



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

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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.

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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 Nº	Description	Model	Serial Nº	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 k Ω
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

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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.

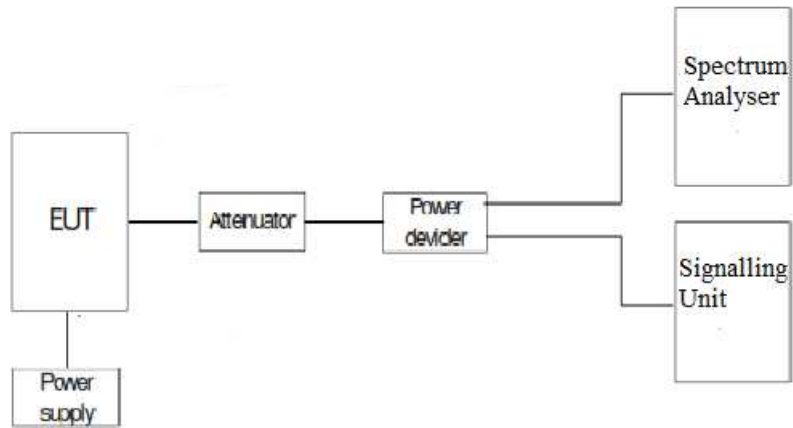
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

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	
				6	0	20.754	
	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	
				6	0	20.471	
	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	5.16
				1	7	21.525	
				1	14	21.646	
				8	0	20.949	
				8	4	20.834	
				8	7	20.862	
				15	0	20.823	
	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	5.46
				1	7	21.777	
				1	14	21.992	
				8	0	20.877	
				8	4	20.891	
				8	7	20.870	
				15	0	20.962	
	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	5.5
				1	7	22.241	
				1	14	22.060	
				8	0	21.325	
				8	4	21.237	
				8	7	21.212	
				15	0	21.161	

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	
				100	0	20.649	
	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	
				100	0	20.825	
	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			

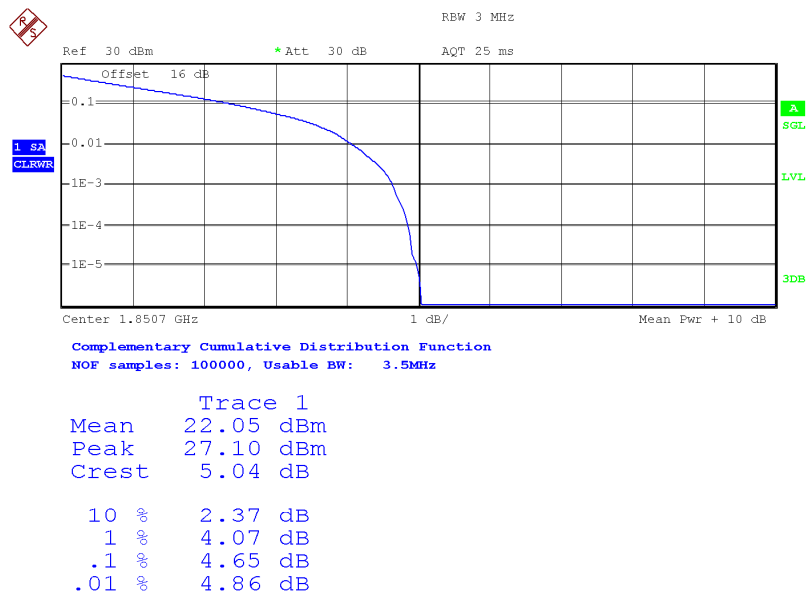
LTE QPSK AND 16QAM MODULATION. Bandwidth = 20 MHz

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

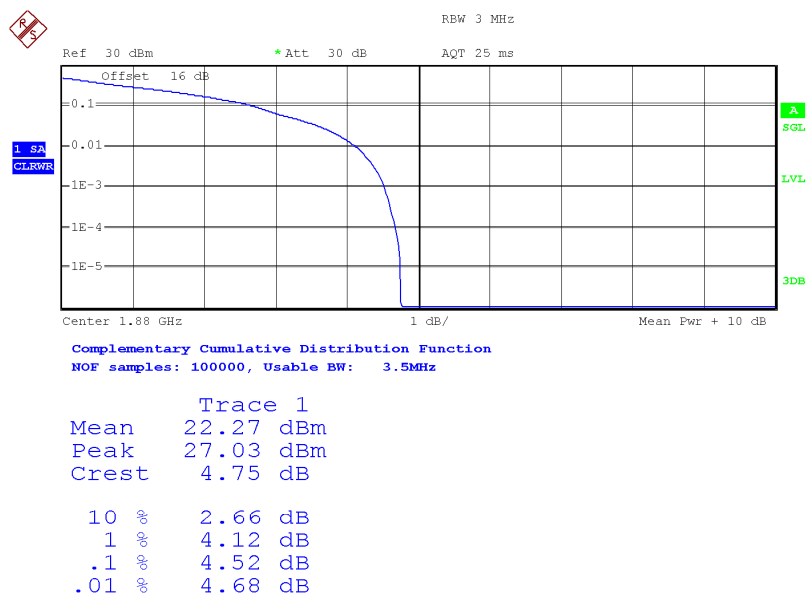
PEAK-TO-AVERAGE POWER RATIO (PAPR).

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



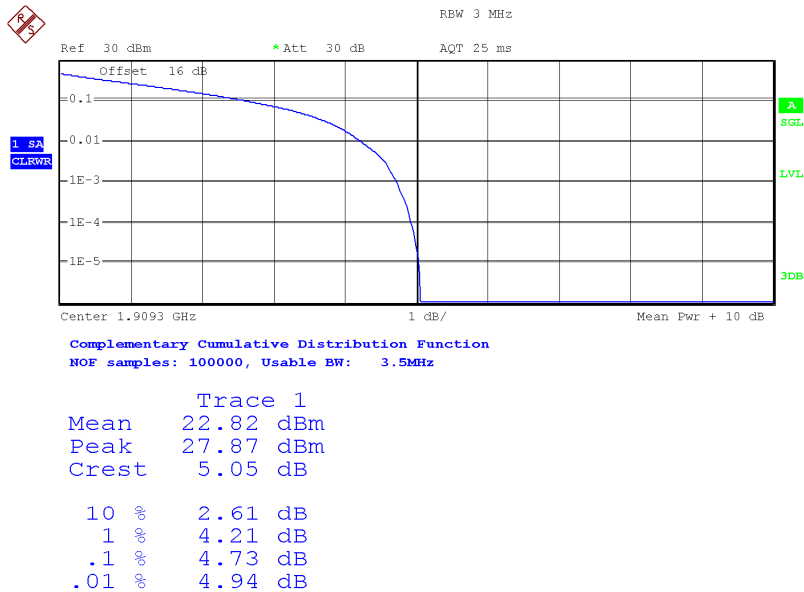
Date: 25.APR.2017 09:48:07

Channel Middle:



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

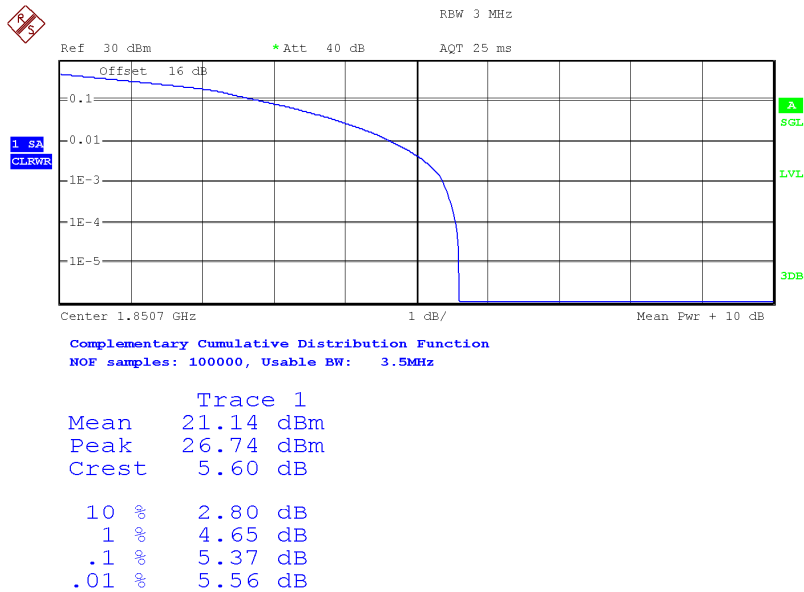
Channel High:



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

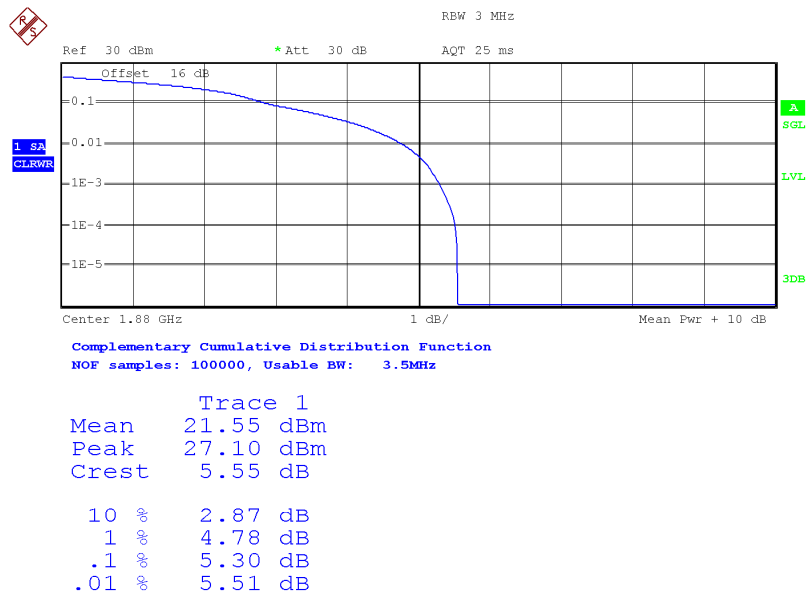
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.

Channel Low:



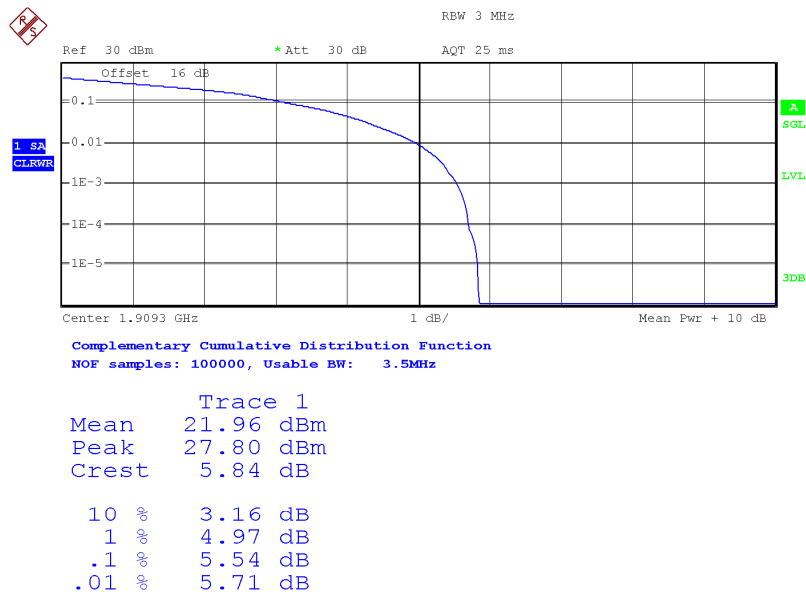
Date: 25.APR.2017 10:04:50

Channel Middle:



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

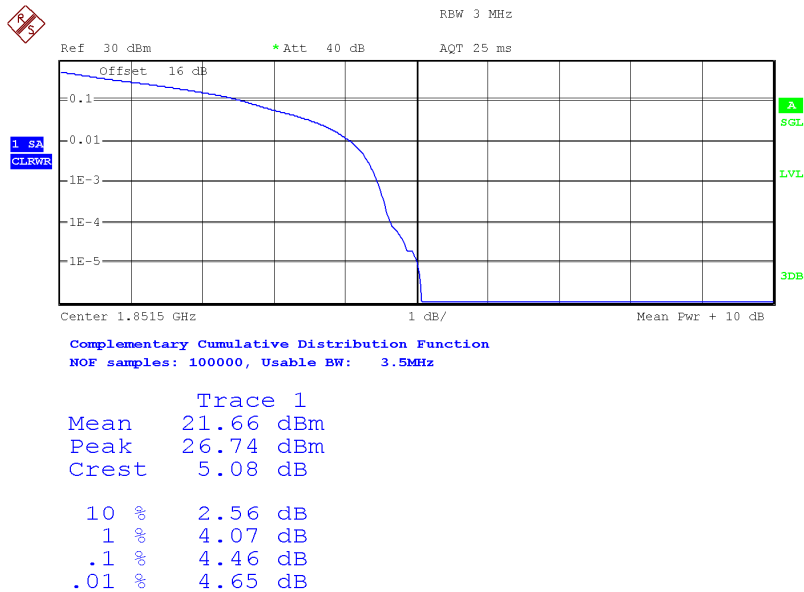
Channel High:



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

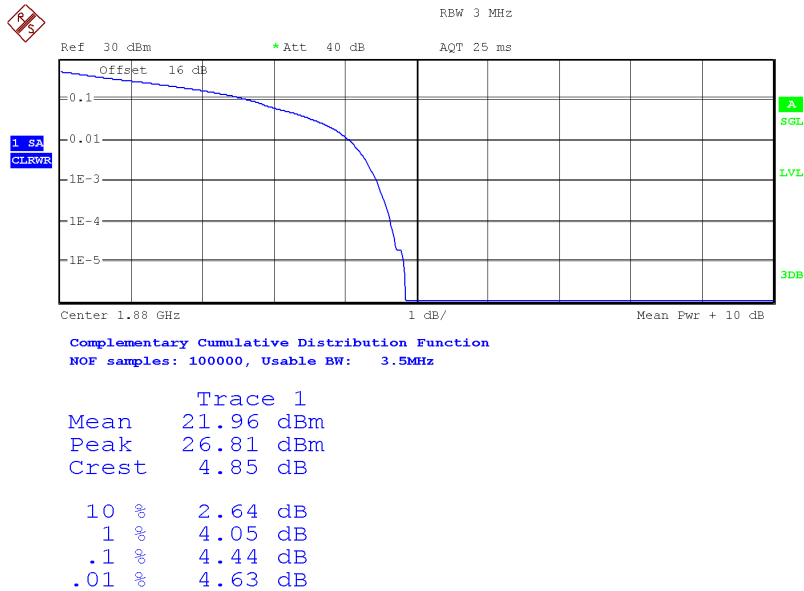
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.

Channel Low:



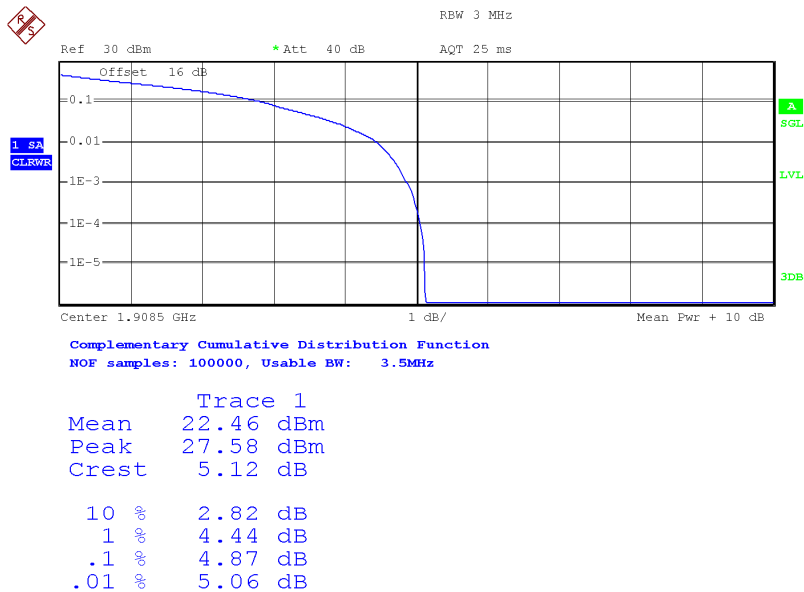
Date: 25.APR.2017 10:01:36

Channel Middle:



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

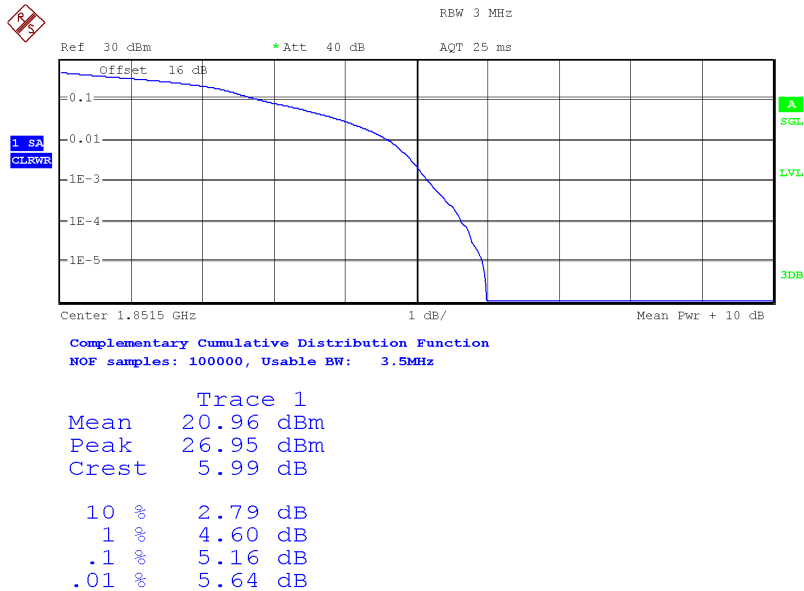
Channel High:



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

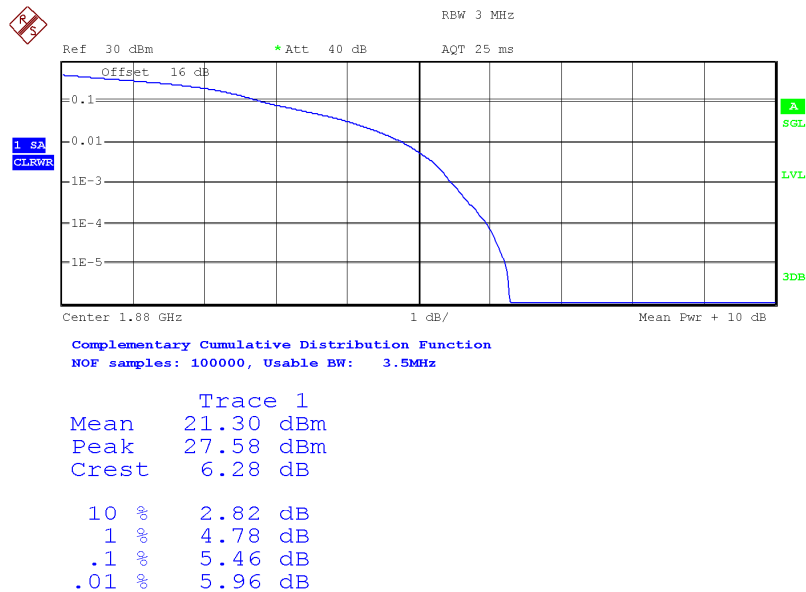
Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

Channel Low:



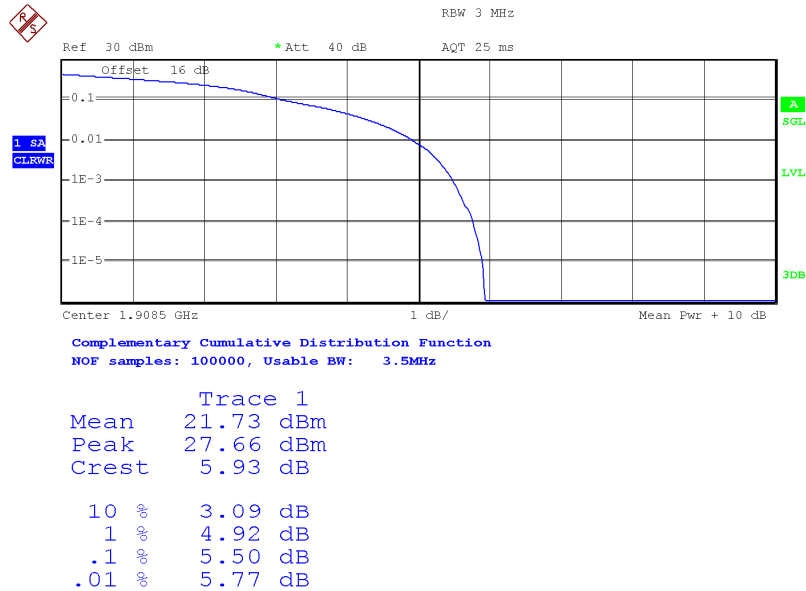
Date: 25.APR.2017 10:07:44

Channel Middle:



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

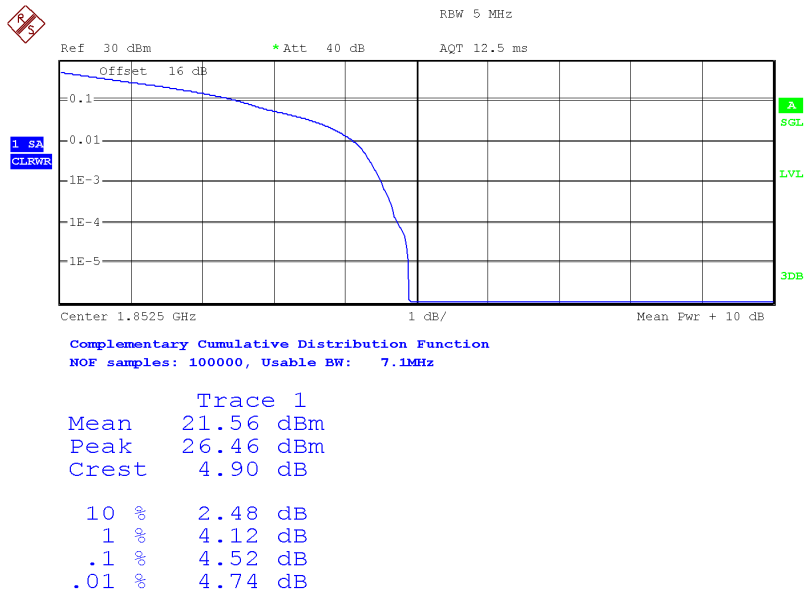
Channel High:



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

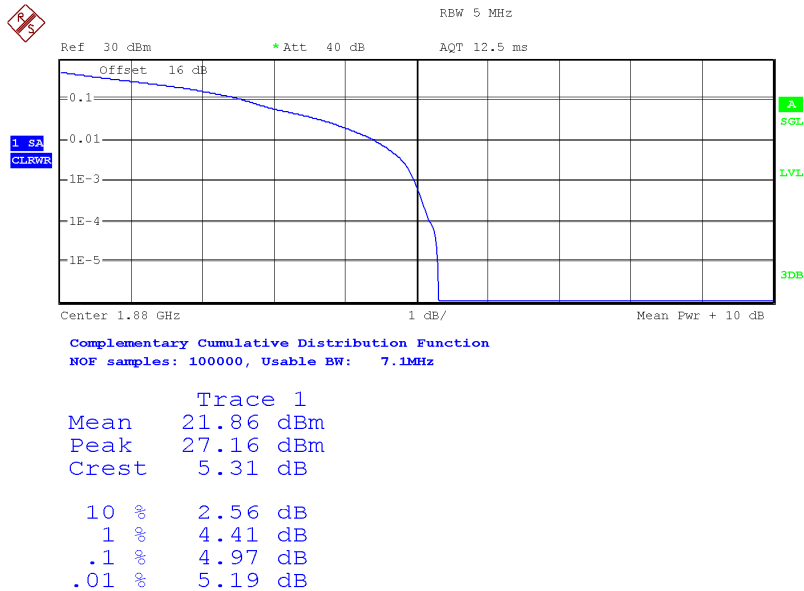
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.

Channel Low:



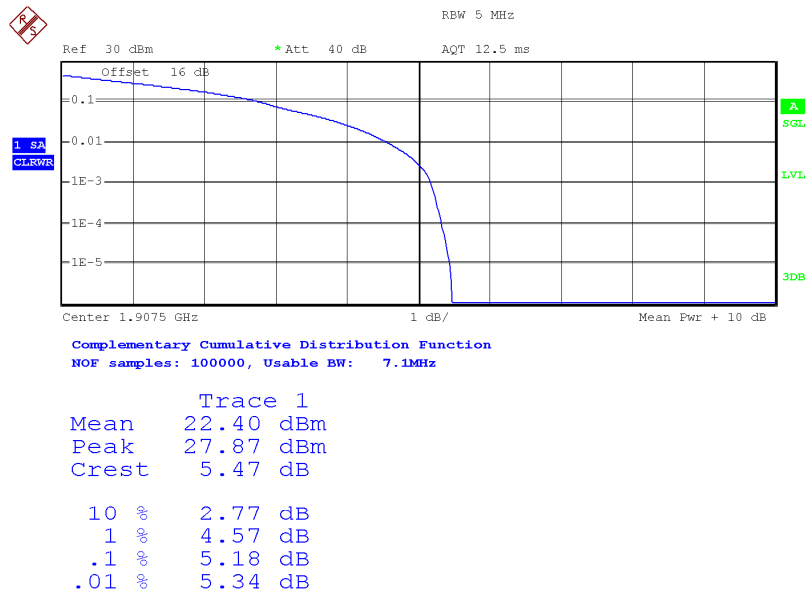
Date: 25.APR.2017 10:18:39

Channel Middle:



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

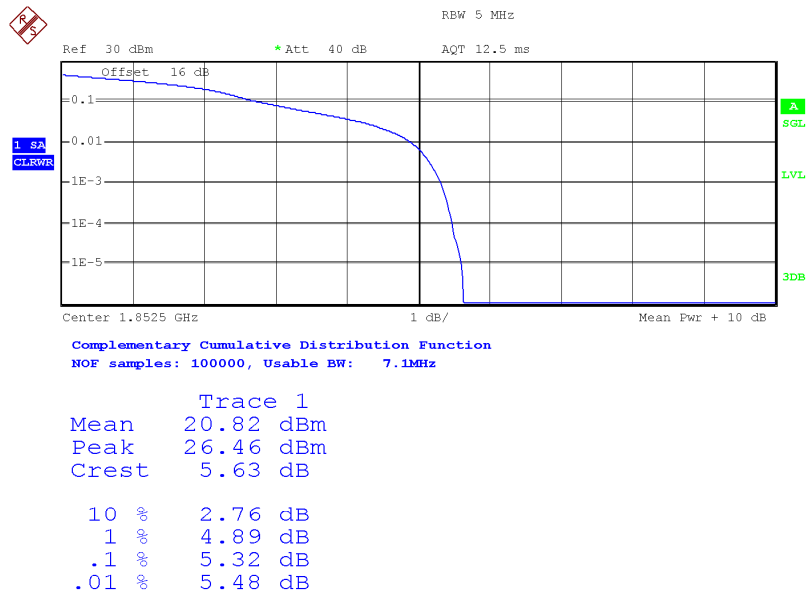
Channel High:



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

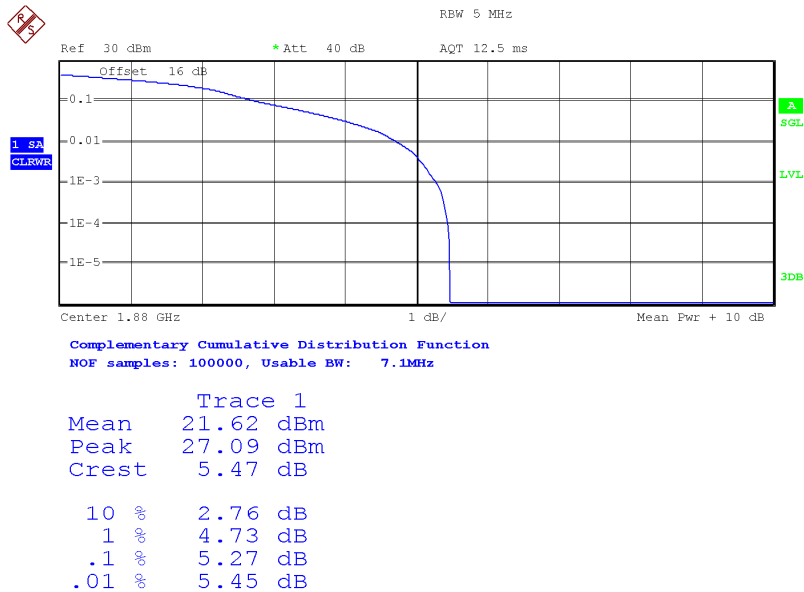
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.

Channel Low:



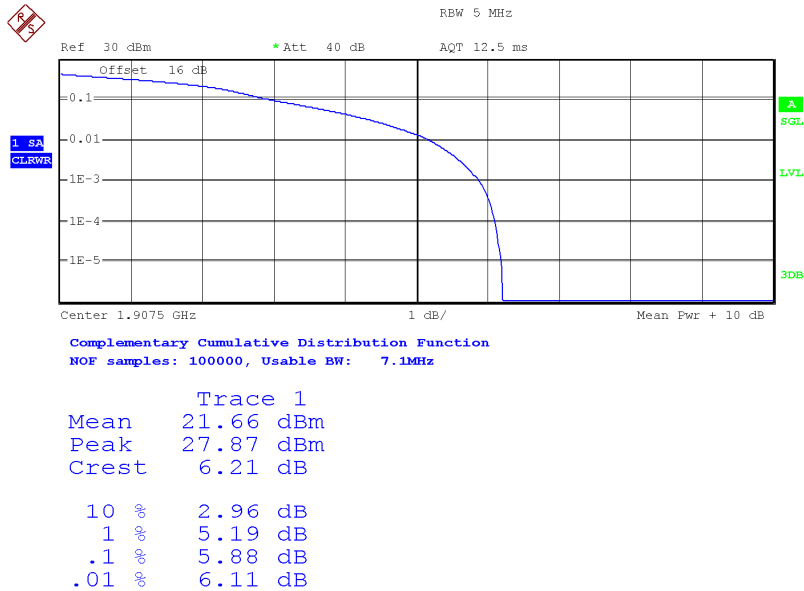
Date: 25.APR.2017 10:19:30

Channel Middle:



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

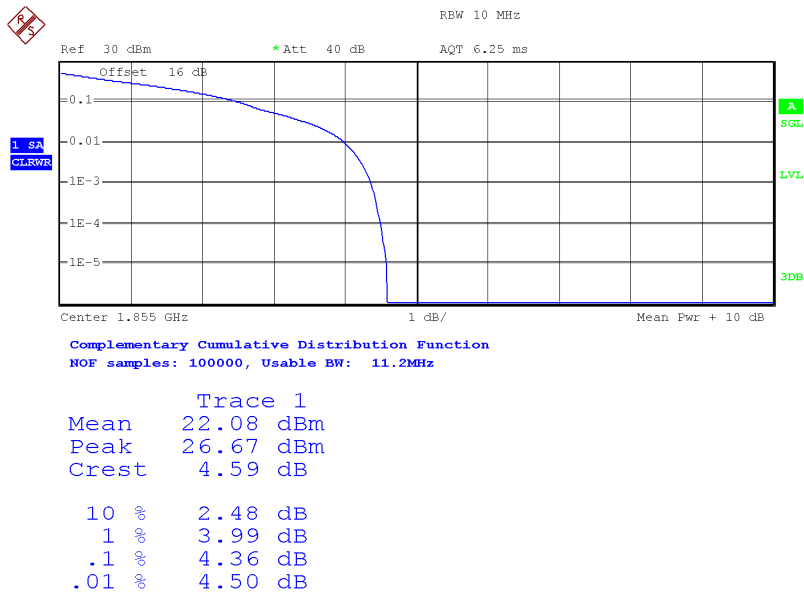
Channel High:



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

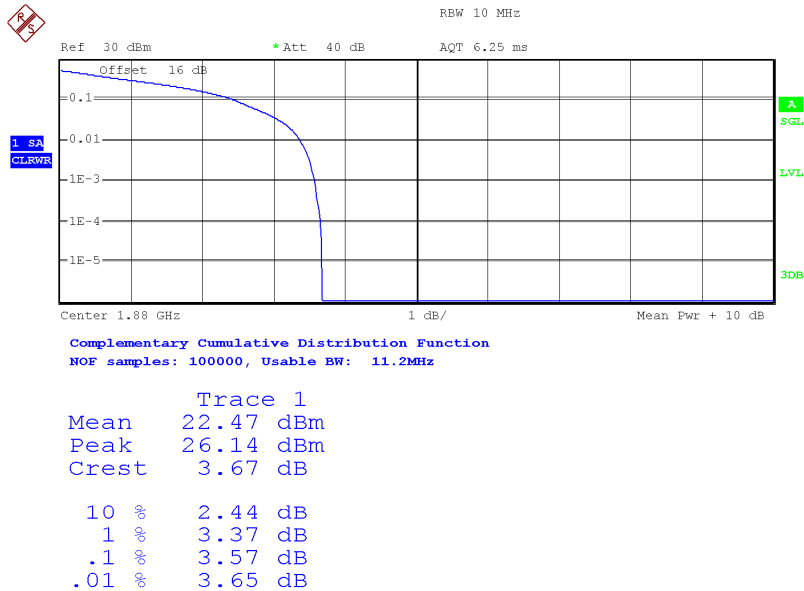
Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

Channel Low:



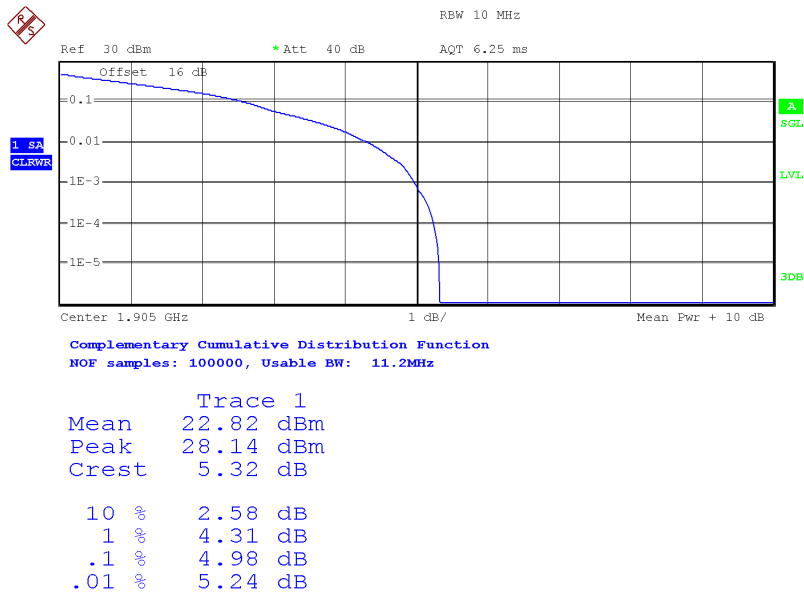
Date: 25.APR.2017 10:32:06

Channel Middle:



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

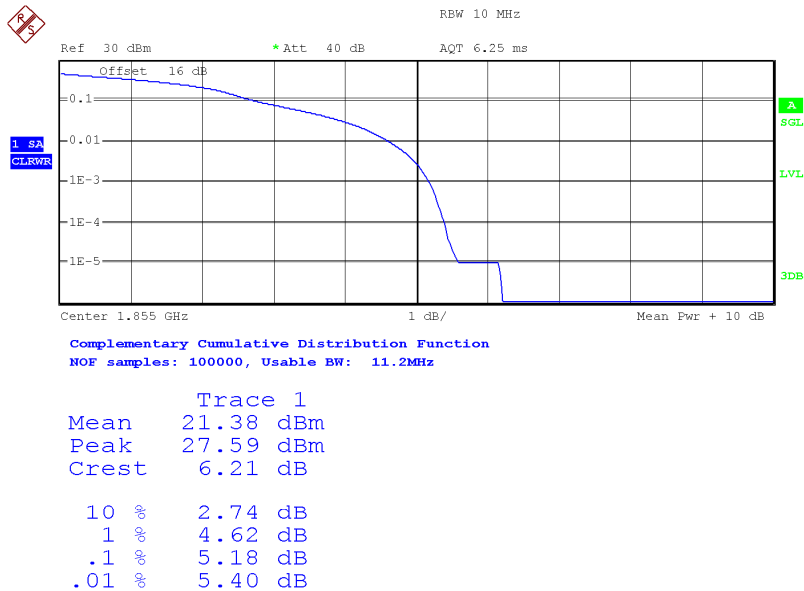
Channel High:



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

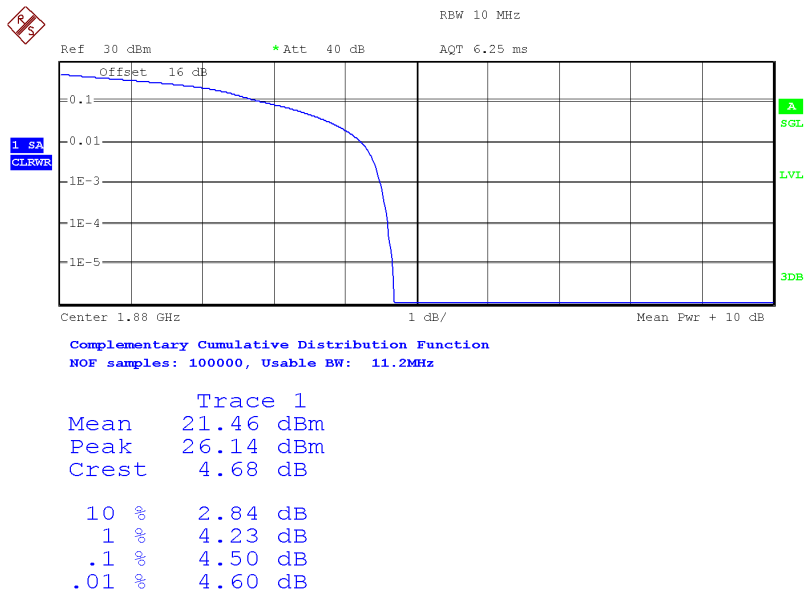
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.

Channel Low:



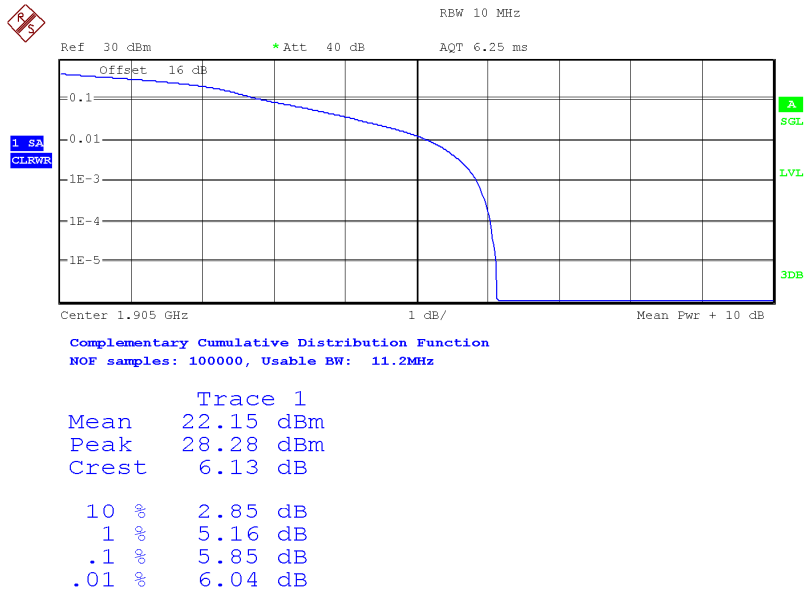
Date: 25.APR.2017 10:33:12

Channel Middle:



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

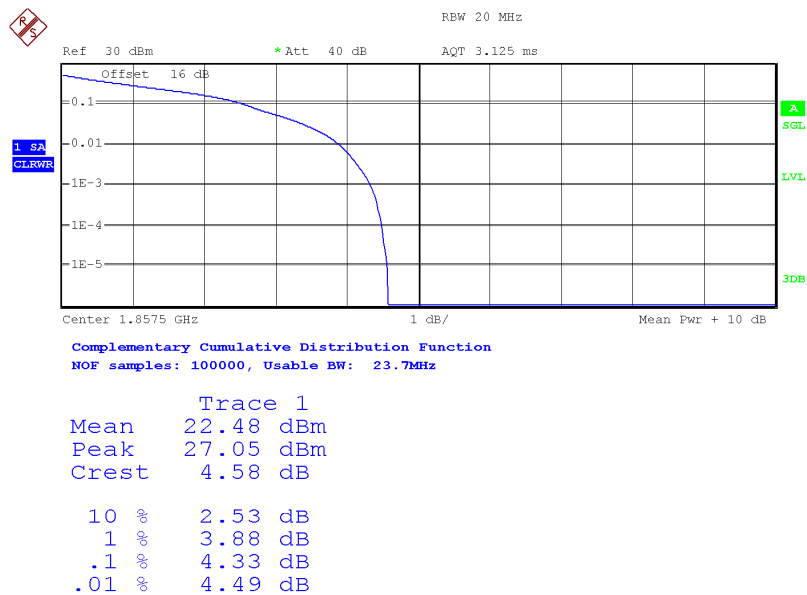
Channel High:



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

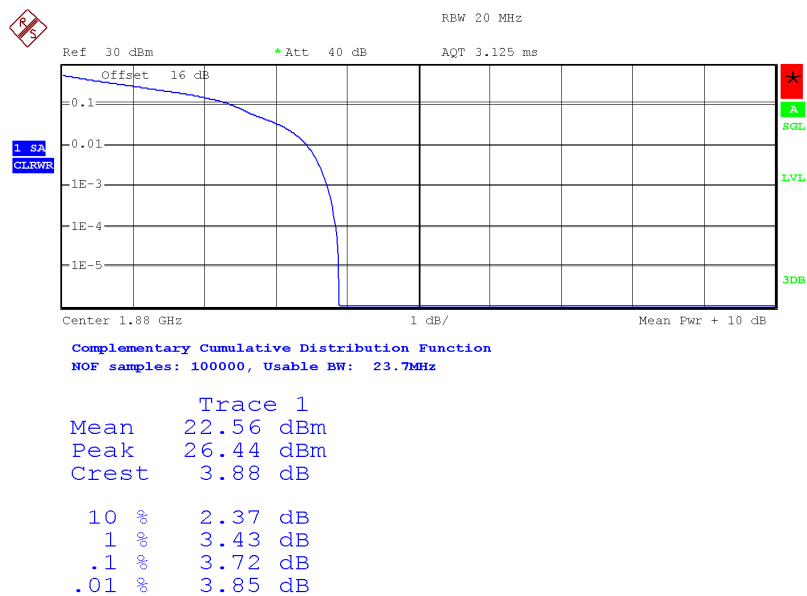
Bandwidth = 15 MHz. Modulation QPSK. RB Size: 75. RB Offset: 0.

Channel Low:



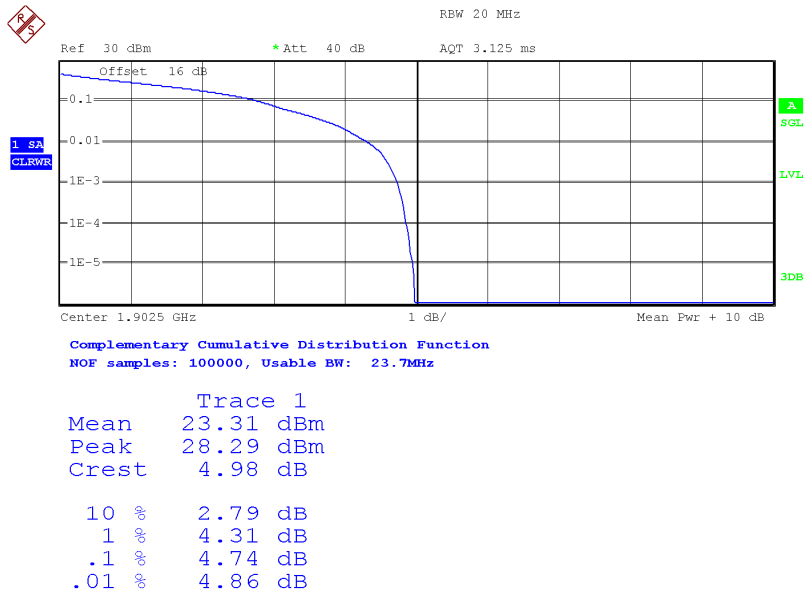
Date: 25.APR.2017 10:44:22

Channel Middle:



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

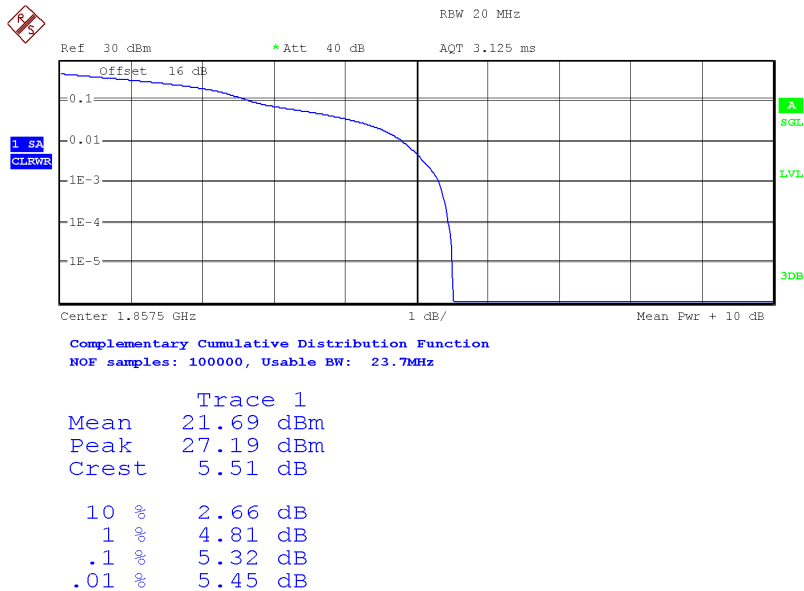
Channel High:



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

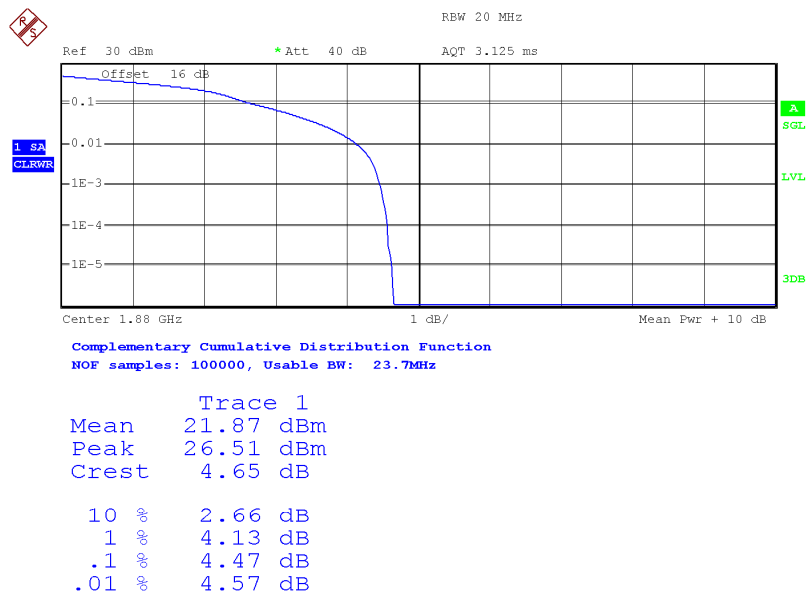
Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.

Channel Low:



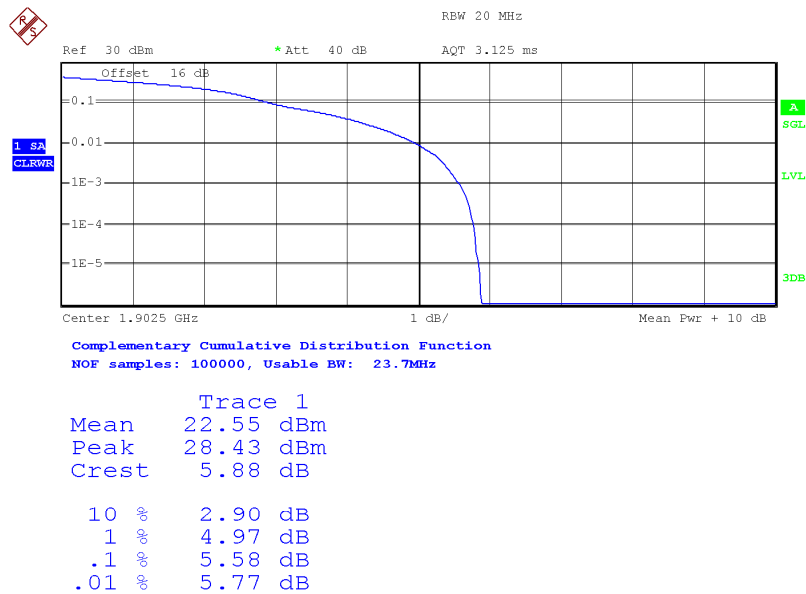
Date: 25.APR.2017 10:47:40

Channel Middle:



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

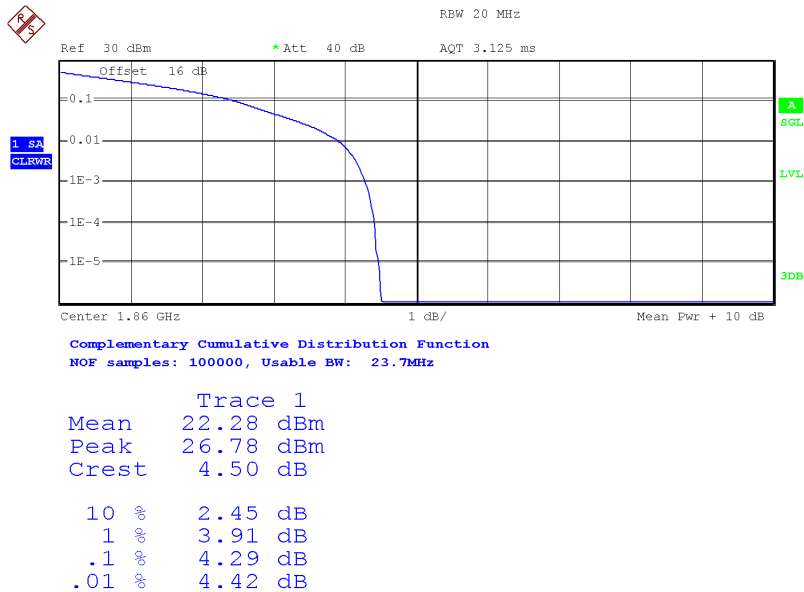
Channel High:



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

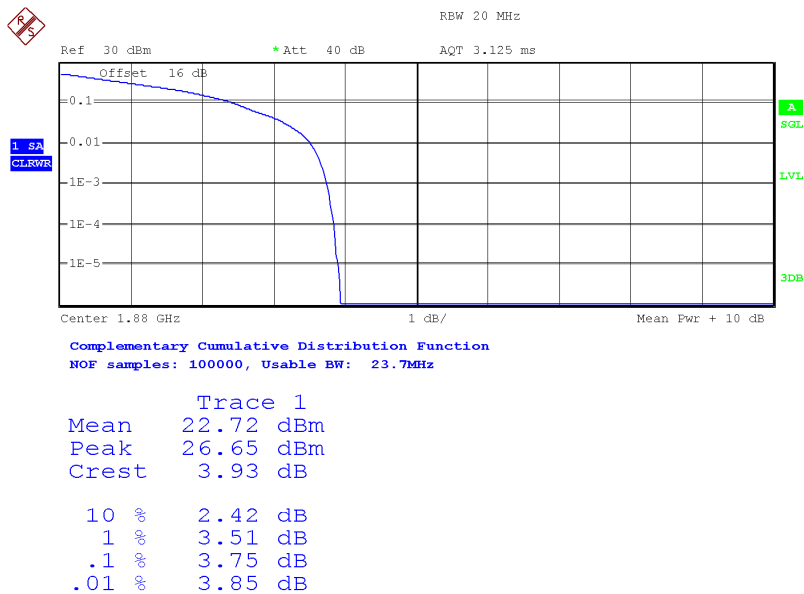
Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.

Channel Low:



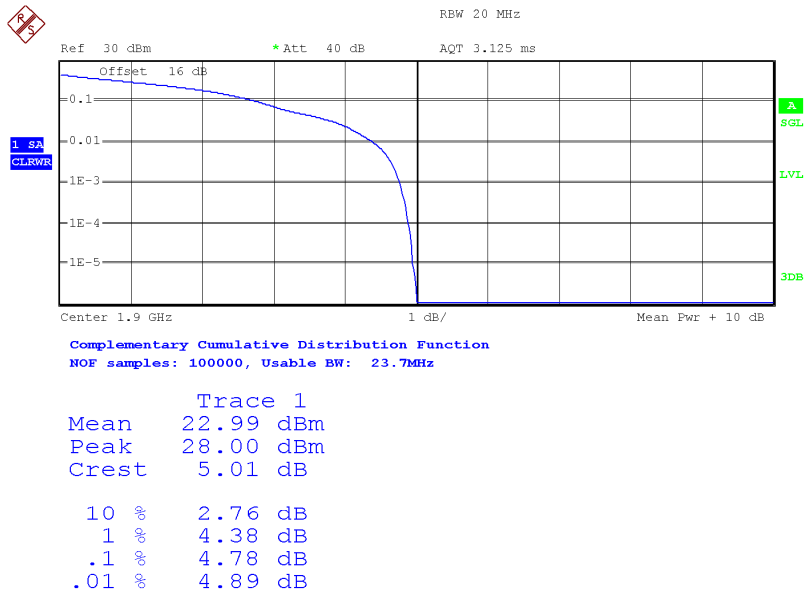
Date: 25.APR.2017 10:55:21

Channel Middle:



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

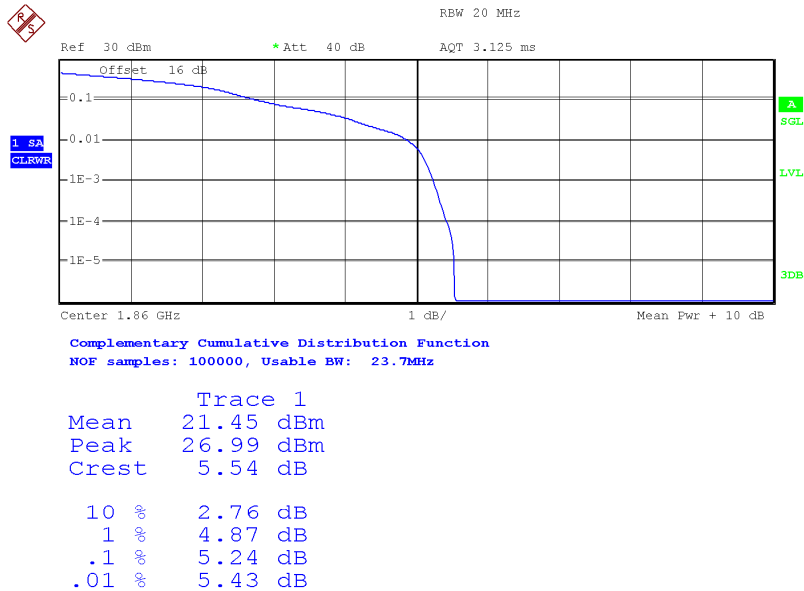
Channel High:



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

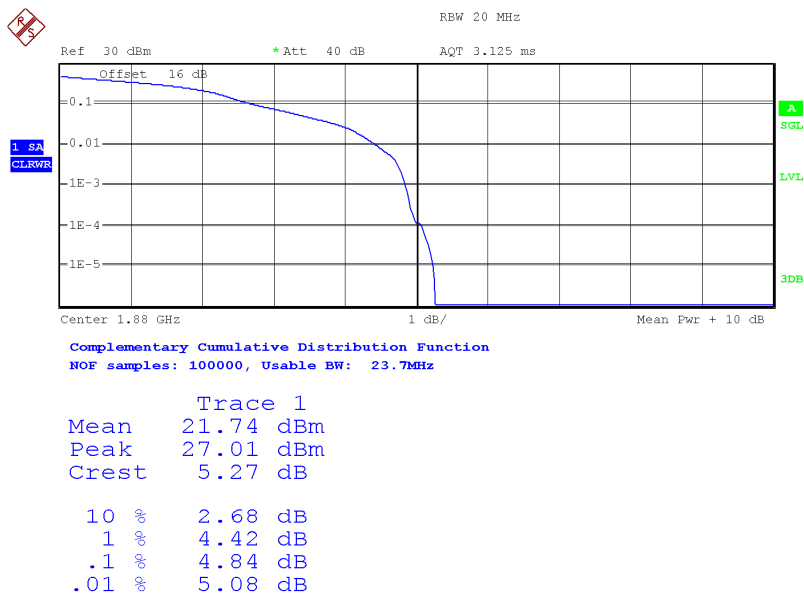
Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.

Channel Low:



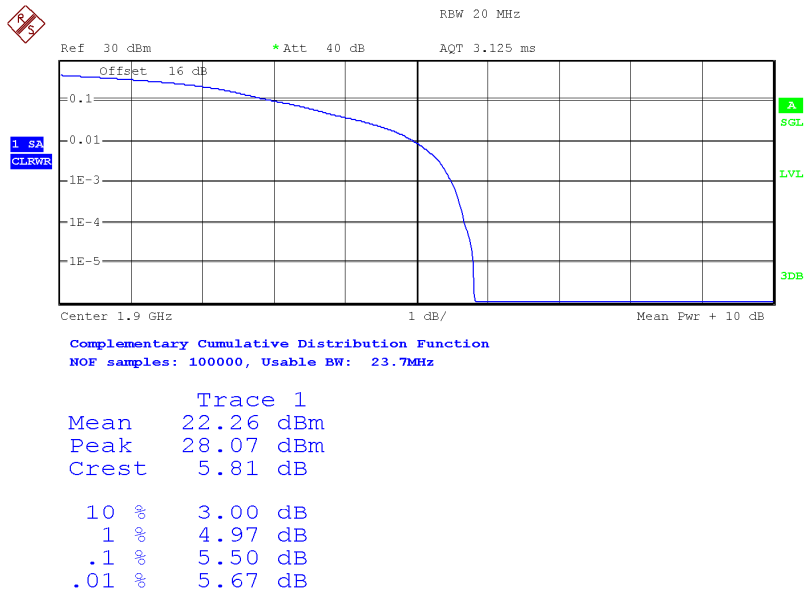
Date: 25.APR.2017 10:56:06

Channel Middle:



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

Channel High:



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

Modulation Characteristics

SPECIFICATION

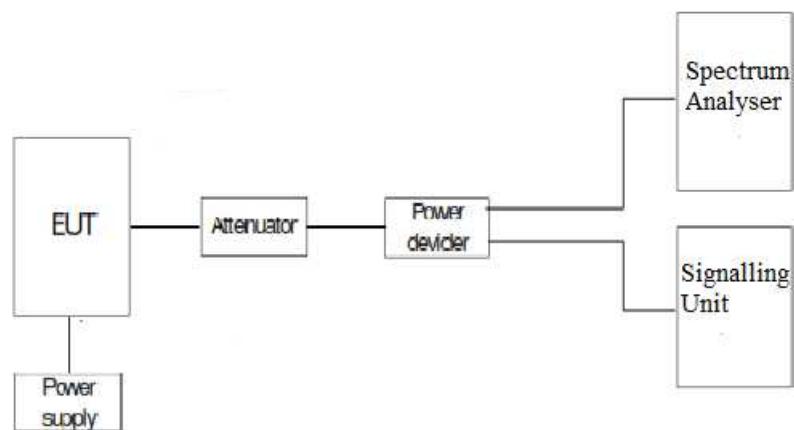
FCC §2.1047

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).

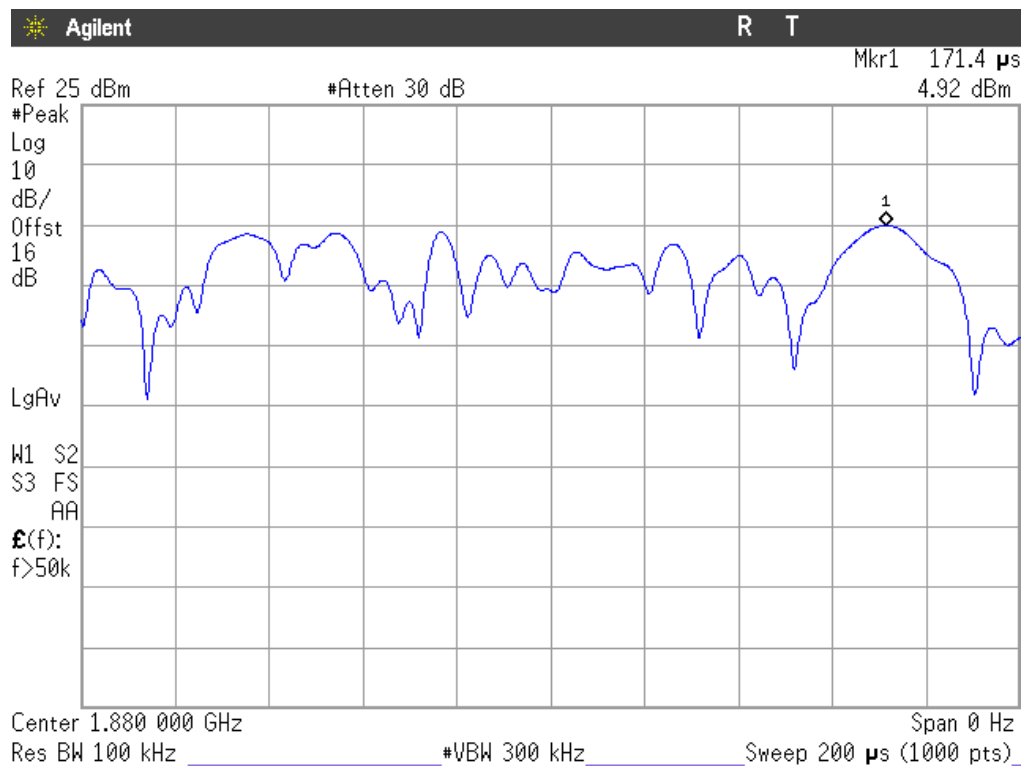
TEST SETUP



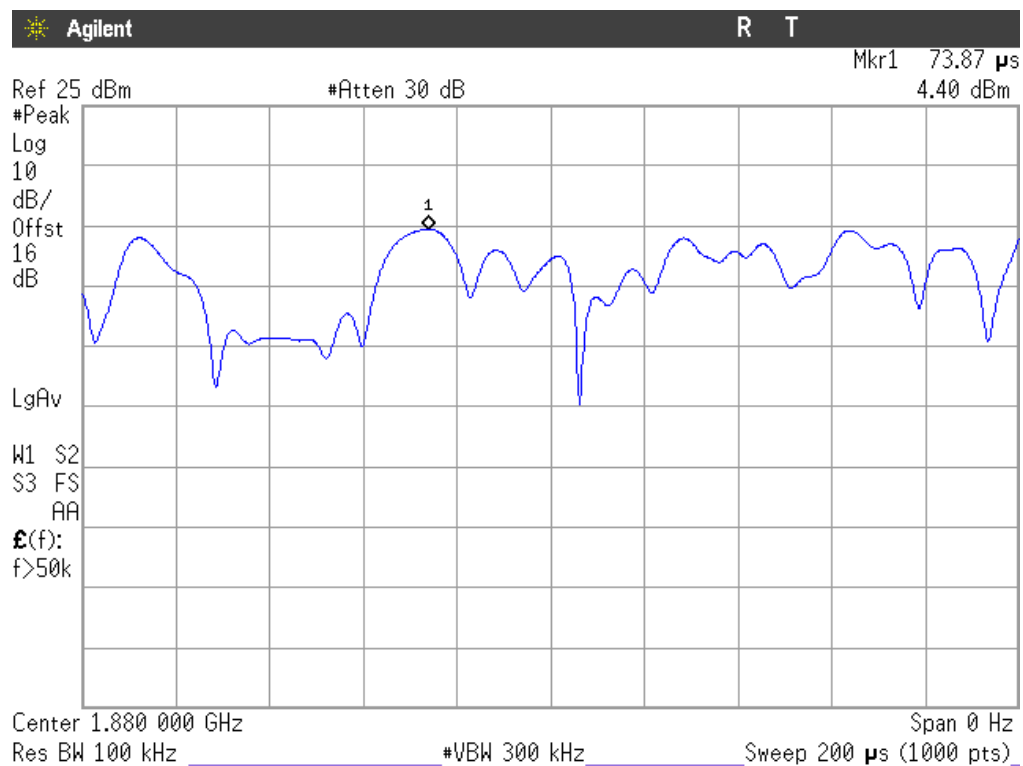
RESULTS

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.

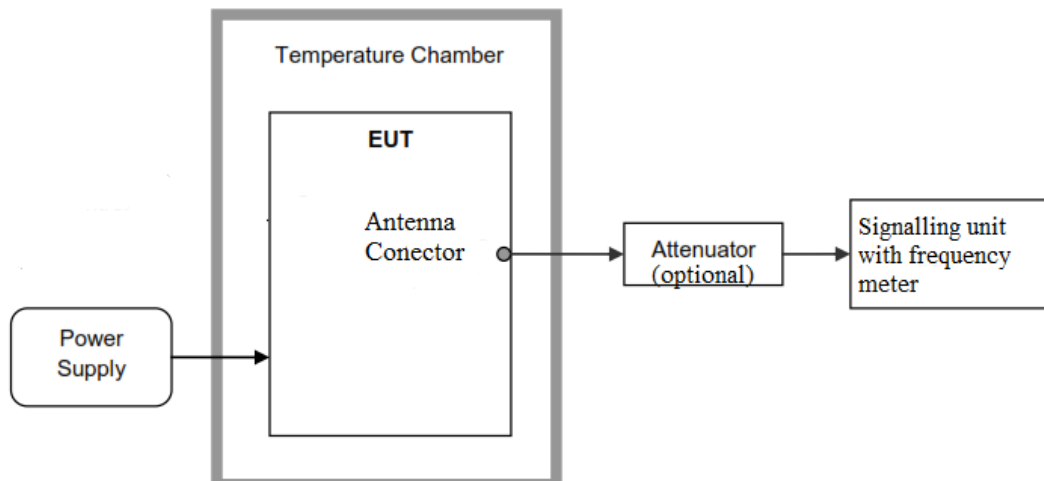
For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.

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.

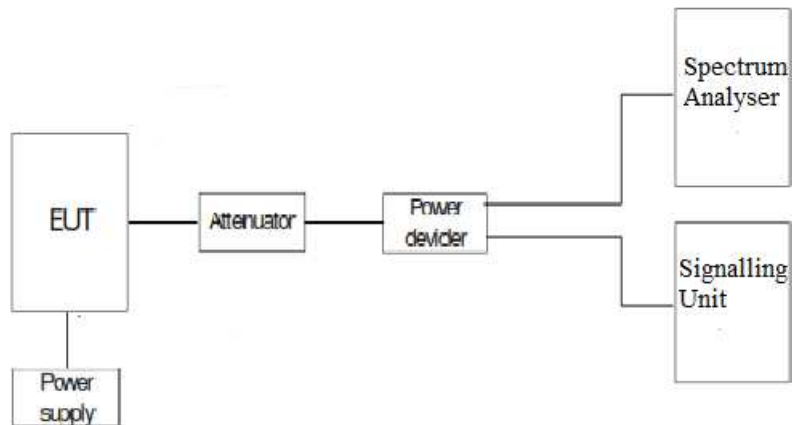
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

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	$<\pm 1 \times 10^{-6}$
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Verdict: PASS

Occupied Bandwidth

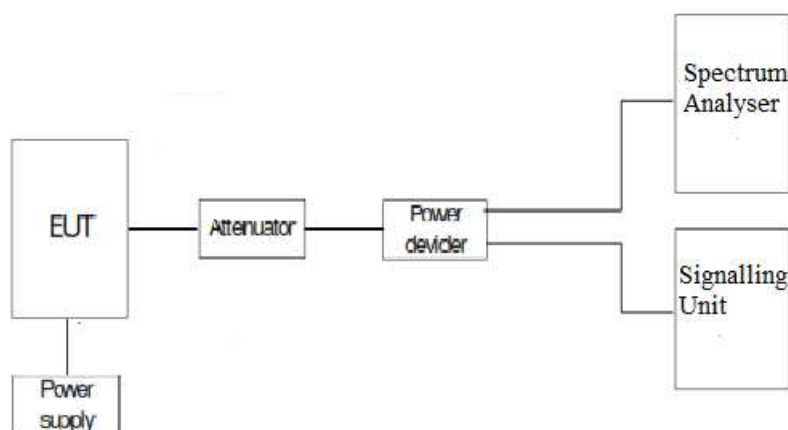
SPECIFICATION

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

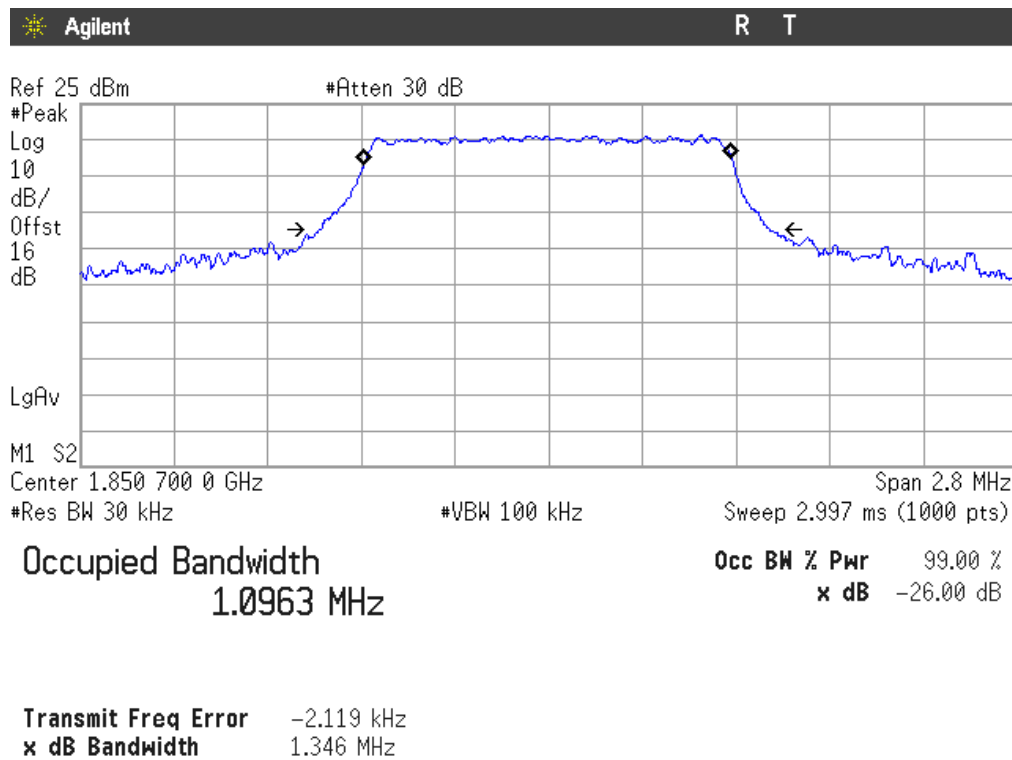
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17955.10	17950.00	17833.80
-26 dBc bandwidth (kHz)	20295.00	20111.00	19561.00
Measurement uncertainty (kHz)	<±66.67		

LTE 16QAM MODULATION. BW = 20 MHz

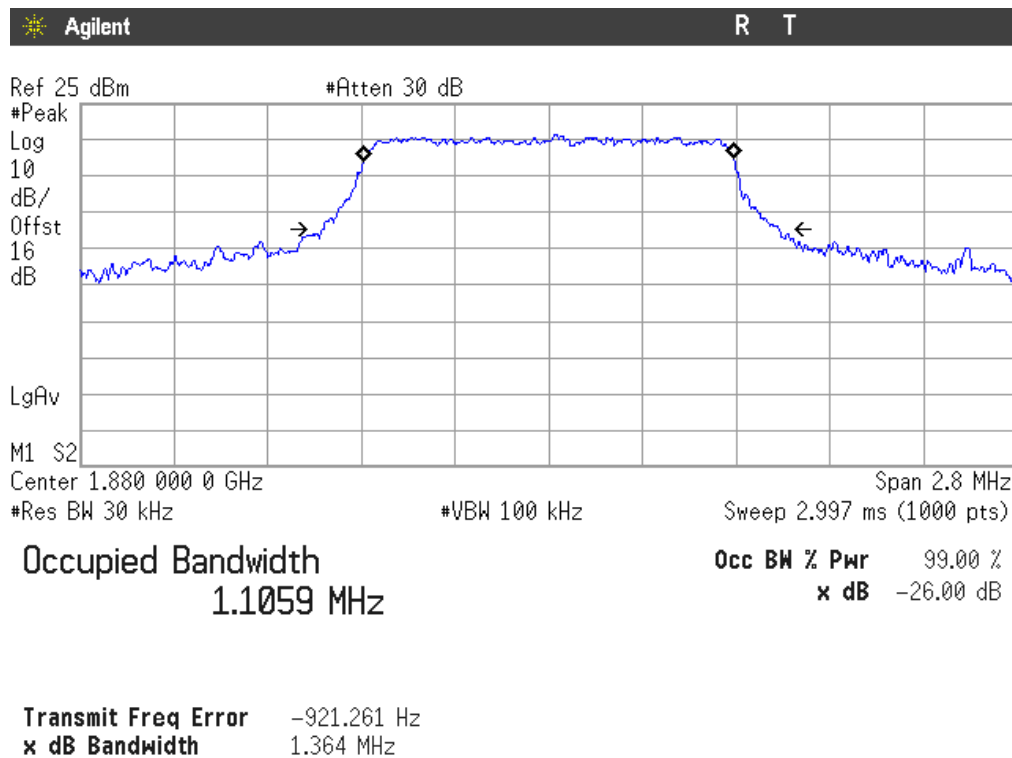
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	17930.40	17919.10	178301.00
-26 dBc bandwidth (kHz)	20346.00	20451.00	20063.00
Measurement uncertainty (kHz)	<±66.67		

