	-0.000000748052
0	-13.70	-0.007907648	-0.000000790765
-10	-14.95	-0.008629149	-0.000000862915
-20	-12.83	-0.007405483	-0.000000740548
-30	-11.36	-0.006556999	-0.000000655700

LTE QPSK MODULATION. BW = 5 MHz. (Band XIII)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	6.65	0.008503836	0.000000850384
+40	9.40	0.012020460	0.000001202046
+30	6.78	0.008670077	0.000000867008
+20	-7.28	-0.009309463	-0.000000930946
+10	6.59	0.008427110	0.000000842711
0	7.72	0.009872123	0.000000987212
-10	6.35	0.008120205	0.000000812020
-20	7.11	0.009092072	0.000000909207
-30	8.18	0.010460358	0.000001046036

LTE QPSK MODULATION. BW = 10 MHz. (Band XIII)

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-7.22	-0.009232737	-0.000000923274
+40	7.65	0.009782609	0.000000978261
+30	7.98	0.010204604	0.000001020460
+20	7.08	0.009053708	0.000000905371
+10	6.67	0.008529412	0.000000852941
0	5.91	0.007557545	0.000000755754
-10	-7.04	-0.009002558	-0.000000900256
-20	-4.94	-0.006317136	-0.000000631714
-30	7.10	0.009079284	0.000000907928

Frequency stability over voltage variations.

LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	5.12	0.002955267	0.000000295527
Vmin	3.23	-1.49	-0.000860029	-0.000000086003

LTE QPSK MODULATION. BW = 3 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	5.44	0.003139971	0.000000313997
Vmin	3.23	-11.43	-0.006597403	-0.000000659740

LTE QPSK MODULATION. BW = 5 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	-5.82	-0.003359307	-0.000000335931
Vmin	3.23	-3.19	-0.001841270	-0.000000184127

LTE QPSK MODULATION. BW = 10 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	-1.00	-0.000577201	-0.000000057720
Vmin	3.23	-12.06	-0.006961039	-0.000000696104

LTE QPSK MODULATION. BW = 15 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	1.73	0.000998557	0.000000099856
Vmin	3.23	-8.43	-0.004865801	-0.000000486580

LTE QPSK MODULATION. BW = 20 MHz (Band IV)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	-2.68	-0.001546898	-0.000000154690
Vmin	3.23	-9.86	-0.005691198	-0.000000569120

LTE QPSK MODULATION. BW = 5 MHz (Band XIII)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	0.77	0.000984655	0.000000098465
Vmin	3.23	0.29	0.000370844	0.000000037084

LTE QPSK MODULATION. BW = 10 MHz (Band XIII)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	-0.34	-0.000434783	-0.000000043478
Vmin	3.23	-2.55	-0.003260870	-0.000000326087

Reference points established at the applicable unwanted emissions limit (worst case):

	LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)	LTE QPSK MODULATION. BW = 3 MHz (Band IV)	LTE QPSK MODULATION. BW = 5 MHz (Band IV)	LTE QPSK MODULATION. BW = 10 MHz (Band IV)	LTE QPSK MODULATION. BW = 15 MHz (Band IV)	LTE QPSK MODULATION. BW = 20 MHz (Band IV)
*f*L (MHz)	1710.0547	1710.0199	1710.0043	1710.0587	1710.0608	1710.3233
fH (MHz)	1754.9558	1754.9920	1754.9864	1754.9579	1754.9362	1754.7158

	LTE QPSK MODULATION. BW = 5 MHz (Band XIII)	LTE QPSK MODULATION. BW = 10 MHz (Band XIII)
*f*L (MHz)	777.0467	777.2333
fH (MHz)	786.9514	786.7470

Reference points *f*L and *fH* with the worst-case frequency offsets added or subtracted:

	LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)	LTE QPSK MODULATION. BW = 3 MHz (Band IV)	LTE QPSK MODULATION. BW = 5 MHz (Band IV)	LTE QPSK MODULATION. BW = 10 MHz (Band IV)	LTE QPSK MODULATION. BW = 15 MHz (Band IV)	LTE QPSK MODULATION. BW = 20 MHz (Band IV)
*f*L (MHz)	1710.05468	1710.01988	1710.00429	1710.05868	1710.06078	1710.32329
fH (MHz)	1754.95581	1754.99201	1754.98641	1754.95791	1754.93621	1754.71581

	LTE QPSK MODULATION. BW = 5 MHz (Band XIII)	LTE QPSK MODULATION. BW = 10 MHz (Band XIII)
*f*L (MHz)	777.04669	777.23330
fH (MHz)	786.95141	786.74701

The reference frequency points stay within the authorized blocks.

Verdict: PASS

Occupied Bandwidth

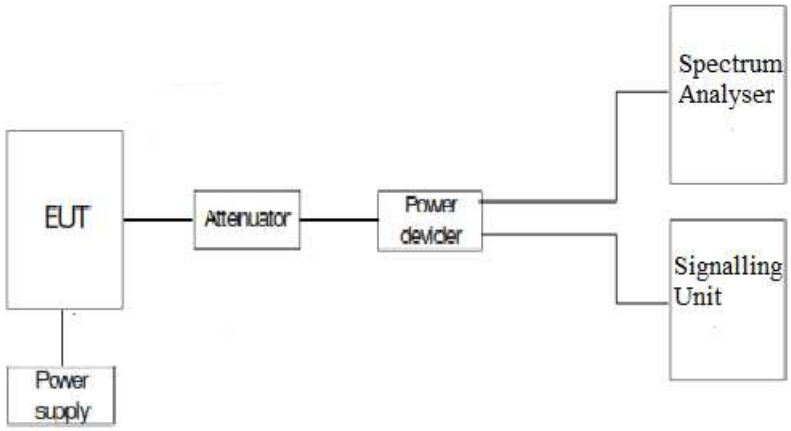
SPECIFICATION

§2.1049

METHOD

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyser.

TEST SETUP



RESULTS

LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	1.1045	1.1127	1.1028
-26 dBc bandwidth (MHz)	1.369	1.364	1.408
Measurement uncertainty (kHz)	<±4.67		

LTE 16QAM MODULATION. BW = 1.4 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	1.1076	1.1024	1.1071
-26 dBc bandwidth (MHz)	1.357	1.351	1.362
Measurement uncertainty (kHz)	<±4.67		

LTE QPSK MODULATION. BW = 3 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	2.7617	2.7605	2.7526
-26 dBc bandwidth (MHz)	3.135	3.150	3.194
Measurement uncertainty (kHz)	<±10.00		

LTE 16QAM MODULATION. BW = 3 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	2.7819	2.7663	2.7555
-26 dBc bandwidth (MHz)	3.137	3.188	3.165
Measurement uncertainty (kHz)	<±10.00		

LTE QPSK MODULATION. BW = 5 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.5189	4.5193	4.5134
-26 dBc bandwidth (MHz)	5.143	5.123	5.169
Measurement uncertainty (kHz)	<±16.67		

LTE 16QAM MODULATION. BW = 5 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.5253	4.5108	4.5227
-26 dBc bandwidth (MHz)	5.133	5.097	5.095
Measurement uncertainty (kHz)	<±16.67		

LTE QPSK MODULATION. BW = 10 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	9.0585	9.1017	9.1011
-26 dBc bandwidth (MHz)	10.615	10.686	10.606
Measurement uncertainty (kHz)	<±33.33		

LTE 16QAM MODULATION. BW = 10 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	9.0585	9.1017	9.1011
-26 dBc bandwidth (MHz)	10.615	10.686	10.606
Measurement uncertainty (kHz)	<±33.33		

LTE QPSK MODULATION. BW = 15 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	13.4575	13.5338	13.4785
-26 dBc bandwidth (MHz)	15.886	16.067	16.033
Measurement uncertainty (kHz)	<±50.00		

LTE 16QAM MODULATION. BW = 15 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	13.5070	13.5508	13.5387
-26 dBc bandwidth (MHz)	15.857	15.772	15.889
Measurement uncertainty (kHz)	<±50.00		

LTE QPSK MODULATION. BW = 20 MHz (Band IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	17.8664	17.9697	17.9244
-26 dBc bandwidth (MHz)	19.934	20.542	20.164
Measurement uncertainty (kHz)	<±66.67		

LTE 16QAM MODULATION. BW = 20 MHz (IV)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	17.9082	17.9462	17.9655
-26 dBc bandwidth (MHz)	20.206	20.338	20.272
Measurement uncertainty (kHz)	<±66.67		

LTE QPSK MODULATION. BW = 5 MHz (Band XIII)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.5098	4.5303	4.5087
-26 dBc bandwidth (MHz)	5.103	5.118	5.056
Measurement uncertainty (kHz)	<±16.67		

LTE 16QAM MODULATION. BW = 5 MHz (Band XIII)

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.5122	4.5046	4.5388
-26 dBc bandwidth (MHz)	5.141	5.056	5.140
Measurement uncertainty (kHz)	<±16.67		

LTE QPSK MODULATION. BW = 10 MHz (Band XIII)

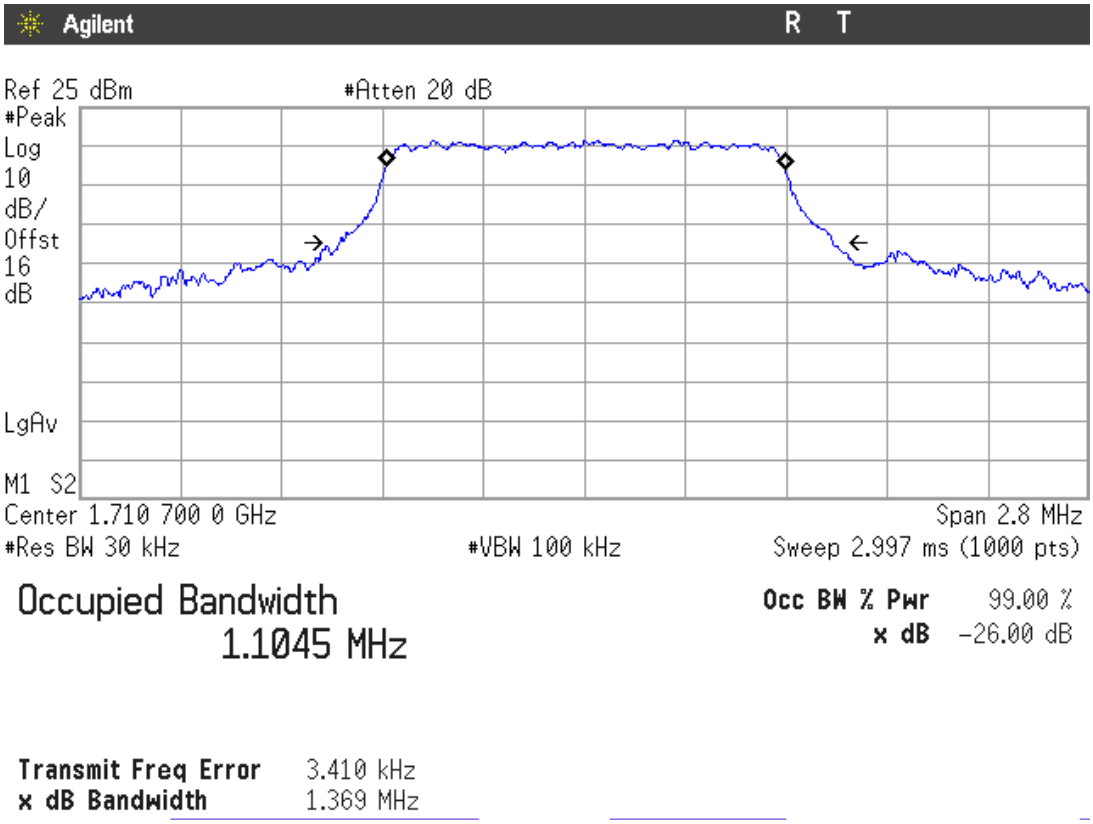
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	N/A	9.0655	N/A
-26 dBc bandwidth (MHz)	N/A	10.484	N/A
Measurement uncertainty (kHz)	<±33.33		

LTE 16QAM MODULATION. BW = 10 MHz (Band XIII)

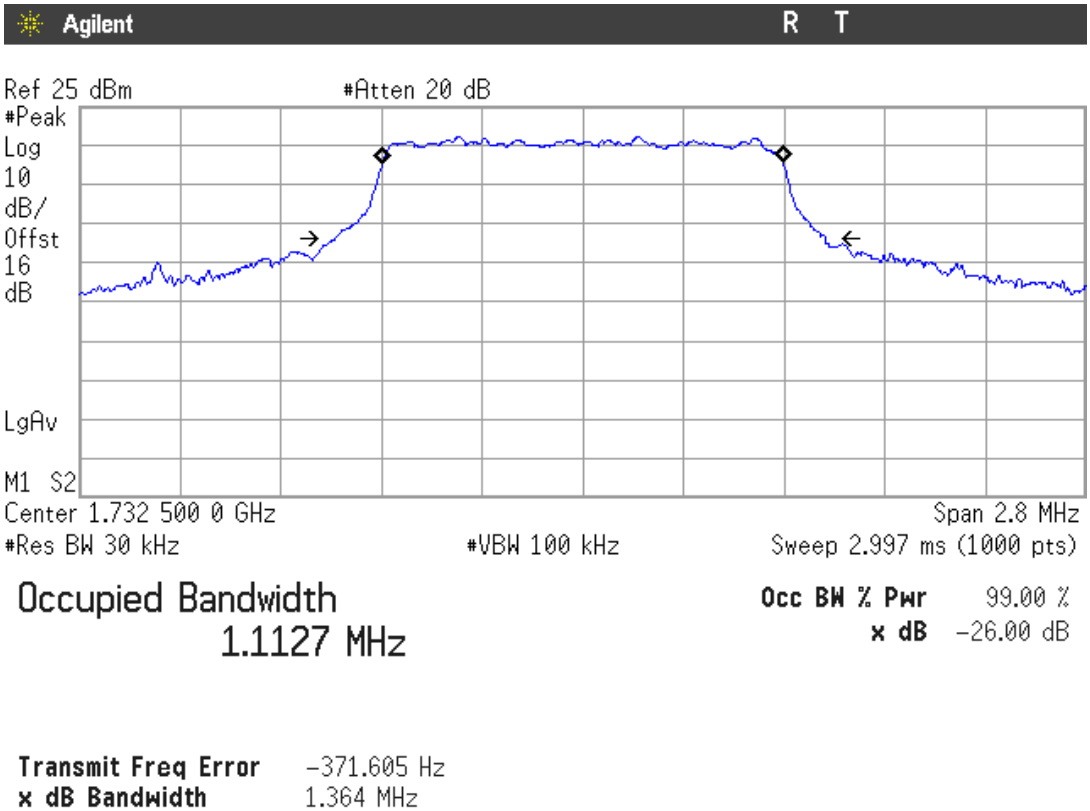
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	N/A	9.0650	N/A
-26 dBc bandwidth (MHz)	N/A	10.550	N/A
Measurement uncertainty (kHz)	<±33.33		

LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

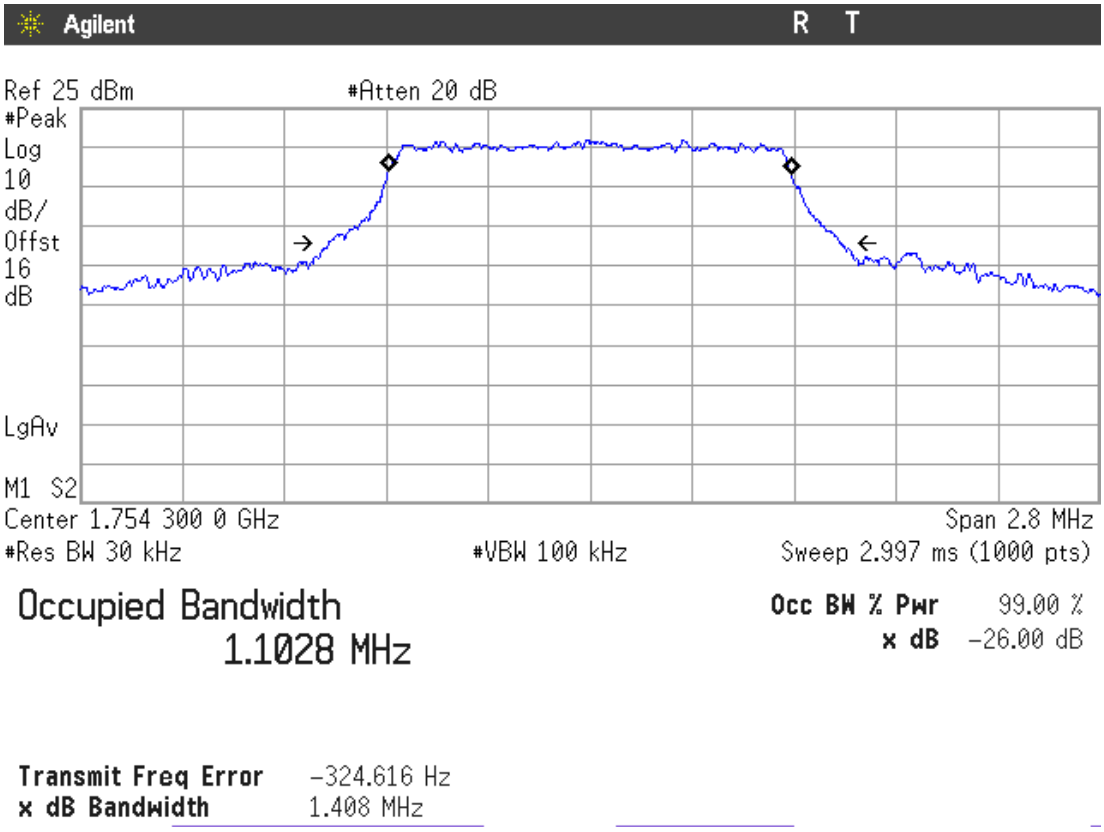
Lowest Channel



Middle Channel

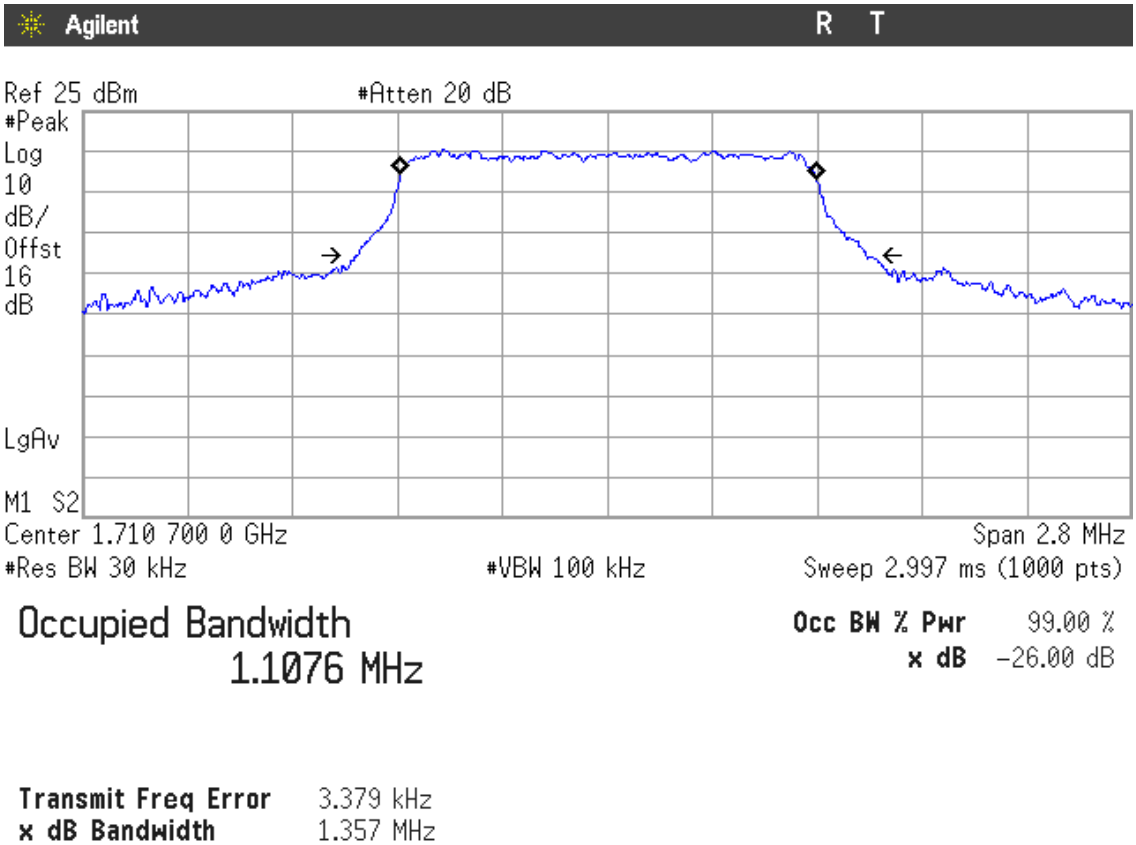


Highest Channel

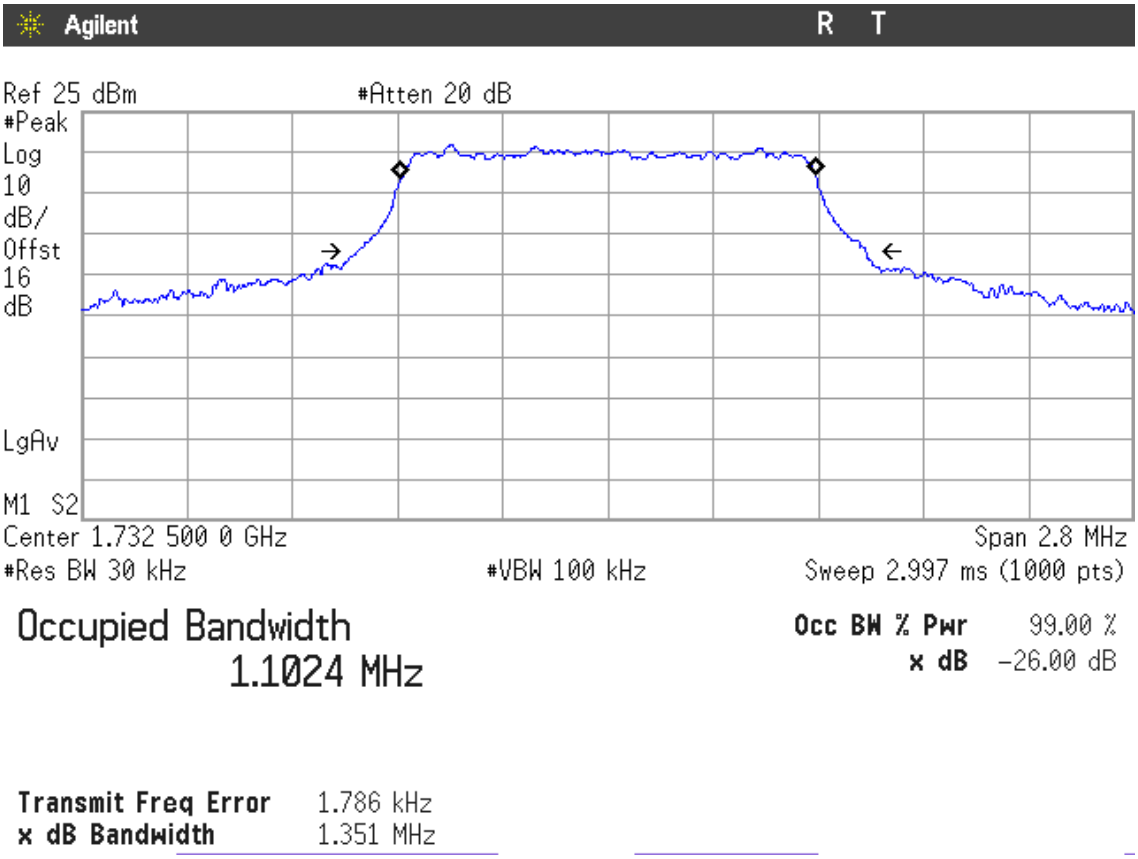


LTE 16QAM MODULATION. BW = 1.4 MHz (Band IV)

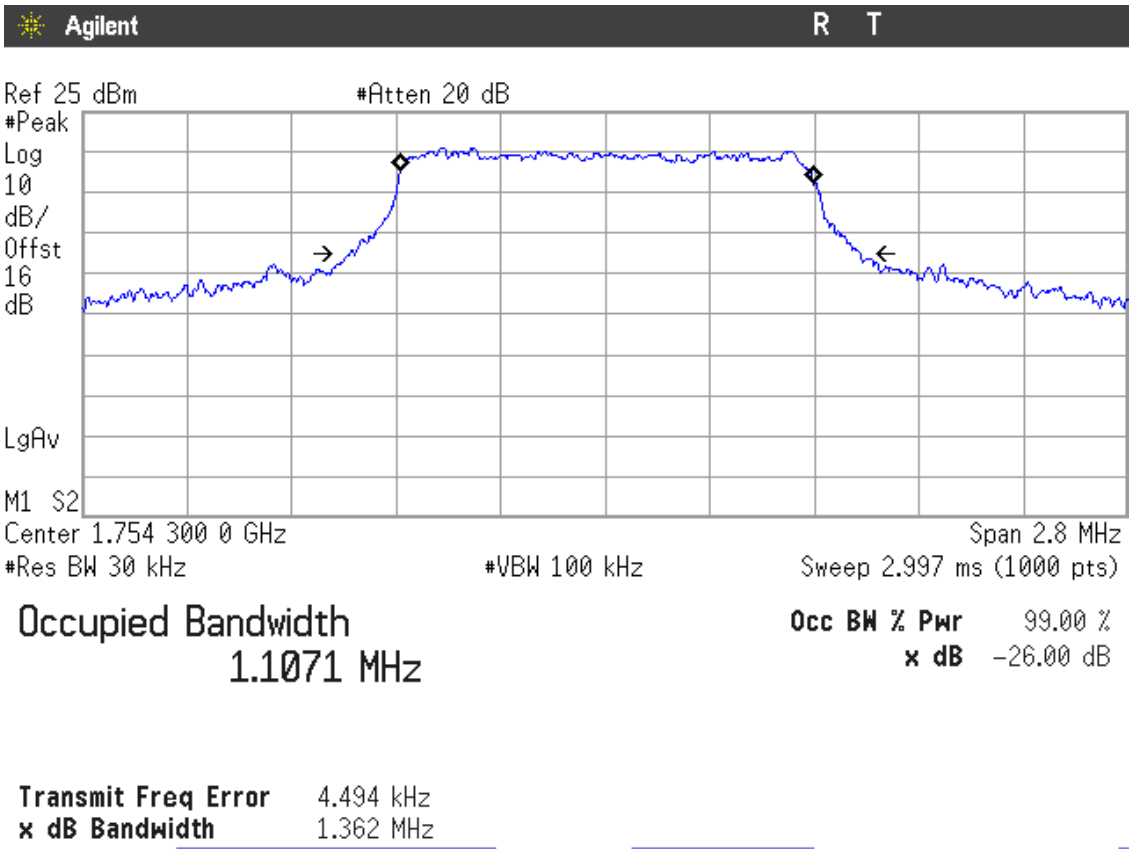
Lowest Channel



Middle Channel

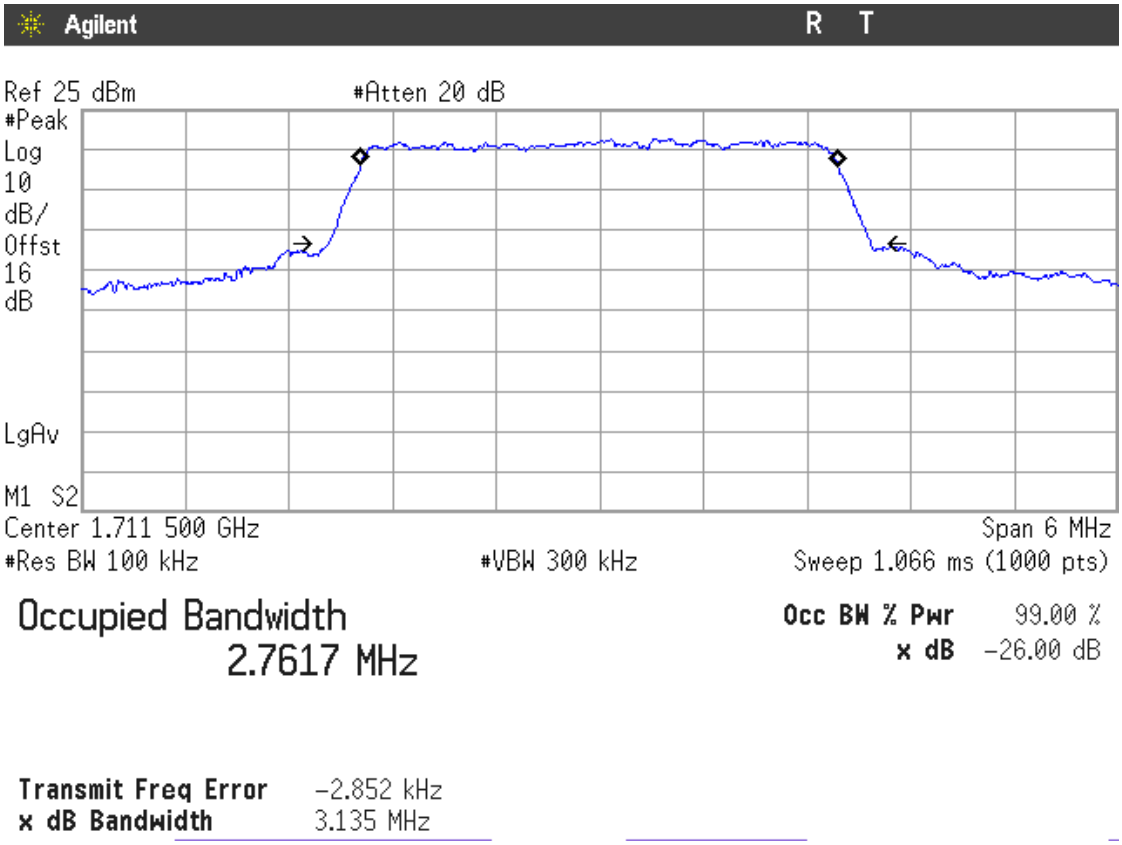


Highest Channel

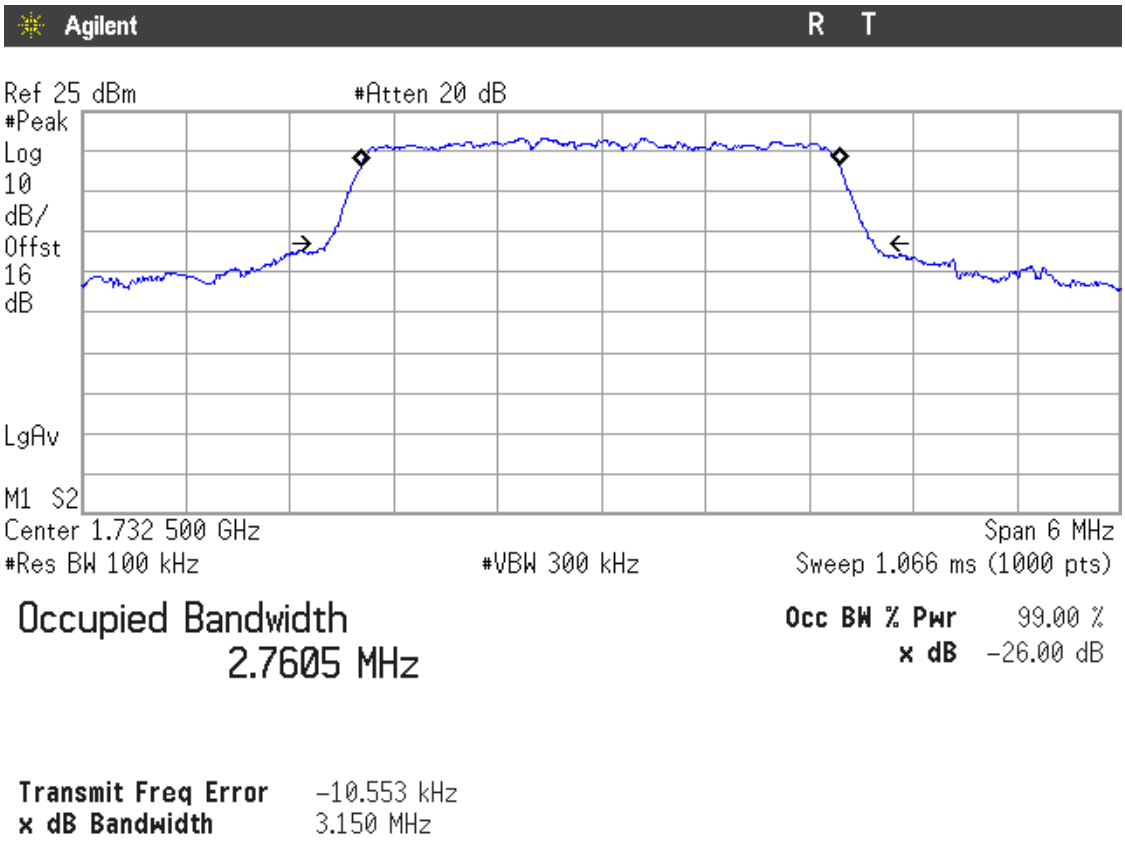


LTE QPSK MODULATION. BW = 3 MHz (Band IV)

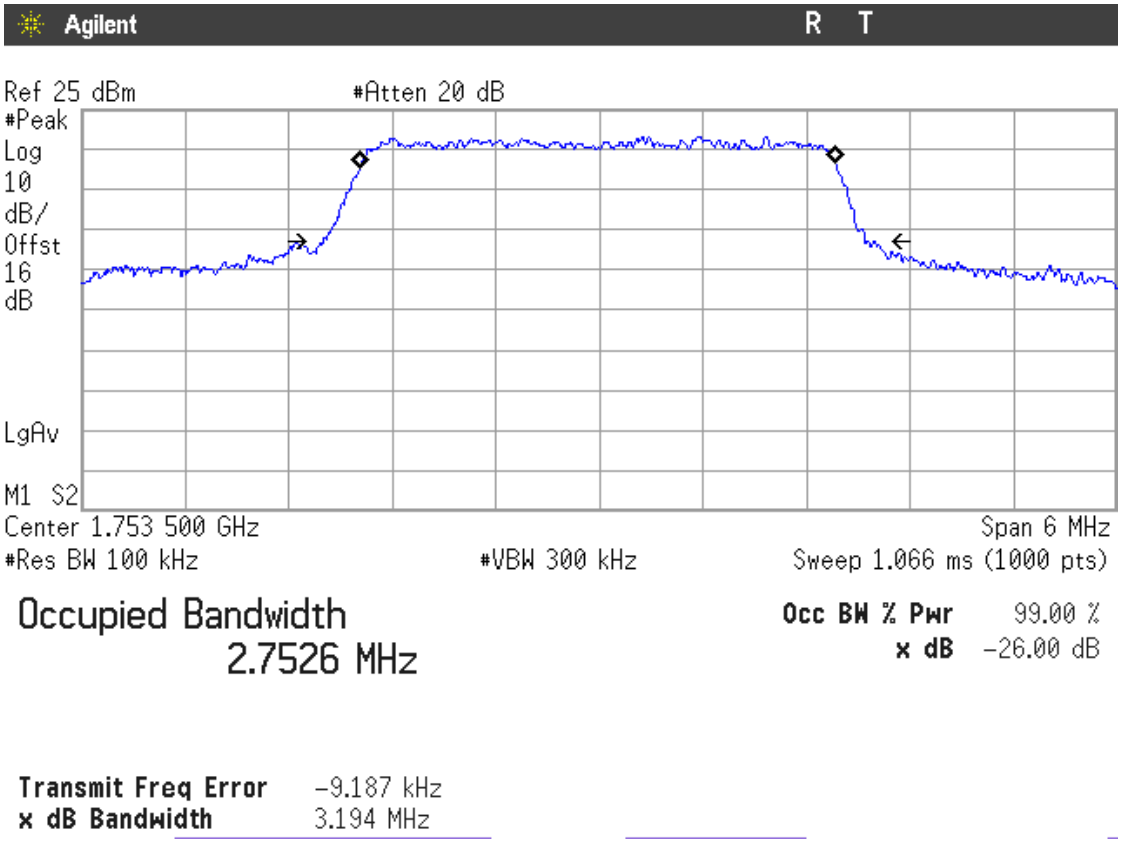
Lowest Channel



Middle Channel

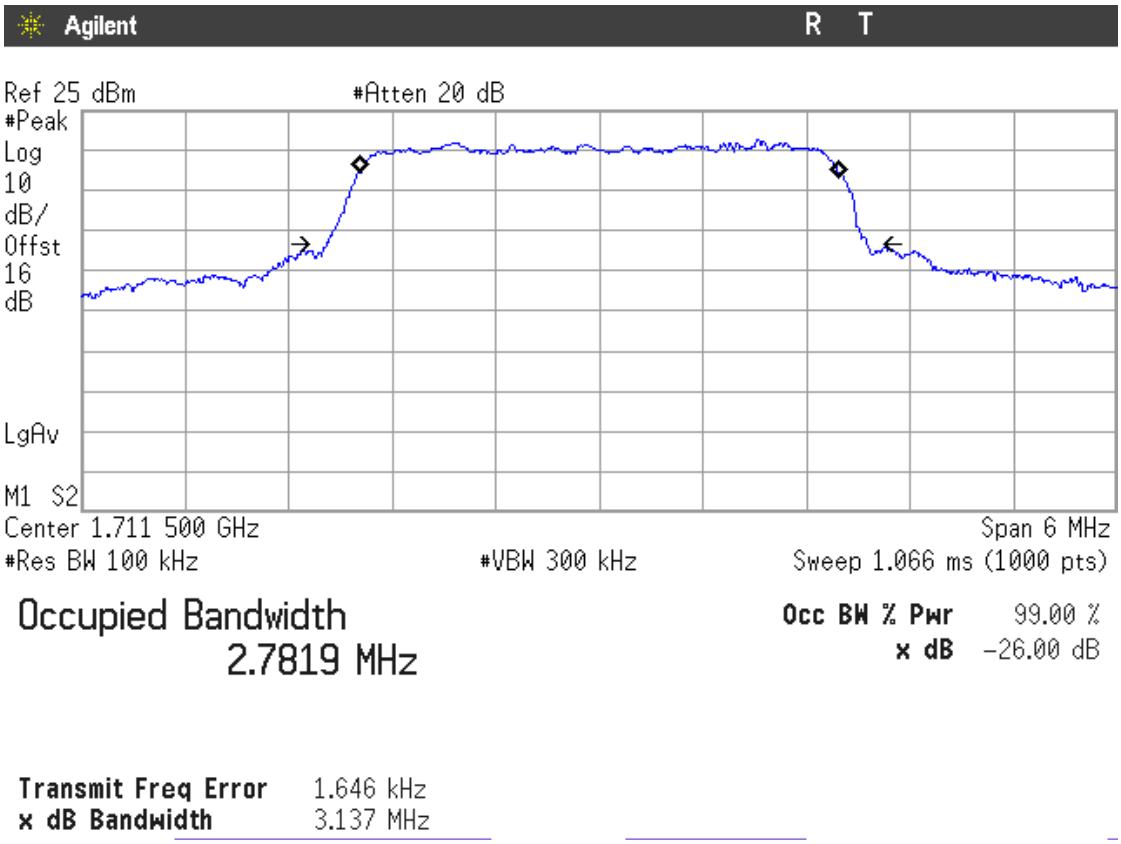


Highest Channel

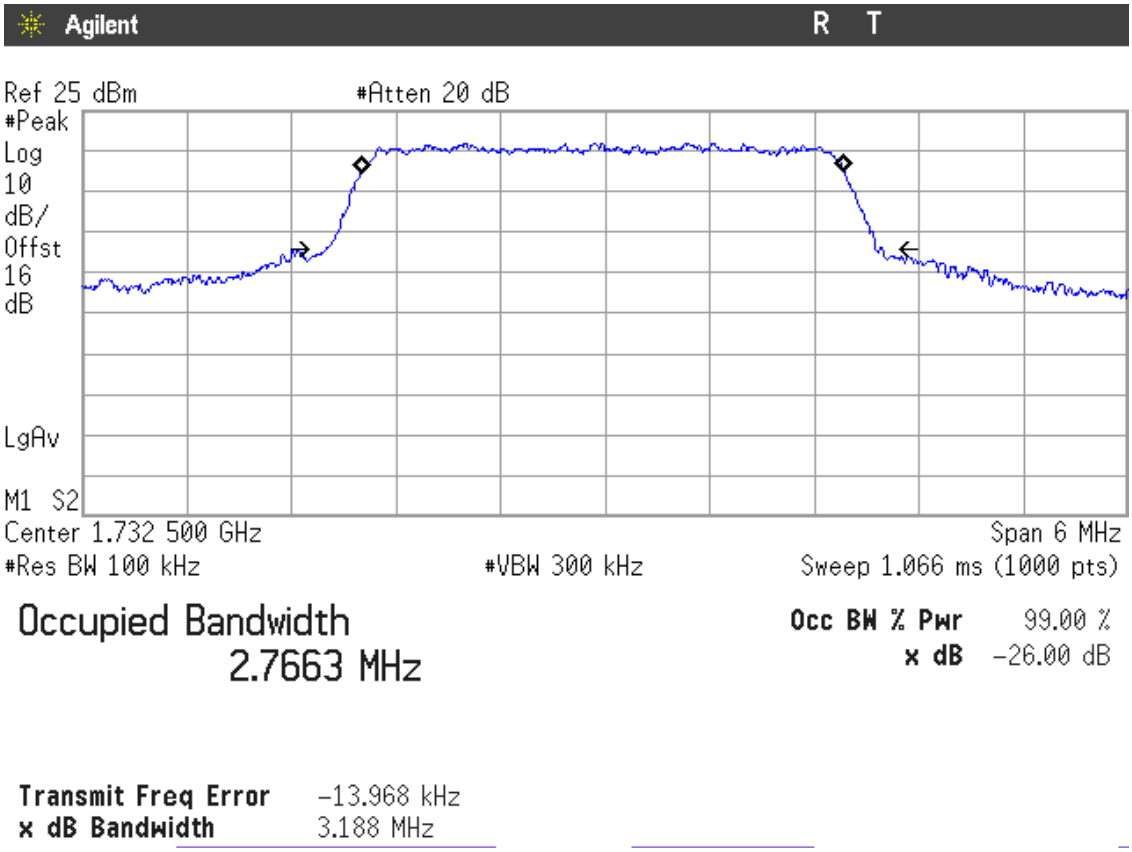


LTE 16QAM MODULATION. BW = 3 MHz (Band IV)

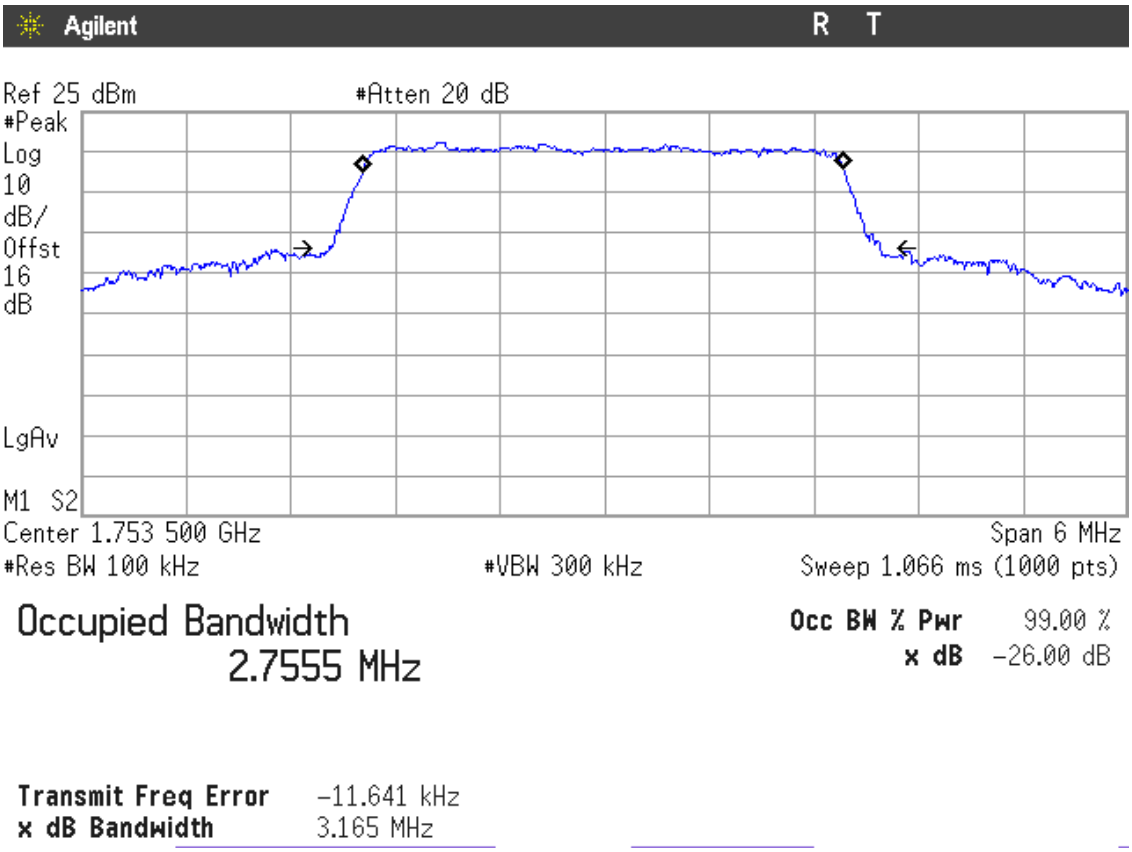
Lowest Channel



Middle Channel

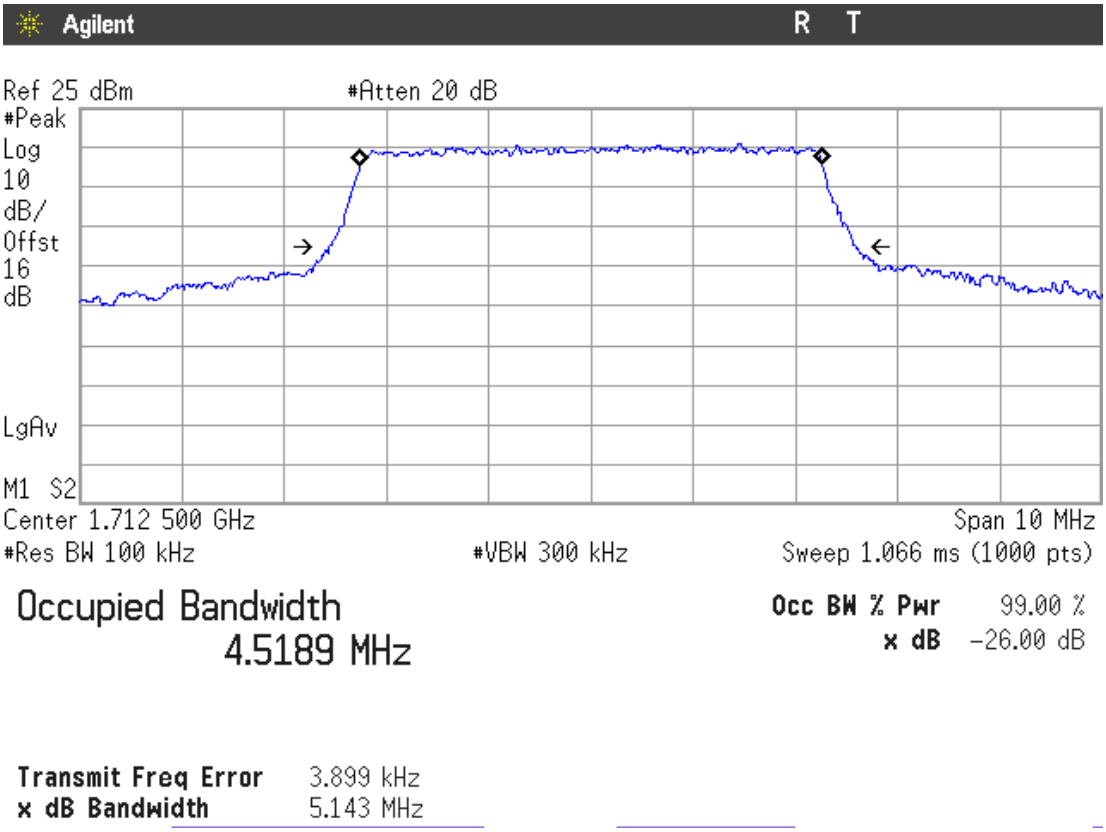


Highest Channel

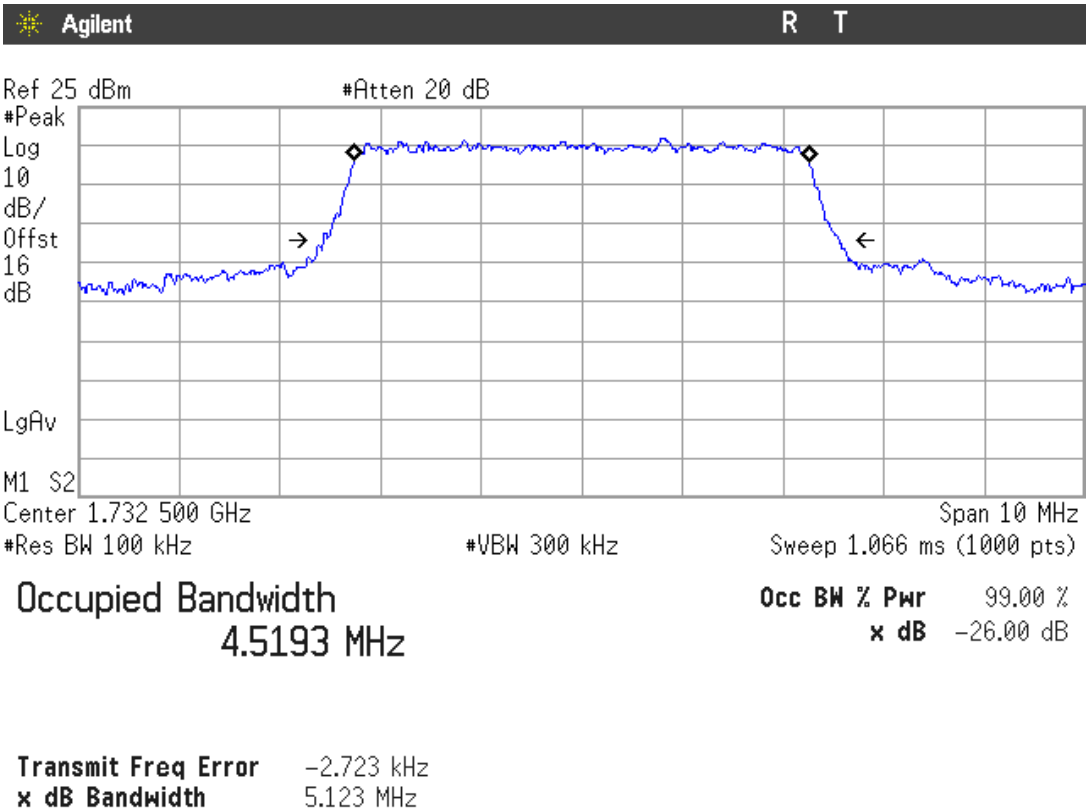


LTE QPSK MODULATION. BW = 5 MHz (Band IV)

