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DEKRA

ACCREDITED
Test Lab
Cert 2764.01

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:
2456ERM.007A1

Test report

REFERENCE STANDARD:
USA FCC Part 22
CANADA ISED RSS-132

Identification of item tested	Wireless Module
Trademark	Cinterion ALAS5-W
Model and /or type reference	ALAS5-W
Other identification of the product	FCC ID: QIPALAS5-W IC: 7830A-ALAS5W
Features	Wireless Module supporting 2G, 3G and 4G Cellular Technologies
Manufacturer	Gemalto M2M GmbH Werinherstr. 81, 81541 Munich, Germany.
Test method requested, standard	USA FCC Part 22 10-1-18 Edition CANADA IC RSS-132 Issue 3, Jan. 2013. KDB 971168 D01 v03r01 Measurement guidance for certification of licensed digital transmitters. KDB 971168 D02 v02r01 for Miscellaneous and basic review and approval items for transmitting equipment used in licensed radio services. ANSI C63.26 – 2015.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA Certification Inc., ou=Regulatory Lab, email=dgalvez@dekra.com, c=US Date: 2019.04.11 19:07:35 -04'00'
Date of issue	04-11-2019
Report template No	FDT08_21

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01.

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

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

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

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

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

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

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

Frequency (MHz)	U(k=2)	Units
30-180	3.82	dB
180-1000	2.61	dB
1000-18000	2.92	dB
18000-40000	2.15	dB

Data provided by the client

Wireless Module supporting 2G,3G and 4G Cellular Technologies.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
2456.03	Cinterion® ALAS5	ALAS5-W	004401083195152	2/7/2019
2456.04	GPS Antenna	AA62	162CT15170382	2/7/2019
2456.05	Antenna	Panorama_LPBEM-7-27	-	2/7/2019
2456.06	Antenna	Panorama_LPBEM-7-27	-	2/7/2019

1. Sample S/01 was used for the following test(s):

   All conducted and radiated tests indicated in appendix A.

Test sample description

Ports…… :	Port name and description	Cable				
		Specified length [m]	Attached during test	Shielded		
	No Data Provided		☐	☐		
			☐	☐		
			☐	☐		
			☐	☐		
			☐	☐		
Supplementary information to the ports…… :	No Data Provided					
Rated power supply .....:	Voltage and Frequency	Reference poles				
		L1	L2	L3	N	PE
	☐ AC: 230Vac / 50Hz.	☐	☐	☐	☐	☐
	☐ AC:	☐	☐	☐	☐	☐
	☒ DC:3.3 to 4.2V					
	☒ DC: 3.8V					
Rated Power .....:	No Data Provided					
Clock frequencies .....:	No Data Provided					
Other parameters.....:	No Data Provided					
Software version .....:	Rev. 00.030					
Hardware version.....:	Rev2.14a					
Dimensions in cm (L x W x D) ....:	40mm x 36mm x 3mm					
Mounting position.....:	☐ Table top equipment					
	☐ Wall/Ceiling mounted equipment					
	☐ Floor standing equipment					
	☐ Hand-held equipment					
	☐ Other:					
Modules/parts .....:	Module/parts of test item	Type	Manufacturer			
	No Data provided					

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
Documents as provided by the applicant.....:	Description	File name	Issue date
	Equipment declaration data	FDT30_15_Declaration_Equipment_Data_Gemalto_ALAS5-W_signed	2019-03-14

Copy of marking plate:

Identification of the client

Gemalto M2M GmbH

Werinherstr. 81, 81541 Munich, Germany

Testing period and place

Test Location	DEKRA Certification, Inc.
Date (start)	04-05-2019
Date (finish)	04-11-2019

Document history

Report number	Date	Description
2456ERM.007	04-10-2019	First release
2456ERM.007A1	04-11-2019	2nd release

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 2456ERM.007 related with the same samples, in the next clauses and sub-clauses:

Clauses/ Sub-Clauses	Modification	Justification
Page 38-40 / A.1: RF OUTPUT POWER	TC#02 test result was added	To meet requirement in KDB 971168 D02 v02r01 VIII
Page:77-83/ A.4: OCCUPIED BANDWIDTH	TC#02 test result was added	To meet requirement in KDB 971168 D02 v02r01 VIII
Page:94-97/ A.5: SPURIOUS EMISSIONS AT ANTENNA TERMINALS	TC#02 test result was added	To meet requirement in KDB 971168 D02 v02r01 VIII

This modification test report cancels and replaces the test report 2456ERM.007

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Sravani Gollamudi and Koji Nishimoto.

Testing verdicts

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

Summary

FCC PART 22 / IC RSS-132 PARAGRAPH					
Report Section	**FCC Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
A.1	§2.1046 and §22.913	RSS-132 Clause 5.4	RF Output power	P	Note:1
A.2	§2.1047	RSS-132 Clause 5.2	Modulation characteristics	P	N/A
A.3	§2.1055 and §22.355	RSS-132 Clause 5.3	Frequency stability	P	N/A
A.4	§2.1049	RSS-132 Clause 5.1	Occupied Bandwidth	P	Note:1
A.5	§2.1051 and §22.917	RSS-132 Clause 5.5	Spurious emissions at antenna terminals	P	Note:1
A.6	§22.917	RSS-132 Clause 5.5	Spurious emissions at antenna terminals at Block edges	P	N/A
A.7	§2.1053 and §22.917	RSS-132 Clause 5.5	Radiated emissions	P	N/A

Supplementary information and remarks:

Note1: According to KDB 971168 D02 v02r01, Band 26 testing is affected by part 22 and 90 crossed rules, the emission testing was performed in extra Frequency with bandwidth centered at the allocation boundary.

List of equipment used during the test

Conducted Measurements

CONTROL NUMBER	DESCRIPTION	LAST CALIBRATION	NEXT CALIBRATION
1039	Spectrum analyzer Rohde & Schwarz FSV40	2018/10	2020/10
1149	Wideband Radio Communication Tester Rohde & Schwarz CMW 500	2018/07	2020/07
1041	EMI Test Receiver Rohde & Schwarz ESR 7	2017/04	2019/03
101	Climatic chamber Espec	2019/10	2020/10

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	LAST CALIBRATION	NEXT CALIBRATION
1179	Semi anechoic Absorber Lined Chamber Frankonia SAC 3 plus “L”	N/A	N/A
1064	BiconicalLog antenna ETS LINDGREN 3142E	2017/03	2020/03
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	2017/03	2020/03
1012	Spectrum analyzer Rohde & Schwarz ESR26	2018/09	2020/09
1039	Spectrum analyzer Rohde & Schwarz FSV40	2018/10	2020/10
1015,1017, 1019, 1020	Rohde & Schwarz EMC32 software	N/A	N/A

Appendix A: Test Results for

FCC Part 22/ IC RSS-132

Appendix A Content

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PRODUCT INFORMATION

The following information is provided by the client

Information	Description
Modulation	QPSK, QAM
Maximum RF Output Power	23 dBm
Operation mode:	
- Operating Frequency Range	Band 26: 824-849 MHz
- Nominal Channel Bandwidth	Band 26: 1.4/ 3/ 5/ 10/ 15 MHz
Extreme operating conditions	
- Temperature range	T_{nom} = +15 to + 35 T_{min} = -30 T_{max} = +50
Antenna type	External attachable Antenna.
Antenna gain	5 dBi
Nominal Voltage	
- Supply Voltage	3.8 Vdc
- Type of power source	DC voltage from power supply.

DESCRIPTION OF TEST CONDITIONS

The worst case was found when positioned as the table below. Following channel(s) was (were selected for the final test as listed below:

<table>
<tr><th>TEST CONDITIONS</th><th>DESCRIPTION</th></tr>
<tr><td>TC#01
LTE Band 26</td><td>
Power supply (V): $V_{nominal}$ = 3.8 Vdc

Test Frequencies for Conducted tests:
1.4 MHz Bandwidth:
-Lowest Channel: 26797 (824.7 MHZ)
-Middle Channel: 26915 (836.5 MHz)
-Highest Channel: 27033 (848.3 MHz)
3 MHz Bandwidth:
-Lowest Channel: 26805 (825.5 MHZ)
-Middle Channel: 26915 (836.5 MHz)
-Highest Channel: 27025 (847.5 MHz)
5 MHz Bandwidth:
-Lowest Channel: 26815 (826.5 MHZ)
-Middle Channel: 26915 (836.5 MHz)
-Highest Channel: 27015 (846.5 MHz)
10 MHz Bandwidth:
-Lowest Channel: 26840 (829.0 MHZ)
-Middle Channel: 26915 (836.5 MHz)
-Highest Channel: 26990 (844.0 MHz)
15 MHz Bandwidth:
-Lowest Channel: 26865 (831.5 MHZ)
-Middle Channel: 26915 (836.5 MHz)
-Highest Channel: 26965 (841.5 MHz)

Test Frequencies for Radiated tests:
<table>
<tr><th>Available Frequencies</th><th>Tested Frequency</th><th>Channel Bandwidth</th><th>Modulation</th><th>Mode</th></tr>
<tr><td>824 to 849 MHz</td><td>825.5, 836.5, 847.5 MHz</td><td>3 MHz</td><td>QPSK</td><td>1 RB</td></tr>
</table>
Note: This device was tested under all bandwidths, RB configurations and modulations. The worst case found in QPSK modulation.
</td></tr>
</table>

TEST CONDITIONS	DESCRIPTION
TC#02 LTE Band 26	Power supply (V): $V_{nominal}$ = 3.8 Vdc Test Frequencies for Conducted tests: 1.4 MHz Bandwidth: - Channel: 26790 (824.0 MHZ) 3 MHz Bandwidth: - Channel: 26790 (824.0 MHZ) 5 MHz Bandwidth: - Channel: 26790 (824.0 MHZ) 10 MHz Bandwidth: - Channel: 26740 (824.0 MHz) 15 MHz Bandwidth: - Channel: 26790 (824.0 MHZ)

TEST A.1: RF OUTPUT POWER

LIMITS:	Product standard:	FCC Part 22 / IC RSS-132
	Test standard:	FCC §2.1046 and §22.913 / RSS-132 Clause 5.4

LIMITS

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

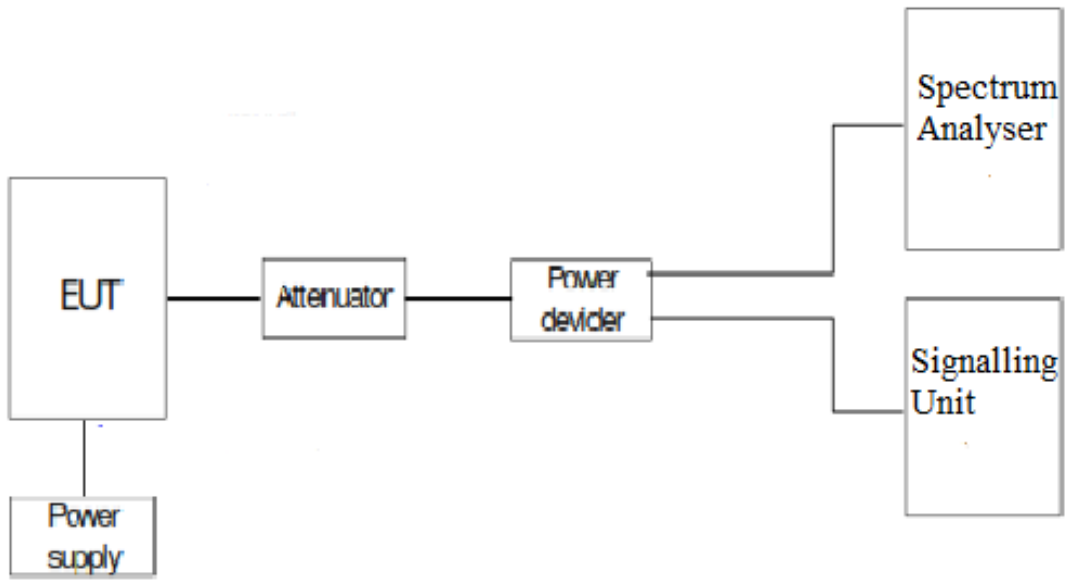
The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

RSS-132 Clause 5.4

The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base station e.i.r.p. limits.

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

TEST SETUP



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

LTE QPSK AND 16QAM MODULATION. Bandwidth = 1.4 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	23.04	5.0	28.04	6.14
Middle	23.06	5.0	28.06	5.57
Highest	23.04	5.0	28.04	5.59

LTE QPSK AND 16QAM MODULATION. Bandwidth = 3 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	23.12	5.0	28.12	5.86
Middle	23.13	5.0	28.13	5.51
Highest	23.15	5.0	28.15	5.71

LTE QPSK AND 16QAM MODULATION. Bandwidth = 5 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	23.16	5.0	28.16	5.80
Middle	23.14	5.0	28.14	5.42
Highest	23.13	5.0	28.13	5.68

LTE QPSK AND 16QAM MODULATION. Bandwidth = 10 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	23.12	5.0	28.12	5.80
Middle	23.10	5.0	28.10	5.86
Highest	23.12	5.0	28.12	5.48

LTE QPSK AND 16QAM MODULATION. Bandwidth = 15 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	23.15	5.0	28.15	5.71
Middle	23.16	5.0	28.16	5.77
Highest	23.11	5.0	28.11	5.65
Measurement uncertainty (dB)			<±0.95	

TEST RESULTS (Cont):

BANDWIDTH (MHz)	CHANNEL FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
1.4	Low 26797 824.7	QPSK	1	0	22.98	5.04
			1	2	23.01	
			1	5	22.97	
			3	0	23.00	
			3	1	22.99	
			3	2	23.04	
			6	0	22.01	
		16-QAM	1	0	22.23	6.14
			1	2	22.29	
			1	5	22.24	
			3	0	22.01	
			3	1	22.06	
			3	2	22.06	
			6	0	21.03	
	Middle 26915 836.5	QPSK	1	0	22.95	4.61
			1	2	23.05	
			1	5	22.93	
			3	0	23.03	
			3	1	23.06	
			3	2	23.05	
			6	0	21.95	
		16-QAM	1	0	22.22	5.57
			1	2	22.22	
			1	5	22.19	
			3	0	21.97	
			3	1	22.02	
			3	2	21.99	
			6	0	21.08	
	High 27033 848.3	QPSK	1	0	22.92	4.64
			1	2	22.98	
			1	5	22.91	
			3	0	22.99	
			3	1	23.04	
			3	2	23.04	
			6	0	21.96	
		16-QAM	1	0	21.87	5.59
			1	2	21.99	
			1	5	21.87	
			3	0	21.90	
			3	1	21.97	
			3	2	21.97	
			6	0	21.04	

TEST RESULTS (Cont):	

BANDWIDTH (MHz)	CHANNEL FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
3	Low 26805 825.5	QPSK	1	0	23.06	4.90
			1	7	23.12	
			1	14	23.03	
			8	0	22.08	
			8	4	22.07	
			8	7	22.02	
			15	0	22.05	
		16-QAM	1	0	22.24	5.86
			1	7	22.33	
			1	14	22.22	
			8	0	21.27	
			8	4	21.23	
			8	7	21.25	
			15	0	21.07	
	Middle 26915 836.5	QPSK	1	0	23.08	4.52
			1	7	23.13	
			1	14	23.01	
			8	0	22.08	
			8	4	22.12	
			8	7	22.05	
			15	0	22.07	
		16-QAM	1	0	22.32	5.51
			1	7	22.39	
			1	14	22.27	
			8	0	21.20	
			8	4	21.21	
			8	7	21.21	
			15	0	21.11	
	High 27025 847.5	QPSK	1	0	23.05	4.78
			1	7	23.15	
			1	14	22.98	
			8	0	22.06	
			8	4	22.09	
			8	7	22.05	
			15	0	22.08	
		16-QAM	1	0	22.27	5.71
			1	7	22.33	
			1	14	22.23	
			8	0	21.20	
			8	4	21.18	
			8	7	21.16	
			15	0	21.10	

TEST RESULTS (Cont):

BANDWIDTH (MHz)	CHANNEL FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
5	Low 26815 826.5	QPSK	1	0	23.12	4.81
			1	12	23.07	
			1	24	23.16	
			12	0	22.07	
			12	6	22.09	
			12	11	22.17	
			25	0	22.08	
		16-QAM	1	0	22.25	5.80
			1	12	22.19	
			1	24	22.33	
			12	0	21.14	
			12	6	21.14	
			12	11	21.20	
			25	0	21.06	
	Middle 26915 836.5	QPSK	1	0	23.13	4.72
			1	12	23.06	
			1	24	23.14	
			12	0	22.10	
			12	6	22.08	
			12	11	22.06	
			25	0	22.10	
		16-QAM	1	0	22.20	5.42
			1	12	22.14	
			1	24	22.21	
			12	0	21.20	
			12	6	21.24	
			12	11	21.20	
			25	0	21.08	
	High 27015 846.5	QPSK	1	0	23.13	4.87
			1	12	23.07	
			1	24	23.03	
			12	0	22.09	
			12	6	22.09	
			12	11	22.08	
			25	0	22.06	
		16-QAM	1	0	22.51	5.68
			1	12	22.49	
			1	24	22.43	
			12	0	21.02	
			12	6	21.04	
			12	11	21.01	
			25	0	21.12	

TEST RESULTS (Cont):

BANDWIDTH (MHz)	CHANNEL FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
10	Low 26840 829	QPSK	1	0	23.06	4.78
			1	24	23.12	
			1	49	23.06	
			25	0	22.07	
			25	12	22.18	
			25	24	22.13	
			50	0	22.13	
		16-QAM	1	0	22.34	5.80
			1	24	22.37	
			1	49	22.29	
			25	0	21.11	
			25	12	21.22	
			25	24	21.16	
			50	0	21.18	
	Middle 26915 836.5	QPSK	1	0	23.10	4.81
			1	24	23.04	
			1	49	23.09	
			25	0	22.09	
			25	12	22.10	
			25	24	22.15	
			50	0	22.09	
		16-QAM	1	0	22.29	5.86
			1	24	22.24	
			1	49	22.33	
			25	0	21.21	
			25	12	21.24	
			25	24	21.26	
			50	0	21.08	
	High 26990 844	QPSK	1	0	23.12	4.72
			1	24	23.06	
			1	49	23.01	
			25	0	22.15	
			25	12	22.16	
			25	24	22.08	
			50	0	22.16	
		16-QAM	1	0	22.33	5.48
			1	24	22.25	
			1	49	22.27	
			25	0	21.20	
			25	12	21.20	
			25	24	21.20	
			50	0	21.12	

