DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

DEKRA

ENAC ENSAYOS Nº 51/LE147

Test report No:
NIE: 57478RRF.003A3

Test report

REFERENCE STANDARD:
USA FCC Part 22 & Part 90
CANADA RSS-132

(*) Identification of item tested	Secure Smartphone
(*) Trademark	Bittium
(*) Model and /or type reference	Tough Mobile 2
Other identification of the product	HW Version: 0302 SW Version: 40.1 FCC ID: V27SD-61 IC: 3282B-SD61
(*) Features	LTE • 3GPP Rel12 • FDD/TDD Cat13/5, • DL 400Mbit/s, • UL 75 Mbit/s UMTS/HSPA • 3GPP rel8, HSPA+, • DL 42 Mbit/s, • UL 5.76 Mbit/s GSM/GPRS/EDGE Complementary Radios • Wi-Fi 802.11 a/b/g/n/ac (2.4 and 5 GHz), 2 x 2 MIMO • BT 5.0 • NFC
Applicant	BITTIUM WIRELESS OY Ritaharjuntie 1, 90590 Oulu, Finland
Test method requested, standard	USA FCC Part 22 10-1-18 Edition. USA FCC Part 90 10-1-18 Edition. CANADA RSS-132 Issue 3, Jan. 2013. ANSI C63.26 - 2015. ANSI/TIA-603-E: 2016. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Summary	IN COMPLIANCE

Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  RAFAEL LÓPEZ MARTÍN 2019.12.10 15:52:32 +01'00'
Date of issue	2019-12-10
Report template No	FDT08_22 (*) "Data provided by the client"

Index

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 FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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

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

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

The results presented in this Test Report apply only to the particular item under test established in this document. **IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

General conditions

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

Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of Tough Mobile 2 consists of a Secure Smartphone targeted for professional use where High Security is required.

DEKRA Testing and Certification S.A.U. 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
57478/032	Secure Smartphone	Tough Mobile 2	---	2018-11-26
57478/033	USB cable	---	---	2018-11-26
57478/034	AC/DC power adapter	---	---	2018-11-26
57478/039	Headphones	---	---	2018-11-26

1. Sample S/01 has undergone the following 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
57478/016	Secure Smartphone	Tough Mobile 2	---	2018-10-25

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

All conducted tests indicated in Appendix A.

Test sample description

<table>
<tr><td rowspan="5">Ports…… :</td><td rowspan="2">Port name and description</td><td colspan="3">Cable</td></tr>
<tr><td>Specified length [m]</td><td>Attached during test</td><td>Shielded</td></tr>
<tr><td>Not provided.</td><td></td><td>☐</td><td>☐</td></tr>
<tr><td></td><td></td><td>☐</td><td>☐</td></tr>
<tr><td></td><td></td><td>☐</td><td>☐</td></tr>
<tr><td></td><td></td><td>☐</td><td>☐</td></tr>
<tr><td>Supplementary information to the ports…… :</td><td colspan="4">N/A</td></tr>
<tr><td rowspan="3">Rated power supply .....:</td><td colspan="2" rowspan="2">Voltage and Frequency</td><td colspan="3">Reference poles</td></tr>
<tr><td>L1</td><td>L2</td><td>L3</td><td>N</td><td>PE</td></tr>
<tr><td>☐</td><td>AC:</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>☒</td><td colspan="5">DC: 3.6 – 4.35 Vdc.</td></tr>
</table>

	☐	DC:
Rated Power .....:	Not provided	
Clock frequencies.....:	Not provided	
Other parameters .....:	FCC ID: V27SD-61 IC: 3282B-SD61	
Software version .....:	40.1	
Hardware version .....:	0302	
Dimensions in cm (L x W x D).....:	Not provided	
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
	N/A		

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	N/A		
	N/A		
	N/A		

Documents as provided by the applicant.....:	Description	File name	Issue date

Identification of the client

BITTIUM WIRELESS OY
Ritaharjuntie 1, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-11-06
Date (finish)	2019-05-02

Document history

Report number	Date	Description
57478RRF.003	2019-09-10	First release
57478RRF.003A1	2019-10-14	Second release. The watermark is removed in all sheets of the report.
57478RRF.003A2	2019-10-22	Third release. RF Output Power measurements were added on the modulation 16 QAM.

57478RRF.003A3	2019-11-25	Fourth modification. Added the measurements for the low, mid and high channels in QPSK and 16QAM for the LTE band 26 and 15MHz bandwidth in the appendix A. This modification test report cancels and replaces the test report 57478RRF.003A2.

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra, José Alberto Aranda and Miguel Angel Torres.

Used instrumentation:

Conducted Measurements

		Last Calibration	Due Calibration
1.	Chamber HERAEUS VMT 04/35	2018/06	2020/06
2.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2018/05	2019/05
3.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/02	2020/02
4.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2018/04	2019/04
5.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
6.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2018/02	2020/02
7.	Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8	2018/08	2020/08
8.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/07	2019/07
9.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

Radiated Measurements

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2018/10	2021/10
3.	EMI Test Receiver R&S ESR7	2018/08	2020/08
4.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
5.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
6.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/05	2020/05
7.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2019/04	2020/04

Testing verdicts

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

Summary

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	**Verdict**	**Remark**
Clause 22.913/RSS-132 Clause 5.4: RF output power	P	
Clause 2.1047/RSS-132 Clause 5.2: Modulation characteristics	P	
Clause 22.355/RSS-132 Clause 5.3: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	P	
Clause 22.917/RSS-132 Clause 5.5: Spurious emissions at antenna terminals	P	
Clause 22.917/RSS-132 Clause 5.5: Radiated emissions	P	
Supplementary information and remarks: None.		

FCC PART 90 PARAGRAPH		
Requirement – Test case	**Verdict**	**Remark**
Clause 90.635 (b): RF output power	P	
Clause 2.1047: Modulation characteristics	P	
Clause 90.213 Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	P	
Clause 90.691 Spurious emissions at antenna terminals (Emission mask requirements for EA-based systems)	P	
Clause 90.691: Radiated emissions	P	
Supplementary information and remarks: None.		

Appendix A: Test results for FCC PART 22 & 90 / RSS-132

INDEX

TEST CONDITIONS

Power supply (V):

Vnom = 3.8 Vdc

Vmax = 4.2 Vdc

Vmin = 3.6 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 rechargeable battery

Type of antenna = Internal antenna (Monopole antenna)

Antenna gain = +0.9 dBi

TEST FREQUENCIES:

814-824MHz Band:

LTE. QPSK AND 16QAM MODULATION (BAND 26)

	Channel (Frequency, MHz)				
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz
Lowest	26697 (814.70)	26705 (815.5)	26715 (816.5)	---	26765 (821.5)
Middle	26740 (819)	26740 (819)	26740 (819)	26740 (819)	---
Highest	26783 (823.30)	26775 (822.50)	26765 (821.50)	---	---

Cross-rule channel (824MHz):

LTE. QPSK AND 16QAM MODULATION (BAND 26)

Channel (Frequency, MHz)				
BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz
26790 (824)	26790 (824)	26790 (824)	26790 (824)	26790 (824)

824-849MHz Band:

LTE. QPSK AND 16QAM MODULATION (BAND 5)

	Channel (Frequency, MHz)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Lowest	20407 (824.70)	20415 (825.50)	20425 (826.50)	20450 (829.00)
Middle	20525 (836.50)	20525 (836.50)	20525 (836.50)	20525 (836.50)
Highest	20643 (848.30)	20635 (847.50)	20625 (846.50)	20600 (844.00)

LTE. QPSK AND 16QAM MODULATION (BAND 26)

	Channel (Frequency, MHz)				
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz
Lowest	26797 (824.70)	26805 (825.50)	26815 (826.50)	26840 (829.00)	26865 (831.50)
Middle	26915 (836.50)	26915 (836.50)	26915 (836.50)	26915 (836.50)	26915 (836.50)
Highest	27033 (848.30)	27025 (847.50)	27015 (846.50)	26990 (844.00)	26965 (841.50)

NOTE: Band 26 is completely included in band 5, so the channels of band 5 were tested to give conformity to the assigned block.

RF Output Power

SPECIFICATION

FCC §2.1046 and §22.913. The Effective Radiated Power (E.R.P.) of mobile transmitter and auxiliary test transmitter must not exceed 7 Watts (38.45 dBm E.R.P.).

RSS-132. Clause 5.4. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts (38.45 dBm E.R.P.).

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.

FCC §90.635. The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

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

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

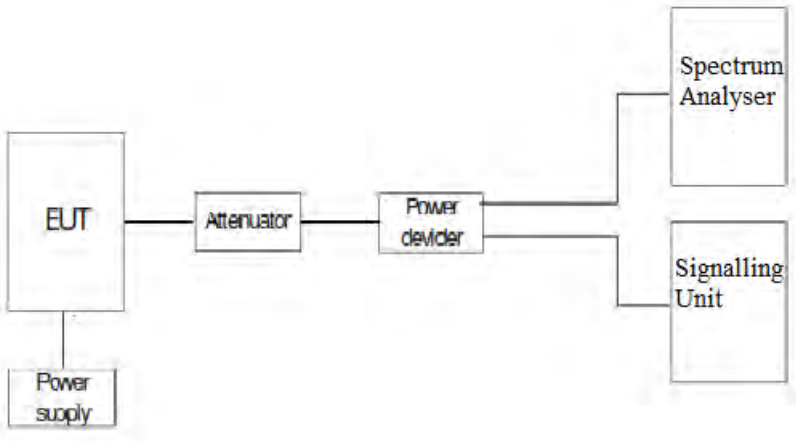
The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

E.R.P. = E.I.R.P. – 2.15 dB

TEST SETUP

Conducted average power.

Peak-to-average power ratio (PAPR)



RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED).

814-824 MHz Band:

LTE Band 26. QPSK MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.48	23.62
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.38	24.52
Maximum effective radiated power E.R.P. (dBm)	22.23	22.37
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. 16QAM MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.32	23.61
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.22	24.51
Maximum effective radiated power E.R.P. (dBm)	22.07	22.36
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 2.

LTE Band 26. QPSK MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.57	23.79
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.47	24.69
Maximum effective radiated power E.R.P. (dBm)	22.32	22.54
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. 16QAM MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.18	23.6
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.08	24.5
Maximum effective radiated power E.R.P. (dBm)	21.93	22.35
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 7.

LTE Band 26. QPSK MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.59	23.94
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.49	24.84
Maximum effective radiated power E.R.P. (dBm)	22.34	22.69
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 24.

LTE Band 26. 16QAM MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Highest
Maximum declared antenna gain (dBi)	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.73	23.51
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.63	24.41
Maximum effective radiated power E.R.P. (dBm)	22.48	22.26
Measurement uncertainty (dB)	<±0.66	

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 24.

LTE Band 26. QPSK MODULATION. Bandwidth = 10 MHz.

Channel	Middle
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	23.63
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.53
Maximum effective radiated power E.R.P. (dBm)	22.38
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 49.

LTE Band 26. 16QAM MODULATION. Bandwidth = 10 MHz.

Channel	Middle
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	23.18
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.08
Maximum effective radiated power E.R.P. (dBm)	21.93
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 49.

Verdict: PASS

824 MHz Cross-rule Channel:

LTE Band 26. QPSK MODULATION. Bandwidth = 1.4 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.12
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.02
Maximum effective radiated power E.R.P. (dBm)	22.87
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 3. RB Offset: 1.

LTE Band 26. 16QAM MODULATION. Bandwidth = 1.4 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.08
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.98
Maximum effective radiated power E.R.P. (dBm)	22.83
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 5.

LTE Band 26. QPSK MODULATION. Bandwidth = 3 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.22
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.12
Maximum effective radiated power E.R.P. (dBm)	22.97
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 7.

LTE Band 26. 16QAM MODULATION. Bandwidth = 3 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	23.96
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.86
Maximum effective radiated power E.R.P. (dBm)	22.71
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 7.

LTE Band 26. QPSK MODULATION. Bandwidth = 5 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.20
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.10
Maximum effective radiated power E.R.P. (dBm)	22.95
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 24.

LTE Band 26. 16QAM MODULATION. Bandwidth = 5 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.13
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.03
Maximum effective radiated power E.R.P. (dBm)	22.88
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 24.

LTE Band 26. QPSK MODULATION. Bandwidth = 10 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.39
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.29
Maximum effective radiated power E.R.P. (dBm)	23.14
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 49

LTE Band 26. 16QAM MODULATION. Bandwidth = 10 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.09
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.99
Maximum effective radiated power E.R.P. (dBm)	22.84
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 49

LTE Band 26. QPSK MODULATION. Bandwidth = 15 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	24.35
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.25
Maximum effective radiated power E.R.P. (dBm)	23.10
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 74.

LTE Band 26. 16QAM MODULATION. Bandwidth = 15 MHz.

Channel, Frequency (MHz)	26790 (824 MHz)
Maximum declared antenna gain (dBi)	0.9
Measured maximum average power (dBm) at antenna port	23.97
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.87
Maximum effective radiated power E.R.P. (dBm)	22.72
Measurement uncertainty (dB)	<±0.66

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 74.

824-849 MHz Band:

LTE Band 5. QPSK MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.084	24.331	23.926
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.984	25.231	24.826
Maximum effective radiated power E.R.P. (dBm)	22.834	23.081	22.676
PAPR (dB)	(*)	4.81	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 2.
Worst case PAPR: Modulation QPSK. RB Size: 6. RB Offset: 0.
(*): Preliminary measurements determined the Middle Channel as the worst case.

LTE Band 5. 16QAM MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.7	24.003	23.38
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.6	24.903	24.28
Maximum effective radiated power E.R.P. (dBm)	22.45	22.753	22.13
PAPR (dB)	5.63	5.75	5.75
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 2.
Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE Band 5. QPSK MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.207	24.378	24.027
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.107	25.278	24.927
Maximum effective radiated power E.R.P. (dBm)	22.957	23.128	22.777
PAPR (dB)	(*)	4.71	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 7.
Worst case PAPR: Modulation QPSK. RB Size: 15. RB Offset: 0
(*): Preliminary measurements determined the Middle Channel as the worst case.

LTE Band 5. 16QAM MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.48	24.141	23.51
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.38	25.041	24.41
Maximum effective radiated power E.R.P. (dBm)	22.23	22.891	22.26
PAPR (dB)	5.82	5.98	5.95
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 7.
Worst case PAPR: Modulation 16QAM. RB Size: 15. RB Offset: 0.

LTE Band 5. QPSK MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.017	24.321	24.102
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.917	25.221	25.002
Maximum effective radiated power E.R.P. (dBm)	22.767	23.071	22.852
PAPR (dB)	(*)	4.87	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
Worst case PAPR: Modulation QPSK. RB Size: 25. RB Offset: 0
(*): Preliminary measurements determined the Middle Channel as the worst case.

LTE Band 5. 16QAM MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.58	24.052	23.58
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.48	24.952	24.48
Maximum effective radiated power E.R.P. (dBm)	22.33	22.802	22.33
PAPR (dB)	5.75	5.93	5.79
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.
Worst case PAPR: Modulation 16QAM. RB Size: 25. RB Offset: 0.

LTE Band 5. QPSK MODULATION. Bandwidth = 10 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.11	24.312	24.07
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.01	25.212	24.97
Maximum effective radiated power E.R.P. (dBm)	22.86	23.062	22.82
PAPR (dB)	(*)	4.86	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 24.
Worst case PAPR: Modulation QPSK. RB Size: 50. RB Offset: 0.
(*): Preliminary measurements determined the Middle Channel as the worst case.

LTE Band 5. 16QAM MODULATION. Bandwidth = 10 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.53	24.071	23.56
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.43	24.971	24.46
Maximum effective radiated power E.R.P. (dBm)	22.28	22.821	22.31
PAPR (dB)	5.71	5.91	5.95
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 24.
Worst case PAPR: Modulation 16QAM. RB Size: 50. RB Offset: 0.

LTE Band 26. QPSK MODULATION. Bandwidth = 15 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.51	24.19	23.97
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.41	25.09	24.87
Maximum effective radiated power E.R.P. (dBm)	23.26	22.94	22..72
PAPR (dB)	(*)	4.58	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 74.
Worst case PAPR: Modulation QPSK. RB Size: 75. RB Offset: 0.
(*): Preliminary measurements determined the Middle Channel as the worst case.

LTE Band 26. 16QAM MODULATION. Bandwidth = 15 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	23.91	23.67	23.55
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.81	24.57	24.45
Maximum effective radiated power E.R.P. (dBm)	22.66	22.42	22.30
PAPR (dB)	5.96	5.88	5.98
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 74.
Worst case PAPR: Modulation 16QAM. RB Size: 75. RB Offset: 0.

Verdict: PASS

PEAK-TO-AVERAGE POWER RATIO (PAPR).

824-849MHz Band:

(LTE Band 5)

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

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

	Trace 1
Mean	22.11 dBm
Peak	27.88 dBm
Crest	5.77 dB
10 %	3.03 dB
1 %	5.05 dB
.1 %	5.63 dB
.01 %	5.71 dB

Channel Middle:

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

	Trace 1
Mean	22.32 dBm
Peak	28.26 dBm
Crest	5.94 dB
10 %	3.06 dB
1 %	5.14 dB
.1 %	5.75 dB
.01 %	5.82 dB

Channel High:

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

	Trace 1
Mean	22.04 dBm
Peak	27.94 dBm
Crest	5.90 dB
10 %	3.06 dB
1 %	5.03 dB
.1 %	5.75 dB
.01 %	5.83 dB

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

Channel Low:

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

	Trace 1
Mean	22.18 dBm
Peak	28.38 dBm
Crest	6.20 dB
10 %	2.95 dB
1 %	4.98 dB
.1 %	5.82 dB
.01 %	6.12 dB

Channel Middle:

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

	Trace 1
Mean	22.27 dBm
Peak	28.76 dBm
Crest	6.49 dB
10 %	2.95 dB
1 %	5.05 dB
.1 %	5.98 dB
.01 %	6.35 dB

Channel High:

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

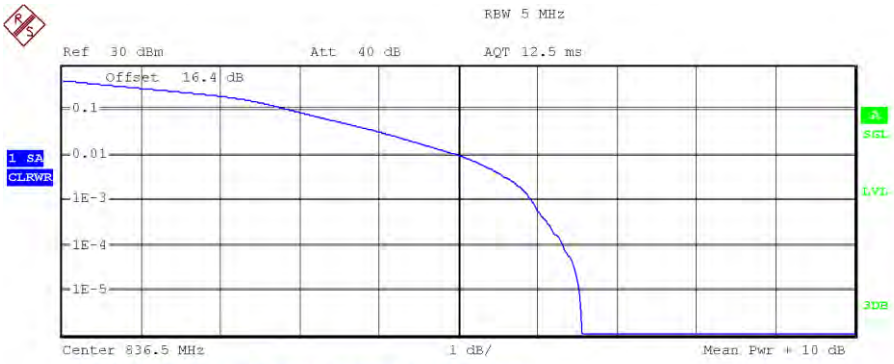
	Trace 1
Mean	22.02 dBm
Peak	28.57 dBm
Crest	6.55 dB
10 %	2.95 dB
1 %	5.02 dB
.1 %	5.95 dB
.01 %	6.28 dB

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

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

	Trace 1
Mean	22.16 dBm
Peak	28.38 dBm
Crest	6.22 dB
10 %	2.87 dB
1 %	5.02 dB
.1 %	5.75 dB
.01 %	6.04 dB

Channel Middle:



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

	Trace 1
Mean	22.27 dBm
Peak	28.83 dBm
Crest	6.56 dB
10 %	2.90 dB
1 %	5.00 dB
.1 %	5.93 dB
.01 %	6.33 dB

Channel High:

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

	Trace 1
Mean	22.19 dBm
Peak	28.36 dBm
Crest	6.17 dB
10 %	2.88 dB
1 %	5.03 dB
.1 %	5.79 dB
.01 %	6.04 dB

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

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

	Trace 1
Mean	22.47 dBm
Peak	28.92 dBm
Crest	6.45 dB
10 %	2.90 dB
1 %	4.95 dB
.1 %	5.71 dB
.01 %	6.01 dB

Channel Middle:

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

	Trace 1
Mean	22.57 dBm
Peak	29.15 dBm
Crest	6.58 dB
10 %	2.92 dB
1 %	5.05 dB
.1 %	5.91 dB
.01 %	6.33 dB

Channel High:

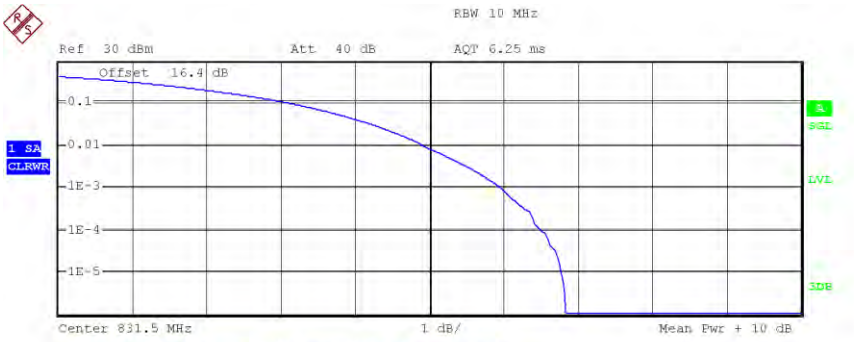
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	22.36 dBm
Peak	29.02 dBm
Crest	6.66 dB
10 %	2.92 dB
1 %	5.00 dB
.1 %	5.95 dB
.01 %	6.31 dB

(LTE Band 26)

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

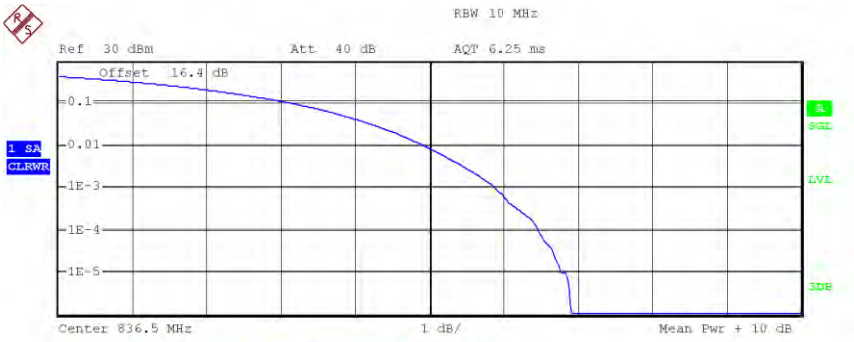
Channel Low:



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

	Trace 1
Mean	22.04 dBm
Peak	28.88 dBm
Crest	6.84 dB
10 %	3.14 dB
1 %	4.92 dB
.1 %	5.96 dB
.01 %	6.49 dB

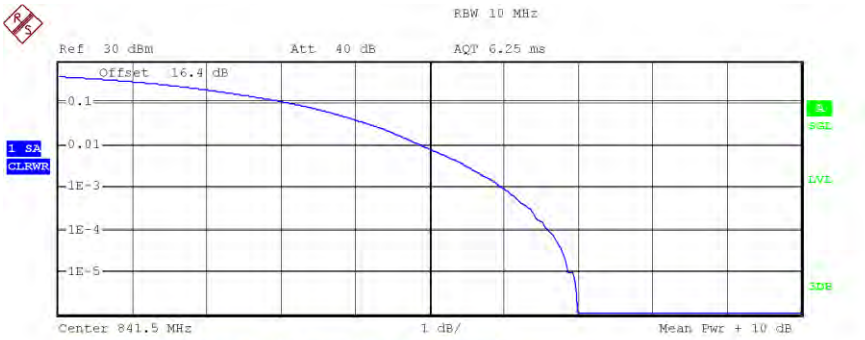
Channel Middle:



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

	Trace 1
Mean	21.98 dBm
Peak	28.89 dBm
Crest	6.91 dB
10 %	3.17 dB
1 %	4.94 dB
.1 %	5.88 dB
.01 %	6.47 dB

Channel High:



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

	Trace 1
Mean	21.83 dBm
Peak	28.83 dBm
Crest	7.00 dB
10 %	3.14 dB
1 %	4.89 dB
.1 %	5.98 dB
.01 %	6.59 dB

Frequency Stability

SPECIFICATION

FCC §2.1055 and §22.355. ±2.5 ppm for mobile stations operating in the range 821 to 896 MHz.

FCC §2.1055 and §90.213. ±2.5 ppm for mobile stations operating in the range 809 to 824 MHz.

RSS-132. Clause 5.3. The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

METHOD

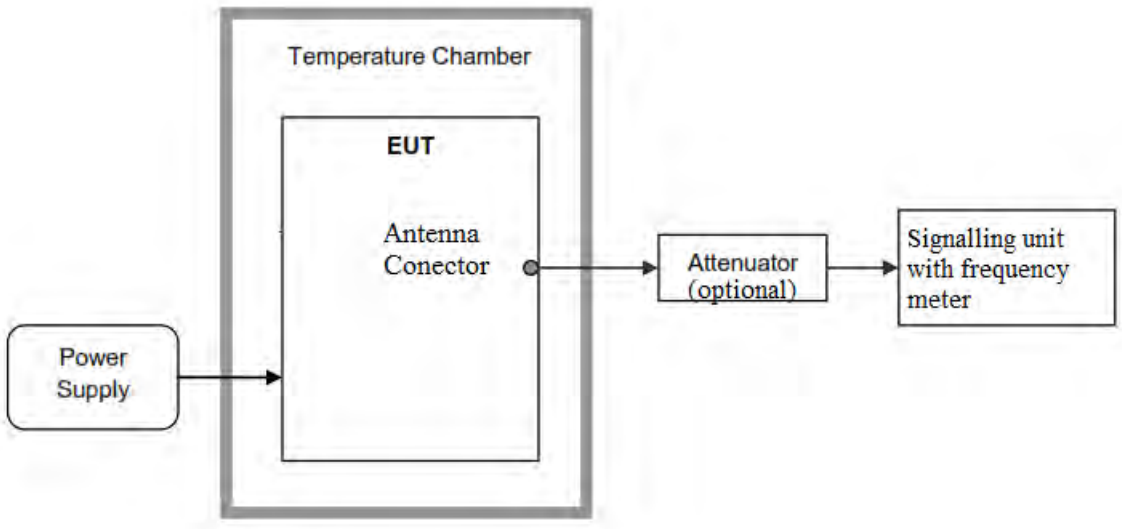
The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

The EUT was set in “Radio Resource Control (RRC) 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.
The worst case LTE mode for conducted power was used for the test.

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.



RESULTS.
Frequency stability over temperature variations.

LTE Band 5 QPSK MODULATION. BW = 1.4 MHz.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-7.2	-0.009
+40	-0.94	-0.001
+30	-3.28	-0.004
+20	-3.39	-0.004
+10	-1.39	-0.002
0	-1.76	-0.002
-10	1.47	0.002
-20	-0.89	-0.001
-30	-3.4	-0.004

LTE Band 26 QPSK MODULATION. BW = 1.4 MHz.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	4.85	0.006
+40	5.46	0.007
+30	3.49	0.004
+20	4.68	0.006
+10	1.92	0.002
0	3.45	0.004
-10	5.75	0.007
-20	2.59	0.003
-30	3.12	0.004

Frequency stability over voltage variations.

LTE Band 5 QPSK MODULATION. BW = 1.4 MHz.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-7.3	-0.009
Vmin	3.6	-6.05	-0.007

LTE Band 26 QPSK MODULATION. BW = 1.4 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	2.8	0.004
Vmin	3.6	1.39	0.002

Verdict: PASS

Modulation Characteristics

SPECIFICATION

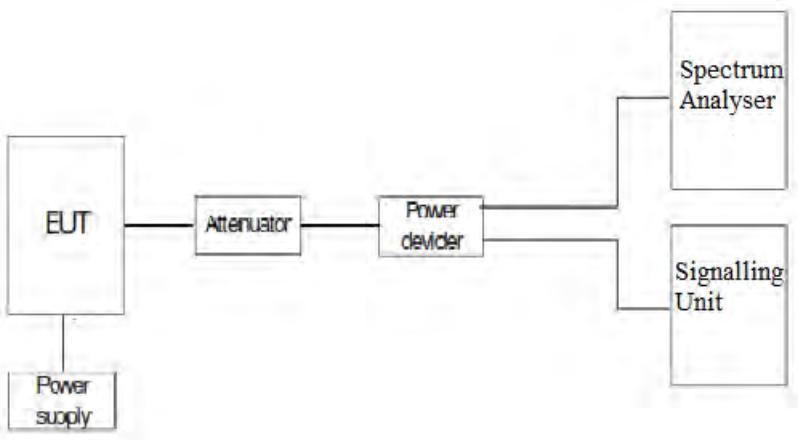
FCC §2.1047

RSS-132. Clause 5.2. Equipment certified under this standard shall use digital modulation.

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).

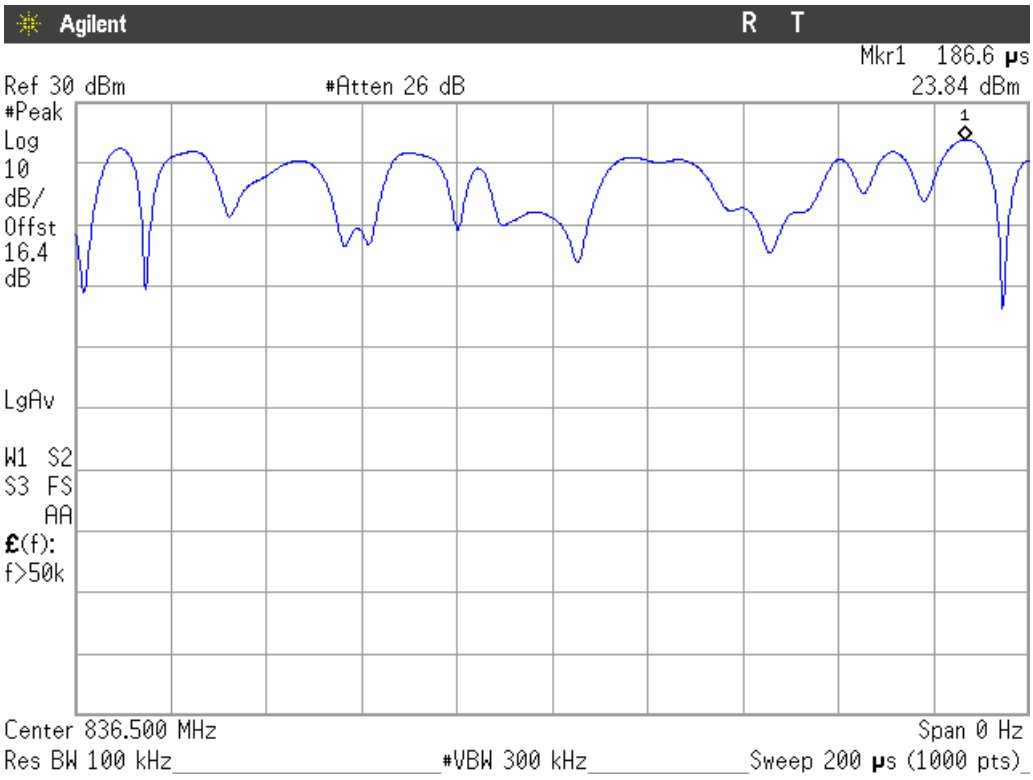
TEST SETUP



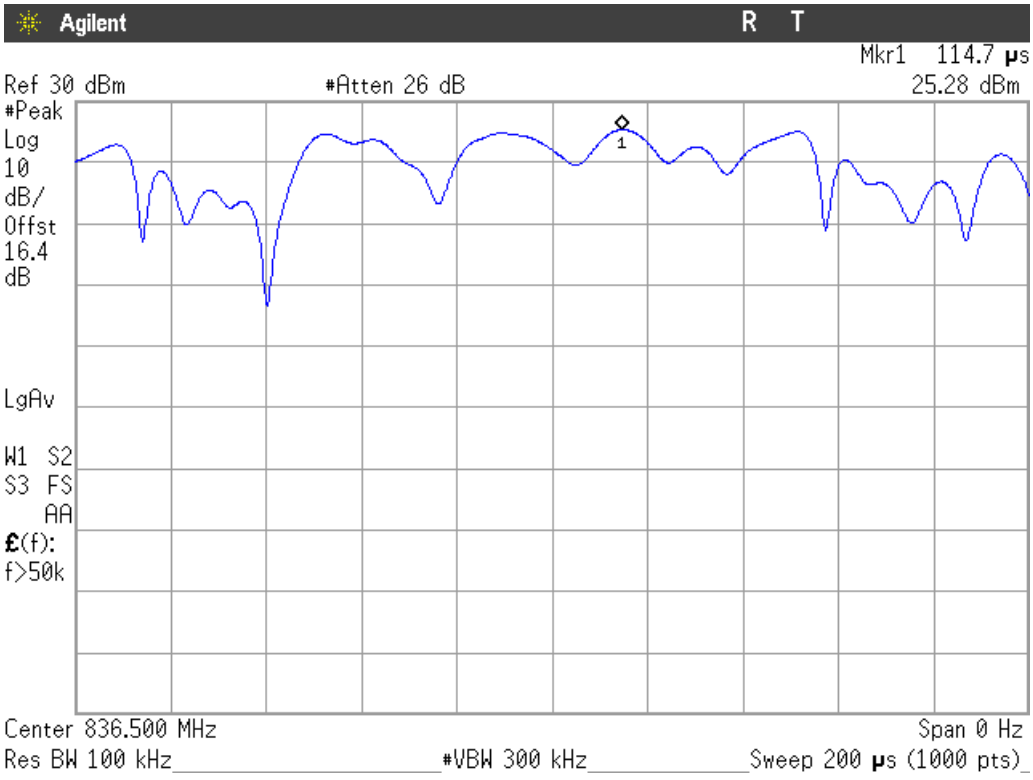
RESULTS

The following plot shows the modulation schemes in the EUT.

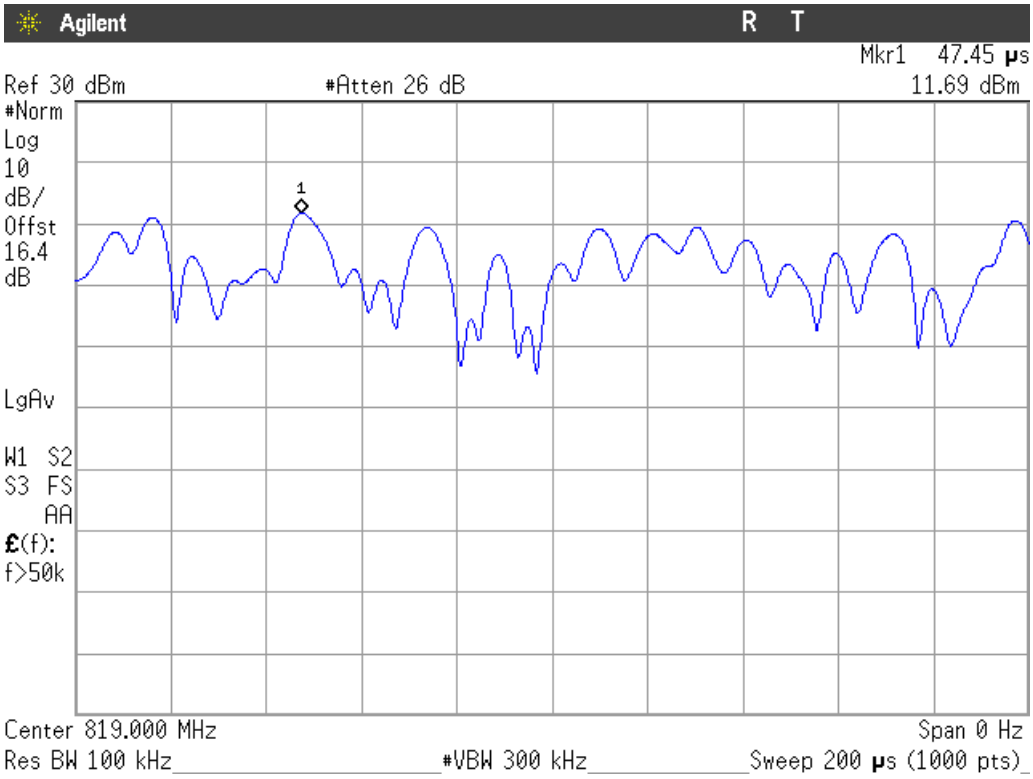
LTE Band 5 MODULATION. QPSK.



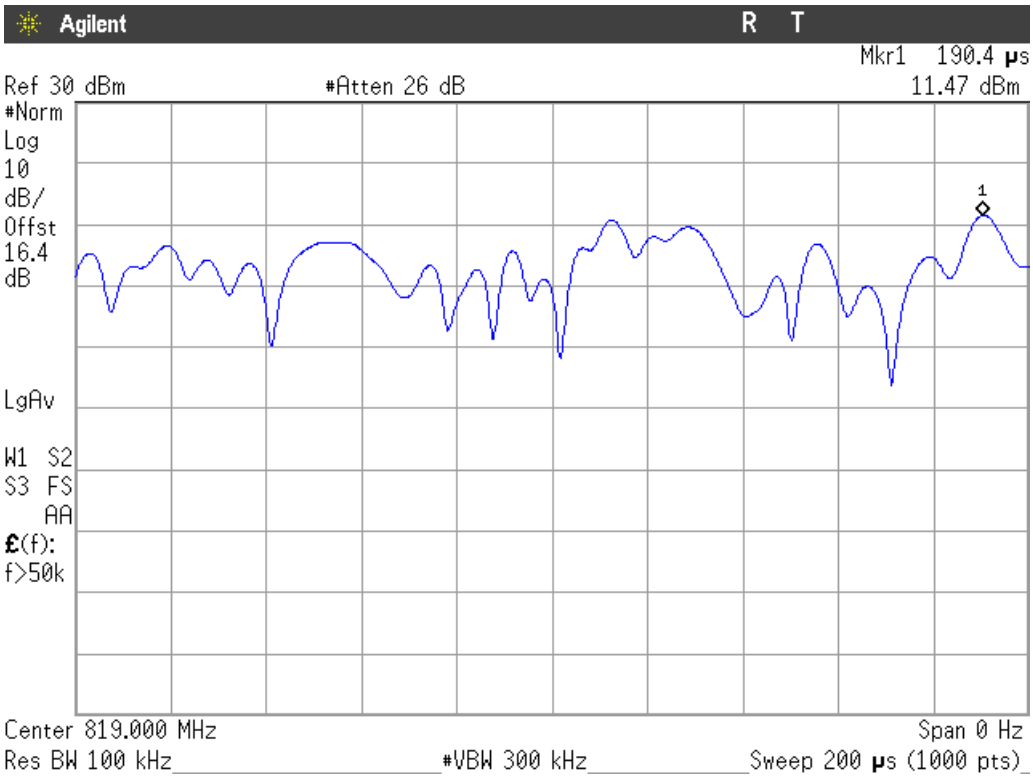
LTE Band 5 MODULATION. 16QAM.



LTE Band 26 MODULATION. QPSK.



LTE Band 26 MODULATION. 16QAM.



Occupied Bandwidth

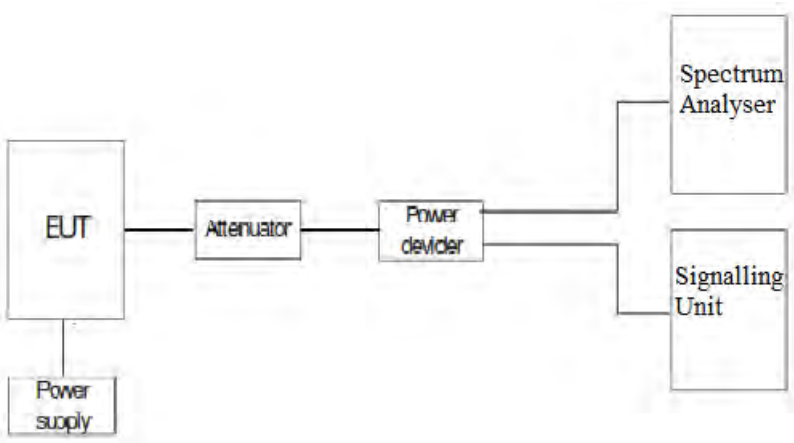
SPECIFICATION

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 (see next plots)

The worst case of occupied bandwidth corresponds to all Resource Blocks (RB) offset 0 regardless either the Narrow band position or the nominal bandwidth selected.

814-824MHz Band:

LTE Band 26 QPSK MODULATION. BW = 1.4 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	1105.6	1096.5
-26 dBc bandwidth (kHz)	1244	1251
Measurement uncertainty (kHz)	<±4.67	

LTE Band 26 16QAM MODULATION. BW = 1.4 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	1086.7	1094.8
-26 dBc bandwidth (kHz)	1243	1246
Measurement uncertainty (kHz)	<±4.67	

LTE Band 26 QPSK MODULATION. BW = 3 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	2749.1	2749.4
-26 dBc bandwidth (kHz)	3080	3092
Measurement uncertainty (kHz)	<±10.0	

LTE Band 26 16QAM MODULATION. BW = 3 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	2747.0	2753.1
-26 dBc bandwidth (kHz)	3047	3114
Measurement uncertainty (kHz)	<±10.0	

LTE Band 26 QPSK MODULATION. BW = 5 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	4514.3	4510.9
-26 dBc bandwidth (kHz)	4991	4936
Measurement uncertainty (kHz)	<±16.67	

LTE Band 26 16QAM MODULATION. BW = 5 MHz

Channel	Lowest	Highest
99% Occupied bandwidth (kHz)	4516	4518.9
-26 dBc bandwidth (kHz)	4964	4975
Measurement uncertainty (kHz)	<±16.67	

LTE Band 26 QPSK MODULATION. BW = 10 MHz

Channel	Middle
99% Occupied bandwidth (kHz)	8933.7
-26 dBc bandwidth (kHz)	9654
Measurement uncertainty (kHz)	<±33.33

LTE Band 26 16QAM MODULATION. BW = 10 MHz

Channel	Middle
99% Occupied bandwidth (kHz)	8941.8
-26 dBc bandwidth (kHz)	9633
Measurement uncertainty (kHz)	<±33.33

Cross-rule channel (824MHz):

LTE Band 26 QPSK MODULATION. BW = 1.4 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	1097.4
-26 dBc bandwidth (kHz)	1259
Measurement uncertainty (kHz)	<±4.67

LTE Band 26 16QAM MODULATION. BW = 1.4 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	1097.5
-26 dBc bandwidth (kHz)	1248
Measurement uncertainty (kHz)	<±4.67

LTE Band 26 QPSK MODULATION. BW = 3 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	2727.8
-26 dBc bandwidth (kHz)	3054
Measurement uncertainty (kHz)	<±10.0

LTE Band 26 16QAM MODULATION. BW = 3 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	2743.7
-26 dBc bandwidth (kHz)	3095
Measurement uncertainty (kHz)	<±10.0

LTE Band 26 QPSK MODULATION. BW = 5 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	4504.4
-26 dBc bandwidth (kHz)	4972
Measurement uncertainty (kHz)	<±16.67

LTE Band 26 16QAM MODULATION. BW = 5 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	4523.4
-26 dBc bandwidth (kHz)	6973
Measurement uncertainty (kHz)	<±16.67

LTE Band 26 QPSK MODULATION. BW = 10 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	8938.7
-26 dBc bandwidth (kHz)	9619
Measurement uncertainty (kHz)	<±33.33

LTE Band 26 16QAM MODULATION. BW = 10 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	8941.6
-26 dBc bandwidth (kHz)	9648
Measurement uncertainty (kHz)	<±33.33

LTE Band 26 QPSK MODULATION. BW = 15 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	13469.1
-26 dBc bandwidth (kHz)	14706
Measurement uncertainty (kHz)	<±66.66

LTE Band 26 16QAM MODULATION. BW = 15 MHz

Channel, Frequency (MHz)	26790 (824)
99% Occupied bandwidth (kHz)	13427.6
-26 dBc bandwidth (kHz)	14664
Measurement uncertainty (kHz)	<±66.66

824-849MHz Band:

LTE Band 5 QPSK MODULATION. BW = 1.4 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1093.4	1085.1	1090.2
-26 dBc bandwidth (kHz)	1256.0	1246.0	1249.0
Measurement uncertainty (kHz)	<±4.67		

LTE Band 5 16QAM MODULATION. BW = 1.4 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	1093.8	1104.0	1102.9
-26 dBc bandwidth (kHz)	1248.0	1253.0	1253.0
Measurement uncertainty (kHz)	<±4.67		

LTE Band 5 QPSK MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2746.3	2762.8	2750.2
-26 dBc bandwidth (kHz)	3088.0	3112.0	3110.0
Measurement uncertainty (kHz)	<±10.0		

LTE Band 5 16QAM MODULATION. BW = 3 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	2745.3	2754.3	2744.5
-26 dBc bandwidth (kHz)	3080.0	3090.0	3087.0
Measurement uncertainty (kHz)	<±10.0		

LTE Band 5 QPSK MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4517.0	4532.7	4504.3
-26 dBc bandwidth (kHz)	4970.0	4992.0	4980.0
Measurement uncertainty (kHz)	<±16.67		

LTE Band 5 16QAM MODULATION. BW = 5 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4513.6	4521.2	4503.8
-26 dBc bandwidth (kHz)	4970.0	5018.0	4969.0
Measurement uncertainty (kHz)	<±16.67		

LTE Band 5 QPSK MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9028.9	9065.0	9039.6
-26 dBc bandwidth (kHz)	9978.0	10110.0	9935.0
Measurement uncertainty (kHz)	<±33.33		

LTE Band 5 16QAM MODULATION. BW = 10 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	9038.3	9053.5	9058.7
-26 dBc bandwidth (kHz)	9981.0	10018.0	9976.0
Measurement uncertainty (kHz)	<±33.33		

LTE Band 26 QPSK MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13.450	13.400	13.425
-26 dBc bandwidth (kHz)	14.675	14.575	14.625
Measurement uncertainty (kHz)	<±14.51		

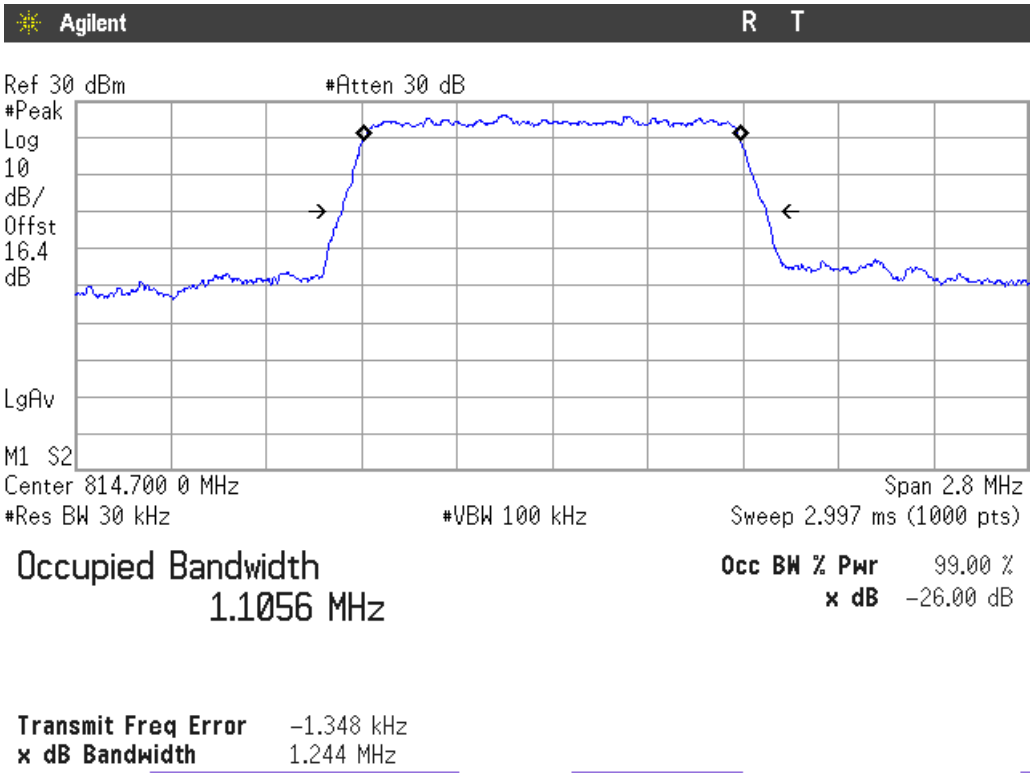
LTE Band 26 16QAM MODULATION. BW = 15 MHz