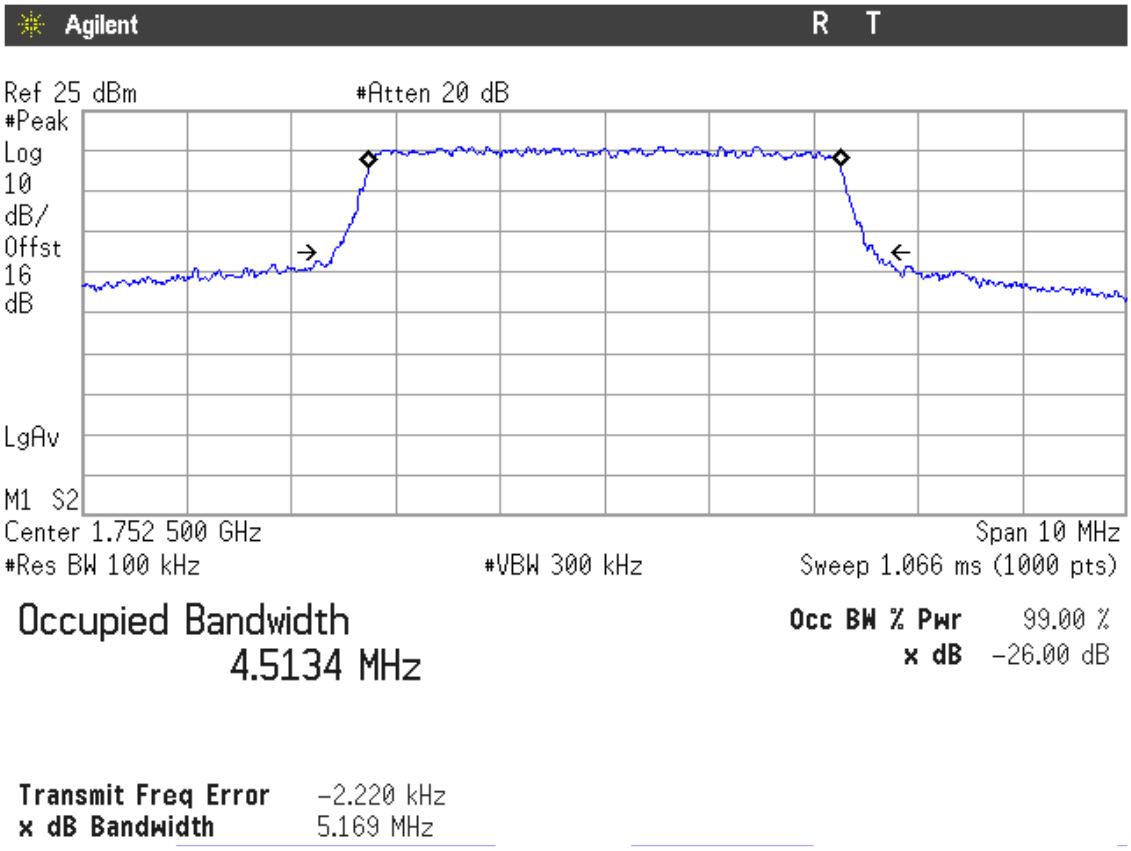
Lowest Channel



Middle Channel

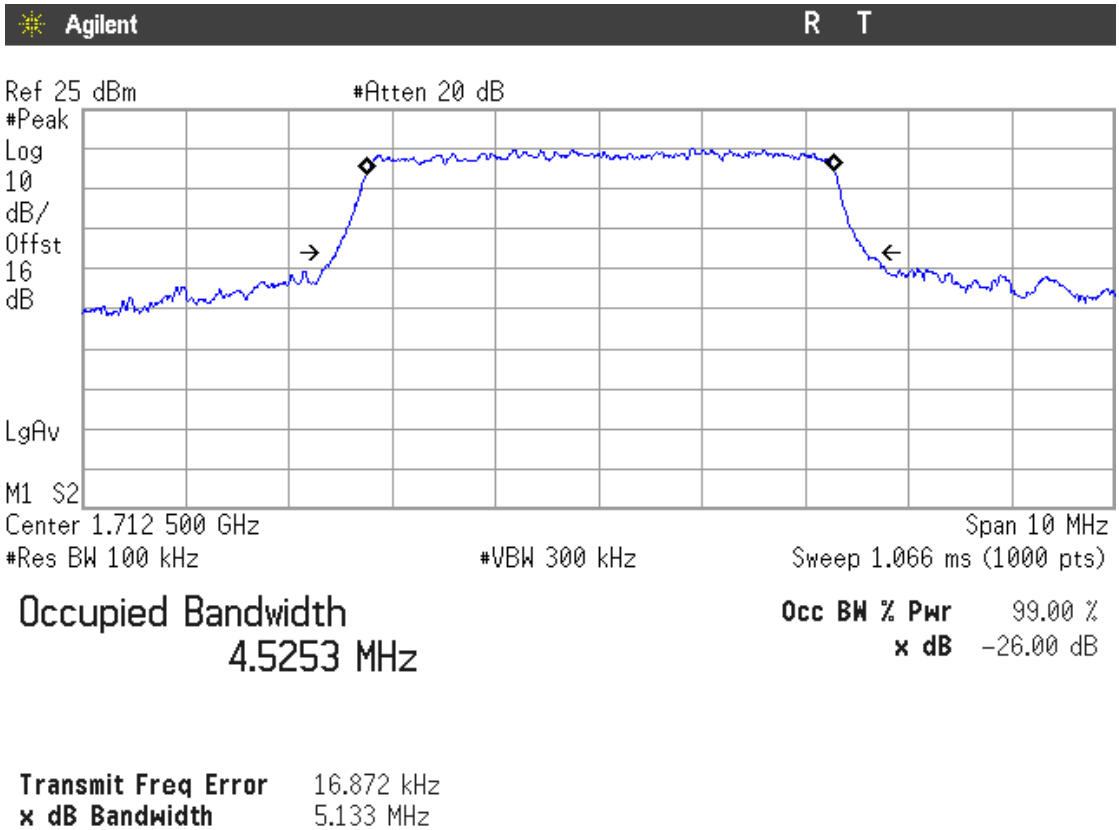


Highest Channel

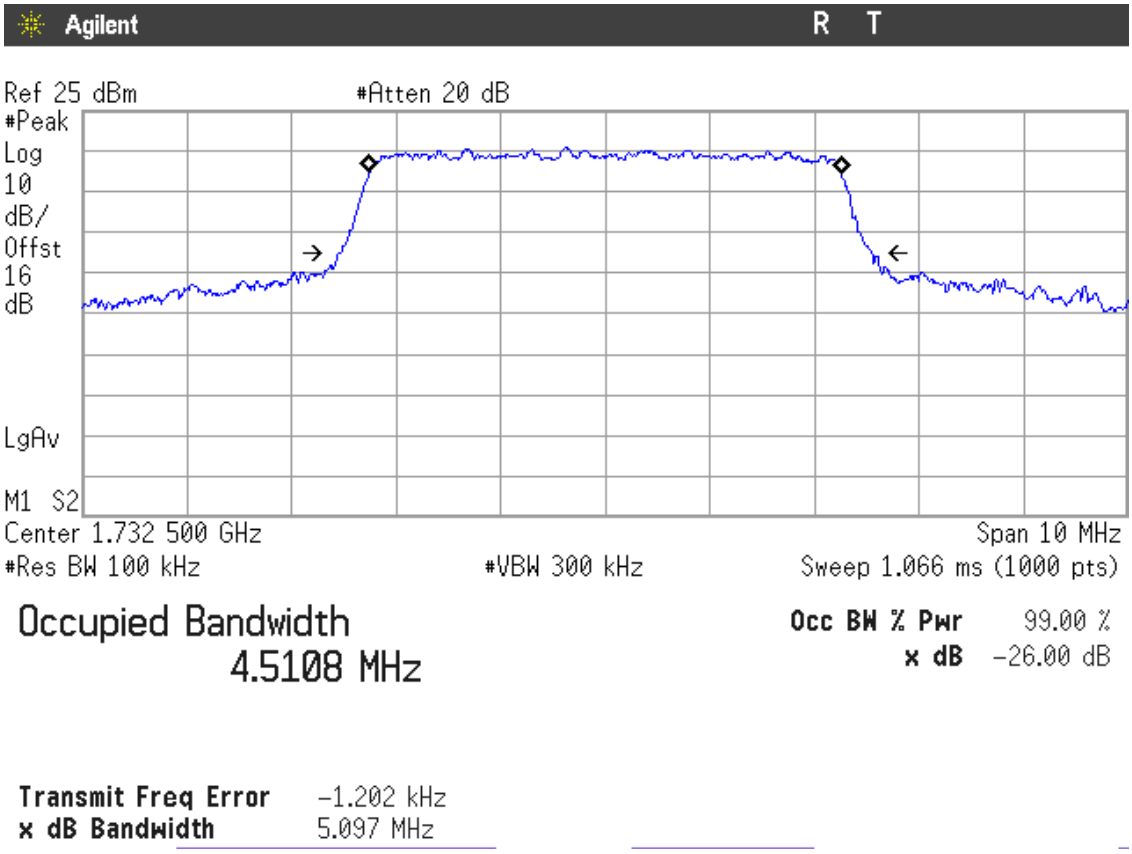


LTE 16QAM MODULATION. BW = 5 MHz (Band IV)

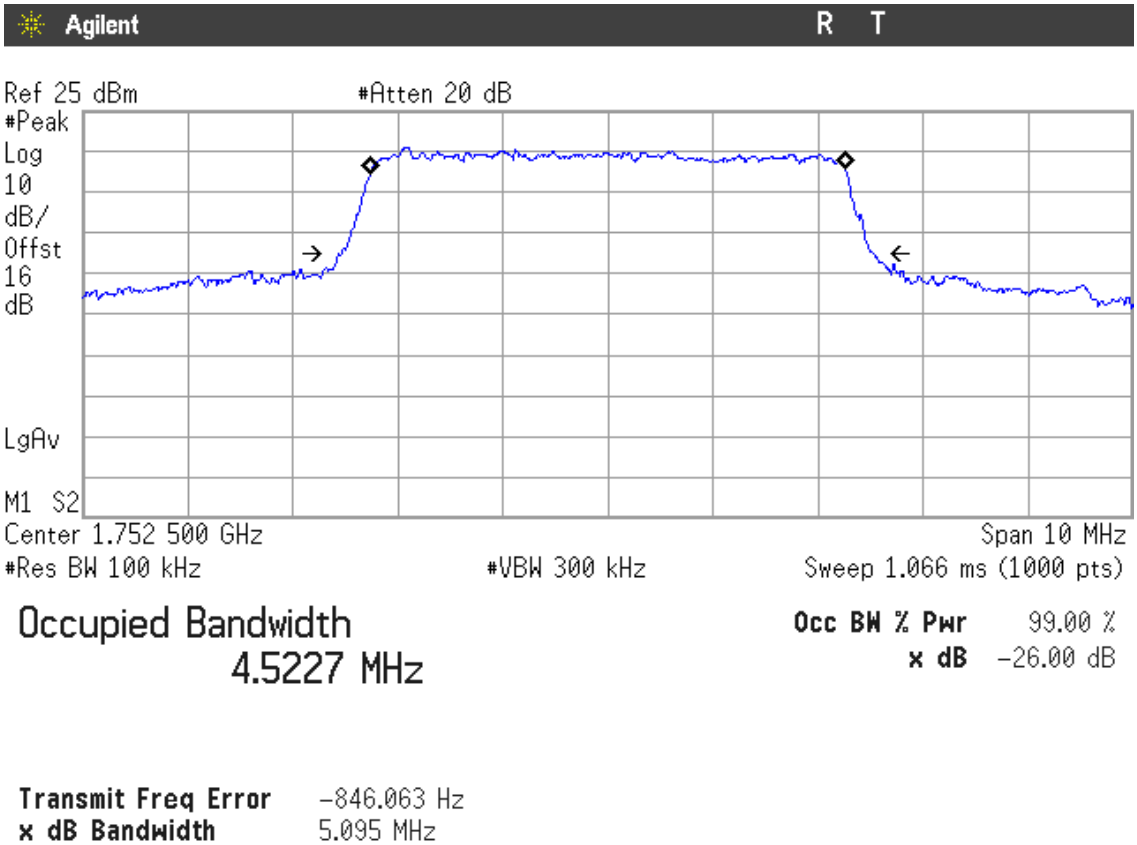
Lowest Channel



Middle Channel

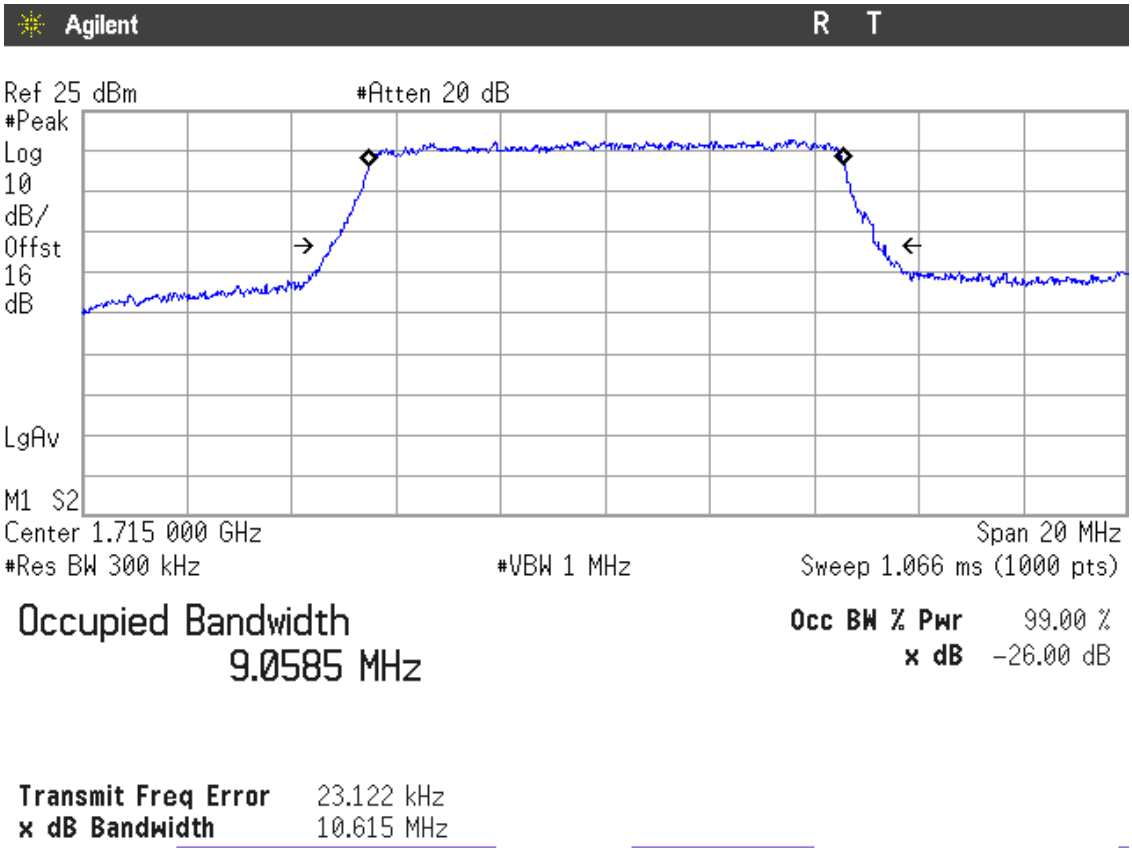


Highest Channel

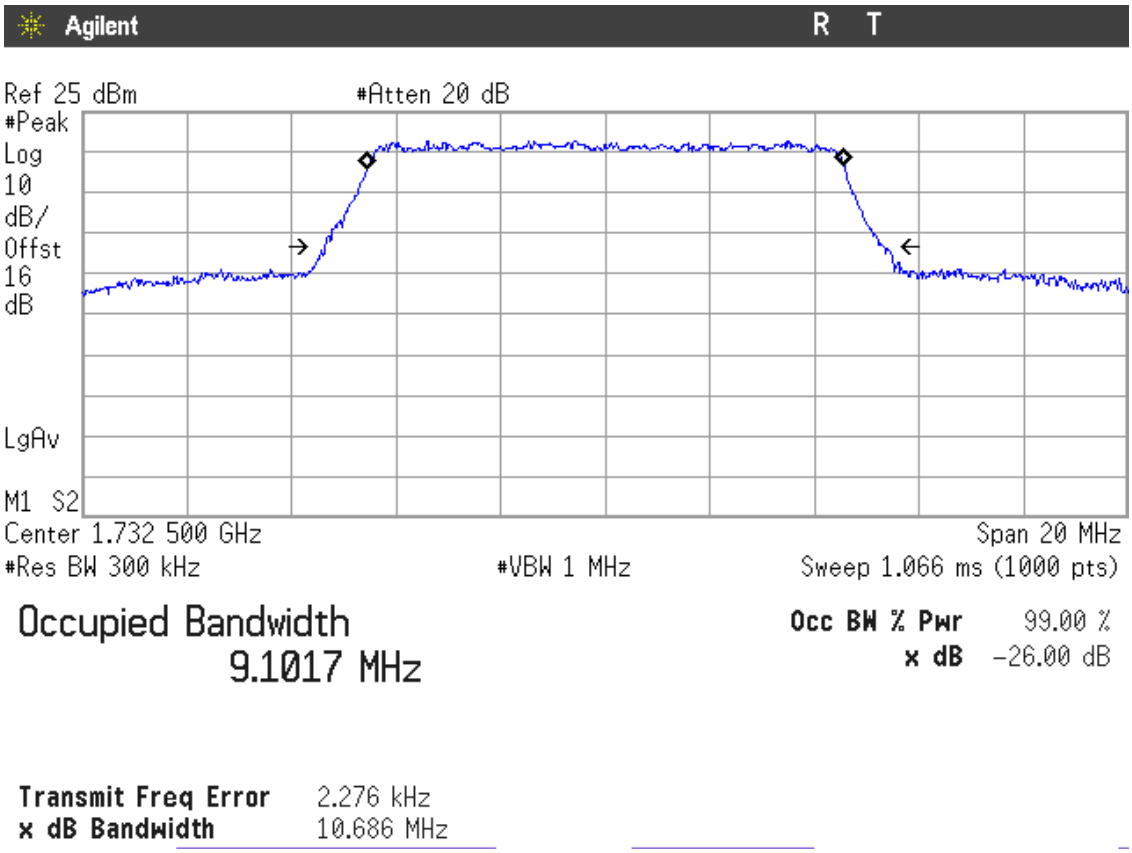


LTE QPSK MODULATION. BW = 10 MHz (Band IV)

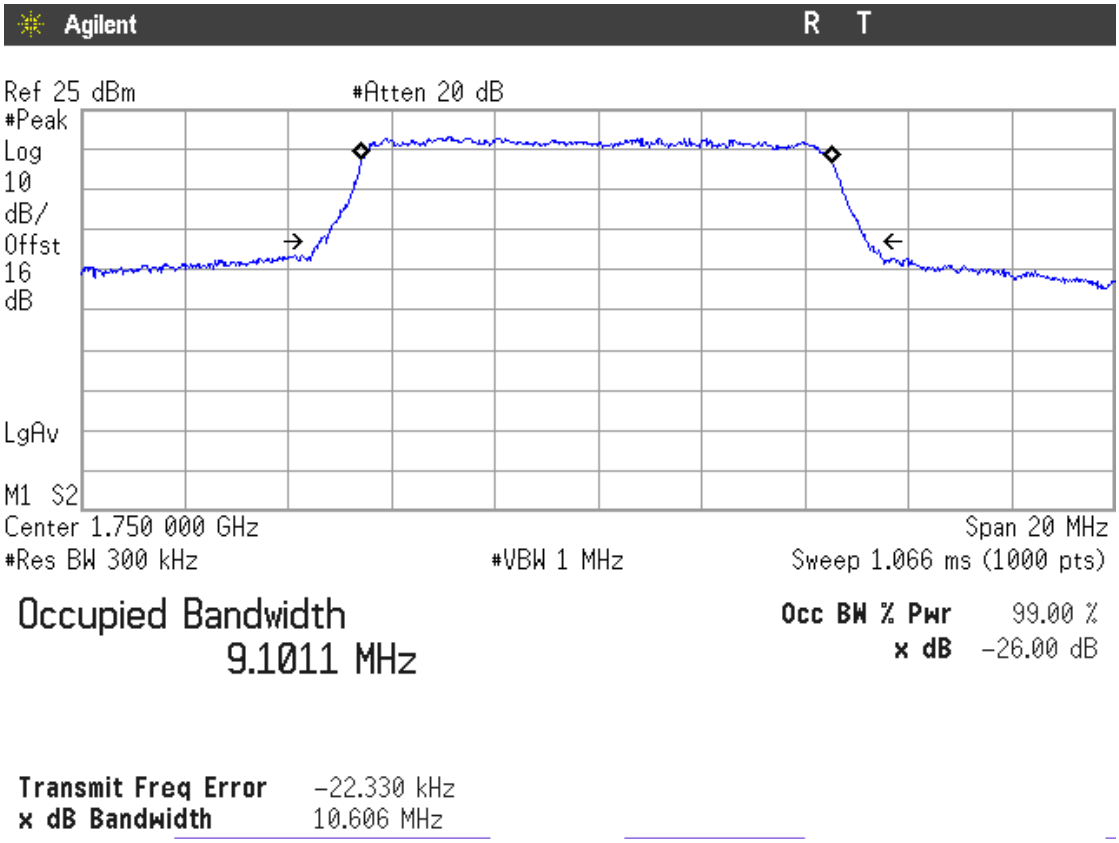
Lowest Channel



Middle Channel

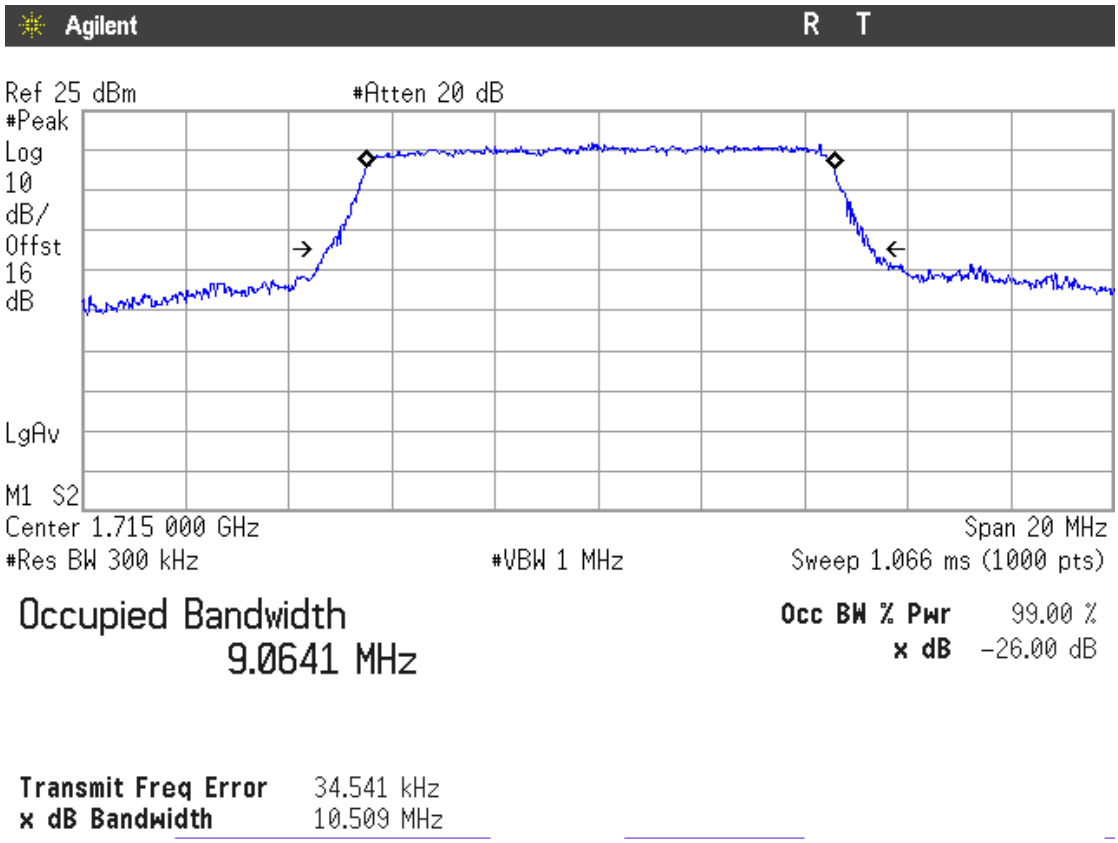


Highest Channel

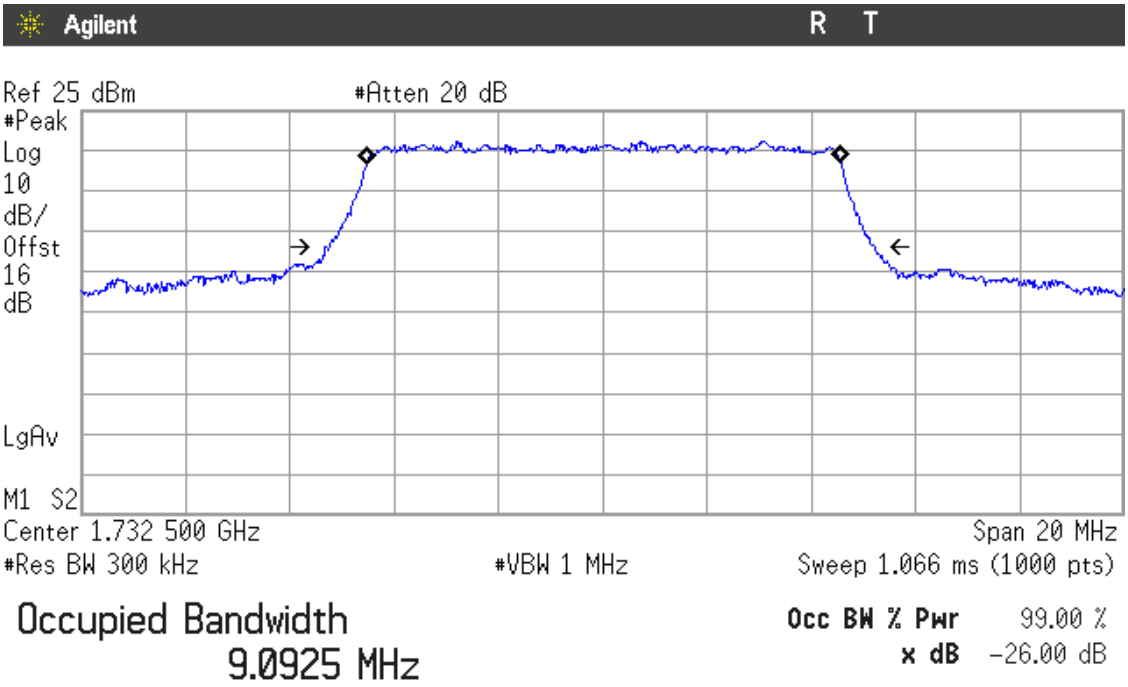


LTE 16QAM MODULATION. BW = 10 MHz (Band IV)

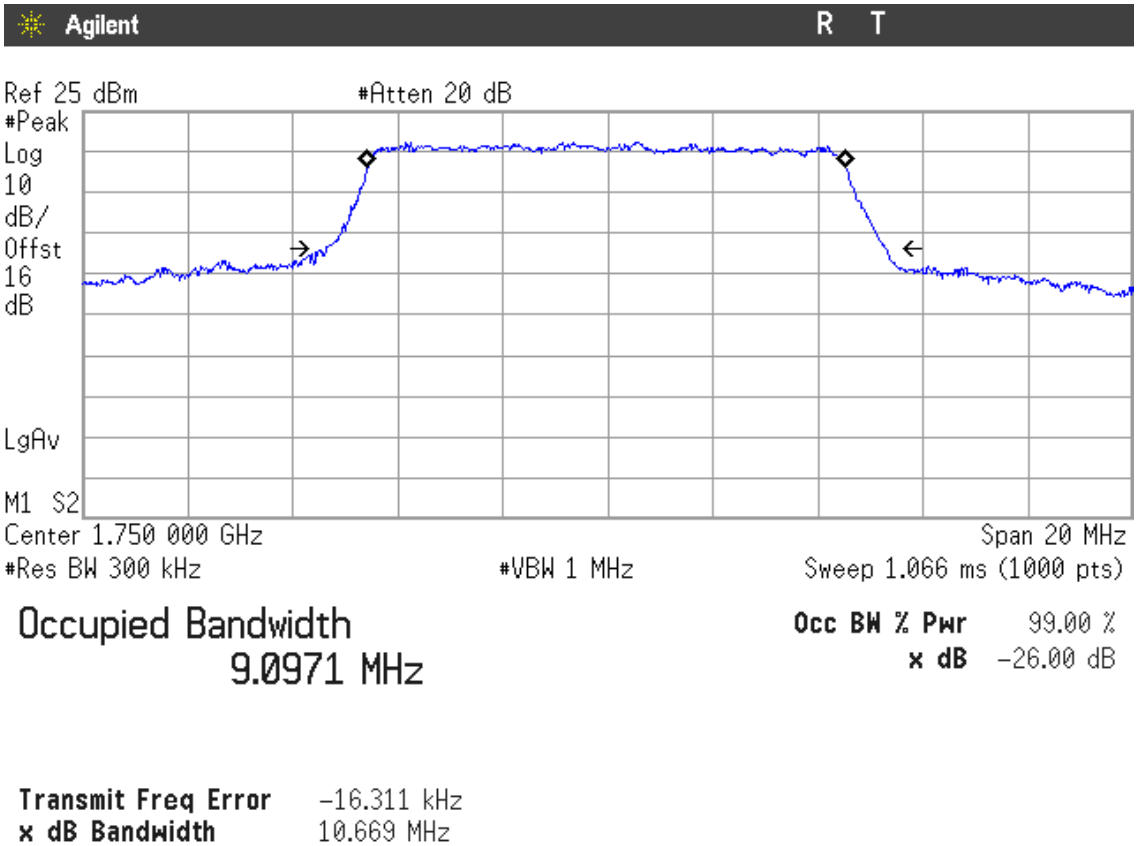
Lowest Channel



Middle Channel

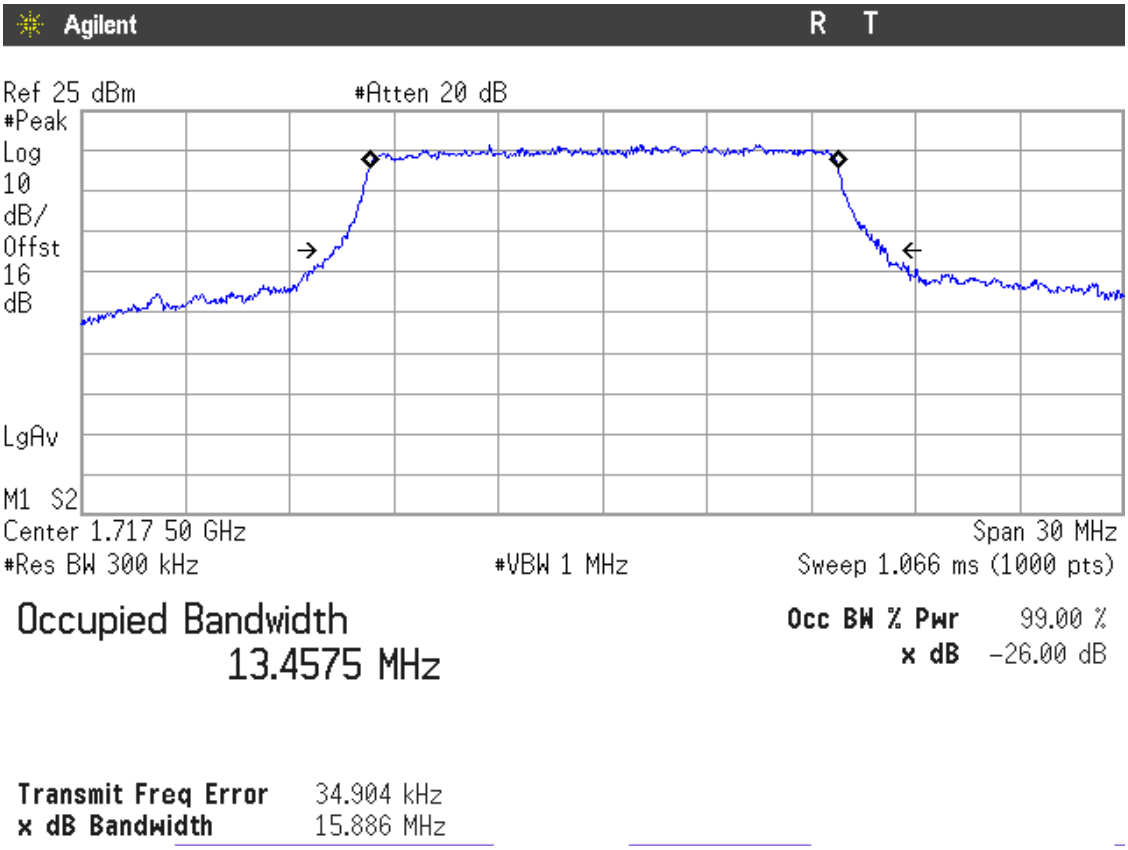


Highest Channel

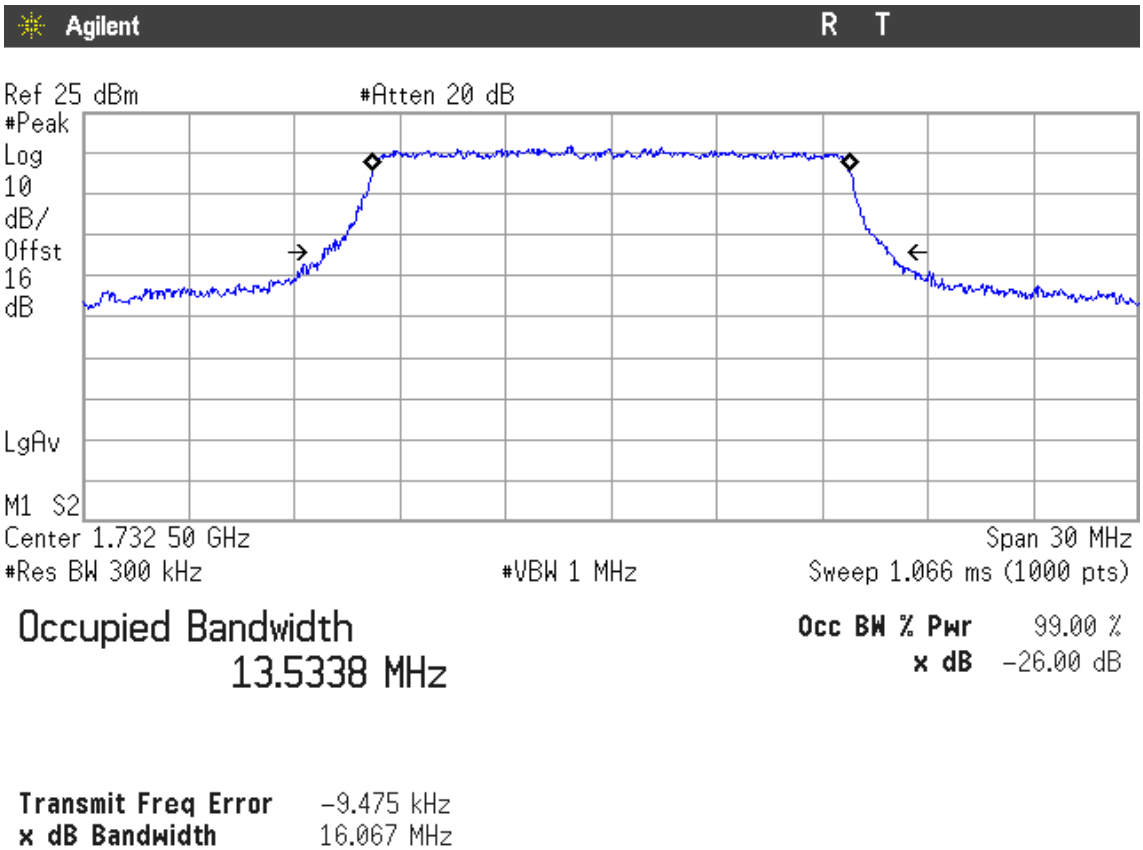


LTE QPSK MODULATION. BW = 15 MHz (Band IV)

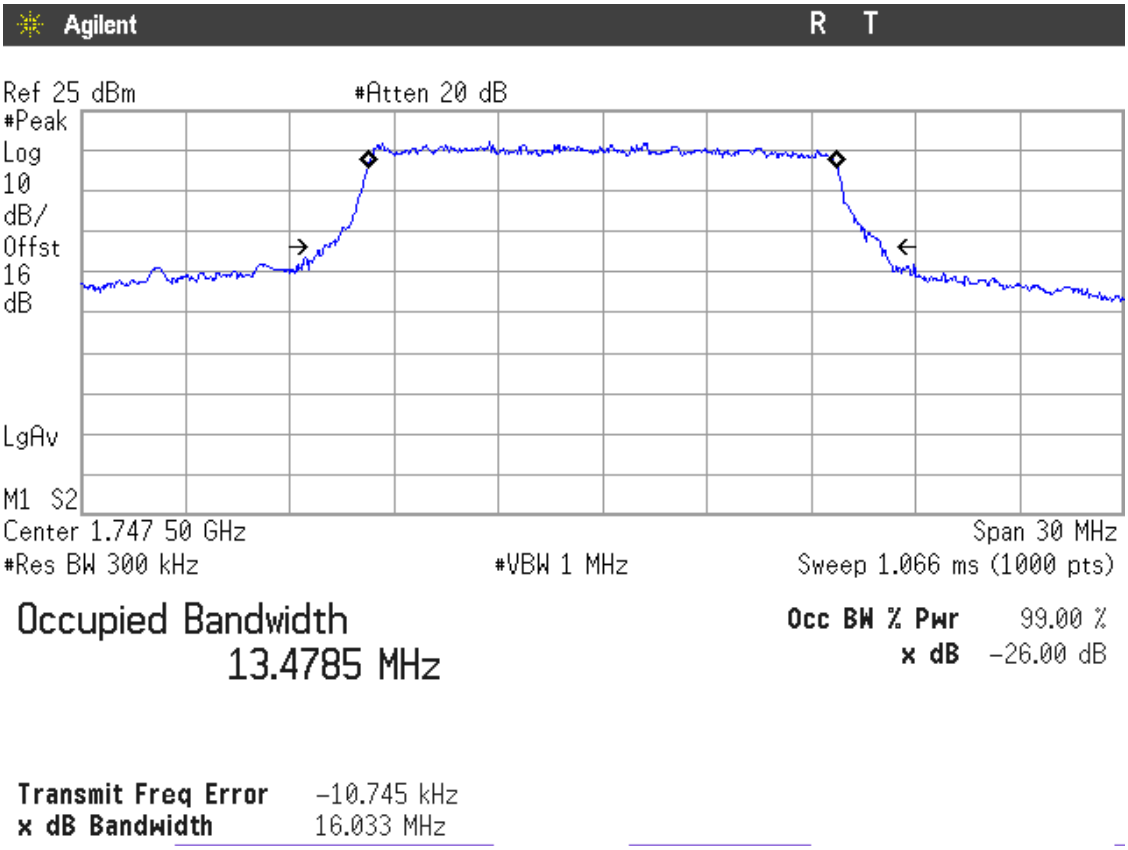
Lowest Channel



Middle Channel

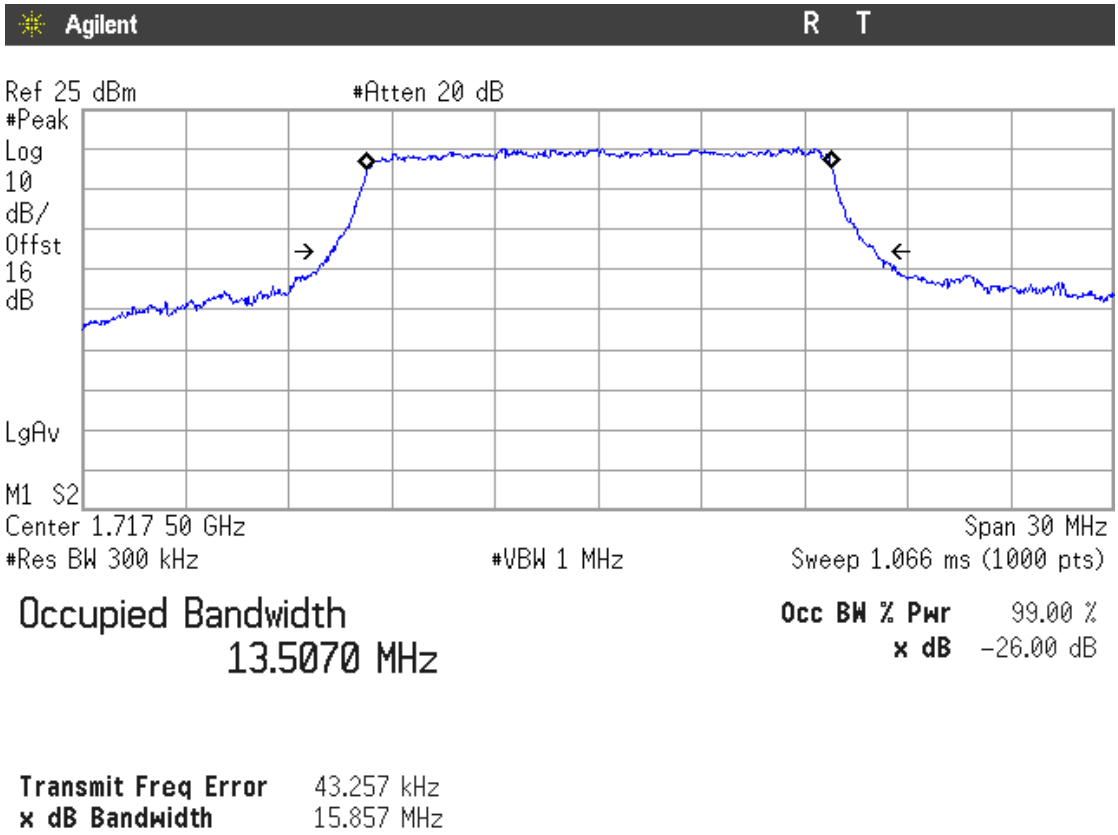


Highest Channel

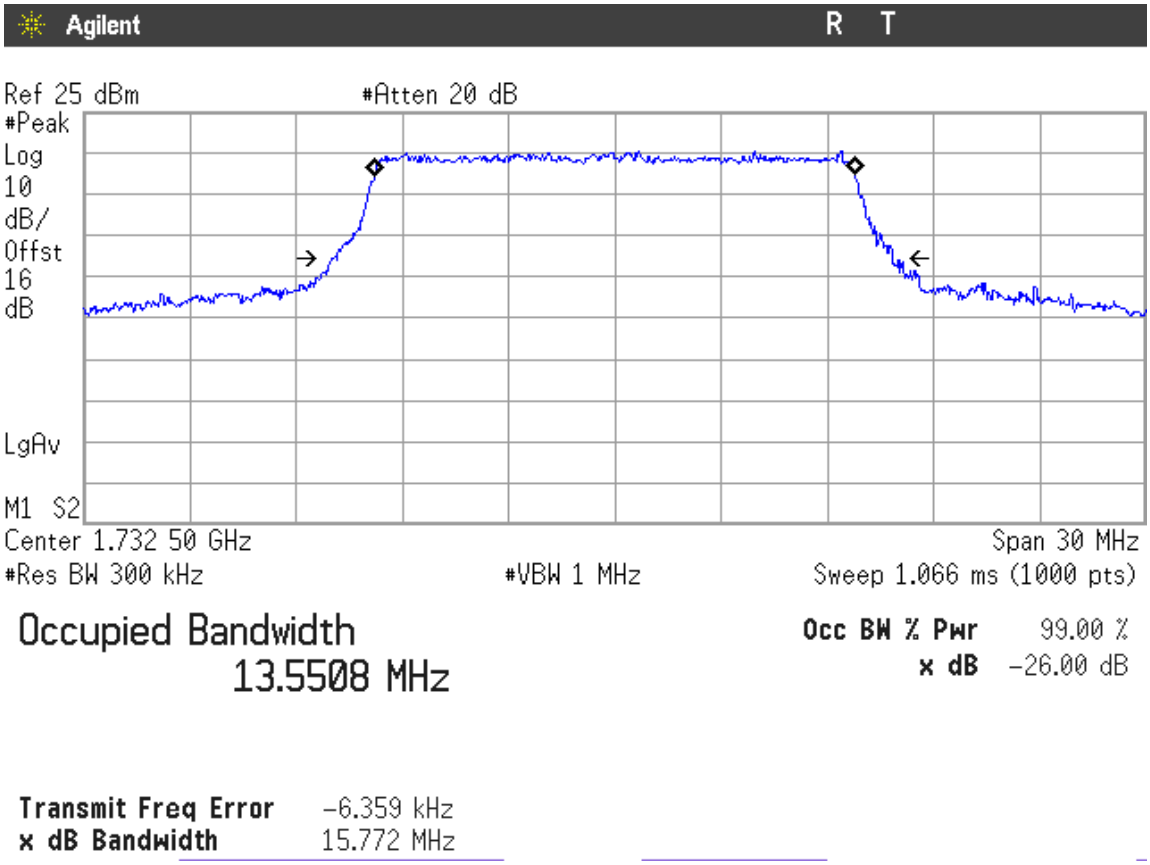


LTE 16QAM MODULATION. BW = 15 MHz (Band IV)

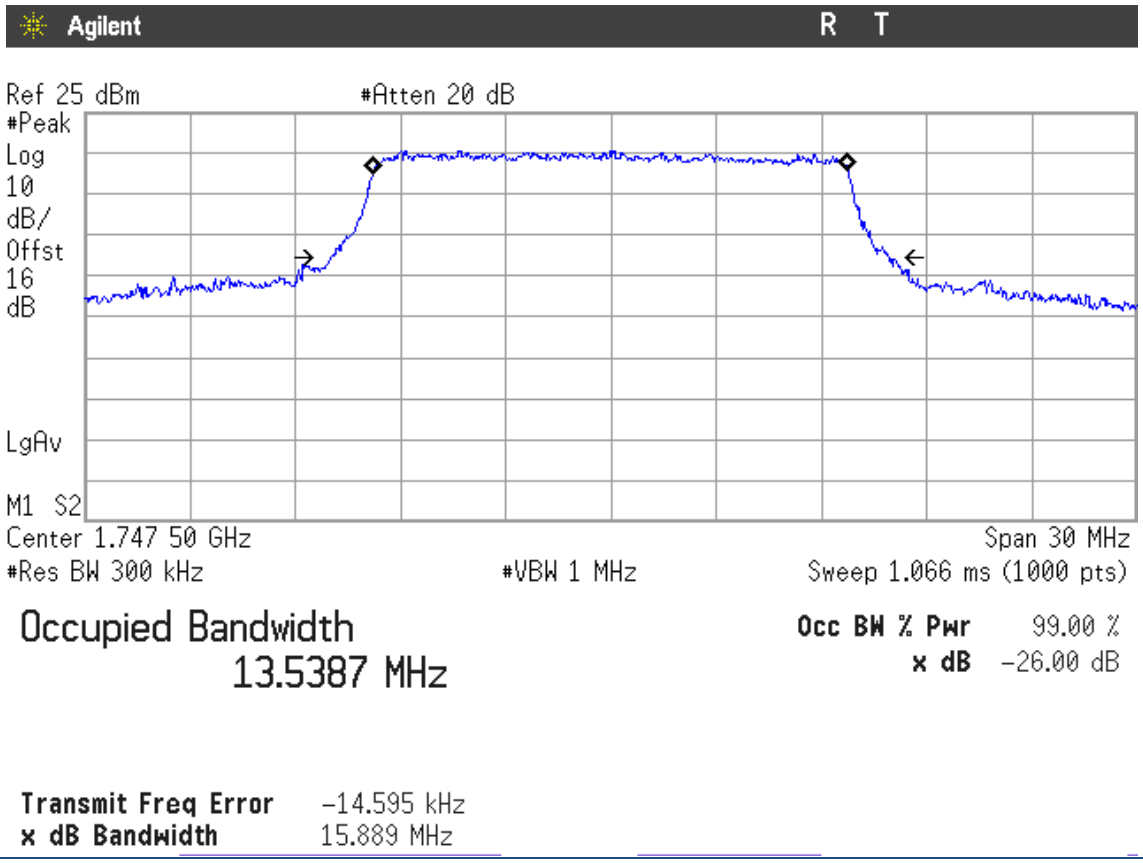
Lowest Channel



Middle Channel

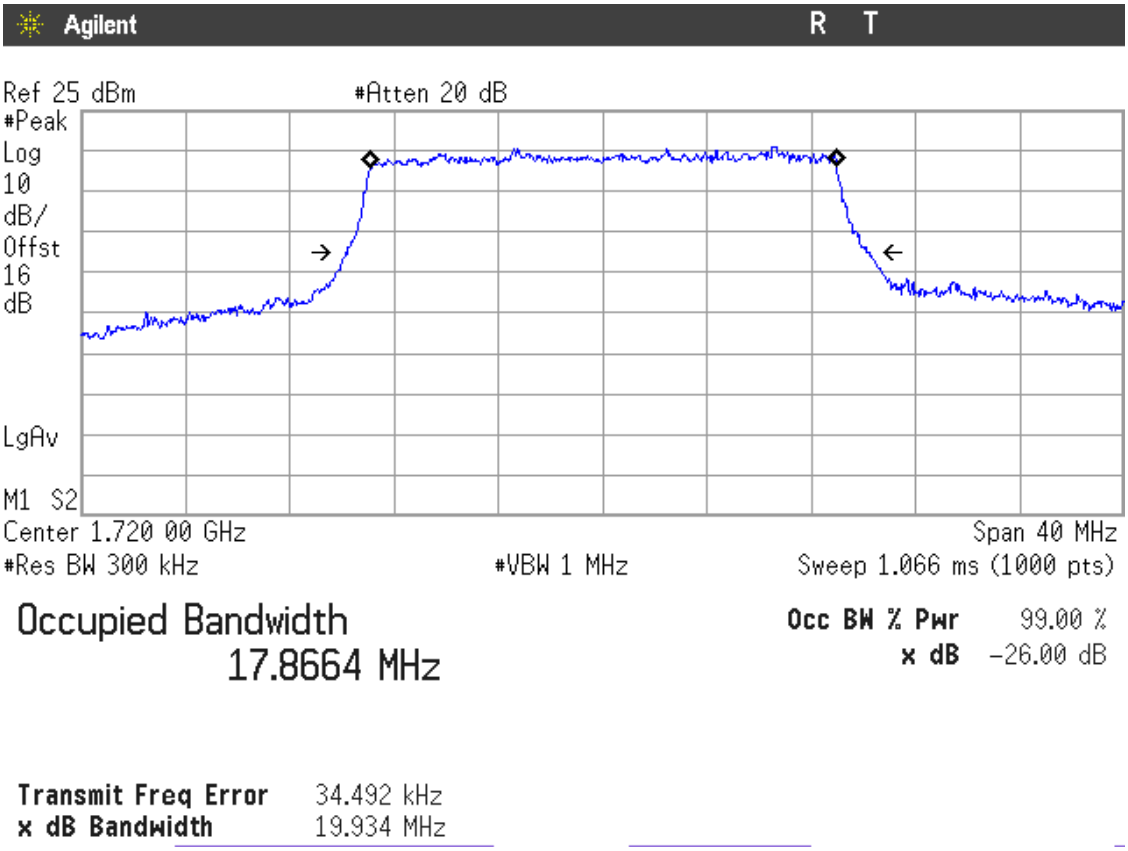


Highest Channel

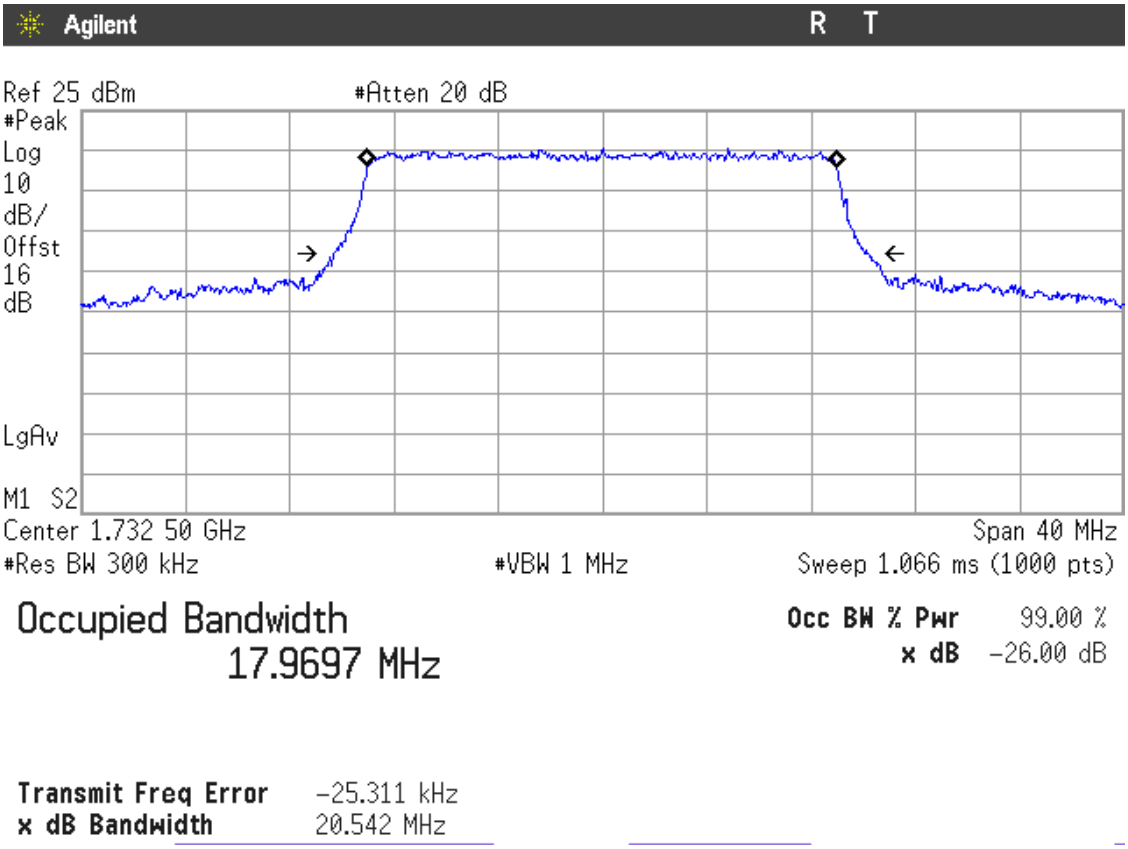


LTE QPSK MODULATION. BW = 20 MHz (Band IV)

