Product Service

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# Report On

FCC and IC Testing of the CBRSYS6500 in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 27

COMMERCIAL-IN-CONFIDENCE

FCC ID: 2AQSOCBRSYS6500

| PREPARED BY | APPROVED BY | DATED |
|---|---|---|
| Nikolai Viktorov<br>Test Personnel | Scott Drysdale<br>Authorised Signatory | October 29, 2018 |

**October 2018**



Report Issued: 10/29/2018

Report File #: **7169004718**
**Report 01 Issue 1**

ACCREDITED
Testing Laboratory
Certificate #2955.02

Product Service

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Product Service

## SECTION 1

## REPORT INFORMATION

## 1.1 REPORT DETAILS

| | |
|---|---|
| Manufacturer | Octasic inc. |
| Address | 300-401 Molson St, Montreal, QC, H1Y 3L1 |
| Product Name | CBRSYS6500 (CBRRFE6400+CBRSYS6000) |
| Product Number | CBRSYS6000 - CBRSYS6008-RE-3E<br>CBRRFE6400 - CBRRFE6407-NC100-EE1 |
| Serial Number(s) | CBRSYS6000 – F-00190<br>CBRRFE6400 – K-15468 |
| Hardware Version | CBRSYS6000 - 3.0<br>CBRRFE6400 - 3.1 |
| Test Specification/Issue/Date | FCC CFR 47 Part 2: 2016<br>FCC CFR 47 Part 27: 2016 |
| Start of Test | September 24, 2018 |
| Finish of Test | October 22, 2018 |
| Name of Test Personnel(s) | Scott Drysdale and Nikolai Viktorov |
| Related Document(s) | KDB 971168 D01 v02r02<br>KDB 662911 D01 v02r01 |

## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results for each configuration, in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 27 is shown below.

| Section | Specification Clause | | Test Description | Result |
|---|---|---|---|---|
| | FCC CFR 47 Part 2 | FCC CFR 47 Part 27 | | |
| 2.1 | 2.1046 | 27.50 | Maximum Peak Output Power, ERP, and Peak to Average Ratio - Conducted | Pass |
| 2.2 | 2.1049 | 27.53 | Occupied Bandwidth | Pass |
| 2.3 | 2.1051 | 27.53 (h) | Band Edge | Pass |
| 2.4 | 2.1051 | 27.53 (h) | Transmitter Spurious Emissions | Pass |
| 2.5 | 2.1055 | 27.54 | Frequency Stability | Pass |
| - | - | 15.111 | Receiver Spurious Emissions | N/A[1] |

N/A[1] – Not Applicable, as this is a transceiver.

## 1.3 CONFIGURATION DESCRIPTION

The CBRSYS6500 supports Single Mode operation from a single port configuration.

The CBRSYS6500 supports LTE in Band 13 (746 MHz – 756 MHz).

TX test cases: Maximum Conducted Output Power, Spurious Emissions at Antenna Terminals (±1MHz) and Conducted Spurious Emissions, measurements were performed on the RF Port. The test limits shown are representative of the worst case. All testing was performed with the EUT transmitting at maximum RF power unless as designated setting by client, otherwise stated.

The EUT was powered via a 120V 60Hz power supply.

LTE B13 (746 MHz – 756 MHz) Channel Configurations

All tests

| RAT | No. of Carriers | Carrier Bandwidth (MHz) | Carrier Frequency Configuration (MHz) | | |
|---|---|---|---|---|---|
| | | | Bottom (BRFBW) | Middle (MRFBW) | Top (TRFBW) |
| L | 1 | 5 | 748.5 | 751 | 753.5 |

## 1.4 DECLARATION OF BUILD STATUS

| MAIN EUT | |
|---|---|
| **MANUFACTURING DESCRIPTION** | CBRSYS6500 |
| **MANUFACTURER** | Octasic inc. |
| **TYPE** | Portable Base Station Unit with Transportable Amplification Unit |
| **PART NUMBER** | CBRSYS6000 - CBRSYS6008-RE-3E<br>CBRRFE6400 - CBRRFE6407-NC100-EE1 |
| **SERIAL NUMBER** | CBRSYS6000 – F-00190<br>CBRRFE6400 – K-15468 |
| **HARDWARE VERSION** | CBRSYS6000 - 3.0<br>CBRRFE6400 - 3.1 |
| **TRANSMITTER OPERATING RANGE** | B13 746 – 756 MHz |
| **RECEIVER OPERATING RANGE** | B13 777 – 787 MHz |
| **COUNTRY OF ORIGIN** | CBRSYS6000 - India<br>CBRRFE6400 - Canada |
| **EMISSION DESIGNATOR(S): (i.e. G1D, GXW)** | LTE: W7D |
| **MODULATION TYPES: (i.e. GMSK, QPSK)** | LTE: QPSK |
| **HIGHEST INTERNALLY GENERATED FREQUENCY** | 756 MHz |
| **OUTPUT POWER (W or dBm)** | 20W |
| **FCC ID** | 2AQSOCBRSYS65000 |
| **TECHNICAL DESCRIPTION (a brief description of the intended use and operation)** | The Transportable Amplification Unit (TAU) is a powerful multiband RF front-end (RFE) designed for use as a Transportable Amplification Unit (TAU) in conjunction with a Portable Base station Unit (PBU). The EUT fits in a standard 19" 6U rack. |

## 1.5 PRODUCT INFORMATION

### 1.5.1 Technical Description

The Equipment Under Test (EUT) operates from a 120V 60Hz supply.

The CBRRFE6400 Transportable Amplification Unit (TAU) is a powerful multiband RF front-end (RFE) designed for use as a Transportable Amplification Unit (TAU) in conjunction with a Portable Base station Unit (PBU) such as the CBRSYS6000. The TAU ships in a ruggedized case for vehicular use and fits in a standard 19" 6U rack.
Depending on band configuration (North American or EMEA), it can support up to 6 bands (EMEA model) or up to 8 bands (NA model).
It has a high sensitivity multiband receiver and an interference mitigation and suppression mechanism to maintain sensitivity in the presence of interference. The transmitter can transmit up to 100W peak per band.
The TAU has automatic RF power control per band for coverage optimization and a standby mode to optimize power consumption.

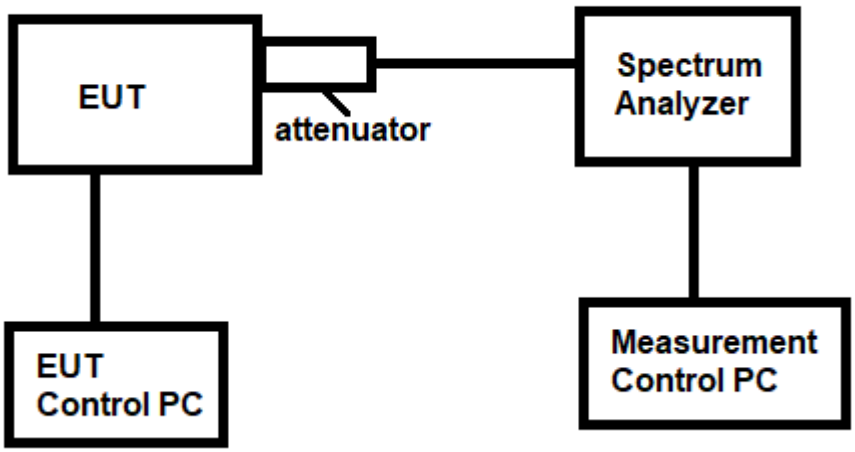
The CBRSYS6000 Portable Base station Unit (PBU) is multi-channel, software-defined radio (SDR) based base station system for wireless applications like Search and Rescue (S&R) and Network in a Box (NIB). It is designed to fit in a standard 19" 3U rack–two PBUs can be fit in a standard 3U rack and ships in a ruggedized 3U rackmount case, ready for vehicular deployment.
The PBU has a basic RF front end that internally combines the TX signals and splits the RX signals of each SDR. It can be coupled with a high-power RF front end Transportable Amplification Unit (TAU) such as the CBRRFE6400 for a complete vehicular system.
The PBU is controlled over wired Ethernet and also has a USB service port for maintenance access to the serial ports of each SDR. The PBU has built-in fans for thermal management.

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturer’s documentation.

Product Service

Equipment Under Test

## 1.6 TEST SETUP



## 1.7 TEST CONDITIONS

For all tests, the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or a chamber as appropriate.

The EUT was powered from a 120V 60Hz supply.

FCC Measurement Facility Accreditation Designation Number: CA6845 - TUV SUD Canada (Laval)

## 1.8 DEVIATION FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

## 1.9 MODIFICATION RECORD

No modifications were made to the EUT during testing.

## 1.10 ALTERNATIVE TEST SITE

Under our Accreditation, TÜV SÜD Canada, Laval conducted the following tests at the TÜV SÜD Canada, Ottawa location.

## 1.11 ADDITIONAL INFORMATION

The CBRSYS6000 Portable Base station Unit (PBU) is multi-channel, software-defined radio (SDR) based base station system for wireless applications like Search and Rescue (S&R) and Network in a Box (NIB). It is designed to fit in a standard 19" 3U rack–two PBUs can be fit in a standard 3U rack and ships in a ruggedized 3U rackmount case, ready for vehicular deployment.

Depending on band configuration (North American or EMEA), it can support up to 6 bands (EMEA model) or up to 8 bands (NA model).
It has a high sensitivity multiband receiver and an interference mitigation and suppression mechanism to maintain sensitivity in the presence of interference. The transmitter can transmit up to 100W peak per band.

Product Service

## SECTION 2

## TEST DETAILS

## 2.1 MAXIMUM PEAK OUTPUT POWER AND PEAK TO AVERAGE RATIO - CONDUCTED

### 2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 27, Clause 27.50

### 2.1.2 Date of Test and Modification State

Septemeber 24, 2018 - Modification State 0

### 2.1.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24°C |
| Relative Humidity | 35% |

### 2.1.5 Test Method

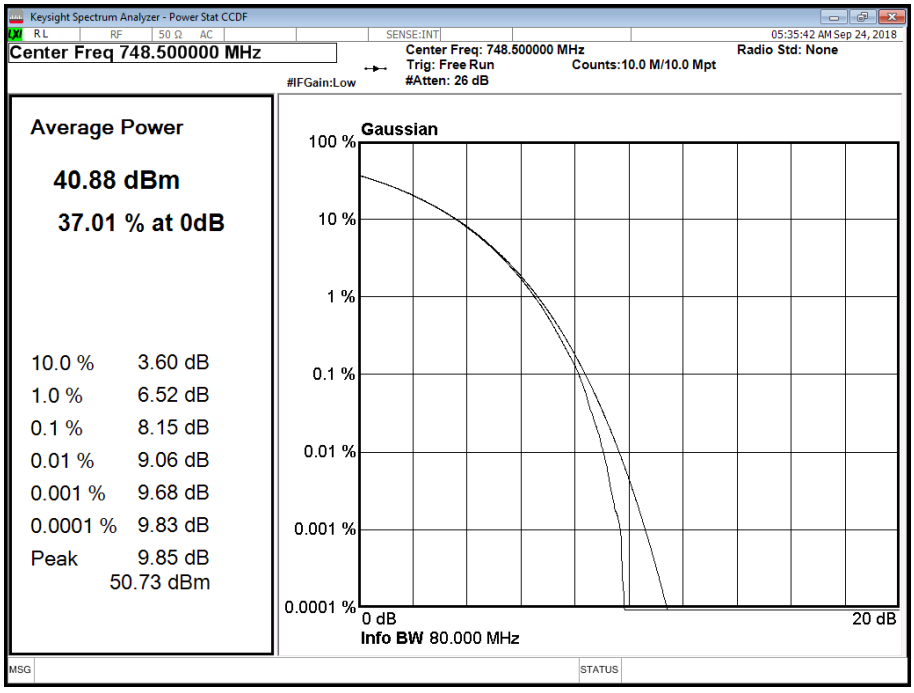
All measurements were made in accordance with FCC KDB 971168 D01, clause 5.2.1 and summed in accordance with FCC KDB 662911 D01.

### 2.1.6 Test Results

Maximum Target Output Power 43 dBm

| Antenna | LTE Modulation | LTE Carrier Bandwidth | Peak to Average Ratio (PAR) / Output Power | | |
|---|---|---|---|---|---|
| | | | Channel Position B | | |
| | | | PAR (dB) | Average Power | |
| | | | | dBm | dBm/MHz |
| A | QPSK | 5.0 MHz | 8.15 | 40.96 | 34.79 |

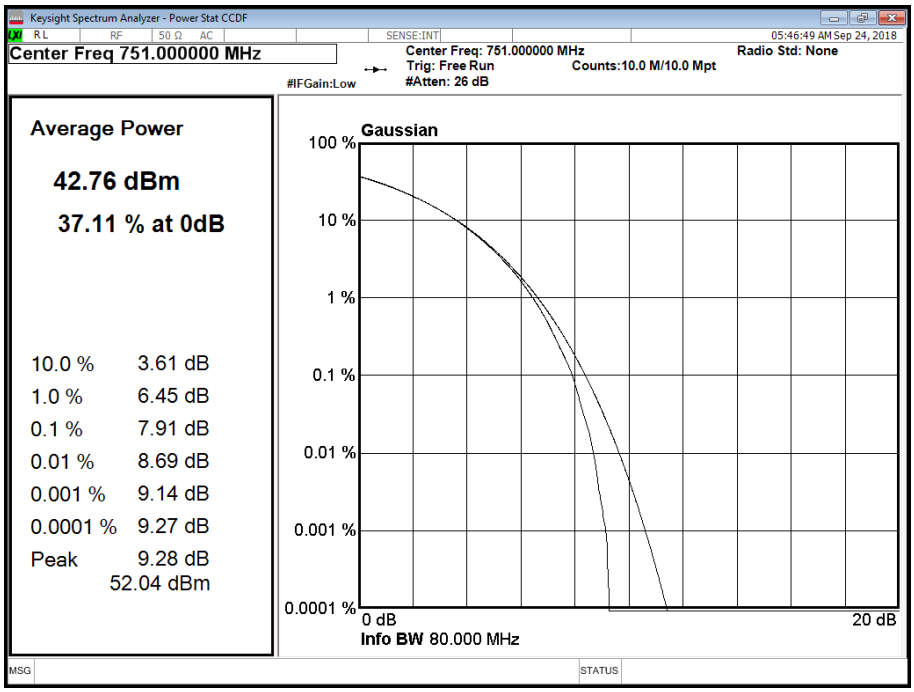
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



Maximum Target Output Power 43 dBm

| Antenna | LTE Modulation | LTE Carrier Bandwidth | Peak to Average Ratio (PAR) / Output Power | | |
|---|---|---|---|---|---|
| | | | Channel Position M | | |
| | | | PAR (dB) | Average Power | |
| | | | | dBm | dBm/MHz |
| A | QPSK | 5.0 MHz | 7.91 | 42.84 | 36.61 |

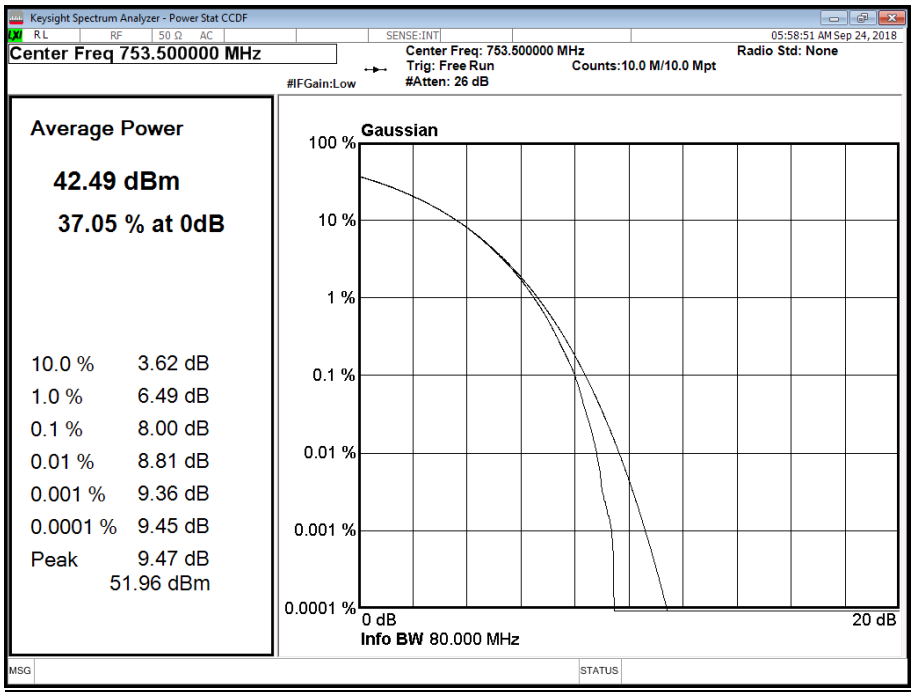
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



Maximum Target Output Power 43 dBm

| Antenna | LTE Modulation | LTE Carrier Bandwidth | Peak to Average Ratio (PAR) / Output Power | | |
|---|---|---|---|---|---|
| | | | Channel Position T | | |
| | | | PAR (dB) | Average Power | |
| | | | | dBm | dBm/MHz |
| A | QPSK | 5.0 MHz | 8.00 | 42.49 | 36.34 |

LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A




| Limit | |
|---|---|
| Peak to Average Ratio | 13 dB |

## 2.2 OCCUPIED BANDWIDTH

### 2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 27, Clause 27.53

### 2.2.2 Date of Test and Modification State

September 24, 2018 - Modification State 0

### 2.2.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24°C |
| Relative Humidity | 35% |

### 2.2.5 Test Method

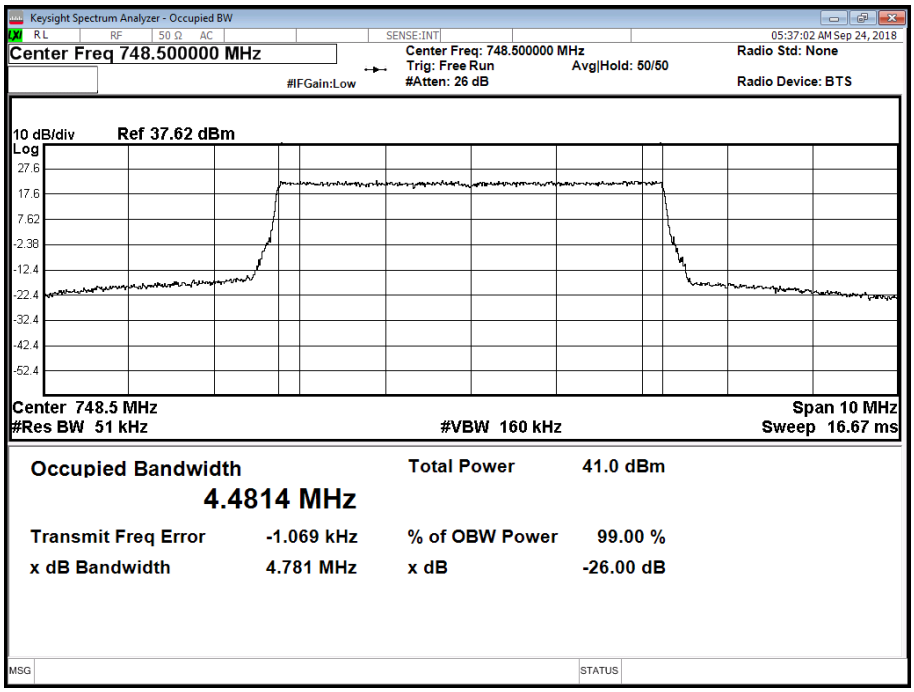
All measurements were made in accordance with FCC KDB 971168 D01.

### 2.2.6 Test Results

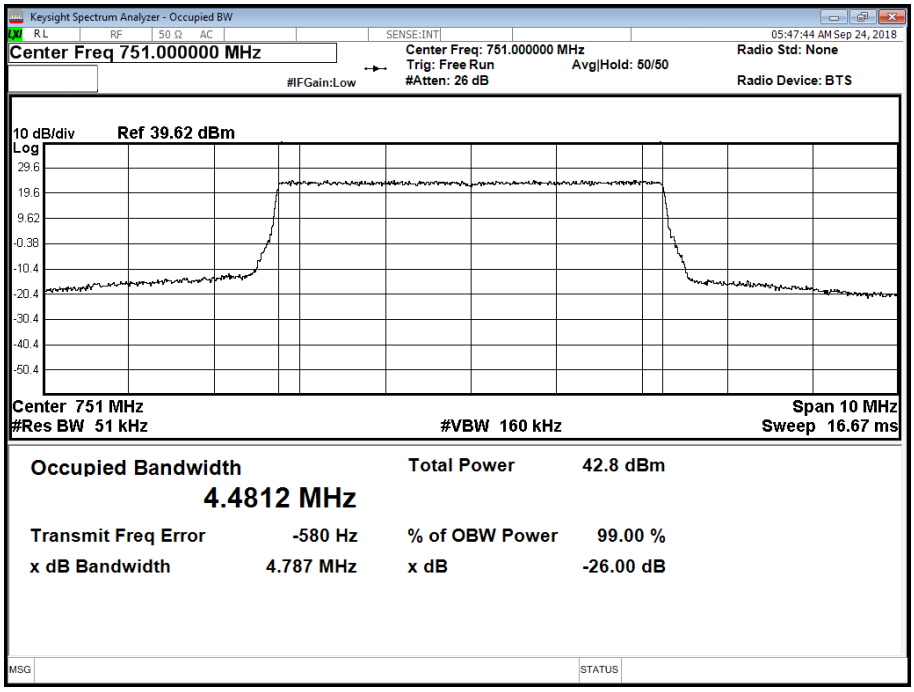
Maximum Target Output Power B:43dBm M:43dBm T:43dBm

| Antenna | LTE Modulation | LTE Carrier Bandwidth | Result (KHz) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Channel Position B | | Channel Position M | | Channel Position T | |
| | | | Occupied Bandwidth | -26 dB Bandwidth | Occupied Bandwidth | -26 dB Bandwidth | Occupied Bandwidth | -26 dB Bandwidth |
| A | QPSK | 5.0 MHz | 4481.43 | 4780.87 | 4481.24 | 4787.17 | 4482.92 | 4798.59 |

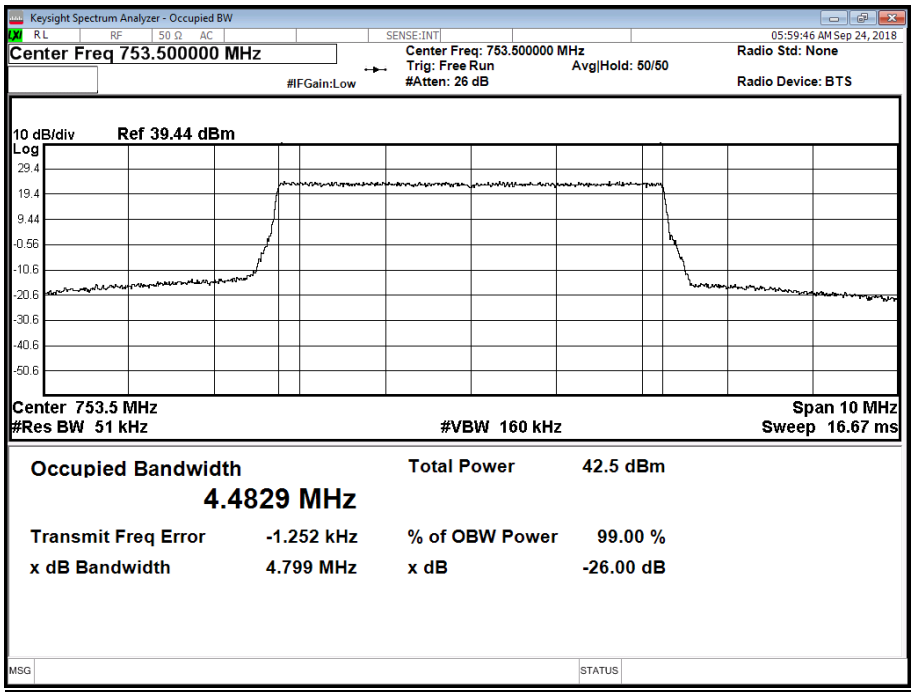
Antenna A - Bandwidth QPSK – Channel B




Antenna A - Bandwidth QPSK - Channel M



Antenna A - Bandwidth QPSK - Channel T



## 2.3 BAND EDGE

### 2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)

### 2.3.2 Date of Test and Modification State

September 24, 2018 - Modification State 0

### 2.3.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24°C |
| Relative Humidity | 35% |

### 2.3.5 Test Method

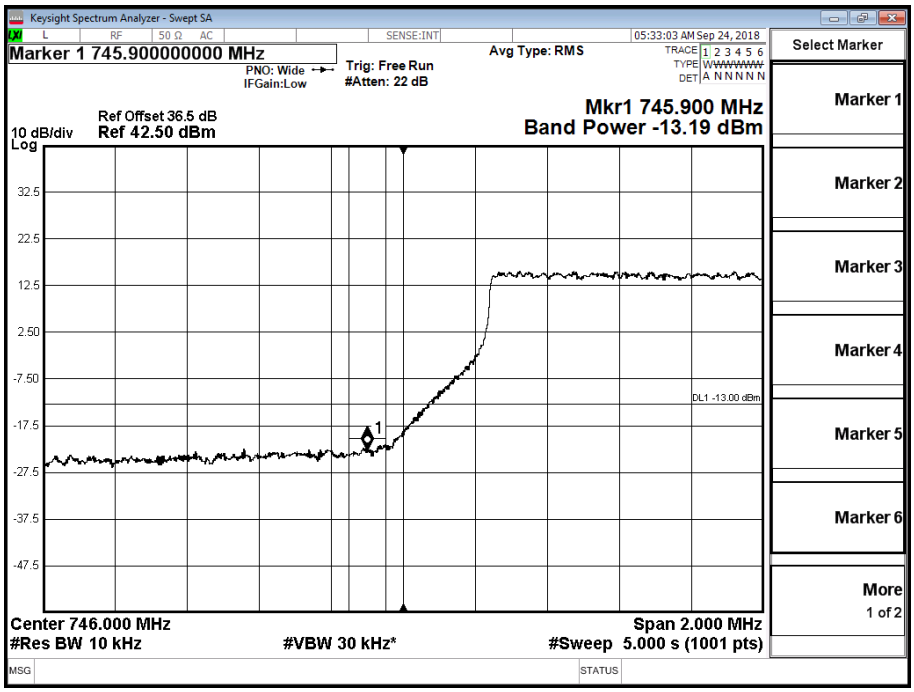
All measurements were made in accordance with FCC KDB 971168 D01 Clause 6.
The EUT was connected to a Spectrum Analyser via an attenuator and switching box. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser. The measured path loss was entered as a Reference Level Offset in the Spectrum Analyser. The Spectrum Analyser RBW was adjusted to be at least 1% of the measured 26dB Bandwidth. Using an RMS detector, the frequency spectrum up to 1MHz away from the Band Edge was Investigated.
The EUT has one transmit port, testing was performed on this port with a test limit of 43+10log(P) = -13 dBm.