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	13.400	13.425	13.425
-26 dBc bandwidth (kHz)	14.600	14.600	14.550
Measurement uncertainty (kHz)	<±14.51		

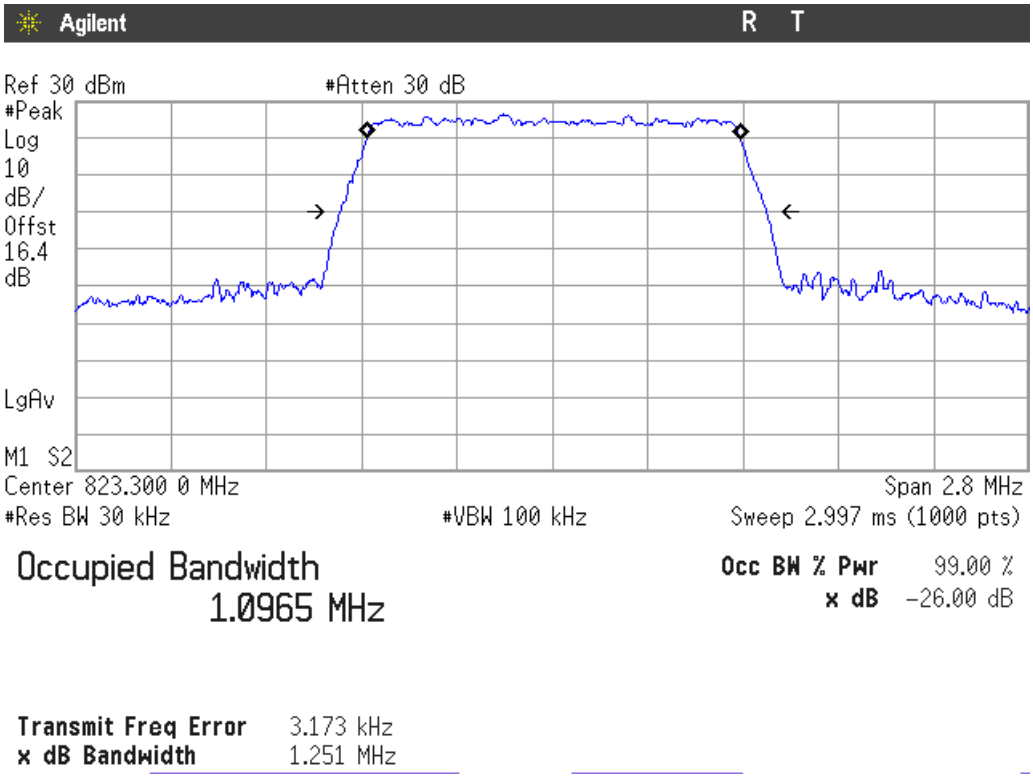
814-824MHz Band:

LTE Band 26 QPSK MODULATION. BW = 1.4 MHz

Lowest Channel

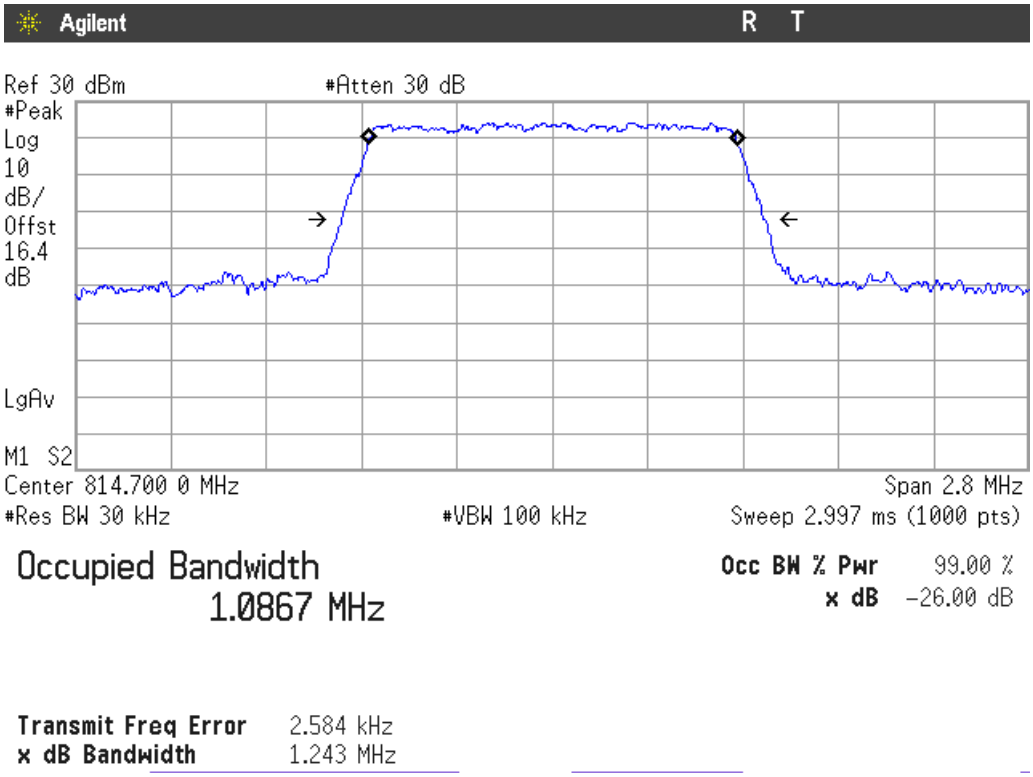


Highest Channel

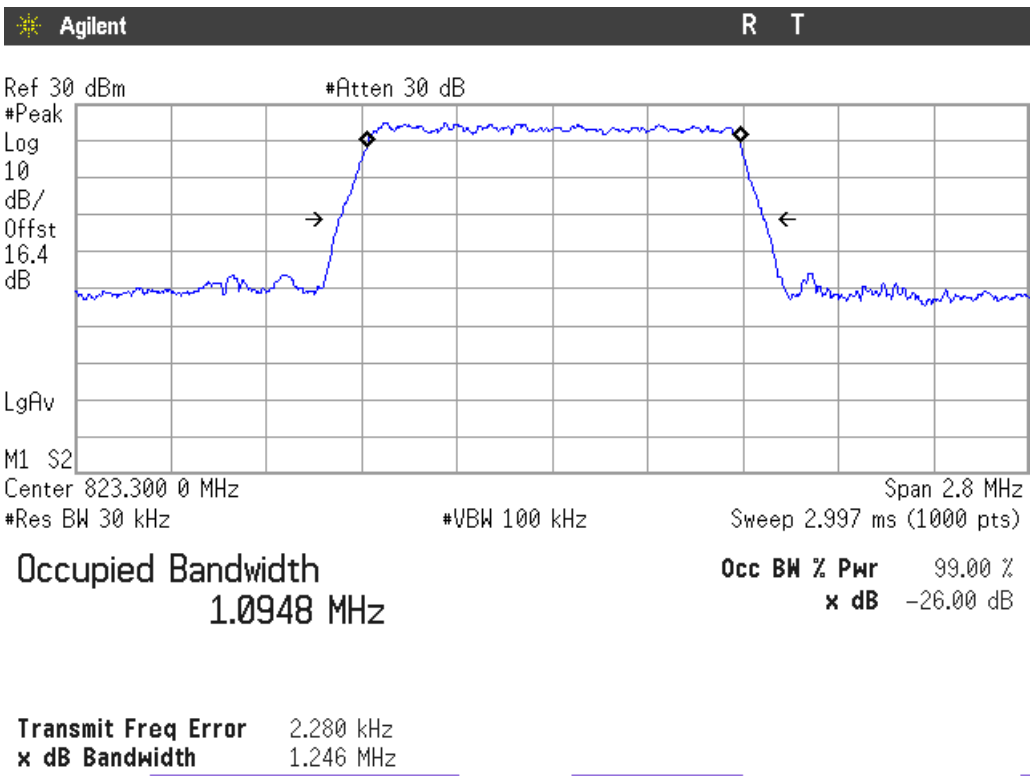


LTE Band 26 16QAM MODULATION. BW = 1.4 MHz

Lowest Channel

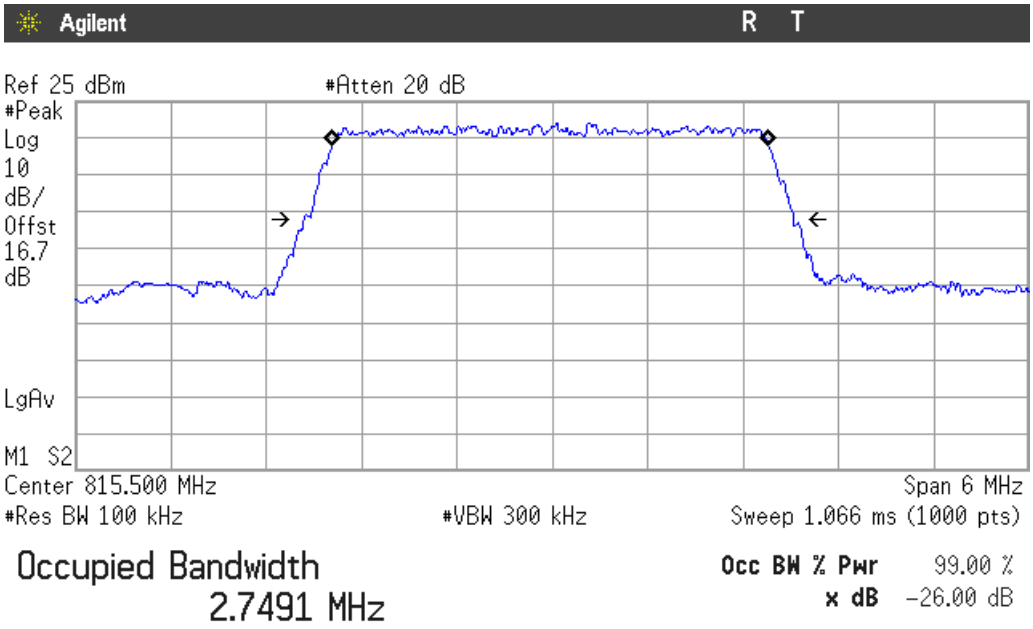


Highest Channel

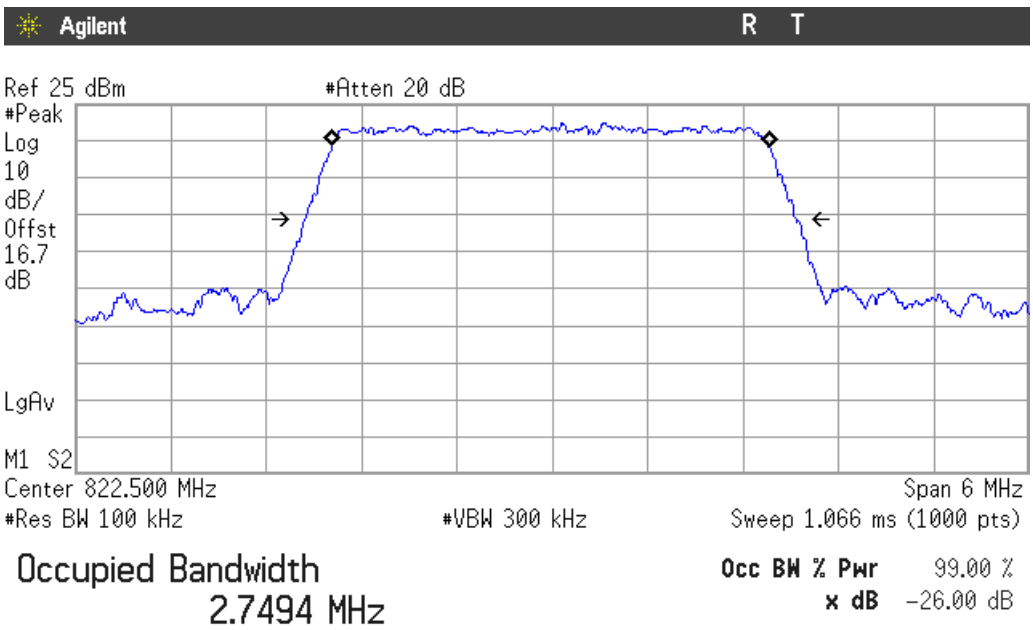


LTE Band 26 QPSK MODULATION. BW = 3 MHz

Lowest Channel

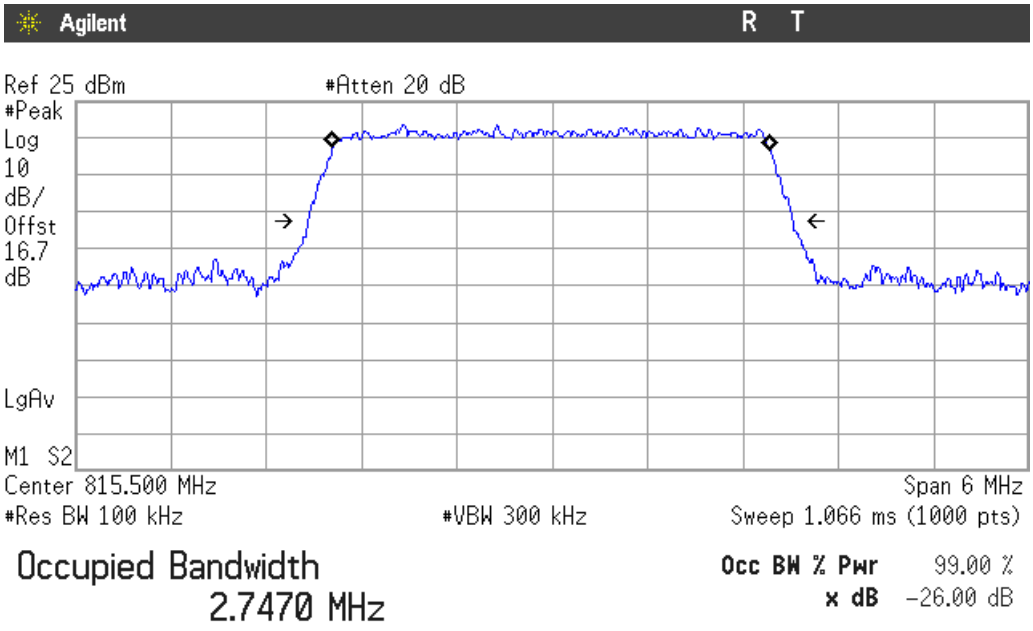


Highest Channel

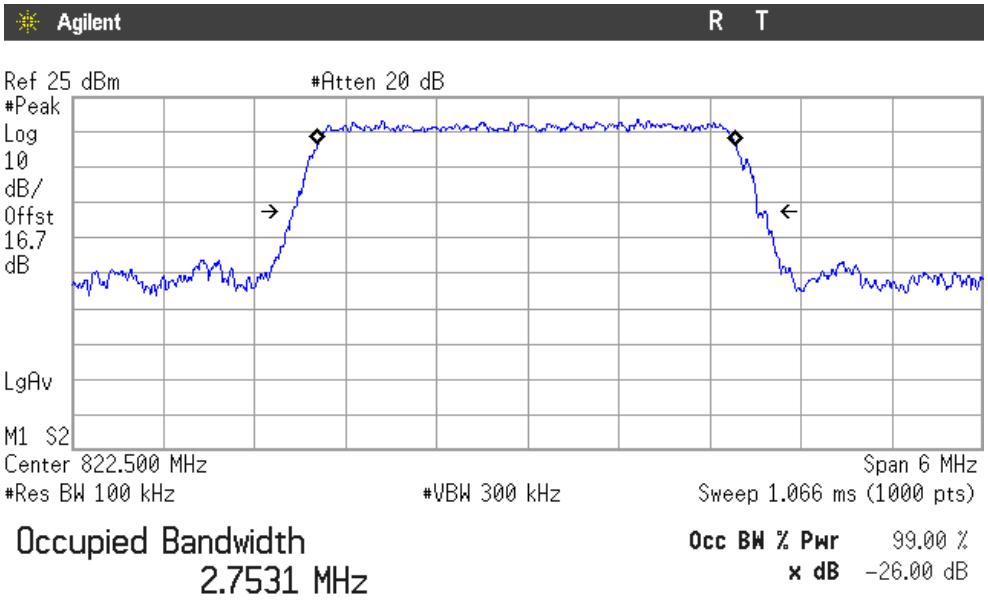


LTE Band 26 16QAM MODULATION. BW = 3 MHz

Lowest Channel

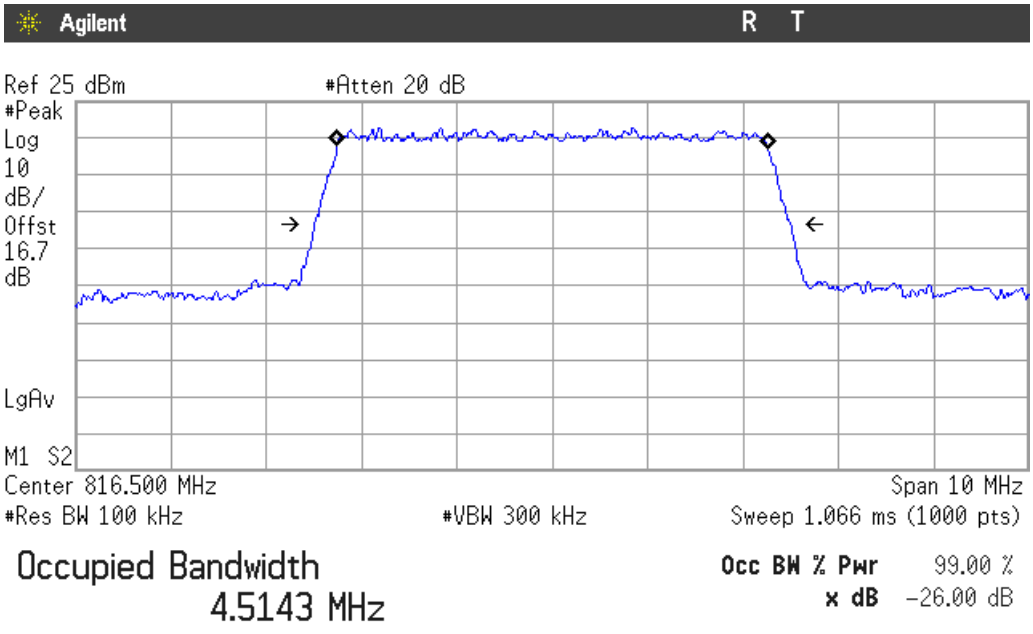


Highest Channel

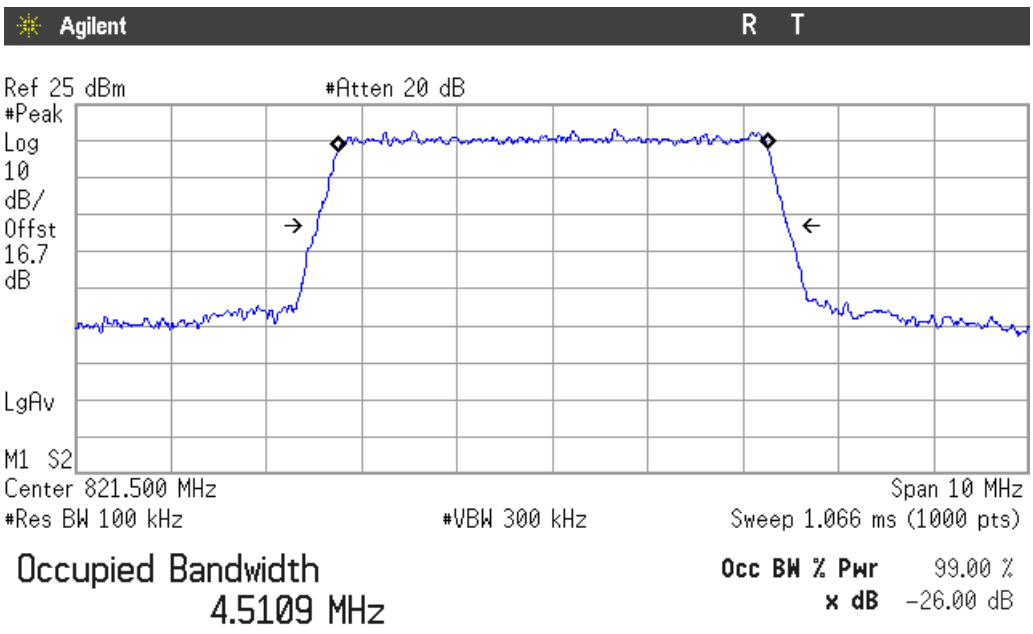


LTE Band 26 QPSK MODULATION. BW = 5 MHz

Lowest Channel

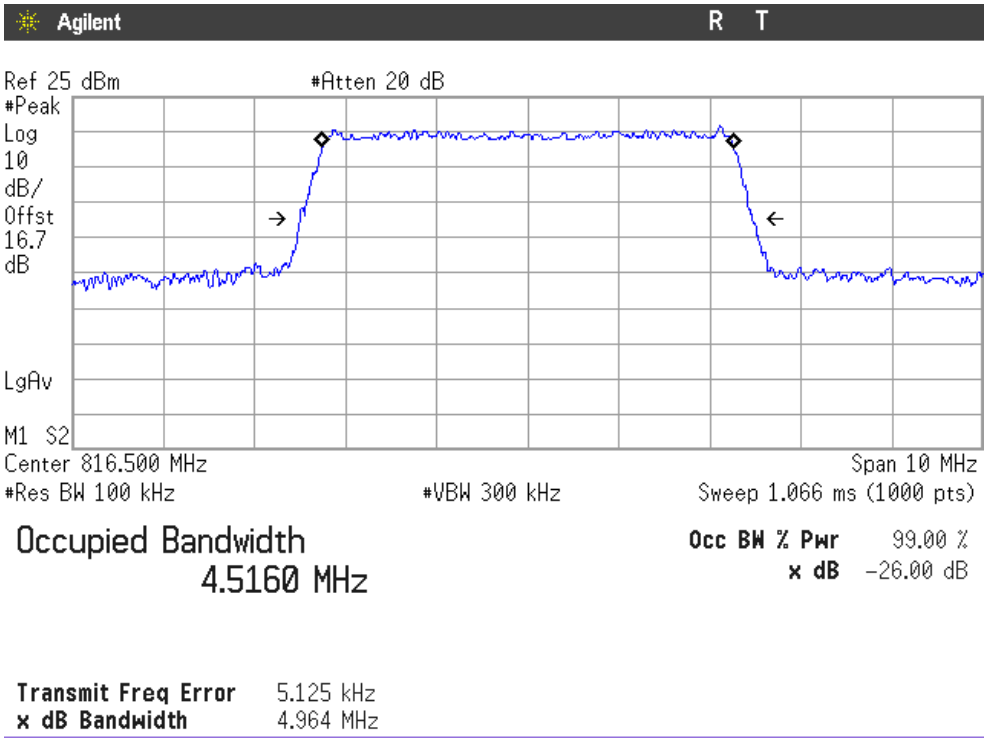


Highest Channel

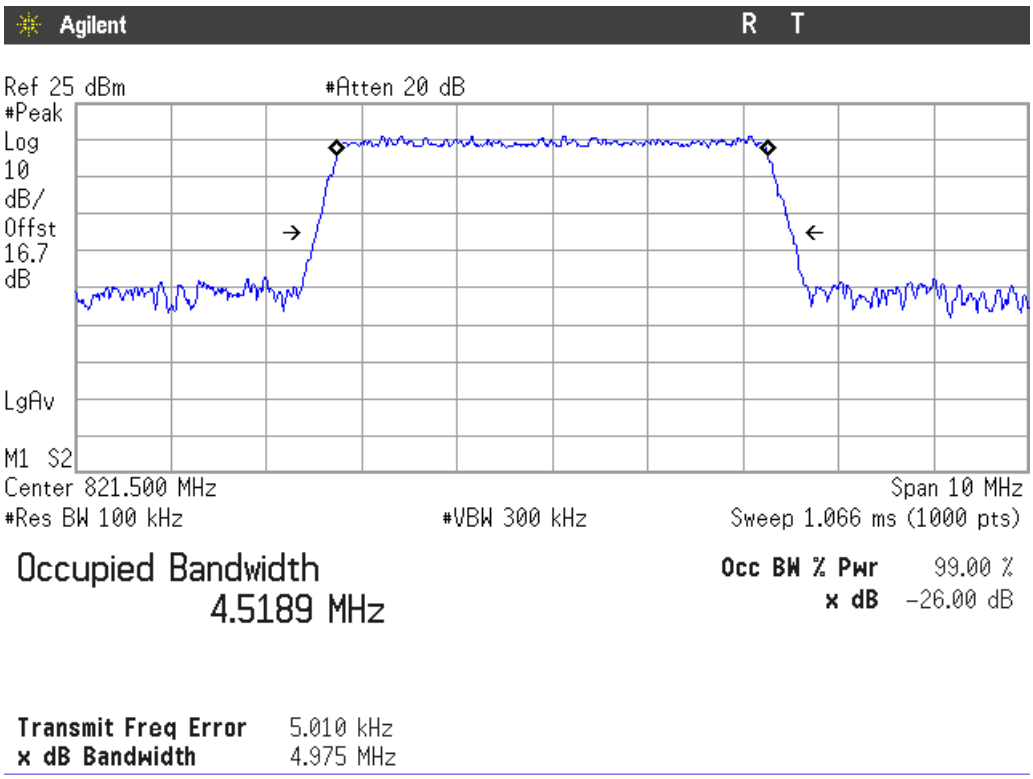


LTE Band 26 16QAM MODULATION. BW = 5 MHz

Lowest Channel

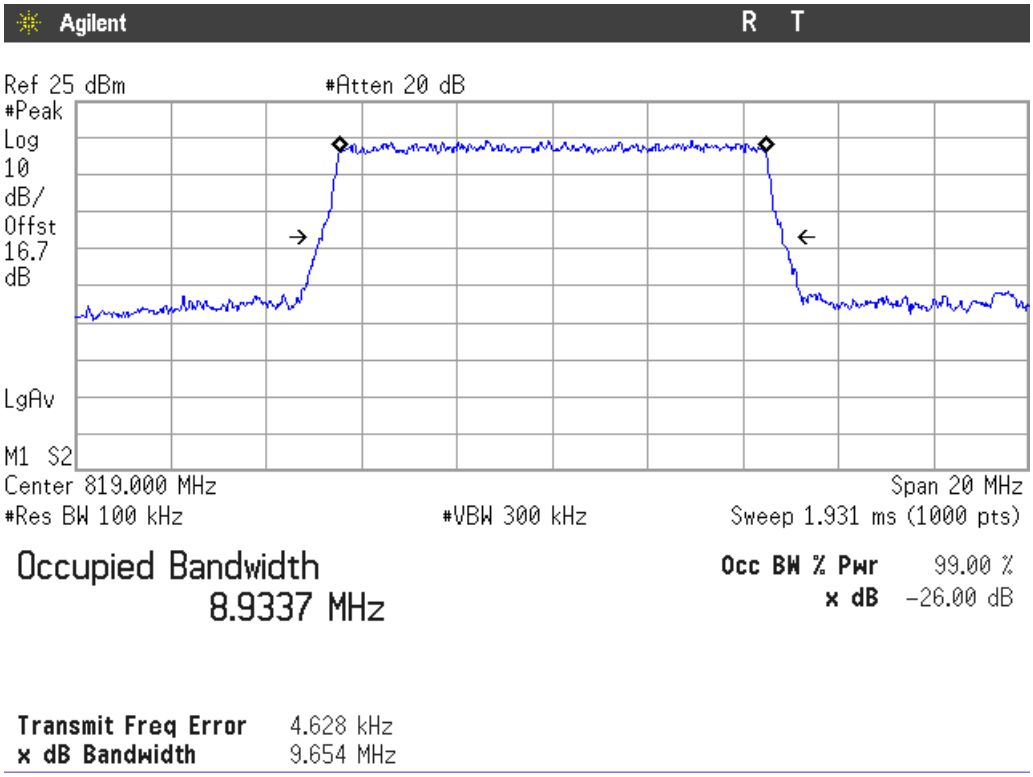


Highest Channel



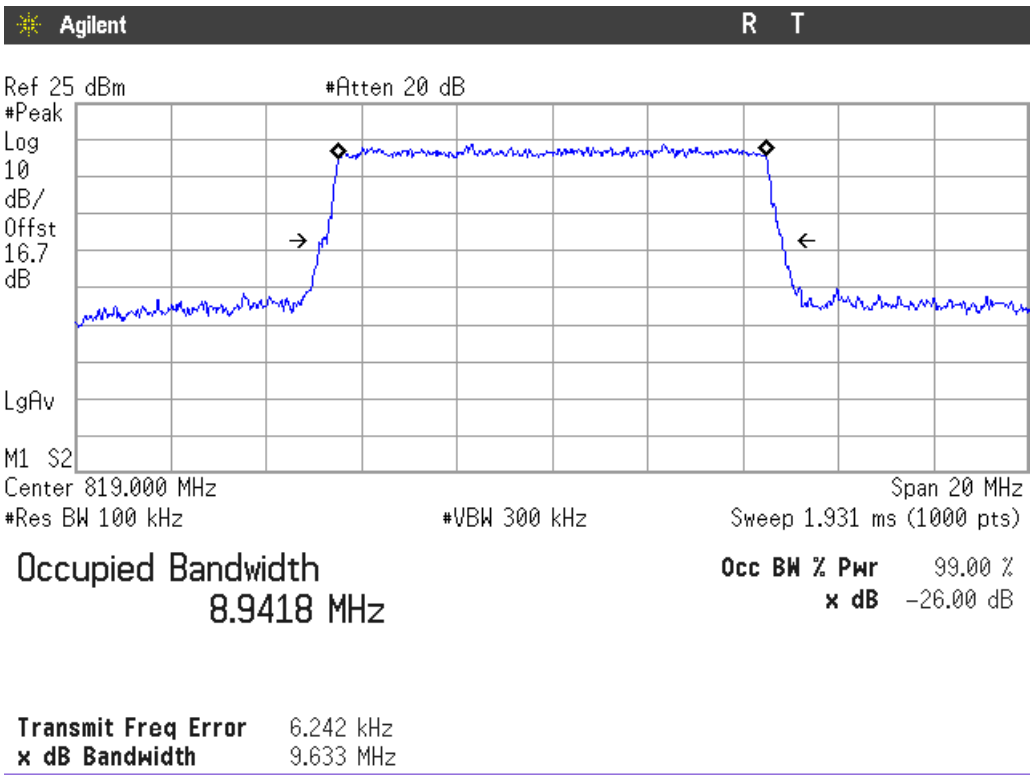
LTE Band 26 QPSK MODULATION. BW = 10 MHz

Middle Channel



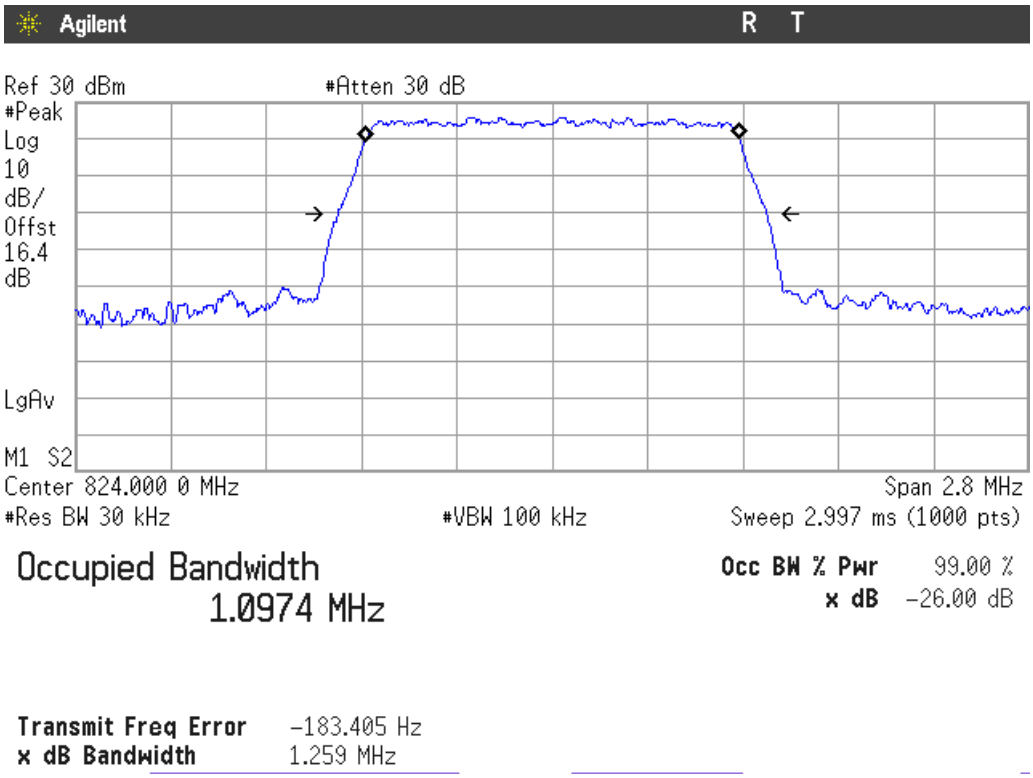
LTE Band 26 16QAM MODULATION. BW = 10 MHz

Middle Channel

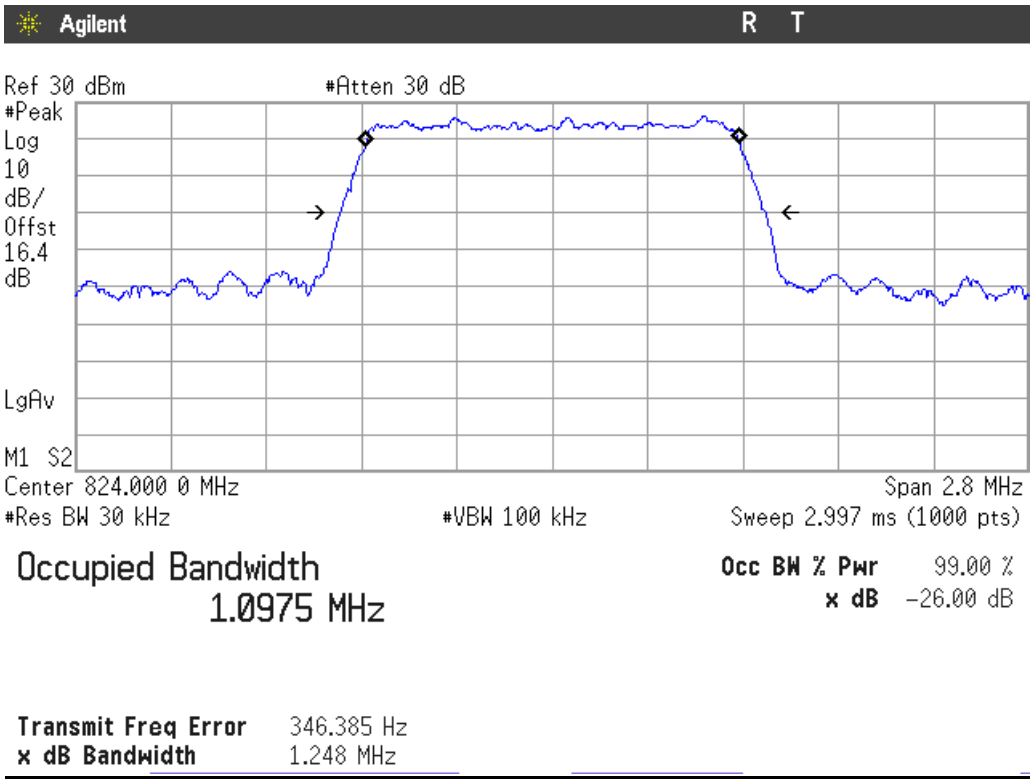


Cross-rule channel (824MHz):

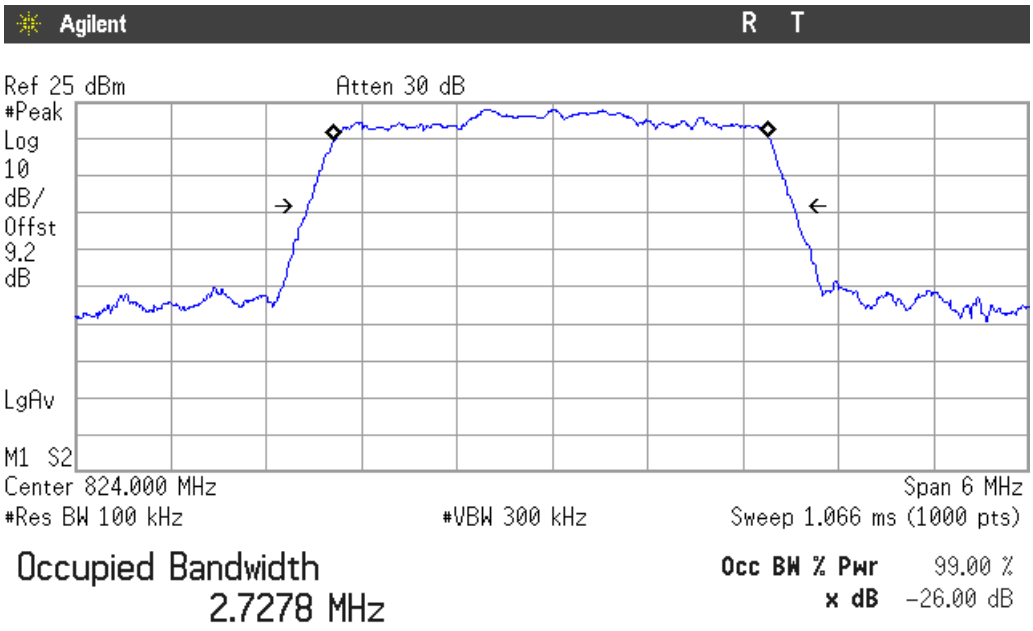
LTE Band 26 QPSK MODULATION. BW = 1.4 MHz



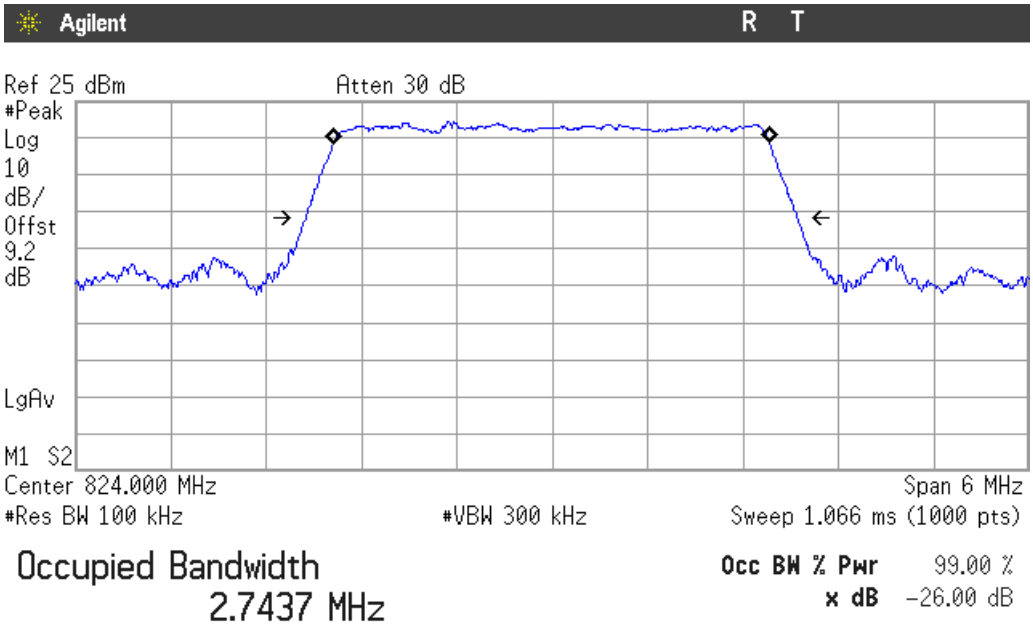
LTE Band 26 16QAM MODULATION. BW = 1.4 MHz



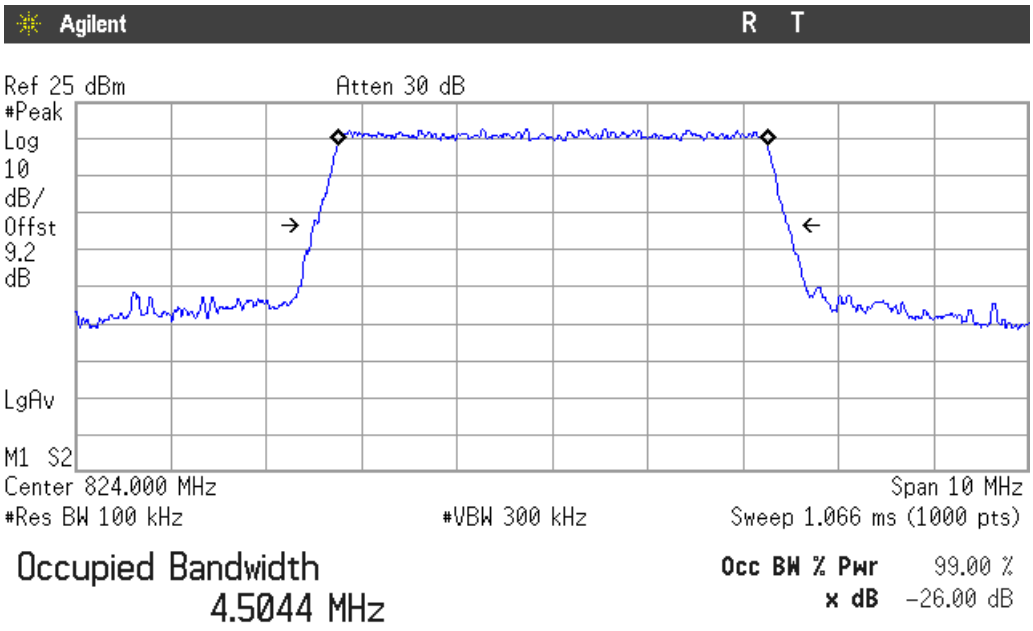
LTE Band 26 QPSK MODULATION. BW = 3 MHz



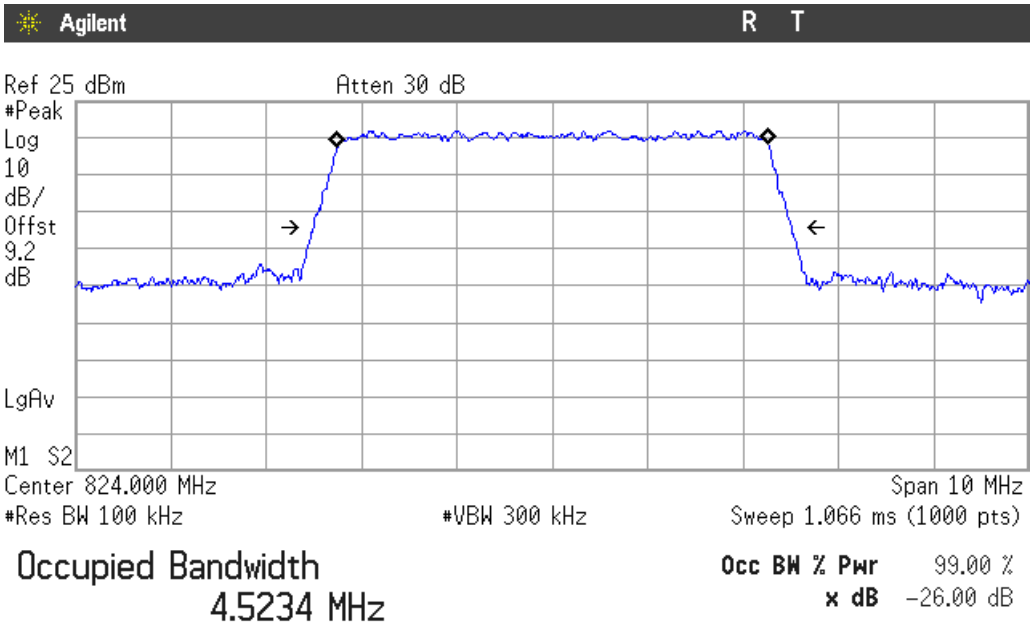
LTE Band 26 16QAM MODULATION. BW = 3 MHz



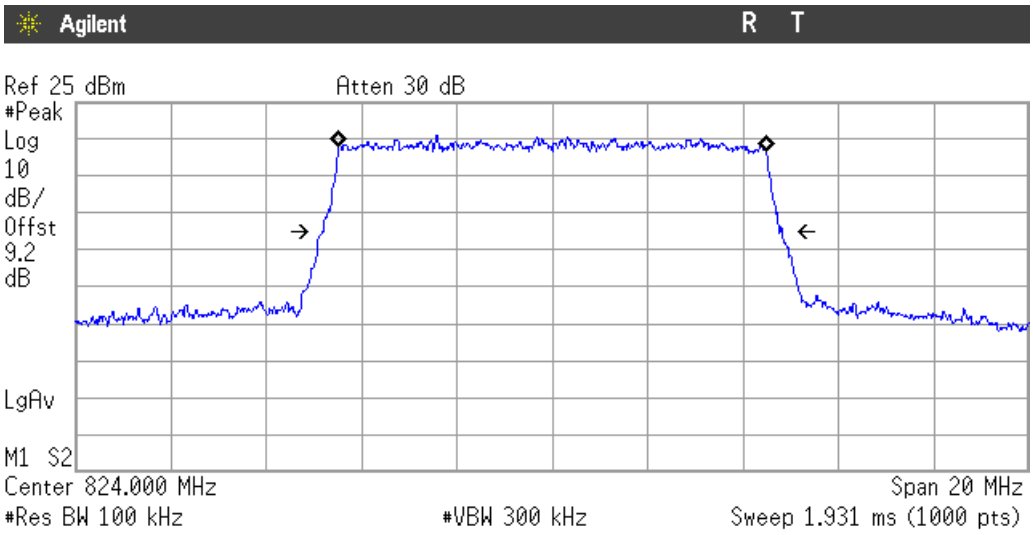
LTE Band 26 QPSK MODULATION. BW = 5 MHz



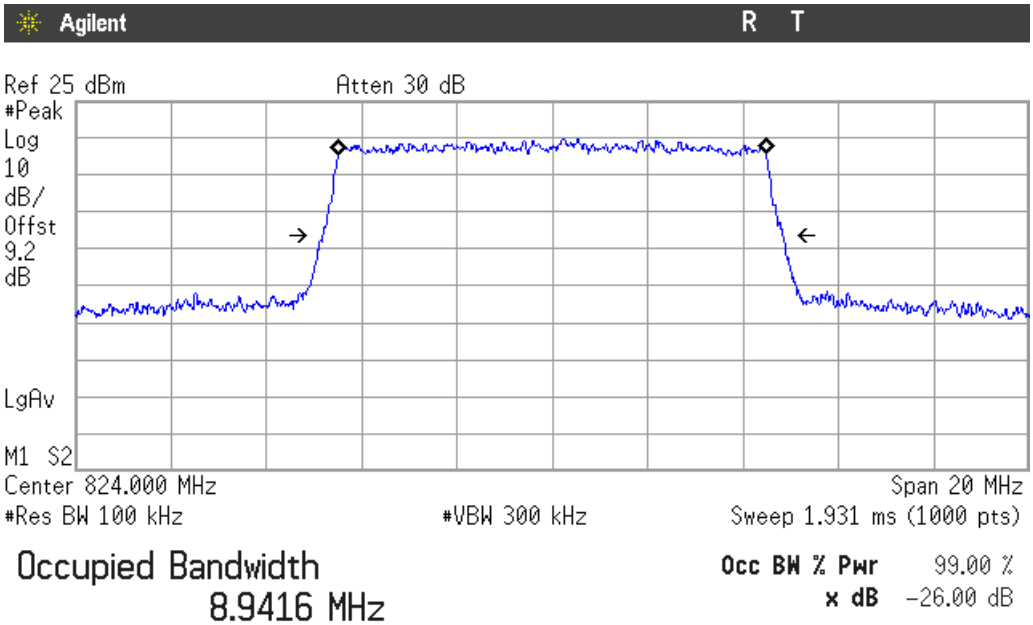
LTE Band 26 16QAM MODULATION. BW = 5 MHz



