



# FCC REPORT

Report Reference No..... : TRE1605009202 R/C.....: 36262

FCC ID..... : YY3-14242

Applicant's name..... : Handheld Group AB

Address.....: Kinnegatan 17, 53133, Lidköping, Sweden

Manufacturer.....: Handheld Group AB

Address.....: Kinnegatan 17, 53133, Lidköping, Sweden

Test item description ..... : Rugged Mobile PDA

Trade Mark .....: Handheld

Model/Type reference.....: NAUTIZ X2

Listed Model(s).....: -

Standard ..... : **FCC Part 22: PUBLIC MOBILE SERVICES**  
**FCC Part 24: PERSONAL COMMUNICATIONS SERVICES**  
**FCC Part 27: MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES**

Date of receipt of test sample.....: May.19, 2016

Date of testing.....: May.20, 2016 ~ Jun.14, 2016

Date of issue.....: Jun.15, 2016

Result.....: Pass

Compiled by  
( position+printed name+signature)..: File administrators Candy Liu

Supervised by  
( position+printed name+signature)..: Project Engineer Lion Cai

Approved by  
( position+printed name+signature)..: Manager Hans Hu

Testing Laboratory Name ..... : Shenzhen Huatongwei International Inspection Co., Ltd

Address.....: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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# 1. TEST STANDARDS AND TEST DESCRIPTION

## 1.1. Test Standards

The tests were performed according to following standards:

[FCC Part 22 \(10-1-13 Edition\)](#): PRIVATE LAND MOBILE RADIO SERVICES.

[FCC Part 24\(10-1-13 Edition\)](#): PUBLIC MOBILE SERVICES

[FCC Part 27](#): MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

[TIA/EIA 603 D June 2010](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[47 CFR FCC Part 15 Subpart B](#): - Unintentional Radiators

[FCC Part 2](#): FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

[971168 D01 Power Meas License Digital Systems v02r02](#): provides a methodology for fully characterizing the fundamental power of wideband (> 1 MHz) digitally modulated RF signals acceptable to the FCC for demonstrating compliance for licensed transmitters.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

## 1.2. Test Description

Test Item	Section in CFR 47	Result
RF Output Power	Part 2.1046 Part 22.913 (a)(2) Part 24.232 (c) Part 27.50 (d)	Pass
Modulation Characteristics	Part 2.1047	Pass
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 22.917 Part 24.238	Pass
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 22.917 (a) Part 24.238 (a) Part 27.53 (h)	Pass
Field Strength of Spurious Radiation	Part 2.1053 Part 22.917 (a) Part 24.238 (a) Part 27.53 (h)	Pass
Out of band emission, Band Edge	Part 22.917 (a) Part 24.238 (a) Part 27.53 (h)	Pass
Frequency stability vs. temperature	Part 2.1055(a)(1)(b)	Pass
Frequency stability vs. voltage	Part 2.1055(d)(1)(2)	Pass
Peak-Average Ratio	Part 24.232 (d) Part 27.50 (d)	Pass

Remark: The measurement uncertainty is not included in the test result.

## 2. SUMMARY

### 2.1. Client Information

Applicant:	Handheld Group AB
Address:	Kinnegatan 17, 53133, Lidköping, Sweden
Manufacturer:	Handheld Group AB
Address:	Kinnegatan 17, 53133, Lidköping, Sweden

### 2.2. Product Description

Name of EUT	Rugged Mobile PDA
Trade Mark:	Handheld
Model No.:	NAUTIZ X2
Listed Model(s):	-
IMEI :	869881011800052
Power supply:	DC 3.7V From internal battery
Adapter information1:	Model:FJ-SW1260502000UN Input:AC 100-240V 50/60Hz 0.4A Max Output: 5Vd.c., 2000mA
Adapter information2:	Model:FJ-SW1202000N Input:AC 100-240V 50/60Hz 0.6A Max Output: 12Vd.c., 2000mA
Hardware version:	A20
Software version:	A20a_Hheld_V0.10

#### RF Technical Description

<input checked="" type="checkbox"/> FDD Band 2	
Operation Frequency:	Uplink:1850.7 MHz – 1909.3 MHz Downlink: 1930.7 MHz – 1989.3 MHz
Channel bandwidth:	<input checked="" type="checkbox"/> 1.4MHz <input checked="" type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 5MHz <input checked="" type="checkbox"/> 10MHz <input checked="" type="checkbox"/> 15MHz <input checked="" type="checkbox"/> 20MHz
<input checked="" type="checkbox"/> FDD Band 4	
Operation Frequency:	Uplink:1710.7 MHz – 1754.3 MHz Downlink: 2110.7 MHz – 2154.3 MHz
Channel bandwidth:	<input checked="" type="checkbox"/> 1.4MHz <input checked="" type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 5MHz <input checked="" type="checkbox"/> 10MHz <input checked="" type="checkbox"/> 15MHz <input checked="" type="checkbox"/> 20MHz
<input checked="" type="checkbox"/> FDD Band 5	
Operation Frequency:	Uplink:824.7 MHz – 848.3 MHz Downlink: 869.7 MHz – 893.3 MHz
Channel bandwidth:	<input checked="" type="checkbox"/> 1.4MHz <input checked="" type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 5MHz <input checked="" type="checkbox"/> 10MHz <input type="checkbox"/> 15MHz <input type="checkbox"/> 20MHz
<input checked="" type="checkbox"/> FDD Band 17	
Operation Frequency:	Uplink:706.5 MHz – 713.5 MHz Downlink: 736.5MHz – 743.5 MHz
Channel bandwidth:	<input type="checkbox"/> 1.4MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 5MHz <input checked="" type="checkbox"/> 10MHz <input type="checkbox"/> 15MHz <input type="checkbox"/> 20MHz
Power Class:	<input type="checkbox"/> Class 1 <input type="checkbox"/> Class 2 <input checked="" type="checkbox"/> Class 3 <input type="checkbox"/> Class 4
Modulation type:	<input checked="" type="checkbox"/> QPSK <input checked="" type="checkbox"/> 16QAM <input type="checkbox"/> 64QAM
Antenna type:	1 * TRX, 1 * RX-only

Antenna gain:	Band 2: 1.0dB;Band 4: 1.0dB;Band 5: 1.0dB;Band 17: 1.0dB
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Test Frequency:

FDD Band 2					
Test Frequency ID	Bandwidth [MHz]	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]
Low Range	1.4	18607	1850.7	607	1930.7
	3	18615	1851.5	615	1931.5
	5	18625	1852.5	625	1932.5
	10	18650	1855	650	1935
	15 <sup>[1]</sup>	18675	1857.5	675	1937.5
	20 <sup>[1]</sup>	18700	1860	700	1940
Mid Range	1.4/3/5/10/15 <sup>[1]</sup> /20 <sup>[1]</sup>	18900	1880	900	1960
High Range	1.4	19193	1909.3	1193	1989.3
	3	19185	1908.5	1185	1988.5
	5	19175	1907.5	1175	1987.5
	10	19150	1905	1150	1985
	15 <sup>[1]</sup>	19125	1902.5	1125	1982.5
	20 <sup>[1]</sup>	19100	1900	1100	1980
NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.					

FDD Band 4					
Test Frequency ID	Bandwidth [MHz]	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]
Low Range	1.4	19957	1710.7	1957	2110.7
	3	19965	1711.5	1965	2111.5
	5	19975	1712.5	1975	2112.5
	10	20000	1715	2000	2115
	15	20025	1717.5	2025	2117.5
	20	20050	1720	2050	2120
Mid Range	1.4/3/5/10/15/20	20175	1732.5	2175	2132.5
High Range	1.4	20393	1754.3	2393	2154.3
	3	20385	1753.5	2385	2153.5
	5	20375	1752.5	2375	2152.5
	10	20350	1750	2350	2150
	15	20325	1747.5	2325	2147.5
	20	20300	1745	2300	2145

FDD Band 5					
Test Frequency ID	Bandwidth [MHz]	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]
Low Range	1.4	20407	824.7	2407	869.7
	3	20415	825.5	2415	870.5
	5	20425	826.5	2425	871.5
	10 <sup>[1]</sup>	20450	829	2450	874
Mid Range	1.4/3/5/10 <sup>[1]</sup>	20525	836.5	2525	881.5
High Range	1.4	20643	848.3	2643	893.3
	3	20635	847.5	2635	892.5
	5	20625	846.5	2625	891.5
	10 <sup>[1]</sup>	20600	844	2600	889
NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.					

FDD Band 17					
Test Frequency ID	Bandwidth [MHz]	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]
Low Range	5 <sup>[1]</sup>	23755	706.5	5755	736.5
	10 <sup>[1]</sup>	23780	709	5780	739
Mid Range	5 <sup>[1]</sup> /10 <sup>[1]</sup>	23790	710	5790	740
High Range	5 <sup>[1]</sup>	23825	713.5	5825	743.5
	10 <sup>[1]</sup>	23800	711	5800	741
NOTE 1: Bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (TS 36.101 [27] Clause 7.3) is allowed.					

### 2.3. EUT operation mode

1.The EUT has been tested under typical operating condition. The Applicant provides software to control the EUT for staying in continous transmitting and receiving mode for testing.

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max Output Power	2	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	4	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	17	-	-	v	v	-	-	v	v	v	v	v	v	v	v
26dB and 99% Bandwidth	2	v	v	v	v	v	v	v	v			v	v	v	v
	4	v	v	v	v	v	v	v	v			v	v	v	v
	5	v	v	v	v	-	-	v	v			v	v	v	v
	17	-	-	v	v	-	-	v	v			v	v	v	v
Conducted Band Edge	2	v	v	v	v	v	v	v	v	v		v	v		v
	4	v	v	v	v	v	v	v	v	v		v	v		v
	5	v	v	v	v	-	-	v	v	v		v	v		v
	17	-	-	v	v	-	-	v	v	v		v	v		v
Conducted Spurious Emission	2	v	v	v	v	v	v	v	v	v			v	v	v
	4	v	v	v	v	v	v	v	v	v			v	v	v
	5	v	v	v	v	-	-	v	v	v			v	v	v
	17	-	-	v	v	-	-	v	v	v			v	v	v
E.R.P./ E.I.R.P.	2	v	v	v	v	v	v	v	v	v			v	v	v
	4	v	v	v	v	v	v	v	v	v			v	v	v
	5	v	v	v	v	-	-	v	v	v			v	v	v
	17	-	-	v	v	-	-	v	v	v			v	v	v
Radiated Spurious Emission	2	v	v	v	v	v	v	v		v			v	v	v
	4	v	v	v	v	v	v	v		v			v	v	v
	5	v	v	v	v	-	-	v		v			v	v	v
	17	-	-	v	v	-	-	v		v			v	v	v
Frequency Stability	2						v	v				v		v	
	4						v	v				v		v	
	5				v			v				v		v	
	17				v			v				v		v	
Peak-to-Average Ratio	2						v	v	v	v		v	v	v	v
	4						v	v	v	v		v	v	v	v
	5				v			v	v	v		v	v	v	v
	17				v			v	v	v		v	v	v	v
Remark	1. The mark "v " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.														

## 2.4. EUT configuration

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

● - supplied by the manufacturer

○ - supplied by the lab

	Length (m) :	/
	Shield :	/
	Detachable :	/
	Manufacturer :	/
	Model No. :	/

## 2.5. Modifications

No modifications were implemented to meet testing criteria.

### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Phone: 86-755-26748019 Fax: 86-755-26748089

#### **3.2. Test Facility**

The test facility is recognized, certified, or accredited by the following organizations:

##### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

##### **A2LA-Lab Cert. No. 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until December 31, 2016.

##### **FCC-Registration No.: 317478**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017.

##### **IC-Registration No.: 5377A&5377B**

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Dec. 31, 2013, valid time is until Dec. 31, 2016.

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B on Dec.03, 2014, valid time is until Dec.03, 2017.

##### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

##### **VCCI**

The 3m Semi-

anechoic chamber (12.2m×7.95m×6.7m) of Shenzhen Huatongwei International Inspection Co., Ltd.

has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 29, 2015.

Radiated disturbance above 1GHz measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2013. Valid time is until Dec. 23, 2016.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.

Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

##### **DNV**

Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2016.



### 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature/Tnor:	15~35°C
Relative Humidity	30~60 %
Air Pressure	950-1050 hPa

### 3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-12.75 GHz	1.60 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emission 1~18GHz	5.16 dB	(1)
Radiated Emission 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)
Emission Mask	-----	(1)
Modulation Characteristic	-----	(1)
Transmitter Frequency Behavior	-----	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

### 3.5. Equipments Used during the Test

<b>Output Power(Conducted) &amp; Occupied Bandwidth &amp; Emission Bandwidth &amp; Band Edge Compliance &amp; Conducted Spurious Emission</b>					
No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	UNIVERSAL RADIO COMMUNICATION	Rohde&Schwarz	CMU200	112012	2015/11/2
2	WIDEB.RADIO COMM.TESRER	Rohde&Schwarz	CMW500	1201.0002K50	2015/11/3
3	Spectrum Analyzer	Rohde&Schwarz	FSU26	201141	2015/11/2
4	Splitter	Mini-Circuit	ZAPD-4	400059	2015/11/2

<b>Frequency Stability</b>					
No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	UNIVERSAL RADIO COMMUNICATION	Rohde&Schwarz	CMU200	112012	2015/11/2
2	WIDEB.RADIO COMM.TESRER	Rohde&Schwarz	CMW500	1201.0002K50	2015/11/3
3	Spectrum Analyzer	Rohde&Schwarz	FSU26	201141	2015/11/2
4	Climate Chamber	ESPEC	EL-10KA	05107008	2015/11/2
5	Splitter	Mini-Circuit	ZAPD-4	400059	2015/11/2

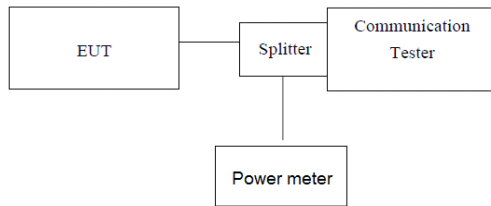
<b>Output Power (Radiated) &amp; Radiated Spurious Emission</b>					
No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	UNIVERSAL RADIO COMMUNICATION	Rohde&Schwarz	CMU200	112012	2015/11/2
2	Spectrum Analyzer	Rohde&Schwarz	FSU26	201141	2015/11/2
3	HORN ANTENNA	ShwarzBeck	9120D	1012	2015/11/2
4	HORN ANTENNA	ShwarzBeck	9120D	1011	2015/11/2
5	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2015/11/2
6	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	2015/11/2
7	TURNTABLE	MATURO	TT2.0	----	N/A
8	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
9	EMI Test Software	Audix	E3	N/A	N/A
10	EMI Test Receiver	Rohde&Schwarz	ESIB 26	100009	2015/11/2
11	RF Test Panel	Rohde&Schwarz	TS / RSP	335015/ 0017	2015/11/2
12	High pass filter	Compliance Direction systems	BSU-6	34202	2015/11/2
13	Splitter	Mini-Circuit	ZAPD-4	400059	2015/11/2
14	Horn Antenna	SCHWARZBECK	BBHA9170	25841	2015/11/2
15	Horn Antenna	SCHWARZBECK	BBHA9170	25842	2015/11/2
16	Preamplifier	ShwarzBeck	BBV 9718	BBV 9718	2015/11/2
17	Broadband Preamplifier	ShwarzBeck	BBV743	9743-0079	2015/11/2
18	Signal Generator	Rohde&Schwarz	SMF100A	101932	2015/11/2
19	Amplifier	Compliance Direction systems	PAP1-4060	120	2015/11/2
20	TURNTABLE	ETS	2088	2149	2015/11/2
21	ANTENNA MAST	ETS	2075	2346	2015/11/2
22	HORN ANTENNA	Rohde&Schwarz	HF906	100068	2015/11/2
23	HORN ANTENNA	Rohde&Schwarz	HF906	100039	2015/11/2
24	WIDEB.RADIO COMM.TESRER	R&S	CMW500	1201.0002K50	2015/11/3

The calibration interval was one year.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Output Power

#### TEST CONFIGURATION



*Note: Measurement setup for testing on Antenna connector*

#### TEST PROCEDURE

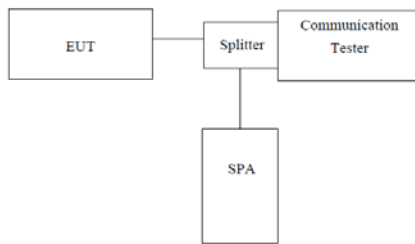
1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure the maximum burst average power.

#### TEST RESULTS

EUT Mode	Frequency (MHz)	Max Avg.Power QPSK (dBm)	Max Avg.Power 16QAM (dBm)
LTE Band 2	1850.70 – 1909.30	22.55	21.90
LTE Band 4	1710.70 – 1754.30	22.40	21.59
LTE Band 5	824.70 – 848.30	22.23	21.46
LTE Band 17	706.50 – 713.50	22.57	21.85

## 4.2. Occupy Bandwidth

### TEST CONFIGURATION



*Note: Measurement setup for testing on Antenna connector*

### TEST PROCEDURE

1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer
2. RBW was set to about 1% of emission BW, VBW= 3 times RBW.
3. -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

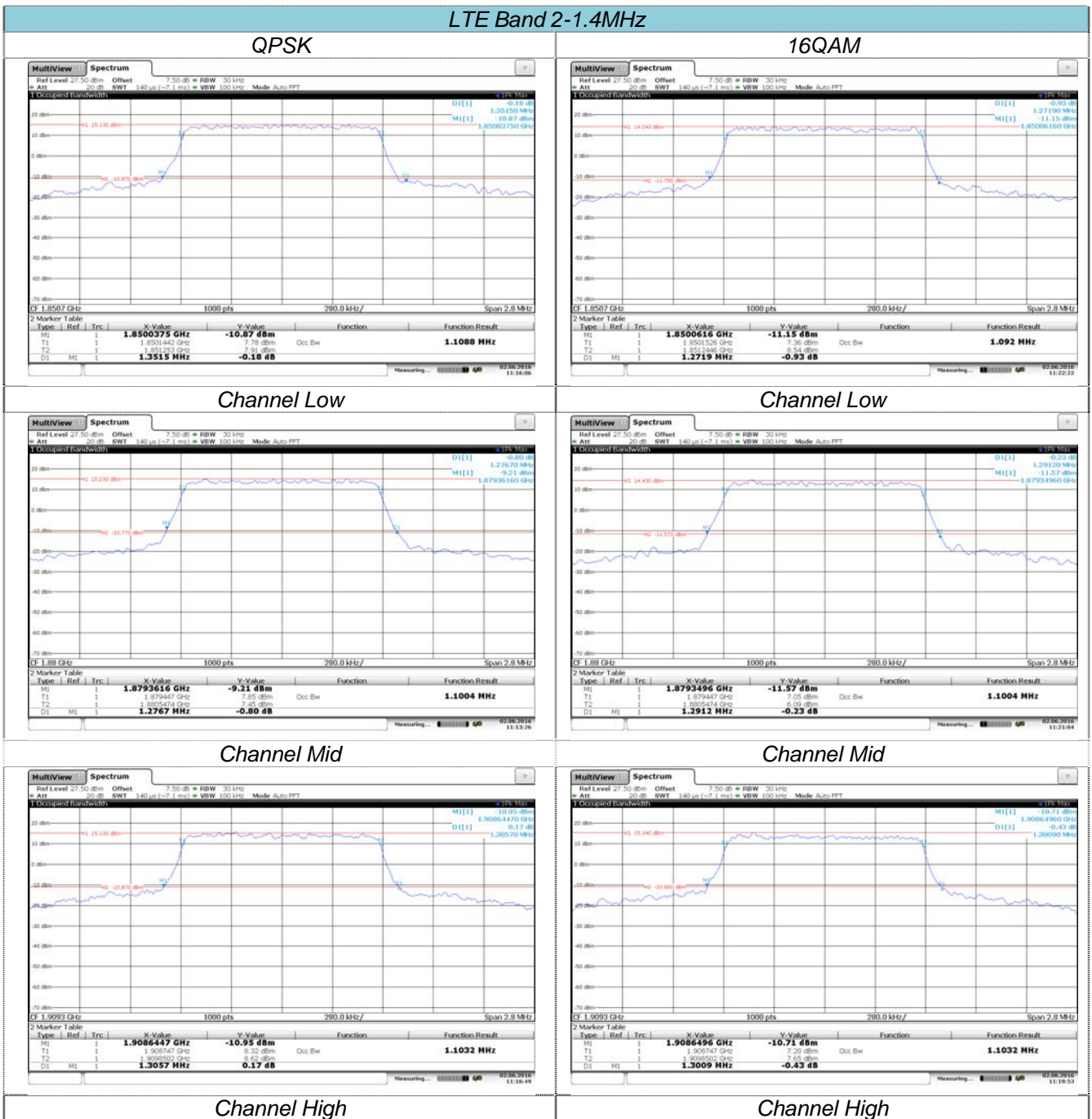
### TEST RESULTS

LTE Band 2					
Bandwidth	Channel	99% Occupy bandwidth (MHz)		-26dB bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
1.4MHz	Low	1.11	1.09	1.35	1.27
	Mid	1.10	1.10	1.28	1.29
	High	1.10	1.10	1.31	1.00
3MHz	Low	2.69	2.69	2.92	2.94
	Mid	2.69	2.69	2.94	2.94
	High	2.69	2.68	2.99	2.93
5MHz	Low	4.52	4.52	5.04	5.14
	Mid	4.53	4.53	5.08	5.06
	High	4.52	4.53	5.11	5.13
10MHz	Low	8.94	8.94	9.86	9.67
	Mid	8.96	8.94	9.86	9.76
	High	8.94	8.94	9.93	9.71
15MHz	Low	13.47	13.53	14.89	14.87
	Mid	13.53	13.53	14.97	15.02
	High	13.50	13.50	14.95	14.70
20MHz	Low	17.92	17.96	19.41	19.55
	Mid	17.96	17.92	19.52	19.72
	High	17.96	17.96	19.52	19.45

LTE Band 4					
Bandwidth	Channel	99% Occupy bandwidth (MHz)		-26dB bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
1.4MHz	Low	1.10	1.09	1.29	1.27
	Mid	1.10	1.10	1.27	1.29
	High	1.10	1.10	1.27	1.28
3MHz	Low	2.69	2.69	2.91	2.94
	Mid	2.69	2.69	2.95	2.94
	High	2.68	2.68	2.94	2.91
5MHz	Low	4.52	4.53	5.10	5.10
	Mid	4.54	4.51	5.12	5.06
	High	4.51	4.55	5.10	5.14
10MHz	Low	8.40	8.94	9.74	9.78
	Mid	8.94	8.96	9.90	9.65
	High	8.98	8.94	9.76	9.78
15MHz	Low	13.50	13.50	14.95	15.00
	Mid	13.53	13.53	14.97	15.00
	High	13.44	13.53	14.89	15.08
20MHz	Low	17.96	17.96	19.48	19.54
	Mid	18.00	18.00	19.76	19.48
	High	17.96	18.00	19.48	19.69

LTE Band 5					
Bandwidth	Channel	99% Occupy bandwidth (MHz)		-26dB bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
1.4MHz	Low	1.10	1.09	1.30	1.28
	Mid	1.11	1.11	1.33	1.32
	High	1.10	1.10	1.32	1.32
3MHz	Low	2.69	2.68	2.91	2.94
	Mid	2.70	2.70	3.00	2.98
	High	2.69	2.68	2.95	2.93
5MHz	Low	4.53	4.51	5.17	5.09
	Mid	4.56	4.53	5.17	5.16
	High	4.51	4.54	5.07	5.09
10MHz	Low	8.94	8.92	9.78	9.74
	Mid	9.00	8.96	10.02	9.83
	High	8.94	8.94	9.79	9.76

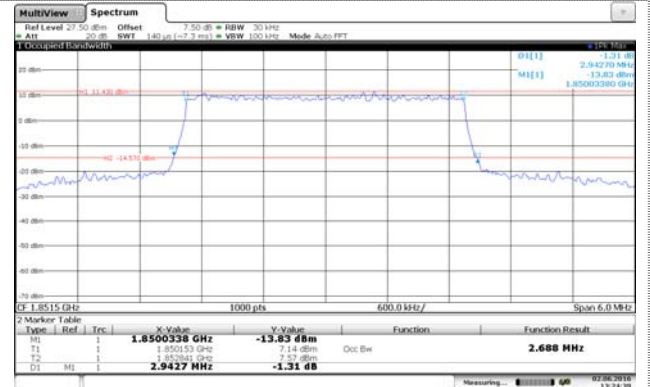
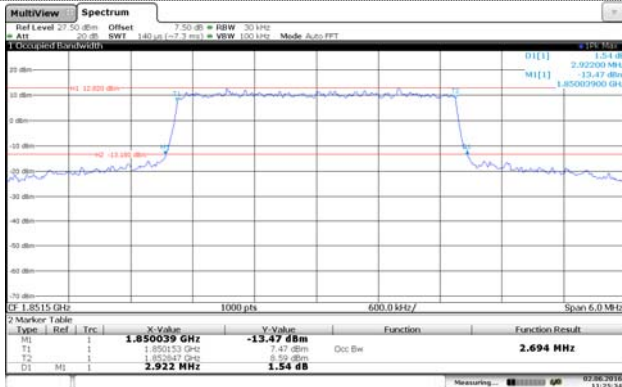
LTE Band 17					
Bandwidth	Channel	99% Occupy bandwidth (MHz)		-26dB bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
5MHz	Low	4.57	4.53	5.13	5.14
	Mid	4.51	4.53	5.12	5.10
	High	4.50	4.52	5.05	5.06
10MHz	Low	8.96	8.98	9.81	9.90
	Mid	8.96	8.96	9.64	9.84
	High	8.90	8.92	9.67	9.62



LTE Band 2-3MHz

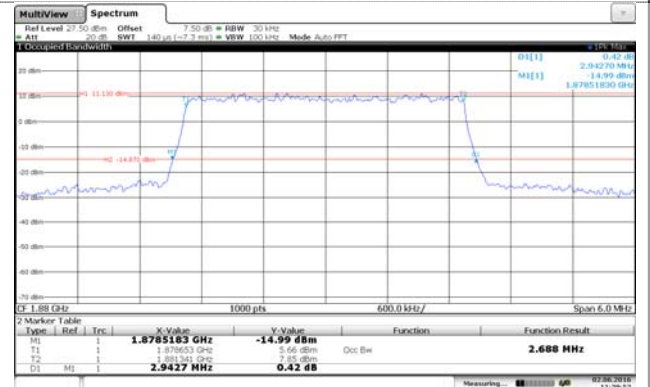
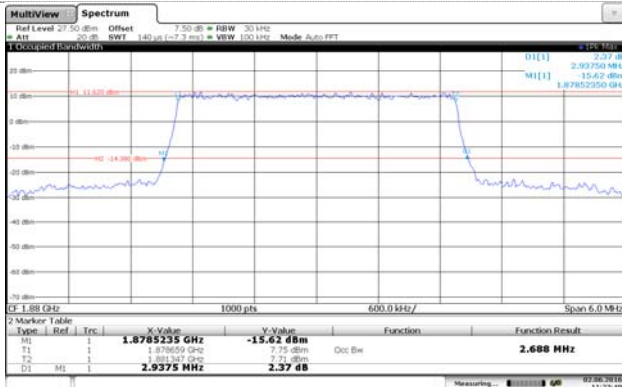
QPSK

16QAM



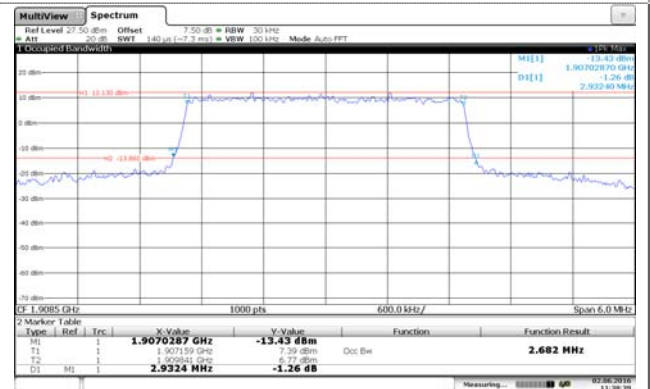
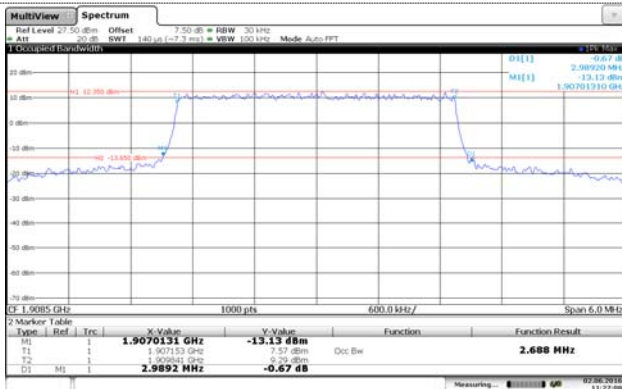
Channel Low

Channel Low



Channel Mid

Channel Mid



Channel High

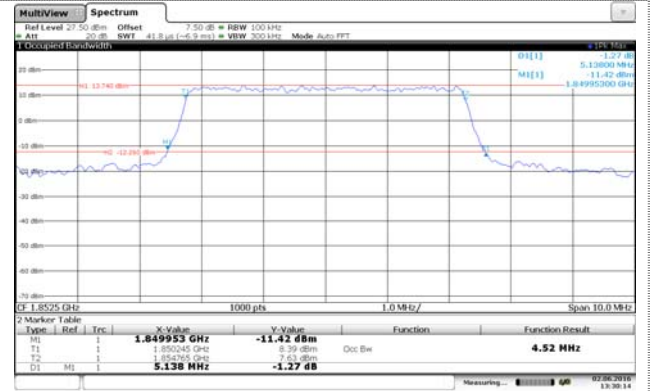
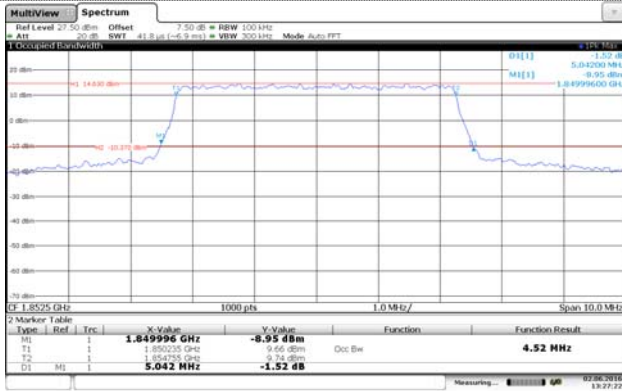
Channel High



LTE Band 2-5MHz

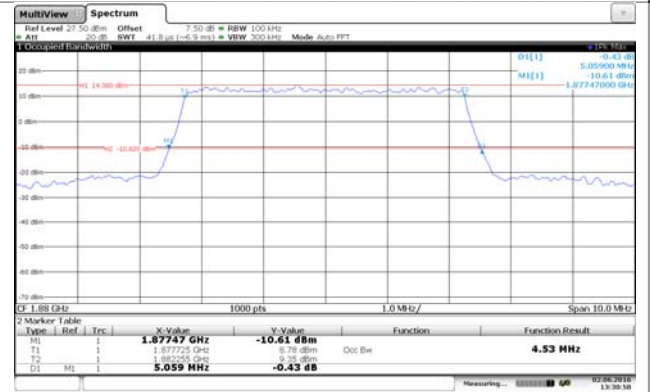
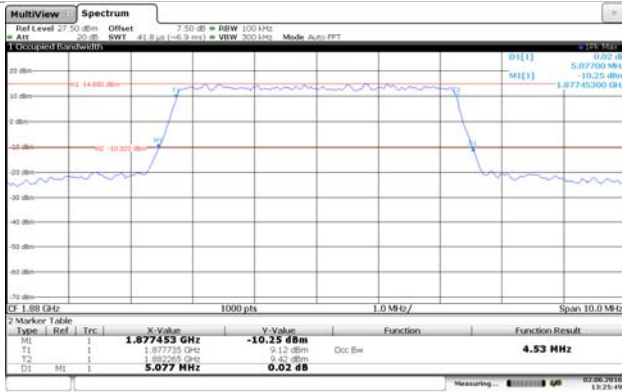
QPSK

16QAM



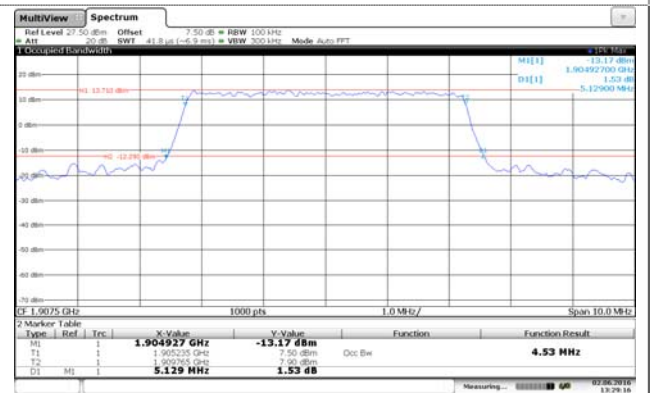
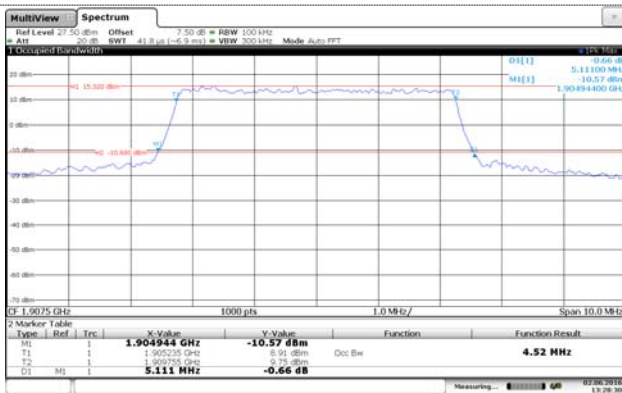
Channel Low

Channel Low



Channel Mid

Channel Mid



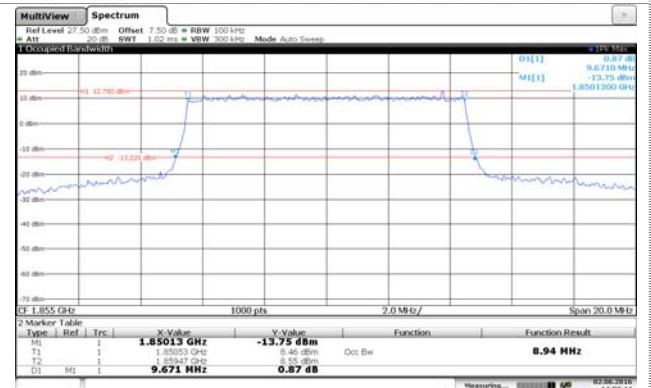
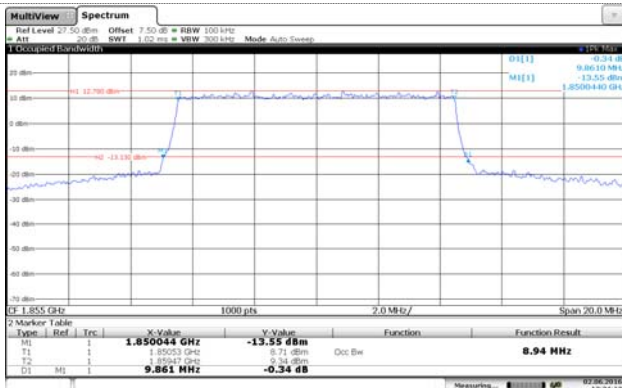
Channel High

Channel High

LTE Band 2-10MHz

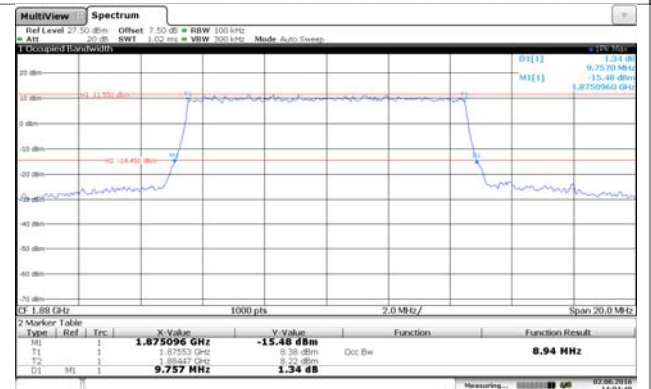
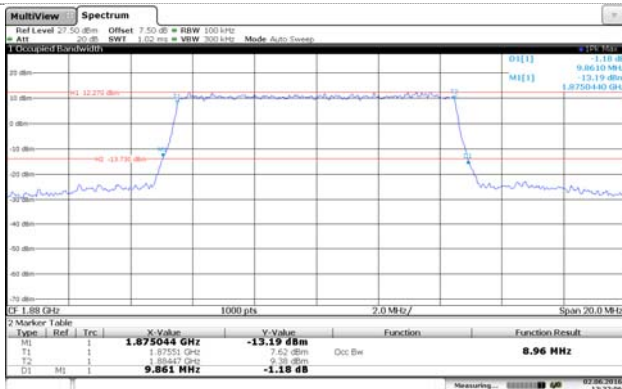
QPSK

16QAM



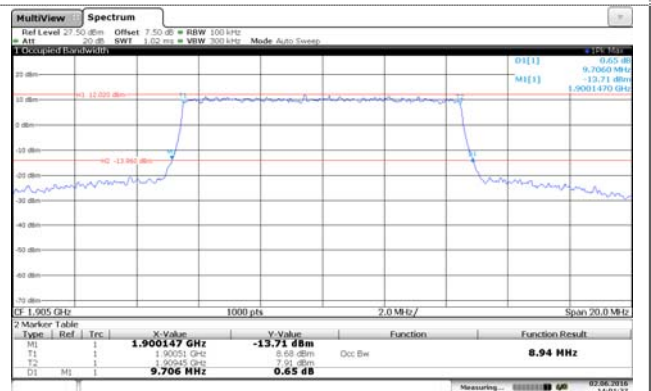
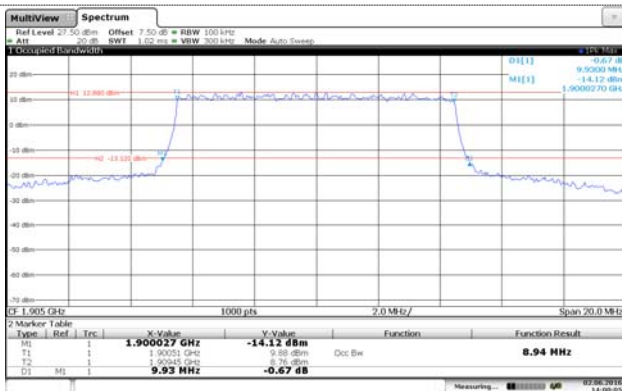
Channel Low

Channel Low



Channel Mid

Channel Mid

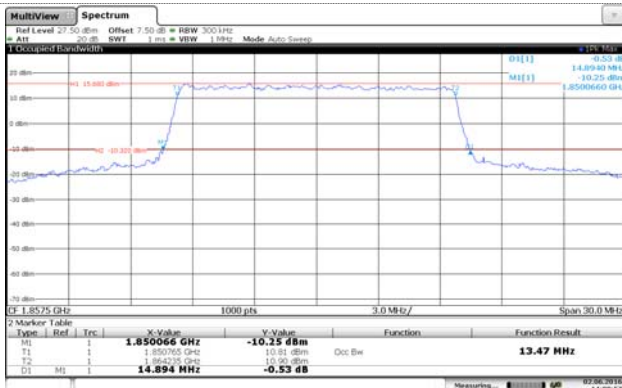


Channel High

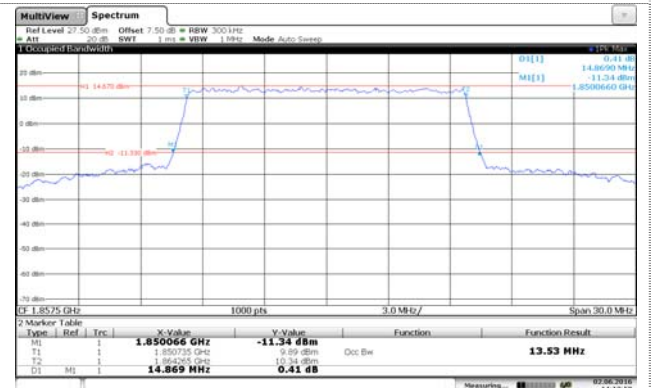
Channel High

LTE Band 2-15MHz

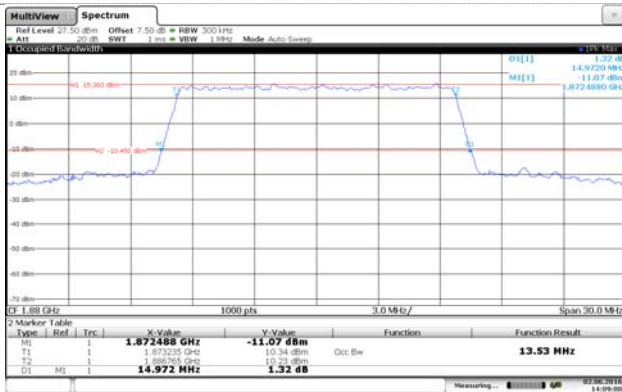
QPSK



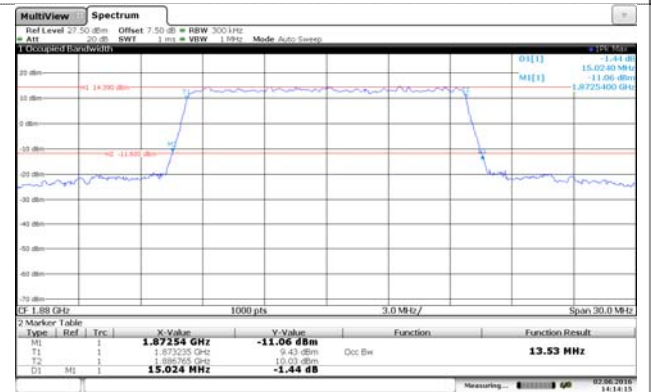
16QAM



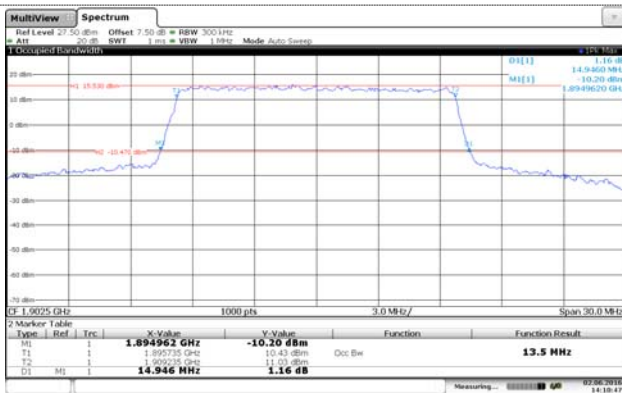
Channel Low



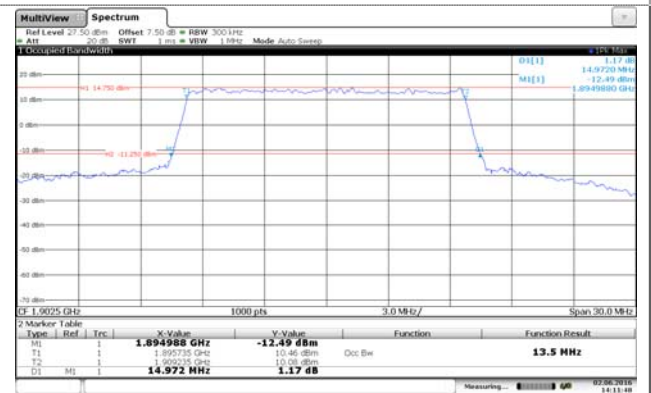
Channel Low



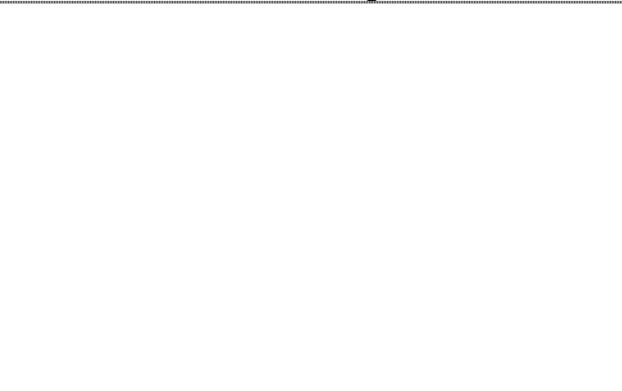
Channel Mid



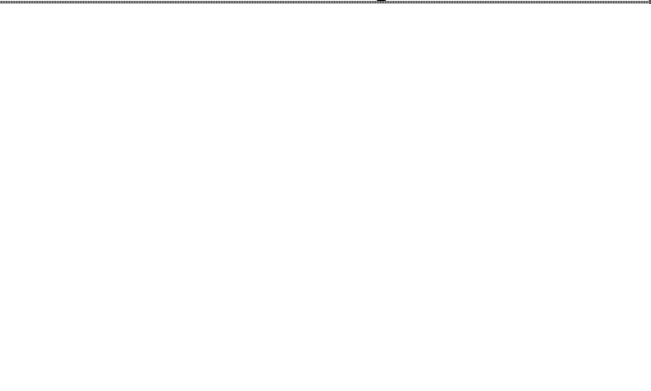
Channel Mid



Channel High



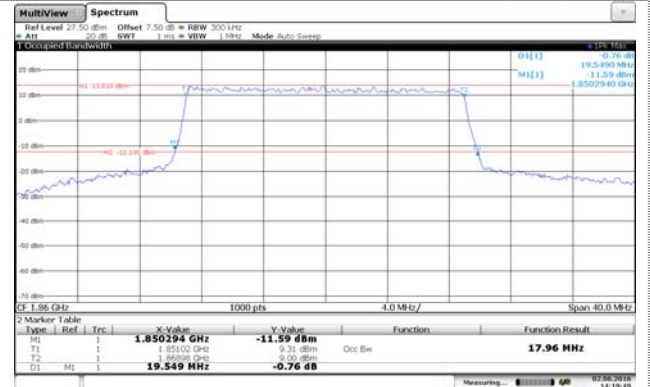
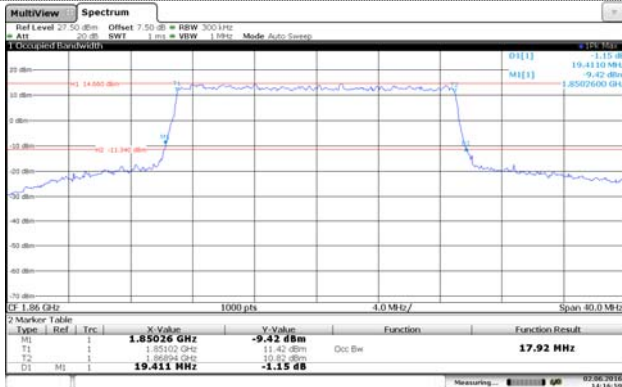
Channel High



LTE Band 2-20MHz

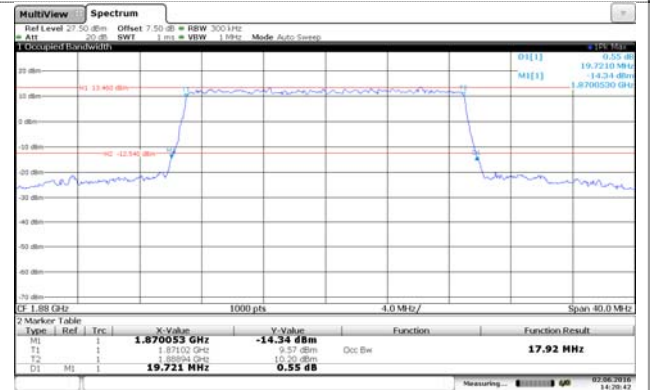
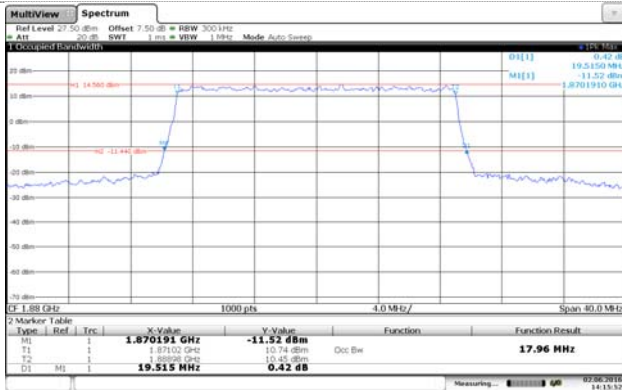
QPSK

16QAM



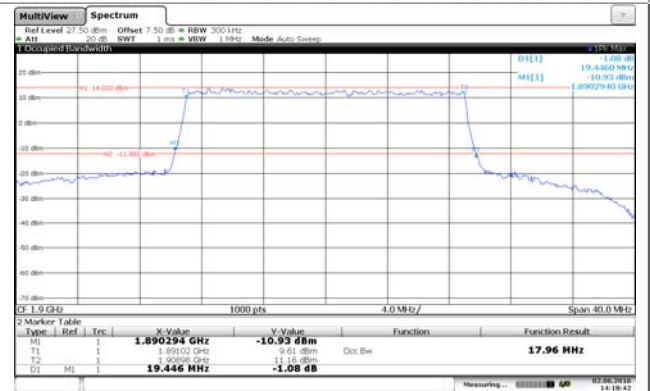
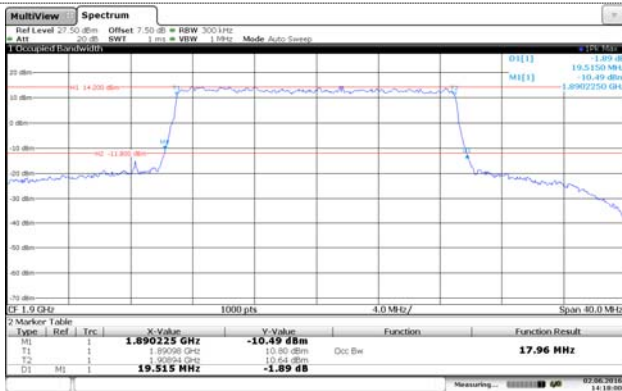
Channel Low

Channel Low



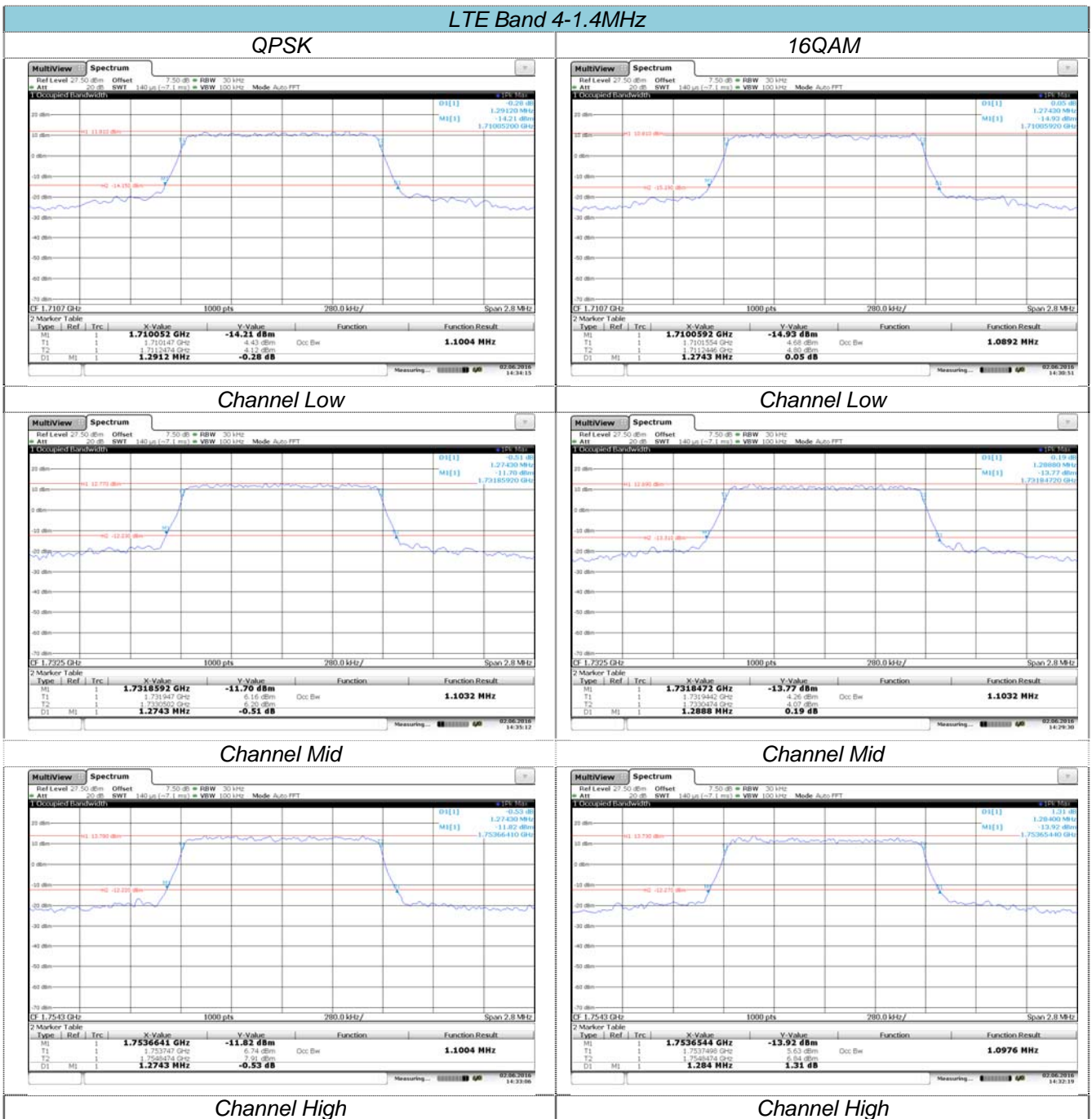
Channel Mid

Channel Mid



Channel High

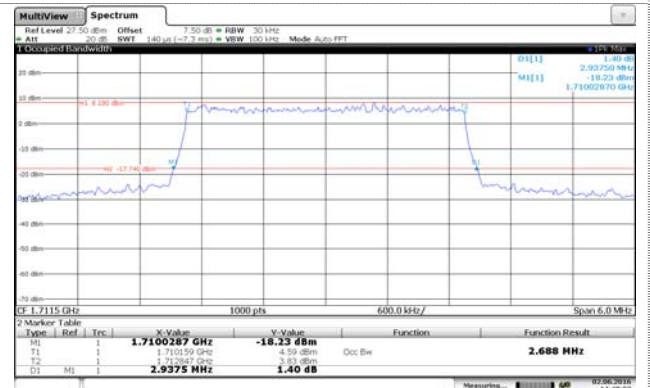
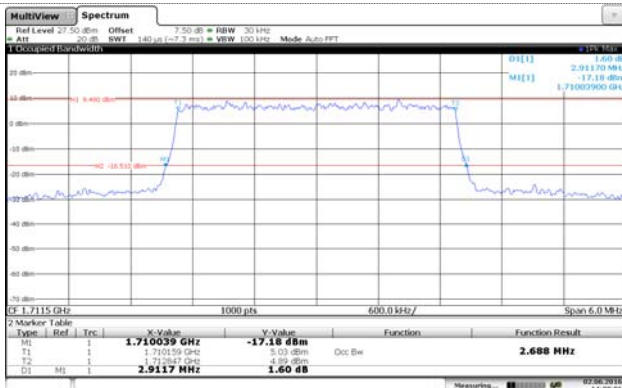
Channel High



LTE Band 4-3MHz

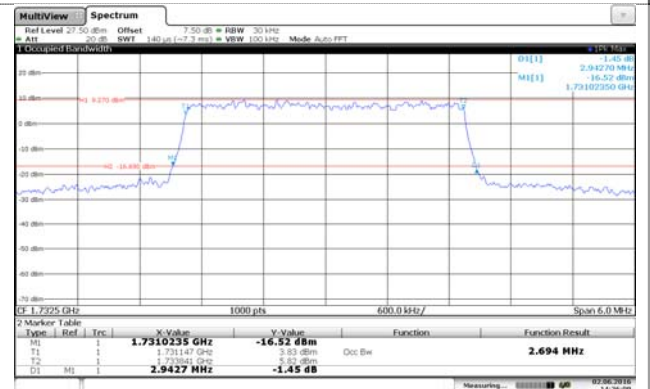
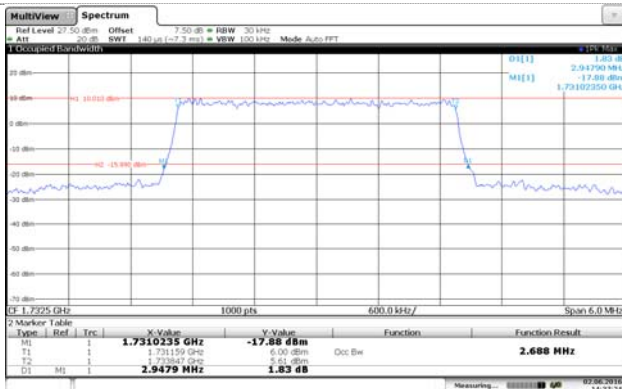
QPSK

16QAM



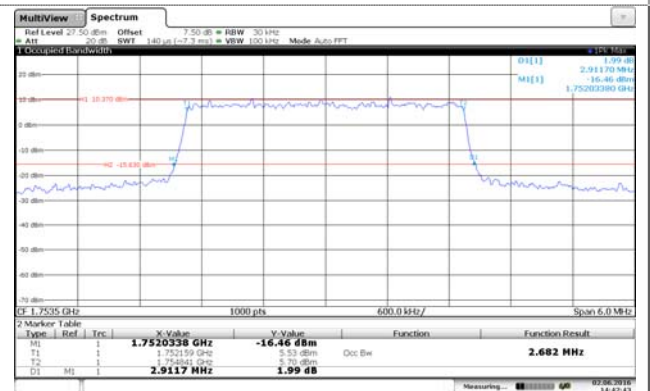
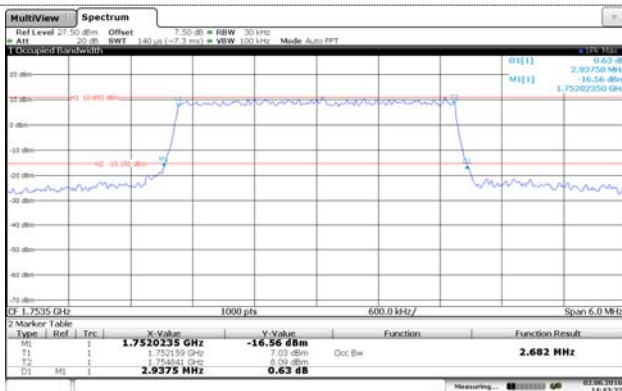
Channel Low

Channel Low



Channel Mid

Channel Mid



Channel High

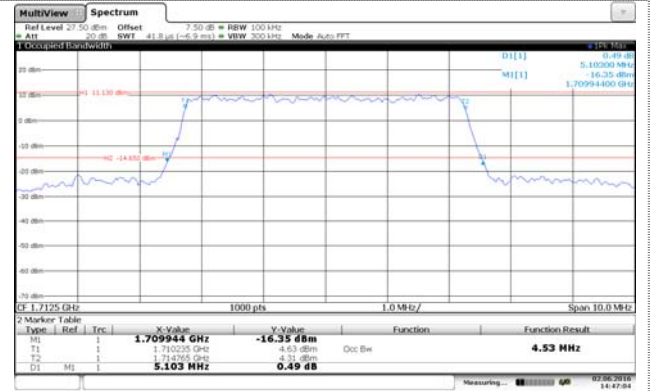
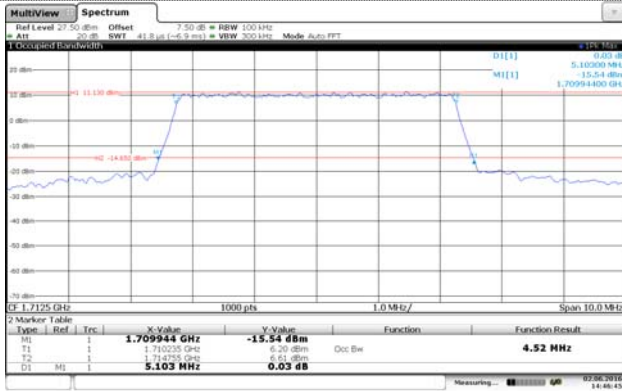
Channel High



LTE Band 4-5MHz

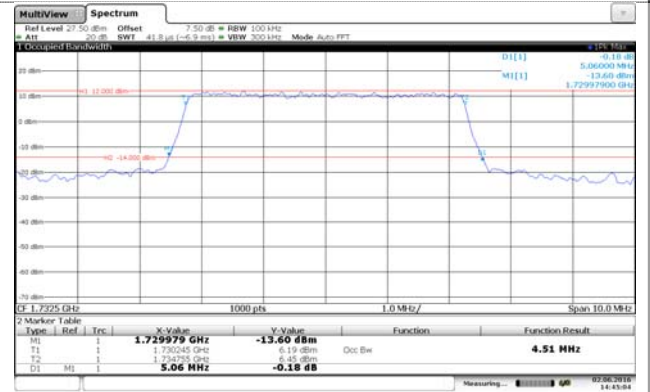
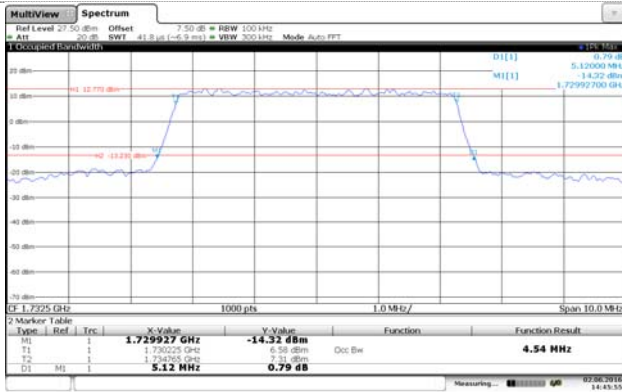
QPSK

16QAM



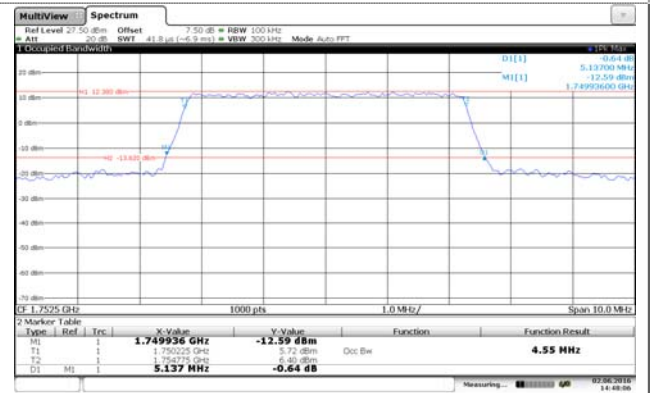
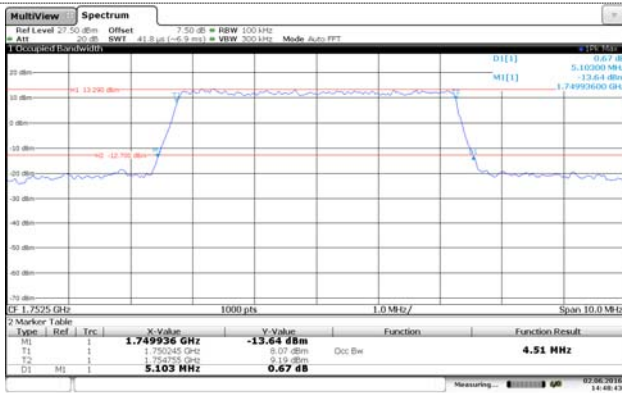
Channel Low

Channel Low



Channel Mid

Channel Mid



Channel High

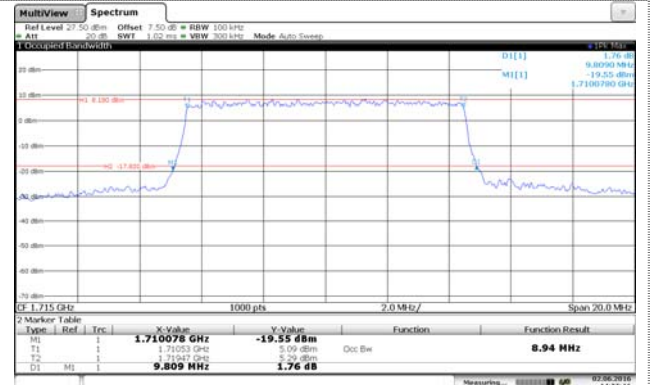
Channel High

LTE Band 4-10MHz

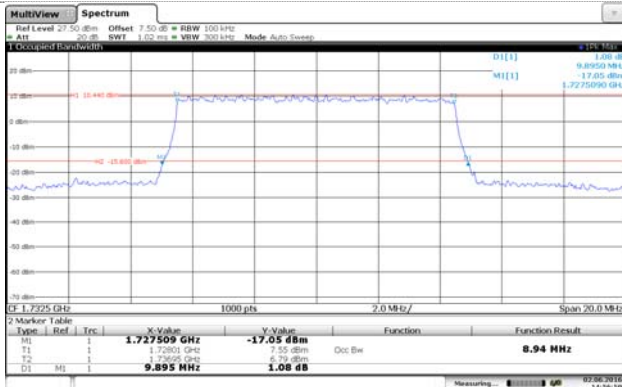
QPSK



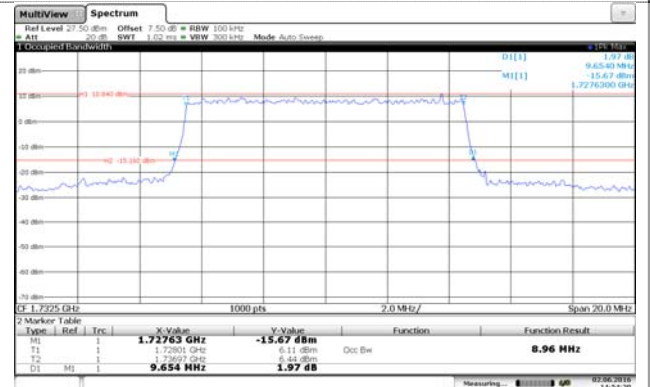
16QAM



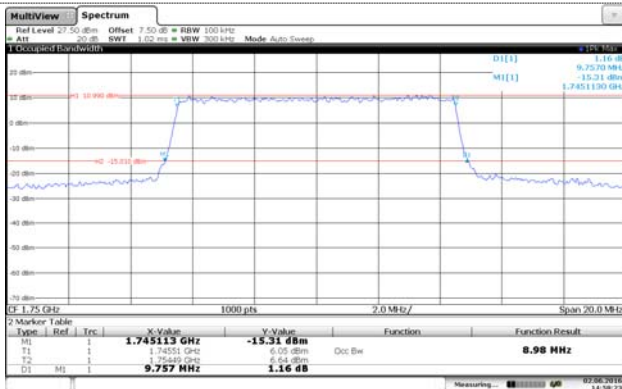
Channel Low



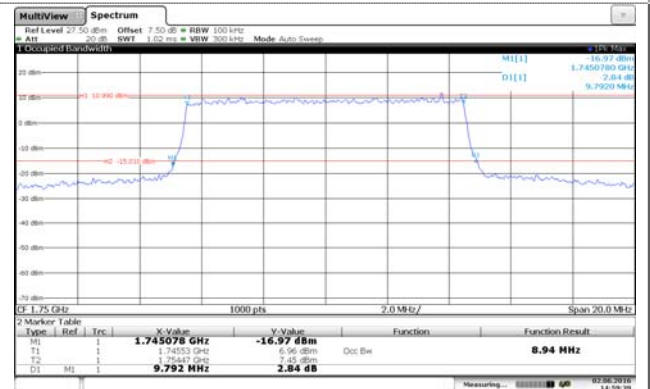
Channel Low



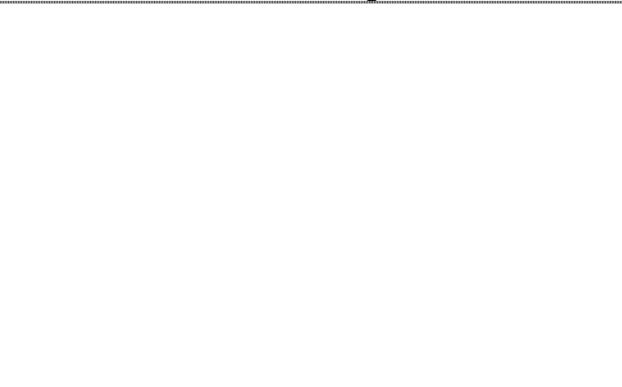
Channel Mid



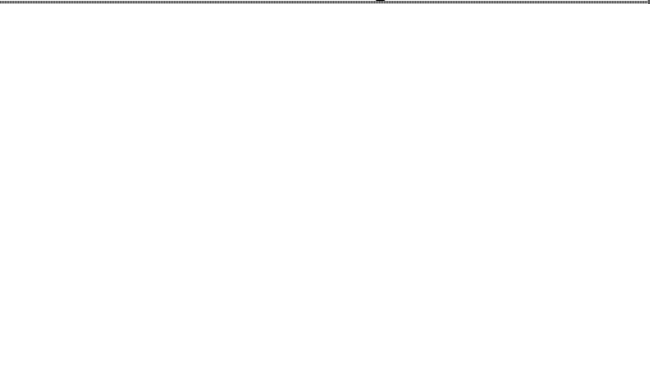
Channel Mid



Channel High



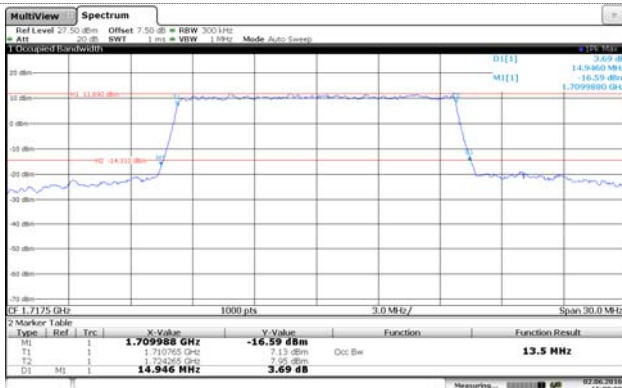
Channel High



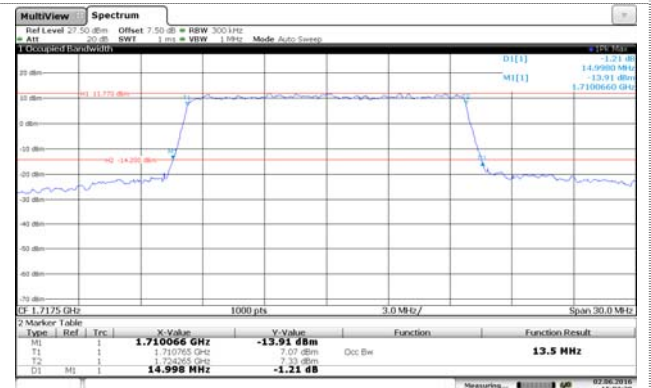


LTE Band 4-15MHz

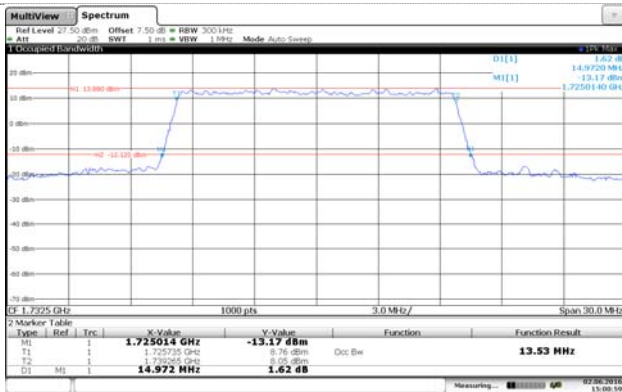
QPSK



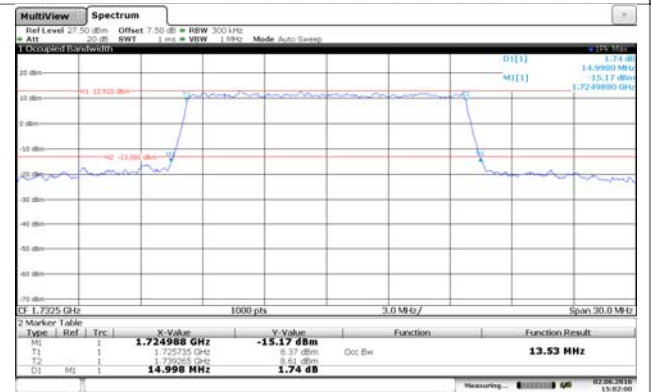
16QAM



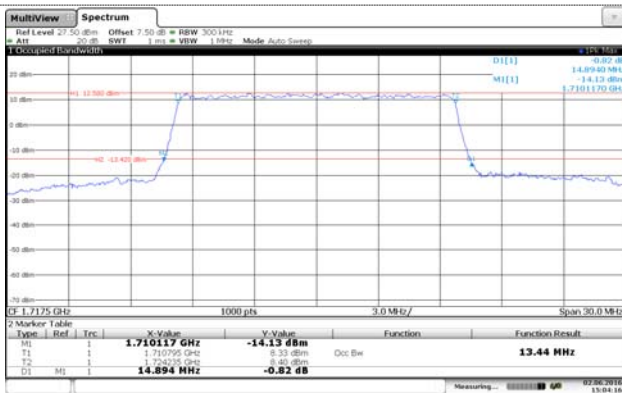
Channel Low



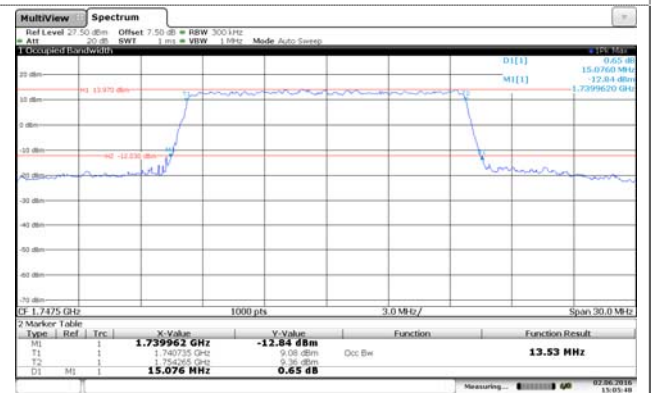
Channel Low



Channel Mid



Channel Mid

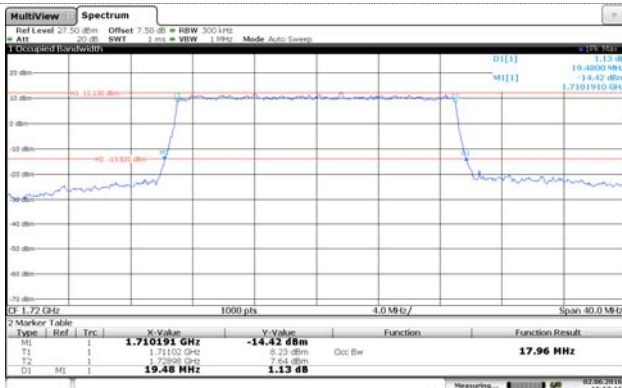


Channel High

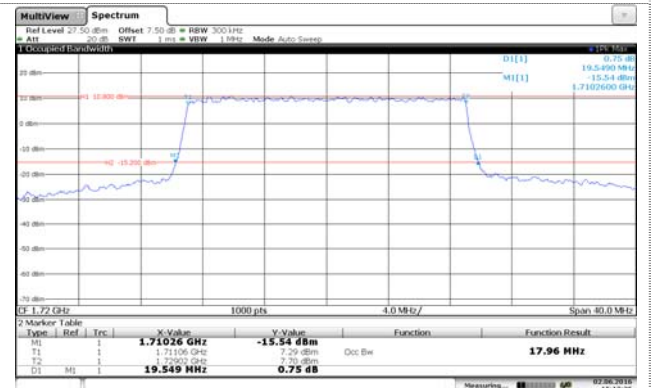
Channel High

LTE Band 4-20MHz

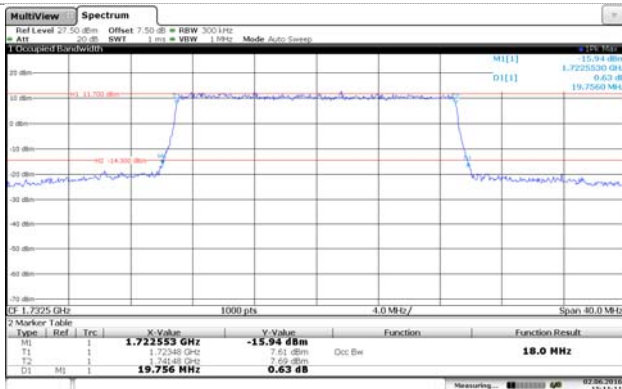
QPSK



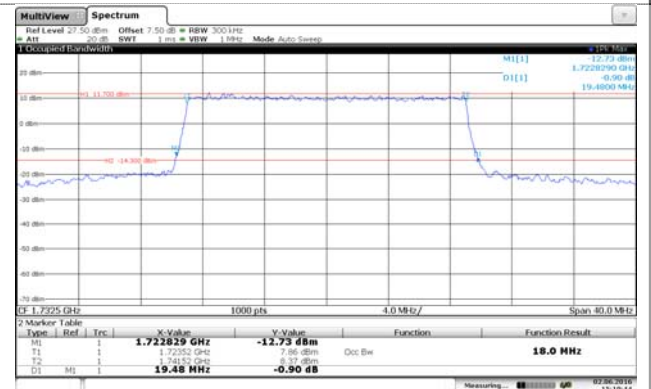
16QAM



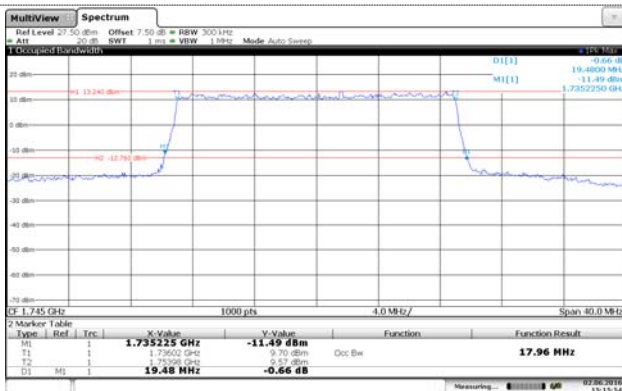
Channel Low



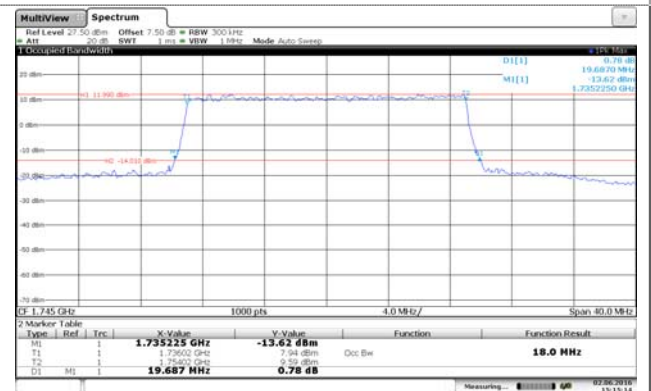
Channel Low



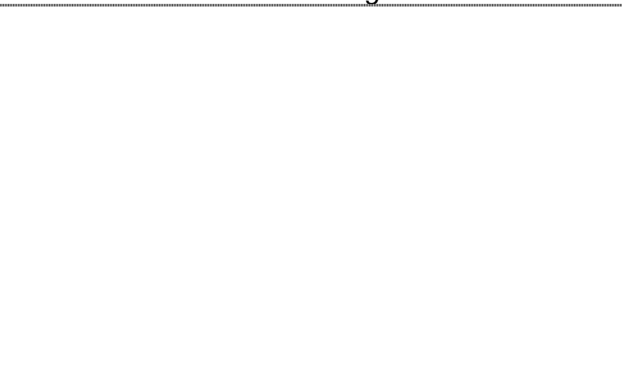
Channel Mid



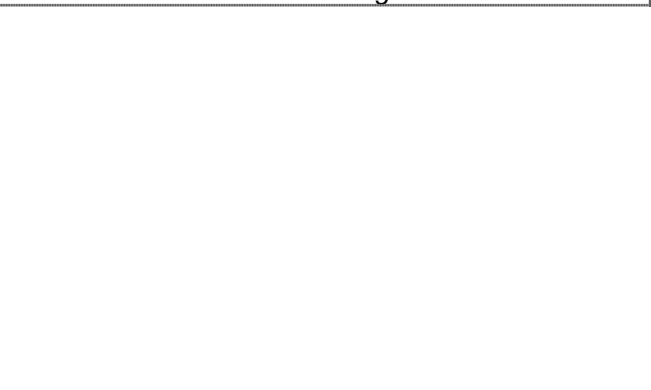
Channel Mid

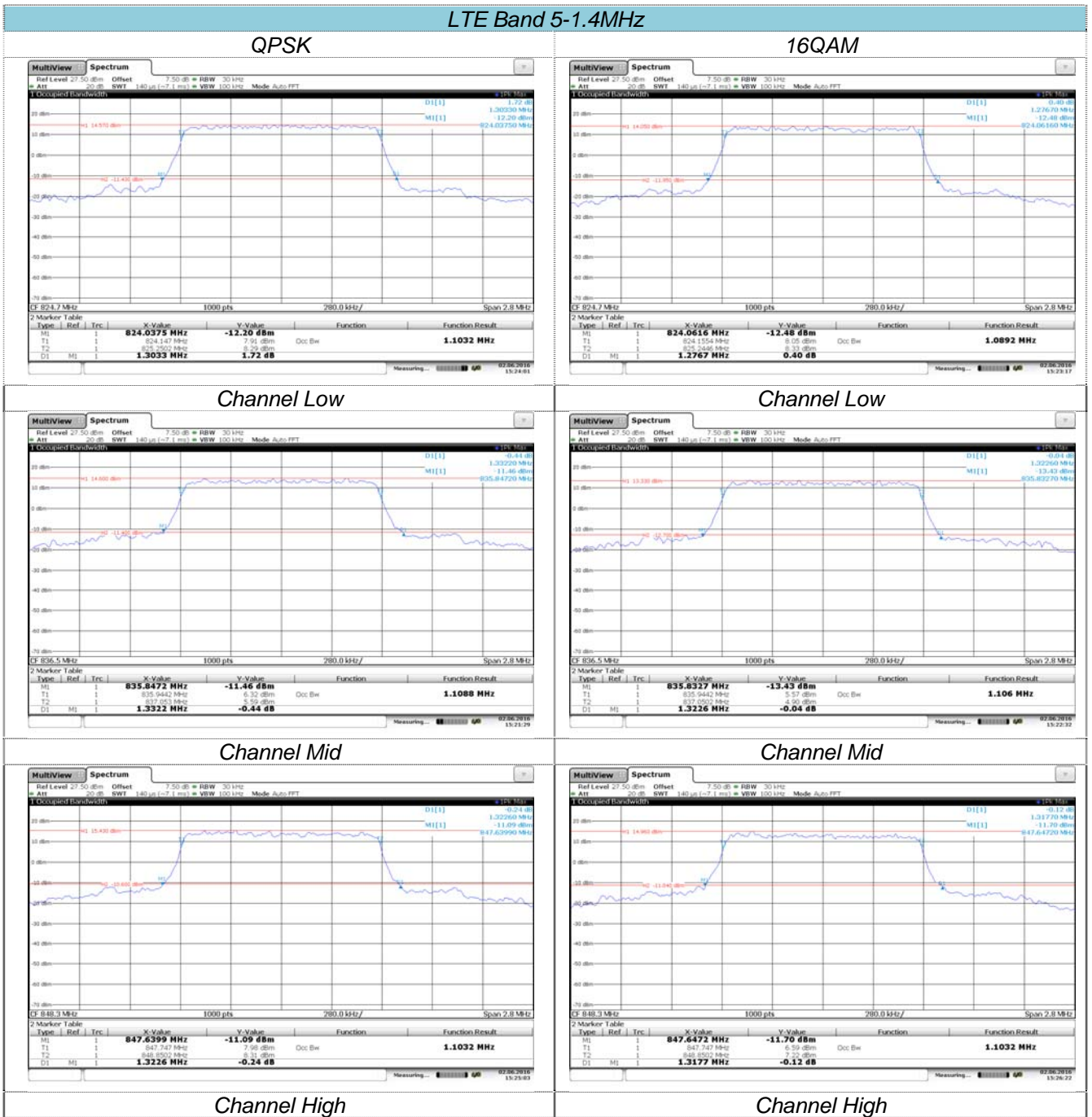


Channel High



Channel High

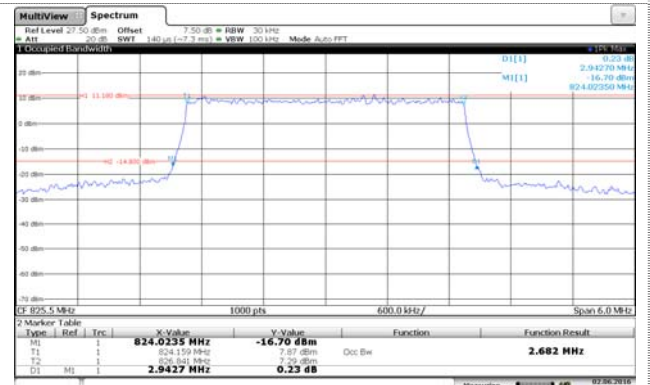
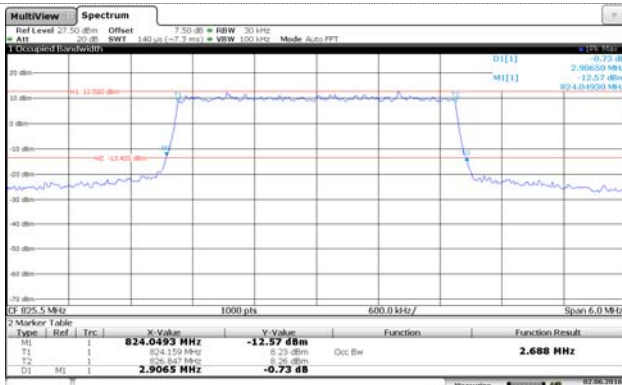




LTE Band 5-3MHz

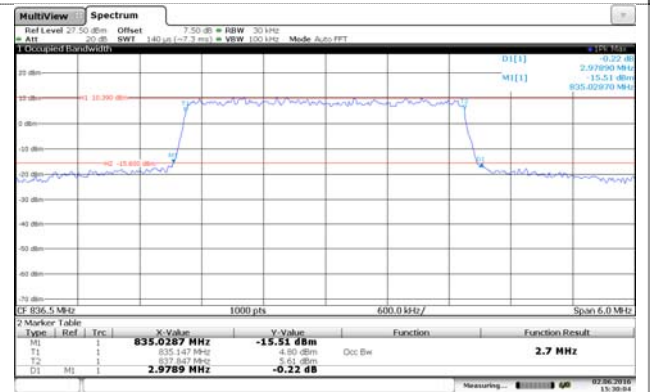
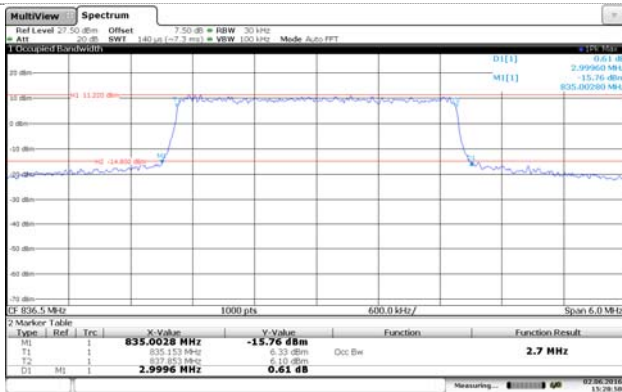
QPSK

16QAM



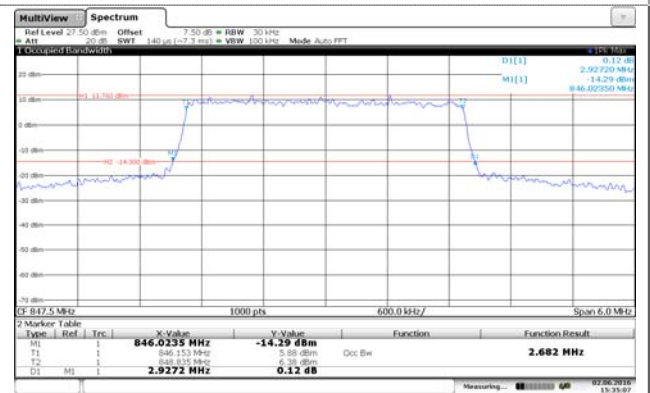
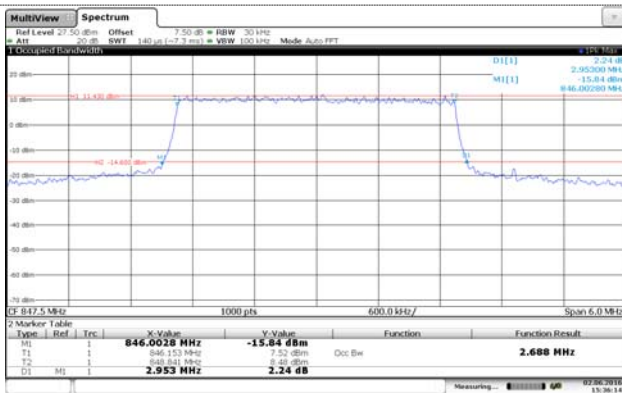
Channel Low

Channel Low



Channel Mid

Channel Mid



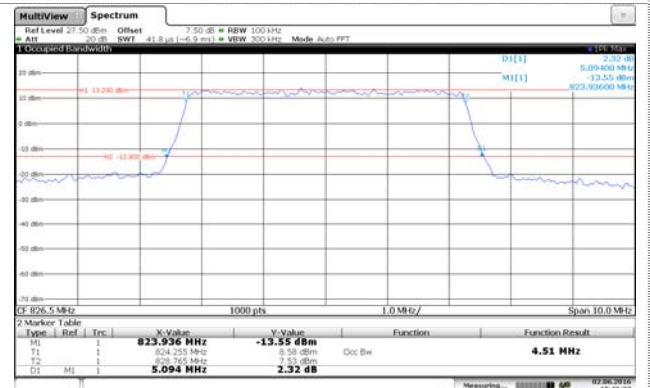
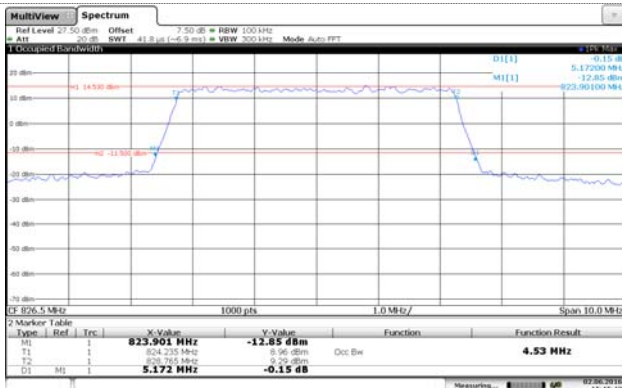
Channel High

Channel High

LTE Band 5-5MHz

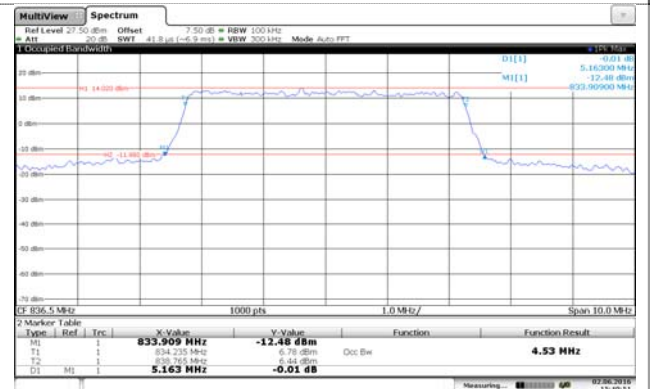
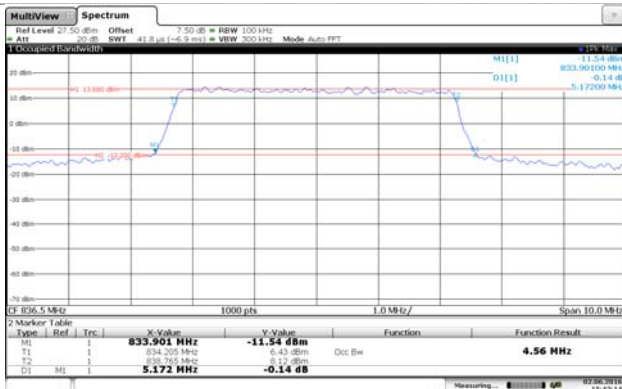
QPSK

16QAM



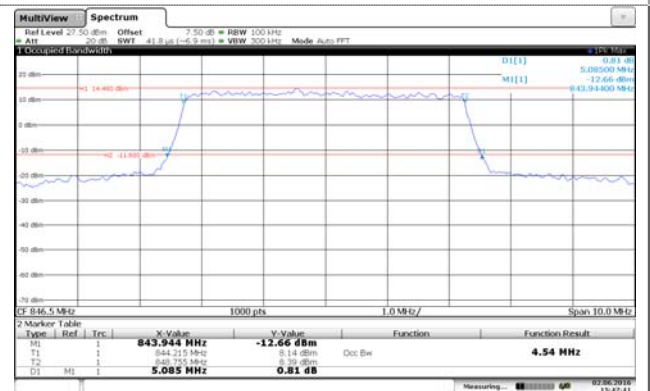
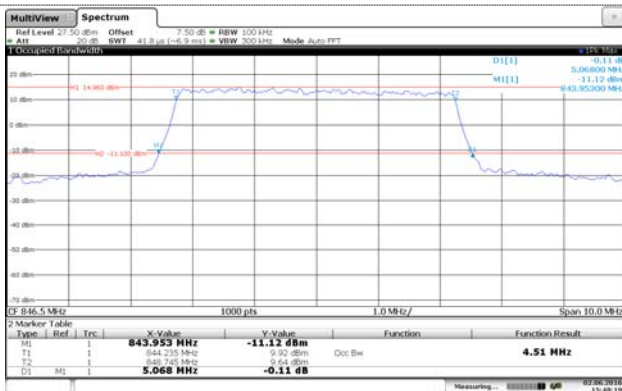
Channel Low

Channel Low



Channel Mid

Channel Mid

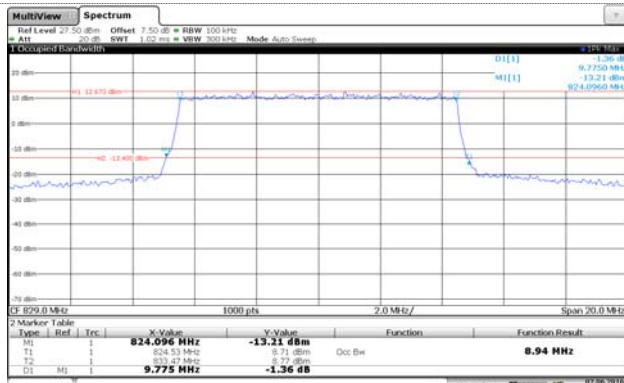


Channel High

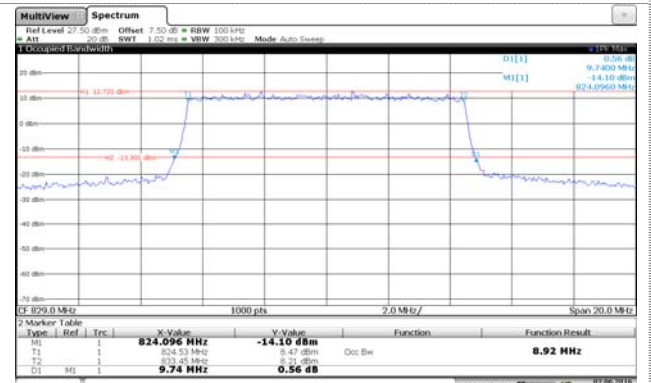
Channel High

LTE Band 5-15MHz

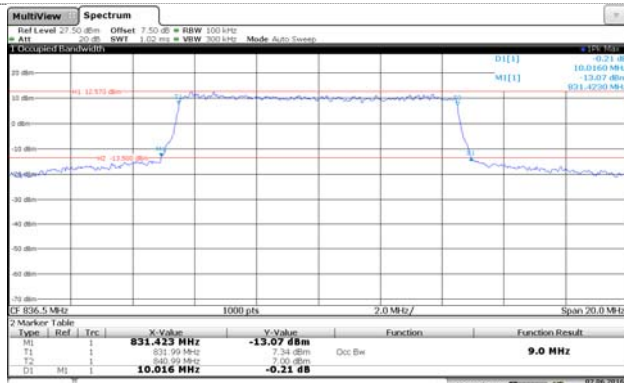
QPSK



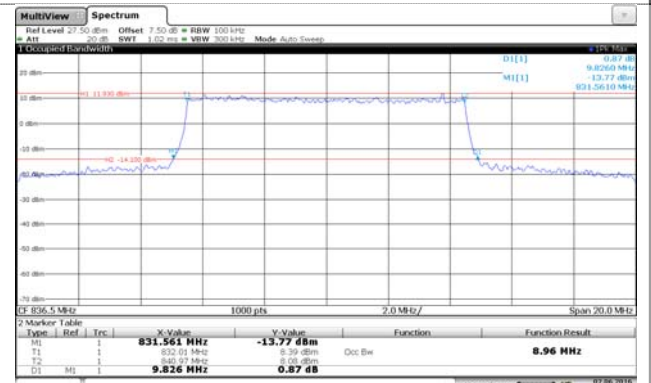
16QAM



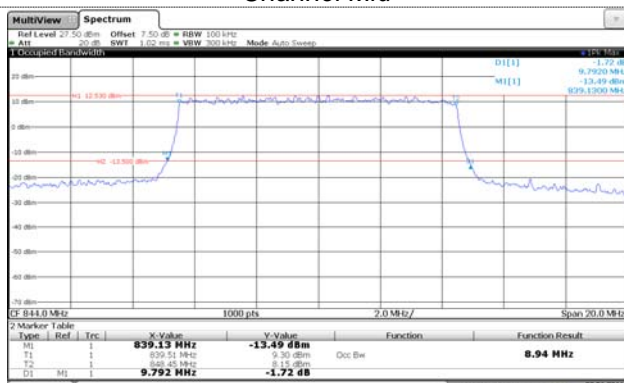
Channel Low



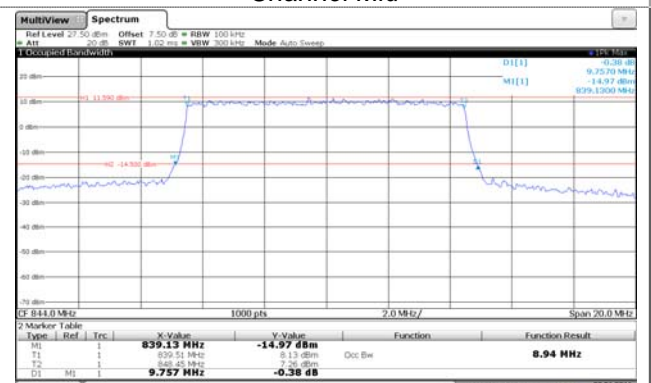
Channel Low



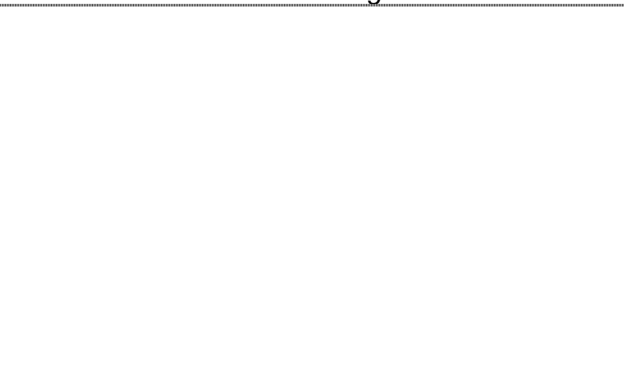
Channel Mid



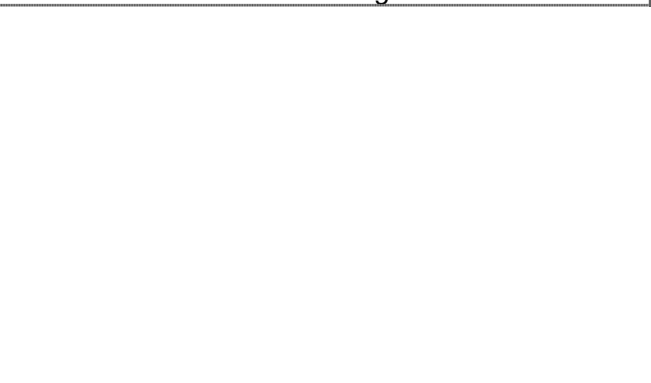
Channel Mid



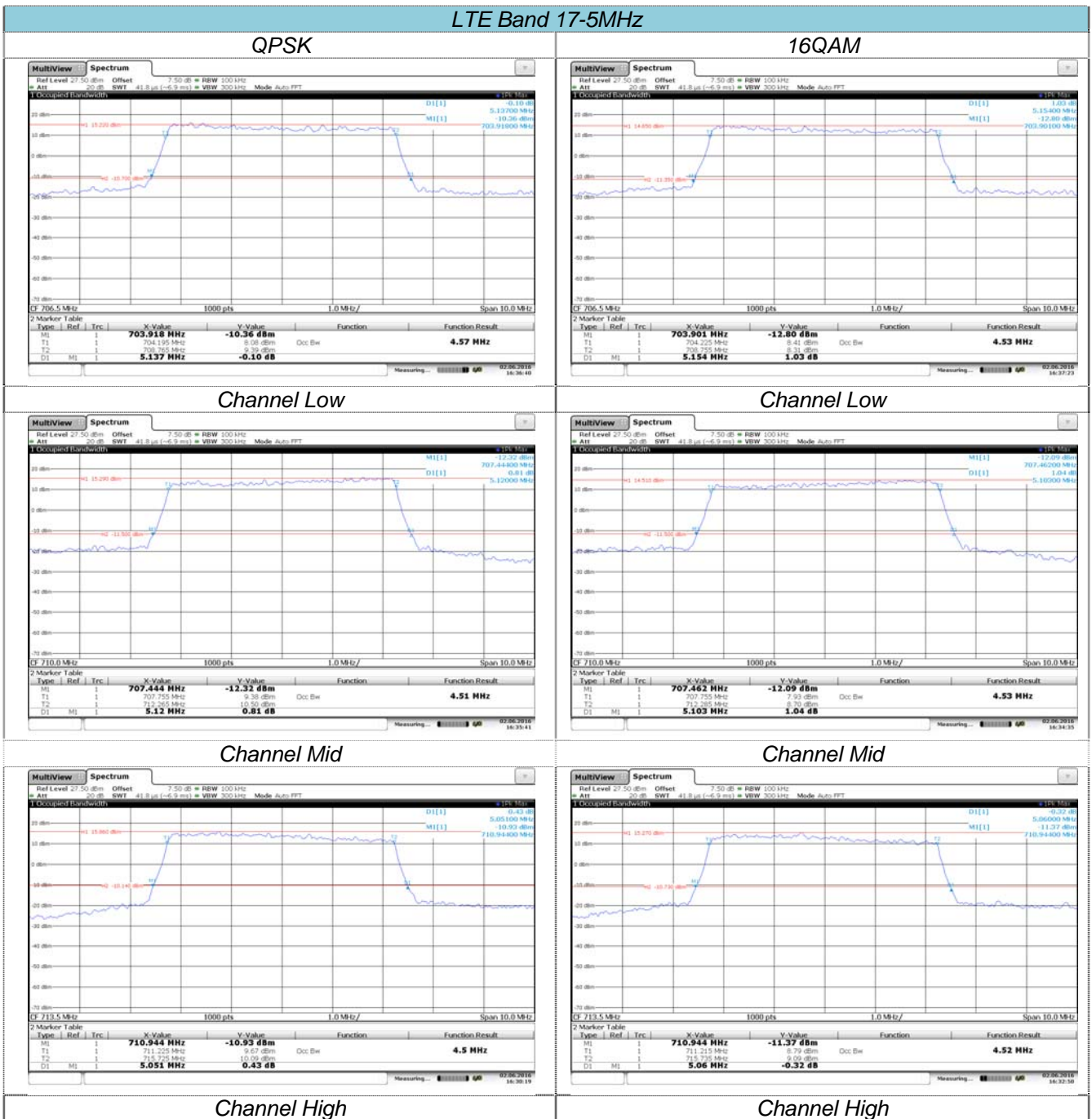
Channel High



Channel High

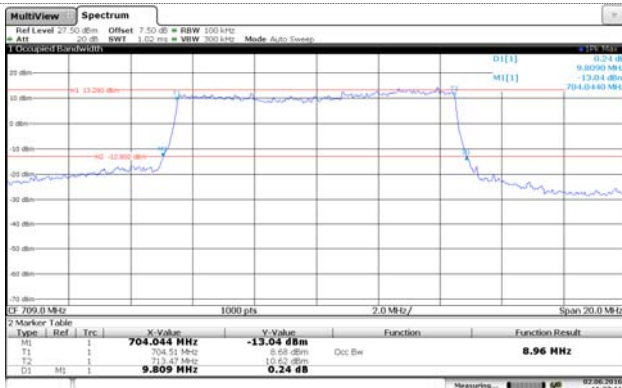




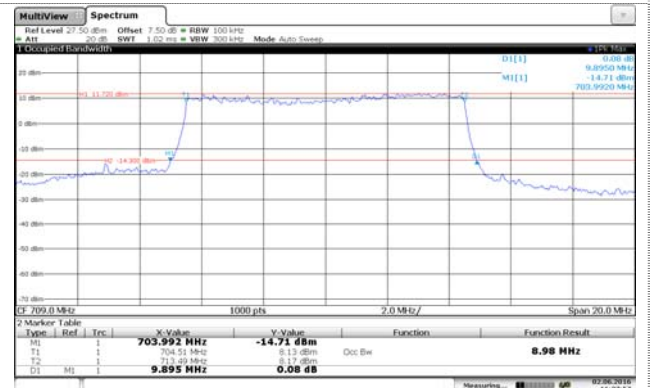


LTE Band 17-10MHz

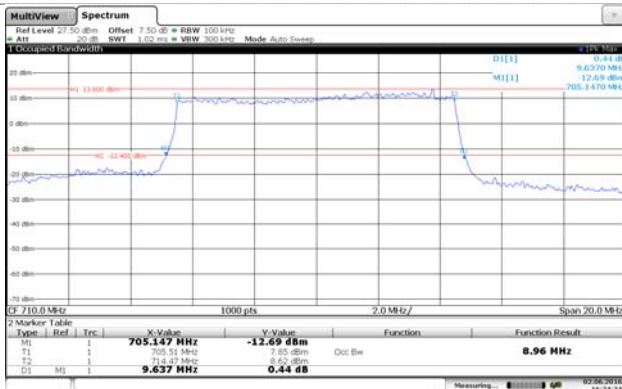
QPSK



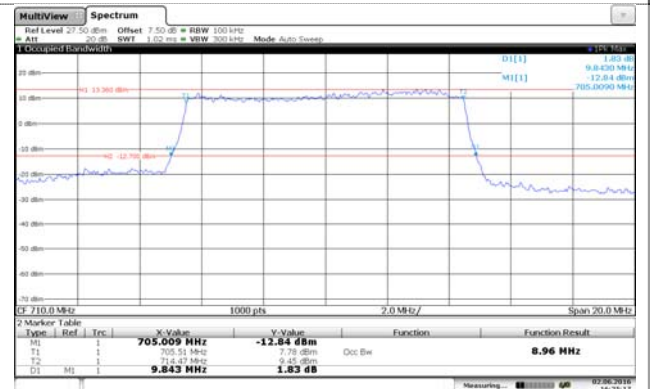
16QAM



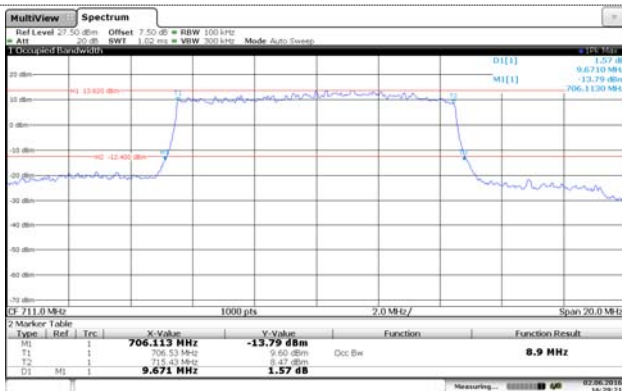
Channel Low



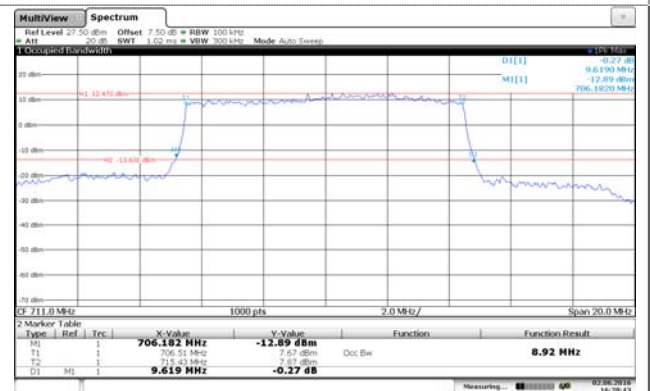
Channel Low



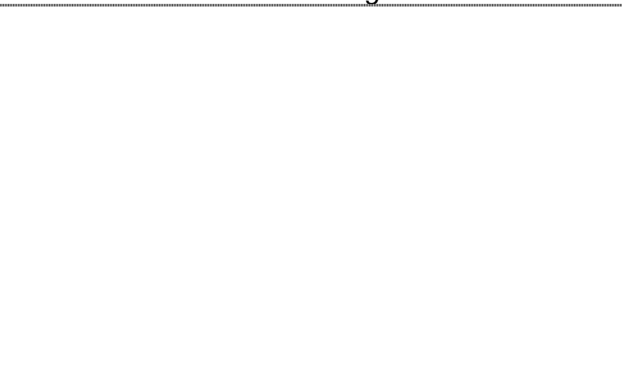
Channel Mid



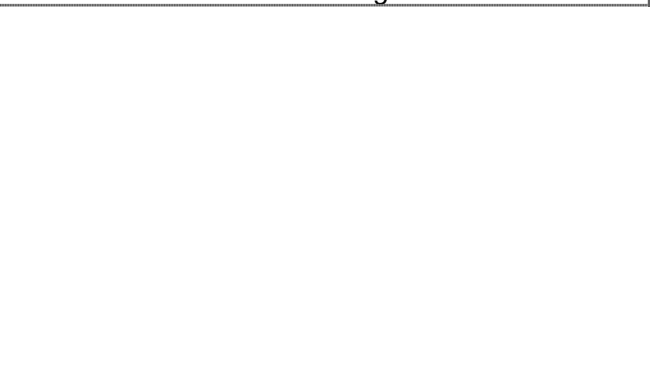
Channel Mid



Channel High



Channel High





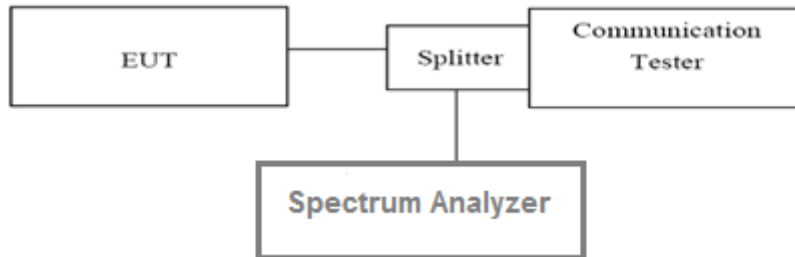
### 4.3. Out of band emission at antenna terminals

#### LIMIT

Part 24.238 and Part 22.917 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

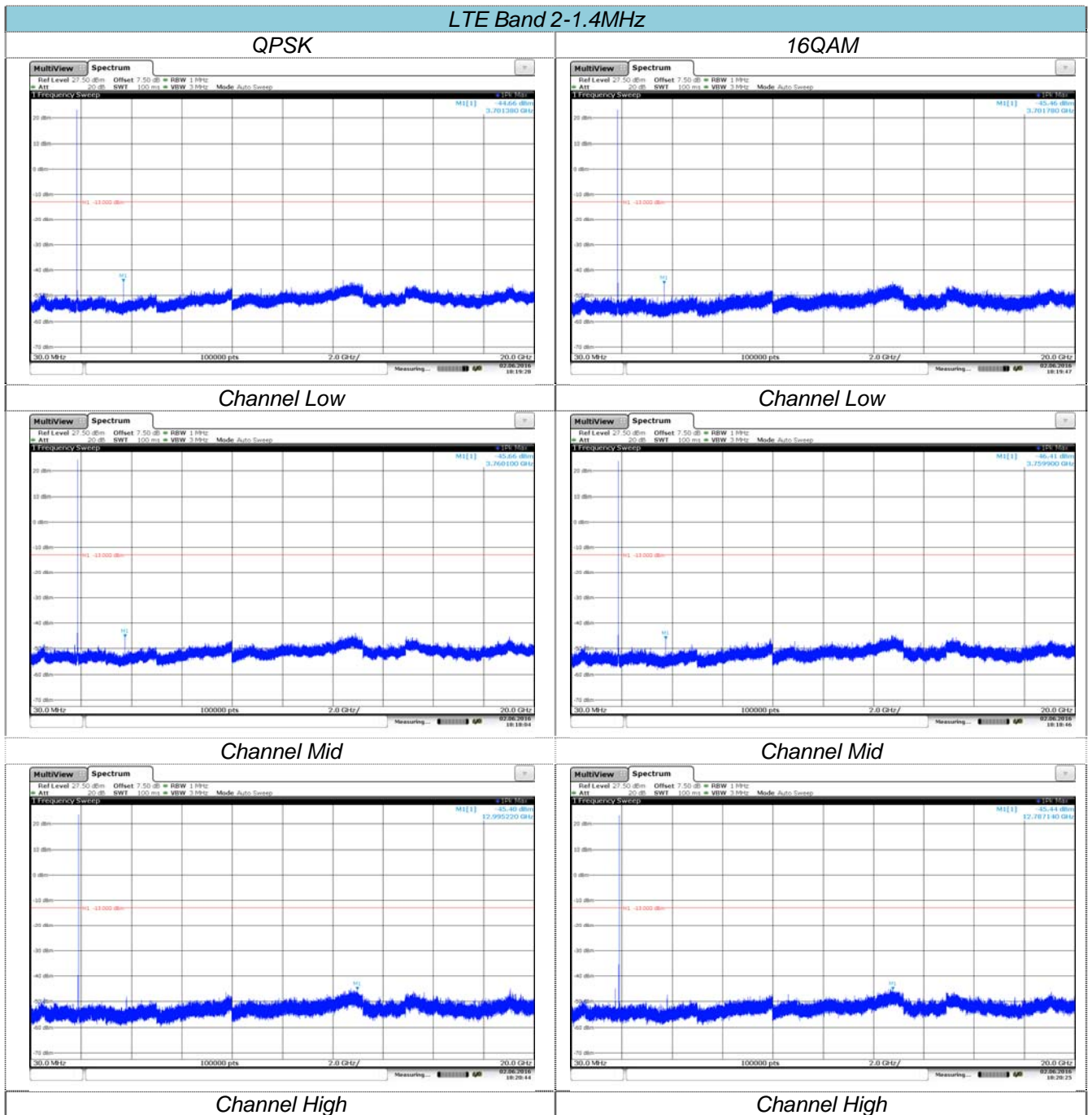
#### TEST CONFIGURATION



#### TEST PROCEDURE

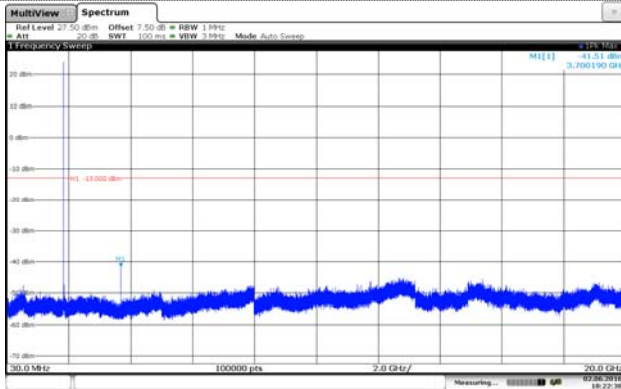
1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.
3. For the out of band: Set the RBW= 1MHz, VBW = 3MHz, Start=30MHz, Stop= 10th harmonic.

#### TEST RESULTS

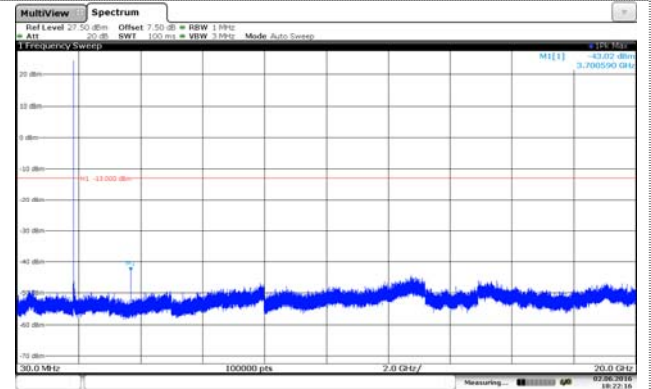


LTE Band 2-3MHz

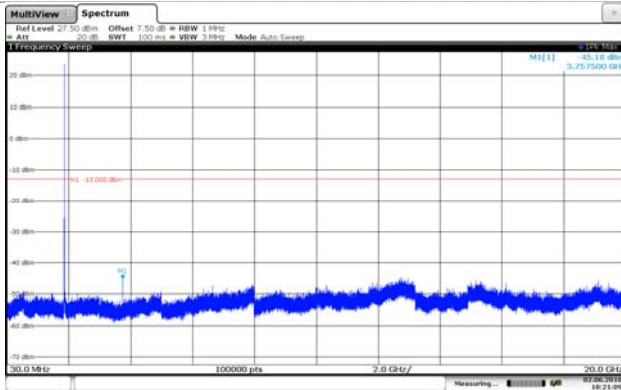
QPSK



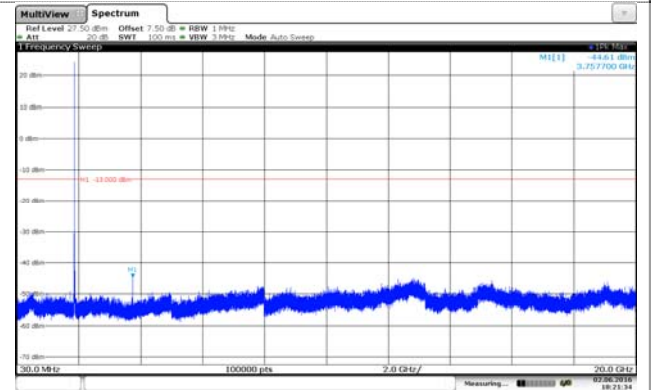
16QAM



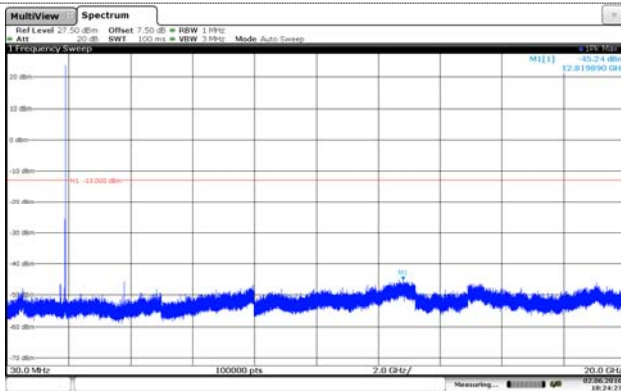
Channel Low



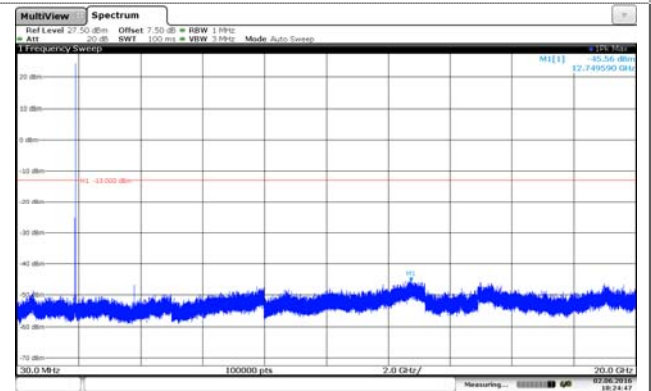
Channel Low



Channel Mid



Channel Mid



Channel High

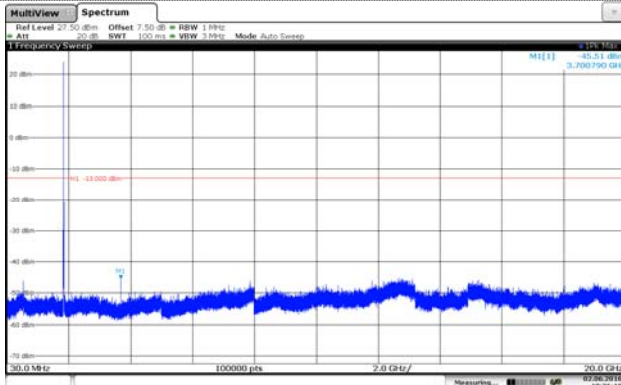


Channel High

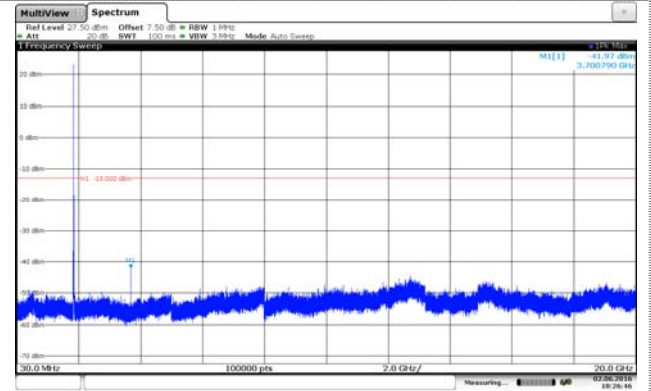


LTE Band 2-5MHz

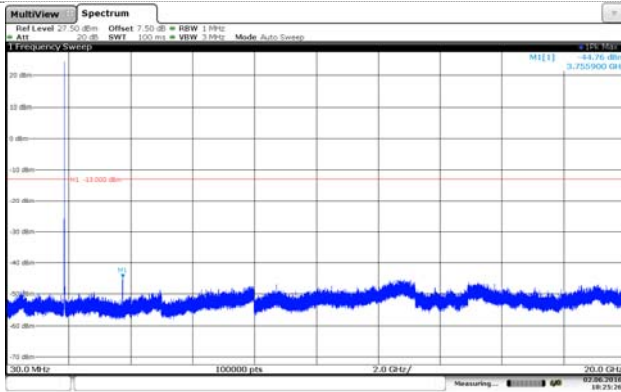
QPSK



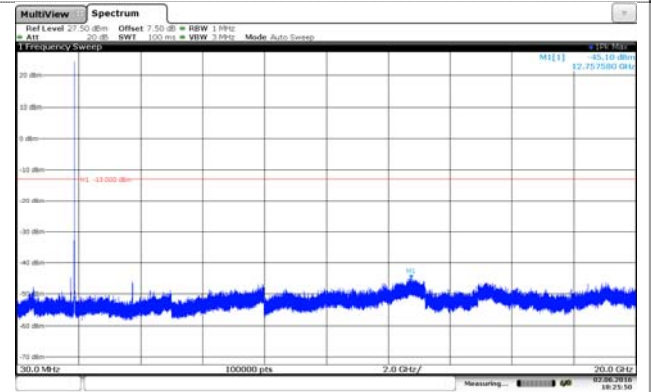
16QAM



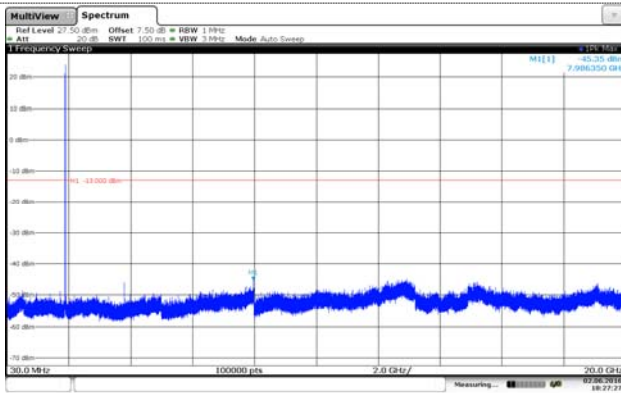
Channel Low



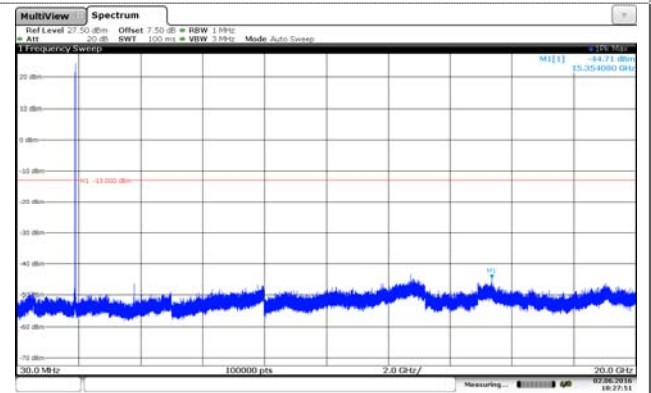
Channel Low



Channel Mid



Channel Mid

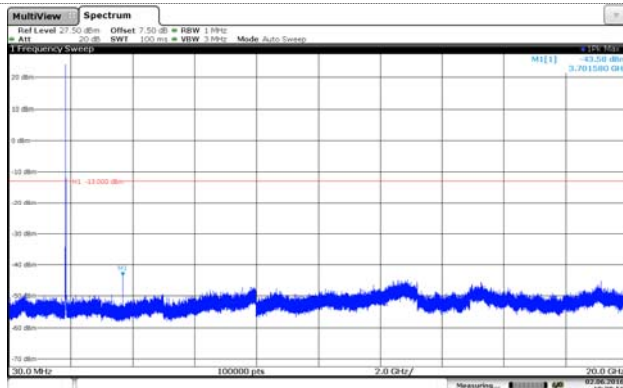


Channel High

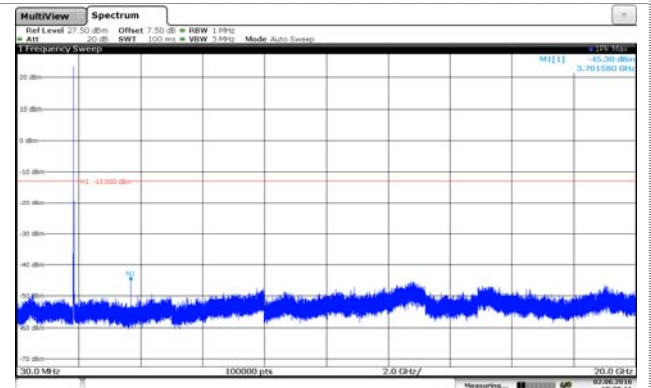
Channel High

LTE Band 2-10MHz

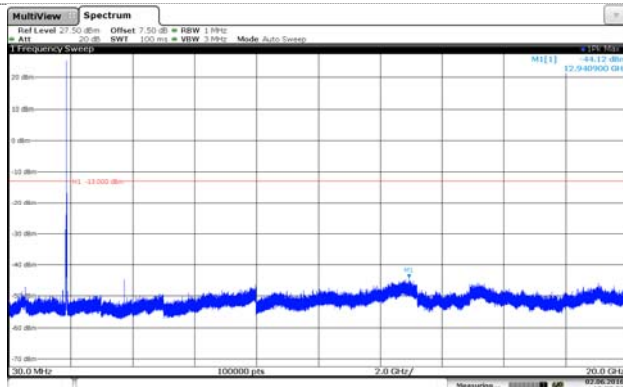
QPSK



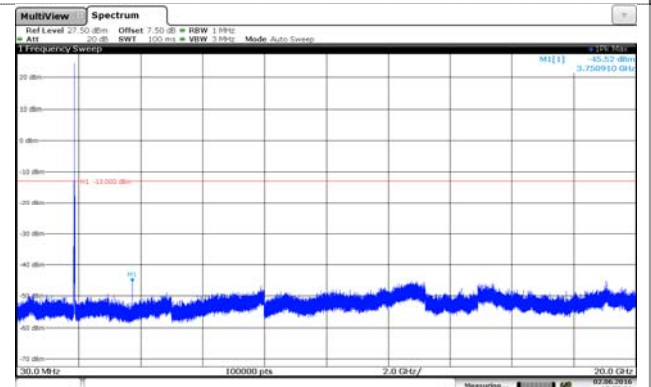
16QAM



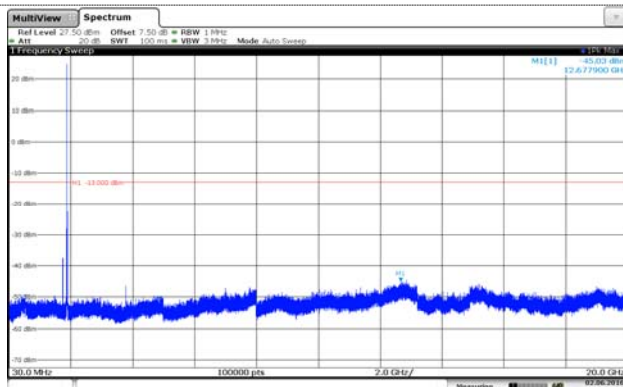
Channel Low



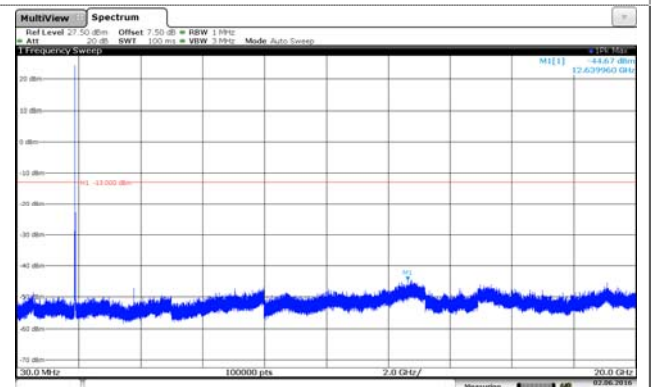
Channel Low



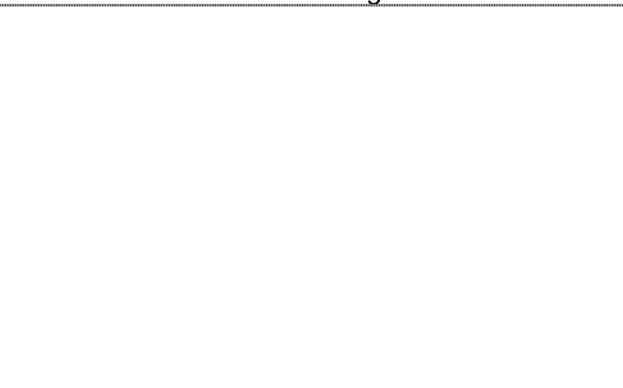
Channel Mid



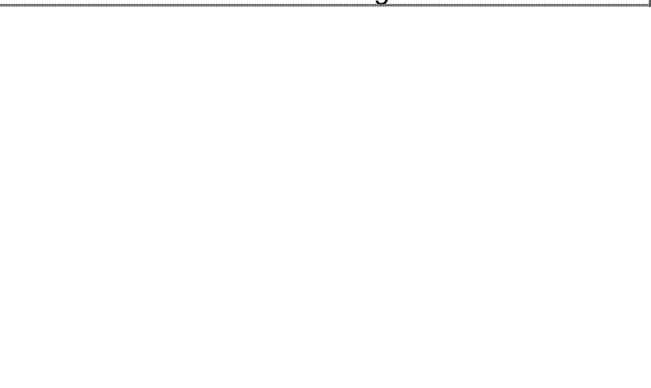
Channel Mid



Channel High

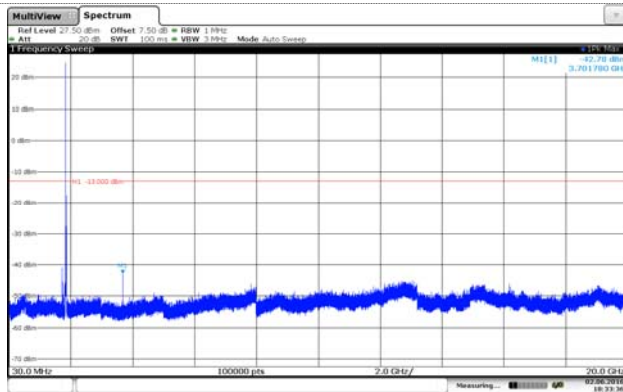


Channel High

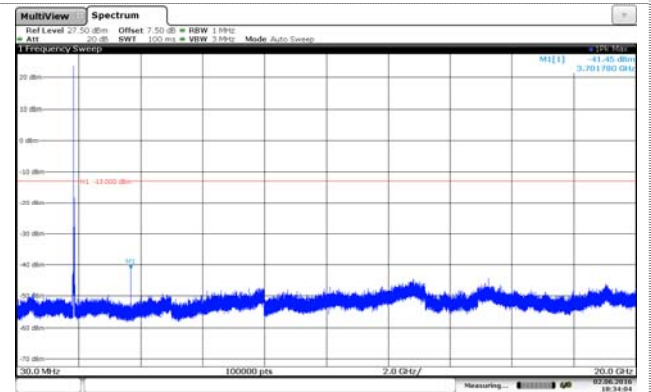


LTE Band 2-15MHz

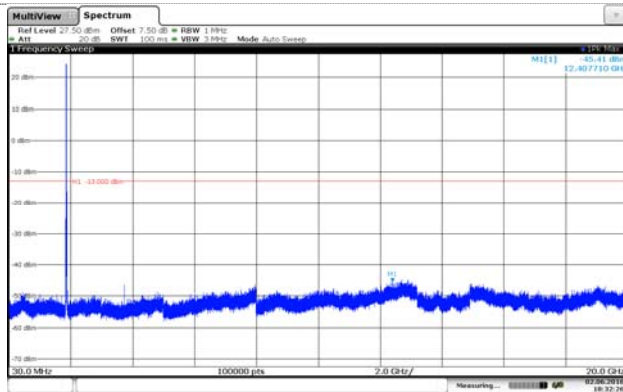
QPSK



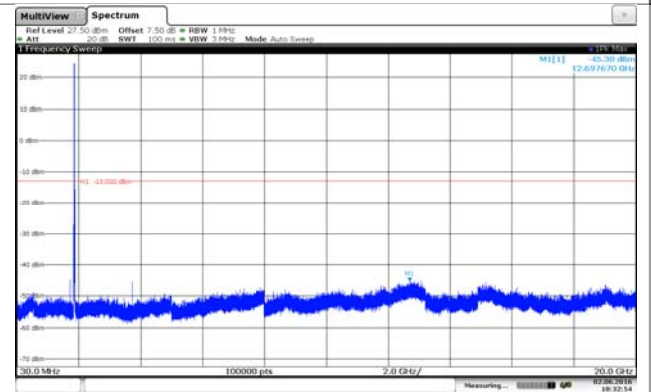
16QAM



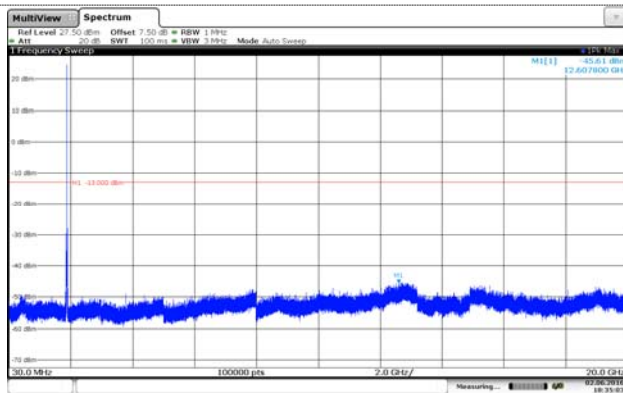
Channel Low



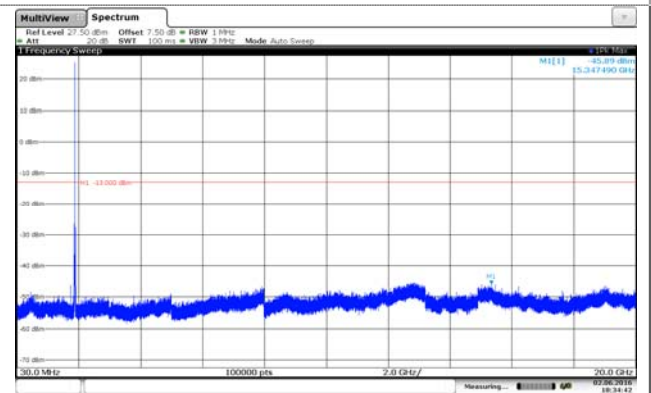
Channel Low



Channel Mid



Channel Mid



Channel High

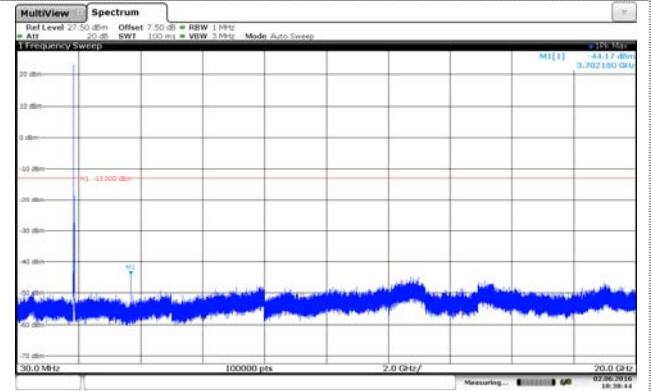
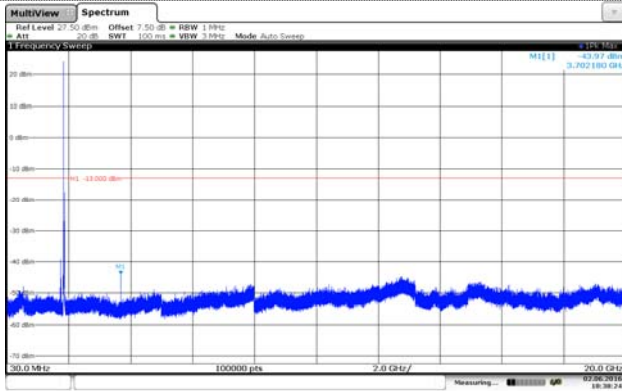
Channel High



LTE Band 2-20MHz

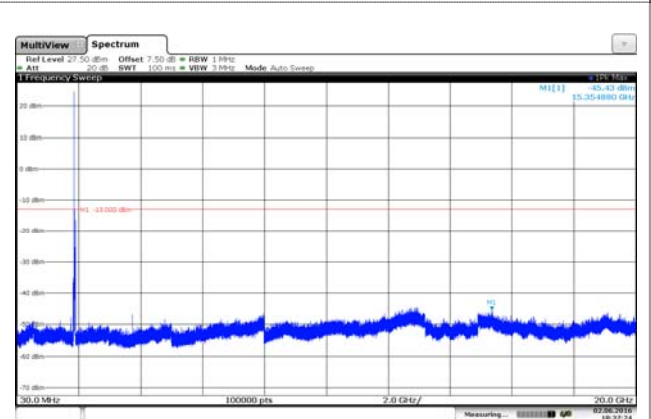
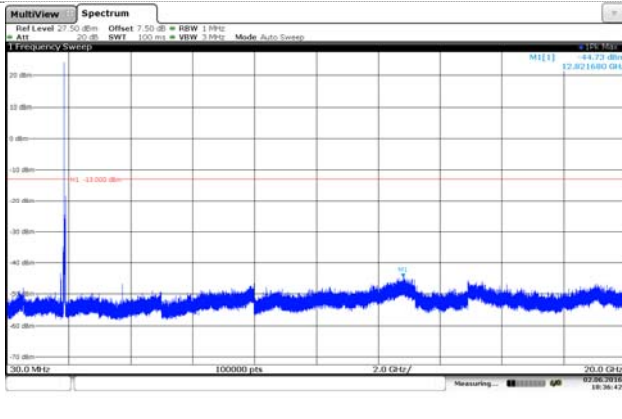
QPSK

16QAM



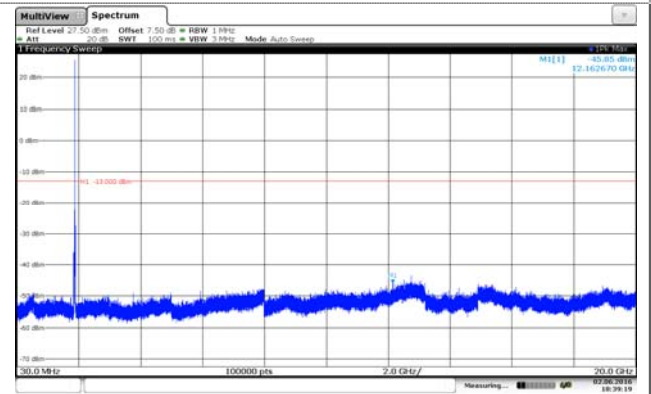
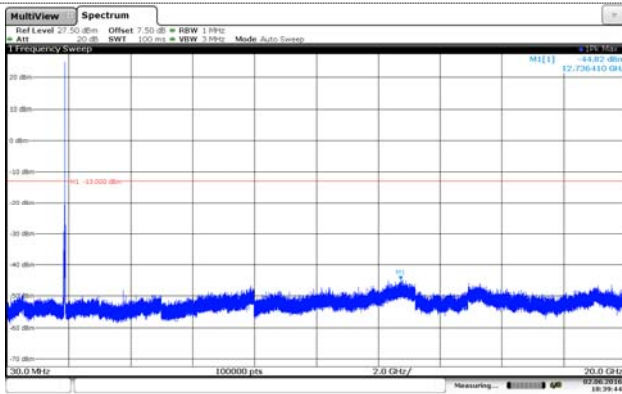
Channel Low

Channel Low



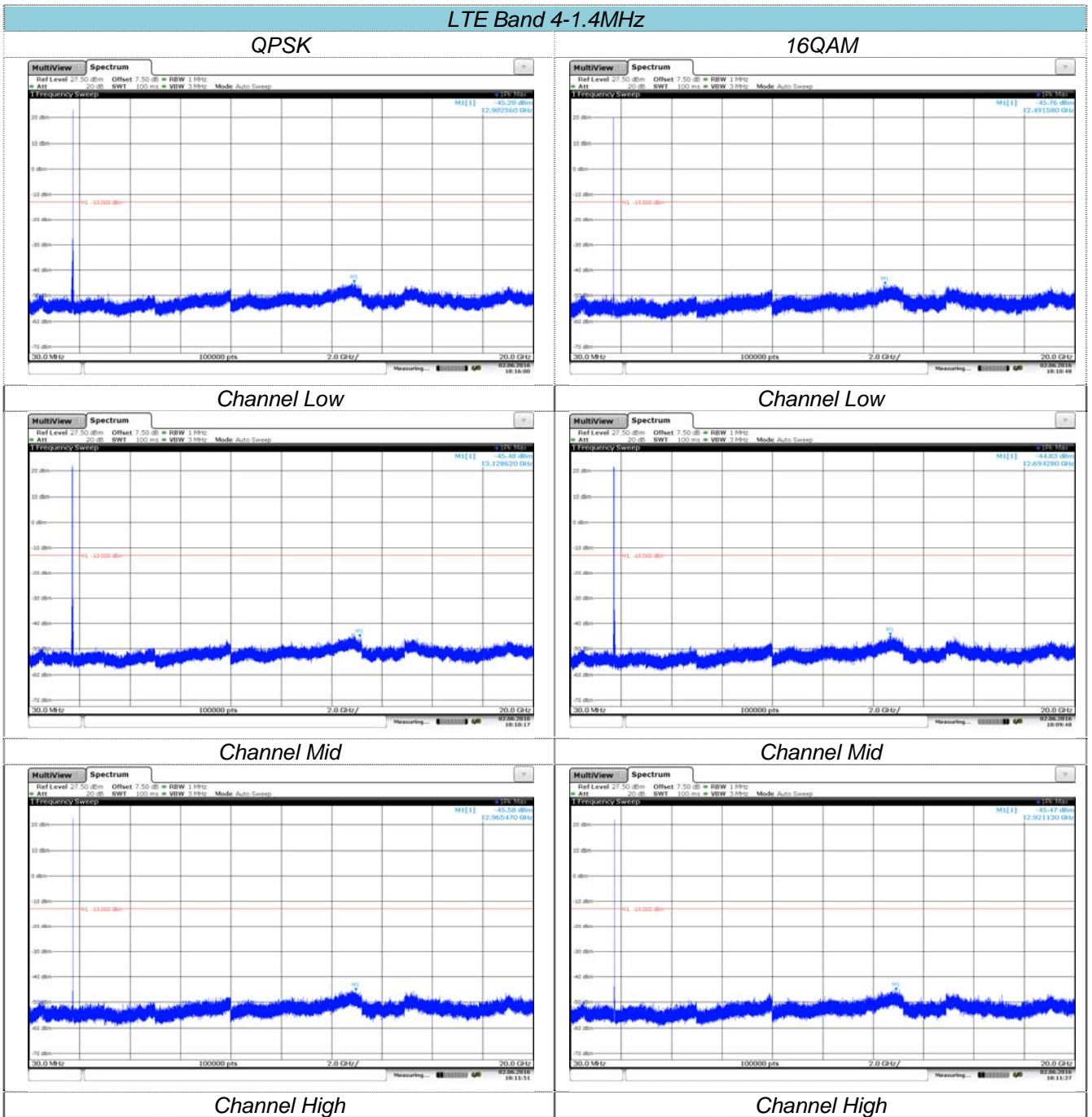
Channel Mid

Channel Mid



Channel High

Channel High

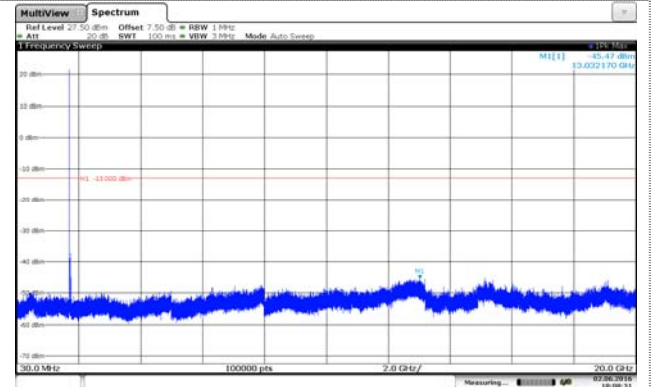
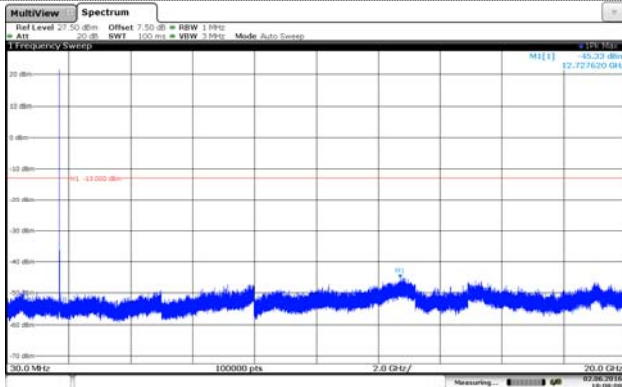




LTE Band 4-3MHz

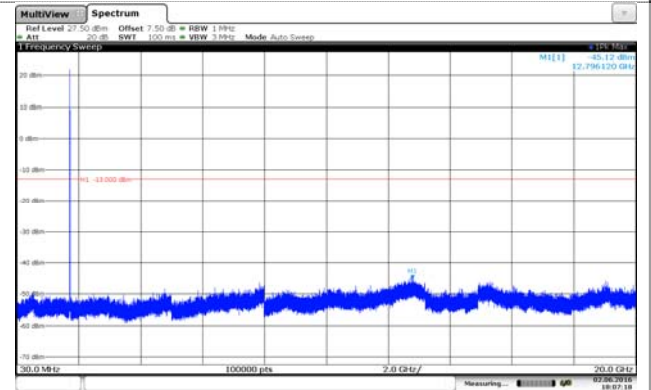
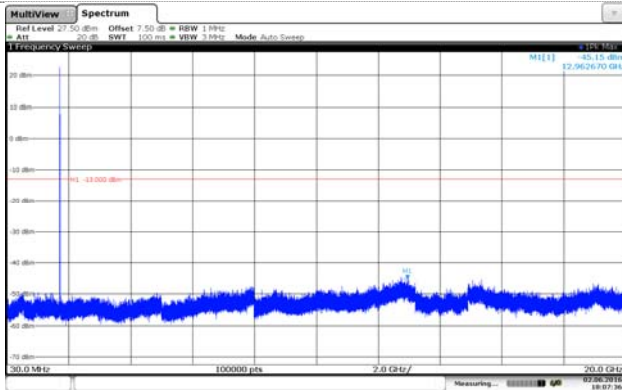
QPSK

16QAM



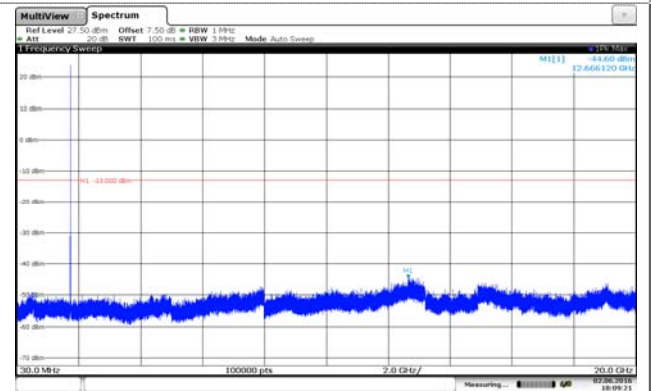
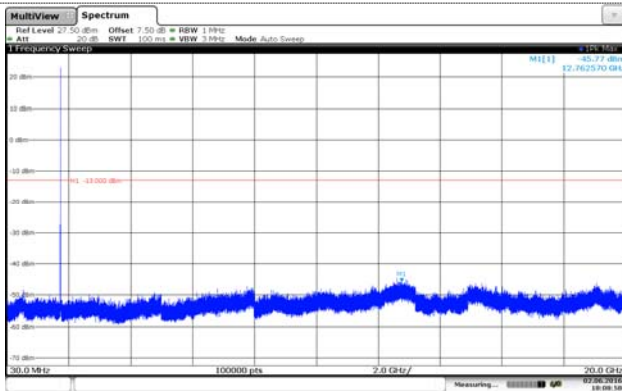
Channel Low

Channel Low



Channel Mid

Channel Mid

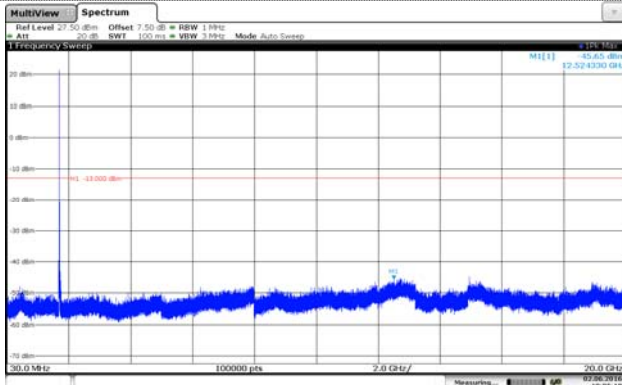


Channel High

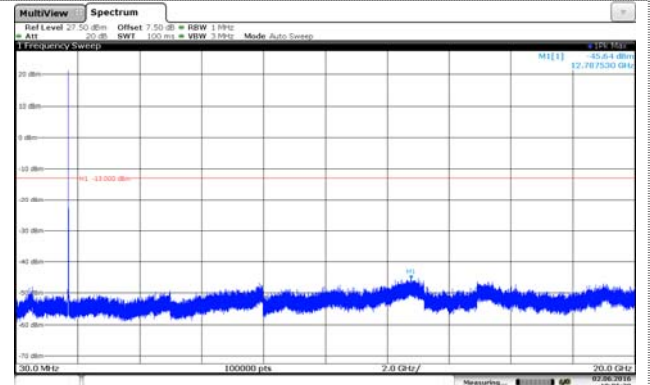
Channel High

LTE Band 4-5MHz

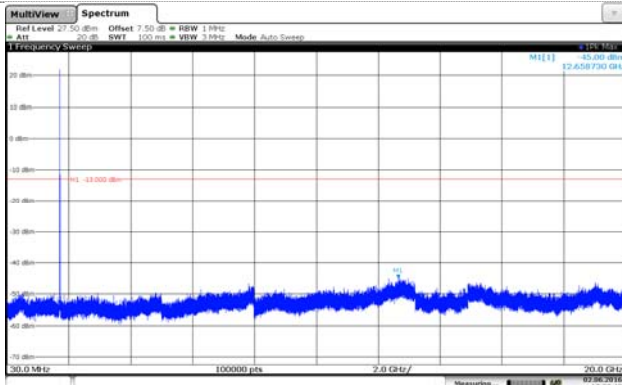
QPSK



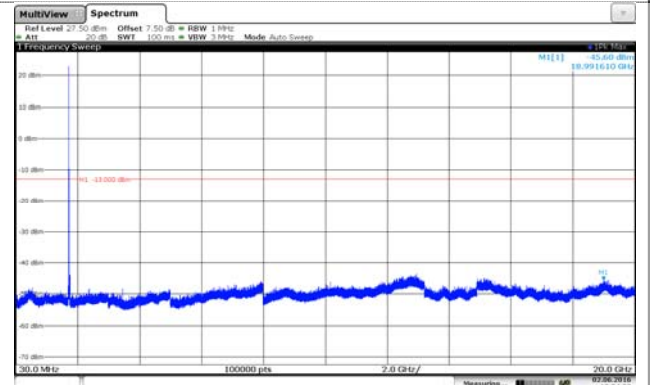
16QAM



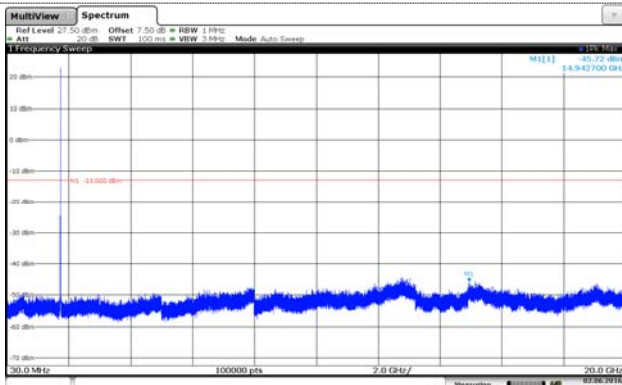
Channel Low



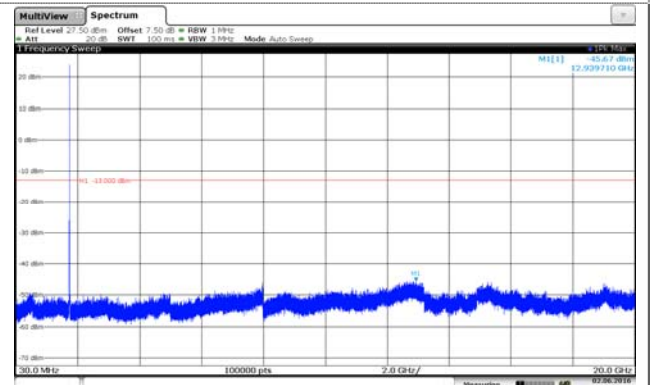
Channel Low



Channel Mid



Channel Mid

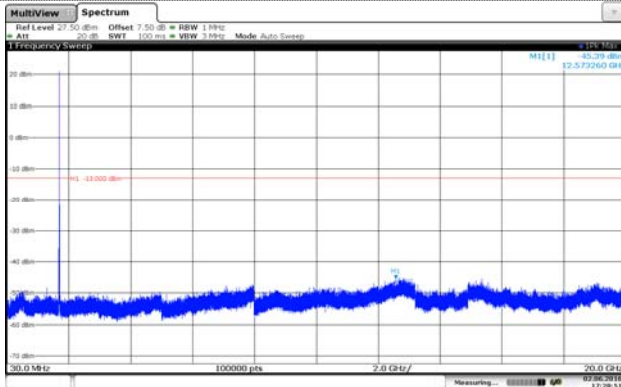


Channel High

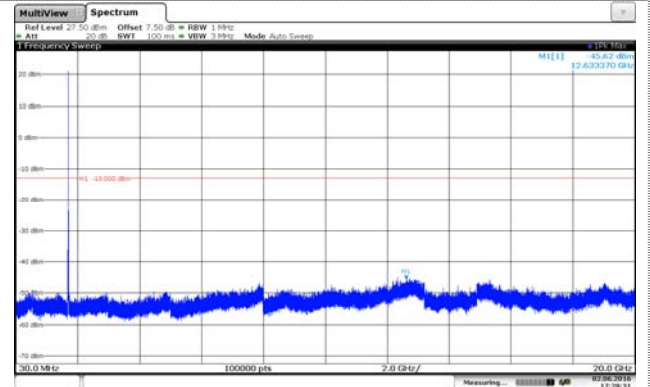
Channel High

LTE Band 4-10MHz

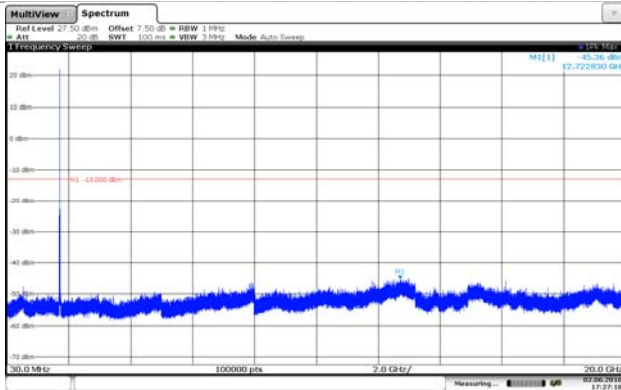
QPSK



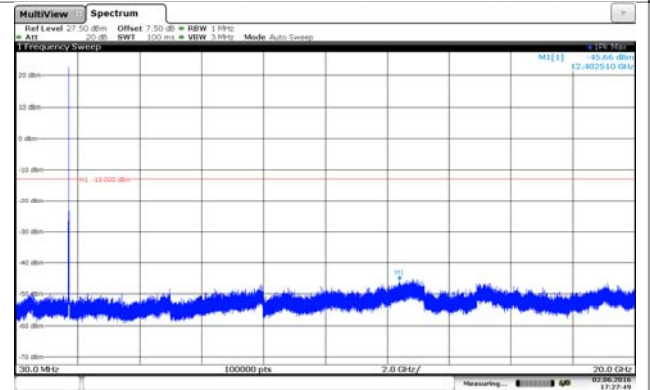
16QAM



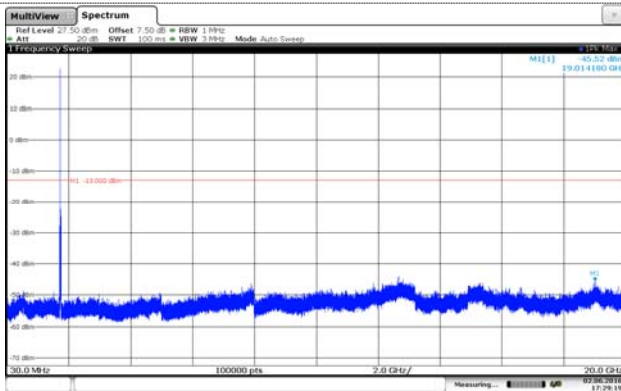
Channel Low



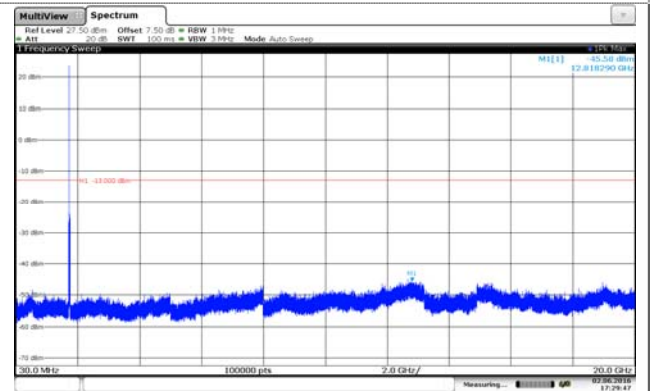
Channel Low



Channel Mid



Channel Mid



Channel High

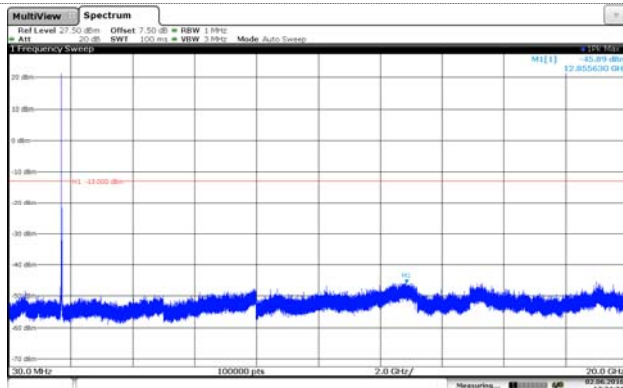


Channel High

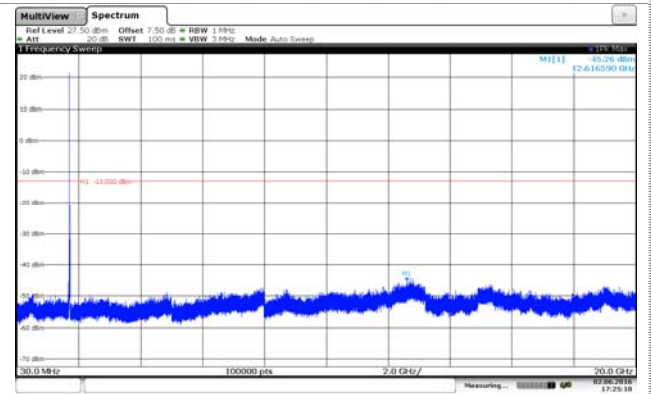


LTE Band 4-15MHz

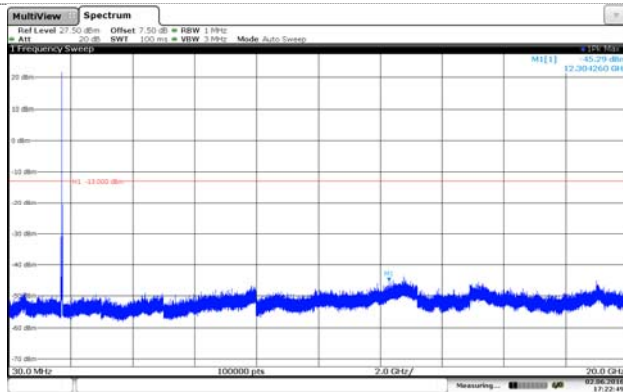
QPSK



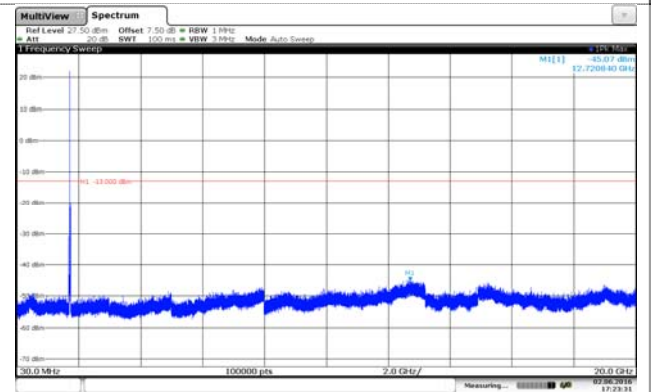
16QAM



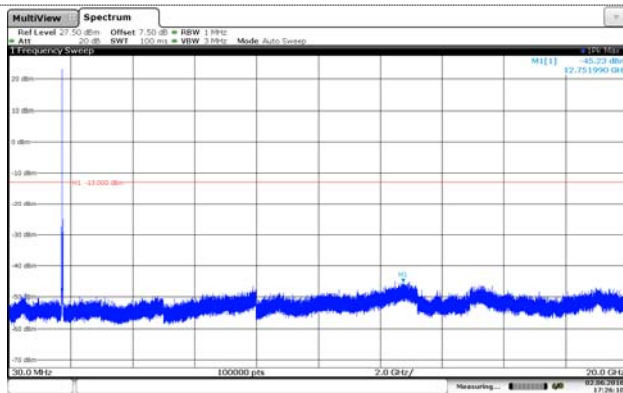
Channel Low



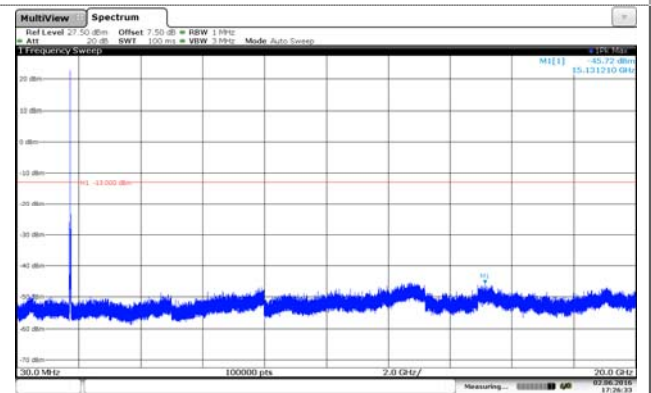
Channel Low



Channel Mid



Channel Mid

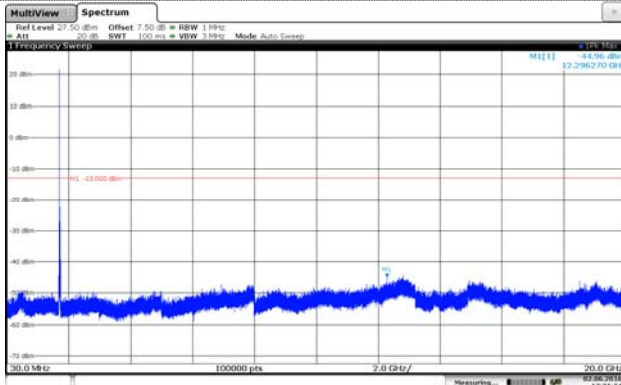


Channel High

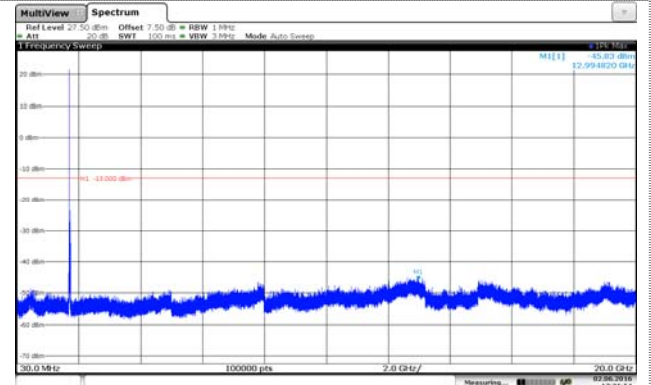
Channel High

LTE Band 4-20MHz

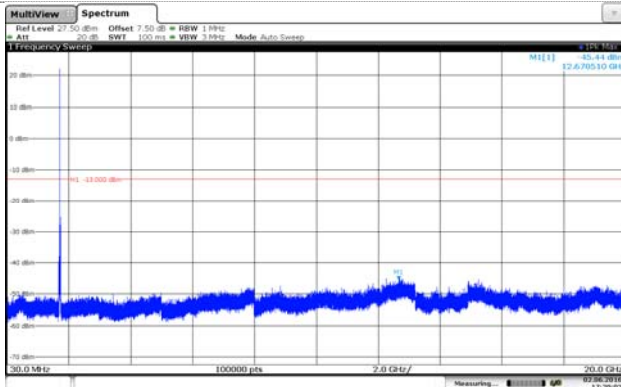
QPSK



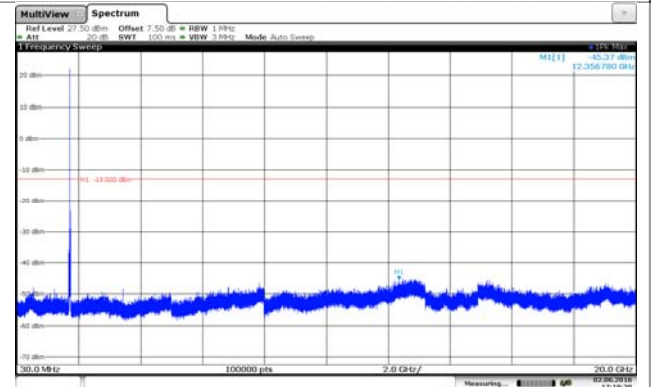
16QAM



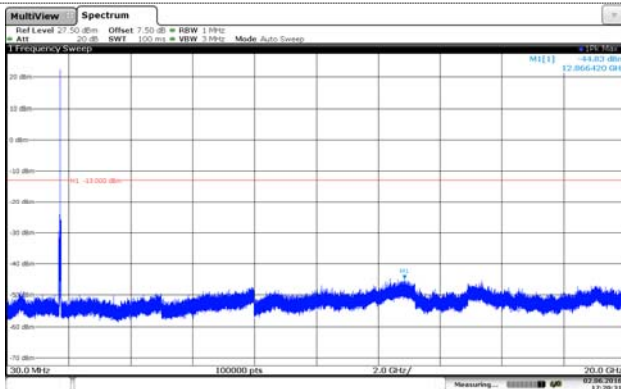
Channel Low



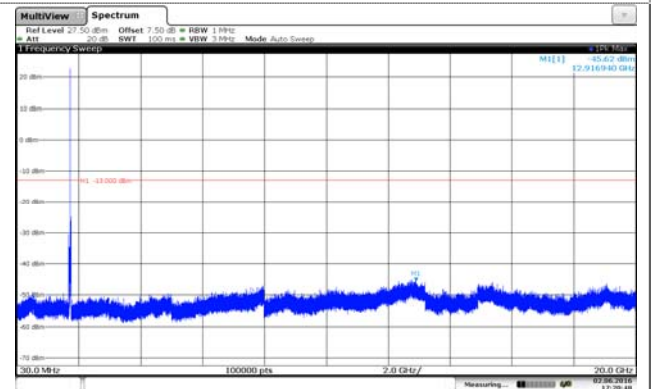
Channel Low



Channel Mid



Channel Mid



Channel High

Channel High