



FCC LISTED,
 REGISTRATION
 NUMBER: 720267
 ISED LISTED
 REGISTRATION NUMBER
 4621A-2

Test report No:

NIE: 51917RRF.001

Test report

REFERENCE STANDARD: USA FCC Part 24 & Part 27 CANADA IC RSS-133, RSS-139, RSS-130

Identificación del objeto ensayado.....: Identification of item tested	LTE Module
Marca Trademark	Telit
Modelo y/o referencia tipo Model and /or type reference	LE910B1-SA
Other identification of the product	FCC ID: RI7LE910B1SA IC: 5131A-LE910B1SA
Final HW version	00
Final SW version	20.00.513
Características Features	LTE Module supporting Band 2, 4 and 12
Solicitante Applicant	TELIT COMMUNICATIONS Via Stazione di Prosecco 5/B. 34010 Sgonico. Trieste-Italy.
Método de ensayo solicitado, norma.....: Test method requested, standard	USA FCC Part 27 10-1-16 Edition. CANADA IC RSS-139 Issue 3, Jul. 2015. CANADA IC RSS-130 Issue 1, Oct. 2013. USA FCC Part 24 10-1-16 Edition. CANADA IC RSS-133 Issue 6, Jan. 2013. Measurement Guidance 971168 D01 v02r02 for certification of Licensed Digital Transmitters. ANSI/TIA-603-E (2016).
Resultado.....: Summary	IN COMPLIANCE
Aprobado por (nombre / cargo y firma) Approved by (name / position & signature)	A. Llamas RF Lab. Manager
Fecha de realización Date of issue	2017-08-11
Formato de informe No.: Report template No	FDT08_20

Index

Competences and guarantees.....	3
General conditions.....	3
Uncertainty	3
Usage of samples.....	3
Test sample description	4
Identification of the client	4
Testing period.....	4
Environmental conditions.....	4
Remarks and comments.....	5
Testing verdicts	7
Appendix A – Test result for FCC Part 24/IC RSS-133.....	8
Appendix B – Test result for FCC Part 27/IC RSS-139/IC RSS-130	104

Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification 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 conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification 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: ISED 4621A-2.

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

DEKRA Testing and Certification 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 DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification 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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

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.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification 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 N°	Description	Model	Serial N°	Date of reception
51917/007	Module	LE910B1-SA	146790000028	2017-03-21
51917/011	LTE antennas	---	---	2017-03-21
40081/003	Test board	---	113990003417	2013-07-23

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 N°	Description	Model	Serial N°	Date of reception
51917/007	Module	LE910B1-SA	146790000028	2017-03-21
43846/005	Test board	---	113990002537	2014-10-21

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 supporting Band 2, 4 and 12.

Identification of the client

TELIT COMMUNICATIONS
Via Stazione di Prosecco 5/B.
34010 Sgonico. Trieste-Italy.

Testing period

The performed test started on 2017-04-10 and finished on 2017-04-28.
The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

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

Temperature	Min. = 15 °C Max. = 35 °C
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 °C Max. = 35 °C
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 °C Max. = 35 °C
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: 1; The tests have been performed by the technical personnel: Pedro Parada, Carolina Postigo, Carlos Contreras and José Carlos Luque.

2: 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	2016/02	2018/02

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	2017/04	2020/04
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/11	2019/11
5.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/03	2020/03
6.	Horn antenna 0.8-18 GHz Rohde & Schwarz R&S HF907 (Link antenna)	N.A.	N.A.
7.	EMI Test Receiver Rohde & Schwarz ESU 40	2016/03	2018/03
8.	Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
9.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2016/02	2018/02
10.	RF pre-amplifier 18-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2015/12	2017/12
11.	Universal Radio communication Tester R&S CMW500	2016/02	2018/02

Testing verdicts

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

FCC PART 24/IC RSS-133 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 24.232/RSS-133 Clause 6.4: RF output power		P		
Clause 2.1047/RSS-133 Clause 6.2: Modulation characteristics		P		
Clause 24.235/RSS-133 Clause 6.3: Frequency stability		P		
Clause 2.1049: Occupied Bandwidth		P		
Clause 24.238/RSS-133 Clause 6.5: Spurious emissions at antenna terminals		P		
Clause 24.238/RSS-133 Clause 6.5: Radiated emissions		P		

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 24/IC RSS-133

INDEX

TEST CONDITIONS	10
RF Output Power	11
Modulation Characteristics	39
Frequency Stability	41
Occupied Bandwidth	47
Spurious emissions at antenna terminals	68
Spurious emissions at antenna terminals at Block Edges	80
Radiated emissions	94

TEST RESULTS FOR FCC PART 24

TEST CONDITIONS

Power supply (V):

$$V_{nom} = 3.8 \text{ Vdc}$$

$$V_{max} = 4.37 \text{ Vdc}$$

$$V_{min} = 3.23 \text{ Vdc}$$

The subscripts nom, min and max indicate voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = External attachable antenna

Antenna gain = 2.14 dBi

TEST FREQUENCIES:

LTE. QPSK AND 16QAM MODULATION (BAND II)

	Channel (Frequency, MHz)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	18607 (1850.70)	18615 (1851.50)	18625 (1852.50)	18650 (1855.00)	18675 (1857.50)	18700 (1860.00)
Middle	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)
Highest	19193 (1909.30)	19185 (1908.50)	19175 (1907.50)	19150 (1905.00)	19125 (1902.50)	19100 (1900.00)

RF Output Power

SPECIFICATION

FCC §2.1046 and 24.232
RSS-133. Clause 6.4.

Mobile/portable stations are limited to 2 Watts (33 dBm) Effective Isotropic Radiated Power (E.I.R.P.).

The peak-to-average ratio (PAR) 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 CMU200 and CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

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

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

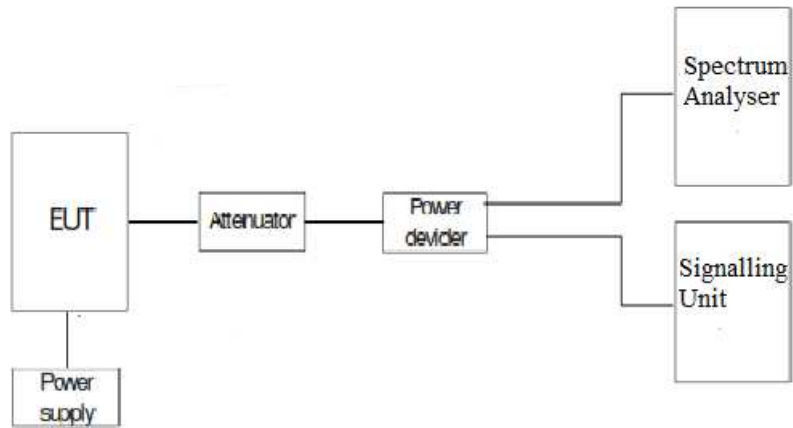
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Conducted average power.



Peak-to-average power ratio (PAPR)



RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED).

LTE. BAND II.

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
1.4	Low	1850.7	QPSK	1	0	22.458	4.65	
				1	2	22.554		
				1	5	22.503		
				3	0	22.352		
				3	1	22.584		
				3	2	22.470		
			6	0	21.524			
			16-QAM	1	0	21.458		5.37
				1	2	21.386		
				1	5	21.564		
				3	0	21.542		
				3	1	21.656		
	3	2		21.305				
	Middle	1880	QPSK	1	0	22.856	4.52	
				1	2	22.548		
				1	5	22.619		
				3	0	22.556		
				3	1	22.658		
				3	2	22.678		
			6	0	21.514			
			16-QAM	1	0	21.291		5.3
				1	2	22.099		
				1	5	21.664		
				3	0	21.521		
3				1	21.840			
3	2	21.823						
High	1909.3	QPSK	1	0	23.009	4.73		
			1	2	22.91			
			1	5	22.997			
			3	0	23.024			
			3	1	23.061			
			3	2	22.840			
		6	0	22.000				
		16-QAM	1	0	21.846		5.54	
			1	2	21.889			
			1	5	22.134			
			3	0	22.004			
			3	1	22.221			
3	2		22.170					
6	0	21.234						

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
3	Low	1851.5	QPSK	1	0	22.625	4.44
				1	7	22.574	
				1	14	22.494	
				8	0	21.724	
				8	4	21.592	
				8	7	21.572	
			15	0	21.608		
			16-QAM	1	0	21.751	
				1	7	21.525	
				1	14	21.646	
				8	0	20.949	
				8	4	20.834	
	8	7		20.862			
	15	0	20.823	5.16			
	Middle	1880	QPSK	1	0	22.841	4.44
				1	7	22.756	
				1	14	22.777	
				8	0	21.732	
				8	4	21.713	
				8	7	21.716	
			15	0	21.737		
			16-QAM	1	0	21.789	
				1	7	21.777	
				1	14	21.992	
8				0	20.877		
8				4	20.891		
8	7	20.870					
15	0	20.962	5.46				
High	1908.5	QPSK	1	0	23.084	4.87	
			1	7	23.009		
			1	14	23.017		
			8	0	22.136		
			8	4	22.077		
			8	7	22.057		
		15	0	22.023			
		16-QAM	1	0	22.399		
			1	7	22.241		
			1	14	22.060		
			8	0	21.325		
			8	4	21.237		
8	7		21.212				
15	0	21.161	5.5				

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
5	Low	1852.5	QPSK	1	0	22.550	4.52
				1	12	22.509	
				1	24	22.516	
				12	0	21.646	
				12	6	21.520	
				12	11	21.593	
				25	0	21.544	
			16-QAM	1	0	21.518	5.32
				1	12	21.492	
				1	24	21.396	
				12	0	20.797	
				12	6	20.688	
				12	11	20.688	
				25	0	20.562	
	Middle	1880	QPSK	1	0	22.641	4.97
				1	12	22.638	
				1	24	22.772	
				12	0	21.798	
				12	6	21.655	
				12	11	21.618	
				25	0	21.595	
			16-QAM	1	0	21.233	5.27
				1	12	21.726	
				1	24	21.399	
12				0	20.814		
12				6	20.684		
12				11	20.907		
25				0	20.877		
High	1907.5	QPSK	1	0	22.998	5.18	
			1	12	22.839		
			1	24	22.883		
			12	0	21.996		
			12	6	22.050		
			12	11	21.946		
			25	0	22.007		
		16-QAM	1	0	22.728	5.88	
			1	12	22.64		
			1	24	22.180		
			12	0	21.173		
			12	6	21.243		
			12	11	21.166		
			25	0	21.097		

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
10	Low	1855	QPSK	1	0	22.673	4.36	
				1	24	22.311		
				1	49	22.34		
				25	0	21.513		
				25	12	21.366		
				25	24	21.346		
				50	0	21.395		
			16-QAM	1	0	21.918		5.18
				1	24	21.614		
				1	49	21.660		
				25	0	20.663		
				25	12	20.534		
				25	24	20.553		
				50	0	20.571		
	Middle	1880	QPSK	1	0	22.618	3.57	
				1	24	22.485		
				1	49	22.643		
				25	0	21.594		
				25	12	21.579		
				25	24	21.602		
				50	0	21.604		
			16-QAM	1	0	21.916		4.5
				1	24	21.838		
				1	49	21.978		
25				0	20.774			
25				12	20.676			
25				24	20.758			
50				0	20.774			
High	1905	QPSK	1	0	23.167	4.98		
			1	24	22.846			
			1	49	22.908			
			25	0	22.012			
			25	12	21.897			
			25	24	21.907			
			50	0	22.004			
		16-QAM	1	0	22.393		5.85	
			1	24	22.051			
			1	49	22.127			
			25	0	21.152			
			25	12	21.152			
			25	24	21.029			
			50	0	21.090			

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
15	Low	1857.5	QPSK	1	0	22.967	4.33
				1	37	22.391	
				1	74	22.471	
				36	0	21.714	
				36	18	21.353	
				36	37	21.500	
				75	0	21.648	
		16-QAM	1	0	21.993	5.32	
			1	37	21.230		
			1	74	21.815		
			36	0	20.791		
			36	18	20.496		
			36	37	20.623		
			75	0	20.714		
	Middle	1880	QPSK	1	0	22.989	3.72
				1	37	22.629	
				1	74	22.663	
				36	0	21.717	
				36	18	21.720	
				36	37	21.745	
				75	0	21.944	
16-QAM		1	0	21.928	4.47		
		1	37	21.870			
		1	74	21.858			
		36	0	20.988			
		36	18	20.708			
		36	37	20.870			
		75	0	20.834			
High	1902.5	QPSK	1	0	23.635	4.74	
			1	37	22.938		
			1	74	23.091		
			36	0	22.271		
			36	18	22.067		
			36	37	22.063		
			75	0	22.217		
	16-QAM	1	0	22.66	5.58		
		1	37	22.154			
		1	74	22.256			
		36	0	21.309			
		36	18	21.095			
		36	37	21.070			
		75	0	21.225			

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
20	Low	1860	QPSK	1	0	22.796	4.29	
				1	49	22.209		
				1	99	22.282		
				50	0	21.691		
				50	24	21.431		
				50	49	21.452		
			100	0	21.566			
			16-QAM	1	0	22.094		5.24
				1	49	21.551		
				1	99	21.547		
				50	0	20.759		
				50	24	20.509		
	50	49		20.525				
	Middle	1880	QPSK	1	0	22.853	3.75	
				1	49	22.436		
				1	99	22.541		
				50	0	21.772		
				50	24	21.580		
				50	49	21.660		
			100	0	21.741			
			16-QAM	1	0	22.117		4.84
				1	49	21.700		
				1	99	21.882		
				50	0	20.884		
50				24	20.693			
50	49	20.737						
High	1900	QPSK	1	0	22.993	4.78		
			1	49	22.639			
			1	99	22.484			
			50	0	21.983			
			50	24	21.805			
			50	49	21.796			
		100	0	21.907				
		16-QAM	1	0	22.378		5.5	
			1	49	21.980			
			1	99	21.905			
			50	0	21.106			
			50	24	20.925			
50	49		20.879					
100	0	20.932						

LTE QPSK AND 16QAM MODULATION. Bandwidth = 1.4 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.584	2.14	24.724	5.37
Middle	22.856	2.14	24.996	5.30
Highest	23.061	2.14	25.201	5.54
Measurement uncertainty (dB)	<±1.11			

LTE QPSK AND 16QAM MODULATION. Bandwidth = 3 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.625	2.14	24.765	5.16
Middle	22.841	2.14	24.981	5.46
Highest	23.084	2.14	25.224	5.50
Measurement uncertainty (dB)	<±1.11			

LTE QPSK AND 16QAM MODULATION. Bandwidth = 5 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.55	2.14	24.690	5.32
Middle	22.772	2.14	24.912	5.27
Highest	22.998	2.14	25.138	5.88
Measurement uncertainty (dB)	<±1.11			

LTE QPSK AND 16QAM MODULATION. Bandwidth = 10 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.673	2.14	24.813	5.18
Middle	22.643	2.14	24.783	4.50
Highest	23.167	2.14	25.307	5.85
Measurement uncertainty (dB)	<±1.11			

LTE QPSK AND 16QAM MODULATION. Bandwidth = 15 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.967	2.14	25.107	5.32
Middle	22.989	2.14	25.129	4.47
Highest	23.635	2.14	25.775	5.58
Measurement uncertainty (dB)	<±1.11			

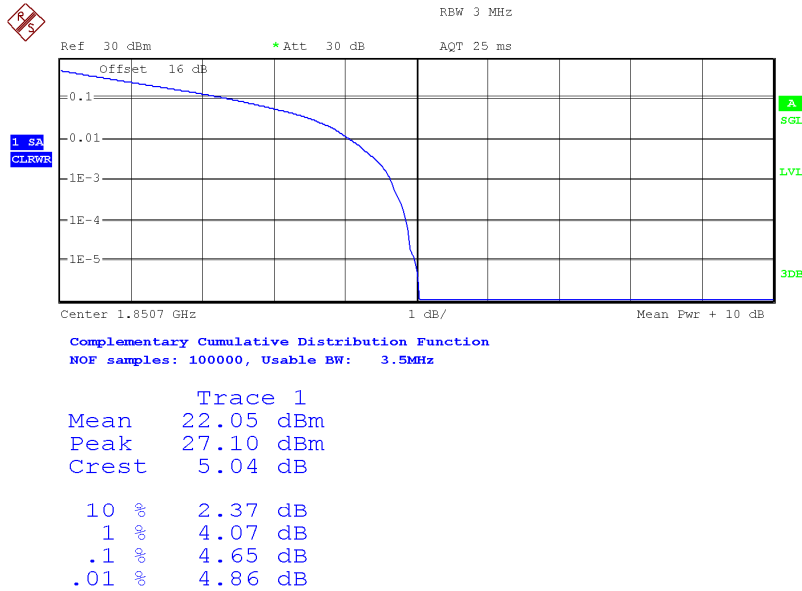
LTE QPSK AND 16QAM MODULATION. Bandwidth = 20 MHz

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.796	2.14	24.936	5.24
Middle	22.853	2.14	24.993	4.84
Highest	22.993	2.14	25.133	5.50
Measurement uncertainty (dB)	<±1.11			

Verdict: PASS

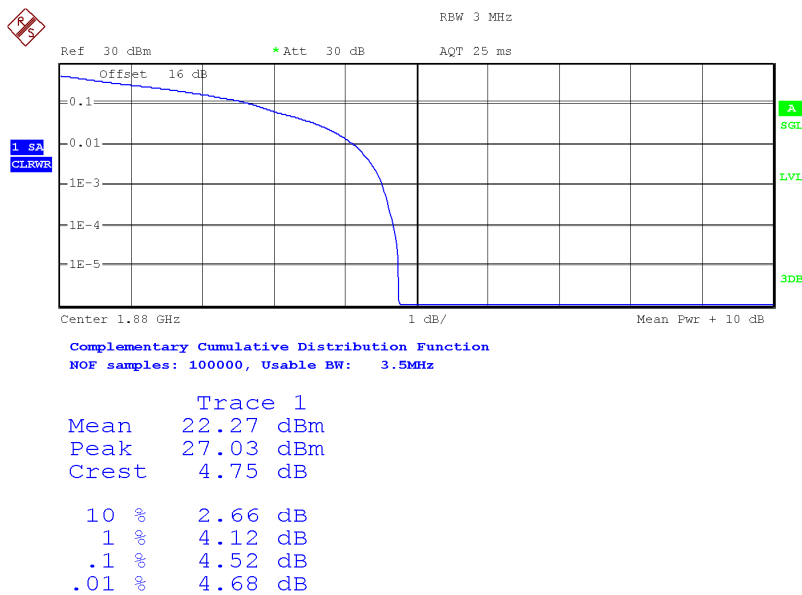
PEAK-TO-AVERAGE POWER RATIO (PAPR).

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



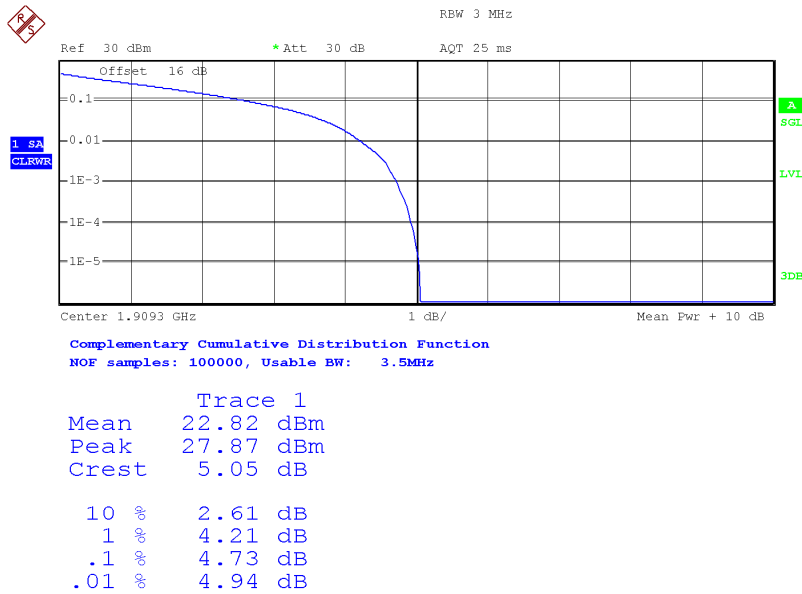
Date: 25.APR.2017 09:48:07

Channel Middle:



Date: 25.APR.2017 09:50:15

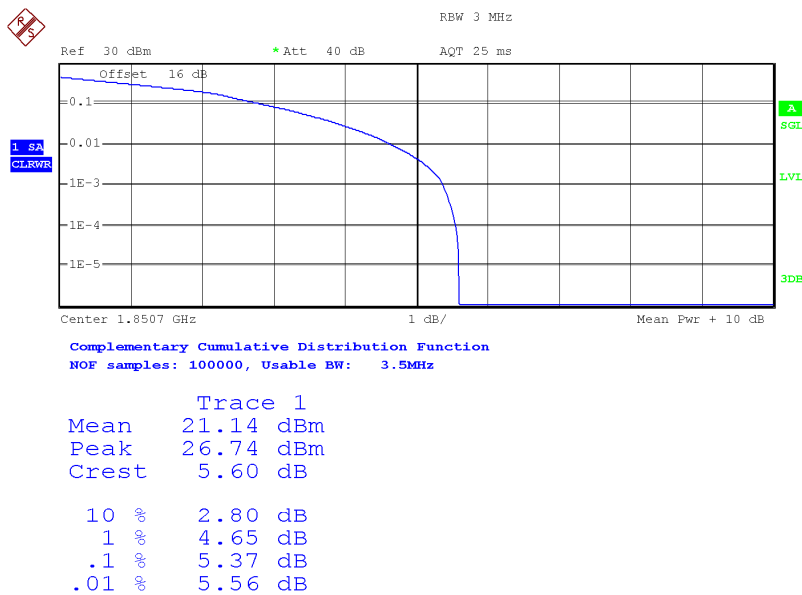
Channel High:



Date: 25.APR.2017 09:53:18

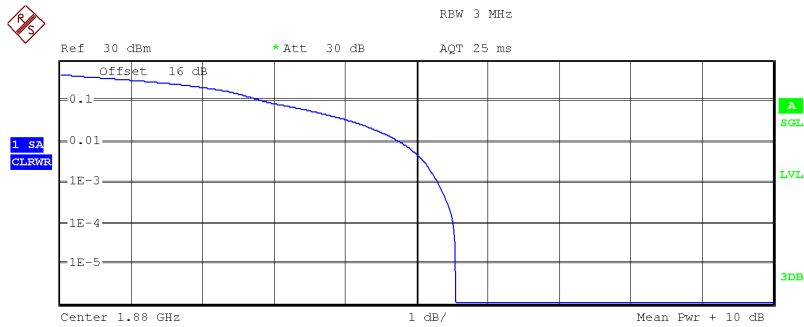
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.

Channel Low:



Date: 25.APR.2017 10:04:50

Channel Middle:

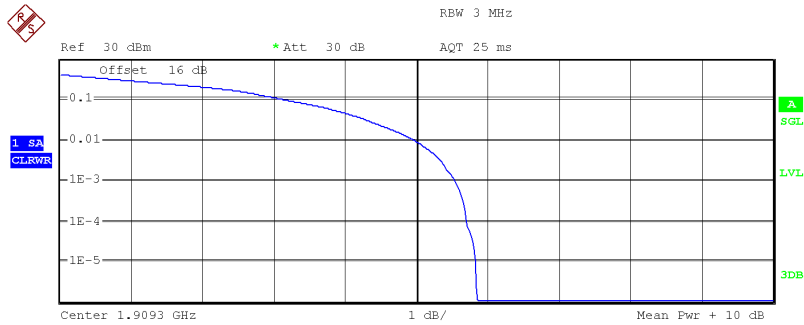


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 3.5MHz

Trace 1	
Mean	21.55 dBm
Peak	27.10 dBm
Crest	5.55 dB
10 %	2.87 dB
1 %	4.78 dB
.1 %	5.30 dB
.01 %	5.51 dB

Date: 25.APR.2017 09:51:09

Channel High:



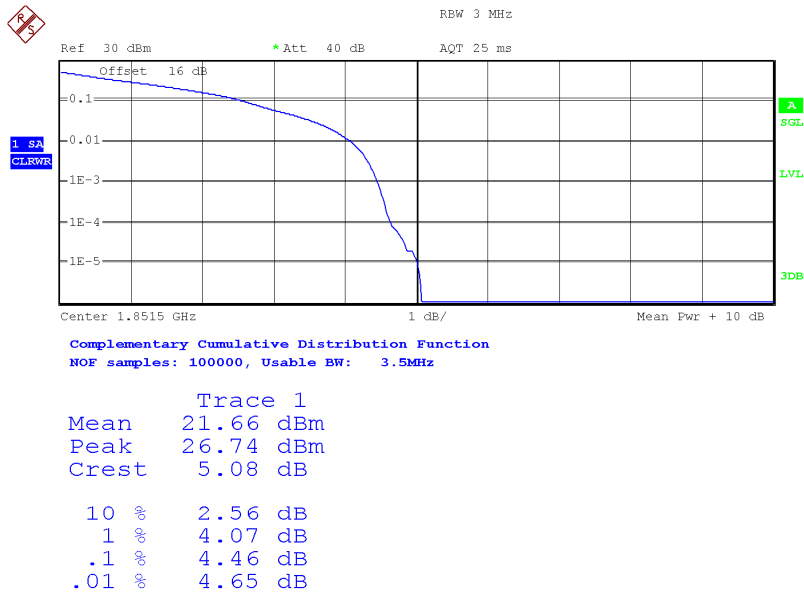
Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 3.5MHz

Trace 1	
Mean	21.96 dBm
Peak	27.80 dBm
Crest	5.84 dB
10 %	3.16 dB
1 %	4.97 dB
.1 %	5.54 dB
.01 %	5.71 dB

Date: 25.APR.2017 09:54:29

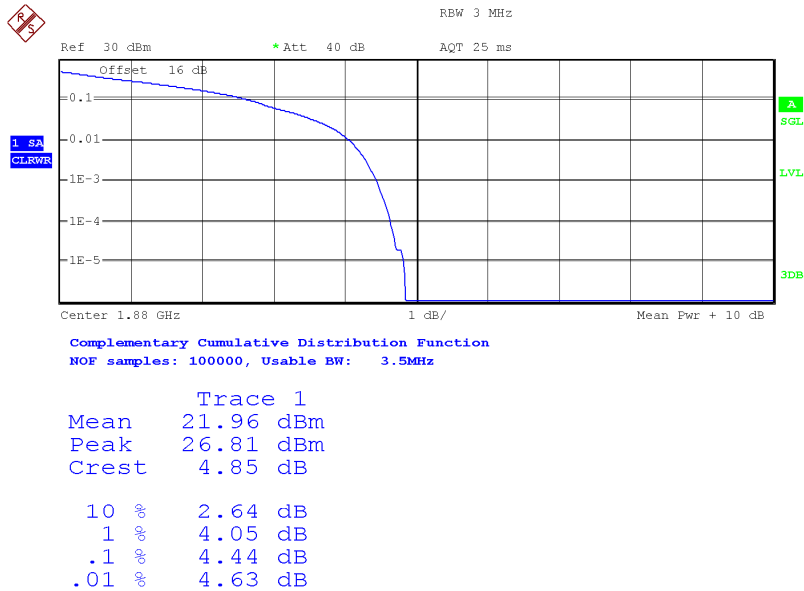
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.

Channel Low:



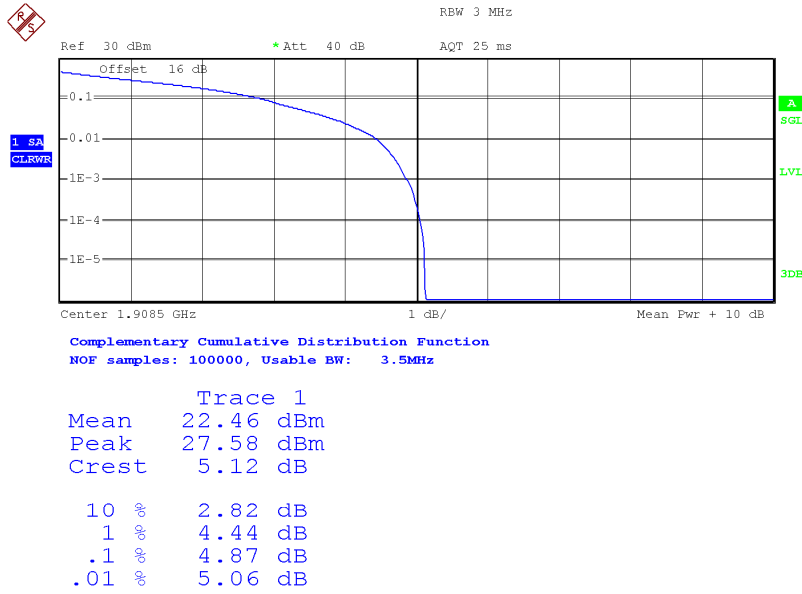
Date: 25.APR.2017 10:01:36

Channel Middle:



Date: 25.APR.2017 10:09:37

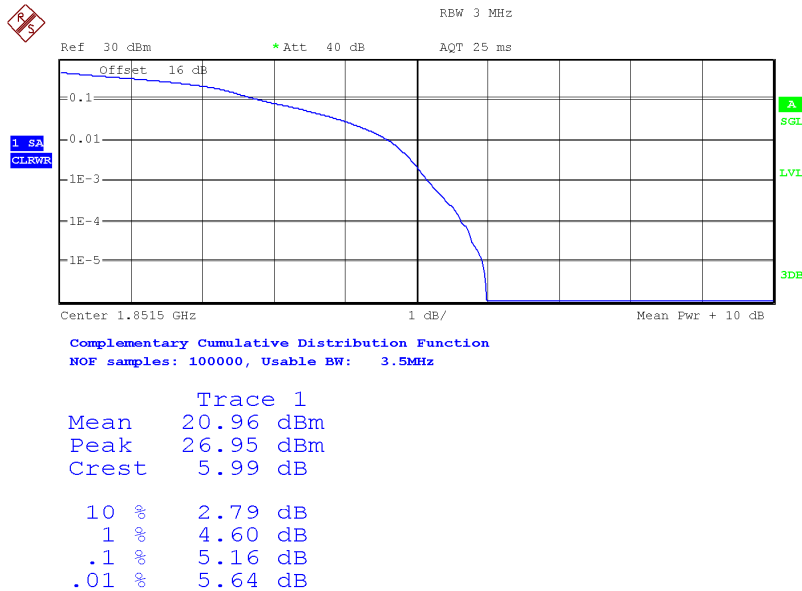
Channel High:



Date: 25.APR.2017 10:12:50

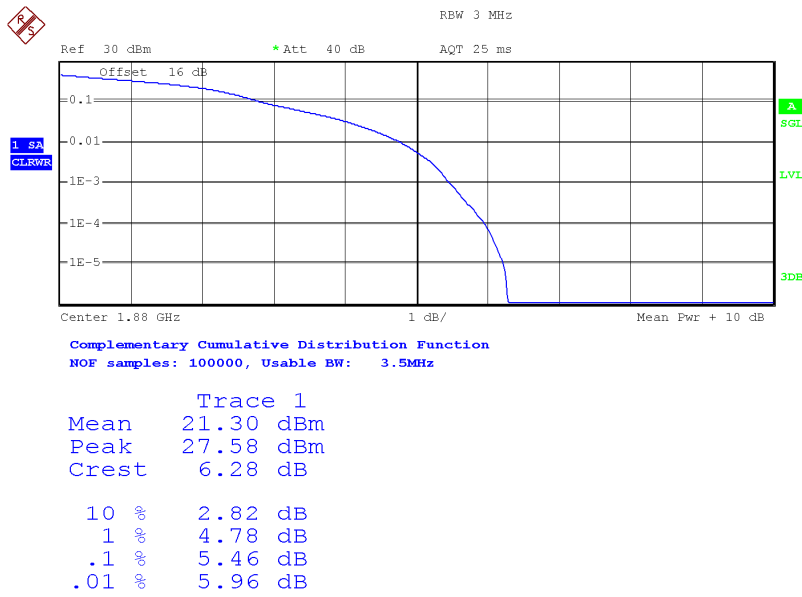
Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

Channel Low:



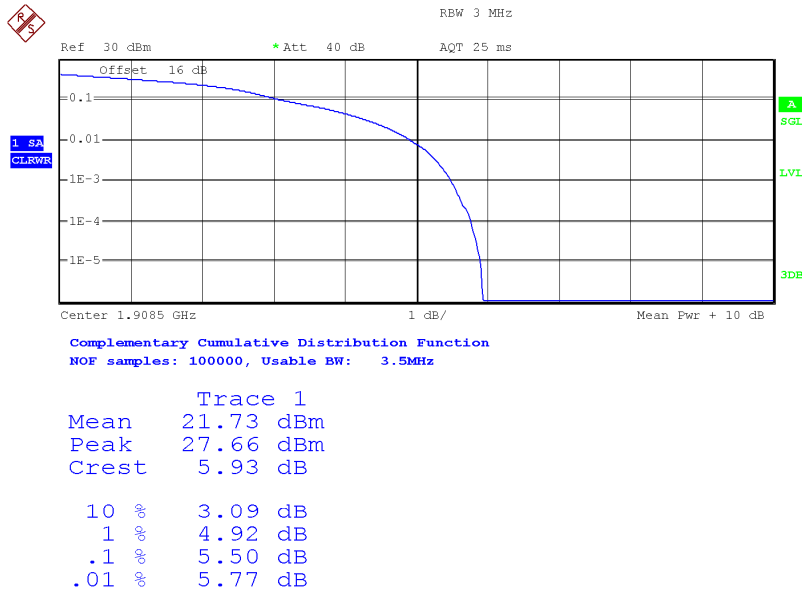
Date: 25.APR.2017 10:07:44

Channel Middle:



Date: 25.APR.2017 10:10:44

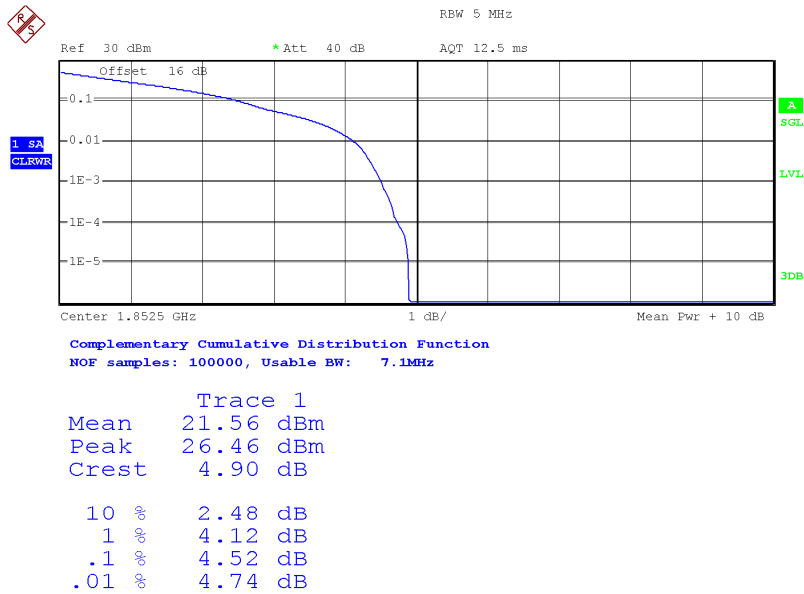
Channel High:



Date: 25.APR.2017 10:13:38

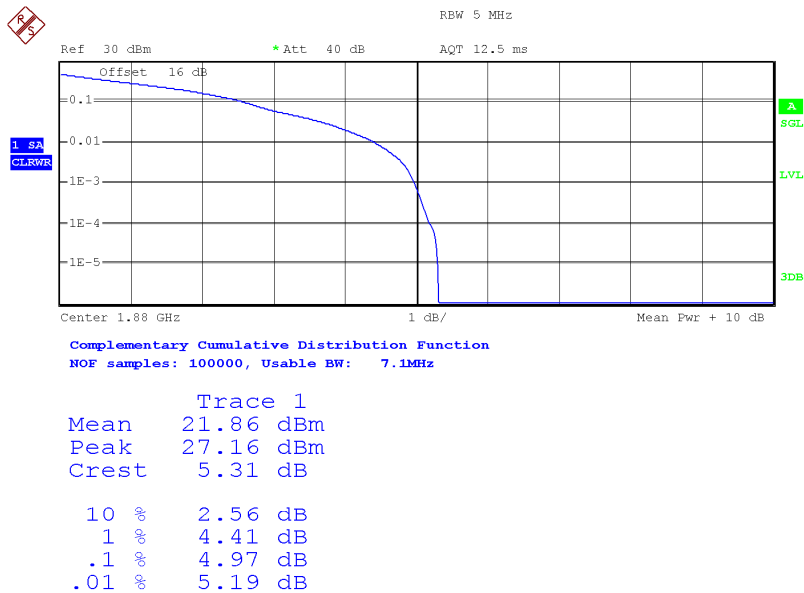
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.

Channel Low:



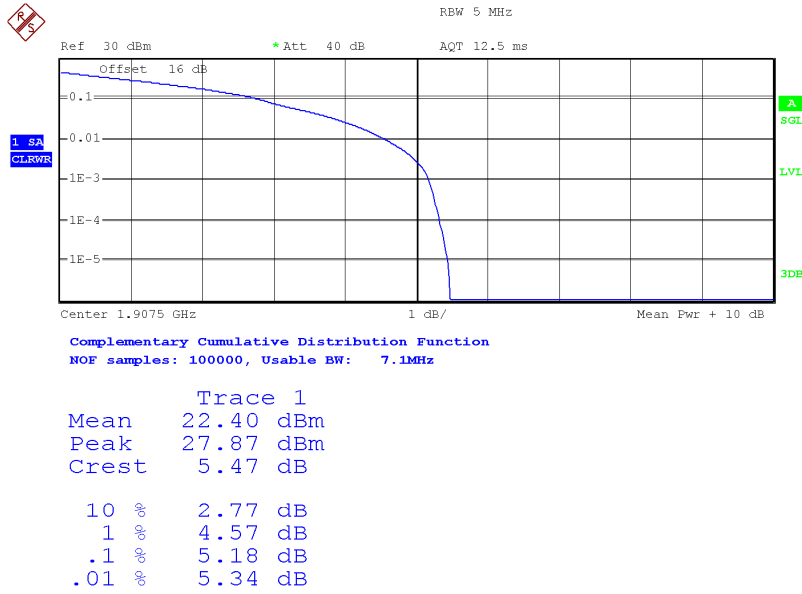
Date: 25.APR.2017 10:18:39

Channel Middle:



Date: 25.APR.2017 10:21:04

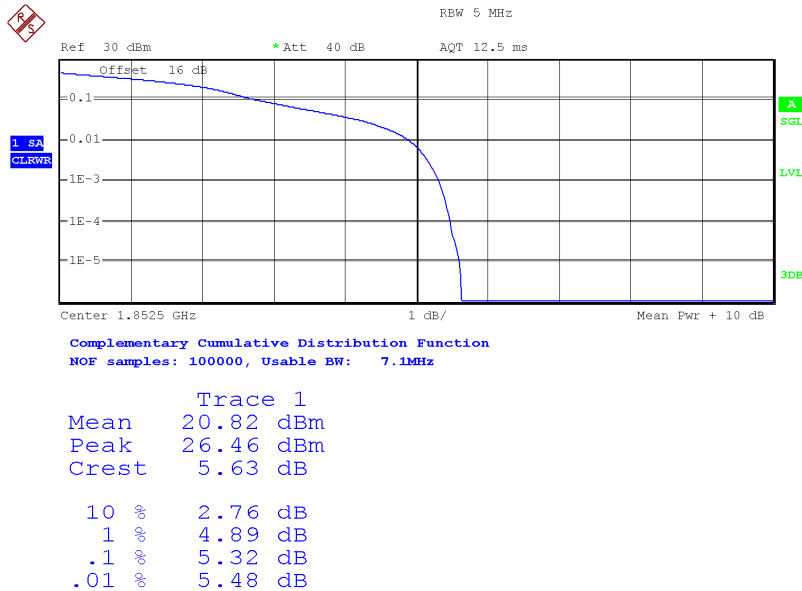
Channel High:



Date: 25.APR.2017 10:23:47

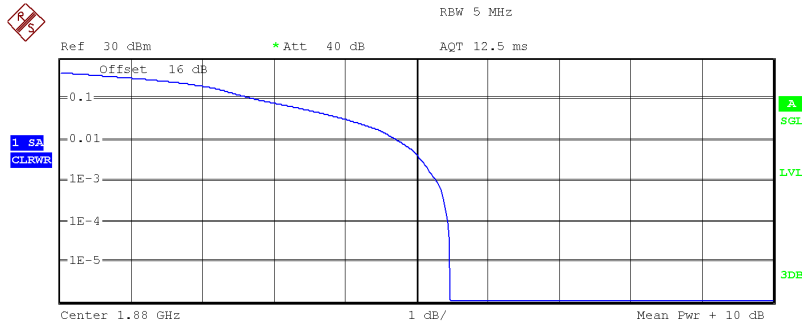
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.

Channel Low:



Date: 25.APR.2017 10:19:30

Channel Middle:

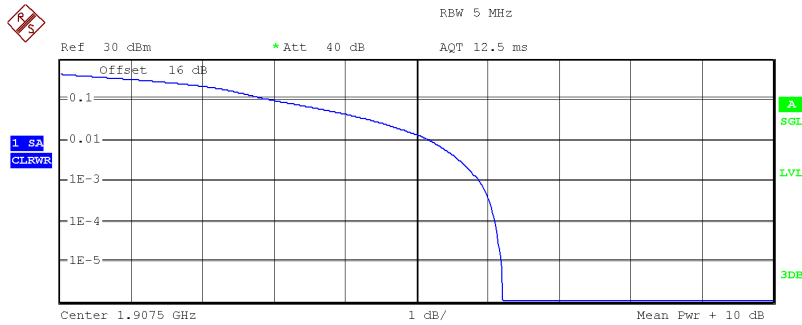


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 7.1MHz

Trace 1	
Mean	21.62 dBm
Peak	27.09 dBm
Crest	5.47 dB
10 %	2.76 dB
1 %	4.73 dB
.1 %	5.27 dB
.01 %	5.45 dB

Date: 25.APR.2017 10:21:59

Channel High:



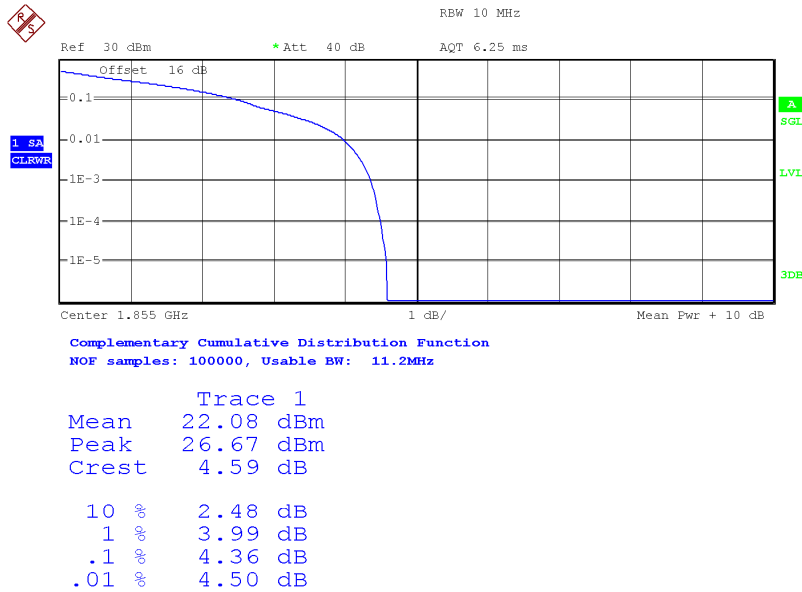
Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 7.1MHz

Trace 1	
Mean	21.66 dBm
Peak	27.87 dBm
Crest	6.21 dB
10 %	2.96 dB
1 %	5.19 dB
.1 %	5.88 dB
.01 %	6.11 dB

Date: 25.APR.2017 10:26:25

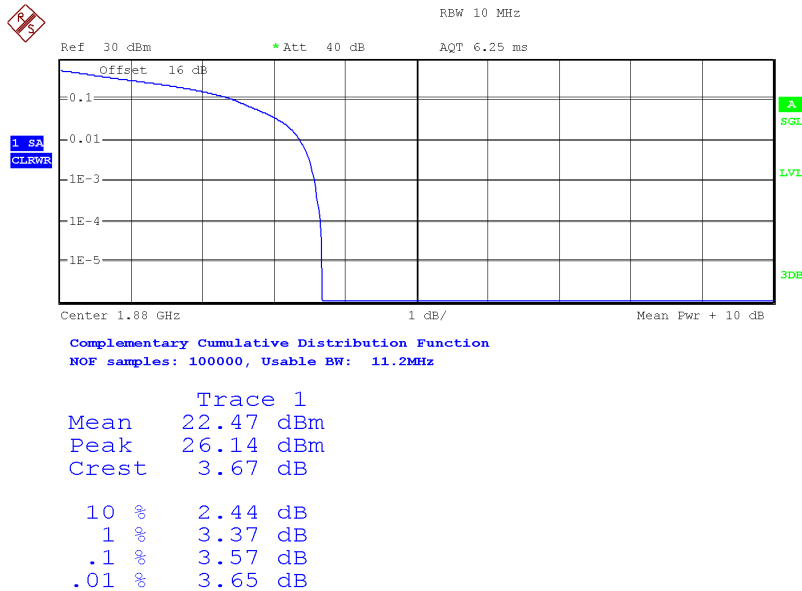
Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

Channel Low:



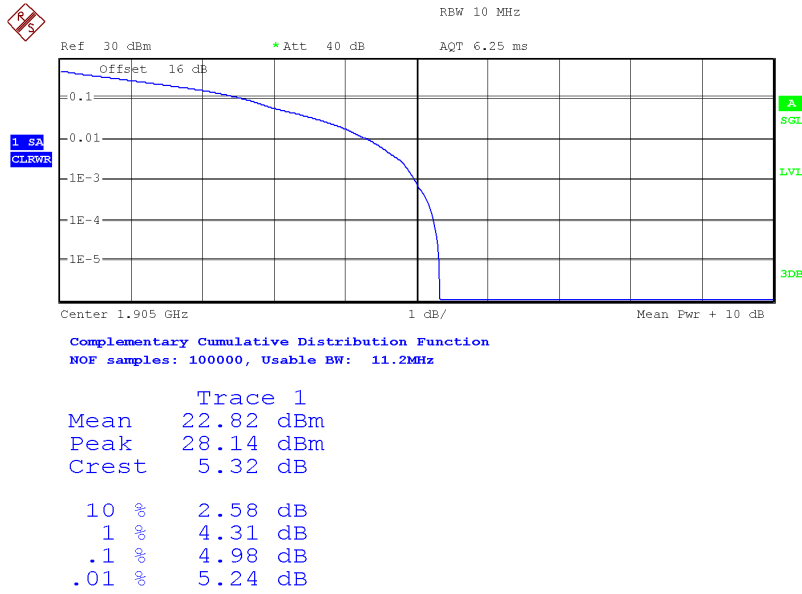
Date: 25.APR.2017 10:32:06

Channel Middle:



Date: 25.APR.2017 10:37:52

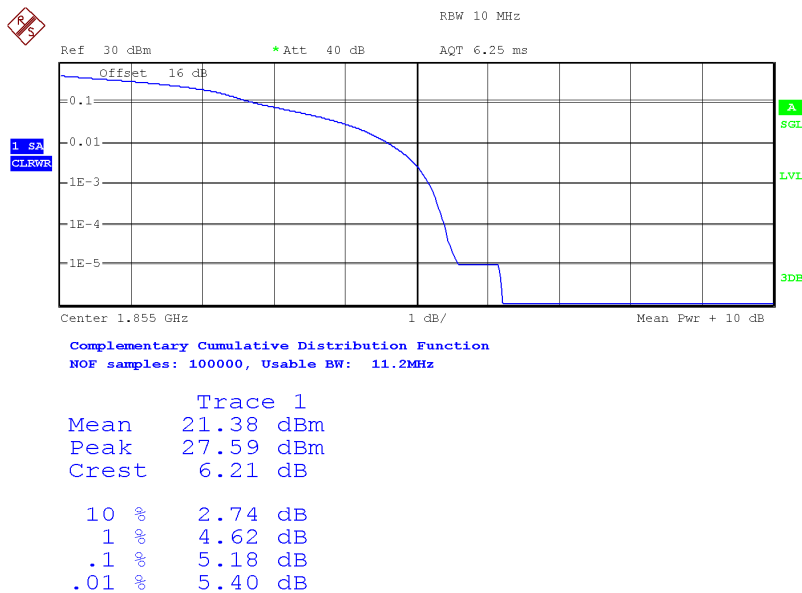
Channel High:



Date: 25.APR.2017 10:40:04

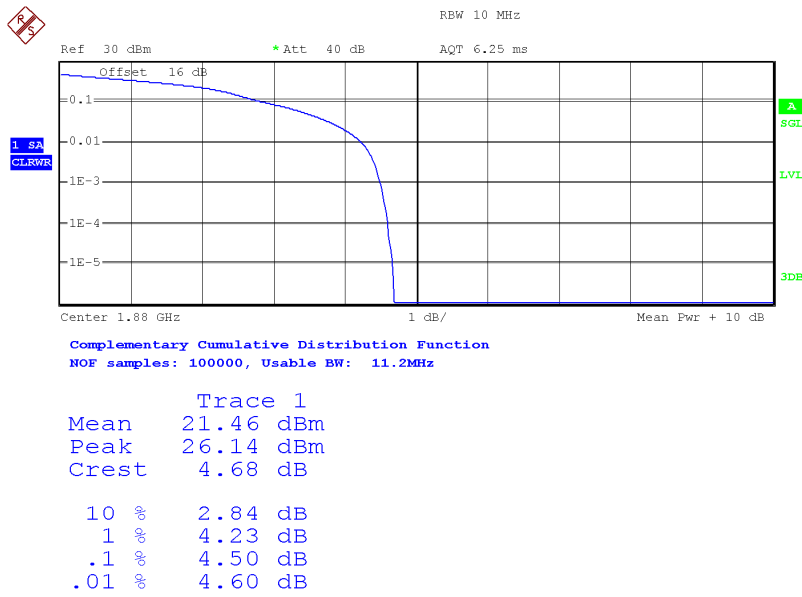
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.

Channel Low:



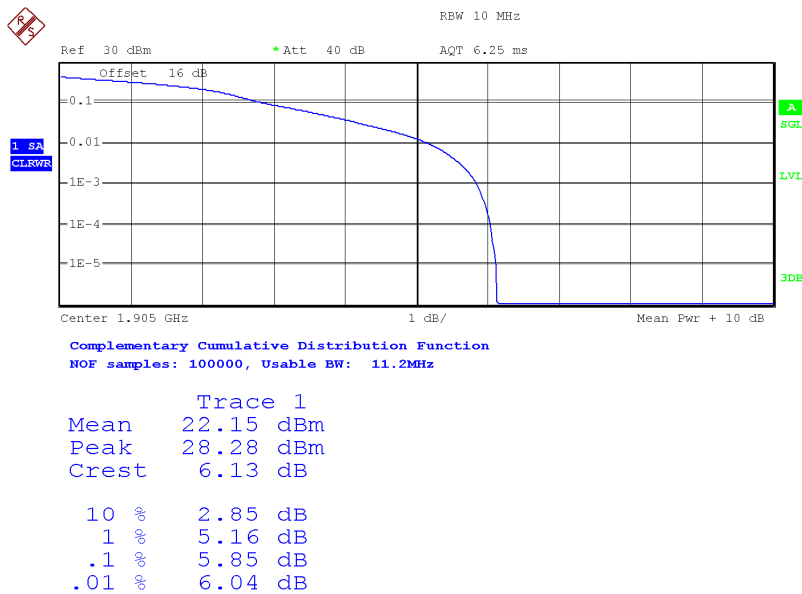
Date: 25.APR.2017 10:33:12

Channel Middle:



Date: 25.APR.2017 10:38:35

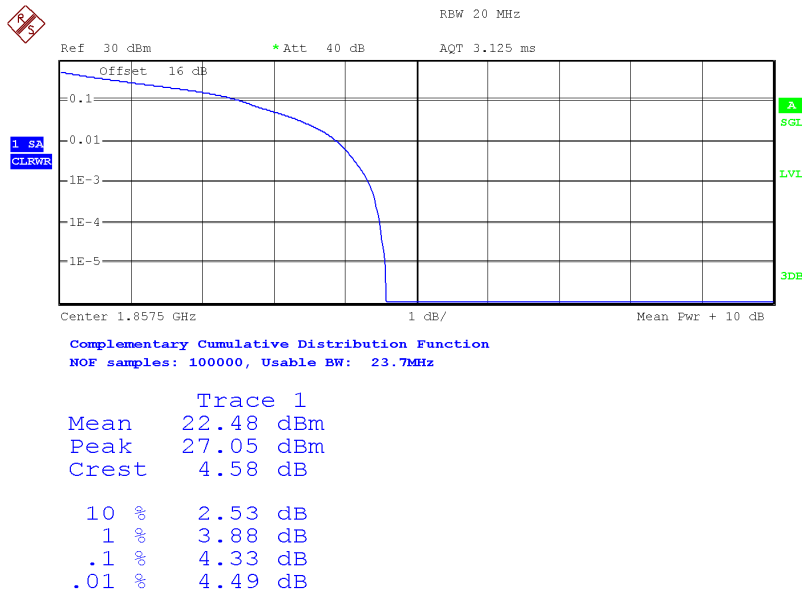
Channel High:



Date: 25.APR.2017 10:40:41

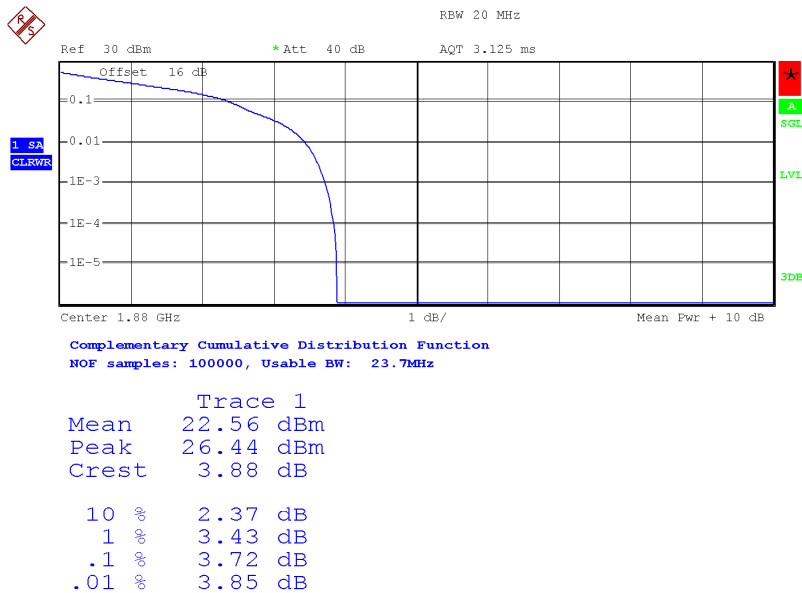
Bandwidth = 15 MHz. Modulation QPSK. RB Size: 75. RB Offset: 0.

Channel Low:



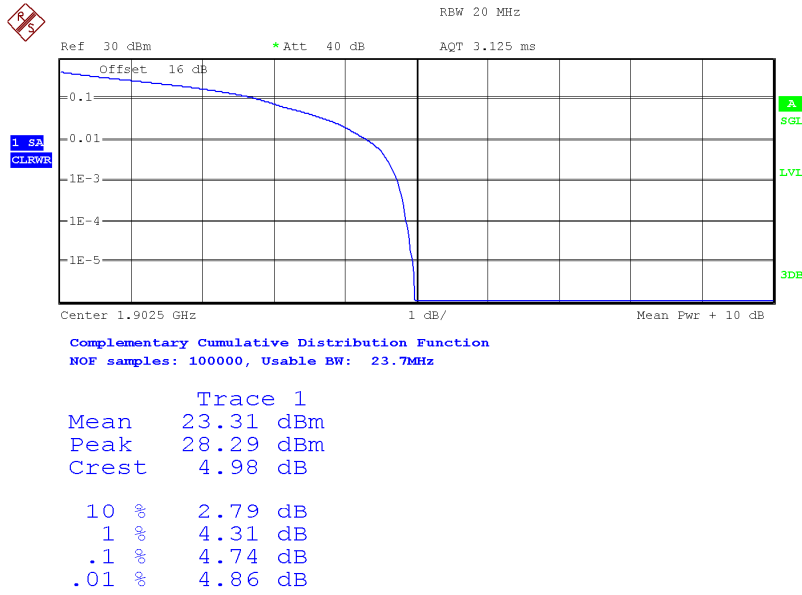
Date: 25.APR.2017 10:44:22

Channel Middle:



Date: 25.APR.2017 10:49:15

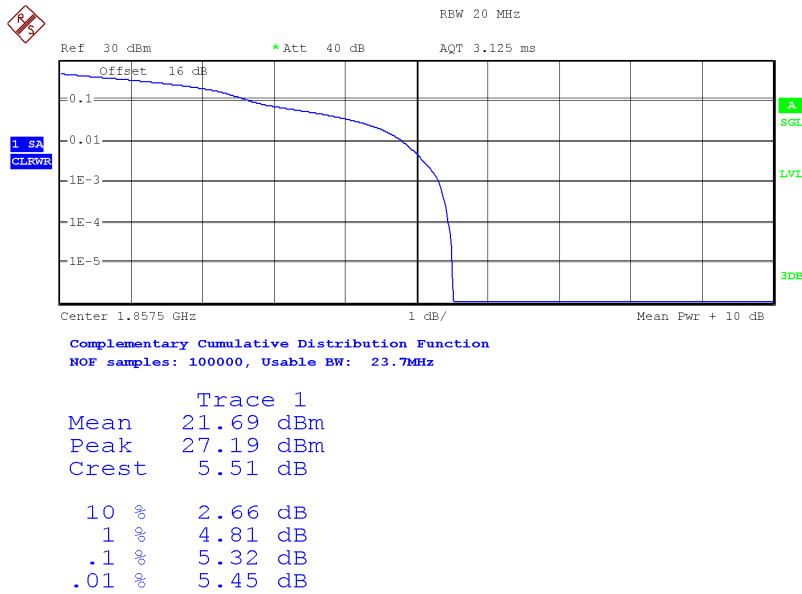
Channel High:



Date: 25.APR.2017 10:51:24

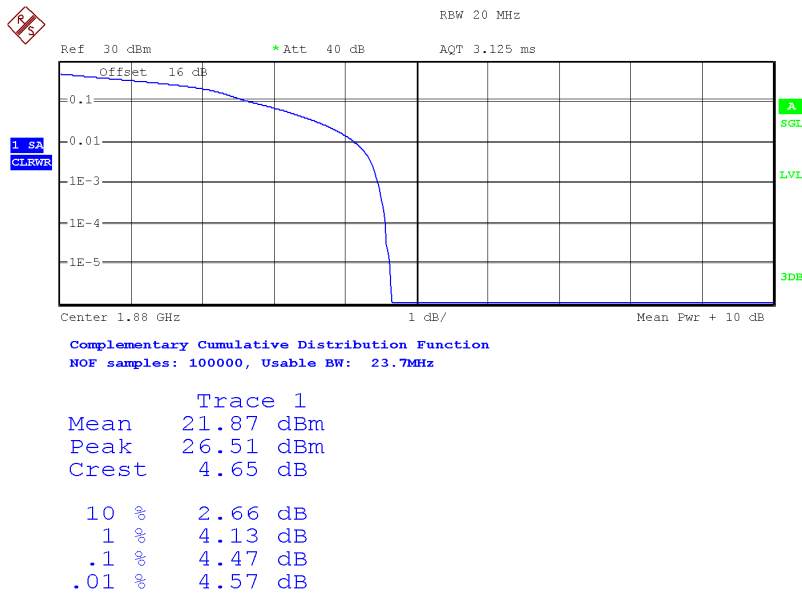
Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.

Channel Low:



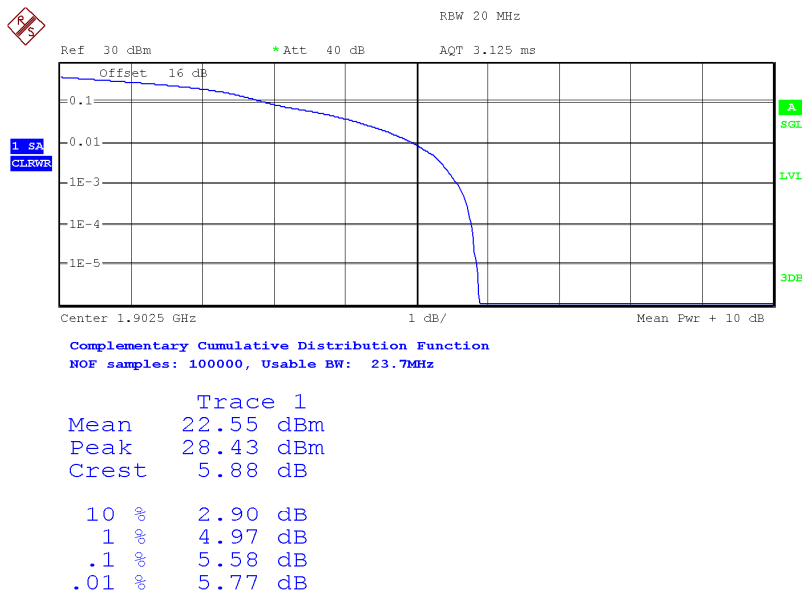
Date: 25.APR.2017 10:47:40

Channel Middle:



Date: 25.APR.2017 10:49:58

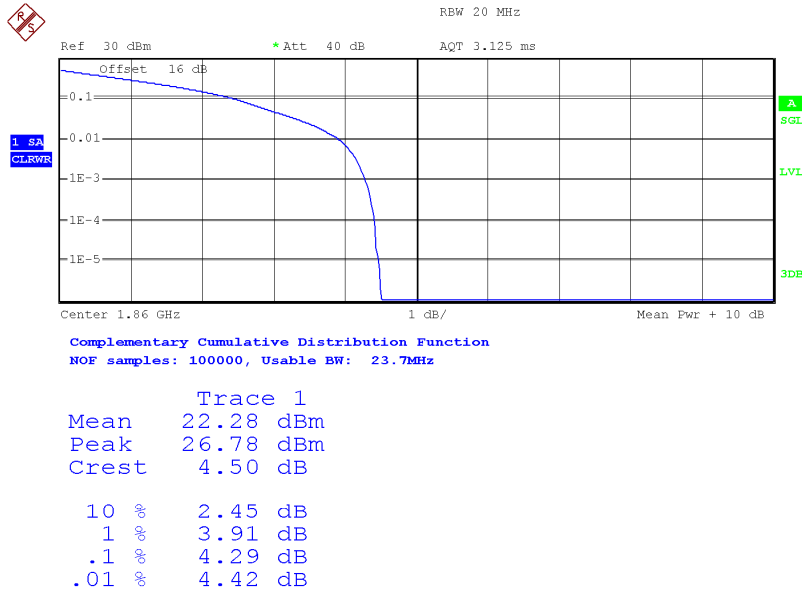
Channel High:



Date: 25.APR.2017 10:52:06

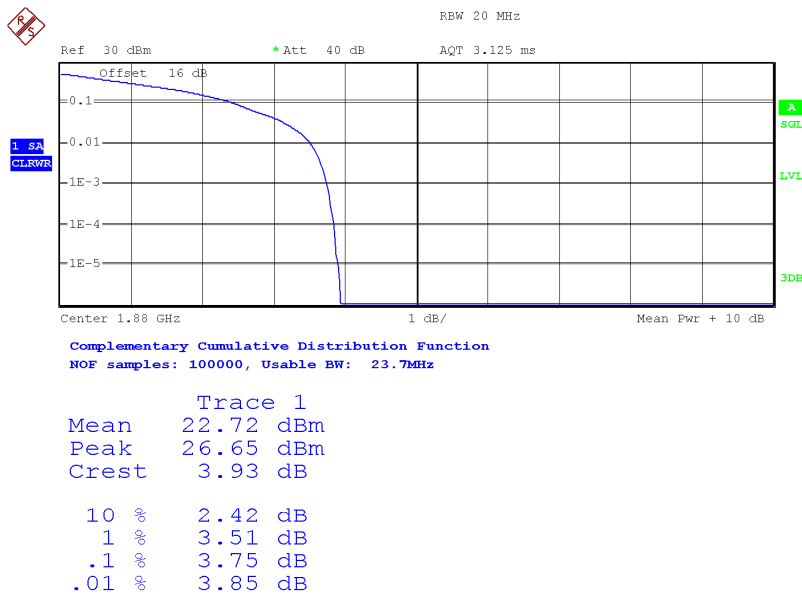
Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.

Channel Low:



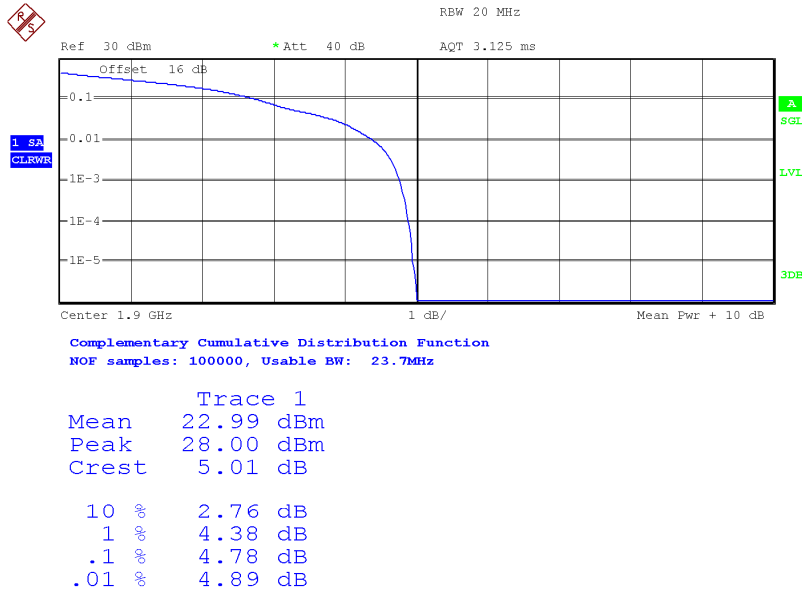
Date: 25.APR.2017 10:55:21

Channel Middle:



Date: 25.APR.2017 10:57:10

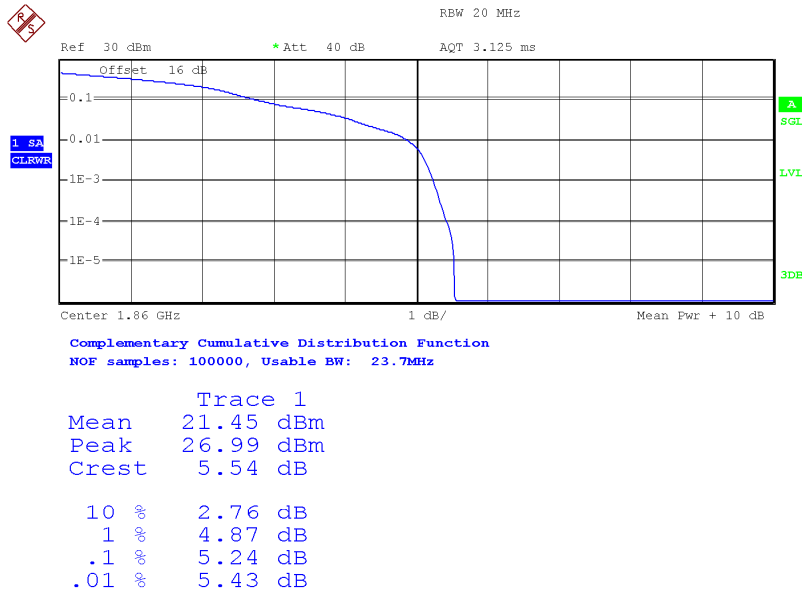
Channel High:



Date: 25.APR.2017 11:00:30

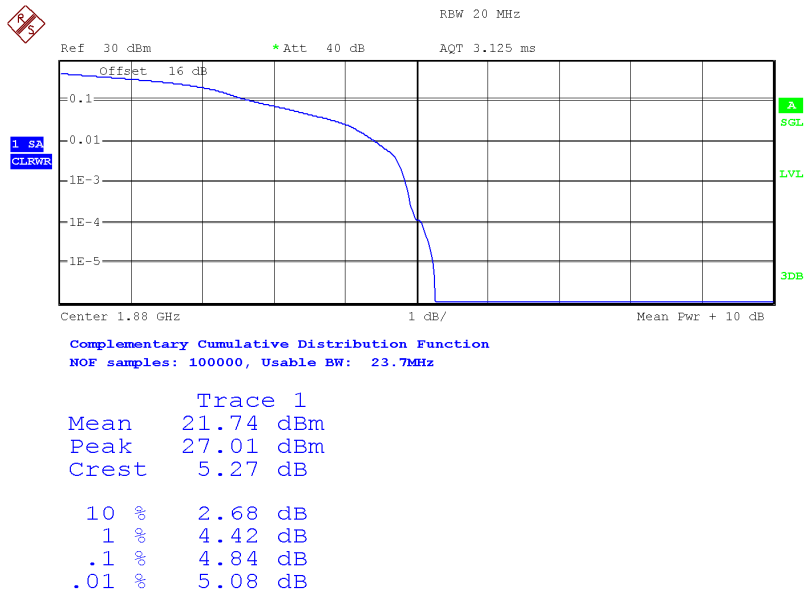
Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.

Channel Low:



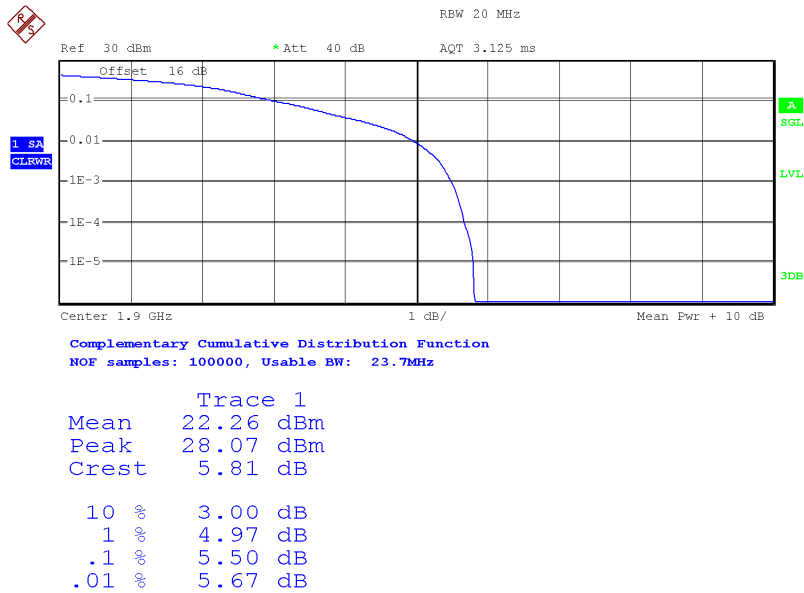
Date: 25.APR.2017 10:56:06

Channel Middle:



Date: 25.APR.2017 10:58:59

Channel High:



Date: 25.APR.2017 11:01:05

Modulation Characteristics

SPECIFICATION

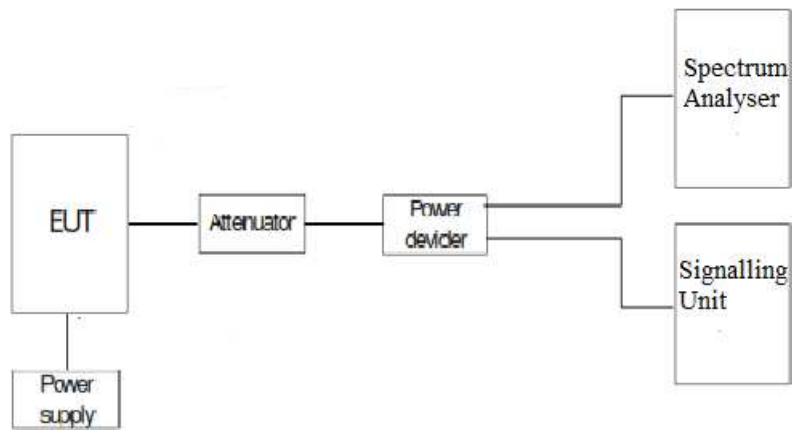
FCC §2.1047

RSS-133. Clause 6.2. 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).

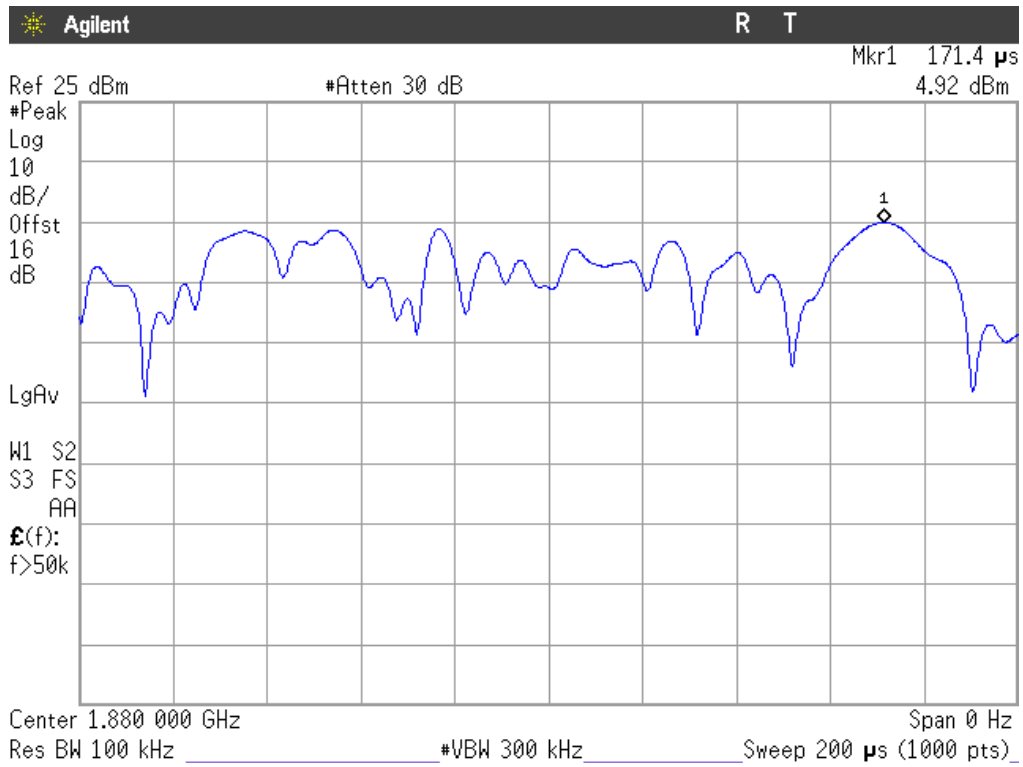
TEST SETUP



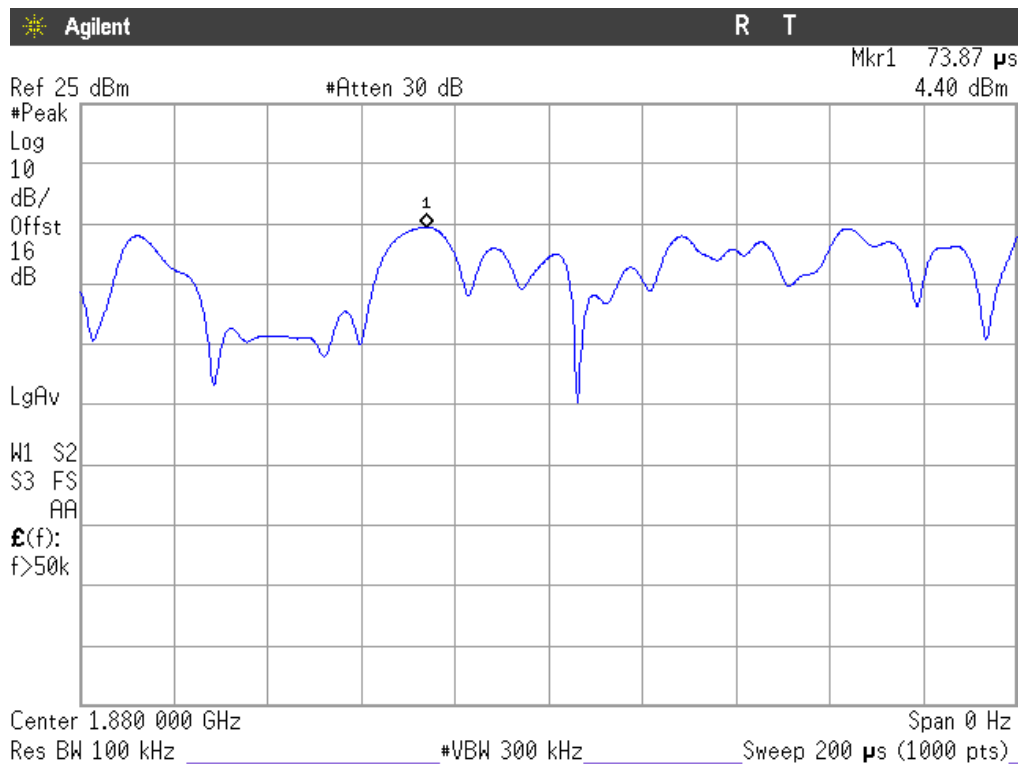
RESULTS

The following plot shows the modulation schemes in the EUT.

LTE MODULATION. QPSK. Band II



LTE MODULATION. 16QAM. Band II



Frequency Stability

SPECIFICATION

FCC §2.1055 and §24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133. Clause 6.3. The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

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.

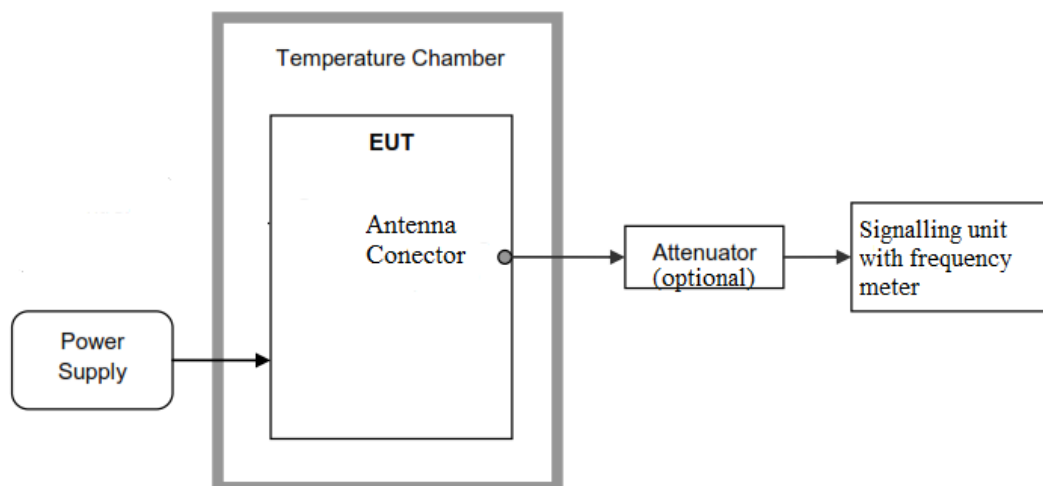
For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.

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 f_H respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of f_L and f_H to check that the resulting frequencies remain within the band.

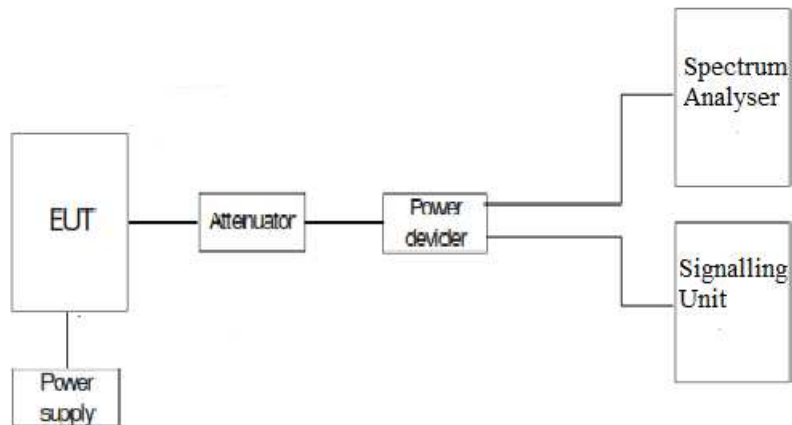
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Frequency tolerance.



Reference points f_L and f_H .



RESULTS

Frequency stability over temperature variations.

LTE QPSK MODULATION. BW = 1.4 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.46	0.000776596
+40	1.79	0.000952128
+30	2.05	0.001090426
+20	1.57	0.000835106
+10	1.95	0.001037234
0	2.2	0.001170213
-10	1.66	0.000882979
-20	1.5	0.000797872
-30	1.47	0.000781915

LTE QPSK MODULATION. BW = 3 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.17	-9.04255E-05
+40	0.37	0.000196809
+30	-0.07	-3.7234E-05
+20	-0.4	-0.000212766
+10	0.11	5.85106E-05
0	0.37	0.000196809
-10	-0.46	-0.000244681
-20	-0.77	-0.000409574
-30	-0.73	-0.000388298

LTE QPSK MODULATION. BW = 5 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.31	-0.000164894
+40	-0.49	-0.000260638
+30	1.53	0.00081383
+20	0.16	8.51064E-05
+10	0.67	0.000356383
0	0.06	3.19149E-05
-10	0.97	0.000515957
-20	0.47	0.00025
-30	-0.77	-0.000409574

LTE QPSK MODULATION. BW = 10 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	0.11	5.85106E-05
+40	-0.2	-0.000106383
+30	0.64	0.000340426
+20	-0.31	-0.000164894
+10	0.36	0.000191489
0	0.33	0.000175532
-10	0.21	0.000111702
-20	-0.26	-0.000138298
-30	0.7	0.00037234

LTE QPSK MODULATION. BW = 15 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.06	-3.19149E-05
+40	0.36	0.000191489
+30	0.53	0.000281915
+20	-0.16	-8.51064E-05
+10	-0.27	-0.000143617
0	0.14	7.44681E-05
-10	0.69	0.000367021
-20	0.7	0.00037234
-30	0.01	5.31915E-06

LTE QPSK MODULATION. BW = 20 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.9	-0.000478723
+40	-0.03	-1.59574E-05
+30	0.11	5.85106E-05
+20	0.54	0.000287234
+10	0.37	0.000196809
0	0.46	0.000244681
-10	0.84	0.000446809
-20	0.19	0.000101064
-30	-0.33	-0.000175532

Frequency stability over voltage variations.

LTE QPSK MODULATION. BW = 1.4 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	1.53	0.00081383
Vmin	3.23	1.52	0.000808511

LTE QPSK MODULATION. BW = 3 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-0.31	-0.000164894
Vmin	3.23	0.27	0.000143617

LTE QPSK MODULATION. BW = 5 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-0.23	-0.00012234
Vmin	3.23	-0.74	-0.000393617

LTE QPSK MODULATION. BW = 10 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	0.82	0.00043617
Vmin	3.23	0	0

LTE QPSK MODULATION. BW = 15 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	0.23	0.00012234
Vmin	3.23	-0.07	-3.7234E-05

LTE QPSK MODULATION. BW = 20 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-0.43	-0.000228723
Vmin	3.23	0.13	6.91489E-05

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

	LTE QPSK MODULATION. BW = 1.4 MHz (Band II)	LTE QPSK MODULATION. BW = 3 MHz (Band II)	LTE QPSK MODULATION. BW = 5 MHz (Band II)	LTE QPSK MODULATION. BW = 10 MHz (Band II)	LTE QPSK MODULATION. BW = 15 MHz (Band II)	LTE QPSK MODULATION. BW = 20 MHz (Band II)
f_L (MHz)	1850.0511	1850.0190	1850.0230	1850.0551	1850.0430	1850.1211
f_H (MHz)	1909.9630	1909.9970	1909.9810	1909.9329	1909.9950	1909.8308

Reference points f_L and f_H with the worst-case frequency offsets added or subtracted:

	LTE QPSK MODULATION. BW = 1.4 MHz (Band II)	LTE QPSK MODULATION. BW = 3 MHz (Band II)	LTE QPSK MODULATION. BW = 5 MHz (Band II)	LTE QPSK MODULATION. BW = 10 MHz (Band II)	LTE QPSK MODULATION. BW = 15 MHz (Band II)	LTE QPSK MODULATION. BW = 20 MHz (Band II)
f_L (MHz)	1850.0511	1850.0190	1850.0230	1850.0551	1850.0430	1850.1211
f_H (MHz)	1909.9630	1909.9970	1909.9810	1909.9329	1909.9950	1909.8308

The reference frequency points stay within the authorized blocks.

Verdict: PASS

Measurement uncertainty	$<\pm 1 \times 10^{-6}$
-------------------------	-------------------------

Verdict: PASS

Occupied Bandwidth

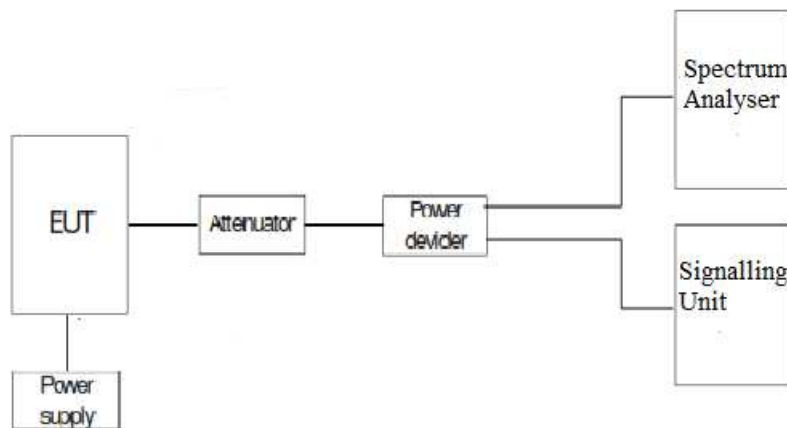
SPECIFICATION

FCC §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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1096.30	1105.90	1113.20
-26 dBc bandwidth (kHz)	1346.00	1364.00	1360.00
Measurement uncertainty (kHz)	<±4.67		

LTE 16QAM MODULATION. BW = 1.4 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1102.80	1107.10	1099.60
-26 dBc bandwidth (kHz)	1352.00	1344.00	1354.00
Measurement uncertainty (kHz)	<±4.67		

LTE QPSK MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2760.30	2753.00	2752.60
-26 dBc bandwidth (kHz)	3248.00	3110.00	3303.00
Measurement uncertainty (kHz)	<±10		

LTE 16QAM MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2752.40	2748.80	2749.90
-26 dBc bandwidth (kHz)	3140.00	3092.00	3566.00
Measurement uncertainty (kHz)	<±10		

LTE QPSK MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4506.70	4555.20	4515.30
-26 dBc bandwidth (kHz)	5054.00	5127.00	5064.00
Measurement uncertainty (kHz)	<±16.67		

LTE 16QAM MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4509.90	4504.70	4520.70
-26 dBc bandwidth (kHz)	5078.00	5021.00	5063.00
Measurement uncertainty (kHz)	<±16.67		

LTE QPSK MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9081.70	9064.30	9073.70
-26 dBc bandwidth (kHz)	10551.00	10616.00	10620.00
Measurement uncertainty (kHz)	<±33.33		

LTE 16QAM MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9139.70	9097.10	9038.80
-26 dBc bandwidth (kHz)	10688.00	10429.00	10448.00
Measurement uncertainty (kHz)	<±33.33		

LTE QPSK MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13524.20	13538.90	13427.60
-26 dBc bandwidth (kHz)	15846.00	15855.00	15365.00
Measurement uncertainty (kHz)	<±50		

LTE 16QAM MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13546.90	13507.80	13475.70
-26 dBc bandwidth (kHz)	15716.00	16233.00	15660.00
Measurement uncertainty (kHz)	<±50		

LTE QPSK MODULATION. BW = 20 MHz

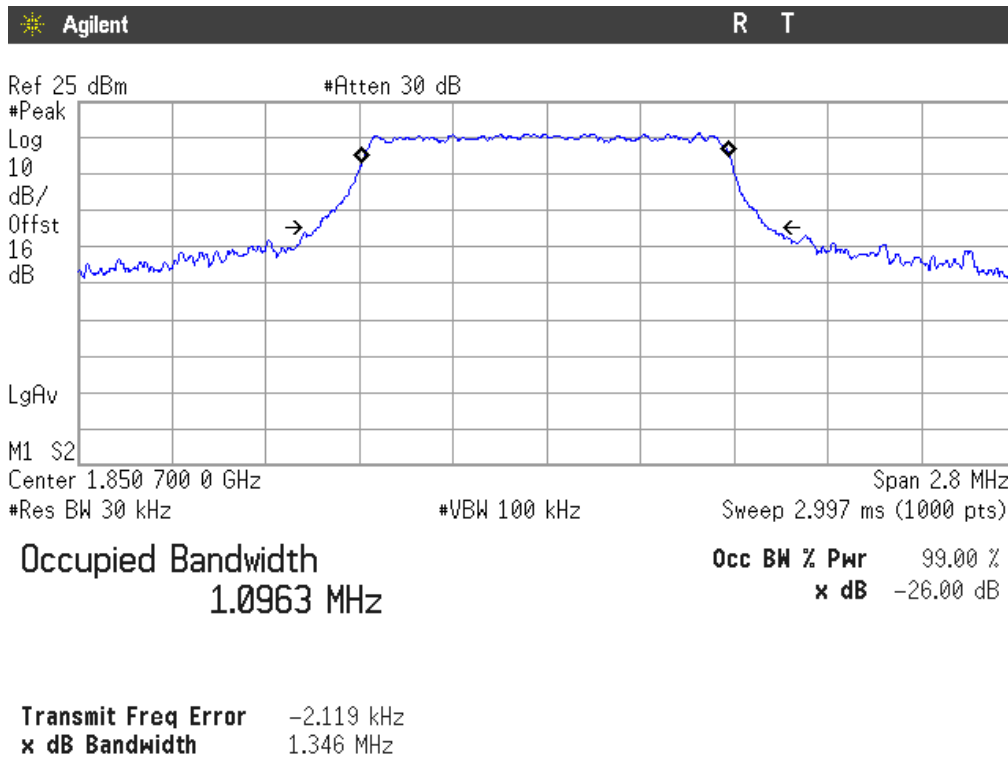
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17955.10	17950.00	17833.80
-26 dBc bandwidth (kHz)	20295.00	20111.00	19561.00
Measurement uncertainty (kHz)	<±66.67		

LTE 16QAM MODULATION. BW = 20 MHz

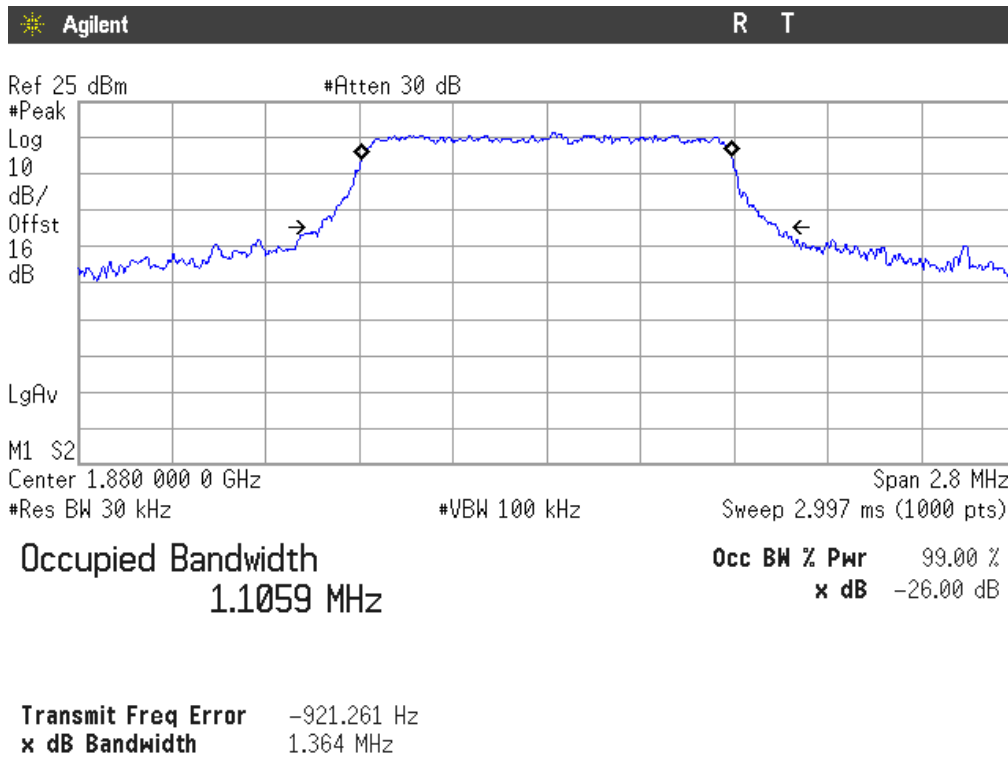
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17930.40	17919.10	178301.00
-26 dBc bandwidth (kHz)	20346.00	20451.00	20063.00
Measurement uncertainty (kHz)	<±66.67		