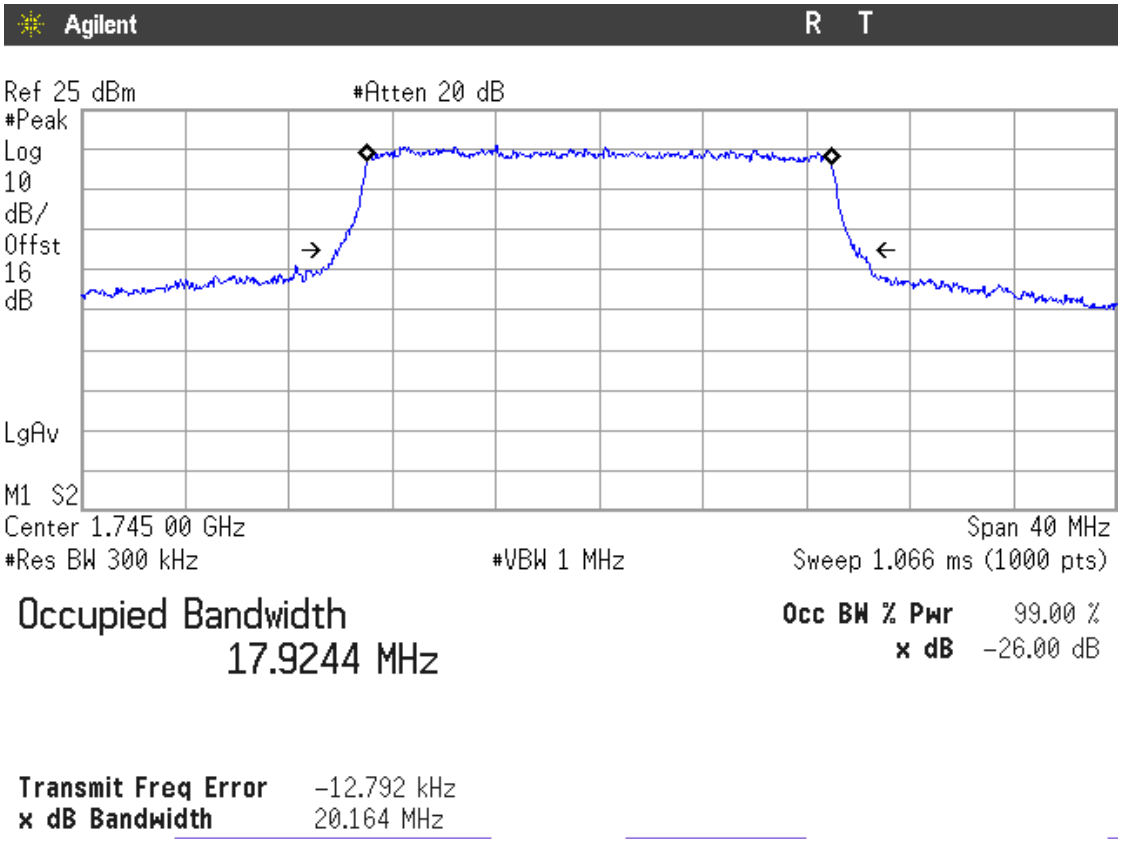
Lowest Channel



Middle Channel

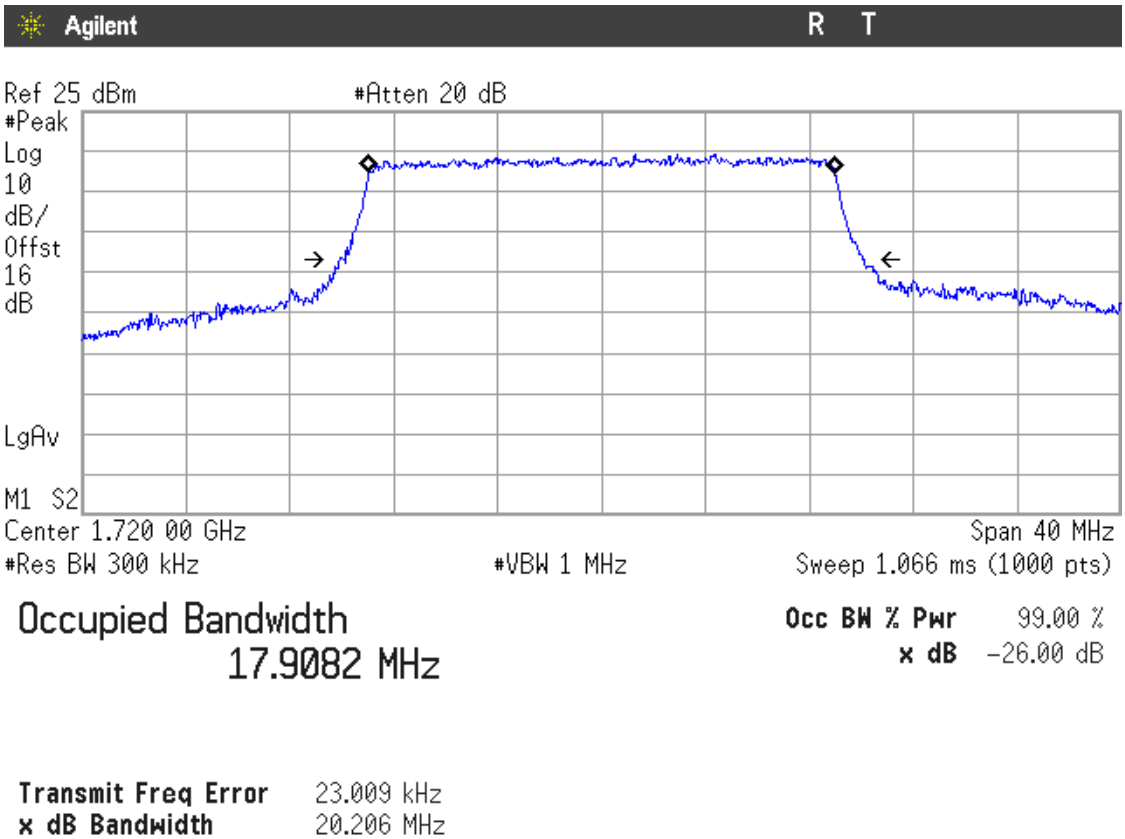


Highest Channel

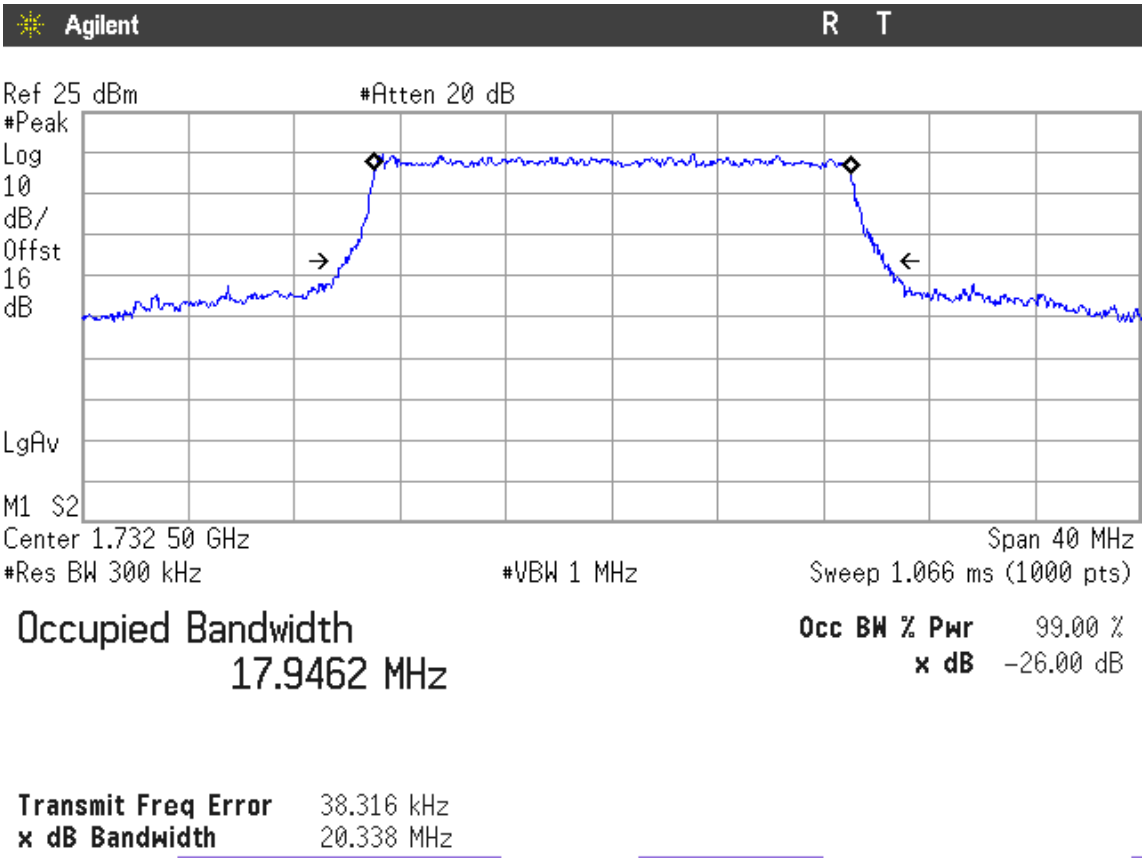


LTE 16QAM MODULATION. BW = 20 MHz (Band IV)

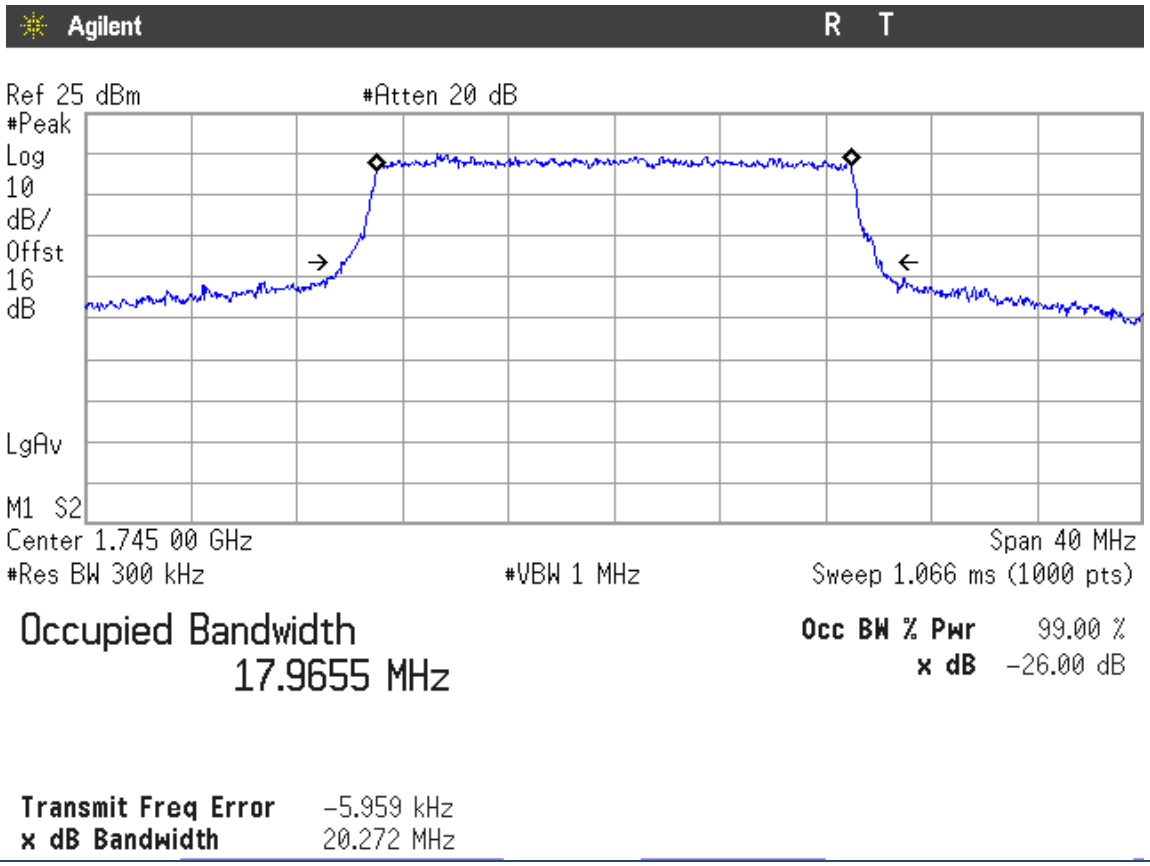
Lowest Channel



Middle Channel

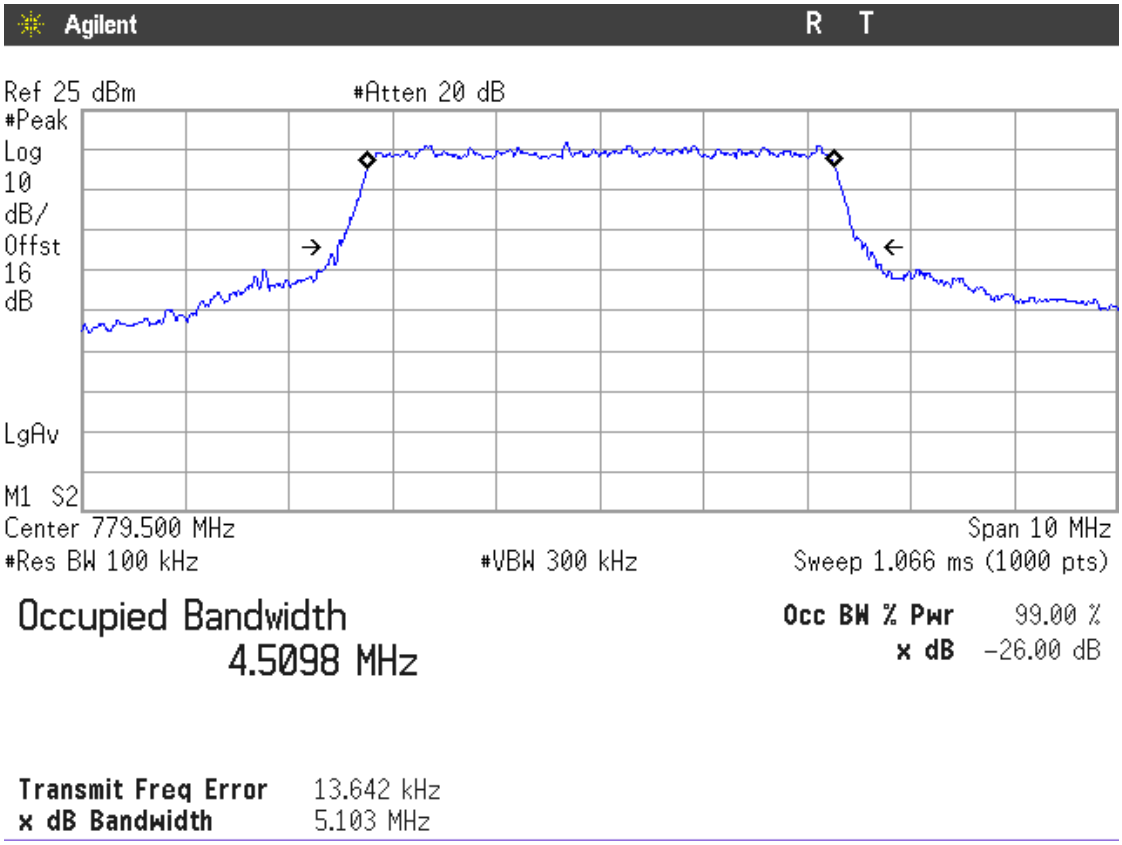


Highest Channel

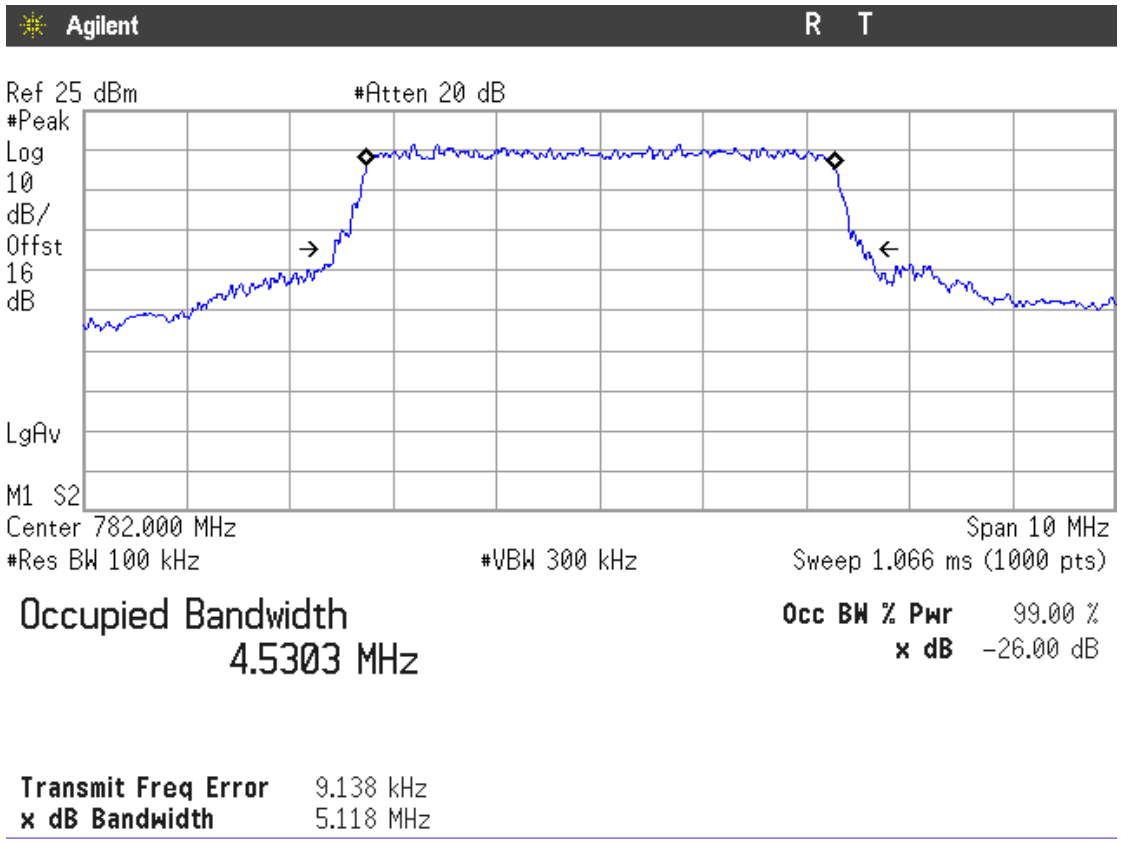


LTE QPSK MODULATION. BW = 5 MHz (Band XIII)

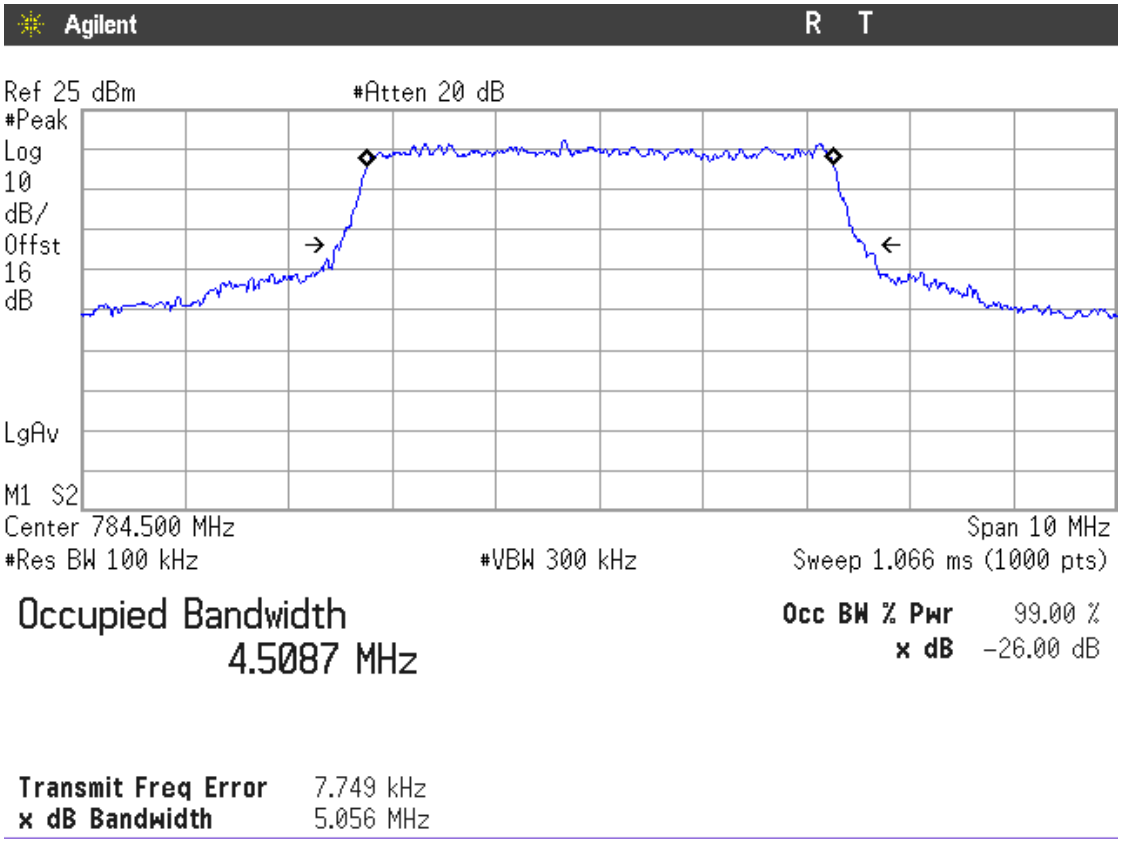
Lowest Channel



Middle Channel

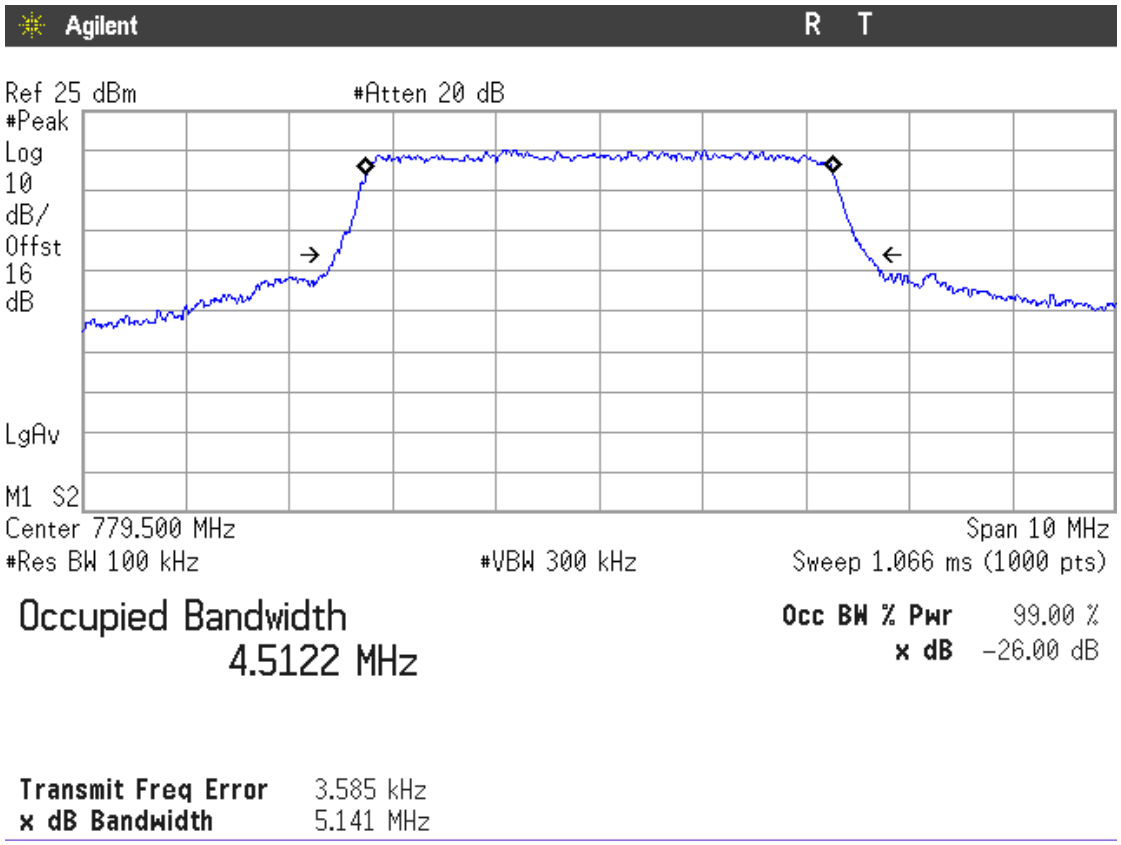


Highest Channel

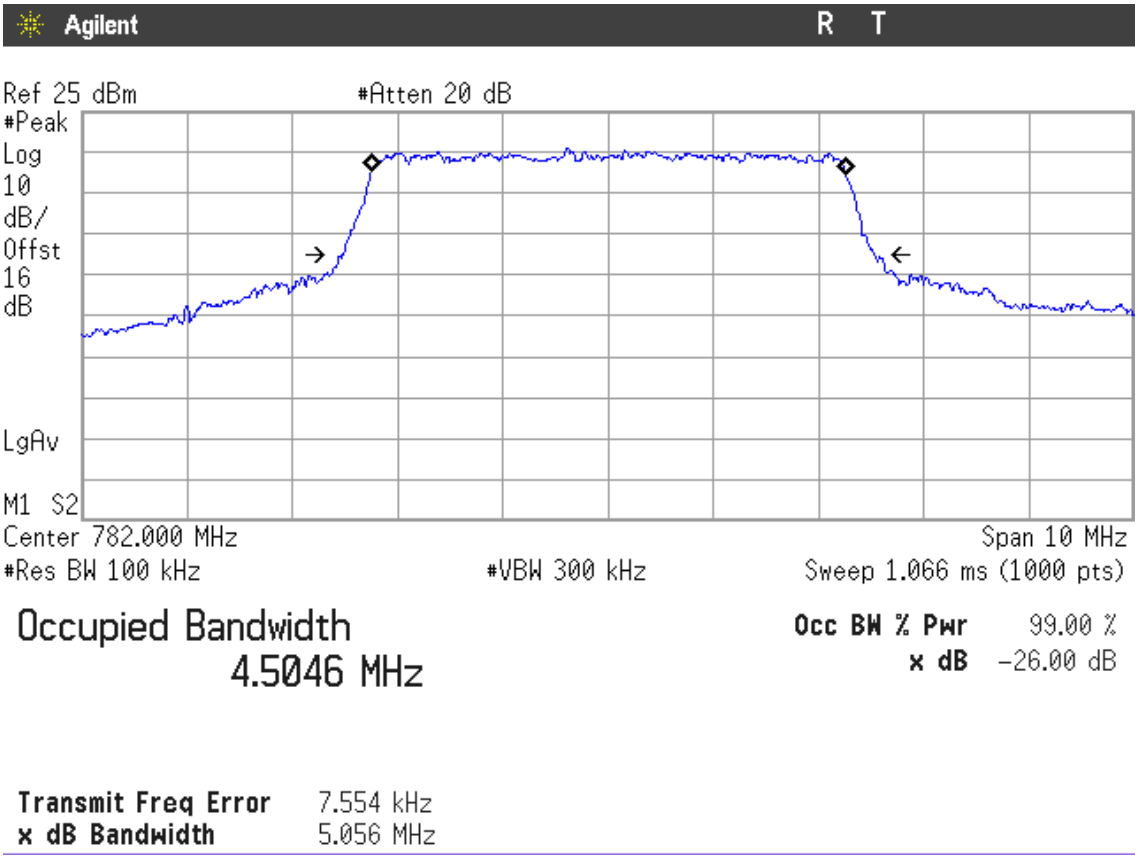


LTE 16QAM MODULATION. BW = 5 MHz (Band XIII)

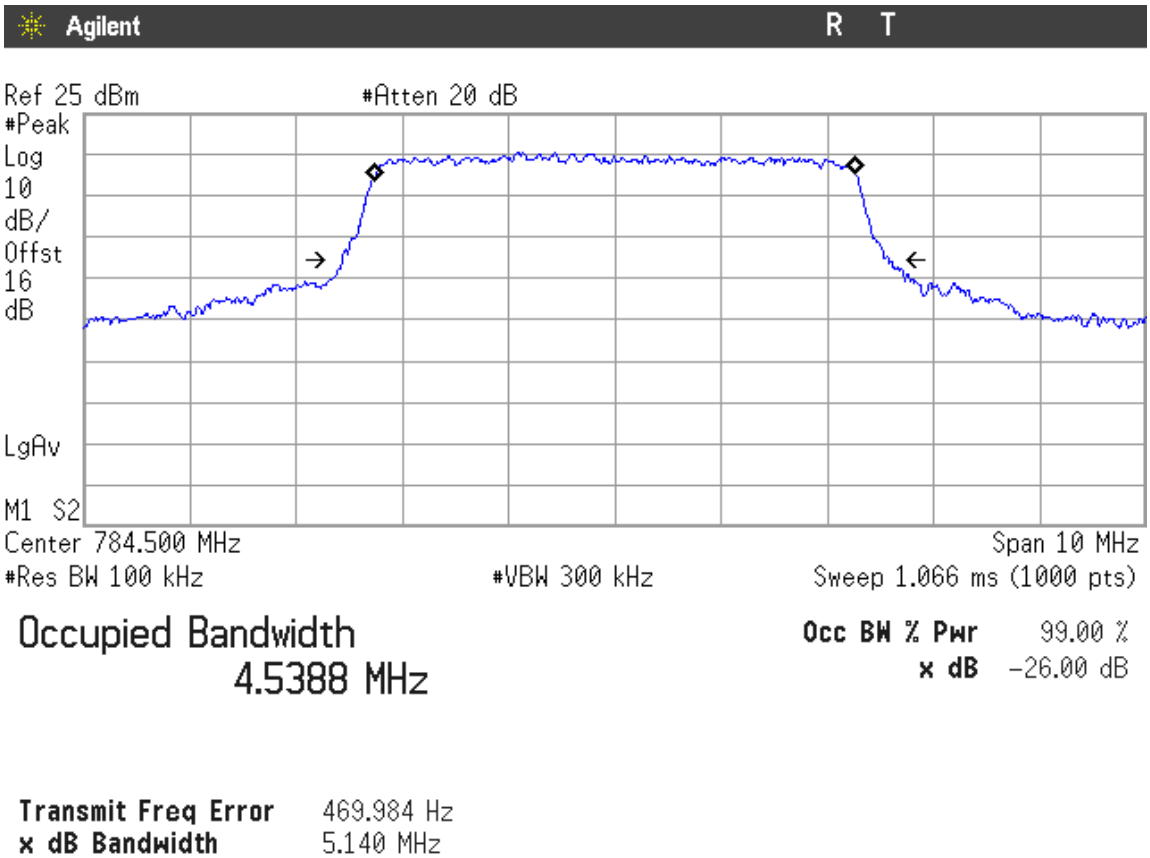
Lowest Channel



Middle Channel

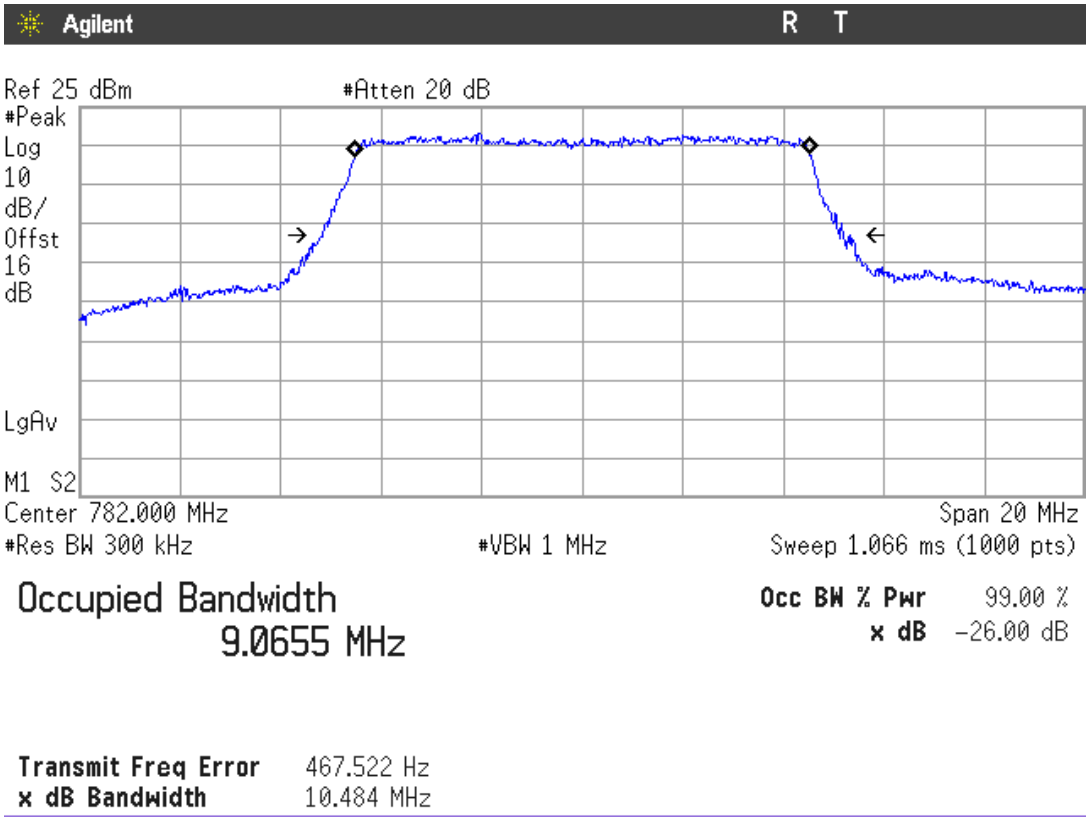


Highest Channel



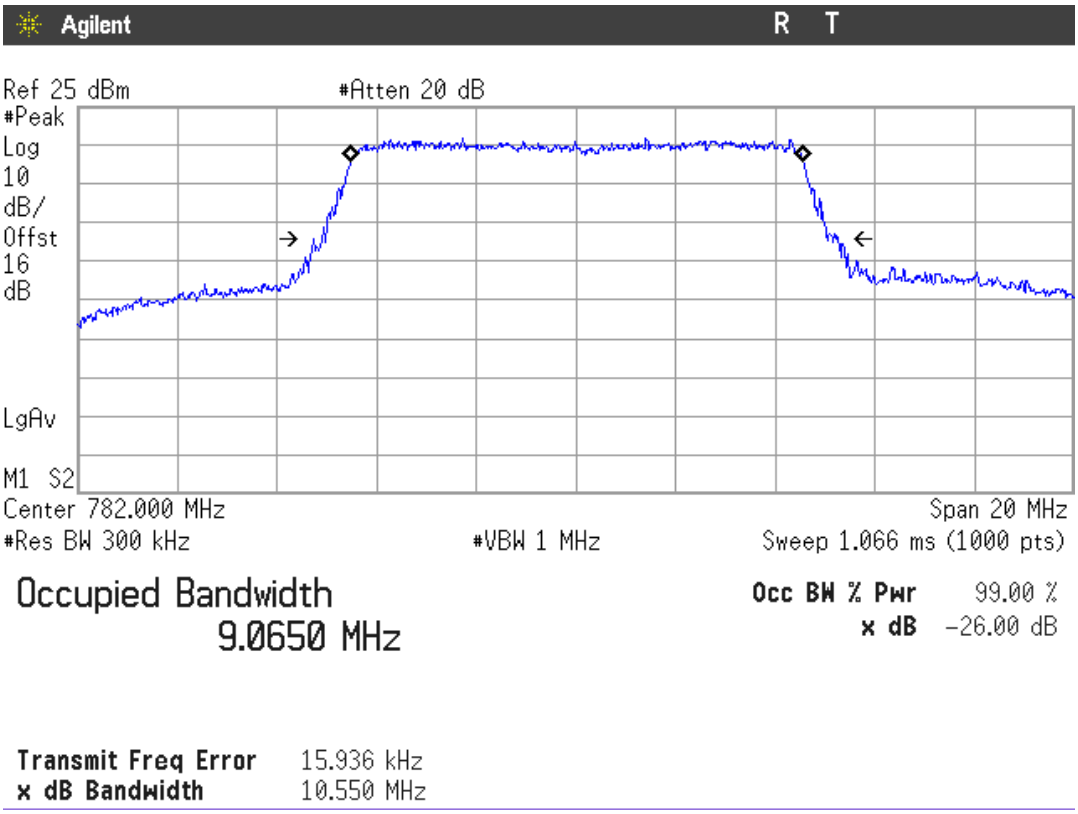
LTE QPSK MODULATION. BW = 10 MHz (Band XIII)

Middle Channel



LTE 16QAM MODULATION. BW = 10 MHz (Band XIII)

Middle Channel



Spurious emissions at antenna terminals

SPECIFICATION

LTE BAND IV. FCC §2.1051 and §27.53 (h). RSS-139 Clause 6.6.

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.

LTE BAND XIII. FCC §2.1051 and §27.53 (c). RSS-130 Clause 4.6.

On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

On all frequencies between 763-775 MHz and 793-806 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

At Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm.

At Po transmitting power, the specified minimum attenuation becomes 65+10 log (Po), and the level in dBm relative Po becomes:
Po (dBm) – [65 + 10 log (Po in mwatts) - 30] = -35 dBm.

METHOD

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

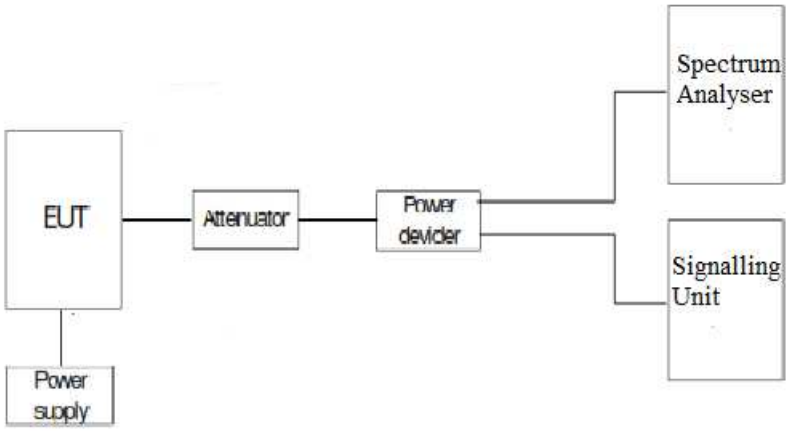
The spectrum was investigated from 9 kHz to 18 GHz for LTE Band IV.

The spectrum was investigated from 9 kHz to 8 GHz, from 763 MHz to 775 MHz and from 793 MHz to 806 MHz for LTE Band XIII.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

For LTE mode the configuration of Resource Blocks and modulation which is the worst case for conducted power was used.

TEST SETUP



RESULTS (see plots in next pages)

LTE QPSK MODULATION. BW = 1.4 MHz. Band IV

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 3 MHz. Band IV

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 5 MHz. Band IV

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 10 MHz. Band IV

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 15 MHz. Band IV
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 20 MHz. Band IV

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 5 MHz. Band XIII

1. CHANNEL: LOWEST
Spurious signals found closest to the limit in all the range:

Frequency (MHz)	Level (dBm)	Limit (dBm)
773.00700	-47.75	-35.00
774.95020	-45.58	-35.00

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

LTE QPSK MODULATION. BW = 10 MHz. Band XIII

1. CHANNEL: MIDDLE
Spurious signals found closest to the limit in all the range:

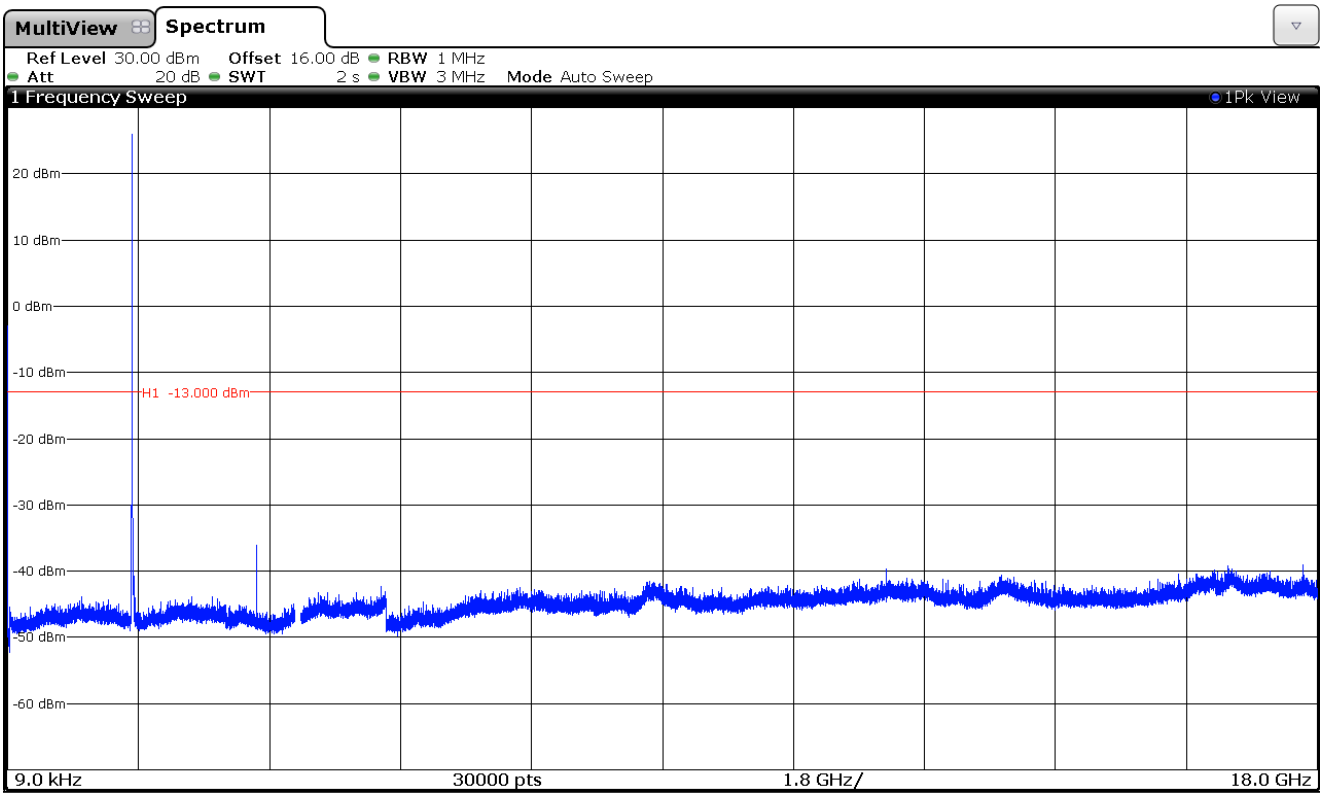
Frequency (MHz)	Level (dBm)	Limit (dBm)
773.13180	-46.43	-35.00
774.97380	-47.04	-35.00
794.40032	-43.39	-35.00
794.53812	-43.62	-35.00

Measurement uncertainty = <±1.20 dB.

Verdict: PASS

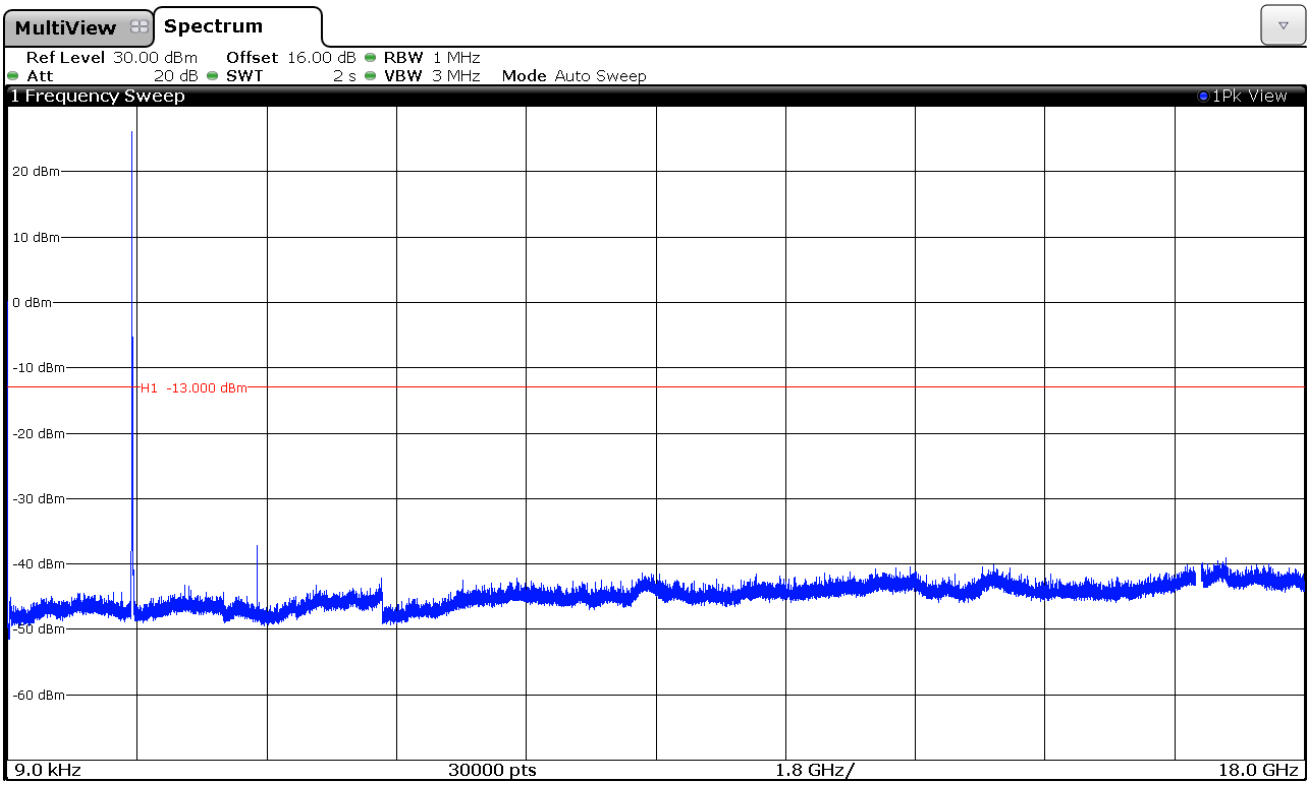
LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

1. CHANNEL: LOWEST



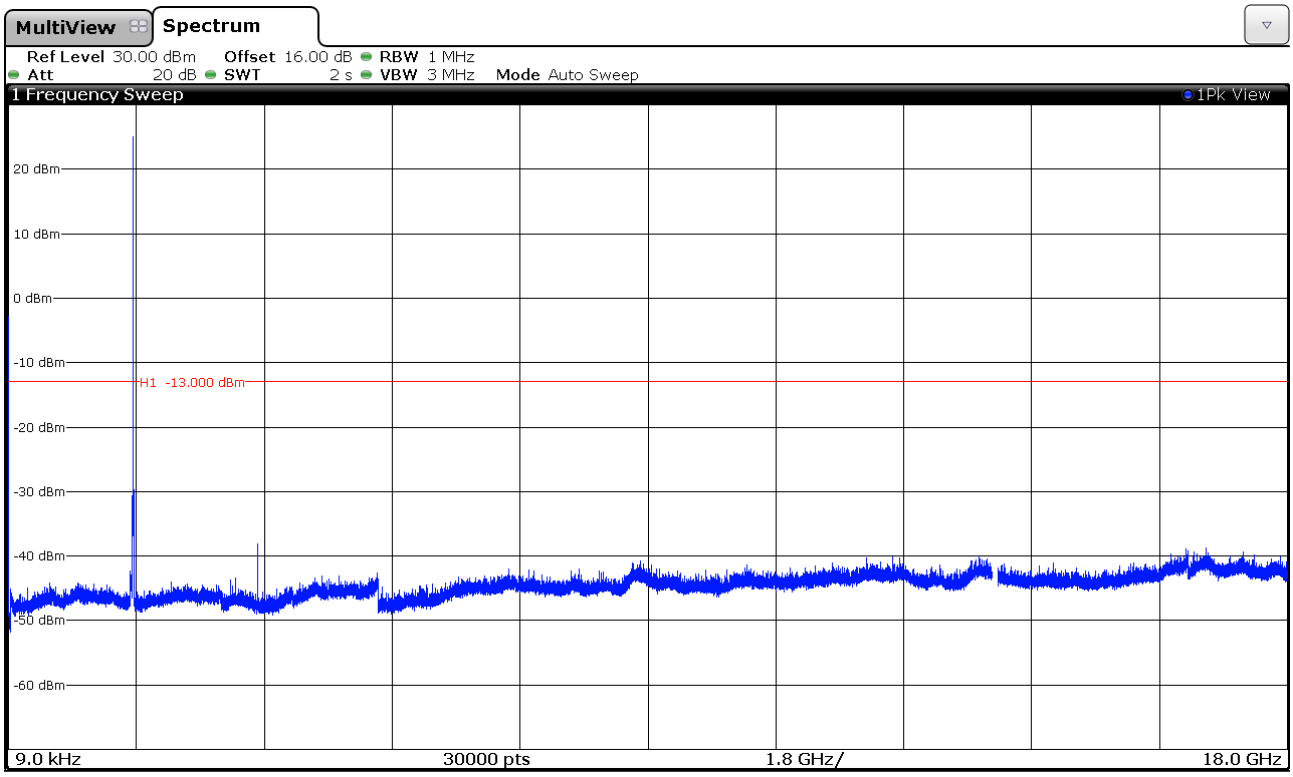
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

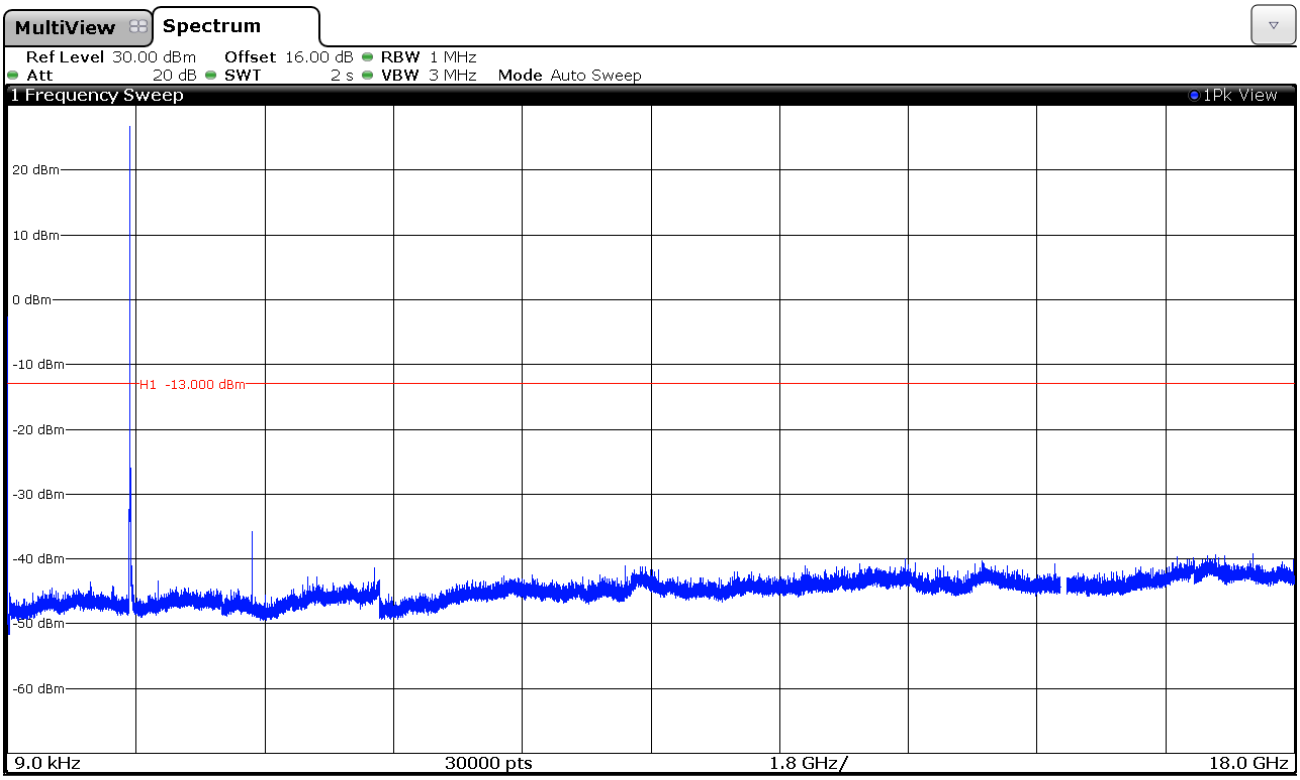
3. CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