LTE QPSK MODULATION. BW = 1.4 MHz

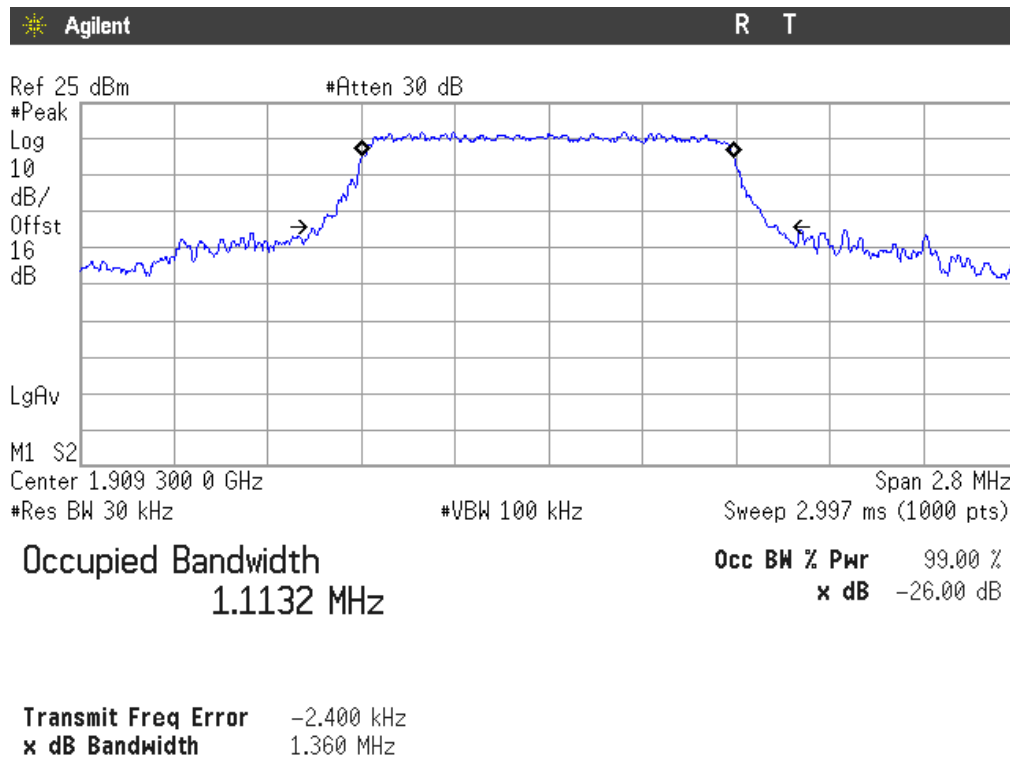
Lowest Channel



Middle Channel

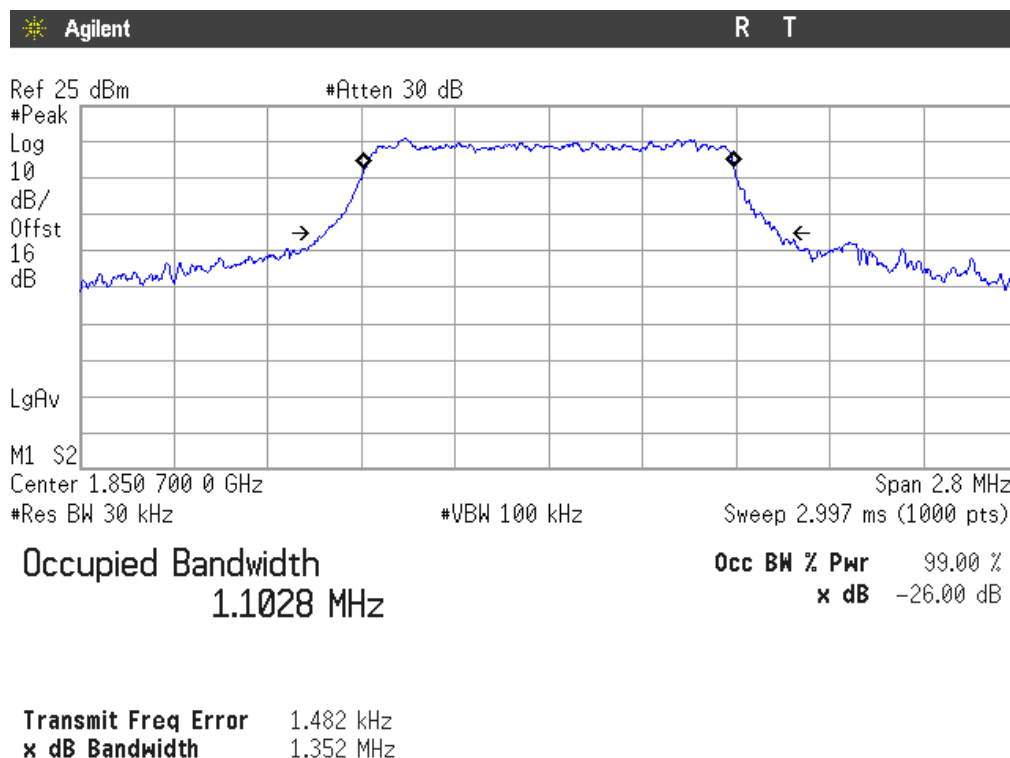


Highest Channel

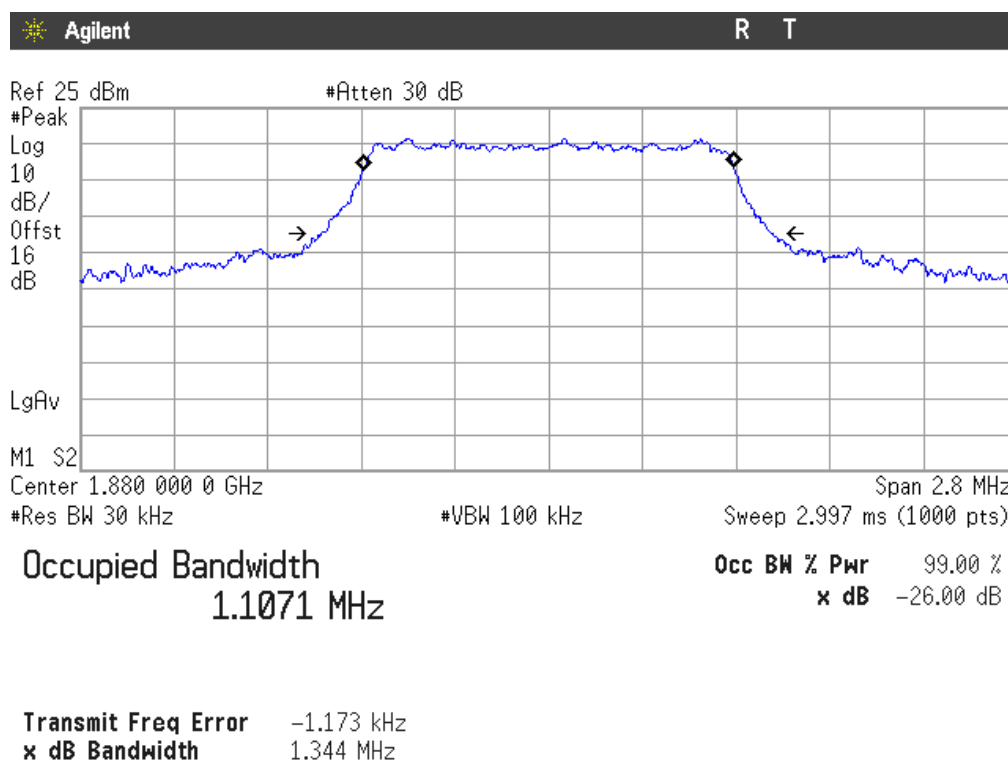


LTE 16QAM MODULATION. BW = 1.4 MHz

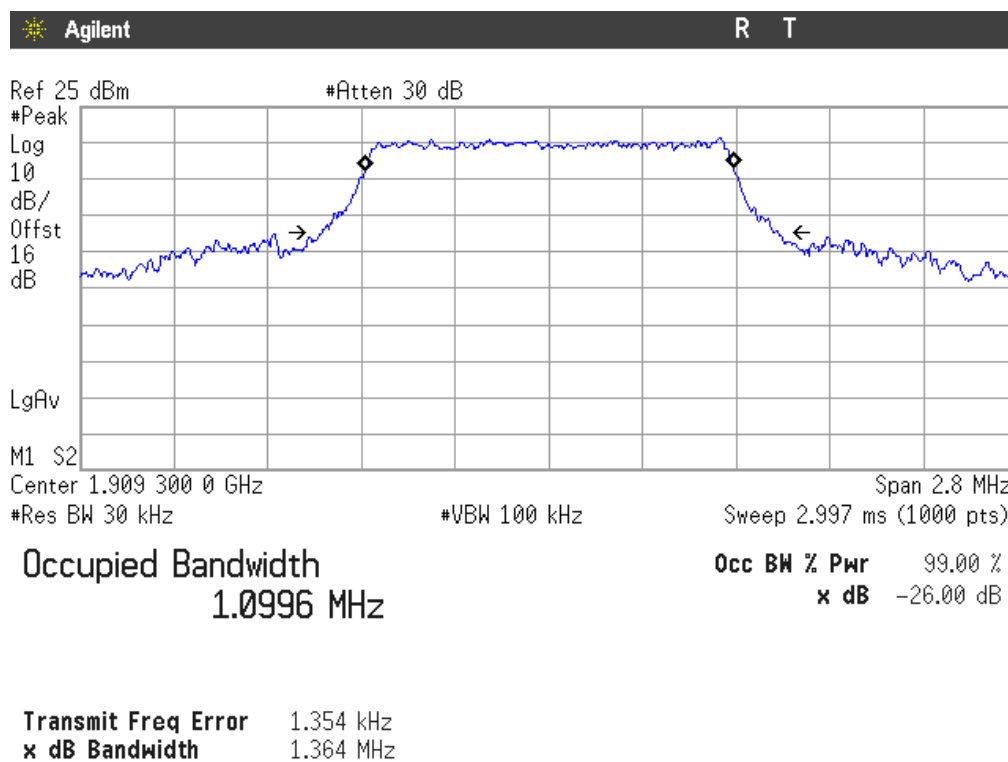
Lowest Channel



Middle Channel

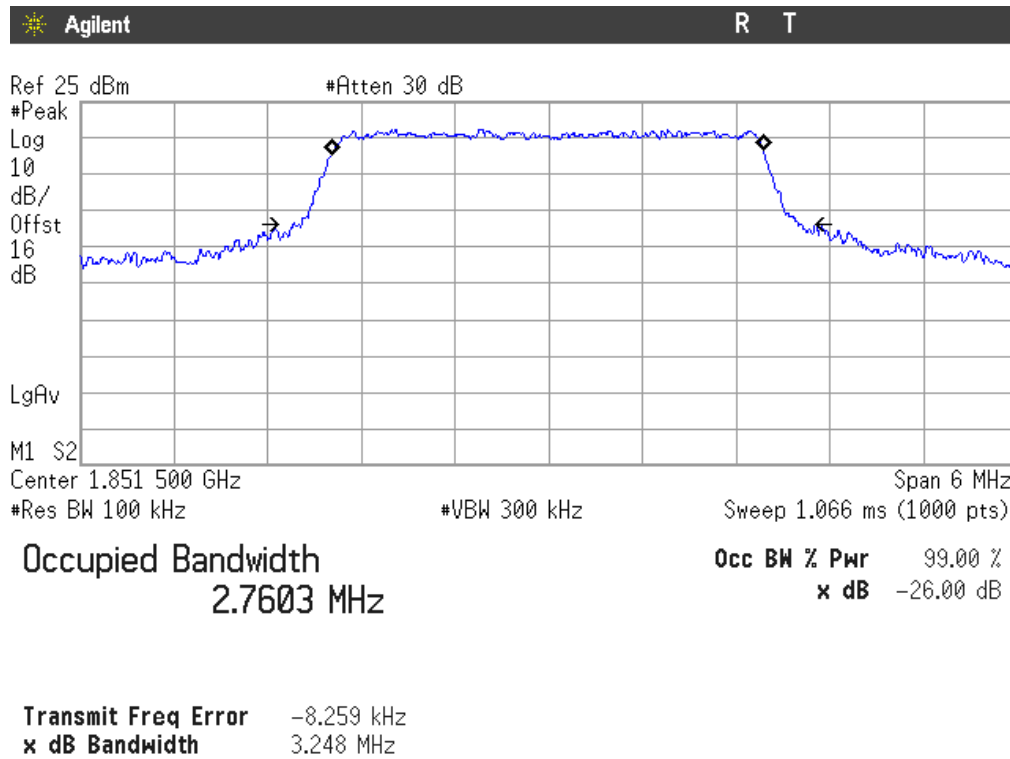


Highest Channel

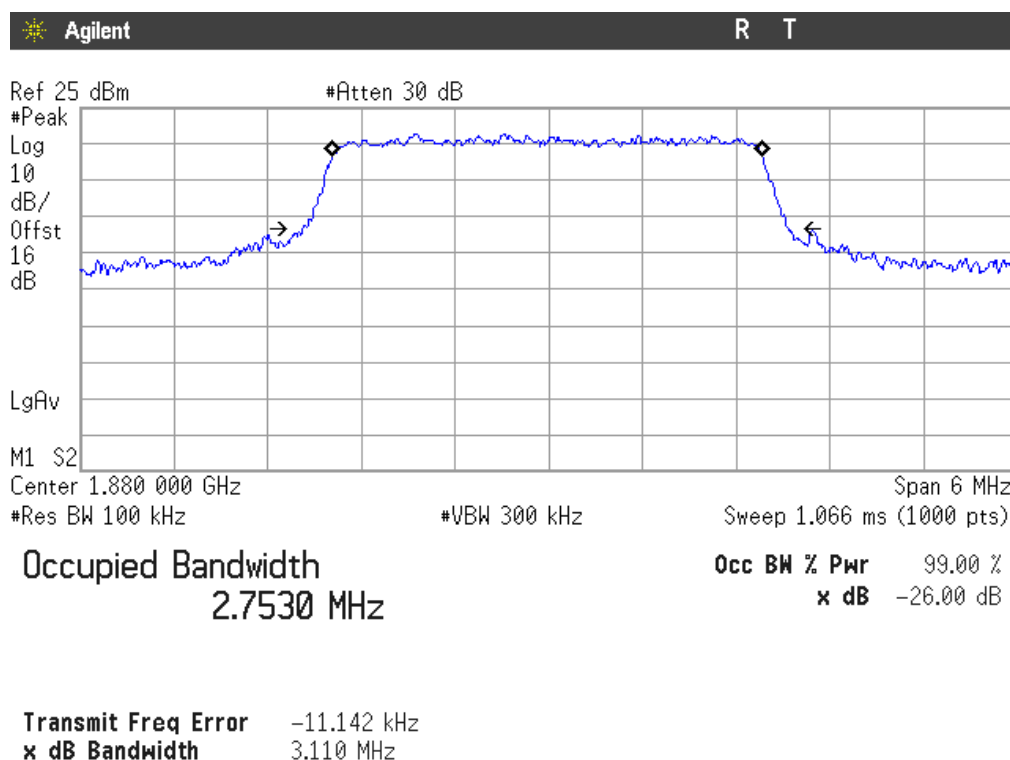


LTE QPSK MODULATION. BW = 3 MHz

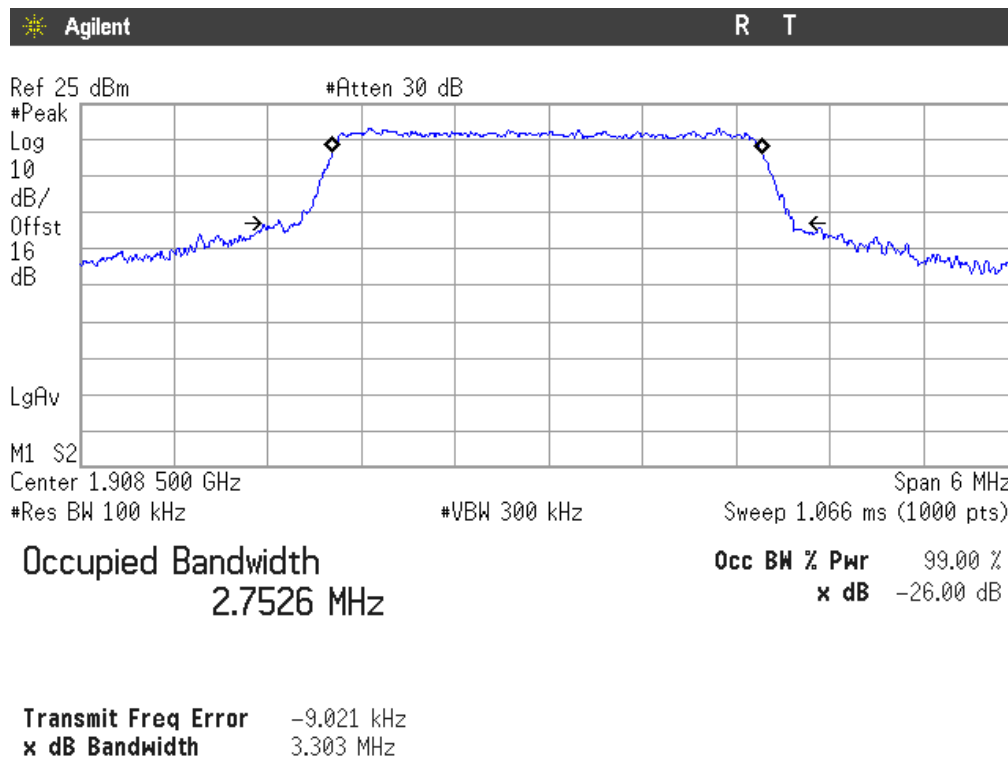
Lowest Channel



Middle Channel

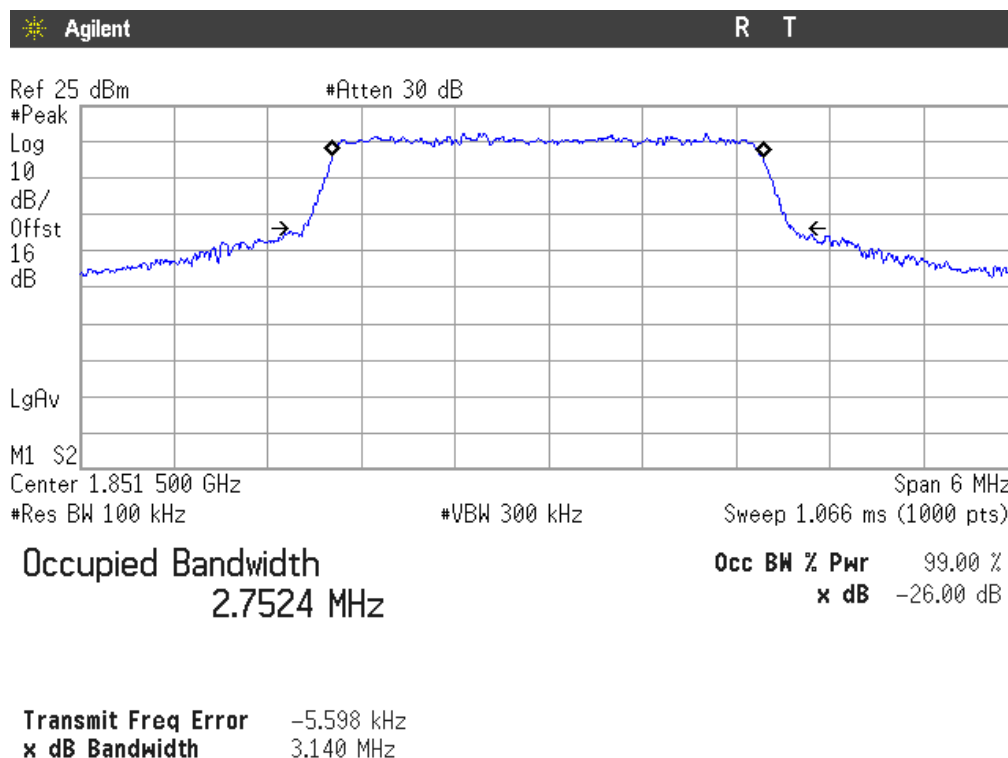


Highest Channel

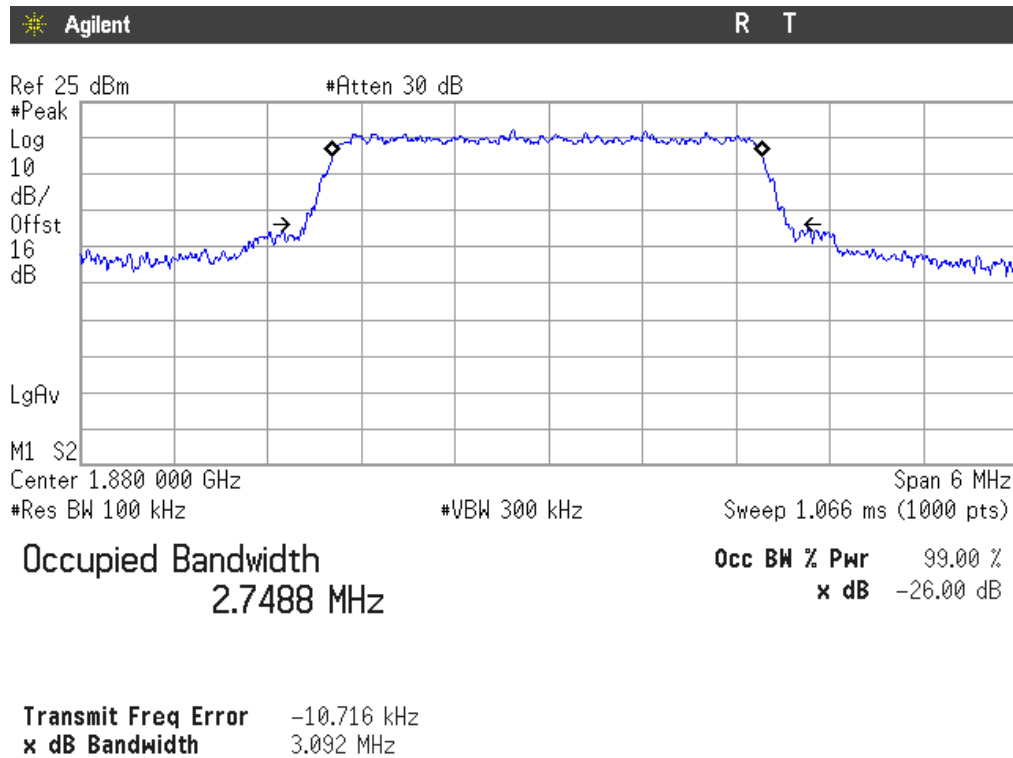


LTE 16QAM MODULATION. BW = 3 MHz

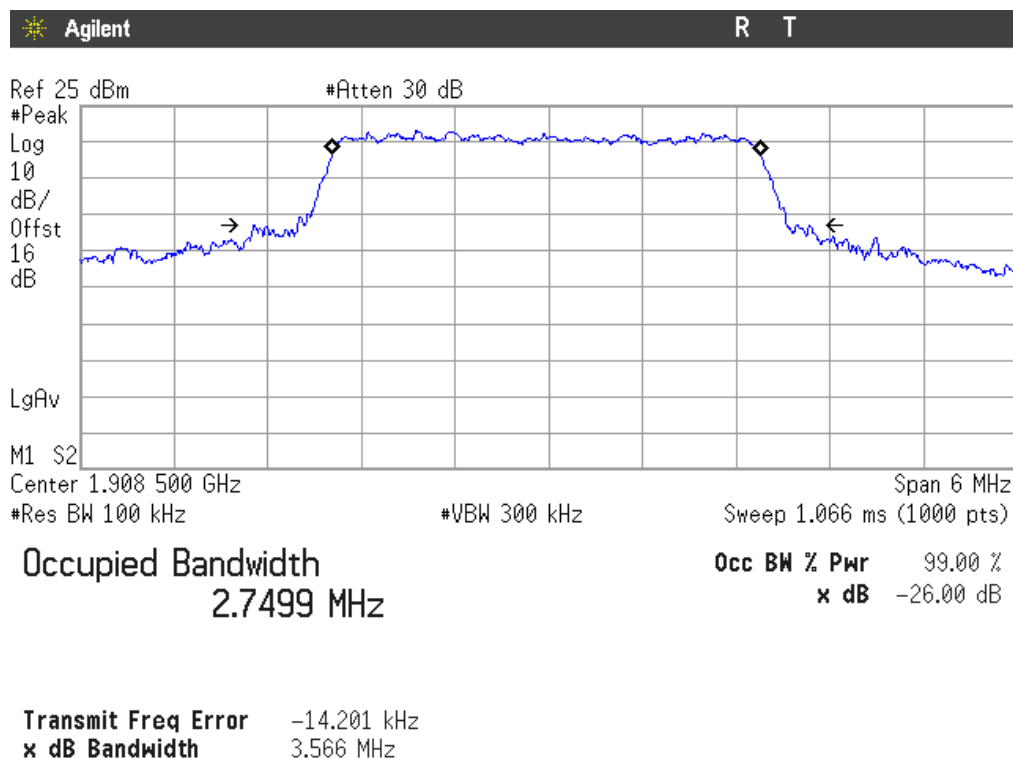
Lowest Channel



Middle Channel

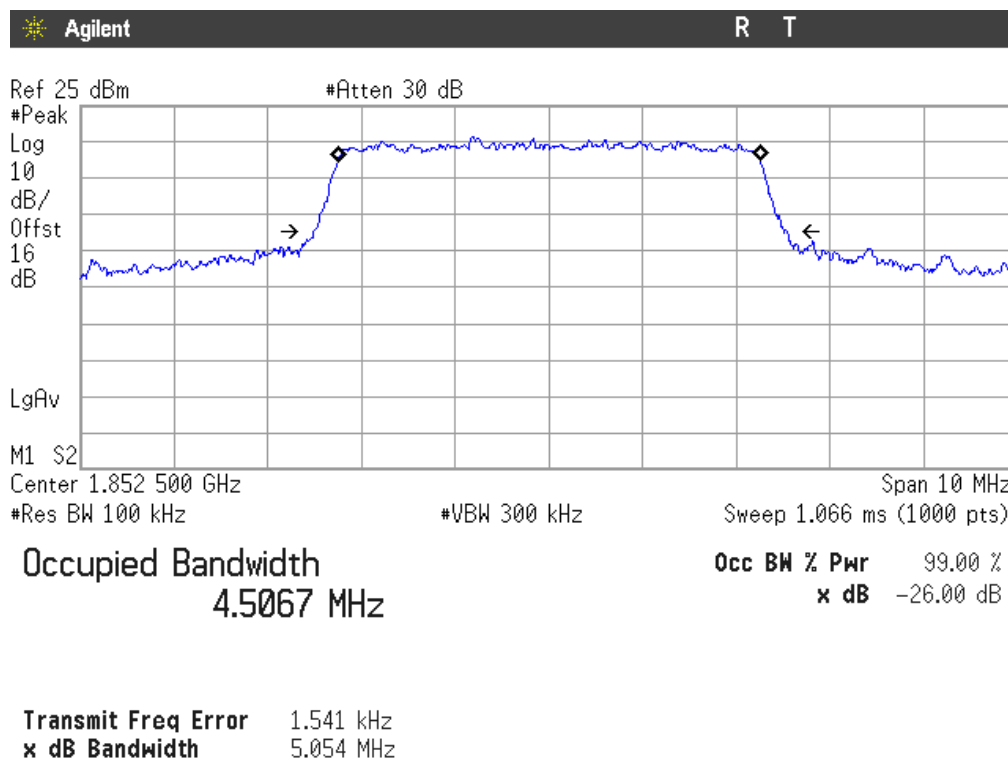


Highest Channel

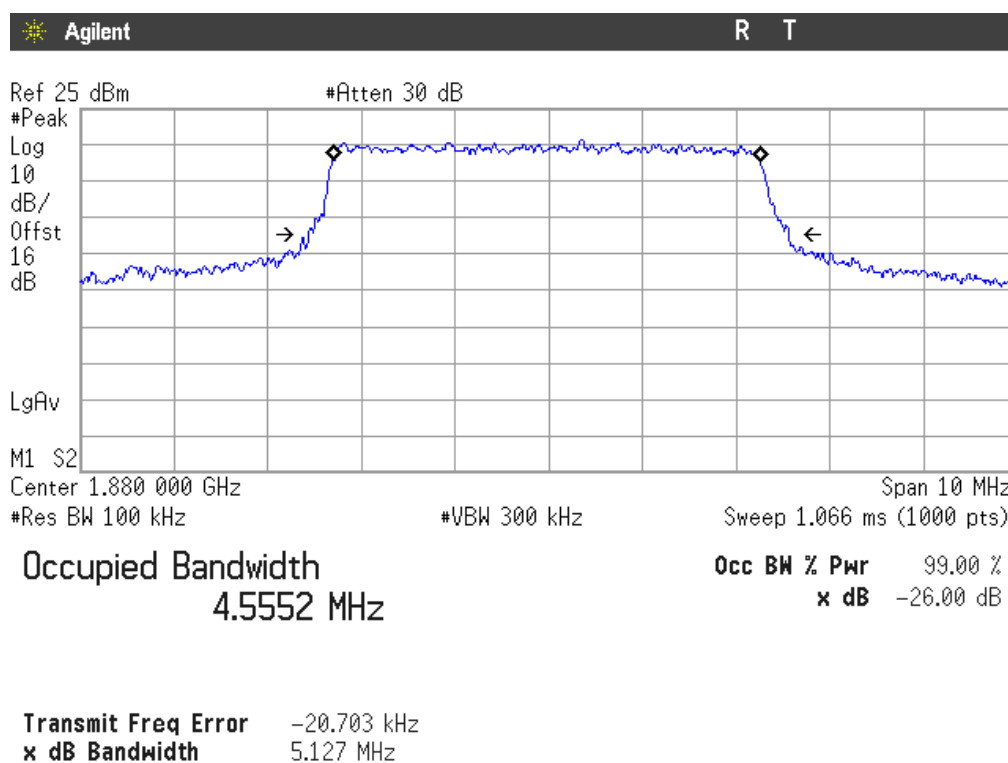


LTE QPSK MODULATION. BW = 5 MHz

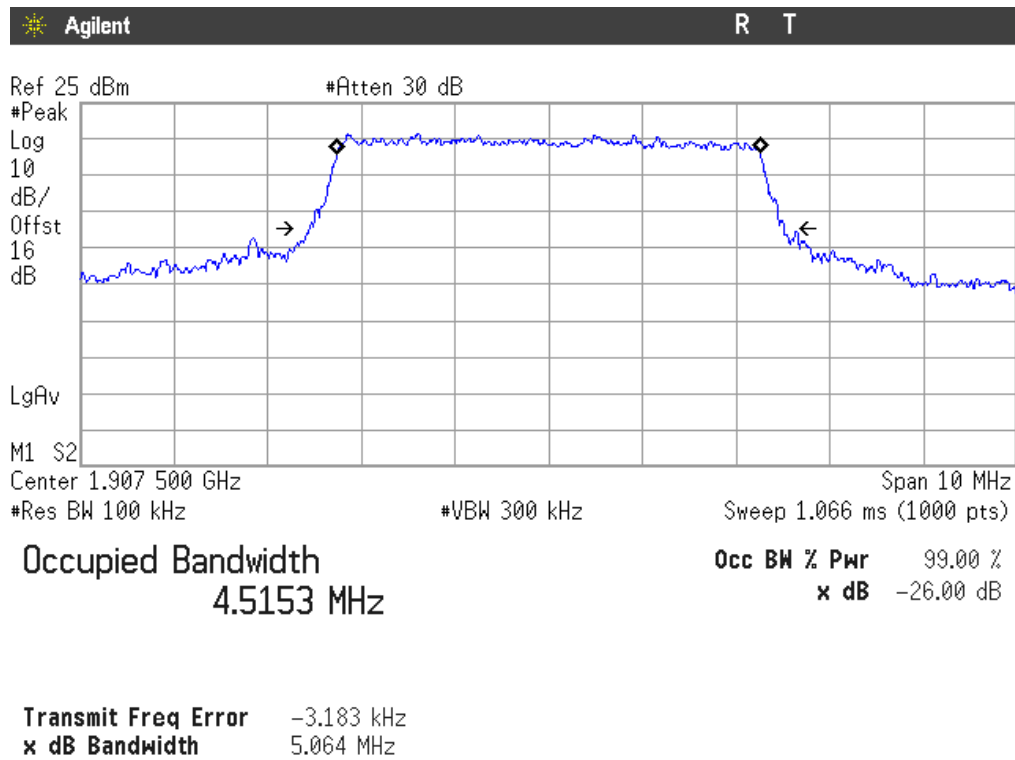
Lowest Channel



Middle Channel

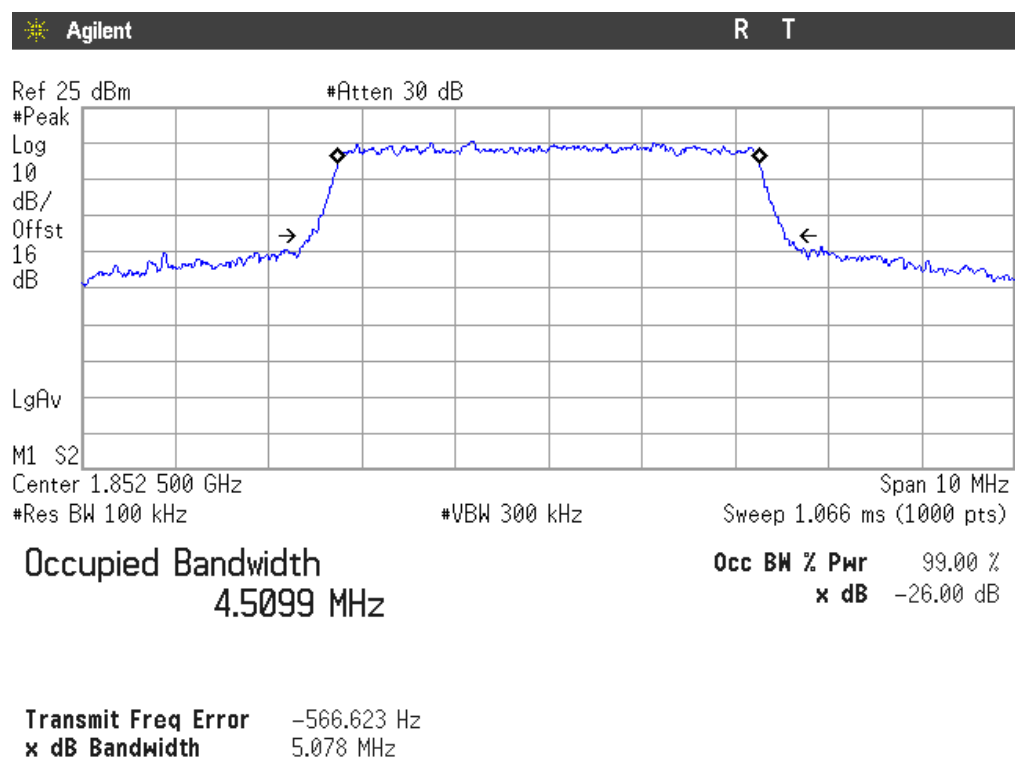


Highest Channel

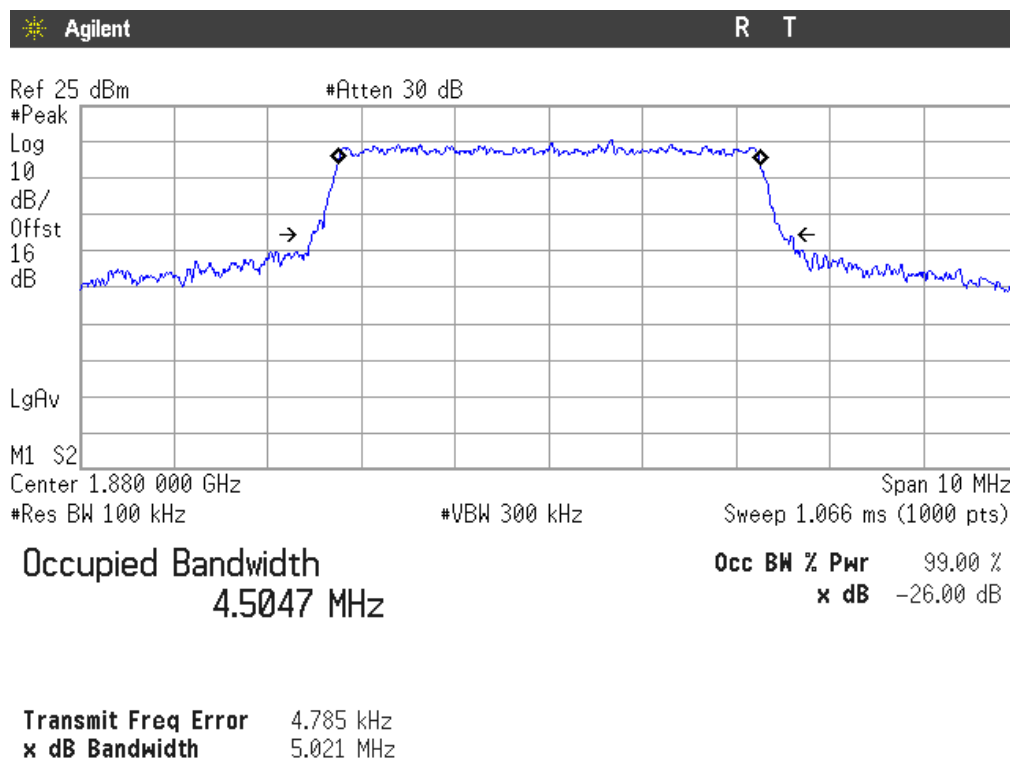


LTE 16QAM MODULATION. BW = 5 MHz

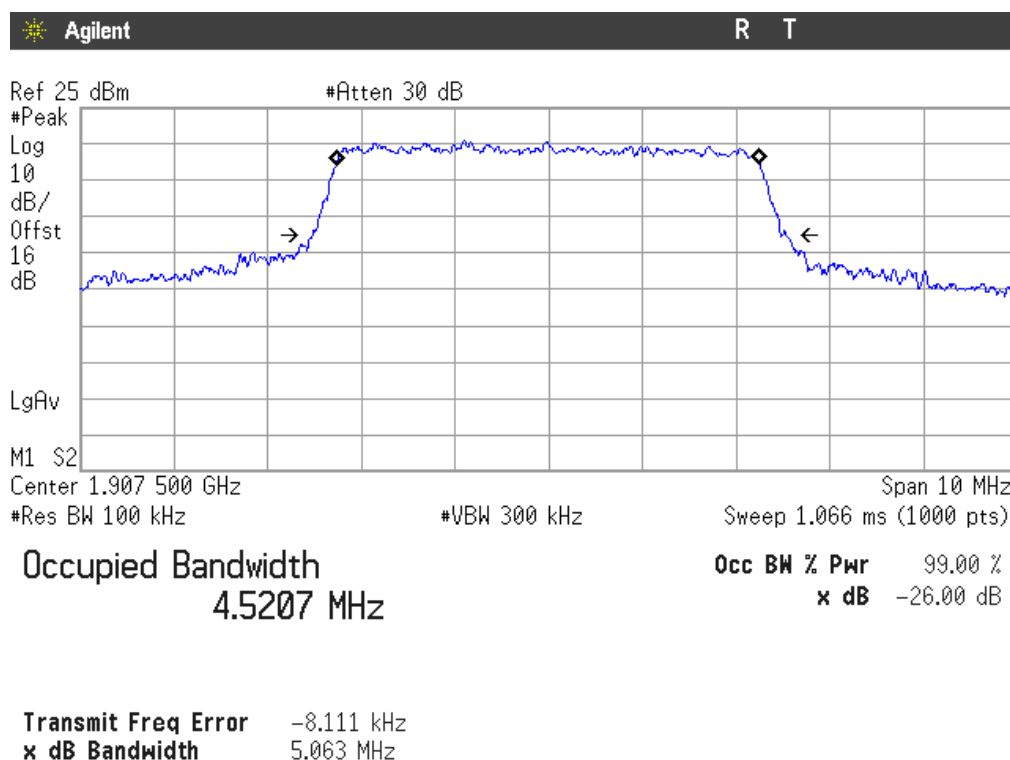
Lowest Channel



Middle Channel

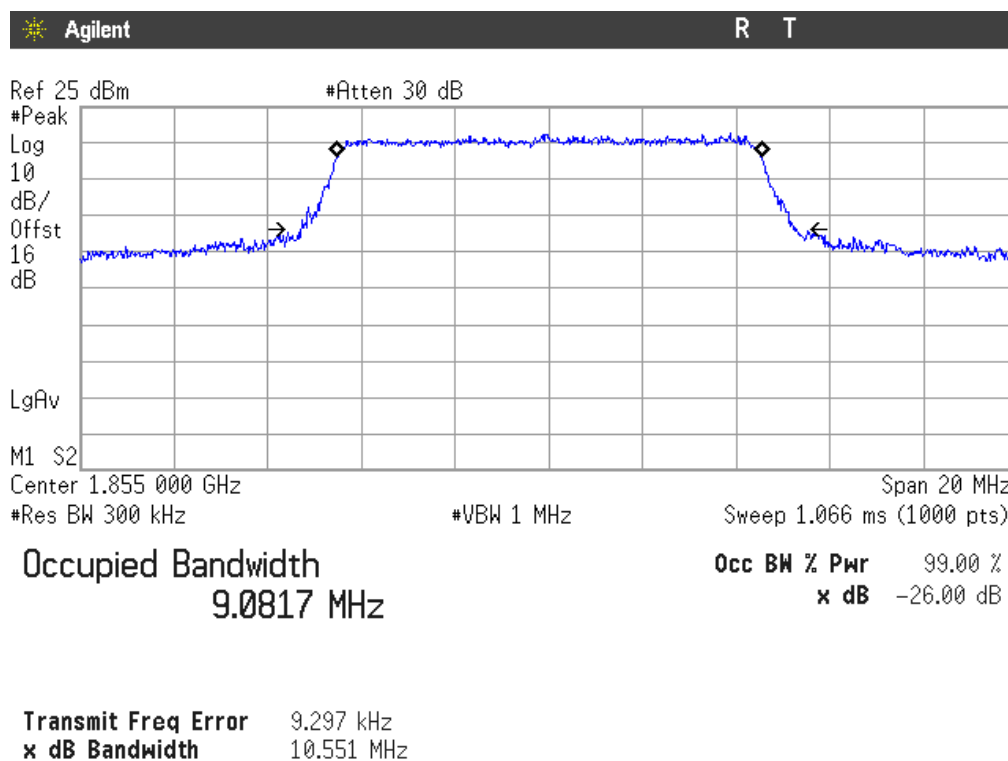


Highest Channel

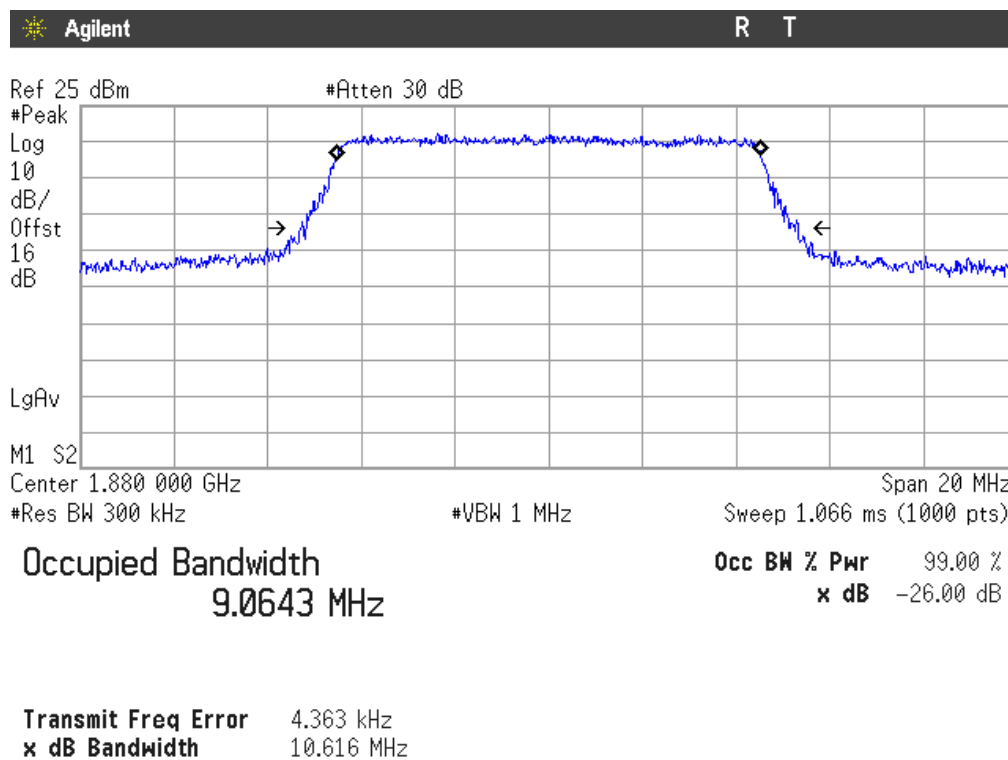


LTE QPSK MODULATION. BW = 10 MHz

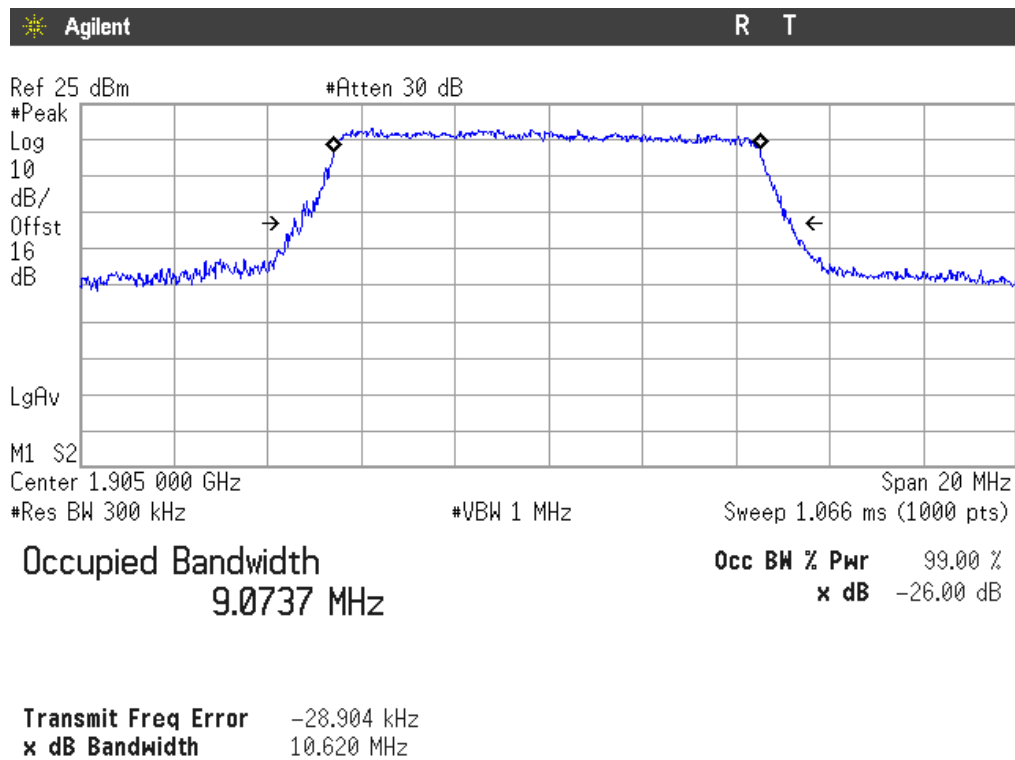
Lowest Channel



Middle Channel

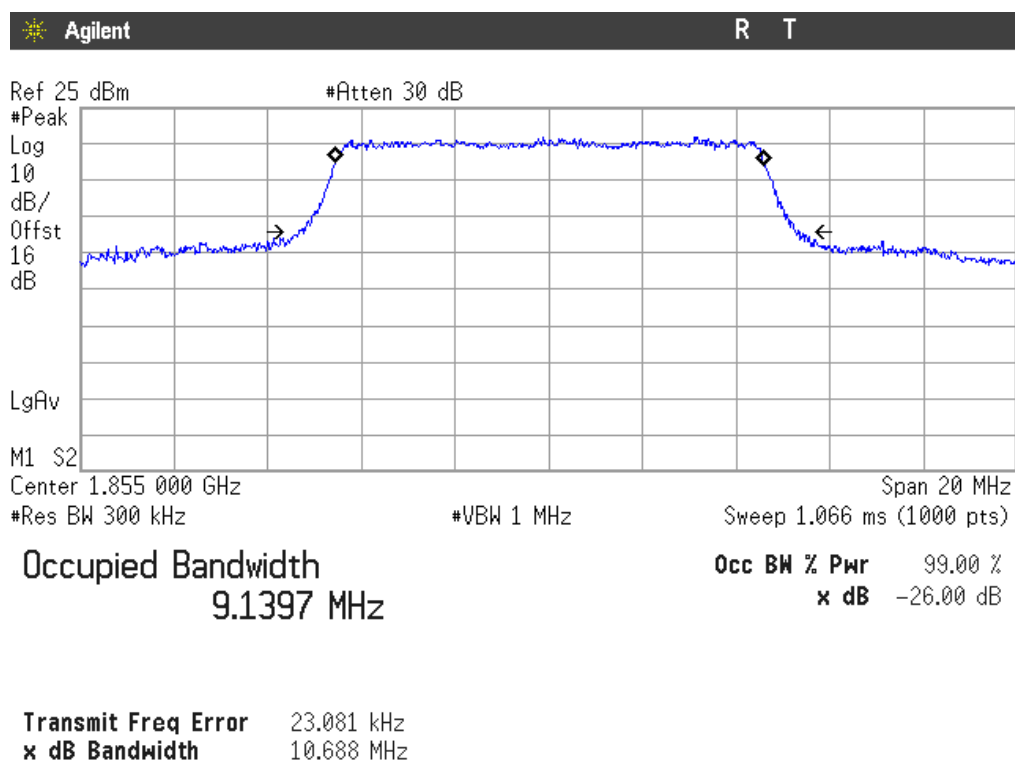


Highest Channel

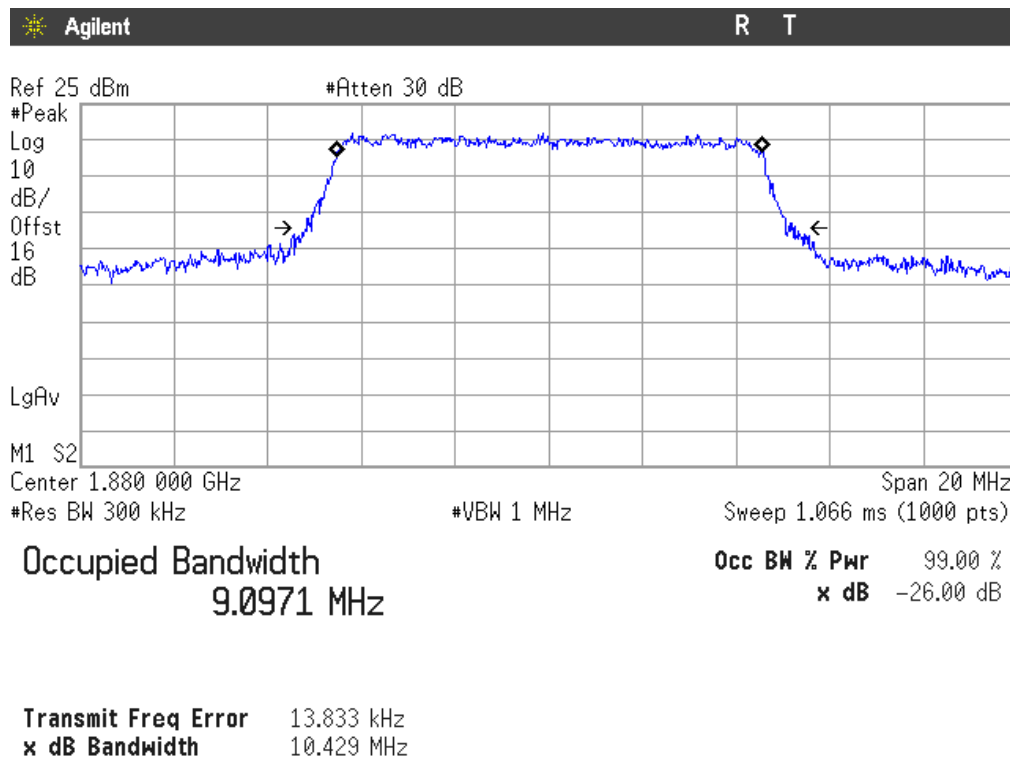


LTE 16QAM MODULATION. BW = 10 MHz

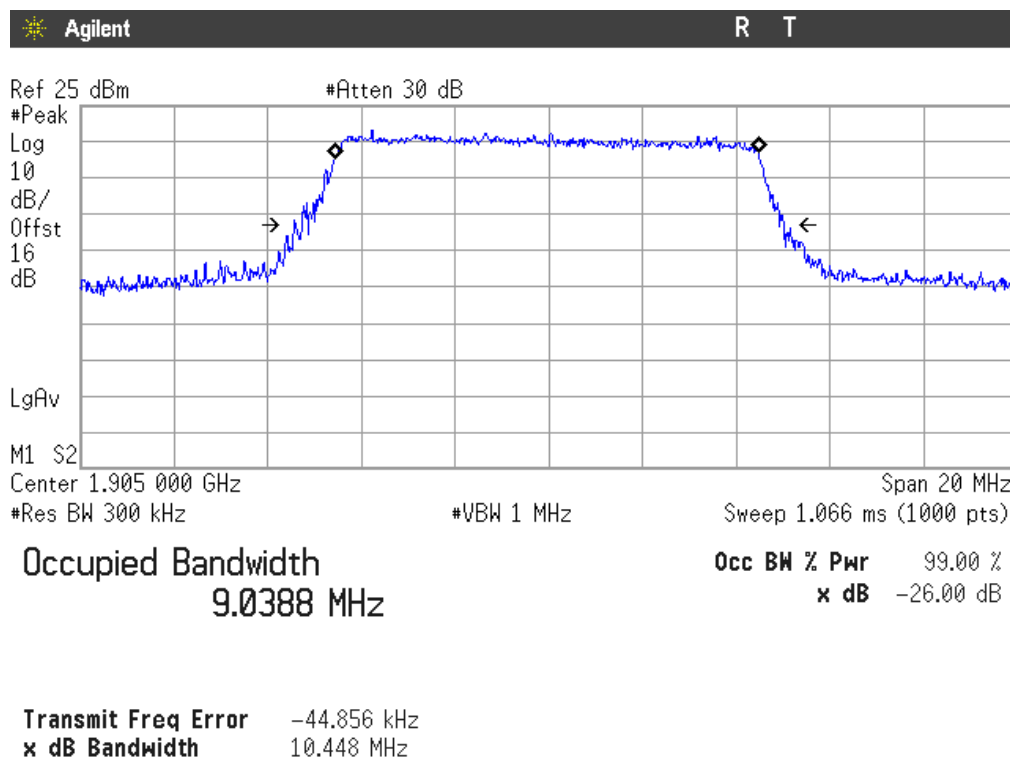
Lowest Channel



Middle Channel

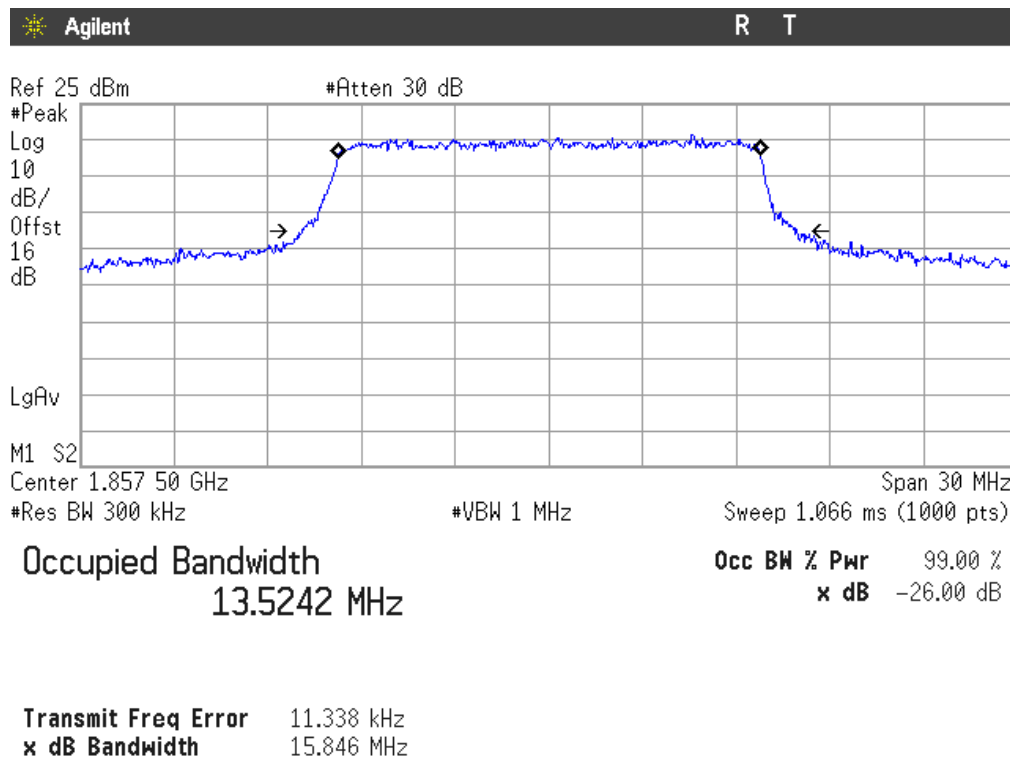


Highest Channel

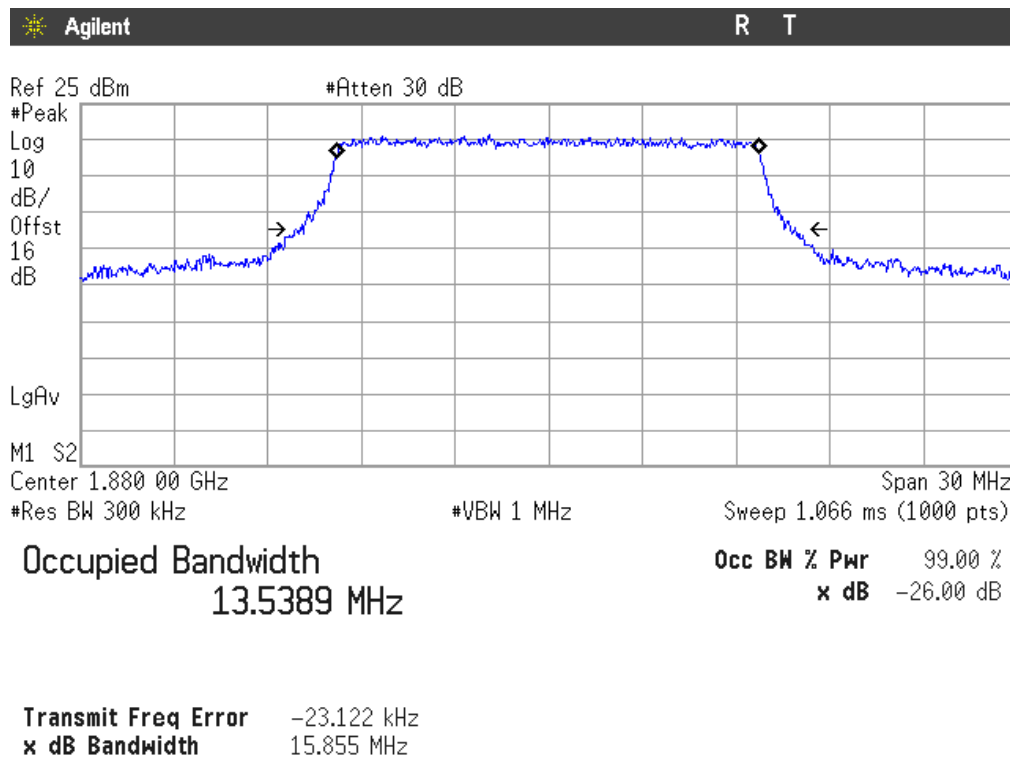


LTE QPSK MODULATION. BW = 15 MHz

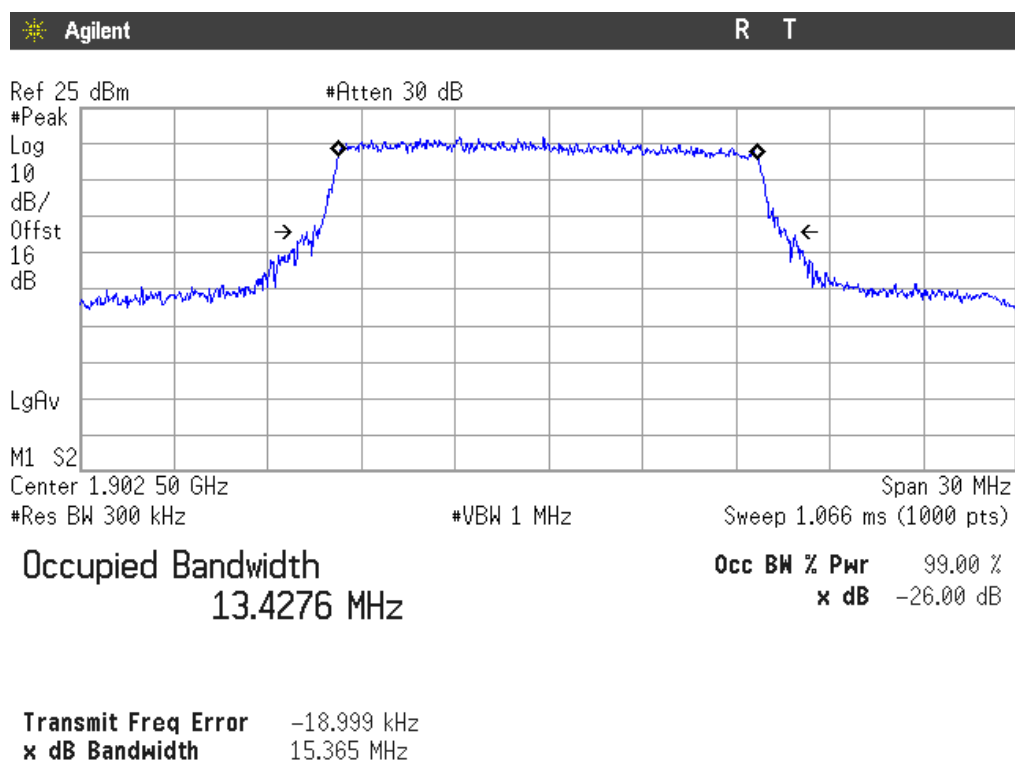
Lowest Channel



Middle Channel

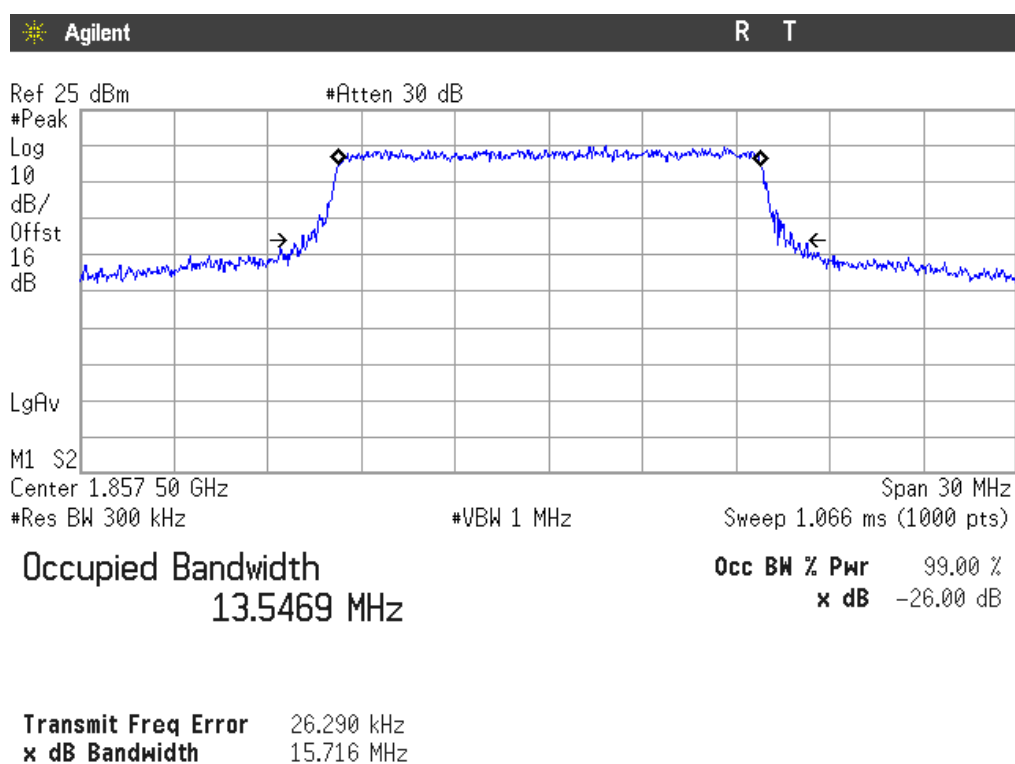


Highest Channel

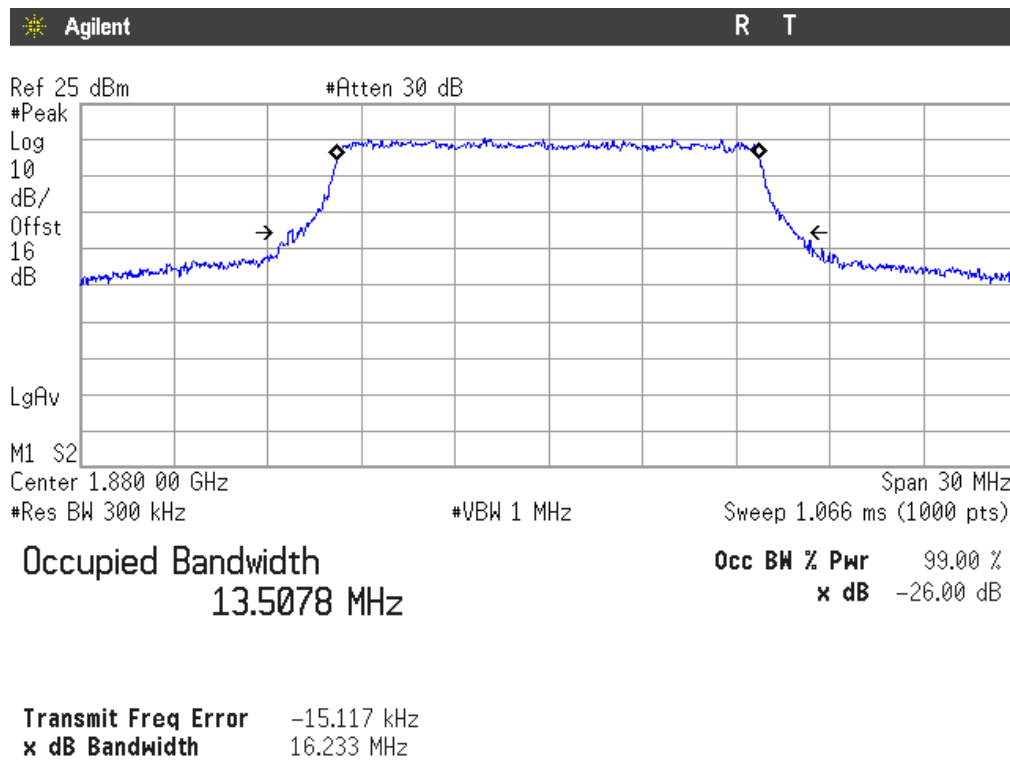


LTE 16QAM MODULATION. BW = 15 MHz

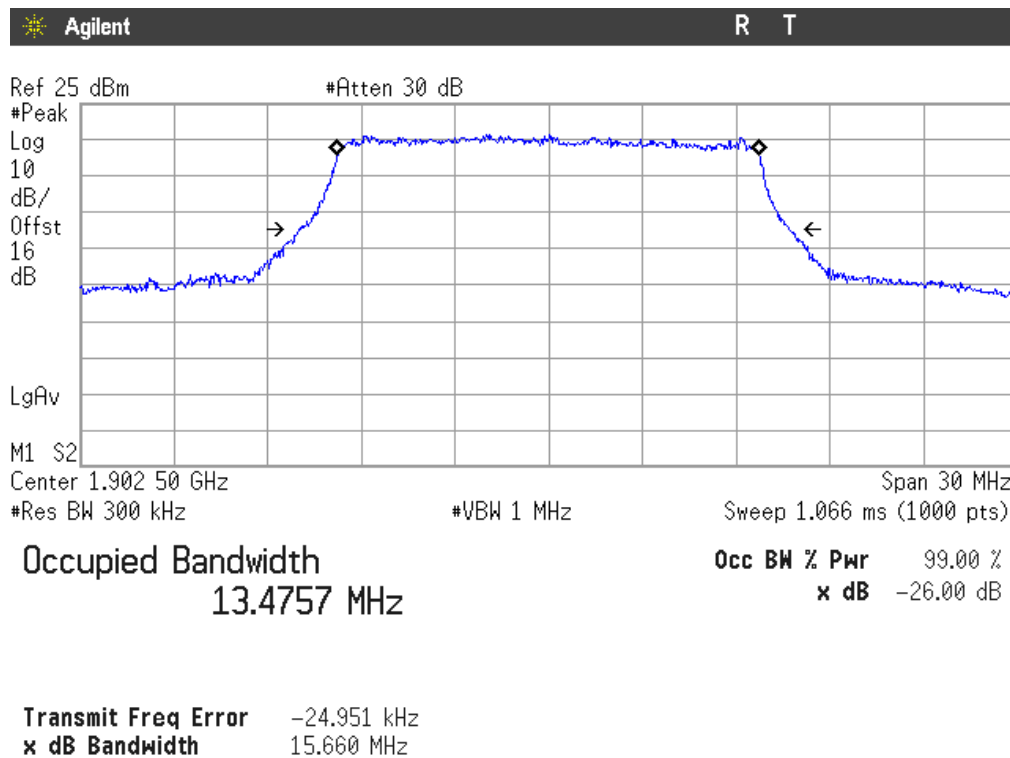
Lowest Channel



Middle Channel

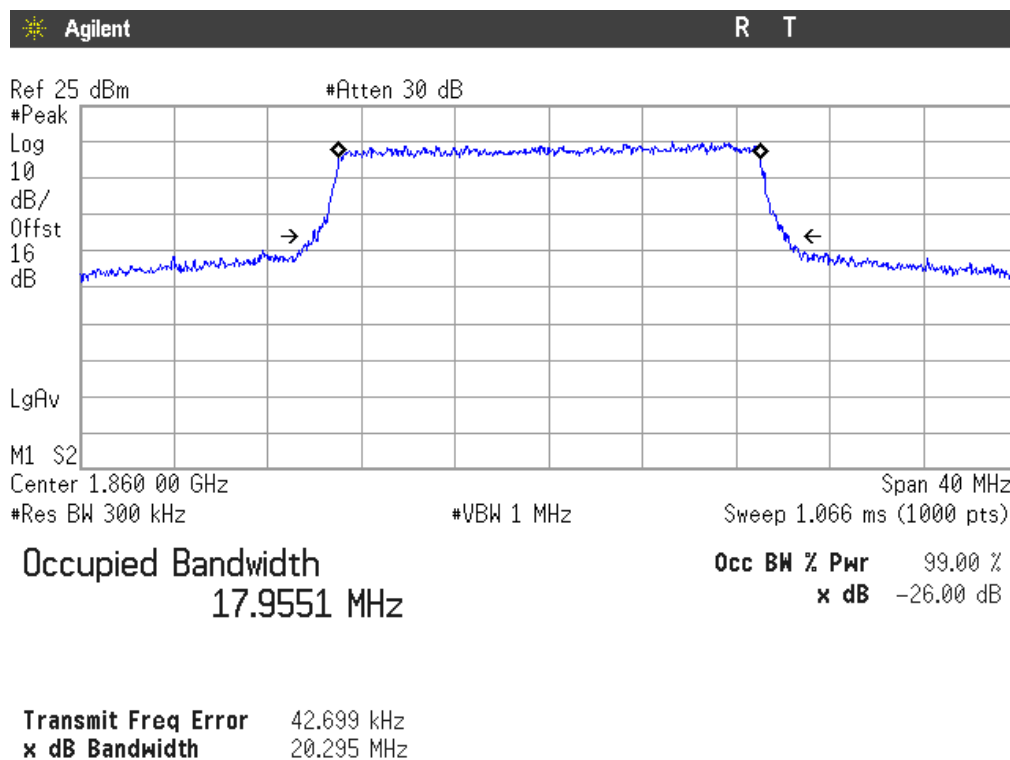


Highest Channel

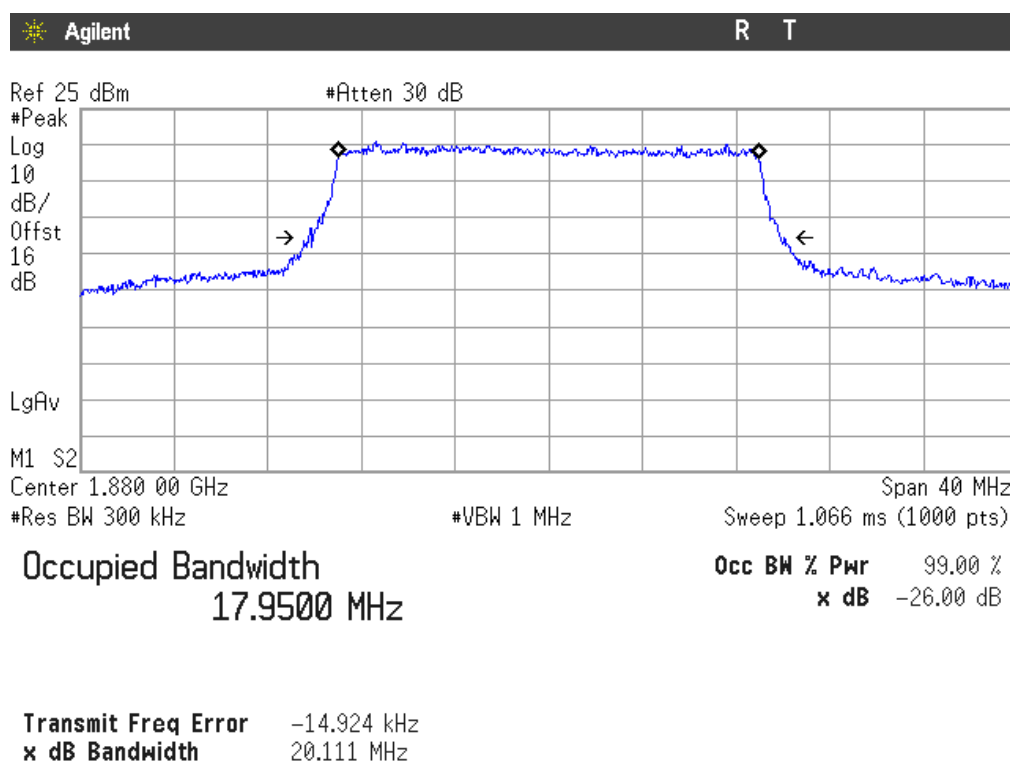


LTE QPSK MODULATION. BW = 20 MHz

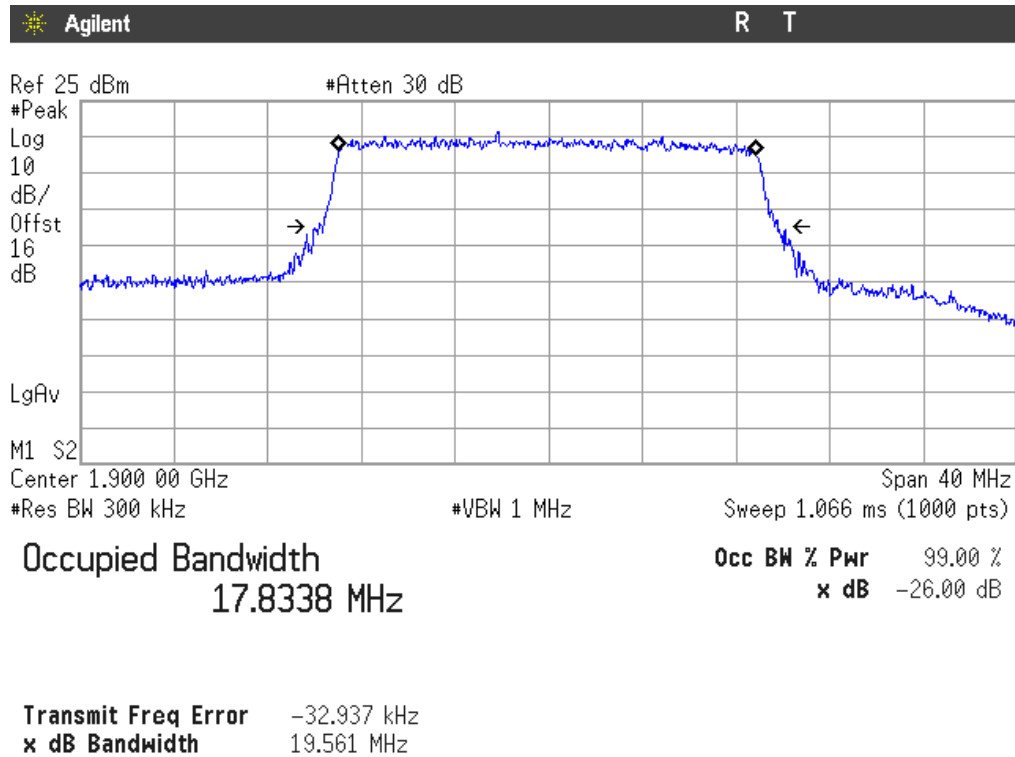
Lowest Channel



Middle Channel

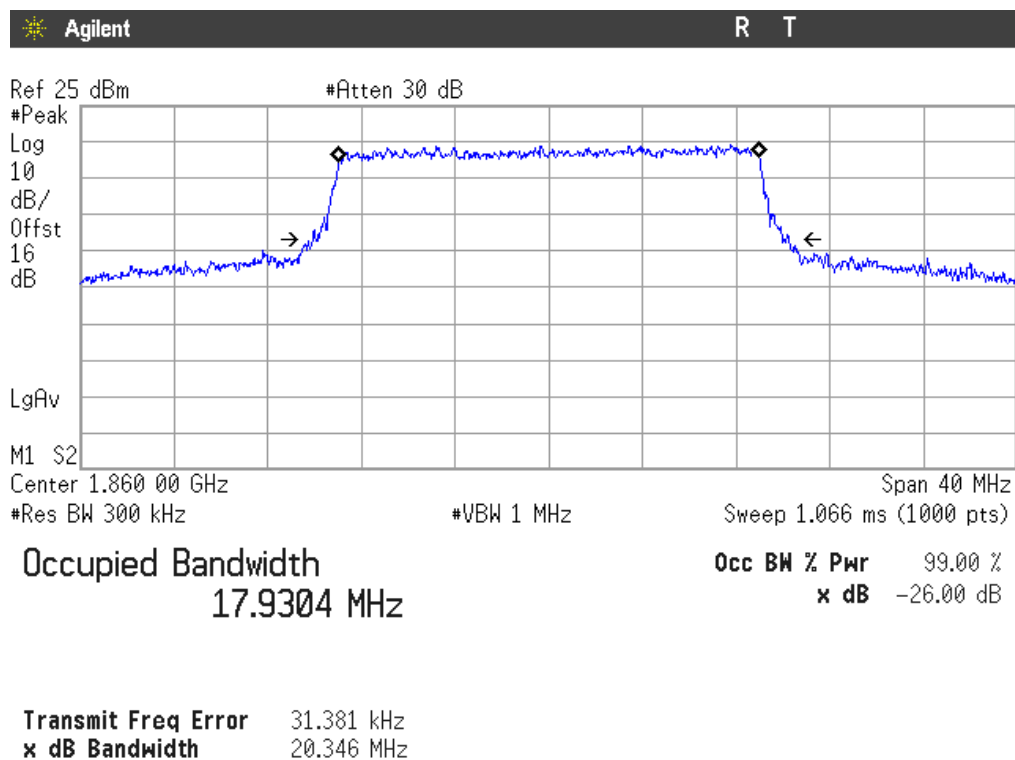


Highest Channel

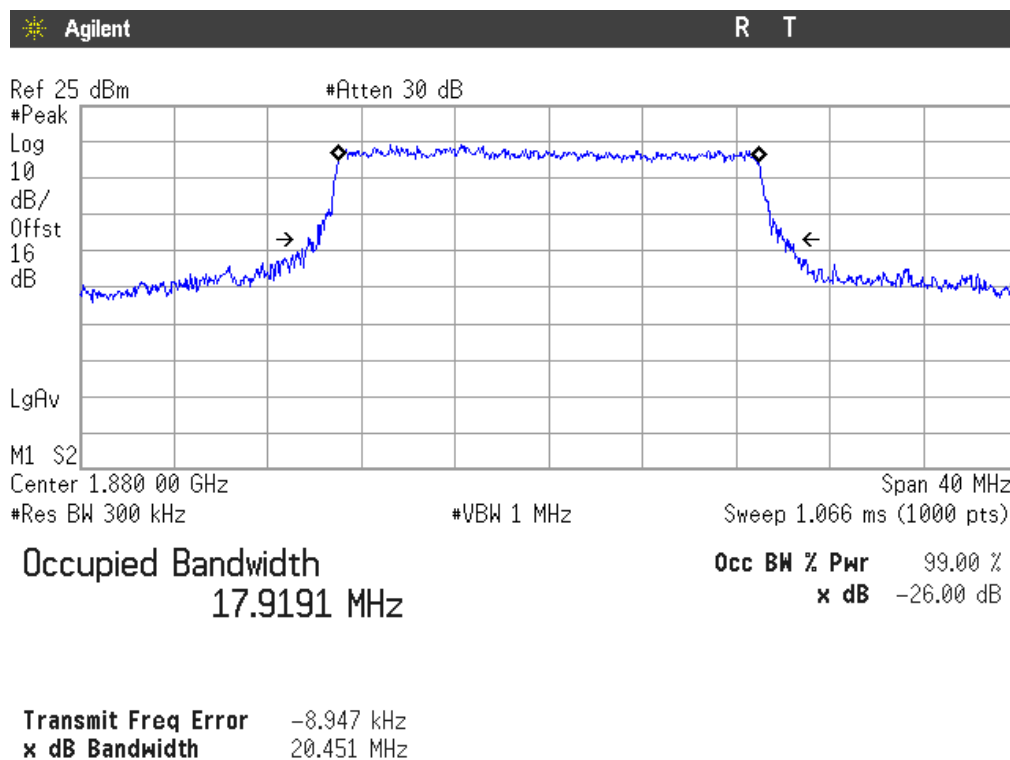


LTE 16QAM MODULATION. BW = 20 MHz

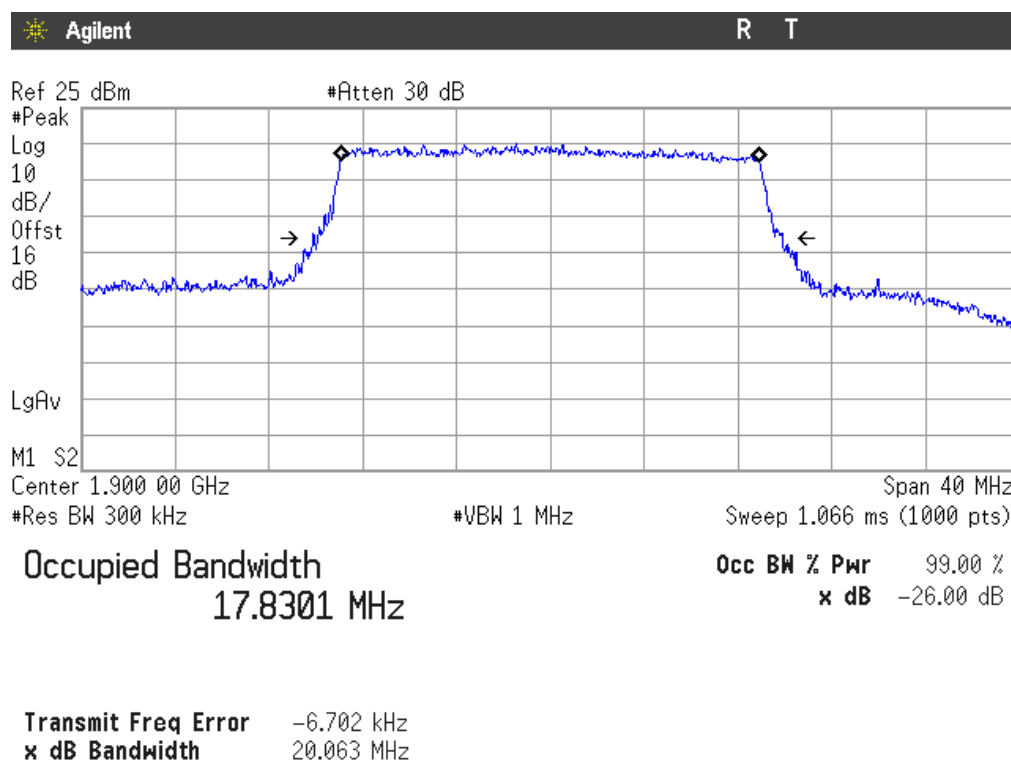
Lowest Channel



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.

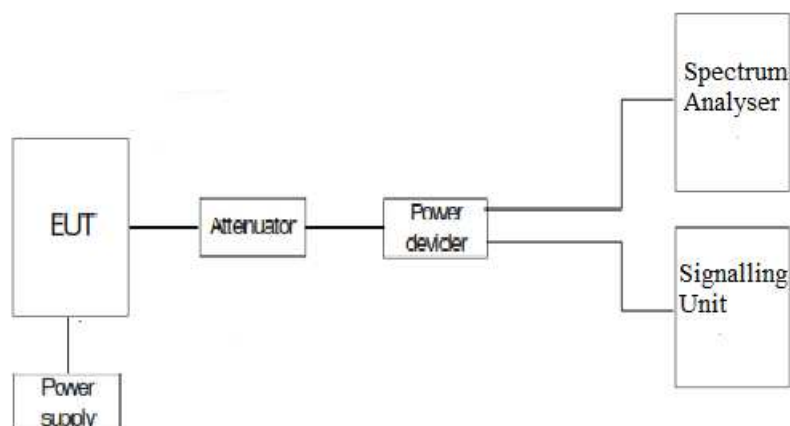
Measurement Limit:

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.

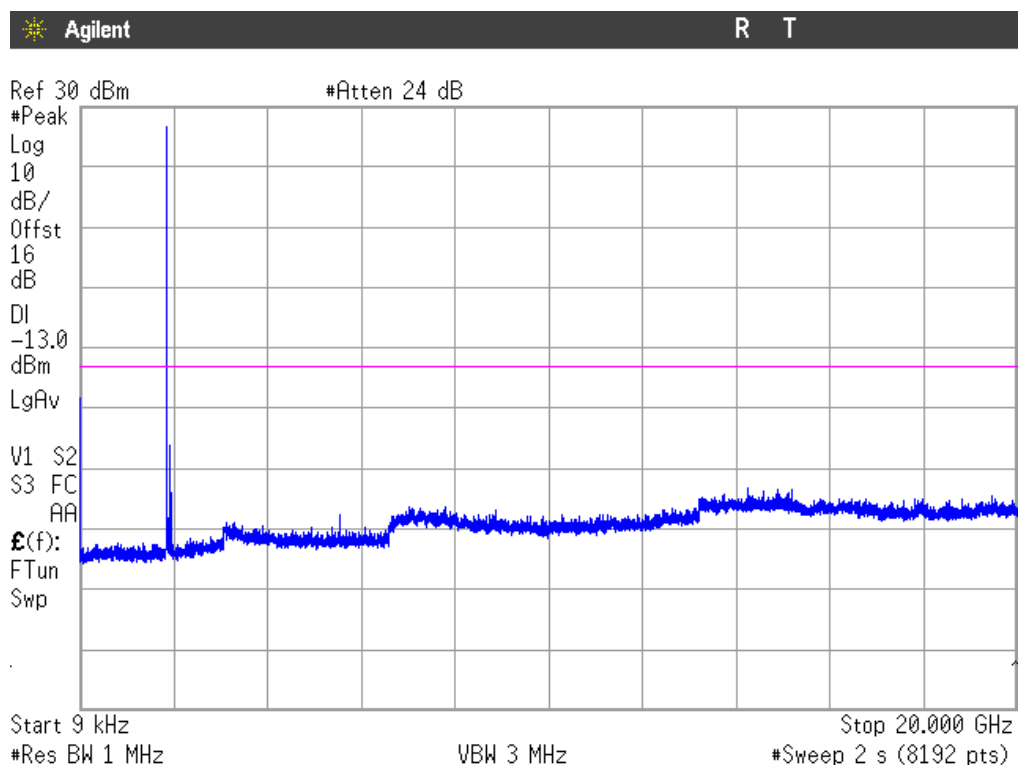
3. CHANNEL: HIGHEST

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

Verdict: PASS

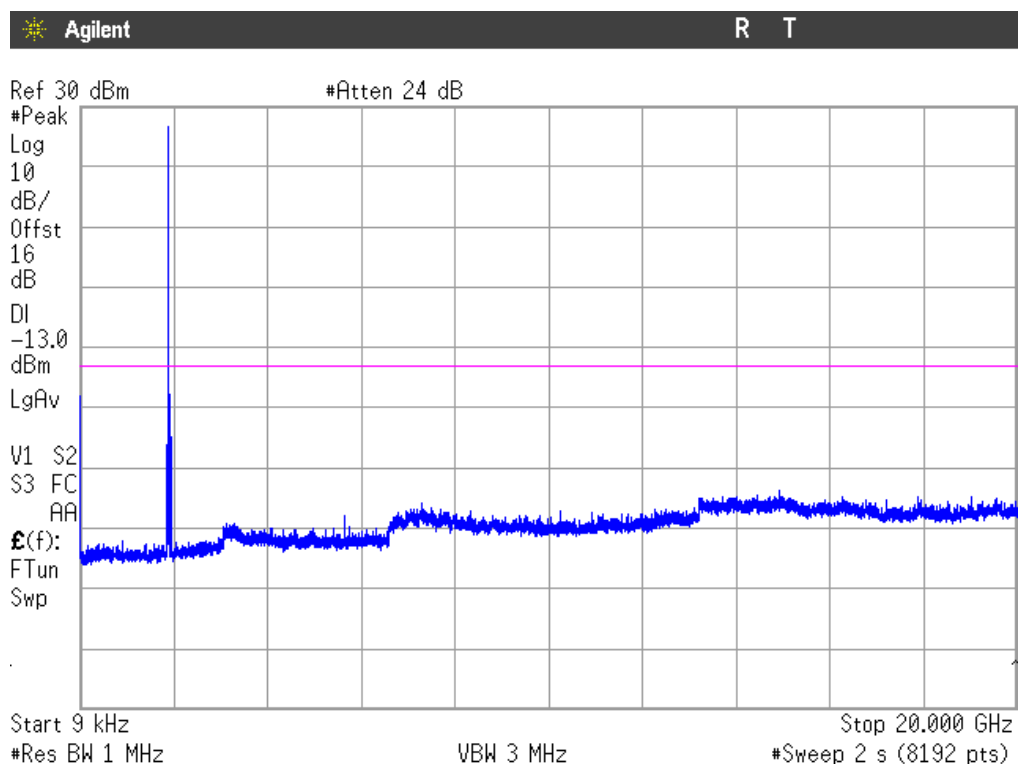
LTE QPSK MODULATION. BW = 1.4 MHz

1. CHANNEL: LOWEST



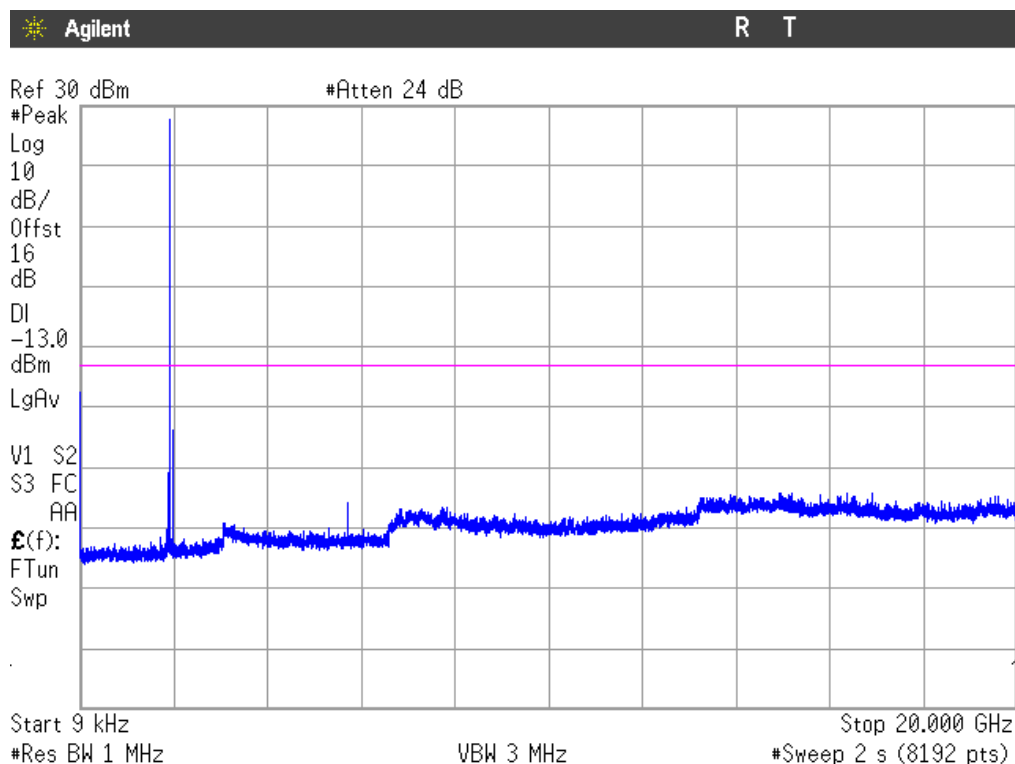
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

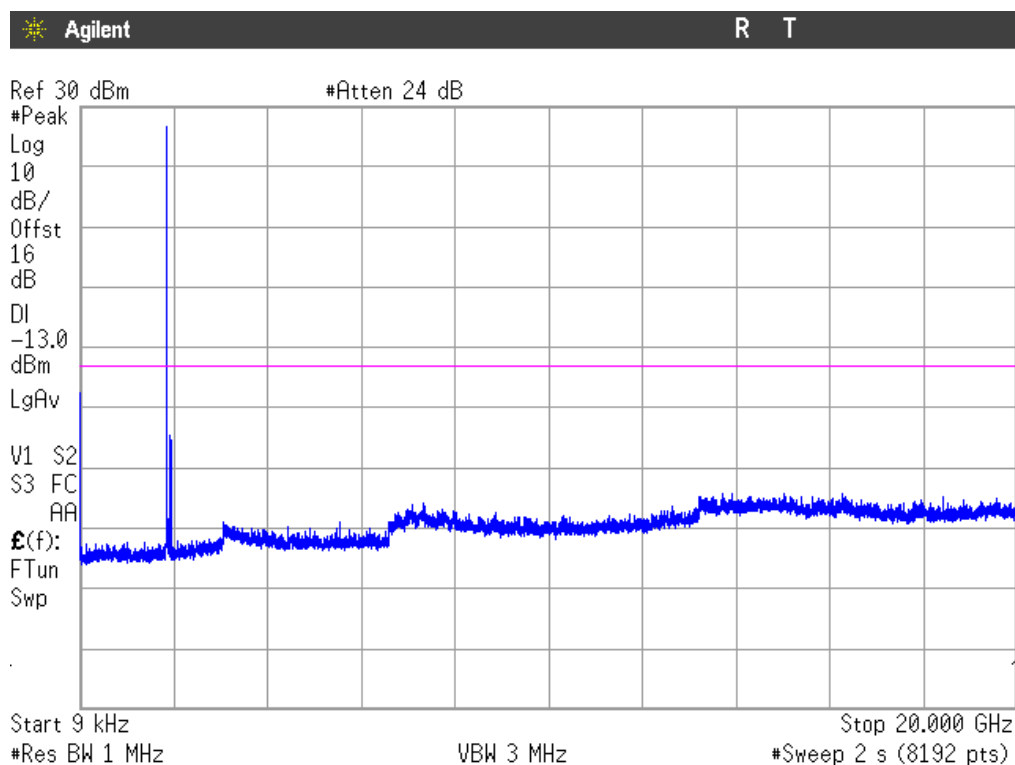
3. CHANNEL: HIGHEST



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

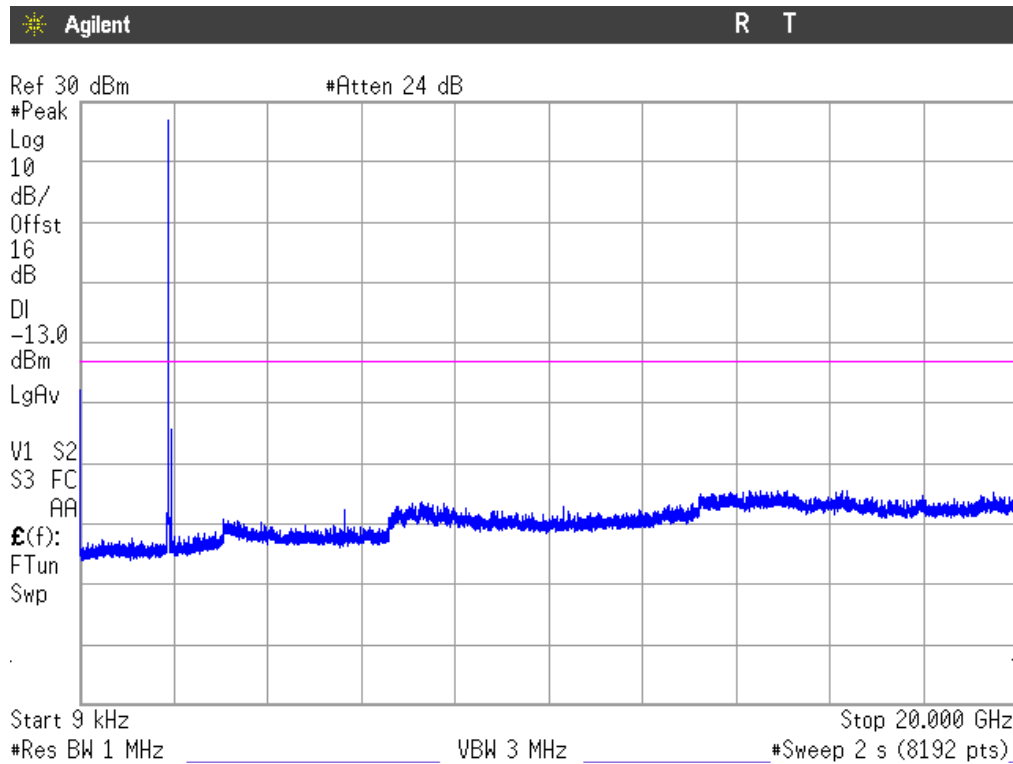
LTE QPSK MODULATION. BW = 3 MHz

1. CHANNEL: LOWEST



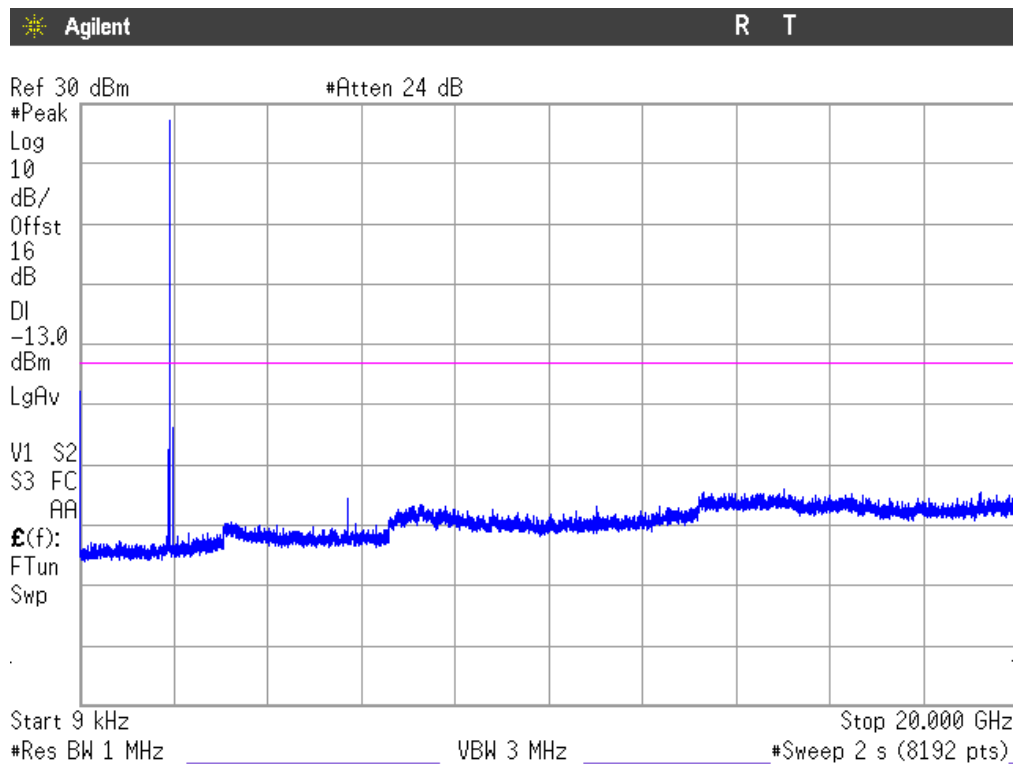
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

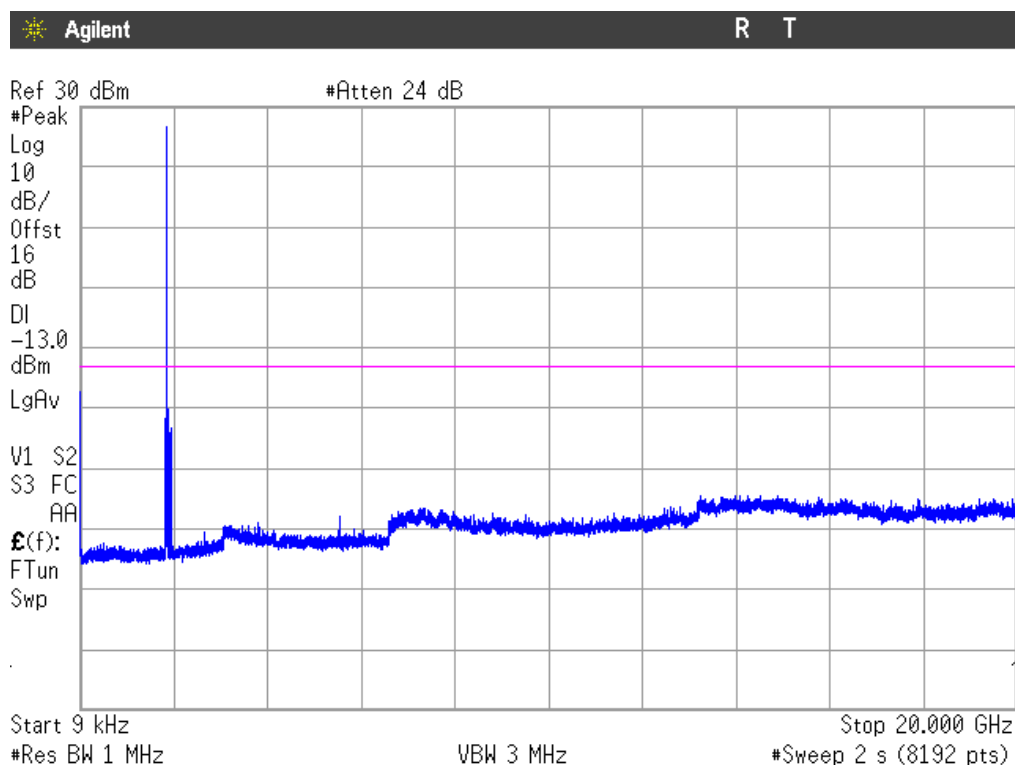
3. CHANNEL: HIGHEST



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

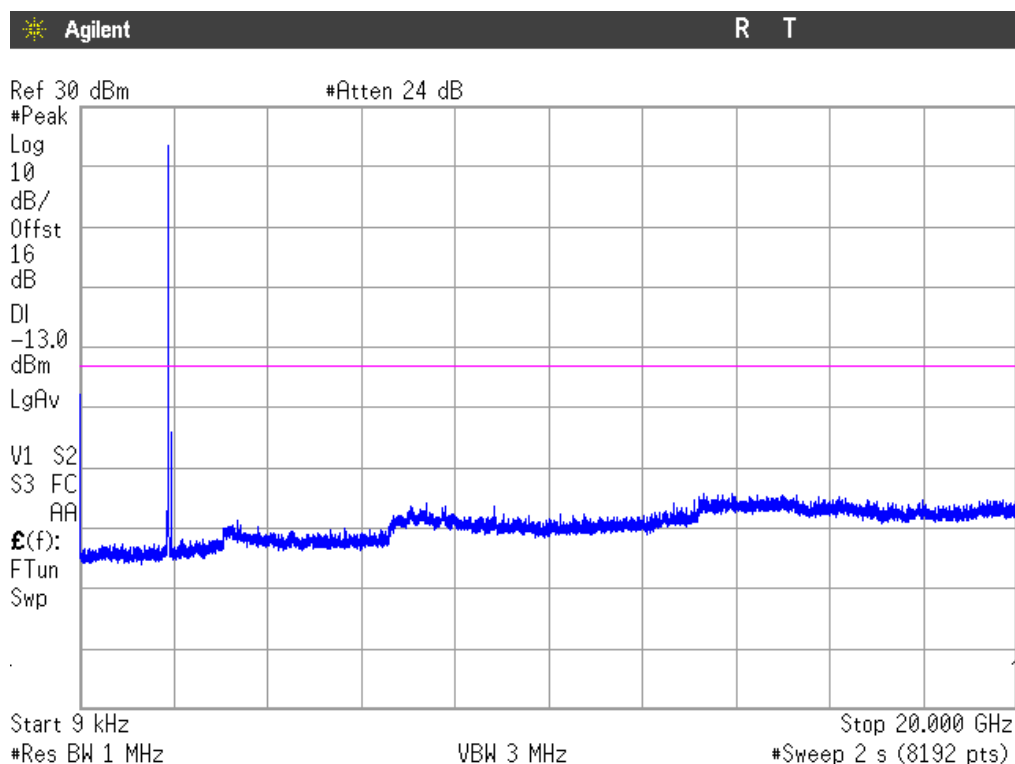
LTE QPSK MODULATION. BW = 5 MHz

1. CHANNEL: LOWEST



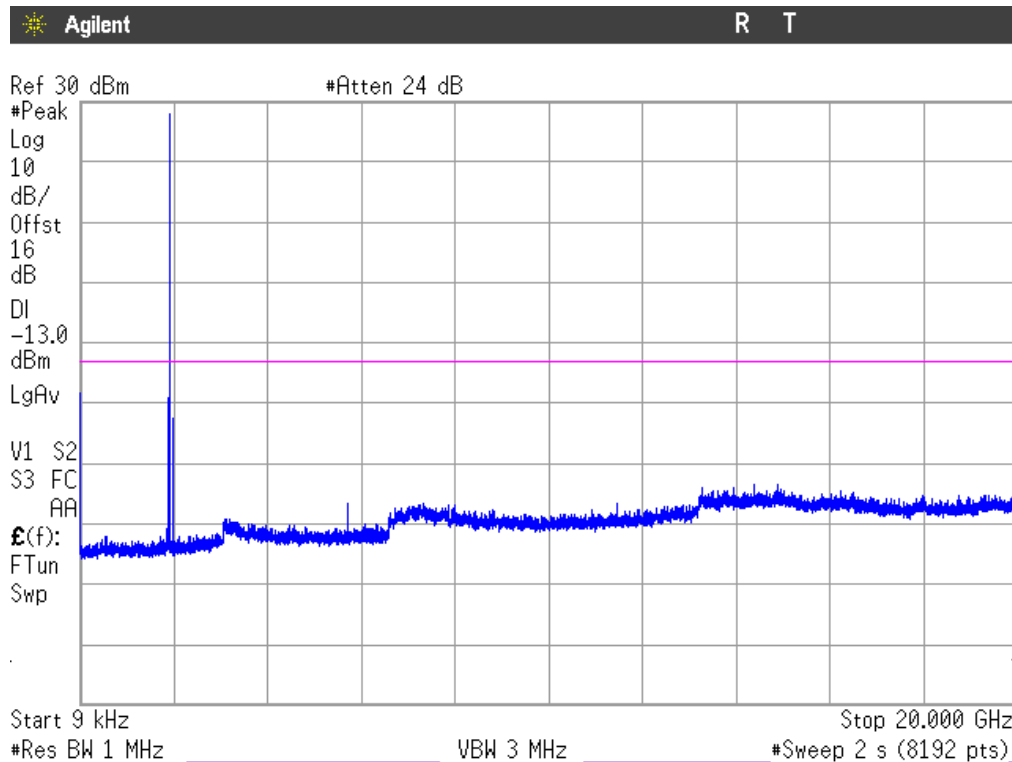
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

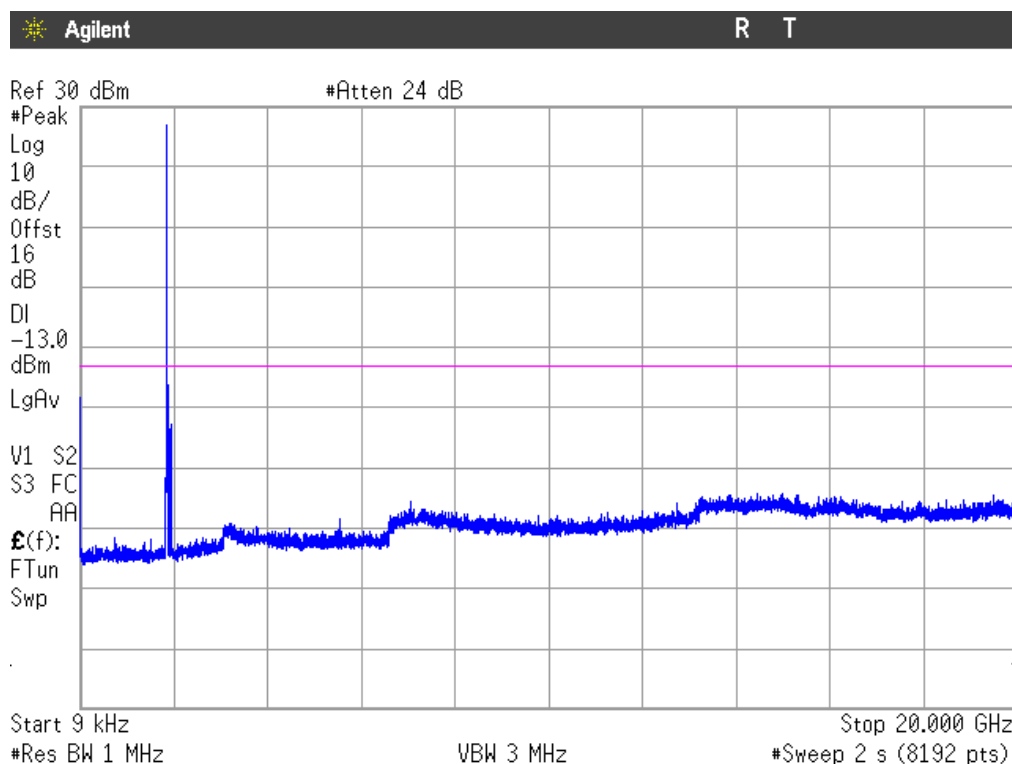
3. CHANNEL: HIGHEST



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

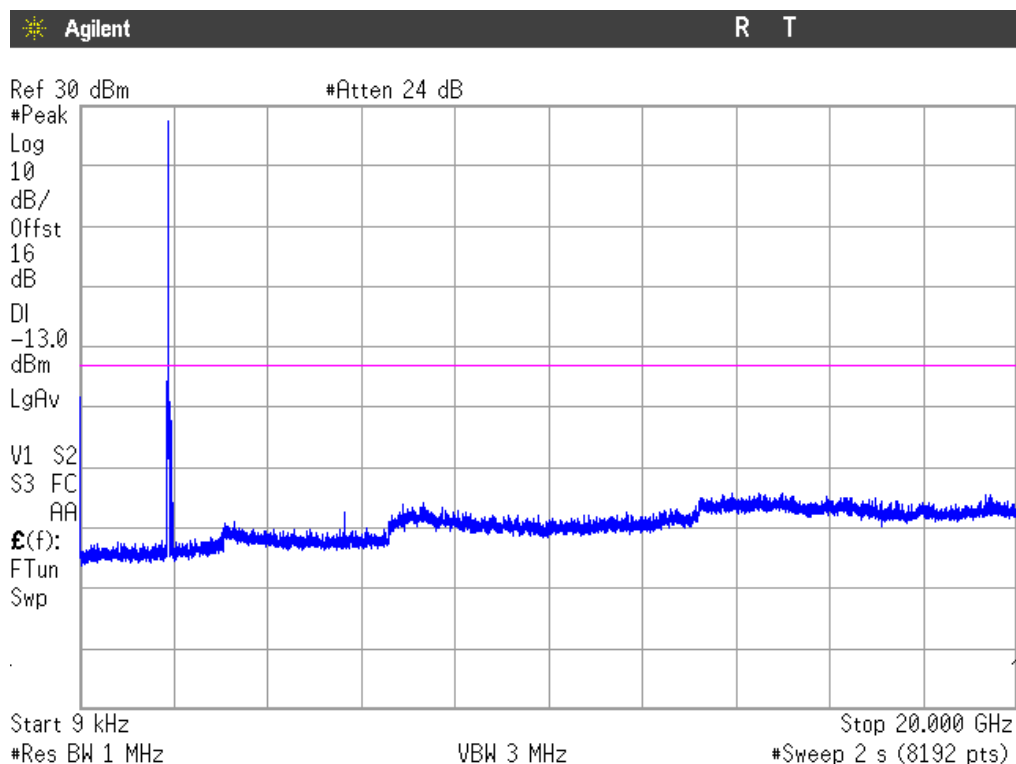
LTE QPSK MODULATION. BW = 10 MHz

1. CHANNEL: LOWEST



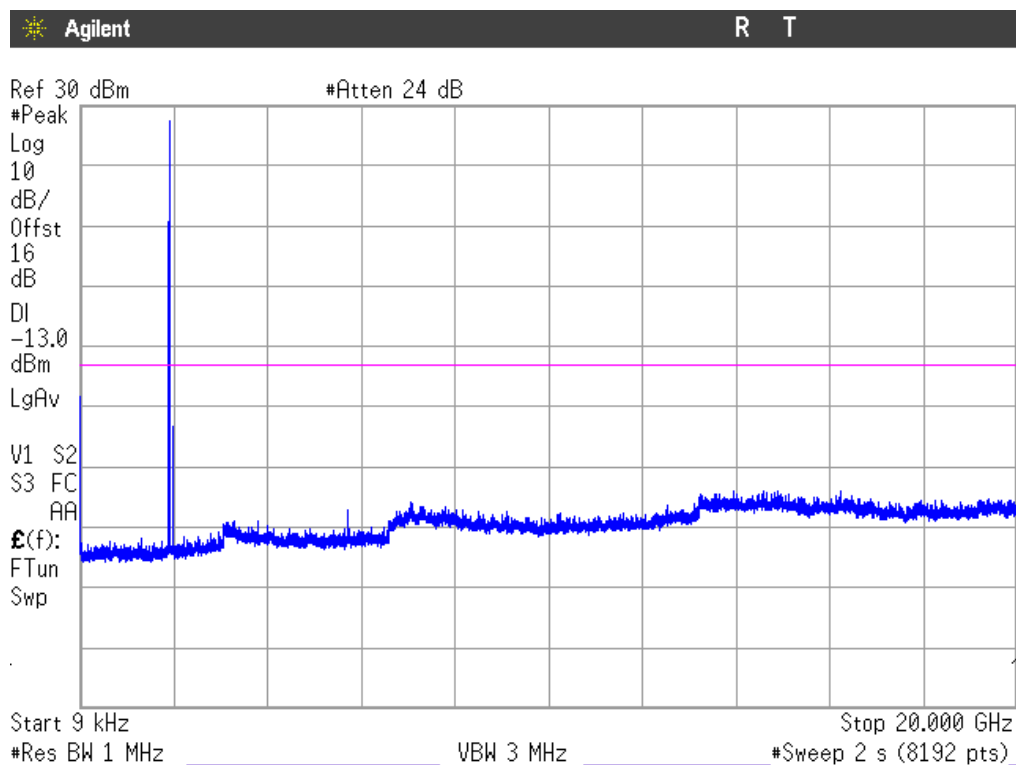
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

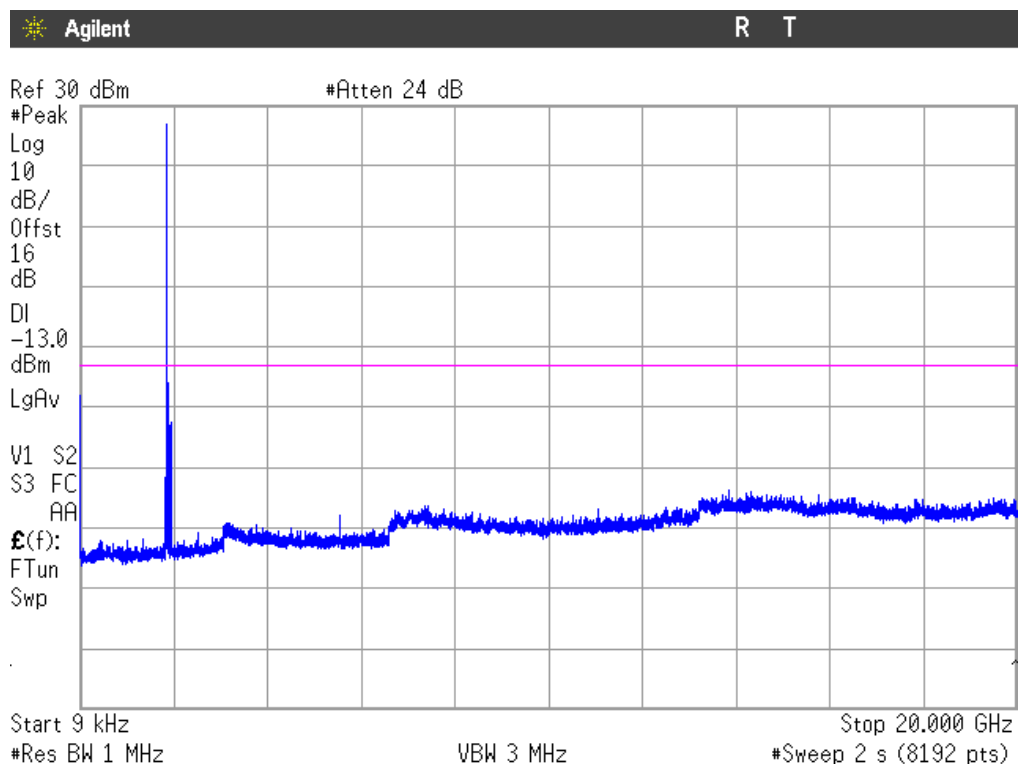
3. CHANNEL: HIGHEST



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

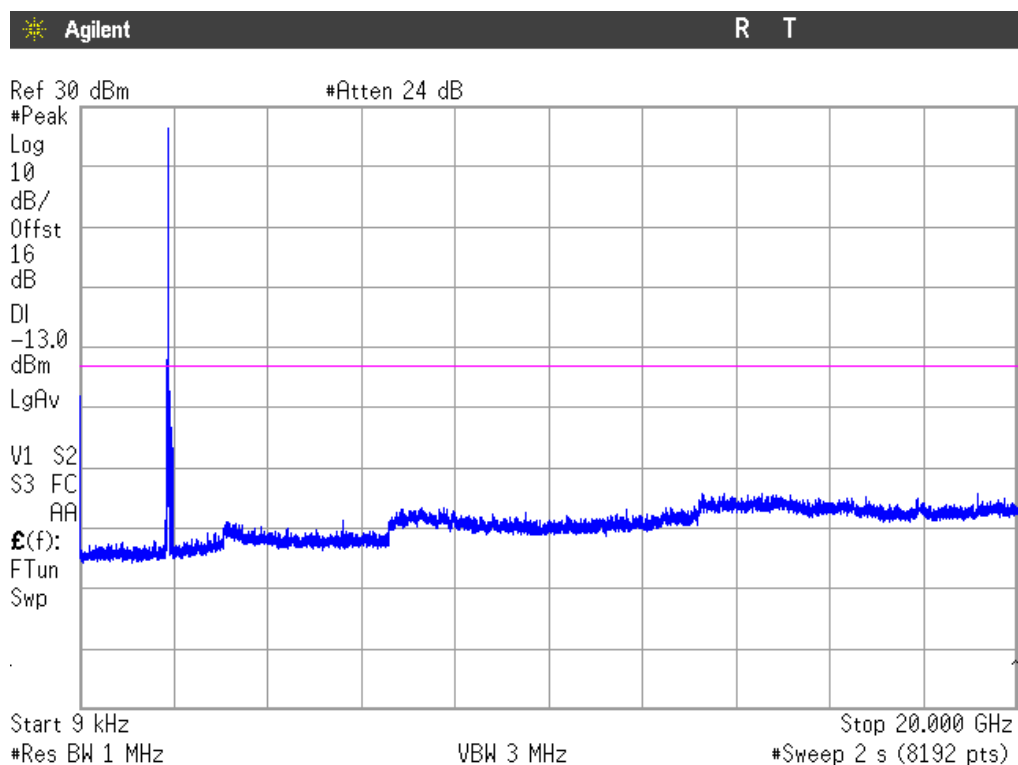
LTE QPSK MODULATION. BW = 15 MHz

1. CHANNEL: LOWEST



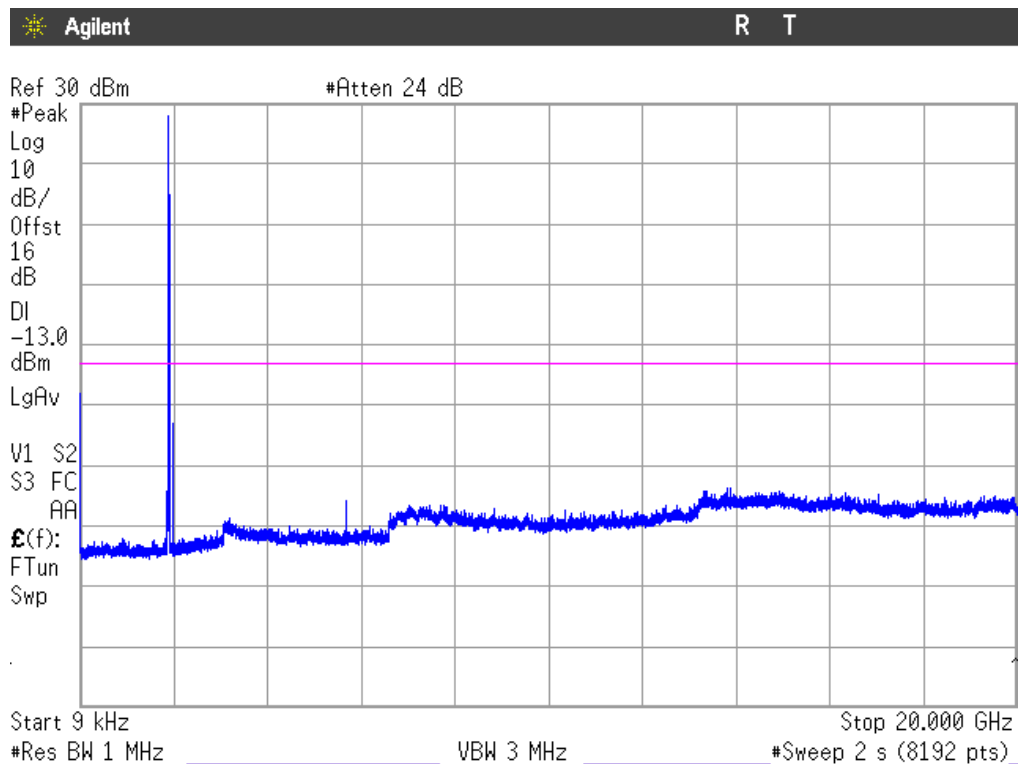
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

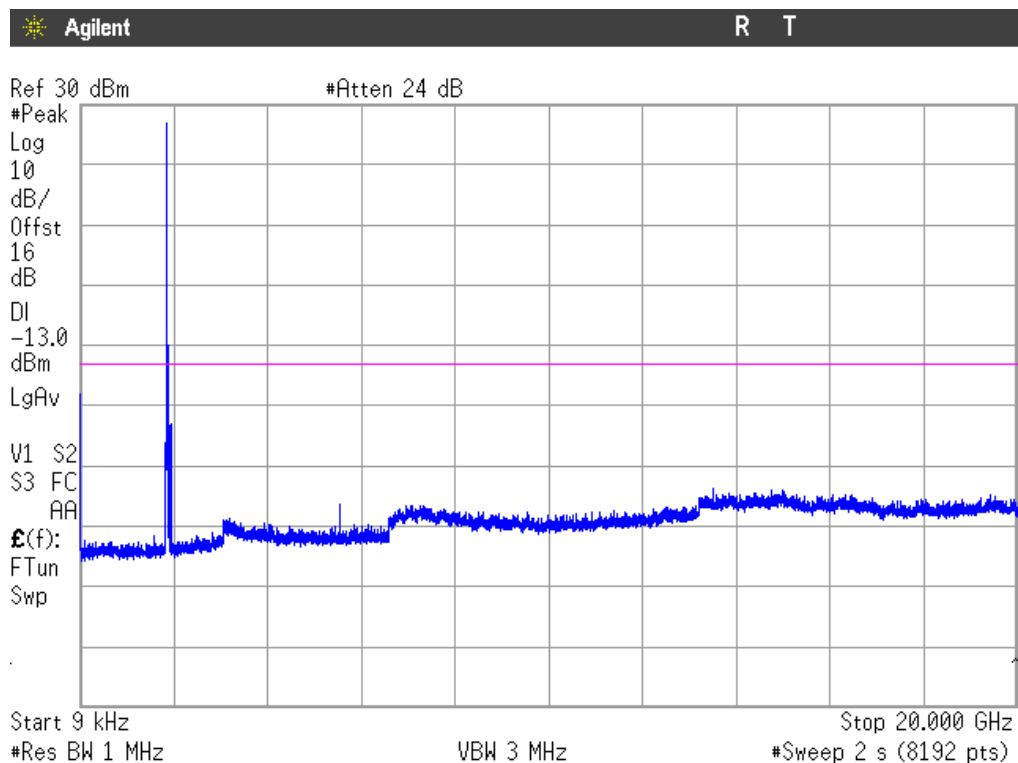
3. CHANNEL: HIGHEST



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

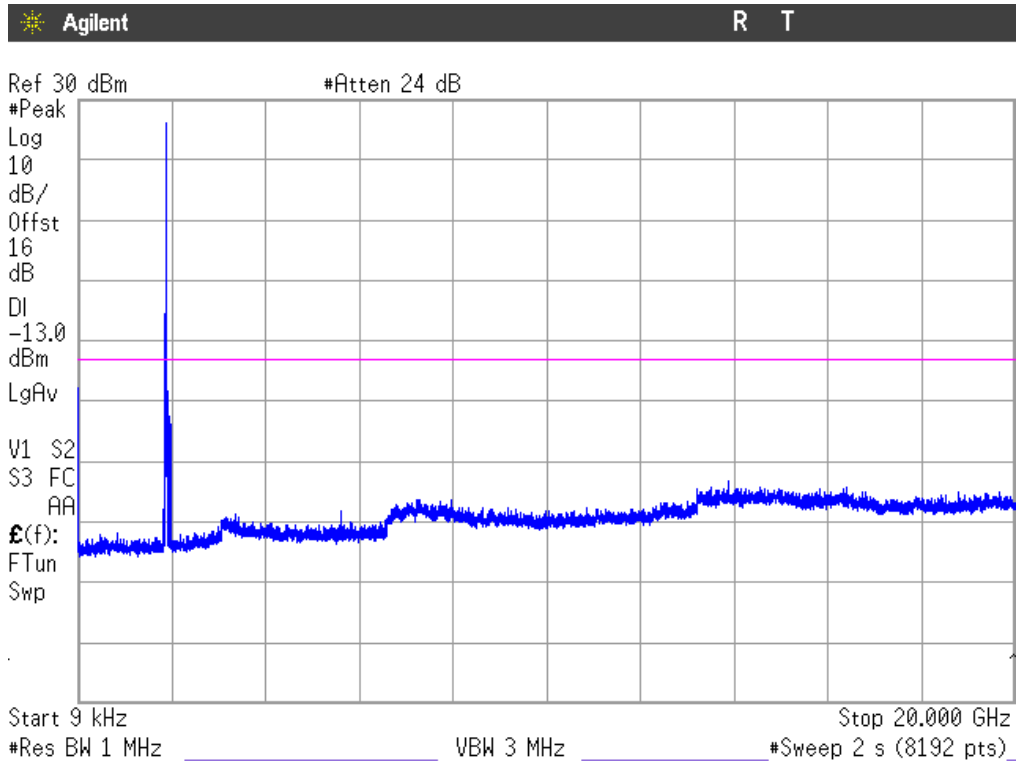
LTE QPSK MODULATION. BW = 20 MHz

1. CHANNEL: LOWEST



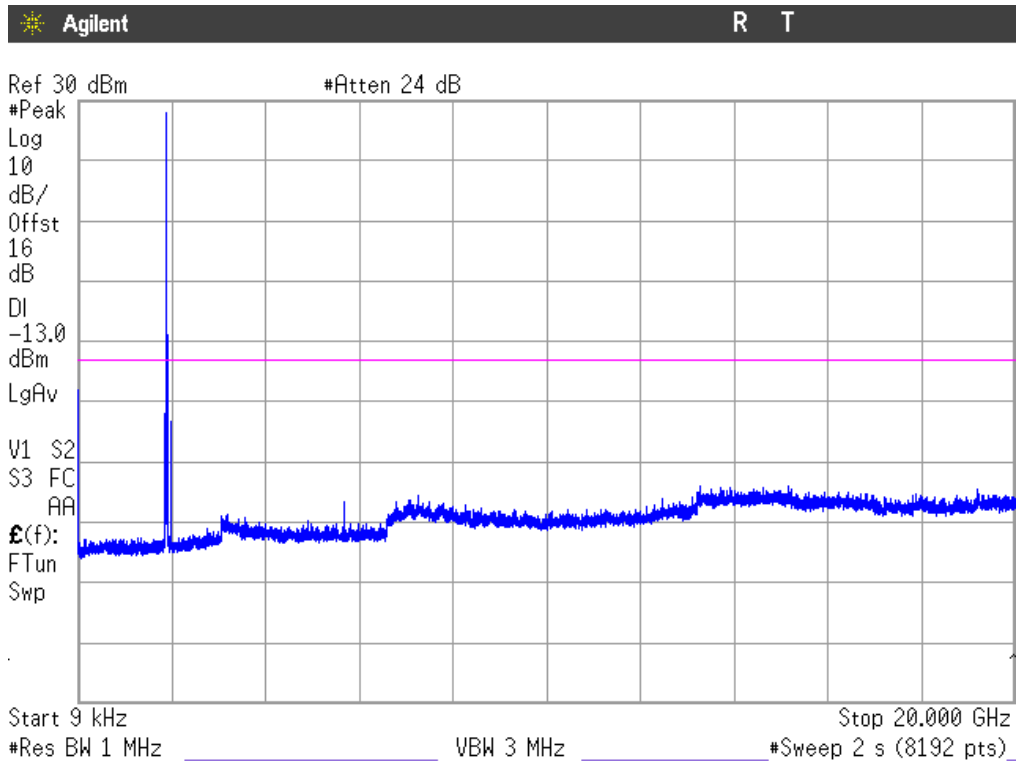
Note: The peak above the limit is the carrier frequency.