LTE QPSK MODULATION. BW = 1.4 MHz

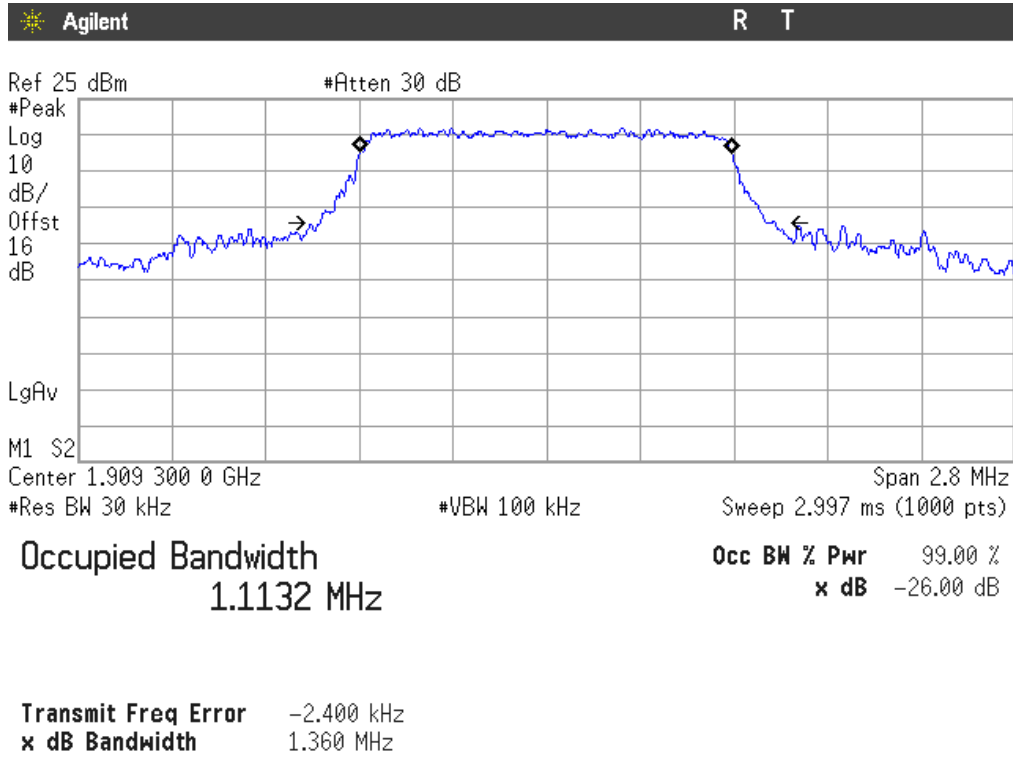
Lowest Channel



Middle Channel

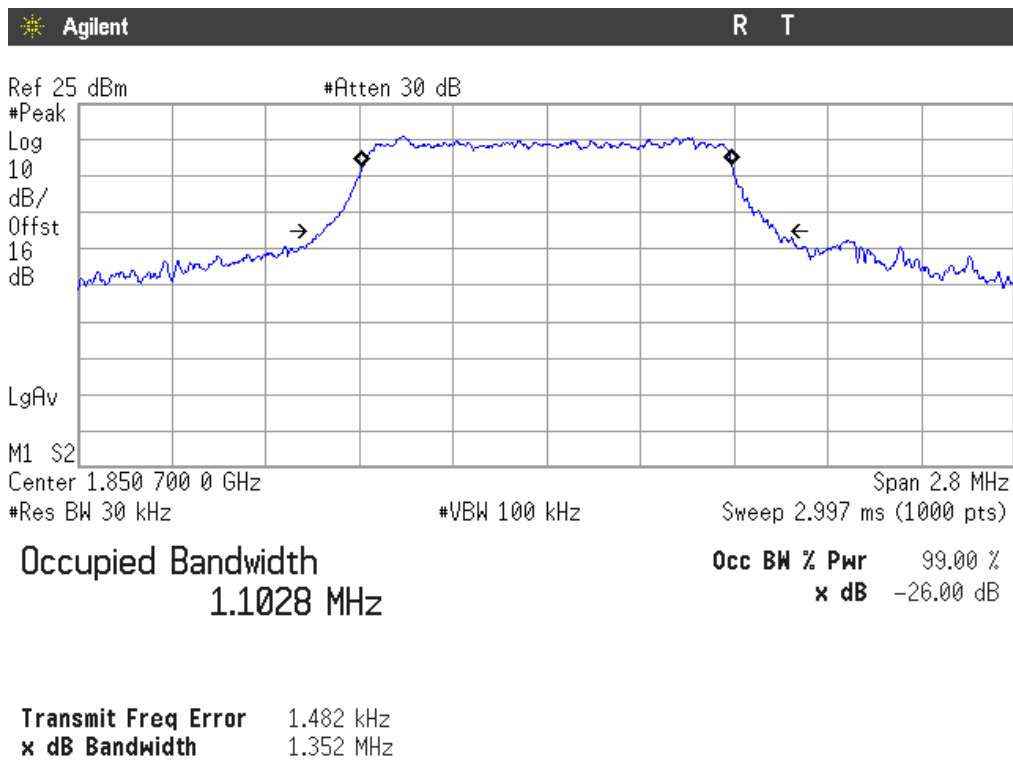


Highest Channel

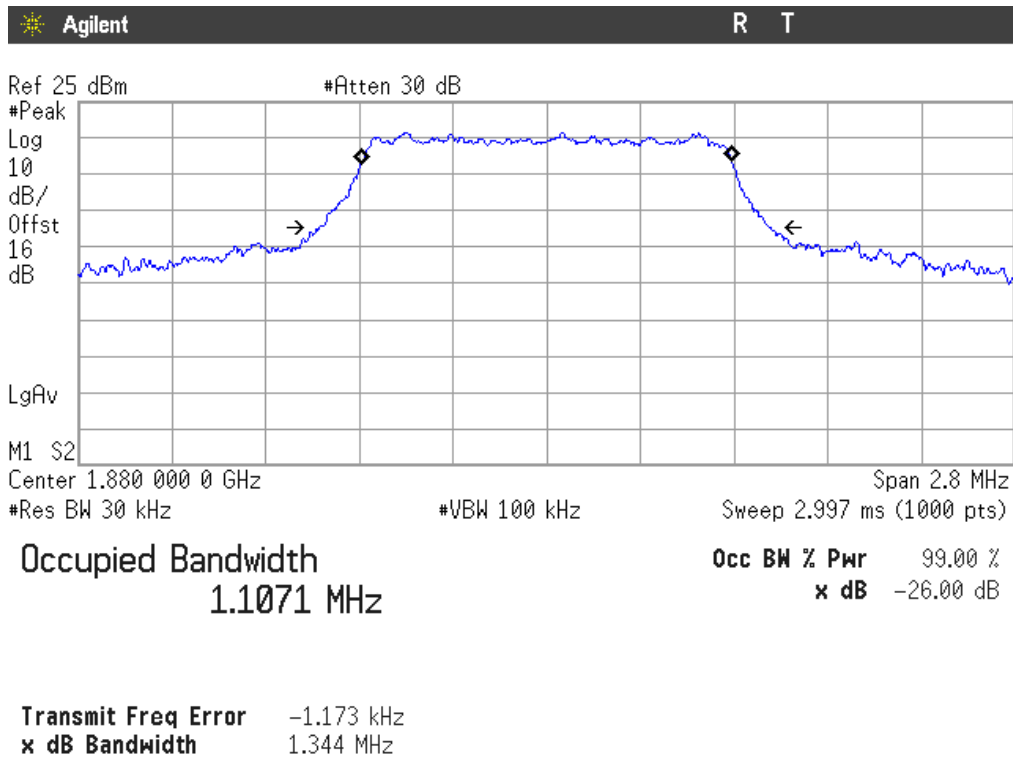


LTE 16QAM MODULATION. BW = 1.4 MHz

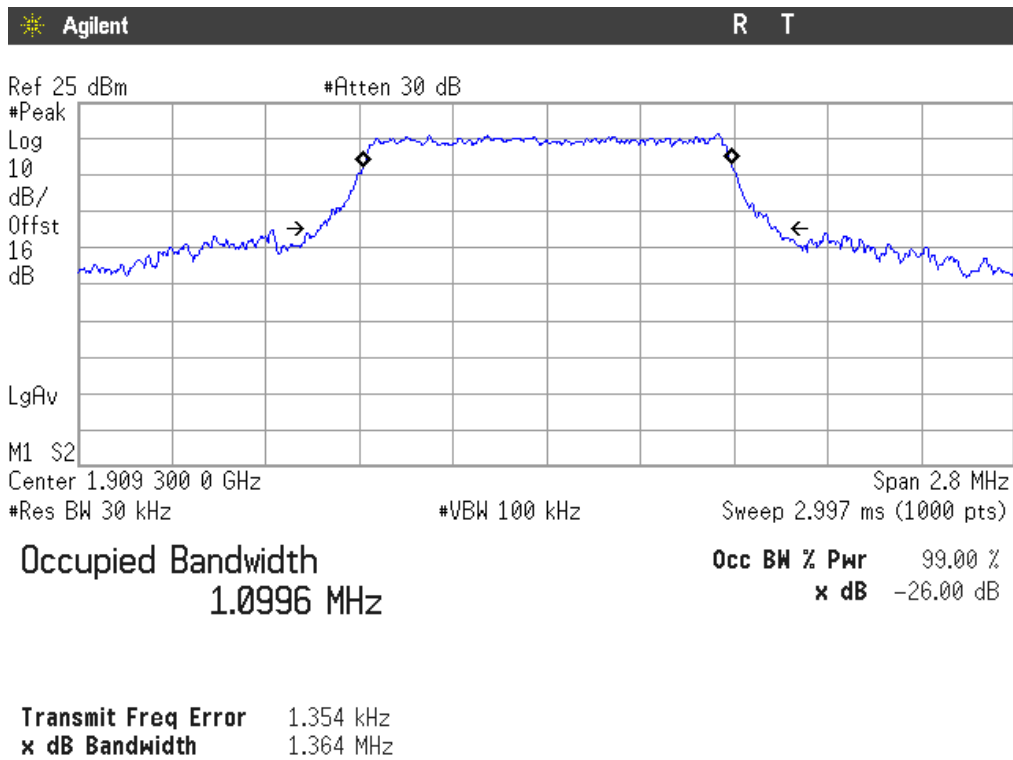
Lowest Channel



Middle Channel

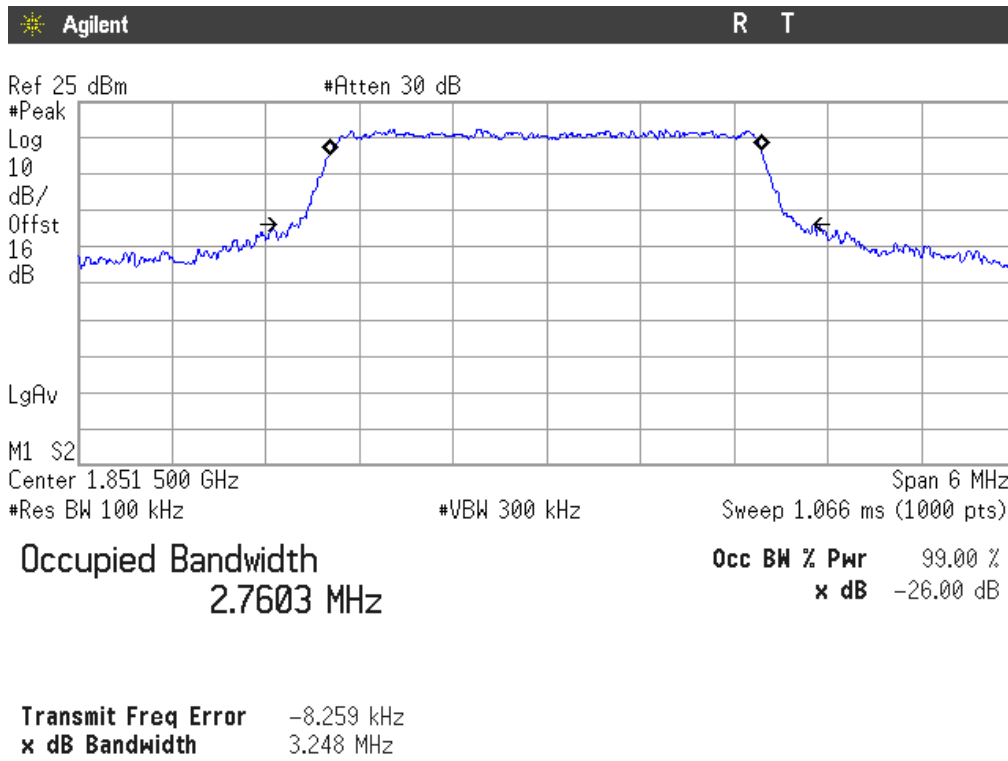


Highest Channel

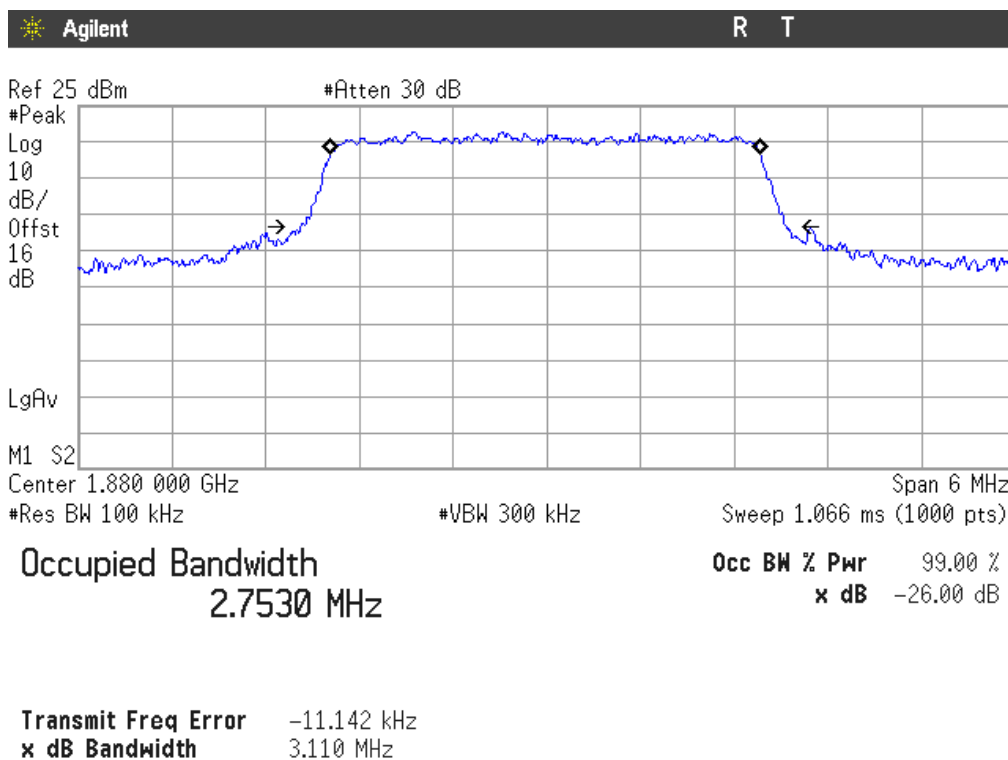


LTE QPSK MODULATION. BW = 3 MHz

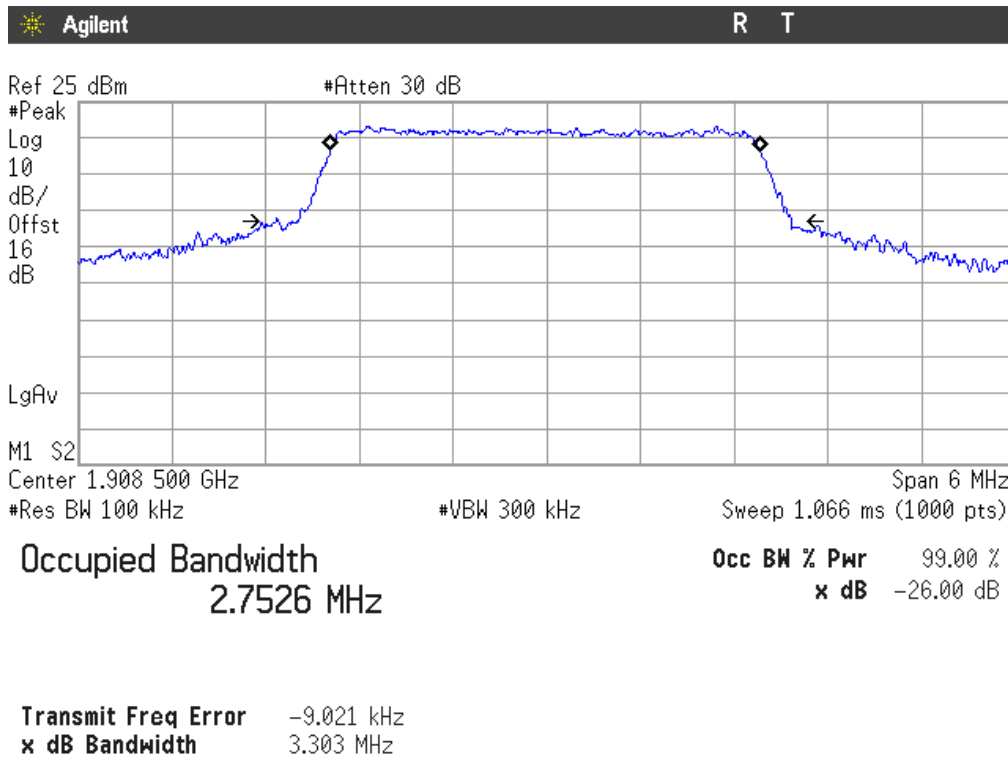
Lowest Channel



Middle Channel

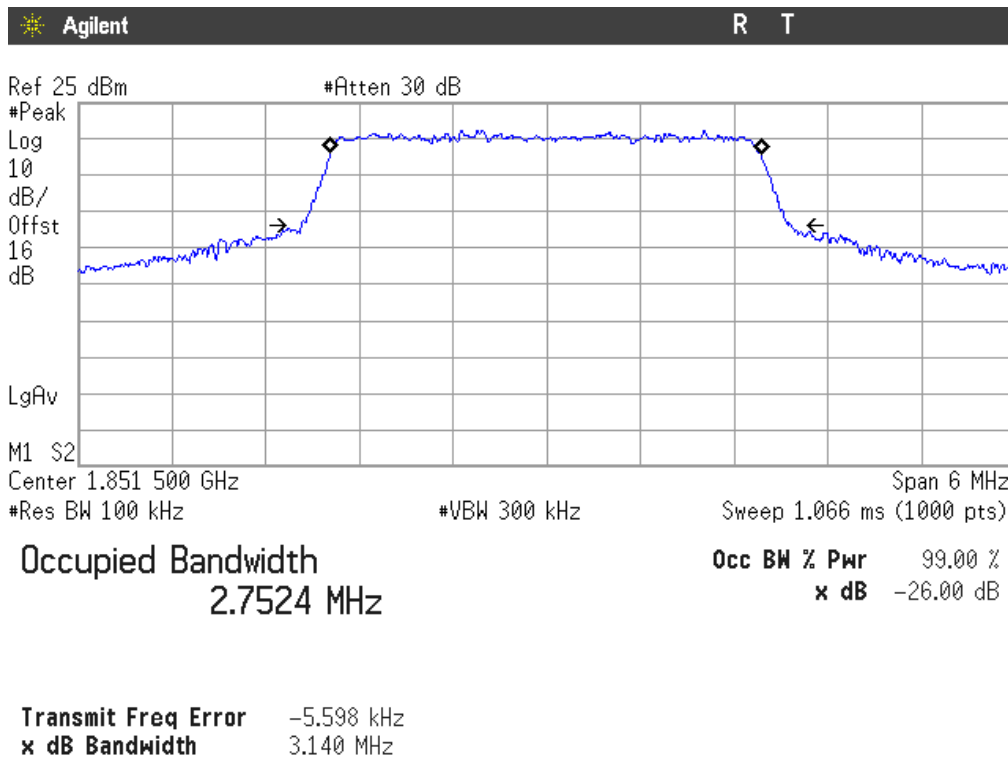


Highest Channel

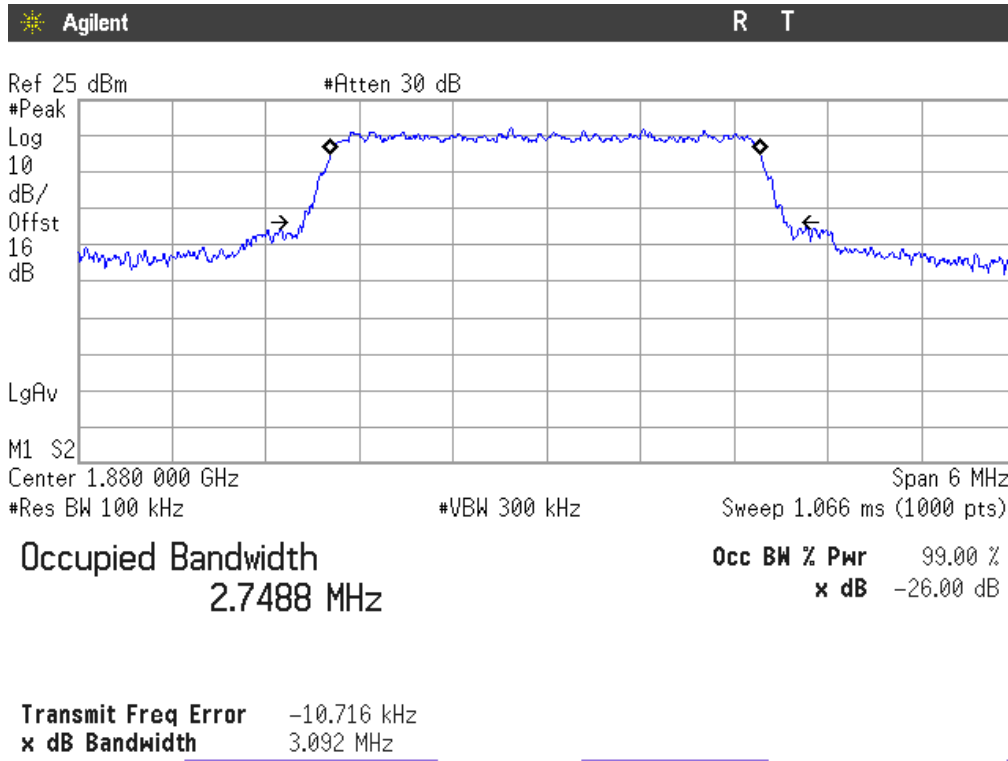


LTE 16QAM MODULATION. BW = 3 MHz

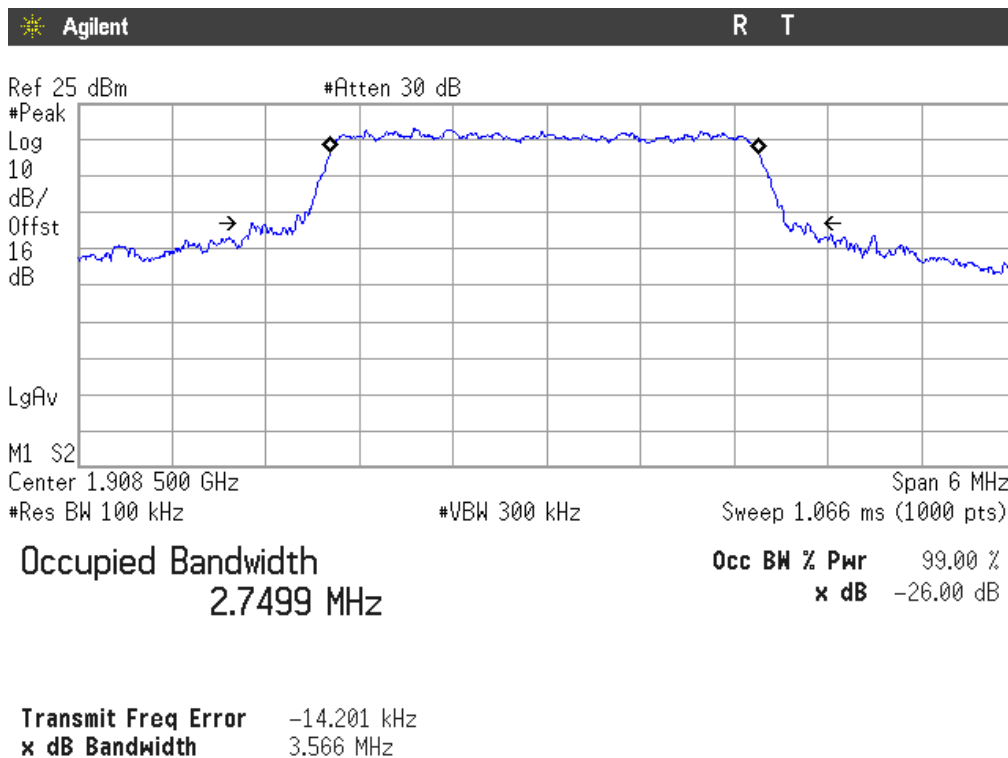
Lowest Channel



Middle Channel

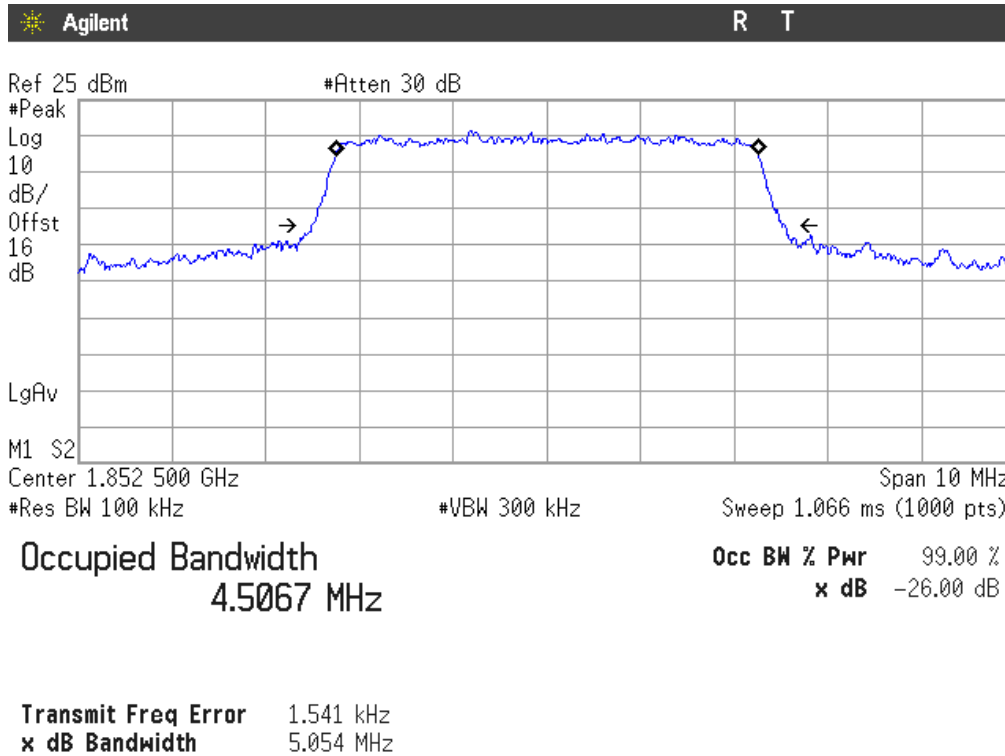


Highest Channel

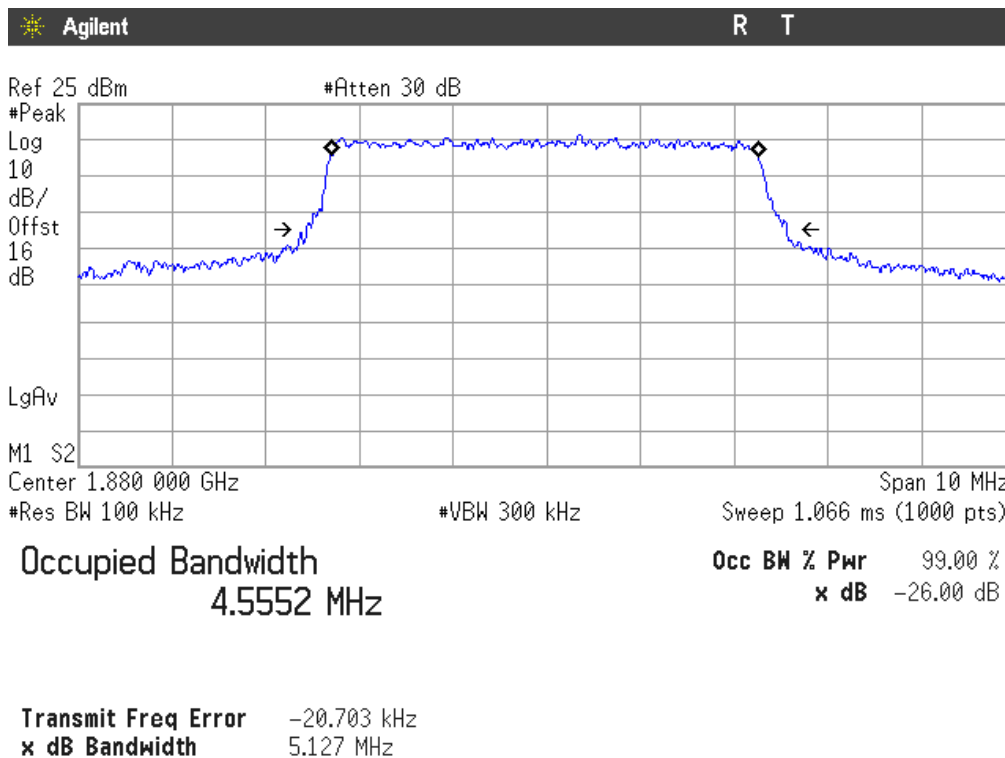


LTE QPSK MODULATION. BW = 5 MHz

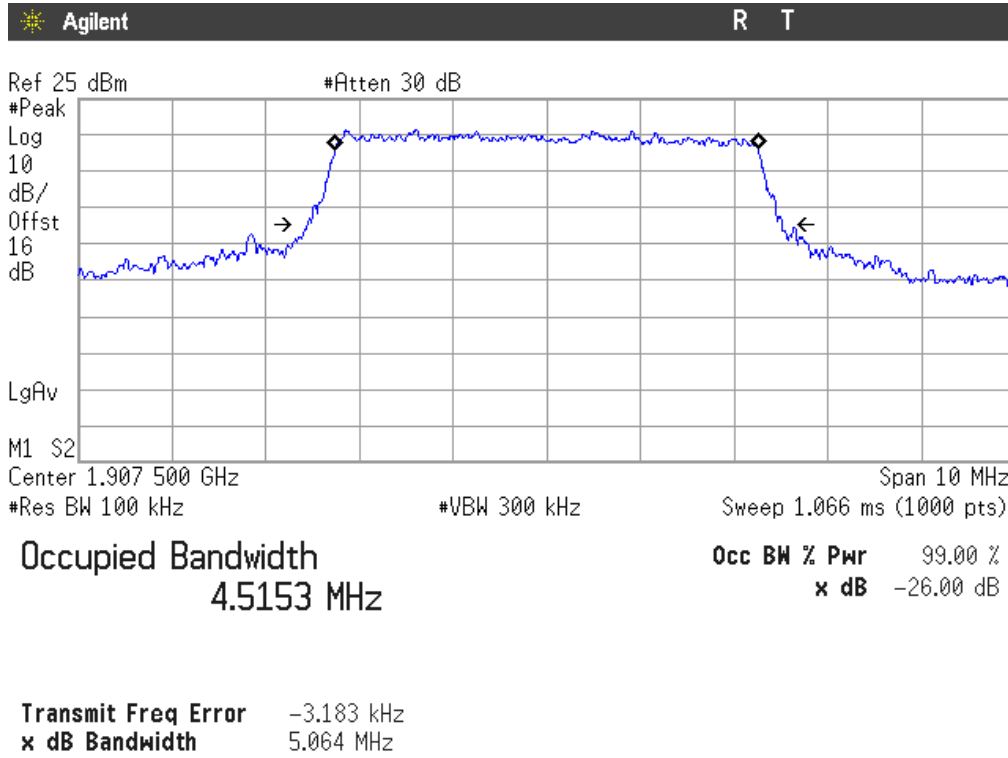
Lowest Channel



Middle Channel

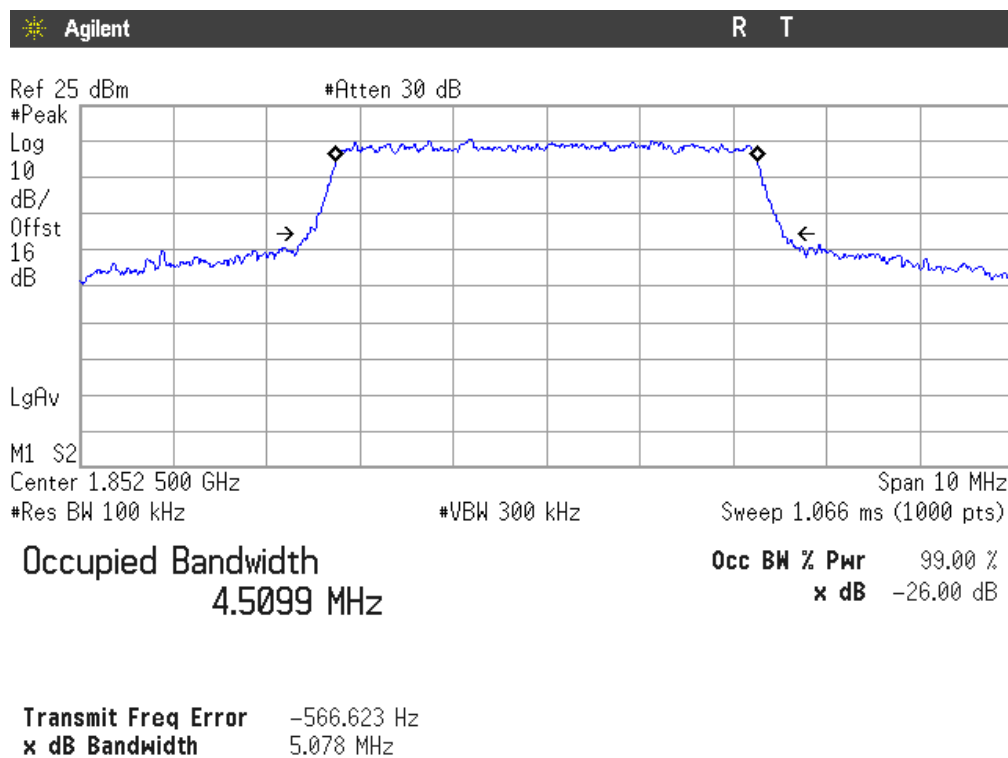


Highest Channel

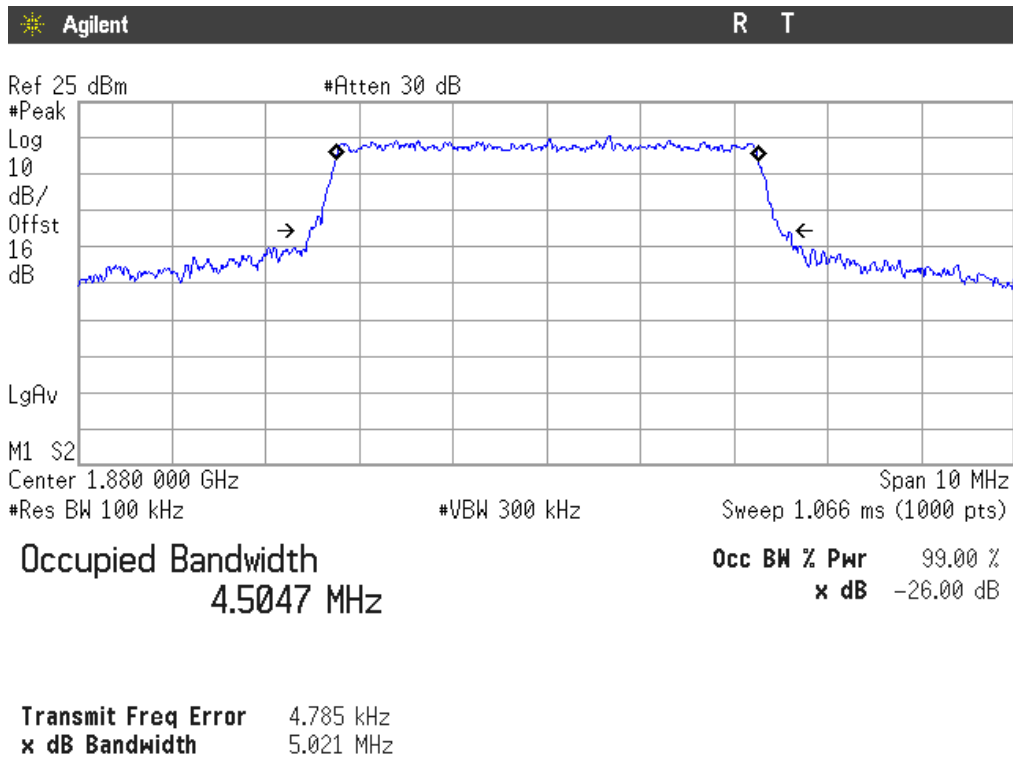


LTE 16QAM MODULATION. BW = 5 MHz

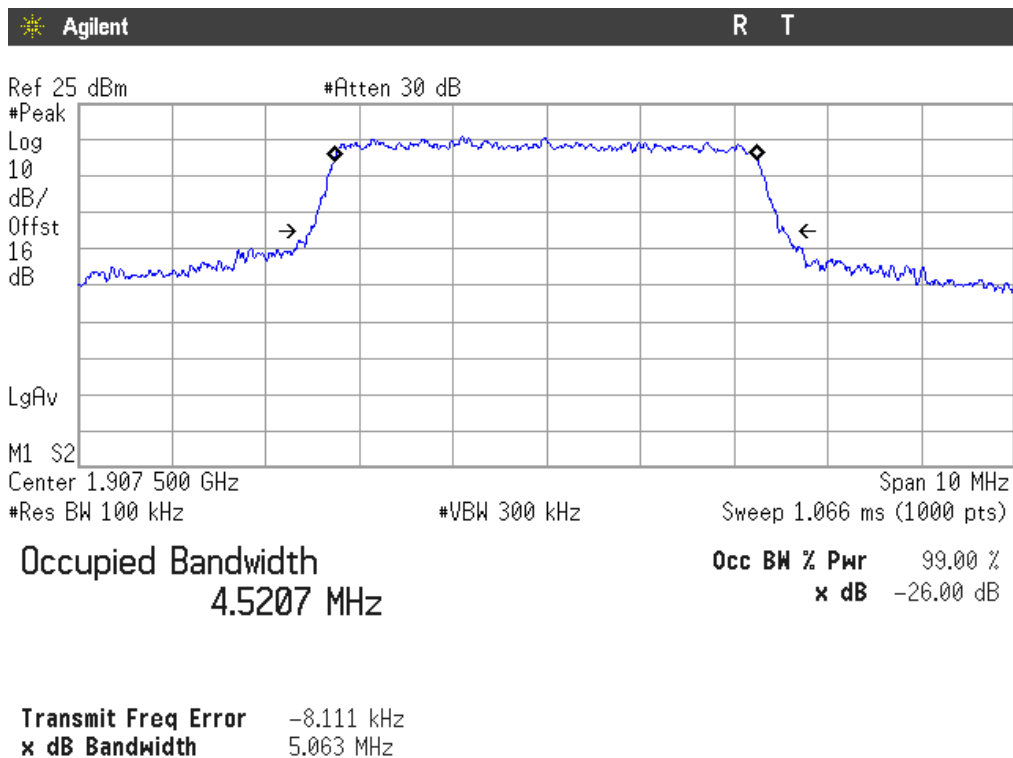
Lowest Channel



Middle Channel

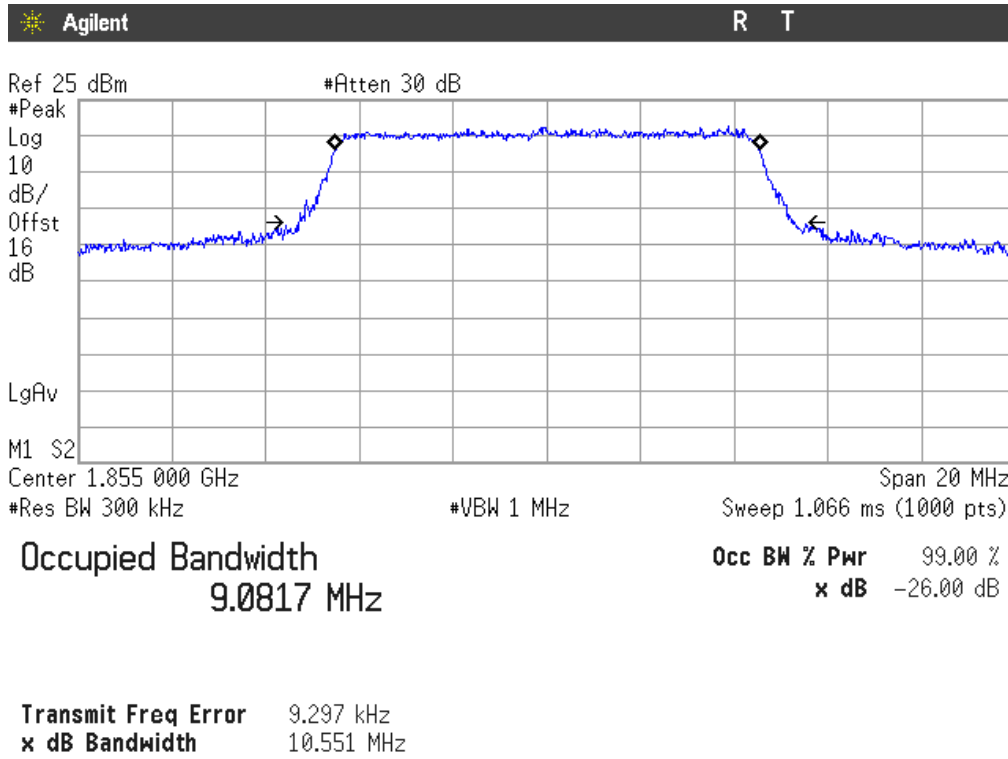


Highest Channel

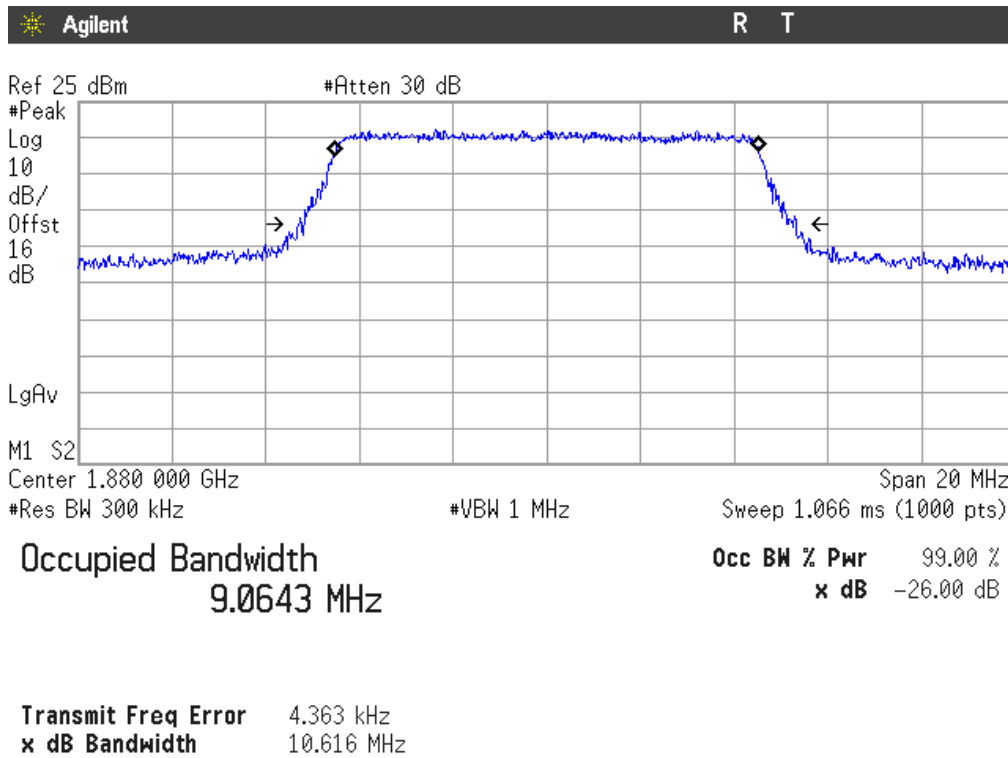


LTE QPSK MODULATION. BW = 10 MHz

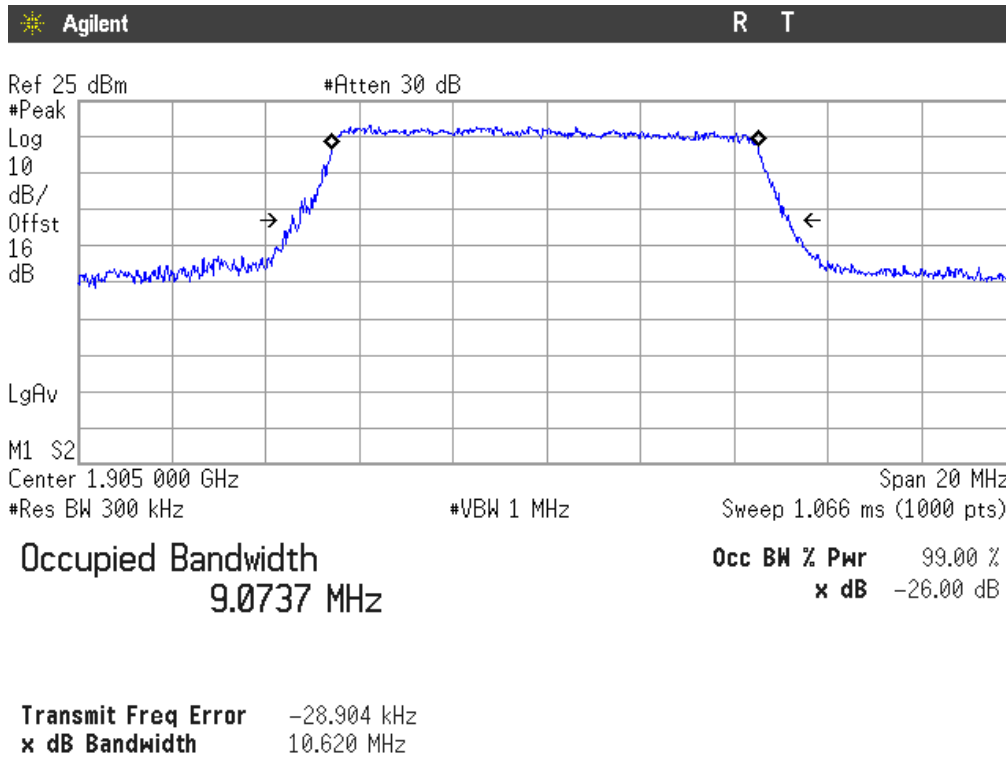
Lowest Channel



Middle Channel

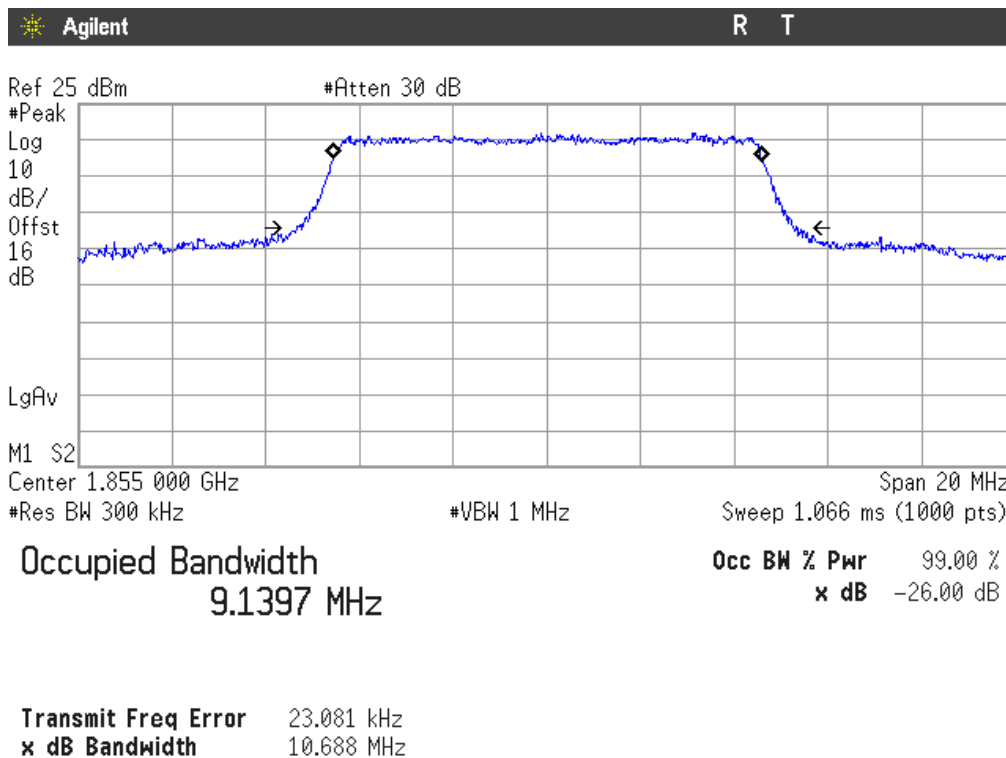


Highest Channel

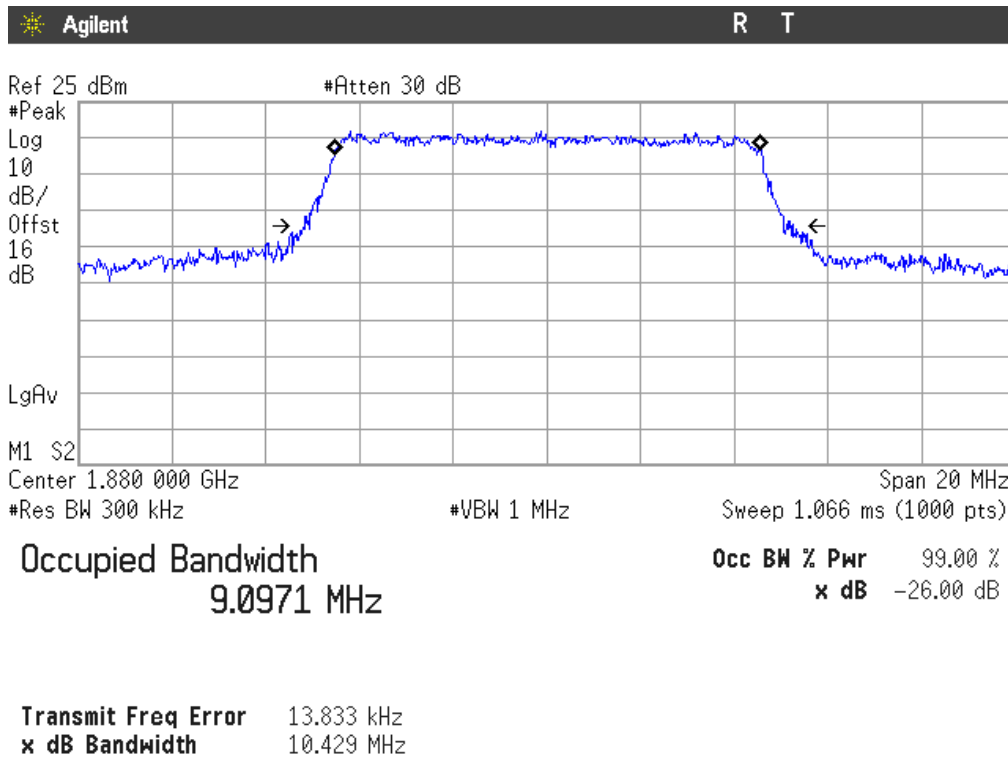


LTE 16QAM MODULATION. BW = 10 MHz

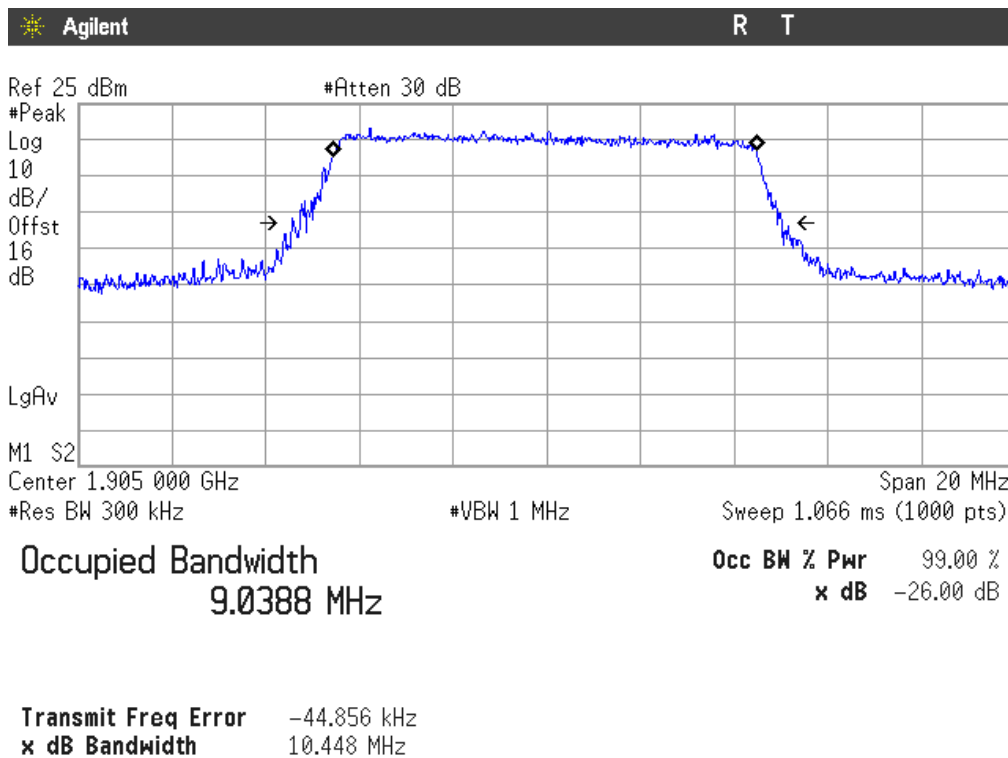
Lowest Channel



Middle Channel

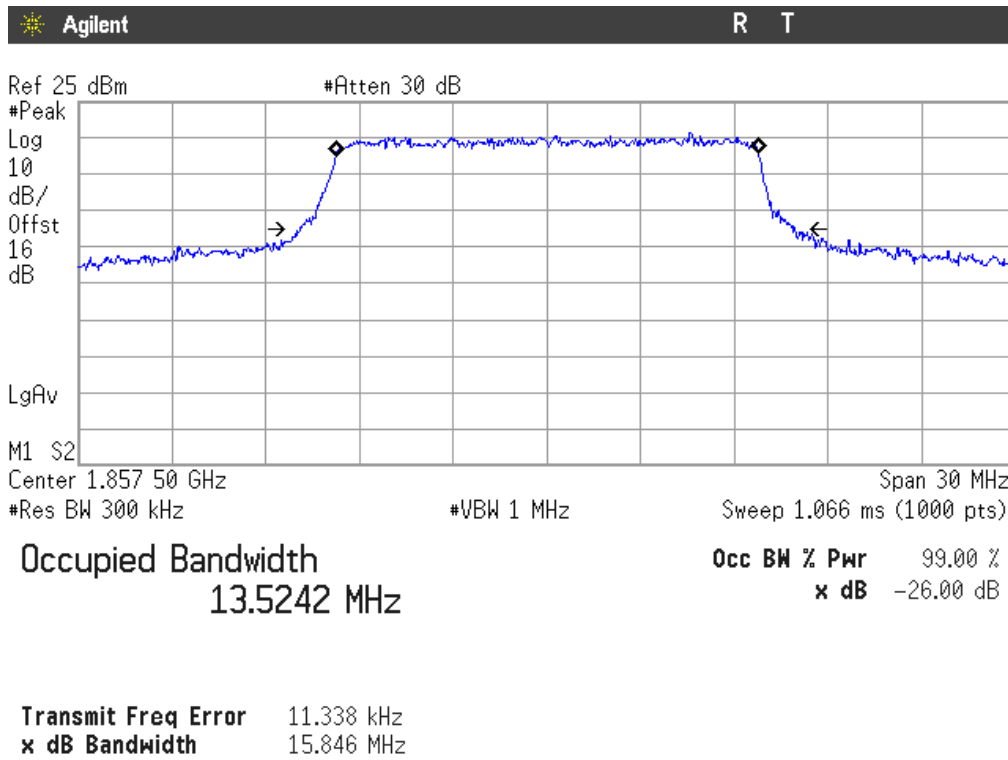


Highest Channel

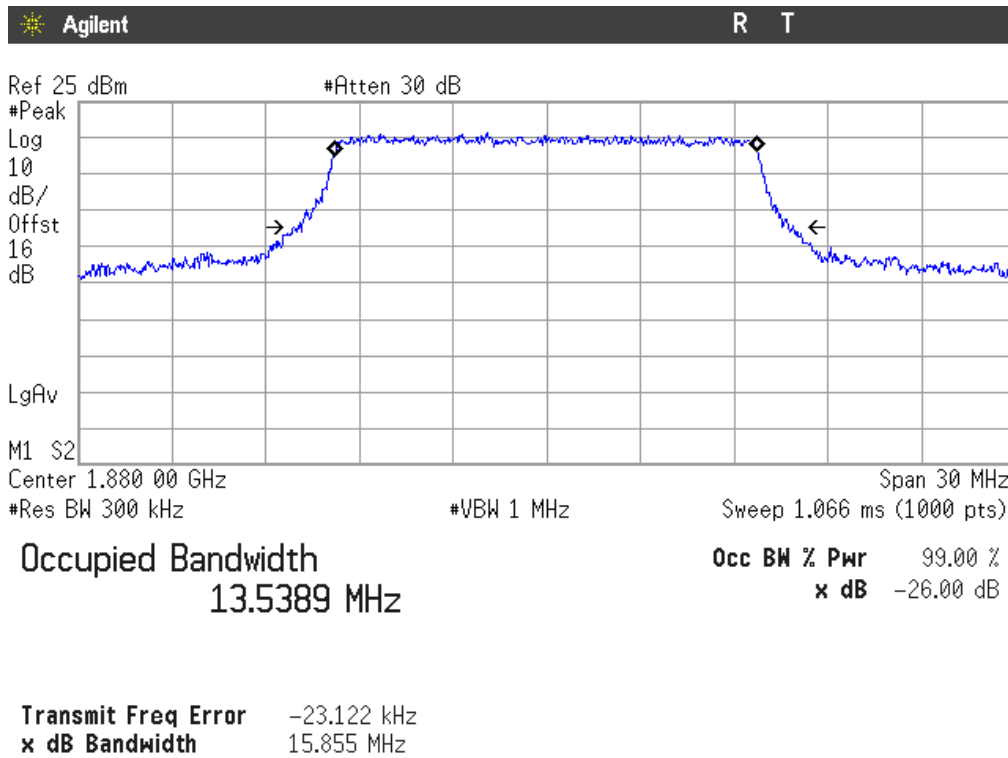


LTE QPSK MODULATION. BW = 15 MHz

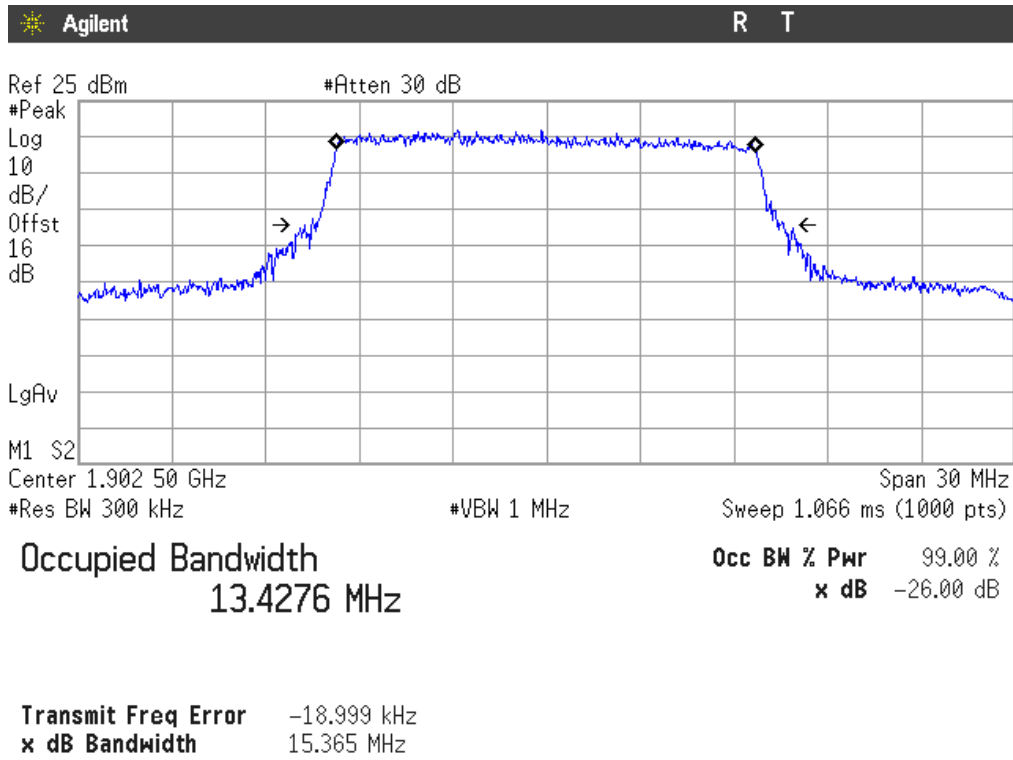
Lowest Channel



Middle Channel

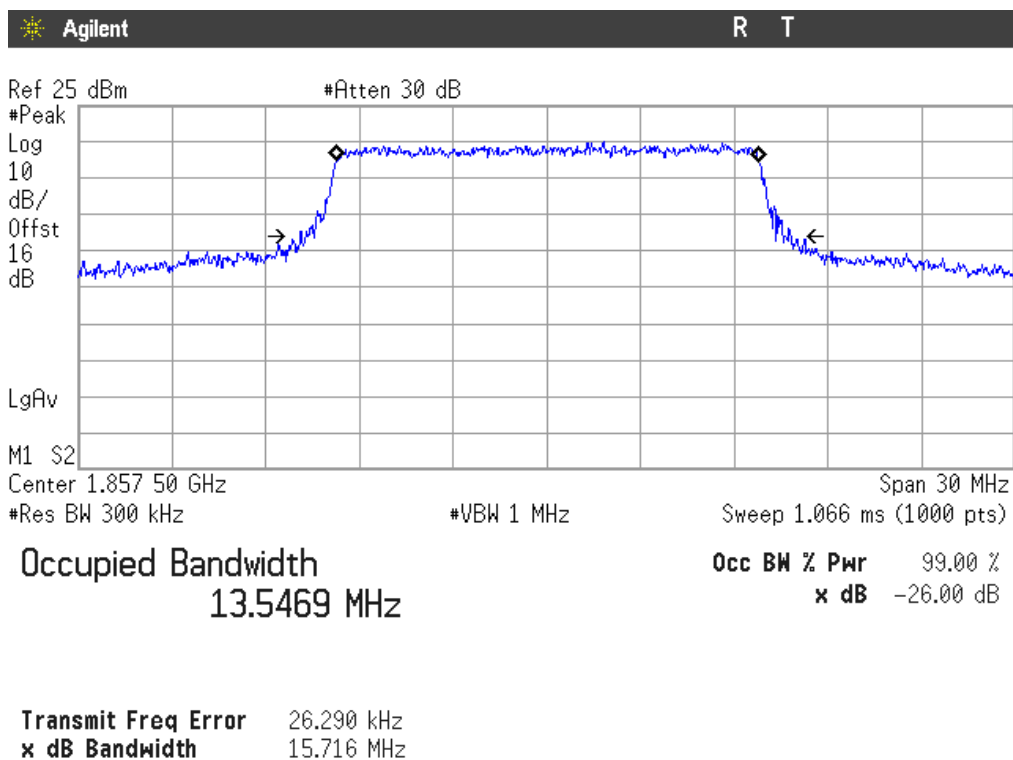


Highest Channel

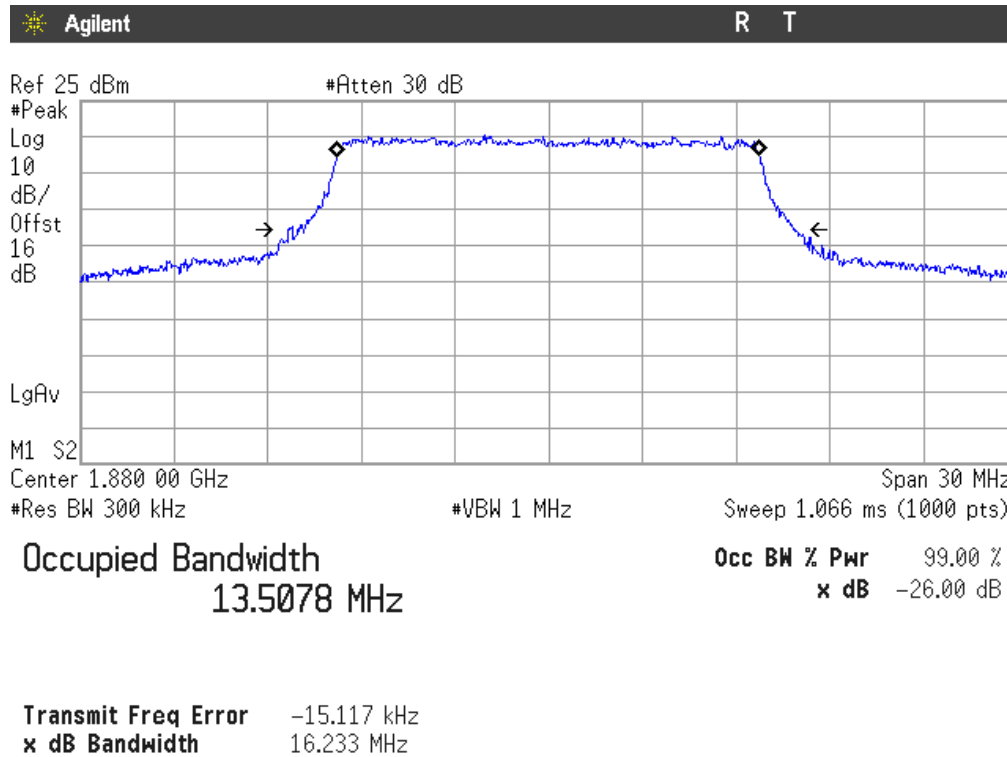


LTE 16QAM MODULATION. BW = 15 MHz

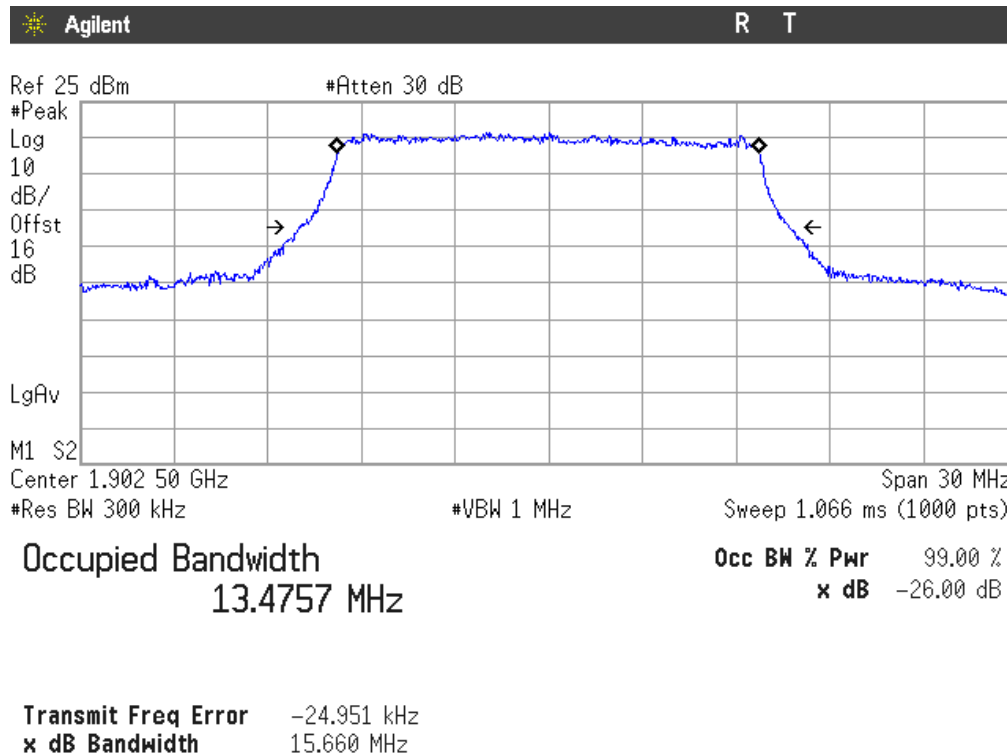
Lowest Channel



Middle Channel

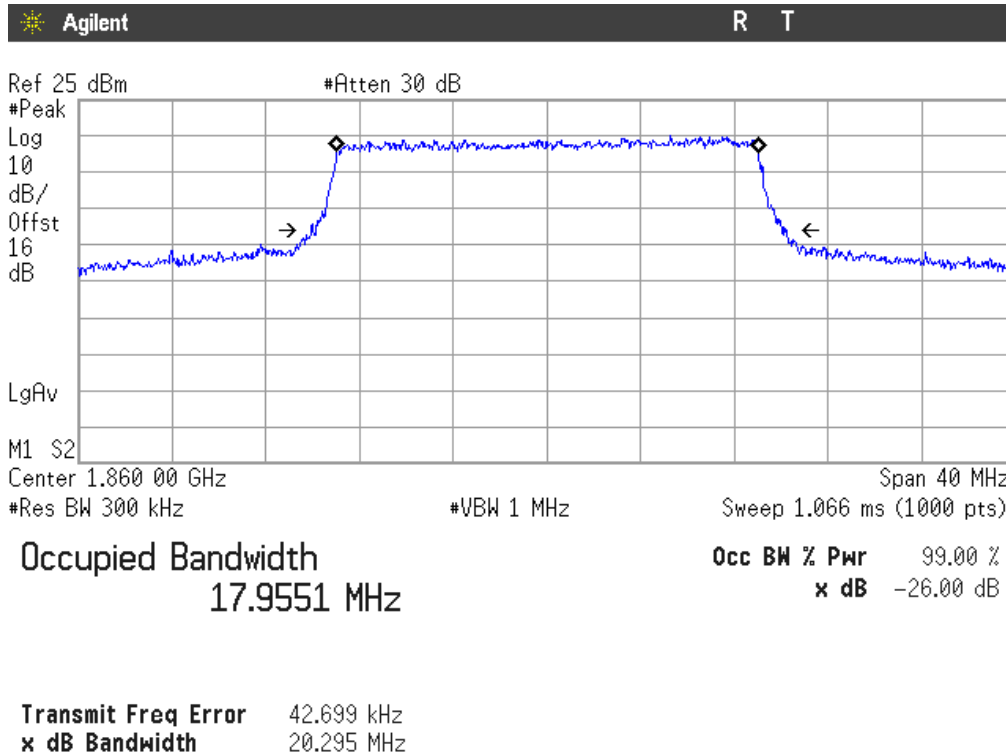


Highest Channel

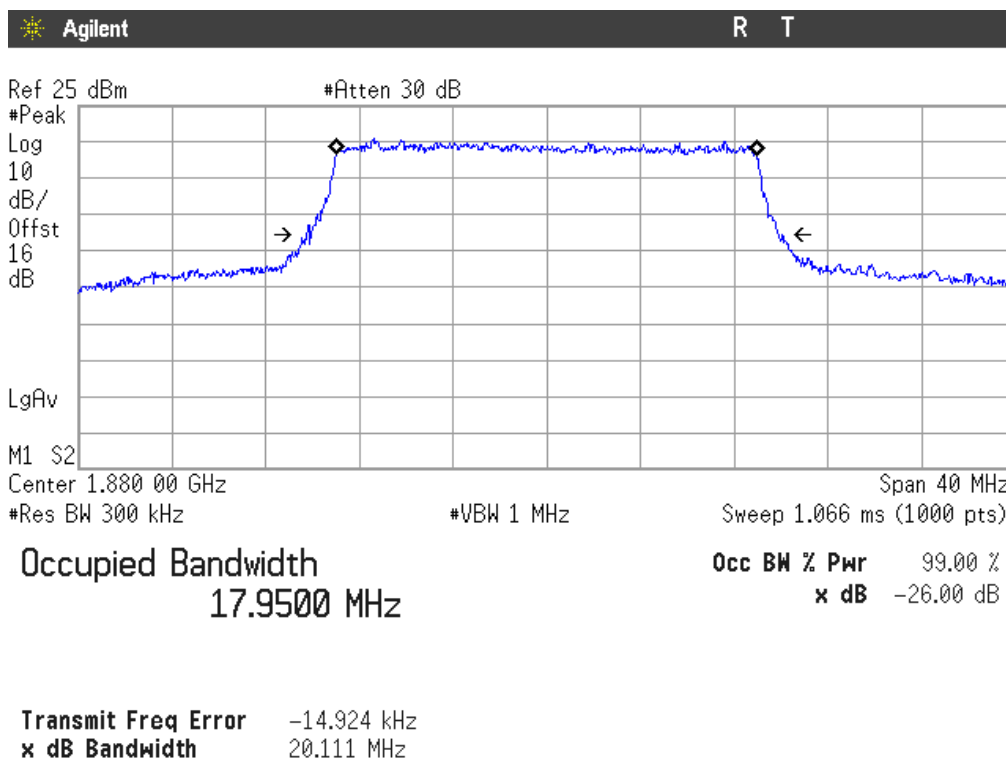


LTE QPSK MODULATION. BW = 20 MHz

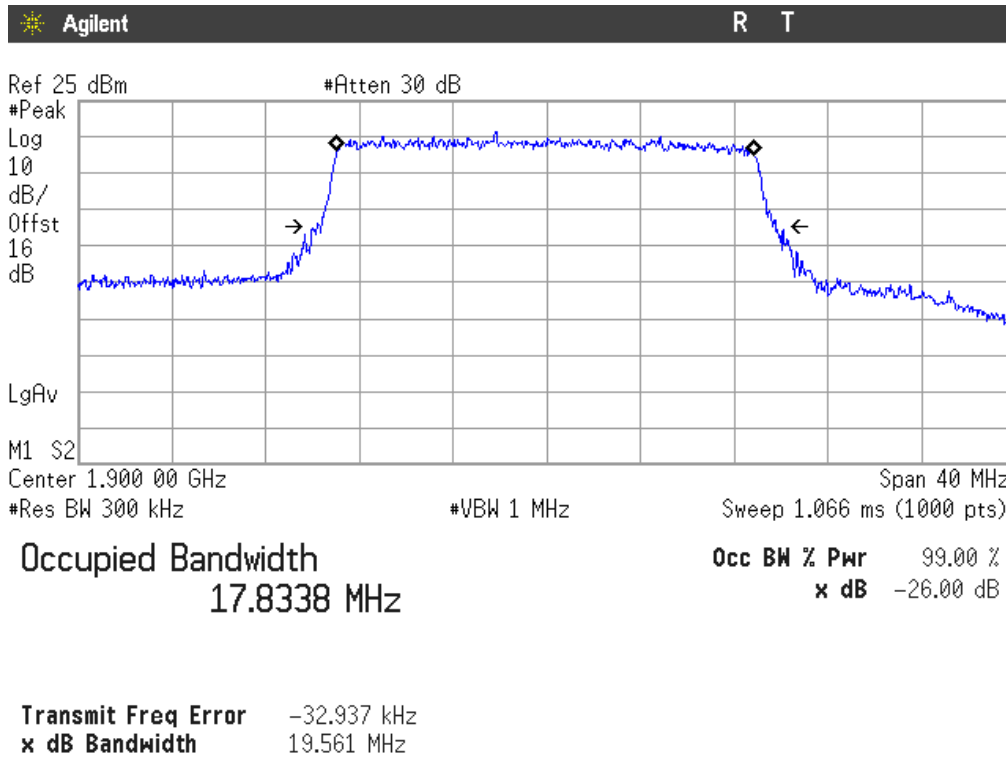
Lowest Channel



Middle Channel

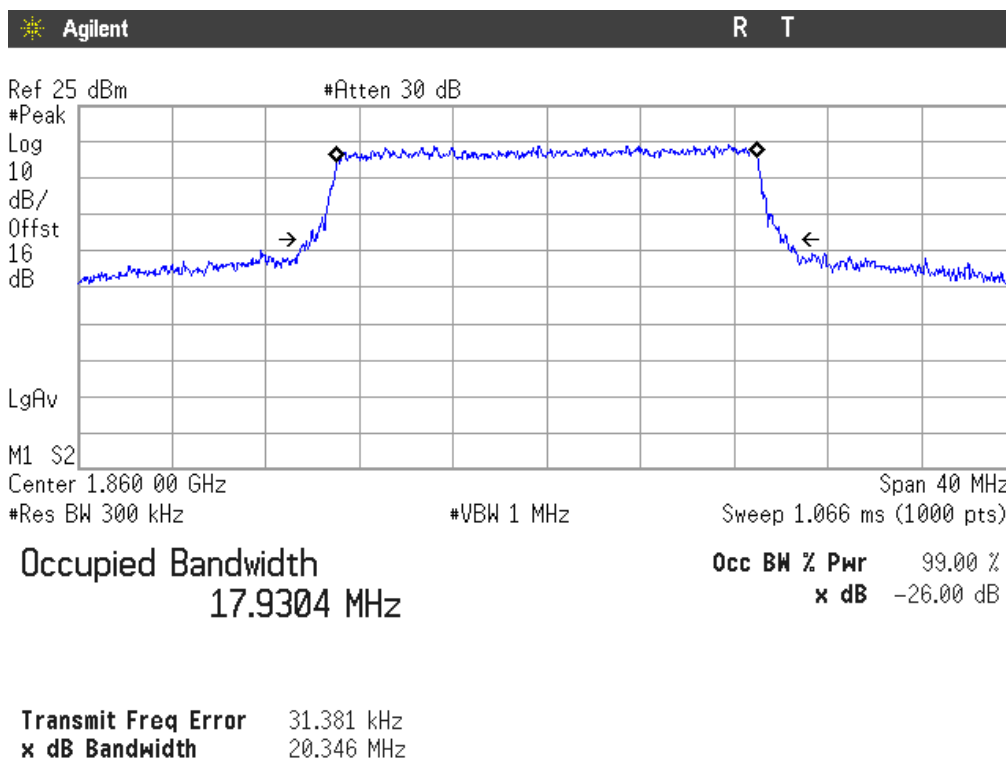


Highest Channel

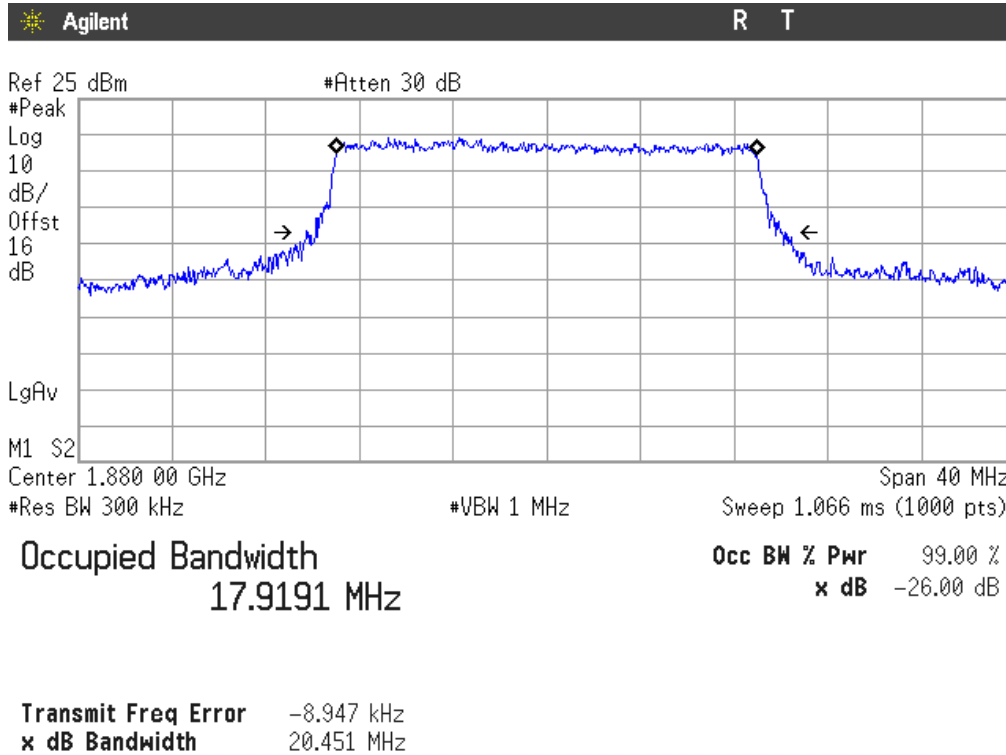


LTE 16QAM MODULATION. BW = 20 MHz

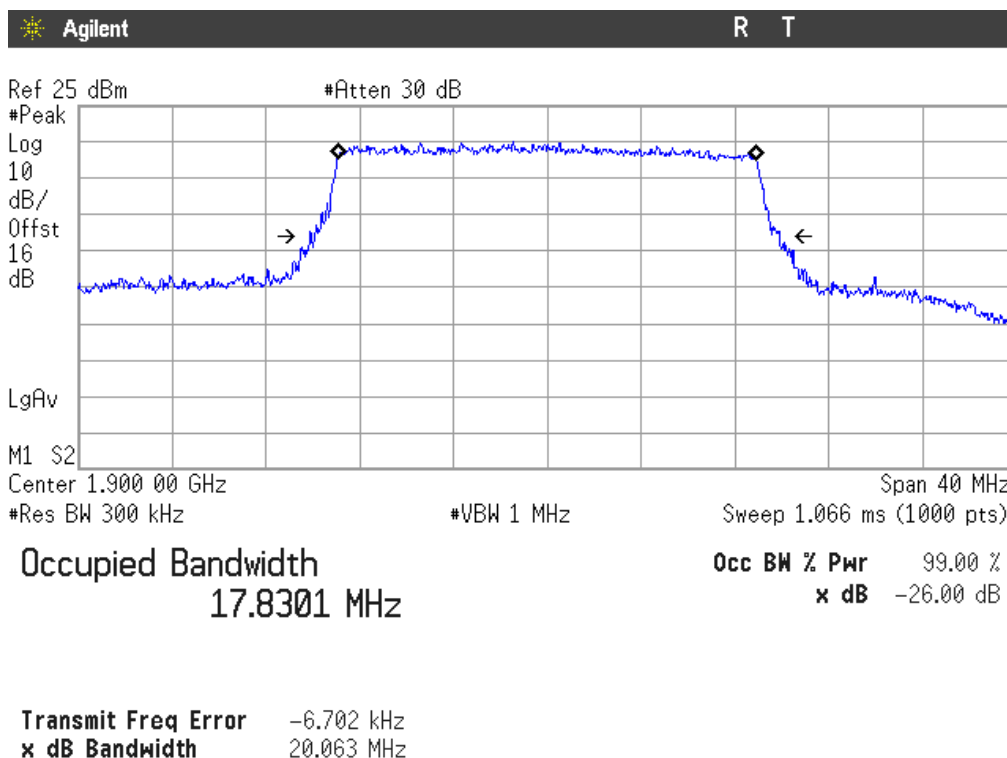
Lowest Channel



Middle Channel



Highest Channel



Spurious emissions at antenna terminals

SPECIFICATION

FCC §2.1051 and §24.238

RSS-133. Clause 6.5.

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.

METHOD

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMU200 and 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 20 GHz.

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

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.

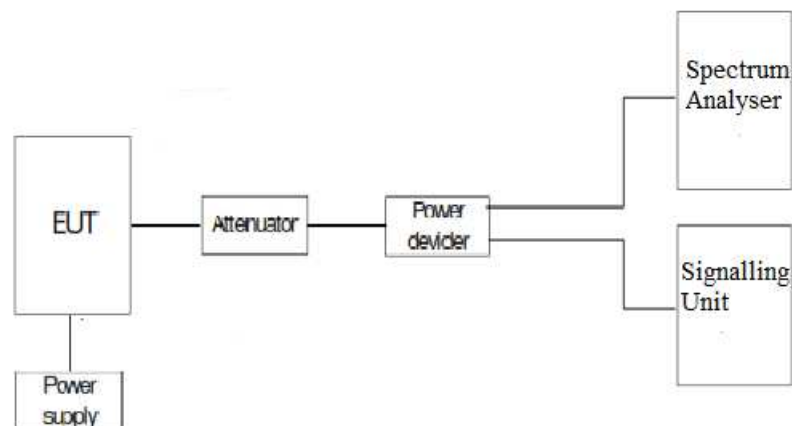
Measurement Limit:

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 P_o transmitting power. the specified minimum attenuation becomes $43+10\log (P_o)$. and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

TEST SETUP



RESULTS (see plots in next pages)

LTE QPSK MODULATION. BW = 1.4 MHz.

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.

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.

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.

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.

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 = 20 MHz.

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.

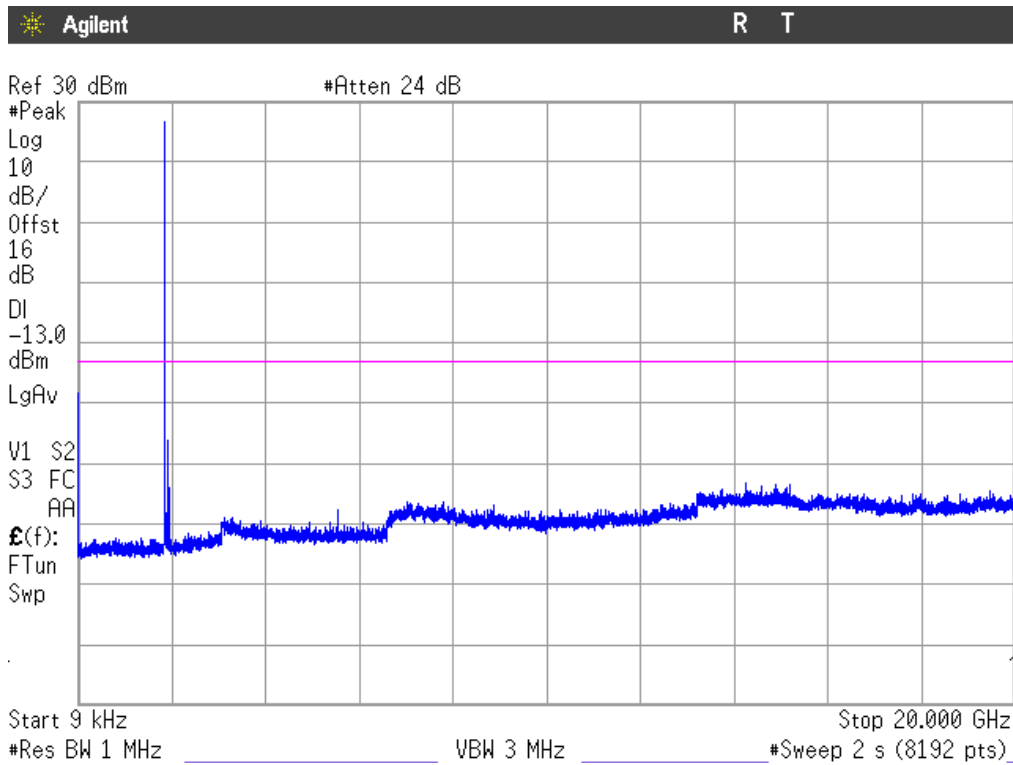
3. CHANNEL: HIGHEST

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

Verdict: PASS

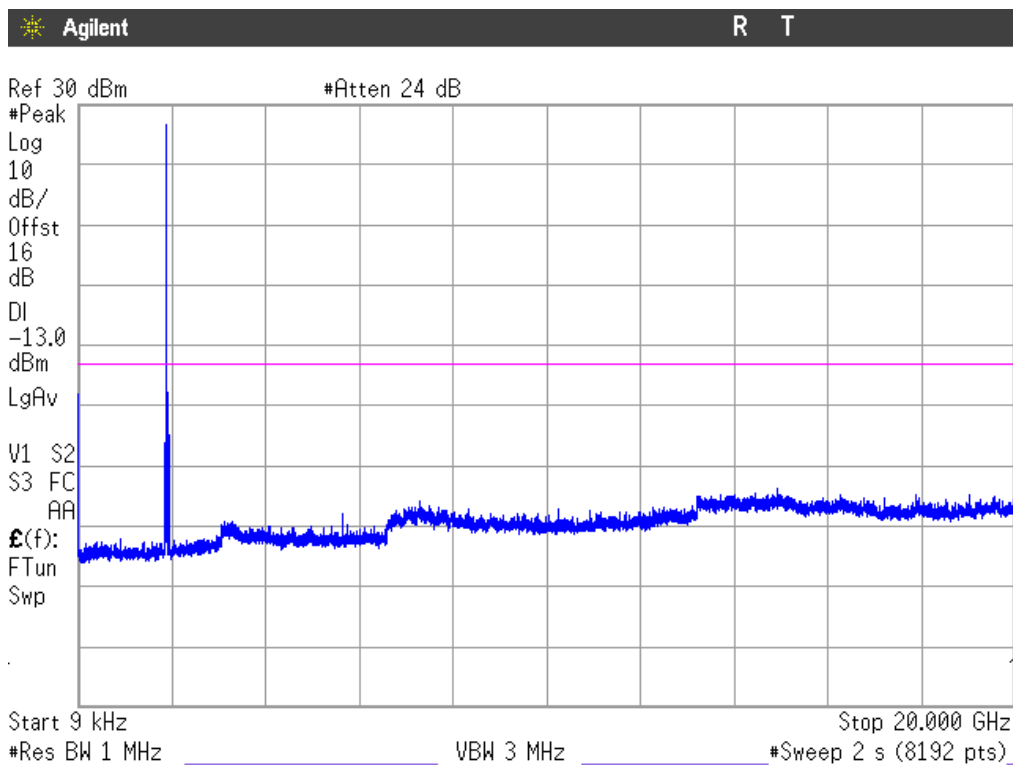
LTE QPSK MODULATION. BW = 1.4 MHz

1. CHANNEL: LOWEST



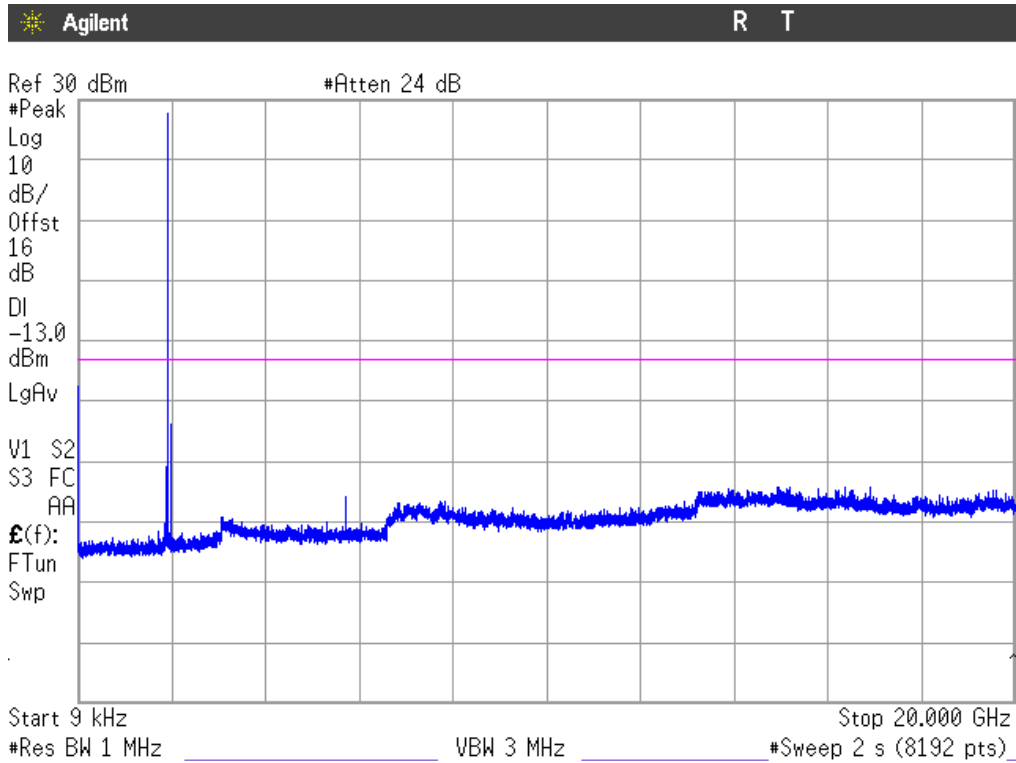
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

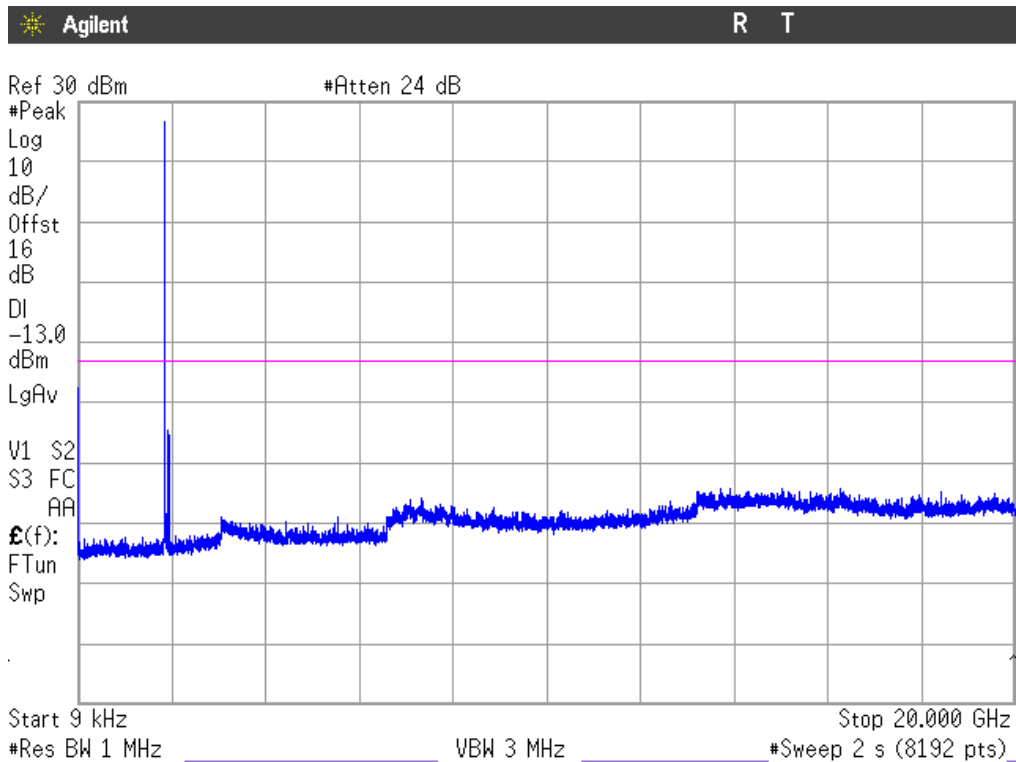
3. CHANNEL: HIGHEST



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

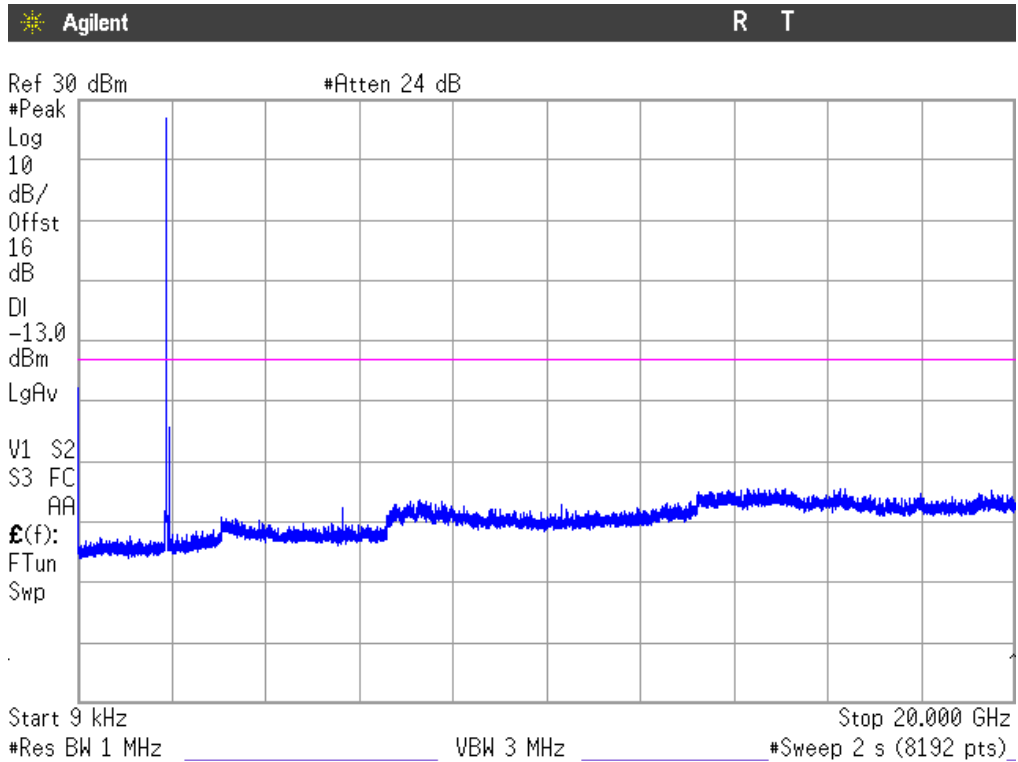
LTE QPSK MODULATION. BW = 3 MHz

1. CHANNEL: LOWEST



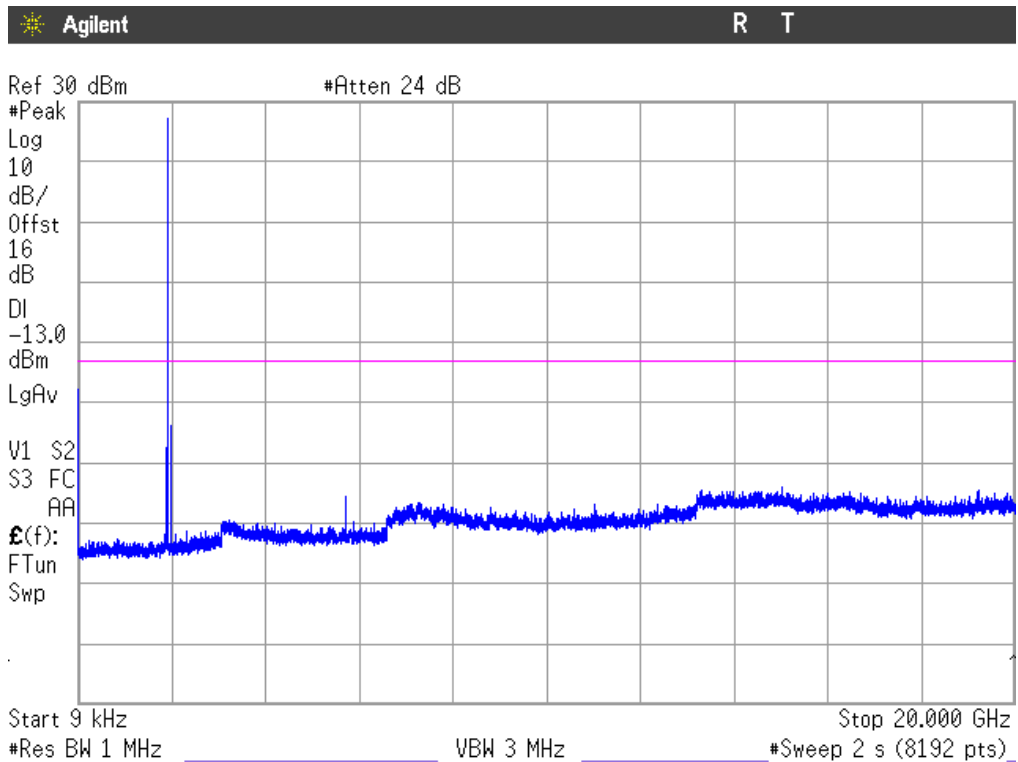
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

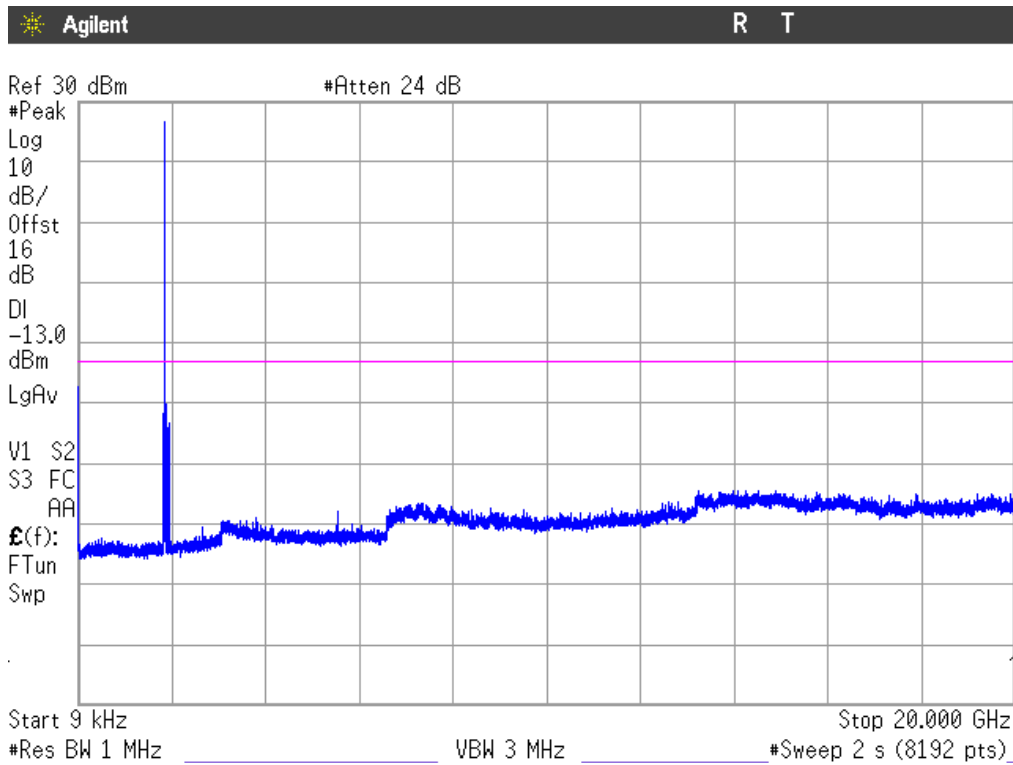
3. CHANNEL: HIGHEST



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

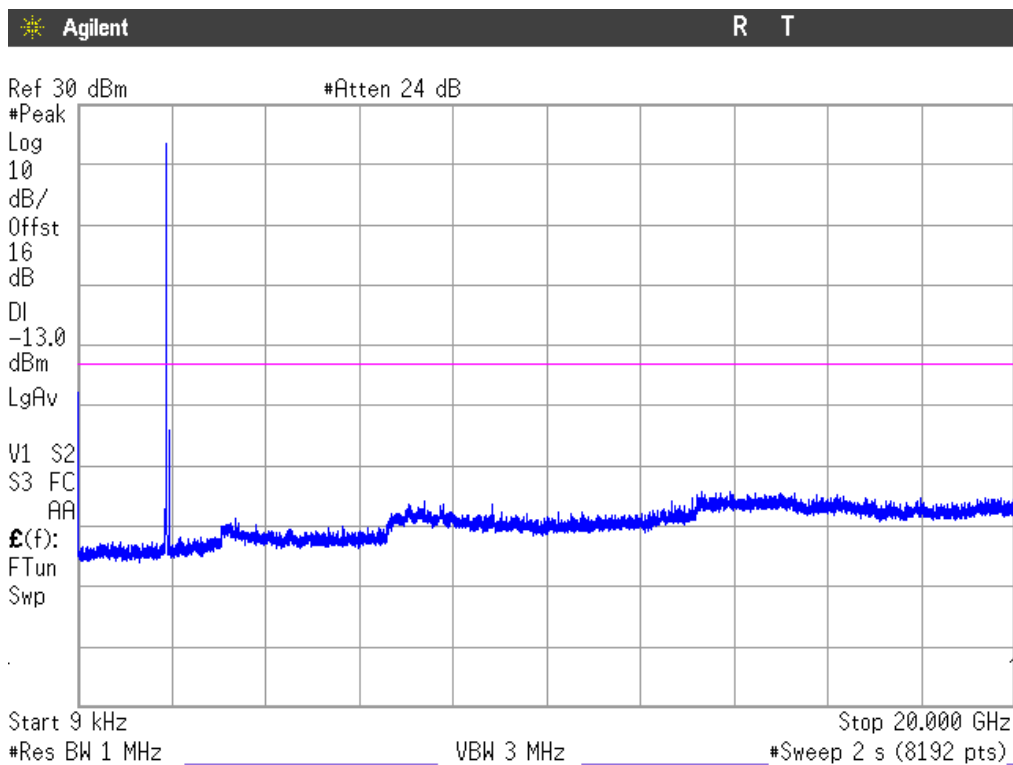
LTE QPSK MODULATION. BW = 5 MHz

1. CHANNEL: LOWEST



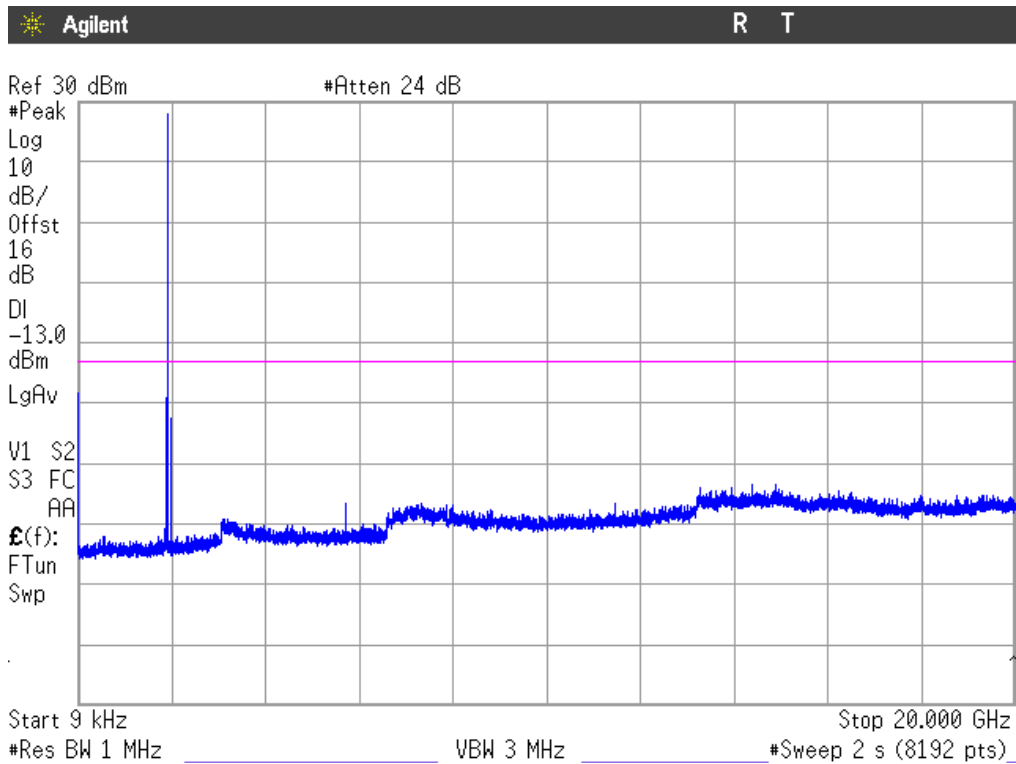
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

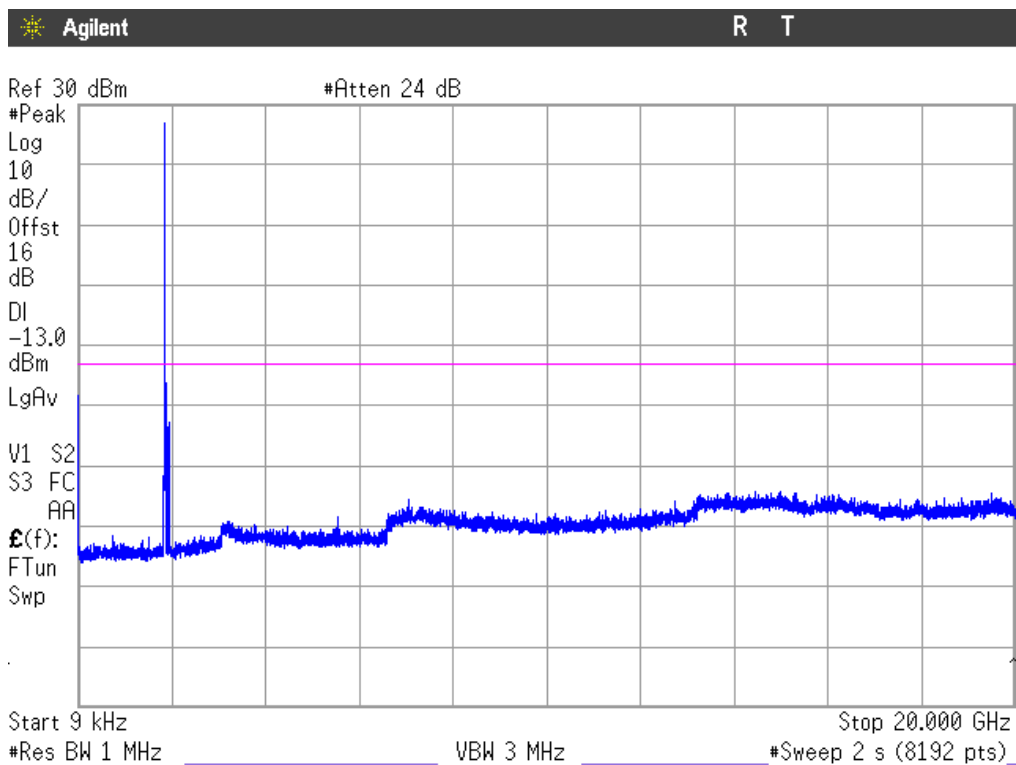
3. CHANNEL: HIGHEST



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

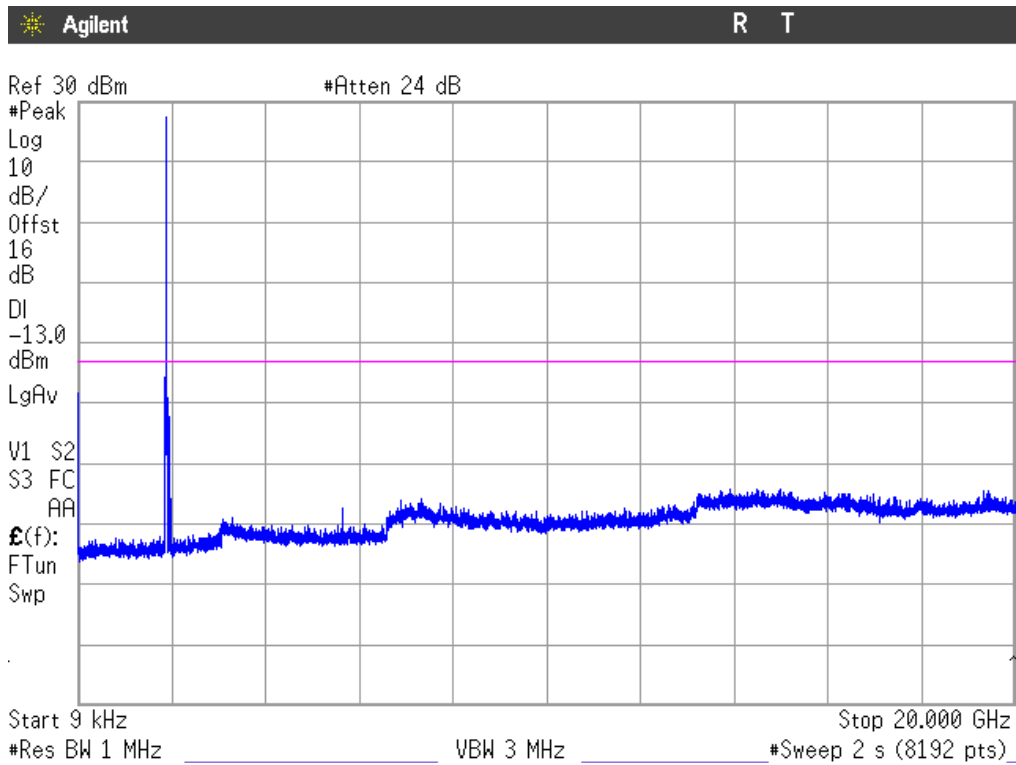
LTE QPSK MODULATION. BW = 10 MHz

1. CHANNEL: LOWEST



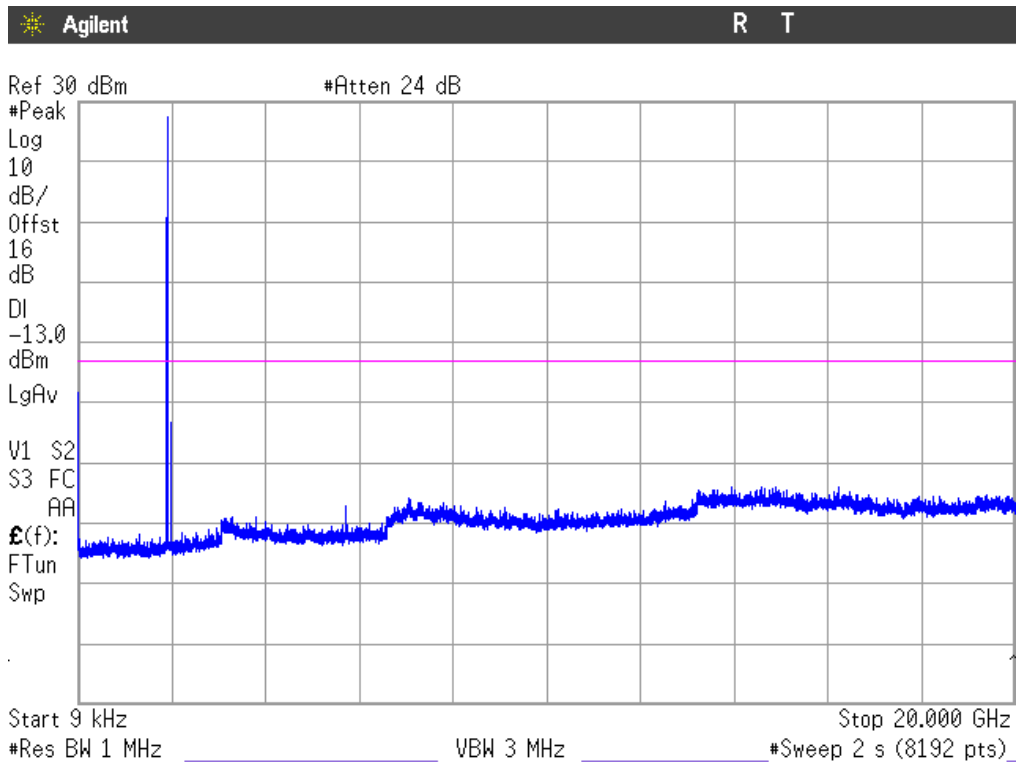
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