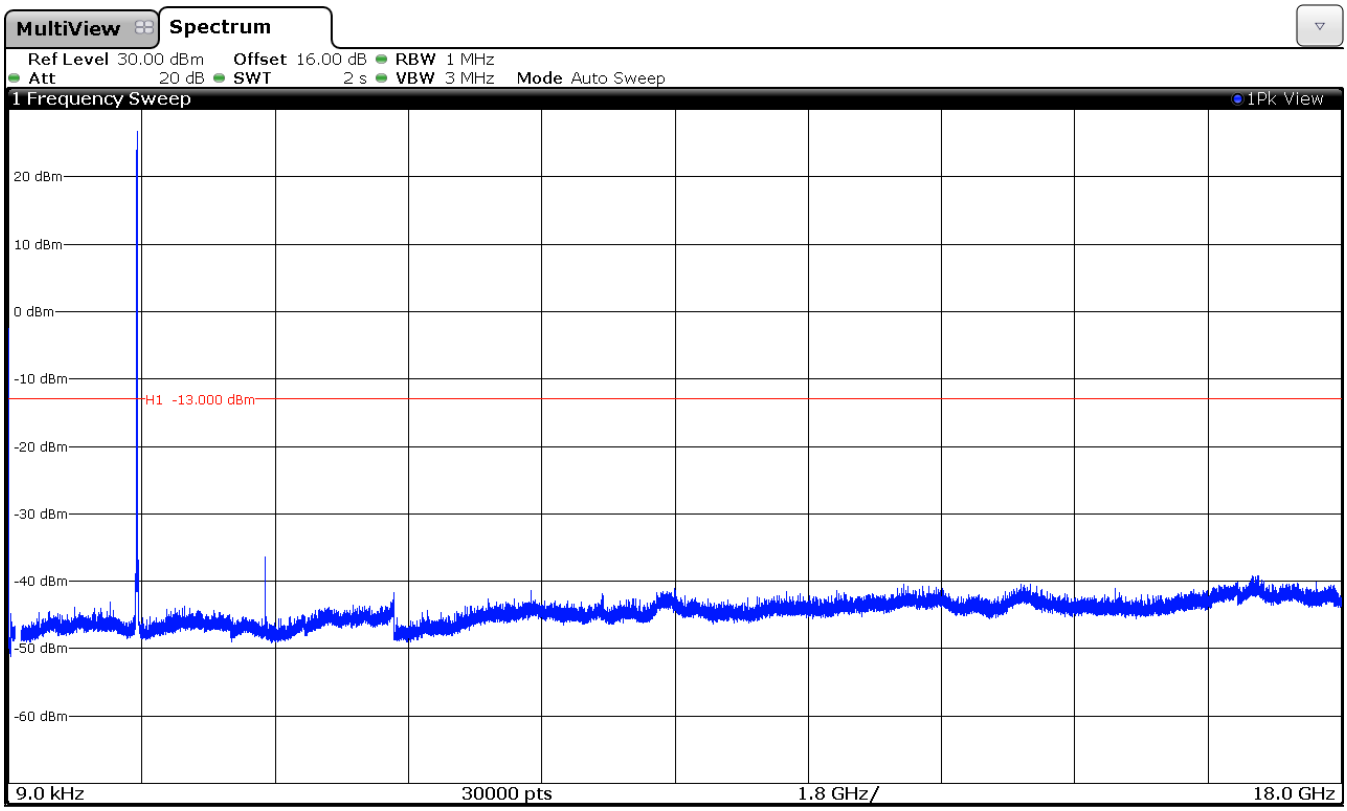
LTE QPSK MODULATION. BW = 3 MHz (Band IV)

1. CHANNEL: LOWEST



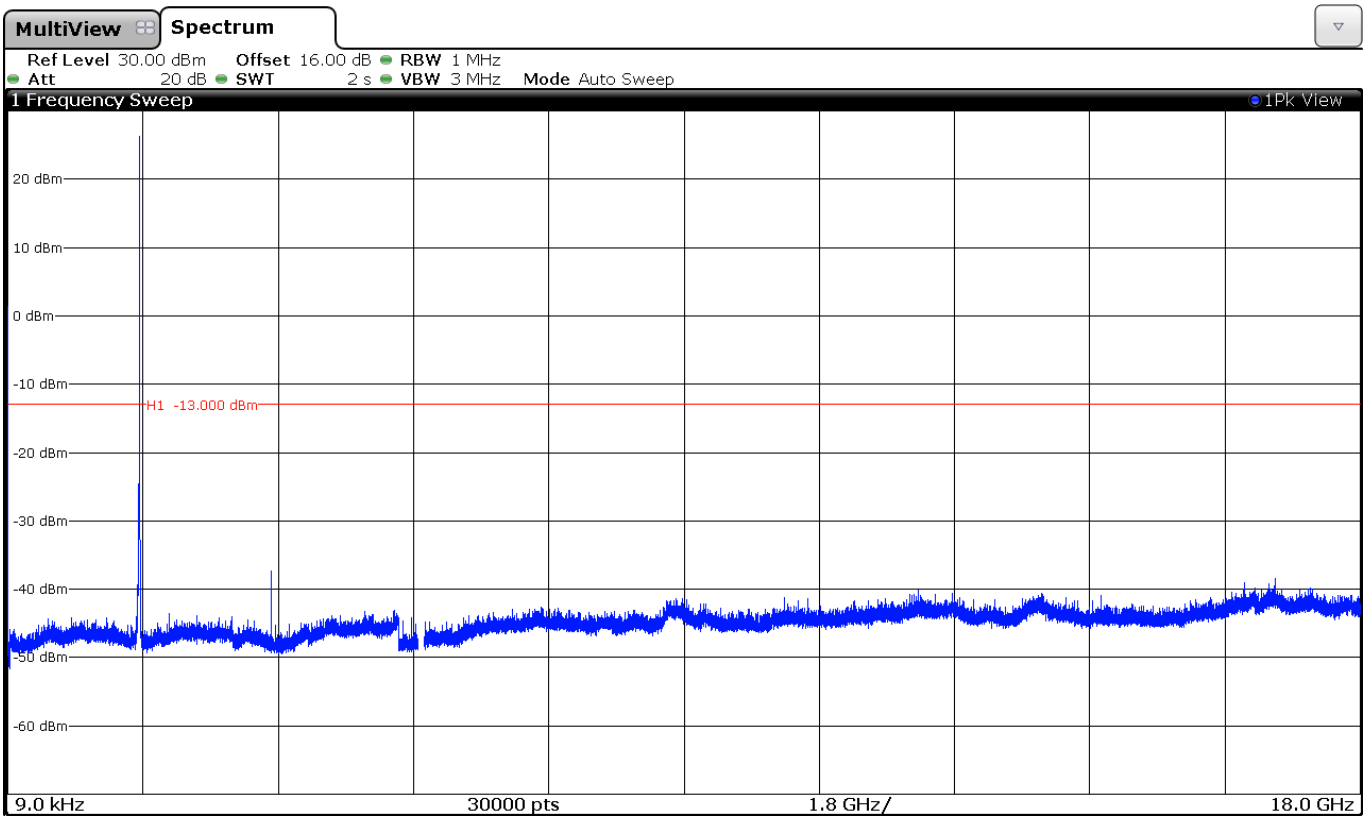
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

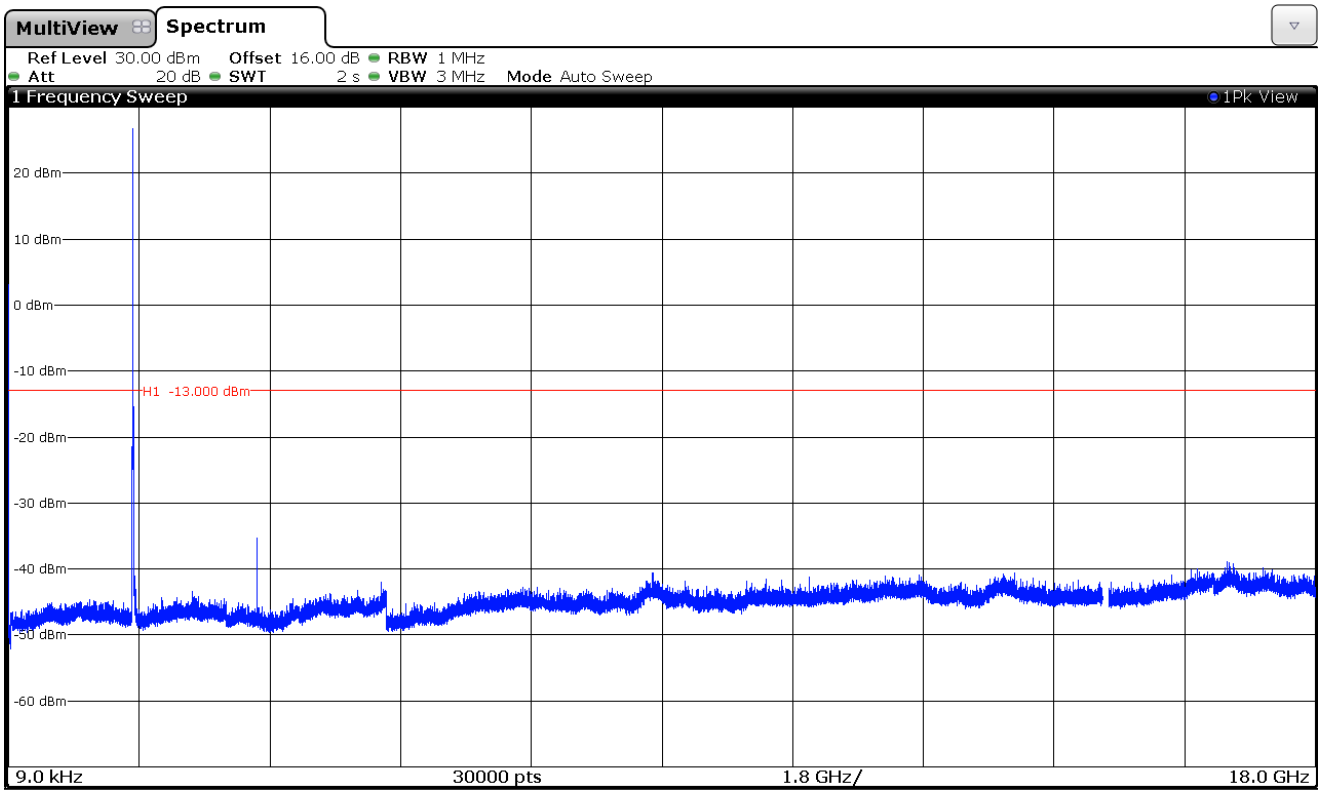
3. CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

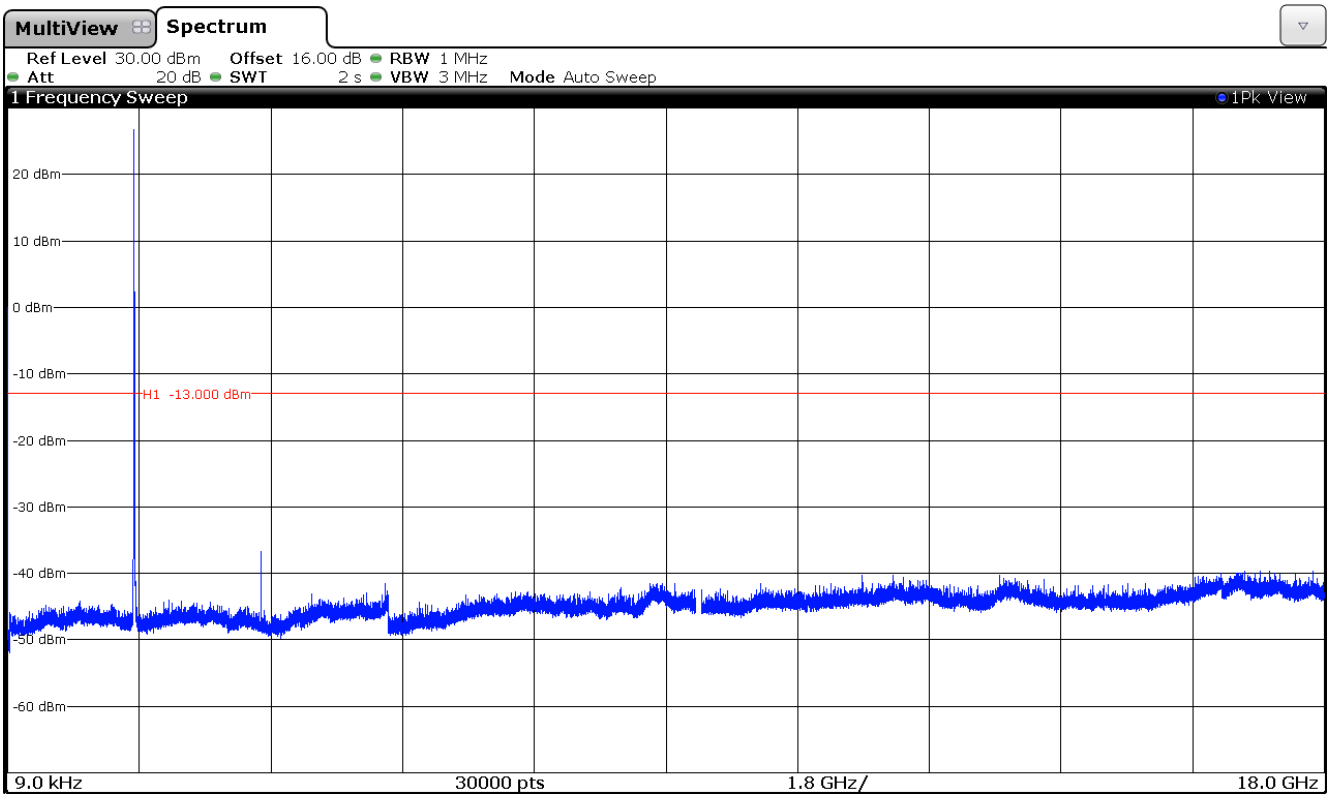
LTE QPSK MODULATION. BW = 5 MHz (Band IV)

1. CHANNEL: LOWEST



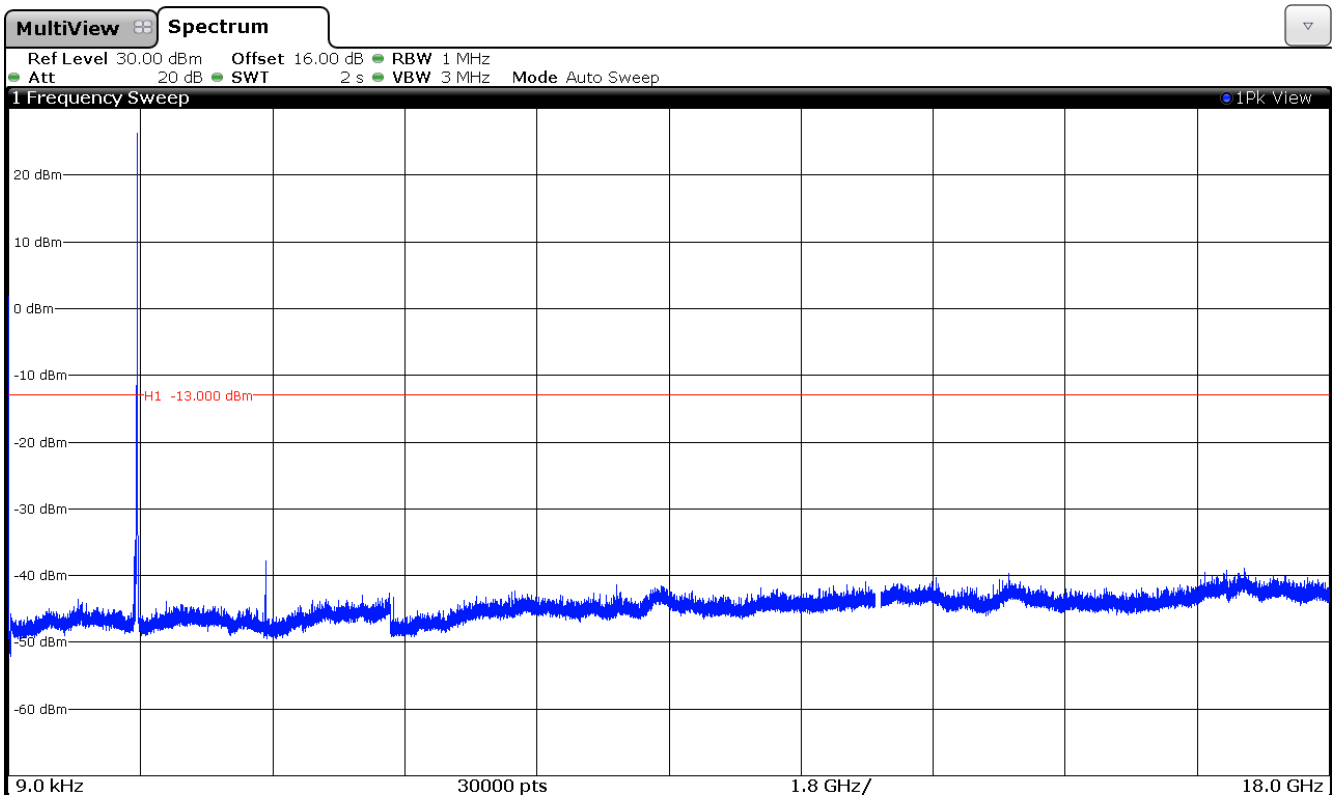
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

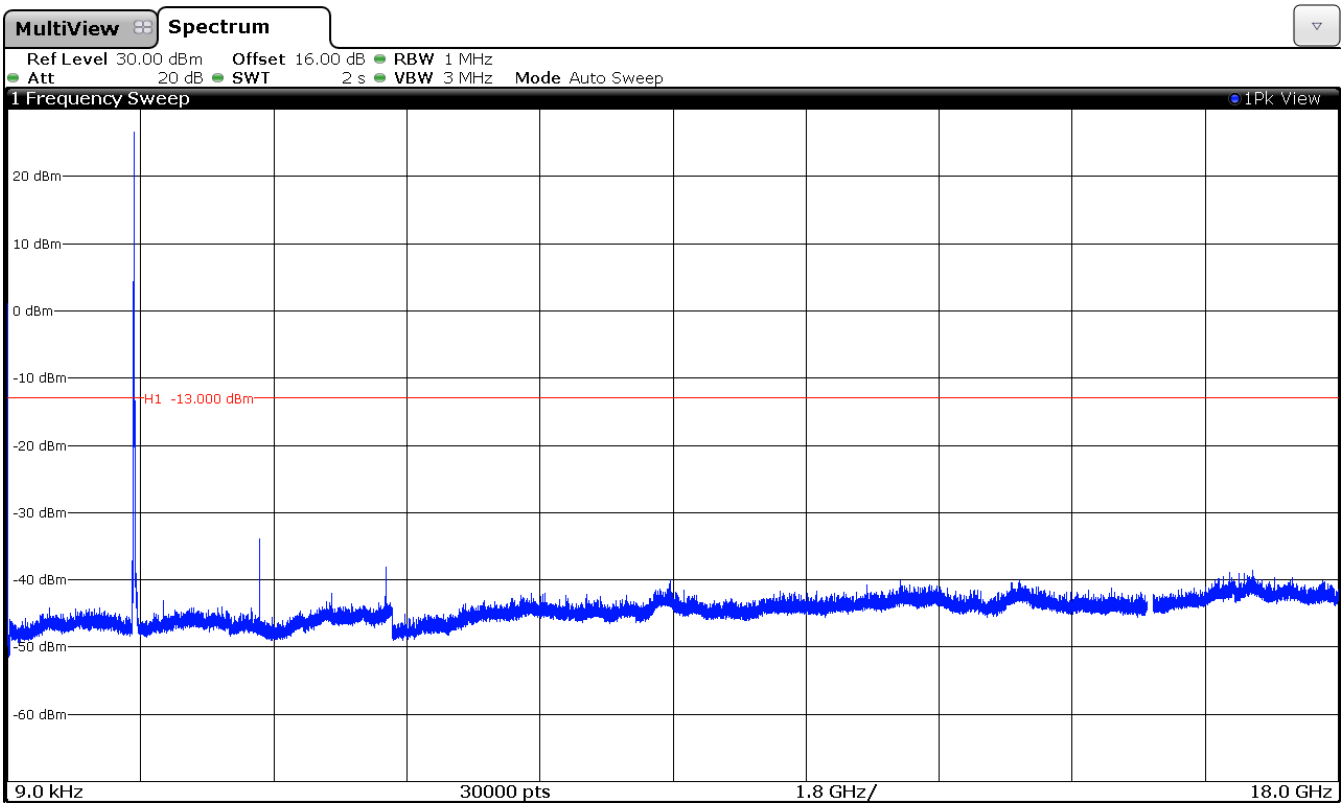
3. CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

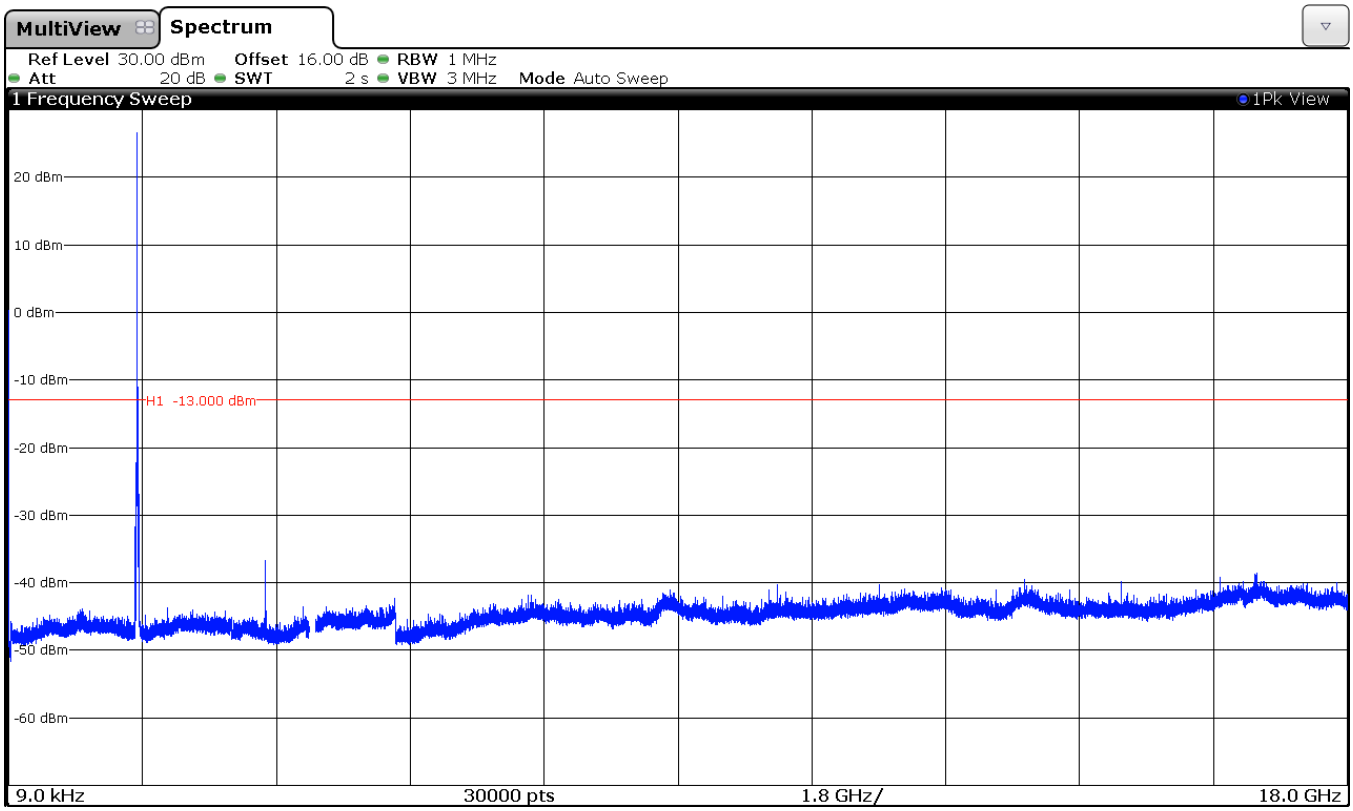
LTE QPSK MODULATION. BW = 10 MHz (Band IV)

1. CHANNEL: LOWEST



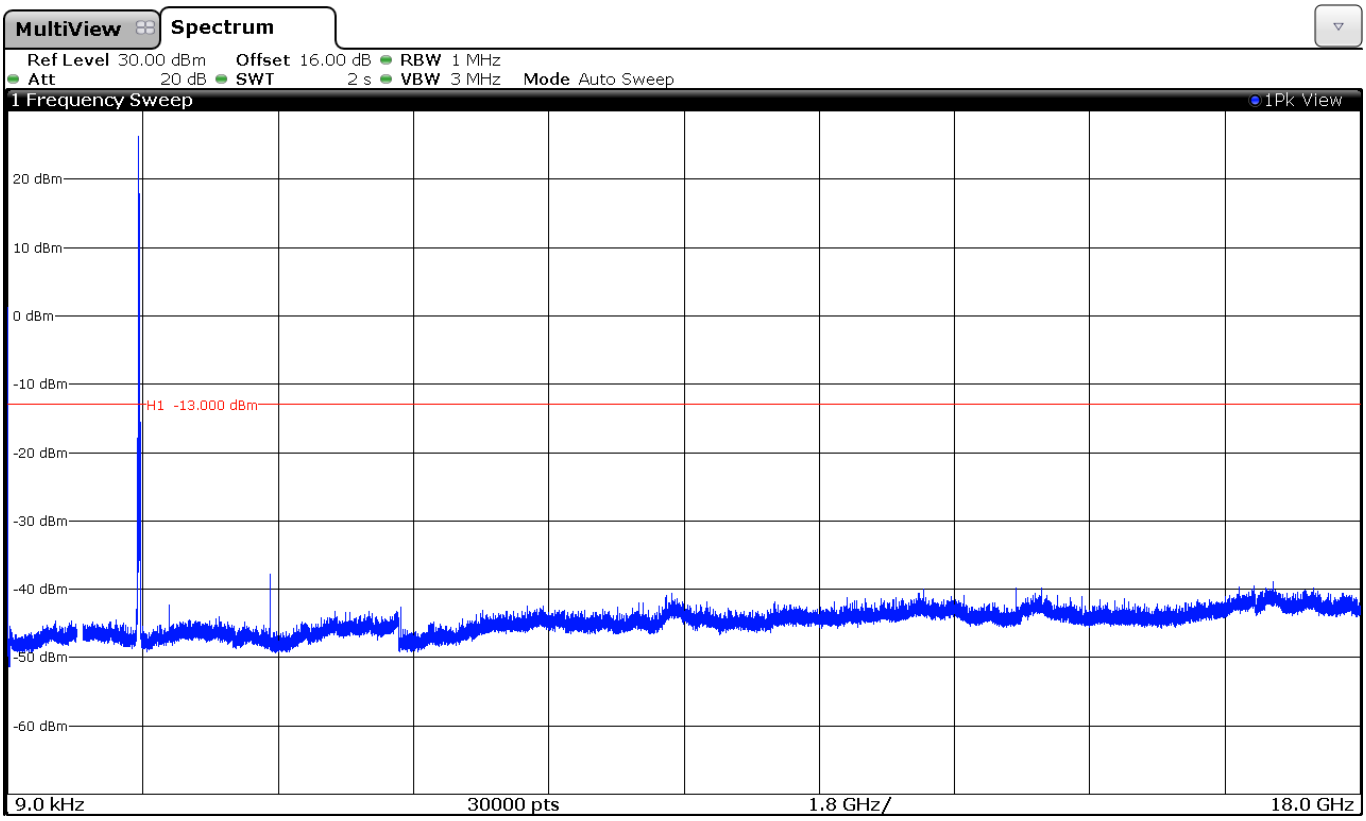
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

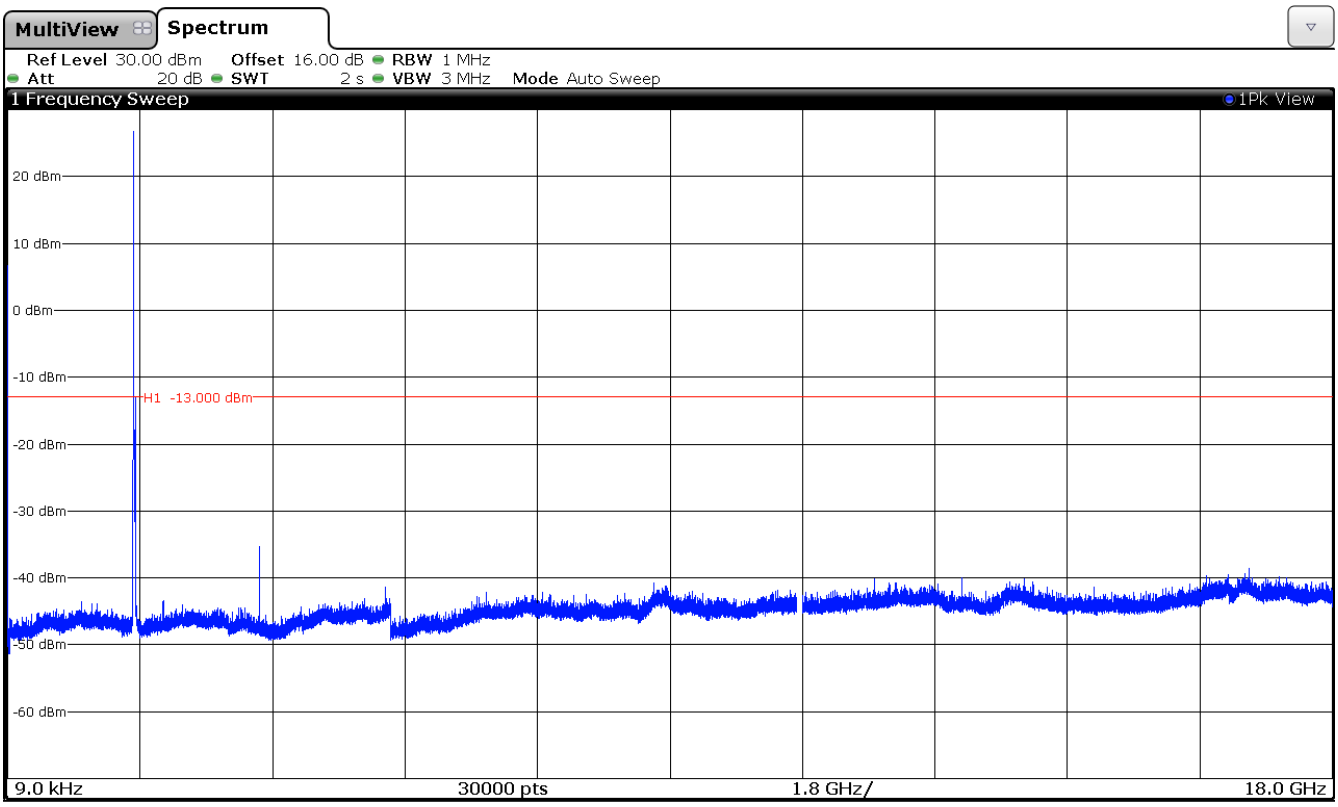
3. CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

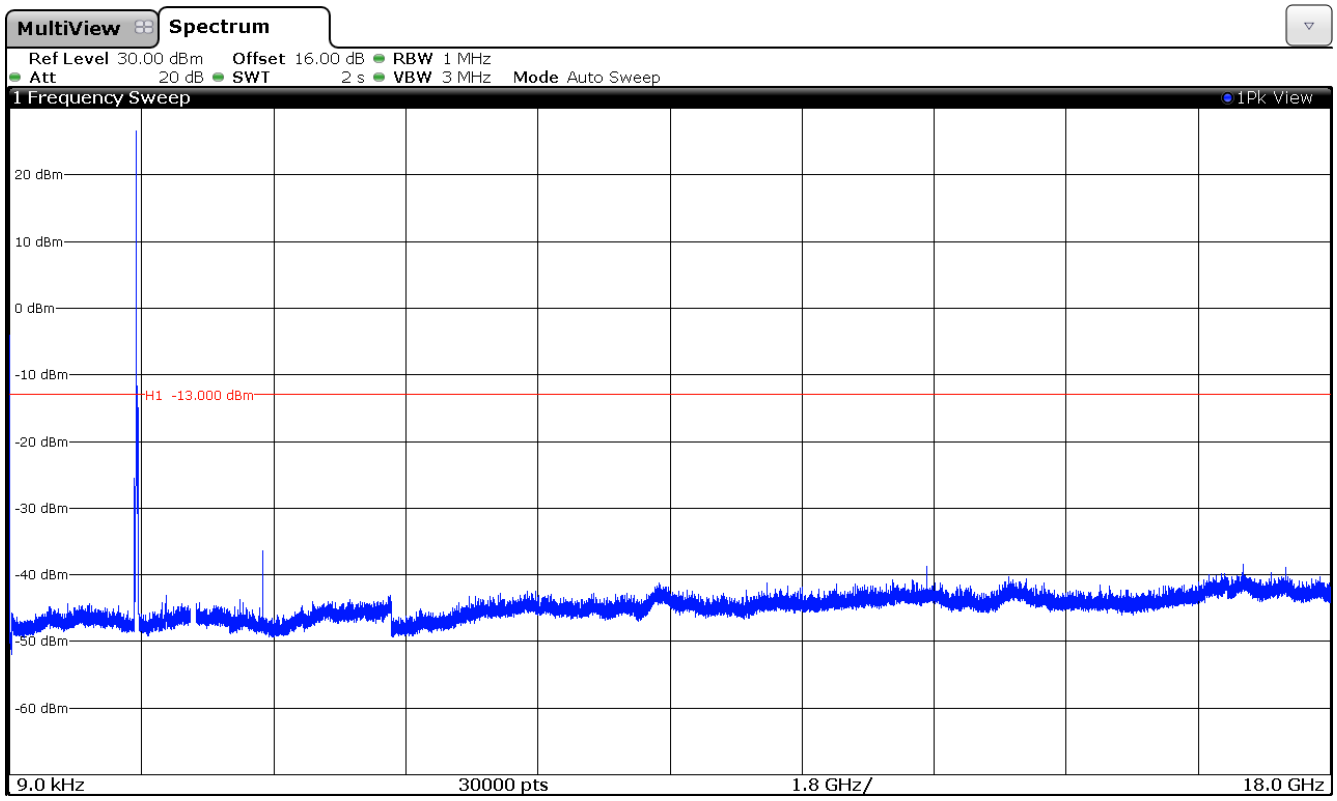
LTE QPSK MODULATION. BW = 15 MHz (Band IV)

1. CHANNEL: LOWEST



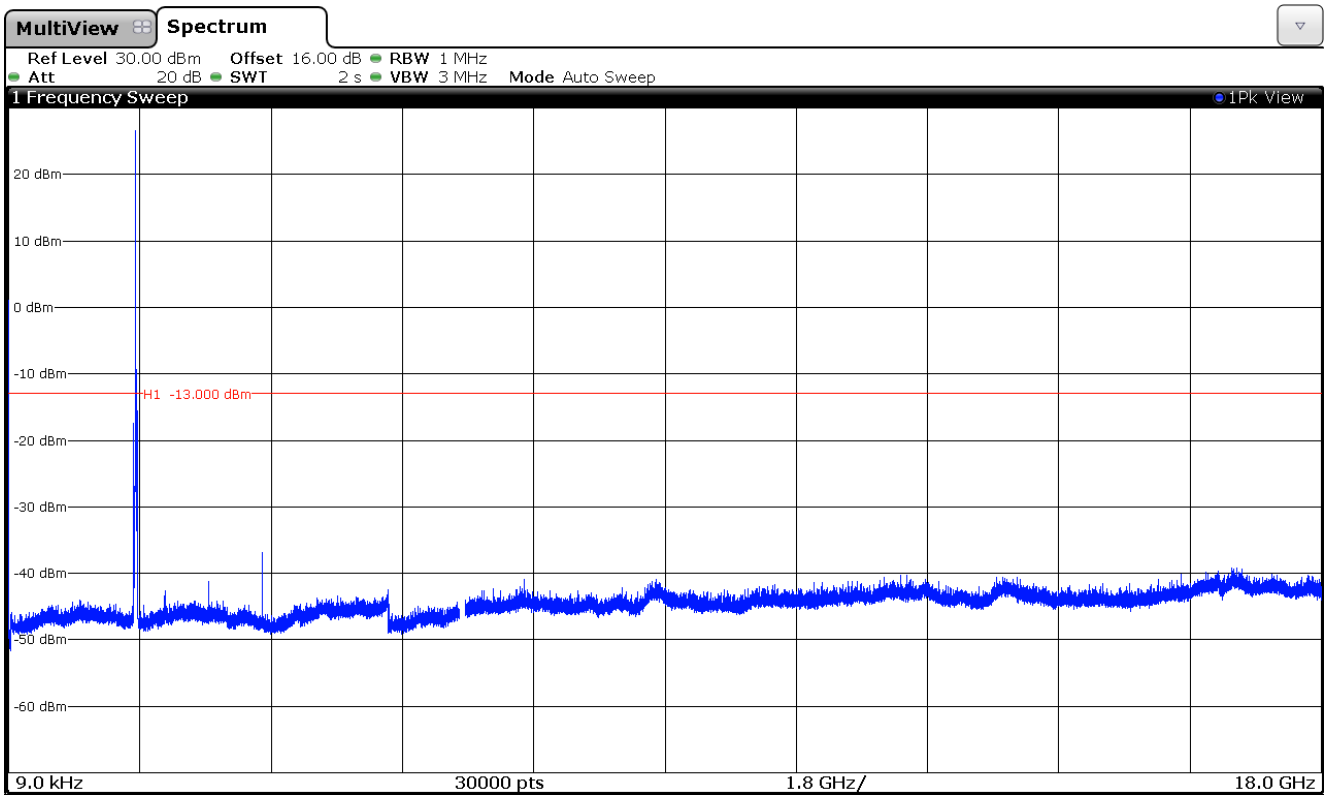
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

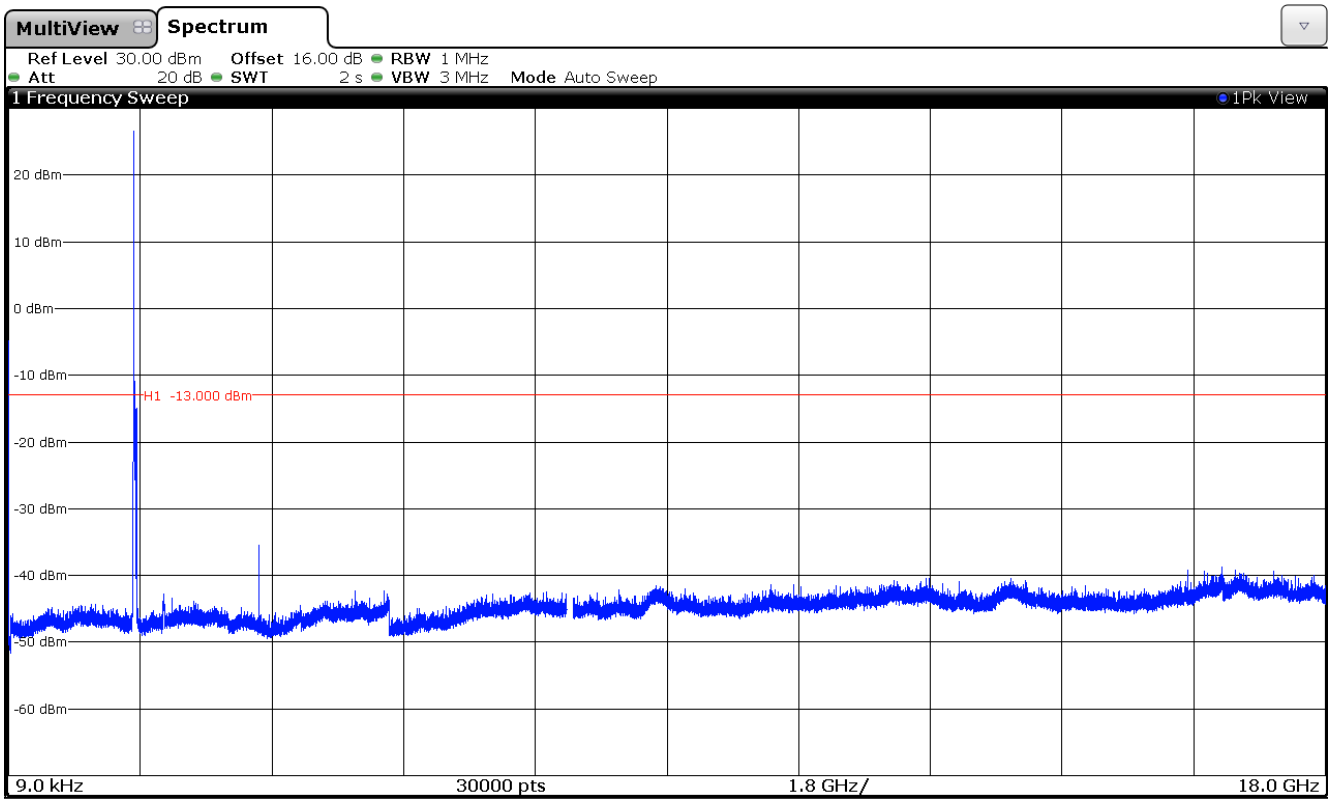
3. CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

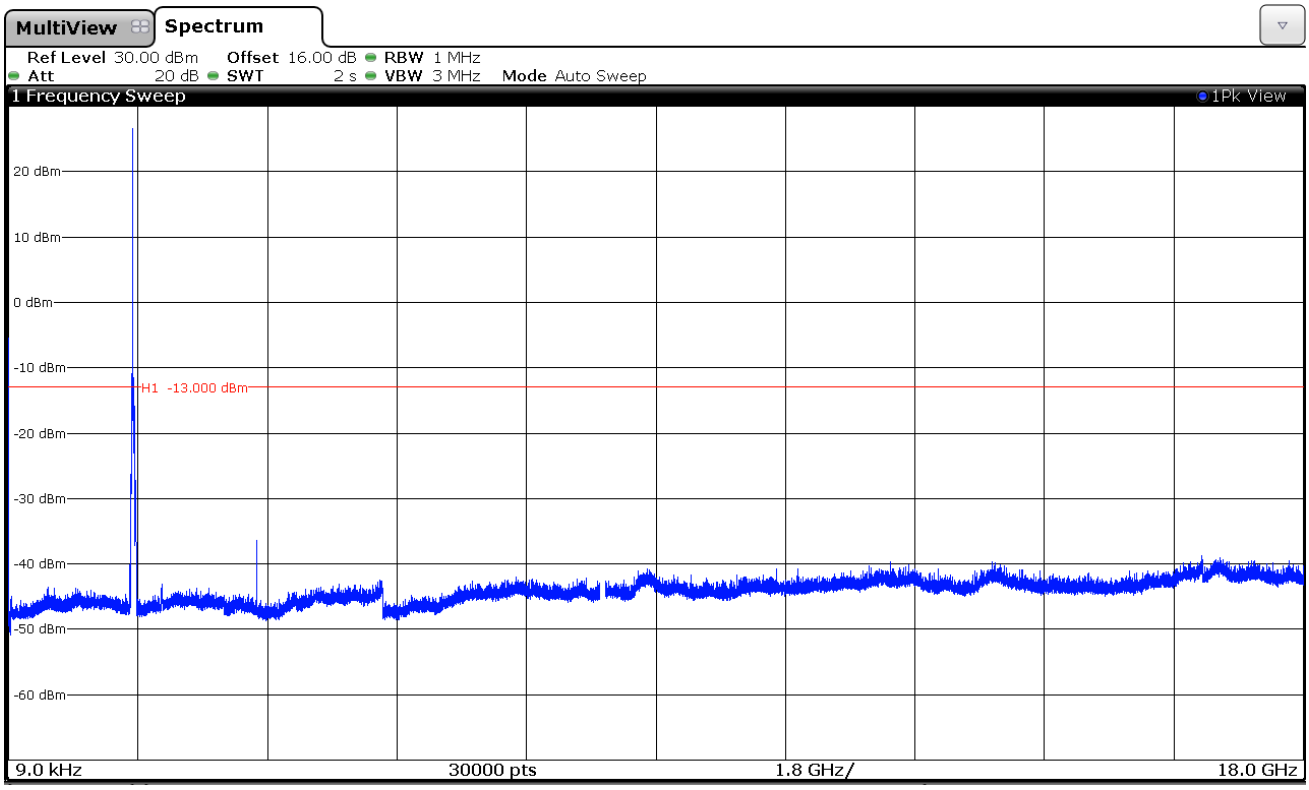
LTE QPSK MODULATION. BW = 20 MHz (Band IV)

1. CHANNEL: LOWEST



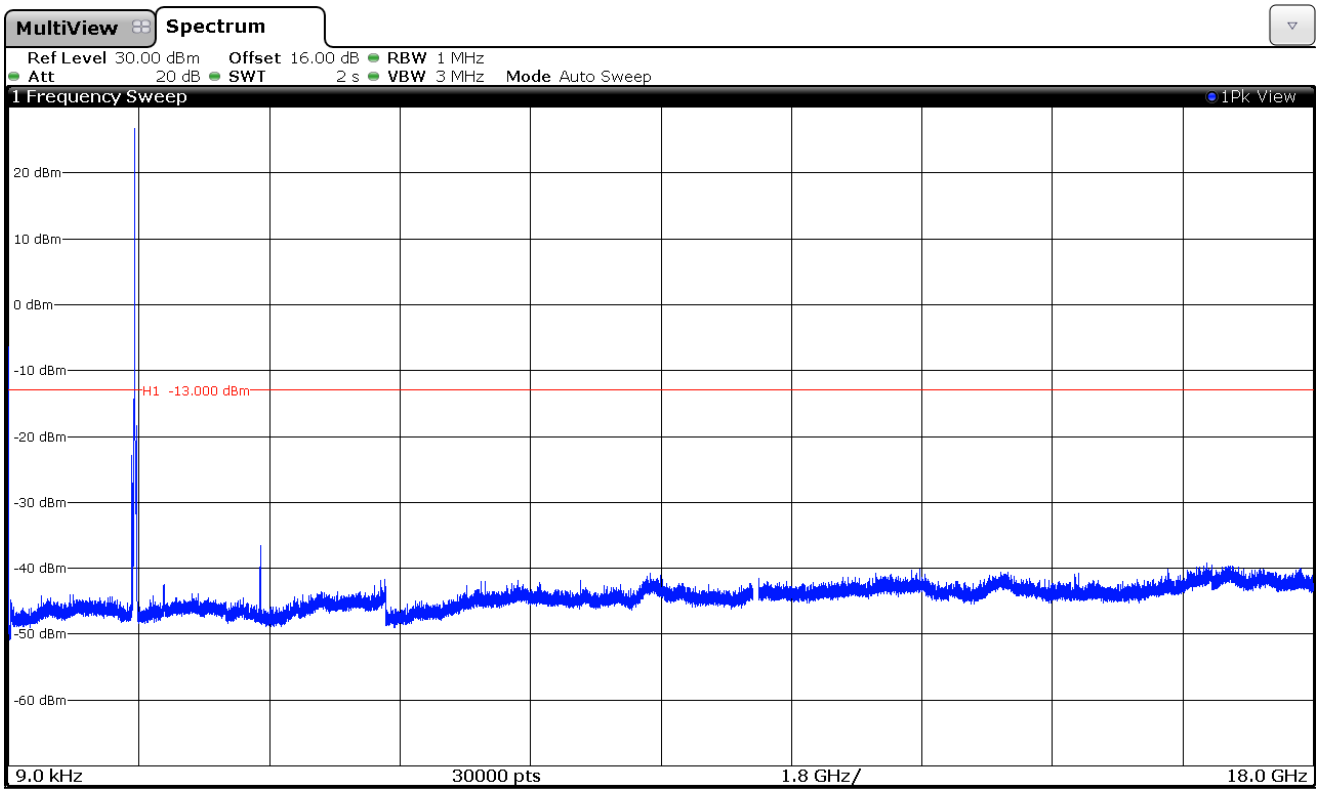
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

3. CHANNEL: HIGHEST

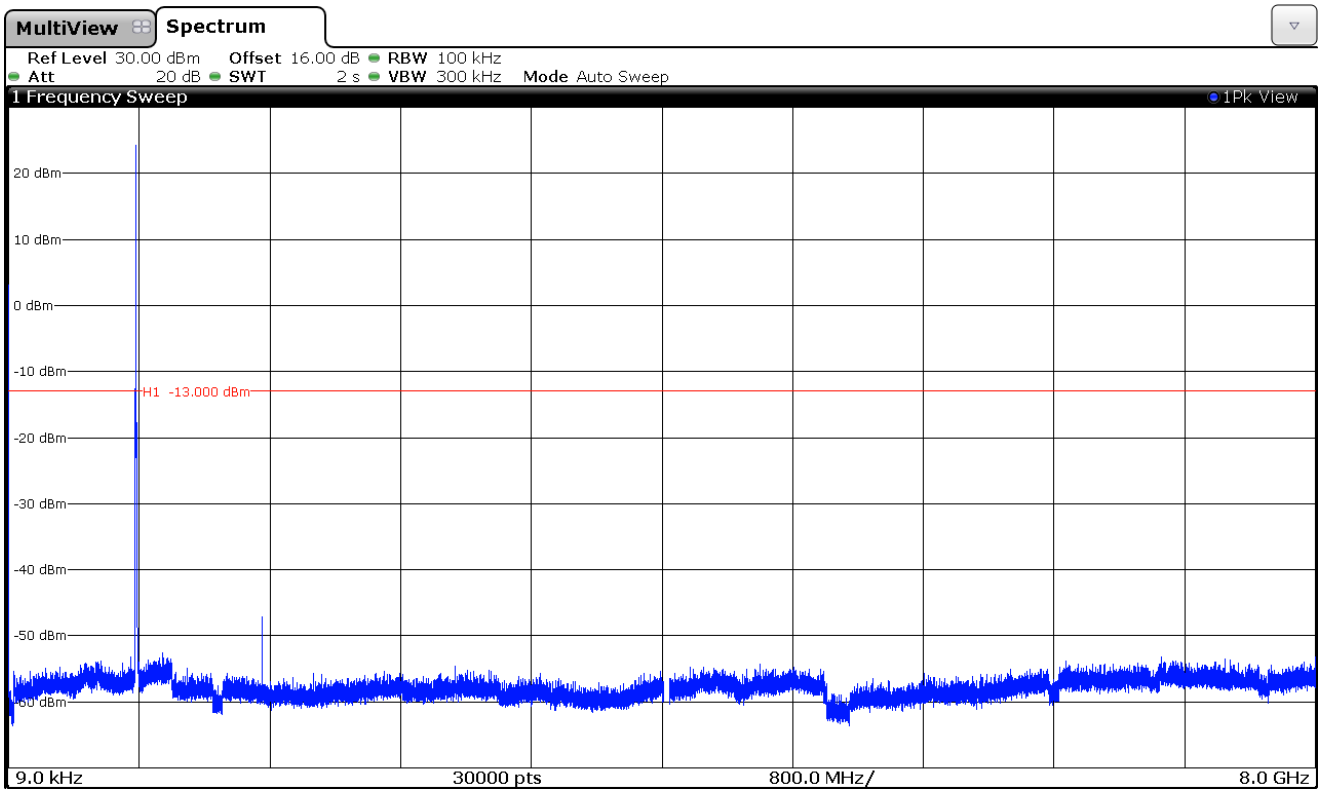


Note: The peak above the limit is the carrier frequency.