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
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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.

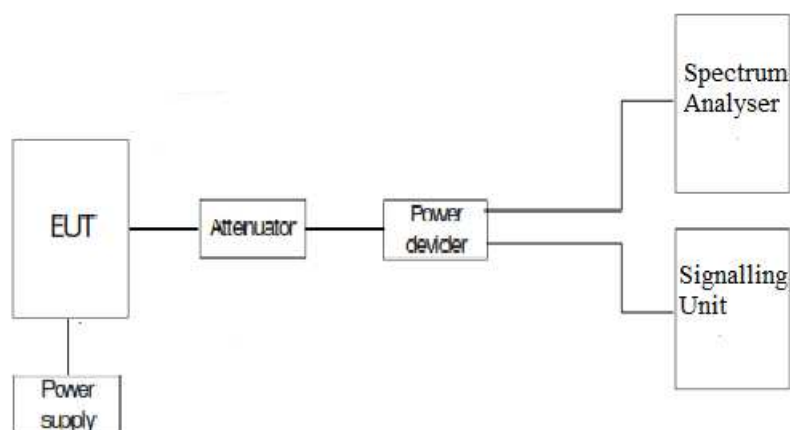
As indicated in FCC part 24/RSS-133. in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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

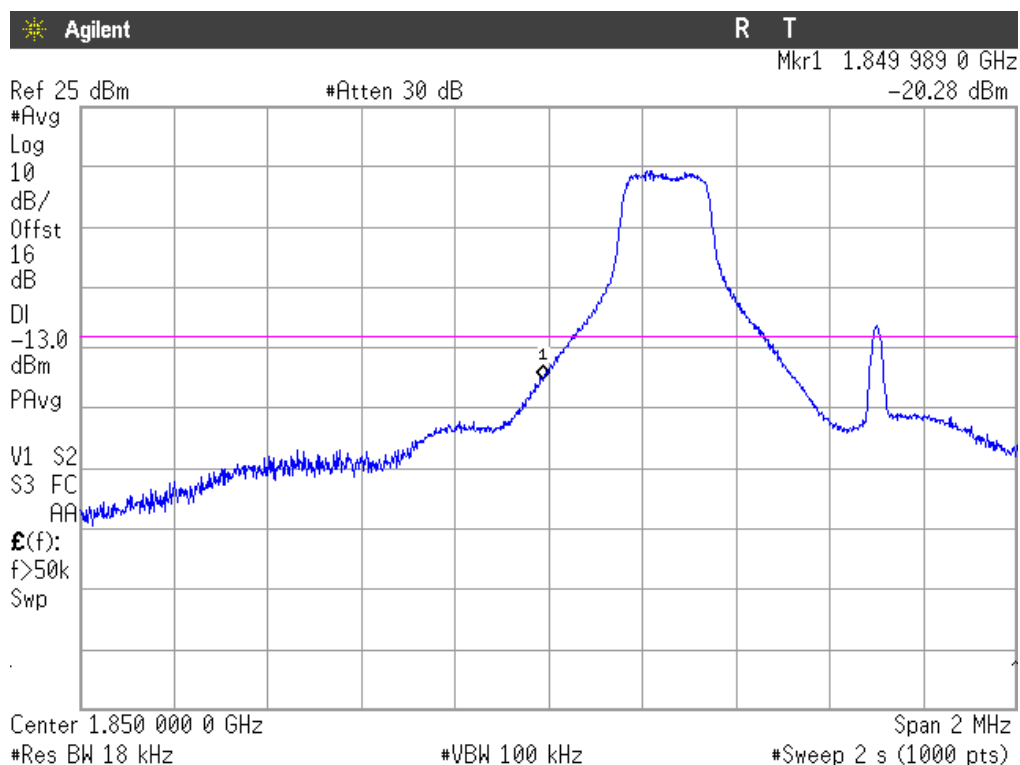
LTE QPSK MODULATION: (Channels in Band II):	RB= All. Offset=0. BW=1.4 MHz	RB= All. Offset =0. BW = 3 MHz	RB= All. Offset =0. BW = 5 MHz	RB= All. Offset =0. BW = 10 MHz	RB= All. Offset =0. BW = 15 MHz	RB= All. Offset =0. BW = 20 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-24.36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

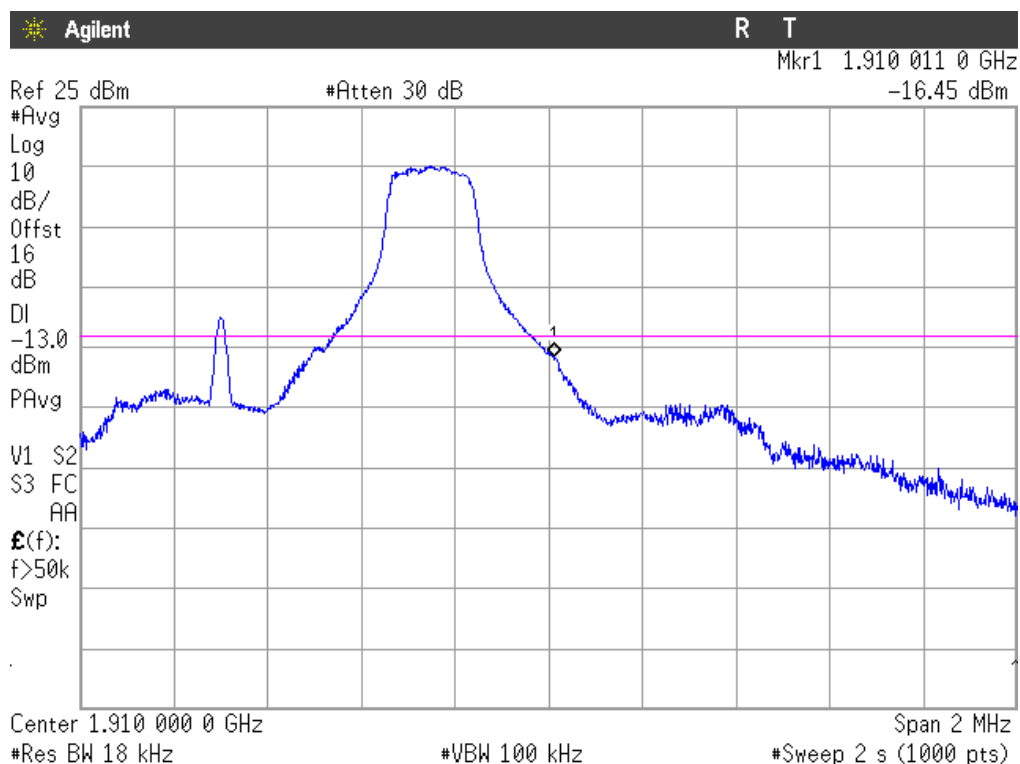
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

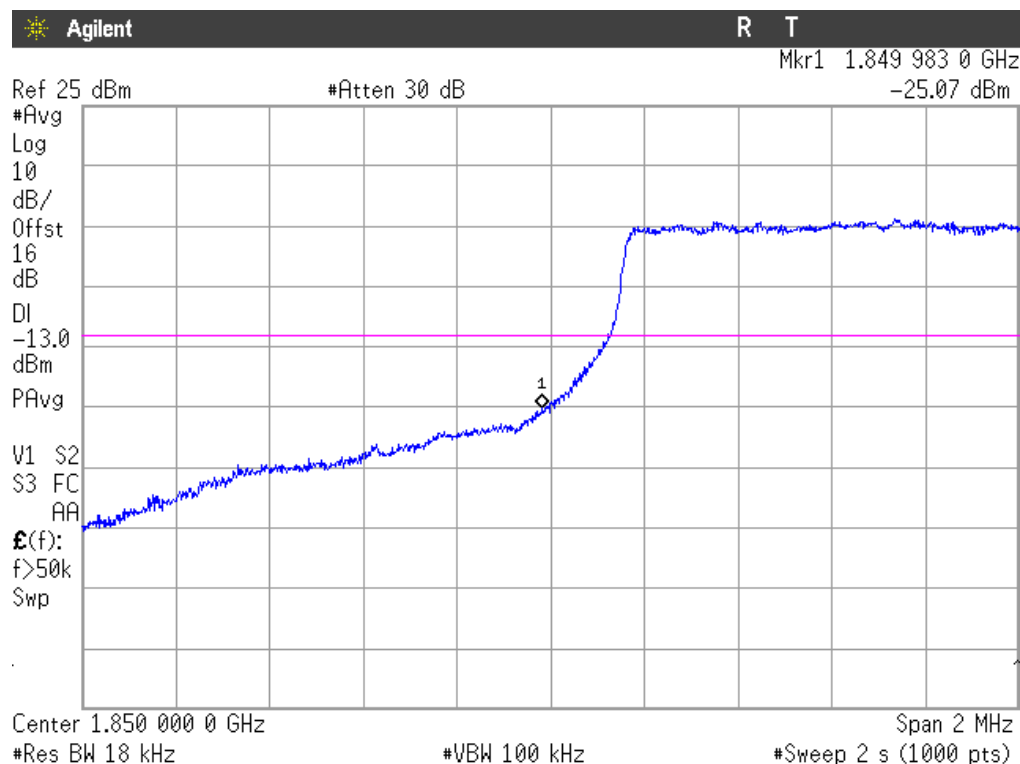
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

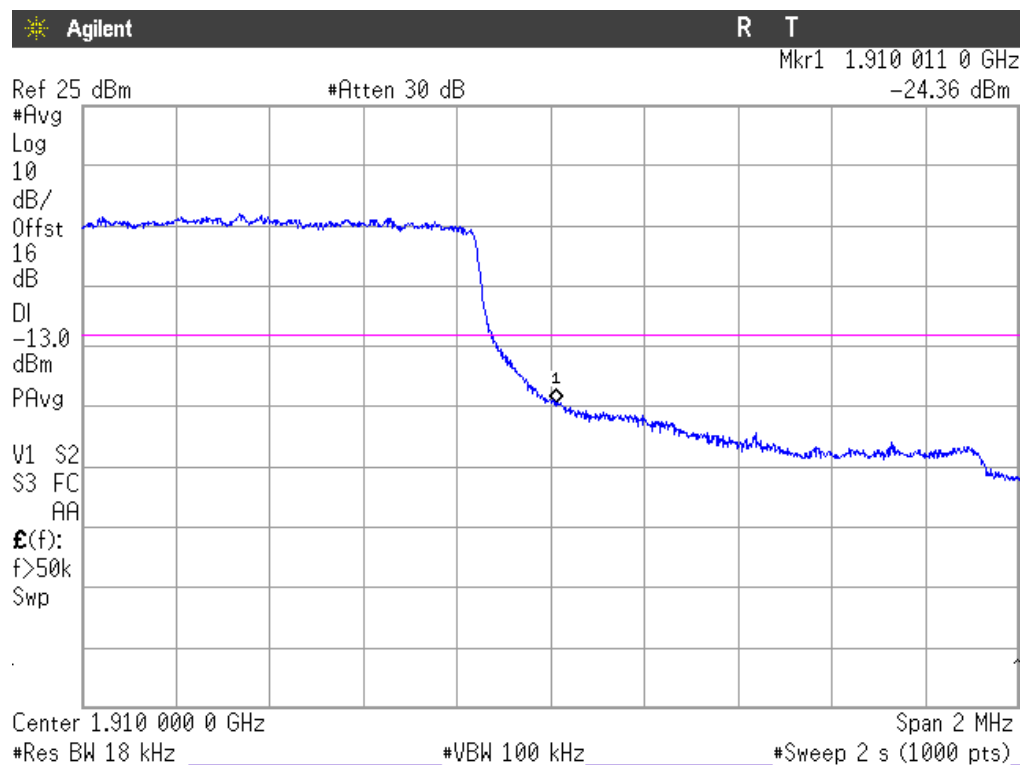
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

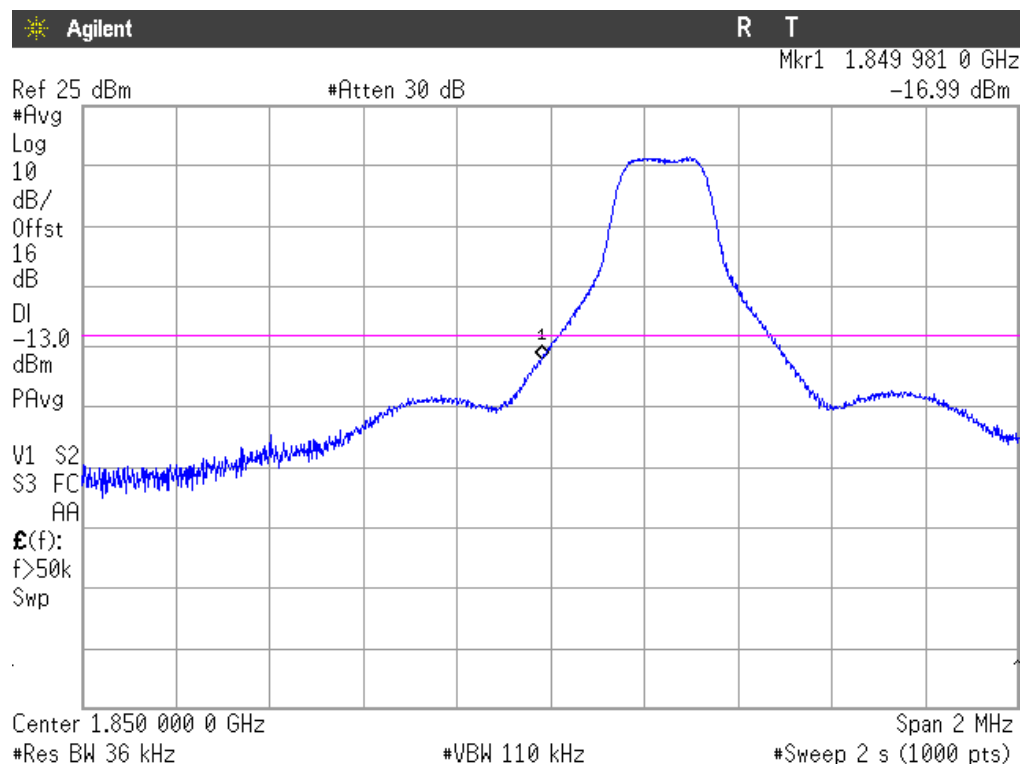


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

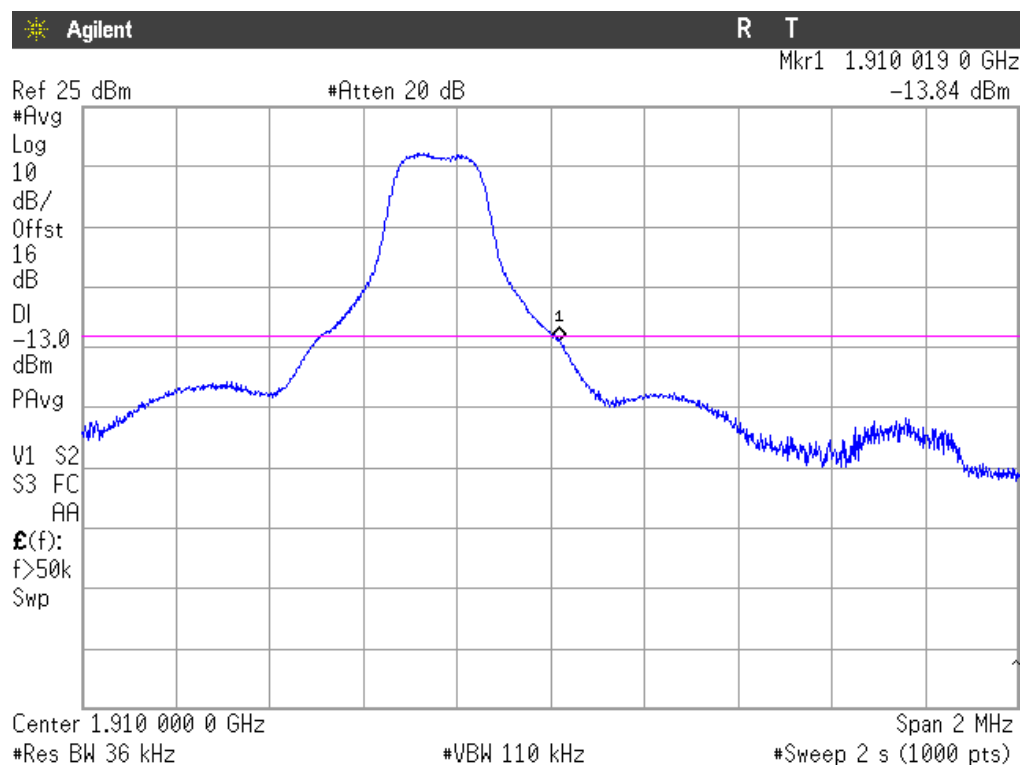
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

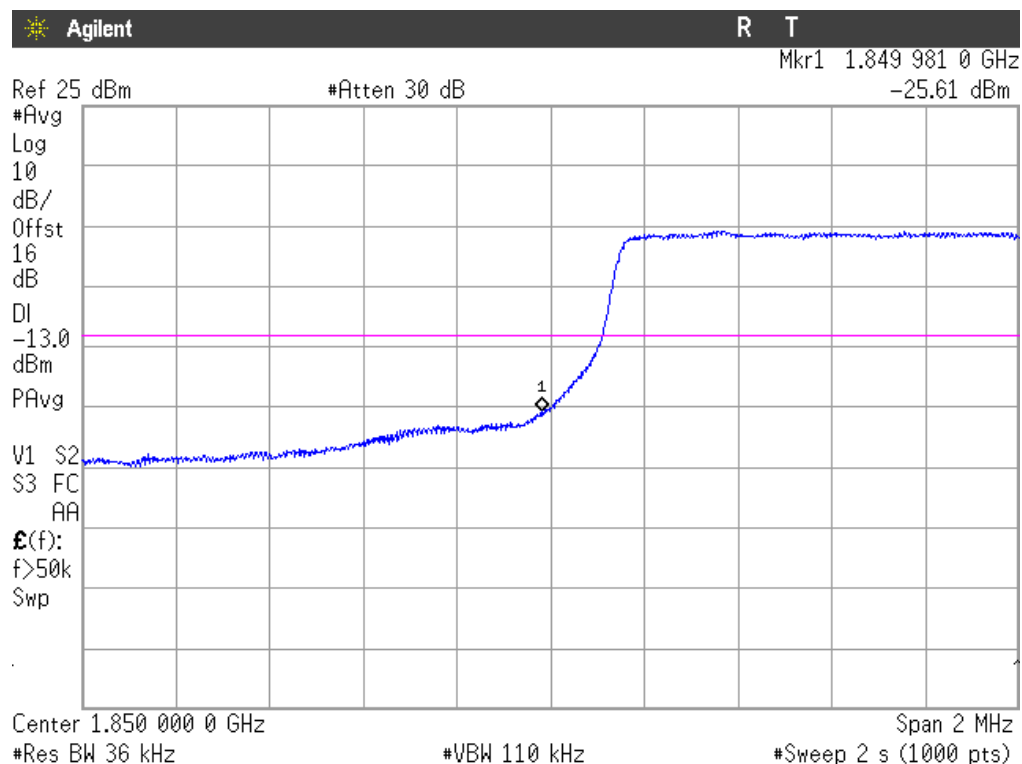
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

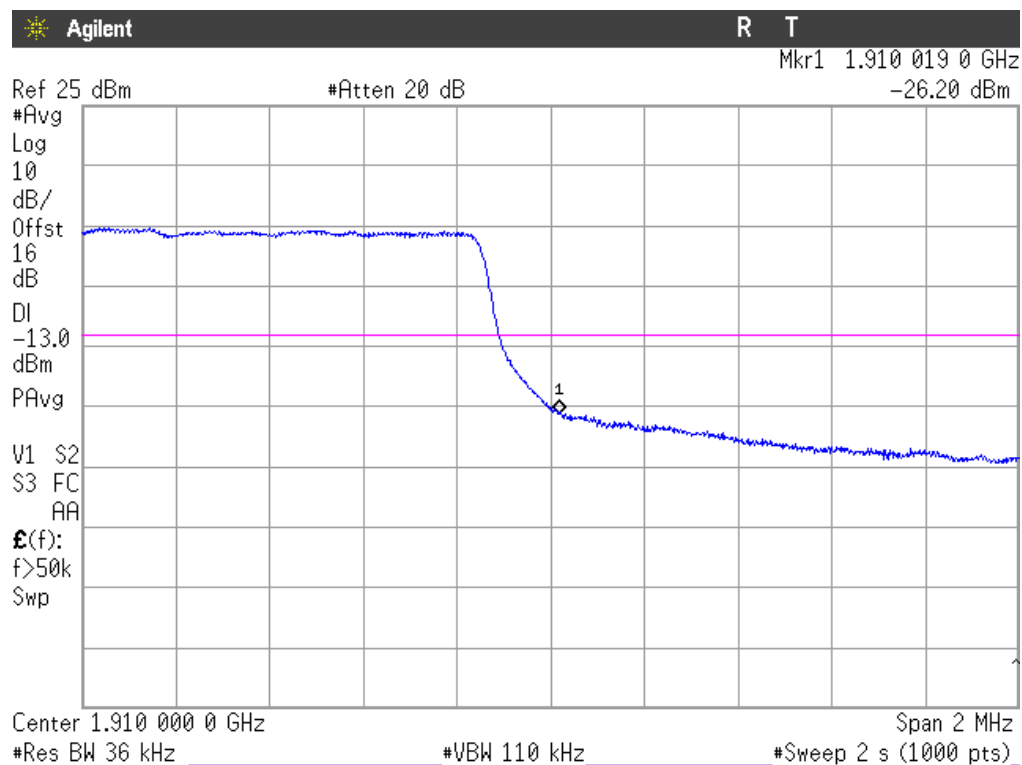
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

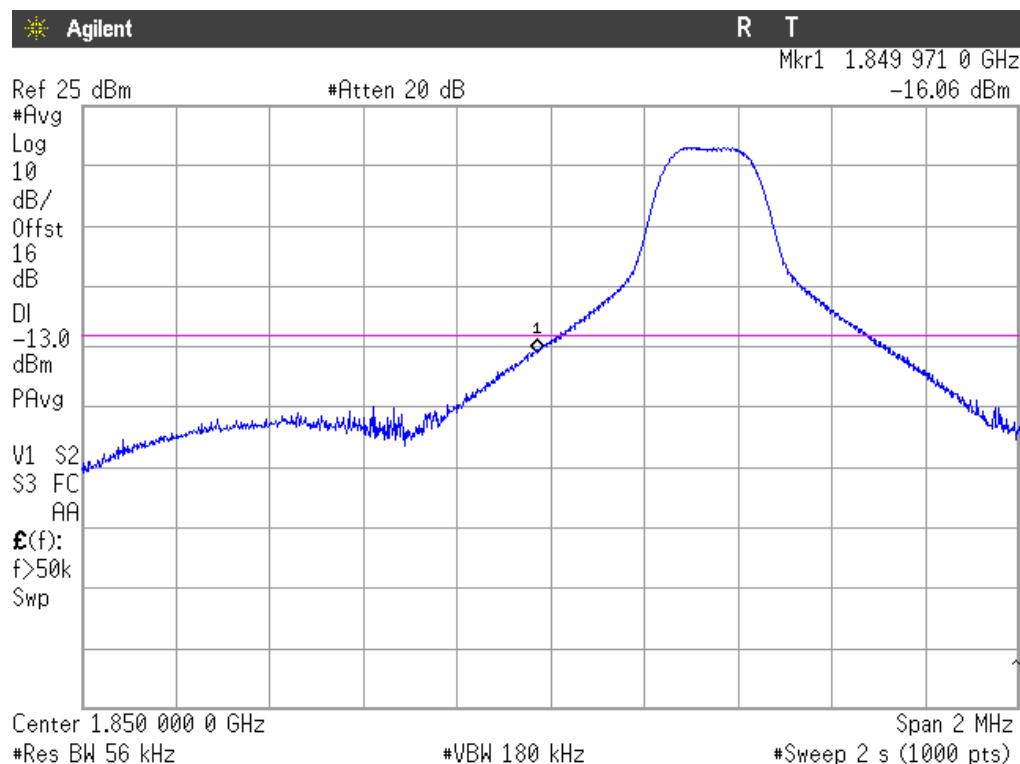


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

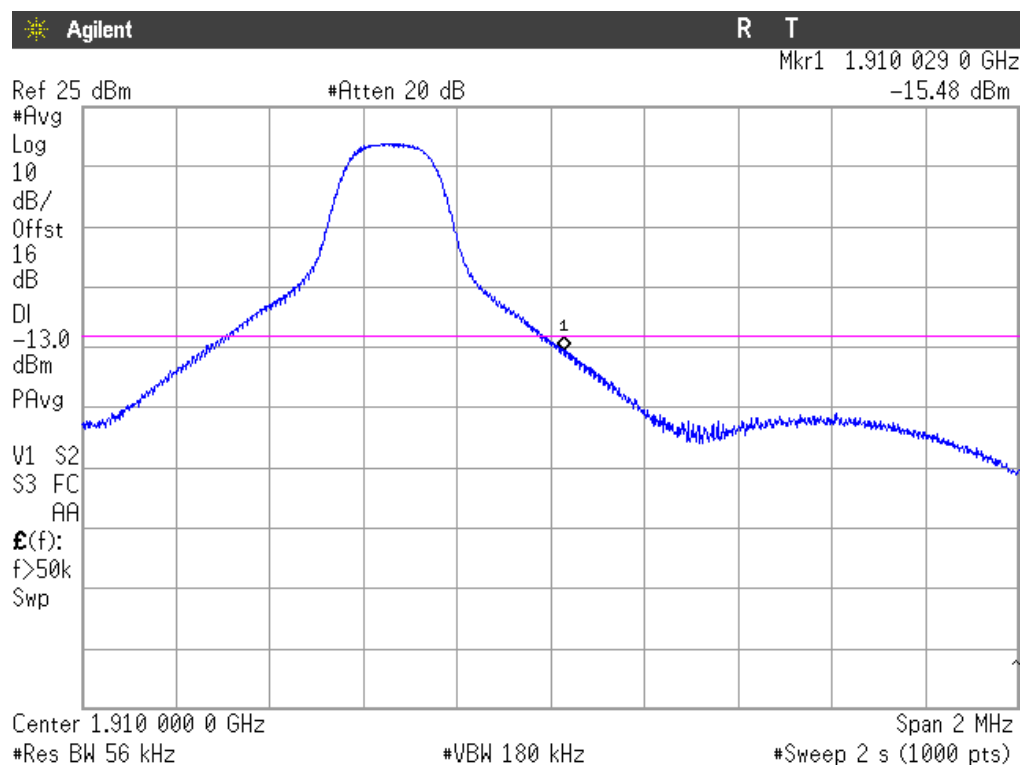
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

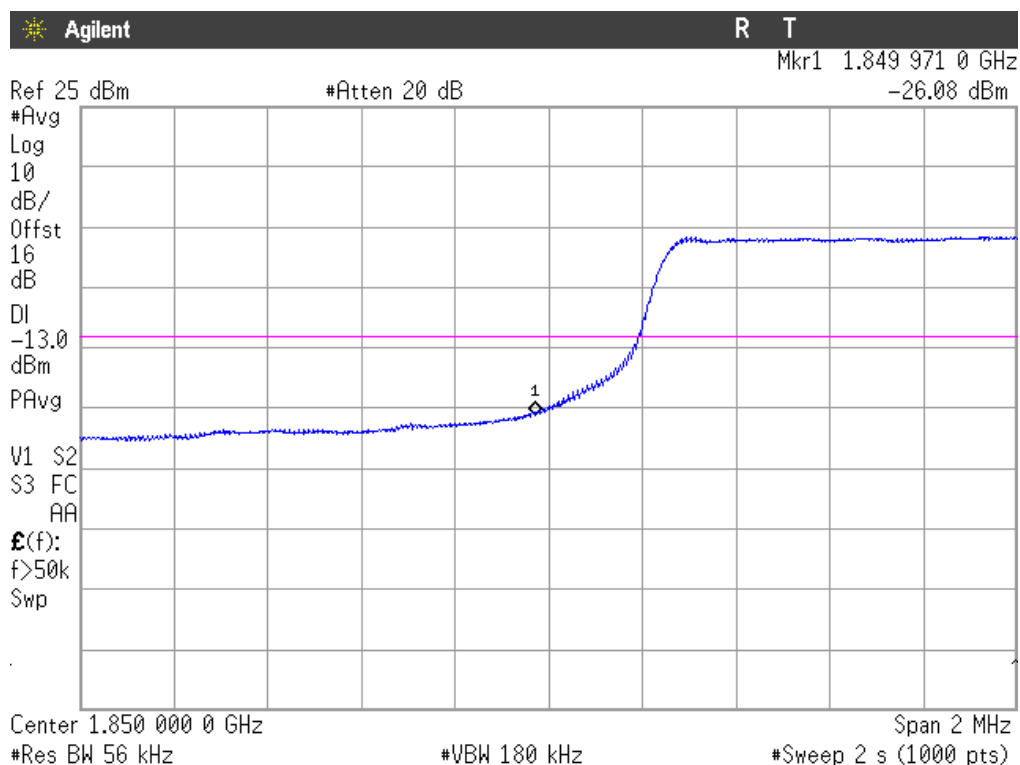
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

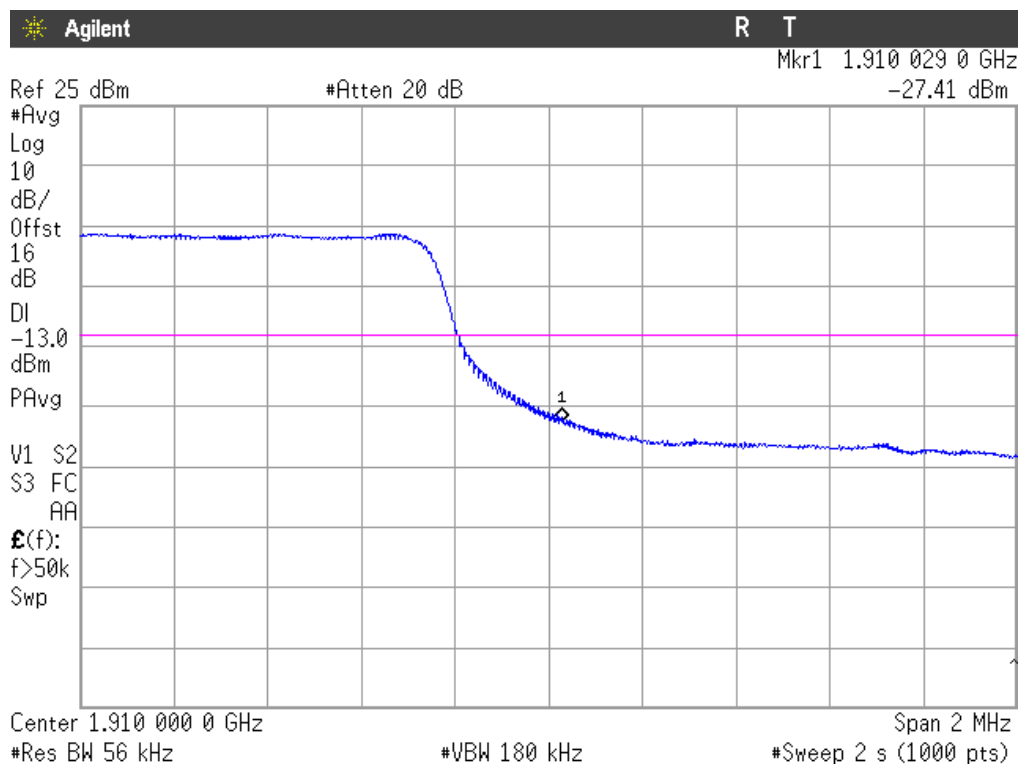
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

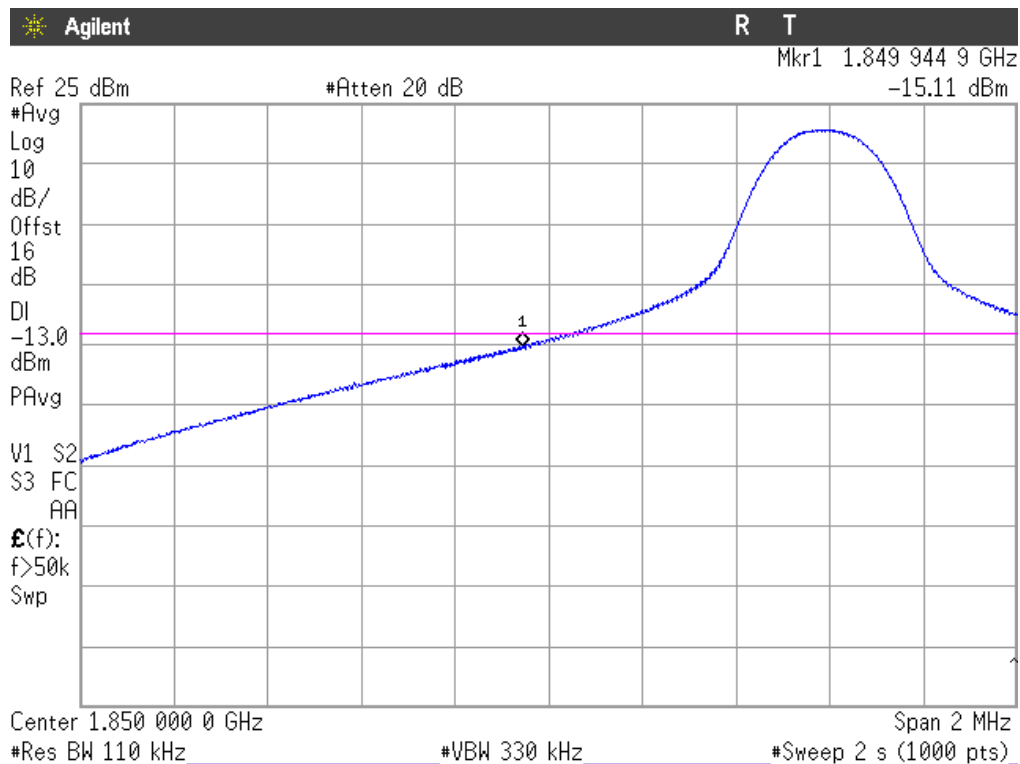


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

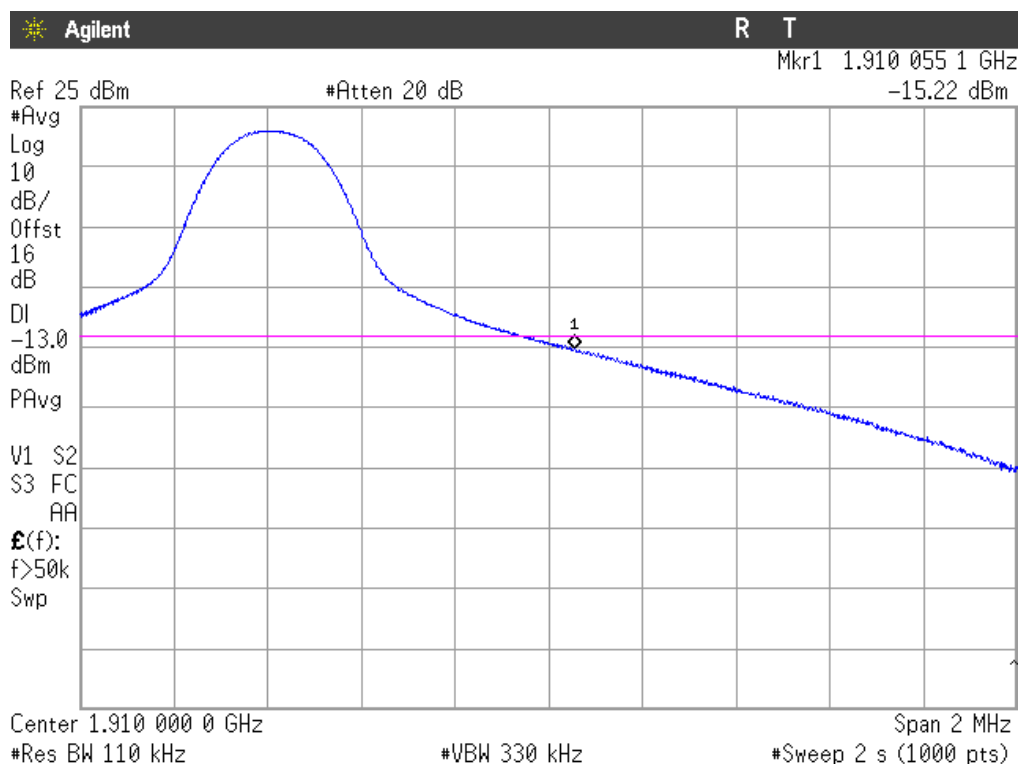
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

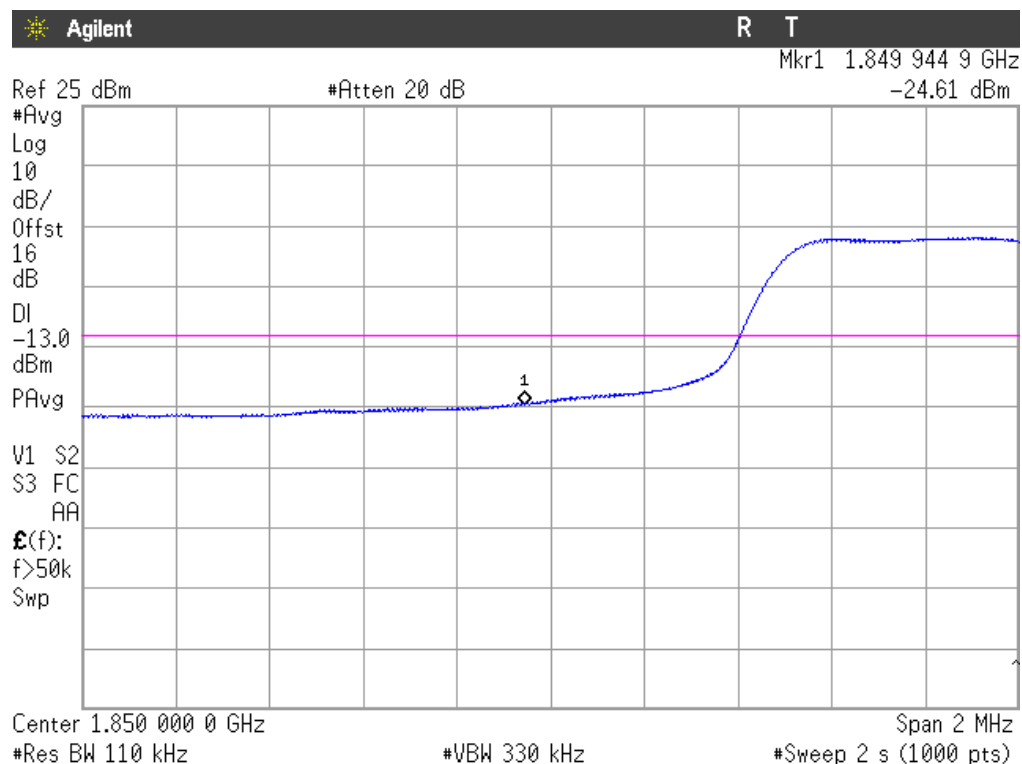
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

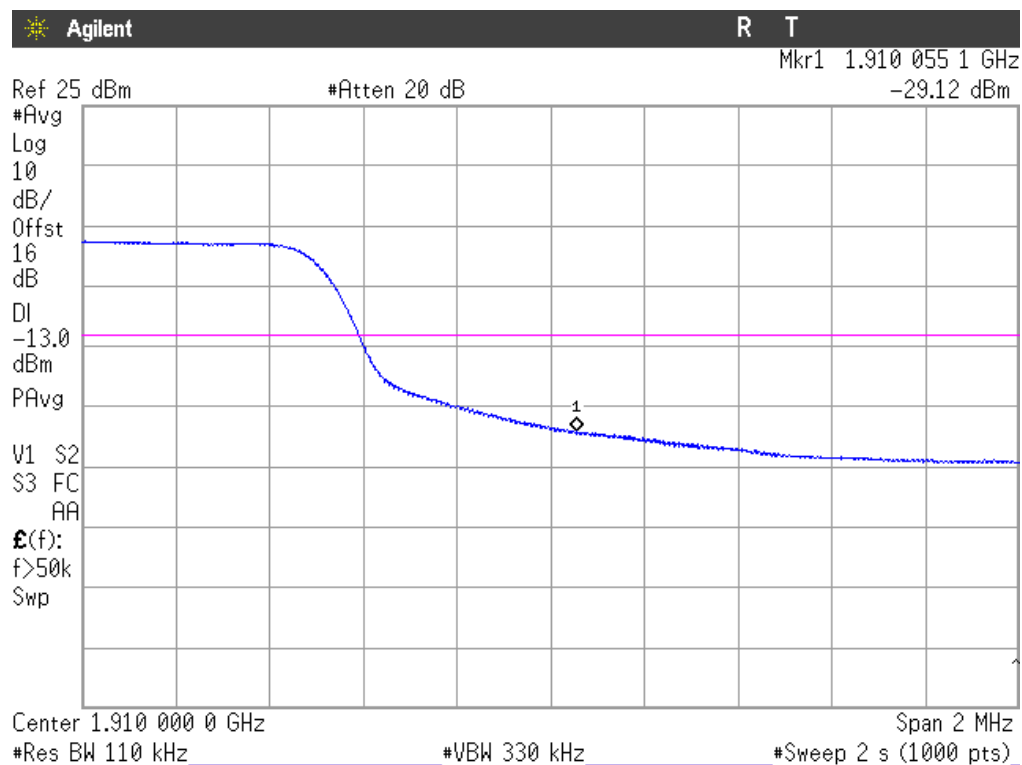
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

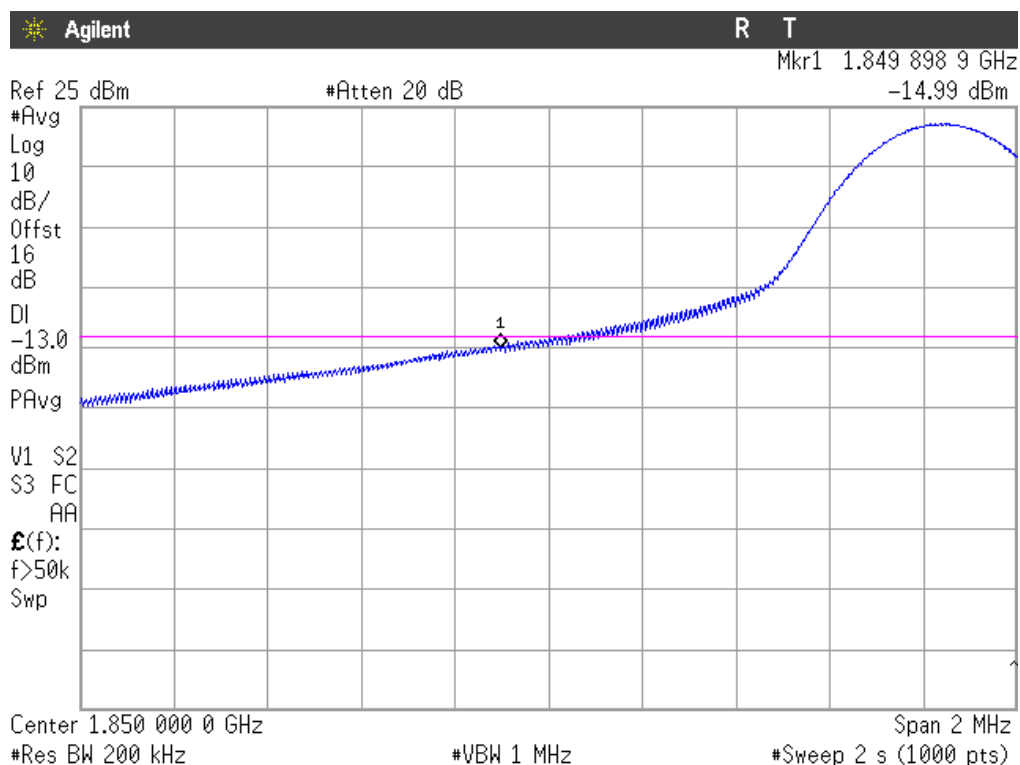


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

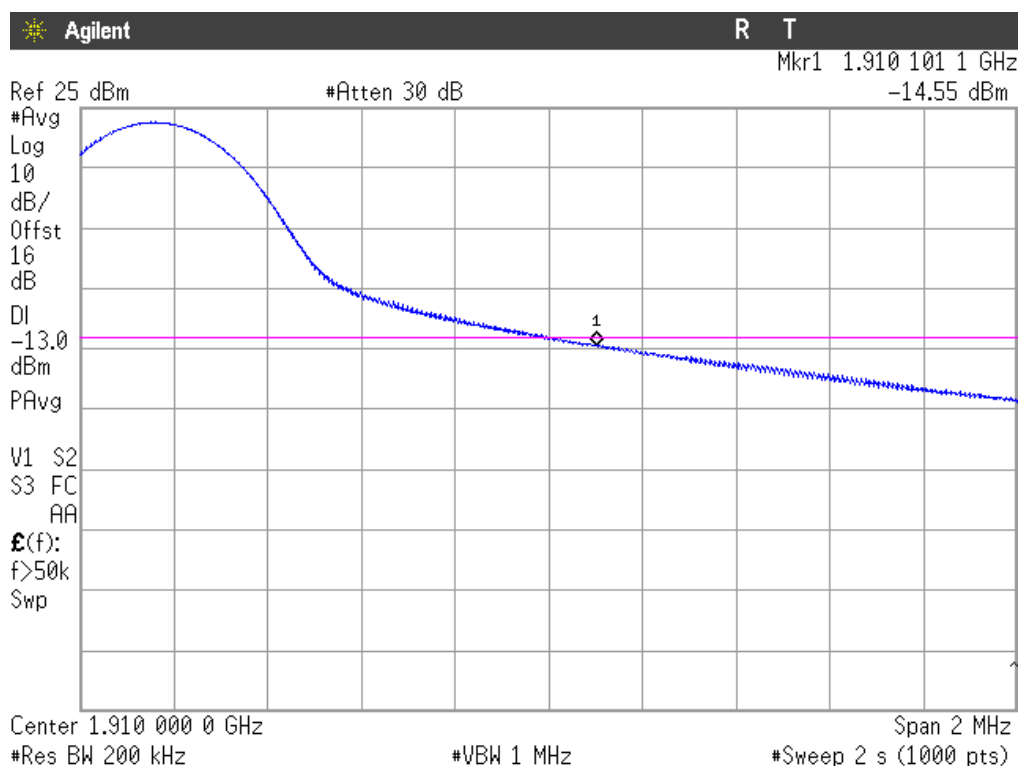
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

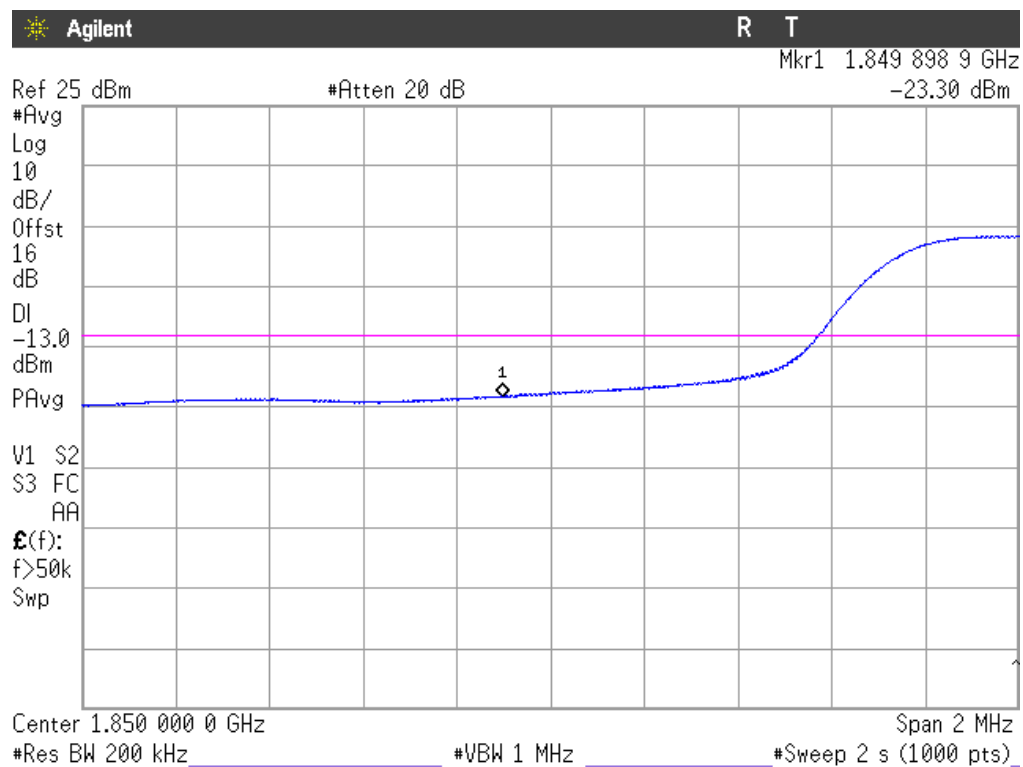
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

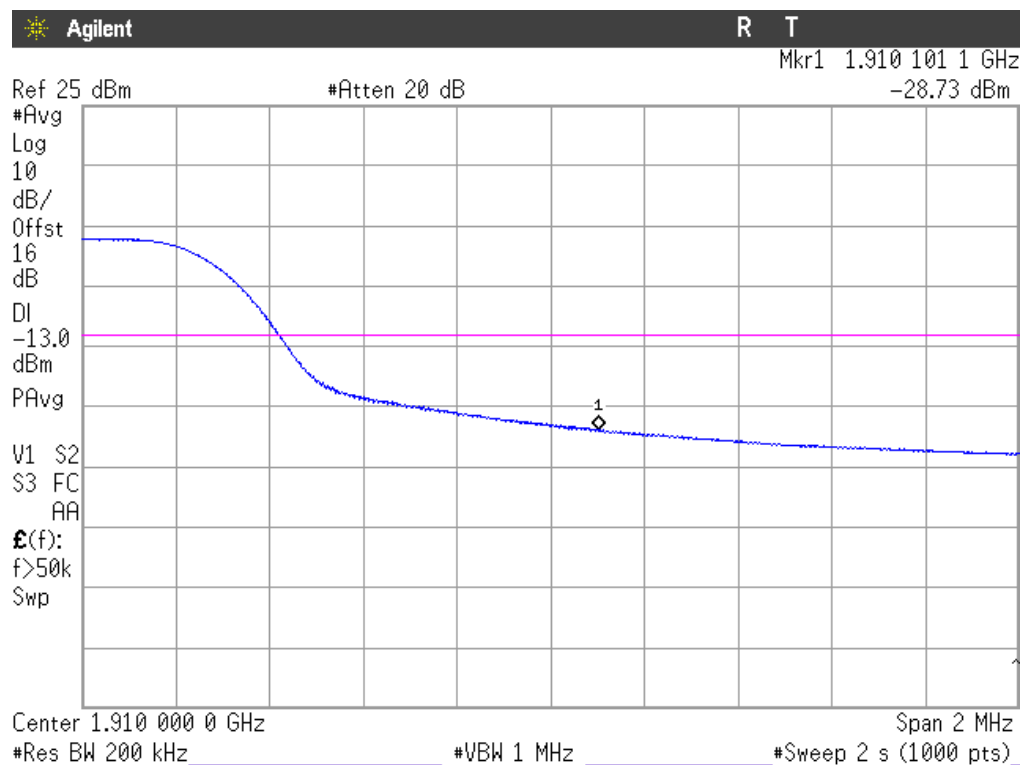
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 15 MHz (Band II)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

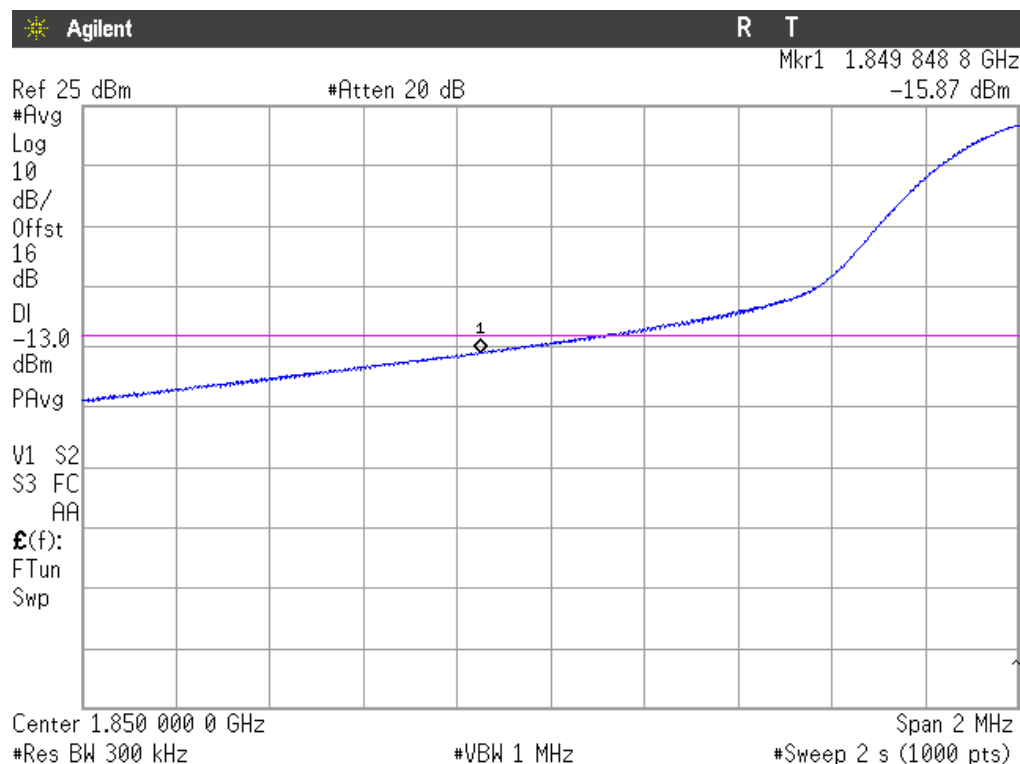


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

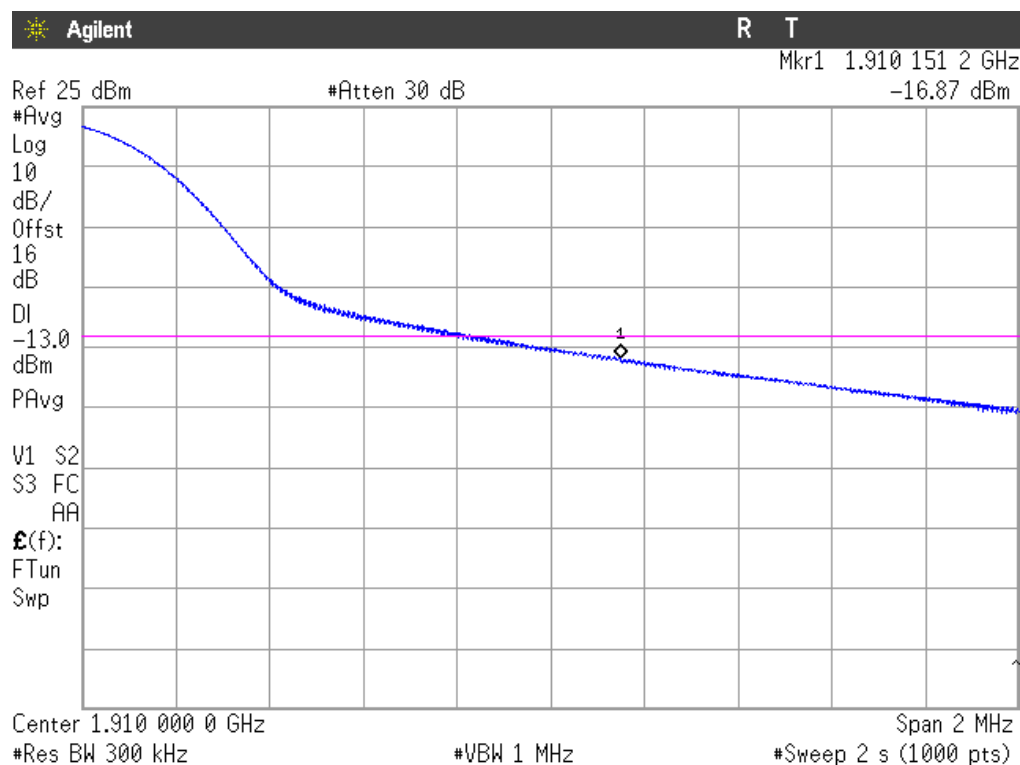
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

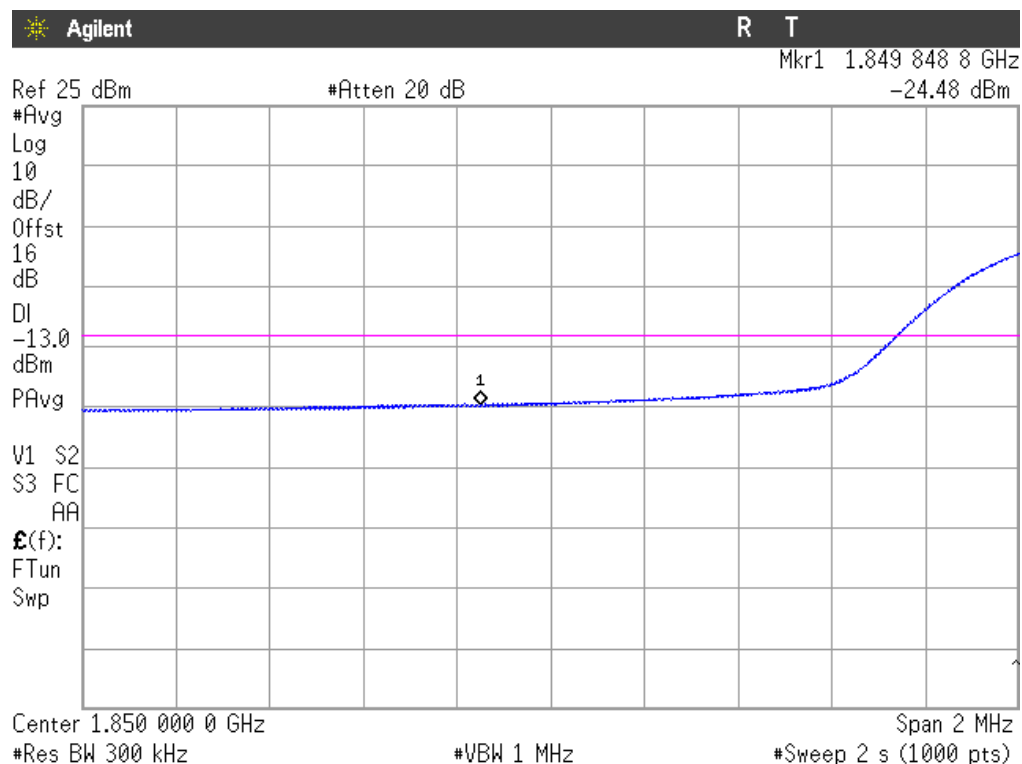
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

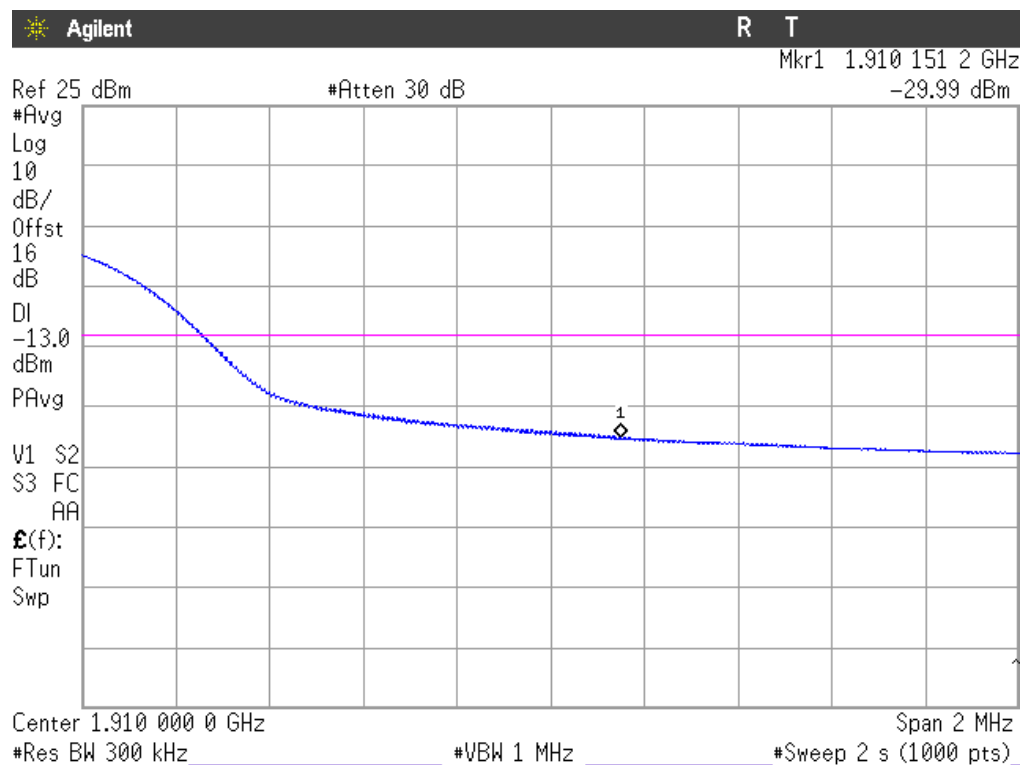
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 20 MHz (Band II)

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:

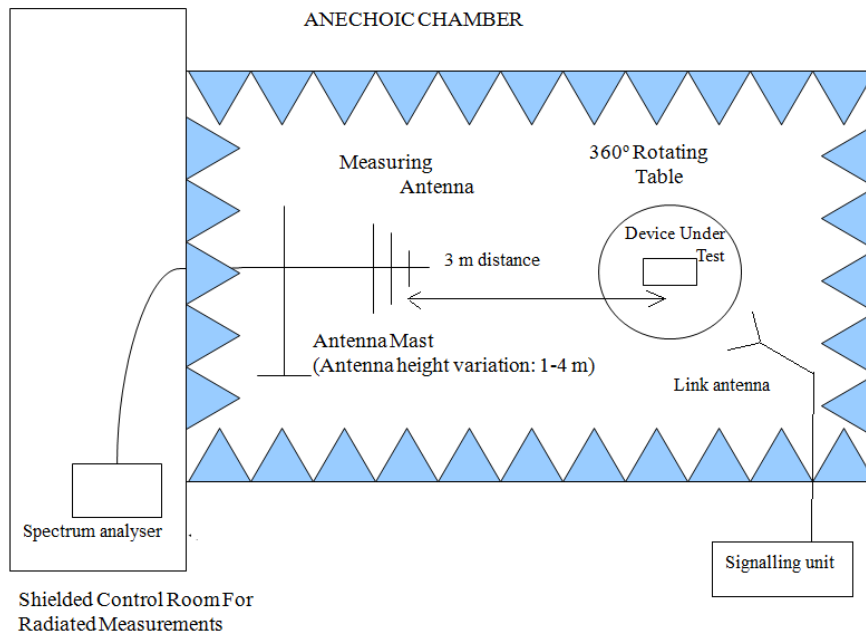
According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. P in watts.

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

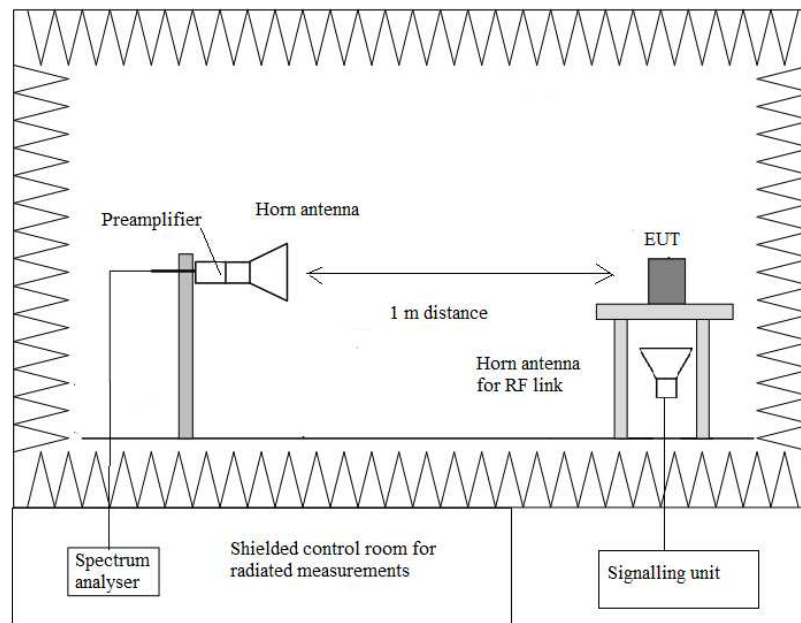
$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = -13 \text{ dBm}$$

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.

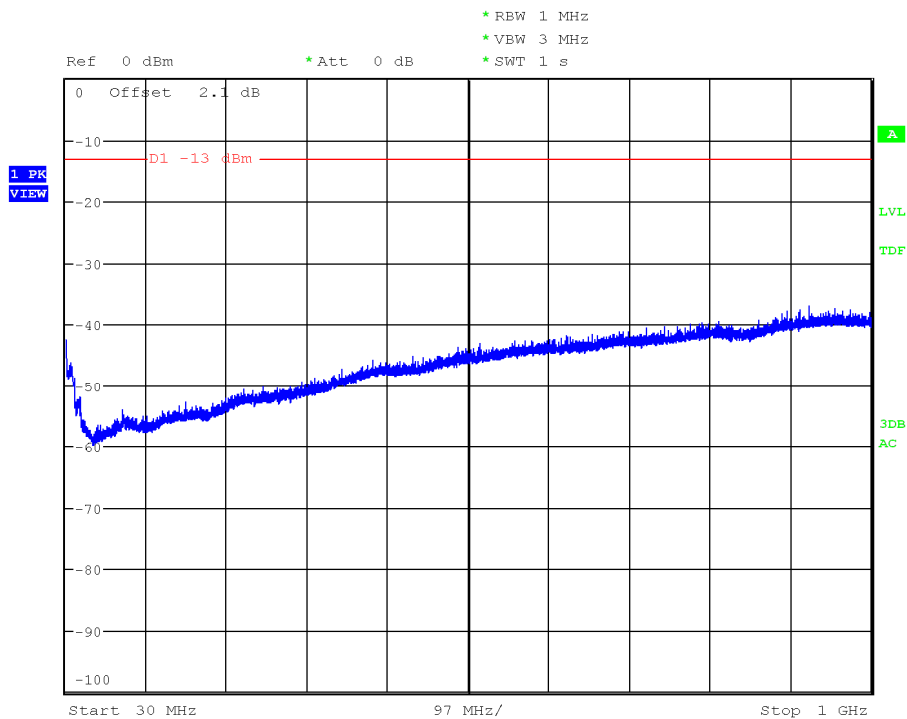
Substitution method data

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)	$\leq \pm 3.88$ for $f < 1\text{GHz}$ $\leq \pm 4.87$ for $f \geq 1\text{GHz}$ up to 18 GHz
------------------------------	--

Verdict: PASS

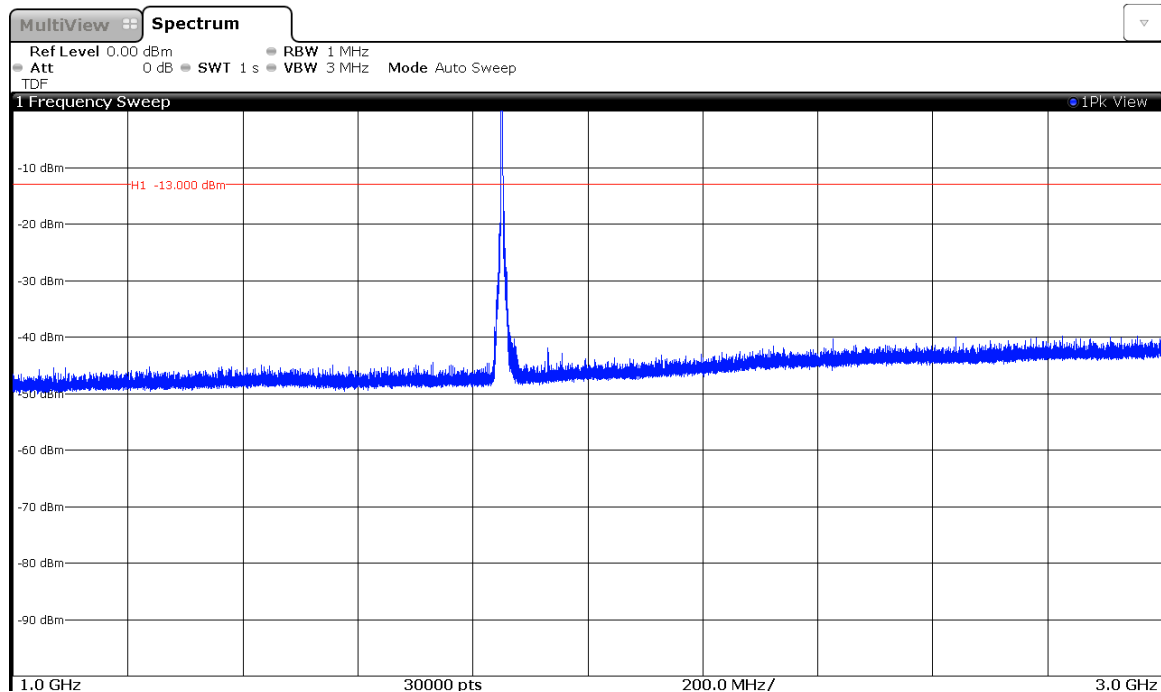
FREQUENCY RANGE 30 MHz-1000 MHz.



(This plot is valid for all three channels)

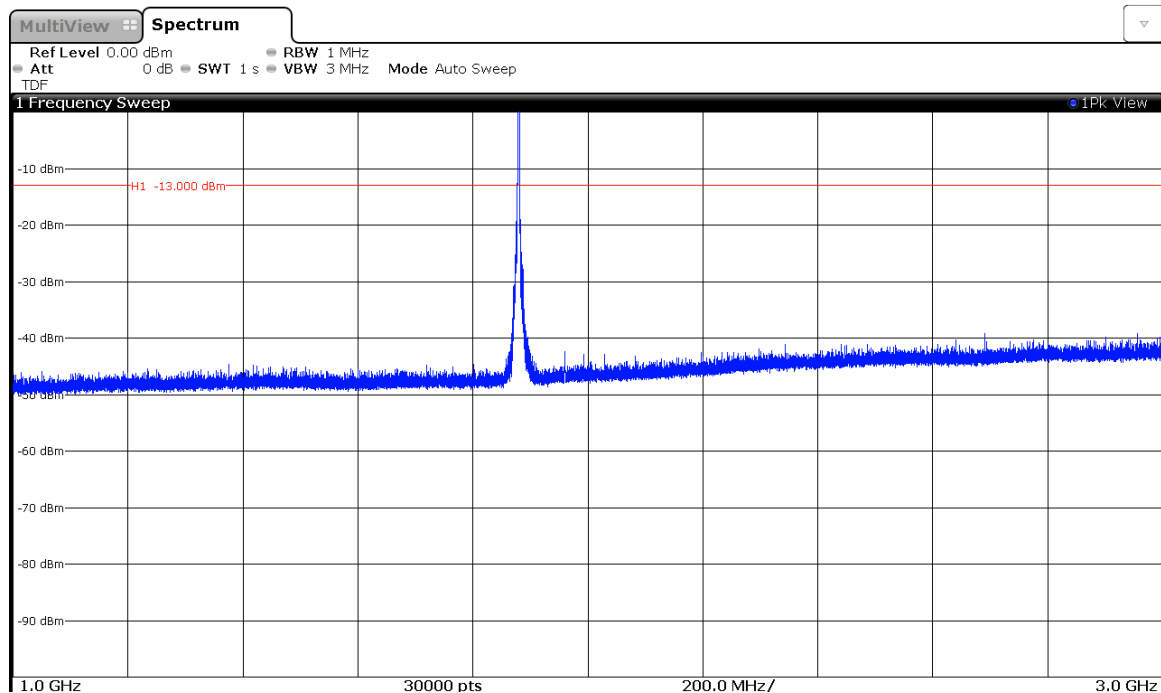
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST



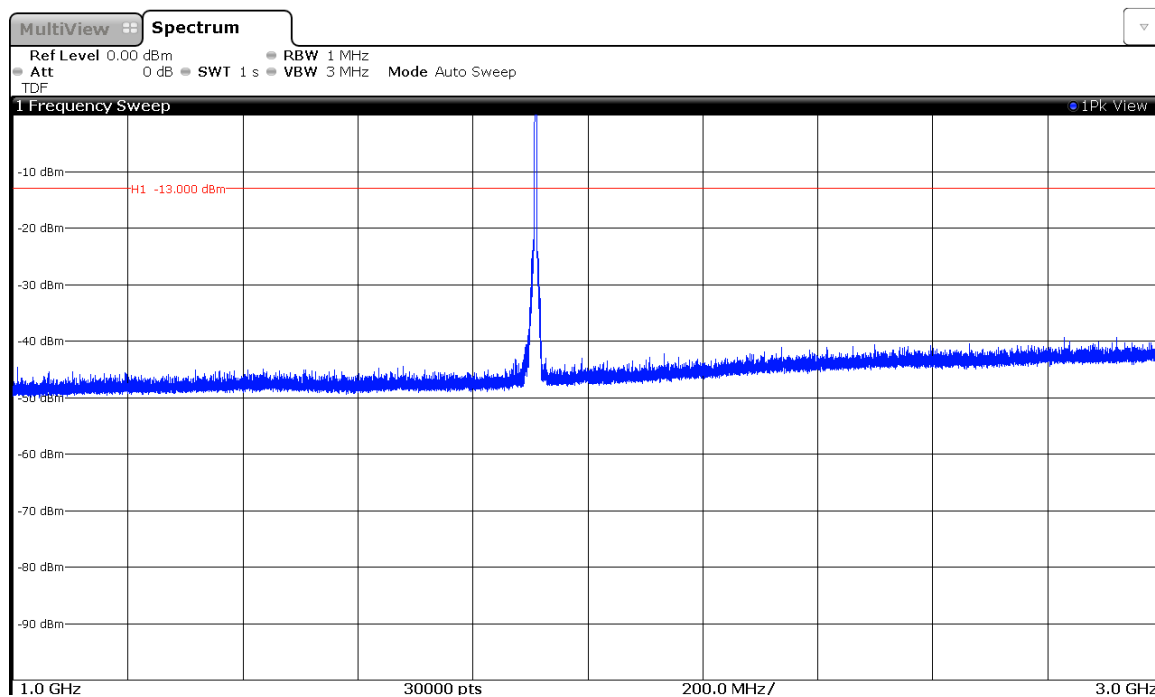
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



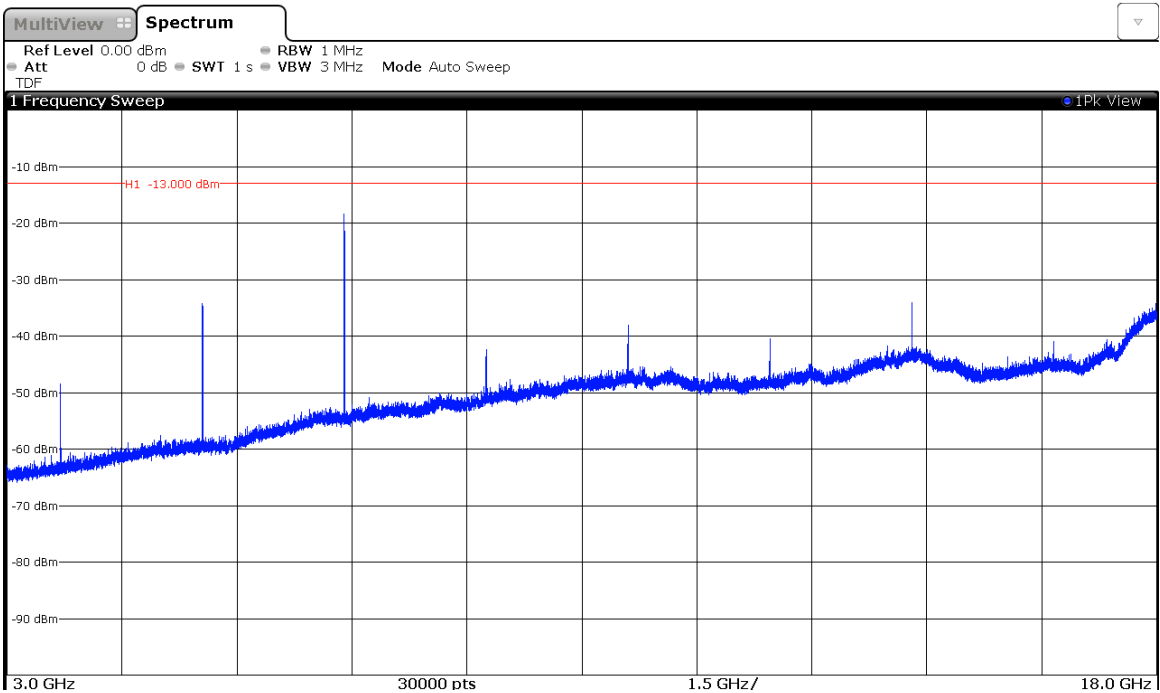
Note: The peak above the limit is the carrier frequency.

CHANNEL: HIGHEST

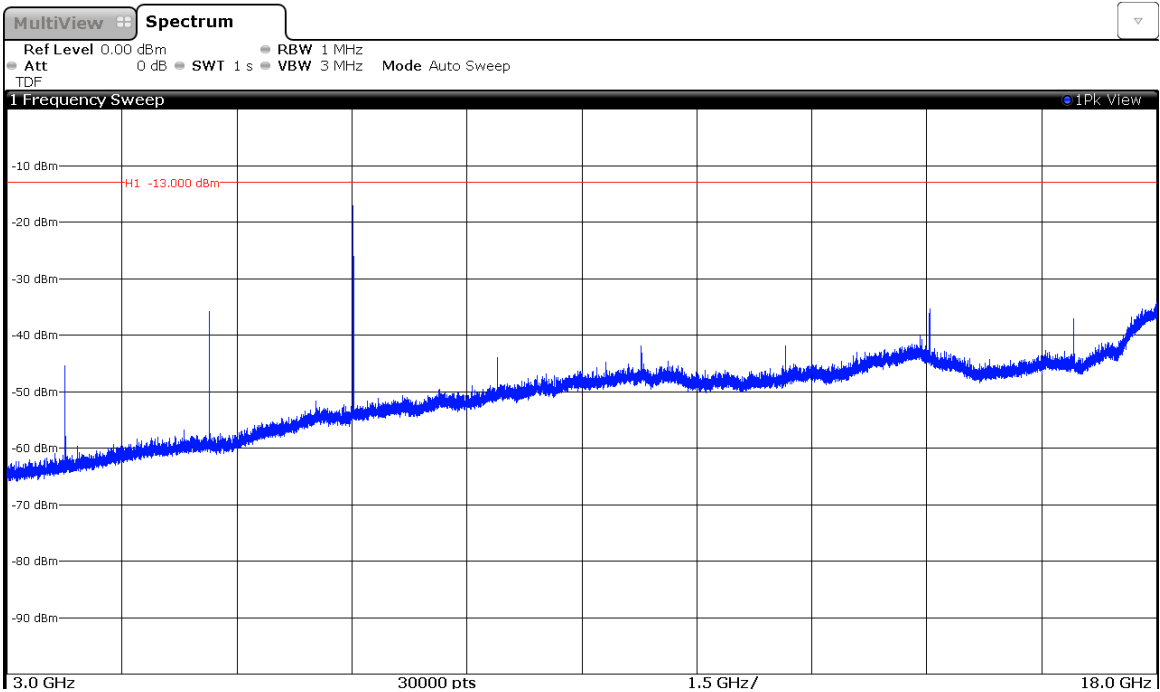


Note: The peak above the limit is the carrier frequency.

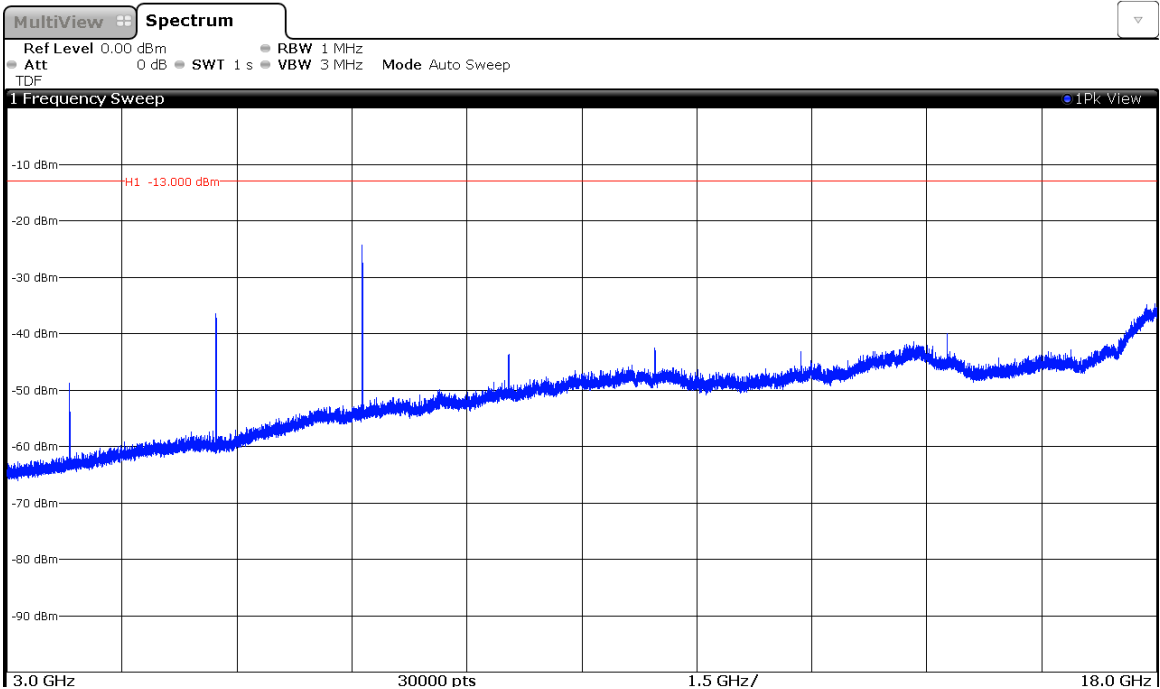
FREQUENCY RANGE 3 GHz to 18 GHz.
CHANNEL: LOWEST



CHANNEL: MIDDLE

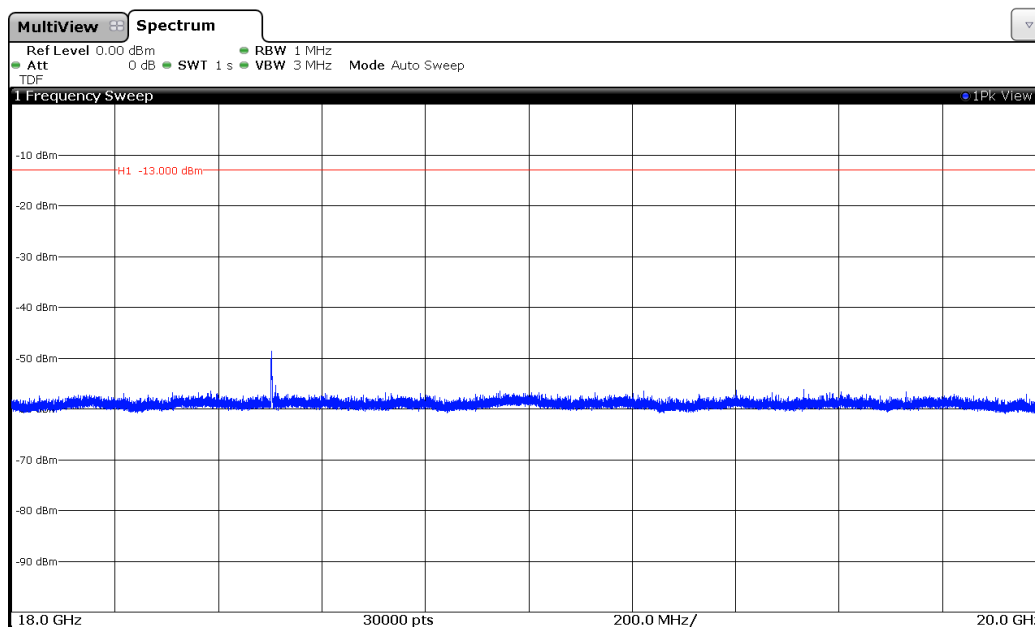


CHANNEL: HIGHEST

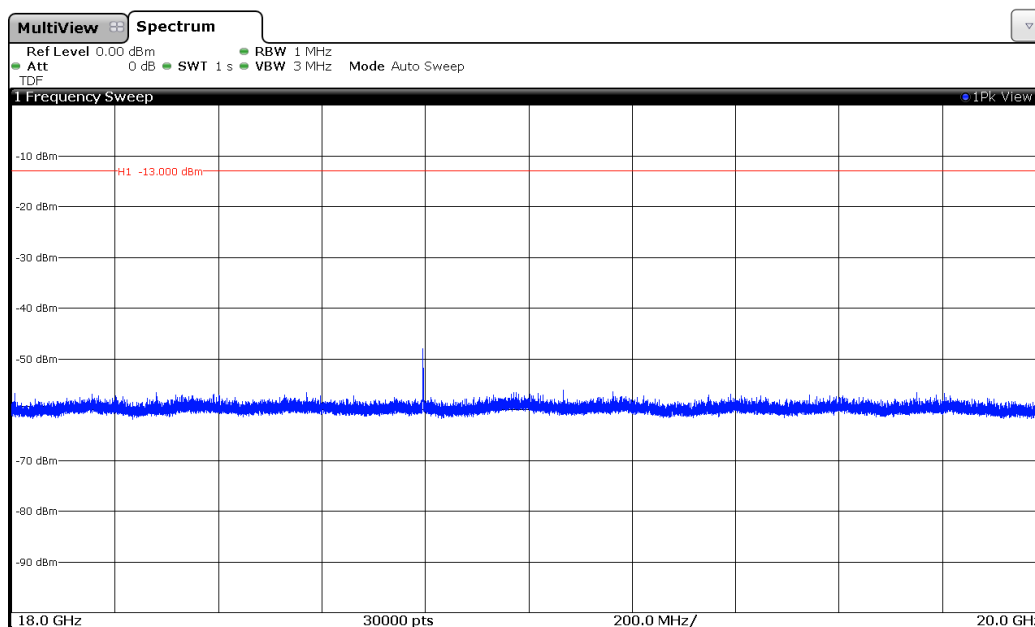


FREQUENCY RANGE 18 GHz TO 20 GHz.

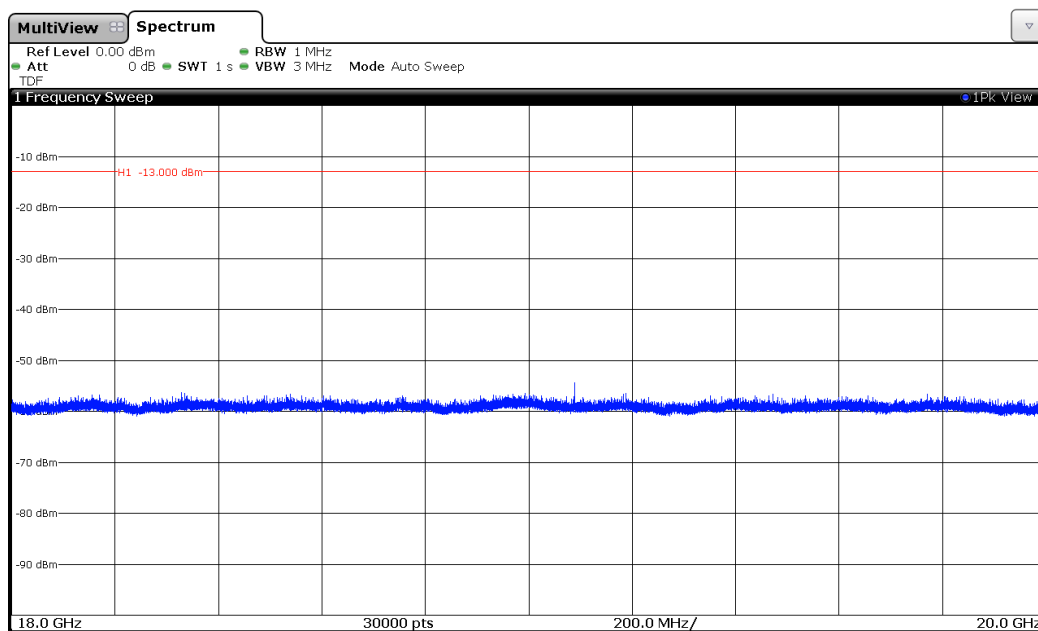
CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST



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

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

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 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.