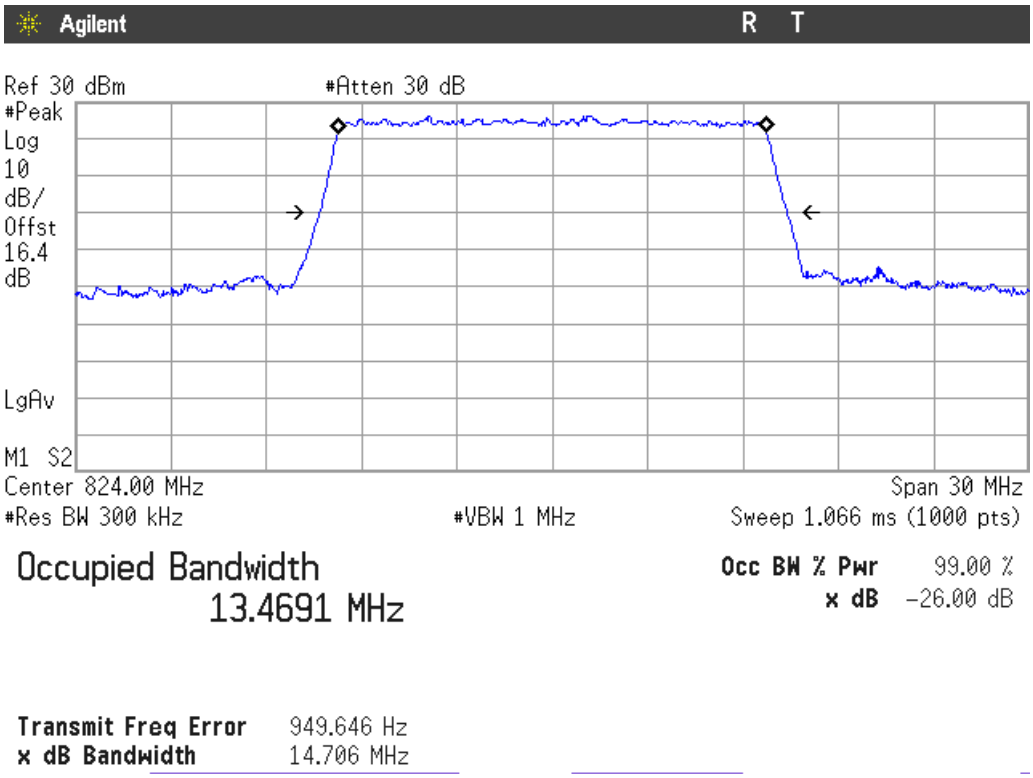
LTE Band 26 QPSK MODULATION. BW = 10 MHz



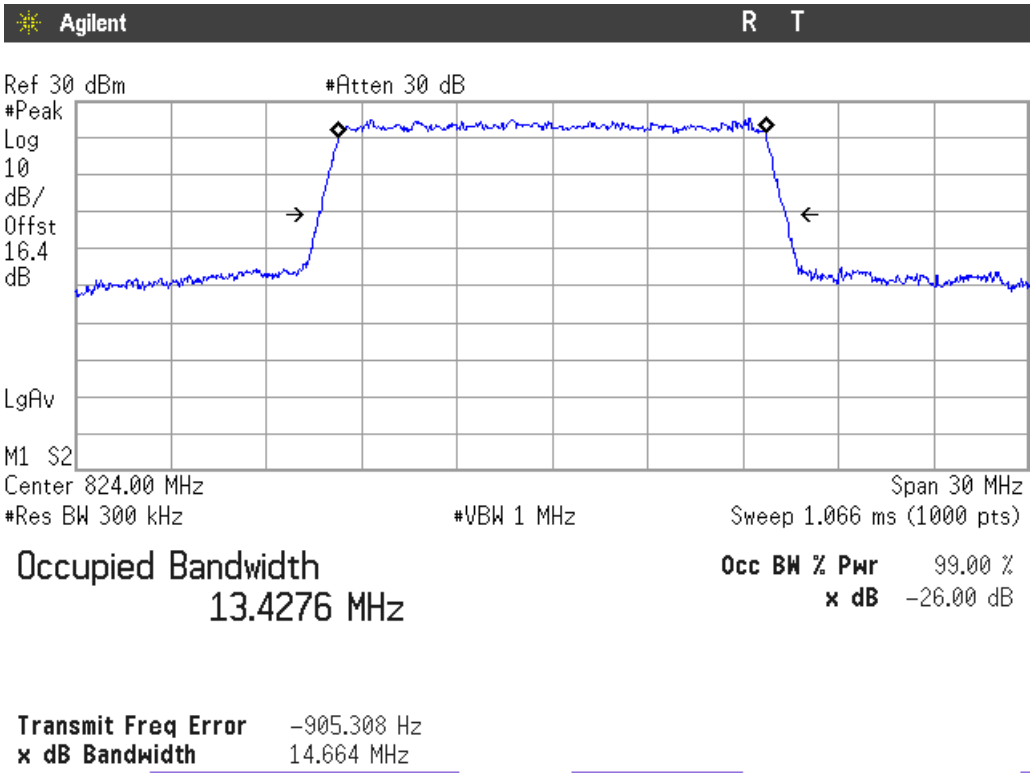
LTE Band 26 16QAM MODULATION. BW = 10 MHz



LTE Band 26 QPSK MODULATION. BW = 15 MHz



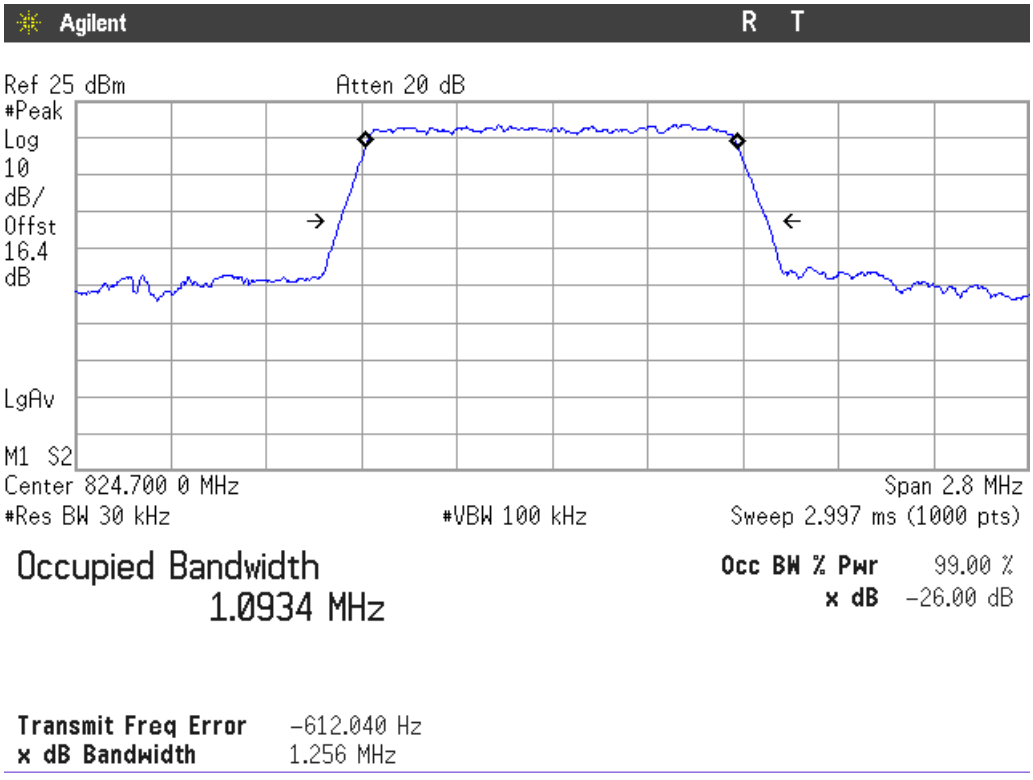
LTE Band 26 16QAM MODULATION. BW = 15 MHz



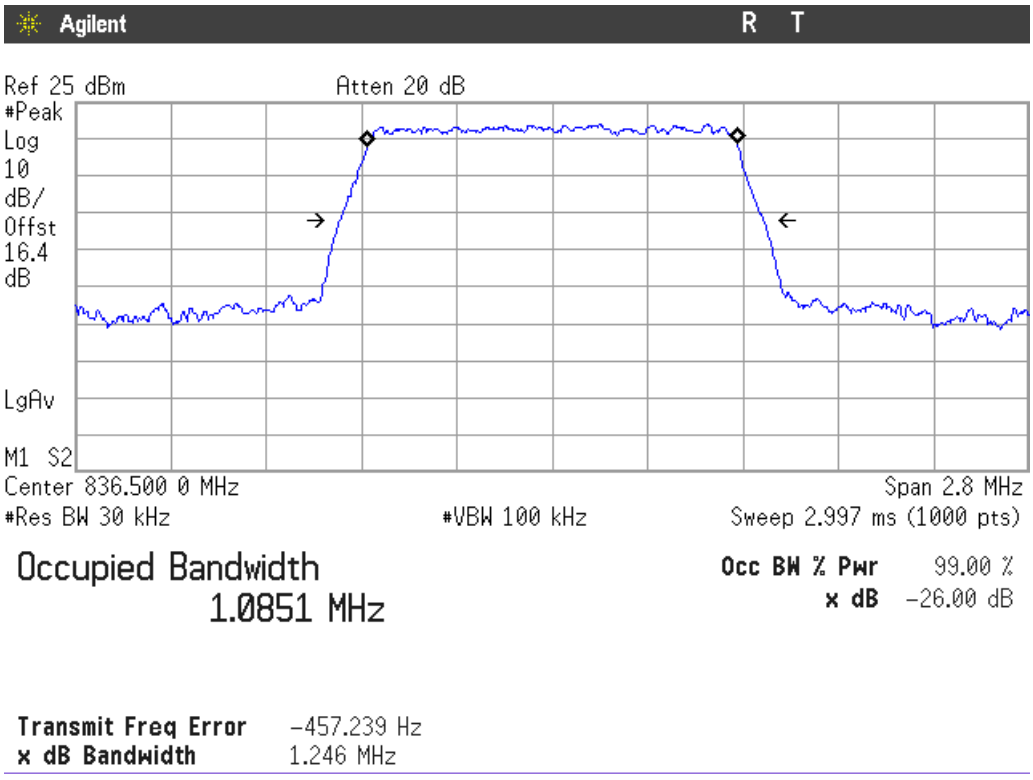
824-849MHz Band:

LTE Band 5 QPSK MODULATION. BW = 1.4 MHz

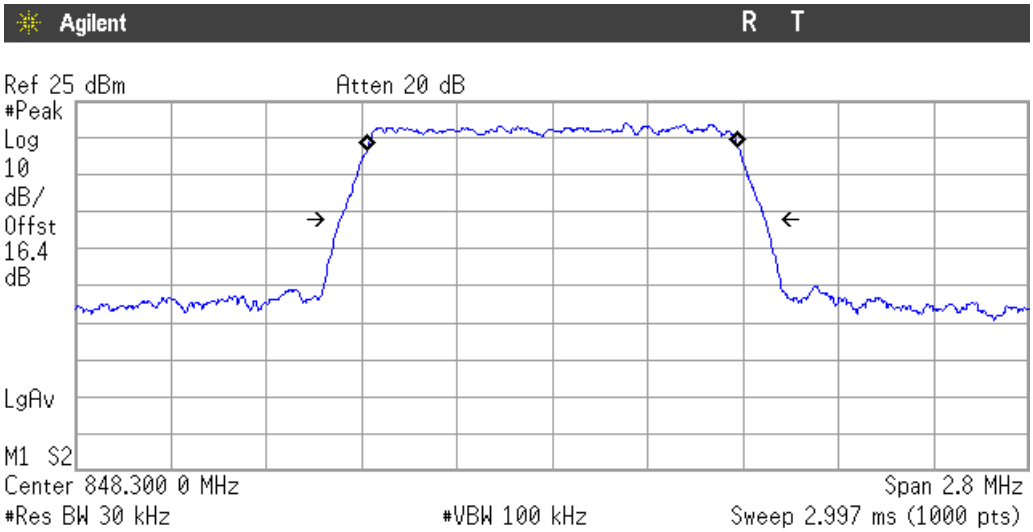
Lowest Channel



Middle Channel

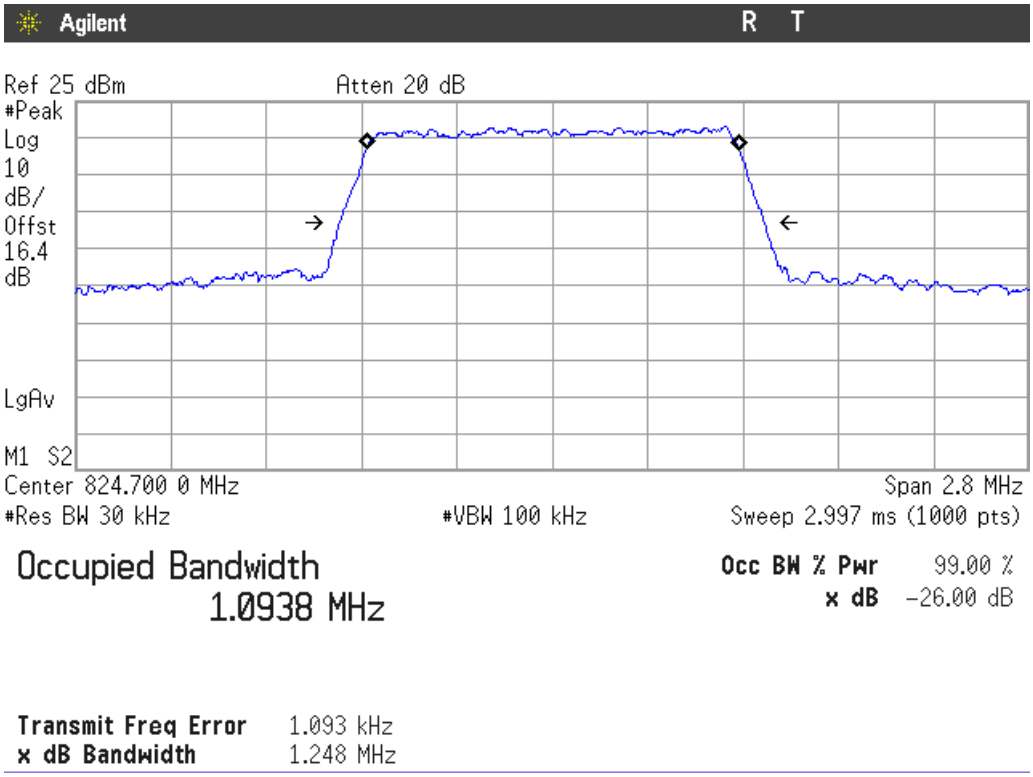


Highest Channel

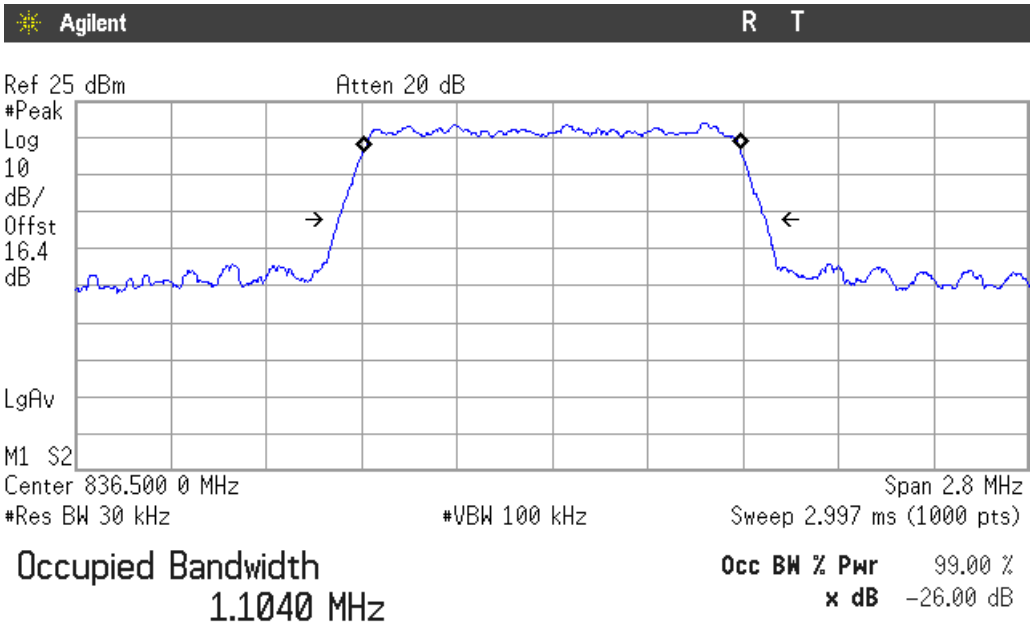


LTE Band 5 16QAM MODULATION. BW = 1.4 MHz

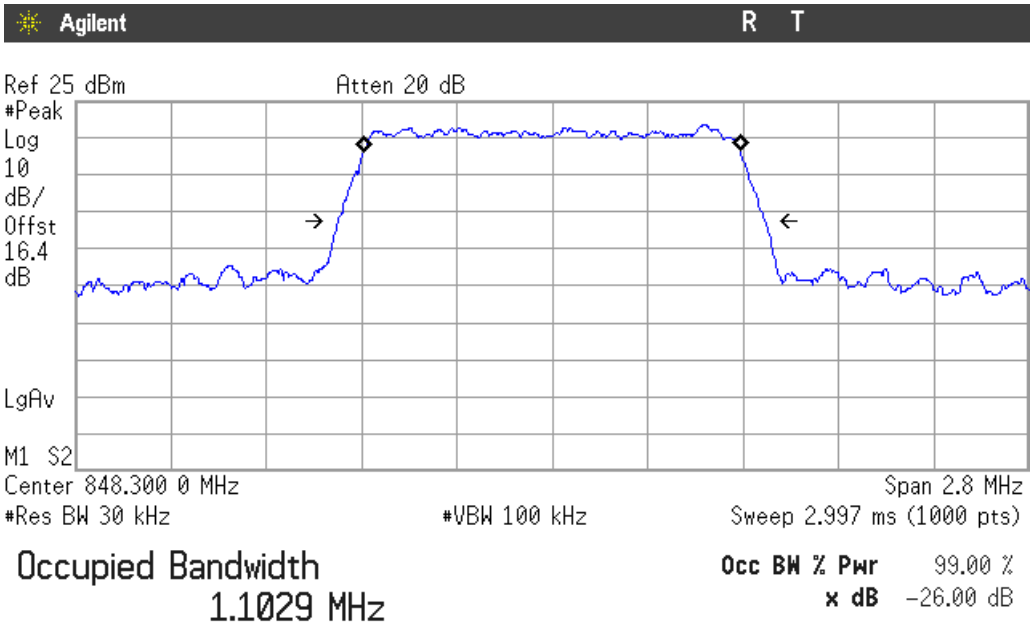
Lowest Channel



Middle Channel

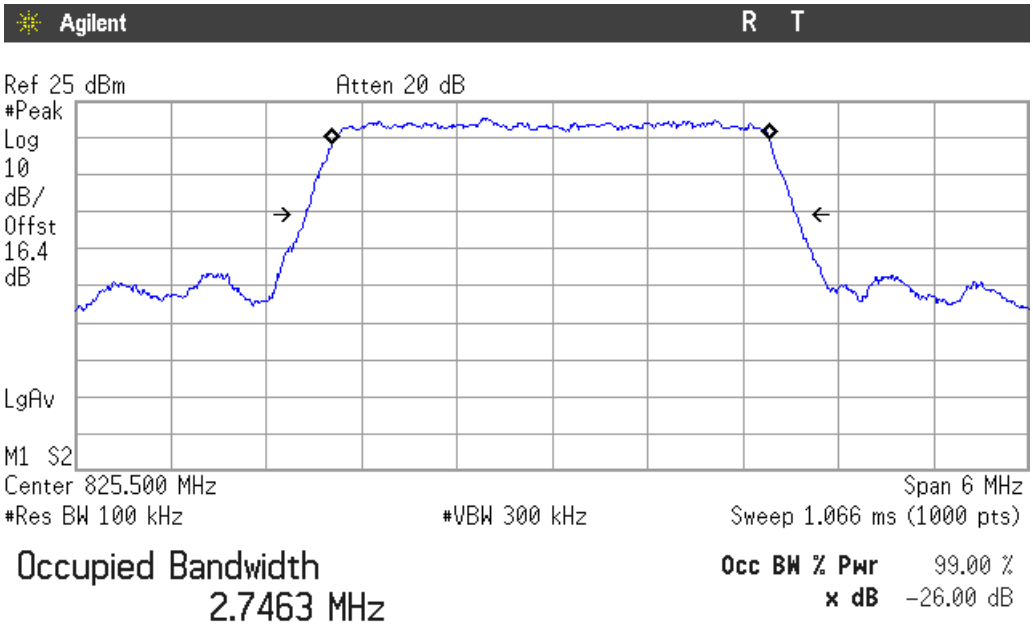


Highest Channel

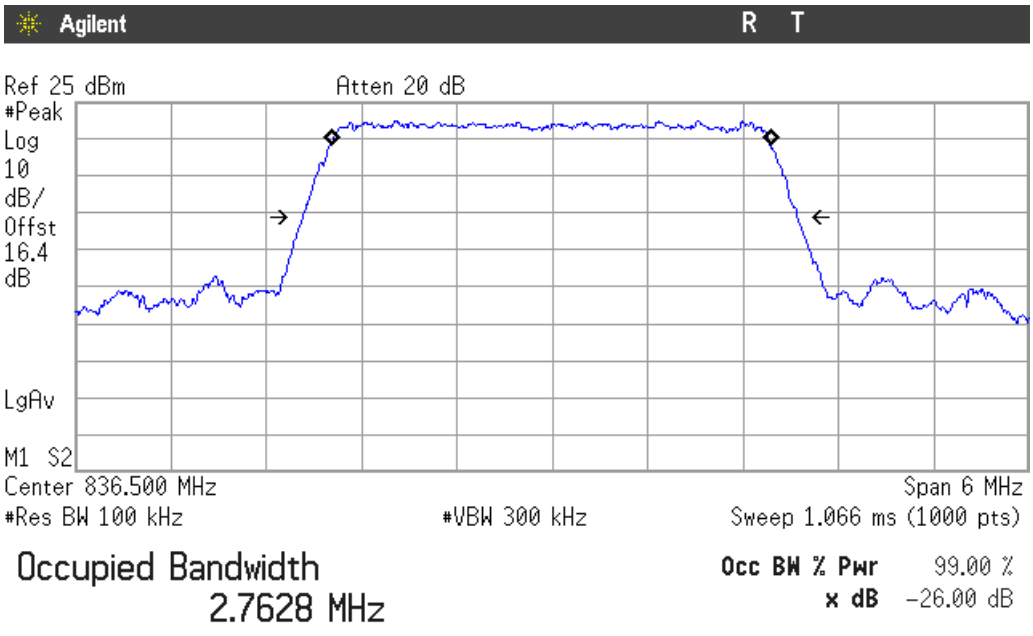


LTE Band 5 QPSK MODULATION. BW = 3 MHz

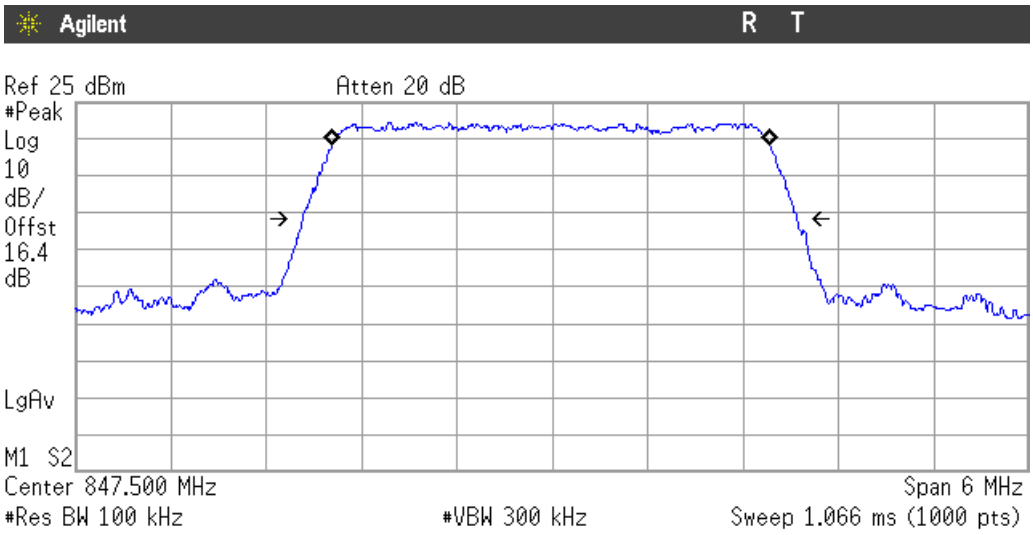
Lowest Channel



Middle Channel

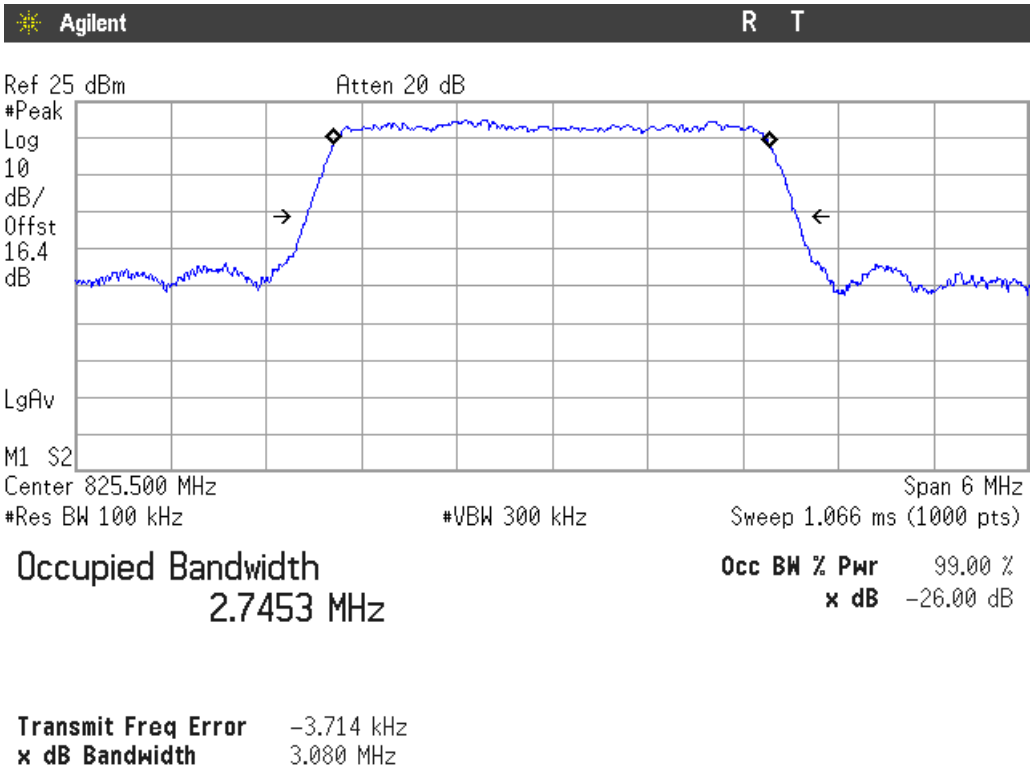


Highest Channel

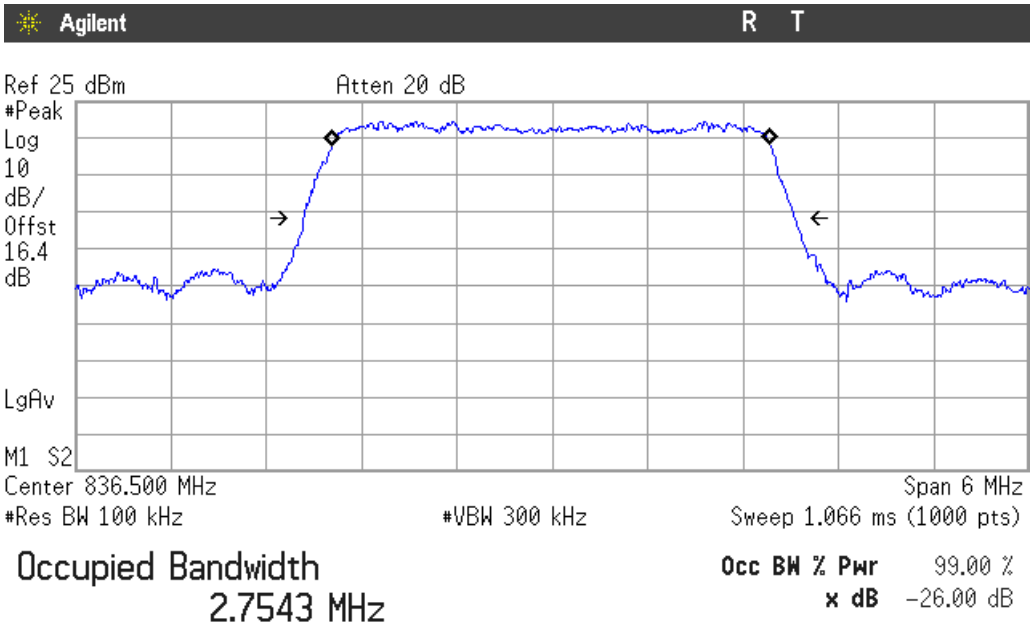


LTE Band 5 16QAM MODULATION. BW = 3 MHz

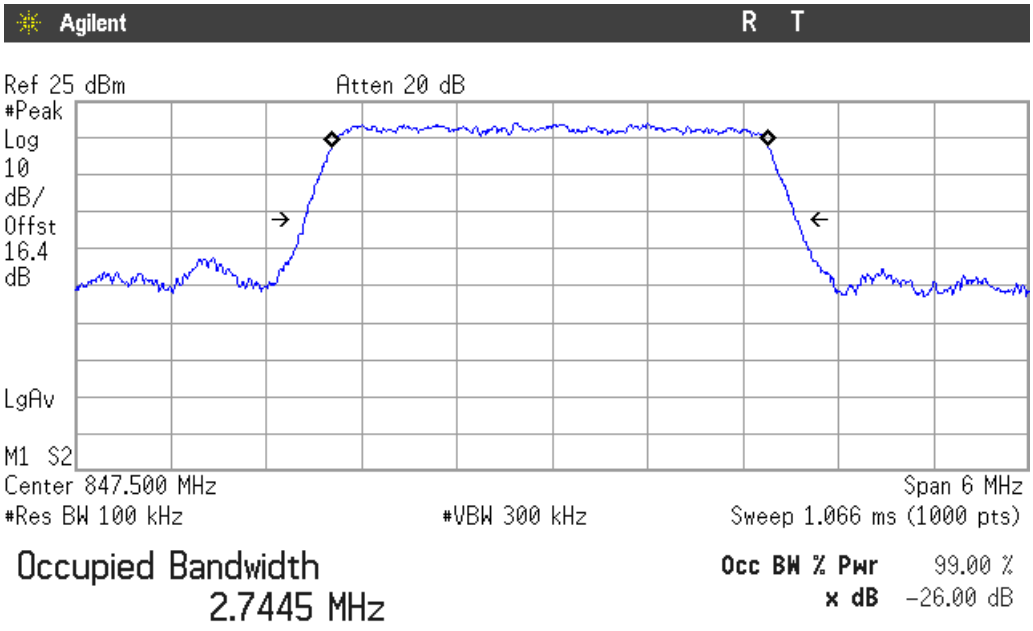
Lowest Channel



Middle Channel

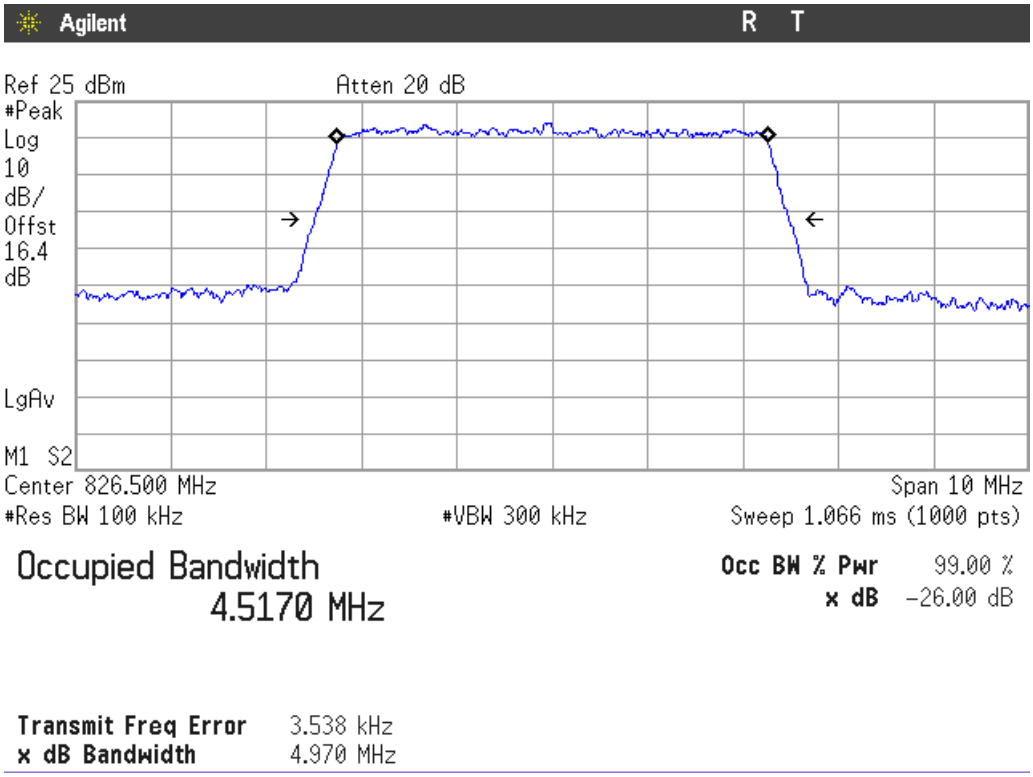


Highest Channel

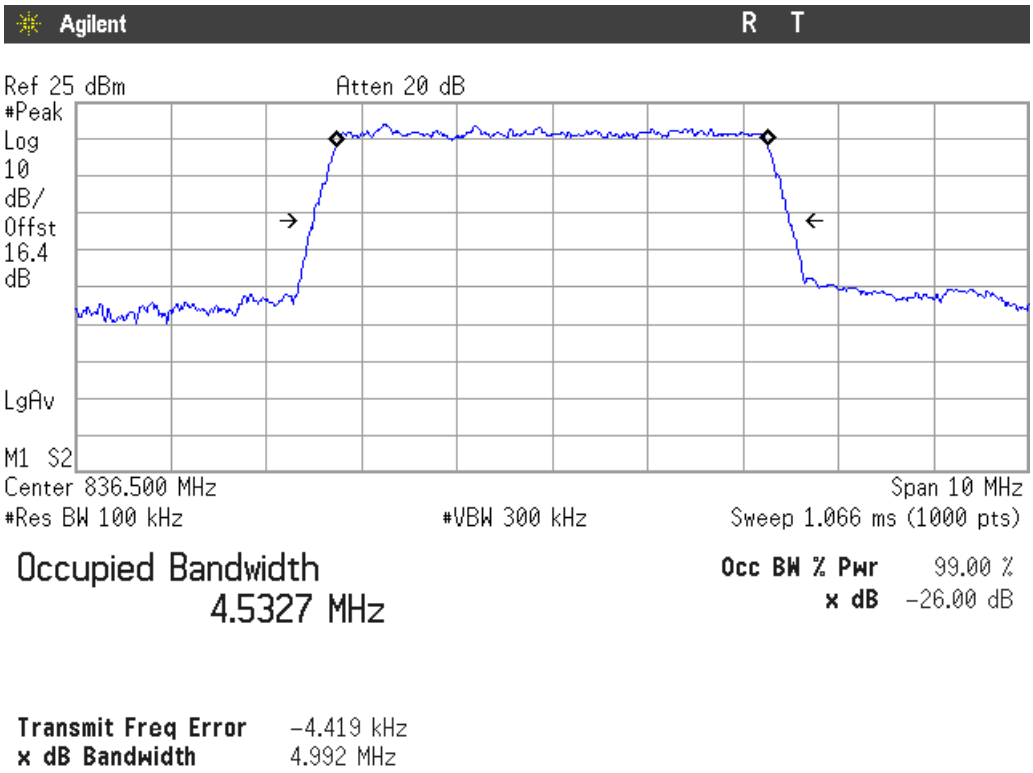


LTE Band 5 QPSK MODULATION. BW = 5 MHz

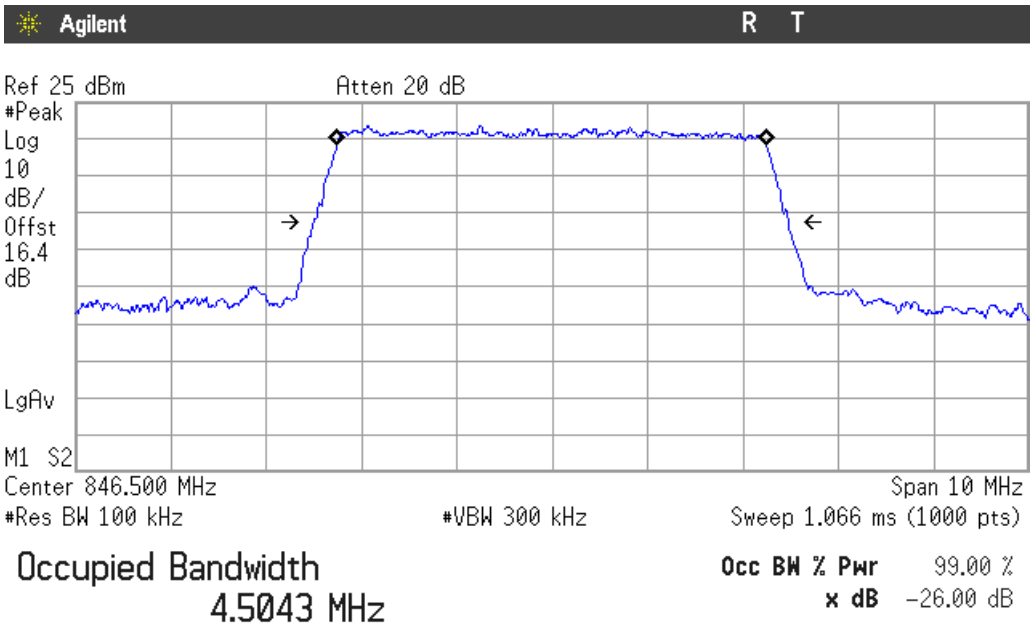
Lowest Channel



Middle Channel

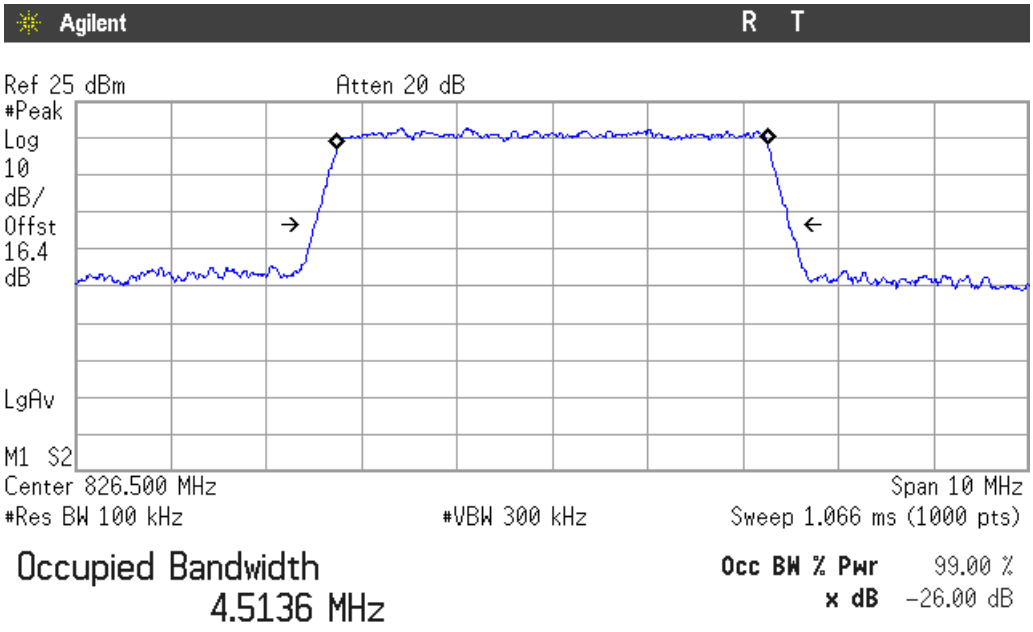


Highest Channel

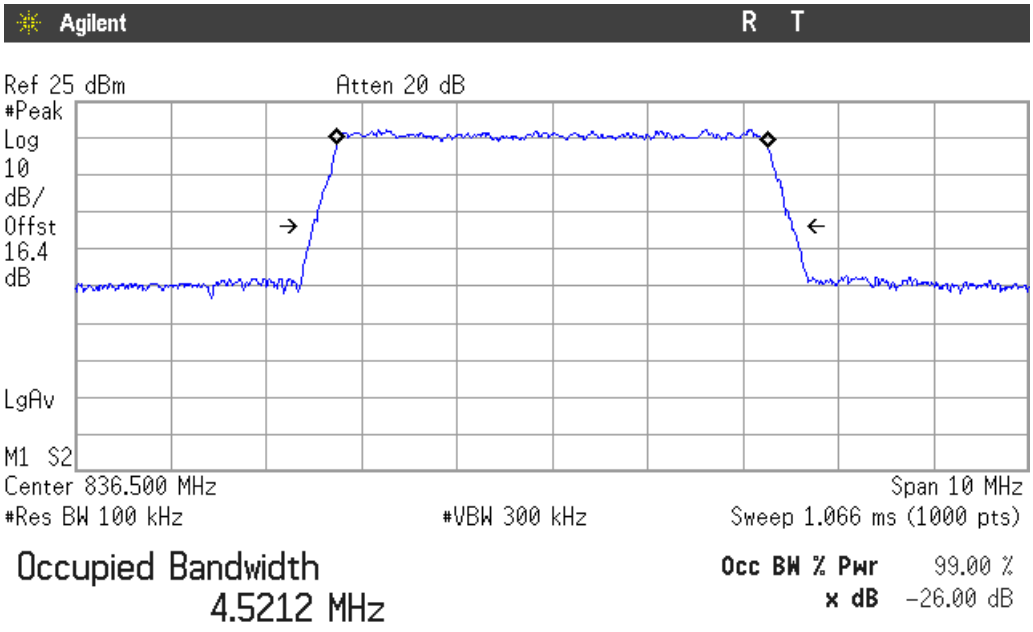


LTE Band 5 16QAM MODULATION. BW = 5 MHz

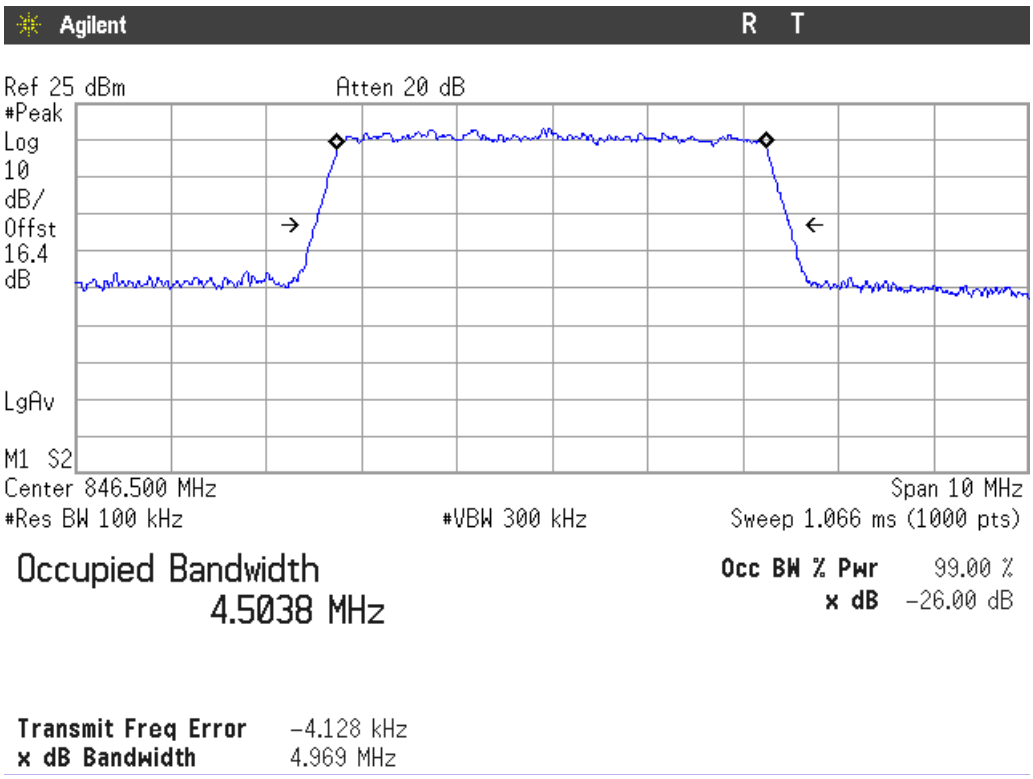
Lowest Channel



Middle Channel

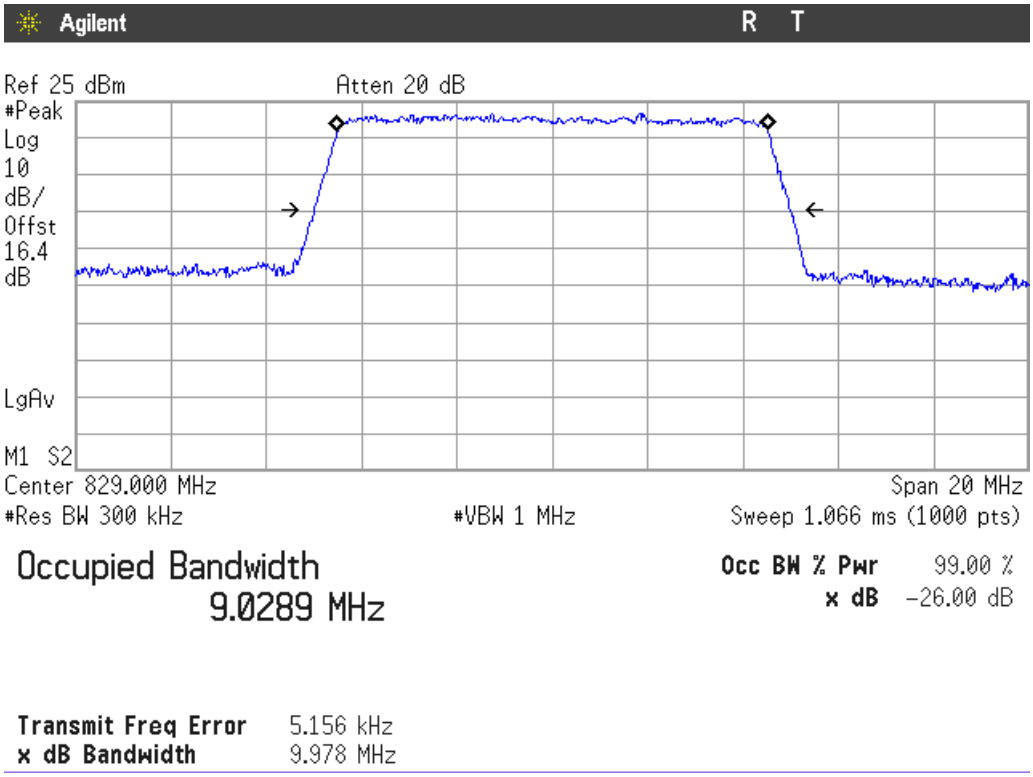


Highest Channel

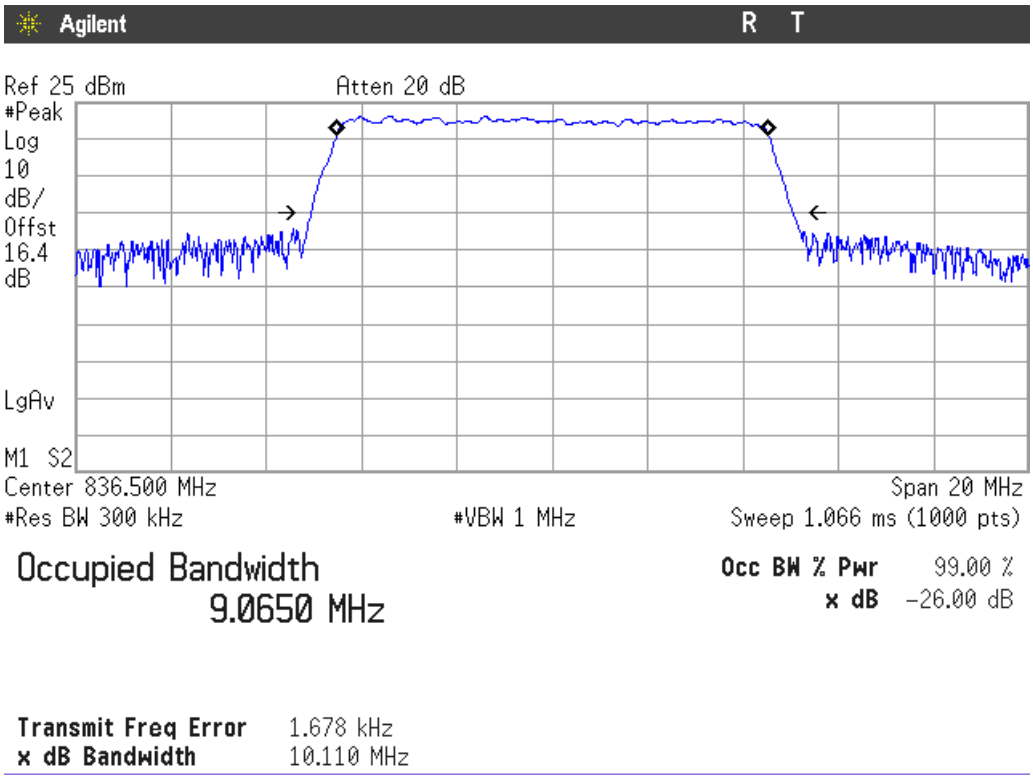


LTE Band 5 QPSK MODULATION. BW = 10 MHz

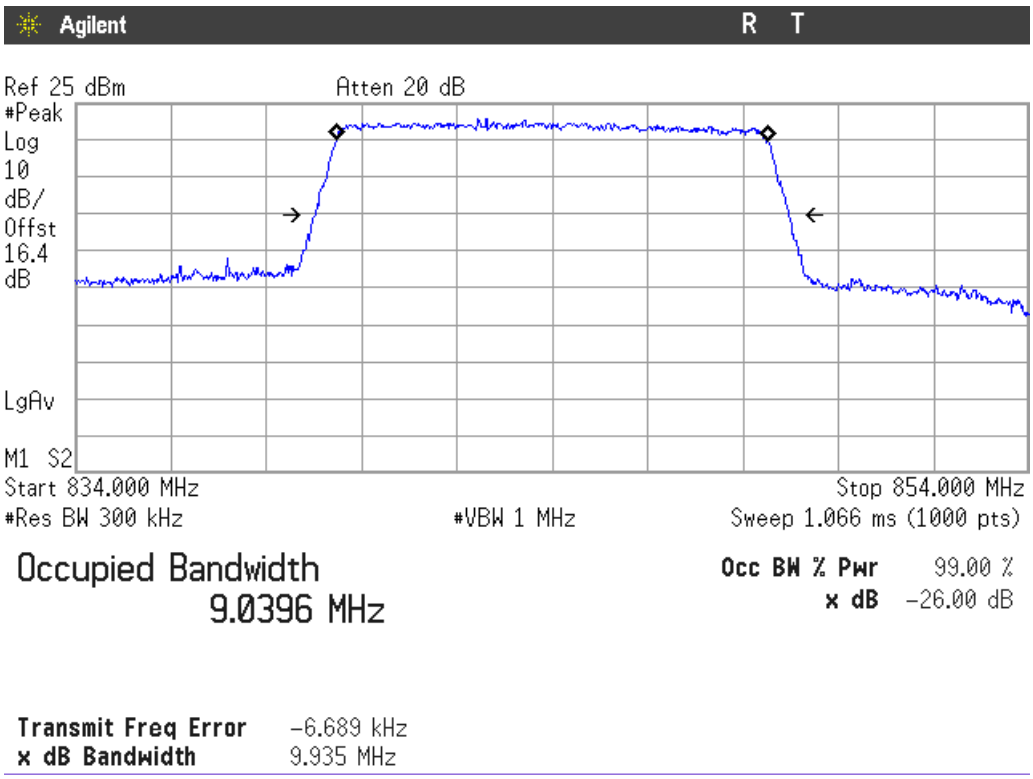
Lowest Channel



Middle Channel

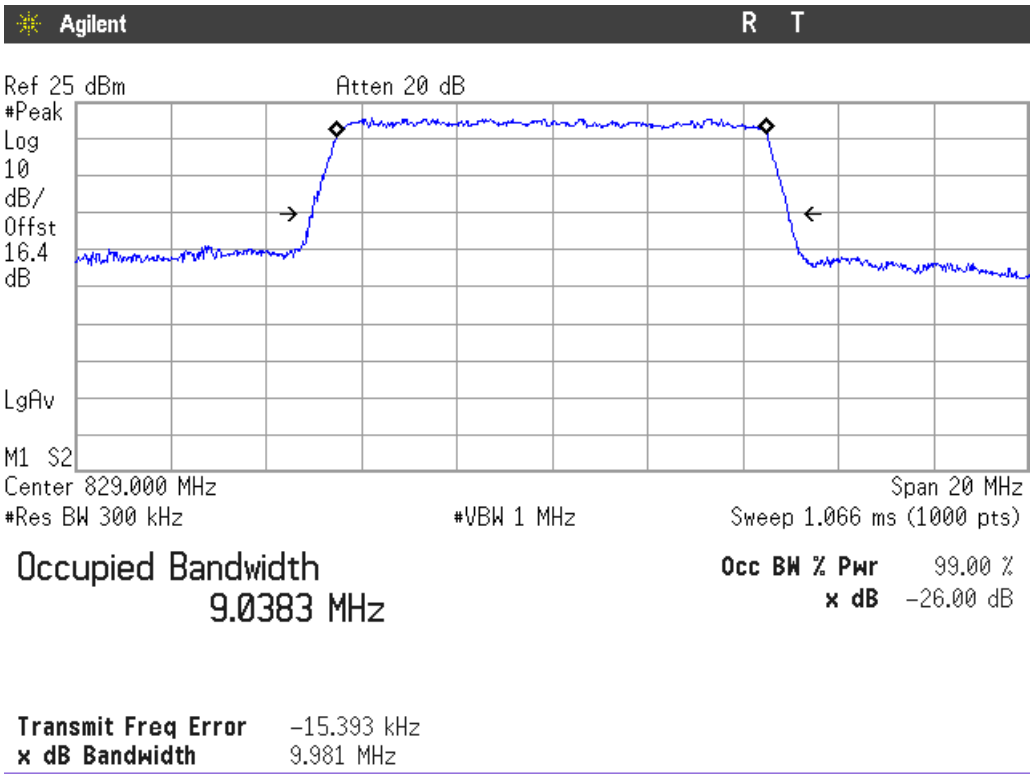


Highest Channel

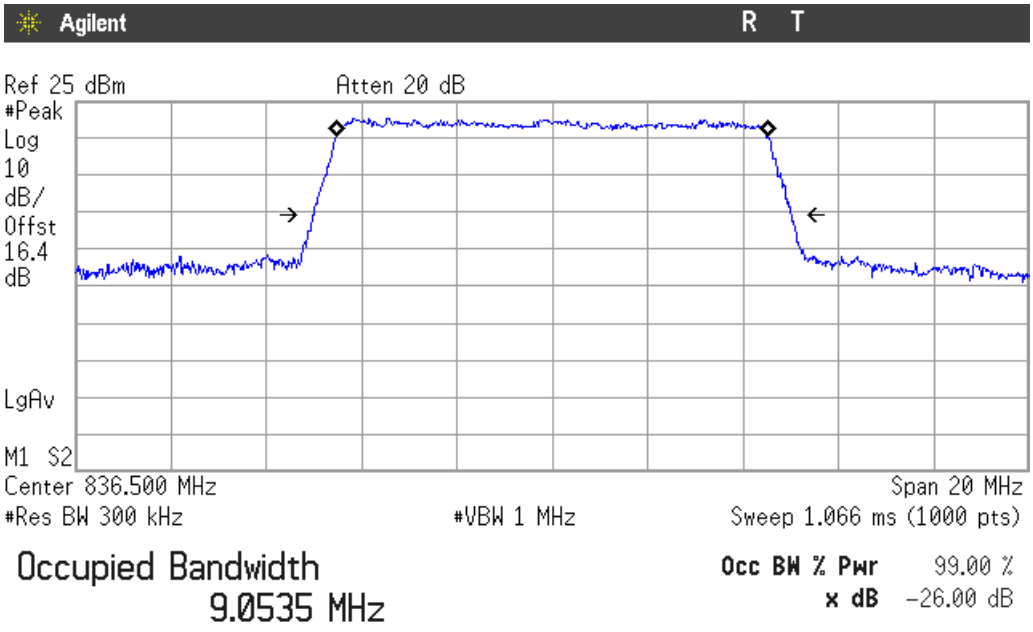


LTE Band 5 16QAM MODULATION. BW = 10 MHz

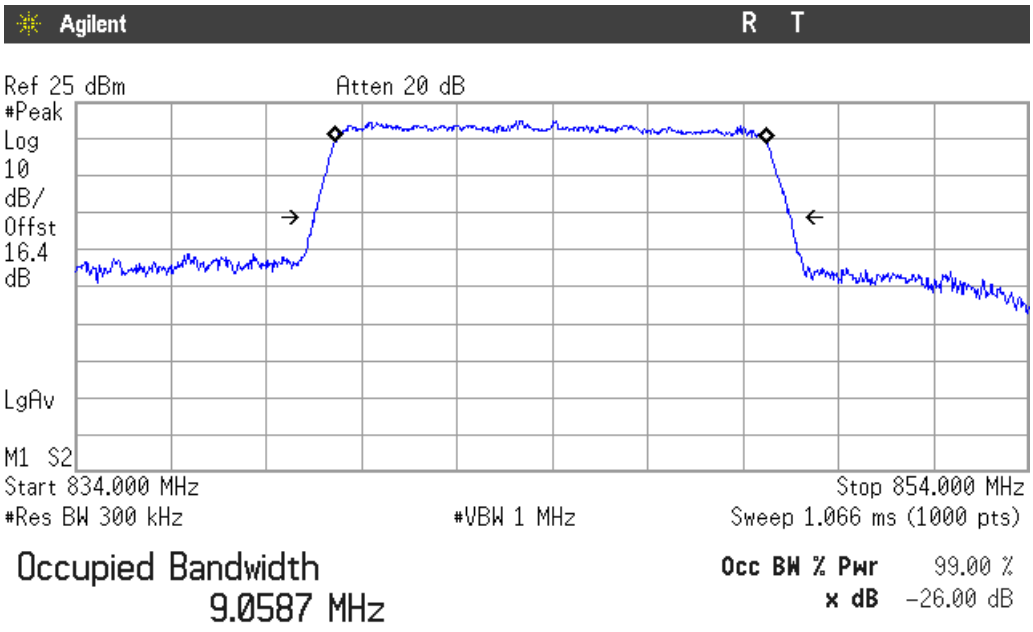
Lowest Channel



Middle Channel

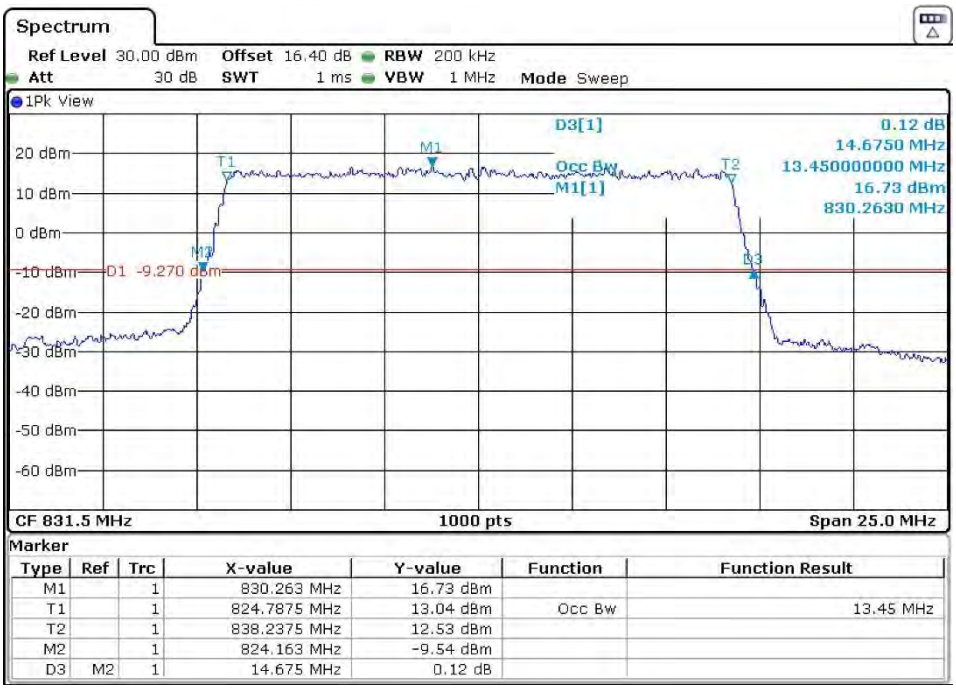


Highest Channel



LTE Band 26 QPSK MODULATION. BW = 15 MHz

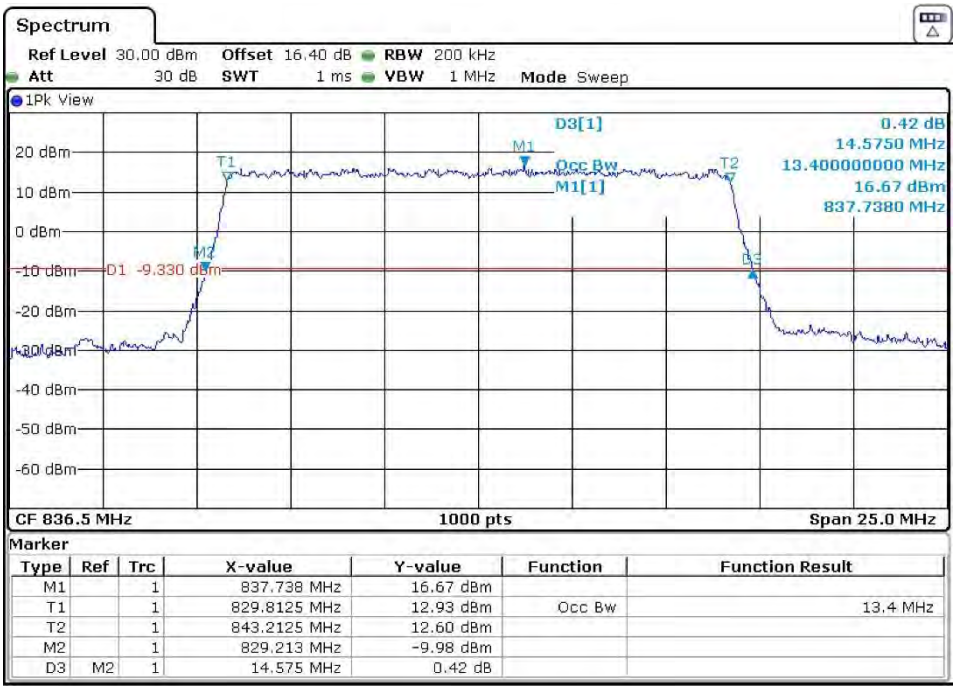
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	830.263 MHz	16.73 dBm		
T1		1	824.7875 MHz	13.04 dBm	Occ Bw	13.45 MHz
T2		1	838.2375 MHz	12.53 dBm		
M2		1	824.163 MHz	-9.54 dBm		
D3	M2	1	14.675 MHz	0.12 dB		

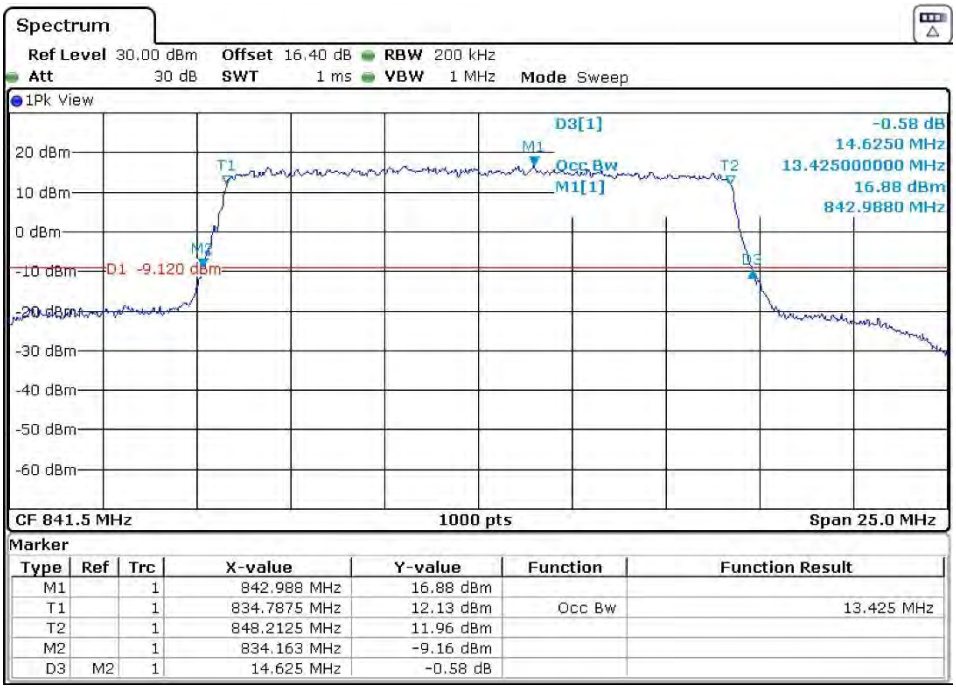
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	837.738 MHz	16.67 dBm		
T1		1	829.8125 MHz	12.93 dBm	Occ Bw	13.4 MHz
T2		1	843.2125 MHz	12.60 dBm		
M2		1	829.213 MHz	-9.98 dBm		
D3	M2	1	14.575 MHz	0.42 dB		

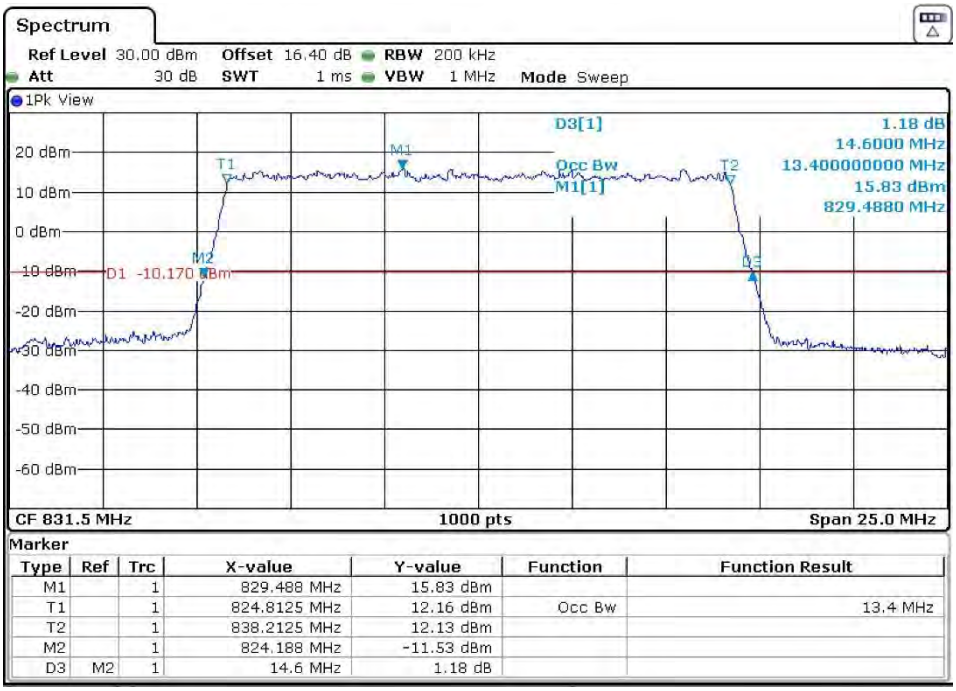
Highest Channel



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	842.988 MHz	16.88 dBm		
T1		1	834.7875 MHz	12.13 dBm	Occ Bw	13.425 MHz
T2		1	848.2125 MHz	11.96 dBm		
M2		1	834.163 MHz	-9.16 dBm		
D3	M2	1	14.625 MHz	-0.58 dB		

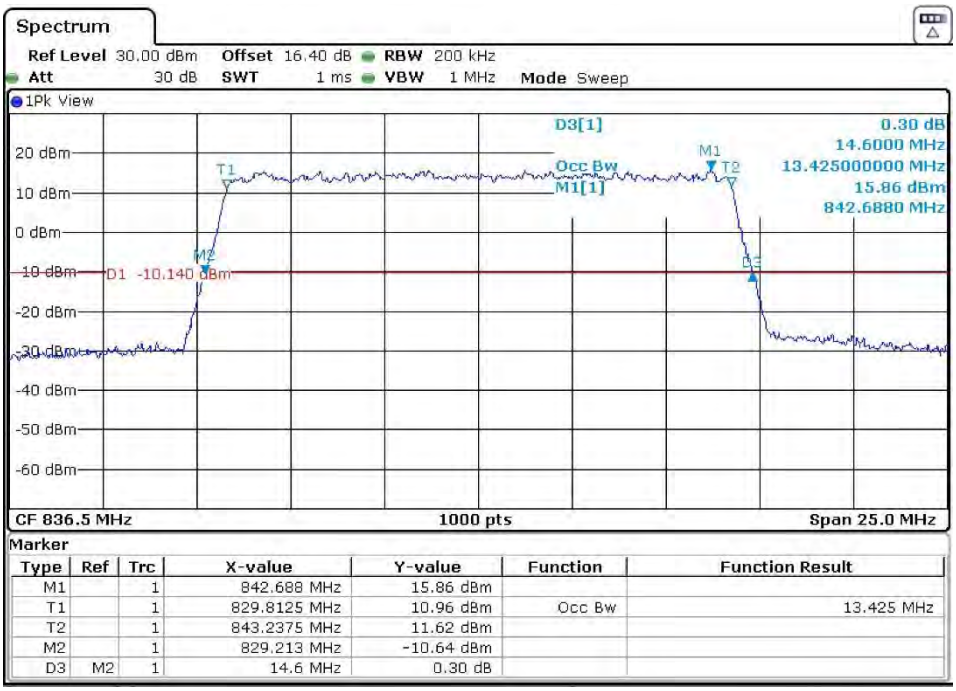
LTE Band 26 16QAM MODULATION. BW = 15 MHz

Lowest Channel



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	829.488 MHz	15.83 dBm		
T1		1	824.8125 MHz	12.16 dBm	Occ Bw	13.4 MHz
T2		1	838.2125 MHz	12.13 dBm		
M2		1	824.188 MHz	-11.53 dBm		
D3	M2	1	14.6 MHz	1.18 dB		

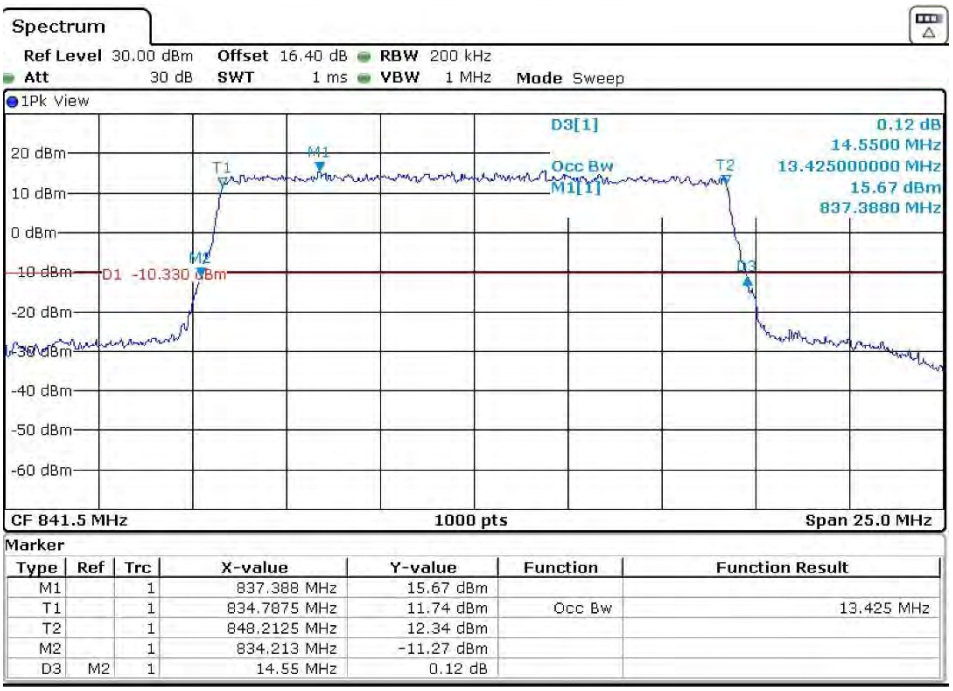
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	842.688 MHz	15.86 dBm		
T1		1	829.8125 MHz	10.96 dBm	Occ Bw	13.425 MHz
T2		1	843.2375 MHz	11.62 dBm		
M2		1	829.213 MHz	-10.64 dBm		
D3	M2	1	14.6 MHz	0.30 dB		

Highest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	837.388 MHz	15.67 dBm		
T1		1	834.7875 MHz	11.74 dBm	Occ Bw	13.425 MHz
T2		1	848.2125 MHz	12.34 dBm		
M2		1	834.213 MHz	-11.27 dBm		
D3	M2	1	14.55 MHz	0.12 dB		

Spurious emissions at antenna terminals

SPECIFICATION

FCC §2.1051 and §22.917

RSS-132. Clause 5.5.

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.

FCC §90.691.

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 divider.

The spectrum was investigated from 9 kHz to 10th harmonic for LTE Band 5 and 26.

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.

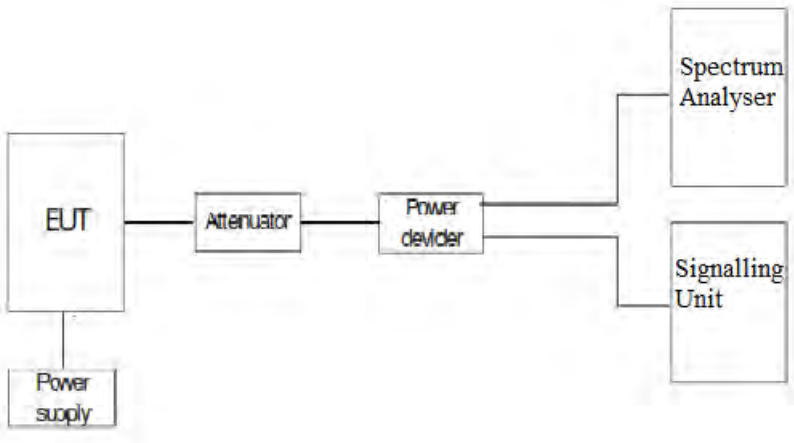
The configuration of Resource Blocks and modulation which is the worst case for conducted power was used.

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

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP



RESULTS (see plots in next pages)

814-824MHz Band:

LTE Band 26 (QPSK MODULATION. BW = 1.4 MHz)

1. CHANNEL: LOWEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.62925	-29.47	< ± 1.20
2.44405	-26.03	< ± 1.20

2. CHANNEL: HIGHEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.64665	-23.64	< ± 1.20
2.46955	-24.97	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 3 MHz)

1. CHANNEL: LOWEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.623255	-31.92	< ± 1.20
2.44915	-31.34	< ± 1.20

2. CHANNEL: HIGHEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.64335	-27.69	< ± 1.20
2.46745	-30.48	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 5 MHz)

1. CHANNEL: LOWEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.63585	-30.65	< ± 1.20
2.44945	-31.38	< ± 1.20

2. CHANNEL: HIGHEST

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.64305	-29.36	< ± 1.20
2.46325	-31.79	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 10 MHz)

1. CHANNEL: MIDDLE

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.63795	-31.85	< ± 1.20
2.45785	-34.46	< ± 1.20

Cross-rule channel (824MHz):

LTE Band 26 (QPSK MODULATION. BW = 1.4 MHz)

1. CHANNEL (26790) 824MHz:

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.6472	-30.71	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 3 MHz)

1. CHANNEL (26790) 824MHz:

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.6483	-31.13	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 5 MHz)

1. CHANNEL (26790) 824MHz:

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.6527	-30.93	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 10 MHz)

1. CHANNEL (26790) 824MHz:

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.6571	-30.78	< ± 1.20

LTE Band 26 (QPSK MODULATION. BW = 15 MHz)

1. CHANNEL (26790) 824MHz:

Spurious frequency (GHz)	Level (dBm)	Measurement uncertainty (dB)
1.6615	-30.40	< ± 1.20

824-849MHz Band:

LTE Band 5 (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 Band 5 (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 Band 5 (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 Band 5 (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

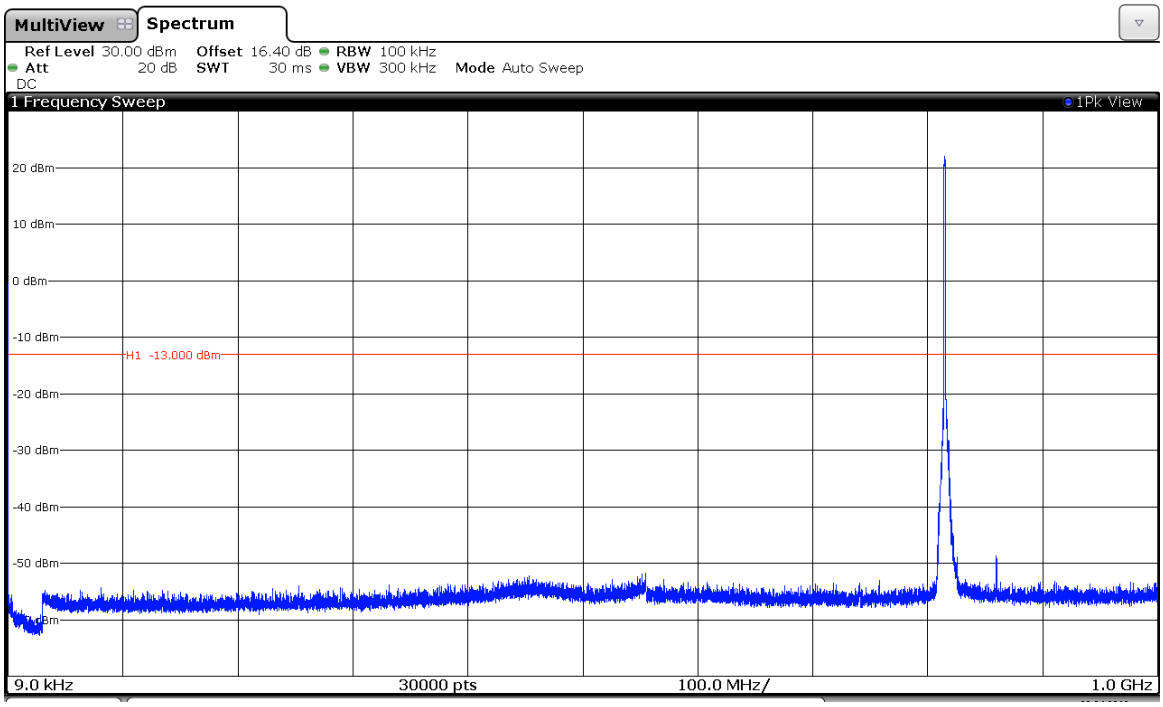
No spurious signals were found at less than 20dB respect to the limit in all the range.

Verdict: PASS

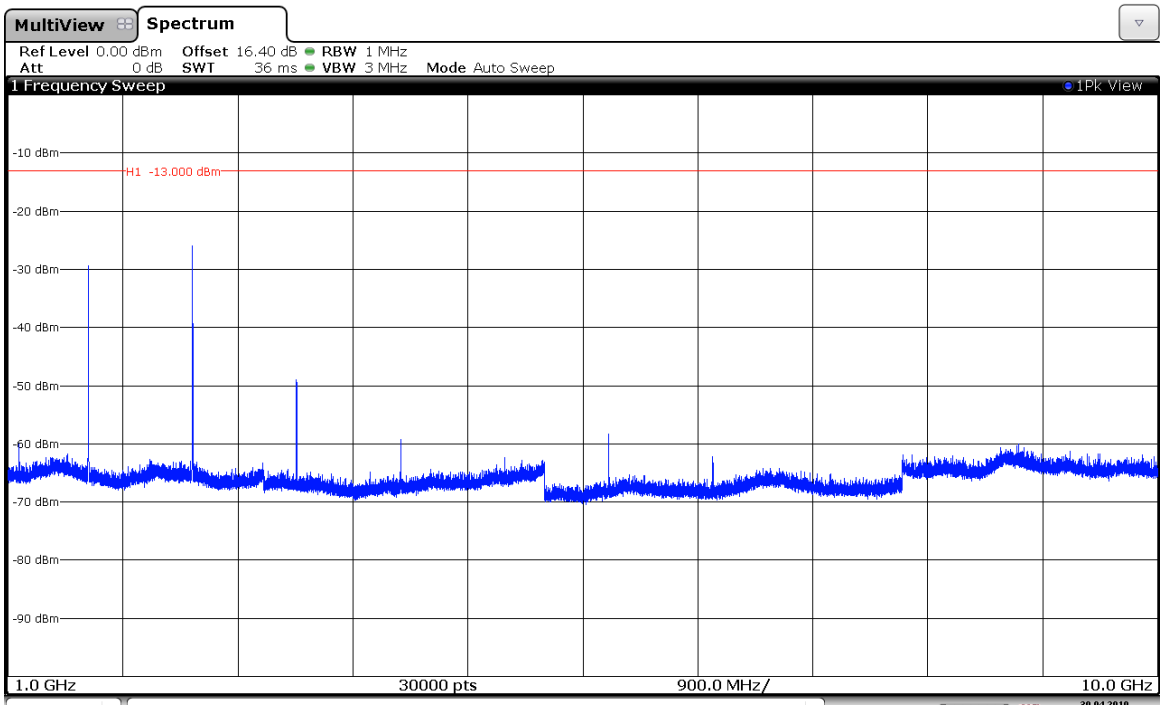
814-824MHz Band:

LTE Band 26 (QPSK MODULATION. BW = 1.4 MHz)

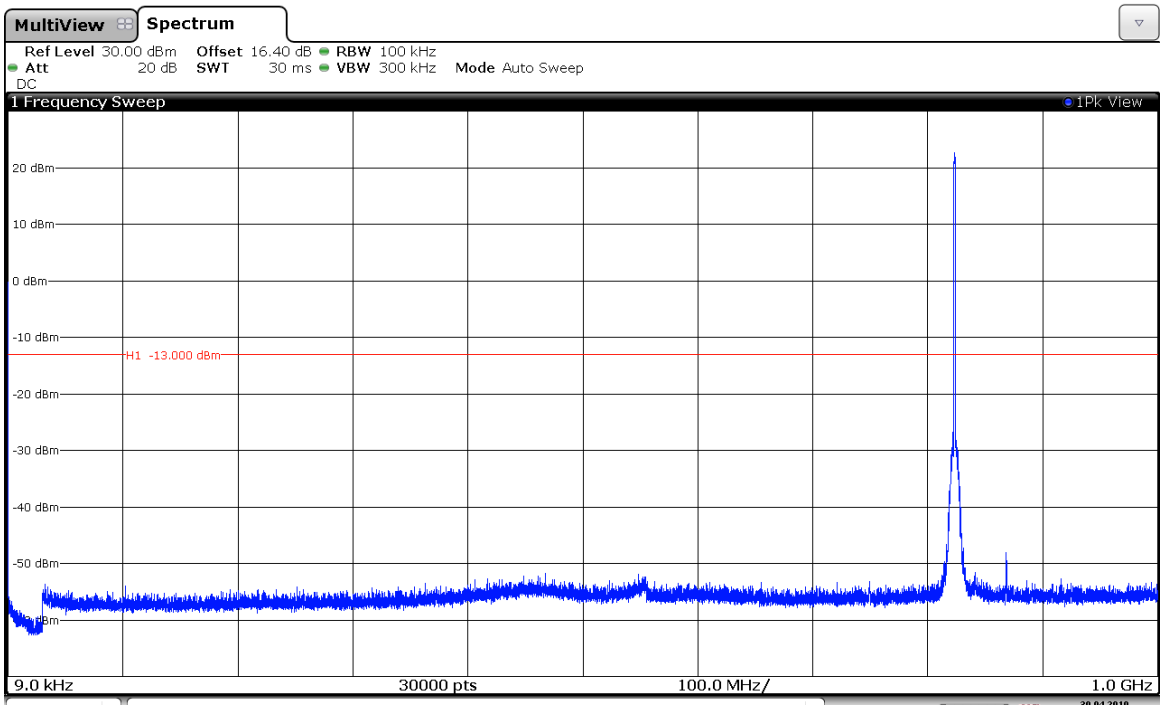
1. CHANNEL: LOWEST



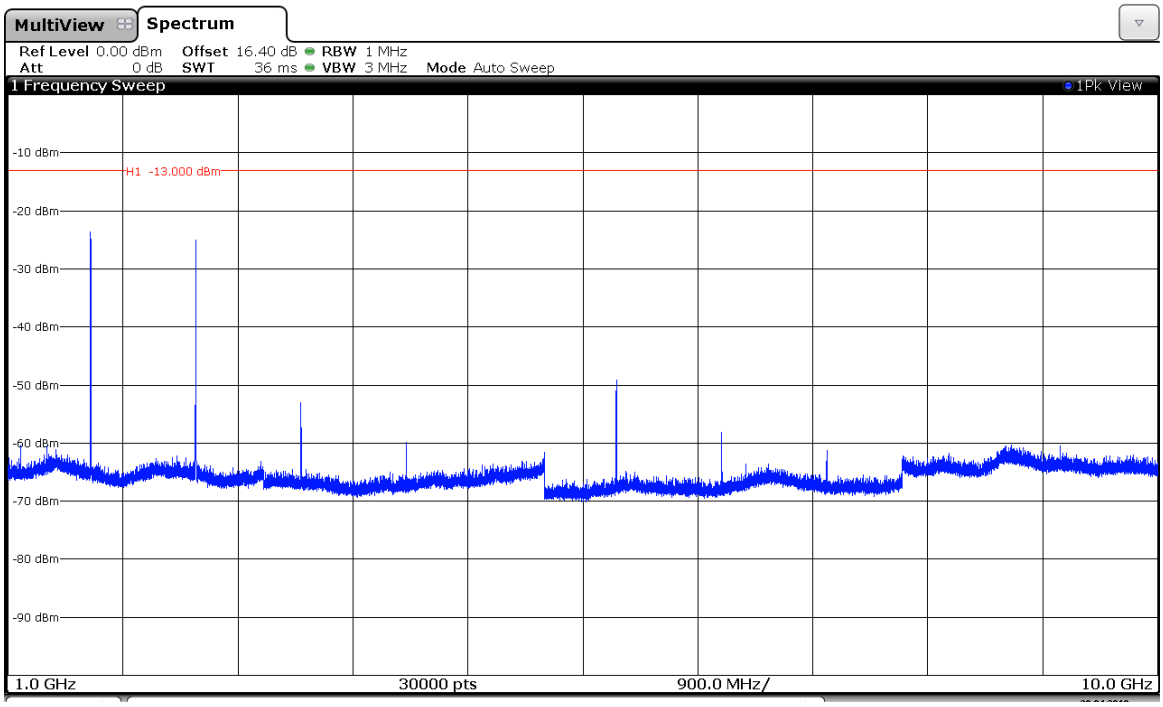
Note: The peak above the limit is the carrier frequency.



2. CHANNEL: HIGHEST

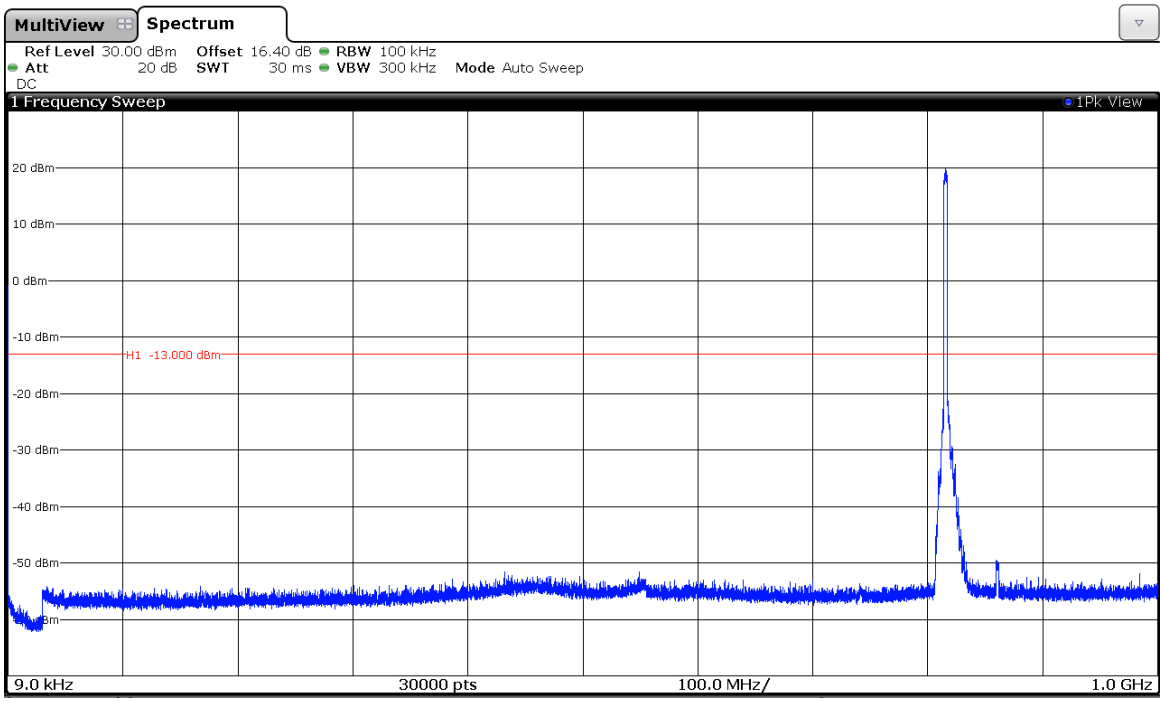


Note: The peak above the limit is the carrier frequency.

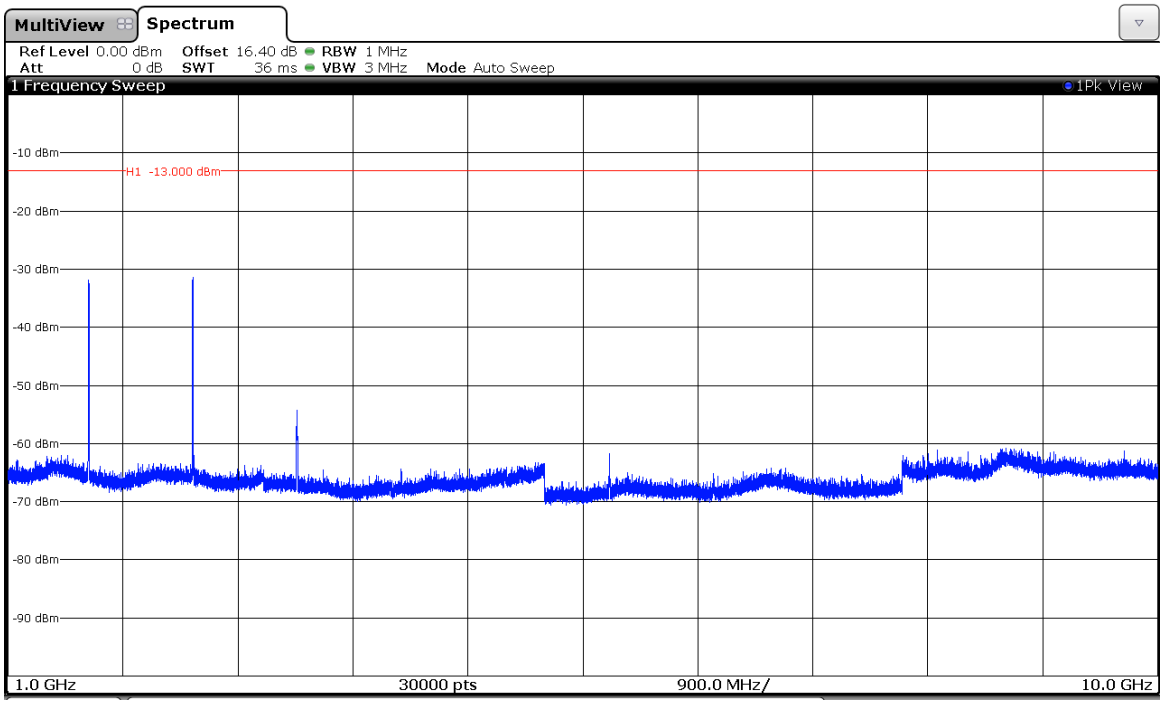


LTE Band 26 (QPSK MODULATION. BW = 3 MHz)

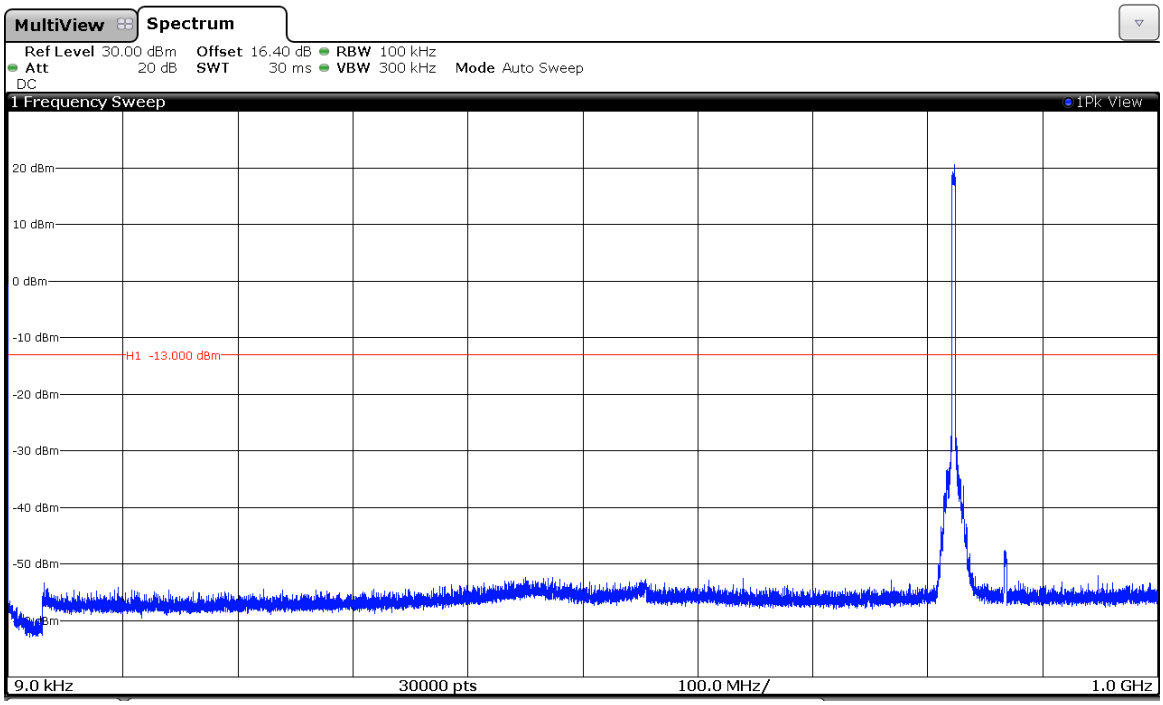
1. CHANNEL: LOWEST



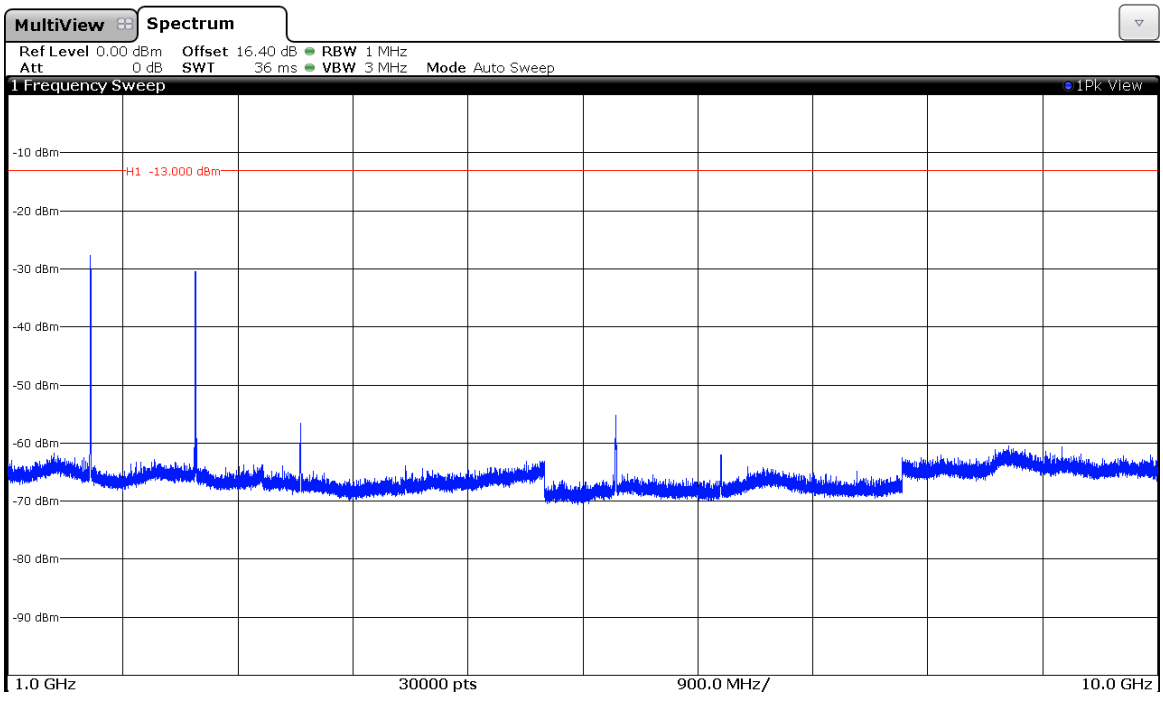
Note: The peak above the limit is the carrier frequency.



