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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 22

COMMERCIAL-IN-CONFIDENCE

FCC ID: 2AQSOCBRSYS6500

PREPARED BY	APPROVED BY	DATED
Nikolai Viktorov Test Personnel	Scott Drysdale Authorised Signatory	Dec 11, 2018

October 2018

Report Issued:
1/29/2019

Report File #: **7169004718**
Report 01 Issue 2

ACCREDITED
Testing Laboratory
Certificate #2955.02

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SECTION 1

REPORT INFORMATION

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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 CBRRFE6400 - CBRRFE6407-NC100-EE1
Serial Number(s)	CBRSYS6000 – F-00190 CBRRFE6400 – K-15468
Hardware Version	CBRSYS6000 - 3.0 CBRRFE6400 - 3.1
Test Specification/Issue/Date	FCC CFR 47 Part 2: 2016 FCC CFR 47 Part 22: 2016
Start of Test	September 26, 2018
Finish of Test	October 22, 2018
Name of Test Personnel(s)	Scott Drysdale and Nikolai Viktorov
Related Document(s)	KDB 971168 D01 v02r02 KDB 662911 D01 v02r01
Test report revision history	0000 - Issue 1. Initial release 0001 – Issue 2. Minor edits to section 1.5.1 as per customer request kept on file.

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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 22H is shown below.

Section	Specification Clause		Test Description	Result
	FCC CFR 47 Part 2	FCC CFR 47 Part 22H		
2.1	2.1046	22.913(a)	Maximum Peak Output Power, ERP, and Peak to Average Ratio - Conducted	Pass
2.2	2.1049	22.917(b)	Occupied Bandwidth	Pass
2.3	2.1051	22.917(b	Band Edge	Pass
2.4	2.1051	22.917(a) (b)	Transmitter Spurious Emissions	Pass
2.5	2.1055	22.355	Frequency Stability	Pass
-	-	15.111	Receiver Spurious Emissions	N/A[1]

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

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1.3 CONFIGURATION DESCRIPTION

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

The CBRSYS6500 supports LTE in Band 26 (859 MHz – 894 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 B26 (859 MHz – 894 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	861.5 + 866.5	876.5	886.5 + 891.5

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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 CBRRFE6400 - CBRRFE6407-NC100-EE1
SERIAL NUMBER	CBRSYS6000 – F-00190 CBRRFE6400 – K-15468
HARDWARE VERSION	CBRSYS6000 - 3.0 CBRRFE6400 - 3.1
TRANSMITTER OPERATING RANGE	B26 859 – 894 MHz
RECEIVER OPERATING RANGE	B26 814 – 849 MHz
COUNTRY OF ORIGIN	CBRSYS6000 - India CBRRFE6400 - Canada
EMISSION DESIGNATOR(S): **(i.e. G1D, GXW)**	LTE: W7D
MODULATION TYPES: **(i.e. GMSK, QPSK)**	LTE: QPSK
HIGHEST INTERNALLY GENERATED FREQUENCY	894 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.

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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 and fits in a standard 19" 6U rack.
Depending on band configuration it can support up to 8 bands. 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 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.
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 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.

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Equipment Under Test

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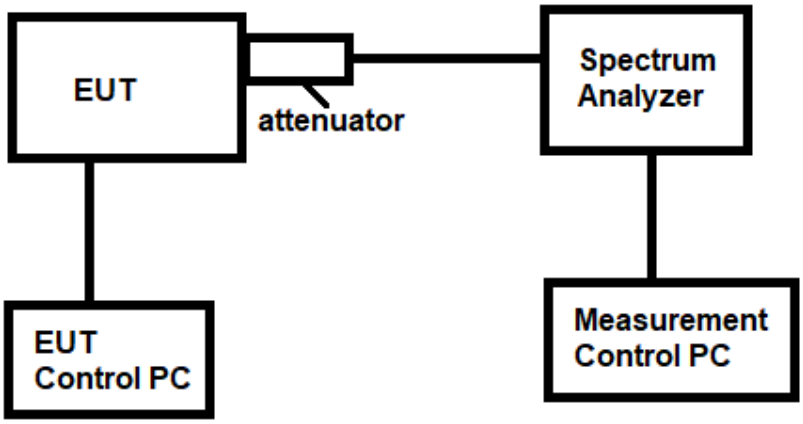
1.6 TEST SETUP



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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 it can support up to 8 bands. 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.

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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 22, Clause 22.913(a)

2.1.2 Date of Test and Modification State

September 26, 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	22°C
Relative Humidity	33%

2.1.5 Test Method

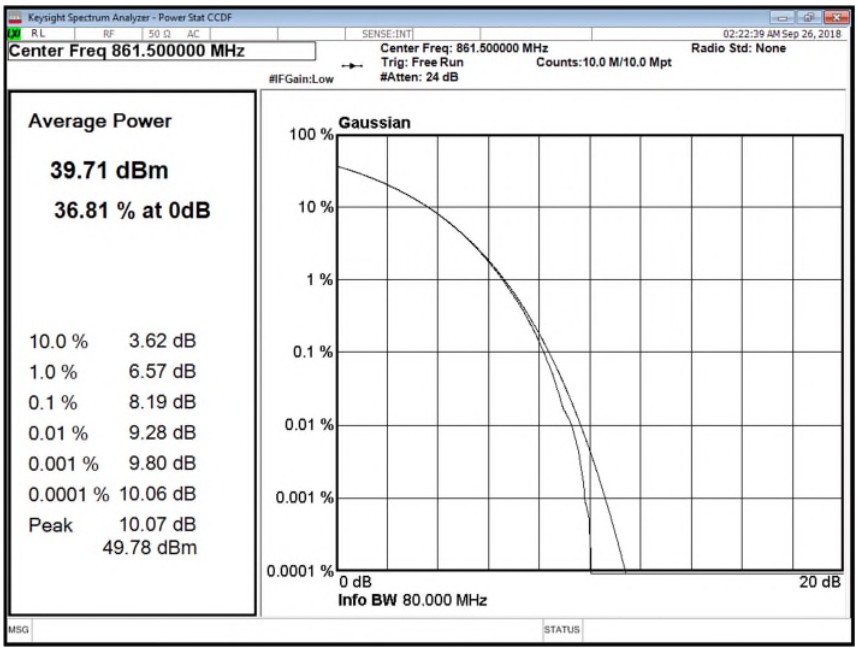
All measurements were made in accordance with FCC KDB 971168 D01, clause 5.2.1 and summed in accordance with FCC KDB 662911 D01.