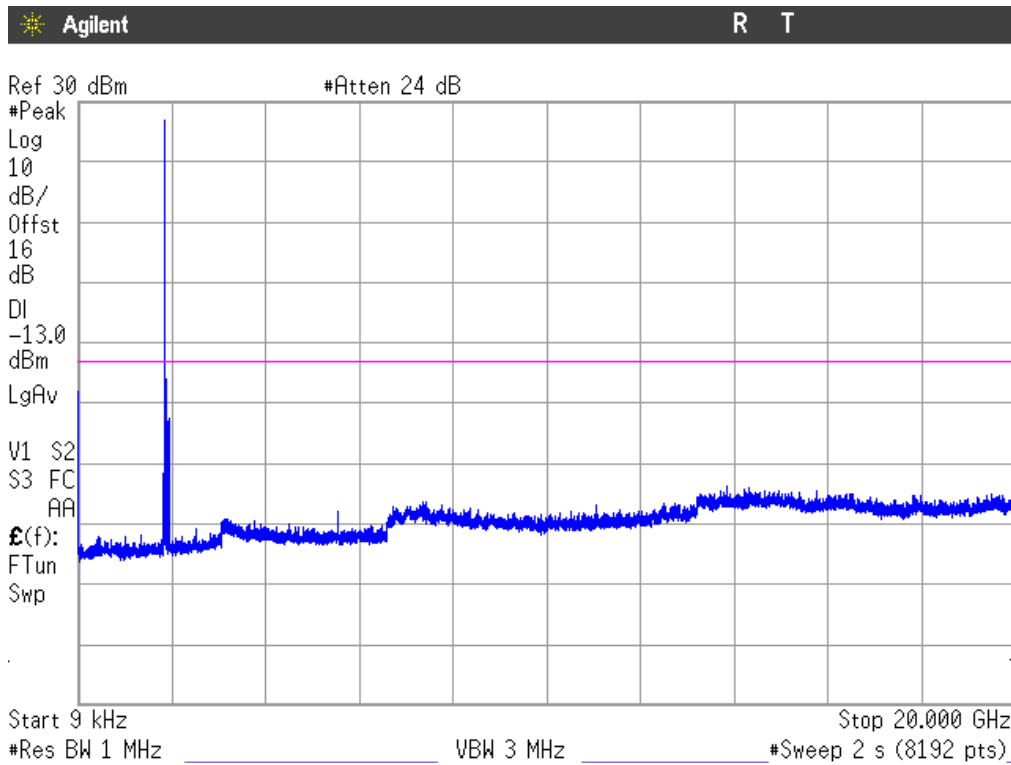
3. CHANNEL: HIGHEST



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

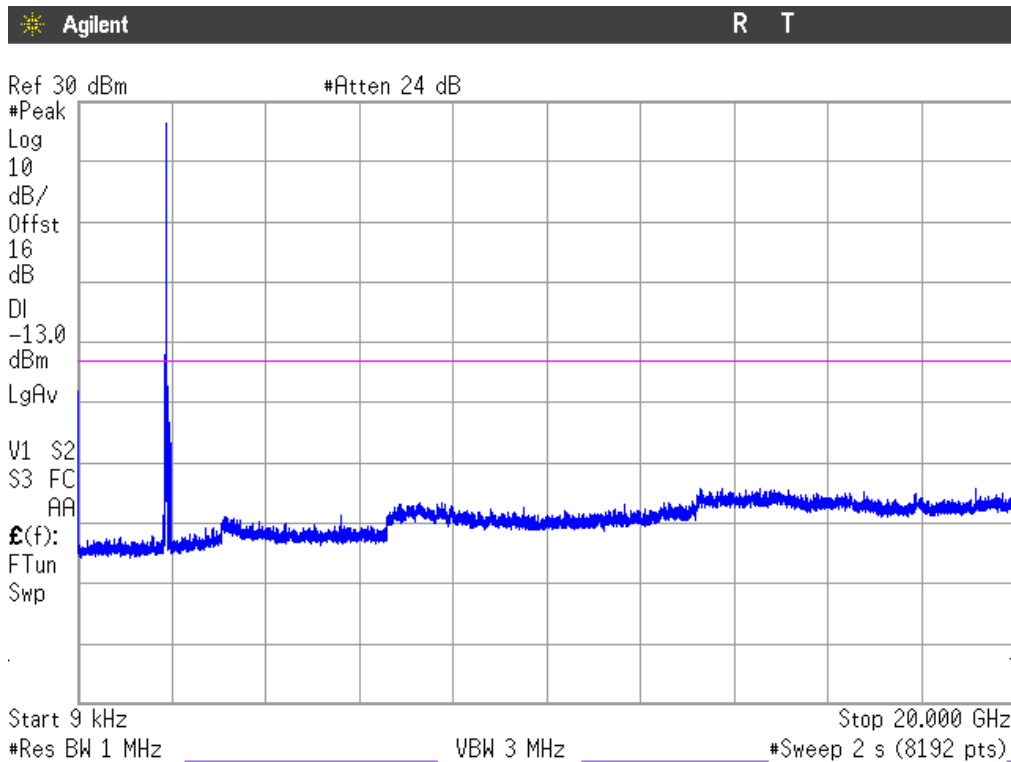
LTE QPSK MODULATION. BW = 15 MHz

1. CHANNEL: LOWEST



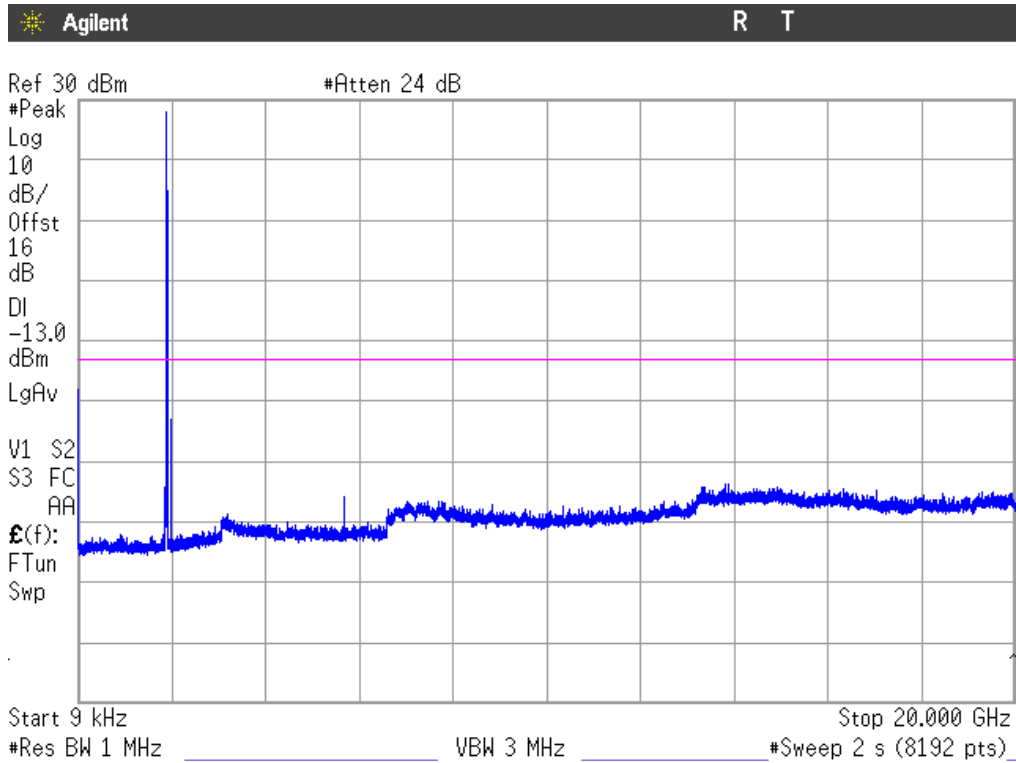
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

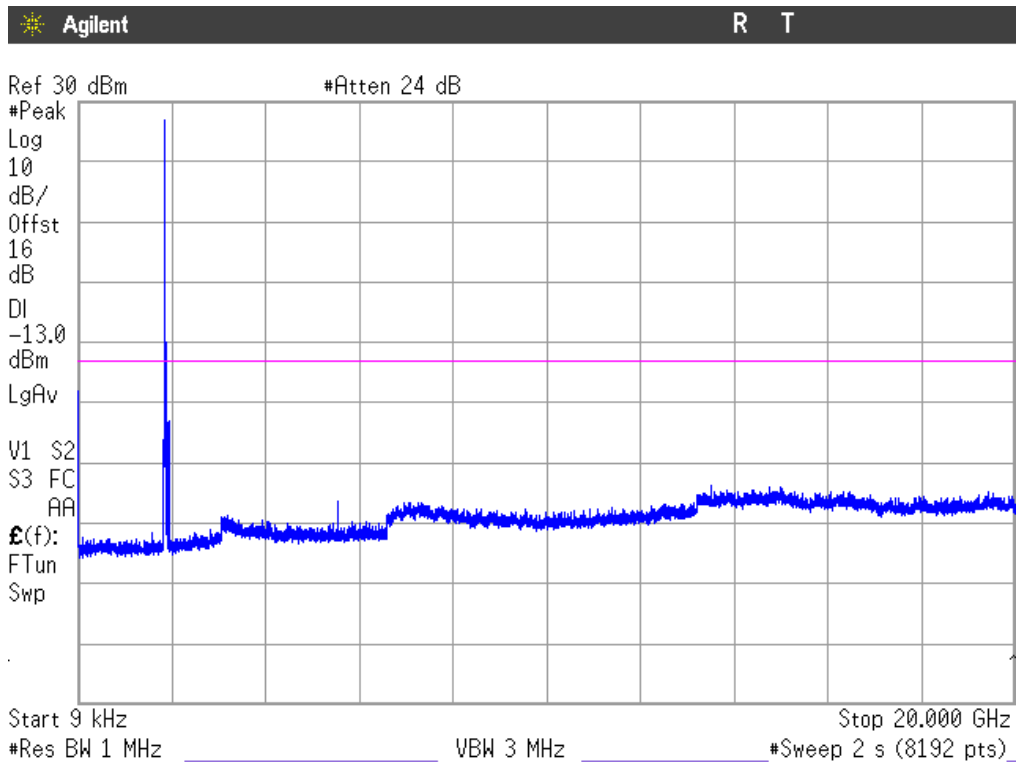
3. CHANNEL: HIGHEST



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

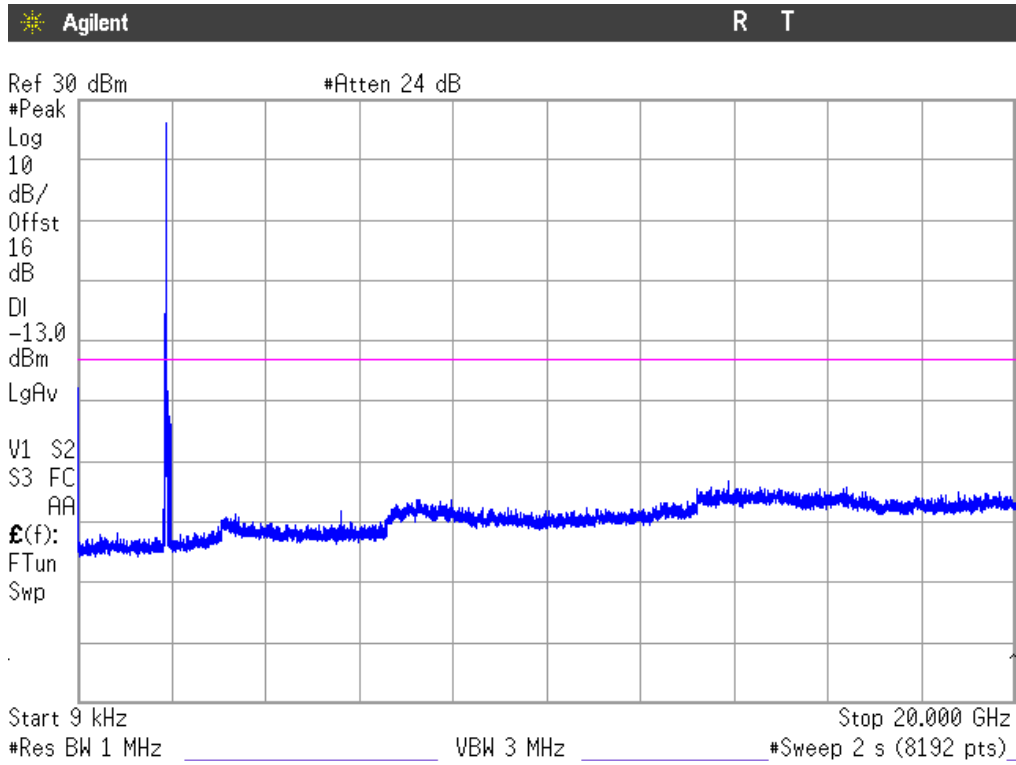
LTE QPSK MODULATION. BW = 20 MHz

1. CHANNEL: LOWEST



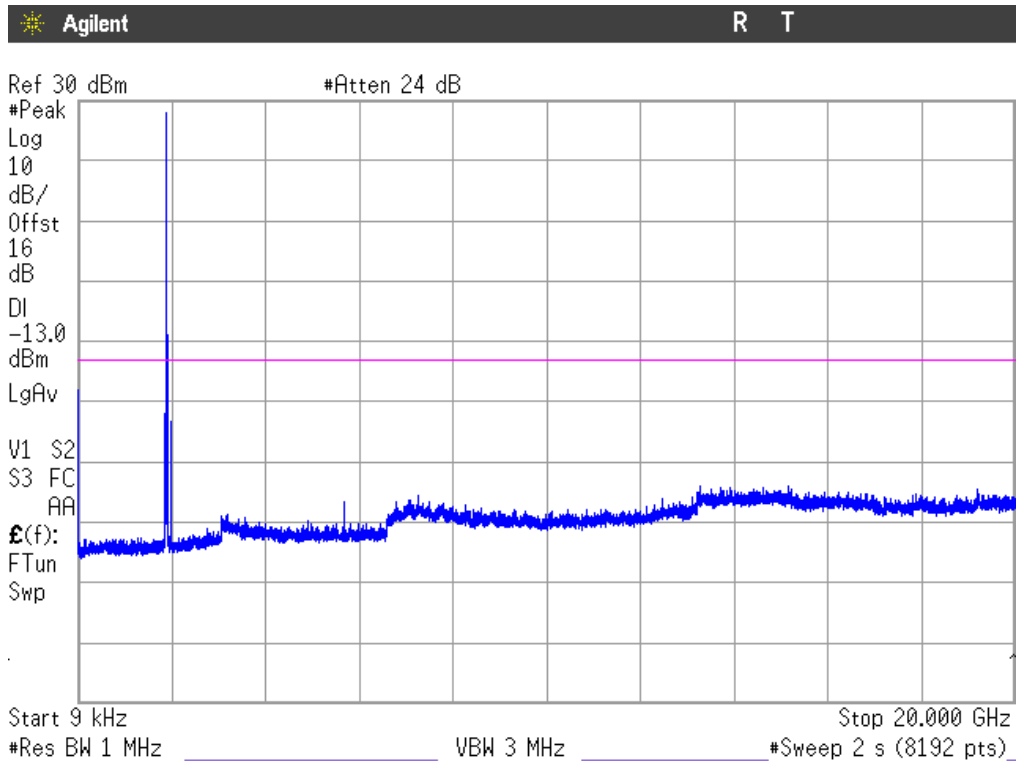
Note: The peak above the limit is the carrier frequency.

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.

Measurement uncertainty (dB)	<±2.03
------------------------------	--------

Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

FCC §2.1051 and §24.238

RSS-133. Clause 6.5.

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.

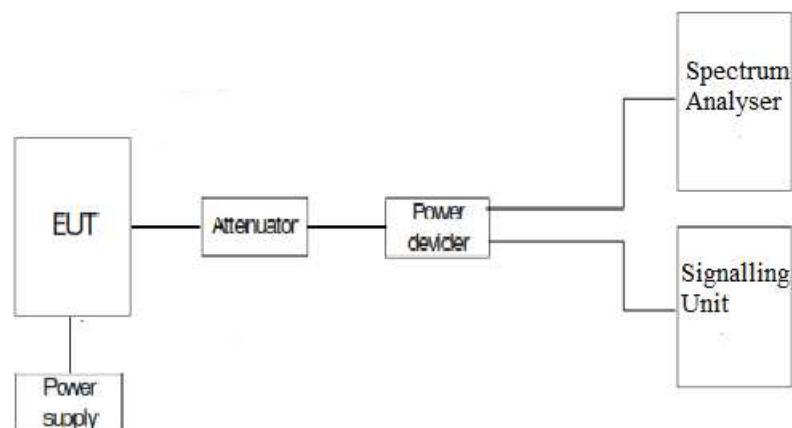
As indicated in FCC part 24/RSS-133. in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Measurement Limit:

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 P_0 transmitting power. the specified minimum attenuation becomes $43+10\log (P_0)$. and the level in dBm relative P_0 becomes:

TEST SETUP



RESULTS (see plots in next pages)

LTE QPSK MODULATION (Channels in Band II):	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)	-20.28	-16.99	-16.06	-15.11	-14.99	-15.87

LTE QPSK MODULATION: (Channels in Band II):	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)	-25.07	-25.61	-26.08	-24.61	-23.30	-24.48

LTE QPSK MODULATION: (Channels in Band II):	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)	-16.45	-13.94	-15.48	-15.22	-14.55	-16.87

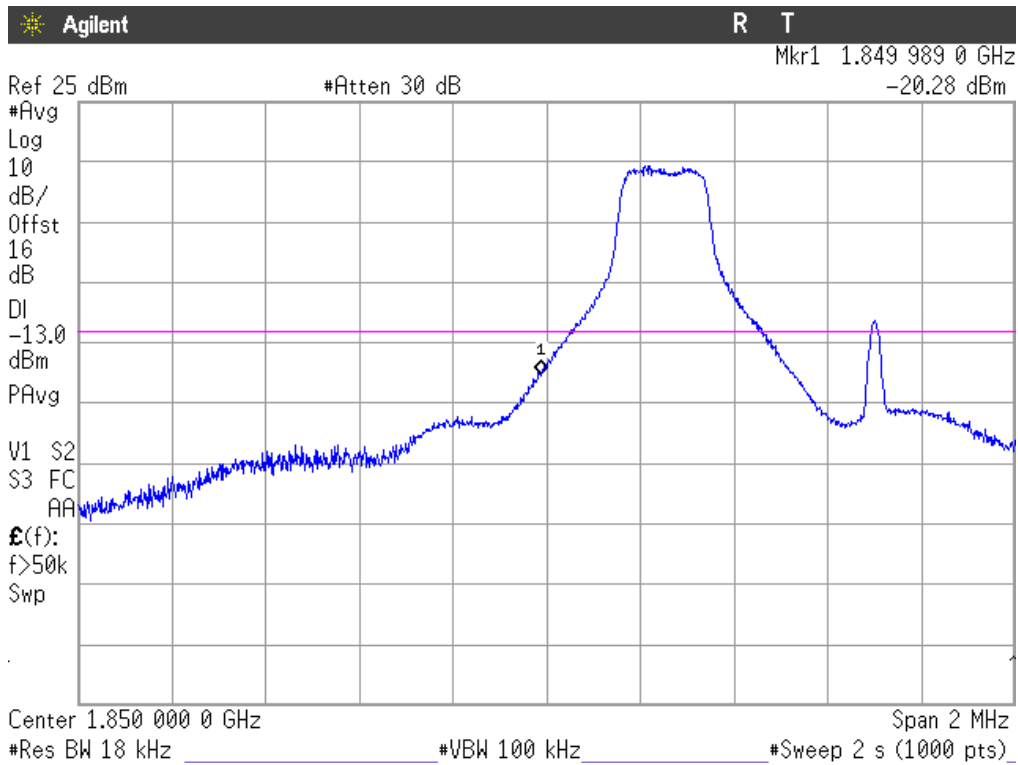
LTE QPSK MODULATION: (Channels in Band II):	RB= All. Offset=0. BW=1.4 MHz	RB= All. Offset =0. BW = 3 MHz	RB= All. Offset =0. BW = 5 MHz	RB= All. Offset =0. BW = 10 MHz	RB= All. Offset =0. BW = 15 MHz	RB= All. Offset =0. BW = 20 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-24.36	-25.84	-27.41	-29.12	-28.73	-29.99

Measurement uncertainty = $\leq \pm 2.03$ dB.

Verdict: PASS

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

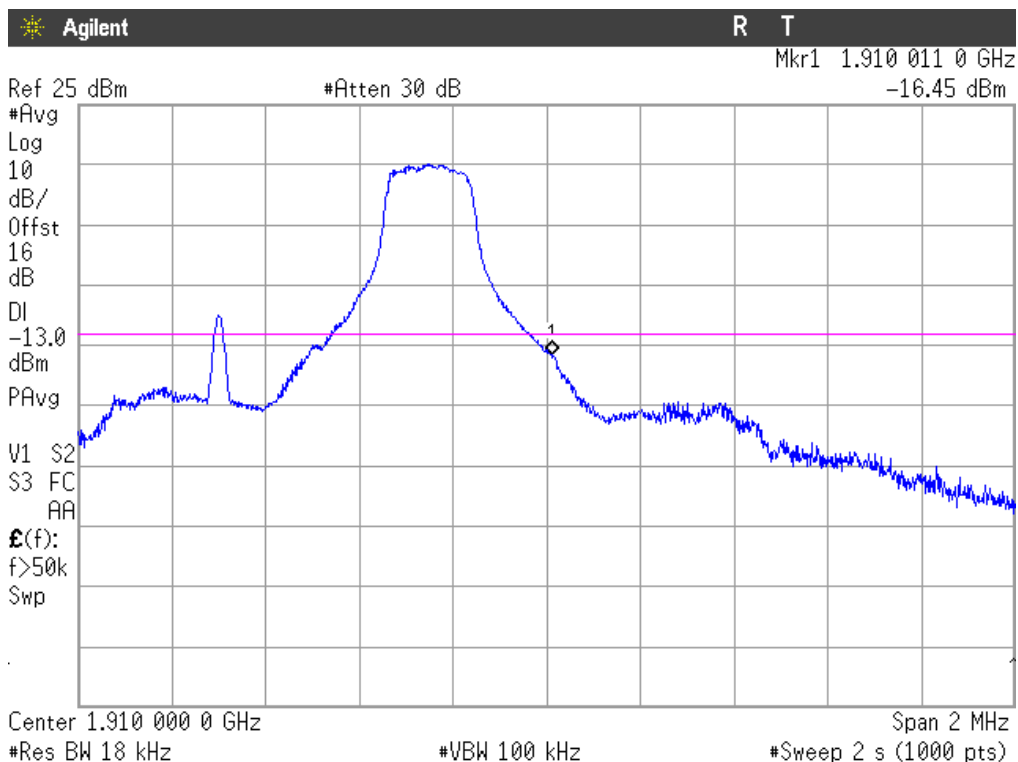
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

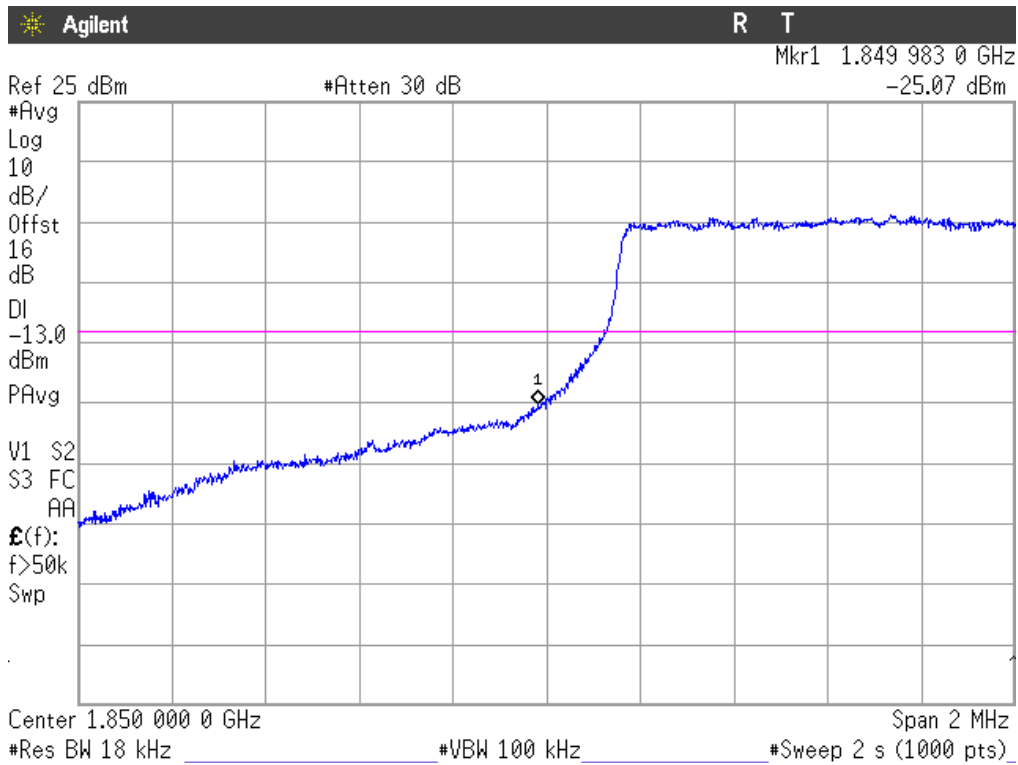
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

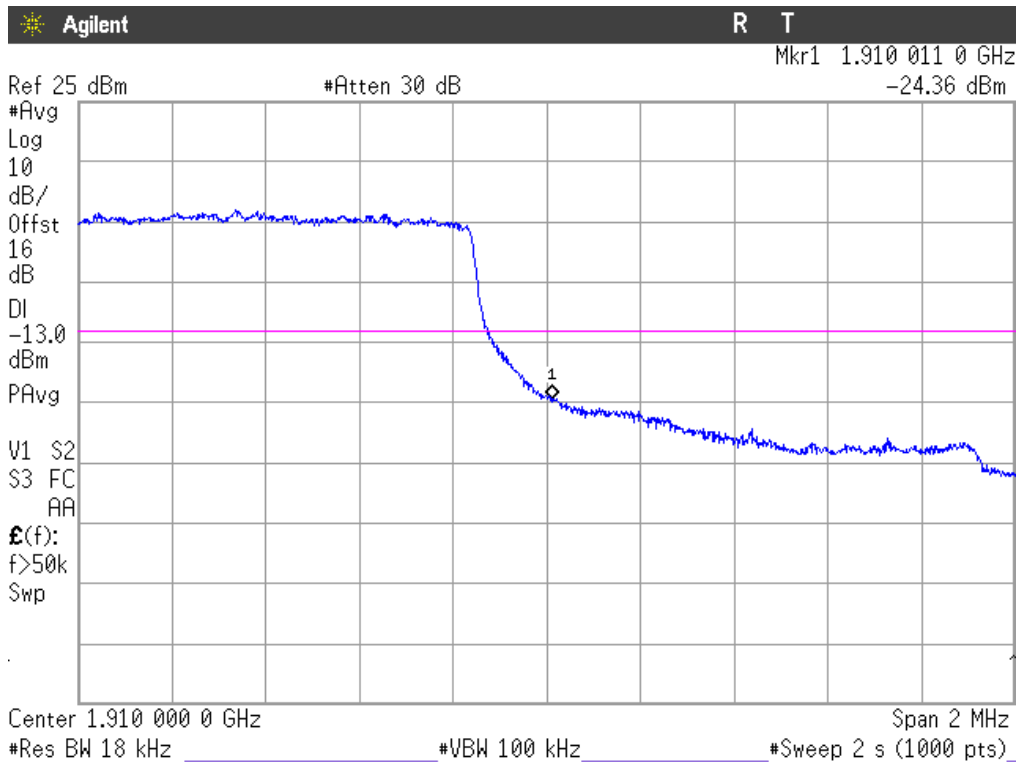
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

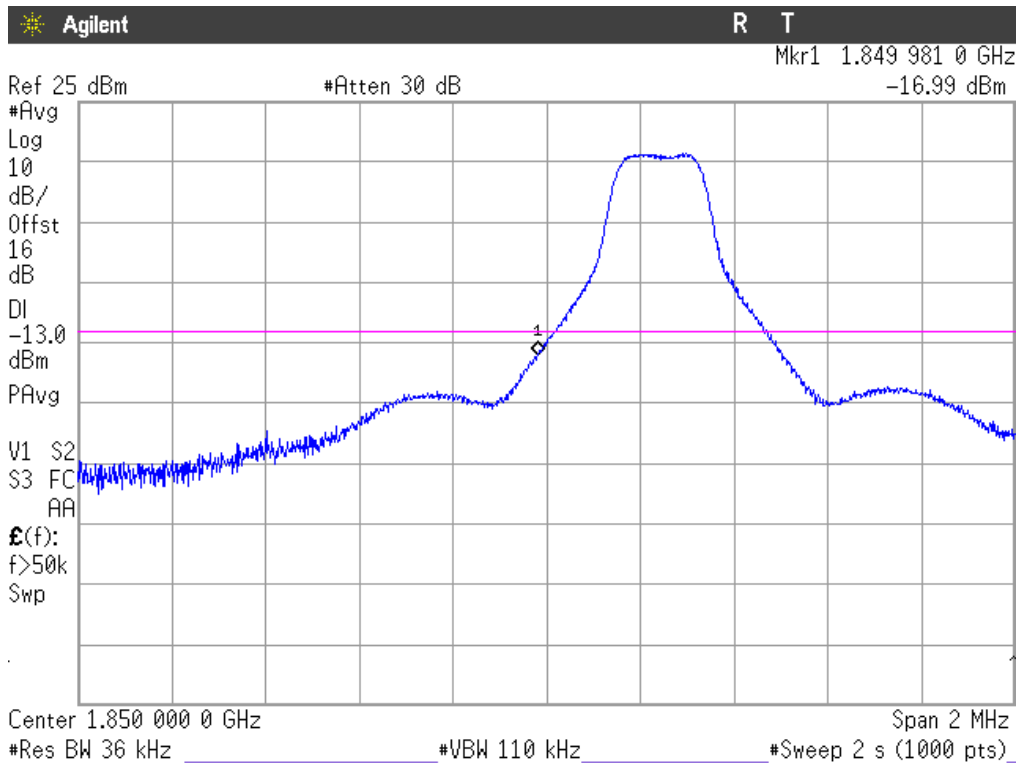


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

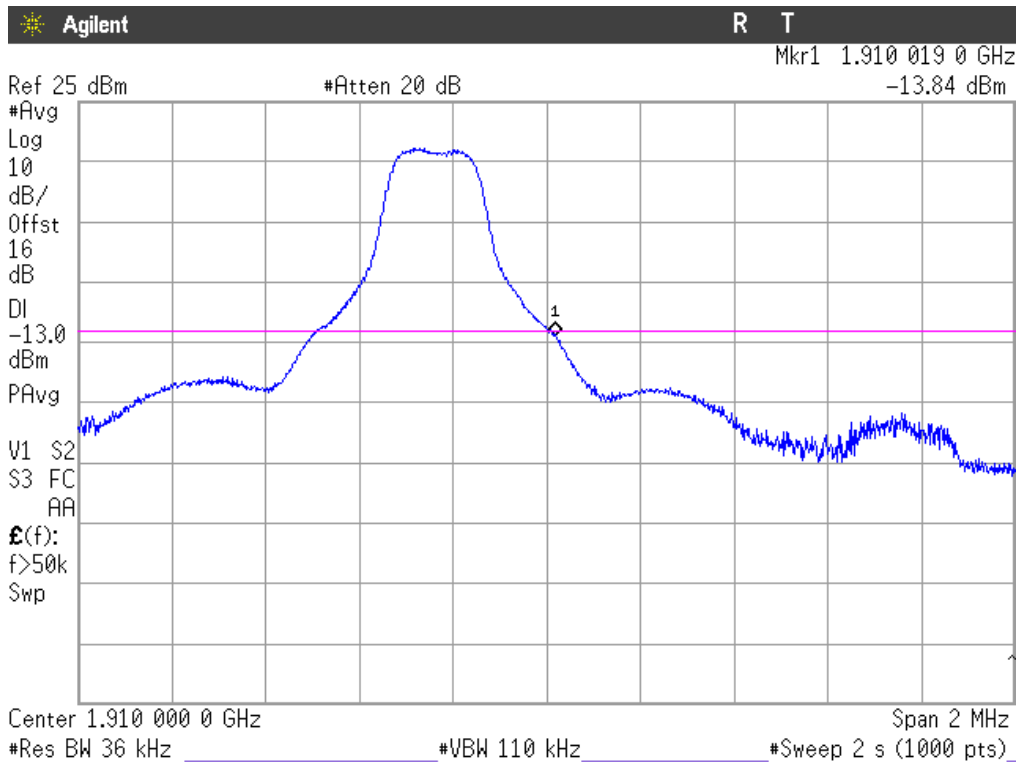
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

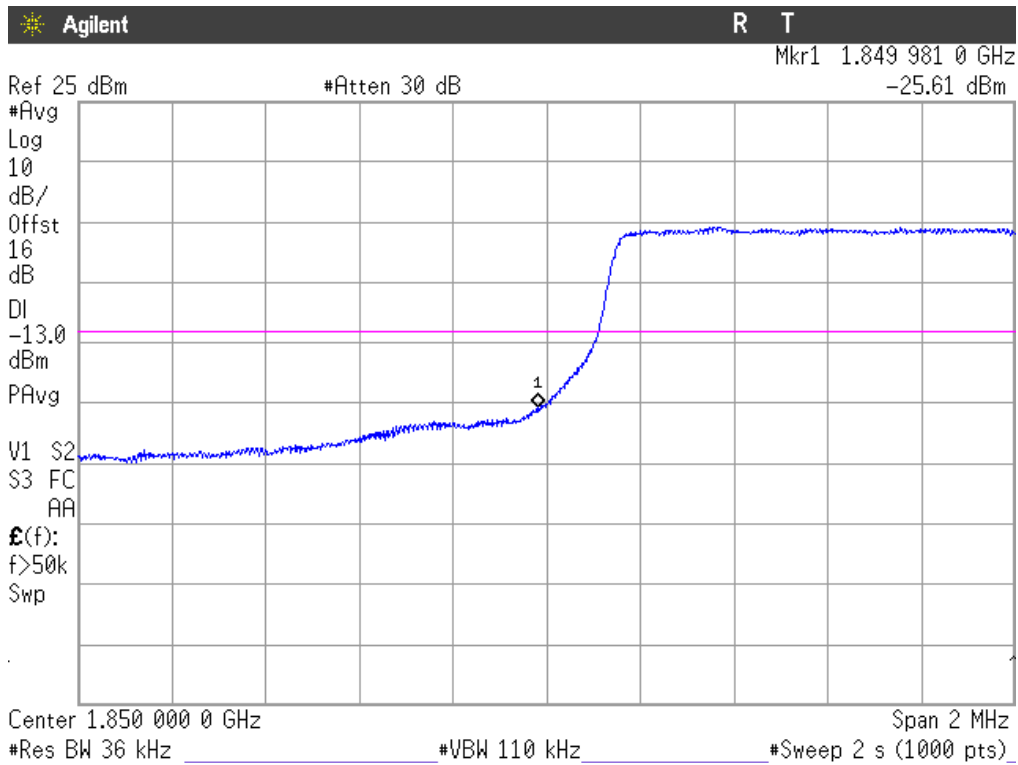
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

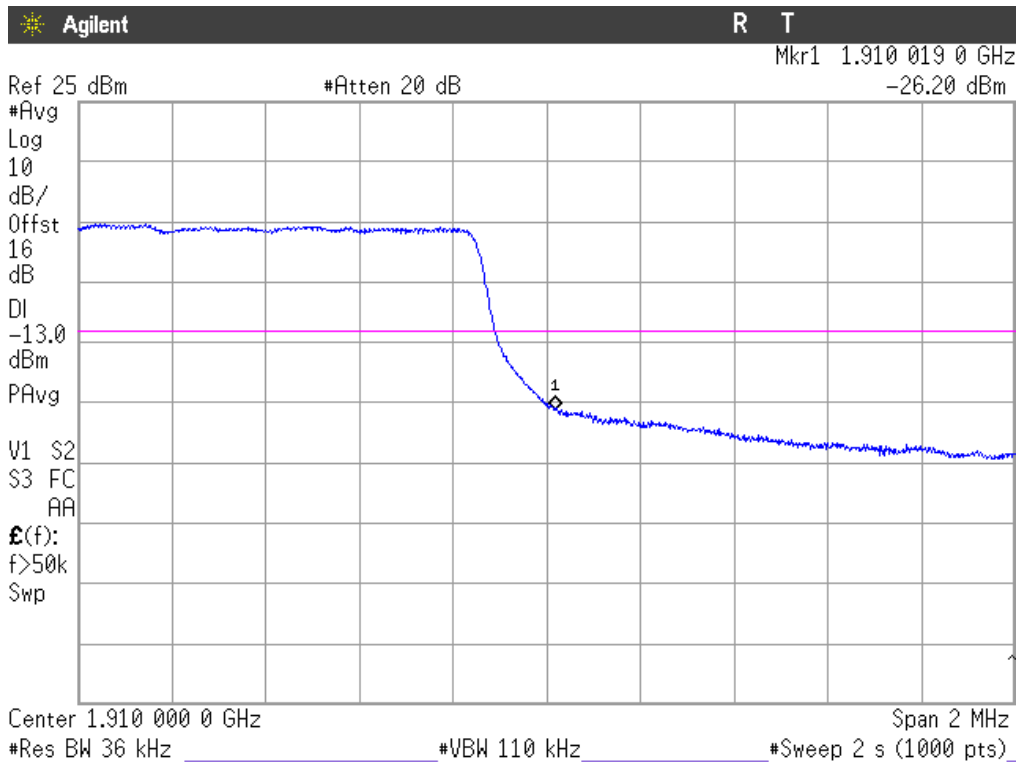
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

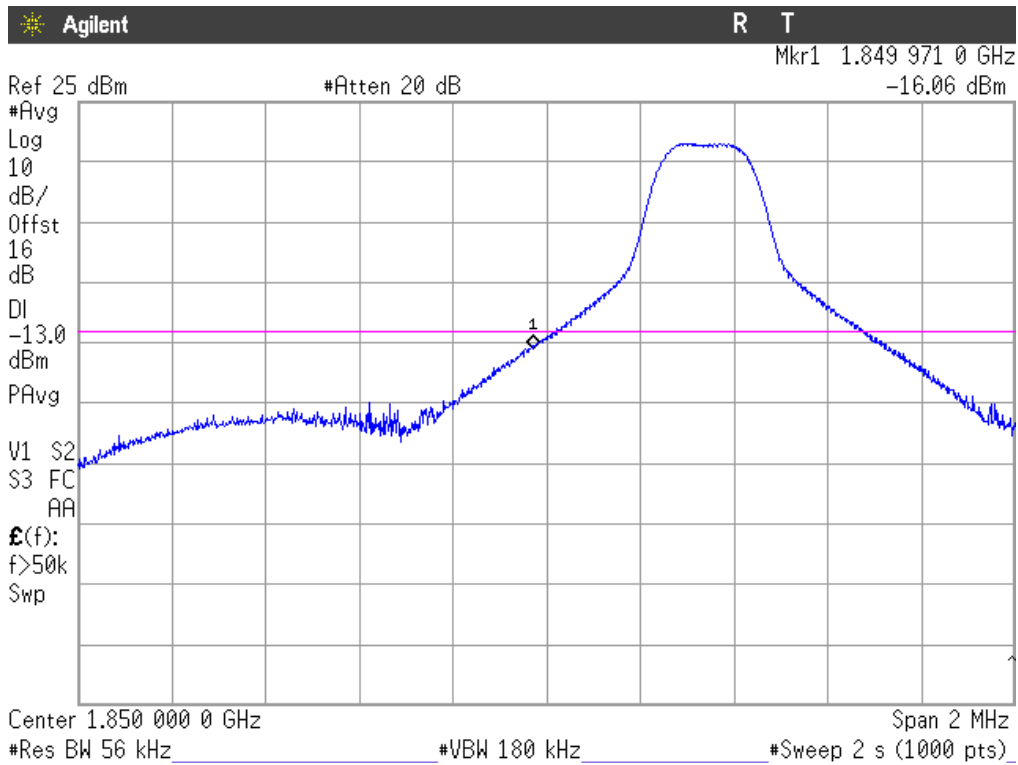


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

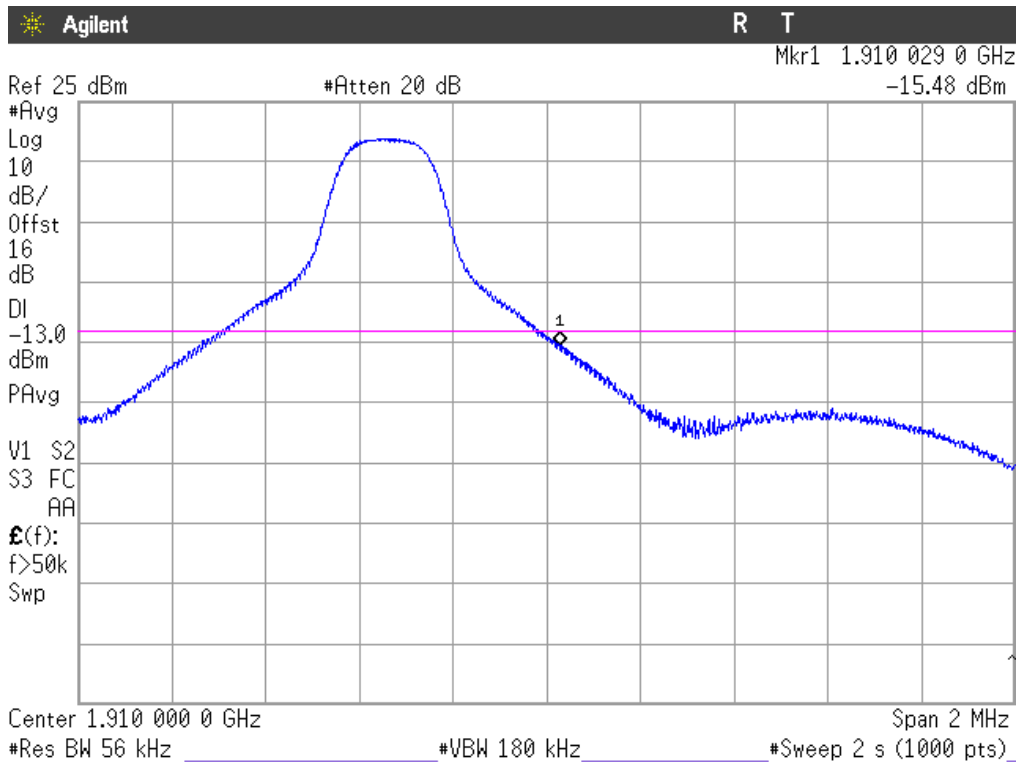
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

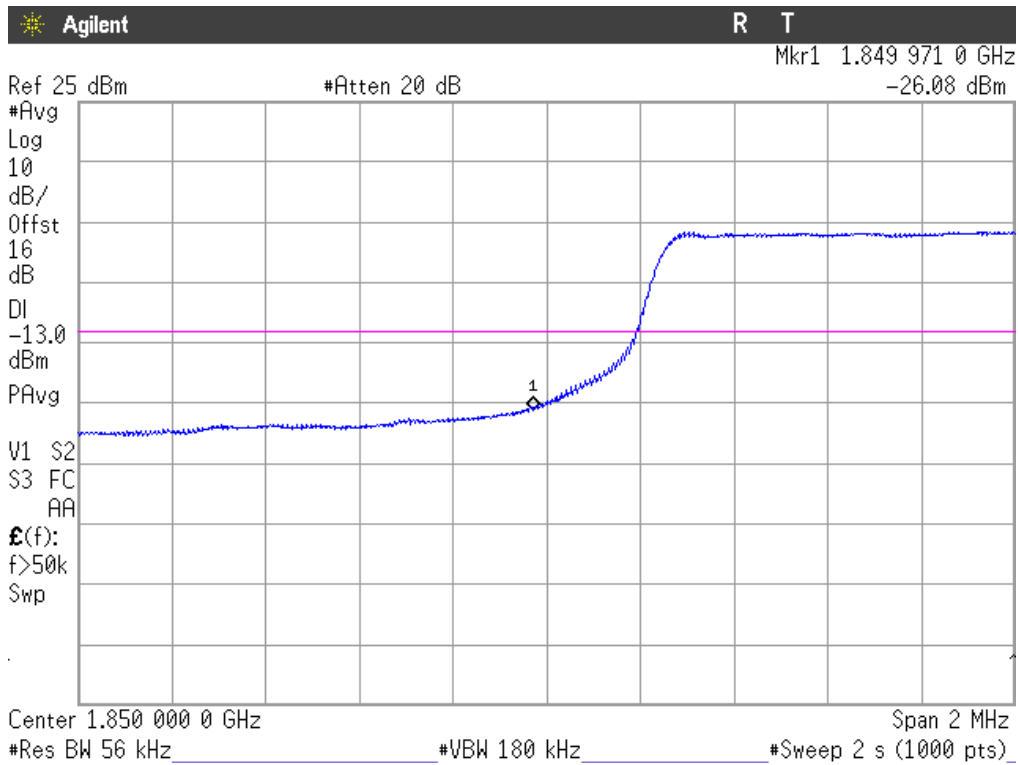
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

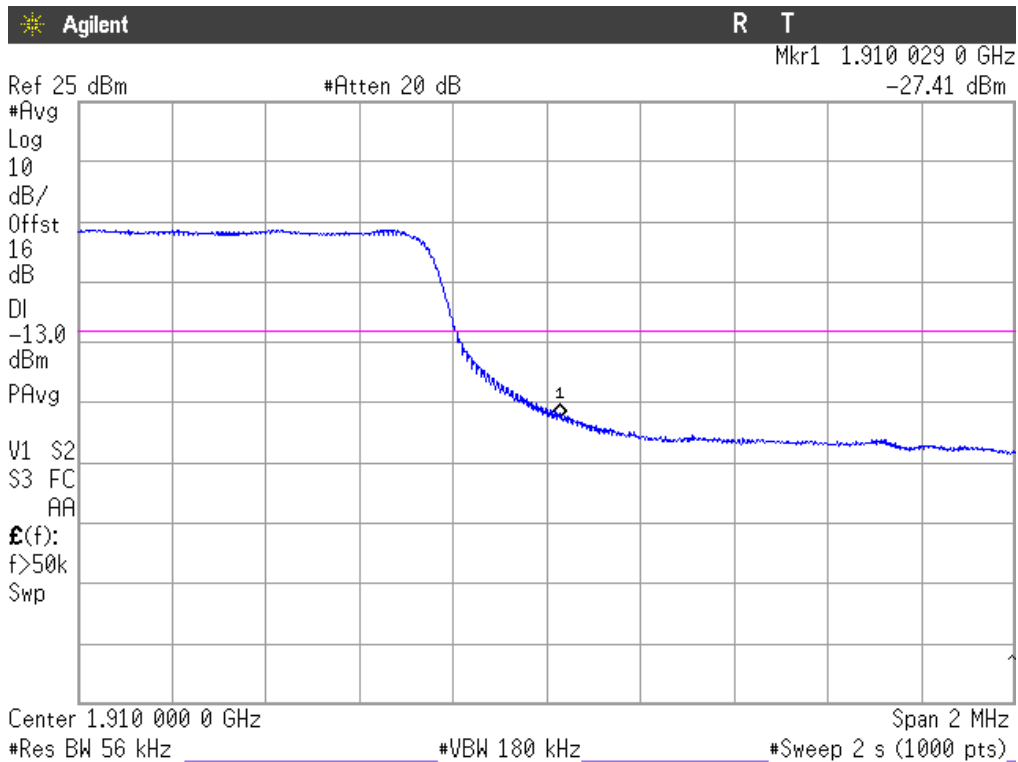
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

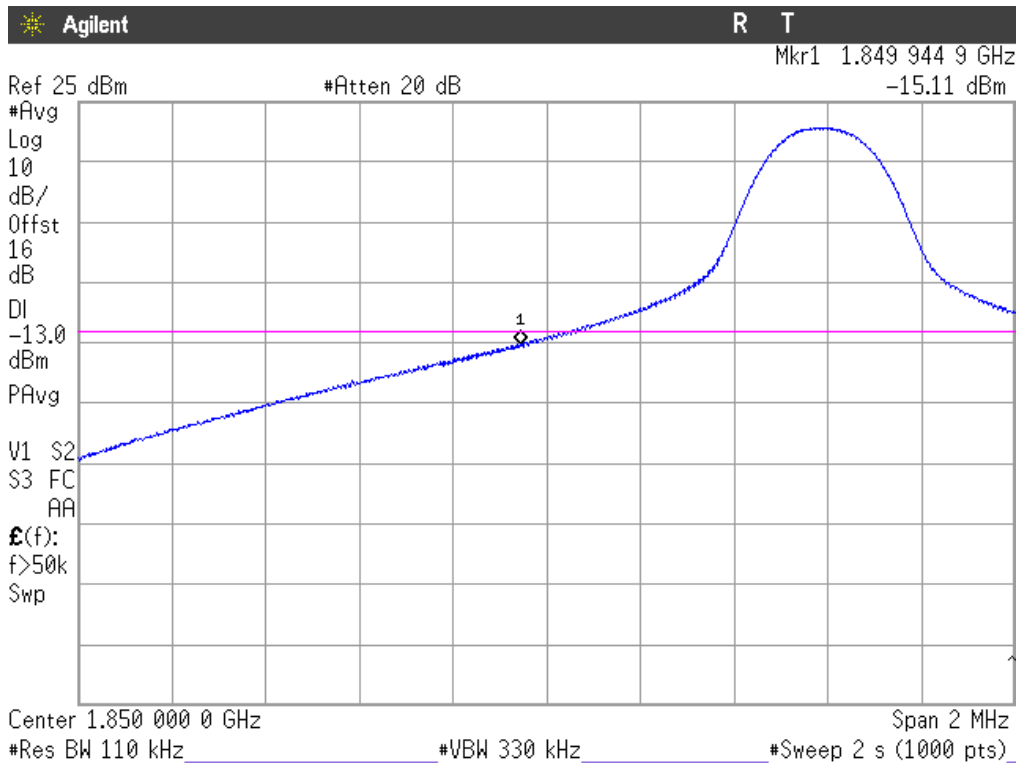


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

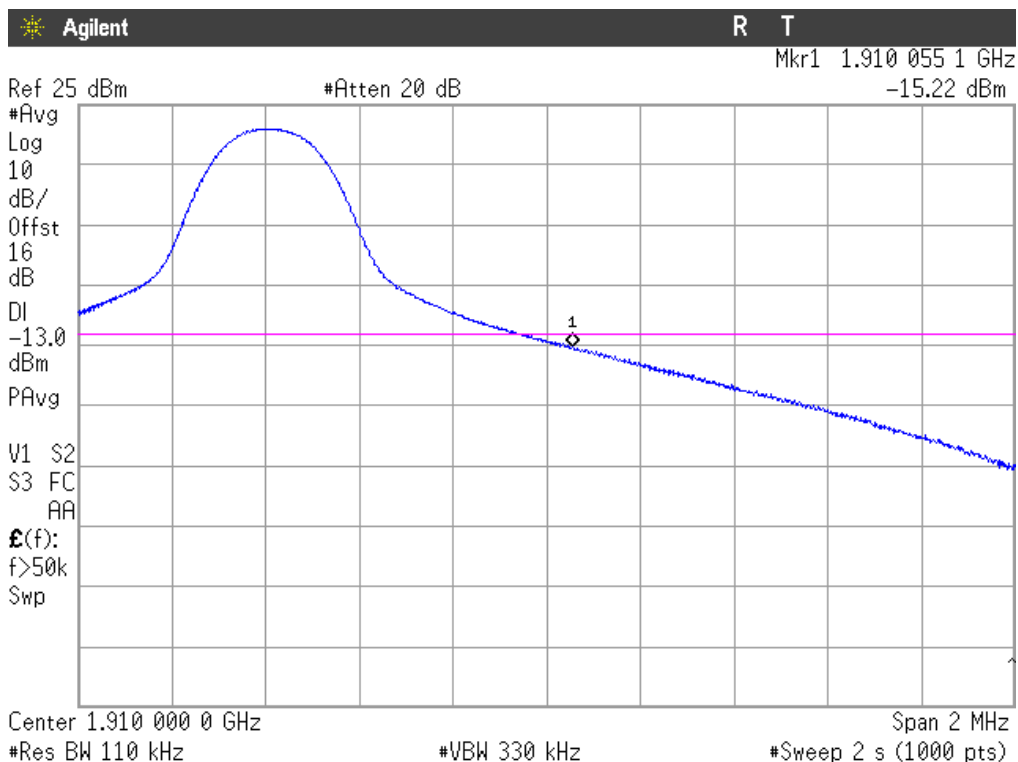
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

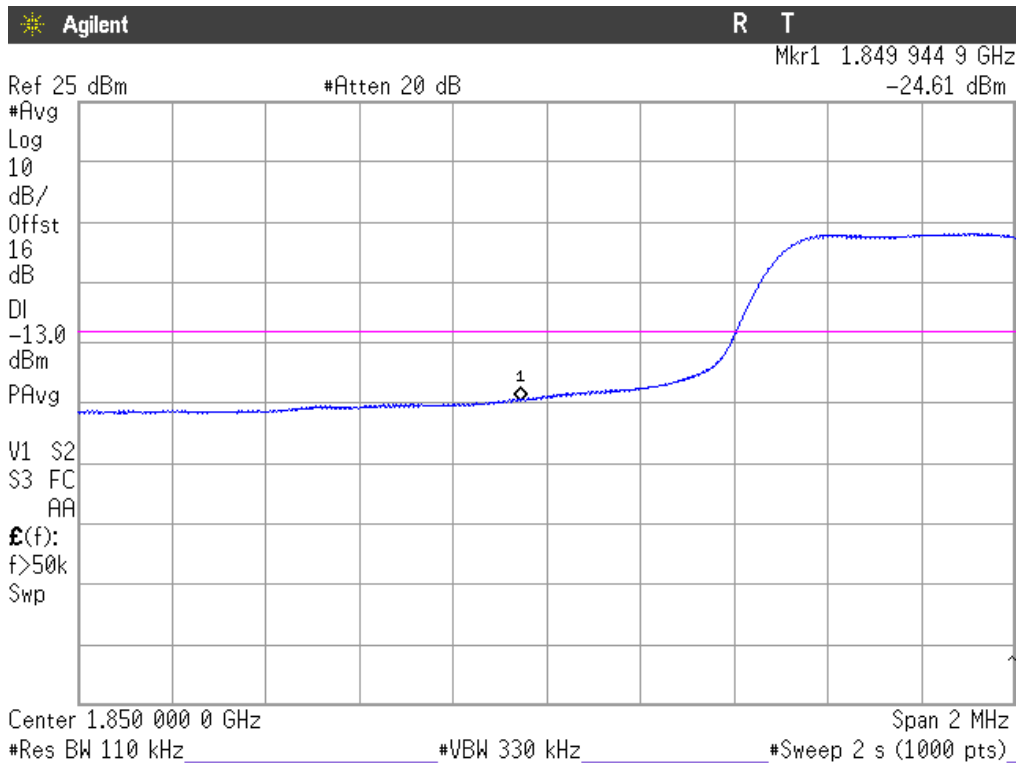
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

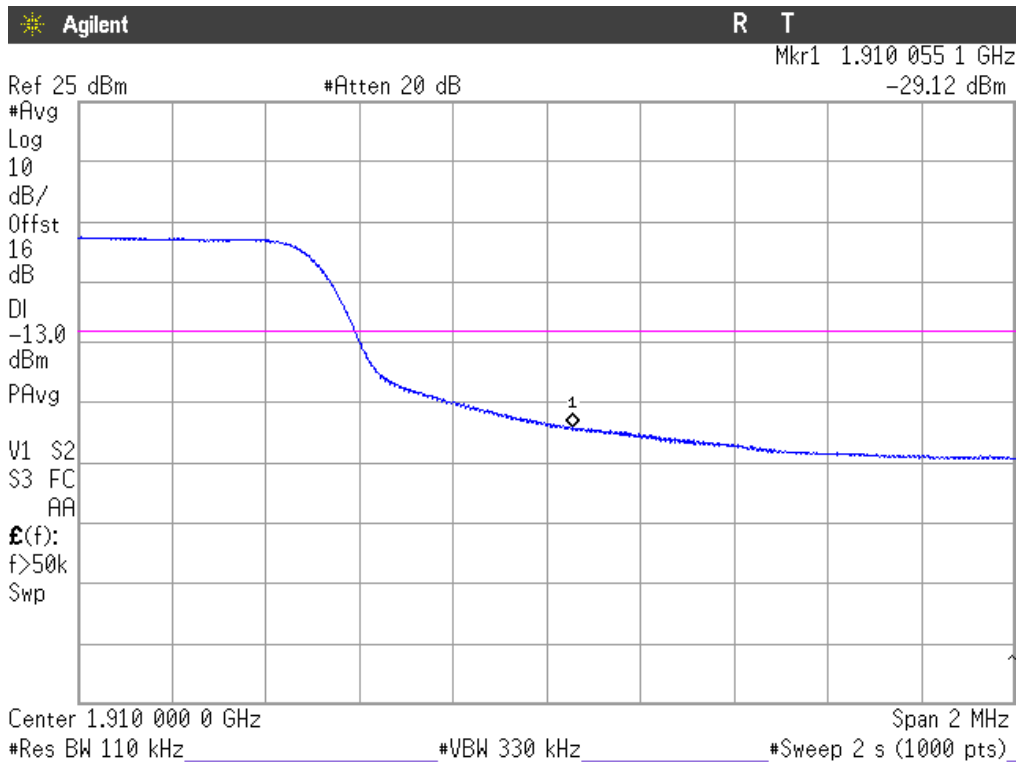
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

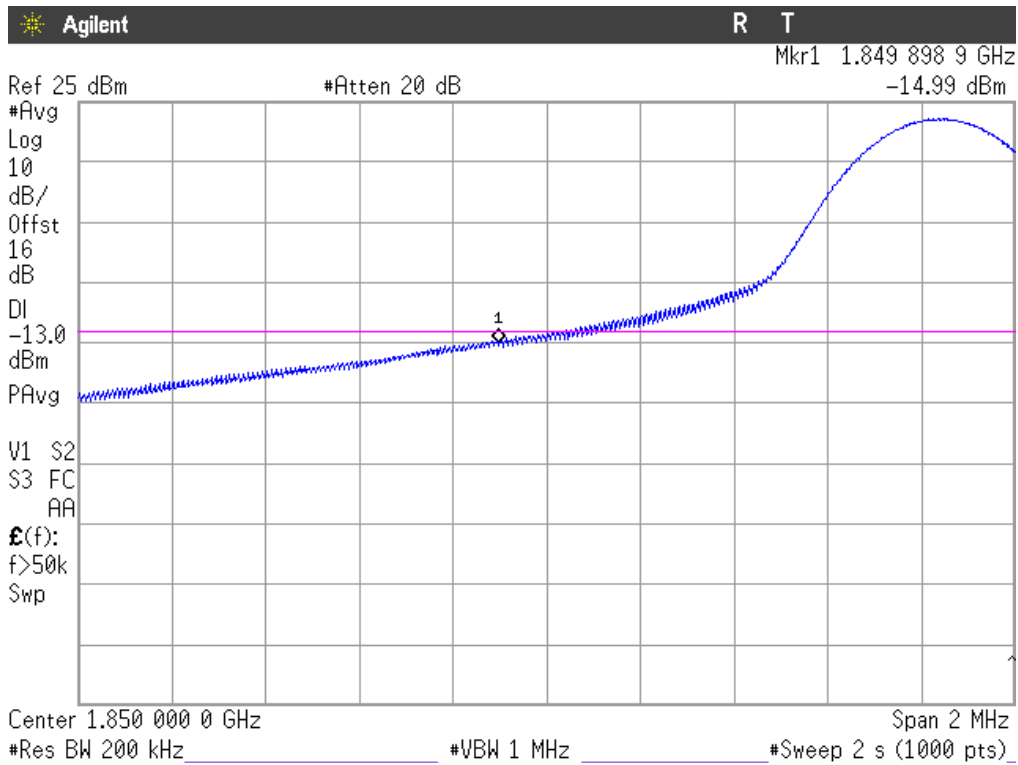


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

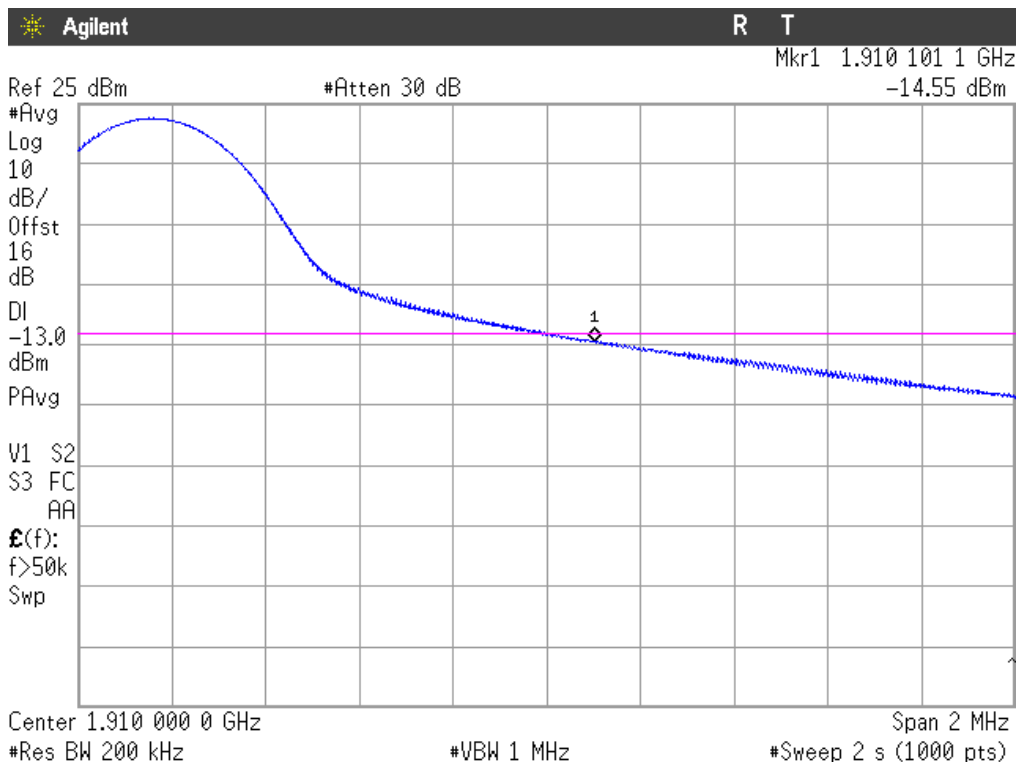
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

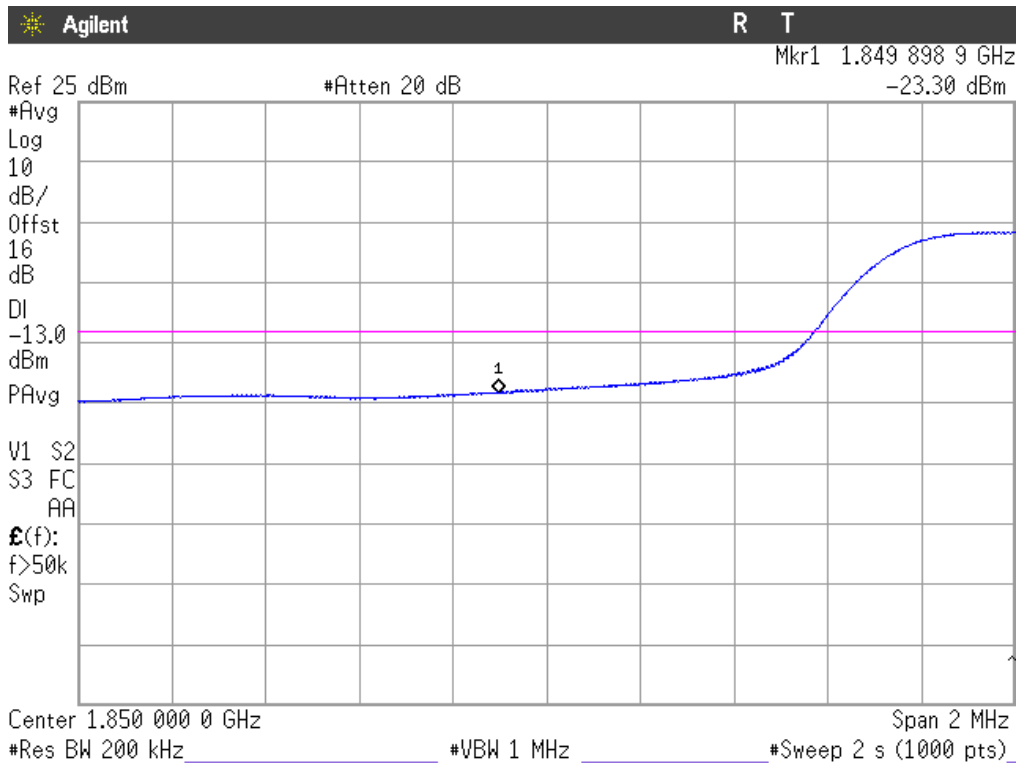
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

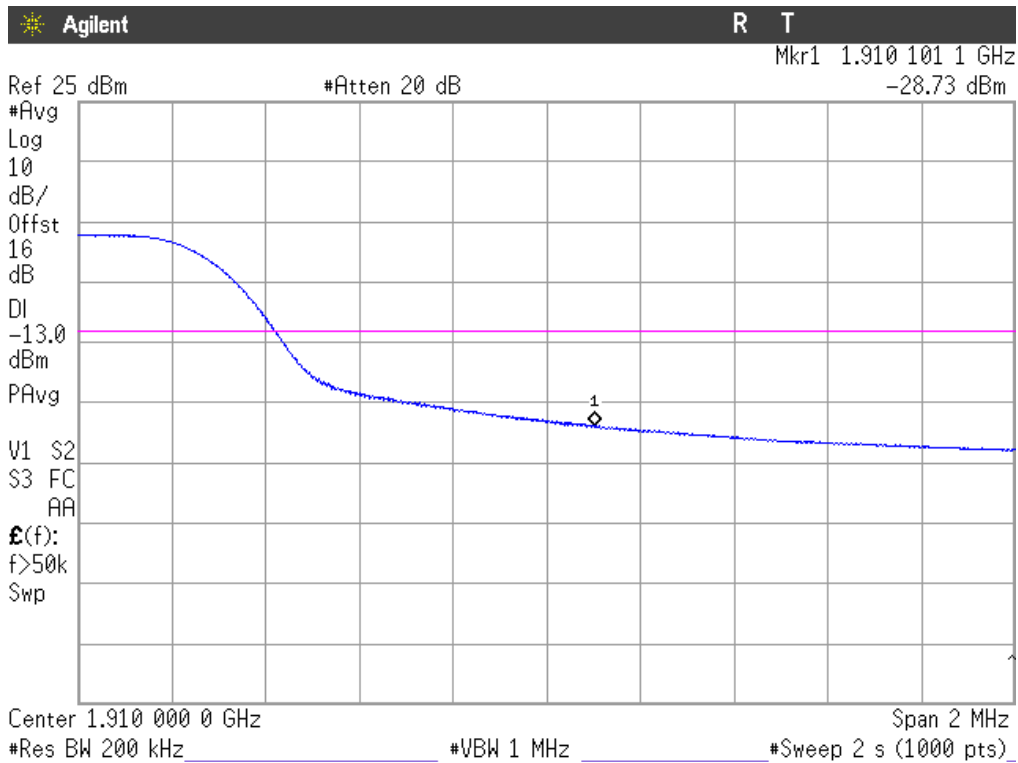
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 15 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

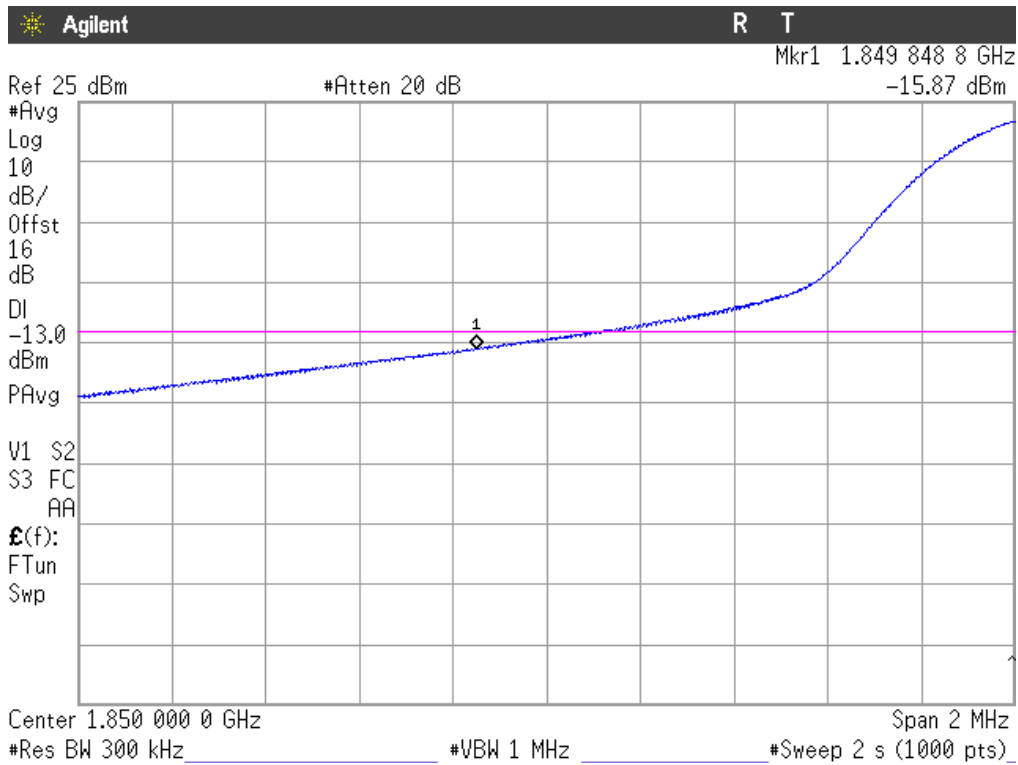


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

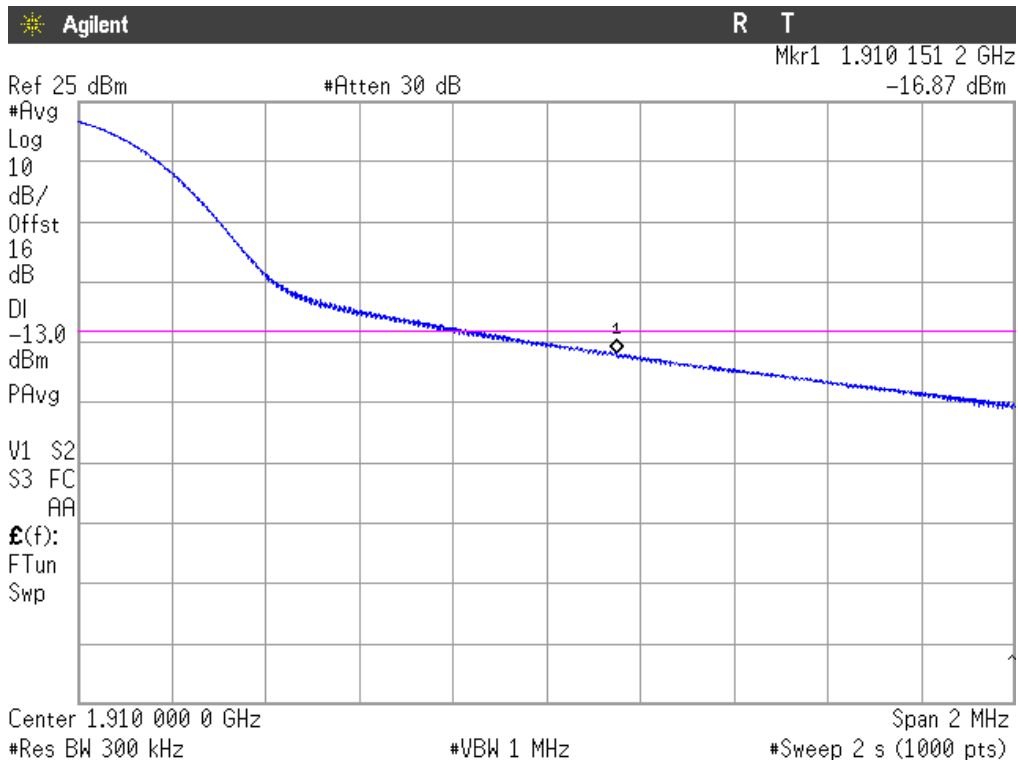
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

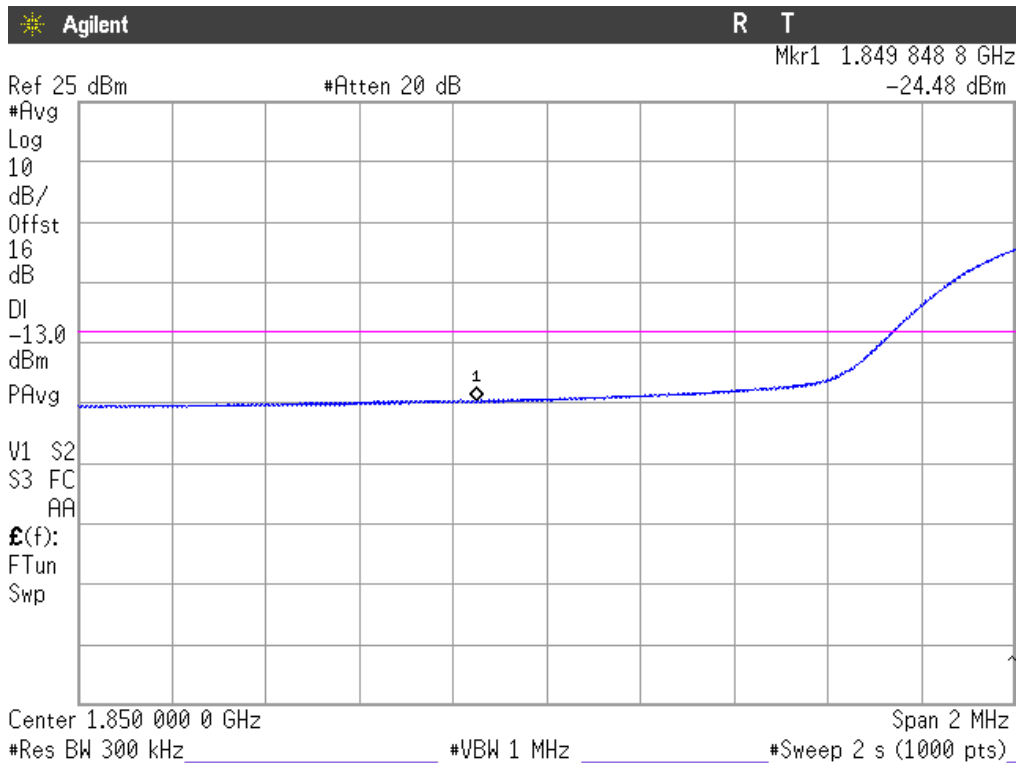
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

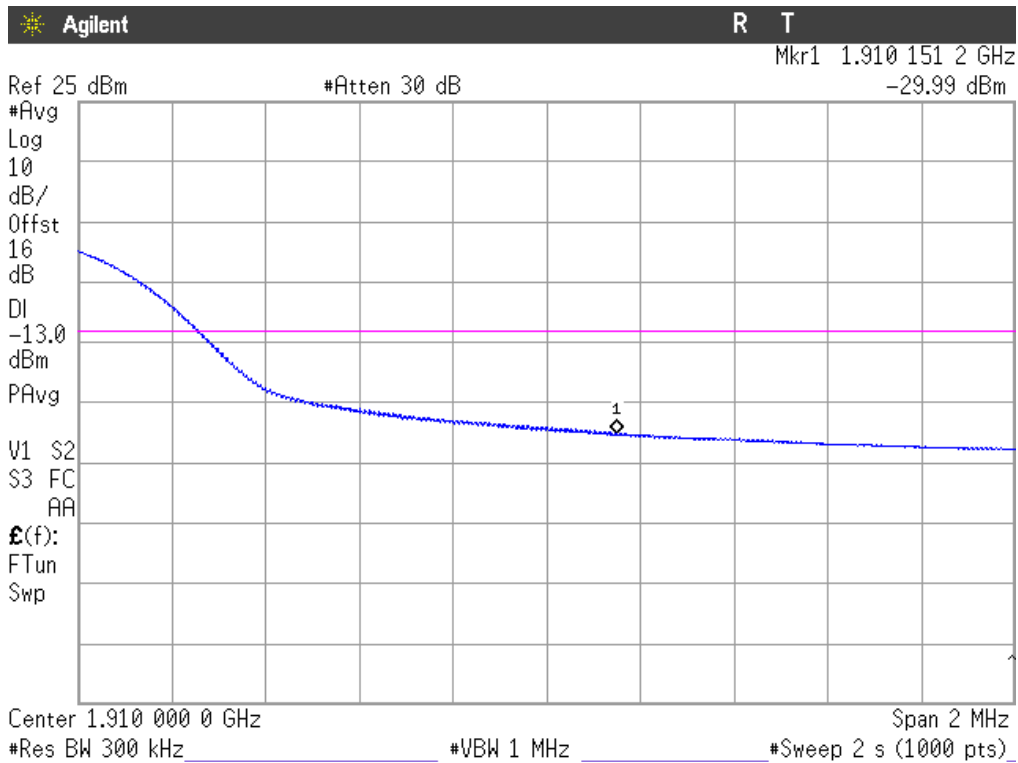
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 20 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

Verdict: PASS

Radiated emissions

SPECIFICATION

FCC §2.1051 and §24.238

RSS-133. Clause 6.5.

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.

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 at less than 20 dB respect to the limit is substituted by the Substitution method. in accordance with the ANSI/TIA/EIA-603-E.

Measurement Limit:

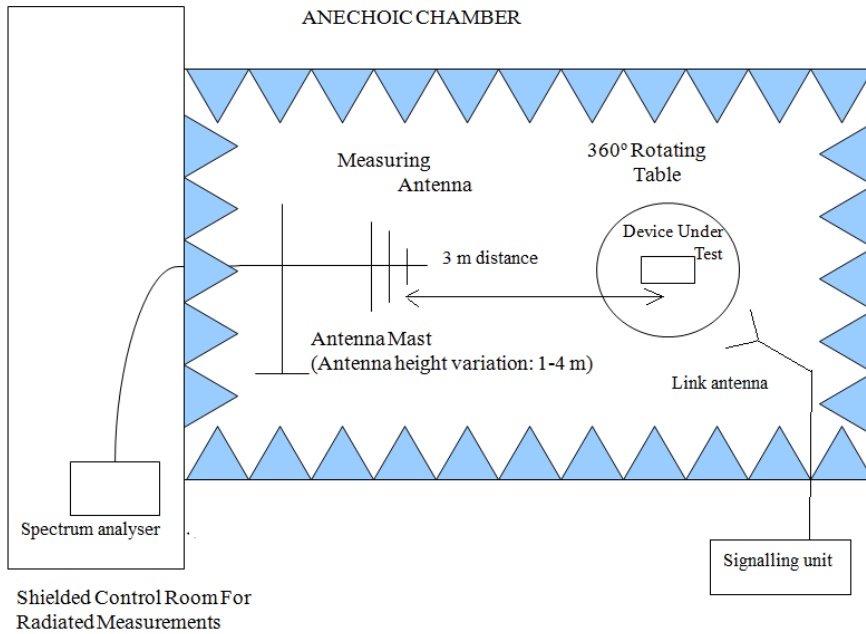
According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. P in watts.

At P_o transmitting power. the specified minimum attenuation becomes $43+10\log (P_o)$ and the level in dBm relative P_o becomes:

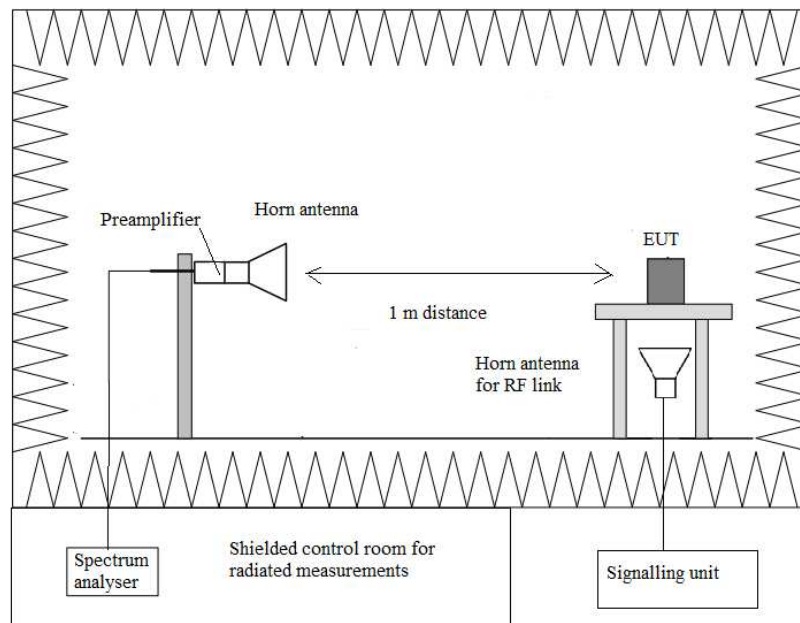
$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

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.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) - (2) + (3)
7400.75	-21.59	Vertical	-24.83	4.10	10.52	-18.41

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-18 GHz.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) - (2) + (3)
7518.25	-20.60	Vertical	-23.74	4.12	10.69	-17.17

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-18 GHz.

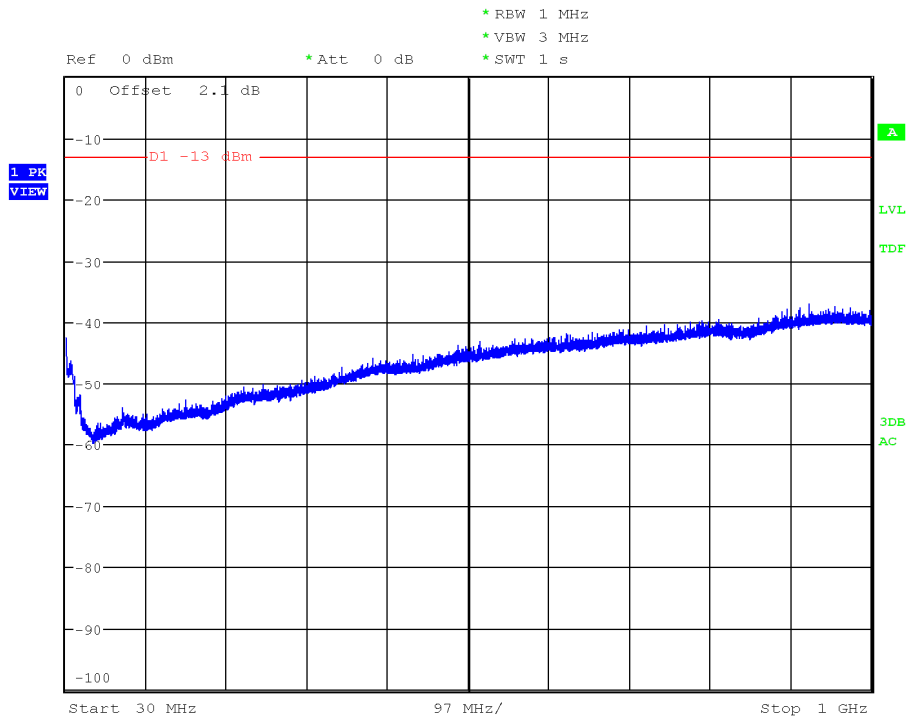
Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) - (2) + (3)
7635.25	-27.80	Vertical	-30.86	4.13	10.62	-24.37

Measurement uncertainty (dB)	$< \pm 3.88$ for $f < 1$ GHz $< \pm 4.87$ for $f \geq 1$ GHz up to 18 GHz
------------------------------	--

Verdict: PASS

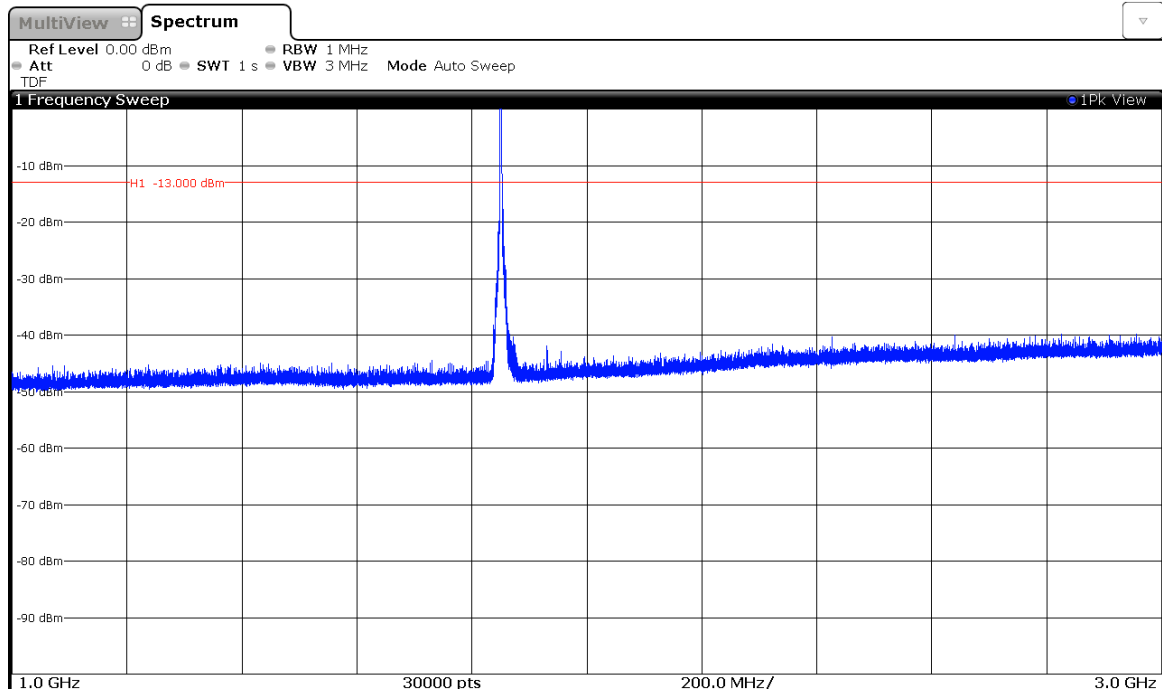
FREQUENCY RANGE 30 MHz-1000 MHz.



(This plot is valid for all three channels)

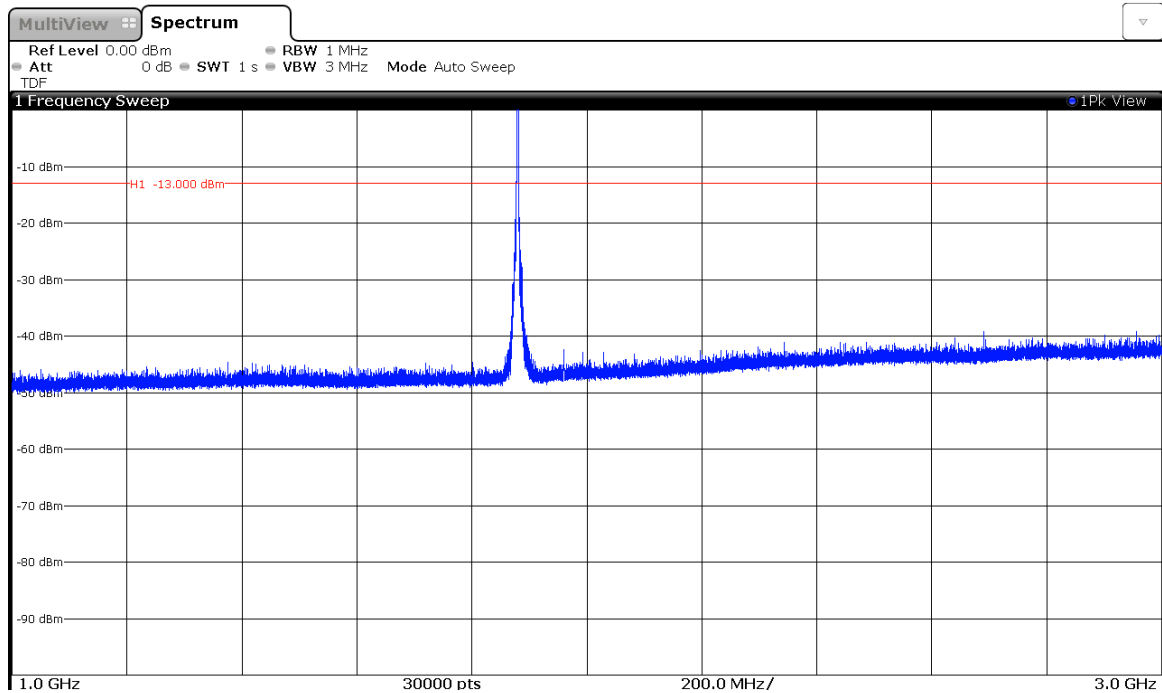
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST



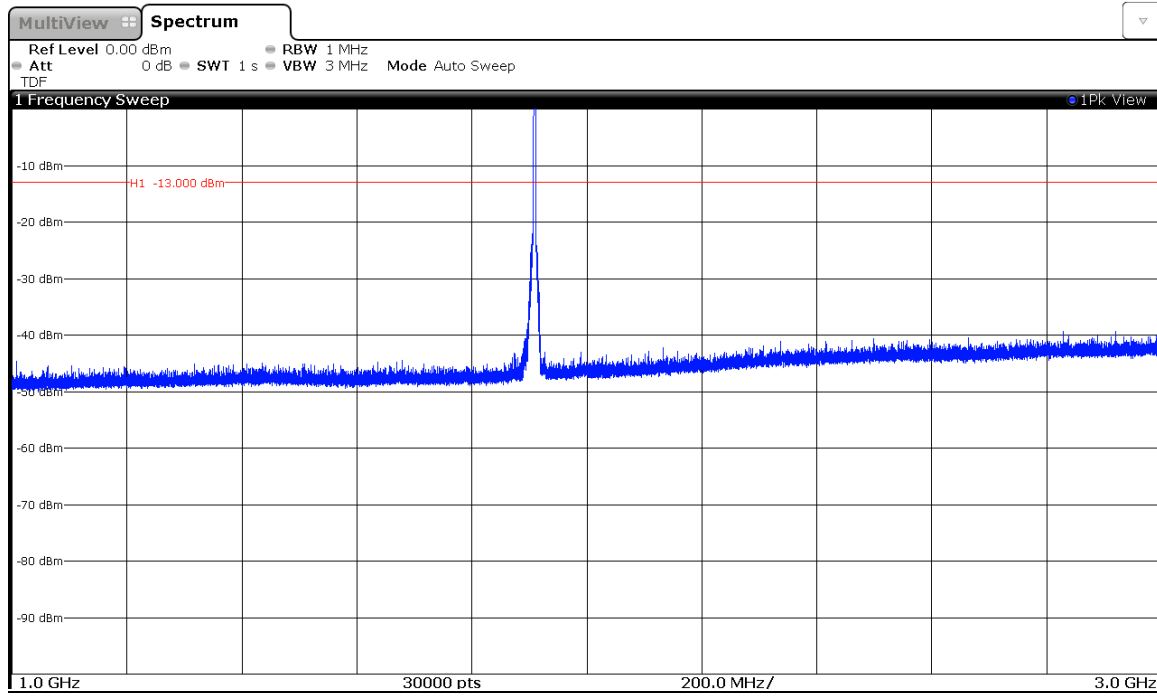
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

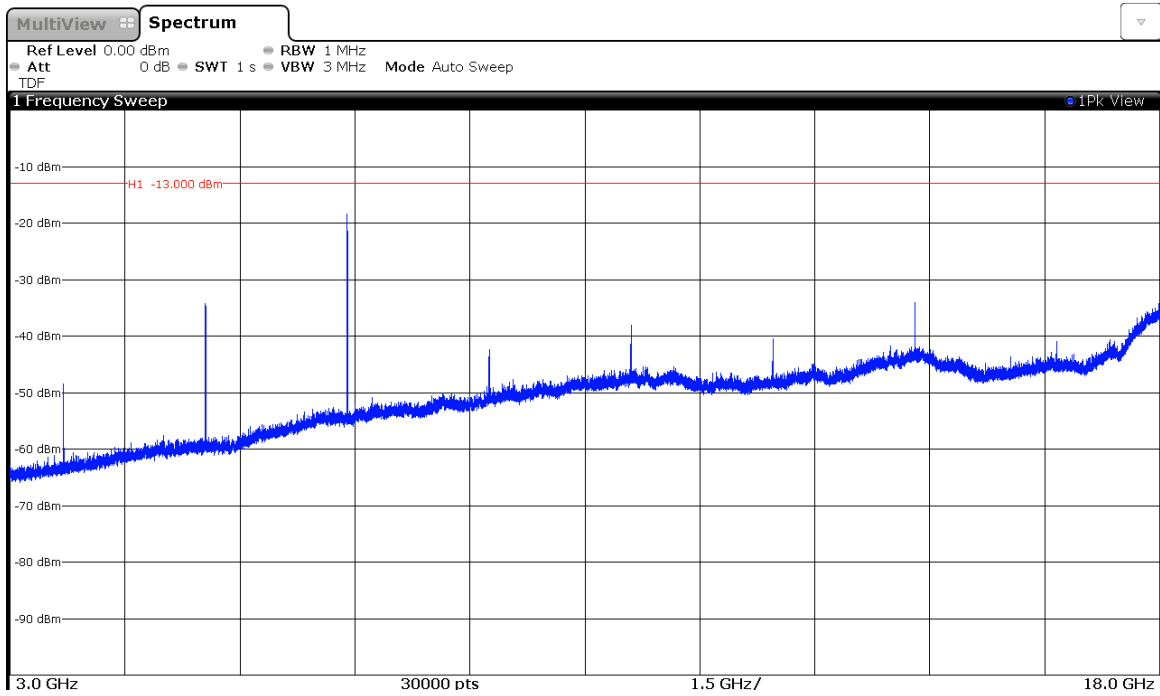
CHANNEL: HIGHEST



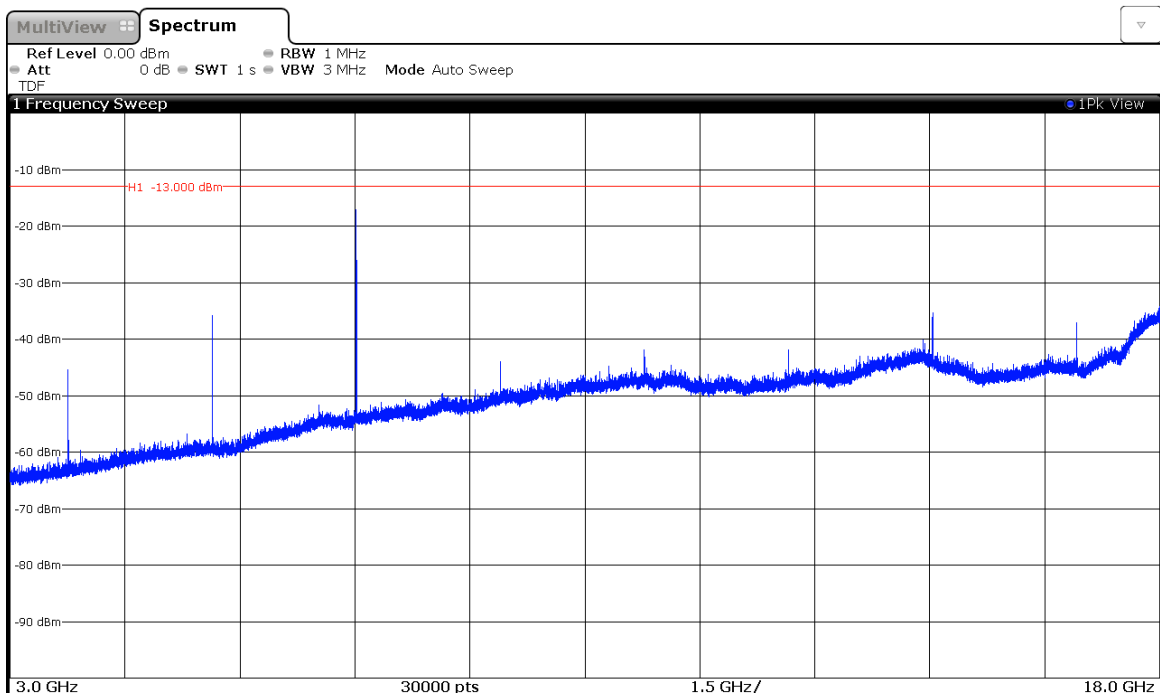
Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 18 GHz.