2. CHANNEL: HIGHEST

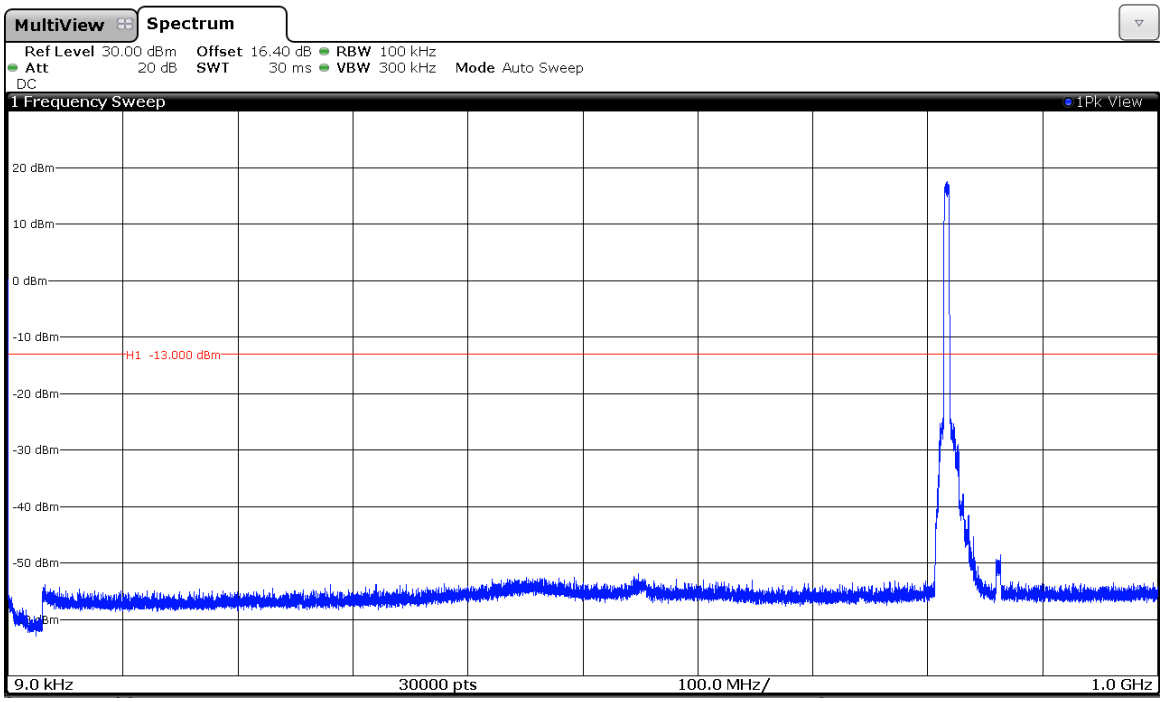


Note: The peak above the limit is the carrier frequency.

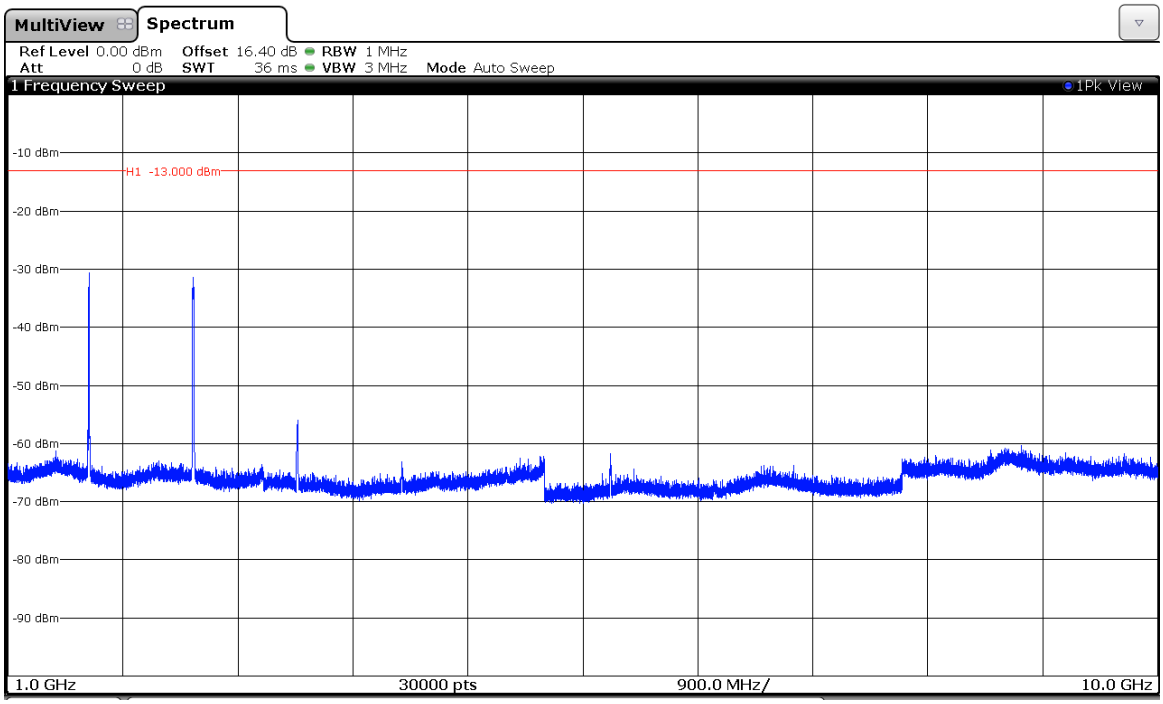


LTE Band 26 (QPSK MODULATION. BW = 5 MHz)

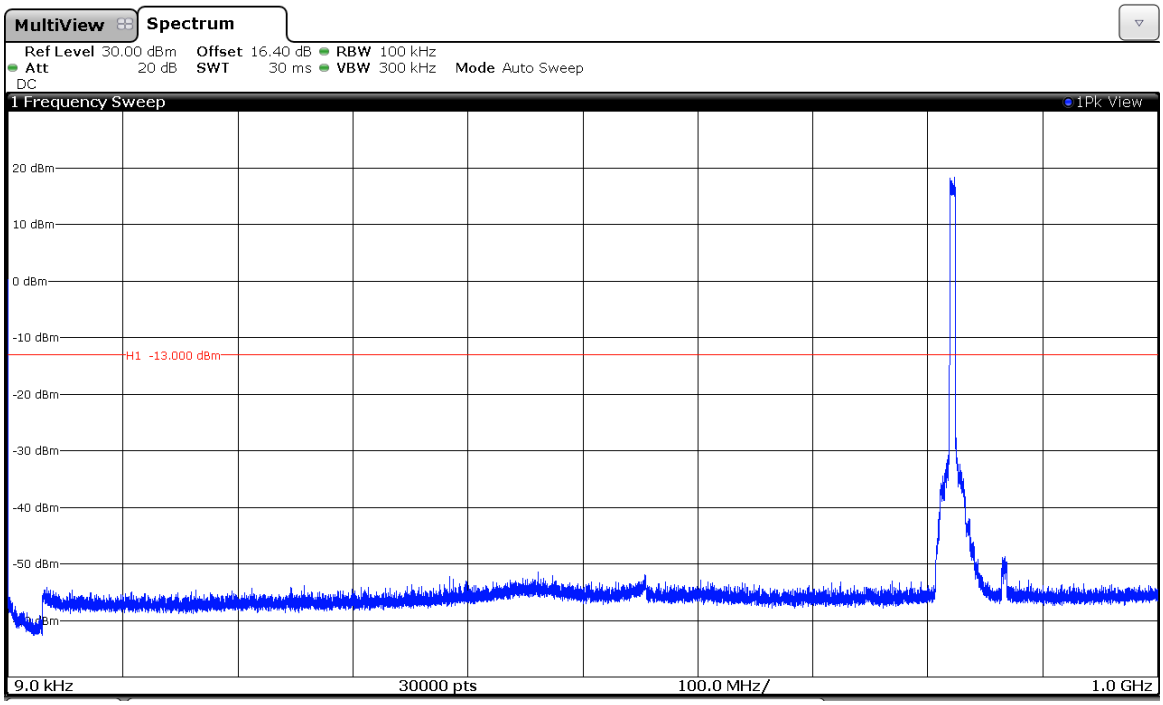
1. CHANNEL: LOWEST



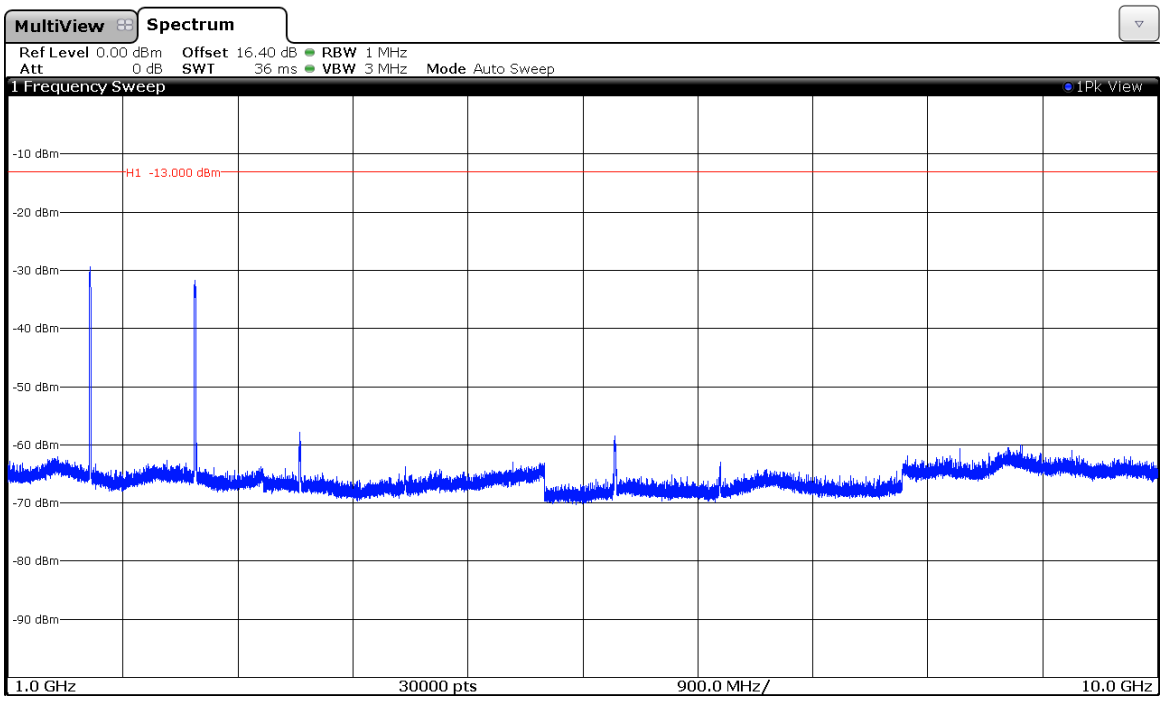
Note: The peak above the limit is the carrier frequency.



2. CHANNEL: HIGHEST

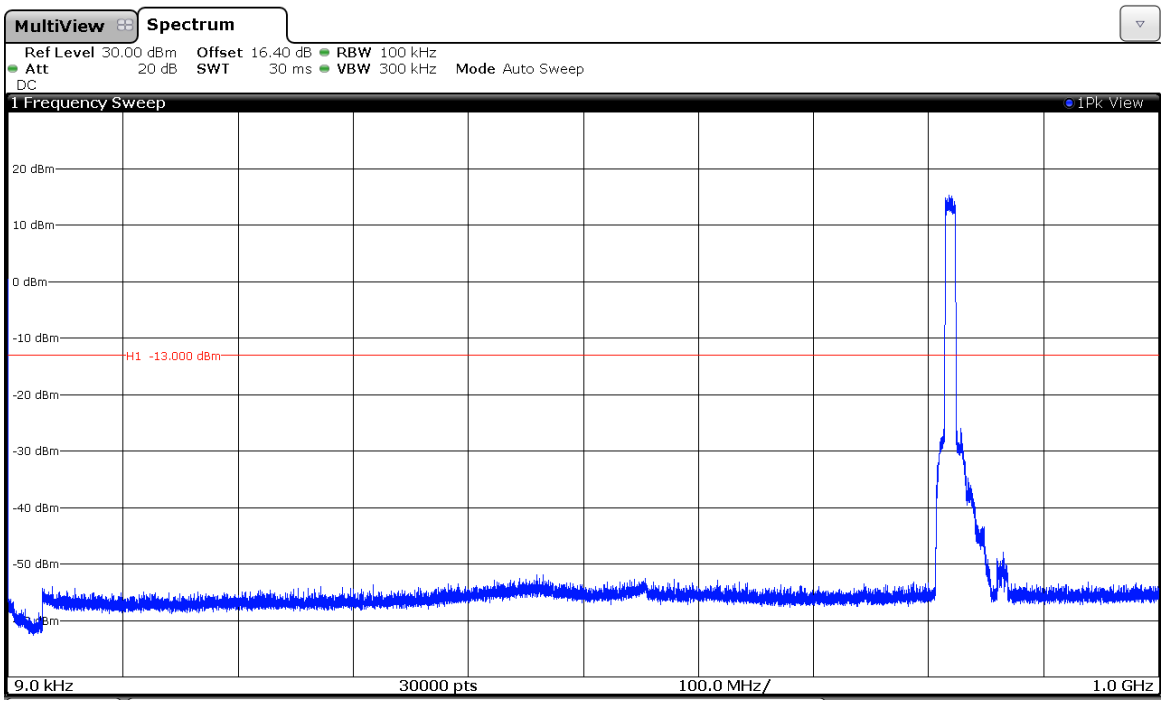


Note: The peak above the limit is the carrier frequency.

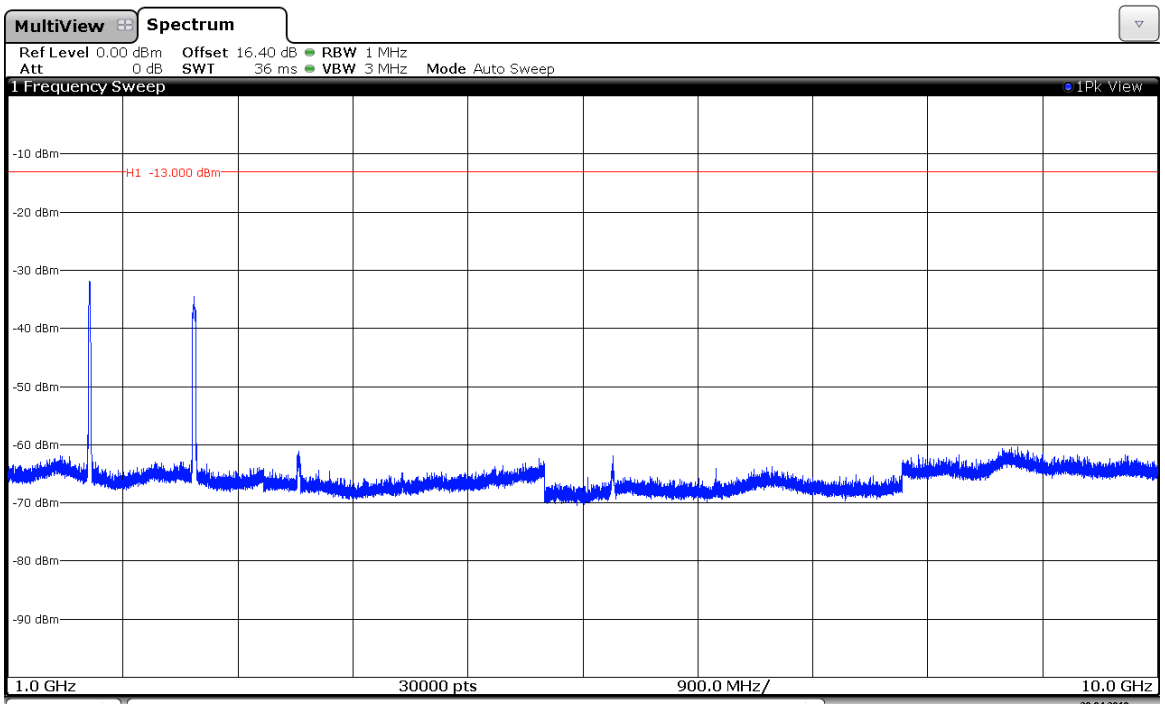


LTE Band 26 (QPSK MODULATION. BW = 10 MHz)

1. CHANNEL: MIDDLE

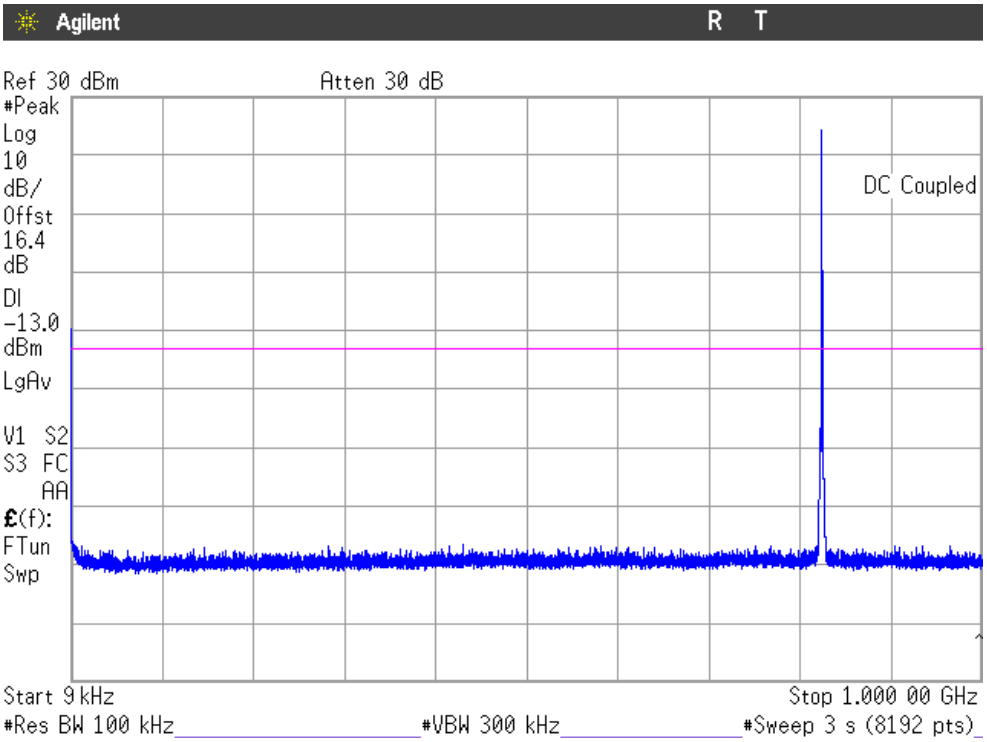


Note: The peak above the limit is the carrier frequency.

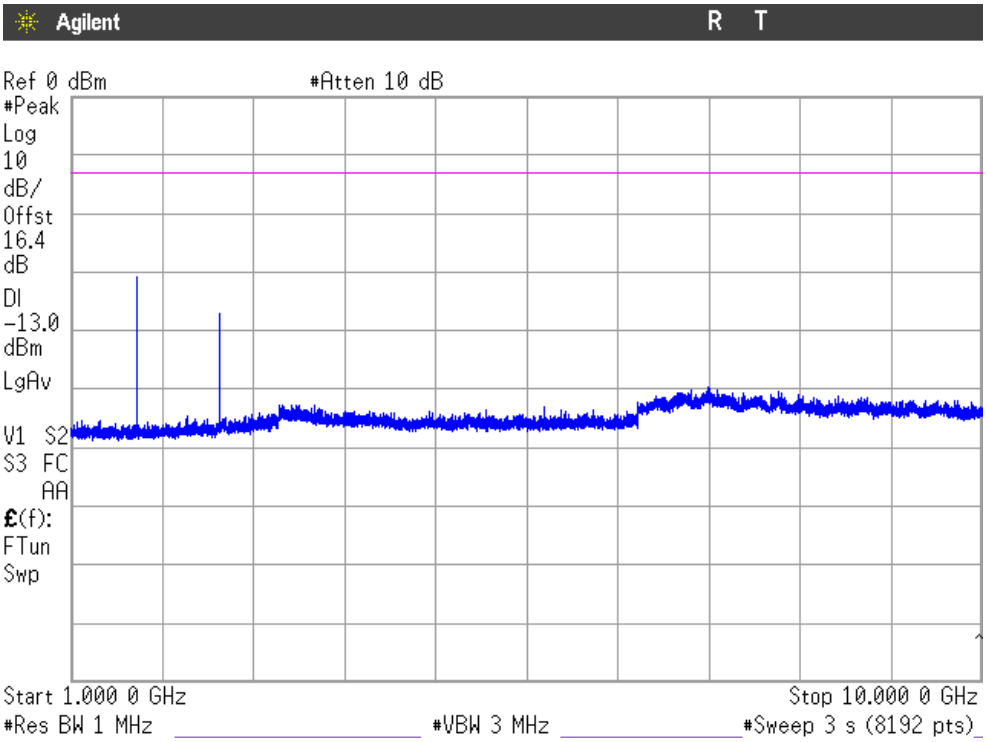


Cross-rule channel (824MHz):

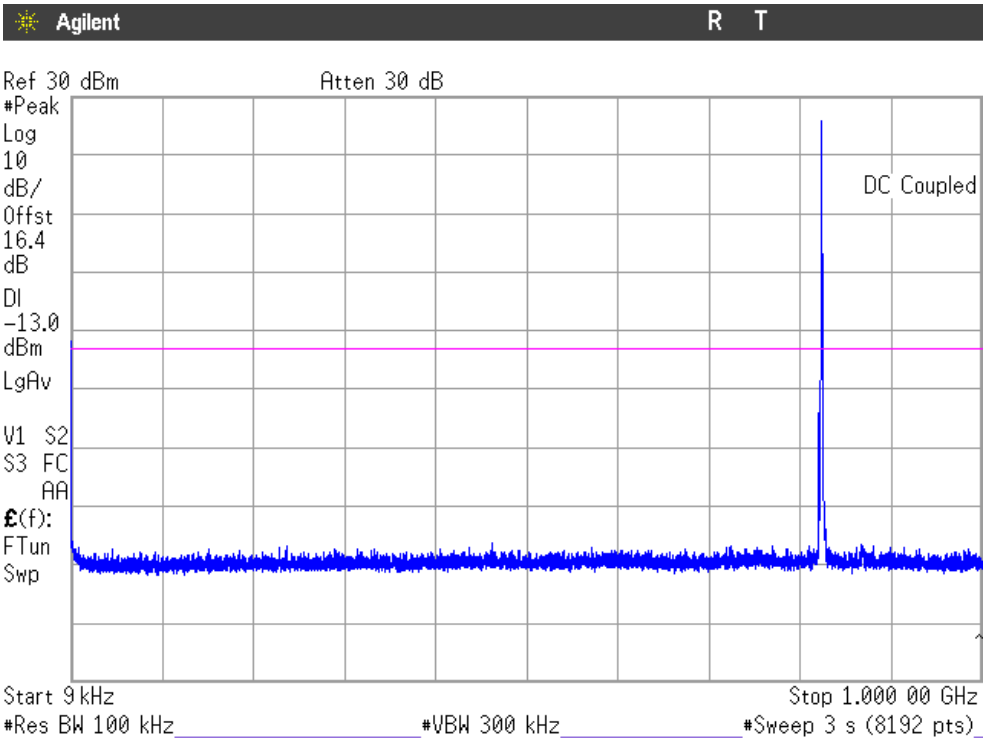
LTE Band 26 (QPSK MODULATION. BW = 1.4 MHz)



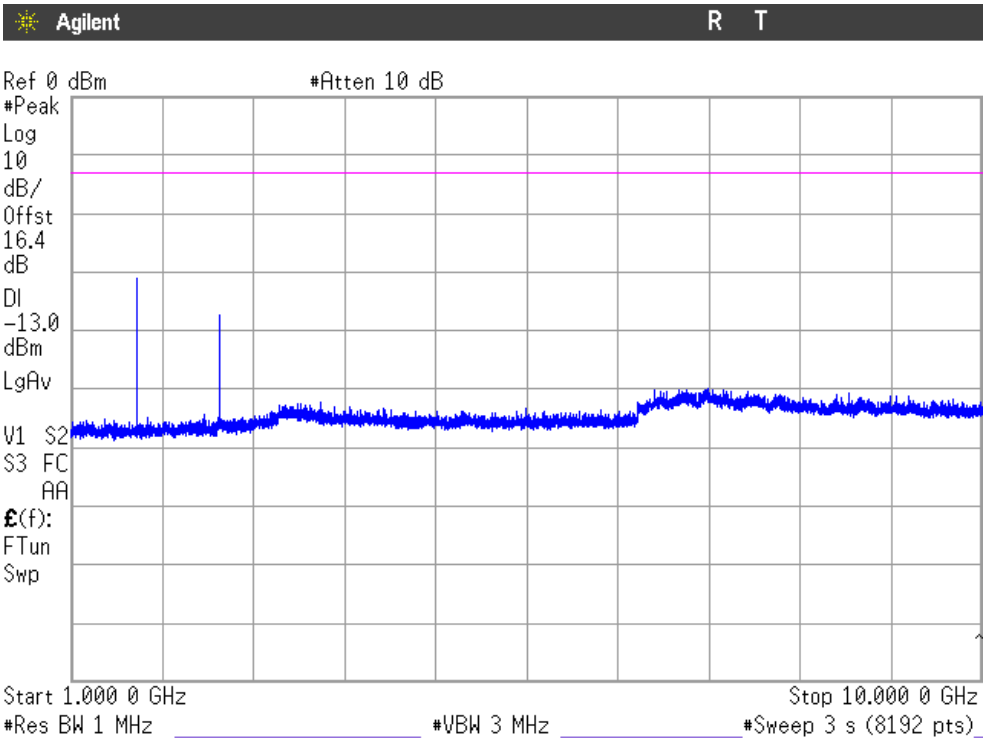
Note: The peak above the limit is the carrier frequency.



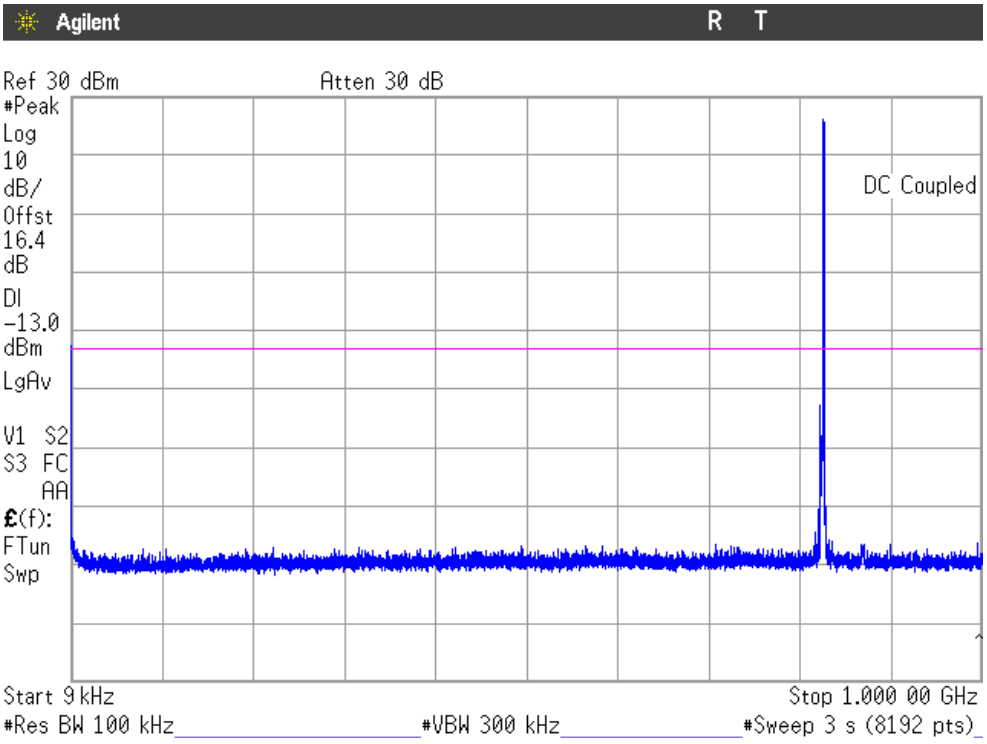
LTE Band 26 (QPSK MODULATION. BW = 3 MHz)



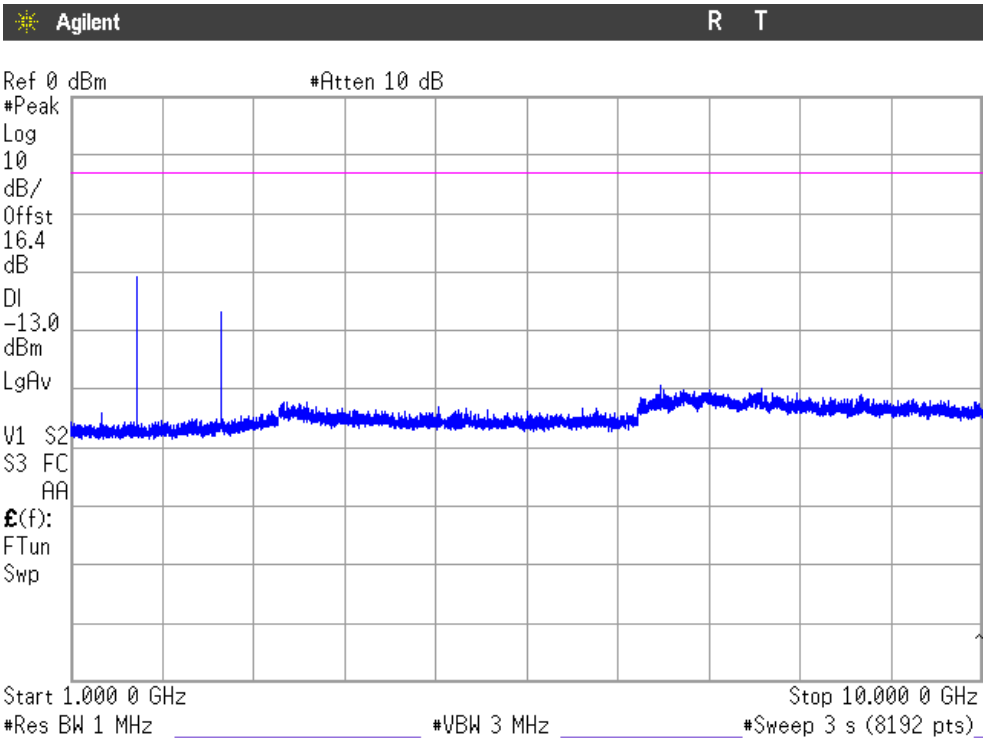
Note: The peak above the limit is the carrier frequency.



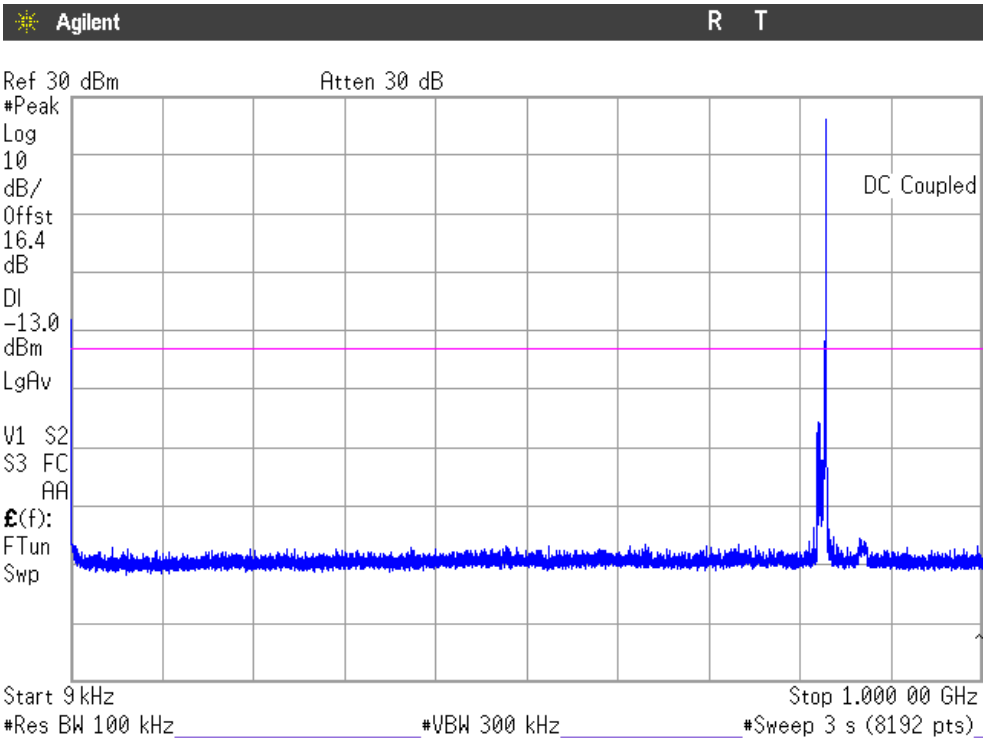
LTE Band 26 (QPSK MODULATION. BW = 5 MHz)



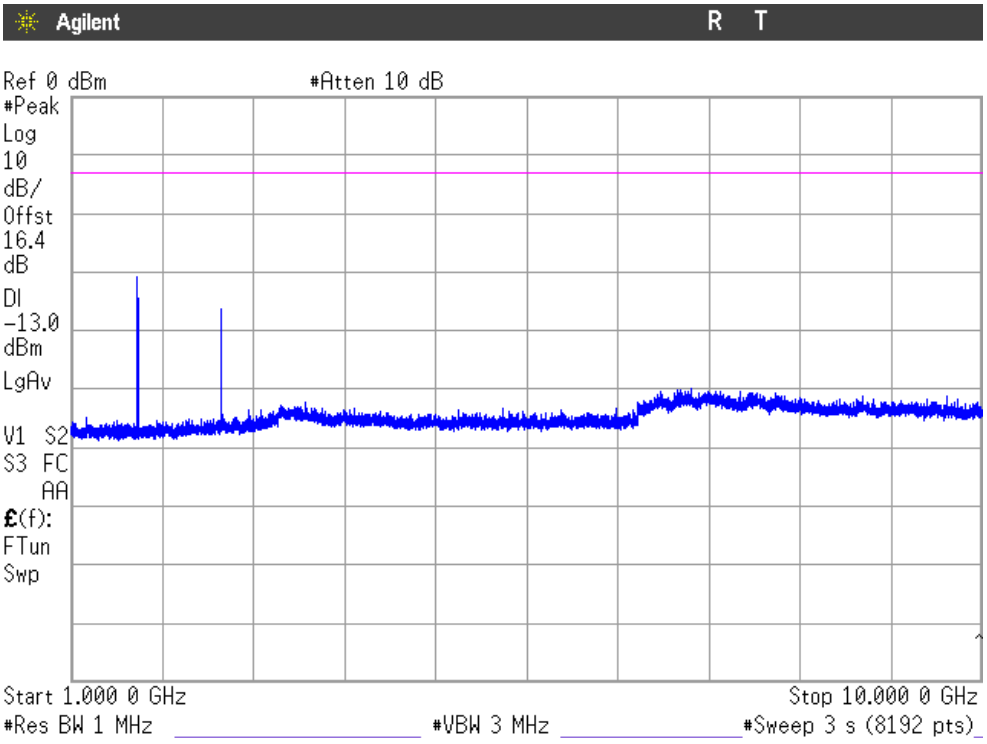
Note: The peak above the limit is the carrier frequency.



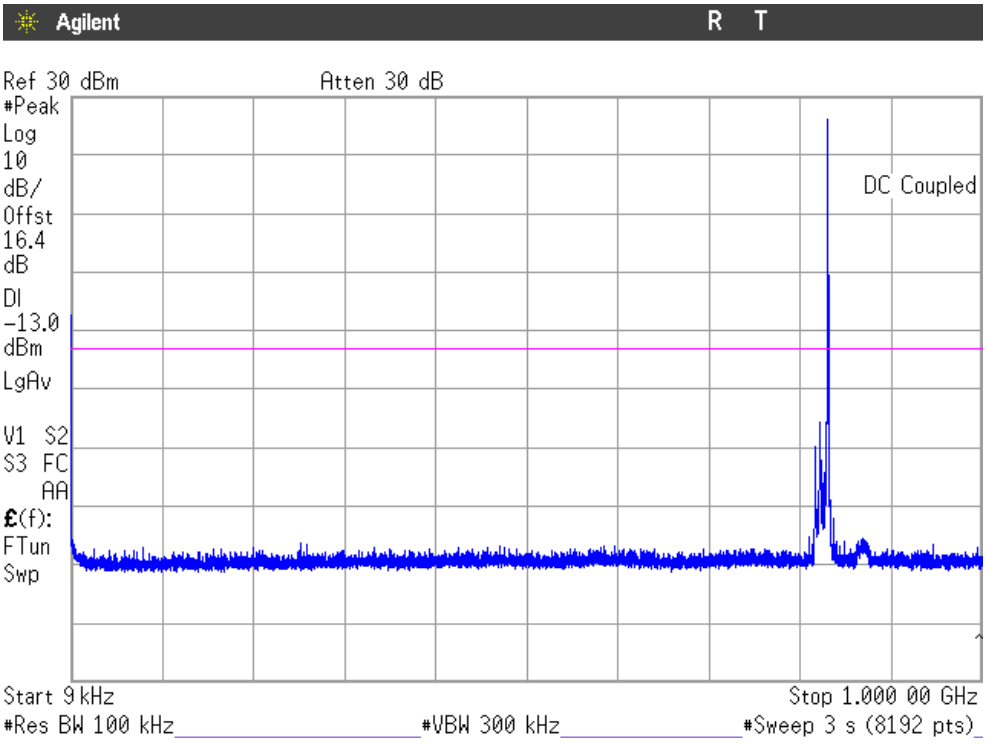
LTE Band 26 (QPSK MODULATION. BW = 10 MHz)



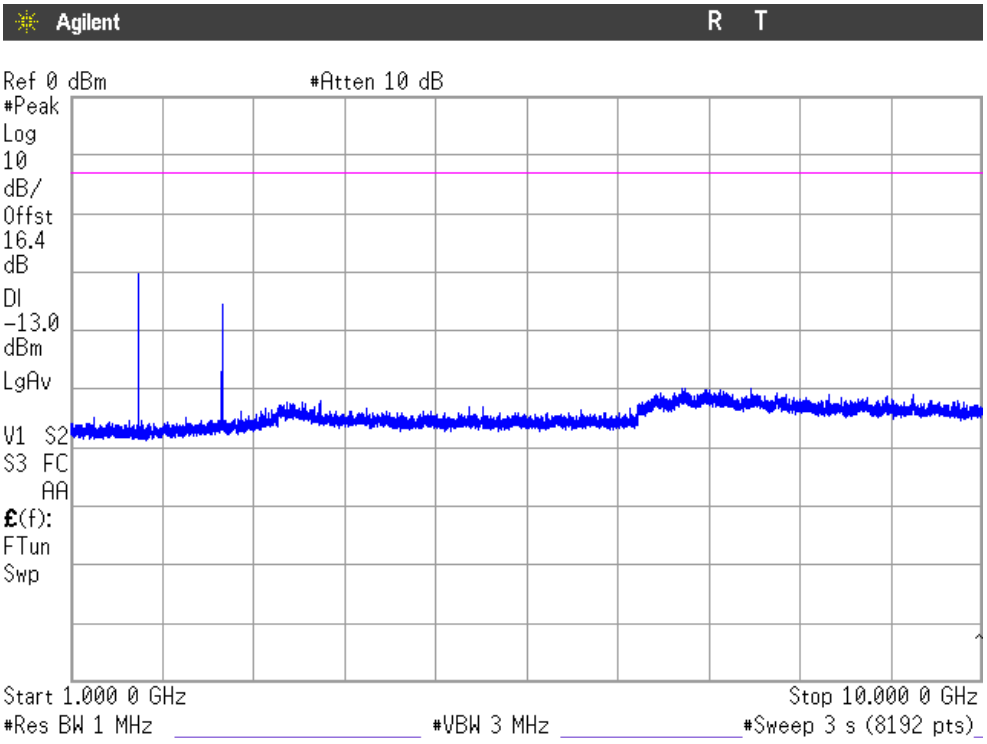
Note: The peak above the limit is the carrier frequency.



LTE Band 26 (QPSK MODULATION. BW = 15 MHz)



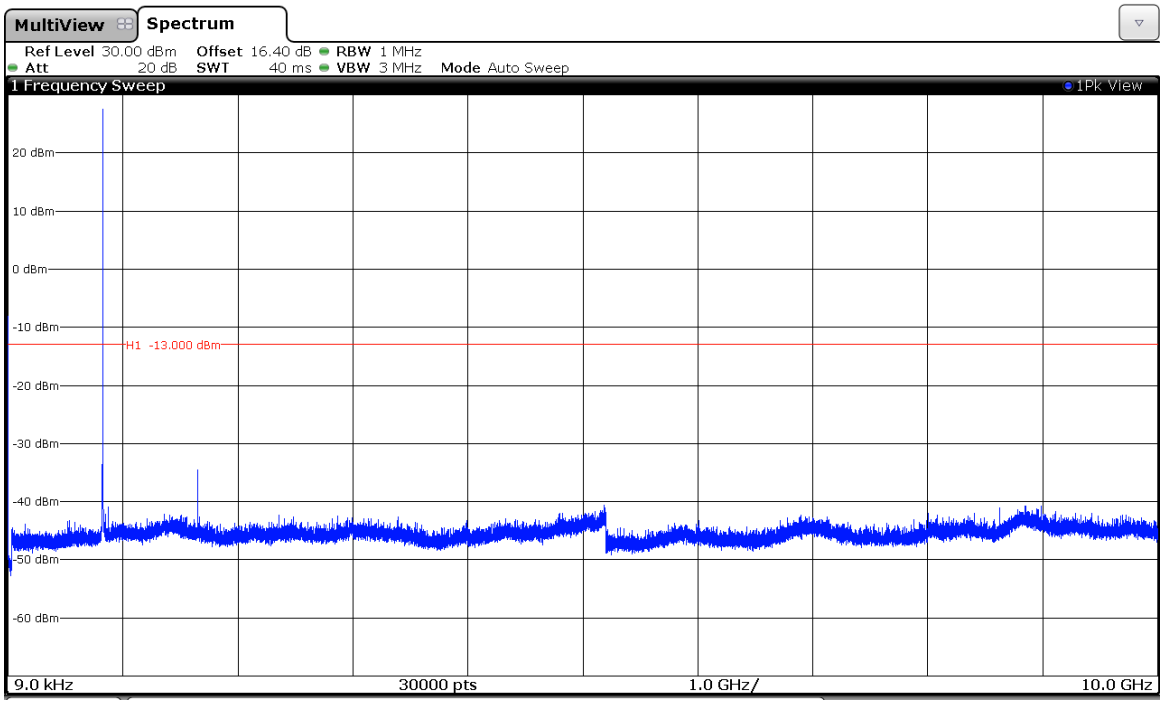
Note: The peak above the limit is the carrier frequency.