2.1.6 Test Results

Maximum Target Output Power 40 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	8.19	39.91	34.37

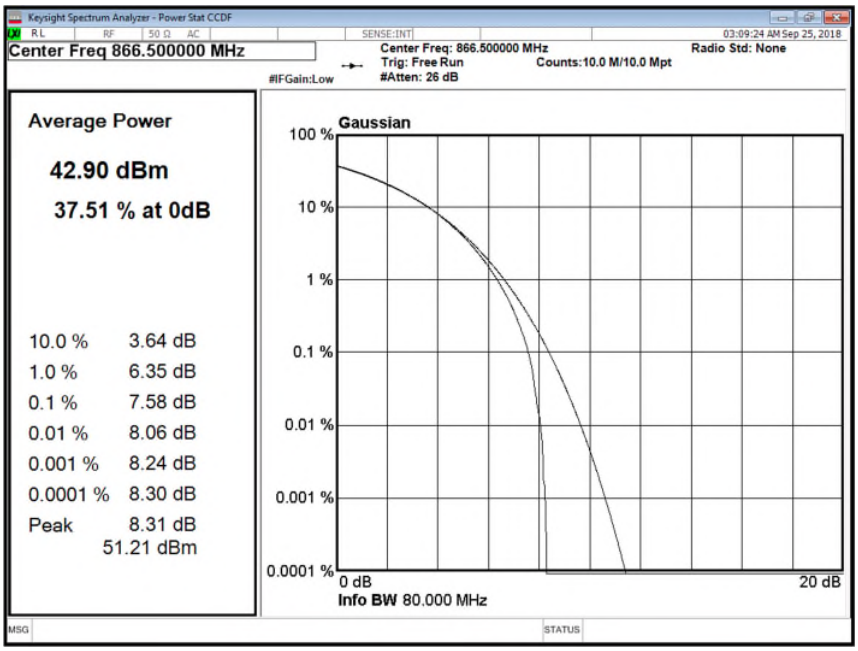
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



Maximum Target Output Power 43 dBm

Antenna	LTE Modulation	LTE Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position B2		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	QPSK	5.0 MHz	7.58	42.99	36.99

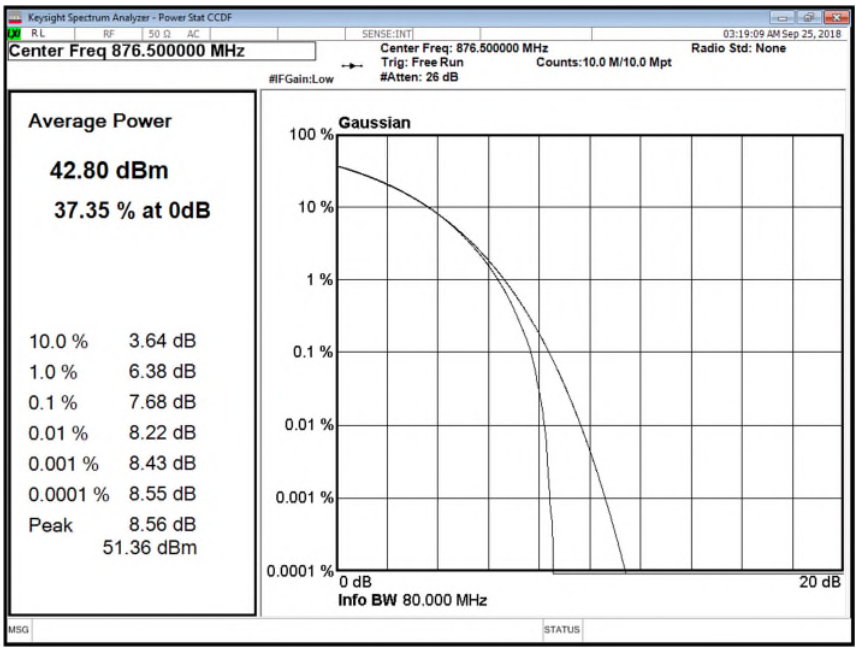
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



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	7.68	42.91	36.82

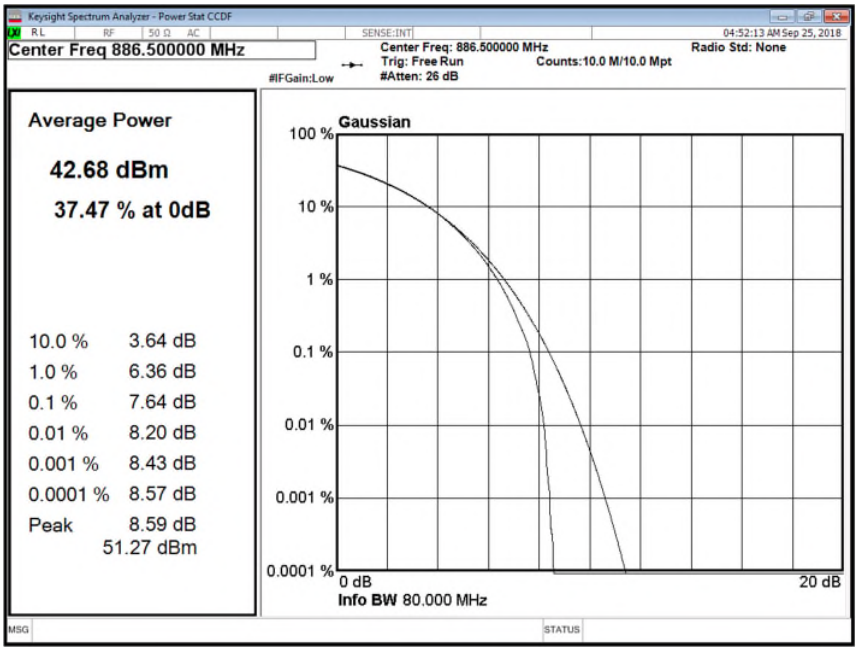
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



Maximum Target Output Power 43 dBm

Antenna	LTE Modulation	LTE Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position T2		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	QPSK	5.0 MHz	7.64	42.81	36.72