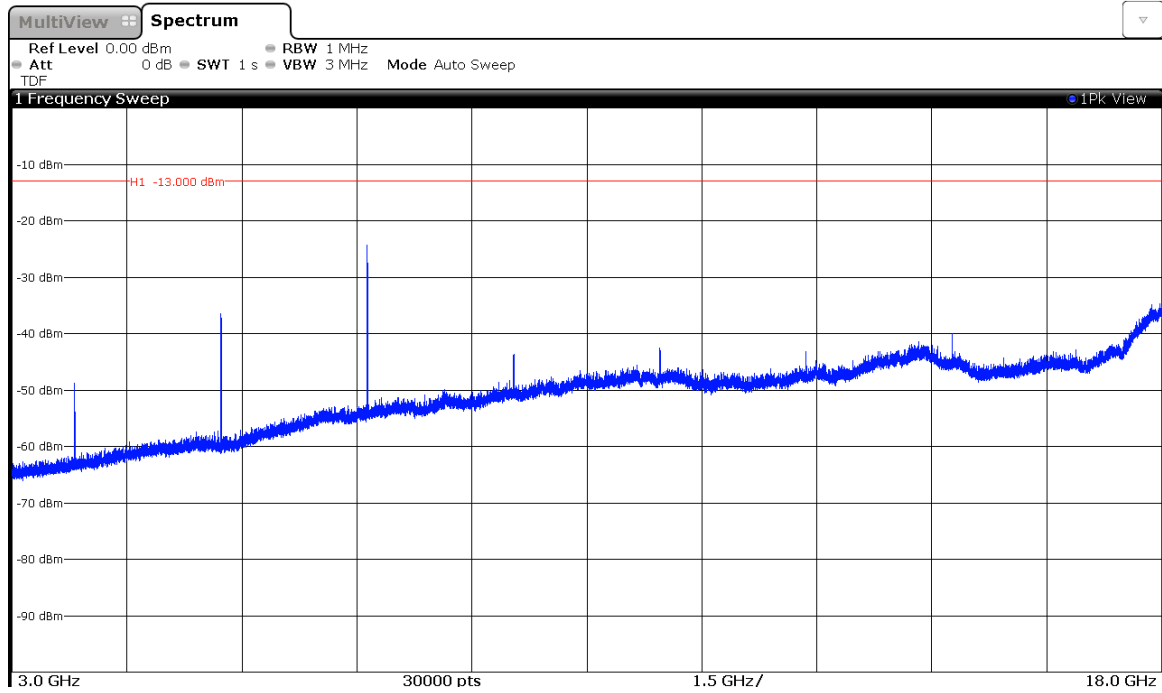
CHANNEL: LOWEST



CHANNEL: MIDDLE

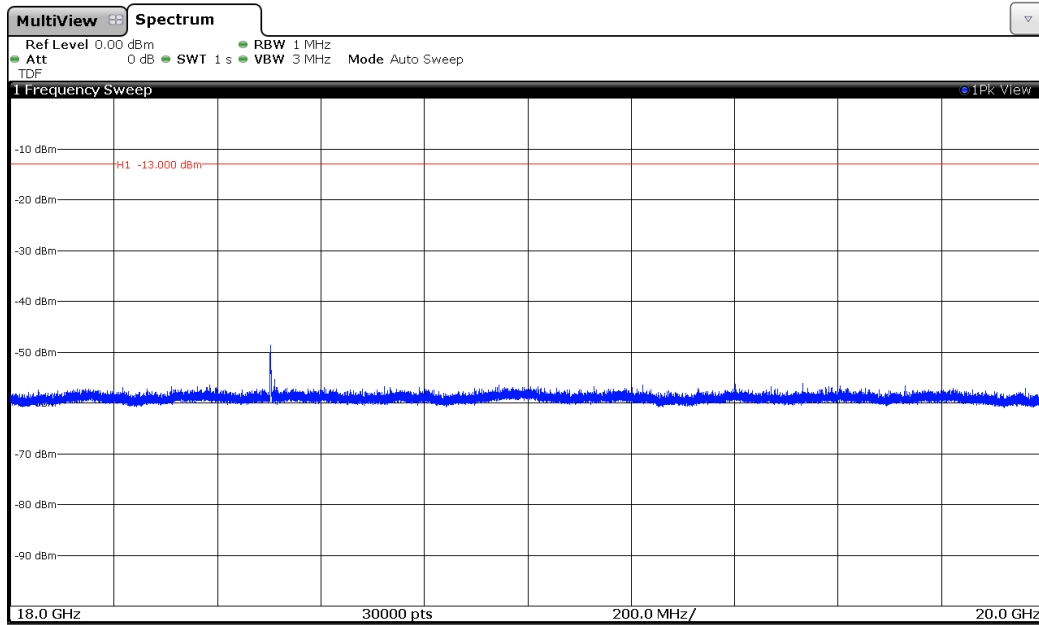


CHANNEL: HIGHEST

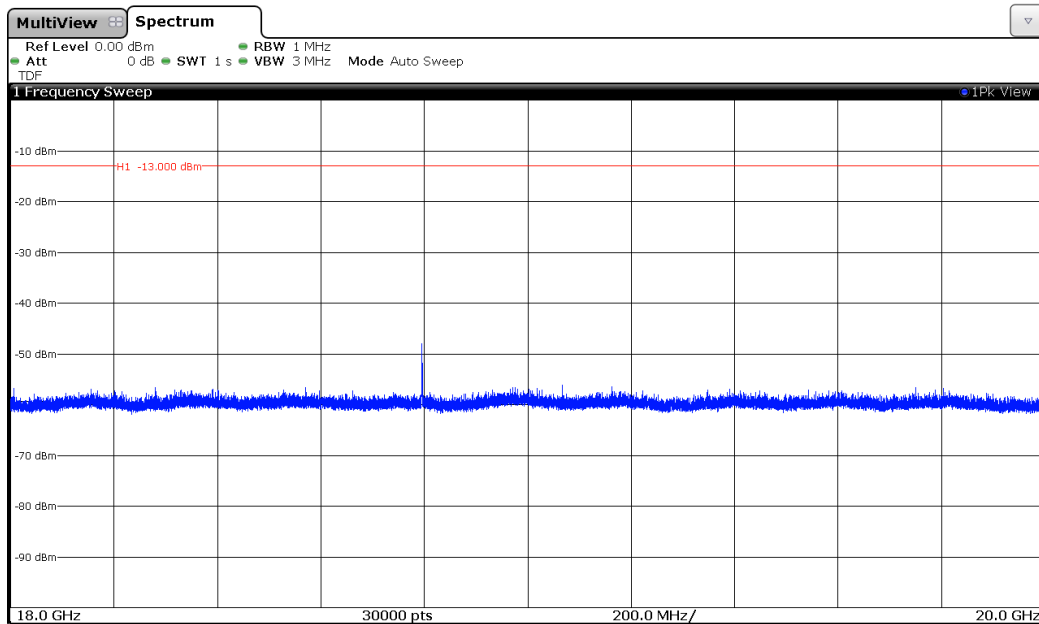


FREQUENCY RANGE 18 GHz TO 20 GHz.

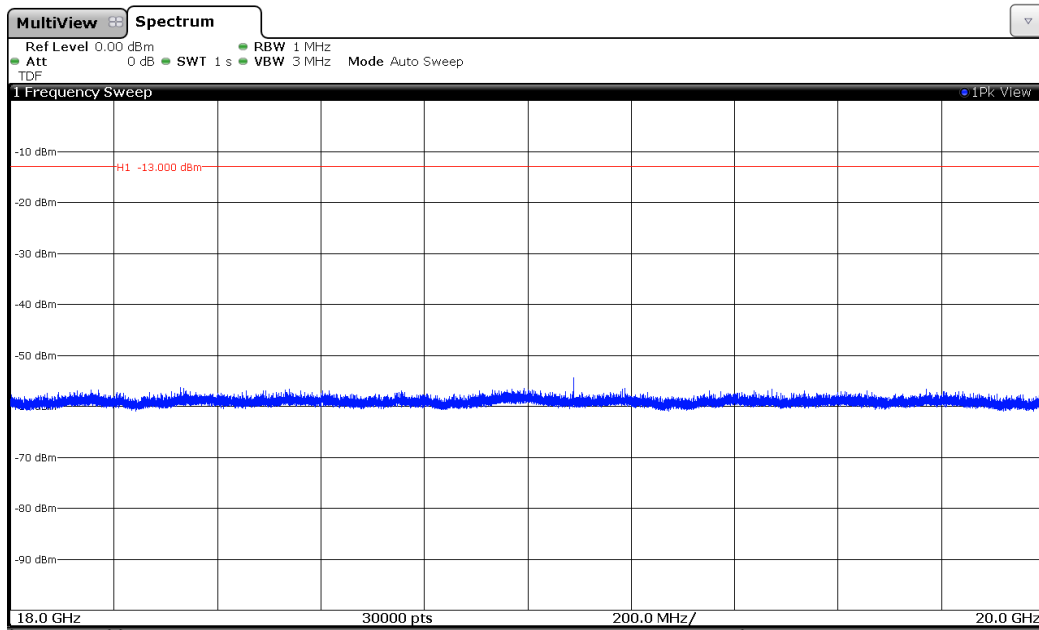
CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST



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

INDEX

TEST CONDITIONS	106
RF Output Power (conducted and E.I.R.P.).....	108
Modulation Characteristics.....	154
Frequency Stability.....	157
Occupied Bandwidth	166
Spurious emissions at antenna terminals	201
Spurious emissions at antenna terminals at Block Edges	220
Radiated emissions	243

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

TEST CONDITIONS

Power supply (V):

V_{nom} = 3.8 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, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = External attachable antenna

Antenna gain = 2.14 dBi

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 XII)

	Channel (Frequency. MHz)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Lowest	23017 (699.7)	23025 (700.5)	23035 (701.5)	23060 (704.0)
Middle	23095 (707.5)	23095 (707.5)	23095 (707.5)	23095 (707.5)
Highest	23173 (715.3)	23165 (714.5)	23155 (713.5)	23130 (711.0)

RF Output Power

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 and mobile stations in the 698-746 MHz band are limited to 30 watts ERP.

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

RSS-130 Clause 4.4.

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 CMU200 and CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

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

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

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

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

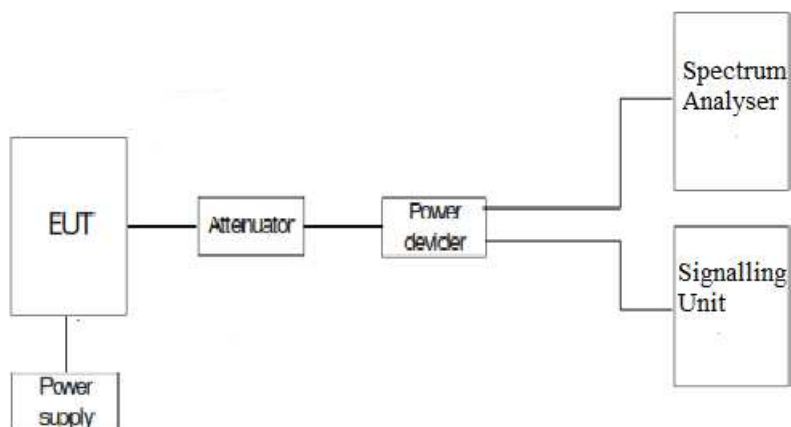
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

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	22.648	5.53	
				1	2	22.557		
				1	5	22.556		
				3	0	22.545		
				3	1	22.614		
				3	2	22.555		
			6	0	21.509			
			16-QAM	1	0	21.790		6.13
				1	2	21.473		
				1	5	21.929		
				3	0	21.753		
				3	1	21.771		
	3	2		21.912				
	Middle 20175	1732.5	QPSK	1	0	22.614	6.49	
				1	2	22.730		
				1	5	22.704		
				3	0	22.739		
				3	1	22.724		
				3	2	22.685		
			6	0	21.706			
			16-QAM	1	0	21.861		7.21
				1	2	21.972		
				1	5	22.086		
				3	0	21.830		
3				1	21.753			
3	2	21.788						
High 20393	1754.3	QPSK	1	0	22.767	4.88		
			1	2	22.704			
			1	5	22.638			
			3	0	22.760			
			3	1	22.770			
			3	2	22.780			
		6	0	21.680				
		16-QAM	1	0	22.020		5.55	
			1	2	22.168			
			1	5	22.225			
			3	0	22.021			
			3	1	21.635			
3	2		21.937					
6	0	20.576						

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
3	Low 19965	1711.5	QPSK	1	0	22.549	5.59	
				1	7	22.572		
				1	14	22.557		
				8	0	21.630		
				8	4	21.587		
				8	7	21.557		
			16-QAM	15	0	21.610		
				1	0	22.133		6.39
				1	7	22.148		
				1	14	21.988		
				8	0	20.880		
				8	4	20.623		
	Middle 20175	1732.5	QPSK	8	7	20.746	6.33	
				8	0	21.685		
				8	4	21.729		
				8	7	21.712		
				15	0	21.686		
				16-QAM	1	0		21.933
			1		7	22.014		
			1		14	21.555		
			8		0	20.795		
			8		4	20.802		
			8		7	20.861		
			High 20385	1753.5	QPSK	15		0
1	0	22.652						
1	7	22.628						
1	14	22.608						
8	0	21.718						
8	4	21.671						
16-QAM	8	7			21.737	5.38		
	15	0			21.700			
	1	0			21.800			
	1	7			21.861			
	1	14			21.620			
	8	0			20.769			
8	4	20.739						
8	7	20.811						
15	0	20.796						

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
5	Low 19975	1712.5	QPSK	1	0	22.610	5.42
				1	12	22.573	
				1	24	22.484	
				12	0	21.611	
				12	6	21.608	
				12	11	21.586	
				25	0	21.625	
				16-QAM	1	0	
	1	12	22.305				
	1	24	21.676				
	12	0	20.789				
	12	6	20.773				
	12	11	20.738				
	25	0	20.602				
	Middle 20175	1732.5	QPSK		1	0	22.767
				1	12	22.731	
				1	24	22.601	
				12	0	21.776	
				12	6	21.760	
				12	11	21.733	
				25	0	21.714	
				16-QAM	1	0	21.984
	1	12	21.846				
	1	24	21.783				
12	0	20.888					
12	6	20.794					
12	11	20.755					
25	0	20.768					
High 20375	1752.5	QPSK	1		0	22.71	4.58
			1	12	22.649		
			1	24	22.674		
			12	0	21.738		
			12	6	21.654		
			12	11	21.664		
			25	0	21.672		
			16-QAM	1	0	21.88	
1	12	21.831					
1	24	21.708					
12	0	20.762					
12	6	20.627					
12	11	20.764					
25	0	20.737					

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
10	Low 20000	1715	QPSK	1	0	22.674	5.4
				1	24	22.568	
				1	49	22.453	
				25	0	21.678	
				25	12	21.618	
				25	24	21.521	
				50	0	21.590	
			16-QAM	1	0	21.989	
				1	24	21.975	
				1	49	21.651	
				25	0	20.598	
				25	12	20.562	
	25	24		20.625			
	50	0		20.763			
	Middle 20175	1732.5	QPSK	1	0	22.735	6.01
				1	24	22.673	
				1	49	22.572	
				25	0	21.841	
				25	12	21.713	
				25	24	21.708	
				50	0	21.741	
			16-QAM	1	0	22.084	
				1	24	21.959	
				1	49	21.65	
25				0	20.839		
25				12	20.817		
25	24	20.769					
50	0	20.711					
High 20350	1750	QPSK	1	0	22.884	4.94	
			1	24	22.658		
			1	49	22.644		
			25	0	21.686		
			25	12	21.681		
			25	24	21.682		
			50	0	21.677		
		16-QAM	1	0	22.085		
			1	24	21.957		
			1	49	21.86		
			25	0	20.787		
			25	12	20.658		
25	24		20.746				
50	0		20.717				

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
15	Low 20025	1717.5	QPSK	1	0	22.847	5.38
				1	37	22.524	
				1	74	22.502	
				36	0	21.781	
				36	18	21.684	
				36	37	21.628	
				75	0	21.698	
			16-QAM	1	0	22.023	
				1	37	21.880	
				1	74	21.818	
				36	0	20.816	
				36	18	20.707	
	36	37		20.656			
	75	0		20.654			
	Middle 20175	1732.5	QPSK	1	0	22.913	6.03
				1	37	22.577	
				1	74	22.441	
				36	0	21.943	
				36	18	21.740	
				36	37	21.688	
				75	0	21.783	
			16-QAM	1	0	22.163	
				1	37	21.785	
				1	74	21.791	
36				0	20.917		
36				18	20.734		
36	37	20.573					
75	0	20.792					
High 20325	1747.5	QPSK	1	0	23.088	5.29	
			1	37	22.587		
			1	74	22.544		
			36	0	21.875		
			36	18	21.661		
			36	37	21.646		
			75	0	21.740		
		16-QAM	1	0	22.355		
			1	37	22.077		
			1	74	21.898		
			36	0	20.853		
			36	18	20.702		
36	37		20.667				
75	0		20.709				
							6.54

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
20	Low 20050	1720	QPSK	1	0	22.678	5.42	
				1	49	22.411		
				1	99	22.158		
				50	0	21.677		
				50	24	21.530		
				50	49	21.548		
				100	0	21.650		
			16-QAM	1	0	22.273		6.04
				1	49	21.829		
				1	99	21.652		
				50	0	20.78		
				50	24	20.606		
	50	49		20.494				
	100	0		20.659				
	Middle 20175	1732.5	QPSK	1	0	22.71	5.75	
				1	49	22.504		
				1	99	22.200		
				50	0	21.802		
				50	24	21.562		
				50	49	21.488		
				100	0	21.631		
			16-QAM	1	0	22.294		6.86
				1	49	21.820		
				1	99	21.449		
50				0	20.836			
50				24	20.64			
50	49	20.647						
100	0	20.579						
High 20300	1745	QPSK	1	0	22.747	5.66		
			1	49	22.515			
			1	99	22.159			
			50	0	21.749			
			50	24	21.624			
			50	49	21.567			
			100	0	21.697			
		16-QAM	1	0	22.045		6.96	
			1	49	22.032			
			1	99	21.688			
			50	0	20.641			
			50	24	20.743			
50	49		20.561					
100	0		20.691					

LTE. BAND XII.

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
1.4	Low 23017	699.7 MHz	QPSK	1	0	22.469	5.74
				1	2	22.409	
				1	5	22.373	
				3	0	22.449	
				3	1	22.389	
				3	2	22.403	
			6	0	22.392		
			16-QAM	1	0	21.799	
				1	2	21.631	
				1	5	21.738	
				3	0	21.469	
				3	1	21.608	
	3	2		21.582			
	Middle 23095	707.5 MHz	QPSK	1	0	22.374	5.75
				1	2	22.395	
				1	5	22.401	
				3	0	22.427	
				3	1	22.448	
				3	2	22.440	
			6	0	21.415		
			16-QAM	1	0	21.975	
				1	2	21.719	
				1	5	21.501	
				3	0	21.448	
3				1	21.452		
3	2	21.392					
High 23173	715.3 MHz	QPSK	1	0	22.360	5.45	
			1	2	22.275		
			1	5	22.391		
			3	0	22.349		
			3	1	22.320		
			3	2	22.329		
		6	0	21.315			
		16-QAM	1	0	21.571		
			1	2	21.514		
			1	5	21.538		
			3	0	21.459		
			3	1	21.377		
3	2		21.427				
6	0	20.341					
6	0	20.341	6.46				

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
3	Low 23025	700.5 MHz	QPSK	1	0	22.406	5.53
				1	7	22.381	
				1	14	22.365	
				8	0	21.455	
				8	4	21.448	
				8	7	21.435	
			15	0	21.438		
			16-QAM	1	0	21.756	
				1	7	21.788	
				1	14	21.707	
				8	0	20.549	
				8	4	20.514	
	8	7		20.528			
	15	0	20.468	6.3			
	Middle 23095	707.5 MHz	QPSK	1	0	22.357	5.79
				1	7	22.35	
				1	14	22.315	
				8	0	21.401	
				8	4	21.400	
				8	7	21.358	
			15	0	21.459		
			16-QAM	1	0	21.467	
				1	7	21.401	
				1	14	21.557	
8				0	20.414		
8				4	20.402		
8	7	20.415					
15	0	20.377	6.38				
High 23165	714.5 MHz	QPSK	1	0	22.358	5.06	
			1	7	22.378		
			1	14	22.287		
			8	0	21.345		
			8	4	21.377		
			8	7	21.386		
		15	0	21.389			
		16-QAM	1	0	21.554		
			1	7	21.594		
			1	14	21.521		
			8	0	20.451		
			8	4	20.428		
8	7		20.461				
15	0	20.419	5.79				

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
5	Low 23035	701.5 MHz	QPSK	1	0	22.360	5.95	
				1	12	22.378		
				1	24	22.292		
				12	0	21.426		
				12	6	21.379		
				12	11	21.367		
			16-QAM	25	0	21.420		6.68
				1	0	21.675		
				1	12	21.652		
				1	24	21.587		
				12	0	20.519		
				12	6	20.476		
	Middle 23095	707.5 MHz	QPSK	1	0	22.345	5.69	
				1	12	22.379		
				1	24	22.309		
				12	0	21.423		
				12	6	21.405		
				12	11	21.400		
			16-QAM	25	0	21.403		6.14
				1	0	21.578		
				1	12	21.608		
				1	24	21.557		
				12	0	20.476		
				12	6	20.461		
High 23155	713.5 MHz	QPSK	1	0	22.33	4.87		
			1	12	22.348			
			1	24	22.278			
			12	0	21.351			
			12	6	21.381			
			12	11	21.400			
		16-QAM	25	0	21.377		5.87	
			1	0	21.655			
			1	12	21.616			
			1	24	21.602			
			12	0	20.465			
			12	6	20.421			

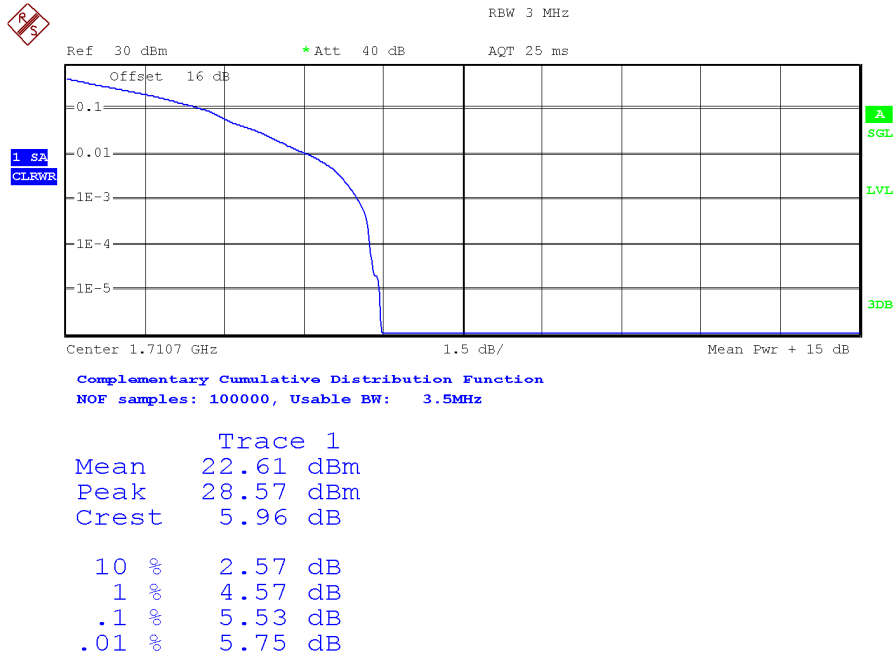
BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)	
10	Low 23060	704 MHz	QPSK	1	0	22.306	5.74	
				1	24	22.321		
				1	49	22.231		
				25	0	21.389		
				25	12	21.348		
				25	24	21.333		
			50	0	21.352			
			16-QAM	1	0	21.682		6.54
				1	24	21.638		
				1	49	21.570		
				25	0	20.383		
				25	12	20.432		
	25	24		20.405				
	Middle 23095	707.5 MHz	QPSK	1	0	22.343	5.53	
				1	24	22.407		
				1	49	22.198		
				25	0	21.411		
				25	12	21.404		
				25	24	21.376		
			50	0	21.374			
			16-QAM	1	0	21.525		6.35
				1	24	21.648		
				1	49	21.524		
				25	0	20.424		
25				12	20.429			
25	24	20.397						
High 23130	711 MHz	QPSK	1	0	22.297	5.67		
			1	24	22.314			
			1	49	22.182			
			25	0	21.363			
			25	12	21.341			
			25	24	21.312			
		50	0	21.373				
		16-QAM	1	0	21.517		6.57	
			1	24	21.657			
			1	49	24.430			
			25	0	20.338			
			25	12	20.338			
25	24		20.375					
50	0	20.372						

PEAK-TO-AVERAGE POWER RATIO (PAPR).

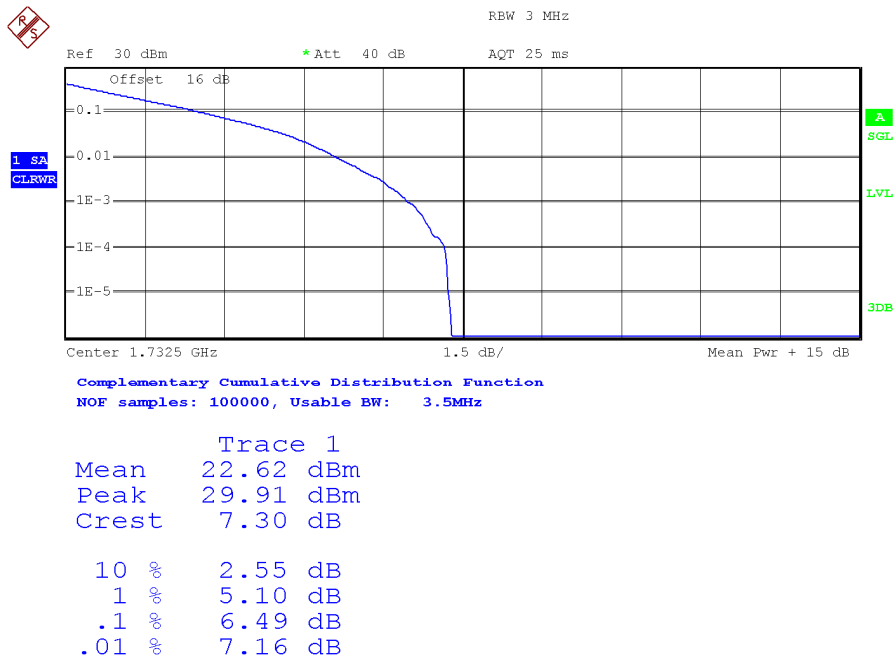
LTE. BAND IV.

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

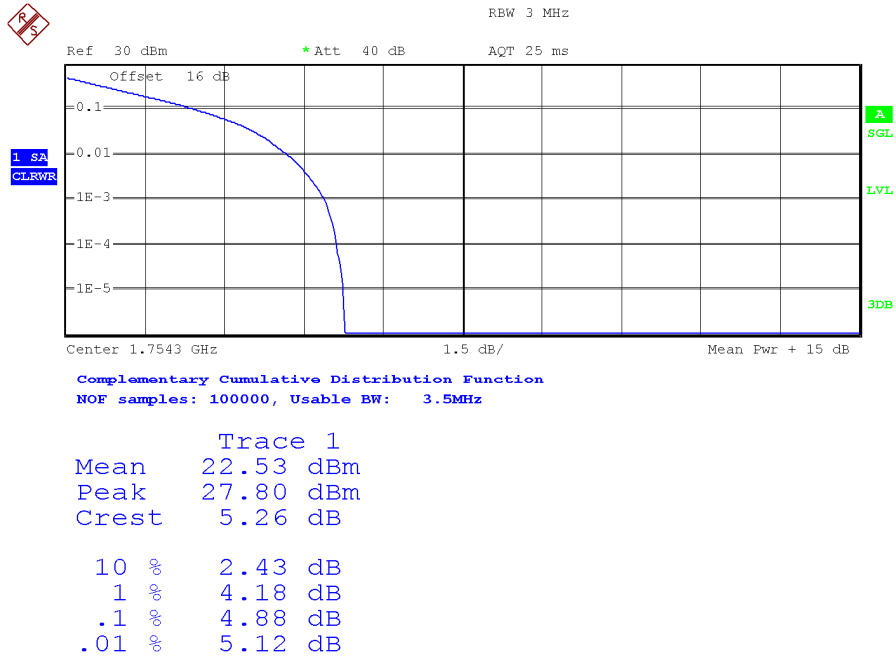
Channel Low:



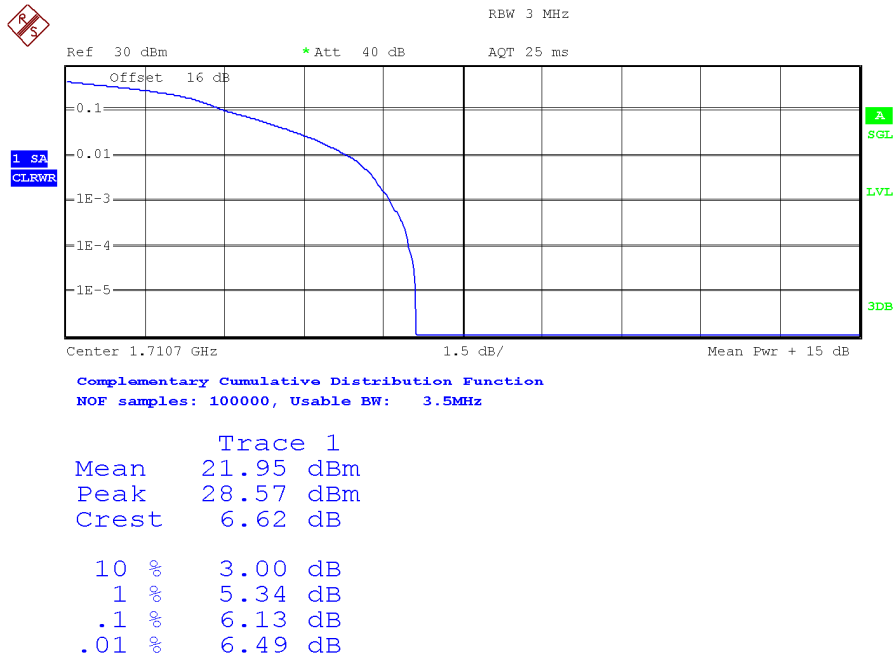
Channel Middle:



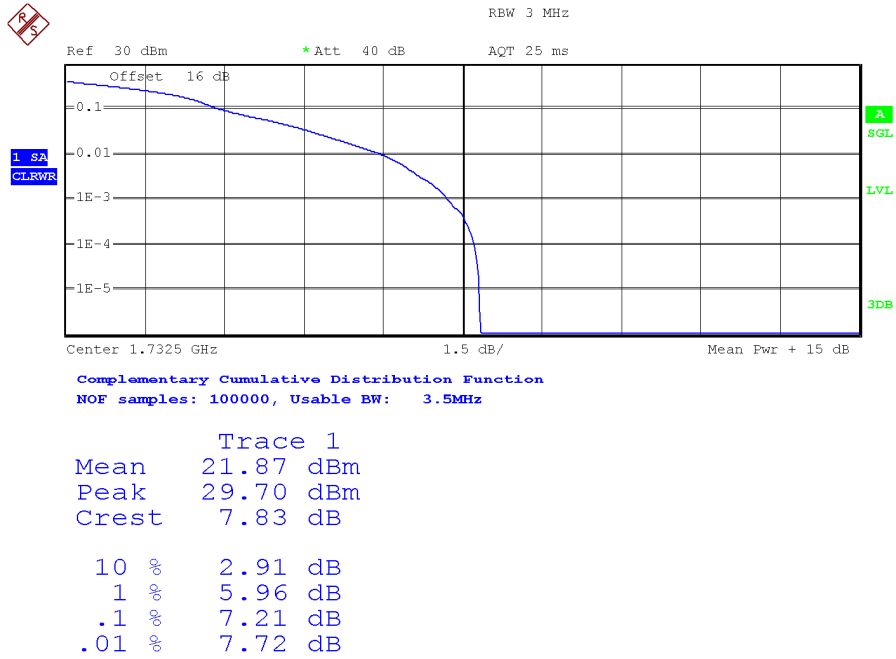
Channel High:



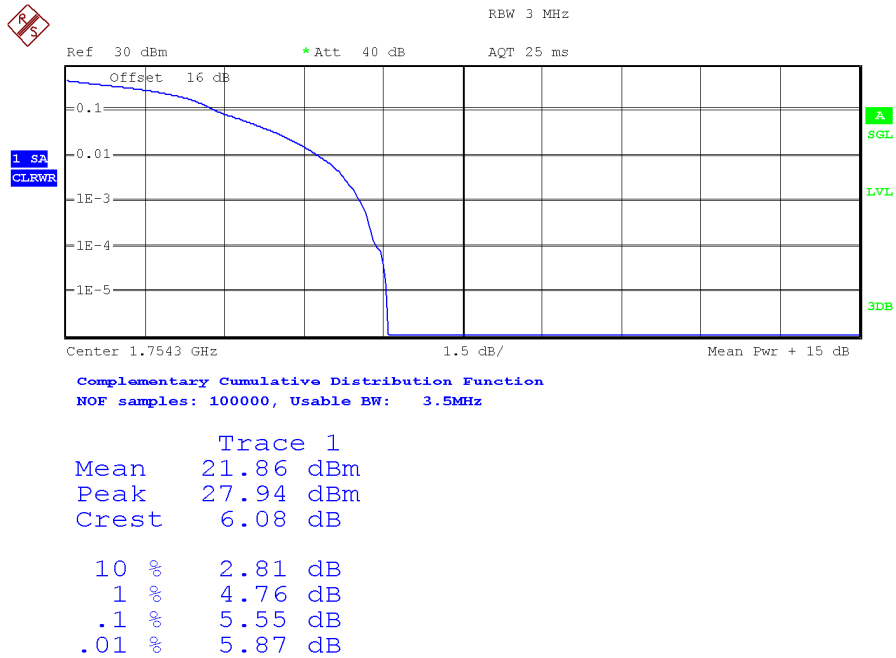
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.
 Channel Low:



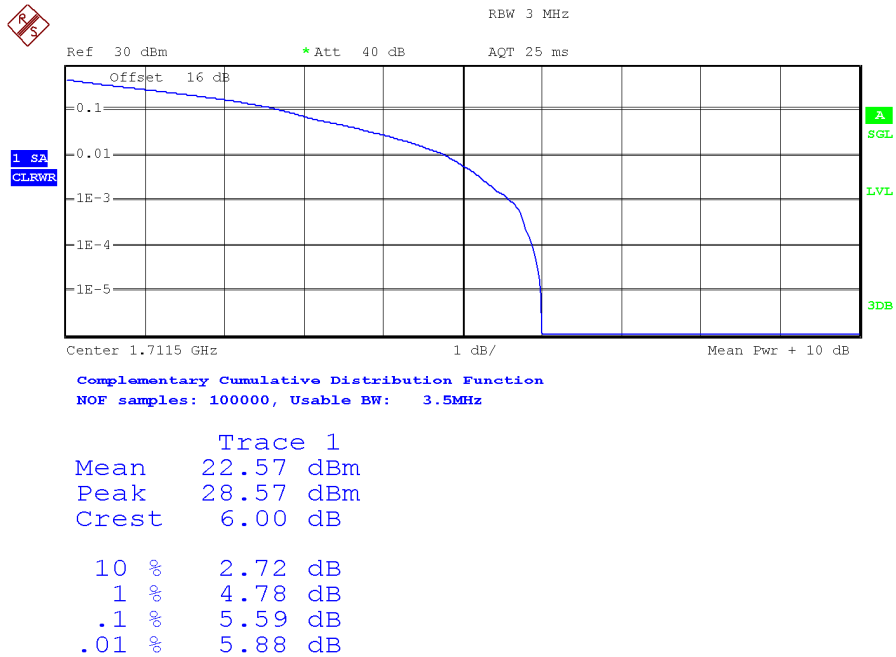
Channel Middle:



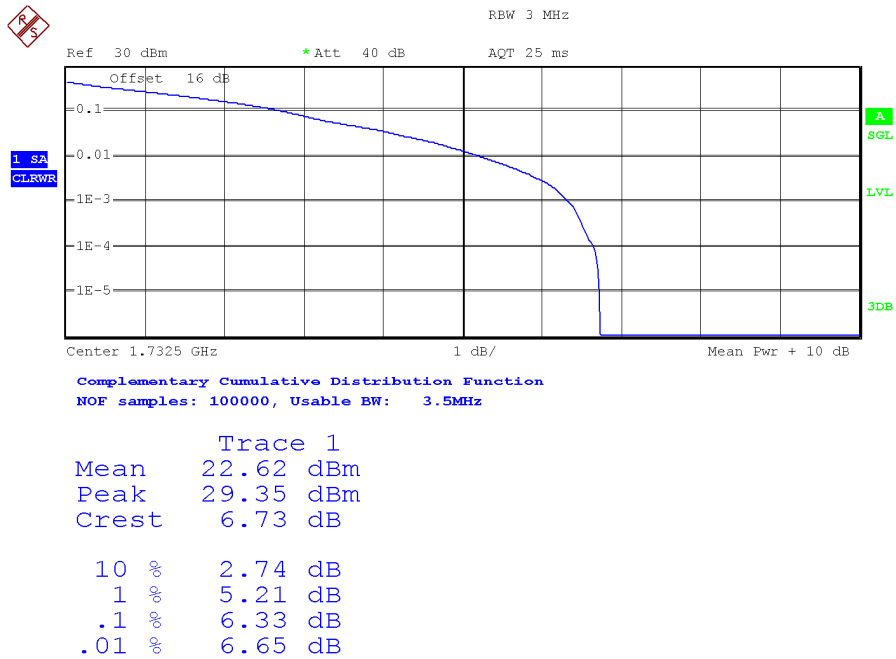
Channel High:



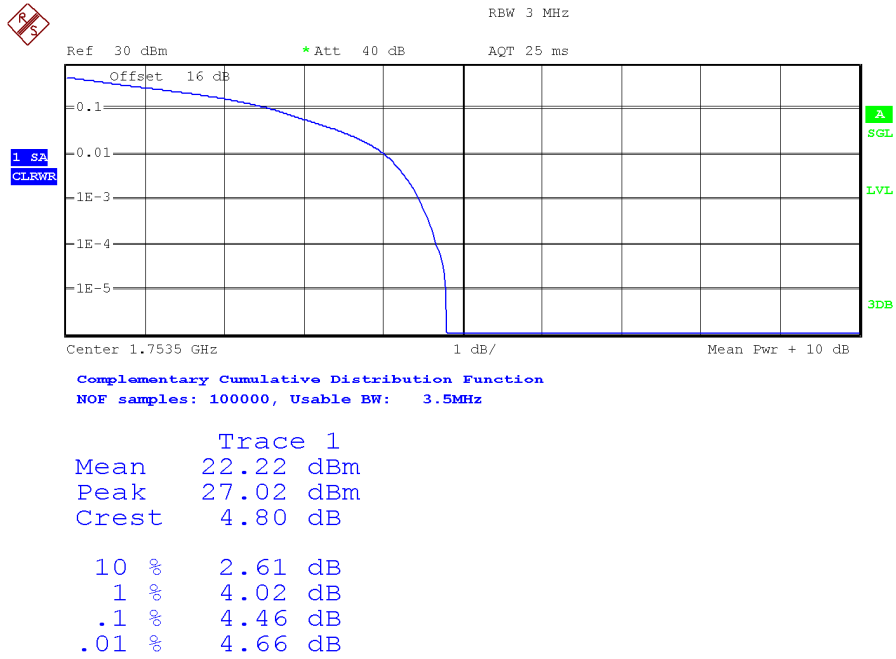
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.
 Channel Low:



Channel Middle:

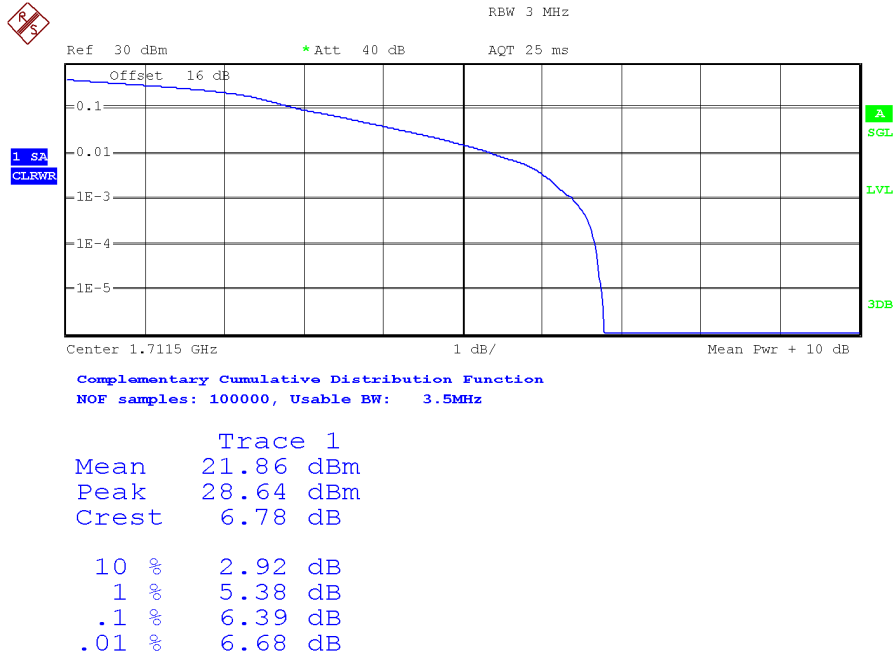


Channel High:

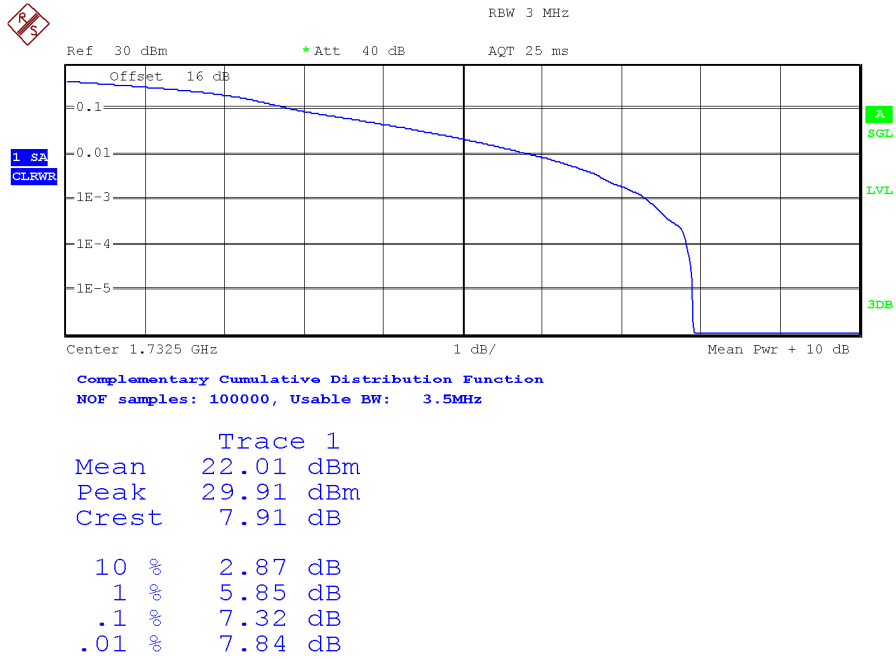


Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

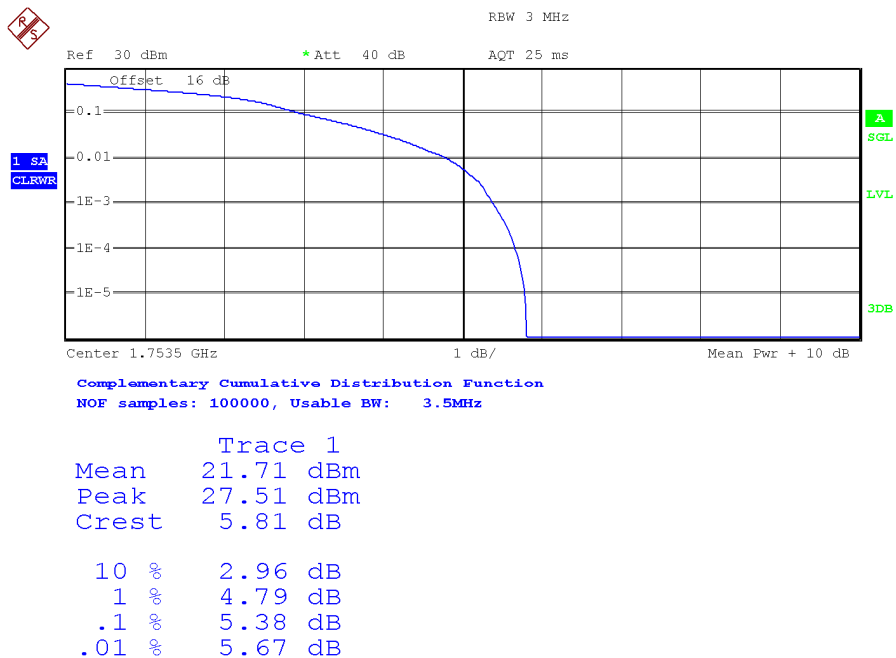
Channel Low:



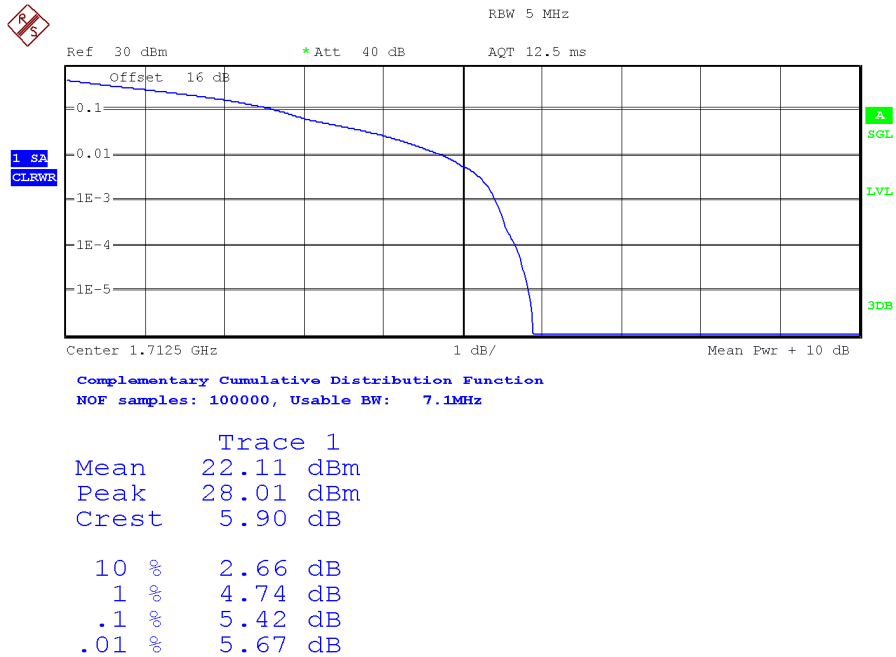
Channel Middle:



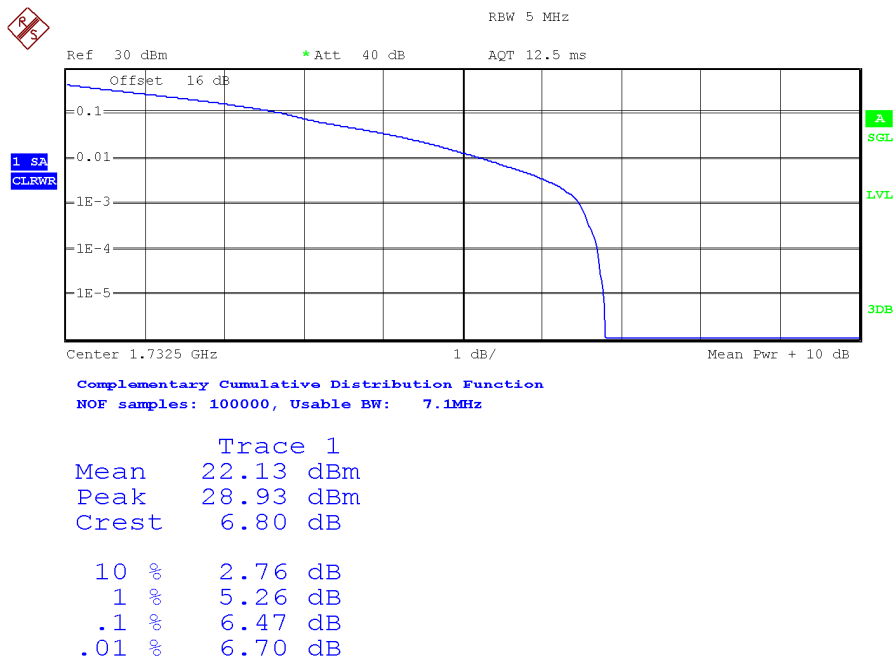
Channel High:



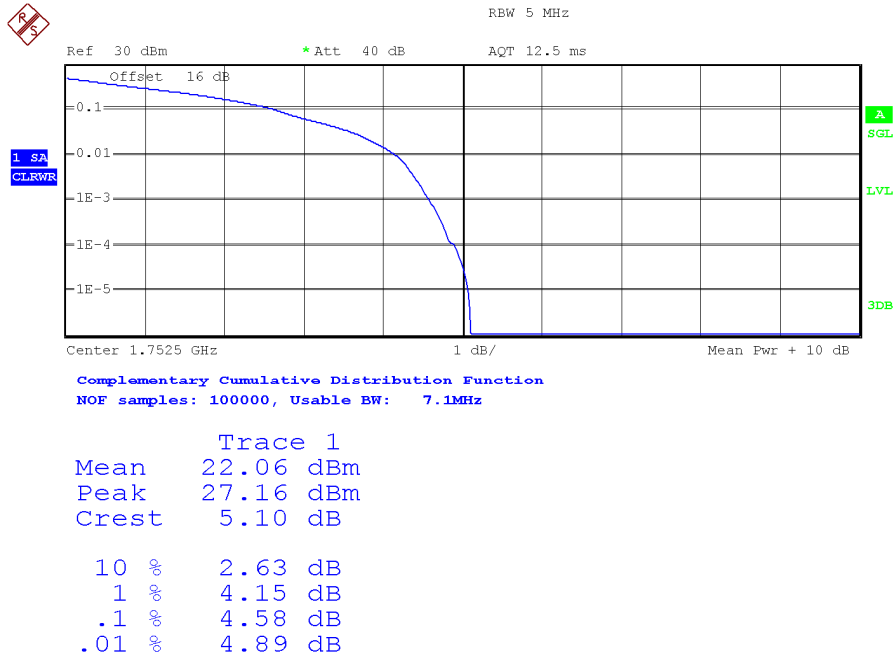
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
 Channel Low:



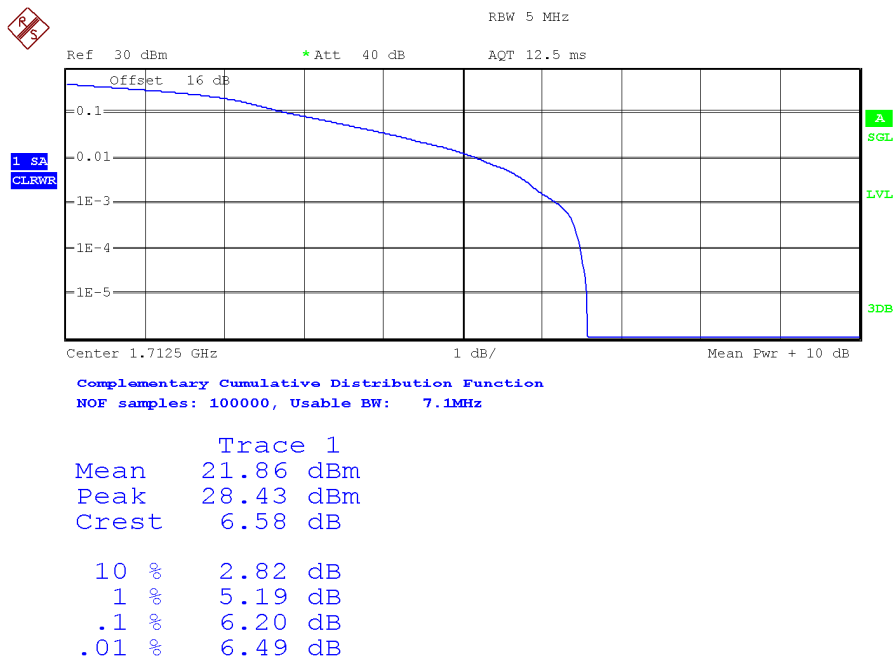
Channel Middle:



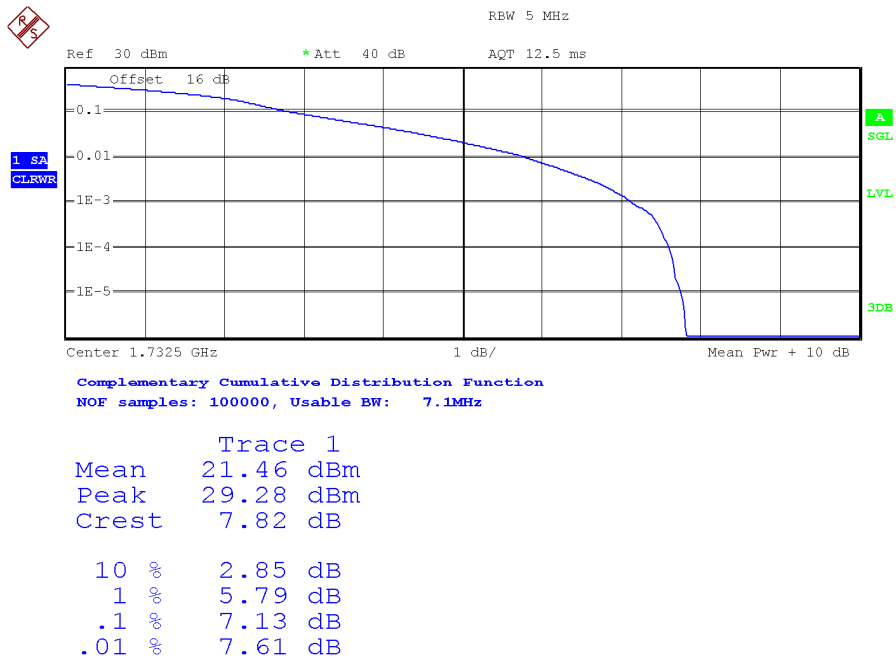
Channel High:



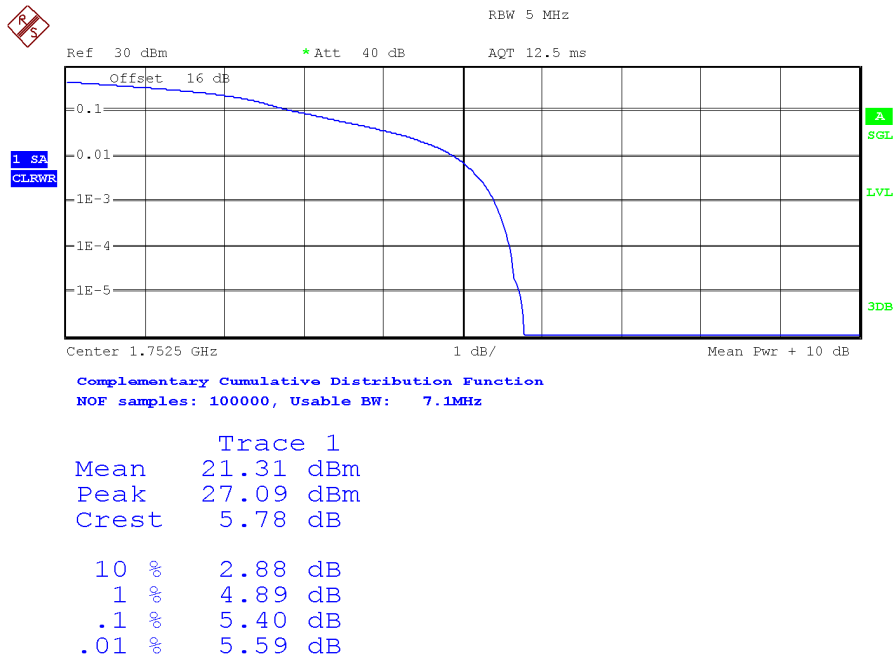
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
 Channel Low:



Channel Middle:

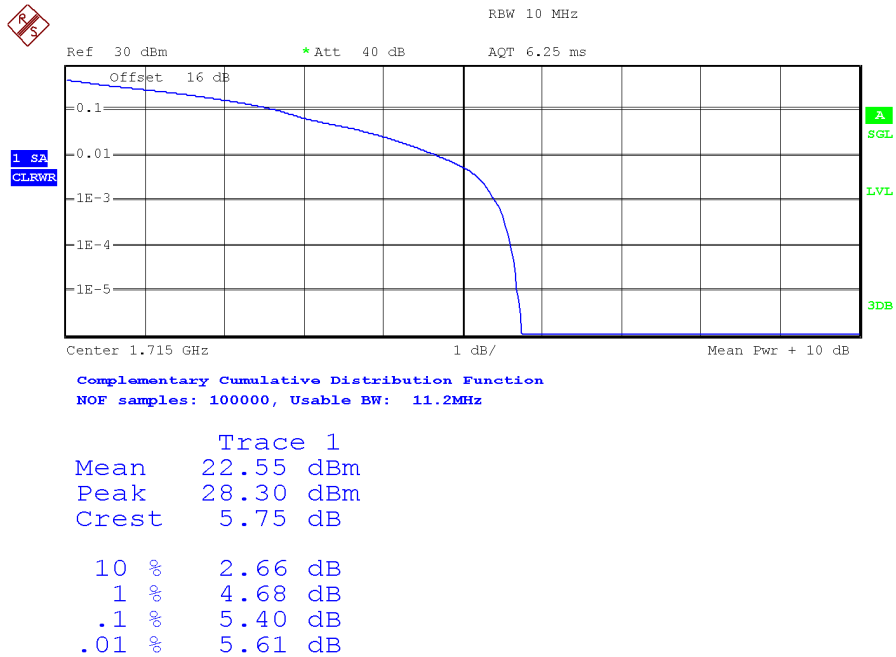


Channel High:

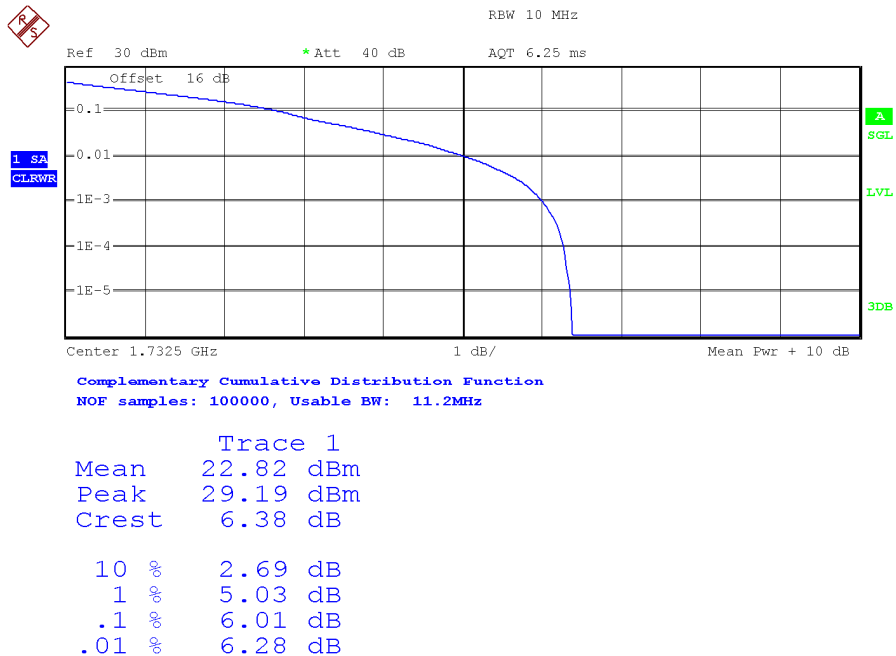


Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

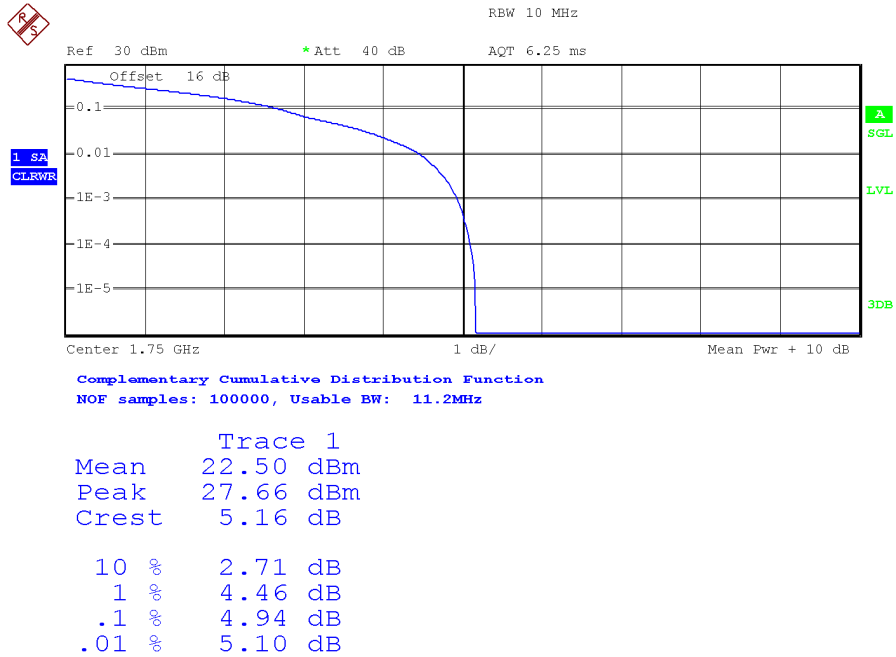
Channel Low:



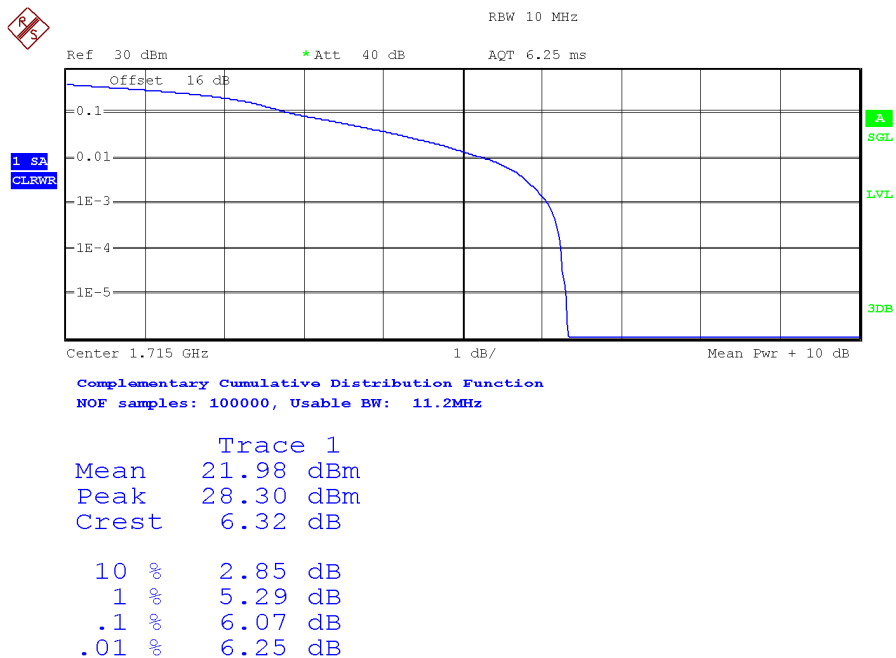
Channel Middle:



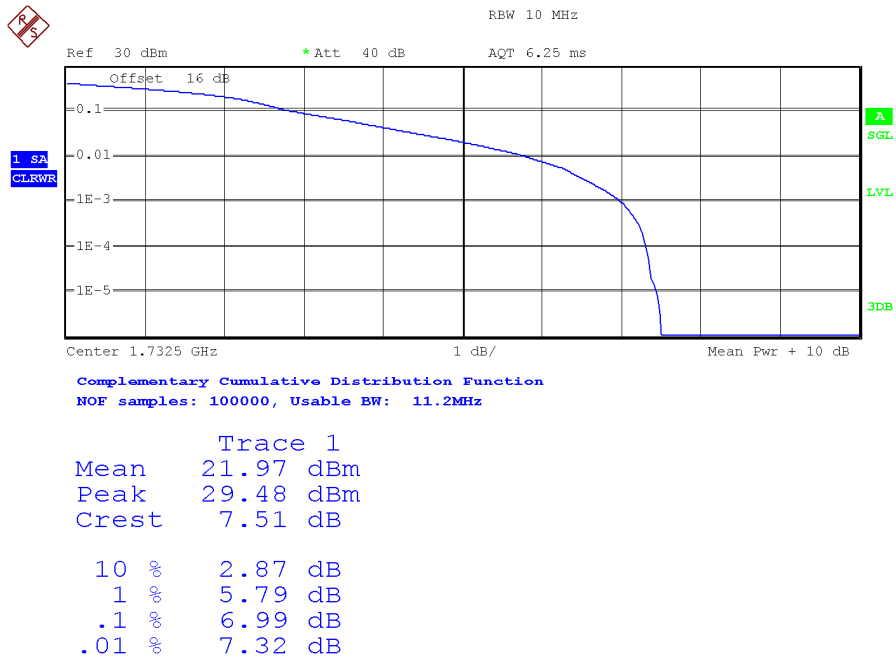
Channel High:



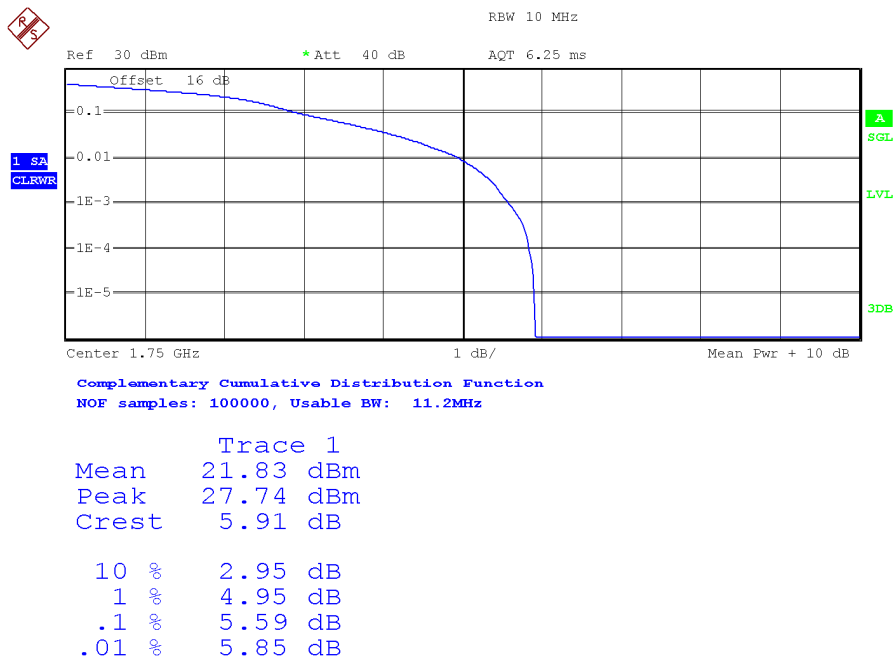
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
 Channel Low:



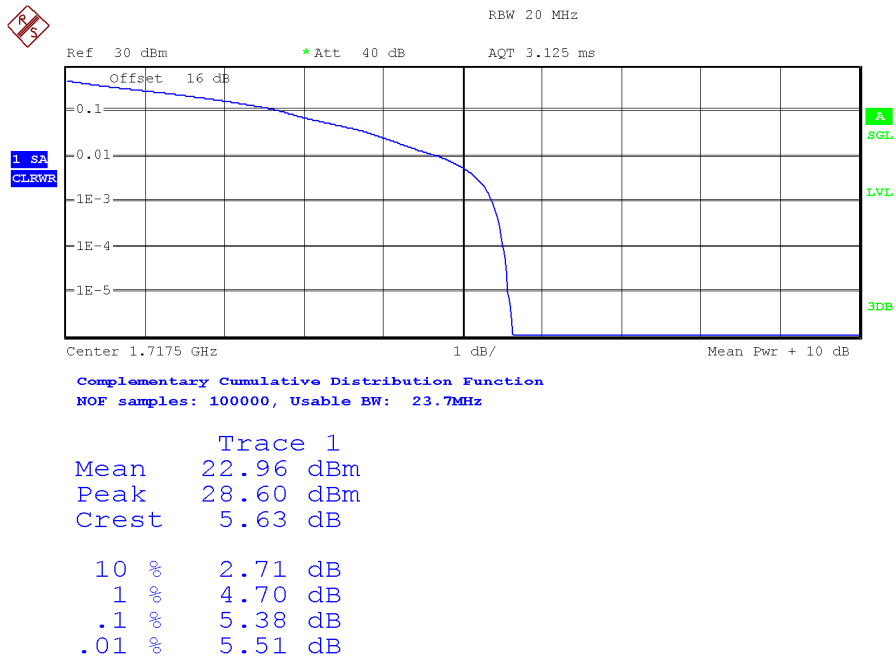
Channel Middle:



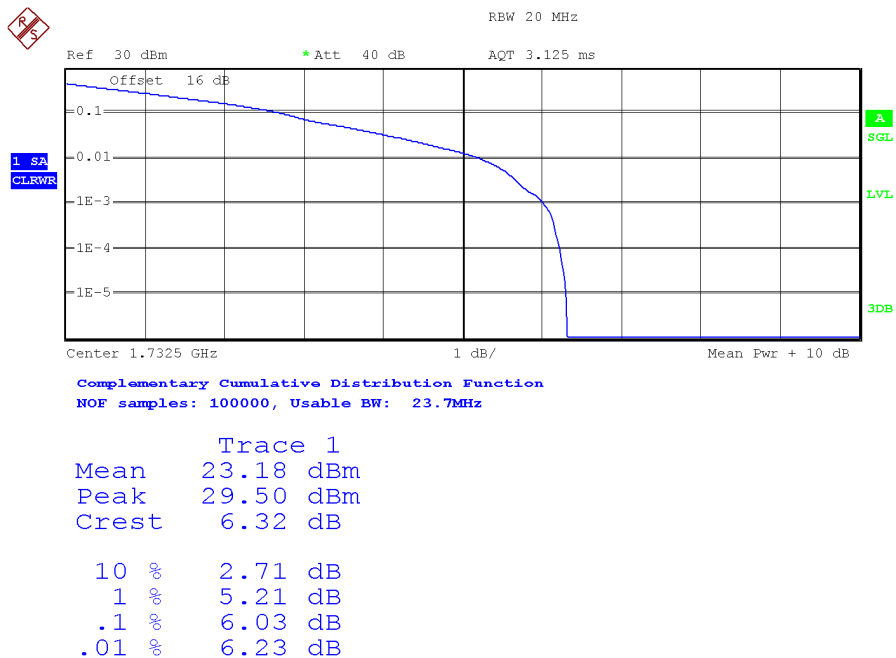
Channel High:



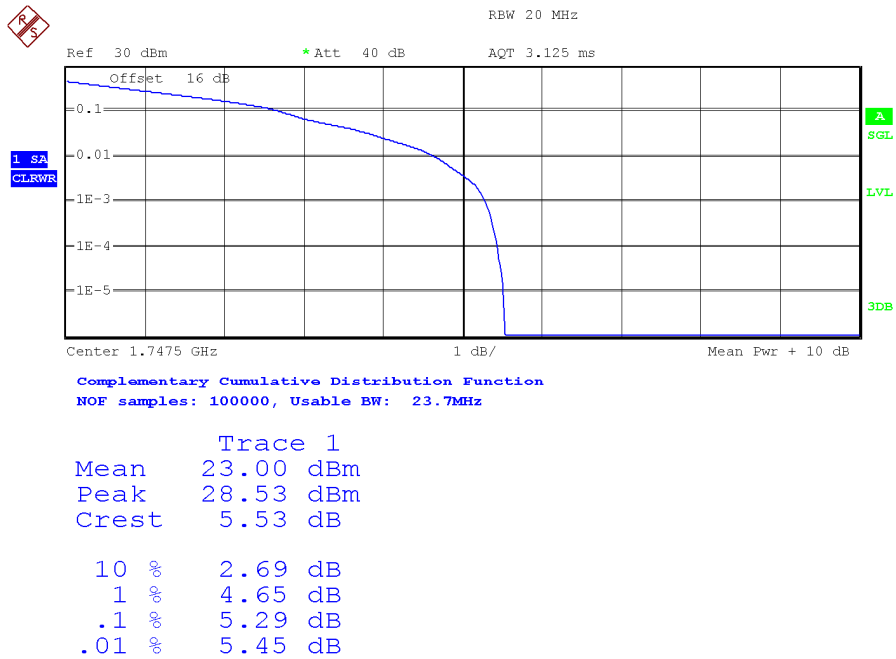
Bandwidth = 15 MHz. Modulation QPSK. RB Size: 75. RB Offset: 0.
 Channel Low:



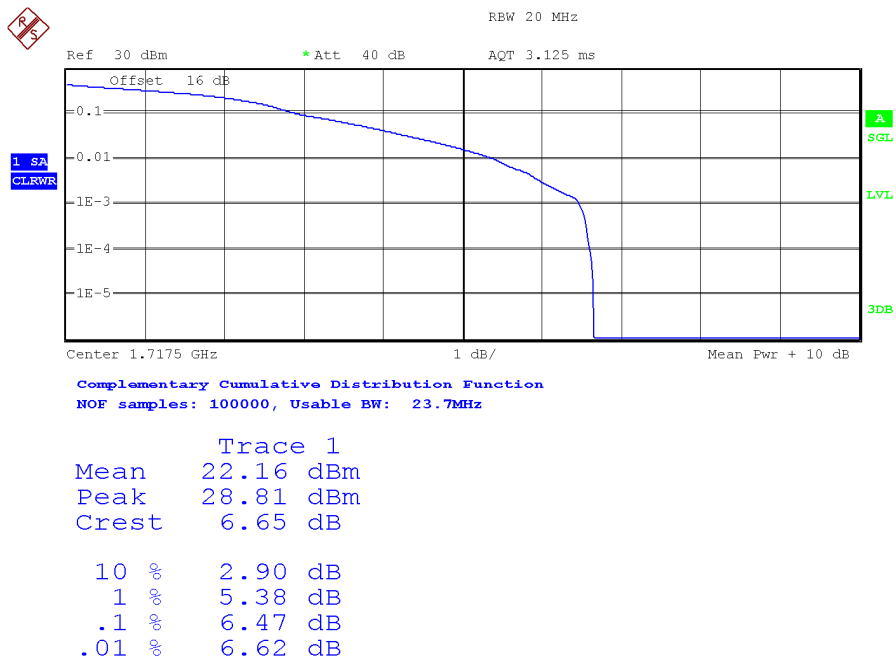
Channel Middle:



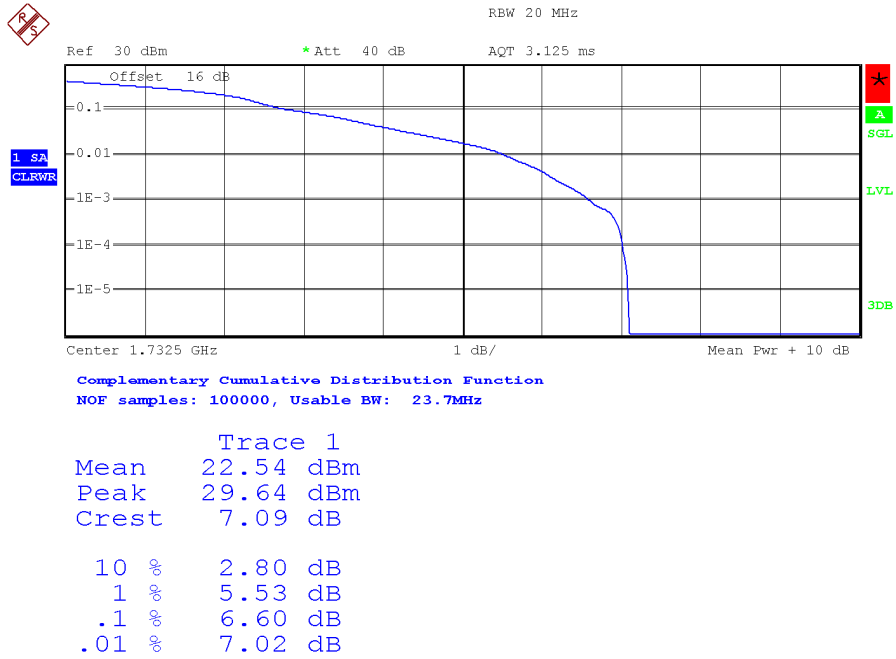
Channel High:



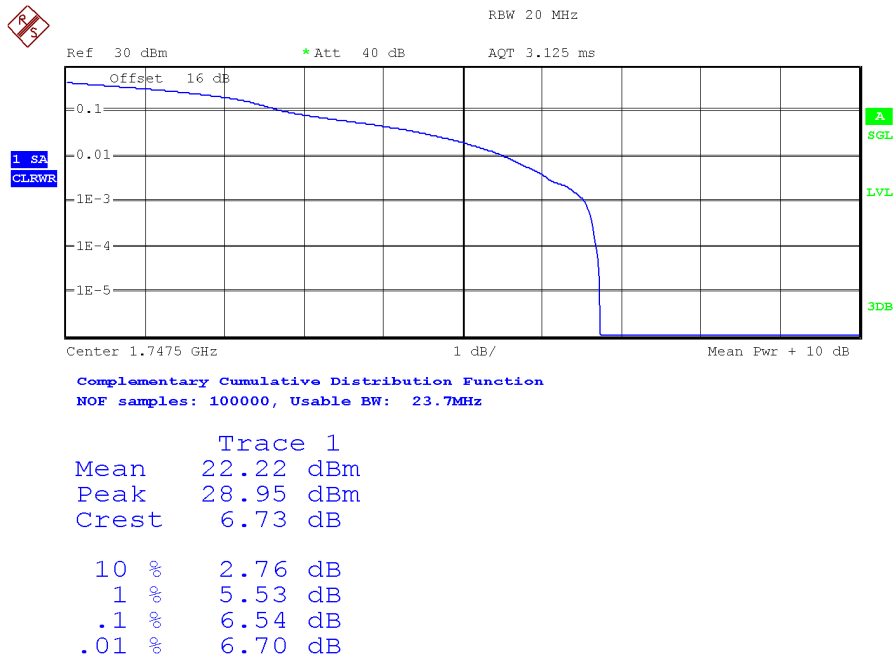
Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.
 Channel Low:



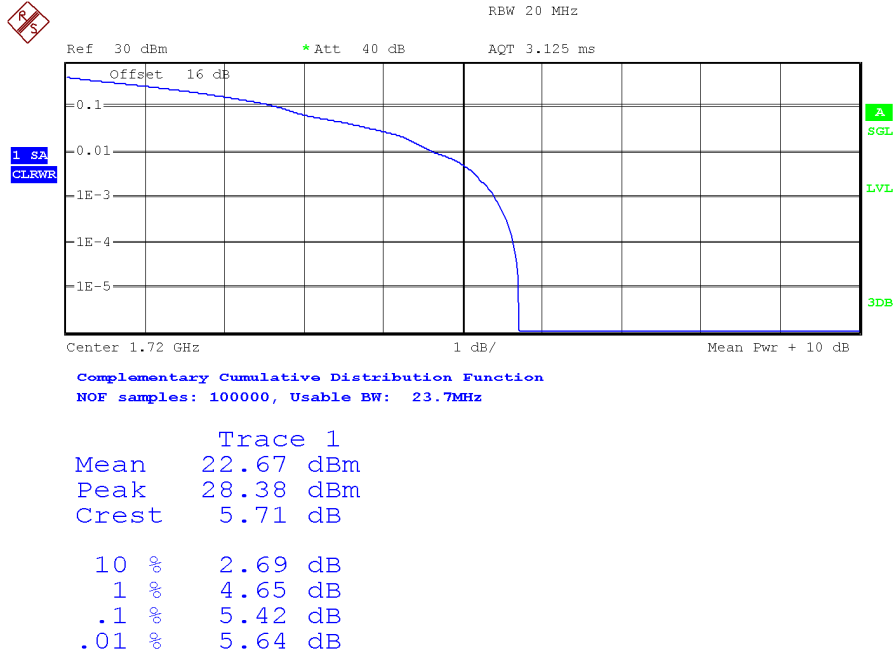
Channel Middle:



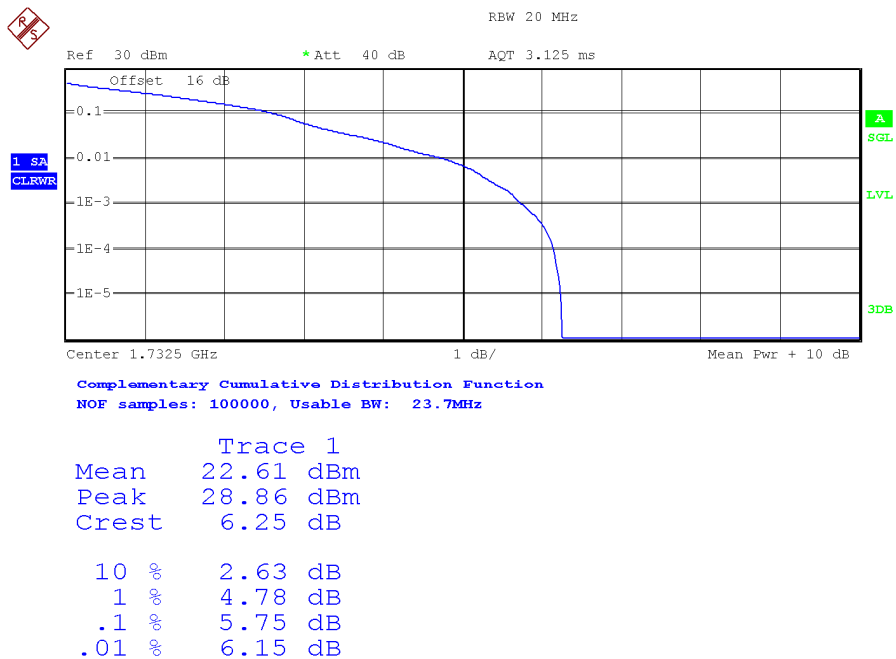
Channel High:



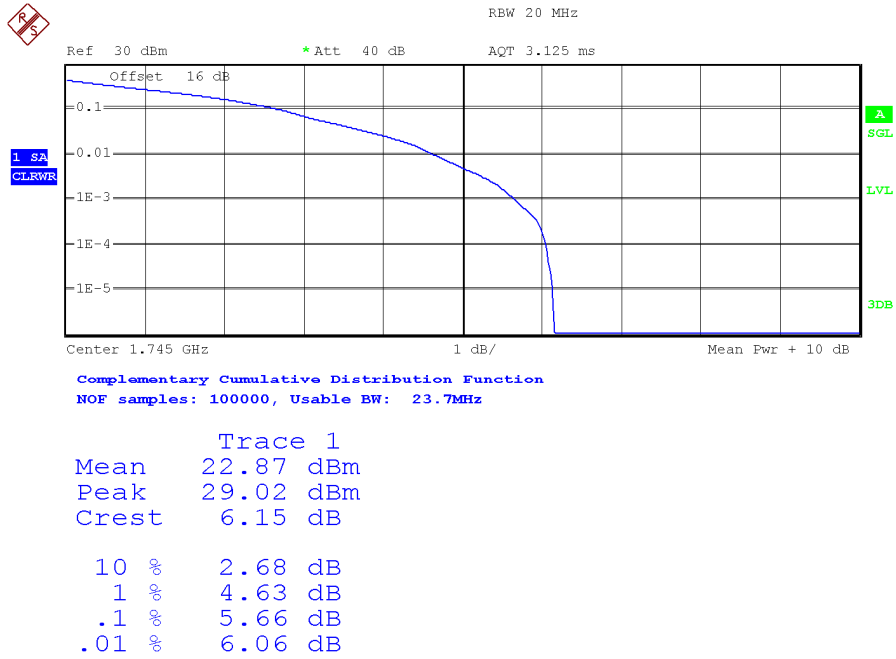
Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.
 Channel Low:



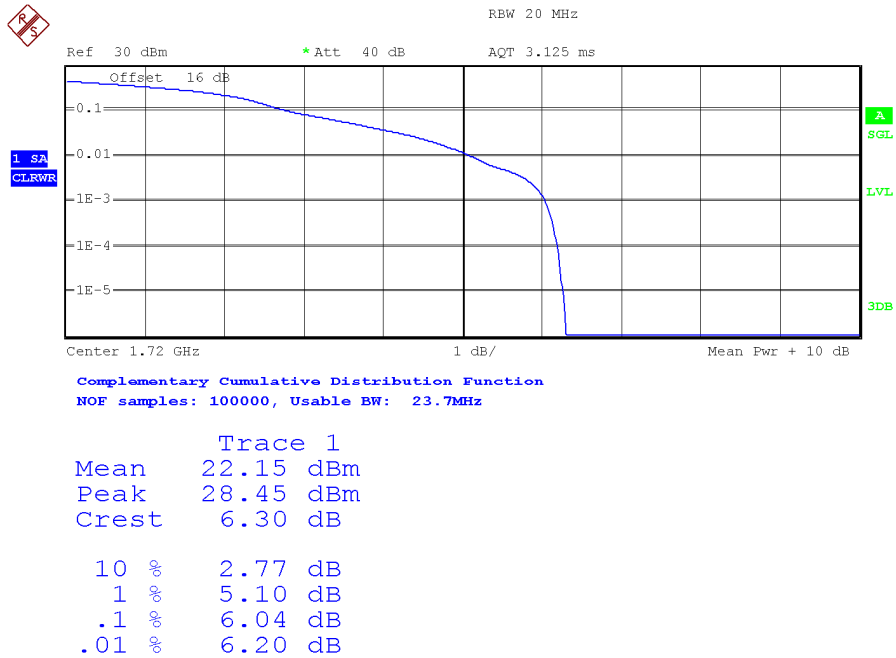
Channel Middle:



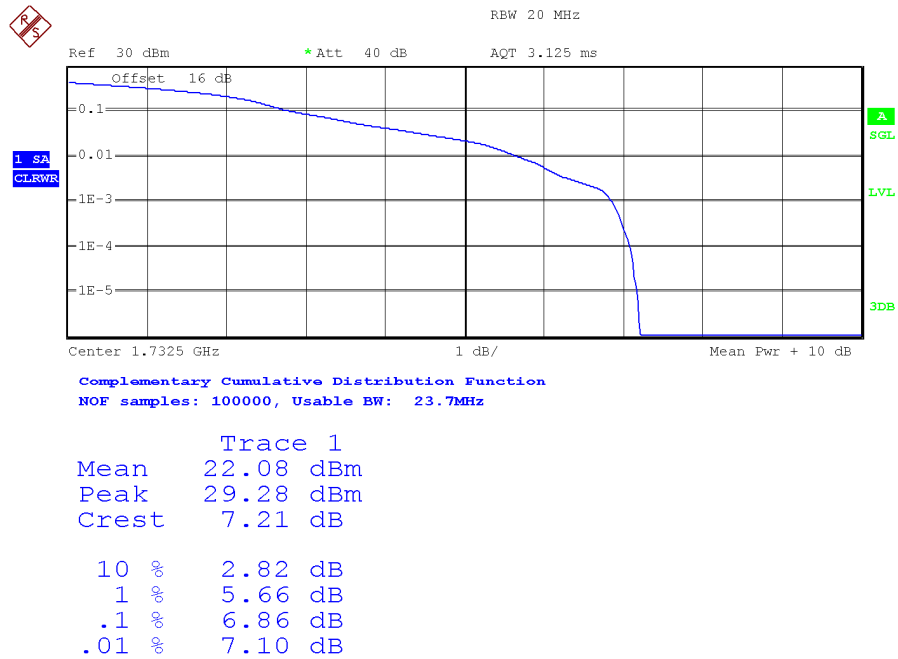
Channel High:



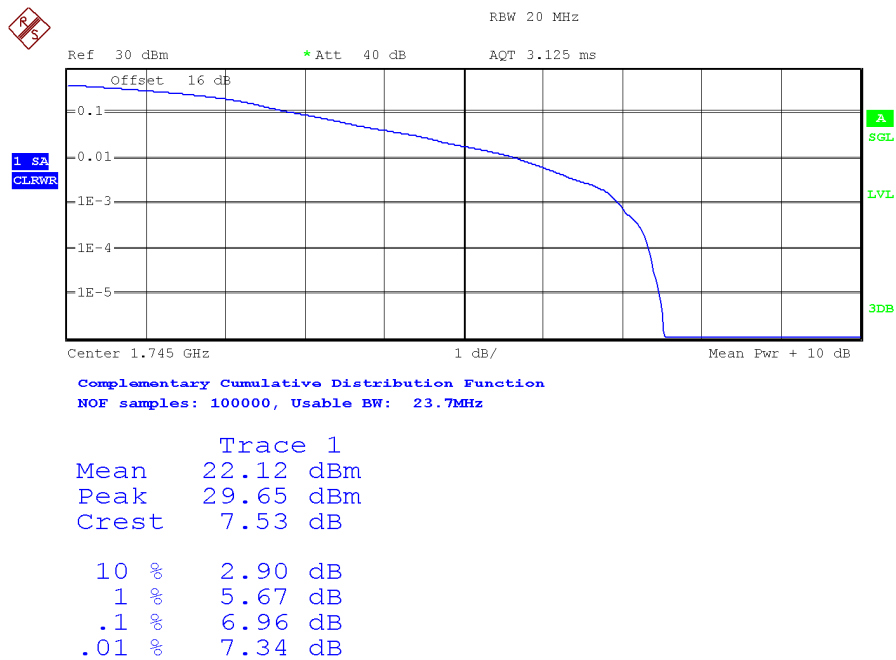
Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.
 Channel Low:



Channel Middle:



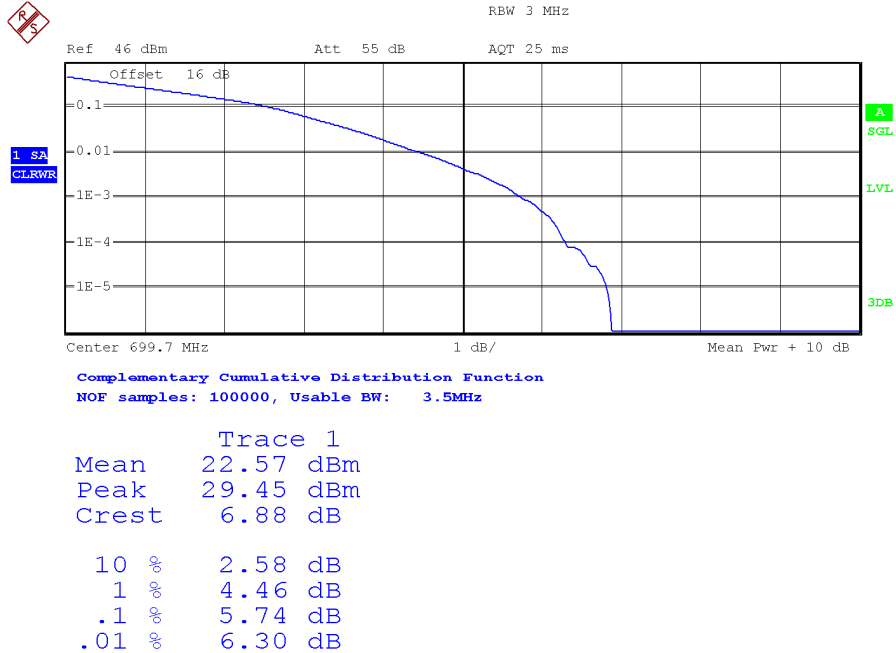
Channel High:



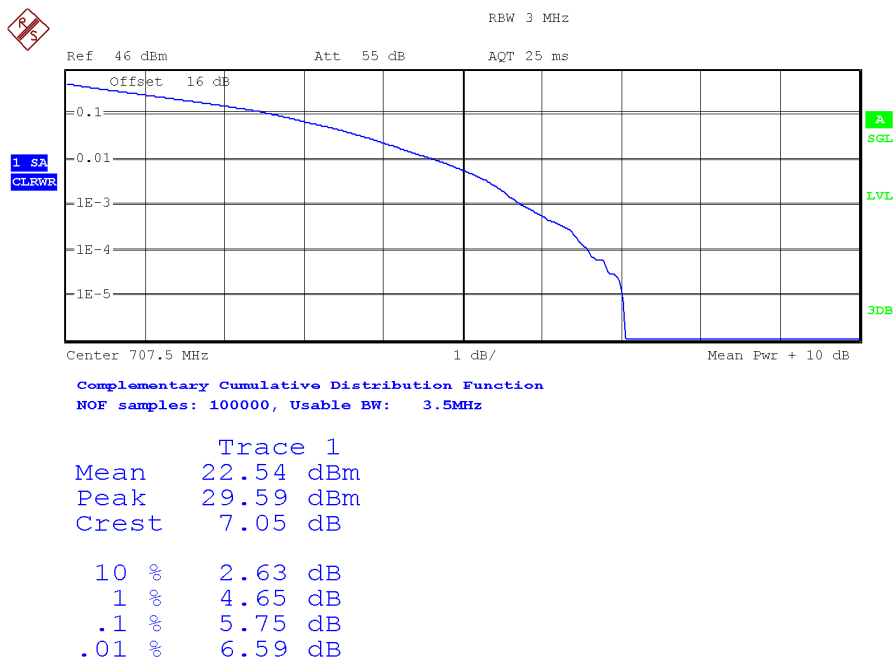
LTE. BAND XII.