824-849MHz Band:

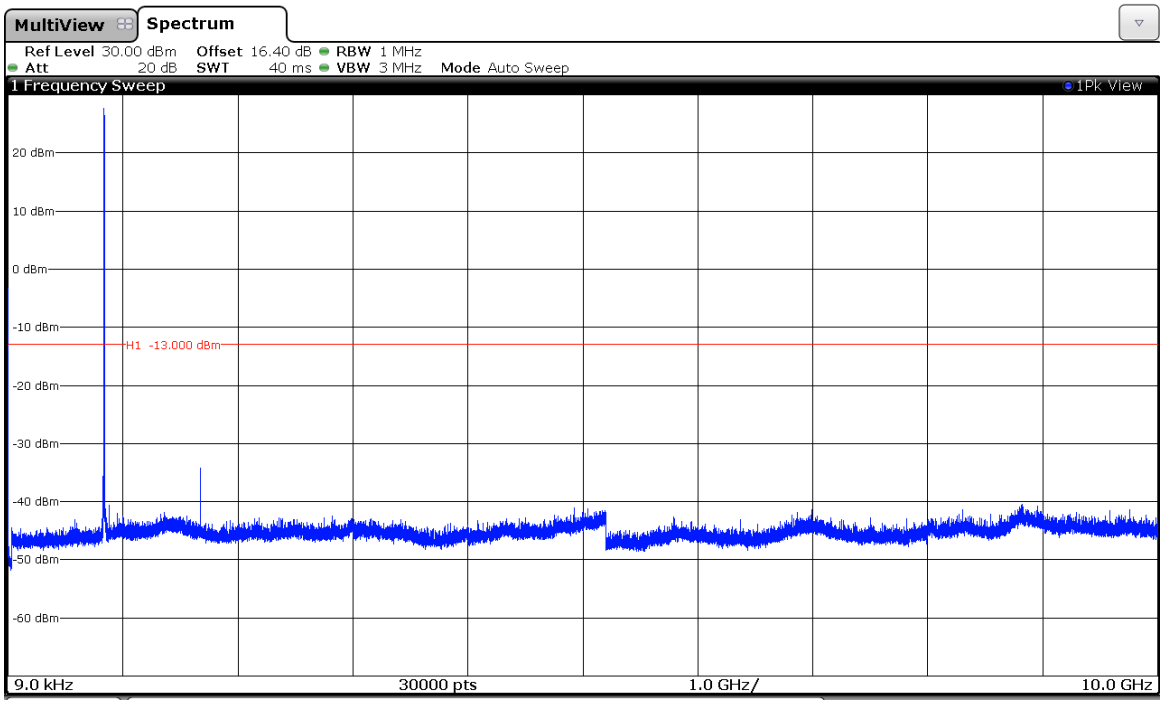
LTE Band 5 (QPSK MODULATION. BW = 1.4 MHz)

1. CHANNEL: LOWEST



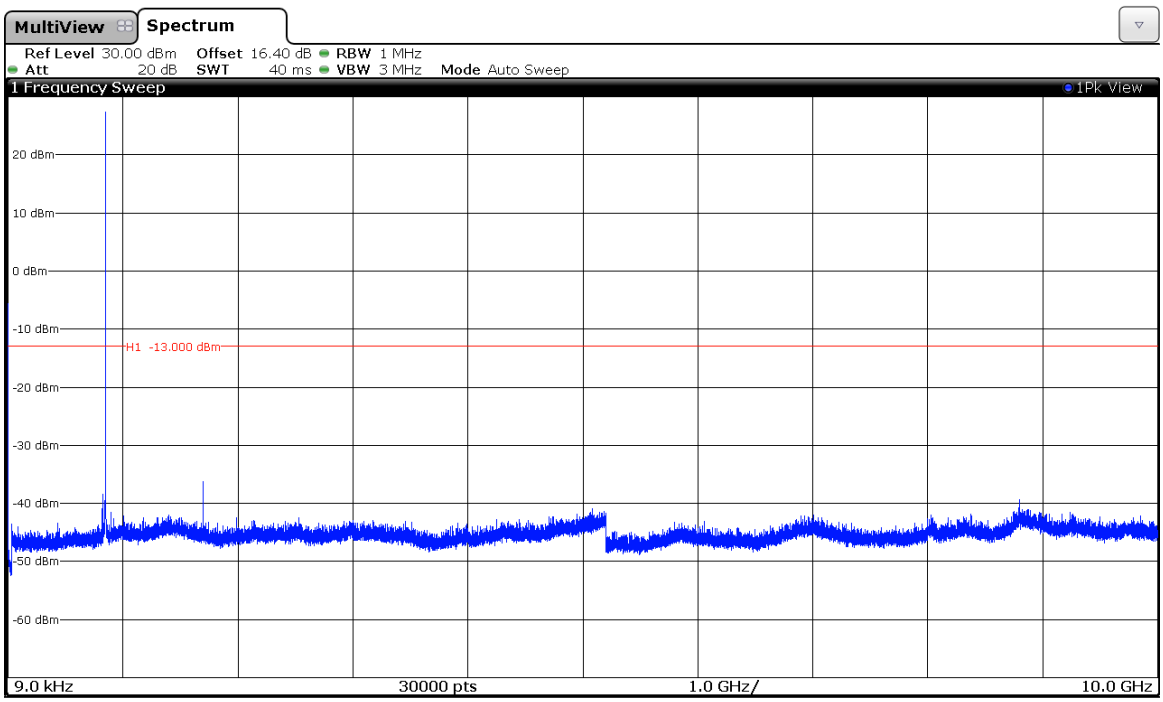
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

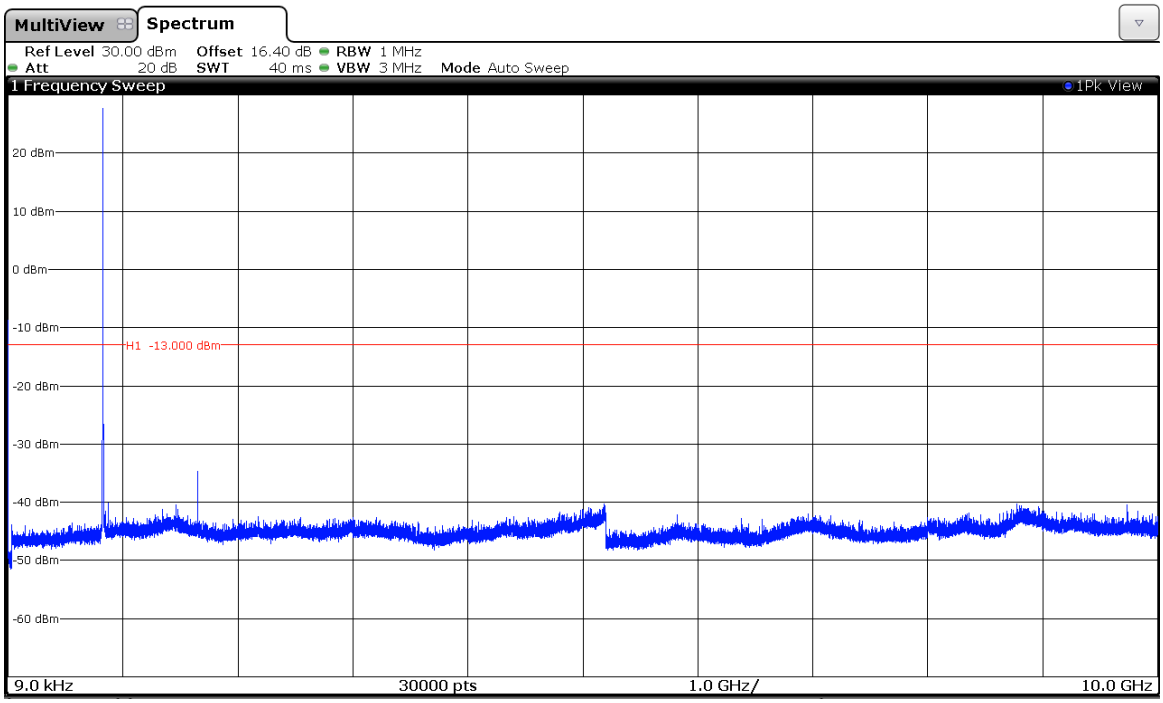
3. CHANNEL: HIGHEST



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

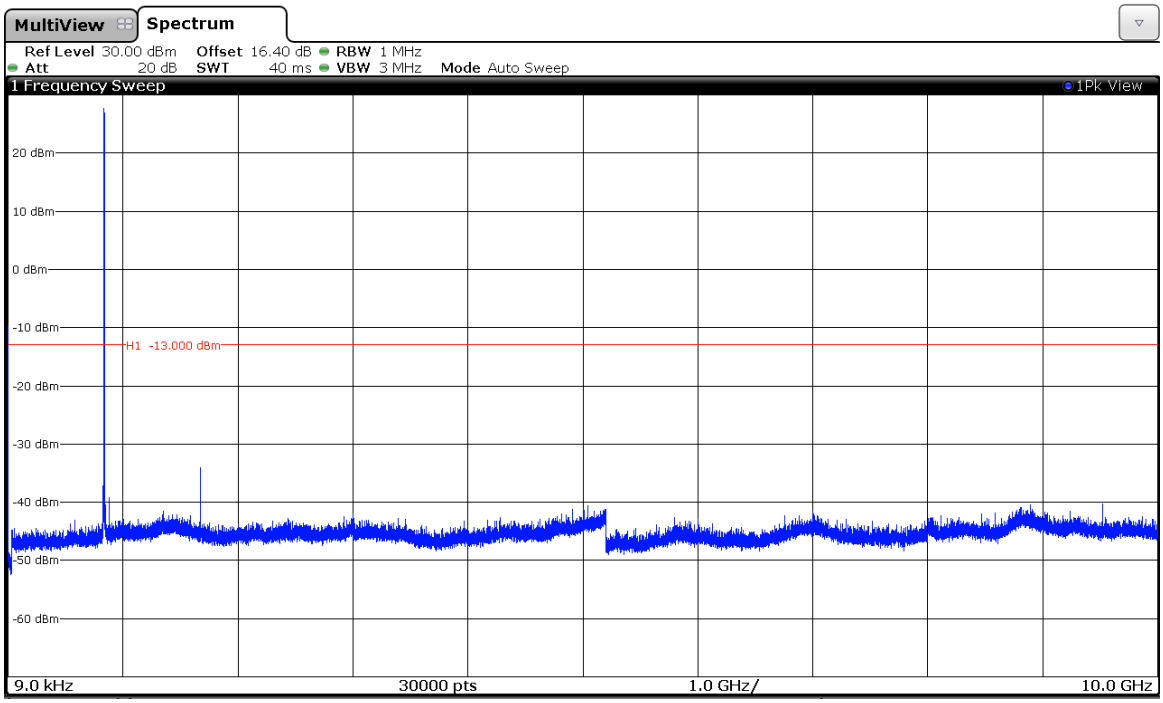
LTE Band 5 (QPSK MODULATION. BW = 3 MHz)

1. CHANNEL: LOWEST



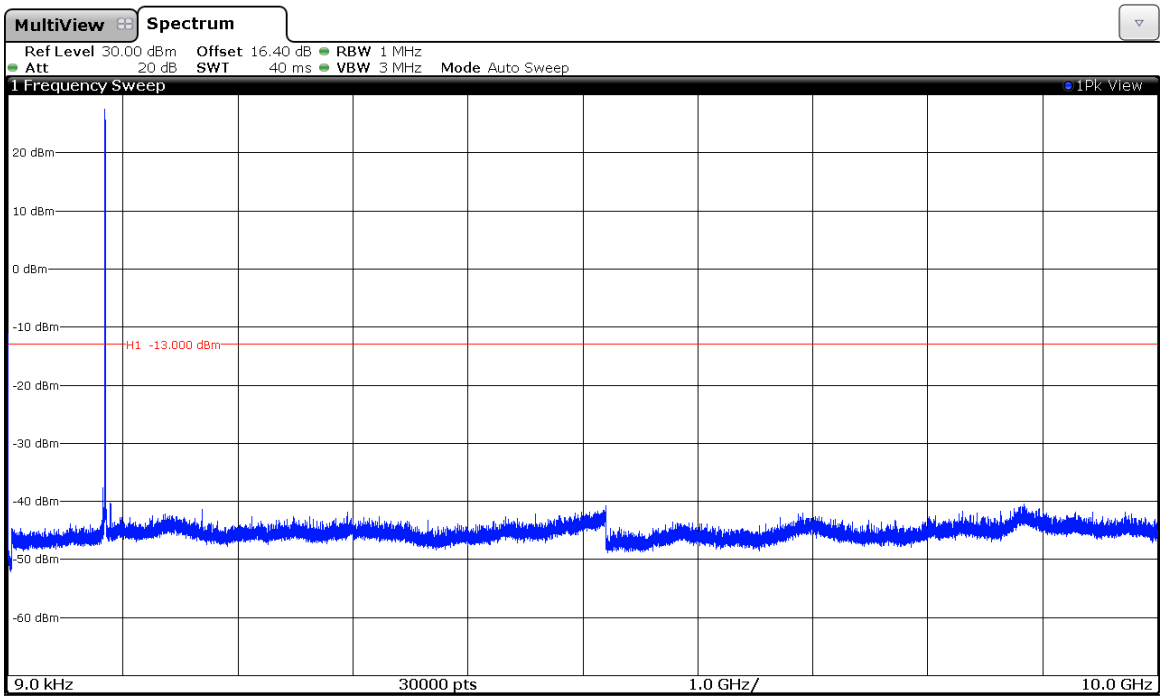
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

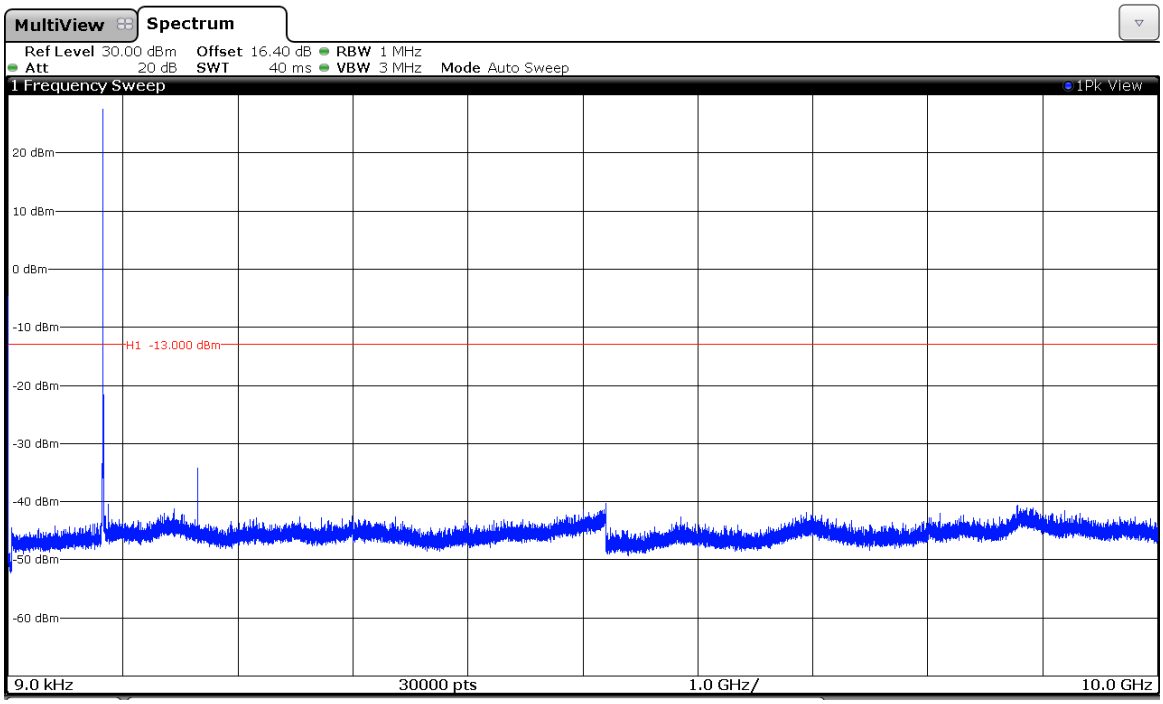
3. CHANNEL: HIGHEST



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

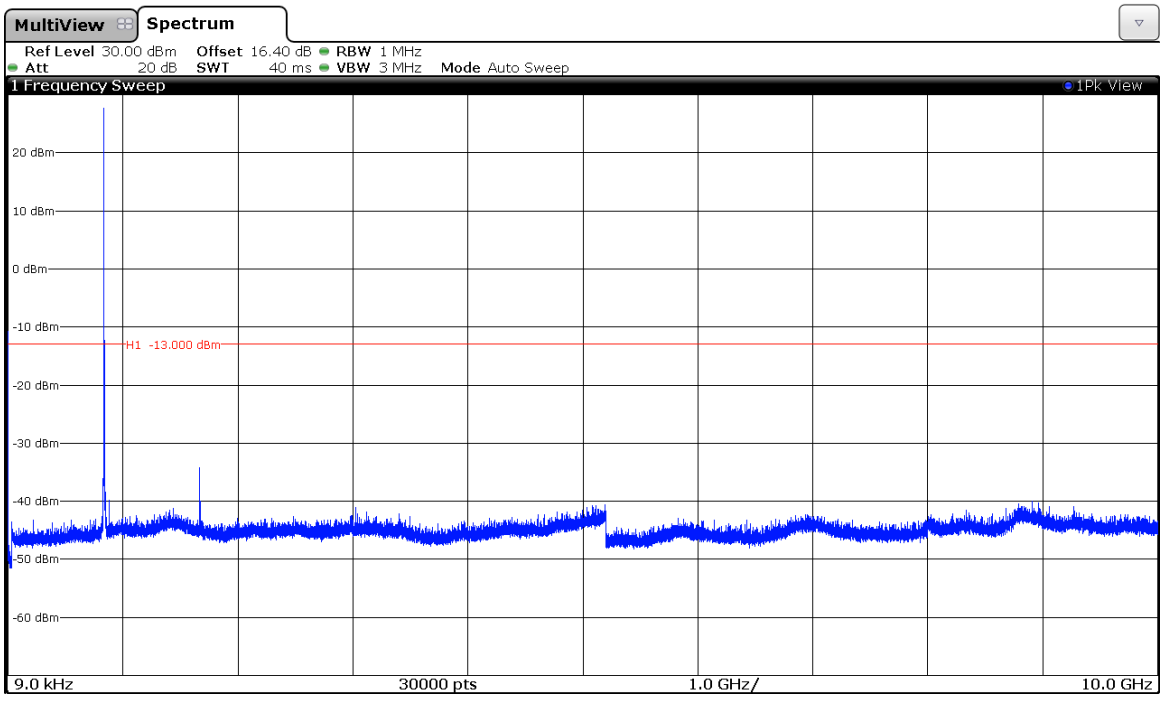
LTE Band 5 (QPSK MODULATION. BW = 5 MHz)

1. CHANNEL: LOWEST



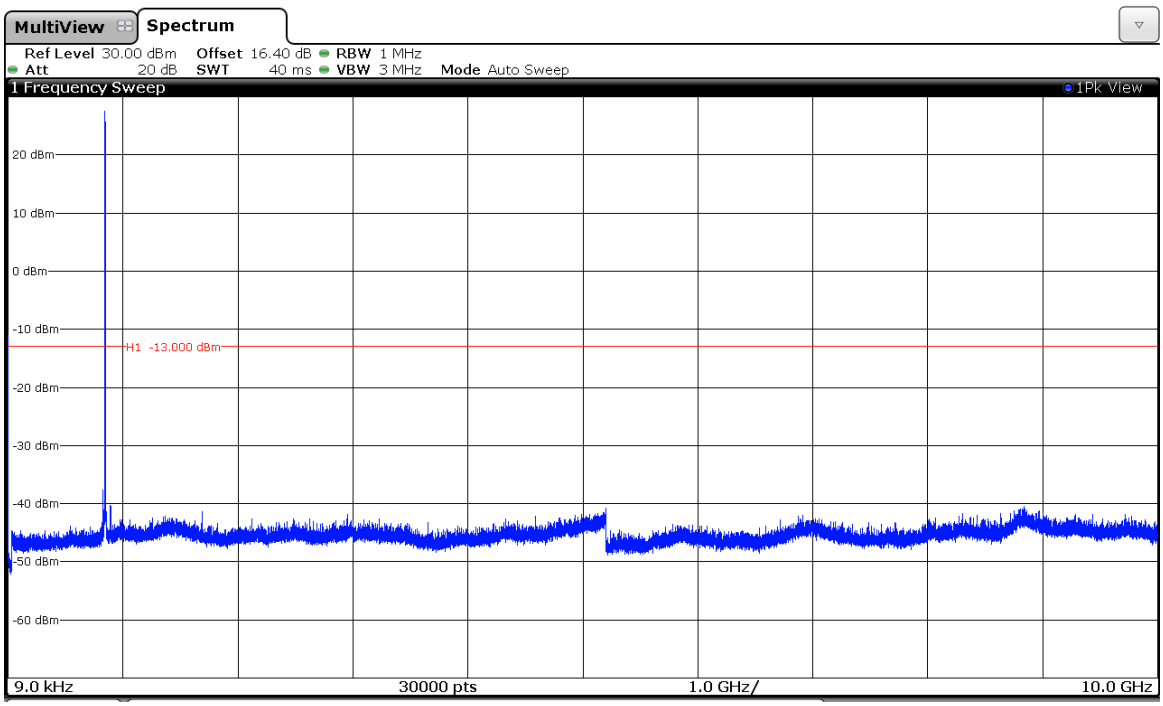
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE



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

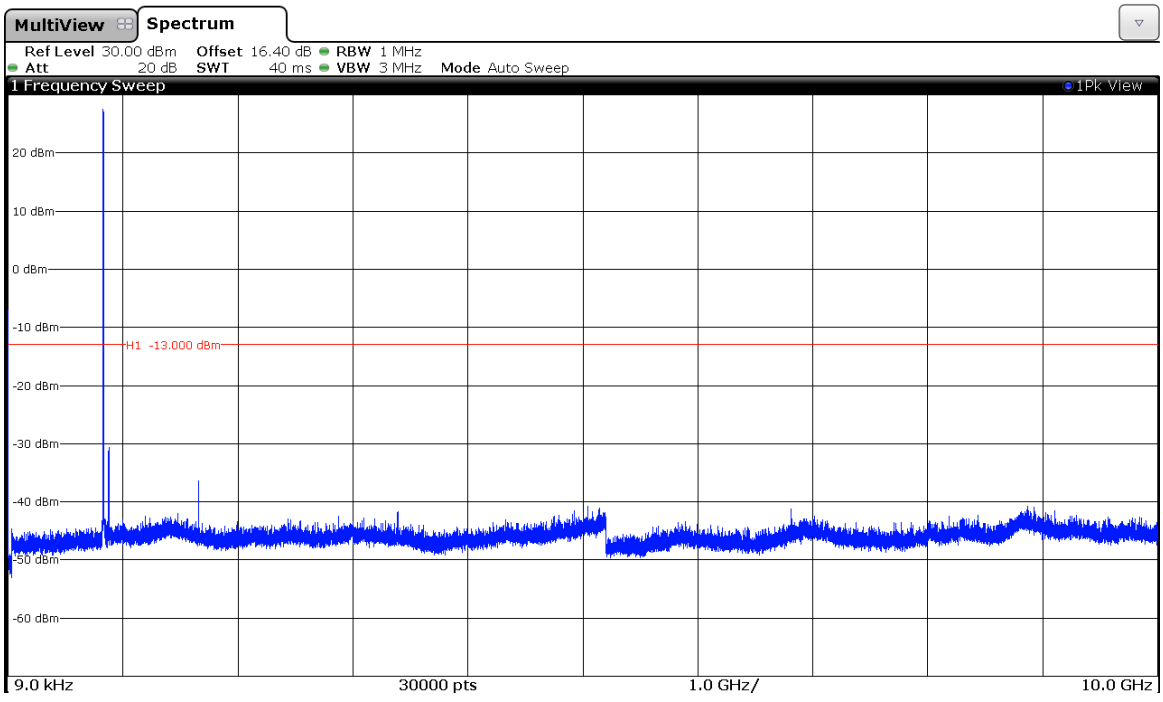
3. CHANNEL: HIGHEST



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

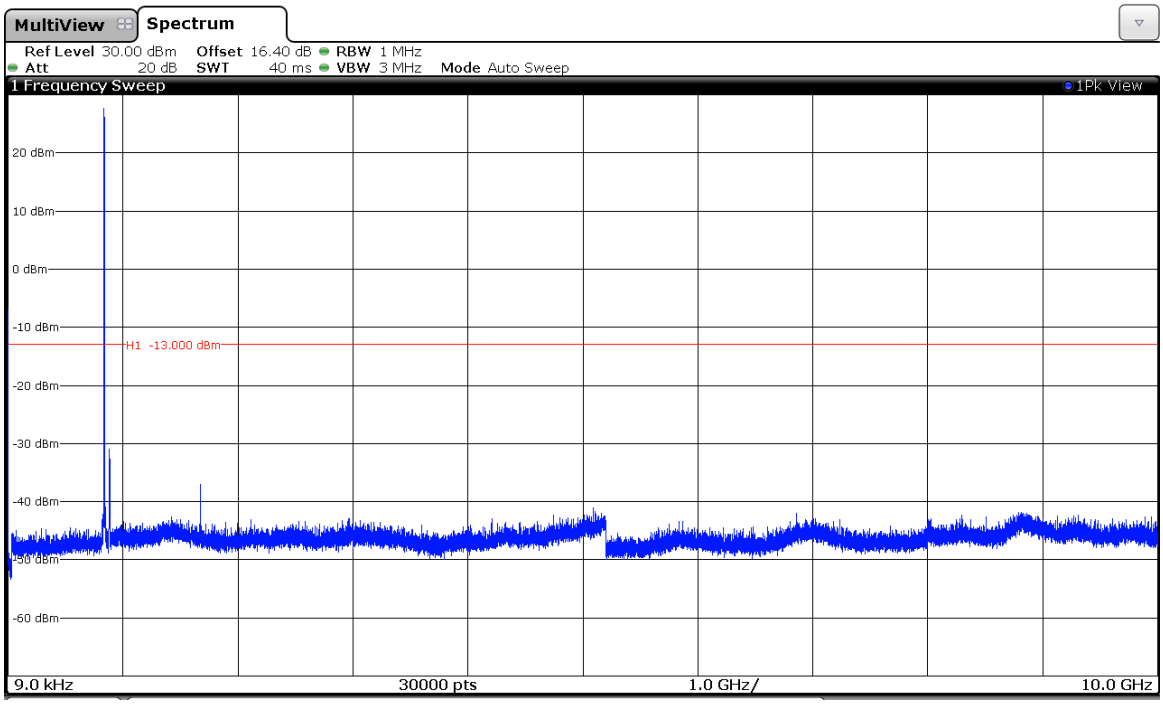
LTE Band 5 (QPSK MODULATION. BW = 10 MHz)

1. CHANNEL: LOWEST



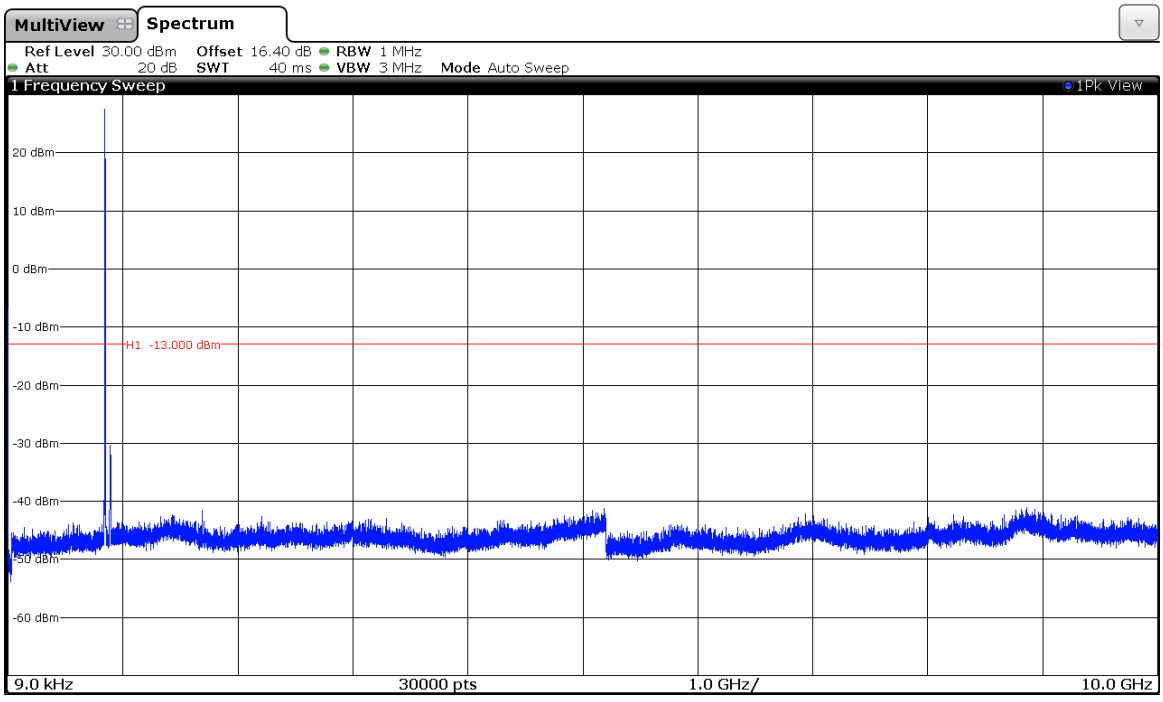
Note: The peak above the limit is the carrier frequency.

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.

Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

FCC §2.1051 and §22.917
RSS-132. Clause 5.5.

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.

FCC §90.691. Emission mask requirements for EA-based systems. Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:
(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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.

The configuration of modulation which is the worst case for conducted power was used.

As indicated in FCC part 22, 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.

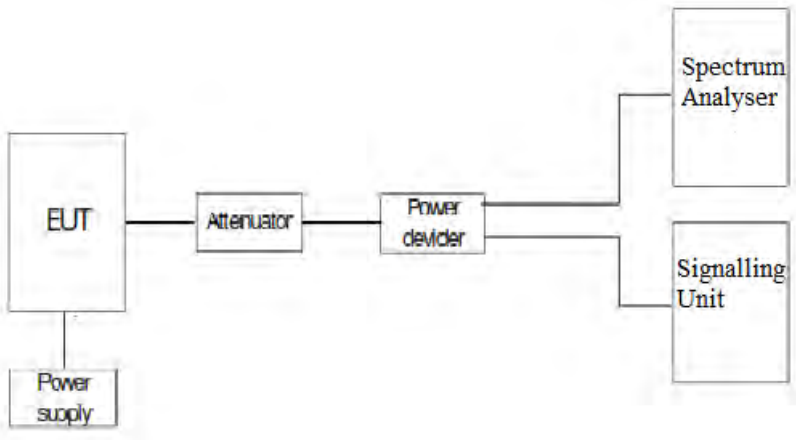
Measurement Limit:

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

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

TEST SETUP



RESULTS (see plots in next pages)

824-849MHz Band:

LTE BAND	LTE Band 5				LTE Band 26
LTE QPSK MODULATION:	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
Maximum measured level at lowest Block Edge at antenna port (dBm)	-31.48	-17.93	-23.16	-32.97	-28.74

LTE BAND	LTE Band 5				LTE Band 26
LTE QPSK MODULATION:	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
Maximum measured level at lowest Block Edge at antenna port (dBm)	-31.46	-23.34	-26.14	-28.20	-28.06

LTE BAND	LTE Band 5				LTE Band 26
LTE QPSK MODULATION:	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
Maximum measured level at highest Block Edge at antenna port (dBm)	-36.25	-20	-29.23	-34.42	-28.64

LTE BAND	LTE Band 5				LTE Band 26
LTE QPSK MODULATION:	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
Maximum measured level at highest Block Edge at antenna port (dBm)	-38.30	-25.88	-31.47	-30.87	-25.28

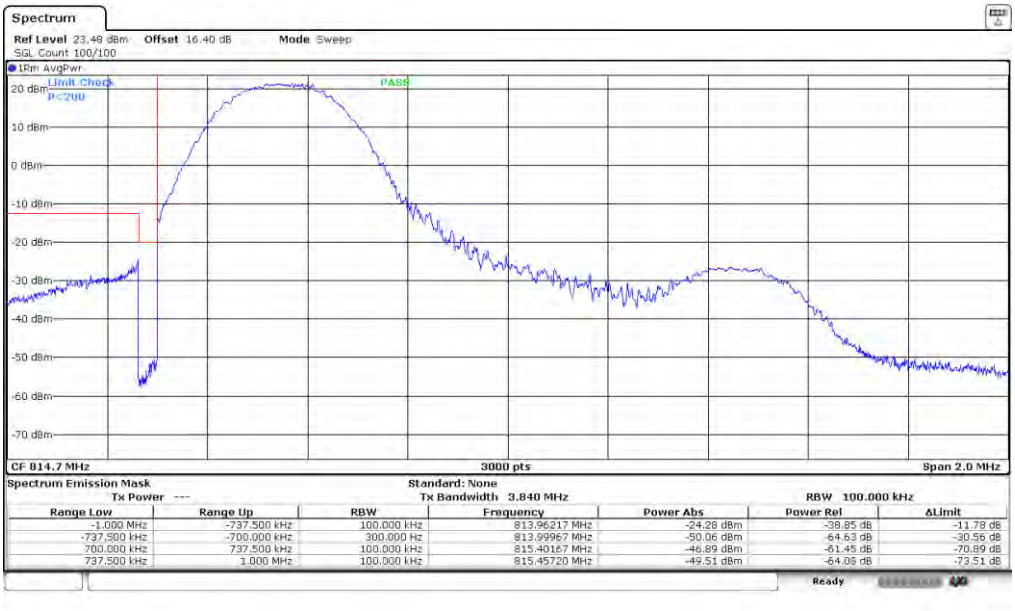
Measurement uncertainty = ±1.57 dB.

Verdict: PASS

814-824MHz Band "EA MASK":

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 1.4 MHz

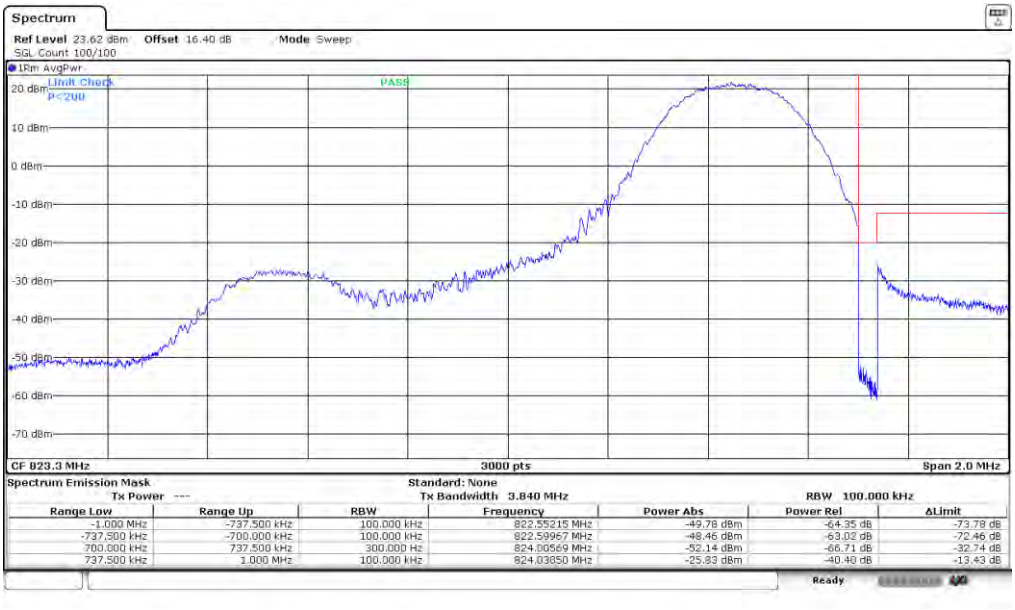
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = Max, BW = 1.4 MHz

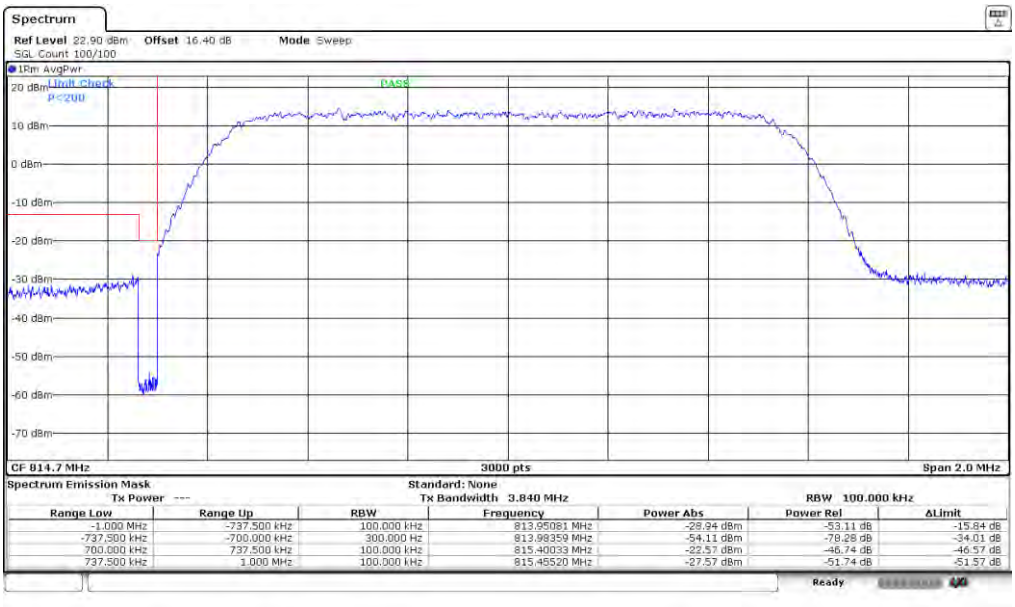
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

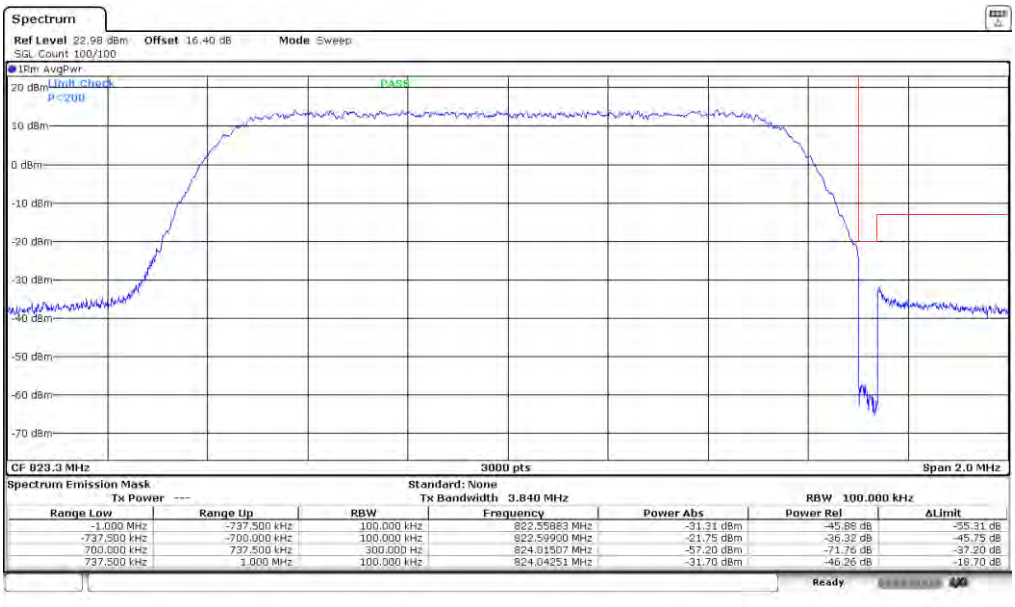
LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 1.4 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

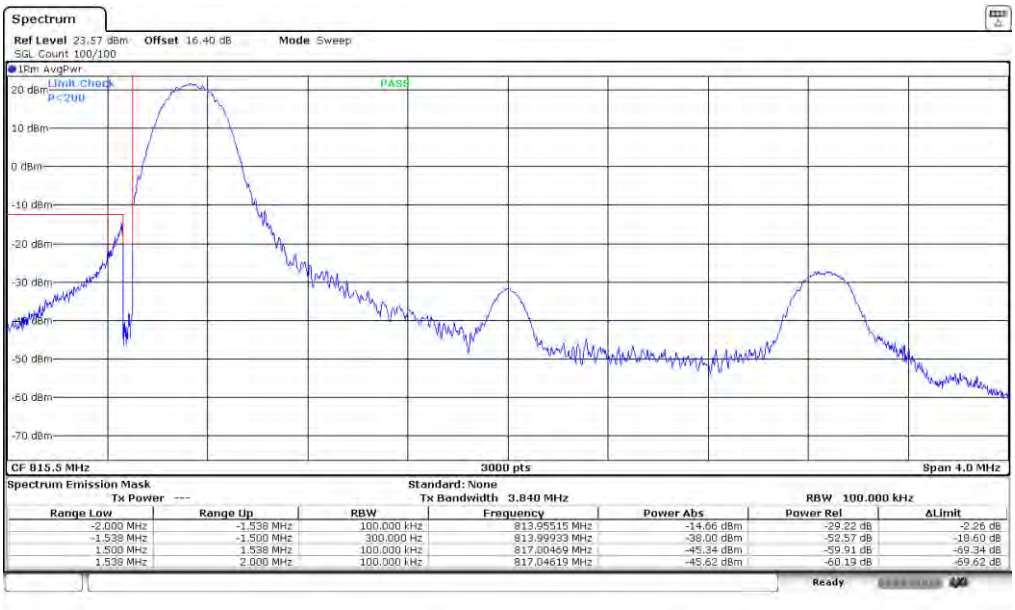


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 3 MHz

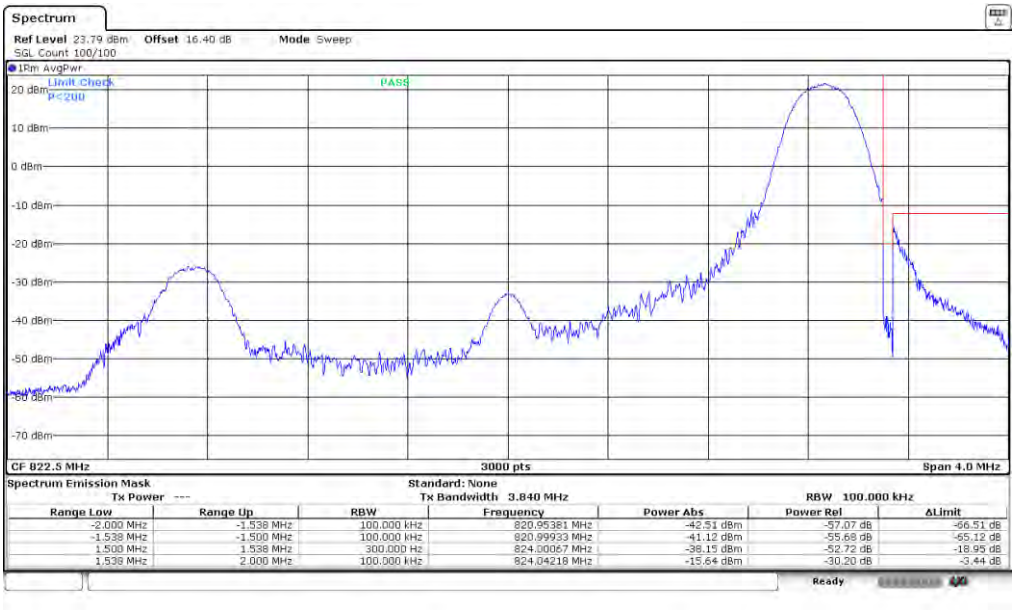
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = Max, BW = 3 MHz

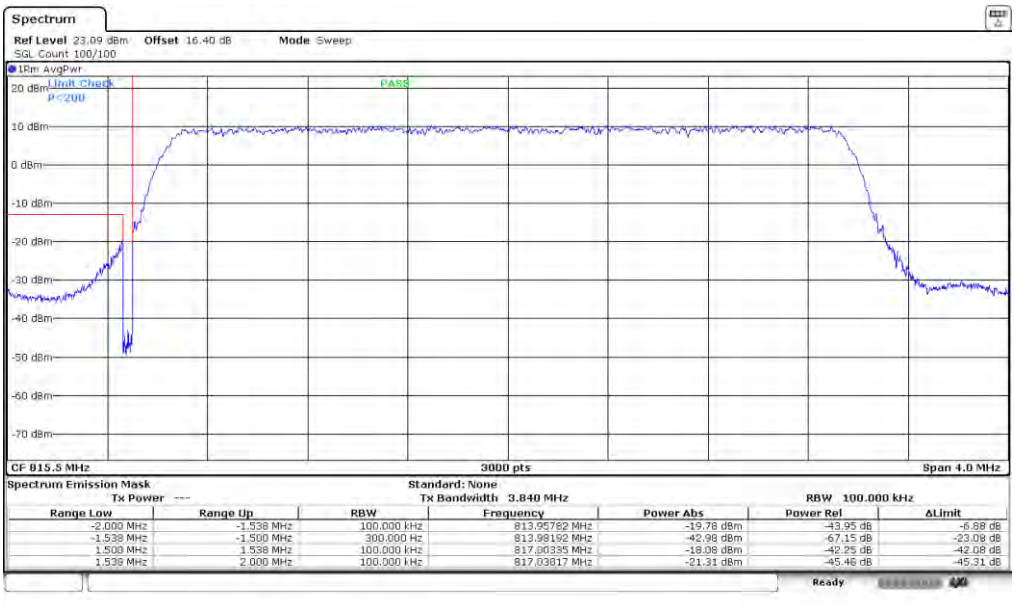
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

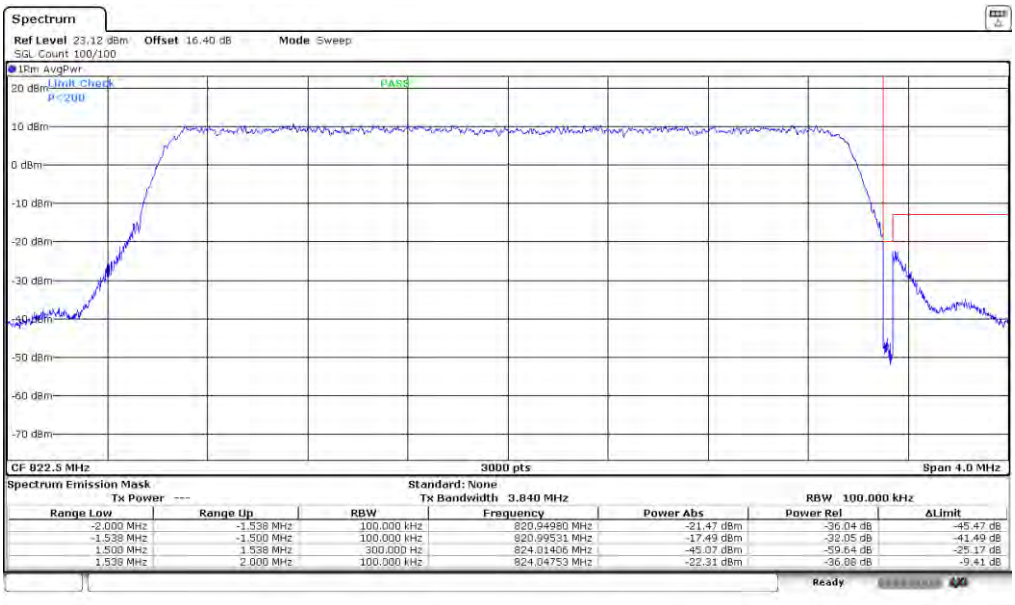
LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 3 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

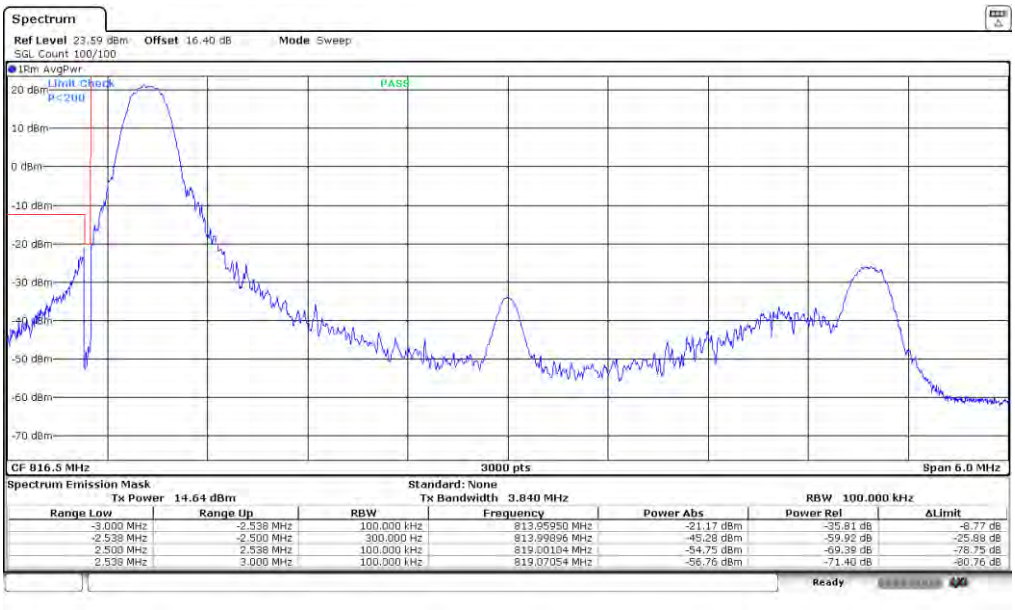


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 5 MHz

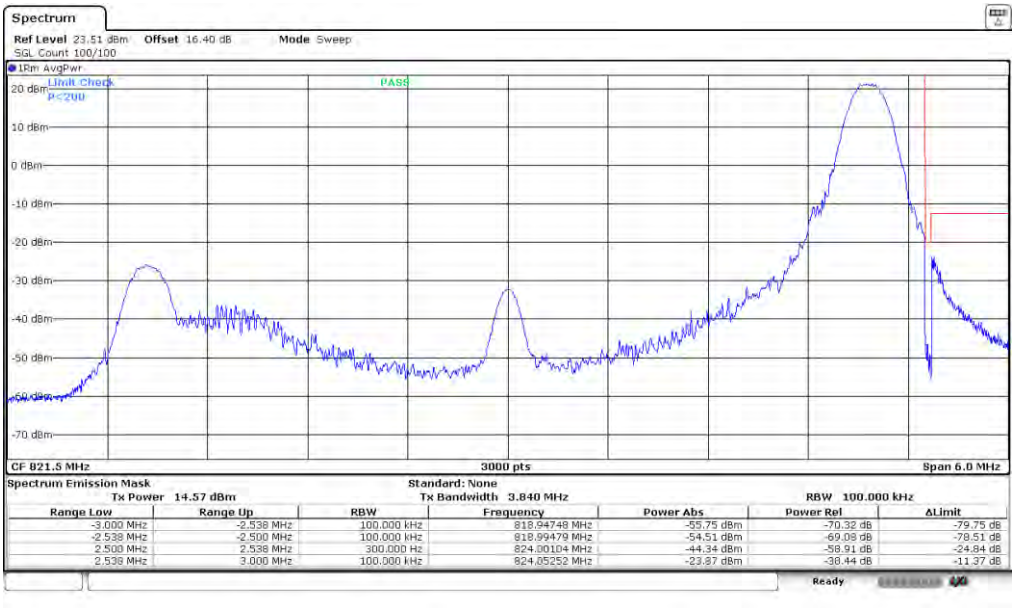
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = Max, BW = 5 MHz