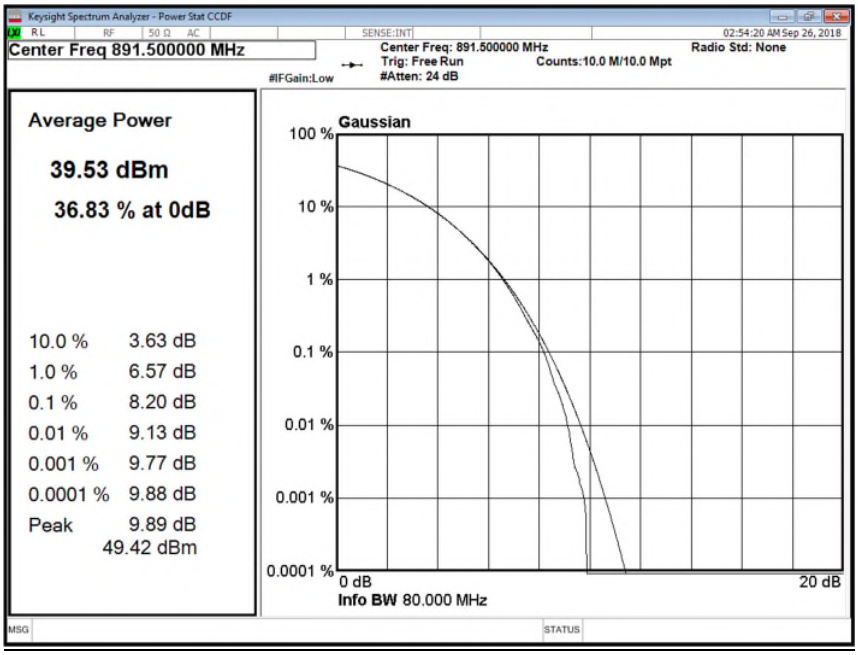
LTE Modulation QPSK - LTE Carrier Bandwidth 5.0 MHz - Antenna A



Maximum Target Output Power 40 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	8.20	39.75	33.72

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 22, Clause 22.917(b)

2.2.2 Date of Test and Modification State

September 26, 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	22°C
Relative Humidity	33%

2.2.5 Test Method

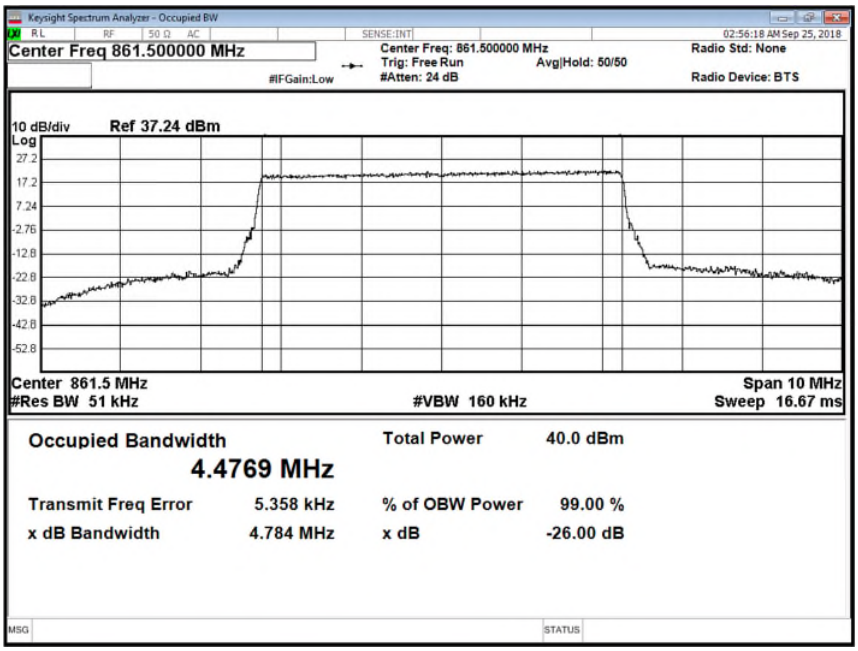
All measurements were made in accordance with FCC KDB 971168 D01.

2.2.6 Test Results

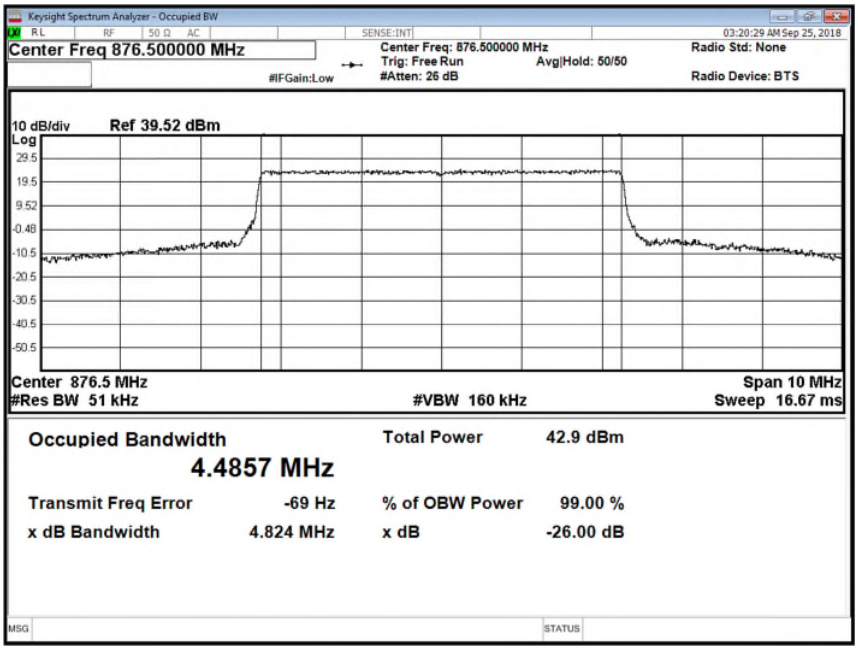
Maximum Target Output Power B:40dBm M:43dBm T:40dBm

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	4476.95	4783.58	4485.74	4823.90	4483.65	4782.09