LTE QPSK MODULATION. BW = 5 MHz (Band XIII)

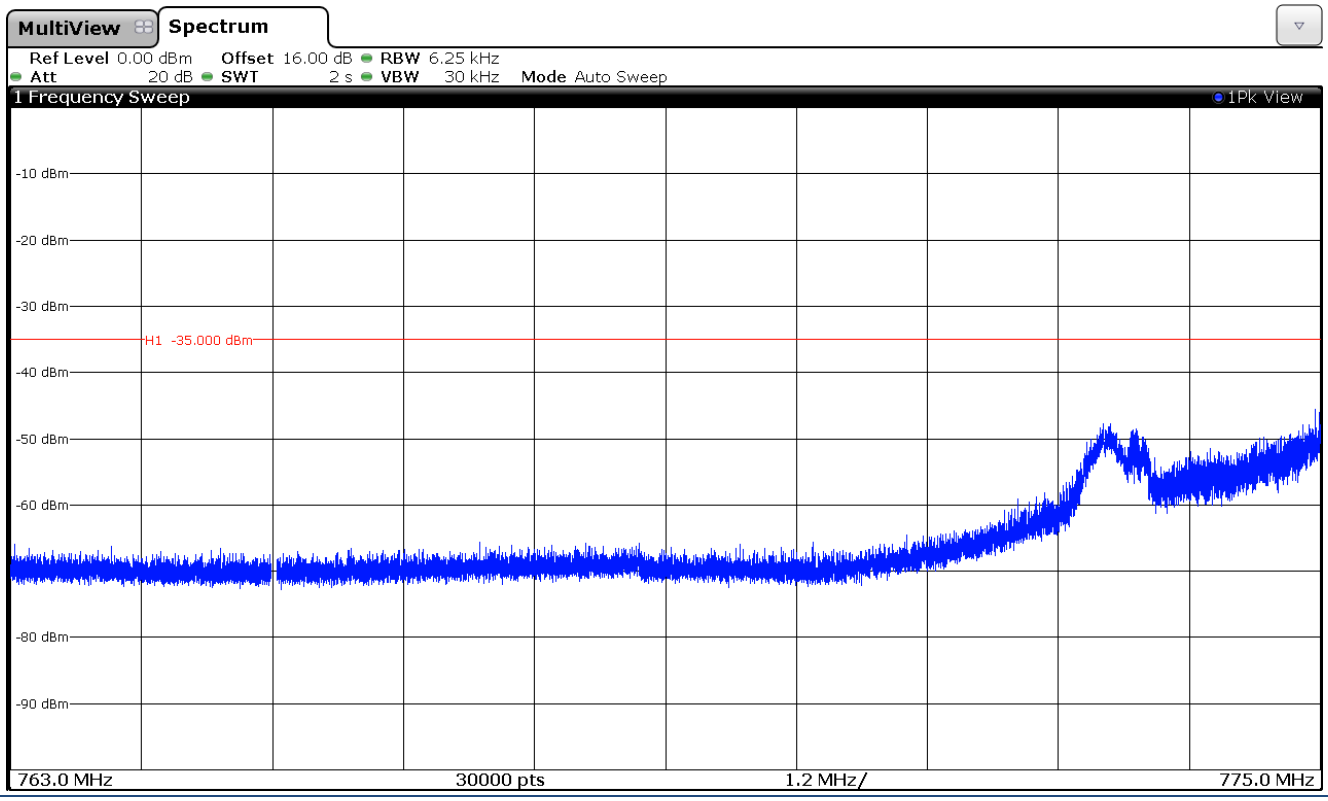
1. CHANNEL: LOWEST

Range 9 kHz – 8 GHz

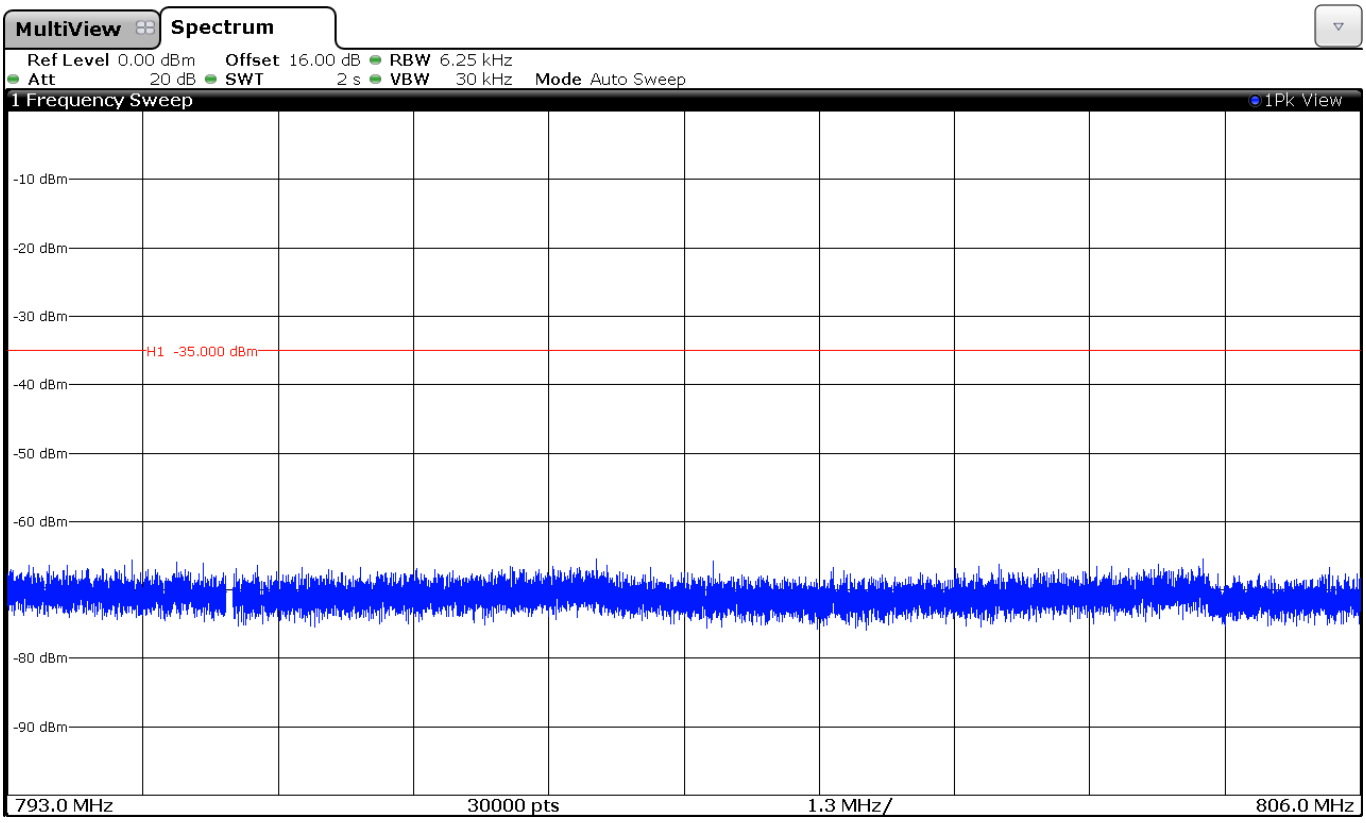


Note: The peak above the limit is the carrier frequency.

Range 763 MHz - 775 MHz

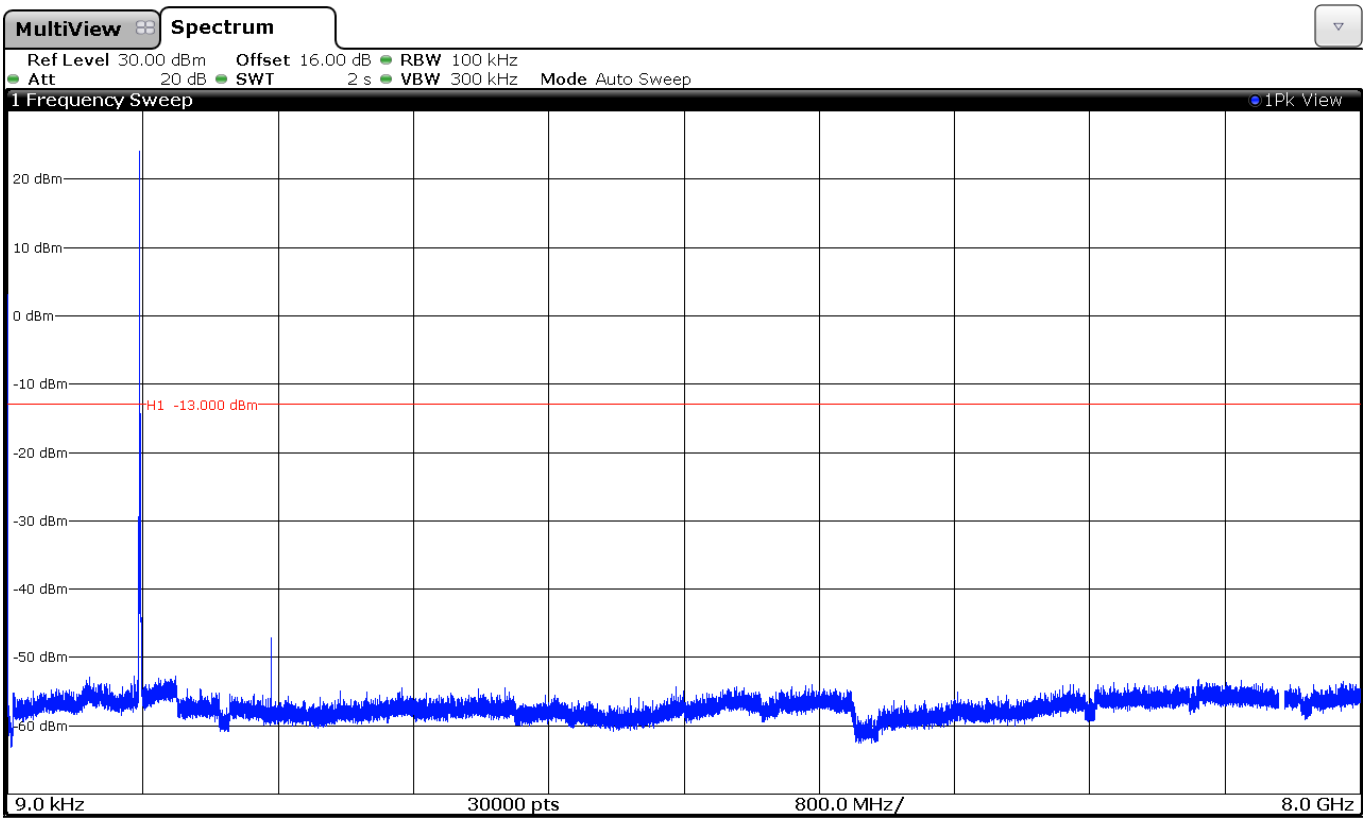


Range 793 MHz - 806 MHz



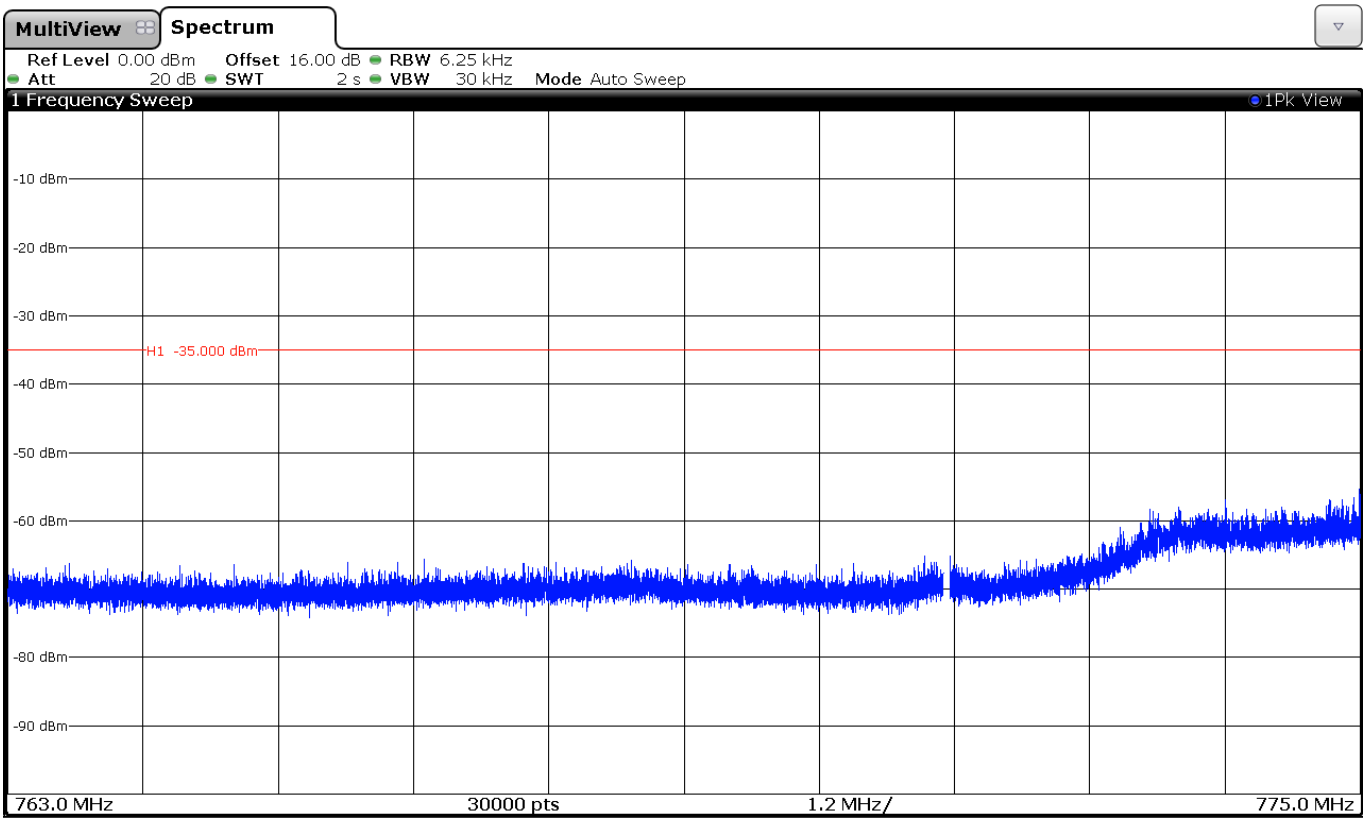
2. CHANNEL: MIDDLE

Range 9 kHz – 8 GHz

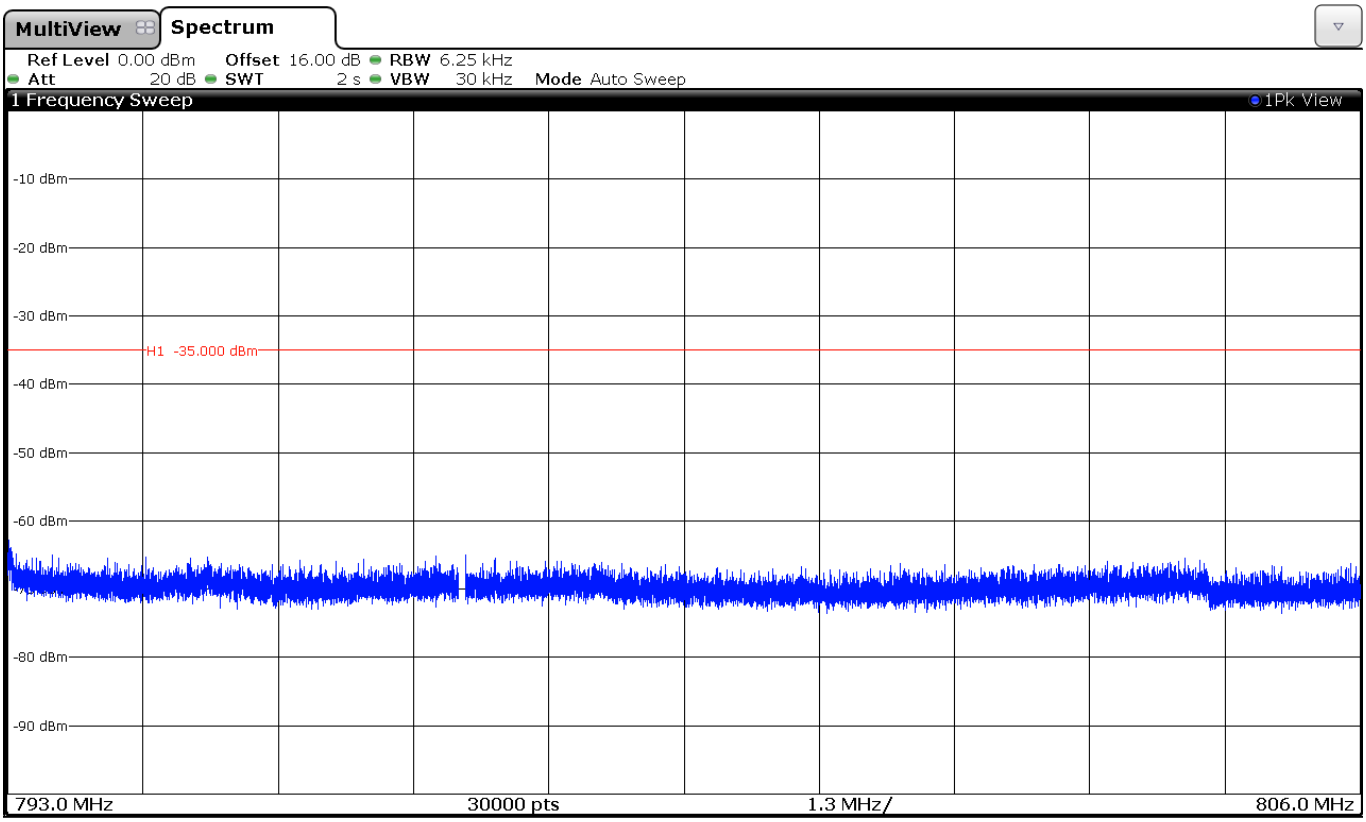


Note: The peak above the limit is the carrier frequency.

Range 763 MHz - 775 MHz

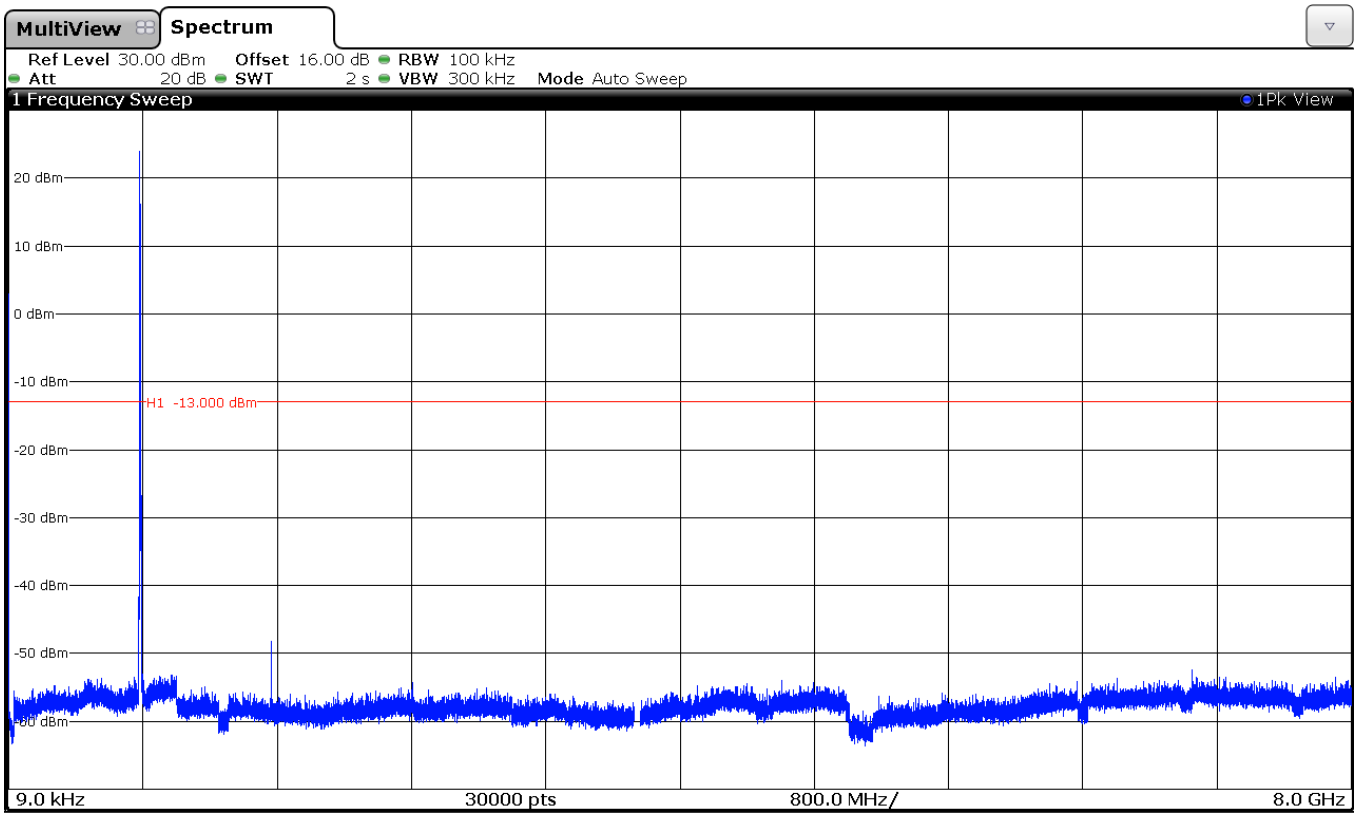


Range 793 MHz - 806 MHz



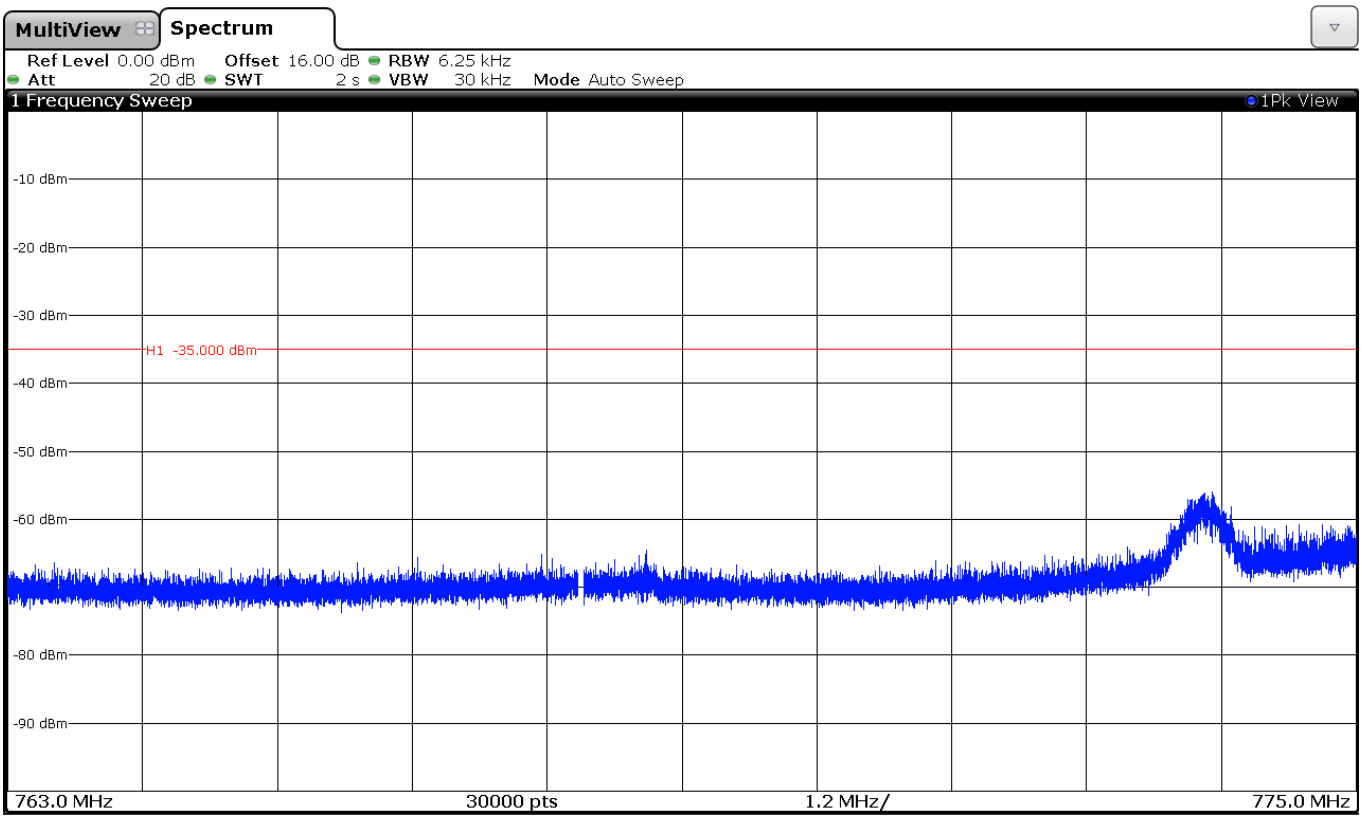
3. CHANNEL: HIGHEST

Range 9 kHz – 8 GHz

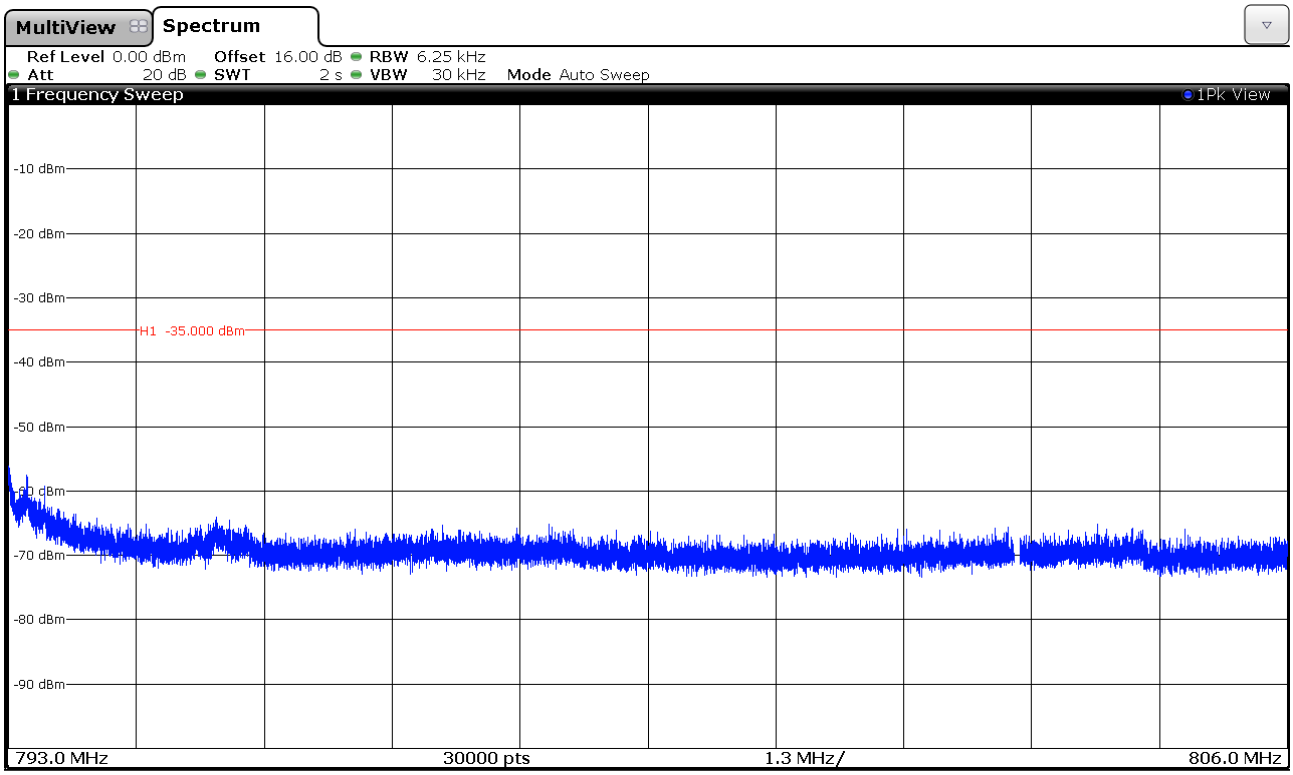


Note: The peak above the limit is the carrier frequency.

Range 763 MHz - 775 MHz



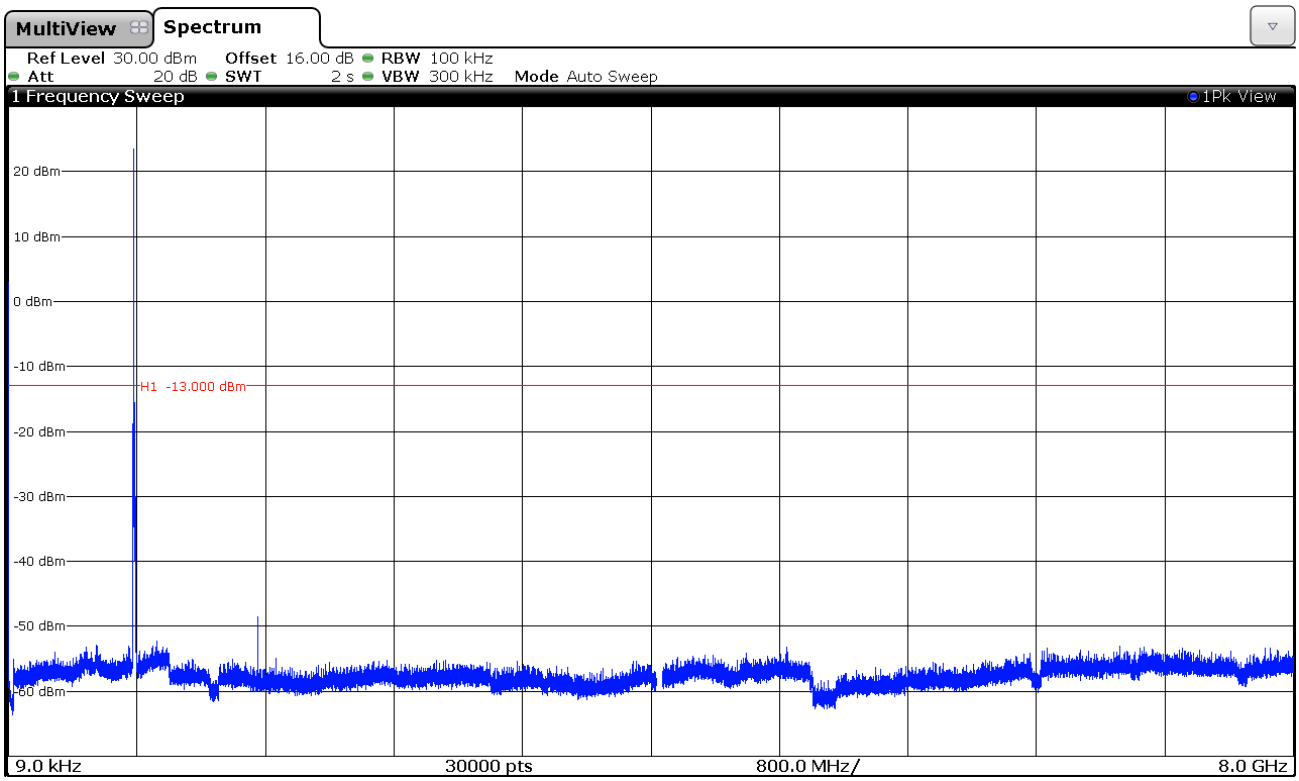
Range 793 MHz - 806 MHz



LTE QPSK MODULATION. BW = 10 MHz (Band XIII)

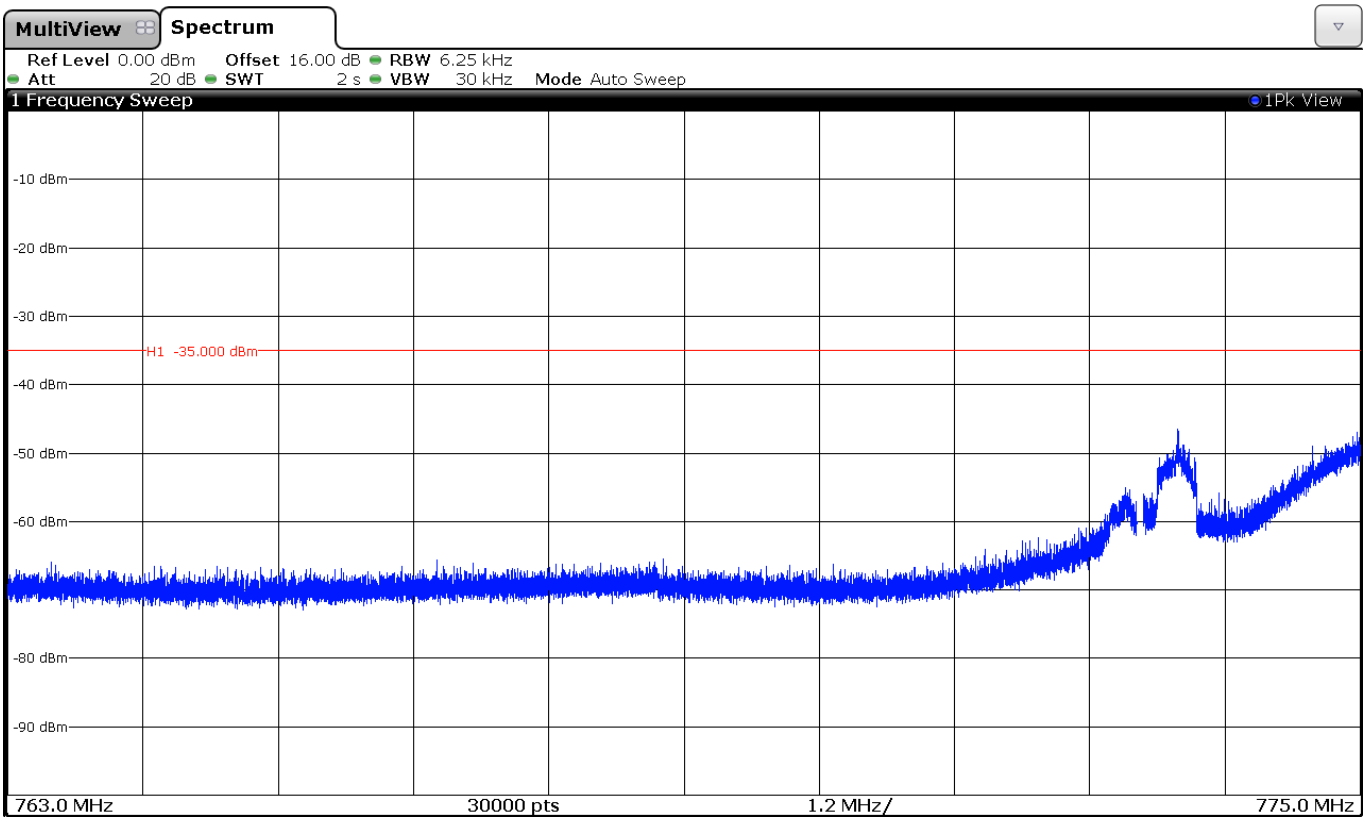
1. CHANNEL: MIDDLE

Range 9 kHz – 8 GHz

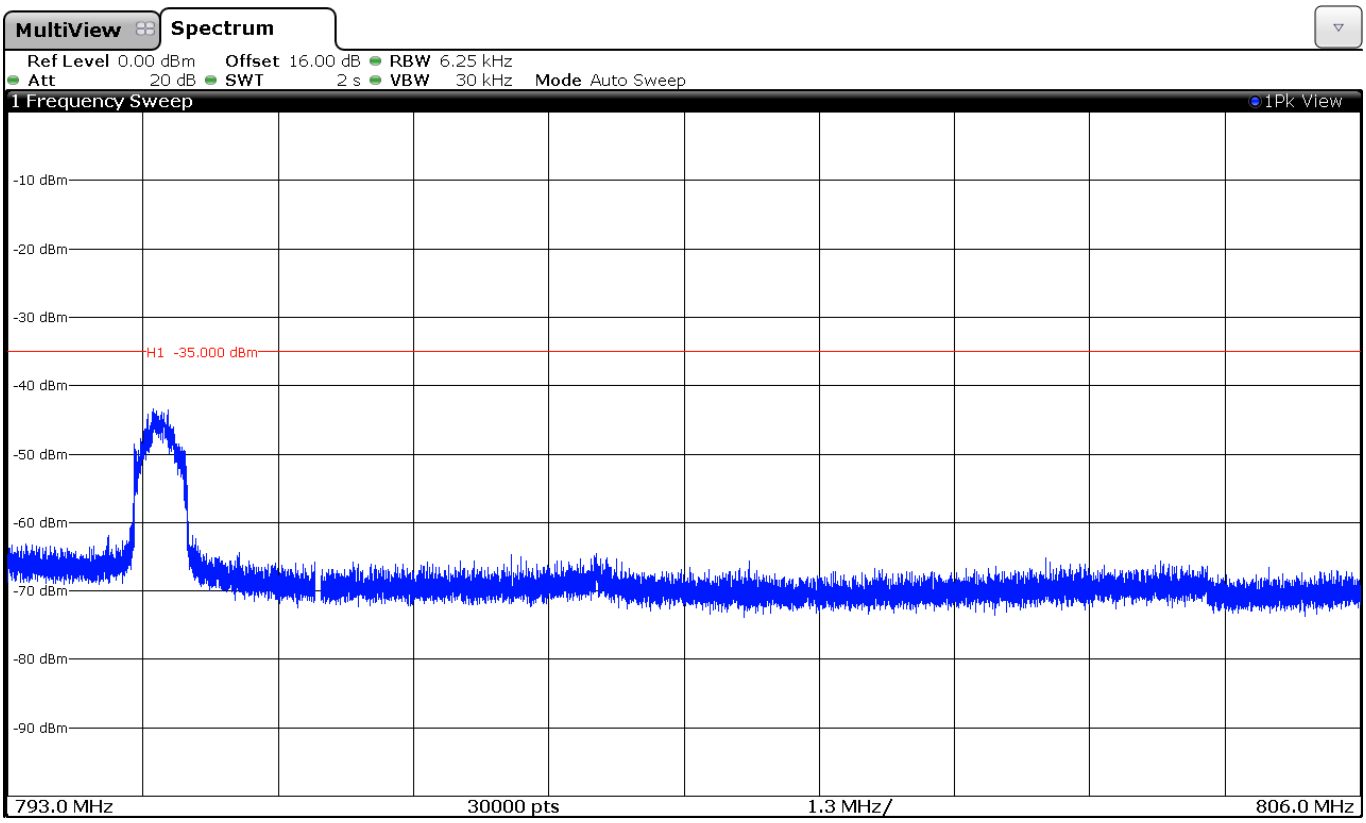


Note: The peak above the limit is the carrier frequency.

Range 763 MHz - 775 MHz



Range 793 MHz - 806 MHz



Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

FCC §2.1051 and §27.53(c) (h). RSS-139 Clause 6.6. RSS-130 Clause 4.6.

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.

At Po transmitting power, the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

METHOD

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

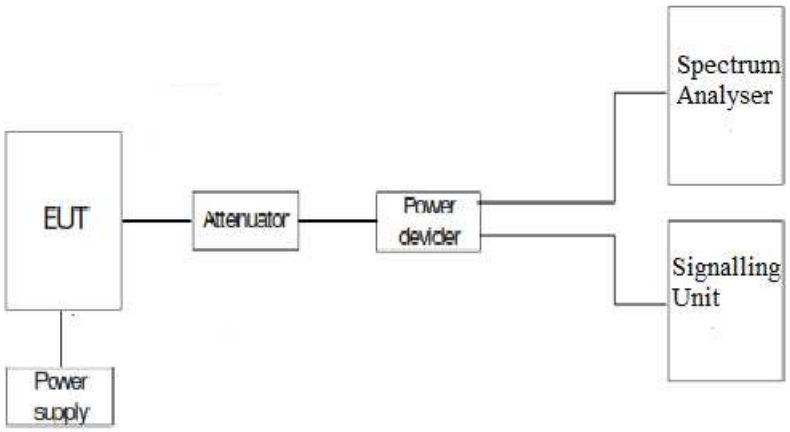
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

For LTE mode the configuration of modulation which is the worst case for conducted power was used.

For LTE Band IV, as indicated in FCC part 27.53 (h) (3)/RSS-139 Clause 6.6., in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block or band, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

For LTE Band XIII, as indicated in FCC part 27.53 (c) (5) /RSS-130 Clause 4.6., in the 100 kHz bands immediately outside and adjacent to the licensee's frequency block or band, a resolution bandwidth of 30 kHz may be employed.

TEST SETUP



RESULTS (see plots in next pages)

LTE QPSK MODULATION (Channels in Band IV):	RB=1, Offset=0, BW=1.4 MHz	RB=1 , Offset =0, BW = 3 MHz	RB=1 , Offset =0, BW = 5 MHz	RB=1 , Offset =0, BW = 10 MHz	RB=1 , Offset =0, BW = 15 MHz	RB=1 , Offset =0, BW = 20 MHz
Maximum measured level at lowest Block Edge at antenna port (dBm)	-19.26	-15.84	-14.67	-13.23	-14.95	-17.39

LTE QPSK MODULATION: (Channels in Band IV):	RB= All, Offset=0, BW=1.4 MHz	RB= All, Offset =0, BW = 3 MHz	RB= All, Offset =0, BW = 5 MHz	RB= All, Offset =0, BW = 10 MHz	RB= All, Offset =0, BW = 15 MHz	RB= All, Offset =0, BW = 20 MHz
Maximum measured level at lowest Block Edge at antenna port (dBm)	-24.43	-25.00	-25.64	-26.56	-28.07	-29.44

LTE QPSK MODULATION: (Channels in Band IV):	RB= 1, Offset=Max, BW=1.4 MHz	RB= 1, Offset=Max, BW = 3 MHz	RB= 1, Offset=Max, BW = 5 MHz	RB= 1, Offset=Max, BW = 10 MHz	RB= 1, Offset=Max, BW = 15 MHz	RB= 1, Offset=Max, BW = 20 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-18.57	-15.09	-14.00	-13.34	-15.32	-16.33

LTE QPSK MODULATION: (Channels in Band IV):	RB= All, Offset=0, BW=1.4 MHz	RB= All, Offset =0, BW = 3 MHz	RB= All, Offset =0, BW = 5 MHz	RB= All, Offset =0, BW = 10 MHz	RB= All, Offset =0, BW = 15 MHz	RB= All, Offset =0, BW = 20 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-23.28	-23.32	-23.84	-23.96	-24.93	-26.07

LTE QPSK MODULATION (Channels in Band XIII):	RB=1 , Offset =0, BW = 5 MHz	RB=1 , Offset =0, BW = 10 MHz
Maximum measured level at lowest Block Edge at antenna port (dBm)	-14.49	-15.99

LTE QPSK MODULATION: (Channels in Band XIII):	RB= All, Offset =0, BW = 5 MHz	RB= All, Offset =0, BW = 10 MHz
Maximum measured level at lowest Block Edge at antenna port (dBm)	-25.61	-28.70

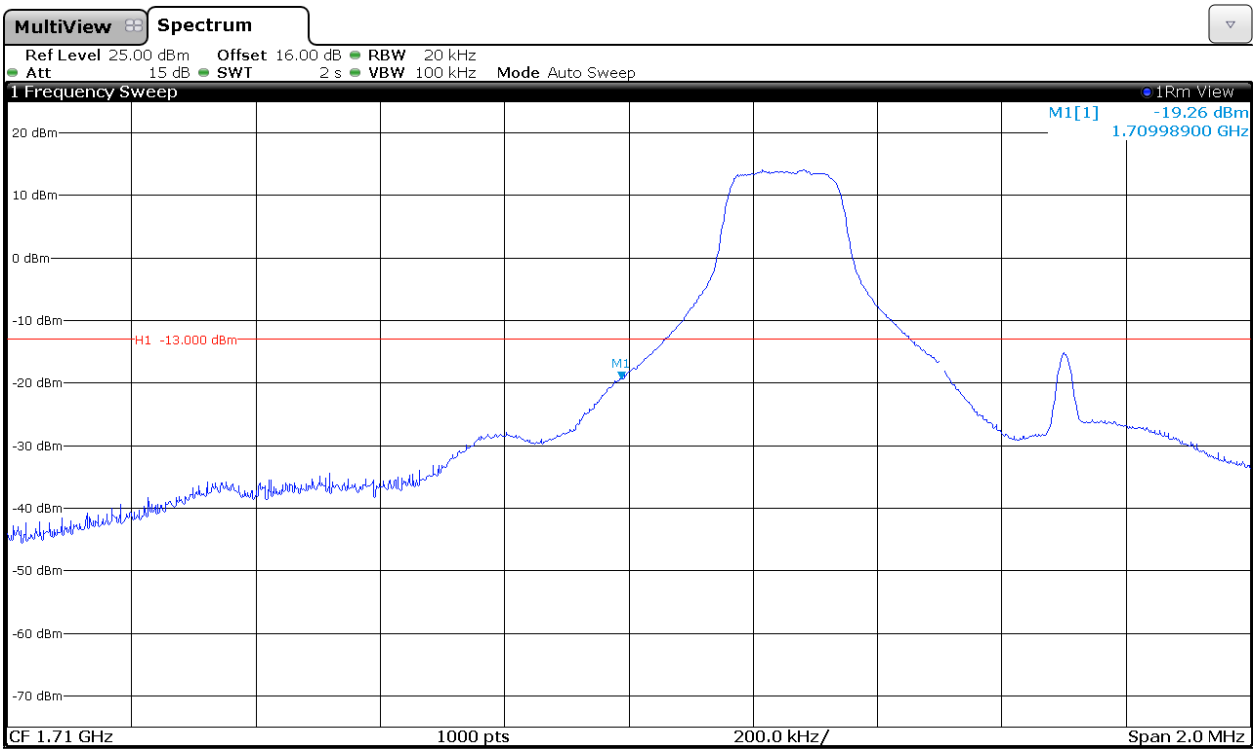
LTE QPSK MODULATION: (Channels in Band XIII):	RB= 1, Offset=Max, BW = 5 MHz	RB= 1, Offset=Max, BW = 10 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-14.60	-16.35

LTE QPSK MODULATION: (Channels in Band XIII):	RB= All, Offset =0, BW = 5 MHz	RB= All, Offset =0, BW = 10 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-24.49	-28.43

Measurement uncertainty = <±1.20 dB.