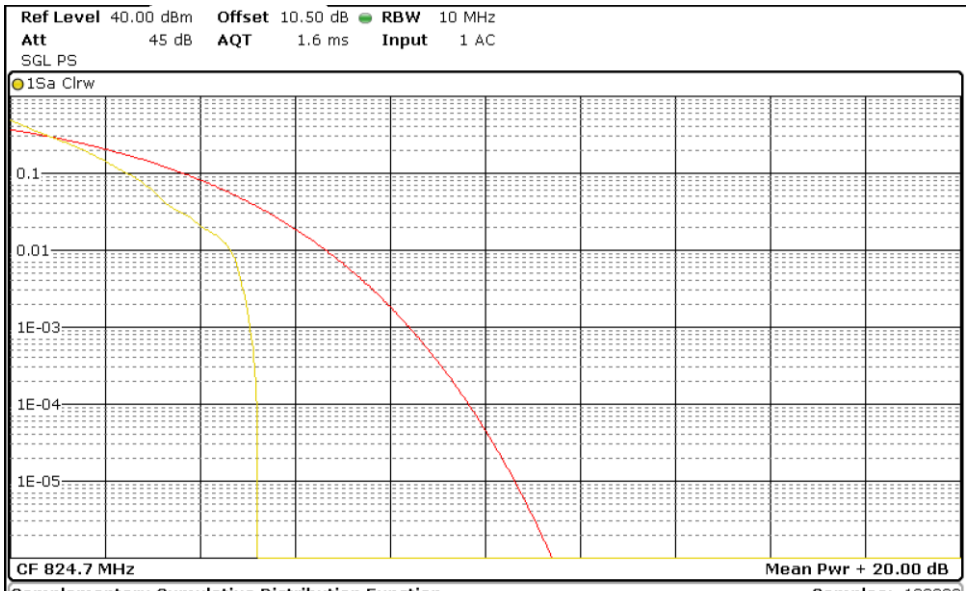
TEST RESULTS (Cont):

BANDWIDTH (MHz)	CHANNEL FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
15	Low 26865 831.5	QPSK	1	0	23.11	4.75
			1	37	23.15	
			1	74	23.02	
			36	0	22.18	
			36	18	22.18	
			36	37	22.13	
			75	0	22.09	
		16-QAM	1	0	22.34	5.71
			1	37	22.35	
			1	74	22.26	
			36	0	21.21	
			36	18	21.23	
			36	37	21.12	
			75	0	21.17	
	Middle 26915 836.5	QPSK	1	0	23.16	4.81
			1	37	23.10	
			1	74	23.08	
			36	0	22.18	
			36	18	22.12	
			36	37	22.15	
			75	0	22.09	
		16-QAM	1	0	22.17	5.77
			1	37	22.08	
			1	74	22.08	
			36	0	21.16	
			36	18	21.19	
			36	37	21.23	
			75	0	21.07	
	High 26965 841.5	QPSK	1	0	23.10	4.67
			1	37	23.11	
			1	74	23.01	
			36	0	22.10	
			36	18	22.20	
			36	37	22.13	
			75	0	22.20	
		16-QAM	1	0	22.35	5.65
			1	37	22.37	
			1	74	22.27	
			36	0	21.15	
			36	18	21.28	
			36	37	21.19	
			75	0	21.18	

TEST RESULTS (Cont):	

PAPR
Bandwidth = 1.4 MHz. Modulation QPSK. RB Size: 1. RB Offset: 0.

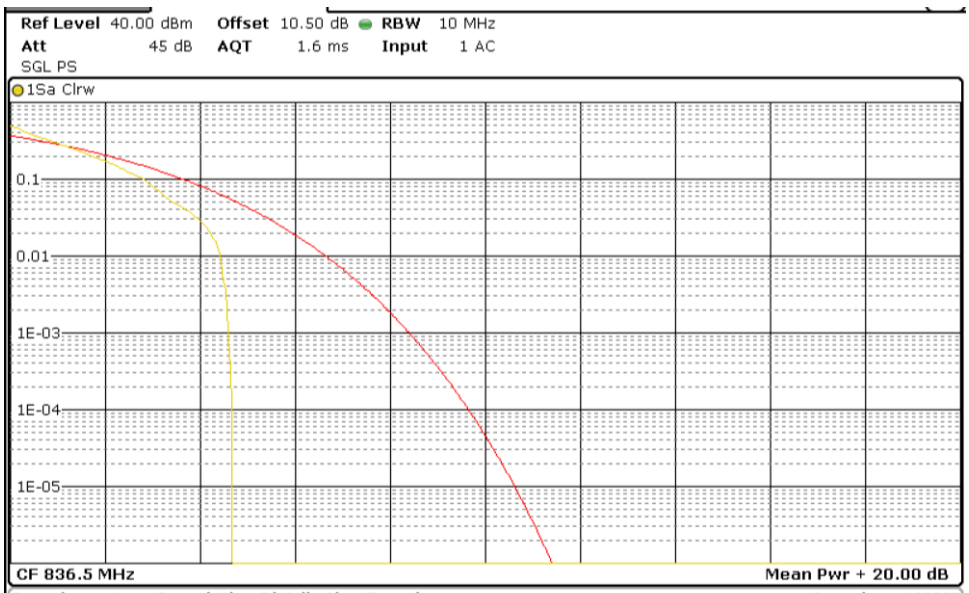
Lowest channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	22.22 dBm	27.41 dBm	5.19 dB	2.46 dB	4.64 dB	5.04 dB	5.19 dB

Middle channel

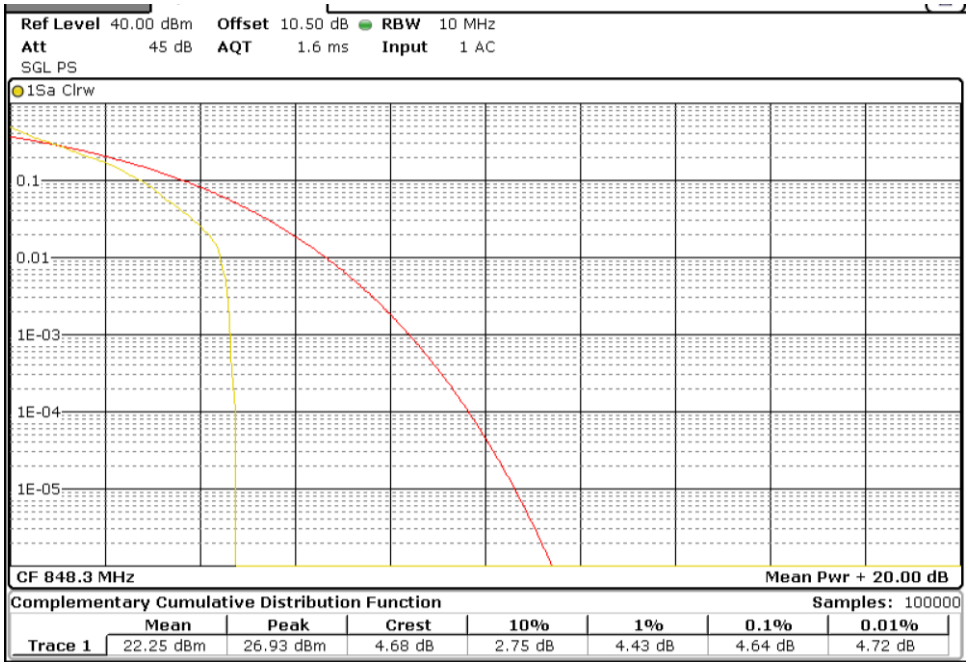


Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	22.24 dBm	26.90 dBm	4.67 dB	2.78 dB	4.43 dB	4.61 dB	4.67 dB

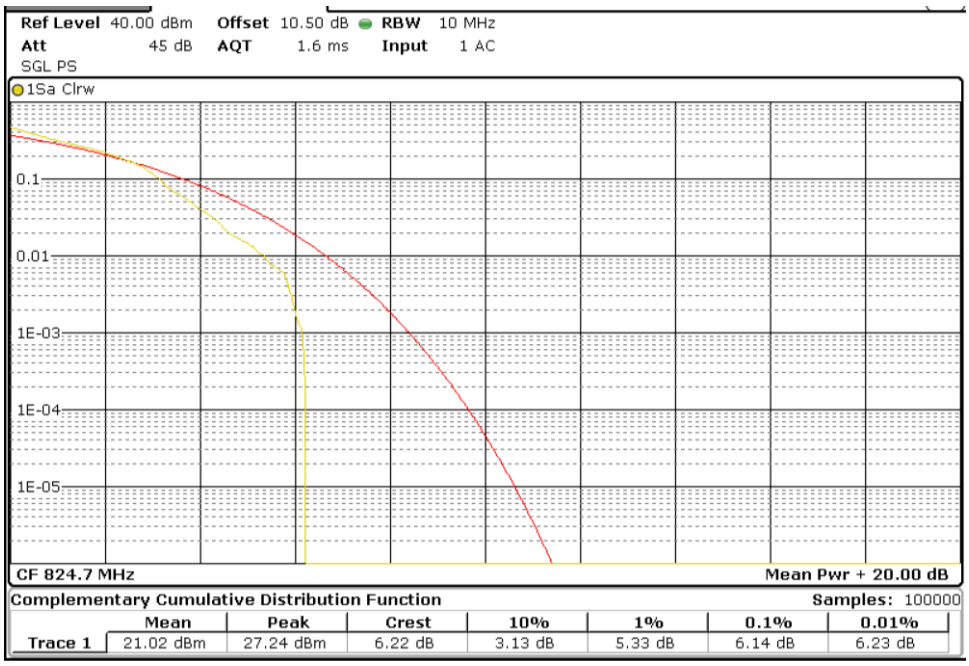
TEST RESULTS (Cont):	

Highest channel



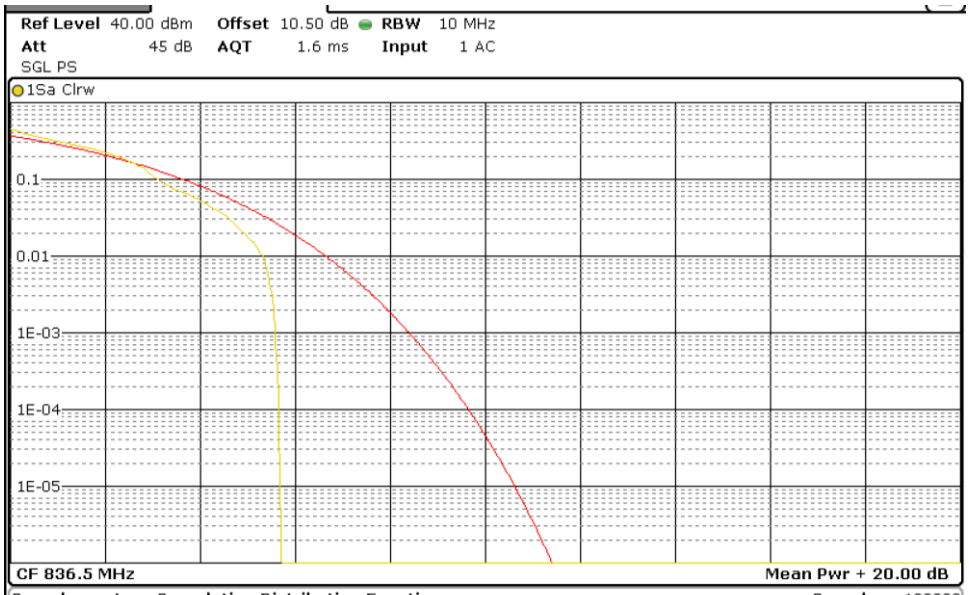
PAPR
Bandwidth = 1.4 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel



TEST RESULTS (Cont):	

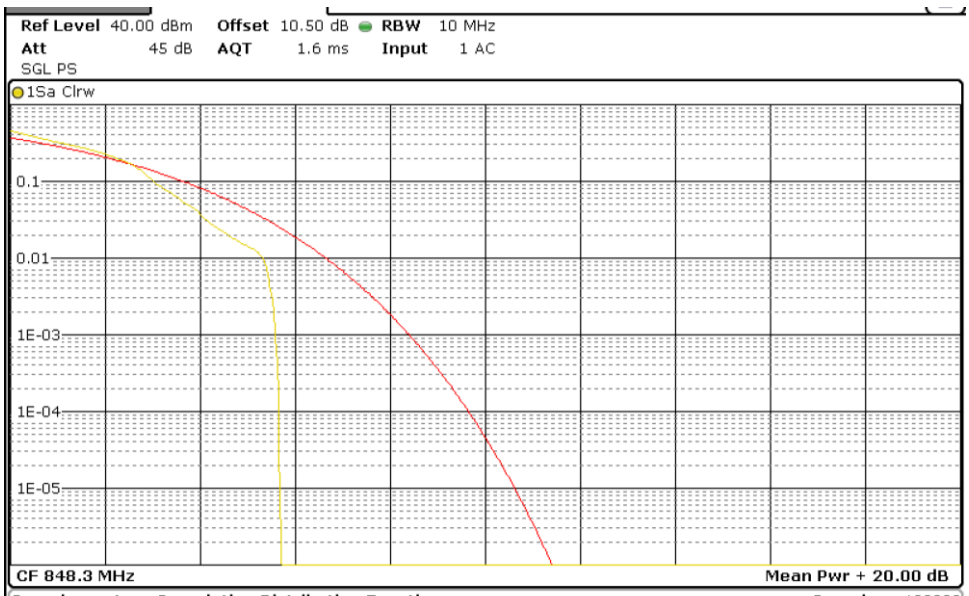
Middle channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.24 dBm	26.89 dBm	5.65 dB	3.10 dB	5.30 dB	5.57 dB	5.68 dB

Highest channel



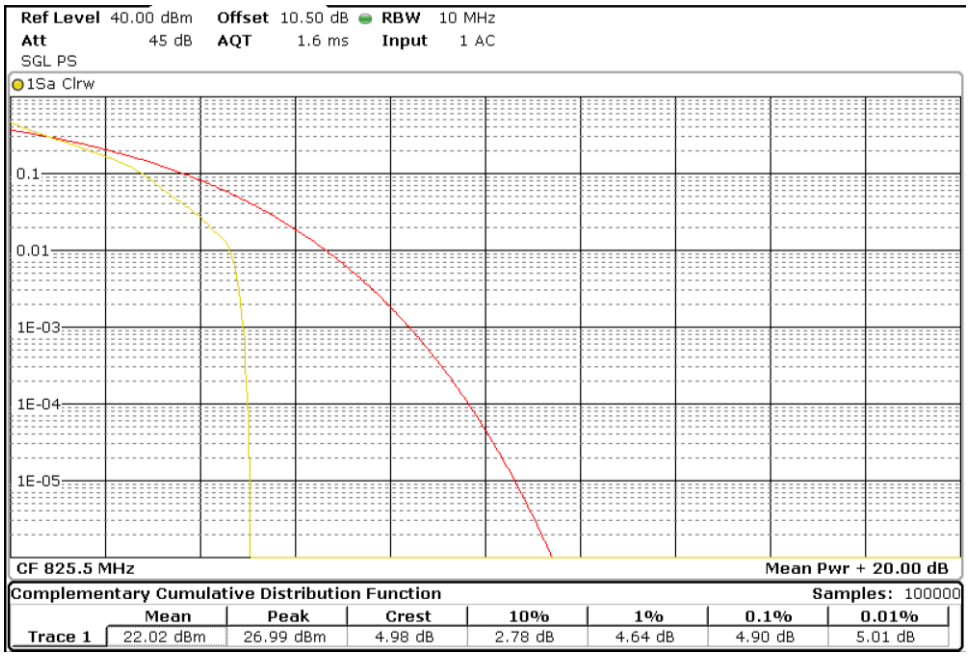
Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.22 dBm	26.89 dBm	5.67 dB	3.01 dB	5.30 dB	5.59 dB	5.68 dB

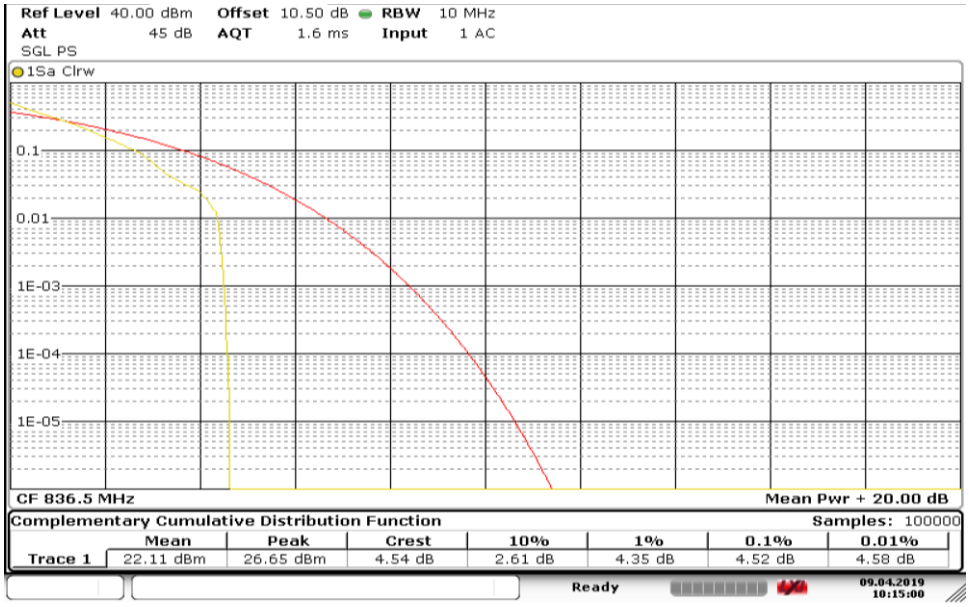
TEST RESULTS (Cont):	

PAPR
Bandwidth = 3 MHz. Modulation QPSK. RB Size: 1. RB Offset: 0.

