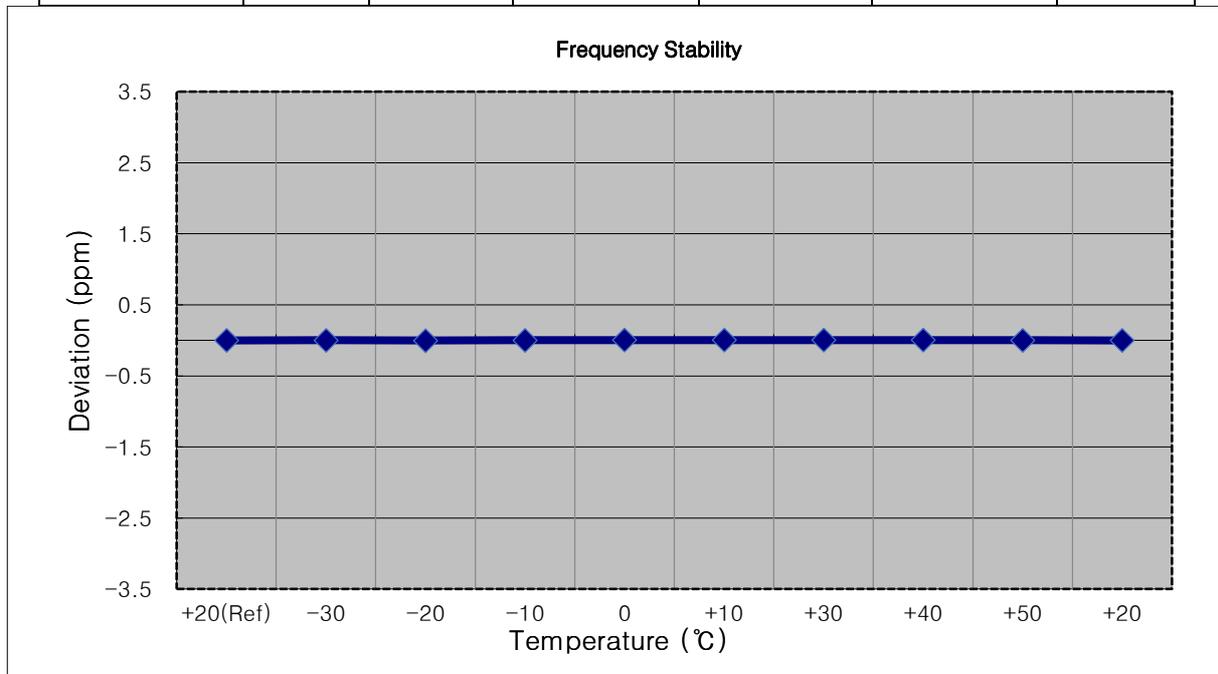


8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

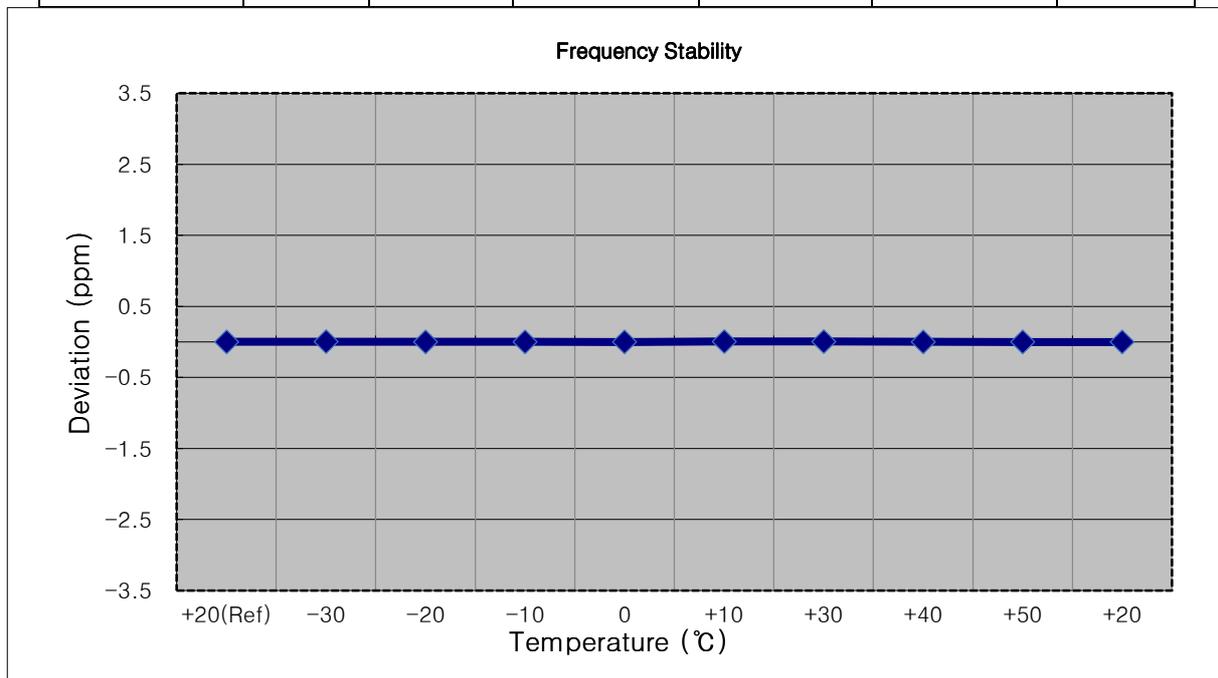
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2498,500,000 Hz
- ▣ BANDWIDTH: 39675 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2498 499 995	0.0	0.000 000	0.000
100%		-30	2498 500 002	7.7	0.000 000	0.003
100%		-20	2498 499 988	-7.1	0.000 000	-0.003
100%		-10	2498 500 001	6.5	0.000 000	0.003
100%		0	2498 500 005	10.7	0.000 000	0.004
100%		+10	2498 500 009	14.4	0.000 001	0.006
100%		+30	2498 500 007	11.9	0.000 000	0.005
100%		+40	2498 500 005	10.1	0.000 000	0.004
100%		+50	2498 500 001	6.1	0.000 000	0.002
85%		3.400	+20	2498 499 998	3.1	0.000 000



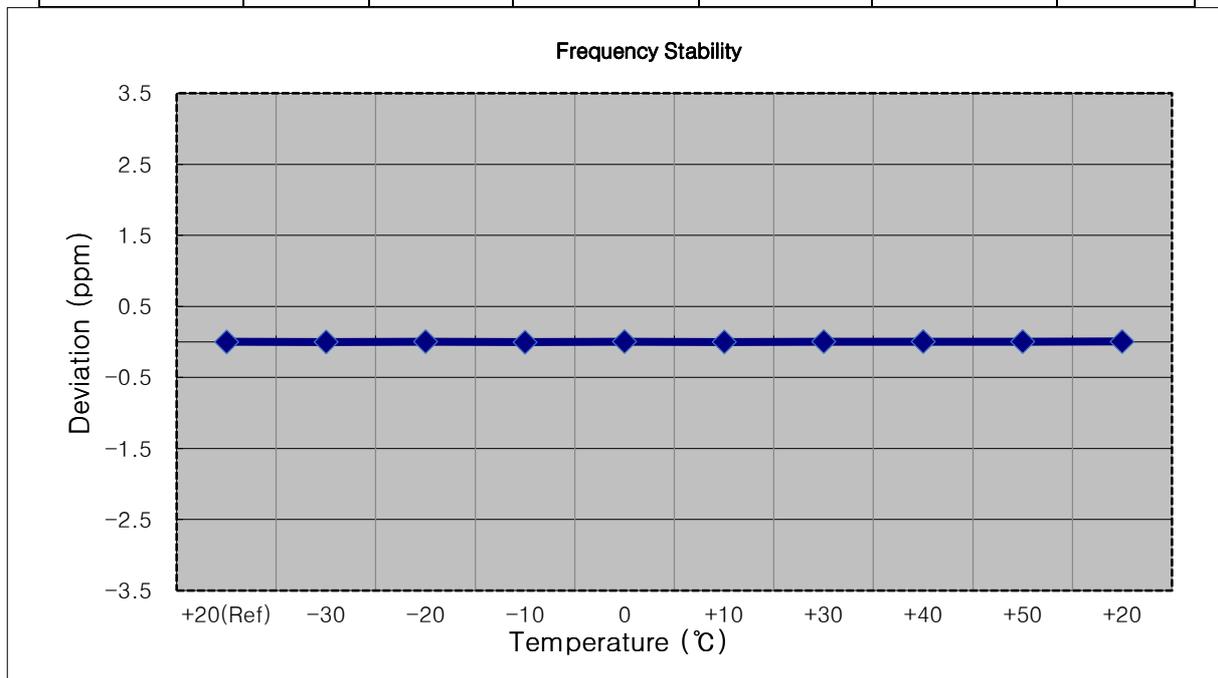
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2501,000,000 Hz
- ▣ BANDWIDTH: 39700 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2500 999 995	0.0	0.000 000	0.000
100%		-30	2501 000 001	6.2	0.000 000	0.002
100%		-20	2501 000 000	5.4	0.000 000	0.002
100%		-10	2501 000 000	5.6	0.000 000	0.002
100%		0	2500 999 990	-5.2	0.000 000	-0.002
100%		+10	2501 000 008	13.0	0.000 001	0.005
100%		+30	2501 000 007	12.1	0.000 000	0.005
100%		+40	2500 999 998	3.0	0.000 000	0.001
100%		+50	2500 999 990	-4.7	0.000 000	-0.002
85%		3.400	+20	2500 999 992	-3.2	0.000 000



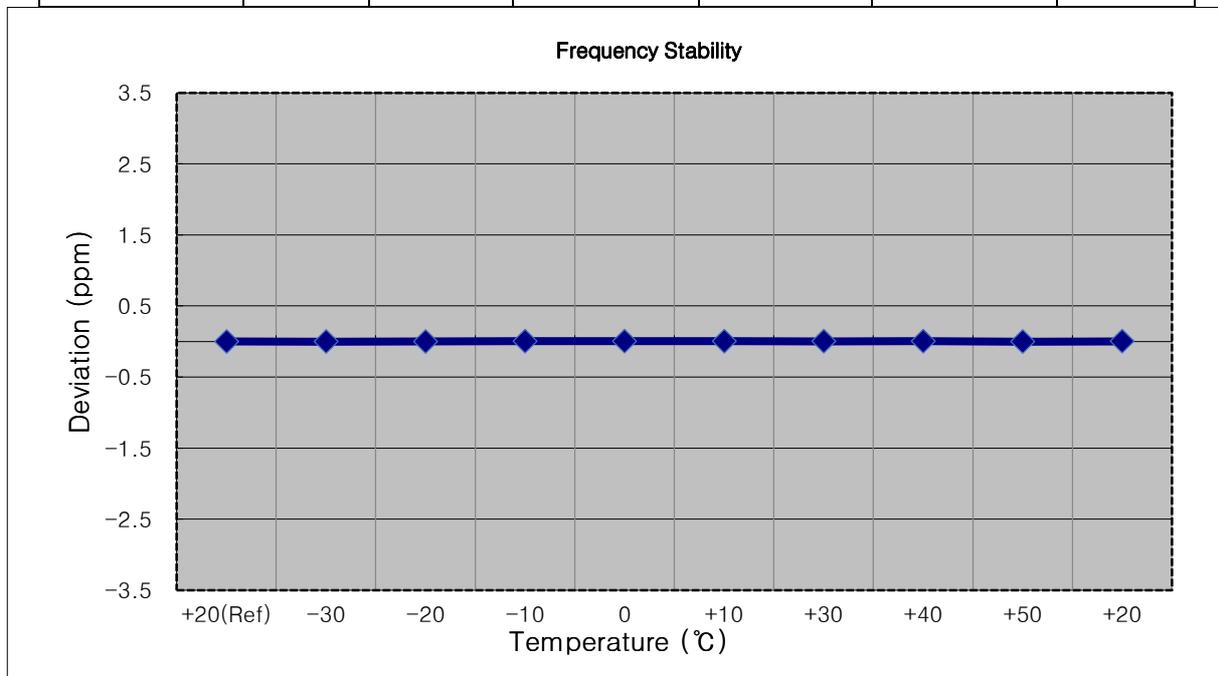
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2503,500,000 Hz
- ▣ BANDWIDTH: 39725 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2503 499 995	0.0	0.000 000	0.000
100%		-30	2503 499 990	-4.8	0.000 000	-0.002
100%		-20	2503 500 005	10.4	0.000 000	0.004
100%		-10	2503 499 988	-6.6	0.000 000	-0.003
100%		0	2503 500 004	9.4	0.000 000	0.004
100%		+10	2503 499 991	-3.4	0.000 000	-0.001
100%		+30	2503 500 004	9.7	0.000 000	0.004
100%		+40	2503 500 004	9.6	0.000 000	0.004
100%		+50	2503 500 006	11.0	0.000 000	0.004
85%	3.400	+20	2503 500 007	11.9	0.000 000	0.005