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 1.4 MHz (Band IV)

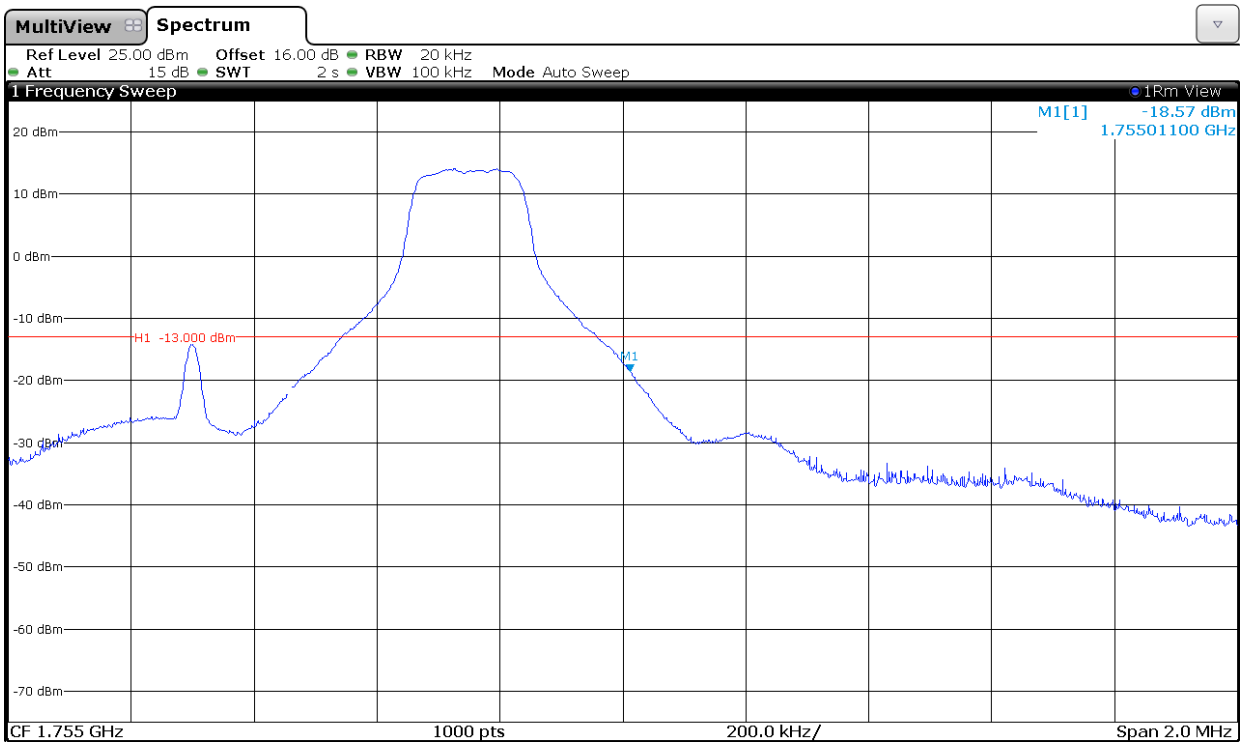
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 1.4 MHz (Band IV)

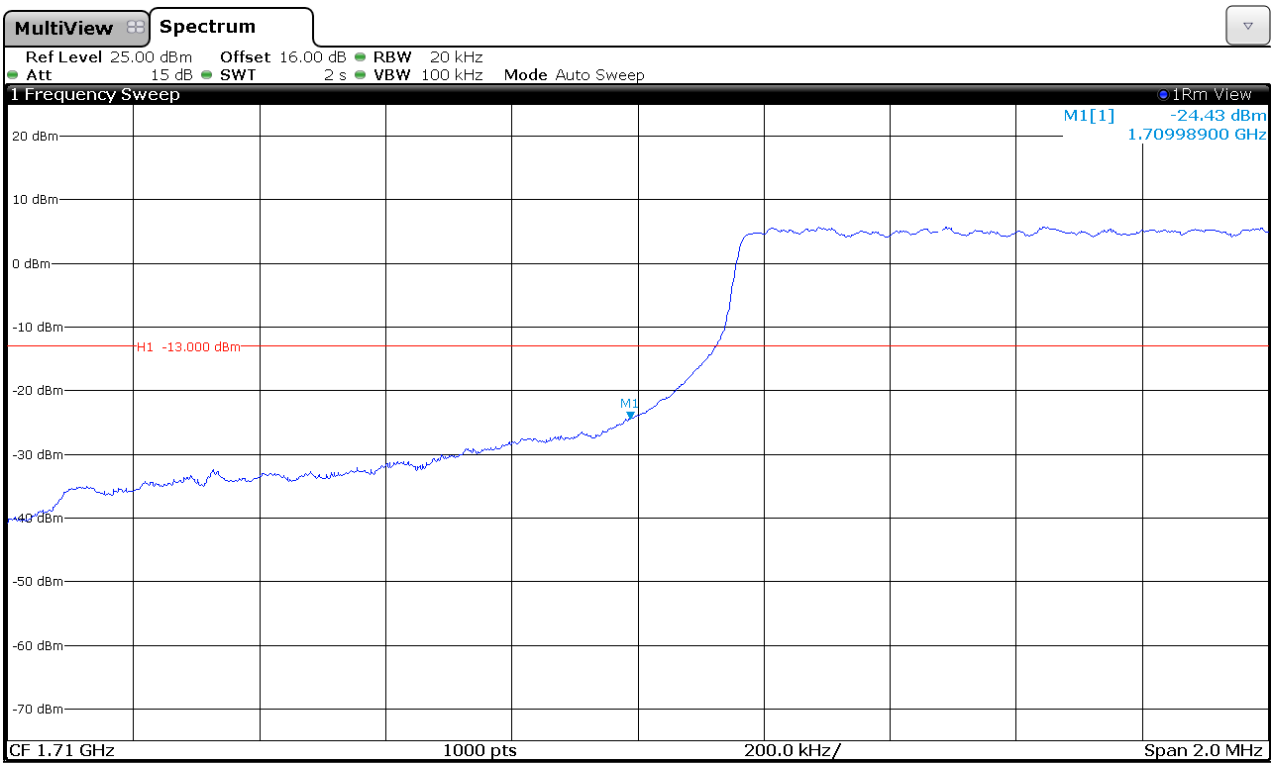
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

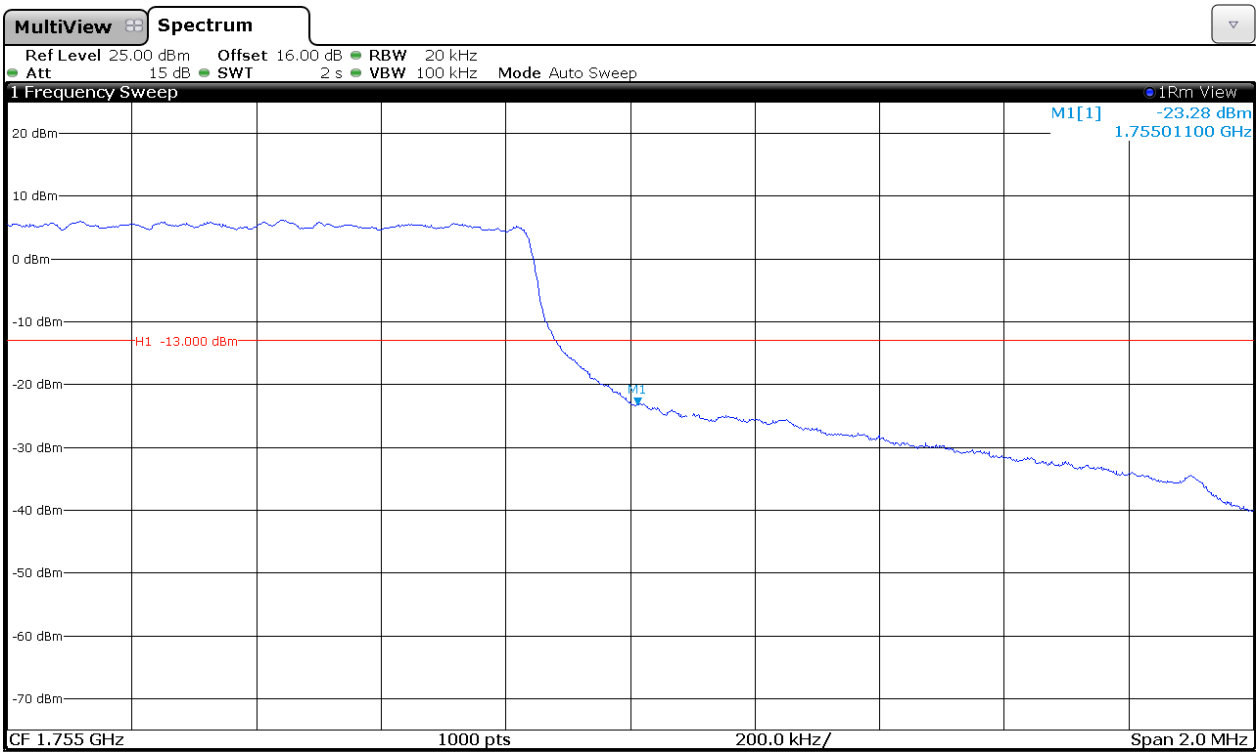
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 1.4 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

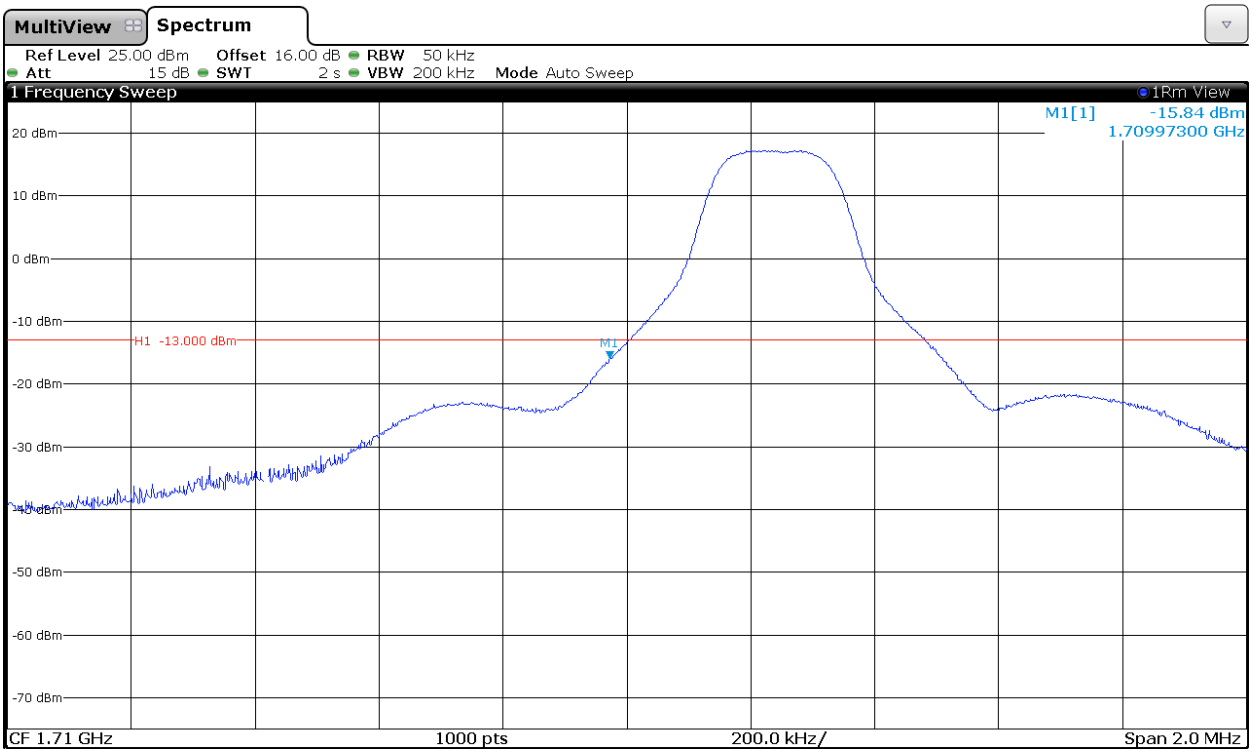


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 3 MHz (Band IV)

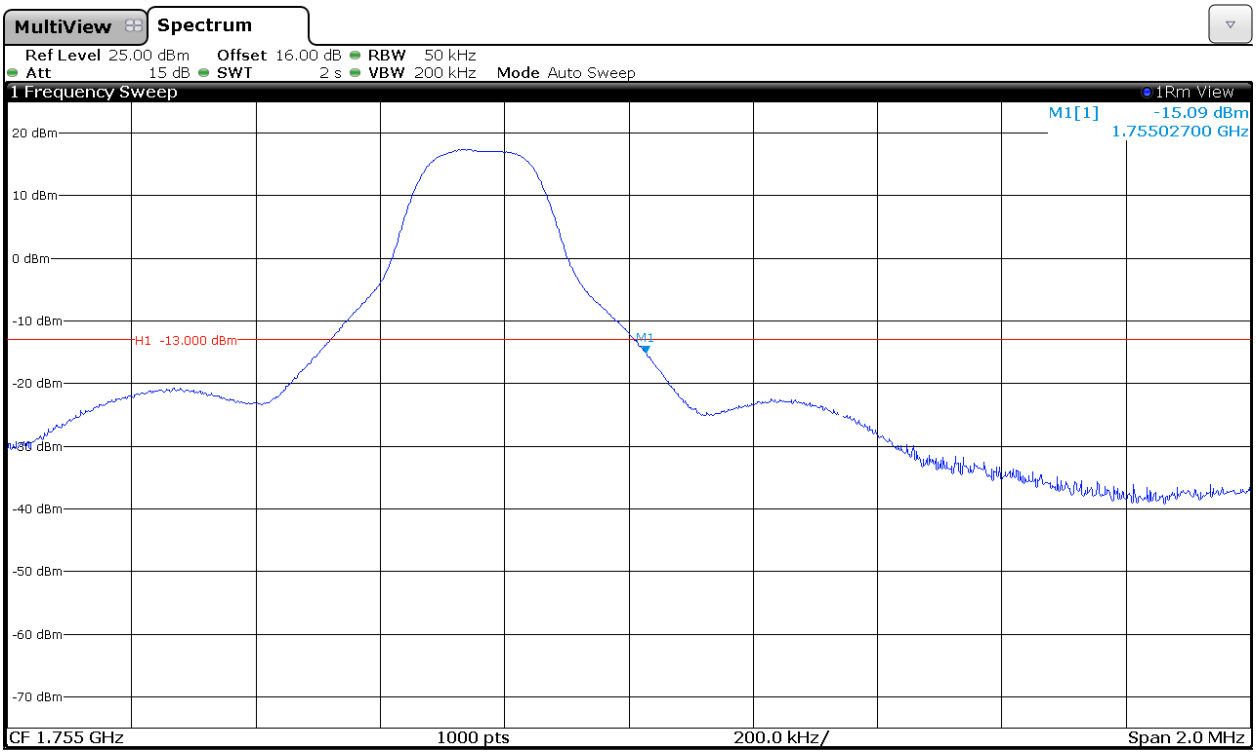
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 3 MHz (Band IV)

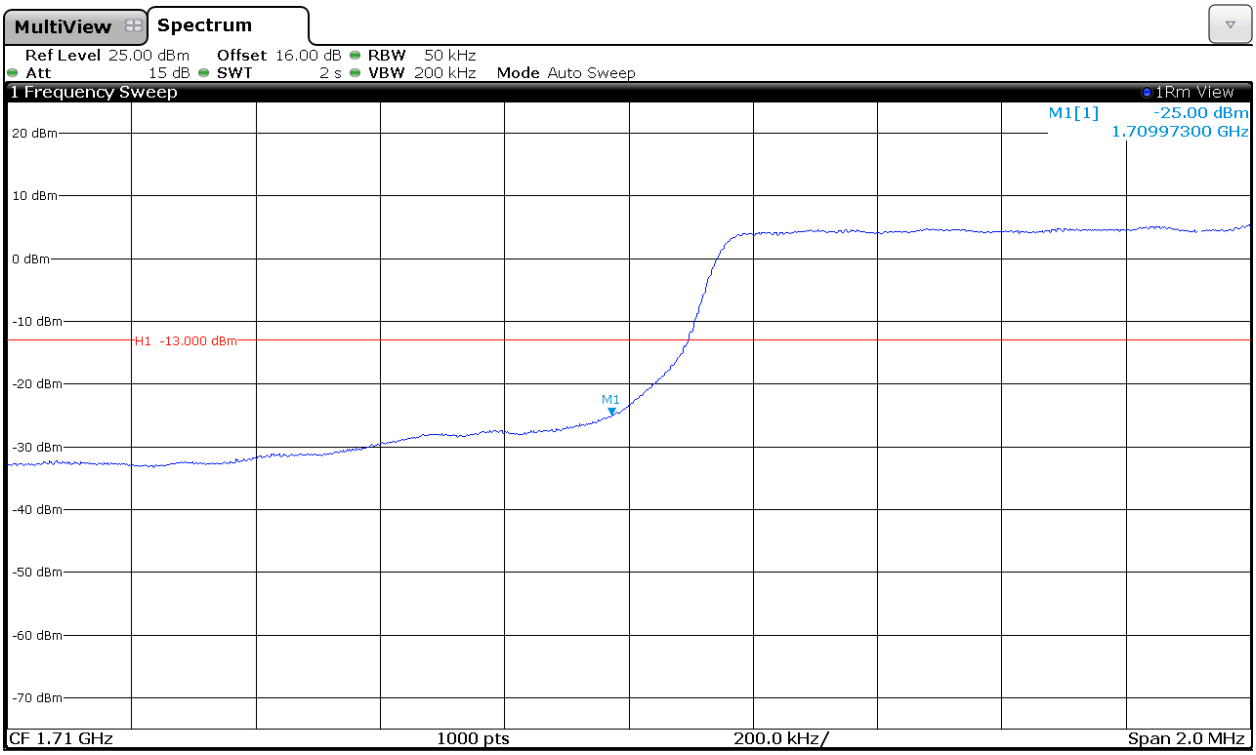
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

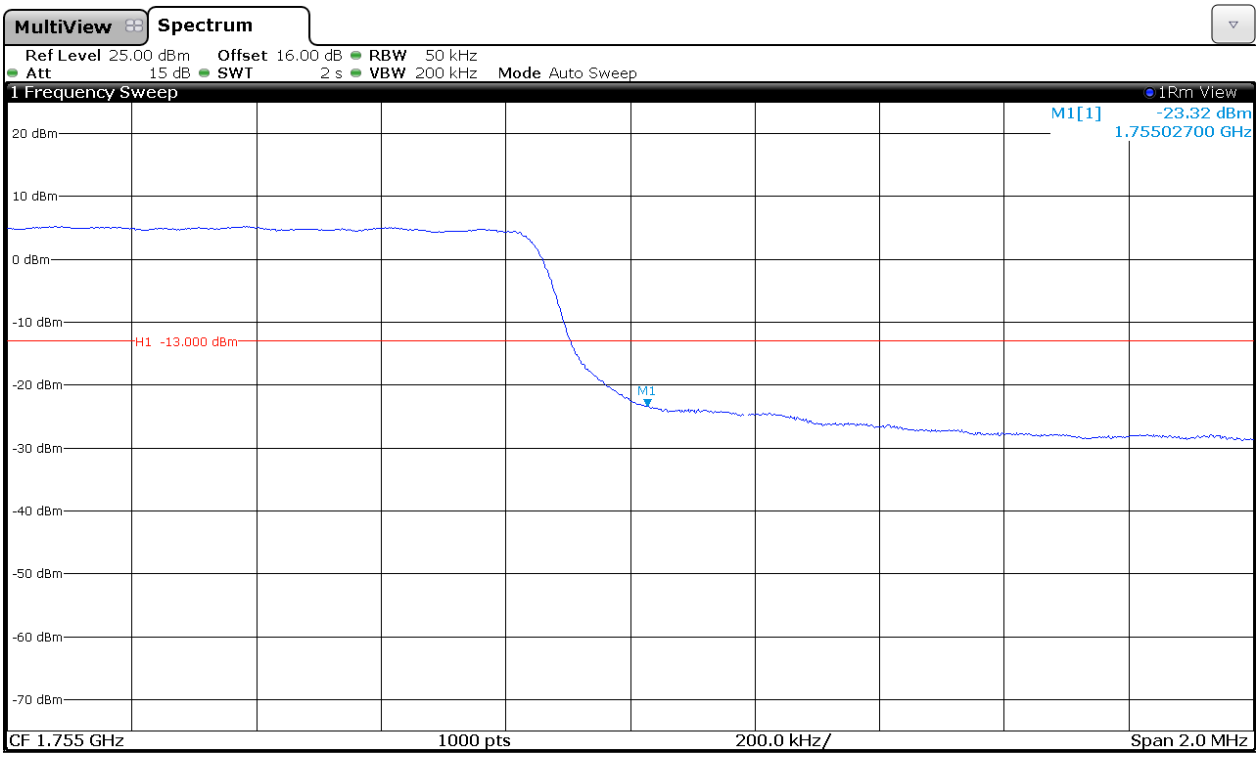
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 3 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

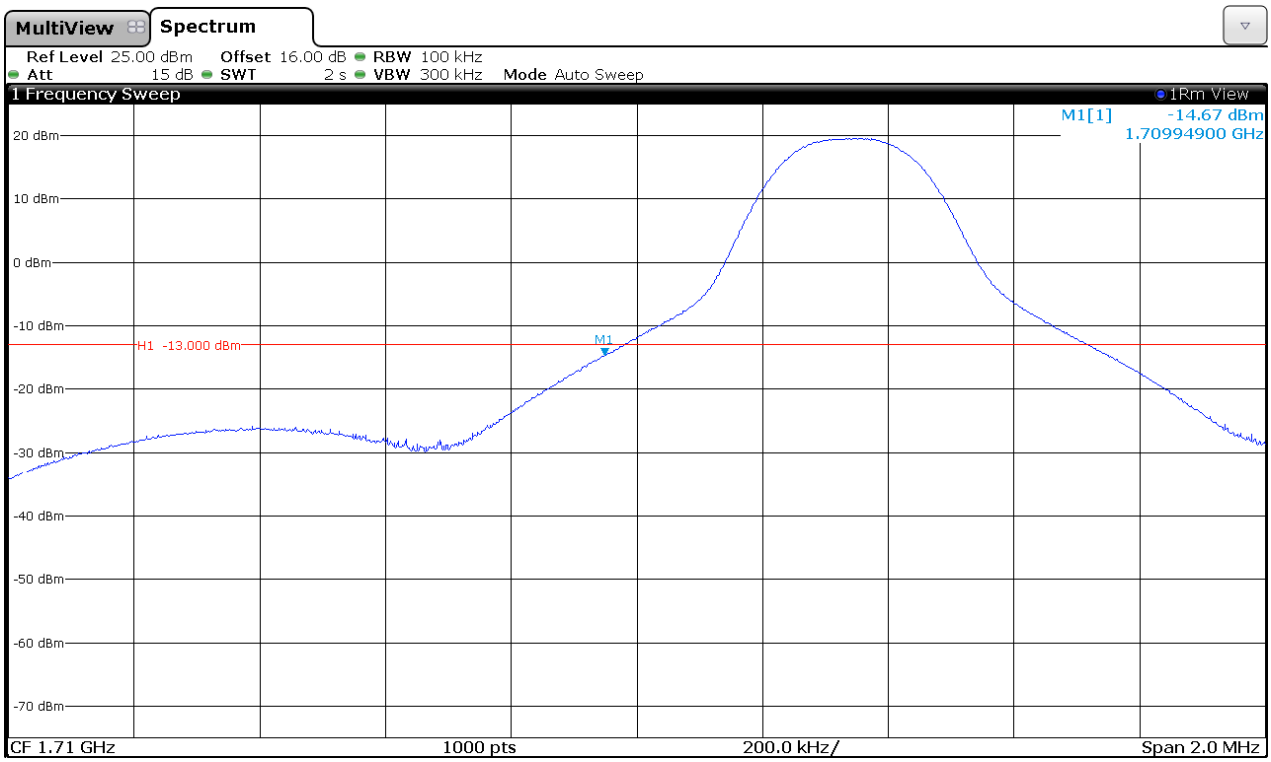


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 5 MHz (Band IV)

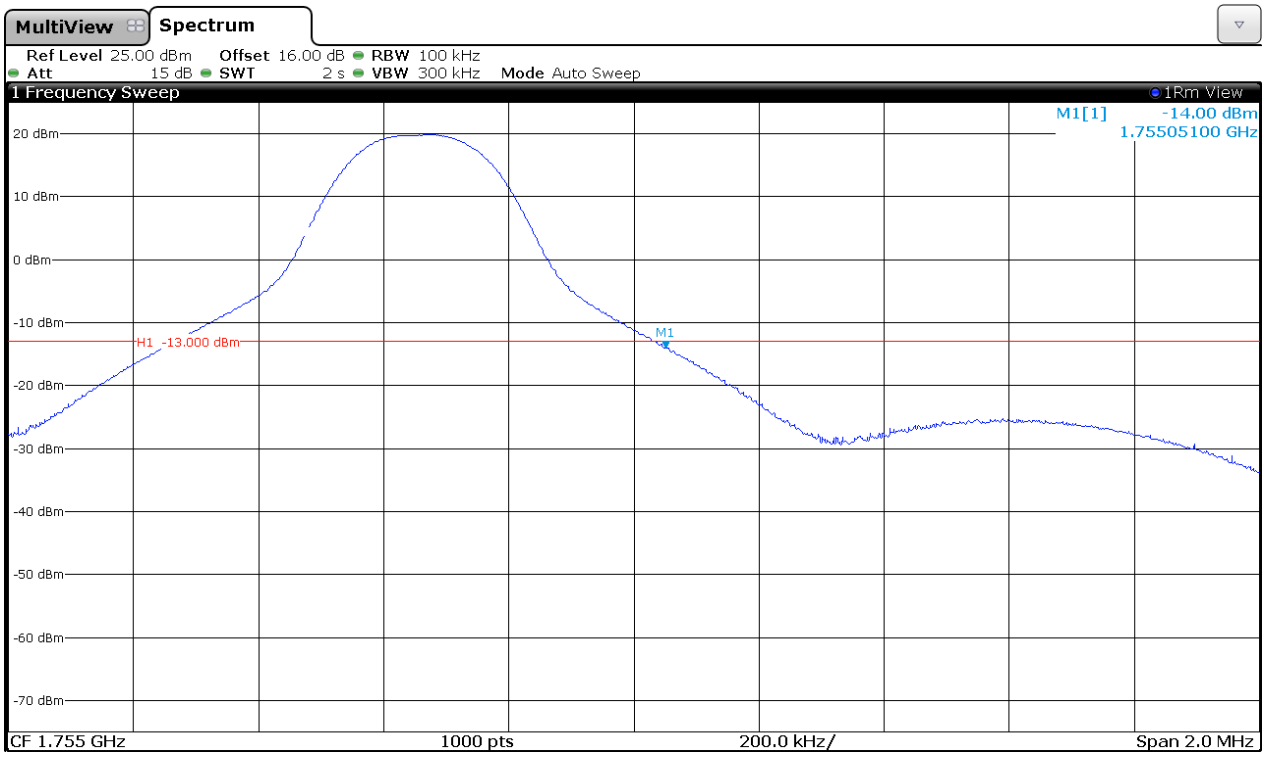
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 5 MHz (Band IV)

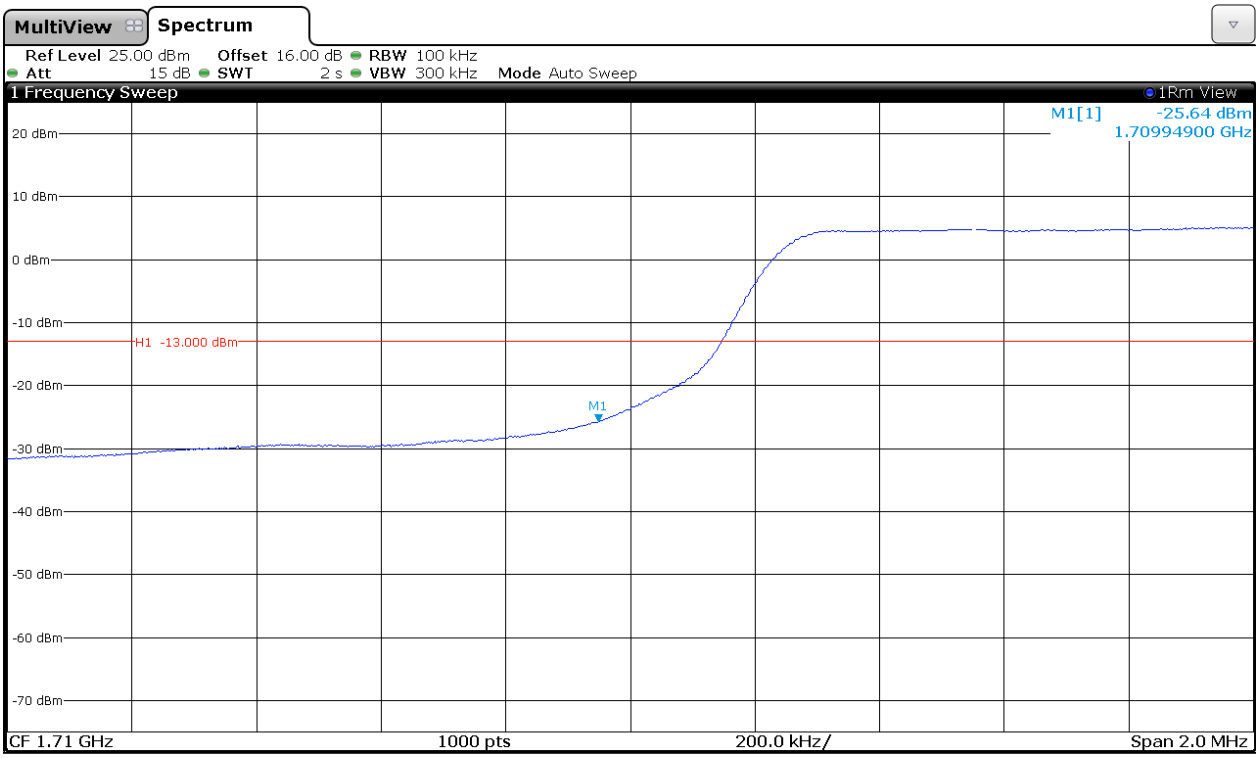
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

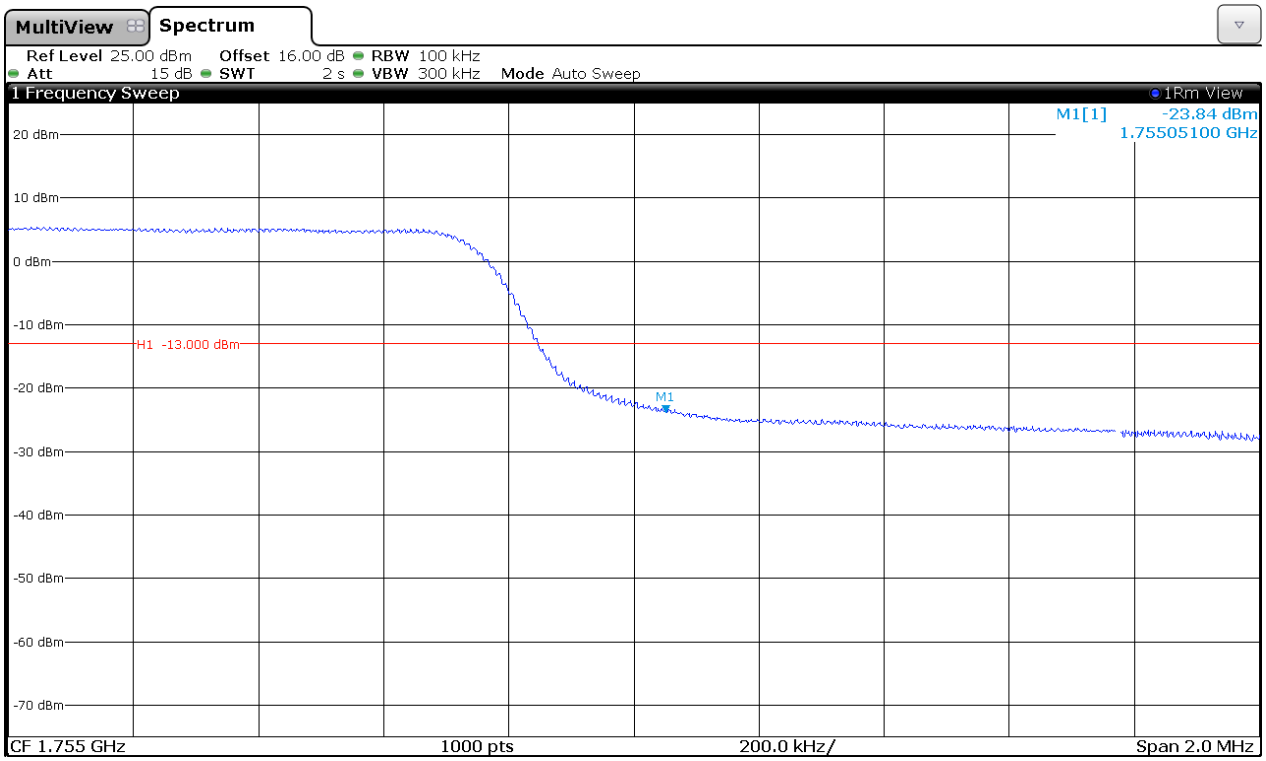
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 5 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

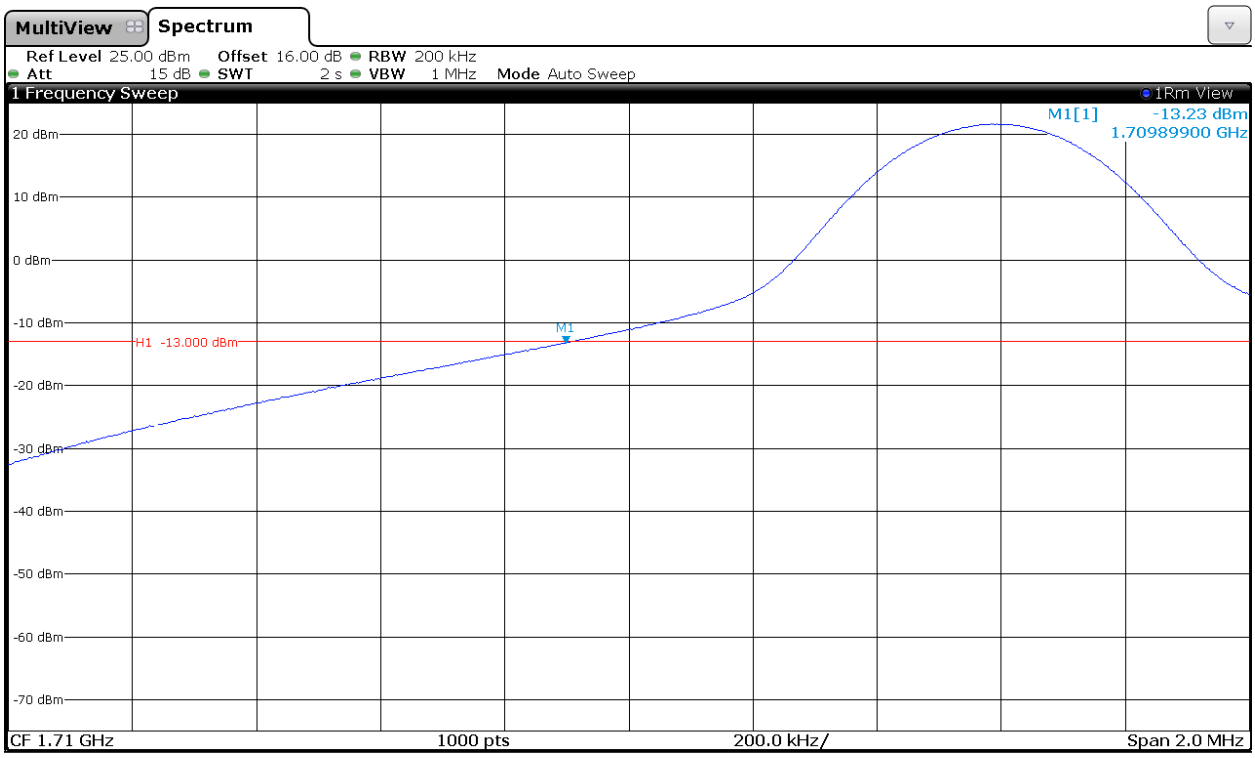


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 10 MHz (Band IV)

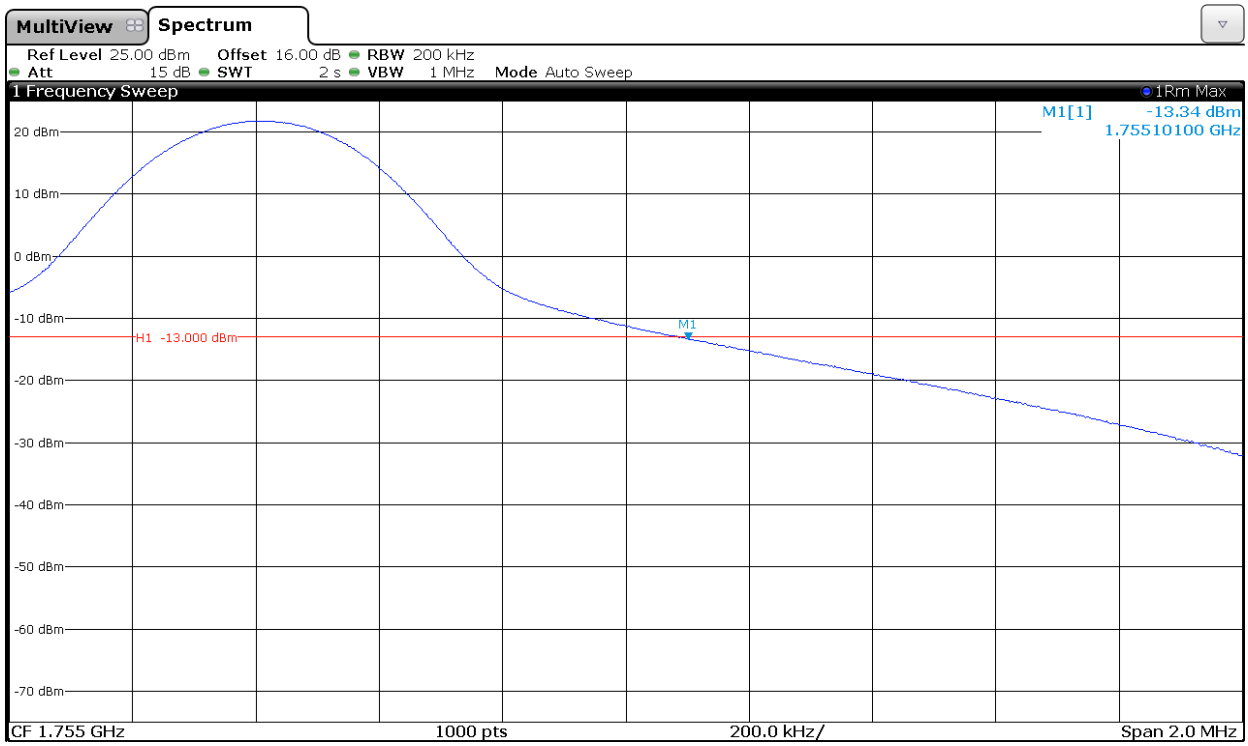
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 10 MHz (Band IV)

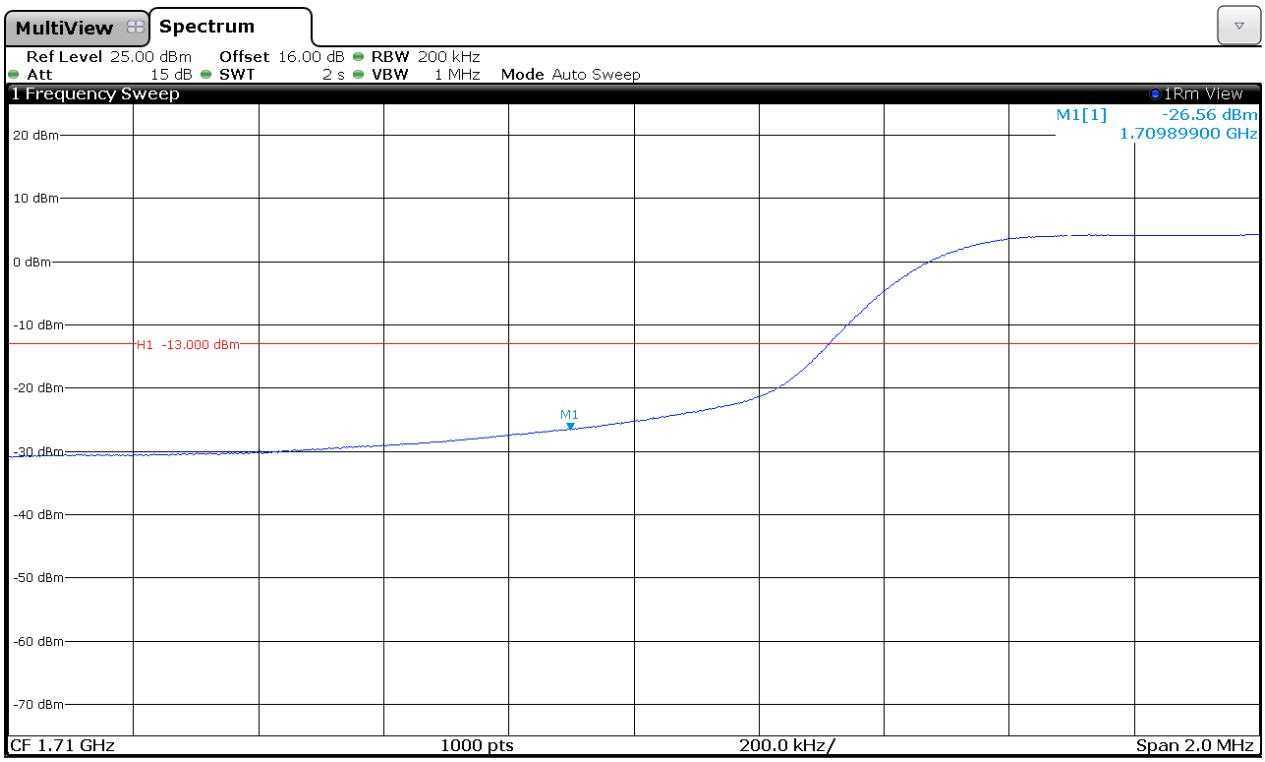
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

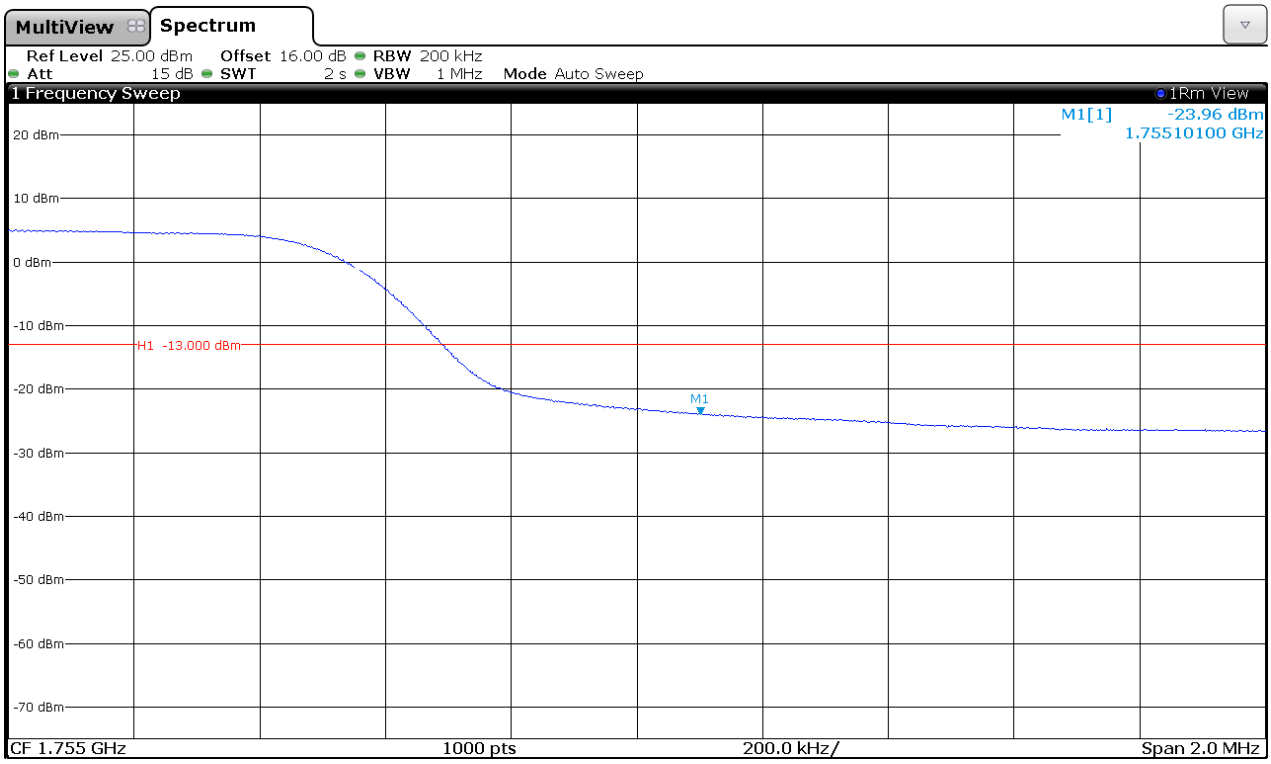
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 10 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

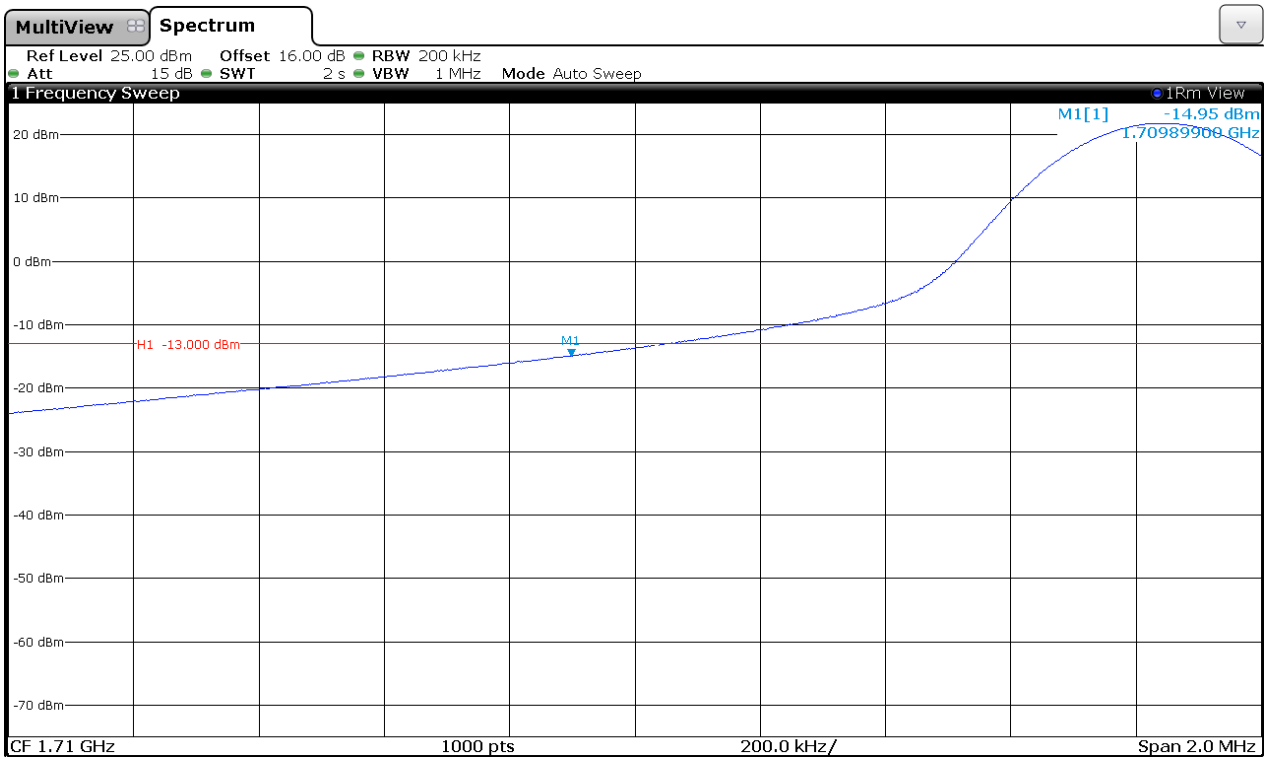


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 15 MHz (Band IV)

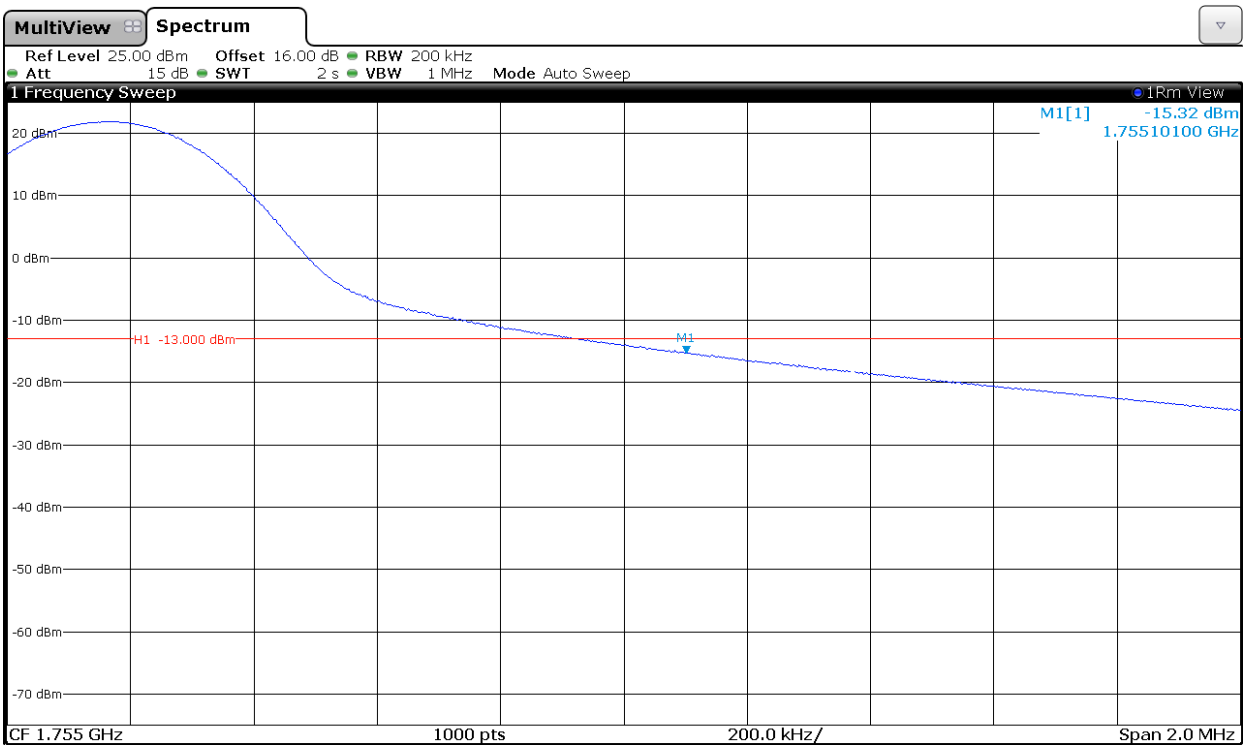
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 15 MHz (Band IV)

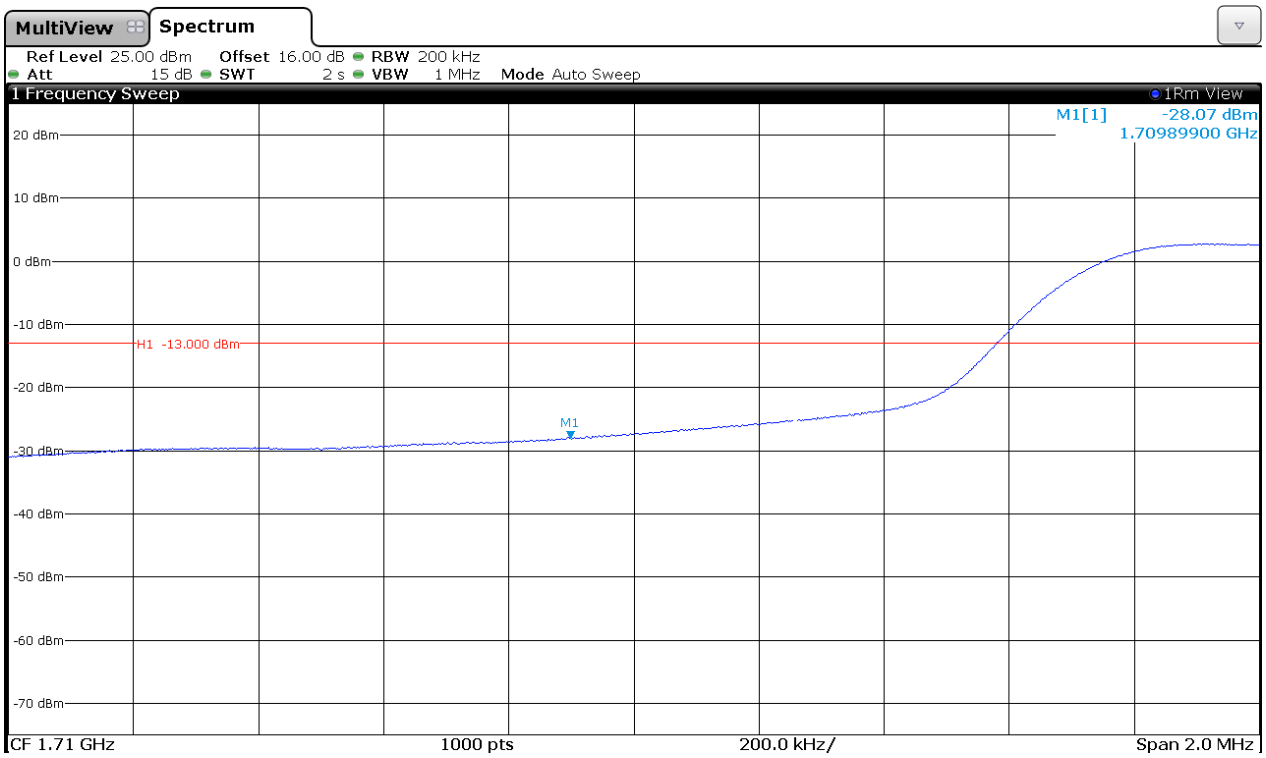
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

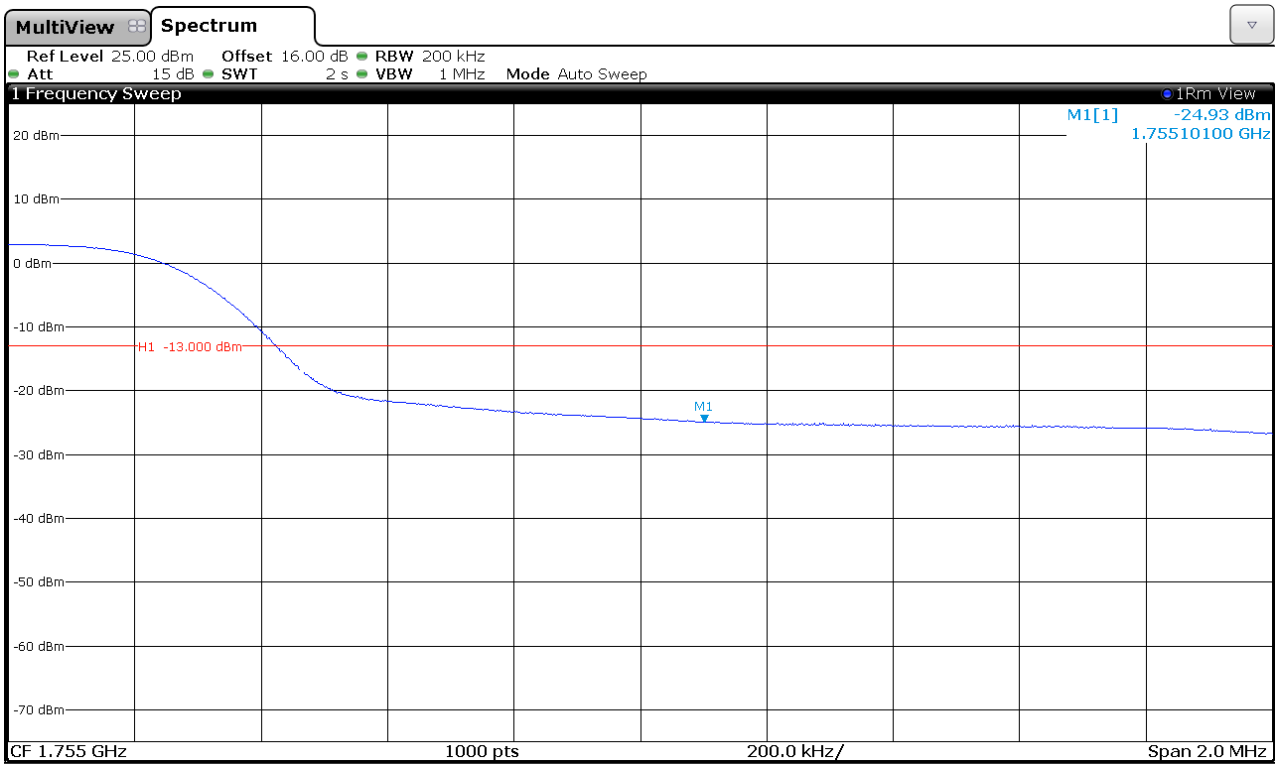
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 15 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

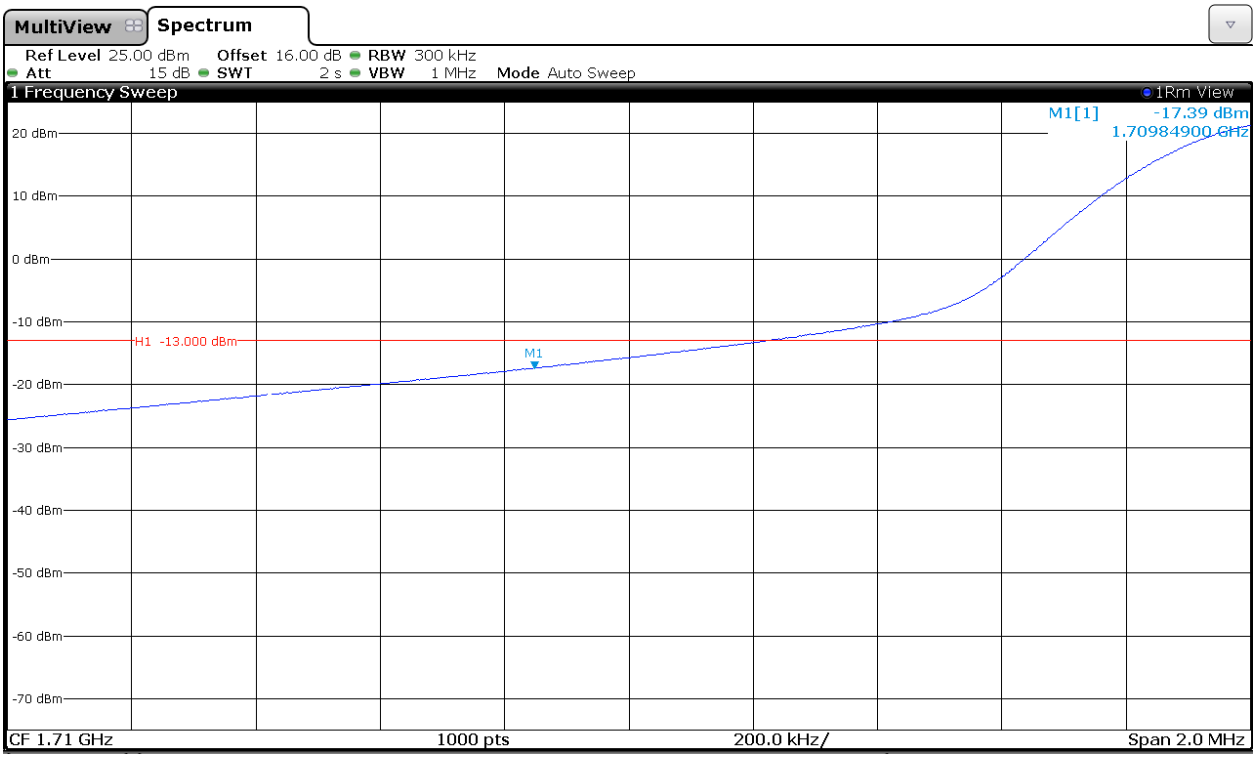


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 20 MHz (Band IV)

