



FCC LISTED, REGISTRATION  
NUMBER: 2764.01

ISED LISTED REGISTRATION  
NUMBER: 23595-1

Test report No:

2456ERM.009

## Test report

**REFERENCE STANDARD:  
USA FCC Part 27  
CANADA ISED RSS-199**

|                                           |                                                                                                                                                                                                  |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identification of item tested             | Wireless Module                                                                                                                                                                                  |
| Trademark                                 | Cinterion ALAS5-W                                                                                                                                                                                |
| Model and /or type reference              | ALAS5-W                                                                                                                                                                                          |
| Other identification of the product       | FCC ID: QIPALAS5-W<br>IC: 7830A-ALAS5W                                                                                                                                                           |
| Features                                  | Wireless Module supporting 2G, 3G and 4G Cellular Technologies                                                                                                                                   |
| Manufacturer                              | Gemalto M2M GmbH<br>Werinherstr. 81, 81541 Munich, Germany.                                                                                                                                      |
| Test method requested, standard           | USA FCC Part 27 10-1-18 Edition<br>CANADA IC RSS-199 Issue 3, Dec. 2016.<br>Measurement Guidance 971168 D01 v02r02 for<br>certification of Licensed Digital Transmitters.<br>ANSI C63.26 – 2015. |
| Summary                                   | IN COMPLIANCE                                                                                                                                                                                    |
| Approved by (name / position & signature) | Domingo Galvez<br>EMC&RF Lab Manager                                                                                                                                                             |
| Date of issue                             | 04-10-2019                                                                                                                                                                                       |
| Report template No                        | FDT08_21                                                                                                                                                                                         |

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## Competences and guarantees

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

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

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

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

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

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

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## General conditions

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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## Uncertainty

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

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

## Data provided by the client

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

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

## Usage of samples

---

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

| Control N° | Description      | Model               | Serial N°       | Date of reception |
|------------|------------------|---------------------|-----------------|-------------------|
| 2456.03    | Cinterion® ALAS5 | ALAS5-W             | 004401083195152 | 2/7/2019          |
| 2456.04    | GPS Antenna      | AA62                | 162CT15170382   | 2/7/2019          |
| 2456.05    | Antenna          | Panorama_LPBEM-7-27 | -               | 2/7/2019          |
| 2456.06    | Antenna          | Panorama_LPBEM-7-27 | -               | 2/7/2019          |

1. Sample S/01 was used for the following test(s):  
All conducted and radiated tests indicated in appendix A.

## Test sample description

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

| Accessories (not part of the test item) .....                                      | Description                | Type                                                           | Manufacturer |
|------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------|--------------|
|                                                                                    |                            |                                                                |              |
| Documents as provided by the applicant.....                                        | Description                | File name                                                      | Issue date   |
|                                                                                    | Equipment declaration data | FDT30_15_Declaration_Equipment_<br>Data_Gemalto_ALAS5-W_signed | 2019-03-14   |
| <b>Copy of marking plate:</b>                                                      |                            |                                                                |              |
|  |                            |                                                                |              |

## Identification of the client

Gemalto M2M GmbH  
Werinherstr. 81, 81541 Munich, Germany

## Testing period and place

|                      |                           |
|----------------------|---------------------------|
| <b>Test Location</b> | DEKRA Certification, Inc. |
| <b>Date (start)</b>  | 04-05-2019                |
| <b>Date (finish)</b> | 04-09-2019                |

## Document history

| Report number | Date       | Description   |
|---------------|------------|---------------|
| 2456ERM.009   | 04-10-2019 | First release |

## Environmental conditions

---

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

|                   |                                     |
|-------------------|-------------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C        |
| Relative humidity | Min. = 30 %<br>Max. = 75 %          |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

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

|                   |                                     |
|-------------------|-------------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C        |
| Relative humidity | Min. = 30 %<br>Max. = 75 %          |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

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

|                   |                                     |
|-------------------|-------------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C        |
| Relative humidity | Min. = 30 %<br>Max. = 60 %          |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

## Remarks and comments

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

## Testing verdicts

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

## Summary

| FCC PART 27 /IC RSS-199 PARAGRAPH             |                    |                    |                                                        |         |        |
|-----------------------------------------------|--------------------|--------------------|--------------------------------------------------------|---------|--------|
| Report Section                                | FCC Spec Clause    | RSS Spec Clause    | Test Description                                       | Verdict | Remark |
| A.1                                           | §2.1046 and §27.50 | RSS-199 Clause 4.4 | RF Output power                                        | P       | N/A    |
| A.2                                           | §2.1047 and §27.50 | RSS-199 Clause 4.1 | Modulation characteristics                             | P       | N/A    |
| A.3                                           | §2.1055 and §27.54 | RSS-199 Clause 4.3 | Frequency stability                                    | P       | N/A    |
| A.4                                           | § 2.1049           | RSS-199 Clause 4.2 | Occupied Bandwidth                                     | P       | N/A    |
| A.5                                           | §2.1051 and §27.53 | RSS-199 Clause 4.5 | Spurious emissions at antenna terminals                | P       | N/A    |
| A.6                                           | §27.53             | RSS-199 Clause 4.5 | Spurious emissions at antenna terminals at Block edges | P       | N/A    |
| A.7                                           | §2.1053 and §27.53 | RSS-199 Clause 4.5 | Radiated emissions                                     | P       | N/A    |
| <u>Supplementary information and remarks:</u> |                    |                    |                                                        |         |        |
| N/A                                           |                    |                    |                                                        |         |        |

## List of equipment used during the test

### Conducted Measurements

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

### Radiated Measurements

| CONTROL NUMBER        | DESCRIPTION                                                   | LAST CALIBRATION | NEXT CALIBRATION |
|-----------------------|---------------------------------------------------------------|------------------|------------------|
| 1179                  | Semi anechoic Absorber Lined Chamber Frankonia SAC 3 plus "L" | N/A              | N/A              |
| 1064                  | BiconicalLog antenna ETS LINDGREN 3142E                       | 2017/03          | 2020/03          |
| 1057                  | Double-ridge Waveguide Horn antenna 1-18 GHz                  | 2017/03          | 2020/03          |
| 1056                  | Double-ridge Waveguide Horn antenna 18-40 GHz                 | 2016/12          | 2019/12          |
| 1012                  | Spectrum analyzer Rohde & Schwarz ESR26                       | 2018/09          | 2020/09          |
| 1039                  | Spectrum analyzer Rohde & Schwarz FSV40                       | 2018/10          | 2020/10          |
| 1015,1017, 1019, 1020 | Rohde & Schwarz EMC32 software                                | N/A              | N/A              |

## Appendix A: Test Results for FCC Part 27/ IC RSS-199

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## PRODUCT INFORMATION

The following information is provided by the client

| Information                  | Description                                                                        |
|------------------------------|------------------------------------------------------------------------------------|
| Modulation                   | QPSK, QAM                                                                          |
| Maximum RF Output Power      | 23 dBm                                                                             |
| Operation mode:              |                                                                                    |
| - Operating Frequency Range  | LTE Band 7: 2500 – 2570MHz                                                         |
| - Nominal Channel Bandwidth  | LTE Band 7: 5/ 10/ 15/ 20 MHz                                                      |
| Extreme operating conditions |                                                                                    |
| - Temperature range          | T <sub>nom</sub> = +15 to + 35<br>T <sub>min</sub> = -30<br>T <sub>max</sub> = +50 |
| Antenna type                 | External attachable Antenna.                                                       |
| Antenna gain                 | 5 dBi                                                                              |
| Nominal Voltage              |                                                                                    |
| - Supply Voltage             | 3.8 Vdc                                                                            |
| - Type of power source       | DC voltage from power supply.                                                      |

## DESCRIPTION OF TEST CONDITIONS

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

| TEST CONDITIONS                                                                                                                | DESCRIPTION                                                                                                                                                                                                                                                                                                                                     |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|------------|------|-----------------------|------------------|-------------------|------------|------|------------------|------------|--------|------|------|------------|------------|
| TC#01<br><br>LTE Band 7                                                                                                        | <u>Power supply (V):</u><br><br>V <sub>nominal</sub> = 3.8 Vdc                                                                                                                                                                                                                                                                                  |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>Test Frequencies for Conducted tests:</u>                                                                                                                                                                                                                                                                                                    |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>5 MHz Bandwidth:</u><br>-Lowest Channel: 20775 (2502.5 MHz)<br>-Middle Channel: 21100 (2535.0 MHz)<br>-Highest Channel: 21425 (2567.5 MHz)                                                                                                                                                                                                   |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>10 MHz Bandwidth:</u><br>-Lowest Channel: 20800 (2505.0 MHz)<br>-Middle Channel: 21100 (2535.0 MHz)<br>-Highest Channel: 21400 (2565.0 MHz)                                                                                                                                                                                                  |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>15 MHz Bandwidth:</u><br>-Lowest Channel: 20825 (2507.5 MHz)<br>-Middle Channel: 21100 (2535.0 MHz)<br>-Highest Channel: 21375 (2562.5 MHz)                                                                                                                                                                                                  |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>20 MHz Bandwidth:</u><br>-Lowest Channel: 20850 (2510.0 MHz)<br>-Middle Channel: 21100 (2535.0 MHz)<br>-Highest Channel:21350 (2560.0 MHz)                                                                                                                                                                                                   |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <u>Test Frequencies for Radiated tests:</u>                                                                                                                                                                                                                                                                                                     |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | <table><tr><td>Available Frequencies</td><td>Tested Frequency</td><td>Channel Bandwidth</td><td>Modulation</td><td>Mode</td></tr><tr><td rowspan="3">2570 to 2610 MHz</td><td>2507.5 MHz</td><td rowspan="3">15 MHz</td><td rowspan="3">QPSK</td><td rowspan="3">1 RB</td></tr><tr><td>2535.0 MHz</td></tr><tr><td>2562.5 MHz</td></tr></table> |                  |                   |            |      | Available Frequencies | Tested Frequency | Channel Bandwidth | Modulation | Mode | 2570 to 2610 MHz | 2507.5 MHz | 15 MHz | QPSK | 1 RB | 2535.0 MHz | 2562.5 MHz |
|                                                                                                                                | Available Frequencies                                                                                                                                                                                                                                                                                                                           | Tested Frequency | Channel Bandwidth | Modulation | Mode |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
|                                                                                                                                | 2570 to 2610 MHz                                                                                                                                                                                                                                                                                                                                | 2507.5 MHz       | 15 MHz            | QPSK       | 1 RB |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
| 2535.0 MHz                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                 |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
| 2562.5 MHz                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                 |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |
| Note: This device was tested under all bandwidths, RB configurations and modulations. The worst case found in QPSK modulation. |                                                                                                                                                                                                                                                                                                                                                 |                  |                   |            |      |                       |                  |                   |            |      |                  |            |        |      |      |            |            |

## TEST A.1: RF OUTPUT POWER

|                |                   |                                             |
|----------------|-------------------|---------------------------------------------|
| <b>LIMITS:</b> | Product standard: | FCC Part 27 / IC RSS-199                    |
|                | Test standard:    | FCC §2.1046 and §27.50 / RSS-199 Clause 4.4 |

### LIMITS

Fixed, mobile, and portable (hand-held) stations operating in the band are limited to 1-watt EIRP (30 dBm). Fixed stations operating in the band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

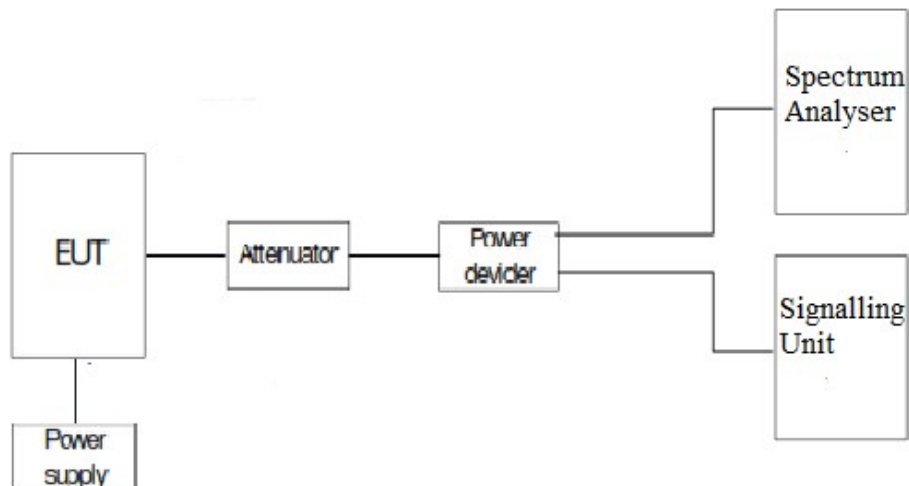
The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

### RSS-199 Clause 6.5

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed two watts.

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

### TEST SETUP



|                                 |       |
|---------------------------------|-------|
| <b>TESTED SAMPLES:</b>          | S/01  |
| <b>TESTED CONDITIONS MODES:</b> | TC#01 |
| <b>TEST RESULTS:</b>            | PASS  |

LTE QPSK AND 16QAM MODULATION. Bandwidth = 5 MHz

| Channel                      | Average power at antenna port (dBm) | Maximum declared antenna gain (dBi) | Maximum E.I.R.P. average power (dBm) | PAPR (dB) |
|------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|-----------|
| Lowest                       | 23.09                               | 5.0                                 | 28.09                                | 4.75      |
| Middle                       | 23.14                               | 5.0                                 | 28.14                                | 5.59      |
| Highest                      | 23.14                               | 5.0                                 | 28.14                                | 5.48      |
| Measurement uncertainty (dB) |                                     |                                     | <±0.95                               |           |

LTE QPSK AND 16QAM MODULATION. Bandwidth = 10 MHz

| Channel                      | Average power at antenna port (dBm) | Maximum declared antenna gain (dBi) | Maximum E.I.R.P. average power (dBm) | PAPR (dB) |
|------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|-----------|
| Lowest                       | 23.01                               | 5.0                                 | 28.01                                | 4.87      |
| Middle                       | 23.09                               | 5.0                                 | 28.09                                | 5.57      |
| Highest                      | 23.09                               | 5.0                                 | 28.09                                | 5.39      |
| Measurement uncertainty (dB) |                                     |                                     | <±0.95                               |           |

LTE QPSK AND 16QAM MODULATION. Bandwidth = 15 MHz

| Channel                      | Average power at antenna port (dBm) | Maximum declared antenna gain (dBi) | Maximum E.I.R.P. average power (dBm) | PAPR (dB) |
|------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|-----------|
| Lowest                       | 23.09                               | 5.0                                 | 28.09                                | 5.16      |
| Middle                       | 23.24                               | 5.0                                 | 28.24                                | 5.68      |
| Highest                      | 23.24                               | 5.0                                 | 28.24                                | 4.75      |
| Measurement uncertainty (dB) |                                     |                                     | <±0.95                               |           |

LTE QPSK AND 16QAM MODULATION. Bandwidth = 20 MHz

| Channel                      | Average power at antenna port (dBm) | Maximum declared antenna gain (dBi) | Maximum E.I.R.P. average power (dBm) | PAPR (dB) |
|------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|-----------|
| Lowest                       | 23.19                               | 5.0                                 | 28.19                                | 5.54      |
| Middle                       | 23.19                               | 5.0                                 | 28.19                                | 5.83      |
| Highest                      | 23.11                               | 5.0                                 | 28.11                                | 5.19      |
| Measurement uncertainty (dB) |                                     |                                     | <±0.95                               |           |

| Test Results (Cont.) |                                 |            |         |           |                     |           |
|----------------------|---------------------------------|------------|---------|-----------|---------------------|-----------|
| BANDWIDTH (MHz)      | CHANNEL FREQUENCY (MHz)         | MODULATION | RB SIZE | RB OFFSET | AVERAGE POWER (dBm) | PAPR (dB) |
| 5                    | Low<br>(20775)<br>2502.5MHz     | QPSK       | 1       | 0         | 22.93               | 3.91      |
|                      |                                 |            | 1       | 12        | 22.88               |           |
|                      |                                 |            | 1       | 24        | 22.93               |           |
|                      |                                 |            | 12      | 0         | 21.94               |           |
|                      |                                 |            | 12      | 6         | 21.94               |           |
|                      |                                 |            | 12      | 11        | 21.92               |           |
|                      |                                 |            | 25      | 0         | 21.96               |           |
|                      |                                 | 16-QAM     | 1       | 0         | 22.43               | 4.75      |
|                      |                                 |            | 1       | 12        | 22.34               |           |
|                      |                                 |            | 1       | 24        | 22.42               |           |
|                      |                                 |            | 12      | 0         | 20.93               |           |
|                      |                                 |            | 12      | 6         | 20.89               |           |
|                      |                                 |            | 12      | 11        | 20.85               |           |
|                      |                                 |            | 25      | 0         | 20.99               |           |
|                      | Middle<br>(21100)<br>2535.0 MHz | QPSK       | 1       | 0         | 23.09               | 4.78      |
|                      |                                 |            | 1       | 12        | 23.06               |           |
|                      |                                 |            | 1       | 24        | 22.96               |           |
|                      |                                 |            | 12      | 0         | 22.04               |           |
|                      |                                 |            | 12      | 6         | 22.10               |           |
|                      |                                 |            | 12      | 11        | 22.05               |           |
|                      |                                 |            | 25      | 0         | 22.06               |           |
|                      |                                 | 16-QAM     | 1       | 0         | 22.20               | 5.59      |
|                      |                                 |            | 1       | 12        | 22.16               |           |
|                      |                                 |            | 1       | 24        | 22.23               |           |
|                      |                                 |            | 12      | 0         | 21.14               |           |
|                      |                                 |            | 12      | 6         | 21.12               |           |
|                      |                                 |            | 12      | 11        | 21.09               |           |
|                      |                                 |            | 25      | 0         | 21.06               |           |
|                      | High<br>(21425)<br>2567.5 MHz   | QPSK       | 1       | 0         | 23.14               | 4.52      |
|                      |                                 |            | 1       | 12        | 23.06               |           |
|                      |                                 |            | 1       | 24        | 23.04               |           |
|                      |                                 |            | 12      | 0         | 22.15               |           |
|                      |                                 |            | 12      | 6         | 22.11               |           |
|                      |                                 |            | 12      | 11        | 22.10               |           |
|                      |                                 |            | 25      | 0         | 22.09               |           |
|                      |                                 | 16-QAM     | 1       | 0         | 22.24               | 5.48      |
|                      |                                 |            | 1       | 12        | 22.22               |           |
|                      |                                 |            | 1       | 24        | 22.18               |           |
|                      |                                 |            | 12      | 0         | 21.21               |           |
|                      |                                 |            | 12      | 6         | 21.24               |           |
|                      |                                 |            | 12      | 11        | 21.19               |           |
|                      |                                 |            | 25      | 0         | 21.09               |           |

**TEST RESULTS (Cont):**

| BANDWIDTH (MHz) | CHANNEL FREQUENCY (MHz)      | MODULATION | RB SIZE | RB OFFSET | AVERAGE POWER (dBm) | PAPR (dB) |
|-----------------|------------------------------|------------|---------|-----------|---------------------|-----------|
| 10              | Low<br>(20800)<br>2505.0 MHz | QPSK       | 1       | 0         | 22.95               | 3.77      |
|                 |                              |            | 1       | 24        | 22.96               |           |
|                 |                              |            | 1       | 49        | 22.86               |           |
|                 |                              |            | 25      | 0         | 21.98               |           |
|                 |                              |            | 25      | 12        | 22.06               |           |
|                 |                              |            | 25      | 24        | 21.96               |           |
|                 |                              |            | 50      | 0         | 22.02               |           |
|                 |                              | 16-QAM     | 1       | 0         | 22.27               | 4.87      |
|                 |                              |            | 1       | 24        | 22.27               |           |
|                 |                              |            | 1       | 49        | 22.25               |           |
|                 |                              |            | 25      | 0         | 21.06               |           |
|                 |                              |            | 25      | 12        | 21.14               |           |
|                 |                              |            | 25      | 24        | 21.06               |           |
|                 |                              |            | 50      | 0         | 21.01               |           |
|                 | Middle<br>21100<br>2535.0    | QPSK       | 1       | 0         | 23.01               | 4.72      |
|                 |                              |            | 1       | 24        | 22.99               |           |
|                 |                              |            | 1       | 49        | 23.03               |           |
|                 |                              |            | 25      | 0         | 22.12               |           |
|                 |                              |            | 25      | 12        | 22.07               |           |
|                 |                              |            | 25      | 24        | 22.01               |           |
|                 |                              |            | 50      | 0         | 22.08               |           |
|                 |                              | 16-QAM     | 1       | 0         | 22.37               | 5.57      |
|                 |                              |            | 1       | 24        | 22.37               |           |
|                 |                              |            | 1       | 49        | 22.36               |           |
|                 |                              |            | 25      | 0         | 21.10               |           |
|                 |                              |            | 25      | 12        | 21.13               |           |
|                 |                              |            | 25      | 24        | 21.07               |           |
|                 |                              |            | 50      | 0         | 21.03               |           |
|                 | High<br>21400<br>2565.0      | QPSK       | 1       | 0         | 23.09               | 4.00      |
|                 |                              |            | 1       | 24        | 23.06               |           |
|                 |                              |            | 1       | 49        | 23.00               |           |
|                 |                              |            | 25      | 0         | 22.18               |           |
|                 |                              |            | 25      | 12        | 22.15               |           |
|                 |                              |            | 25      | 24        | 22.08               |           |
|                 |                              |            | 50      | 0         | 22.15               |           |
|                 |                              | 16-QAM     | 1       | 0         | 22.22               | 5.39      |
|                 |                              |            | 1       | 24        | 22.23               |           |
|                 |                              |            | 1       | 49        | 22.18               |           |
|                 |                              |            | 25      | 0         | 21.26               |           |
|                 |                              |            | 25      | 12        | 21.25               |           |
|                 |                              |            | 25      | 24        | 21.17               |           |
|                 |                              |            | 50      | 0         | 21.10               |           |

**TEST RESULTS (Cont):**

| BANDWIDTH (MHz) | CHANNEL FREQUENCY (MHz)   | MODULATION | RB SIZE | RB OFFSET | AVERAGE POWER (dBm) | PAPR (dB) |
|-----------------|---------------------------|------------|---------|-----------|---------------------|-----------|
| 15              | Low<br>20825<br>2507.5    | QPSK       | 1       | 0         | 22.98               | 4.20      |
|                 |                           |            | 1       | 37        | 22.93               |           |
|                 |                           |            | 1       | 74        | 22.99               |           |
|                 |                           |            | 36      | 0         | 21.98               |           |
|                 |                           |            | 36      | 18        | 22.02               |           |
|                 |                           |            | 36      | 37        | 21.91               |           |
|                 |                           |            | 75      | 0         | 21.97               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.39               | 5.16      |
|                 |                           |            | 1       | 37        | 22.21               |           |
|                 |                           |            | 1       | 74        | 22.31               |           |
|                 |                           |            | 36      | 0         | 21.08               |           |
|                 |                           |            | 36      | 18        | 21.08               |           |
|                 |                           |            | 36      | 37        | 20.98               |           |
|                 |                           |            | 75      | 0         | 21.01               |           |
|                 | Middle<br>21100<br>2535.0 | QPSK       | 1       | 0         | 23.09               | 4.67      |
|                 |                           |            | 1       | 37        | 23.01               |           |
|                 |                           |            | 1       | 74        | 23.06               |           |
|                 |                           |            | 36      | 0         | 22.10               |           |
|                 |                           |            | 36      | 18        | 22.06               |           |
|                 |                           |            | 36      | 37        | 21.99               |           |
|                 |                           |            | 75      | 0         | 22.02               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.39               | 5.68      |
|                 |                           |            | 1       | 37        | 22.30               |           |
|                 |                           |            | 1       | 74        | 22.31               |           |
|                 |                           |            | 36      | 0         | 21.16               |           |
|                 |                           |            | 36      | 18        | 21.11               |           |
|                 |                           |            | 36      | 37        | 21.00               |           |
|                 |                           |            | 75      | 0         | 21.11               |           |
|                 | High<br>21375<br>2562.5   | QPSK       | 1       | 0         | 23.24               | 3.91      |
|                 |                           |            | 1       | 37        | 23.11               |           |
|                 |                           |            | 1       | 74        | 23.02               |           |
|                 |                           |            | 36      | 0         | 22.13               |           |
|                 |                           |            | 36      | 18        | 22.17               |           |
|                 |                           |            | 36      | 37        | 22.04               |           |
|                 |                           |            | 75      | 0         | 22.14               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.11               | 4.75      |
|                 |                           |            | 1       | 37        | 22.06               |           |
|                 |                           |            | 1       | 74        | 22.00               |           |
|                 |                           |            | 36      | 0         | 21.14               |           |
|                 |                           |            | 36      | 18        | 21.22               |           |
|                 |                           |            | 36      | 37        | 21.12               |           |
|                 |                           |            | 75      | 0         | 21.14               |           |

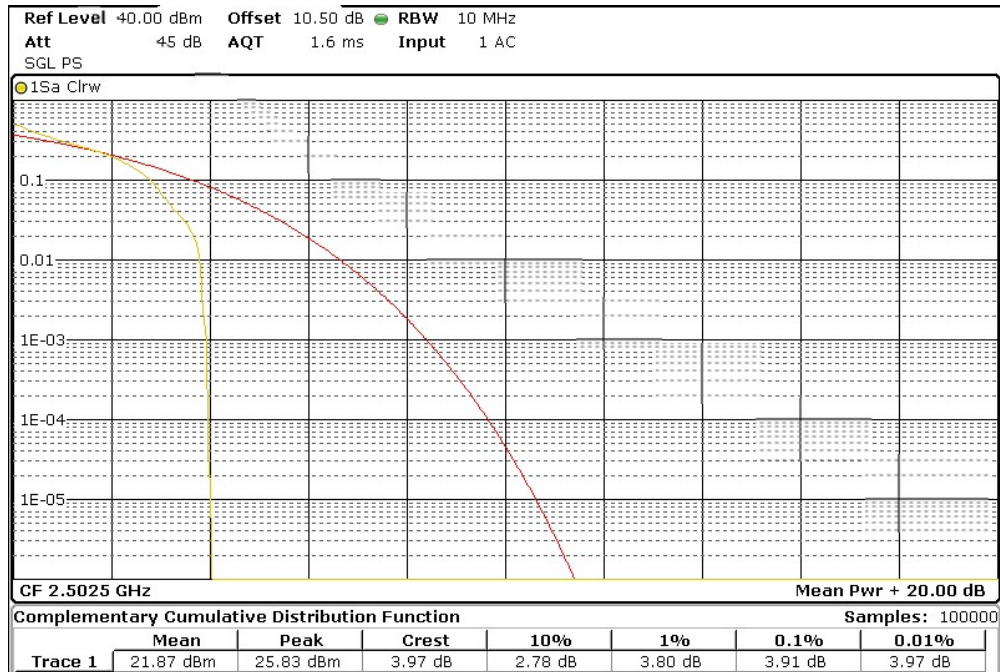
**TEST RESULTS (Cont):**

| BANDWIDTH (MHz) | CHANNEL FREQUENCY (MHz)   | MODULATION | RB SIZE | RB OFFSET | AVERAGE POWER (dBm) | PAPR (dB) |
|-----------------|---------------------------|------------|---------|-----------|---------------------|-----------|
| 20              | Low<br>20850<br>2510.0    | QPSK       | 1       | 0         | 23.08               | 4.26      |
|                 |                           |            | 1       | 49        | 22.91               |           |
|                 |                           |            | 1       | 99        | 22.97               |           |
|                 |                           |            | 50      | 0         | 22.08               |           |
|                 |                           |            | 50      | 24        | 21.97               |           |
|                 |                           |            | 50      | 49        | 22.04               |           |
|                 |                           |            | 100     | 0         | 21.99               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.30               | 5.54      |
|                 |                           |            | 1       | 49        | 22.12               |           |
|                 |                           |            | 1       | 99        | 22.17               |           |
|                 |                           |            | 50      | 0         | 21.12               |           |
|                 |                           |            | 50      | 24        | 21.05               |           |
|                 |                           |            | 50      | 49        | 21.00               |           |
|                 |                           |            | 100     | 0         | 20.99               |           |
|                 | Middle<br>21100<br>2535.0 | QPSK       | 1       | 0         | 23.19               | 4.75      |
|                 |                           |            | 1       | 49        | 23.12               |           |
|                 |                           |            | 1       | 99        | 23.07               |           |
|                 |                           |            | 50      | 0         | 22.04               |           |
|                 |                           |            | 50      | 24        | 22.07               |           |
|                 |                           |            | 50      | 49        | 22.07               |           |
|                 |                           |            | 100     | 0         | 22.05               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.60               | 5.83      |
|                 |                           |            | 1       | 49        | 22.37               |           |
|                 |                           |            | 1       | 99        | 22.56               |           |
|                 |                           |            | 50      | 0         | 21.01               |           |
|                 |                           |            | 50      | 24        | 21.11               |           |
|                 |                           |            | 50      | 49        | 21.04               |           |
|                 |                           |            | 100     | 0         | 21.14               |           |
|                 | High<br>21350<br>2560.0   | QPSK       | 1       | 0         | 23.11               | 4.35      |
|                 |                           |            | 1       | 49        | 23.00               |           |
|                 |                           |            | 1       | 99        | 23.00               |           |
|                 |                           |            | 50      | 0         | 22.16               |           |
|                 |                           |            | 50      | 24        | 22.10               |           |
|                 |                           |            | 50      | 49        | 22.11               |           |
|                 |                           |            | 100     | 0         | 22.11               |           |
|                 |                           | 16-QAM     | 1       | 0         | 22.76               | 5.19      |
|                 |                           |            | 1       | 49        | 22.63               |           |
|                 |                           |            | 1       | 99        | 22.62               |           |
|                 |                           |            | 50      | 0         | 21.14               |           |
|                 |                           |            | 50      | 24        | 21.05               |           |
|                 |                           |            | 50      | 49        | 21.08               |           |
|                 |                           |            | 100     | 0         | 21.13               |           |

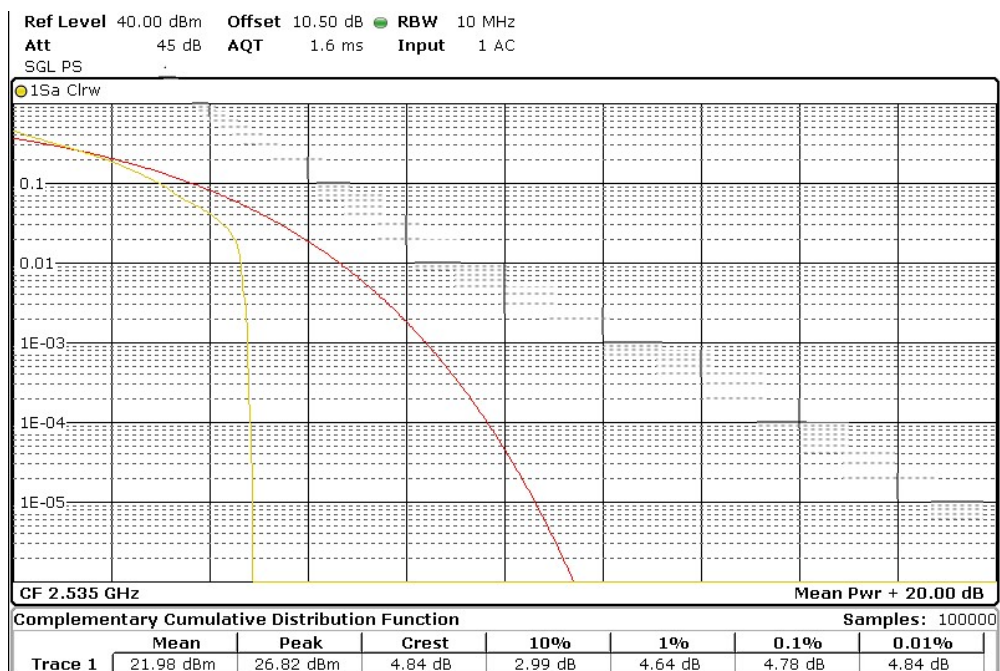
## TEST RESULTS (Cont):

### PAPR

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

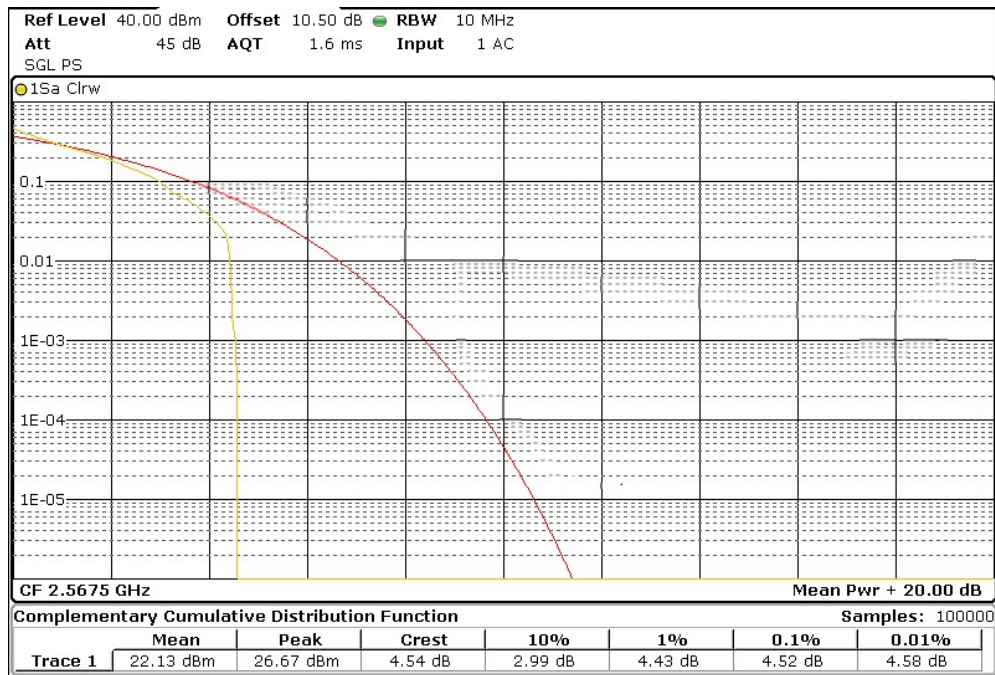


### Middle channel



## TEST RESULTS (Cont):

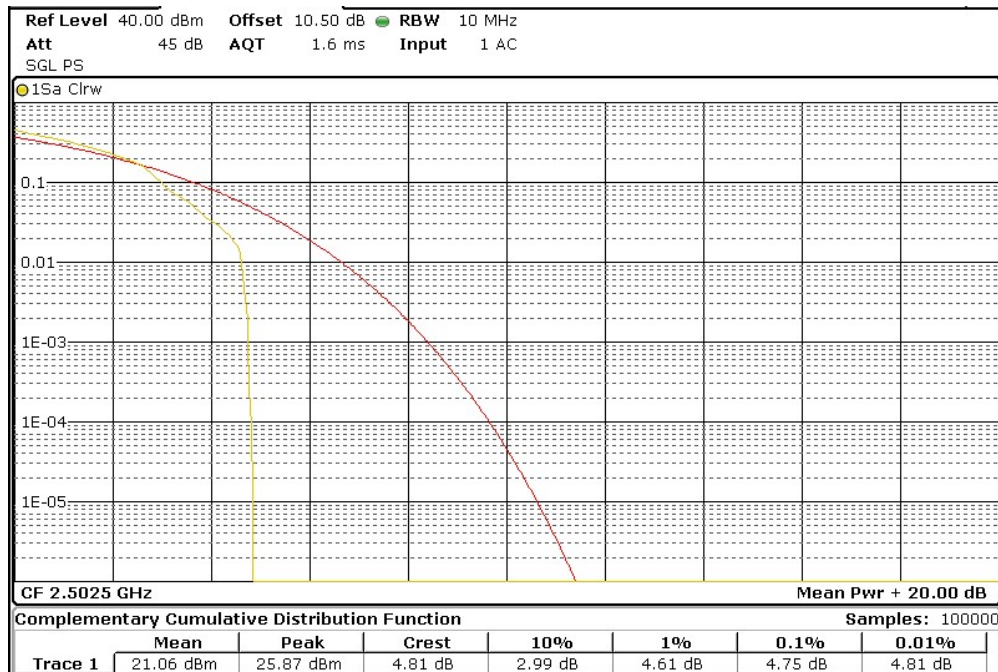
Highest channel



PAPR

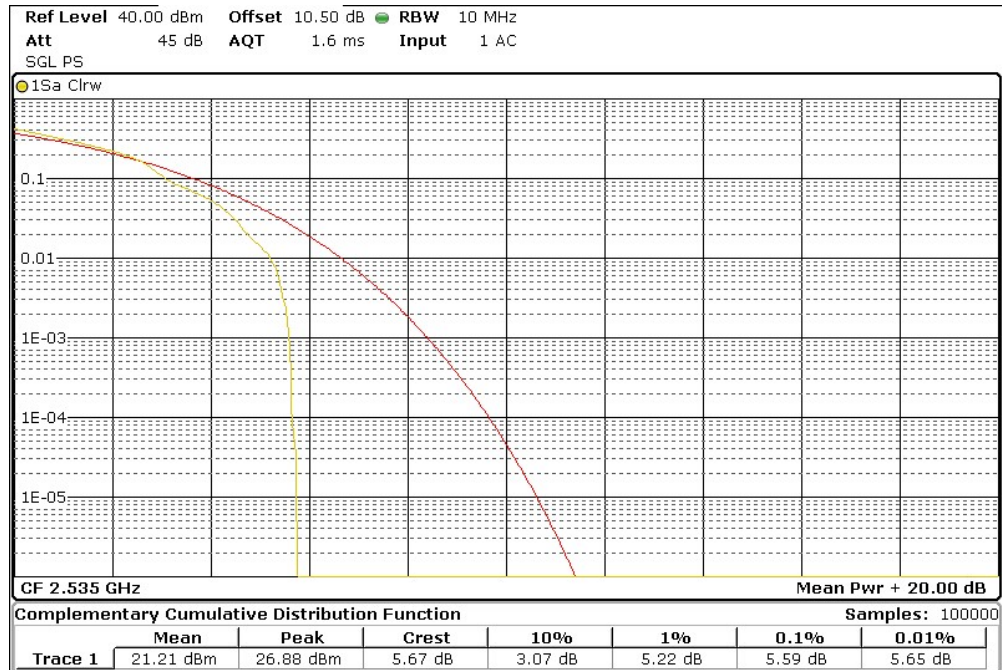
Bandwidth = 5 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel

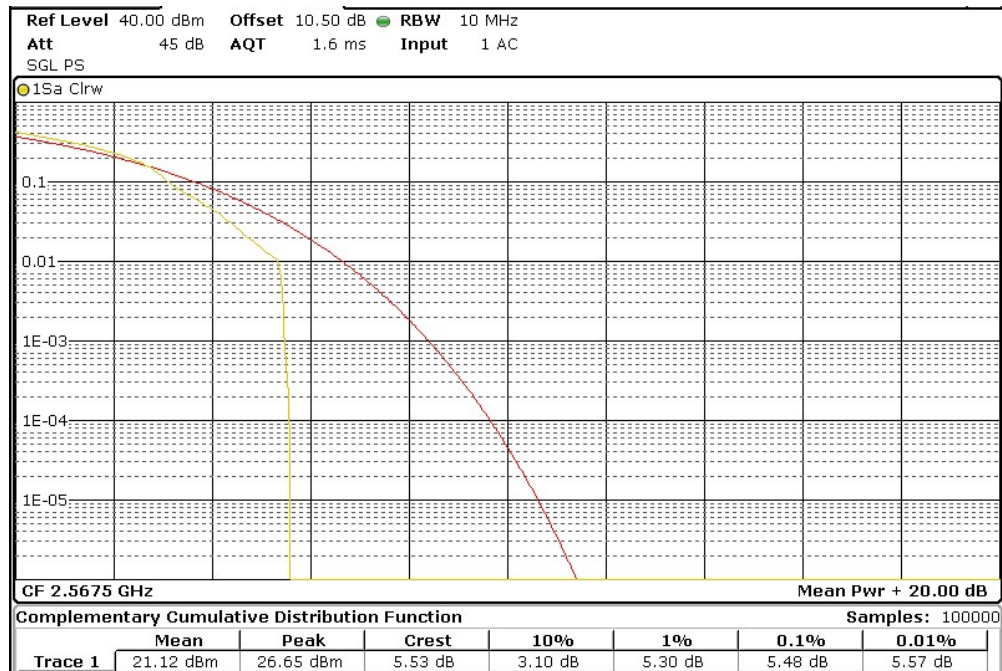


## TEST RESULTS (Cont):

### Middle channel



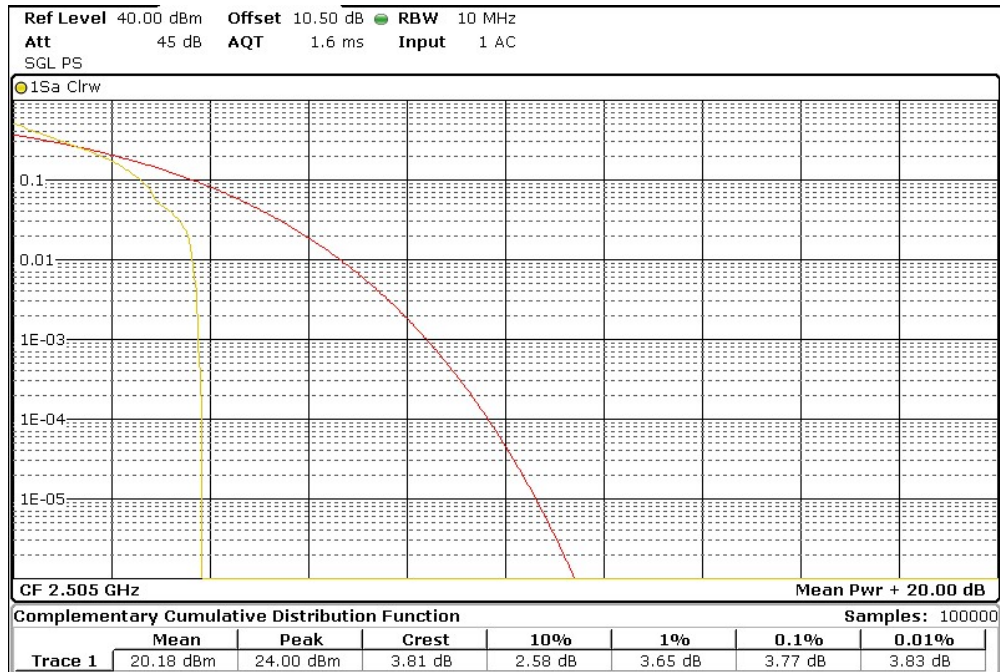
### Highest channel



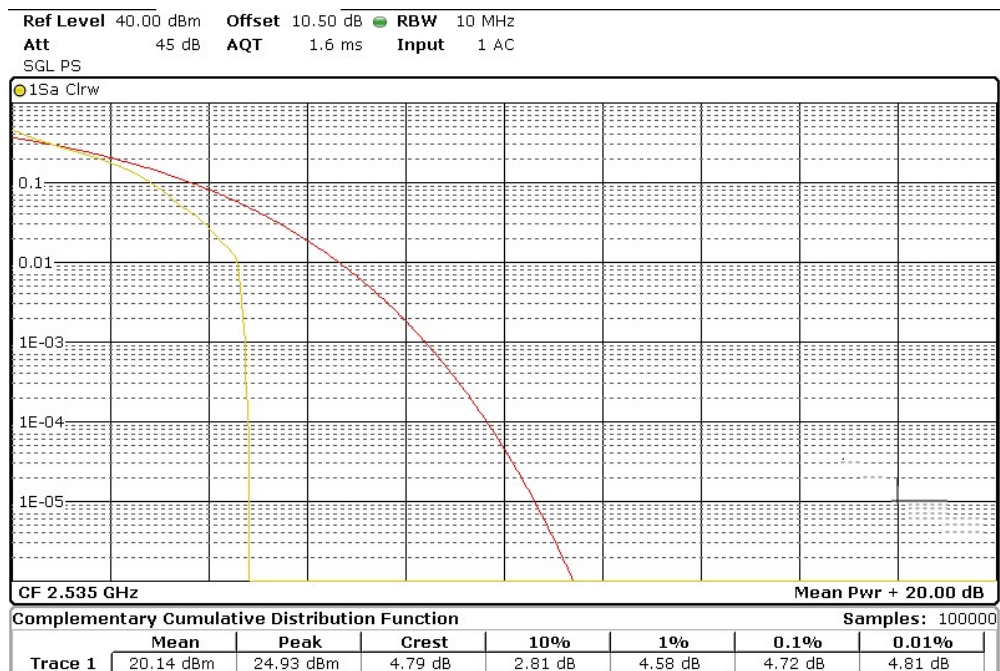
## TEST RESULTS (Cont):

### PAPR

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

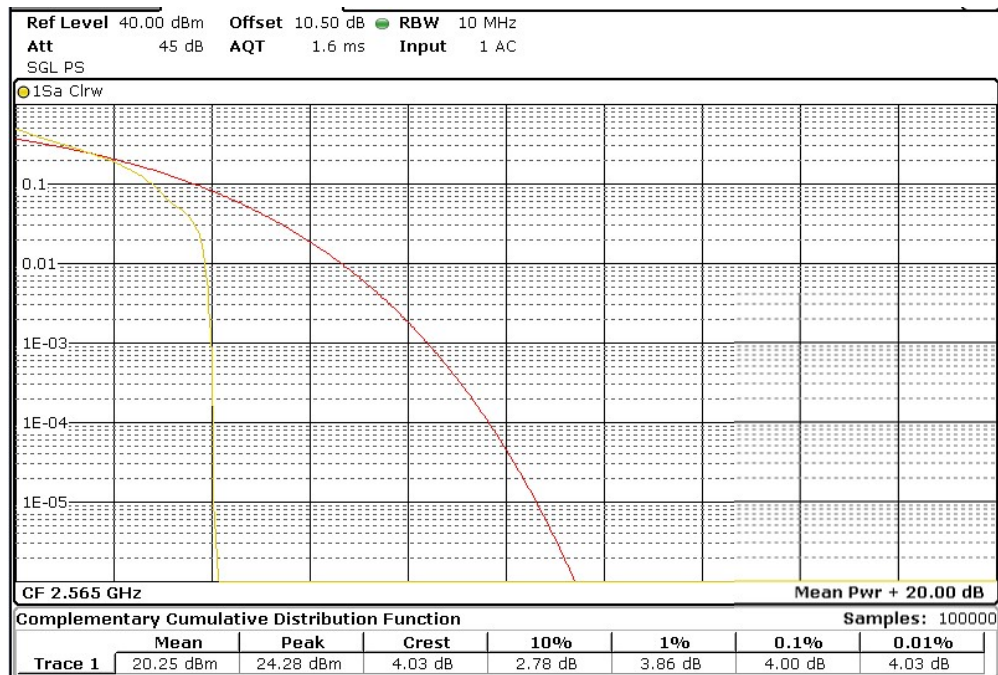


### Middle channel



## TEST RESULTS (Cont):

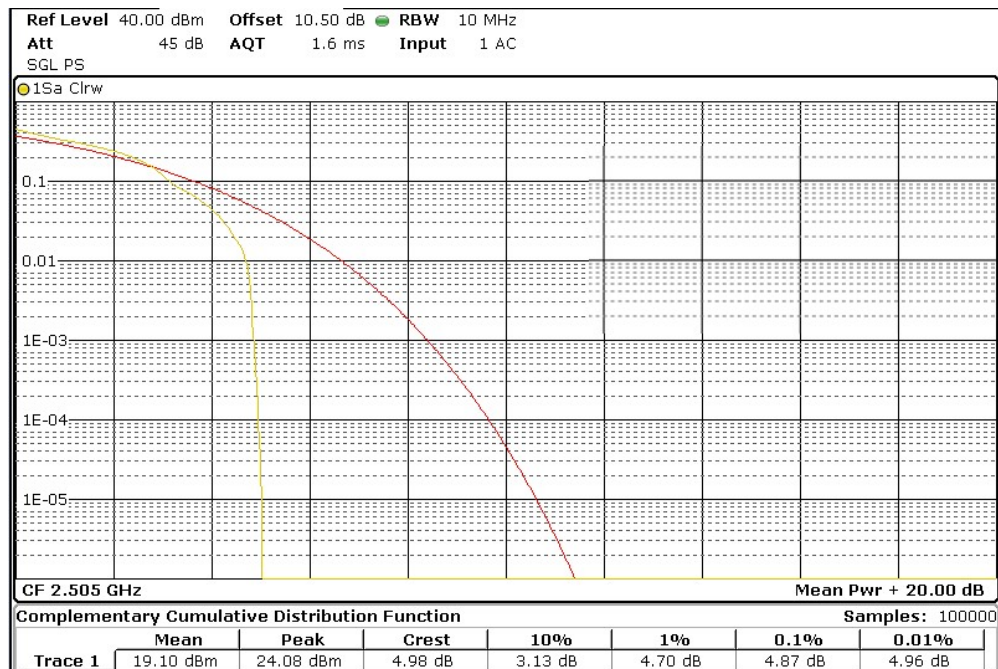
Highest channel



PAPR

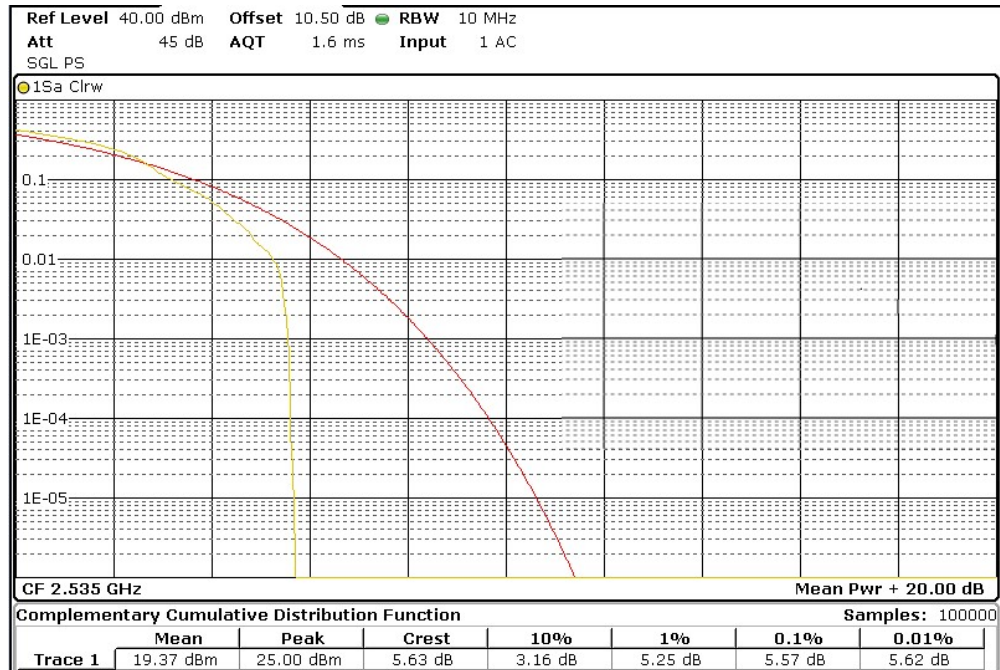
Bandwidth = 10 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.

Lowest channel

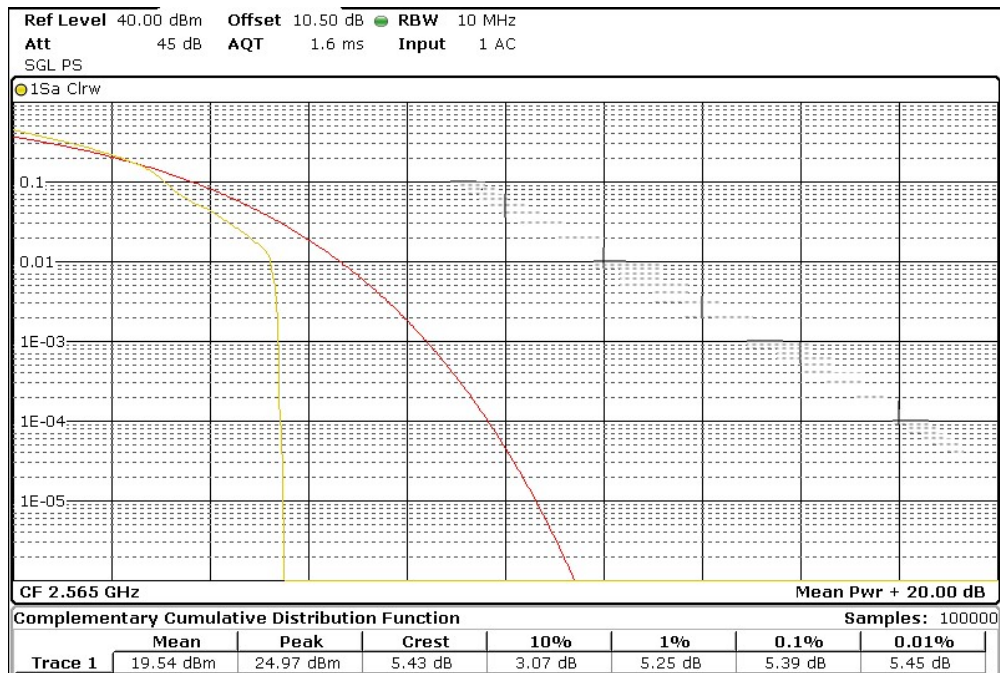


## TEST RESULTS (Cont):

### Middle channel



### Highest channel

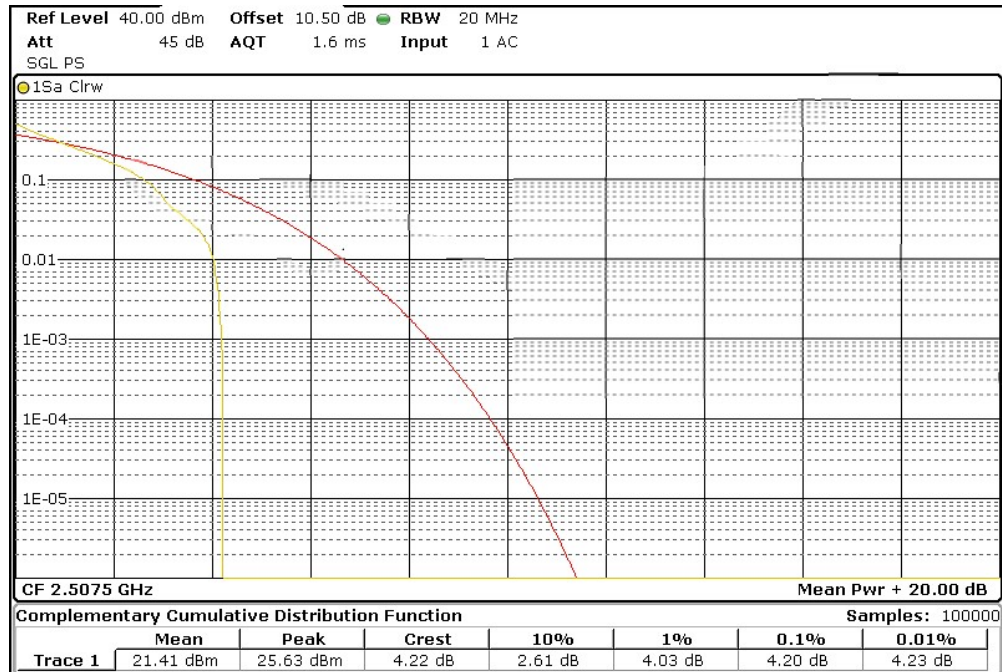


## TEST RESULTS (Cont):

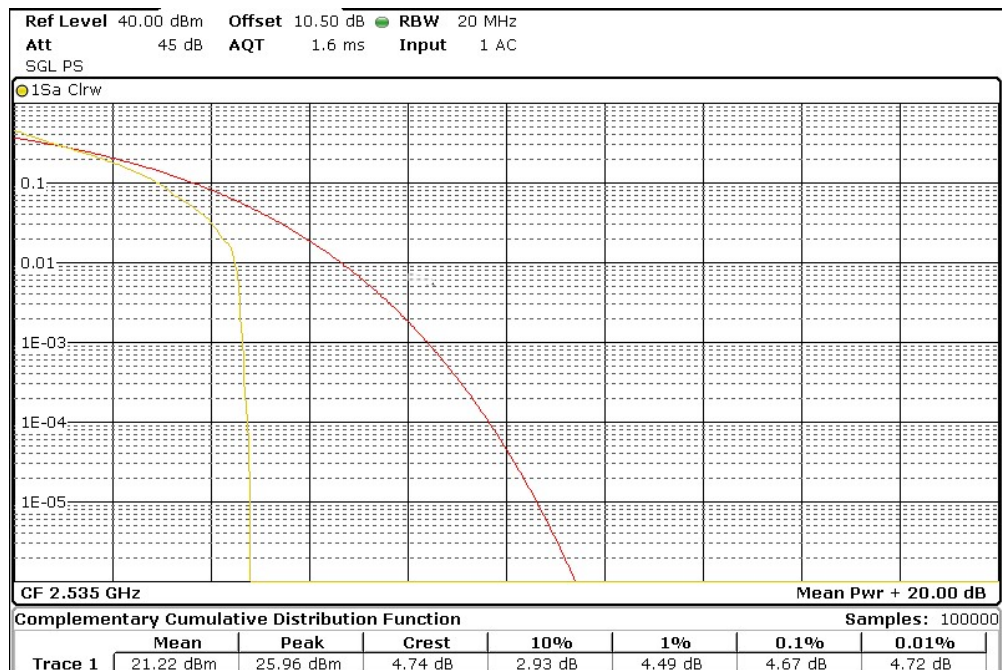
PAPR

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

Lowest channel

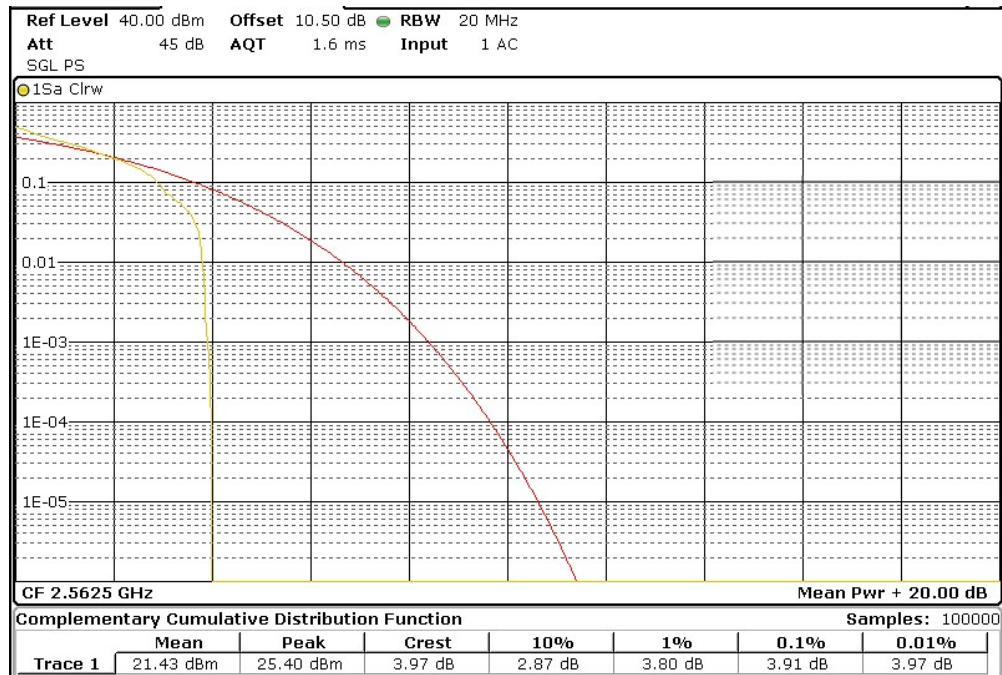


Middle channel



## TEST RESULTS (Cont):

Highest channel

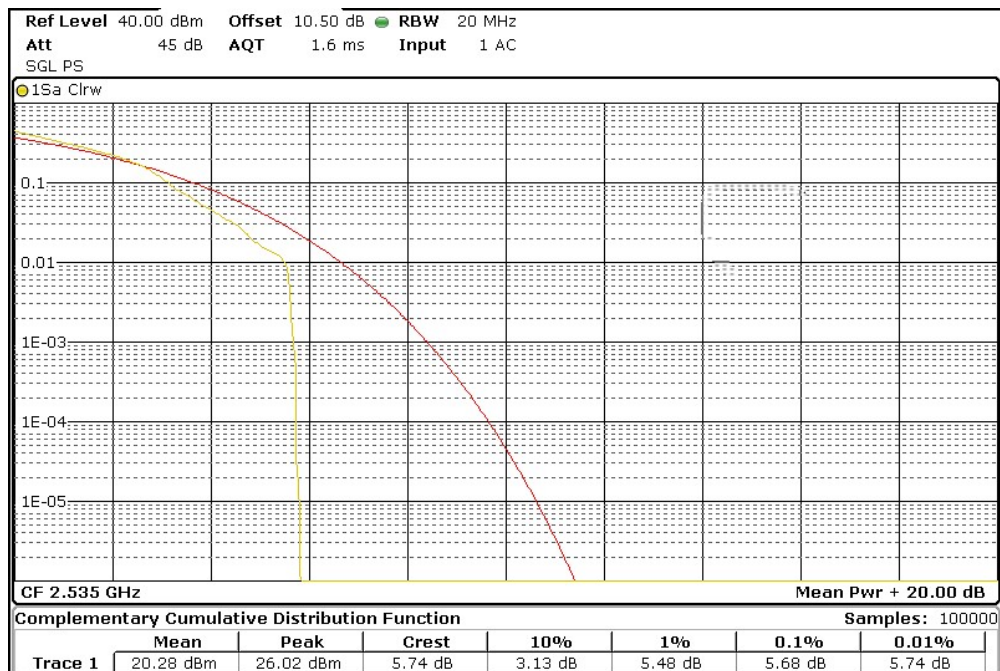


Bandwidth = 15 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Lowest channel

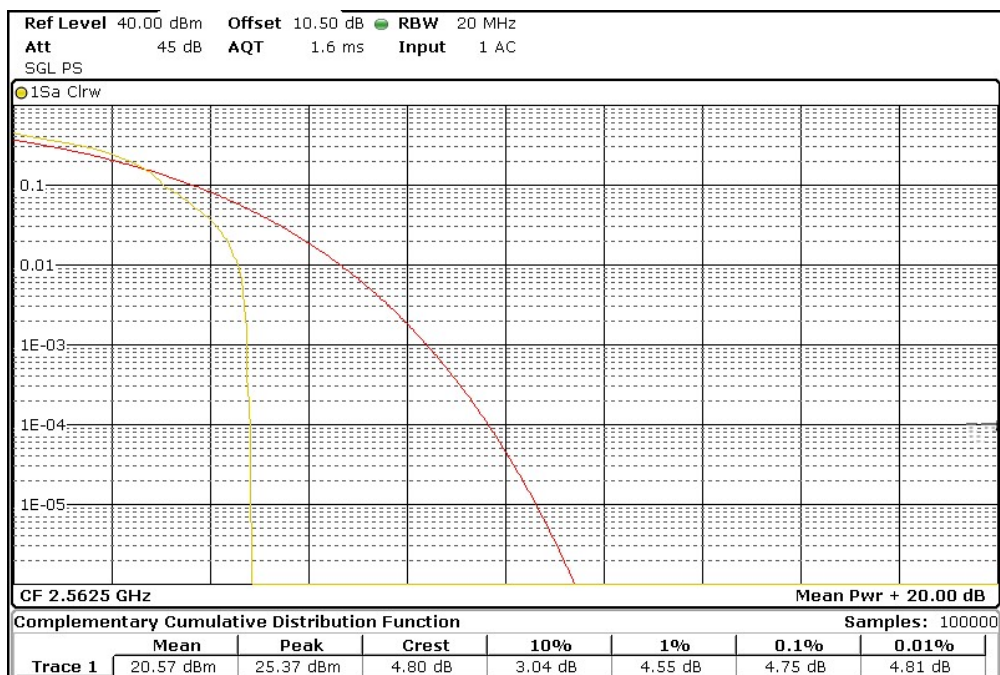


## TEST RESULTS (Cont):

### Middle channel

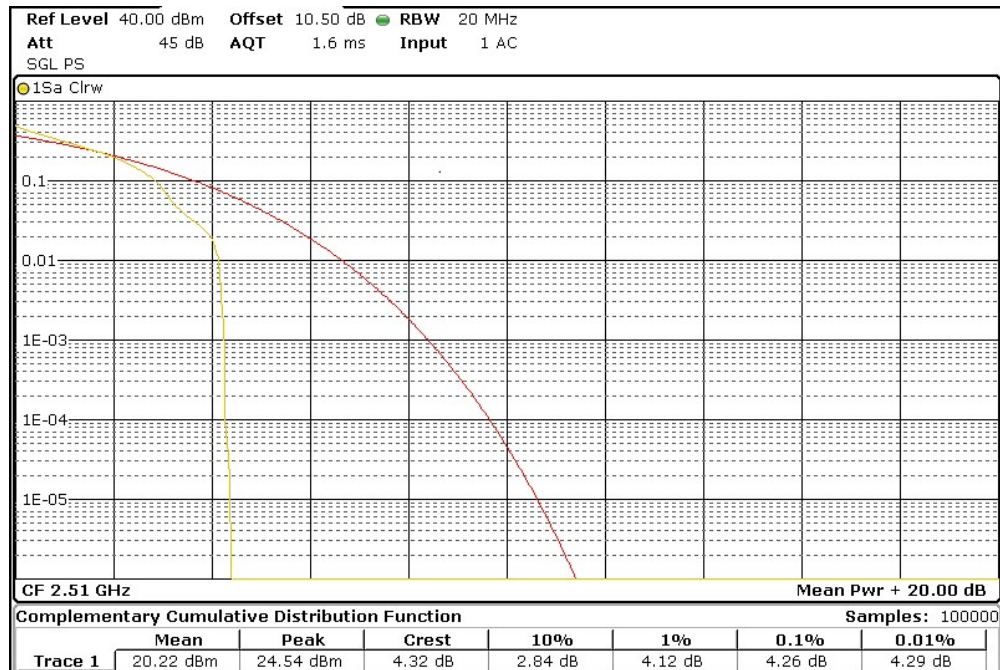


### Highest channel

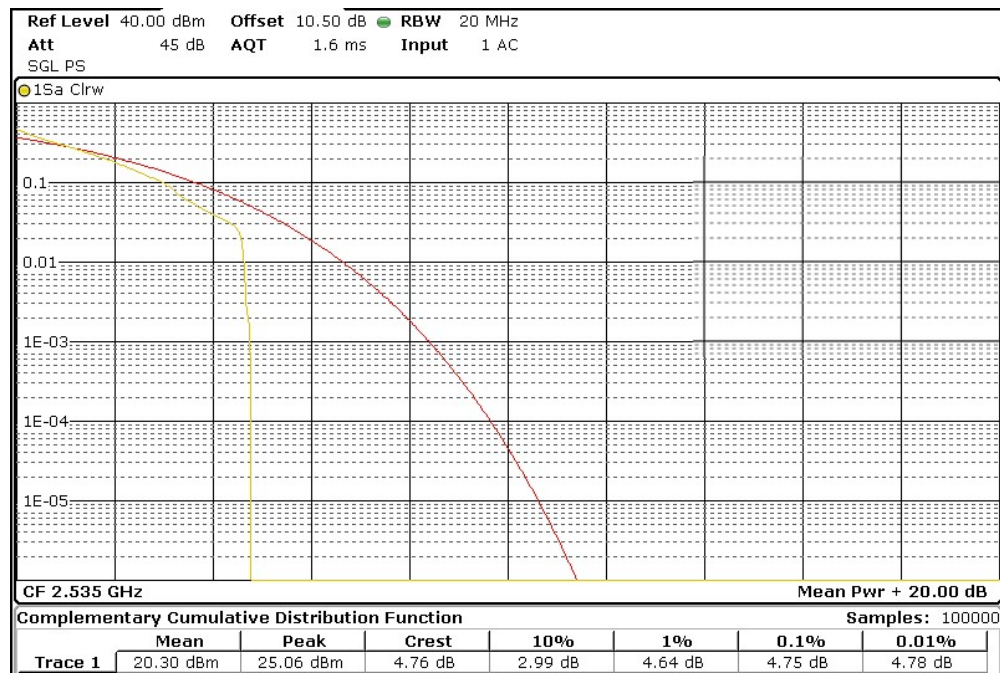


## TEST RESULTS (Cont):

Bandwidth = 20 MHz. Modulation QPSK. RB Size: 1. RB Offset: 0.  
Lowest channel

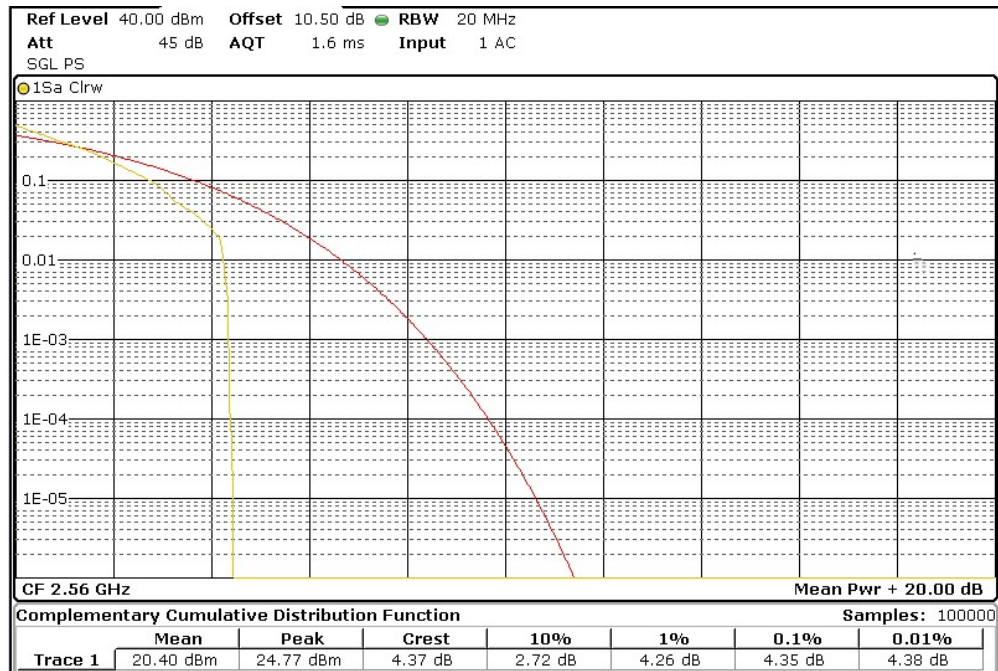


Middle channel

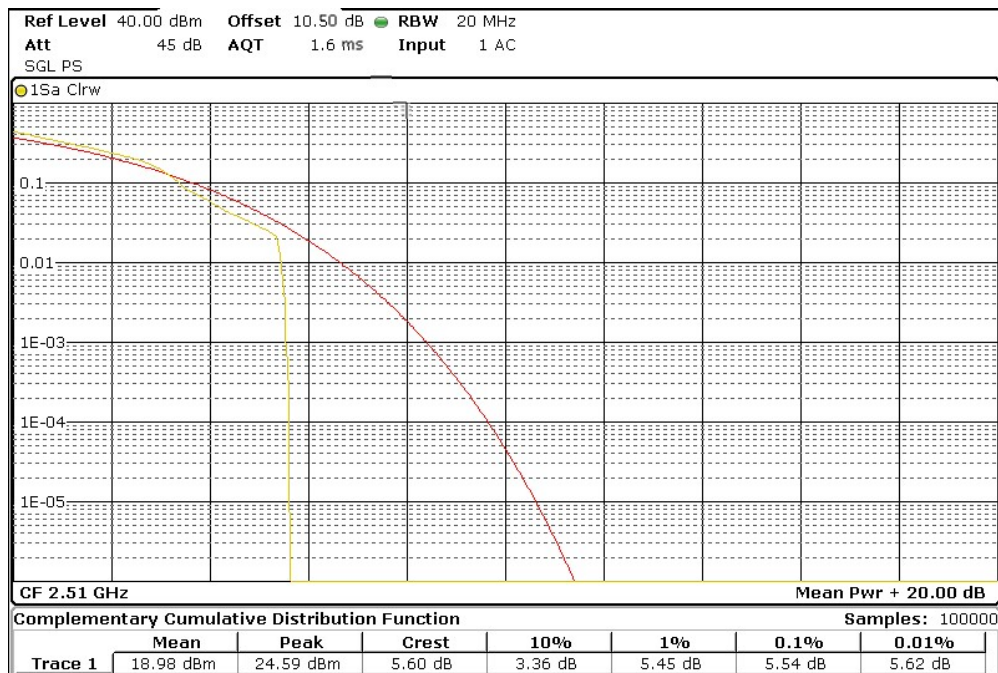


## TEST RESULTS (Cont):

Highest channel

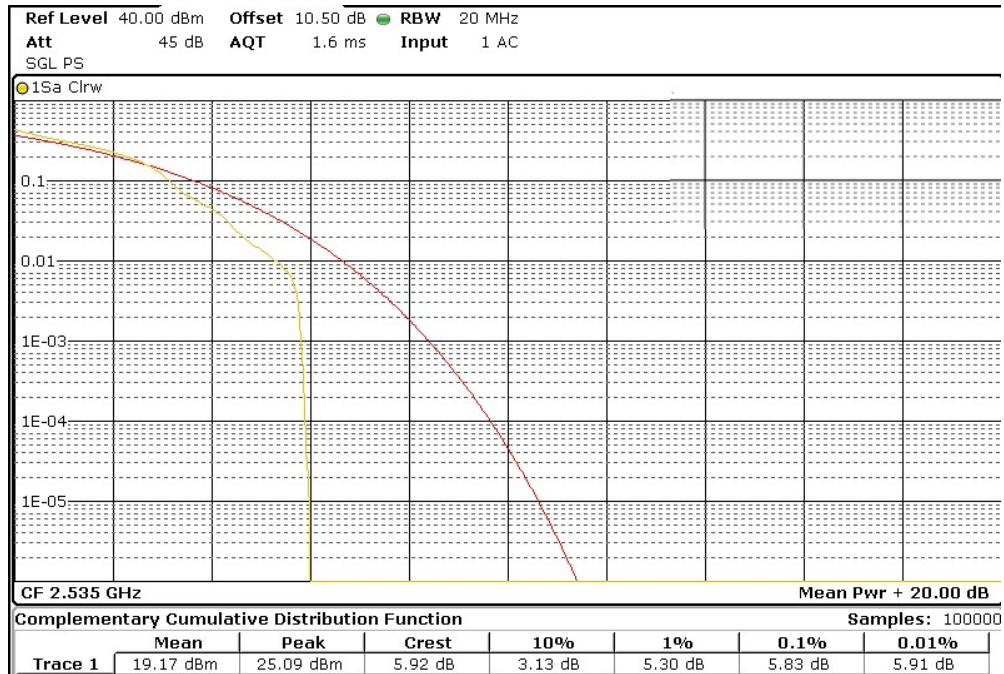


Bandwidth = 20 MHz. Modulation 16QAM. RB Size: 1. RB Offset: 0.  
Lowest channel

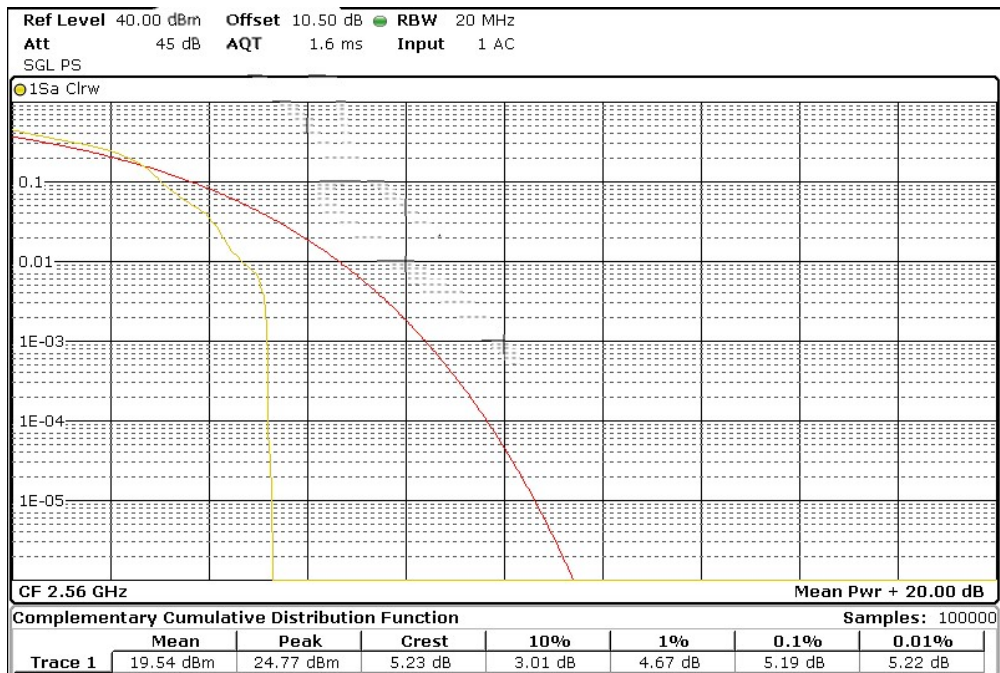


## TEST RESULTS (Cont):

### Middle channel



### Highest channel



## TEST A.2: MODULATION CHARACTERISTICS

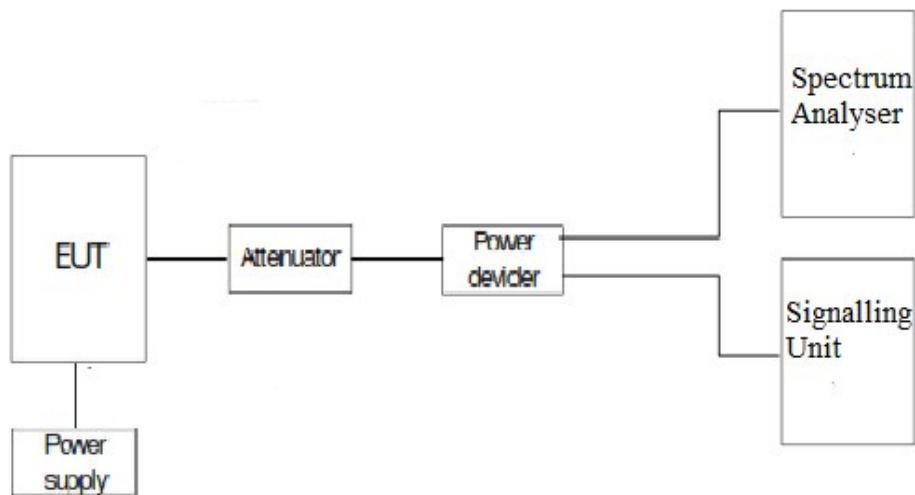
|                |                   |                                             |
|----------------|-------------------|---------------------------------------------|
| <b>LIMITS:</b> | Product standard: | FCC Part 27 / IC RSS-199                    |
|                | Test standard:    | FCC §2.1047 and §27.50 / RSS-199 Clause 4.1 |

### LIMITS

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

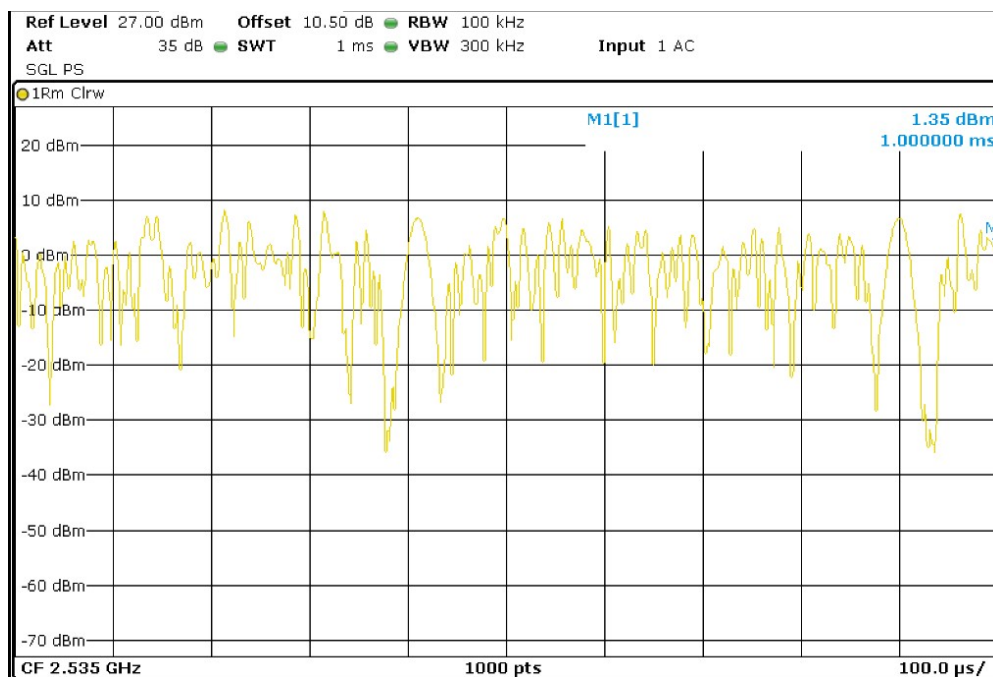
### TEST SETUP

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

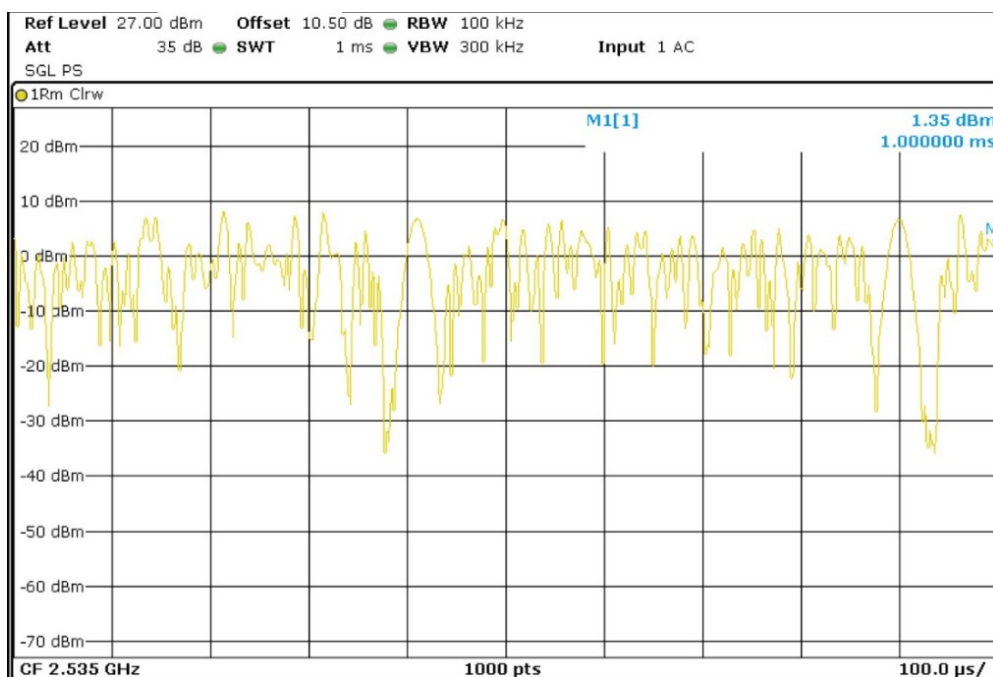


|                                 |       |
|---------------------------------|-------|
| <b>TESTED SAMPLES:</b>          | S/01  |
| <b>TESTED CONDITIONS MODES:</b> | TC#01 |
| <b>TEST RESULTS:</b>            | PASS  |

#### QPSK Modulation



#### 16QAM Modulation



## TEST A.3: FREQUENCY STABILITY

|                |                   |                                              |
|----------------|-------------------|----------------------------------------------|
| <b>LIMITS:</b> | Product standard: | FCC Part 27 / IC RSS-199                     |
|                | Test standard:    | FCC §2.1055 and § 27.54 / RSS-199 Clause 4.3 |

### LIMITS

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

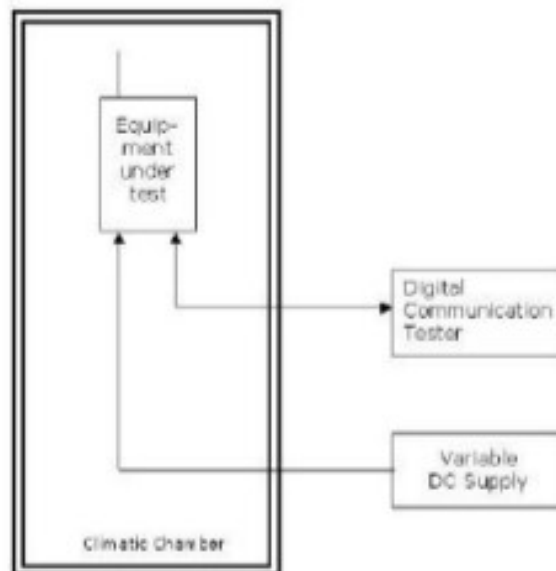
### TEST SETUP

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

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

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

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



|                                 |       |
|---------------------------------|-------|
| <b>TESTED SAMPLES:</b>          | S/01  |
| <b>TESTED CONDITIONS MODES:</b> | TC#01 |
| <b>TEST RESULTS:</b>            | PASS  |

LTE QPSK MODULATION. BW = 5 MHz

Frequency stability over temperature variations

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) | Frequency Error (%) |
|------------------|----------------------|-----------------------|---------------------|
| 50               | 5.16                 | -0.0129               | -0.00000129         |
| 40               | -6.82                | -0.0127               | -0.00000127         |
| 30               | 2.2                  | -0.0069               | -0.00000069         |
| 20               | 0.8                  | -0.0094               | -0.00000094         |
| 10               | 4.69                 | -0.0051               | -0.00000051         |
| 0                | -1.56                | -0.0077               | -0.00000077         |
| -10              | 4.28                 | -0.0072               | -0.00000072         |
| -20              | 2.49                 | -0.0097               | -0.00000097         |
| -30              | -1.73                | -0.0070               | -0.00000070         |

Frequency stability over voltage variations

| Battery Supply voltage | Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) | Frequency Error (%) |
|------------------------|-------------|----------------------|-----------------------|---------------------|
| Vmax                   | 4.37        | 4.18                 | -0.0082               | -0.00000082         |
| Vmin                   | 3.23        | -9.08                | -0.0110               | -0.00000110         |

## TEST A.4: OCCUPIED BANDWIDTH

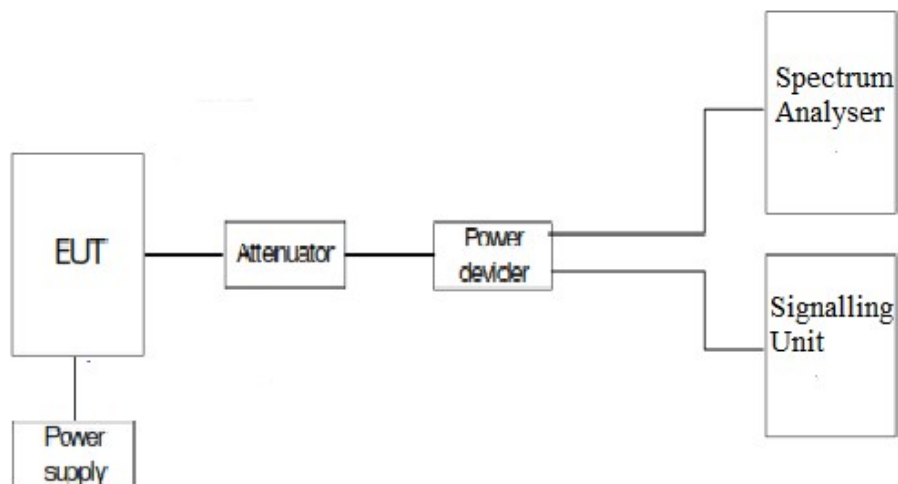
|                |                   |                                   |
|----------------|-------------------|-----------------------------------|
| <b>LIMITS:</b> | Product standard: | FCC Part 27 / IC RSS-199          |
|                | Test standard:    | FCC § 2.1049 / RSS-199 Clause 4.2 |

### LIMITS

Reference only.

### TEST SETUP

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



|                                 |       |
|---------------------------------|-------|
| <b>TESTED SAMPLES:</b>          | S/01  |
| <b>TESTED CONDITIONS MODES:</b> | TC#01 |
| <b>TEST RESULTS:</b>            | PASS  |

## RESULTS

LTE QPSK MODULATION. BW = 5 MHz

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

LTE 16QAM MODULATION. BW = 5 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 4.58   | 4.57   | 4.56    |
| -26 dBc bandwidth (MHz)      | 5.17   | 5.20   | 5.15    |

LTE QPSK MODULATION. BW = 10 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 8.96   | 8.96   | 8.98    |
| -26 dBc bandwidth (MHz)      | 10.45  | 10.39  | 10.42   |

LTE 16QAM MODULATION. BW = 10 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 8.98   | 9.00   | 8.98    |
| -26 dBc bandwidth (MHz)      | 10.42  | 10.42  | 10.42   |

# TEST RESULTS (Cont):

LTE QPSK MODULATION. BW = 15 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 13.41  | 13.38  | 13.41   |
| -26 dBc bandwidth (MHz)      | 15.24  | 15.20  | 15.15   |

LTE 16QAM MODULATION. BW = 15 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 13.41  | 13.44  | 13.44   |
| -26 dBc bandwidth (MHz)      | 15.11  | 15.11  | 15.20   |

LTE QPSK MODULATION. BW = 20 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 17.96  | 18.00  | 18.00   |
| -26 dBc bandwidth (MHz)      | 19.10  | 19.23  | 19.51   |

LTE 16QAM MODULATION. BW = 20 MHz

| Channel                      | Lowest | Middle | Highest |
|------------------------------|--------|--------|---------|
| 99% Occupied bandwidth (MHz) | 18.04  | 18.00  | 17.96   |
| -26 dBc bandwidth (MHz)      | 19.28  | 19.40  | 19.28   |