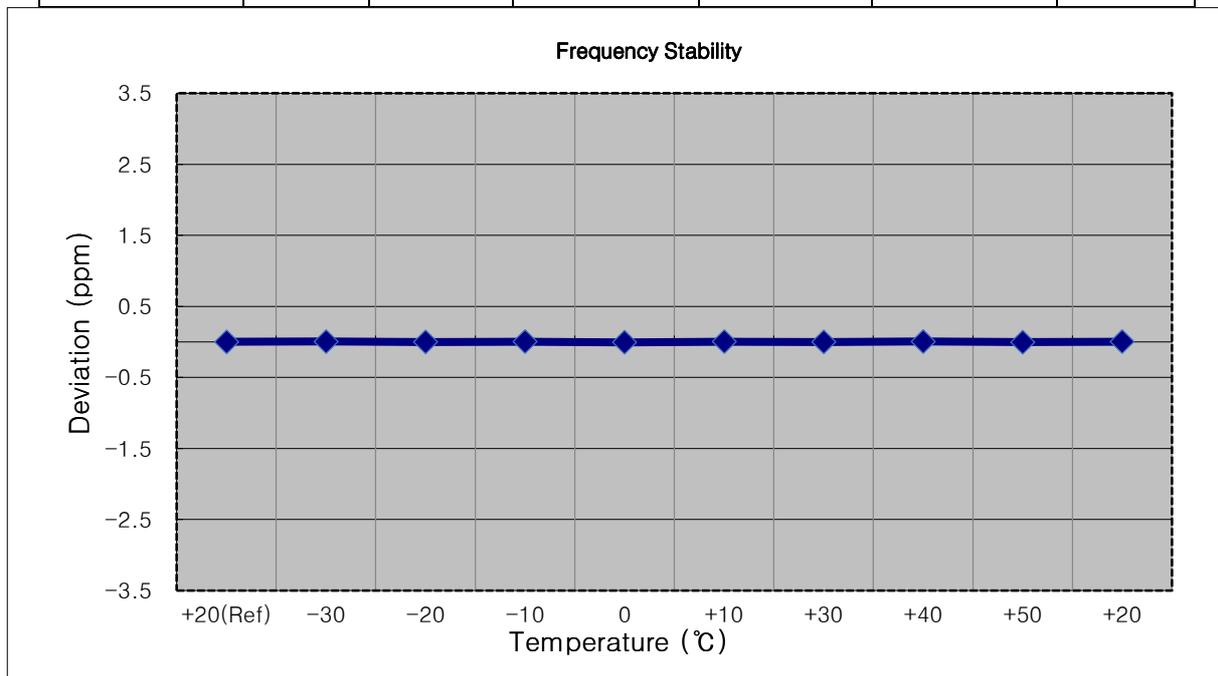
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2506,000,000 Hz
- ▣ BANDWIDTH: 39750 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2506 000 008	0.0	0.000 000	0.000
100%		-30	2506 000 003	-5.0	0.000 000	-0.002
100%		-20	2506 000 010	2.3	0.000 000	0.001
100%		-10	2506 000 016	8.3	0.000 000	0.003
100%		0	2506 000 018	9.7	0.000 000	0.004
100%		+10	2506 000 019	11.2	0.000 000	0.004
100%		+30	2506 000 013	5.2	0.000 000	0.002
100%		+40	2506 000 019	10.7	0.000 000	0.004
100%		+50	2506 000 002	-5.7	0.000 000	-0.002
85%		3.400	+20	2506 000 013	5.2	0.000 000



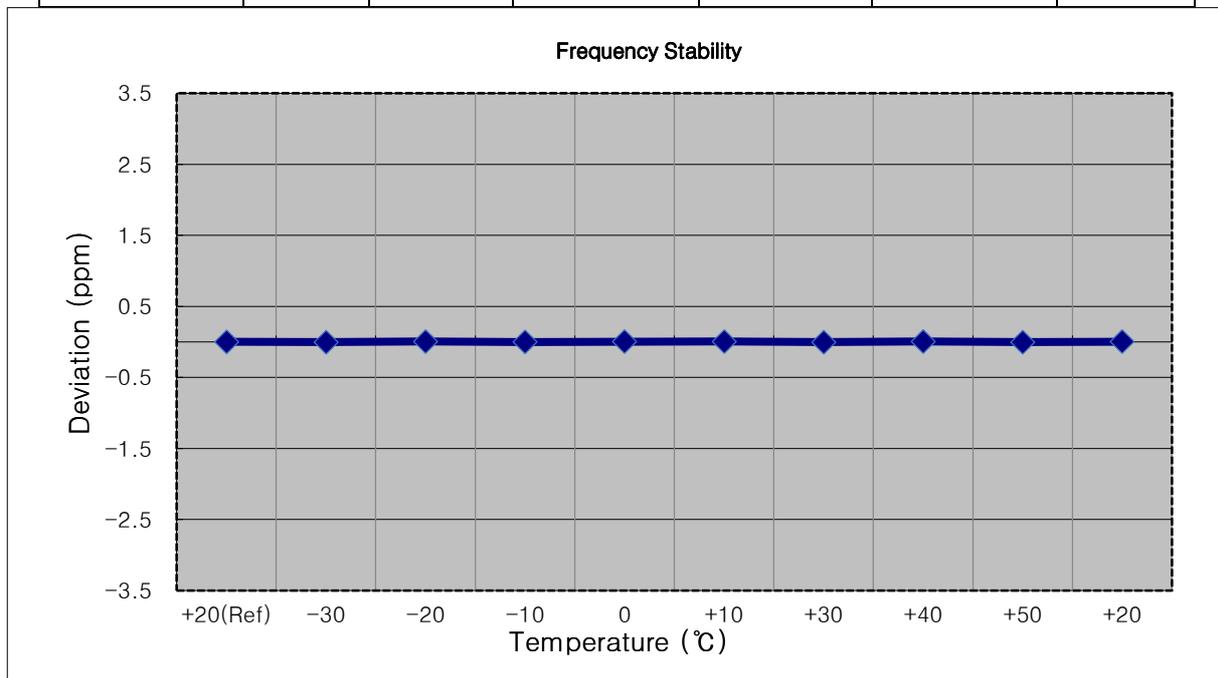
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 994	0.0	0.000 000	0.000
100%		-30	2593 000 006	12.0	0.000 000	0.005
100%		-20	2592 999 989	-4.3	0.000 000	-0.002
100%		-10	2593 000 001	7.4	0.000 000	0.003
100%		0	2592 999 981	-12.9	0.000 000	-0.005
100%		+10	2593 000 000	6.6	0.000 000	0.003
100%		+30	2592 999 989	-5.0	0.000 000	-0.002
100%		+40	2593 000 007	13.5	0.000 001	0.005
100%		+50	2592 999 986	-7.4	0.000 000	-0.003
85%	3.400	+20	2593 000 000	5.9	0.000 000	0.002



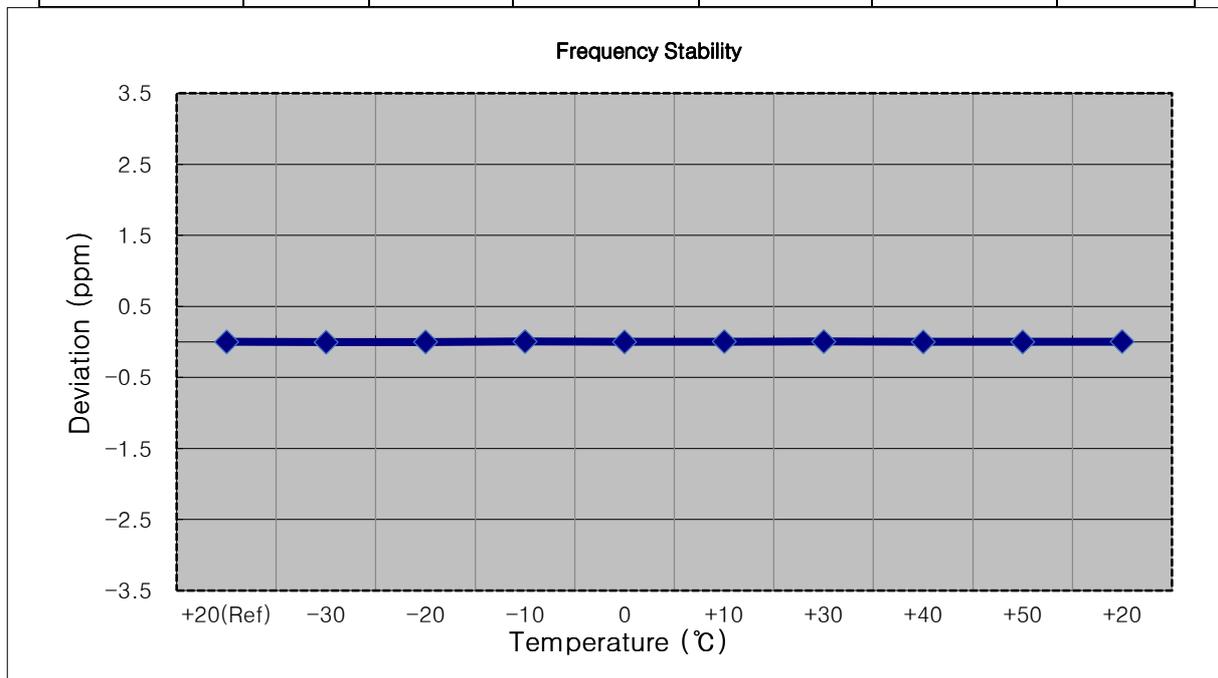
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 006	0.0	0.000 000	0.000
100%		-30	2593 000 000	-5.9	0.000 000	-0.002
100%		-20	2593 000 018	12.8	0.000 000	0.005
100%		-10	2593 000 002	-3.4	0.000 000	-0.001
100%		0	2593 000 013	7.4	0.000 000	0.003
100%		+10	2593 000 018	11.9	0.000 000	0.005
100%		+30	2592 999 997	-8.8	0.000 000	-0.003
100%		+40	2593 000 018	11.9	0.000 000	0.005
100%		+50	2592 999 999	-6.4	0.000 000	-0.002
85%	3.400	+20	2593 000 014	8.1	0.000 000	0.003