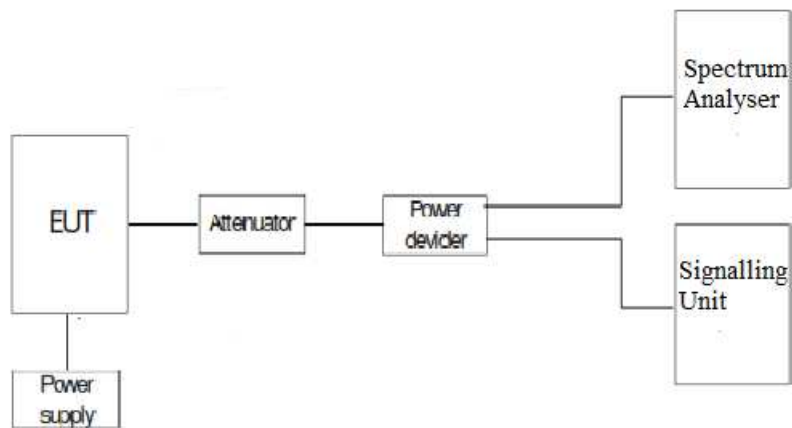
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

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	
				6	0	20.633	
	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	
				6	0	20.767	
	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	
				15	0	21.610	
			16-QAM	1	0	22.133	6.39
				1	7	22.148	
				1	14	21.988	
				8	0	20.880	
				8	4	20.623	
				8	7	20.746	
				15	0	20.587	
	Middle 20175	1732.5	QPSK	1	0	22.661	6.33
				1	7	22.732	
				1	14	22.665	
				8	0	21.685	
				8	4	21.729	
				8	7	21.712	
				15	0	21.686	
			16-QAM	1	0	21.933	7.32
				1	7	22.014	
				1	14	21.555	
				8	0	20.795	
				8	4	20.802	
				8	7	20.861	
				15	0	20.770	
	High 20385	1753.5	QPSK	1	0	22.652	4.46
				1	7	22.628	
				1	14	22.608	
				8	0	21.718	
				8	4	21.671	
				8	7	21.737	
				15	0	21.700	
			16-QAM	1	0	21.800	5.38
				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	21.731	6.2
				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	6.47
				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	7.13
				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	5.4
				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	6.07
				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	6.99
				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	5.59
				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	6.47
				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	6.6
				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	6.54
				1	37	22.077	
				1	74	21.898	
				36	0	20.853	
				36	18	20.702	
				36	37	20.667	
				75	0	20.709	

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	6.33
				1	2	21.631	
				1	5	21.738	
				3	0	21.469	
				3	1	21.608	
				3	2	21.582	
				6	0	20.528	
	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	6.71
				1	2	21.719	
				1	5	21.501	
				3	0	21.448	
				3	1	21.452	
				3	2	21.392	
				6	0	20.523	
	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	6.46
				1	2	21.514	
				1	5	21.538	
				3	0	21.459	
				3	1	21.377	
				3	2	21.427	
				6	0	20.341	

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	6.3
				1	7	21.788	
				1	14	21.707	
				8	0	20.549	
				8	4	20.514	
				8	7	20.528	
				15	0	20.468	
	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	6.38
				1	7	21.401	
				1	14	21.557	
				8	0	20.414	
				8	4	20.402	
				8	7	20.415	
				15	0	20.377	
	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	5.79
				1	7	21.594	
				1	14	21.521	
				8	0	20.451	
				8	4	20.428	
				8	7	20.461	
				15	0	20.419	

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	
				25	0	21.420	
			16-QAM	1	0	21.675	6.68
				1	12	21.652	
				1	24	21.587	
				12	0	20.519	
				12	6	20.476	
				12	11	20.469	
				25	0	20.394	
	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	
				25	0	21.403	
			16-QAM	1	0	21.578	6.14
				1	12	21.608	
				1	24	21.557	
				12	0	20.476	
				12	6	20.461	
				12	11	20.453	
				25	0	20.405	
	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	
				25	0	21.377	
			16-QAM	1	0	21.655	5.87
				1	12	21.616	
				1	24	21.602	
				12	0	20.465	
				12	6	20.421	
				12	11	20.444	
				25	0	20.385	

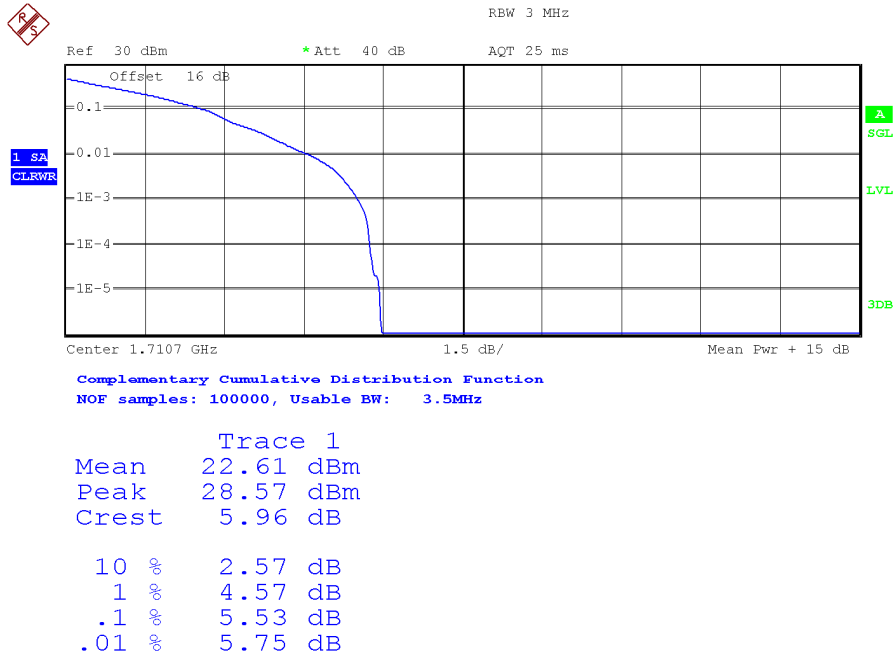
BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
10	Low 23060	704 MHz	QPSK	1	0	22.306	5.74
				1	24	22.321	
				1	49	22.231	
				25	0	21.389	
				25	12	21.348	
				25	24	21.333	
				50	0	21.352	
			16-QAM	1	0	21.682	6.54
				1	24	21.638	
				1	49	21.570	
				25	0	20.383	
				25	12	20.432	
				25	24	20.405	
				50	0	20.448	
	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	
				50	0	20.401	
	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).

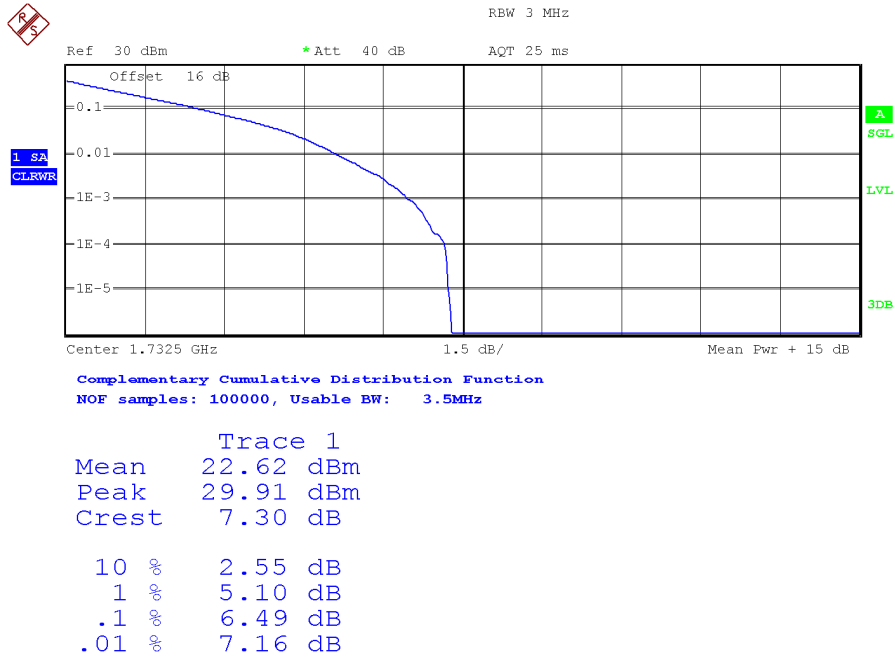
LTE. BAND IV.

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

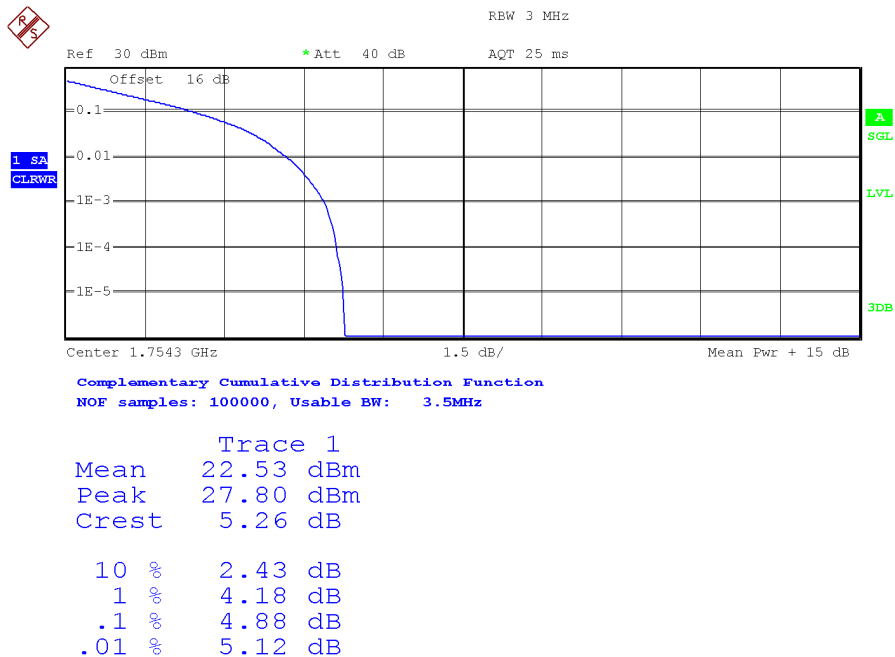
Channel Low:



Channel Middle:

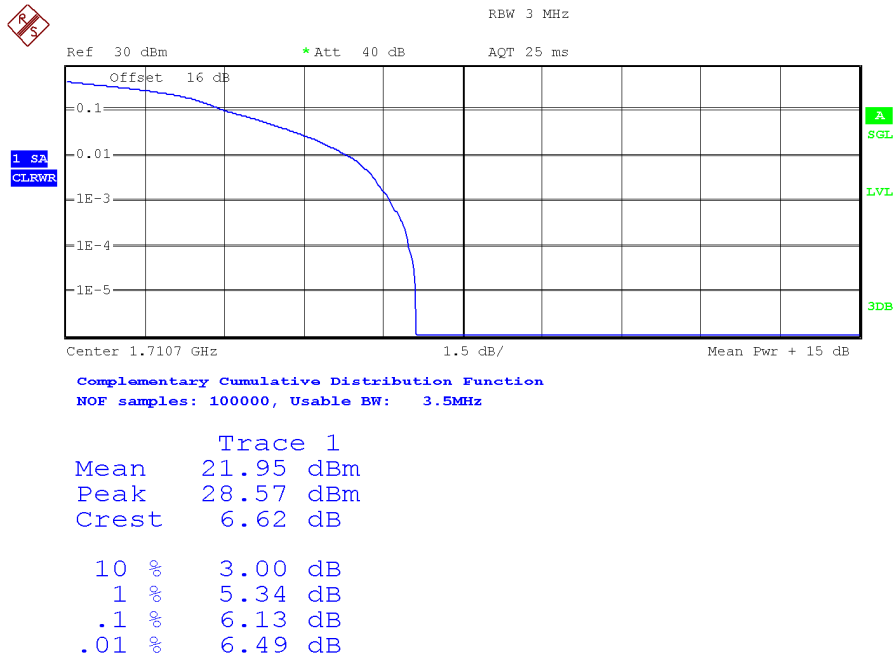


Channel High:

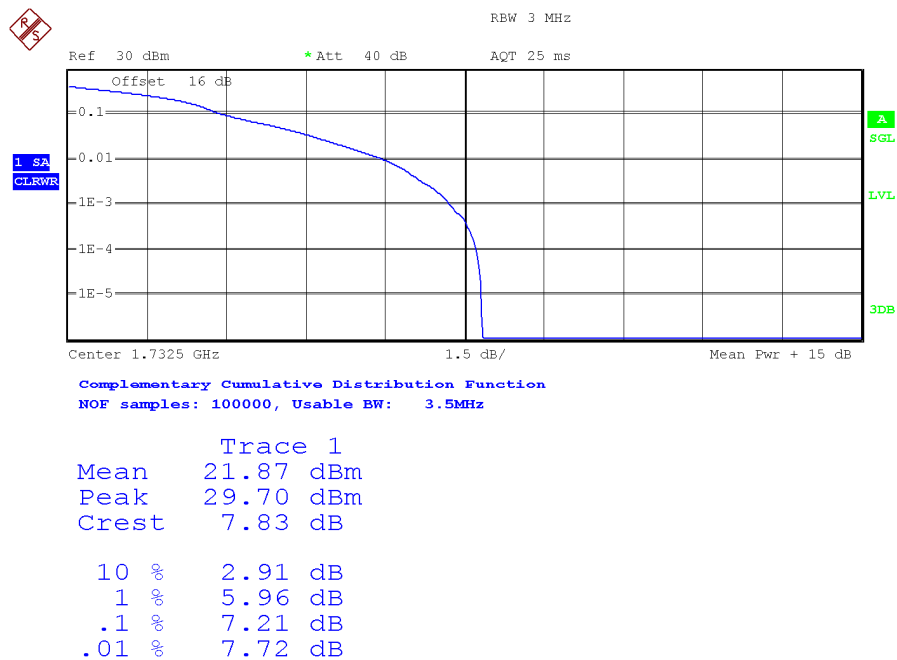


Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.

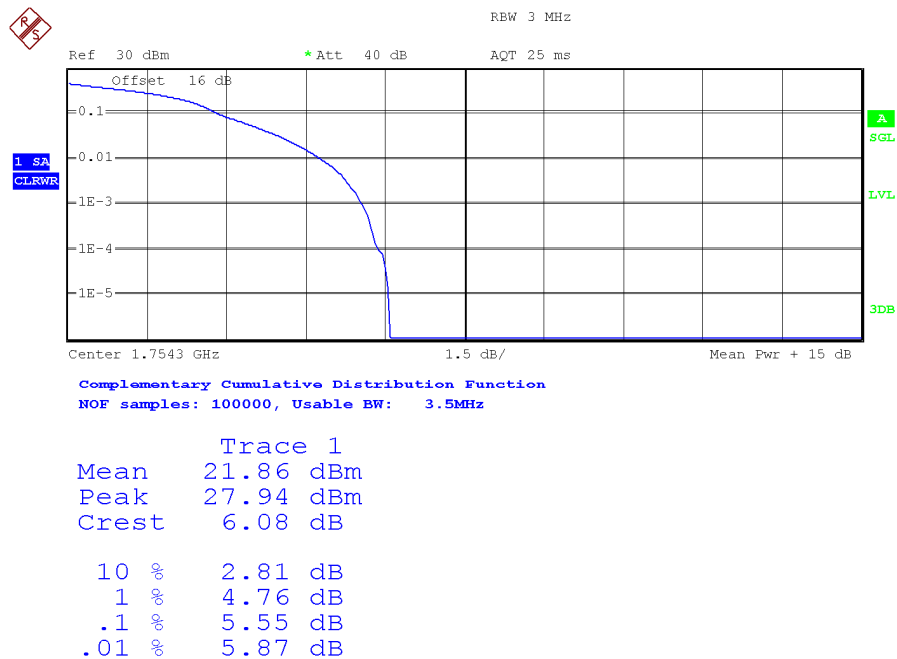
Channel Low:



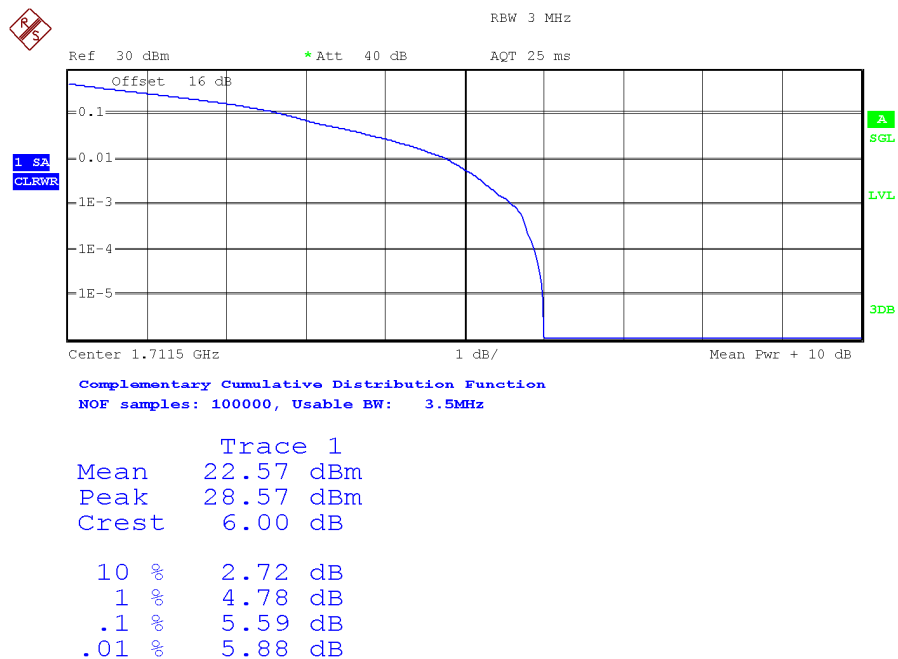
Channel Middle:



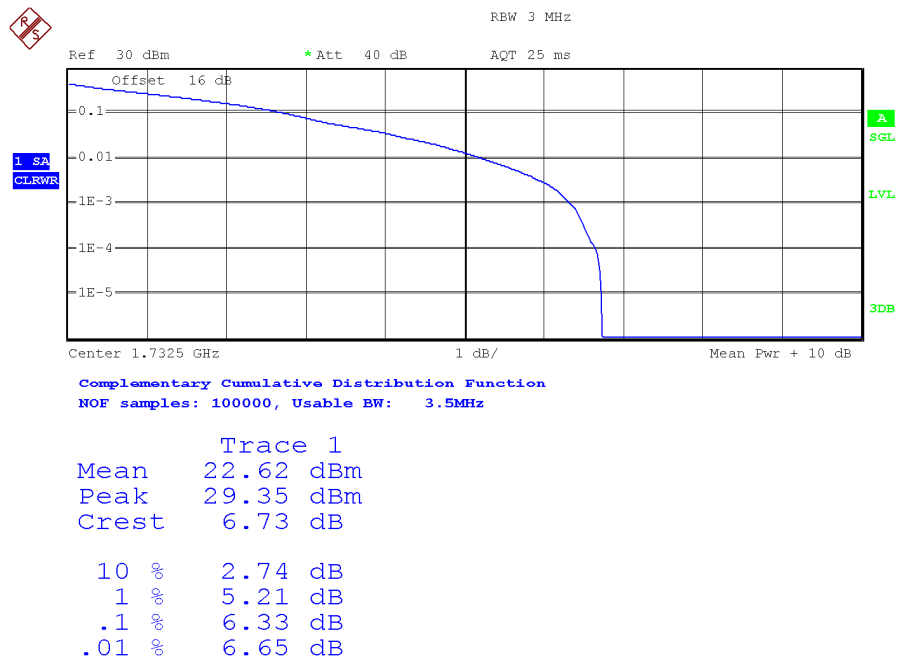
Channel High:



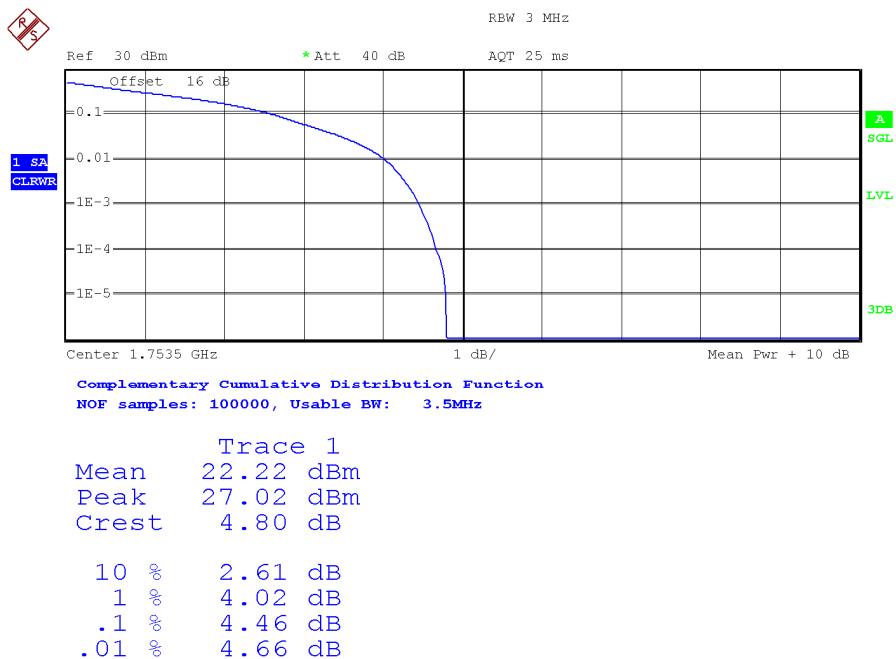
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.
Channel Low:



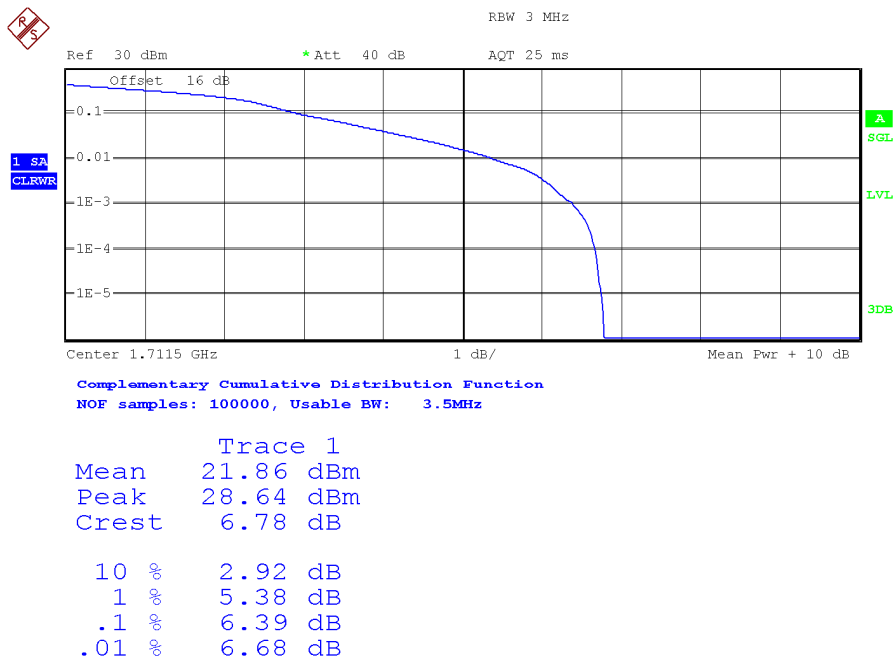
Channel Middle:



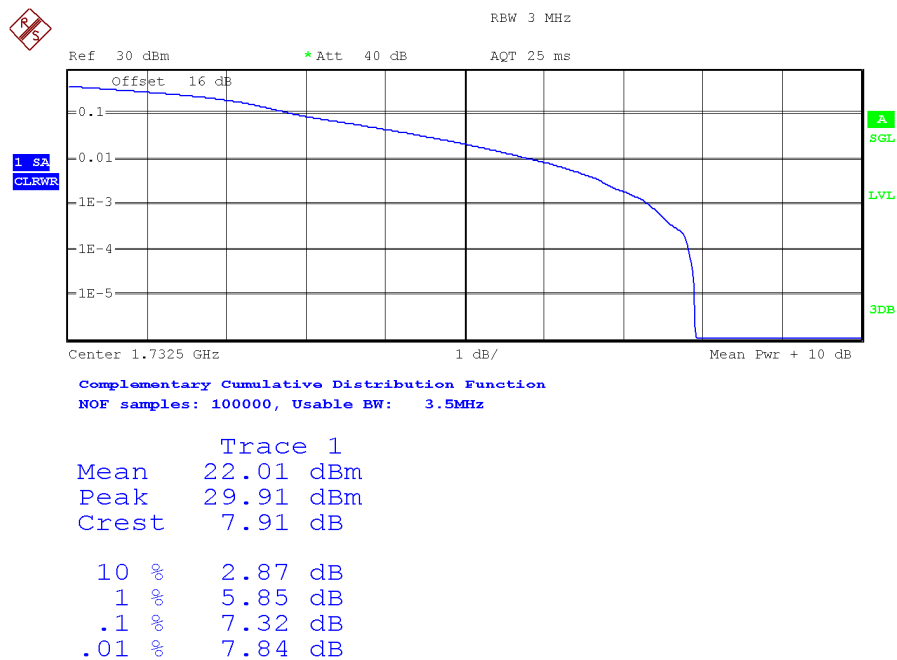
Channel High:



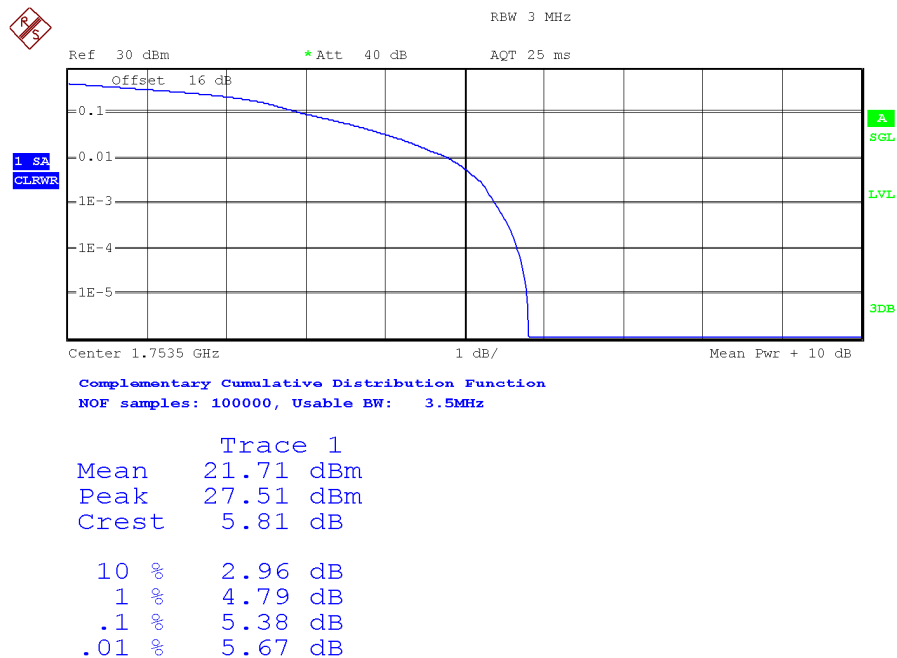
Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.
Channel Low:



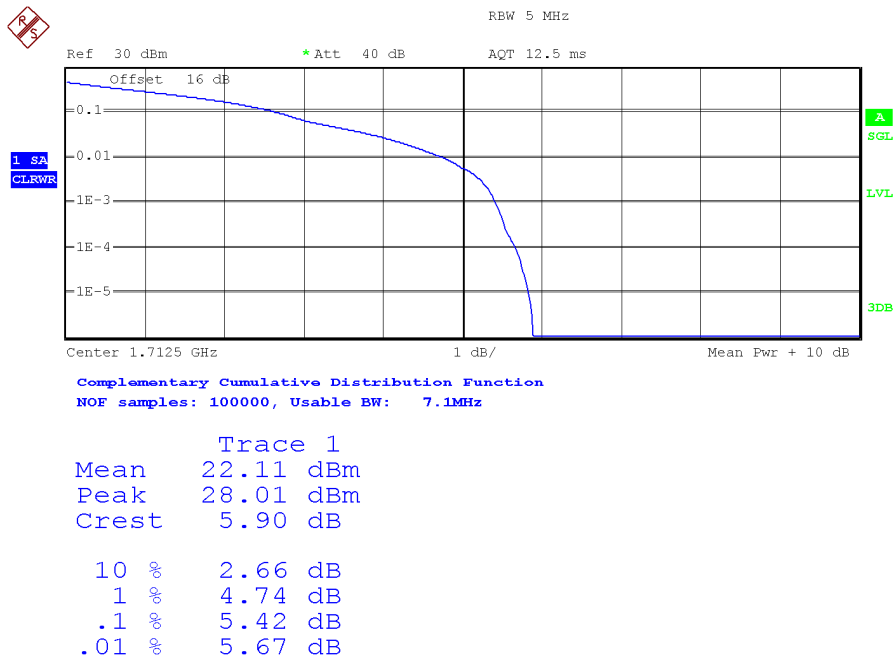
Channel Middle:



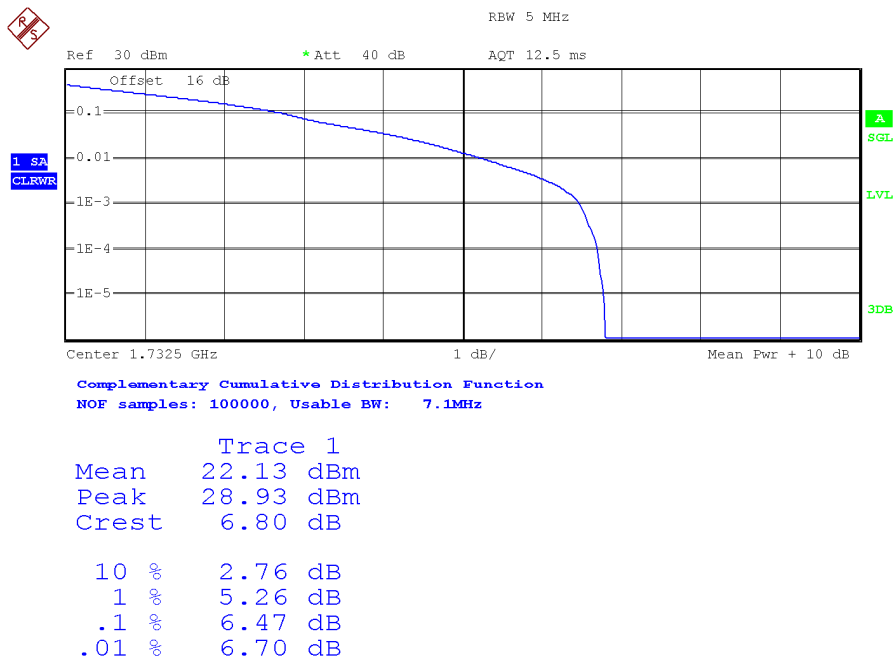
Channel High:



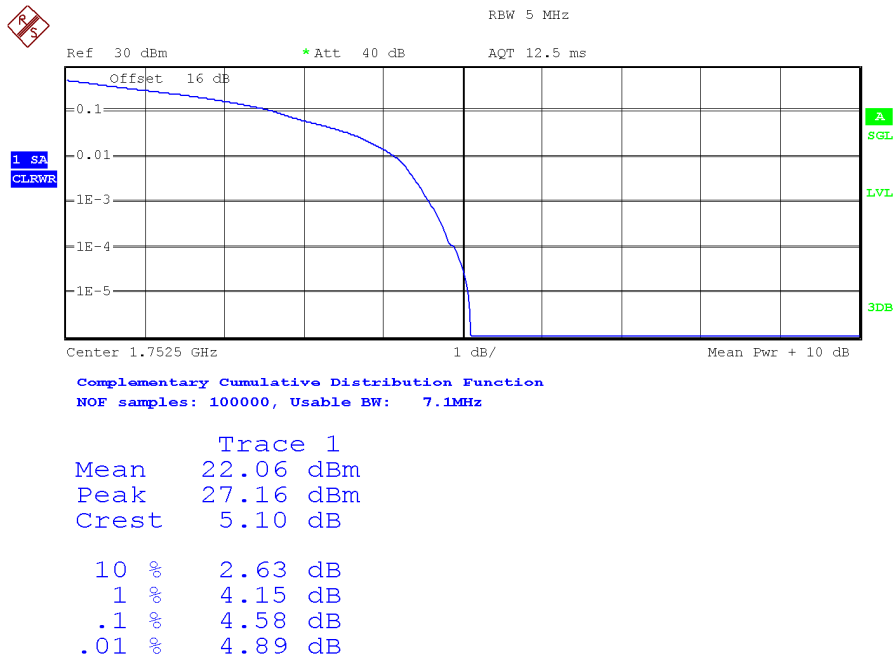
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
Channel Low:



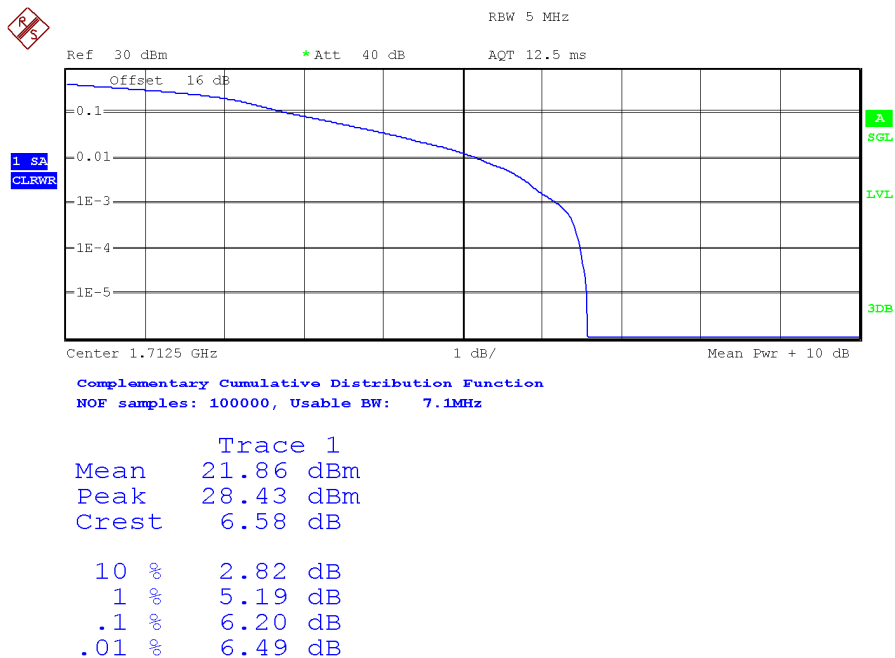
Channel Middle:



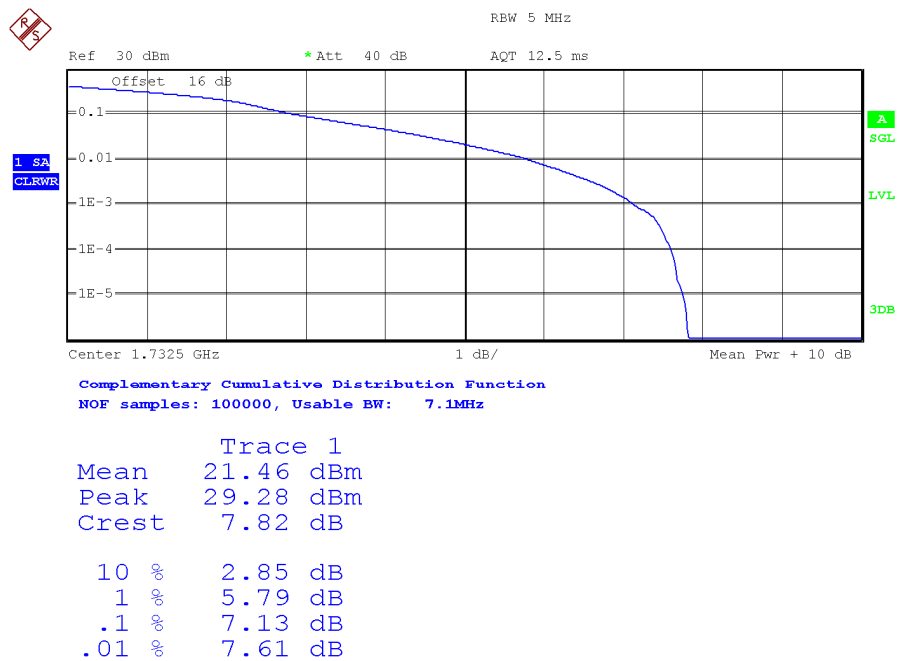
Channel High:



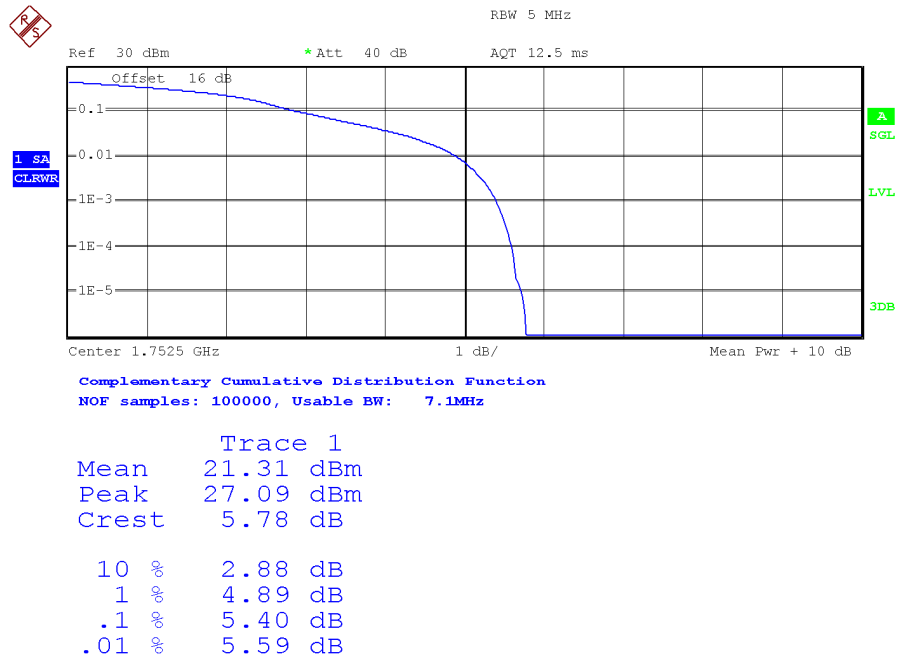
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
Channel Low:



Channel Middle:

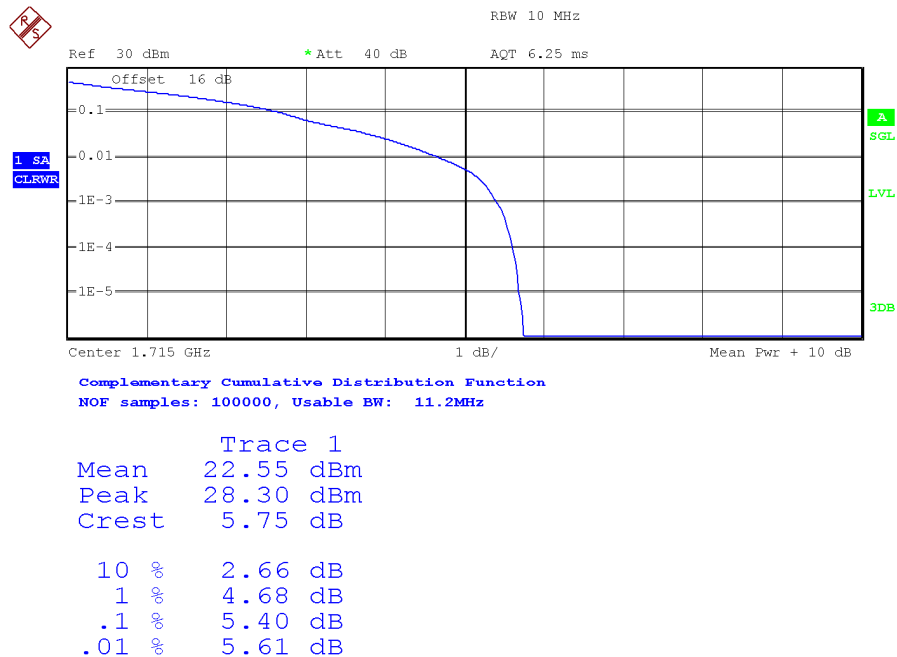


Channel High:

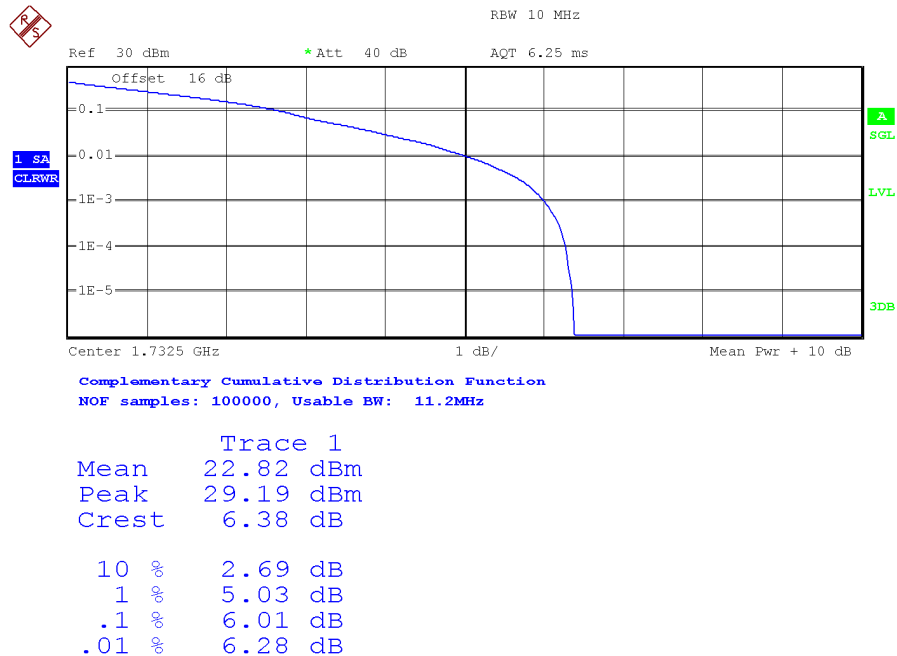


Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

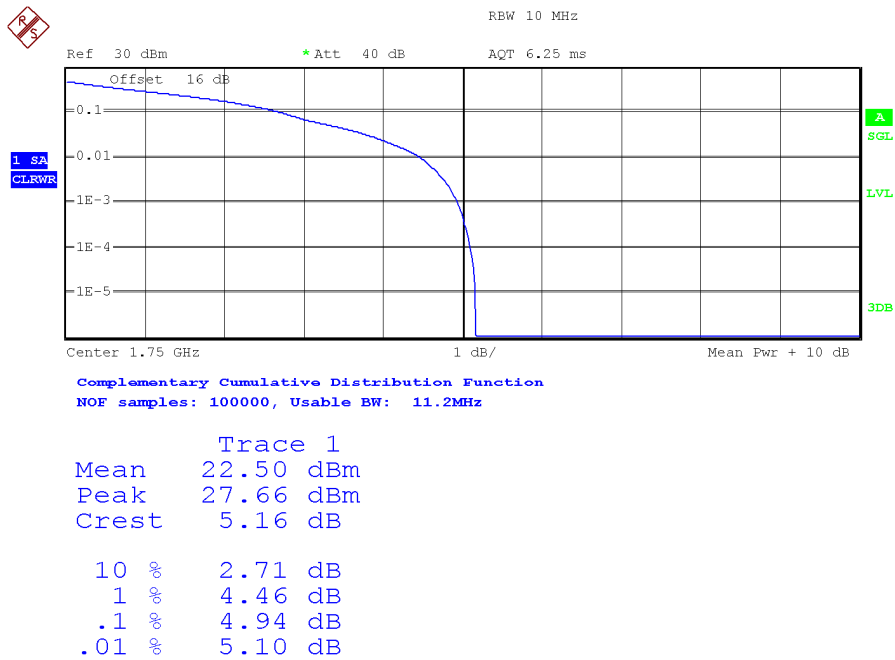
Channel Low:



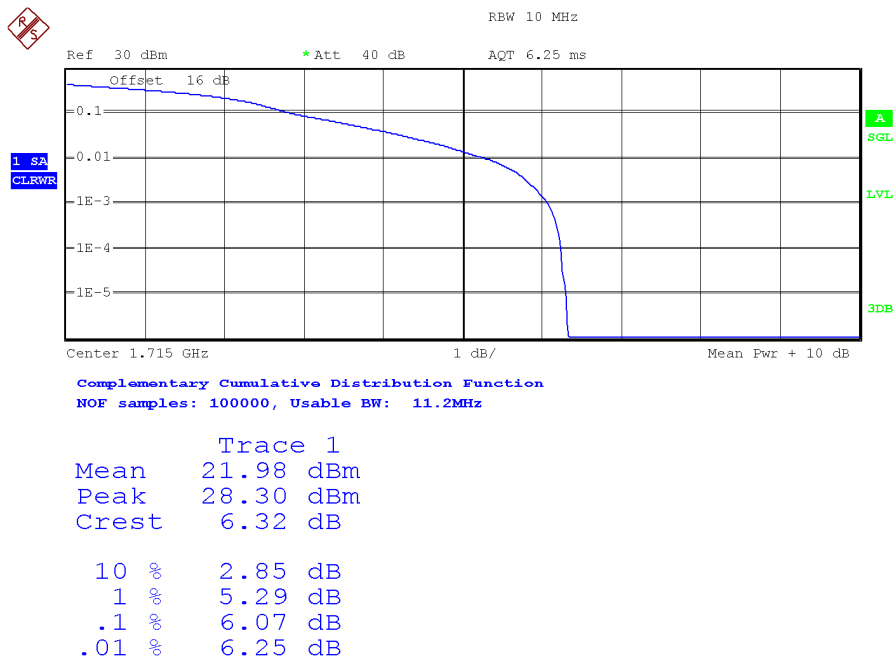
Channel Middle:



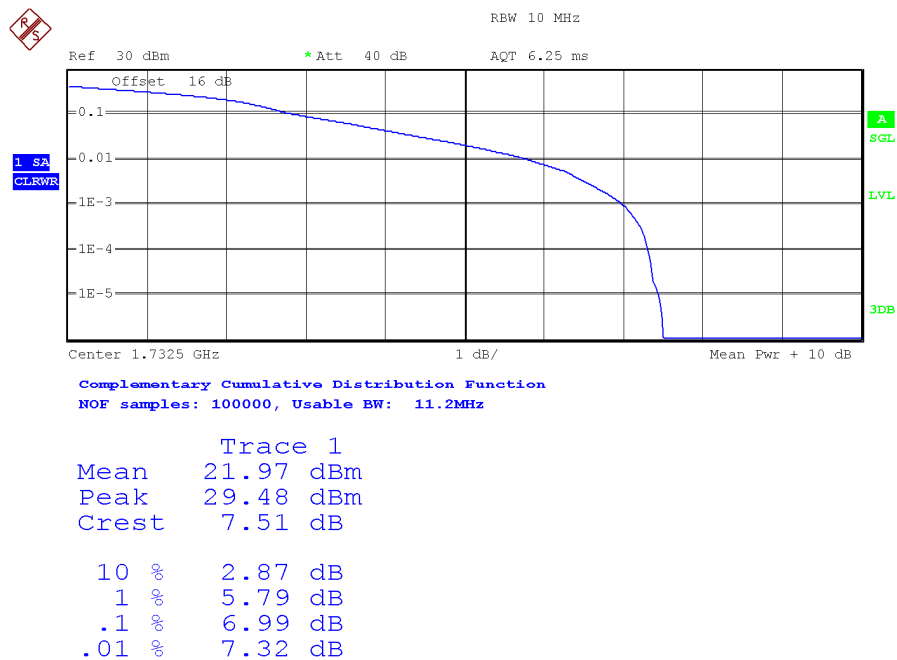
Channel High:



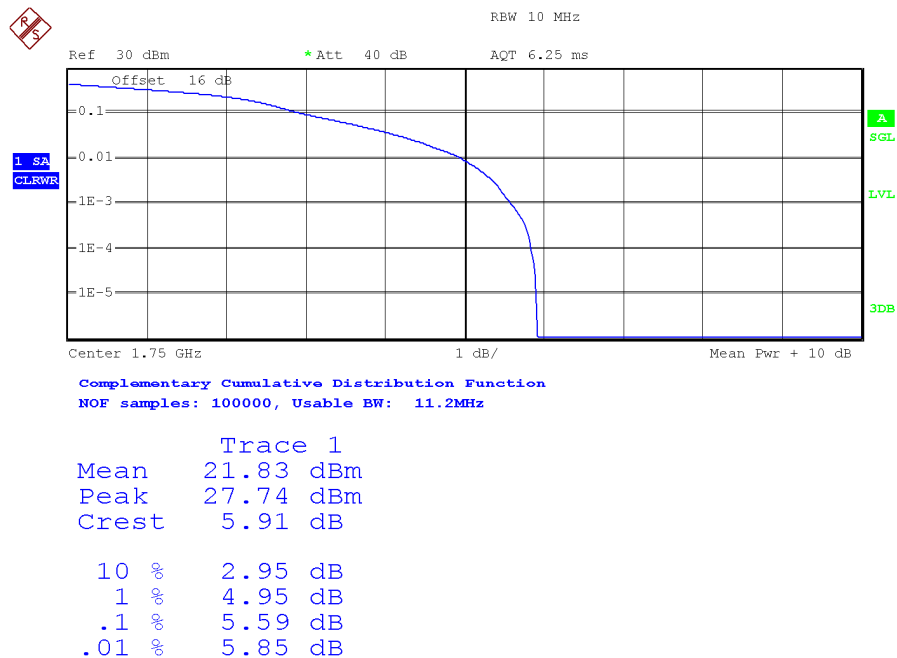
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
Channel Low:



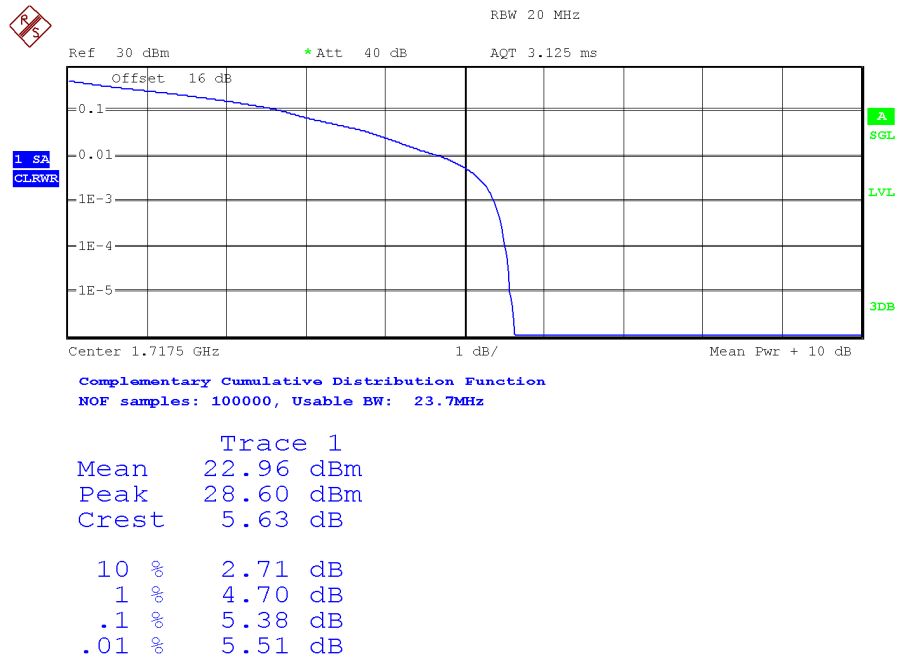
Channel Middle:



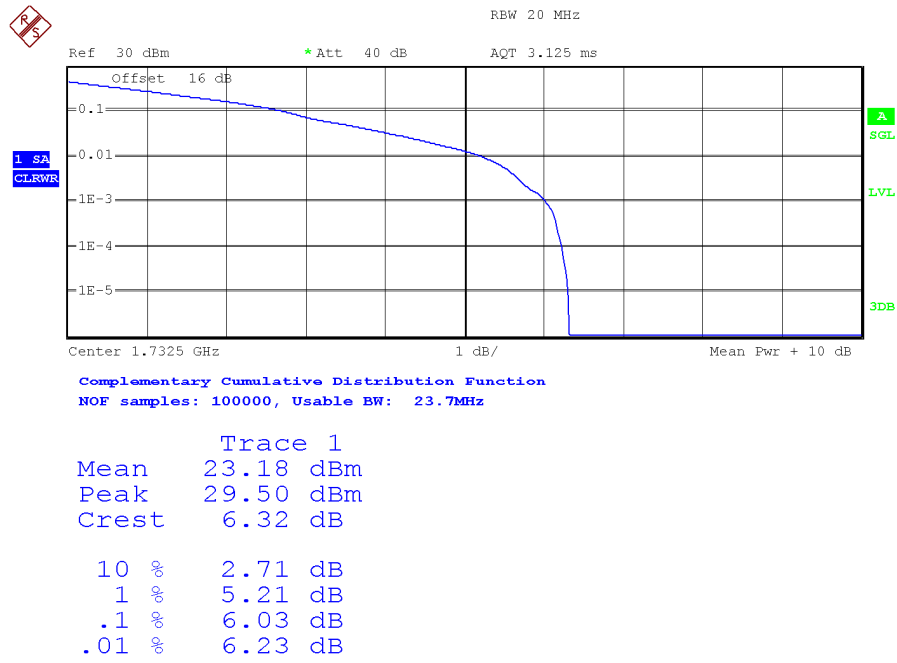
Channel High:



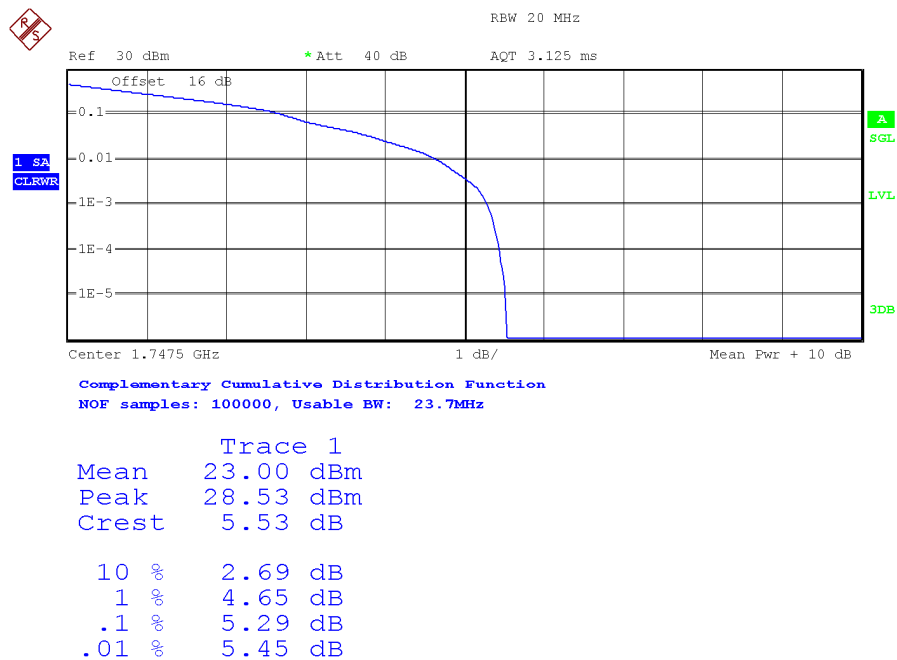
Bandwidth = 15 MHz. Modulation QPSK. RB Size: 75. RB Offset: 0.
Channel Low:



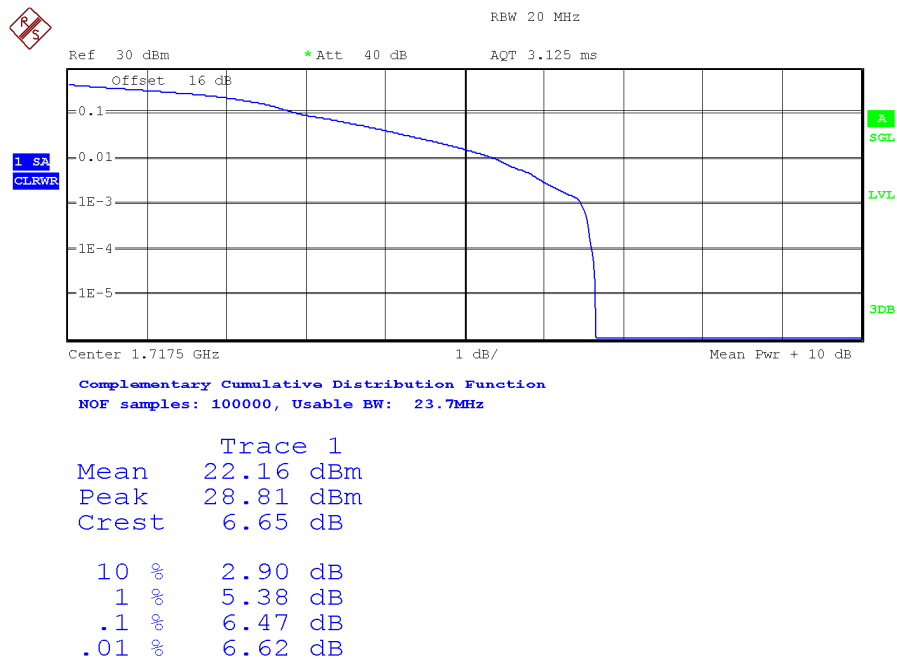
Channel Middle:



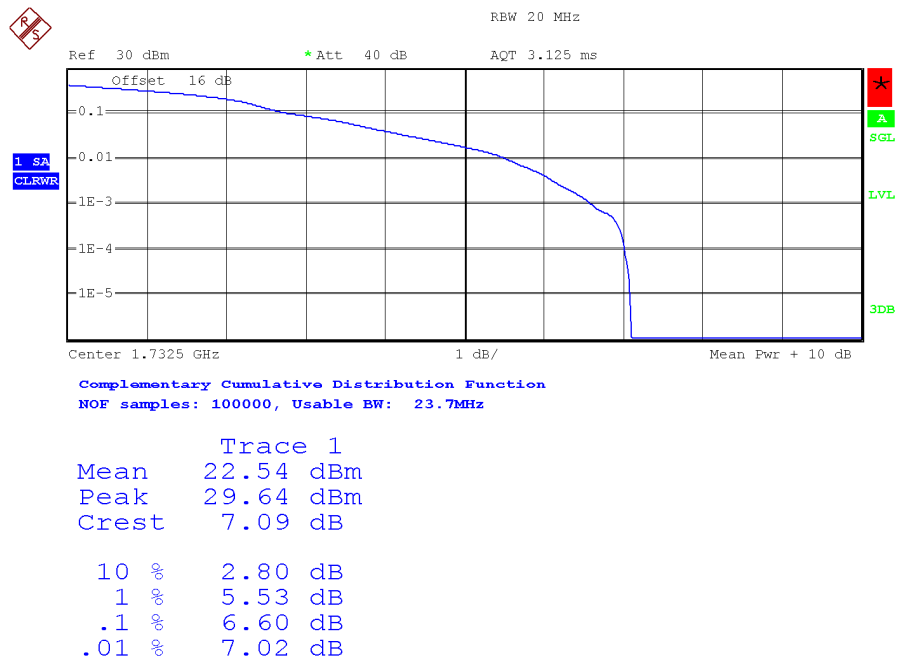
Channel High:



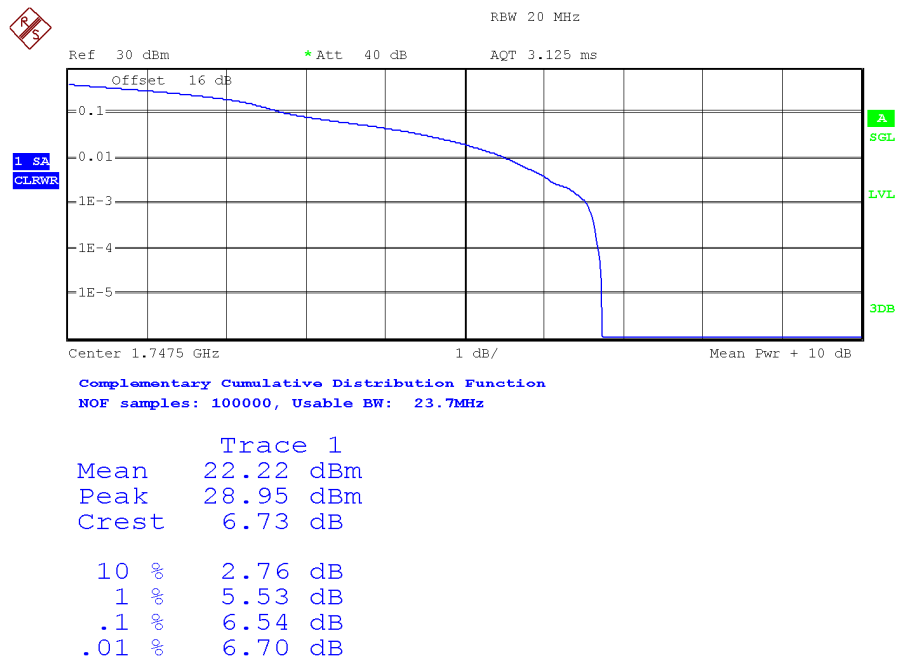
Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.
Channel Low:



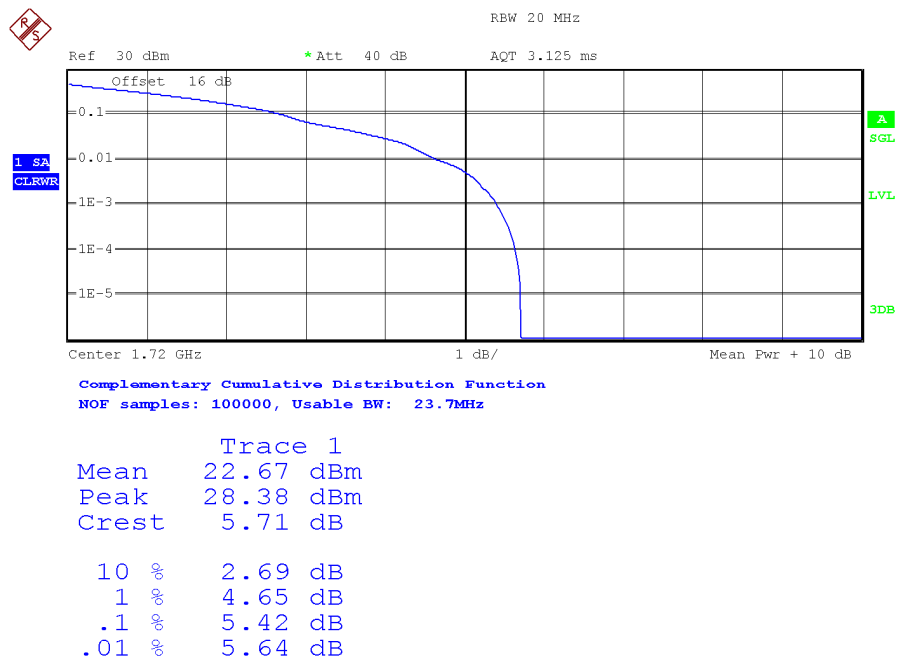
Channel Middle:



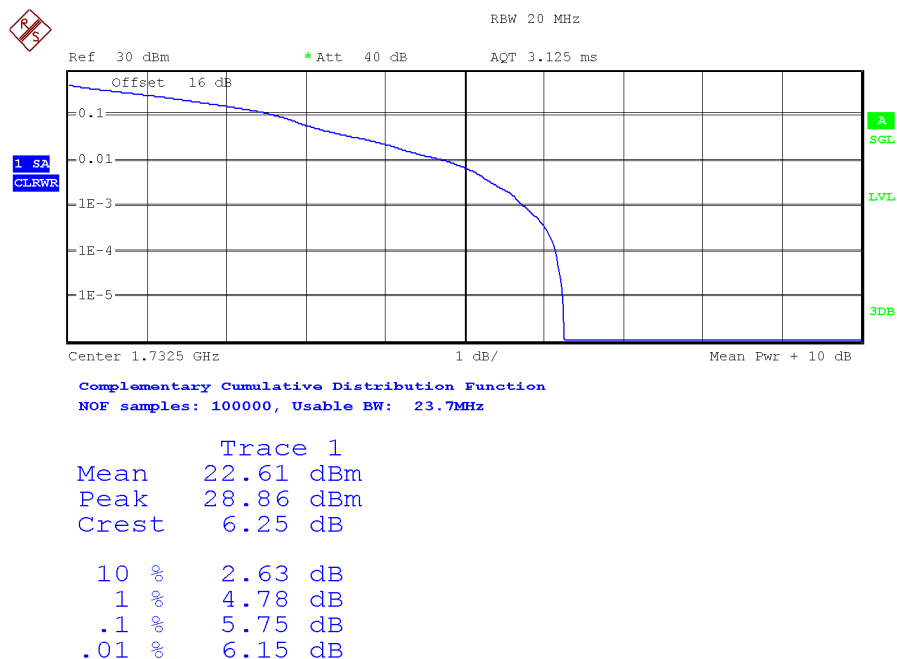
Channel High:



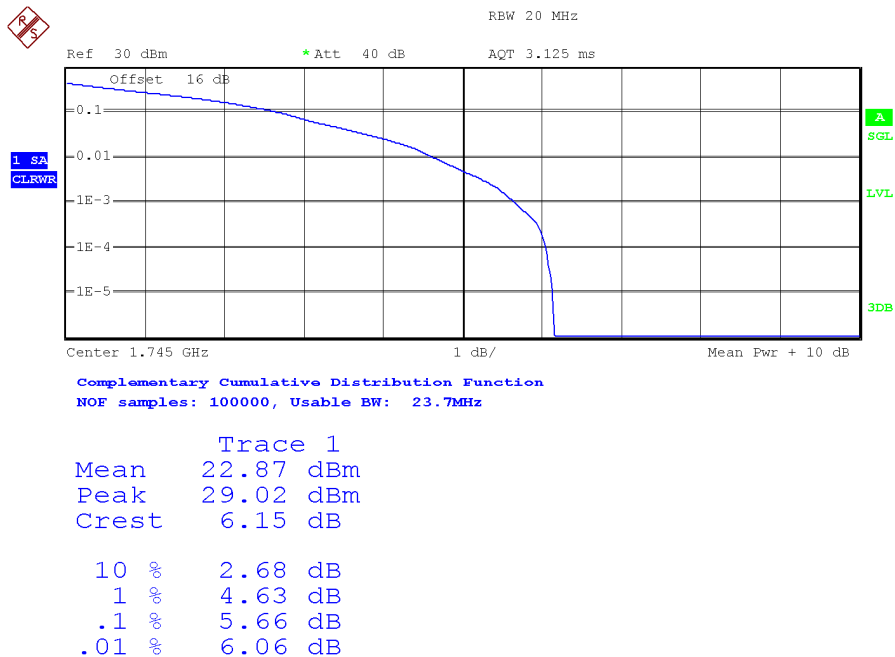
Bandwidth = 20 MHz. Modulation QPSK. RB Size: 100. RB Offset: 0.
Channel Low:



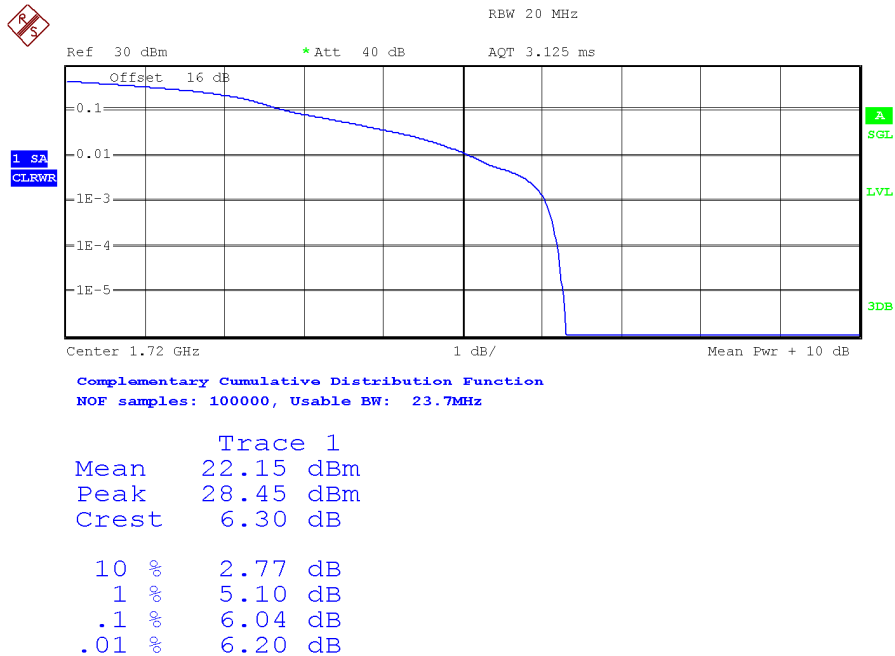
Channel Middle:



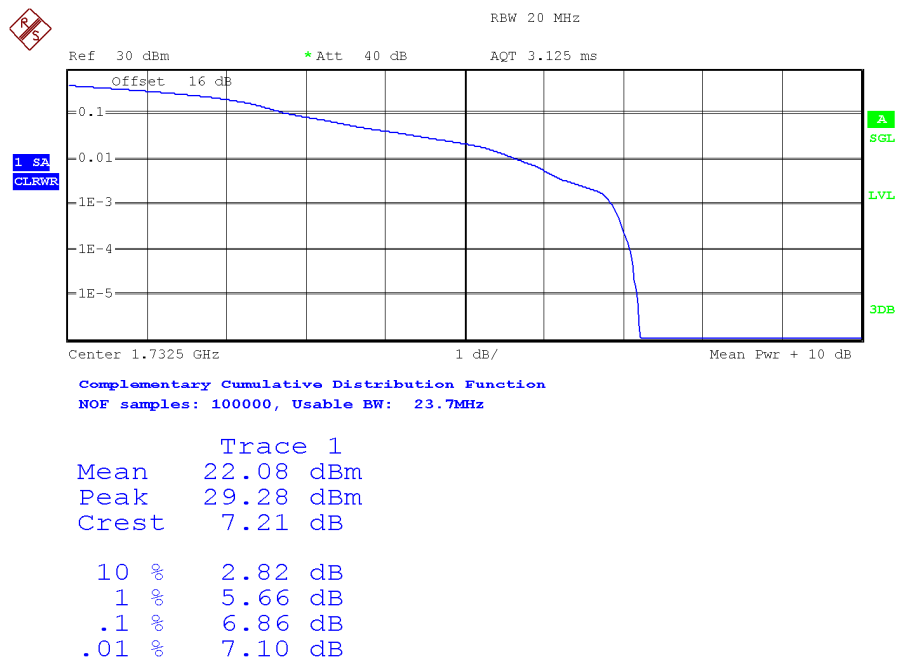
Channel High:



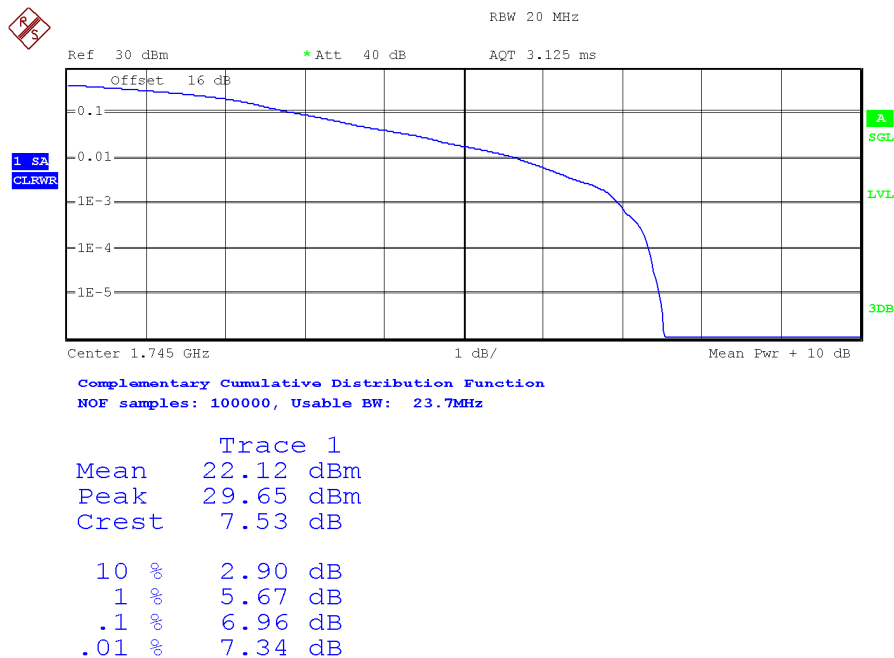
Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.
Channel Low:



Channel Middle:

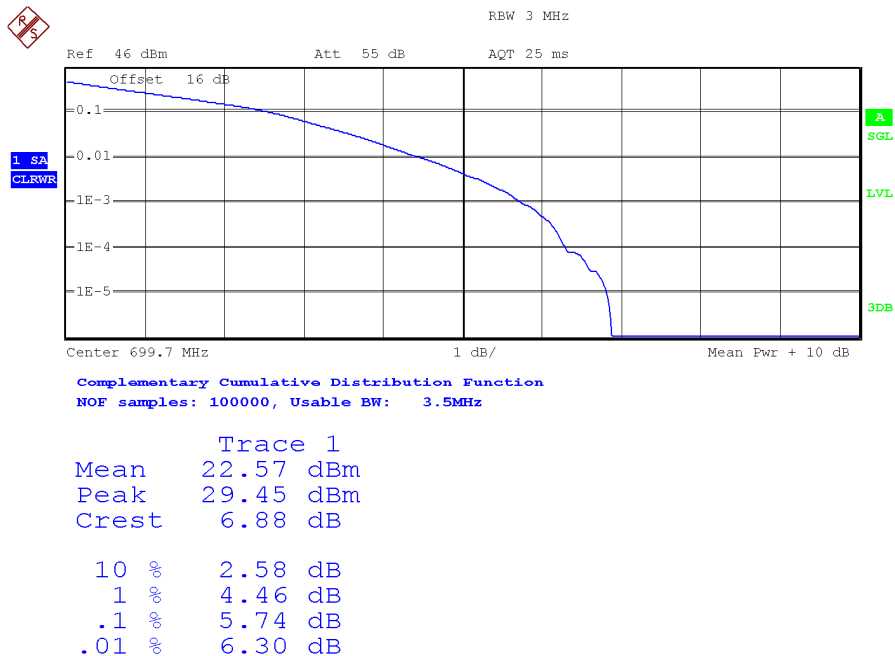


Channel High:

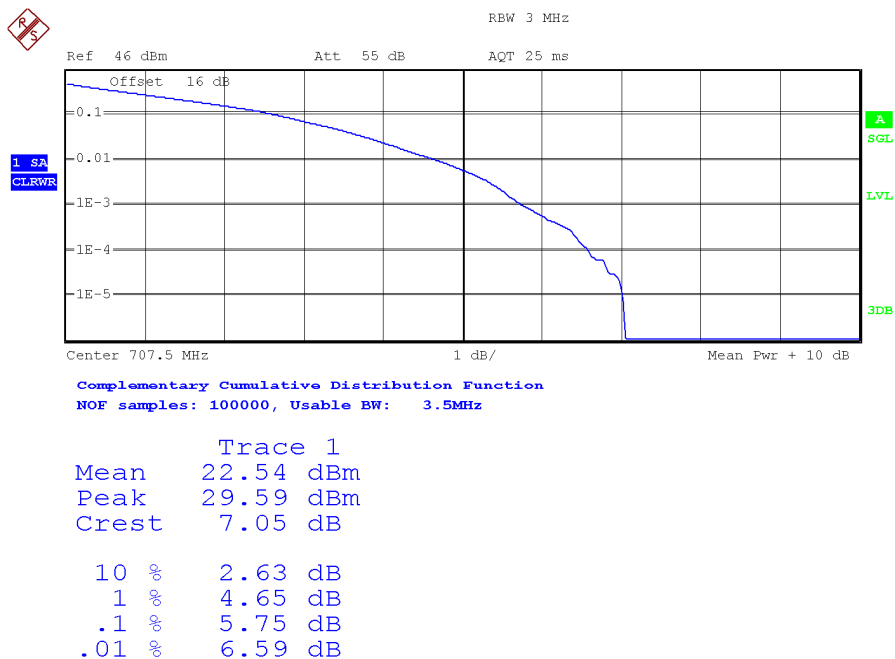


LTE. BAND XII.

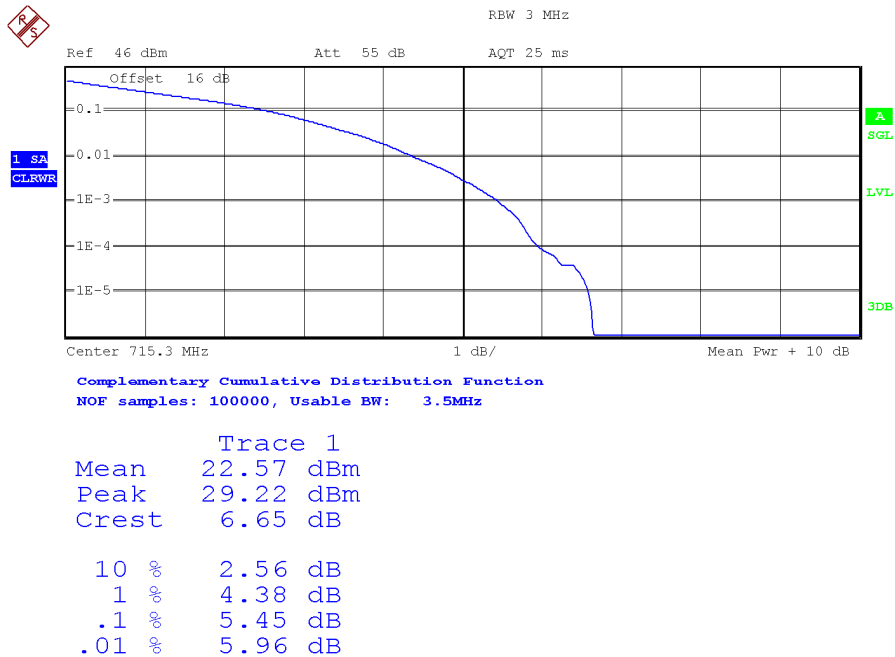
Bandwidth = 1.4 MHz. Modulation QPSK. RB Size: 6. RB Offset: 0.
Channel Low:



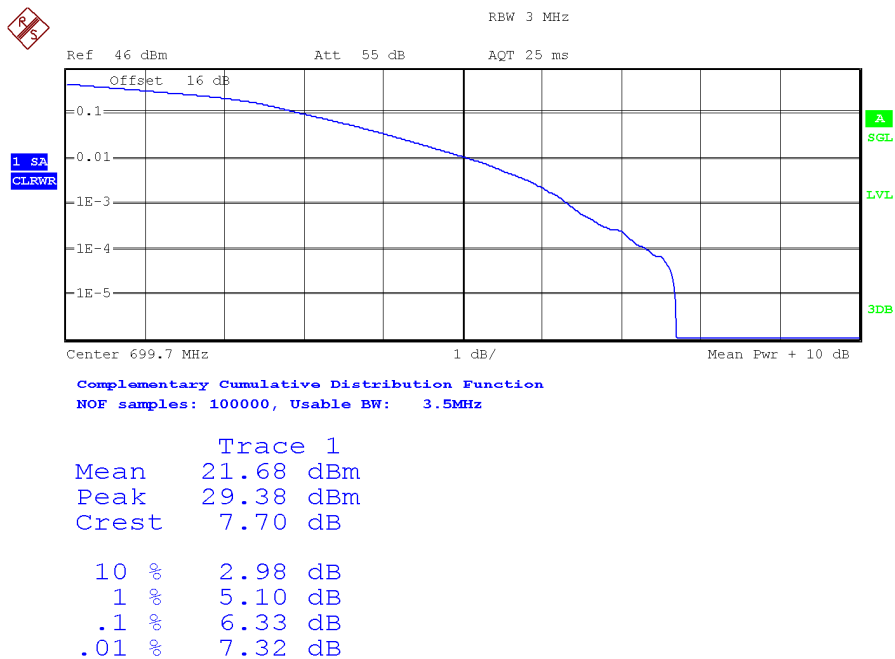
Channel Middle:



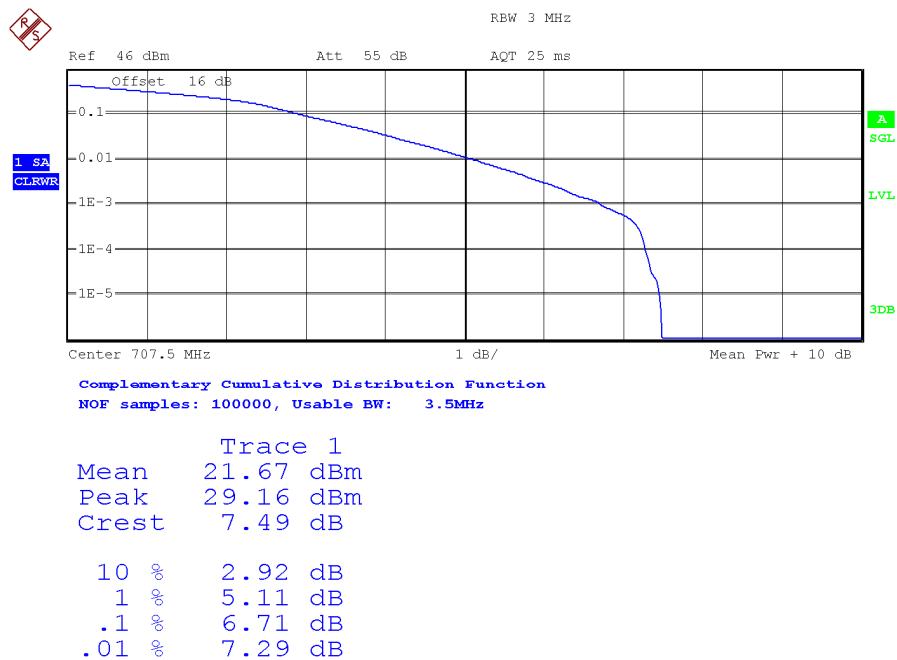
Channel High:



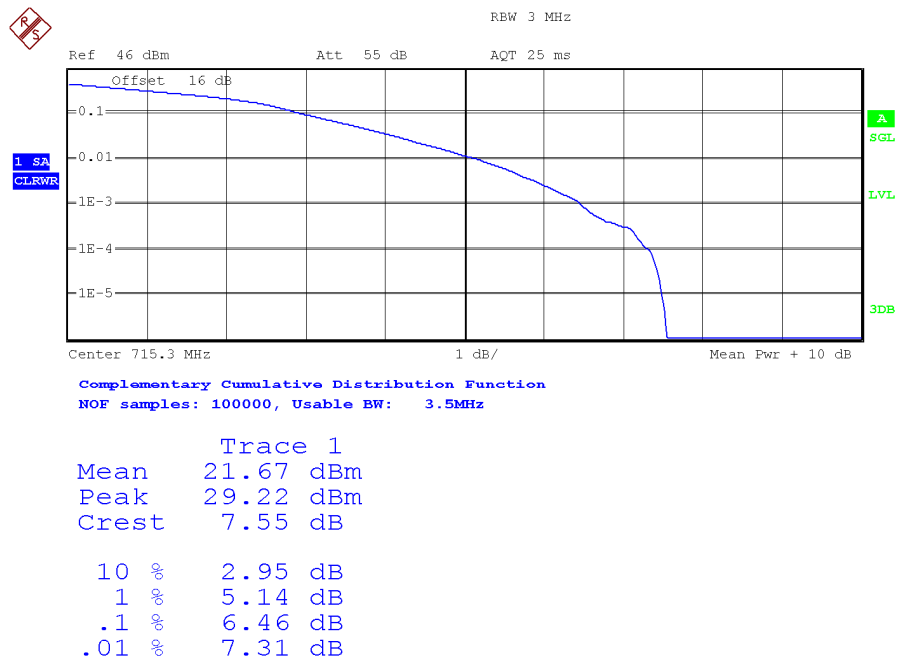
Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.
Channel Low:



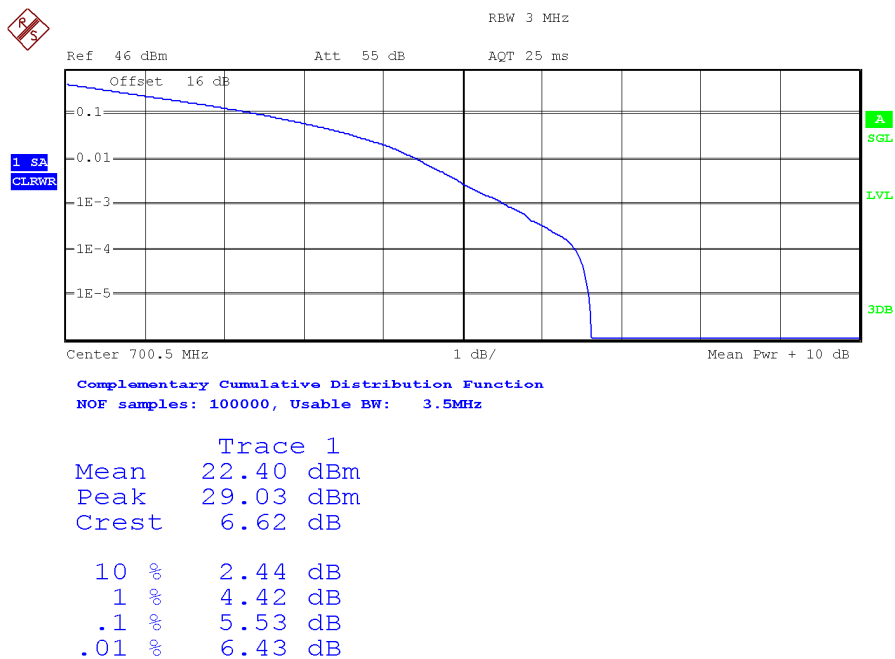
Channel Middle:



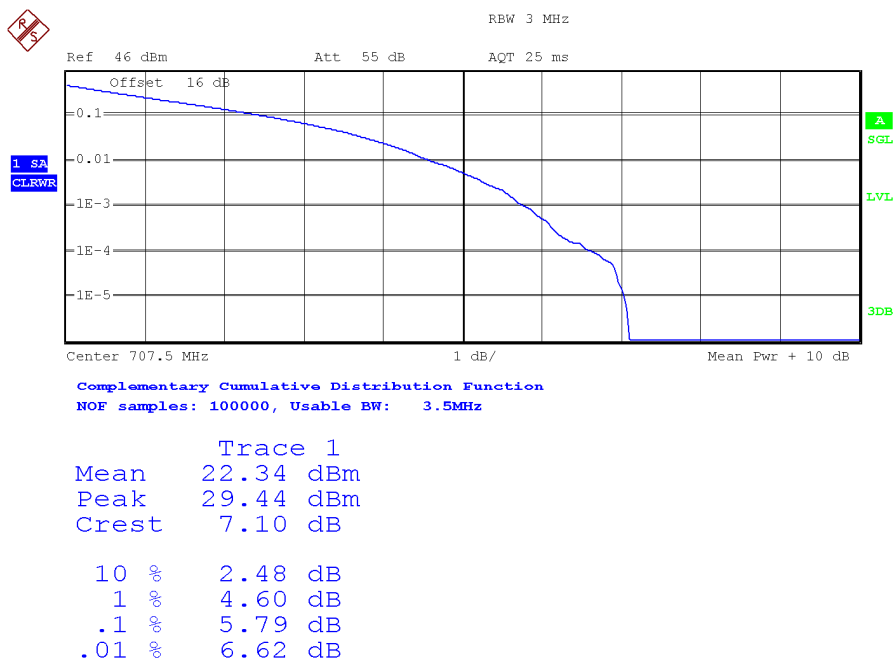
Channel High:



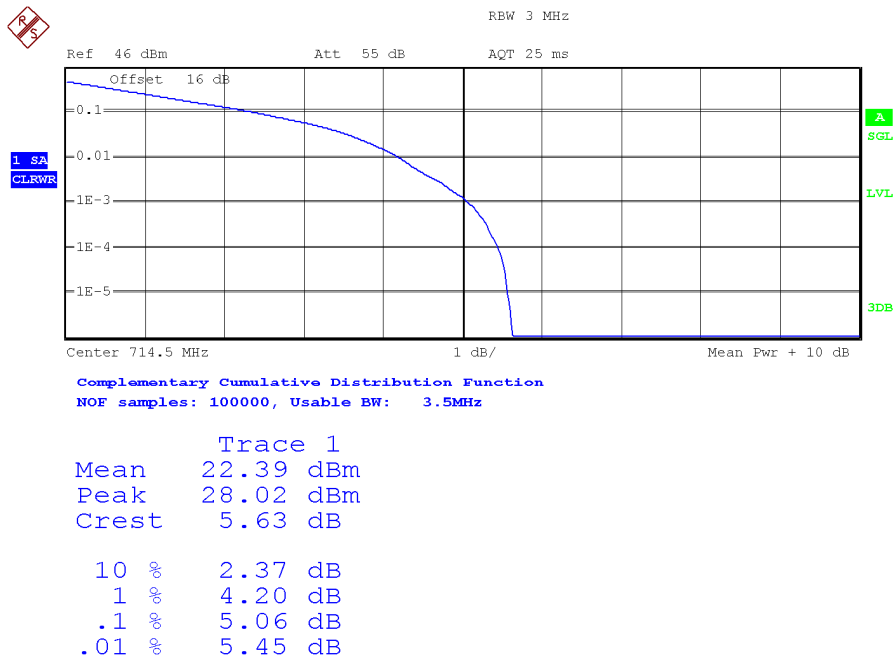
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 15. RB Offset: 0.
Channel Low:



Channel Middle:

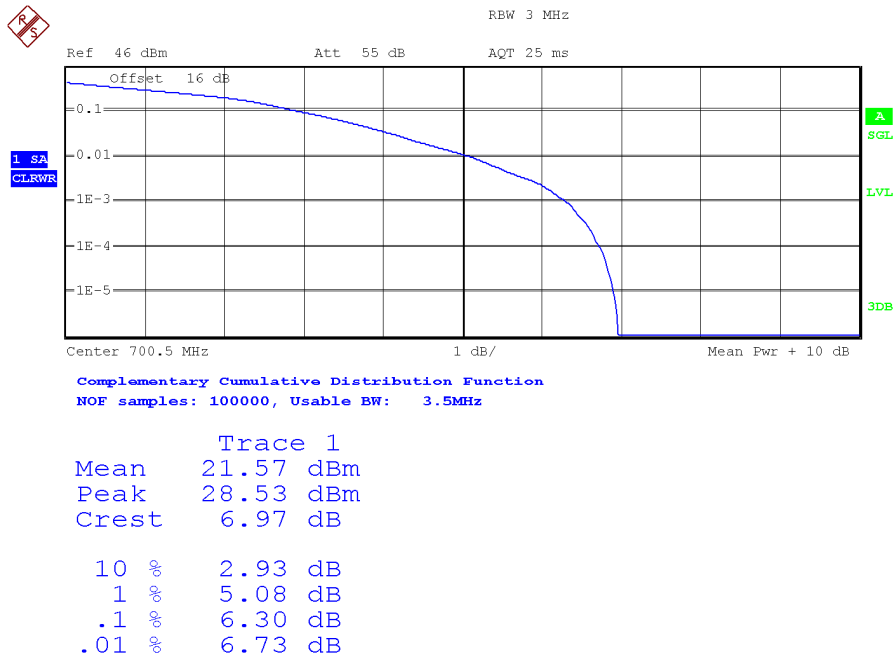


Channel High:

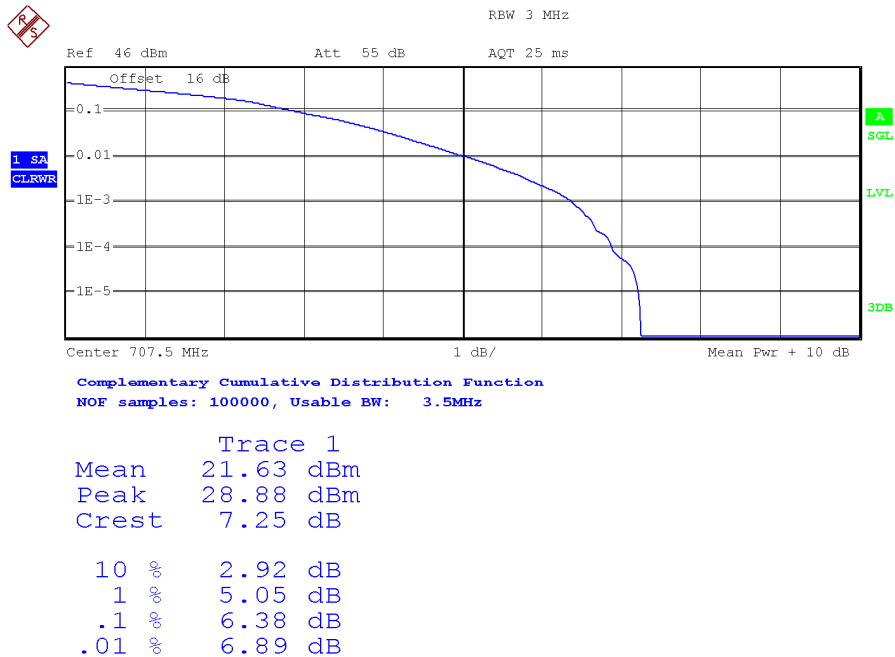


Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

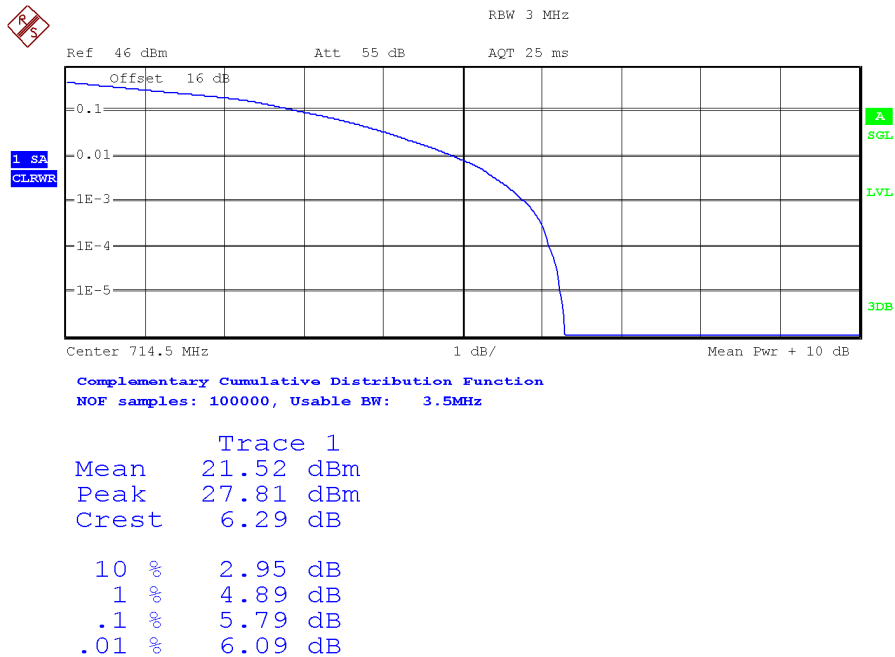
Channel Low:



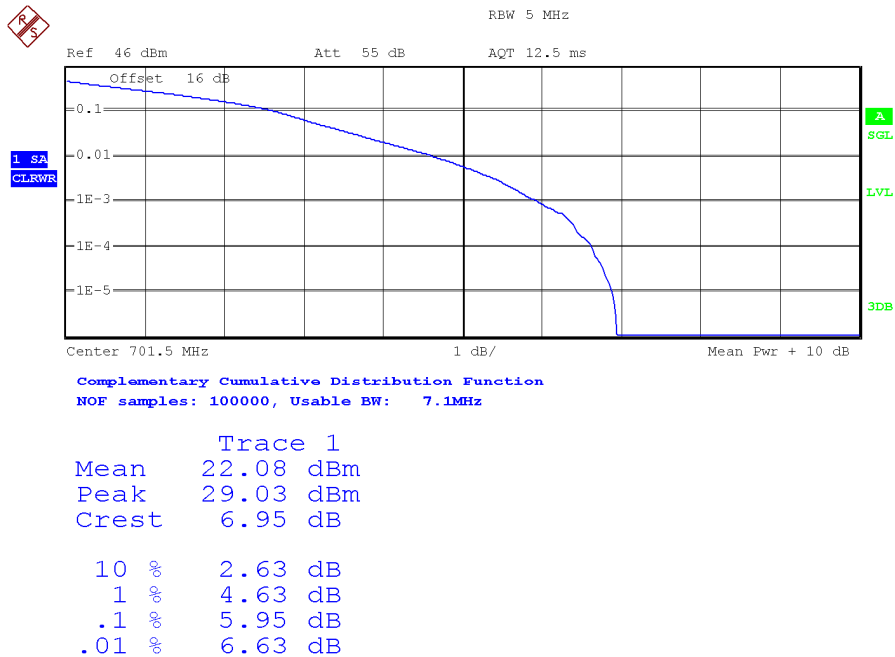
Channel Middle:



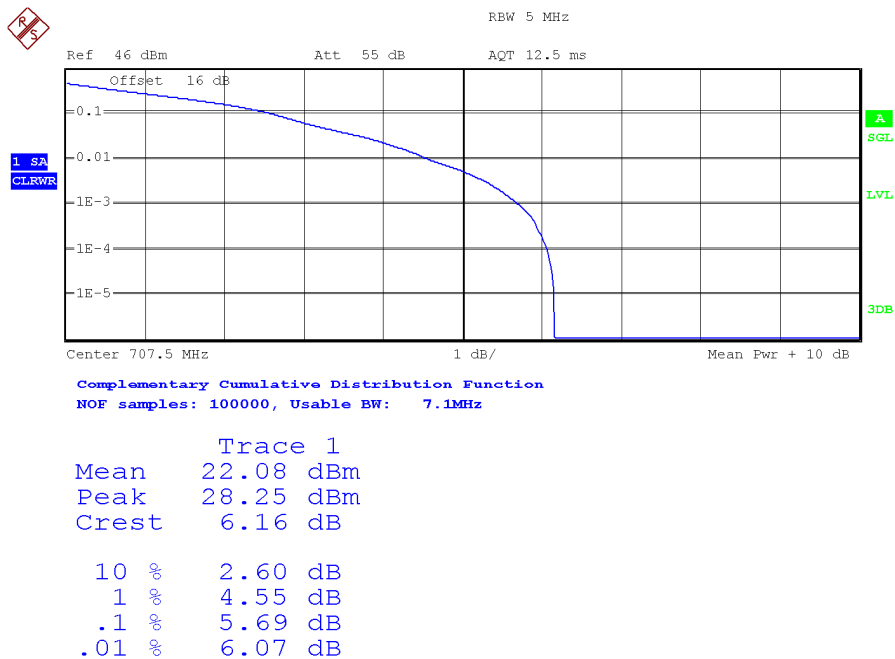
Channel High:



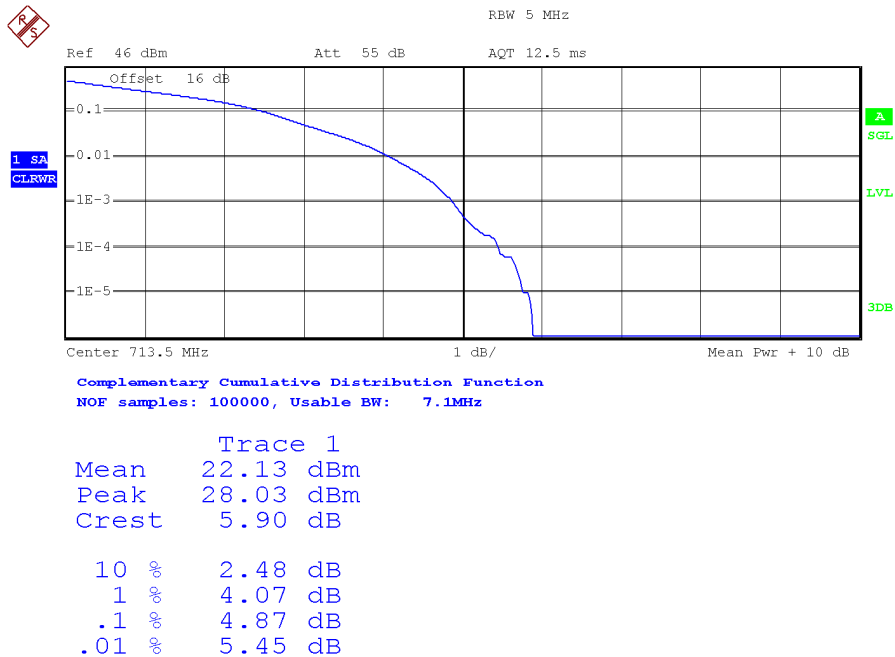
Bandwidth = 5 MHz. Modulation QPSK. RB Size: 25. RB Offset: 0.
Channel Low:



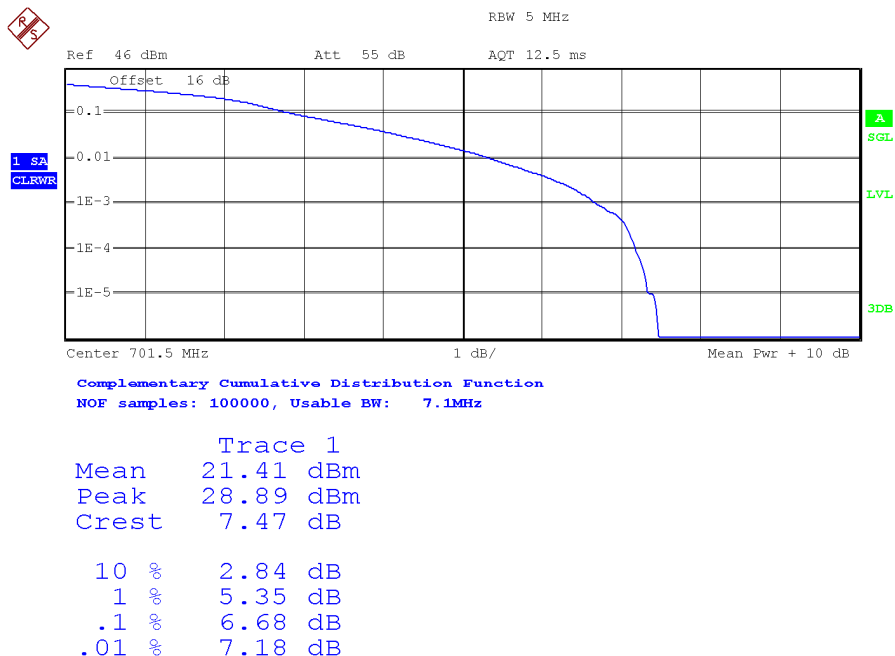
Channel Middle:



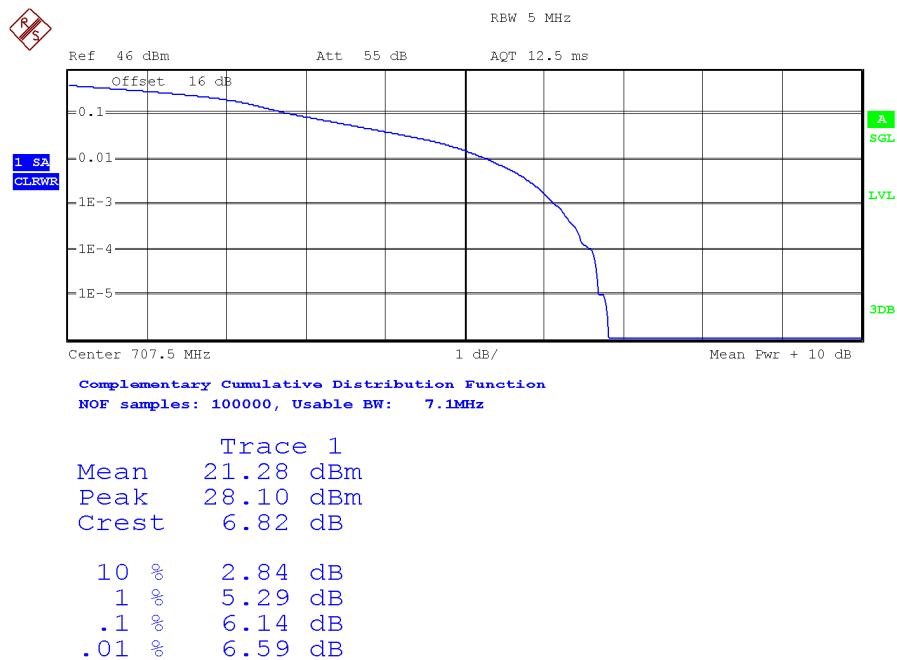
Channel High:



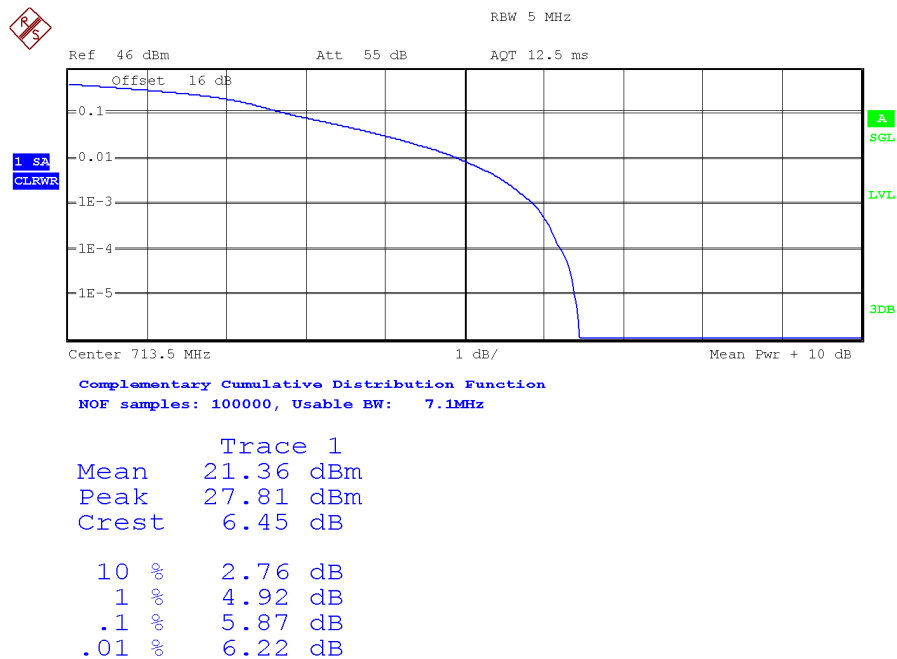
Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.
Channel Low:



Channel Middle:

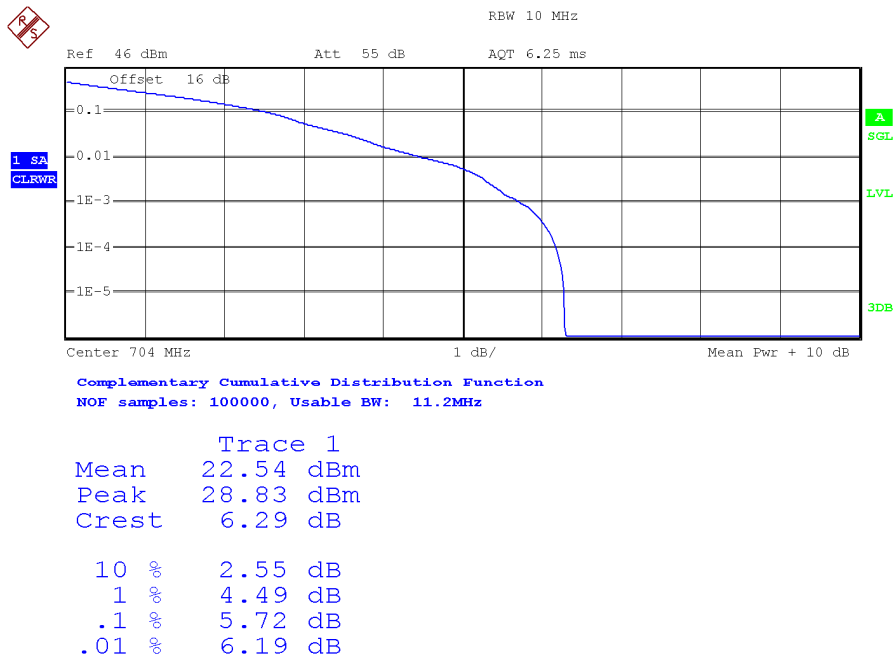


Channel High:

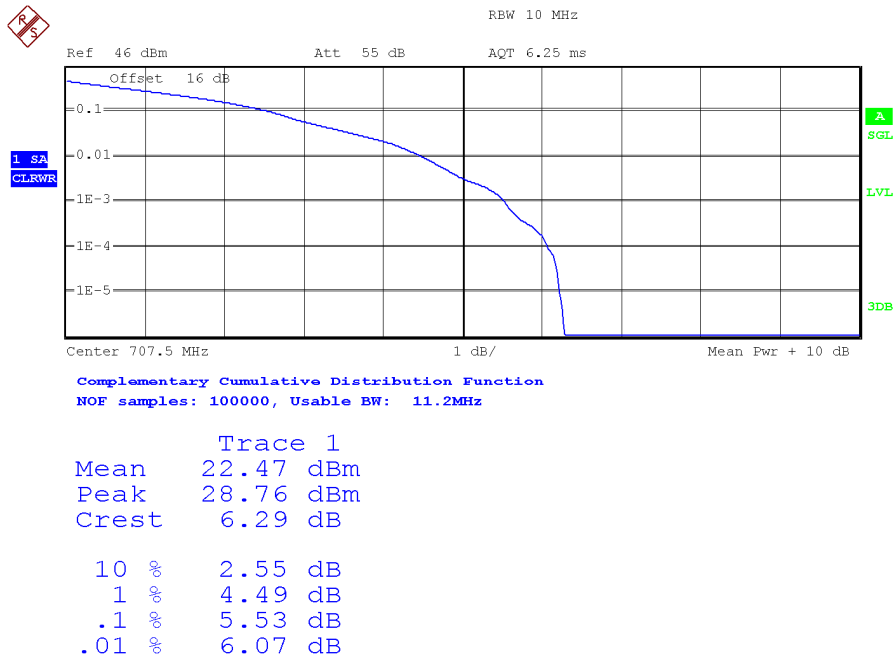


Bandwidth = 10 MHz. Modulation QPSK. RB Size: 50. RB Offset: 0.