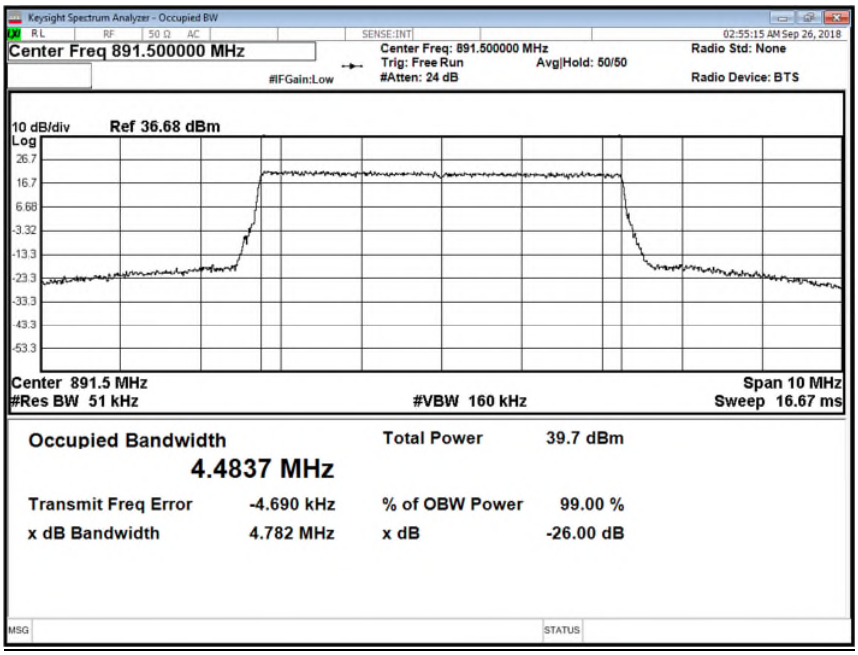
Antenna A - Bandwidth QPSK – Channel B



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 22, Clause 22.917(b)

2.3.2 Date of Test and Modification State

September 26, 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	22°C
Relative Humidity	33%

2.3.5 Test Method

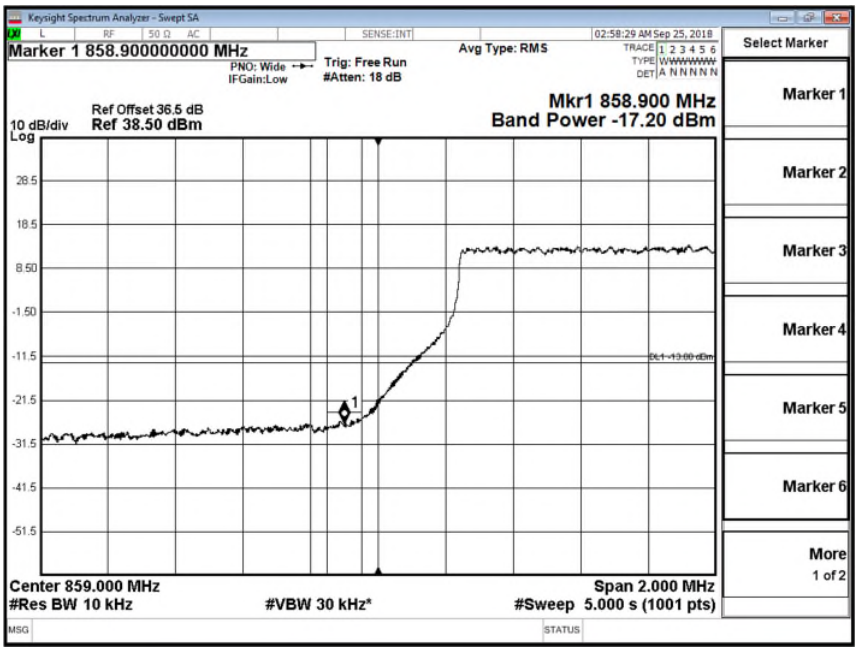
All measurements were made in accordance with FCC KDB 971168 D01 Clause 6.
The EUT was connected to a Spectrum Analyser via an attenuator and switching box. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser.
The measured path loss was entered as a Reference 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.