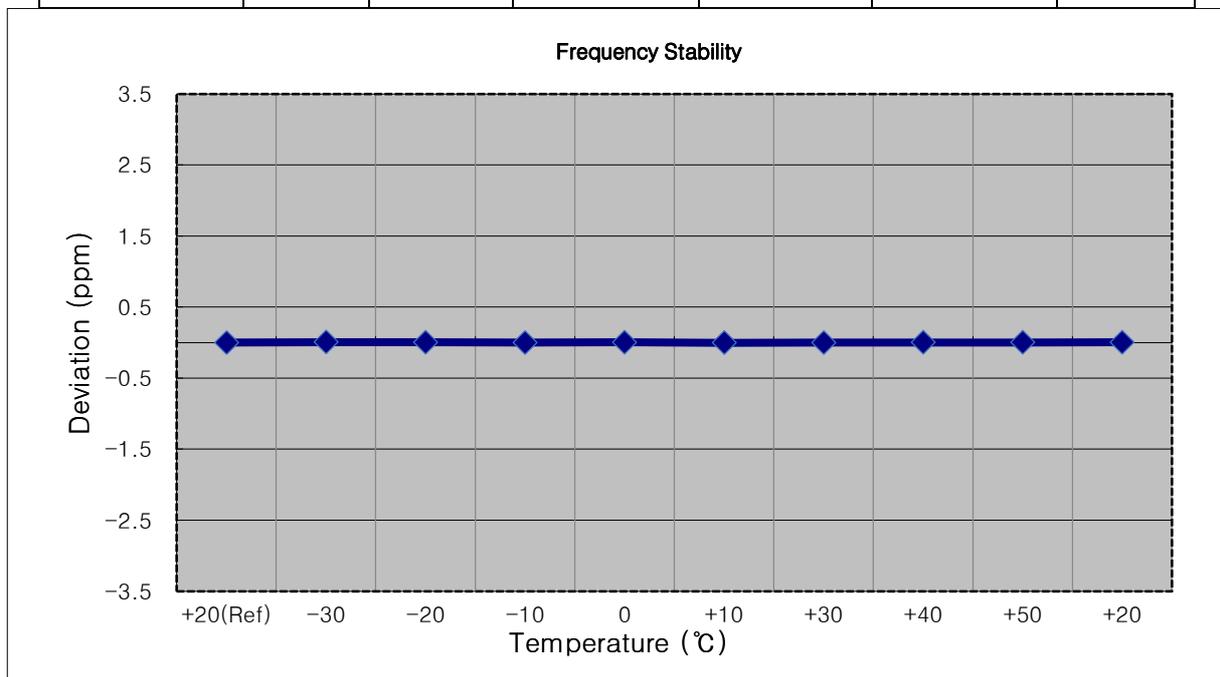
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 011	0.0	0.000 000	0.000
100%		-30	2593 000 003	-8.1	0.000 000	-0.003
100%		-20	2593 000 007	-4.2	0.000 000	-0.002
100%		-10	2593 000 026	14.9	0.000 001	0.006
100%		0	2593 000 014	3.0	0.000 000	0.001
100%		+10	2593 000 021	9.8	0.000 000	0.004
100%		+30	2593 000 027	16.5	0.000 001	0.006
100%		+40	2593 000 015	3.8	0.000 000	0.001
100%		+50	2593 000 017	5.7	0.000 000	0.002
85%	3.400	+20	2593 000 021	10.4	0.000 000	0.004



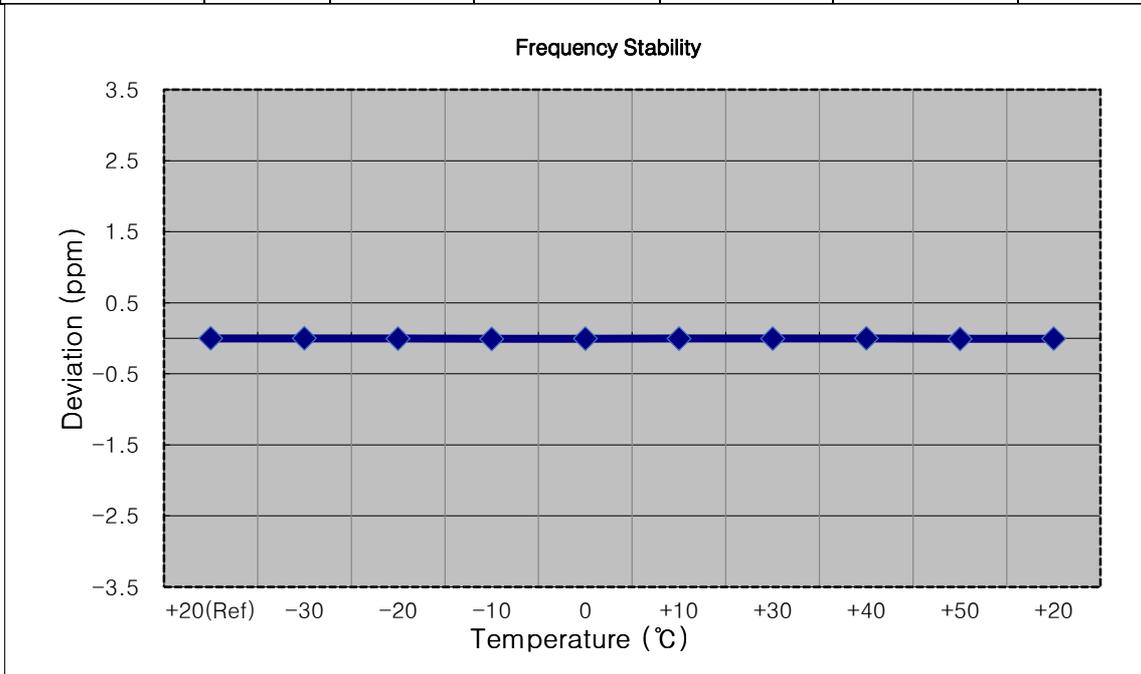
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 011	0.0	0.000 000	0.000
100%		-30	2593 000 027	16.1	0.000 001	0.006
100%		-20	2593 000 018	7.7	0.000 000	0.003
100%		-10	2593 000 006	-4.7	0.000 000	-0.002
100%		0	2593 000 021	10.4	0.000 000	0.004
100%		+10	2593 000 003	-7.6	0.000 000	-0.003
100%		+30	2593 000 006	-4.6	0.000 000	-0.002
100%		+40	2593 000 015	4.0	0.000 000	0.002
100%		+50	2593 000 017	6.4	0.000 000	0.002
85%	3.400	+20	2593 000 022	11.7	0.000 000	0.005



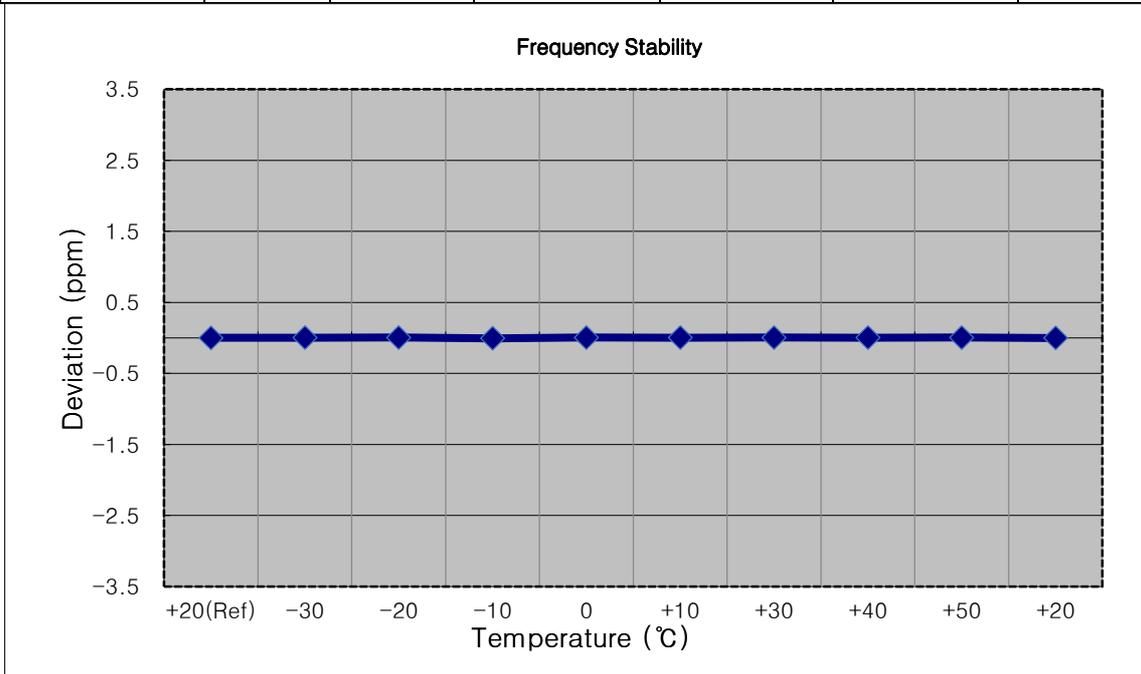
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2687,500,000 Hz
- ▣ BANDWIDTH: 41565 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2687 499 980	0.0	0.000 000	0.000
100%		-30	2687 499 974	-5.4	0.000 000	-0.002
100%		-20	2687 499 971	-9.0	0.000 000	-0.003
100%		-10	2687 499 960	-19.3	-0.000 001	-0.007
100%		0	2687 499 965	-15.1	-0.000 001	-0.006
100%		+10	2687 499 969	-10.2	0.000 000	-0.004
100%		+30	2687 499 973	-6.9	0.000 000	-0.003
100%		+40	2687 499 977	-2.8	0.000 000	-0.001
100%		+50	2687 499 961	-19.0	-0.000 001	-0.007
85%	3.400	+20	2687 499 962	-17.9	-0.000 001	-0.007



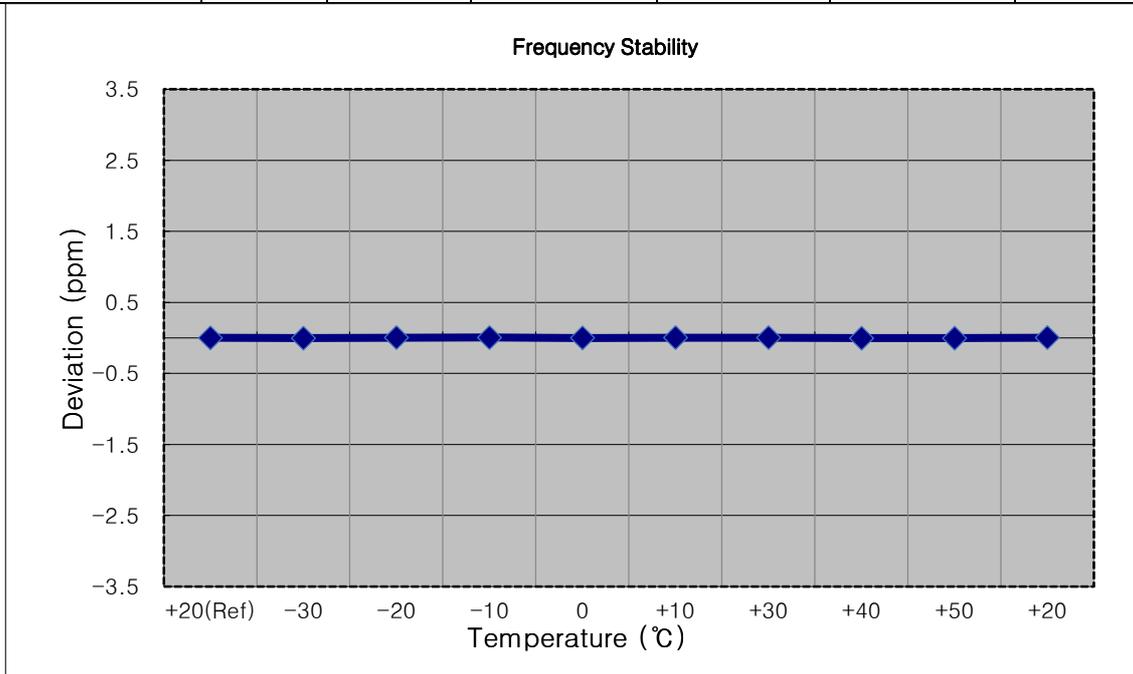
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2685,000,000 Hz
- ▣ BANDWIDTH: 41540 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2685 000 004	0.0	0.000 000	0.000
100%		-30	2685 000 014	9.8	0.000 000	0.004
100%		-20	2685 000 016	12.3	0.000 000	0.005
100%		-10	2684 999 991	-13.2	0.000 000	-0.005
100%		0	2685 000 016	12.1	0.000 000	0.005
100%		+10	2685 000 016	11.7	0.000 000	0.004
100%		+30	2685 000 018	13.6	0.000 001	0.005
100%		+40	2685 000 014	10.1	0.000 000	0.004
100%		+50	2685 000 018	14.3	0.000 001	0.005
85%	3.400	+20	2685 000 001	-3.3	0.000 000	-0.001