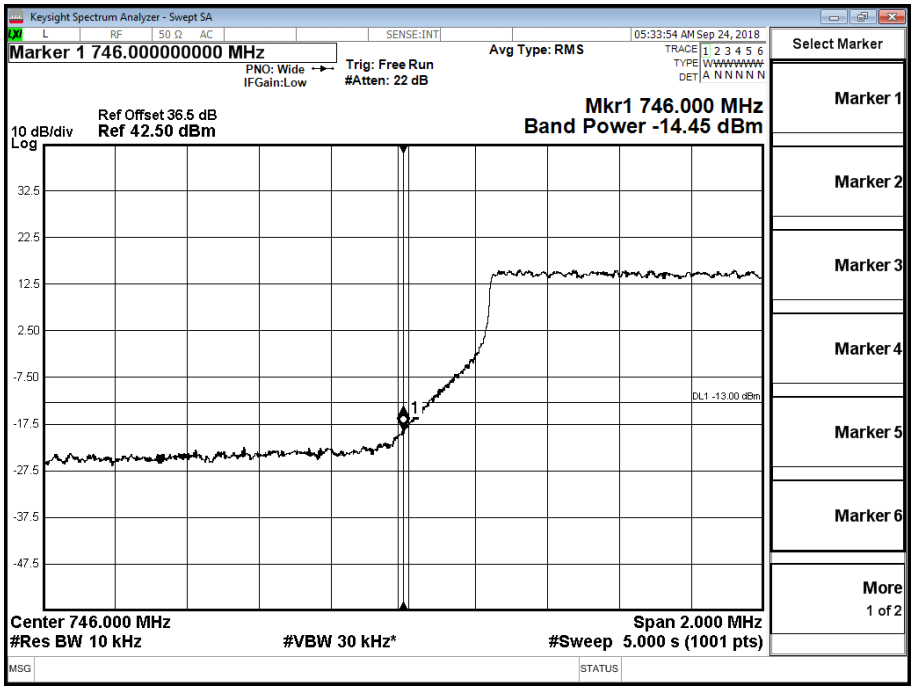
### 2.3.6 Test Results

Maximum Target Output Power T:43dBm B:43dBm

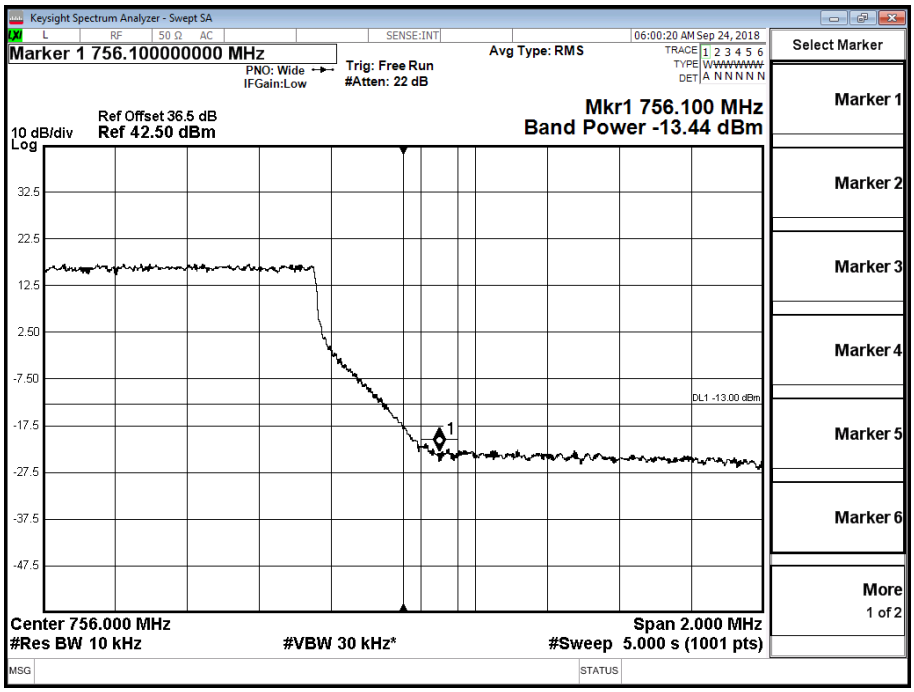
| Antenna | LTE Modulation | LTE Carrier Bandwidth | Band Edge (MHz) | |
|---|---|---|---|---|
| | | | Channel Position B | Channel Position T |
| A | QPSK | 5.0 MHz | 748.5 | 753.5 |

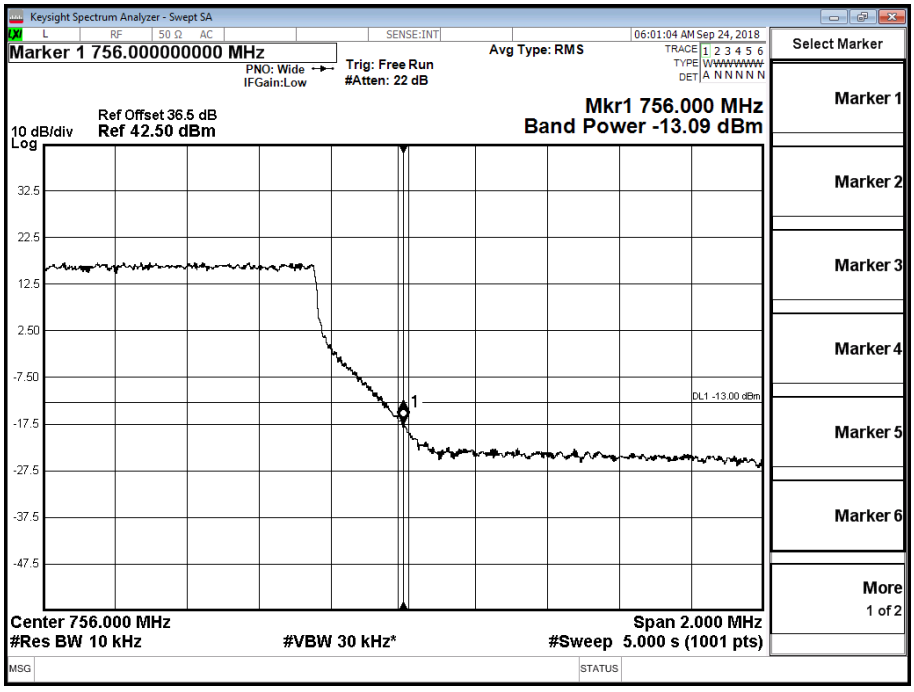
Antenna A - LTE Modulation QPSK - Channel B, 5MHz



Antenna A - LTE Modulation QPSK - Channel T, 5MHz




| | |
|---|---|
| Limit | -13 dBm |

## 2.4 TRANSMITTER SPURIOUS EMISSIONS

### 2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)

### 2.4.2 Date of Test and Modification State

September 24, 2018 - Modification State 0

### 2.4.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24°C |
| Relative Humidity | 35% |

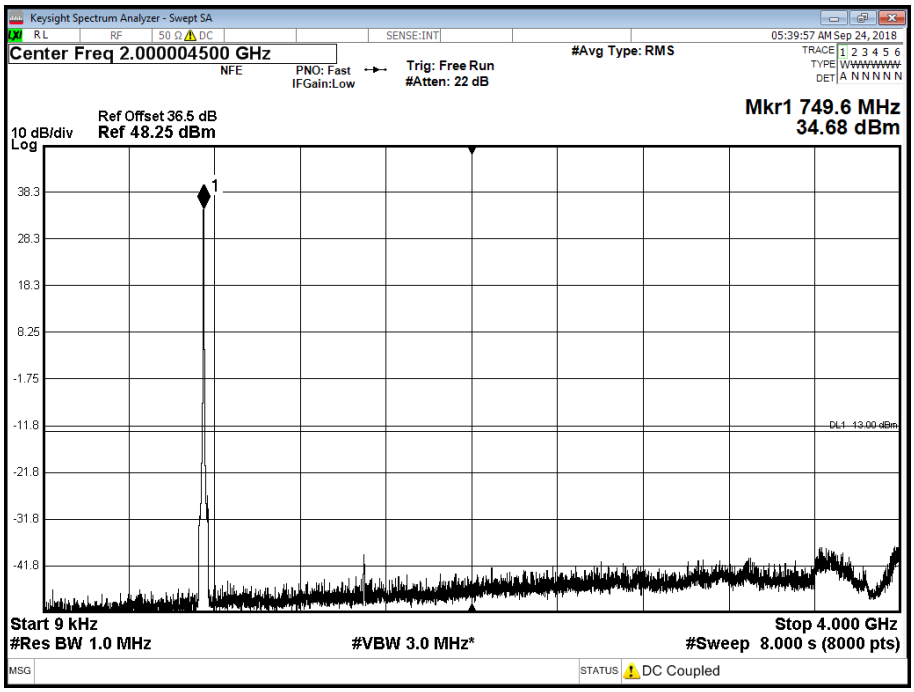
### 2.4.5 Test Method

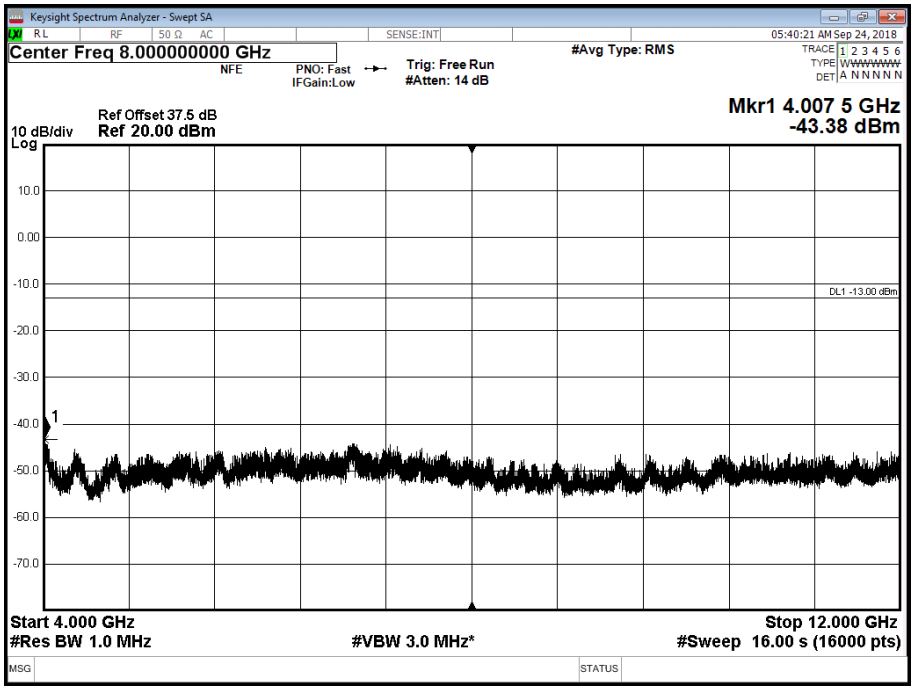
All measurements were made in accordance with FCC KDB 971168 D01 Clause 6.
The EUT was connected to a Spectrum Analyser via an attenuator and switching box. Prior to testing, a Network Analyser was used to calibrate the path loss between the EUT and the Spectrum Analyser. The worst-case path loss in the measured ranges was entered as a reference level offset. Over the measured ranges, the RBW was set to 1MHz with a VBW of 3MHz. All measurement results are specified as average with an RMS detector being used in conjunction with a trace setting of Max Hold. Measurements were performed in configurations of the EUT as reported below.
Testing was performed on this port with a test limit of 43+10log(P) = -13 dBm.

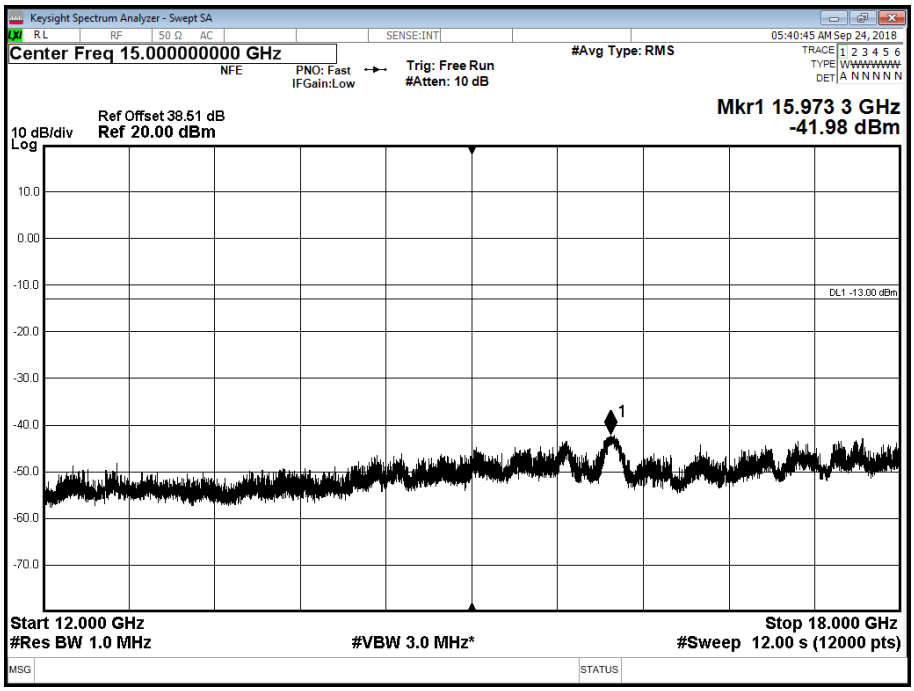
### 2.4.6 Test Results

Maximum Target Output Power B:43dBm, M:43dBm, T:43dBm
LTE 5 MHz Bandwidth setting

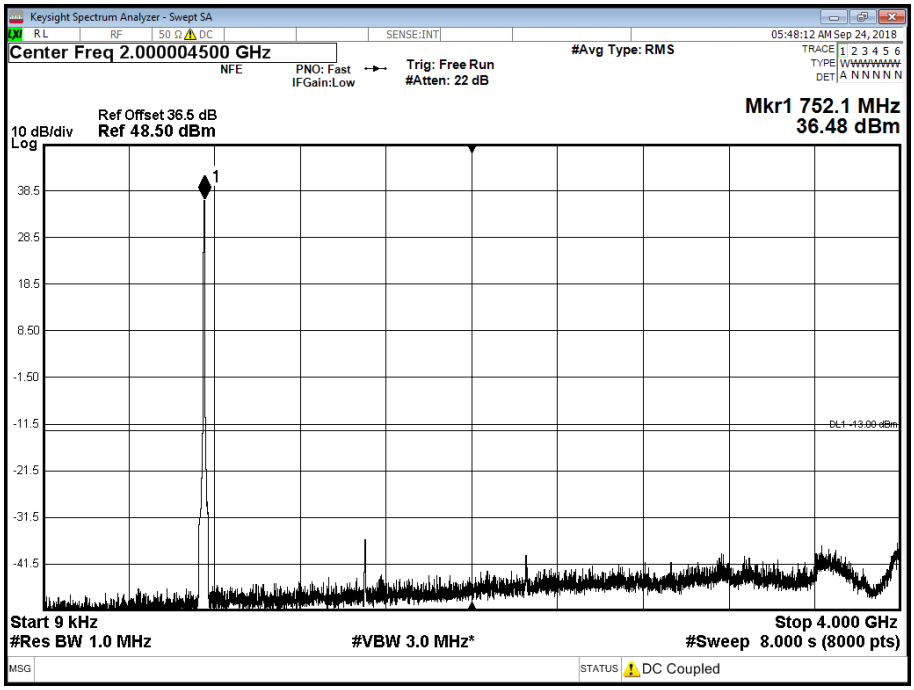
Antenna A - LTE Modulation QPSK - Channel B

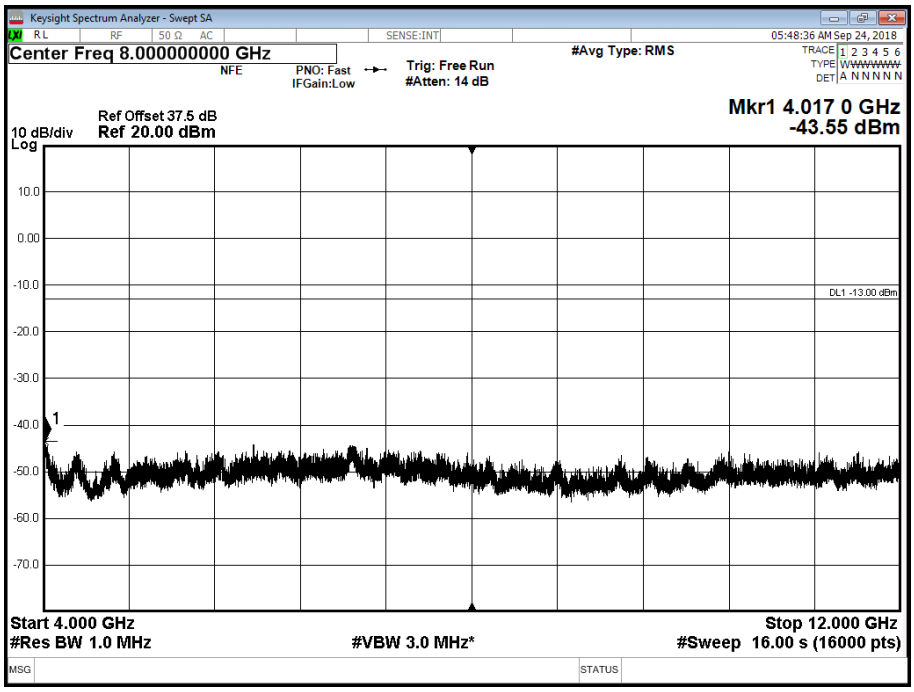


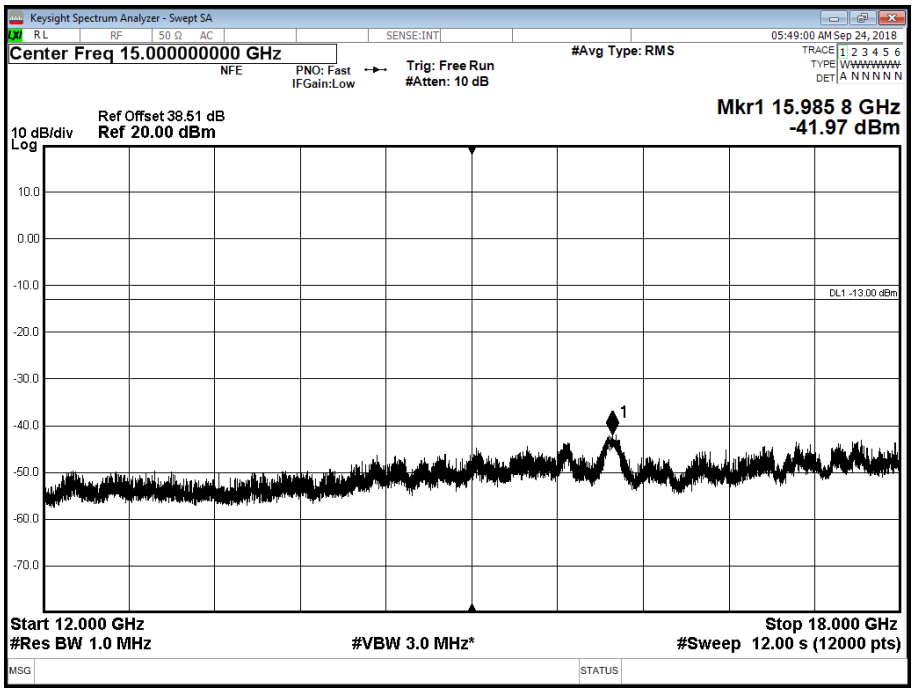





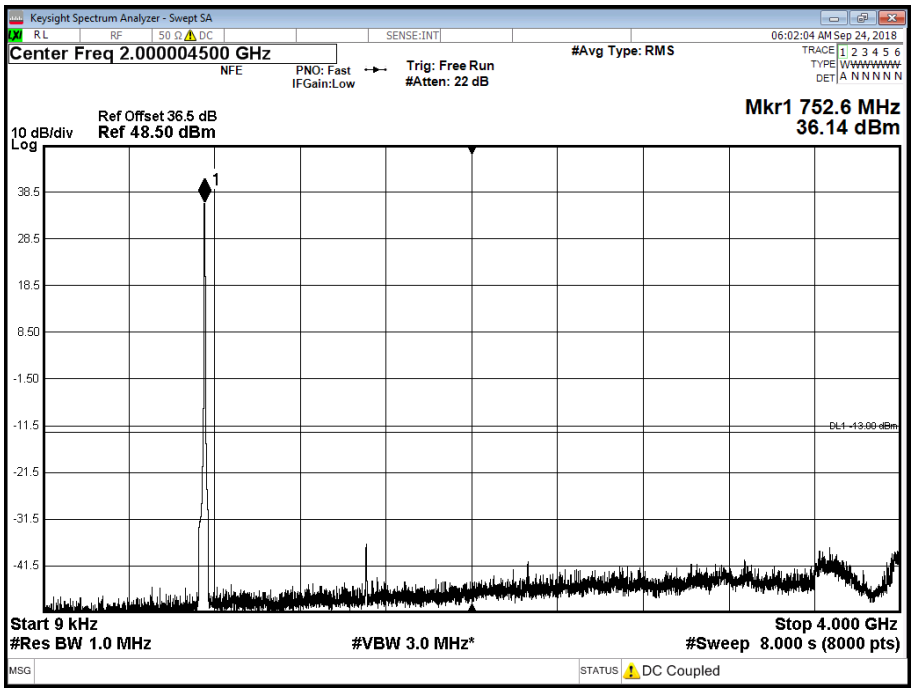

Antenna A - LTE Modulation QPSK - Channel M

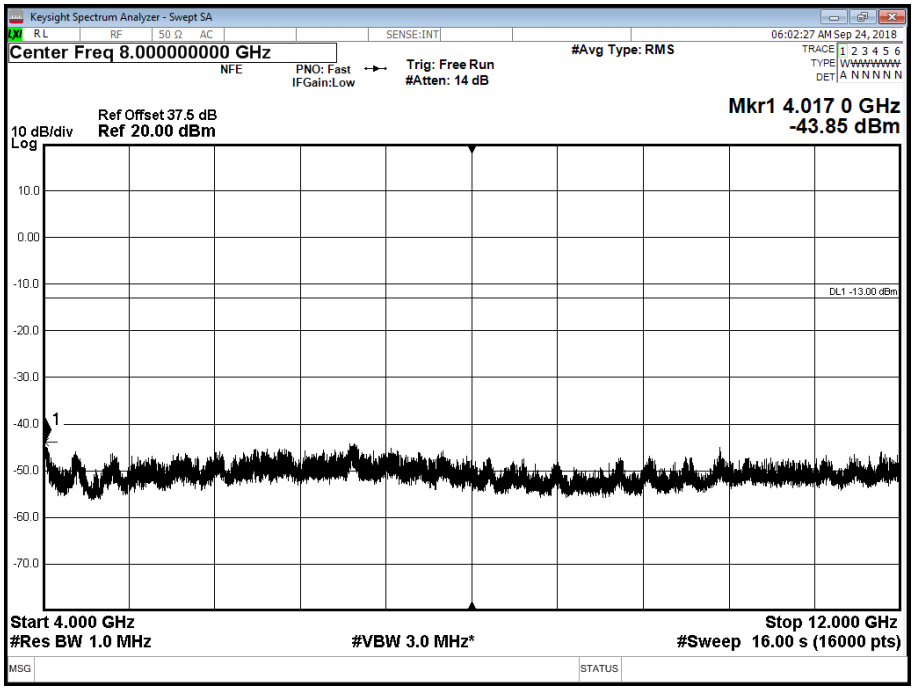


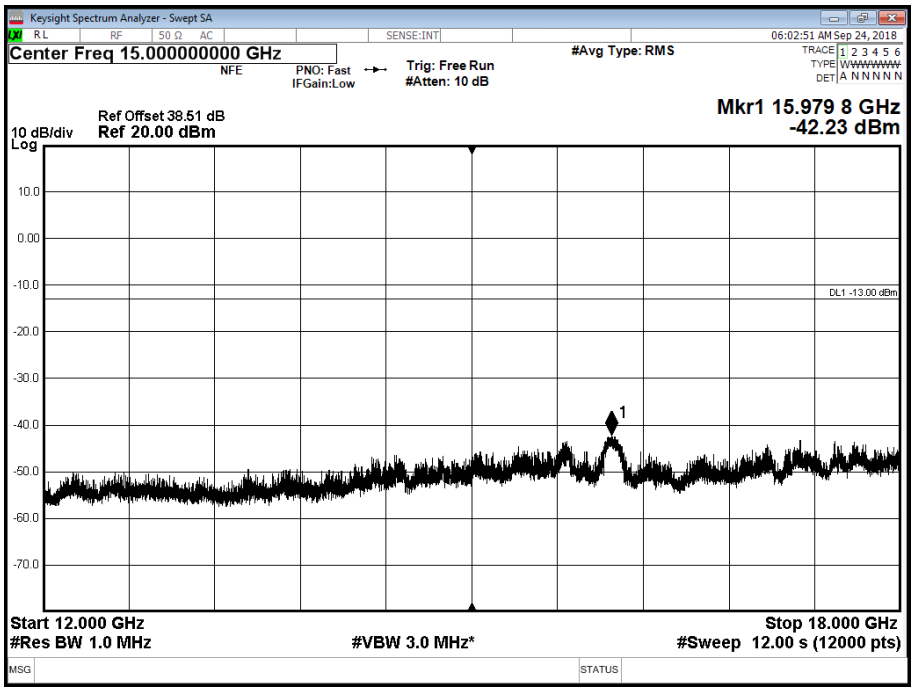

Keysight Spectrum Analyzer - Swept SA
Center Freq 8.000000000 GHz
NFE
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
#Avg Type: RMS
05:48:36 AM Sep 24, 2018
Ref Offset 37.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 4.017 0 GHz
-43.55 dBm
DL1 -13.00 dBm
Start 4.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 12.000 GHz
#Sweep 16.00 s (16000 pts)


Keysight Spectrum Analyzer - Swept SA
Center Freq 15.000000000 GHz
NFE
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
05:49:00 AM Sep 24, 2018
Ref Offset 38.51 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 15.985 8 GHz
-41.97 dBm
DL1 -13.00 dBm
Start 12.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 18.000 GHz
#Sweep 12.00 s (12000 pts)

Antenna A - LTE Modulation QPSK - Channel T




Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
06:02:51 AM Sep 24, 2018
Center Freq 15.000000000 GHz
NFE
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET A N N N N N
Mkr1 15.979 8 GHz
-42.23 dBm
Ref Offset 38.51 dB
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -13.00 dBm
1
Start 12.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 18.000 GHz
#Sweep 12.00 s (12000 pts)
MSG
STATUS

| | |
|---|---|
| Limit | -13dBm |

## 2.5 FREQUENCY STABILITY

### 2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 27, Clause 27.54

### 2.5.2 Date of Test and Modification State

October 12 and 15th, 2018 - Modification State 0

### 2.5.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.5.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23°C |
| Relative Humidity | 36% |

### 2.5.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

### 2.5.6 Test Results

Maximum Target Output Power 43 dBm

| Temperature | Voltage | Frequency Error (Hz) |
|---|---|---|
| | | Channel Position M |
| -30°C | 120V AC | EUT non-operational |
| -20°C | 120V AC | EUT non-operational |
| -10°C | 120V AC | 0 |
| 0°C | 120V AC | 0 |
| +10°C | 120V AC | 0 |
| +20°C | 99V AC | 0 |
| +20°C | 120V AC | 0 |
| +20°C | 135V AC | 0 |
| +30°C | 120V AC | 0 |
| +40°C | 120V AC | 0 |
| +50°C | 120V AC | 0 |

| | |
|---|---|
| Limit | +/- 1 ppm |

## SECTION 3

## TEST EQUIPMENT USED

## 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| Instrument | Manufacturer | Type No. | Serial No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| PXA Signal Analyzer | Keysight | N9030A | MY53310519 | 12 | 2019-07-17 |

N/A – Not Applicable
O/P Mon – Output Monitored with Calibrated Equipment

## 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

| Test Discipline | Frequency / Parameter | MU |
|---|---|---|
| Conducted Maximum Peak Output Power | 30 MHz to 20 GHz Amplitude | ± 0.1 dB |
| Conducted Emissions | 30 MHz to 20 GHz Amplitude | ± 2.3 dB |
| Frequency Stability | 30 MHz to 2 GHz | ± 5.0 Hz |
| Occupied Bandwidth | Up to 20 MHz Bandwidth | ± 1.1 Hz |
| Band Edge | 30 MHz to 20 GHz Amplitude | ± 2.3 dB |

## SECTION 5

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT

## 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Testing Laboratory
Certificate #2955.02

This report relates only to the actual item/items tested.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

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