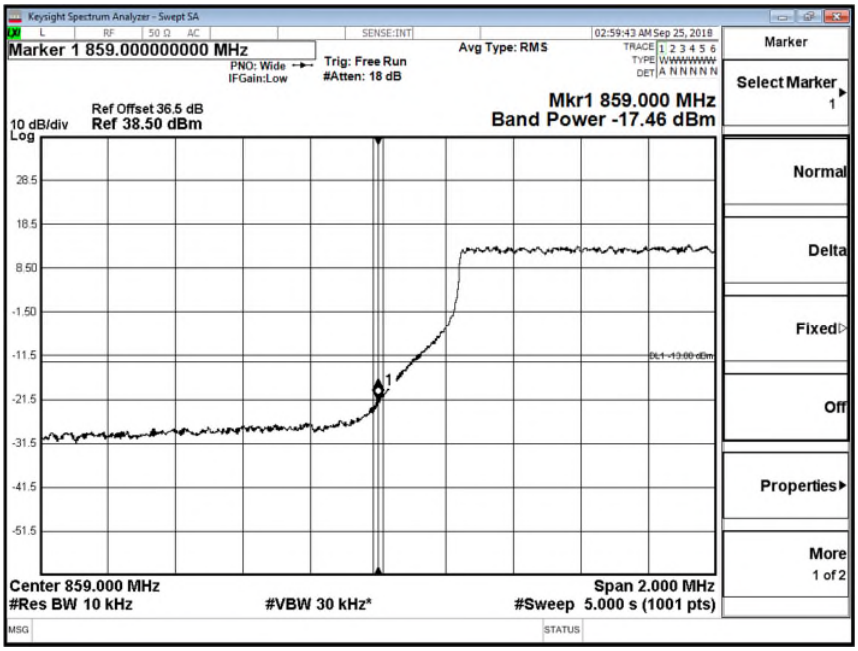
2.3.6 Test Results

Maximum Target Output Power T:40dBm B:40dBm

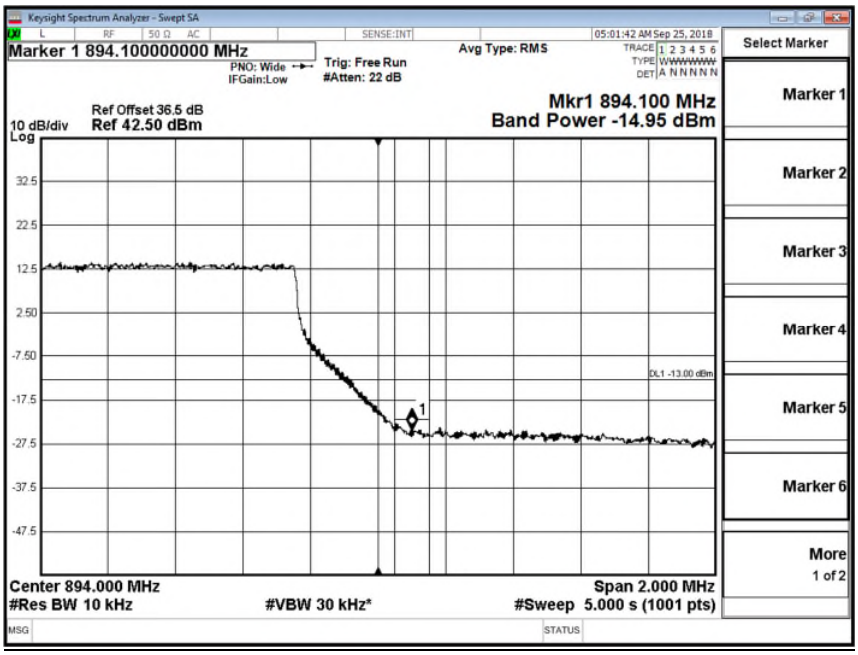
Antenna	LTE Modulation	LTE Carrier Bandwidth	Band Edge (MHz)	
			Channel Position B	Channel Position T
A	QPSK	5.0 MHz	861.5	891.5

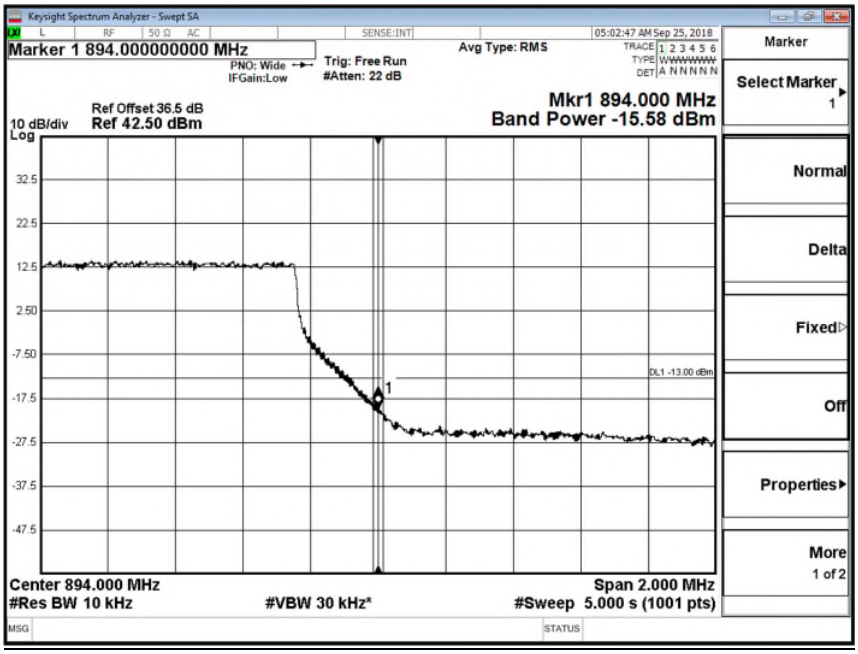
Antenna A - LTE Modulation QPSK - Channel B, 5MHz





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

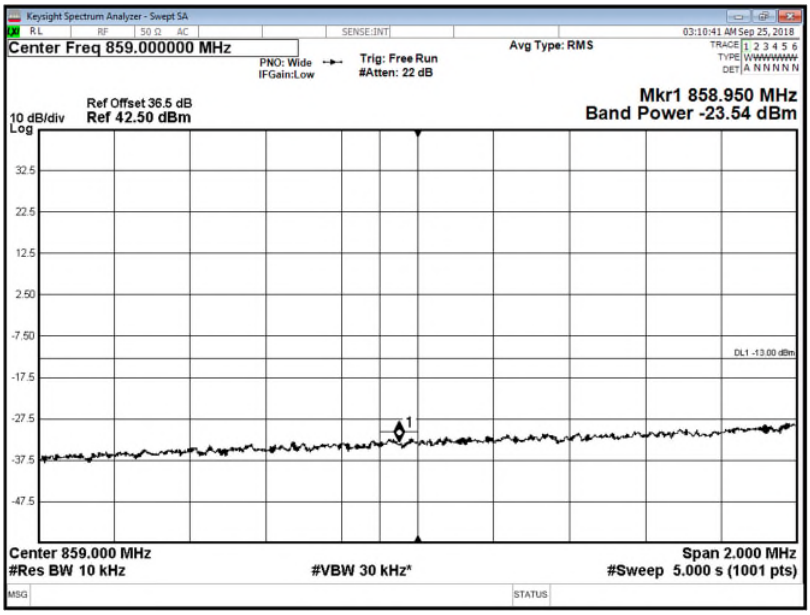




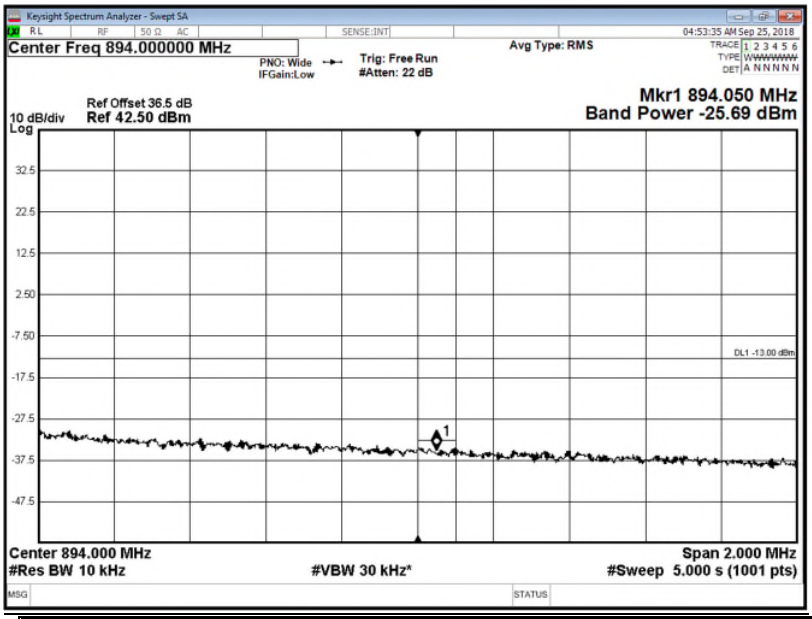
Maximum Target Output Power T2:43dBm B2:43dBm

Antenna	LTE Modulation	LTE Carrier Bandwidth	Band Edge (MHz)	
			Channel Position B2	Channel Position T2
A	QPSK	5.0 MHz	876.5	886.5

Antenna A - LTE Modulation QPSK - Channel B2, 5MHz



Antenna A - LTE Modulation QPSK - Channel T2, 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 22, Clause 22.917(a)(b)

2.4.2 Date of Test and Modification State

September 26, 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	22°C
Relative Humidity	33%

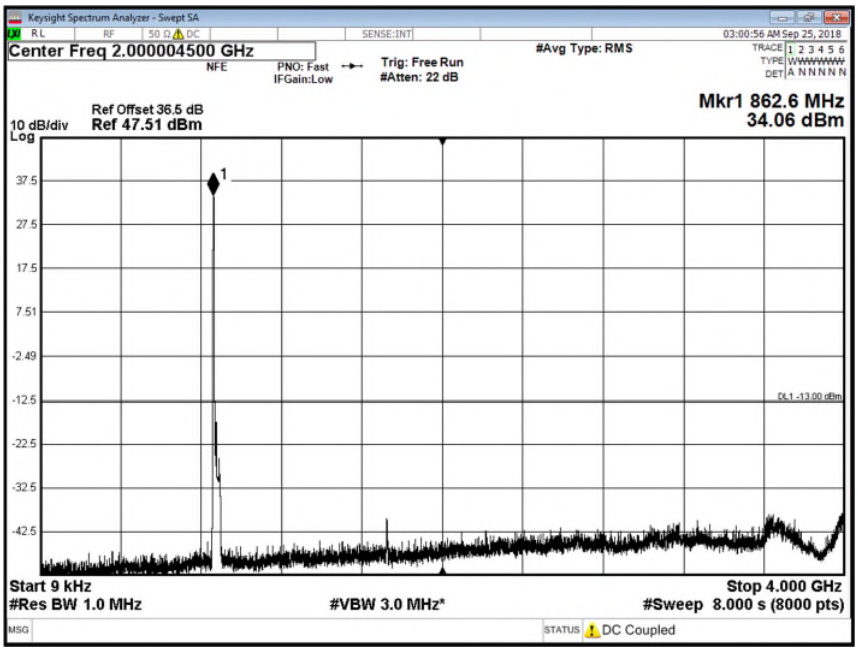
2.4.5 Test Method

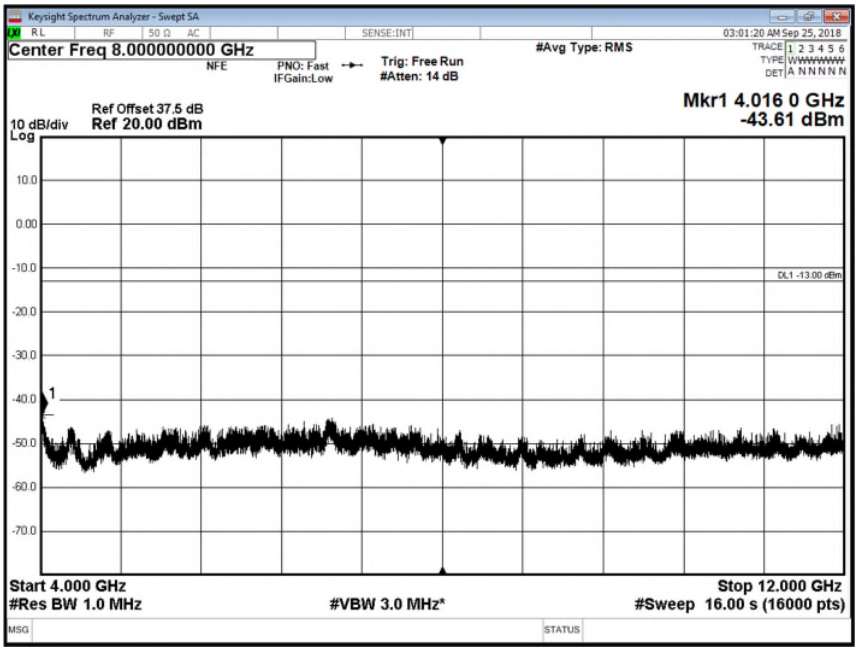
All measurements were made in accordance with FCC KDB 971168 D01 Clause 6.
The EUT was connected to a Spectrum Analyser via an attenuator and switching box. Prior to testing, a Network Analyser was used to calibrate the path loss between the EUT and the Spectrum Analyser. The worst-case path loss in 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.

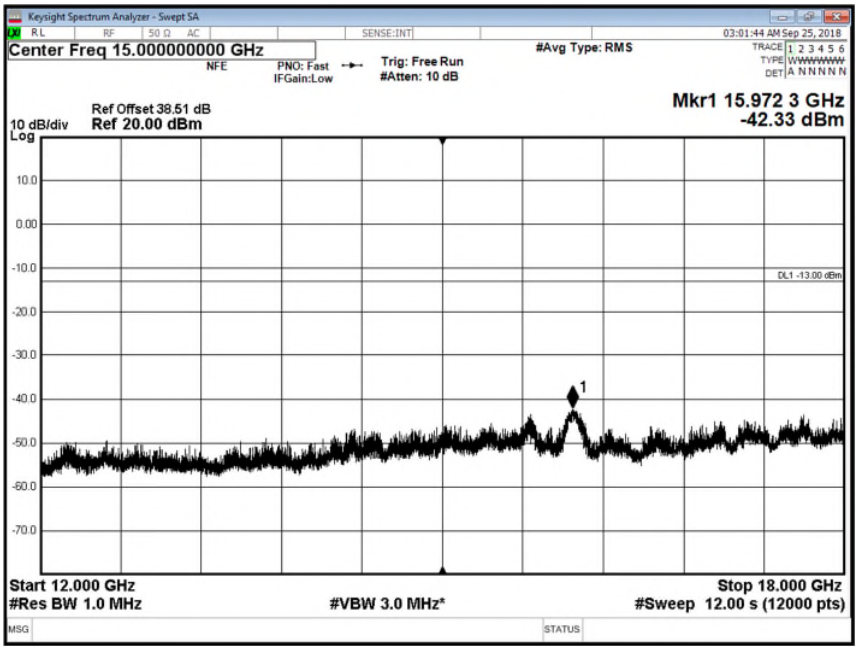
2.4.6 Test Results

Maximum Target Output Power B:40dBm, M:43dBm, T:40dBm
LTE 5 MHz Bandwidth setting