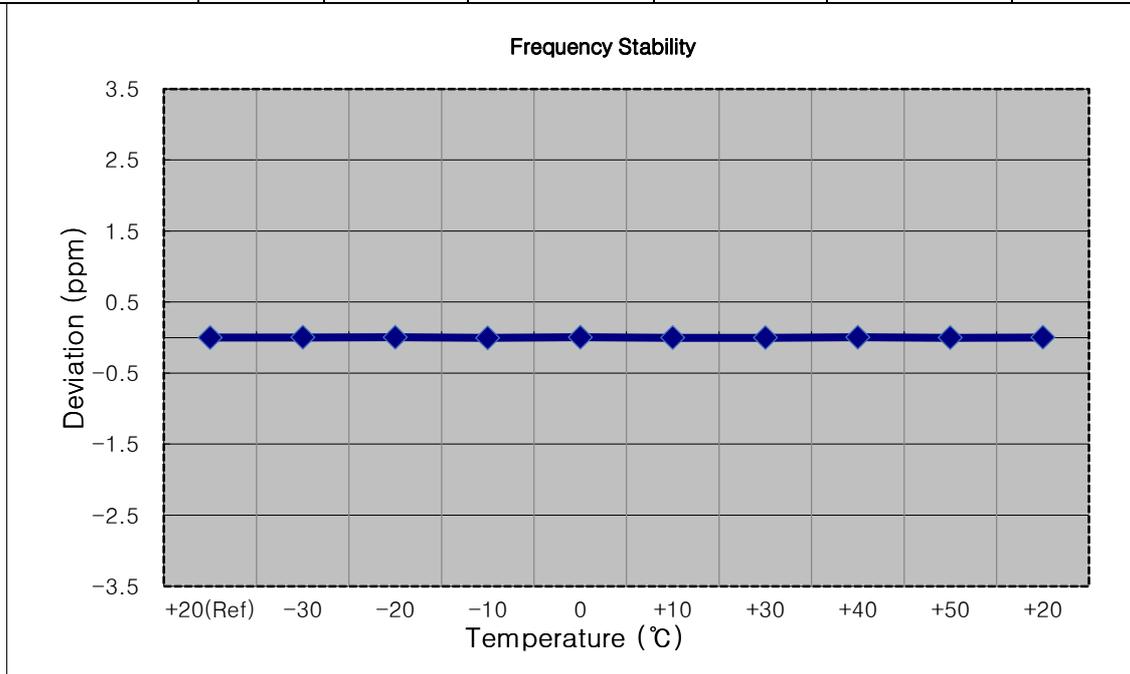
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2682,500,000 Hz
- ▣ BANDWIDTH: 41515 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2682 499 998	0.0	0.000 000	0.000
100%		-30	2682 499 990	-7.8	0.000 000	-0.003
100%		-20	2682 500 007	9.3	0.000 000	0.003
100%		-10	2682 500 011	13.8	0.000 001	0.005
100%		0	2682 499 993	-4.2	0.000 000	-0.002
100%		+10	2682 500 004	6.1	0.000 000	0.002
100%		+30	2682 500 008	10.4	0.000 000	0.004
100%		+40	2682 499 987	-10.3	0.000 000	-0.004
100%		+50	2682 499 990	-7.7	0.000 000	-0.003
85%		3.400	+20	2682 500 007	9.2	0.000 000



- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2680,000,000 Hz
- ▣ BANDWIDTH: 41490 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2679 999 991	0.0	0.000 000	0.000
100%		-30	2679 999 996	5.0	0.000 000	0.002
100%		-20	2680 000 002	11.2	0.000 000	0.004
100%		-10	2679 999 979	-11.4	0.000 000	-0.004
100%		0	2680 000 002	11.5	0.000 000	0.004
100%		+10	2679 999 983	-7.6	0.000 000	-0.003
100%		+30	2679 999 983	-7.8	0.000 000	-0.003
100%		+40	2680 000 003	11.8	0.000 000	0.004
100%		+50	2679 999 982	-9.1	0.000 000	-0.003
85%	3.400	+20	2679 999 996	4.8	0.000 000	0.002



8.8 GEO-LOCATION MECHANISM

The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

The validation of this mechanism is provided below. The device was configured for cellular communications to a test set and the MCC code was adjusted on the test set between the US MCC and then an MCC code valid for a country where the LTE band is supported.

Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)
38	Did not connect	Connected (Canada)
40	Did not connect	Connected (Canada)
41	Connected	Connected (Canada)

The verification tests confirmed the operational of the geo-location mechanism.

Verification test

Connected(LTE B7)
(MCC = Canada)

2019/07/18 13:01 Connected Phone-2 Phone-1
 <Fundamental Measurement> Output Main Continuous LTE

Parameter Fundamental UE Report Band Cal.

Measuring UE Power : 22.4 dBm Parameter

Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency Avg. 2534.999995 MHz

Carrier Frequency Error Avg. Max. Min. Limit
 -0.0054 -0.0054 -0.0054 kHz

Call Processing Parameter

Base Station Identity

Cell ID	0
MCC	302
MNC	220
TAC	0001 H

Mobile Station Identity

IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H
Temporary C-RNTI for Handover	AAAA H

SIM Model Number User
 Authentication On

Common
 Physical Channel
 Call Processing
 TX Measurement Setup
 RX Measurement Setup
 Fundamental Measurement

1 2 3 4

Connected(LTE B38)

(MCC = Canada)

2019/07/18 13:01 Connected Phone-2 Phone-1
 <Fundamental Measurement> Output Main Continuous --- LTE
 Parameter Fundamental UE Report Hard Call

Measuring UE Power : 22.8 dBm
 Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency	Avg.	Max.	Min.	Limit
2595.000015 MHz				
Carrier Frequency Error	Avg.	Max.	Min.	Limit
0.0147 kHz	0.0147	0.0147	0.0147	

Call Processing Parameter

Base Station Identity	Value
Cell ID	0
MCC	302
MNC	220
TAC	0001 H

Mobile Station Identity

Parameter	Value
IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H
Temporary C-RNTI for Handover	AAAA H

SIM Model Number User
 Authentication On

Parameter List (Right Sidebar):
 Common
 Physical Channel
 Call Processing
 TX Measurement Setup
 RX Measurement Setup
 Fundamental Measurement

Page Navigation: 1 | 2 | 3 | 4

Connected(LTE B40)

(MCC = Canada)

2019/07/18 13:00 Connected Phone-2 Phone-1
 <Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report Band Cal.

Measuring UE Power : 22.9 dBm Parameter

Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency Avg. 2350.000004 MHz

Carrier Frequency Error Avg. Max. Min. Limit
 0.0038 0.0038 0.0038 kHz

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 302

MNC 220

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Temporary C-RNTI for Handover AAAA H

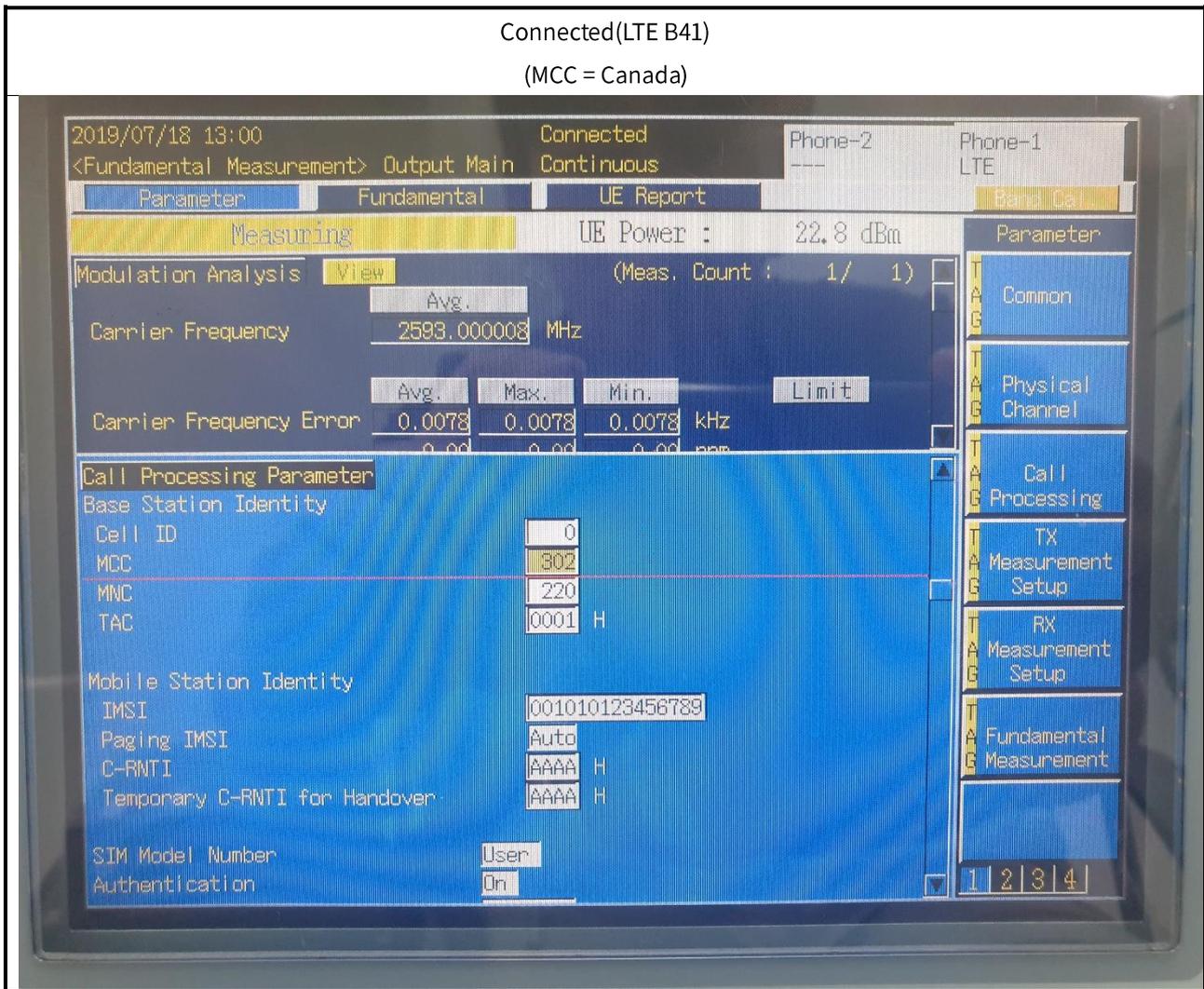
SIM Model Number User

Authentication On

1 2 3 4

Connected(LTE B41)

(MCC = Canada)



Connected(LTE B41)

(MCC = US)

2019/07/18 13:03 Connected
 <Fundamental Measurement> Output Main Continuous Phone-2 Phone-1
 --- LTE

Parameter Fundamental UE Report
 Measuring UE Power : 22.8 dBm
 Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency	Avg. 2593.000000 MHz		
Carrier Frequency Error	Avg. 0.0001	Max. 0.0001	Min. 0.0001 kHz
	Limit		

Call Processing Parameter

Base Station Identity	
Cell ID	0
MCC	311
MNC	01
TAC	0001 H
Mobile Station Identity	
IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H
Temporary C-RNTI for Handover	AAAA H
SIM Model Number	User
Authentication	On

Parameter
 Common
 Physical Channel
 Call Processing
 TX Measurement Setup
 RX Measurement Setup
 Fundamental Measurement
 1 | 2 | 3 | 4

Did not connect (LTE B7)
(MCC = US)

2019/07/18 13:04 Idle Phone-2 Phone-1
<Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report

Reference signal not found UE Power : -26.9 dBm Parameter

Modulation Analysis View (Meas. Count : 1 / 1)

Carrier Frequency Avg. ***** MHz

Carrier Frequency Error Avg. Max. Min. Limit ***** kHz

***** ***** *****

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 311

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Temporary C-RNTI for Handover AAAA H

SIM Model Number User

Authentication On

1 | 2 | 3 | 4

Did not connect (LTE B38)
(MCC = US)

2019/07/18 13:04 Idle Phone-2 Phone-1
 <Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report Band Cal.

Reference Signal not found UE Power : -27.2 dBm Parameter

Modulation Analysis View (Meas. Count : 1 / 1)

Carrier Frequency Avg. ***** MHz

Carrier Frequency Error Avg. Max. Min. Limit ***** ***** ***** kHz

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 311

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Temporary C-RNTI for Handover AAAA H

SIM Model Number User

Authentication On

1 | 2 | 3 | 4

Did not connect (LTE B40)
(MCC = US)

2019/07/18 13:04 Idle Phone-2 Phone-1
<Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report

Reference Signal not found UE Power : -26.9 dBm

Modulation Analysis View (Meas. Count : 1 / 1)

Carrier Frequency Avg. ***** MHz

Carrier Frequency Error Avg. Max. Min. Limit ***** kHz

Call Processing Parameter

Base Station Identity

Cell ID	0
MCC	311
MNC	01
TAC	0001 H

Mobile Station Identity

IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H
Temporary C-RNTI for Handover	AAAA H

SIM Model Number User

Authentication On

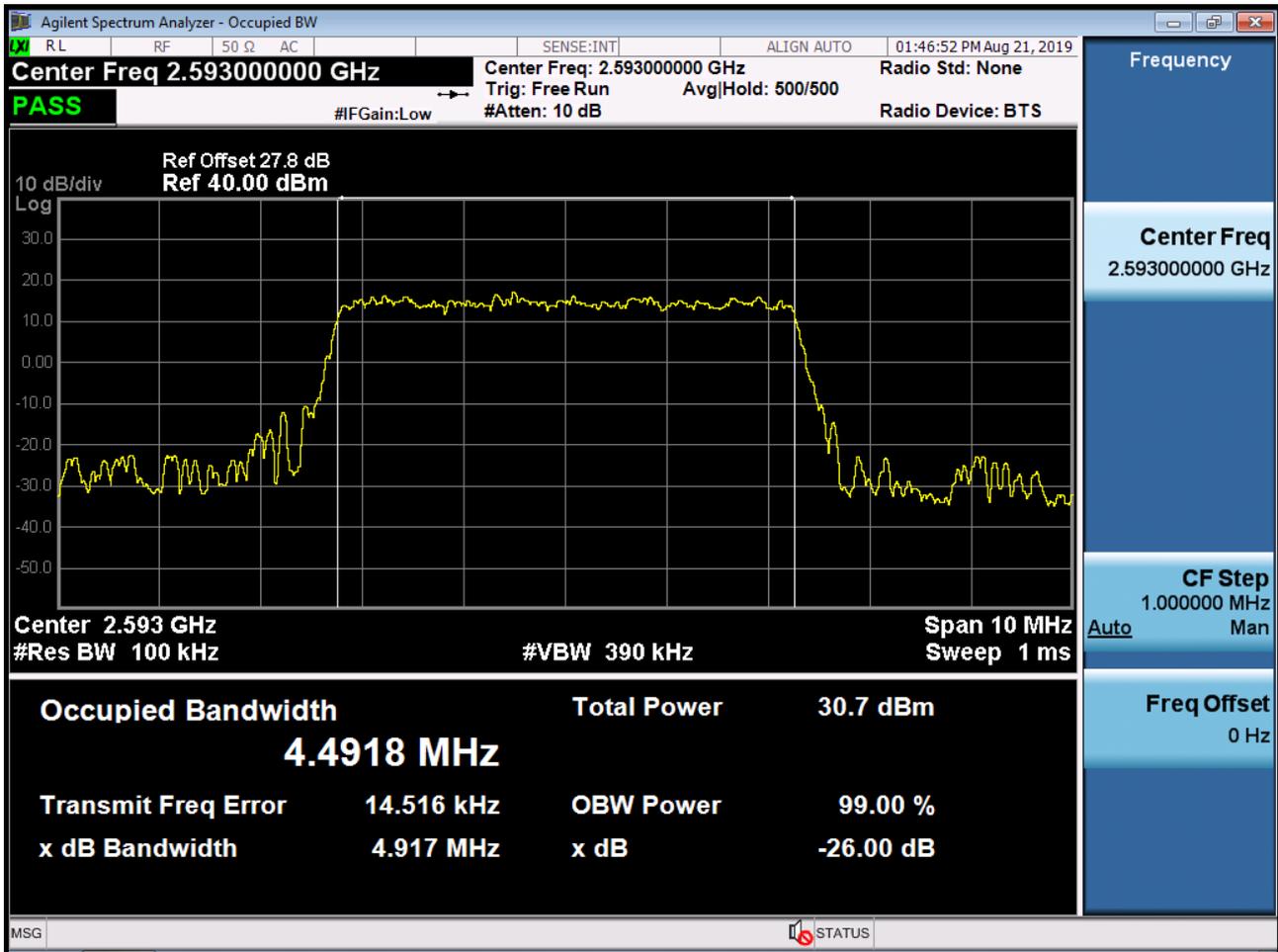
Parameter

- Common
- Physical Channel
- Call Processing
- TX Measurement Setup
- RX Measurement Setup
- Fundamental Measurement

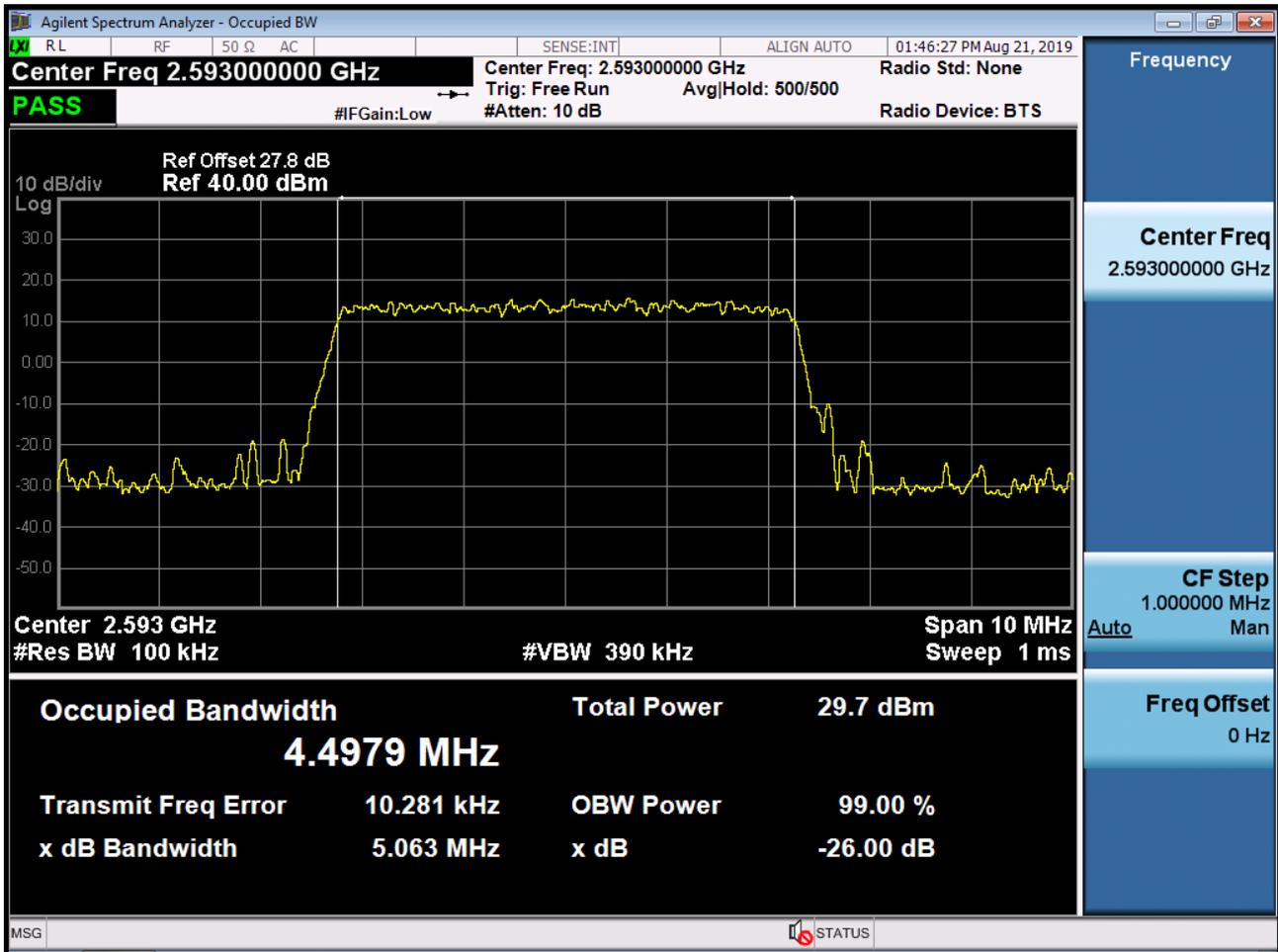
1 | 2 | 3 | 4

9. TEST PLOTS

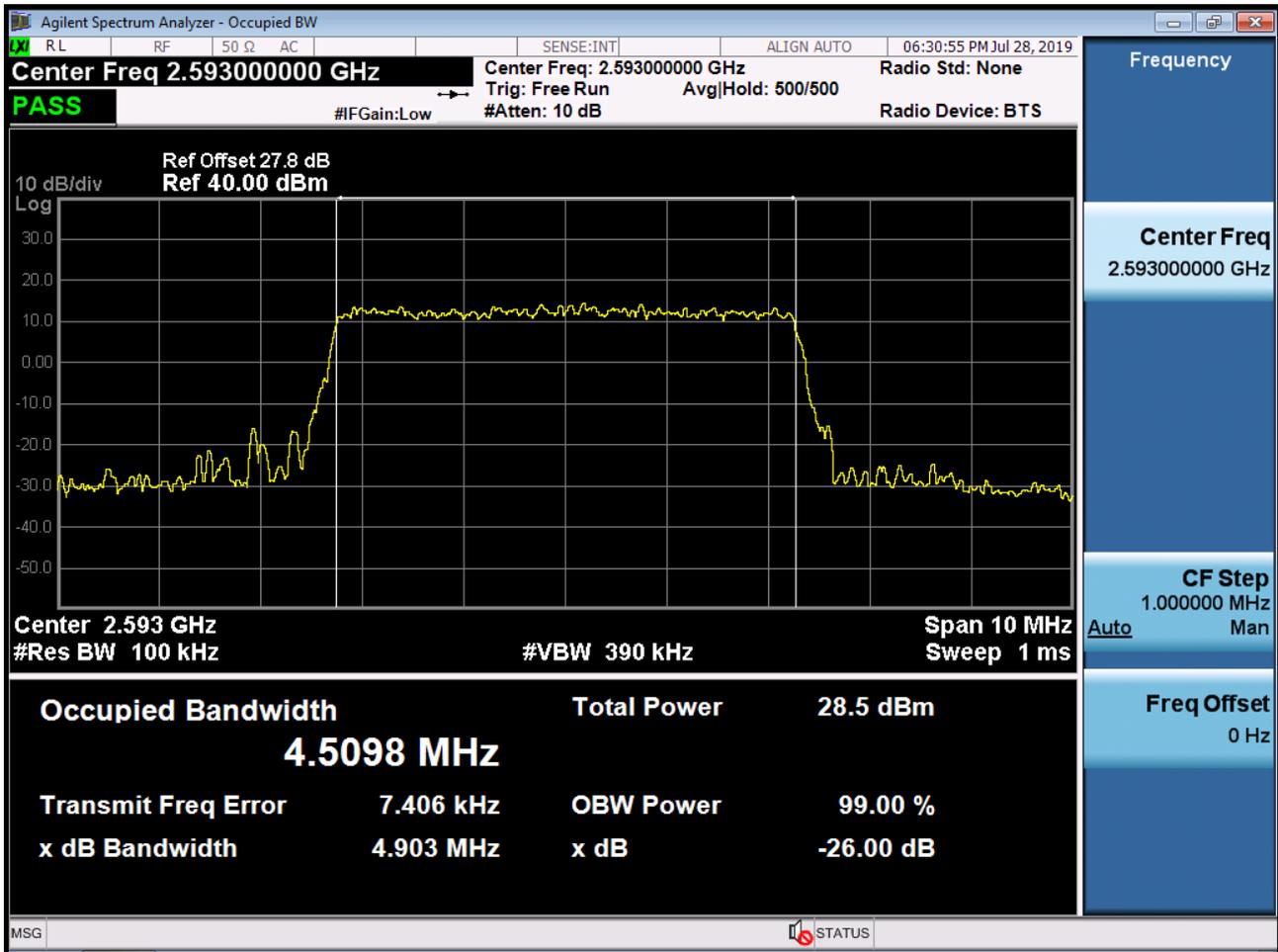
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25)