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

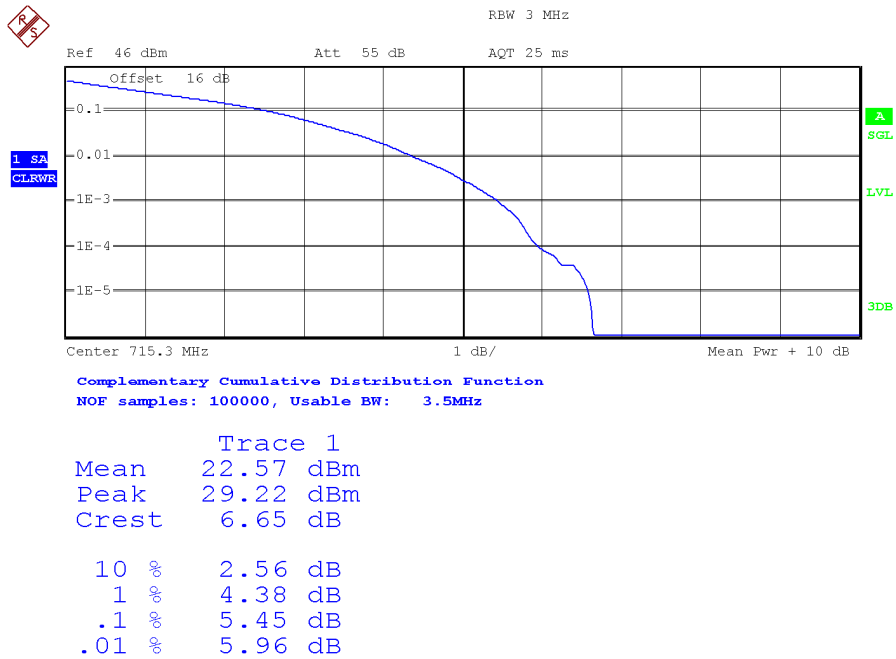
Channel Low:



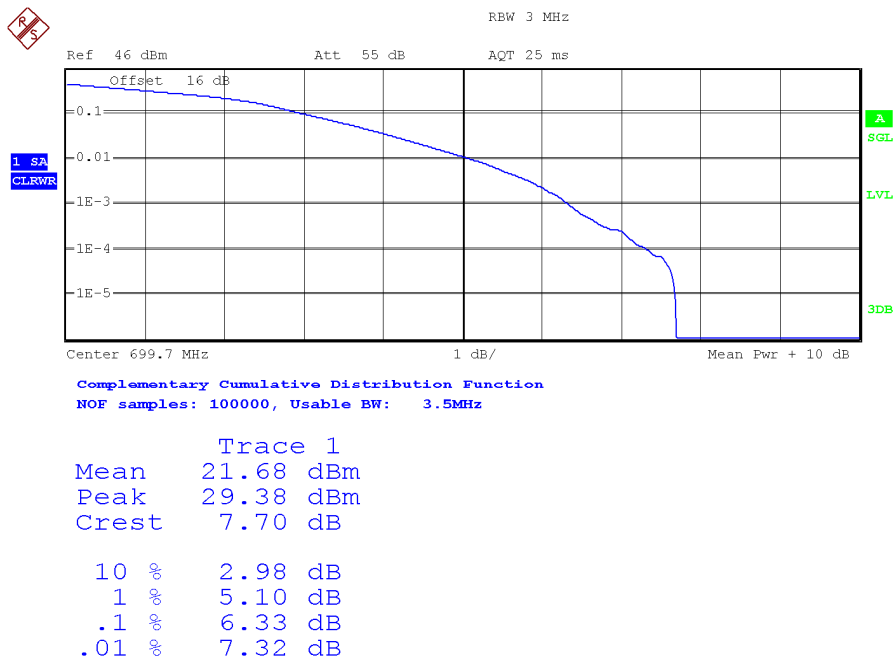
Channel Middle:



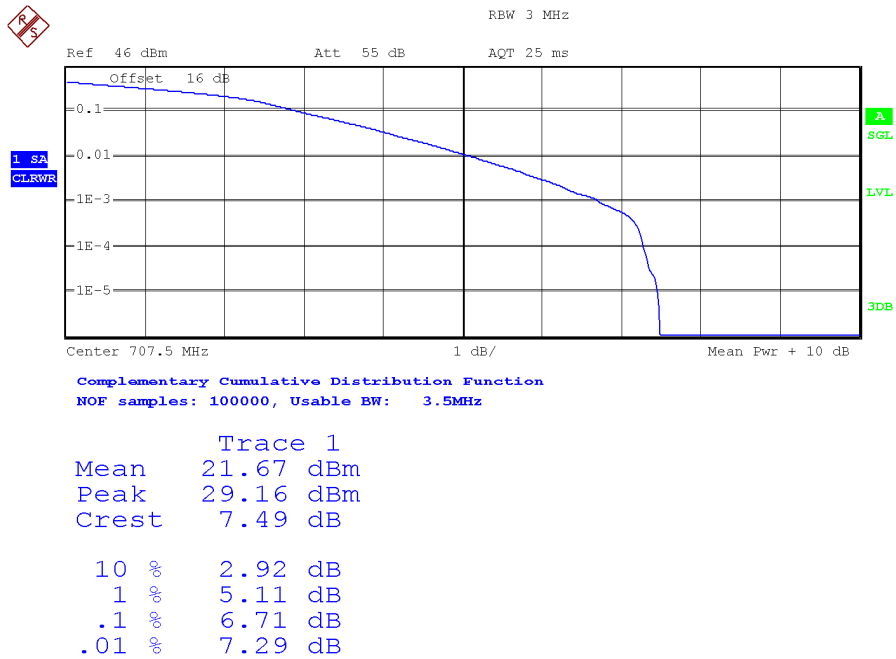
Channel High:



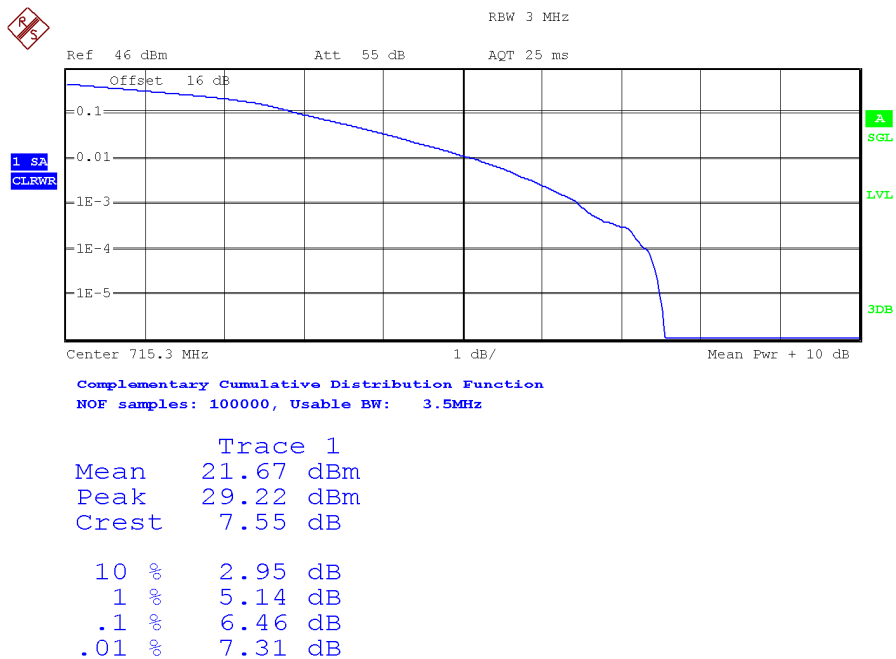
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.
 Channel Low:



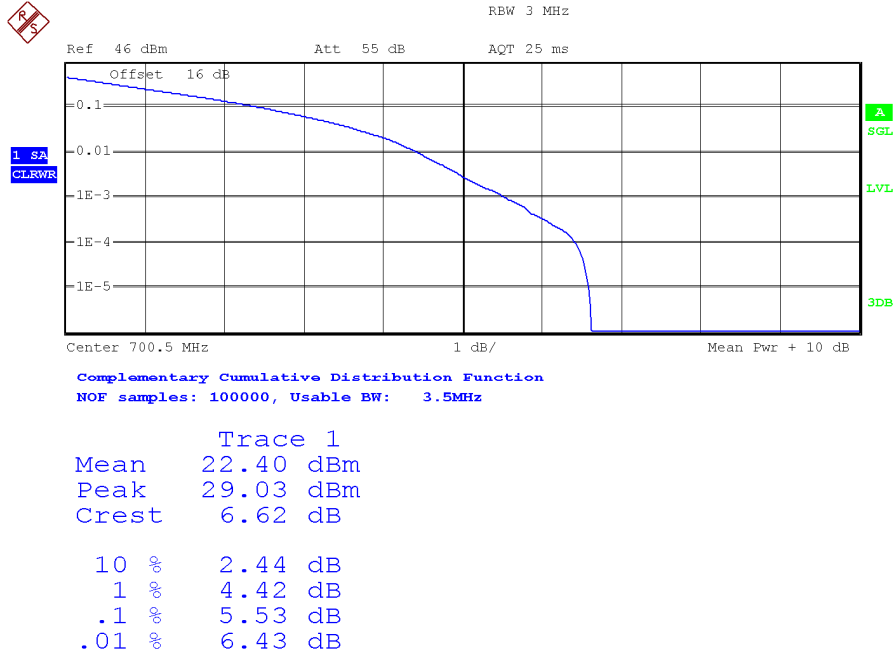
Channel Middle:



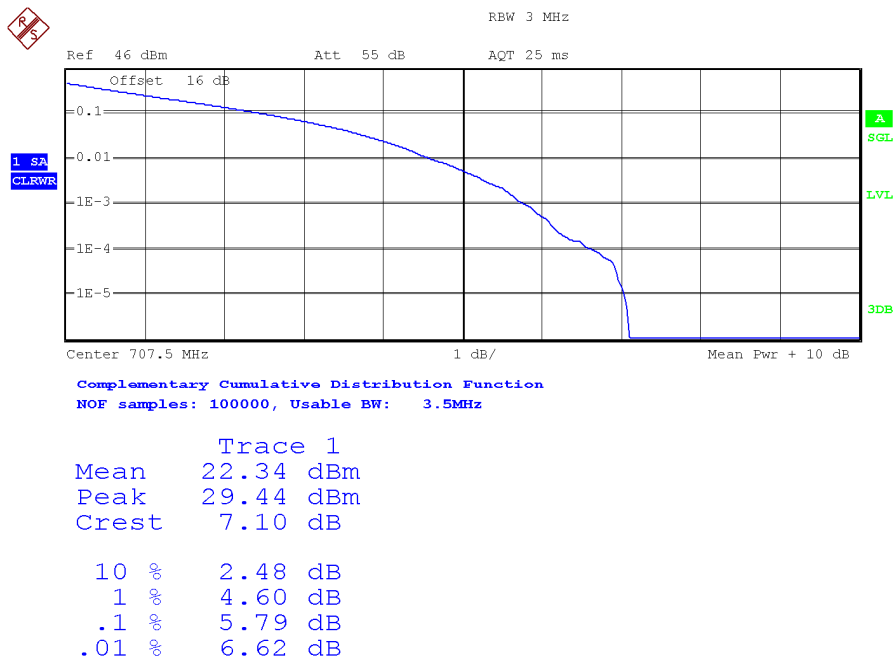
Channel High:



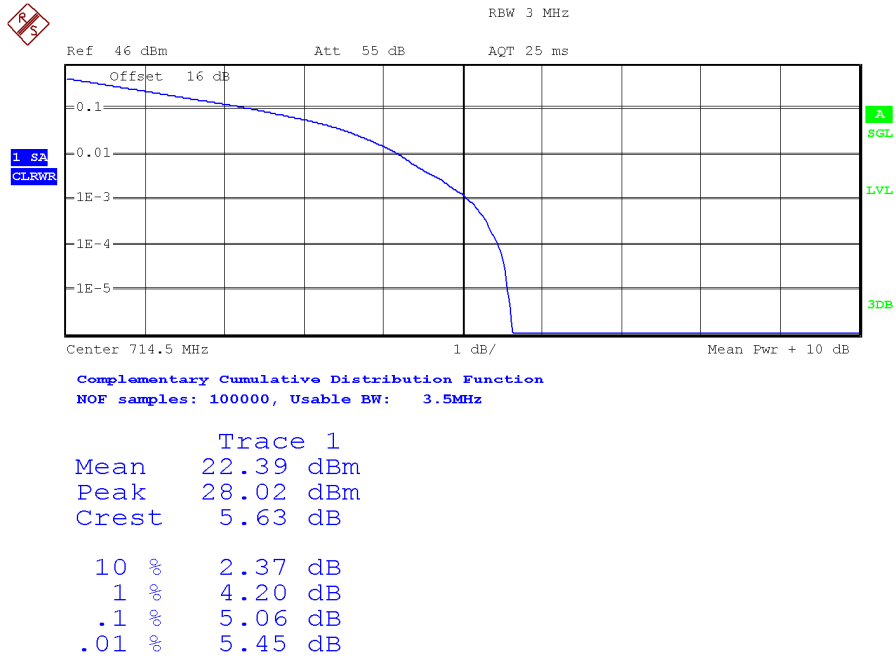
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.
 Channel Low:



Channel Middle:

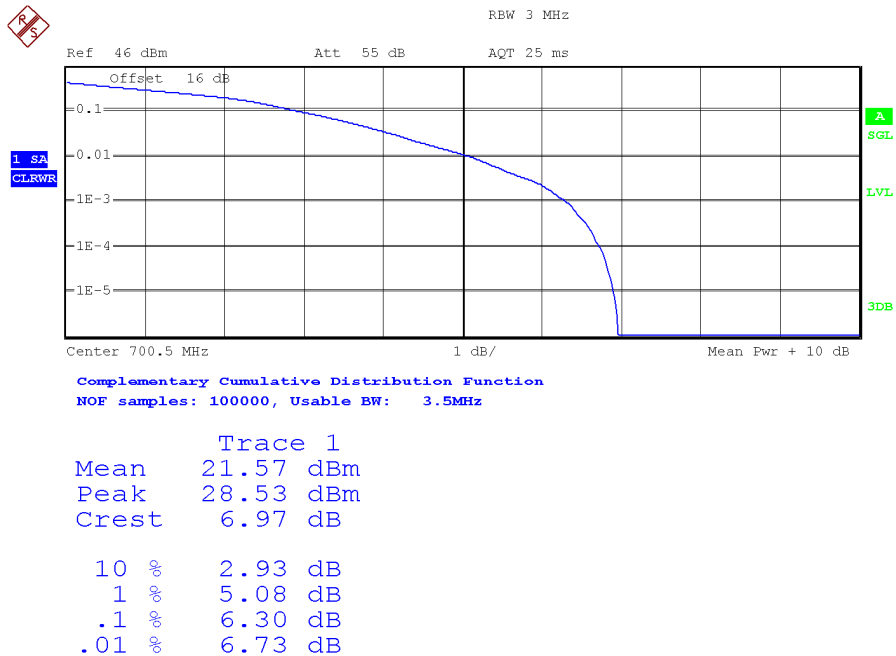


Channel High:

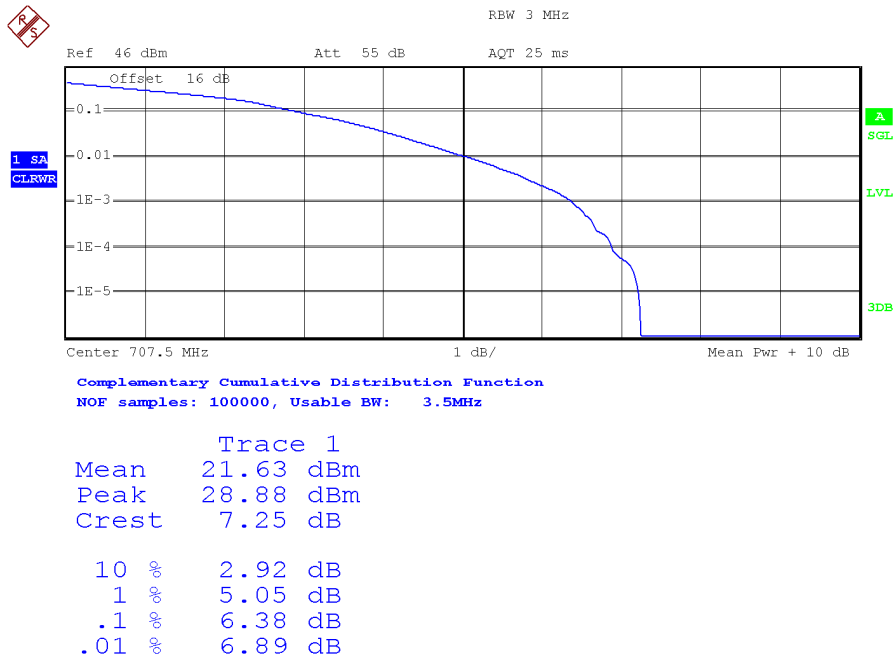


Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

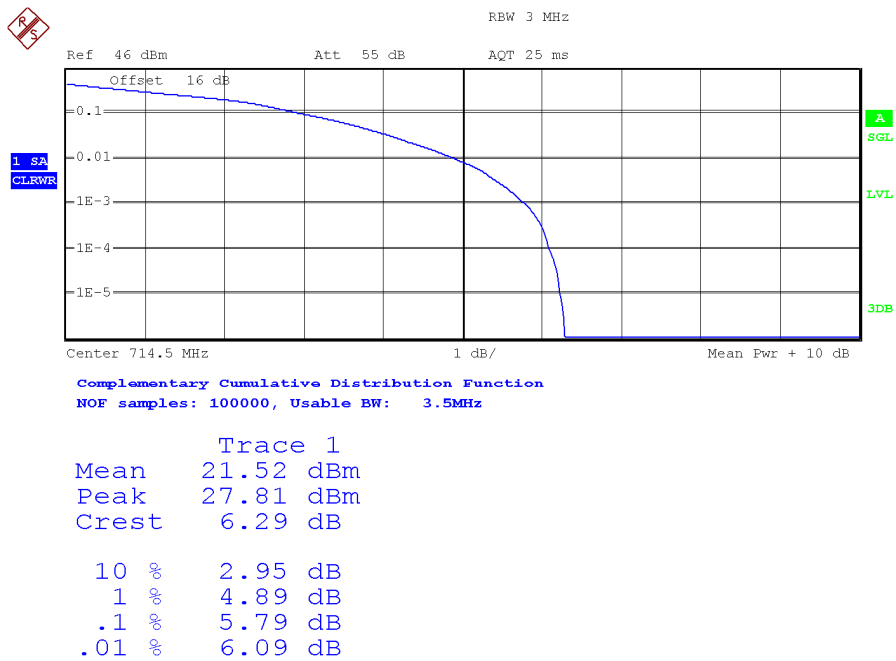
Channel Low:



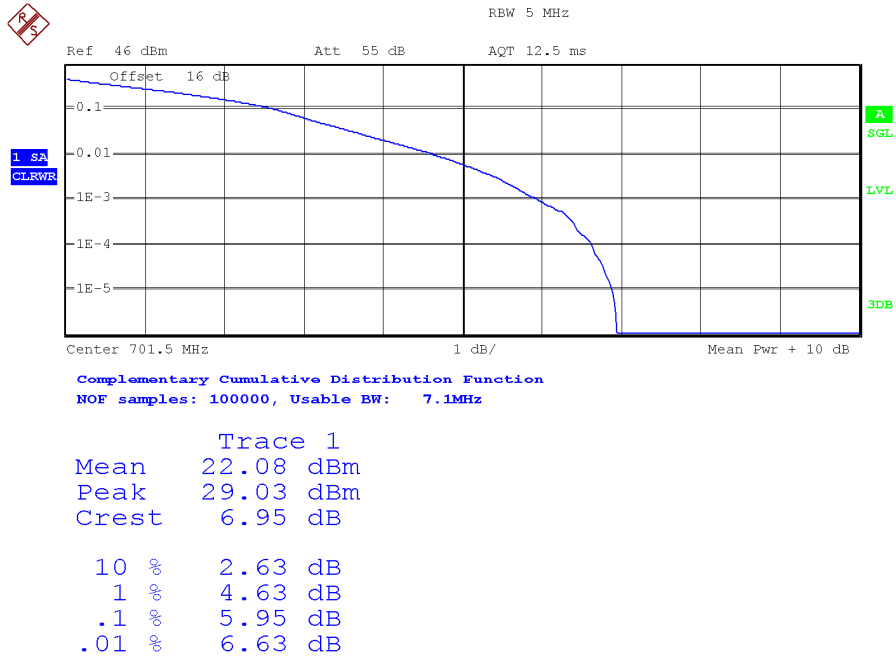
Channel Middle:



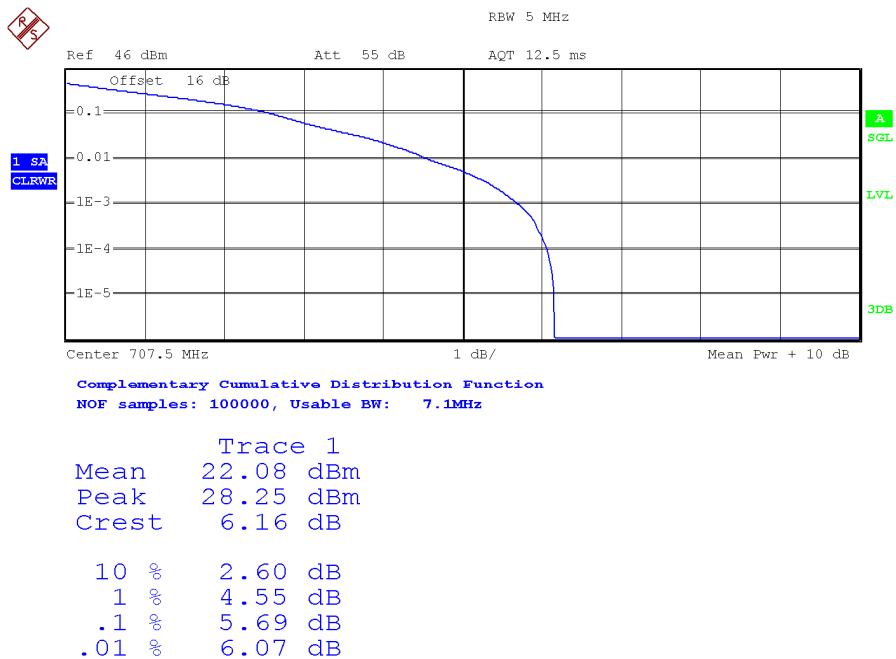
Channel High:



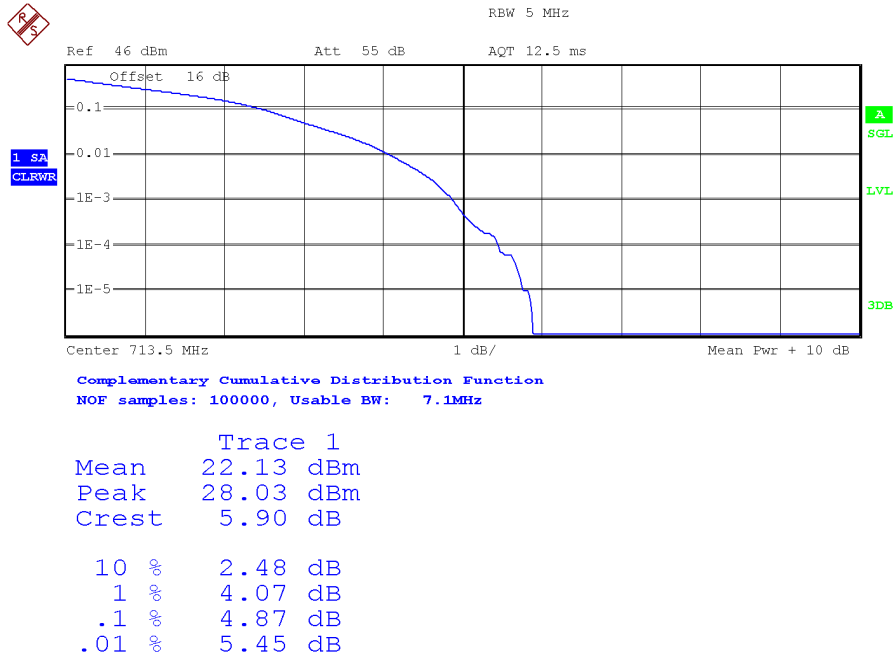
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
 Channel Low:



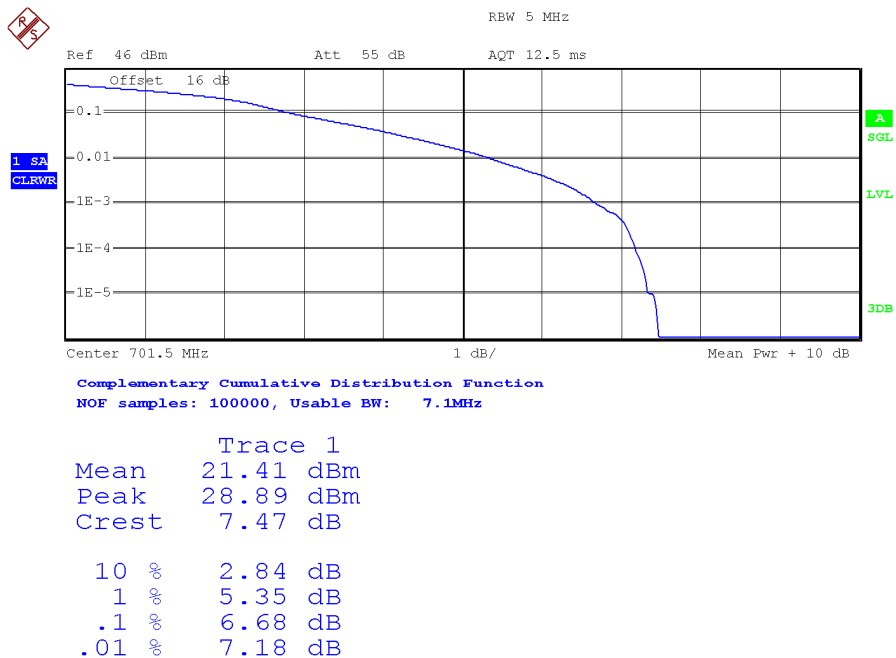
Channel Middle:



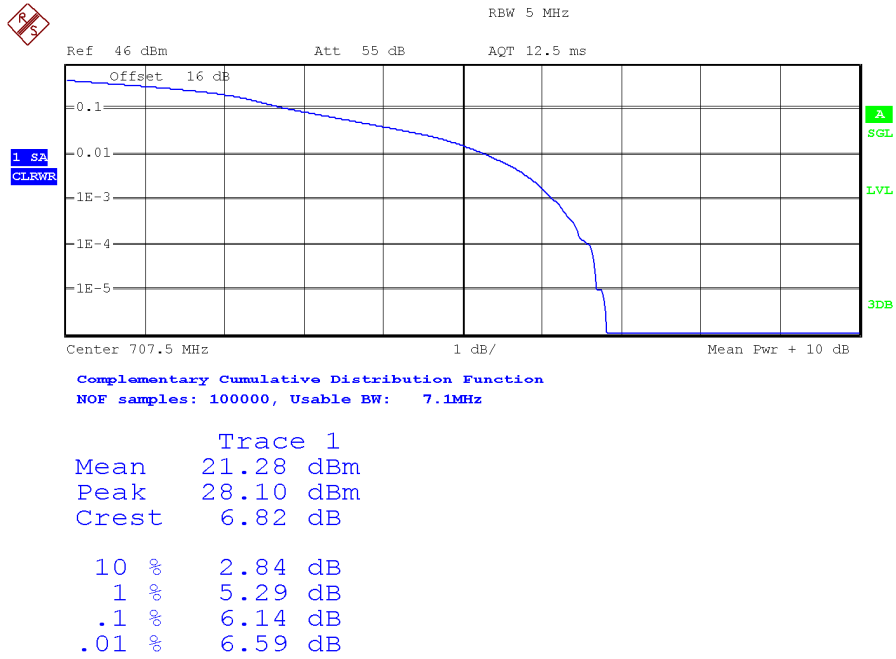
Channel High:



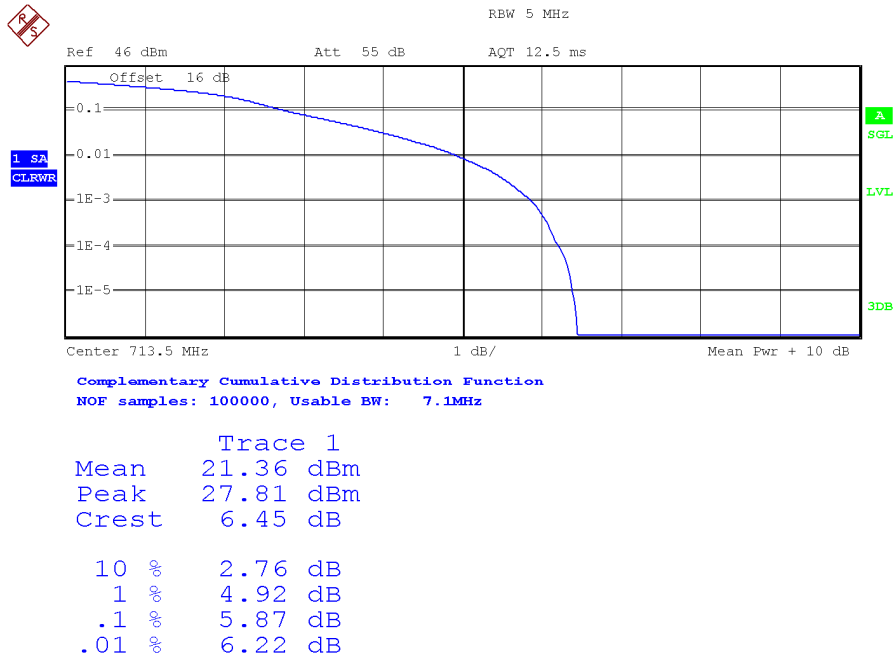
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
 Channel Low:



Channel Middle:

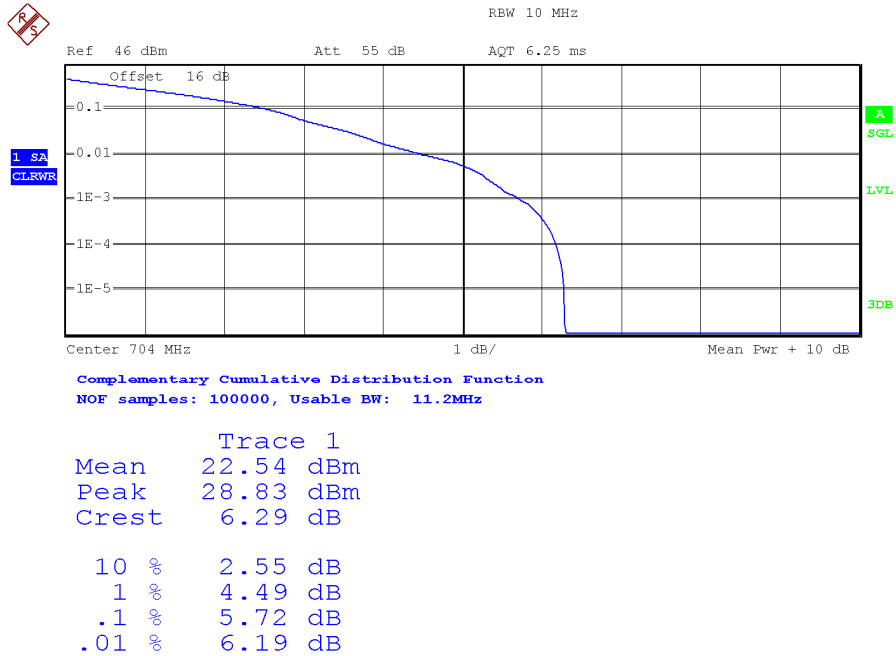


Channel High:

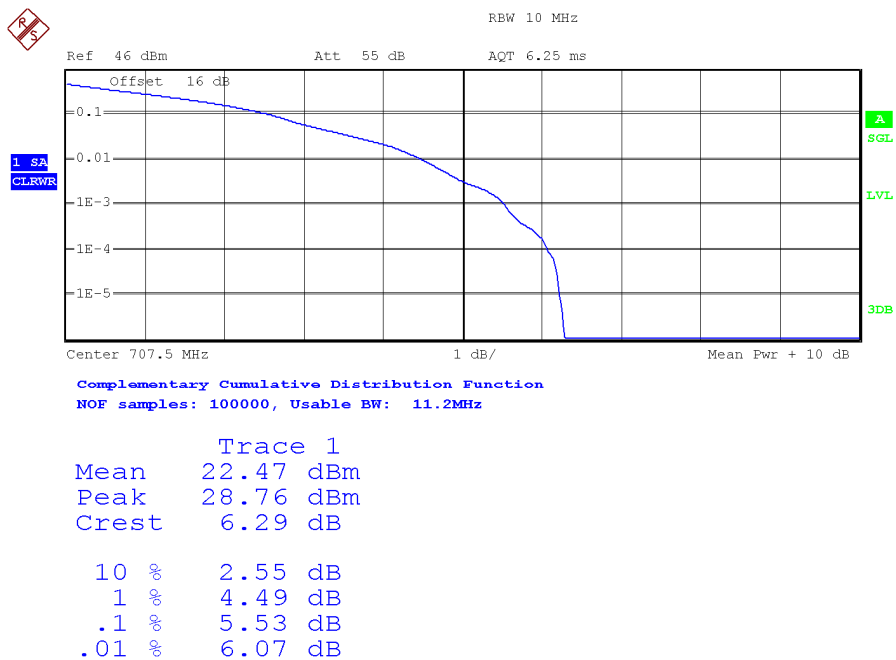


Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

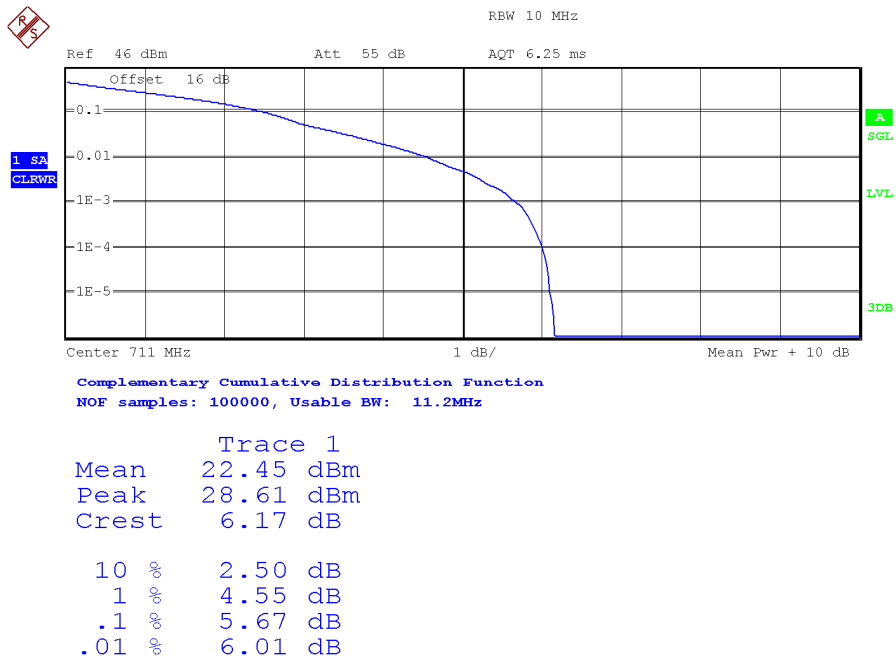
Channel Low:



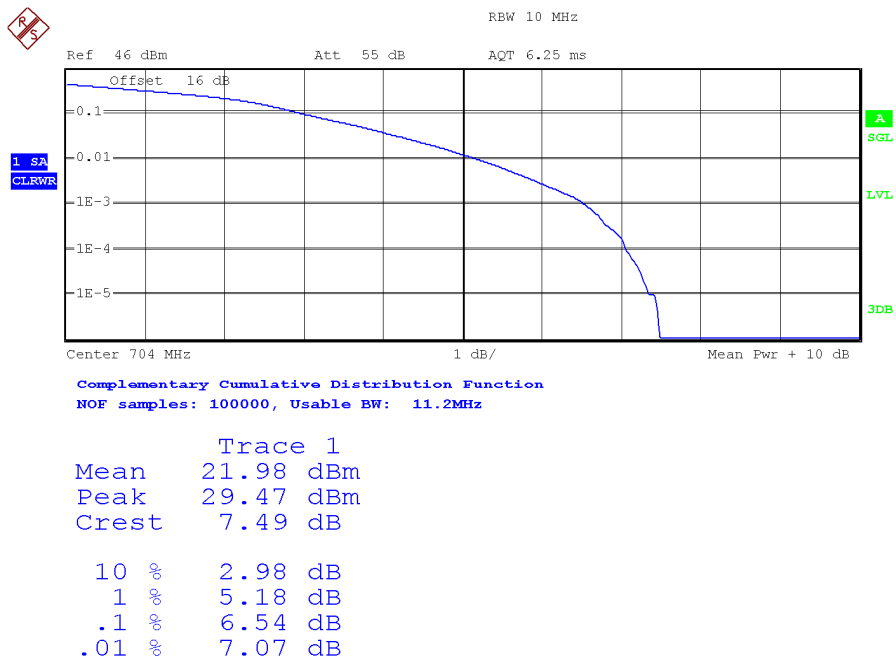
Channel Middle:



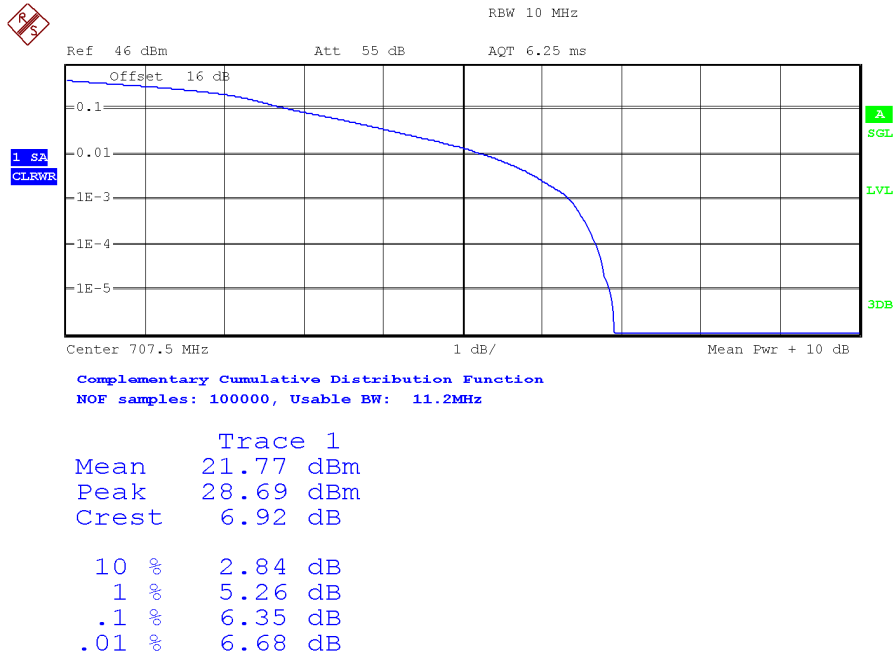
Channel High:



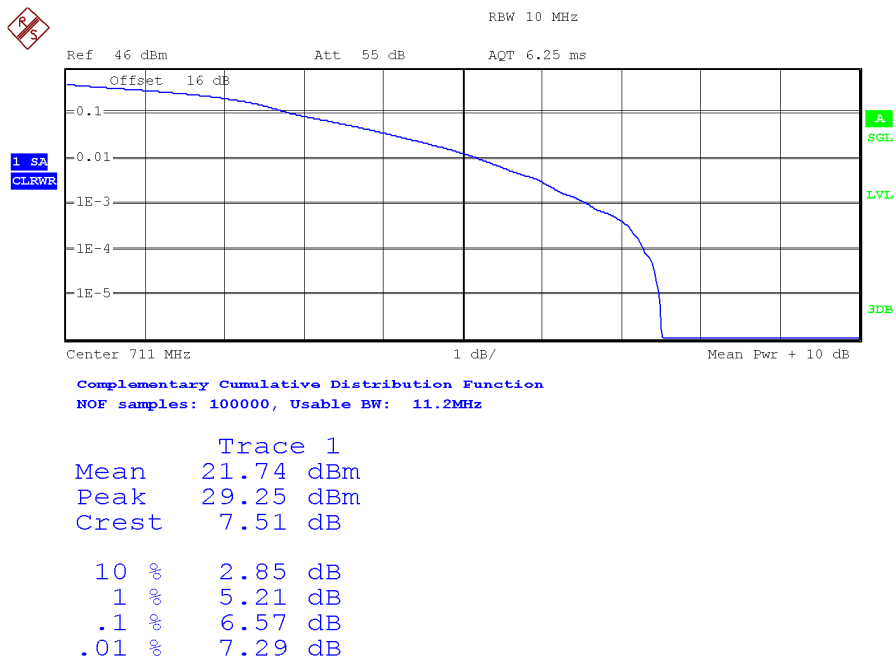
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
 Channel Low:



Channel Middle:



Channel High:



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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.648	2.14	24.788	6.13
Middle	22.739	2.14	24.879	7.21
Highest	22.780	2.14	24.920	5.55
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.572	2.14	24.712	6.39
Middle	22.732	2.14	24.872	7.32
Highest	22.652	2.14	24.792	5.38
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.610	2.14	24.750	6.20
Middle	22.767	2.14	24.907	7.13
Highest	22.710	2.14	24.850	5.40
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.674	2.14	24.814	6.07
Middle	22.735	2.14	24.875	6.99
Highest	22.884	2.14	25.024	5.59
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.847	2.14	24.987	6.47
Middle	22.913	2.14	25.053	6.60
Highest	23.088	2.14	25.228	6.54
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	PAPR (dB)
Lowest	22.678	2.14	24.818	6.04
Middle	22.710	2.14	24.850	6.86
Highest	22.747	2.14	24.887	6.96
Measurement uncertainty (dB)	$<\pm 1.11$			

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	22.469	2.14	24.609	22.459	6.33
Middle	22.448	2.14	24.588	22.438	6.71
Highest	22.391	2.14	24.531	22.381	6.46
Measurement uncertainty (dB)	<±1.11				

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	22.406	2.14	24.546	22.396	6.30
Middle	22.357	2.14	24.497	22.347	6.38
Highest	22.378	2.14	24.518	22.368	5.79
Measurement uncertainty (dB)	<±1.11				

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	22.378	2.14	24.518	22.368	6.68
Middle	22.379	2.14	24.519	22.369	6.14
Highest	22.348	2.14	24.488	22.338	5.87
Measurement uncertainty (dB)	<±1.11				

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

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	22.321	2.14	24.461	22.311	6.54
Middle	22.407	2.14	24.547	22.397	6.35
Highest	24.430	2.14	26.57	24.420	6.57
Measurement uncertainty (dB)	<±1.11				

Verdict: PASS

Modulation Characteristics

SPECIFICATION

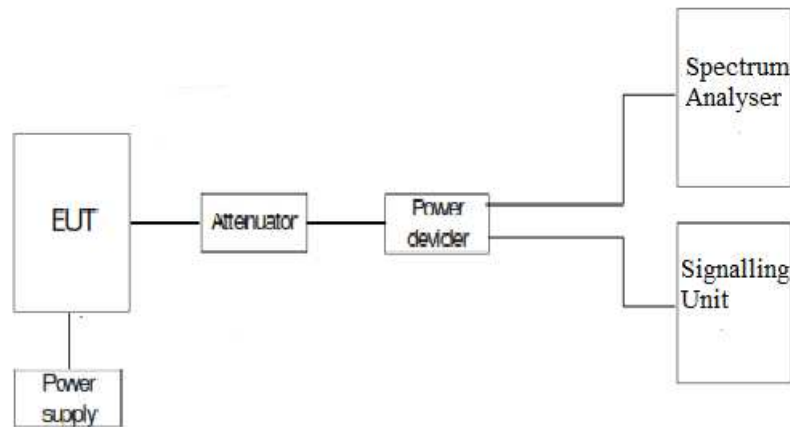
FCC §2.1047.

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).

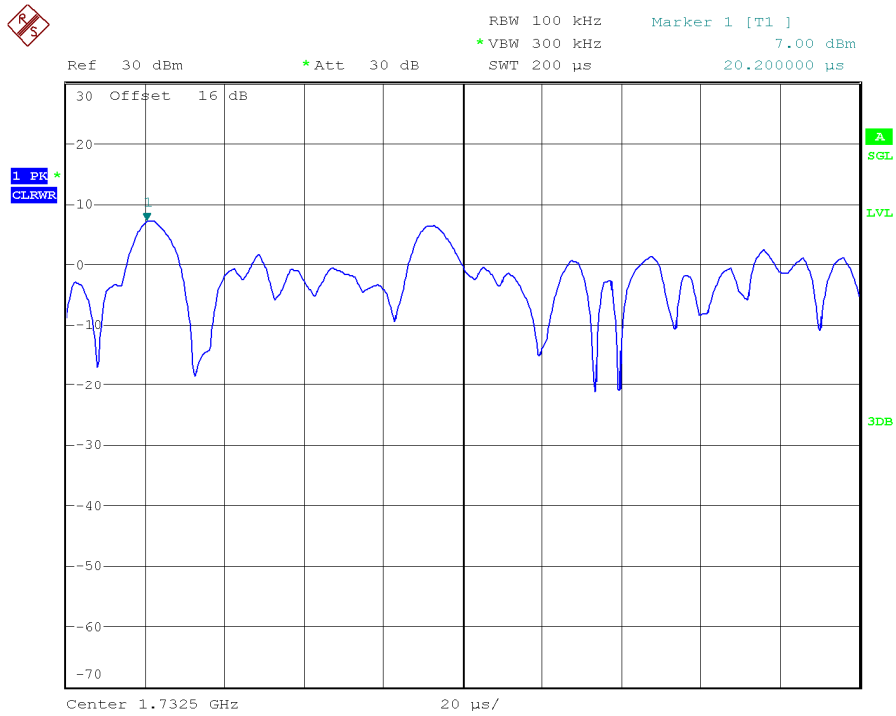
TEST SETUP



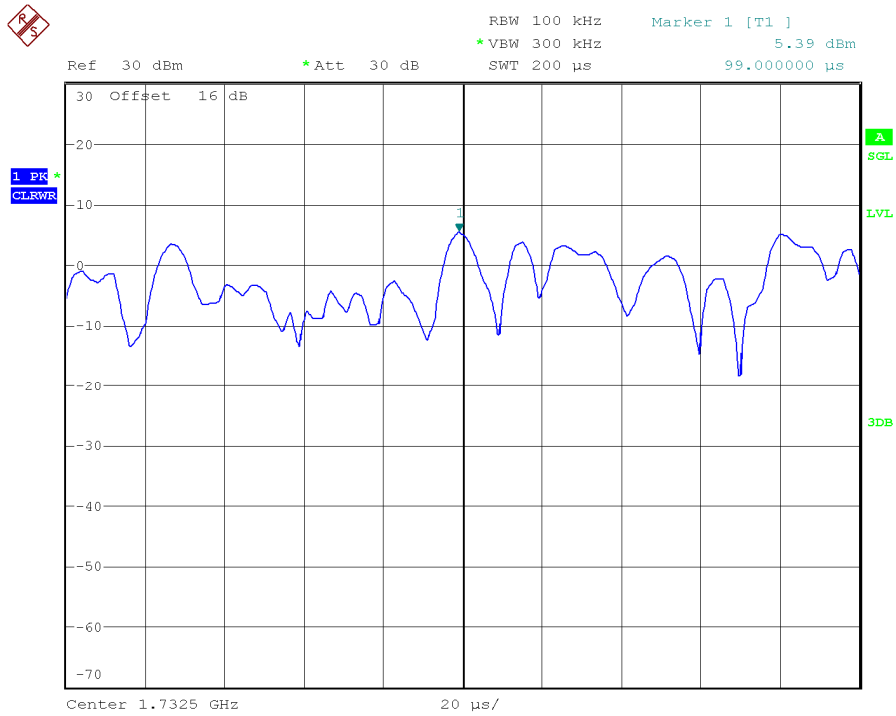
RESULTS

The following plots show the modulation schemes in the EUT.

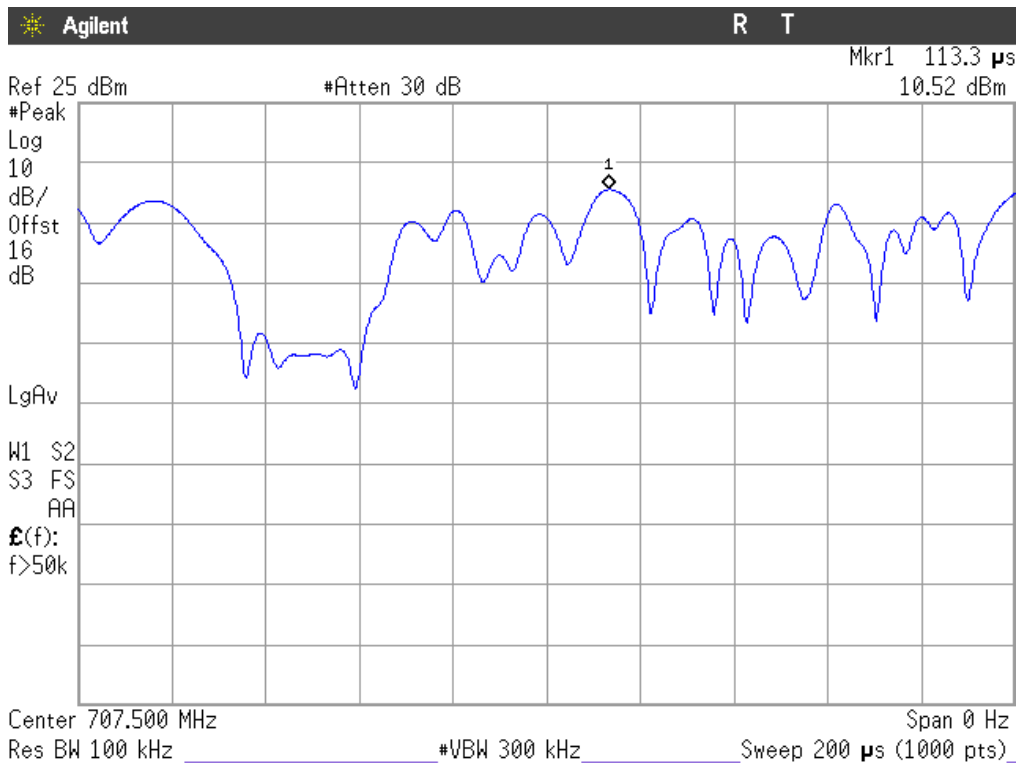
LTE MODULATION. QPSK. Band IV



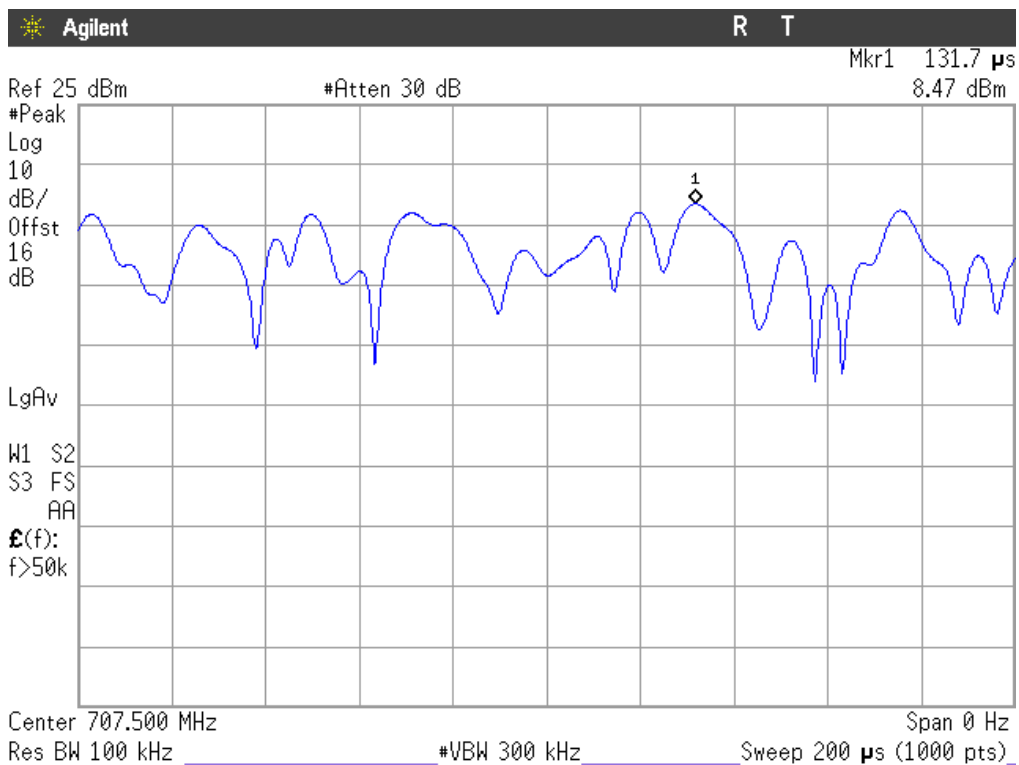
LTE MODULATION. 16QAM. Band IV



LTE MODULATION. QPSK. Band XII



LTE MODULATION. 16QAM. Band XII



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 f_L minus the frequency offset and f_H 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 -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

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.

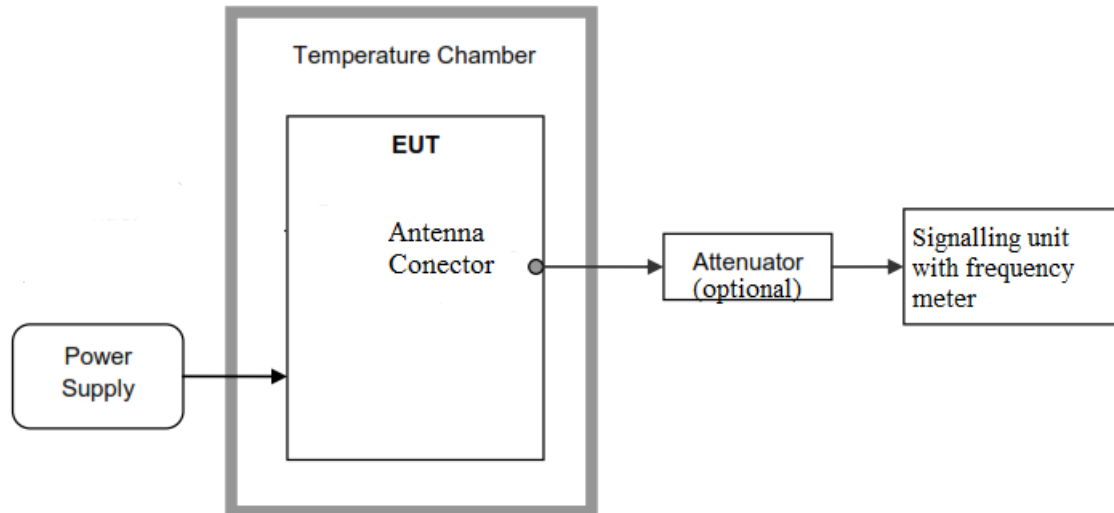
For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.

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 f_H respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of f_L and f_H to check that the resulting frequencies remain within the band.

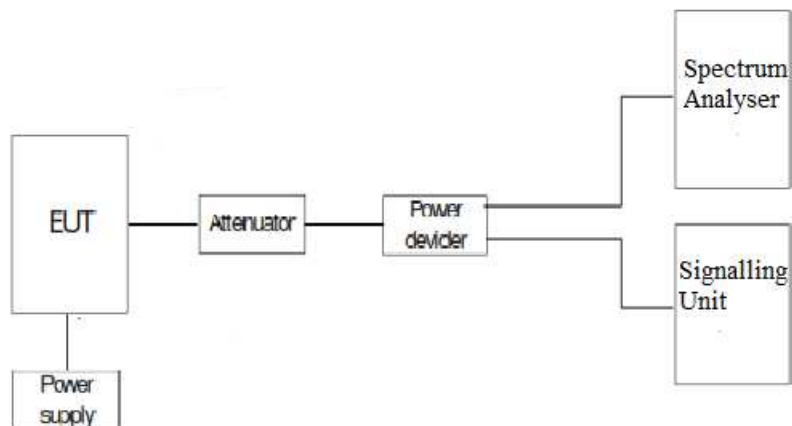
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Frequency tolerance.



Reference points f_L and f_H .



RESULTS

Frequency stability over temperature variations.

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	0.19	0.000109668
+40	0.49	0.000282828
+30	-0.31	-0.000178932
+20	-0.41	-0.000236652
+10	-1.14	-0.000658009
0	-0.7	-0.00040404
-10	-1.4	-0.000808081
-20	-1.99	-0.001148629
-30	-2.09	-0.001206349

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-2.88	-0.001662338
+40	-3.2	-0.001847042
+30	-3.05	-0.001760462
+20	-2.23	-0.001287157
+10	-2.17	-0.001252525
0	-2.18	-0.001258297
-10	-2.7	-0.001558442
-20	-2.63	-0.001518038
-30	-3.05	-0.001760462

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-2.75	-0.001587302
+40	-1.8	-0.001038961
+30	-1.2	-0.000692641
+20	-1.52	-0.000877345
+10	-1.53	-0.000883117
0	-1.72	-0.000992785
-10	-1.92	-0.001108225
-20	-1.67	-0.000963925
-30	-1.73	-0.000998557

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.43	-0.000825397
+40	-2.65	-0.001529582
+30	-1.7	-0.000981241
+20	-1.63	-0.000940837
+10	-1.92	-0.001108225
0	-1.65	-0.000952381
-10	-1.4	-0.000808081
-20	-2.16	-0.001246753
-30	-1.59	-0.000917749

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.72	-0.000992785
+40	-2.02	-0.001165945
+30	-2.13	-0.001229437
+20	-2.85	-0.001645022
+10	-1.89	-0.001090909
0	-1.44	-0.000831169
-10	-1	-0.000577201
-20	-1.5	-0.000865801
-30	-1.73	-0.000998557

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.86	-0.001073593
+40	-2.23	-0.001287157
+30	-1.76	-0.001015873
+20	-2.02	-0.001165945
+10	-1.89	-0.001090909
0	-1.36	-0.000784993
-10	-1.37	-0.000790765
-20	-1.86	-0.001073593
-30	-2.06	-0.001189033

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	2.65	0.003745583
+40	2.25	0.003180212
+30	2.46	0.003477032
+20	2.43	0.003434629
+10	2.57	0.003632509
0	2.06	0.002911661
-10	2.7	0.003816254
-20	1.77	0.002501767
-30	1.92	0.002713781

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.06	0.001498233
+40	1.02	0.001441696
+30	1.09	0.001540636
+20	0.93	0.001314488
+10	1.03	0.00145583
0	1.12	0.001583039
-10	1.23	0.001738516
-20	0.82	0.001159011
-30	0.6	0.000848057

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	2.06	0.002911661
+40	2.2	0.003109541
+30	1.6	0.002261484
+20	1.99	0.002812721
+10	1.92	0.002713781
0	1.8	0.00254417
-10	1.62	0.002289753
-20	2.1	0.002968198
-30	2.07	0.002925795

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.92	0.002713781
+40	0.6	0.000848057
+30	2	0.002826855
+20	0.33	0.000466431
+10	0.72	0.001017668
0	0.5	0.000706714
-10	0.49	0.00069258
-20	0.07	9.89399E-05
-30	0.19	0.000268551

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)
Vmax	4.37	3.46	0.001997114
Vmin	3.23	2.96	0.001708514

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-1.53	-0.000883117
Vmin	3.23	-1.32	-0.000761905

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-1.52	-0.000877345
Vmin	3.23	-1.4	-0.000808081

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-1.79	-0.001033189
Vmin	3.23	-1.65	-0.000952381

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-2.25	-0.001298701
Vmin	3.23	-1.7	-0.000981241

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-1.93	-0.001113997
Vmin	3.23	-1.89	-0.001090909

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	2.35	0.003321555
Vmin	3.23	2.3	0.003250883

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	0.69	0.000975265
Vmin	3.23	0.54	0.000763251

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	1.6	0.002261484
Vmin	3.23	1.96	0.002770318

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

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	0.3	0.000424028
Vmin	3.23	0.14	0.00019788

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)	1710.0711	1710.0170	1710.0751	1710.1231	1710.1532	1710.2372
f_H (MHz)	1754.9269	1754.9670	1754.9449	1754.9169	1754.8769	1754.7748

	LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)	LTE QPSK MODULATION. BW = 3 MHz (Band XII)	LTE QPSK MODULATION. BW = 5 MHz (Band XII)	LTE QPSK MODULATION. BW = 10 MHz (Band XII)
f_L (MHz)	699.0549	699.0544	699.0354	699.0630
f_H (MHz)	715.9493	715.9800	715.9633	715.9479

Reference points f_L and f_H 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)	1710.0711	1710.0170	1710.0751	1710.1231	1710.1532	1710.2372
f_H (MHz)	1754.9269	1754.9670	1754.9449	1754.9169	1754.8769	1754.7748

	LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)	LTE QPSK MODULATION. BW = 3 MHz (Band XII)	LTE QPSK MODULATION. BW = 5 MHz (Band XII)	LTE QPSK MODULATION. BW = 10 MHz (Band XII)
f_L (MHz)	699.0549	699.0544	699.0354	699.0630
f_H (MHz)	715.9493	715.9800	715.9633	715.9479

The reference frequency points stay within the authorized blocks.

Verdict: PASS

Occupied Bandwidth

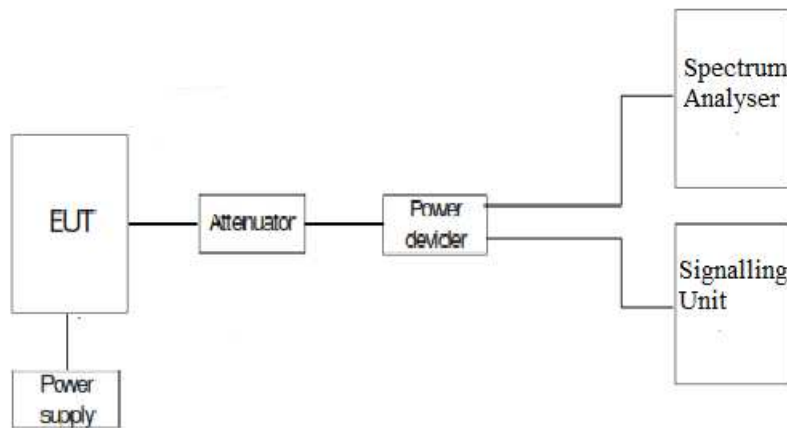
SPECIFICATION

§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 (kHz)	1098.50	1115.80	1107.00
-26 dBc bandwidth (kHz)	1412.00	1415.00	1353.00
Measurement uncertainty (kHz)	<±4.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1101.20	1105.00	1104.20
-26 dBc bandwidth (kHz)	1408.00	1443.00	1360.00
Measurement uncertainty (kHz)	<±4.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2746.30	2745.40	2751.60
-26 dBc bandwidth (kHz)	3103.00	3322.00	3152.00
Measurement uncertainty (kHz)	<±10.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2751.80	2745.80	2743.20
-26 dBc bandwidth (kHz)	3191.00	3330.00	3134.00
Measurement uncertainty (kHz)	<±10.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4552.90	4540.00	4507.40
-26 dBc bandwidth (kHz)	5066.00	5050.00	5062.00
Measurement uncertainty (kHz)	<±16.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4516.00	4517.20	4513.50
-26 dBc bandwidth (kHz)	5081.00	5131.00	5102.00
Measurement uncertainty (kHz)	<±16.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9060.60	9076.00	9050.00
-26 dBc bandwidth (kHz)	10295.00	10437.00	10298.00
Measurement uncertainty (kHz)	<±33.33		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9046.60	9088.20	9060.10
-26 dBc bandwidth (kHz)	10394.00	10630.00	10372.00
Measurement uncertainty (kHz)	<±33.33		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13480.90	13538.30	13484.30
-26 dBc bandwidth (kHz)	15645.00	15.971.00	15375.00
Measurement uncertainty (kHz)	<±50.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13485.80	13523.20	13448.00
-26 dBc bandwidth (kHz)	15554.00	15603.00	15772.00
Measurement uncertainty (kHz)	<±50.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17882.60	17991.90	17905.60
-26 dBc bandwidth (kHz)	19712.00	20646.00	19984.00
Measurement uncertainty (kHz)	<±66.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17883.80	17976.50	17892.10
-26 dBc bandwidth (kHz)	19669.00	20603.00	19602.00
Measurement uncertainty (kHz)	<±66.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1098.50	1117.60	1099.20
-26 dBc bandwidth (kHz)	1340.00	1348.00	1350.00
Measurement uncertainty (kHz)	<±4.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1100.10	1101.30	1105.10
-26 dBc bandwidth (kHz)	1343.00	1357.00	1355.00
Measurement uncertainty (kHz)	<±4.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2744.90	2748.70	2751.20
-26 dBc bandwidth (kHz)	3074.00	3172.00	3123.00
Measurement uncertainty (kHz)	<±10.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2735.50	2743.00	2745.50
-26 dBc bandwidth (kHz)	3050.00	3110.00	3092.00
Measurement uncertainty (kHz)	<±10.00		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4502.50	4530.50	4500.20
-26 dBc bandwidth (kHz)	5032.00	5106.00	5062.00
Measurement uncertainty (kHz)	<±16.67		

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

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4505.60	4512.50	4505.10
-26 dBc bandwidth (kHz)	5081.00	5134.00	5011.00
Measurement uncertainty (kHz)	<±16.67		

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

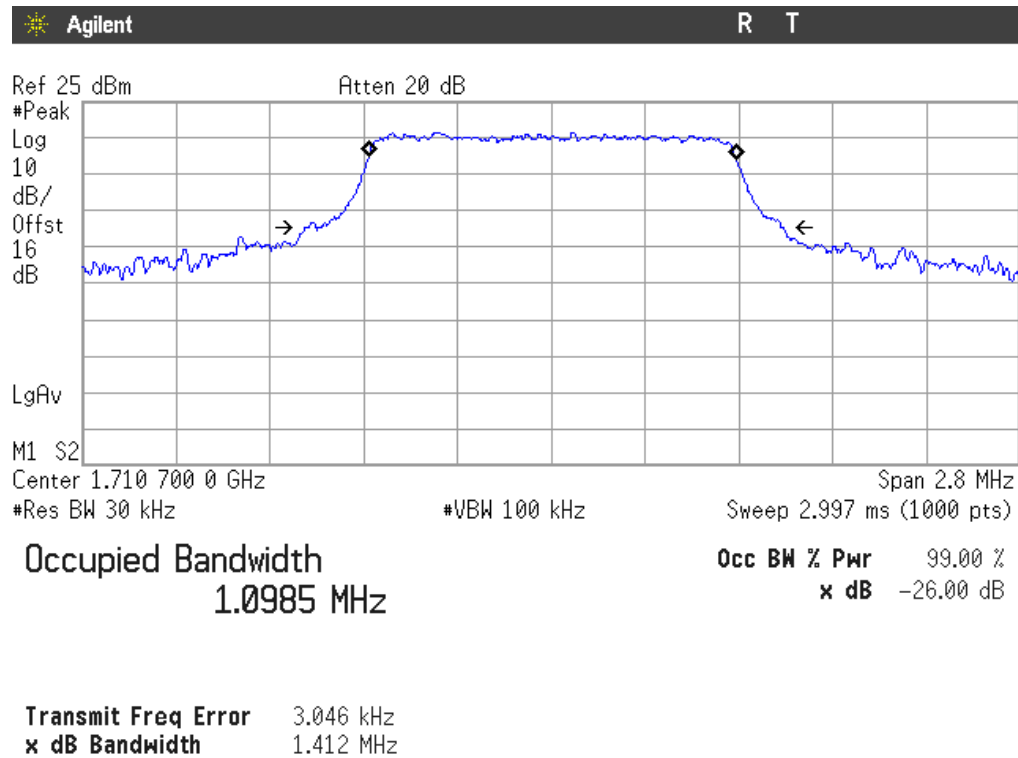
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9054.60	9088.60	9034.50
-26 dBc bandwidth (kHz)	10419.00	10535.00	10448.00
Measurement uncertainty (kHz)	<±33.33		

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

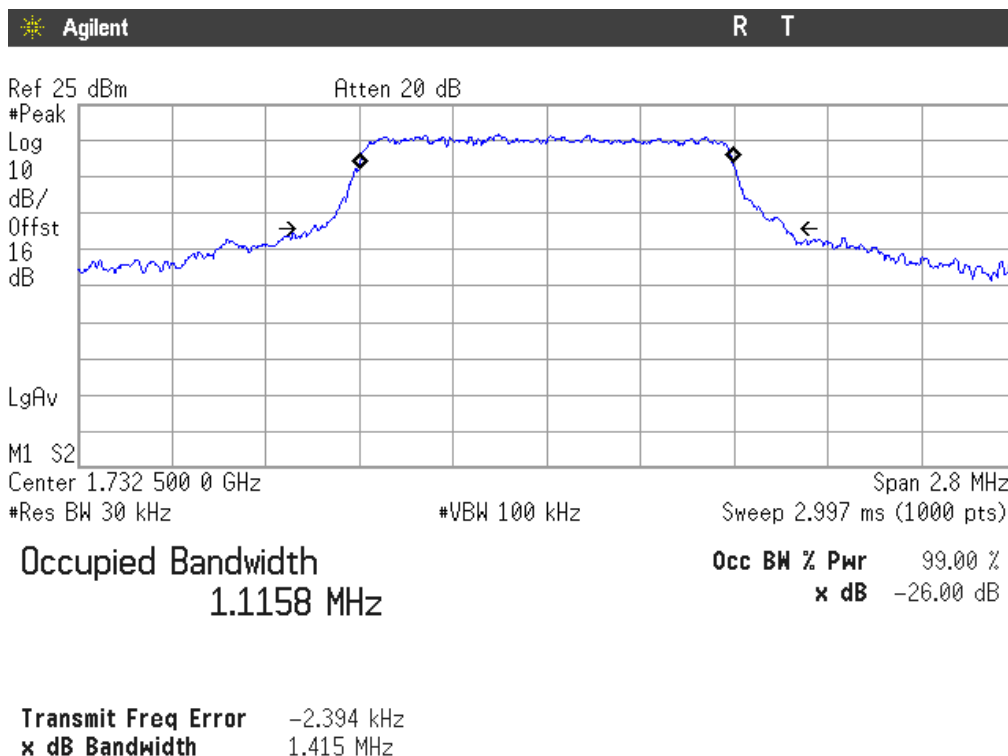
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9051.90	9093.80	9042.20
-26 dBc bandwidth (kHz)	10322.00	10471.00	10162.00
Measurement uncertainty (kHz)	<±33.33		

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

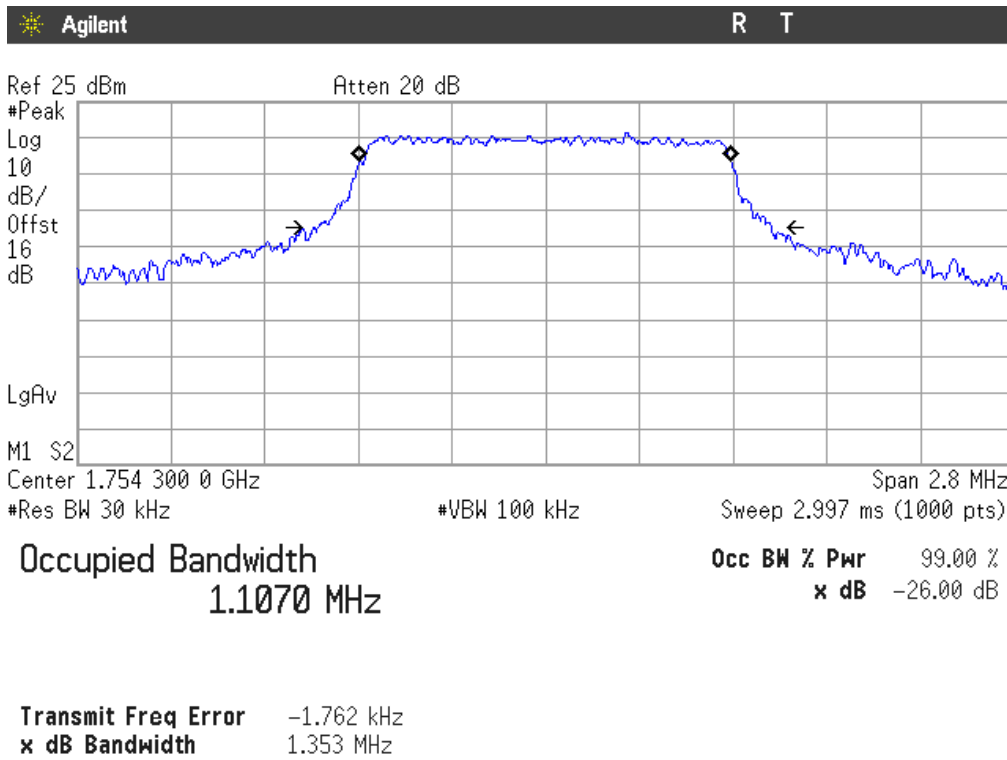
Lowest Channel



Middle Channel

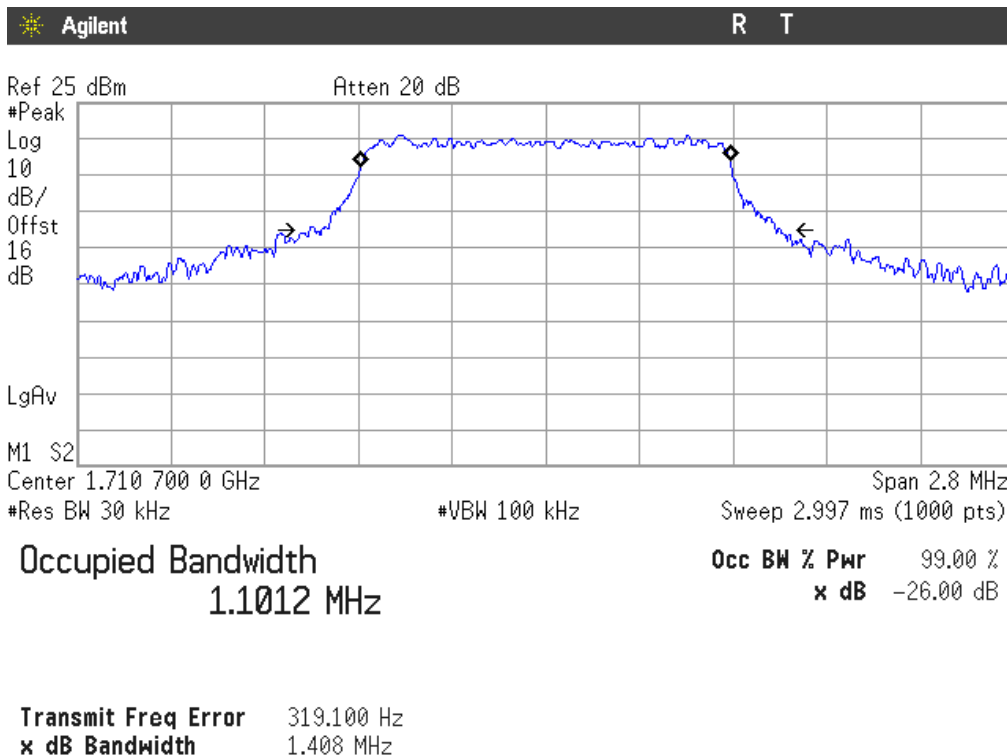


Highest Channel

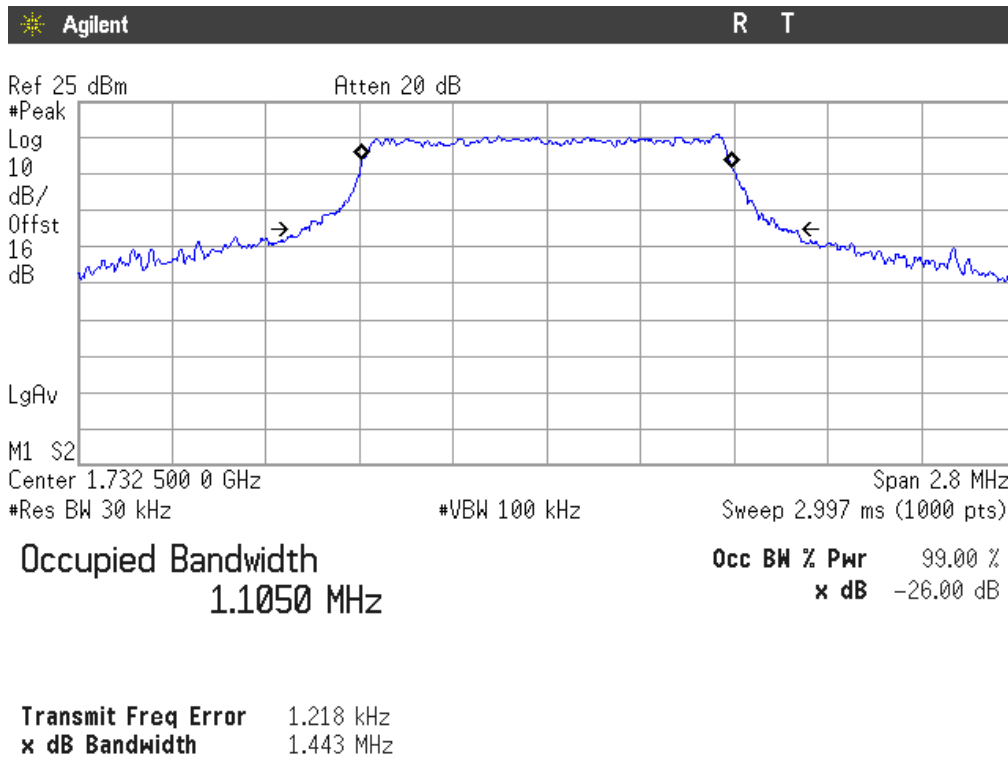


LTE 16QAM MODULATION. BW = 1.4 MHz (Band IV)

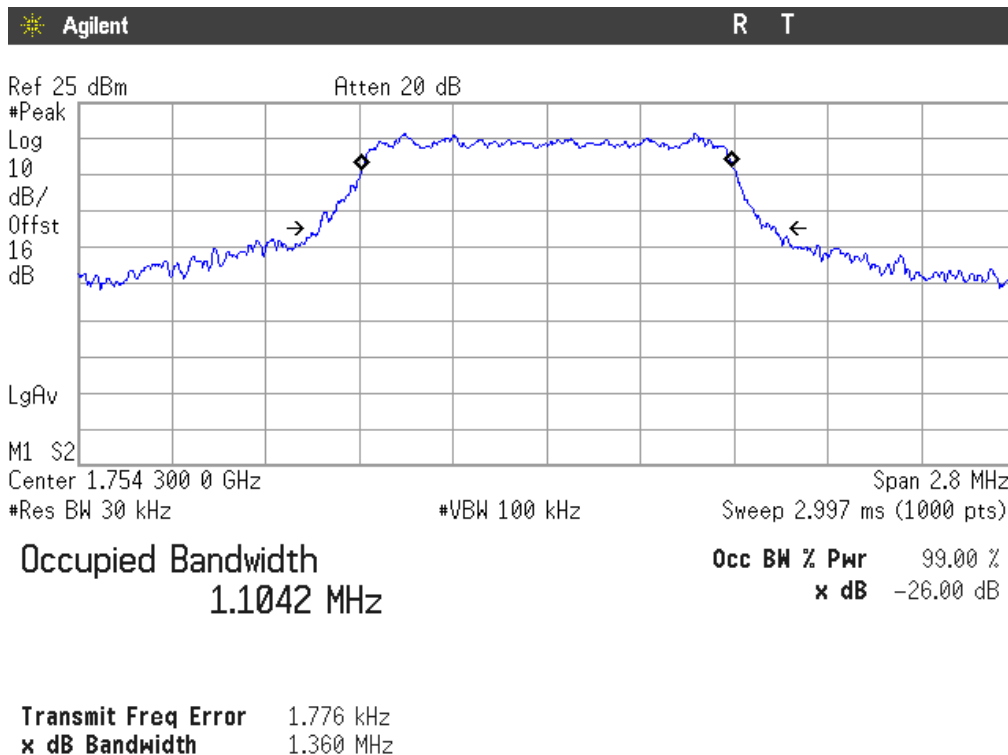
Lowest Channel



Middle Channel

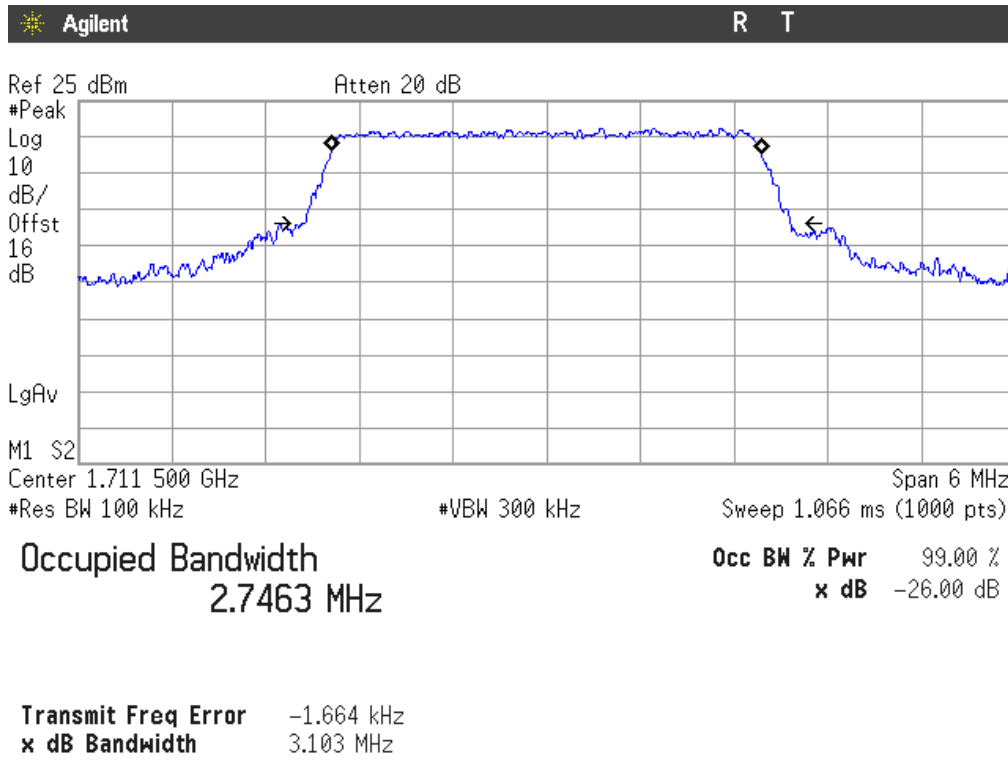


Highest Channel

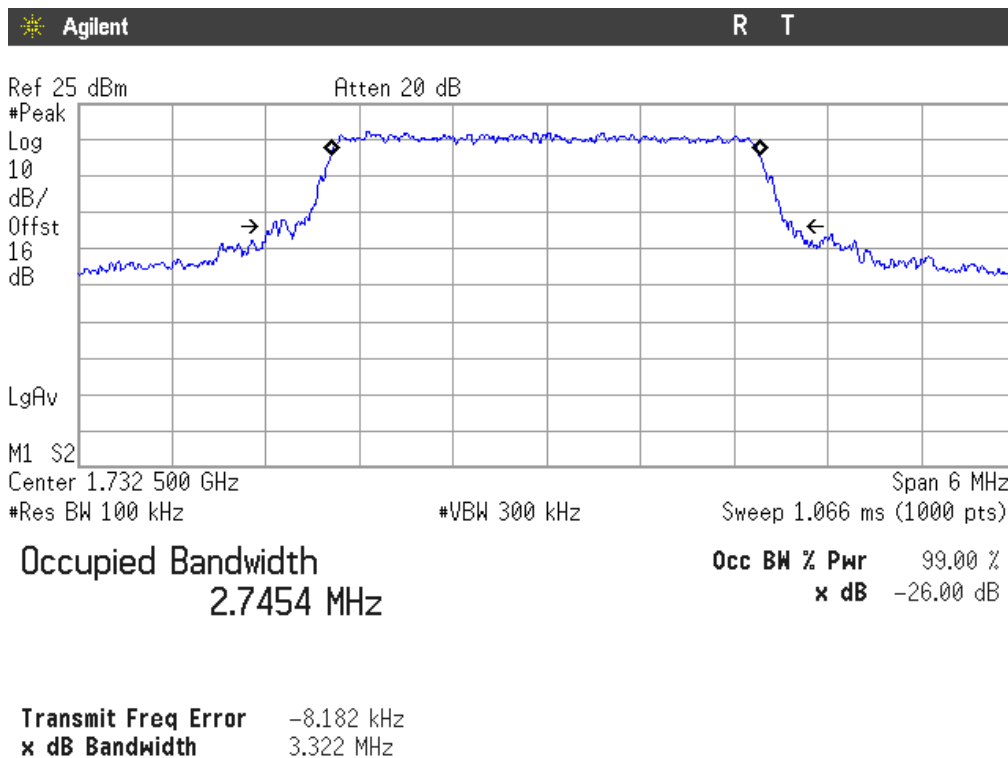


LTE QPSK MODULATION. BW = 3 MHz (Band IV)

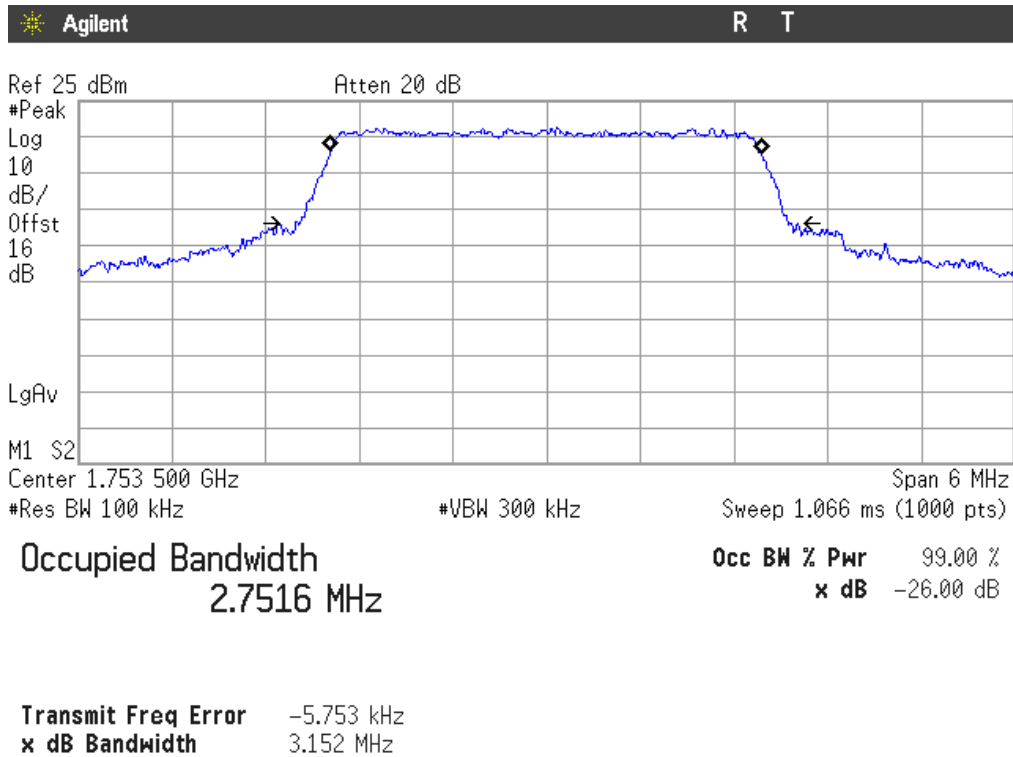
Lowest Channel



Middle Channel

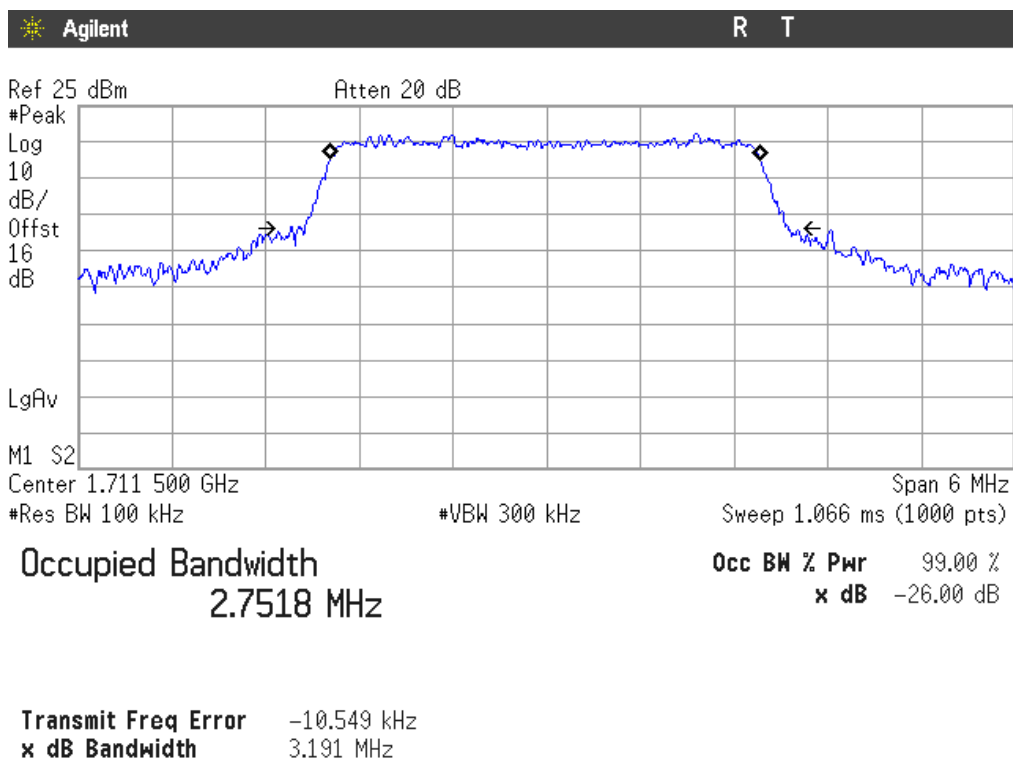


Highest Channel

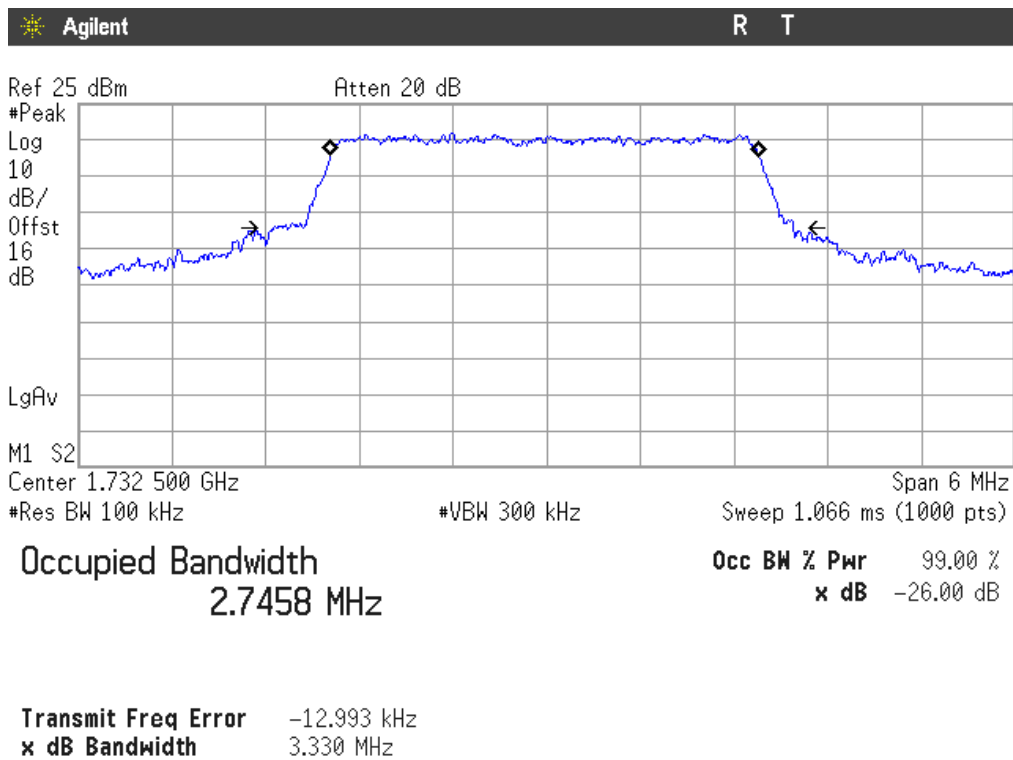


LTE 16QAM MODULATION. BW = 3 MHz (Band IV)

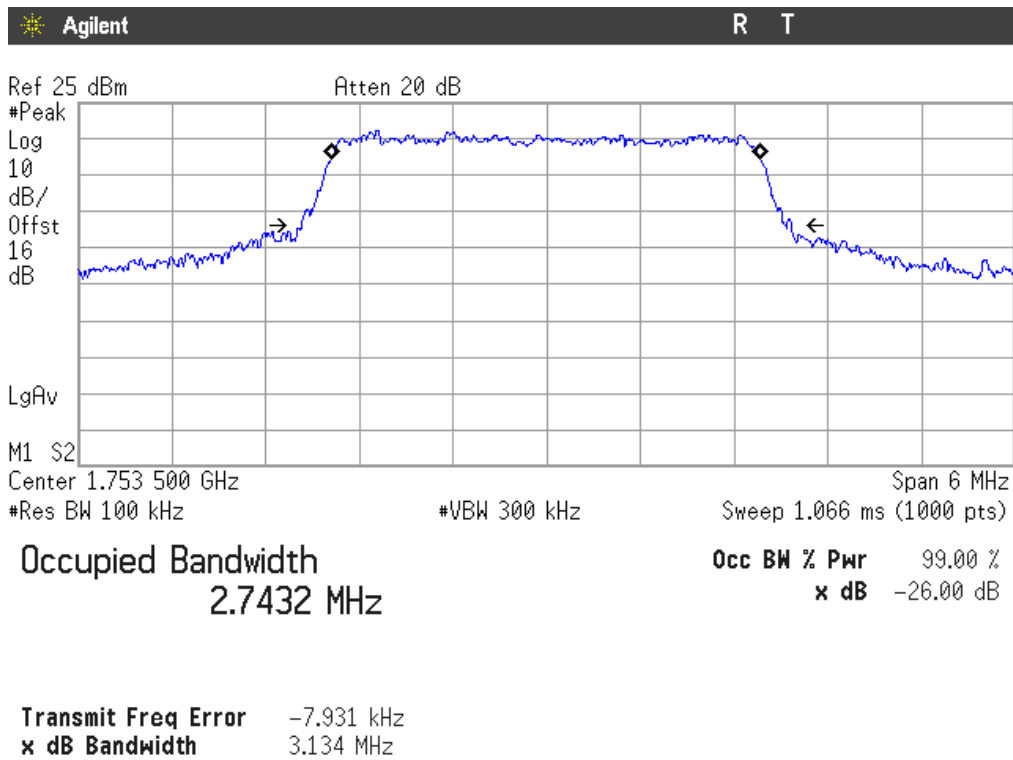
Lowest Channel



Middle Channel

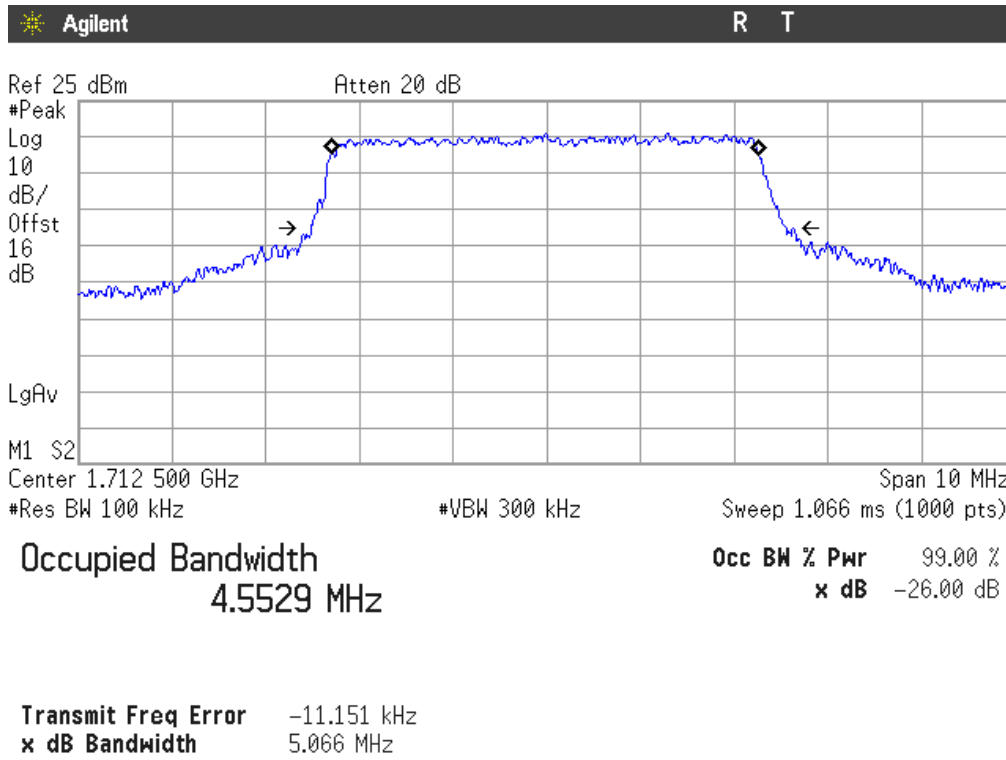


Highest Channel

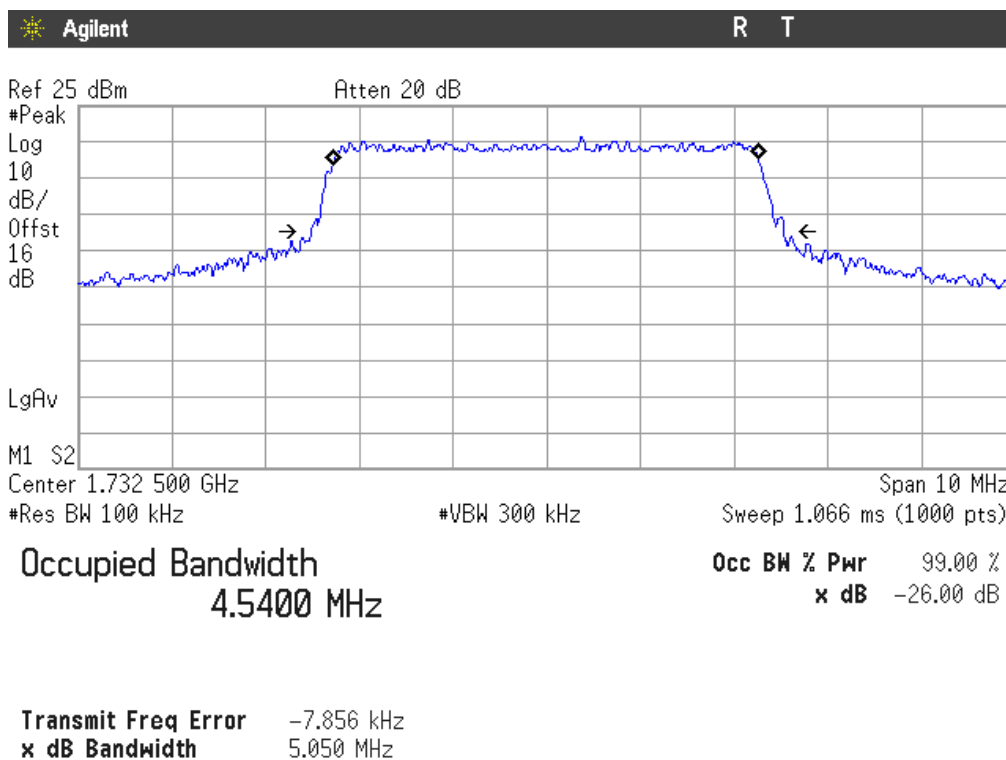


LTE QPSK MODULATION. BW = 5 MHz (Band IV)

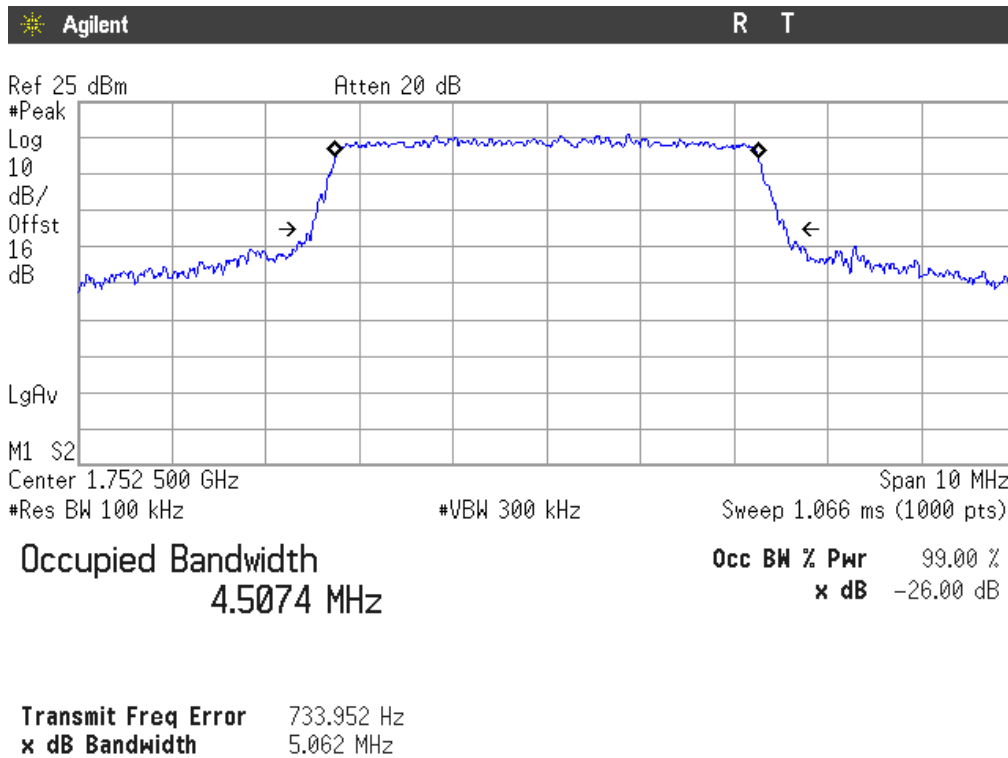
Lowest Channel



Middle Channel

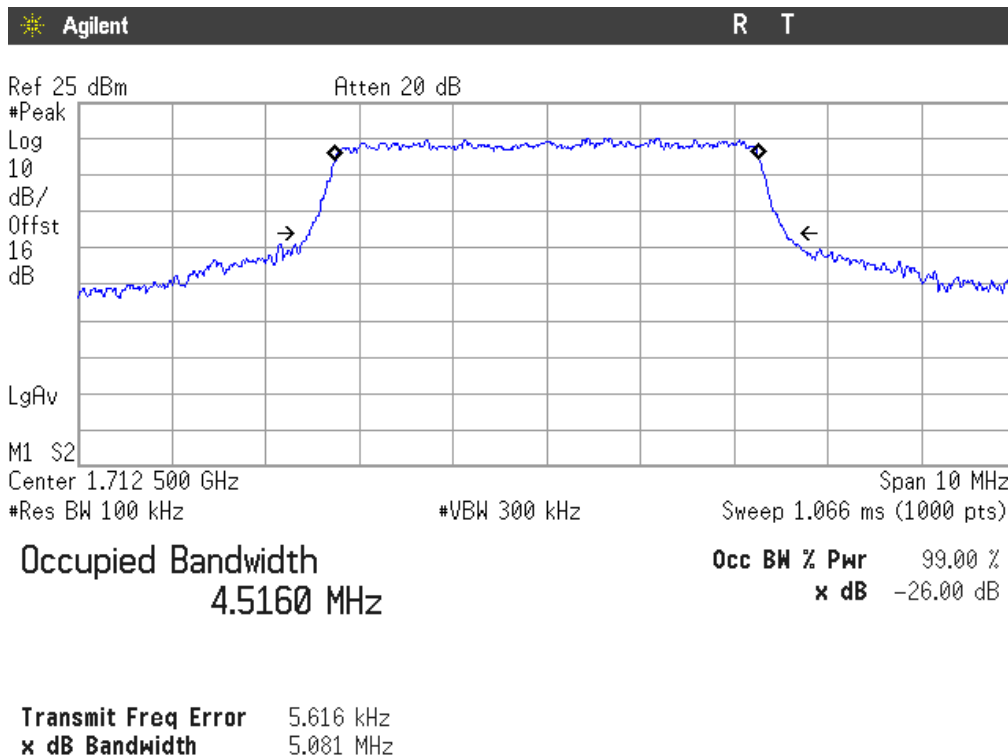


Highest Channel

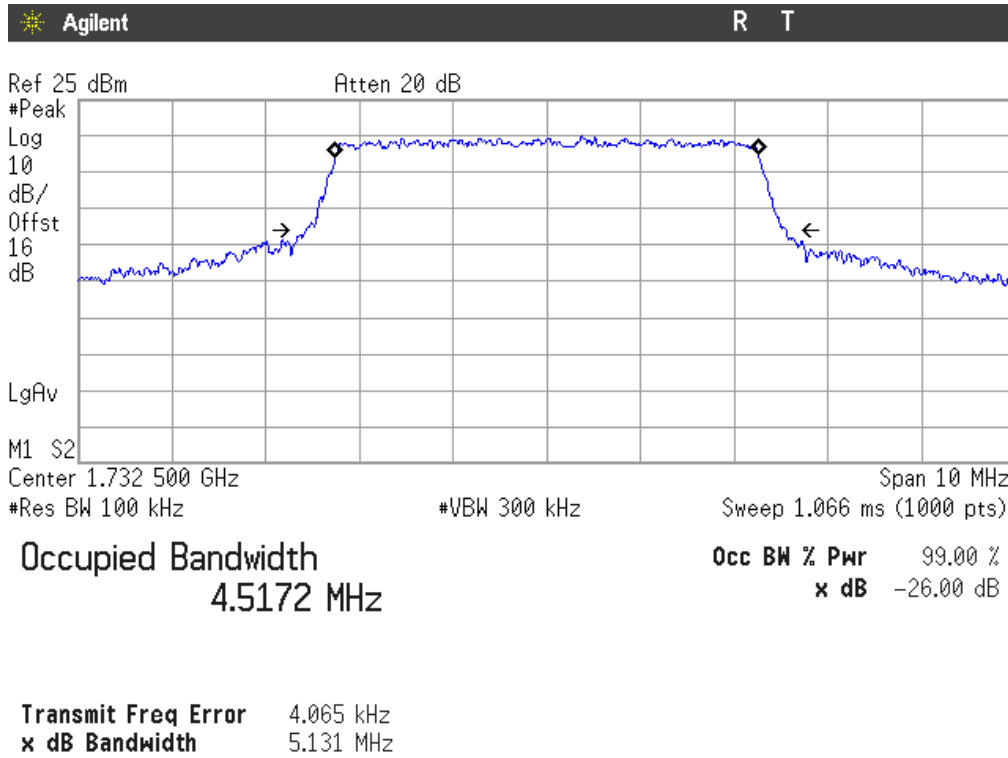


LTE 16QAM MODULATION. BW = 5 MHz (Band IV)

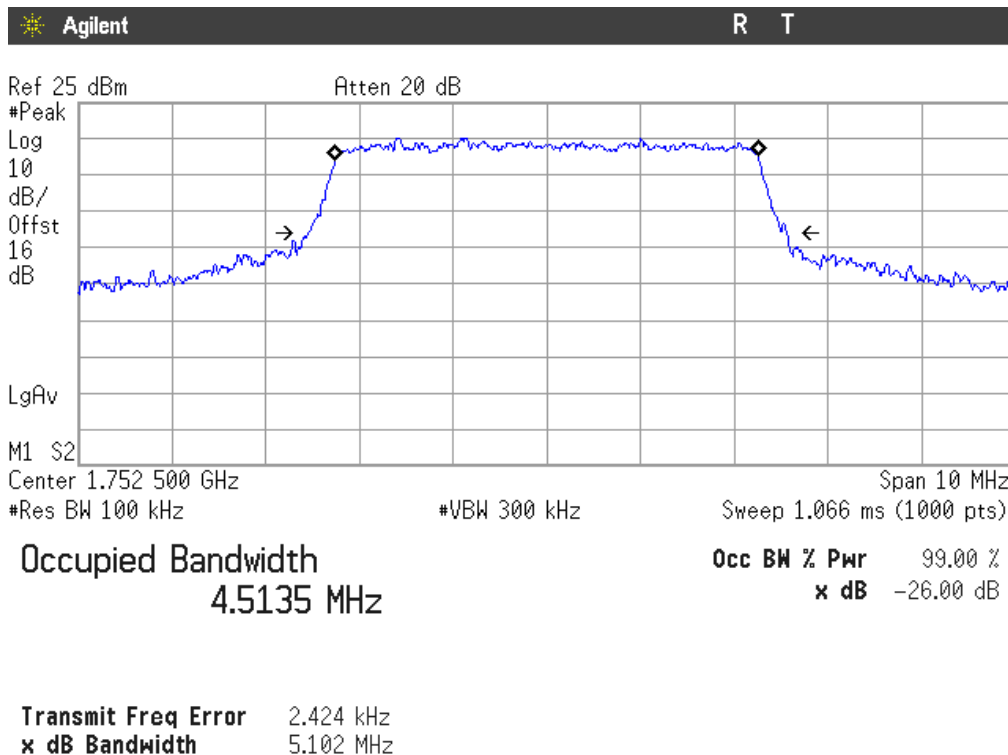
Lowest Channel



Middle Channel

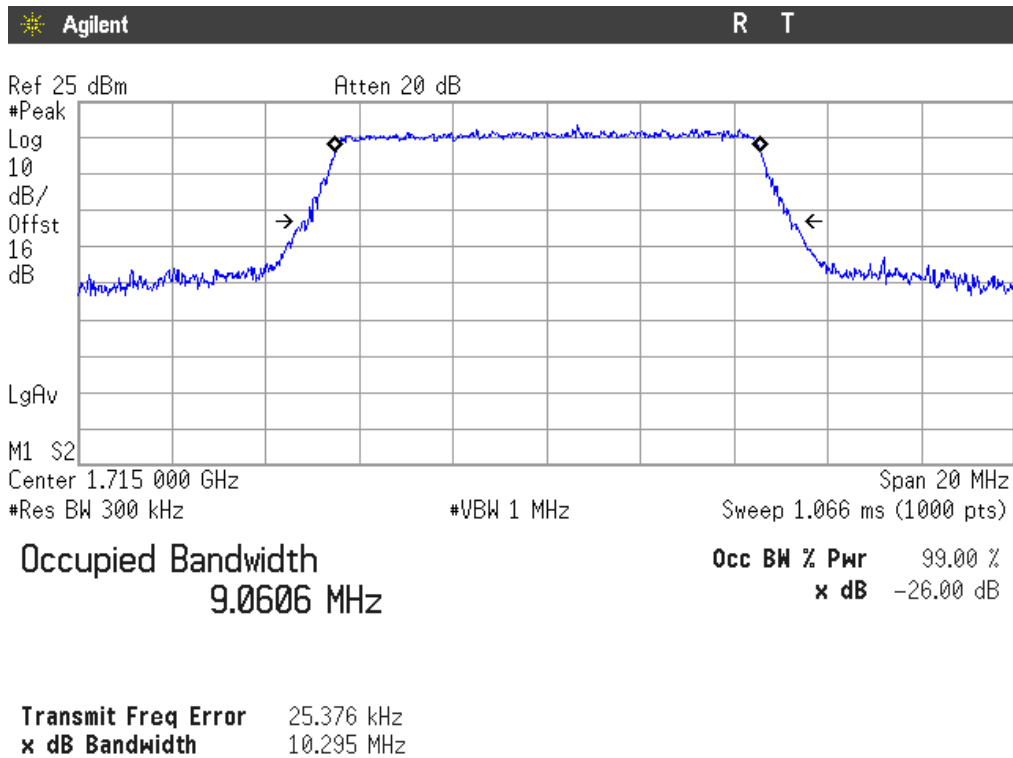


Highest Channel

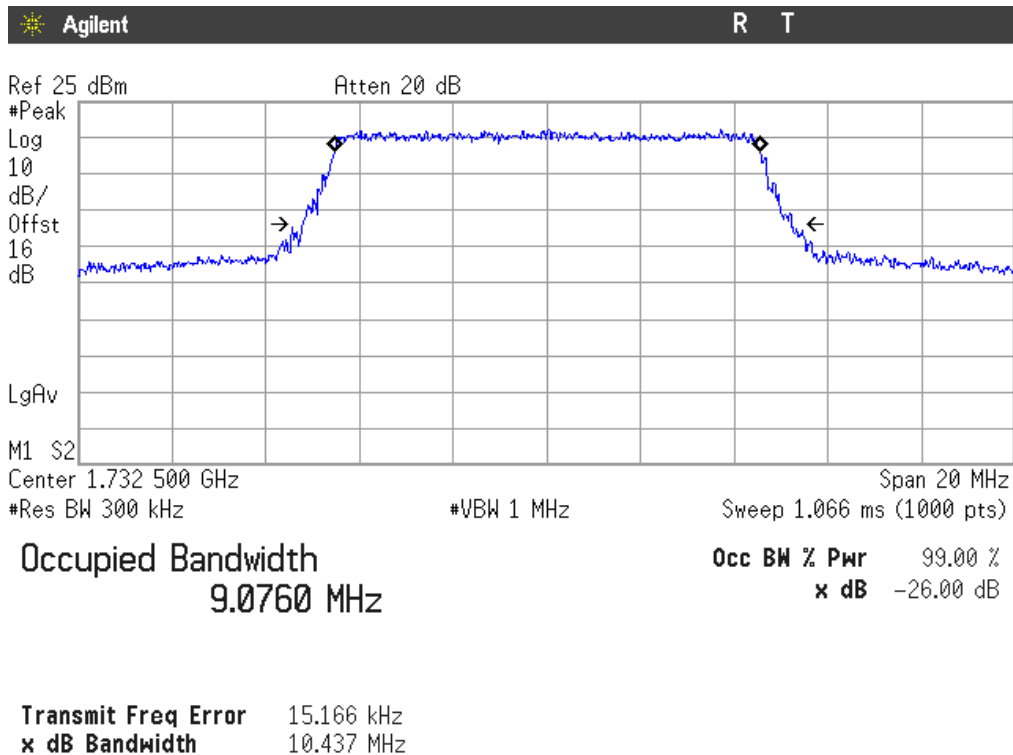


LTE QPSK MODULATION. BW = 10 MHz (Band IV)