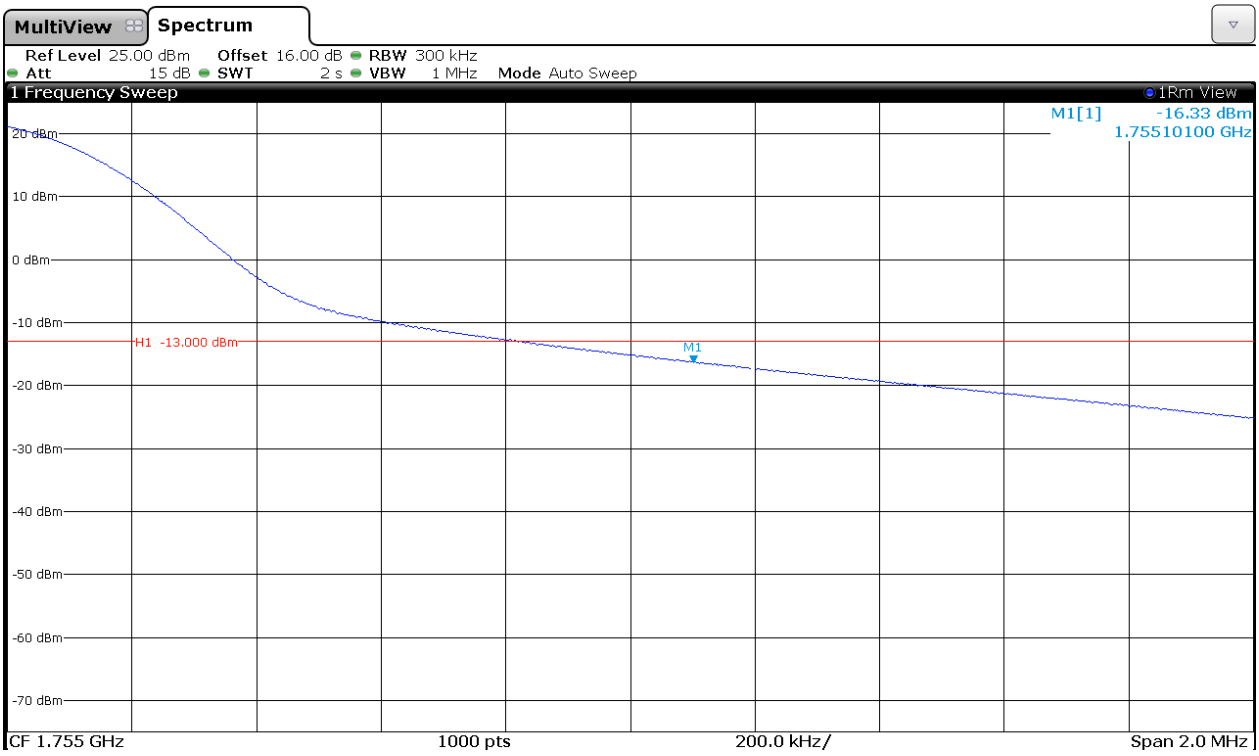
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 20 MHz (Band IV)

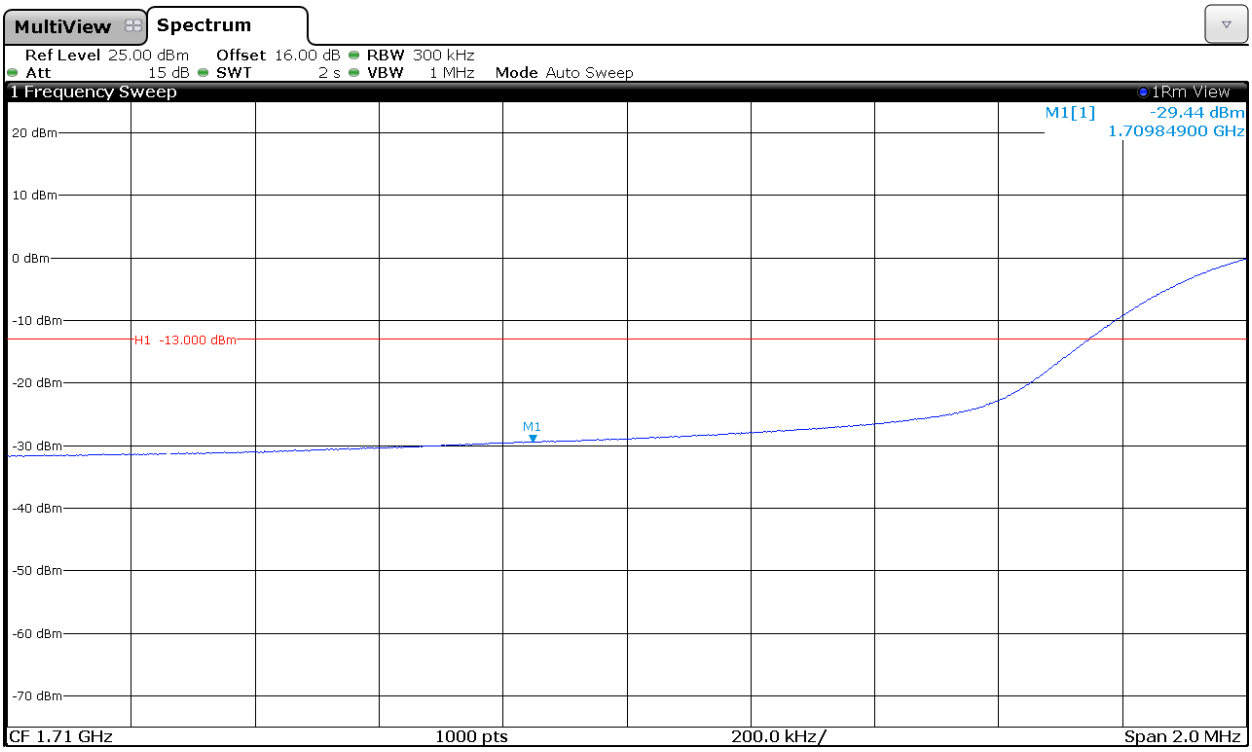
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

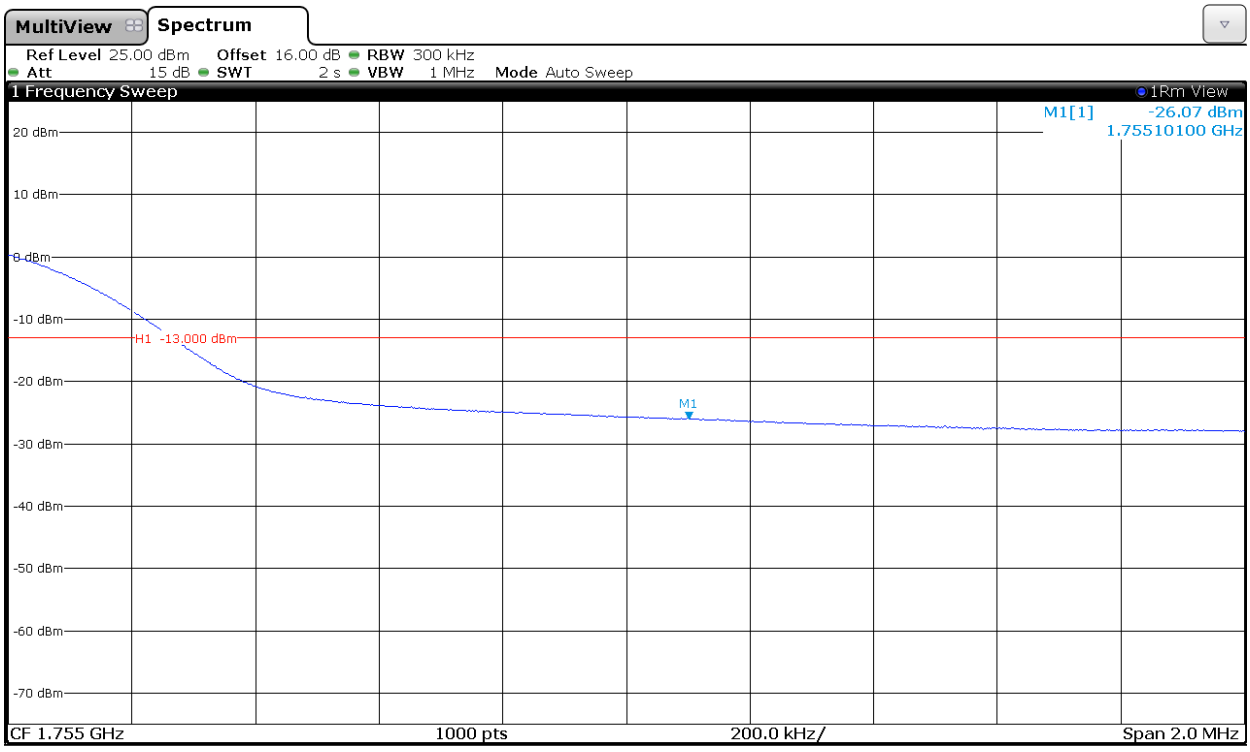
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 20 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

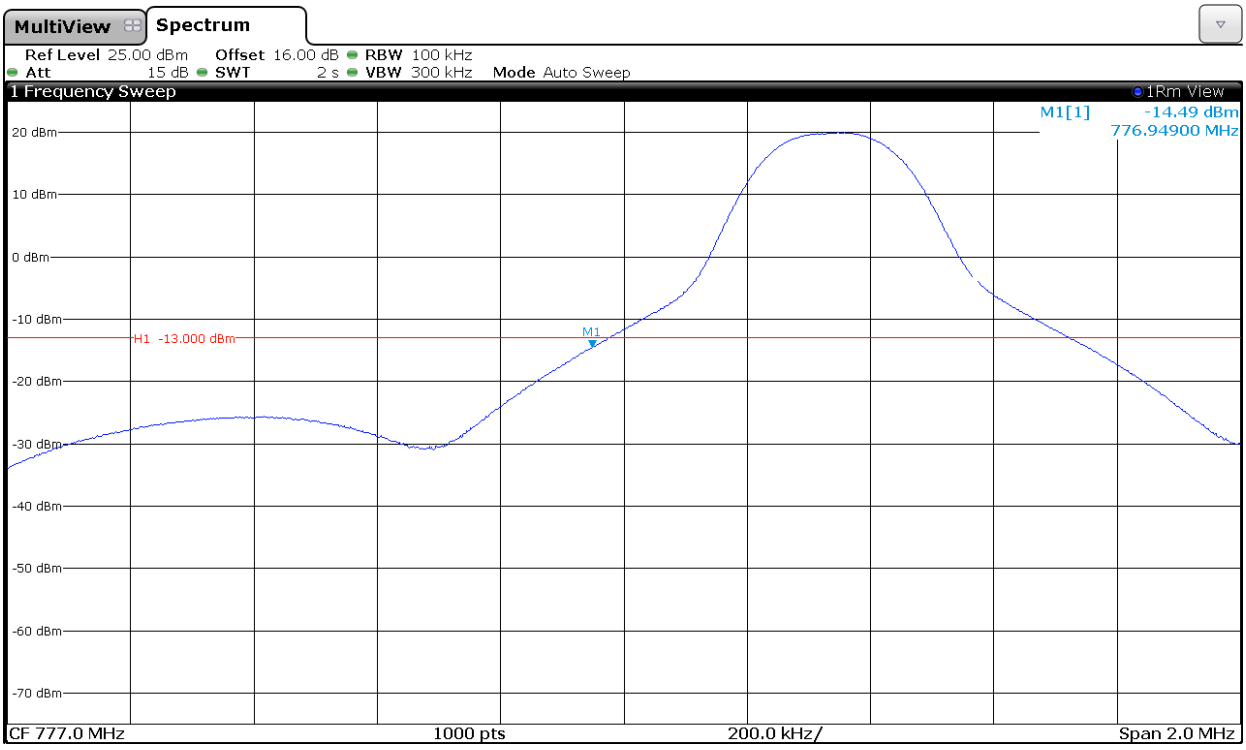


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 5 MHz (Band XIII)

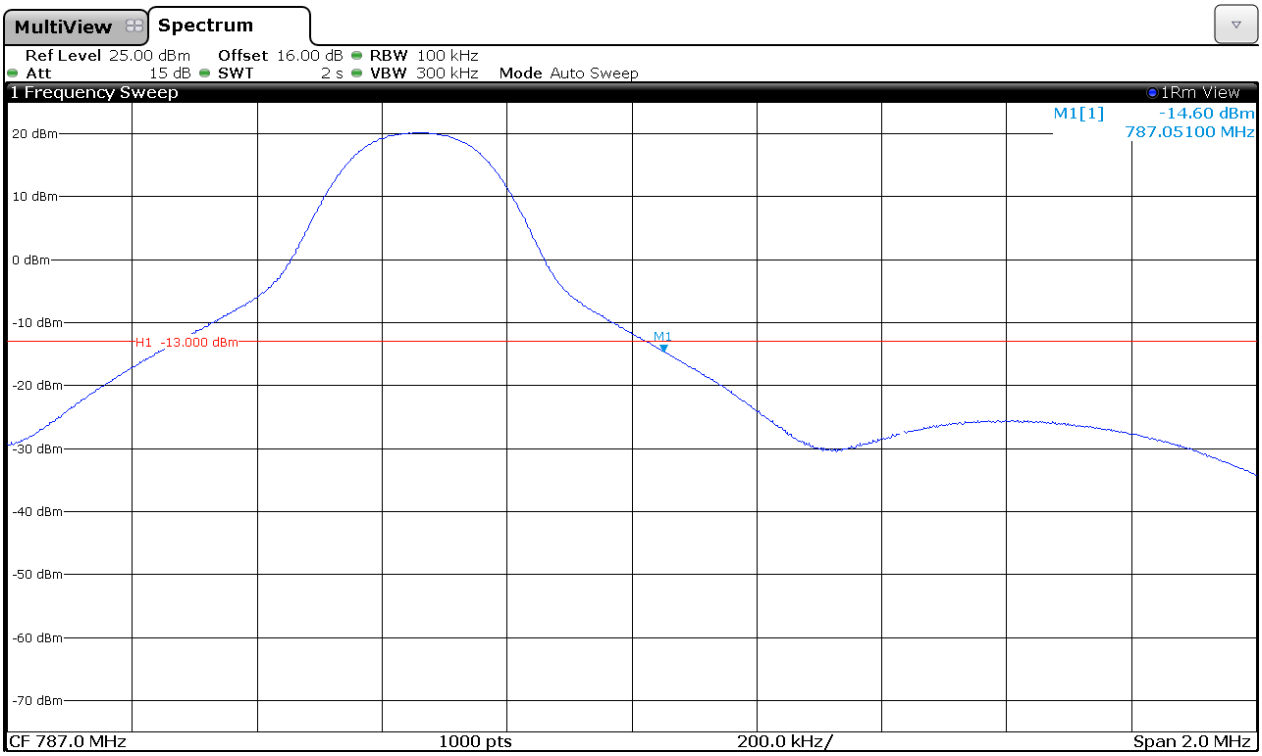
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 5 MHz (Band XIII)

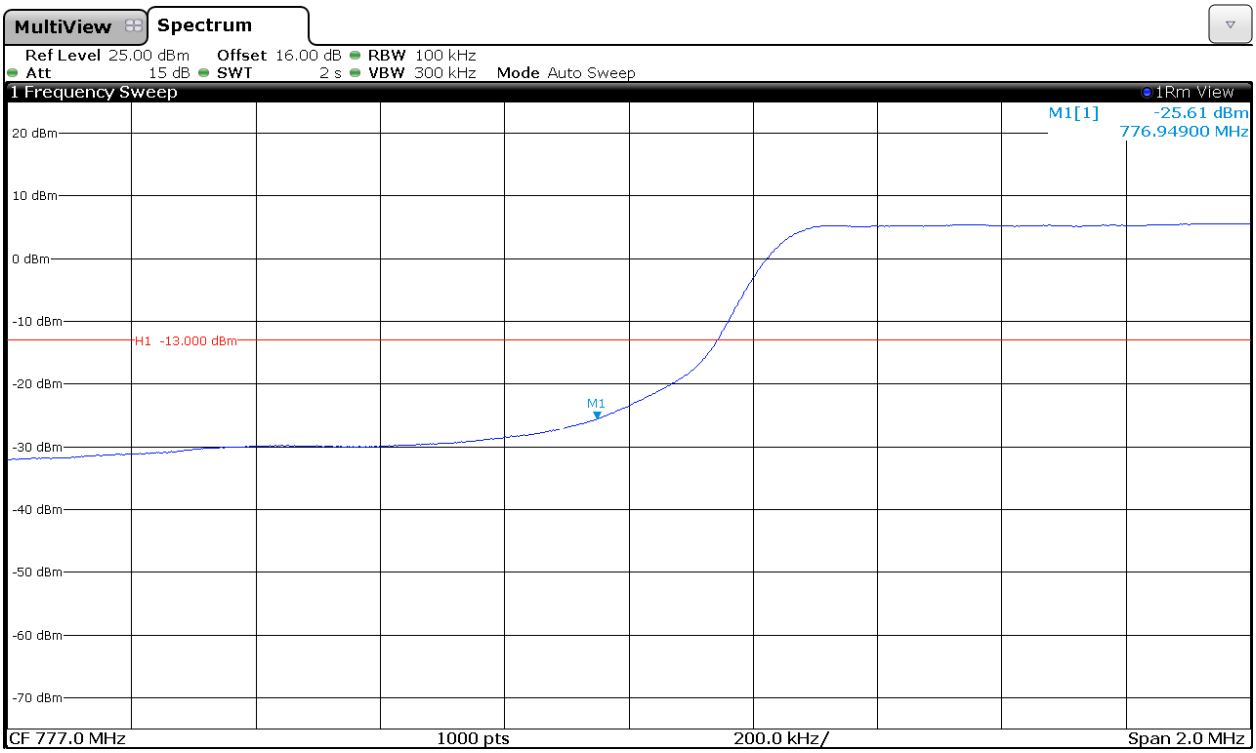
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

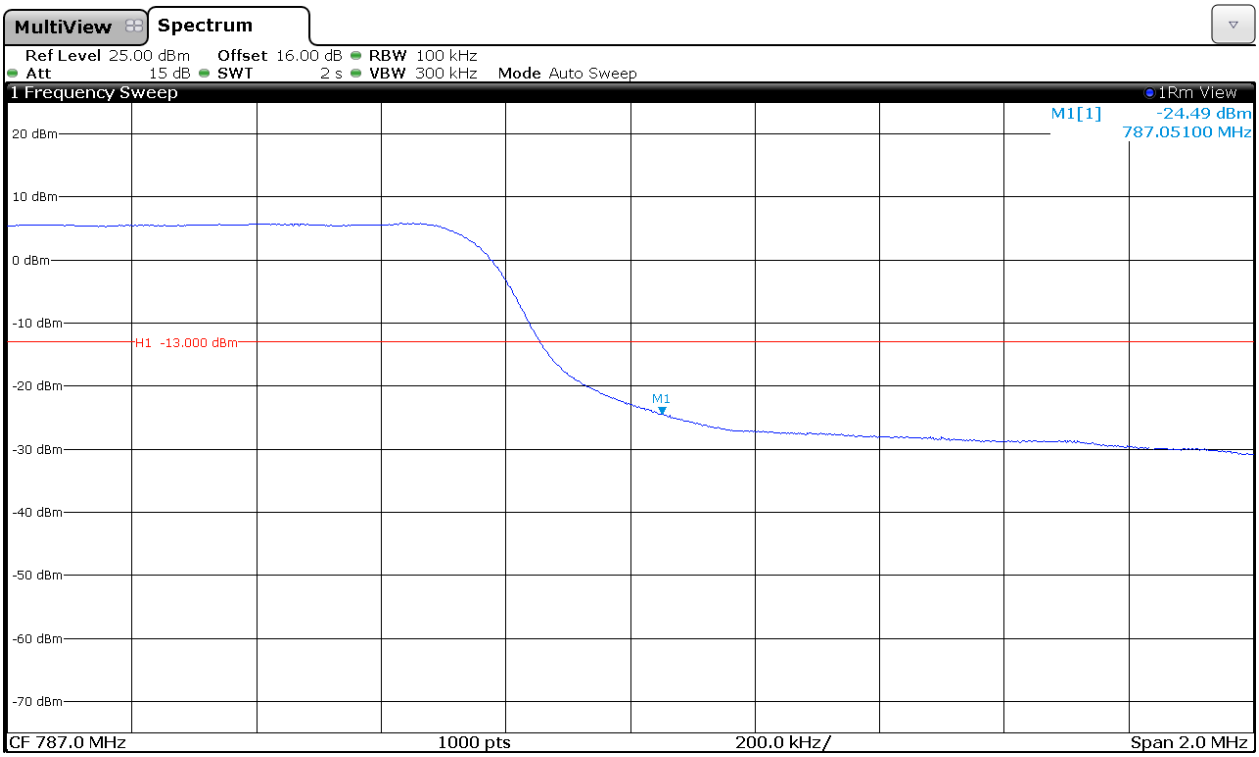
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 5 MHz (Band XIII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

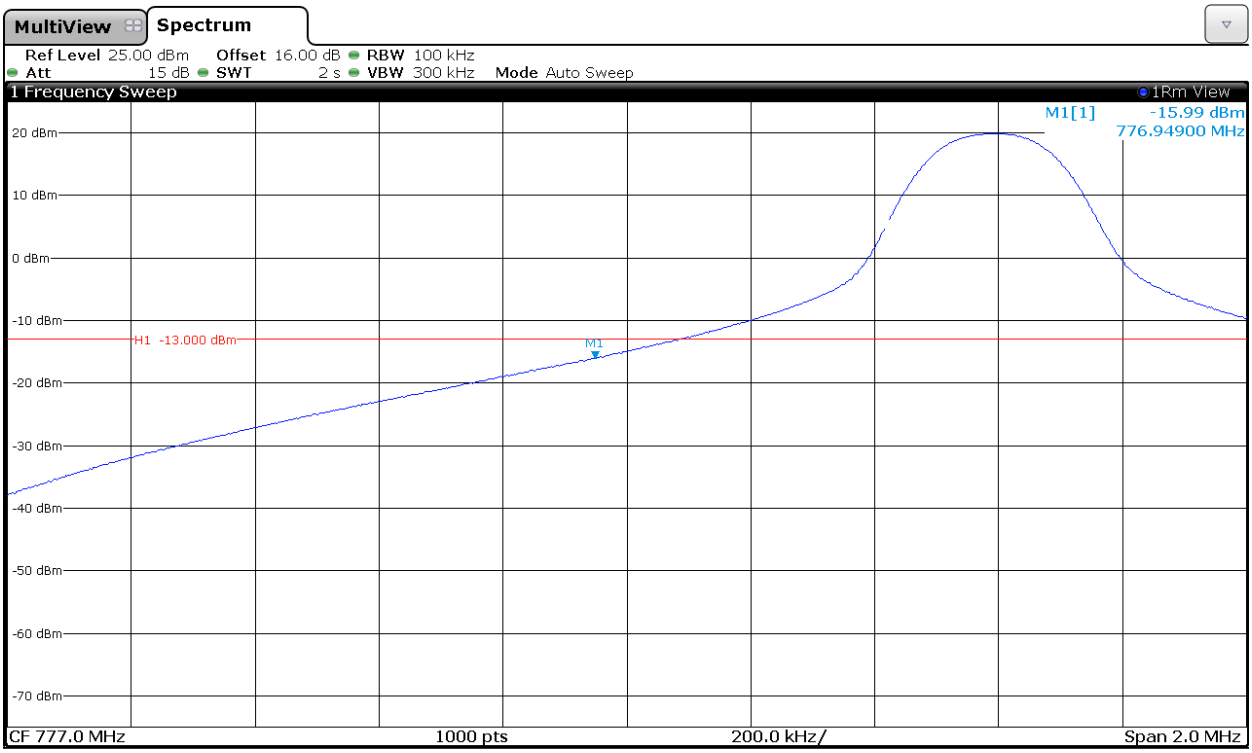


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE QPSK MODULATION. RB = 1, Offset = 0, BW = 10 MHz (Band XIII)

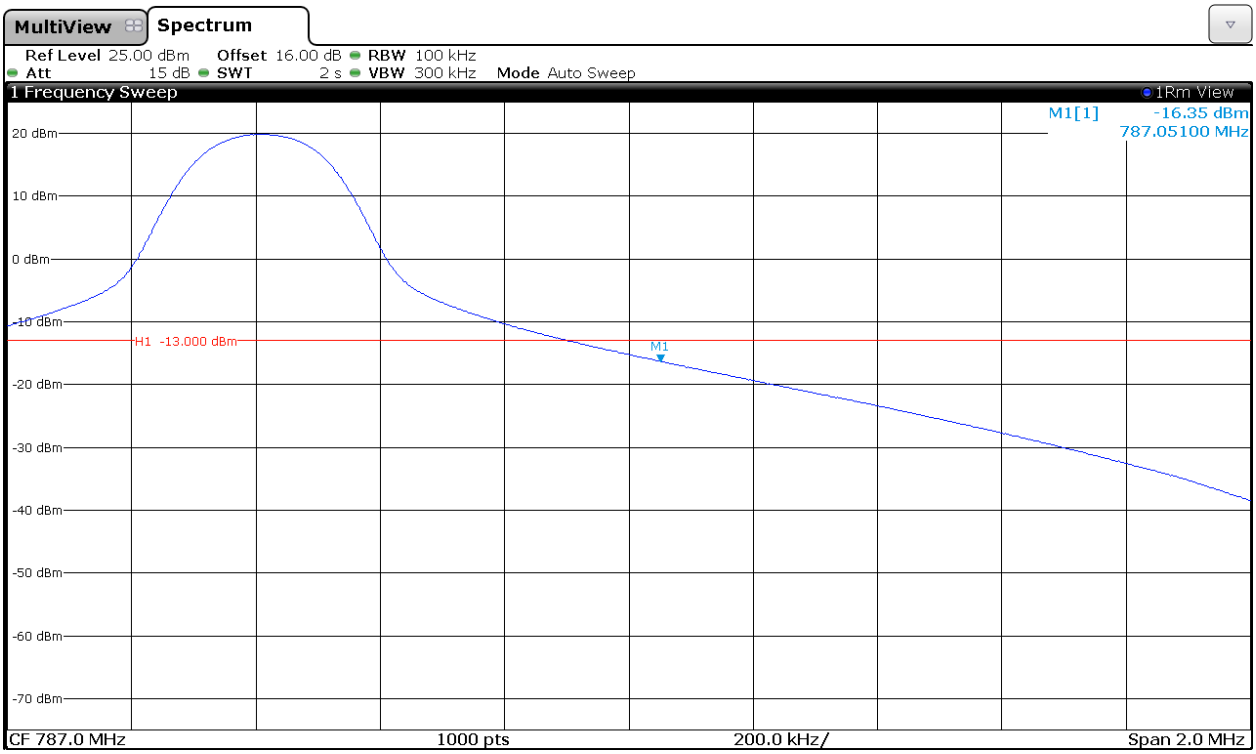
LOW FREQUENCY SECTION



NOTE: The equipment transmits at the maximum output power

LTE QPSK MODULATION. RB = 1, Offset = Max, BW = 10 MHz (Band XIII)

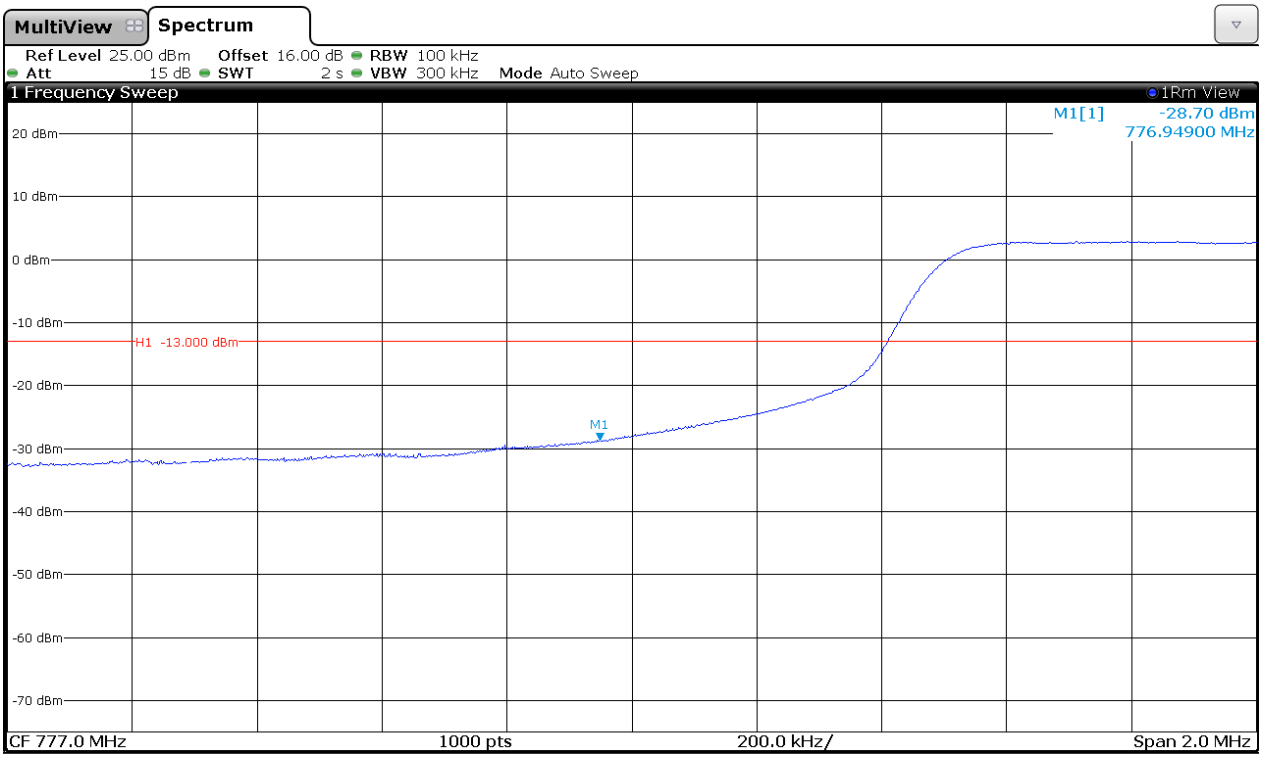
HIGH FREQUENCY SECTION



NOTE: The equipment transmits at the maximum output power

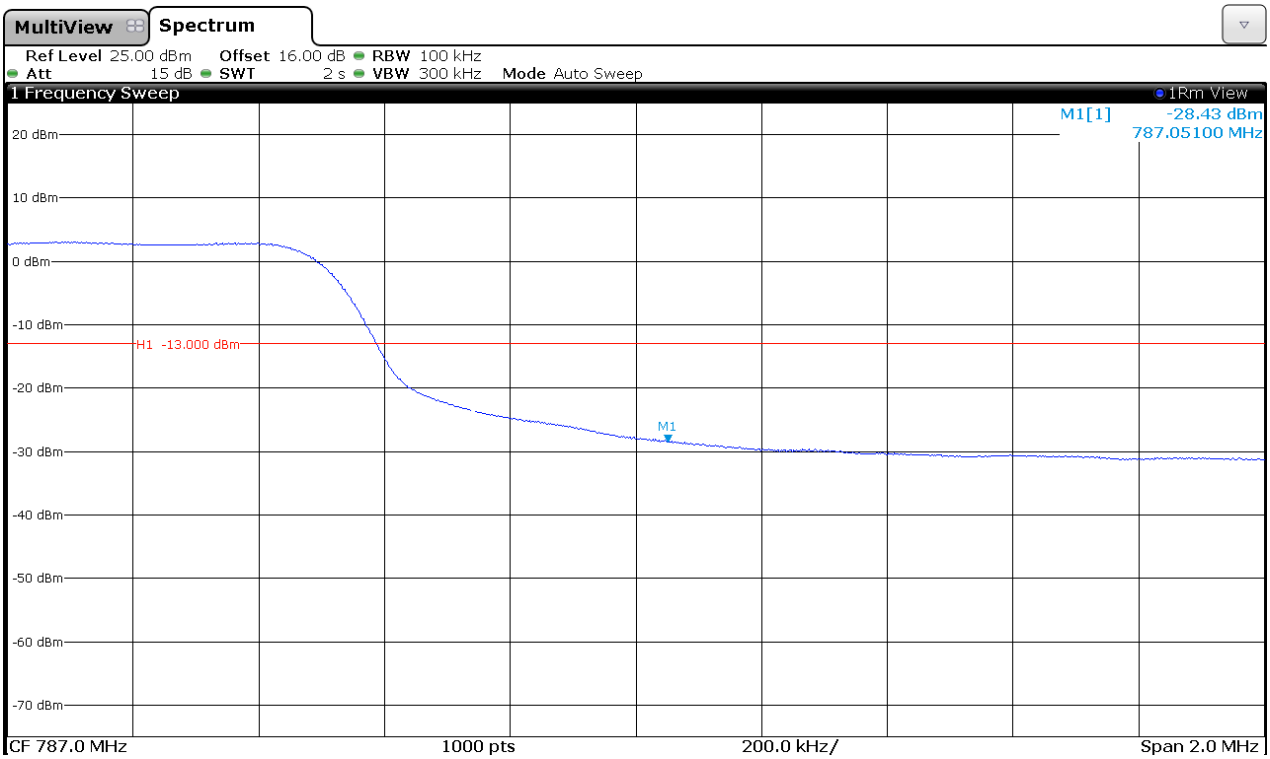
LTE QPSK MODULATION. RB = All, Offset = 0, BW = 10 MHz (Band XIII)

LOW FREQUENCY SECTION



NOTE: The equipment transmits at the maximum output power

HIGH FREQUENCY SECTION



NOTE: The equipment transmits at the maximum output power

Verdict: PASS

Radiated emissions

SPECIFICATION

FCC §2.1051 and §27.53(c) (f) (h). RSS-139 Clause 6.6. RSS-130 Clause 4.6.

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.

At Po transmitting power, the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

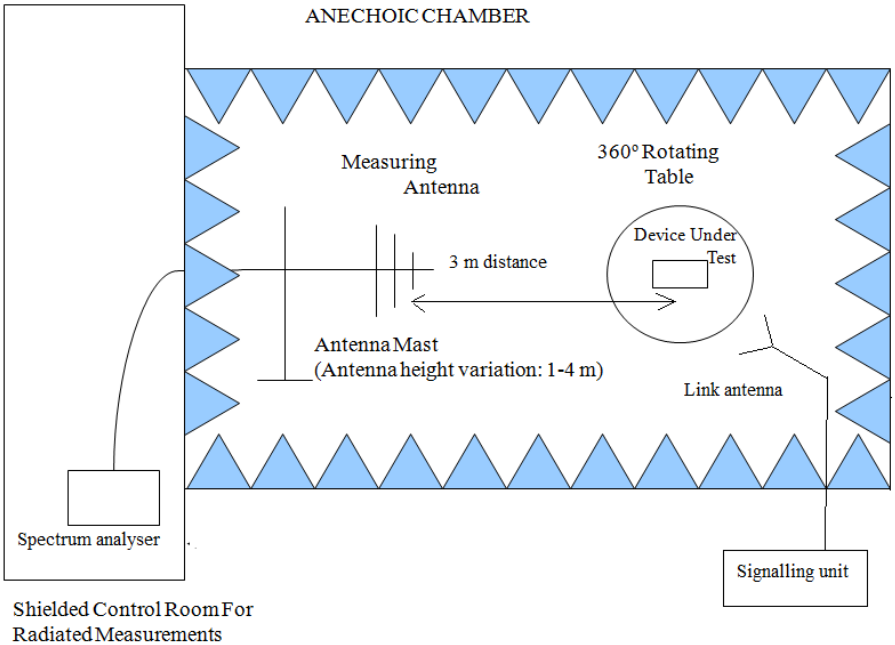
For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW (-50 dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

METHOD

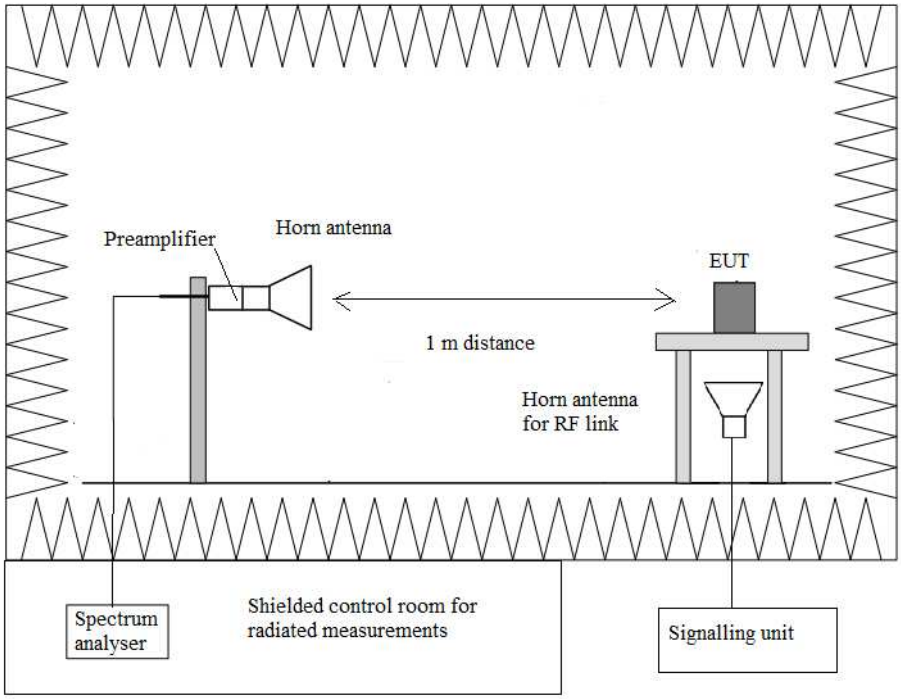
The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.
Each detected emission is substituted by the Substitution method, in accordance with the ANSI/TIA-603-D: 2010.

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

LTE QPSK AND 16QAM MODULATION. Band IV. BW = 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz.

A preliminary scan determined the QPSK 1.4 MHz bandwidth as the worst case. The configuration of Resource Blocks which is the worst case for conducted power was used.

The following tables and plots show the results for this configuration.

1. CHANNEL: LOWEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-18 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
6843.25	-36.29	V	-42.91	1.87	10.15	-34.63
8553.75	-42.32	V	-46.76	2.11	11.02	-37.85
11975.75	-46.08	V	-46.35	2.53	12.25	-36.63
13686.25	-47.56	V	-44.81	2.72	12.35	-35.18
15396.75	-40.95	V	-39.29	2.90	15.80	-26.39
17107.75	-52.09	V	-46.10	3.09	13.17	-36.02

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-18 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
6930.25	-40.73	V	-46.79	1.88	9.95	-38.72
8662.75	-37.15	V	-41.39	2.13	11.07	-32.45
10395.25	-44.75	V	-44.44	2.34	10.18	-36.60
12127.75	-42.60	V	-43.17	2.55	12.53	-33.19
13859.75	-42.60	V	-39.10	2.74	12.21	-29.63
15593.25	-43.60	V	-43.17	2.92	16.44	-29.65

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-18 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
7017.25	-38.66	V	-44.27	1.89	9.83	-36.33
8772.25	-37.59	V	-41.63	2.14	11.11	-32.66
10526.25	-40.23	V	-39.56	2.36	10.13	-31.79
12280.75	-44.19	V	-45.04	2.57	12.80	-34.81
14034.75	-32.13	V	-27.90	2.76	12.09	-18.57
15789.75	-51.37	V	-51.35	2.94	16.51	-37.78

LTE QPSK AND 16QAM MODULATION. Band XIII. BW = 5 MHz and 10 MHz.

A preliminary scan determined the QPSK 5 MHz bandwidth as the worst case. The configuration of Resource Blocks which is the worst case for conducted power was used.

The following tables and plots show the results for this configuration.

1. CHANNEL: LOWEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1554.75	-51.09	V	-70.29	0.79	8.31	-62.77
2331.98	-52.24	H	-71.20	1.04	10.44	-61.80
3886.68	-51.55	V	-68.02	1.39	11.96	-57.45
4676.98	-47.51	V	-61.64	1.52	11.63	-51.53
5942.12	-62.67	V	-73.21	1.78	11.53	-63.46
7662.48	-71.27	V	-67.12	2.01	7.25	-61.88

Frequency range 1559 MHz-1610 MHz. RBW = 1 kHz
No radiated spurious signals were detected.

Frequency range 1559 MHz-1610 MHz. RBW = 1 MHz
No radiated spurious signals were detected.

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1559.65	-48.28	V	-67.49	0.79	8.33	-59.95
2339.45	-41.61	V	-60.56	1.04	10.45	-51.15
3119.25	-61.71	V	-78.97	1.22	11.13	-69.06
4691.92	-55.38	V	-69.47	1.52	11.62	-59.37
5940.95	-62.47	V	-72.89	1.78	11.49	-63.18

Frequency range 1559 MHz-1610 MHz. RBW = 1 kHz
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1559.6486	-61.88	V	-81.08	0.79	8.31	-73.56

Frequency range 1559 MHz-1610 MHz. RBW = 1 MHz
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1559.534	-41.62	V	-60.82	0.79	8.31	-53.30

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1564.55	-49.57	V	-68.78	0.79	8.35	-61.22
2347.15	-41.07	H	-60.01	1.04	10.47	-50.58
3911.88	-57.41	V	-73.83	1.39	11.97	-63.25
4707.08	-53.47	V	-67.52	1.53	11.62	-57.43
7629.35	-71.27	H	-67.12	2.01	7.25	-61.88

Frequency range 1559 MHz-1610 MHz. RBW = 1 kHz
Spurious signals closest to limit.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1564.6959	-64.75	V	-83.96	0.79	8.33	-76.42

Frequency range 1559 MHz-1610 MHz. RBW = 1 MHz
Spurious signals closest to limit.

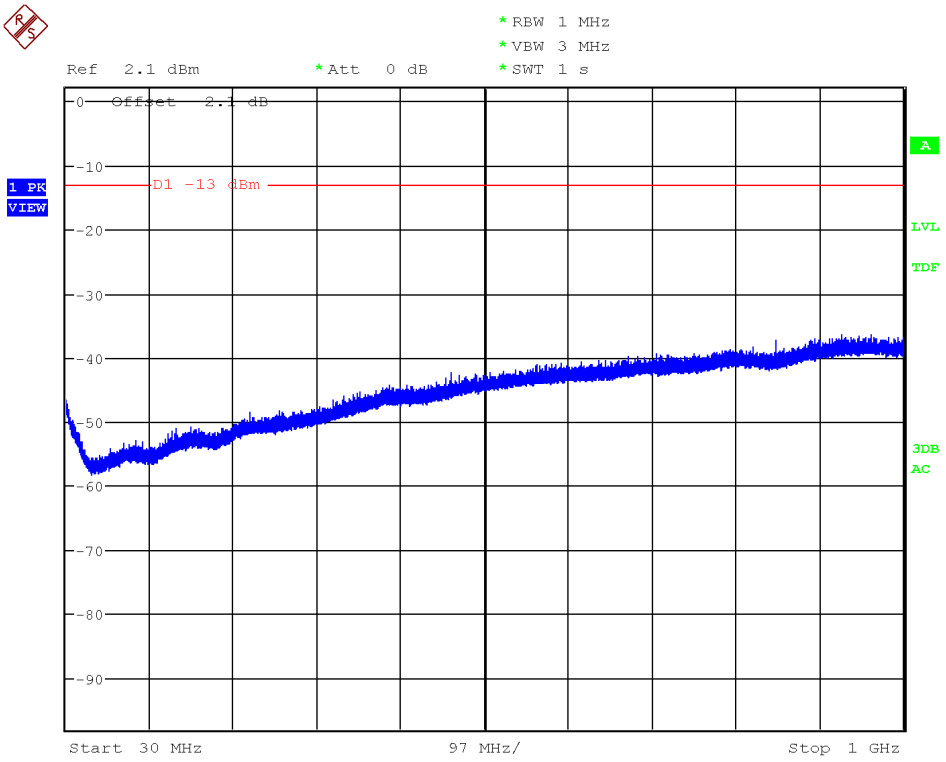
Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1564.8166	-45.38	V	-64.59	0.79	8.33	-57.05

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

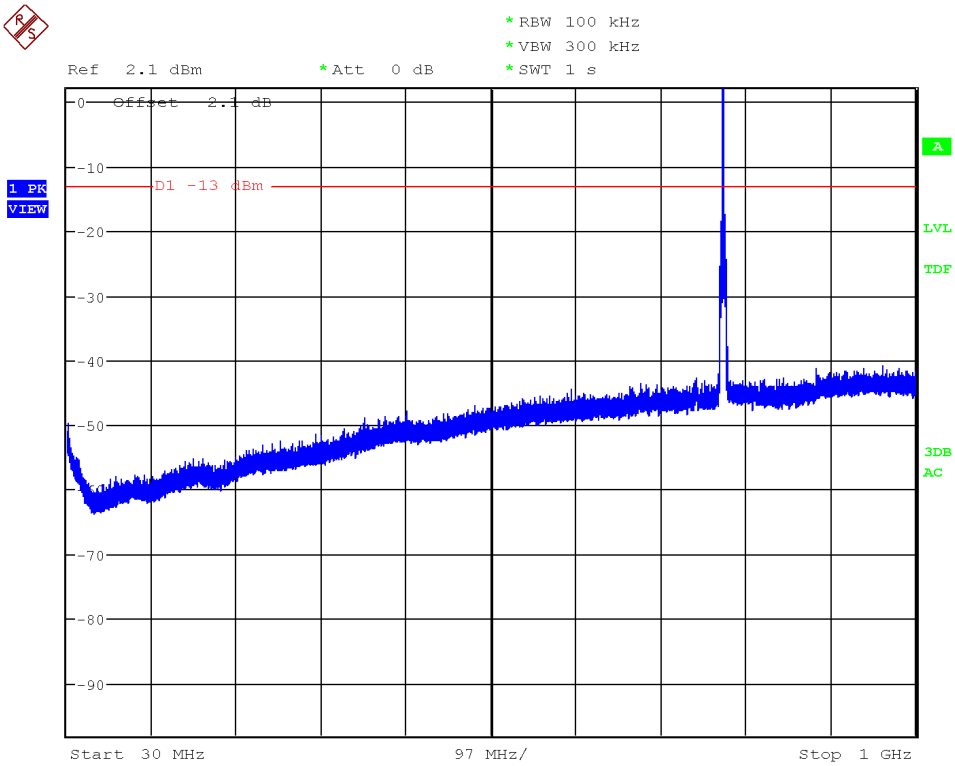
LTE QPSK MODULATION. BW=1.4 MHz. Band IV



(This plot is valid for all three channels)

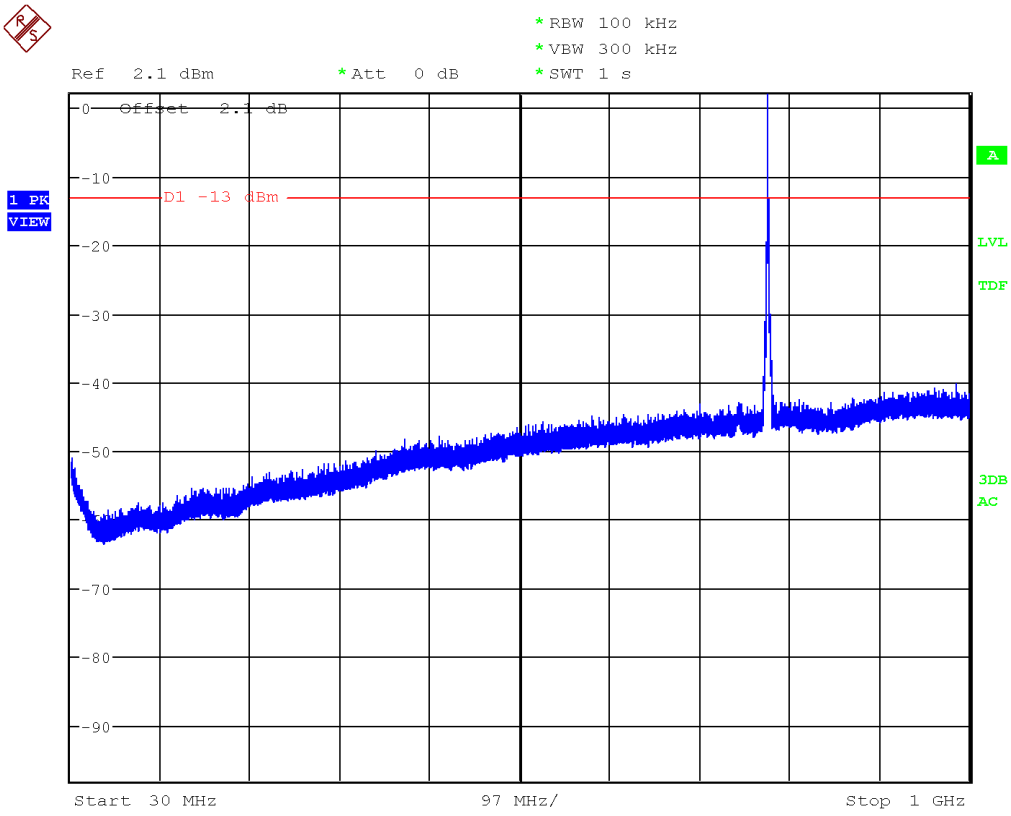
LTE QPSK MODULATION. BW=5 MHz. Band XIII

CHANNEL: LOWEST



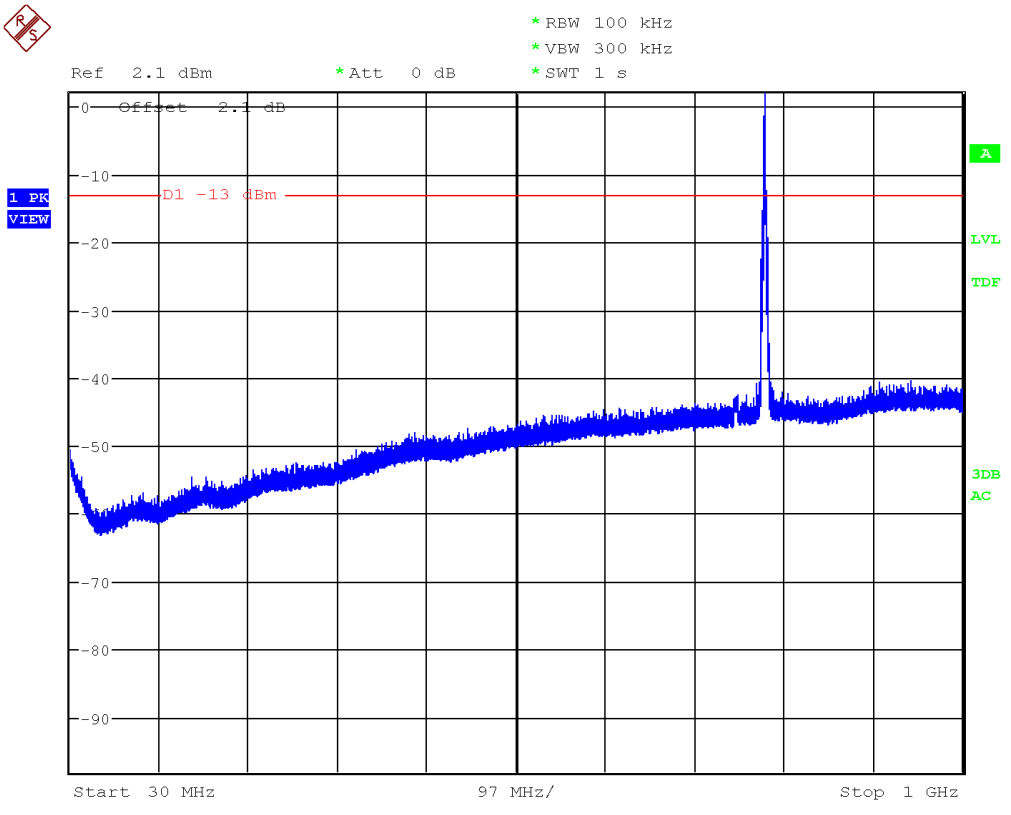
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

CHANNEL: HIGHEST

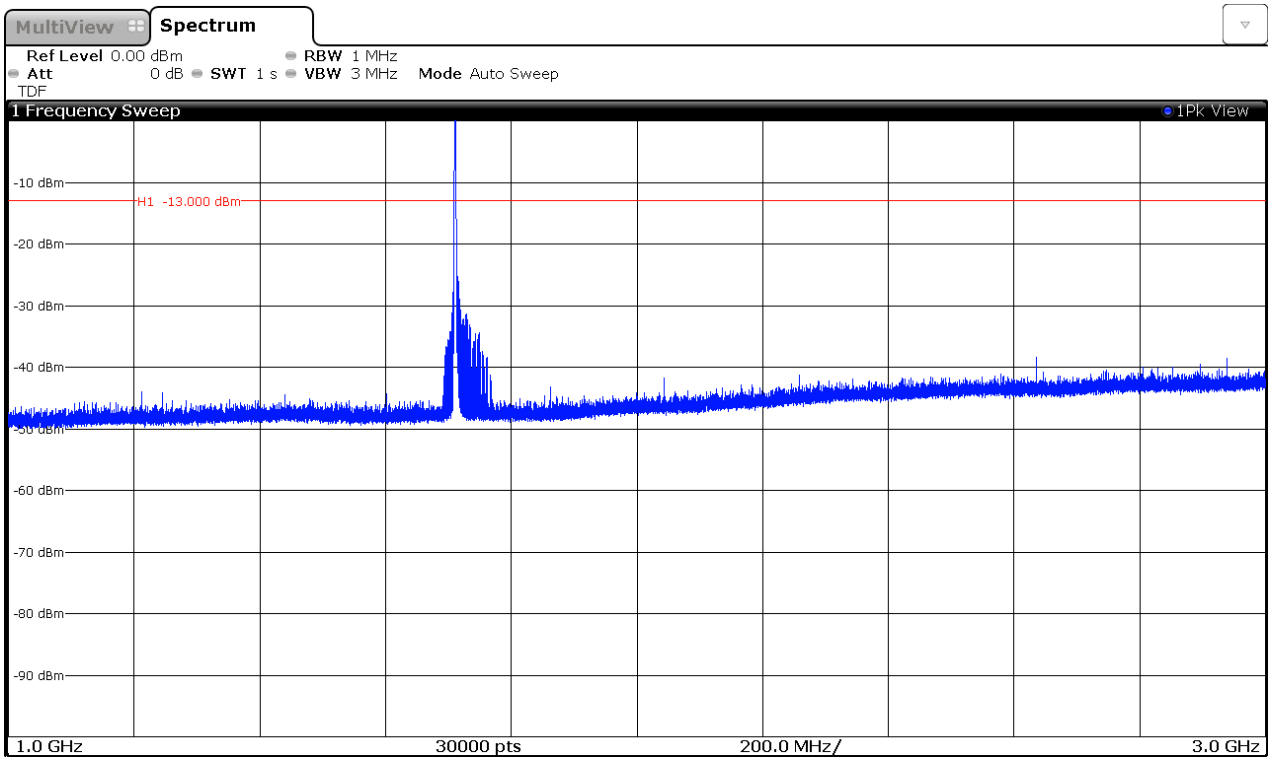


Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz to 3 GHz.