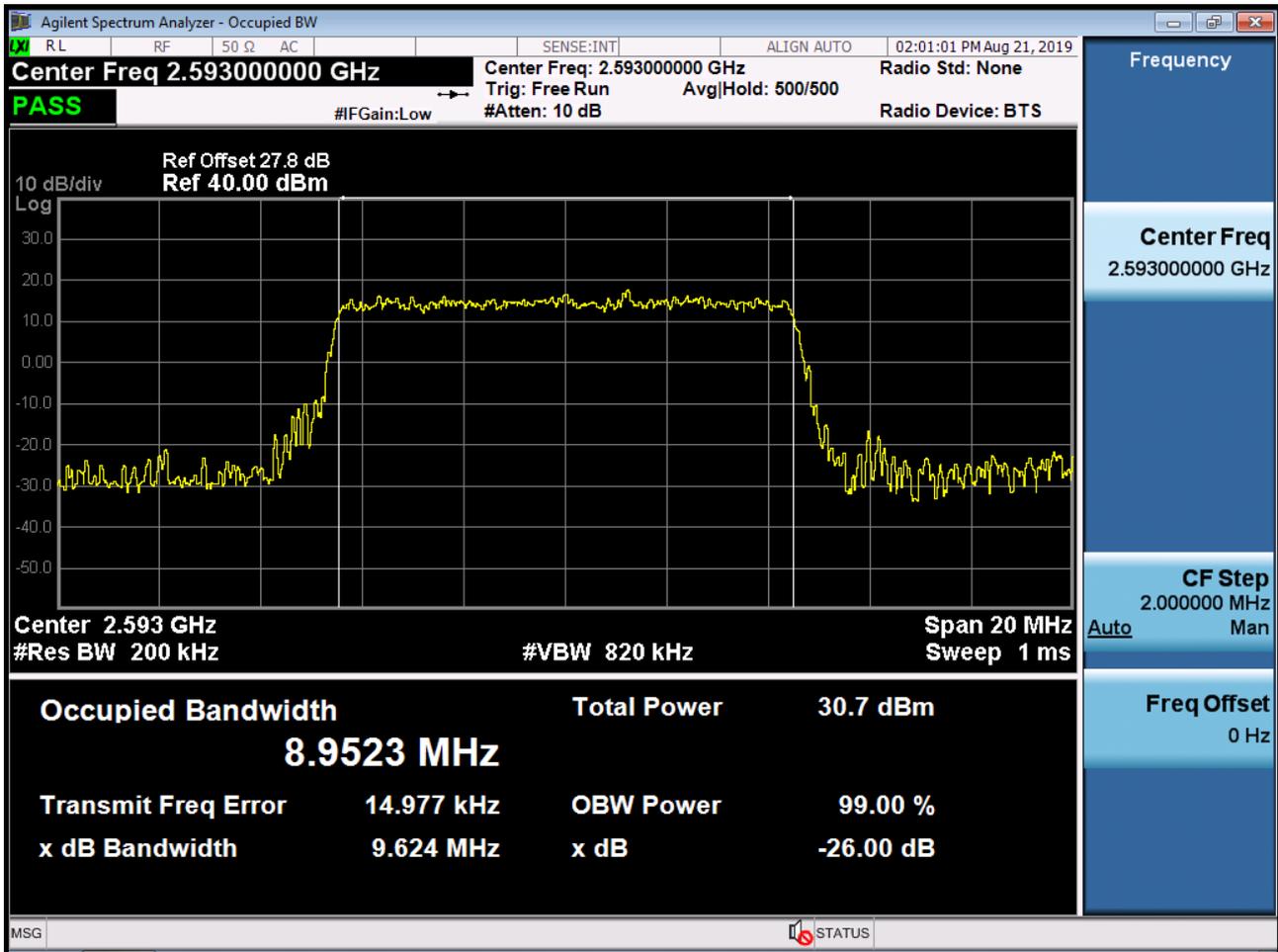
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25)



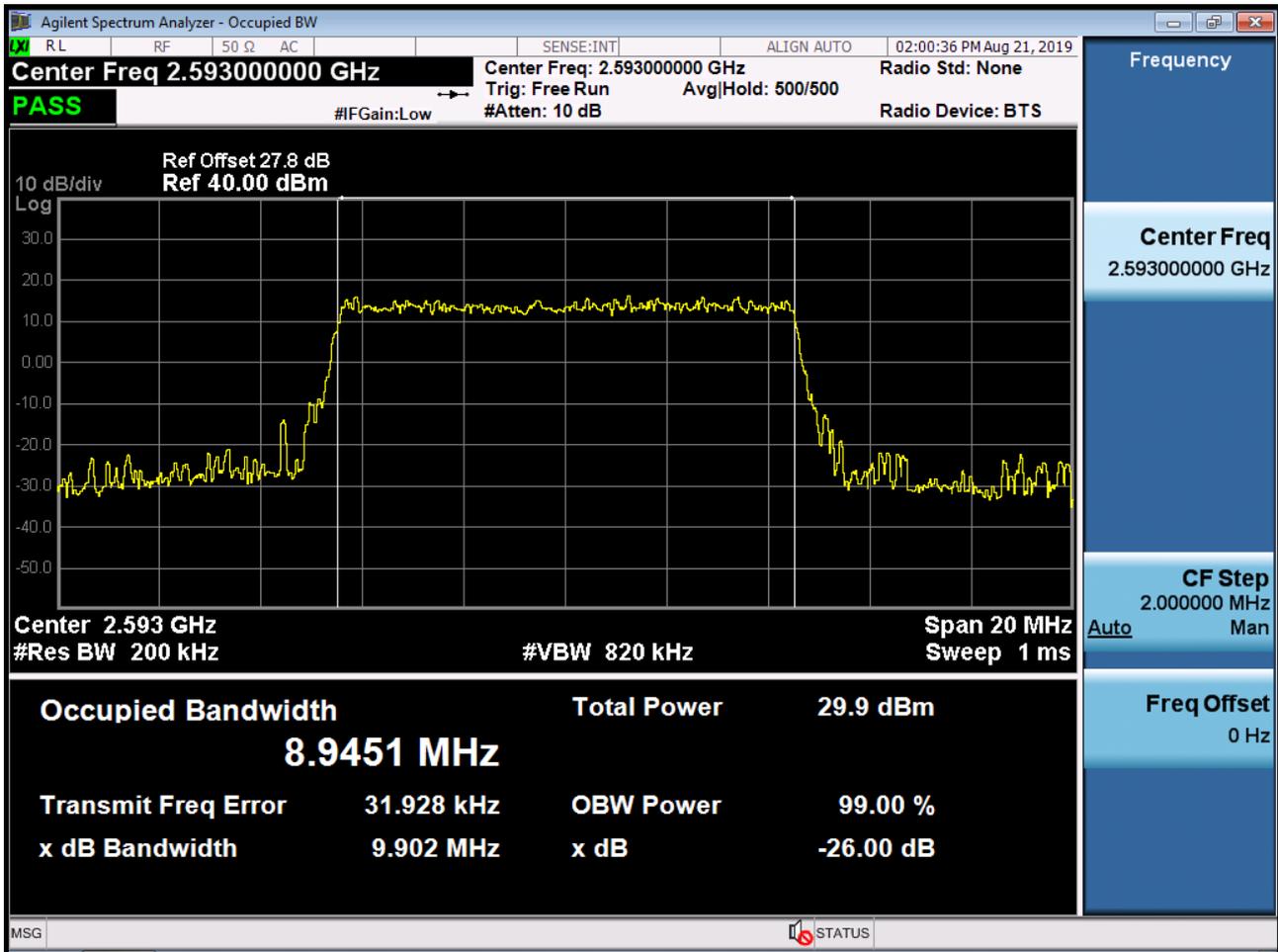
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 64-QAM RB 25)



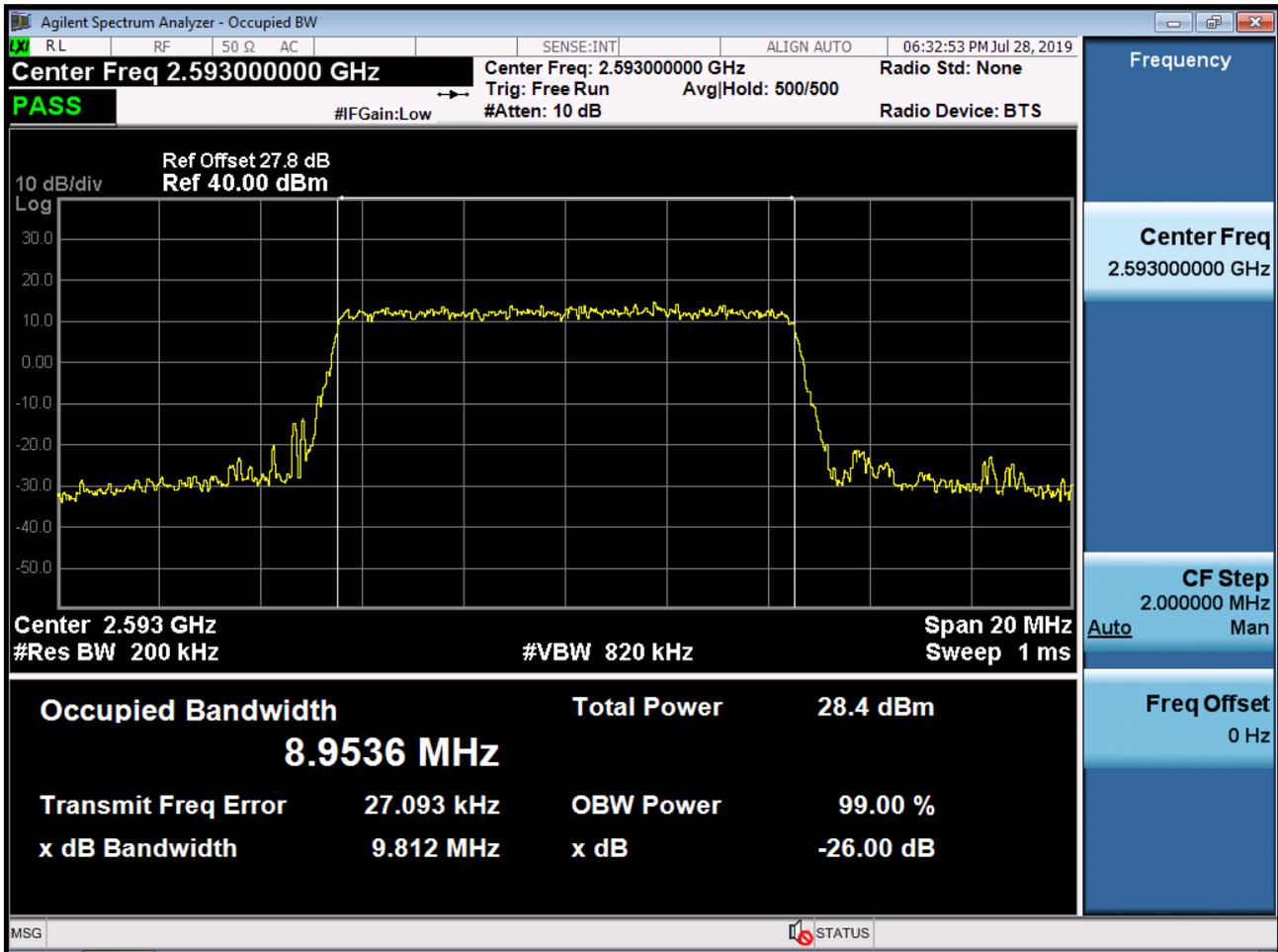
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50)