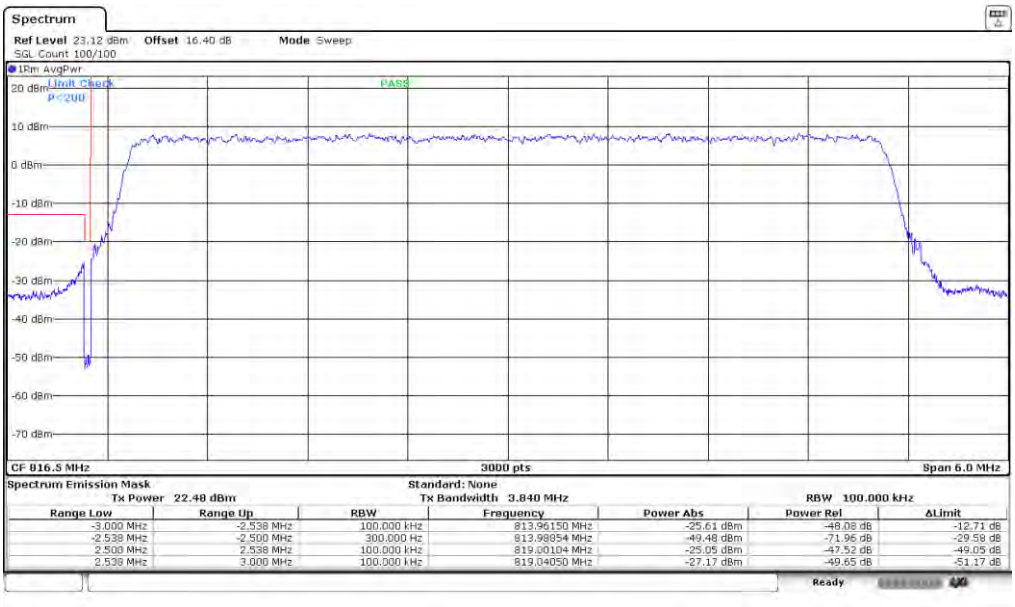
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

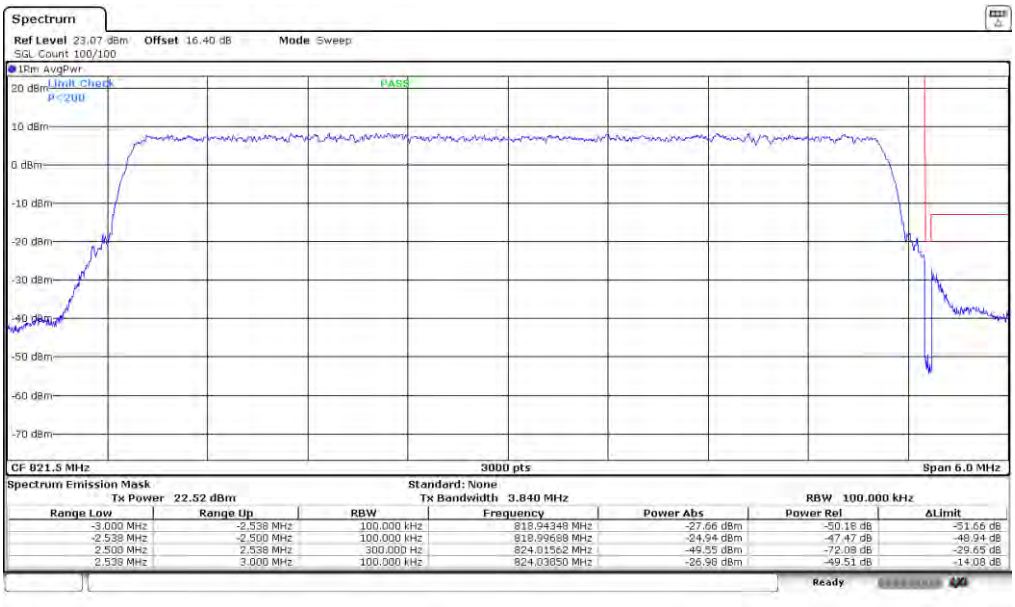
LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 5 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

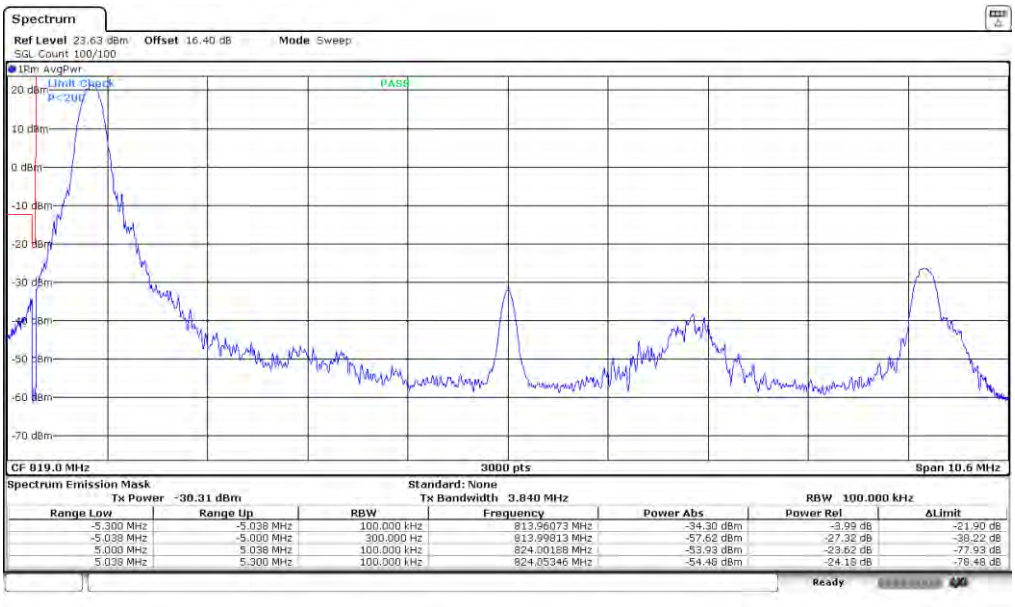


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 10 MHz

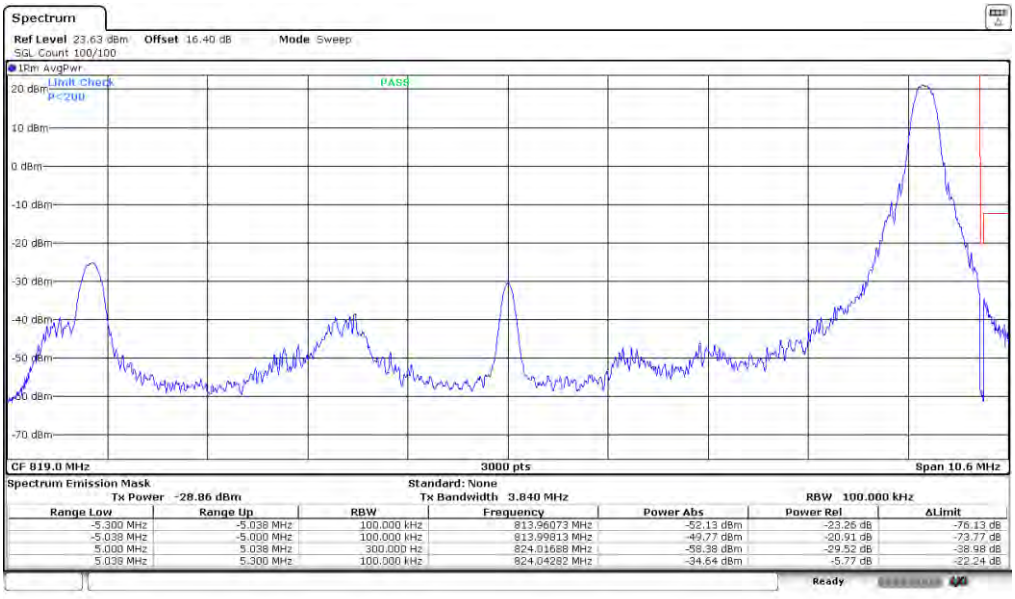
CHANNEL MIDDLE



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = Max, BW = 10 MHz

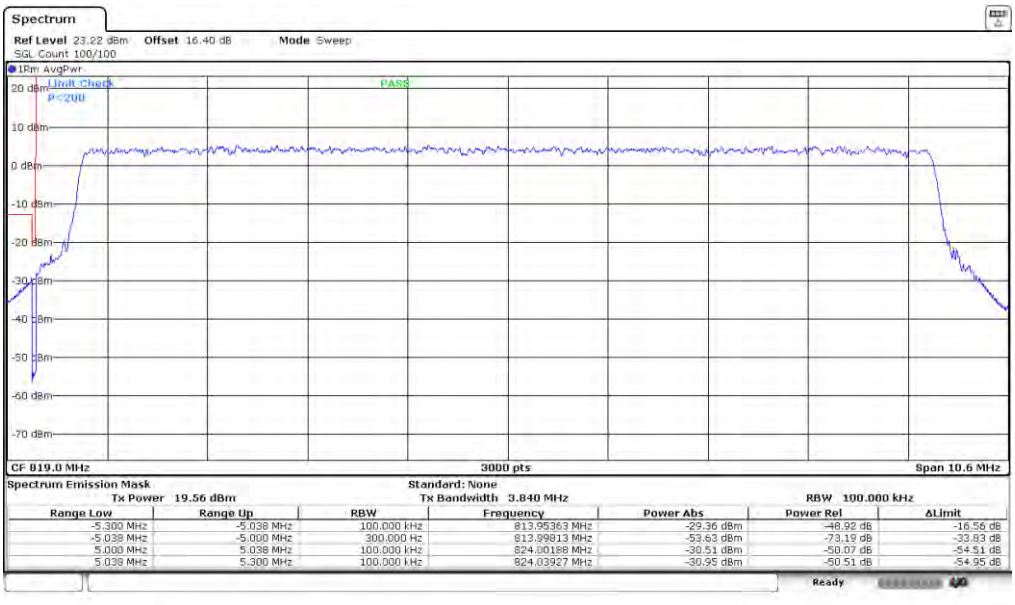
CHANNEL MIDDLE



NOTE: The equipment transmits at the maximum output power

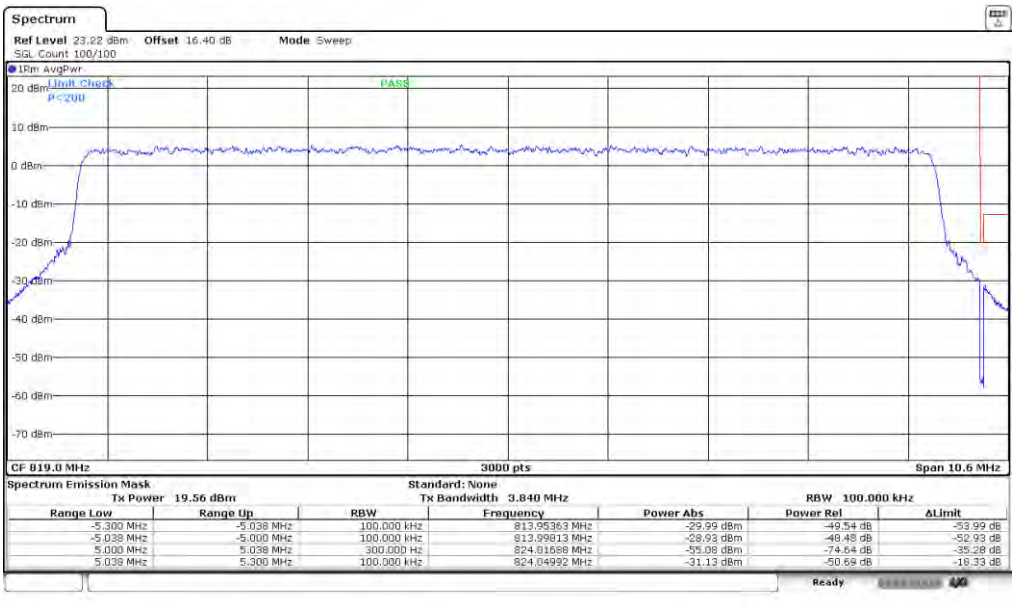
LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 10 MHz

CHANNEL MIDDLE



NOTE: The equipment transmits at the maximum output power

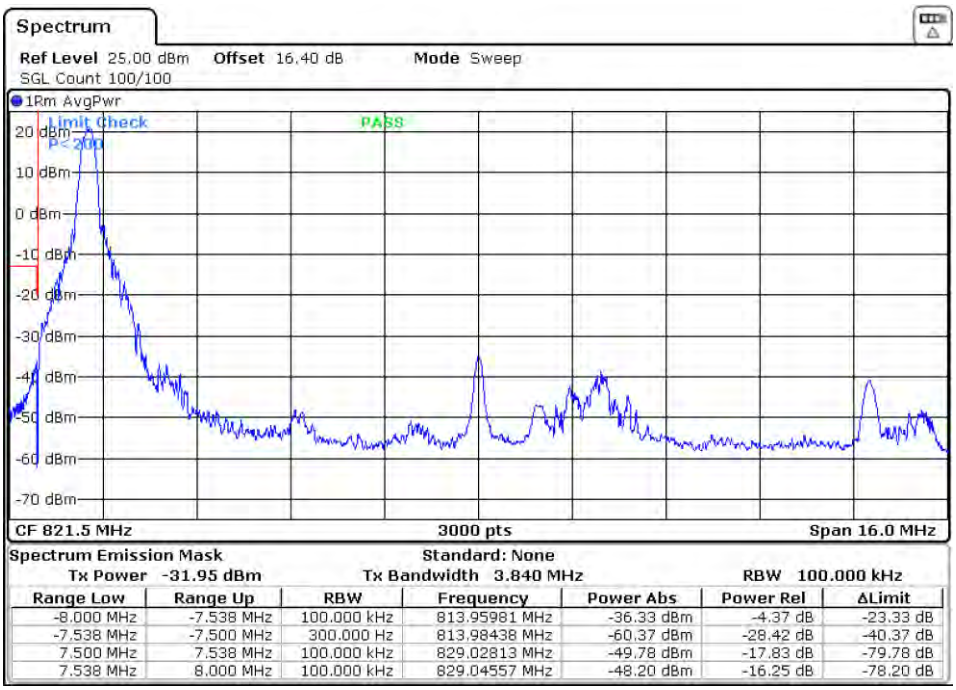
CHANNEL MIDDLE



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 15 MHz

CHANNEL LOWEST

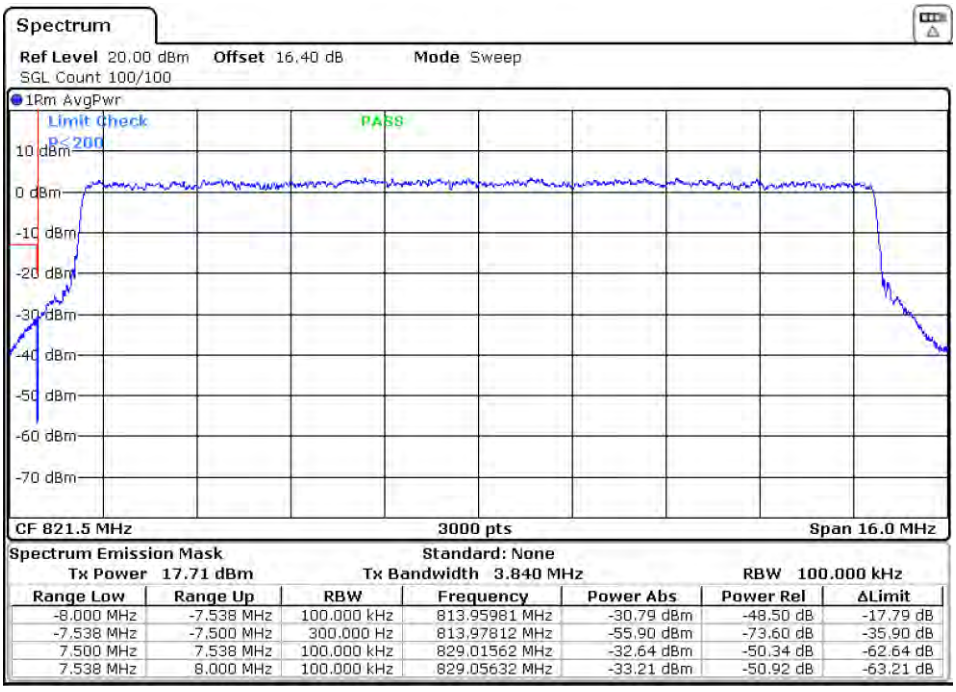


Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-8.000 MHz	-7.538 MHz	100.000 kHz	813.95981 MHz	-36.33 dBm	-4.37 dB	-23.33 dB
-7.538 MHz	-7.500 MHz	300.000 Hz	813.98438 MHz	-60.37 dBm	-28.42 dB	-40.37 dB
7.500 MHz	7.538 MHz	100.000 kHz	829.02813 MHz	-49.78 dBm	-17.83 dB	-79.78 dB
7.538 MHz	8.000 MHz	100.000 kHz	829.04557 MHz	-48.20 dBm	-16.25 dB	-78.20 dB

NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 15 MHz

CHANNEL LOWEST



Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-8.000 MHz	-7.538 MHz	100.000 kHz	813.95981 MHz	-30.79 dBm	-48.50 dB	-17.79 dB
-7.538 MHz	-7.500 MHz	300.000 Hz	813.97812 MHz	-55.90 dBm	-73.60 dB	-35.90 dB
7.500 MHz	7.538 MHz	100.000 kHz	829.01562 MHz	-32.64 dBm	-50.34 dB	-62.64 dB
7.538 MHz	8.000 MHz	100.000 kHz	829.05632 MHz	-33.21 dBm	-50.92 dB	-63.21 dB

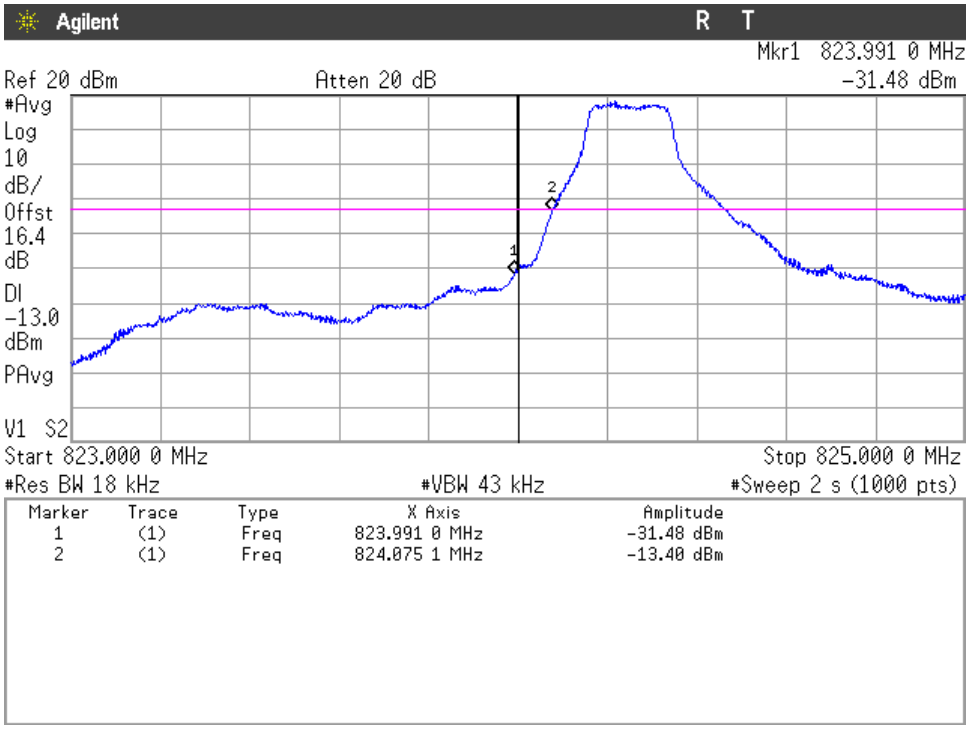
NOTE: The equipment transmits at the maximum output power

Verdict: PASS

824-849MHz Band:

LTE Band 5 QPSK MODULATION. RB = 1, Offset = 0, BW = 1.4 MHz

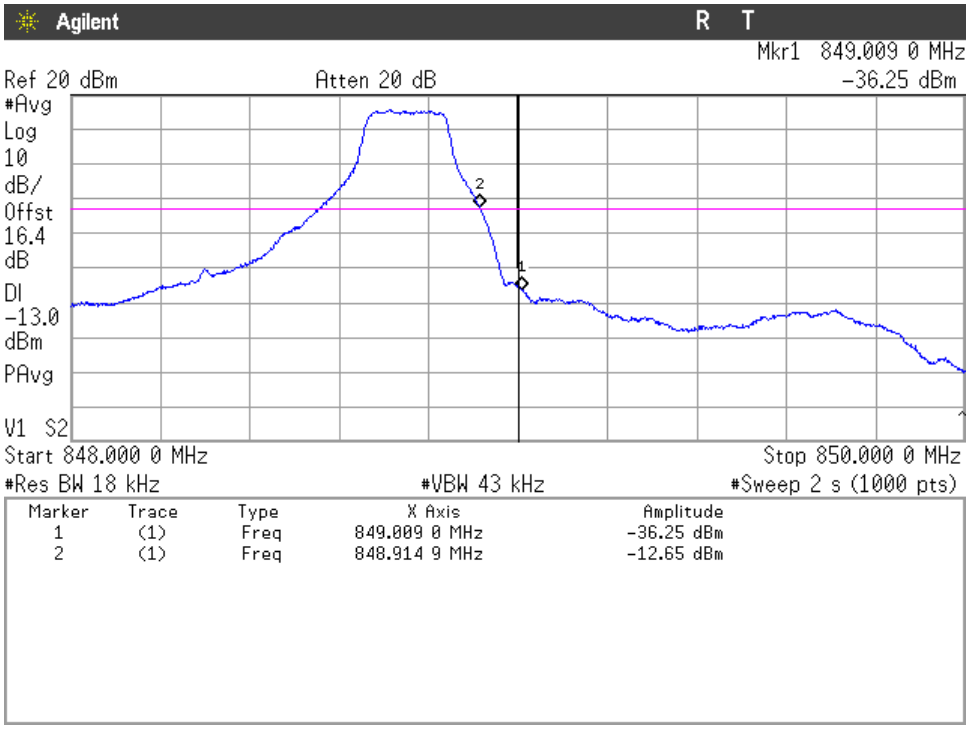
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 5 QPSK MODULATION. RB = 1, Offset = Max, BW = 1.4 MHz

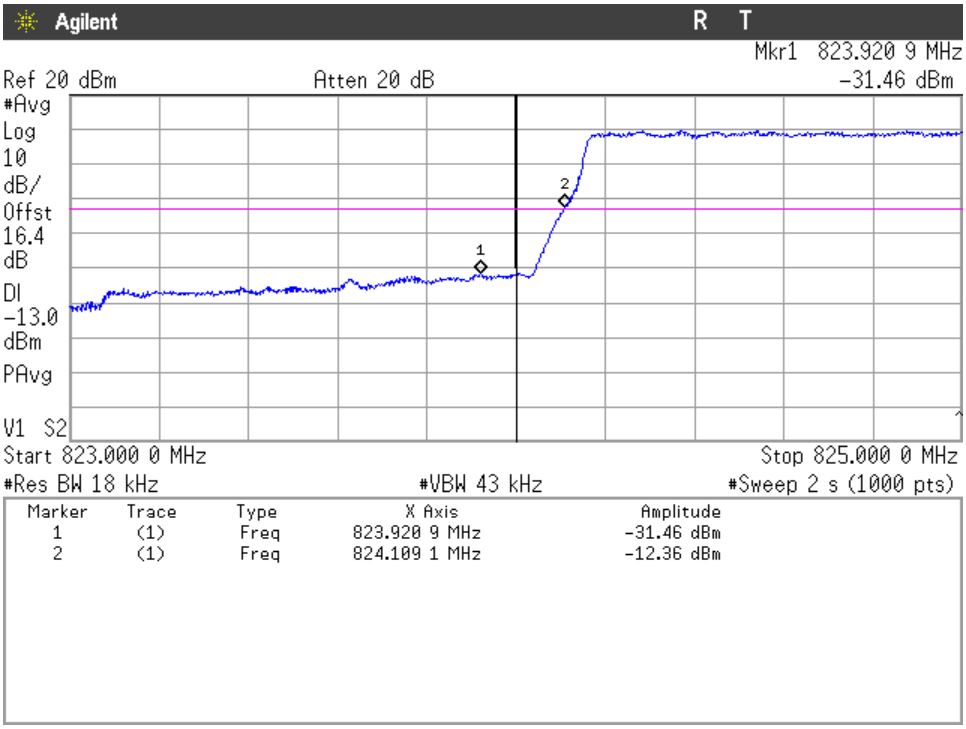
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

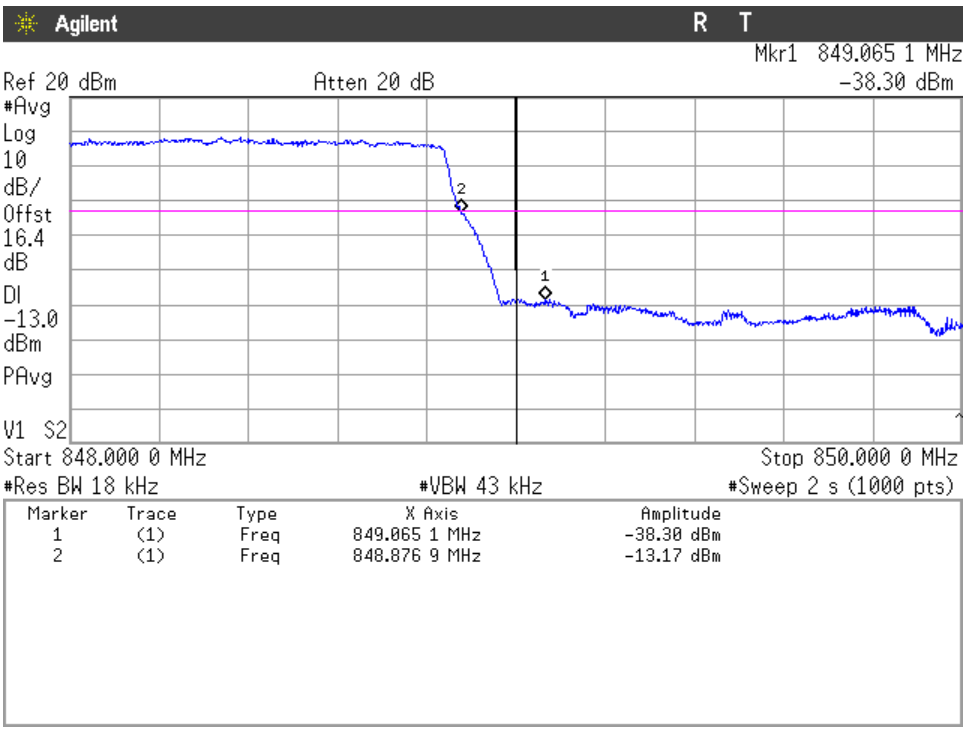
LTE Band 5 QPSK MODULATION. RB = All, Offset = 0, BW = 1.4 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

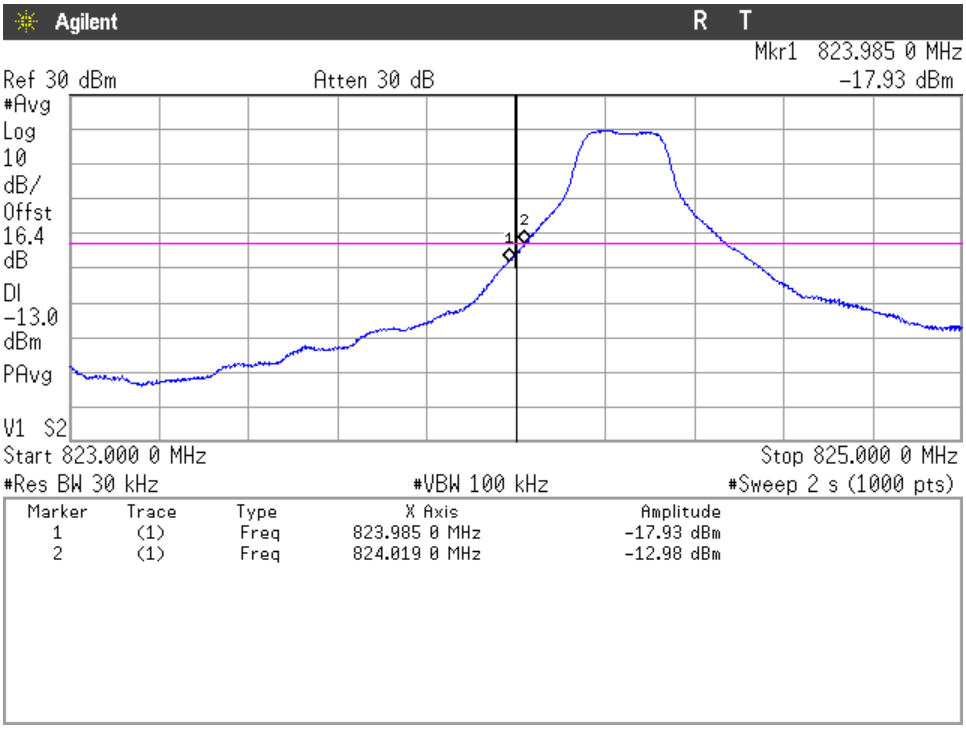


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE Band 5 QPSK MODULATION. RB = 1, Offset = 0, BW = 3 MHz

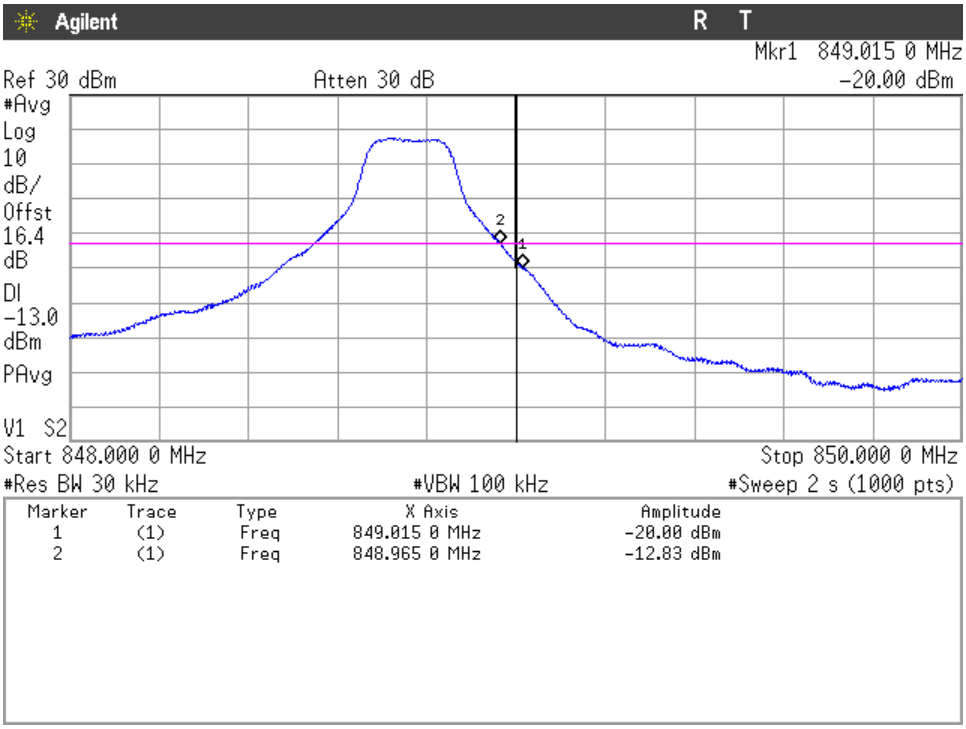
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 5 QPSK MODULATION. RB = 1, Offset = Max, BW = 3 MHz

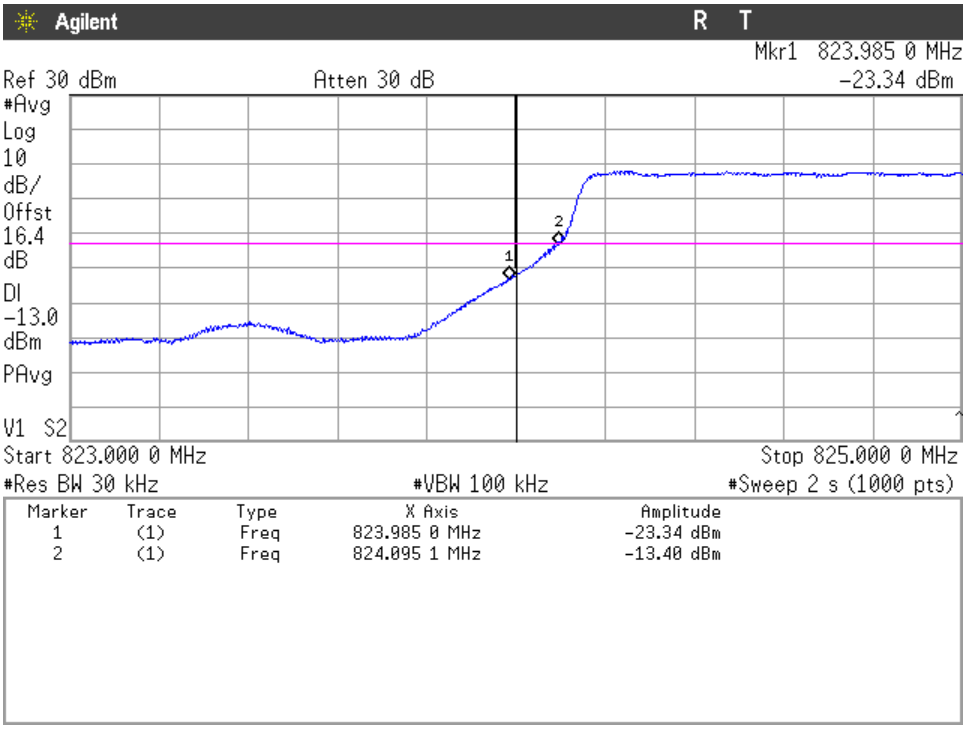
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

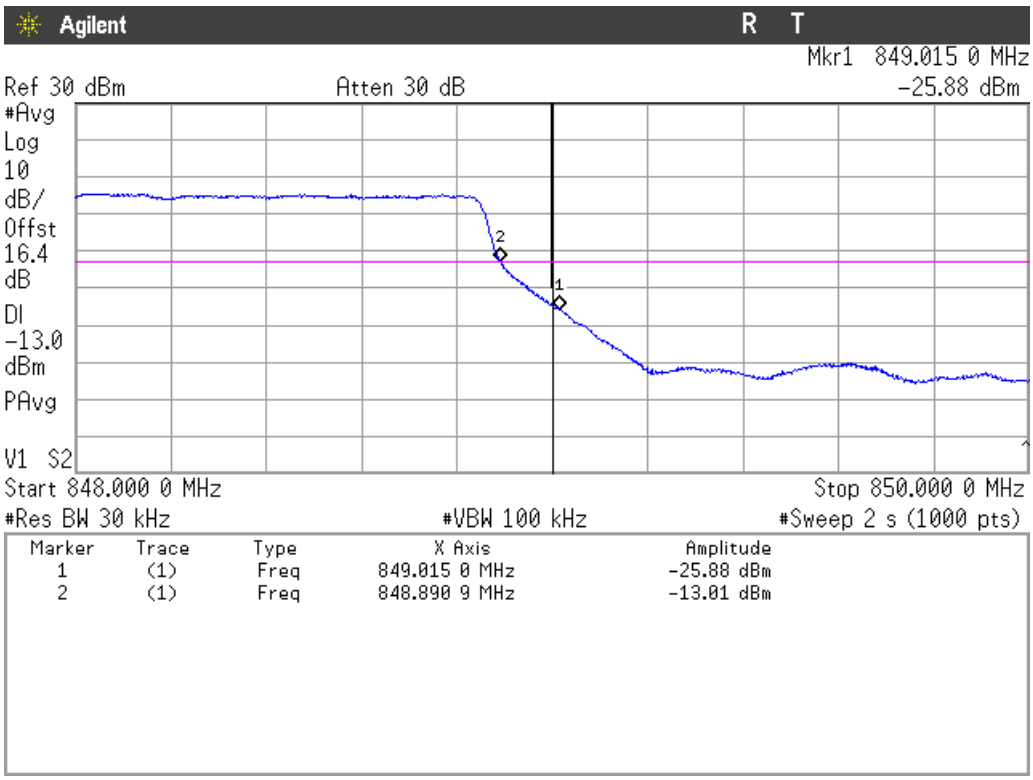
LTE Band 5 QPSK MODULATION. RB = All, Offset = 0, BW = 3 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

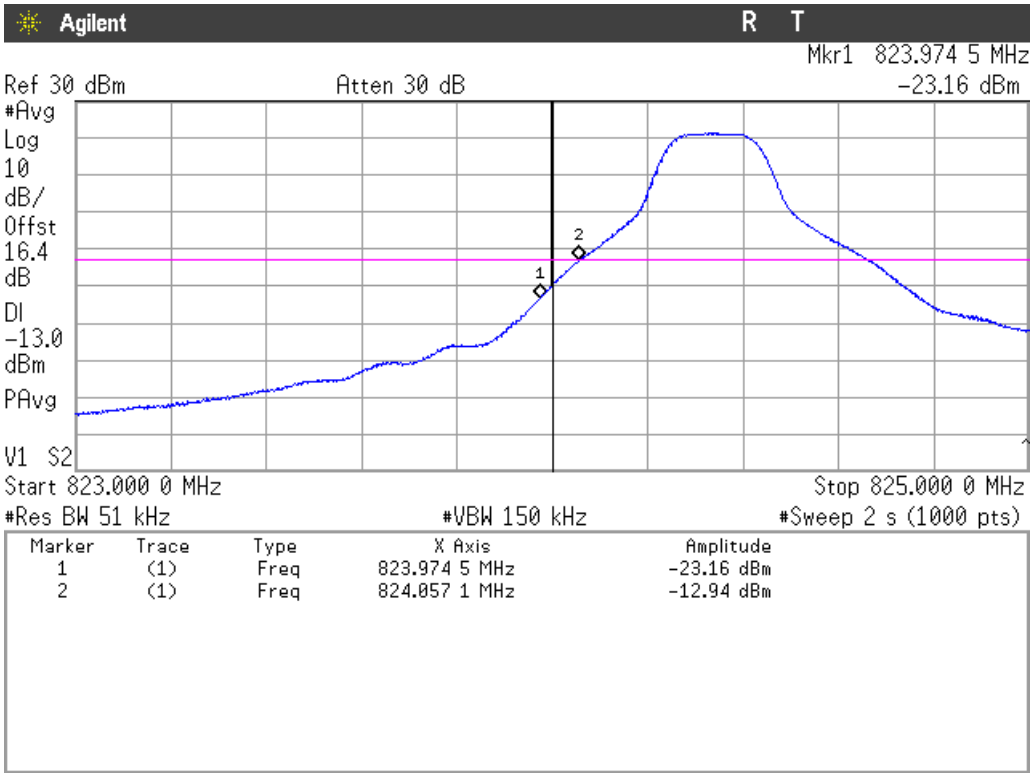


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

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

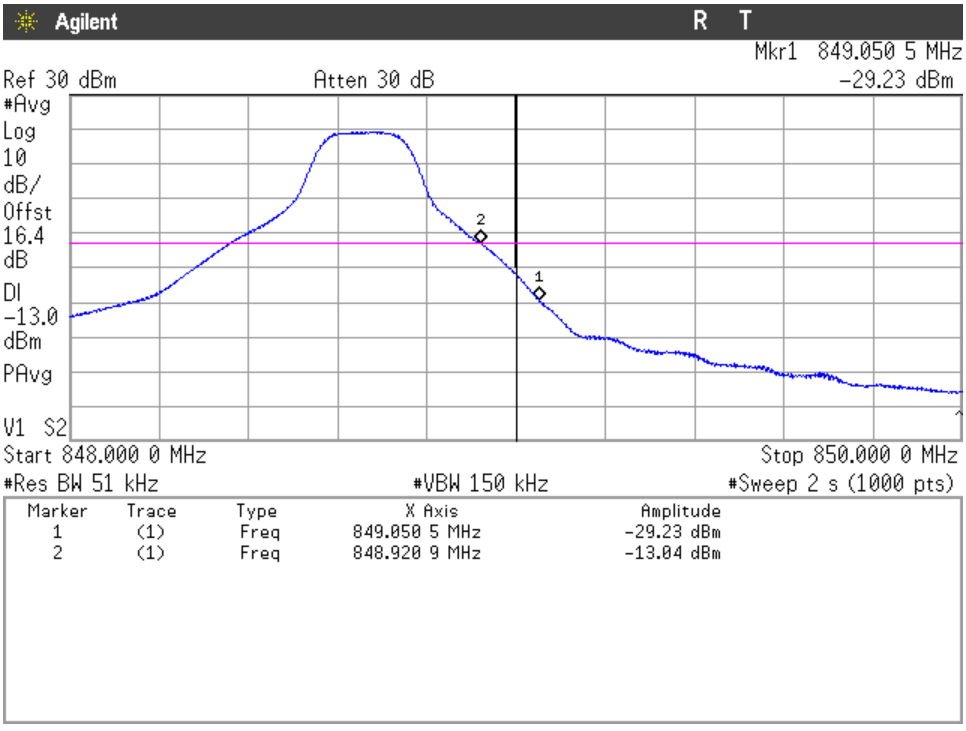
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

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

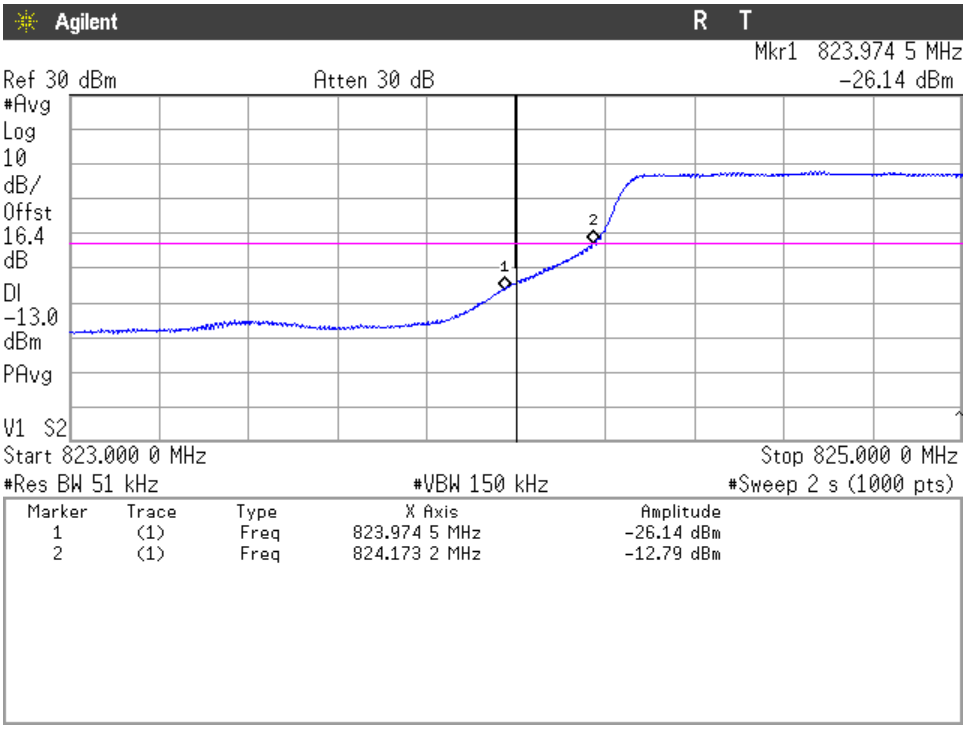
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

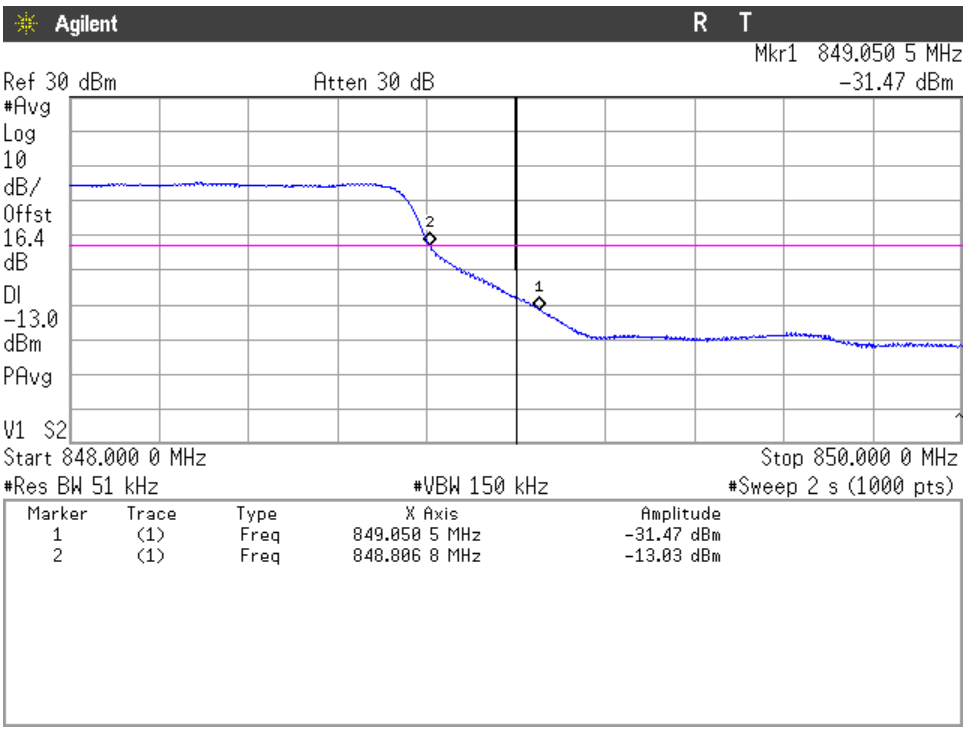
LTE Band 5 QPSK MODULATION. RB = All, Offset = 0, BW = 5 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

CHANNEL HIGHEST

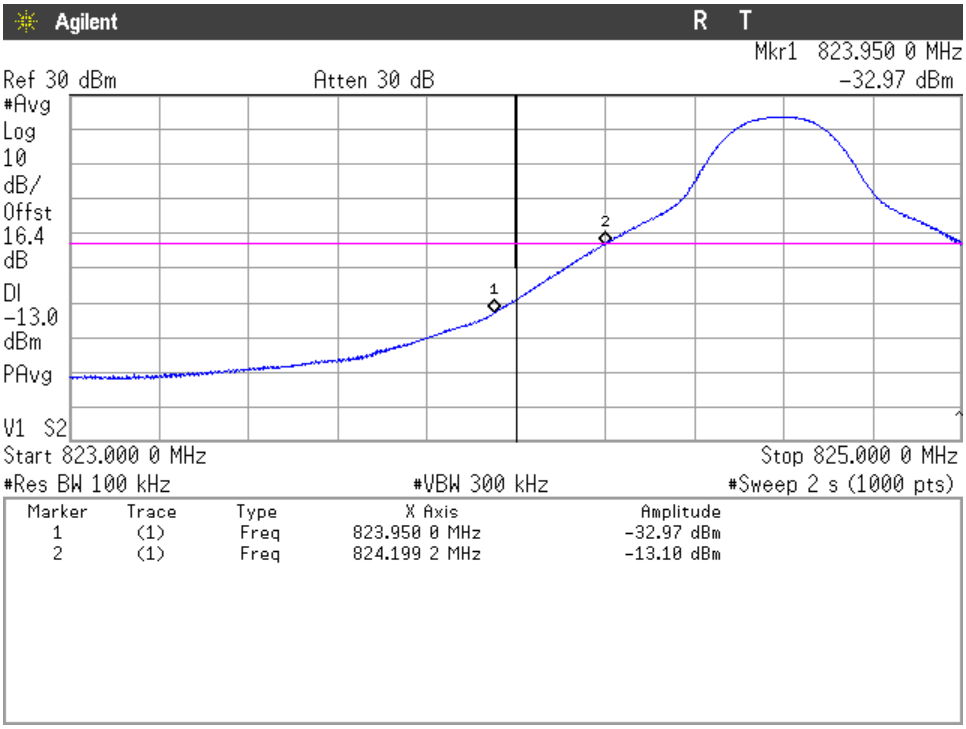


NOTE: The equipment transmits at the maximum output power

Verdict: PASS

LTE Band 5 QPSK MODULATION. RB = 1, Offset = 0, BW = 10 MHz

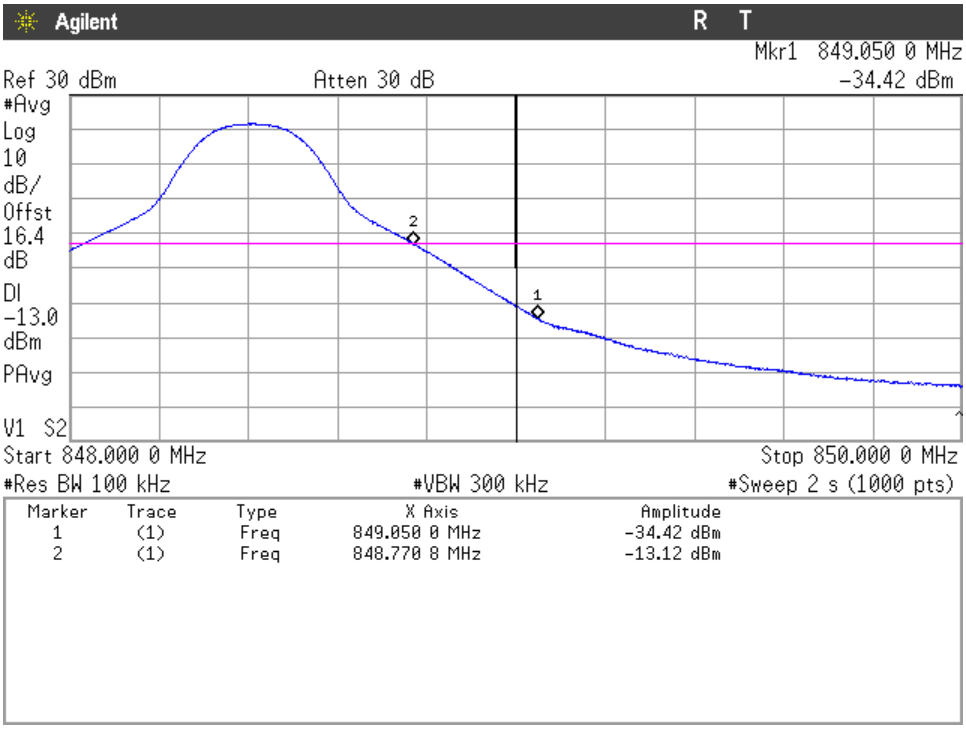
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 5 QPSK MODULATION. RB = 1, Offset = Max, BW = 10 MHz

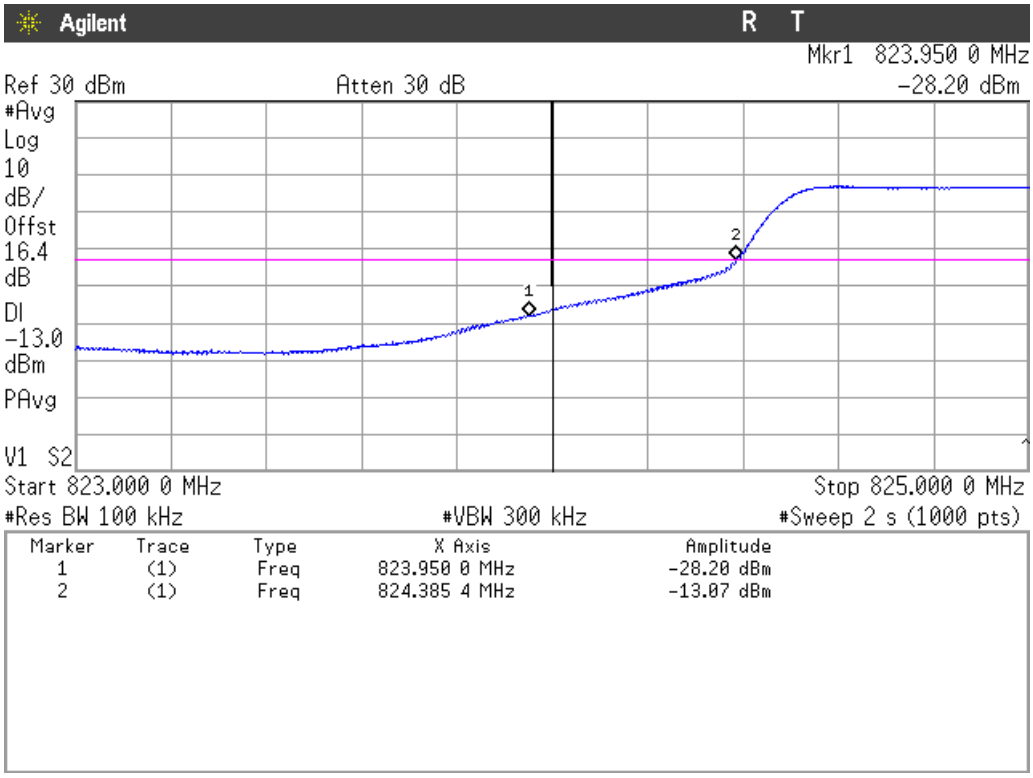
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

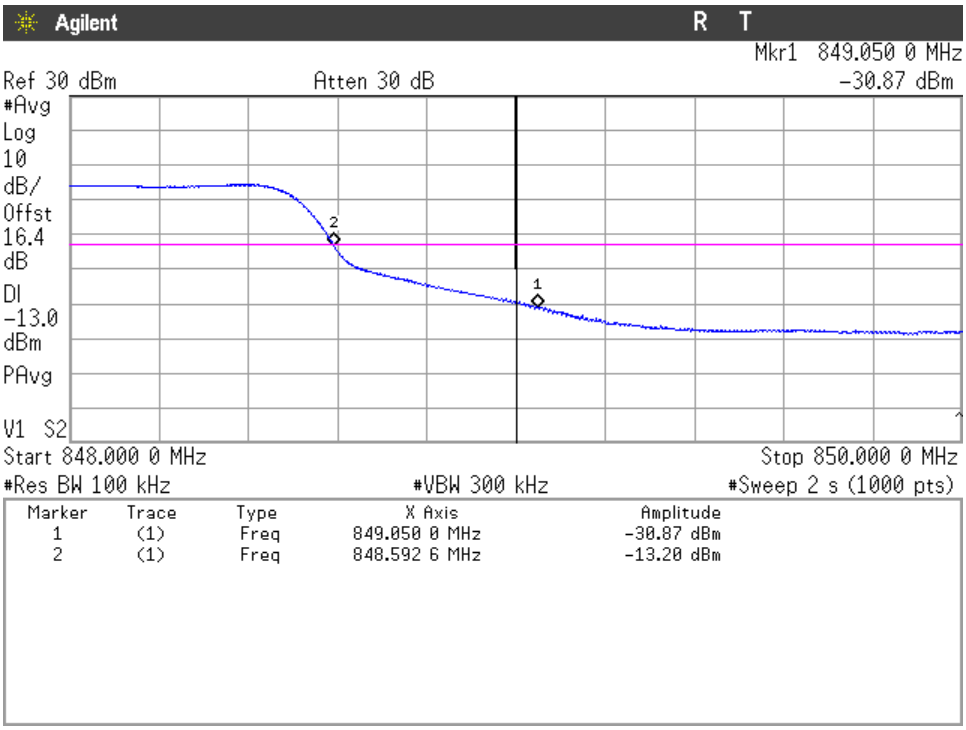
LTE Band 5 QPSK MODULATION. RB = All, Offset = 0, BW = 10 MHz

CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

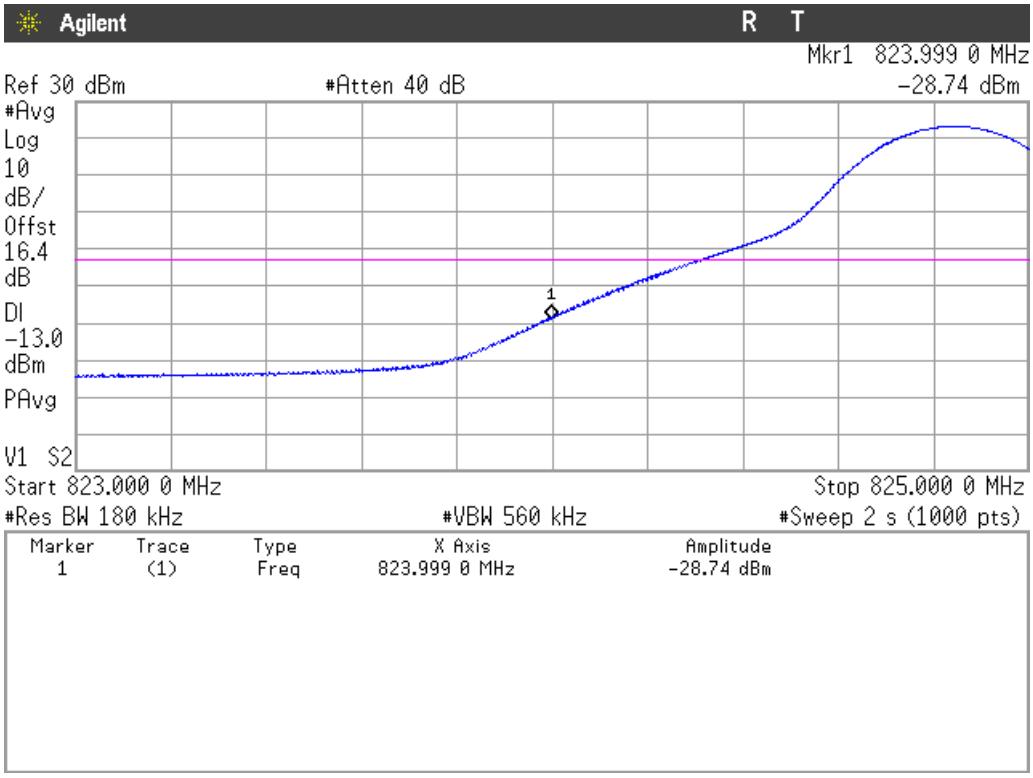
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = 0, BW = 15 MHz

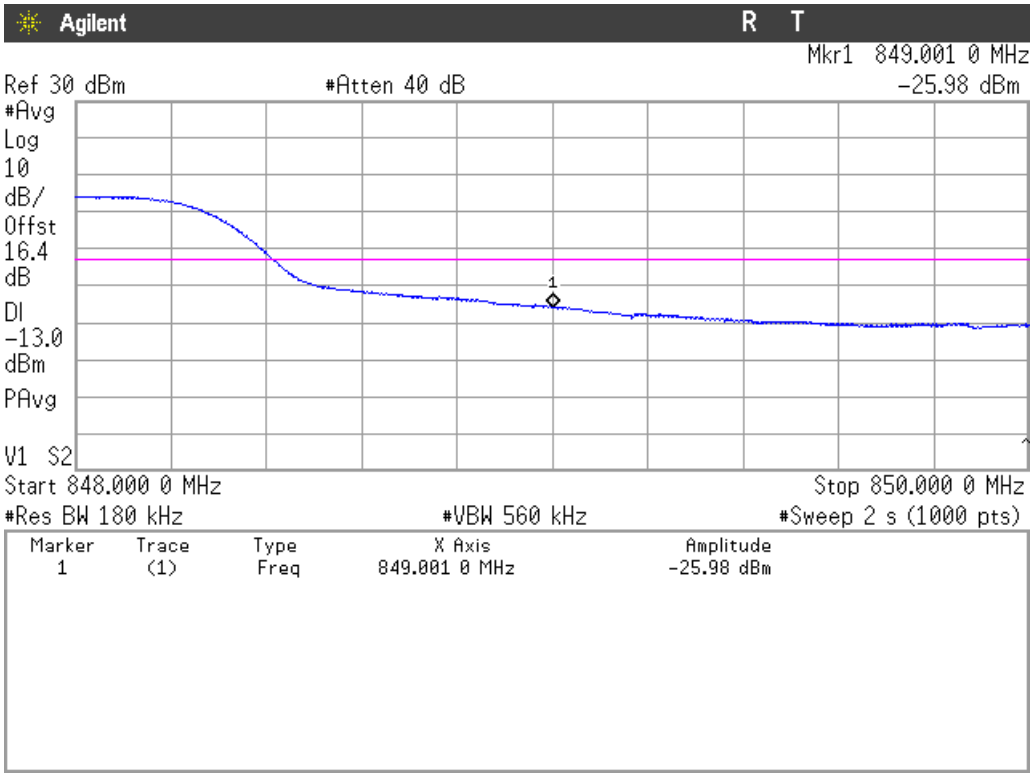
CHANNEL LOWEST



NOTE: The equipment transmits at the maximum output power

LTE Band 26 QPSK MODULATION. RB = 1, Offset = Max, BW = 15 MHz

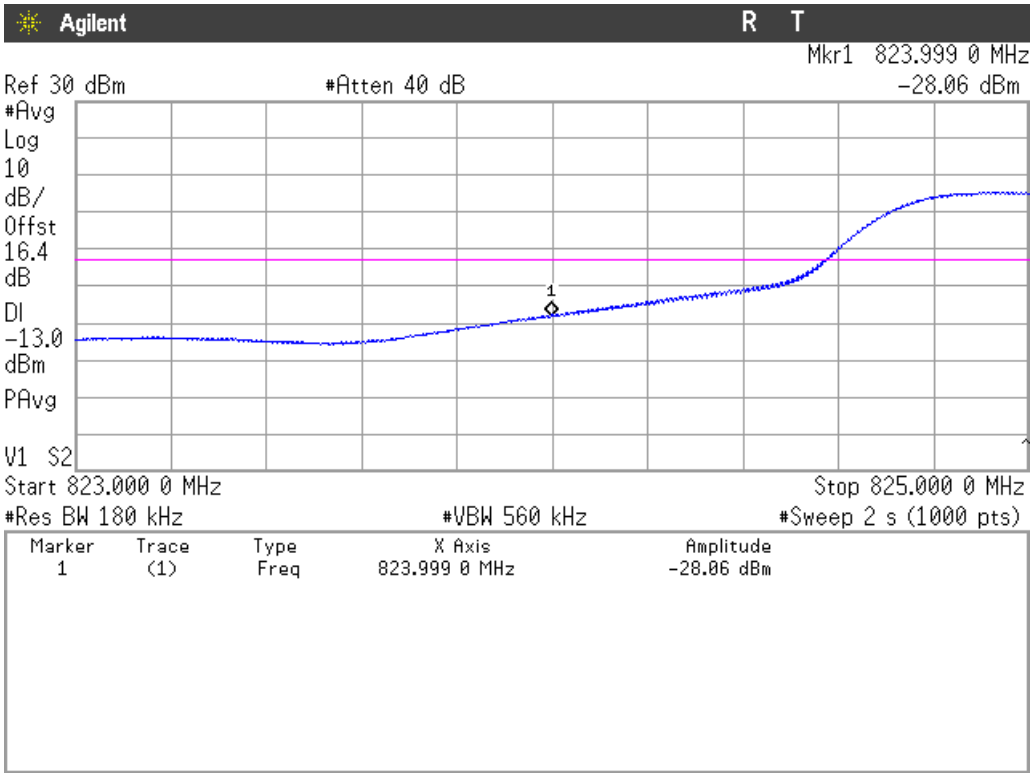
CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

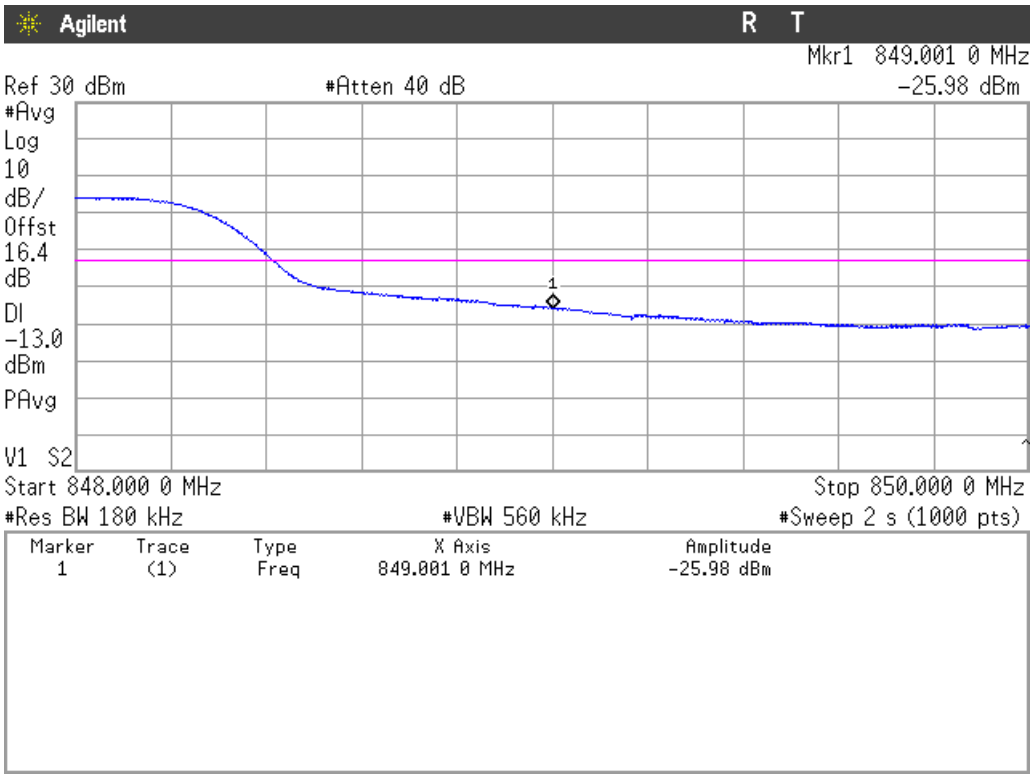
LTE Band 26 QPSK MODULATION. RB = All, Offset = 0, BW = 15 MHz

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 § 22.917

RSS-132. Clause 5.5.

FCC §2.1051, §90.691

Emission mask requirements for EA-based systems.

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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 1 meter high 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. The radiated emissions were measured with peak detector and 1 MHz bandwidth.
Each detected emission is substituted by the Substitution method, in accordance with the ANSI/TIA/EIA-603-C: 2004.

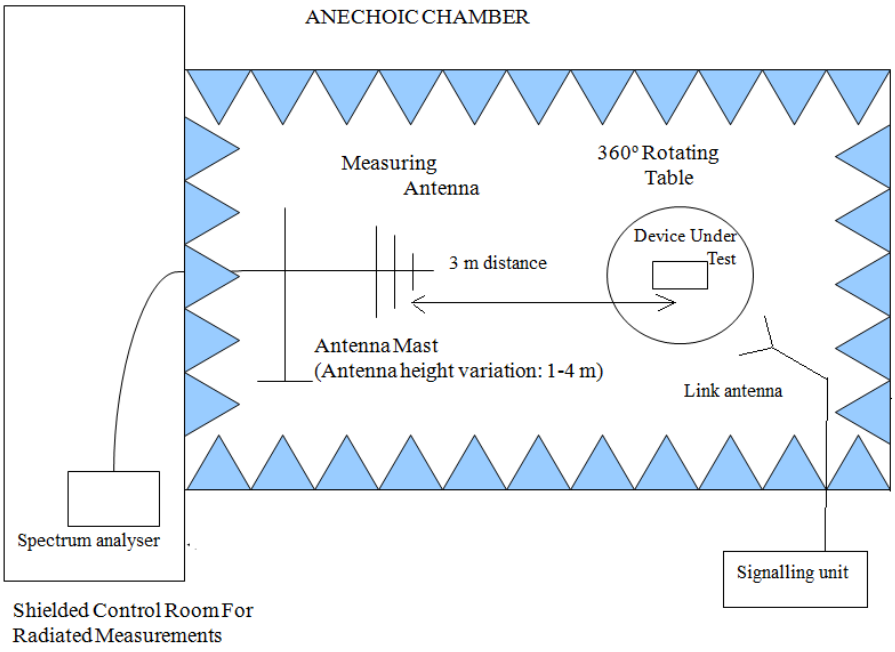
Measurement Limit:

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

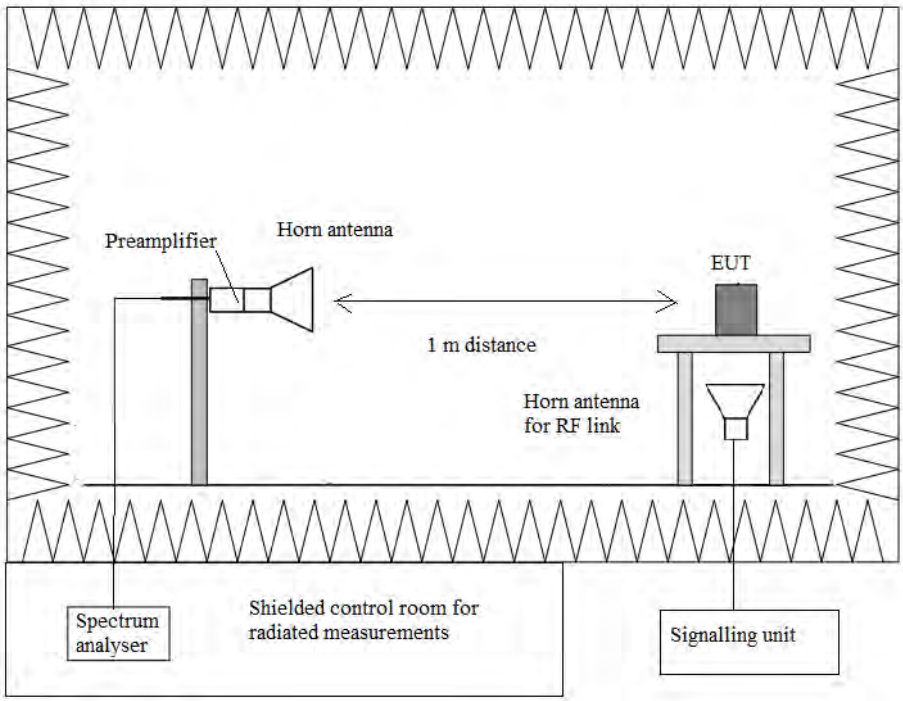
$$Po\ (dBm) – [43 + 10 \log (Po \text{ in mwatts}) - 30] = -13\ dBm$$

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



814-824MHz Band:

LTE QPSK AND 16QAM MODULATION. BW = 1.4 MHz, 3 MHz, 5 MHz, 10 MHz.

A preliminary scan determined the QPSK modulation with 3 MHz bandwidth and RB=1 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 at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

2. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Verdict: PASS

824-849MHz Band:

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

A preliminary scan determined the QPSK modulation with 1.4 MHz bandwidth and RB=1 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 at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

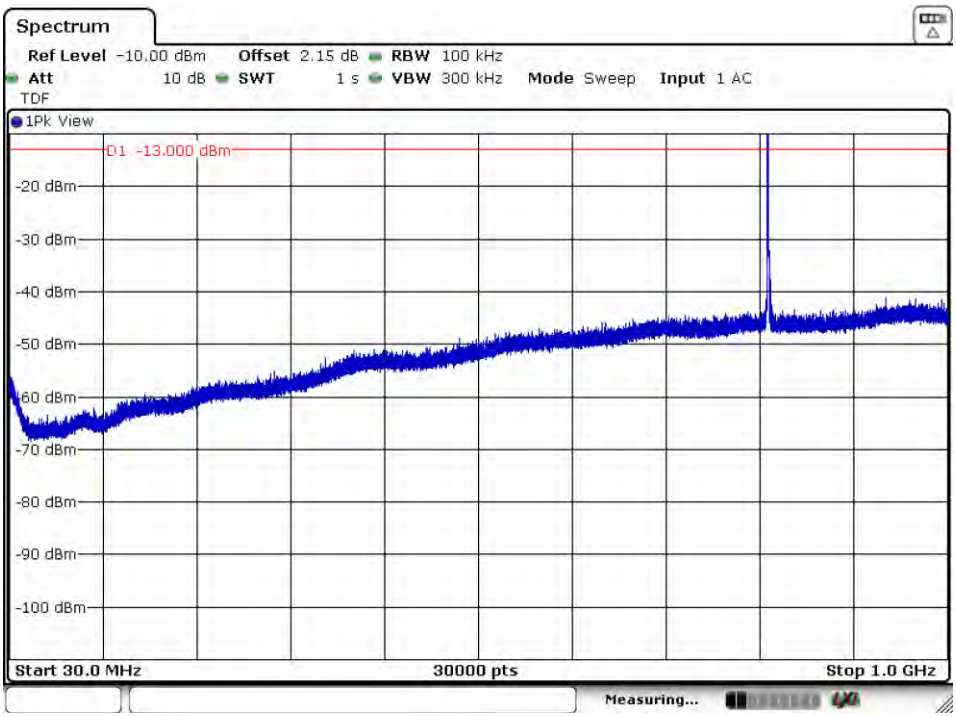
Verdict: PASS

814-824MHz Band:

FREQUENCY RANGE 30 MHz-1000 MHz.

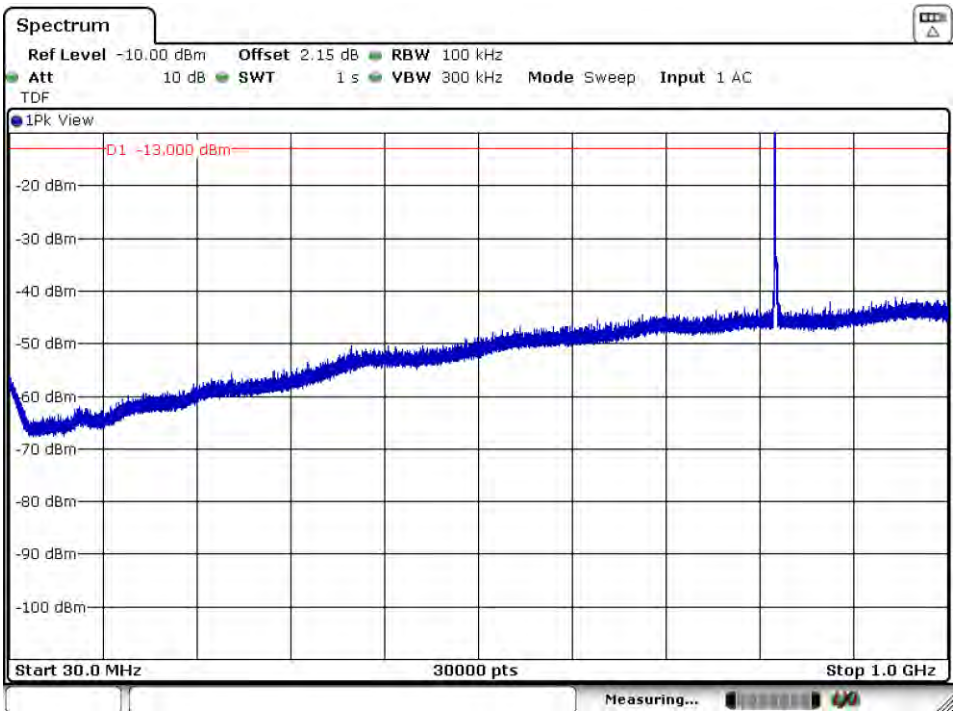
LTE QPSK MODULATION. BW=3 MHz

CHANNEL: LOWEST



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

CHANNEL: HIGHEST

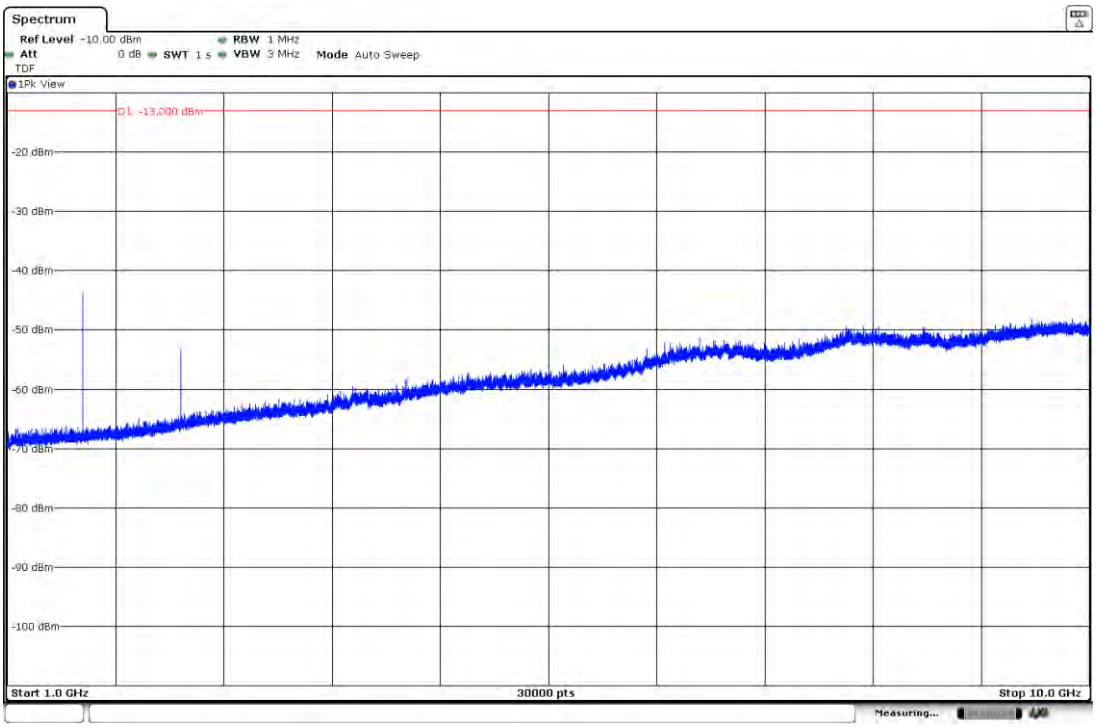


Note: The peak above the limit is the carrier frequency.

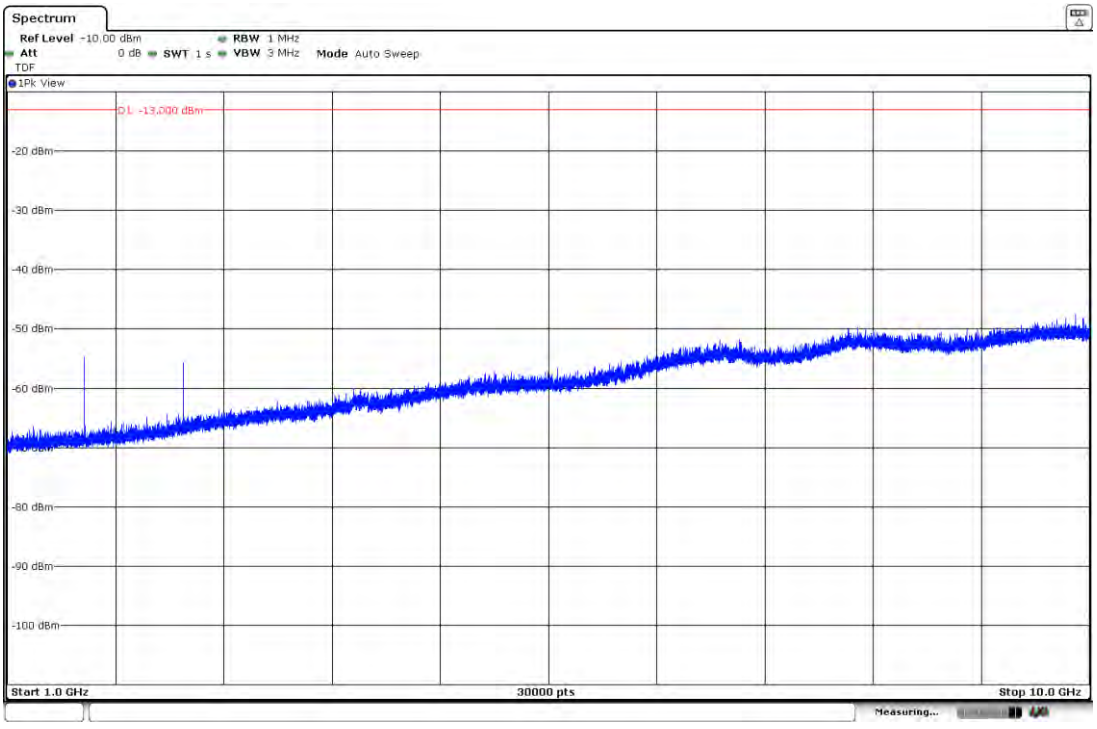
FREQUENCY RANGE 1 GHz to 10 GHz.

LTE QPSK MODULATION. BW=3 MHz

CHANNEL: LOWEST



CHANNEL: HIGHEST

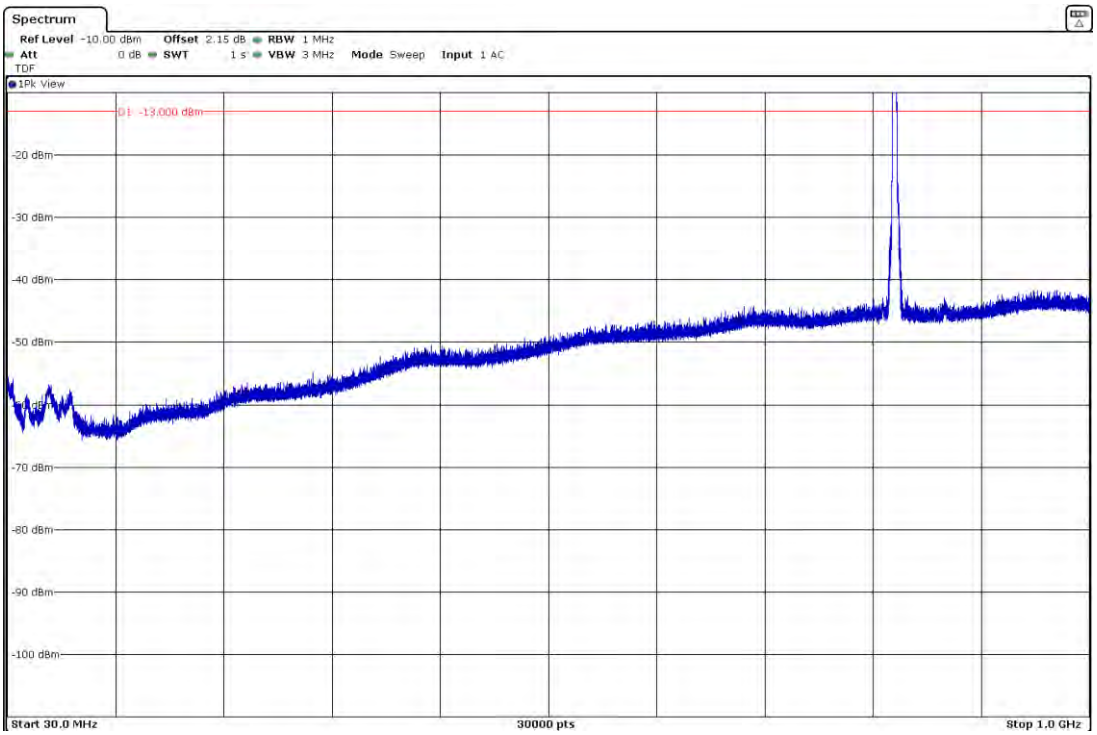


824-849MHz Band:

FREQUENCY RANGE 30 MHz-1000 MHz.

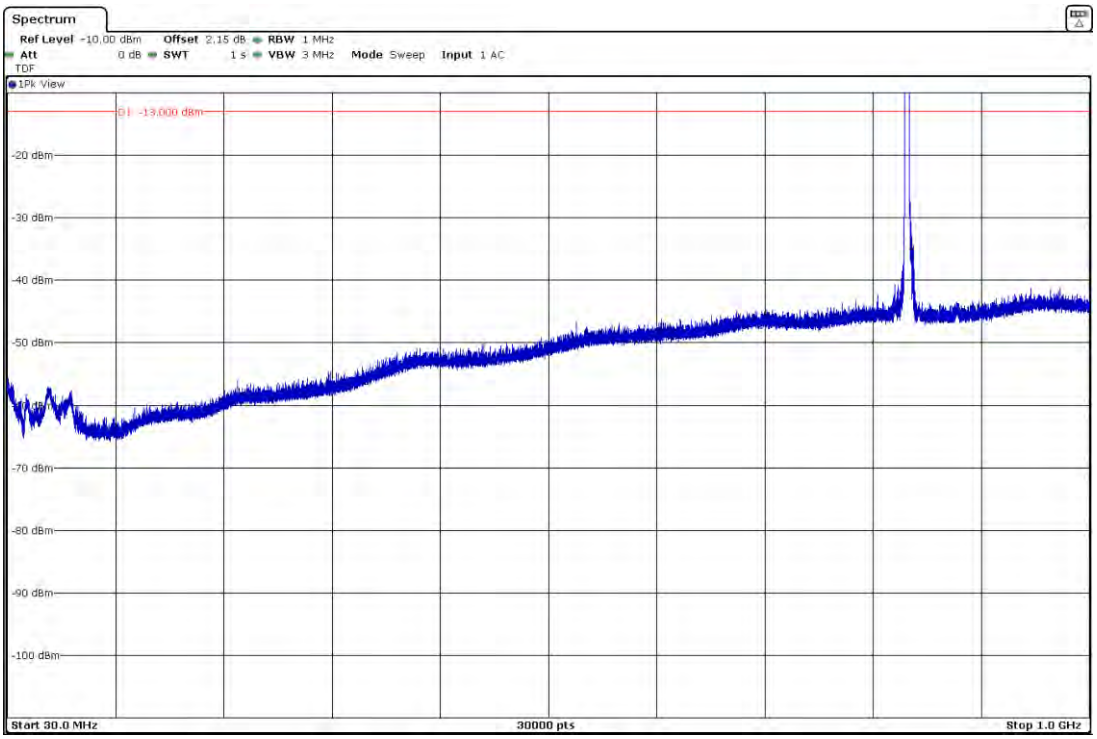
LTE QPSK MODULATION. BW=1.4 MHz

CHANNEL: LOWEST



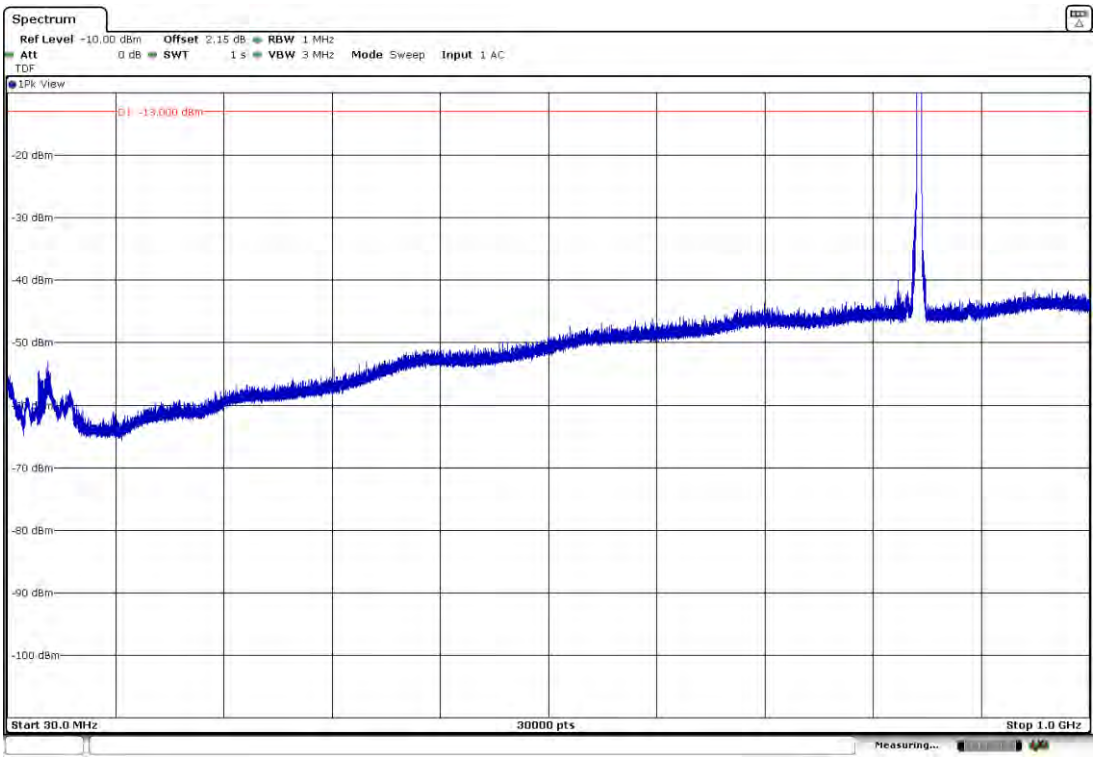
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



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

CHANNEL: HIGHEST

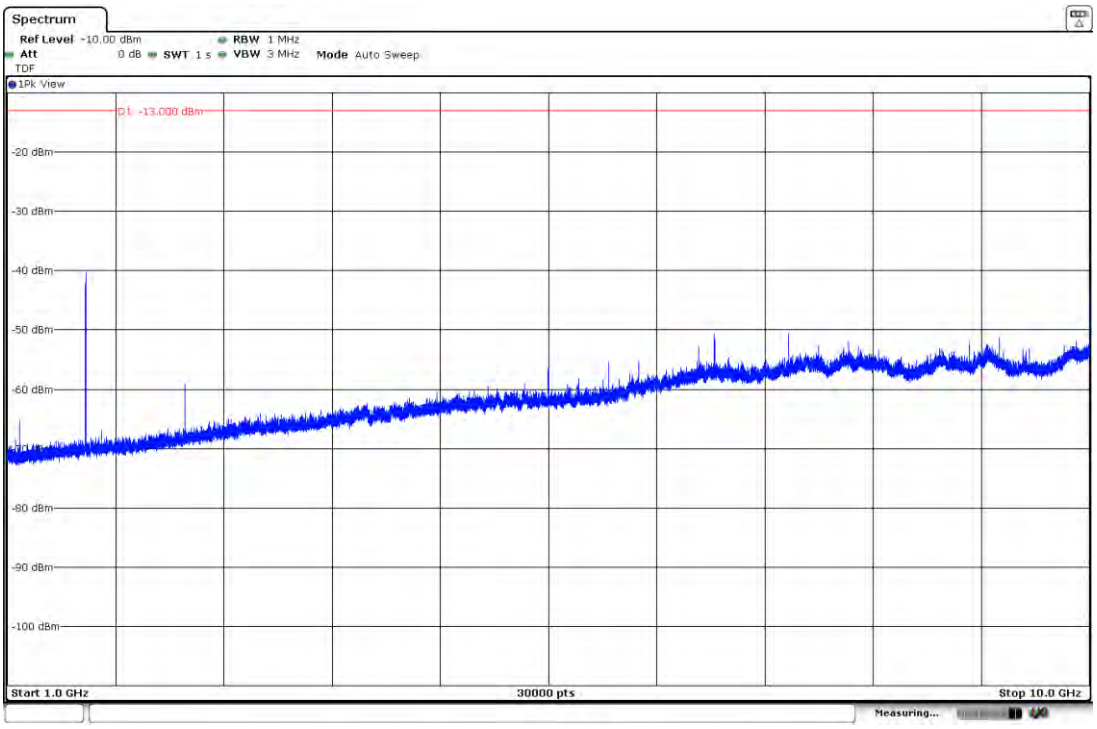


Note: The peak above the limit is the carrier frequency.

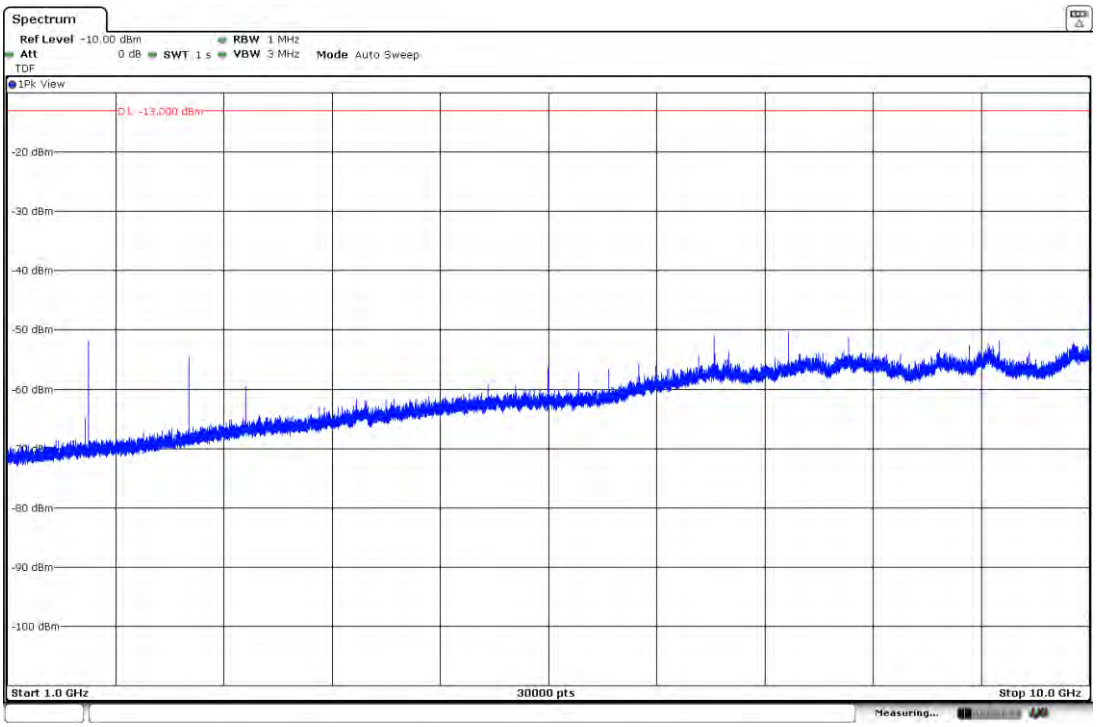
FREQUENCY RANGE 1 GHz to 10 GHz.

LTE QPSK MODULATION. BW=1.4 MHz

CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST