

## FCC PART 27

## TEST REPORT

For

**Pycom Ltd**

High Point 9 Sydenham Road, Guildford Surrey GU1 3RX, Surrey, United Kingdom

**FCC ID: 2AJMTFIPY01R**

|                                                                                                                                                                                                                                                                                                                             |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                                                                                                      | <b>Product Type:</b><br>FiPy Module |
| <b>Report Number:</b> RSH180305059-00                                                                                                                                                                                                                                                                                       |                                     |
| <b>Report Date:</b> 2018-06-12                                                                                                                                                                                                                                                                                              |                                     |
| Rocky Kang                                                                                                                                                                                                                                                                                                                  |                                     |
| <b>Reviewed By:</b> RF Engineer                                                                                                                                                                                                                                                                                             | <i>Rocky Kang</i>                   |
| <b>Prepared By:</b> Bay Area Compliance Laboratories Corp. (Shenzhen)<br>6/F., West Wing, Third Phase of Wanli Industrial<br>Building, Shihua Road, Futian Free Trade Zone,<br>Shenzhen, Guangdong, China<br>Tel: +86-755-33320018<br>Fax: +86-755-33320008<br><a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a> |                                     |

## **TABLE OF CONTENTS**

|                                                                                           |           |
|-------------------------------------------------------------------------------------------|-----------|
| <b>GENERAL INFORMATION.....</b>                                                           | <b>3</b>  |
| PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....                                  | 3         |
| OBJECTIVE .....                                                                           | 3         |
| RELATED SUBMITTAL(S)/GRANT(S).....                                                        | 3         |
| TEST METHODOLOGY .....                                                                    | 3         |
| MEASUREMENT UNCERTAINTY .....                                                             | 3         |
| TEST FACILITY .....                                                                       | 4         |
| <b>SYSTEM TEST CONFIGURATION.....</b>                                                     | <b>5</b>  |
| DESCRIPTION OF TEST CONFIGURATION .....                                                   | 5         |
| EQUIPMENT MODIFICATIONS .....                                                             | 6         |
| SUPPORT EQUIPMENT LIST AND DETAILS .....                                                  | 6         |
| BLOCK DIAGRAM OF TEST SETUP .....                                                         | 6         |
| <b>SUMMARY OF TEST RESULTS .....</b>                                                      | <b>7</b>  |
| <b>TEST EQUIPMENT LIST .....</b>                                                          | <b>8</b>  |
| <b>FCC §2.1047 - MODULATION CHARACTERISTIC .....</b>                                      | <b>10</b> |
| <b>FCC § 2.1046, §27.50(B)(C) (D) - RF OUTPUT POWER.....</b>                              | <b>11</b> |
| APPLICABLE STANDARD .....                                                                 | 11        |
| TEST PROCEDURE .....                                                                      | 11        |
| TEST DATA .....                                                                           | 11        |
| <b>FCC §2.1049 &amp; §27.53 - OCCUPIED BANDWIDTH.....</b>                                 | <b>18</b> |
| APPLICABLE STANDARD .....                                                                 | 18        |
| TEST PROCEDURE .....                                                                      | 18        |
| TEST DATA .....                                                                           | 18        |
| <b>FCC §2.1051 §27.53 (C) (F) (G) (H) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS .....</b> | <b>30</b> |
| APPLICABLE STANDARD .....                                                                 | 30        |
| TEST PROCEDURE .....                                                                      | 30        |
| TEST DATA .....                                                                           | 30        |
| <b>FCC § 2.1053; §27.53 (C) (G)(H) SPURIOUS RADIATED EMISSIONS .....</b>                  | <b>44</b> |
| APPLICABLE STANDARD .....                                                                 | 44        |
| TEST PROCEDURE .....                                                                      | 44        |
| TEST DATA .....                                                                           | 44        |
| <b>§27.53 (C) (G)(H) - BAND EDGES .....</b>                                               | <b>46</b> |
| APPLICABLE STANDARD .....                                                                 | 46        |
| TEST PROCEDURE .....                                                                      | 46        |
| TEST DATA .....                                                                           | 46        |
| <b>FCC § 2.1055; §27.54 - FREQUENCY STABILITY.....</b>                                    | <b>79</b> |
| APPLICABLE STANDARD .....                                                                 | 79        |
| TEST PROCEDURE .....                                                                      | 79        |
| TEST DATA .....                                                                           | 79        |

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Pycom Ltd*'s product, model number: Fipy 1.0 (FCC ID: 2AJMTFIPY01R) or the "EUT" in this report was a FiPy Module, which was measured approximately: 55 mm (L) × 20 mm (W) × 10 mm (H).

*\*All measurement and test data in this report was gathered from production sample serial number: 180305059 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-03-05.*

### Objective

This test report is prepared on behalf of *Pycom Ltd* in accordance with Subpart 27 of the Federal Communication Commissions rules.

### Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS, Part 15.247 DTS, Part 15.249 DXX submissions with FCC ID: 2AJMTFIPY01R.

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 27 – Miscellaneous wireless communications services

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### Measurement Uncertainty

| Parameter                    |            | Uncertainty |
|------------------------------|------------|-------------|
| Occupied Channel Bandwidth   |            | ±5%         |
| RF output power, conducted   |            | ±1.5dB      |
| Unwanted Emission, conducted |            | ±1.5dB      |
| Emissions,<br>radiated       | Below 1GHz | ±4.70dB     |
|                              | Above 1GHz | ±4.80dB     |
| Temperature                  |            | ±1 °C       |
| Supply voltages              |            | ±0.4%       |

### **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

**eMTC Auto Mode: Narrowband and resource blocks per cell BW**

| Test Item                              | LTE Band | Bandwidth(MHz) |    |    |    | Modulation |       | RB setting                                                    |         | Test channel |
|----------------------------------------|----------|----------------|----|----|----|------------|-------|---------------------------------------------------------------|---------|--------------|
|                                        |          | 5              | 10 | 15 | 20 | QPSK       | 16QAM | NB                                                            | TBS Idx |              |
| RF Output Power**                      | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | L/M/H        |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | L/M/H        |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | L/M/H*       |
| Peak-to-average ratio                  | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
| Radiated power                         | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
| Occupied Bandwidth                     | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
| Spurious Emissions at Antenna Terminal | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
| Field Strength of Spurious Radiation   | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
| Band Edge**                            | 4        | √              | √  | √  | √  | √          | √     | 0/3@5MHz BW<br>0/7@10MHz BW<br>0/11@15MHz BW<br>0/15@20MHz BW | 10      | L/H          |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0/3@5MHz BW<br>0/7@10MHz BW                                   | 10      | L/H          |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0/3@5MHz BW<br>0/7@10MHz BW                                   | 10      | M*           |
| Frequency stability                    | 4        | √              | √  | √  | √  | √          | √     | 0                                                             | 10      | M            |
|                                        | 12       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |
|                                        | 13       | √              | √  | ×  | ×  | √          | √     | 0                                                             | 10      | M            |

Note \*: only middle channel with LTE band 13 @10MHz bandwidth.

Note \*\*: Both RB 0 and RB 6 were test for QPSK, both RB 0 and RB 5 were test for 16QAM. other item only test RB 6 with QPSK and RB 5 with 16QAM.

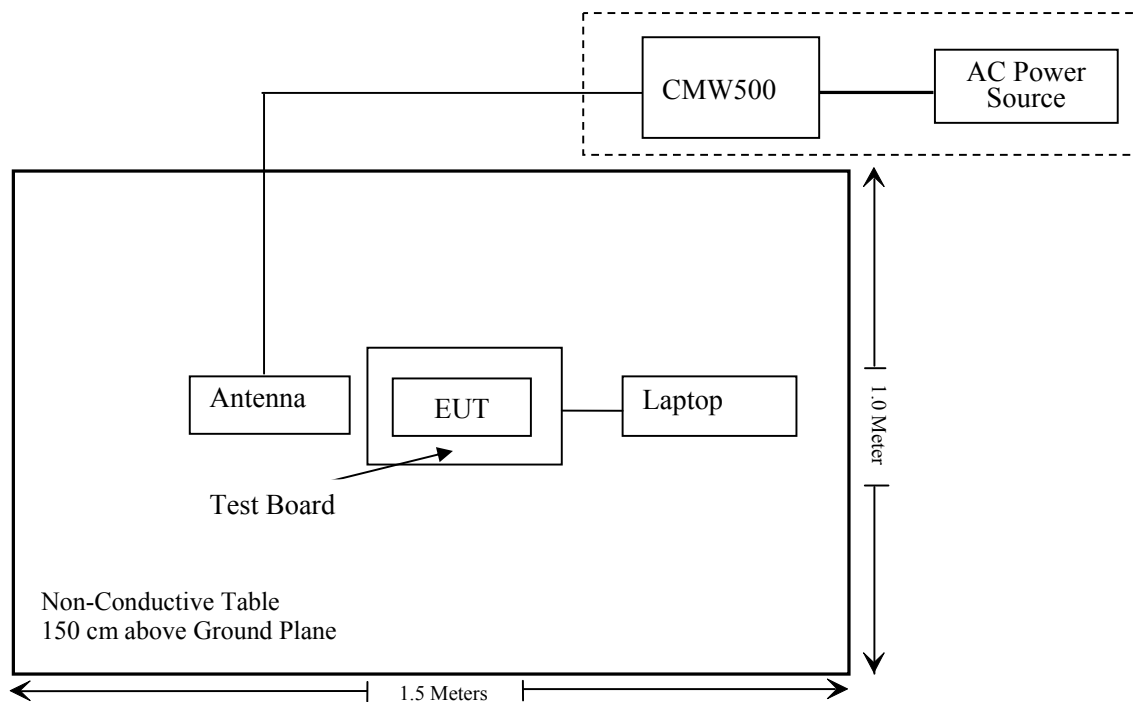
## Equipment Modifications

No modification was made to the EUT.

## Support Equipment List and Details

| Manufacturer    | Description                         | Model  | Serial Number         |
|-----------------|-------------------------------------|--------|-----------------------|
| Rohde & Schwarz | Wideband Radio Communication Tester | CMW500 | 1201.002K50-116218-UY |
| DELL            | Laptop                              | E6410  | GYXJ3A00 JSD2         |
| Pycom Ltd       | Expansion Board                     | /      | 1630001501            |

## Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| FCC Rules                       | Description of Test                    | Result         |
|---------------------------------|----------------------------------------|----------------|
| §2.1046; §27.50 (b) (c) (d)     | RF Output Power                        | Compliance     |
| § 2.1047                        | Modulation Characteristics             | Not Applicable |
| § 2.1049; §27.53                | Occupied Bandwidth                     | Compliance     |
| § 2.1051; §27.53 (c) (f) (g)(h) | Spurious Emissions at Antenna Terminal | Compliance     |
| § 2.1053; §27.53 (c) (g) (h)    | Field Strength of Spurious Radiation   | Compliance     |
| §27.53 (c) (g) (h)              | Band Edge                              | Compliance     |
| § 2.1055; §27.54;               | Frequency stability                    | Compliance     |

**TEST EQUIPMENT LIST**

| Manufacturer                  | Description                         | Model                 | Serial Number         | Calibration Date | Calibration Due Date |
|-------------------------------|-------------------------------------|-----------------------|-----------------------|------------------|----------------------|
| <b>Radiated Emission Test</b> |                                     |                       |                       |                  |                      |
| Sunol Sciences                | Horn Antenna                        | DRH-118               | A052604               | 2017-12-22       | 2020-12-21           |
| Rohde & Schwarz               | Signal Analyzer                     | FSEM                  | 845987/005            | 2018-04-24       | 2019-04-24           |
| Sunol Sciences                | Bi-log Antenna                      | JB1                   | A040904-1             | 2017-12-22       | 2020-12-21           |
| Mini                          | Pre-amplifier                       | ZVA-183-S+            | 5969001149            | 2017-05-21       | 2018-05-21           |
| HP                            | Amplifier                           | HP8447E               | 1937A01046            | 2017-11-19       | 2018-05-21           |
| Anritsu                       | Signal Generator                    | 68369B                | 004114                | 2017-12-24       | 2018-12-24           |
| Rohde & Schwarz               | EMI Test Receiver                   | ESCI                  | 101120                | 2018-01-11       | 2019-01-11           |
| COM POWER                     | Dipole Antenna                      | AD-100                | 041000                | NCR              | NCR                  |
| A.H. System                   | Horn Antenna                        | SAS-200/571           | 135                   | 2015-08-18       | 2018-08-17           |
| Ducommun technologies         | RF Cable                            | UFA210A-1-4724-30050U | MFR64369 223410-001   | 2017-11-19       | 2018-05-21           |
| Ducommun technologies         | RF Cable                            | 104PEA                | 218124002             | 2017-11-19       | 2018-05-21           |
| Rohde & Schwarz               | Wideband Radio Communication Tester | CMW500                | 1201.002K50-146520-wh | 2018-04-24       | 2019-04-24           |
| Ducommun technologies         | RF Cable                            | RG-214                | 1                     | 2017-11-19       | 2018-05-21           |
| Ducommun technologies         | RF Cable                            | RG-214                | 2                     | 2017-11-19       | 2018-05-21           |
| Ducommun Technologies         | Horn Antenna                        | ARH-4223-02           | 1007726-04            | 2017-12-29       | 2020-12-28           |
| Ducommun technologies         | Horn Antenna                        | ARH-4223-02           | 1007726-03            | 2017-12-29       | 2020-12-28           |
| Ducommun technologies         | Pre-amplifier                       | ALN-22093530-01       | 991373-01             | 2017-08-03       | 2018-08-03           |

| Manufacturer             | Description                         | Model     | Serial Number         | Calibration Date | Calibration Due Date |
|--------------------------|-------------------------------------|-----------|-----------------------|------------------|----------------------|
| <b>RF Conducted Test</b> |                                     |           |                       |                  |                      |
| Rohde & Schwarz          | SPECTRUM ANALYZER                   | FSU26     | 200120                | 2017-12-24       | 2018-12-24           |
| ESPEC                    | Temperature & Humidity Chamber      | EL-10KA   | 09107726              | 2017-12-21       | 2018-12-21           |
| Long Wei                 | DC Power Supply                     | TPR-6420D | 398363                | NCR              | NCR                  |
| Agilent                  | ESG Vector Signal Generator         | E4438C    | MY42080875            | 2018-05-09       | 2019-05-09           |
| Rohde & Schwarz          | Wideband Radio Communication Tester | CMW500    | 1201.002K50-146520-wh | 2018-04-24       | 2019-04-24           |
| Ducommun technologies    | RF Cable                            | RG-214    | 3                     | Each Time        |                      |
| WEINSCHTEL               | 3dB Attenuator                      | N/A       | N/A                   | Each Time        |                      |
| N/A                      | Power Splitter                      | N/A       | N/A                   | 2017-05-21       | 2018-05-21           |

\* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

---

## **FCC §2.1047 - MODULATION CHARACTERISTIC**

---

According to FCC § 2.1047(d), Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

**FCC § 2.1046, §27.50(b)(c) (d) - RF OUTPUT POWER****Applicable Standard**

According to §27.50(b), Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

According to §27.50(c), Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

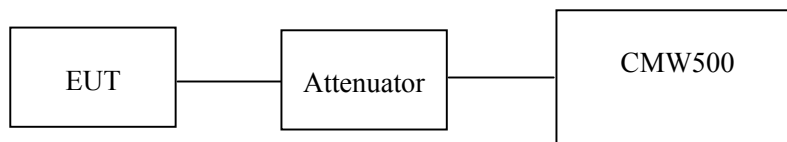
According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHz.

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

**Test Procedure**

*Conducted method:*

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.



*Radiated method:*

TIA 603-D section 2.2.17

**Test Data****Environmental Conditions**

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Jacob Kong on 2018-05-14.*

**LTE Band 4:****Maximum Output Power**

| Bandwidth (MHz) | Modulation | RB size/ NB Index   | Low Channel (dBm) | Middle Channel (dBm) | High Channel (dBm) |
|-----------------|------------|---------------------|-------------------|----------------------|--------------------|
| 5.0             | QPSK       | RB Size=0, Index=10 | 22.41             | 22.52                | 22.34              |
|                 |            | RB Size=6, Index=10 | 22.15             | 22.10                | 22.22              |
|                 | 16QAM      | RB Size=0, Index=10 | 22.24             | 22.18                | 22.23              |
|                 |            | RB Size=5, Index=10 | 22.56             | 22.76                | 22.88              |
| 10.0            | QPSK       | RB Size=0, Index=10 | 22.38             | 22.25                | 22.57              |
|                 |            | RB Size=6, Index=10 | 22.44             | 22.39                | 22.42              |
|                 | 16QAM      | RB Size=0, Index=10 | 22.64             | 22.45                | 22.55              |
|                 |            | RB Size=5, Index=10 | 22.442            | 22.24                | 22.45              |
| 15.0            | QPSK       | RB Size=0, Index=10 | 22.34             | 22.42                | 22.4               |
|                 |            | RB Size=6, Index=10 | 22.41             | 22.52                | 22.3               |
|                 | 16QAM      | RB Size=0, Index=10 | 22.50             | 22.34                | 22.3               |
|                 |            | RB Size=5, Index=10 | 22.62             | 22.5                 | 22.4               |
| 20.0            | QPSK       | RB Size=0, Index=10 | 22.55             | 22.55                | 22.25              |
|                 |            | RB Size=6, Index=10 | 22.46             | 22.75                | 22.34              |
|                 | 16QAM      | RB Size=0, Index=10 | 22.62             | 22.34                | 22.76              |
|                 |            | RB Size=5, Index=10 | 22.28             | 22.25                | 22.46              |

**Peak-to-average ratio (PAR)**

| Bandwidth | Modulation | Middle Channel (dB) | PAR Limit (dB) | Result |
|-----------|------------|---------------------|----------------|--------|
| 5MHz      | QPSK       | 5.61                | 13             | Pass   |
|           | 16QAM      | 5.31                | 13             | Pass   |
| 10MHz     | QPSK       | 5.58                | 13             | Pass   |
|           | 16QAM      | 5.68                | 13             | Pass   |
| 15MHz     | QPSK       | 5.13                | 13             | Pass   |
|           | 16QAM      | 5.49                | 13             | Pass   |
| 20MHz     | QPSK       | 5.77                | 13             | Pass   |
|           | 16QAM      | 5.86                | 13             | Pass   |

**QPSK:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5 MHz Bandwidth    |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 86.25                         | 83                               | 1.3           | H              | 13.1           | 1.30                  | 9.10                    | 20.9                       | 30             |
| 1732.50            | 84.24                         | 126                              | 1.4           | V              | 11.7           | 1.30                  | 9.10                    | 19.5                       | 30             |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 85.31                         | 179                              | 1.5           | H              | 12.3           | 1.30                  | 9.10                    | 20.1                       | 30             |
| 1732.50            | 84.15                         | 341                              | 1.3           | V              | 11.8           | 1.30                  | 9.10                    | 19.6                       | 30             |
| 15 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 85.51                         | 162                              | 1.4           | H              | 12.4           | 1.30                  | 9.10                    | 20.2                       | 30             |
| 1732.50            | 83.40                         | 10                               | 1.6           | V              | 10.9           | 1.30                  | 9.10                    | 18.7                       | 30             |
| 20 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 85.23                         | 189                              | 1.3           | H              | 12.0           | 1.30                  | 9.10                    | 19.8                       | 30             |
| 1732.50            | 84.11                         | 349                              | 1.5           | V              | 11.5           | 1.30                  | 9.10                    | 19.3                       | 30             |

**16QAM:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5 MHz Bandwidth    |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 86.65                         | 10                               | 1.5           | H              | 13.5           | 1.30                  | 9.10                    | 21.3                       | 30             |
| 1732.50            | 85.32                         | 175                              | 1.5           | V              | 12.7           | 1.30                  | 9.10                    | 20.5                       | 30             |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 86.10                         | 196                              | 1.6           | H              | 13.1           | 1.30                  | 9.10                    | 20.9                       | 30             |
| 1732.50            | 84.96                         | 130                              | 1.4           | V              | 12.5           | 1.30                  | 9.10                    | 20.3                       | 30             |
| 15 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 86.34                         | 160                              | 1.3           | H              | 13.2           | 1.30                  | 9.10                    | 21                         | 30             |
| 1732.50            | 85.46                         | 172                              | 1.3           | V              | 12.8           | 1.30                  | 9.10                    | 20.6                       | 30             |
| 20 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 1732.50            | 85.21                         | 114                              | 1.4           | H              | 11.8           | 1.30                  | 9.10                    | 19.6                       | 30             |
| 1732.50            | 84.72                         | 19                               | 1.6           | V              | 12.1           | 1.30                  | 9.10                    | 19.9                       | 30             |

**LTE Band 12:**

| Bandwidth (MHz) | Modulation | RB size/ NB Index   | Low Channel (dBm) | Middle Channel (dBm) | High Channel (dBm) |
|-----------------|------------|---------------------|-------------------|----------------------|--------------------|
| 5               | QPSK       | RB Size=1, Index=10 | 22.21             | 22.31                | 23.24              |
|                 |            | RB Size=6, Index=10 | 21.99             | 22.12                | 22.34              |
|                 | 16QAM      | RB Size=1, Index=10 | 22.05             | 21.89                | 22.41              |
|                 |            | RB Size=5, Index=10 | 22.13             | 22.34                | 22.12              |
| 10              | QPSK       | RB Size=1, Index=10 | 22.35             | 22.55                | 22.37              |
|                 |            | RB Size=6, Index=10 | 22.31             | 22.24                | 22.13              |
|                 | 16QAM      | RB Size=1, Index=10 | 22.15             | 22.27                | 22.11              |
|                 |            | RB Size=5, Index=10 | 21.96             | 22.16                | 22.31              |

**Peak-to-average ratio (PAR)**

| Bandwidth | Modulation | Middle Channel (dB) | PAR Limit (dB) | Result |
|-----------|------------|---------------------|----------------|--------|
| 5MHz      | QPSK       | 4.93                | 13             | Pass   |
|           | 16QAM      | 5.15                | 13             | Pass   |
| 10MHz     | QPSK       | 5.24                | 13             | Pass   |
|           | 16QAM      | 5.03                | 13             | Pass   |

**EIRP:****QPSK:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5 MHz Bandwidth    |                               |                                  |               |                |                |                       |                         |                            |                |
| 707.5              | 90.21                         | 275                              | 1.4           | H              | 20.8           | 0.62                  | 0                       | 20.18                      | 34.77          |
| 707.5              | 90.00                         | 130                              | 1.6           | V              | 21.1           | 0.62                  | 0                       | 20.48                      | 34.77          |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 707.5              | 90.43                         | 79                               | 1.5           | H              | 20.7           | 0.62                  | 0                       | 20.08                      | 34.77          |
| 707.5              | 89.98                         | 186                              | 1.3           | V              | 20.5           | 0.62                  | 0                       | 19.88                      | 34.77          |

**16QAM:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5MHz Bandwidth     |                               |                                  |               |                |                |                       |                         |                            |                |
| 707.5              | 89.56                         | 186                              | 1.5           | H              | 20.1           | 0.62                  | 0                       | 19.48                      | 34.77          |
| 707.5              | 89.63                         | 173                              | 1.7           | V              | 20.9           | 0.62                  | 0                       | 20.28                      | 34.77          |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 707.5              | 89.63                         | 105                              | 1.6           | H              | 19.9           | 0.62                  | 0                       | 19.28                      | 34.77          |
| 707.5              | 89.30                         | 320                              | 1.5           | V              | 19.8           | 0.62                  | 0                       | 19.18                      | 34.77          |

**Note:**

All above data were tested with no amplifier

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

**LTE Band 13:**

| Bandwidth (MHz) | Modulation | RB size/ NB Index   | Low Channel (dBm) | Middle Channel (dBm) | High Channel (dBm) |
|-----------------|------------|---------------------|-------------------|----------------------|--------------------|
| 5               | QPSK       | RB Size=1, Index=10 | 22.04             | 22.32                | 22.39              |
|                 |            | RB Size=6, Index=10 | 22.14             | 22.42                | 22.14              |
|                 | 16QAM      | RB Size=1, Index=10 | 22.21             | 22.28                | 22.06              |
|                 |            | RB Size=5, Index=10 | 22.19             | 22.23                | 22.29              |
| 10              | QPSK       | RB Size=1, Index=10 | /                 | 22.51                | /                  |
|                 |            | RB Size=6, Index=10 | /                 | 22.36                | /                  |
|                 | 16QAM      | RB Size=1, Index=10 | /                 | 22.16                | /                  |
|                 |            | RB Size=5, Index=10 | /                 | 22.67                | /                  |

**Peak-to-average ratio (PAR)**

| Bandwidth | Modulation | Middle Channel (dB) | PAR Limit (dB) | Result |
|-----------|------------|---------------------|----------------|--------|
| 5MHz      | QPSK       | 5.96                | 13             | Pass   |
|           | 16QAM      | 6.05                | 13             | Pass   |
| 10MHz     | QPSK       | 6.15                | 13             | Pass   |
|           | 16QAM      | 6.21                | 13             | Pass   |

**EIRP:****QPSK:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5 MHz Bandwidth    |                               |                                  |               |                |                |                       |                         |                            |                |
| 782                | 90.23                         | 277                              | 1.2           | H              | 20.7           | 0.65                  | 0                       | 20.05                      | 34.77          |
| 782                | 90.01                         | 41                               | 1.4           | V              | 20.5           | 0.65                  | 0                       | 19.85                      | 34.77          |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 782                | 90.24                         | 166                              | 1.4           | H              | 20.7           | 0.65                  | 0                       | 20.05                      | 34.77          |
| 782                | 90.14                         | 158                              | 1.3           | V              | 19.8           | 0.65                  | 0                       | 19.15                      | 34.77          |

**16QAM:**

| Frequency<br>(MHz) | Receiver<br>Reading<br>(dBμV) | Turn<br>table<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) |
|--------------------|-------------------------------|----------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|
|                    |                               |                                  | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |
| Middle Channel     |                               |                                  |               |                |                |                       |                         |                            |                |
| 5MHz Bandwidth     |                               |                                  |               |                |                |                       |                         |                            |                |
| 782                | 90.12                         | 49                               | 1.6           | H              | 20.7           | 0.65                  | 0                       | 20.05                      | 34.77          |
| 782                | 89.96                         | 168                              | 1.8           | V              | 20.5           | 0.65                  | 0                       | 19.85                      | 34.77          |
| 10 MHz Bandwidth   |                               |                                  |               |                |                |                       |                         |                            |                |
| 782                | 90.21                         | 360                              | 1.5           | H              | 20.7           | 0.65                  | 0                       | 20.05                      | 34.77          |
| 782                | 89.21                         | 157                              | 1.4           | V              | 20.0           | 0.65                  | 0                       | 19.35                      | 34.77          |

**Note:**

All above data were tested with no amplifier

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

## FCC §2.1049 & §27.53 - OCCUPIED BANDWIDTH

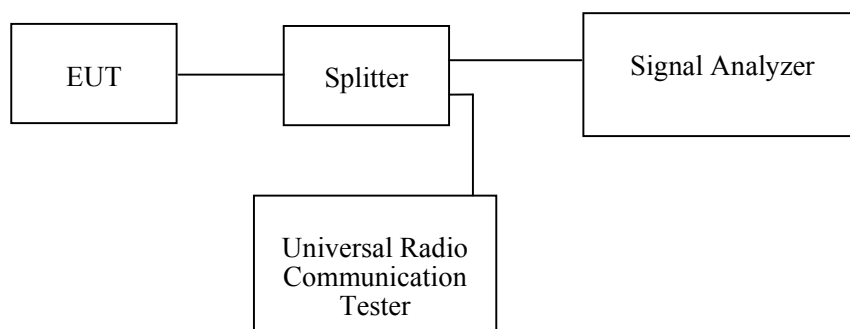
### Applicable Standard

FCC 47 §2.1049 and §27.53.

### Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1% to 5% of the anticipated emission bandwidth and the 26 dB & 99% bandwidth was recorded.



### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Jacob Kong on 2018-05-13 and 2018-05-14.*

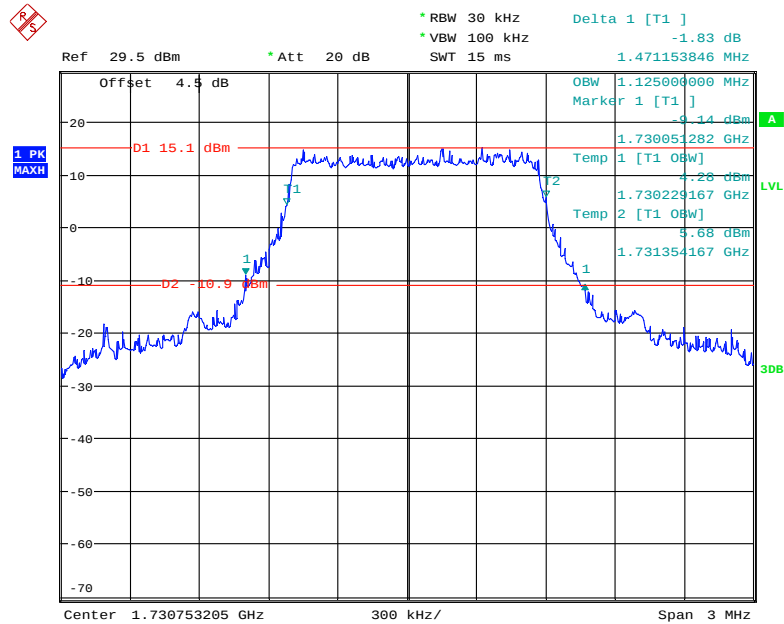
*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to the following tables and plots.*

**LTE Band 4: (Middle Channel)**

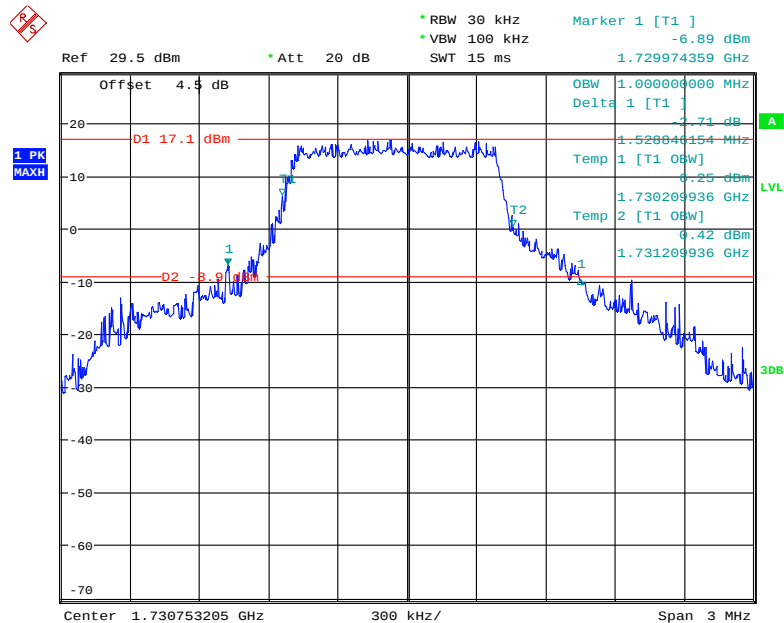
| Bandwidth<br>(MHz) | Modulation | 99% Occupied<br>Bandwidth<br>(MHz) | 26 dB Emission<br>Bandwidth<br>(MHz) |
|--------------------|------------|------------------------------------|--------------------------------------|
| 5.0                | QPSK       | 1.125                              | 1.471                                |
|                    | 16QAM      | 1.000                              | 1.529                                |
| 10.0               | QPSK       | 1.135                              | 1.462                                |
|                    | 16QAM      | 0.990                              | 1.462                                |
| 15.0               | QPSK       | 1.130                              | 1.457                                |
|                    | 16QAM      | 1.014                              | 1.457                                |
| 20.0               | QPSK       | 1.130                              | 1.471                                |
|                    | 16QAM      | 0.966                              | 1.457                                |

### QPSK (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



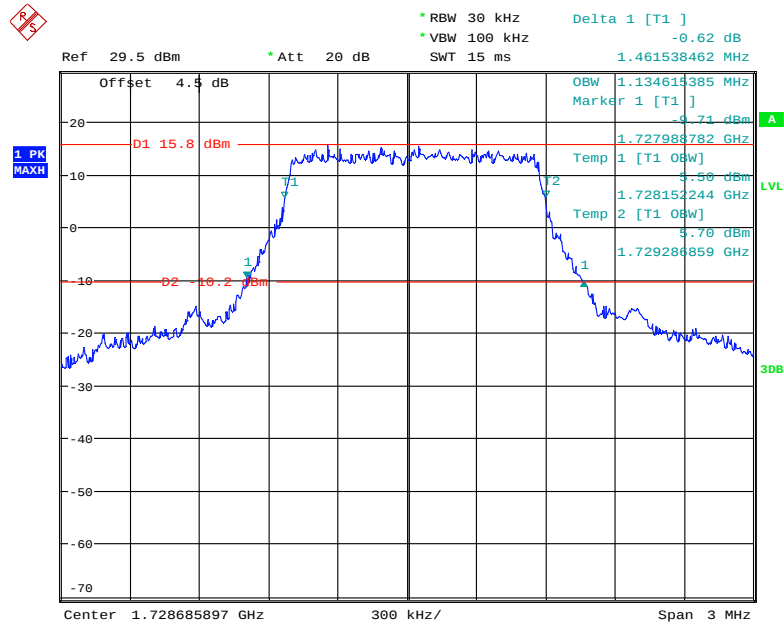
Date: 13.MAY.2018 19:15:10

### 16-QAM (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



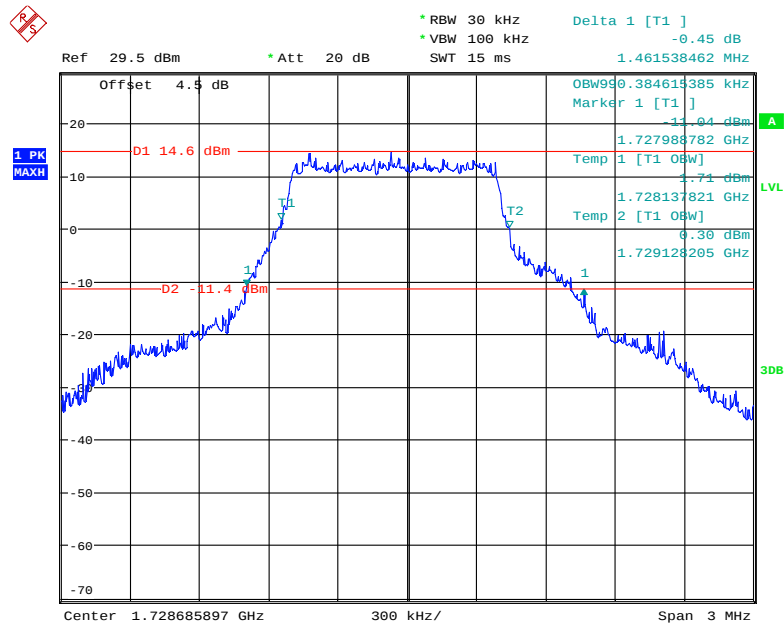
Date: 13.MAY.2018 19:18:44

### QPSK (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



Date: 13.MAY.2018 19:22:57

### 16-QAM (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



Date: 13.MAY.2018 19:25:00

Ref 29.5 dBm Att 20 dB

RBW 30 kHz VBW 100 kHz SWT 15 ms

Delta 1 [T1 ] -1.96 dB

1.456730769 MHz

Offset 4.5 dB

OBW 1.129807692 MHz

Marker 1 [T1 ]

1.725740385 GHz

Temp 1 [T1 OBW]

1.725899038 GHz

Temp 2 [T1 OBW]

1.727028846 GHz

D1 15.3 dBm

D2 -10 dBm

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

377

378

379

380

381

382

383

384

385

386

387

388

389

390

391

392

393

394

395

396

397

398

399

400

401

402

403

404

405

406

407

408

409

410

411

412

413

414

415

416

417

418

419

420

421

422

423

RBW 30 kHz  
 VBW 100 kHz  
 SWT 15 ms  
 Delta 1 [T1] -0.72 dB  
 1.456730769 MHz

Ref 29.5 dBm  
 Att 20 dB

Offset 4.5 dB

1 PK  
 MAXH

D1 14.5 dBm  
 D2 -11.15 dBm

T1  
 T2

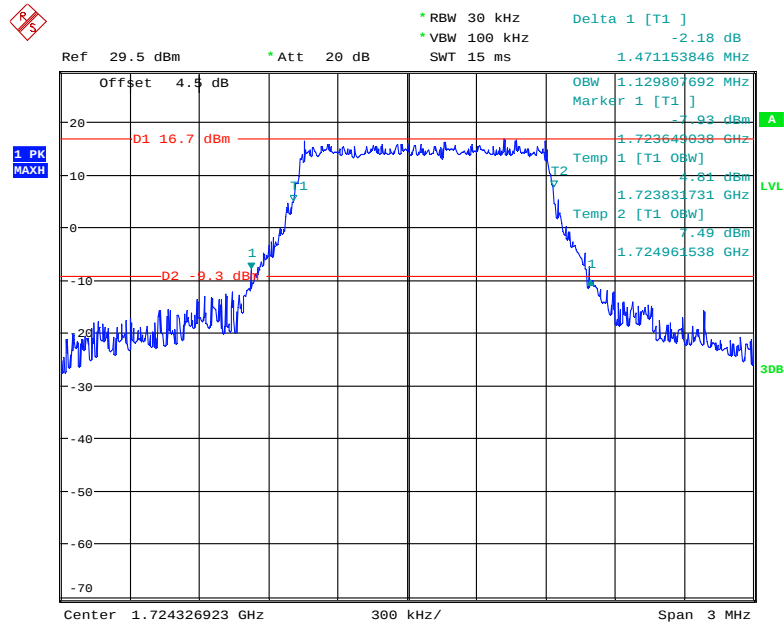
OBW 1.014423077 MHz  
 Marker 1 [T1]  
 1.725745192 GHz  
 Temp 1 [T1 OBW] -4.79 dBm  
 1.725894231 GHz  
 Temp 2 [T1 OBW] -0.32 dBm  
 1.726908654 GHz

LVL  
 3DB

Center 1.726538462 GHz  
 300 kHz/  
 Span 3 MHz

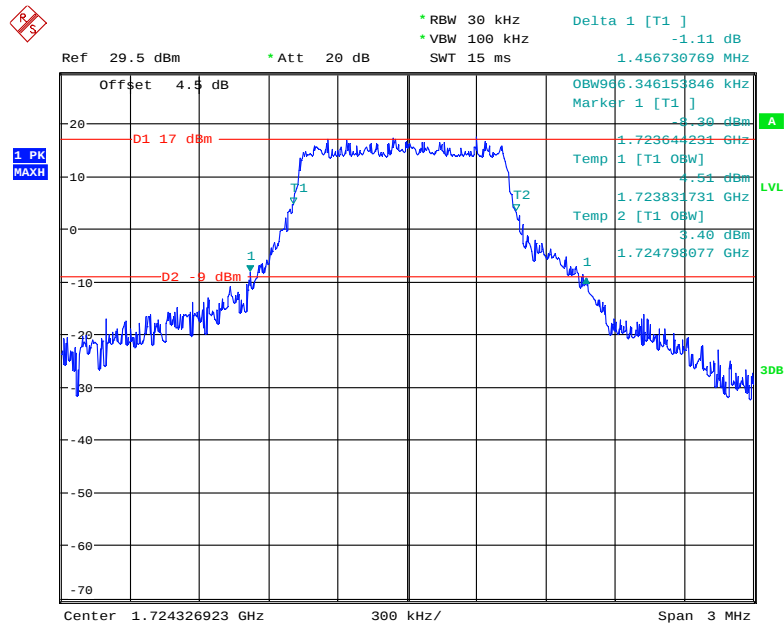
Page 22 of 82

### QPSK (20.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



Date: 14.MAY.2018 00:25:50

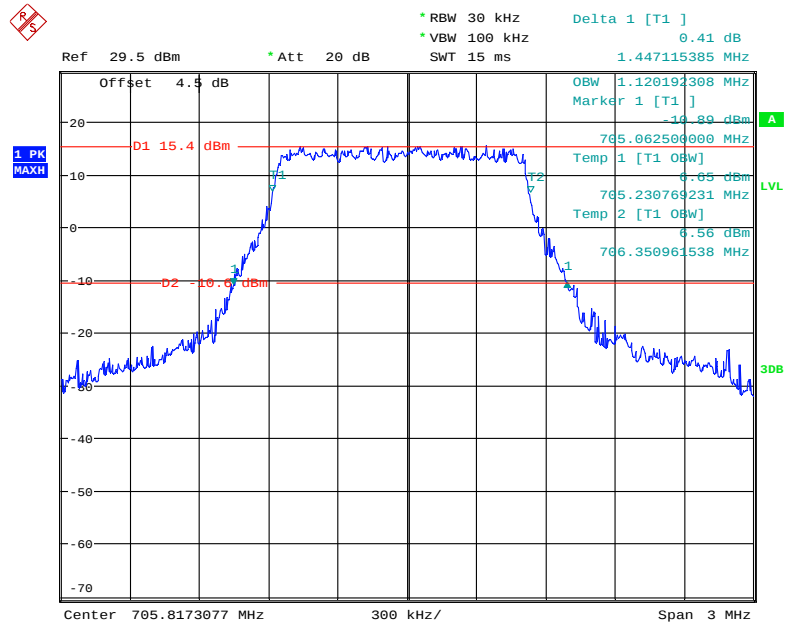
### 16-QAM (20.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



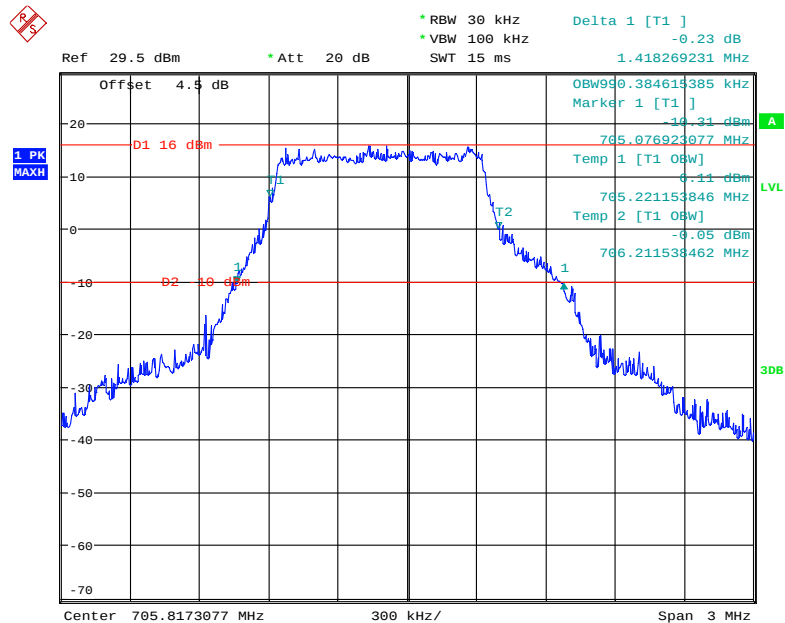
Date: 14.MAY.2018 00:27:03

**LTE Band 12: (Middle Channel)**

| Bandwidth<br>(MHz) | Modulation | 99% Occupied<br>Bandwidth<br>(MHz) | 26 dB Emission<br>Bandwidth<br>(MHz) |
|--------------------|------------|------------------------------------|--------------------------------------|
| 5.0                | QPSK       | 1.120                              | 1.447                                |
|                    | 16QAM      | 0.990                              | 1.418                                |
| 10.0               | QPSK       | 1.139                              | 1.500                                |
|                    | 16QAM      | 0.990                              | 1.490                                |

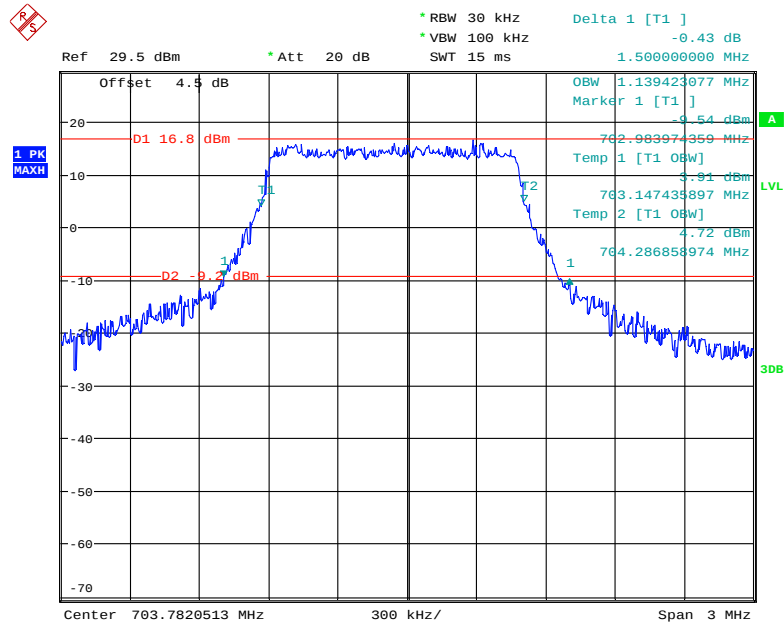
**QPSK (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

Date: 13.MAY.2018 19:39:49

**16-QAM (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

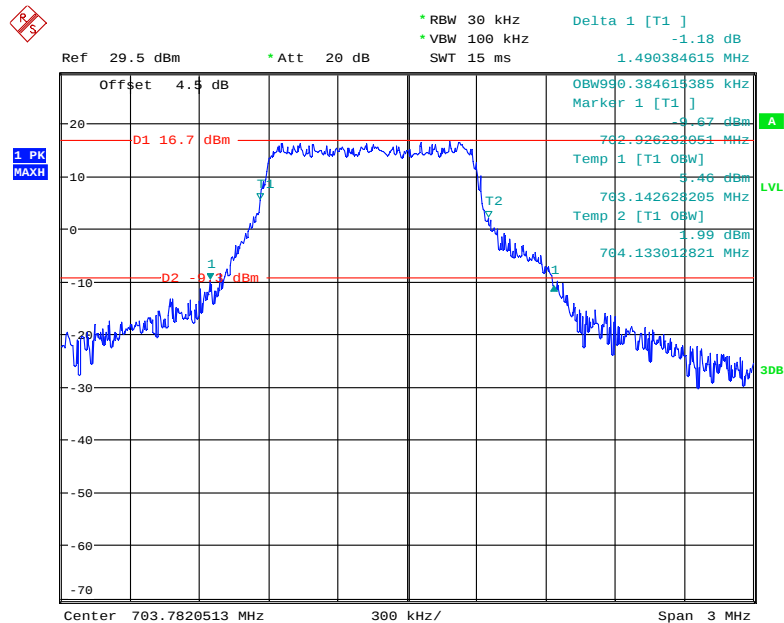
Date: 13.MAY.2018 19:41:48

### QPSK (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



Date: 14.MAY.2018 00:21:12

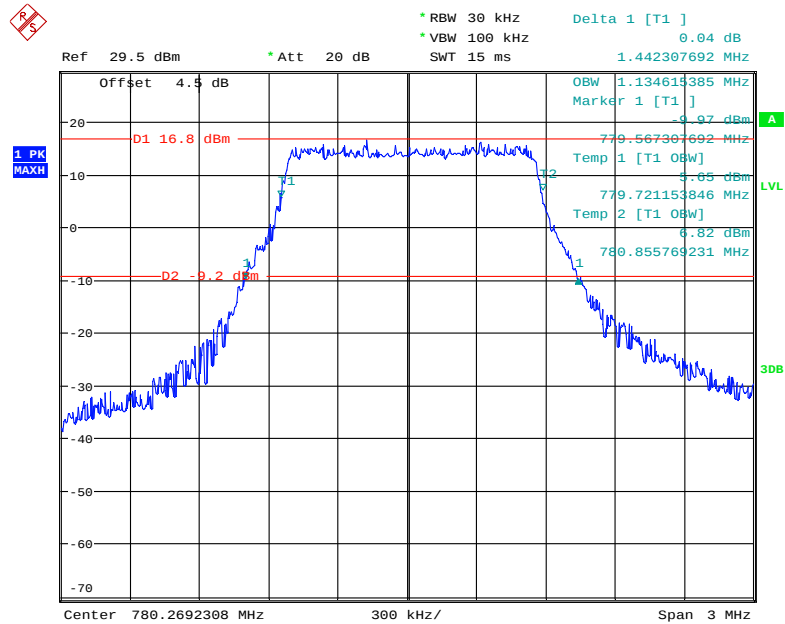
### 16-QAM (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



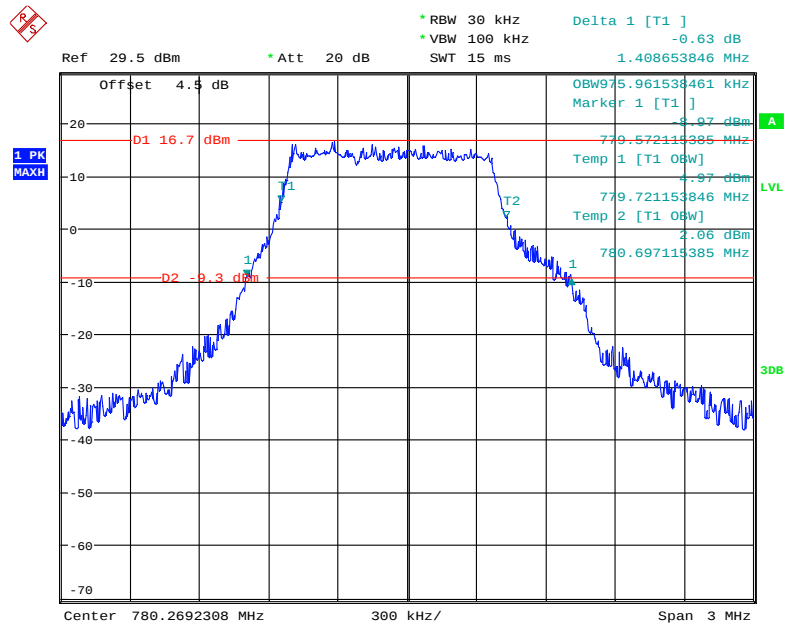
Date: 14.MAY.2018 00:22:55

**LTE Band 13: (Middle Channel)**

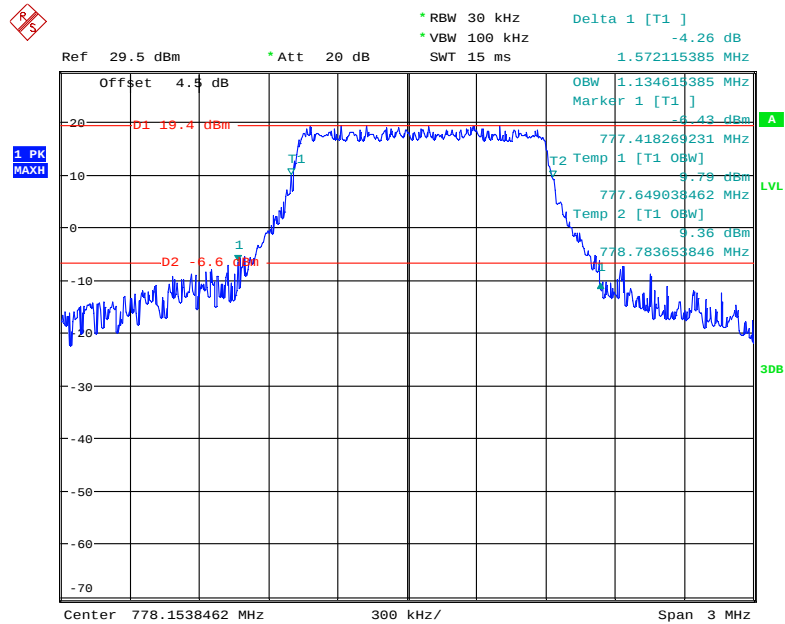
| Bandwidth<br>(MHz) | Modulation | 99% Occupied<br>Bandwidth<br>(MHz) | 26 dB Emission<br>Bandwidth<br>(MHz) |
|--------------------|------------|------------------------------------|--------------------------------------|
| 5.0                | QPSK       | 1.135                              | 1.442                                |
|                    | 16QAM      | 0.976                              | 1.409                                |
| 10.0               | QPSK       | 1.135                              | 1.572                                |
|                    | 16QAM      | 0.986                              | 1.486                                |

**QPSK (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

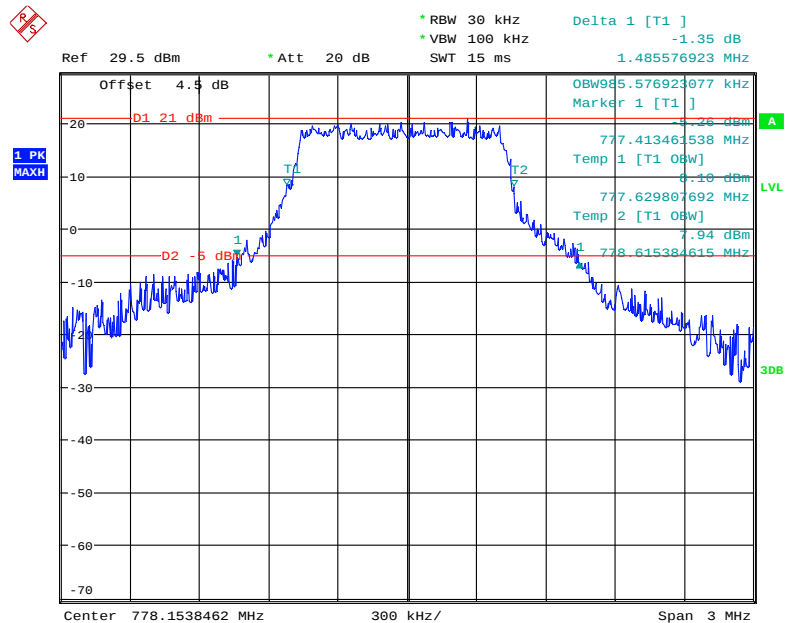
Date: 13.MAY.2018 19:53:09

**16-QAM (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

Date: 13.MAY.2018 19:55:24

**QPSK (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

Date: 14.MAY.2018 00:16:31

**16-QAM (10.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel**

Date: 14.MAY.2018 00:17:46

## FCC §2.1051 §27.53 (c) (f) (g) (h) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

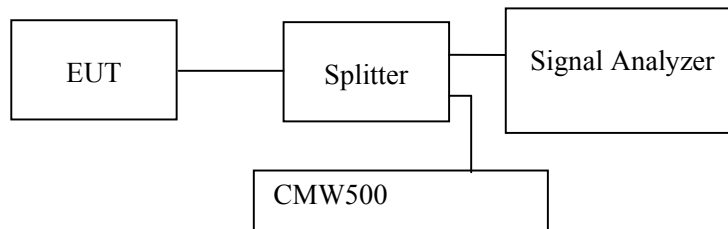
### Applicable Standard

FCC §2.1051 and §27.53(c) (f) (g) (h).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

### Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Jacob Kong on 2018-05-12 and 2018-05-13.*

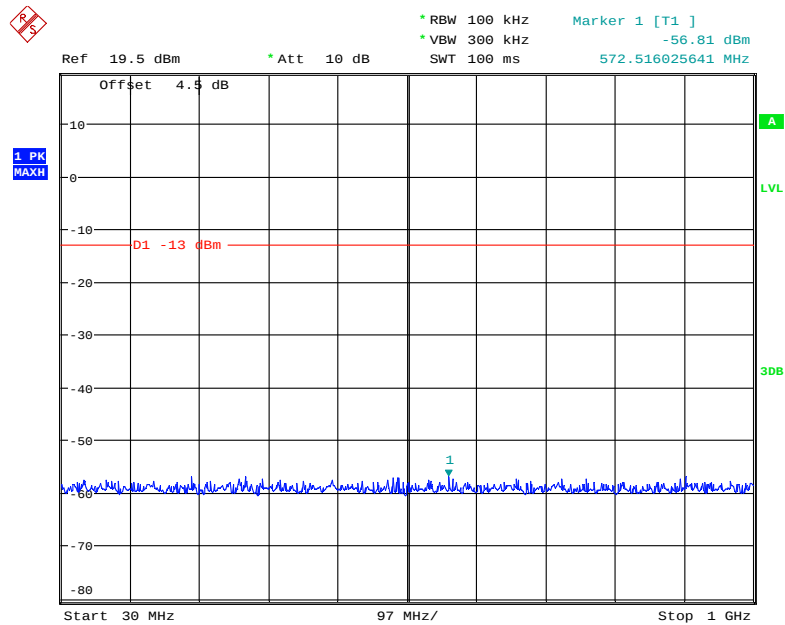
*Test result: Compliance.*

*EUT operation mode: transmitting*

*Please refer to the following plots.*

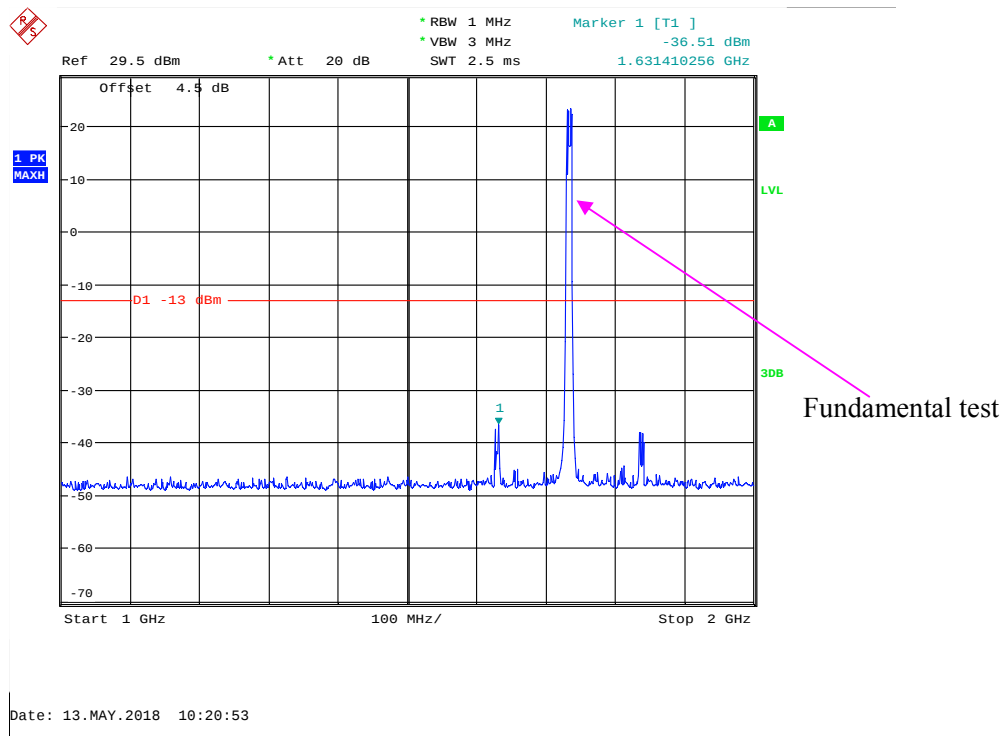
**LTE Band 4:**

**30 MHz - 1 GHz (5.0 MHz, Middle Channel)**



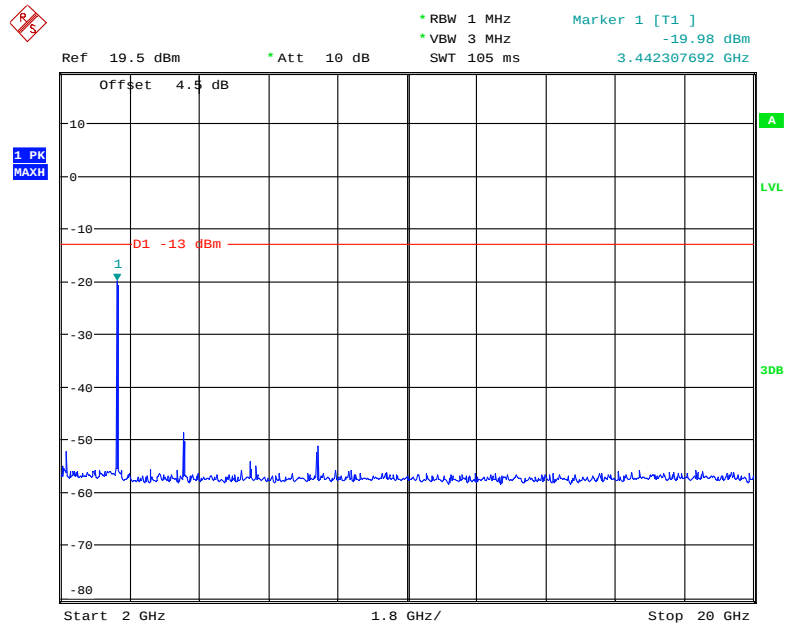
Date: 13.MAY.2018 10:19:53

**1 GHz - 2 GHz (5.0 MHz, Middle Channel)**



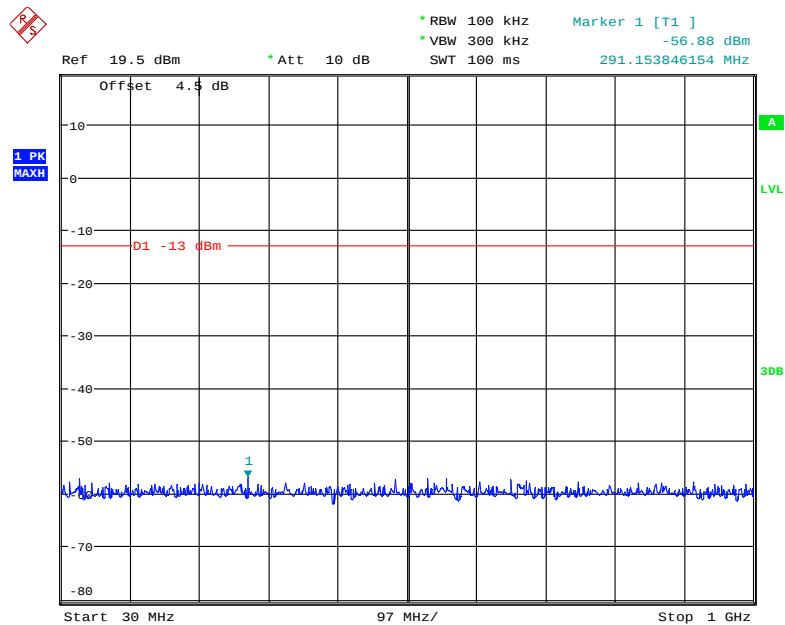
Date: 13.MAY.2018 10:20:53

### 2 GHz – 20 GHz (5.0 MHz, Middle Channel)



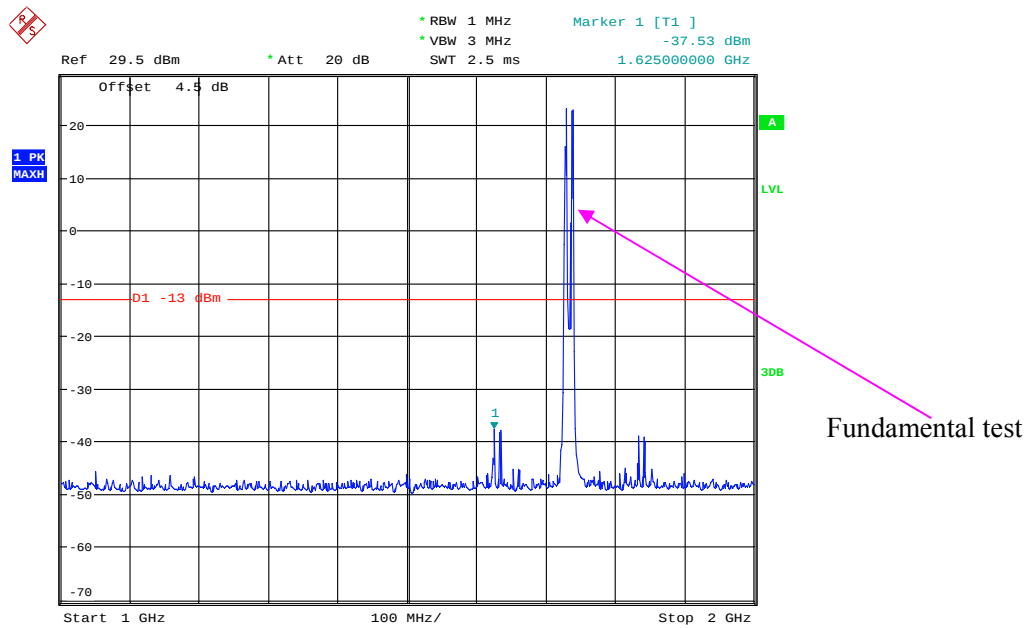
Date: 13.MAY.2018 10:22:57

### 30 MHz - 1 GHz (10.0 MHz, Middle Channel)



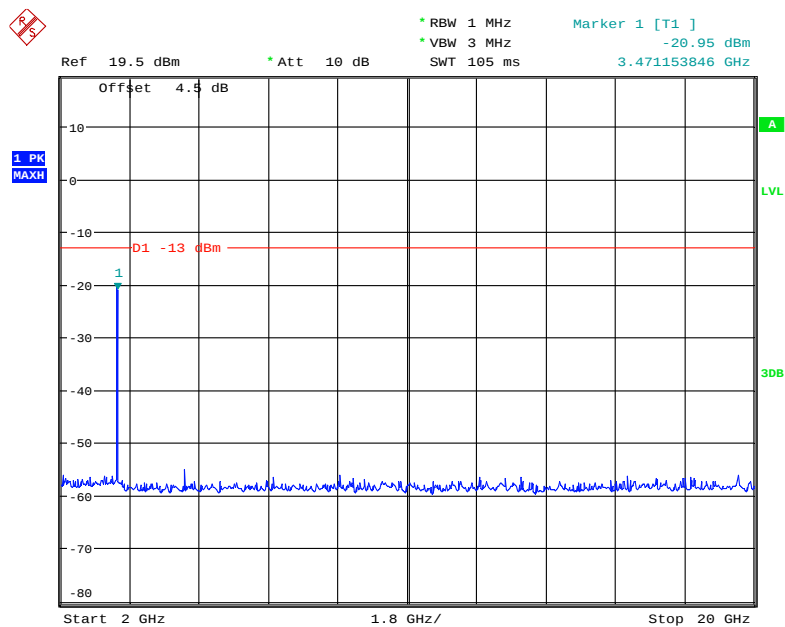
Date: 13.MAY.2018 10:26:24

### 1 GHz – 2 GHz (10.0 MHz, Middle Channel)



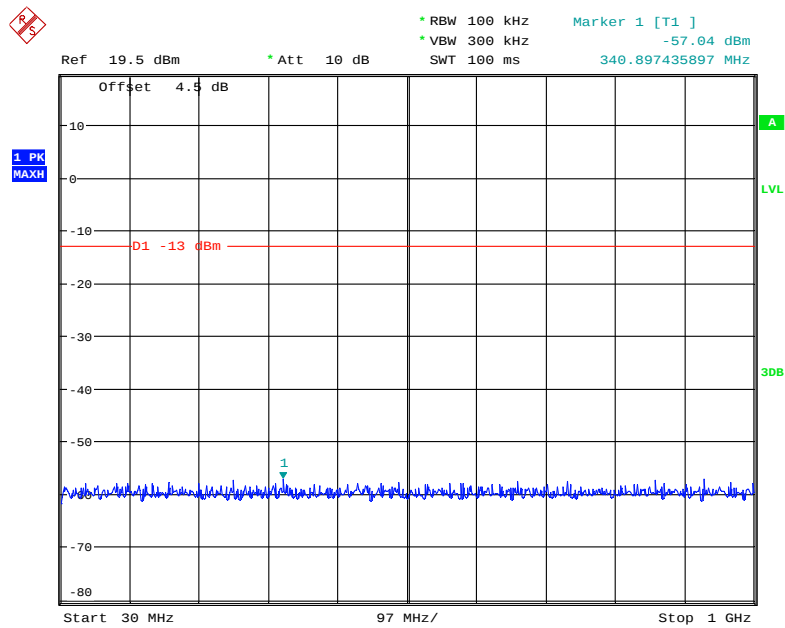
Date: 13.MAY.2018 10:25:03

### 2 GHz – 20 GHz (10.0 MHz, Middle Channel)



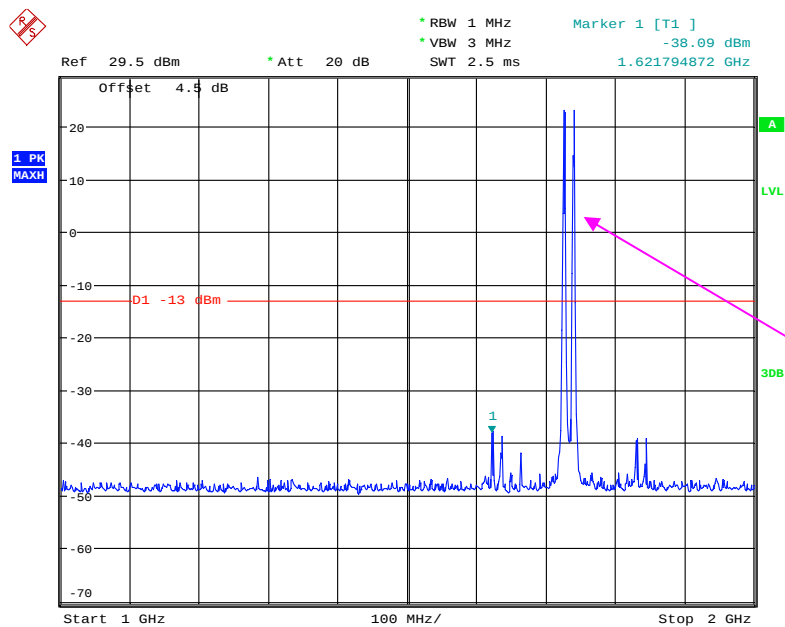
Date: 13.MAY.2018 10:24:33

### 30 MHz - 1 GHz (15.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:27:58

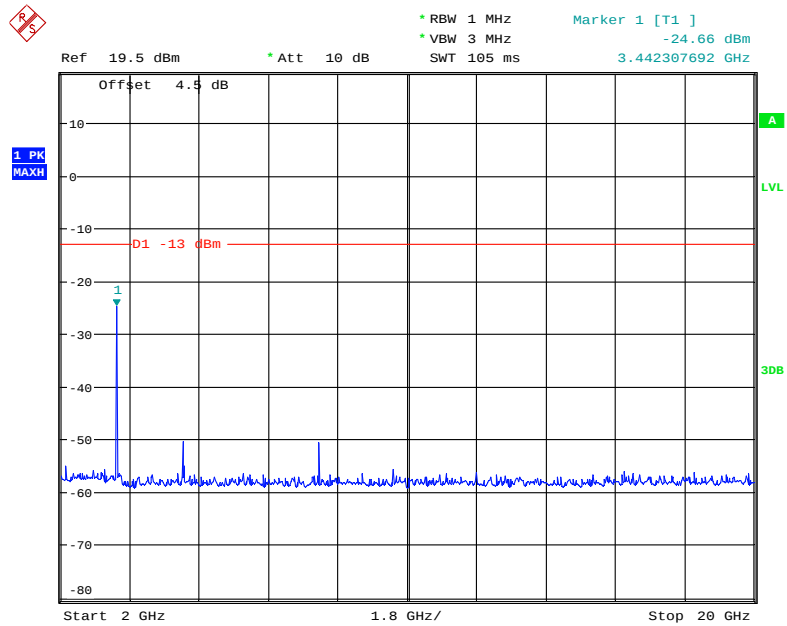
### 1 GHz - 2 GHz (15.0 MHz, Middle Channel)



Fundamental test

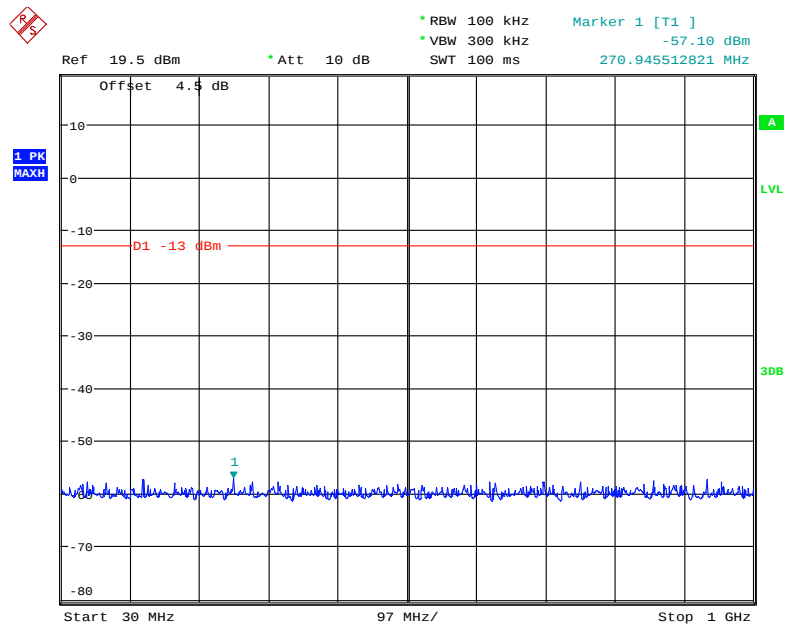
Date: 13.MAY.2018 10:28:32

### 2 GHz – 20 GHz (15.0 MHz, Middle Channel)



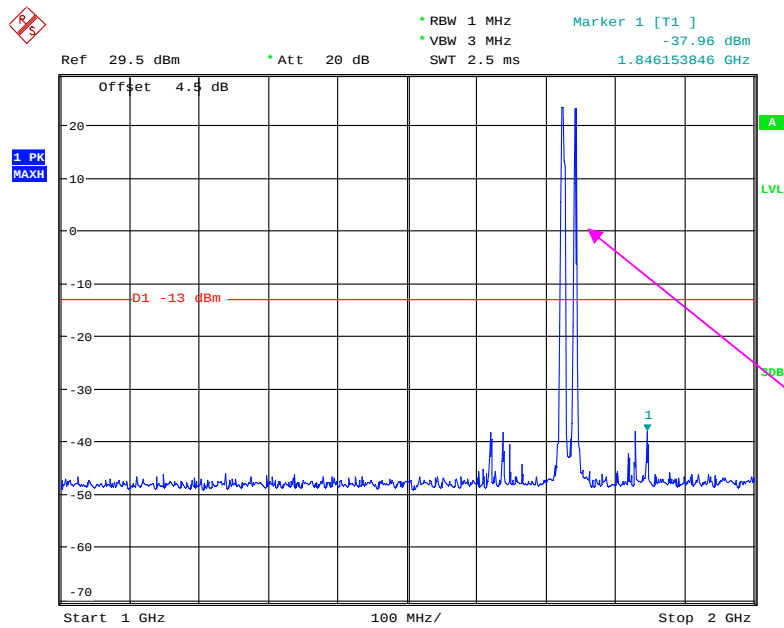
Date: 13.MAY.2018 10:29:38

### 30 MHz - 1 GHz (20.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:33:23

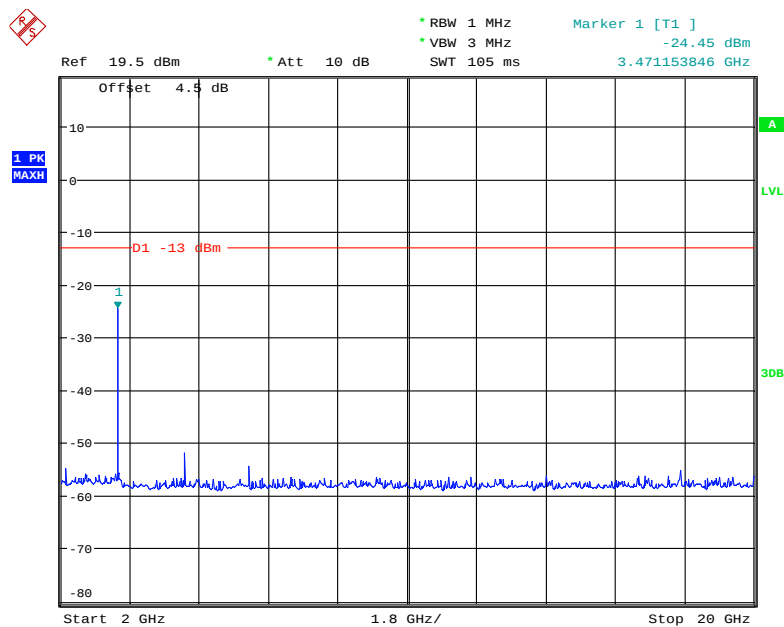
### 1 GHz – 2 GHz (20.0 MHz, Middle Channel)



Fundamental test

Date: 13.MAY.2018 10:31:59

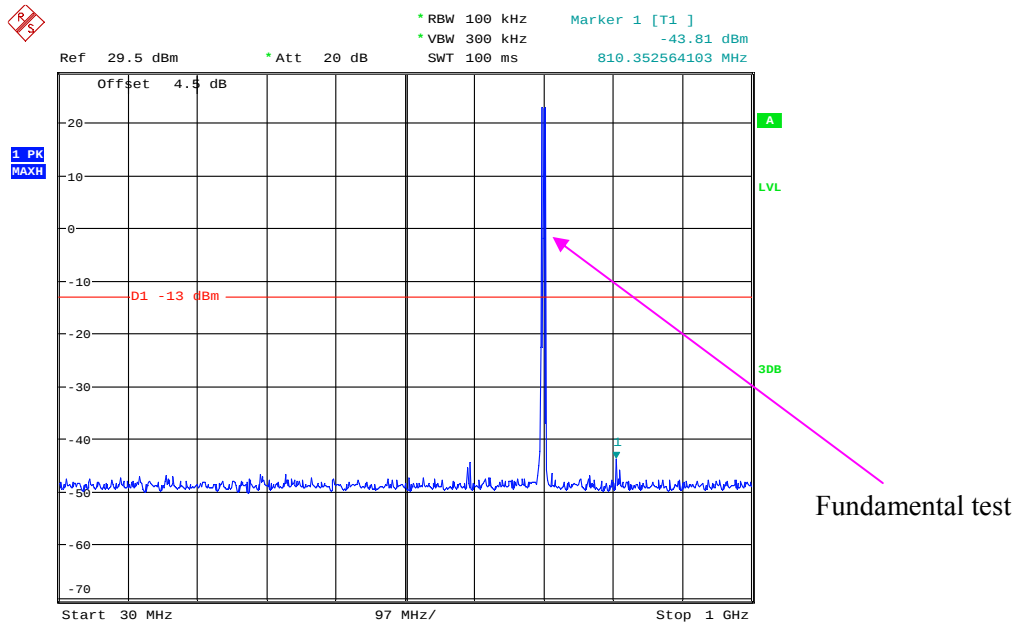
### 2 GHz – 20 GHz (20.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:31:24

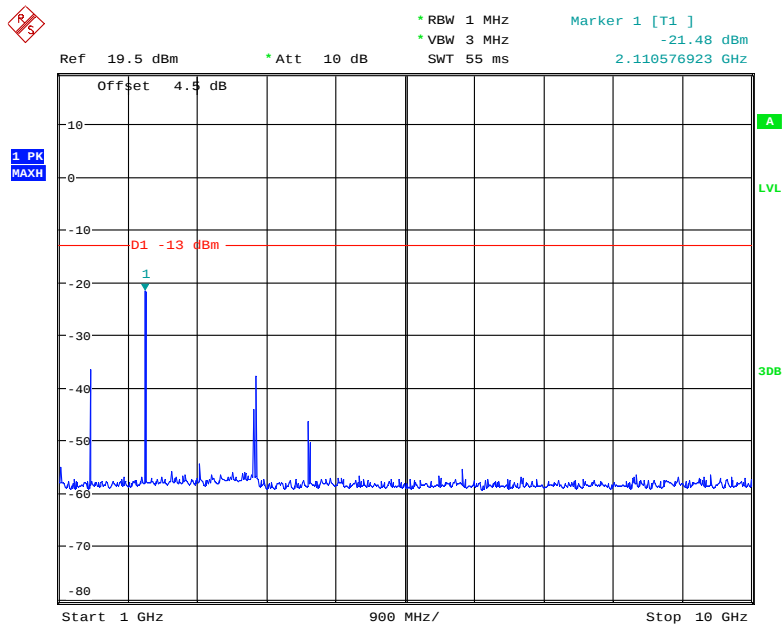
**LTE Band 12:**

**30 MHz – 1 GHz (5.0 MHz, Middle Channel)**



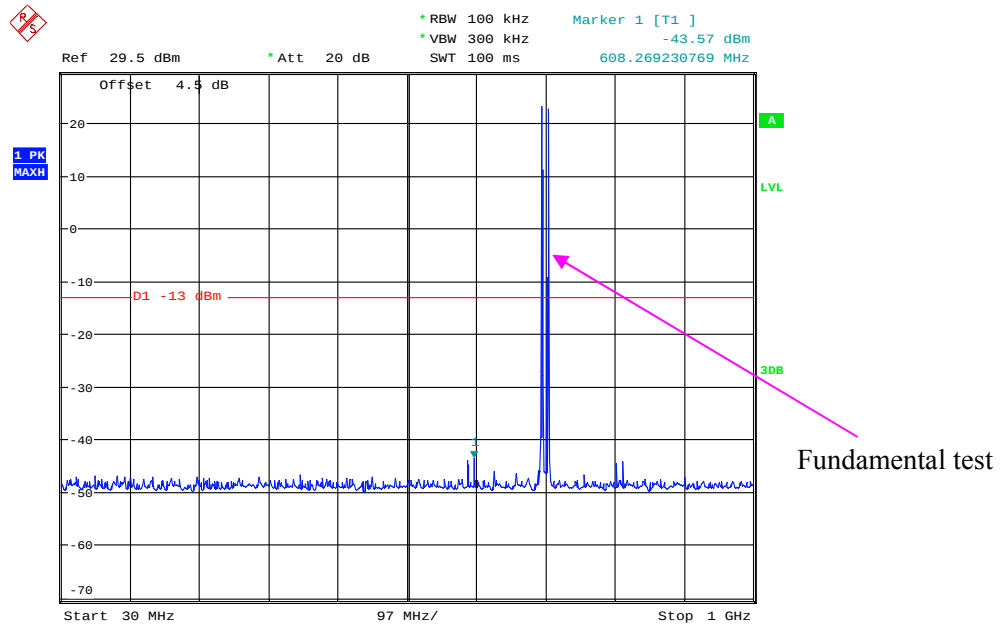
Date: 13.MAY.2018 10:42:38

**1 GHz – 8GHz (5.0 MHz, Middle Channel)**



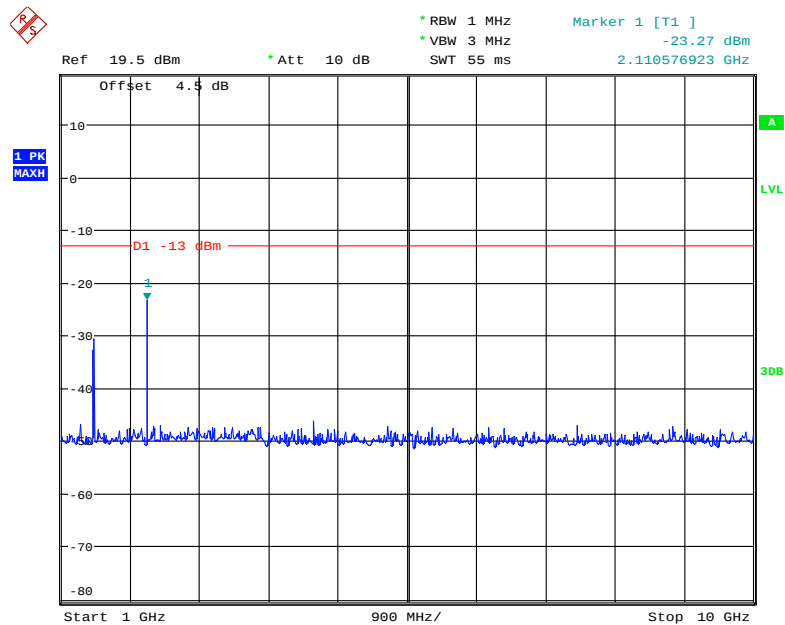
Date: 13.MAY.2018 10:41:58

### 30 MHz – 1 GHz (10.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:38:45

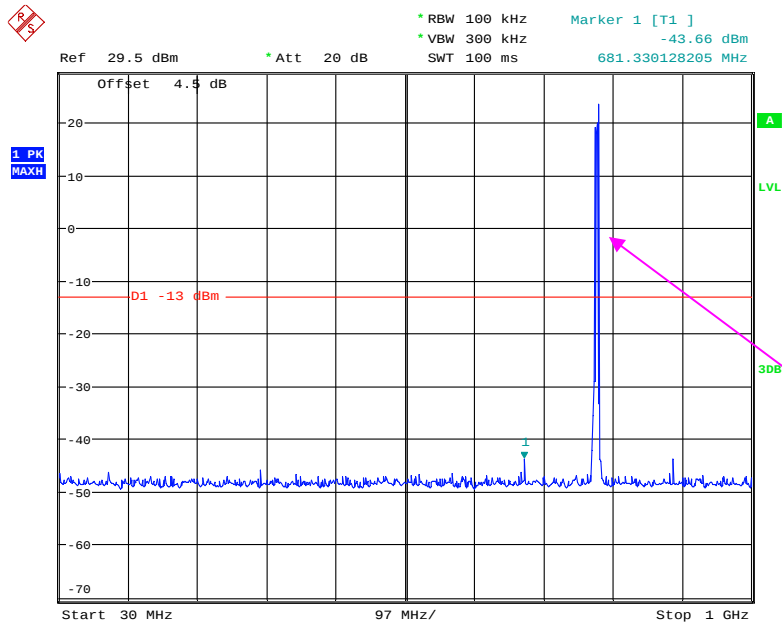
### 1 GHz – 8 GHz (10.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:39:16

**LTE Band 13:**

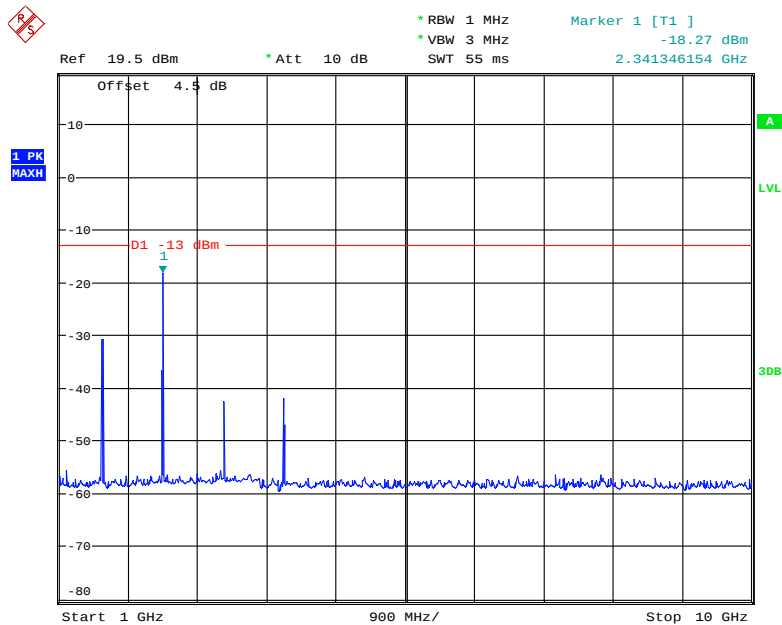
**30 MHz – 1 GHz (5.0 MHz, Middle Channel)**



Fundamental test

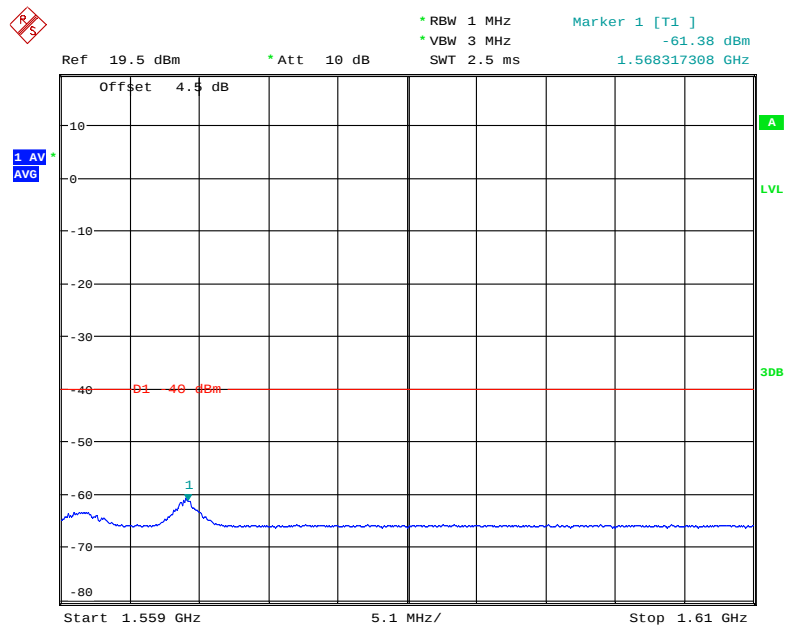
Date: 13.MAY.2018 10:46:25

**1 GHz – 10GHz (5.0 MHz, Middle Channel)**



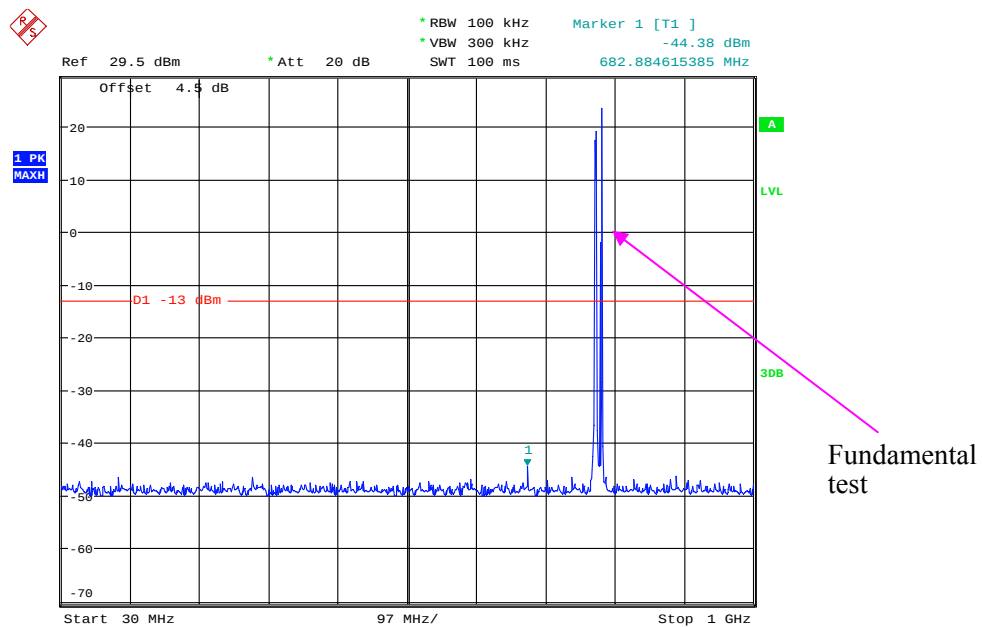
Date: 13.MAY.2018 10:48:42

### 1.559 GHz – 1.610 GHz (5.0 MHz, Middle Channel)



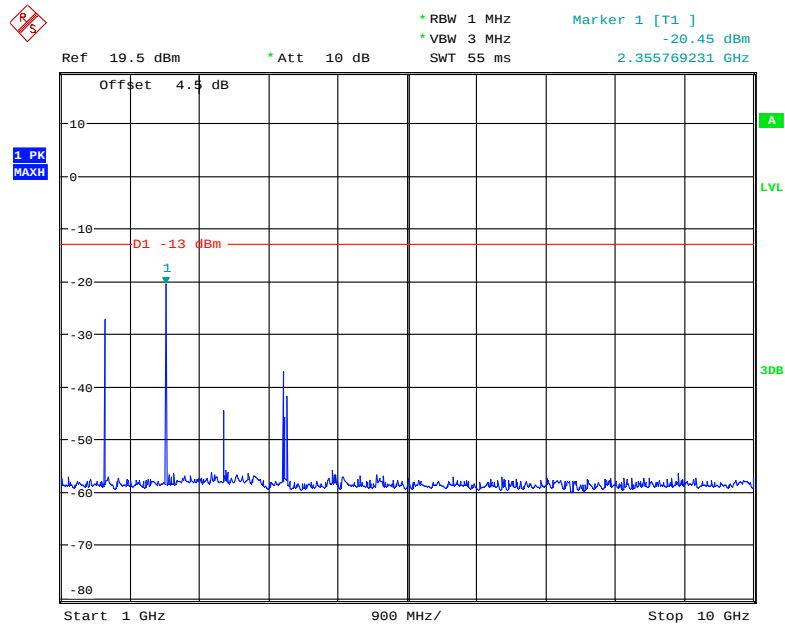
Date: 13.MAY.2018 11:00:06

### 30 MHz – 1 GHz (10.0 MHz, Middle Channel)



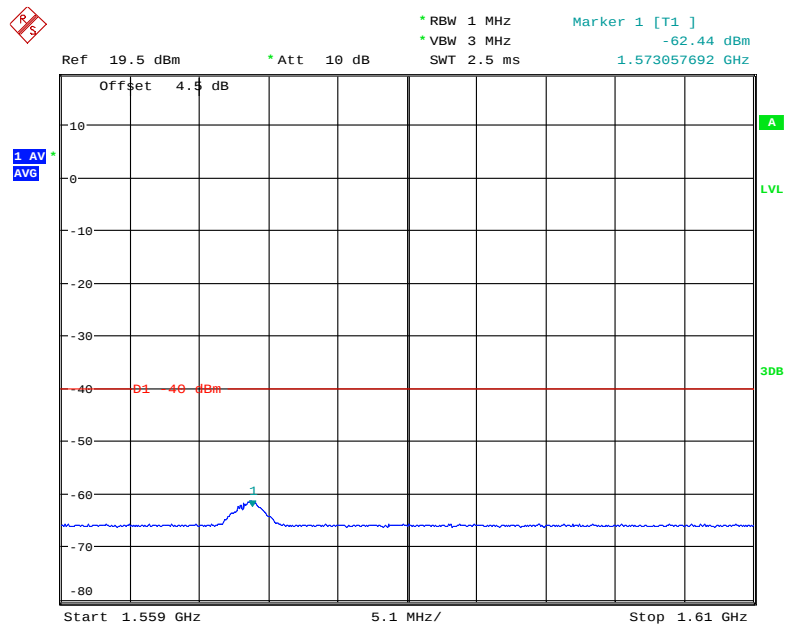
Date: 13.MAY.2018 10:52:23

### 1 GHz – 10 GHz (10.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:50:10

### 1.559 GHz – 1.610 GHz (10.0 MHz, Middle Channel)

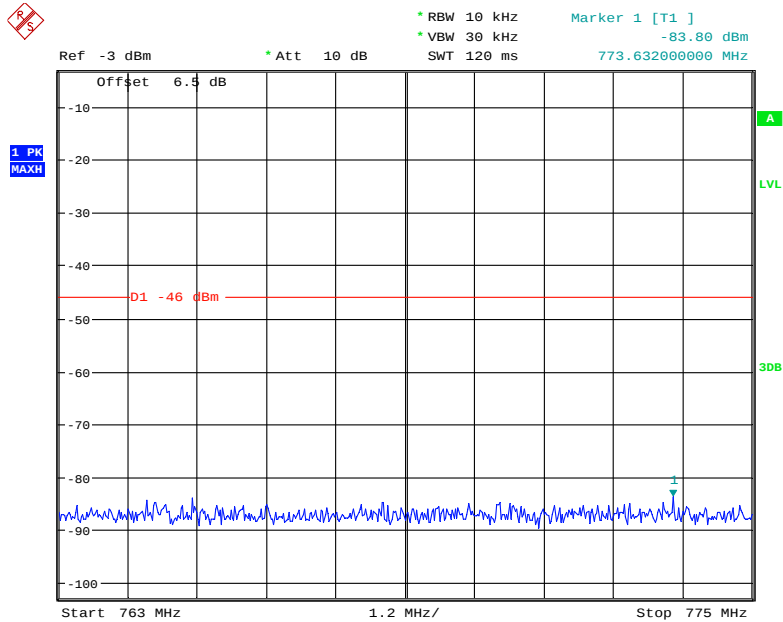


Date: 13.MAY.2018 10:57:15

# **Additional Conducted Spurious Emissions Evaluations in accordance with FCC §27.53 (c)**

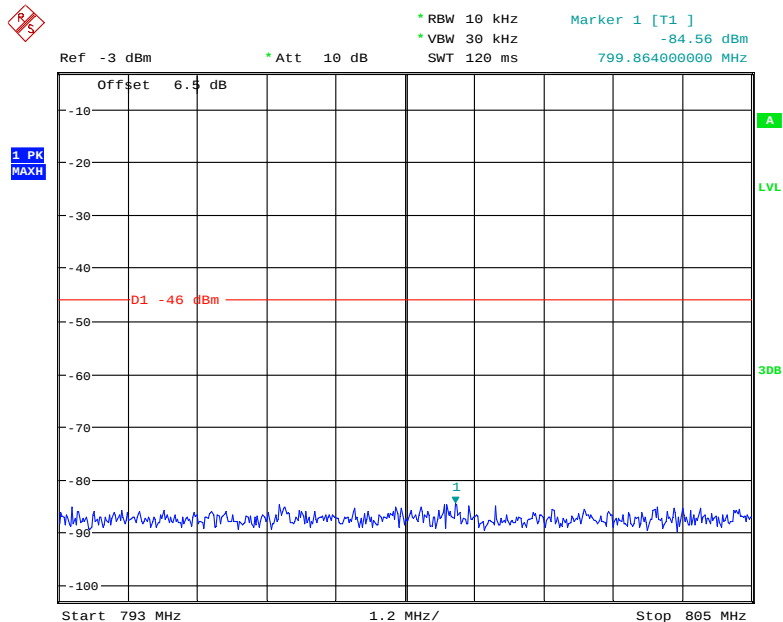
Note: because of RBW 6.25kHz convert to 10kHz,  $10\lg(10/6.25)=2$ , offset added with more 2dB.

## **763 MHz – 775 MHz, 5MHz**



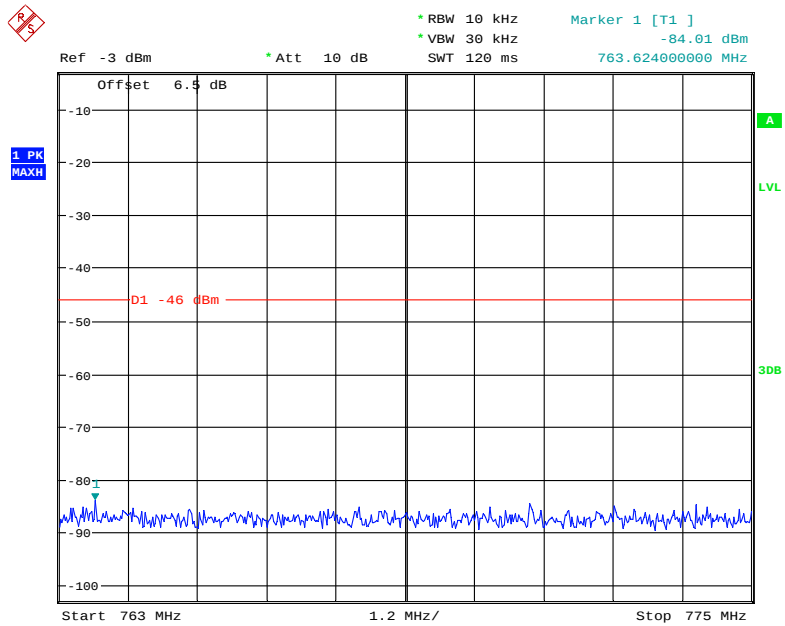
Date: 12.MAY.2018 13:32:49

## **793 MHz – 805 MHz, 5MHz**



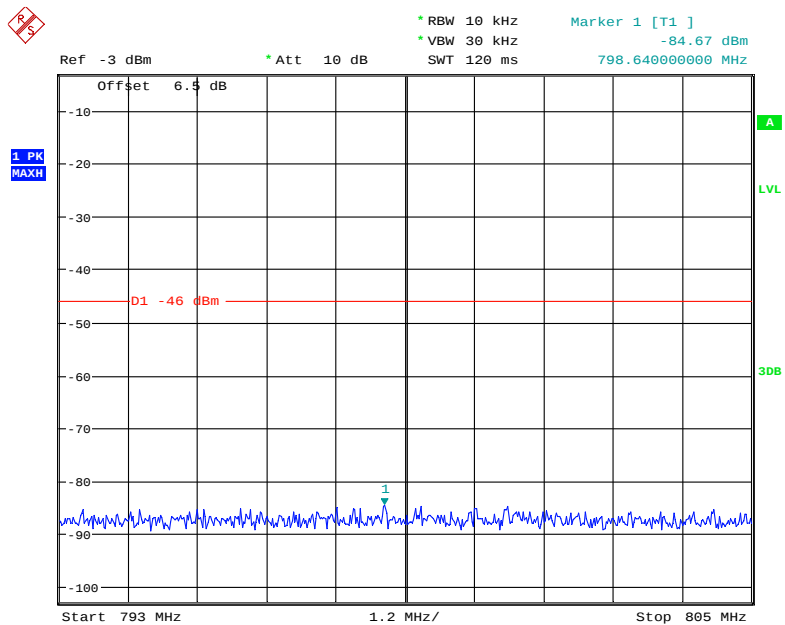
Date: 12.MAY.2018 13:33:15

### 763 MHz – 775 MHz, 10MHz



Date: 12.MAY.2018 13:35:57

### 793 MHz – 805 MHz, 10MHz



Date: 12.MAY.2018 13:35:39

**FCC § 2.1053; §27.53 (c) (g)(h) SPURIOUS RADIATED EMISSIONS****Applicable Standard**

FCC § 2.1053 and § 27.53(c) (g)(h)

**Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Jacob Kong on 2018-05-13.*

*EUT operation mode: Transmitting*

Pre-scan with Low, Middle and High channel, the worst case as below:

**LTE Band:** (Pre-scan with all the bandwidth, and worse case as below)

| Frequency                                    | Receiver       | Turntable    | Rx Antenna |             | Substituted |                 |                    | Absolute Level | Limit | Margin |
|----------------------------------------------|----------------|--------------|------------|-------------|-------------|-----------------|--------------------|----------------|-------|--------|
| (MHz)                                        | Reading (dBμV) | Angle Degree | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | (dBm)          | (dBm) | (dB)   |
| <b>Band 4</b>                                |                |              |            |             |             |                 |                    |                |       |        |
| <b>Test frequency range: 30 MHz ~ 18 GHz</b> |                |              |            |             |             |                 |                    |                |       |        |
| 386.20                                       | 33.05          | 294          | 2.5        | H           | -63.9       | 0.42            | 0                  | -64.32         | -13   | 51.32  |
| 386.20                                       | 34.55          | 265          | 2.3        | V           | -62.4       | 0.26            | 0                  | -62.66         | -13   | 49.66  |
| 3465.00                                      | 55.28          | 36           | 2.1        | H           | -45.1       | 1.50            | 12.00              | -34.60         | -13   | 21.60  |
| 3465.00                                      | 53.52          | 279          | 1.4        | V           | -47.6       | 1.50            | 12.00              | -37.10         | -13   | 24.10  |
| 5197.50                                      | 46.51          | 345          | 1.1        | H           | -52.1       | 1.60            | 12.10              | -41.60         | -13   | 28.60  |
| 5197.50                                      | 48.91          | 280          | 1.8        | V           | -49.2       | 1.60            | 12.10              | -38.70         | -13   | 25.70  |
| 6930.00                                      | 44.21          | 249          | 2.3        | H           | -51.3       | 1.80            | 11.30              | -41.80         | -13   | 28.80  |
| 6930.00                                      | 48.47          | 134          | 2.4        | V           | -47.1       | 1.80            | 11.30              | -37.60         | -13   | 24.60  |
| <b>Band 12</b>                               |                |              |            |             |             |                 |                    |                |       |        |
| <b>Test frequency range: 30 MHz ~ 10GHz</b>  |                |              |            |             |             |                 |                    |                |       |        |
| 386.20                                       | 33.74          | 229          | 1.5        | H           | -63.3       | 0.42            | 0                  | -63.72         | -13   | 50.72  |
| 386.20                                       | 34.68          | 315          | 1.4        | V           | -62.3       | 0.26            | 0                  | -62.56         | -13   | 49.56  |
| 1415.00                                      | 47.1           | 6            | 1.5        | H           | -60.7       | 1.60            | 7.90               | -54.40         | -13   | 41.40  |
| 1415.00                                      | 49.21          | 250          | 1.9        | V           | -58.9       | 1.60            | 7.90               | -52.60         | -13   | 39.60  |
| 2122.50                                      | 69.09          | 62           | 2.0        | H           | -33.0       | 1.30            | 9.70               | -24.60         | -13   | 11.60  |
| 2122.50                                      | 71.61          | 269          | 1.7        | V           | -31.3       | 1.30            | 9.70               | -22.90         | -13   | 9.90   |
| 2830.00                                      | 44.05          | 154          | 1.9        | H           | -59.7       | 1.80            | 10.50              | -51.00         | -13   | 38.00  |
| 2830.00                                      | 43.67          | 119          | 1.8        | V           | -59.8       | 1.80            | 10.50              | -51.10         | -13   | 38.10  |
| <b>Band 13</b>                               |                |              |            |             |             |                 |                    |                |       |        |
| <b>Test frequency range: 30 MHz ~ 10GHz</b>  |                |              |            |             |             |                 |                    |                |       |        |
| 386.20                                       | 34.97          | 28           | 1.8        | H           | -62.0       | 0.42            | 0                  | -62.42         | -13   | 49.42  |
| 386.20                                       | 34.13          | 208          | 1.4        | V           | -62.9       | 0.26            | 0                  | -63.16         | -13   | 50.16  |
| 1564.00                                      | 71.84          | 60           | 2.5        | H           | -36.2       | 1.40            | 8.70               | -28.90         | -13   | 15.90  |
| 1564.00                                      | 74.93          | 135          | 2.0        | V           | -32.9       | 1.40            | 8.70               | -25.60         | -13   | 12.60  |
| 2346.00                                      | 73.14          | 347          | 1.9        | H           | -31.4       | 1.30            | 10.00              | -22.70         | -13   | 9.70   |
| 2346.00                                      | 69.97          | 340          | 1.1        | V           | -34.4       | 1.30            | 10.00              | -25.70         | -13   | 12.70  |
| 3128.00                                      | 44.81          | 296          | 1.1        | H           | -56.5       | 1.70            | 11.30              | -46.90         | -13   | 33.90  |
| 3128.00                                      | 45.06          | 175          | 1.8        | V           | -56.1       | 1.70            | 11.30              | -46.50         | -13   | 33.50  |

**Note:**

- 1) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 2) Margin = Limit- Absolute Level

## §27.53 (c) (g)(h) - BAND EDGES

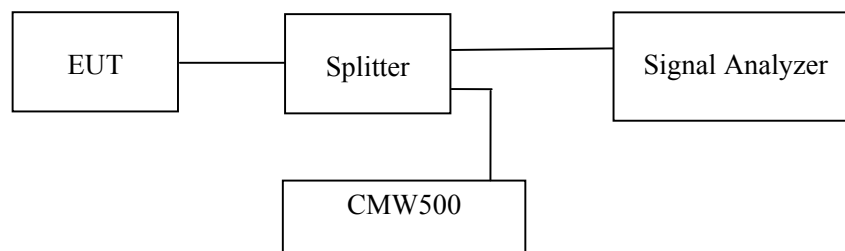
### Applicable Standard

According to FCC §27.53(c) (g)(h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

### Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

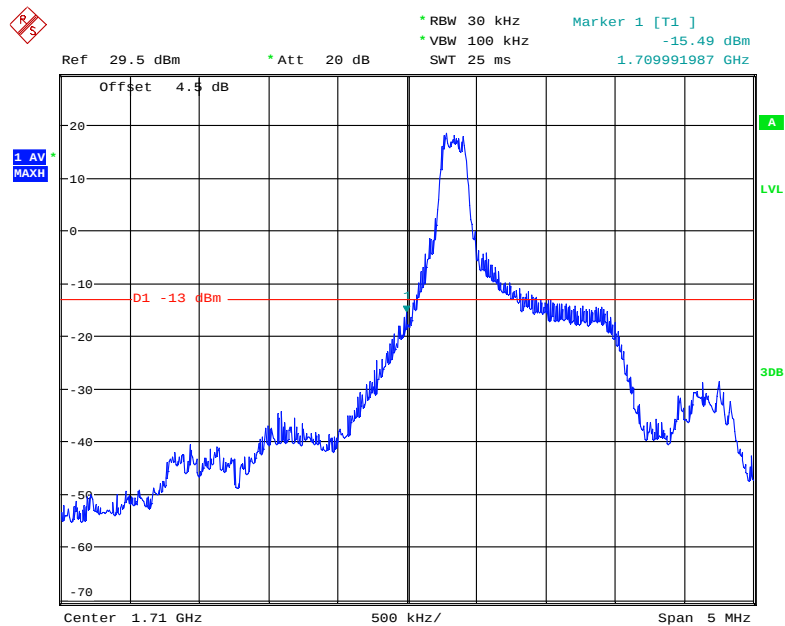
*The testing was performed by Jacob Kong on 2018-05-13 and 2018-05-14.*

*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to the following plots.*

**Band 4:**

**QPSK (5.0 MHz, RB0) - Left Band Edge**



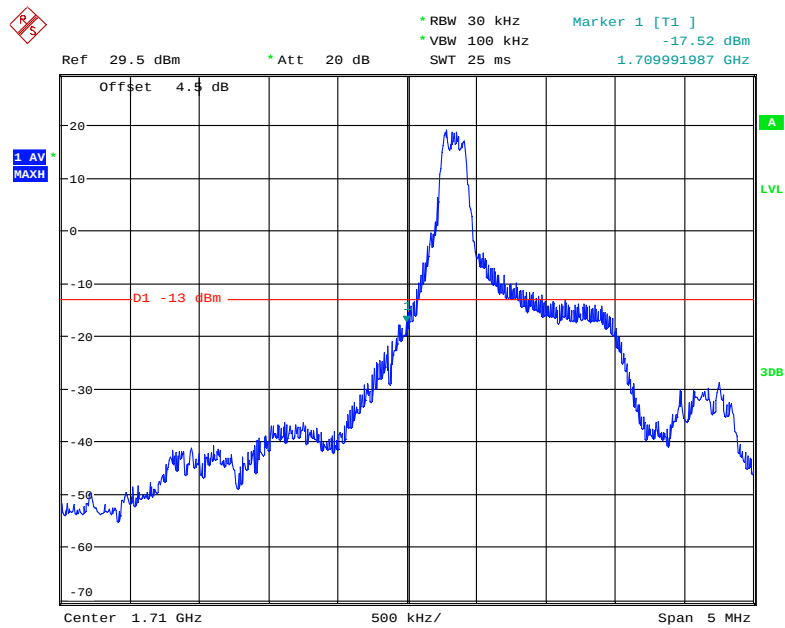
Date: 13.MAY.2018 21:17:20

**QPSK (5.0 MHz, RB0) - Right Band Edge**



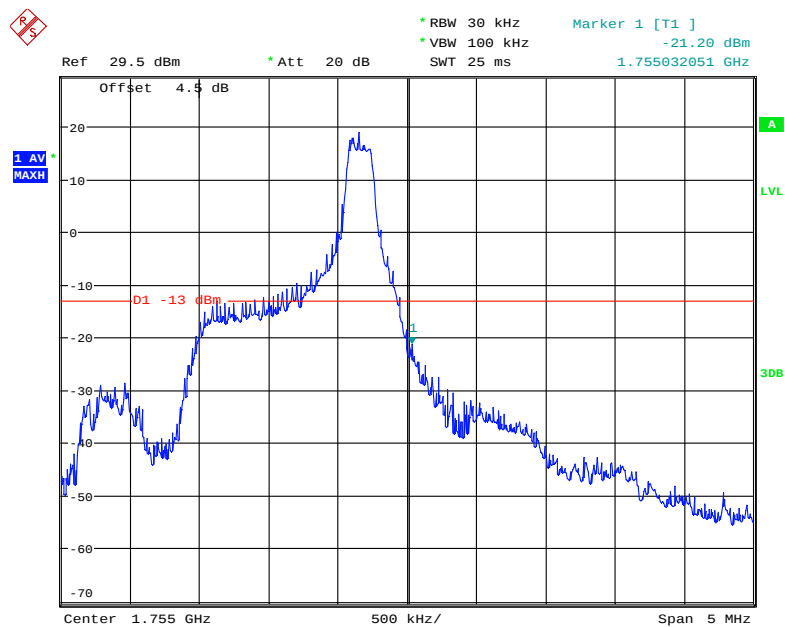
Date: 13.MAY.2018 21:29:47

### 16-QAM (5.0 MHz, RB0) - Left Band Edge



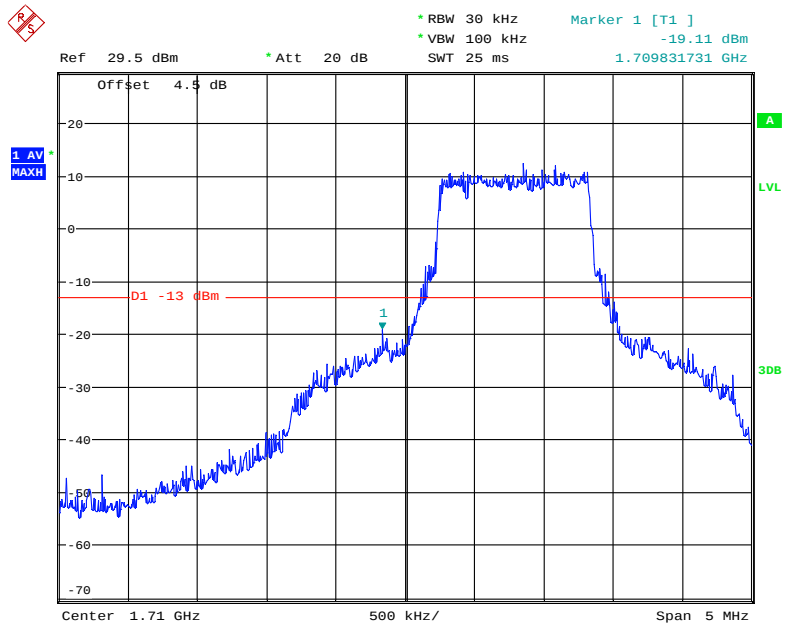
Date: 13.MAY.2018 21:20:17

### 16-QAM (5.0 MHz, RB0) - Right Band Edge



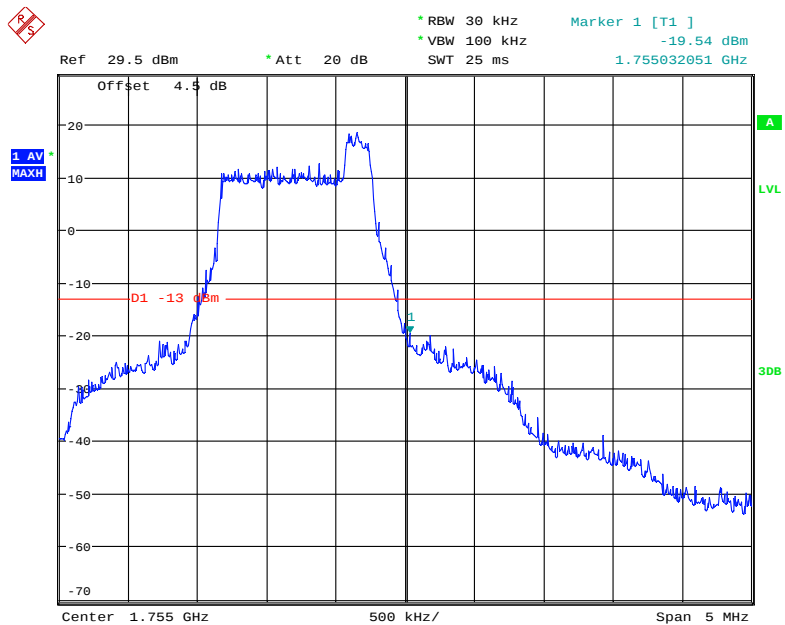
Date: 13.MAY.2018 21:30:53

### QPSK (5.0 MHz, RB6) - Left Band Edge



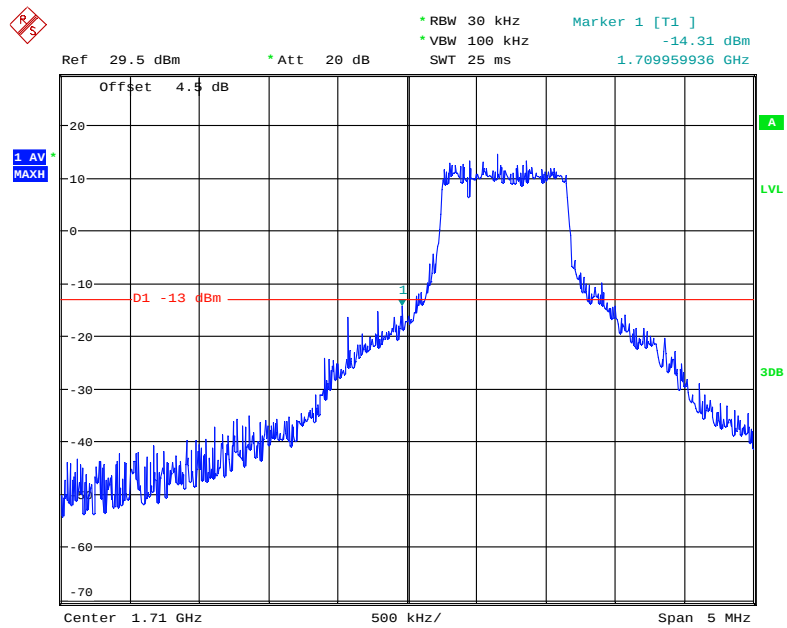
Date: 13.MAY.2018 21:14:56

### QPSK (5.0 MHz, RB6) - Right Band Edge



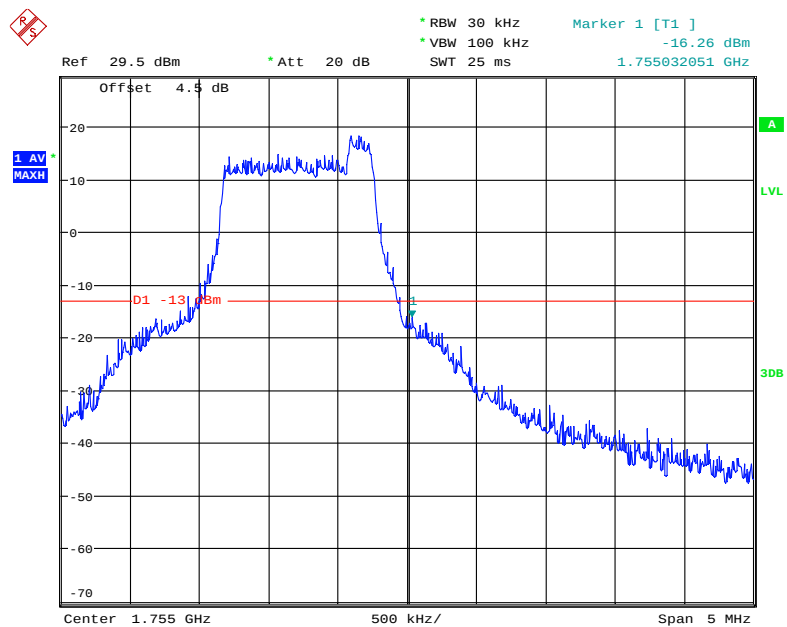
Date: 13.MAY.2018 21:27:27

### 16-QAM (5.0 MHz, RB5) - Left Band Edge



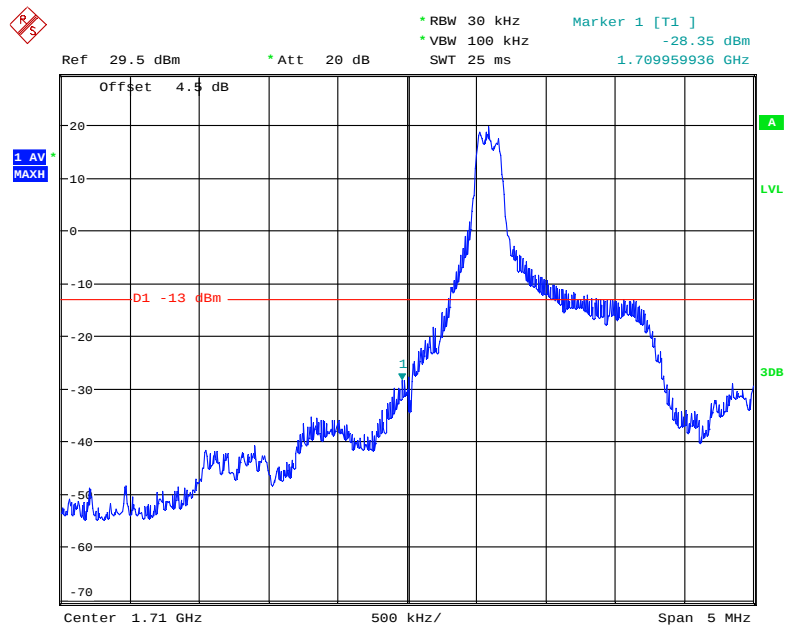
Date: 13.MAY.2018 21:23:01

### 16-QAM (5.0 MHz, RB5) - Right Band Edge



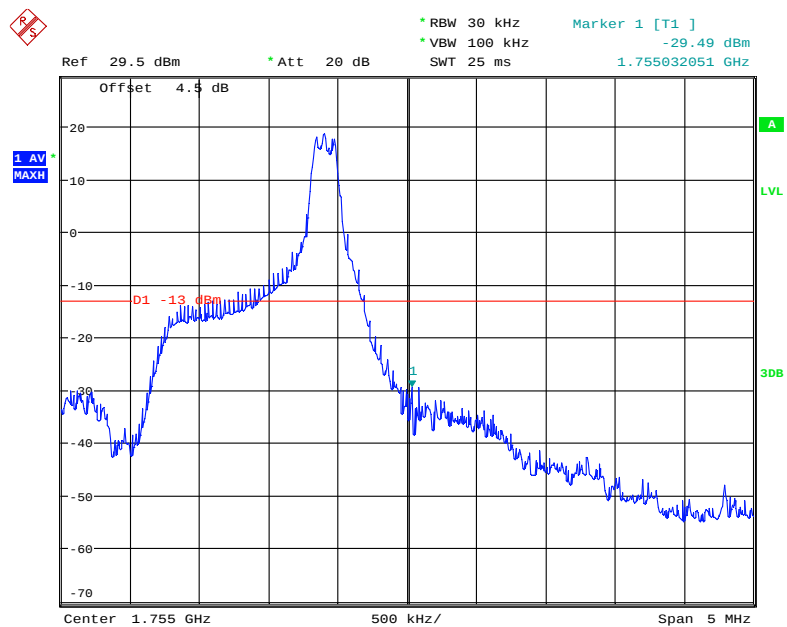
Date: 13.MAY.2018 21:32:42

### QPSK (10.0 MHz, RB0) - Left Band Edge



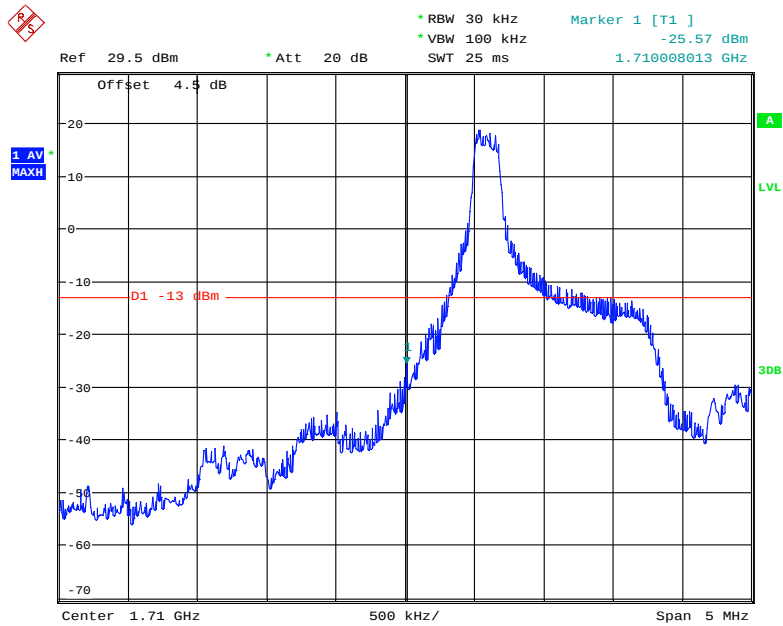
Date: 13.MAY.2018 22:50:35

### QPSK (10.0 MHz, RB0) - Right Band Edge



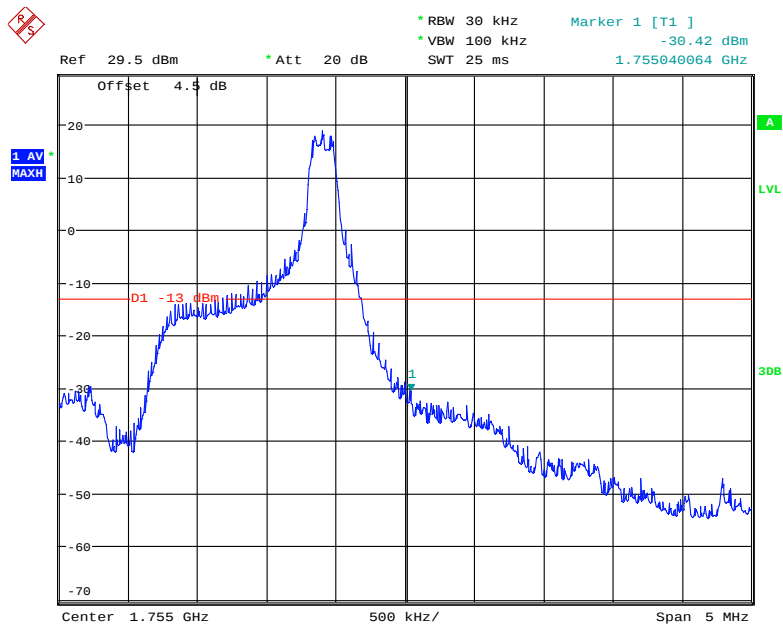
Date: 13.MAY.2018 21:36:55

### 16-QAM (10.0 MHz, RB0) - Left Band Edge



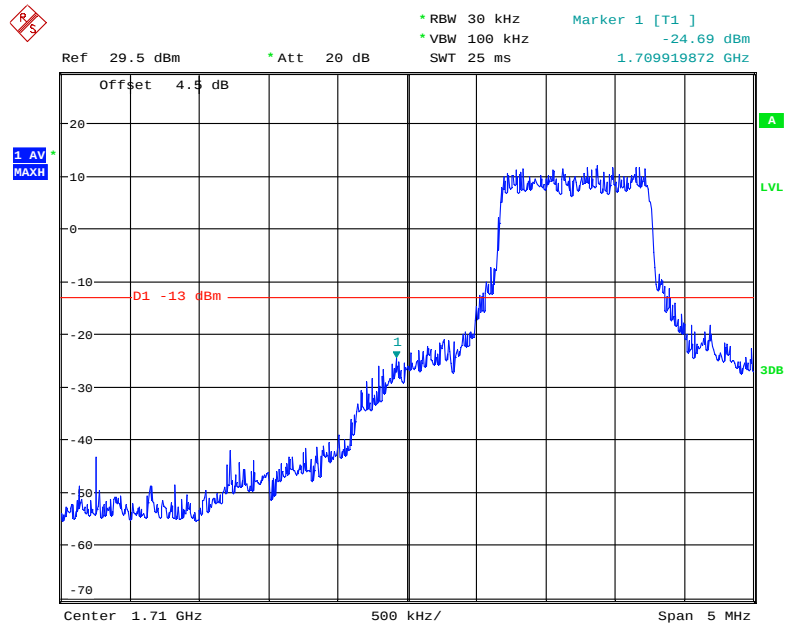
Date: 13.MAY.2018 22:52:10

### 16-QAM (10.0 MHz, RB0) - Right Band Edge



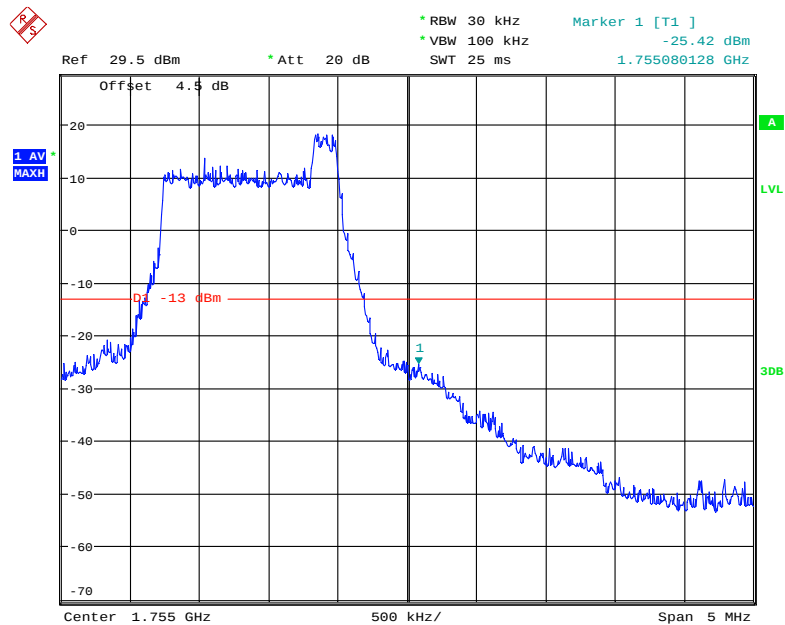
Date: 13.MAY.2018 22:45:04

### QPSK (10.0 MHz, RB6) - Left Band Edge



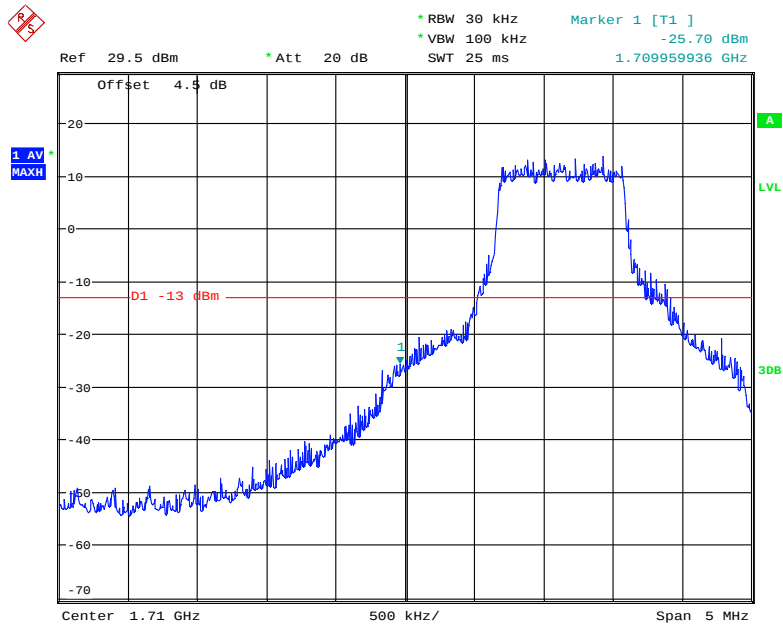
Date: 13.MAY.2018 22:48:31

### QPSK (10.0 MHz, RB6) - Right Band Edge



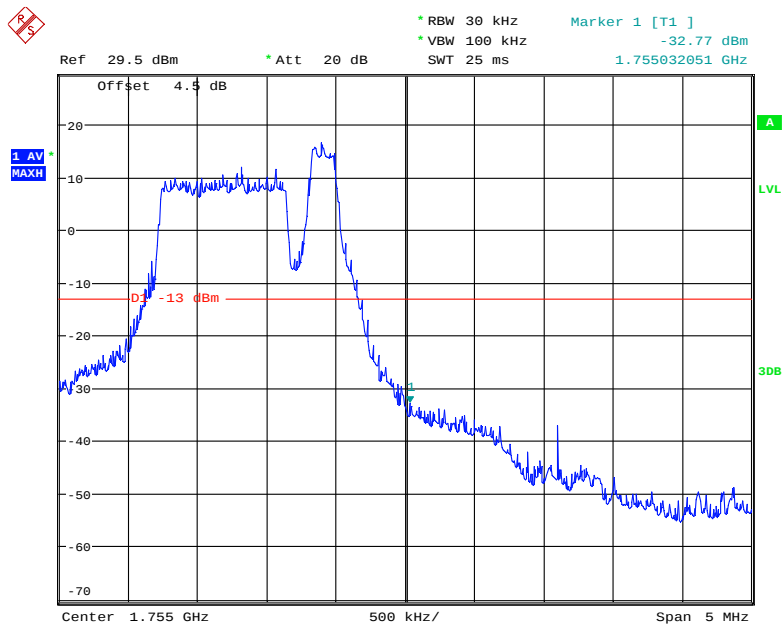
Date: 13.MAY.2018 21:35:07

### 16-QAM (10.0 MHz, RB5) - Left Band Edge



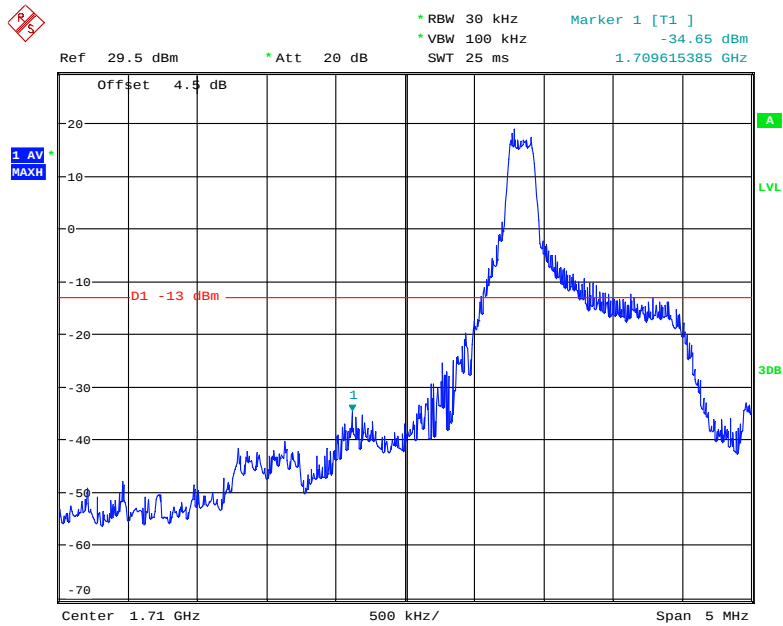
Date: 13.MAY.2018 22:53:37

### 16-QAM (10.0 MHz, RB5) - Right Band Edge



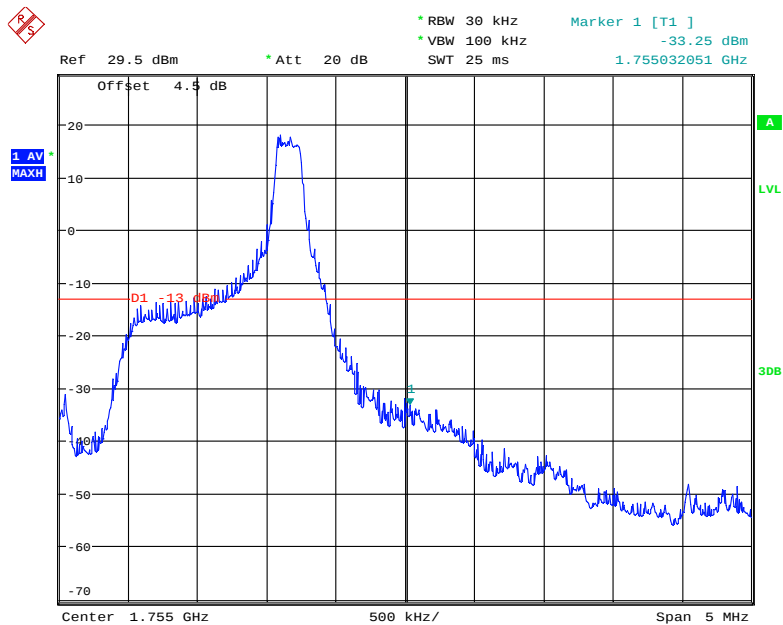
Date: 13.MAY.2018 22:46:20

### QPSK (15.0 MHz, RB0) - Left Band Edge



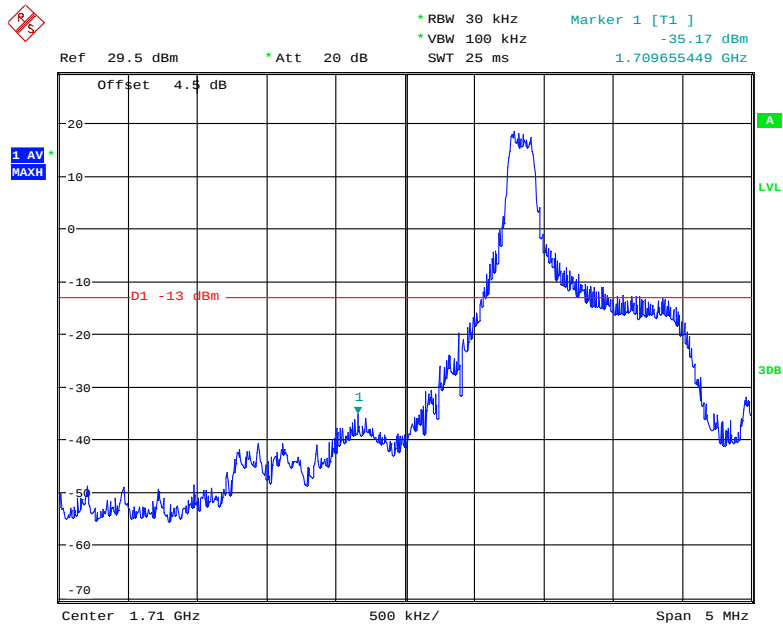
Date: 13.MAY.2018 22:57:23

### QPSK (15.0 MHz, RB0) - Right Band Edge



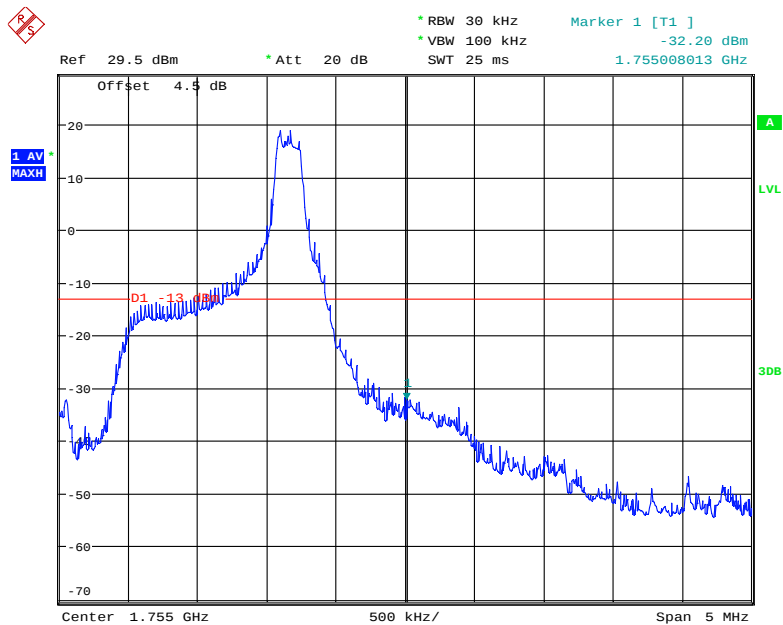
Date: 13.MAY.2018 23:03:29

### 16-QAM (15.0 MHz, RB0) - Left Band Edge



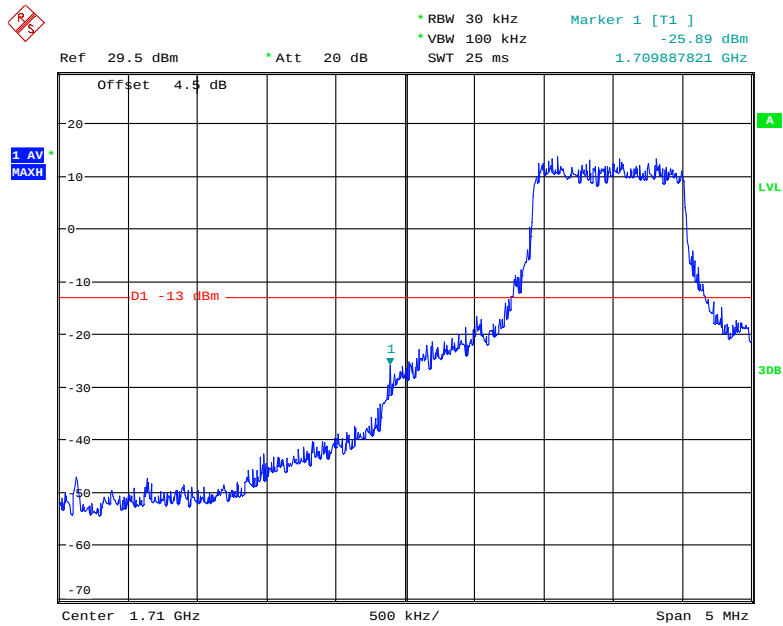
Date: 13.MAY.2018 22:58:44

### 16-QAM (15.0 MHz, RB0) - Right Band Edge



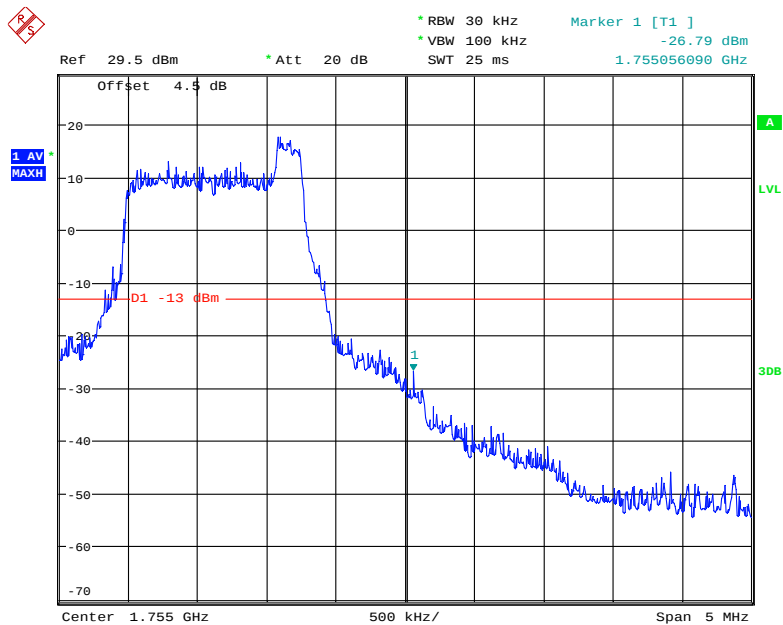
Date: 13.MAY.2018 23:05:31

### QPSK (15.0 MHz, RB6) - Left Band Edge



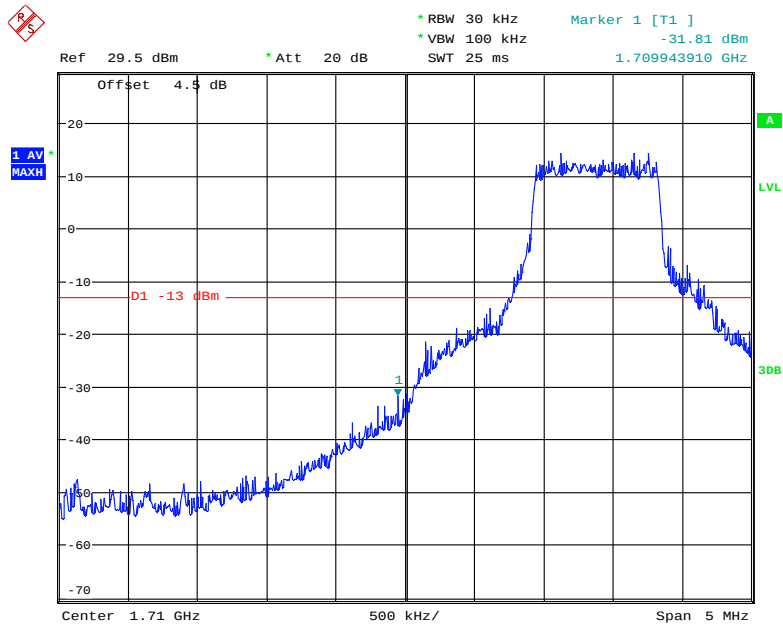
Date: 13.MAY.2018 22:56:03

### QPSK (15.0 MHz, RB6) - Right Band Edge



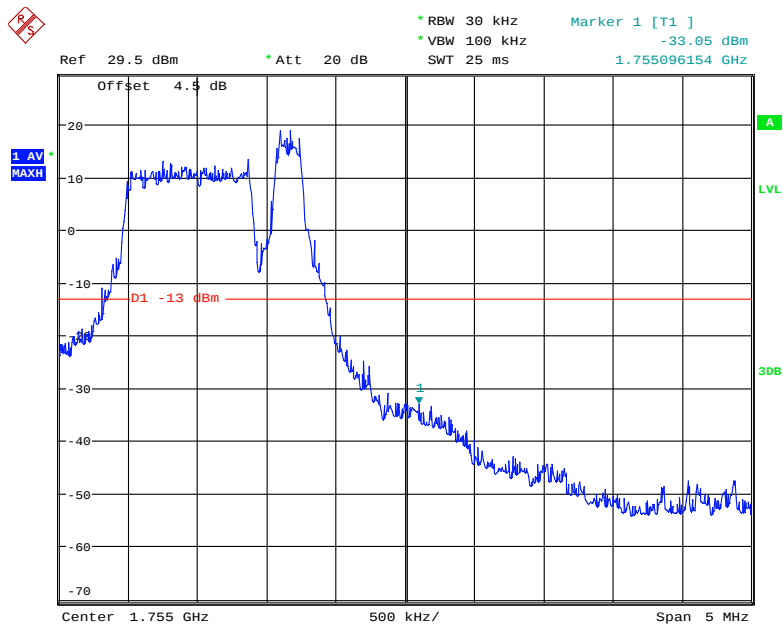
Date: 13.MAY.2018 23:01:56

### 16-QAM (15.0 MHz, RB5) - Left Band Edge



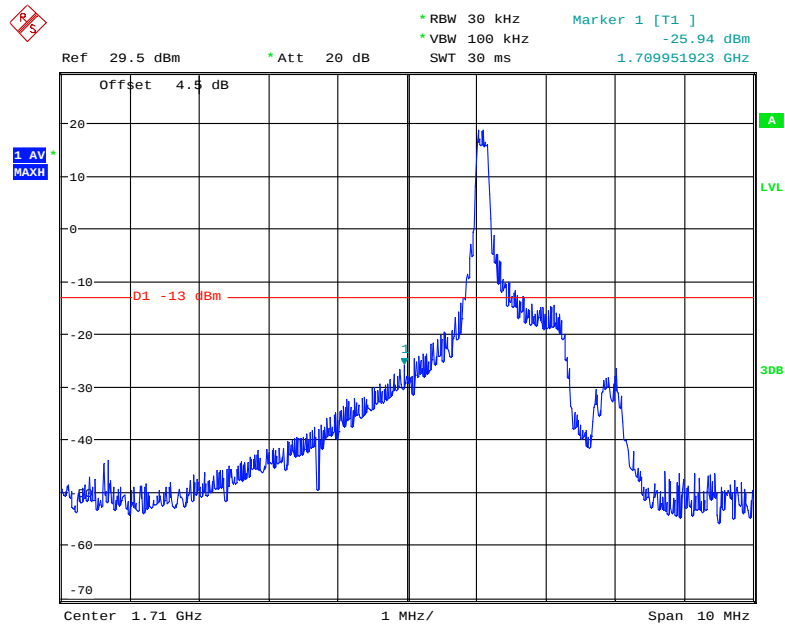
Date: 13.MAY.2018 22:59:51

### 16-QAM (15.0 MHz, RB5) - Right Band Edge



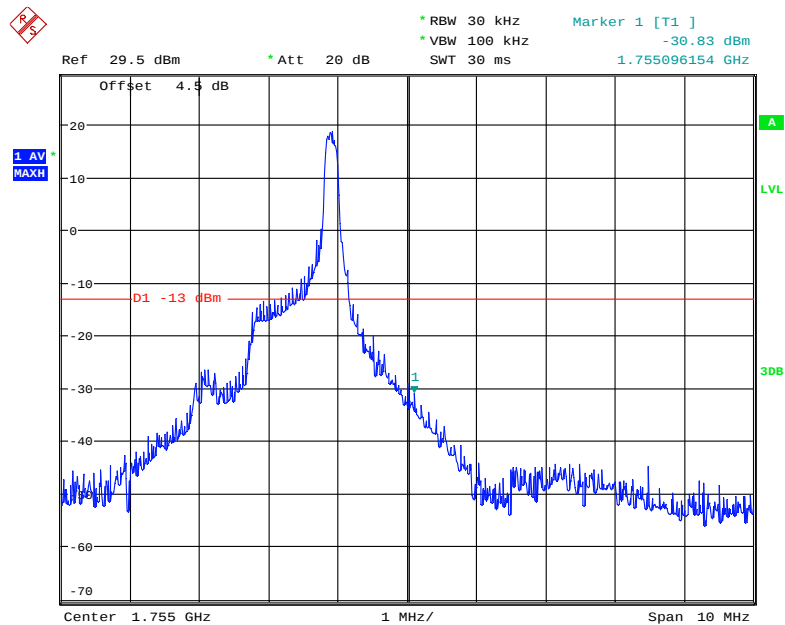
Date: 13.MAY.2018 23:07:49

### QPSK (20.0 MHz, RB0) - Left Band Edge



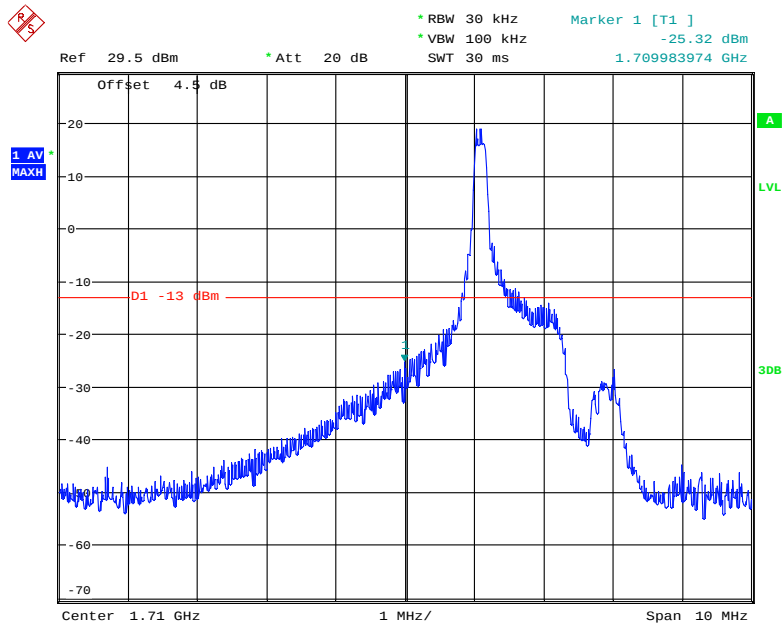
Date: 13.MAY.2018 23:27:14

### QPSK (20.0 MHz, RB0) - Right Band Edge



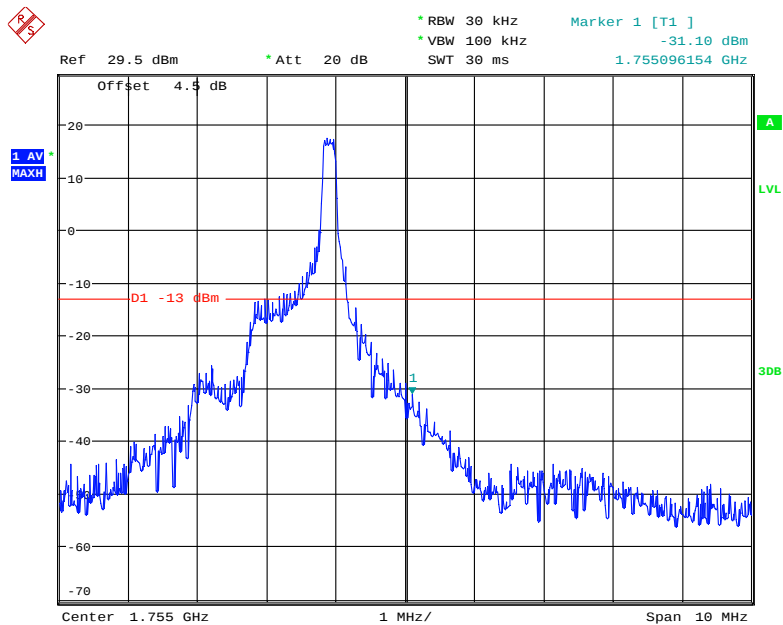
Date: 13.MAY.2018 23:17:50

### 16-QAM (20.0 MHz, RB0) - Left Band Edge



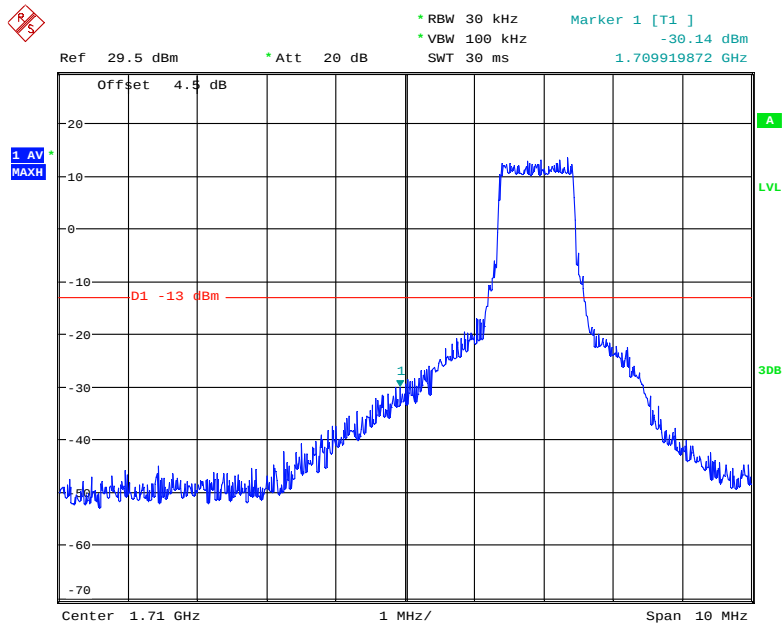
Date: 13.MAY.2018 23:30:15

### 16-QAM (20.0 MHz, RB0) - Right Band Edge



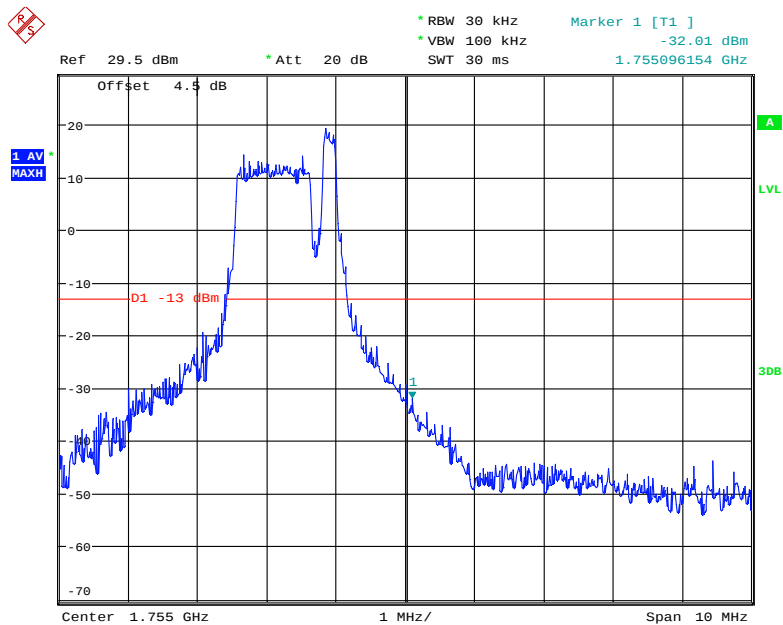
Date: 13.MAY.2018 23:19:24

### QPSK (20.0 MHz, RB6) - Left Band Edge



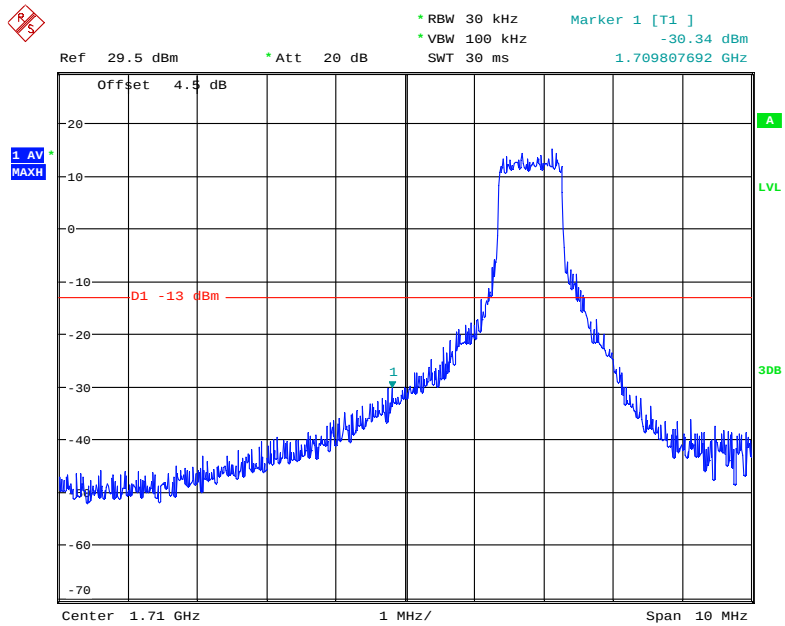
Date: 13.MAY.2018 23:24:36

### QPSK (20.0 MHz, RB6) - Right Band Edge



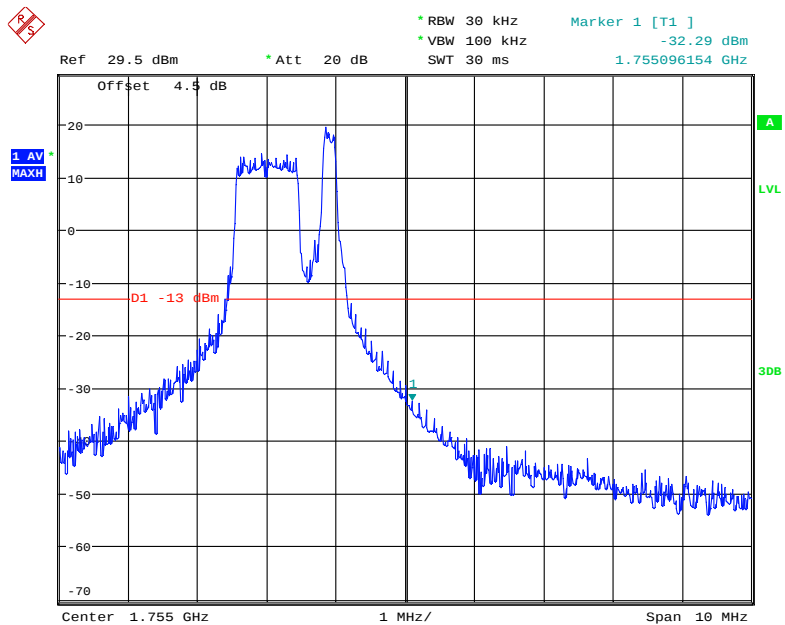
Date: 13.MAY.2018 23:14:36

### 16-QAM (20.0 MHz, RB5) - Left Band Edge



Date: 13.MAY.2018 23:33:39

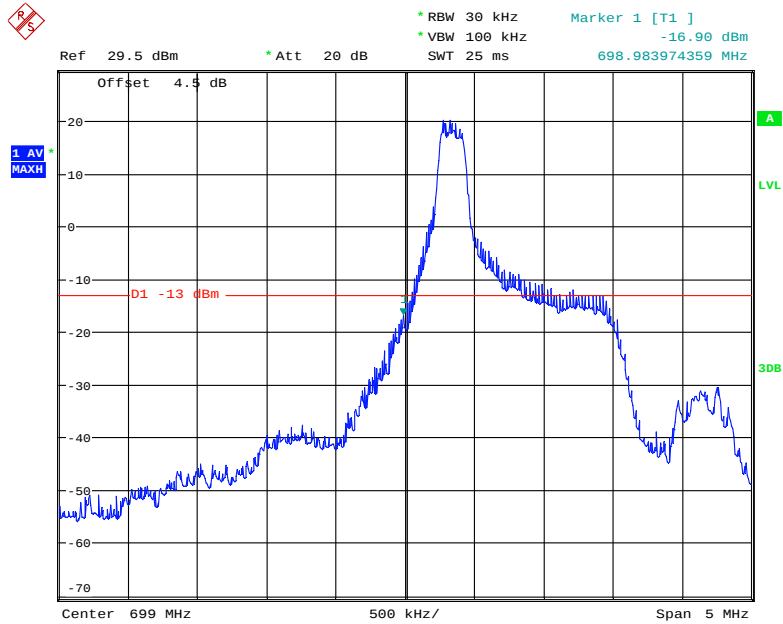
### 16-QAM (20.0 MHz, RB5) - Right Band Edge



Date: 13.MAY.2018 23:21:15

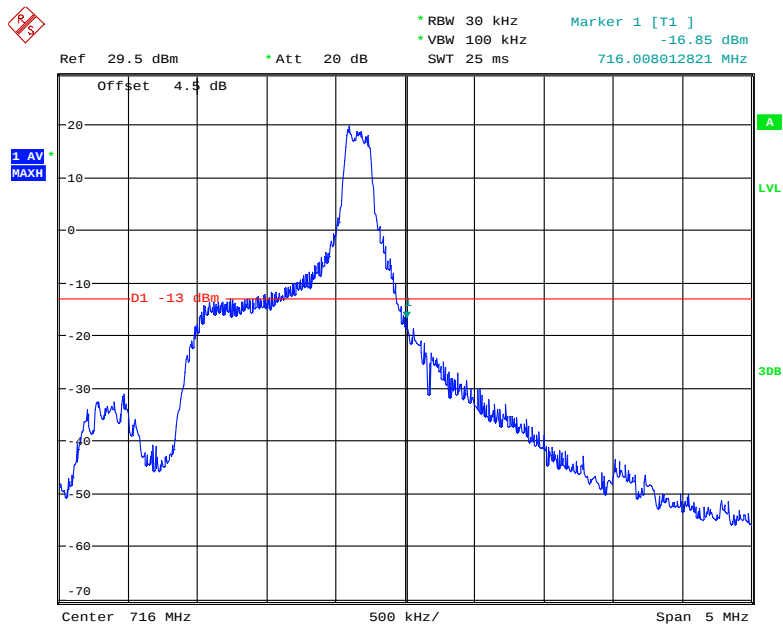
**Band 12:**

**QPSK (5.0 MHz, RB0) - Left Band Edge**



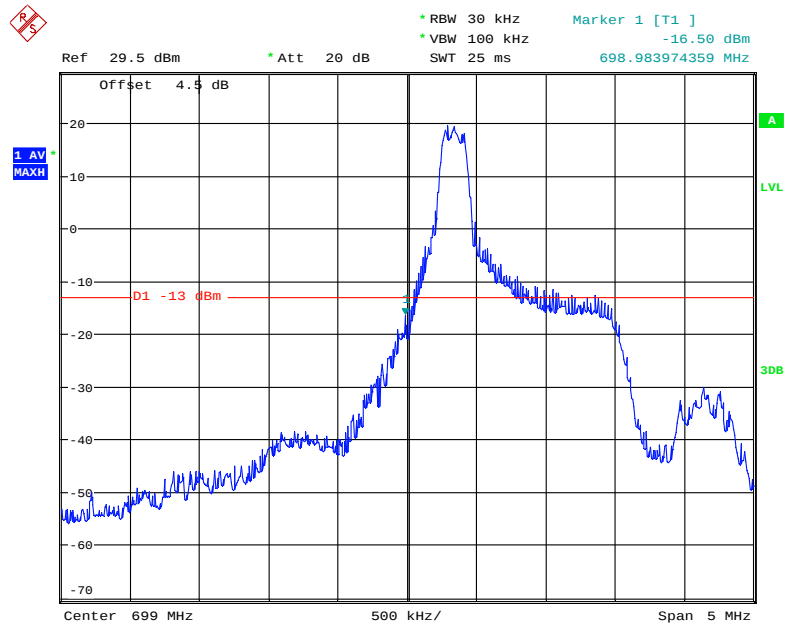
Date: 13.MAY.2018 20:28:46

**QPSK (5.0 MHz, RB0) - Right Band Edge**



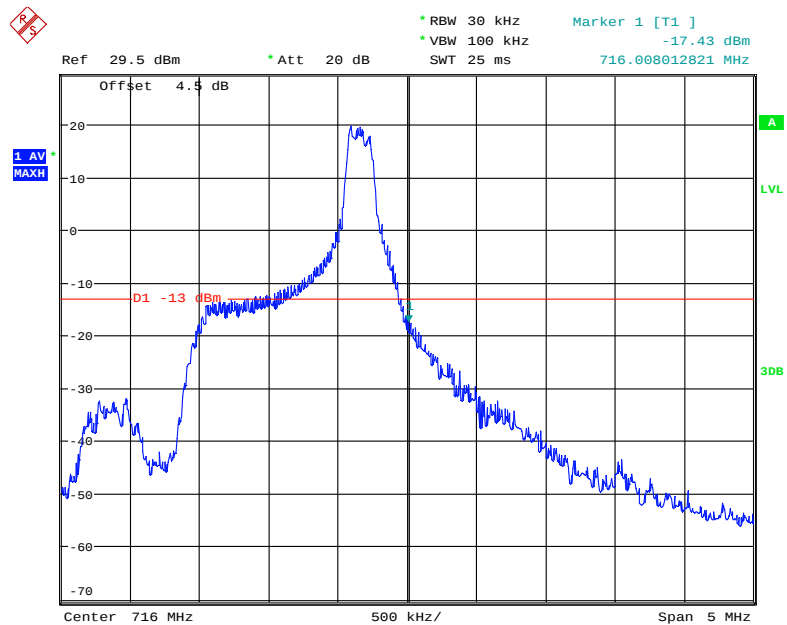
Date: 13.MAY.2018 20:37:58

### 16-QAM (5.0 MHz, RB0) - Left Band Edge



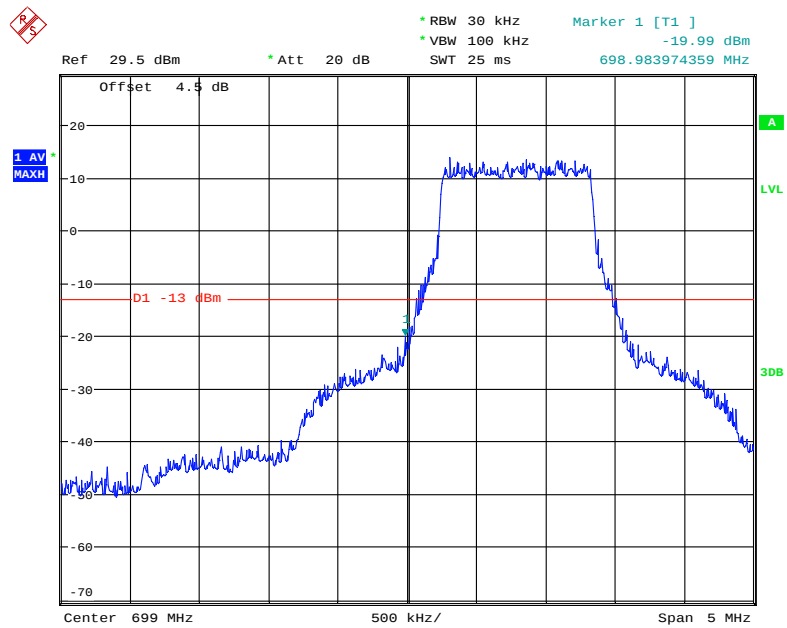
Date: 13.MAY.2018 20:30:20

### 16-QAM (5.0 MHz, RB0) - Right Band Edge



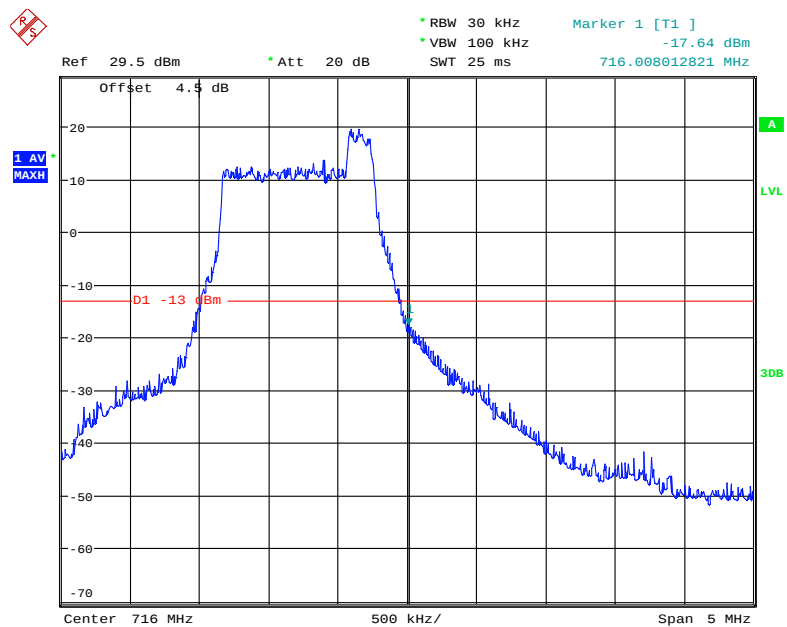
Date: 13.MAY.2018 20:39:36

### QPSK (5.0 MHz, RB6) - Left Band Edge



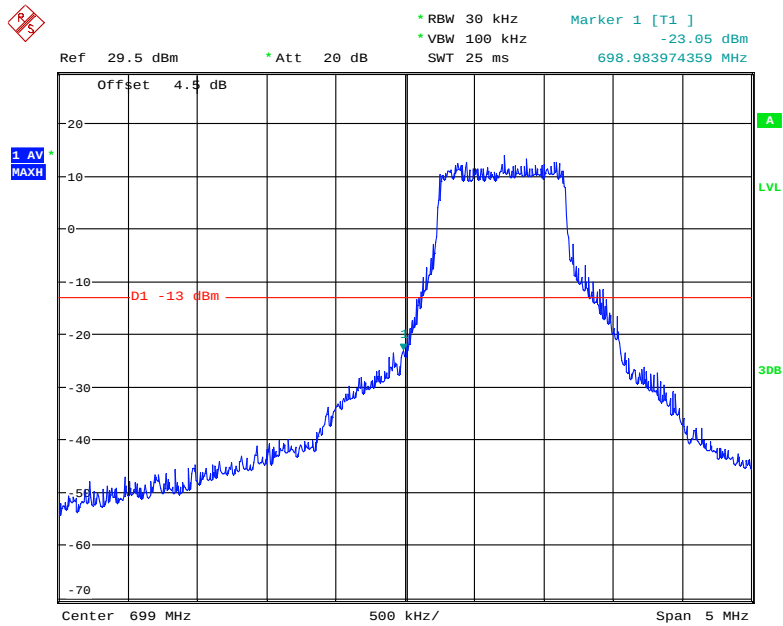
Date: 13.MAY.2018 20:26:14

### QPSK (5.0 MHz, RB6) - Right Band Edge



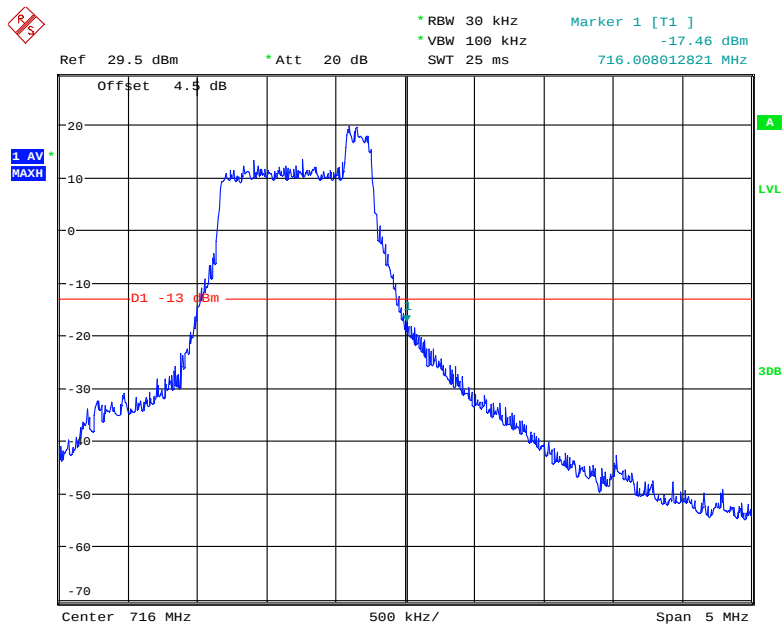
Date: 13.MAY.2018 20:36:06

### 16-QAM (5.0 MHz, RB5) - Left Band Edge



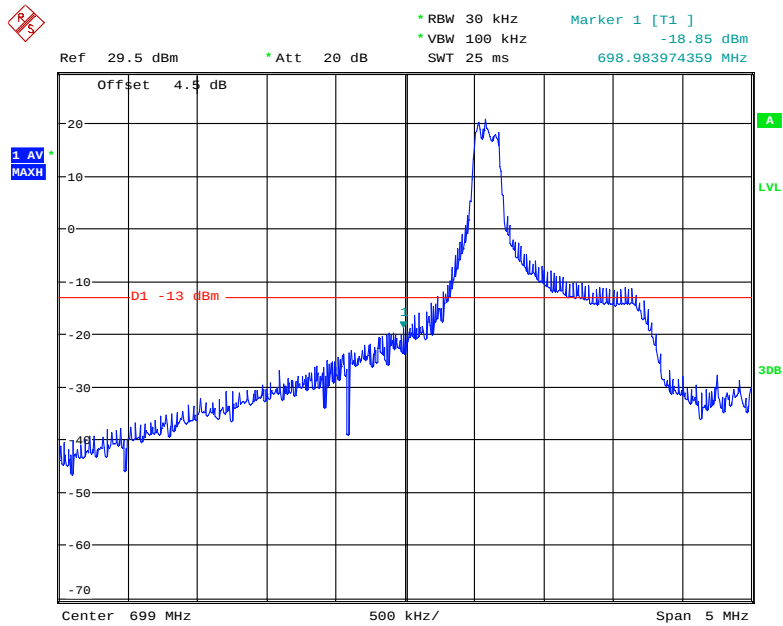
Date: 13.MAY.2018 20:31:49

### 16-QAM (5.0 MHz, RB5) - Right Band Edge



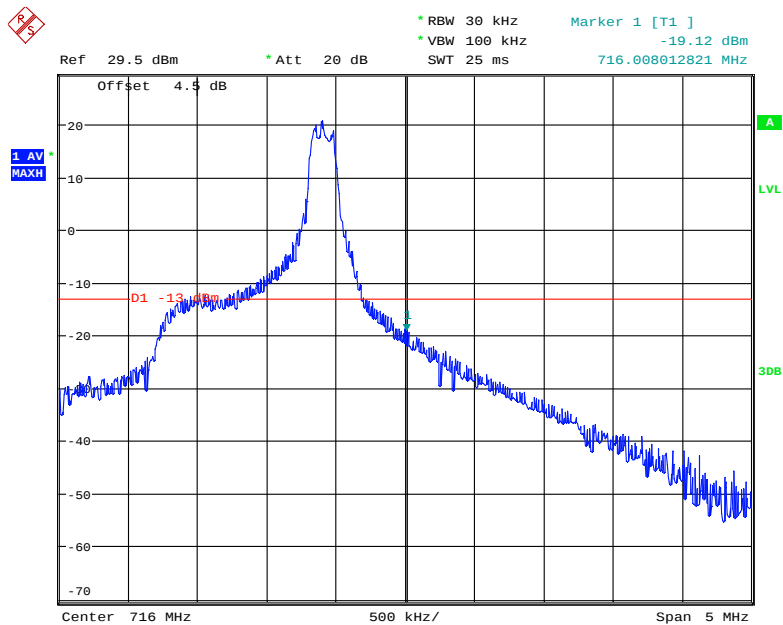
Date: 13.MAY.2018 20:41:24

### QPSK (10.0 MHz, RB0) - Left Band Edge



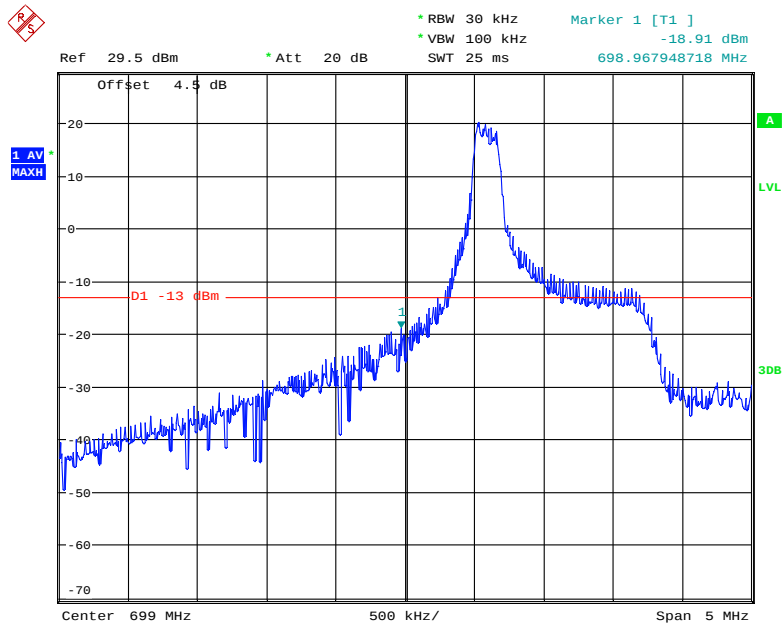
Date: 13.MAY.2018 23:41:37

### QPSK (10.0 MHz, RB0) - Right Band Edge



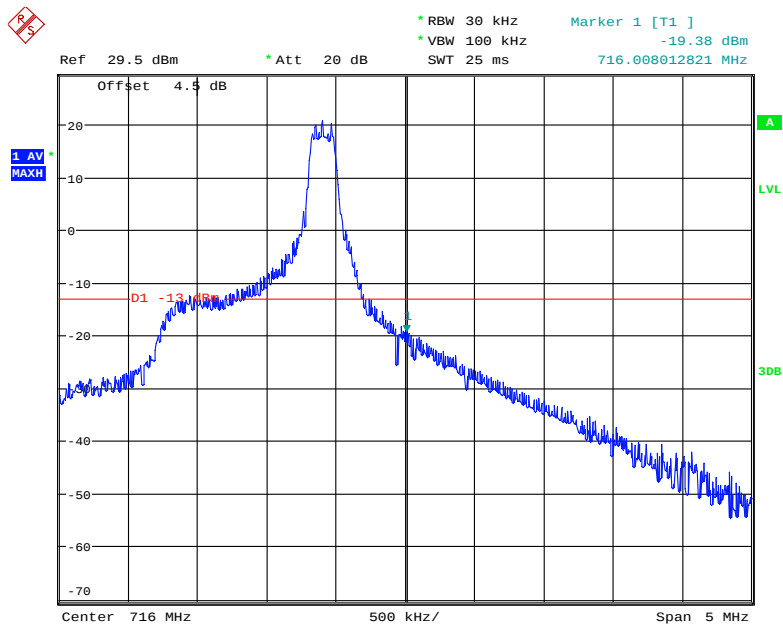
Date: 13.MAY.2018 23:50:47

### 16-QAM (10.0 MHz, RB0) - Left Band Edge



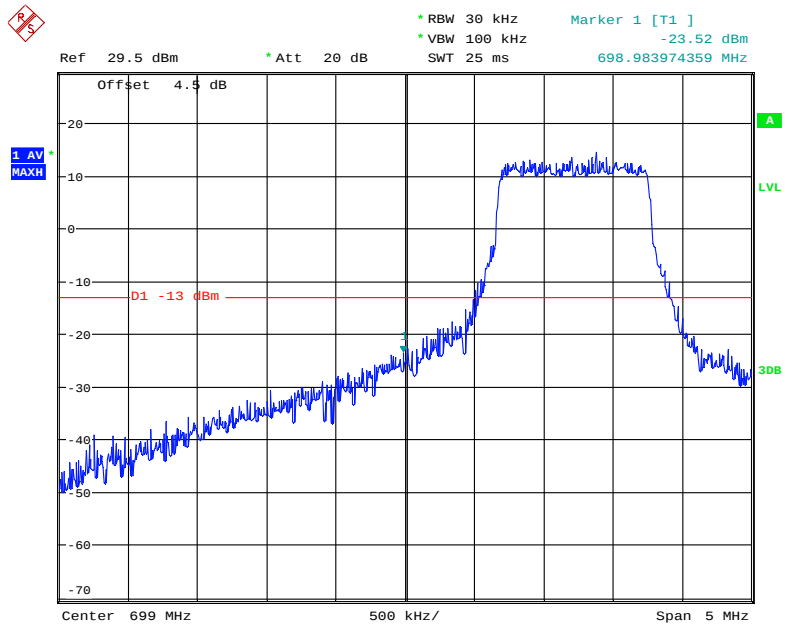
Date: 13.MAY.2018 23:43:02

### 16-QAM (10.0 MHz, RB0) - Right Band Edge



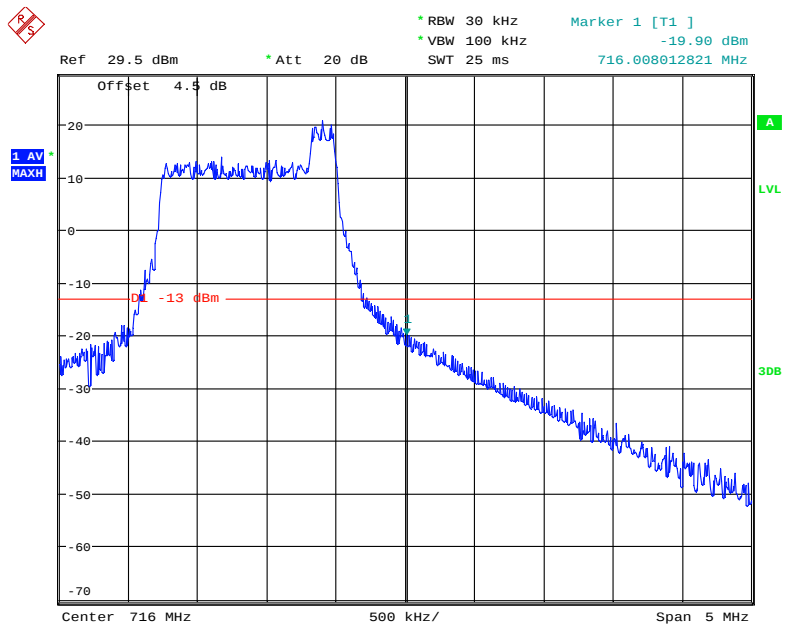
Date: 13.MAY.2018 23:52:48

### QPSK (10.0 MHz, RB6) - Left Band Edge



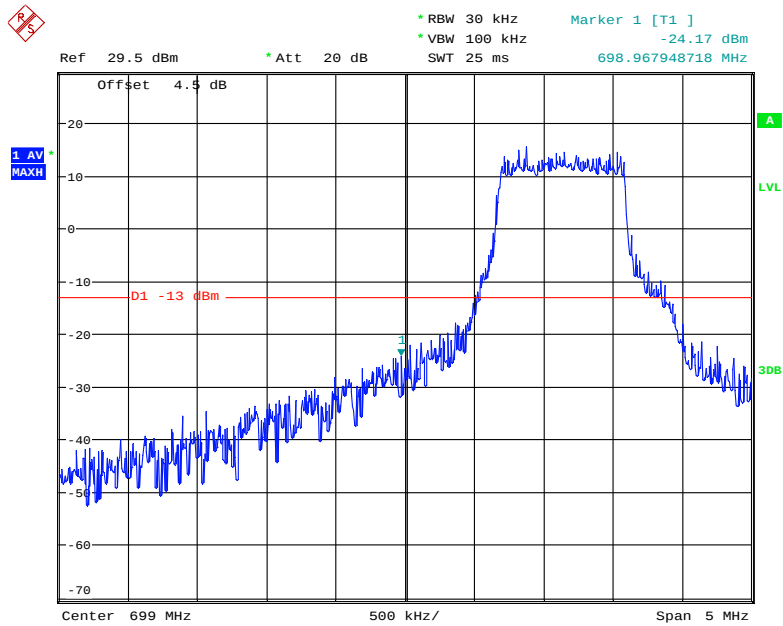
Date: 13.MAY.2018 23:39:05

### QPSK (10.0 MHz, RB6) - Right Band Edge



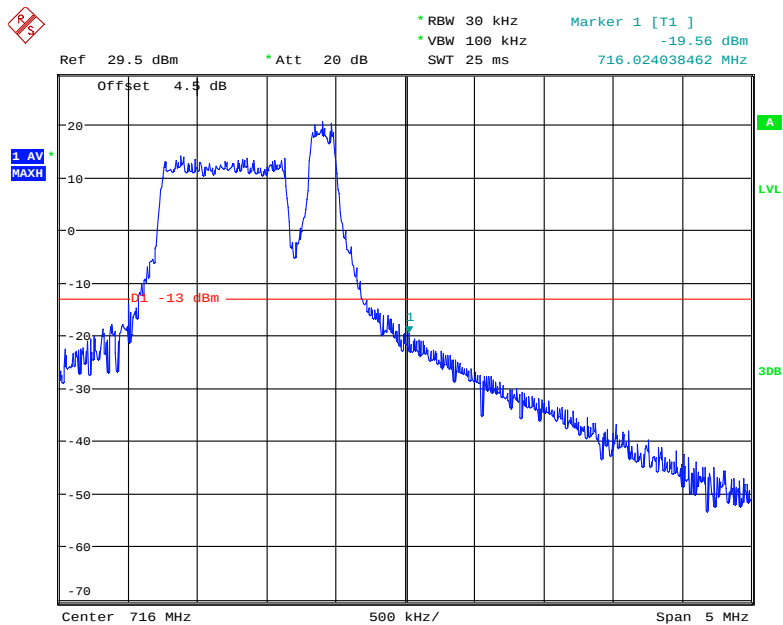
Date: 13.MAY.2018 23:48:34

### 16-QAM (10.0 MHz, RB5) - Left Band Edge



Date: 13.MAY.2018 23:44:05

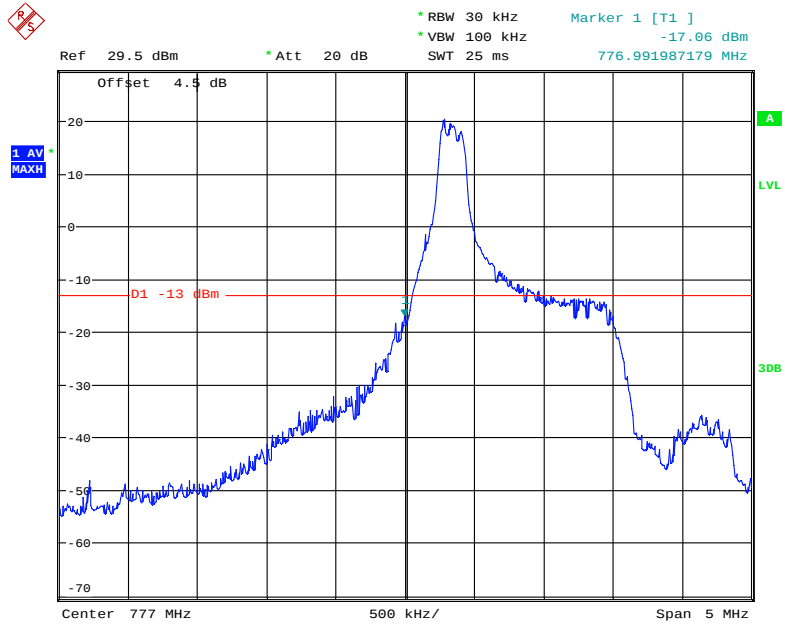
### 16-QAM (10.0 MHz, RB5) - Right Band Edge



Date: 13.MAY.2018 23:54:02

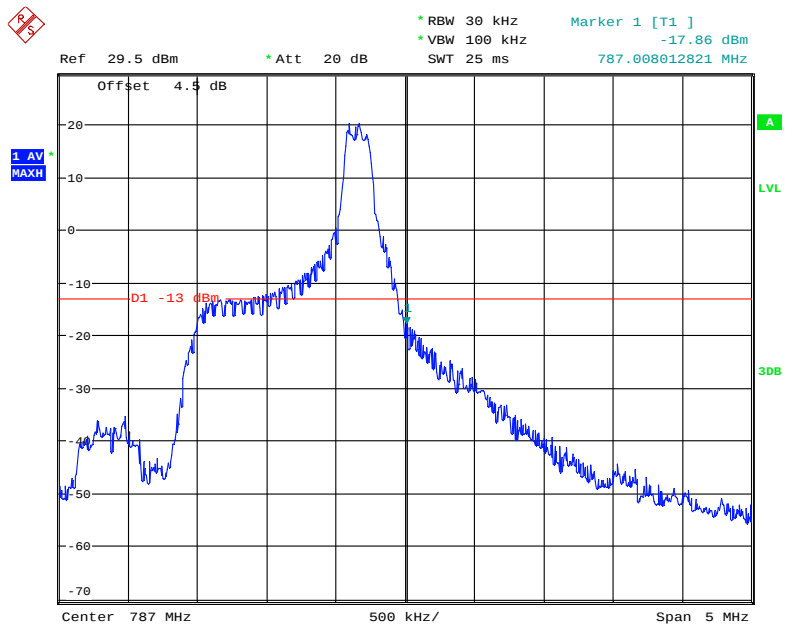
**Band 13:**

**QPSK (5.0 MHz, RB0) - Left Band Edge**



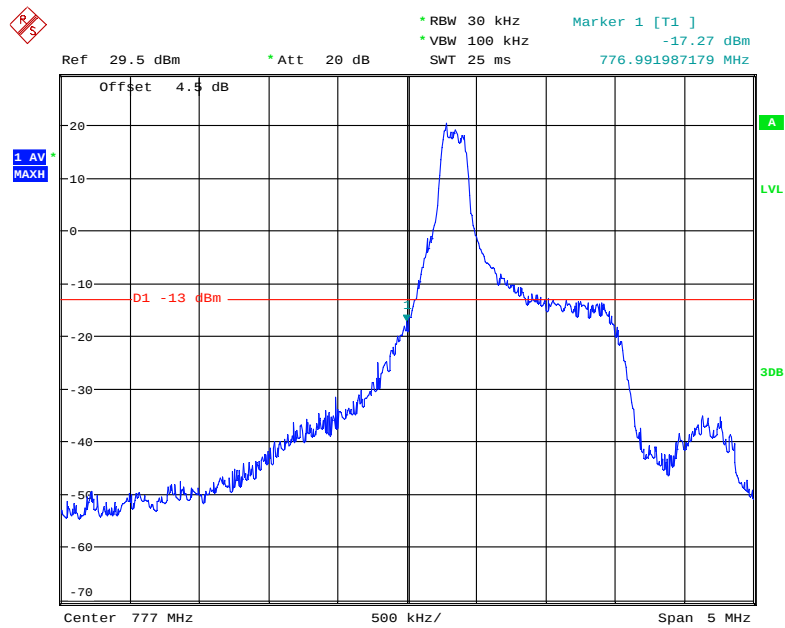
Date: 13.MAY.2018 20:05:32

**QPSK (5.0 MHz, RB0) - Right Band Edge**



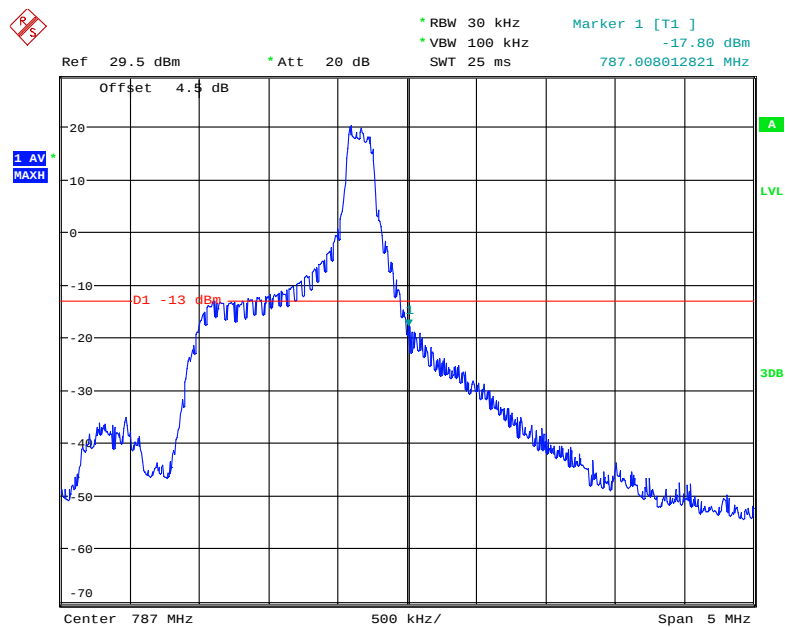
Date: 13.MAY.2018 20:17:40

### 16-QAM (5.0 MHz, RB0) - Left Band Edge



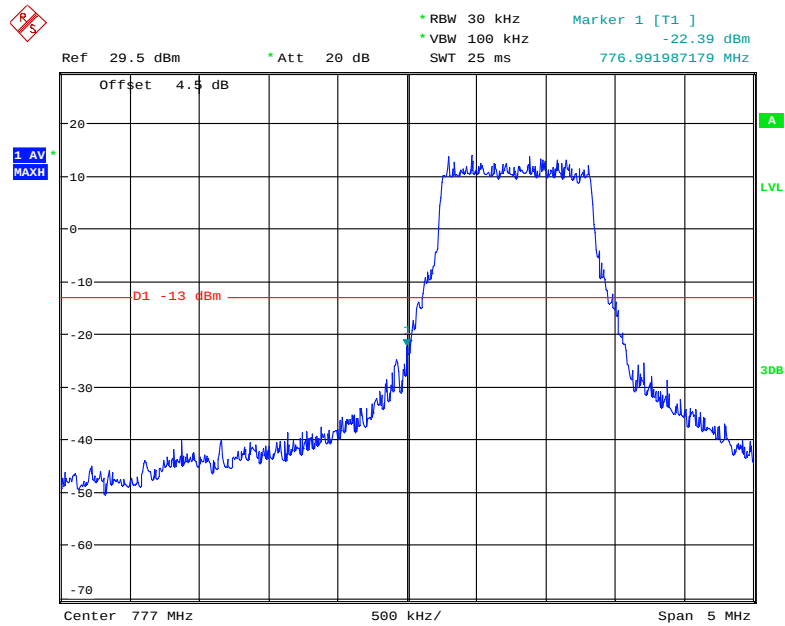
Date: 13.MAY.2018 20:11:23

### 16-QAM (5.0 MHz, RB0) - Right Band Edge



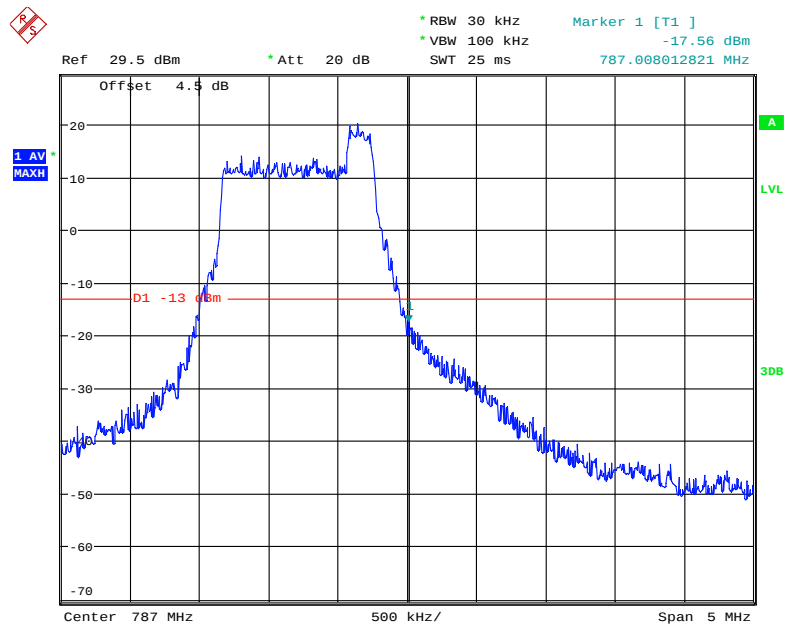
Date: 13.MAY.2018 20:20:36

### QPSK (5.0 MHz, RB6) - Left Band Edge



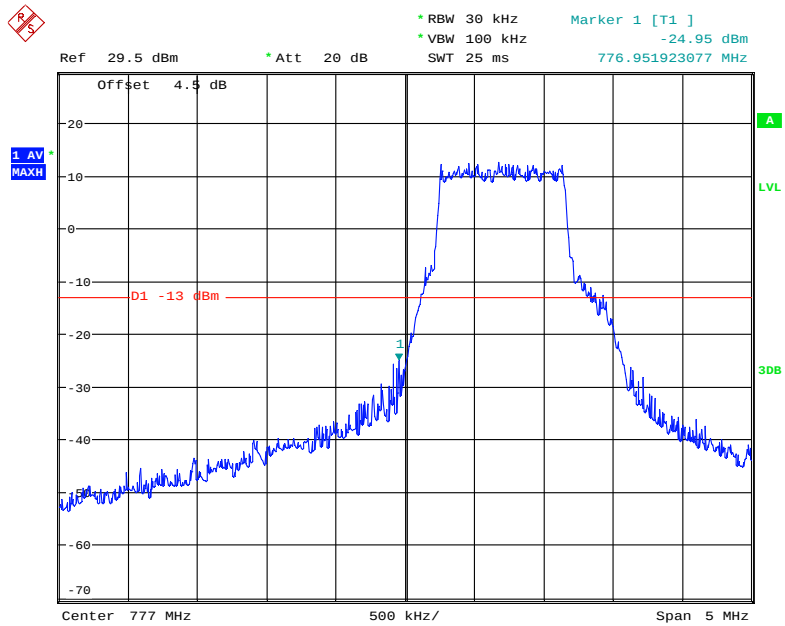
Date: 13.MAY.2018 20:03:16

### QPSK (5.0 MHz, RB6) - Right Band Edge



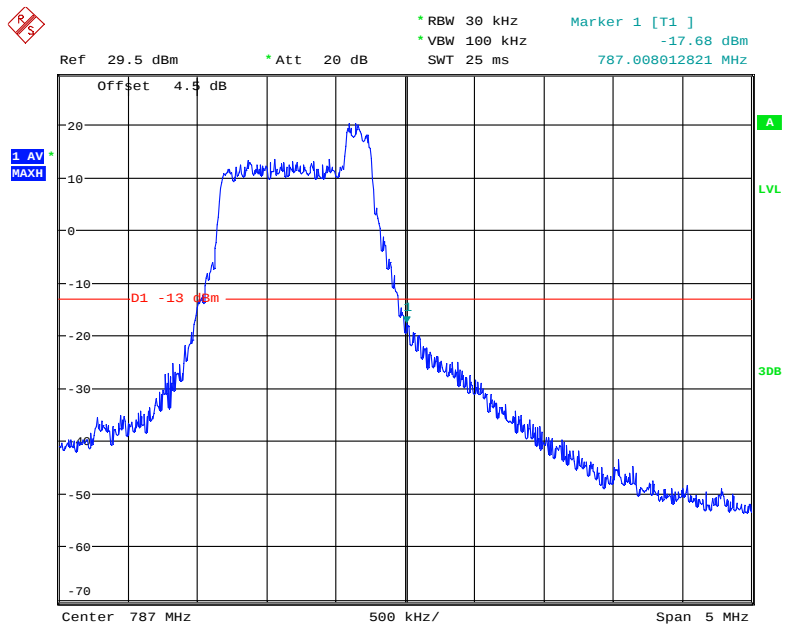
Date: 13.MAY.2018 20:15:32

### 16-QAM (5.0 MHz, RB5) - Left Band Edge



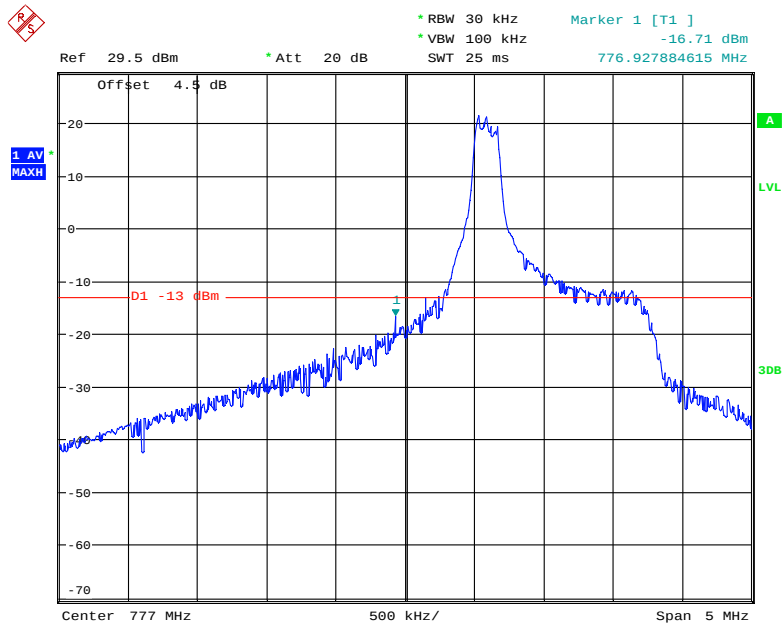
Date: 13.MAY.2018 20:12:26

### 16-QAM (5.0 MHz, RB5) - Right Band Edge



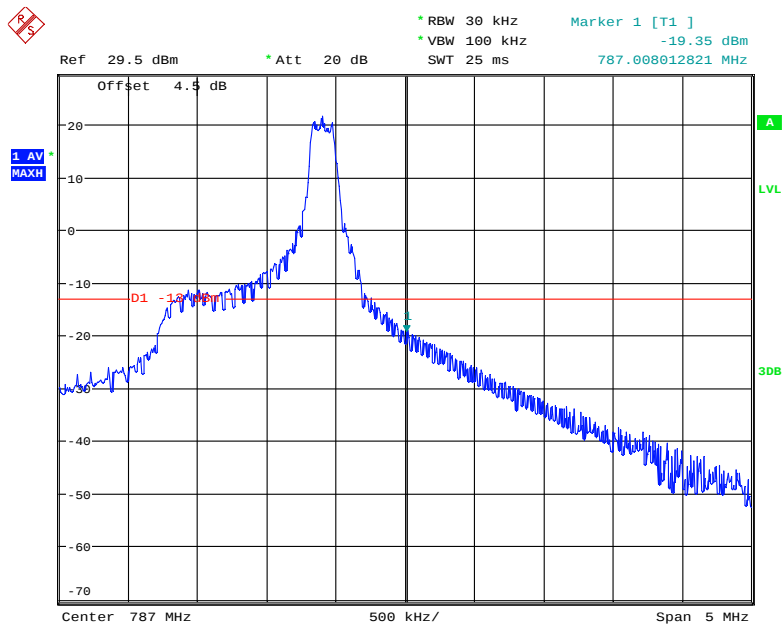
Date: 13.MAY.2018 20:23:02

### QPSK (10.0 MHz, RB0) - Left Band Edge



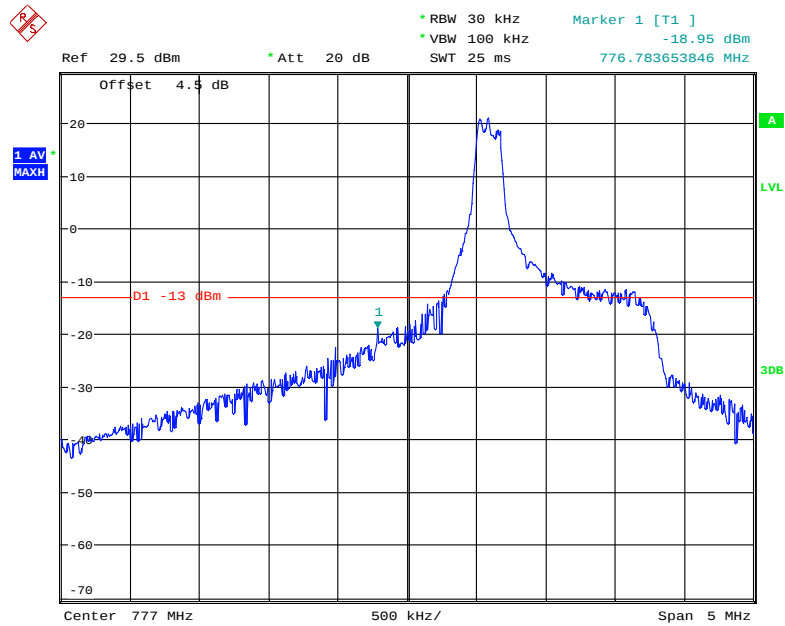
Date: 14.MAY.2018 00:03:37

### QPSK (10.0 MHz, RB0) - Right Band Edge



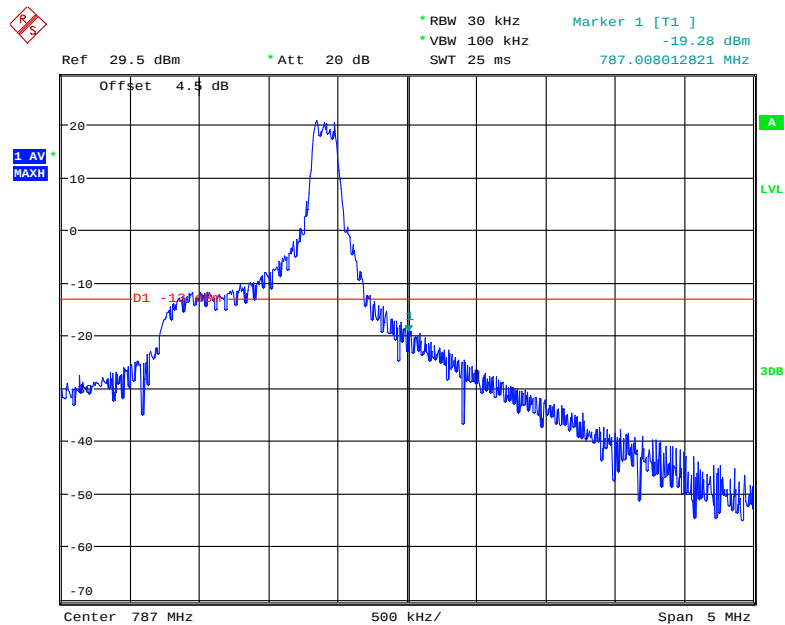
Date: 14.MAY.2018 00:10:44

### 16-QAM (10.0 MHz, RB0) - Left Band Edge



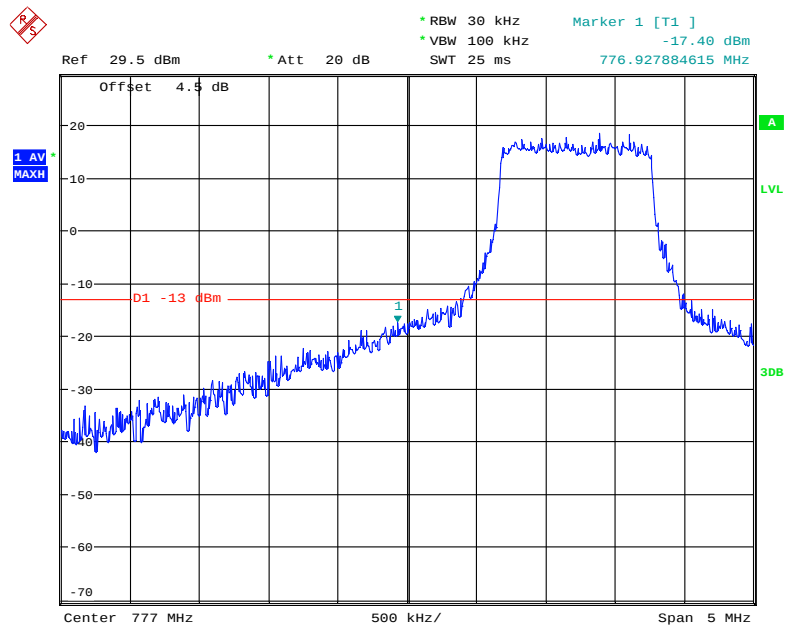
Date: 14.MAY.2018 00:05:18

### 16-QAM (10.0 MHz, RB0) - Right Band Edge



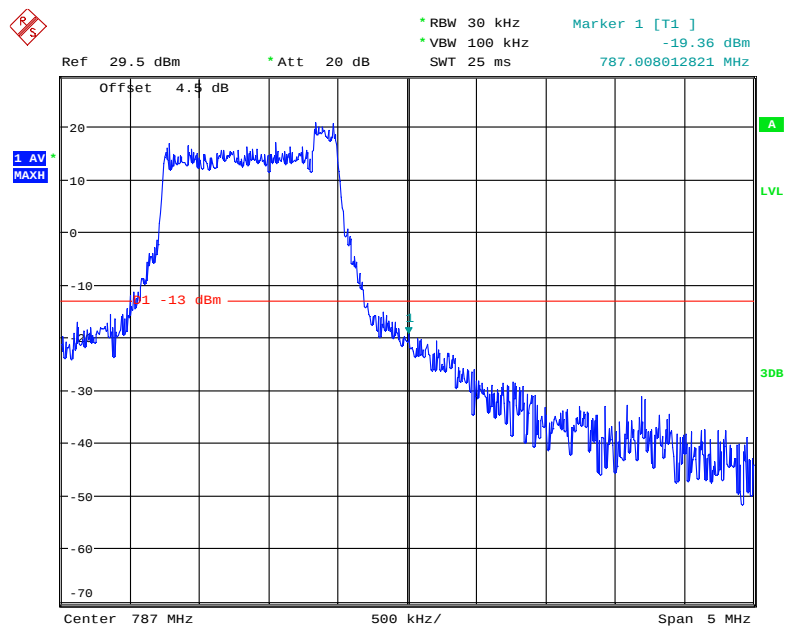
Date: 14.MAY.2018 00:13:02

### QPSK (10.0 MHz, RB6) - Left Band Edge



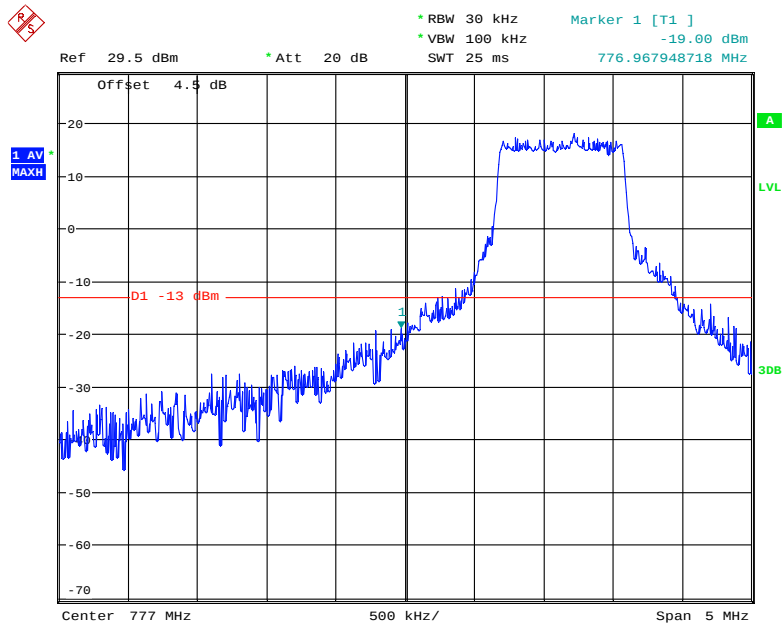
Date: 13.MAY.2018 23:59:58

### QPSK (10.0 MHz, RB6) - Right Band Edge



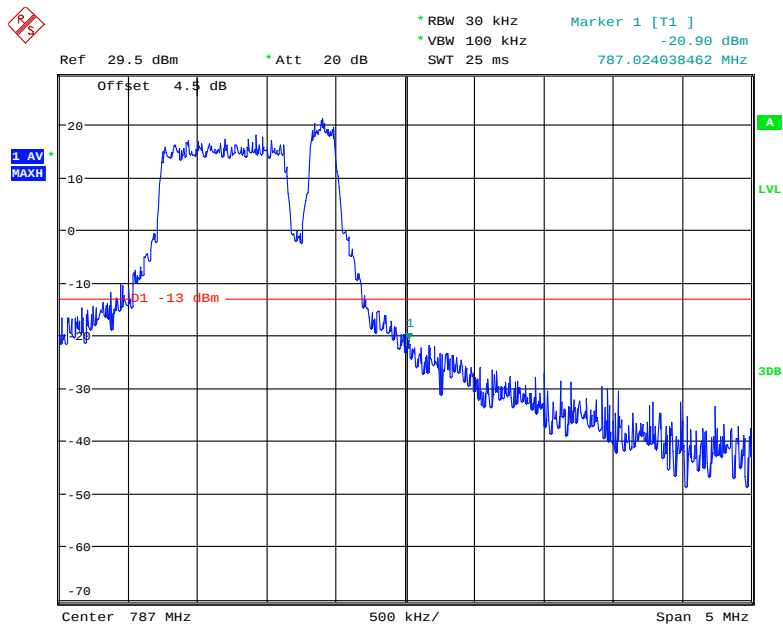
Date: 14.MAY.2018 00:08:01

### 16-QAM (10.0 MHz, RB5) - Left Band Edge



Date: 14.MAY.2018 00:06:42

### 16-QAM (10.0 MHz, RB5) - Right Band Edge



Date: 14.MAY.2018 00:14:14

## FCC § 2.1055; §27.54 - FREQUENCY STABILITY

### Applicable Standard

FCC § 2.1055 and §27.54.

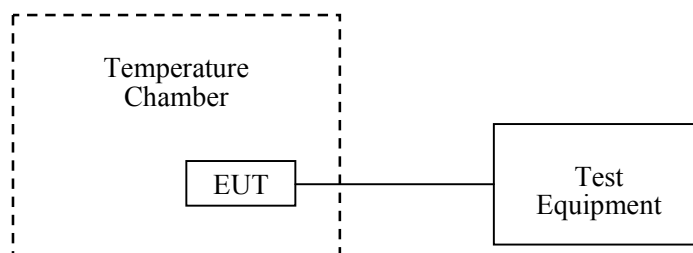
According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Jacob Kong on 2018-05-10.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables.

**QPSK:****Band 4:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 1710.213751          | 1754.786324          | 1710                       | 1755                       |
| -20              |                                     | 1710.213624          | 1754.786256          | 1710                       | 1755                       |
| -10              |                                     | 1710.213703          | 1754.786103          | 1710                       | 1755                       |
| 0                |                                     | 1710.213674          | 1754.786078          | 1710                       | 1755                       |
| 10               |                                     | 1710.213609          | 1754.786127          | 1710                       | 1755                       |
| 20               |                                     | 1710.213701          | 1754.786221          | 1710                       | 1755                       |
| 30               |                                     | 1710.213666          | 1754.786158          | 1710                       | 1755                       |
| 40               |                                     | 1710.213789          | 1754.786128          | 1710                       | 1755                       |
| 50               |                                     | 1710.213821          | 1754.786217          | 1710                       | 1755                       |
| 20               | 4.25                                | 1710.213819          | 1754.786215          | 1710                       | 1755                       |
| 20               | 5.75                                | 1710.213823          | 1754.786219          | 1710                       | 1755                       |

**Band 12:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 699.223152           | 715.782365           | 699                        | 716                        |
| -20              |                                     | 699.223247           | 715.782457           | 699                        | 716                        |
| -10              |                                     | 699.223051           | 715.782614           | 699                        | 716                        |
| 0                |                                     | 699.223162           | 715.782315           | 699                        | 716                        |
| 10               |                                     | 699.221582           | 715.782765           | 699                        | 716                        |
| 20               |                                     | 699.223068           | 715.782651           | 699                        | 716                        |
| 30               |                                     | 699.2227968          | 715.782462           | 699                        | 716                        |
| 40               |                                     | 699.221983           | 715.782365           | 699                        | 716                        |
| 50               |                                     | 699.224571           | 715.783214           | 699                        | 716                        |
| 20               | 4.25                                | 699.224573           | 715.783211           | 699                        | 716                        |
| 20               | 5.75                                | 699.224568           | 715.783209           | 699                        | 716                        |

**Band 13:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 777.22102            | 786.786863           | 777                        | 787                        |
| -20              |                                     | 777.222152           | 786.787521           | 777                        | 787                        |
| -10              |                                     | 777.221025           | 786.787102           | 777                        | 787                        |
| 0                |                                     | 777.220321           | 786.786352           | 777                        | 787                        |
| 10               |                                     | 777.221021           | 786.786245           | 777                        | 787                        |
| 20               |                                     | 777.219862           | 786.786242           | 777                        | 787                        |
| 30               |                                     | 777.219872           | 786.785698           | 777                        | 787                        |
| 40               |                                     | 777.220163           | 786.785320           | 777                        | 787                        |
| 50               |                                     | 777.219863           | 786.787154           | 777                        | 787                        |
| 20               | 4.25                                | 777.219861           | 786.787153           | 777                        | 787                        |
| 20               | 5.75                                | 777.219859           | 786.787149           | 777                        | 787                        |

**16QAM:****Band 4:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 1710.213789          | 1754.785761          | 1710                       | 1755                       |
| -20              |                                     | 1710.213715          | 1754.785763          | 1710                       | 1755                       |
| -10              |                                     | 1710.213762          | 1754.785719          | 1710                       | 1755                       |
| 0                |                                     | 1710.213780          | 1754.785638          | 1710                       | 1755                       |
| 10               |                                     | 1710.213745          | 1754.785498          | 1710                       | 1755                       |
| 20               |                                     | 1710.213709          | 1754.785627          | 1710                       | 1755                       |
| 30               |                                     | 1710.213766          | 1754.785446          | 1710                       | 1755                       |
| 40               |                                     | 1710.213698          | 1754.785784          | 1710                       | 1755                       |
| 50               |                                     | 1710.213697          | 1754.785639          | 1710                       | 1755                       |
| 20               | 4.25                                | 1710.213693          | 1754.785636          | 1710                       | 1755                       |
| 20               | 5.75                                | 1710.213699          | 1754.785638          | 1710                       | 1755                       |

**Band 12:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 699.222362           | 715.78362            | 699                        | 716                        |
| -20              |                                     | 699.221853           | 715.78372            | 699                        | 716                        |
| -10              |                                     | 699.222157           | 715.78396            | 699                        | 716                        |
| 0                |                                     | 699.222351           | 715.782463           | 699                        | 716                        |
| 10               |                                     | 699.222150           | 715.78312            | 699                        | 716                        |
| 20               |                                     | 699.221986           | 715.783110           | 699                        | 716                        |
| 30               |                                     | 699.222060           | 715.782983           | 699                        | 716                        |
| 40               |                                     | 699.221586           | 715.782896           | 699                        | 716                        |
| 50               |                                     | 699.222145           | 715.782587           | 699                        | 716                        |
| 20               | 4.25                                | 699.222143           | 715.782583           | 699                        | 716                        |
| 20               | 5.75                                | 699.222148           | 715.782589           | 699                        | 716                        |

**Band 13:**

| Temperature (°C) | Voltage Supplied (V <sub>DC</sub> ) | F <sub>L</sub> (MHz) | F <sub>H</sub> (MHz) | F <sub>L</sub> Limit (MHz) | F <sub>H</sub> Limit (MHz) |
|------------------|-------------------------------------|----------------------|----------------------|----------------------------|----------------------------|
| -30              | 5                                   | 777.221010           | 786.785520           | 777                        | 787                        |
| -20              |                                     | 777.220965           | 786.785325           | 777                        | 787                        |
| -10              |                                     | 777.221452           | 786.785412           | 777                        | 787                        |
| 0                |                                     | 777.220362           | 786.784214           | 777                        | 787                        |
| 10               |                                     | 777.219985           | 786.786325           | 777                        | 787                        |
| 20               |                                     | 777.220145           | 786.786010           | 777                        | 787                        |
| 30               |                                     | 777.219652           | 786.7854125          | 777                        | 787                        |
| 40               |                                     | 777.219352           | 786.783525           | 777                        | 787                        |
| 50               |                                     | 777.220021           | 786.7873214          | 777                        | 787                        |
| 20               | 4.25                                | 777.220023           | 786.7863206          | 777                        | 787                        |
| 20               | 5.75                                | 777.220019           | 786.784639           | 777                        | 787                        |

\*\*\*\*\* END OF REPORT \*\*\*\*\*