Electromagnetic Network Global

FCC CFR47 Part 27 Subpart C Certification Test Report

For the

Product	**: Airway Clearance System**
Model	**: PMACS14G**
FCC ID	**: 2AJKO-PMACS14G**
Applicant	**: Hill-Rom Service Private Limited**
FCC Rule	**: CFR 47 Part 27 Subpart C**

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. **TR-W1703-008**

Signature

Youn, In-soub / Technical Manager

Date: 2017-03-16

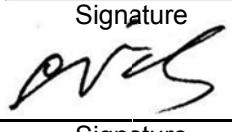
Test Laboratory: ENG Co., Ltd.

FCC CERTIFICATION TEST REPORT

Project Number	**: EA1702Q-178**
Test Report Number	**: TR-W1703-008**
Type of Equipment	**: Airway Clearance System**
FCC ID.	**: 2AJKO-PMACS14G**
Model Name	**: PMACS14G**
Multiple Model Name	**: N/A**
Applicant	**: Hill-Rom Service Private Limited**
Address	**: 1 Yishun Avenue 7, 768923, Singapore**
Manufacturer	**: Hill-Rom Service Private Limited**
Address	**: 1 Yishun Avenue 7, 768923, Singapore**
Regulation	**: FCC Part 27 Subpart C**
Total page of Report	**: 99 Pages**
Date of Receipt	**: 2017-02-27**
Date of Issue	**: 2017-03-16**
Test Result	**: PASS**

This test report only contains the result of a single test of the sample supplied for the examination.
It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by Song, In-young / Senior Engineer  Signature 2017-03-16 Date

Reviewed by Youn, In-soub / Technical Manager  Signature 2017-03-16 Date

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Release Control Record

Issue Report No.	Issued Date	Revisions	Effect Section
TR-W1703-008	2017-03-16	Initial Release	All

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
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1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation (Referred to below as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	Description	P (Pass)	F (Fail)	N.T. (Not Tested)	Note
27.50(b)(10) and (d)(4), §2.1046	RF Output Power	P			
27.50(d)(5)	Peak to Average Ratio	P			
27.53(h) §2.1049	Occupied Bandwidth	P			
27.53(h) §2.1051	Band Edge Compliance	P			
27.53(h) §2.1053	Unwanted Emission	P			
27.54 §2.1055	Frequency Stability	P			

1.2 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 27.Subpart C.

1.3 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 27 and TIA-603-D.

KDB 971168 D01 Power Meas License Digital Systems v02r02

1.3 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

1.4 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Description details of test facilities were submitted to the FCC and IC, designated by the RRA (Radio Research Agency), and accredited by Korea and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea according to the requirement of ISO 17025.

Agency Name	Registration No.	Mark
FCC	955964	
Industry Canada (IC)	IC 12721A-1	
RRA	KR0160	
Korean Agency for Technology and Standards	KT733	

2. EUT (Equipment Under Test)

2.1 General Description

The EUT, Airway Clearance System is intended to provide Airway Clearance Therapy and promote bronchial drainage where external manipulation of the thorax is the physician's choice of treatment. It is indicated for patients having difficulty with secretion clearance, or the presence of atelectasis caused by mucus plugging. The Monarch™ product is intended for Single Patient Use (SPU) in the Home Care environment.

Description of equipment	Airway Clearance System
Model Name	PMACS14G
FCC ID	2AJKO-PMACS14G
Serial Number	R001PP0001
Operating Frequency	LTE Band 13 (700 MHz): 777 MHz – 787 MHz LTE Band 4 (1 700 MHz): 1 710 – 1 755 MHz
Max. RF Output Power	LTE Band 13 (700 MHz): 23.90 dBm LTE Band 4 (1 700 MHz): 24.20 dBm
Modulation Types	QPSK and 16 QAM
Channel Bandwidth	LTE Band 13: 5 MHz / 10 MHz LTE Band 4: 5 MHz / 10 MHz / 15 MHz / 20 MHz
Emission Designator	LTE Band 13: 8M73G7D (QPSK) / 4M61W7D (16QAM) LTE Band 4: 17M9G7D (QPSK) / 4M57W7D (16QAM)
Type of Antenna	□ Integrated Type ■ Dedicated Type(Flex antenna)
Antenna Gain	LTE Band 13: 1.56 dBi LTE Band 4: 3.37 dBi
Operating Temperature	5 ℃ ~ 35 ℃
Normal Test Voltage	DC 24 V
Electrical Rating	(Rechargeable Lithium Ion Battery) DC 24 V, 2700 mAh, 64.8 Wh (AC Adapter) DC 24 V, 5 A

2.2 Available channel number and frequency

Operating Mode: LTE Band 13				
Band	Bandwidth	Mode	Channel	Frequency(MHz)
LTE Band 13	5	QPSK	23230	782
		16QAM	23230	782
	10	QPSK	23230	782
Operating Mode: LTE Band 4				
Band	Bandwidth	Mode	Channel	Frequency(MHz)
LTE Band 4	5	QPSK	19975	1712.5
			20175	1732.5
			20375	1752.5
		16QAM	19975	1712.5
			20175	1732.5
			20375	1752.5
	10	QPSK	20000	1715.0
			20175	1732.5
			20350	1750.0
	15	QPSK	20025	1717.5
			20175	1732.5
			20325	1747.5
	20	QPSK	20175	1732.5

2.3 Additional Model

None

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3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
Airway Clearance System (EUT)	PMACS14G	R001PP0001	Hill-Rom Service Private Limited
AC/DC Adapter	MANGO120-24CK	N/A	SHENZHEN MEGMEET ELECTRICAL CO., LTD.

3.2 Mode of operation during the test

For finding worse case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission were performed with the EUT set to transmit at the channel with the highest output power as worse case scenario.

Based on preliminary testing following operating modes were selected for the final test as listed below.

3.2.1 Radiated/Conducted Spurious Emission Test Mode for LTE Band 4

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)		
						20050	20175	20300
						1720.0 MHz	1732.5 MHz	1745.0 MHz
LTE Band 4	20	QPSK	1	0	0		23.10	
			1	49	0		22.90	
			1	99	0		24.20	
			50	0	1		22.00	
			50	24	1		22.10	
			50	50	1		22.50	
			100	0	1		22.30	
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)		
						20025	20175	20325
						1717.5 MHz	1732.5 MHz	1747.5 MHz
LTE Band 4	15	QPSK	1	0	0	22.80	22.00	23.30
			1	37	0	23.10	23.20	24.30
			1	74	0	22.00	22.70	22.30
			36	0	1	22.50	21.50	23.00
			36	20	1	22.40	22.10	23.00
			36	39	1	21.70	22.10	22.90
			75	0	1	22.00	21.80	23.00

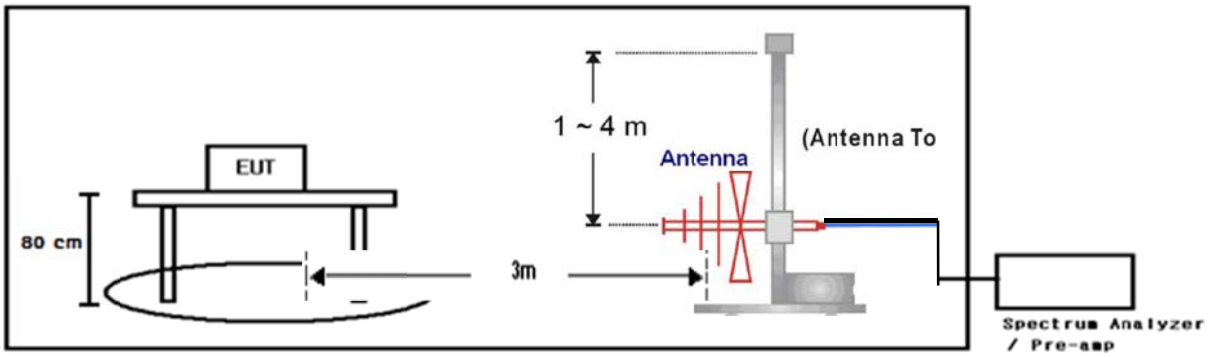
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)		
						20000	20175	20350
						1715 MHz	1732.5 MHz	1750 MHz
LTE Band 4	10	QPSK	1	0	0	22.90	22.00	23.30
			1	25	0	23.20	22.60	23.80
			1	49	0	22.00	22.20	22.40
			25	0	1	22.10	21.20	22.70
			25	12	1	22.20	21.50	22.70
			25	25	1	21.80	21.60	22.20
			50	0	1	22.00	21.30	22.50
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)		
						19975	20175	20375
						1712.5 MHz	1732.5 MHz	1752.5 MHz
LTE Band 4	5	QPSK	1	0	0	23.20	22.50	23.50
			1	12	0	23.30	22.60	23.60
			1	24	0	23.00	22.80	23.00
			12	0	1	22.35	21.40	22.60
			12	7	1	22.40	21.60	22.50
			12	13	1	22.30	21.70	22.30
			25	0	1	22.30	21.60	22.45
		16QAM	1	0	1	22.30	21.60	23.00
			1	12	1	22.50	21.80	23.00
			1	24	1	22.10	21.90	22.30
			12	0	2	21.40	20.60	21.60
			12	7	2	21.40	20.60	21.50
			12	13	2	21.30	20.70	21.20
			25	0	2	21.40	20.60	21.40

3.2.2 Radiated/Conducted Spurious Emission Test Mode for LTE Band 13

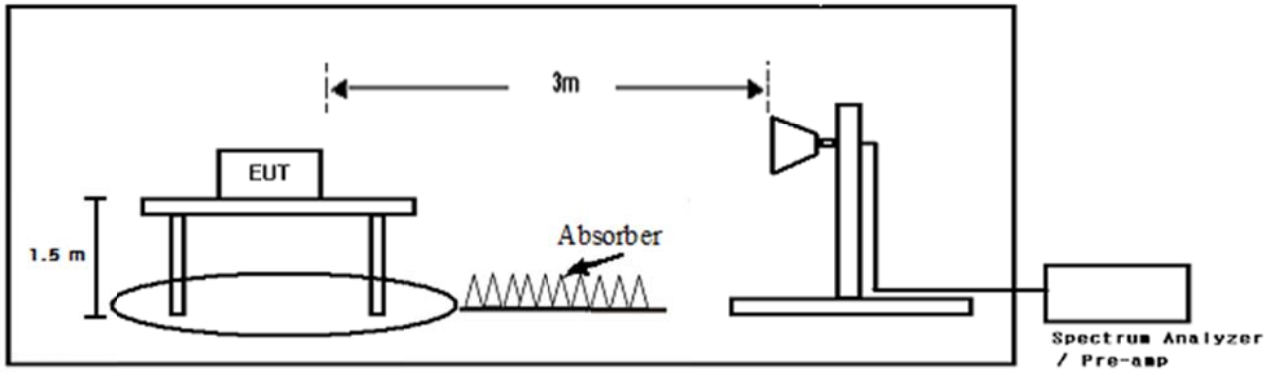
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)
						23230
						782 MHz
LTE Band 13	10	QPSK	1	0	0	23.12
			1	25	0	23.50
			1	49	0	**23.90**
			25	0	1	22.44
			25	12	1	22.60
			25	25	1	22.70
			50	0	1	22.60
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Average Power (dBm)
						23230
						782 MHz
LTE Band 13	5	QPSK	1	0	0	23.35
			1	12	0	23.45
			1	24	0	**23.65**
			12	0	1	22.30
			12	7	1	22.30
			12	13	1	22.40
			25	0	1	22.40
		16QAM	1	0	1	22.50
			1	12	1	22.60
			1	24	1	22.90
			12	0	2	21.30
			12	7	2	21.30
			12	13	2	21.40
			25	0	2	21.30

3.3 Test Setup Drawing

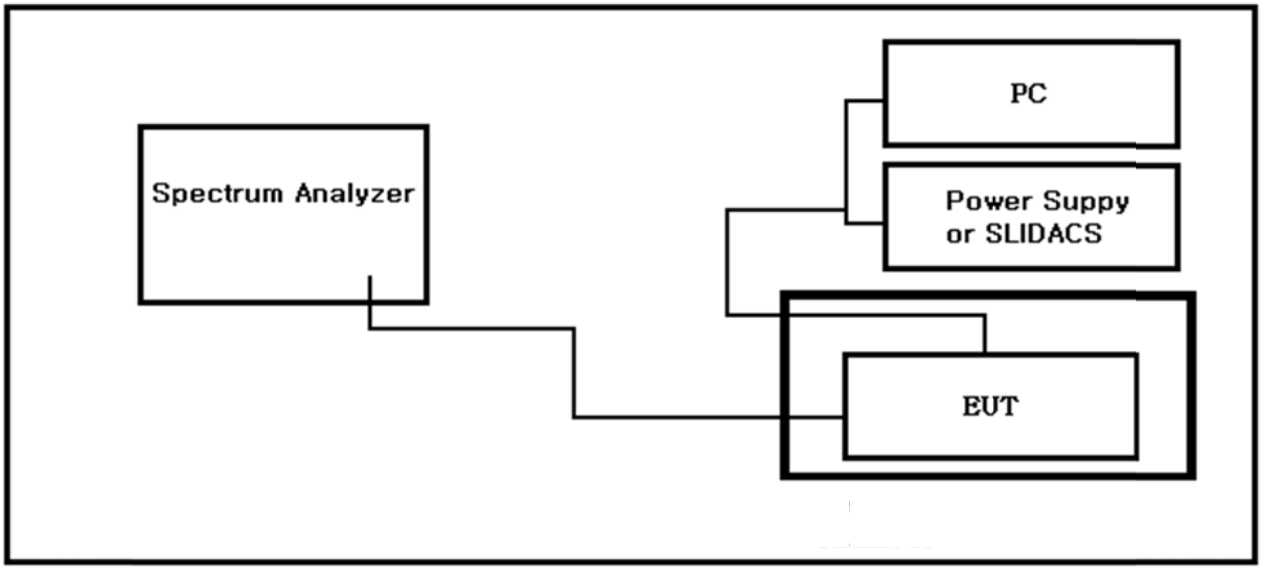
(Radiated Test below 1 GHz)



(Radiated Test above 1 GHz)



(Conducted Test)



3.4 EUT Modifications

Following modifications were implemented on the EUT for fixing the problem caused by EMC testing and the product will have all of the modifications incorporated into the product when manufactured and placed on the market.

- None.

4. ANTENNA REQUIREMENT

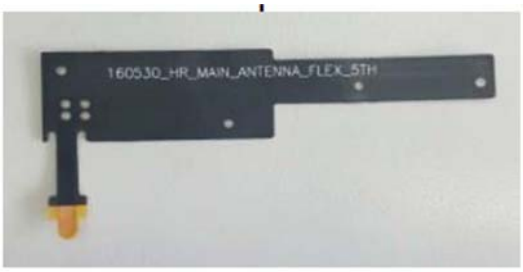
According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section.

4.1 Antenna Description

Frequency Band (MHz)	Antenna Type	Max Peak Gain (dBi)	Connector Type
777 - 787	Flex Antenna	1.56	None
1710 - 1755		3.37	None

4.2 Conclusion

The antenna of the EUT is used a dedicate antenna (Flex type), so the EUT met the requirement.



Main Antenna

Antenna Ground Extension

5. TEST RESULT

5.1 RF Power Output

5.1.1 Limit

The RF Output Power shall be limited at 3 W ERP acc to Part 27, Subpart C Section 27.50 (b)(10), and 1 W EIRP acc. to Section 27.50 (d)(4).

5.1.2 Method of Measurement

Reference to KDB 971168 D01 Power Meas License Digital Systems v02r02 and Part27.50 (d)(6)

The Antenna output of the EUT was connected to a spectrum analyzer directly and the EUT transmitted RF signal continuously..

The cable assembly insertion loss was entered as an offset in the spectrum analyzer to allow for direct reading of power and following procedure was used for the testing.

a) Set span to at least 1.5 times the OBW.

b) Set RBW = (1 - 5) % of the OBW, not to exceed 1 MHz.

c) Set VBW ≥ 3 × RBW.

d) Set number of points in sweep ≥ 2 × span / RBW.

e) Sweep time = auto-couple.

f) Detector = RMS (power averaging).

g) If the EUT can be configured to transmit continuously (i.e., burst duty cycle ≥ 98%), then set the trigger to free run.

h) If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98 %), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.

i) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges.

5.1.3 Test Data for LTE Band 13

Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

5.1.3.1 Bandwidth 5 MHz (QPSK Modulation)

LTE Band 13 (777 MHz ~ 787 MHz)							
RB Size: 1		BW (MHz): 5			Modulation: QPSK		
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	Average ERP (dBm)	Average ERP Limit (dBm)
Middle	782.0	29.45	23.71	5.74	1.21	22.77	34.8

NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.

Average ERP (dBm)= Average Power(dBm) + Antenna Gain(dBi) – 2.15 (dBi)

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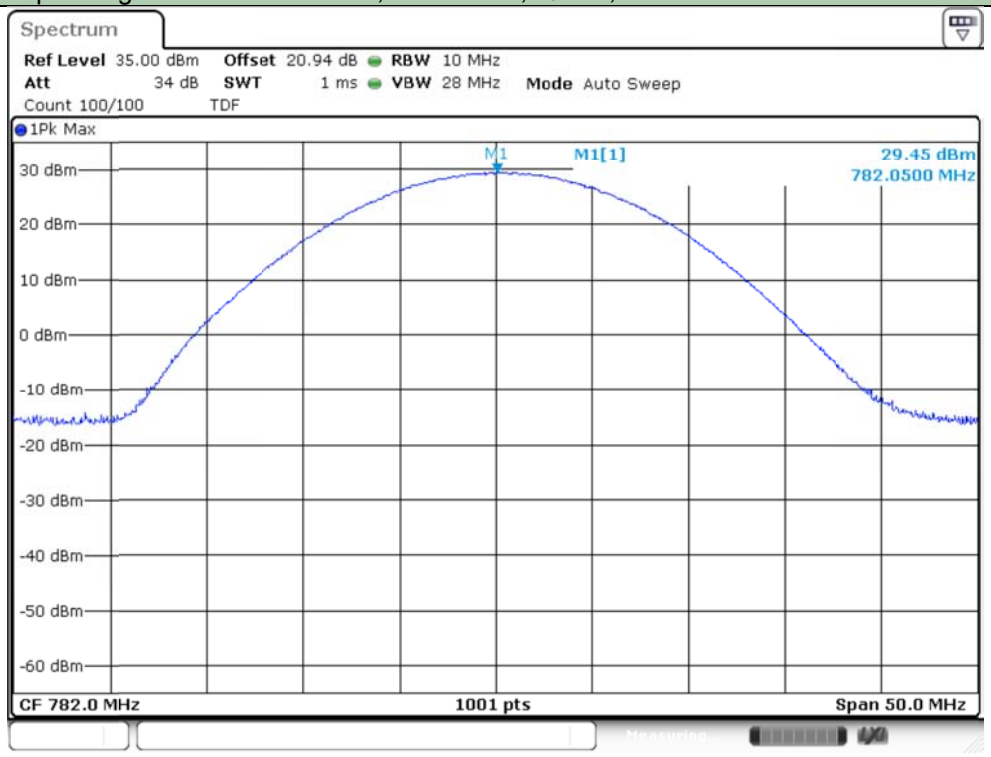
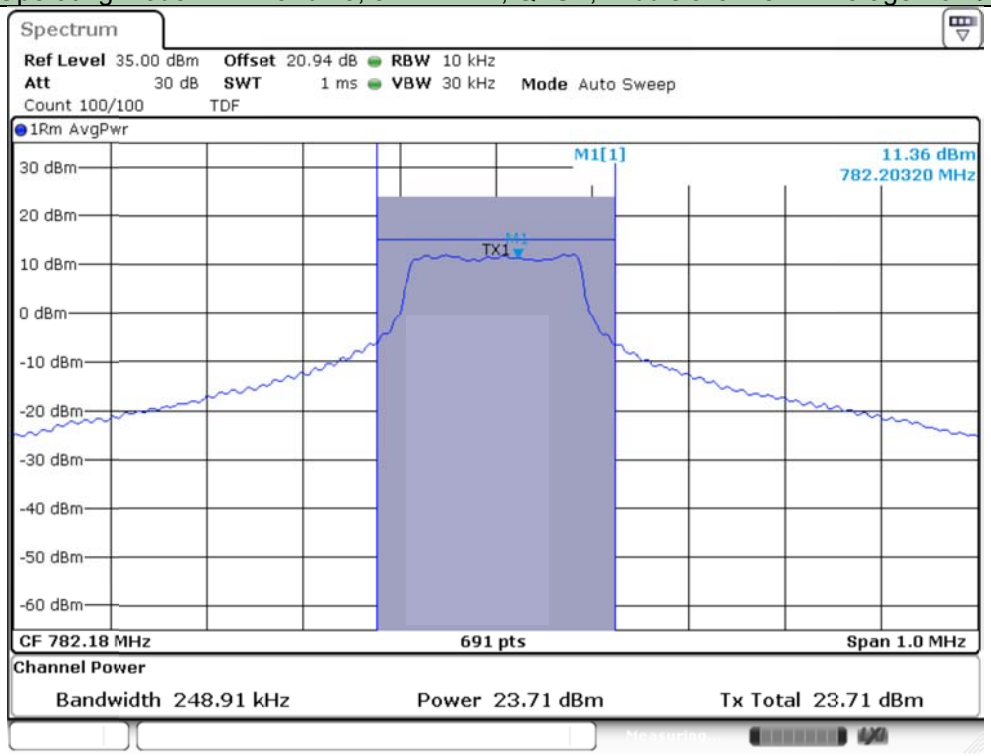
5.1.3.2 Test Plots - Bandwidth 5 MHz (QPSK Modulation)

Operating Mode: LTE Band 13, 5 MHz BW, QPSK, Middle channel – Peak Power



Operating Mode: LTE Band 13, 5 MHz BW, QPSK, Middle channel – Average Power

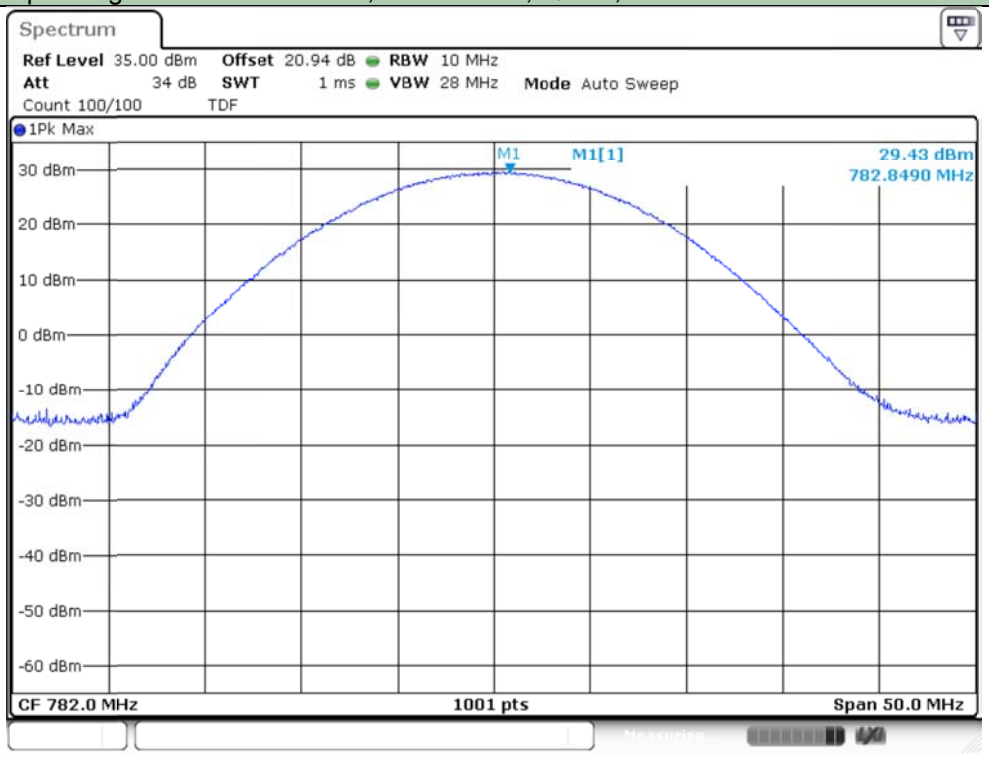


5.1.3.3 Bandwidth 10 MHz (QPSK Modulation)

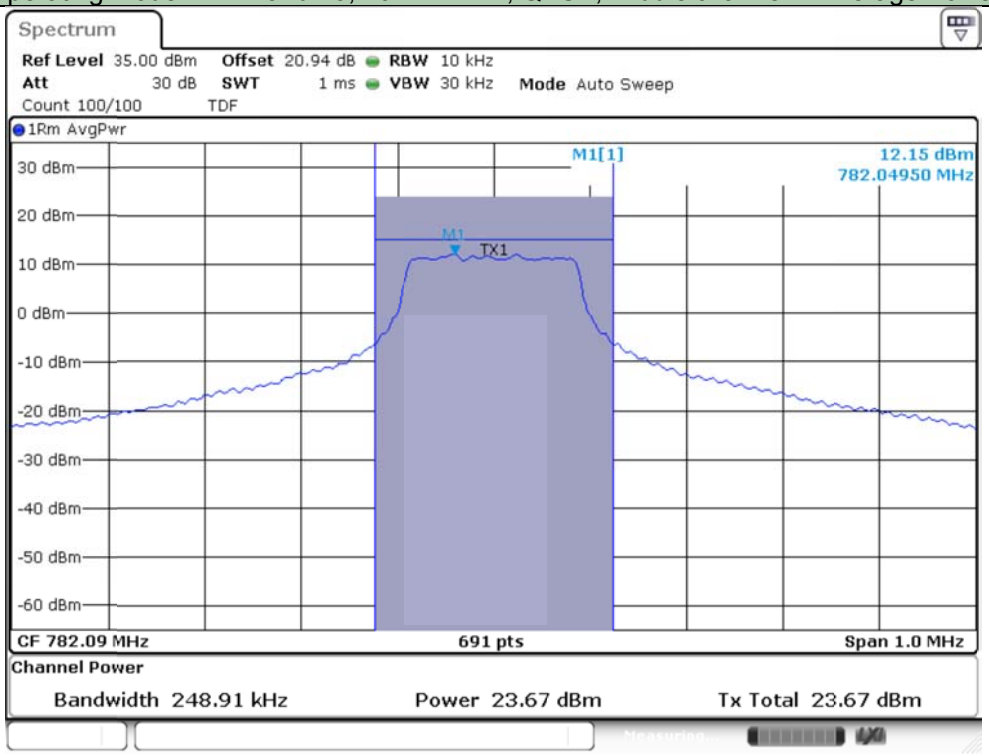
LTE Band 13 (777 MHz ~ 787 MHz)							
RB Size: 1			BW (MHz): 10			Modulation: QPSK	
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	Average ERP (dBm)	Average ERP Limit (dBm)
Middle	782.0	29.43	23.67	5.76	1.21	22.73	34.8
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB. Average ERP (dBm)= Average Power(dBm) + Antenna Gain(dBi) – 2.15 (dBi)							