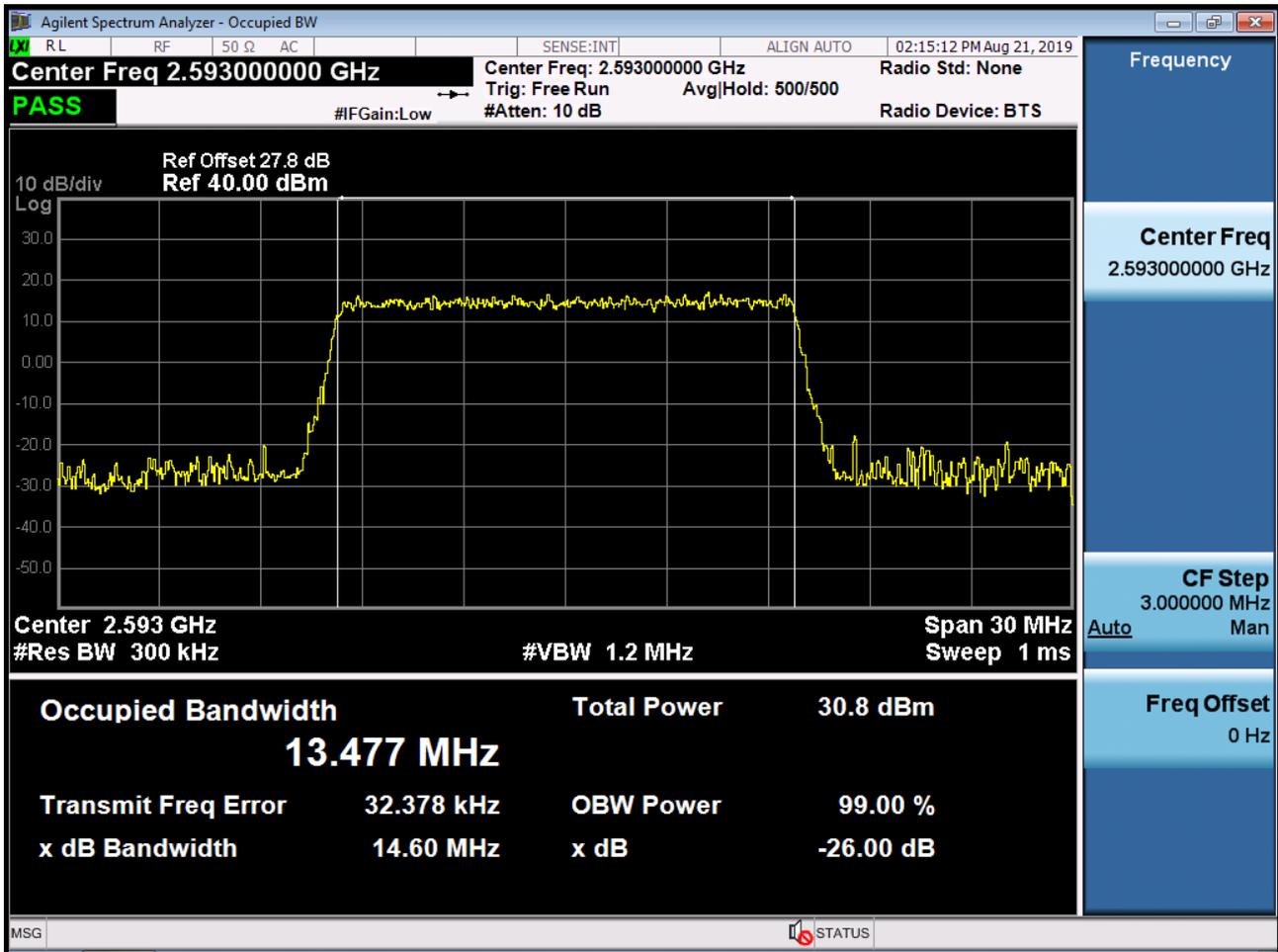
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50)



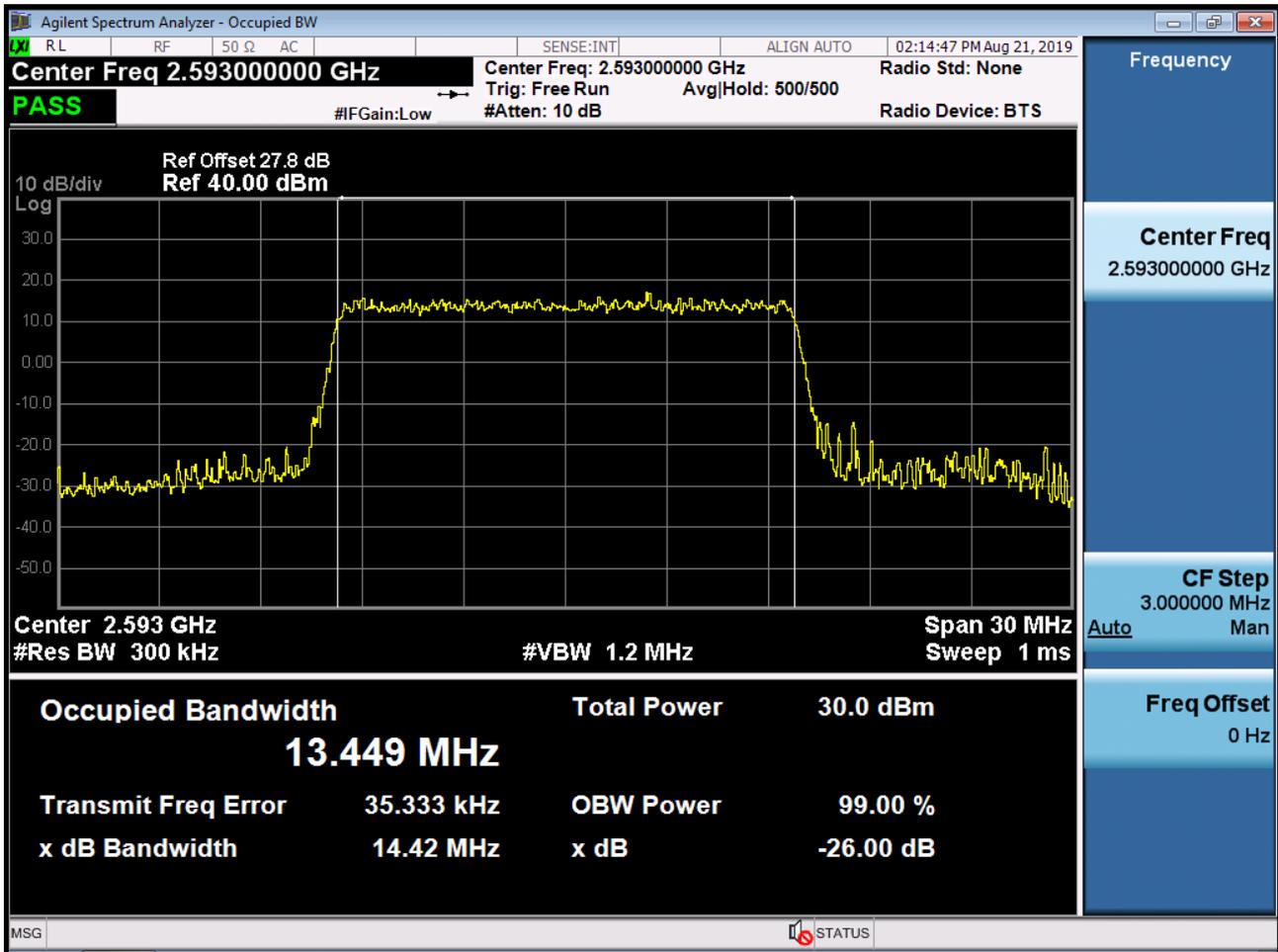
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 64-QAM RB 50)



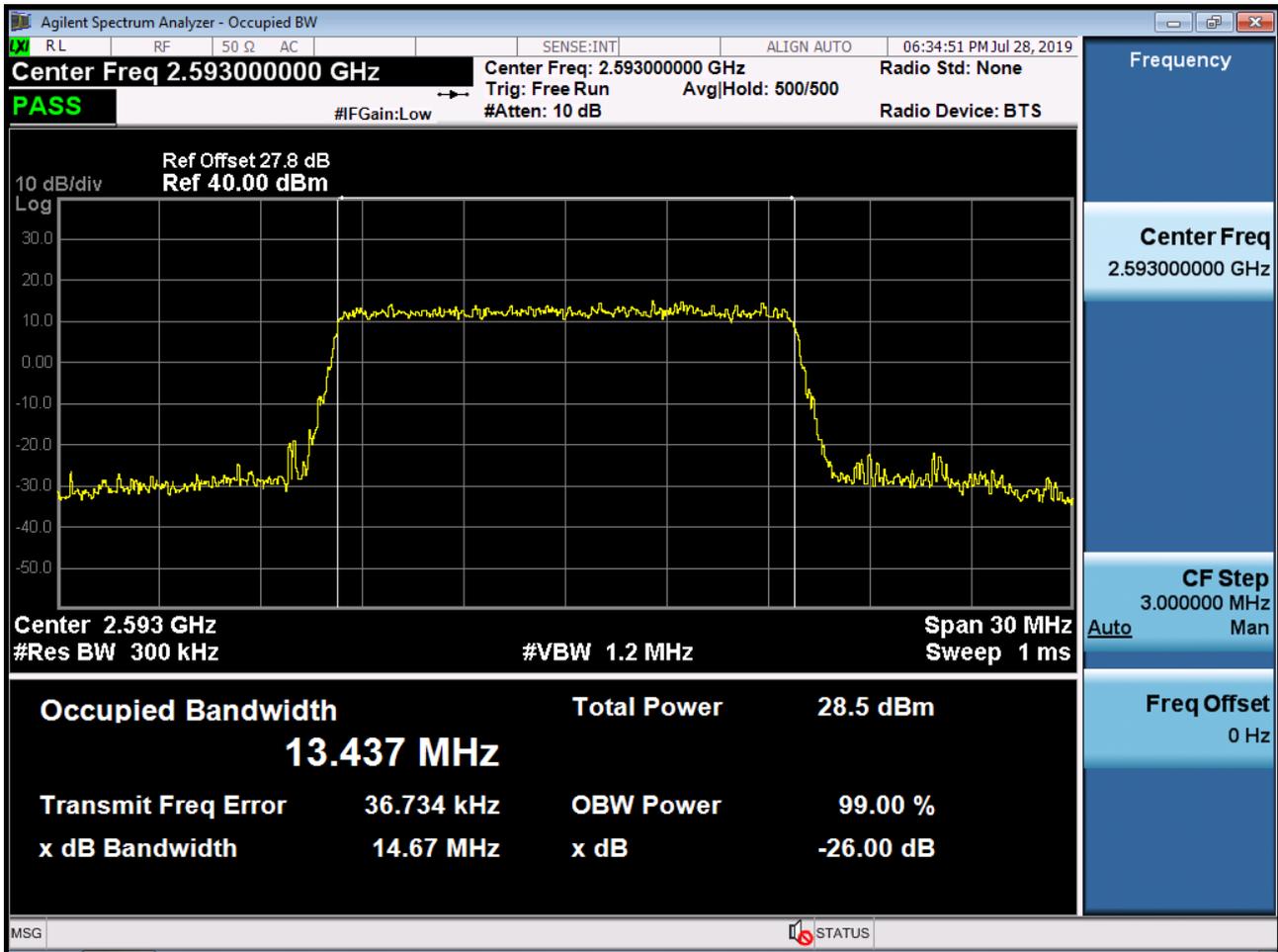
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75)