Lowest channel



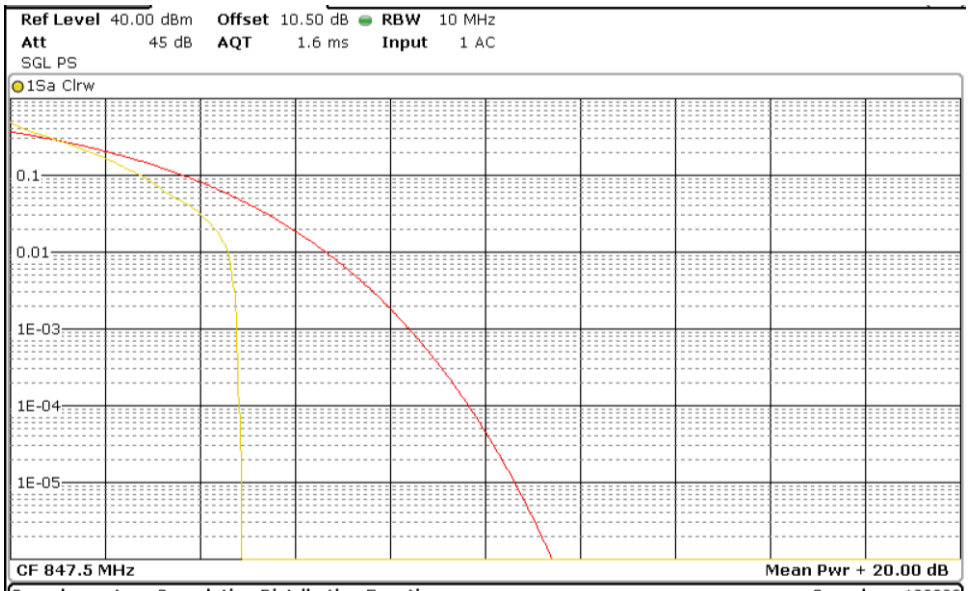
Middle channel



Date: 9.APR.2019 10:15:00

TEST RESULTS (Cont):	

Highest channel

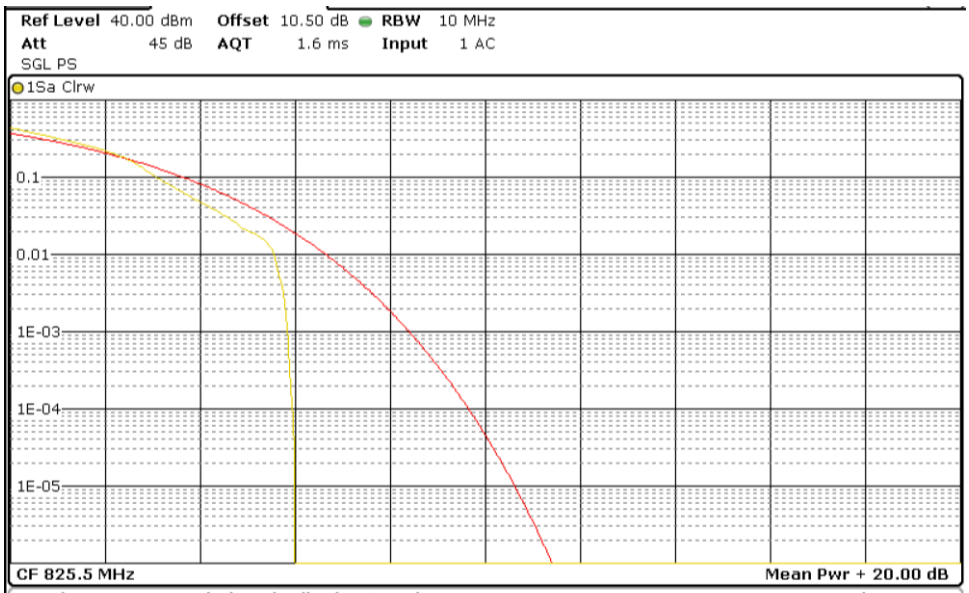


Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	22.02 dBm	26.83 dBm	4.81 dB	2.72 dB	4.58 dB	4.78 dB	4.84 dB

PAPR
Bandwidth = 3 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel

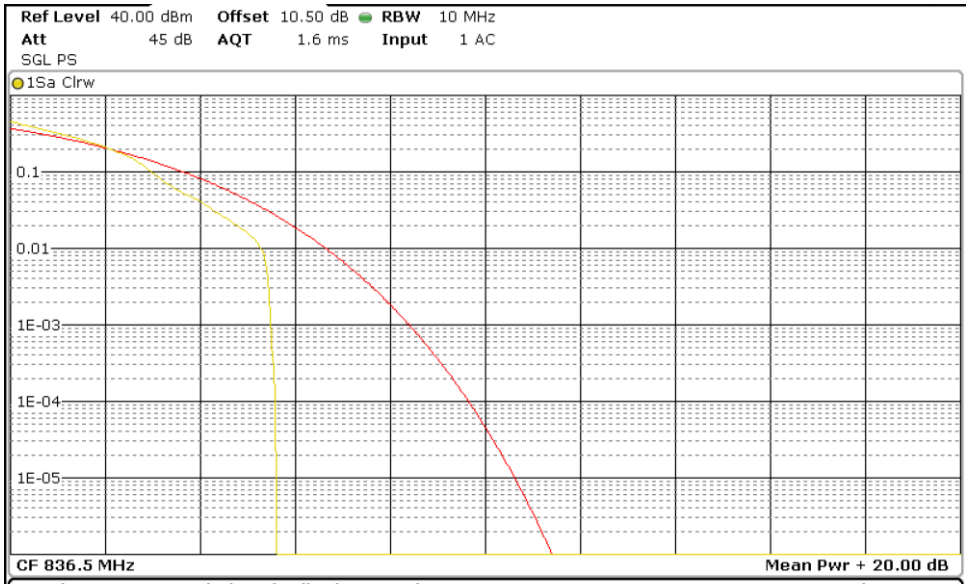


Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.26 dBm	27.19 dBm	5.93 dB	3.07 dB	5.54 dB	5.86 dB	5.94 dB

TEST RESULTS (Cont):	

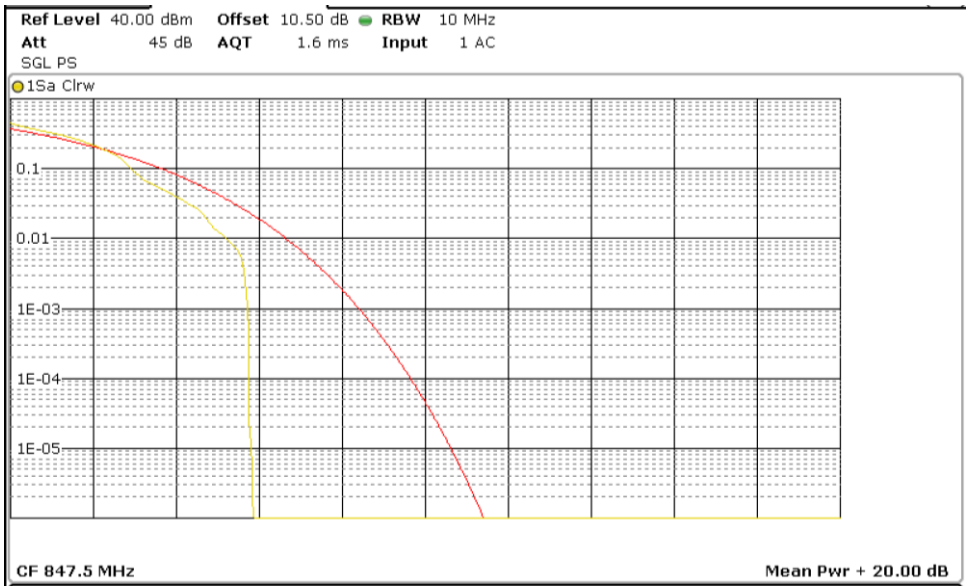
Middle channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.14 dBm	26.69 dBm	5.55 dB	2.96 dB	5.28 dB	5.51 dB	5.57 dB

Highest channel



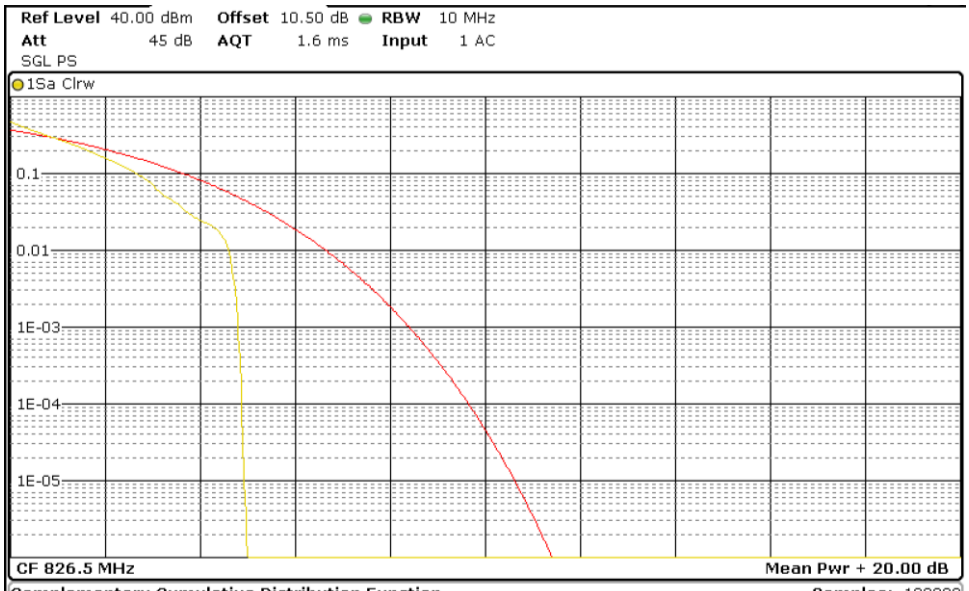
Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.14 dBm	26.90 dBm	5.76 dB	2.90 dB	5.22 dB	5.71 dB	5.77 dB

TEST RESULTS (Cont):	

PAPR
Bandwidth = 5 MHz Modulation QPSK. RB Size: 1. RB Offset: 0.

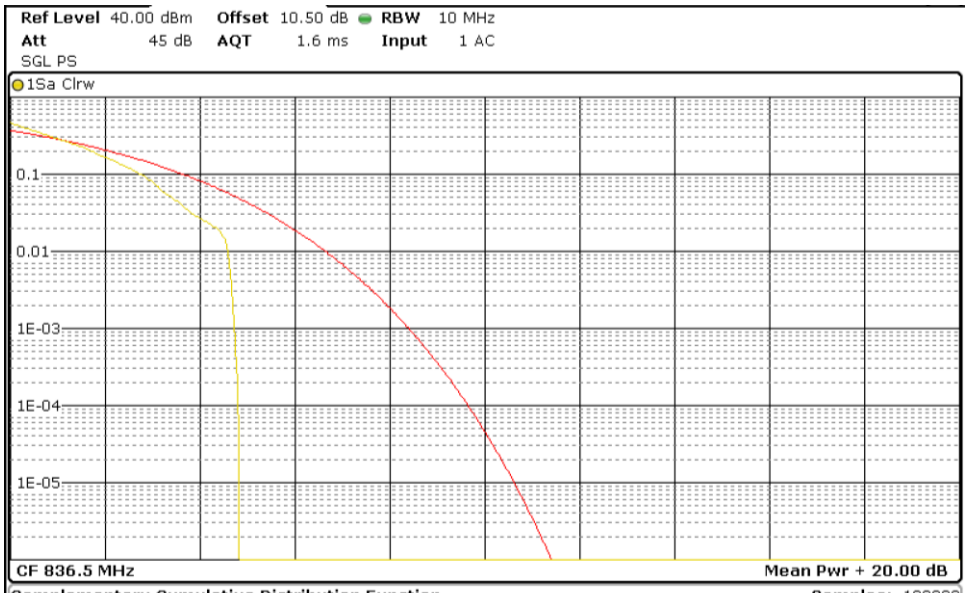
Lowest channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.89 dBm	26.79 dBm	4.90 dB	2.67 dB	4.61 dB	4.81 dB	4.90 dB

Middle channel

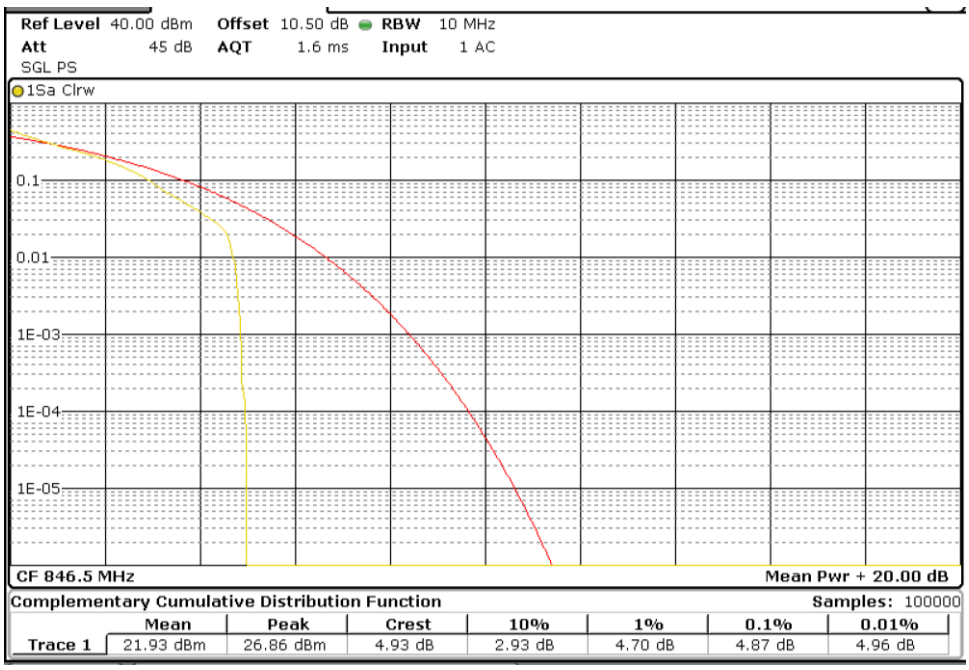


Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	21.91 dBm	26.68 dBm	4.76 dB	2.75 dB	4.58 dB	4.72 dB	4.81 dB

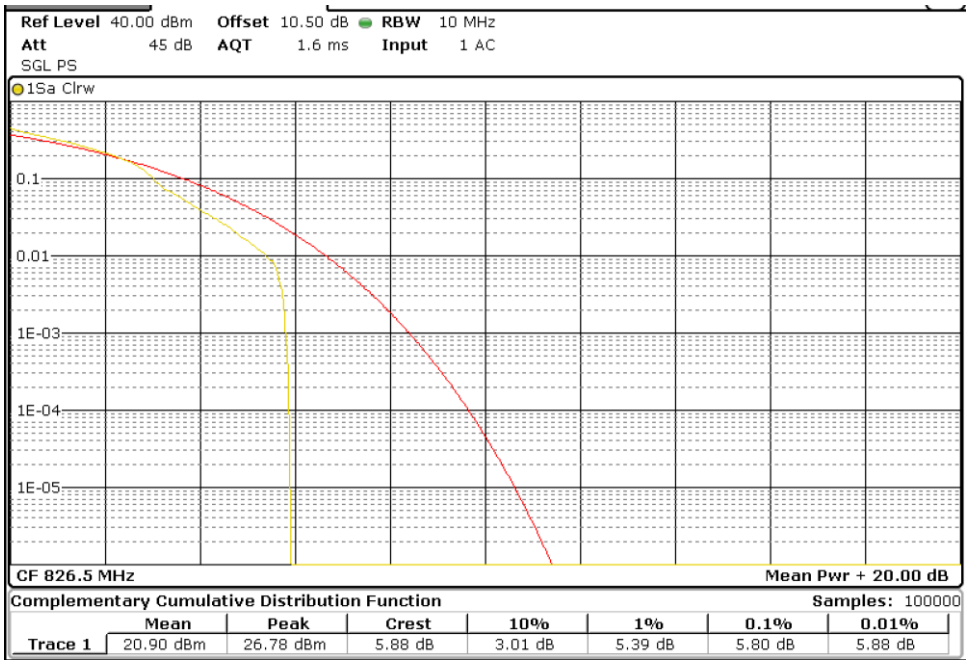
TEST RESULTS (Cont):	

Highest channel



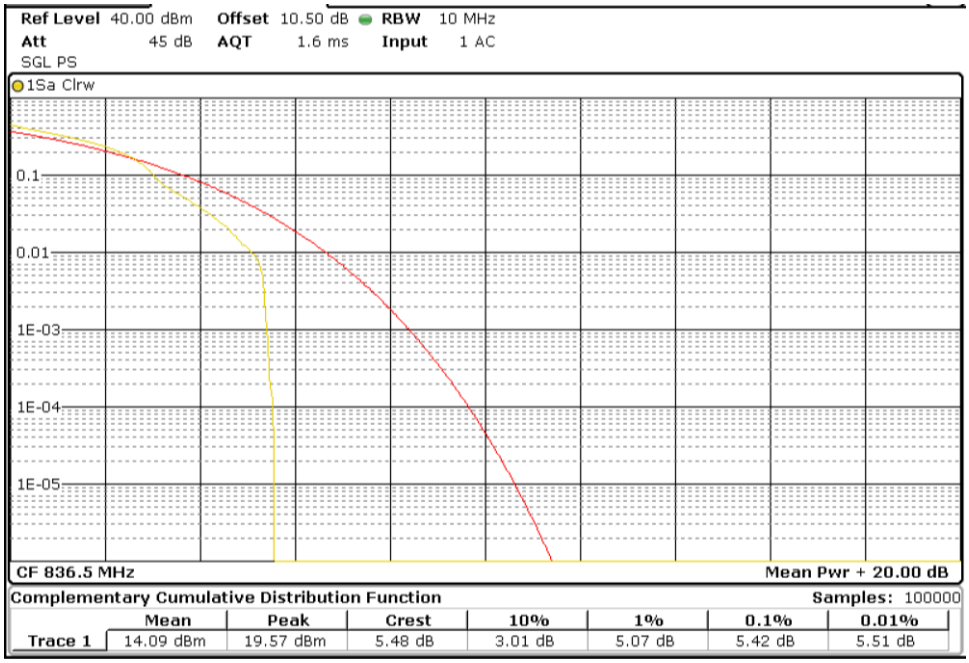
Bandwidth = 5 MHz Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel

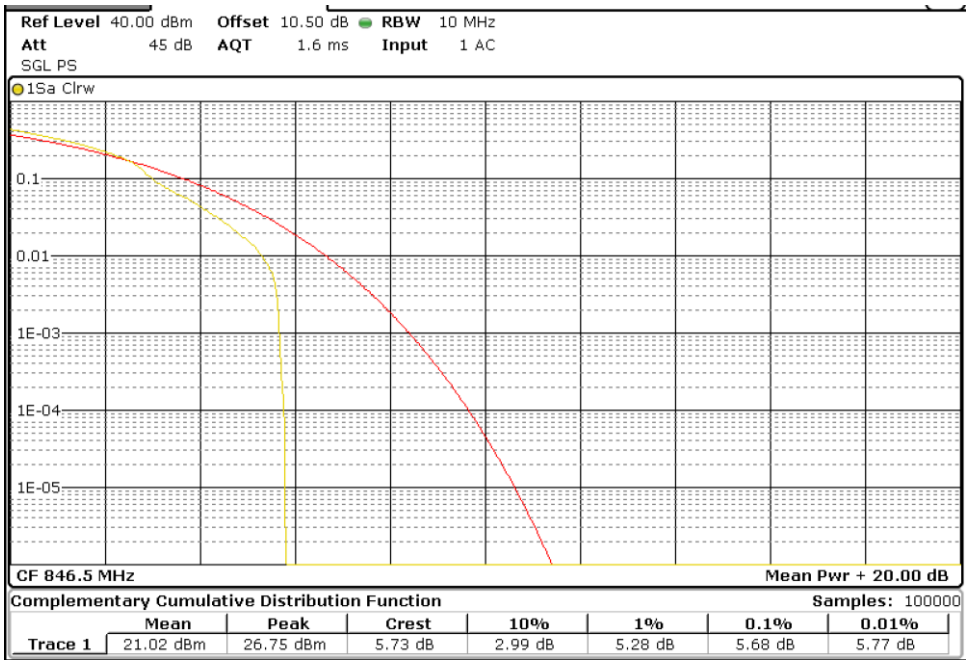


TEST RESULTS (Cont):	

Middle channel



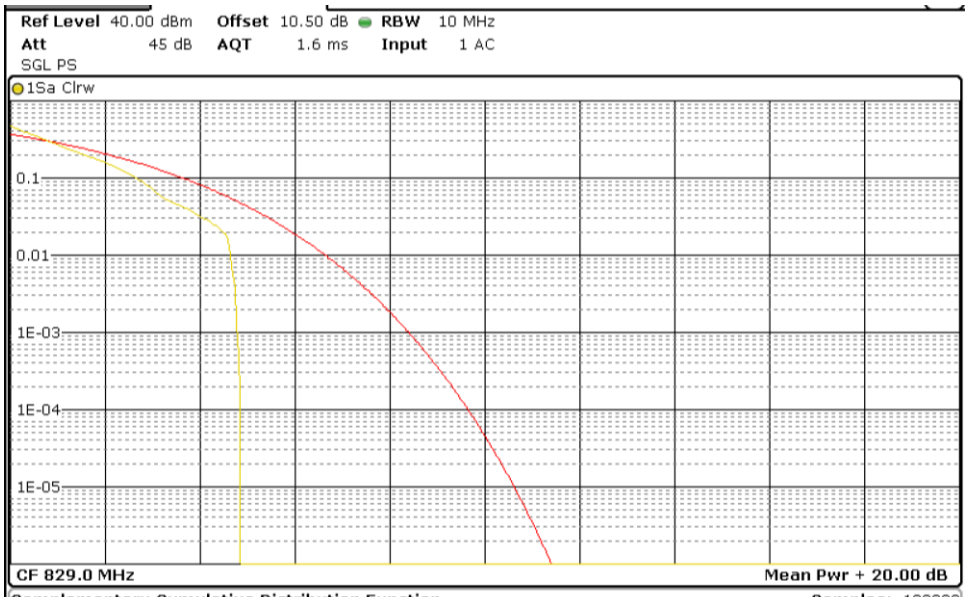
Highest channel



TEST RESULTS (Cont):	

Bandwidth = 10 MHz Modulation QPSK. RB Size: 1. RB Offset: 0.

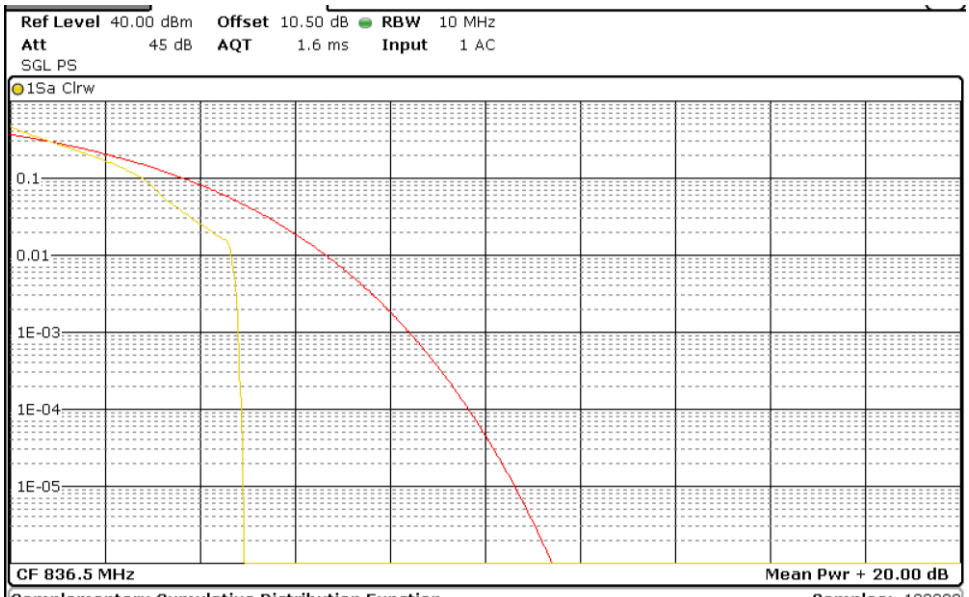
Lowest channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	20.07 dBm	24.91 dBm	4.84 dB	2.64 dB	4.64 dB	4.78 dB	4.87 dB

Middle channel

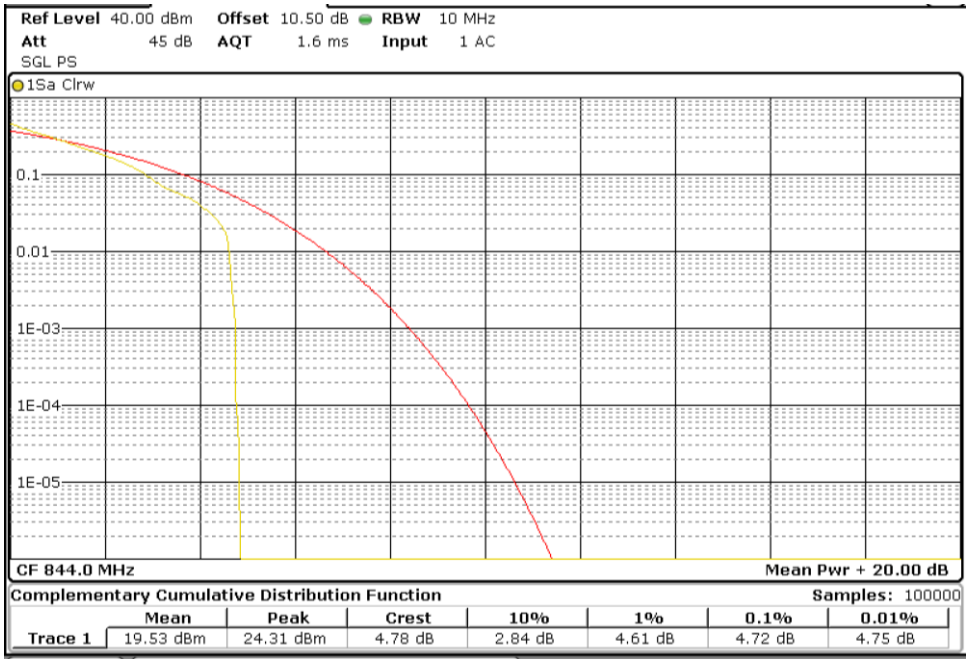


Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	19.85 dBm	24.71 dBm	4.86 dB	2.75 dB	4.67 dB	4.81 dB	4.87 dB

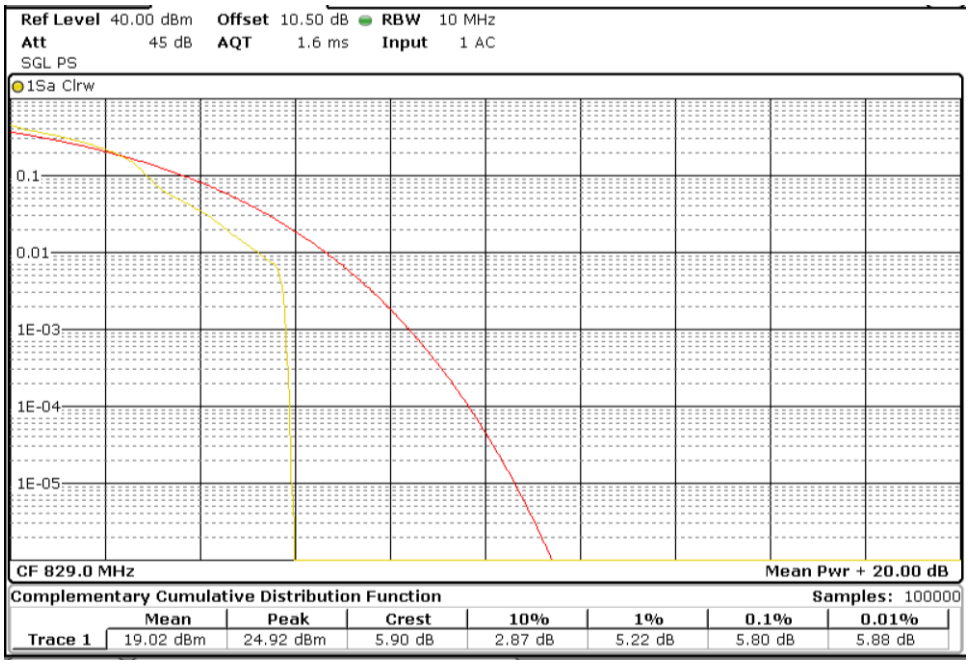
TEST RESULTS (Cont):	

Highest channel



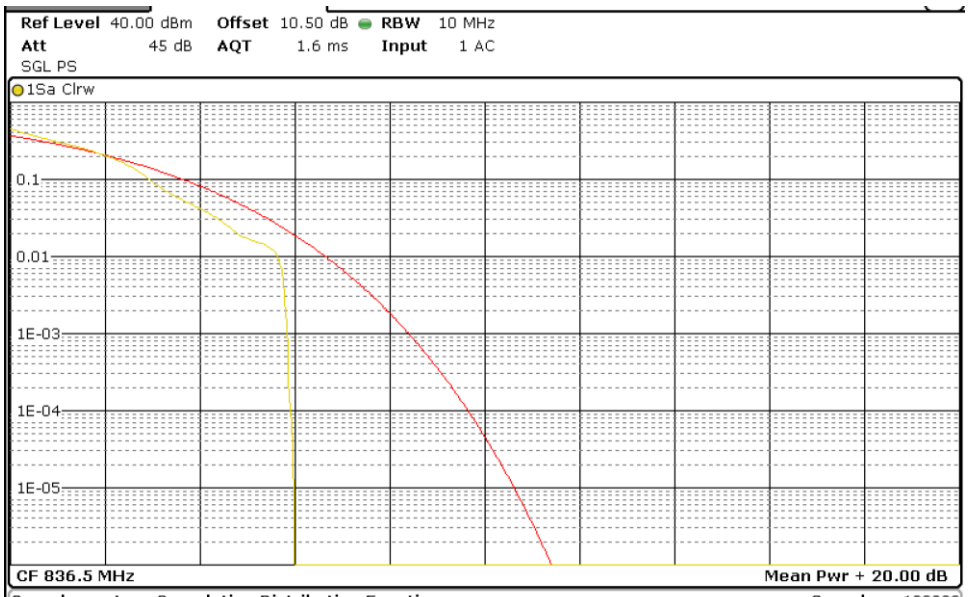
Bandwidth = 10 MHz Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel



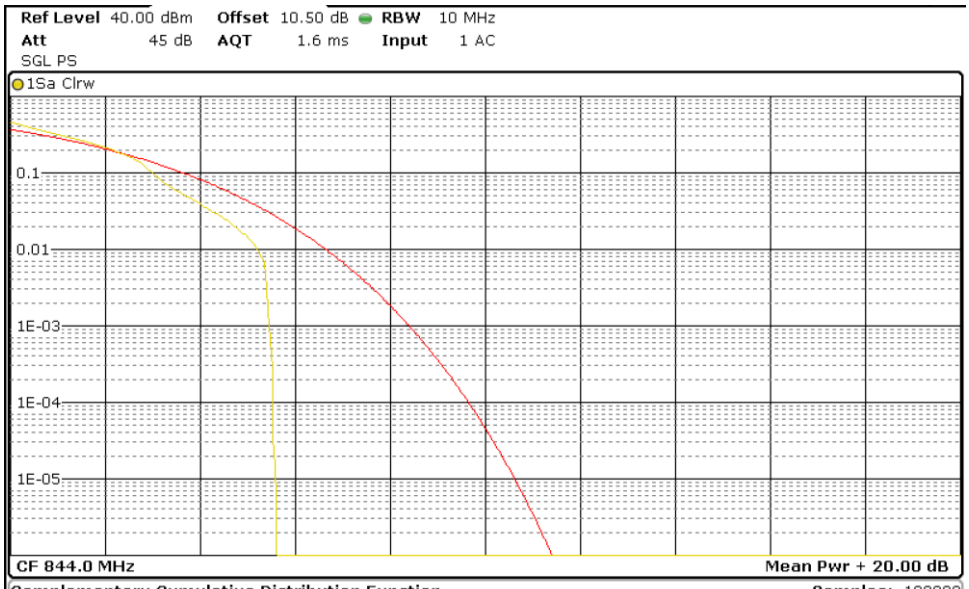
TEST RESULTS (Cont):	

Middle channel



	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	18.78 dBm	24.71 dBm	5.93 dB	2.93 dB	5.62 dB	5.86 dB	5.91 dB

Highest channel

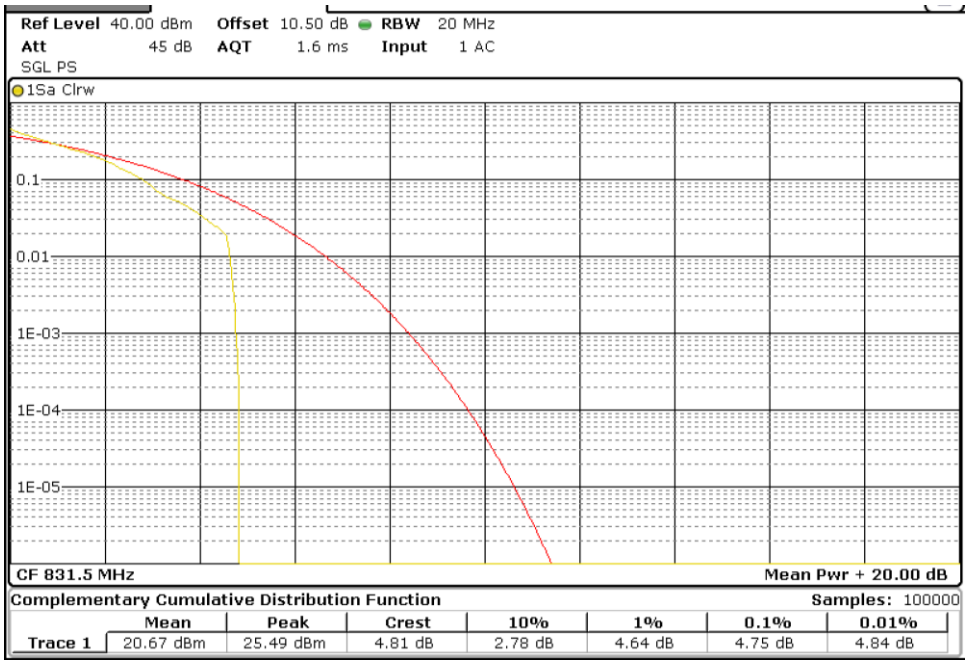


	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	18.85 dBm	24.40 dBm	5.55 dB	2.99 dB	5.22 dB	5.48 dB	5.54 dB

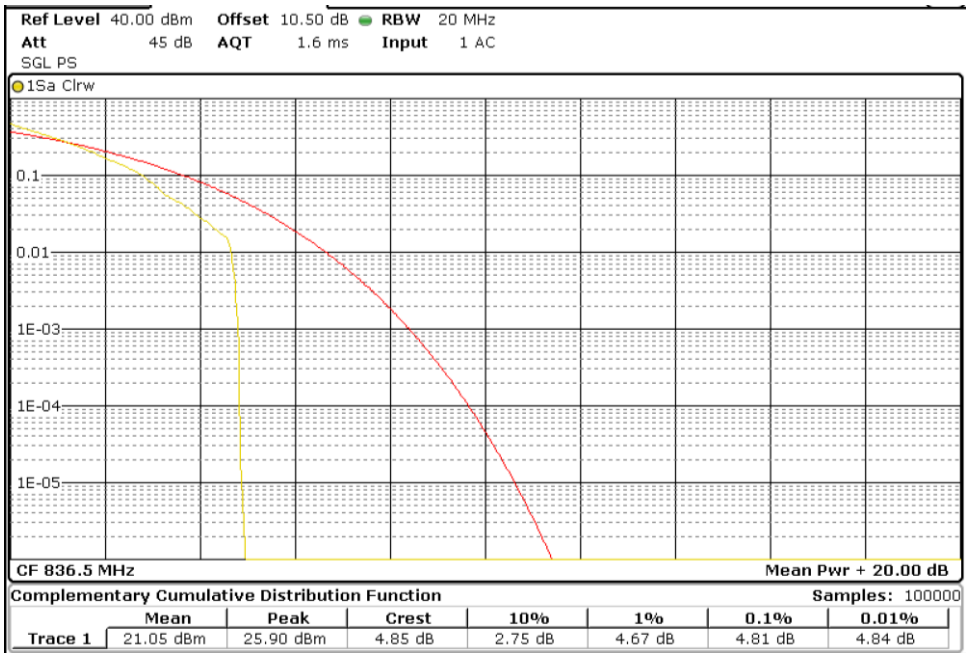
TEST RESULTS (Cont):	

Bandwidth = 15 MHz Modulation QPSK. RB Size: 1. RB Offset: 0.

Lowest channel

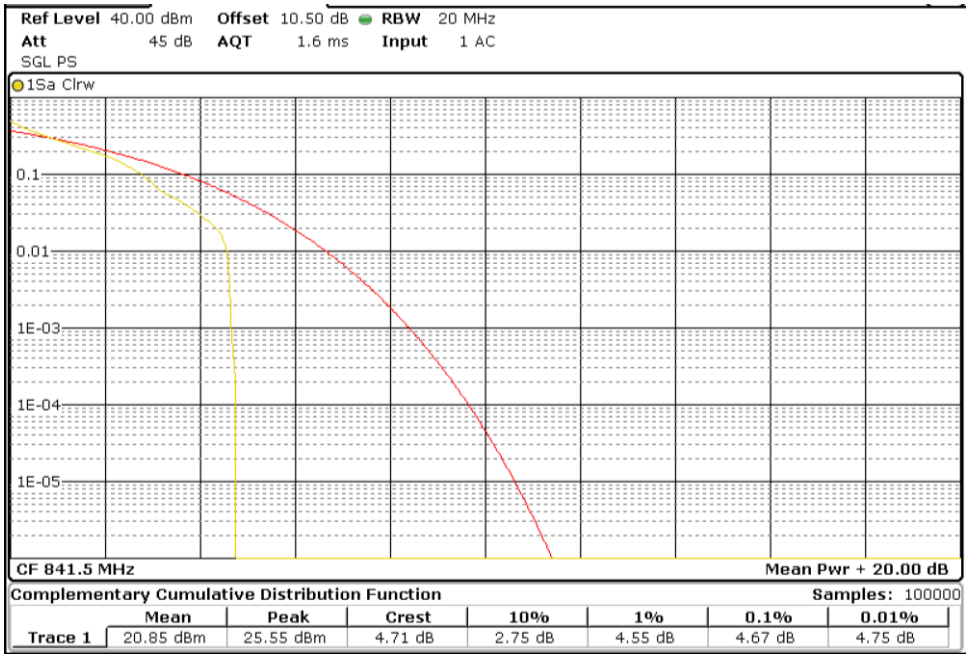


Middle channel



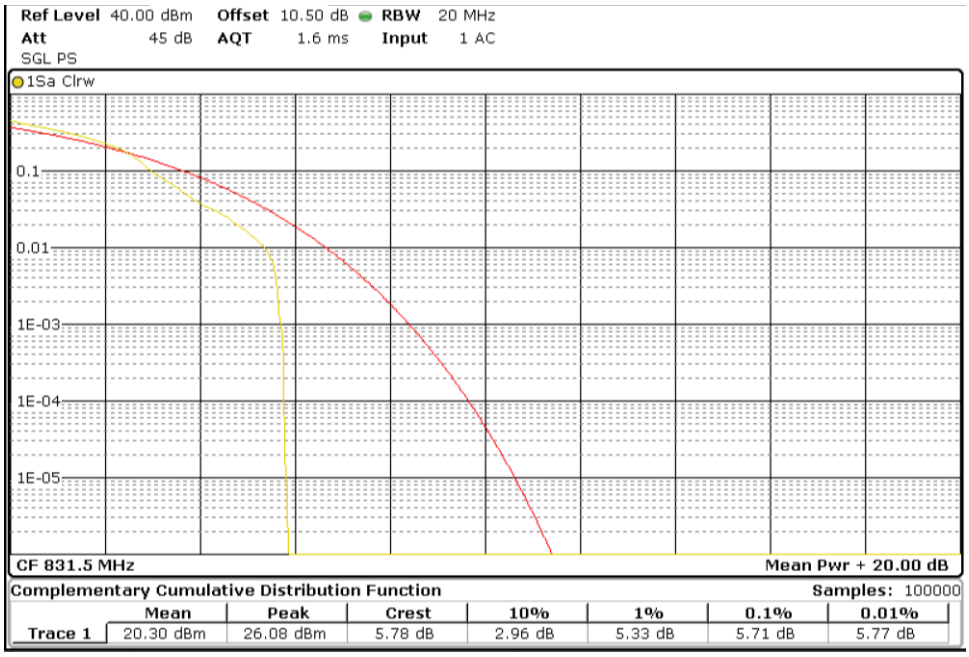
TEST RESULTS (Cont):	

Highest channel



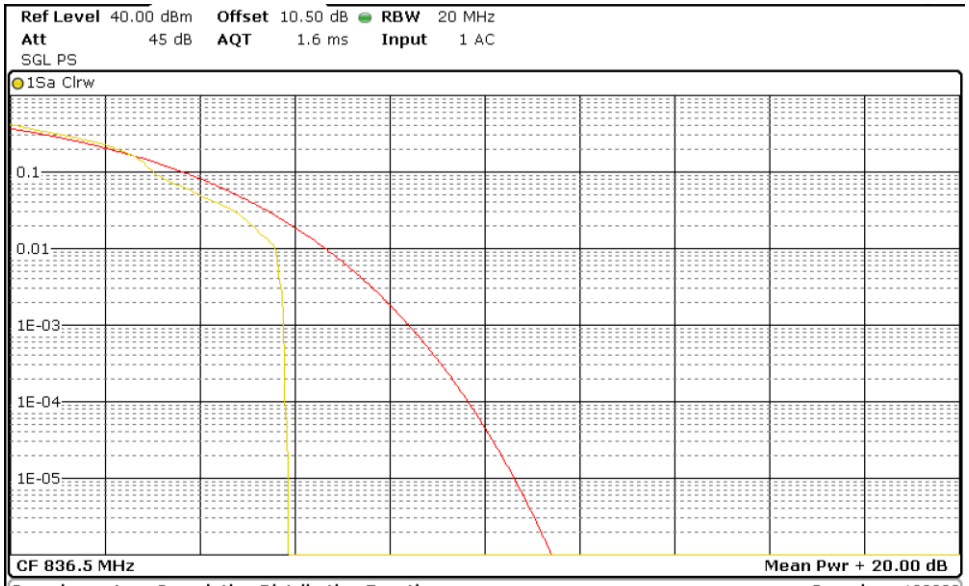
Bandwidth = 15 MHz Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel



TEST RESULTS (Cont):	

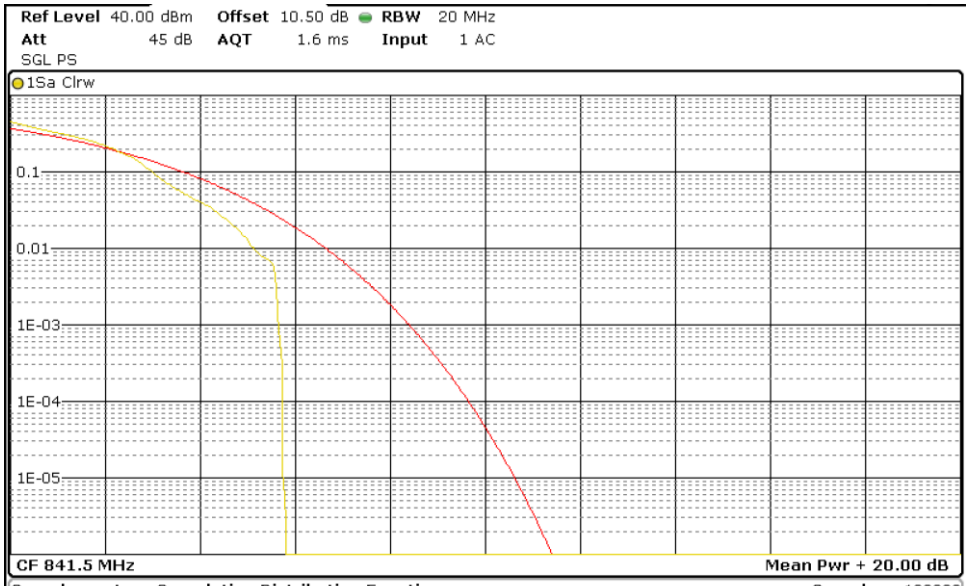
Middle channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	20.21 dBm	26.01 dBm	5.80 dB	3.01 dB	5.57 dB	5.77 dB	5.80 dB

Highest channel



Complementary Cumulative Distribution Function — Samples: 100000

	Mean	Peak	Crest	10%	1%	0.1%	0.01%
Trace 1	19.86 dBm	25.59 dBm	5.73 dB	2.99 dB	5.13 dB	5.65 dB	5.74 dB

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02
TEST RESULTS:	PASS

LTE QPSK AND 16QAM MODULATION. Bandwidth = 1.4 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
26790V	23.03	5.0	28.03
Measurement uncertainty (dB)			<±0.95

LTE QPSK AND 16QAM MODULATION. Bandwidth = 3 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
26790	23.08	5.0	28.08
Measurement uncertainty (dB)			<±0.95

LTE QPSK AND 16QAM MODULATION. Bandwidth = 5 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
26790	23.05	5.0	28.05
Measurement uncertainty (dB)			<±0.95

LTE QPSK AND 16QAM MODULATION. Bandwidth = 10 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
26790	23.09	5.0	28.09
Measurement uncertainty (dB)			<±0.95

LTE QPSK AND 16QAM MODULATION. Bandwidth = 15 MHz

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
26790	23.04	5.0	28.04
Measurement uncertainty (dB)			<±0.95

TEST RESULTS (Cont):

CHANNEL FREQUENCY (MHz)	BANDWIDTH (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)
26790 824.0	1.4	QPSK	1	0	22.93
			1	2	22.96
			1	5	22.90
			3	0	22.95
			3	1	23.02
			3	2	23.03
			6	0	21.90
		16-QAM	1	0	21.84
			1	2	21.87
			1	5	21.85
			3	0	21.87
			3	1	21.91
			3	2	21.93
			6	0	21.00
	3	QPSK	1	0	22.99
			1	7	23.08
			1	14	22.95
			8	0	22.01
			8	4	22.01
			8	7	22.00
			15	0	21.98
		16-QAM	1	0	22.19
			1	7	22.28
			1	14	22.17
			8	0	21.20
			8	4	21.23
			8	7	21.17
			15	0	21.01
	5		1	0	23.05
			1	12	23.02
			1	24	23.05
			12	0	22.01
			12	6	22.03
			12	11	22.00
			25	0	22.02
			1	0	22.20
			1	12	22.14
			1	24	22.22
			12	0	21.05
			12	6	21.07
			12	11	21.06
			25	0	20.97

TEST RESULTS (Cont):

CHANNEL FREQUENCY (MHz)	BANDWIDTH (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)
26790 824.0	10	QPSK	1	0	23.05
			1	24	23.00
			1	49	23.09
			25	0	22.04
			25	12	22.04
			25	24	21.99
			50	0	22.02
		16-QAM	1	0	22.29
			1	24	22.12
			1	49	22.21
			25	0	21.11
			25	12	21.08
			25	24	21.05
			50	0	21.00
	15	QPSK	1	0	22.99
			1	37	23.02
			1	74	23.04
			36	0	22.06
			36	18	22.08
			36	37	22.11
			75	0	22.03
		16-QAM	1	0	22.21
			1	37	22.21
			1	74	22.20
			36	0	21.10
			36	18	21.16
			36	37	21.17
			75	0	21.05

TEST A.2: MODULATION CHARACTERISTICS

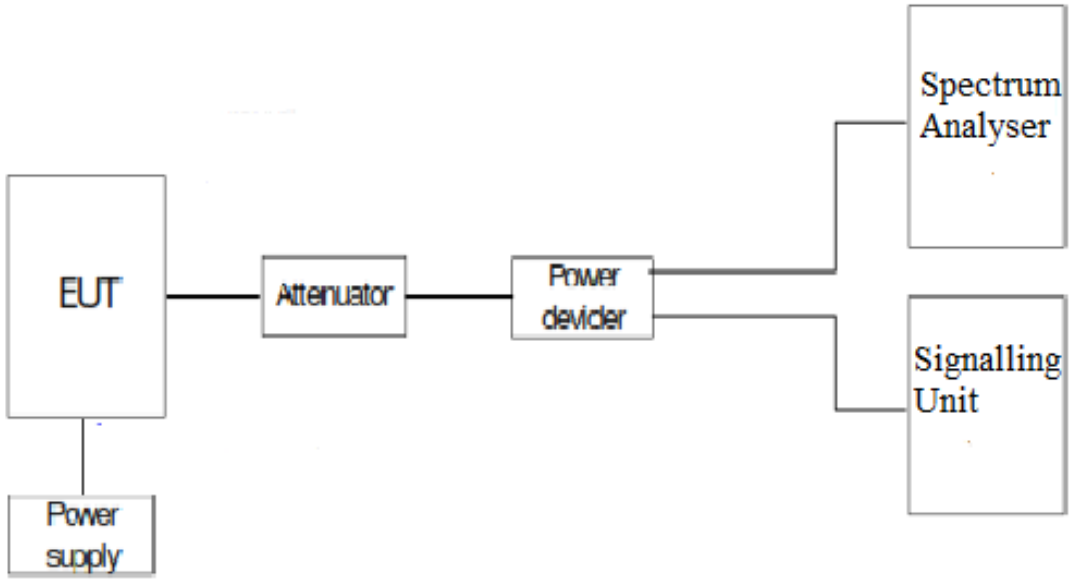
LIMITS:	Product standard:	FCC Part 22 / IC RSS-132
	Test standard:	FCC §2.1047 / RSS-132 Clause 5.2

LIMITS

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

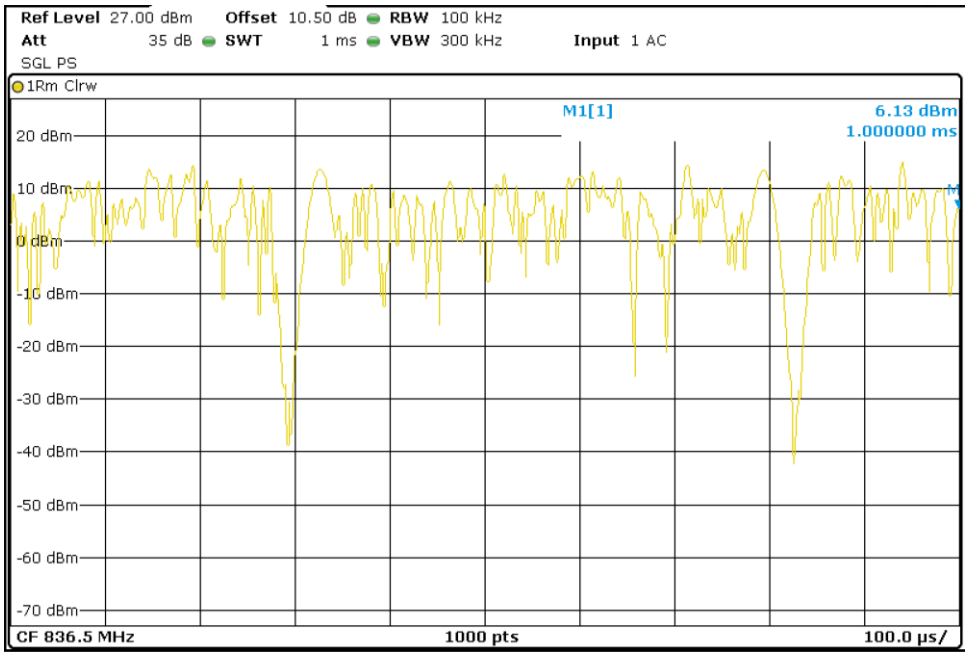
TEST SETUP

For LTE the EUT operates with QPSK and 16QAM modulation modes in which the information is digitized 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).