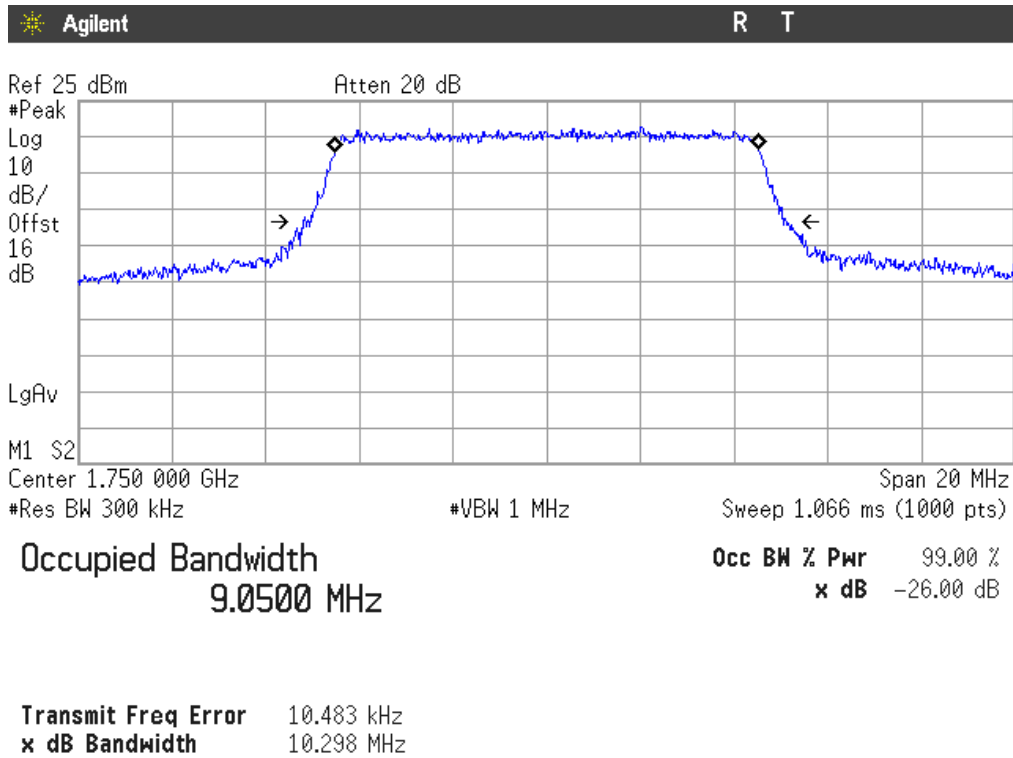
Lowest Channel



Middle Channel

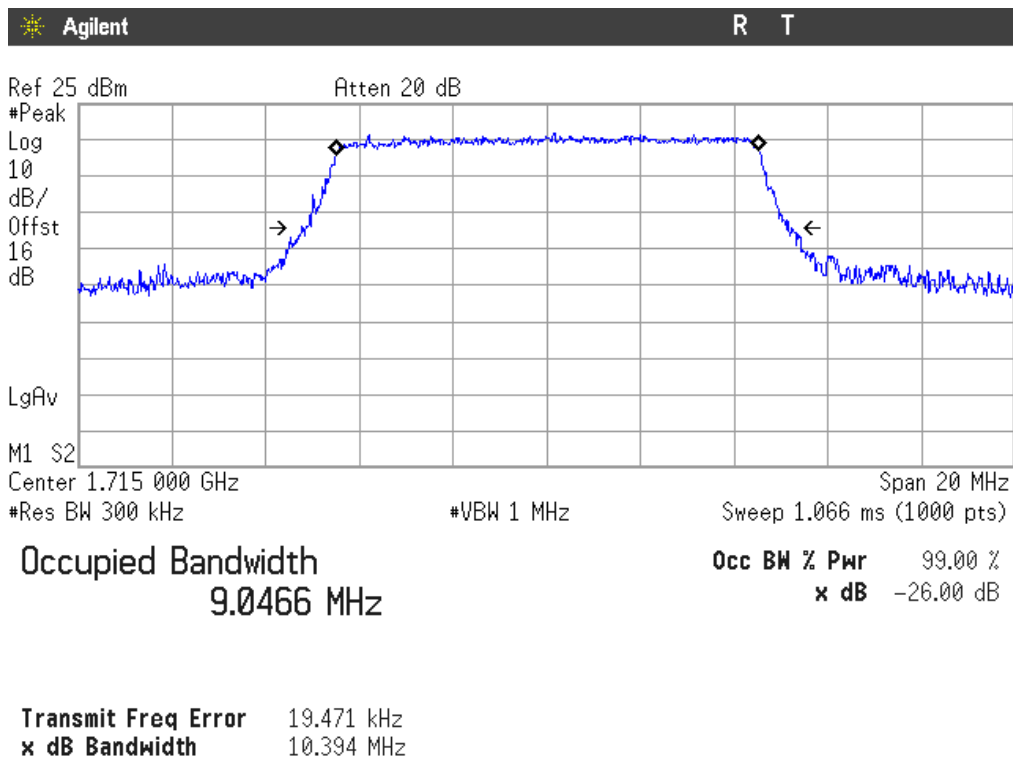


Highest Channel

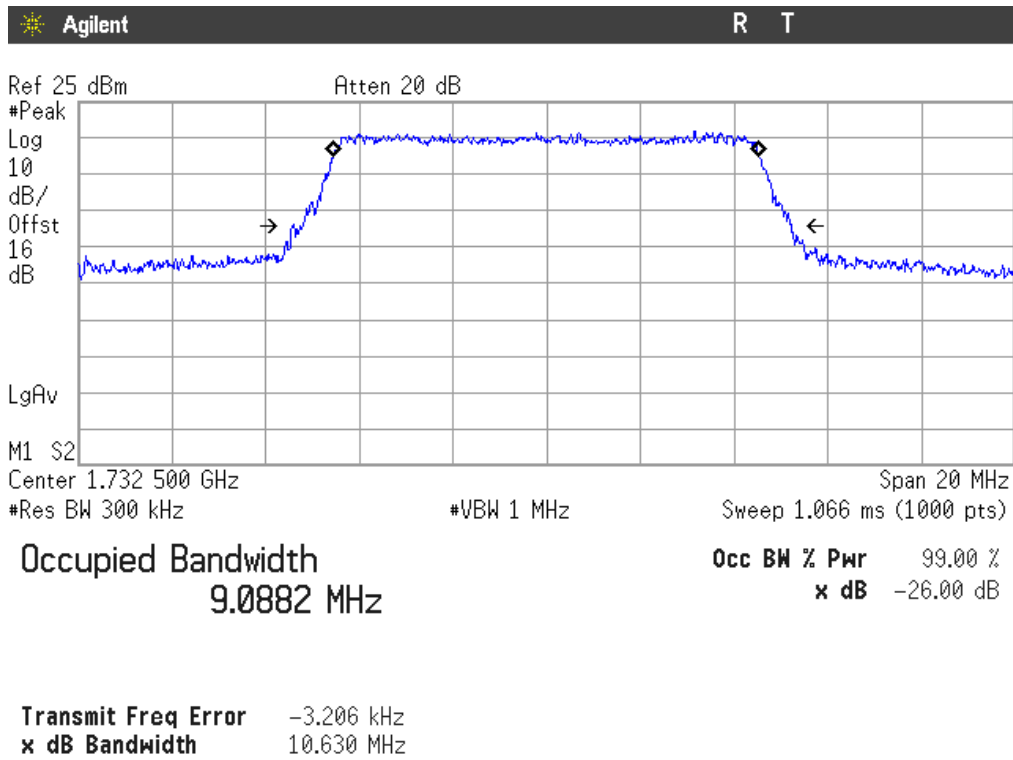


LTE 16QAM MODULATION. BW = 10 MHz (Band IV)

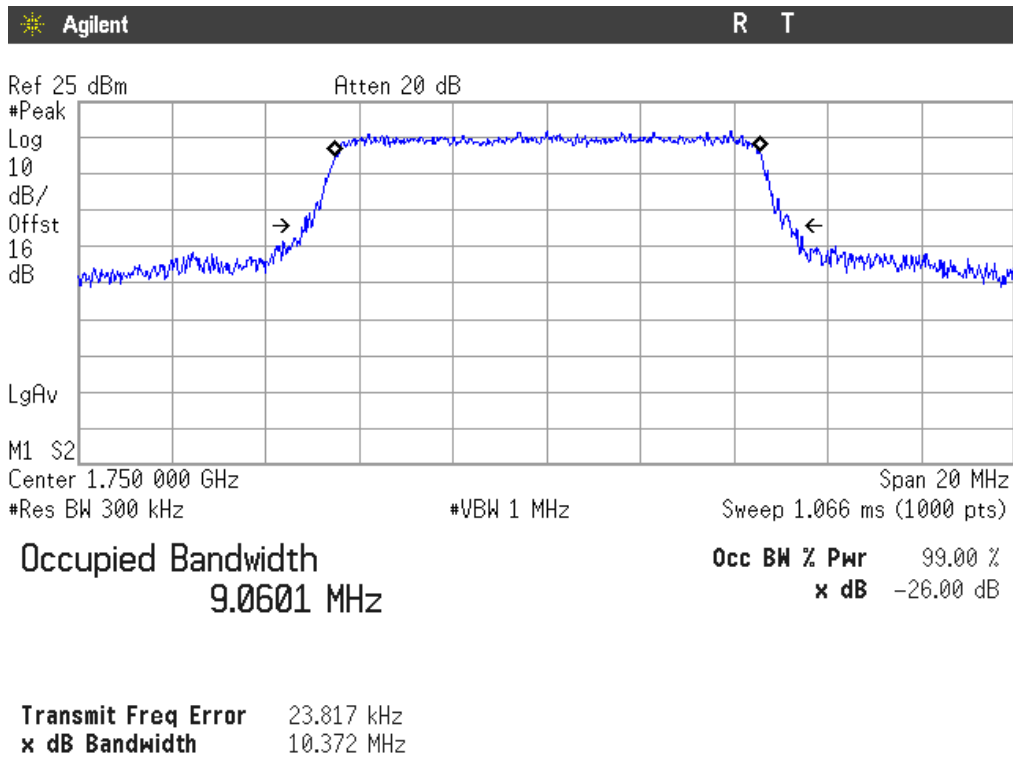
Lowest Channel



Middle Channel

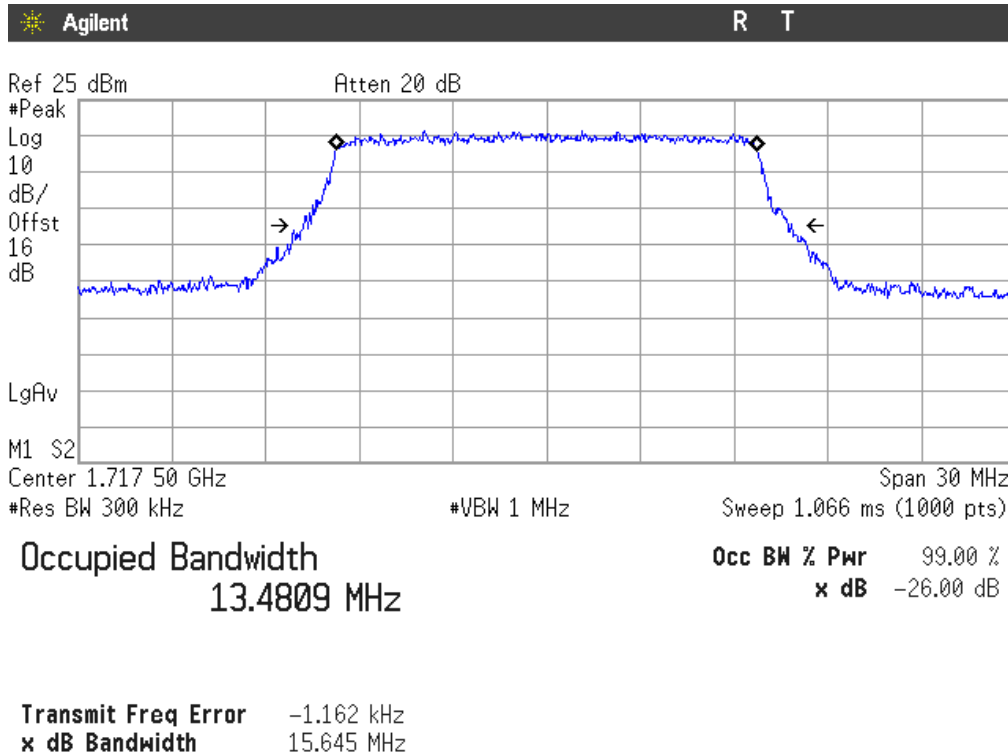


Highest Channel

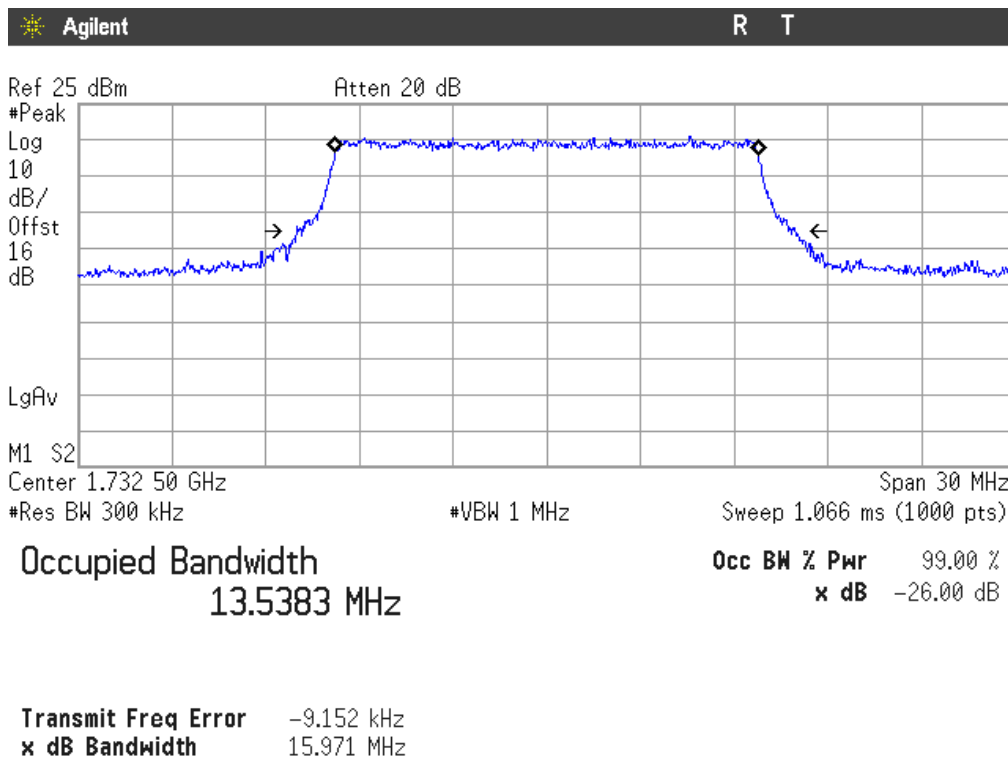


LTE QPSK MODULATION. BW = 15 MHz (Band IV)

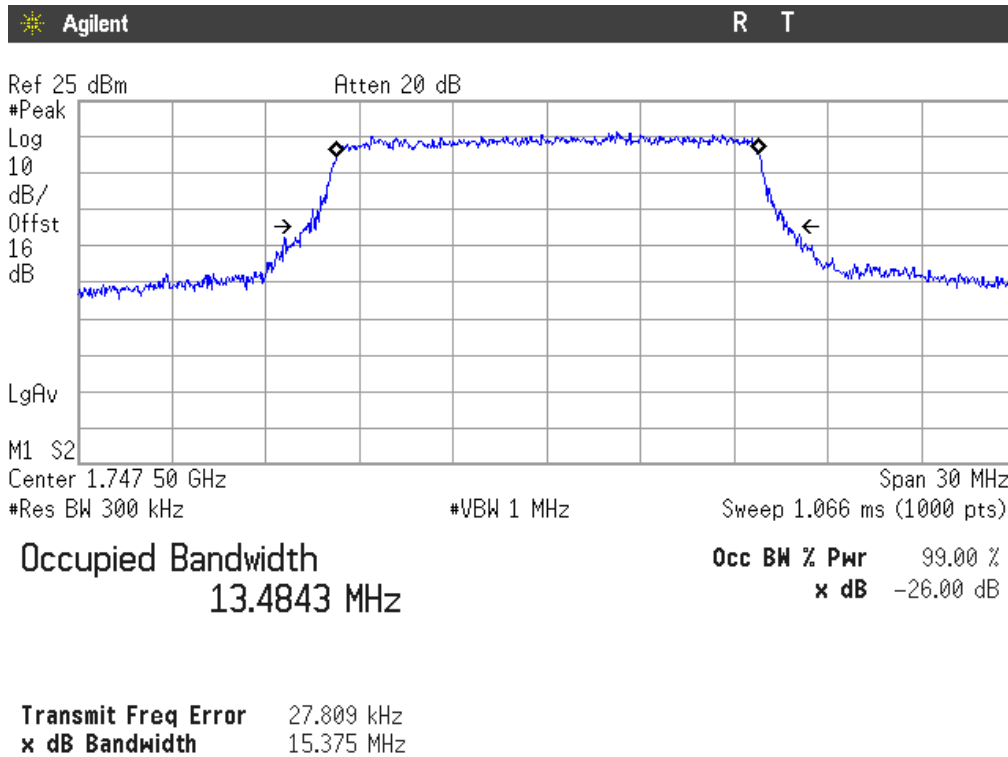
Lowest Channel



Middle Channel

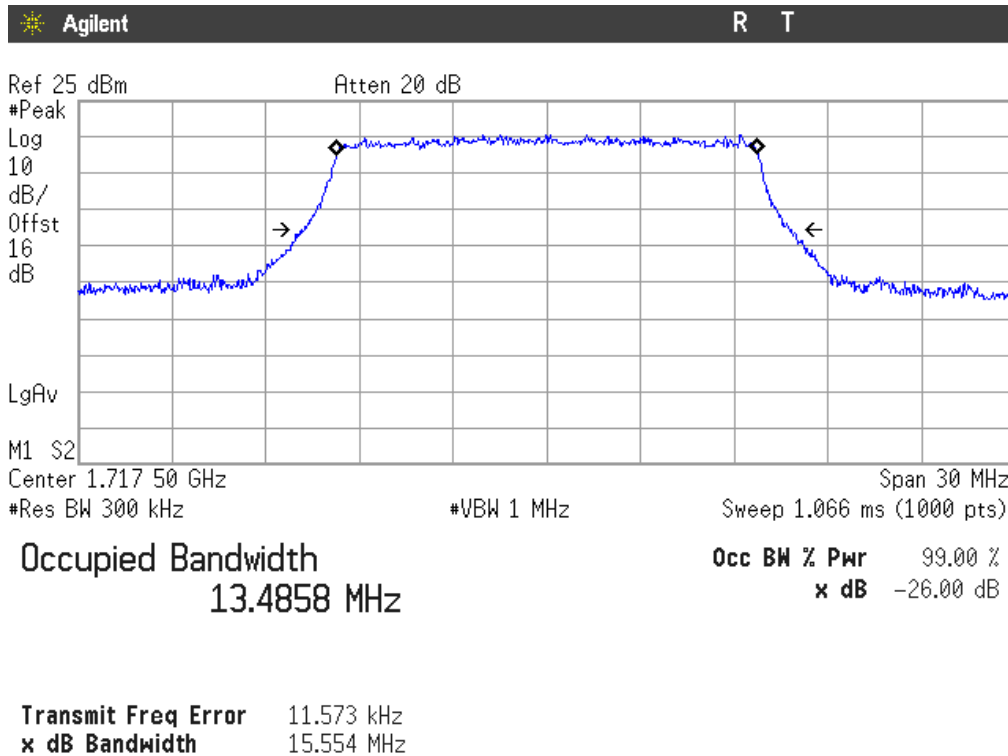


Highest Channel

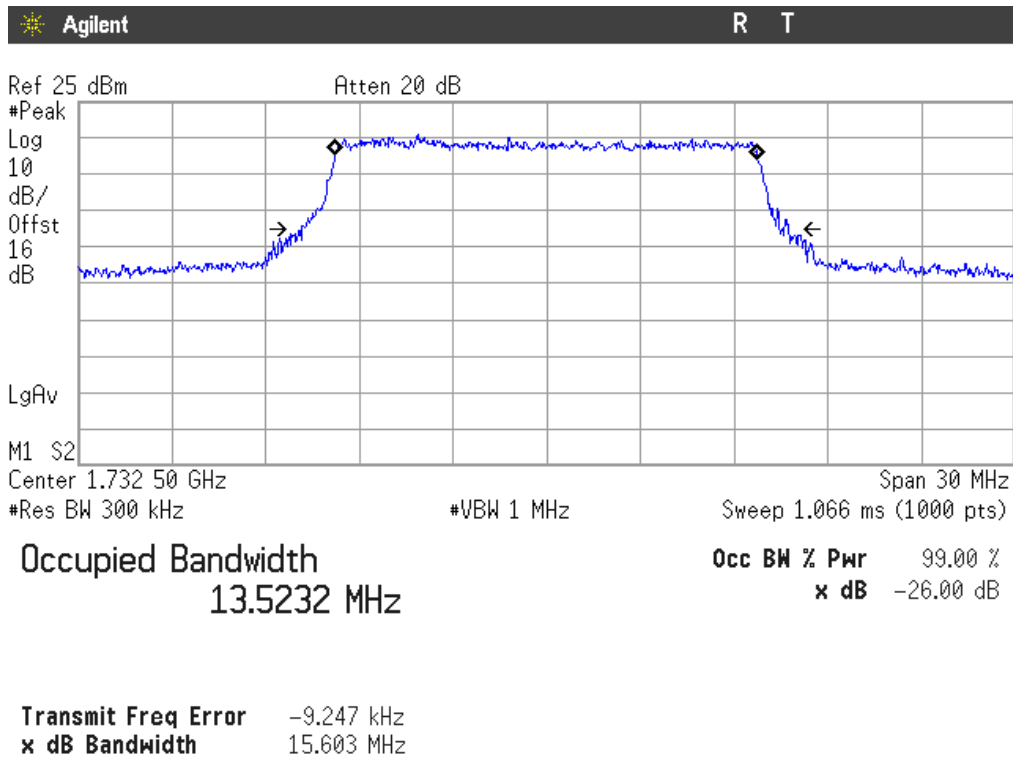


LTE 16QAM MODULATION. BW = 15 MHz (Band IV)

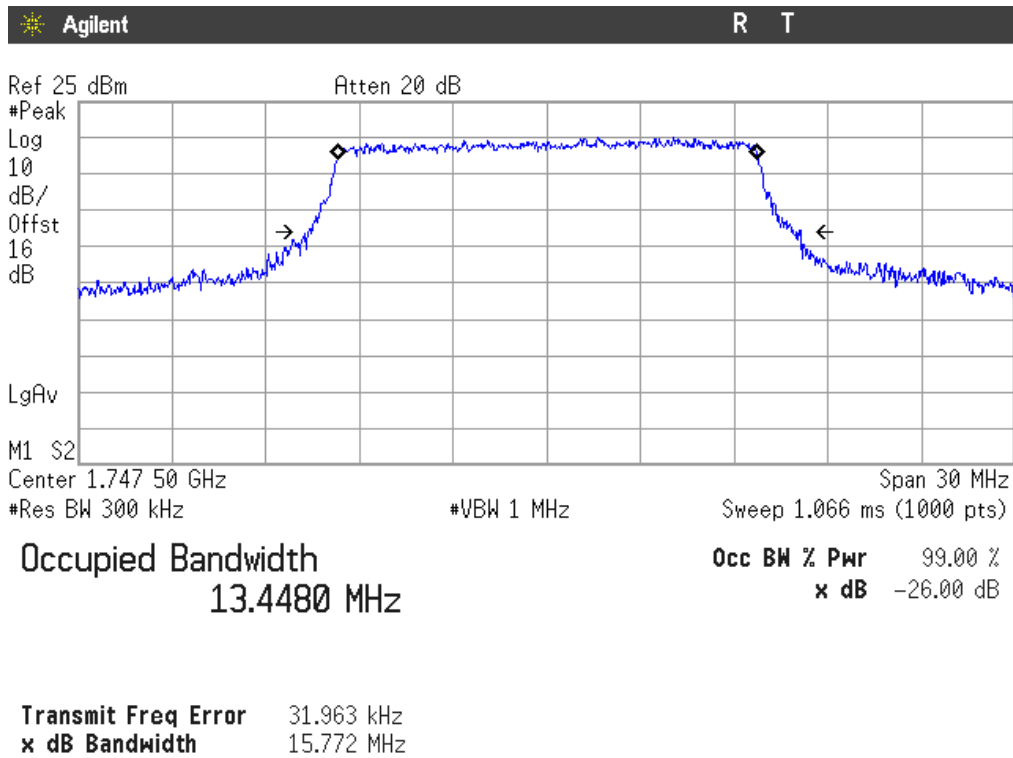
Lowest Channel



Middle Channel

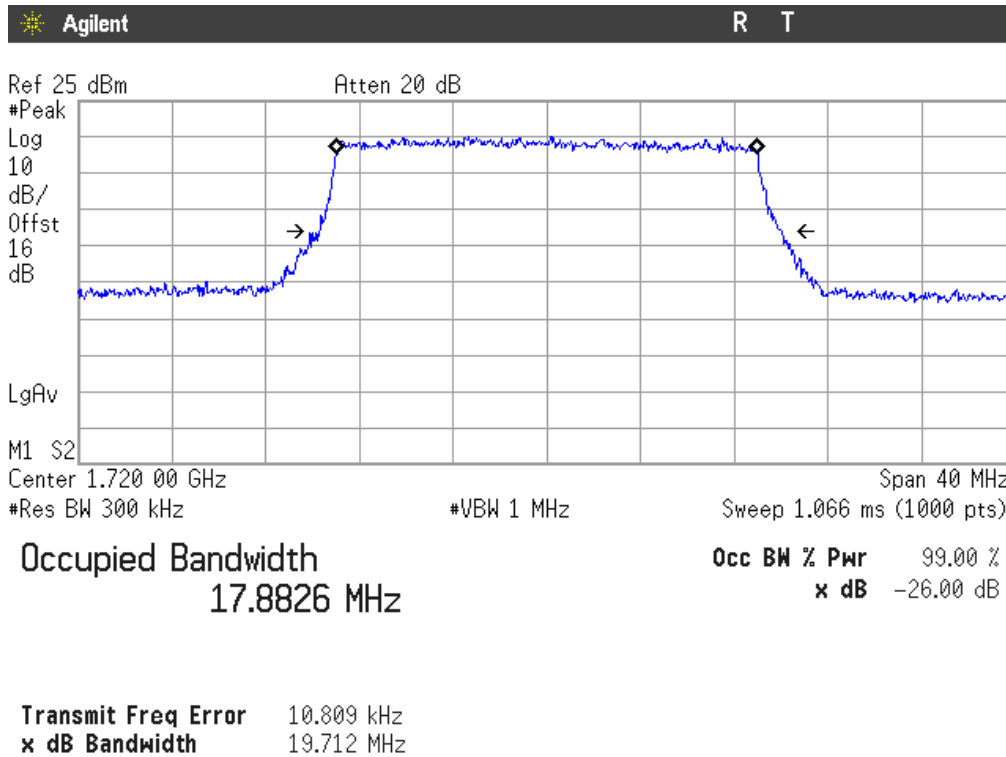


Highest Channel

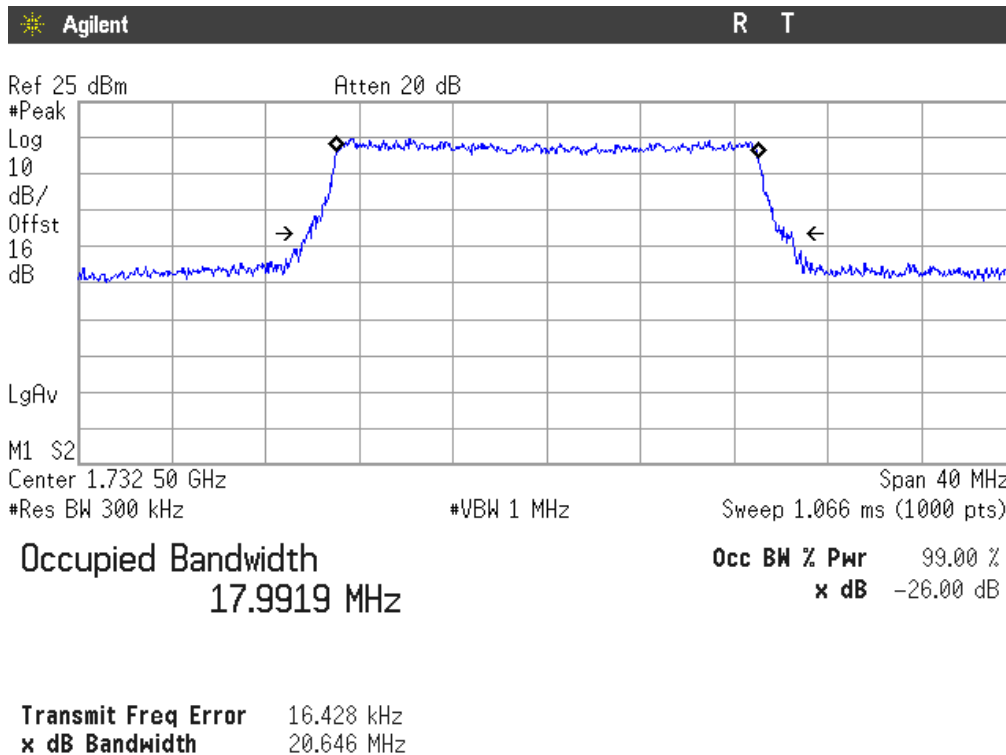


LTE QPSK MODULATION. BW = 20 MHz (Band IV)

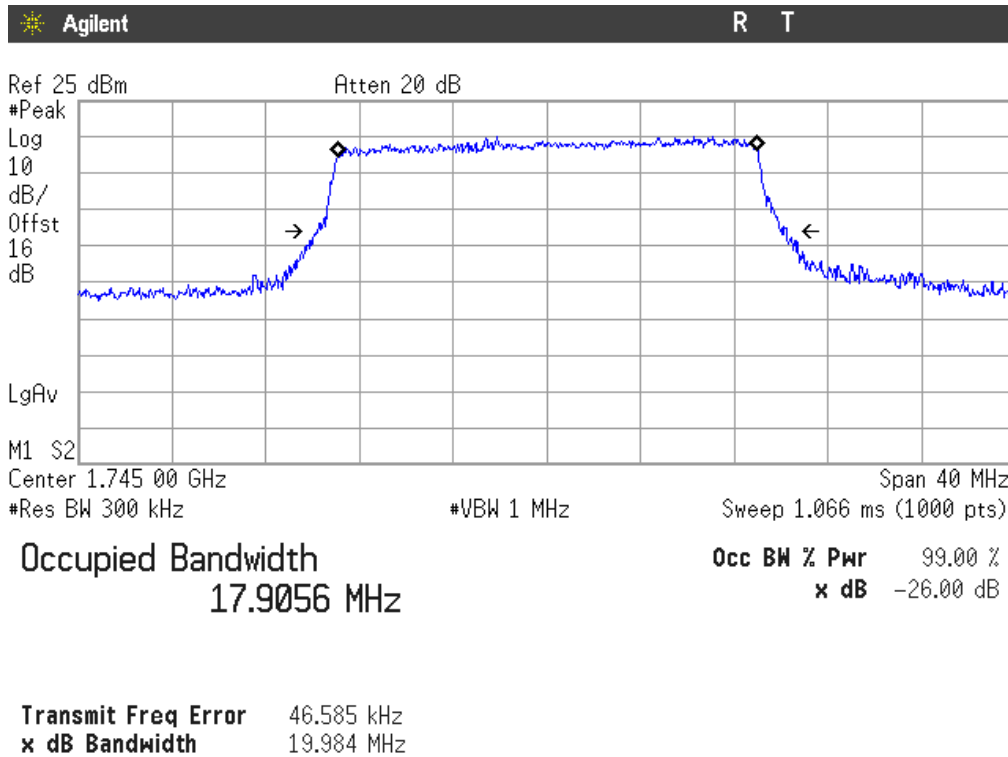
Lowest Channel



Middle Channel

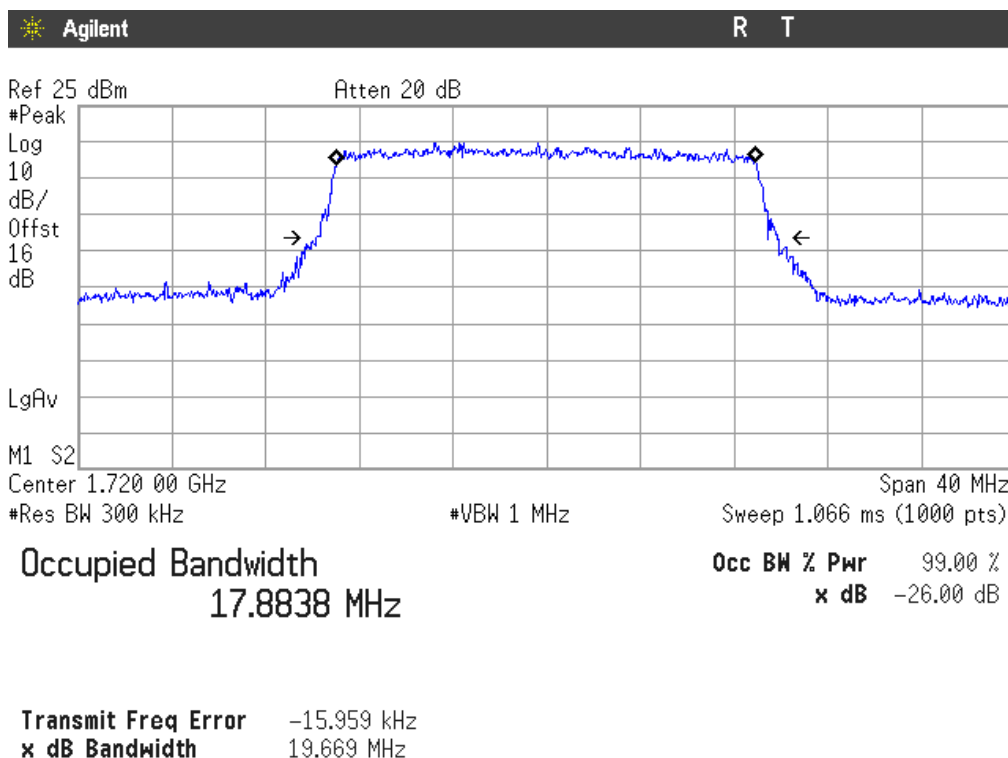


Highest Channel

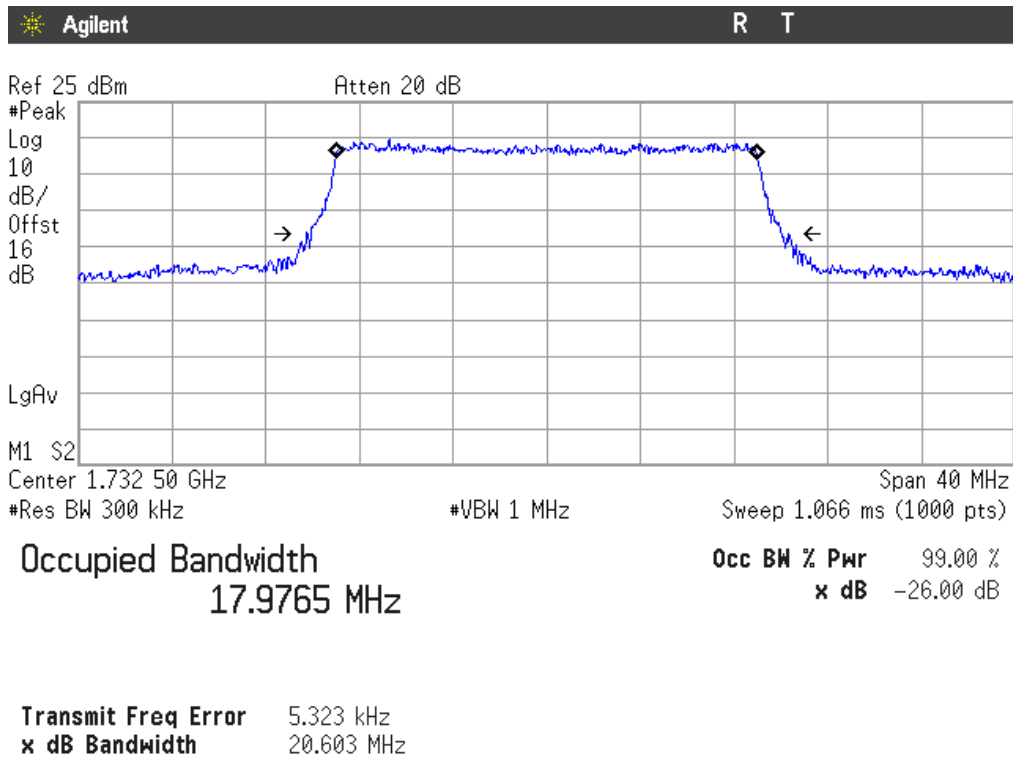


LTE 16QAM MODULATION. BW = 20 MHz (Band IV)

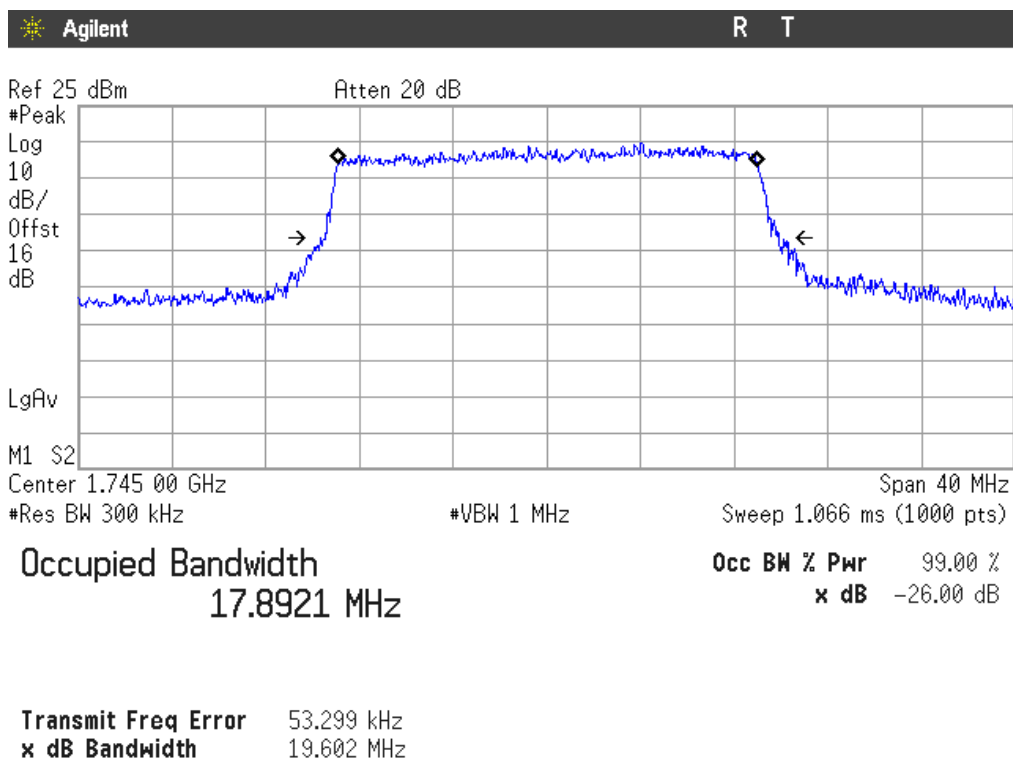
Lowest Channel



Middle Channel

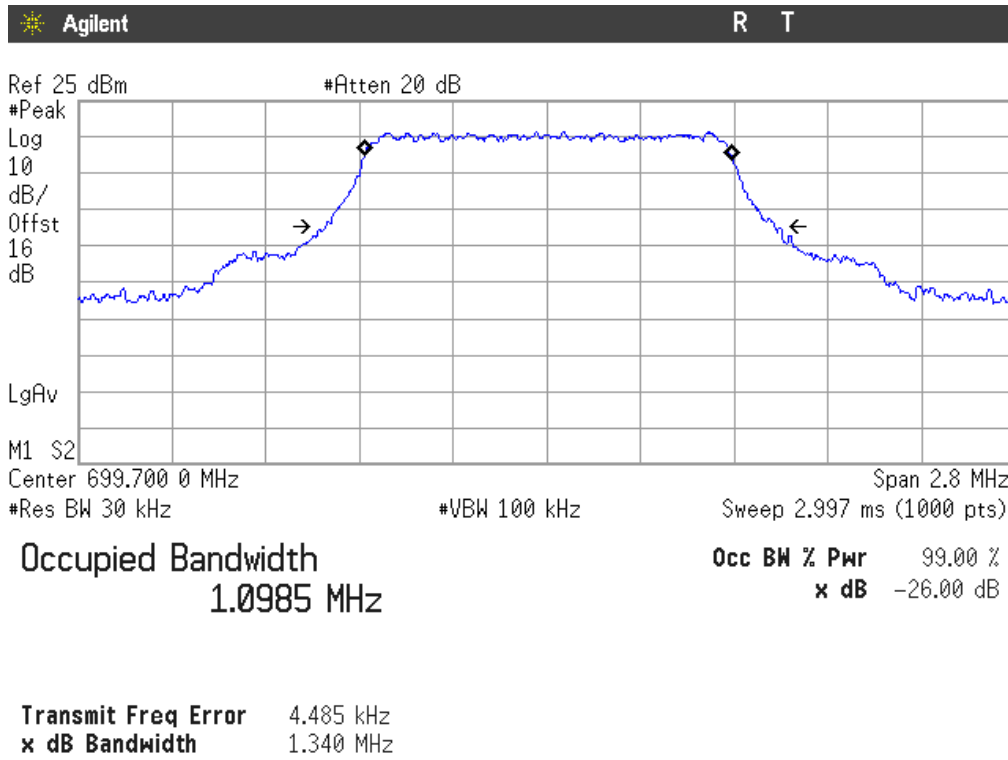


Highest Channel

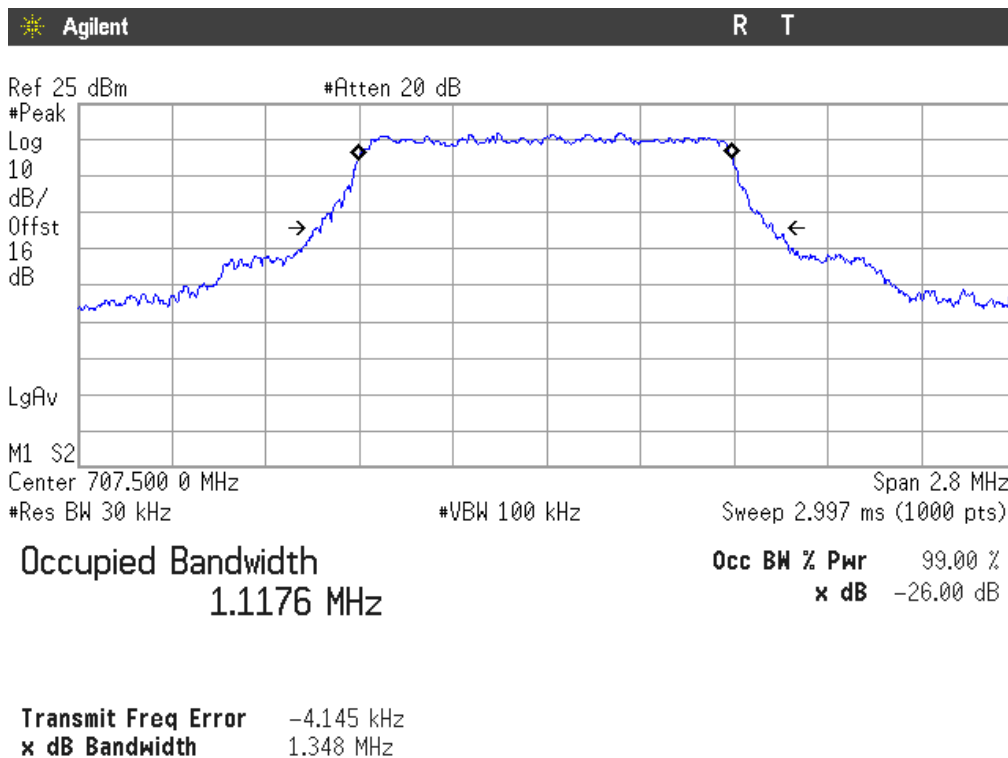


LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)

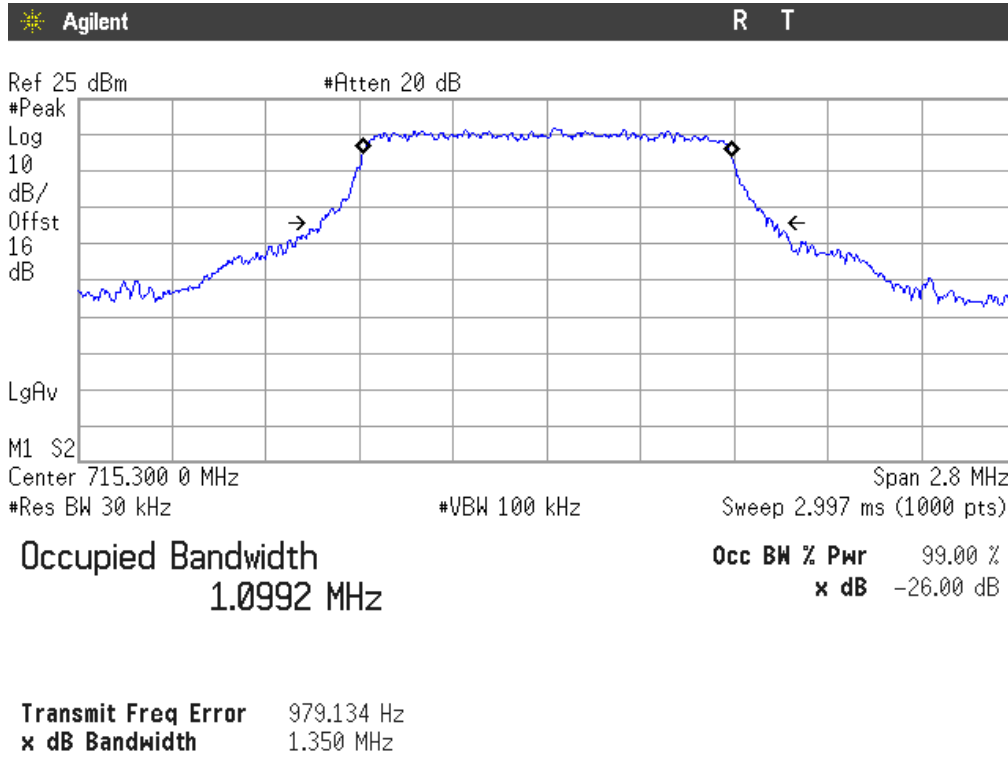
Lowest Channel



Middle Channel

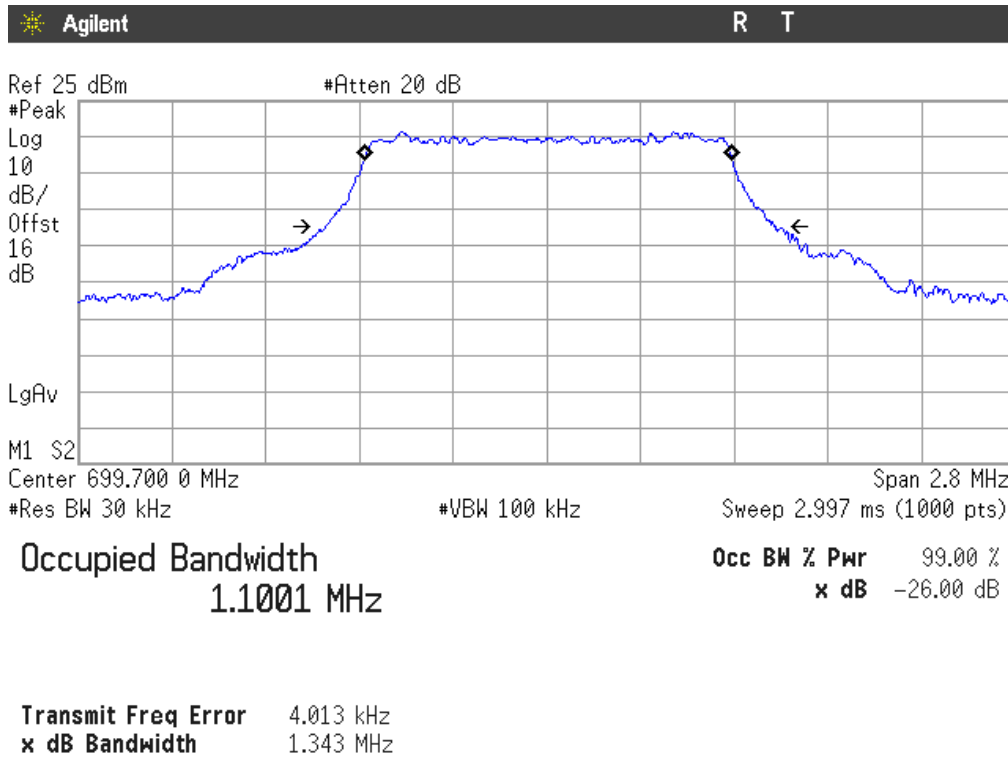


Highest Channel

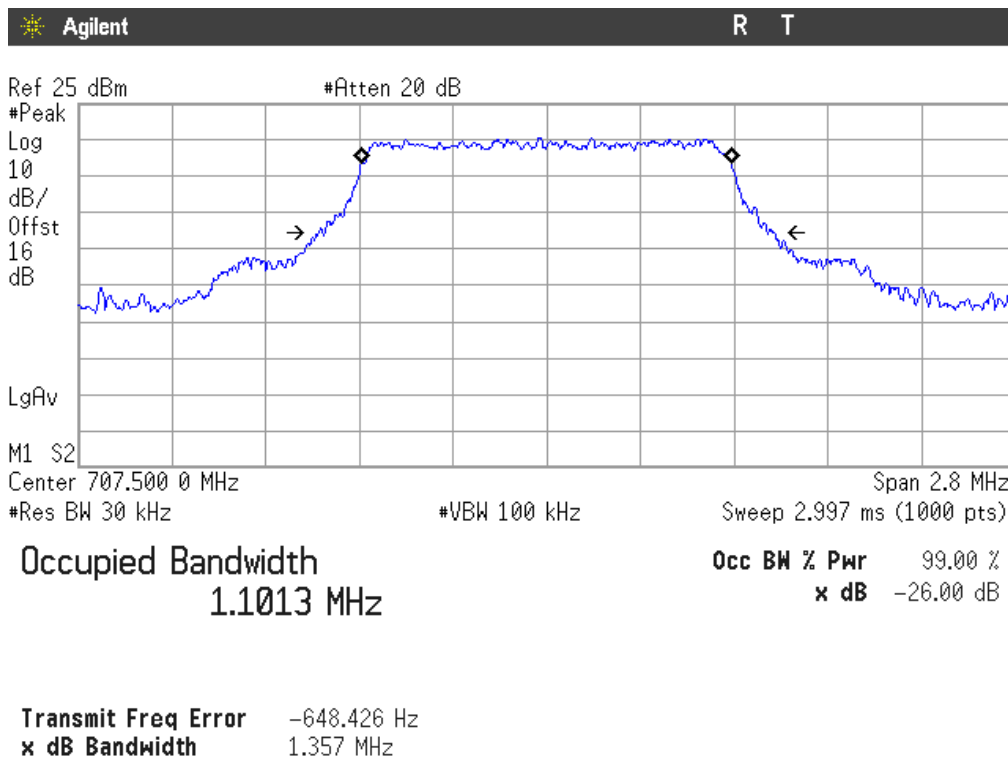


LTE 16QAM MODULATION. BW = 1.4 MHz (Band XII)

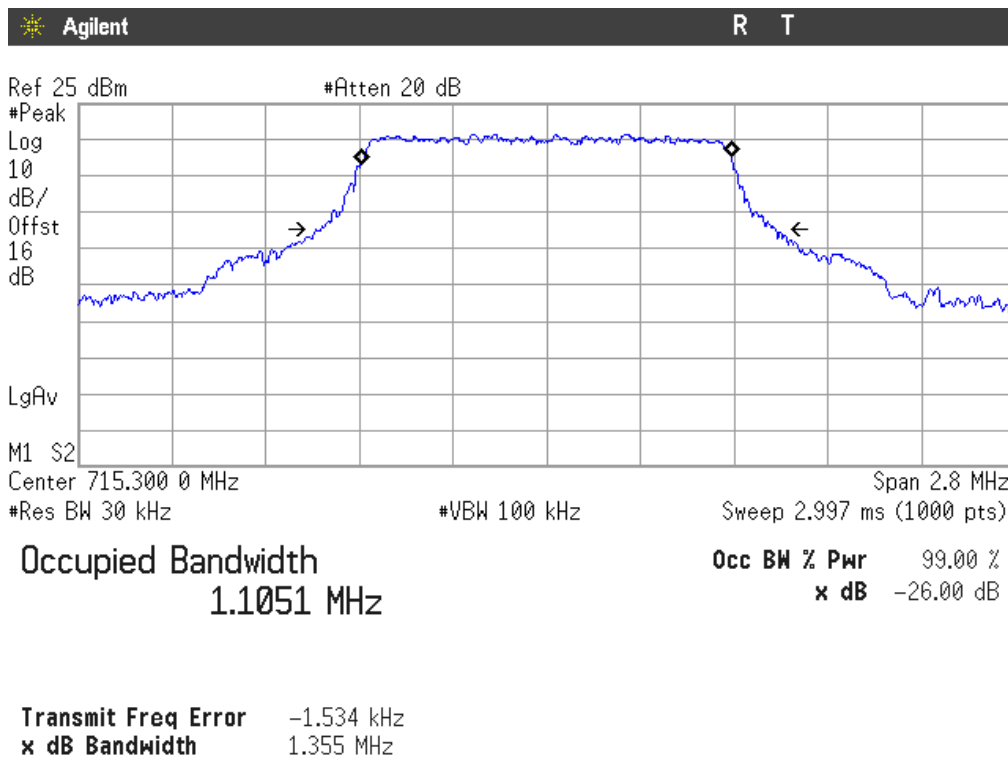
Lowest Channel



Middle Channel

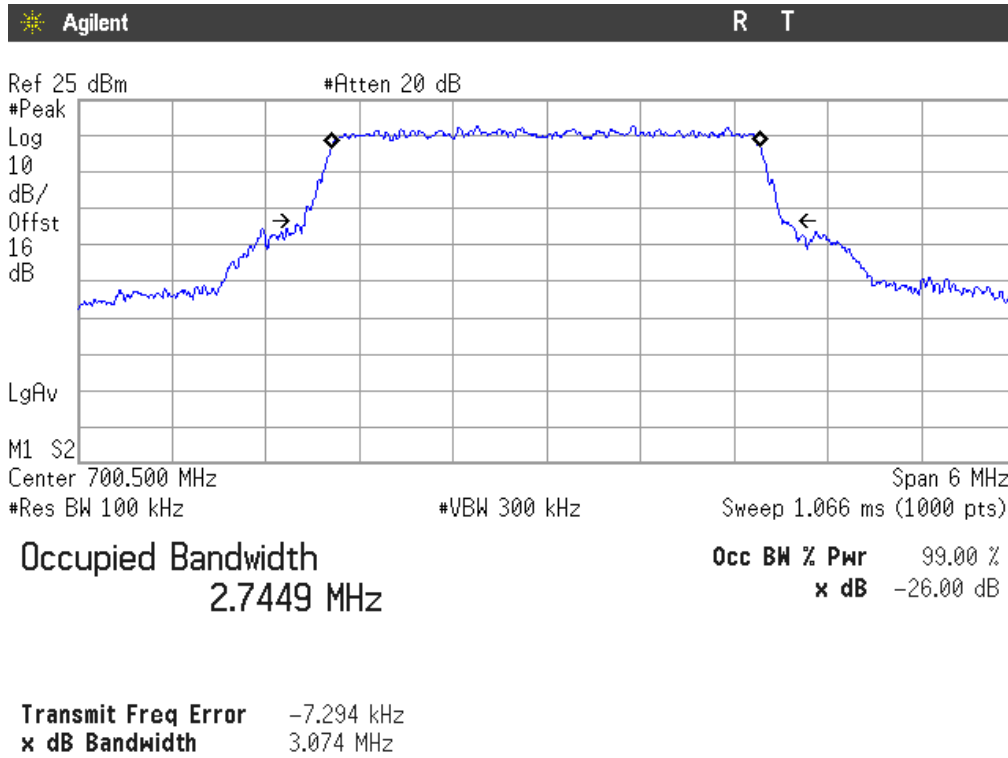


Highest Channel

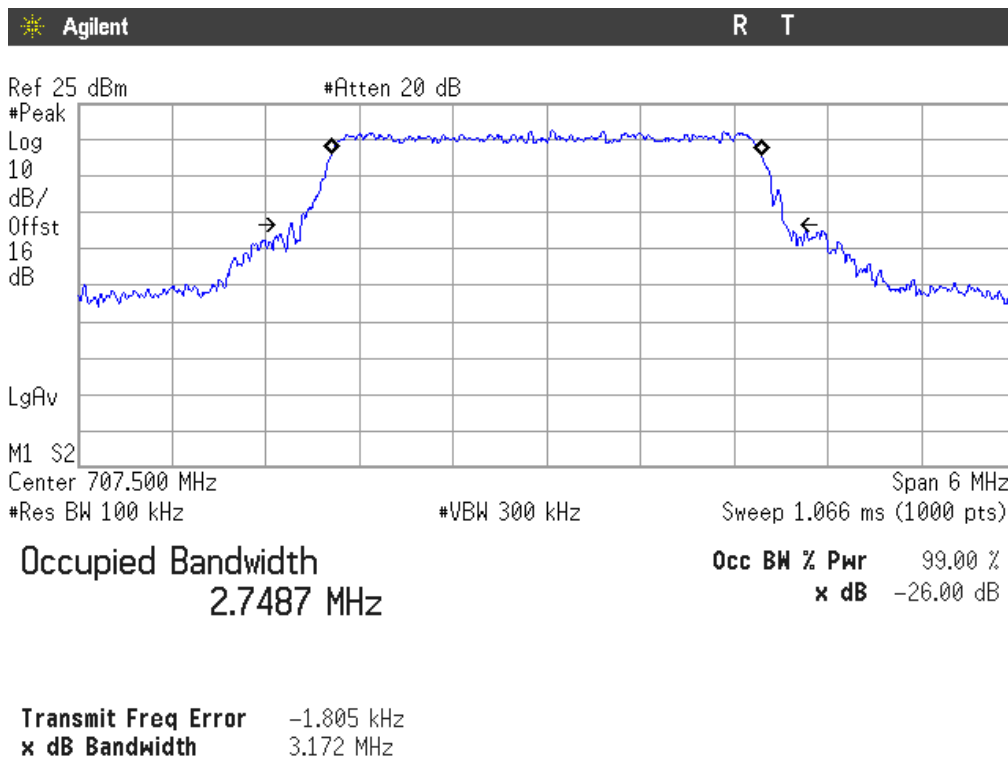


LTE QPSK MODULATION. BW = 3 MHz (Band XII)

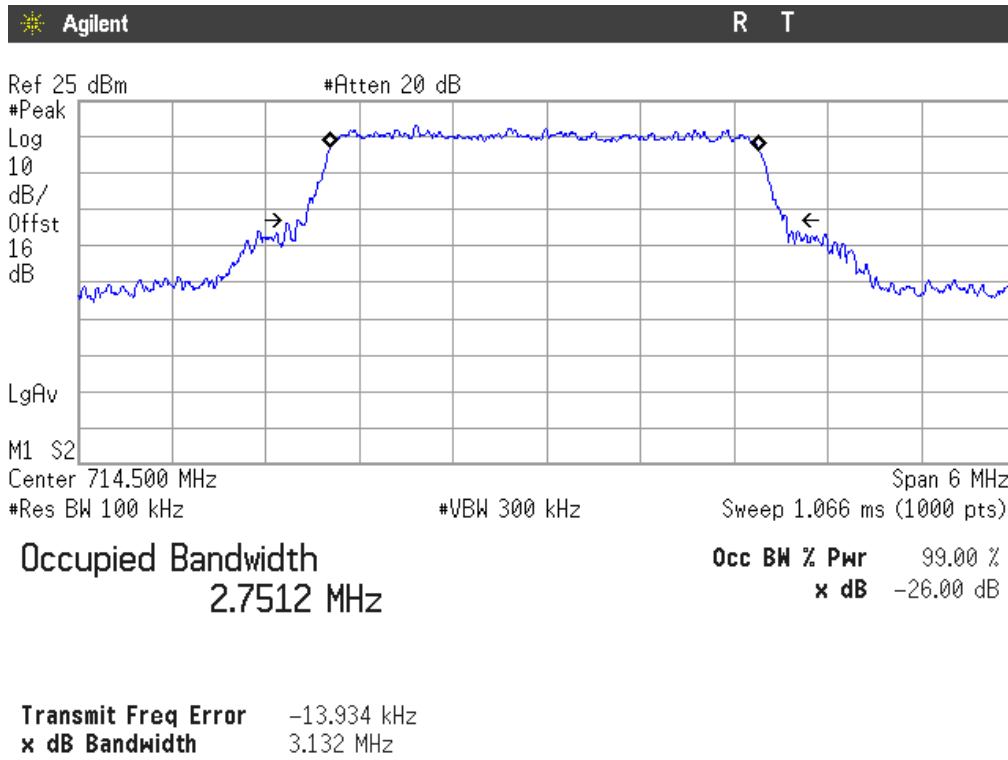
Lowest Channel



Middle Channel

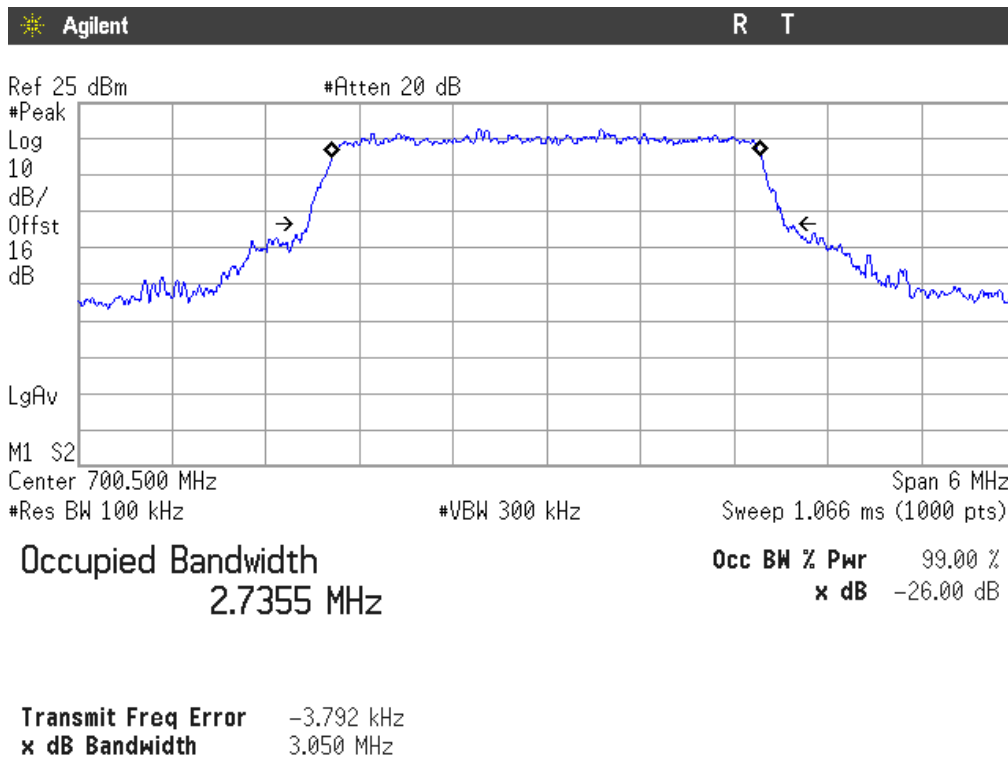


Highest Channel

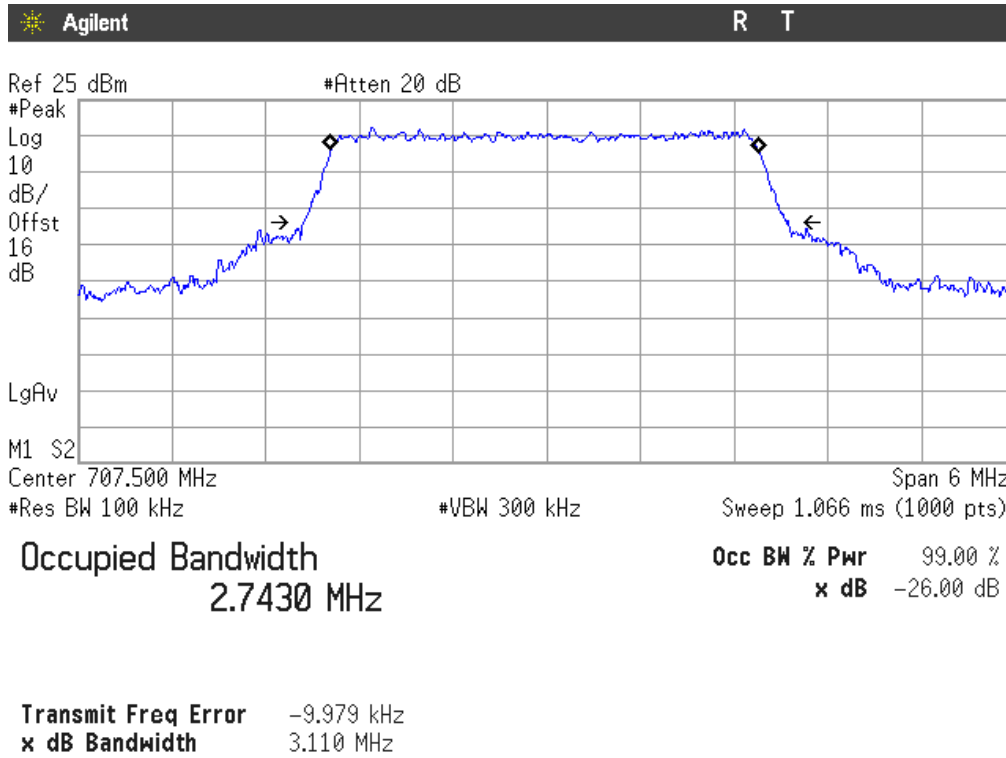


LTE 16QAM MODULATION. BW = 3 MHz (Band XII)

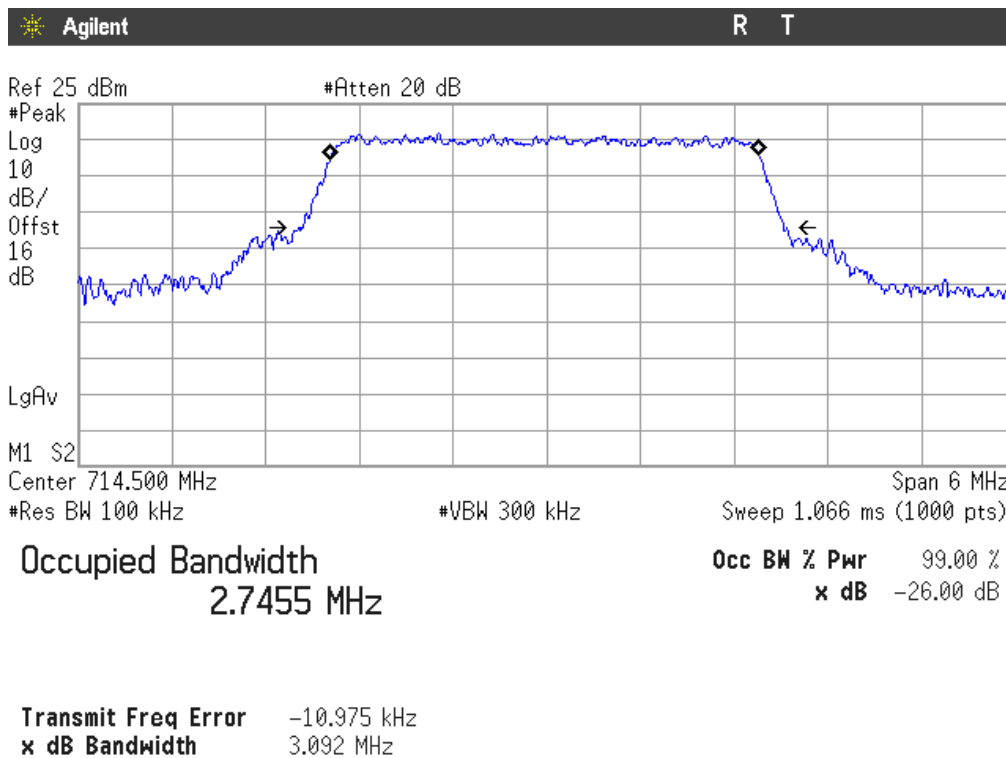
Lowest Channel



Middle Channel

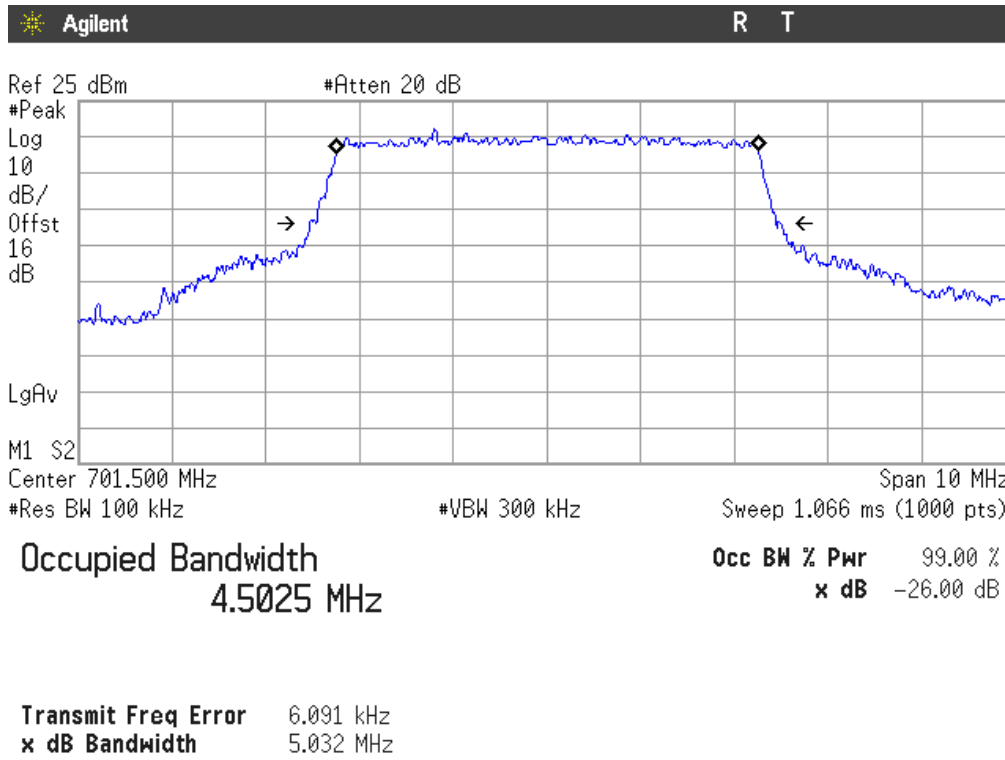


Highest Channel

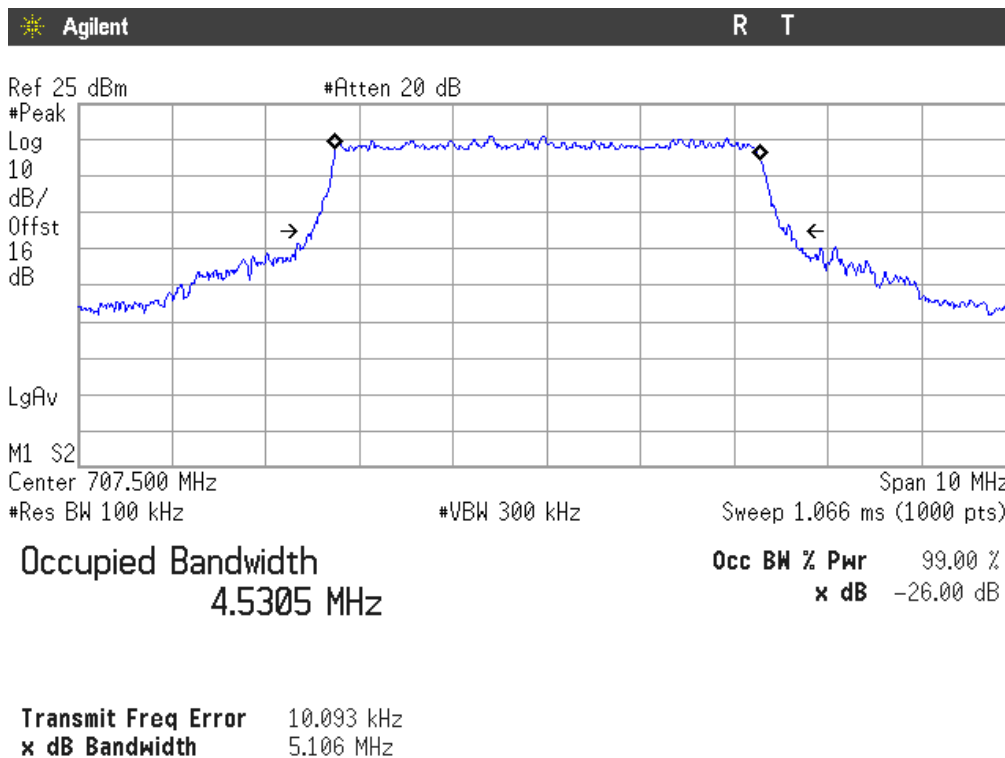


LTE QPSK MODULATION. BW = 5 MHz (Band XII)

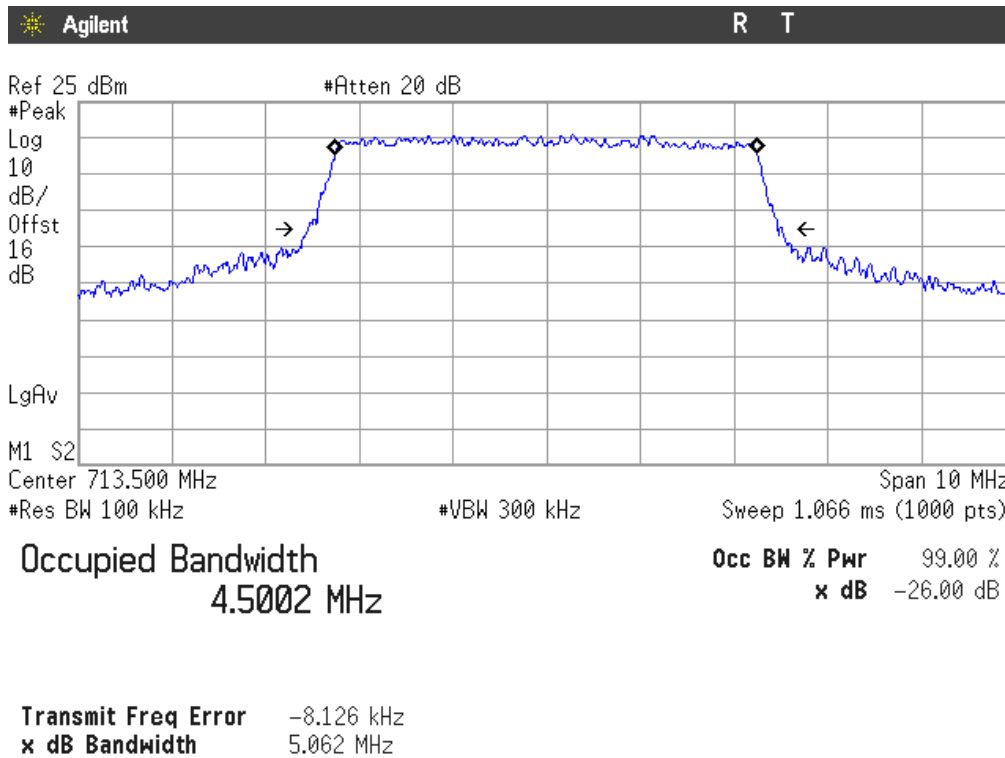
Lowest Channel



Middle Channel

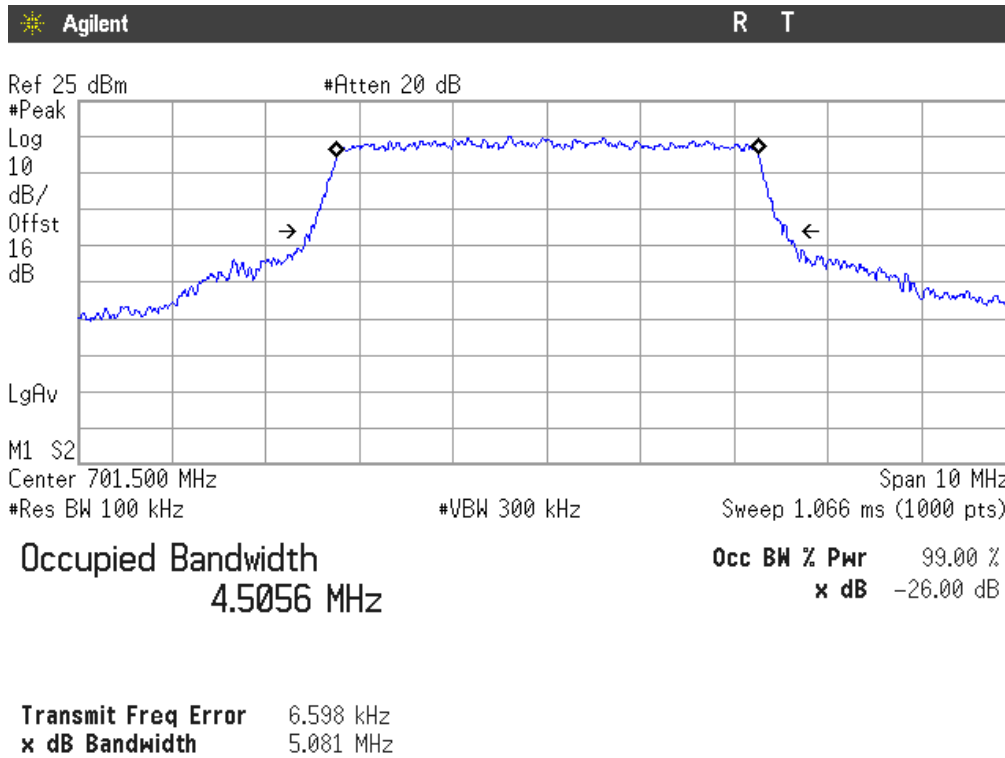


Highest Channel

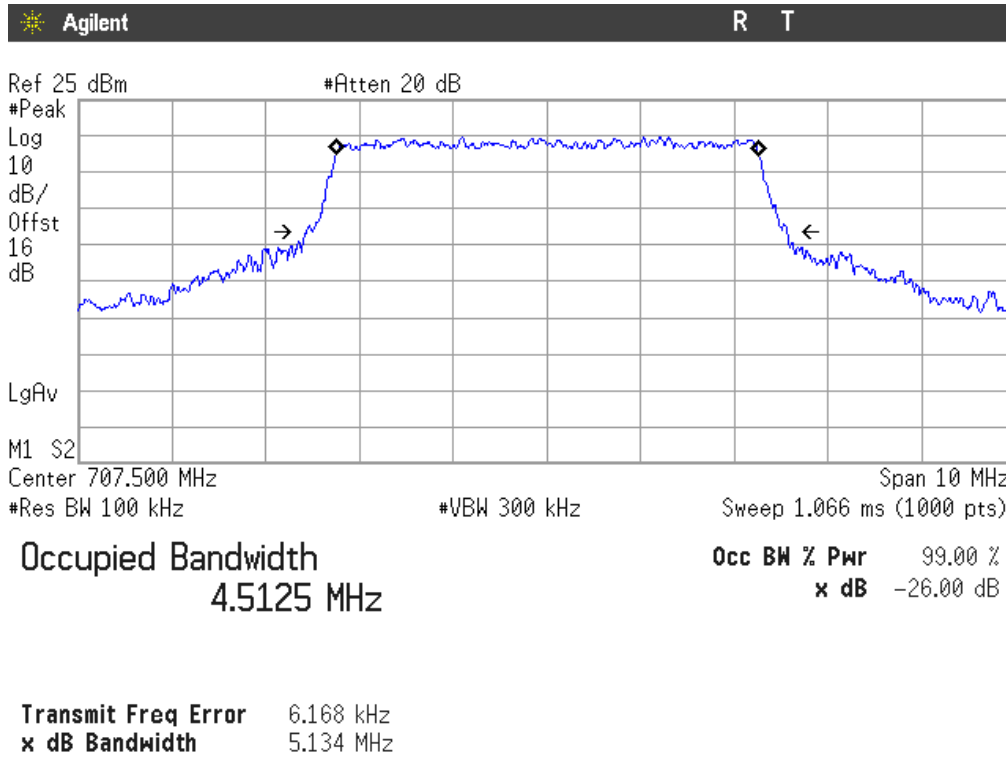


LTE 16QAM MODULATION. BW = 5 MHz (Band XII)

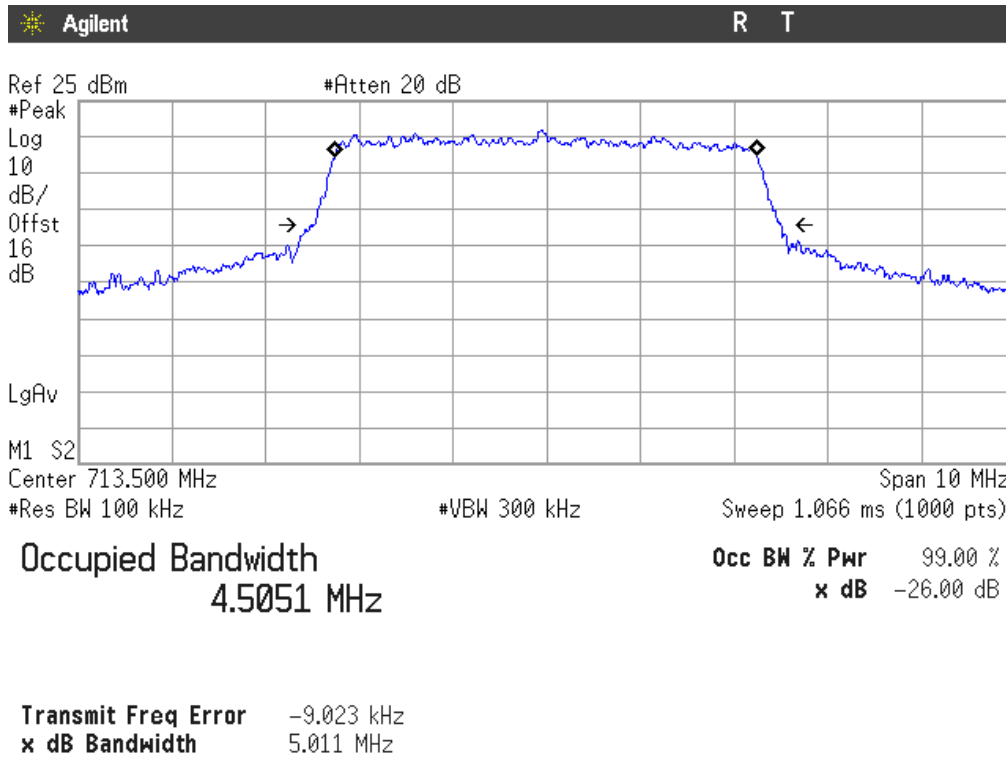
Lowest Channel



Middle Channel

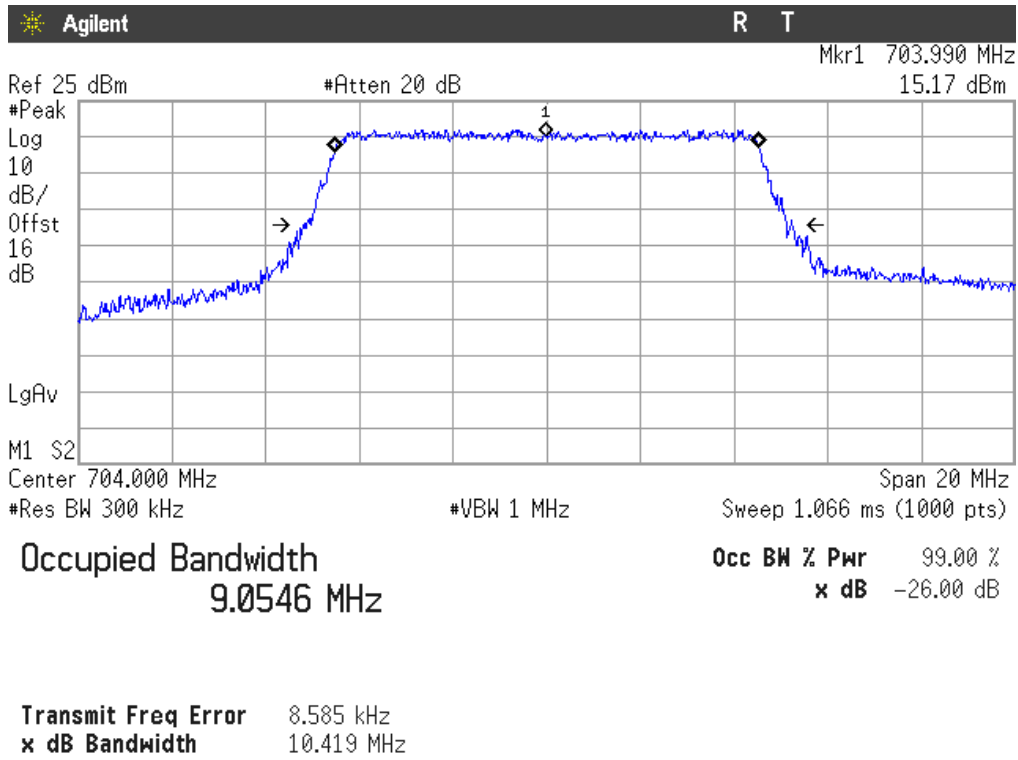


Highest Channel

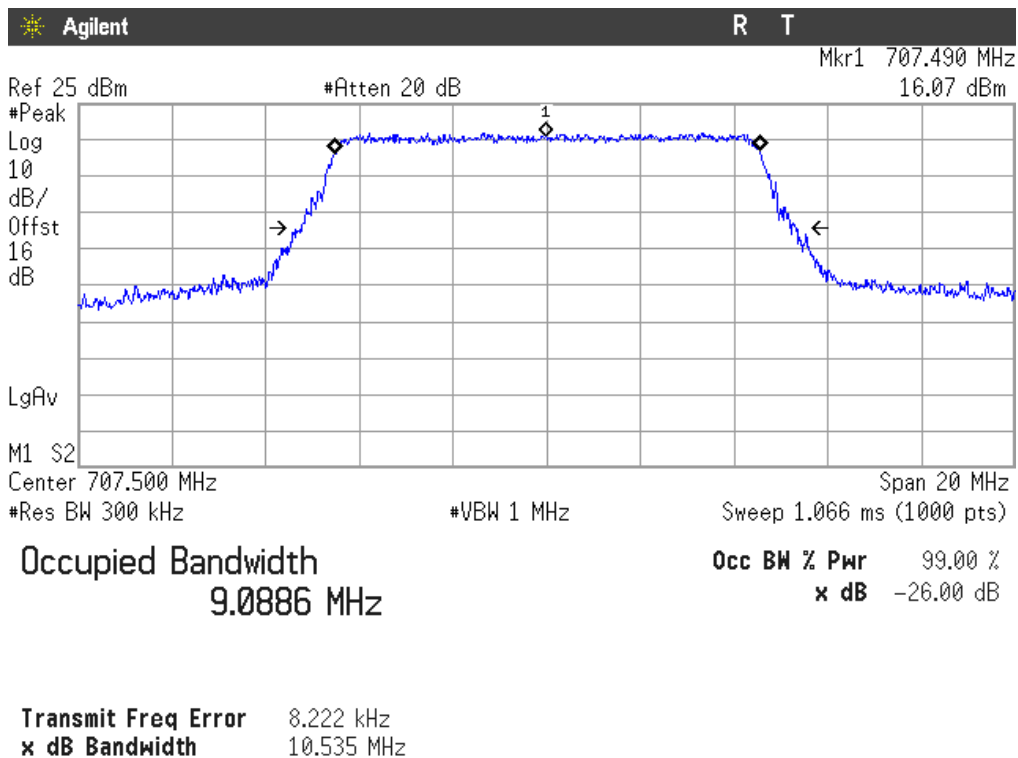


LTE QPSK MODULATION. BW = 10 MHz (Band XII)

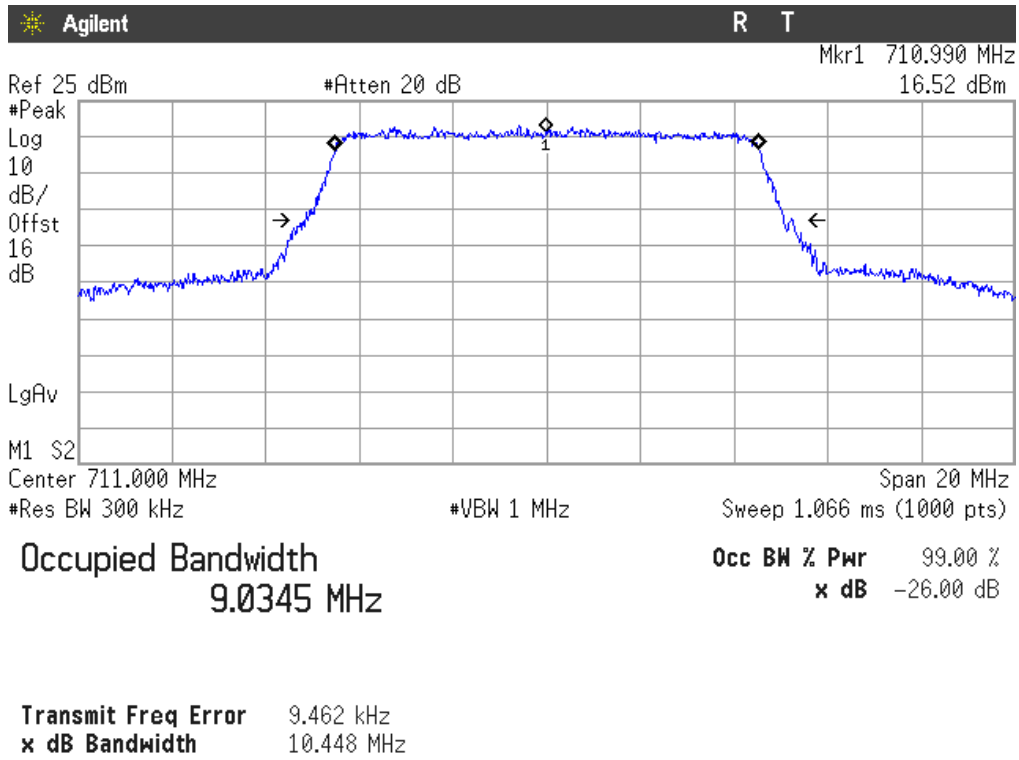
Lowest Channel



Middle Channel

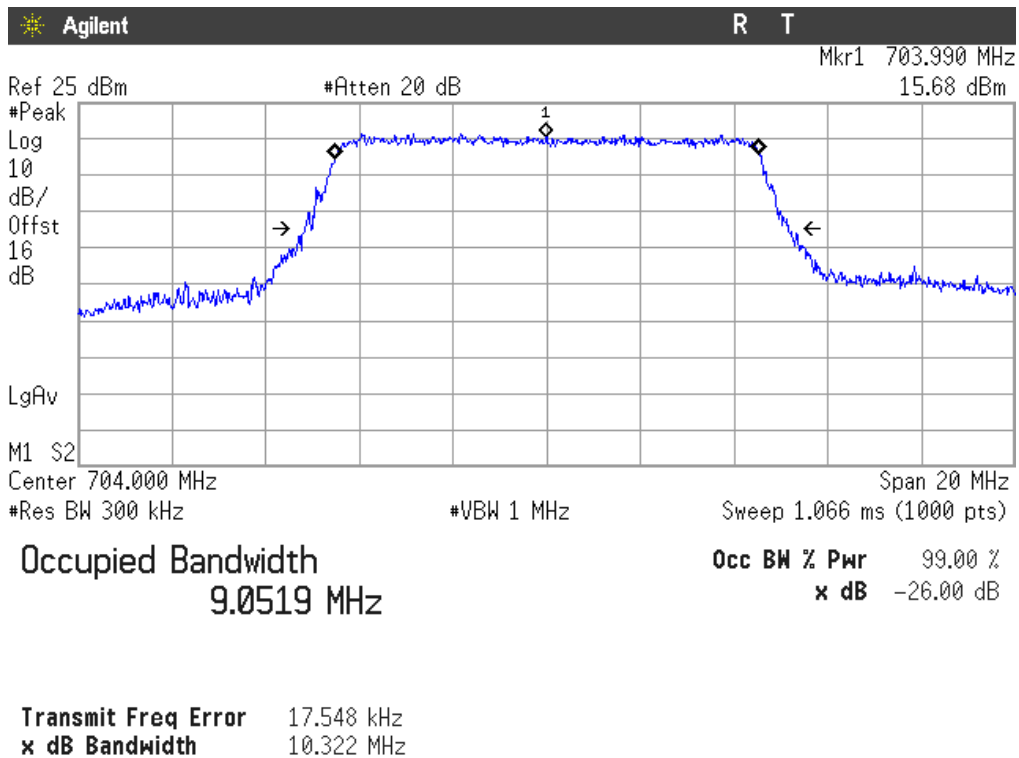


Highest Channel

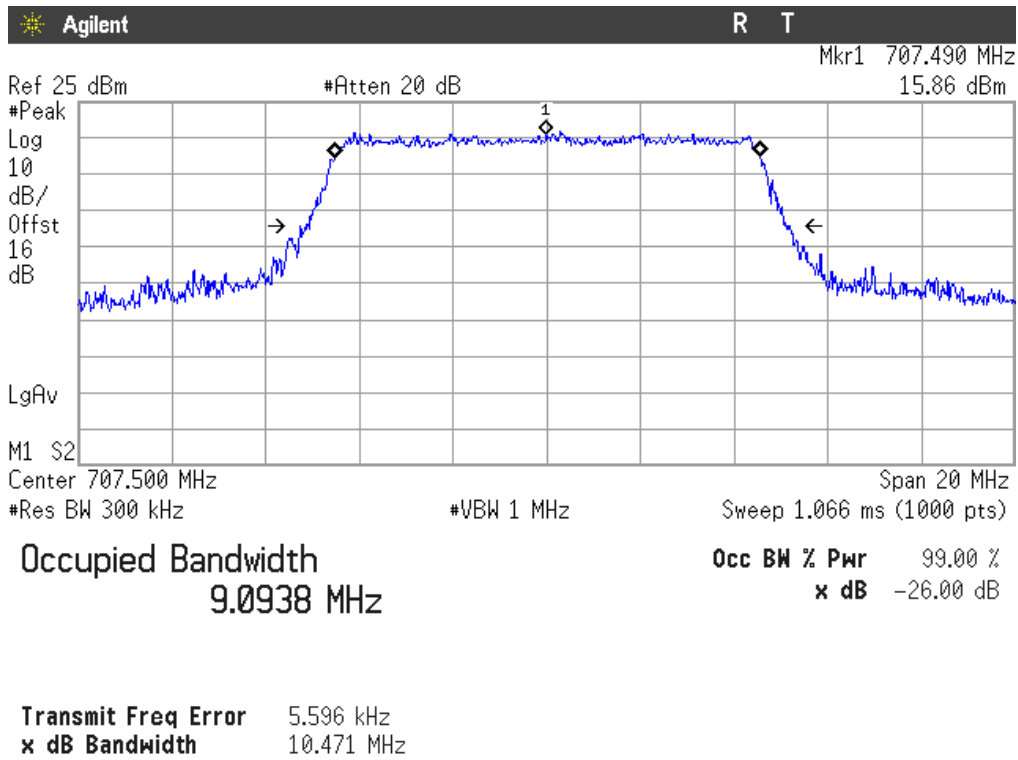


LTE 16QAM MODULATION. BW = 10 MHz (Band XII)

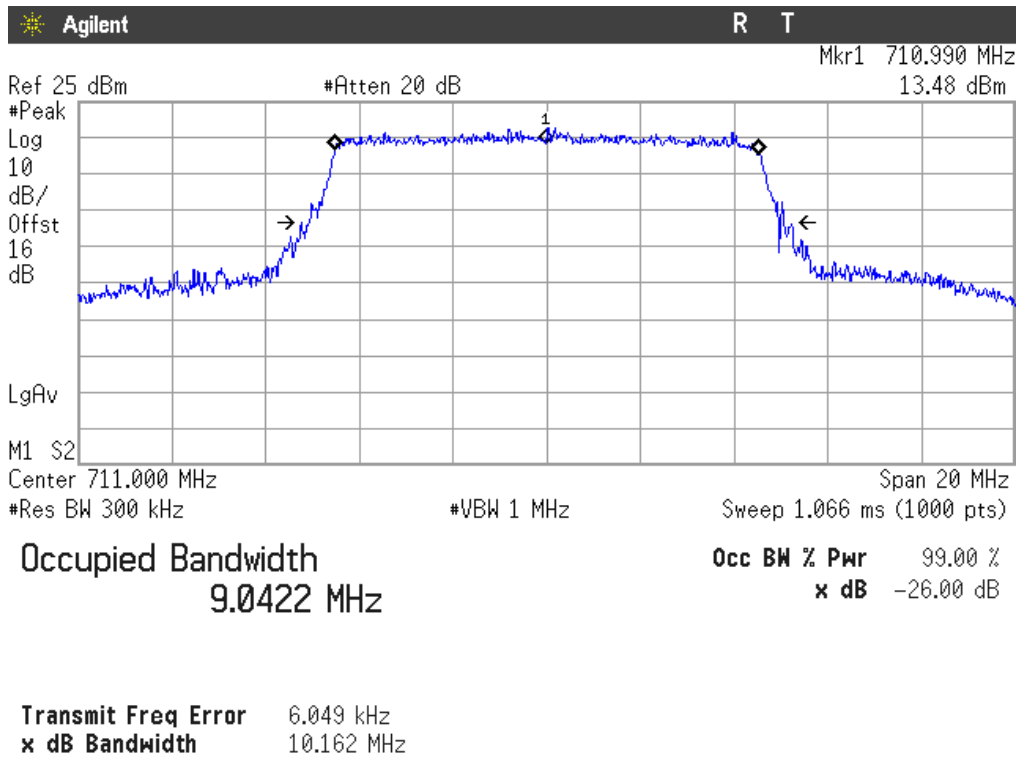
Lowest Channel



Middle Channel



Highest 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 XII. FCC §2.1051 and §27.53 (g). 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 P_o transmitting power, the specified minimum attenuation becomes $43+10 \log (P_o)$, and the level in dBm relative P_o becomes:

P_o (dBm) – $[43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13$ 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.

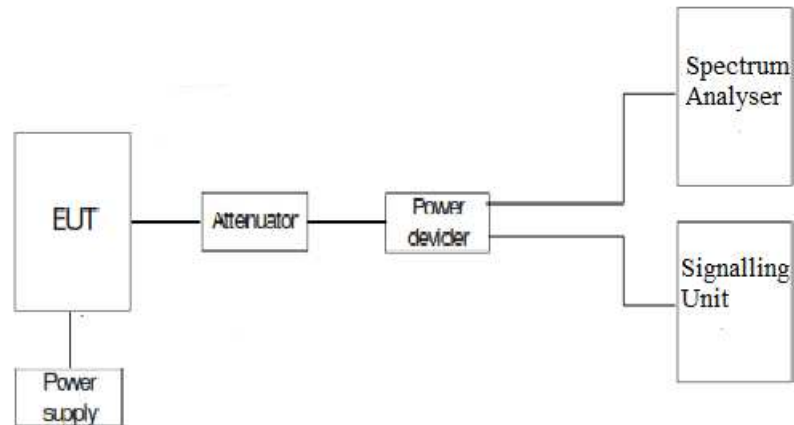
The spectrum was investigated from 9 kHz to 18 GHz for LTE Band IV.

The spectrum was investigated from 9 kHz to 8 GHz for LTE Band XII.

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

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 = 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 = 1.4 MHz. Band XII

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 XII

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 XII

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 XII

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

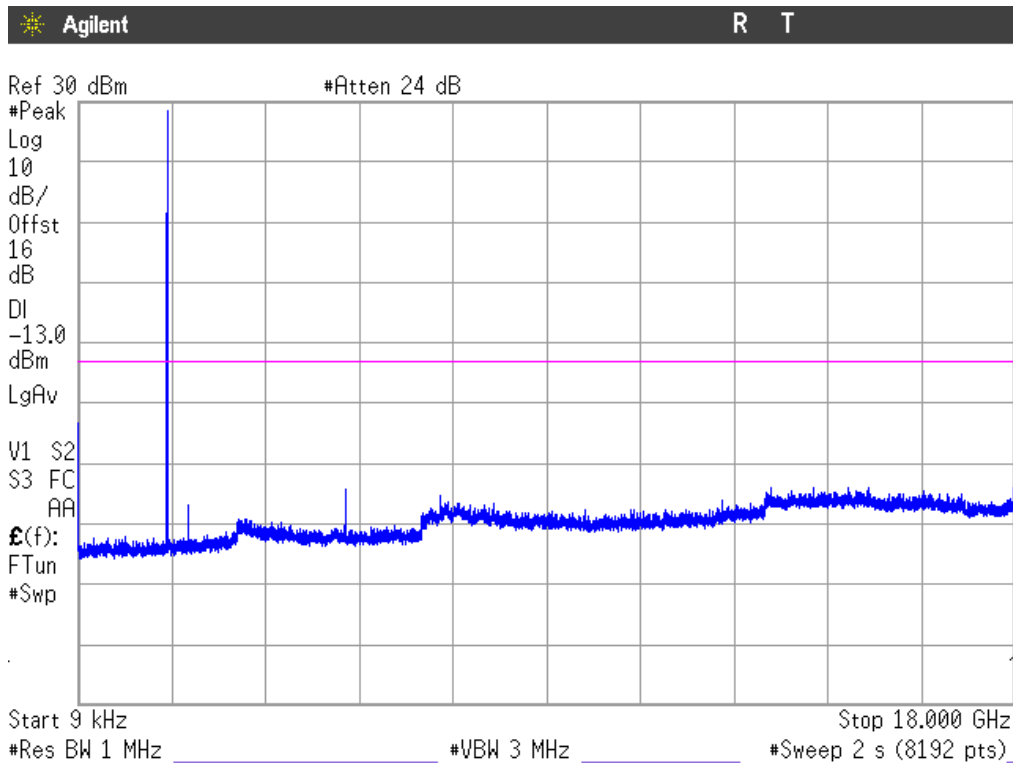
No spurious signals were found at less than 20dB respect to the limit in all the range.