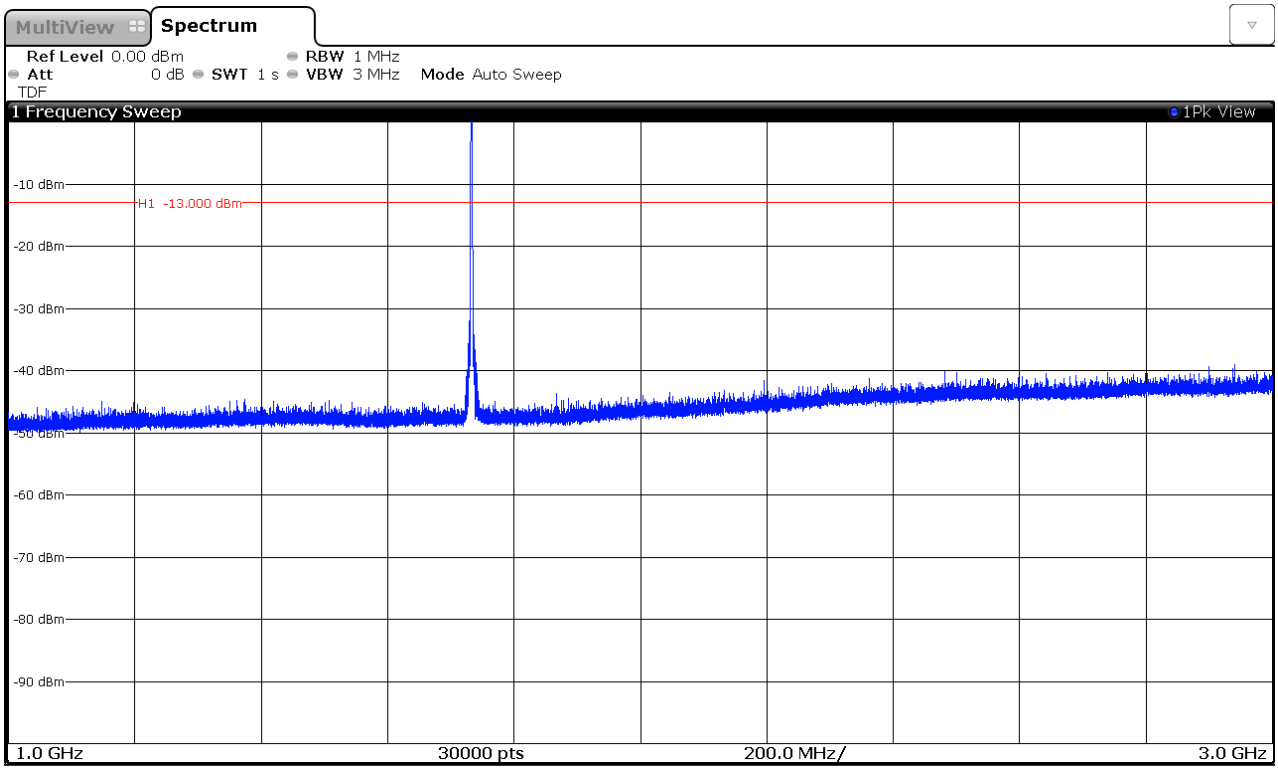
LTE QPSK MODULATION. BW=1.4 MHz. Band IV

CHANNEL: LOWEST



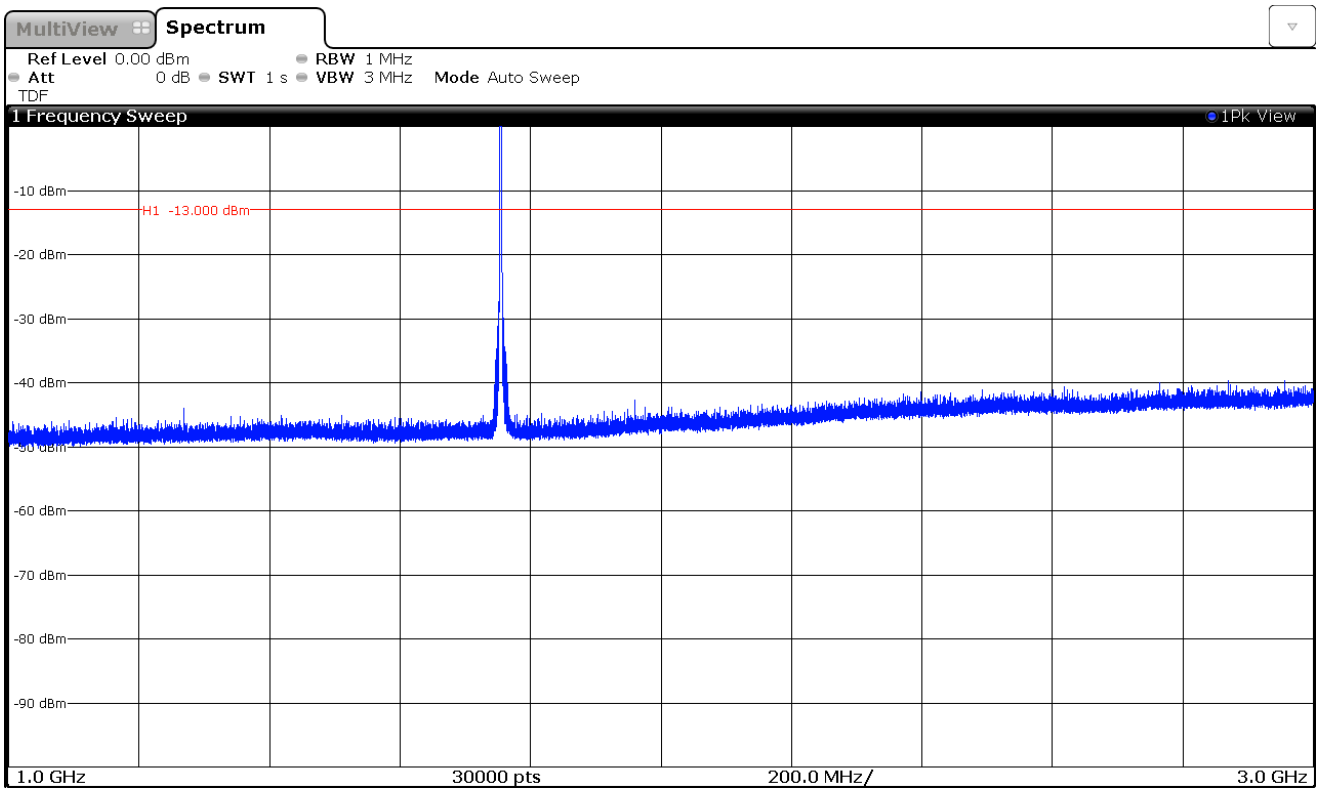
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

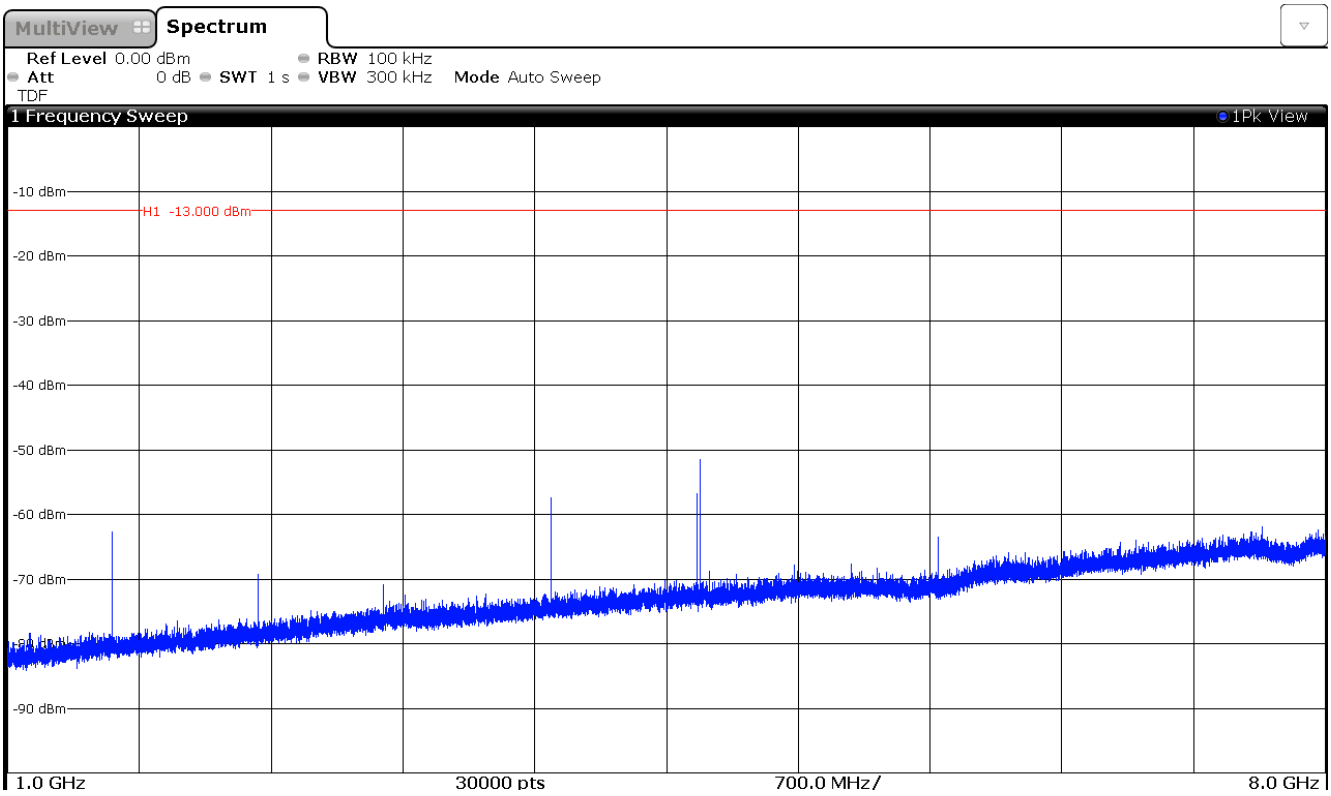
CHANNEL: HIGHEST



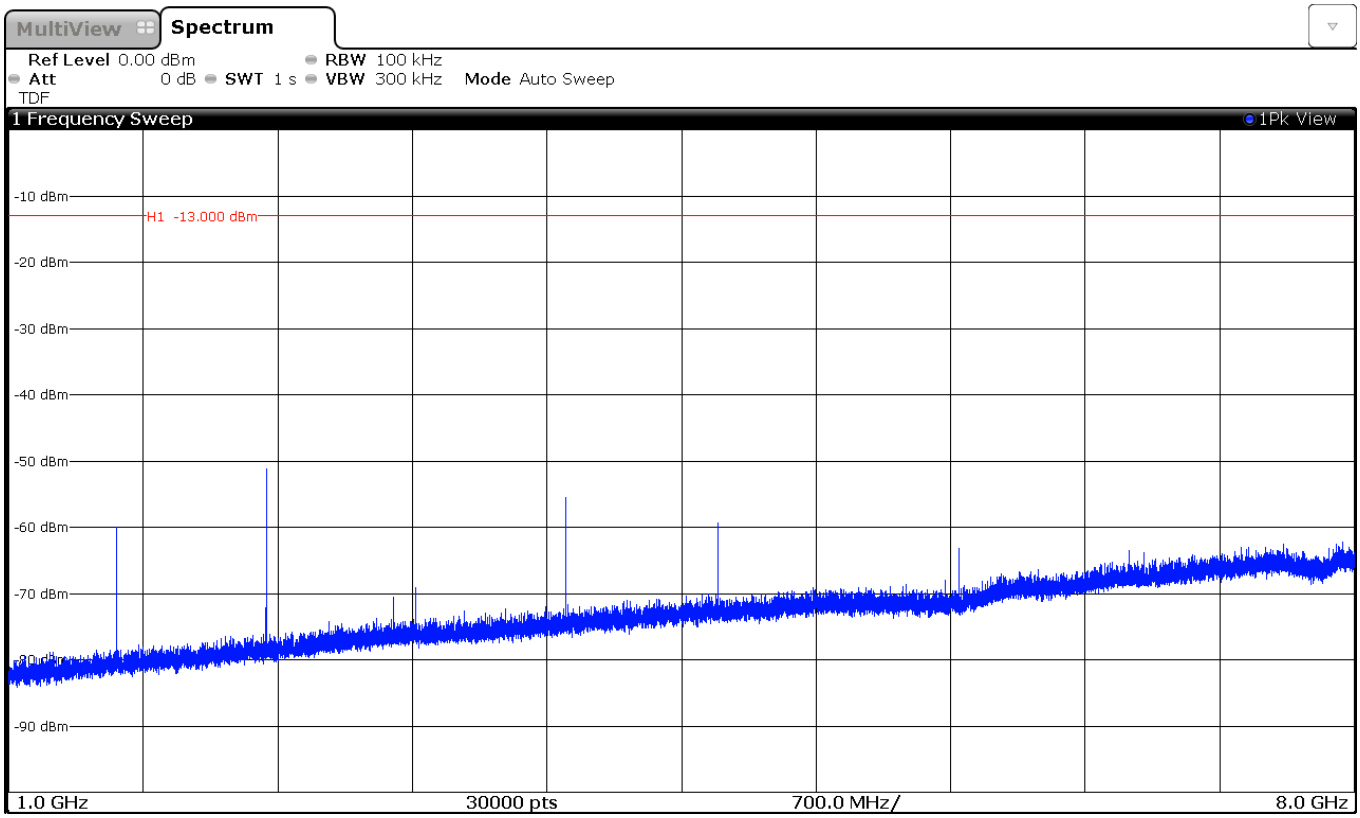
Note: The peak above the limit is the carrier frequency.

LTE QPSK MODULATION. BW=5 MHz. Band XIII. Range 1 GHz to 8 GHz.

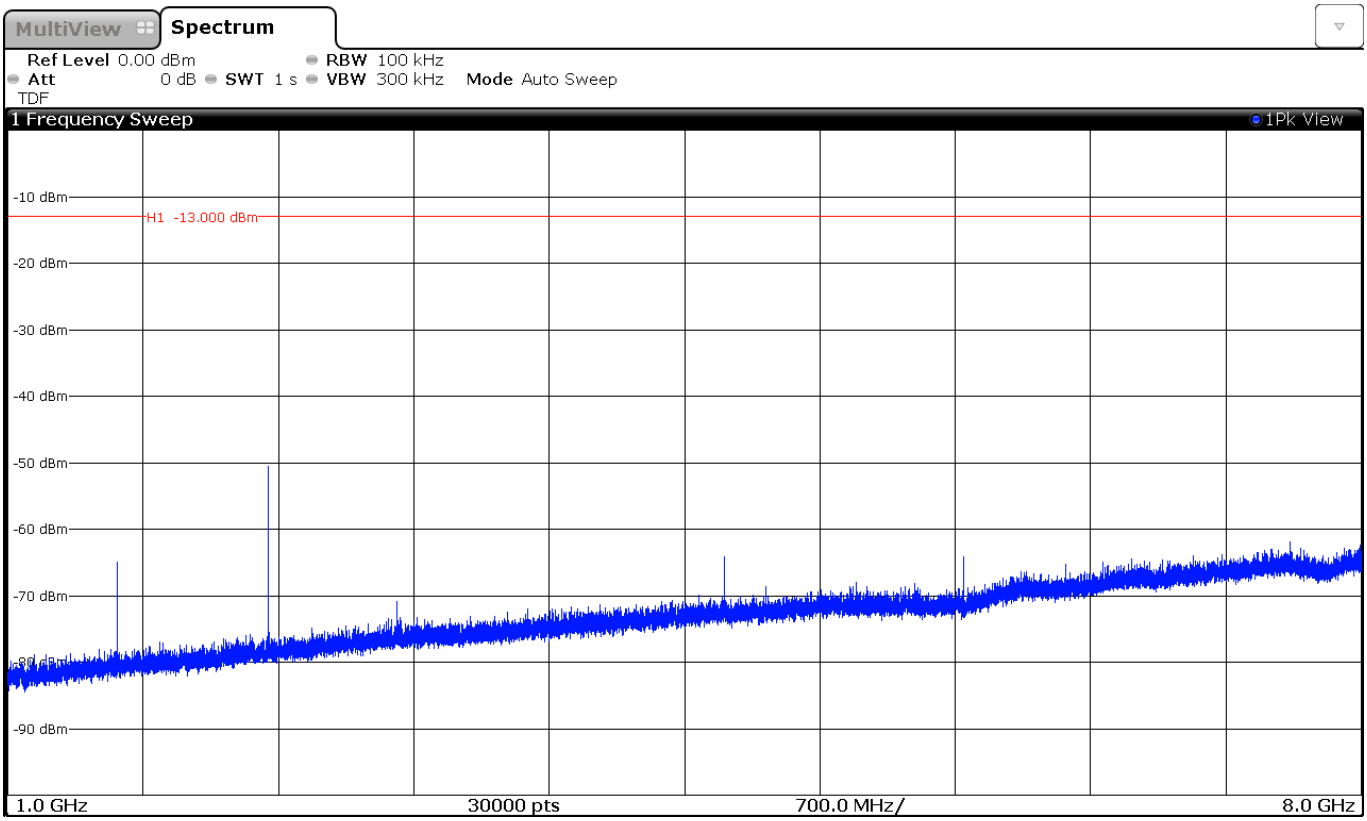
CHANNEL: LOWEST



CHANNEL: MIDDLE



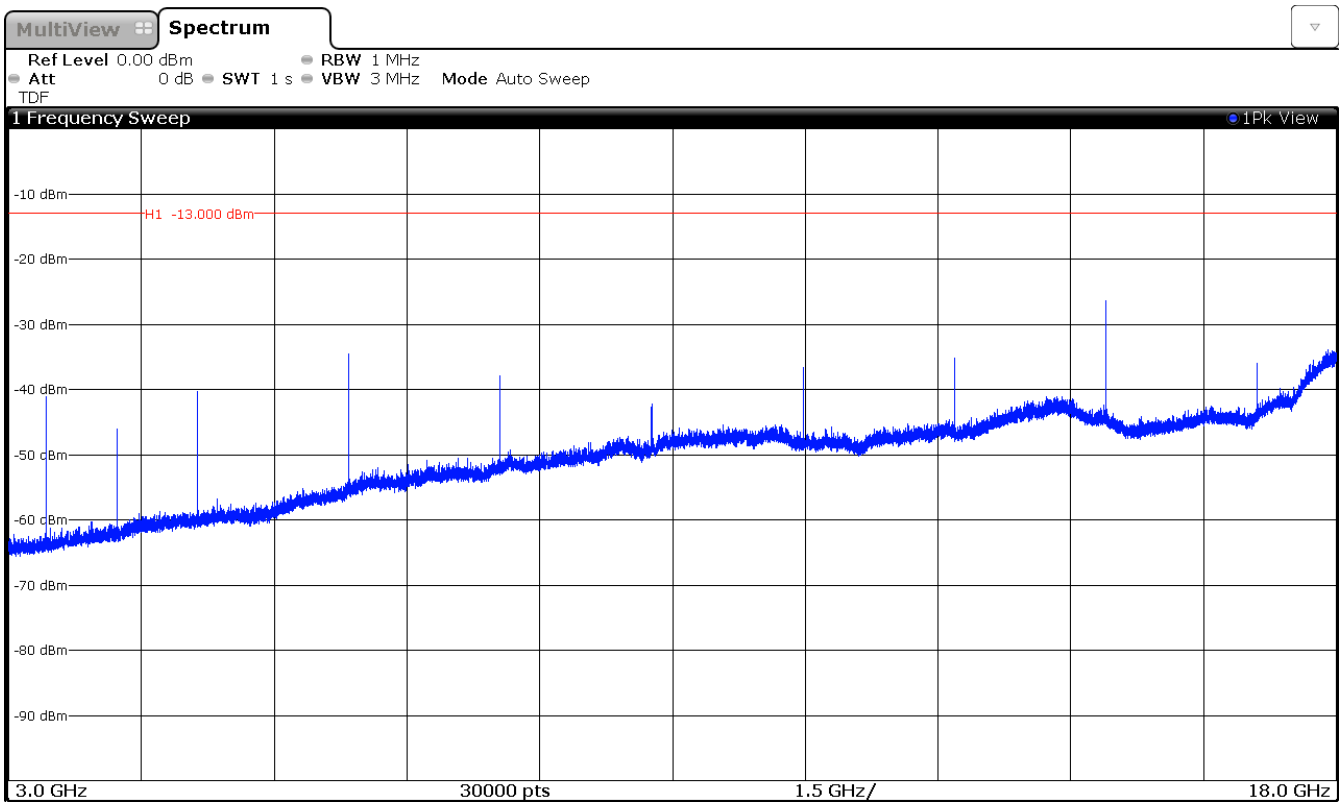
CHANNEL: HIGHEST



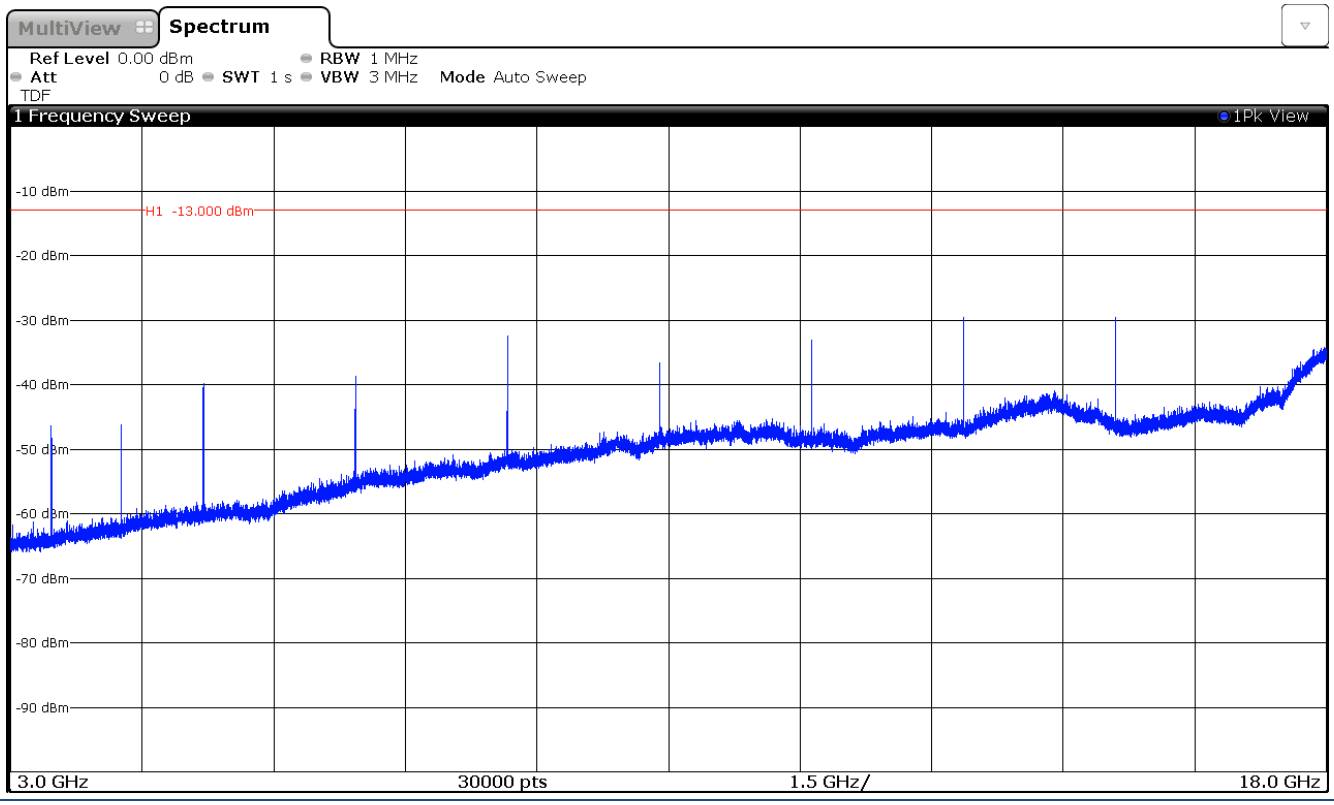
FREQUENCY RANGE 3 GHz to 18 GHz.

LTE QPSK MODULATION. BW=1.4 MHz. Band IV

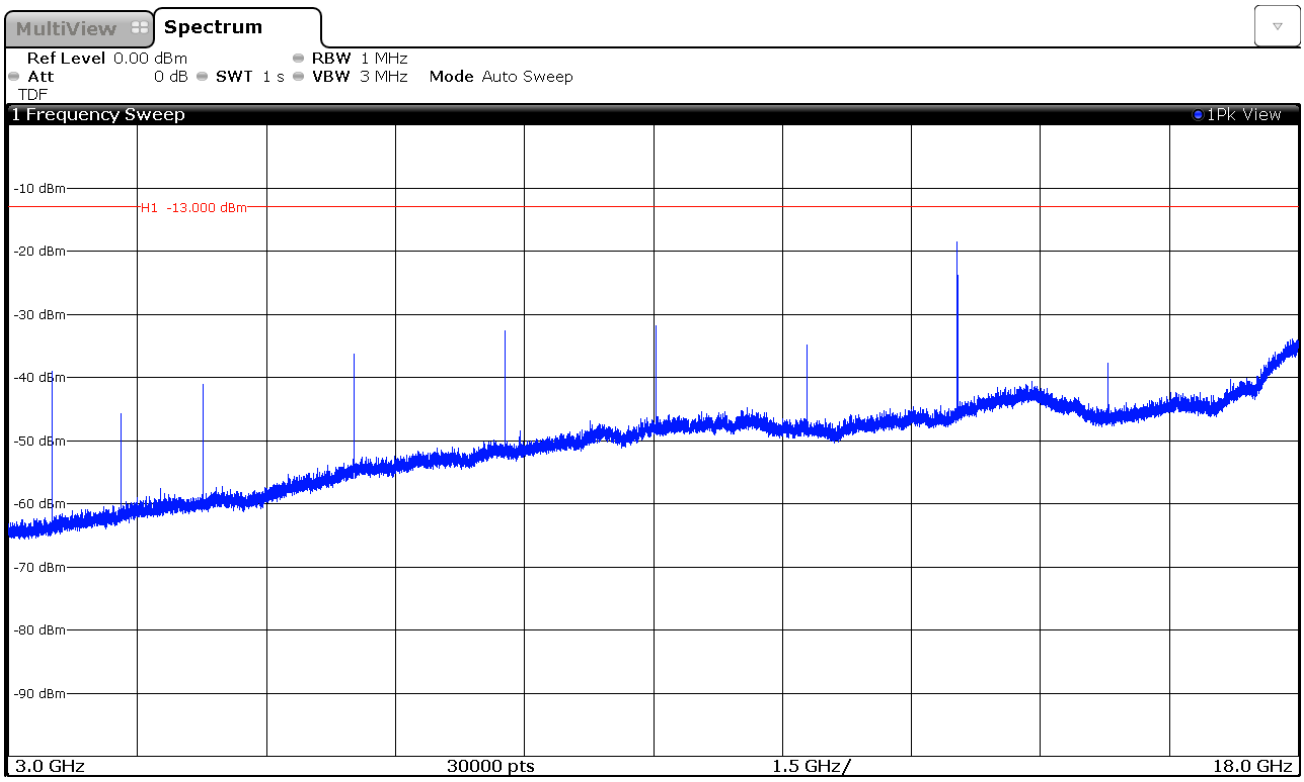
CHANNEL: LOWEST



CHANNEL: MIDDLE



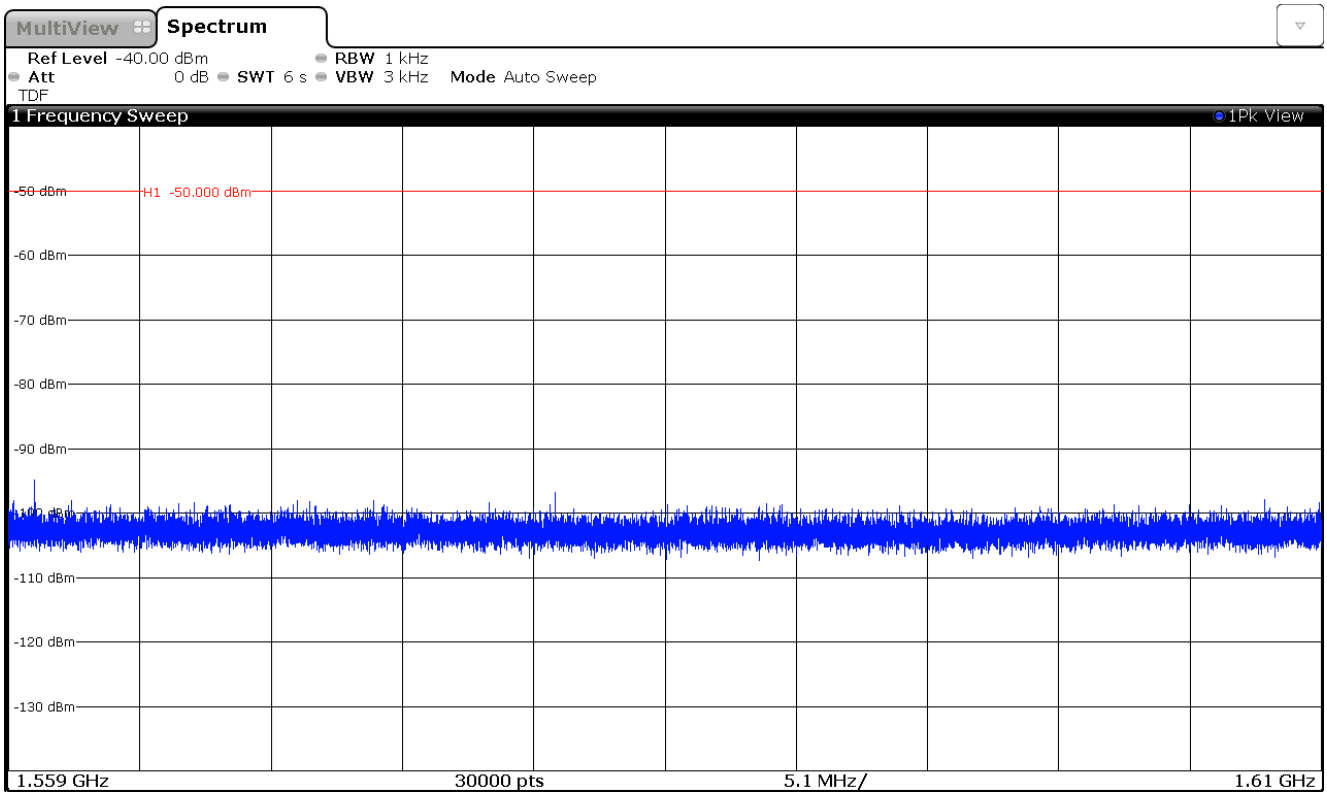
CHANNEL: HIGHEST

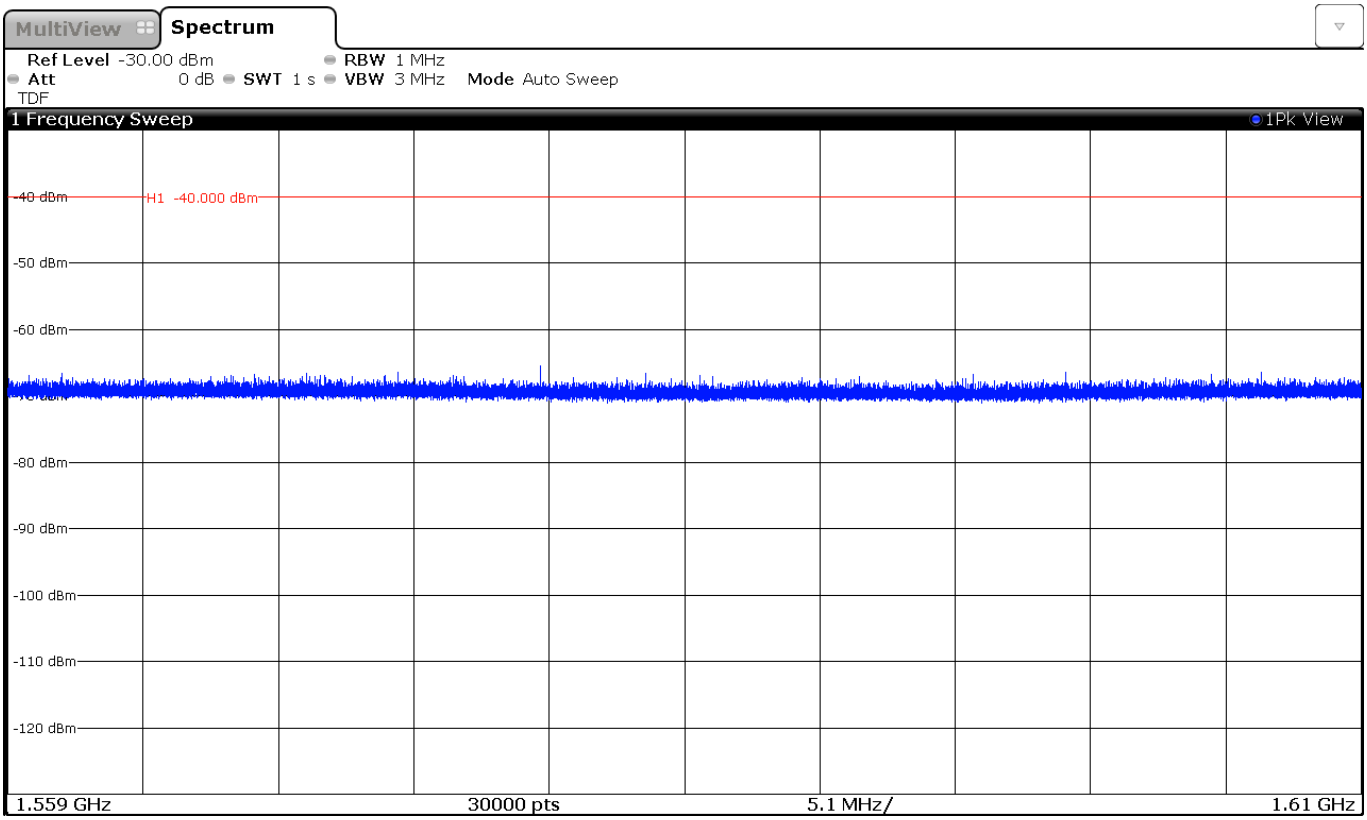


FREQUENCY RANGE 1559 MHz to 1610 MHz.

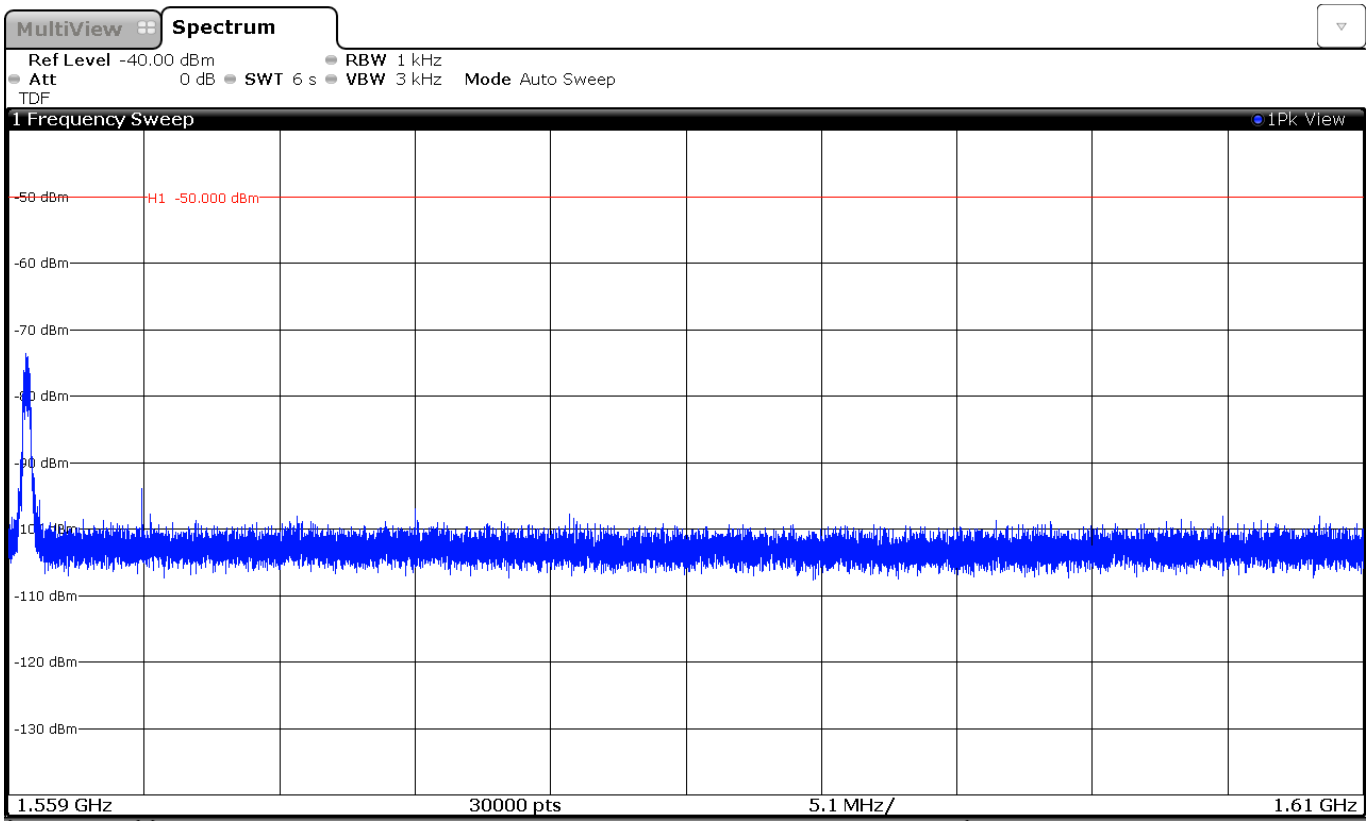
LTE QPSK MODULATION. BW=5 MHz. Band XIII

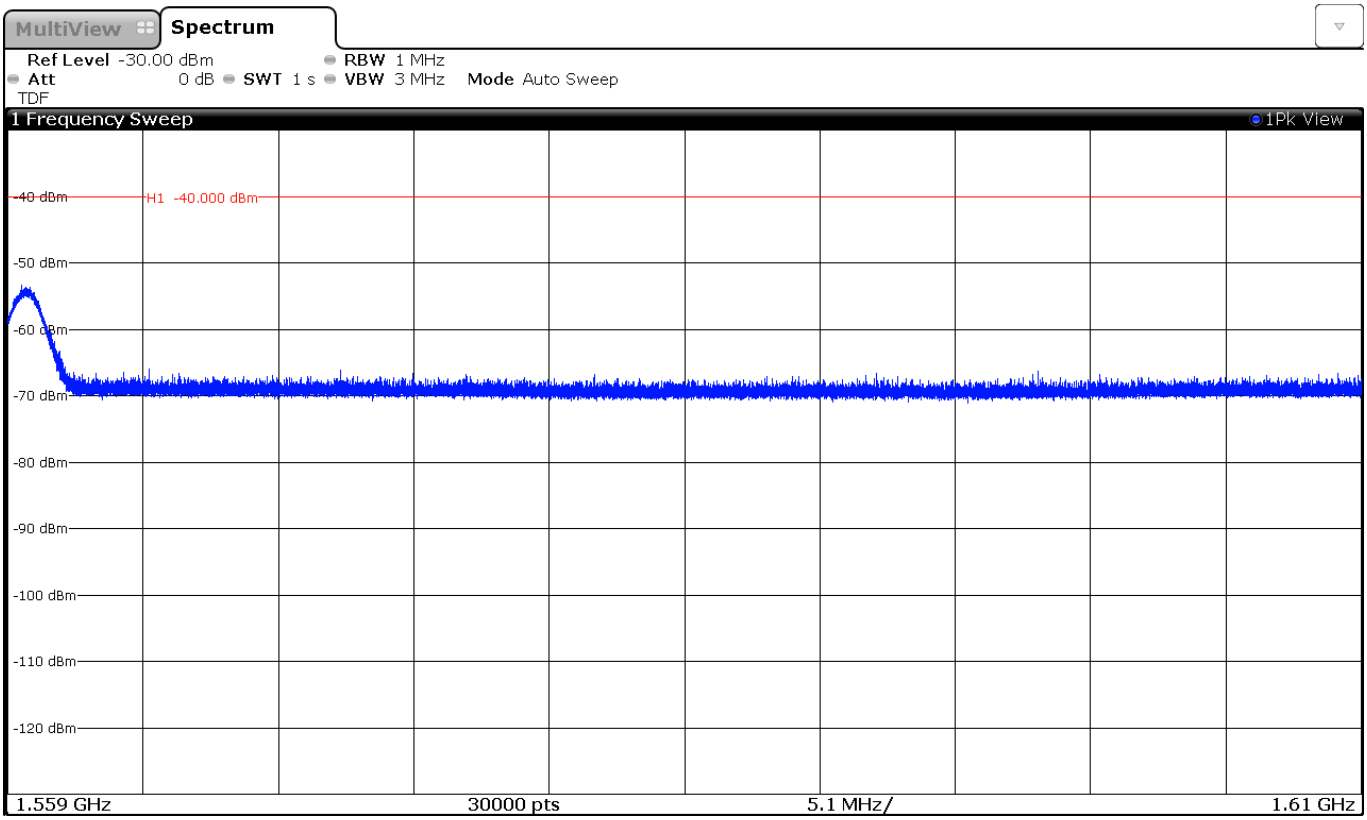
CHANNEL: LOWEST



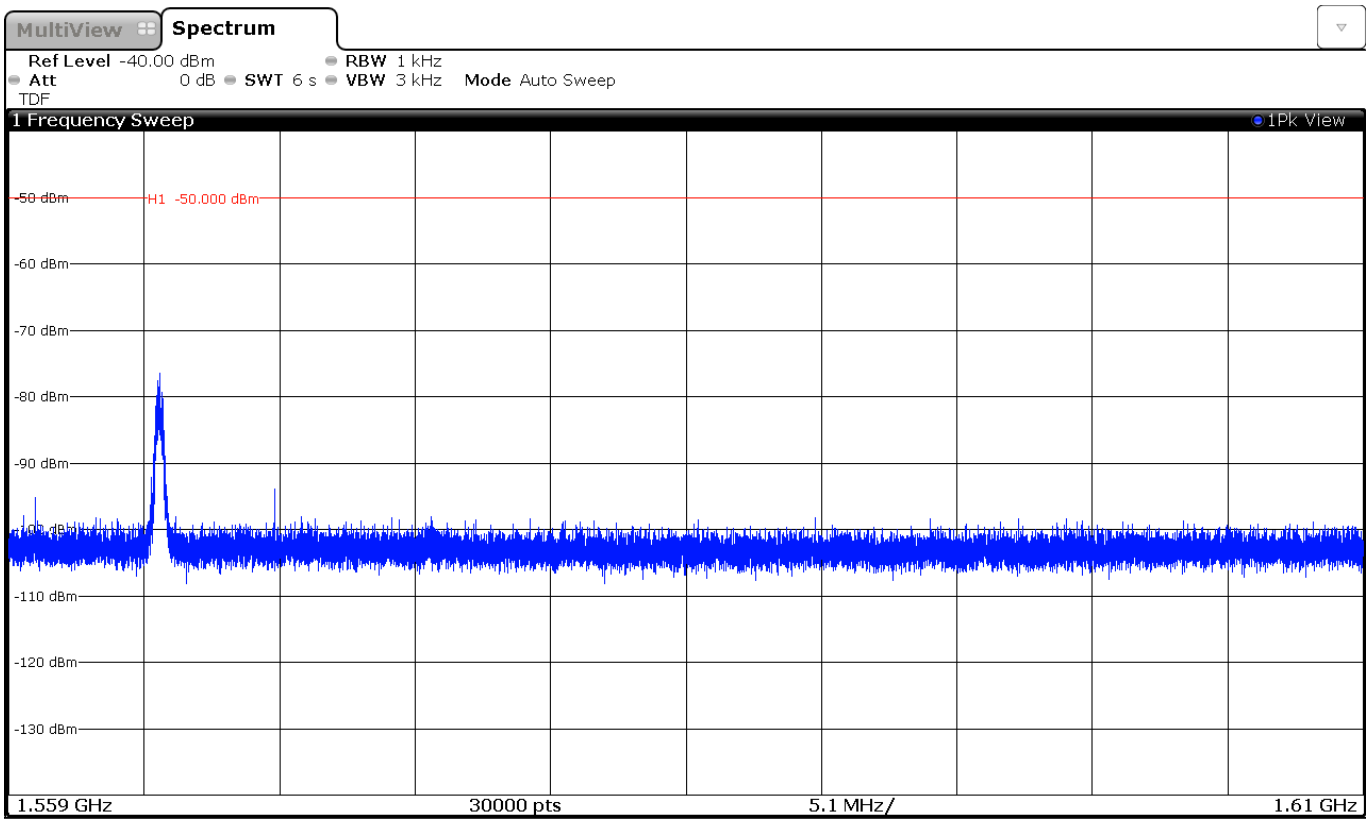


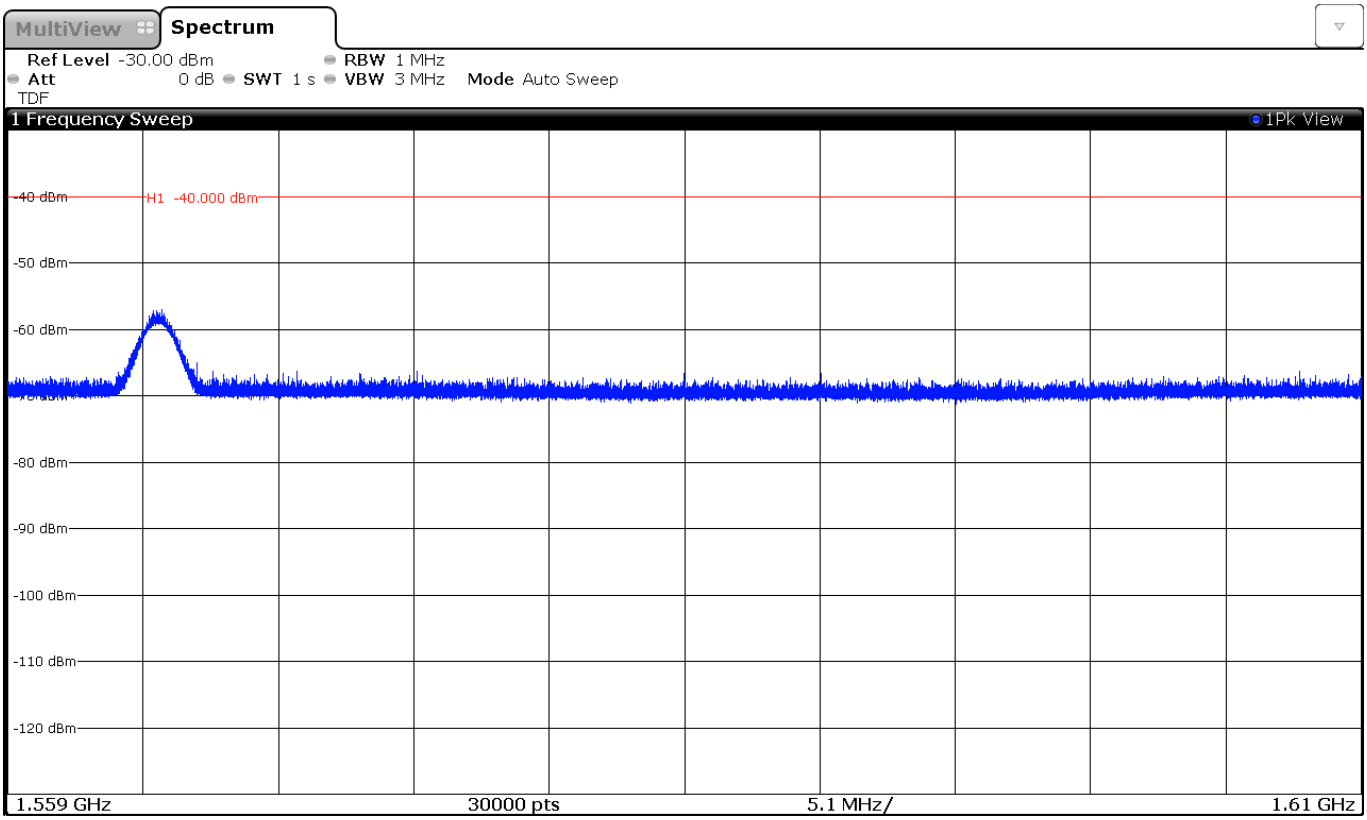
CHANNEL: MIDDLE





CHANNEL: HIGHEST




MultiView
Spectrum
Ref Level -30.00 dBm
RBW 1 MHz
Att 0 dB SWT 1 s VBW 3 MHz Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk View
H1 -40.000 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
-100 dBm
-110 dBm
-120 dBm
1.559 GHz
30000 pts
5.1 MHz/
1.61 GHz