5.1.3.4 Test Plots - Bandwidth 10 MHz (QPSK Modulation)

Operating Mode: LTE Band 13, 10 MHz BW, QPSK, Middle channel – Peak Power



Operating Mode: LTE Band 13, 10 MHz BW, QPSK, Middle channel – Average Power

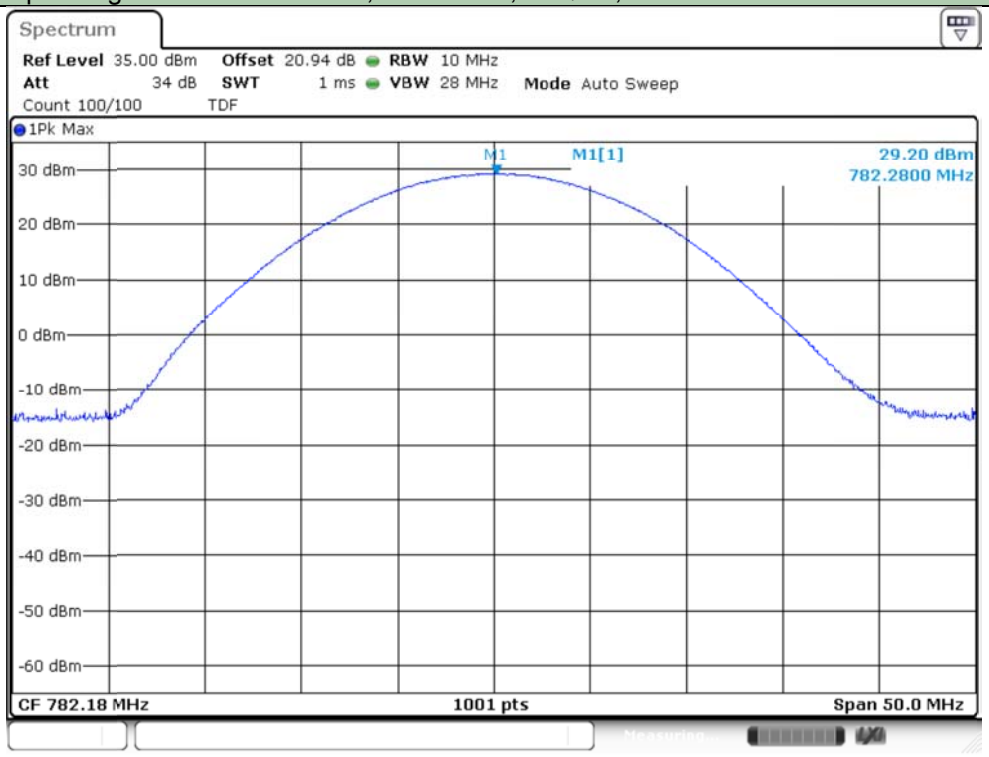


5.1.3.5 Bandwidth 5 MHz (16QAM Modulation)

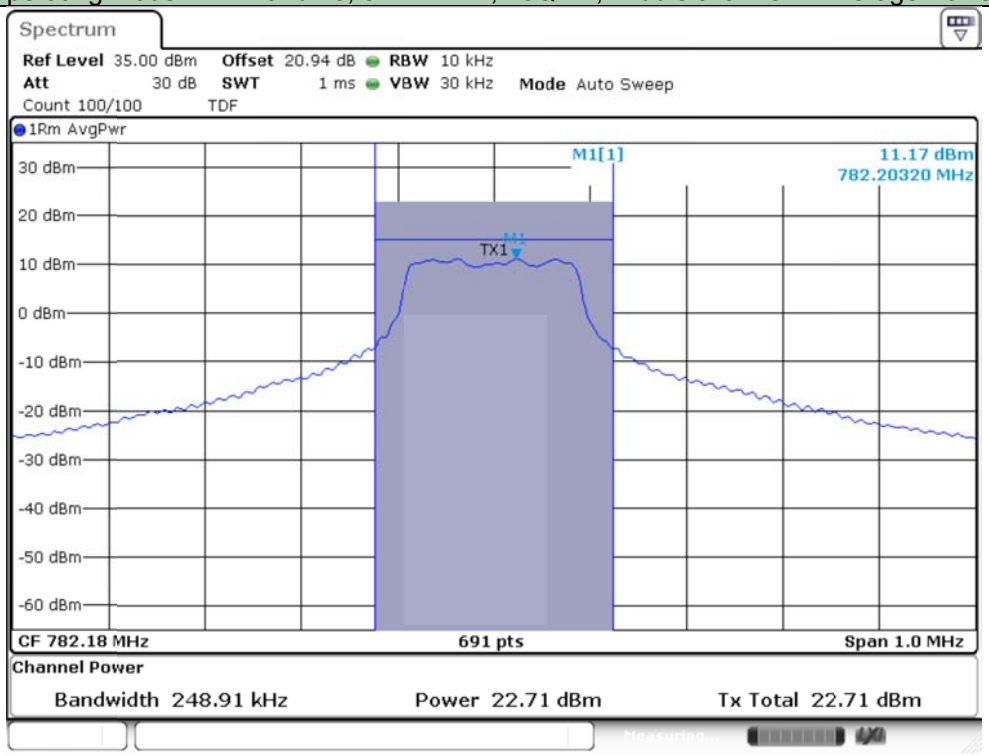
LTE Band 13 (777 MHz ~ 787 MHz)							
RB Size: 1			BW (MHz): 5			Modulation: 16QAM	
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	Average ERP (dBm)	Average ERP Limit (dBm)
Middle	782.0	29.20	22.71	6.49	1.21	21.77	34.8
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB. Average ERP (dBm)= Average Power(dBm) + Antenna Gain(dBi) – 2.15 (dBi)							

5.1.3.6 Test Plots - Bandwidth 5 MHz (16QAM Modulation)

Operating Mode: LTE Band 13, 5 MHz BW, 16QAM, Middle channel – Peak Power



Operating Mode: LTE Band 13, 5 MHz BW, 16QAM, Middle channel – Average Power



5.1.4 Test Data for LTE Band 4

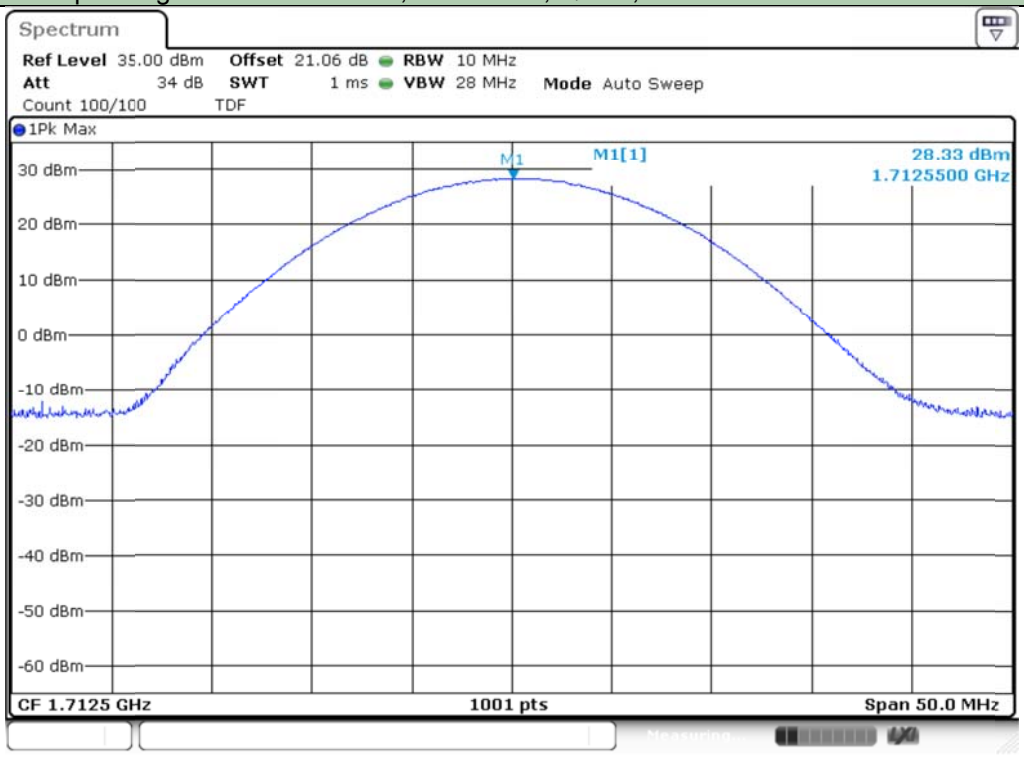
Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

5.1.4.1 Bandwidth 5 MHz (QPSK Modulation)

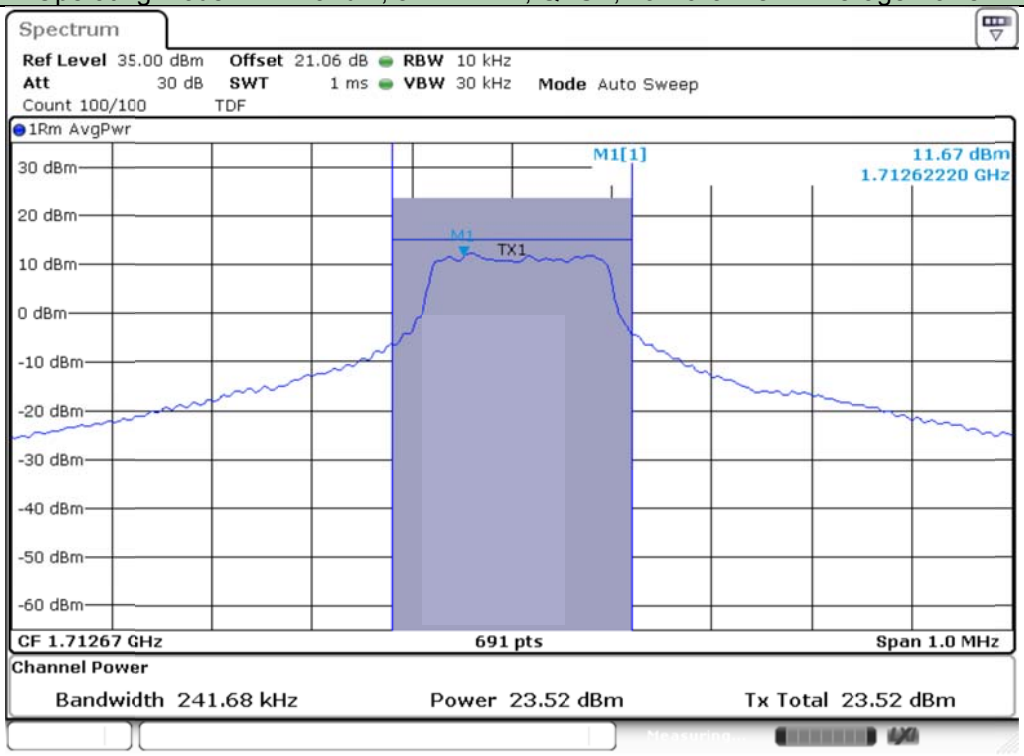
LTE Band 4 (1 710 MHz ~ 1 755 MHz)							
RB Size: 1		BW (MHz): 5			Modulation: QPSK		
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	EIRP Average (dBm)	EIRP Average Limit(dBm)
Low	1712.5	28.33	23.52	4.81	2.80	26.32	30.0
Middle	1732.5	29.02	23.13	5.89	3.04	26.17	30.0
High	1752.5	28.33	23.55	4.78	3.37	26.92	30.0
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.							

5.1.4.2 Test Plots - Bandwidth 5 MHz (QPSK Modulation)

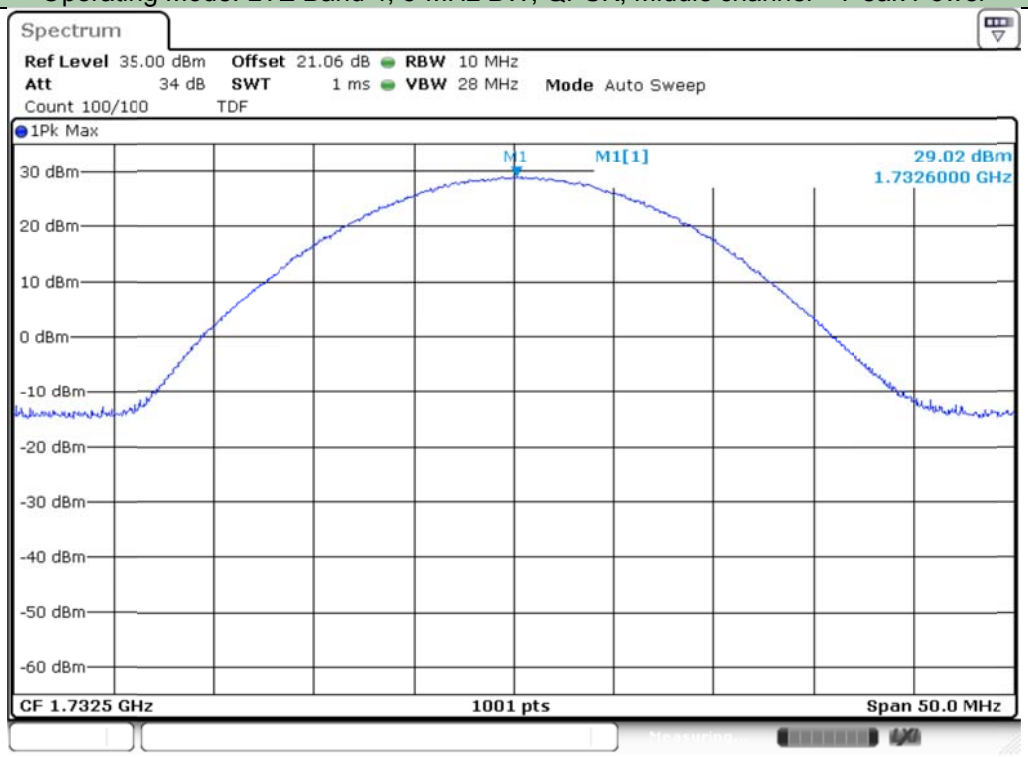
Operating Mode: LTE Band 4, 5 MHz BW, QPSK, Low channel – Peak Power



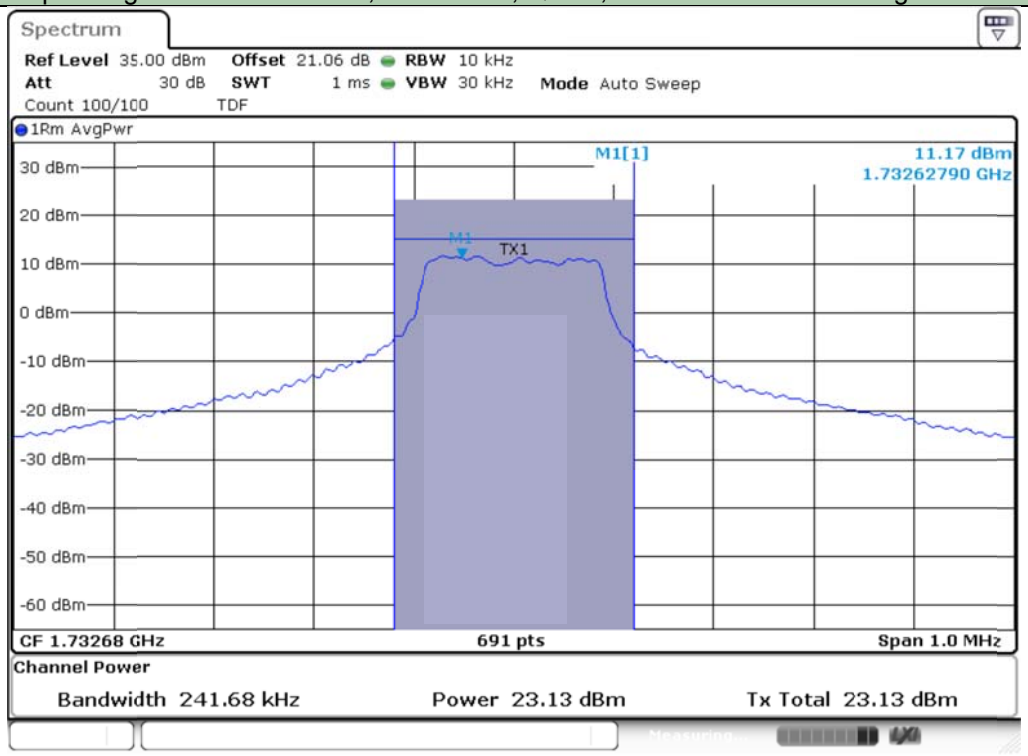
Operating Mode: LTE Band 4, 5 MHz BW, QPSK, Low channel – Average Power



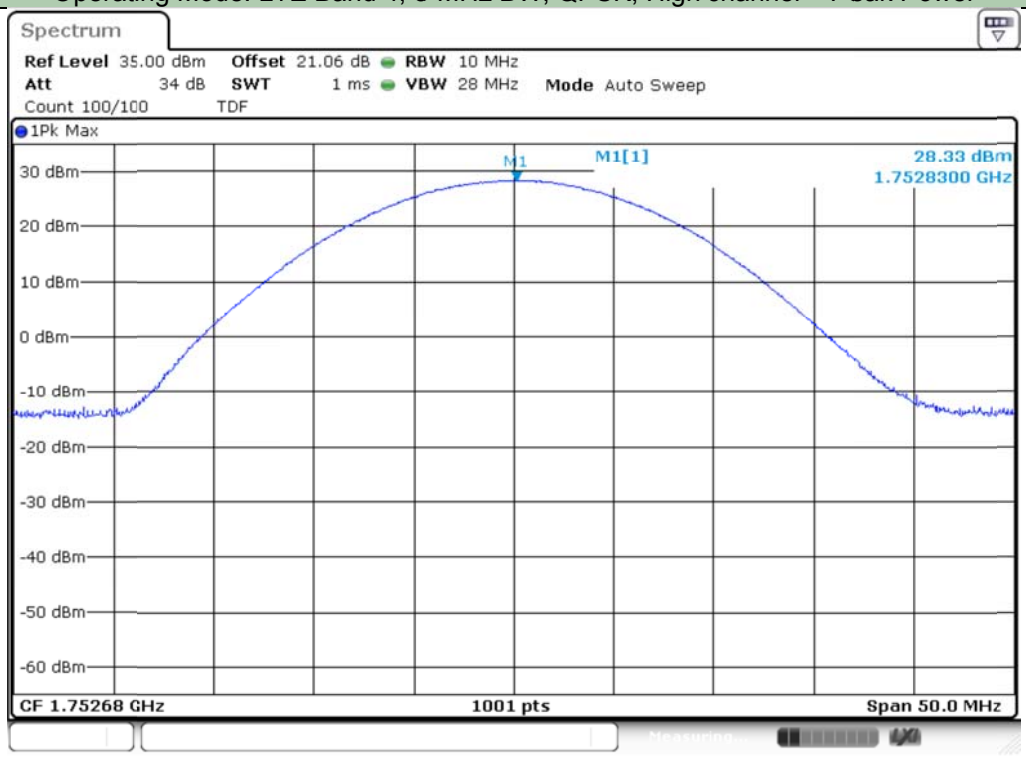
Operating Mode: LTE Band 4, 5 MHz BW, QPSK, Middle channel – Peak Power



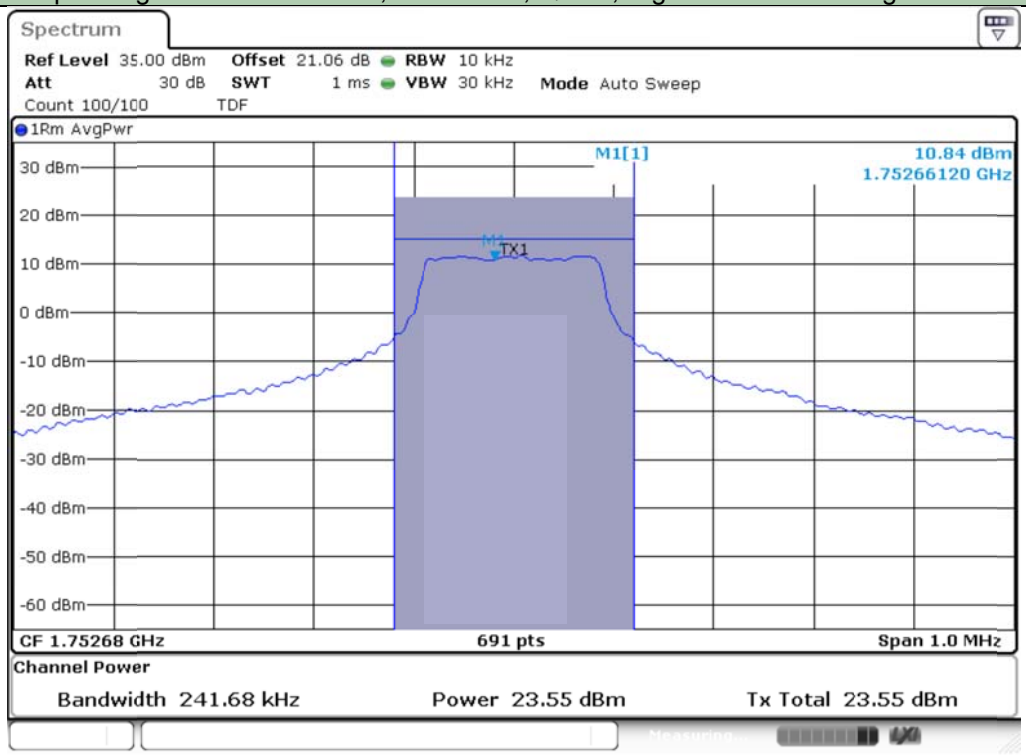
Operating Mode: LTE Band 4, 5 MHz BW, QPSK, Middle channel – Average Power



Operating Mode: LTE Band 4, 5 MHz BW, QPSK, High channel – Peak Power



Operating Mode: LTE Band 4, 5 MHz BW, QPSK, High channel – Average Power

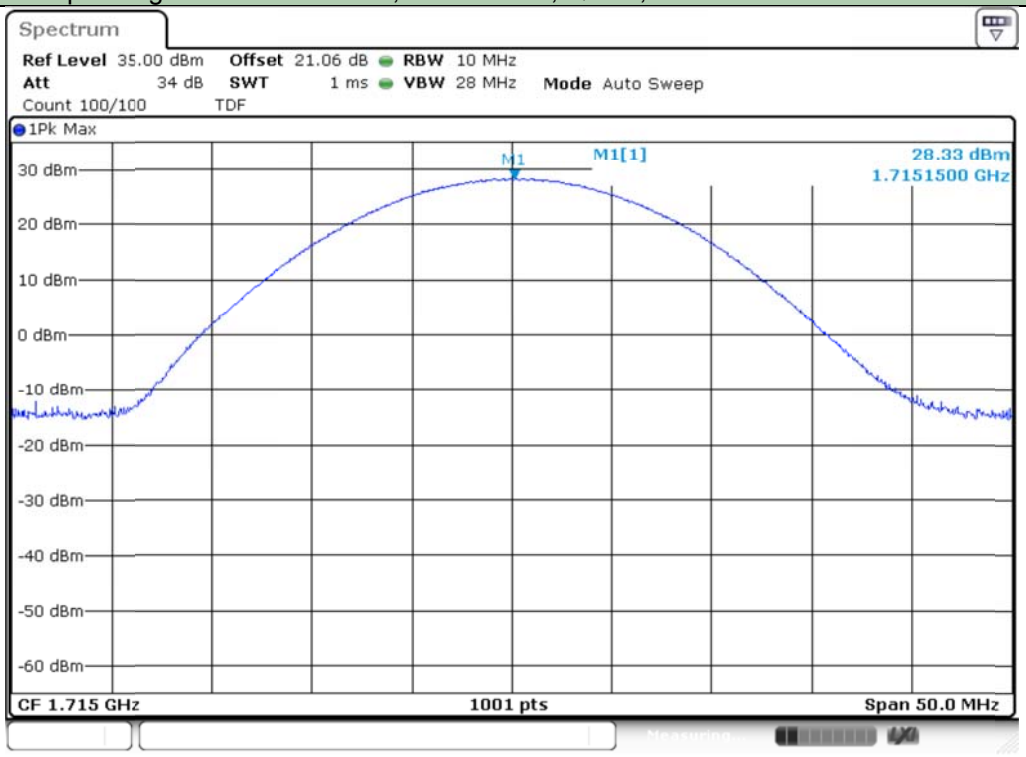


5.1.4.3 Bandwidth 10 MHz (QPSK Modulation)

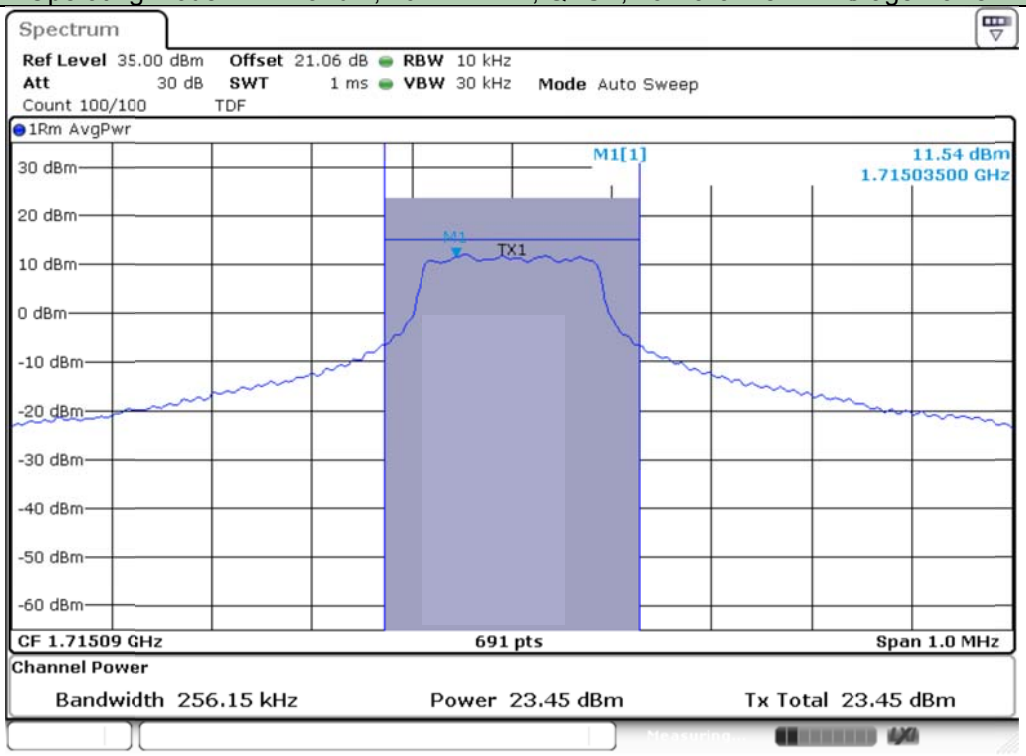
LTE Band 4 (1 710 MHz ~ 1 755 MHz)							
RB Size: 1			BW (MHz): 10			Modulation: QPSK	
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	EIRP Average (dBm)	EIRP Average Limit(dBm)
Low	1715.0	28.33	23.45	4.88	2.80	26.25	30.0
Middle	1732.5	28.89	23.02	5.87	3.04	26.06	30.0
High	1750.0	28.39	23.87	4.52	3.37	27.24	30.0
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.							

5.1.4.4 Test Plots - Bandwidth 10 MHz (QPSK Modulation)

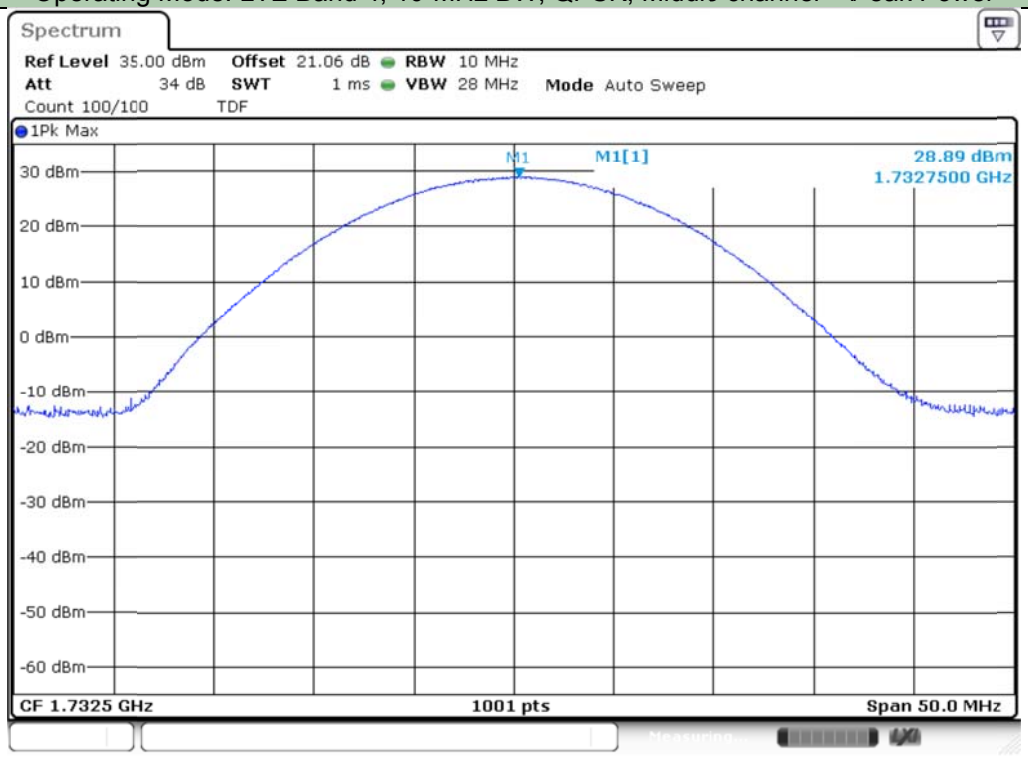
Operating Mode: LTE Band 4, 10 MHz BW, QPSK, Low channel – Peak Power



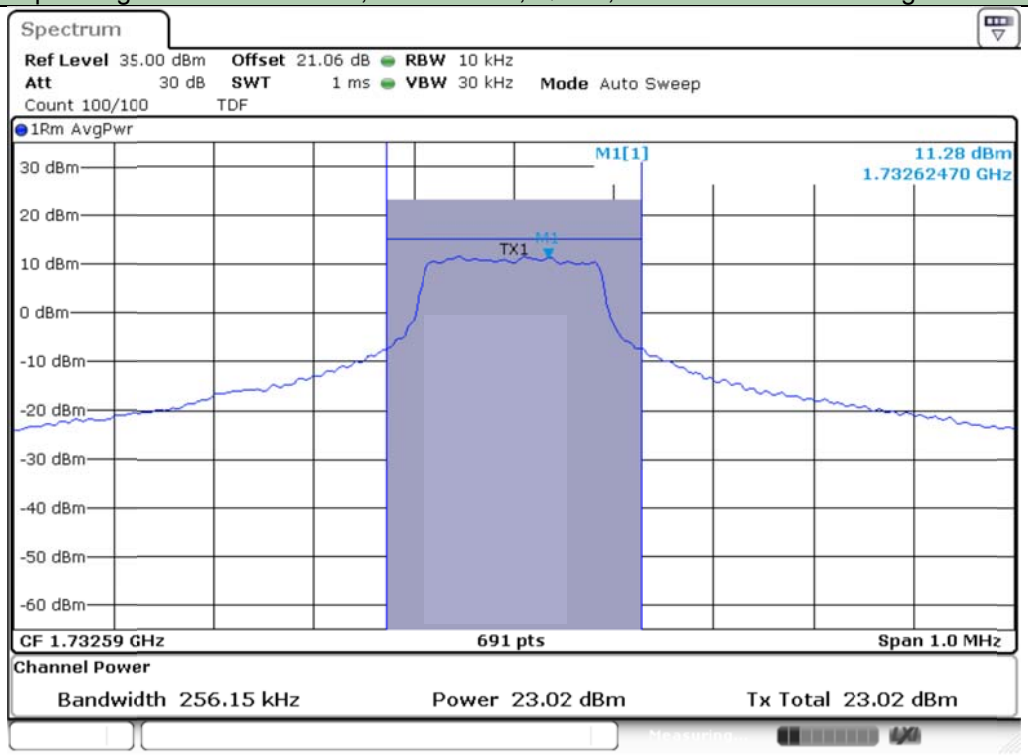
Operating Mode: LTE Band 4, 10 MHz BW, QPSK, Low channel – Average Power



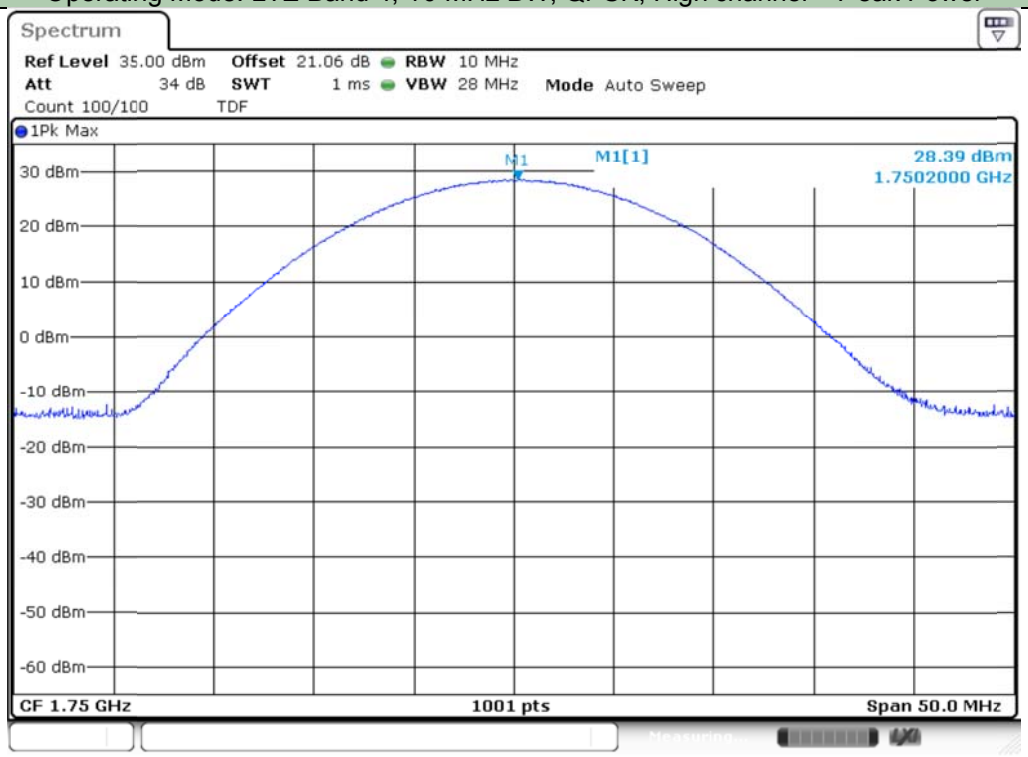
Operating Mode: LTE Band 4, 10 MHz BW, QPSK, Middle channel – Peak Power



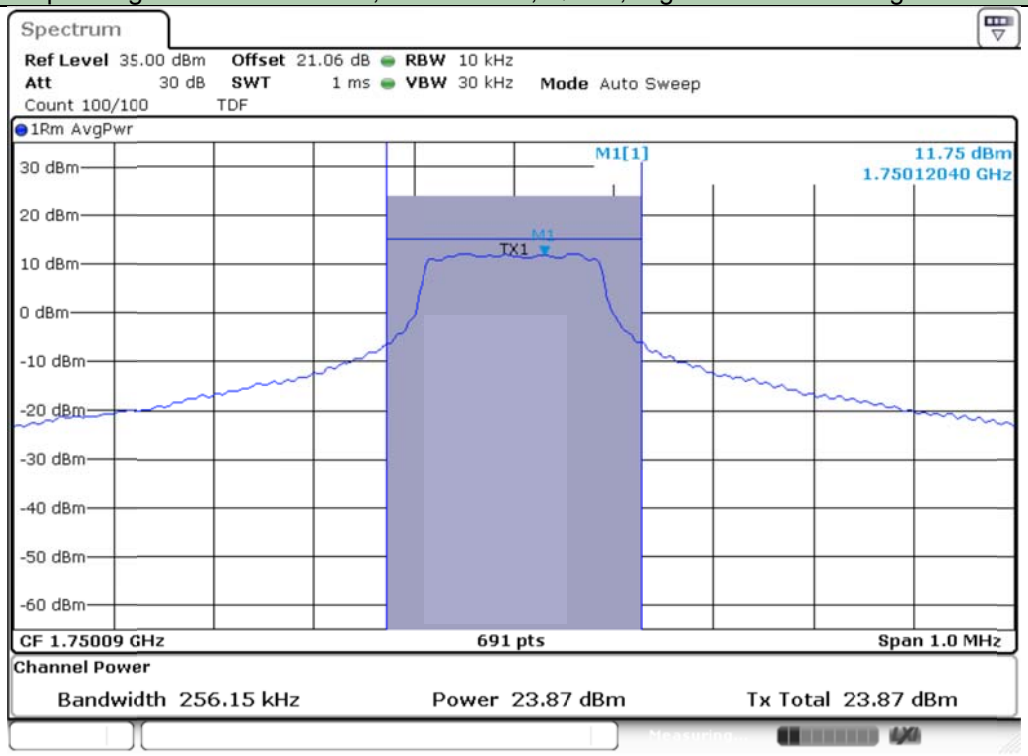
Operating Mode: LTE Band 4, 10 MHz BW, QPSK, Middle channel – Average Power



Operating Mode: LTE Band 4, 10 MHz BW, QPSK, High channel – Peak Power



Operating Mode: LTE Band 4, 10 MHz BW, QPSK, High channel – Average Power

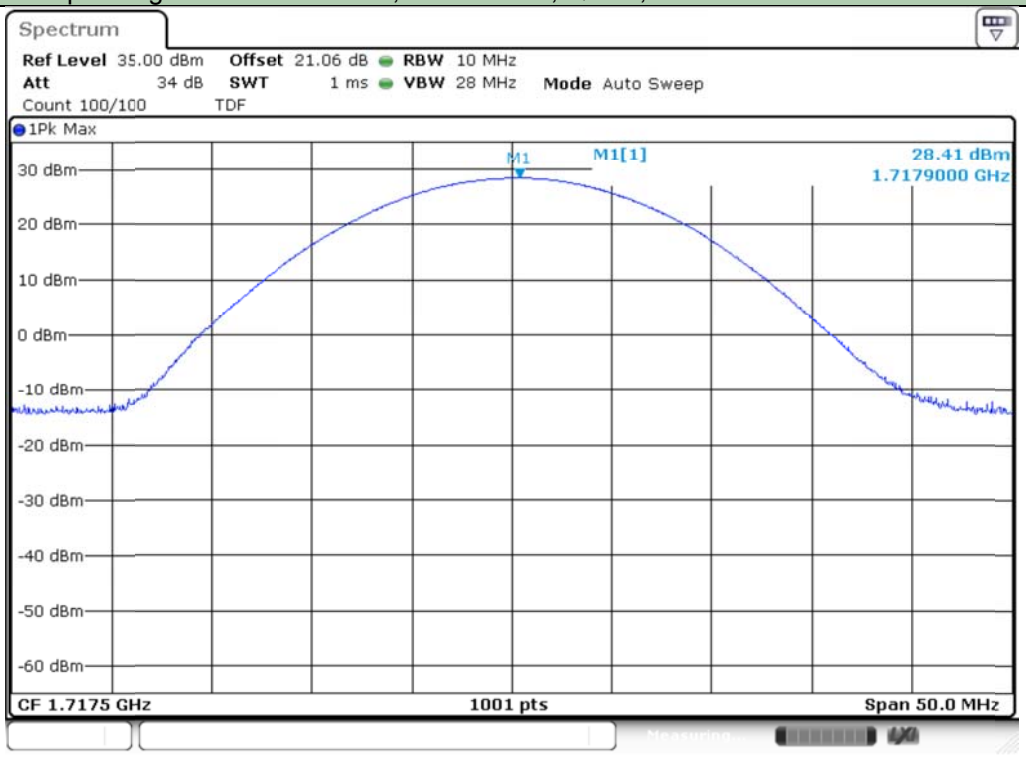


5.1.4.5 Bandwidth 15 MHz (QPSK Modulation)

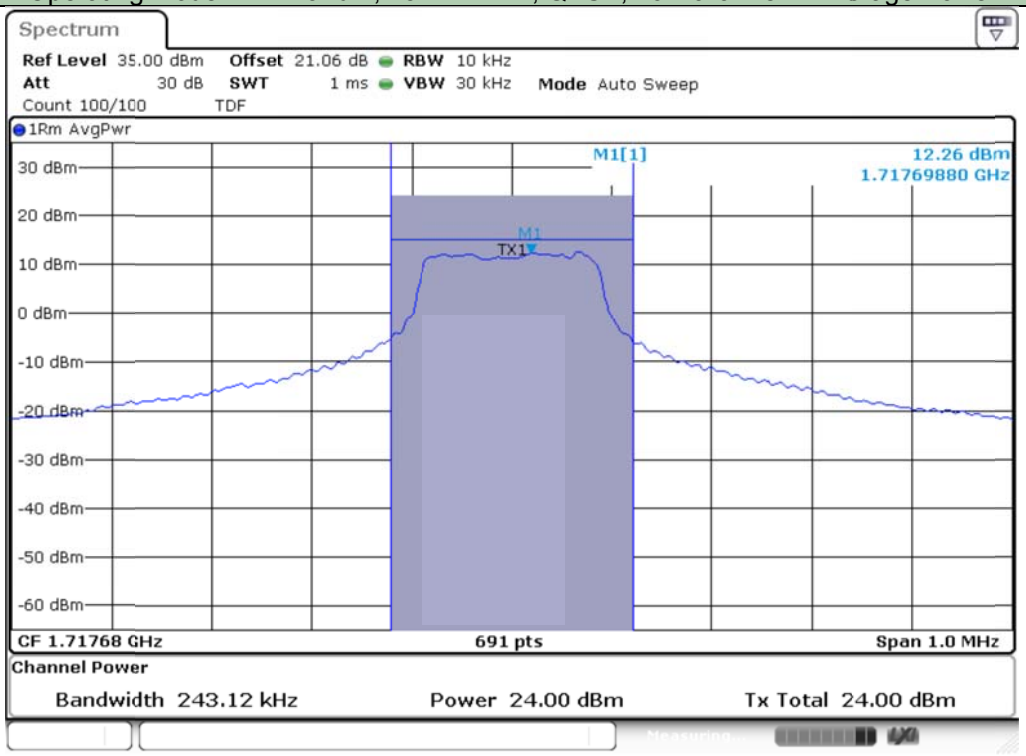
LTE Band 4 (1 710 MHz ~ 1 755 MHz)							
RB Size: 1			BW (MHz): 15			Modulation: QPSK	
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	EIRP Average (dBm)	EIRP Average Limit(dBm)
Low	1717.5	28.41	24.00	4.41	2.80	26.80	30.0
Middle	1732.5	28.88	23.86	5.02	3.04	26.90	30.0
High	1747.5	28.78	24.36	4.42	3.37	27.73	30.0
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.							

5.1.4.6 Test Plots - Bandwidth 15 MHz (QPSK Modulation)

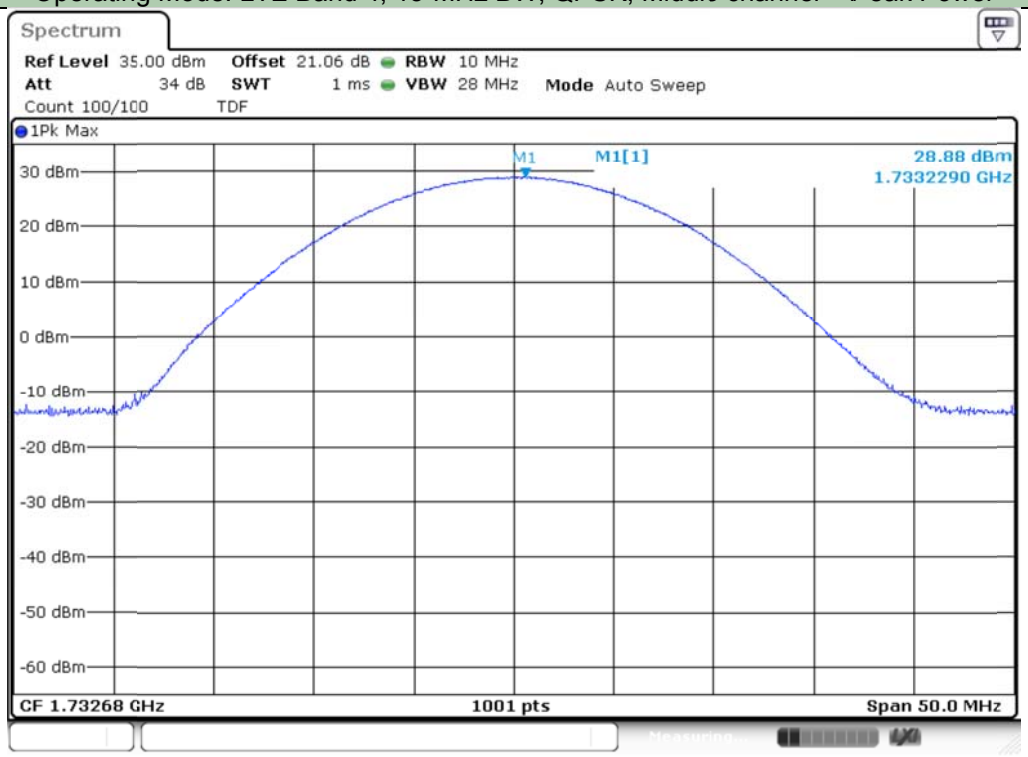
Operating Mode: LTE Band 4, 15 MHz BW, QPSK, Low channel – Peak Power



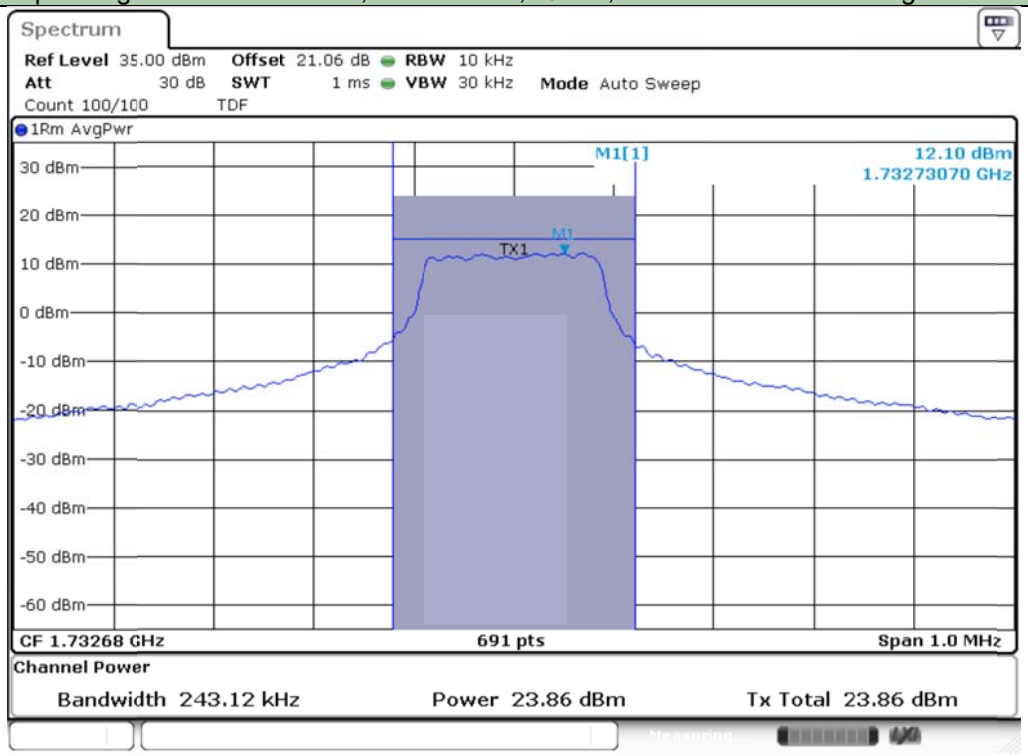
Operating Mode: LTE Band 4, 15 MHz BW, QPSK, Low channel – Average Power



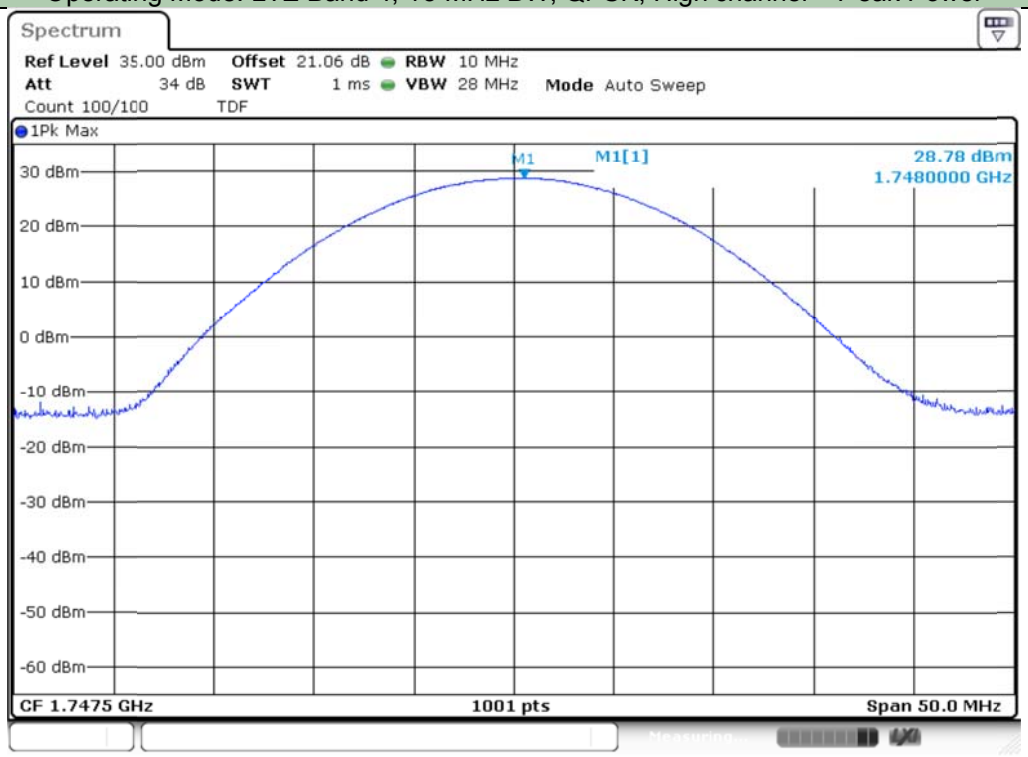
Operating Mode: LTE Band 4, 15 MHz BW, QPSK, Middle channel – Peak Power



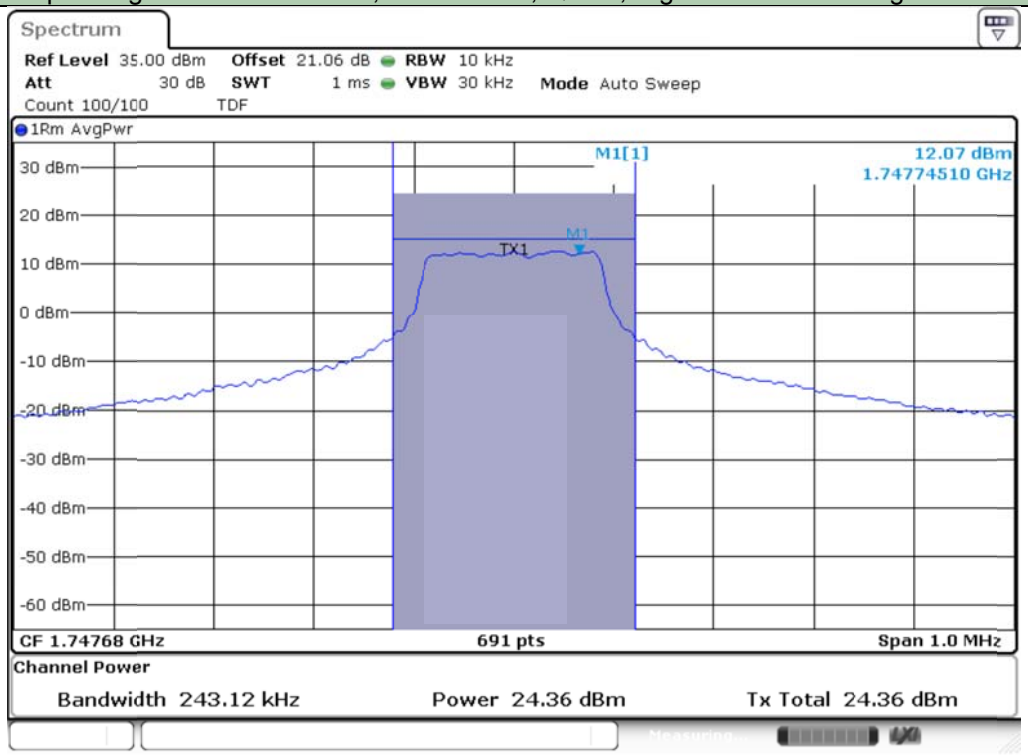
Operating Mode: LTE Band 4, 15 MHz BW, QPSK, Middle channel – Average Power



Operating Mode: LTE Band 4, 15 MHz BW, QPSK, High channel – Peak Power



Operating Mode: LTE Band 4, 15 MHz BW, QPSK, High channel – Average Power

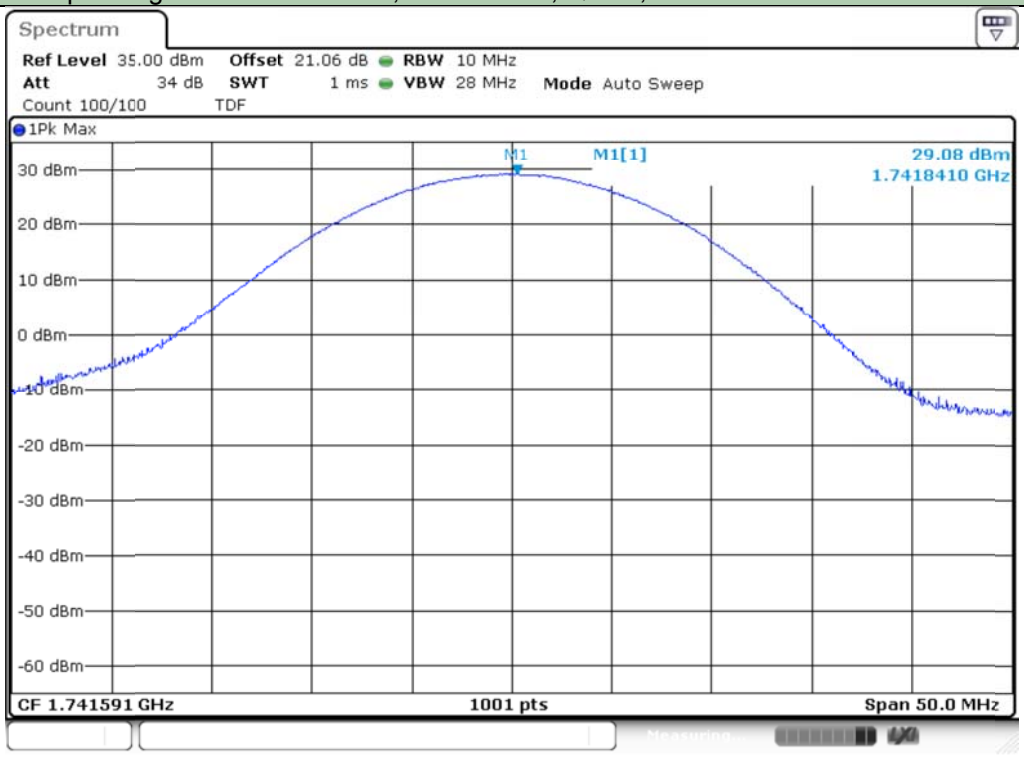


5.1.4.7 Bandwidth 20 MHz (QPSK Modulation)

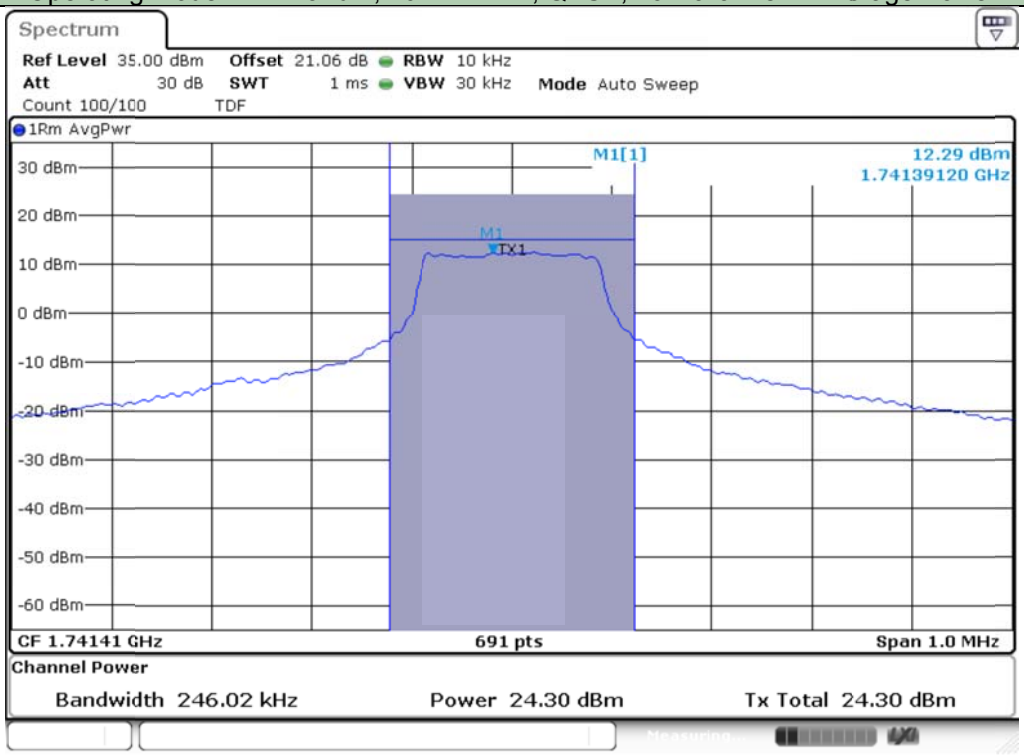
LTE Band 4 (1 710 MHz ~ 1 755 MHz)							
RB Size: 1			BW (MHz): 20			Modulation: QPSK	
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	EIRP Average (dBm)	EIRP Average Limit(dBm)
Middle	1732.5	29.08	24.30	4.78	3.04	27.34	30.0
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.							

5.1.4.8 Test Plots - Bandwidth 20 MHz (QPSK Modulation)

Operating Mode: LTE Band 4, 20 MHz BW, QPSK, Low channel – Peak Power



Operating Mode: LTE Band 4, 20 MHz BW, QPSK, Low channel – Average Power

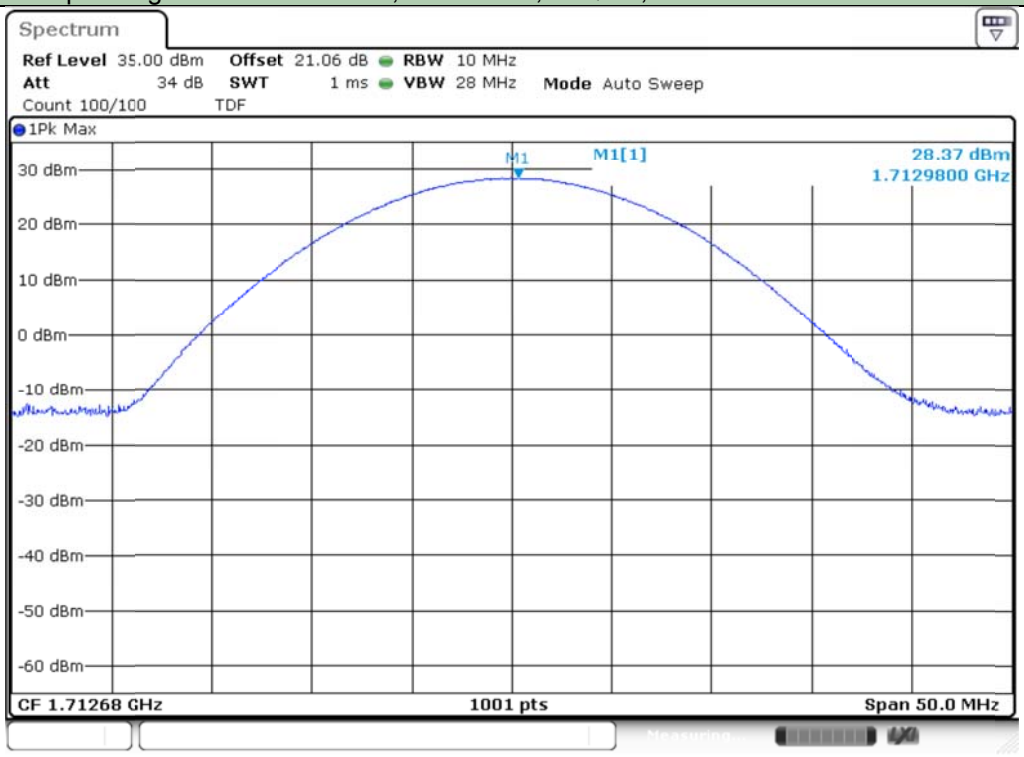


5.1.4.9 Test Data - Bandwidth 5 MHz (16QAM Modulation)

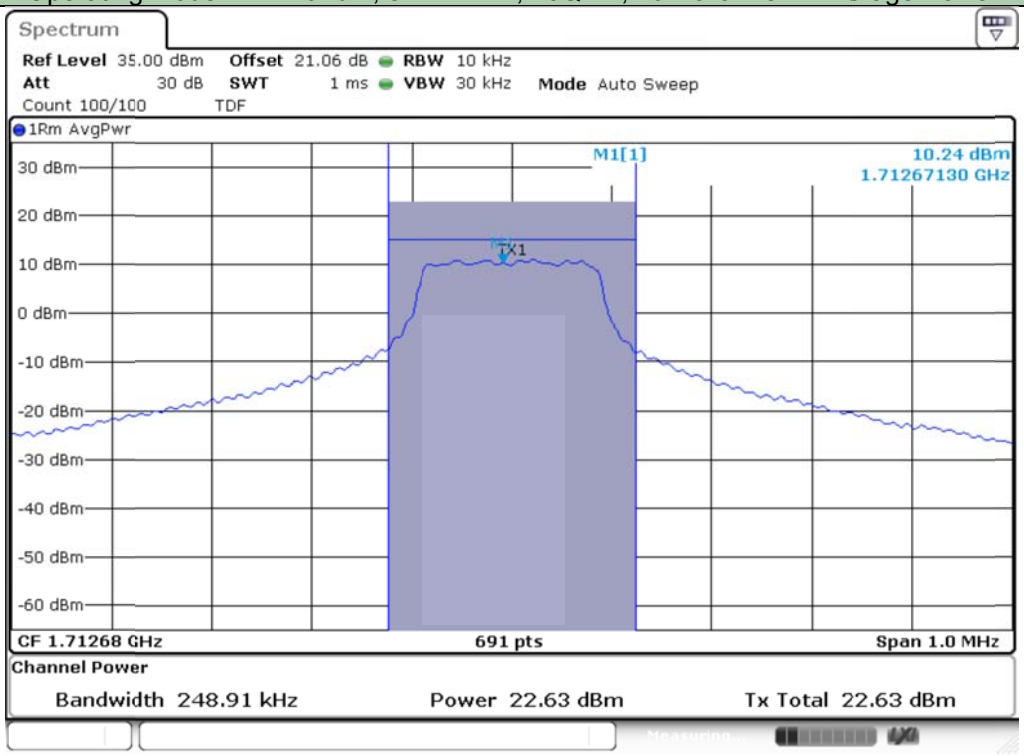
LTE Band 4 (1 710 MHz ~ 1 755 MHz)							
RB Size: 1			BW (MHz): 5		Modulation: 16QAM		
Channel	Freq. (MHz)	Peak Power (dBm)	Average Power (dBm)	PAR	Antenna Gain (dBi)	EIRP Average (dBm)	EIRP Average Limit(dBm)
Low	1712.5	28.37	22.63	5.74	2.80	25.43	30.0
Middle	1732.5	28.89	22.25	6.64	3.04	25.29	30.0
High	1752.5	28.38	22.55	5.83	3.37	25.92	30.0
NOTE: PAR (Peak-to-Average Ratio) may not exceed 13 dB.							

5.1.4.10 Test Plots - Bandwidth 5 MHz (16QAM Modulation)

Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, Low channel – Peak Power

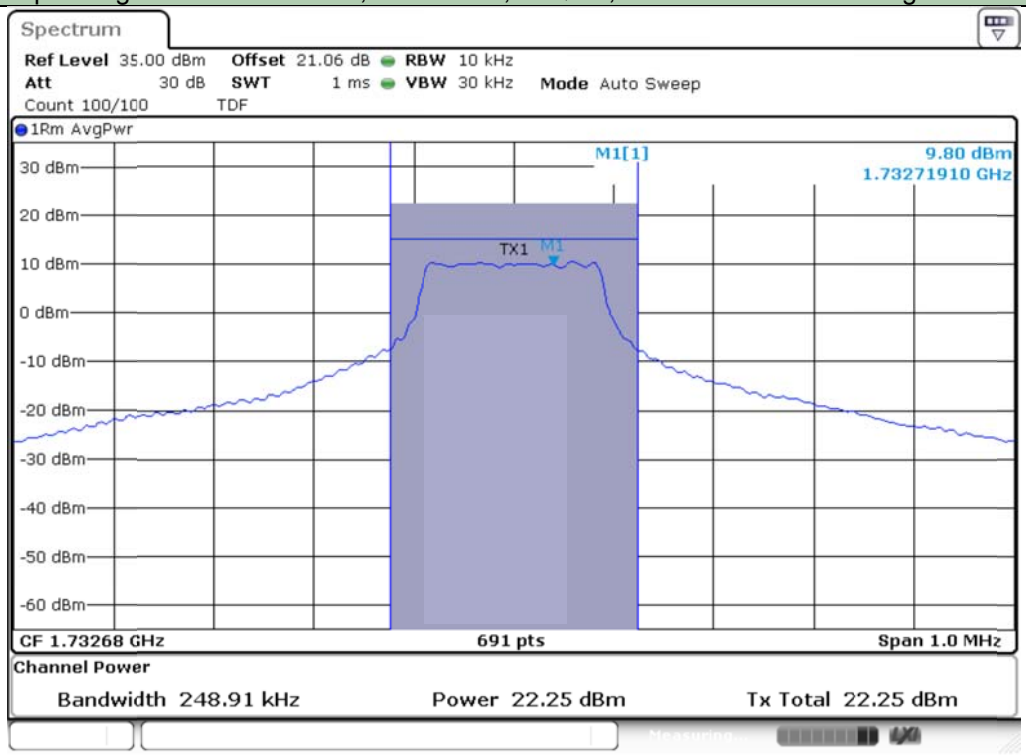


Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, Low channel – Average Power

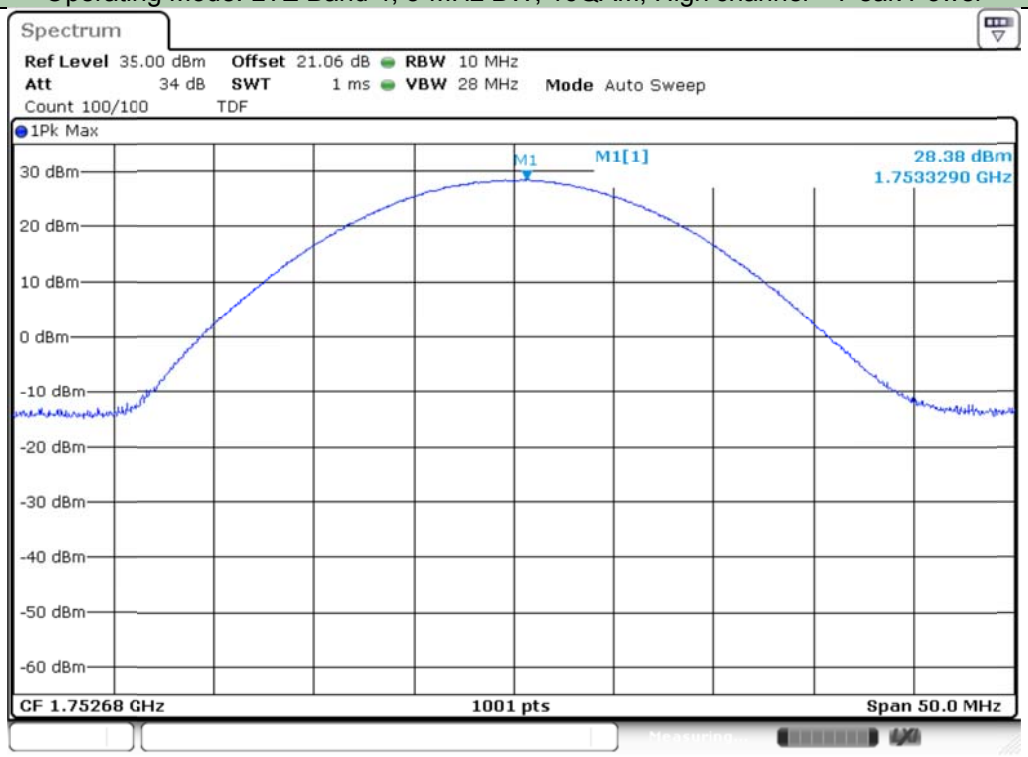


Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, Middle channel – Peak Power

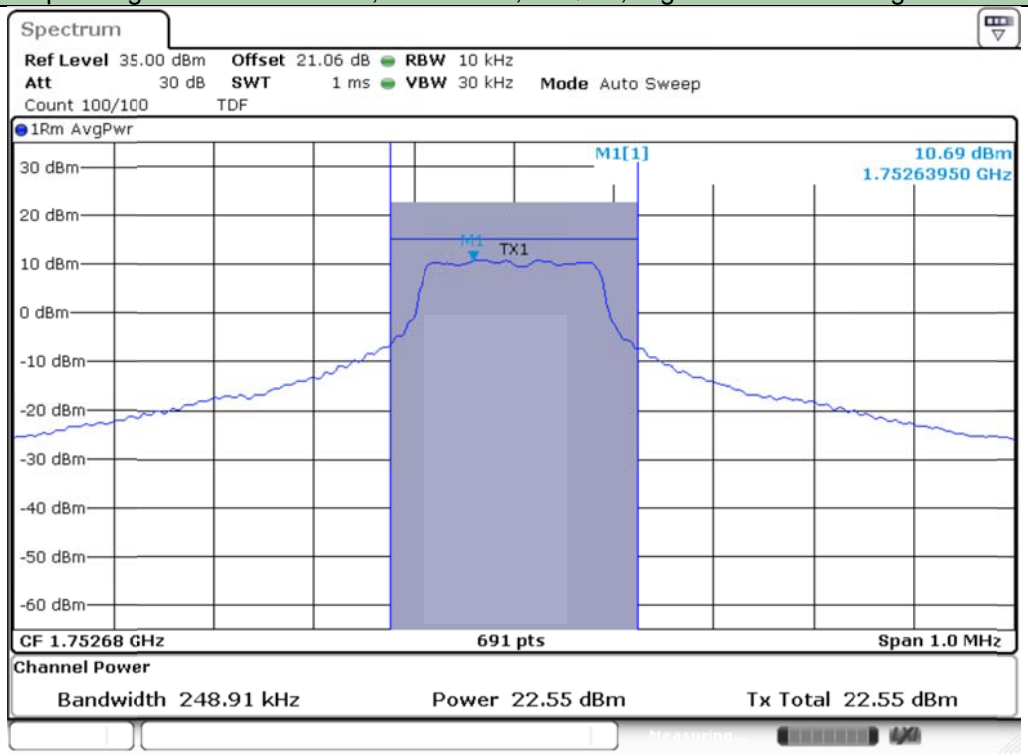
Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, Middle channel – Average Power



Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, High channel – Peak Power



Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, High channel – Average Power



5.2 Peak-to-Average Ratio

5.2.1 Limit

The Peak-to-Average ratio (PAR) may not exceed 13 dB acc. to Part 27 Subpart C Section Part 27.50(d)(5)

5.2.2 Method of Measurement

Power measurements for transmissions by the EUT may be made either in accordance with a Commission-approved average power technique or peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

5.2.3 Test Data

Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song
NOTE: Test results are contained in the table of the RF Output Power under column 'PAR'			

5.3 Occupied Bandwidth

5.3.1 Limit

The channel bandwidth shall be equal to or greater than 1 MHz

5.3.2 Method of Measurement

Reference to KDB 971168 D01 Power Meas License Digital Systems v02r02 section 4.

Section 4.1 for 26 dB bandwidth and Section 4.2 for 99 % OBW

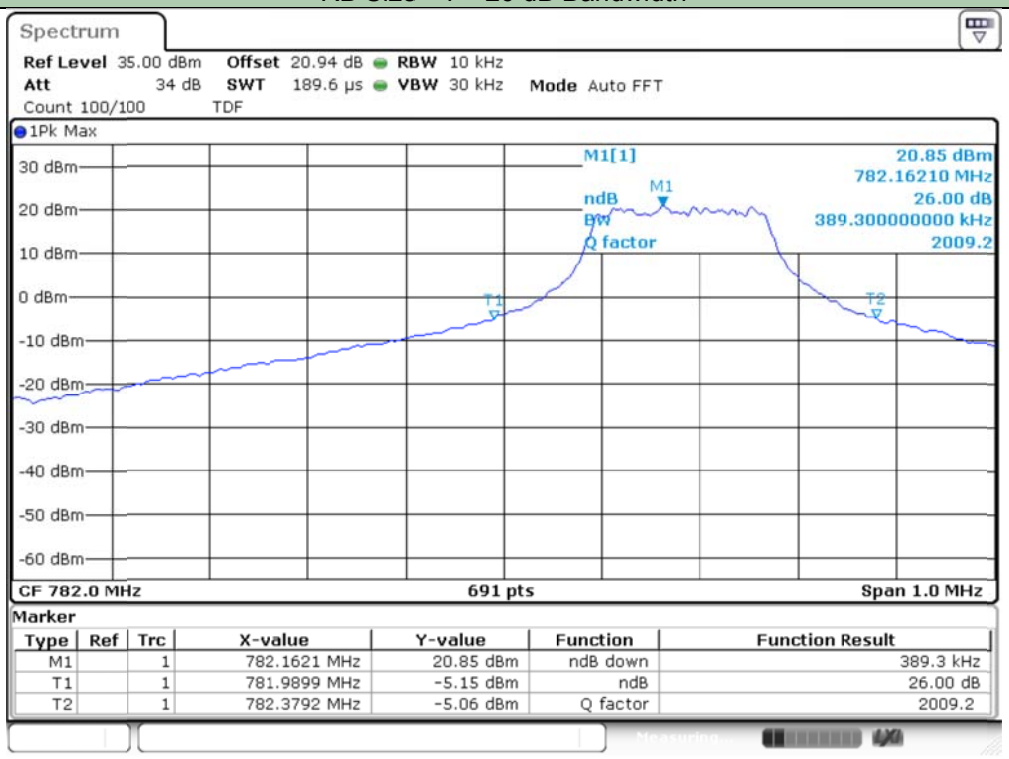
5.3.3 Test Data for LTE Band 13

Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

LTE Band 13 (777 MHz ~ 787 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	5	782.0	0.389	0.249
25		782.0	6.049	4.616
LTE Band 13 (777 MHz ~ 787 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	10	782.0	0.408	0.249
50		782.0	10.854	8.973
LTE Band 13 (777 MHz ~ 787 MHz), Modulation: 16QAM				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	5	782.0	0.408	0.249
25		782.0	6.020	4.616

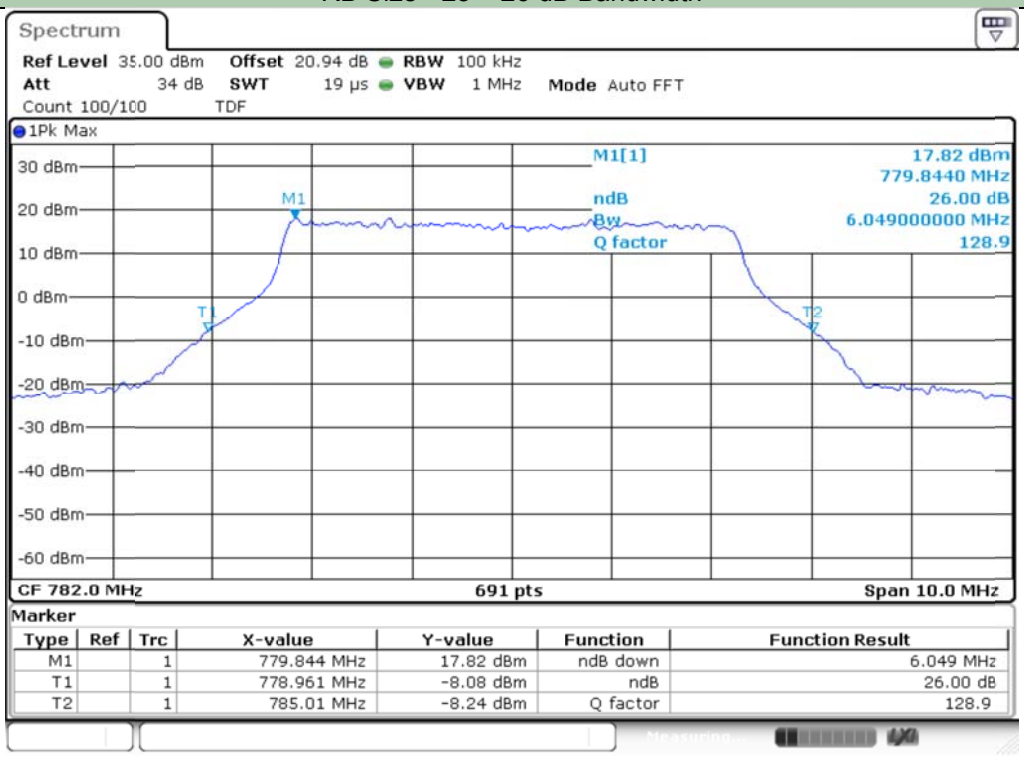
5.3.3.1 Test Plots - Bandwidth 5 MHz (QPSK Modulation)

RB Size= 1 – 26 dB Bandwidth

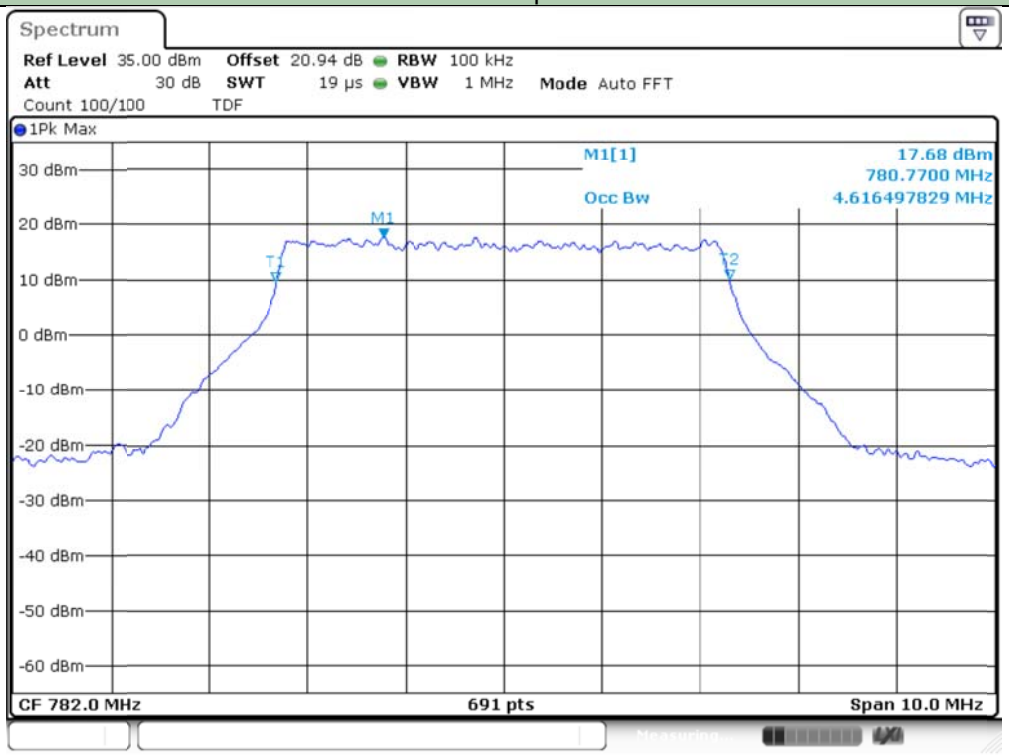


RB Size= 1 – Occupied Bandwidth

RB Size= 25 – 26 dB Bandwidth

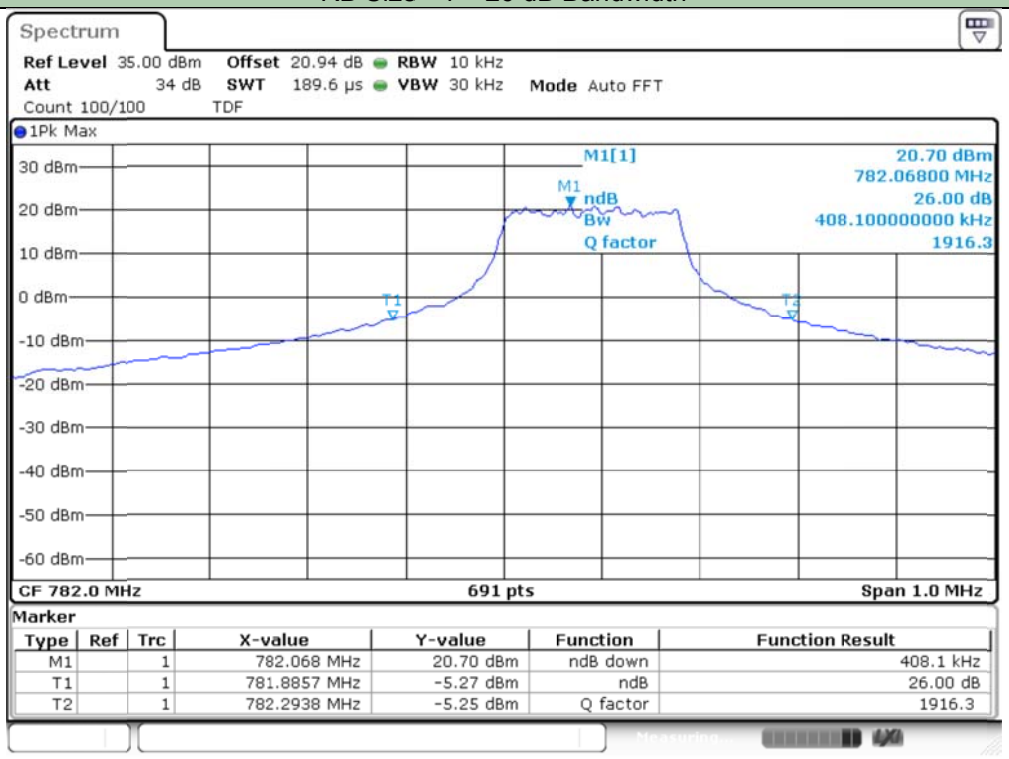


RB Size= 25 – Occupied Bandwidth

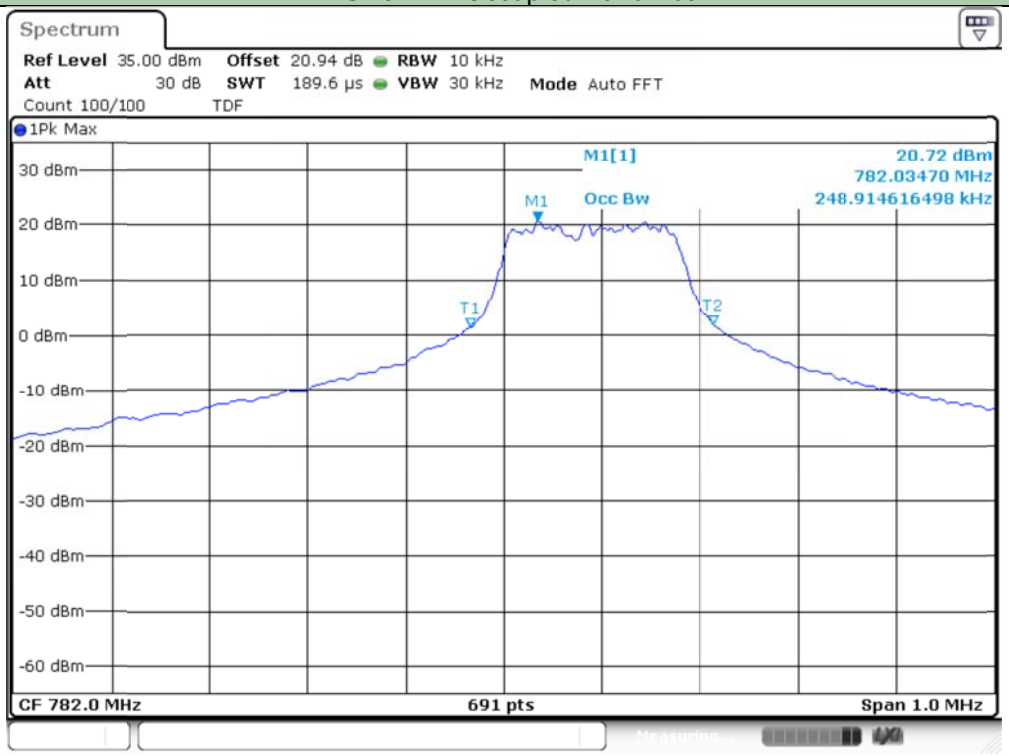


5.3.3.2 Test Plots - Bandwidth 10 MHz (QPSK Modulation)

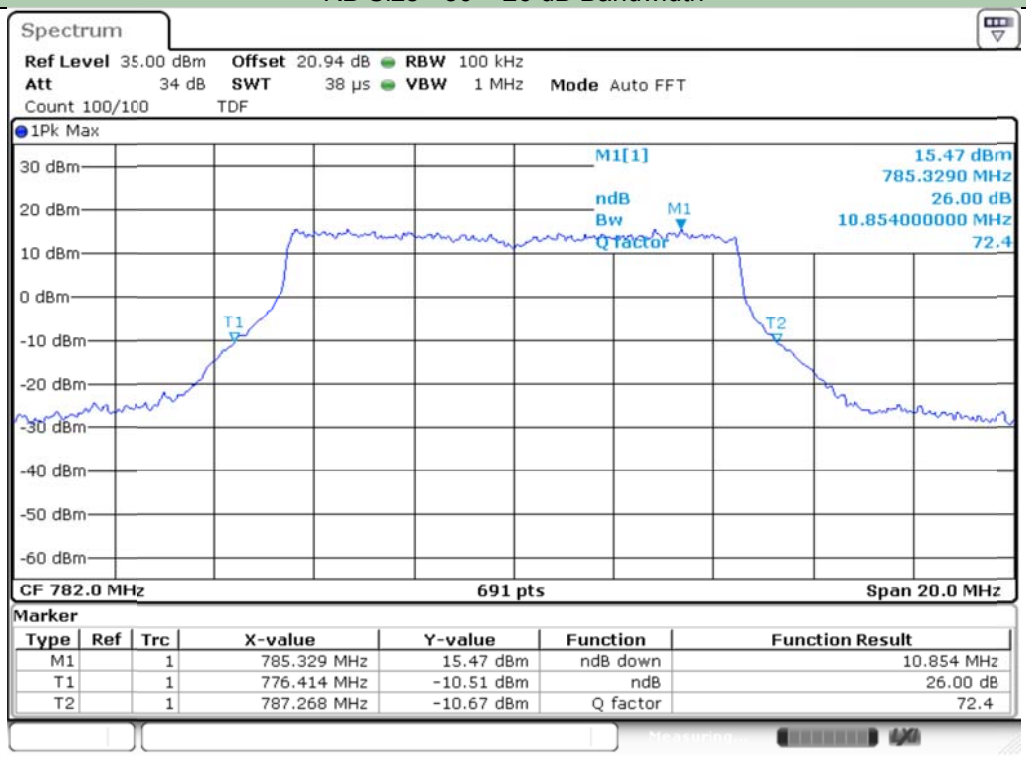
RB Size= 1 – 26 dB Bandwidth



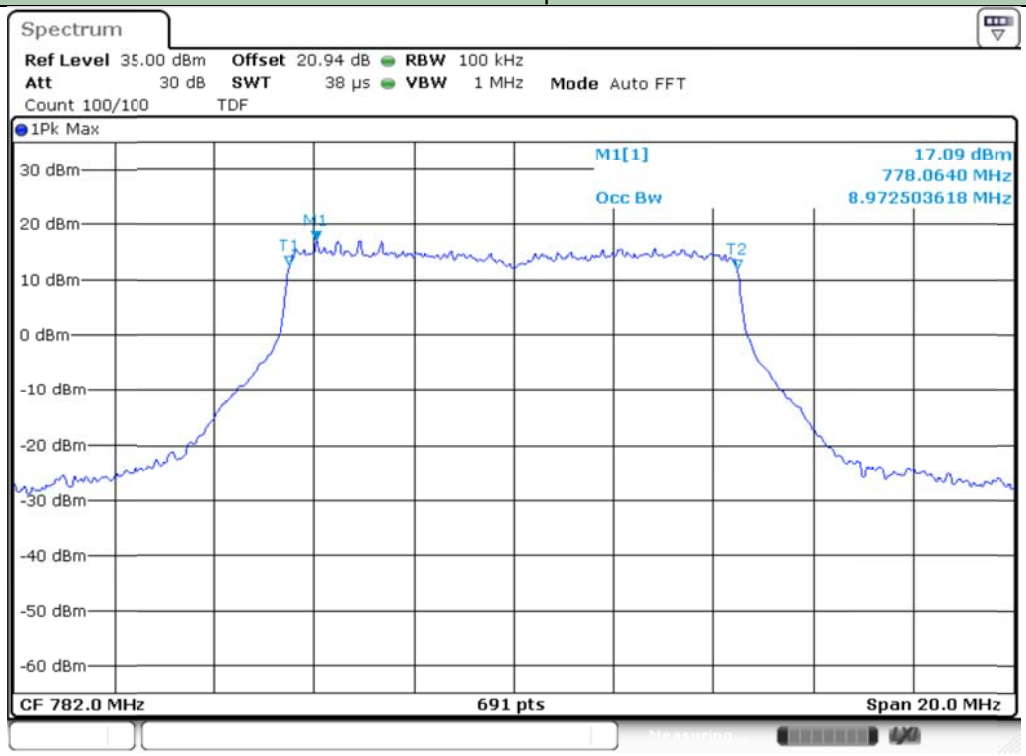
RB Size= 1 – Occupied Bandwidth



RB Size= 50 – 26 dB Bandwidth

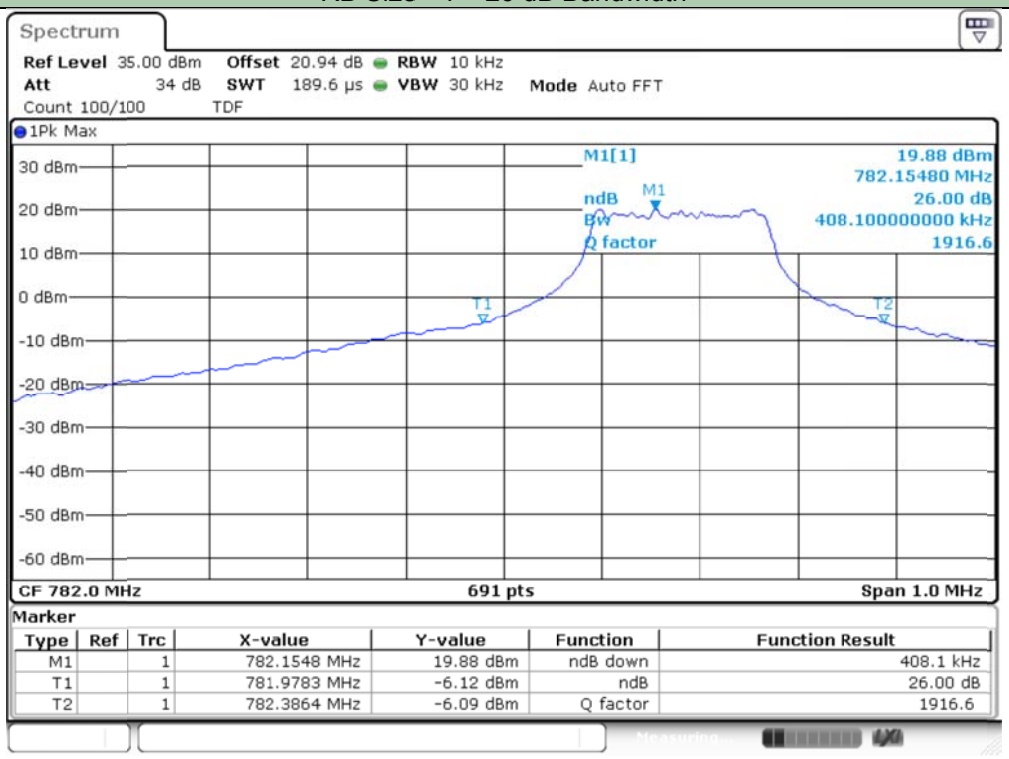


RB Size= 50 – Occupied Bandwidth



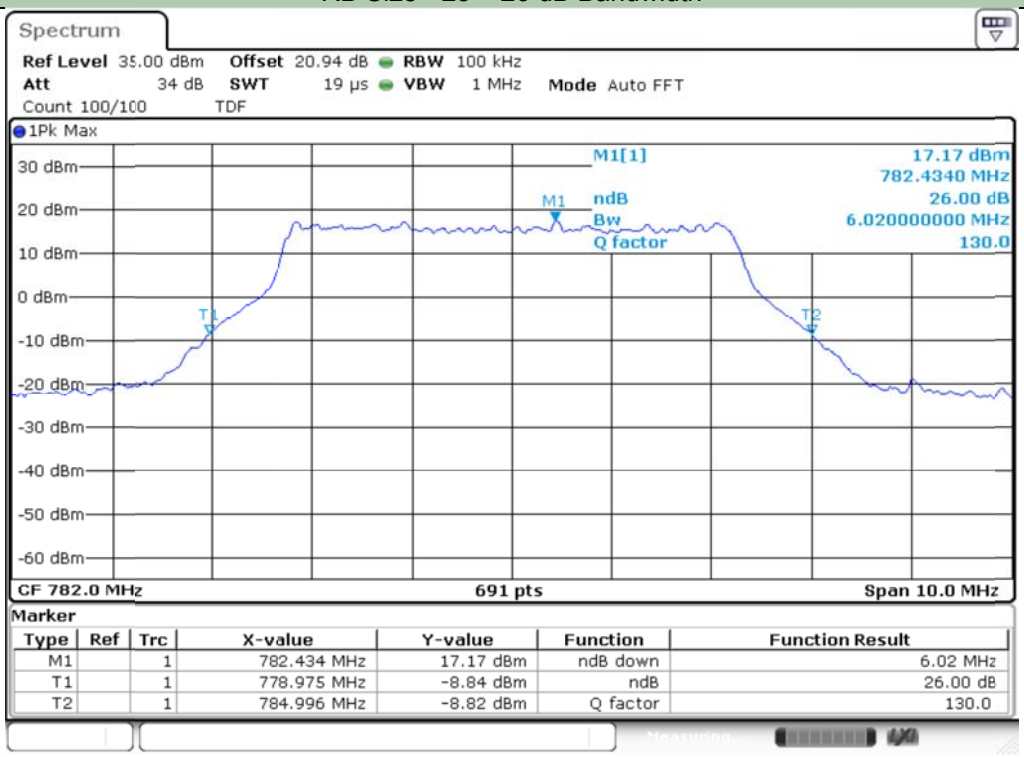
5.3.3.3 Test Plots - Bandwidth 5 MHz (16QAM Modulation)

RB Size= 1 – 26 dB Bandwidth

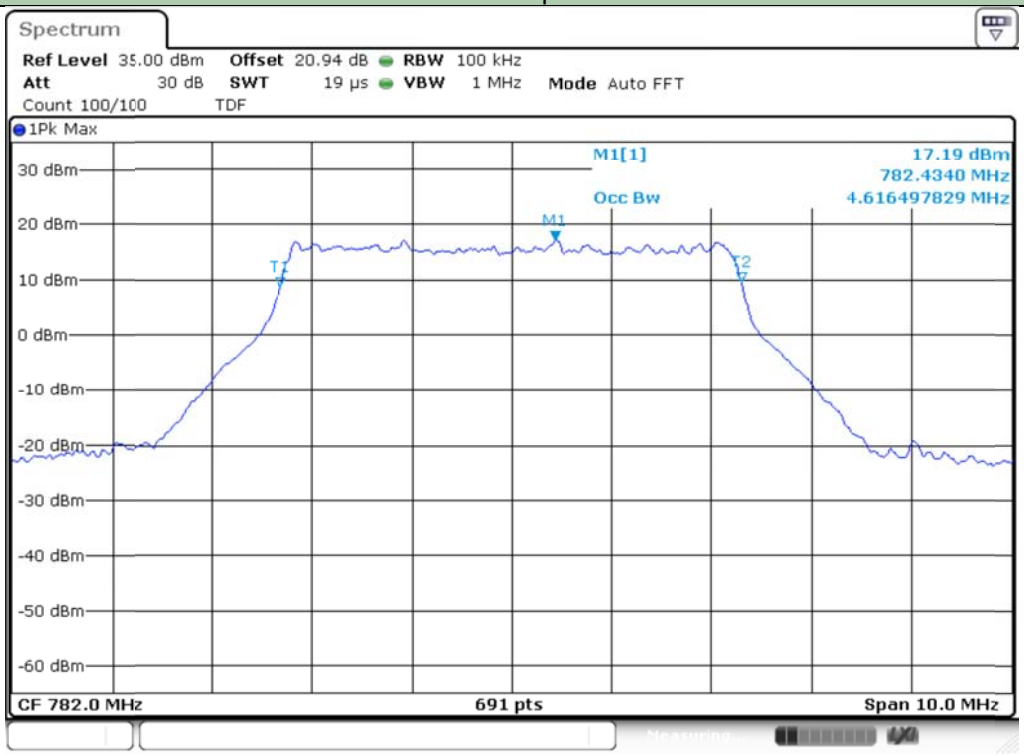


RB Size= 1 – Occupied Bandwidth

RB Size= 25 – 26 dB Bandwidth



RB Size= 25 – Occupied Bandwidth



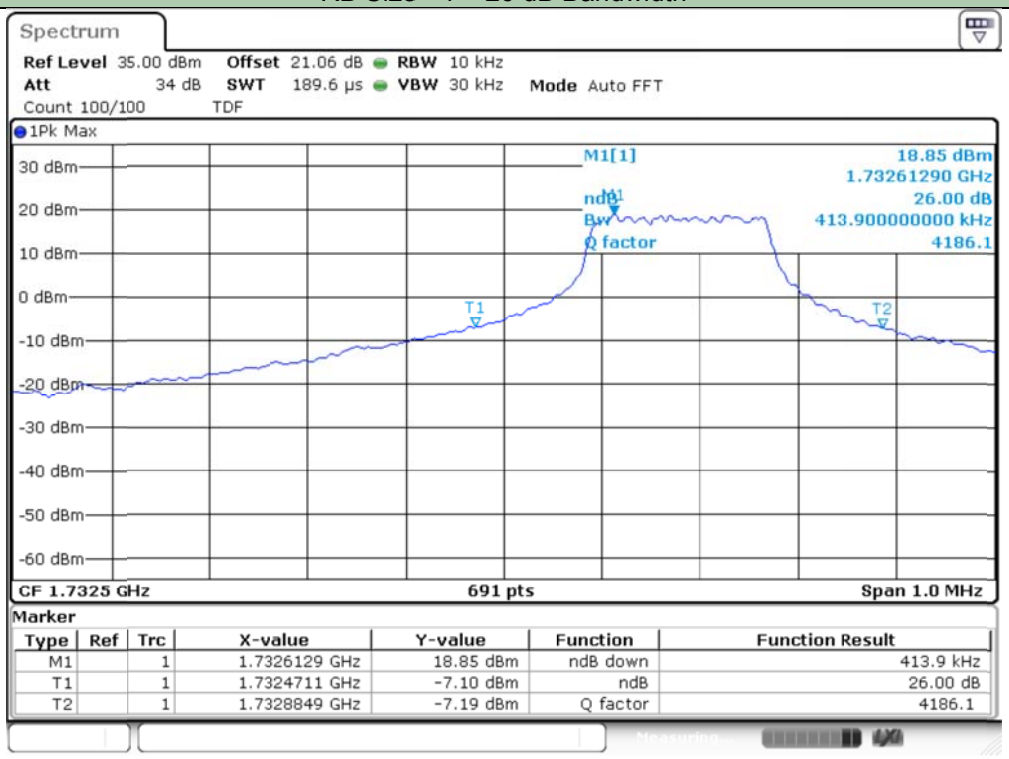
5.3.4 Test Data for LTE Band 4

Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

LTE Band 4 (1710 MHz ~ 1755 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	5	1732.5	0.414	0.242
25		1732.5	6.151	4.616
LTE Band 4 (1710 MHz ~ 1755 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	10	1732.5	0.366	0.256
50		1732.5	11.375	9.001
LTE Band 4 (1710 MHz ~ 1755 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	15	1732.5	0.382	0.243
75		1732.5	16.151	13.589
LTE Band 4 (1710 MHz ~ 1755 MHz), Modulation: QPSK				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	20	1732.5	0.363	0.246
100		1732.5	20.376	17.945
LTE Band 4 (1710 MHz ~ 1755 MHz), Modulation: 16QAM				
RB Size	BW (MHz)	Frequency (MHz)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
1	5	1732.5	0.412	0.249
25		1732.5	5.948	4.573

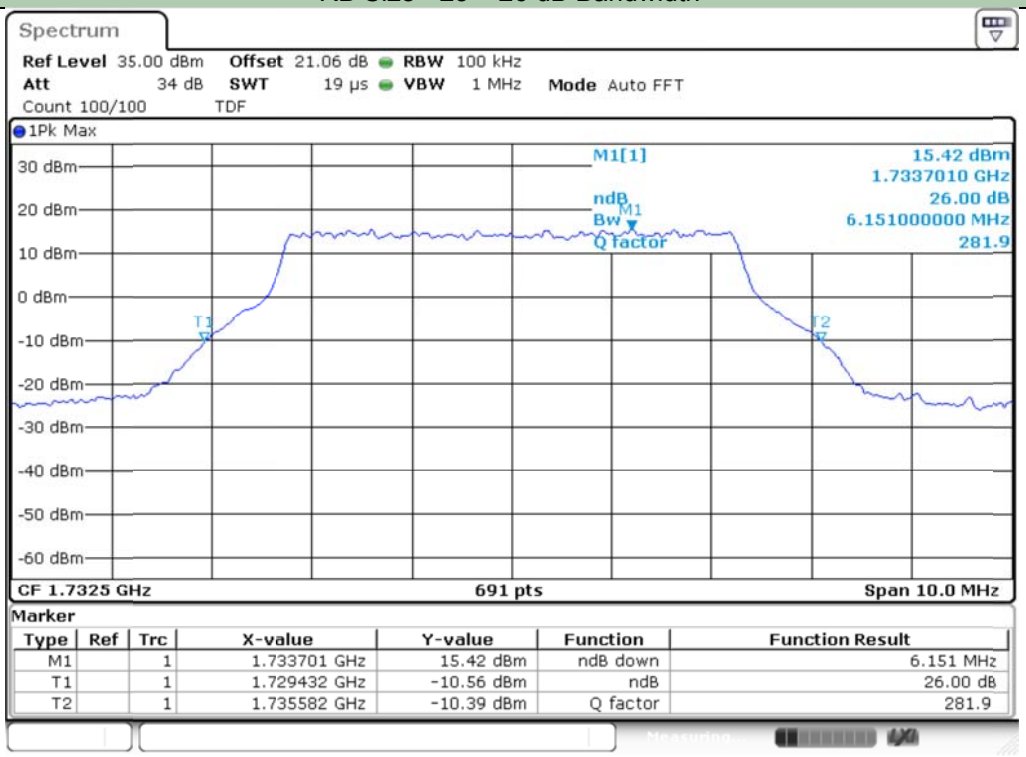
5.3.4.1 Test Plots - Bandwidth 5 MHz (QPSK Modulation)

RB Size= 1 – 26 dB Bandwidth

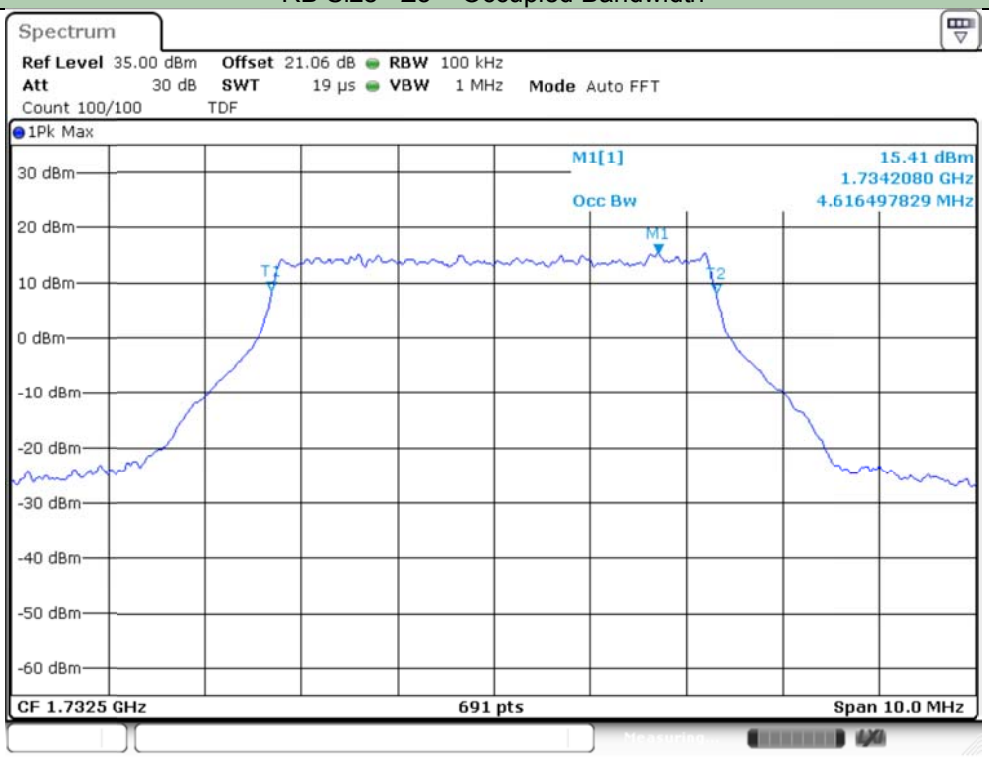


Operating Mode: LTE Band 4, 5 MHz BW, QPSK, RB Size= 1 – Occupied Bandwidth

RB Size= 25 – 26 dB Bandwidth

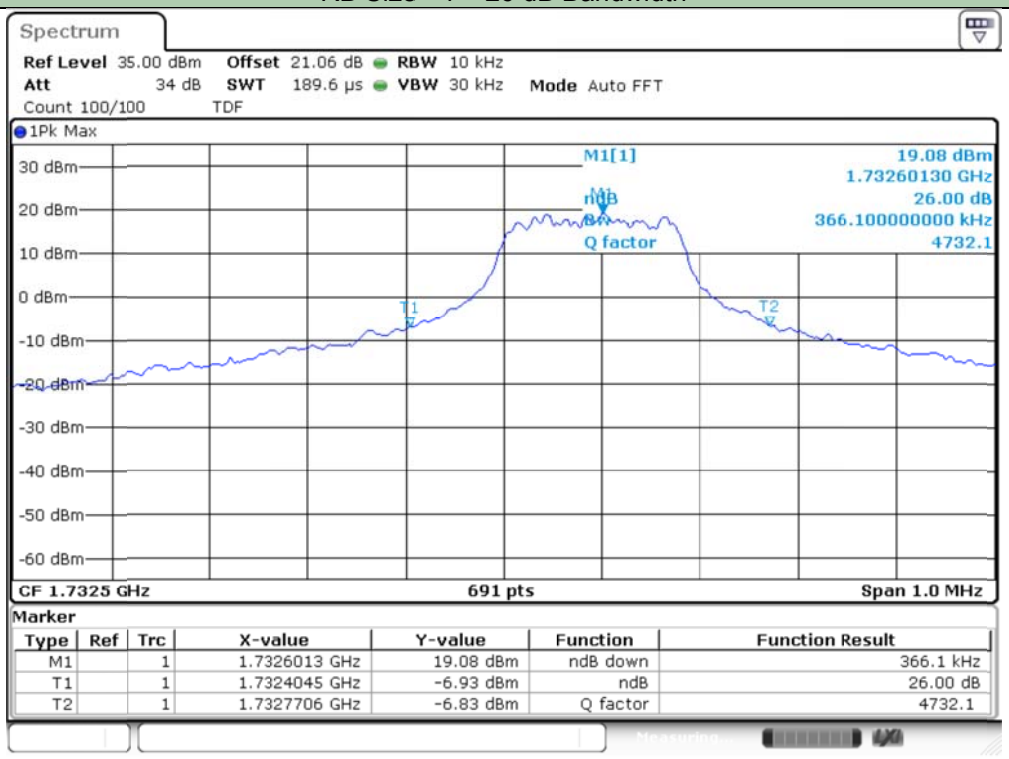


RB Size= 25 – Occupied Bandwidth



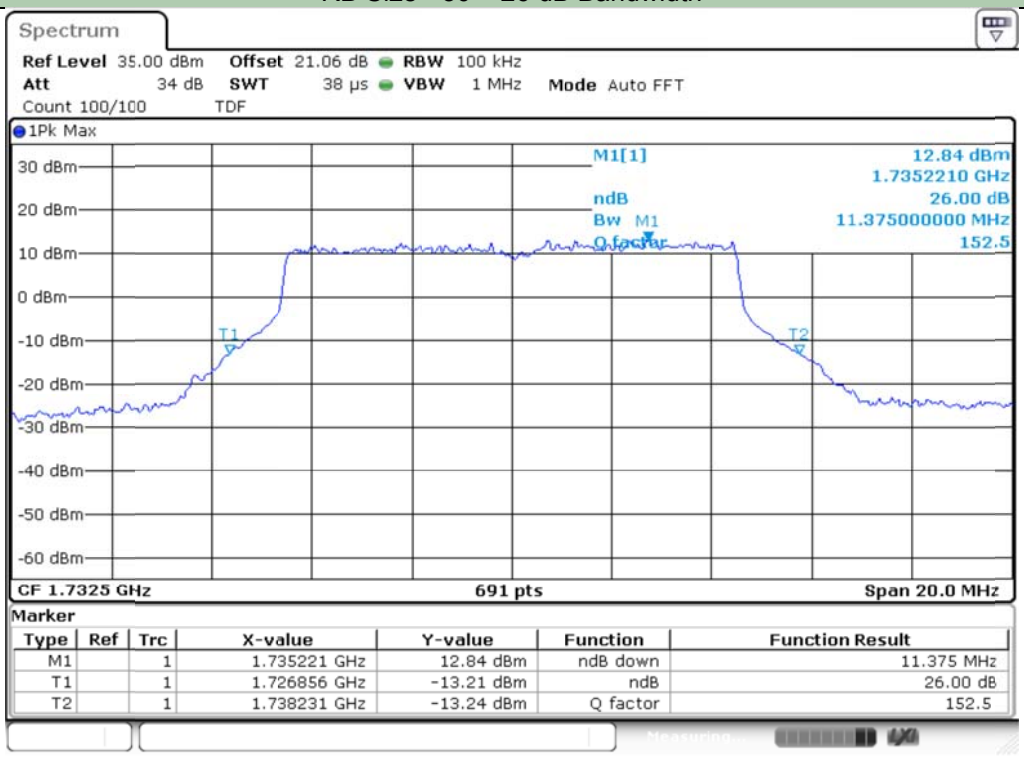
5.3.4.2 Test Plots - Bandwidth 10 MHz (QPSK Modulation)

RB Size= 1 – 26 dB Bandwidth

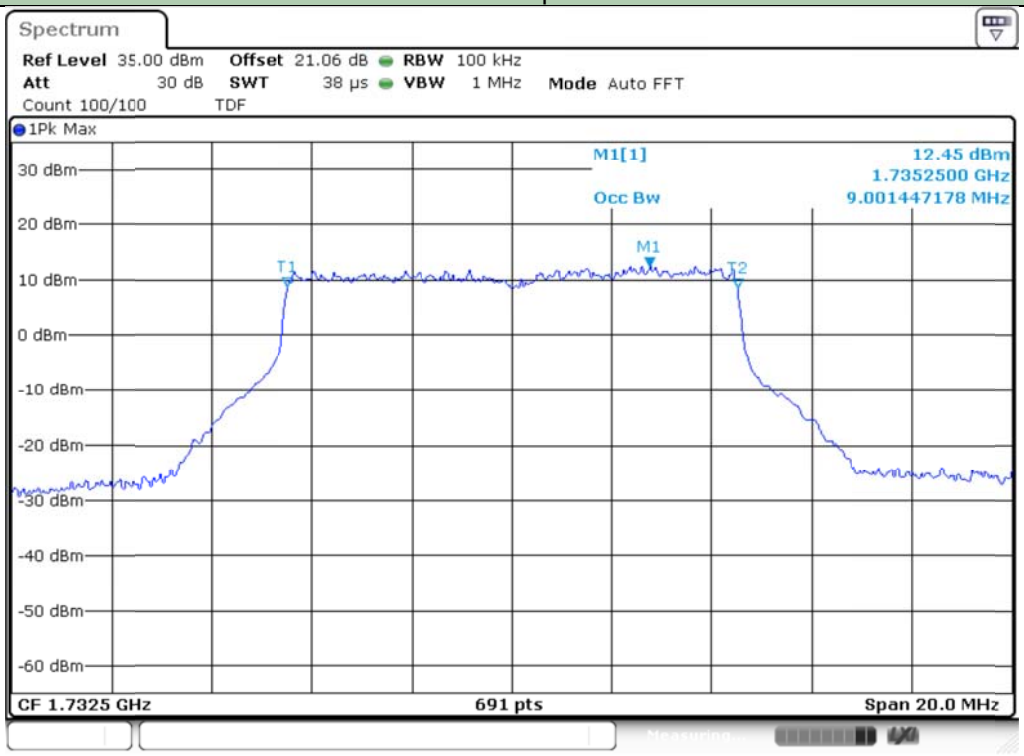


RB Size= 1 – Occupied Bandwidth

RB Size= 50 – 26 dB Bandwidth

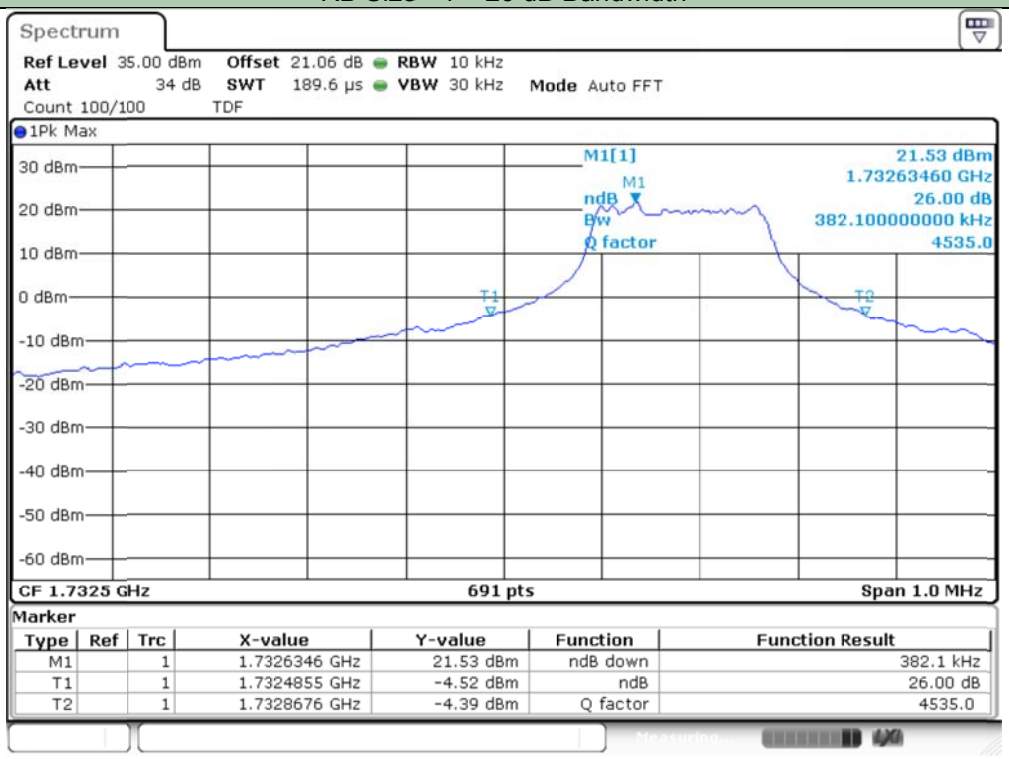


RB Size= 50 – Occupied Bandwidth

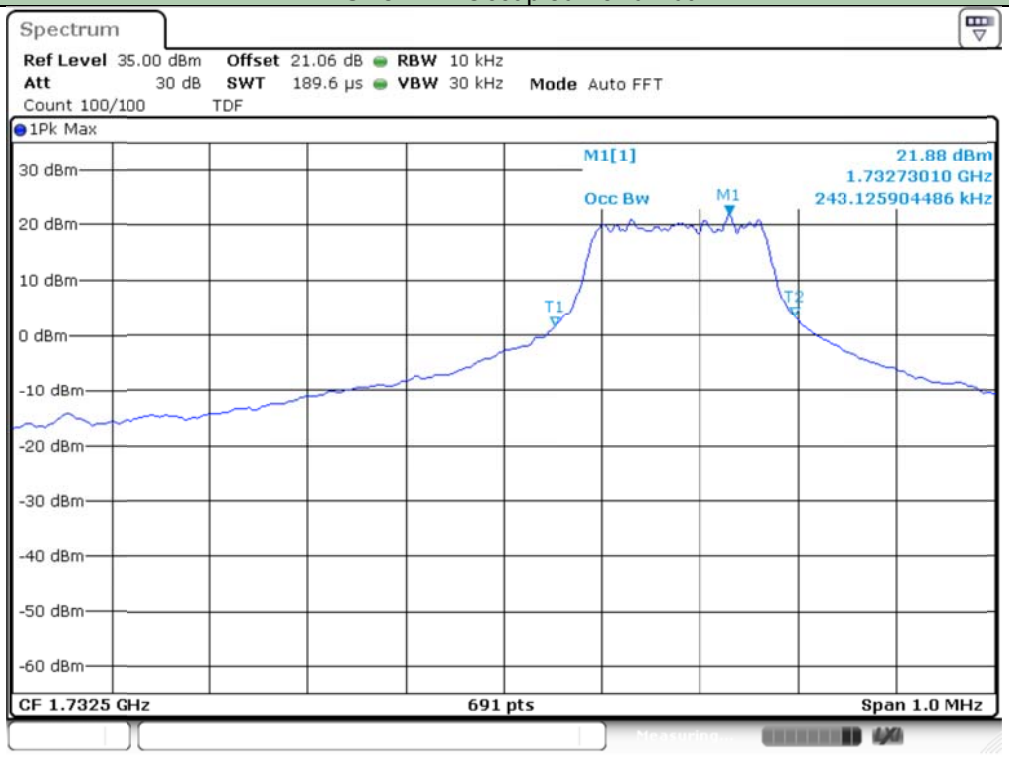


5.3.4.3 Test Plots - Bandwidth 15 MHz (QPSK Modulation)

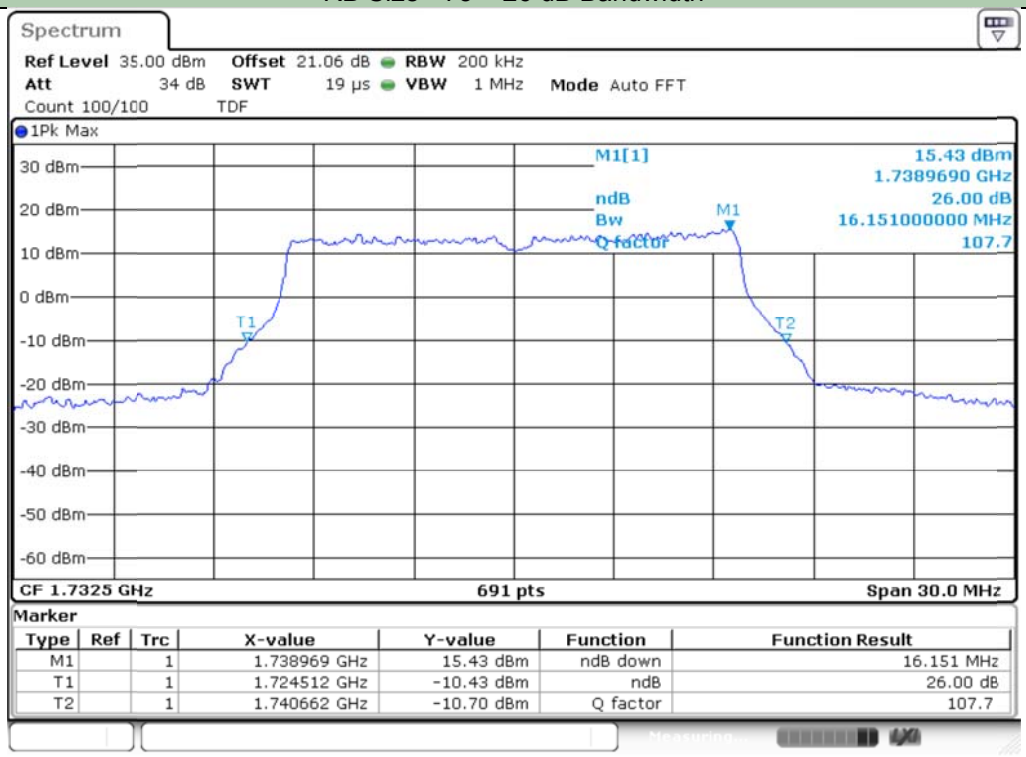
RB Size= 1 – 26 dB Bandwidth



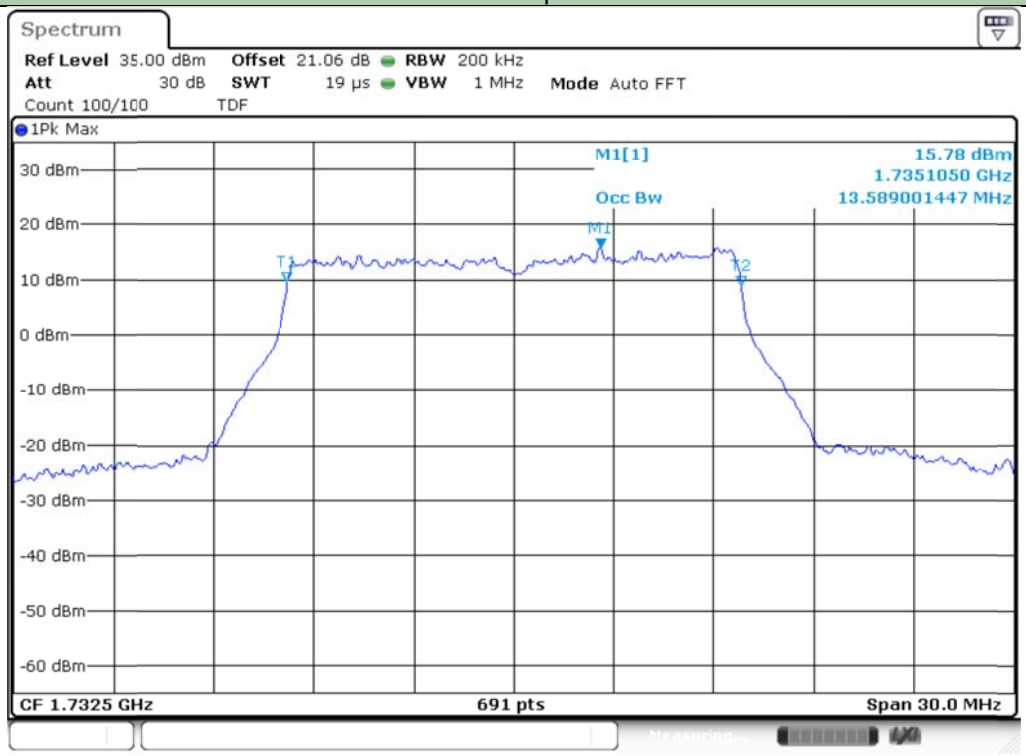
RB Size= 1 – Occupied Bandwidth



RB Size= 75 – 26 dB Bandwidth

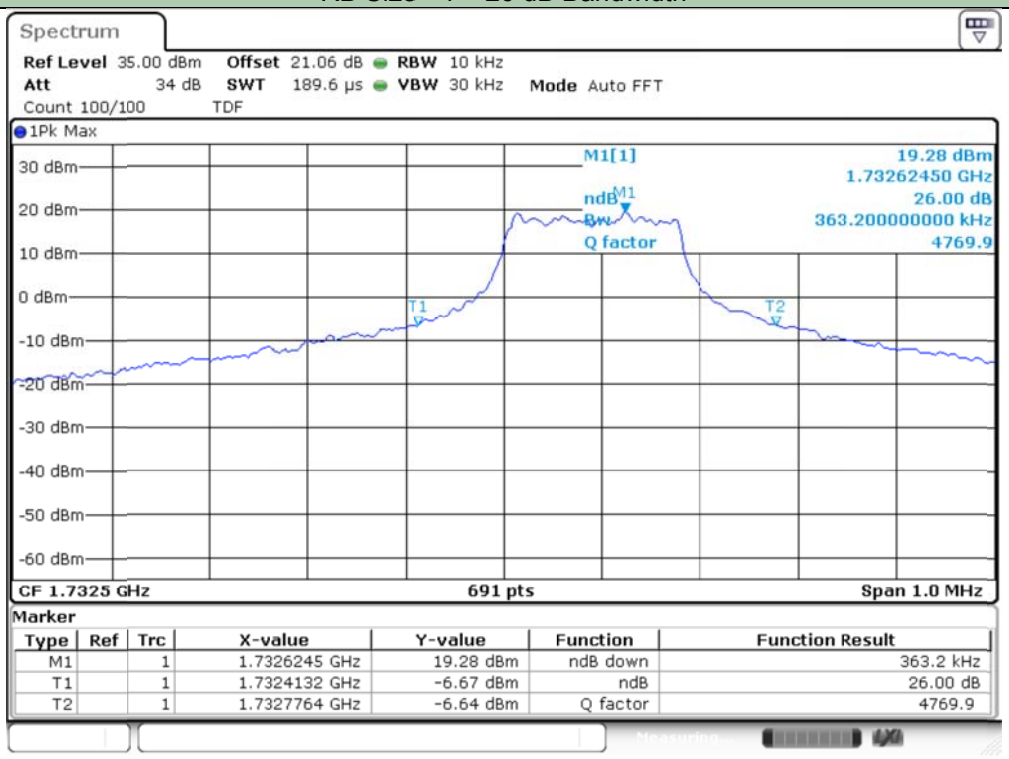


RB Size= 75 – Occupied Bandwidth

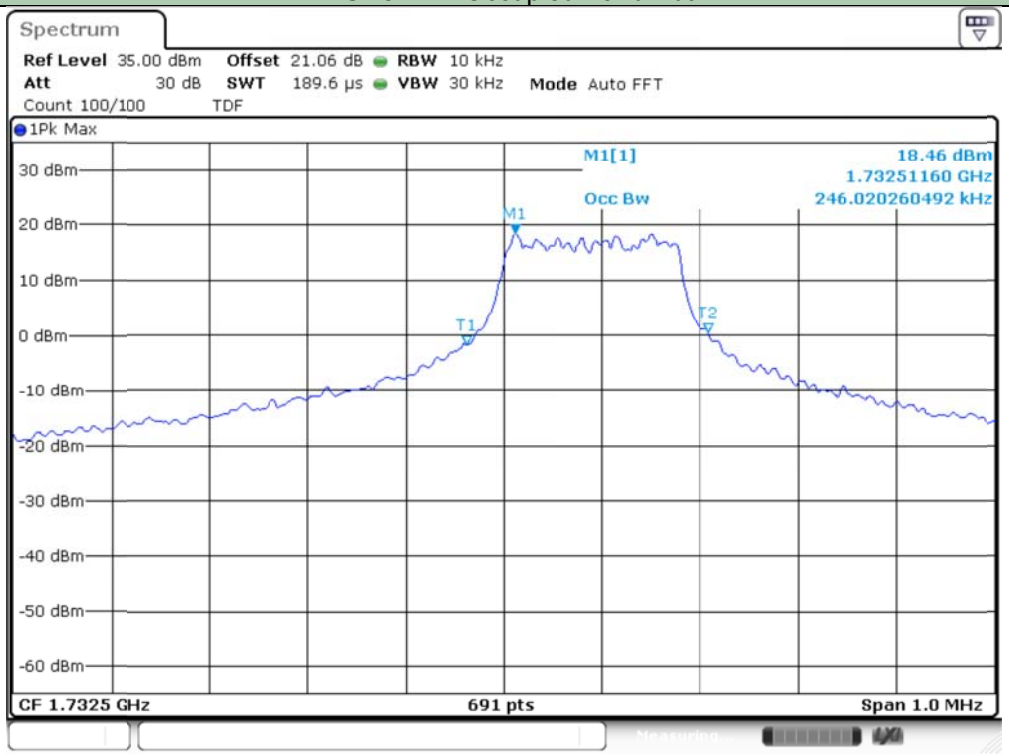


5.3.4.4 Test Plots - Bandwidth 20 MHz (QPSK Modulation)

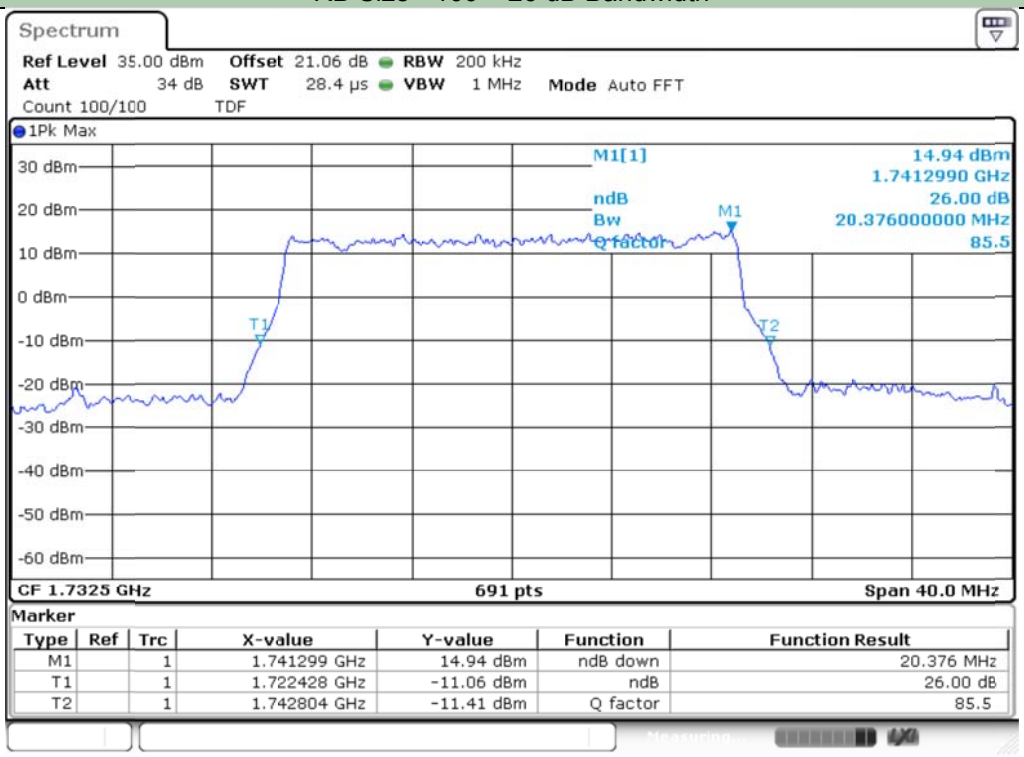
RB Size= 1 – 26 dB Bandwidth



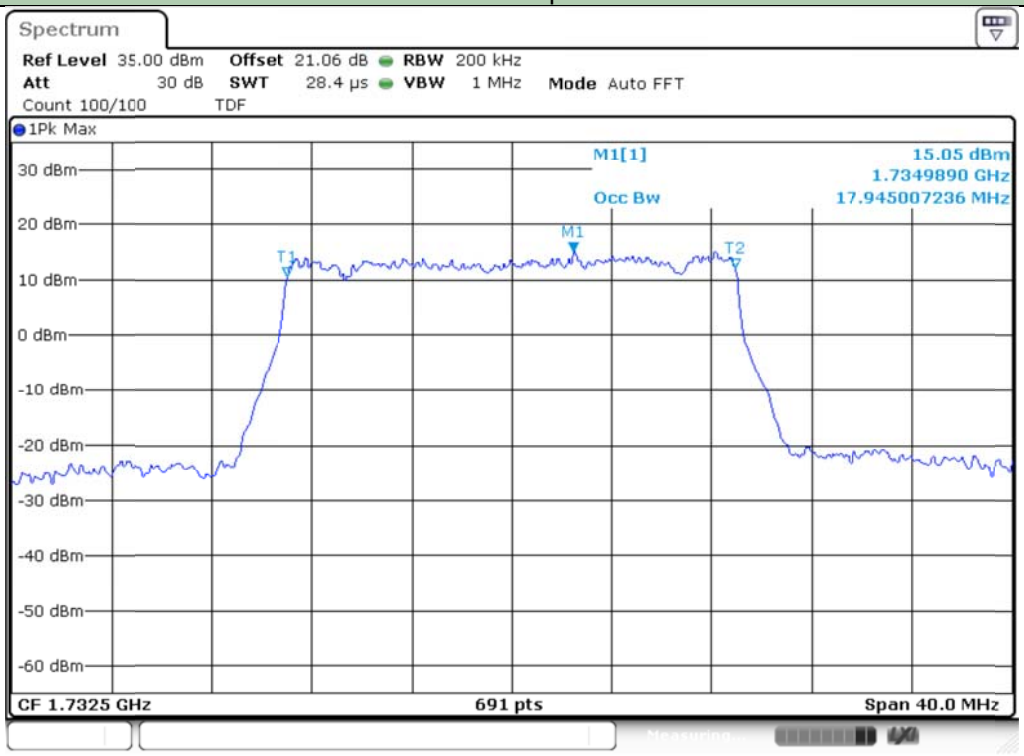
RB Size= 1 – Occupied Bandwidth



RB Size= 100 – 26 dB Bandwidth

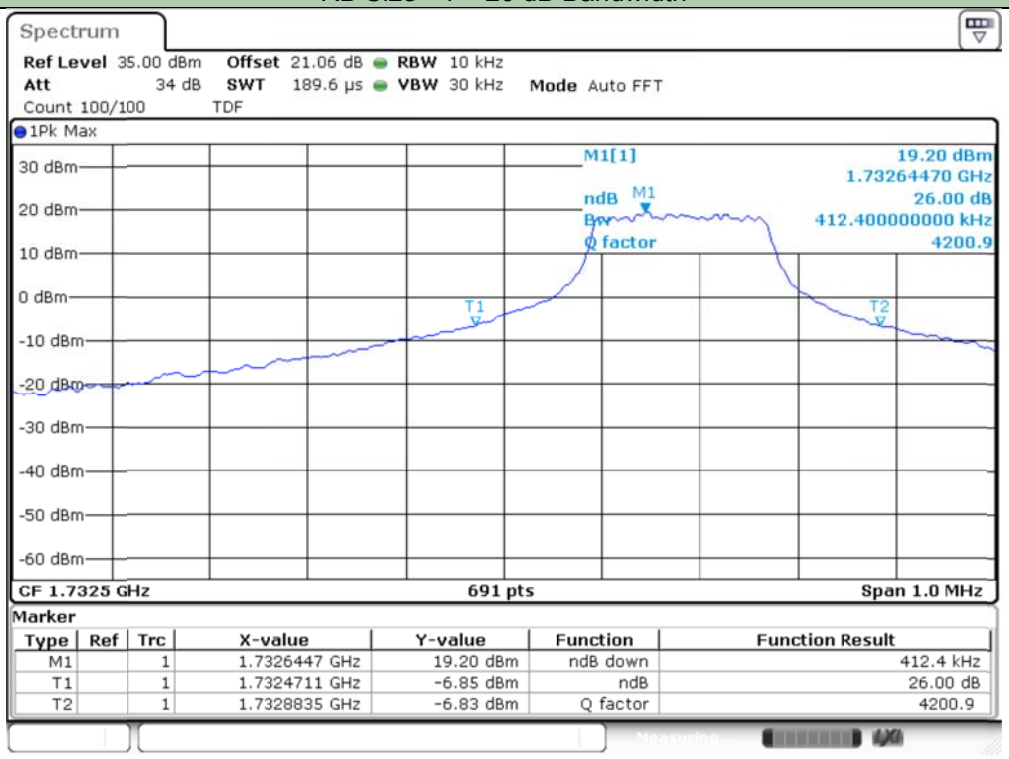


RB Size= 100 – Occupied Bandwidth



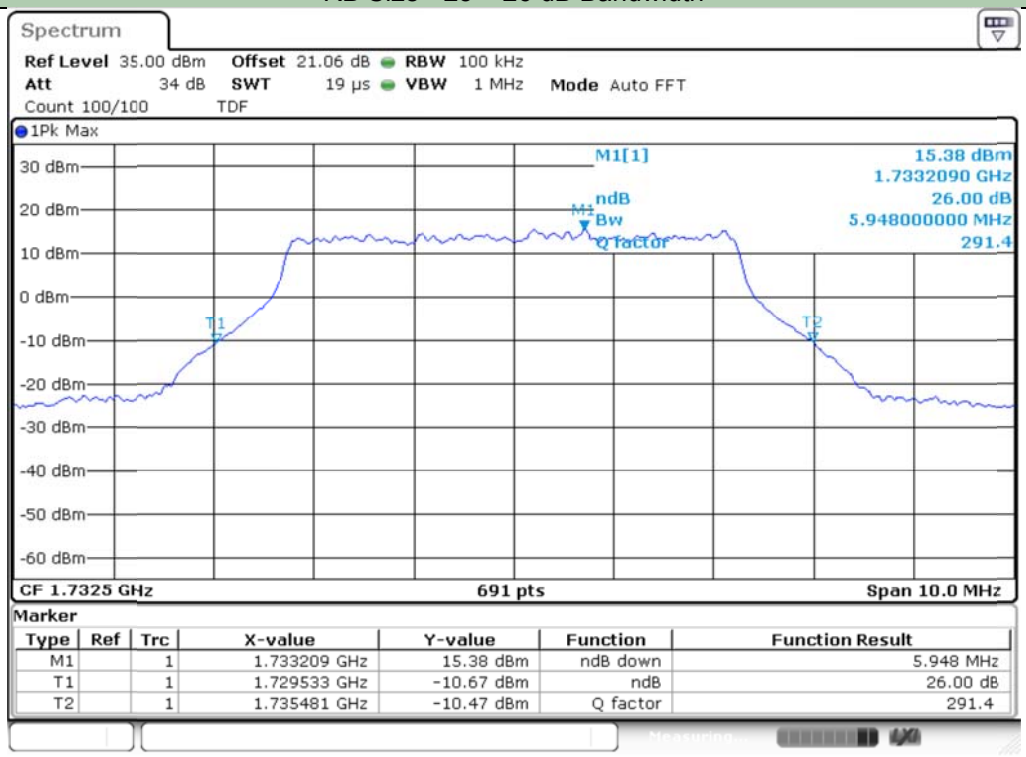
5.3.3.5 Test Plots - Bandwidth 5 MHz (16QAM Modulation)

RB Size= 1 – 26 dB Bandwidth

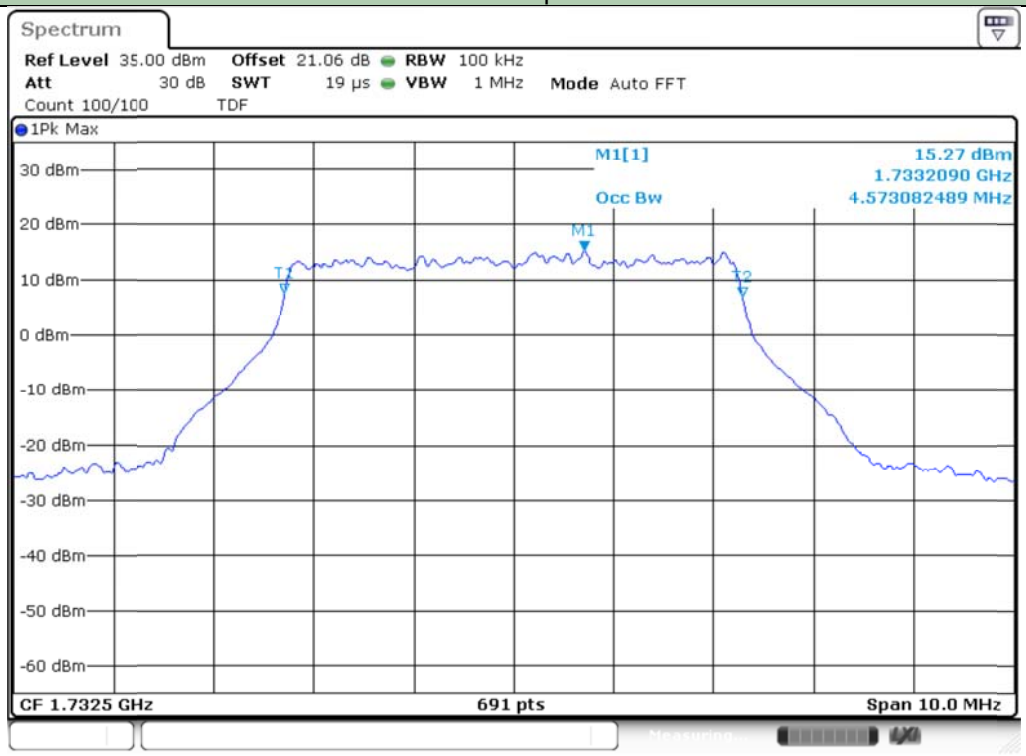


Operating Mode: LTE Band 4, 5 MHz BW, 16QAM, RB Size= 1 – Occupied Bandwidth

RB Size= 25 – 26 dB Bandwidth



RB Size= 25 – Occupied Bandwidth



5.4 Frequency Stability

5.4.1 Limit

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation acc. to Part 27 Subpart C Section 27.54

5.4.2 Method of Measurement

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from 5 °C to +35 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

5.4.3 Test Data for LTE Band 13

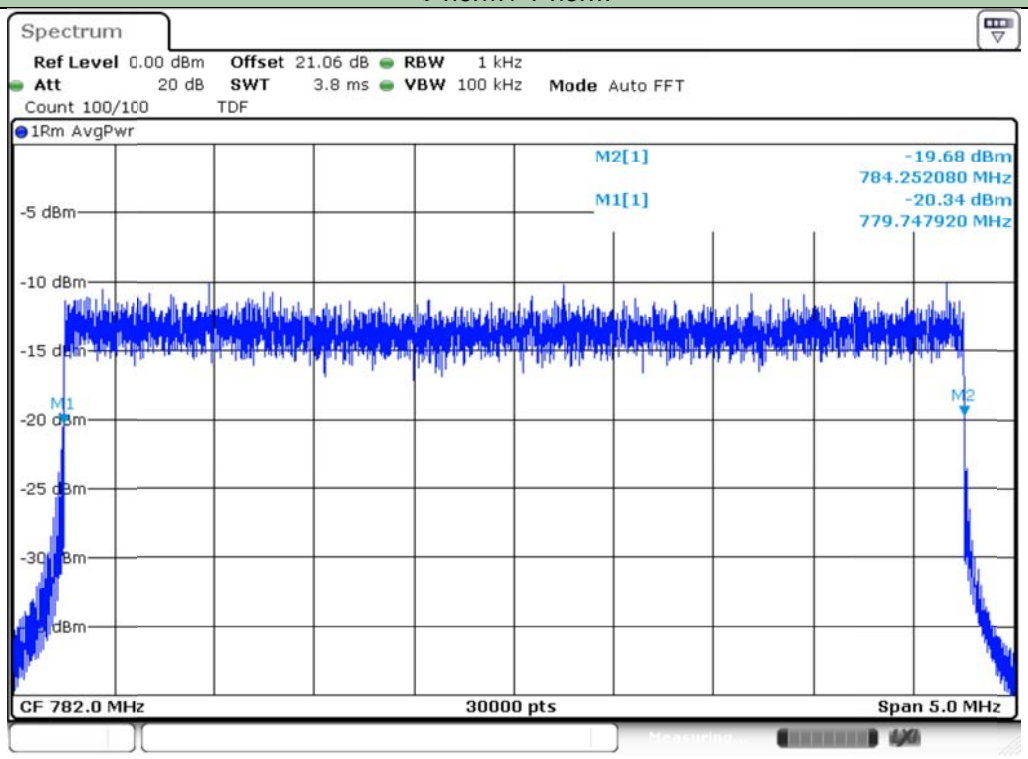
Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

LTE Band 13 (777 MHz ~ 787 MHz), 5 MHz Bandwidth, Modulation: QPSK

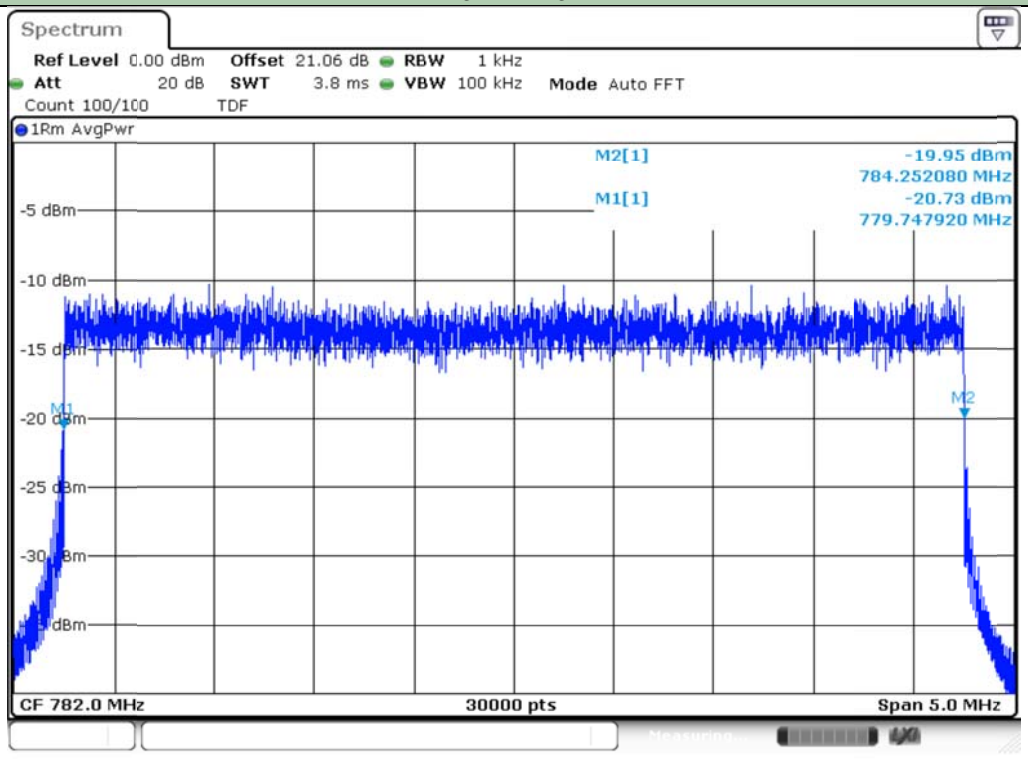
Temp. (°C)	Input Voltage	Upper Freq. (MHz)	Lower Freq. (MHz)	Nominal Freq (MHz)	Carrier Freq. (MHz)	Result (ppm)
5	DC 24.0 V	784.25242	779.74742	782	781.99992	-0.10
	DC 21.6 V	784.25242	779.74742	782	781.99992	-0.10
	DC 26.4 V	784.25242	779.74742	782	781.99992	-0.10
22	DC 24.0 V	784.25208	779.74792	782	782.00000	0.00
	DC 21.6 V	784.25208	779.74792	782	782.00000	0.00
	DC 26.4 V	784.25208	779.74792	782	782.00000	0.00
35	DC 24.0 V	784.25158	779.74858	782	782.00008	0.10
	DC 21.6 V	784.25158	779.74858	782	782.00008	0.10
	DC 26.4 V	784.25158	779.74858	782	782.00008	0.10

5.4.3.1 Test Plots

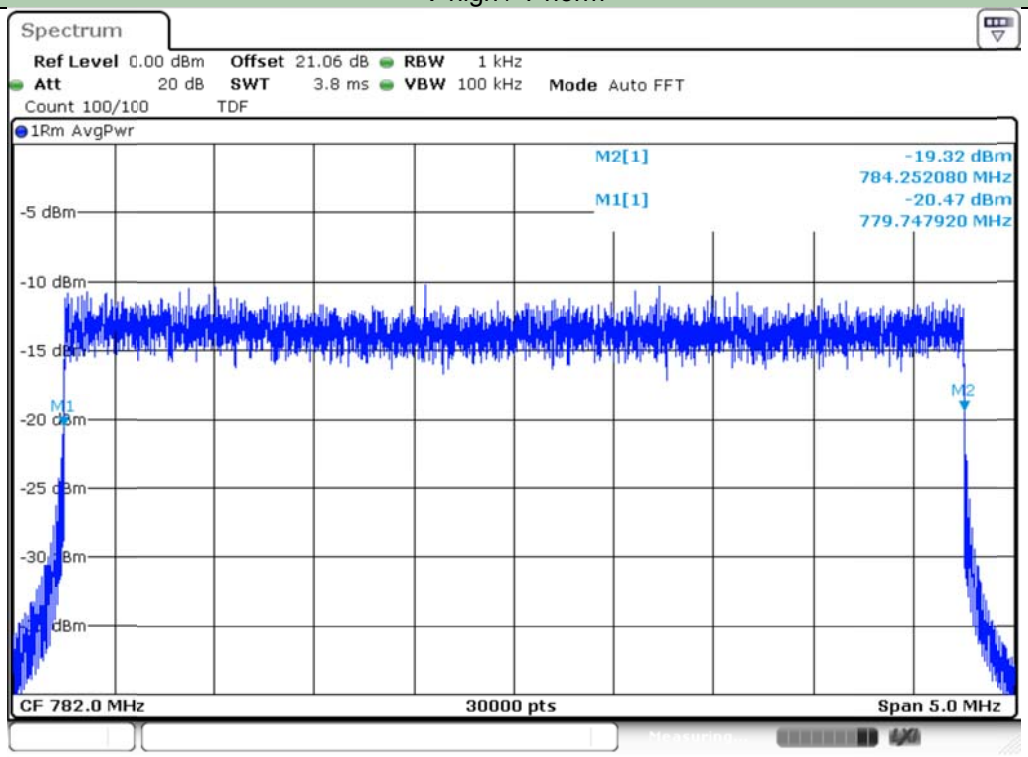
V norm / T norm



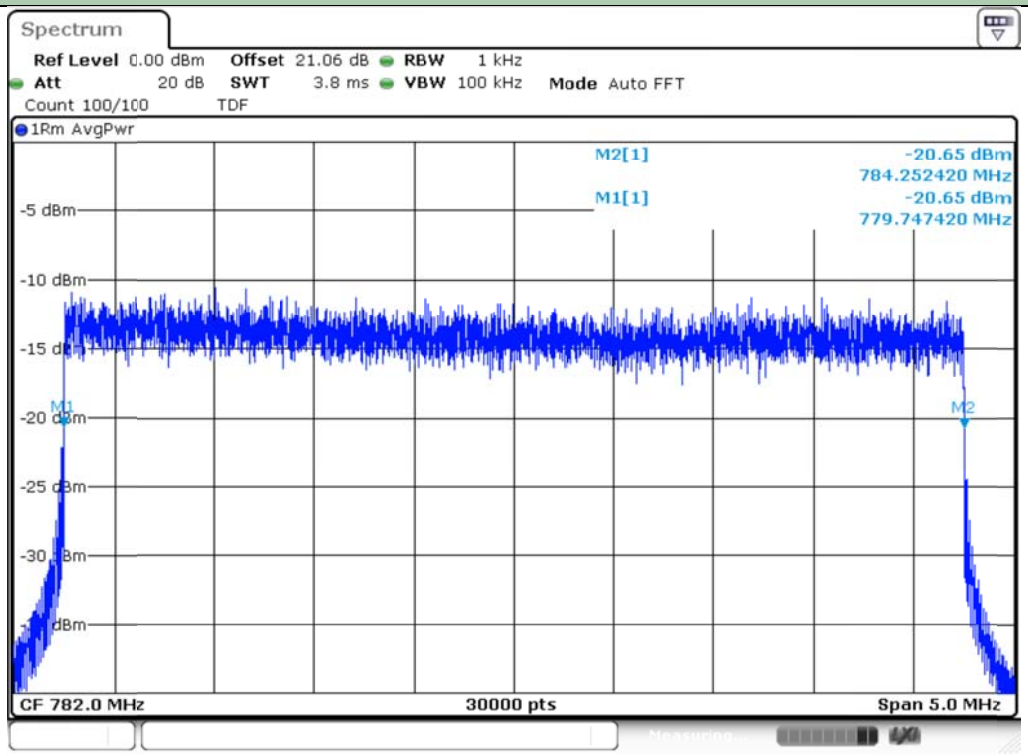
V low / T norm



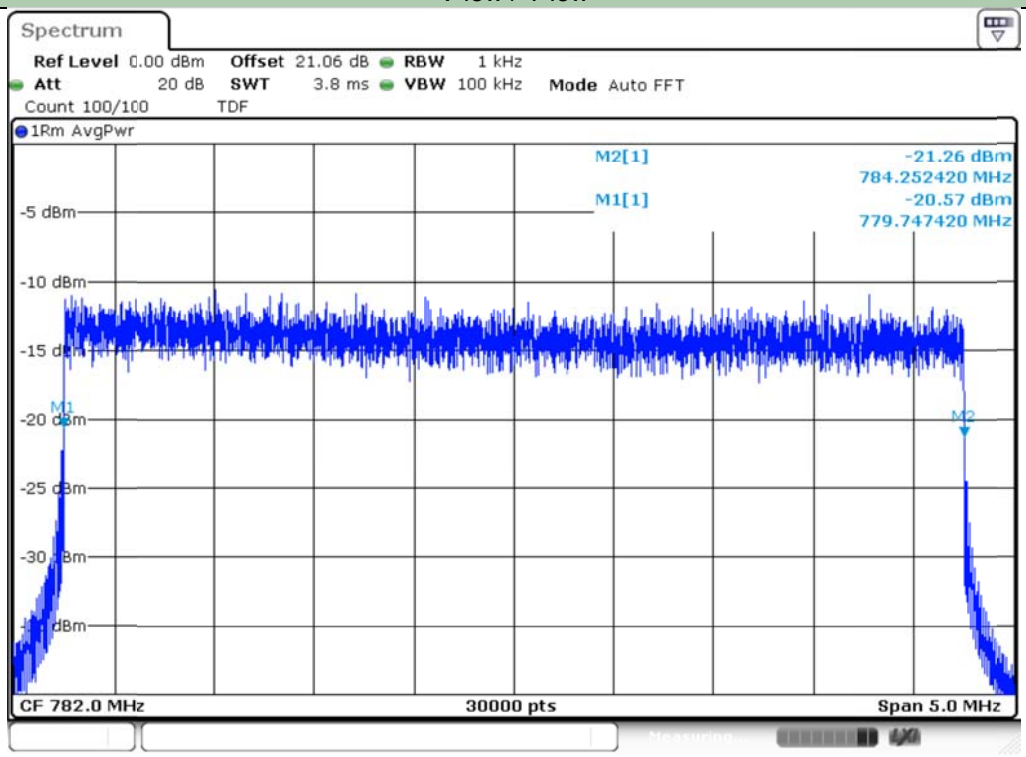
V high / T norm



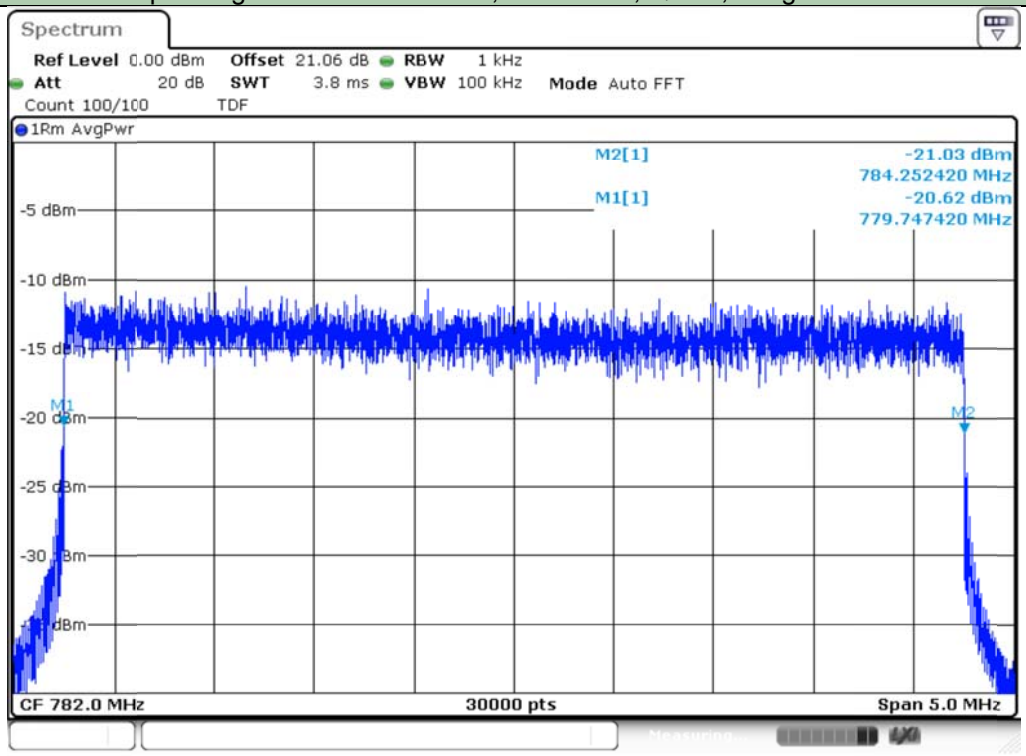
V norm / T low



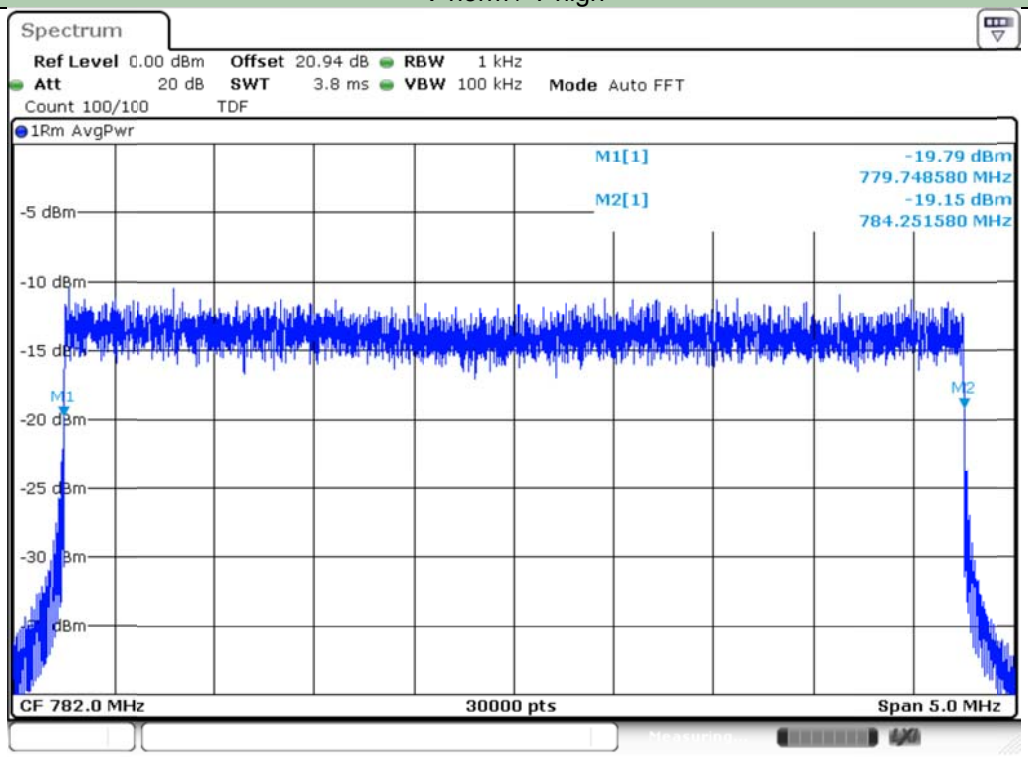
V low / T low



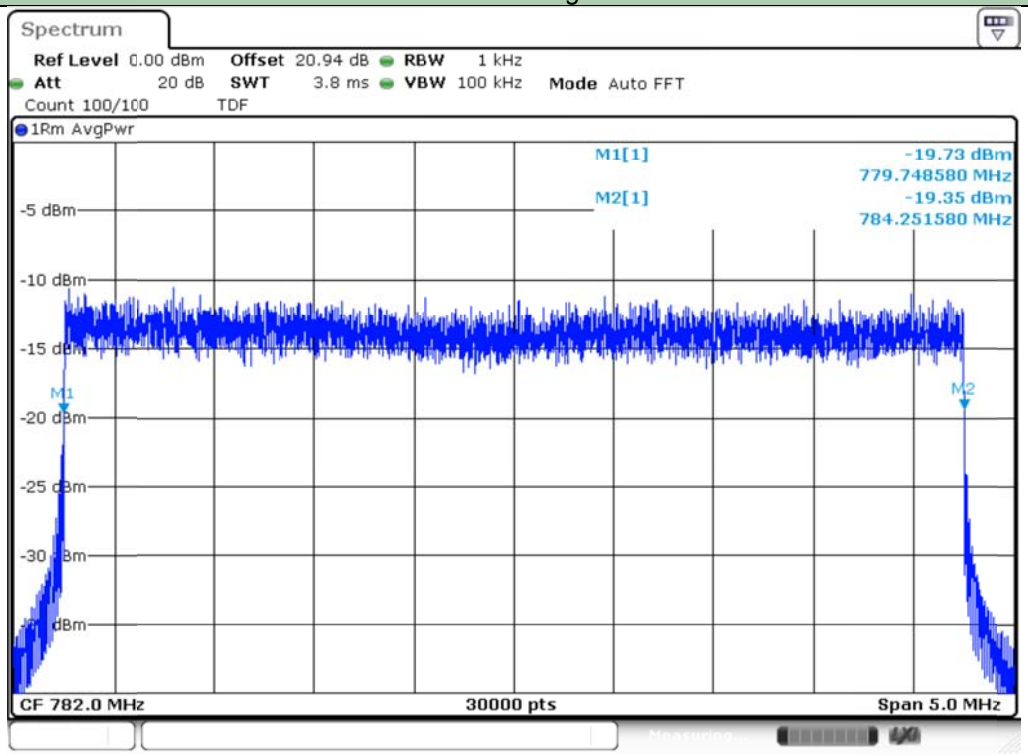
Operating Mode: LTE Band 13, 5 MHz BW, QPSK, V high / T low



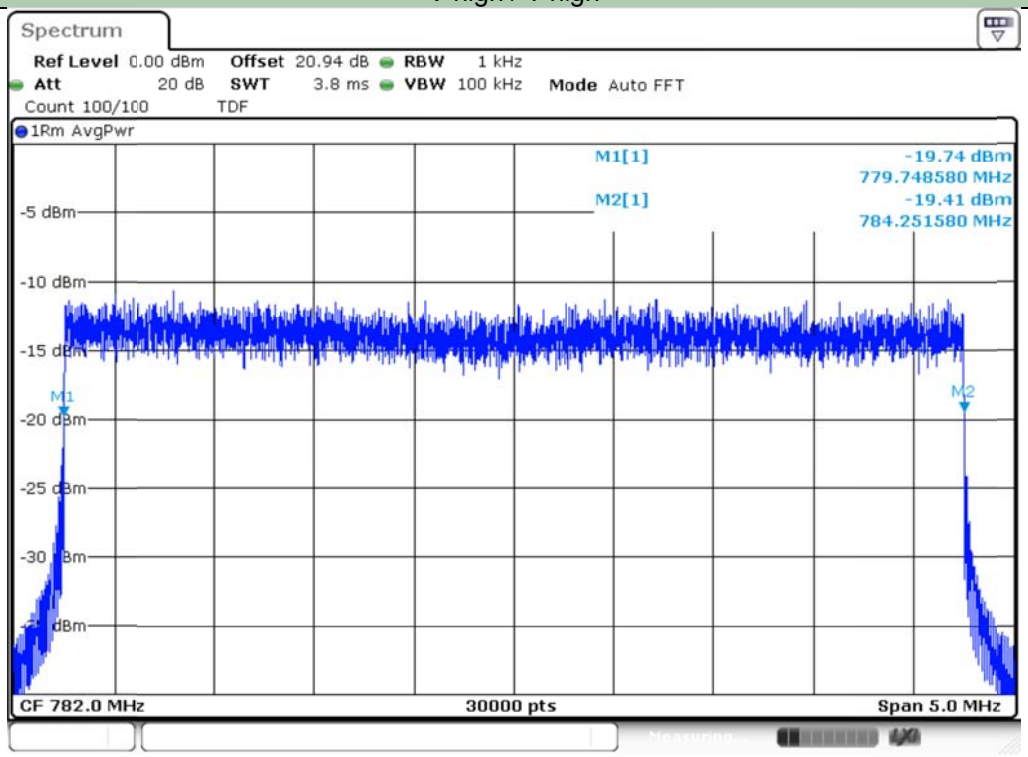
V norm / T high



V low / T high



V high / T high


Spectrum
Ref Level 0.00 dBm Offset 20.94 dB RBW 1 kHz
Att 20 dB SWT 3.8 ms VBW 100 kHz Mode Auto FFT
Count 100/100 TDF
1Rm AvgPwr
M1[1] -19.74 dBm
779.748580 MHz
M2[1] -19.41 dBm
784.251580 MHz
-5 dBm
-10 dBm
-15 dBm
-20 dBm
-25 dBm
M1
M2
CF 782.0 MHz
30000 pts
Span 5.0 MHz

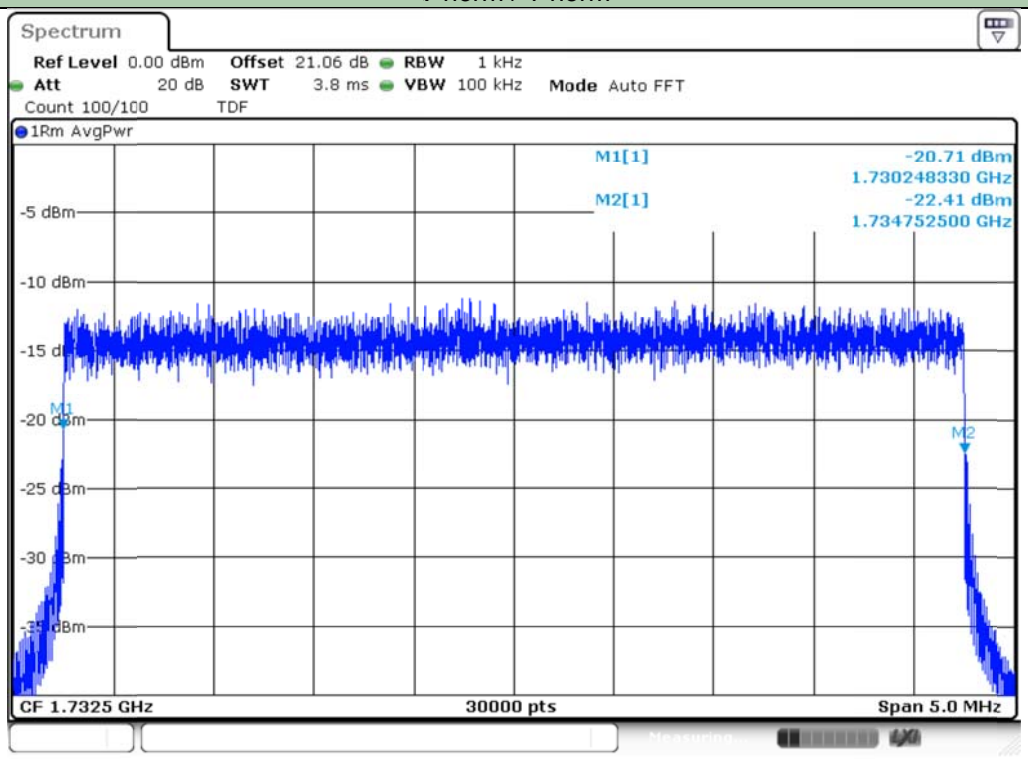
5.4.4 Test Data for LTE Band 4

Date of Test	2017-03-02	Temperature	(21.2 ~ 22.1) °C
		Relative humidity	(26.8 ~ 28.6) % R.H.
Test Result	***PASS***	Tested By	In-yong Song

LTE Band 4 (1710 MHz ~ 1755 MHz), 5 MHz Bandwidth, Modulation: QPSK						
Temp. (°C)	Input Voltage	Upper Freq. (MHz)	Lower Freq. (MHz)	Nominal Freq (MHz)	Carrier Freq. (MHz)	Result (ppm)
5	DC 24.0 V	1734.75225	1730.24758	1732.5	1732.499915	-0.05
	DC 21.6 V	1734.75225	1730.24758	1732.5	1732.499915	-0.05
	DC 26.4 V	1734.75225	1730.24758	1732.5	1732.499915	-0.05
22	DC 24.0 V	1734.7525	1730.24833	1732.5	1732.500415	0.24
	DC 21.6 V	1734.7525	1730.24833	1732.5	1732.500415	0.24
	DC 26.4 V	1734.7525	1730.24833	1732.5	1732.500415	0.24
35	DC 24.0 V	1734.75208	1730.24892	1732.5	1732.5005	0.29
	DC 21.6 V	1734.75208	1730.24892	1732.5	1732.5005	0.29
	DC 26.4 V	1734.75208	1730.24892	1732.5	1732.5005	0.29

5.4.4.1 Test Plots

V norm / T norm



V low / T norm