Measurement uncertainty = ± 1.20 dB.

Verdict: PASS

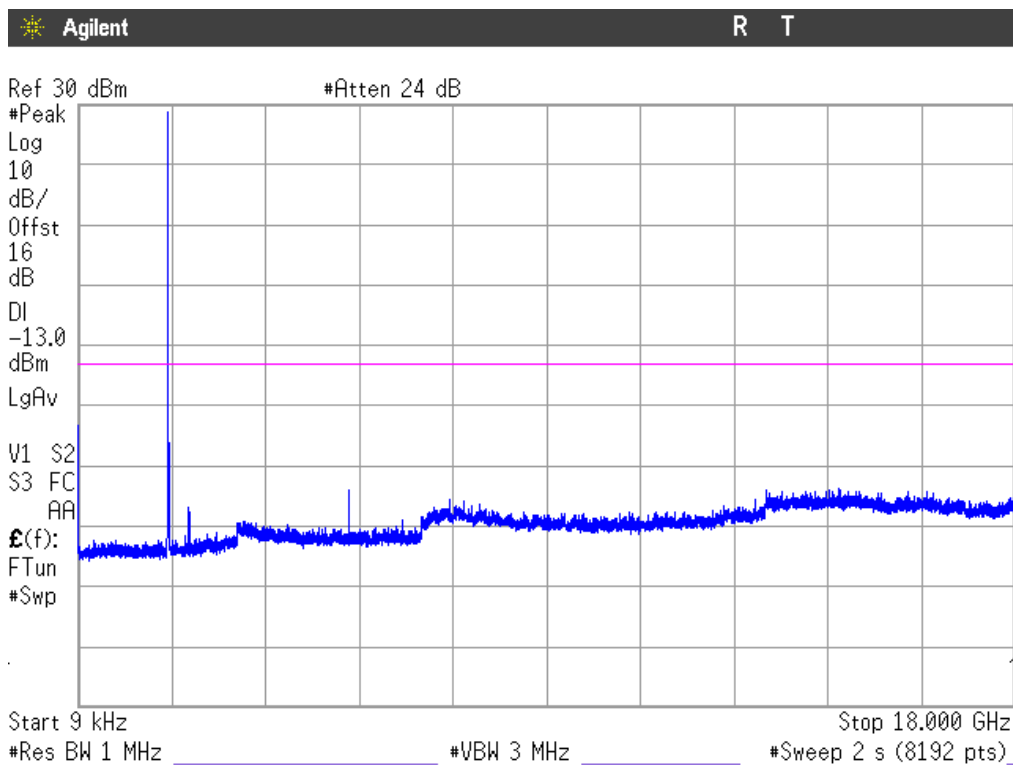
LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

1. CHANNEL: LOWEST



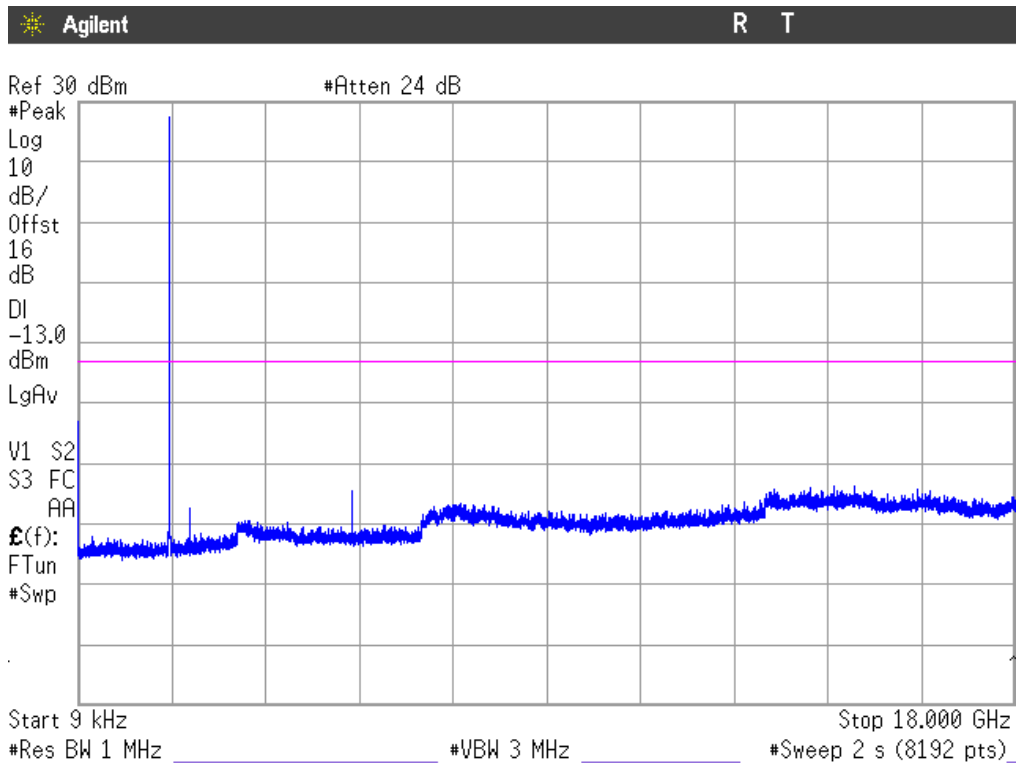
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

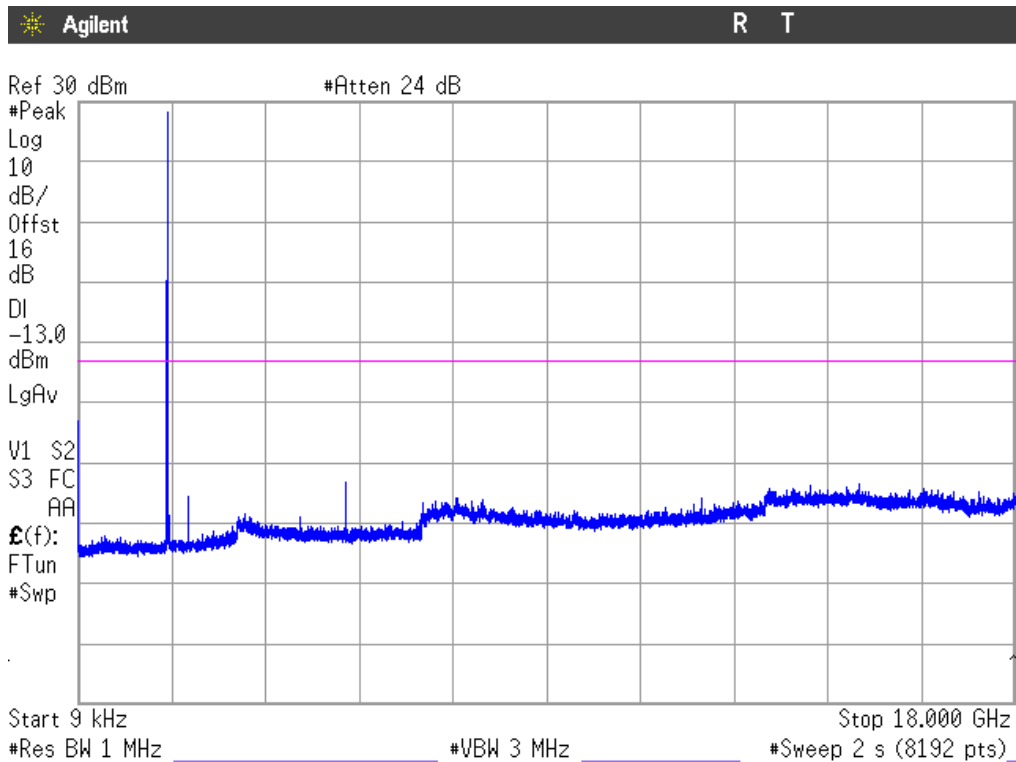
3. CHANNEL: HIGHEST



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

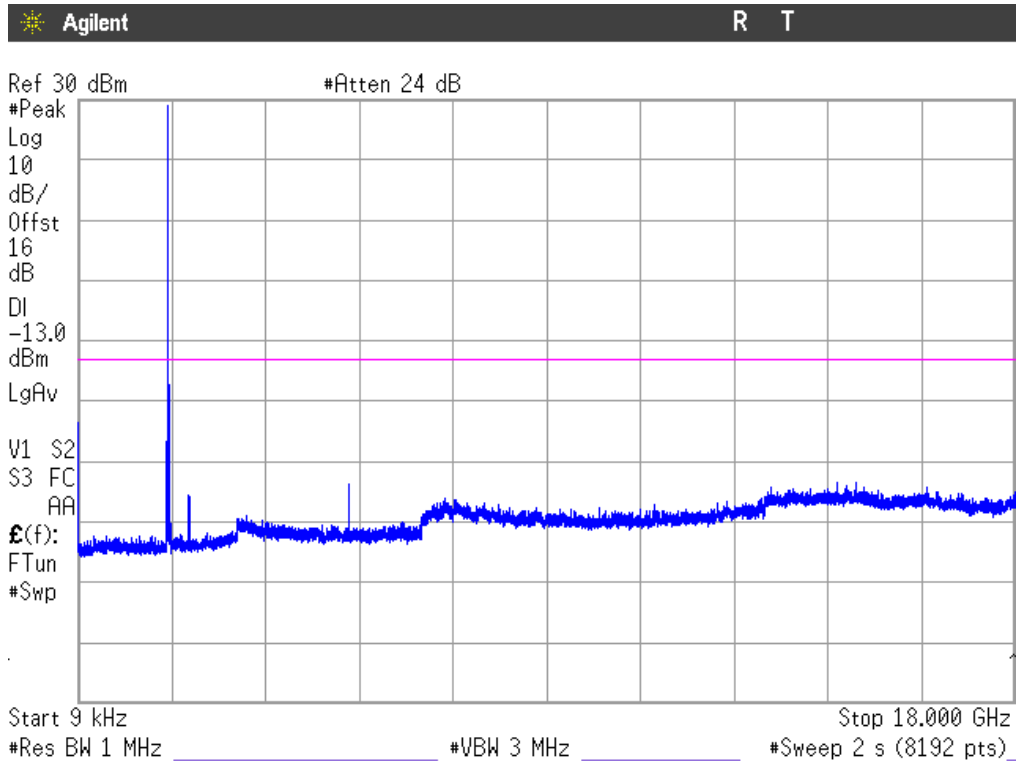
LTE QPSK MODULATION. BW = 3 MHz (Band IV)

1. CHANNEL: LOWEST



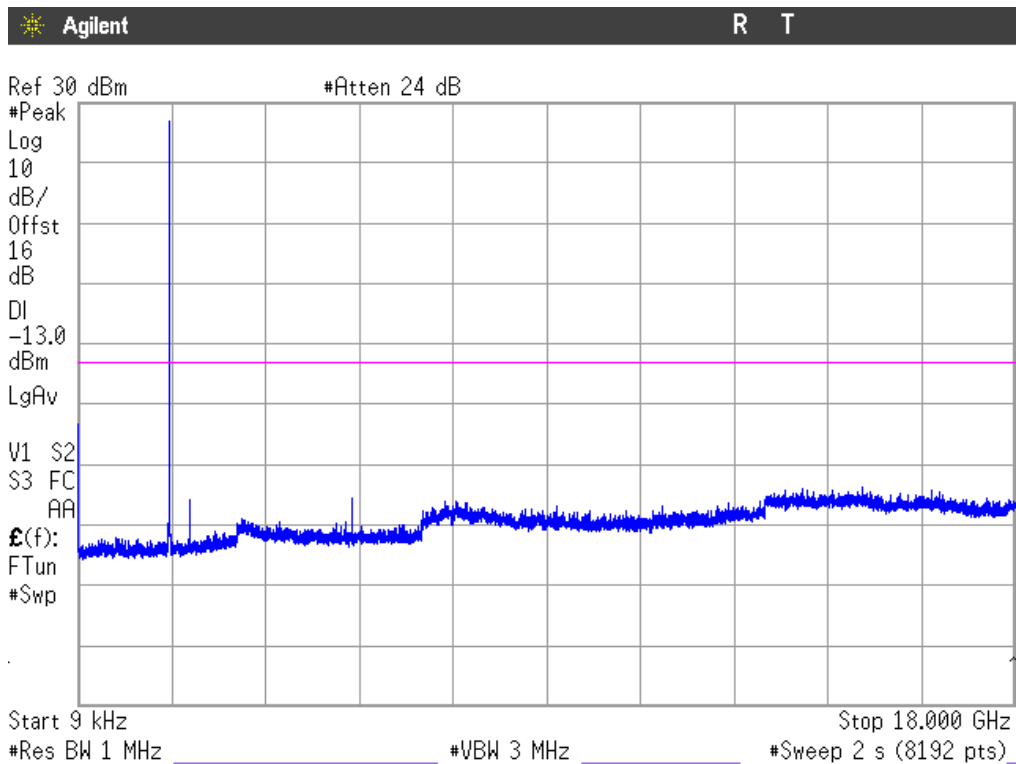
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

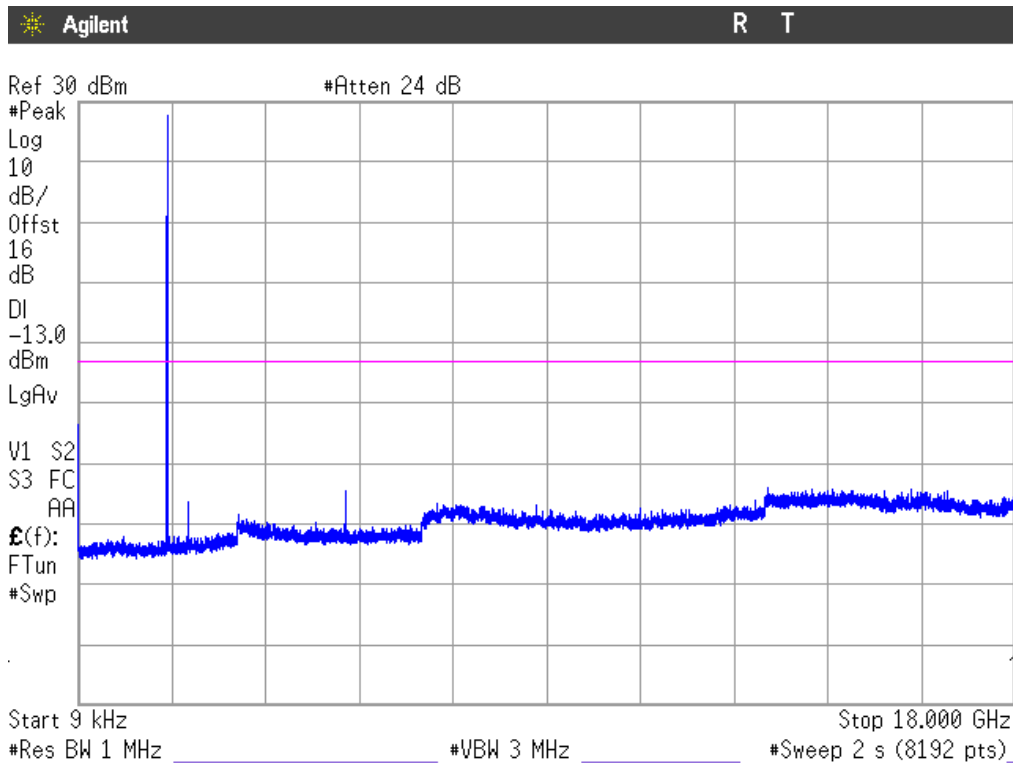
3. CHANNEL: HIGHEST



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

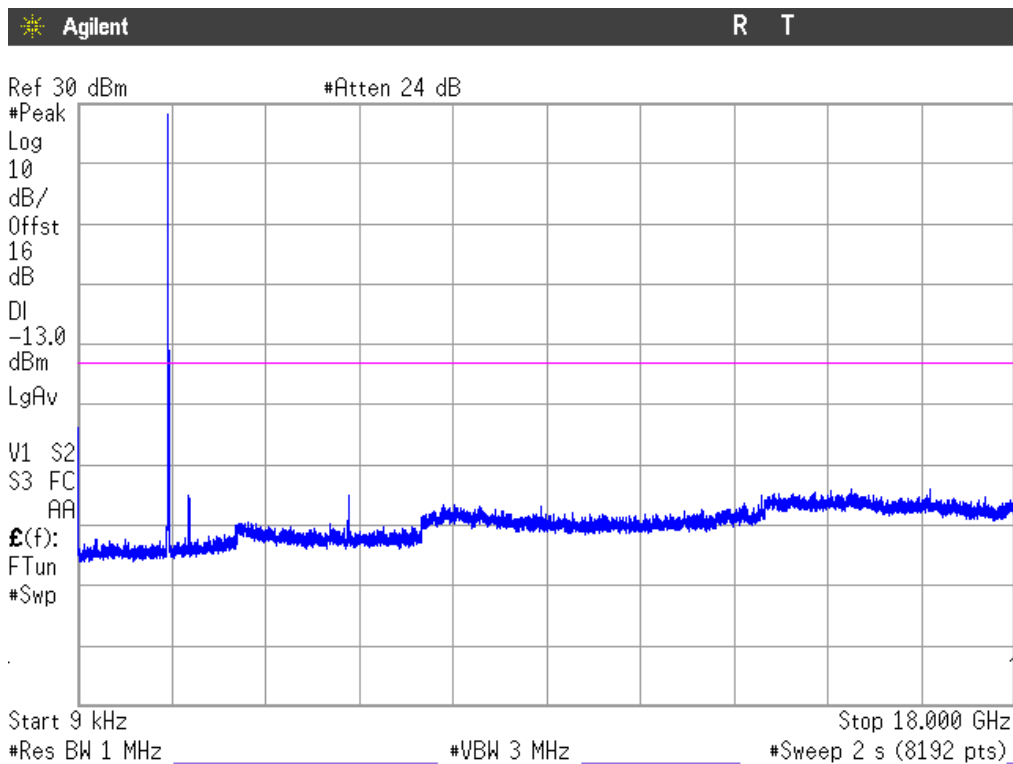
LTE QPSK MODULATION. BW = 5 MHz (Band IV)

1. CHANNEL: LOWEST



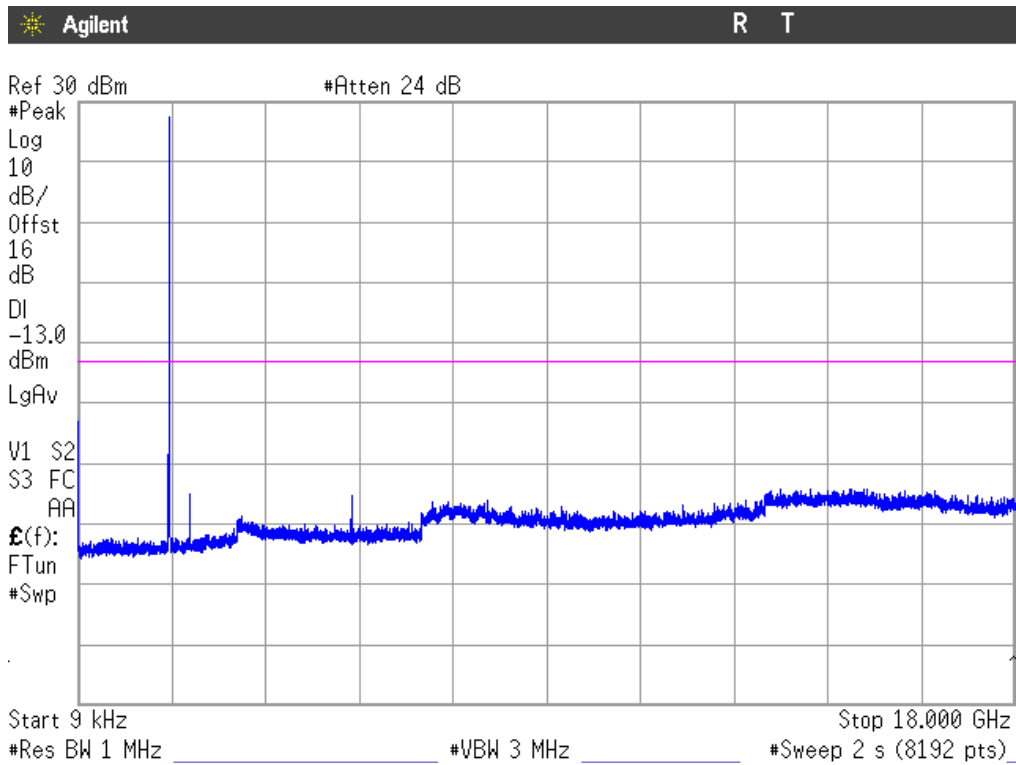
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

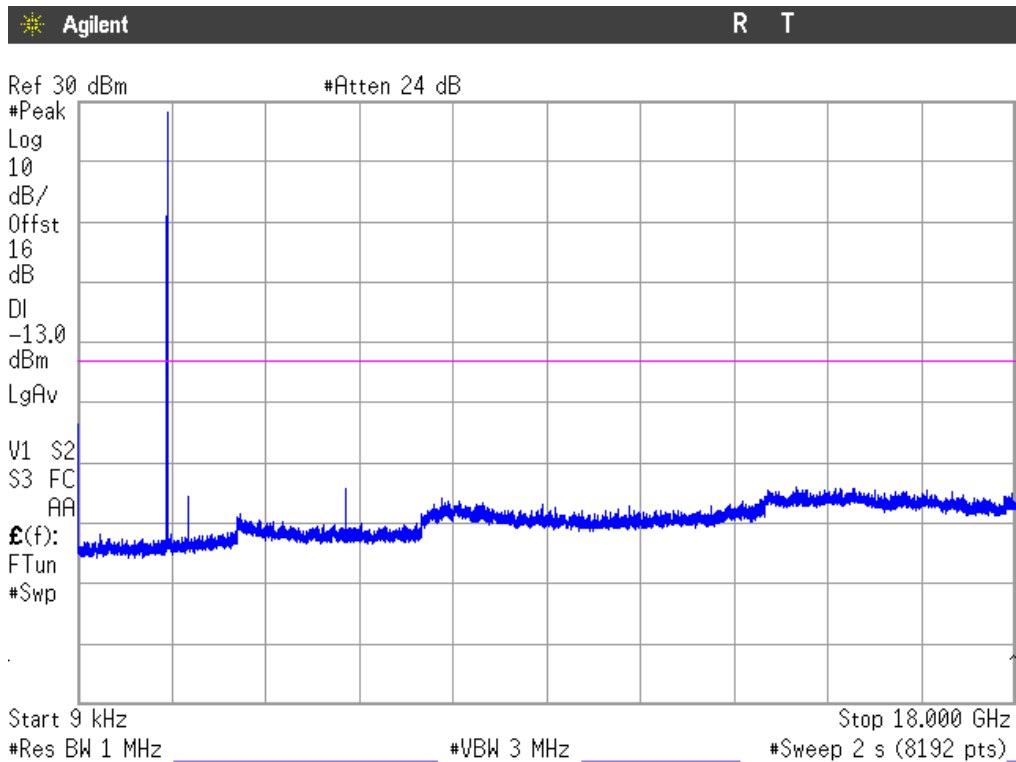
3. CHANNEL: HIGHEST



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

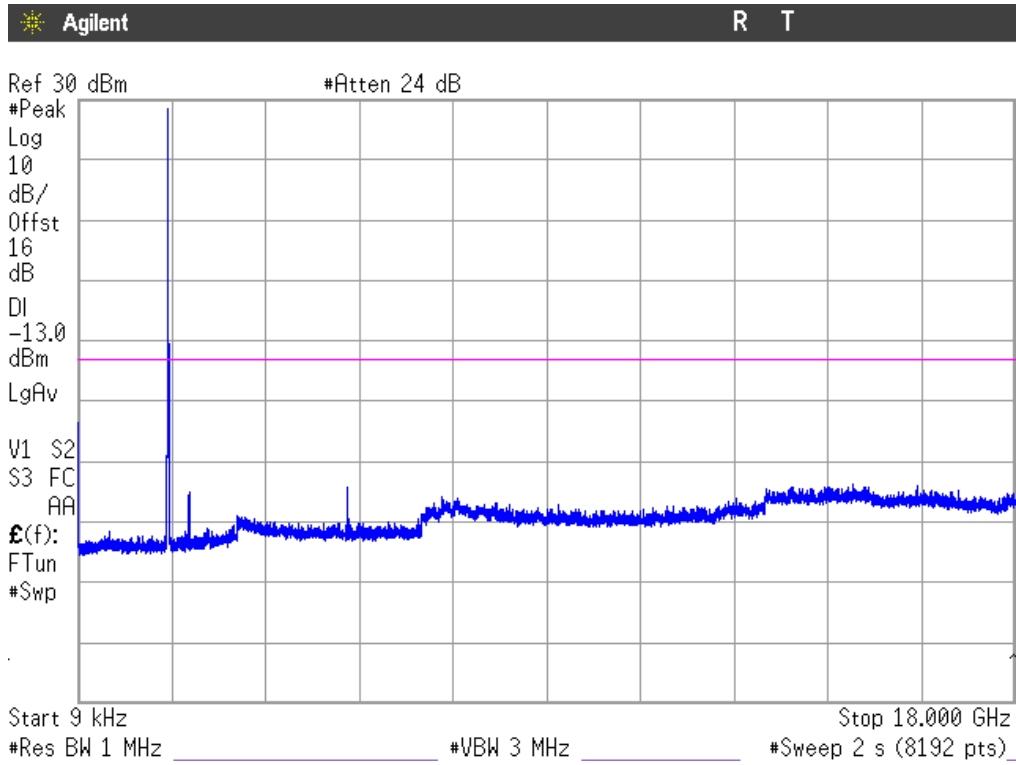
LTE QPSK MODULATION. BW = 10 MHz (Band IV)

1. CHANNEL: LOWEST



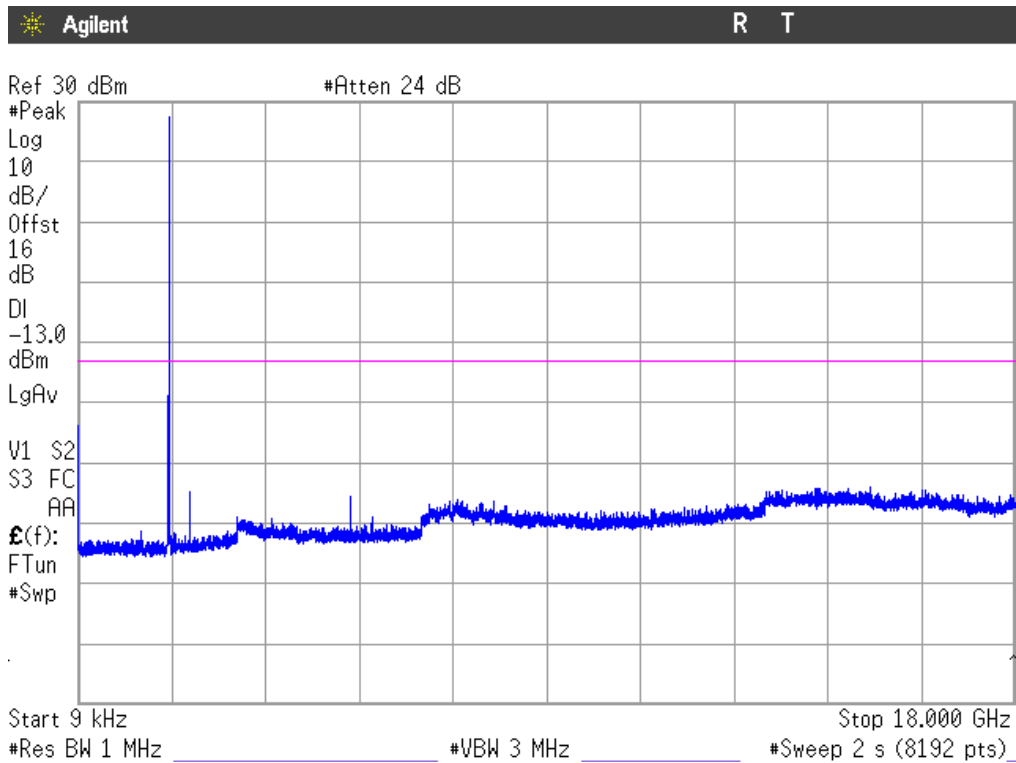
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

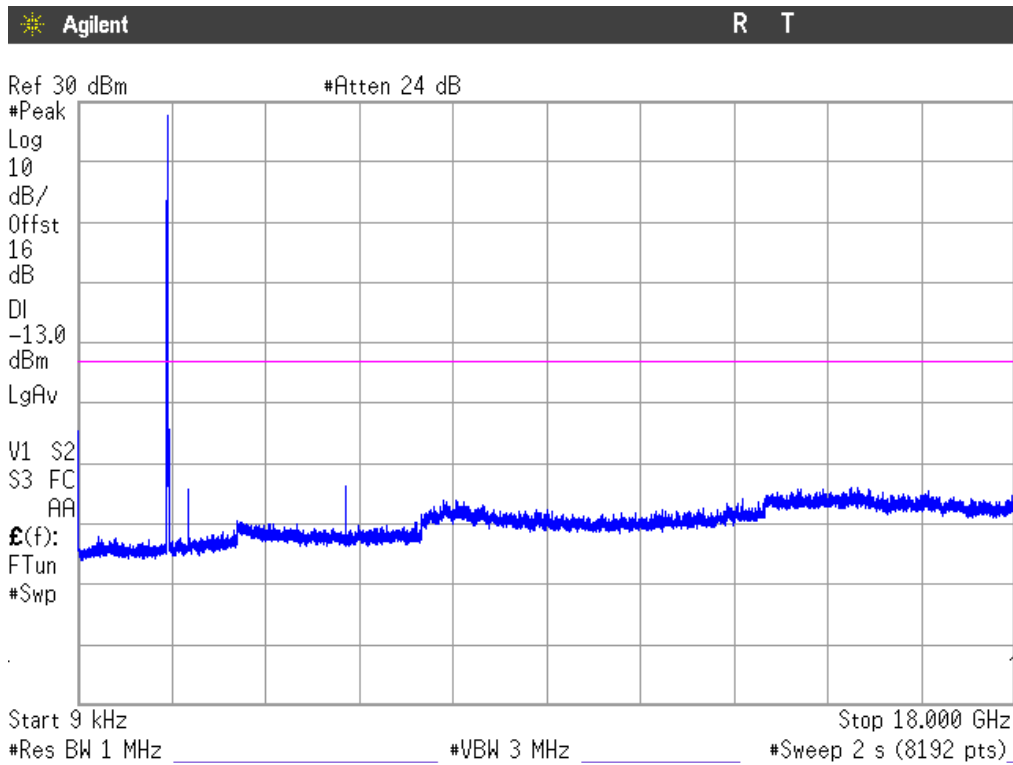
3. CHANNEL: HIGHEST



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

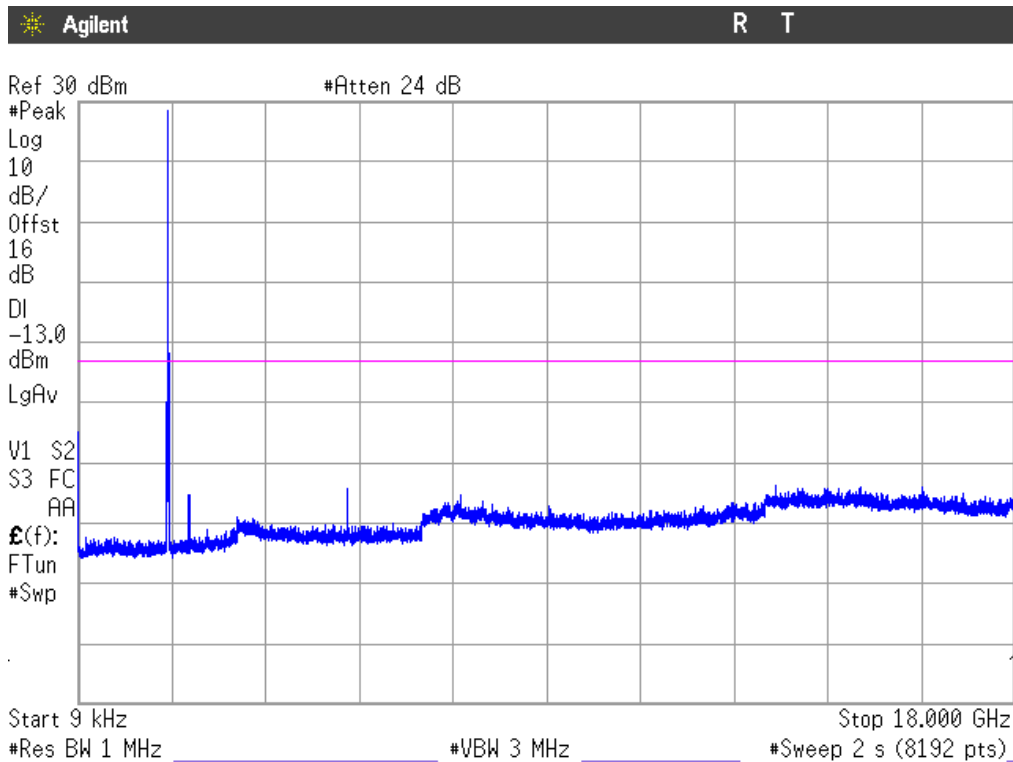
LTE QPSK MODULATION. BW = 15 MHz (Band IV)

1. CHANNEL: LOWEST



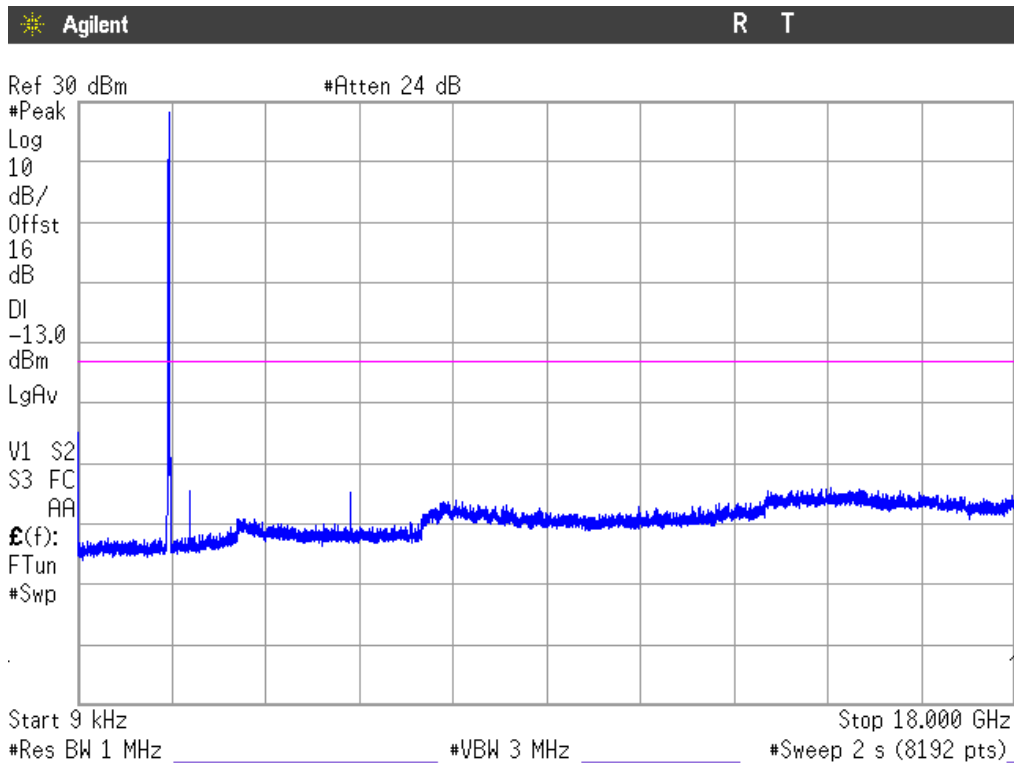
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

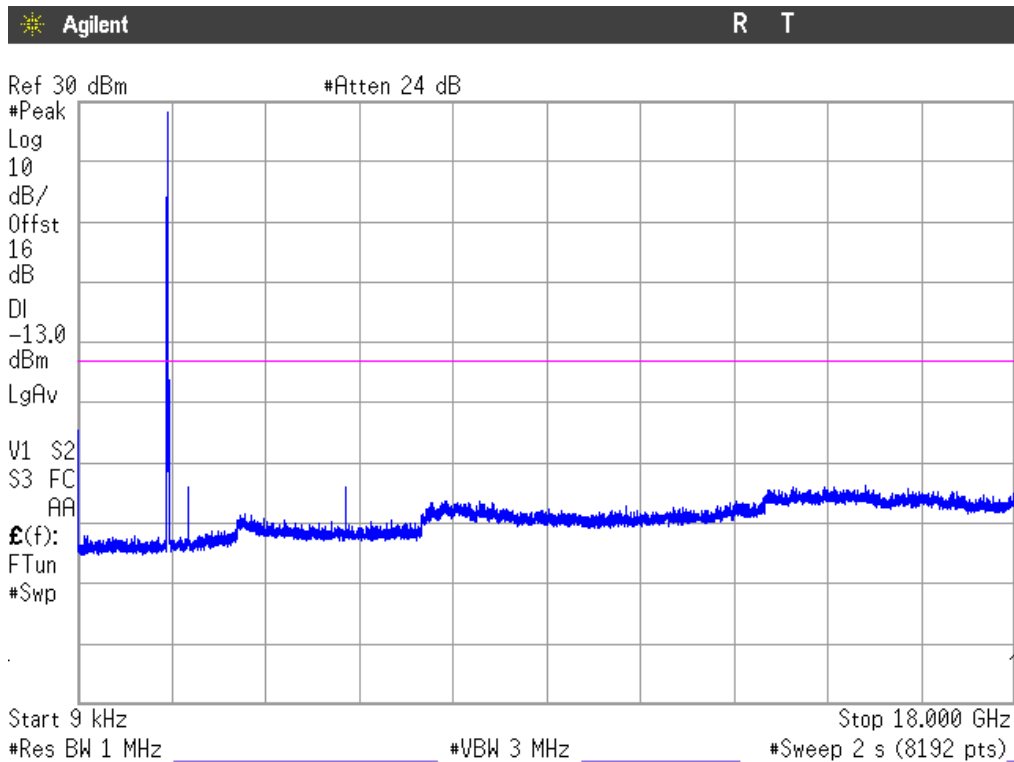
3. CHANNEL: HIGHEST



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

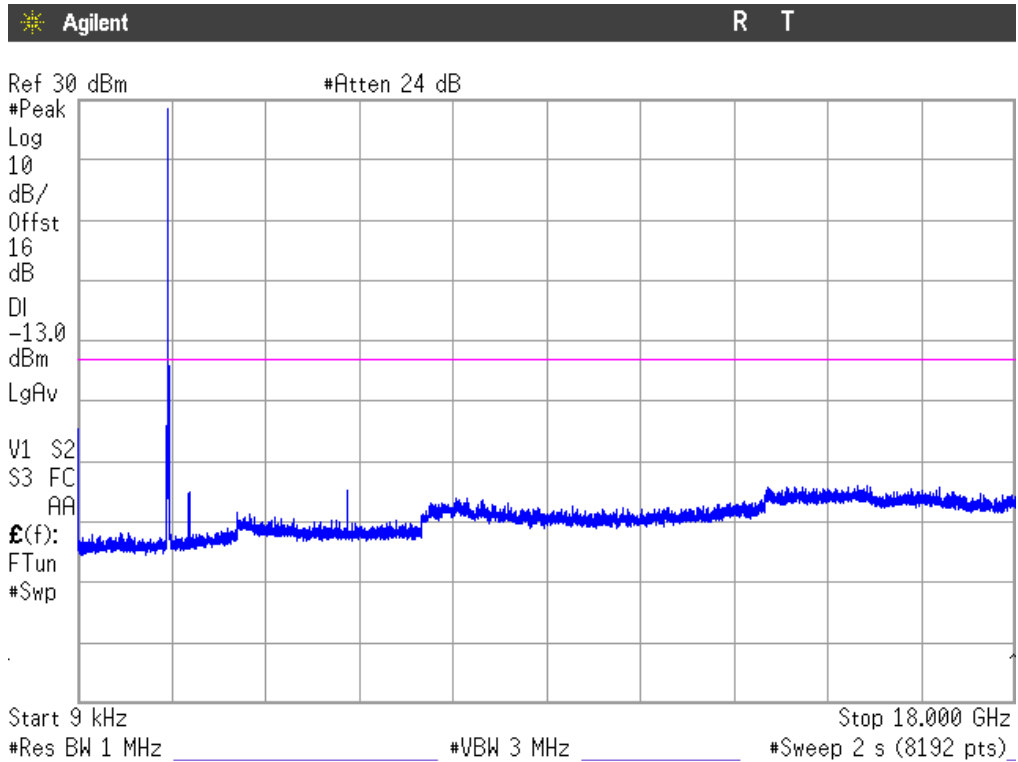
LTE QPSK MODULATION. BW = 20 MHz (Band IV)

1. CHANNEL: LOWEST



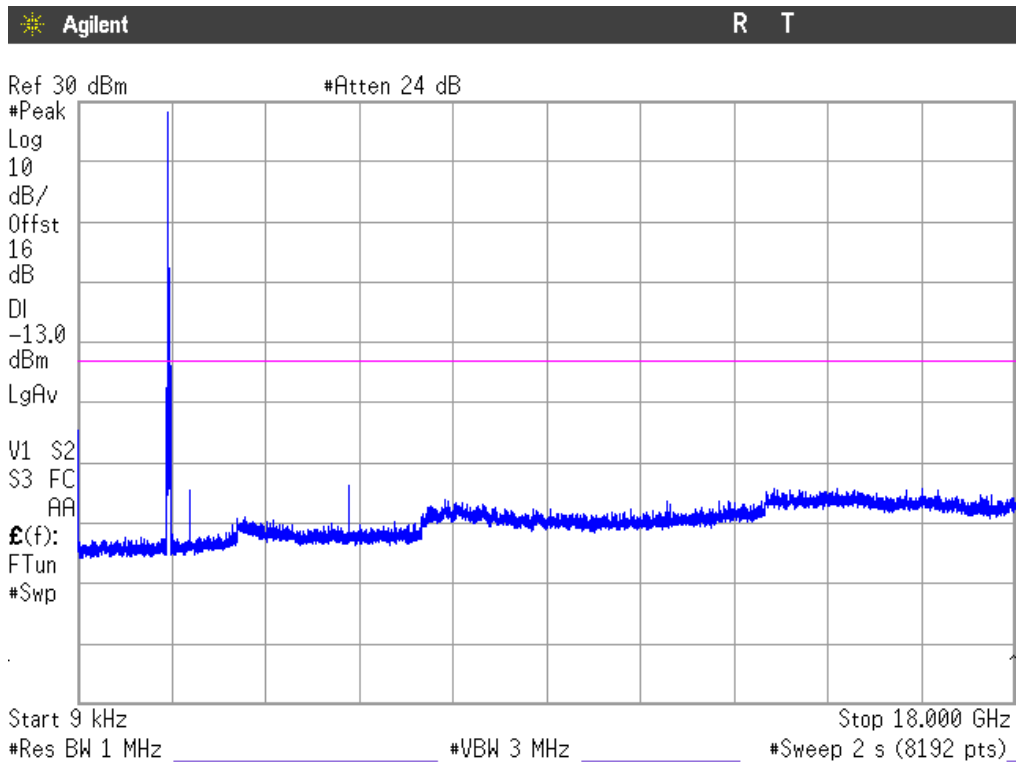
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

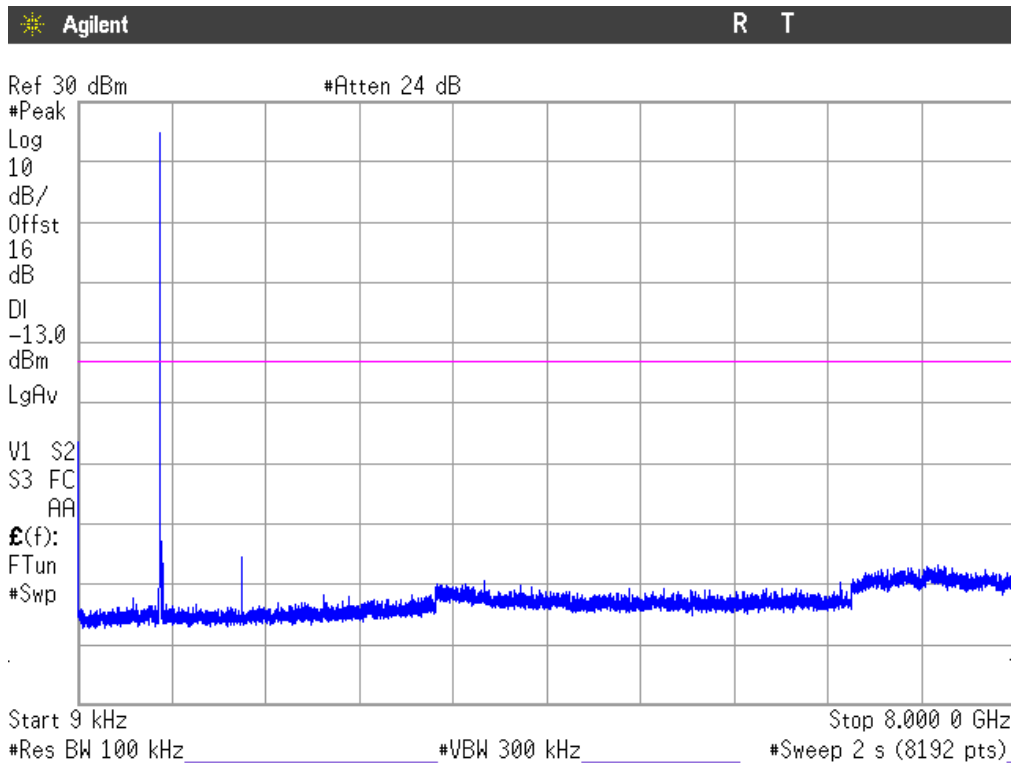
3. CHANNEL: HIGHEST



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

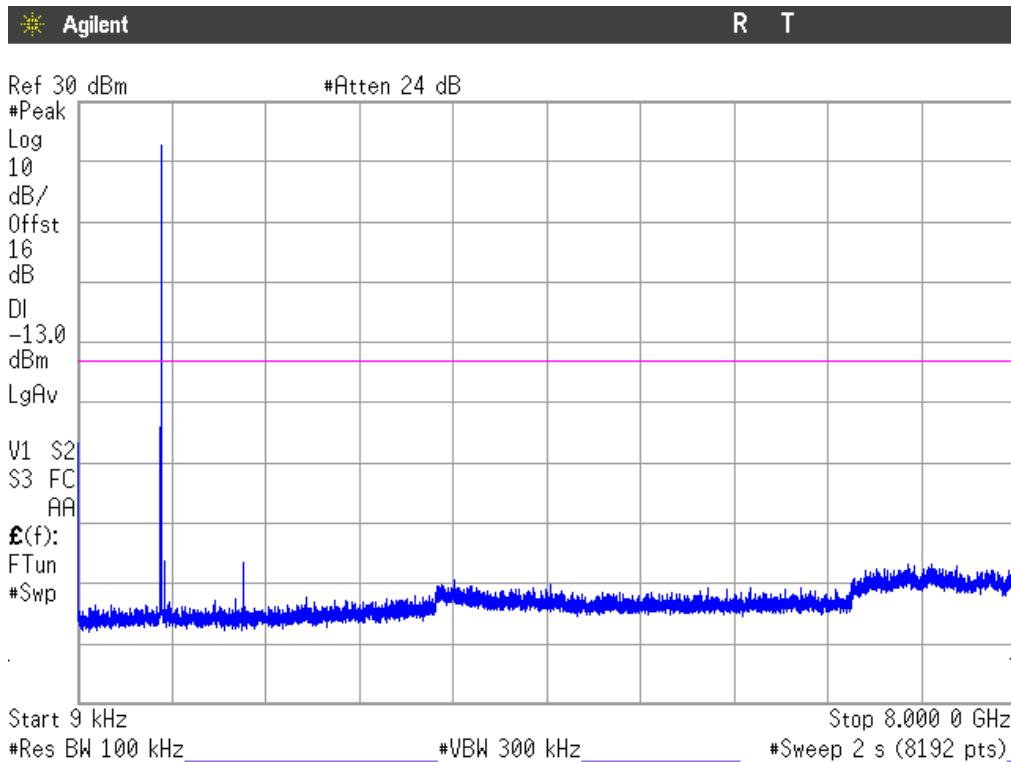
LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)

1. CHANNEL: LOWEST



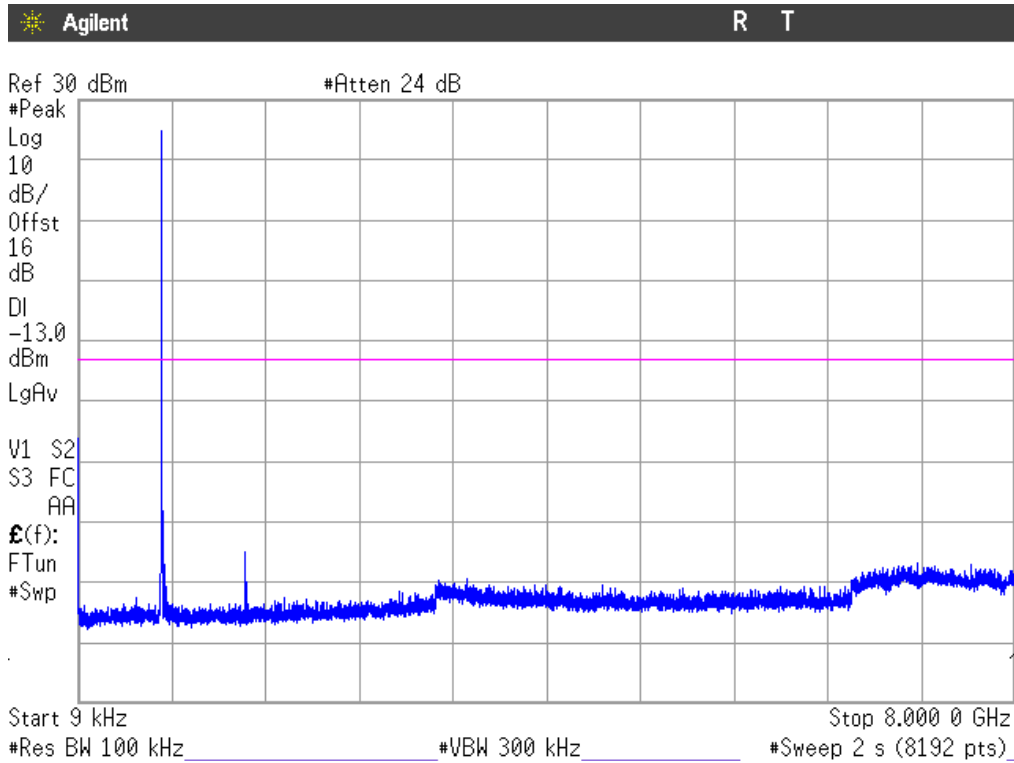
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

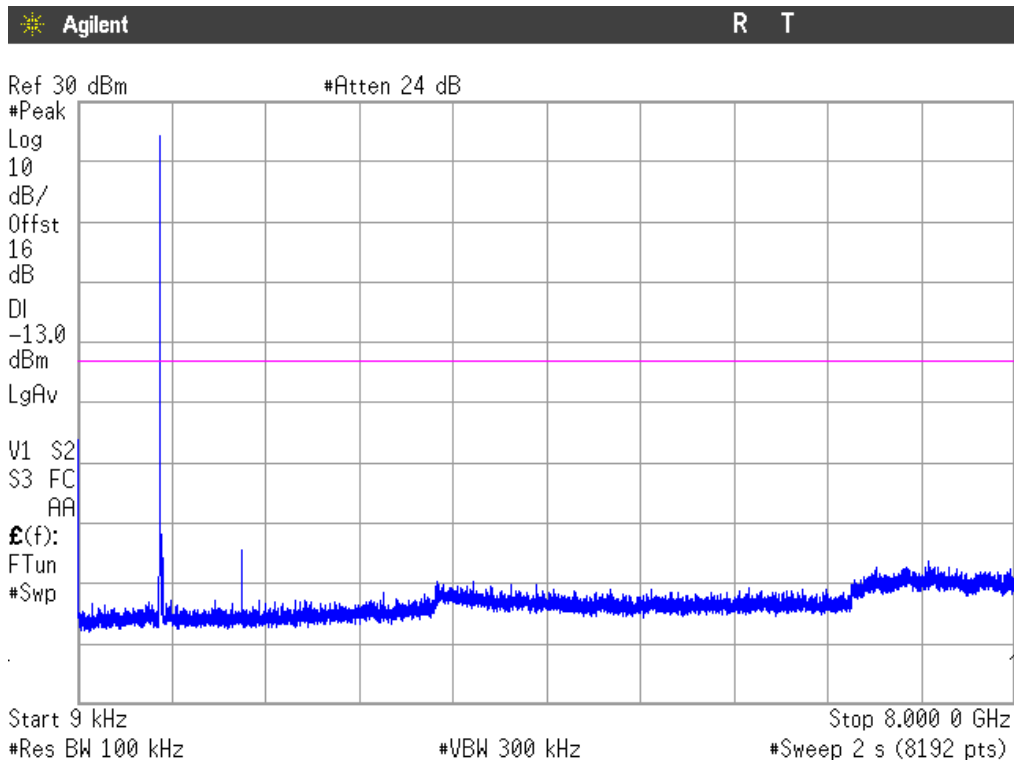
3. CHANNEL: HIGHEST



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

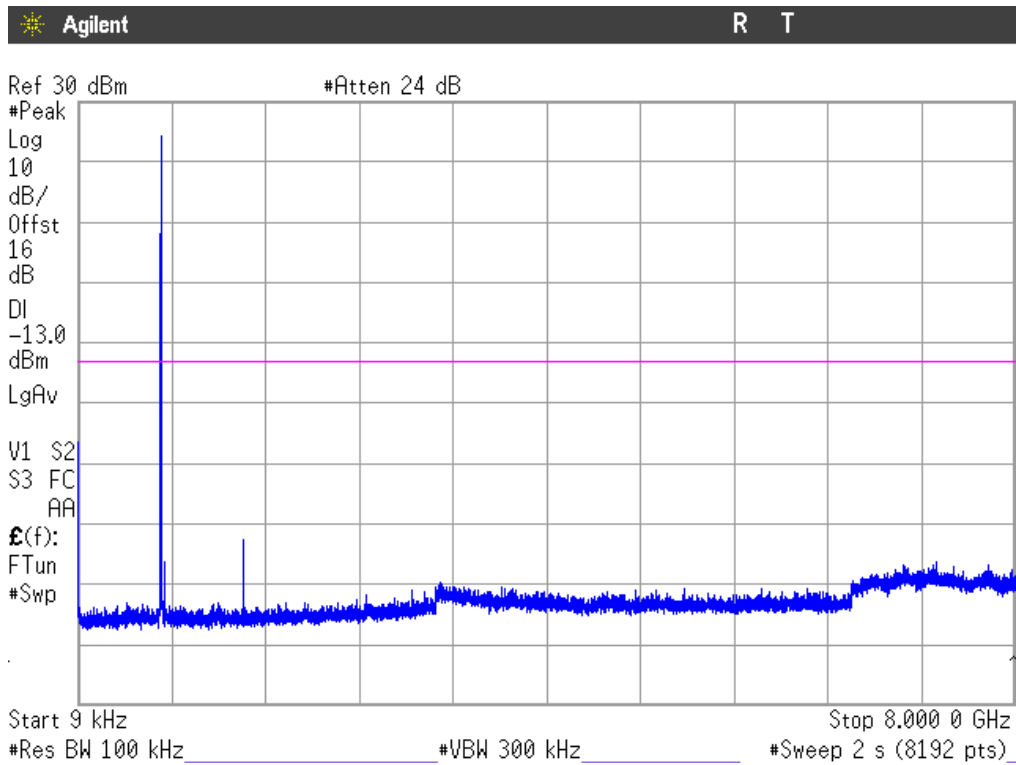
LTE QPSK MODULATION. BW = 3 MHz (Band XII)

1. CHANNEL: LOWEST



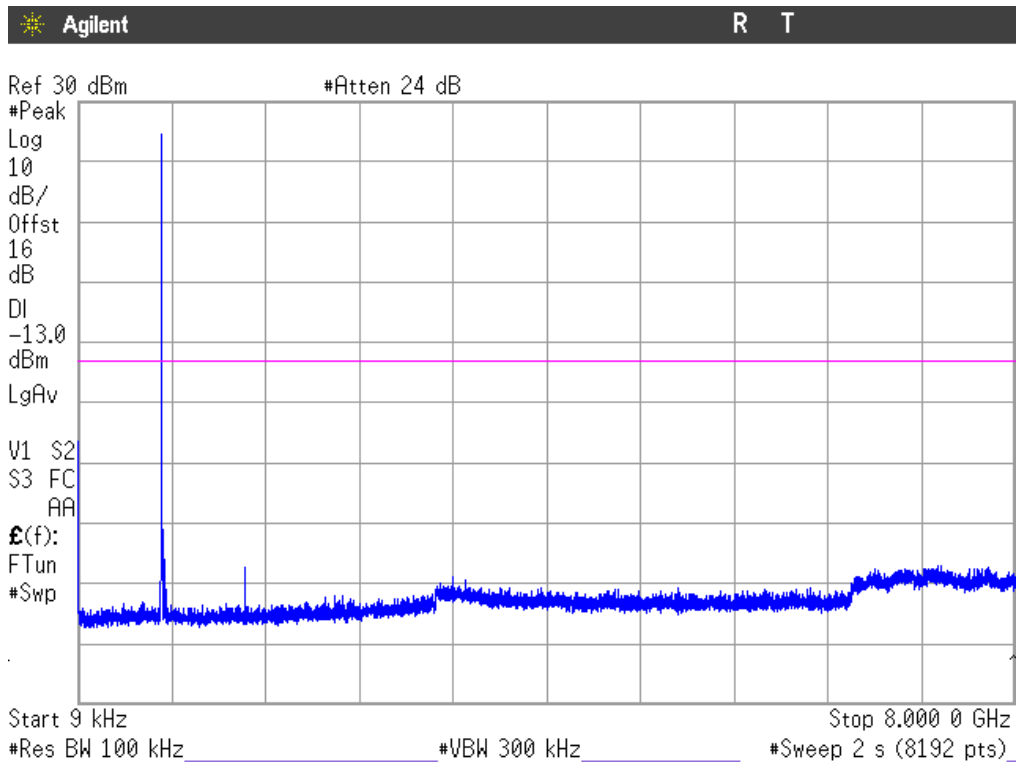
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

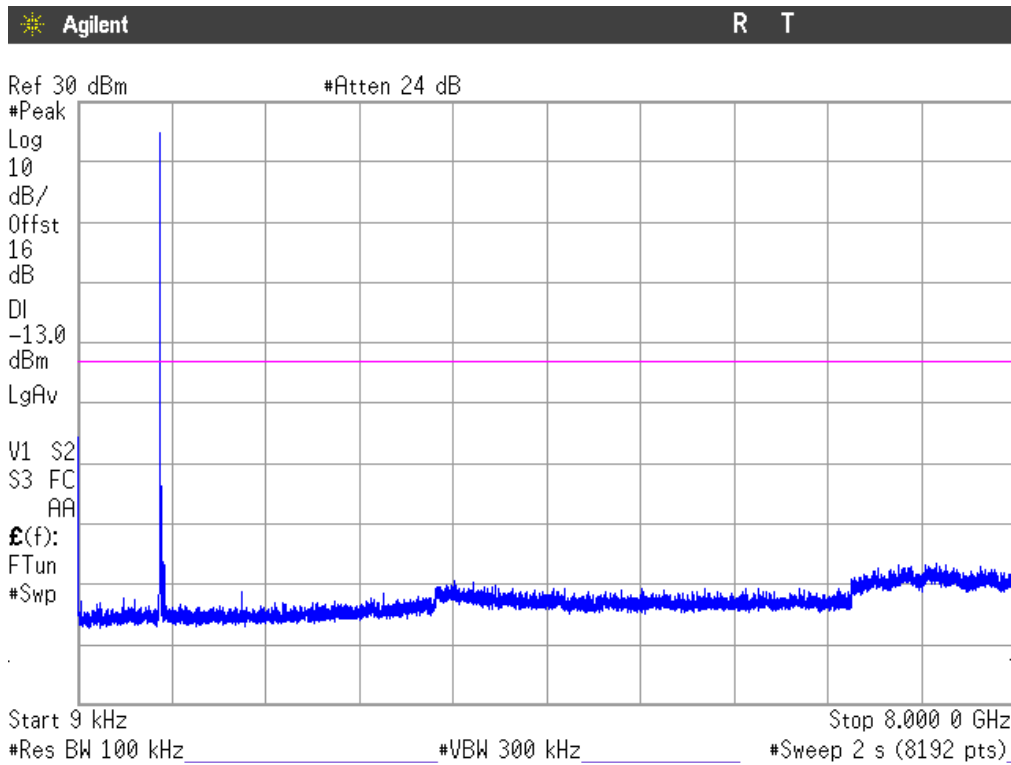
3. CHANNEL: HIGHEST



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

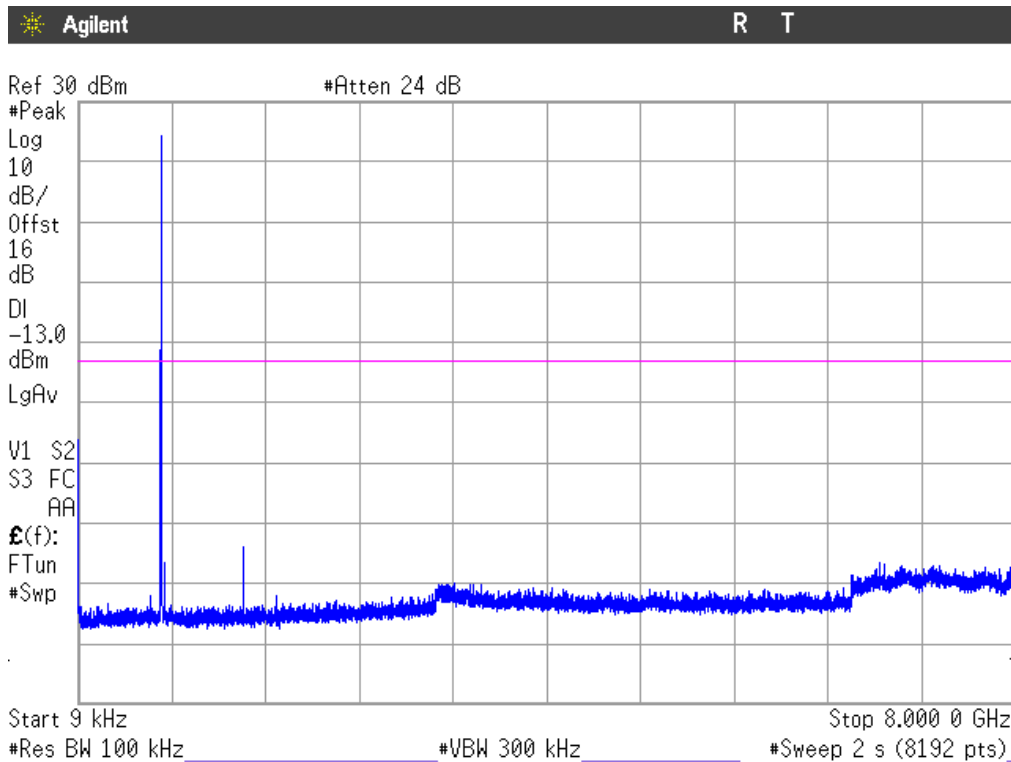
LTE QPSK MODULATION. BW = 5 MHz (Band XII)

1. CHANNEL: LOWEST



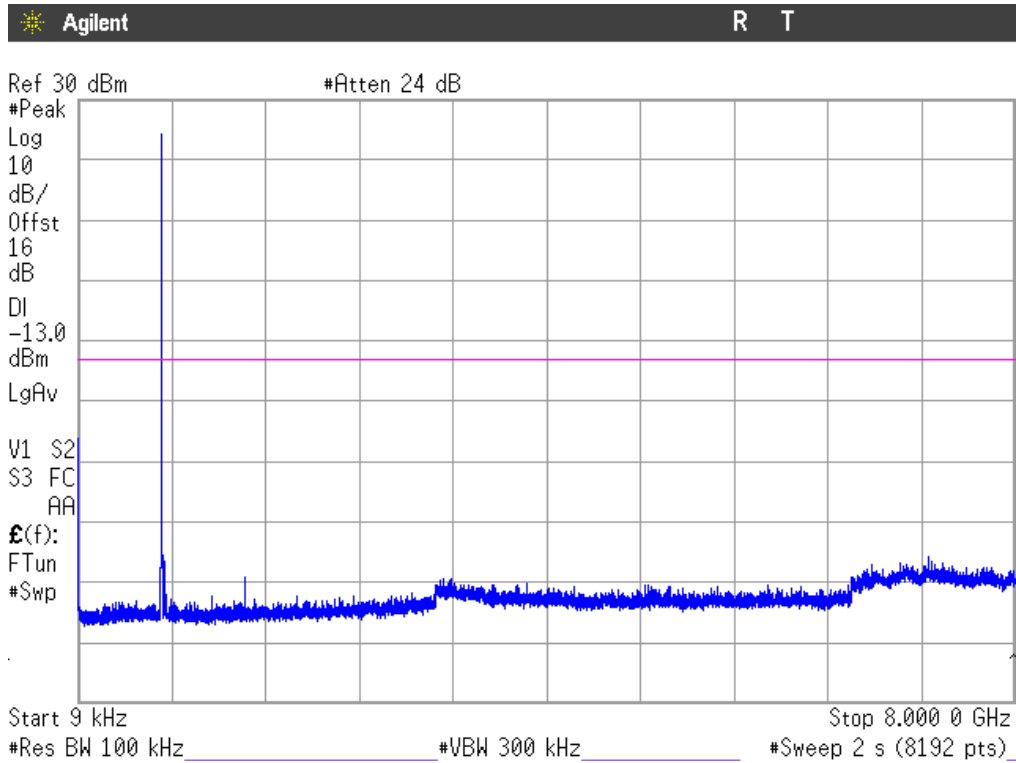
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

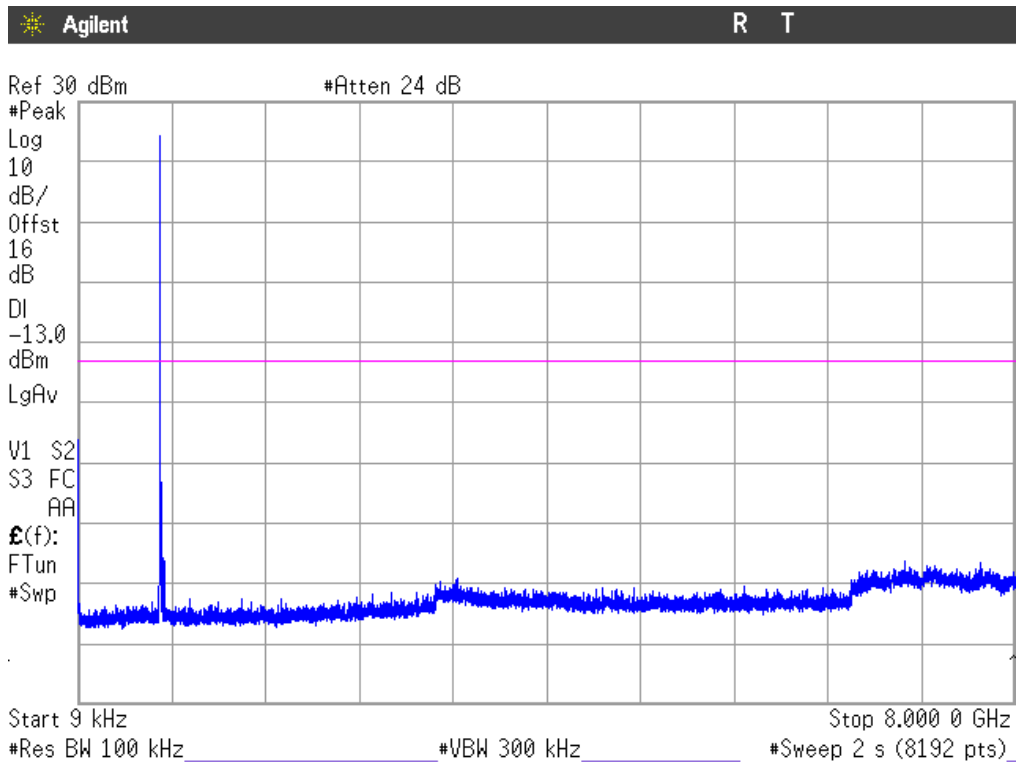
3. CHANNEL: HIGHEST



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

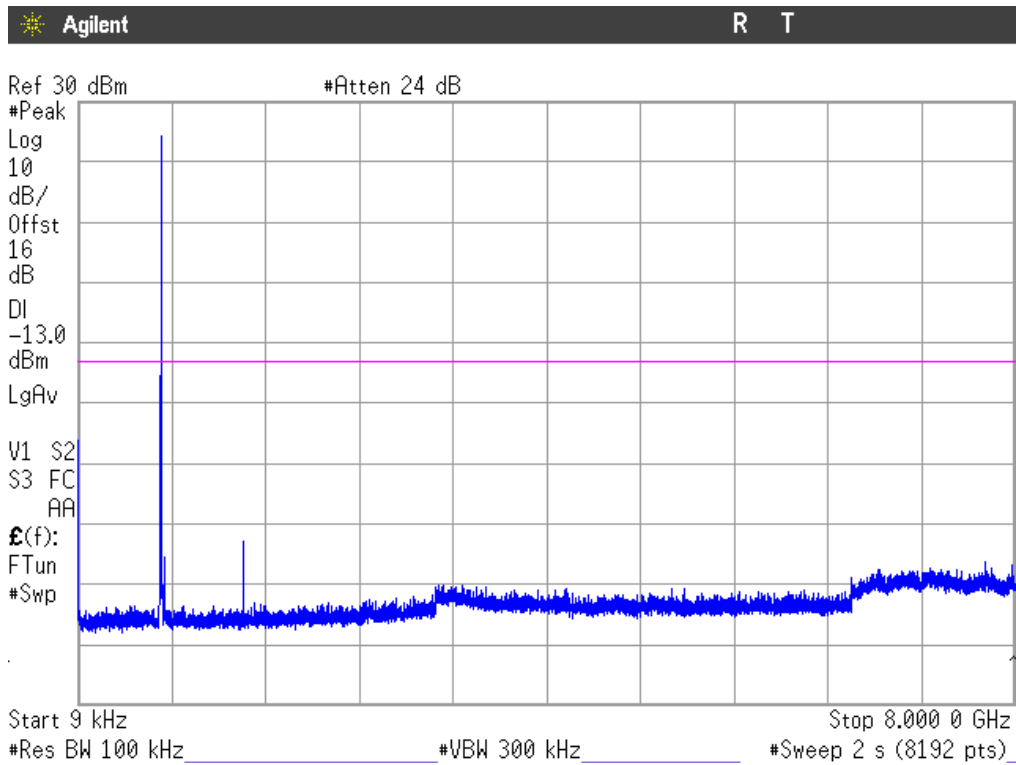
LTE QPSK MODULATION. BW = 10 MHz (Band XII)

1. CHANNEL: LOWEST



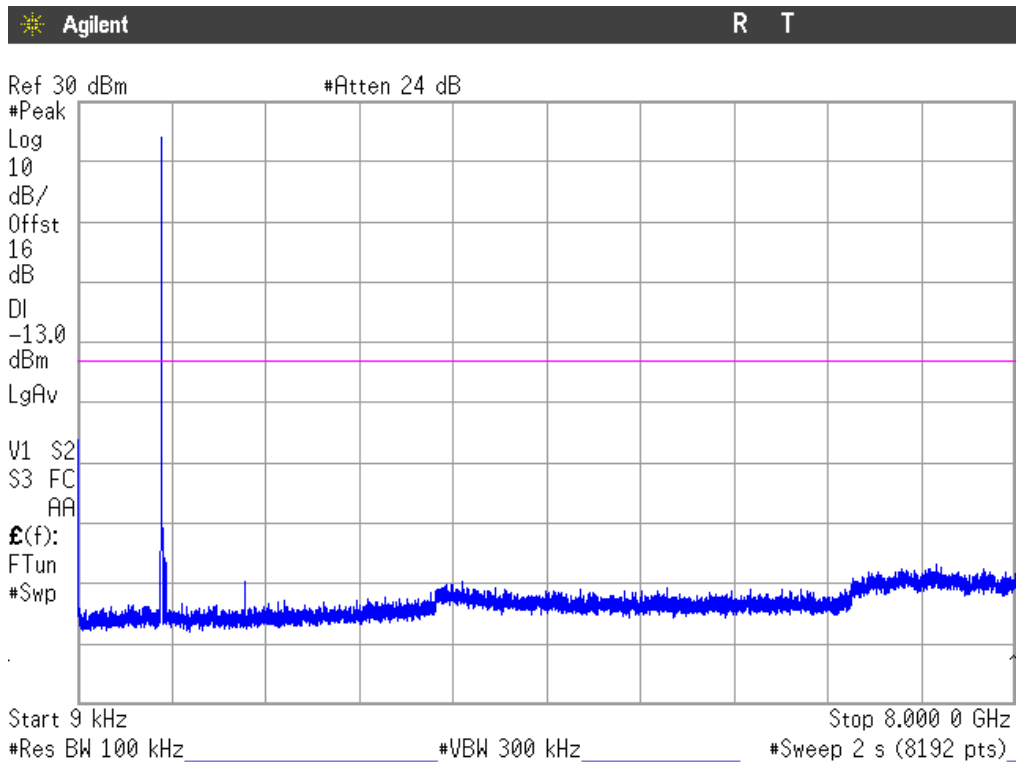
Note: The peak above the limit is the carrier frequency.

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.

Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

FCC §2.1051 and §27.53(g) (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 P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm}$$

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.

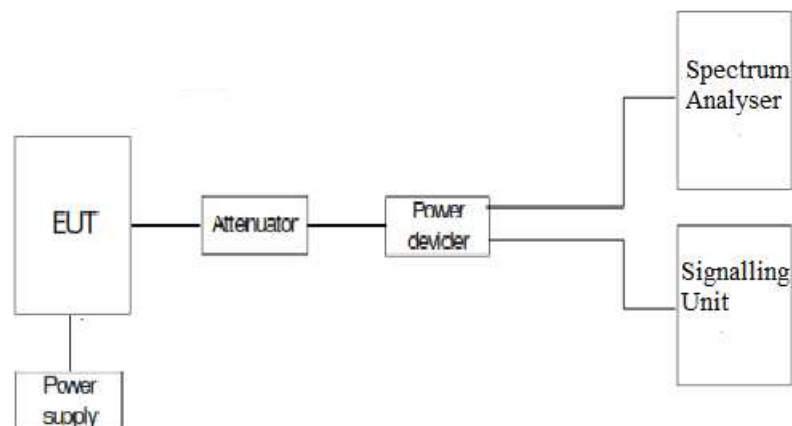
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

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 XII, as indicated in FCC part 27.53 (g) /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)	-20.78	-16.84	-18.25	-16.52	-16.85	-18.40

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)	-25.01	-25.52	-30.24	-32.63	-31.63	-31.90

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)	-20.52	-18.18	-17.73	-16.09	-15.61	-17.79

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)	-25.23	-25.49	-29.13	-28.9	-28.22	-28.99

LTE QPSK MODULATION (Channels in Band XII):	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
Maximum measured level at lowest Block Edge at antenna port (dBm)	-44.81	-31.13	-37.06	-37.76

LTE QPSK MODULATION: (Channels in Band XII):	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
Maximum measured level at lowest Block Edge at antenna port (dBm)	-41.28	-35.99	-36.07	-41.22

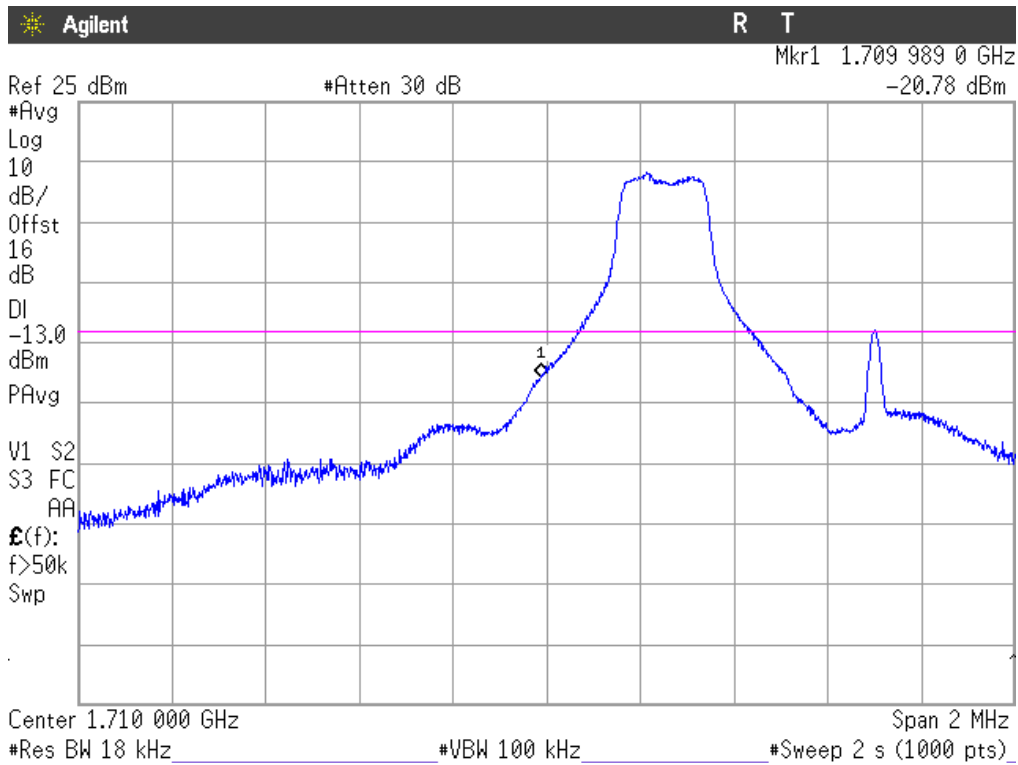
LTE QPSK MODULATION: (Channels in Band XII):	RB= 1. Offset=Max. BW=1.4 MHz	RB= 1. Offset=Max. BW = 3 MHz	RB= 1. Offset=Max. BW = 5 MHz	RB= 1. Offset=Max. BW = 10 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-15.56	-14.66	-14.71	-15.12

LTE QPSK MODULATION: (Channels in Band XII):	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
Maximum measured level at highest Block Edge at antenna port (dBm)	-21.04	-24.41	-25.82	-30.34

Measurement uncertainty = <+2.01 dB.

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

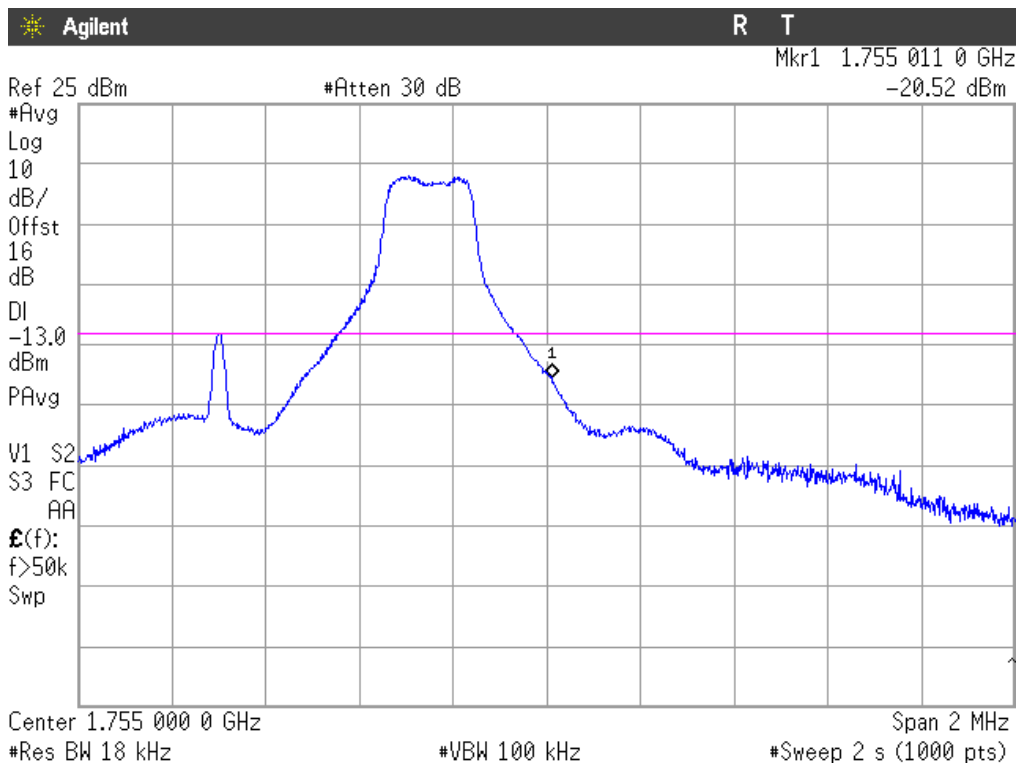
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

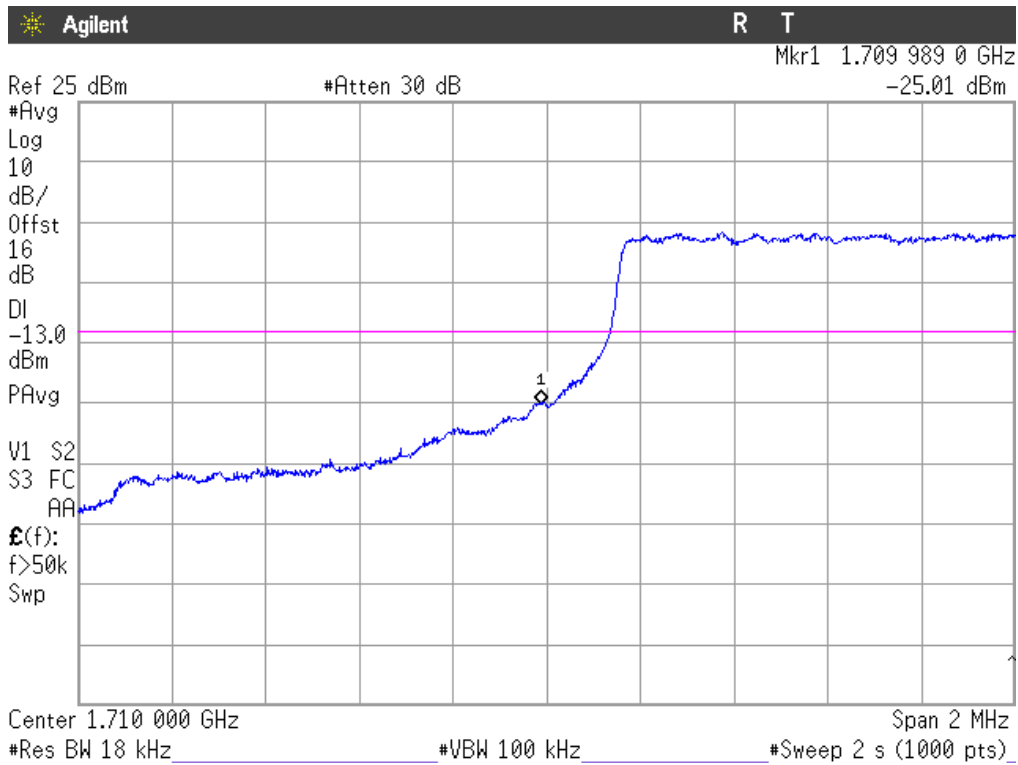
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

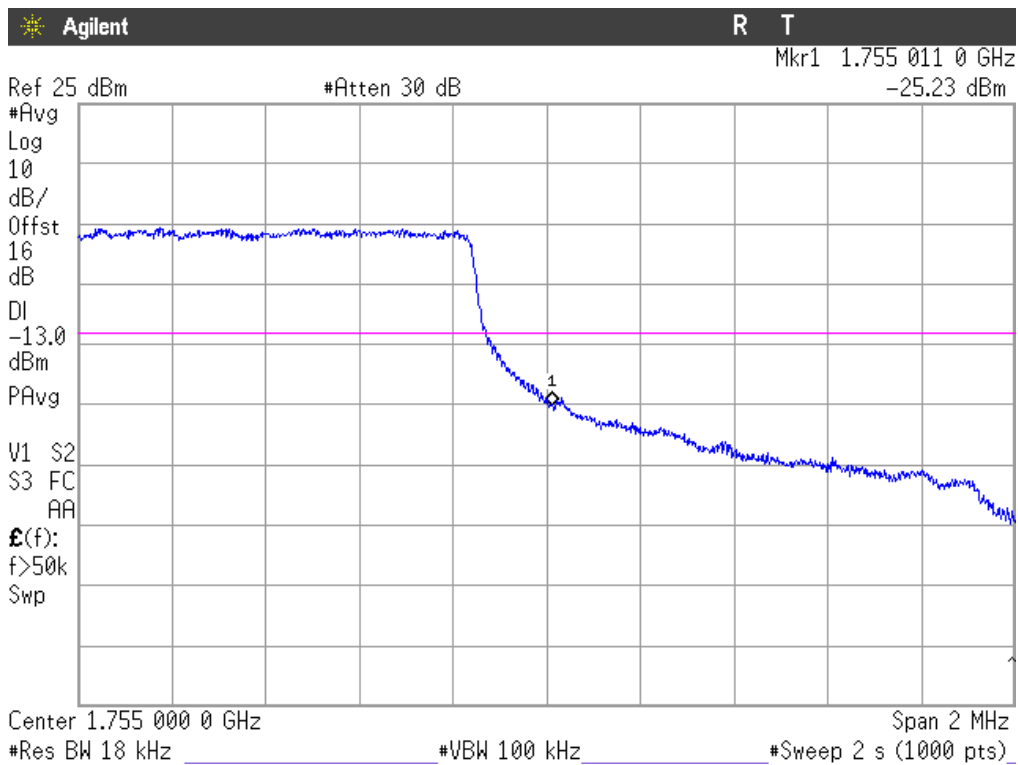
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

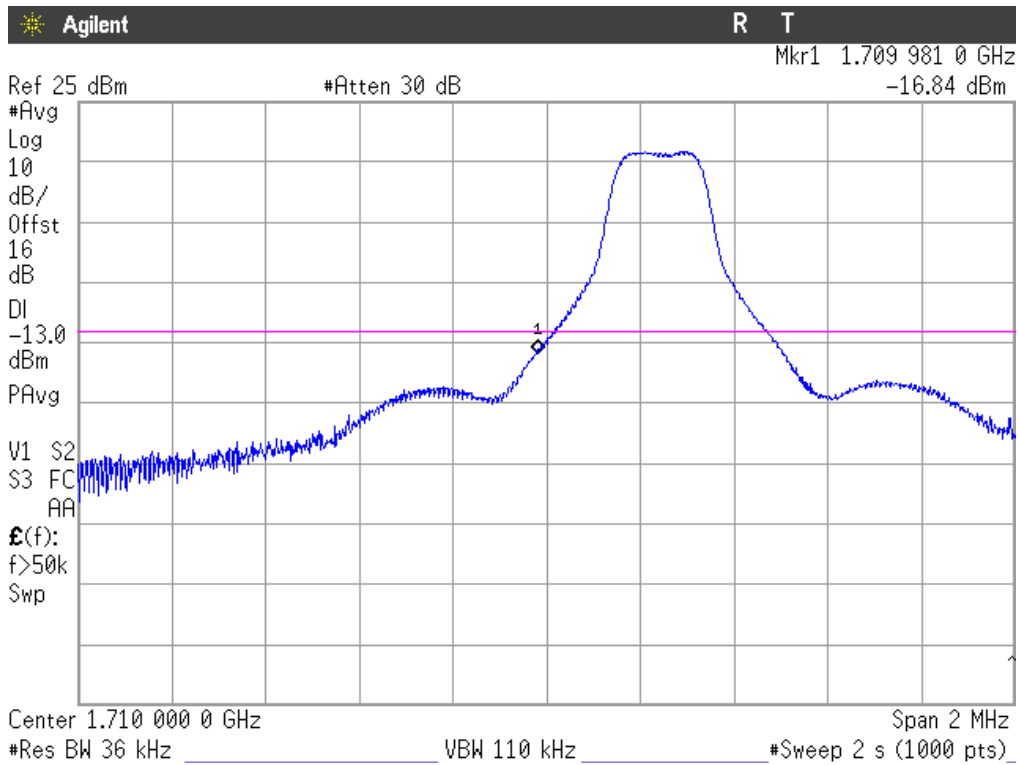


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

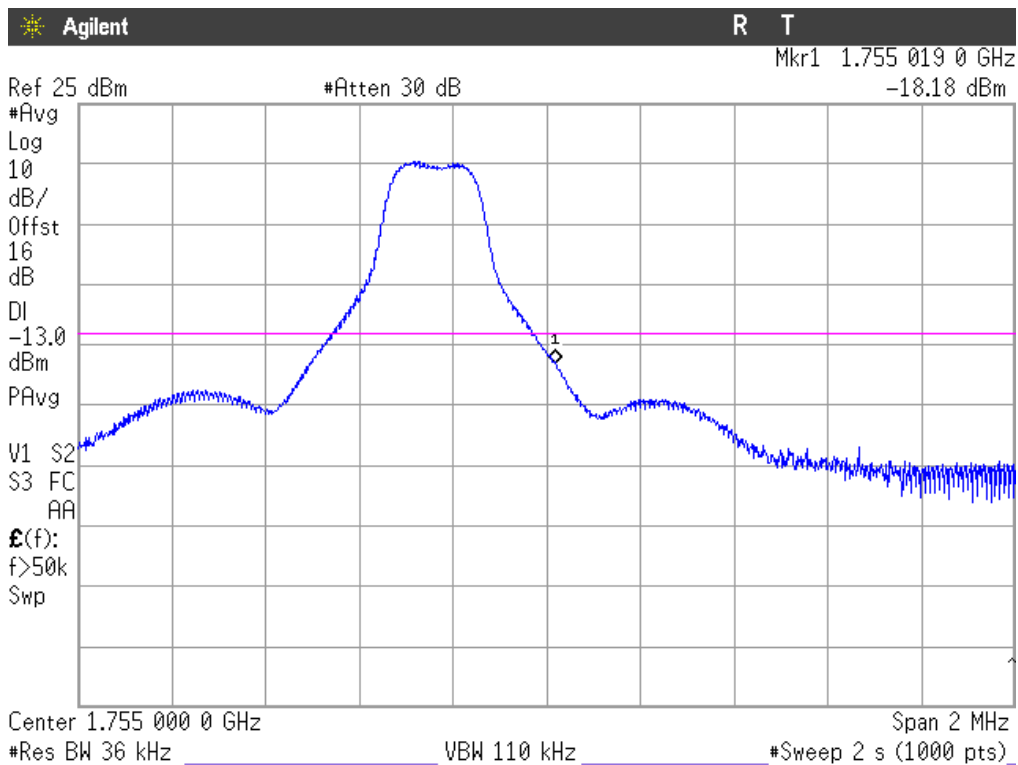
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

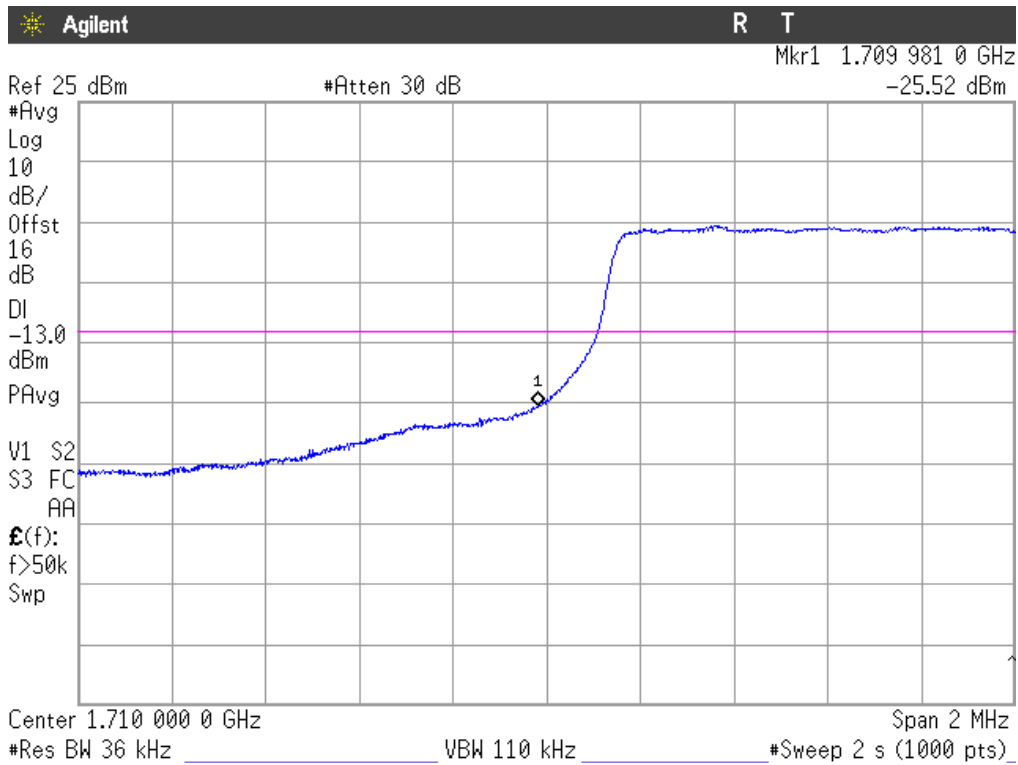
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

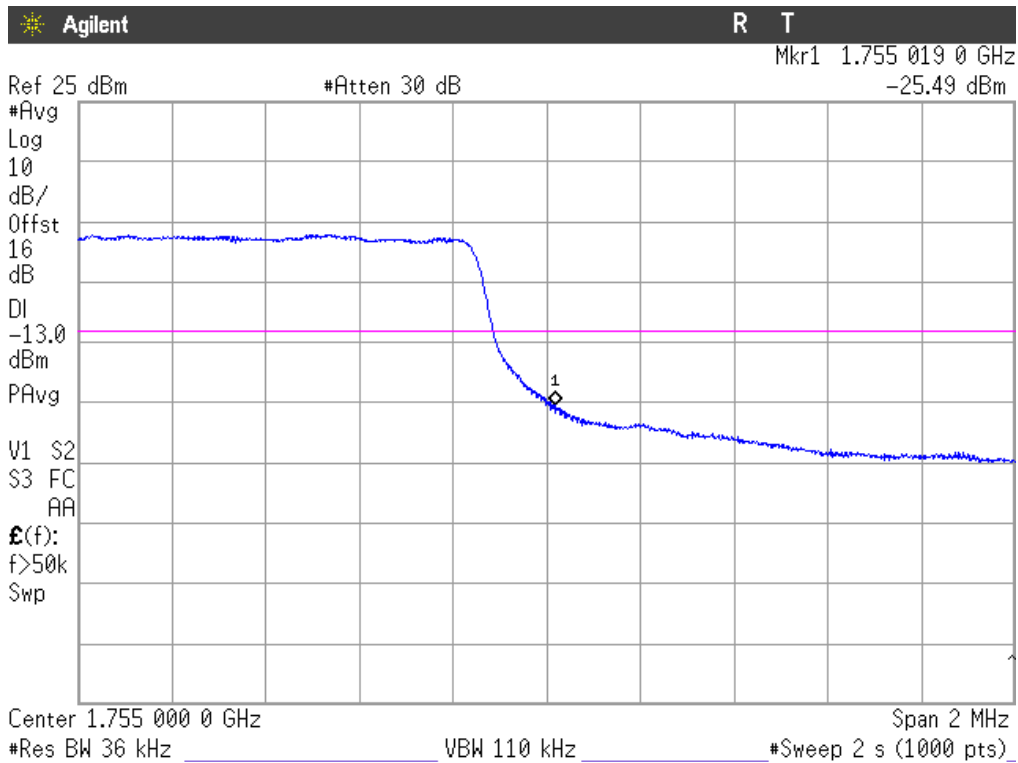
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

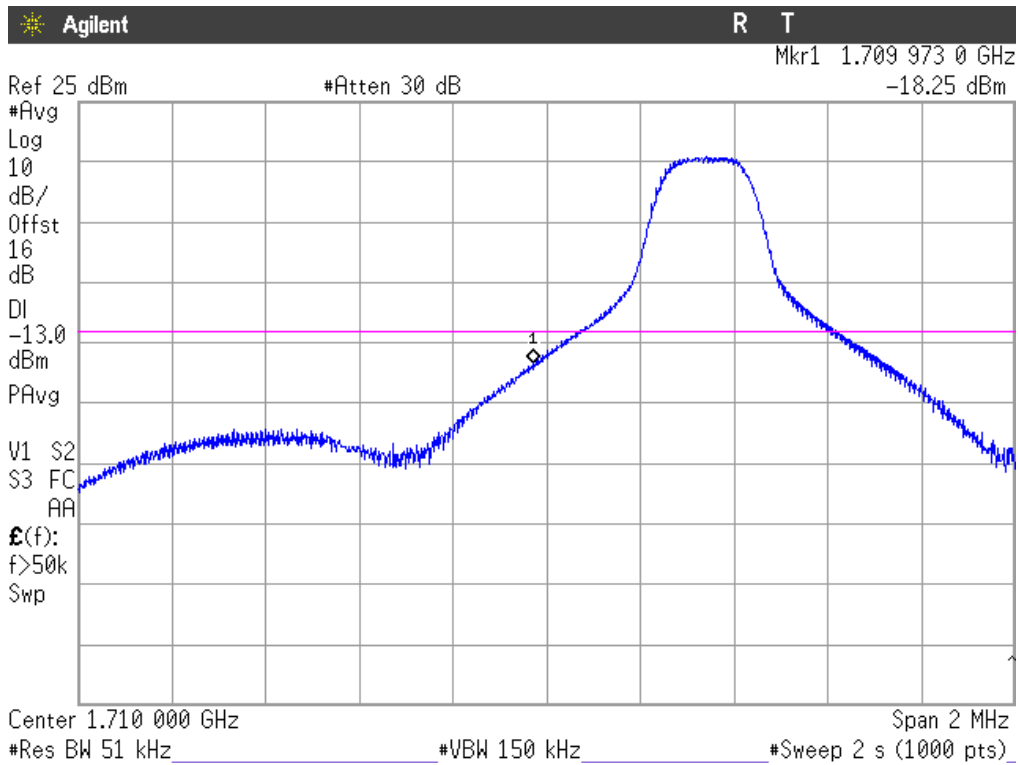


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

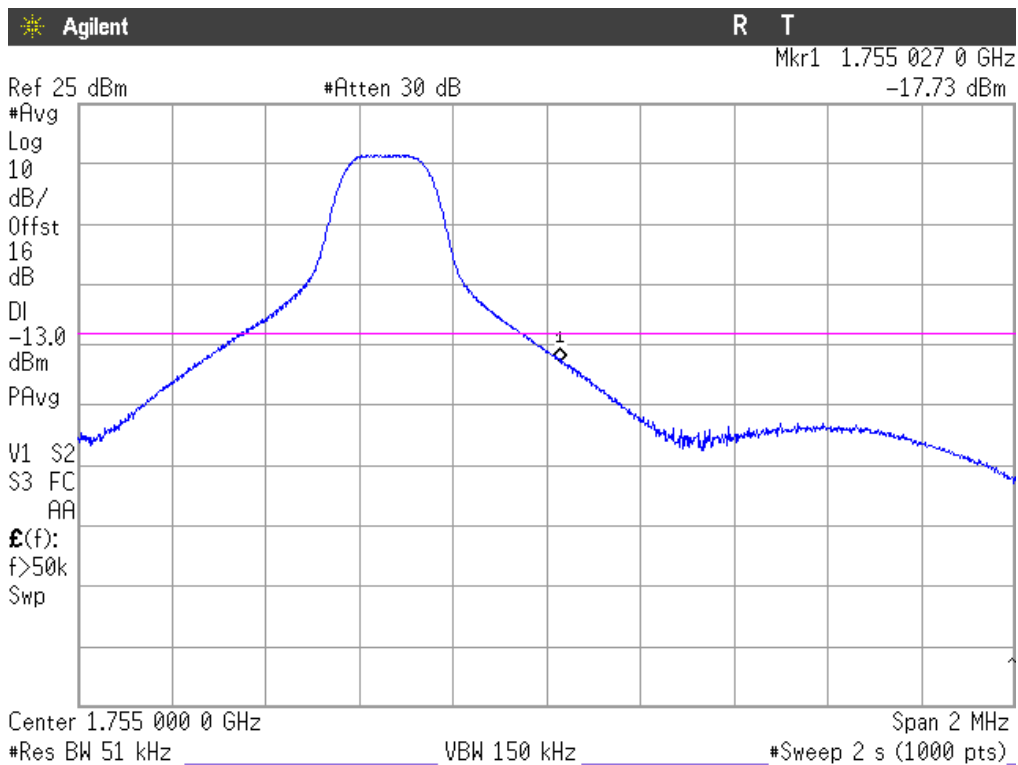
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

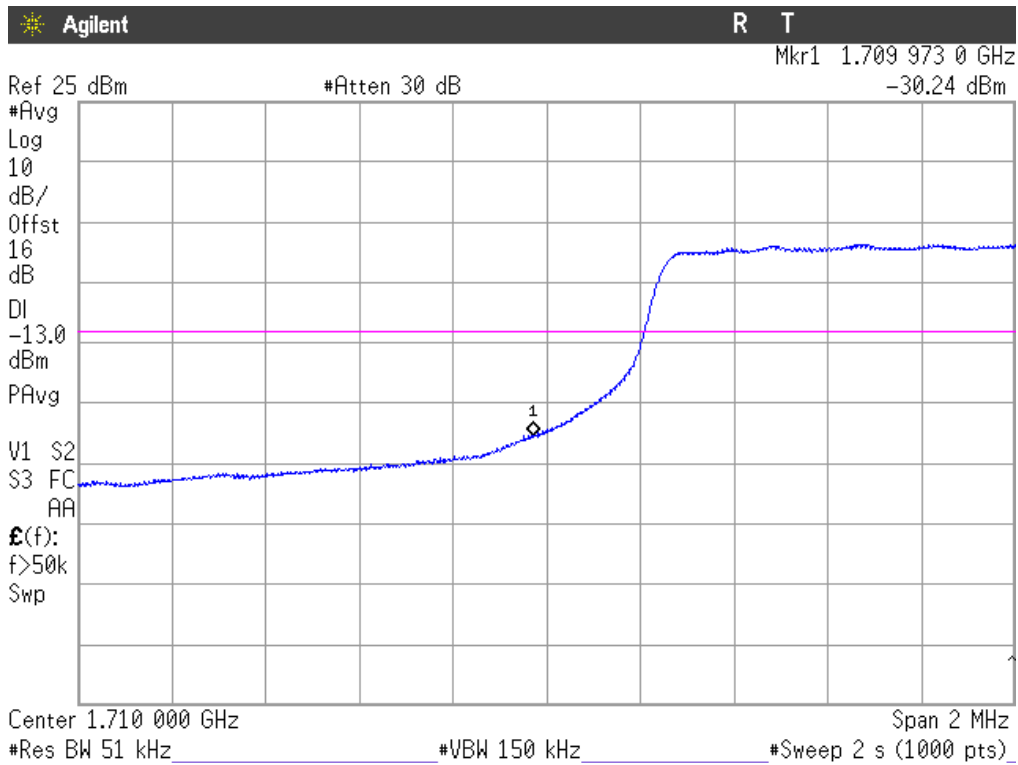
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