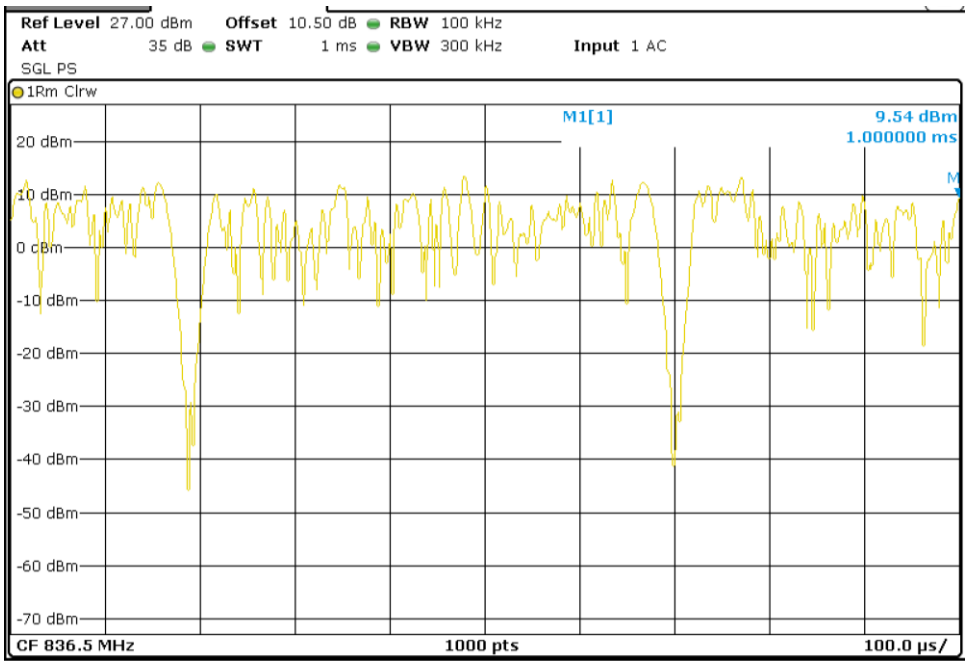


TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

QPSK Modulation



16QAM Modulation



TEST A.3: FREQUENCY STABILITY

LIMITS:	Product standard:	FCC Part 22 / IC RSS-132
	Test standard:	FCC §2.1055 and § 22.355 / RSS-132 Clause 5.3

LIMITS

The frequency stability shall be enough to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST SETUP	

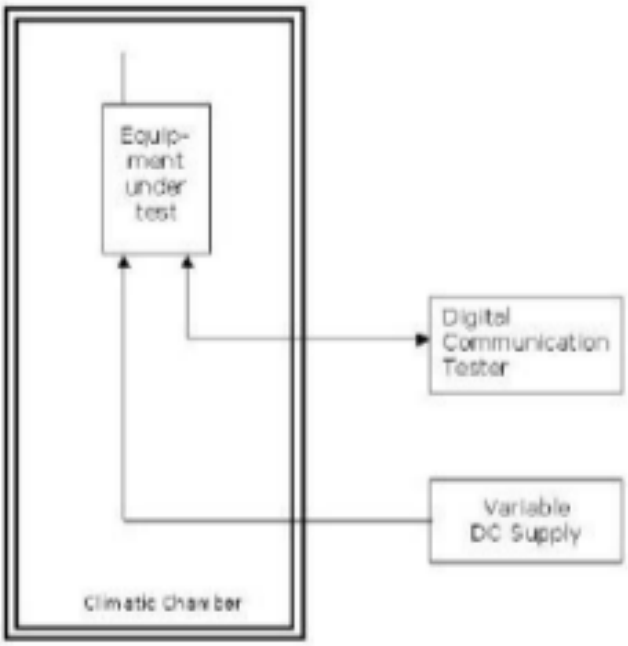
The frequency tolerance measurements over temperature variations were made over the temperature range of

–30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.

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

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

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



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

LTE QPSK MODULATION. BW = 3 MHz

Frequency stability over temperature variations

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
50	1.59	0.0020	0.00000020
40	9.77	-0.0010	-0.00000010
30	-9.48	0.0007	0.00000007
20	-1.8	-0.0024	-0.00000024
10	-11.36	0.0006	0.00000006
0	-3.63	-0.0002	-0.00000002
-10	-9.36	-0.0010	-0.00000010
-20	2.05	0.0009	0.00000009
-30	2.36	-0.0006	-0.00000006

Frequency stability over voltage variations

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.4	7.72	0.0001	0.00000001
Vmin	3.3	10.01	-0.0010	-0.00000010

TEST A.4: OCCUPIED BANDWIDTH

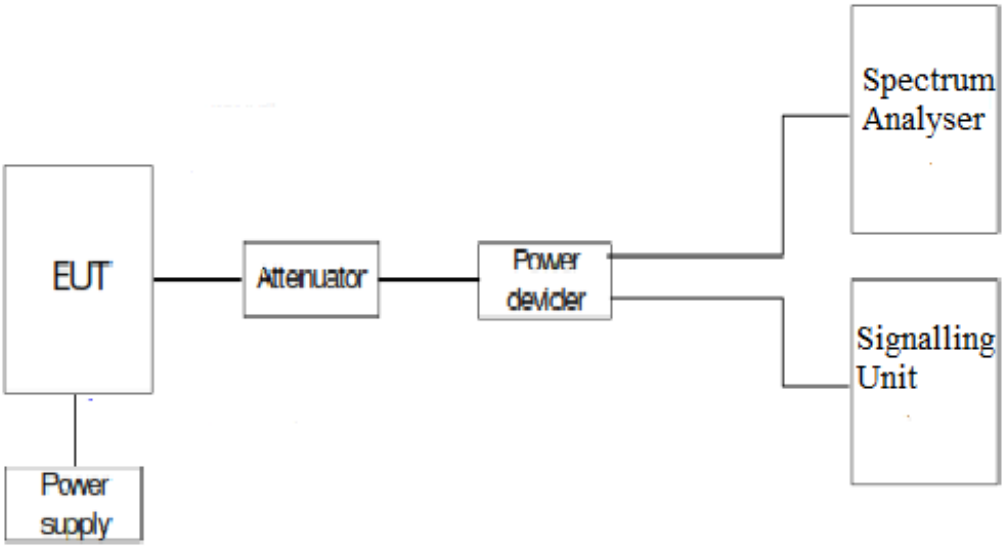
LIMITS:	Product standard:	FCC Part 22 / IC RSS-132
	Test standard:	FCC § 2.1049/ RSS-132 Clause 5.1

LIMITS

Reference only.

TEST SETUP	

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator, power splitter and spectrum analyzer. 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 analyzer.



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

LTE QPSK MODULATION. BW = 1.4 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	1.12	1.12	1.11
-26 dBc bandwidth (MHz)	1.28	1.27	1.28

LTE 16QAM MODULATION. BW = 1.4 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	1.10	1.11	1.11
-26 dBc bandwidth (MHz)	1.27	1.27	1.28

LTE QPSK MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	2.74	2.74	2.74
-26 dBc bandwidth (MHz)	3.10	3.08	3.08

LTE 16QAM MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	2.76	2.73	2.73
-26 dBc bandwidth (MHz)	3.11	3.09	3.08

LTE QPSK MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.58	4.56	4.57
-26 dBc bandwidth (MHz)	5.18	5.17	5.15

TEST RESULTS (Cont):	

LTE 16QAM MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	4.56	4.56	4.57
-26 dBc bandwidth (MHz)	5.15	5.17	5.17

LTE QPSK MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	9.24	9.18	9.22
-26 dBc bandwidth (MHz)	10.51	10.39	10.47

LTE 16QAM MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	9.22	9.12	9.22
-26 dBc bandwidth (MHz)	10.51	10.39	10.41

LTE QPSK MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	13.59	13.50	13.56
-26 dBc bandwidth (MHz)	15.28	15.07	15.20

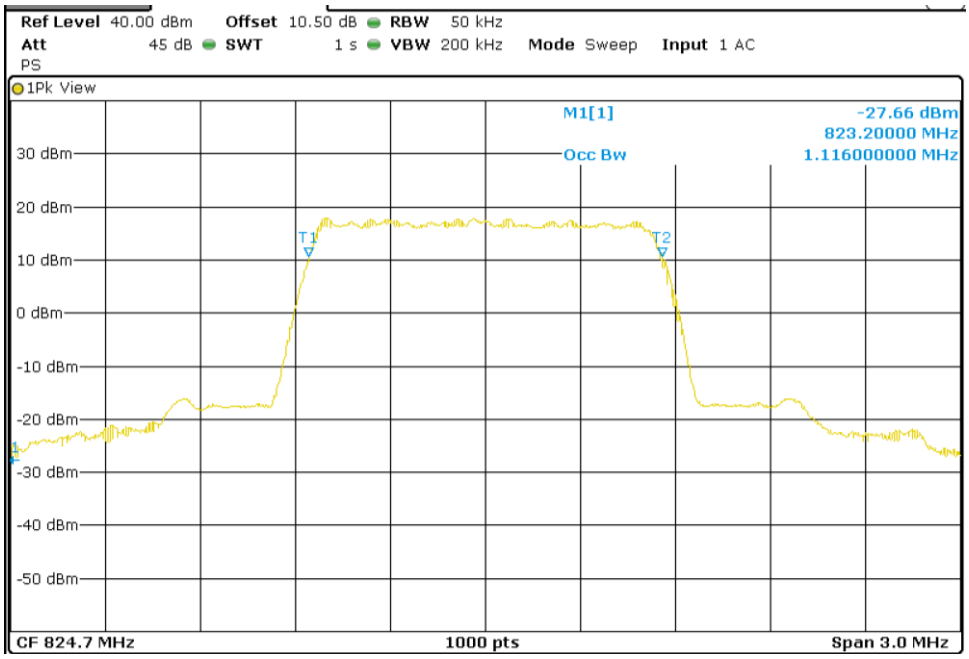
LTE 16QAM MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (MHz)	13.62	13.50	13.62
-26 dBc bandwidth (MHz)	15.07	15.11	15.15

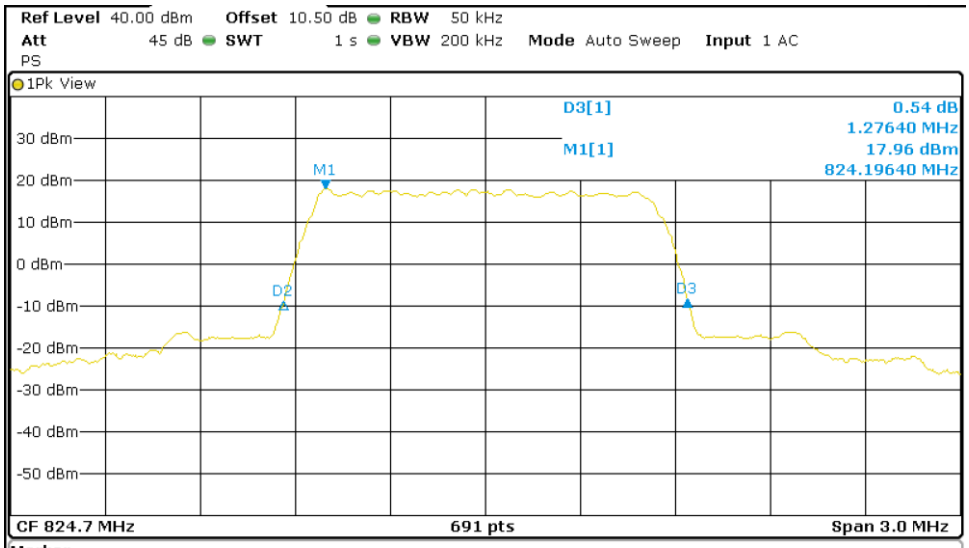
TEST RESULTS (Cont):	

LTE QPSK MODULATION. BW = 1.4 MHz

Lowest Channel 99% Occupied Bandwidth



Lowest Channel -26dBc Bandwidth kHz

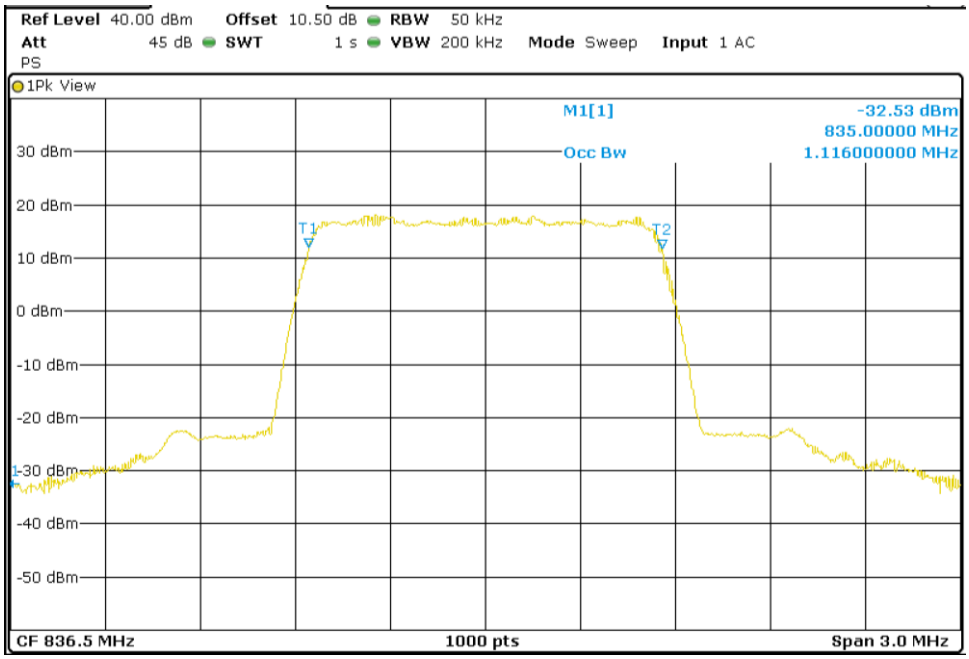


Marker

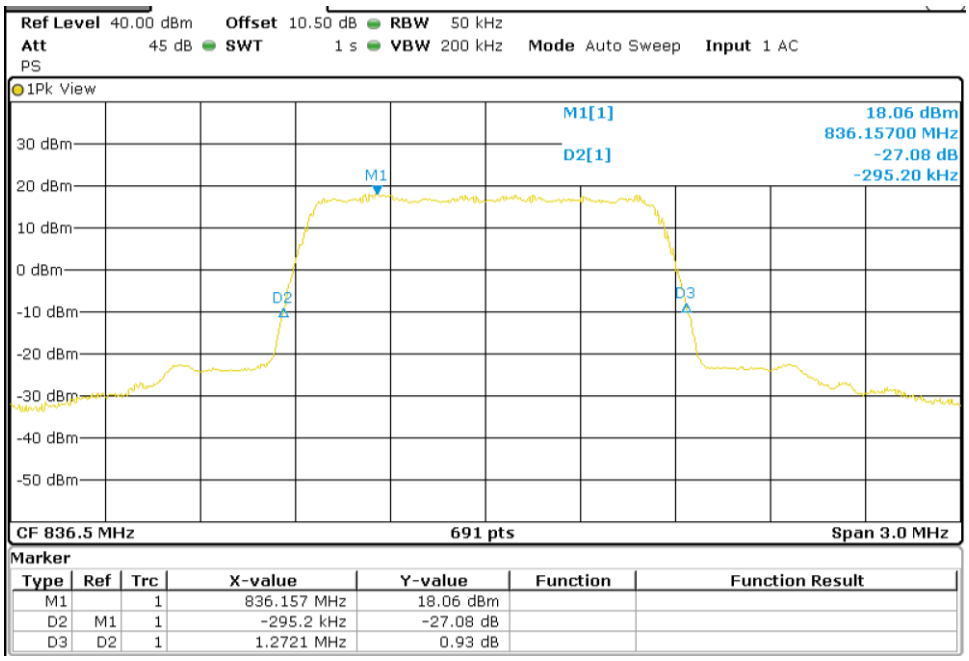
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	824.1964 MHz	17.96 dBm		
D2	M1	1	-134.6 kHz	-26.86 dB		
D3	D2	1	1.2764 MHz	0.54 dB		

TEST RESULTS (Cont):	

Middle Channel 99% Occupied Bandwidth



Middle Channel 26dBc Bandwidth kHz

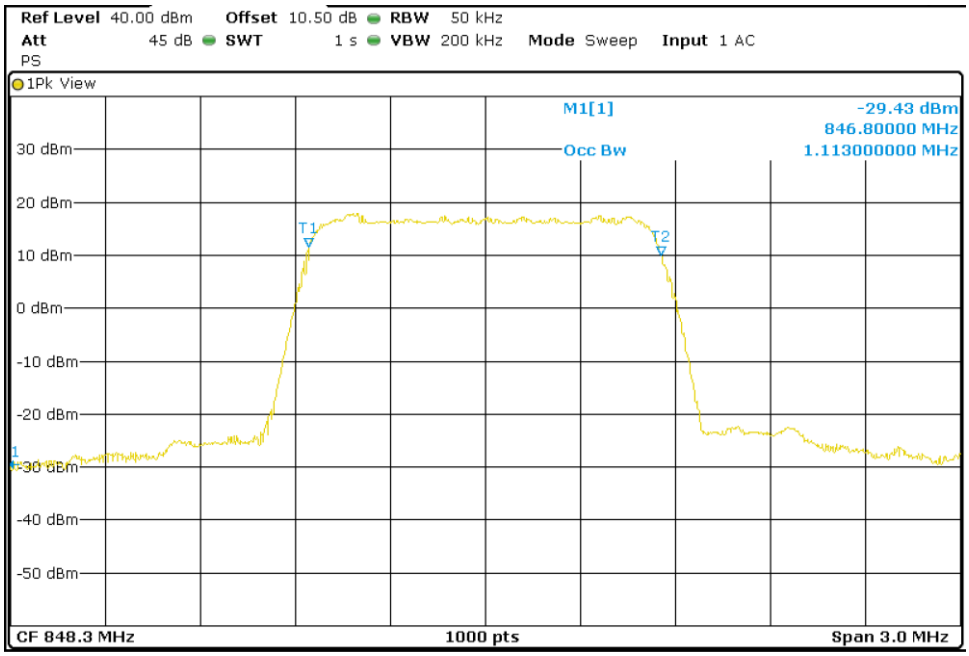


Marker

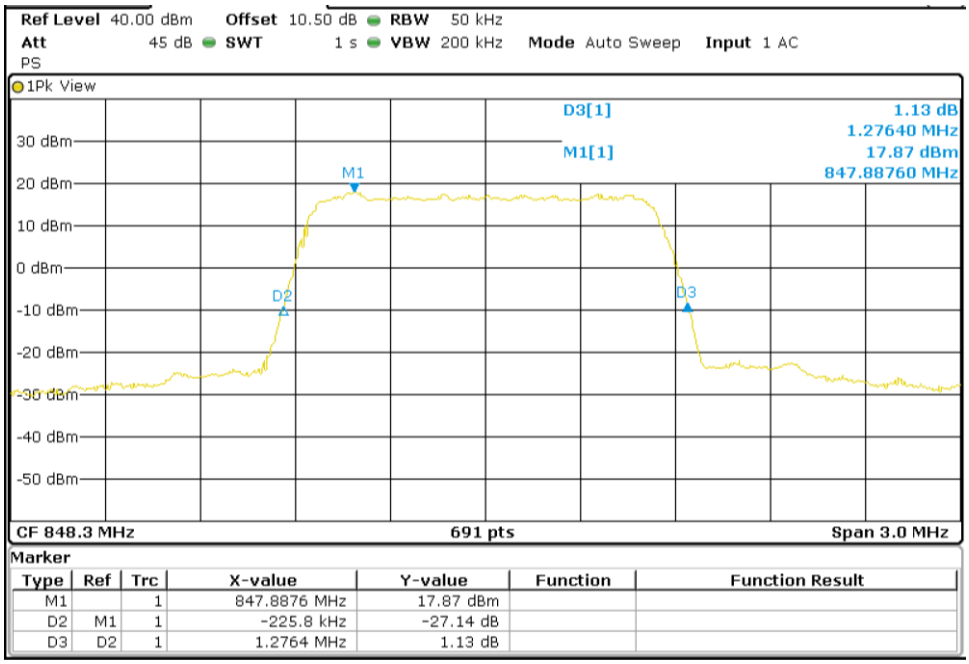
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	836.157 MHz	18.06 dBm		
D2	M1	1	-295.2 kHz	-27.08 dB		
D3	D2	1	1.2721 MHz	0.93 dB		

TEST RESULTS (Cont):	

Highest Channel 99% Occupied Bandwidth



Highest Channel 26dBc Bandwidth kHz



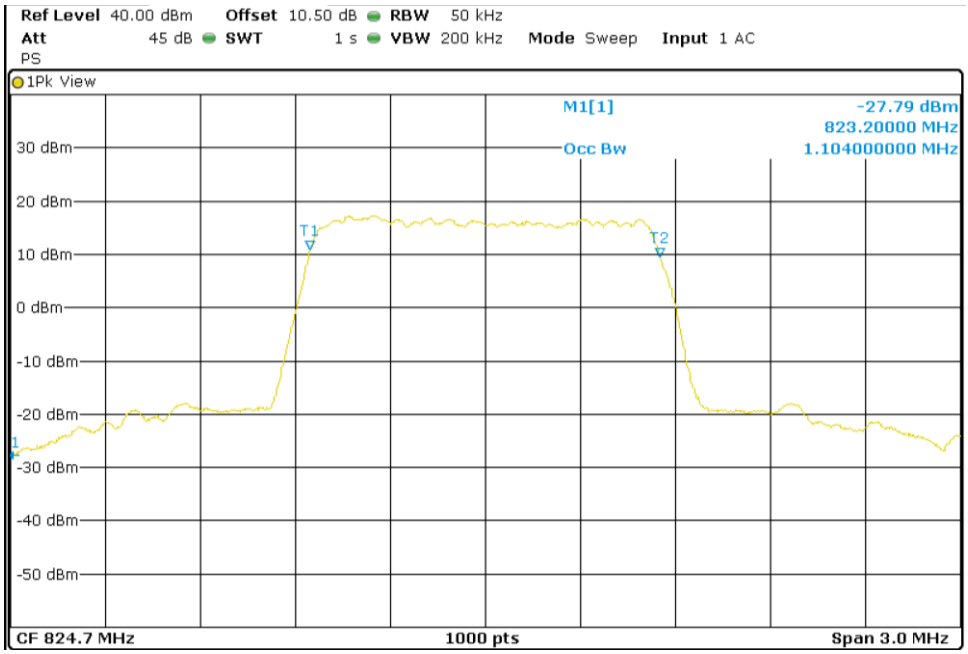
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	847.8876 MHz	17.87 dBm		
D2	M1	1	-225.8 kHz	-27.14 dB		
D3	D2	1	1.2764 MHz	1.13 dB		

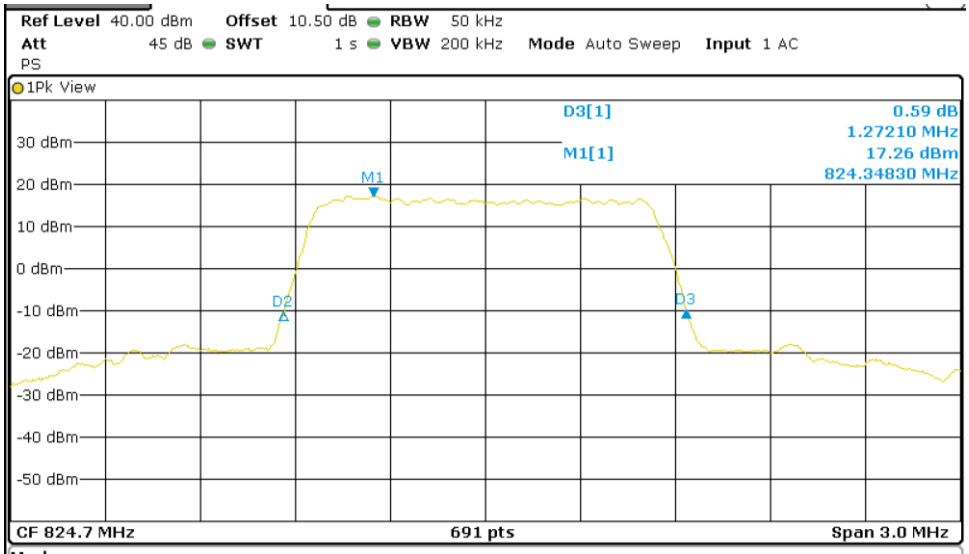
TEST RESULTS (Cont):	

LTE 16QAM MODULATION. BW = 1.4 MHz

Lowest Channel 99% Occupied Bandwidth



Lowest Channel -26dBc Bandwidth kHz

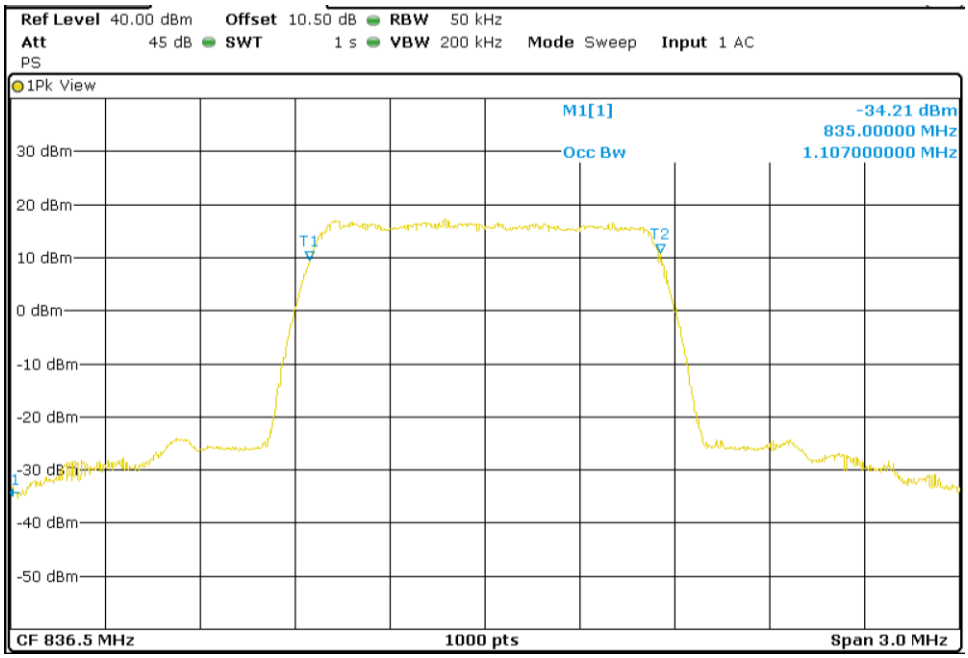


Marker

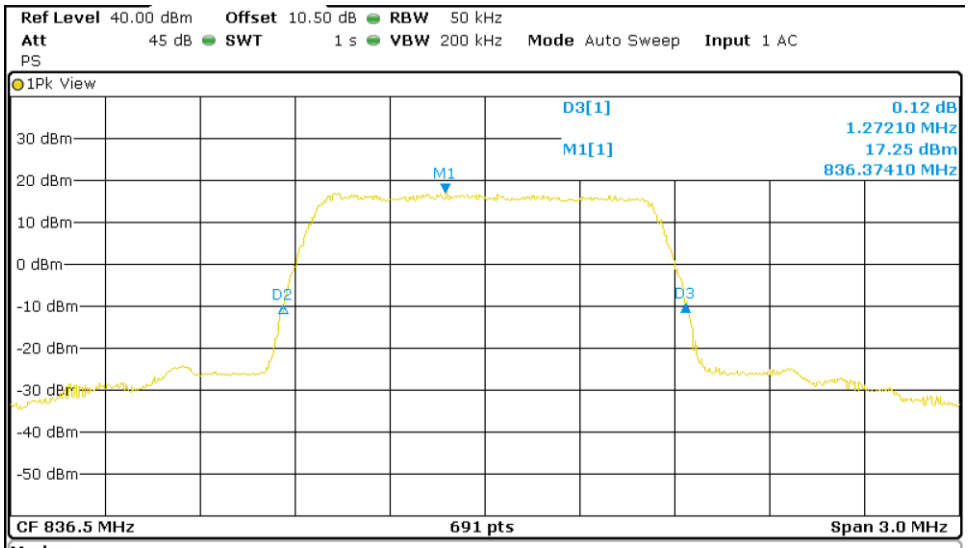
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	824.3483 MHz	17.26 dBm		
D2	M1	1	-286.5 kHz	-27.54 dB		
D3	D2	1	1.2721 MHz	0.59 dB		

TEST RESULTS (Cont):	

Middle Channel 99% Occupied Bandwidth



Middle Channel 26dBc Bandwidth kHz

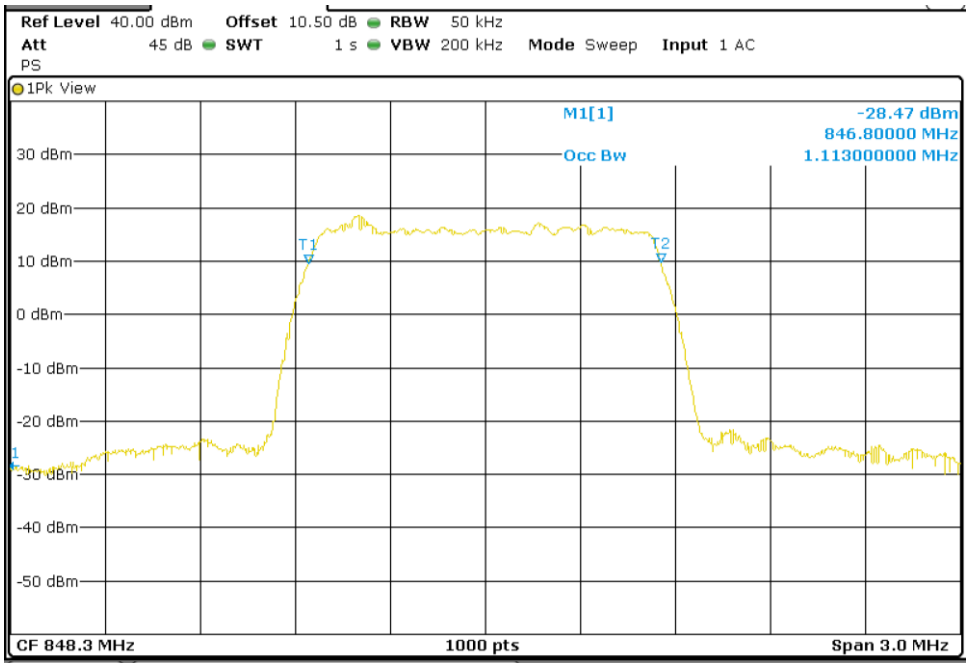


Marker

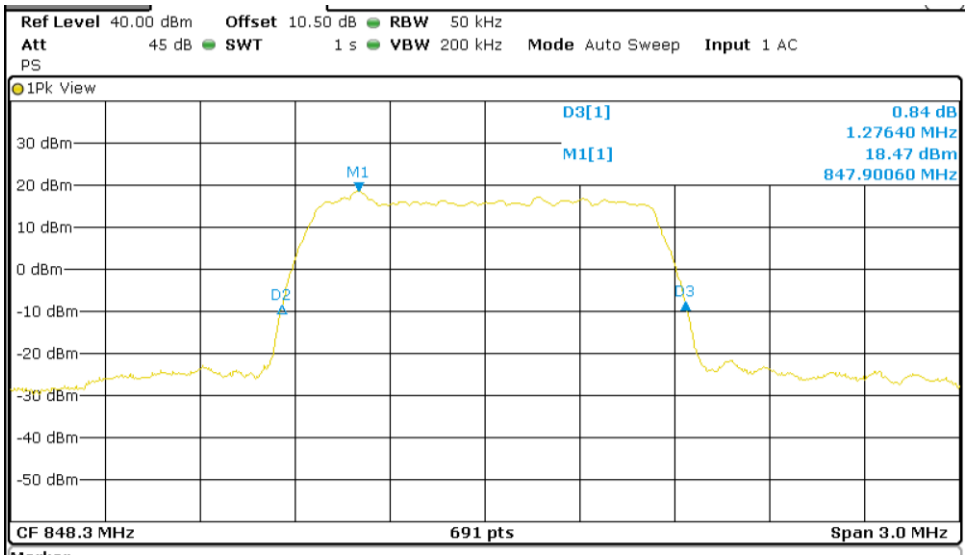
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	836.3741 MHz	17.25 dBm		
D2	M1	1	-512.3 kHz	-26.94 dB		
D3	D2	1	1.2721 MHz	0.12 dB		

TEST RESULTS (Cont):	

Highest Channel 99% Occupied Bandwidth



Highest Channel 26dBc Bandwidth kHz



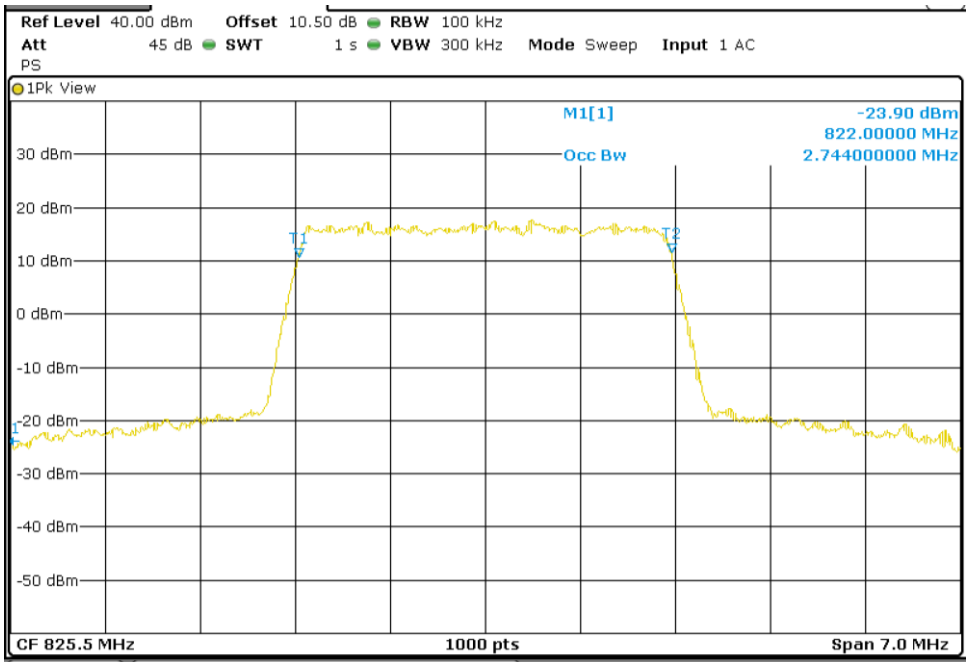
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	847.9006 MHz	18.47 dBm		
D2	M1	1	-243.1 kHz	-27.07 dB		
D3	D2	1	1.2764 MHz	0.84 dB		

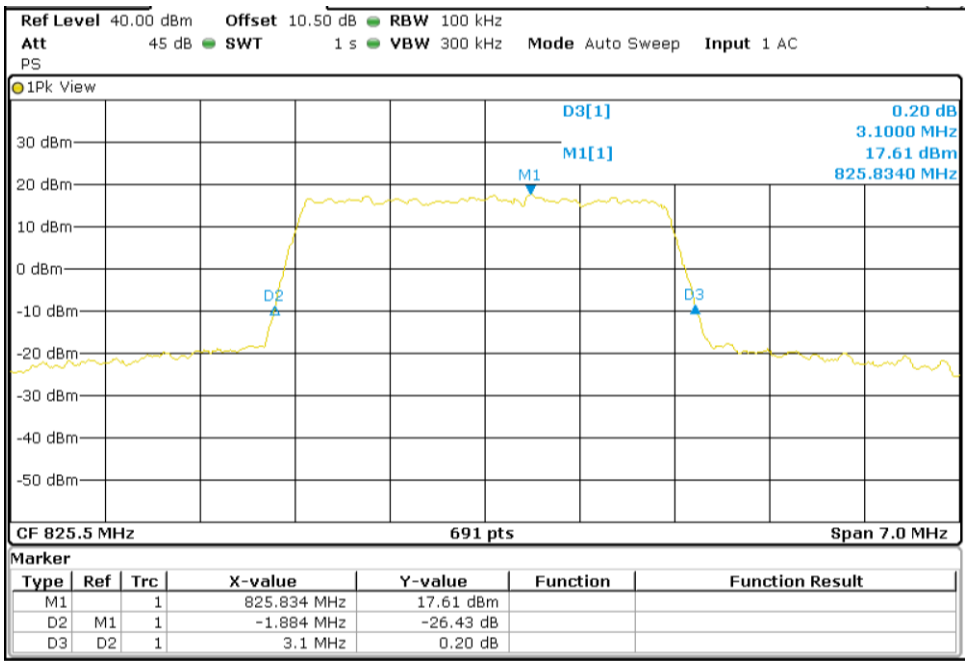
TEST RESULTS (Cont):	