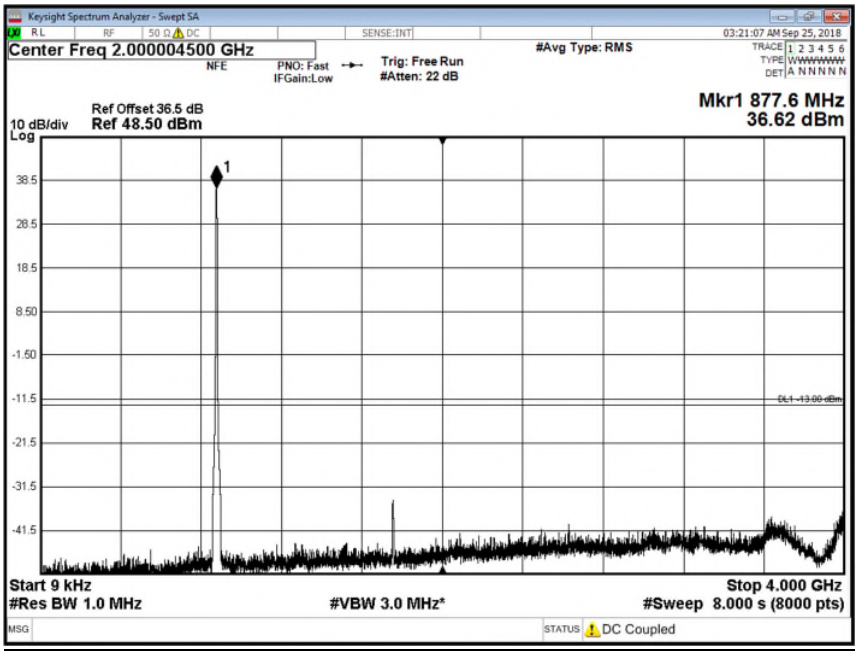
Antenna A - LTE Modulation QPSK - Channel B