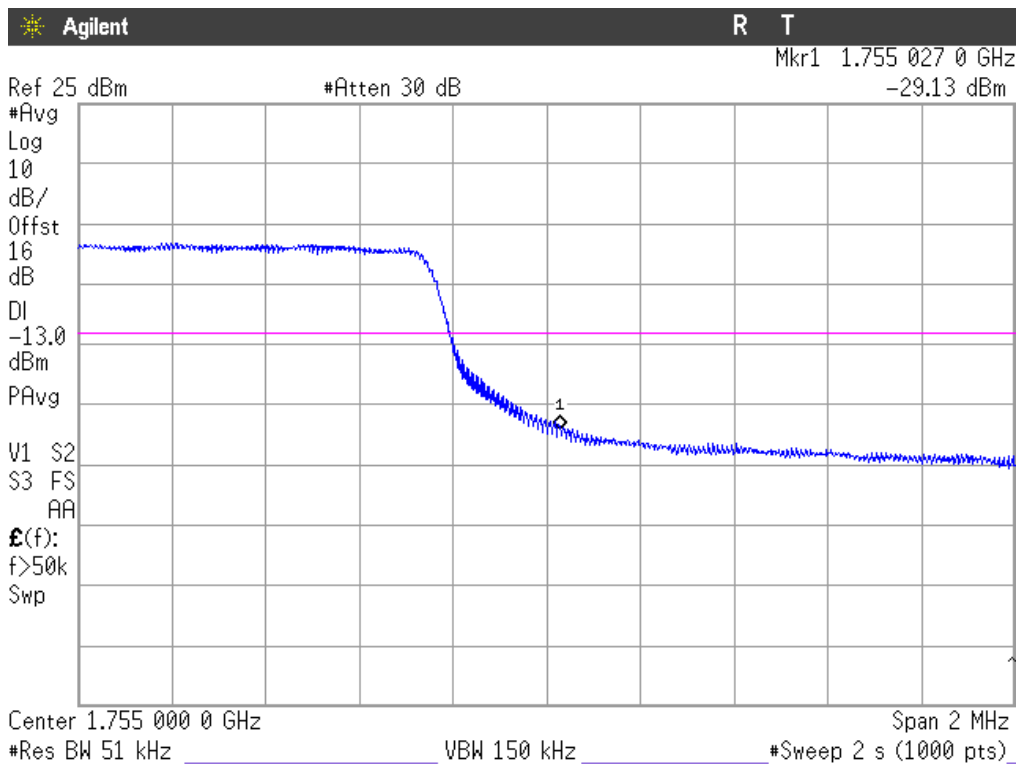
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

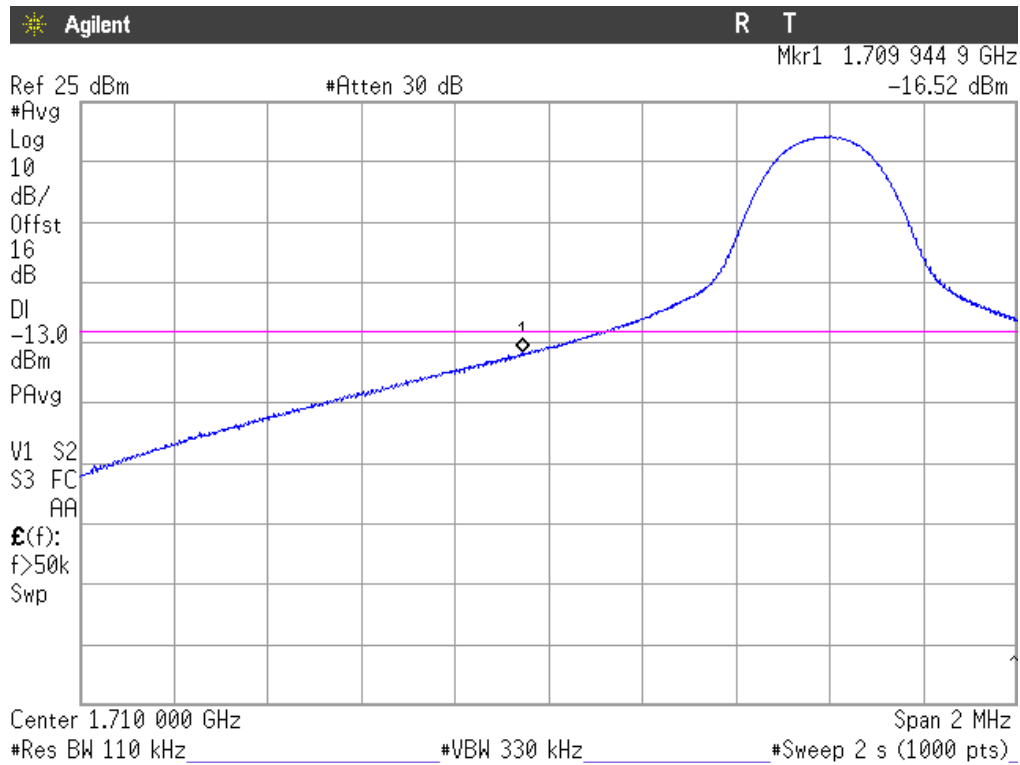


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

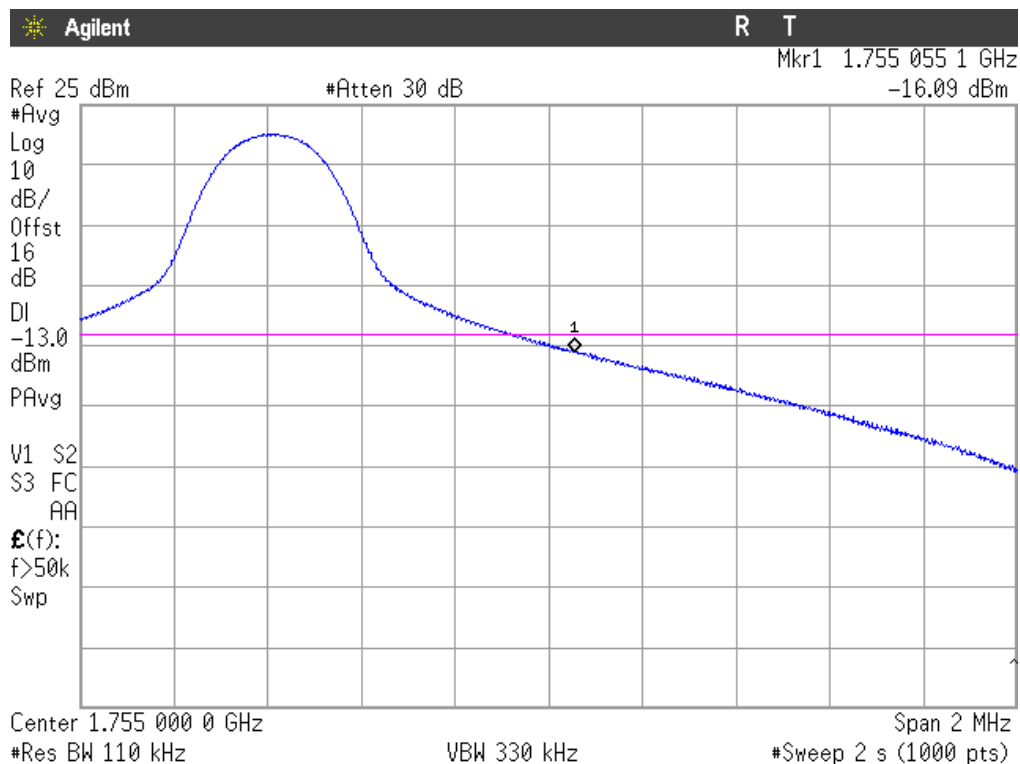
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

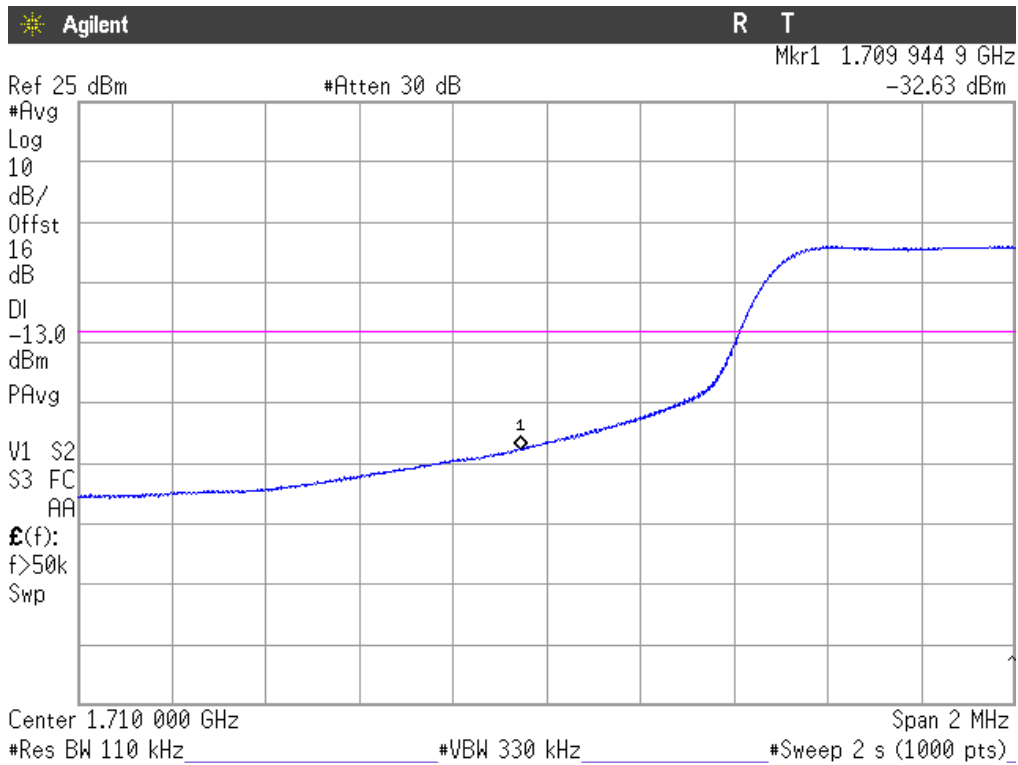
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

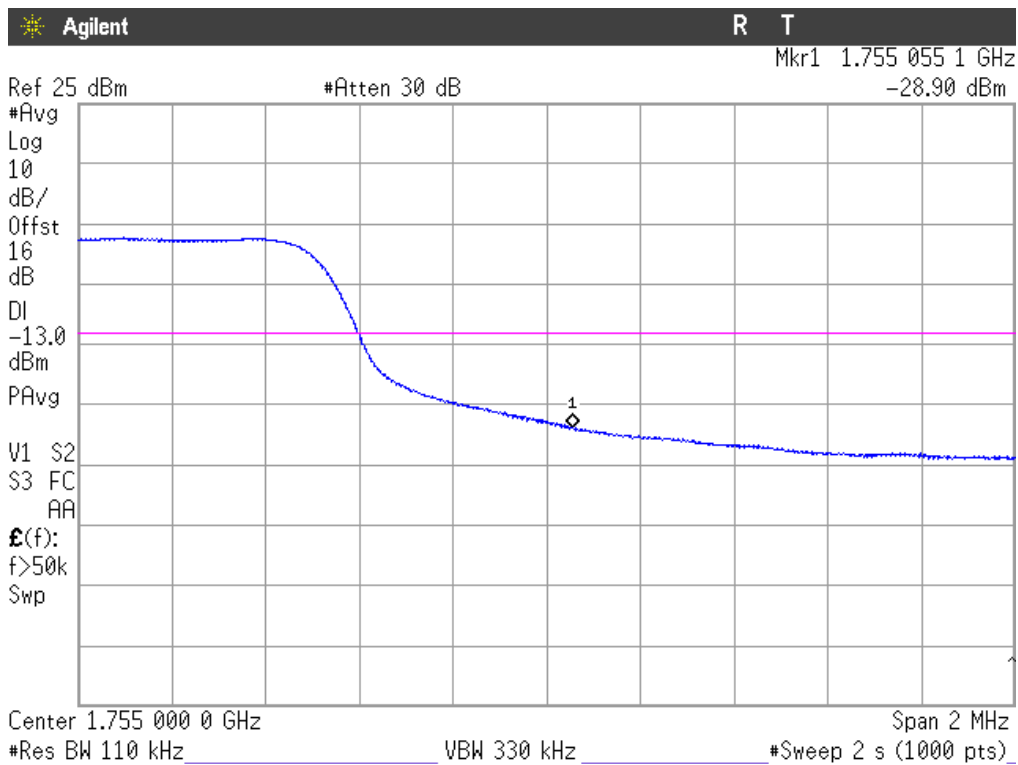
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

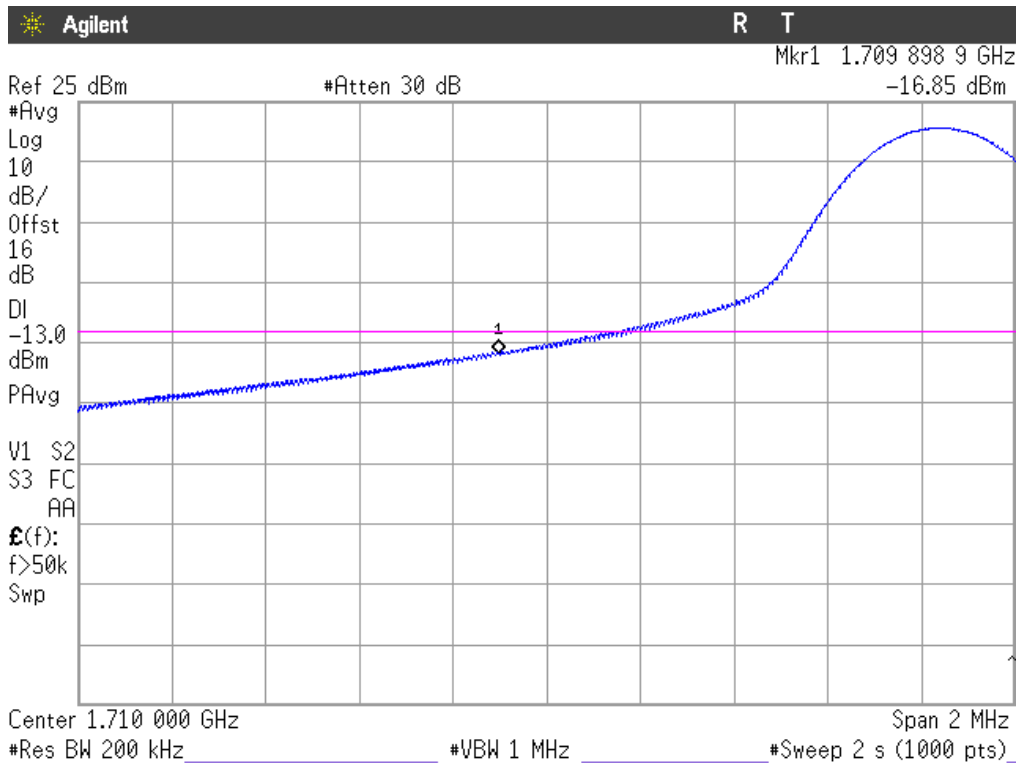


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

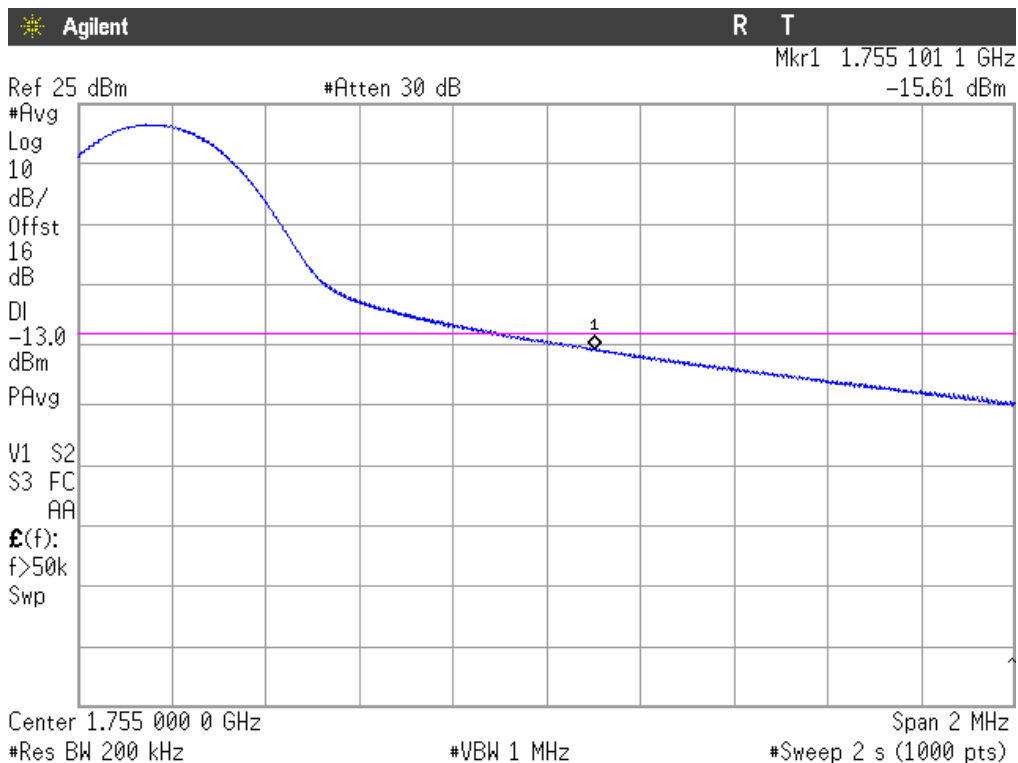
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

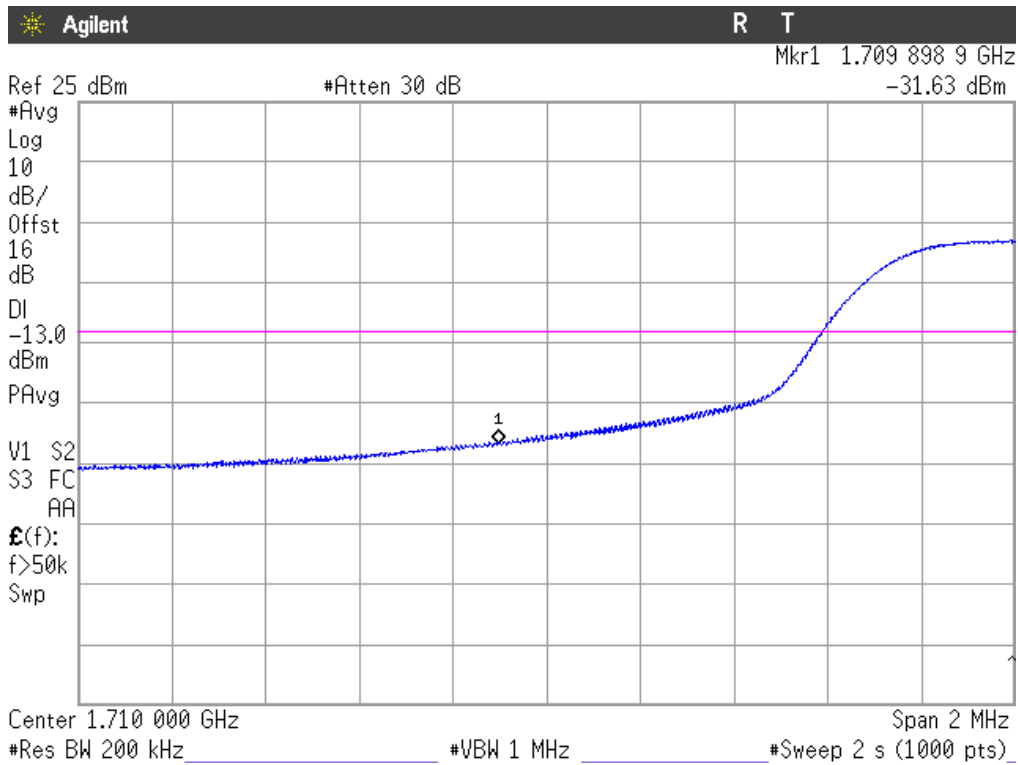
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

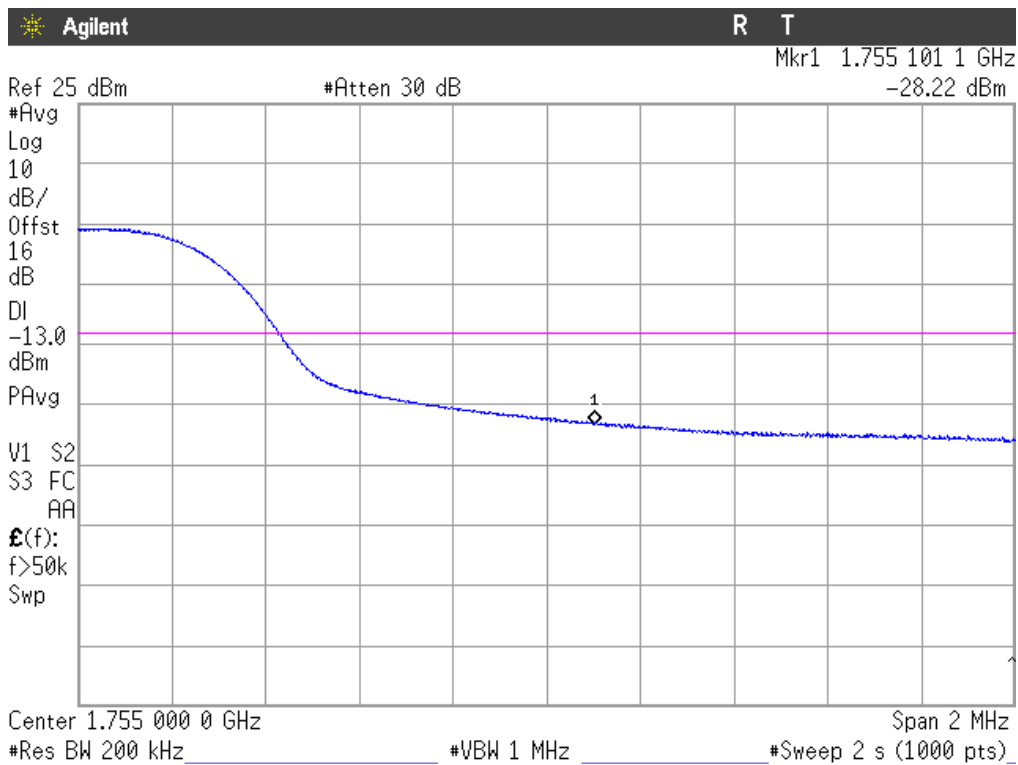
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 15 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

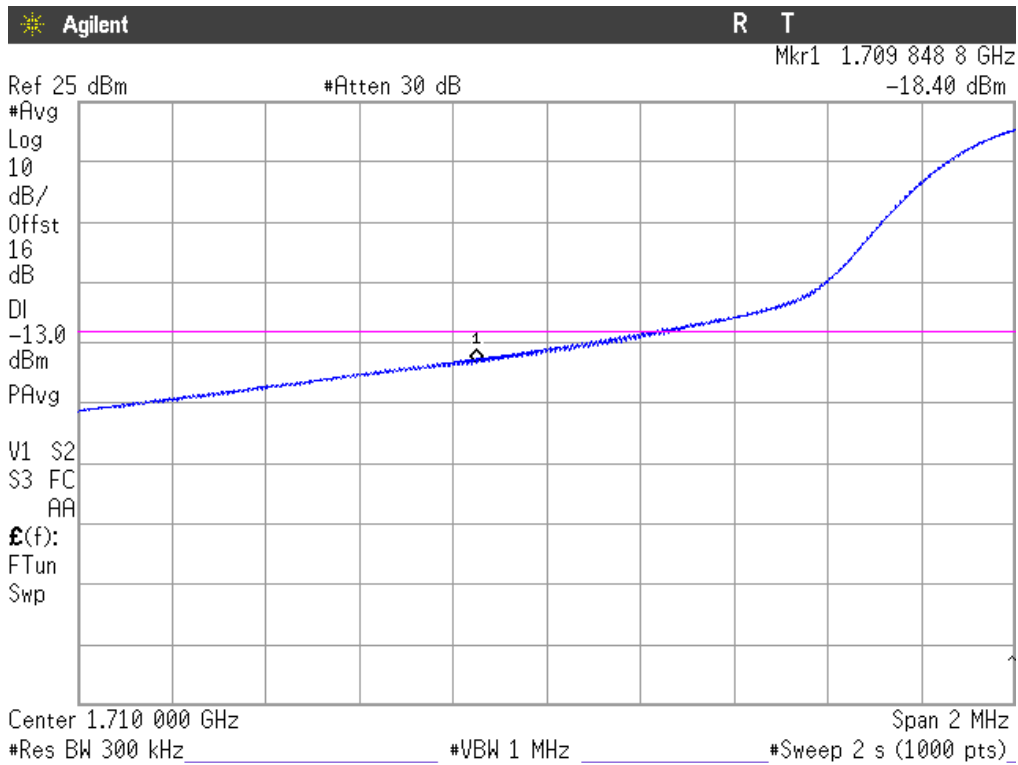


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

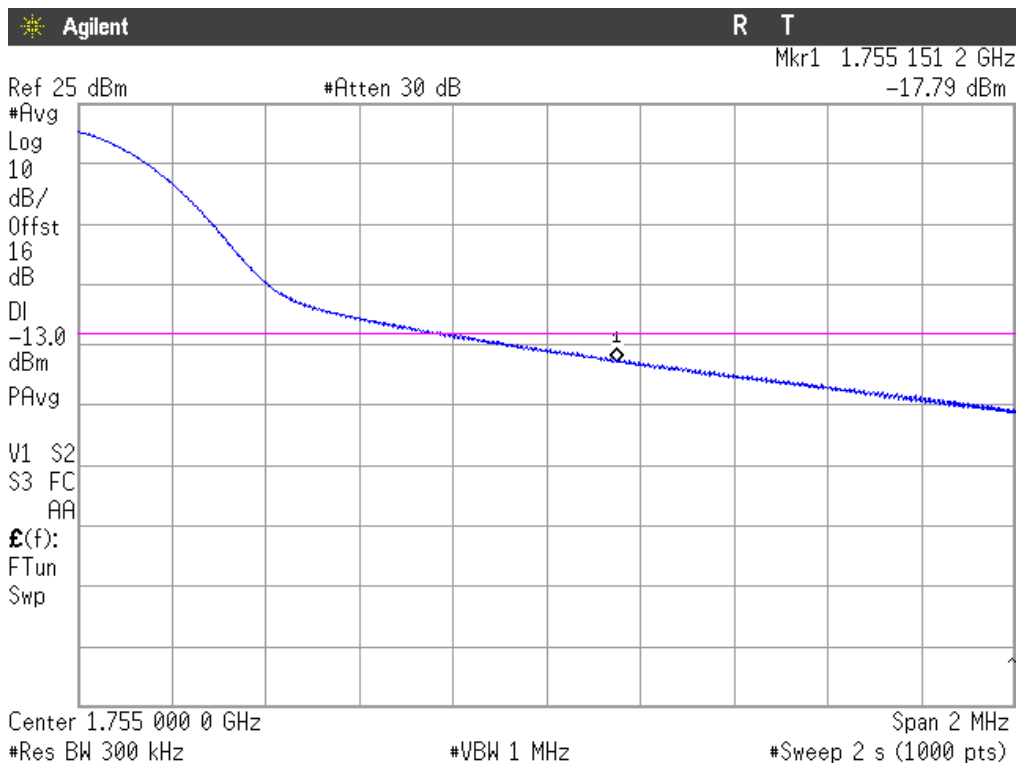
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

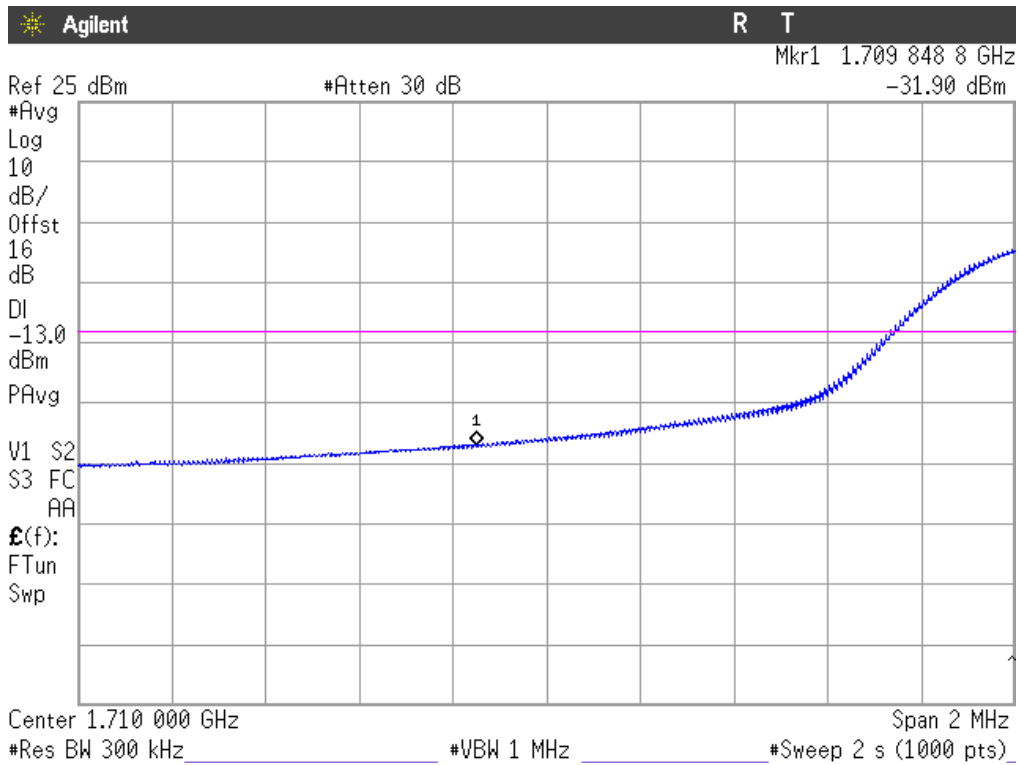
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

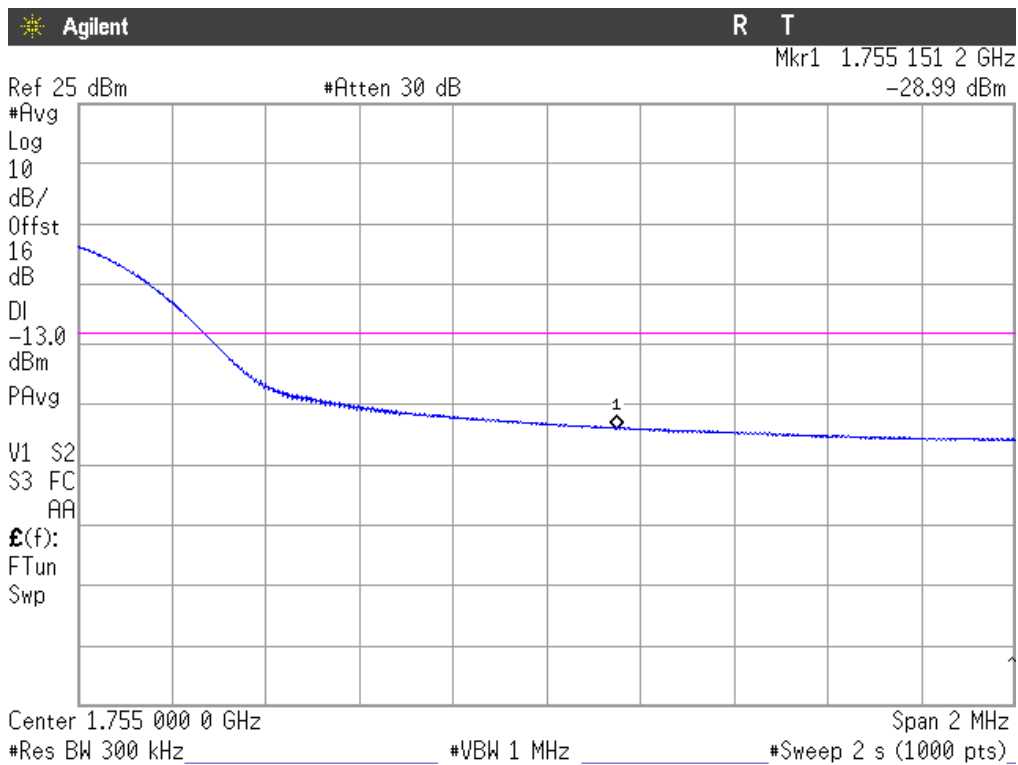
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 20 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

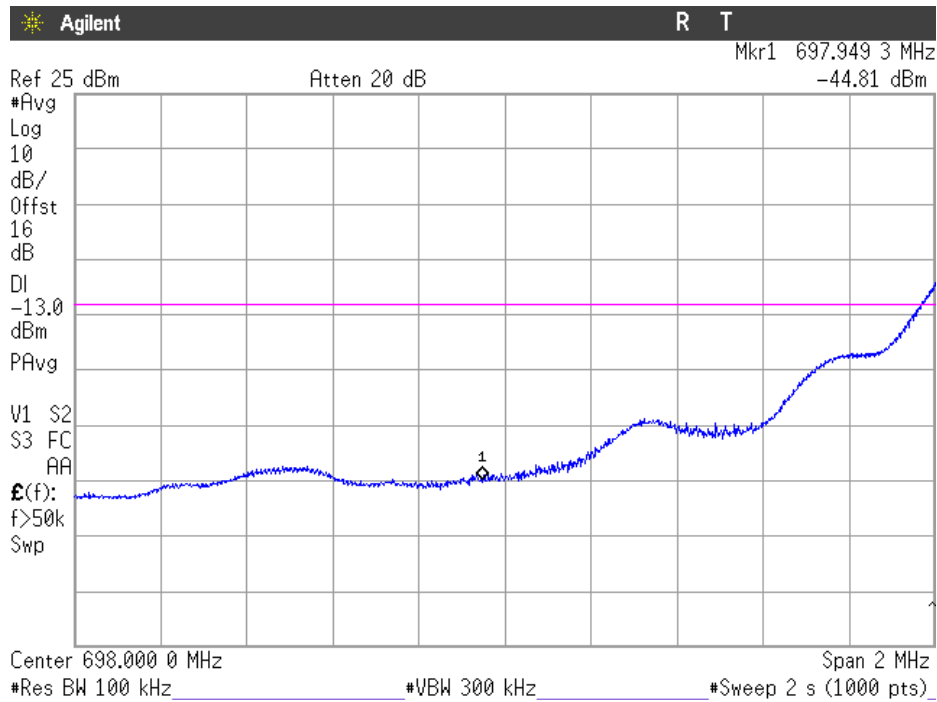


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

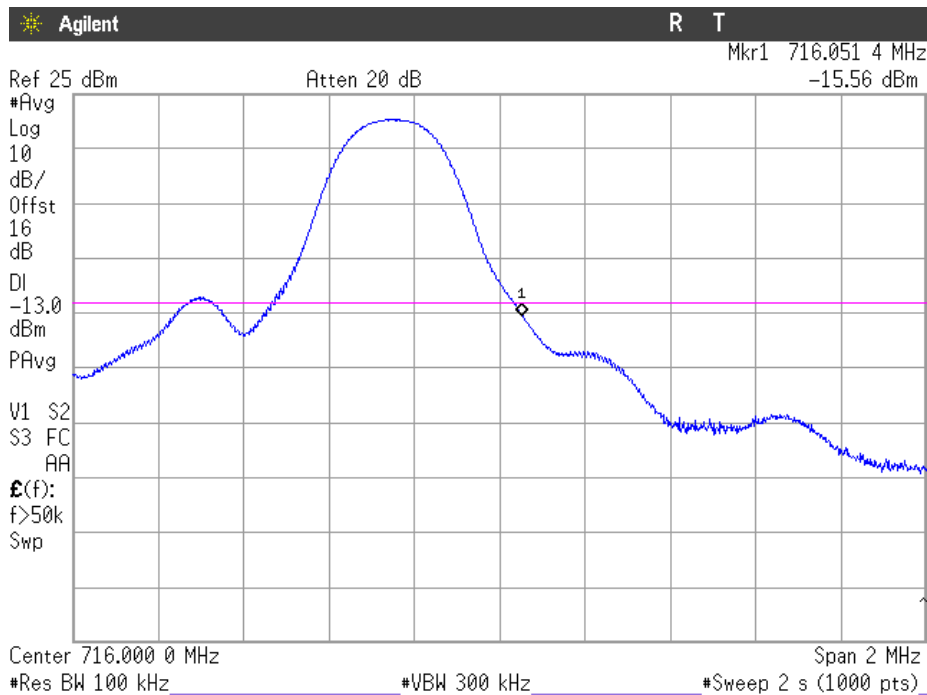
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

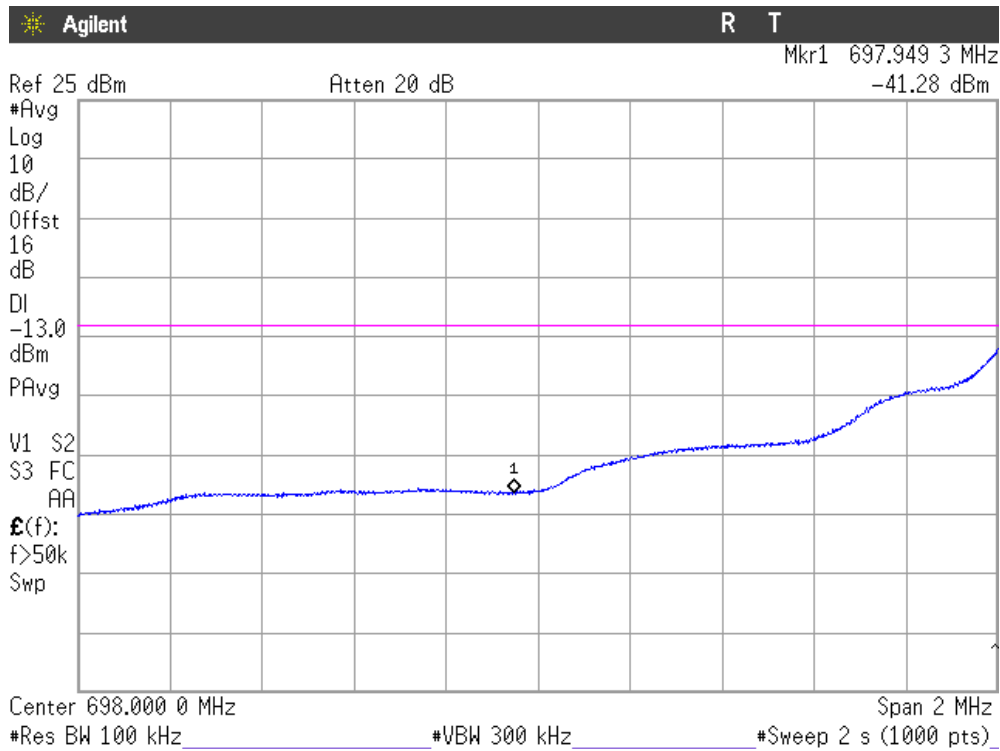
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

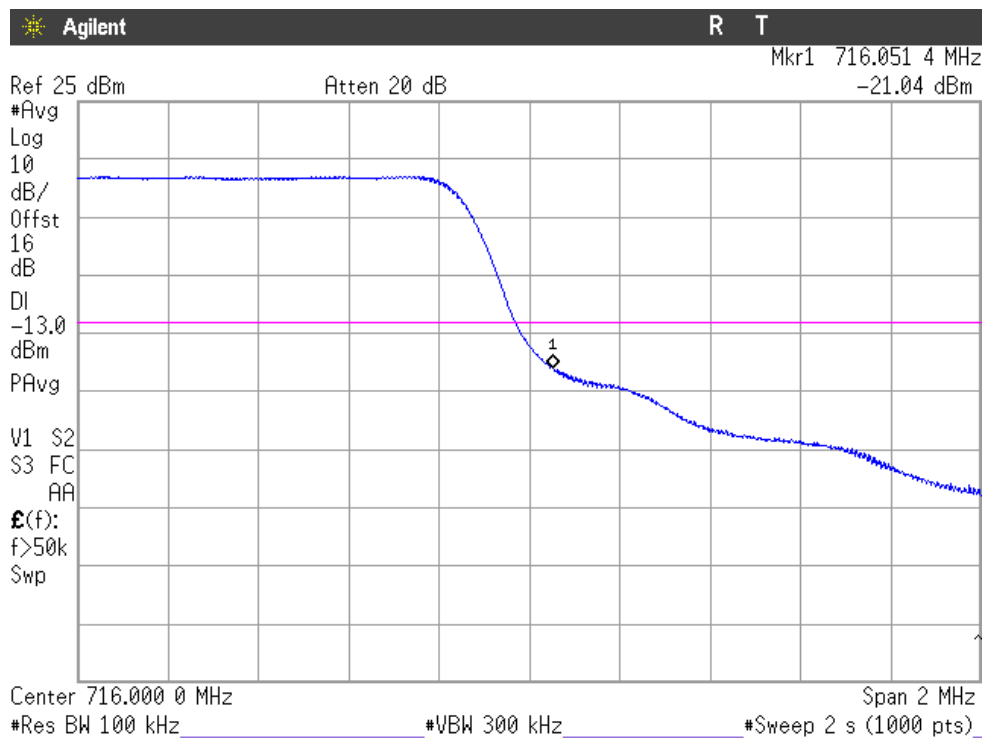
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

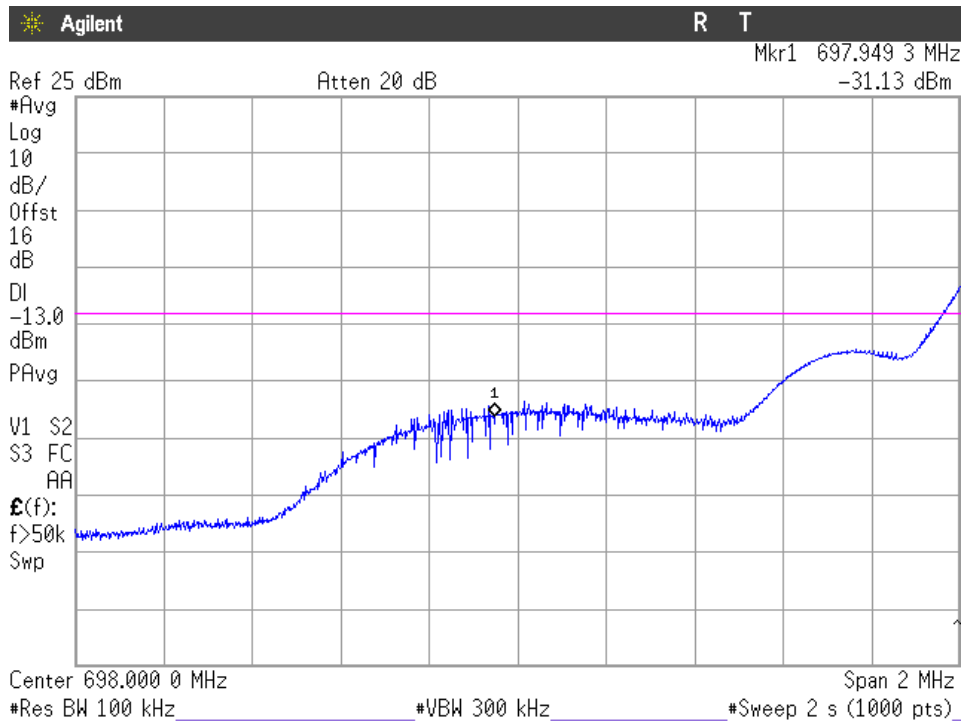


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

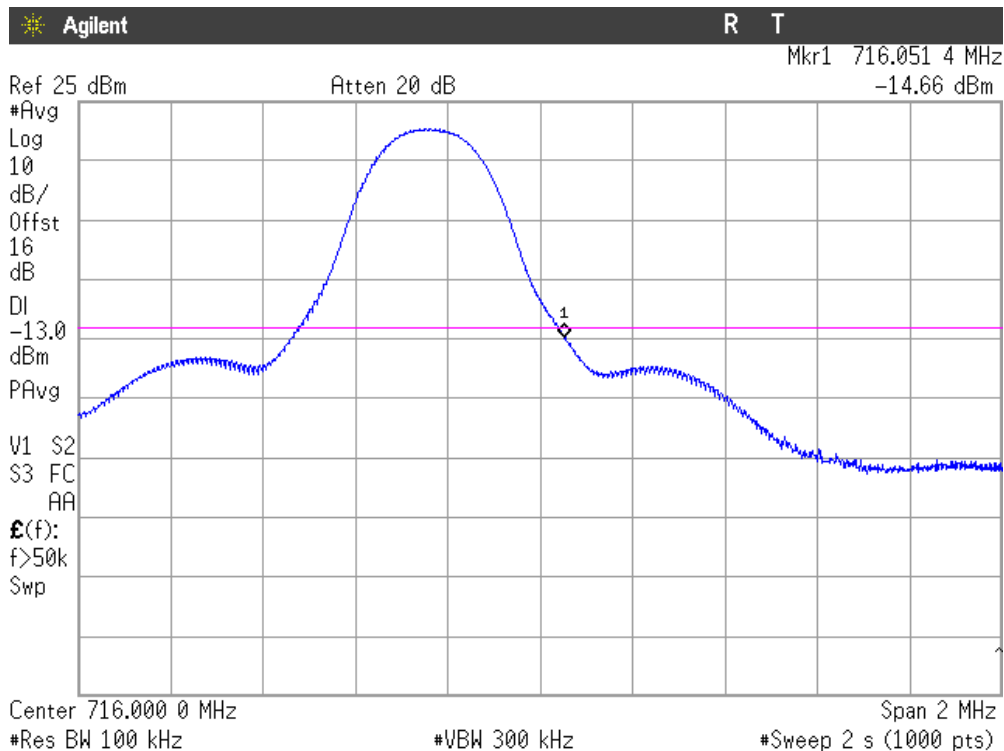
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

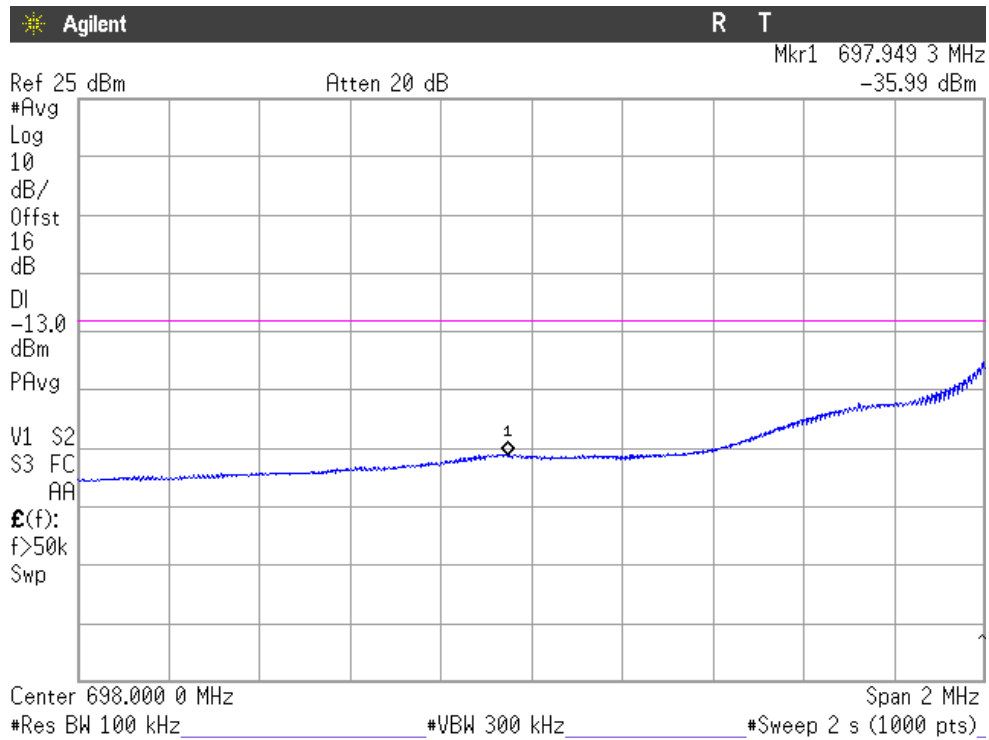
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

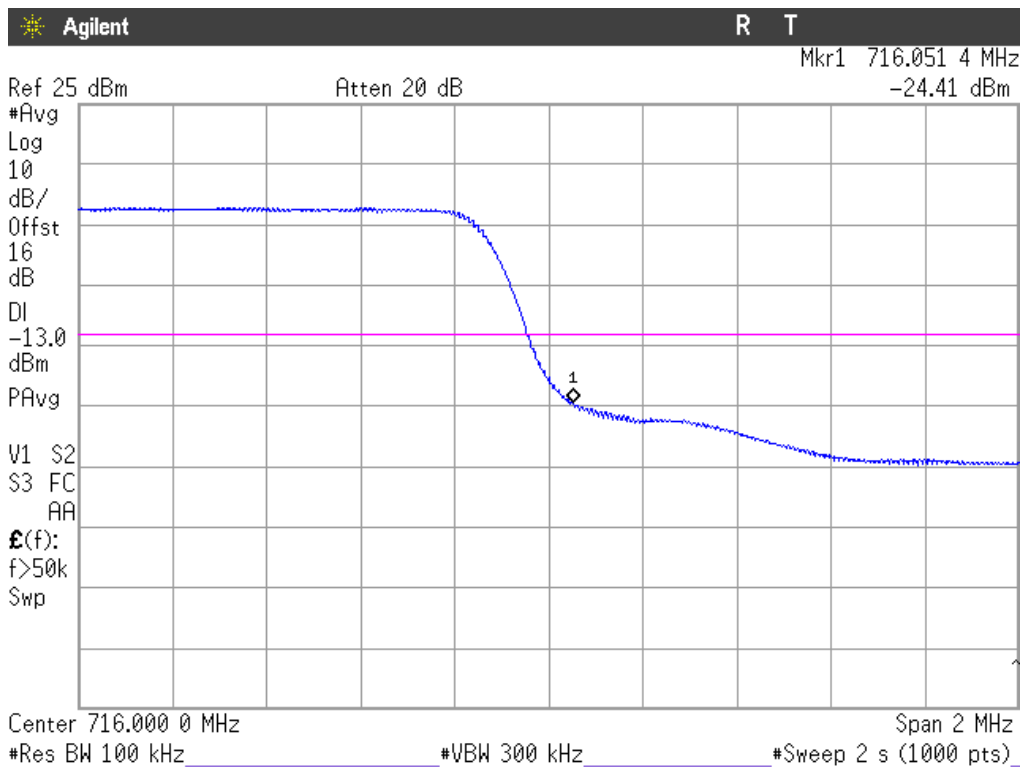
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

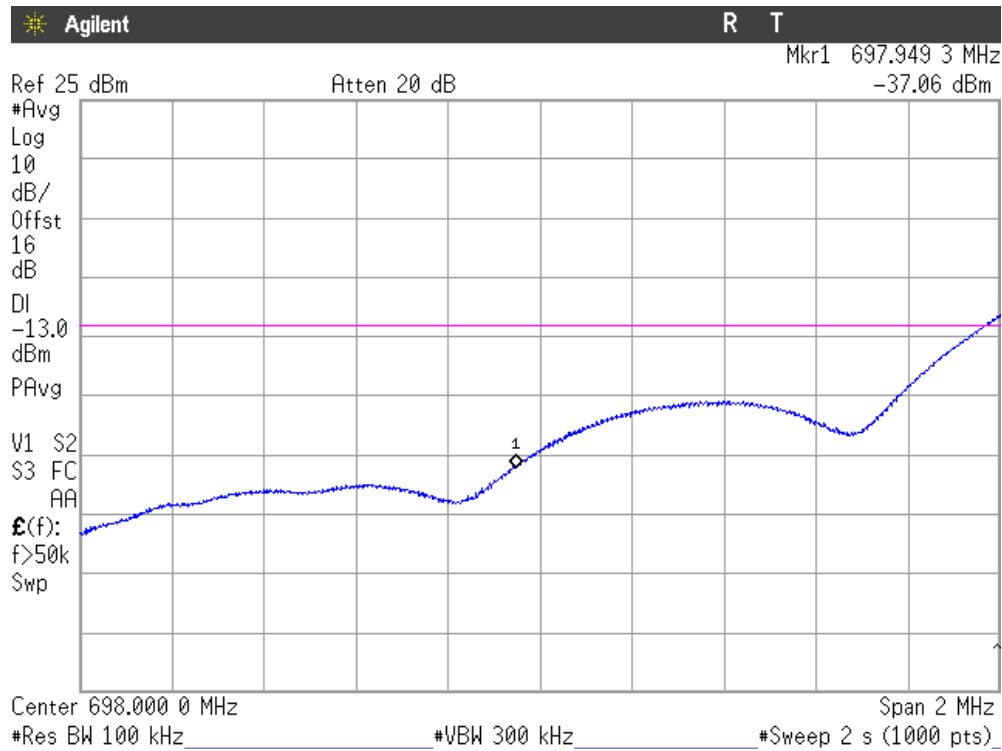


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

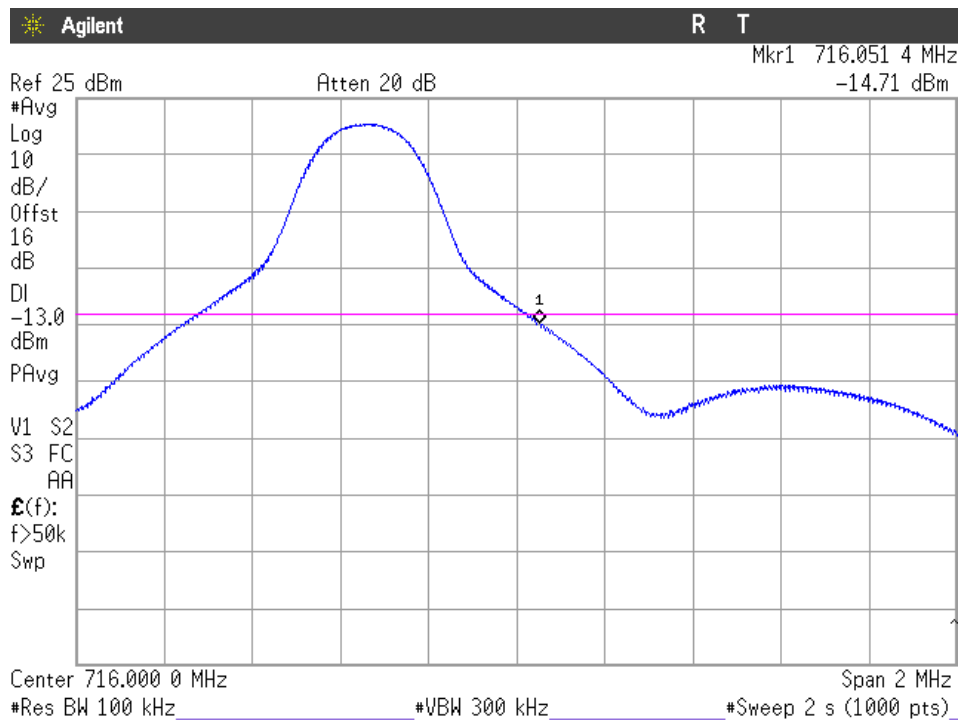
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

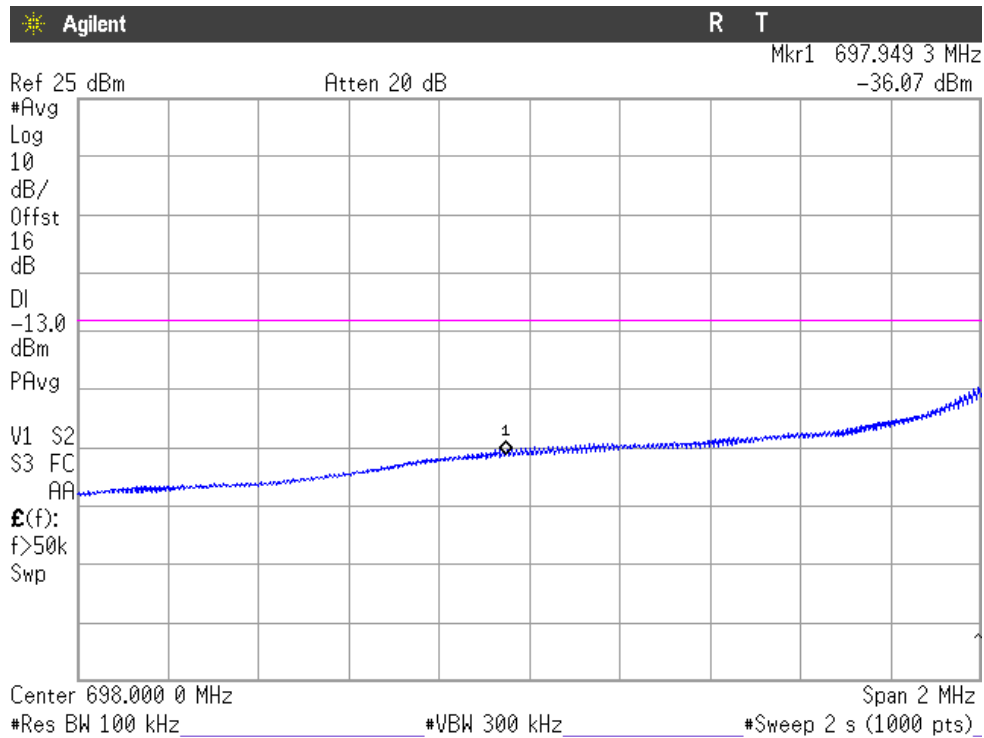
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

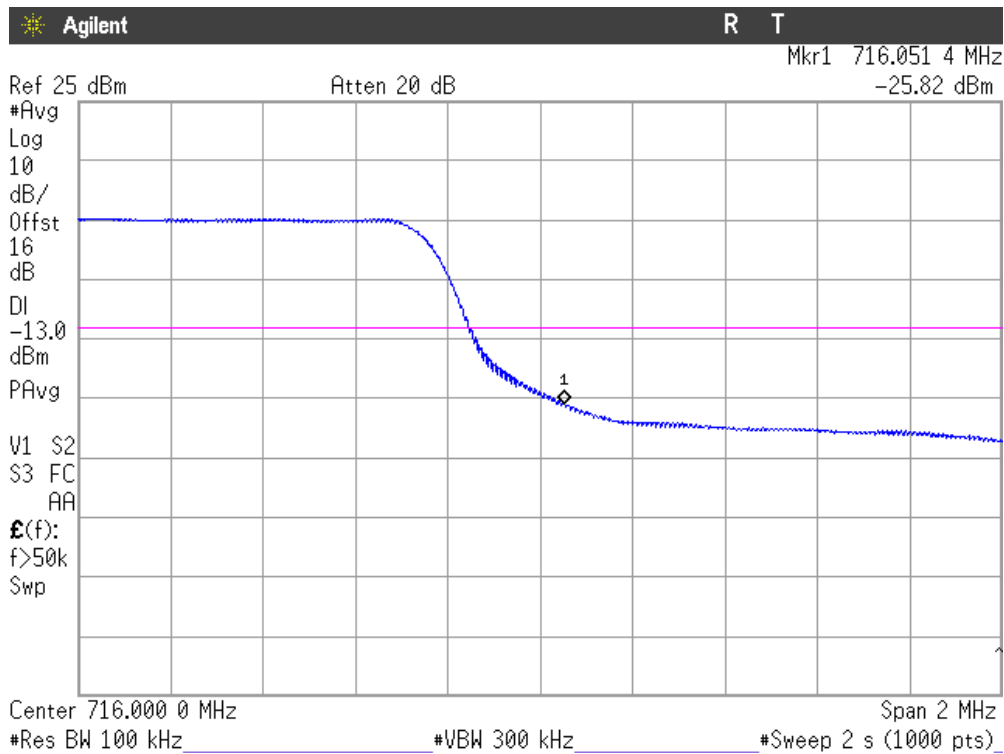
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

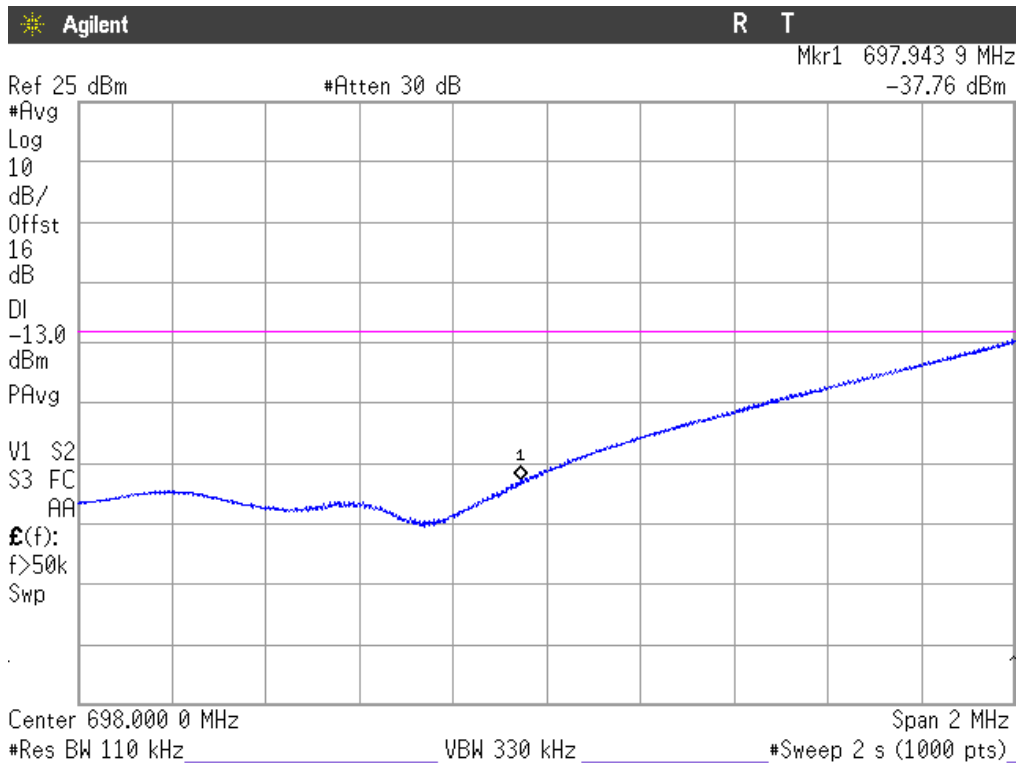


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

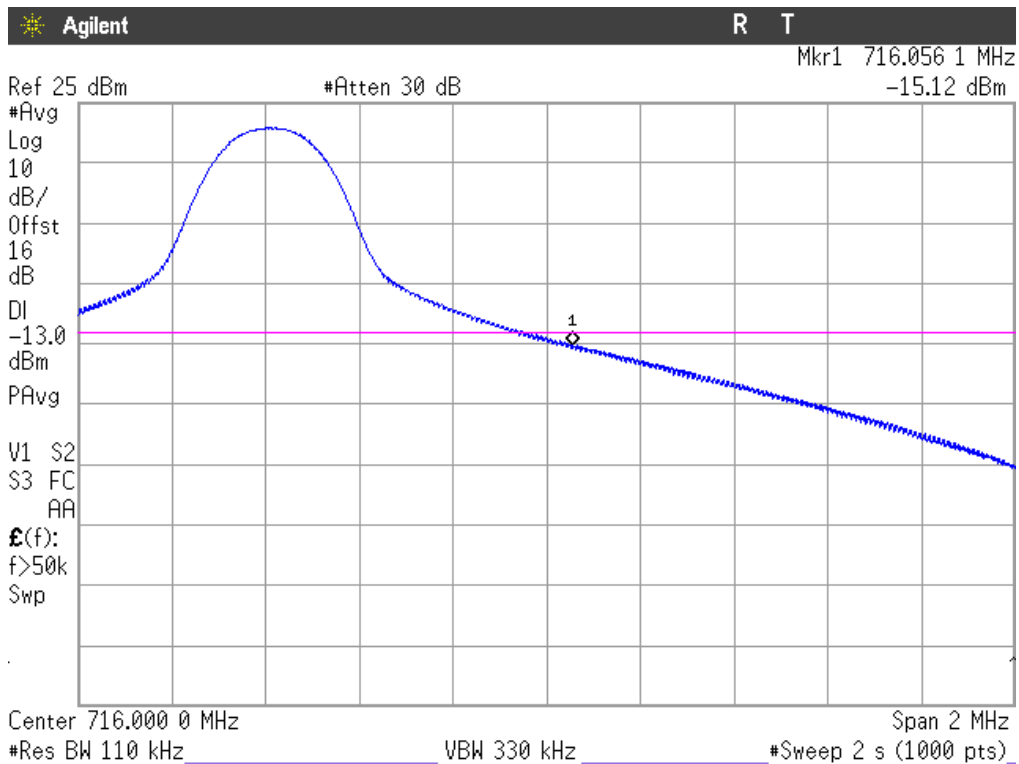
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

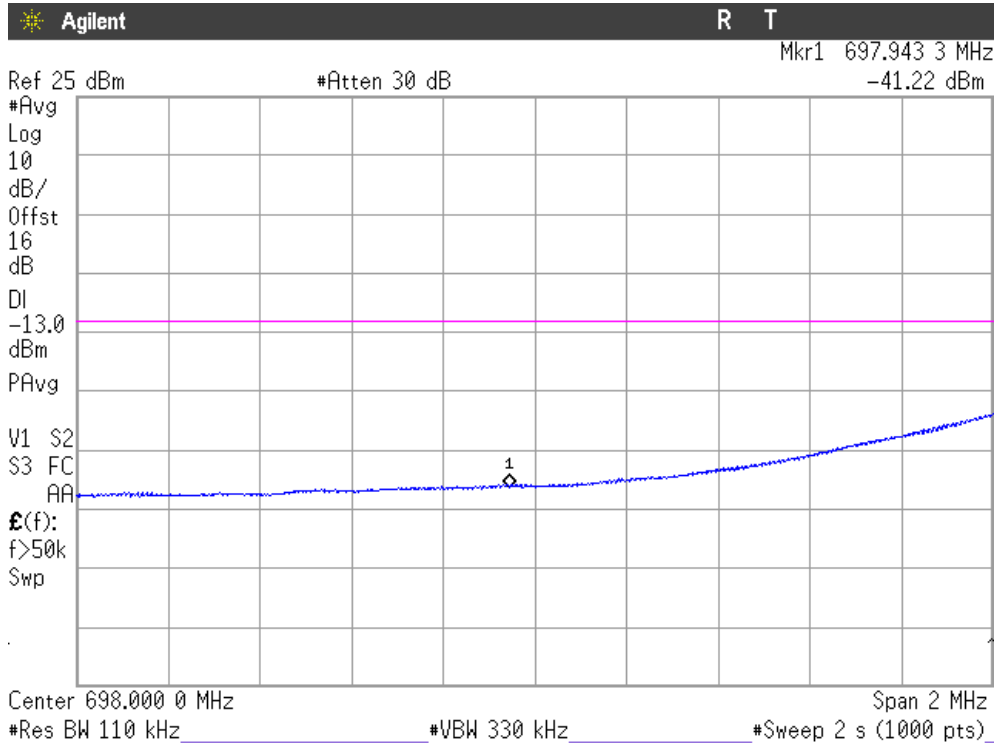
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

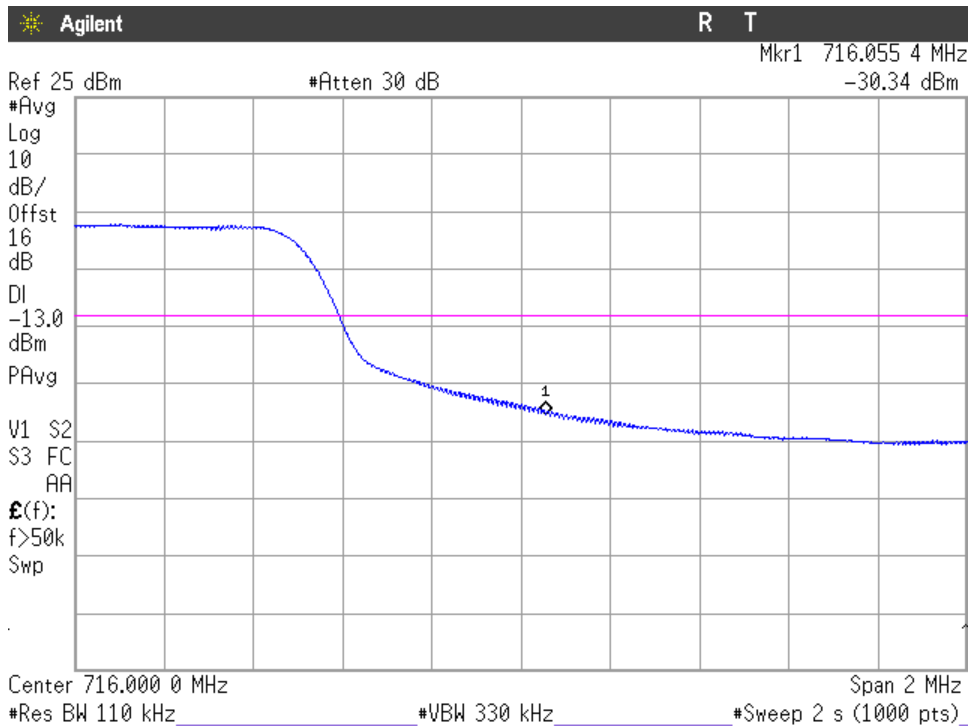
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

Verdict: PASS

Radiated emissions

SPECIFICATION

FCC §2.1051 and §27.53(g) (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 P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm}$$

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.

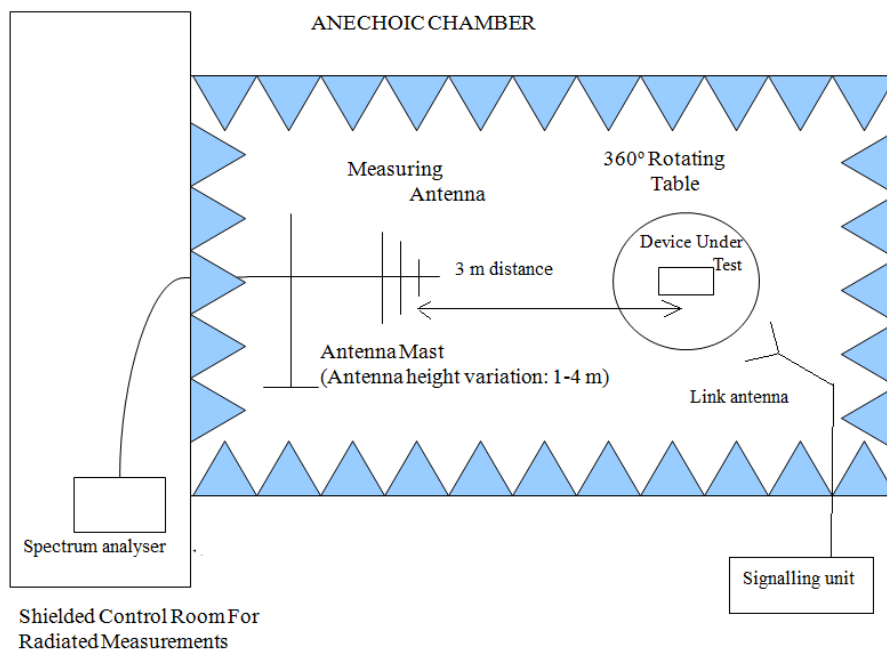
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

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.

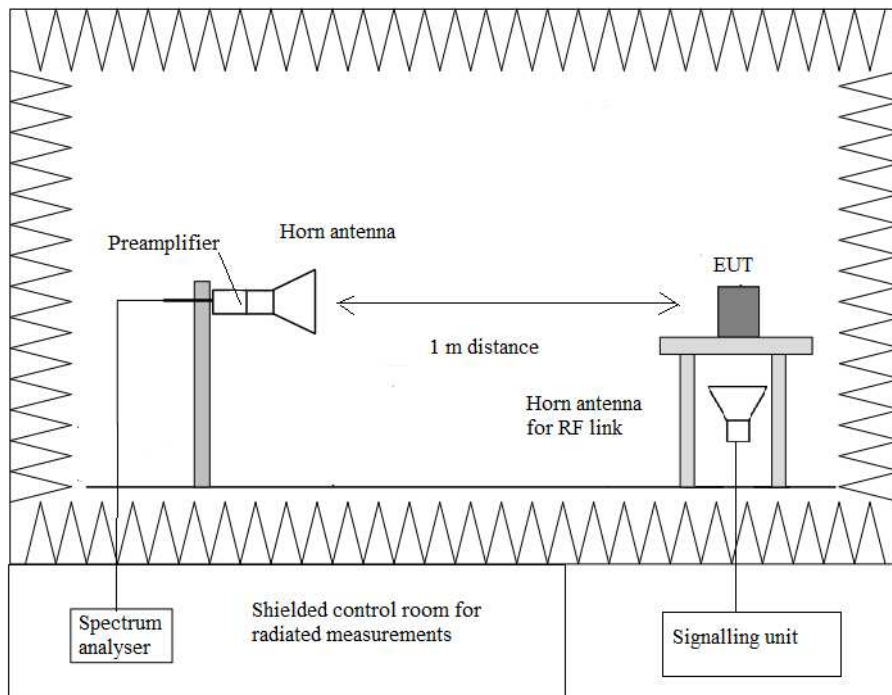
Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method, in accordance with the ANSI/TIA-603-E.

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)
6840.75	-26.33	V	-30.96	3.87	10.15	-24.68
8551.25	-36.81	V	-38.90	4.46	11.02	-32.34

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)
6928.25	-24.55	V	-28.61	3.90	9.96	-22.55
10392.25	-39.52	V	-36.40	5.15	10.19	-31.37

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)
7015.25	-29.88	V	-33.46	3.93	9.83	-27.56

LTE QPSK AND 16QAM MODULATION. Band XII. BW = 1.4 MHz. 3 MHz. 5 MHz and 10 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-8 GHz.

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

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.

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

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

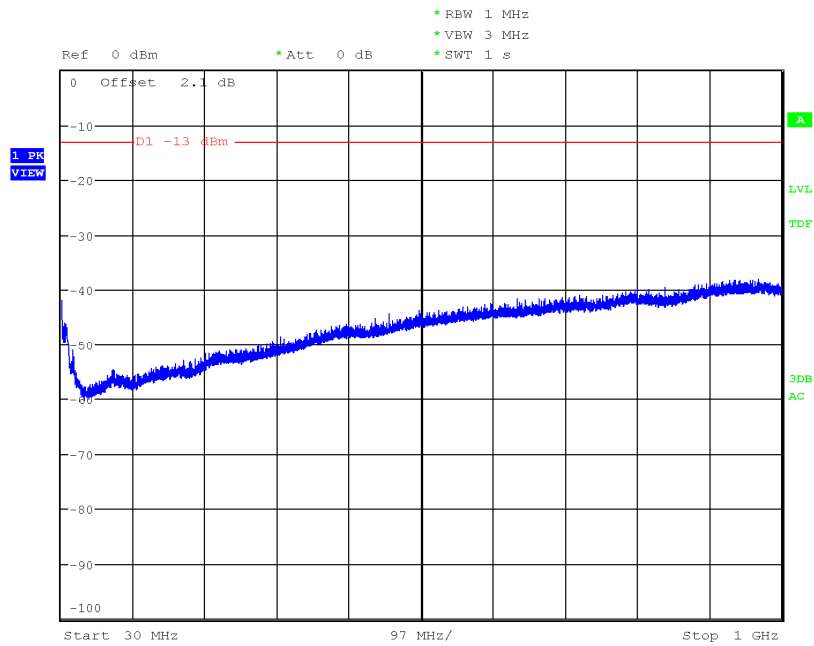
Frequency range 1 GHz-8 GHz.

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

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

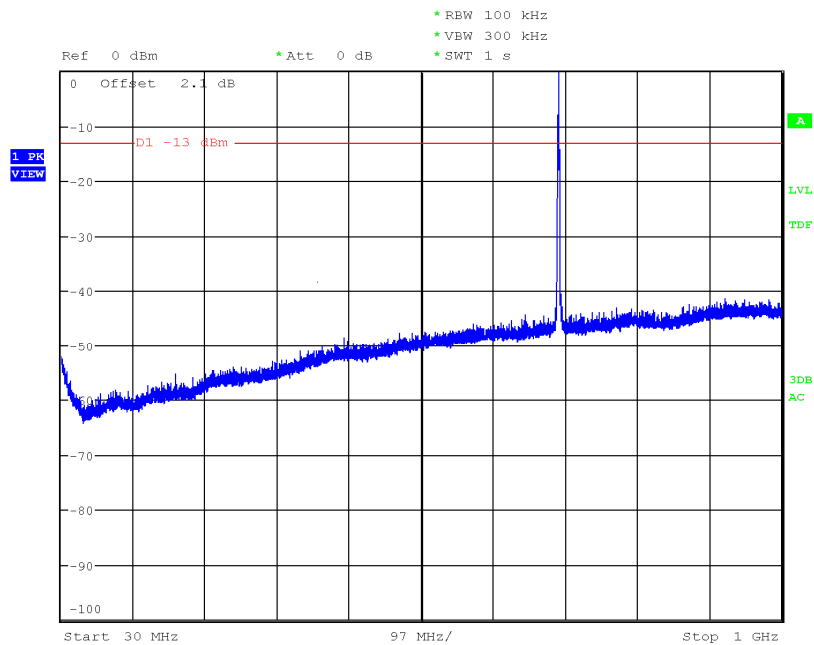
LTE QPSK MODULATION. BW=1.4 MHz. Band IV



(This plot is valid for all three channels)

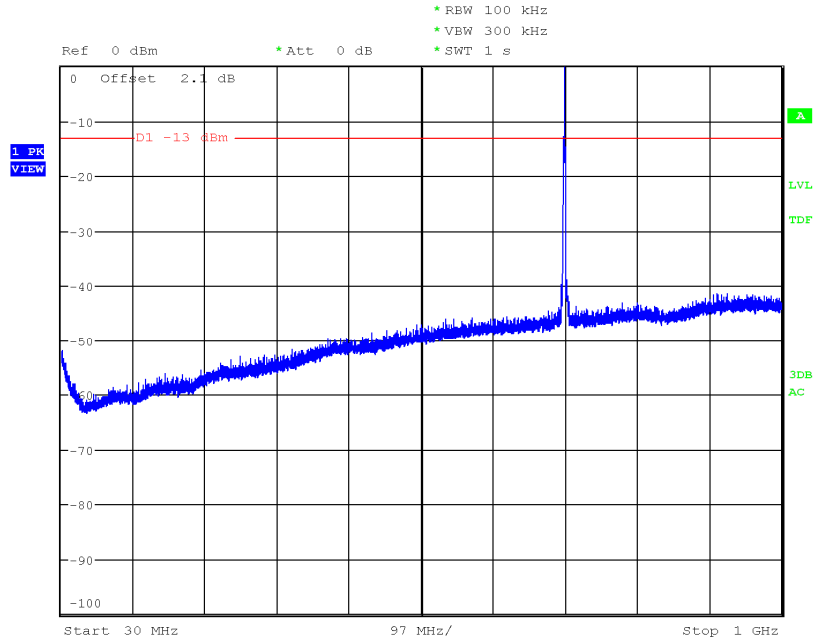
LTE QPSK MODULATION. BW=1.4 MHz. Band XII

CHANNEL: LOWEST



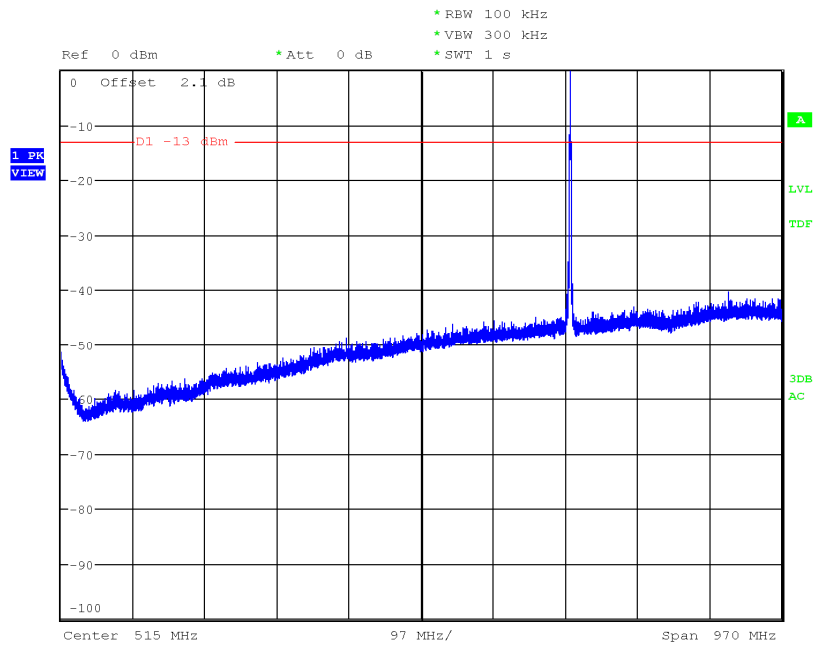
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

CHANNEL: HIGHEST

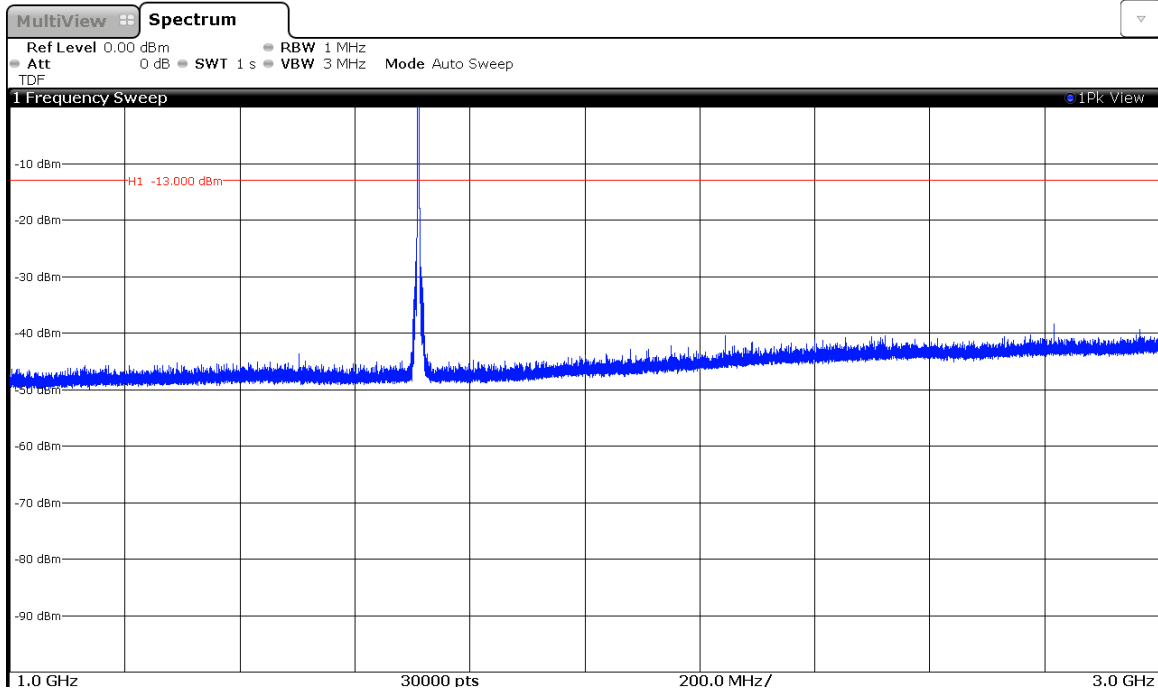


Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz to 3 GHz.

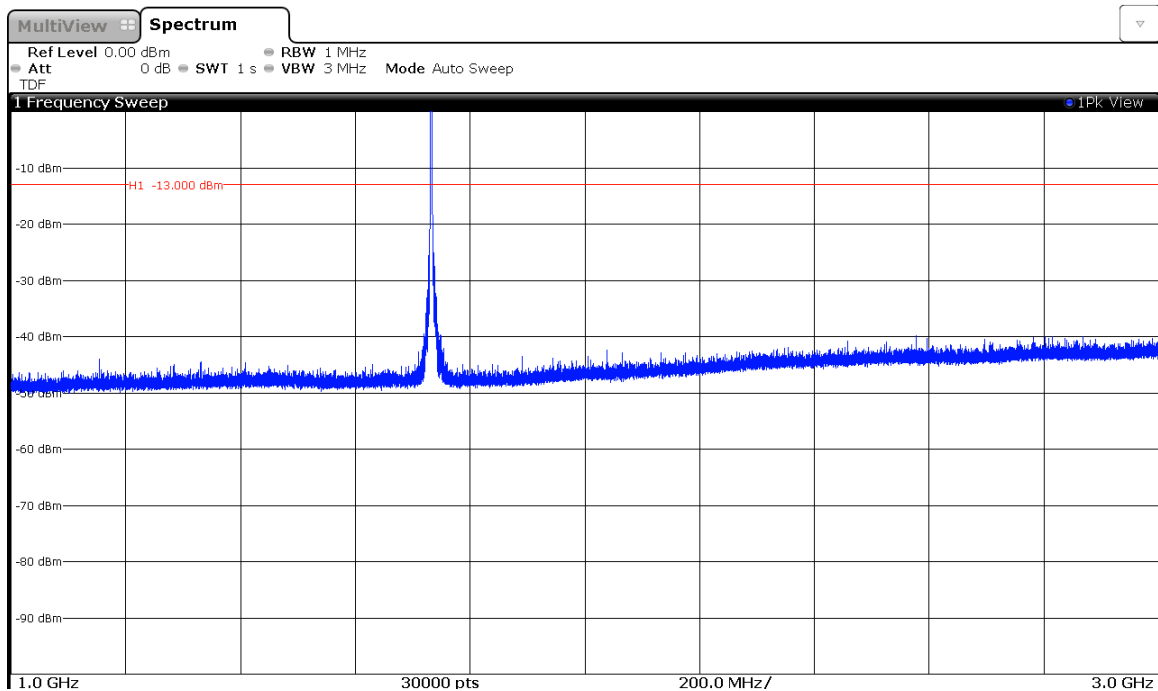
LTE QPSK MODULATION. BW=1.4 MHz. Band IV

CHANNEL: LOWEST



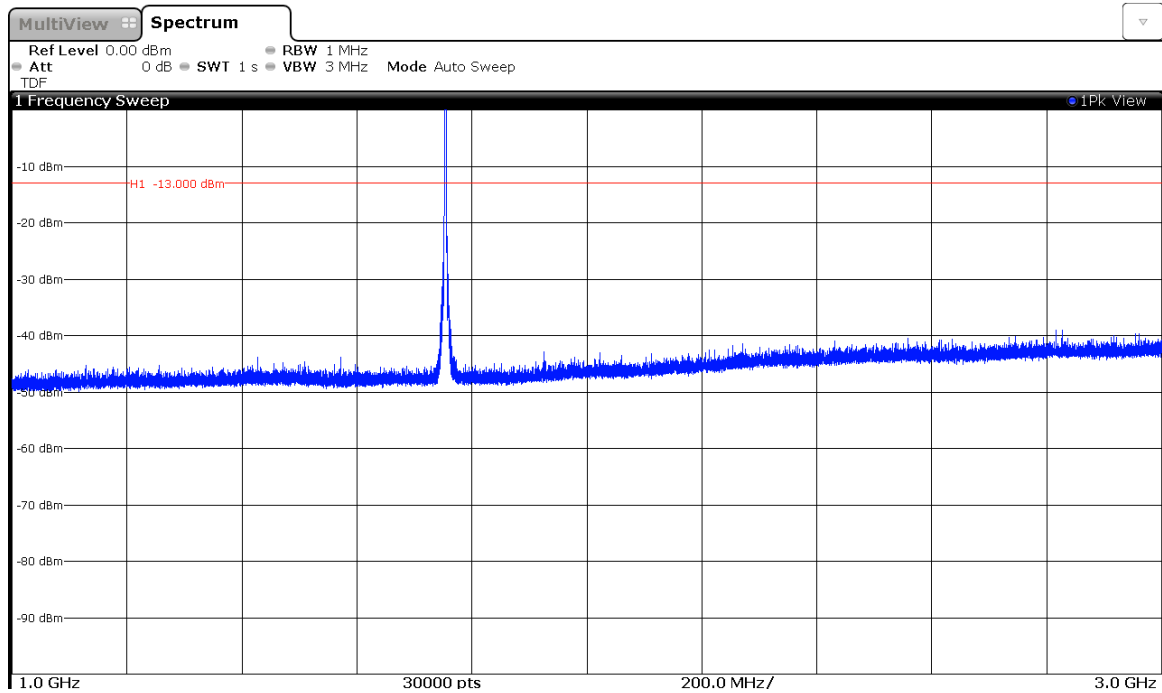
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

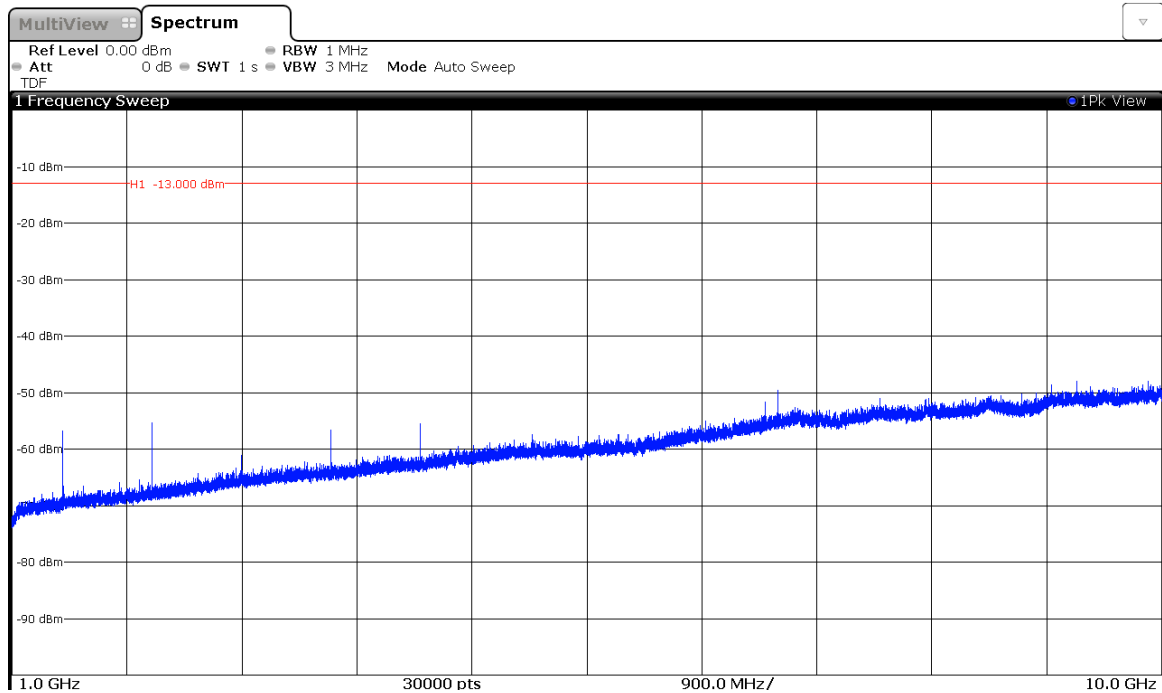
CHANNEL: HIGHEST



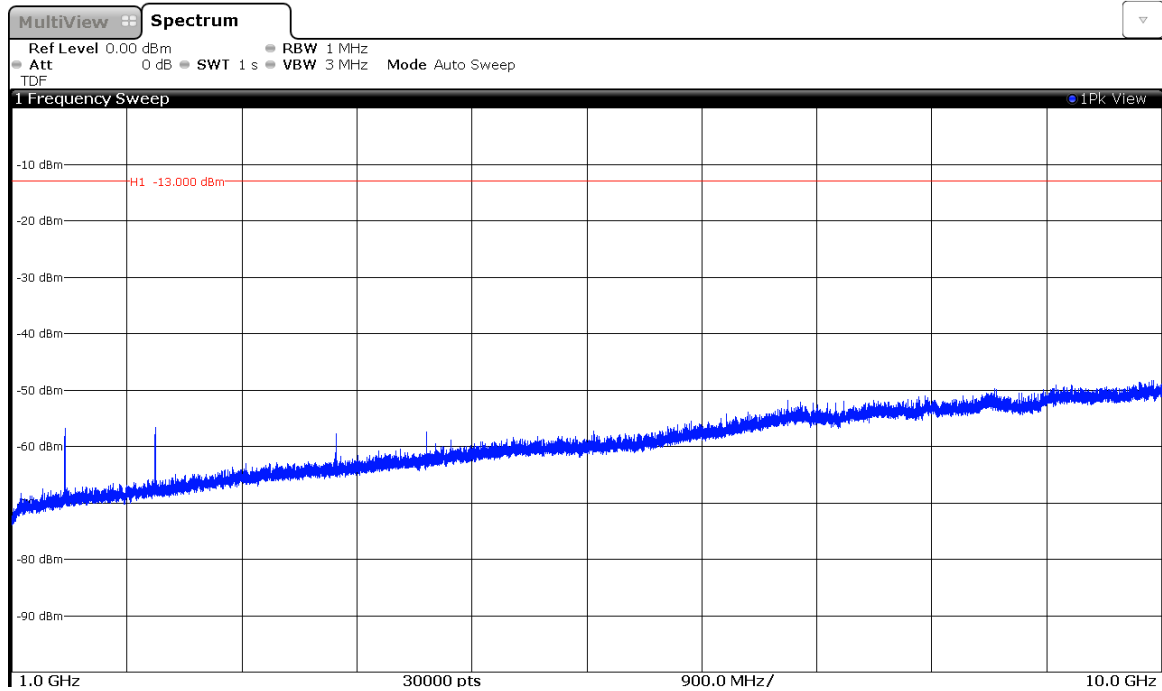
Note: The peak above the limit is the carrier frequency.

LTE QPSK MODULATION. BW=1.4 MHz. Band XII. Range 1 GHz to 10 GHz.

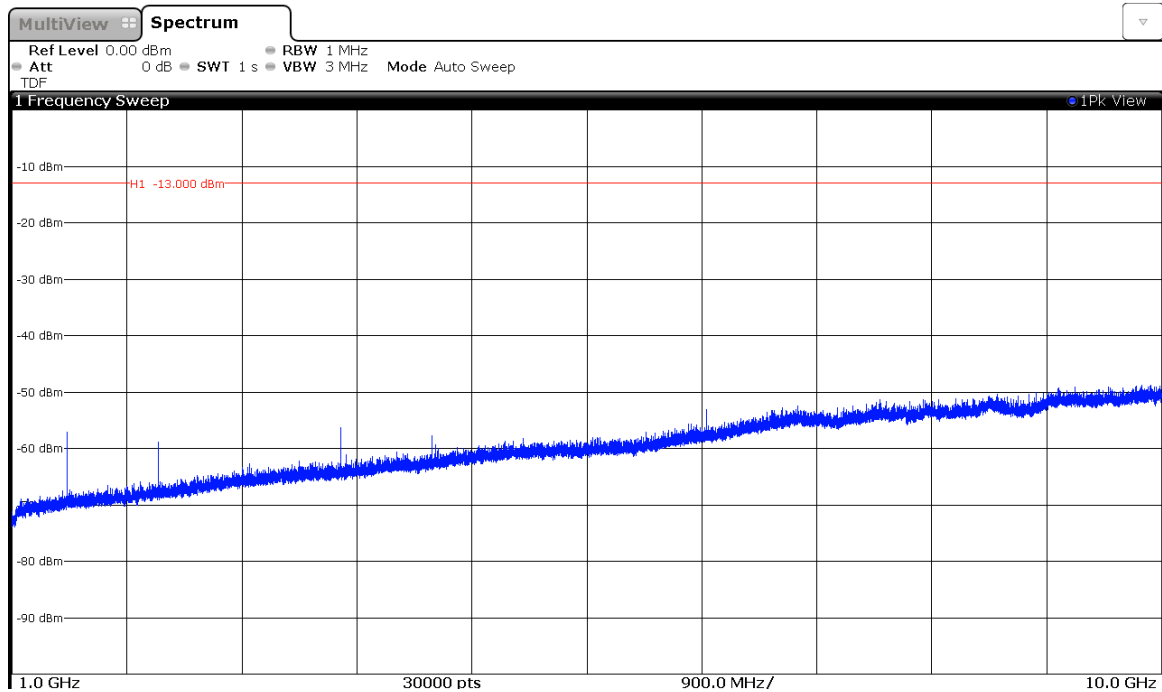
CHANNEL: LOWEST



CHANNEL: MIDDLE



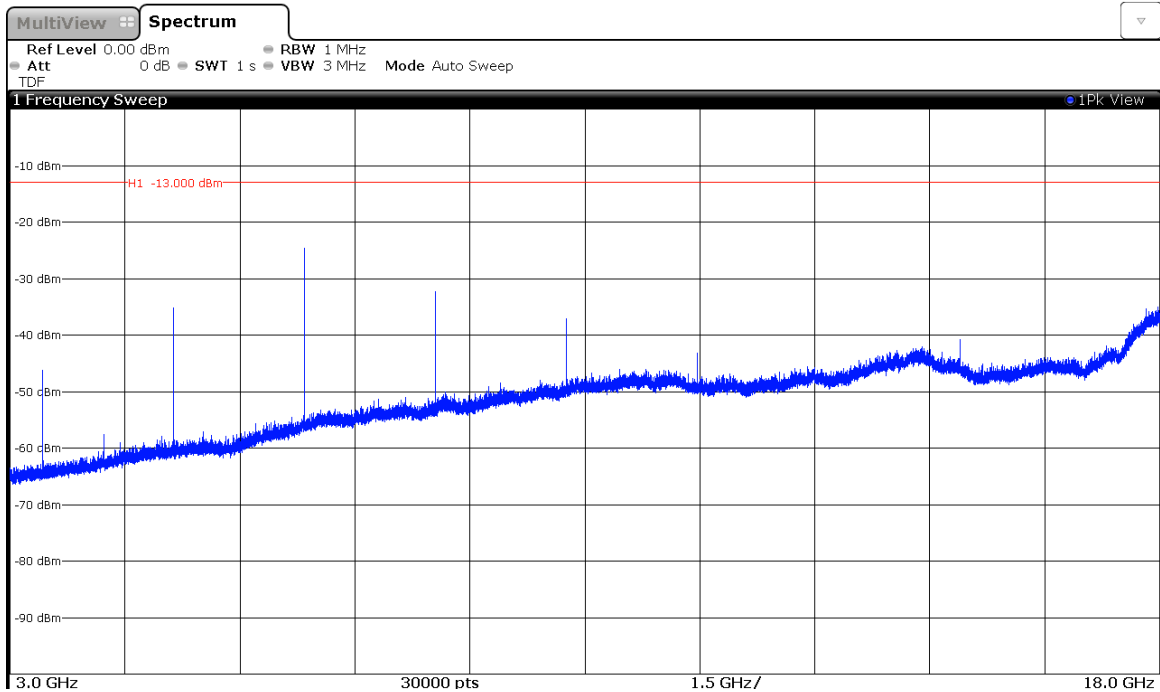
CHANNEL: HIGHEST



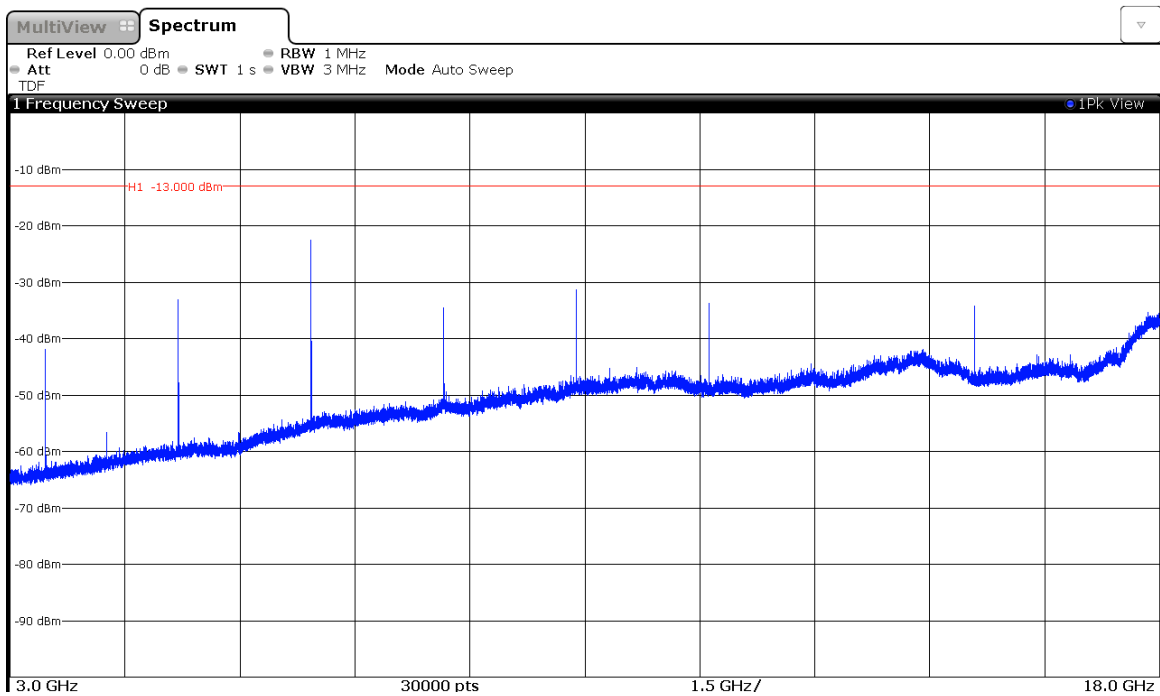
FREQUENCY RANGE 3 GHz to 18 GHz.

LTE QPSK MODULATION. BW=1.4 MHz. Band IV

CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST