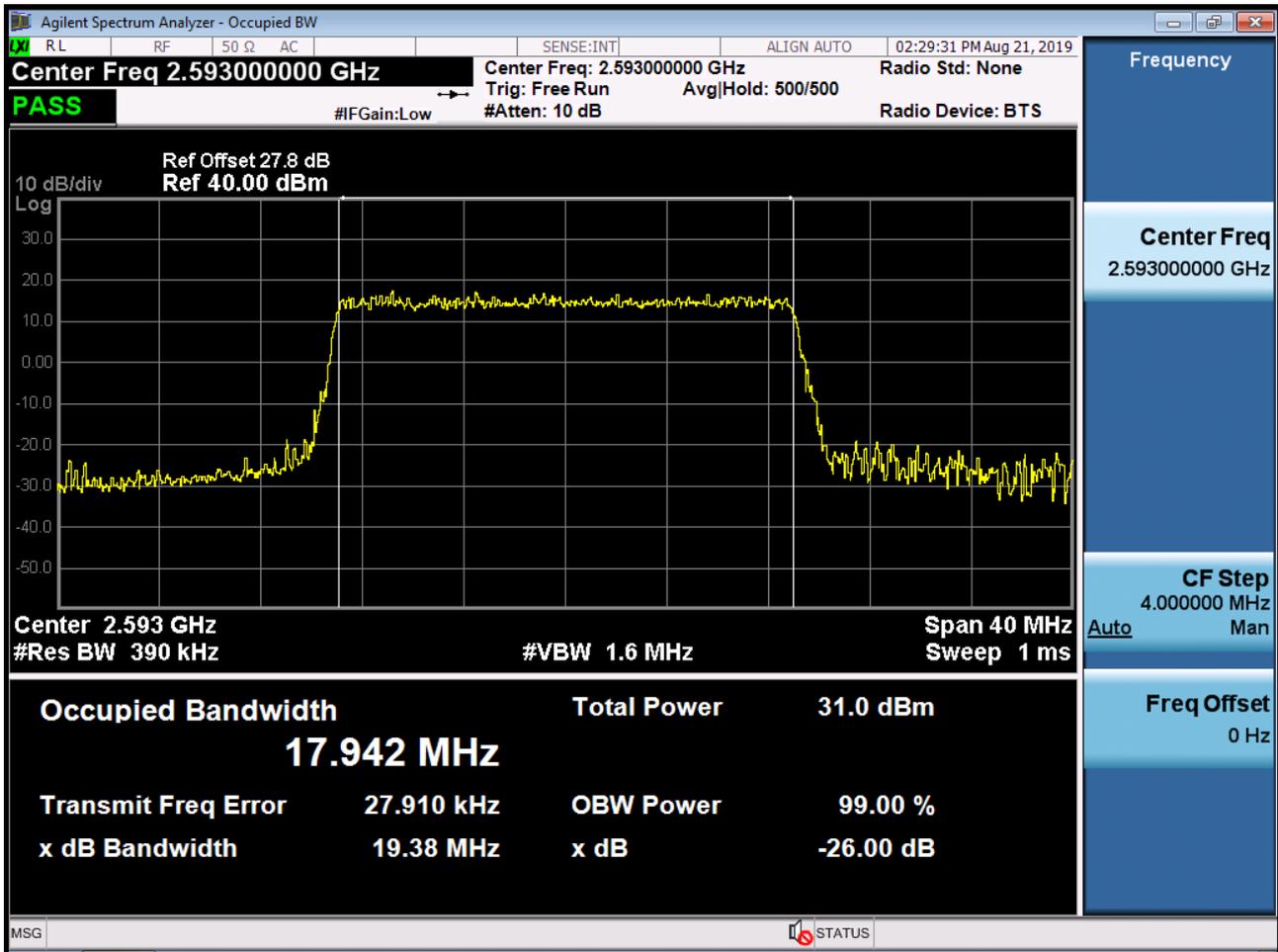
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)



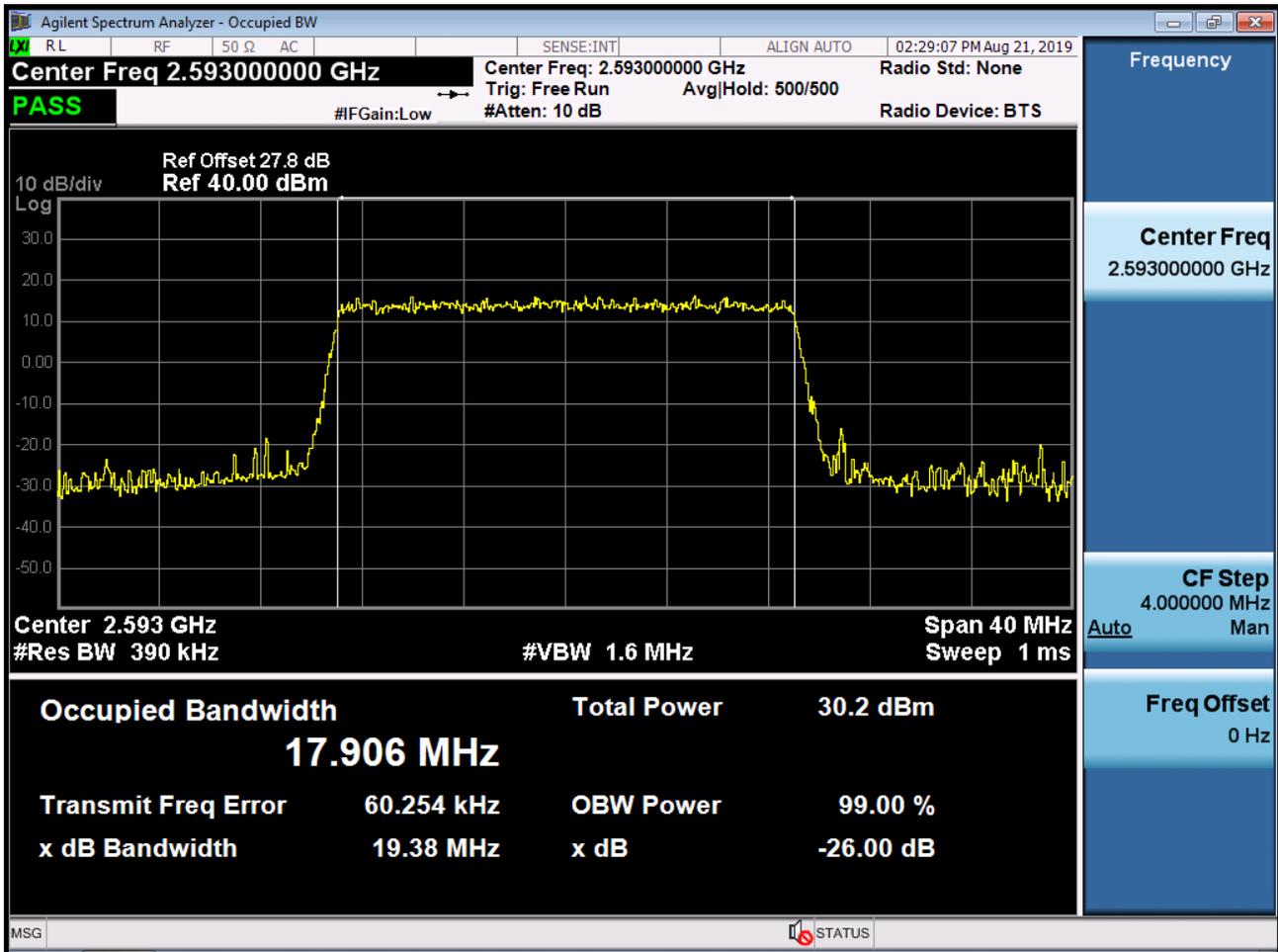
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 64-QAM RB 75)



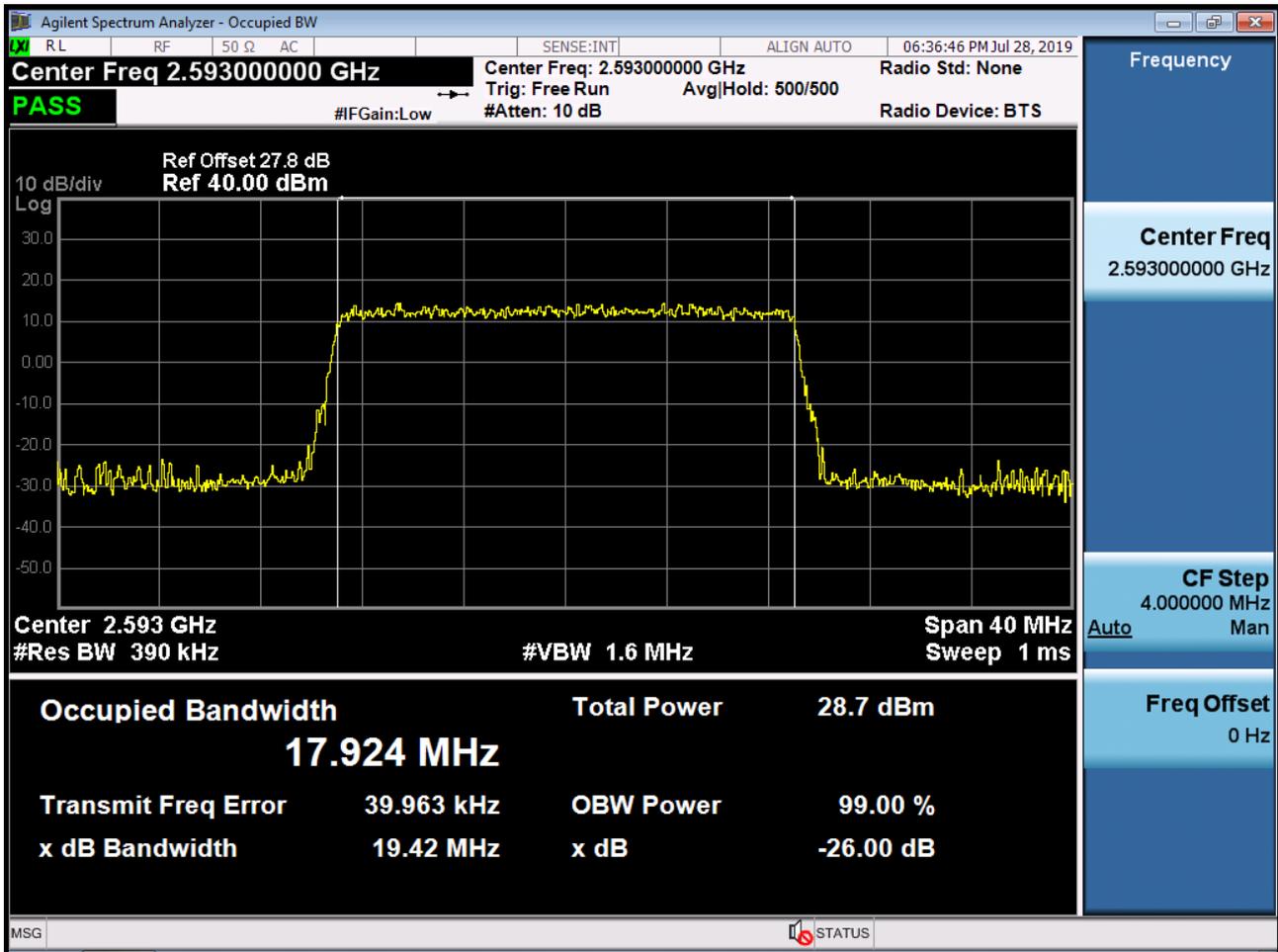
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)



BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100)



BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 64-QAM RB 100)



BAND 41. PAR Plot (5M BW_Ch.40620_QPSK_RB25_0)