LTE QPSK MODULATION. BW = 3 MHz

Lowest Channel 99% Occupied Bandwidth



Lowest Channel -26dBc Bandwidth kHz

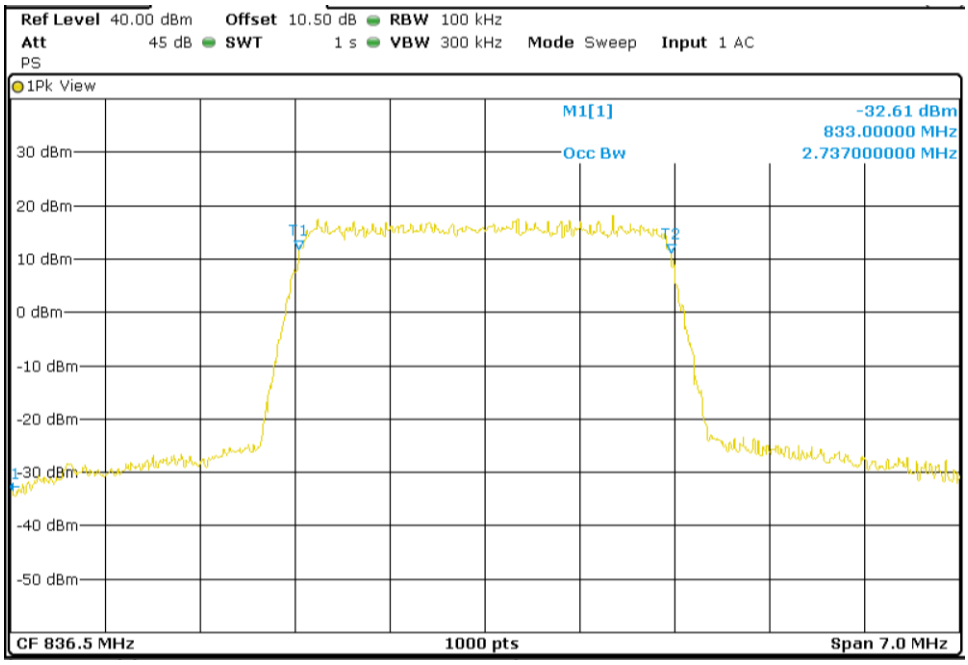


Marker

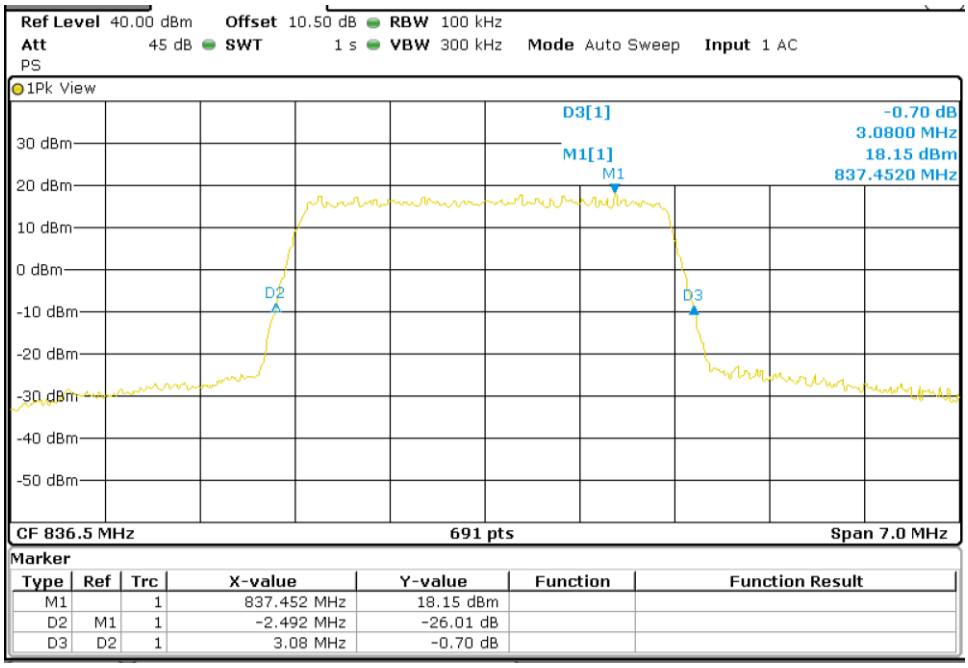
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	825.834 MHz	17.61 dBm		
D2	M1	1	-1.884 MHz	-26.43 dB		
D3	D2	1	3.1 MHz	0.20 dB		

TEST RESULTS (Cont):	

Middle Channel 99% Occupied Bandwidth



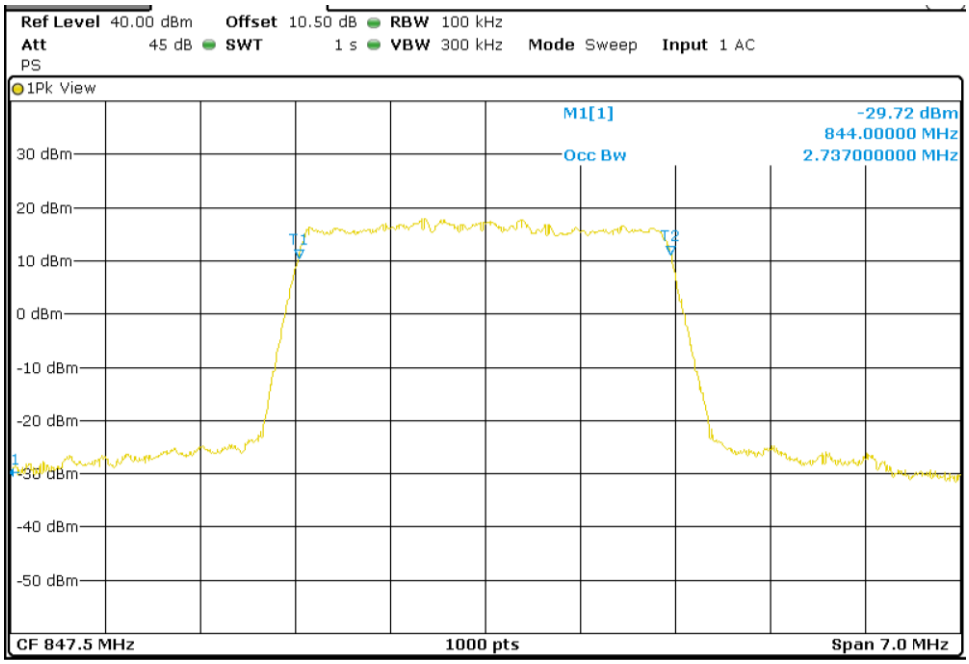
Middle Channel 26dBc Bandwidth kHz



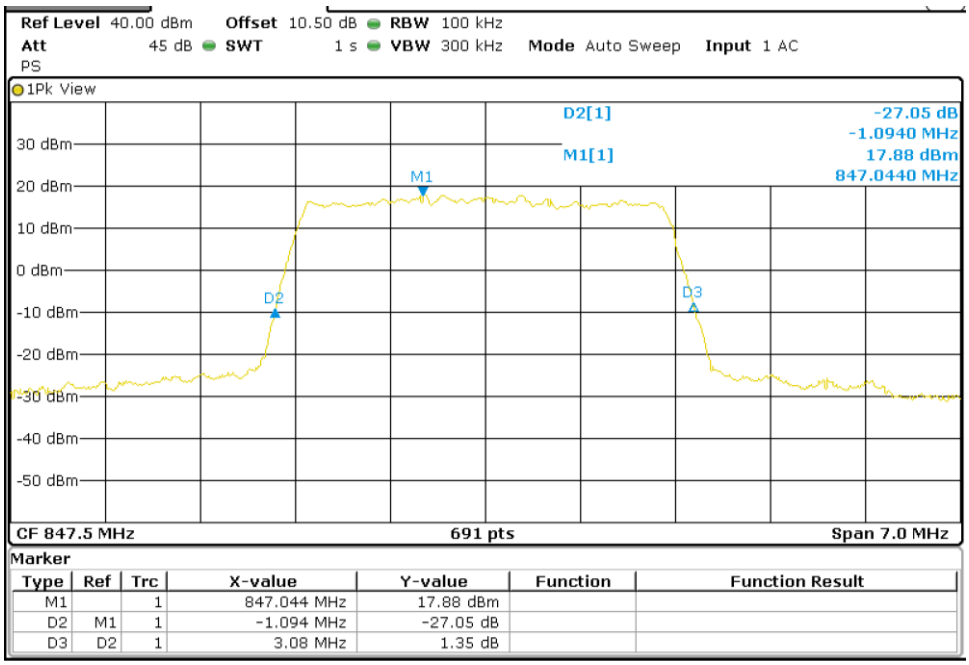
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	837.452 MHz	18.15 dBm		
D2	M1	1	-2.492 MHz	-26.01 dB		
D3	D2	1	3.08 MHz	-0.70 dB		

TEST RESULTS (Cont):	

Highest Channel 99% Occupied Bandwidth



Highest Channel 26dBc Bandwidth kHz



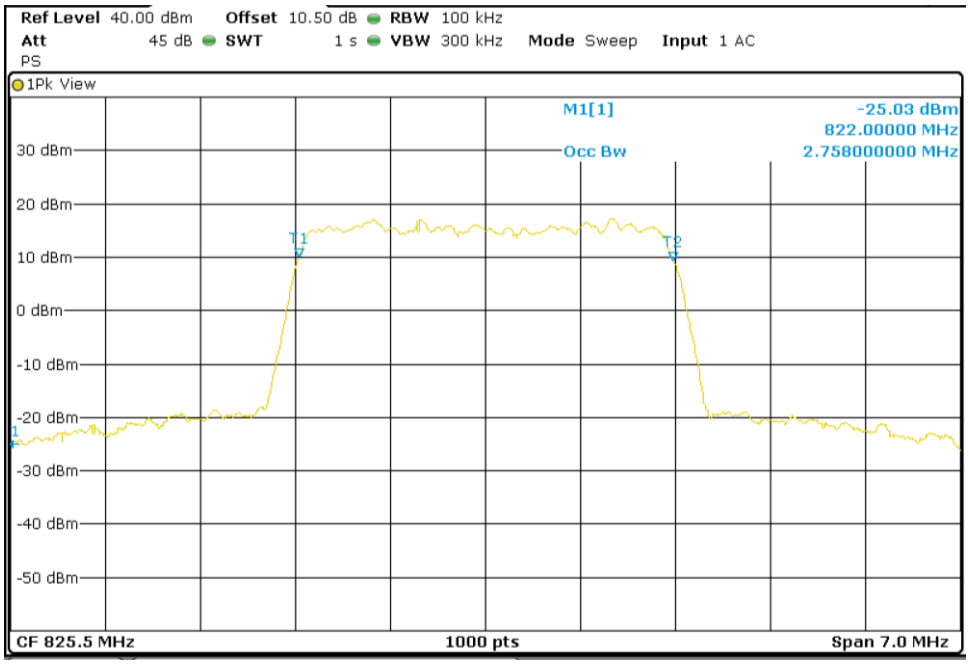
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	847.044 MHz	17.88 dBm		
D2	M1	1	-1.094 MHz	-27.05 dB		
D3	D2	1	3.08 MHz	1.35 dB		

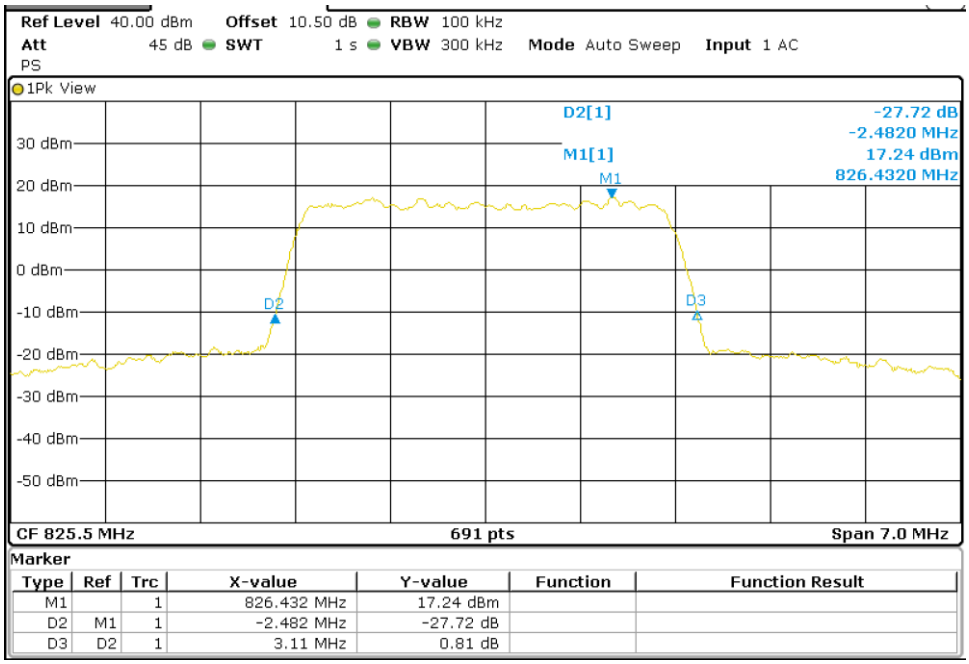
TEST RESULTS (Cont):	

LTE 16QAM MODULATION. BW = 3 MHz

Lowest Channel 99% Occupied Bandwidth



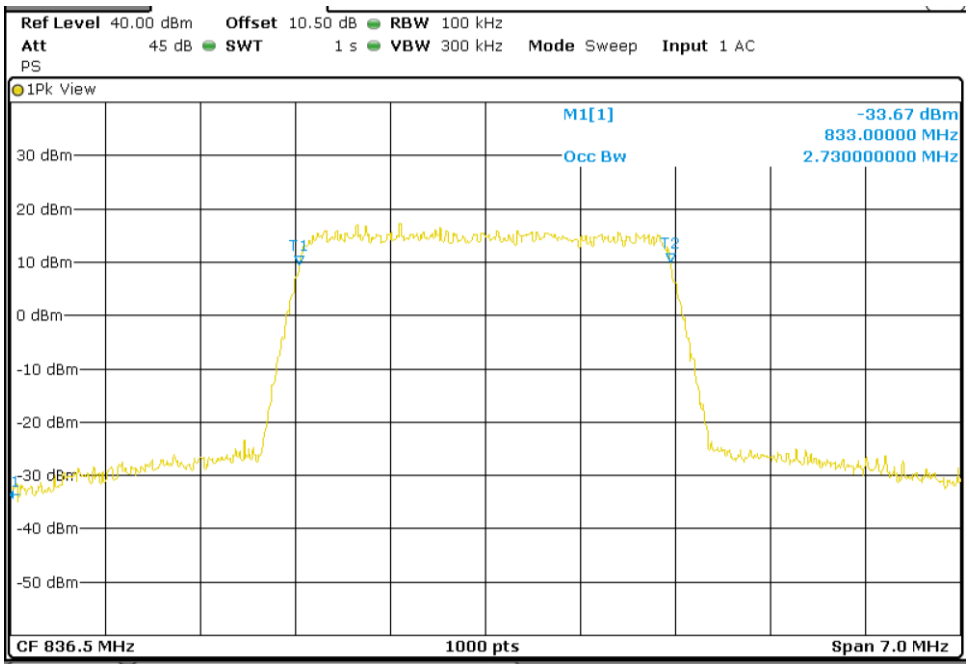
Lowest Channel 26dBc Bandwidth kHz



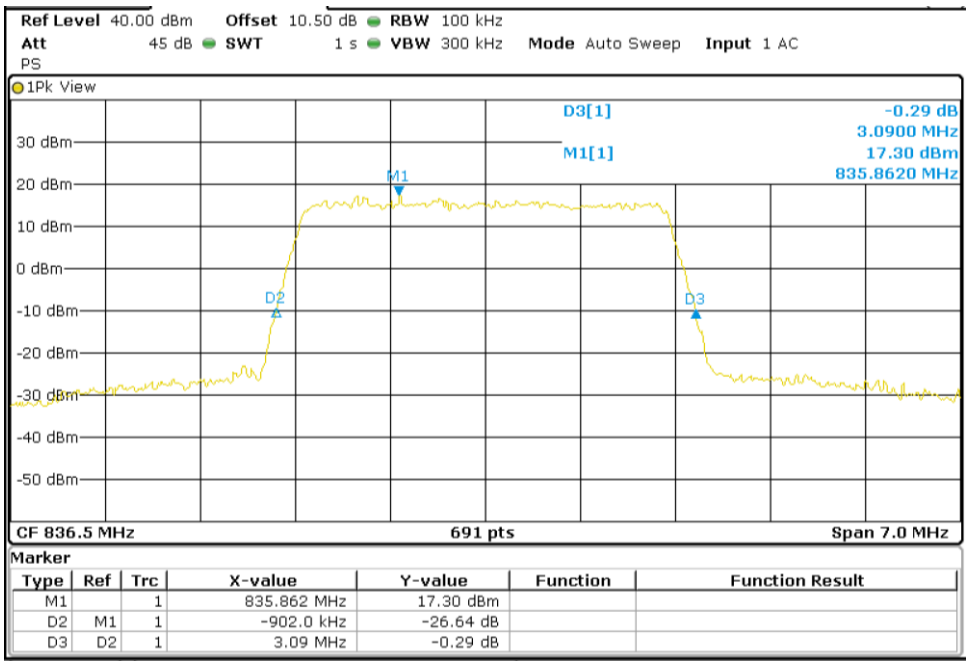
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	826.432 MHz	17.24 dBm		
D2	M1	1	-2.482 MHz	-27.72 dB		
D3	D2	1	3.11 MHz	0.81 dB		

TEST RESULTS (Cont):	

Middle Channel 99% Occupied Bandwidth



Middle Channel 26dBc Bandwidth kHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	835.862 MHz	17.30 dBm		
D2	M1	1	-902.0 kHz	-26.64 dB		
D3	D2	1	3.09 MHz	-0.29 dB		