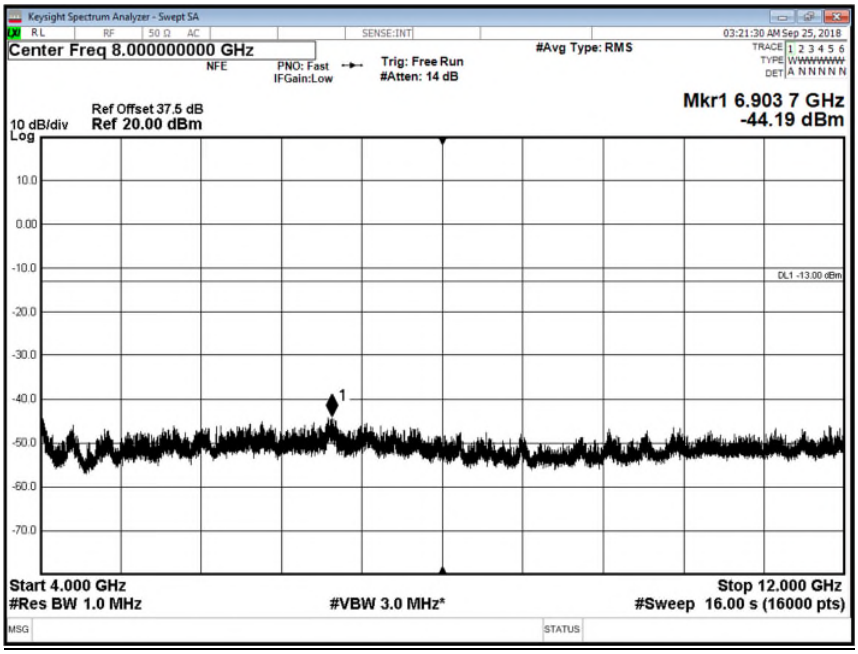


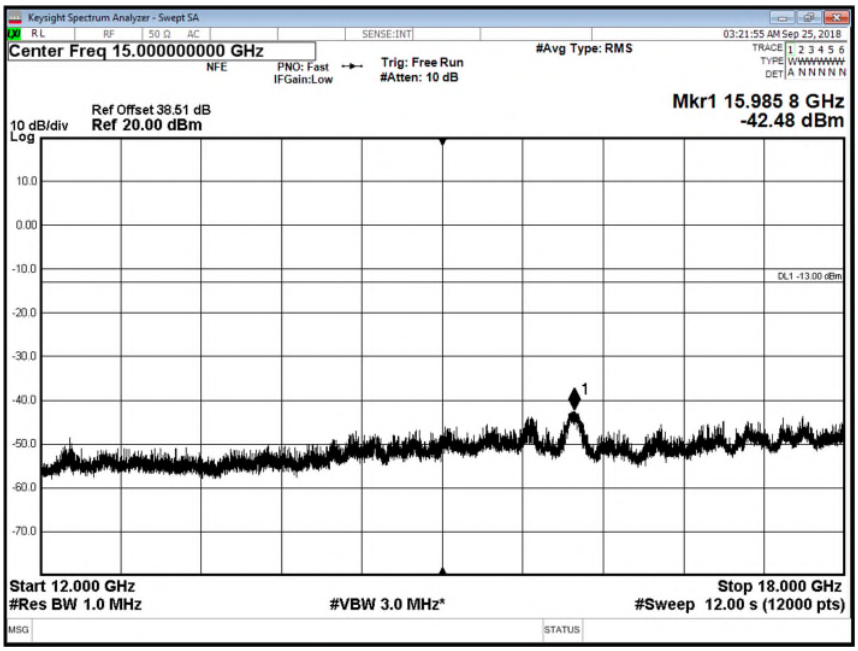




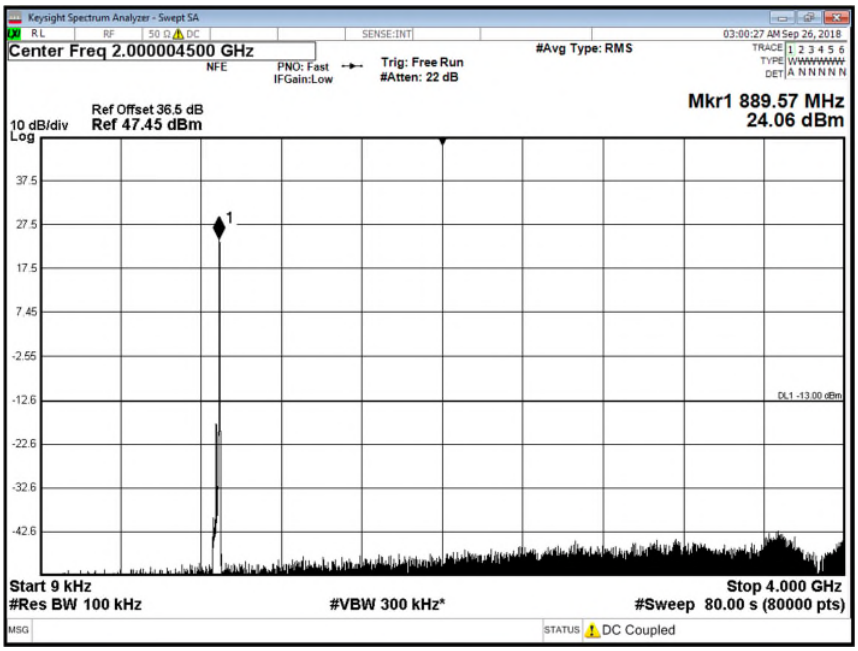
Antenna A - LTE Modulation QPSK - Channel M

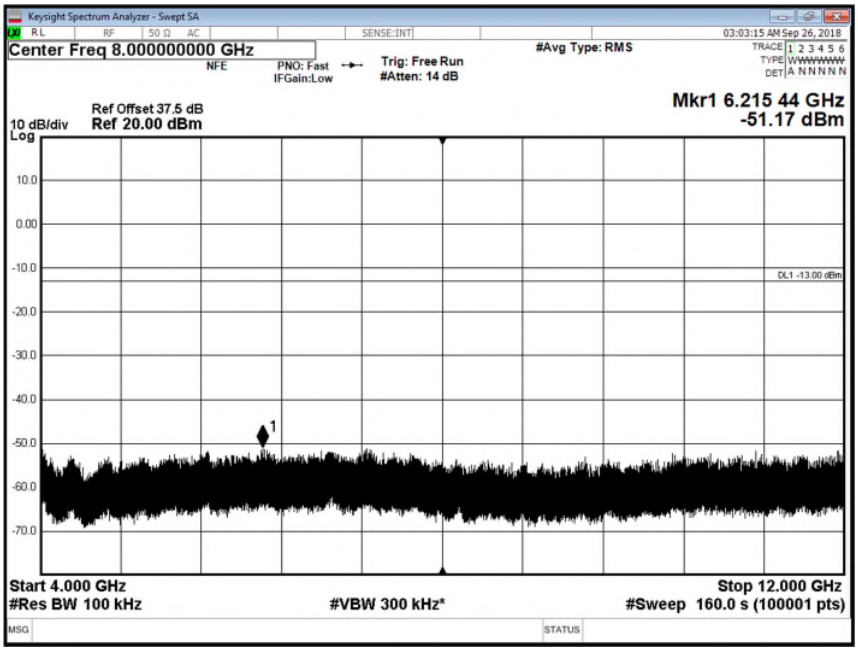


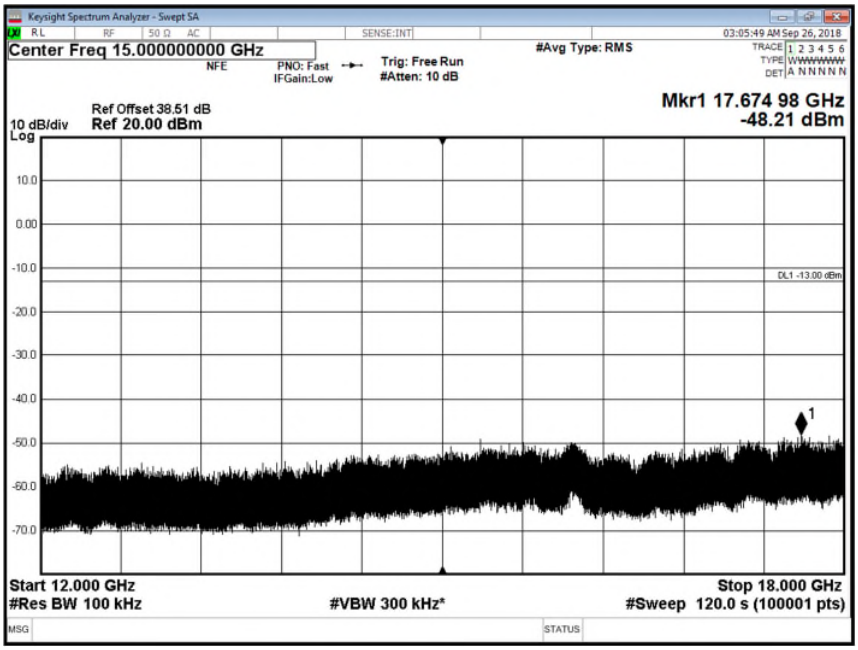

Keysight Spectrum Analyzer - Swept SA
Center Freq 8.000000000 GHz
NFE
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
#Avg Type: RMS
03:21:30 AM Sep 25, 2018
Ref Offset 37.5 dB
10 dB/div
Ref 20.00 dBm
Mkr1 6.903 7 GHz
-44.19 dBm
DL1 -13.00 dBm
Start 4.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 12.000 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
03:21:55 AM Sep 25, 2018
Ref Offset 38.51 dB
10 dB/div
Ref 20.00 dBm
Mkr1 15.985 8 GHz
-42.48 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
Center Freq 15.000000000 GHz
NFE
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
03:05:49 AM Sep 26, 2018
Mkr1 17.674 98 GHz
-48.21 dBm
Ref Offset 38.51 dB
10 dB/div
Ref 20.00 dBm
Log
DL1 -13.00 dBm
Start 12.000 GHz
#Res BW 100 kHz
#VBW 300 kHz*
Stop 18.000 GHz
#Sweep 120.0 s (100001 pts)

Limit	-13dBm

2.5 FREQUENCY STABILITY

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 22, Clause 22.355

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	5

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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