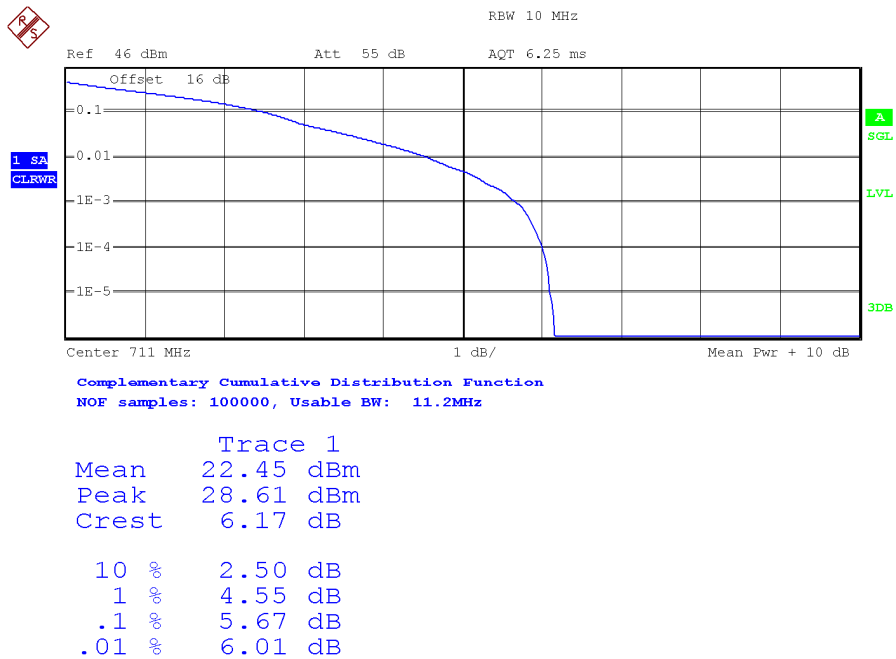
Channel Low:



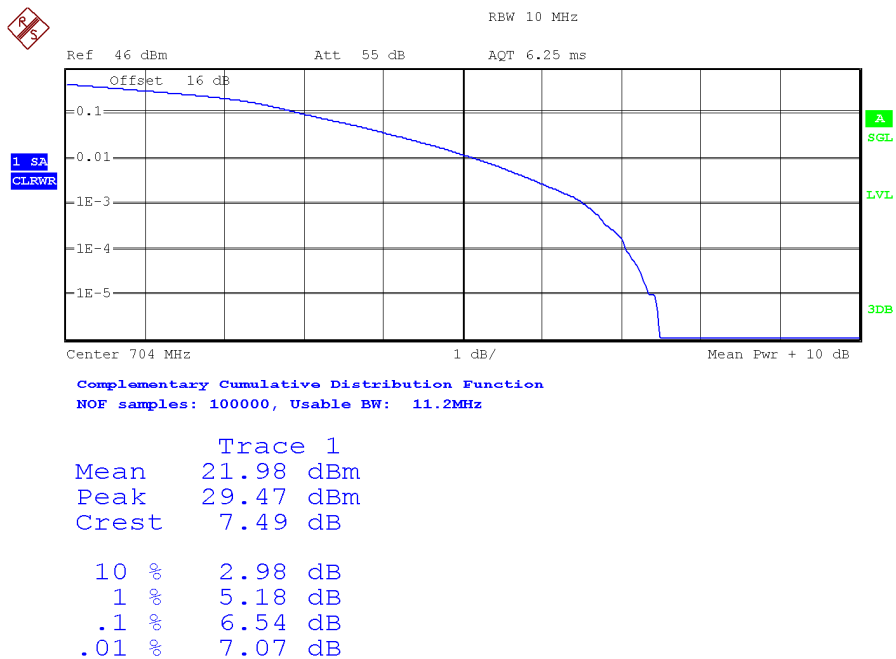
Channel Middle:



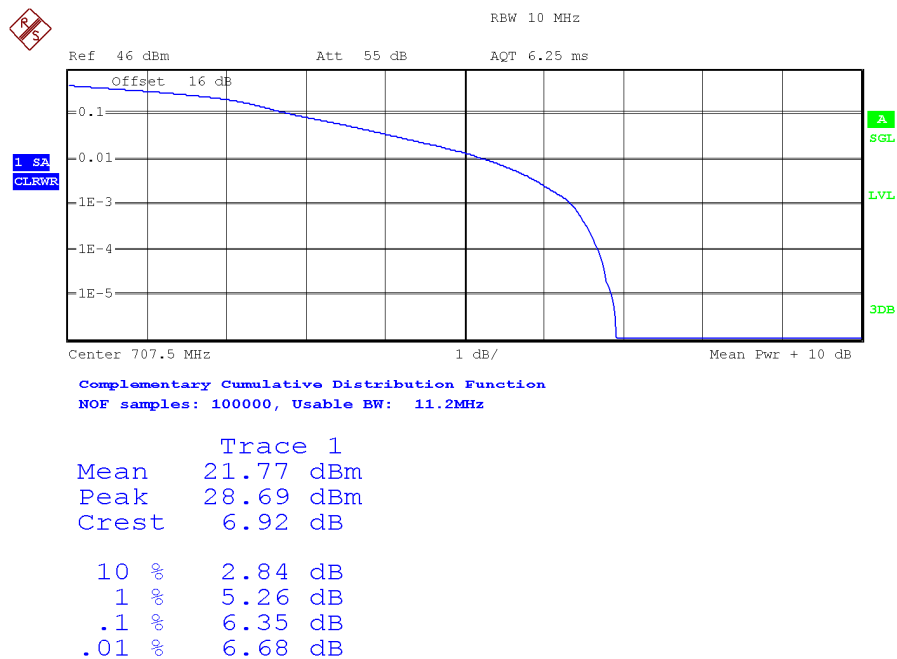
Channel High:



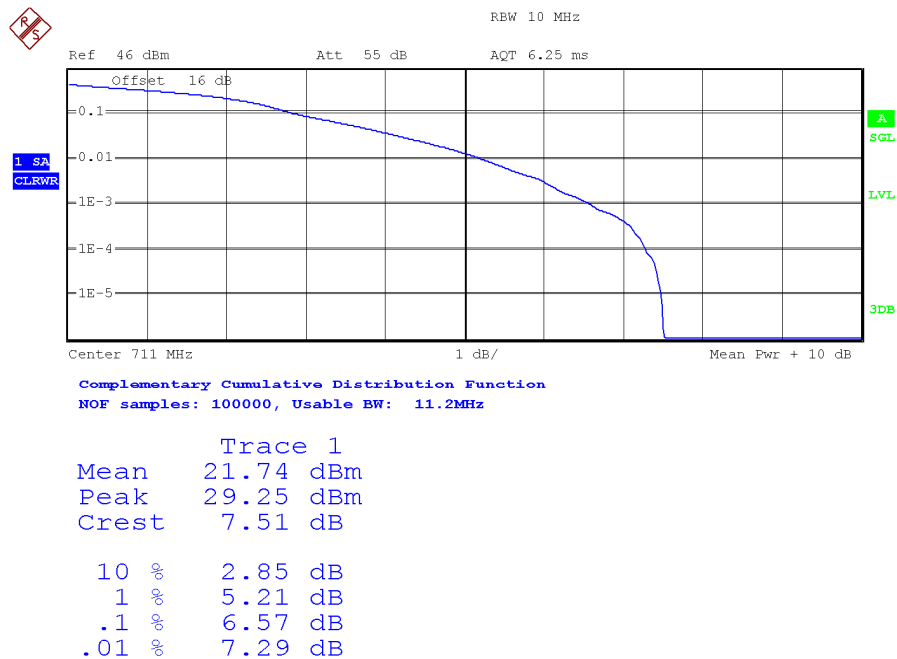
Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.
Channel Low:



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)	<±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)	<±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)	<±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)	<±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)	<±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)	<±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

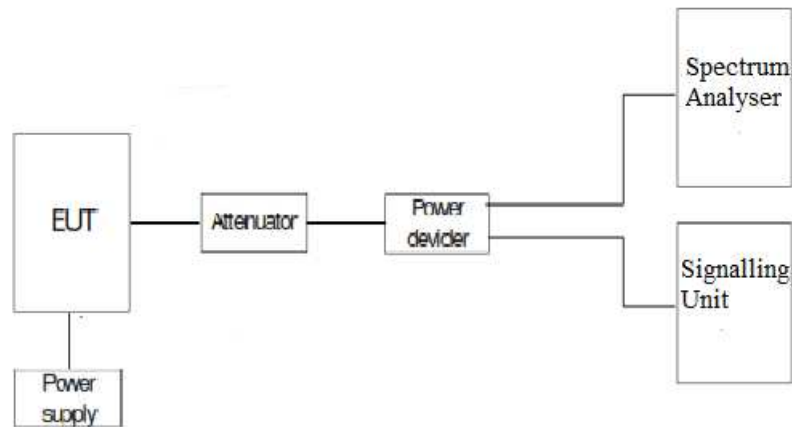
FCC §2.1047.

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).

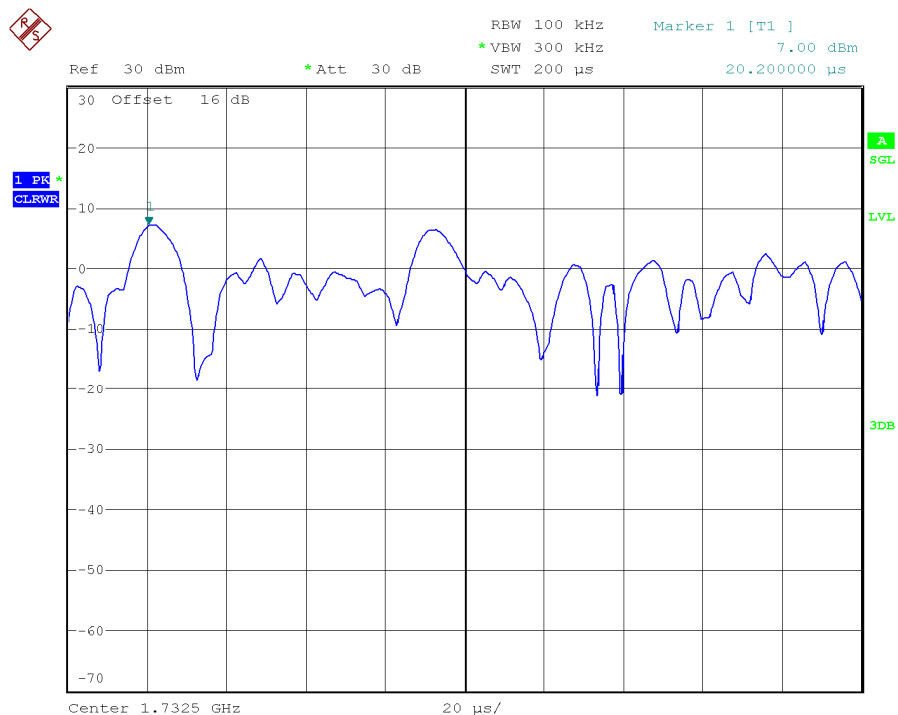
TEST SETUP



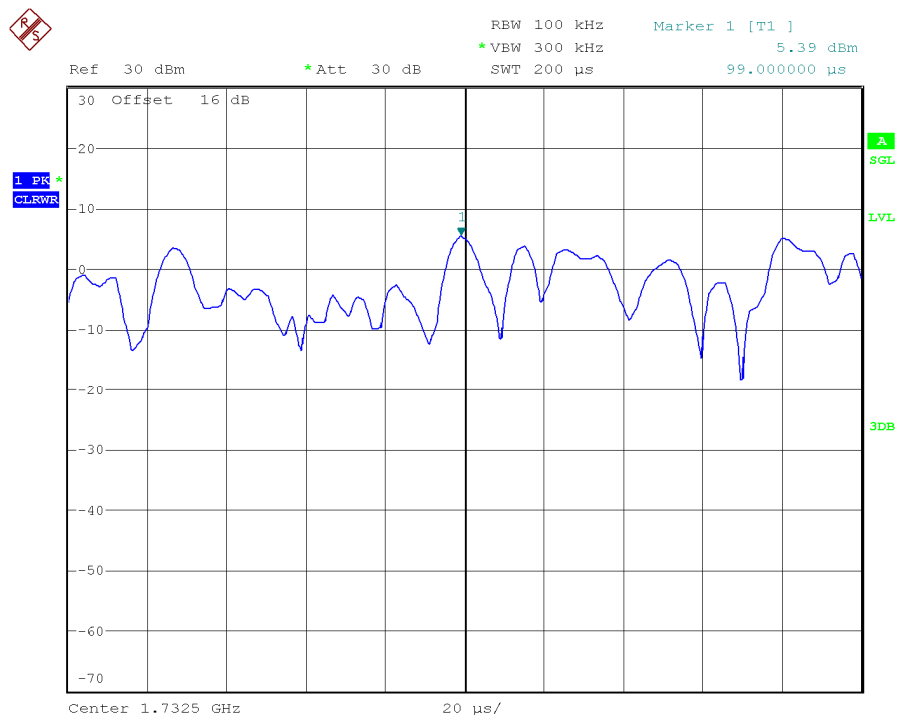
RESULTS

The following plots show the modulation schemes in the EUT.

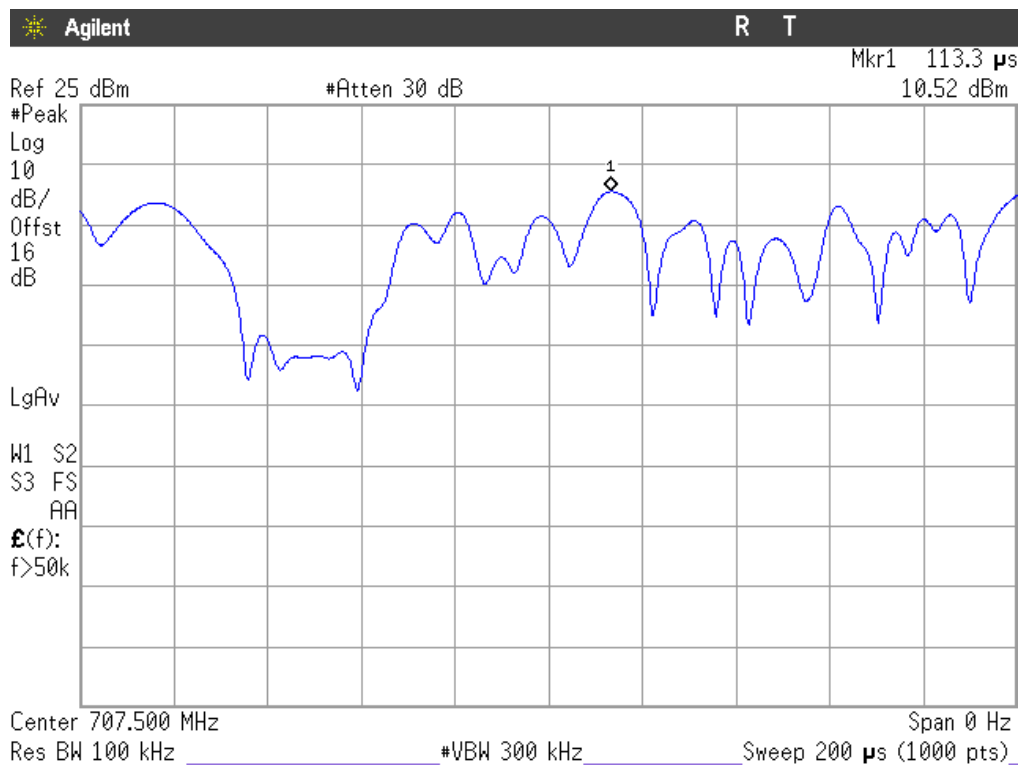
LTE MODULATION. QPSK. Band IV



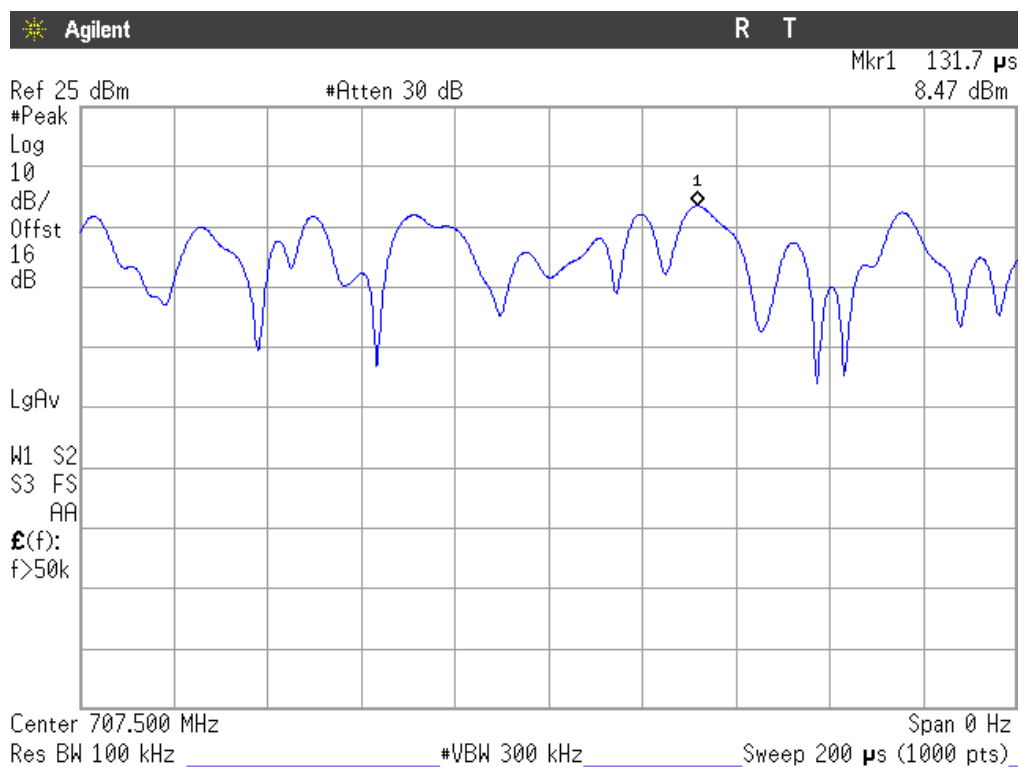
LTE MODULATION. 16QAM. Band IV



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.

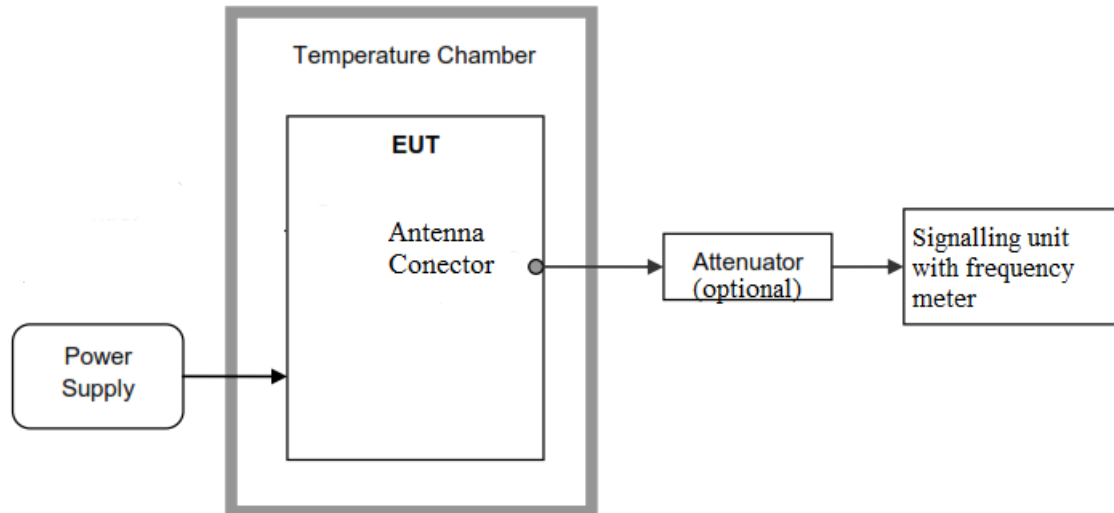
For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.

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.

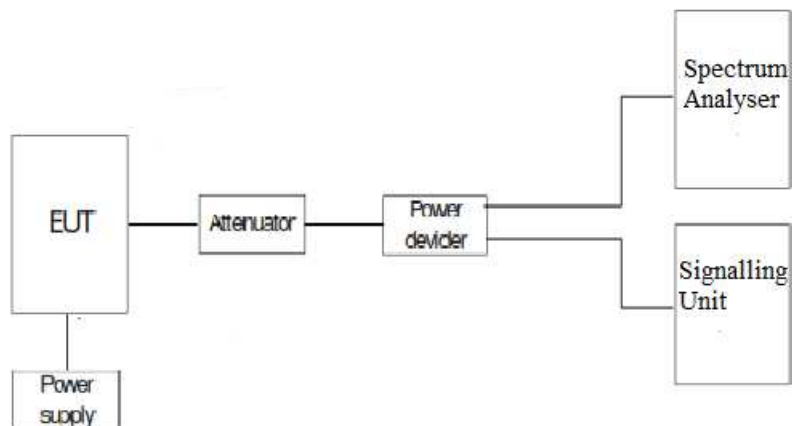
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

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)
V _{max}	4.37	1.6	0.002261484
V _{min}	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)
V _{max}	4.37	0.3	0.000424028
V _{min}	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

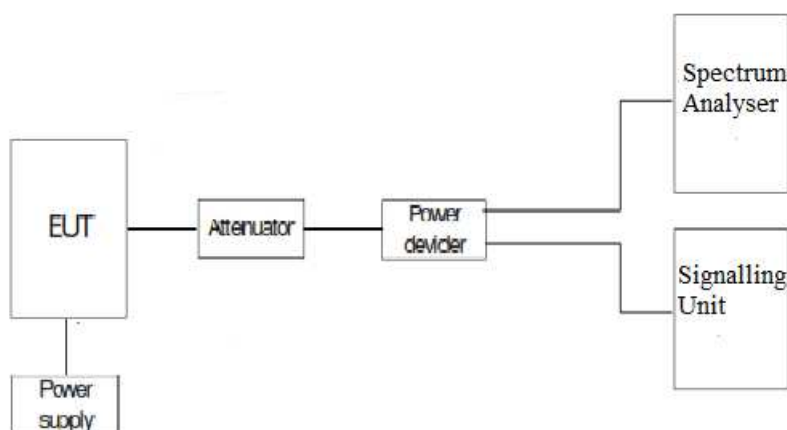
SPECIFICATION

§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)

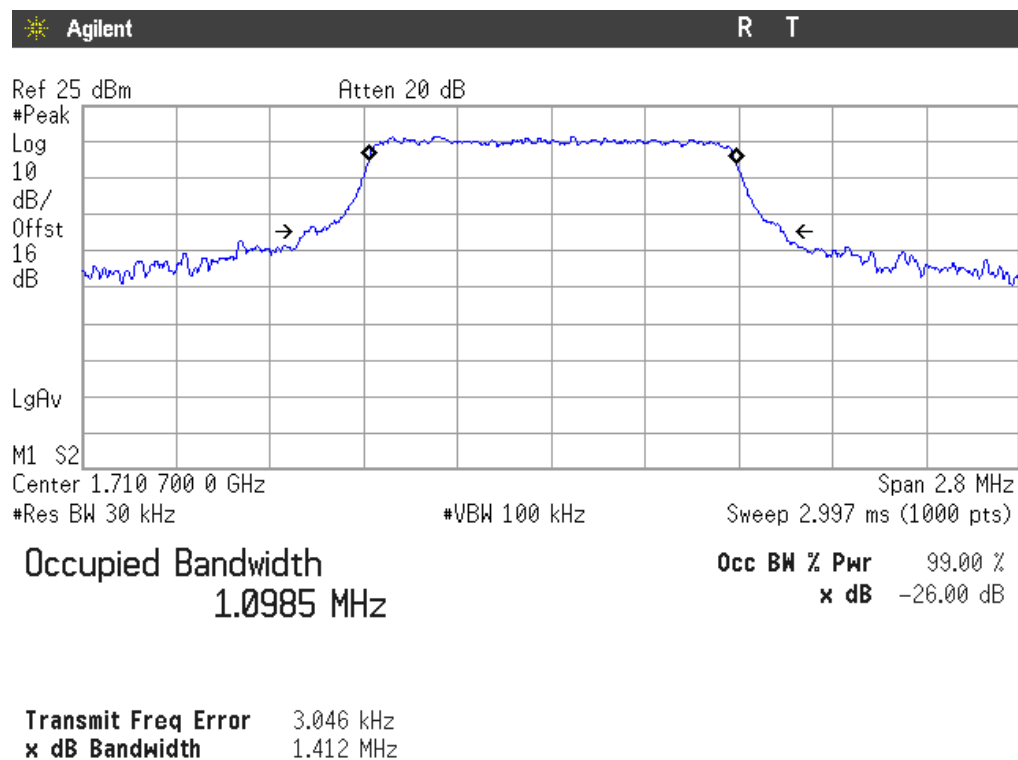
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9054.60	9088.60	9034.50
-26 dBc bandwidth (kHz)	10419.00	10535.00	10448.00
Measurement uncertainty (kHz)	<±33.33		

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

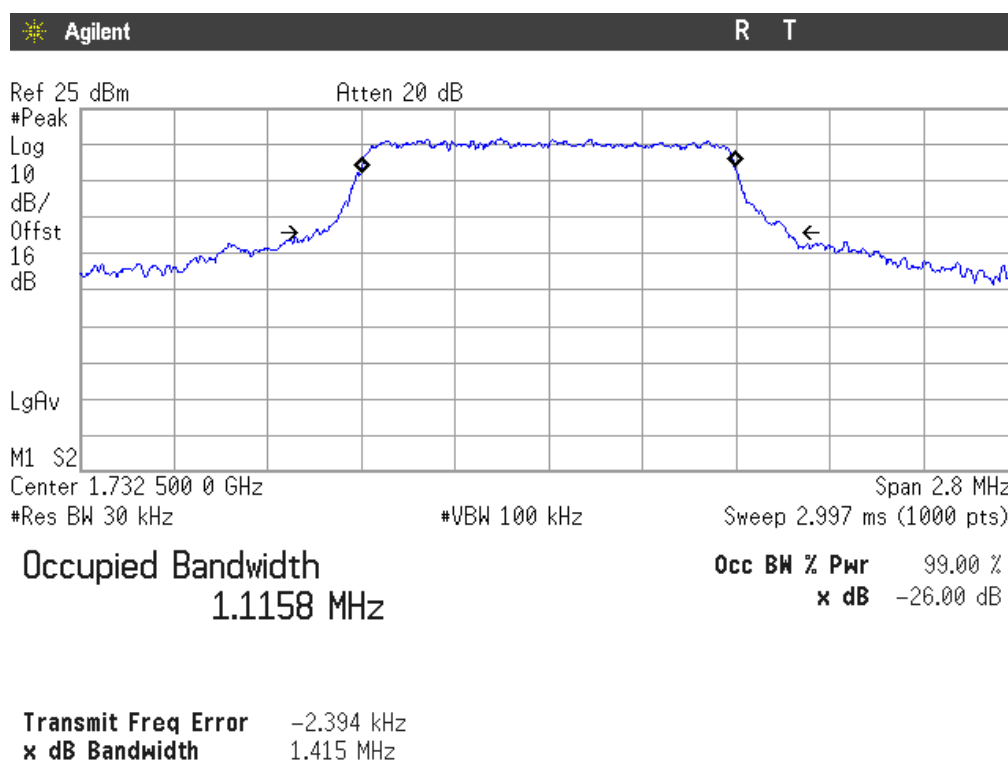
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9051.90	9093.80	9042.20
-26 dBc bandwidth (kHz)	10322.00	10471.00	10162.00
Measurement uncertainty (kHz)	<±33.33		

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

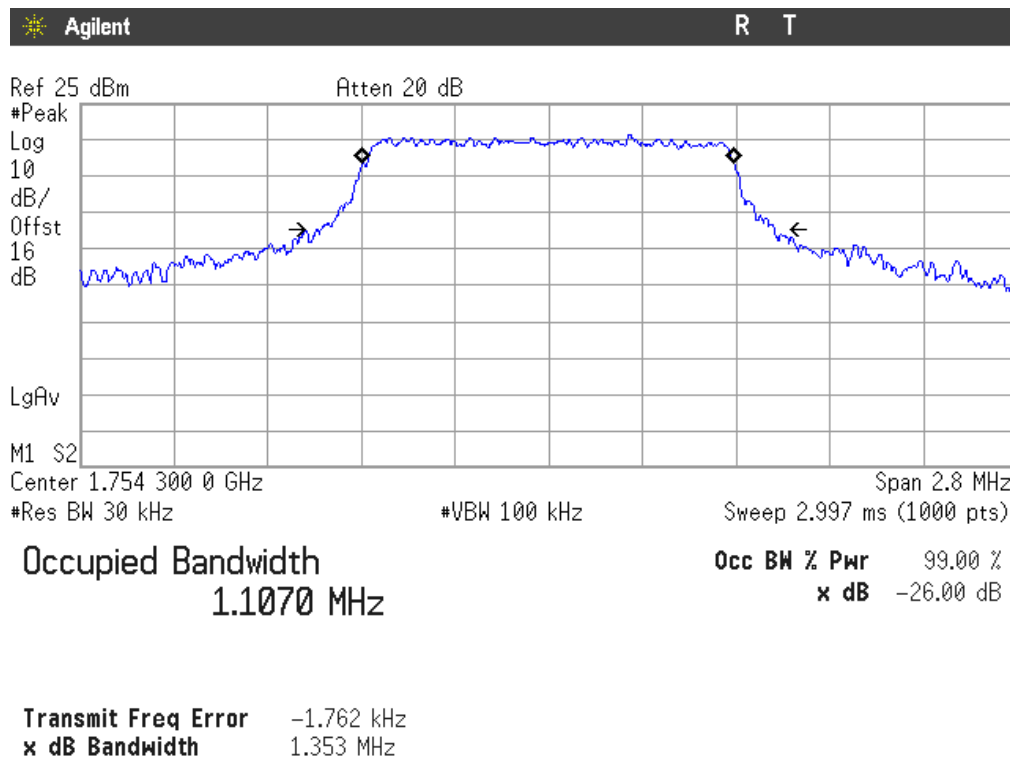
Lowest Channel



Middle Channel

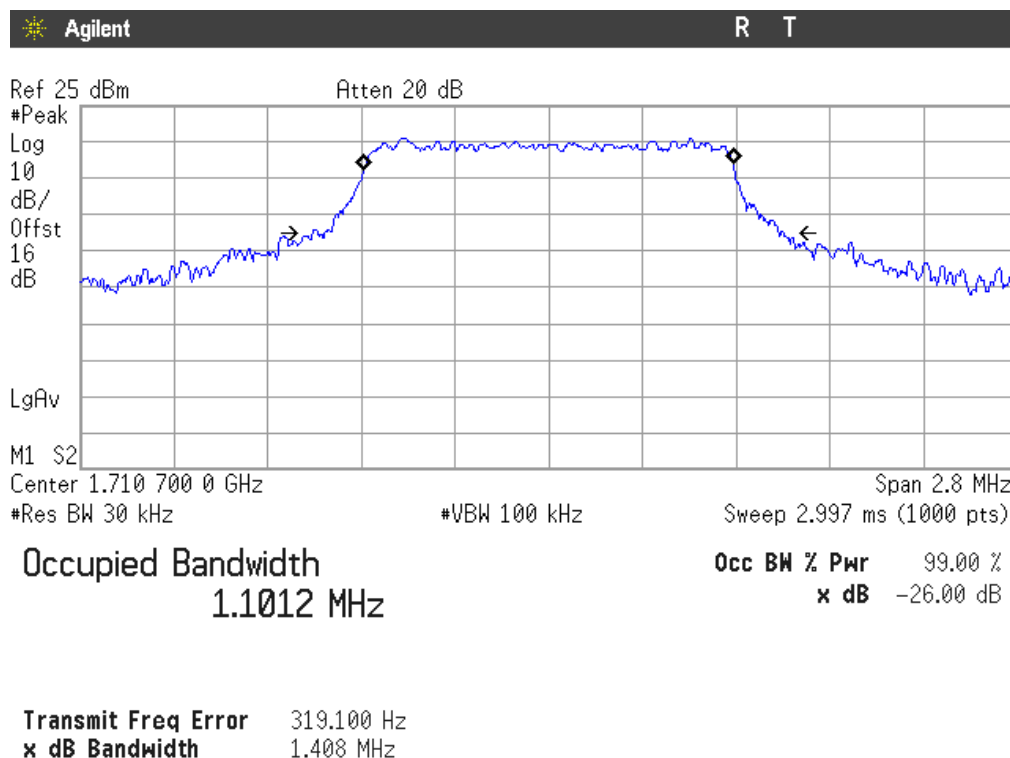


Highest Channel

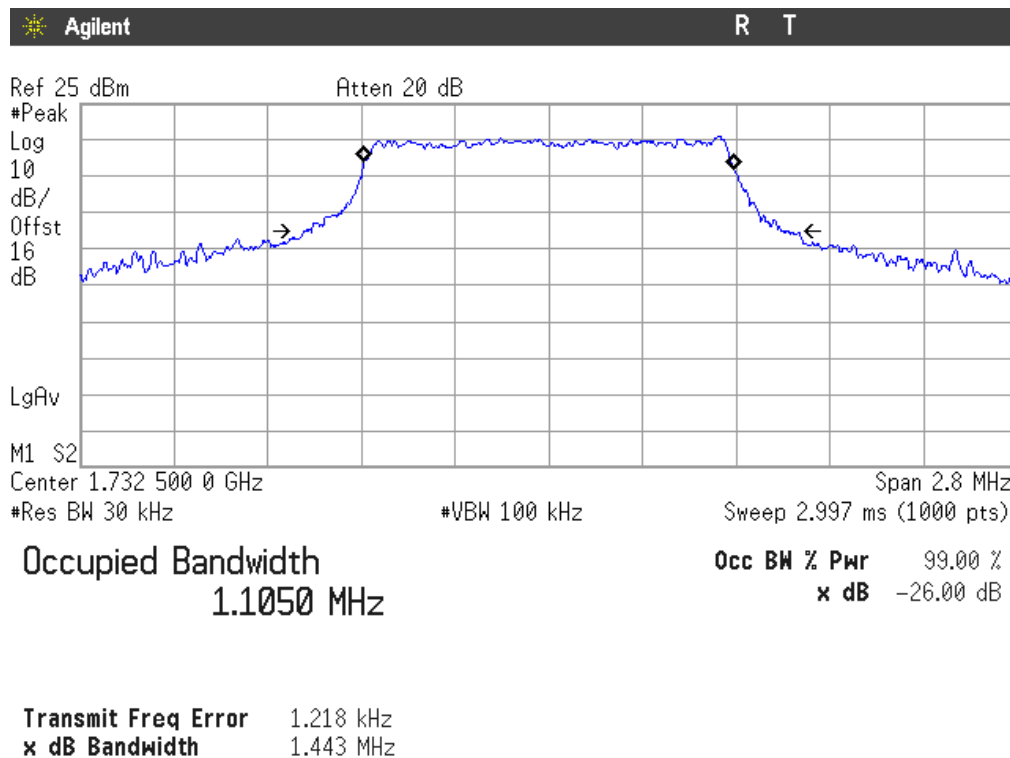


LTE 16QAM MODULATION. BW = 1.4 MHz (Band IV)

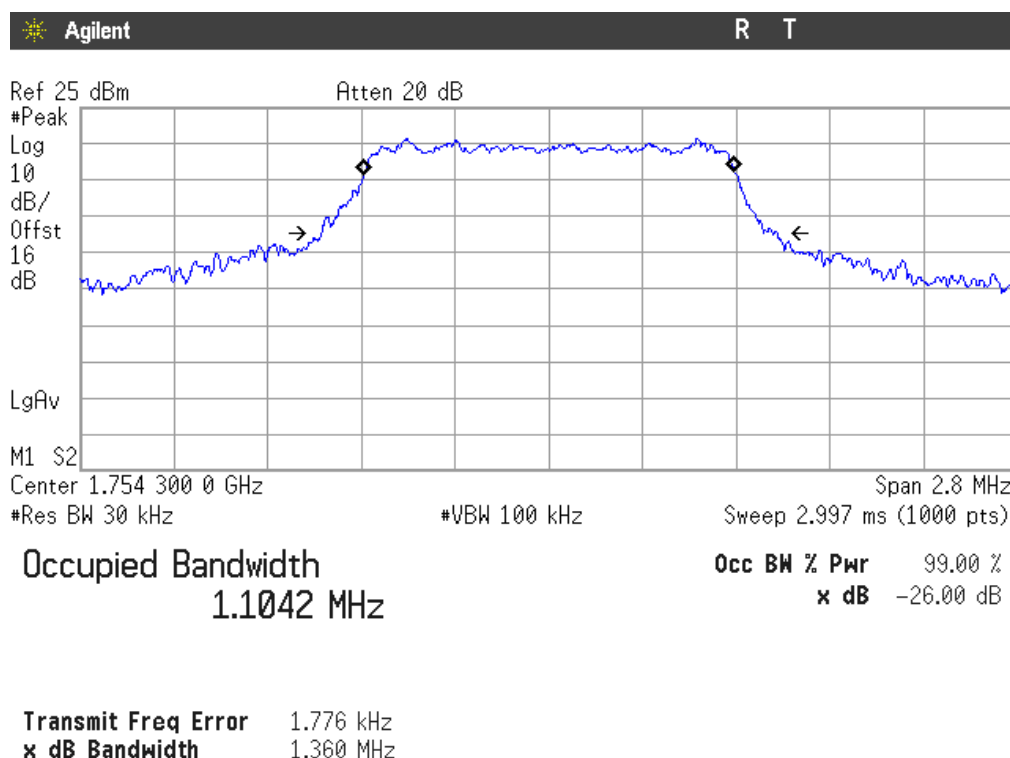
Lowest Channel



Middle Channel

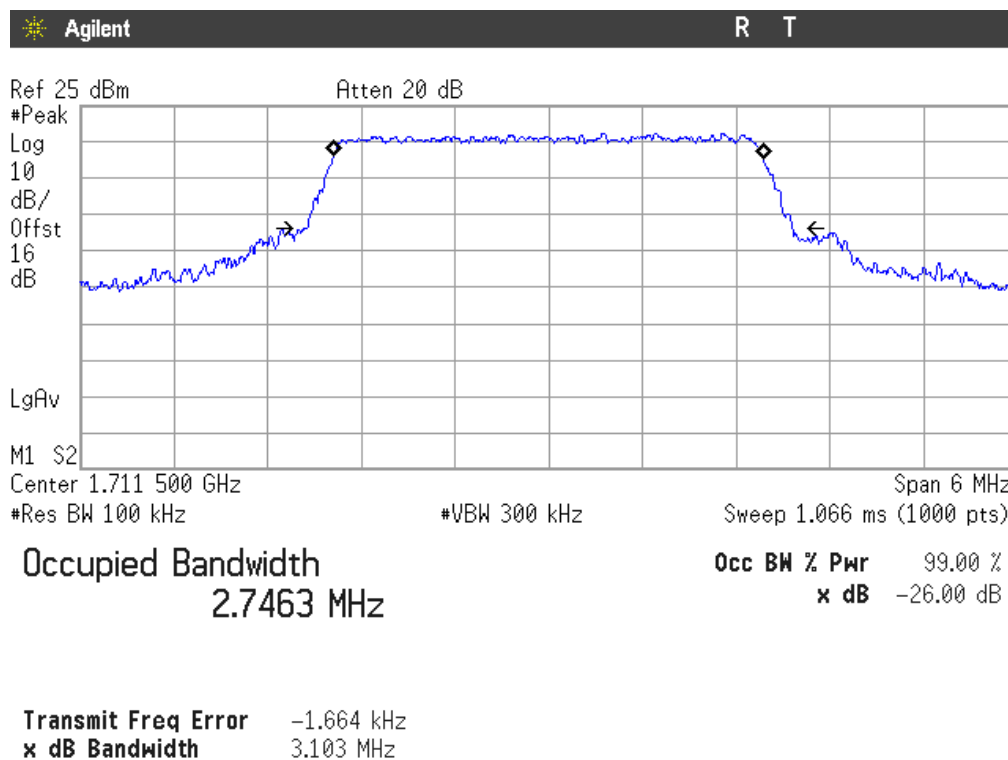


Highest Channel

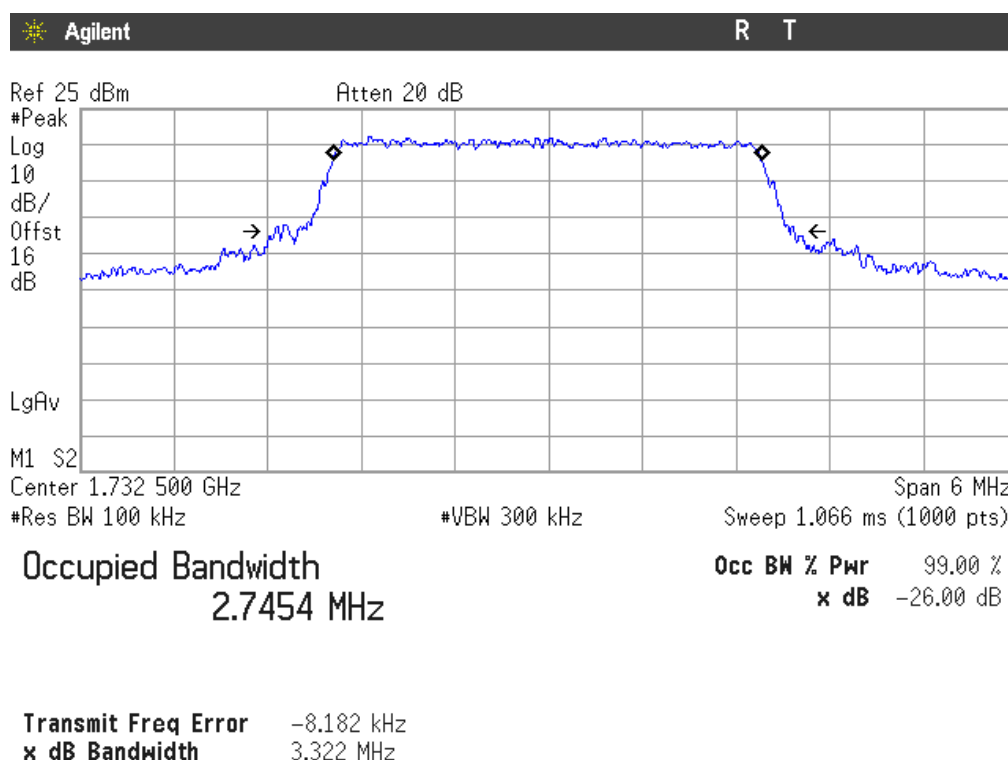


LTE QPSK MODULATION. BW = 3 MHz (Band IV)

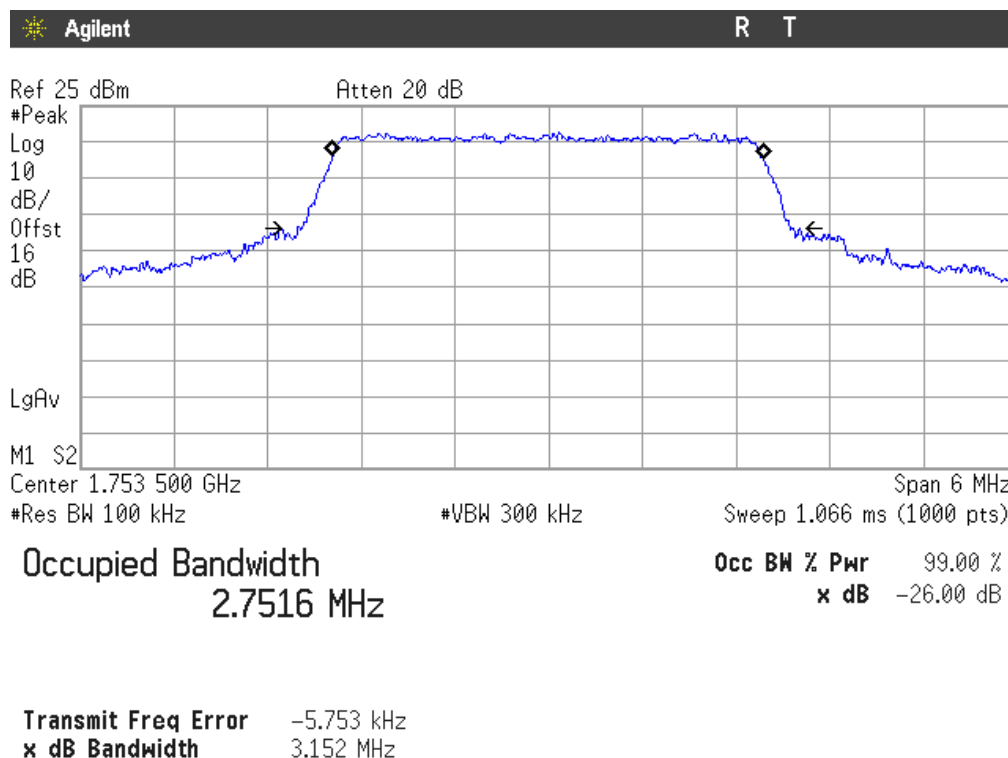
Lowest Channel



Middle Channel

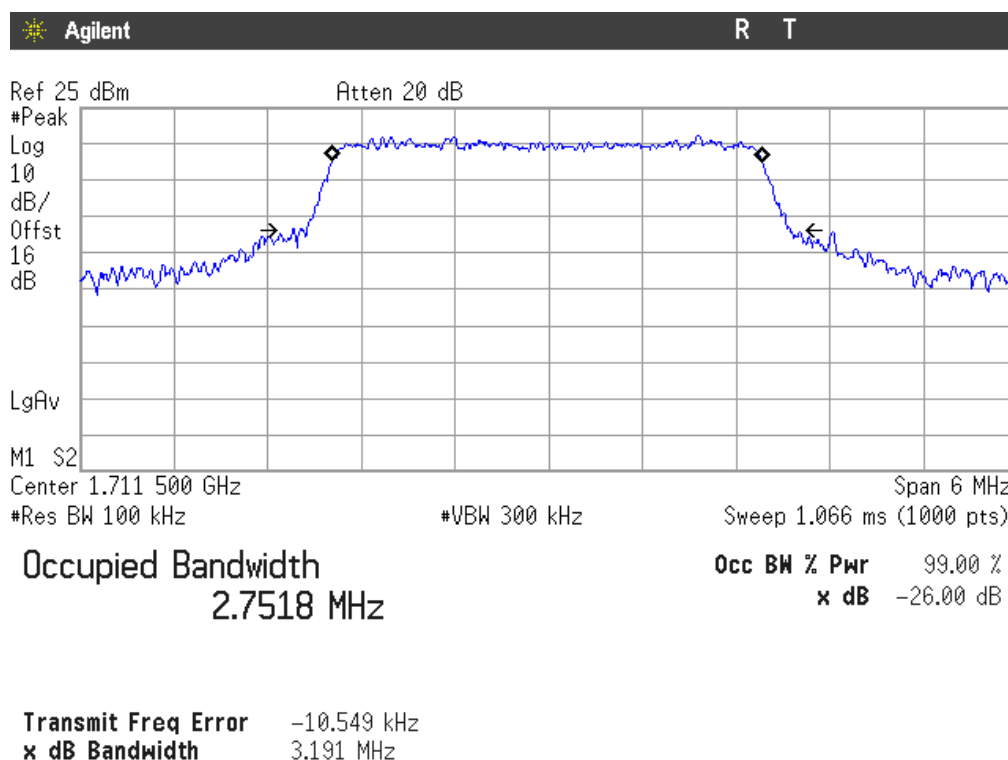


Highest Channel

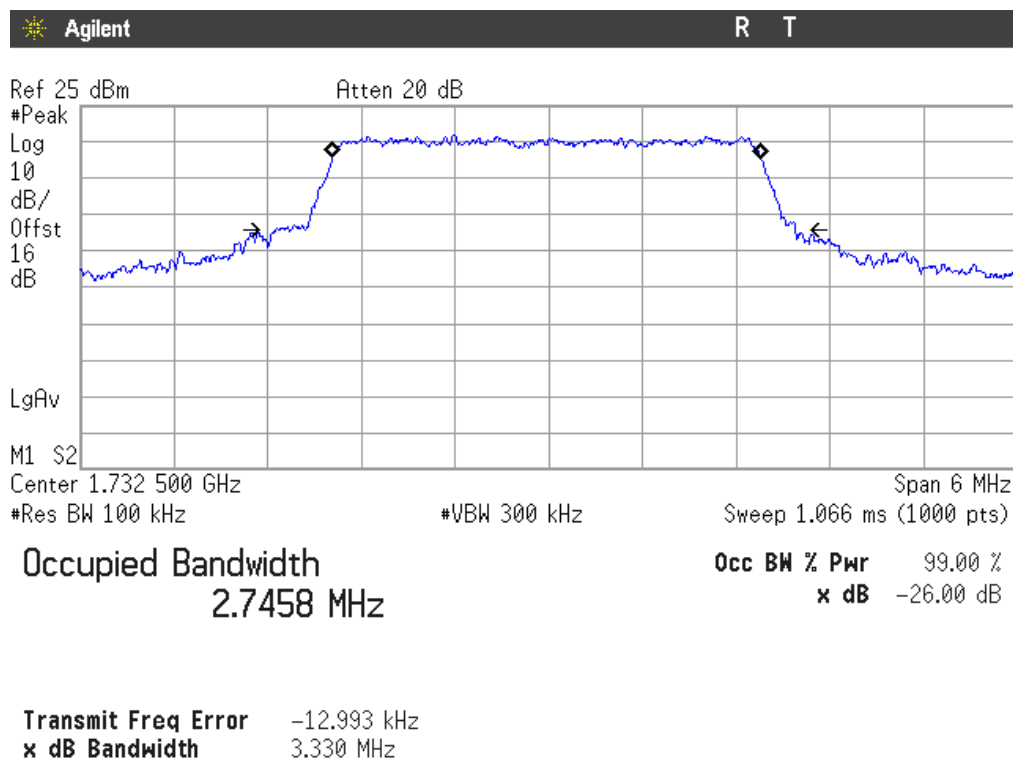


LTE 16QAM MODULATION. BW = 3 MHz (Band IV)

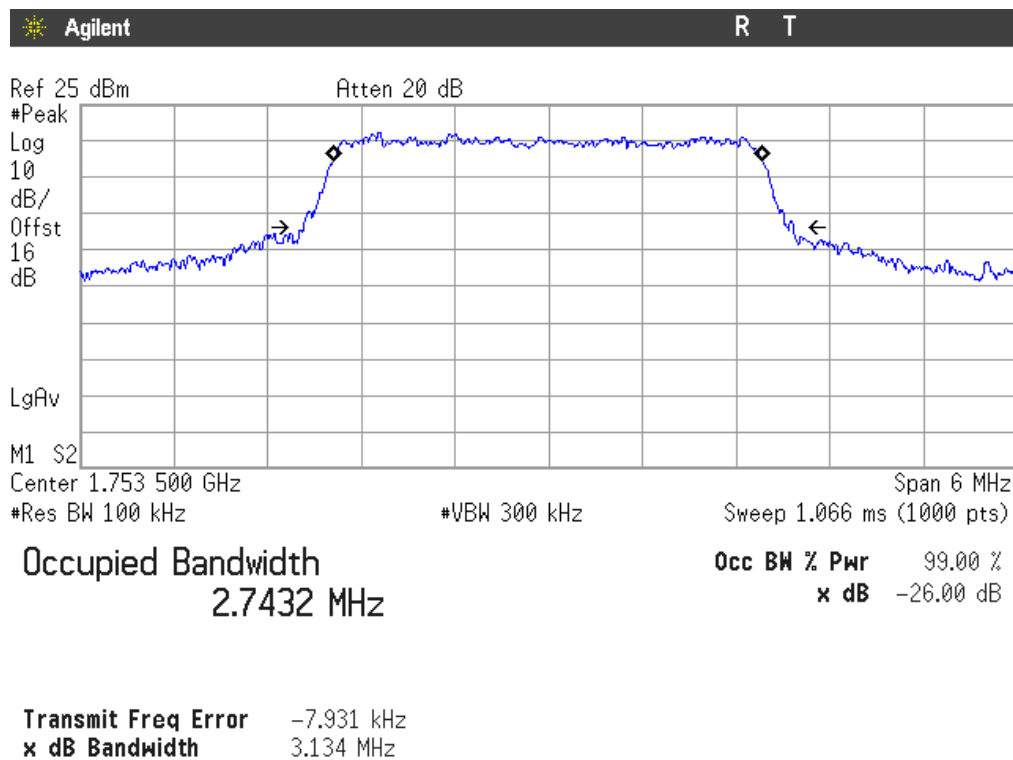
Lowest Channel



Middle Channel

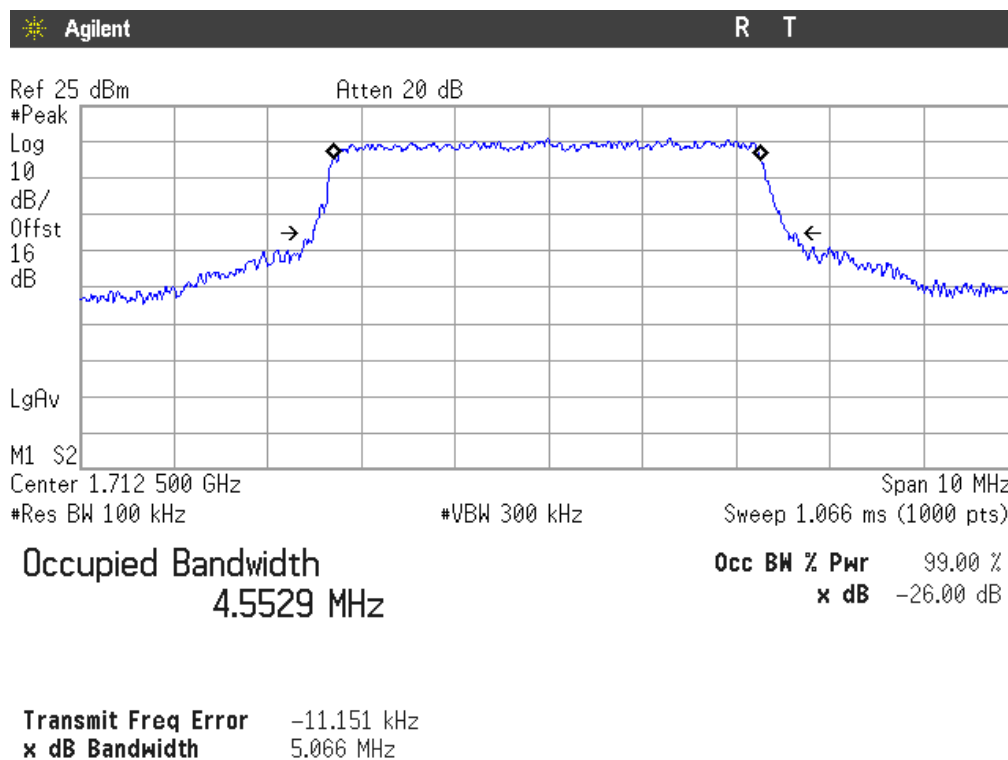


Highest Channel

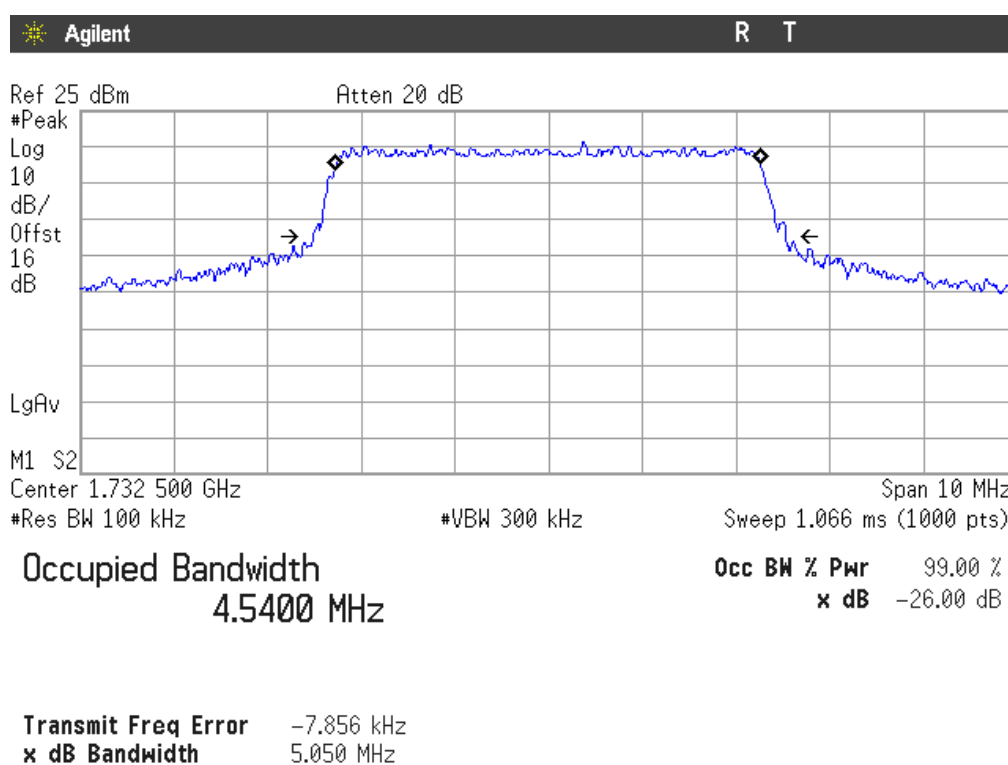


LTE QPSK MODULATION. BW = 5 MHz (Band IV)

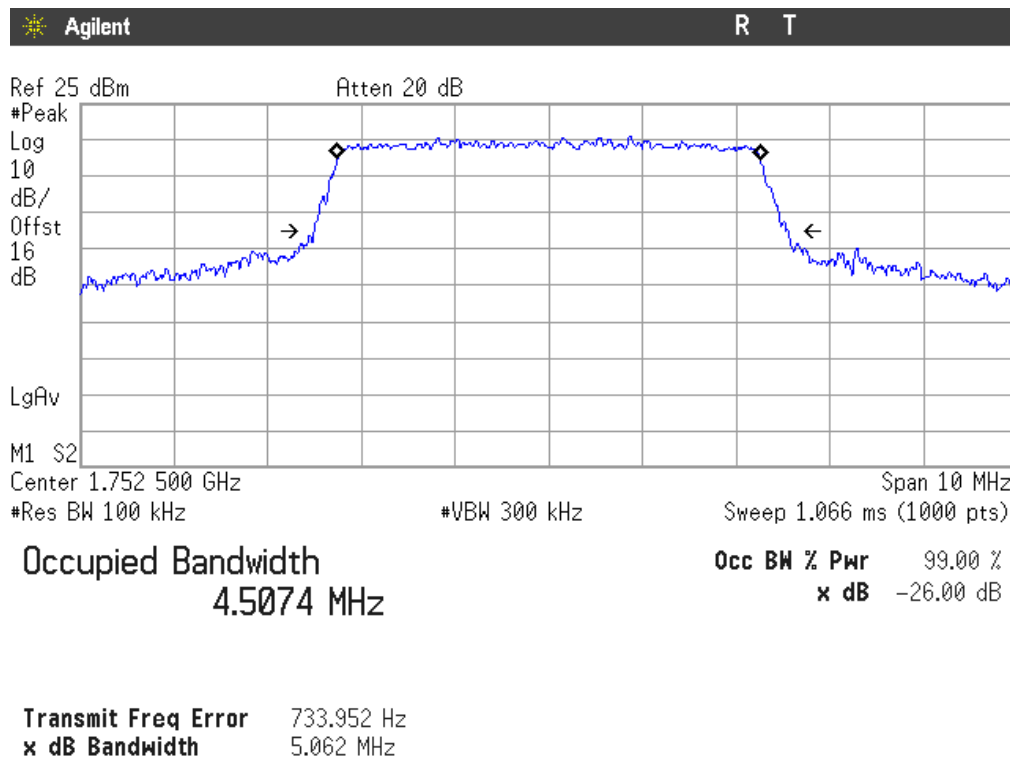
Lowest Channel



Middle Channel

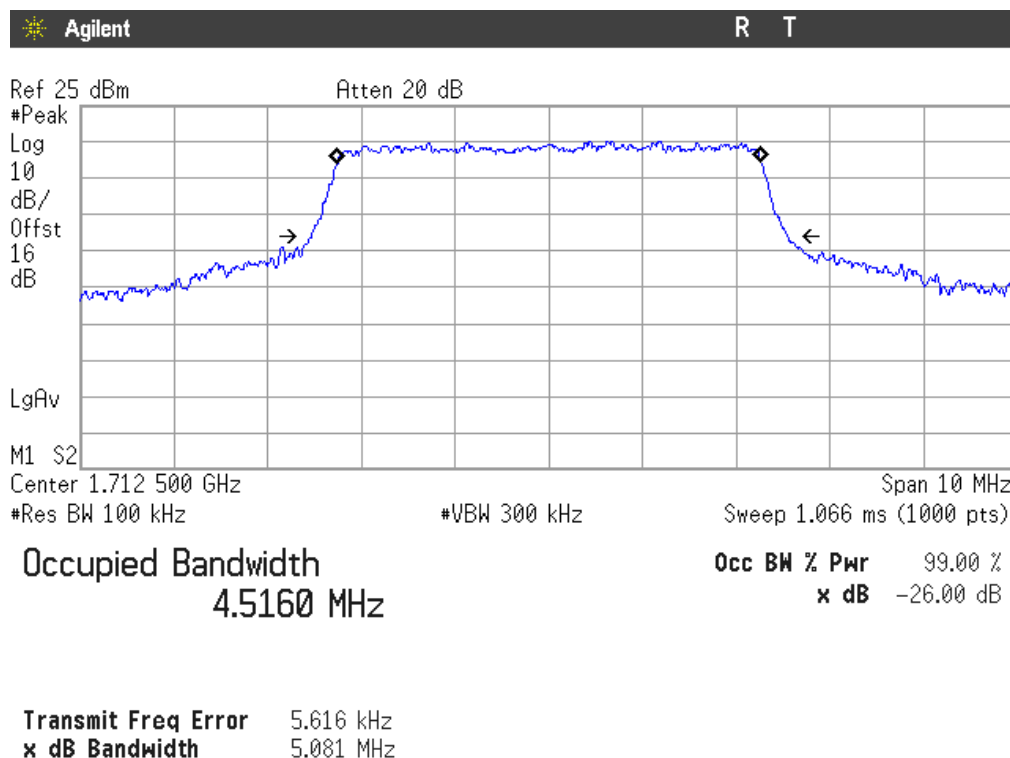


Highest Channel

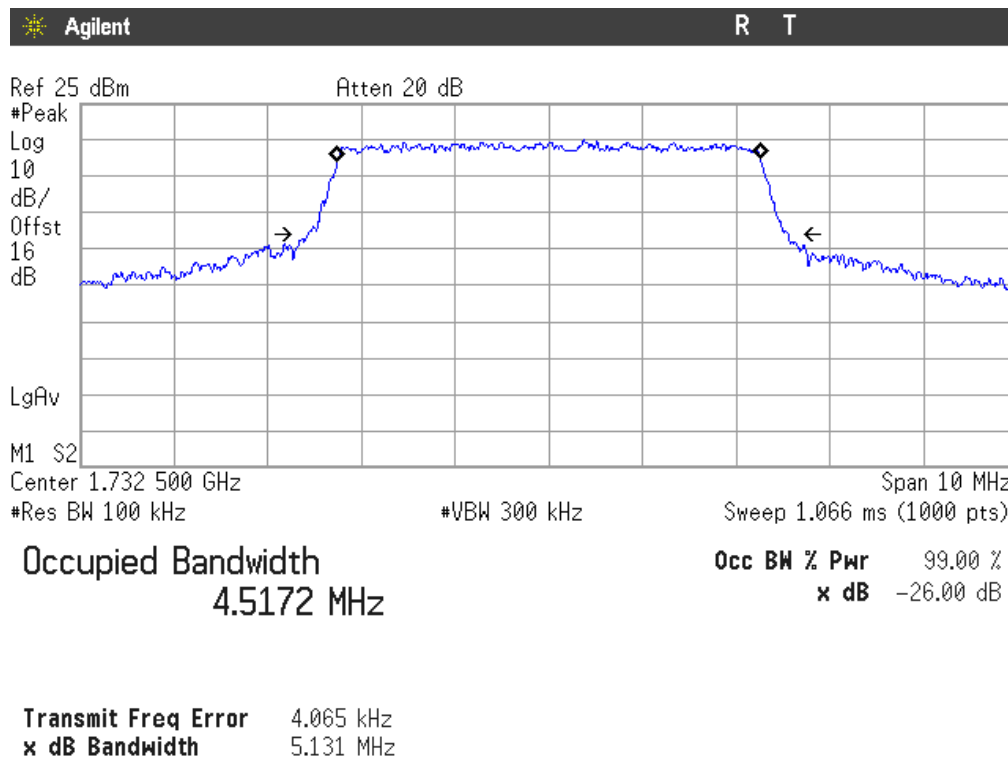


LTE 16QAM MODULATION. BW = 5 MHz (Band IV)

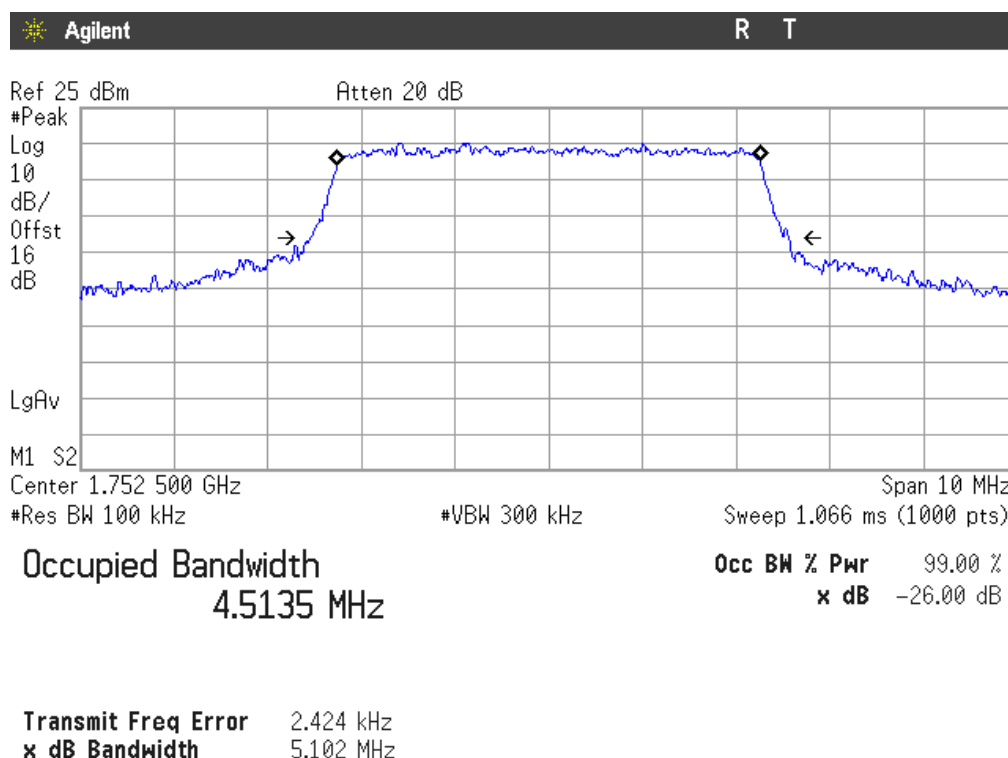
Lowest Channel



Middle Channel

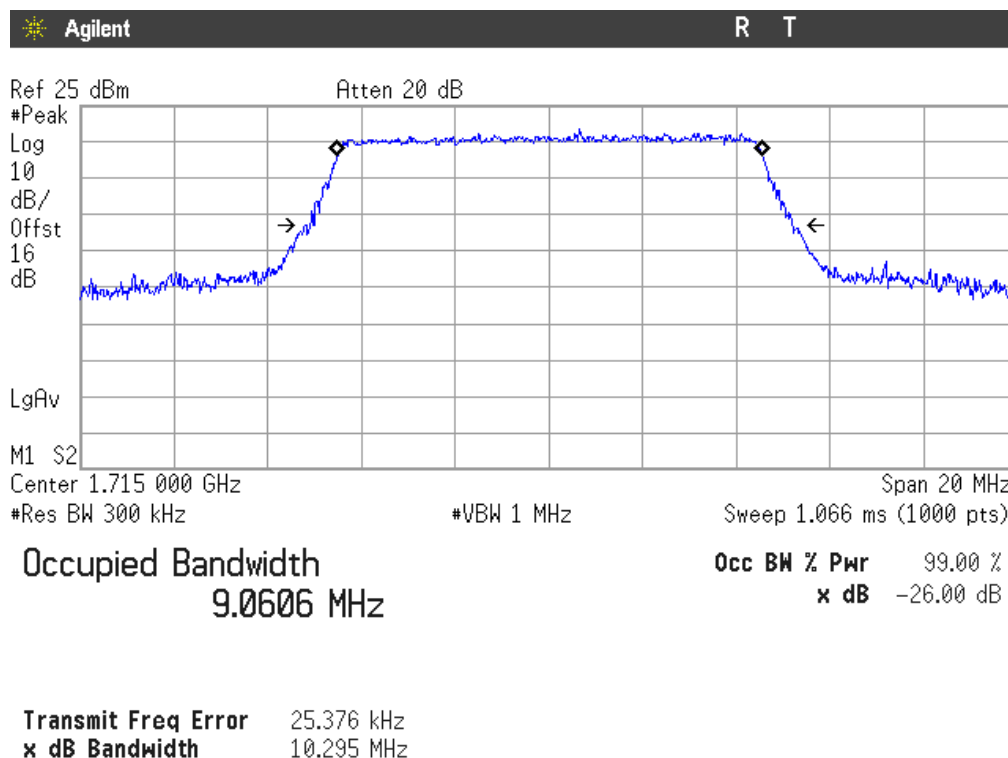


Highest Channel

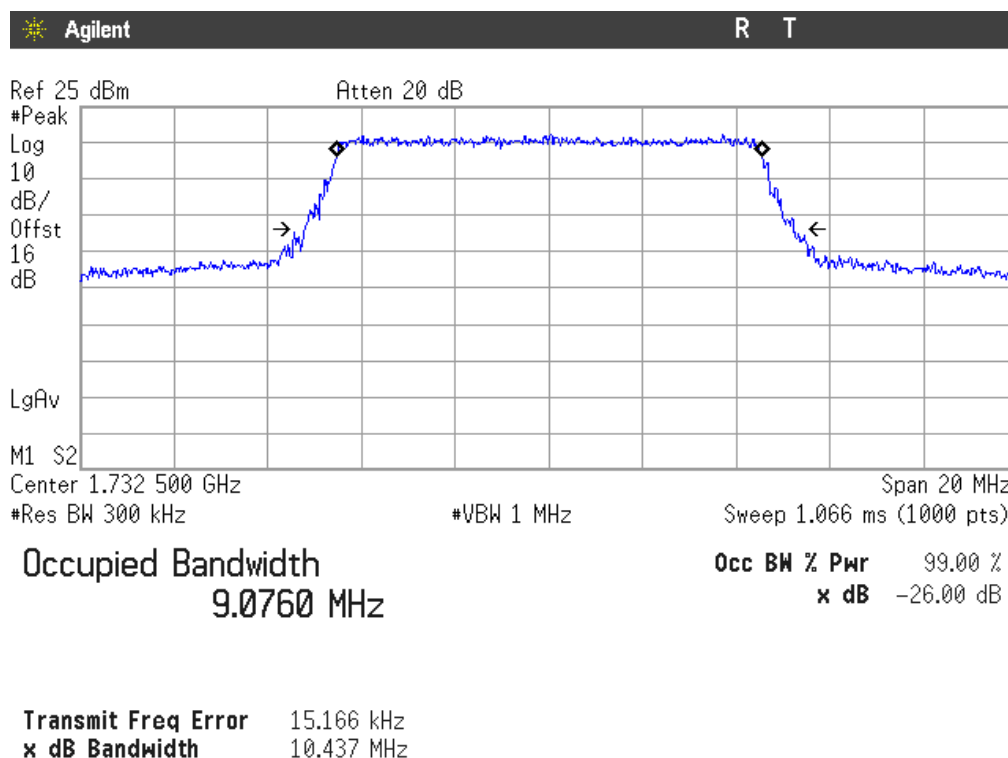


LTE QPSK MODULATION. BW = 10 MHz (Band IV)

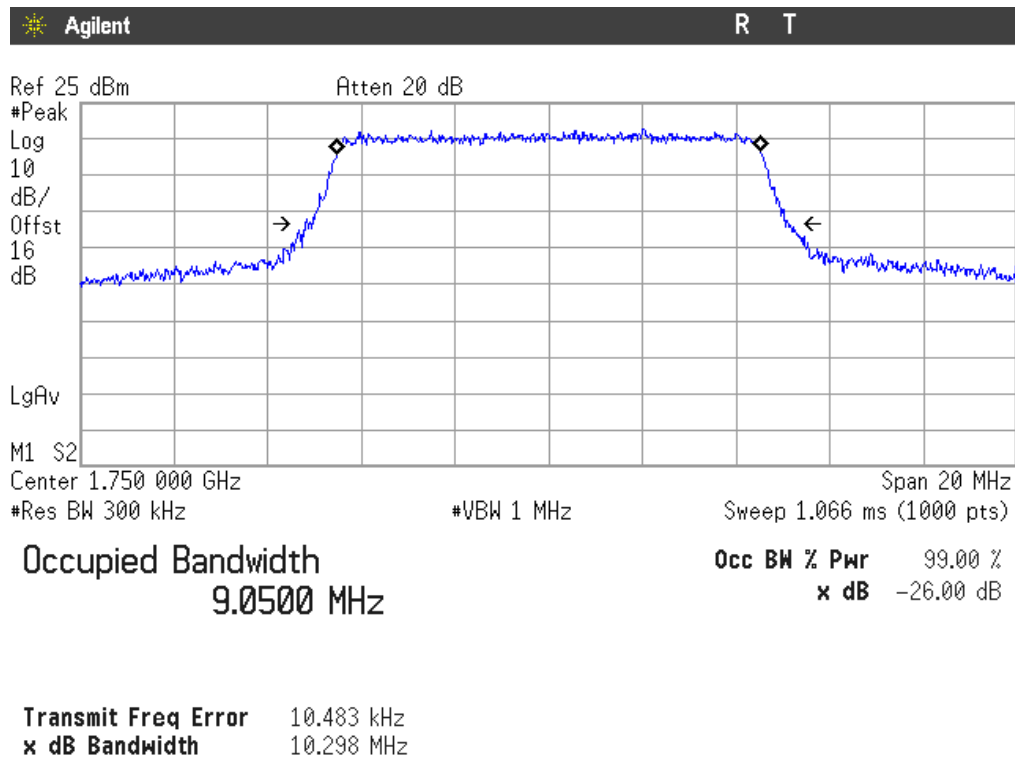
Lowest Channel



Middle Channel

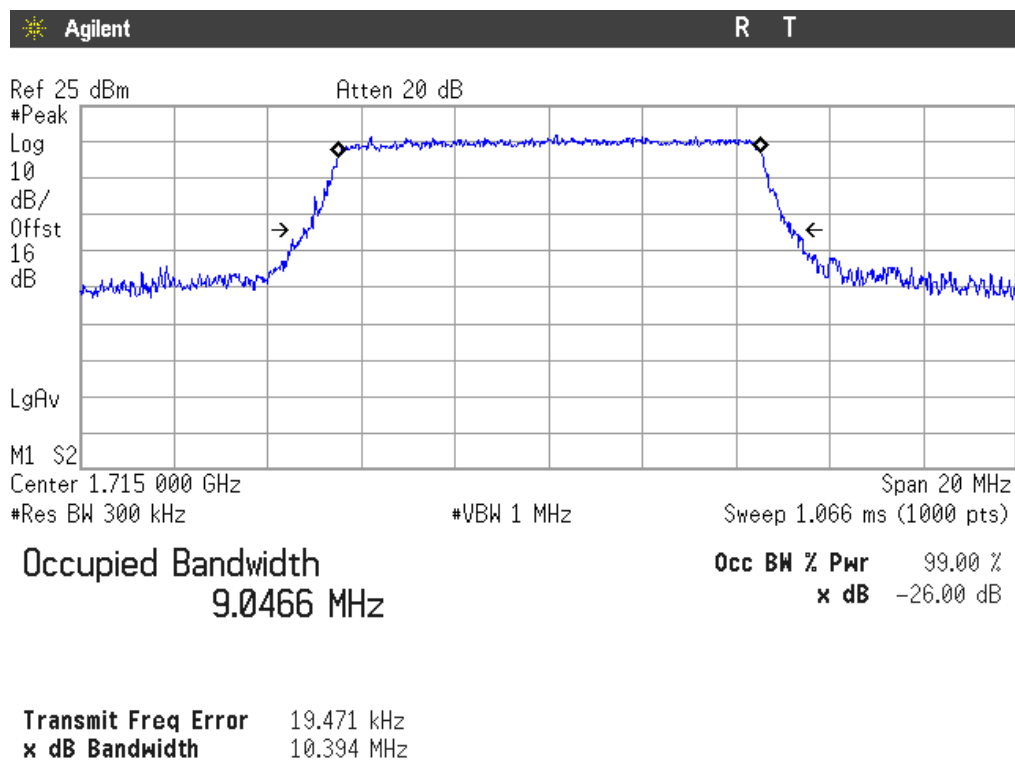


Highest Channel

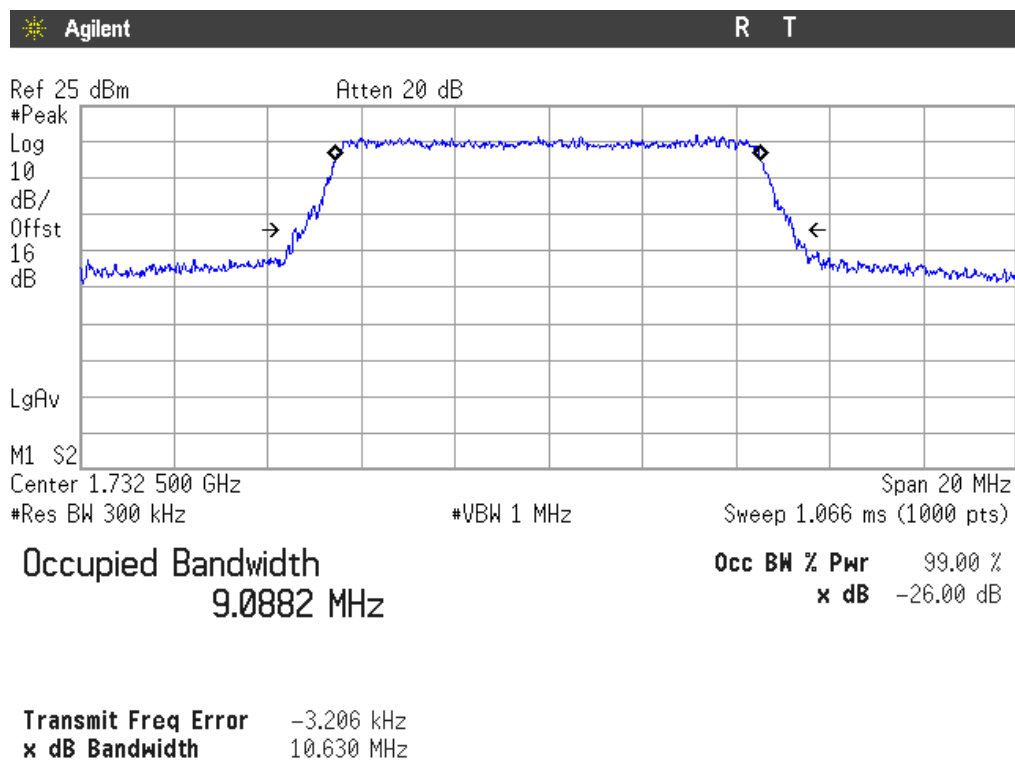


LTE 16QAM MODULATION. BW = 10 MHz (Band IV)

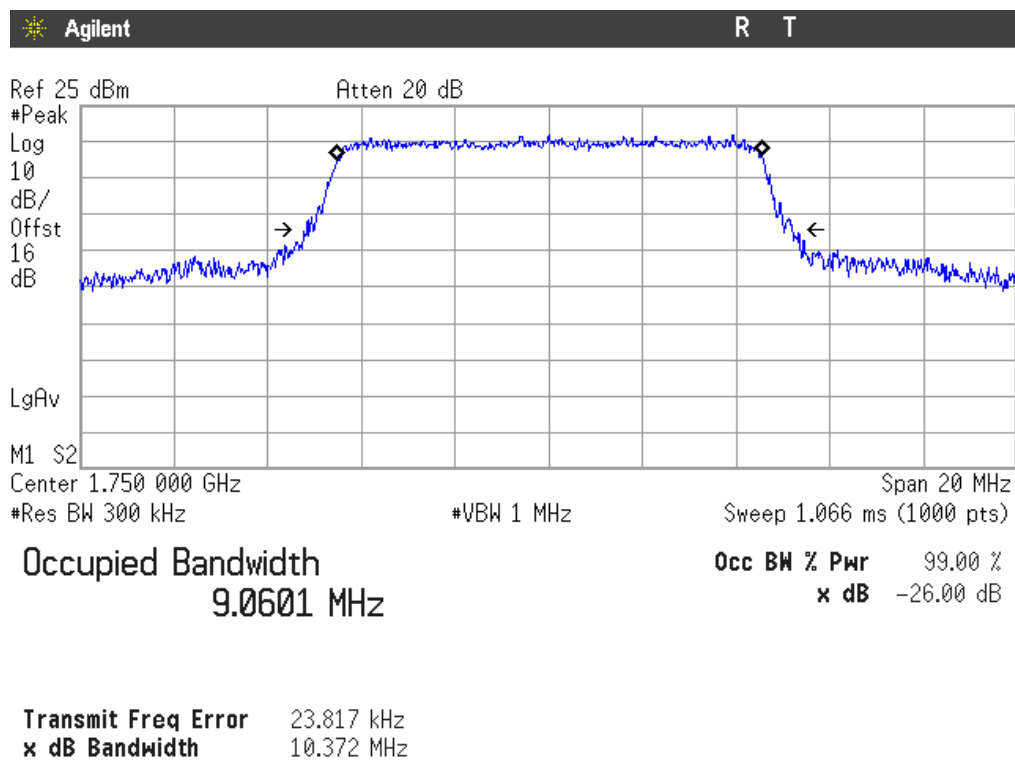
Lowest Channel



Middle Channel

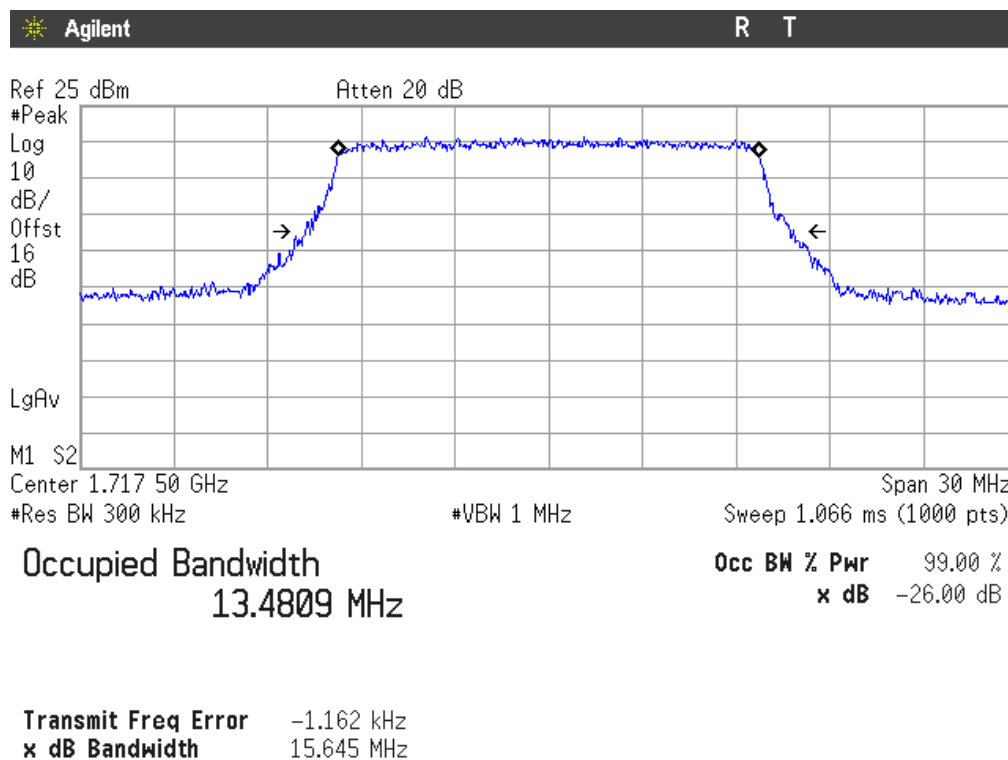


Highest Channel

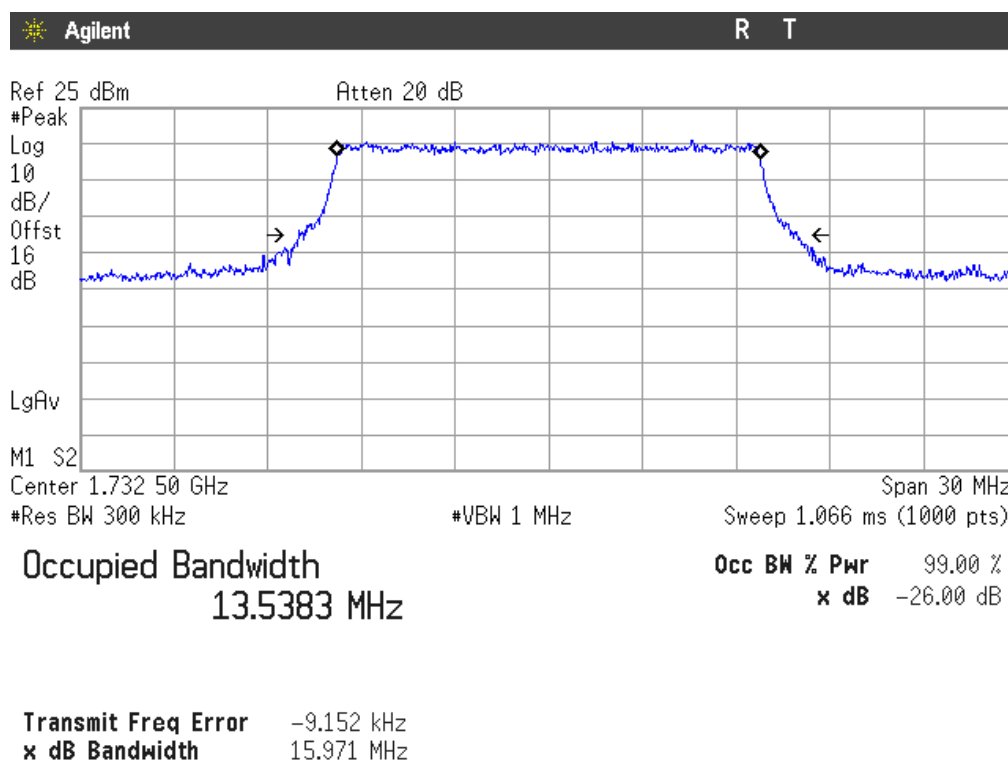


LTE QPSK MODULATION. BW = 15 MHz (Band IV)

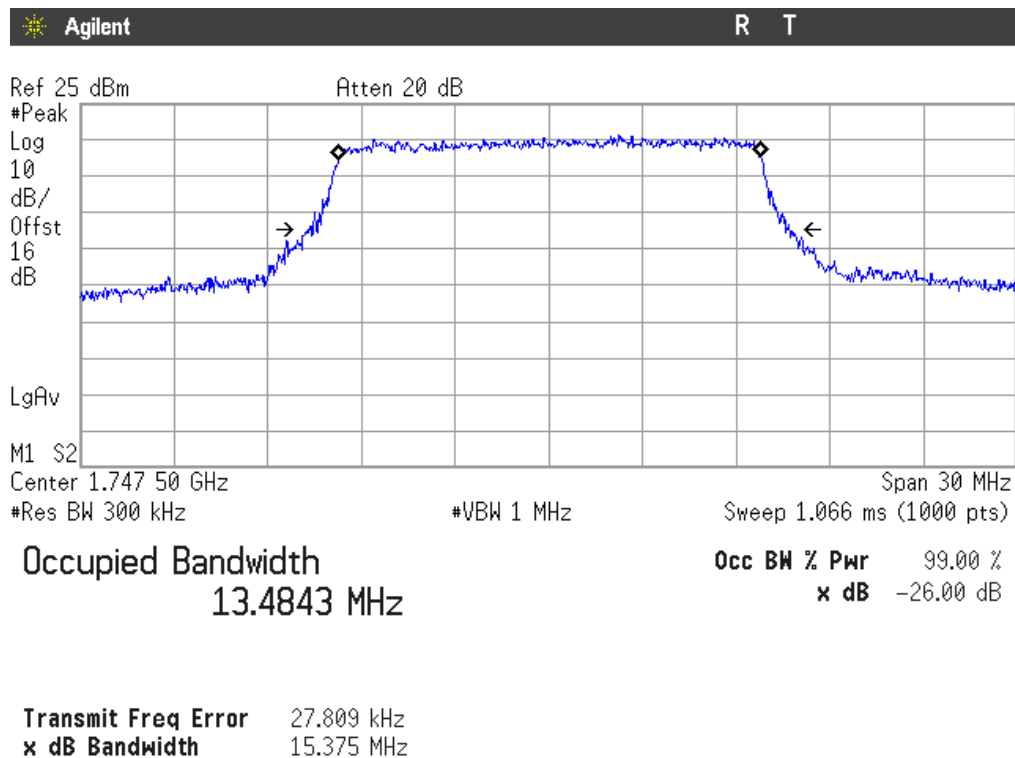
Lowest Channel



Middle Channel

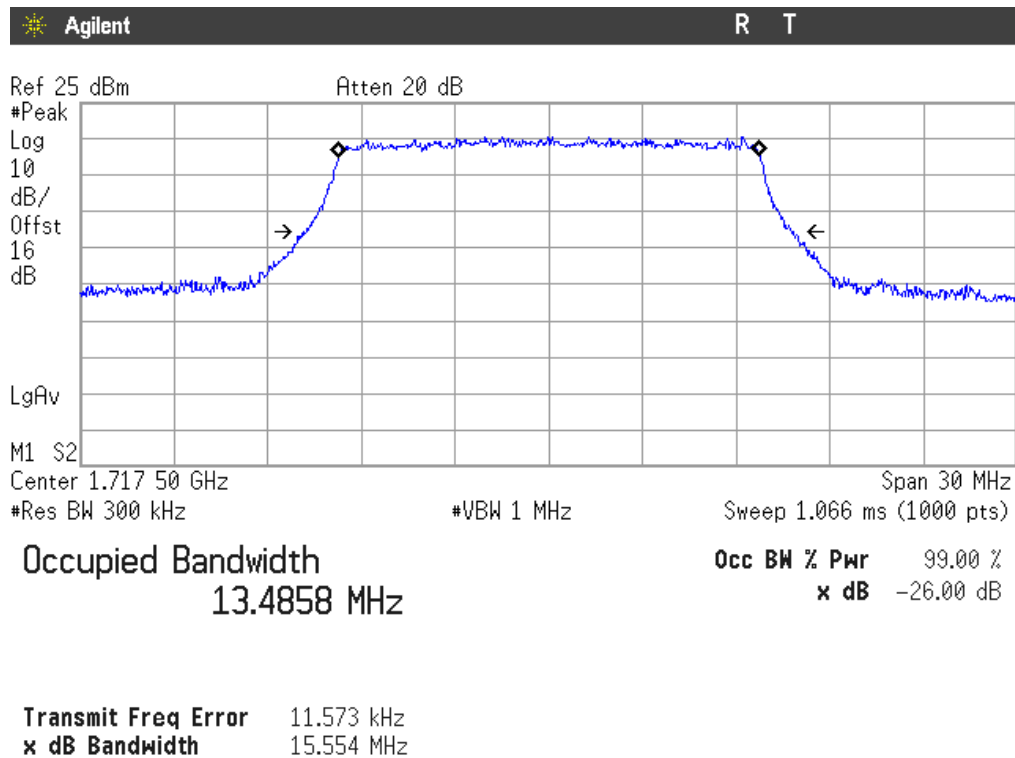


Highest Channel

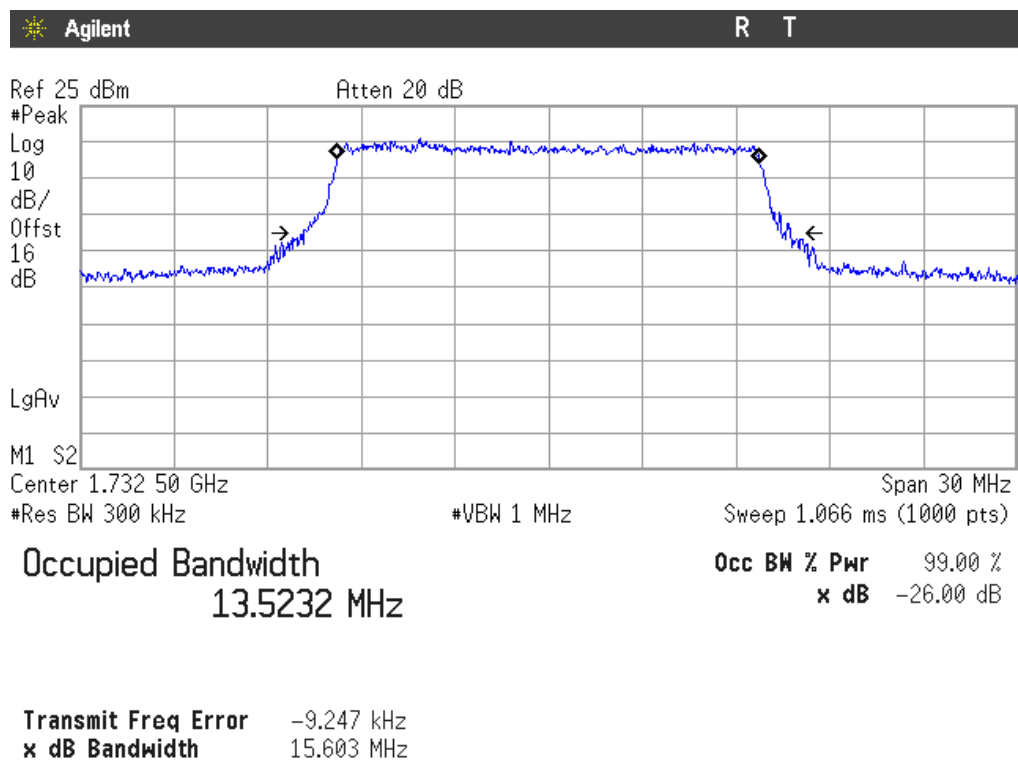


LTE 16QAM MODULATION. BW = 15 MHz (Band IV)

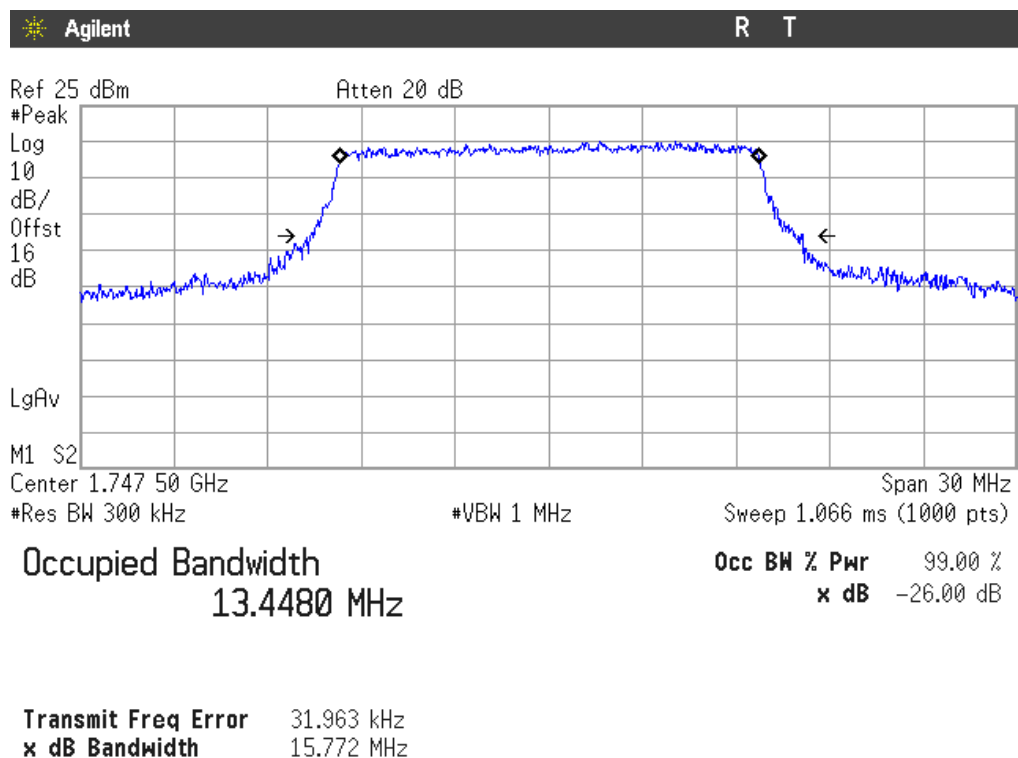
Lowest Channel



Middle Channel

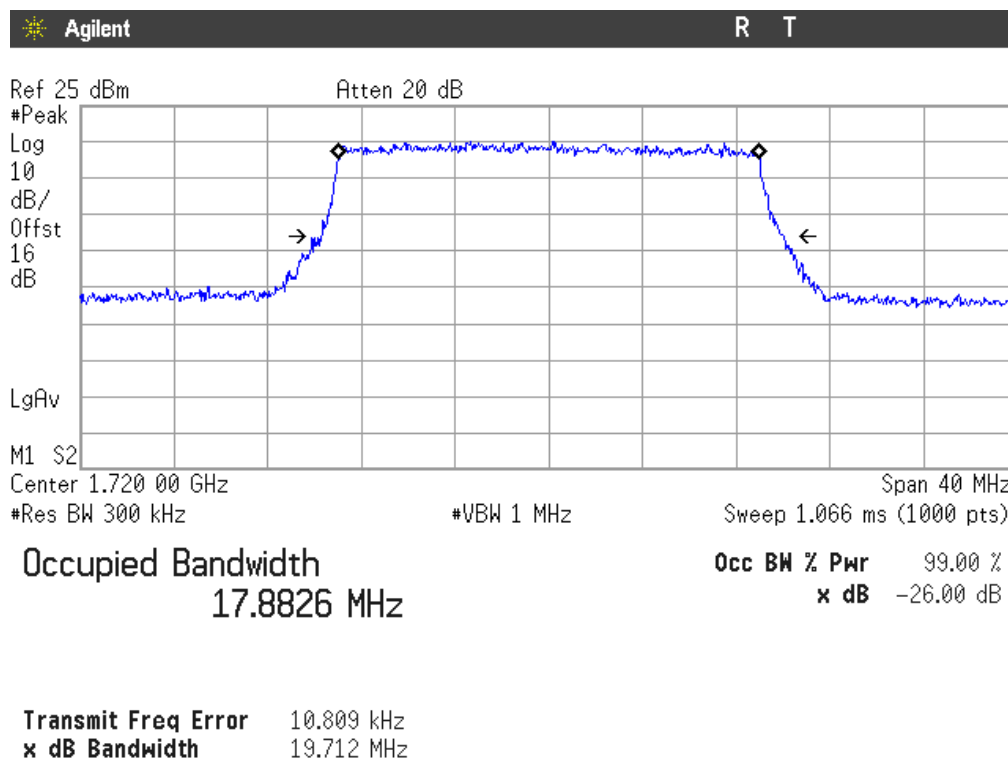


Highest Channel

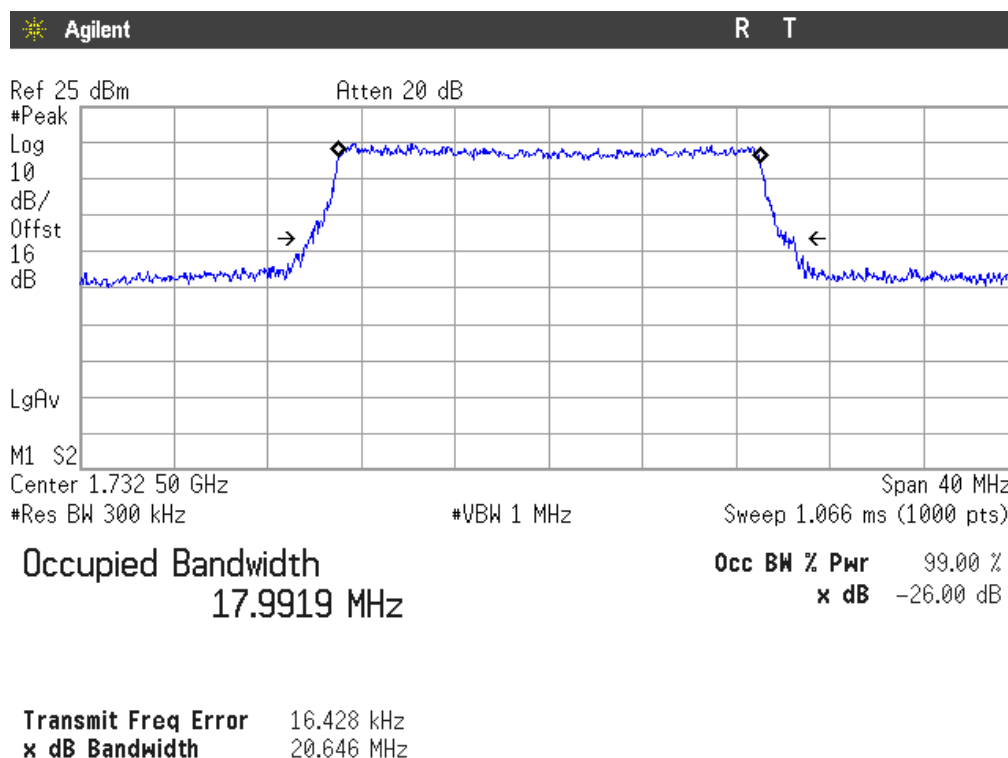


LTE QPSK MODULATION. BW = 20 MHz (Band IV)

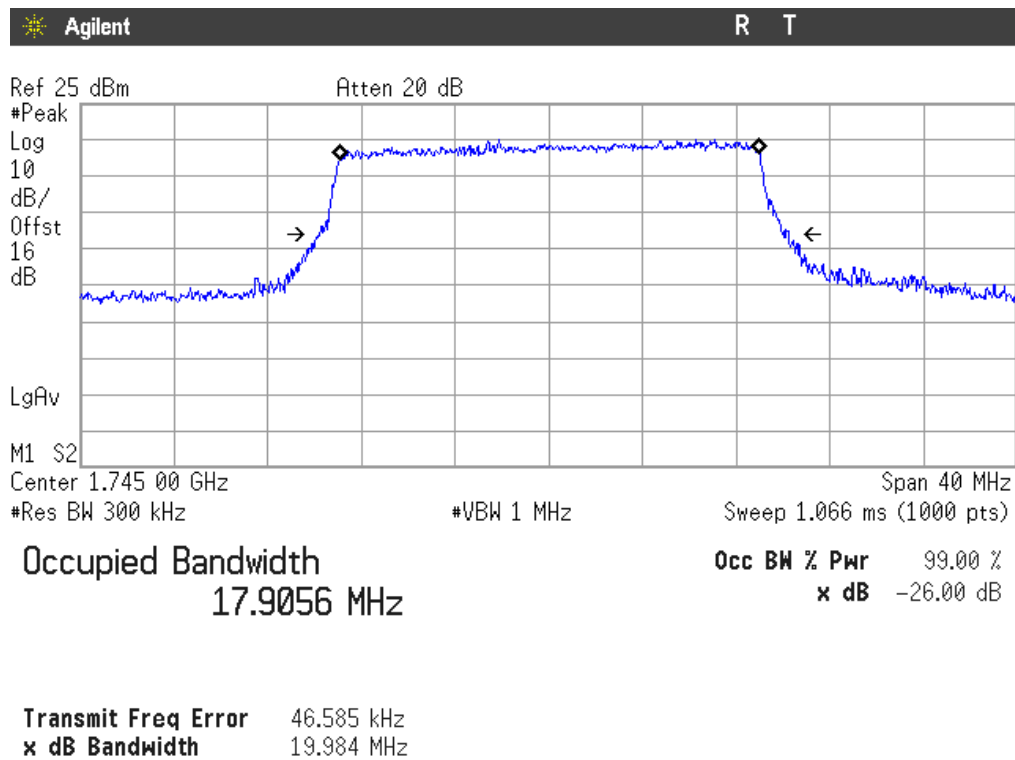
Lowest Channel



Middle Channel

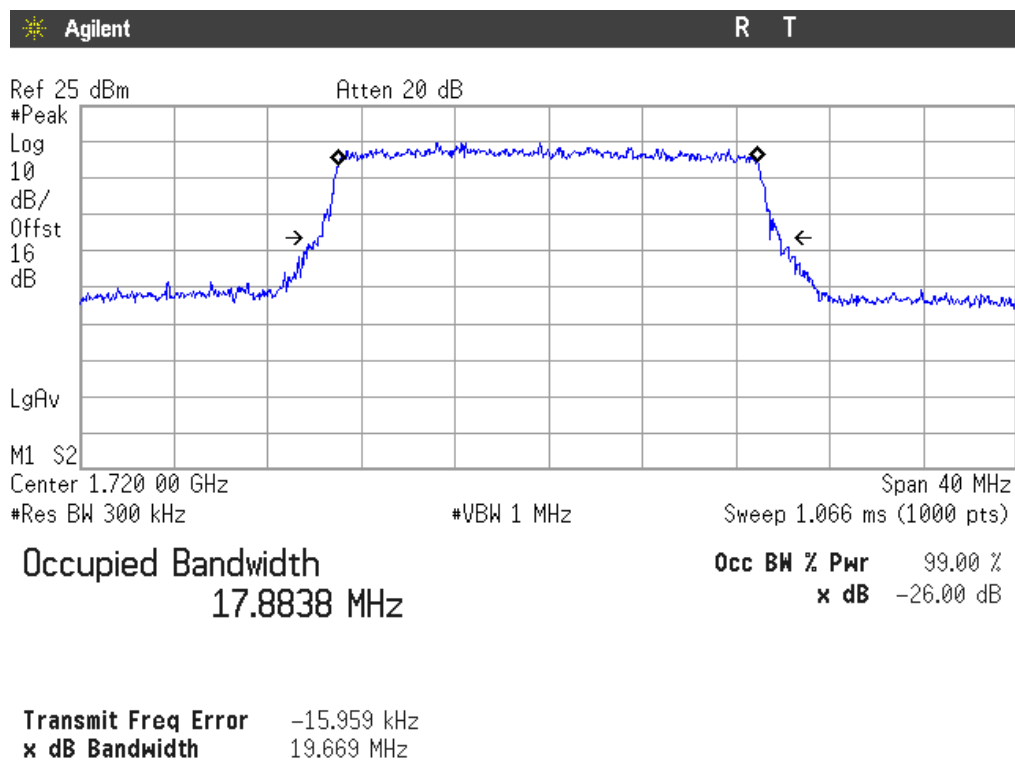


Highest Channel

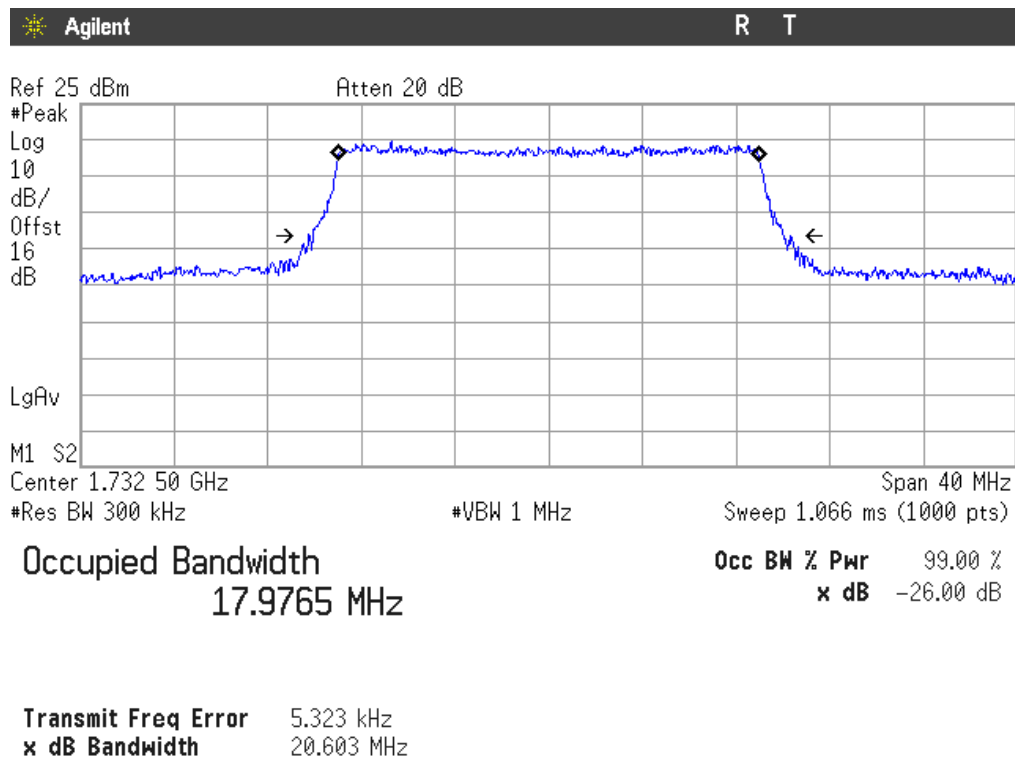


LTE 16QAM MODULATION. BW = 20 MHz (Band IV)

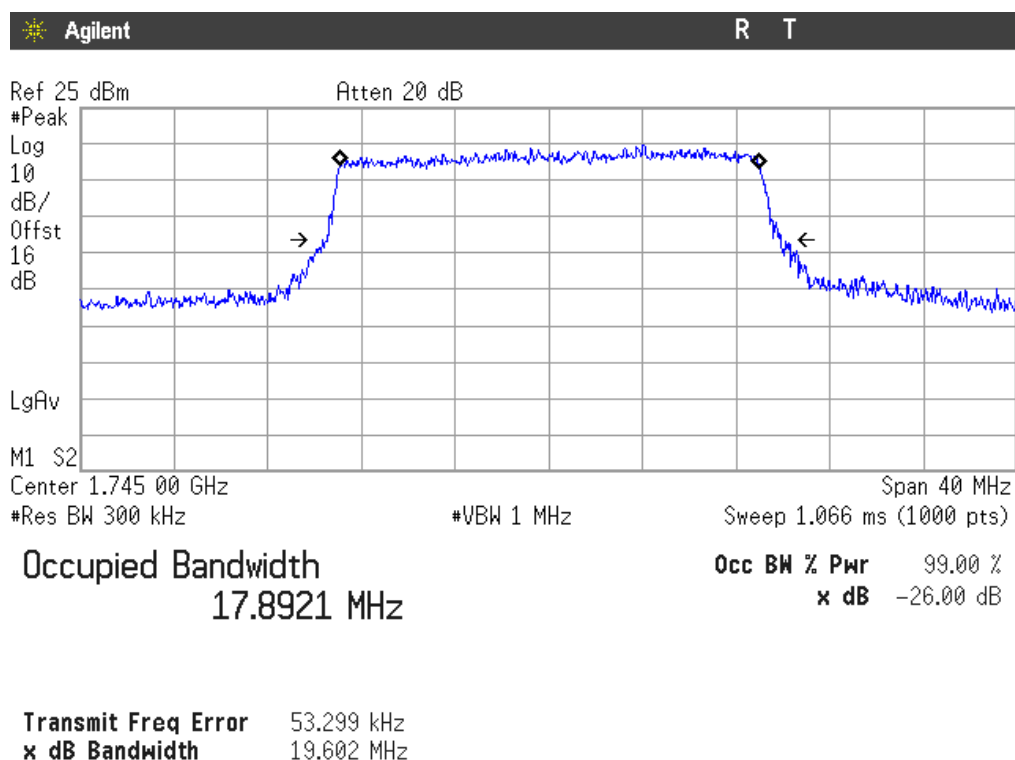
Lowest Channel



Middle Channel

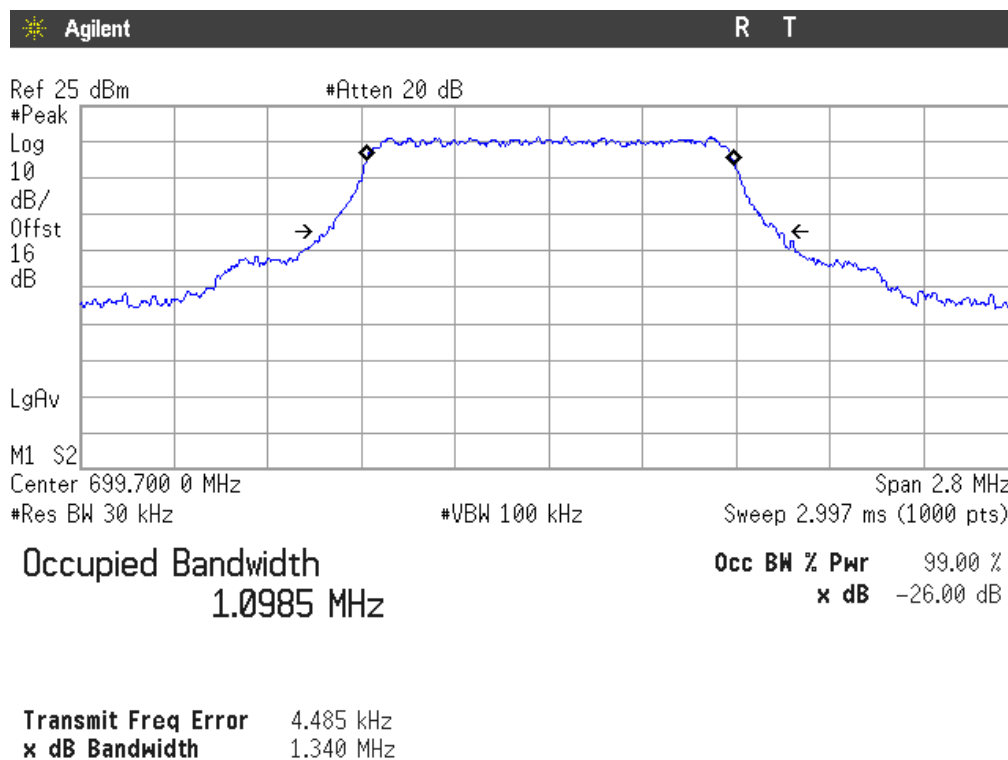


Highest Channel

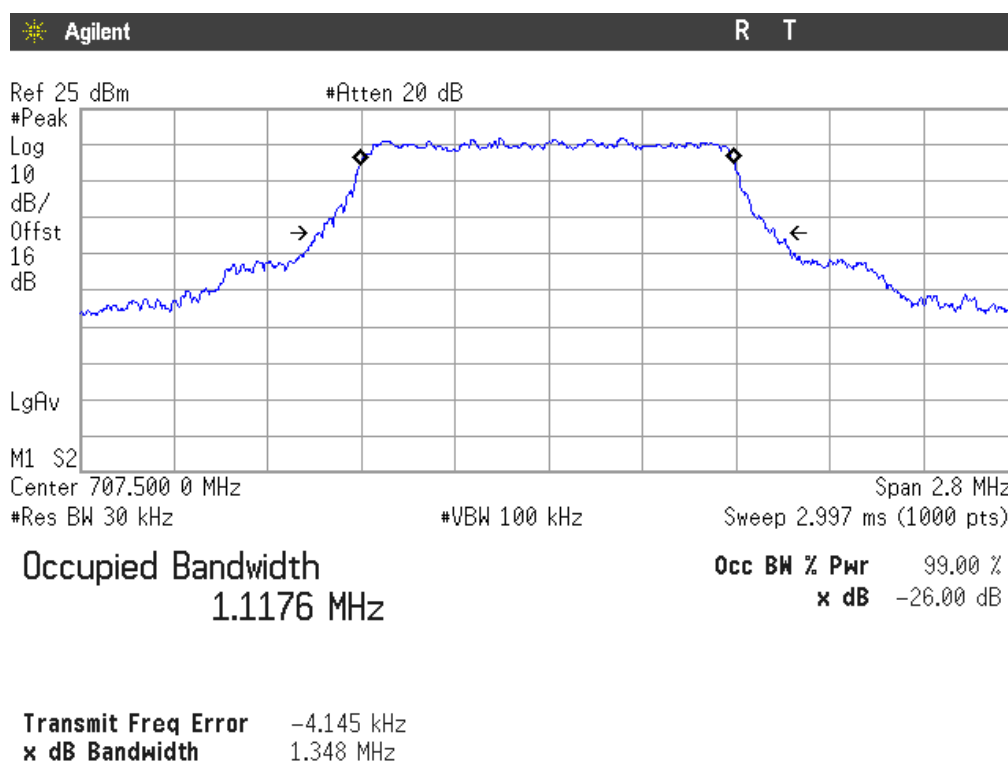


LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)

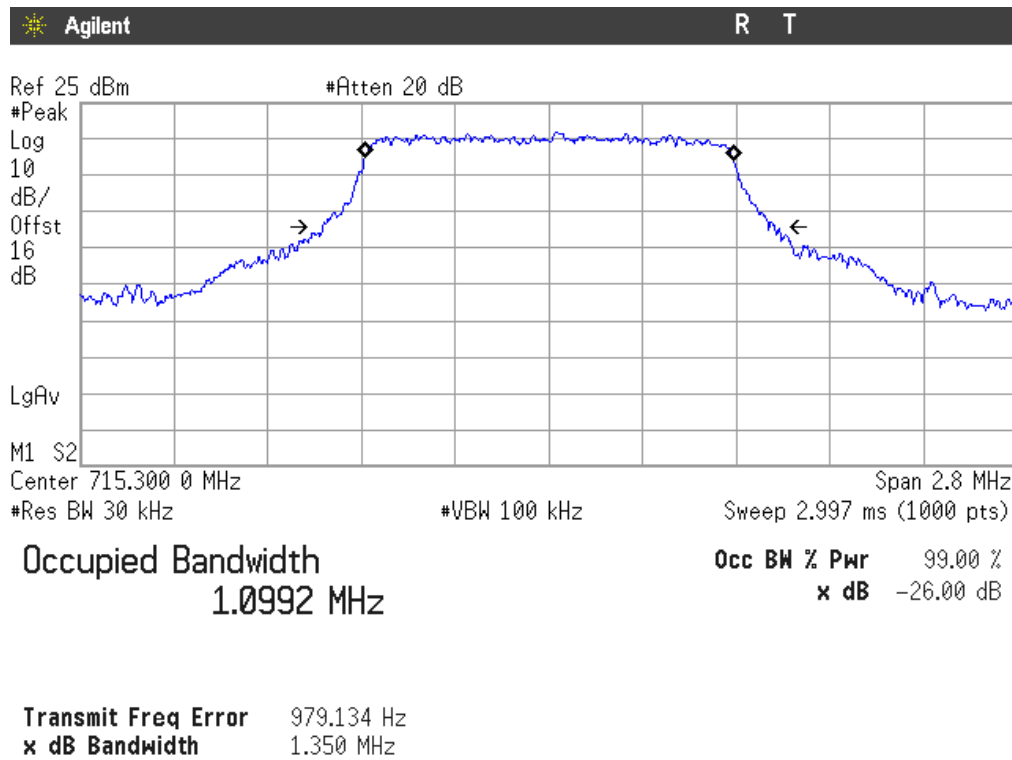
Lowest Channel



Middle Channel

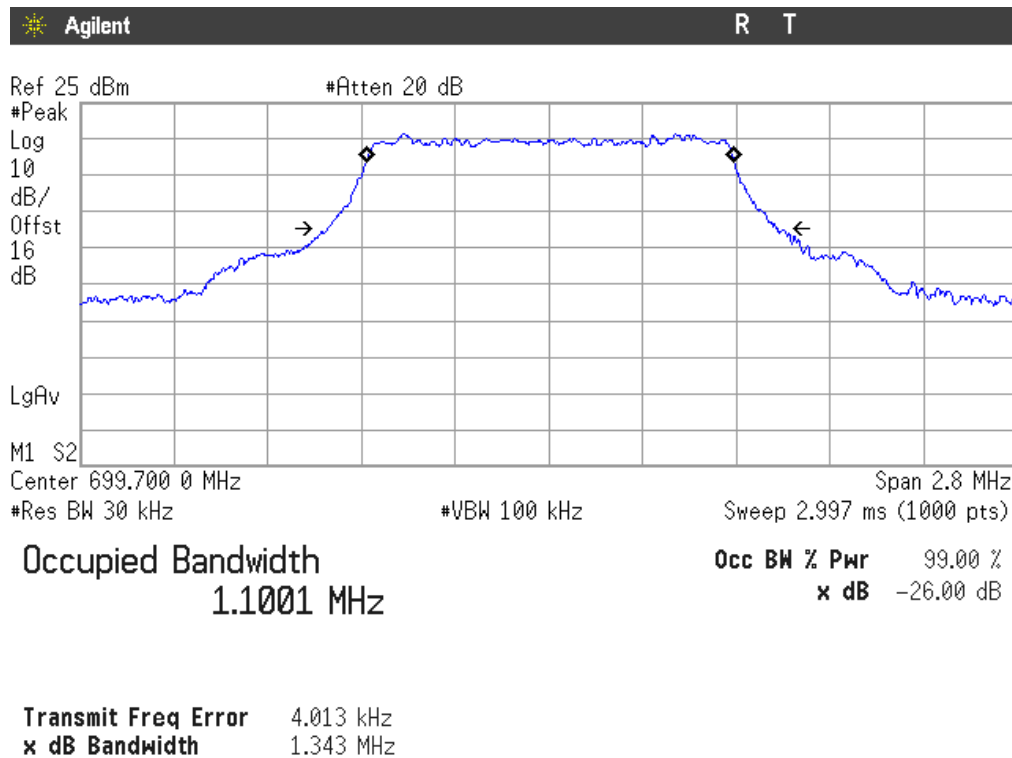


Highest Channel

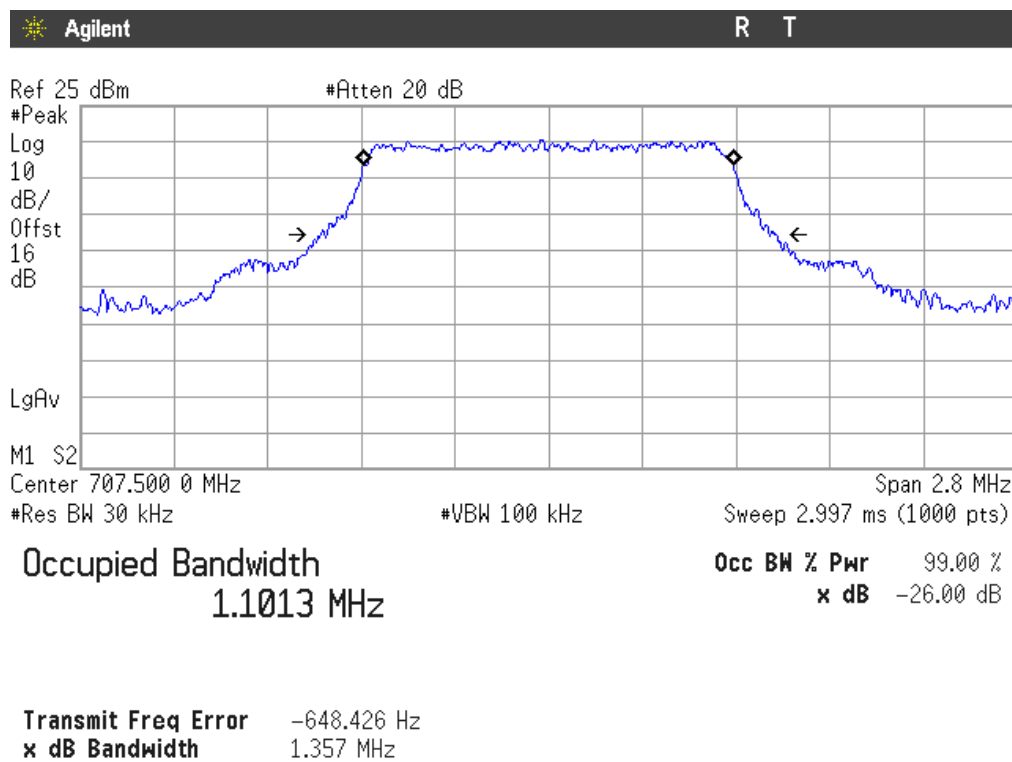


LTE 16QAM MODULATION. BW = 1.4 MHz (Band XII)

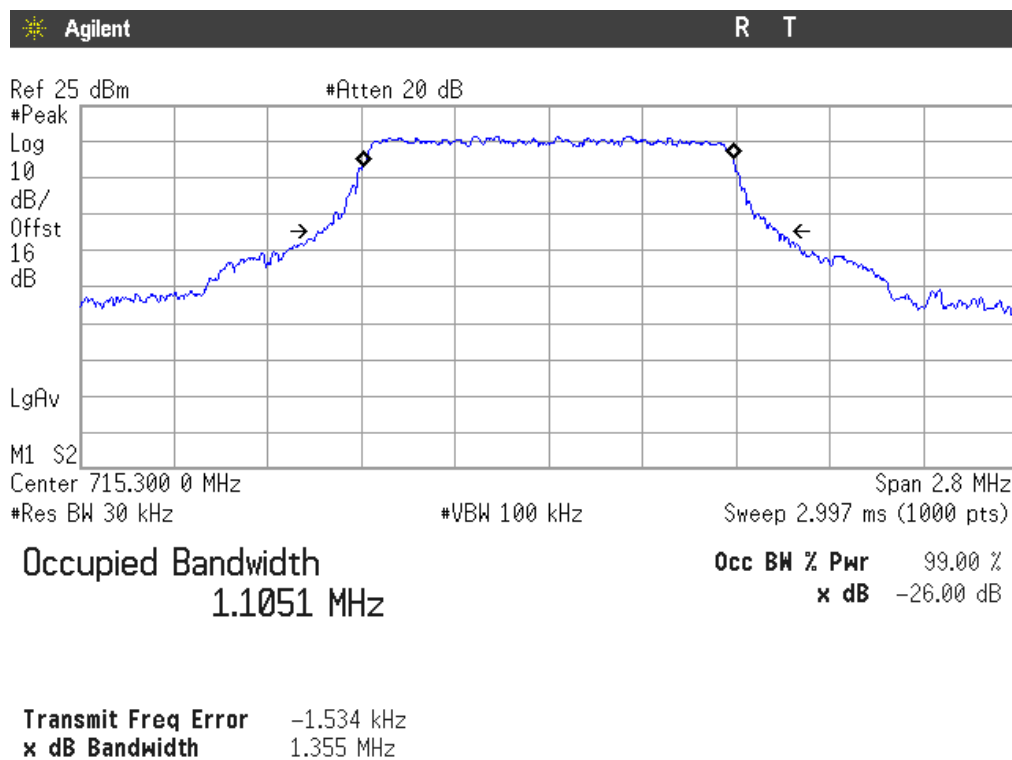
Lowest Channel



Middle Channel

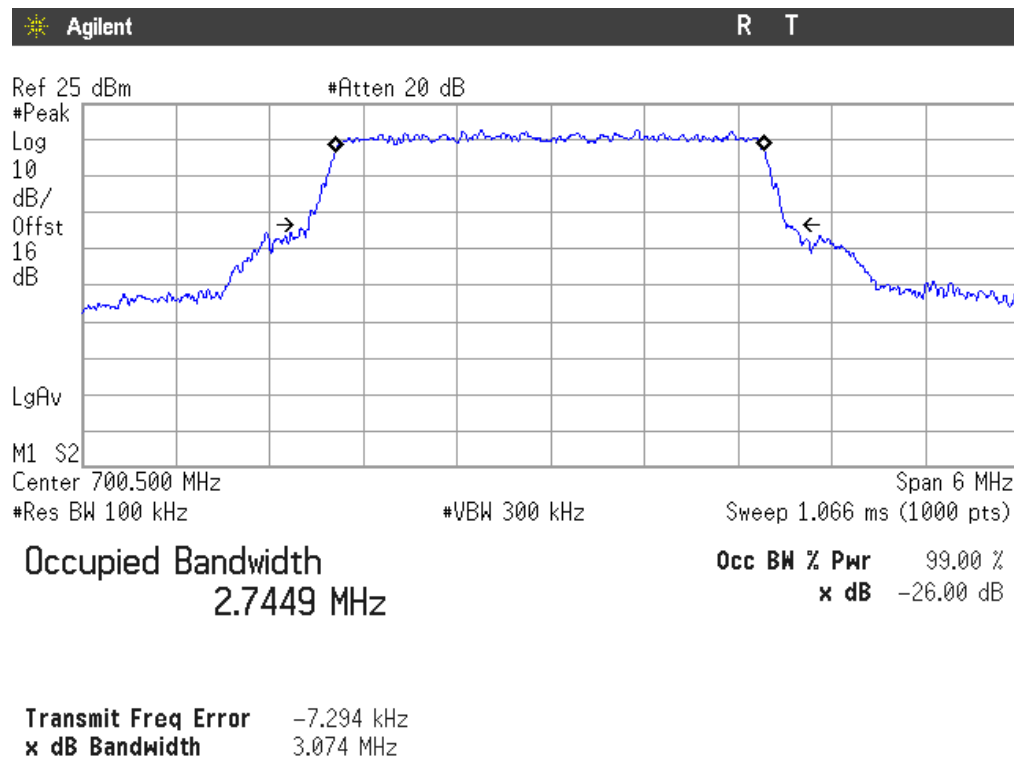


Highest Channel

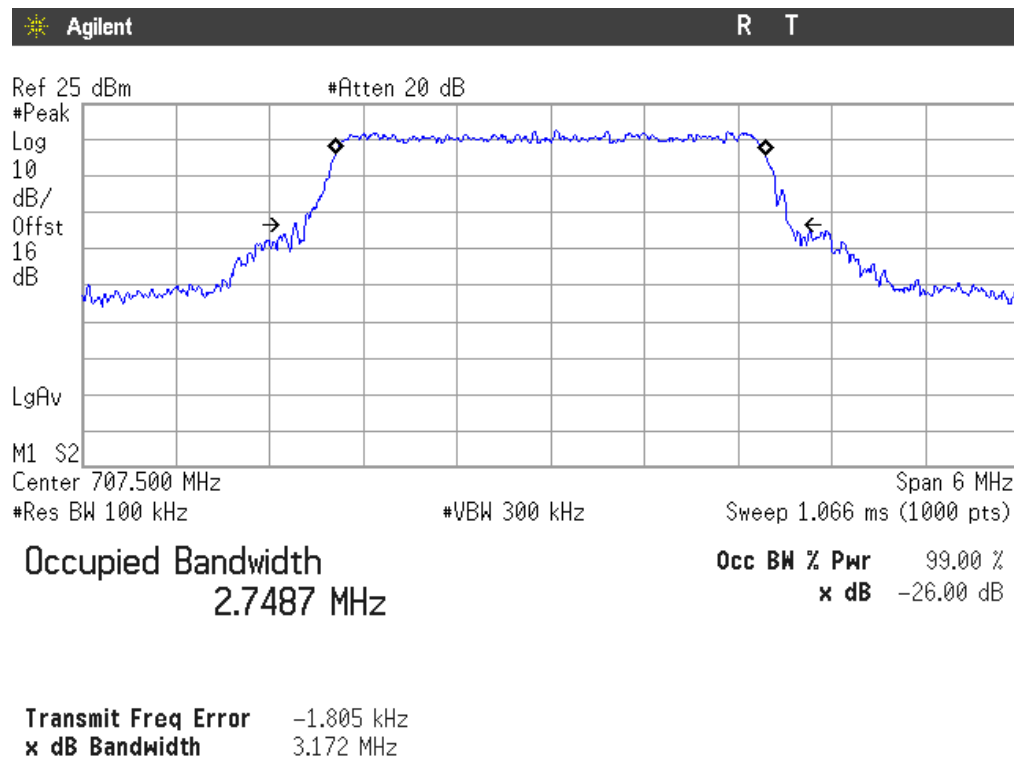


LTE QPSK MODULATION. BW = 3 MHz (Band XII)

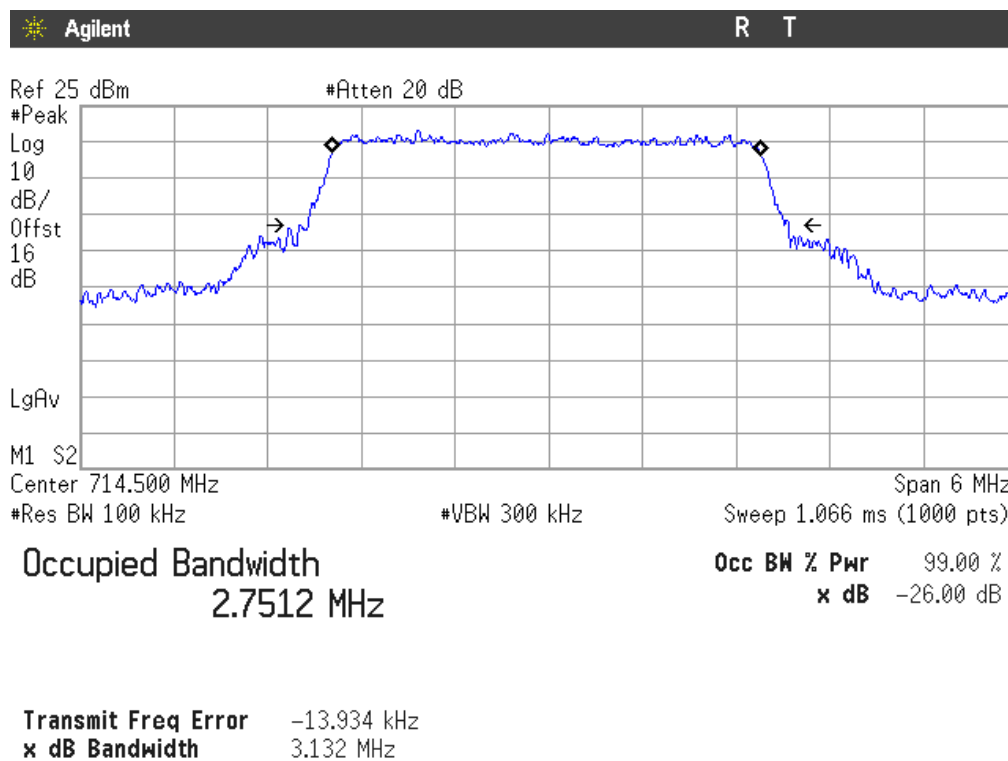
Lowest Channel



Middle Channel

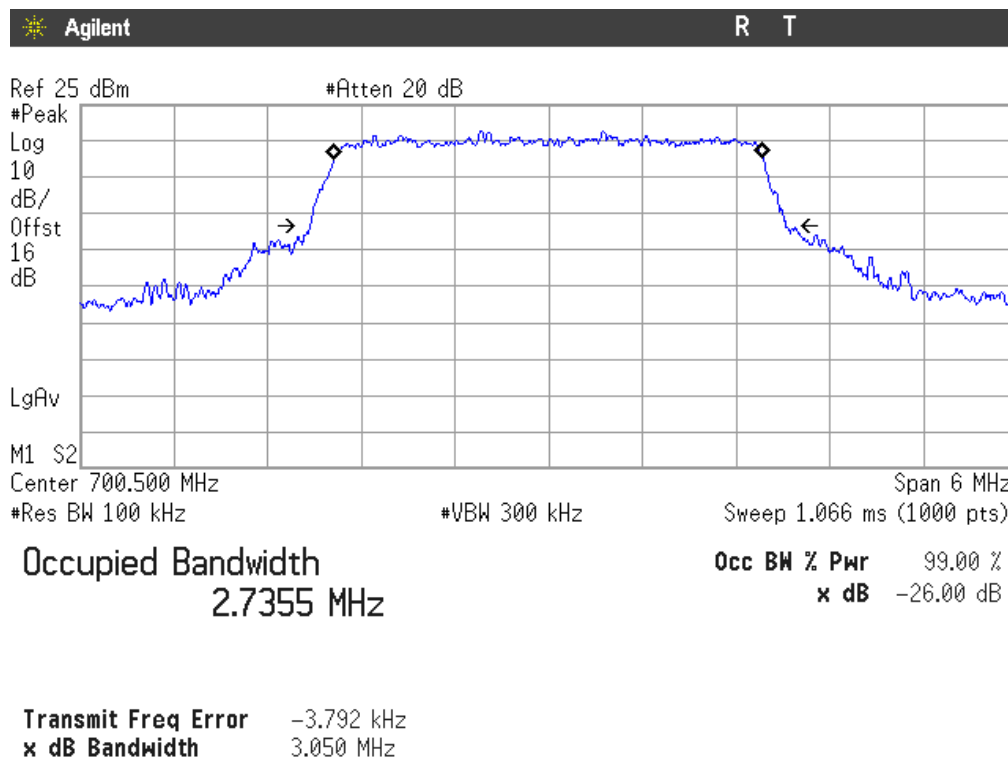


Highest Channel

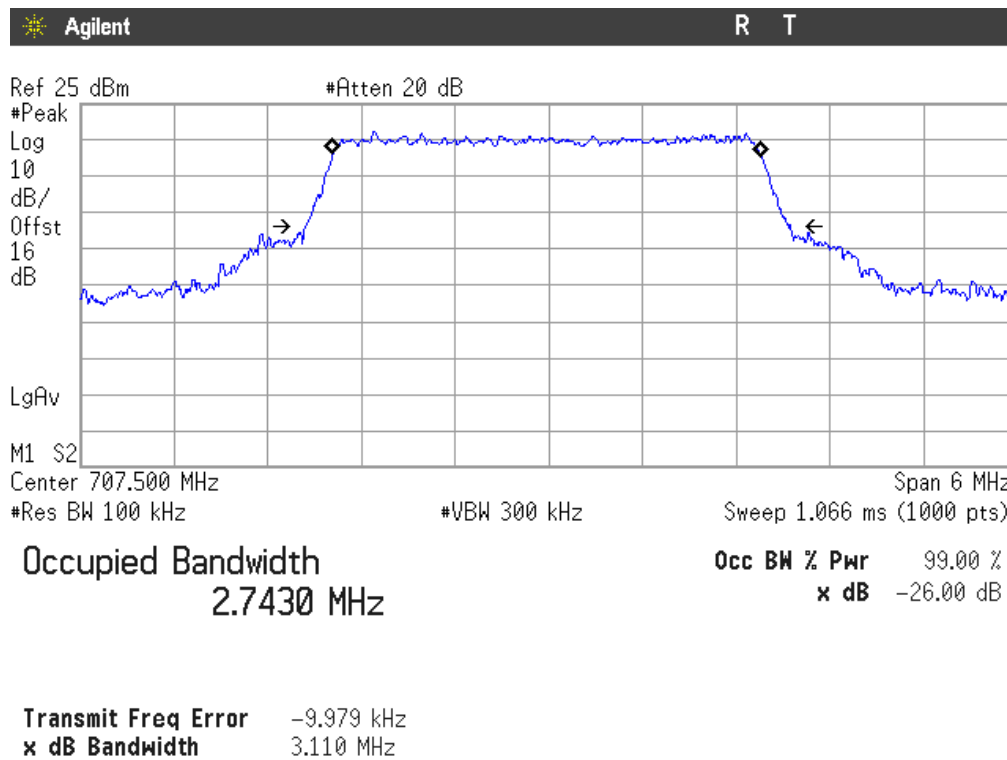


LTE 16QAM MODULATION. BW = 3 MHz (Band XII)

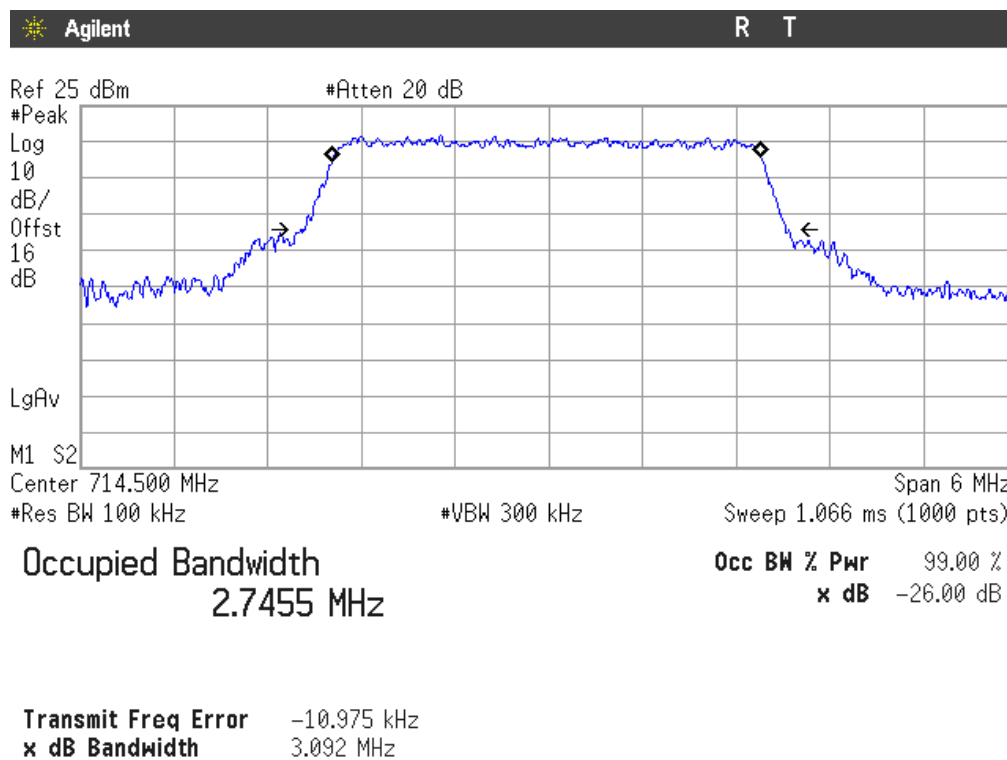
Lowest Channel



Middle Channel

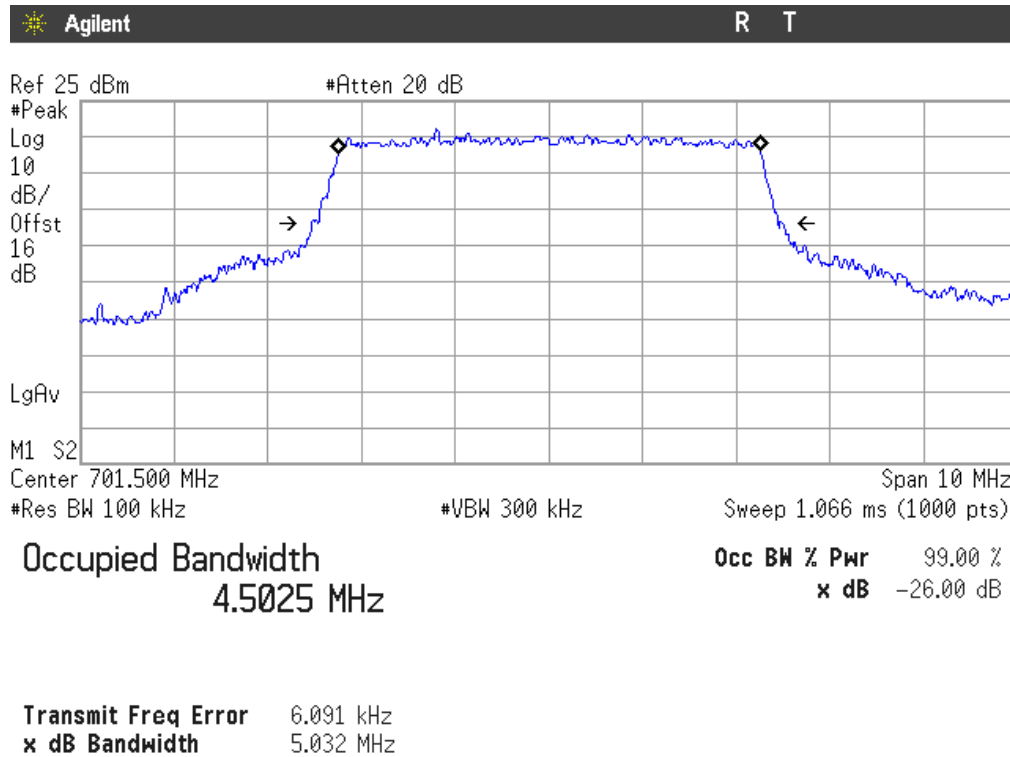


Highest Channel

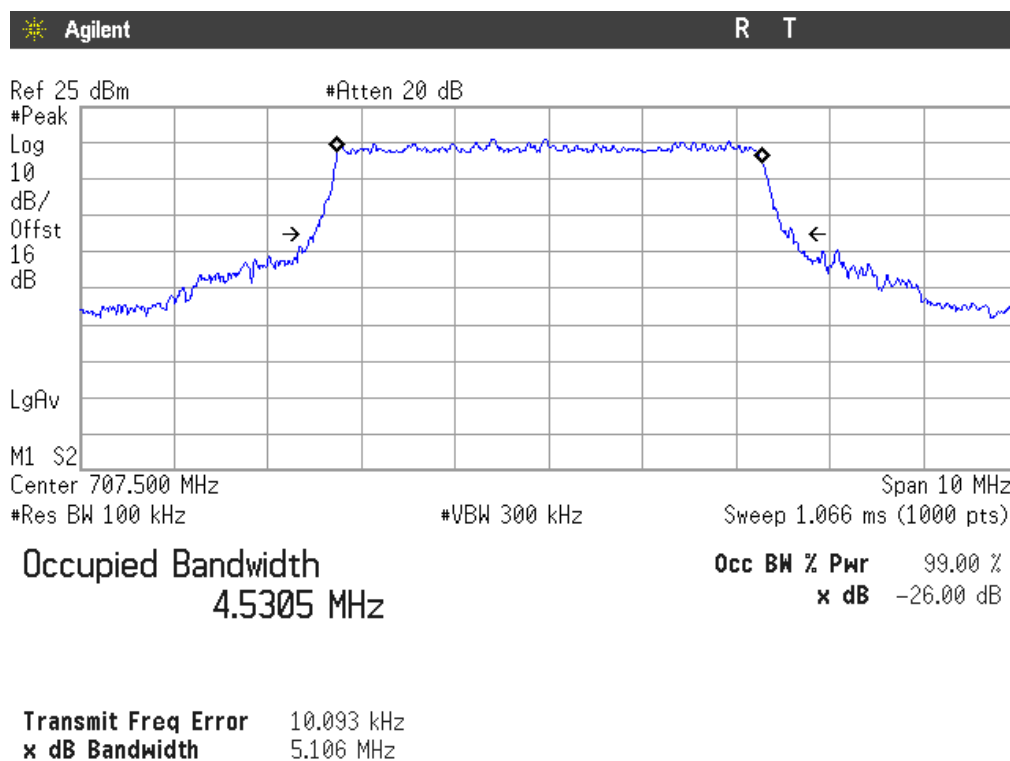


LTE QPSK MODULATION. BW = 5 MHz (Band XII)

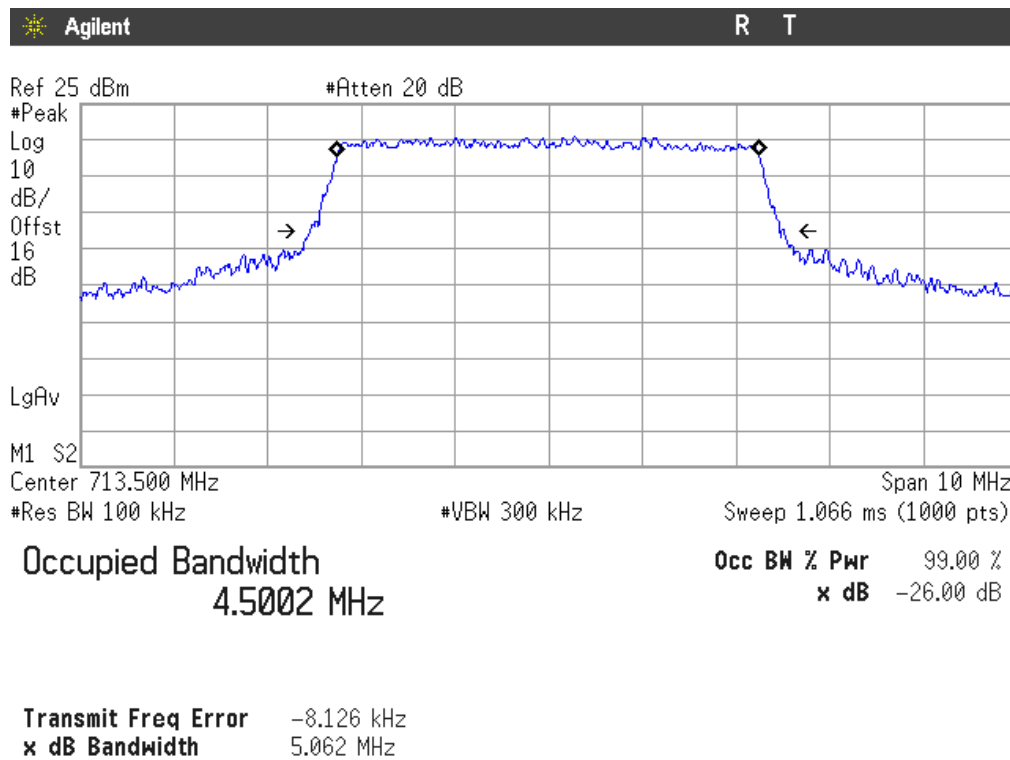
Lowest Channel



Middle Channel

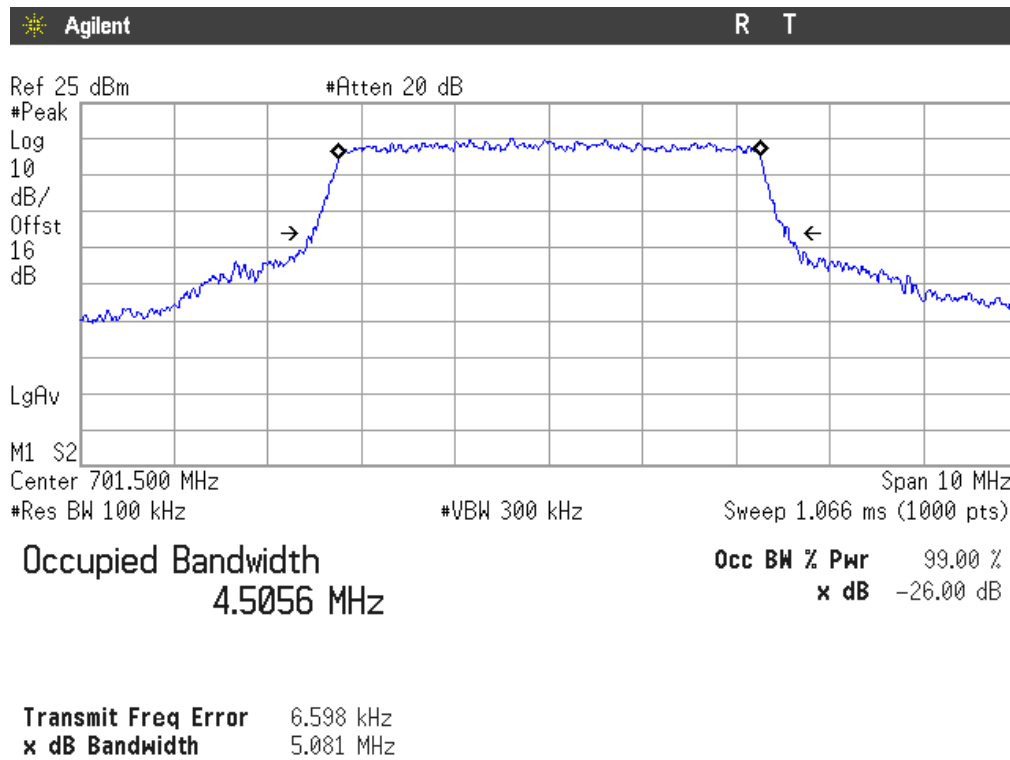


Highest Channel

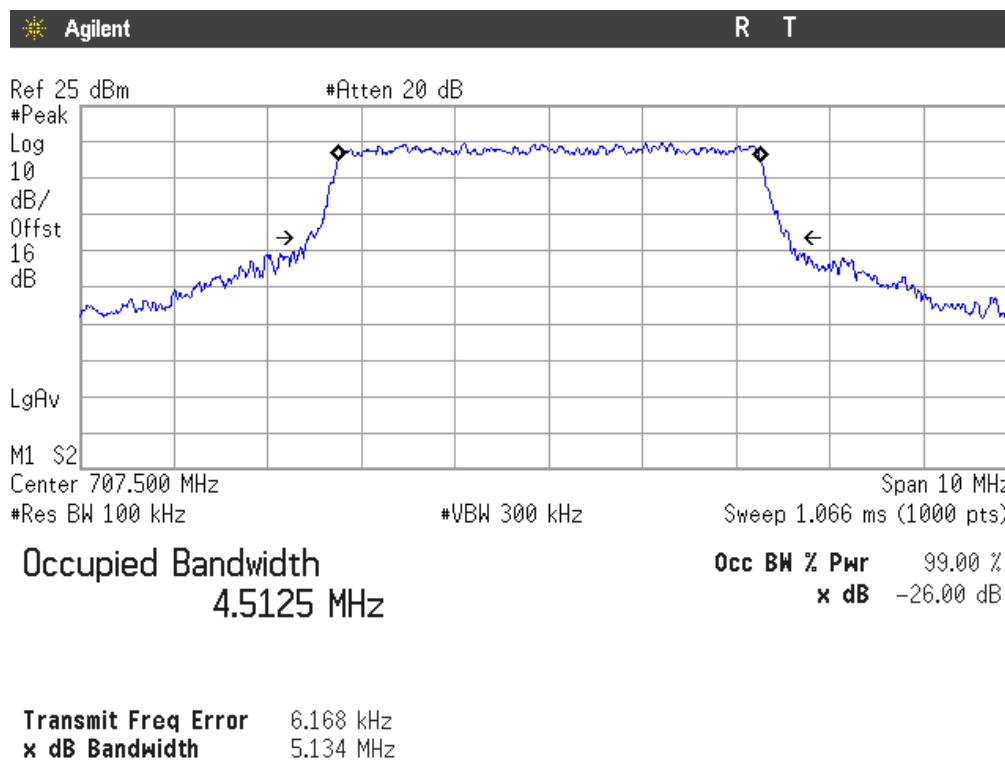


LTE 16QAM MODULATION. BW = 5 MHz (Band XII)

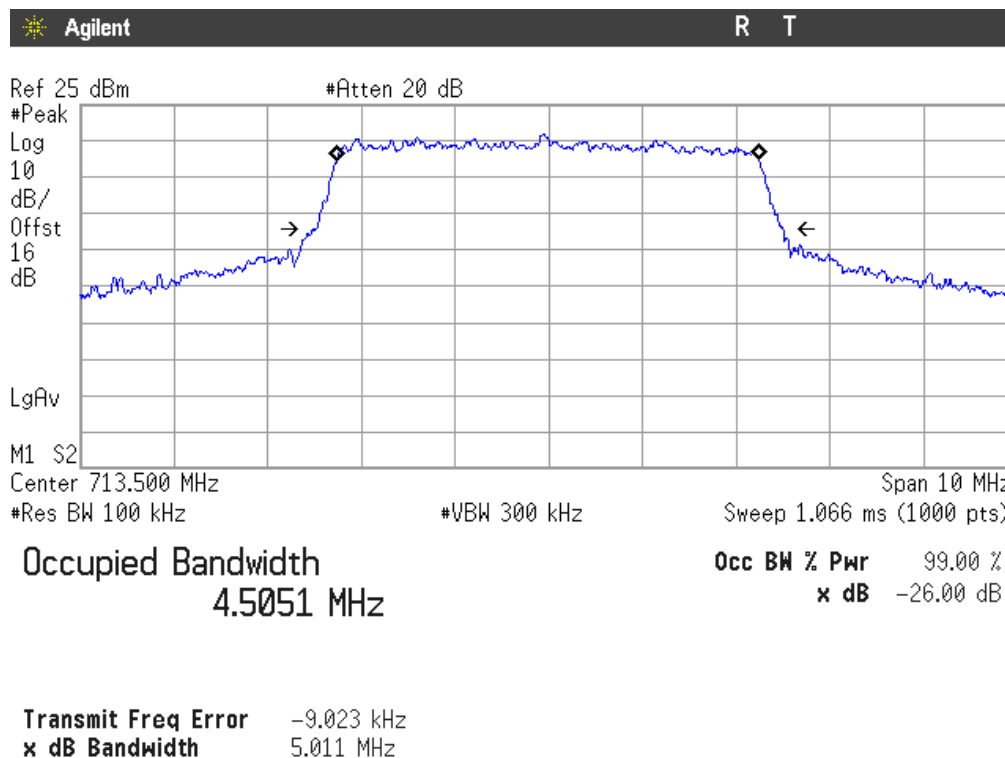
Lowest Channel



Middle Channel

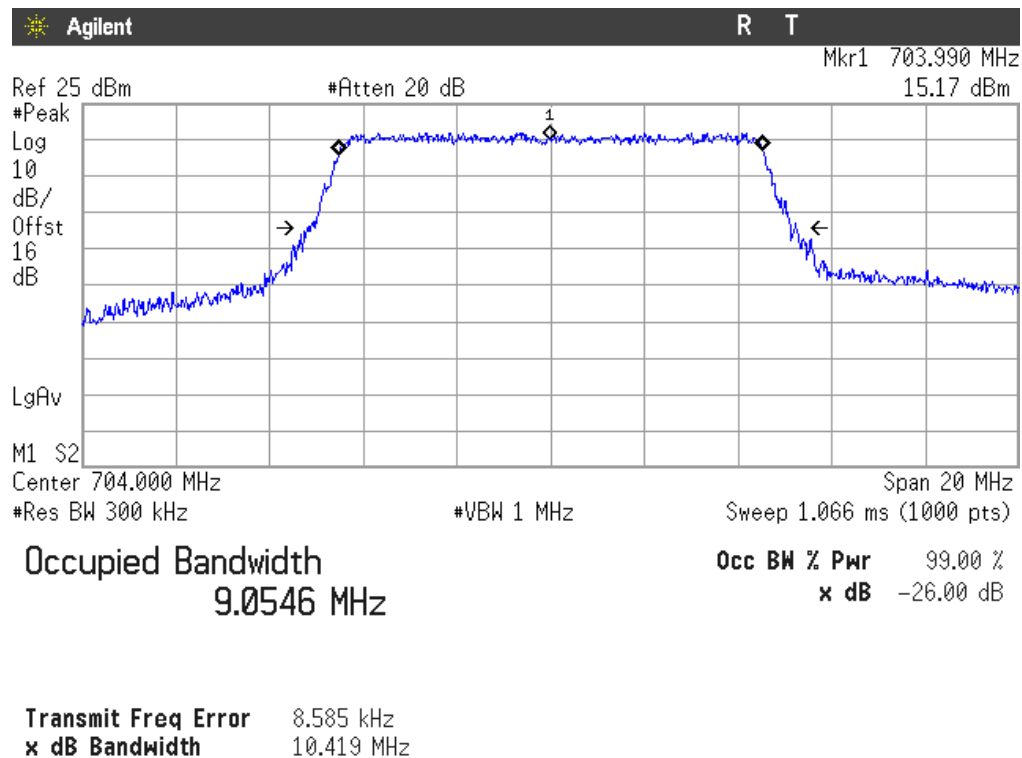


Highest Channel

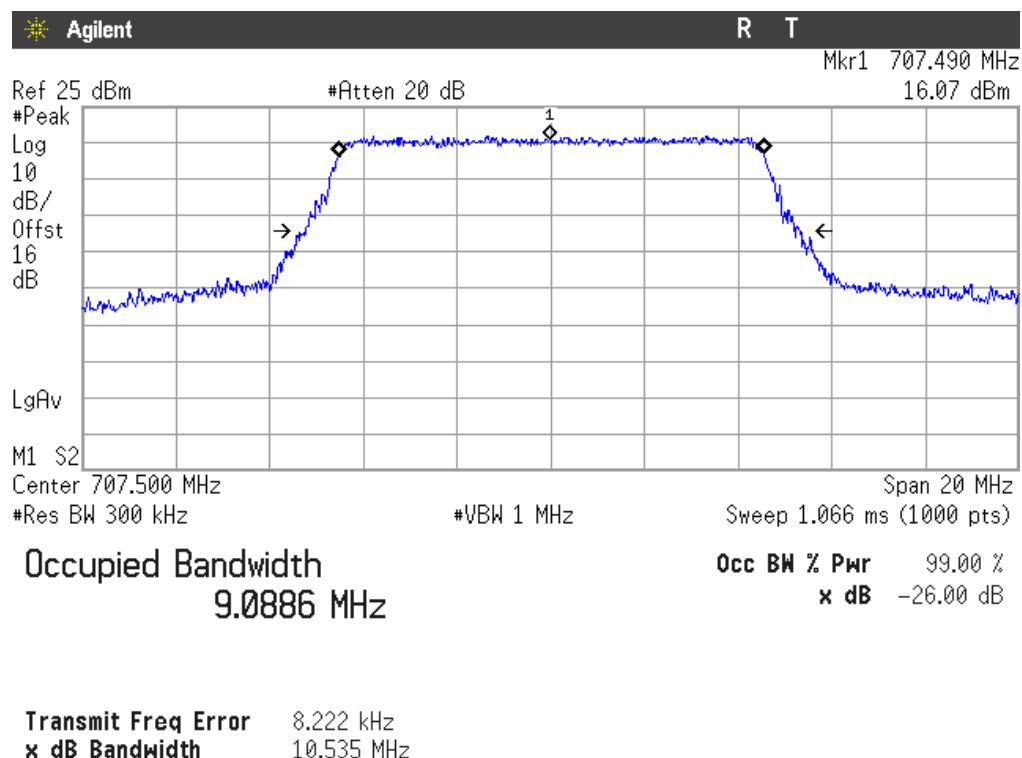


LTE QPSK MODULATION. BW = 10 MHz (Band XII)

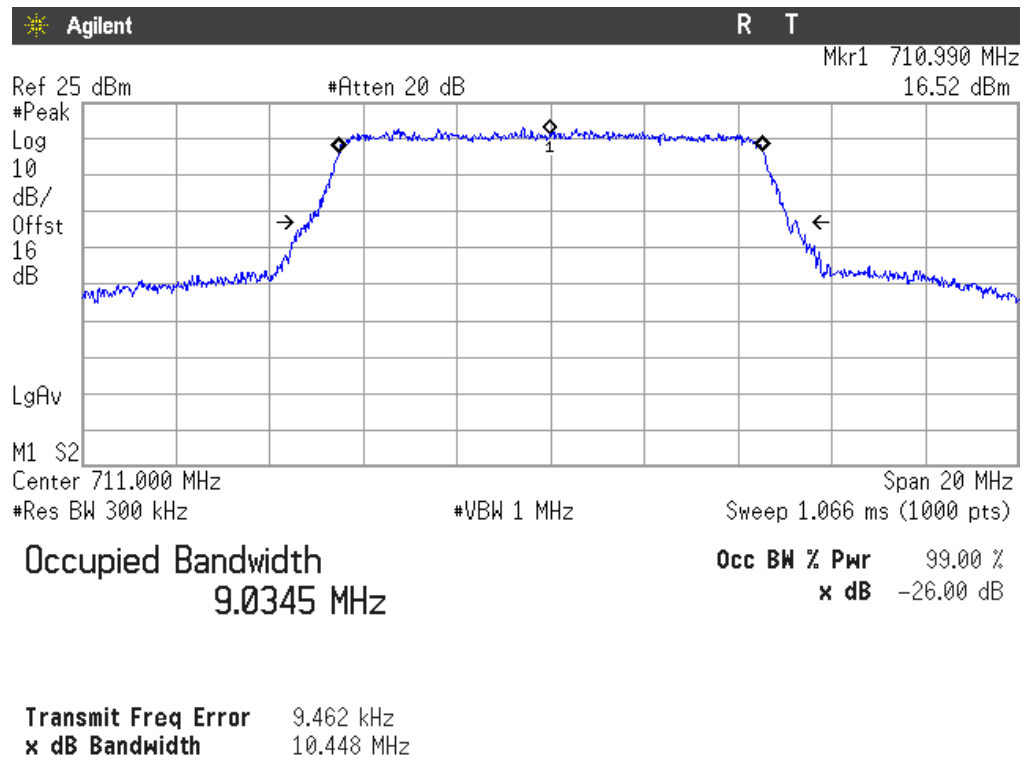
Lowest Channel



Middle Channel

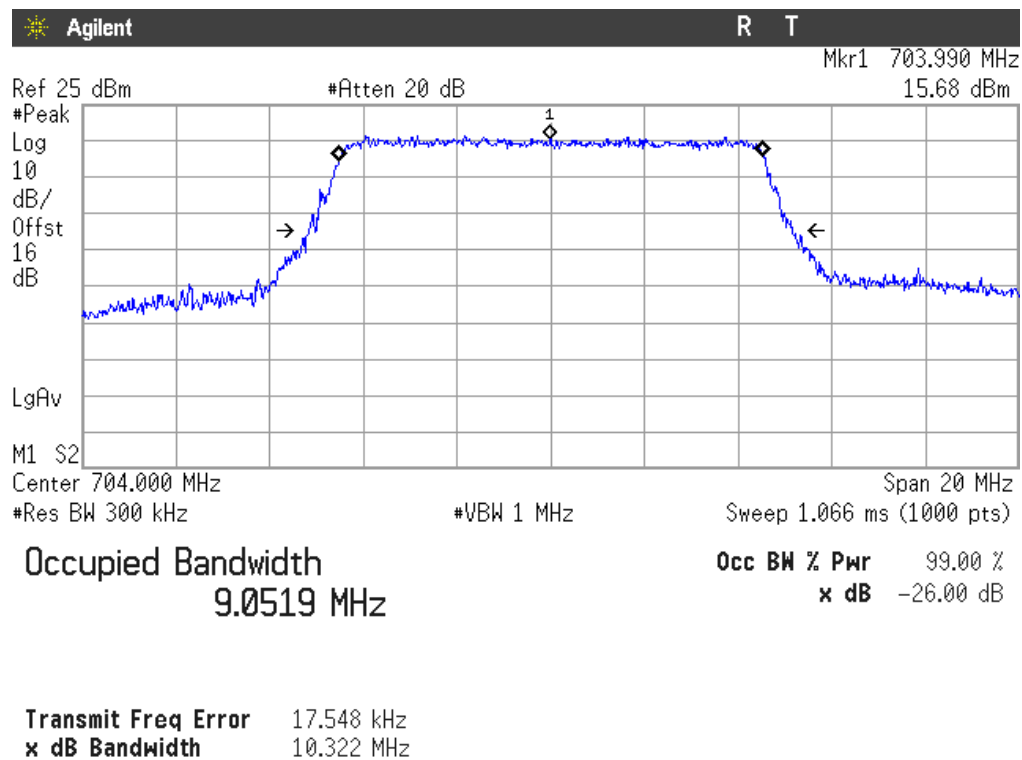


Highest Channel

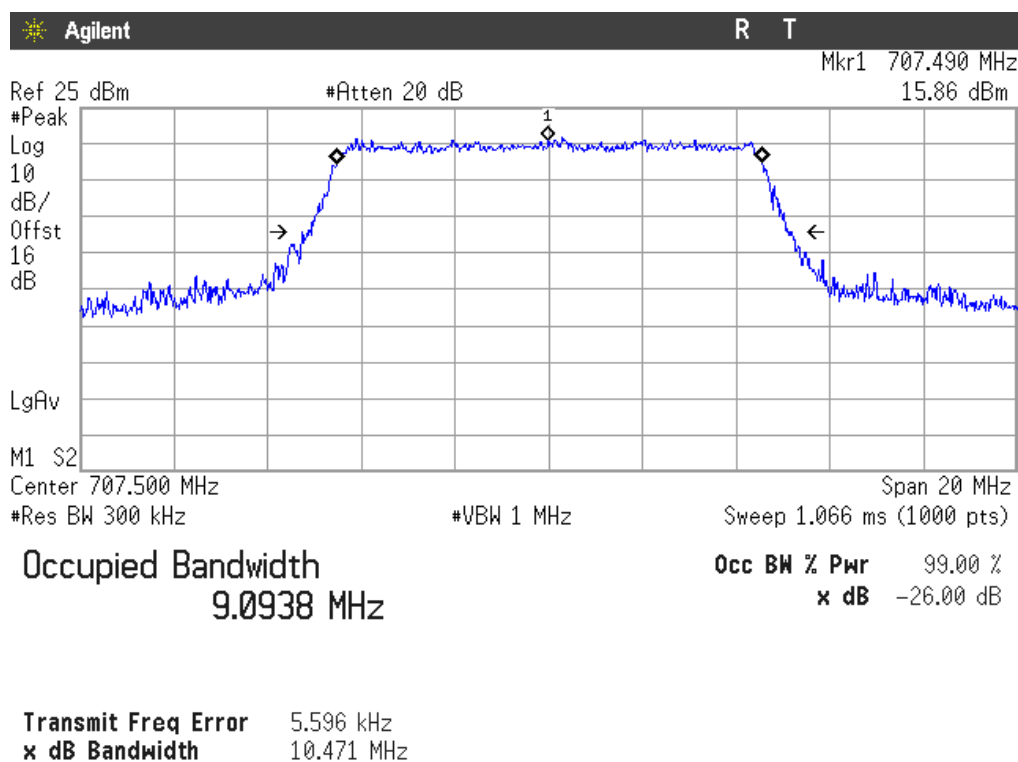


LTE 16QAM MODULATION. BW = 10 MHz (Band XII)

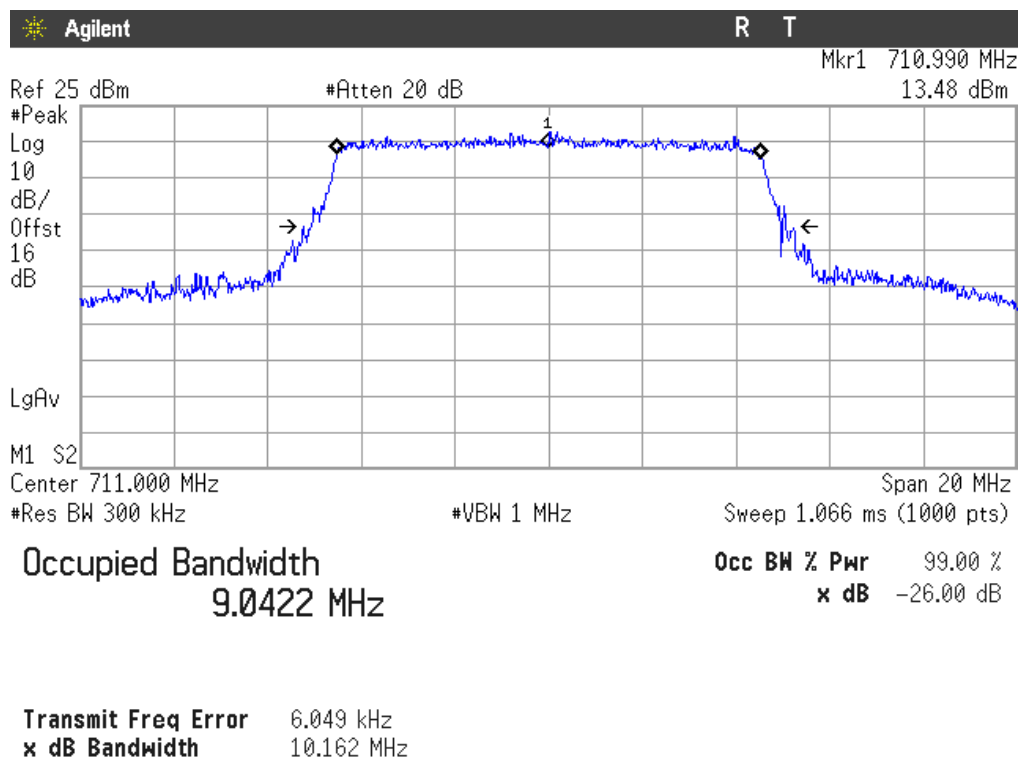
Lowest Channel



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:

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

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.

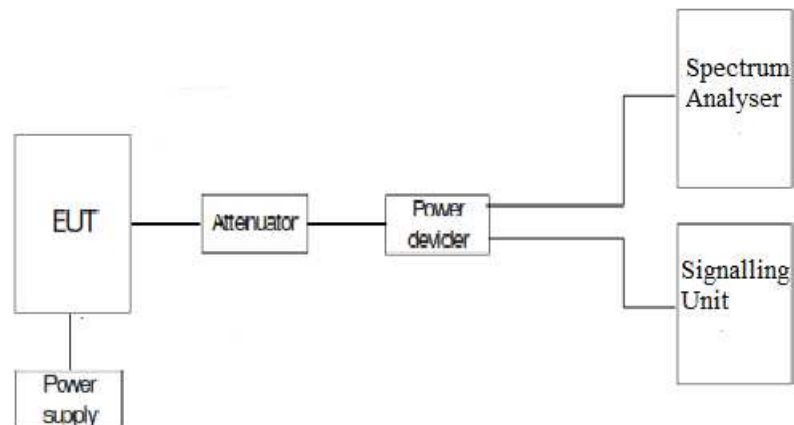
The spectrum was investigated from 9 kHz to 18 GHz for LTE Band IV.

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

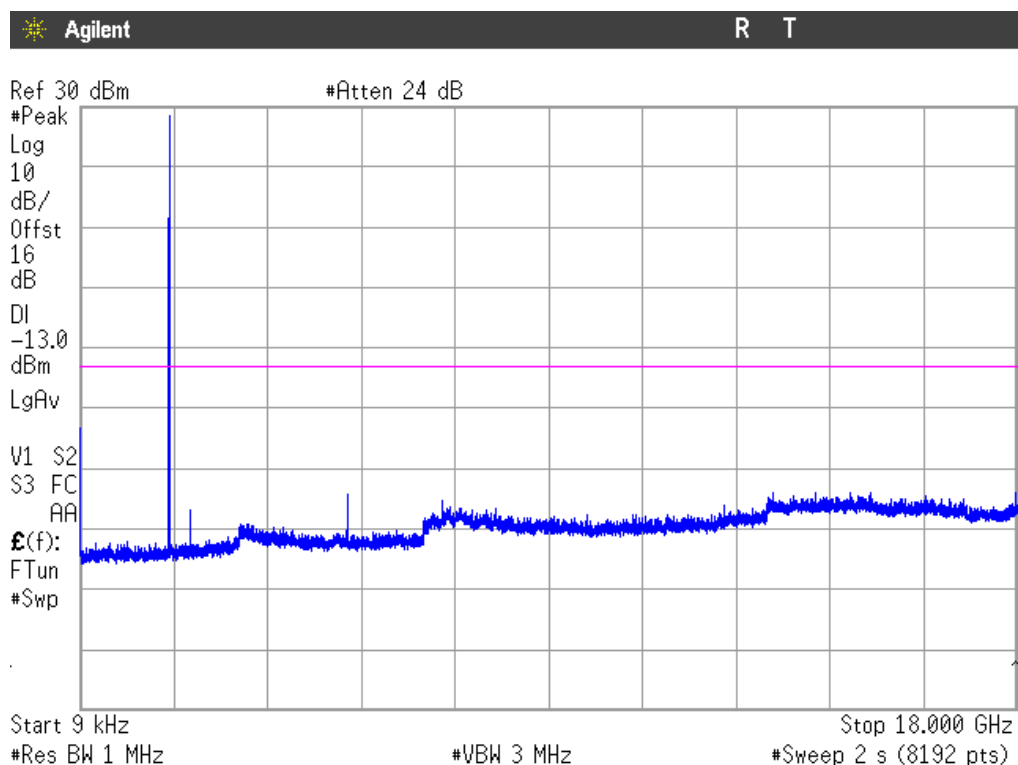
No spurious signals were found at less than 20dB respect to the limit in all the range.

Measurement uncertainty = ± 1.20 dB.

Verdict: PASS

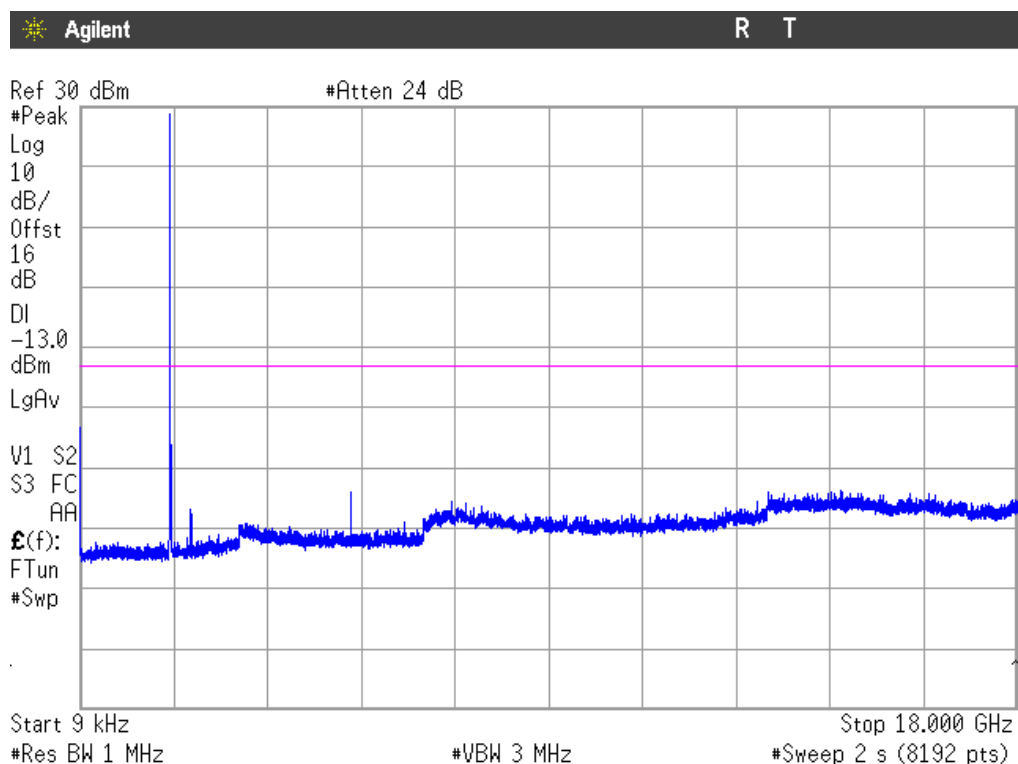
LTE QPSK MODULATION. BW = 1.4 MHz (Band IV)

1. CHANNEL: LOWEST



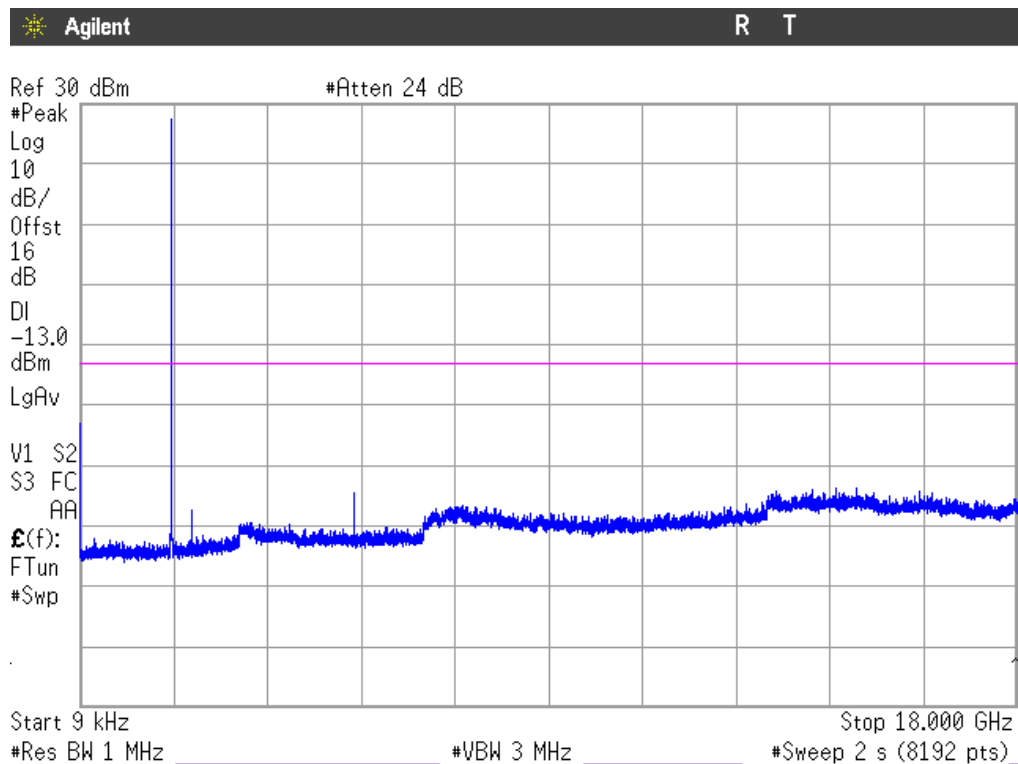
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

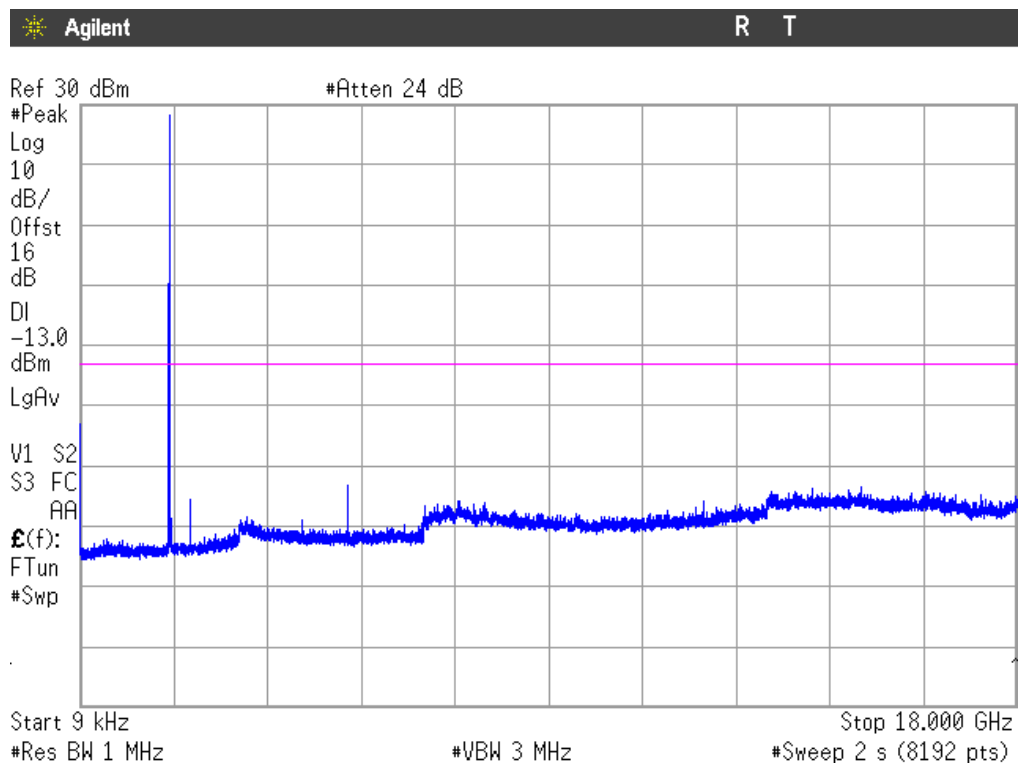
3. CHANNEL: HIGHEST



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

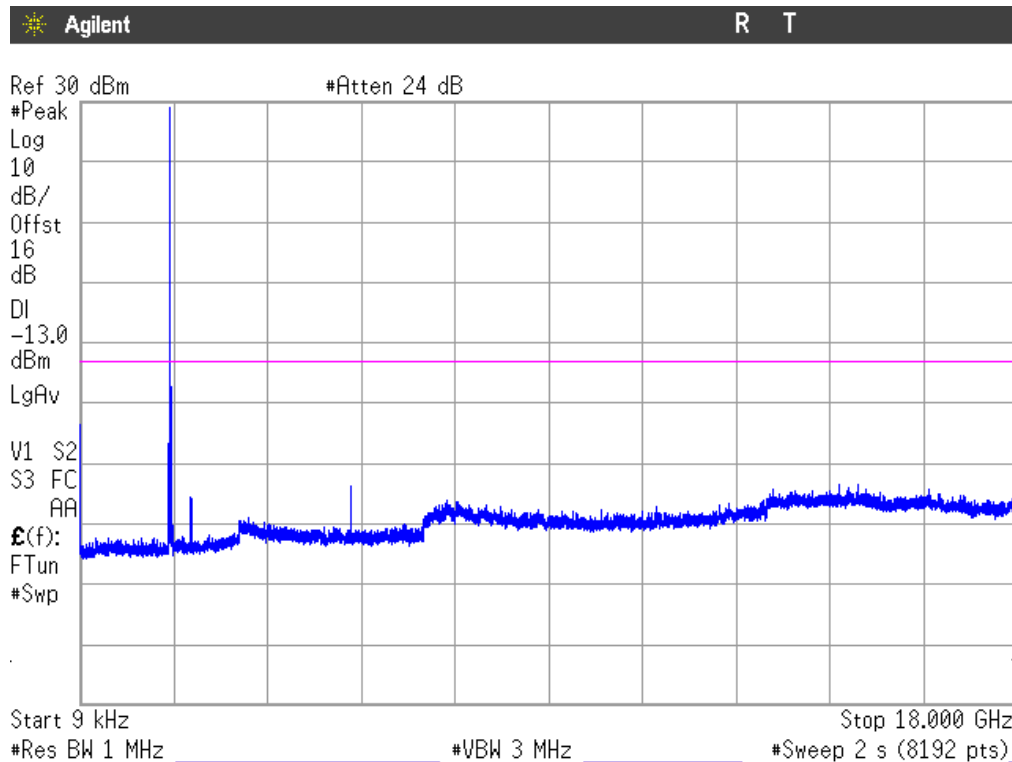
LTE QPSK MODULATION. BW = 3 MHz (Band IV)

1. CHANNEL: LOWEST



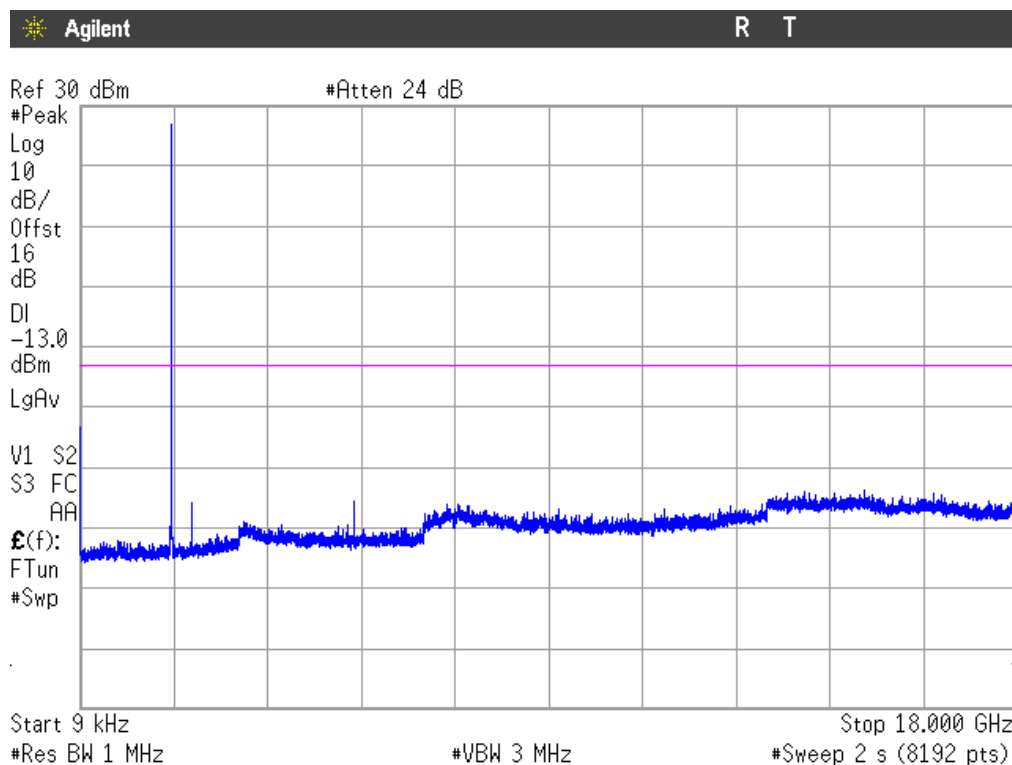
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

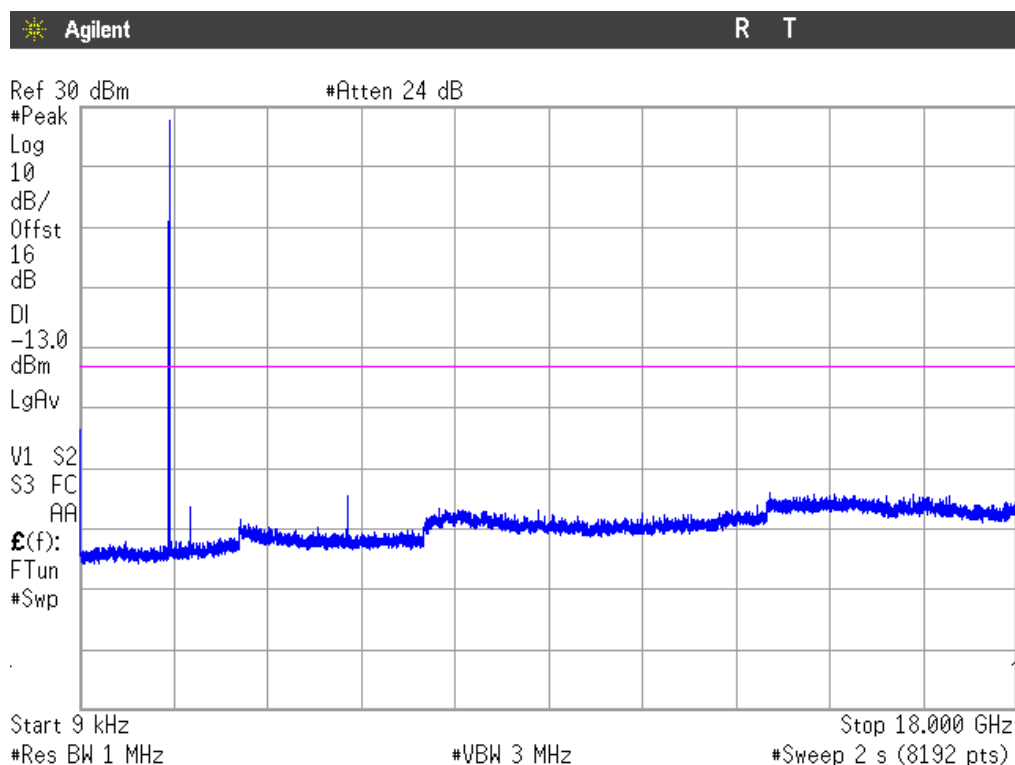
3. CHANNEL: HIGHEST



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

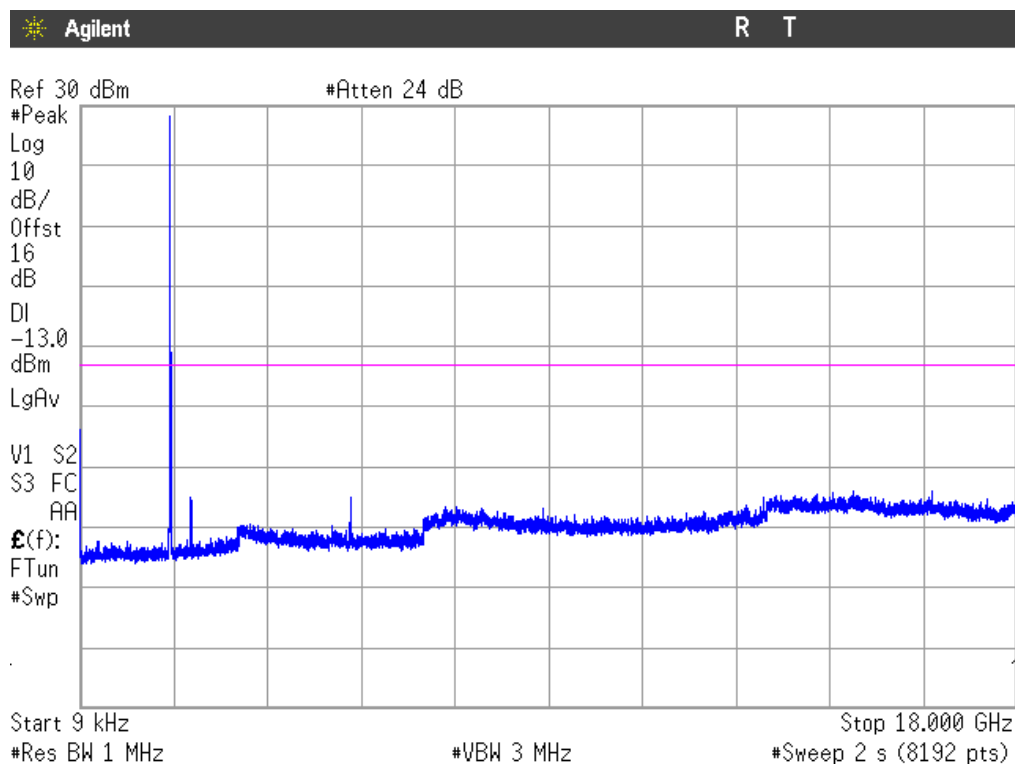
LTE QPSK MODULATION. BW = 5 MHz (Band IV)

1. CHANNEL: LOWEST



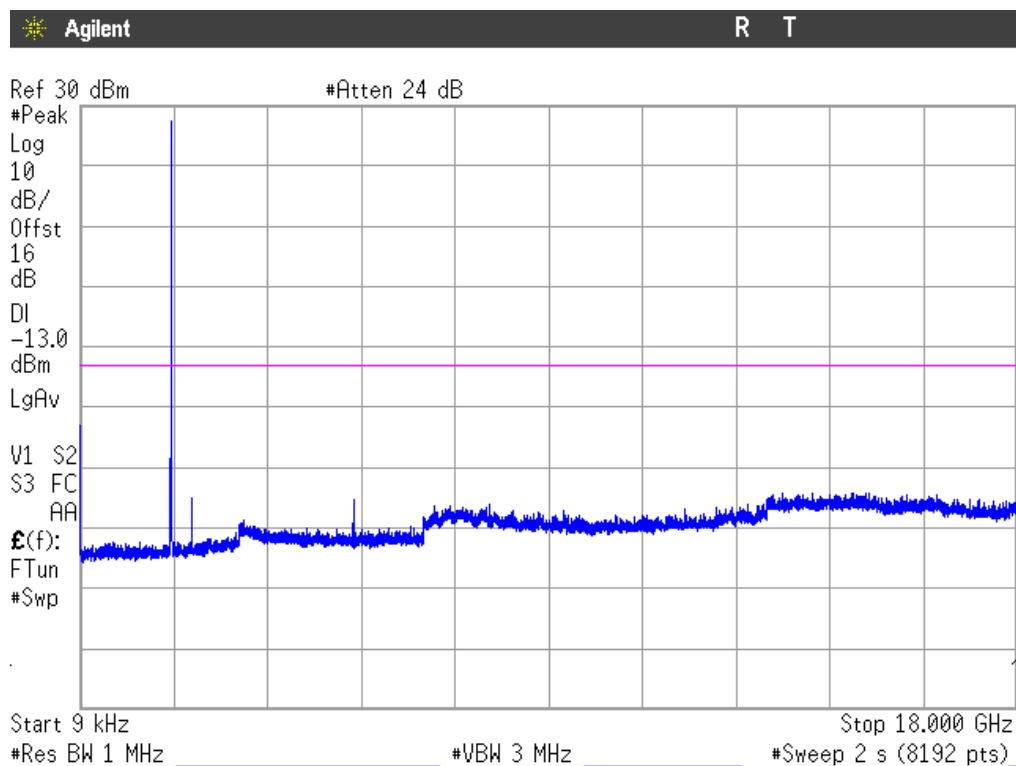
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

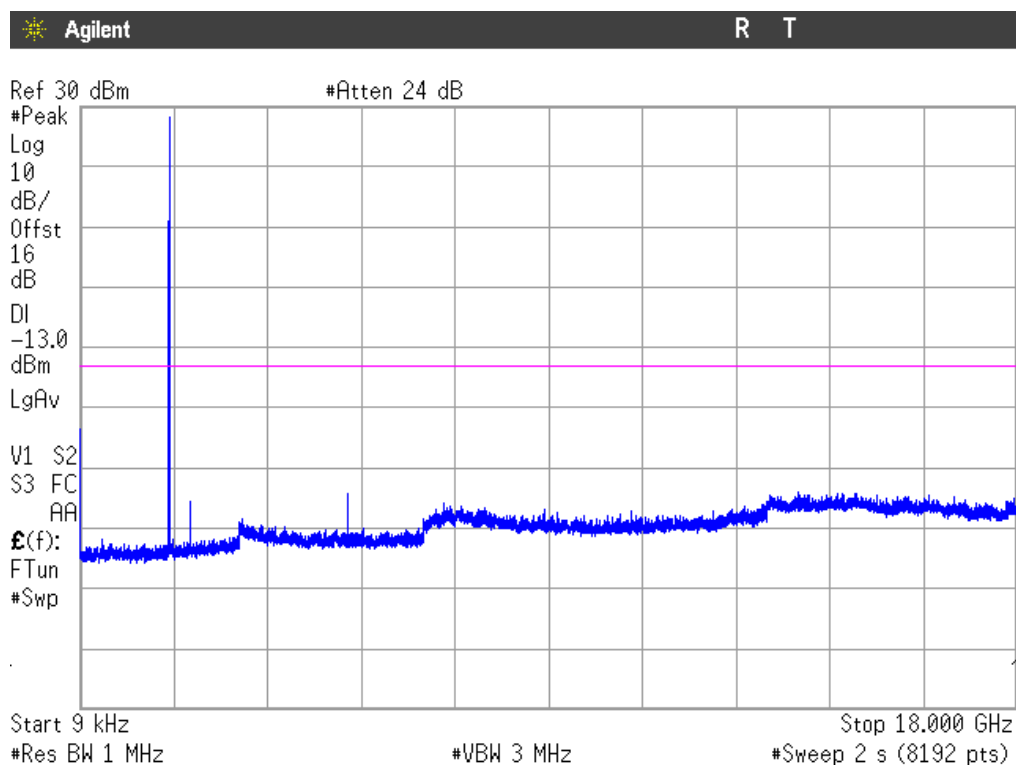
3. CHANNEL: HIGHEST



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

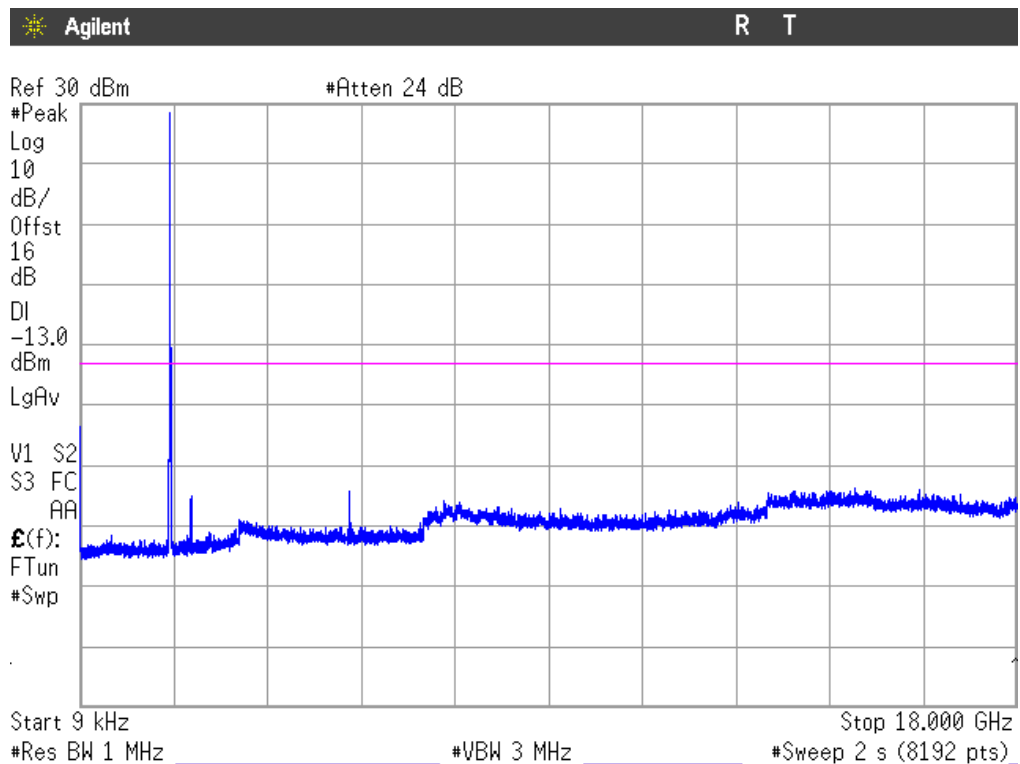
LTE QPSK MODULATION. BW = 10 MHz (Band IV)

1. CHANNEL: LOWEST



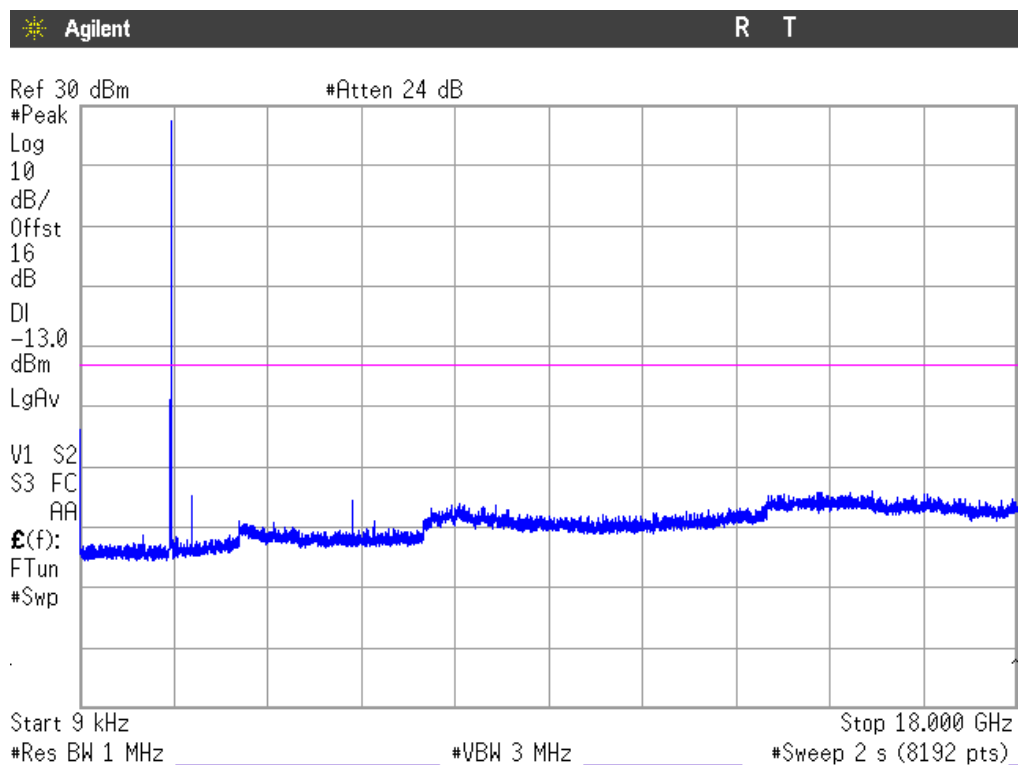
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

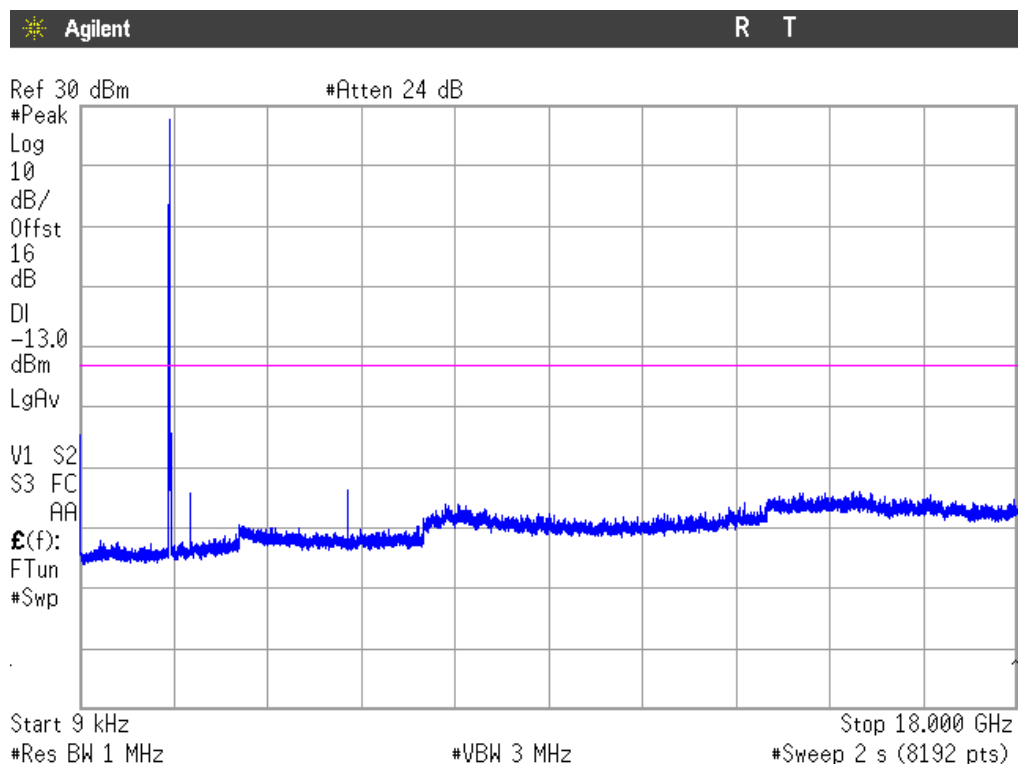
3. CHANNEL: HIGHEST



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

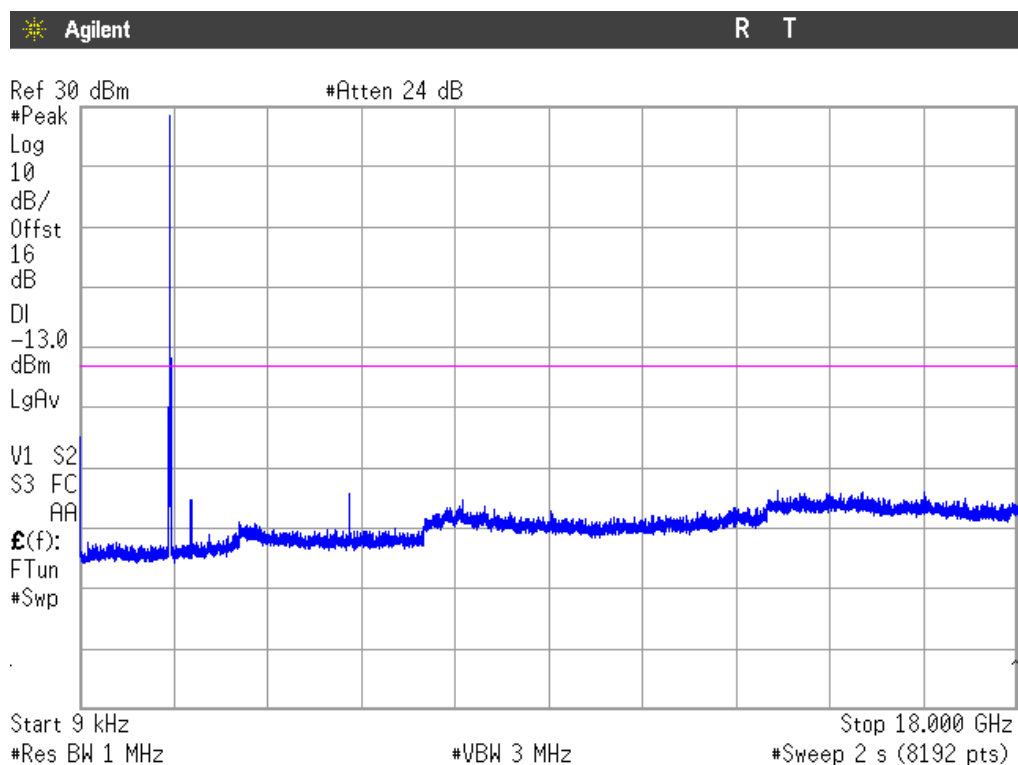
LTE QPSK MODULATION. BW = 15 MHz (Band IV)

1. CHANNEL: LOWEST



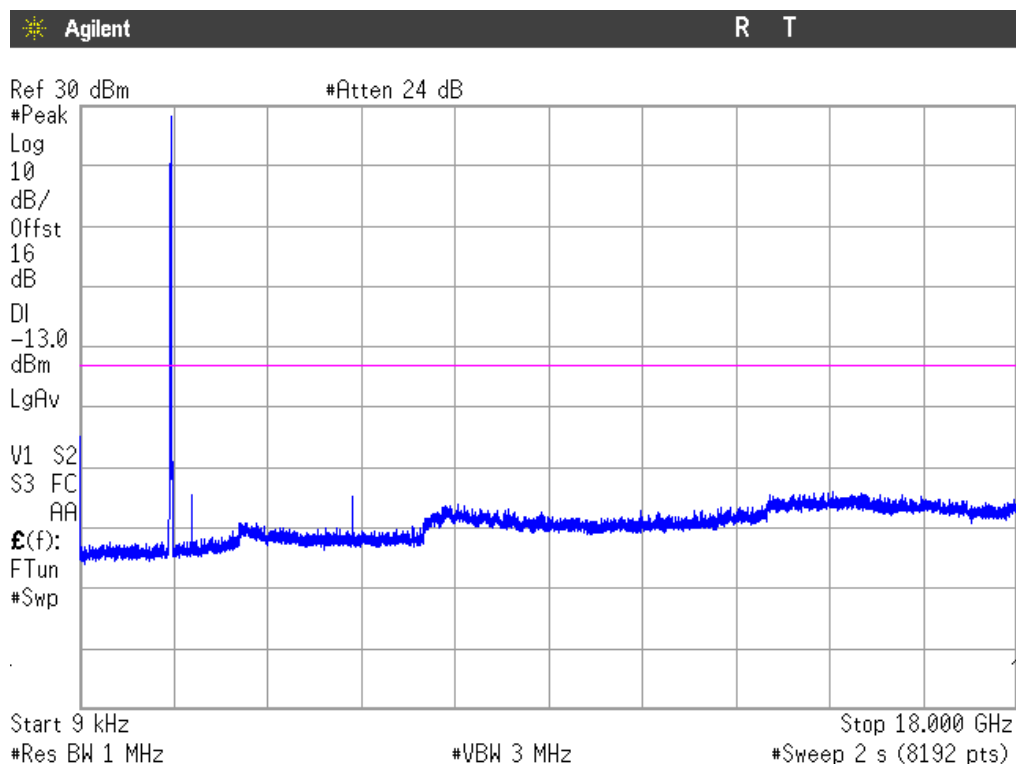
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

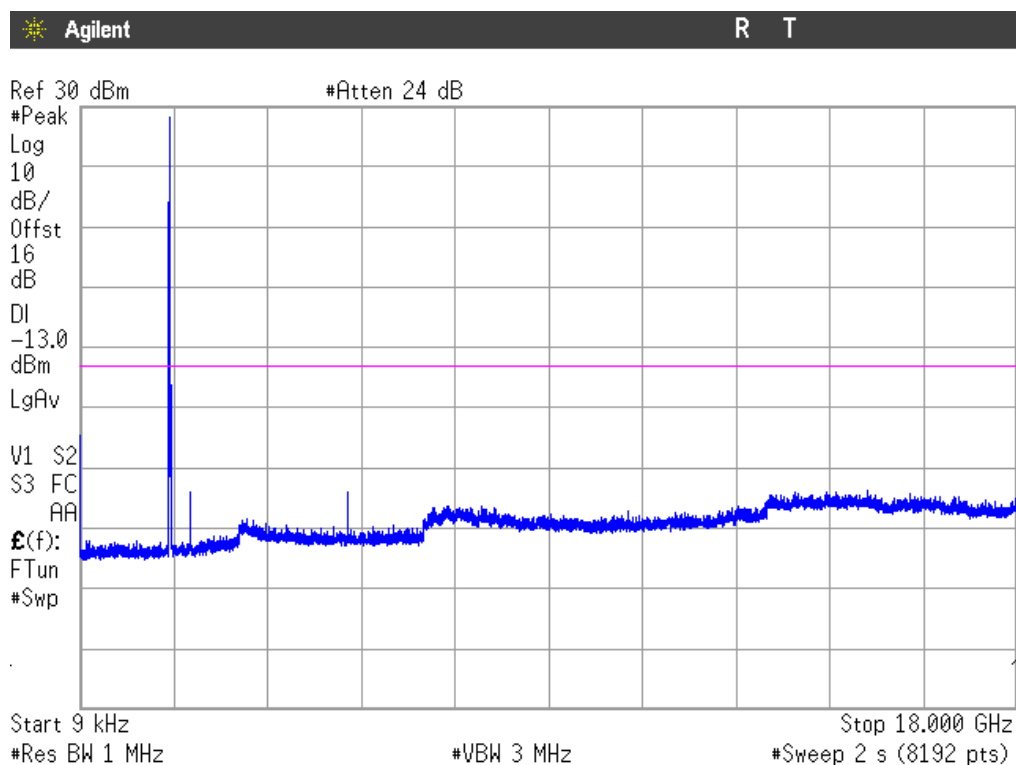
3. CHANNEL: HIGHEST



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

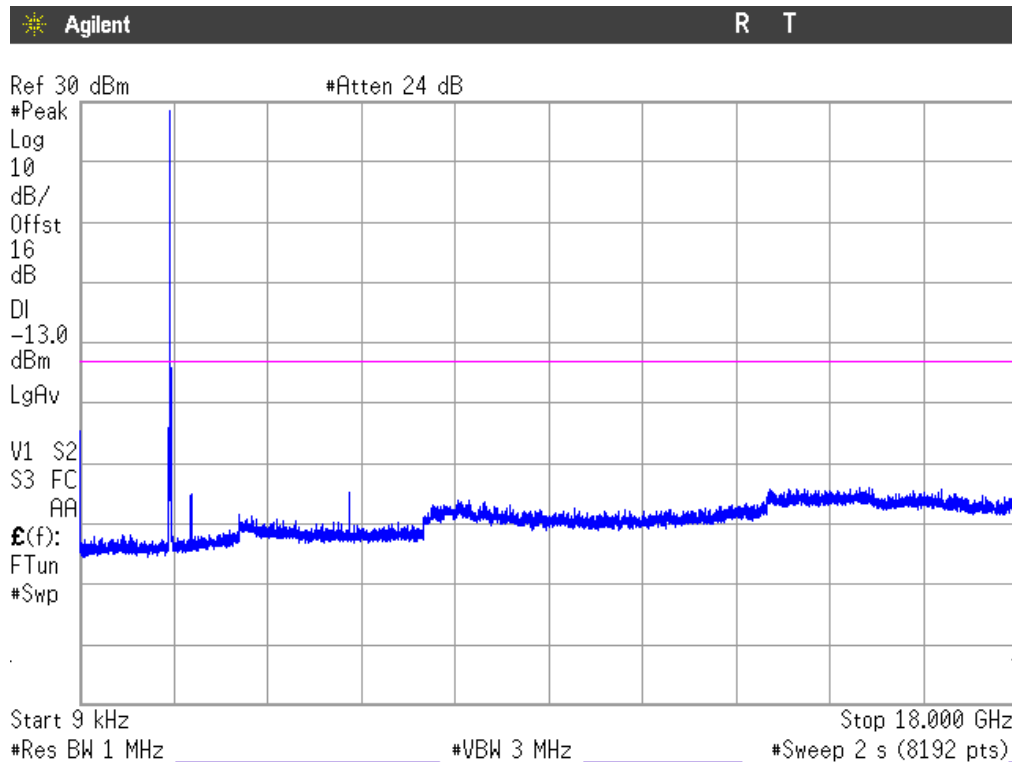
LTE QPSK MODULATION. BW = 20 MHz (Band IV)

1. CHANNEL: LOWEST



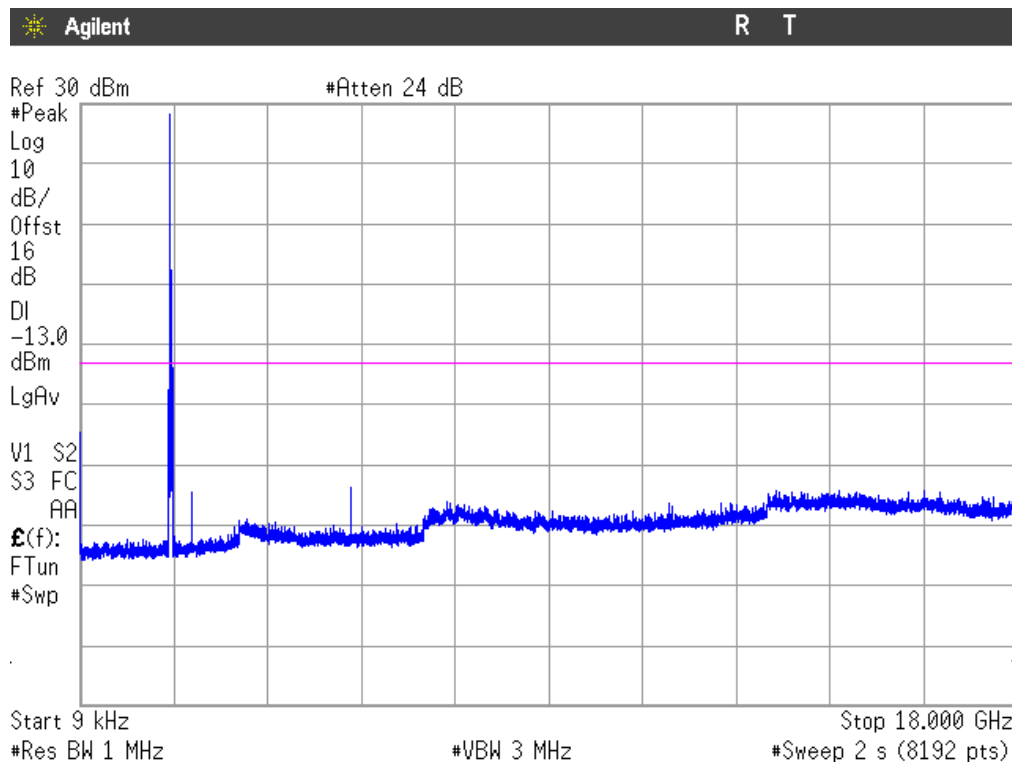
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

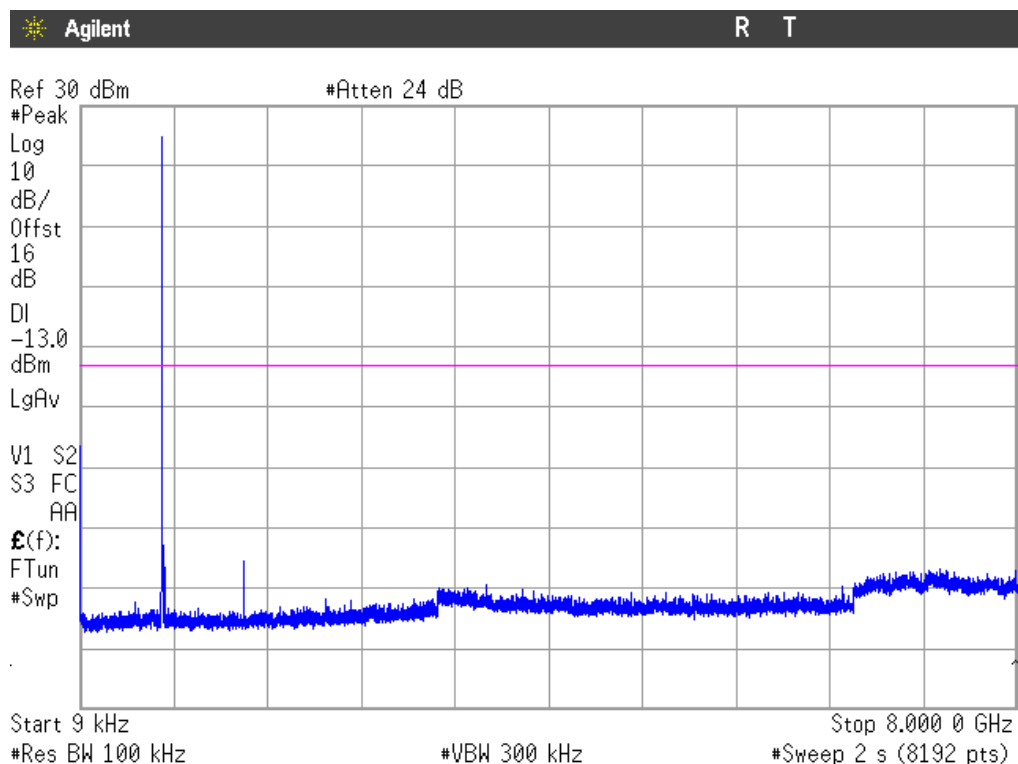
3. CHANNEL: HIGHEST



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

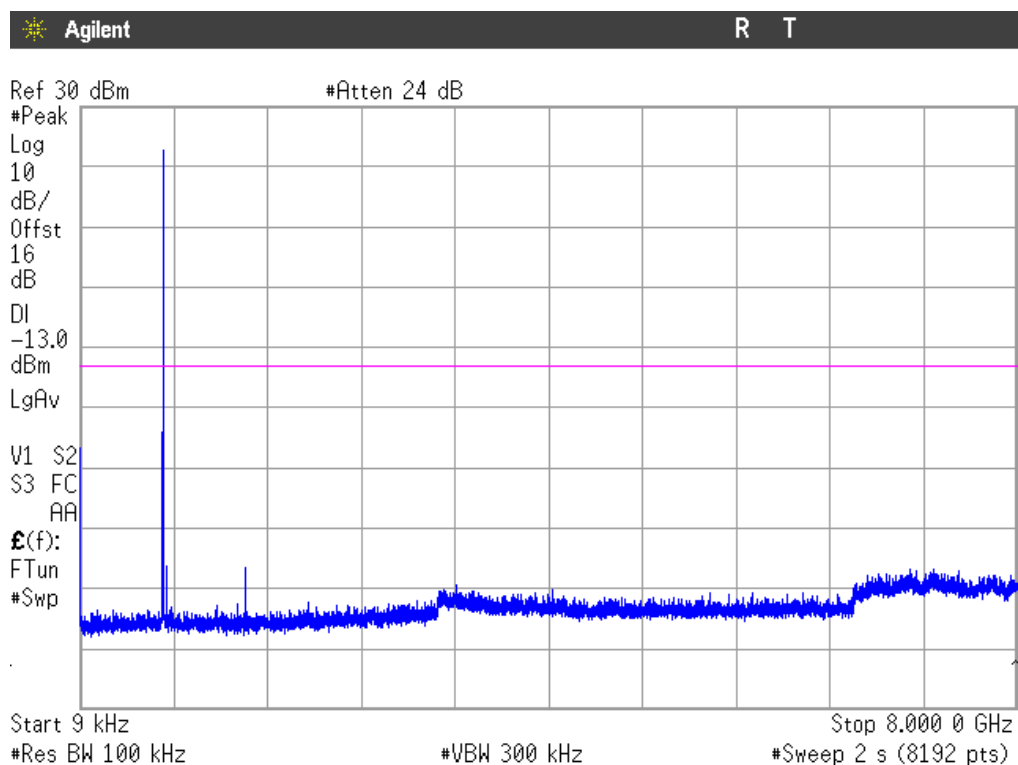
LTE QPSK MODULATION. BW = 1.4 MHz (Band XII)

1. CHANNEL: LOWEST



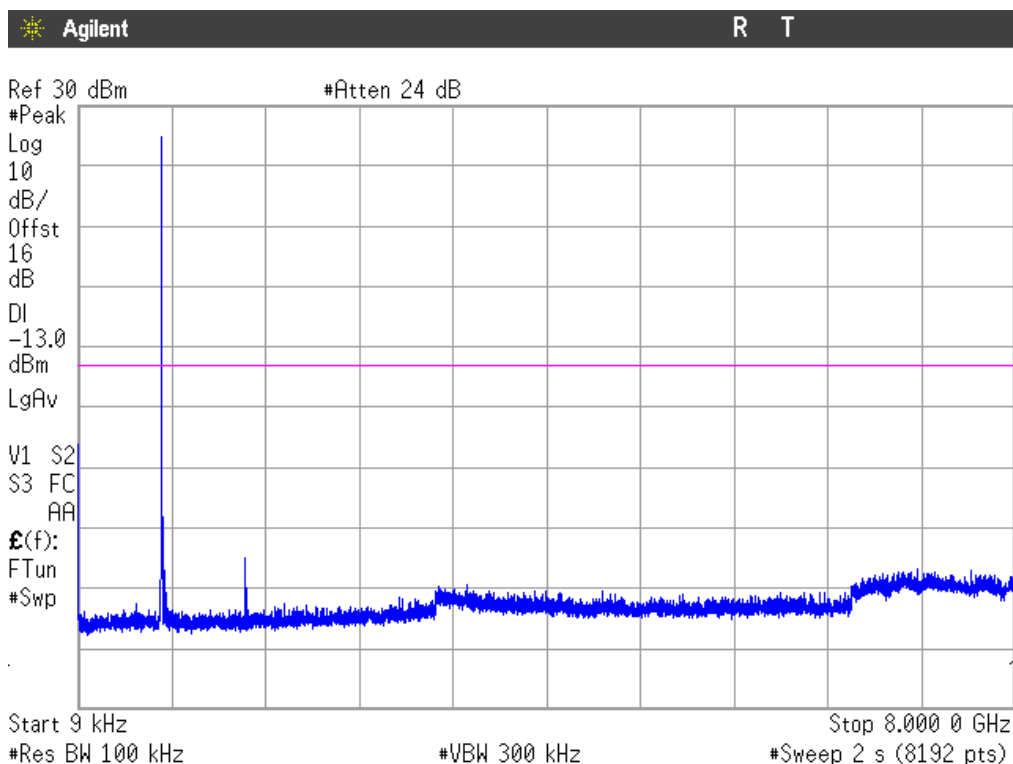
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

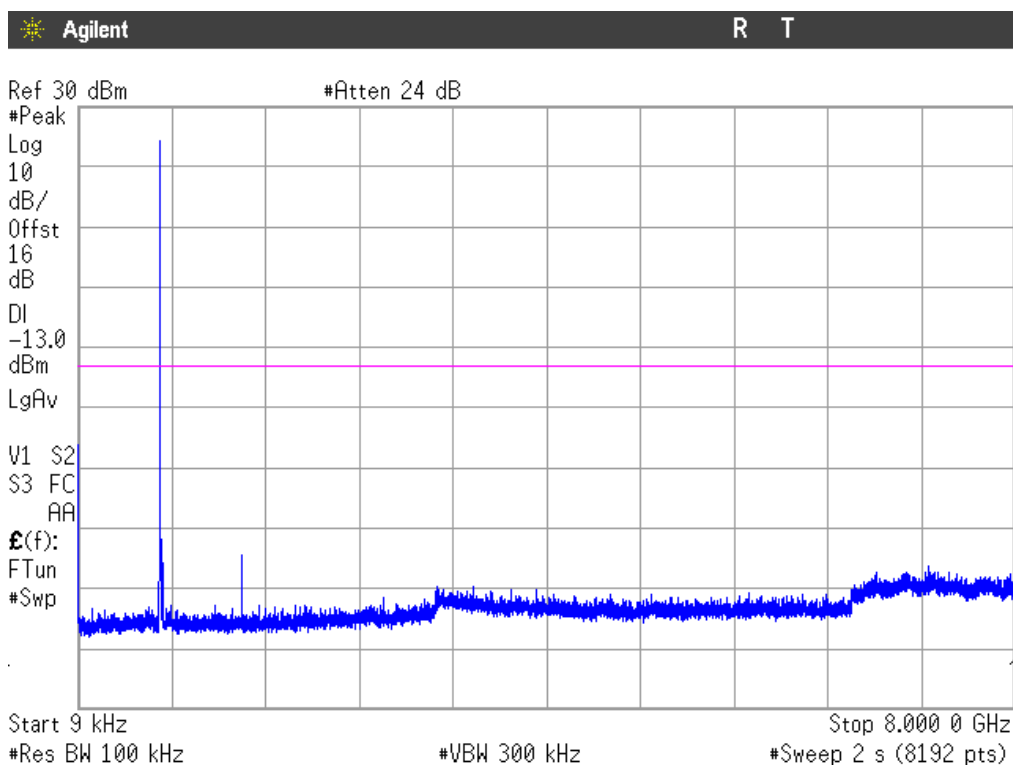
3. CHANNEL: HIGHEST



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

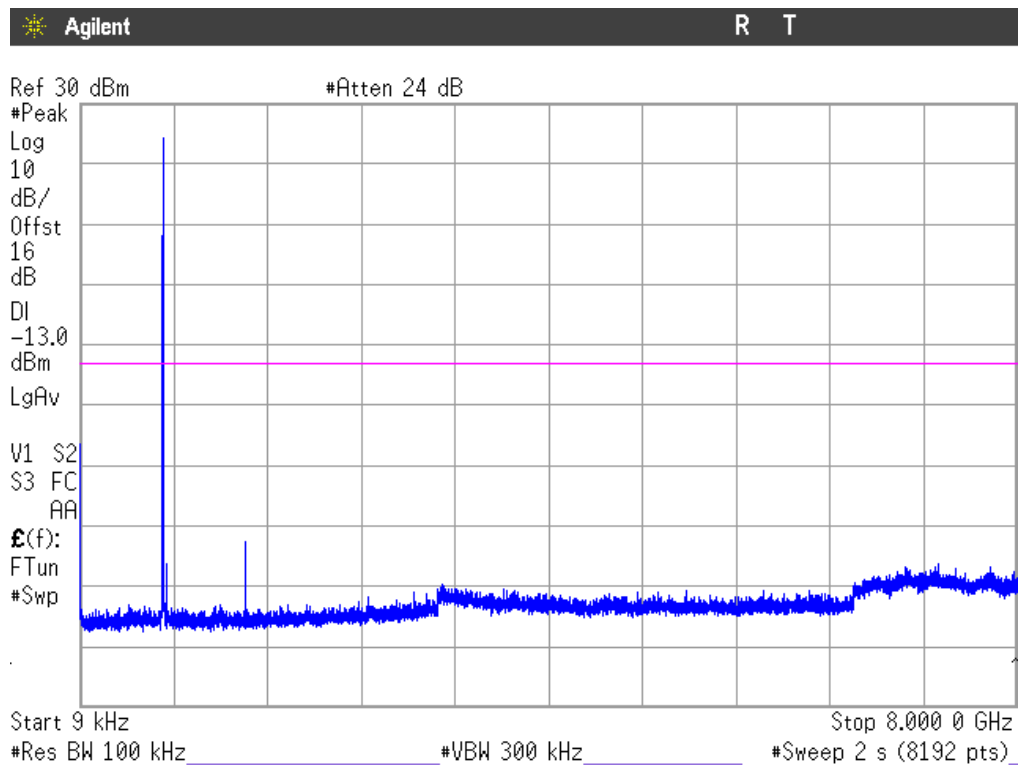
LTE QPSK MODULATION. BW = 3 MHz (Band XII)

1. CHANNEL: LOWEST



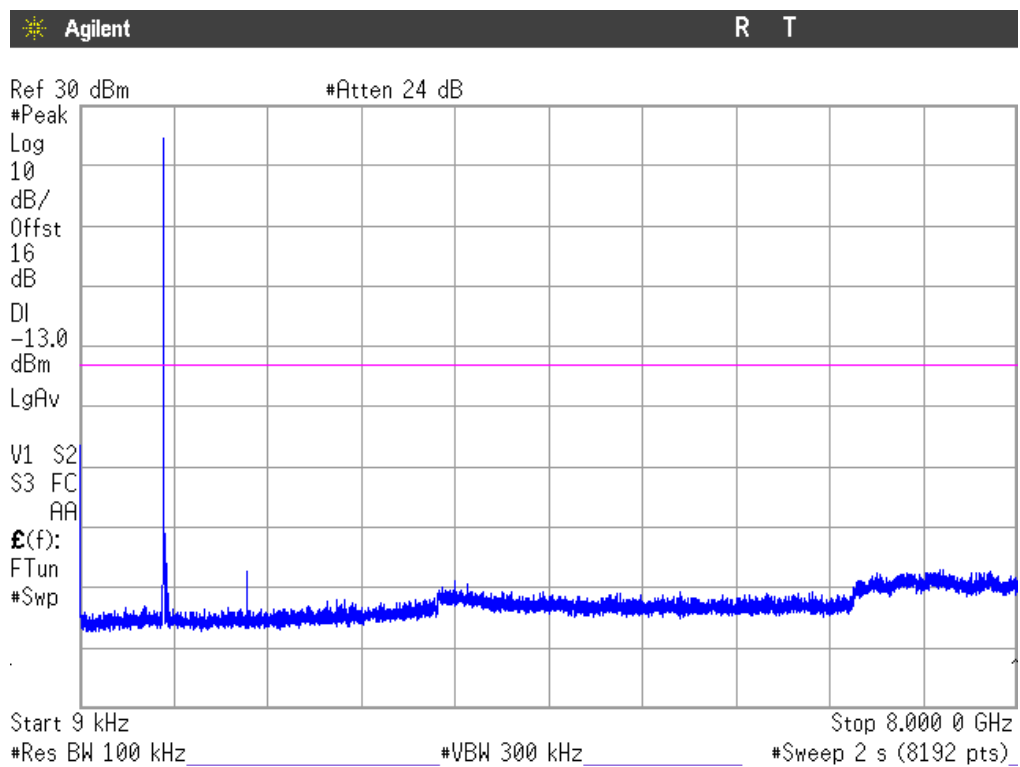
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

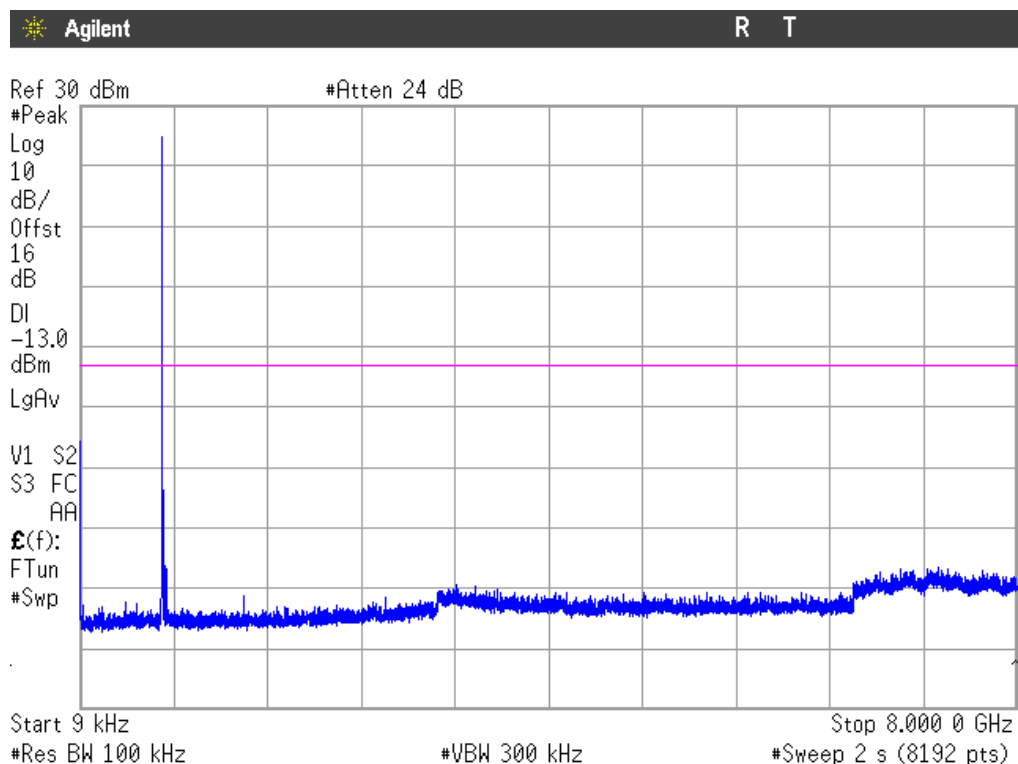
3. CHANNEL: HIGHEST



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

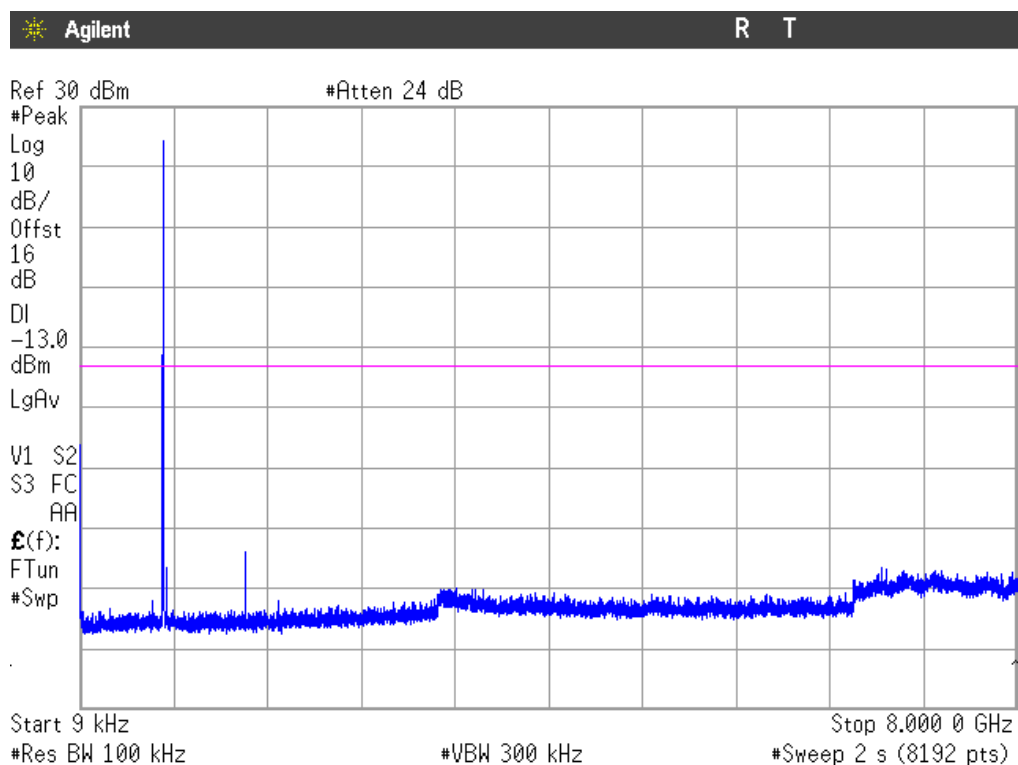
LTE QPSK MODULATION. BW = 5 MHz (Band XII)

1. CHANNEL: LOWEST



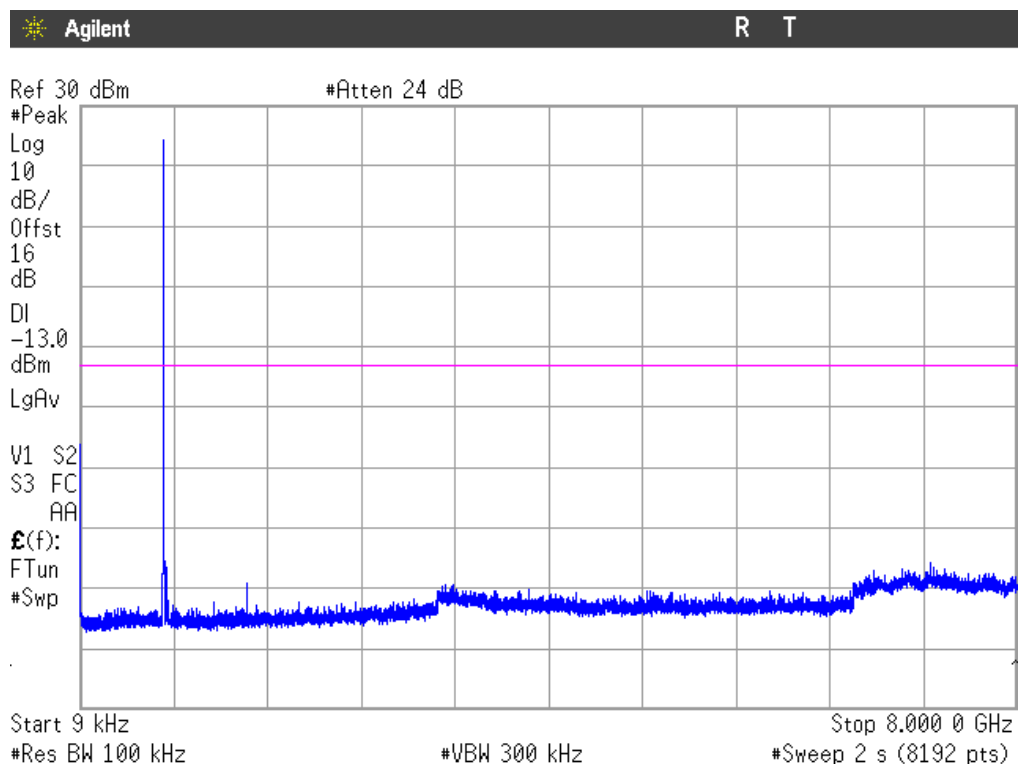
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

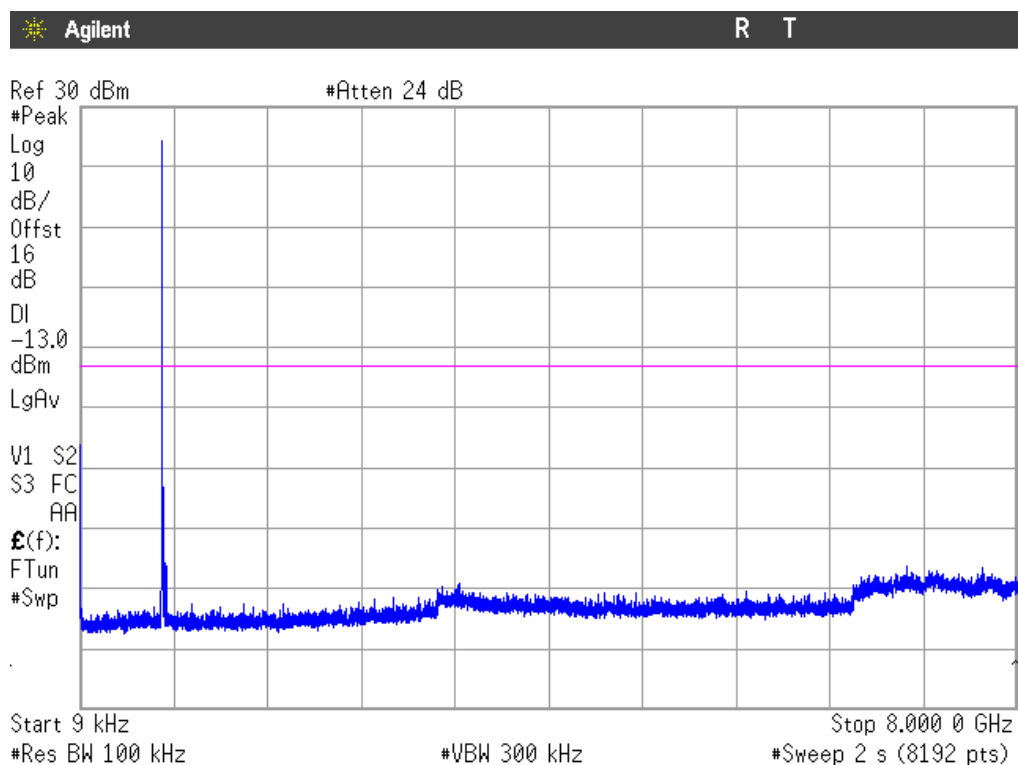
3. CHANNEL: HIGHEST



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

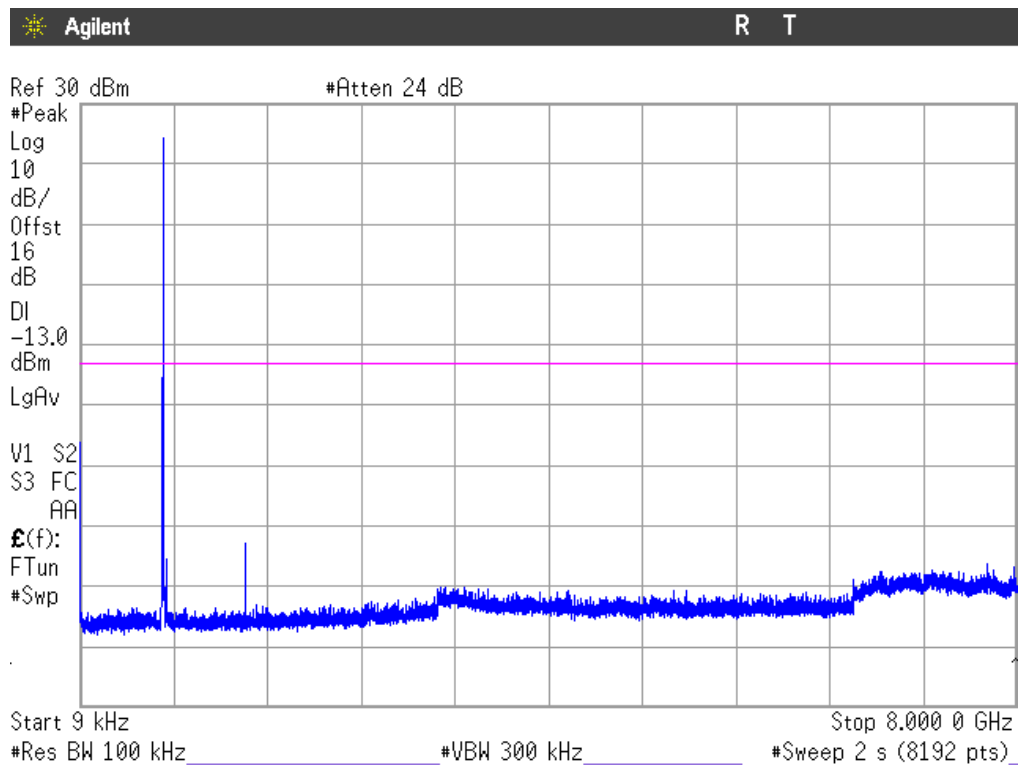
LTE QPSK MODULATION. BW = 10 MHz (Band XII)

1. CHANNEL: LOWEST



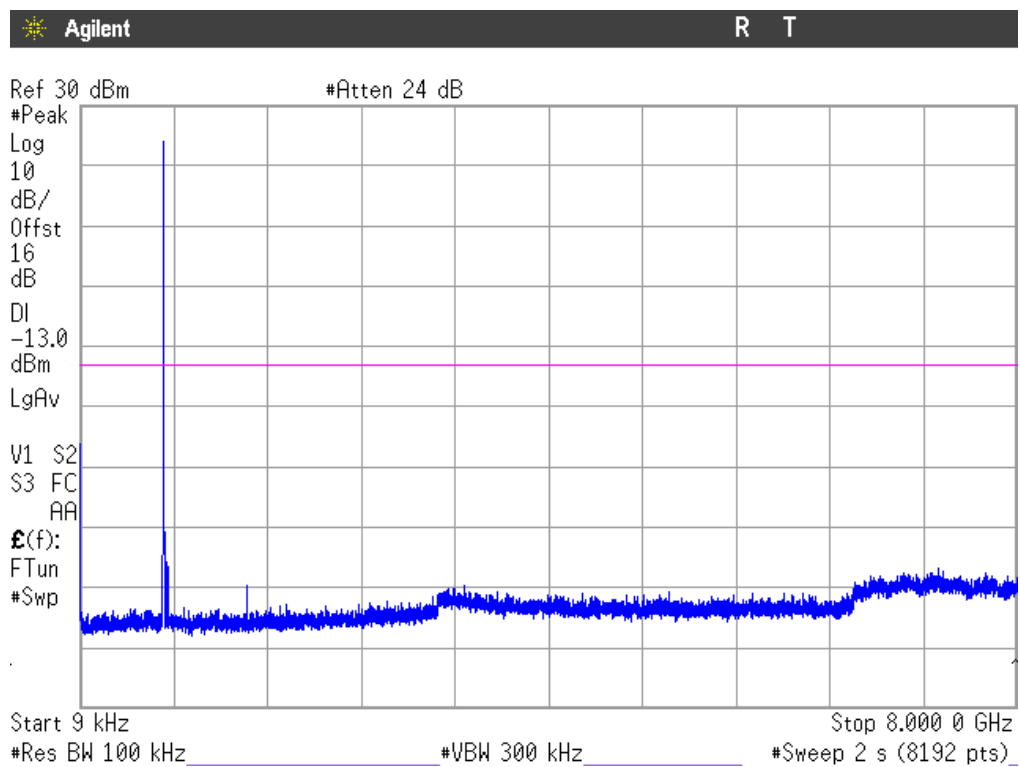
Note: The peak above the limit is the carrier frequency.

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.

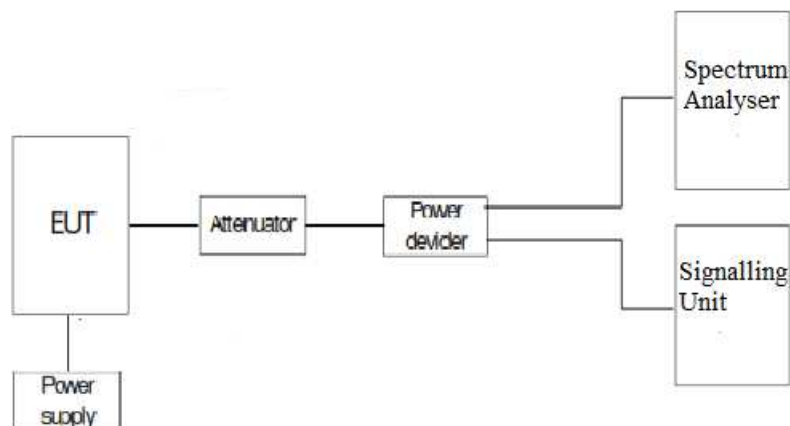
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

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

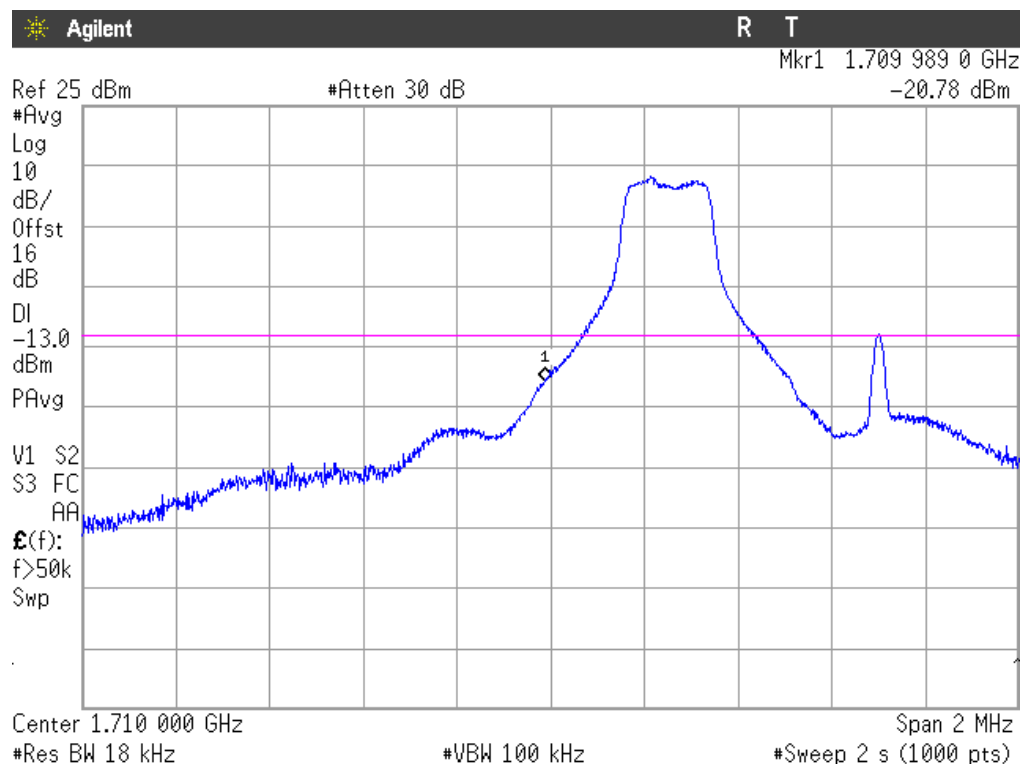
LTE QPSK MODULATION: (Channels in Band XII):	RB= 1. Offset=Max. BW=1.4 MHz	RB= 1. Offset=Max. BW = 3 MHz	RB= 1. Offset=Max. BW = 5 MHz	RB= 1. Offset=Max. BW = 10 MHz
Maximum measured level at highest Block Edge at antenna port (dBm)	-15.56	-14.66	-14.71	-15.12

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)

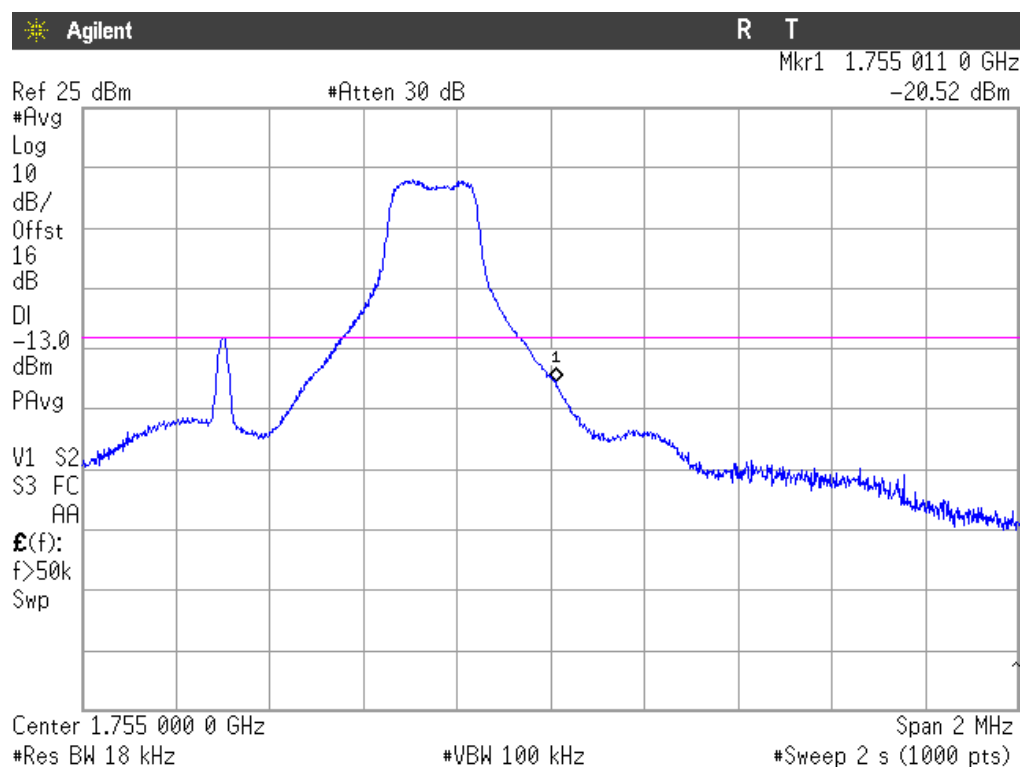
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

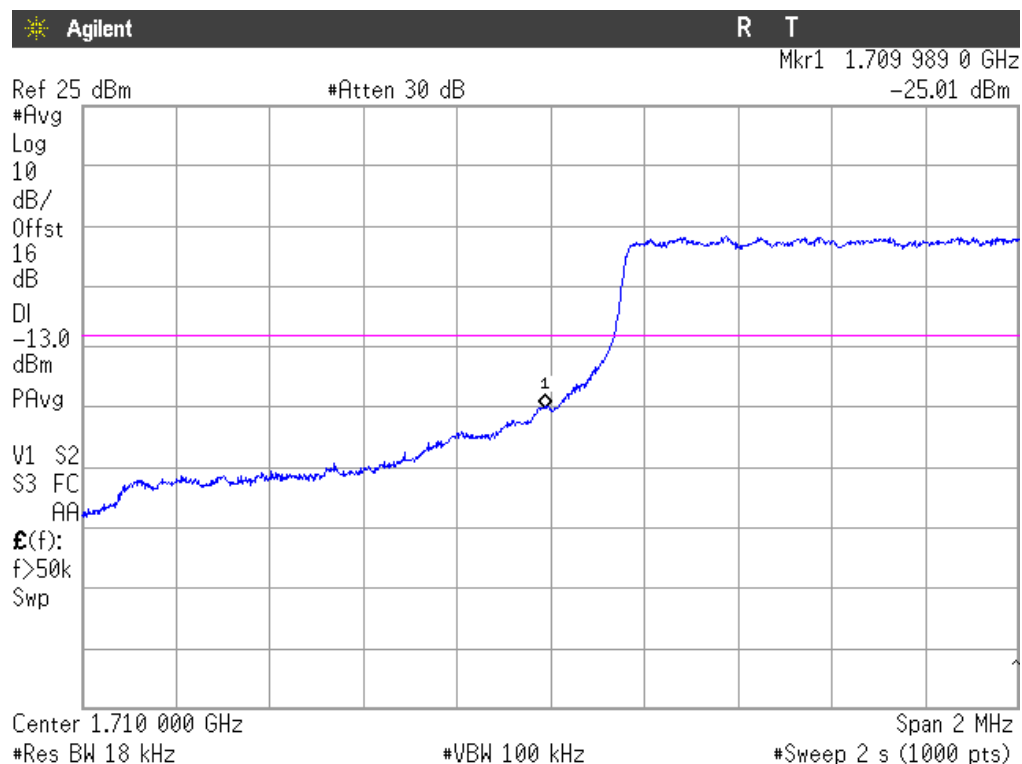
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

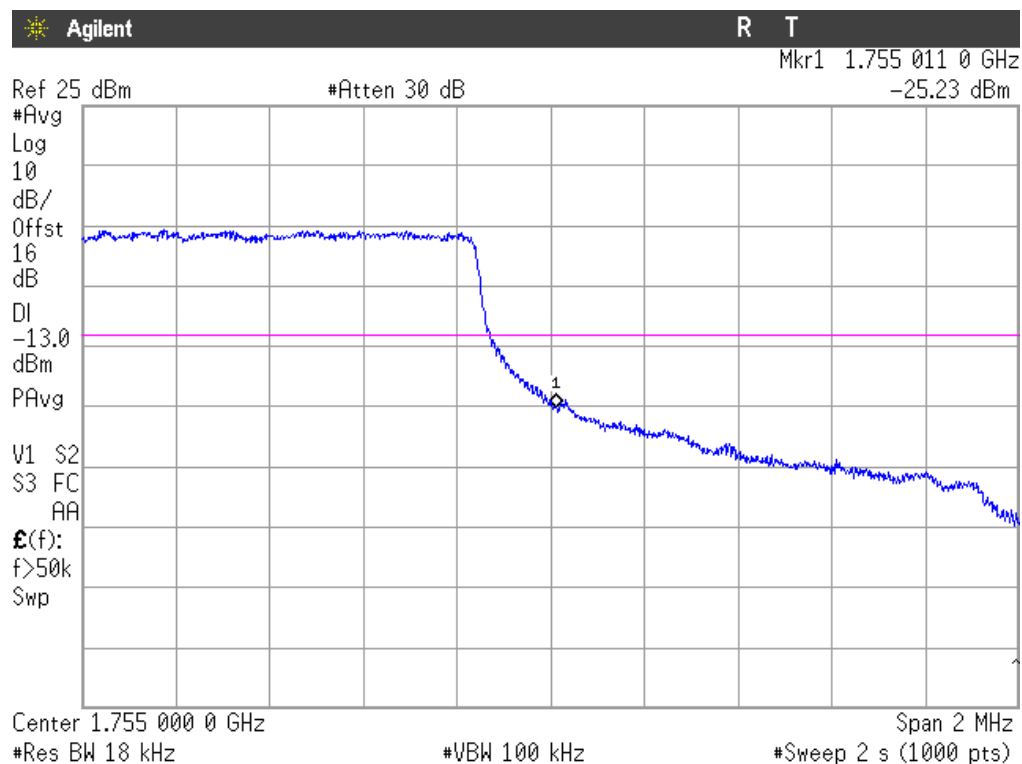
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

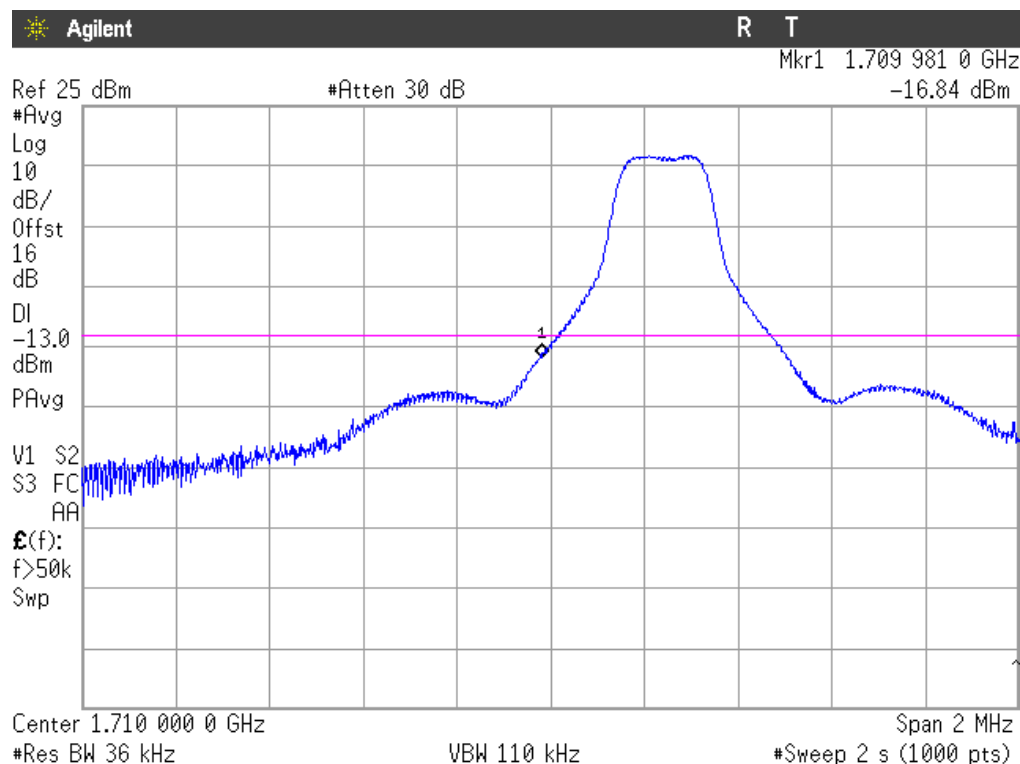


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

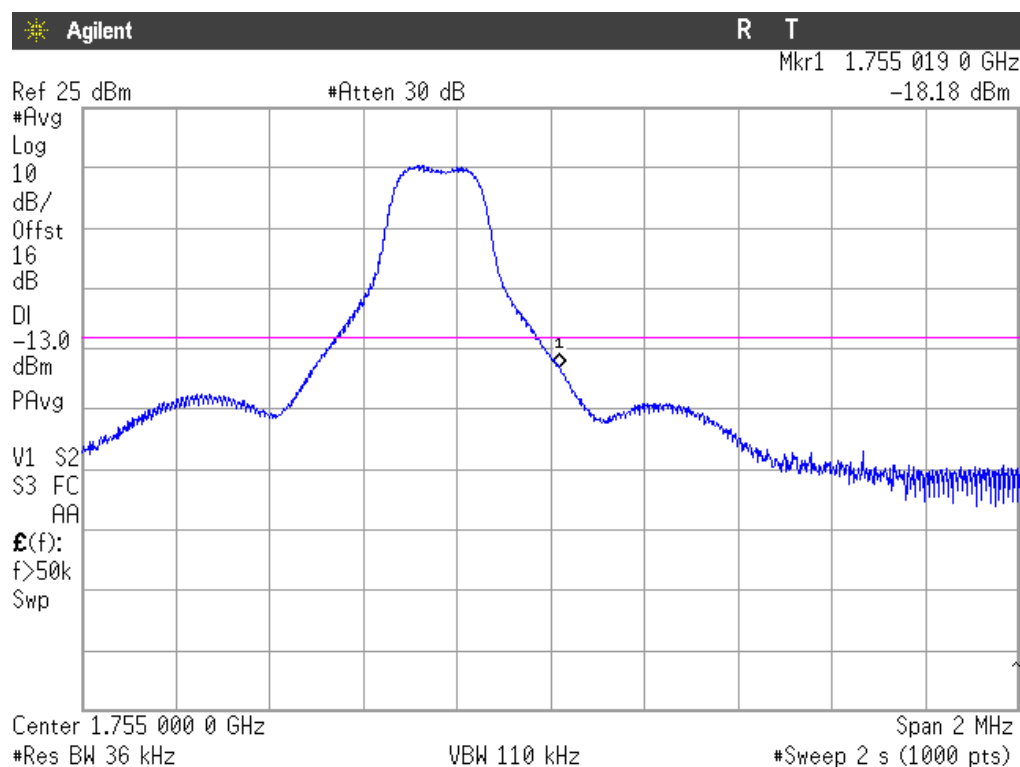
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

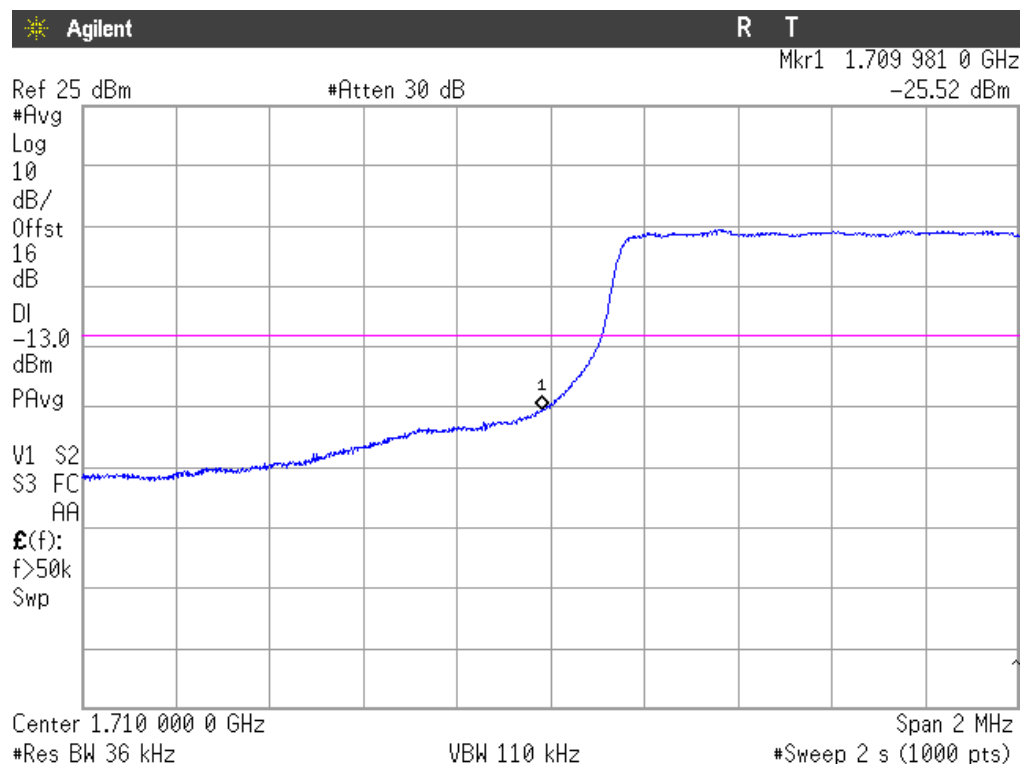
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

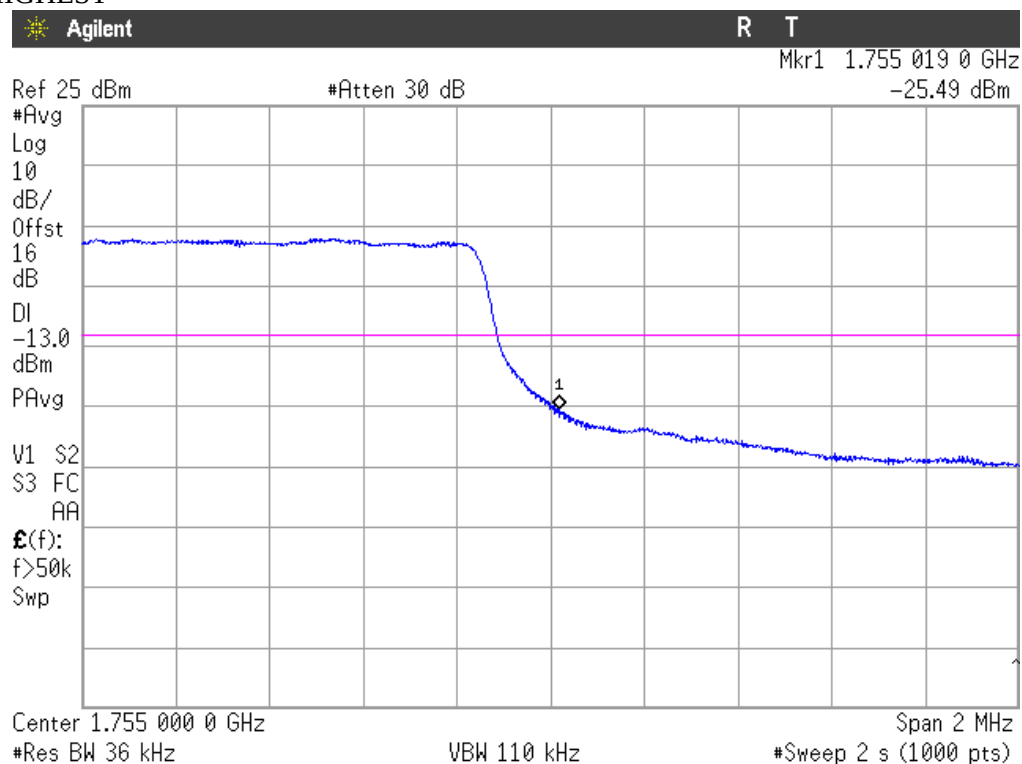
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

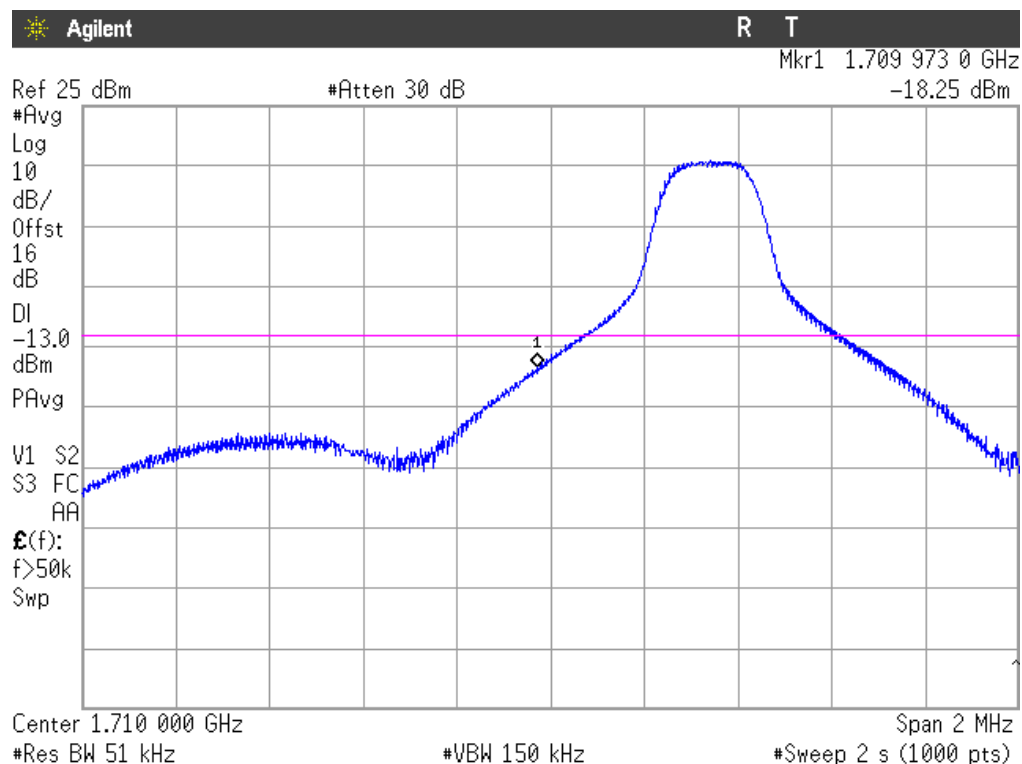


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

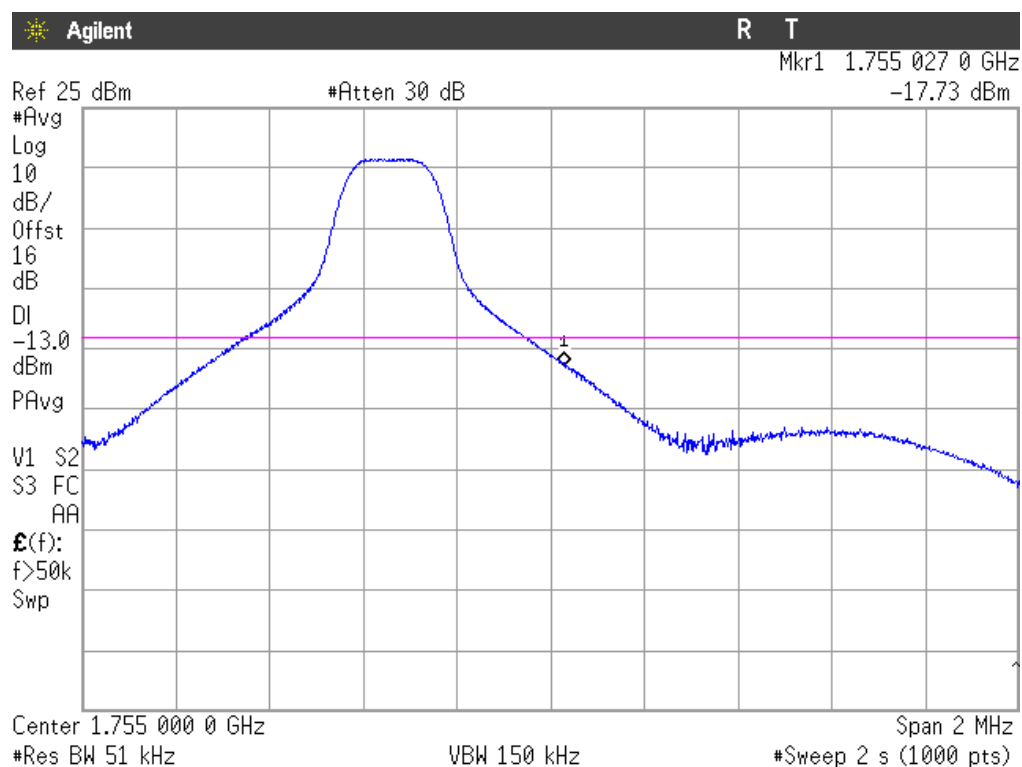
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

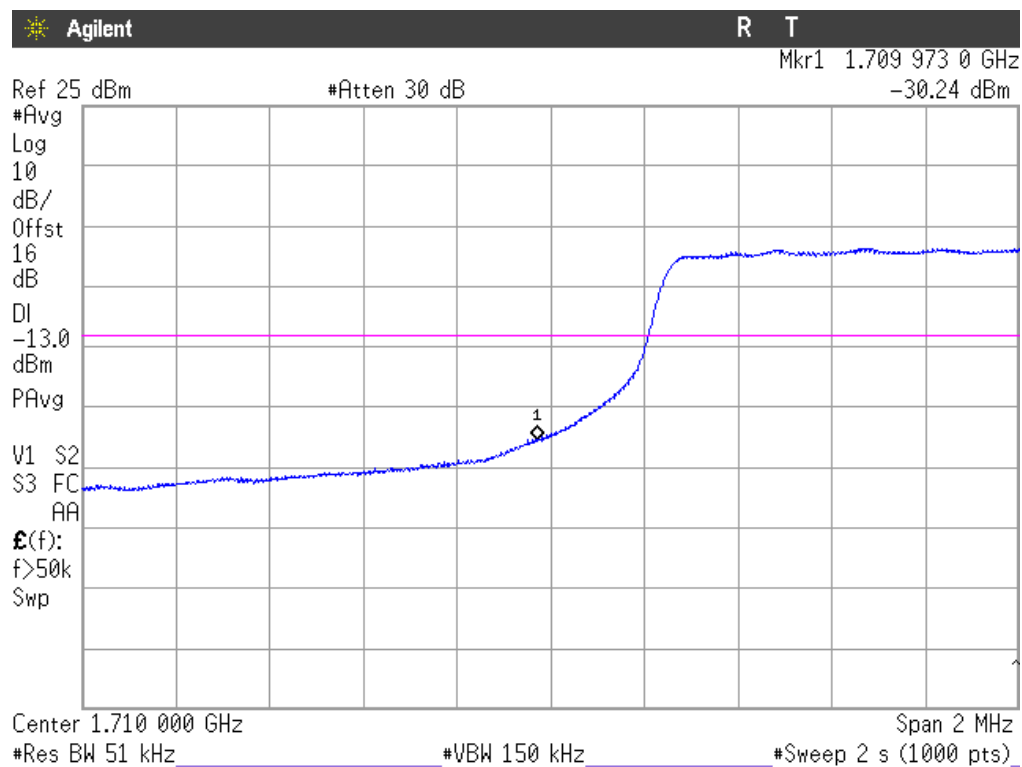
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

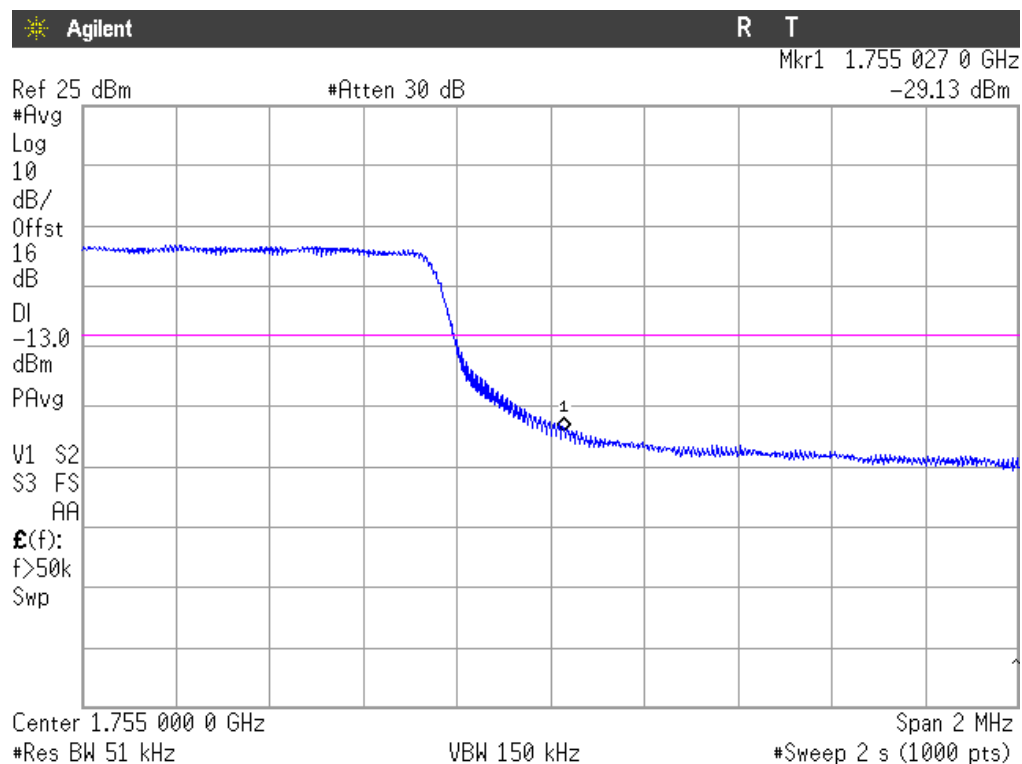
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

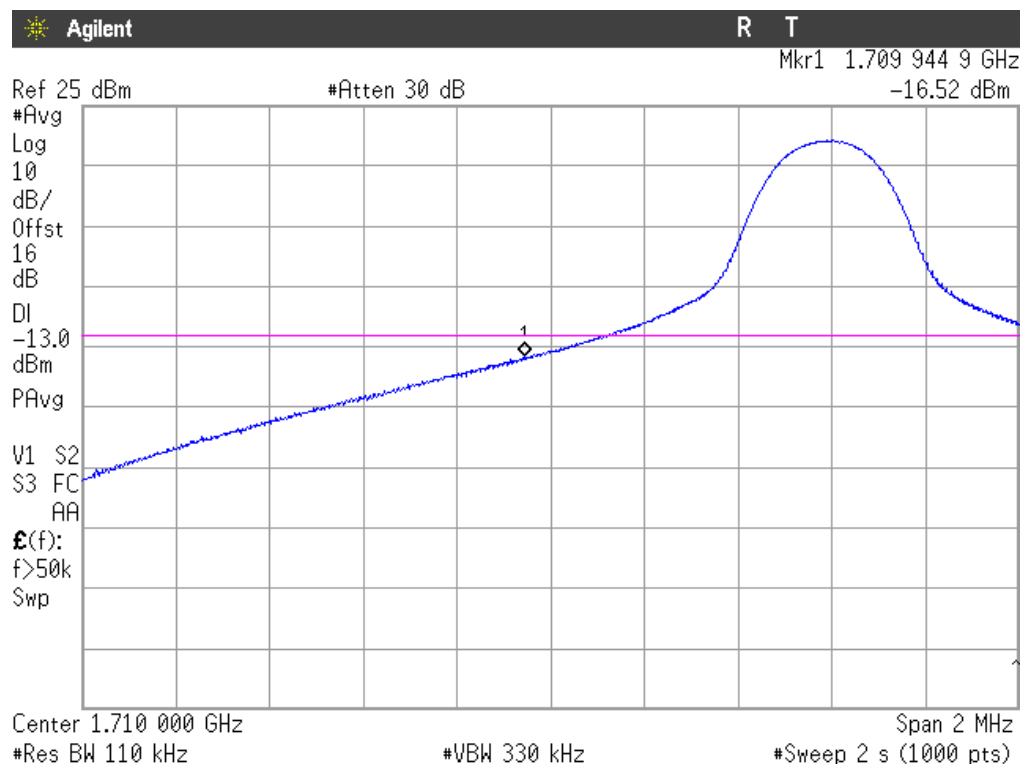


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

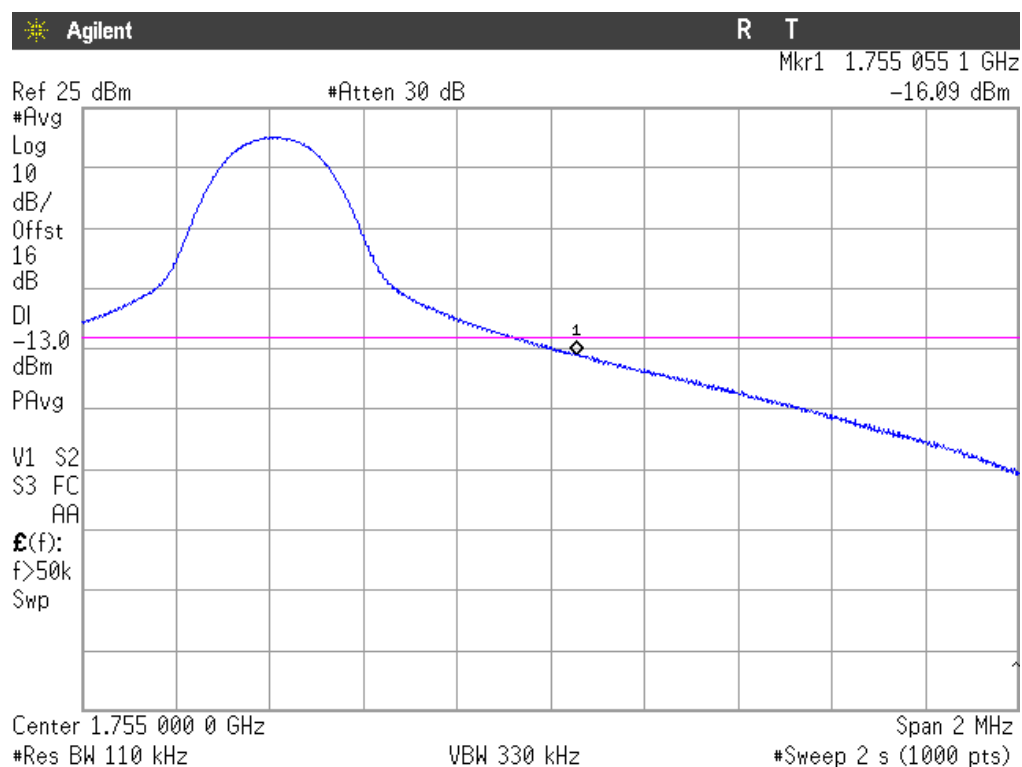
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

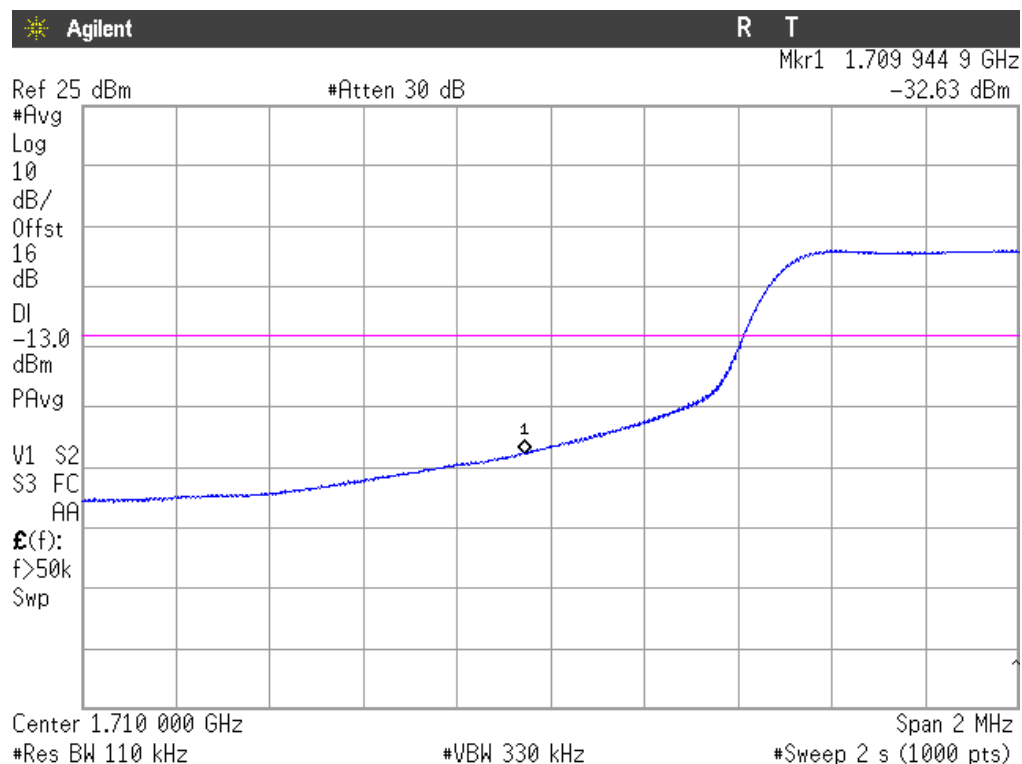
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

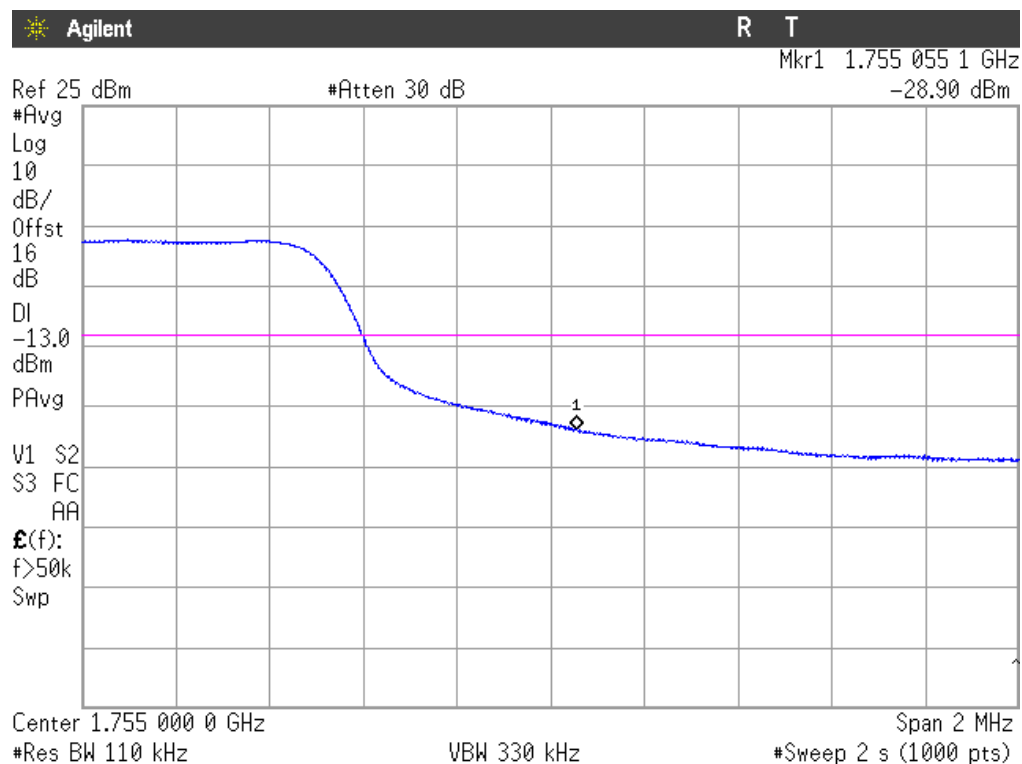
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

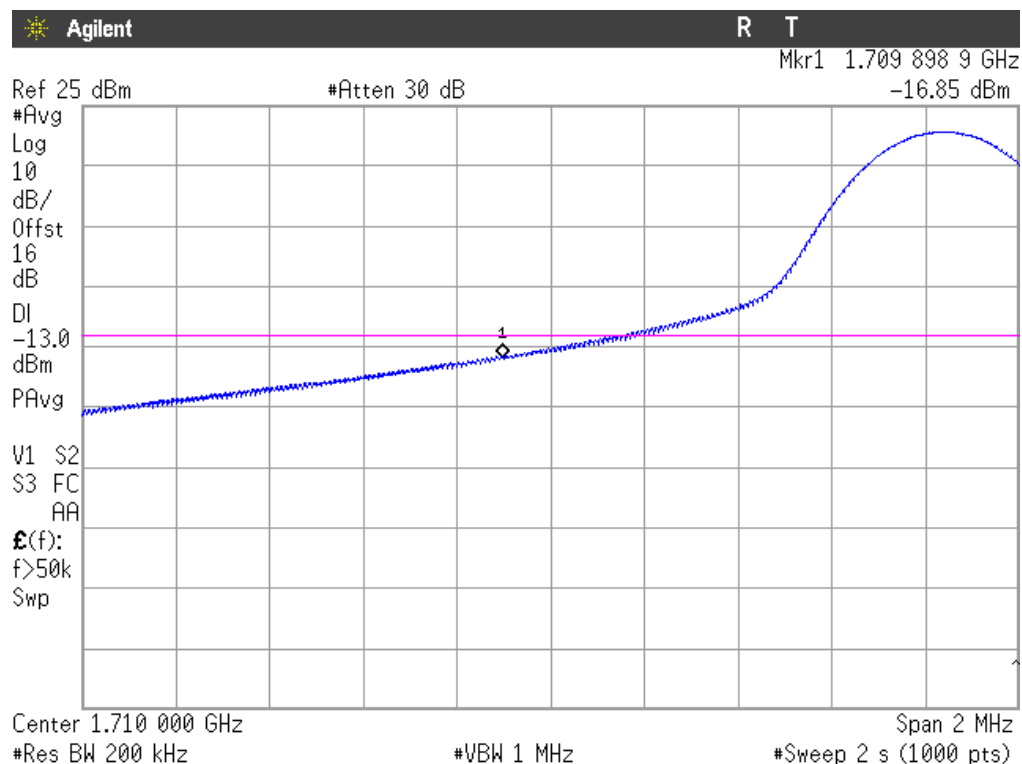


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

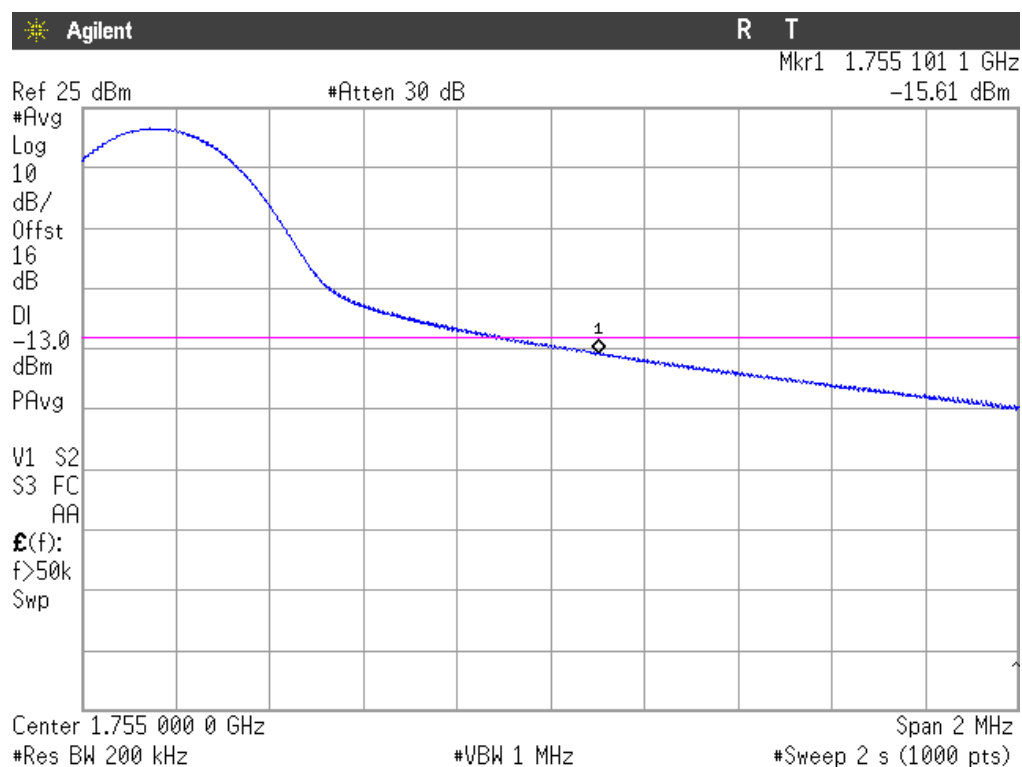
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

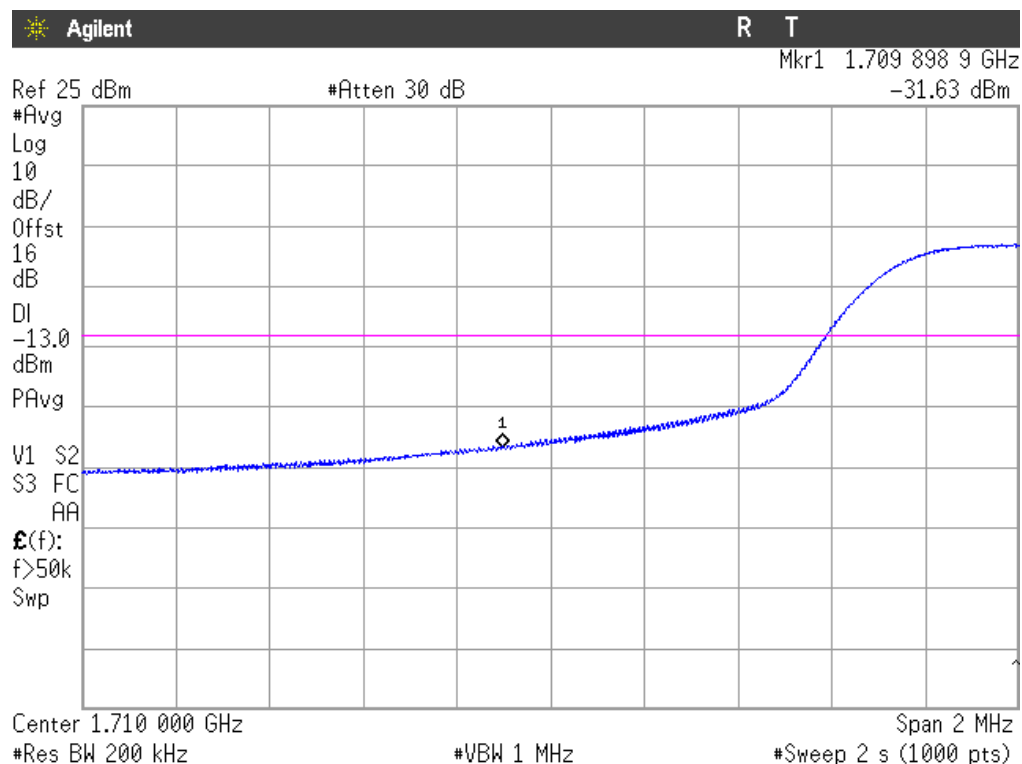
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

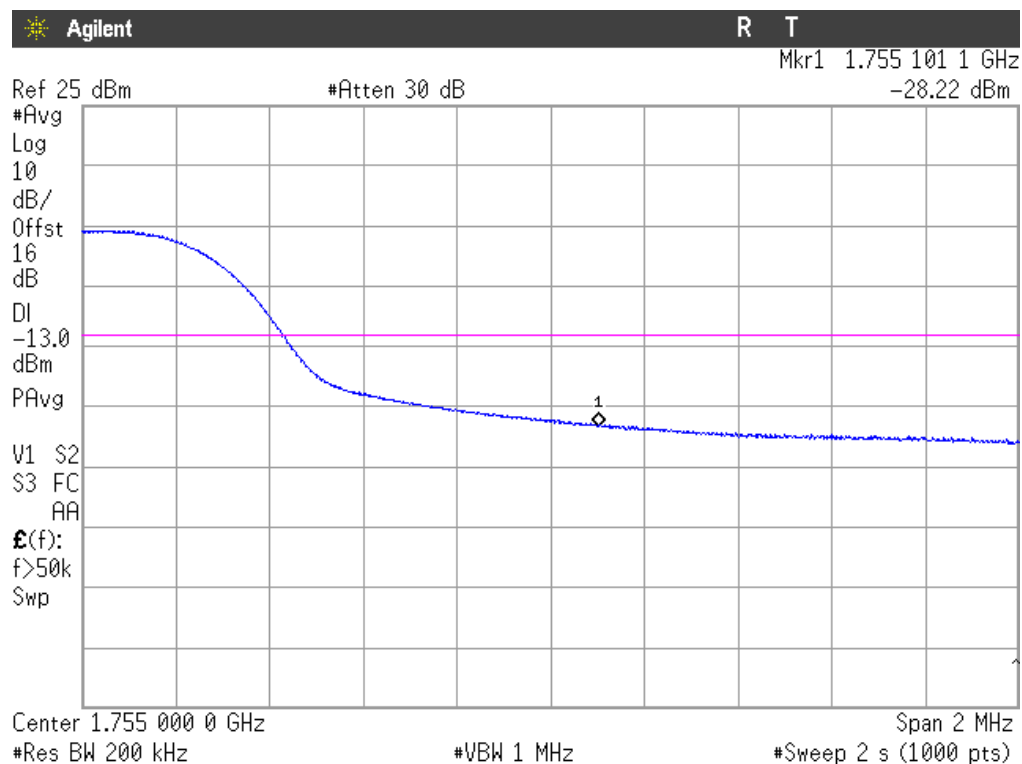
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 15 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

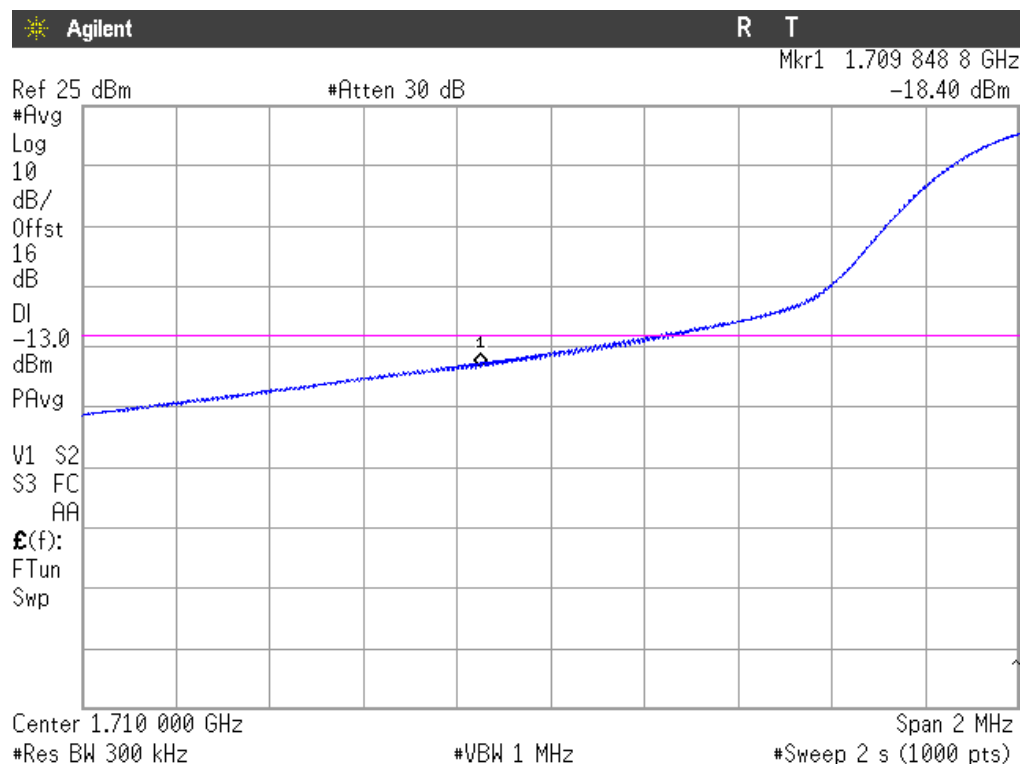


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

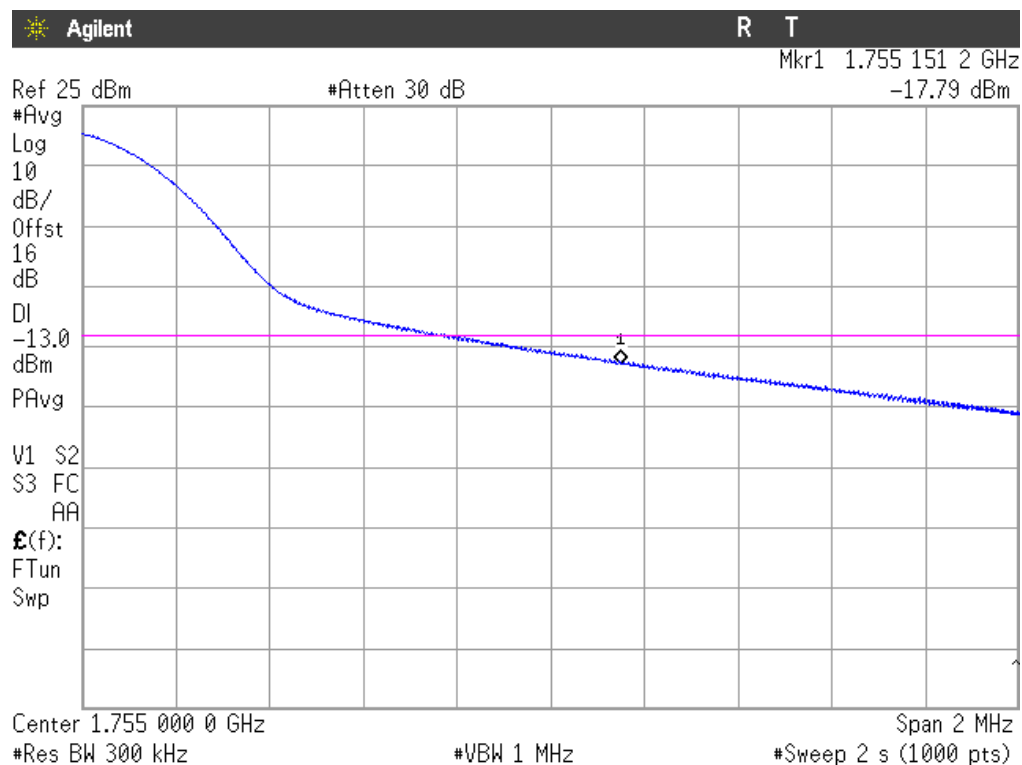
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

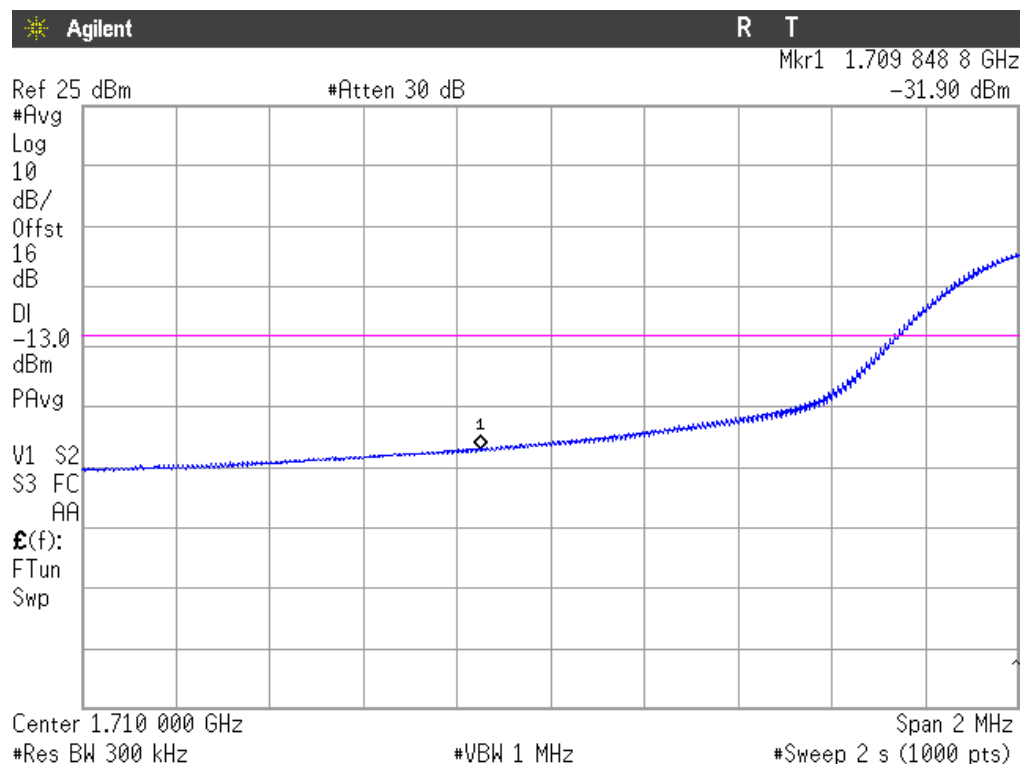
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

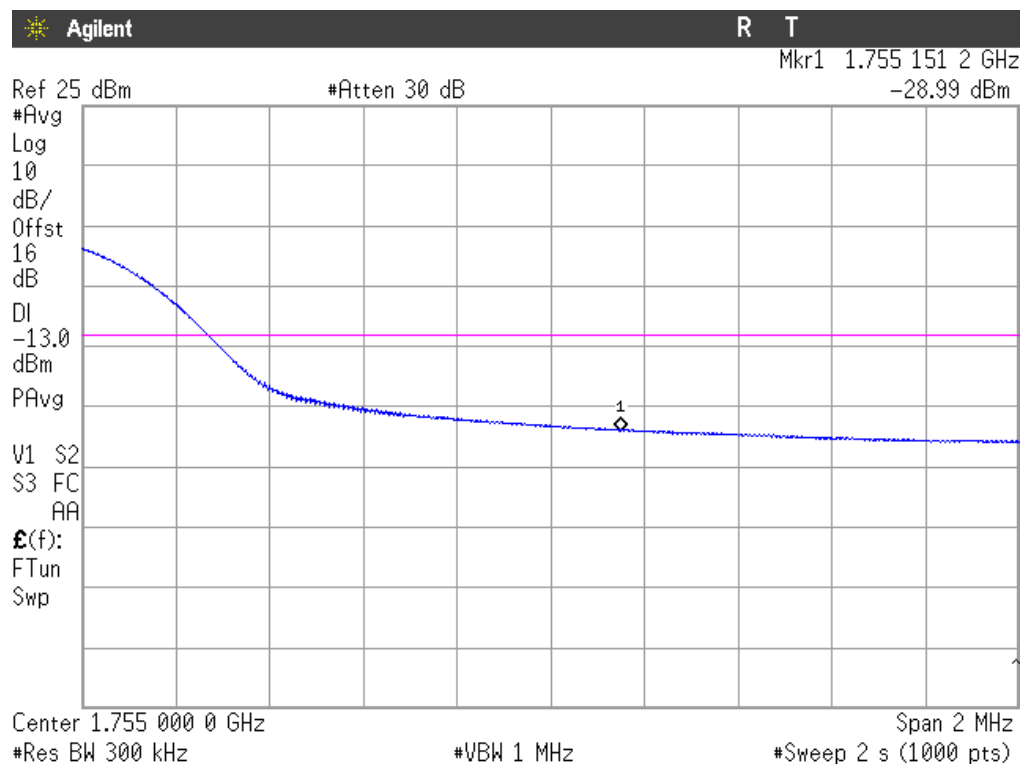
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 20 MHz (Band IV)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

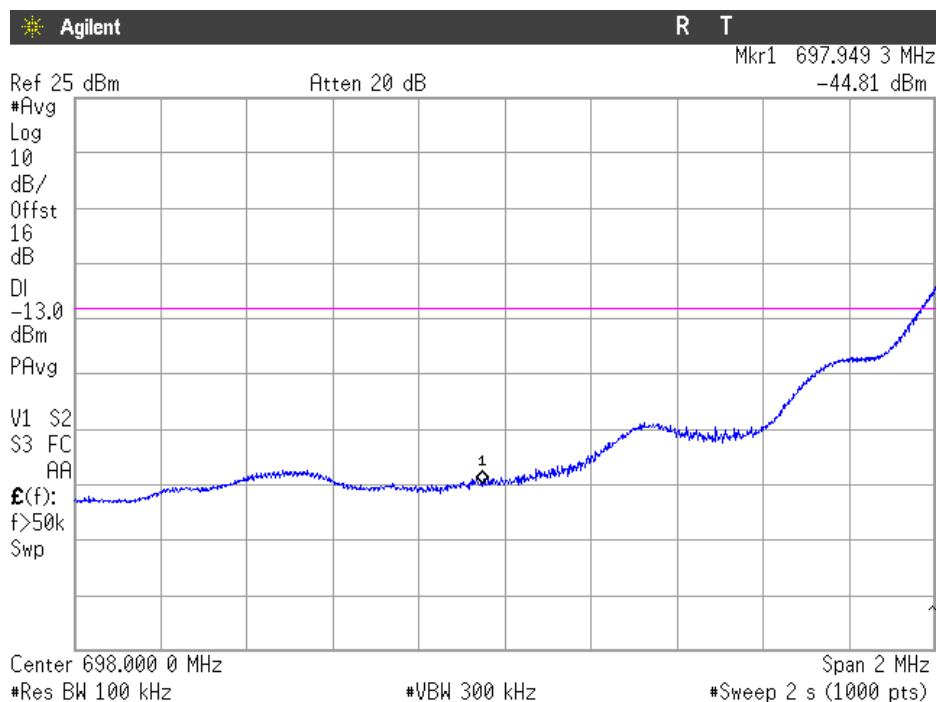


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

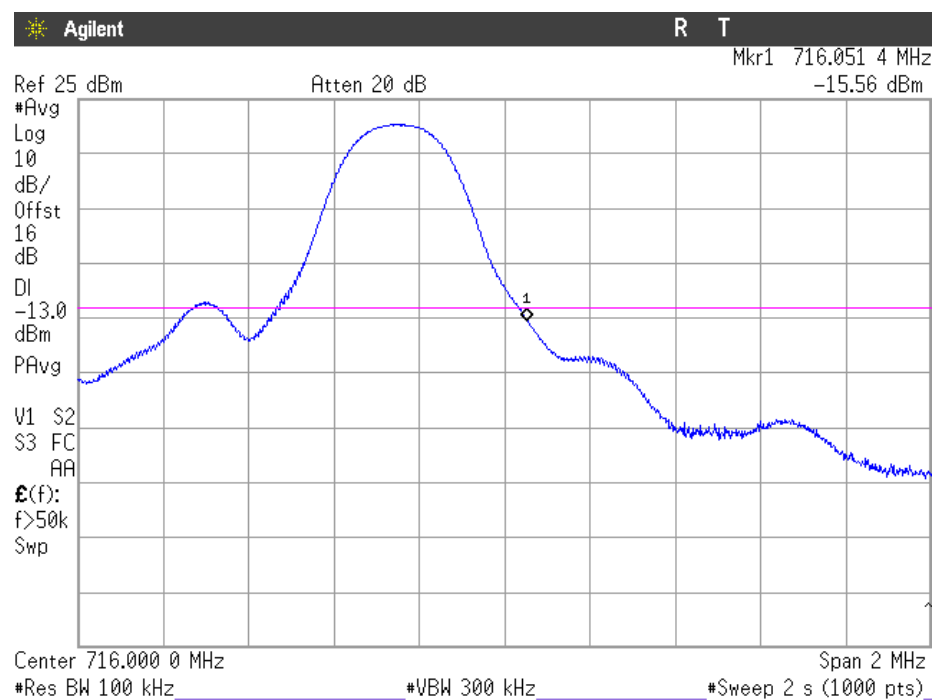
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

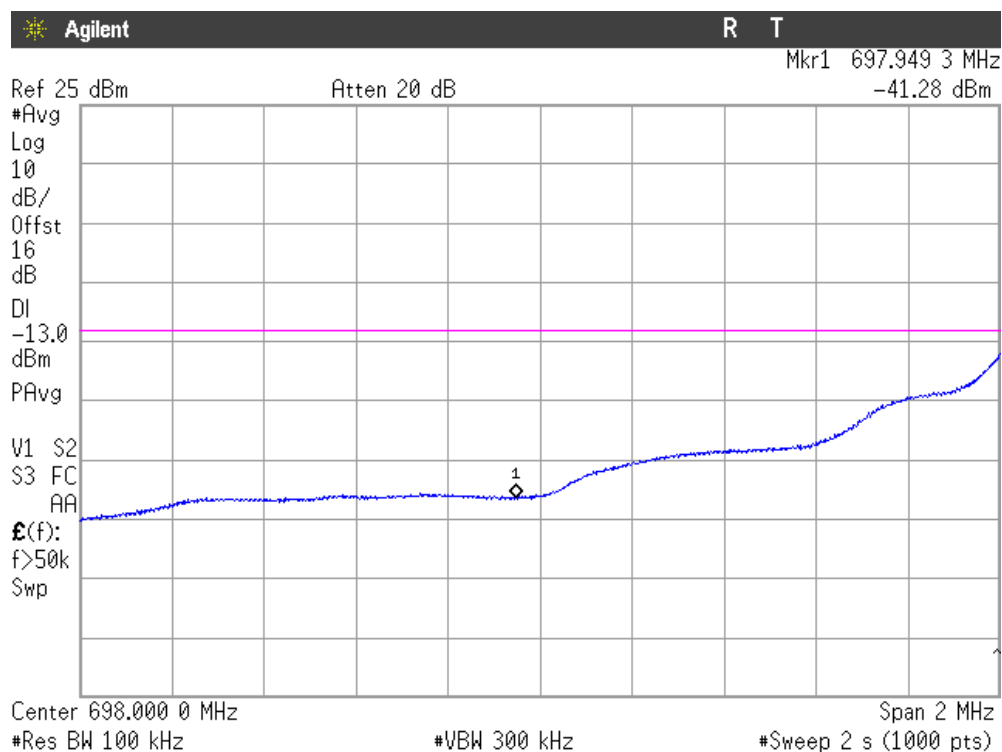
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

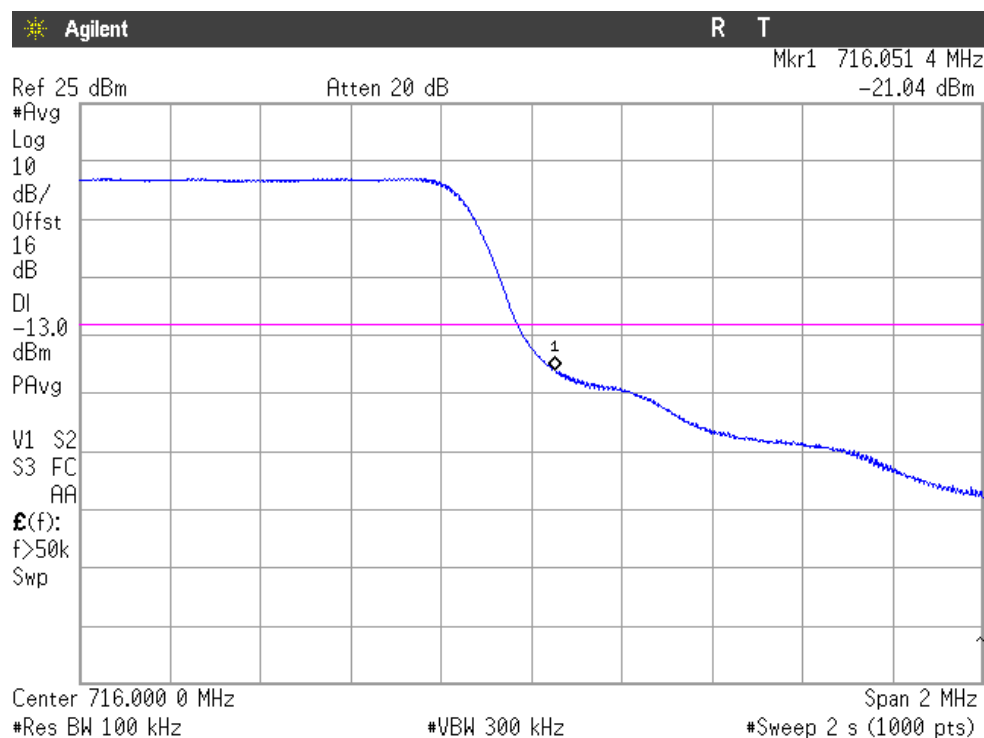
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 1.4 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

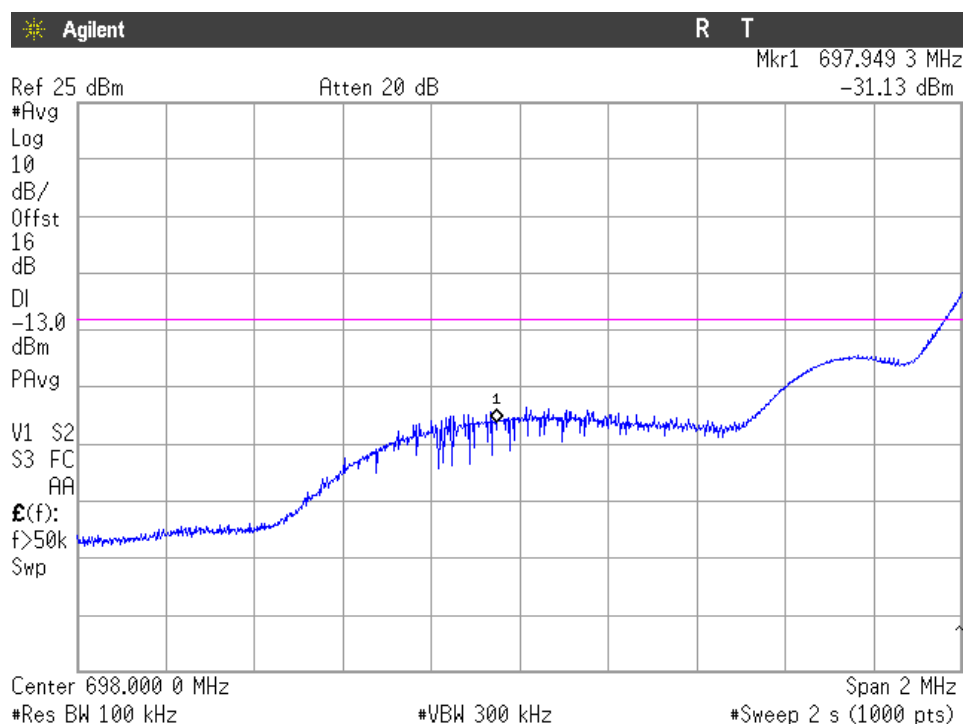


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

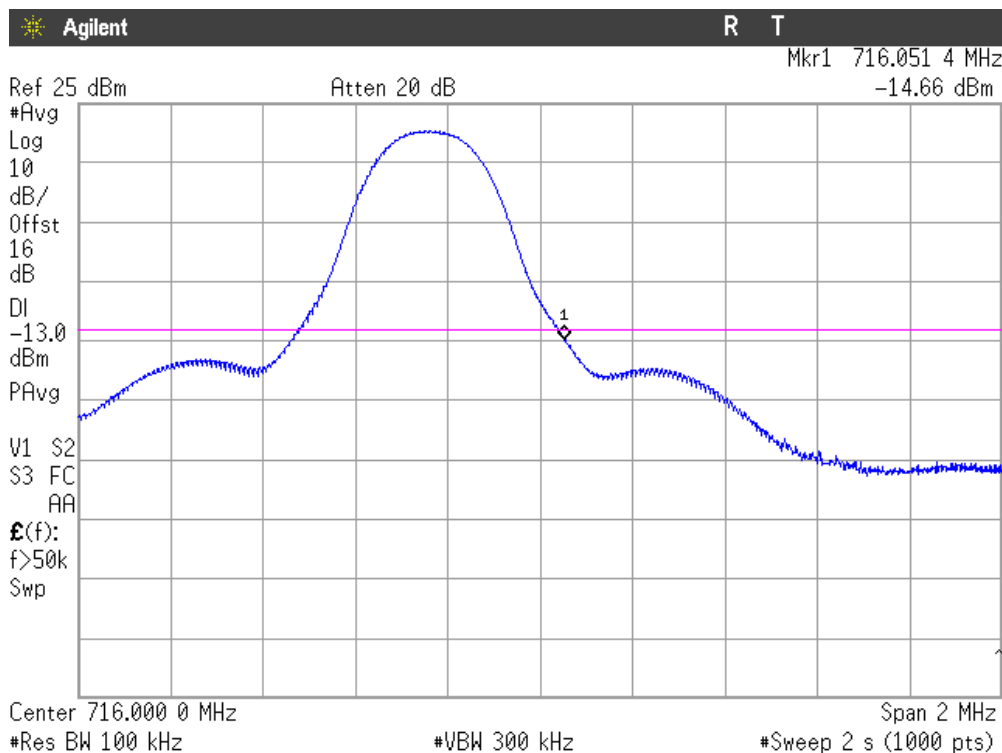
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

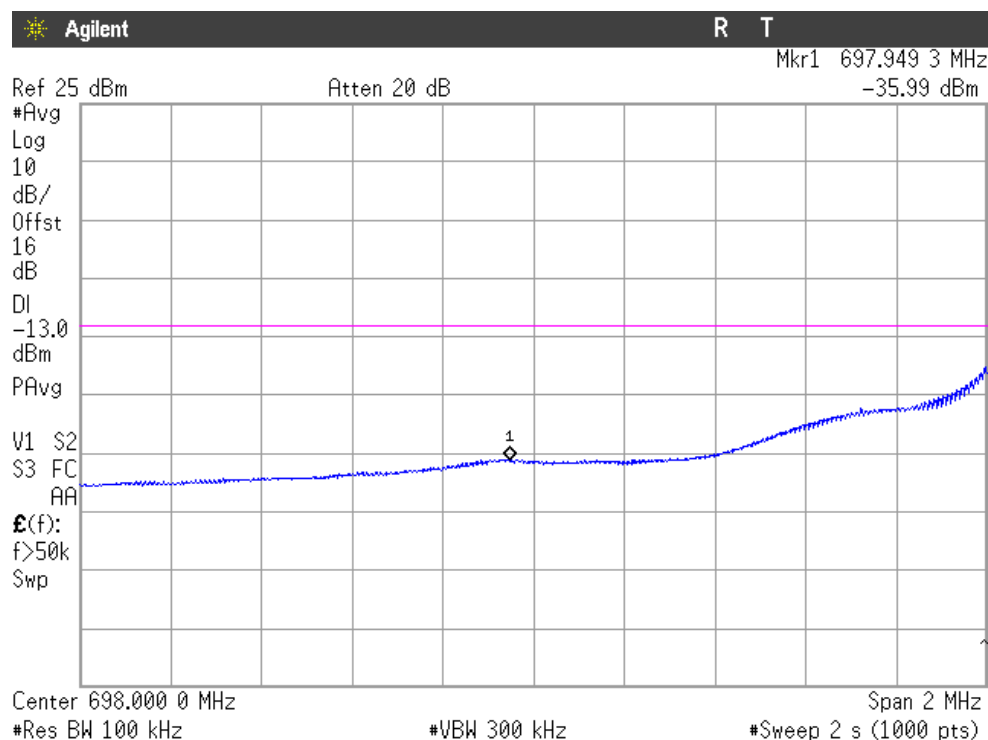
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

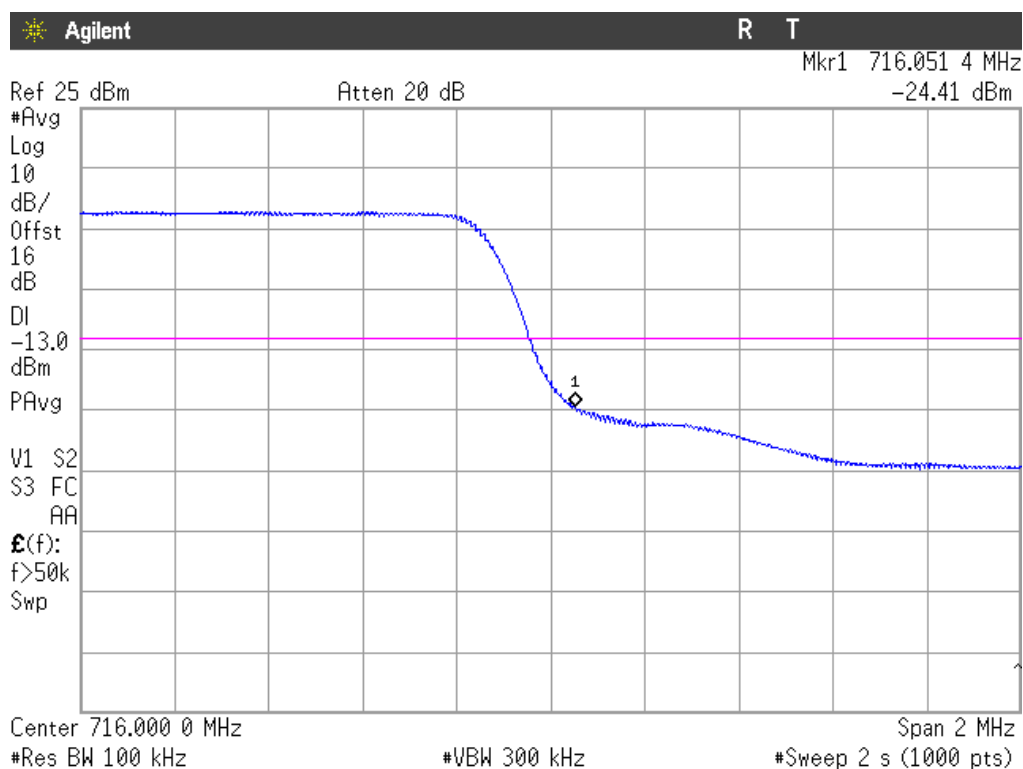
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 3 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

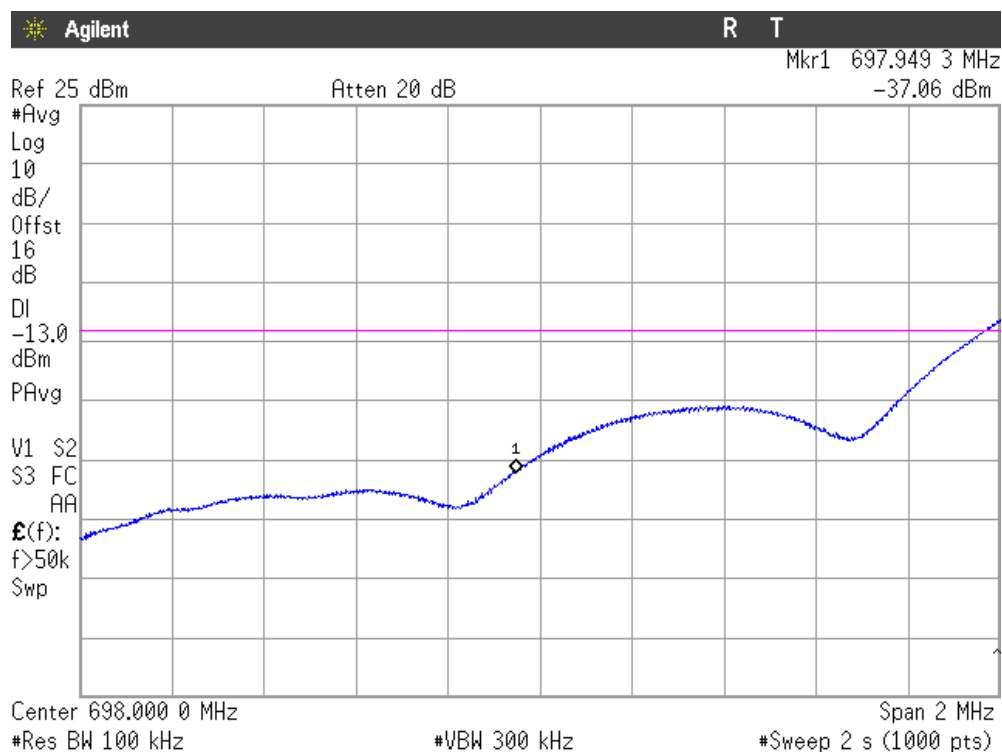


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

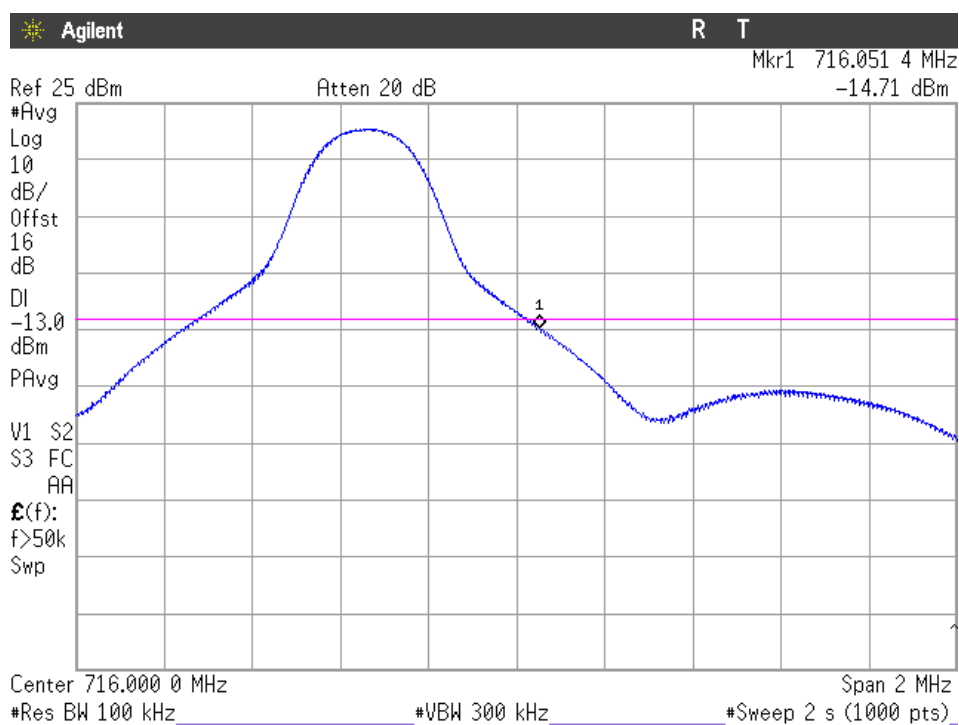
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

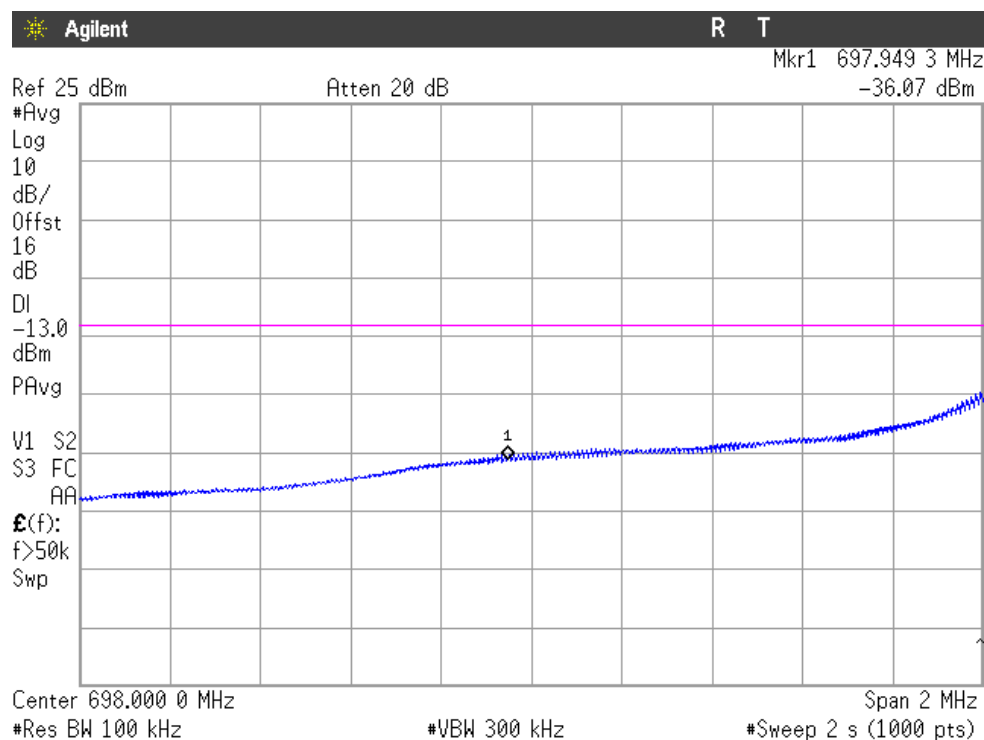
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

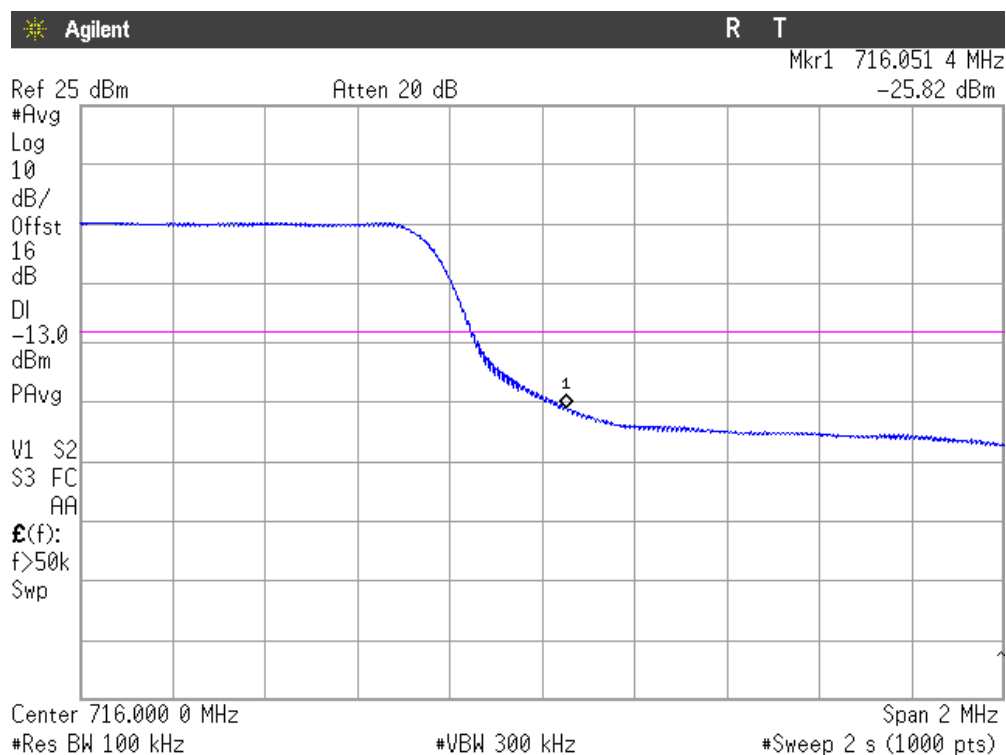
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 5 MHz (Band XII)

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

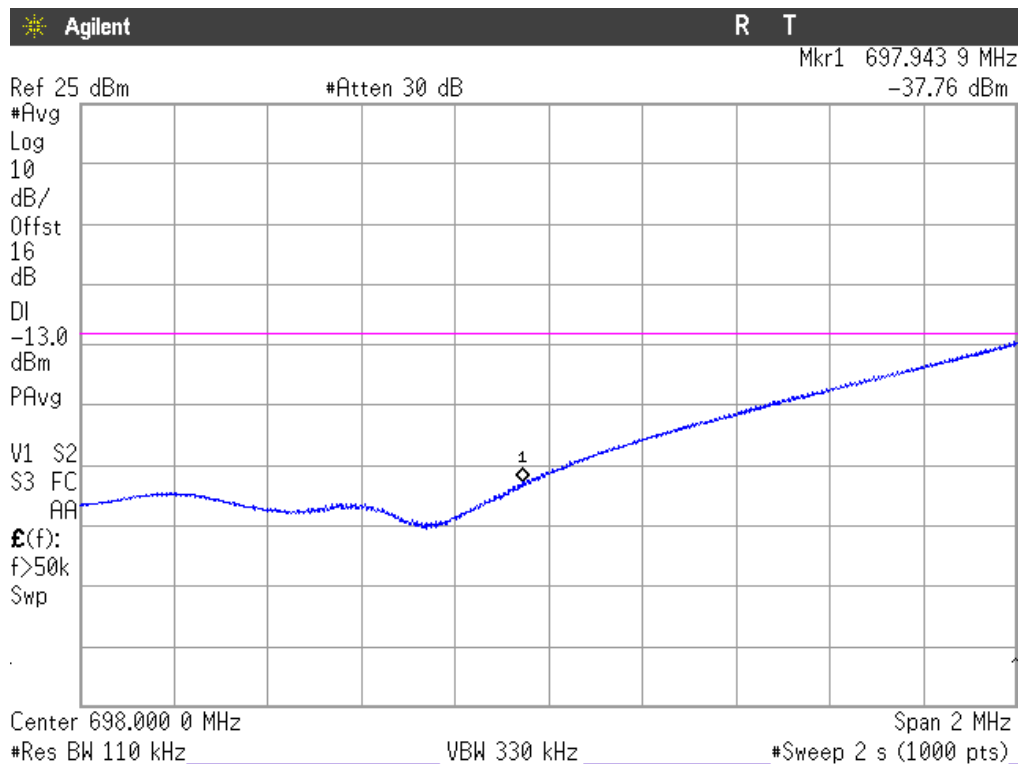


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

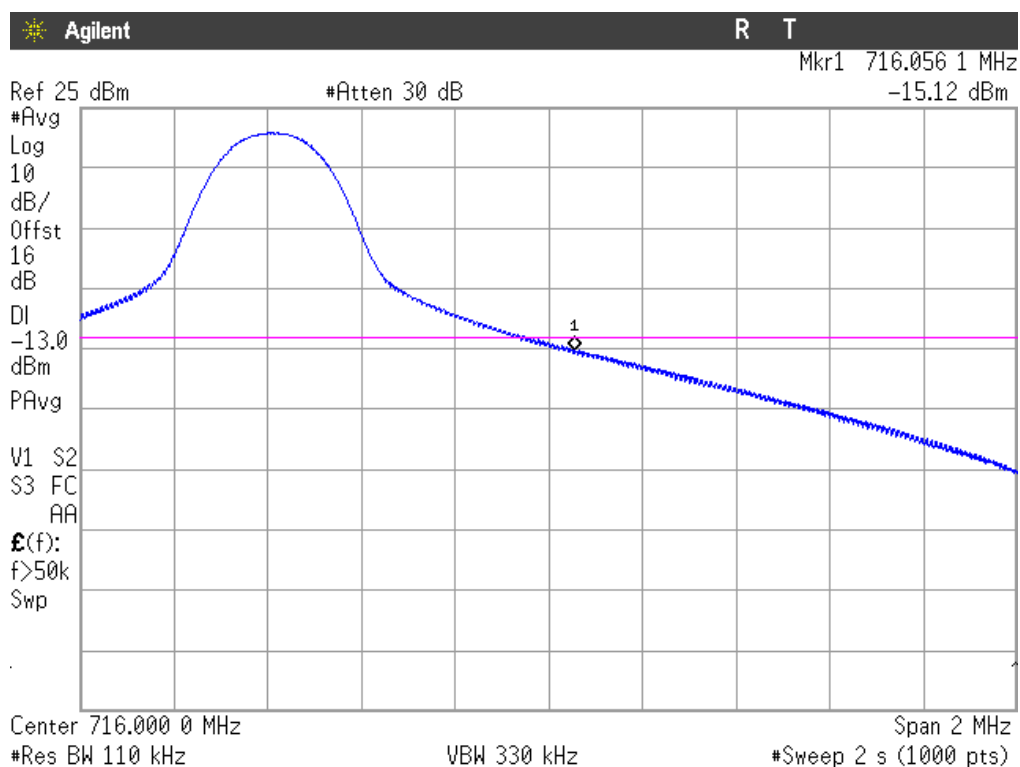
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

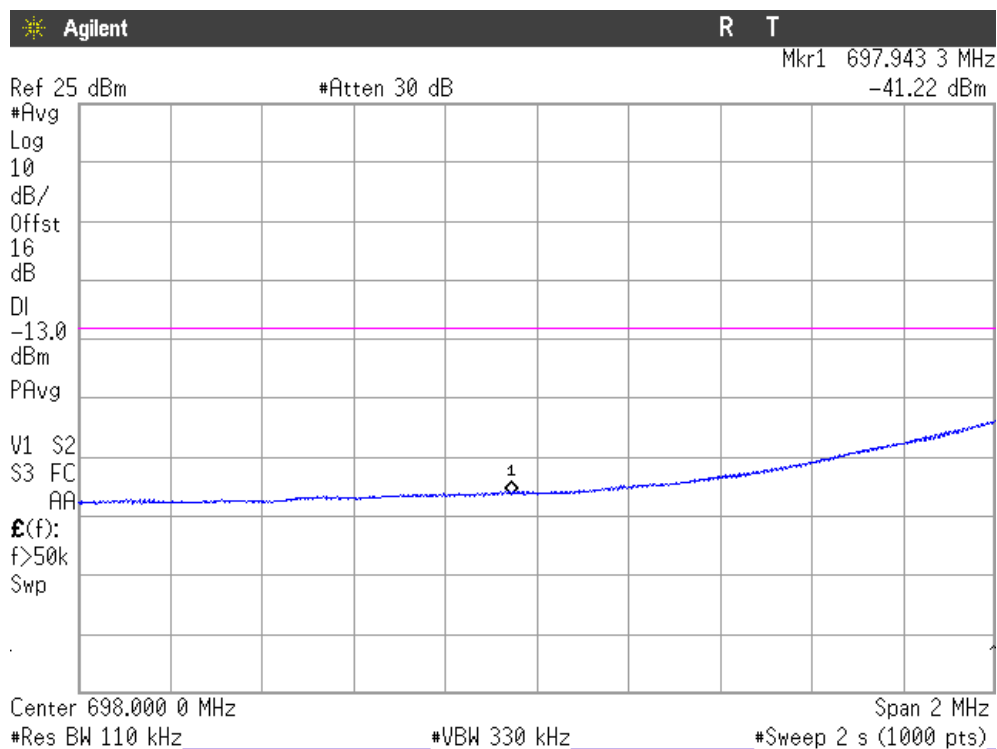
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

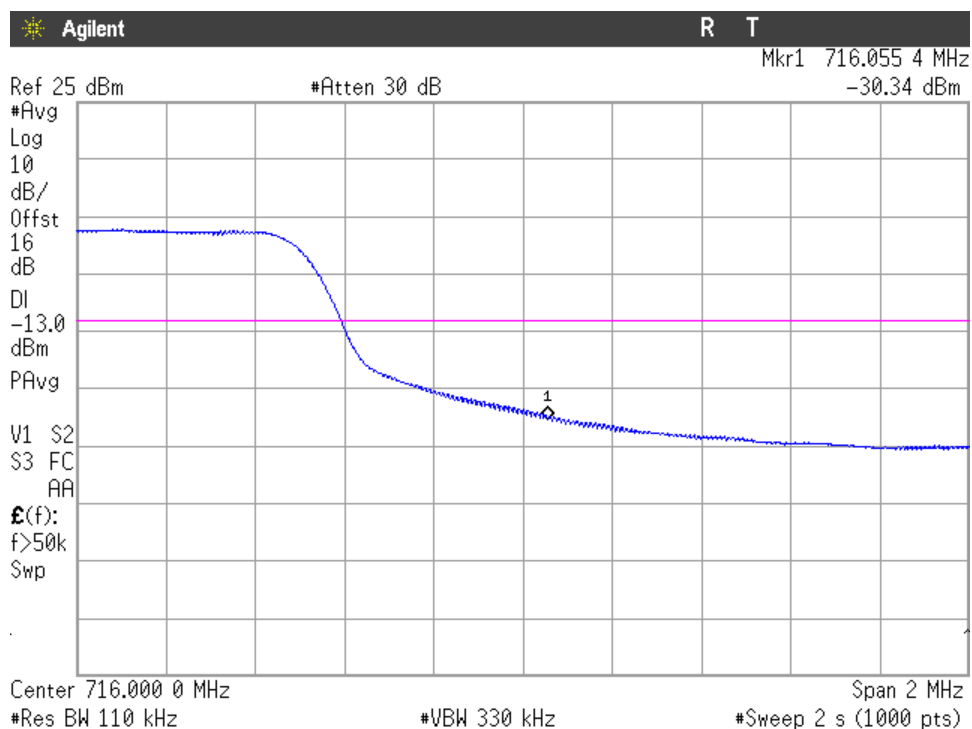
LTE QPSK MODULATION. RB = All. Offset = 0. BW = 10 MHz (Band XII)

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.

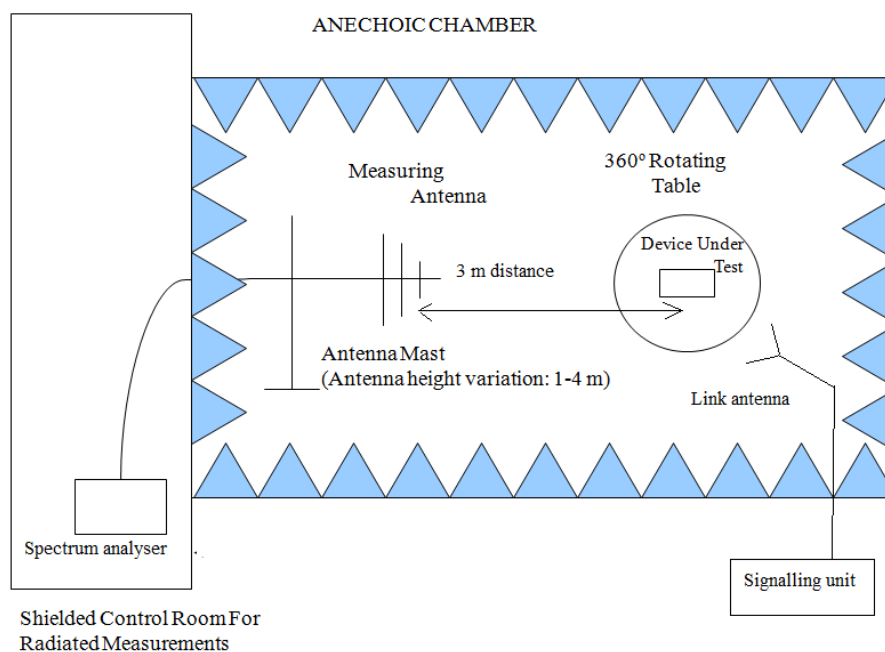
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

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.

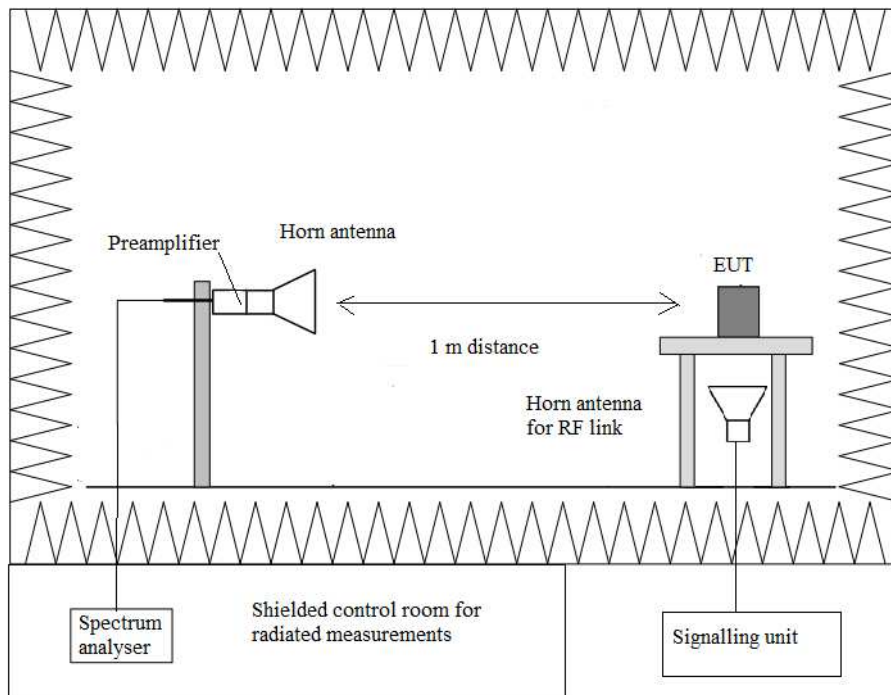
Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method, in accordance with the ANSI/TIA-603-E.

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 G_i (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 G_i (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 G_i (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.

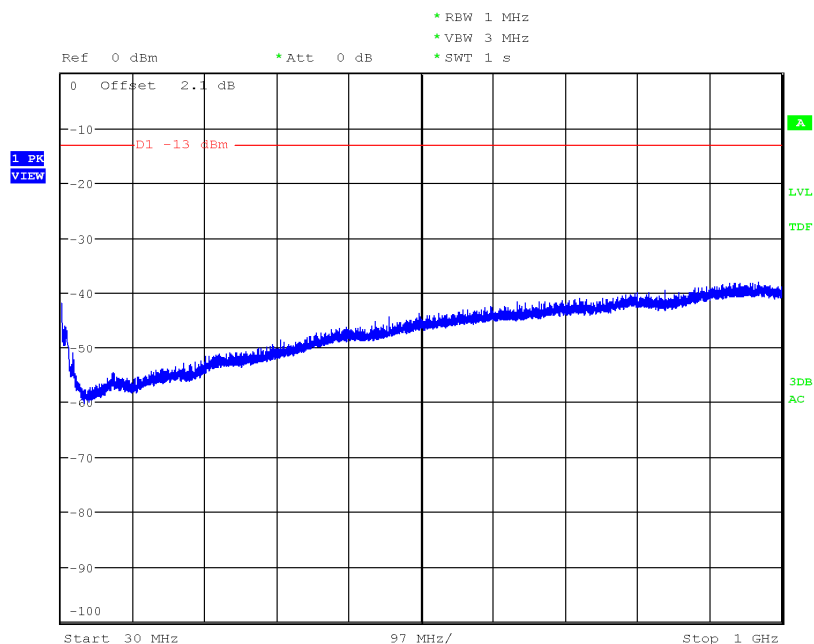
Frequency range 1 GHz-8 GHz.

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.

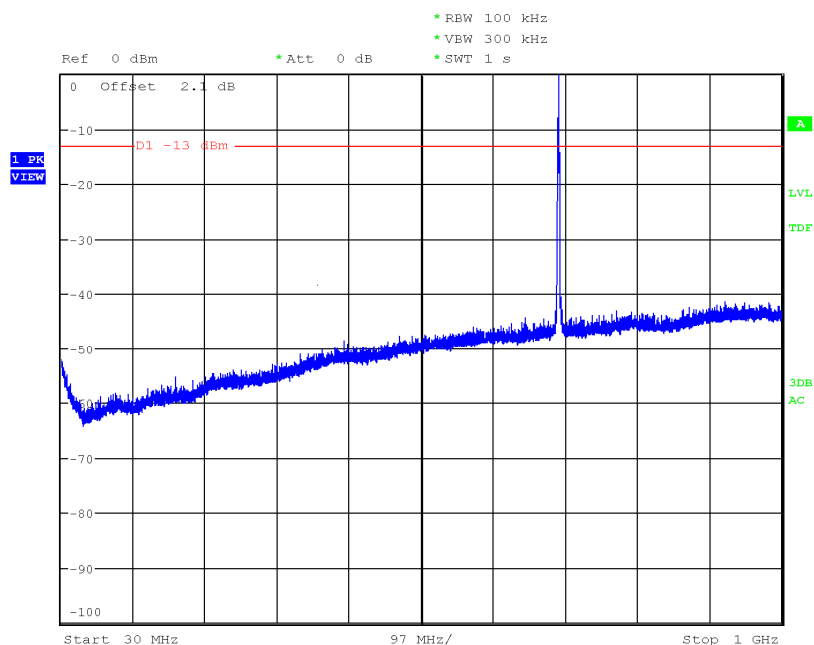
LTE QPSK MODULATION. BW=1.4 MHz. Band IV



(This plot is valid for all three channels)

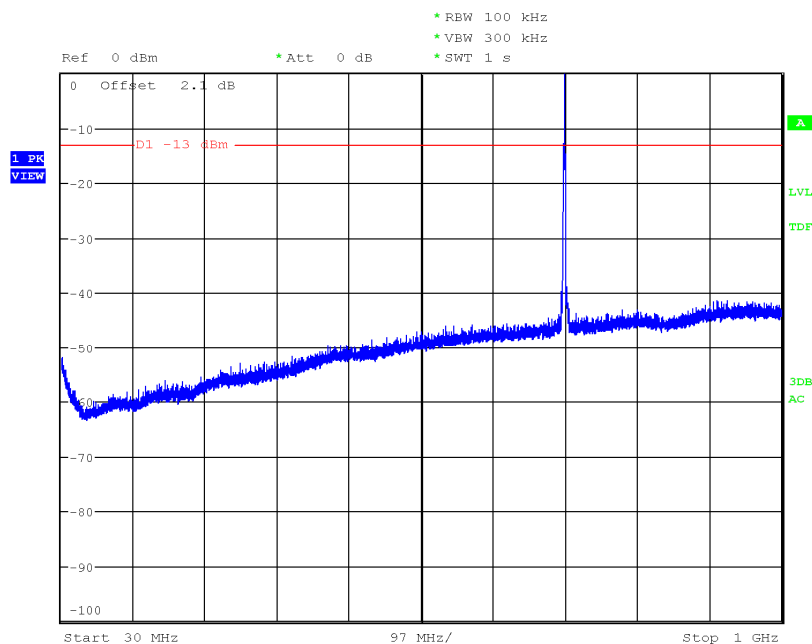
LTE QPSK MODULATION. BW=1.4 MHz. Band XII

CHANNEL: LOWEST



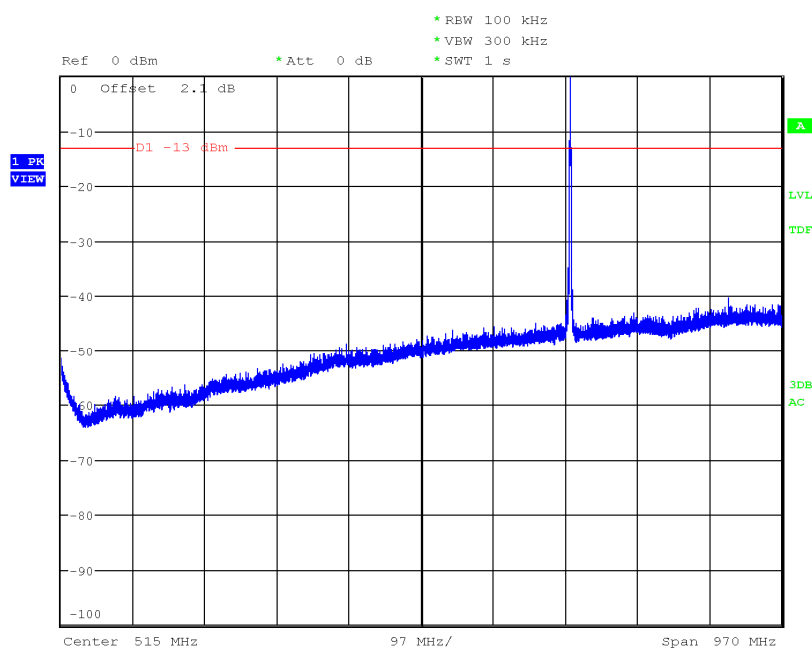
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

CHANNEL: HIGHEST

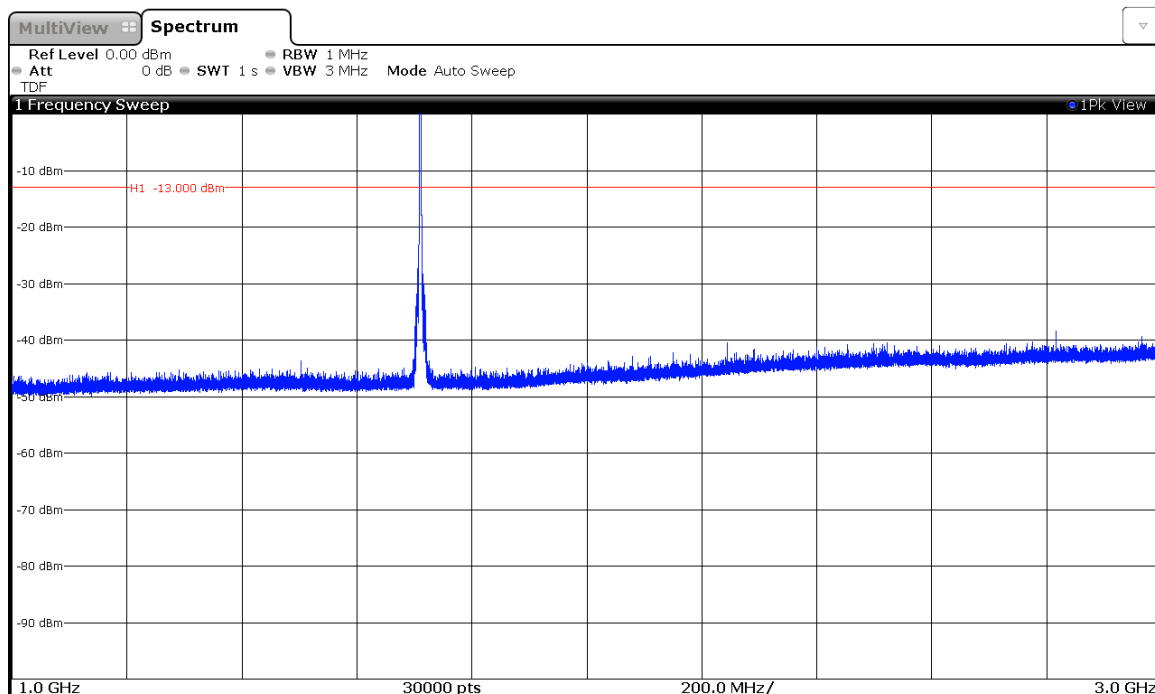


Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz to 3 GHz.

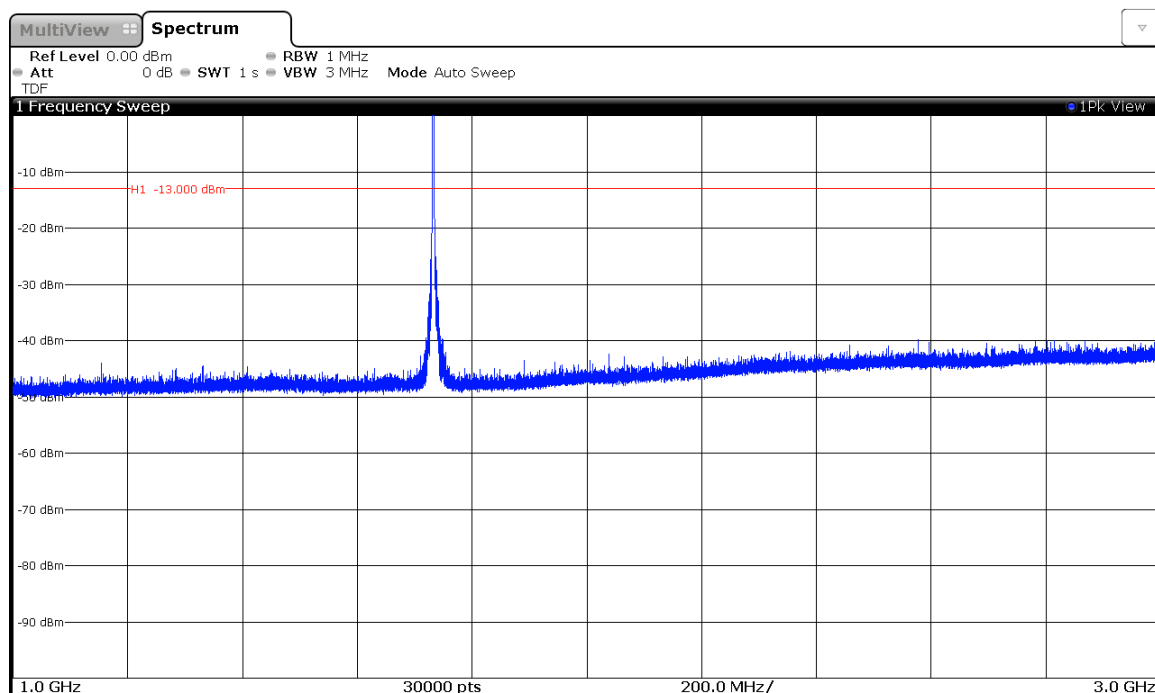
LTE QPSK MODULATION. BW=1.4 MHz. Band IV

CHANNEL: LOWEST



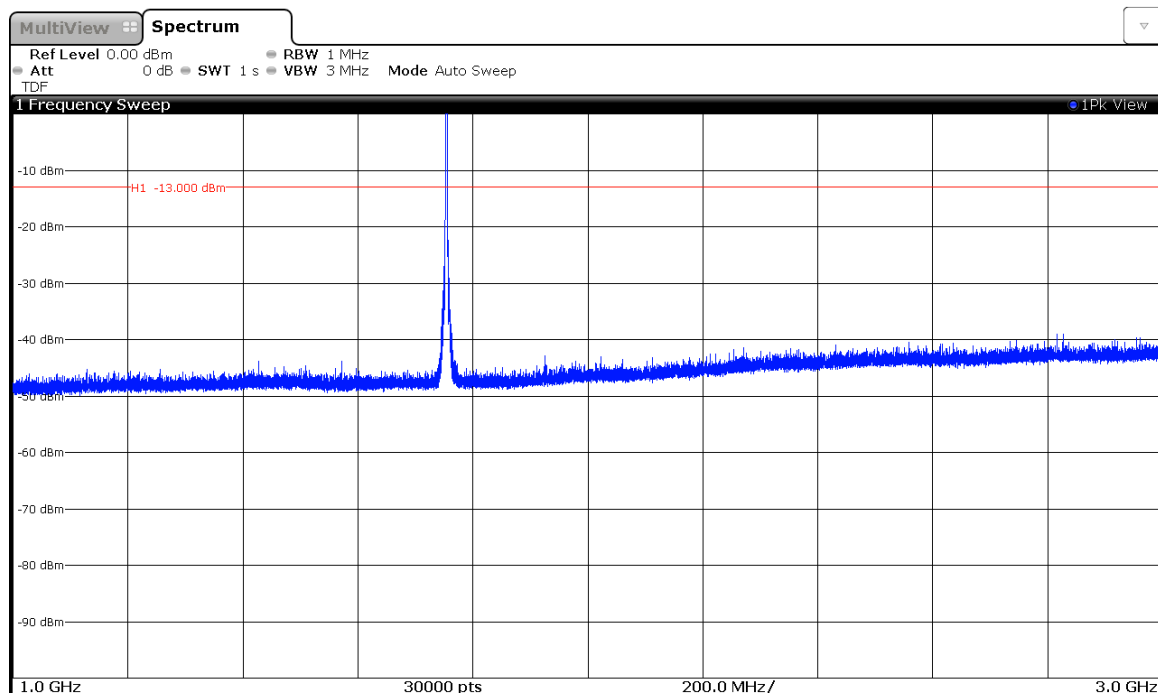
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

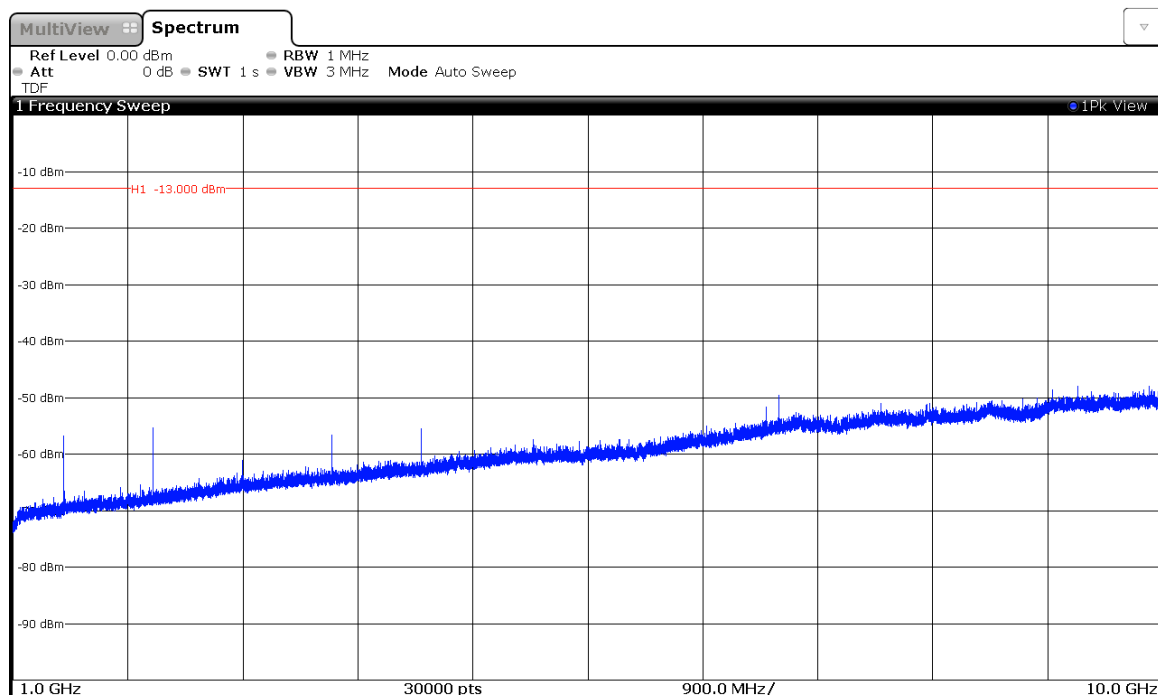
CHANNEL: HIGHEST



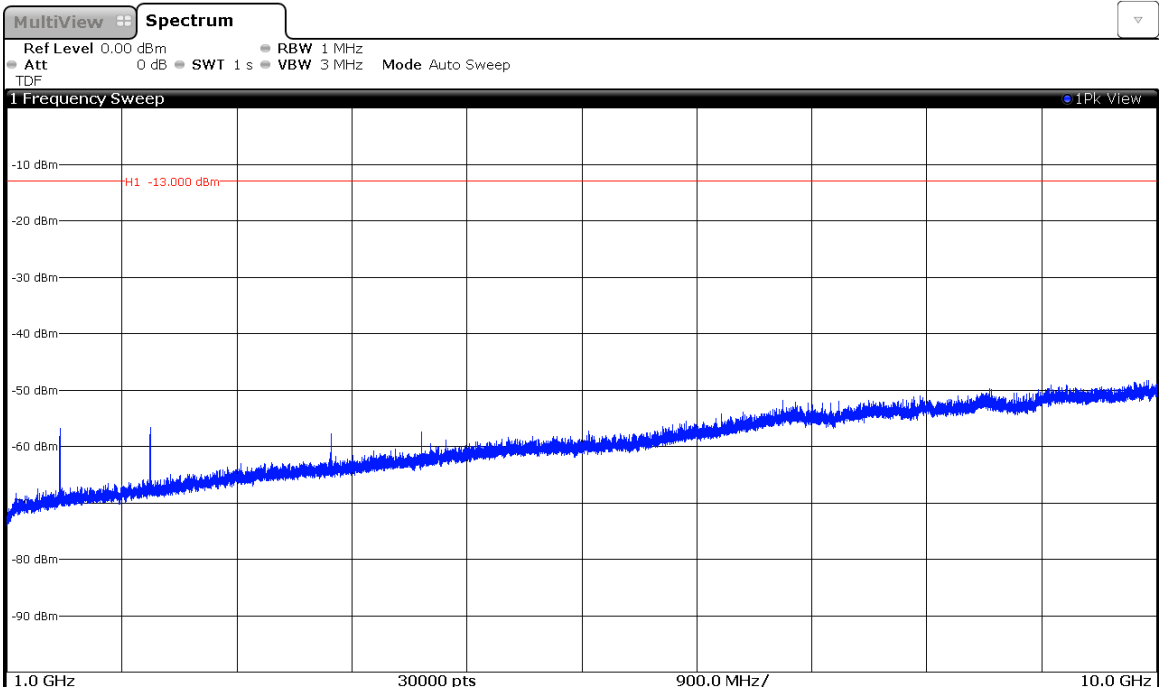
Note: The peak above the limit is the carrier frequency.

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

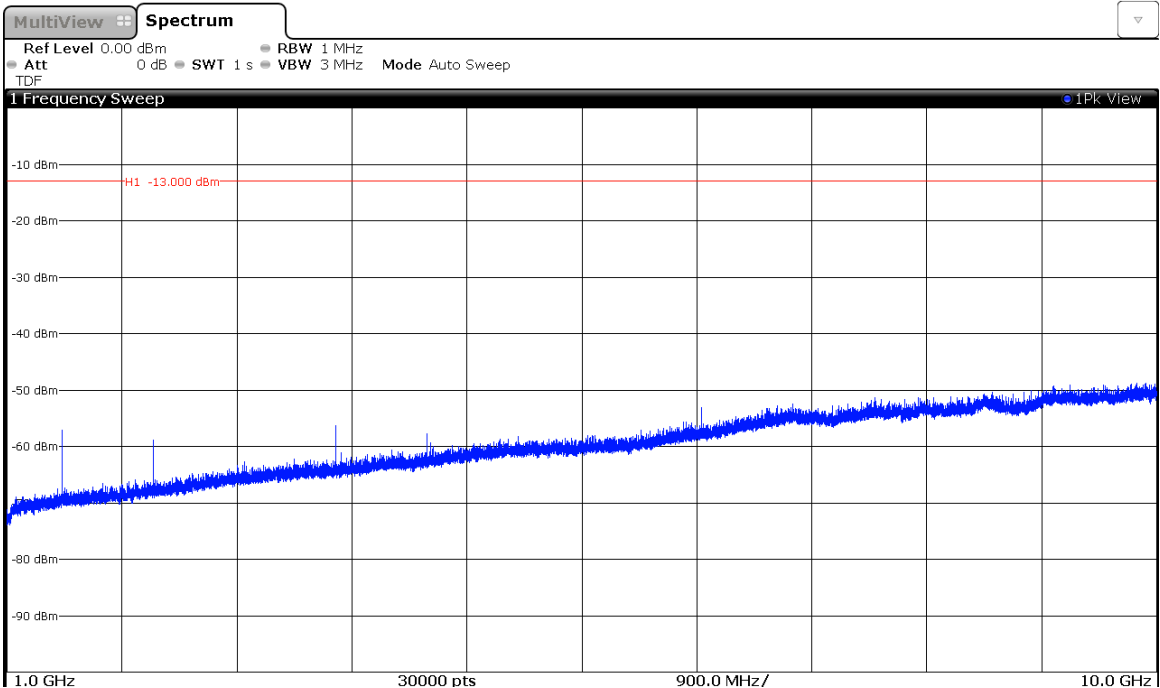
CHANNEL: LOWEST



CHANNEL: MIDDLE



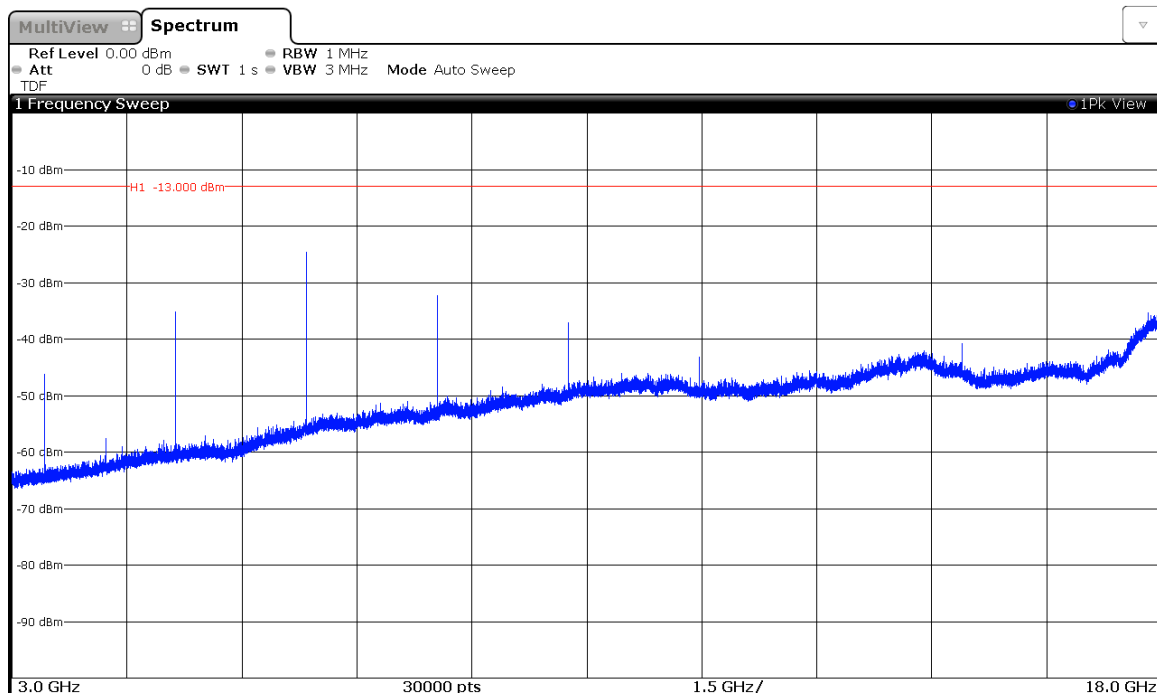
CHANNEL: HIGHEST



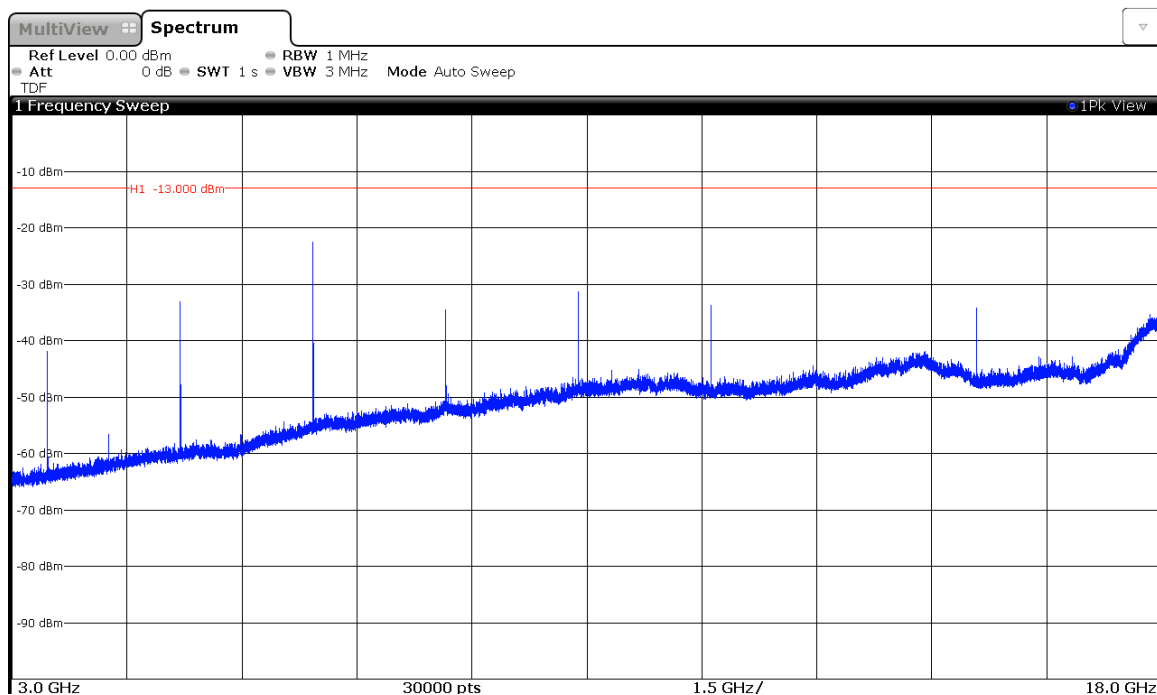
FREQUENCY RANGE 3 GHz to 18 GHz.

LTE QPSK MODULATION. BW=1.4 MHz. Band IV

CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST

