Spectrum Report (LTE)

Applicant:	Shanghai Notion Information Technology CO. LTD
Address of Applicant:	Floor 5,Building 5,NO 289,Bisheng Rd,Pudong district,Shanghai,China
Manufacturer:	Shanghai Notion Information Technology CO. LTD
Address of Manufacturer:	Floor 5,Building 5,NO 289,Bisheng Rd,Pudong district,Shanghai,China
Equipment Under Test (EUT)	
Product Name:	CPE
Model No.:	R01, R05, R051, R0511, R0516, P01, P05, P051, P0511, P056I
FCC ID:	2AR45-CPE
Applicable standards:	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part 24 FCC CFR Title 47 Part 27
Date of sample receipt:	December 01, 2018
Date of Test:	December 02-17, 2018
Date of report issued:	December 18, 2018
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Lo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	*December 18, 2018*	*Original*

Prepared By: ***Date:*** *December 18, 2018*

Project Engineer

Check By: ***Date:*** *December 18, 2018*

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass* (Please refer to MPE Report)
RF Output Power	Part 2.1046 Part 24.232 (c) Part 27.50(c)(10)/(d)(4)	Pass
Peak-to-Average Ratio	FCC part24.232(d) FCC Part 27.50	Pass
Modulation Characteristics	Part 2.1047	N/A
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 24.238 Part 27.53(h)/(g)	Pass
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 24.238 (a) Part 27.53(h)/(g)	Pass
Field Strength of Spurious Radiation	Part 2.1053 Part 24.238 (a) Part 27.53(h)/(g)	Pass
Out of band emission, Band Edge	Part 24.238 (a) Part 27.53(h)/(g)	Pass
Frequency stability vs. temperature	Part 2.1055(a)(1)(b)	Pass
Frequency stability vs. voltage	Part 2.1055(d)(1)(2)	Pass

Pass: The EUT complies with the essential requirements in the standard.

N/A: Not applicable.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 General Description of EUT

Product Name:	CPE
Model No.:	R01, R05, R051, R0511, R0516, P01, P05, P051, P0511, P056I
Test Model No.:	R01
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are model name for commercial purpose.	
S/N:	R051618121200056
Tested Sample(s) ID:	GTS201812000123-1
Hardware Version:	P056I_1_10
Software Version:	P056IAvantel1_AP_R0516_V006/P056Avantel1_CP_R0516_V006
Support Networks:	LTE
Support Bands:	LTE Band 4, LTE Band 7
Channel Bandwidth:	LTE Band 4: 1.4MHz; 3MHz; 5MHz; 10MHz; 15MHz; 20MHz LTE Band 7: 5MHz; 10MHz; 15MHz; 20MHz
TX Frequency:	LTE Band 4: 1710.70MHz-1754.30MHz LTE Band 7: 2502.50MHz-2567.50MHz
Modulation type:	LTE Band 4/7: QPSK, 16QAM
Antenna type:	Integral antenna
Antenna gain:	2.0dBi for band 4 3.0dBi for band7 (declare by manufacturer)
Power supply:	POWER ADAPTER MODEL: RD1201000-C55-91MG INPUT: AC 100-240V,50/60Hz,0.6A MAX OUTPUT: DC 12V/1A

5.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 27 and Part 24 subpart E of the FCC CFR 47 Rules.

5.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on TIA/EIA 603 and ANSI C63.4, FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057

5.4 Test Facility

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

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383, January 08, 2018.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.5 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 27 2018	June. 26 2019
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 27 2018	June. 26 2019
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 27 2018	June. 26 2019
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 27 2018	June. 26 2019
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 27 2018	June. 26 2019
9	Coaxial Cable	GTS	N/A	GTS211	June. 27 2018	June. 26 2019
10	Coaxial cable	GTS	N/A	GTS210	June. 27 2018	June. 26 2019
11	Coaxial Cable	GTS	N/A	GTS212	June. 27 2018	June. 26 2019
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 27 2018	June. 26 2019
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 27 2018	June. 26 2019
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 27 2018	June. 26 2019
15	Band filter	Amindeon	82346	GTS219	June. 27 2018	June. 26 2019
16	Power Meter	Anritsu	ML2495A	GTS540	June. 27 2018	June. 26 2019
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 27 2018	June. 26 2019
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 27 2018	June. 26 2019
19	Splitter	Agilent	11636B	GTS237	June. 27 2018	June. 26 2019
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 27 2018	June. 26 2019

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 27 2018	June. 26 2019
2	Barometer	ChangChun	DYM3	GTS255	June. 27 2018	June. 26 2019

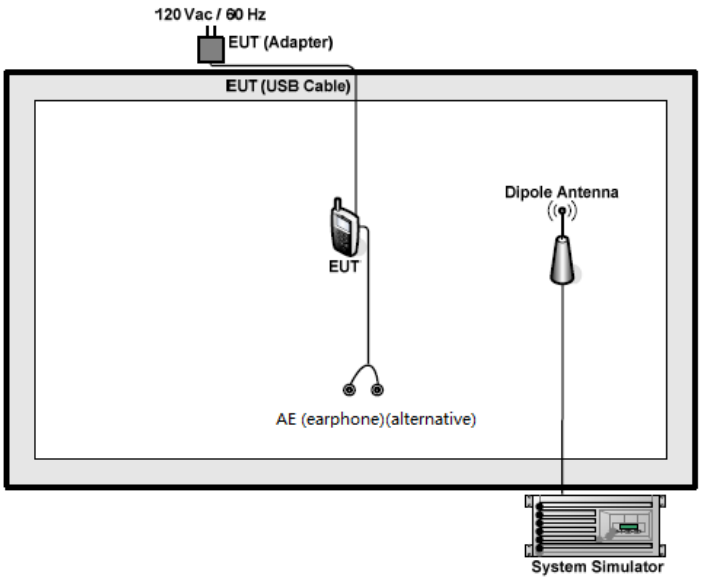
7 System test configuration

7.1 Test mode

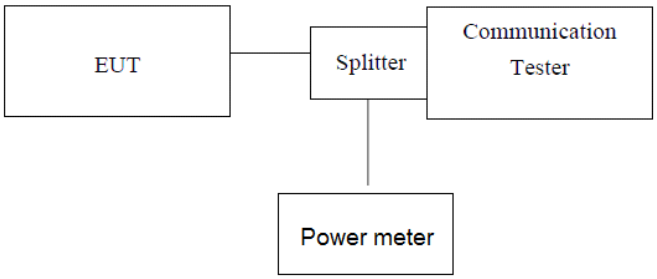
During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Test modes		
Band	Radiated	Conducted
LTE Band 4	■ QPSK and 16QAM link	■ QPSK and 16QAM link
LTE Band 7	■ QPSK and 16QAM link	■ QPSK and 16QAM link

7.2 Configuration of Tested System



7.3 Conducted Average Output Power

Test Requirement for FCC:	Part 24.232 (c); Part 27.50(c)(10)/(d)(4)
Limit for FCC:	LTE Band 4: 1W LTE Band 7: 2W
Test setup:	 *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 Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

Band 4						
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 19957 1710.7MHz	Channel 20175 1732.5MHz	Channel 20393 1754.3MHz
1.4MHz	QPSK	1	0	22.84	21.47	22.69
		1	2	22.64	22.21	21.14
		1	5	21.58	22.40	21.93
		3	0	21.23	21.21	22.40
		3	1	22.07	22.64	21.36
		3	2	21.35	22.39	22.72
		6	0	21.19	22.64	22.29
	16QAM	1	0	21.60	22.81	21.10
		1	2	22.73	22.94	21.57
		1	5	22.76	22.07	22.11
		3	0	22.17	22.43	22.41
		3	1	21.58	22.43	21.99
		3	2	22.92	22.40	**22.98**
		6	0	21.01	22.73	22.23
Bandwidth	Mode	RB Size	RB Offset	Actual output po2wer(dBm)		
				Channel 19965 1711.5MHz	Channel 20175 1732.5MHz	Channel 20385 753.5MHz
3MHz	QPSK	1	0	21.22	21.60	22.78
		1	8	22.22	21.27	21.28
		1	14	22.31	22.69	21.43
		8	0	21.71	21.53	21.70
		8	4	22.27	21.66	21.39
		8	7	21.72	22.29	21.67
		15	0	22.44	22.22	21.39
	16QAM	1	0	21.28	22.78	21.62
		1	8	21.56	21.96	22.33
		1	14	22.70	21.64	22.06
		8	0	21.94	22.18	22.09
		8	4	22.34	22.24	22.80
		8	7	21.11	**22.99**	21.03
		15	0	22.10	22.79	21.76

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 19975 1712.5MHz	Channel 20175 1732.5MHz	Channel 20375 1752.5MHz
5MHz	QPSK	1	0	22.83	22.62	21.16
		1	13	21.42	22.66	21.81
		1	24	22.15	22.08	21.55
		12	0	21.64	21.07	22.12
		12	6	21.04	22.11	22.59
		12	13	21.03	21.04	22.78
		25	0	21.73	22.32	21.15
	16QAM	1	0	21.58	22.12	22.18
		1	13	21.33	22.70	21.67
		1	24	21.35	21.55	**22.96**
		12	0	22.78	22.63	21.59
		12	6	22.83	21.72	22.68
		12	13	21.13	22.65	21.78
		25	0	22.17	22.39	21.39

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20000 1715.0MHz	Channel 20175 1732.5MHz	Channel 20350 1750.0MHz
10MHz	QPSK	1	0	22.53	21.71	22.91
		1	25	22.57	22.12	21.53
		1	49	22.84	22.32	21.52
		25	0	22.61	22.57	21.46
		25	13	22.35	22.03	21.93
		25	25	22.56	22.03	22.83
		50	0	21.51	22.39	21.57
	16QAM	1	0	22.50	22.64	21.95
		1	25	22.78	22.93	21.97
		1	49	21.73	**22.94**	21.67
		25	0	21.40	22.82	22.08
		25	13	22.07	22.21	22.67
		25	25	21.24	22.34	22.37
		50	0	22.02	22.67	21.24

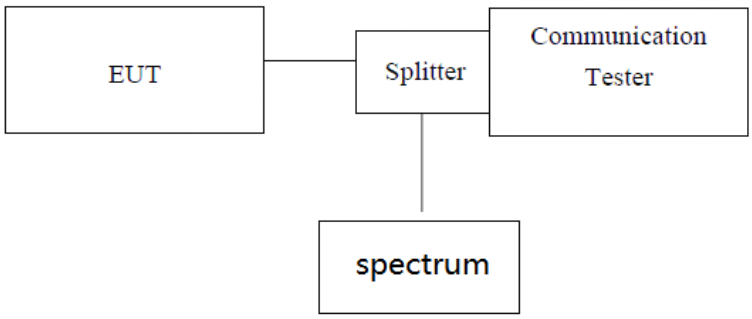
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20025 1717.5MHz	Channel 20175 1732.5MHz	Channel 20325 1747.5MHz
15MHz	QPSK	1	0	21.85	21.70	21.27
		1	38	22.18	21.59	22.90
		1	74	22.84	22.32	22.43
		36	0	22.52	21.18	21.07
		36	18	22.11	21.76	21.14
		36	39	21.19	22.22	21.52
		75	0	**22.93**	21.17	21.41
	16QAM	1	0	22.30	21.17	22.29
		1	38	22.48	22.66	22.07
		1	74	22.11	22.11	21.81
		36	0	22.01	21.48	22.67
		36	18	21.04	21.13	22.59
		36	39	22.53	22.66	21.54
		75	0	22.80	21.32	21.64
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20050 1720.0MHz	Channel 20175 1732.5MHz	Channel 20300 1745.0MHz
20MHz	QPSK	1	0	21.49	22.25	21.17
		1	50	22.33	22.03	21.21
		1	99	**22.96**	22.74	22.45
		50	0	21.77	22.76	21.57
		50	25	21.45	22.42	21.61
		50	50	21.26	21.98	21.21
		100	0	22.95	21.16	22.16
	16QAM	1	0	21.30	21.30	21.32
		1	50	21.44	22.54	22.60
		1	99	22.14	21.98	21.11
		50	0	21.43	22.65	21.69
		50	25	22.70	21.08	21.44
		50	50	21.72	21.72	21.77
		100	0	21.05	21.63	21.41

Band 7						
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20775 2502.5MHz	Channel 21100 2535MHz	Channel 21425 2567.5MHz
5MHz	QPSK	1	0	23.59	23.15	23.22
		1	13	23.64	23.19	23.24
		1	24	23.23	23.54	23.15
		12	0	23.34	23.26	23.16
		12	6	23.51	23.51	23.25
		12	13	23.52	23.43	23.46
		25	0	23..34	23.26	23.58
	16QAM	1	0	23.15	23.51	**23.68**
		1	13	23.54	23.43	23.49
		1	24	23.52	23.22	23.59
		12	0	23.58	23.16	23.61
		12	6	23.22	23.15	23.46
		12	13	23.11	23.24	23.25
		25	0	23.13	23.15	23.26
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20800 2505.0MHz	Channel 21100 2535MHz	Channel 21400 2565.0MHz
10MHz	QPSK	1	0	23.15	23.73	23.46
		1	25	23.57	23.74	23.59
		1	49	23.68	23.71	23.18
		25	0	23.49	23.76	23.66
		25	13	23.28	23.59	23.55
		25	25	23.49	23.81	23.53
		50	0	23.39	23.59	23.49
	16QAM	1	0	23.19	23.68	23.58
		1	25	23.59	23.59	23.16
		1	49	23.68	23.67	23.13
		25	0	23.49	23.19	23.11
		25	13	23.83	23.29	23.12
		25	25	**23.91**	23.67	23.31
		50	0	23.81	23.51	23.33

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20825 2507.5MHz	Channel 21100 2535MHz	Channel 21375 2562.5MHz
15MHz	QPSK	1	0	23.64	23.64	23.59
		1	38	23.85	23.52	23.61
		1	74	23.91	23.16	23.49
		36	0	23.67	23.55	23.58
		36	18	23.81	23.44	23.61
		36	39	**23.95**	23.38	23.49
		75	0	23.59	23.62	23.51
	16QAM	1	0	23.46	23.53	23.62
		1	38	23.59	23.19	23.24
		1	74	23.49	23.58	23.66
		36	0	23.68	23.61	23.28
		36	18	23.66	23.53	23.54
		36	39	23.77	23.57	23.39
		75	0	23.84	23.19	23.68

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 20850 2510.0MHz	Channel 21100 2535MHz	Channel 21350 2560.0MHz
20MHz	QPSK	1	0	23.12	23.15	23.64
		1	50	23.26	23.16	23.59
		1	99	23.11	23.52	23.68
		50	0	23.62	23.46	23.51
		50	25	23.45	23.29	23.61
		50	50	23.92	23.61	23.59
		100	0	23.51	23.52	23.64
	16QAM	1	0	23.26	23.83	23.15
		1	50	23.15	23.73	23.38
		1	99	23.26	23.51	**23.95**
		50	0	23.52	23.46	23.18
		50	25	23.36	23.53	23.16
		50	50	23.34	23.18	23.16
		100	0	23.13	23.29	23.18

7.4 Peak-to-Average Ratio

Test Requirement for FCC:	FCC part24.232(d) & FCC Part 27.50
Limit:	13db
Test setup:	 *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. 6. Record the maximum peak-to-average ratio value.
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

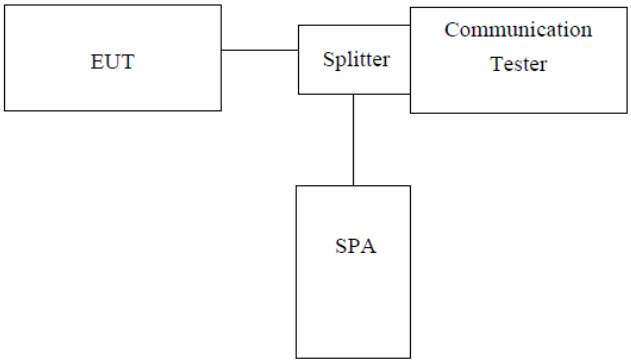
Measurement data:
QPSK mode:

Test Band	Bandwidth	Peak to Average Ratio（dB）			Limit（dB）	Result
		Low Ch.	Middle Ch.	High Ch.		
LTE Band 4	1.4MHz	2.10	2.52	2.84	13	PASS
	3MHz	3.17	3.62	3.68	13	PASS
	5MHz	4.07	4.78	4.25	13	PASS
	10MHz	5.76	5.94	5.18	13	PASS
	15MHz	5.43	5.31	5.65	13	PASS
	20MHz	6.86	6.85	6.19	13	PASS
LTE Band 7	5MHz	4.85	5.07	5.04	13	PASS
	10MHz	4.62	4.58	4.59	13	PASS
	15MHz	5.79	5.77	5.75	13	PASS
	20MHz	6.56	6.53	6.54	13	PASS

16QAM mode:

Test Band	Bandwidth	Peak to Average Ratio（dB）			Limit（dB）	Result
		Low Ch.	Middle Ch.	High Ch.		
LTE Band 4	1.4MHz	2.83	2.77	2.33	13	PASS
	3MHz	3.82	3.61	3.41	13	PASS
	5MHz	4.89	4.66	4.63	13	PASS
	10MHz	5.51	5.65	5.46	13	PASS
	15MHz	5.35	5.90	5.38	13	PASS
	20MHz	6.71	6.51	6.12	13	PASS
LTE Band 5	5MHz	4.59	4.57	4.19	13	PASS
	10MHz	5.68	5.65	5.85	13	PASS
	15MHz	5.58	5.47	5.49	13	PASS
	20MHz	6.61	6.59	6.61	13	PASS

7.5 Occupy Bandwidth

Test Requirement for FCC:	Part 24.238; FCC Part 27.53(h)/(g)
Test setup:	 ***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 Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

QPSK mode：

EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 4	1.4MHz	Low range	6	0	1112.2	1318
		Mid range	6	0	1098.8	1435
		High range	6	0	1106.1	1342
	3MHz	Low range	15	0	2692.2	2975
		Mid range	15	0	2687.4	2991
		High range	15	0	2678.3	2931
	5MHz	Low range	25	0	4512.1	5111
		Mid range	25	0	4516.5	5038
		High range	25	0	4508.1	5060
	10MHz	Low range	50	0	8976.8	10012
		Mid range	50	0	8942.2	9861
		High range	50	0	8957.7	9889
	15MHz	Low range	75	0	13467.5	15633
		Mid range	75	0	13373.7	15188
		High range	75	0	13420.2	15179
	20MHz	Low range	100	0	17892.1	20009
		Mid range	100	0	17775.9	19318
		High range	100	0	17918.4	19783

EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 7	5MHz	Low range	25	0	4511.6	4970
		Mid range	25	0	4520.4	5045
		High range	25	0	4495.9	4977
	10MHz	Low range	50	0	8951.9	9722
		Mid range	50	0	8933.2	9688
		High range	50	0	8947.3	9765
	15MHz	Low range	75	0	13471.4	14793
		Mid range	75	0	13384.7	14554
		High range	75	0	13380.7	14498
	20MHz	Low range	100	0	17898.1	19244
		Mid range	100	0	17799.3	19205
		High range	100	0	17847.1	19213

16QAM mode：

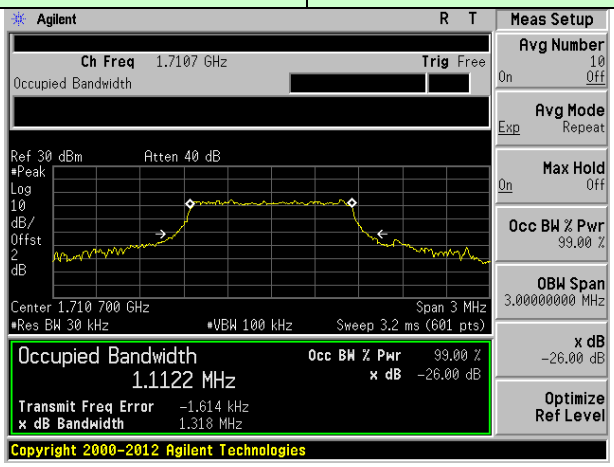
EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 4	1.4MHz	Low range	6	0	1114.5	1333
		Mid range	6	0	1108.0	1450
		High range	6	0	1104.6	1363
	3MHz	Low range	15	0	2692.5	2965
		Mid range	15	0	2686.4	2984
		High range	15	0	2681.5	2938
	5MHz	Low range	25	0	4505.7	5093
		Mid range	25	0	4526.5	5065
		High range	25	0	4512.2	5038
	10MHz	Low range	50	0	8963.8	10101
		Mid range	50	0	8937.8	10157
		High range	50	0	8953.0	10003
	15MHz	Low range	75	0	13513.0	15181
		Mid range	75	0	13403.8	15171
		High range	75	0	13411.9	14972
	20MHz	Low range	100	0	17807.9	19468
		Mid range	100	0	17805.6	19388
		High range	100	0	17899.1	20146

EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 7	5MHz	Low range	25	0	4506.3	5059
		Mid range	25	0	4510.0	4974
		High range	25	0	4488.8	4994
	10MHz	Low range	50	0	8959.2	9764
		Mid range	50	0	8935.1	9633
		High range	50	0	8953.5	9627
	15MHz	Low range	75	0	13445.3	14692
		Mid range	75	0	13376.6	14635
		High range	75	0	13393.6	14543
	20MHz	Low range	100	0	17861.9	19230
		Mid range	100	0	17801.4	19346
		High range	100	0	17830.0	19257

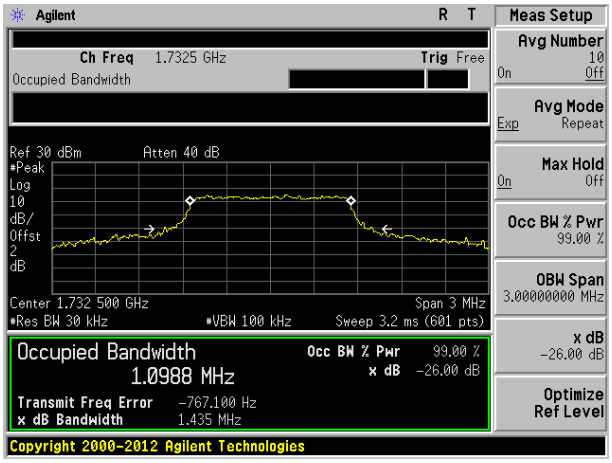
Test plot as follows:

QPSK mode:

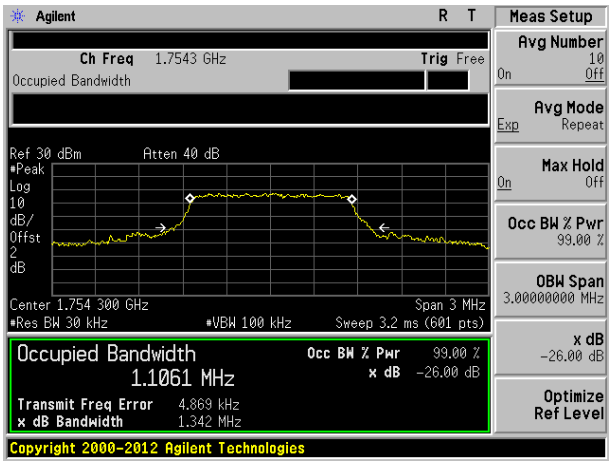
Test band: LTE Band 4	Channel Bandwidth: 1.4MHz



Lowest channel

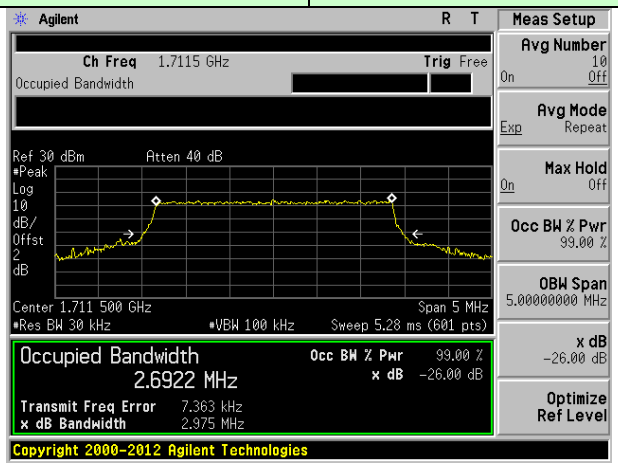


Middle channel

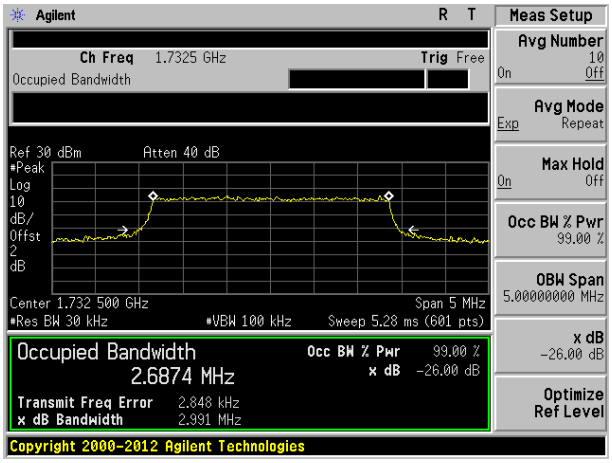


Highest channel

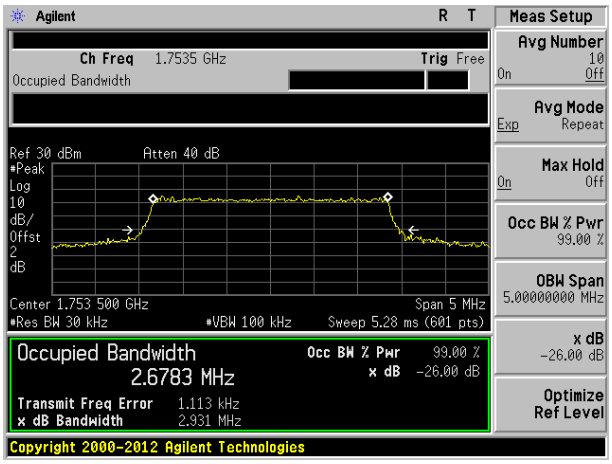
Test band: LTE Band 4	Channel Bandwidth: 3MHz



Lowest channel

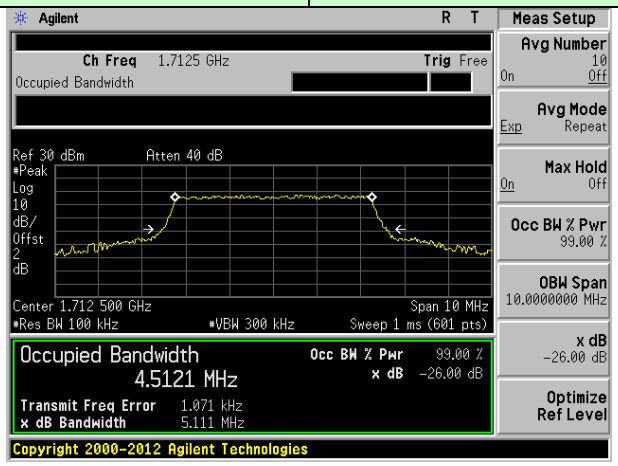


Middle channel

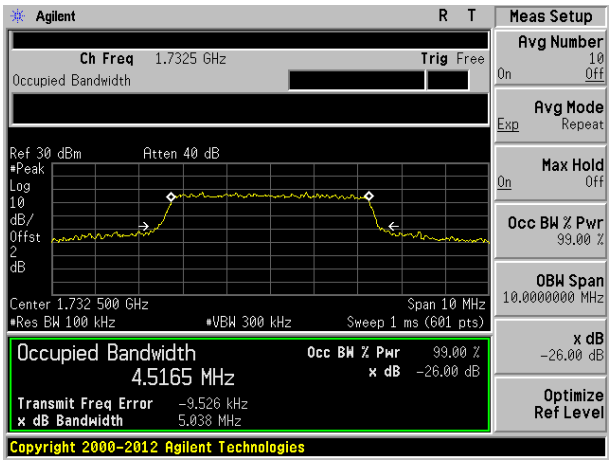


Highest channel

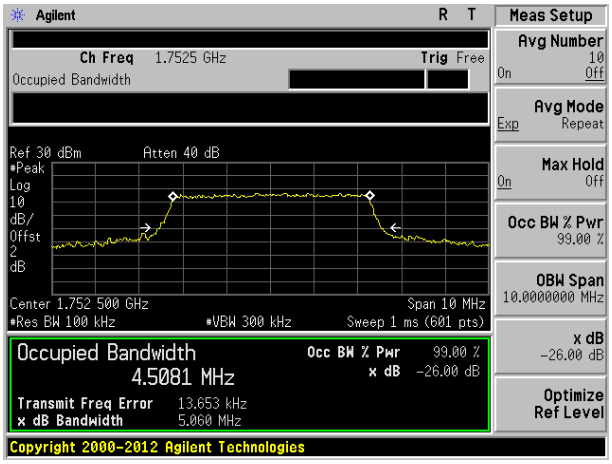
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

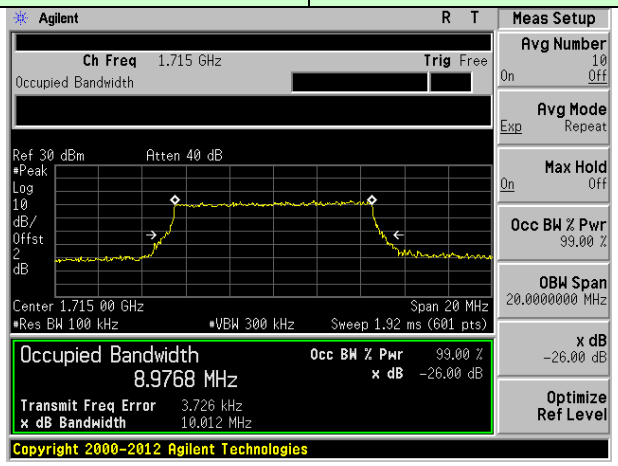


Middle channel

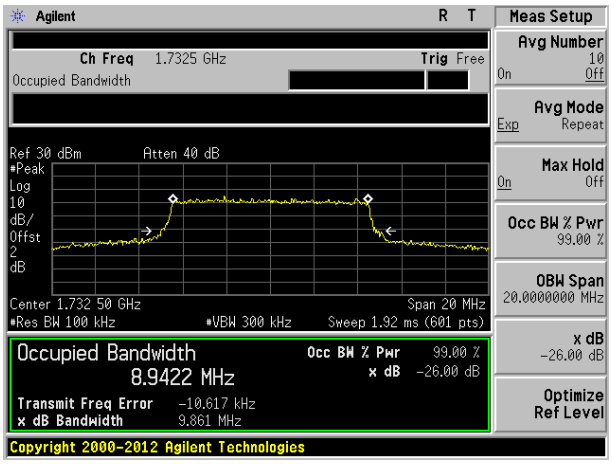


Highest channel

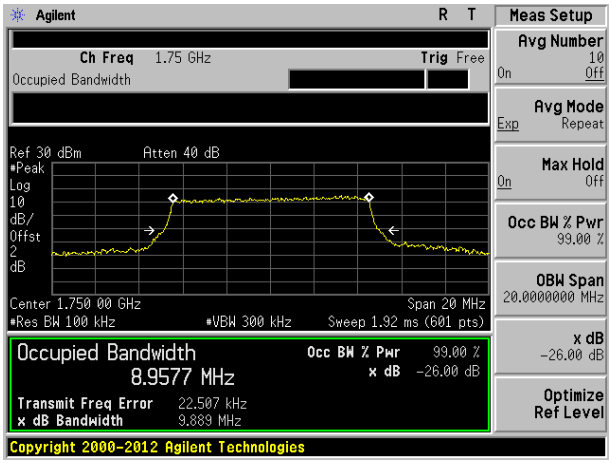
Test band: LTE Band 4	Channel Bandwidth: 10MHz



Lowest channel

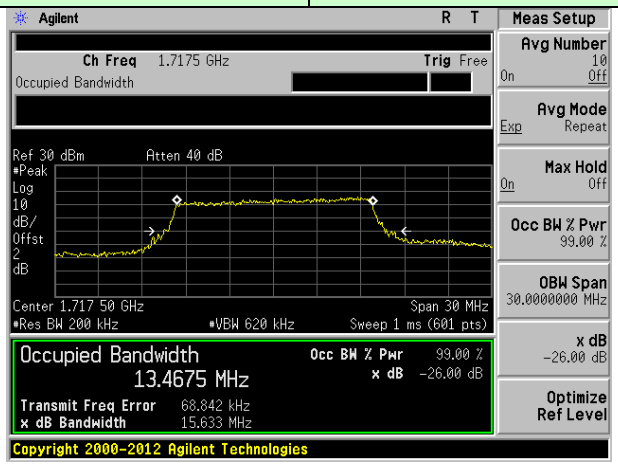


Middle channel

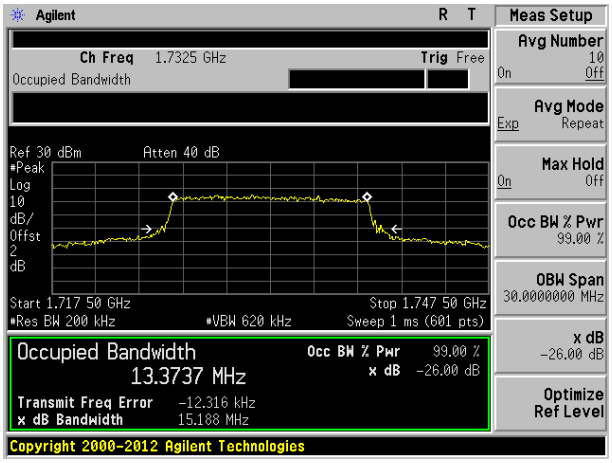


Highest channel

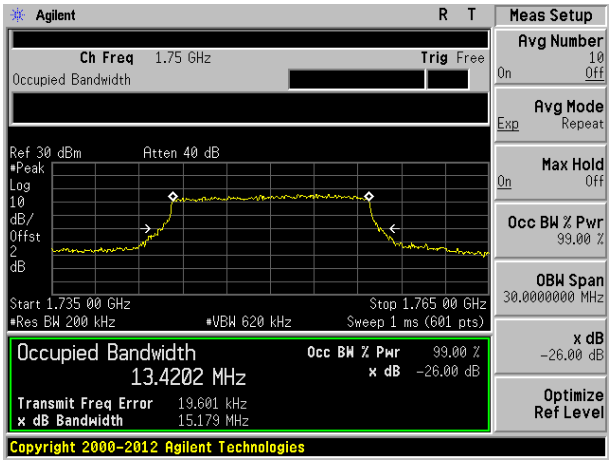
Test band: LTE Band 4	Channel Bandwidth: 15MHz



Lowest channel

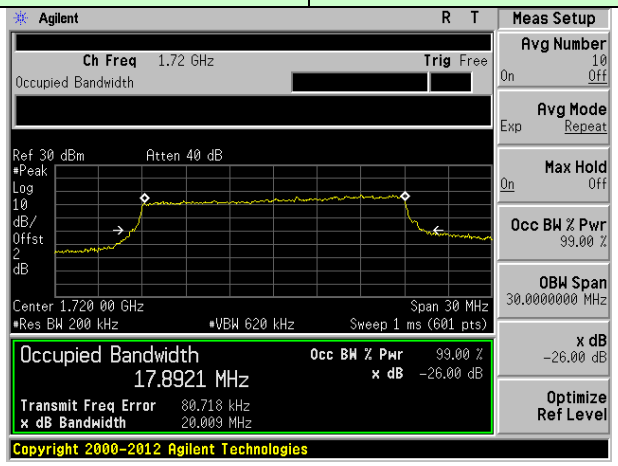


Middle channel

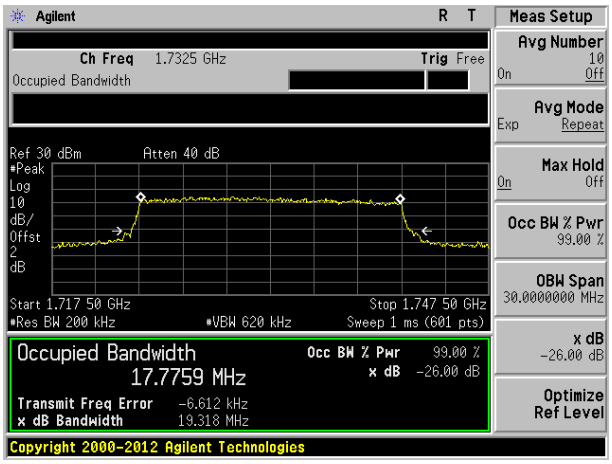


Highest channel

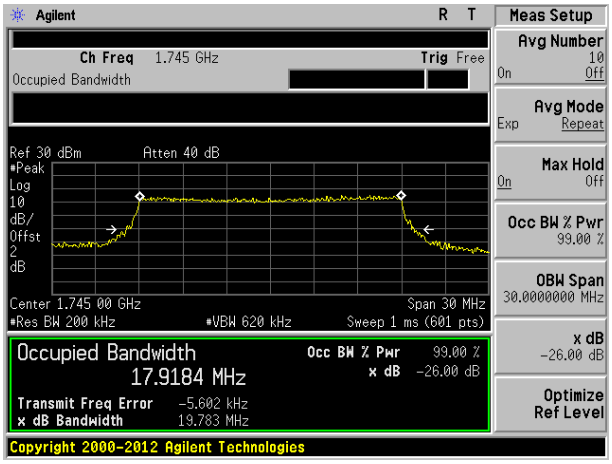
Test band: LTE Band 4	Channel Bandwidth: 20MHz



Lowest channel

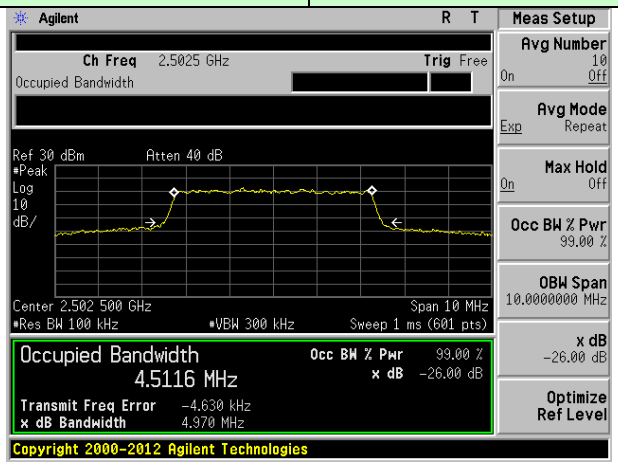


Middle channel

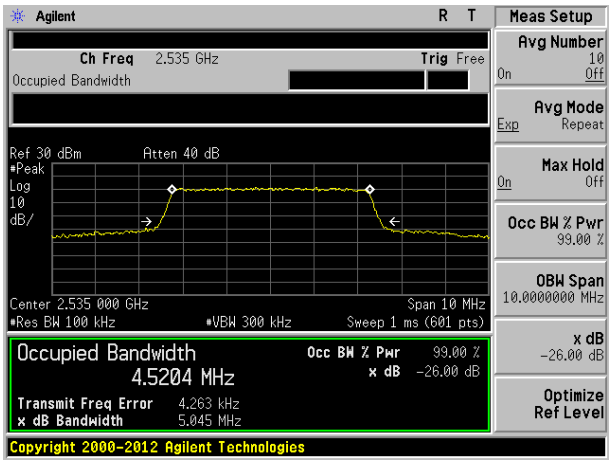


Highest channel

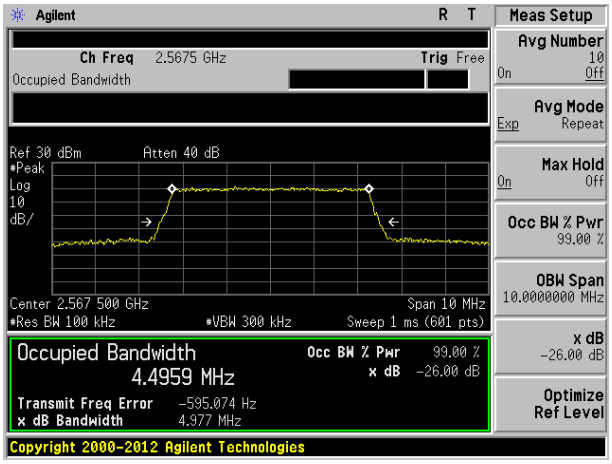
Test band: LTE Band 7	Channel Bandwidth: 5MHz



Lowest channel

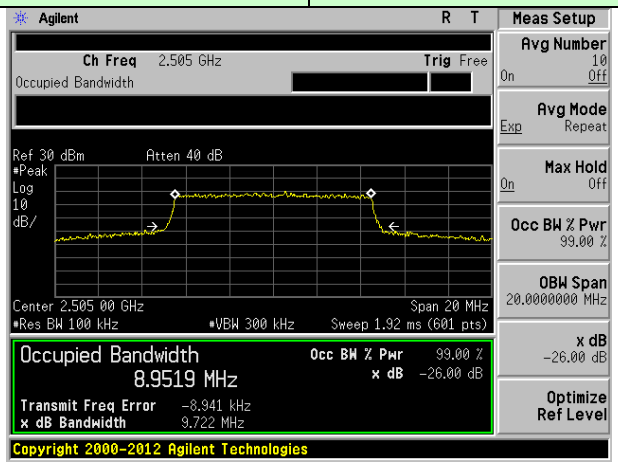


Middle channel

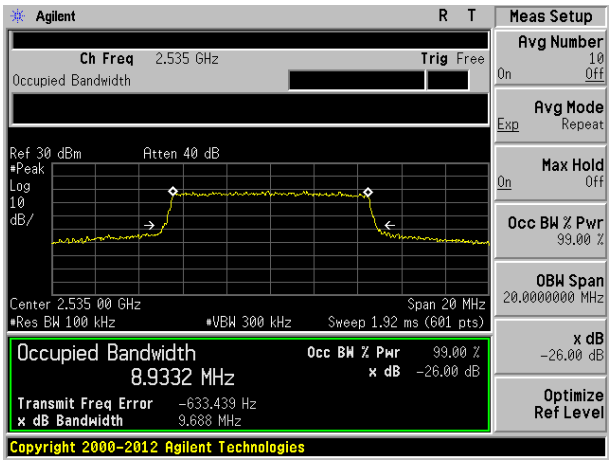


Highest channel

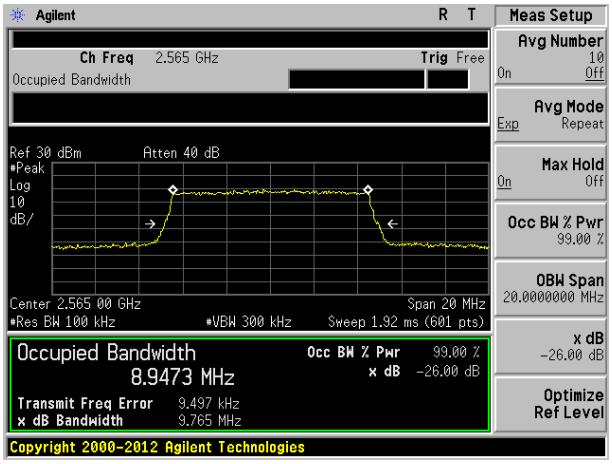
Test band: LTE Band 7	Channel Bandwidth: 10MHz



Lowest channel

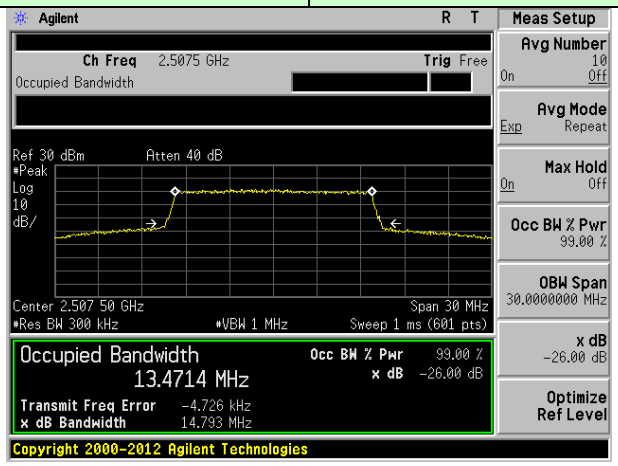


Middle channel

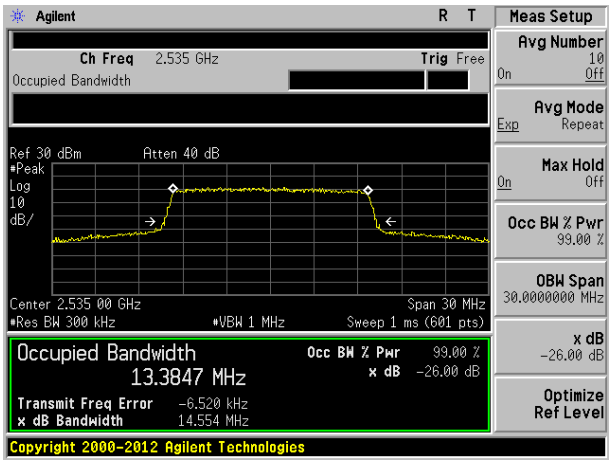


Highest channel

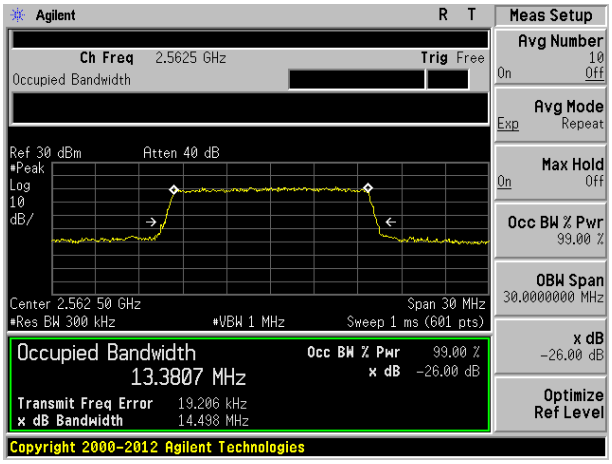
Test band: LTE Band 7	Channel Bandwidth: 15MHz



Lowest channel

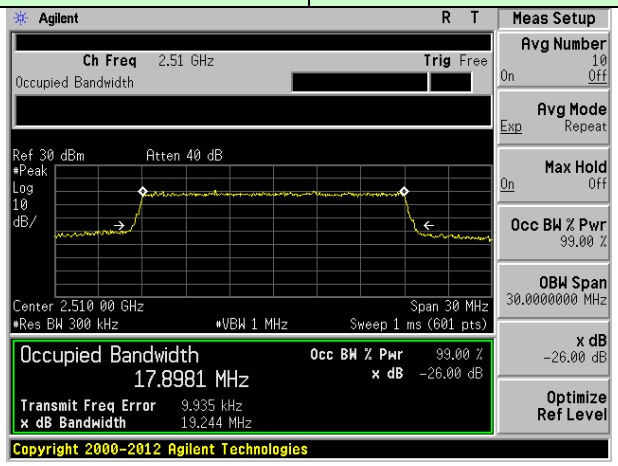


Middle channel

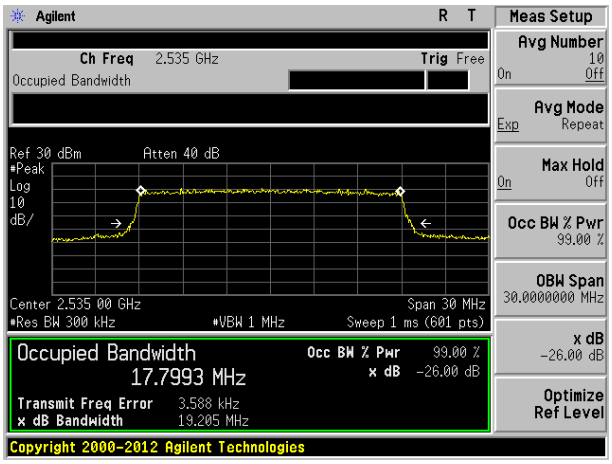


Highest channel

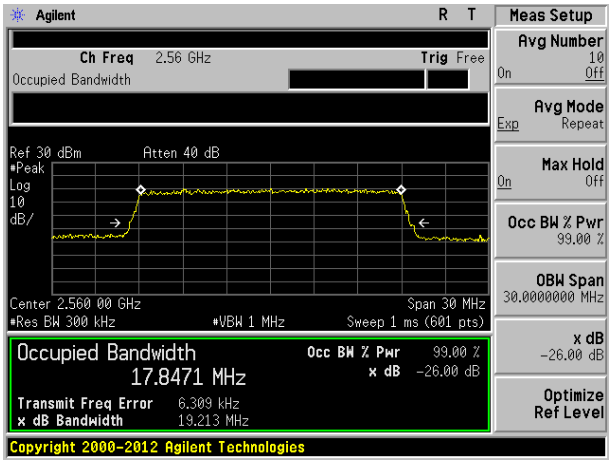
Test band: LTE Band 7	Channel Bandwidth: 20MHz



Lowest channel



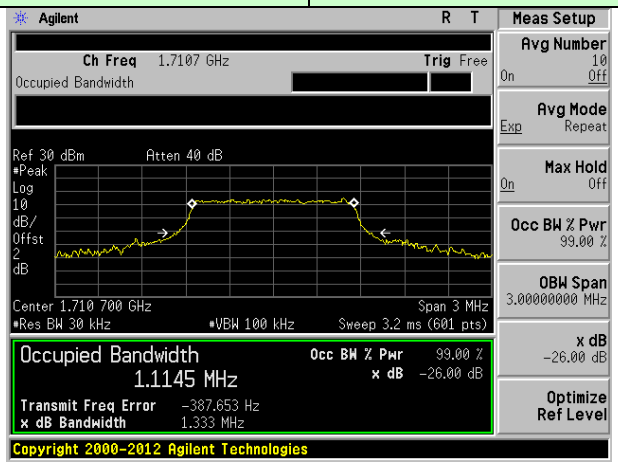
Middle channel



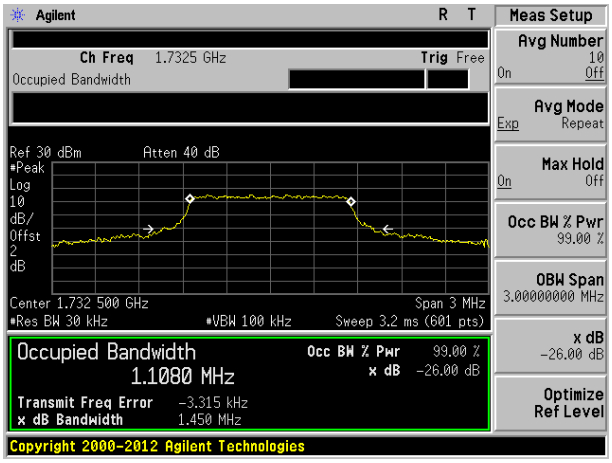
Highest channel

16QAM mode:

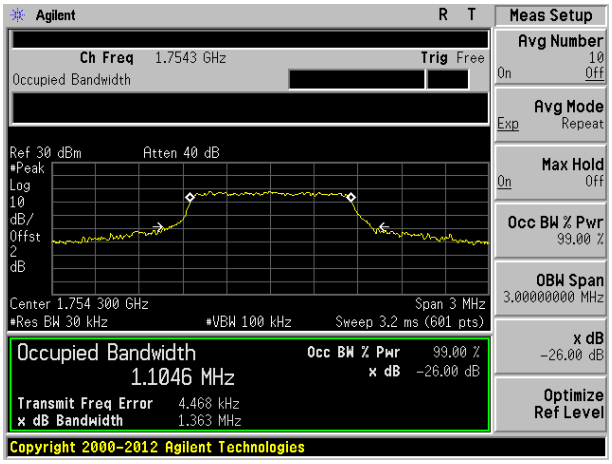
Test band: LTE Band 4	Channel Bandwidth: 1.4MHz



Lowest channel

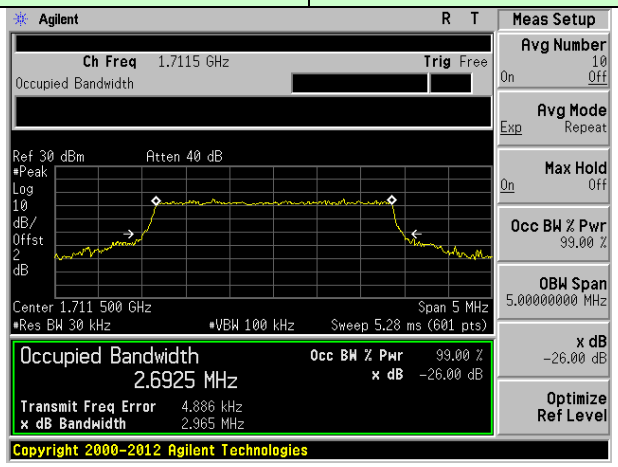


Middle channel

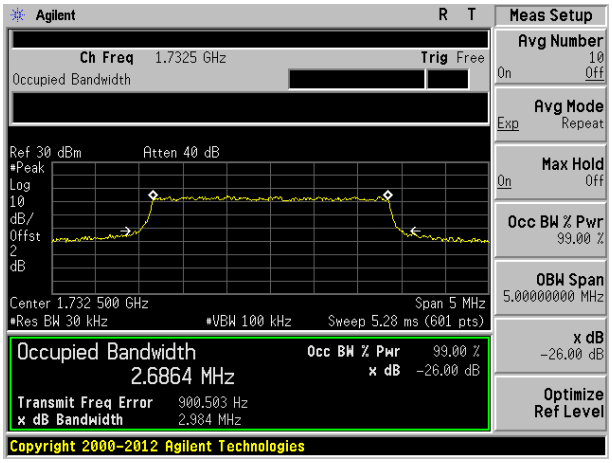


Highest channel

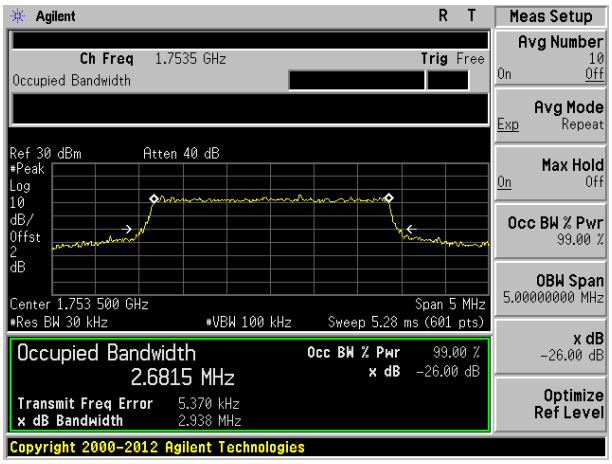
Test band: LTE Band 4	Channel Bandwidth: 3MHz



Lowest channel

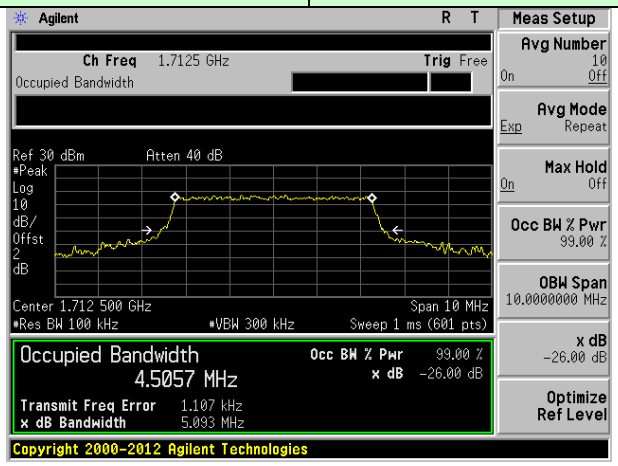


Middle channel

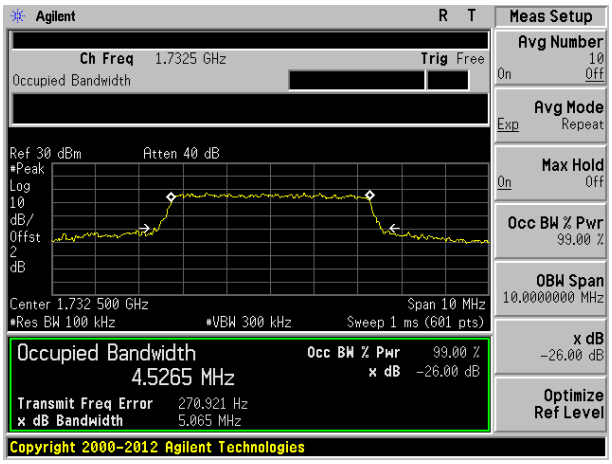


Highest channel

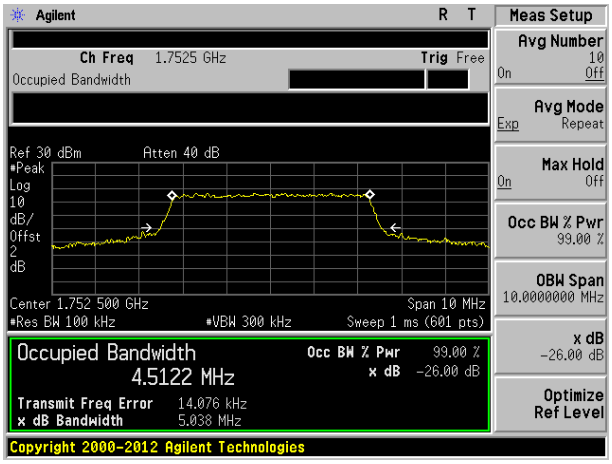
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

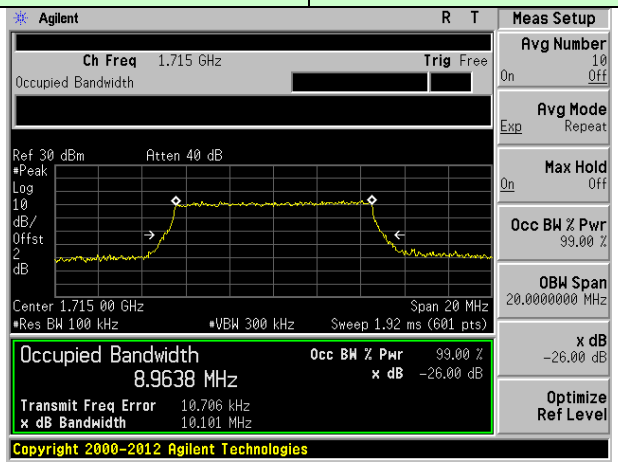


Middle channel

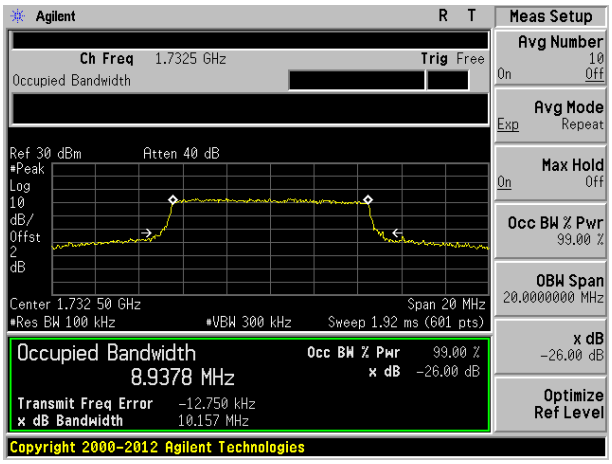


Highest channel

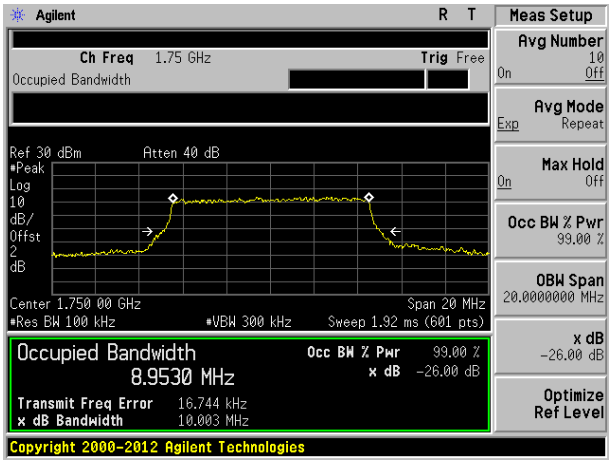
Test band: LTE Band 4	Channel Bandwidth: 10MHz



Lowest channel

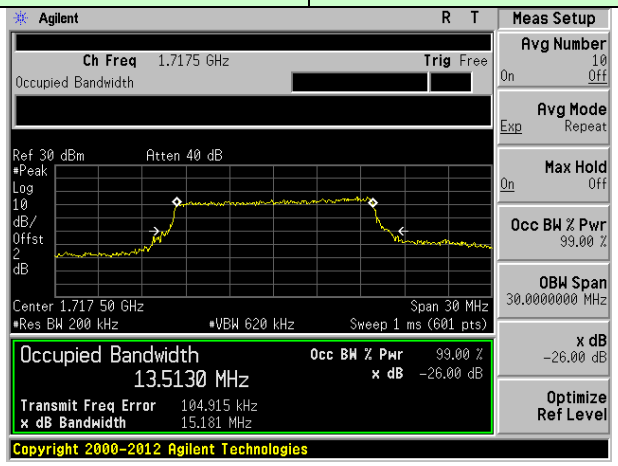


Middle channel

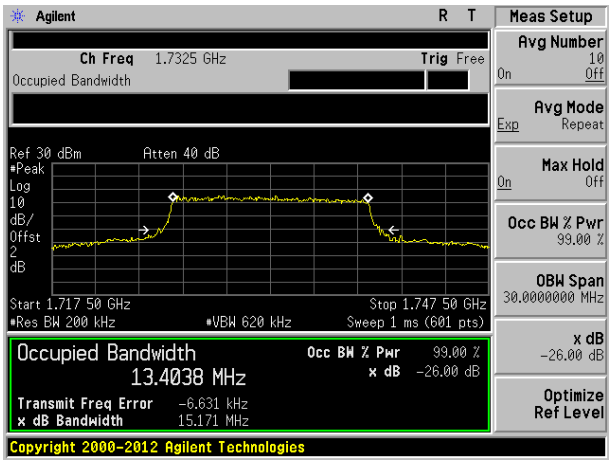


Highest channel

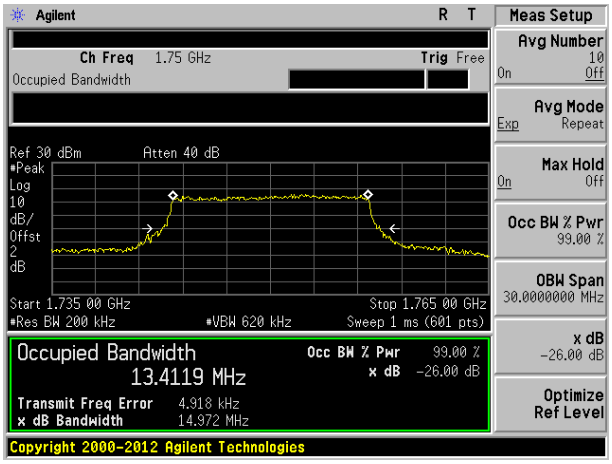
Test band: LTE Band 4	Channel Bandwidth: 15MHz



Lowest channel

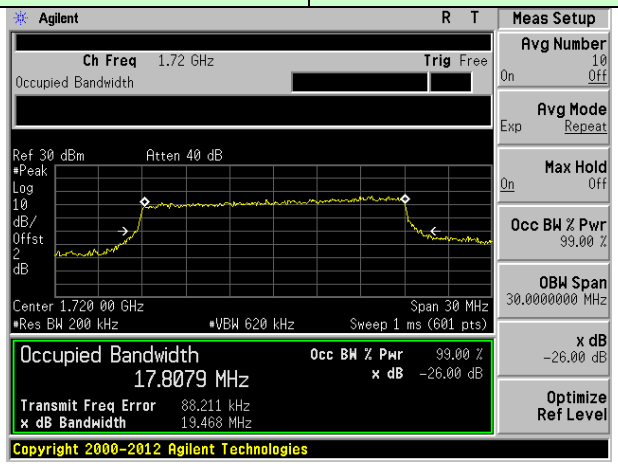


Middle channel

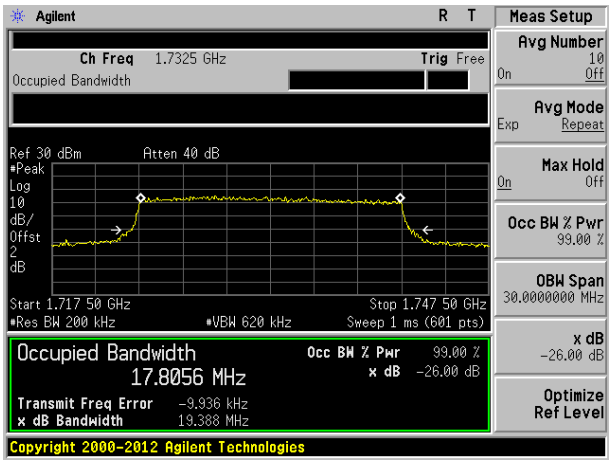


Highest channel

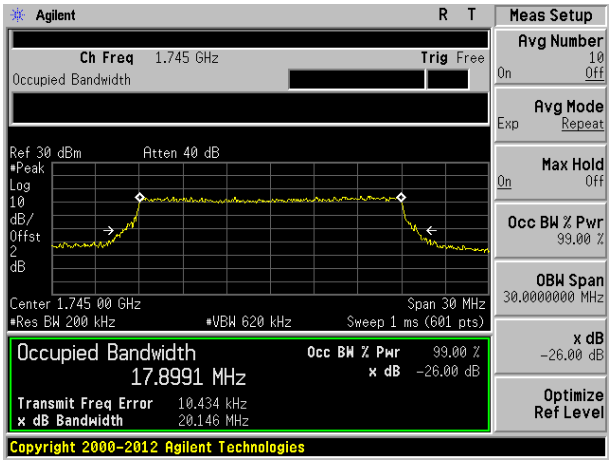
Test band: LTE Band 4	Channel Bandwidth: 20MHz



Lowest channel

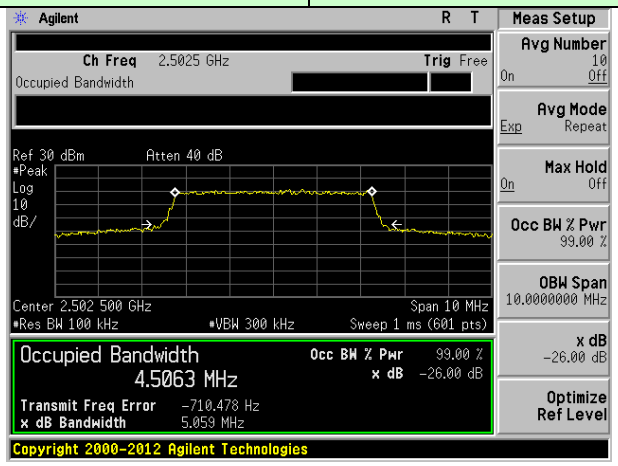


Middle channel

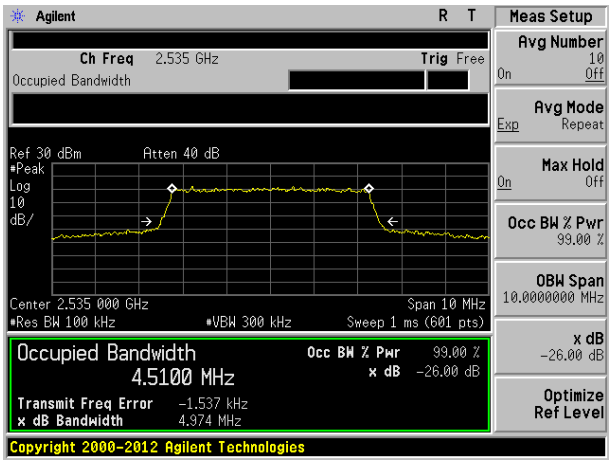


Highest channel

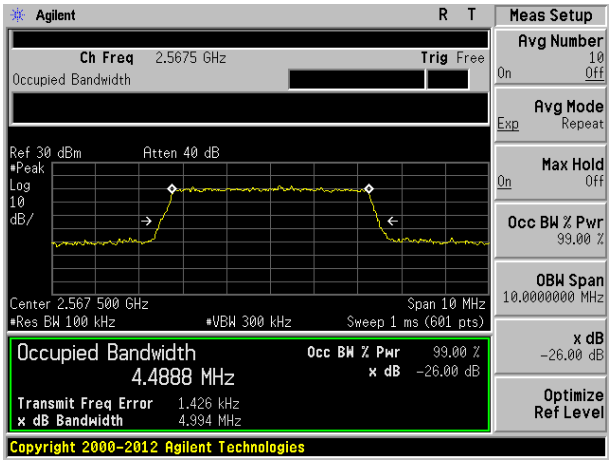
Test band: LTE Band 7	Channel Bandwidth: 5MHz



Lowest channel

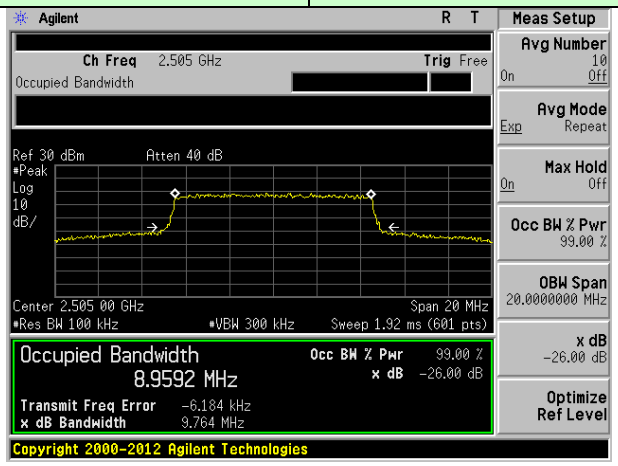


Middle channel

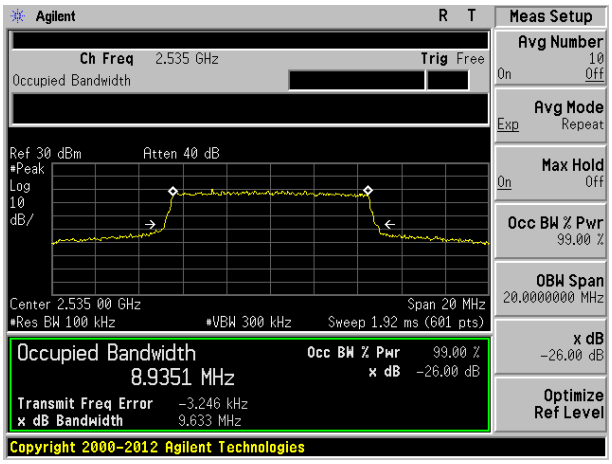


Highest channel

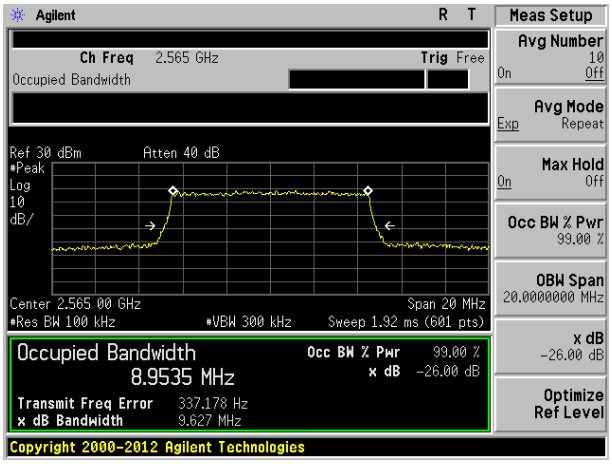
Test band: LTE Band 7	Channel Bandwidth: 10MHz



Lowest channel

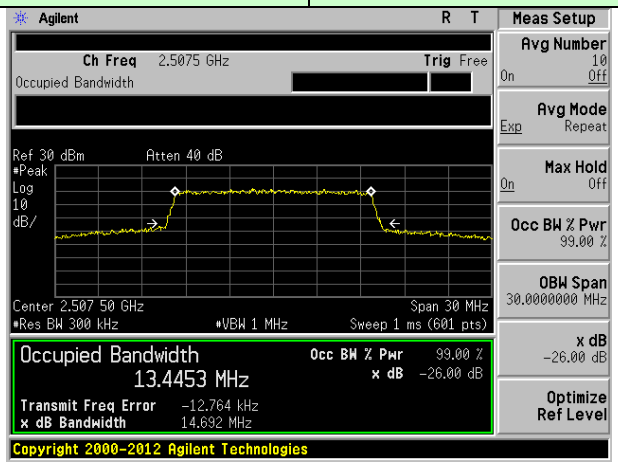


Middle channel

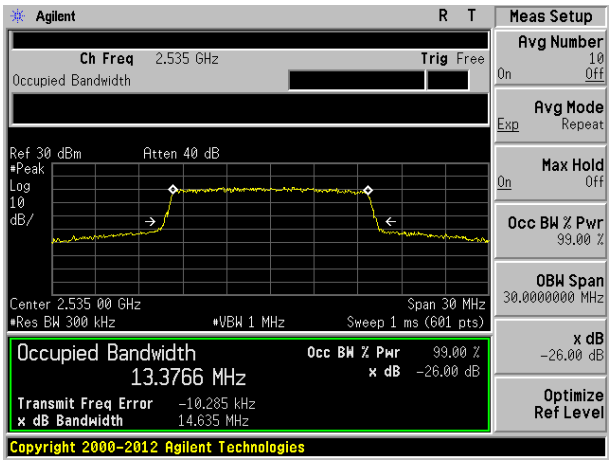


Highest channel

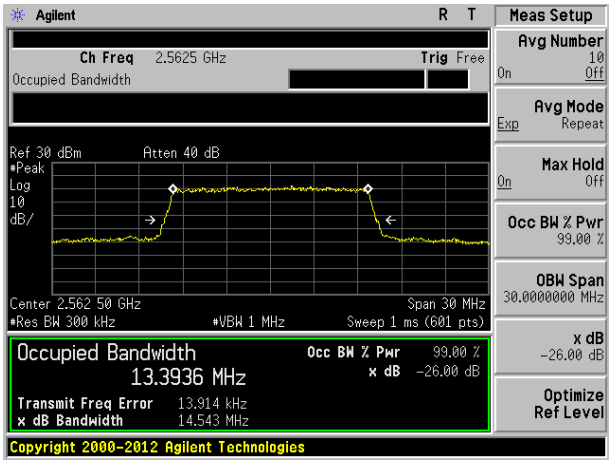
Test band: LTE Band 7	Channel Bandwidth: 15MHz



Lowest channel

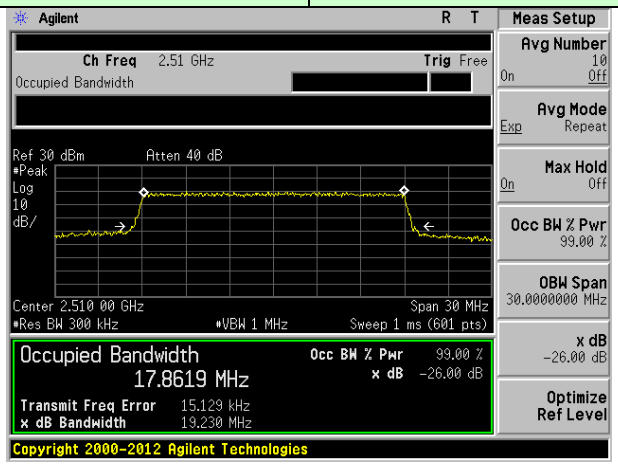


Middle channel

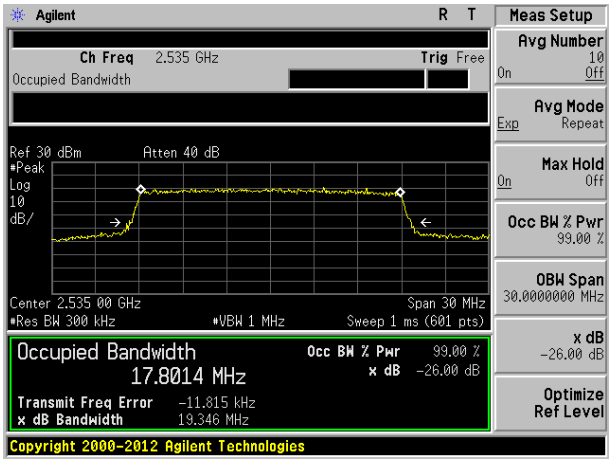


Highest channel

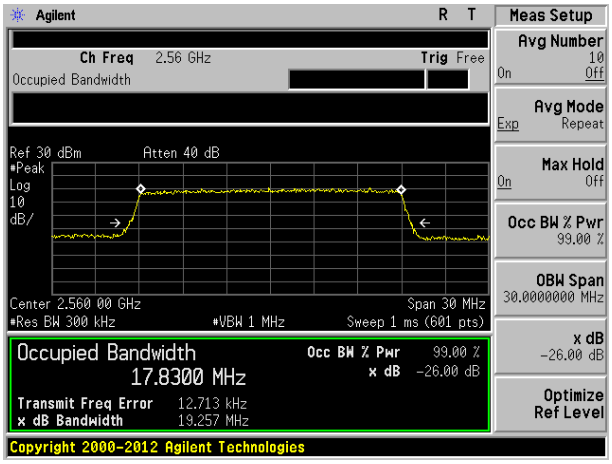
Test band: LTE Band 7	Channel Bandwidth: 20MHz



Lowest channel



Middle channel

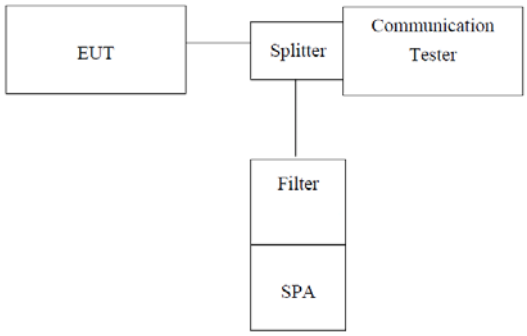


Highest channel

7.6 MODULATION CHARACTERISTIC

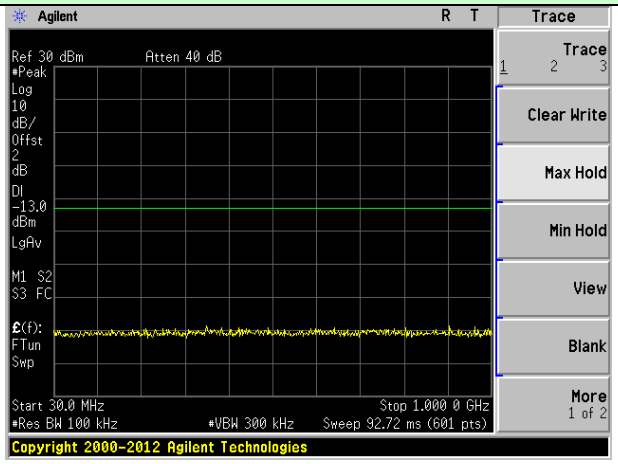
According to FCC § 2.1047(d), Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

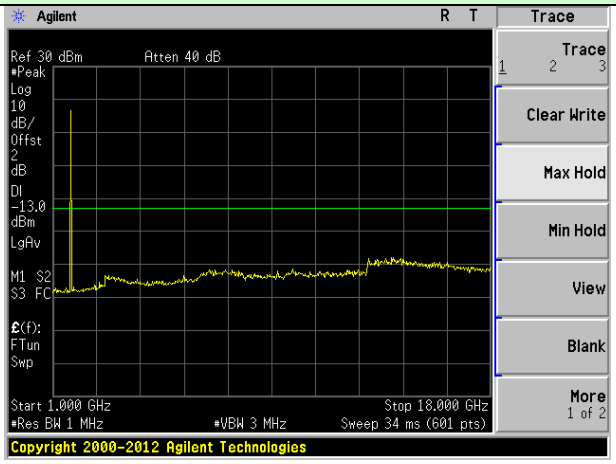
7.7 Out of band emission at antenna terminals

Test Requirement for FCC:	Part 24.238 (a); FCC Part 27.53(h)/(g)
Limit:	-13dBm
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
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, VBW = 1MHz, Start=30MHz, Stop= 10th harmonic. 4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

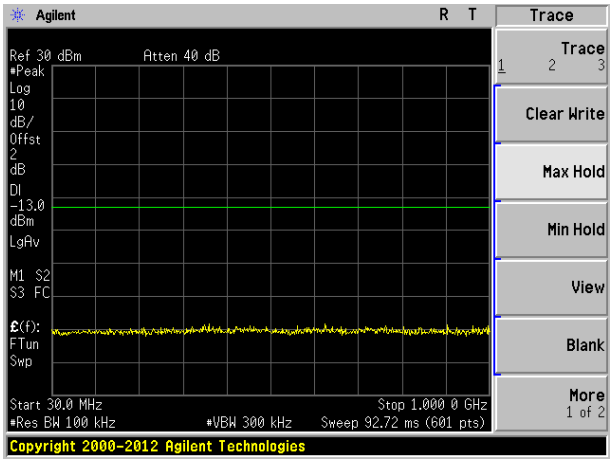
Test plot as follows:

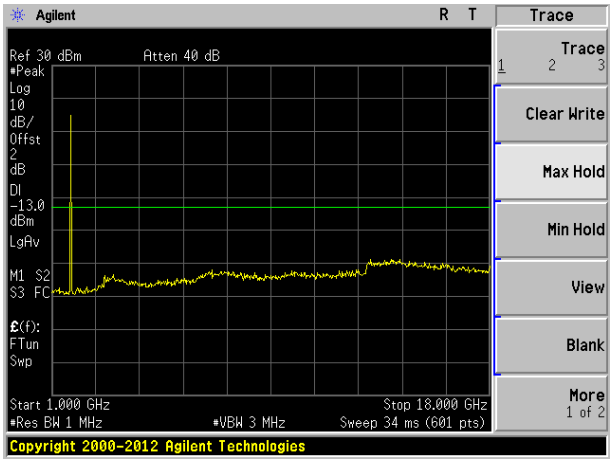
Test Mode: LTE Band 4	Channel Bandwidth: 1.4MHz



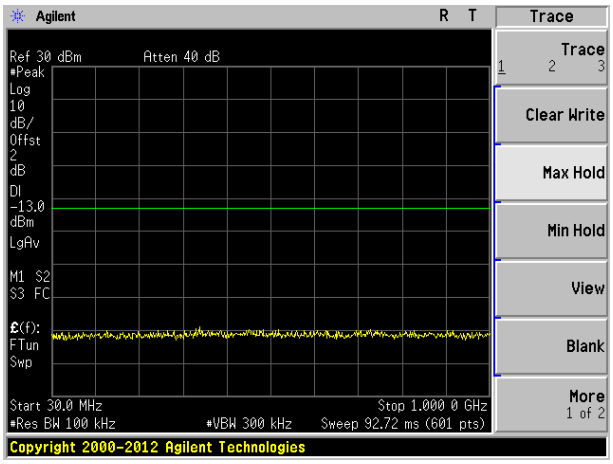


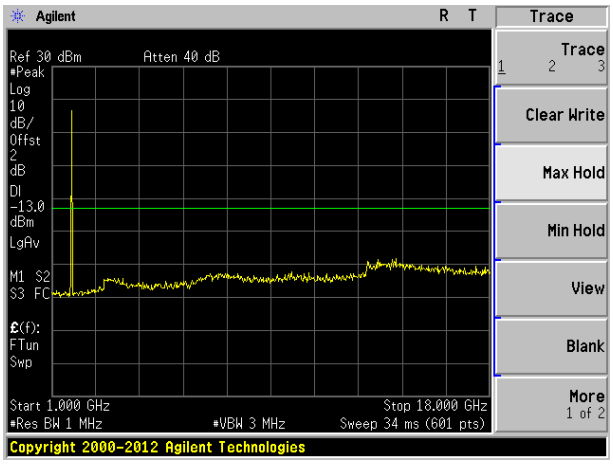
Lowest channel





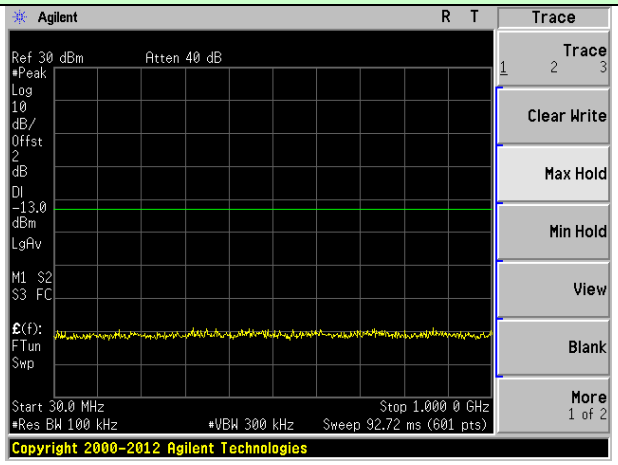
Middle channel

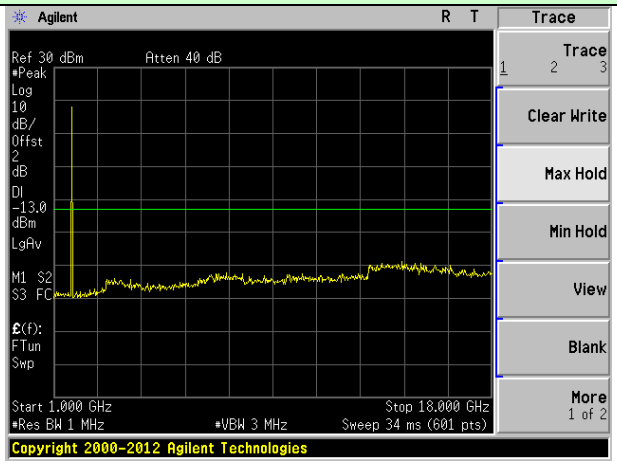




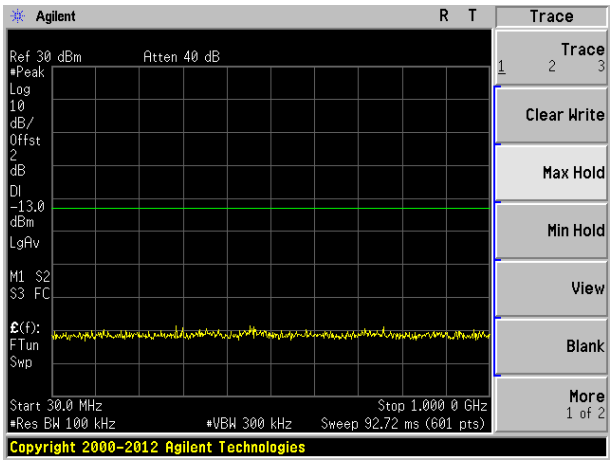
Highest channel

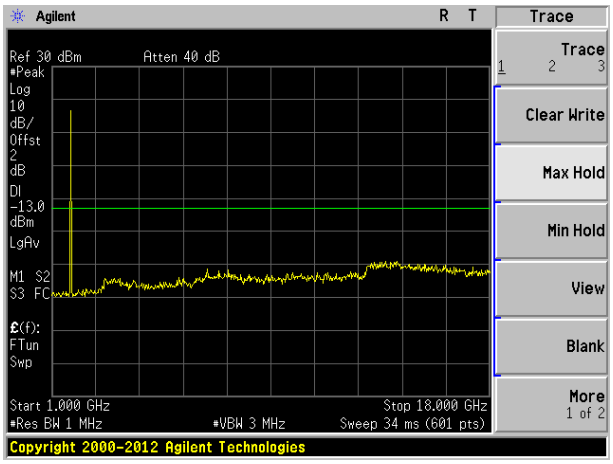
Test Mode: LTE Band 4	Channel Bandwidth: 3MHz



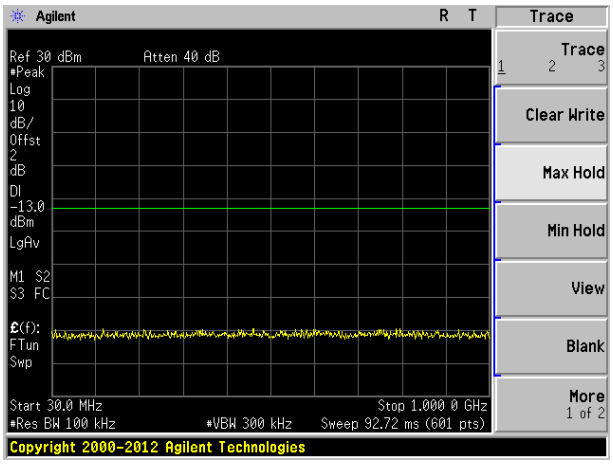


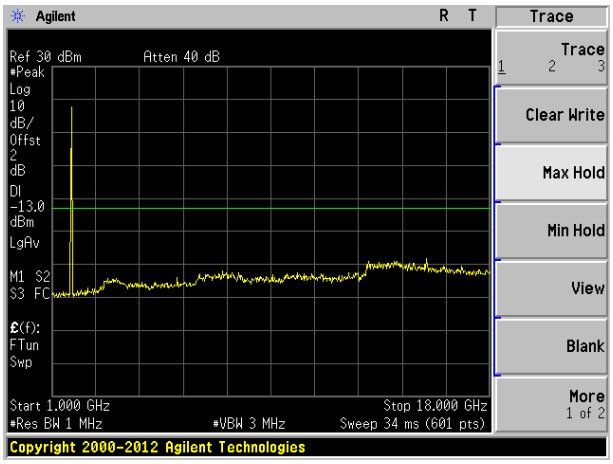
Lowest channel





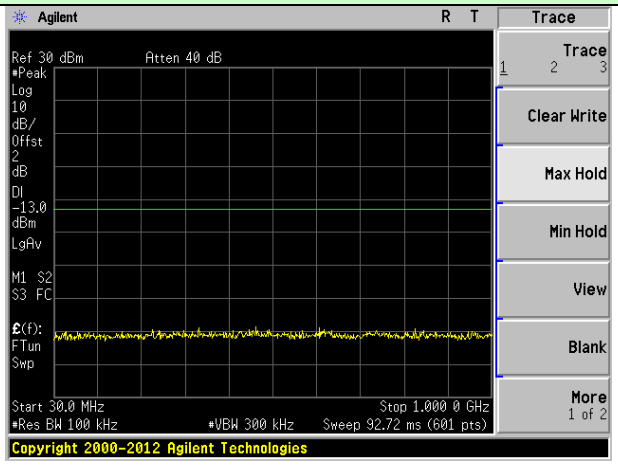
Middle channel

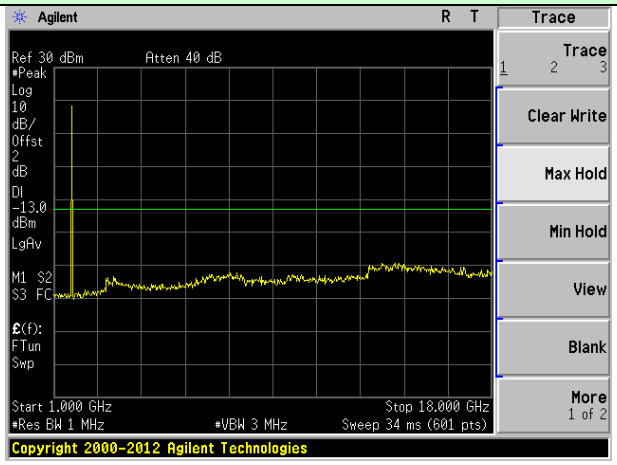




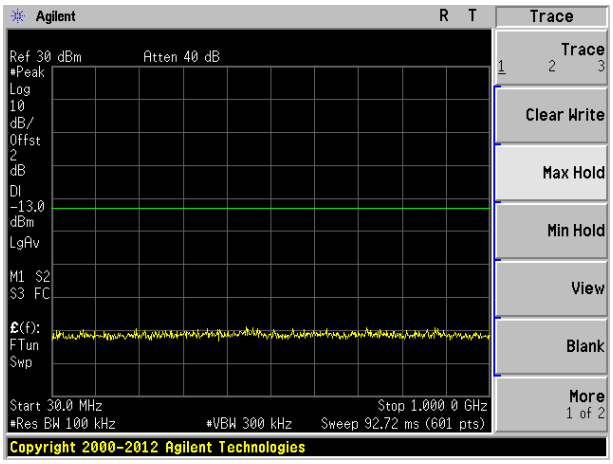
Highest channel

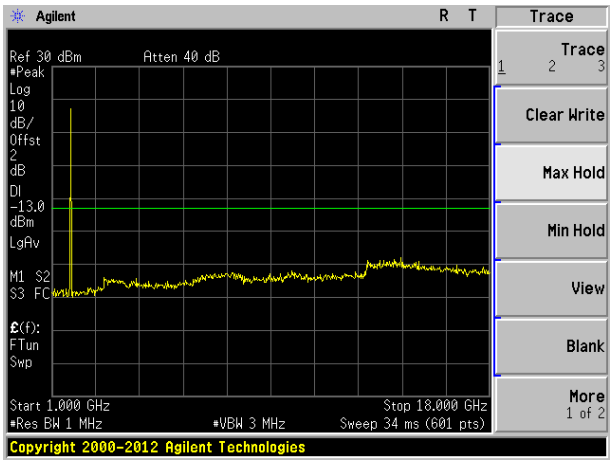
Test Mode: LTE Band 4	Channel Bandwidth: 5MHz



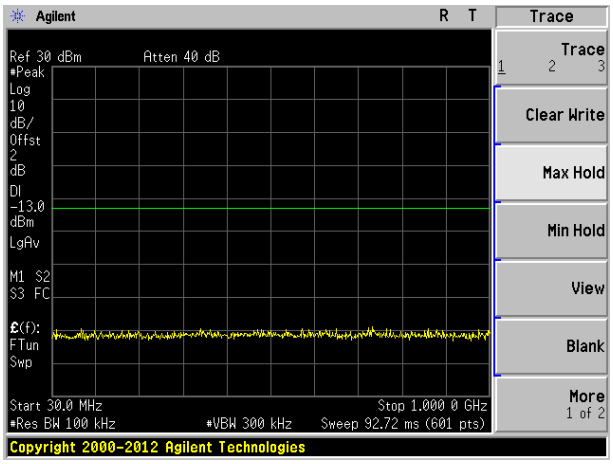


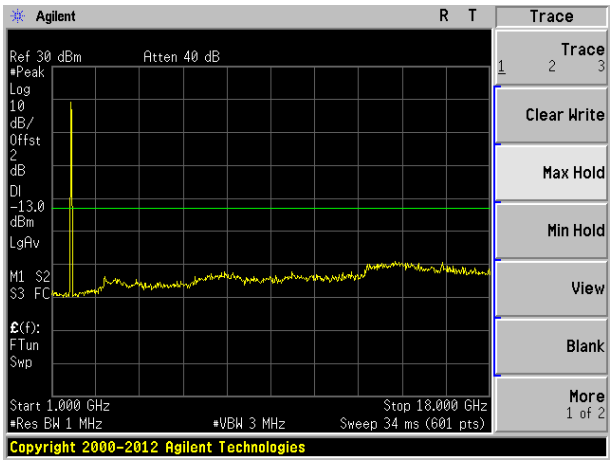
Lowest channel





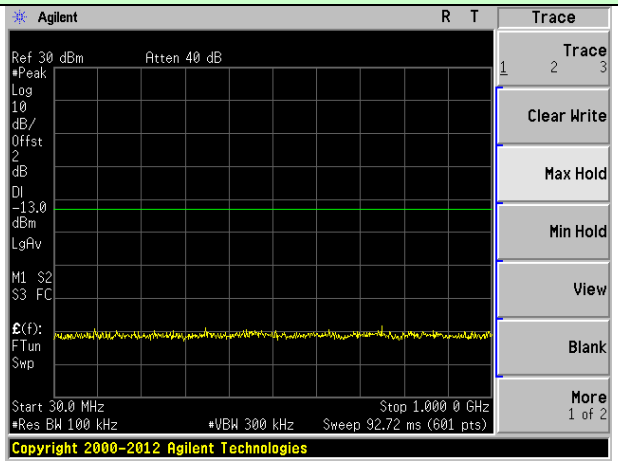
Middle channel

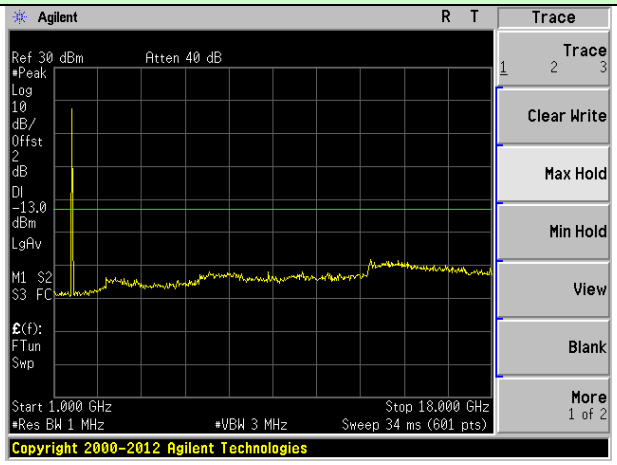




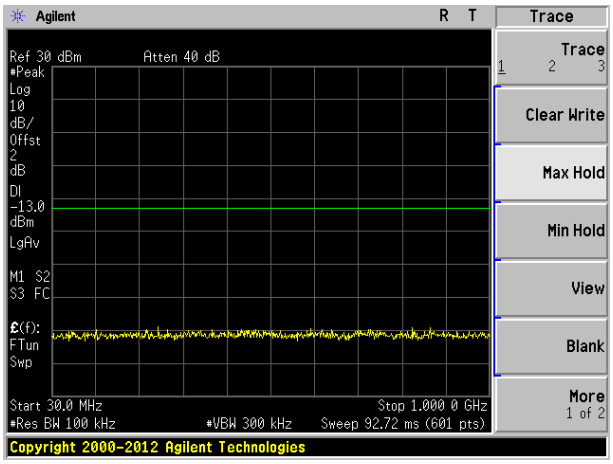
Highest channel

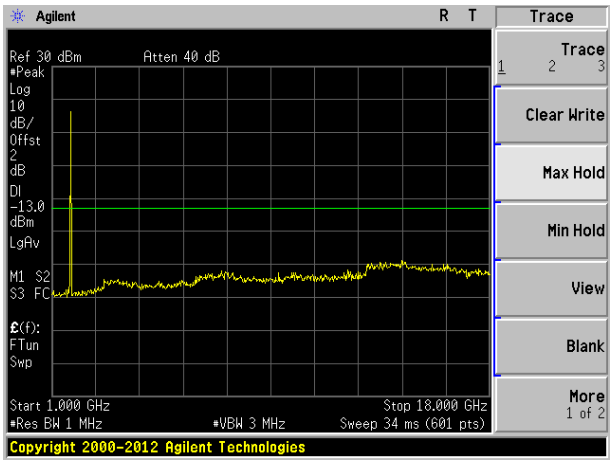
Test Mode: LTE Band 4	Channel Bandwidth: 10MHz



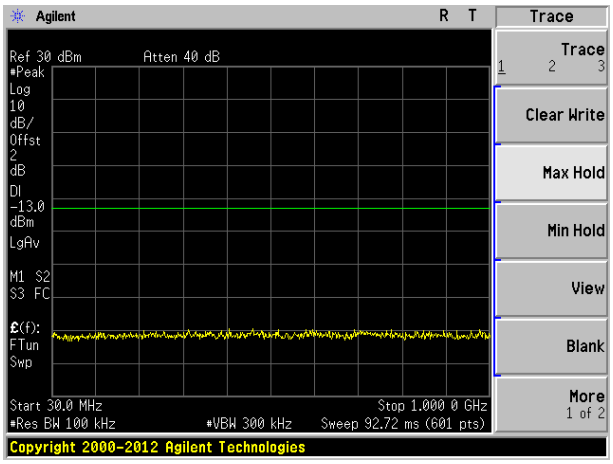


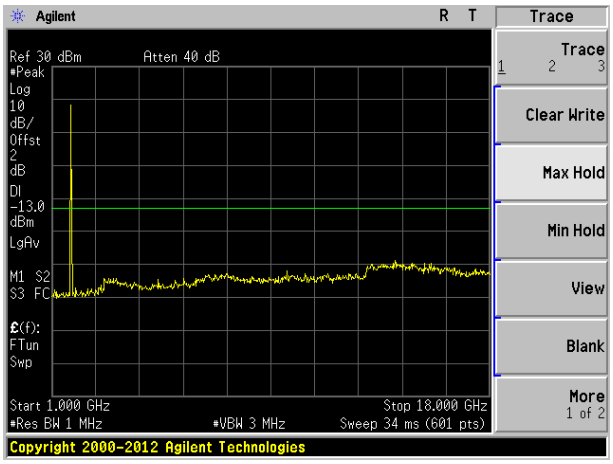
Lowest channel





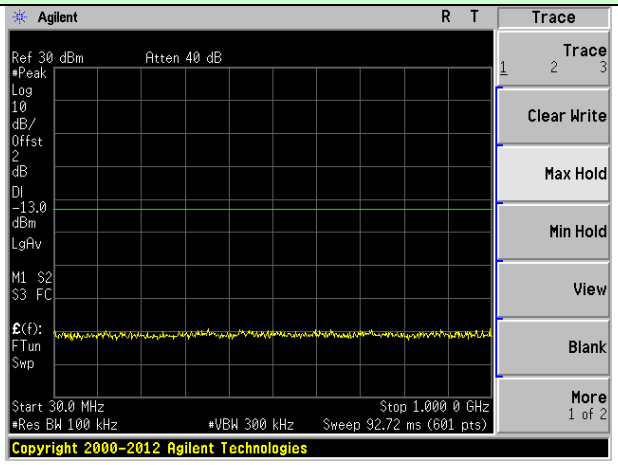
Middle channel

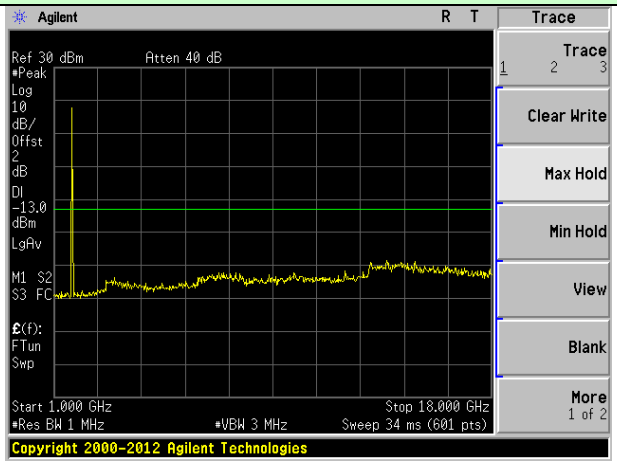




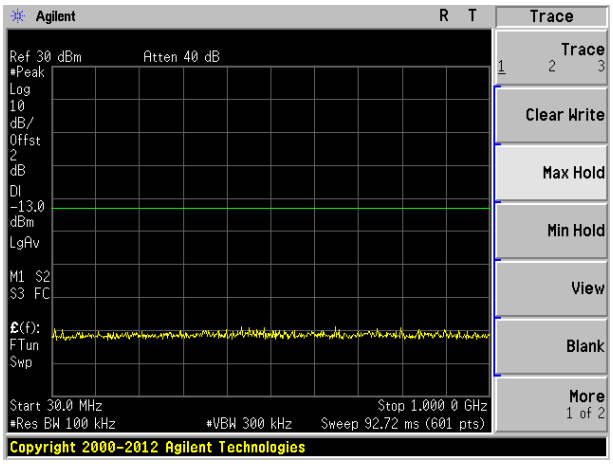
Highest channel

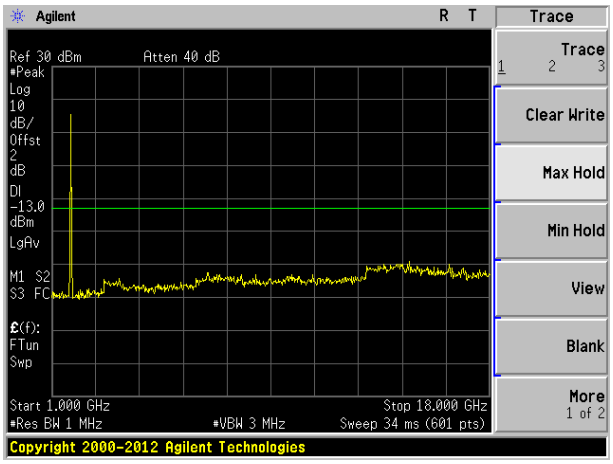
Test Mode: LTE Band 4	Channel Bandwidth: 15MHz



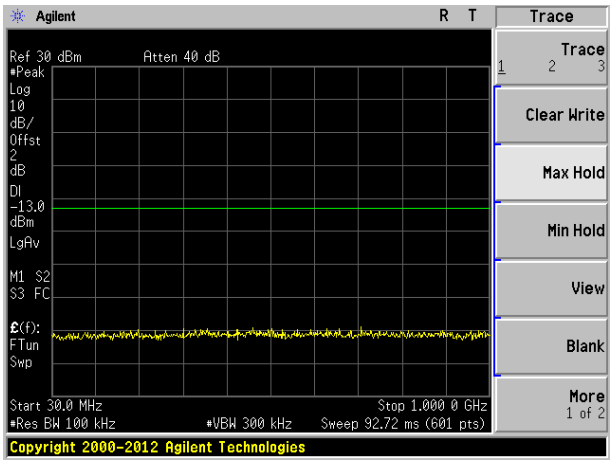


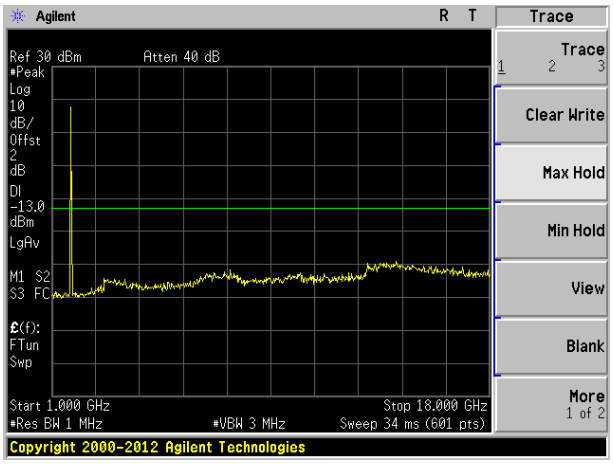
Lowest channel





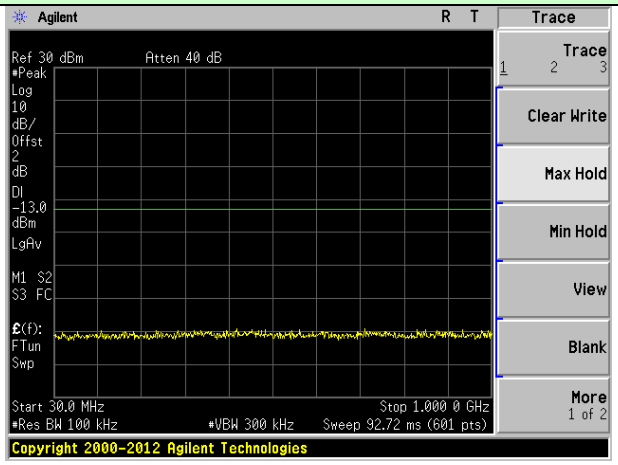
Middle channel

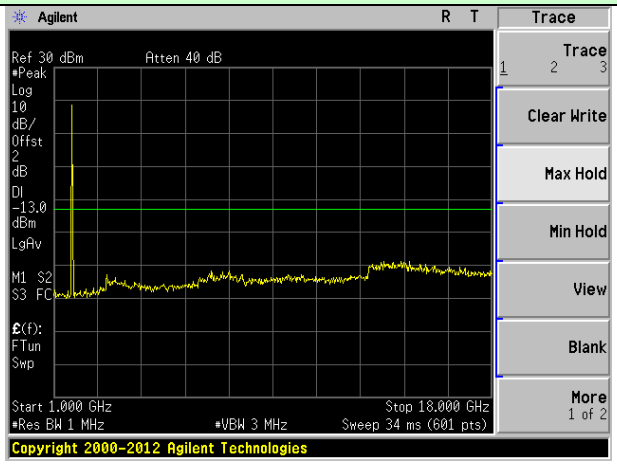




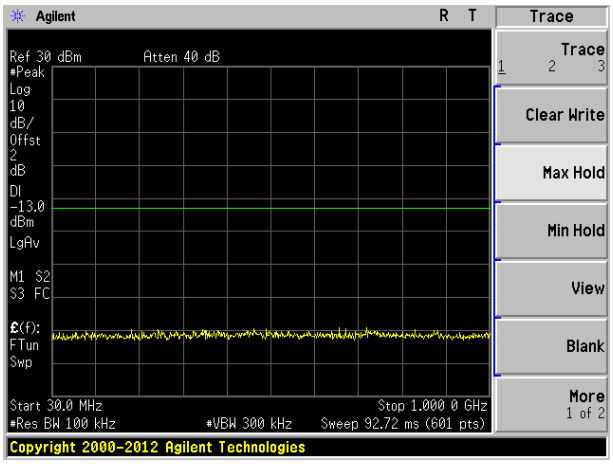
Highest channel

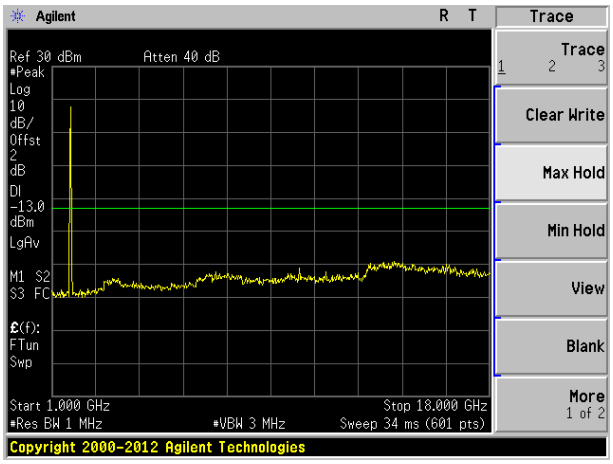
Test Mode: LTE Band 4	Channel Bandwidth: 20MHz



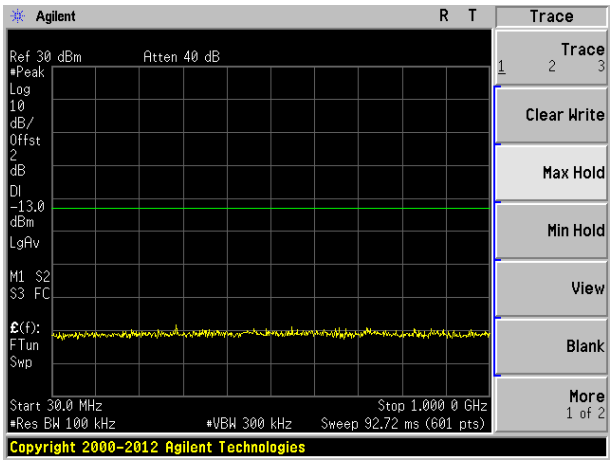


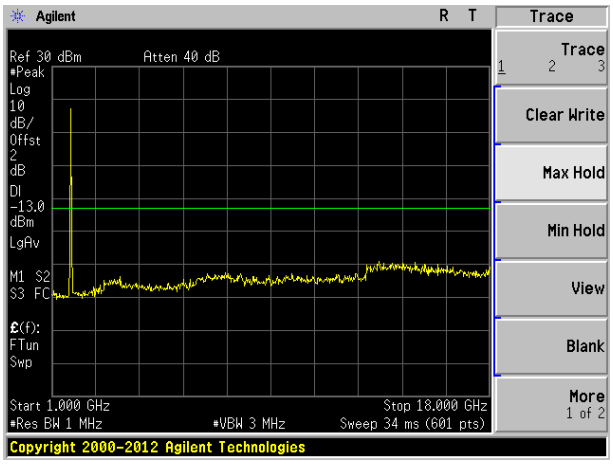
Lowest channel





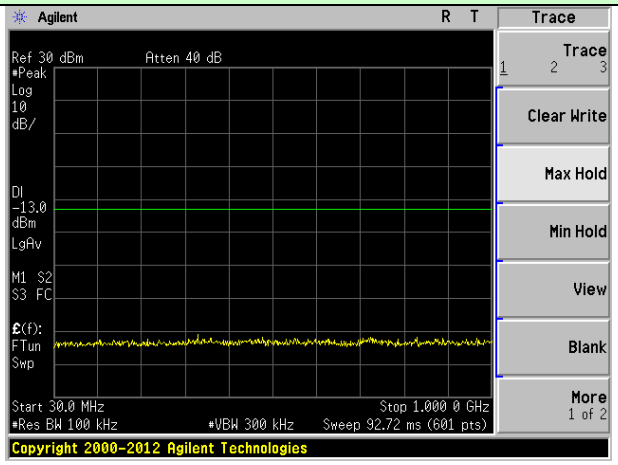
Middle channel

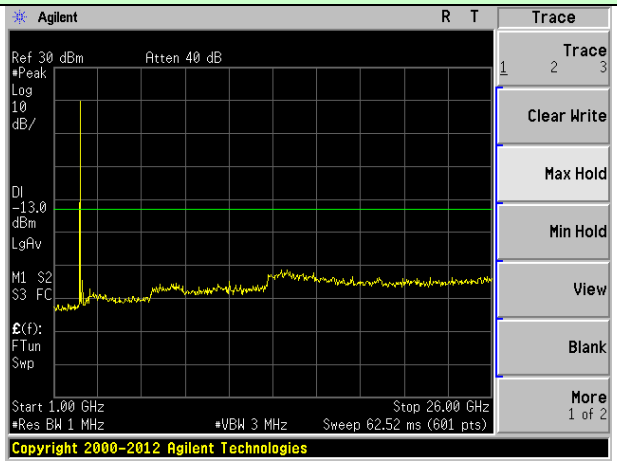




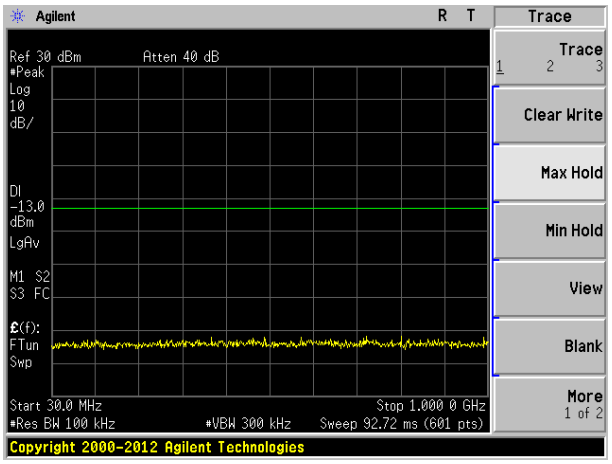
Highest channel

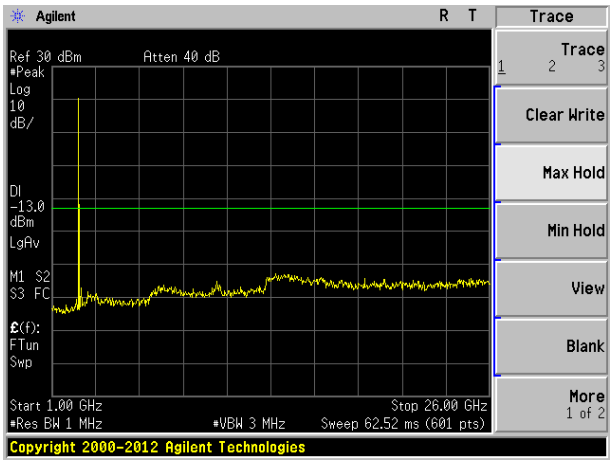
Test Mode: LTE Band 7	Channel Bandwidth: 5MHz



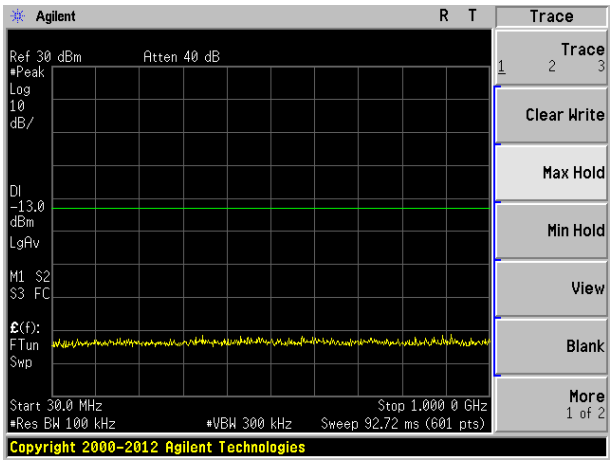


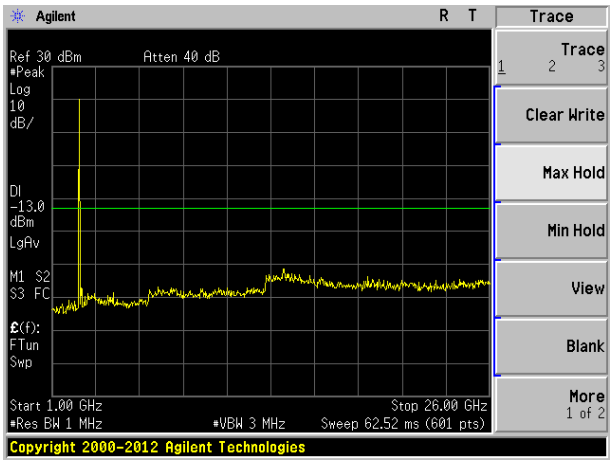
Lowest channel





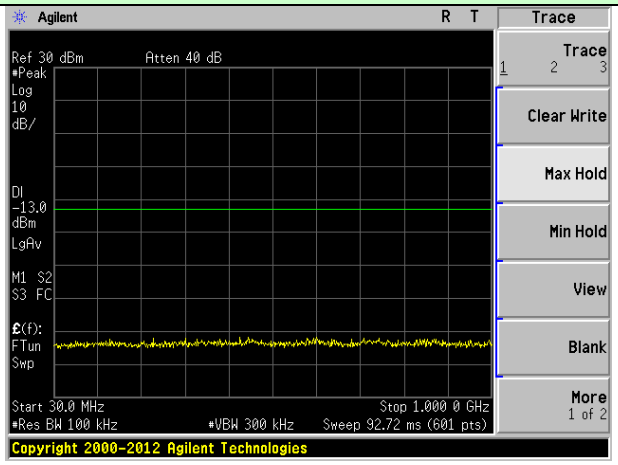
Middle channel

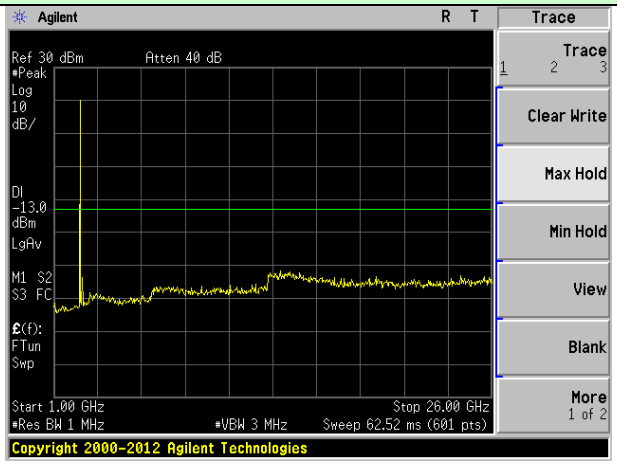




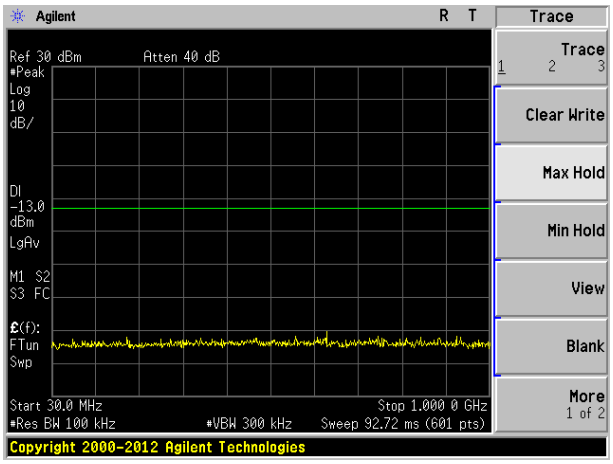
Highest channel

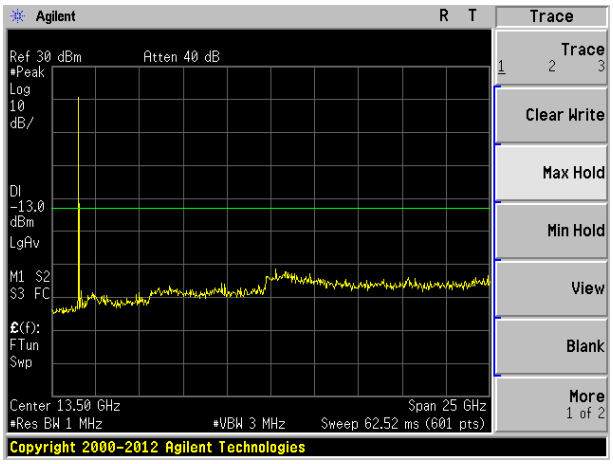
Test Mode: LTE Band 7	Channel Bandwidth: 10MHz



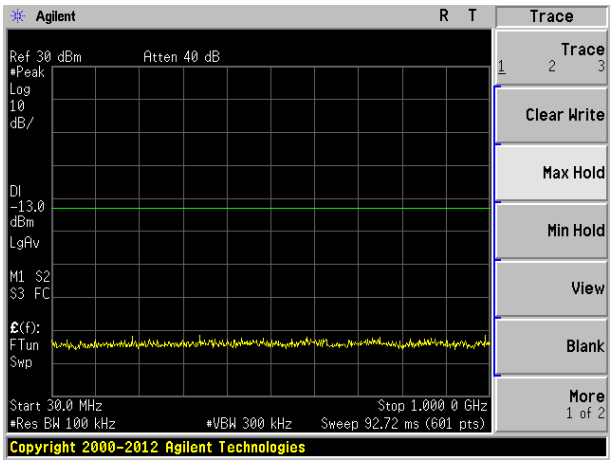


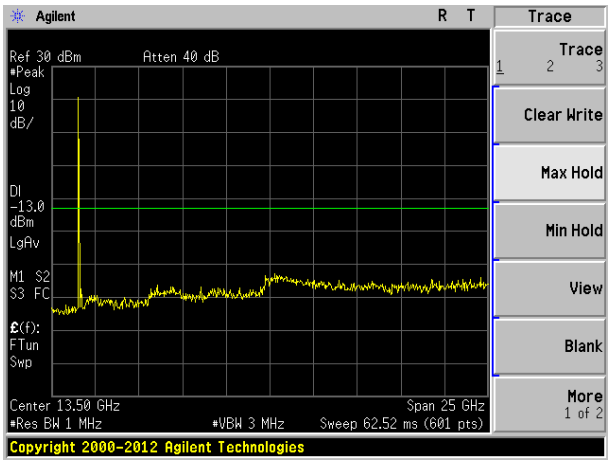
Lowest channel





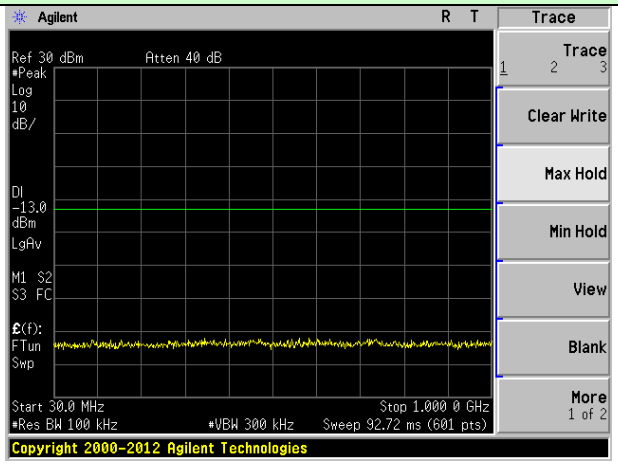
Middle channel

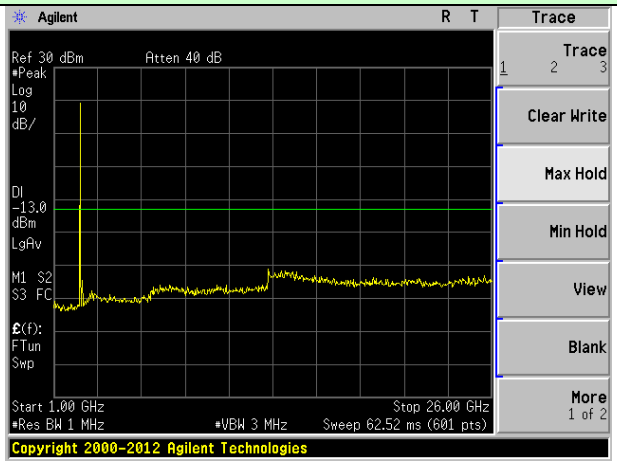




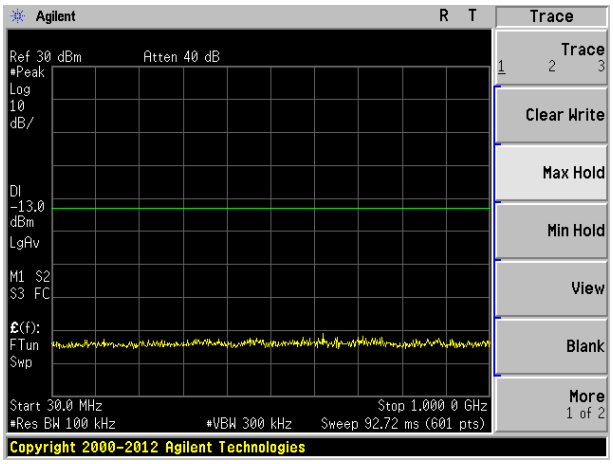
Highest channel

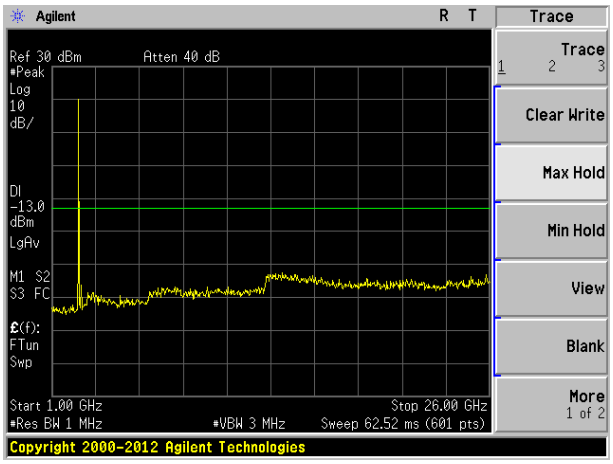
Test Mode: LTE Band 7	Channel Bandwidth: 15MHz



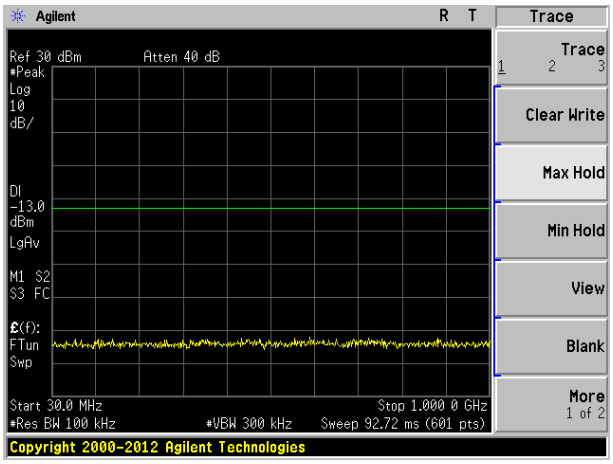


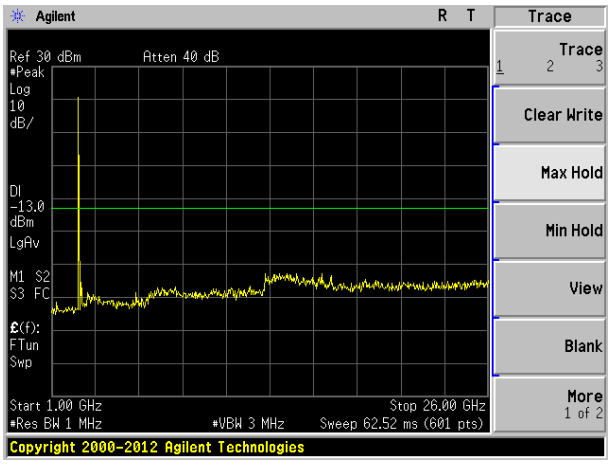
Lowest channel





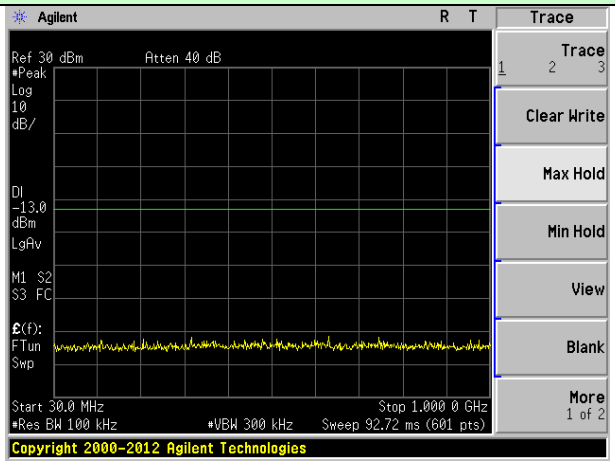
Middle channel

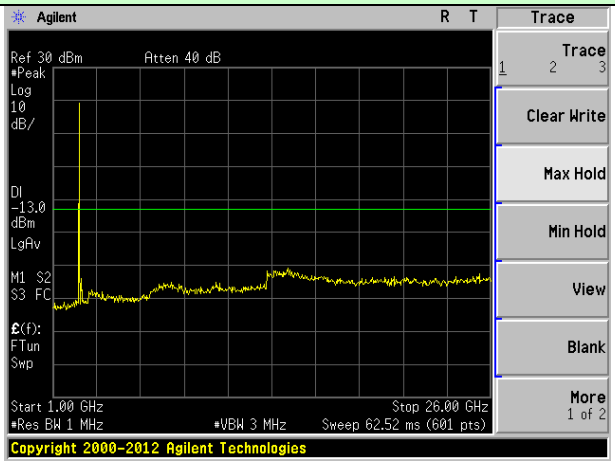




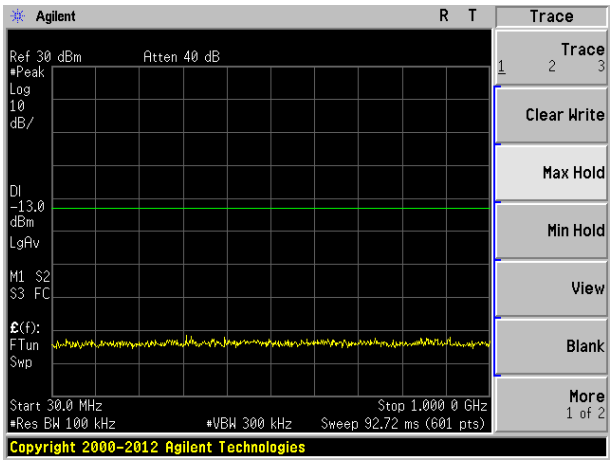
Highest channel

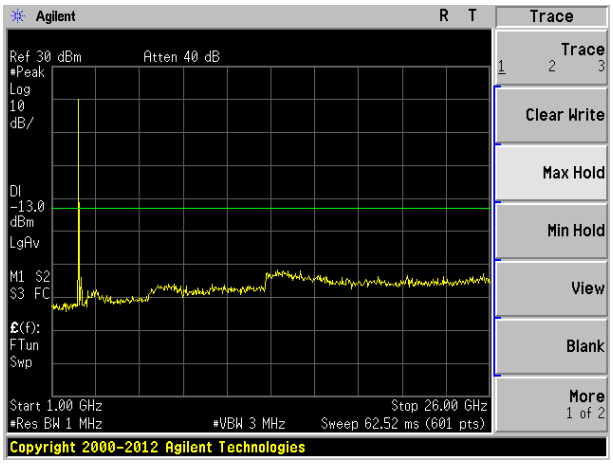
Test Mode: LTE Band 7	Channel Bandwidth: 20MHz



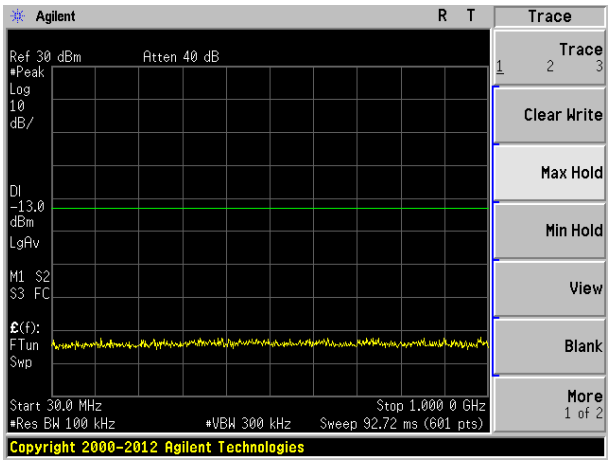


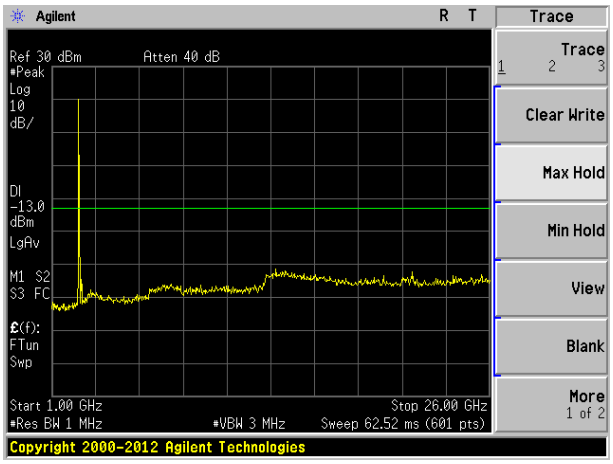
Lowest channel





Middle channel

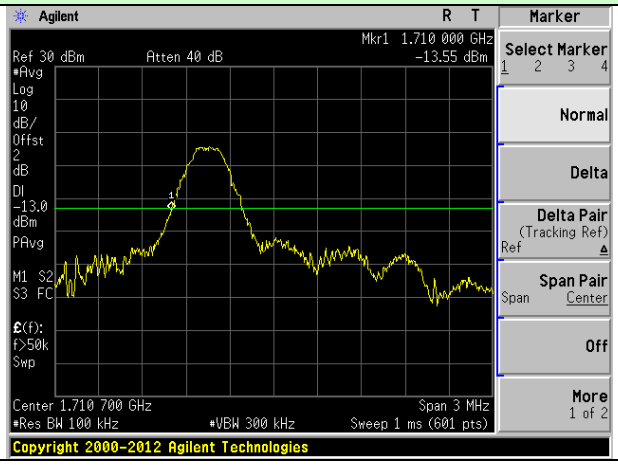
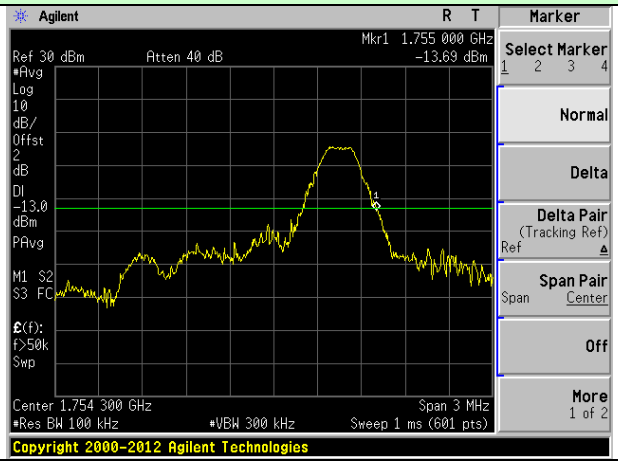


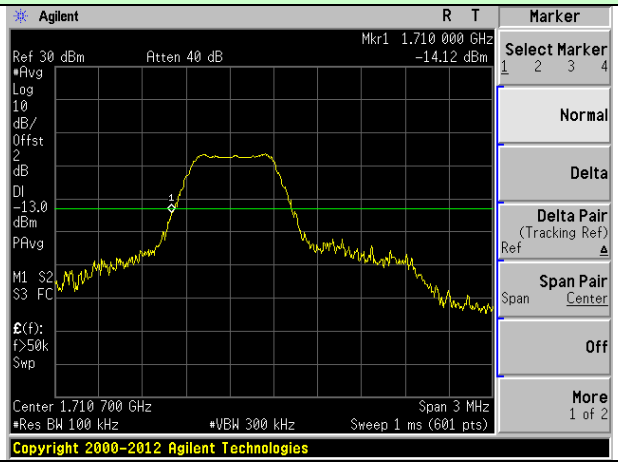
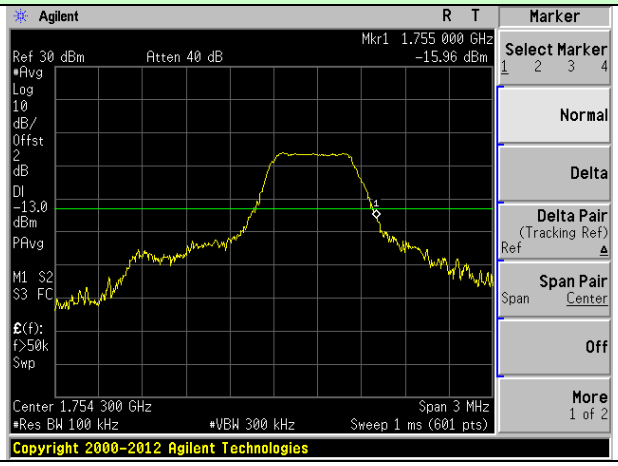


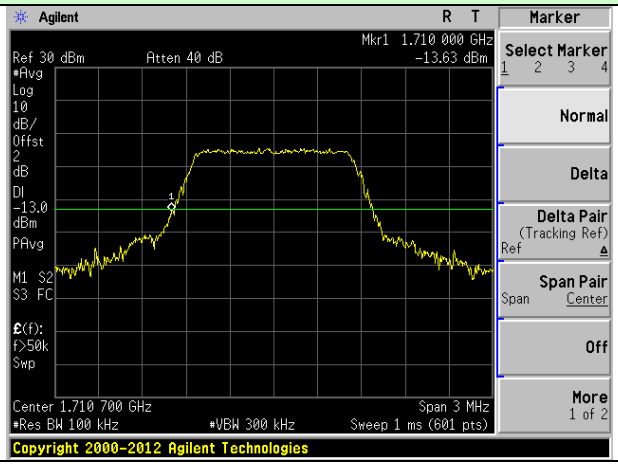
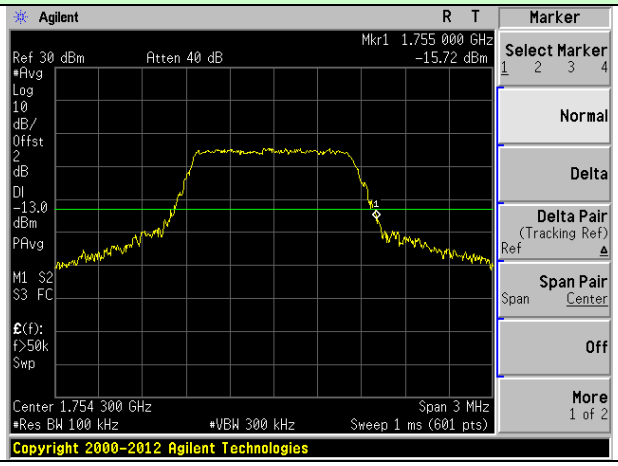
Highest channel

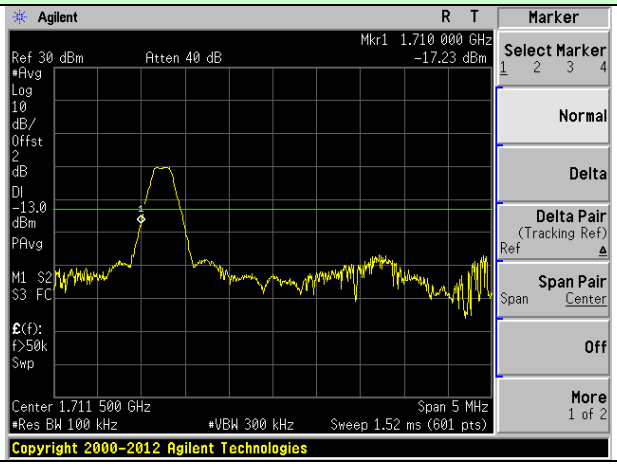
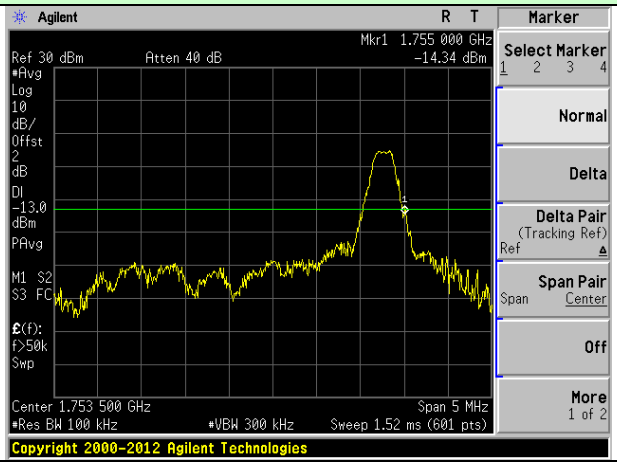
Band Edge:

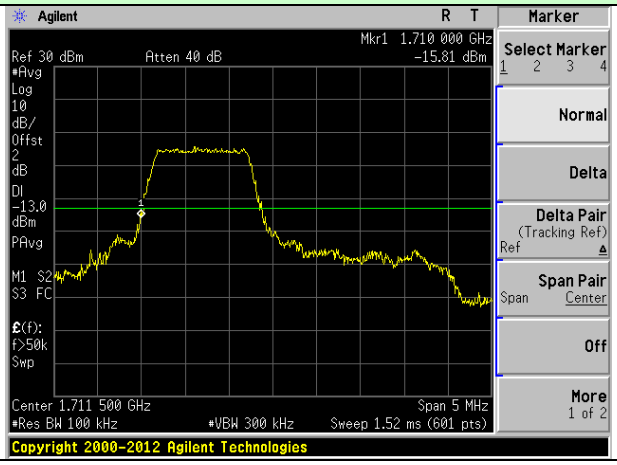
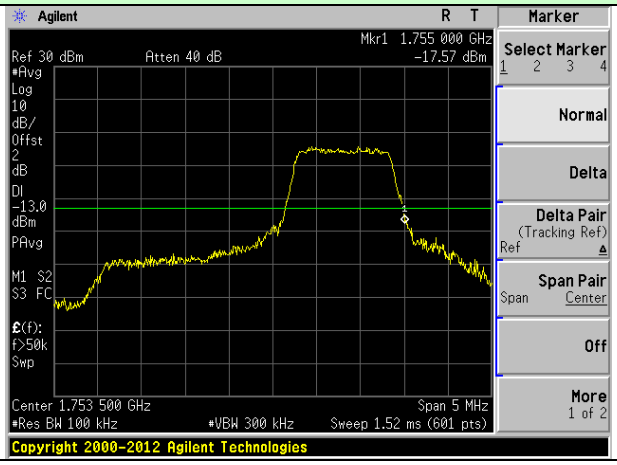
QPSK mode: LTE Band 4

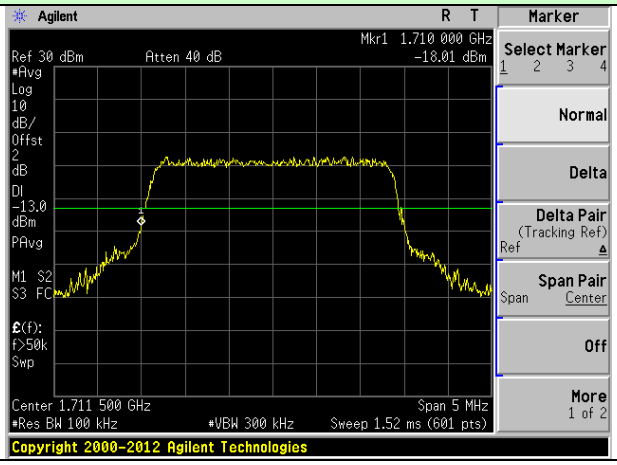
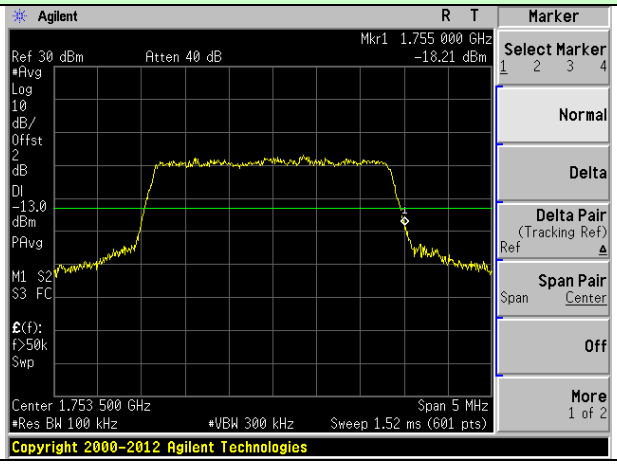
1.4MHz Bandwidth (RB size:1# RB offset:0#)	1.4MHz Bandwidth (RB size:1# RB offset:5#)
	
Lowest channel	Highest channel

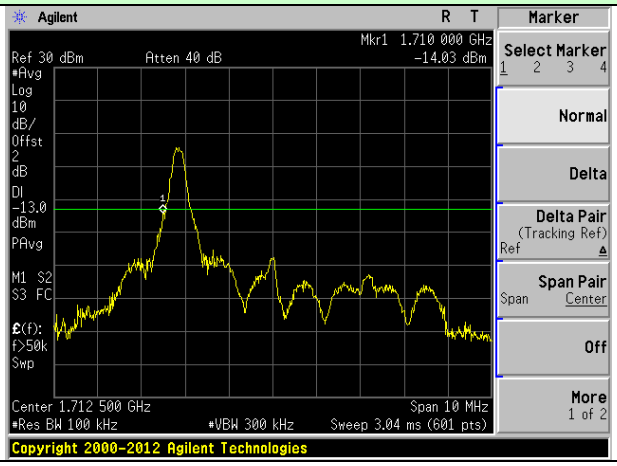
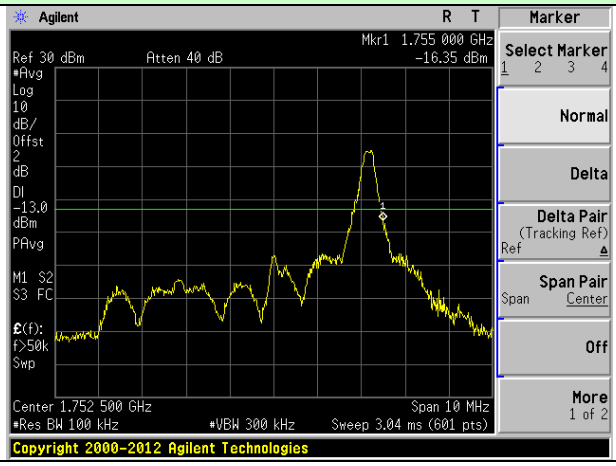
1.4MHz Bandwidth (RB size:3# RB offset:0#)	1.4MHz Bandwidth (RB size:3# RB offset:2#)
	
Lowest channel	Highest channel

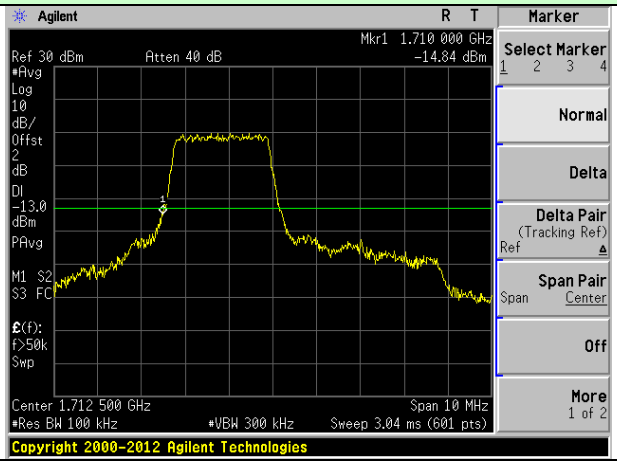
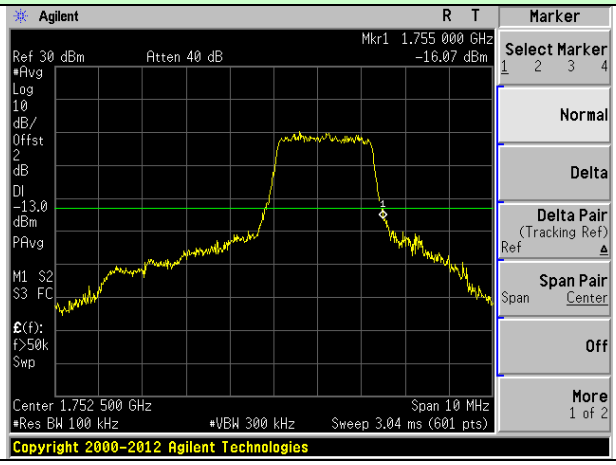
1.4MHz Bandwidth (RB size:6# RB offset:0#)	1.4MHz Bandwidth (RB size:6# RB offset:0#)
	
Lowest channel	Highest channel

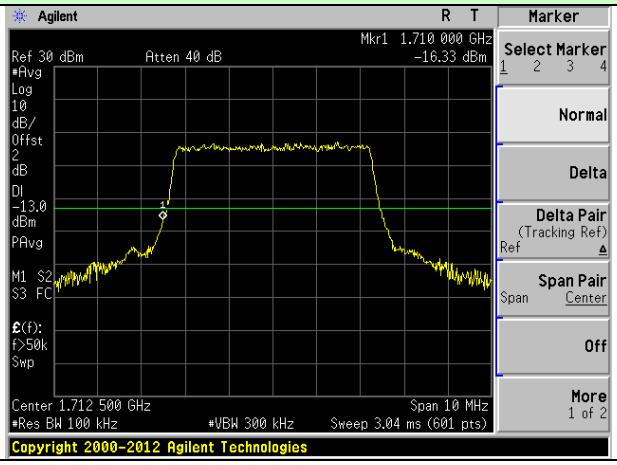
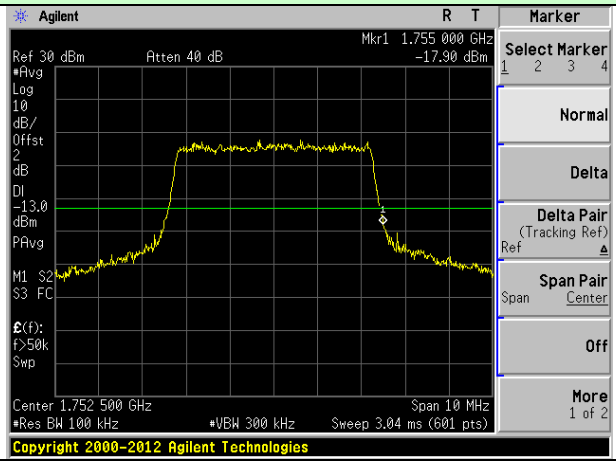
3MHz Bandwidth (RB size:1# RB offset:0#)	3MHz Bandwidth (RB size:1# RB offset:14#)
	
Lowest channel	Highest channel

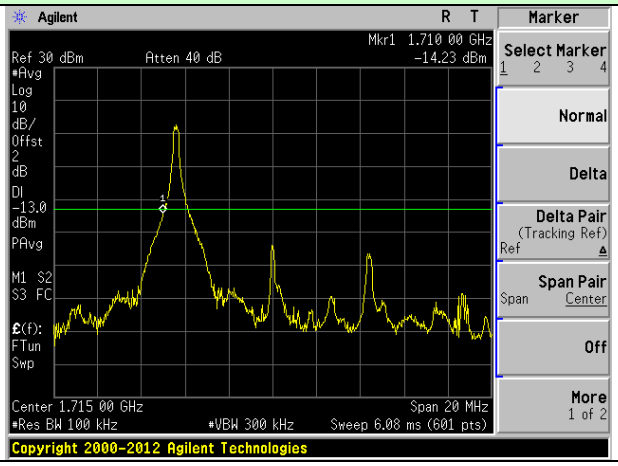
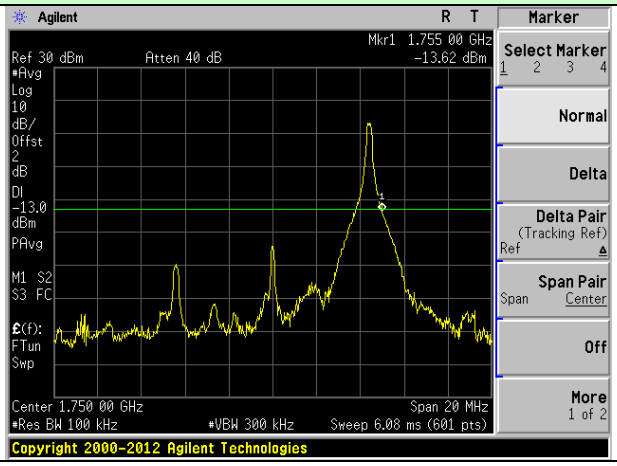
3MHz Bandwidth (RB size:8# RB offset:0#)	3MHz Bandwidth (RB size:8# RB offset:7#)
	
Lowest channel	Highest channel

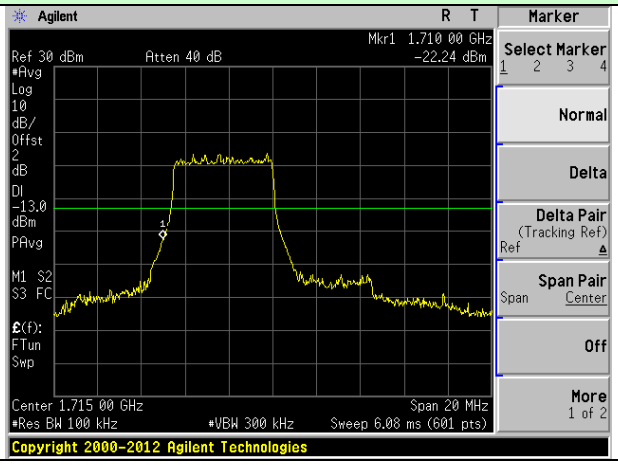
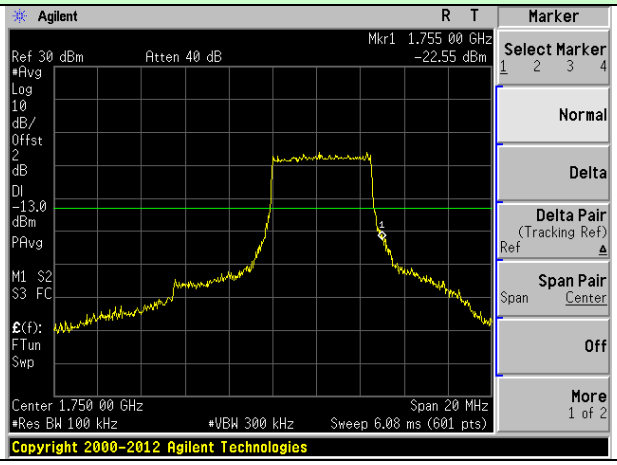
3MHz Bandwidth (RB size:15# RB offset:0#)	3MHz Bandwidth (RB size:15# RB offset:0#)
	
Lowest channel	Highest channel

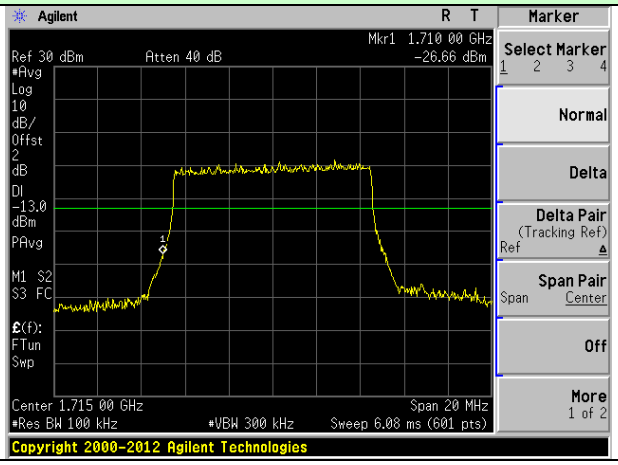
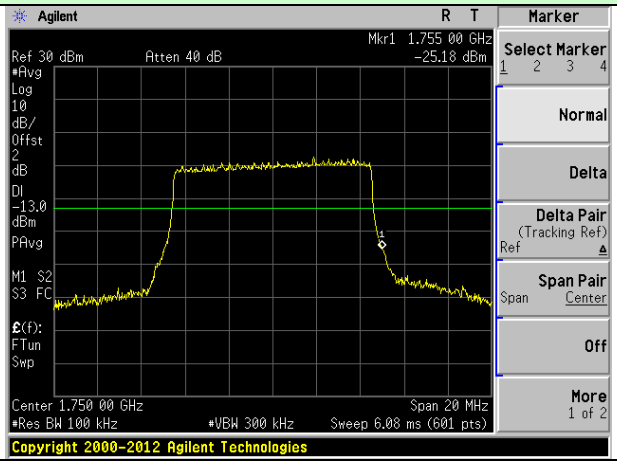
5MHz Bandwidth (RB size:1# RB offset:0#)	5MHz Bandwidth (RB size:1# RB offset:24#)
	
Lowest channel	Highest channel

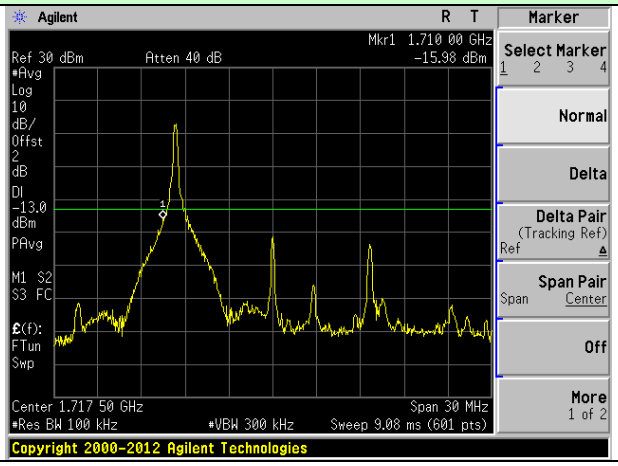
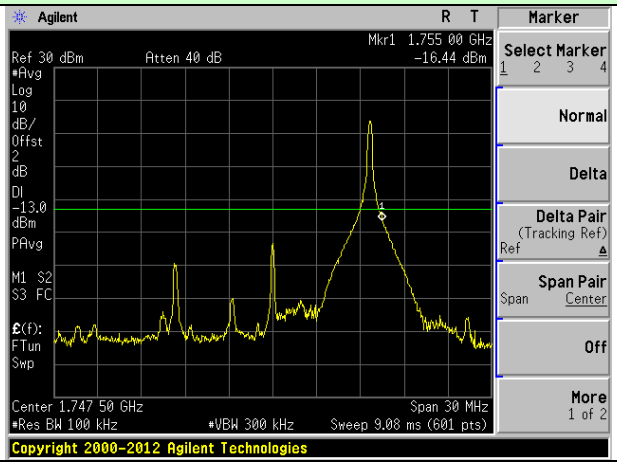
5MHz Bandwidth (RB size:12# RB offset:0#)	5MHz Bandwidth (RB size:12# RB offset:13#)
	
Lowest channel	Highest channel

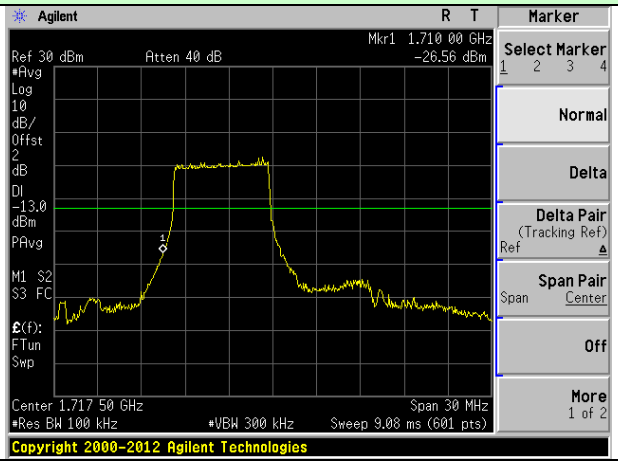
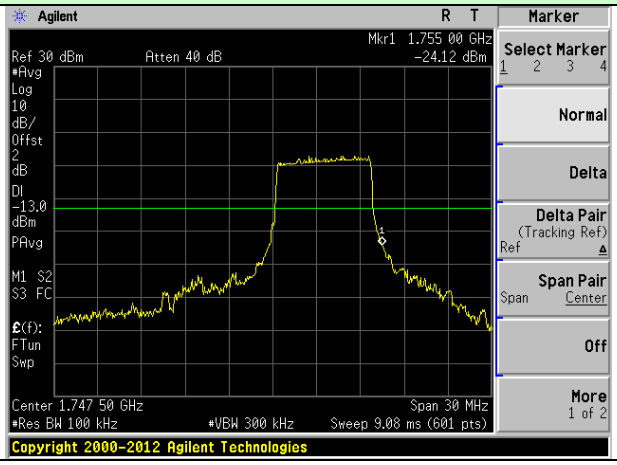
5MHz Bandwidth (RB size:25# RB offset:0#)	5MHz Bandwidth (RB size:25# RB offset:0#)
	
Lowest channel	Highest channel

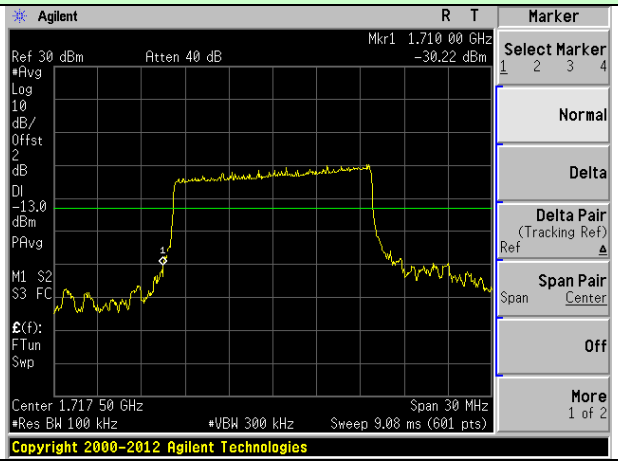
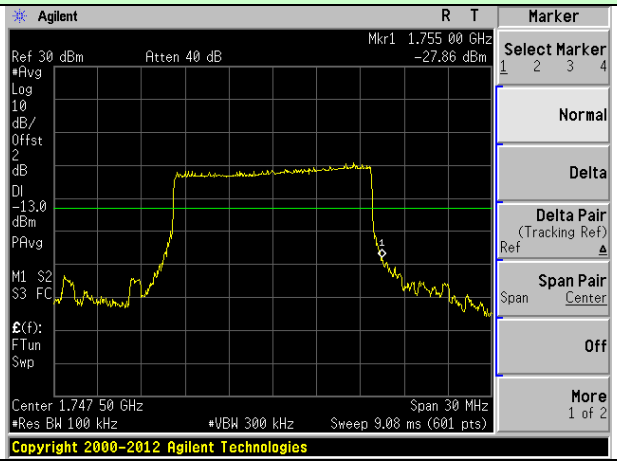
10MHz Bandwidth (RB size:1# RB offset:0#)	10MHz Bandwidth (RB size:1# RB offset:49#)
	
Lowest channel	Highest channel

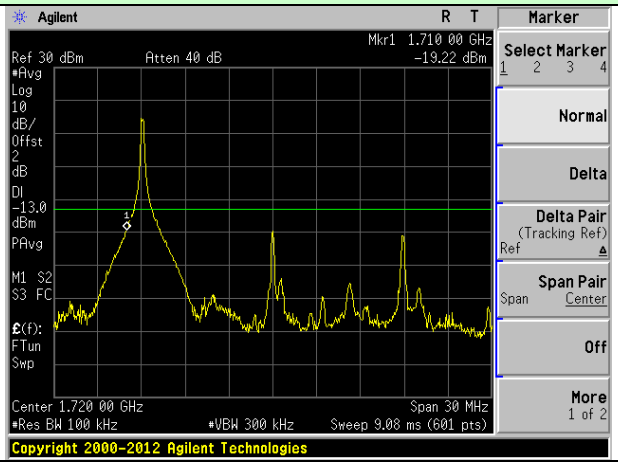
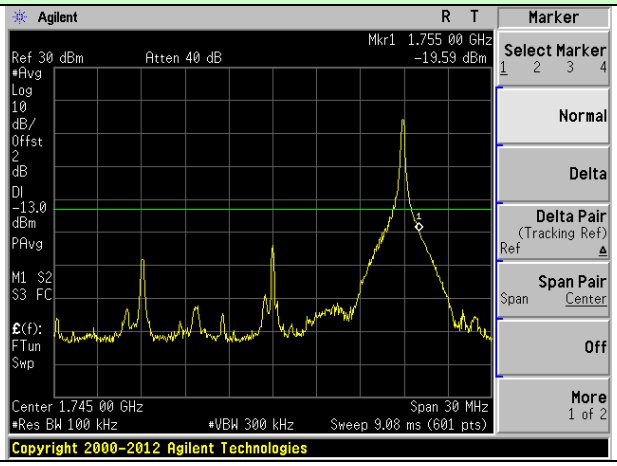
10MHz Bandwidth (RB size:25# RB offset:0#)	10MHz Bandwidth (RB size:25# RB offset:25#)
	
Lowest channel	Highest channel

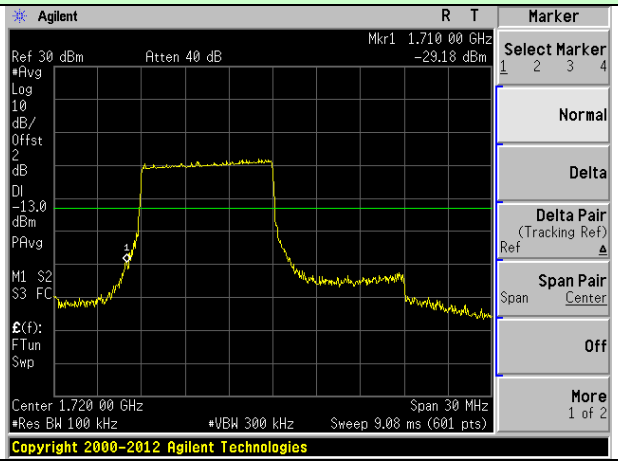
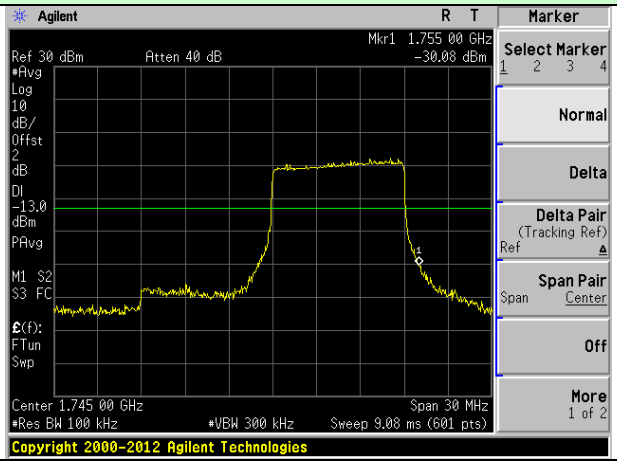
10MHz Bandwidth (RB size:50# RB offset:0#)	10MHz Bandwidth (RB size:50# RB offset:0#)
	
Lowest channel	Highest channel

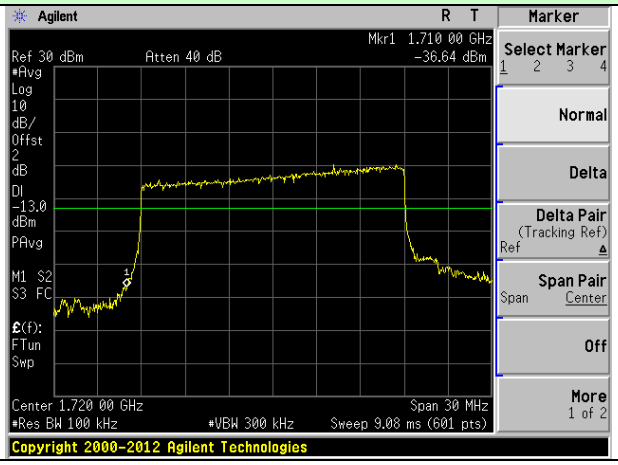
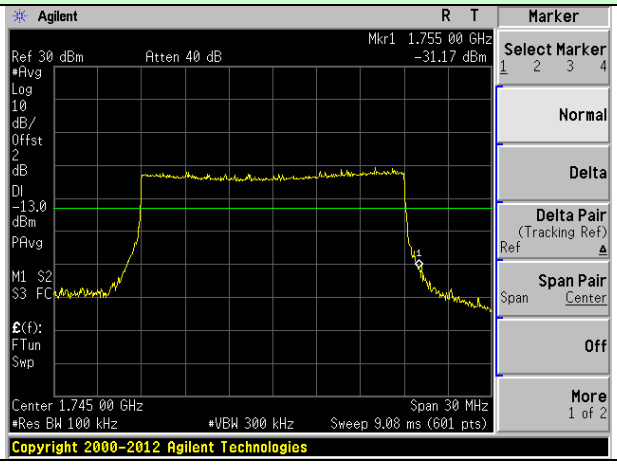
15MHz Bandwidth (RB size:1# RB offset:0#)	15MHz Bandwidth (RB size:1# RB offset:74#)
	
Lowest channel	Highest channel

15MHz Bandwidth (RB size:36# RB offset:0#)	15MHz Bandwidth (RB size:36# RB offset:39#)
	
Lowest channel	Highest channel

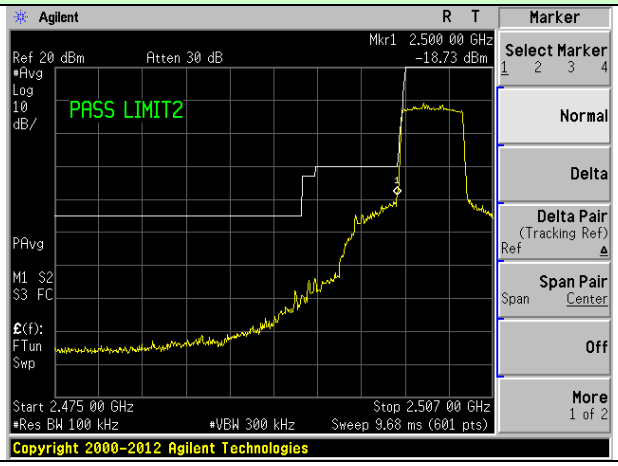
15MHz Bandwidth (RB size:75# RB offset:0#)	15MHz Bandwidth (RB size:75# RB offset:0#)
	
Lowest channel	Highest channel

20MHz Bandwidth (RB size:1# RB offset:0#)	20MHz Bandwidth (RB size:1# RB offset:99#)
	
Lowest channel	Highest channel

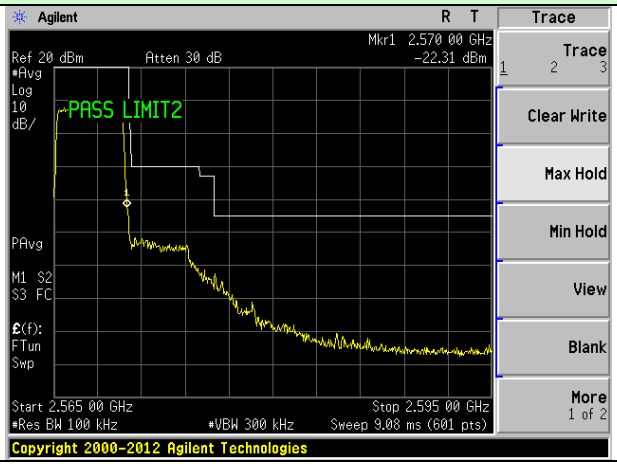
20MHz Bandwidth (RB size:50# RB offset:0#)	20MHz Bandwidth (RB size:50# RB offset:50#)
	
Lowest channel	Highest channel

20MHz Bandwidth (RB size:100# RB offset:0#)	20MHz Bandwidth (RB size:100# RB offset:0#)
	
Lowest channel	Highest channel

Test Mode: LTE Band 7	Channel Bandwidth: 5MHz

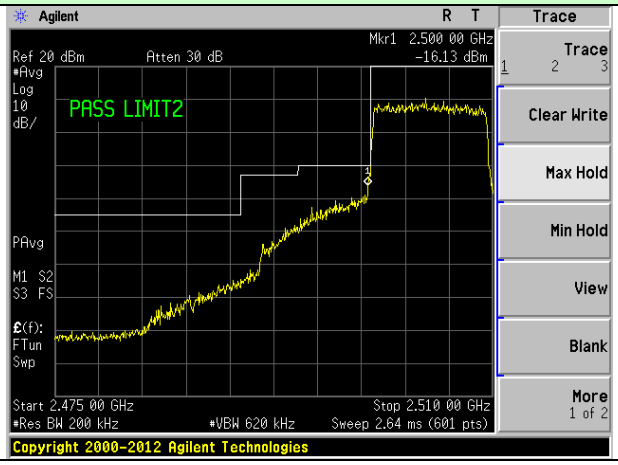


Lowest channel

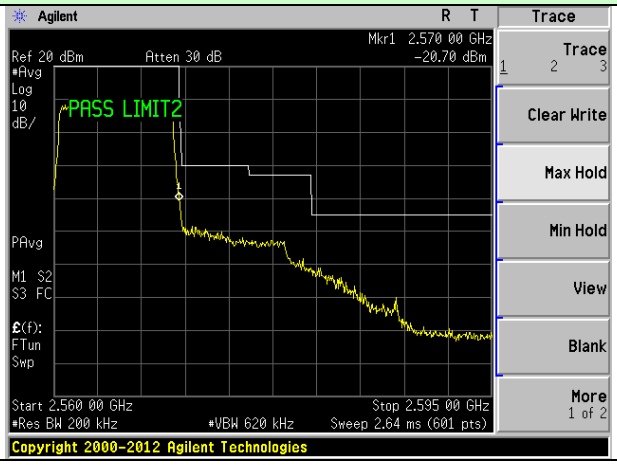


Highest channel

Test Mode: LTE Band 7	Channel Bandwidth: 10MHz

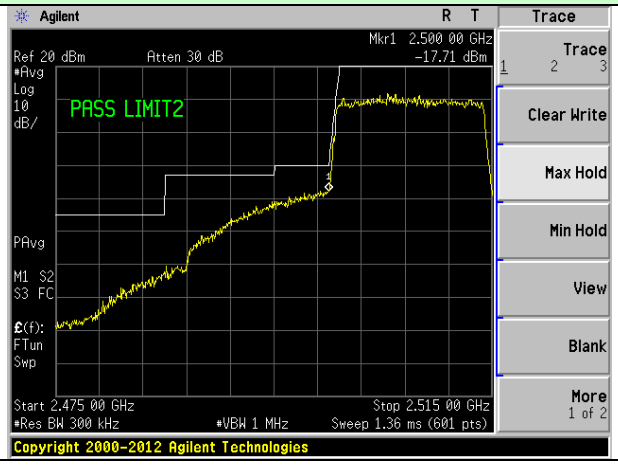


Lowest channel



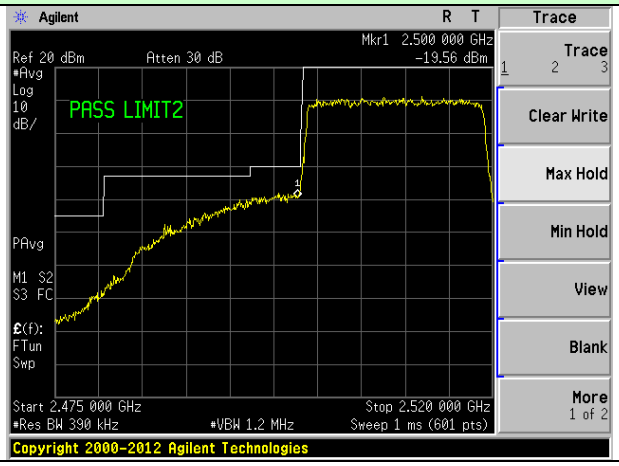
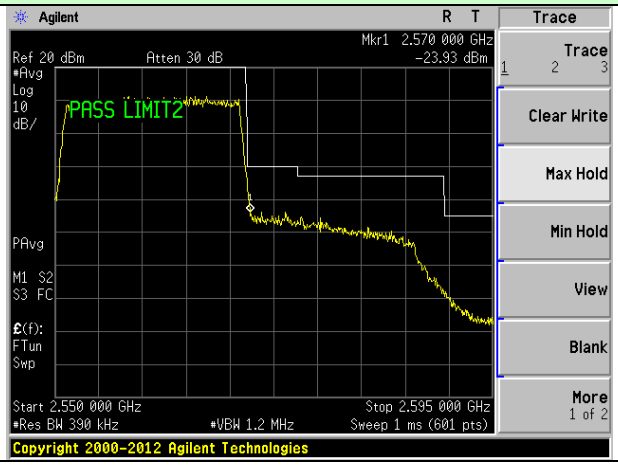
Highest channel

Test Mode: LTE Band 7	Channel Bandwidth: 15MHz

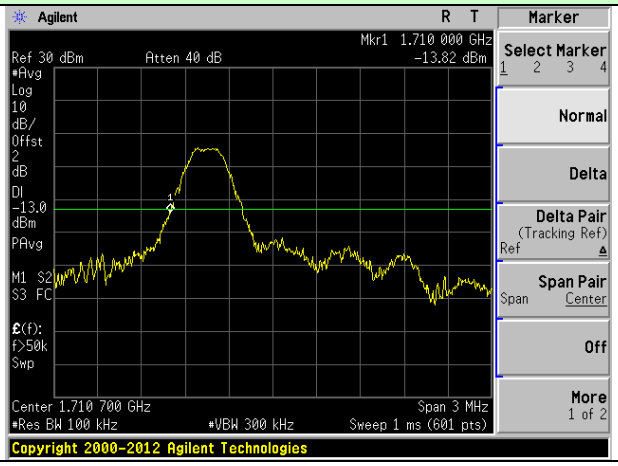
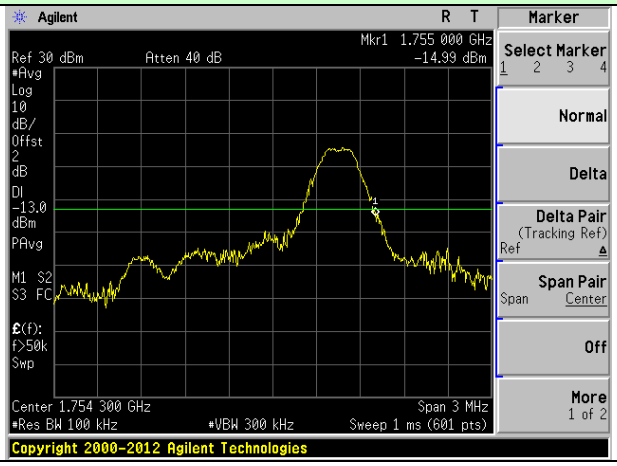


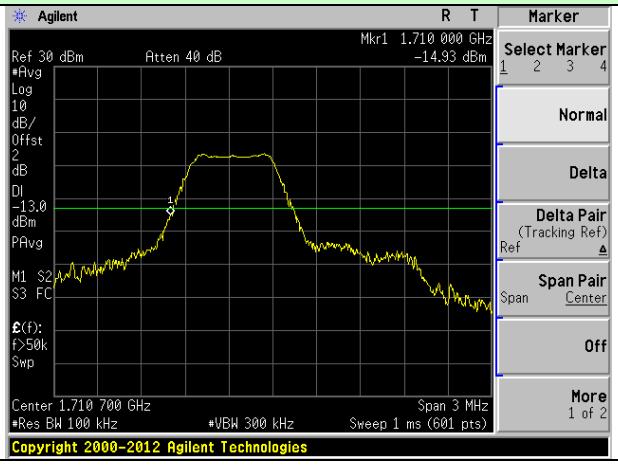
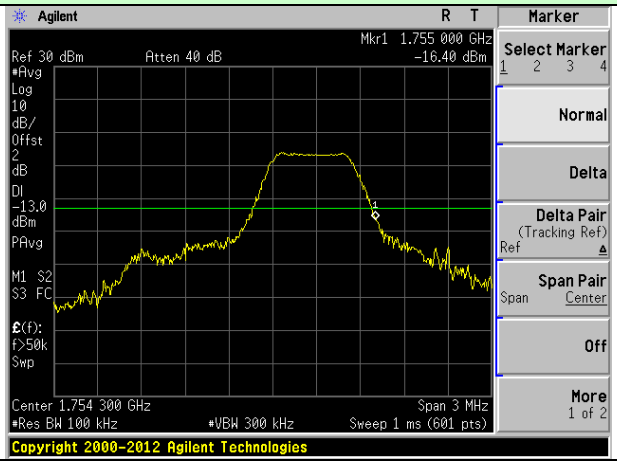
Lowest channel

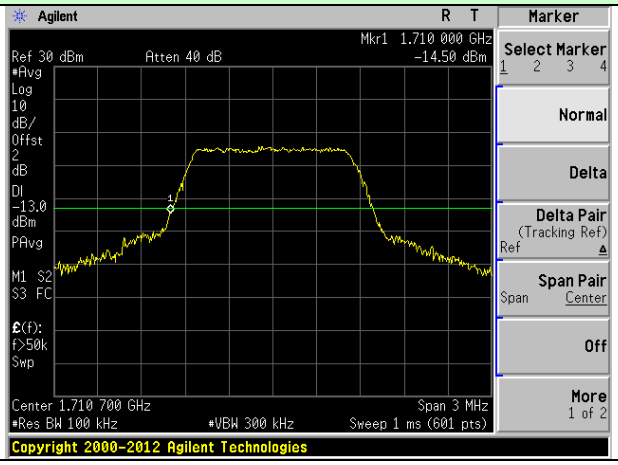
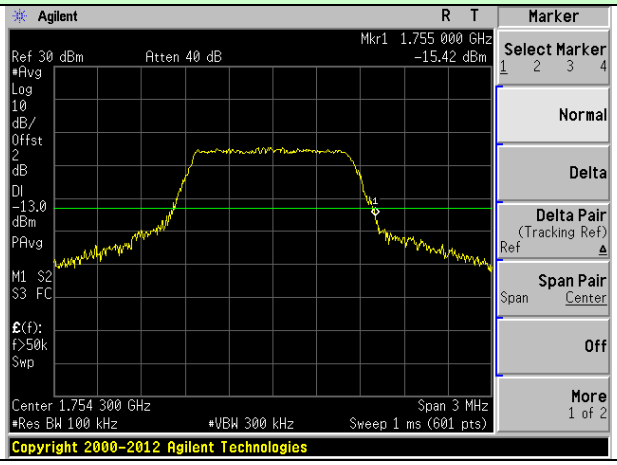
Highest channel

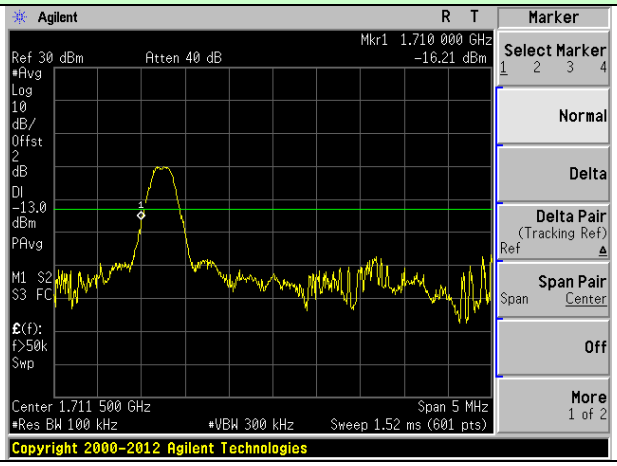
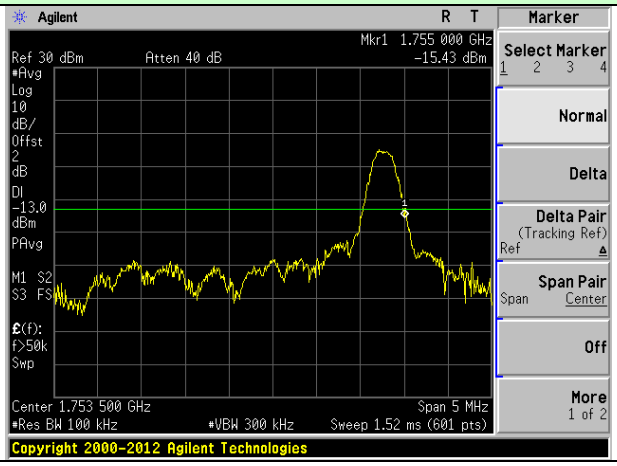
Test Mode: LTE Band 7	Channel Bandwidth: 20MHz
	
Lowest channel	Highest channel

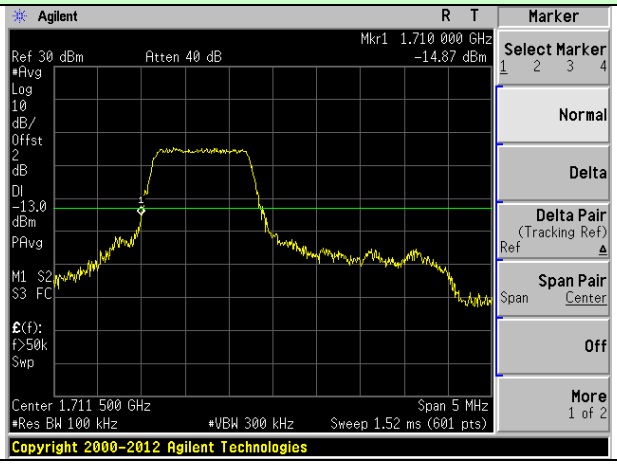
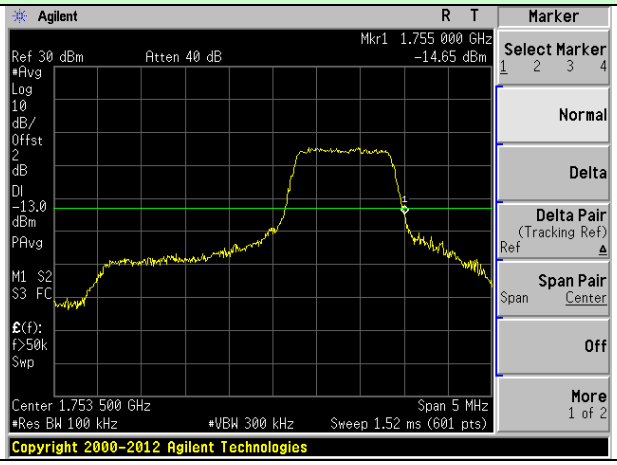
LTE Band 4 (16QAM mode):

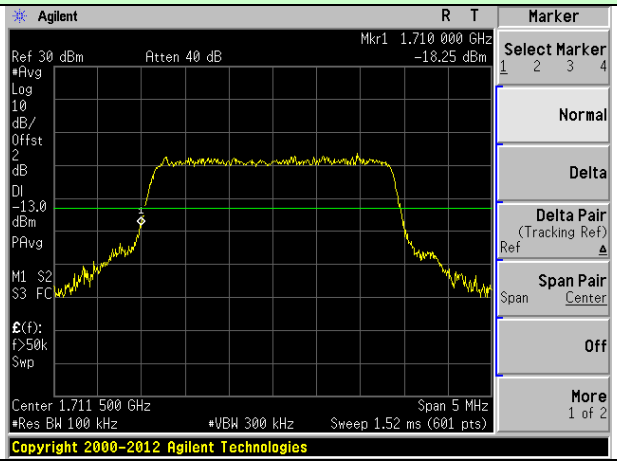
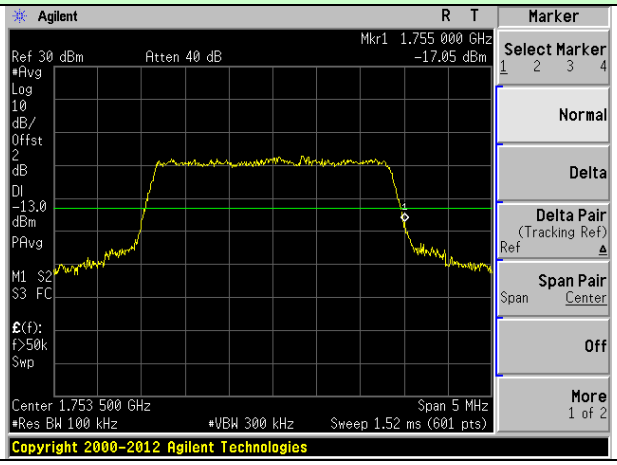
1.4MHz Bandwidth (RB size:1# RB offset:0#)	1.4MHz Bandwidth (RB size:1# RB offset:5#)
	
Lowest channel	Highest channel

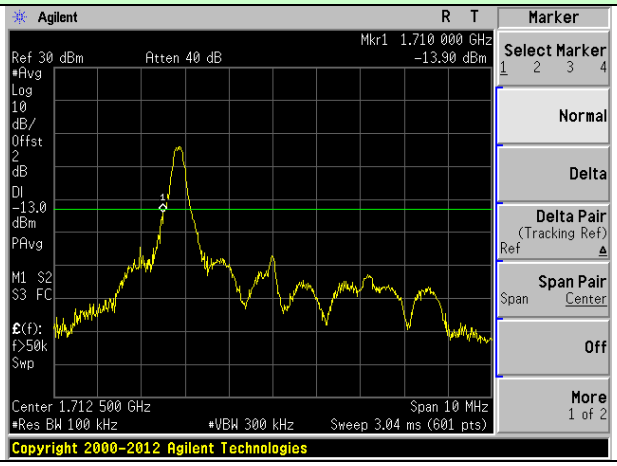
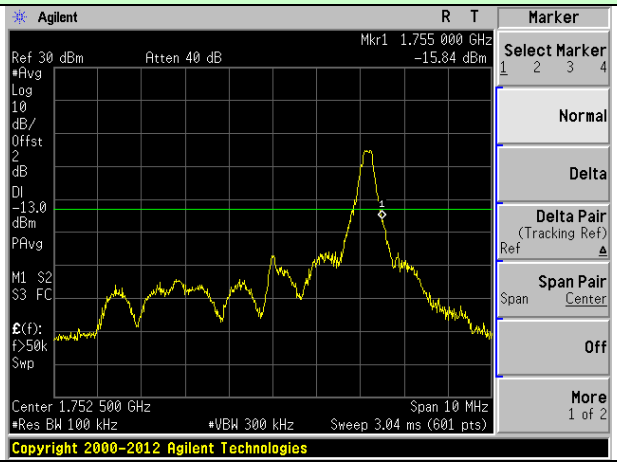
1.4MHz Bandwidth (RB size:3# RB offset:0#)	1.4MHz Bandwidth (RB size:3# RB offset:2#)
	
Lowest channel	Highest channel

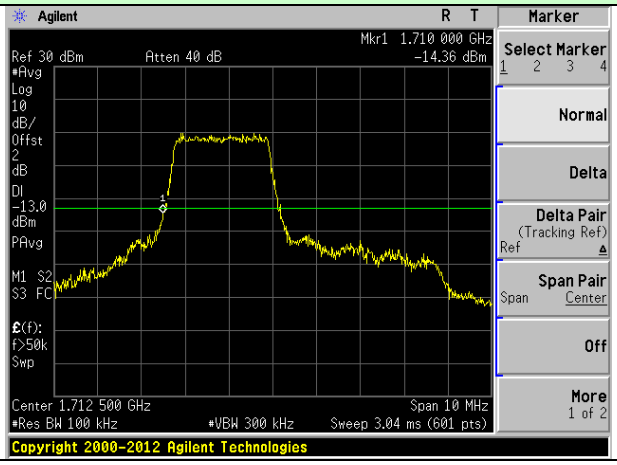
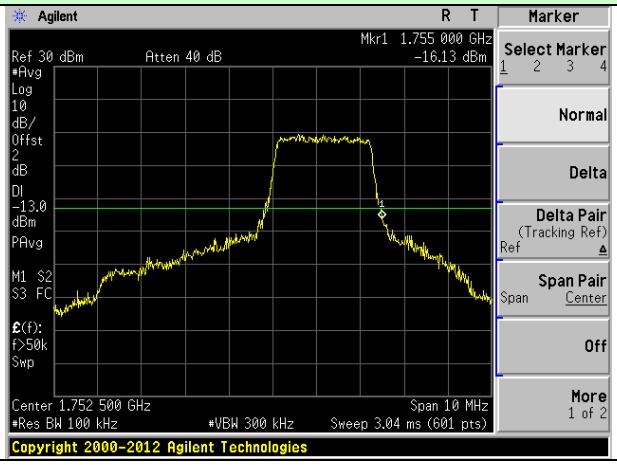
1.4MHz Bandwidth (RB size:6# RB offset:0#)	1.4MHz Bandwidth (RB size:6# RB offset:0#)
	
Lowest channel	Highest channel

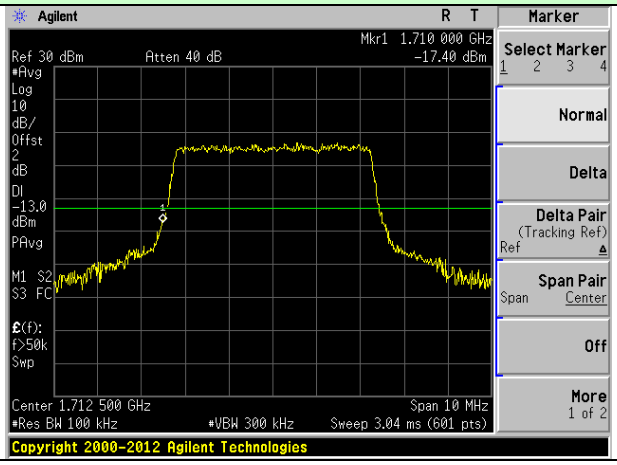
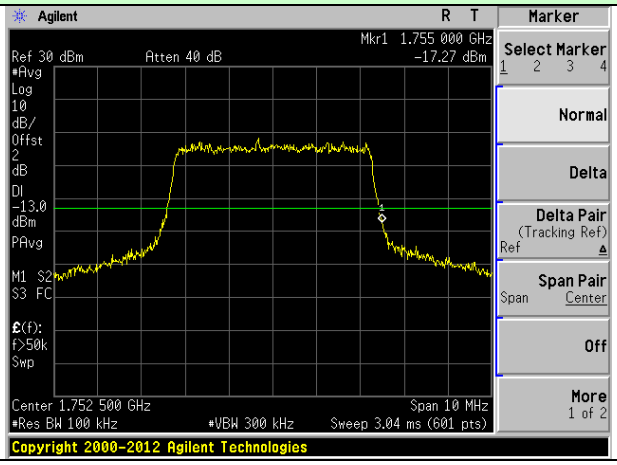
3MHz Bandwidth (RB size:1# RB offset:0#)	3MHz Bandwidth (RB size:1# RB offset:14#)
	
Lowest channel	Highest channel

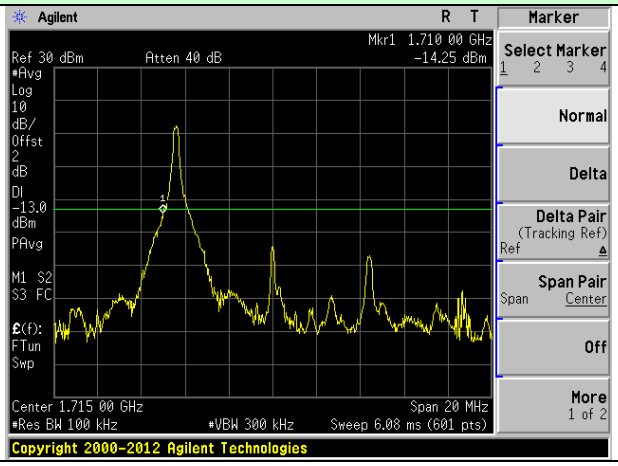
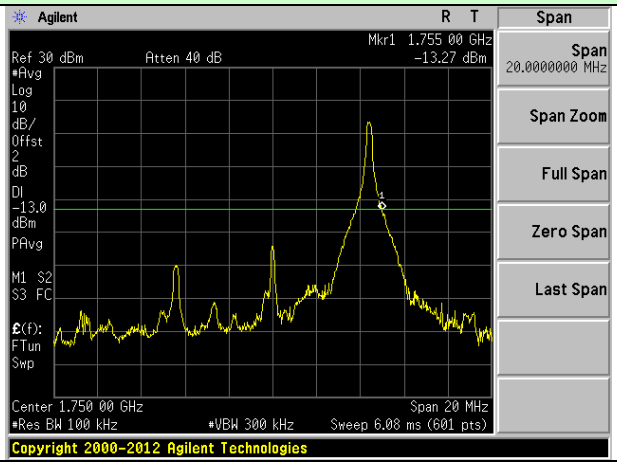
3MHz Bandwidth (RB size:8# RB offset:0#)	3MHz Bandwidth (RB size:8# RB offset:7#)
	
Lowest channel	Highest channel

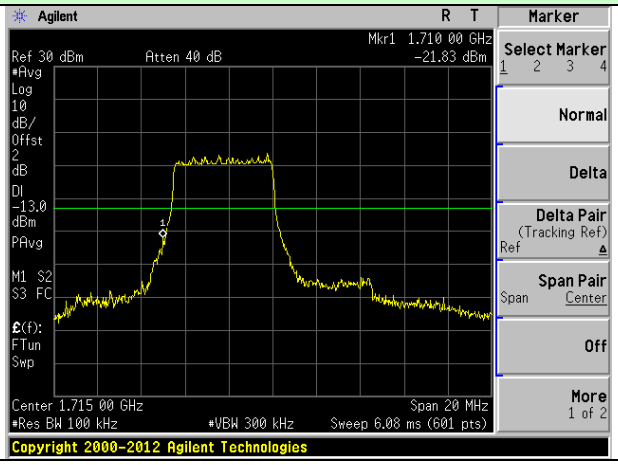
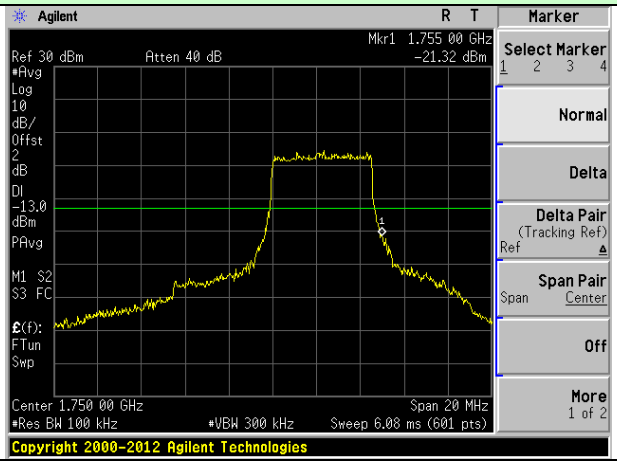
3MHz Bandwidth (RB size:15# RB offset:0#)	3MHz Bandwidth (RB size:15# RB offset:0#)
	
Lowest channel	Highest channel

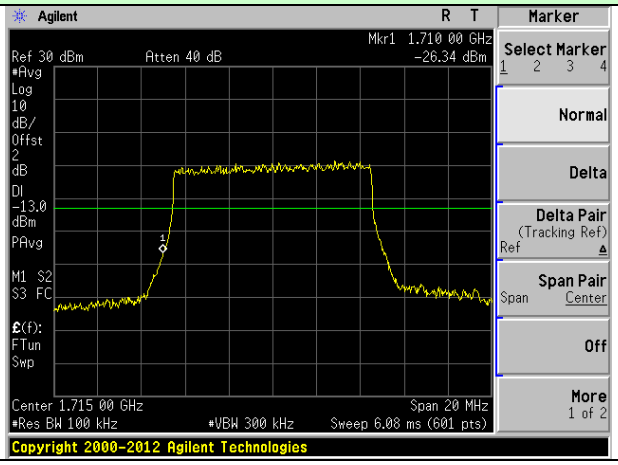
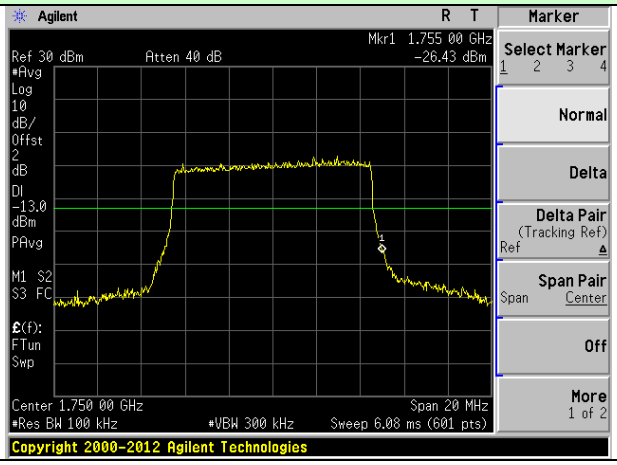
5MHz Bandwidth (RB size:1# RB offset:0#)	5MHz Bandwidth (RB size:1# RB offset:24#)
	
Lowest channel	Highest channel

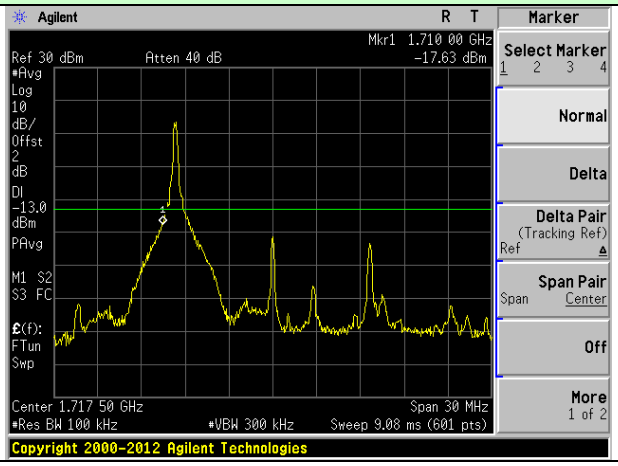
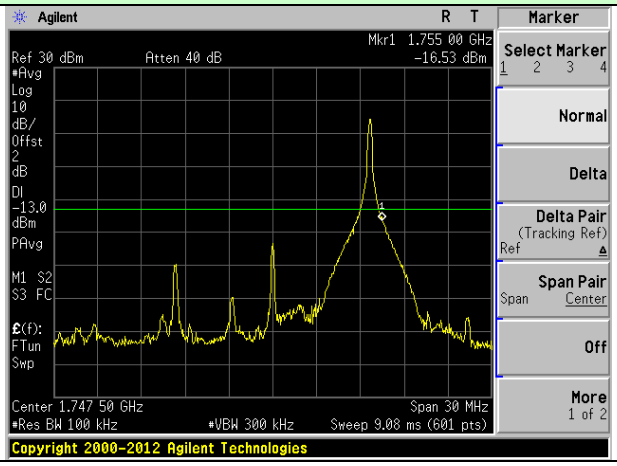
5MHz Bandwidth (RB size:12# RB offset:0#)	5MHz Bandwidth (RB size:12# RB offset:13#)
	
Lowest channel	Highest channel

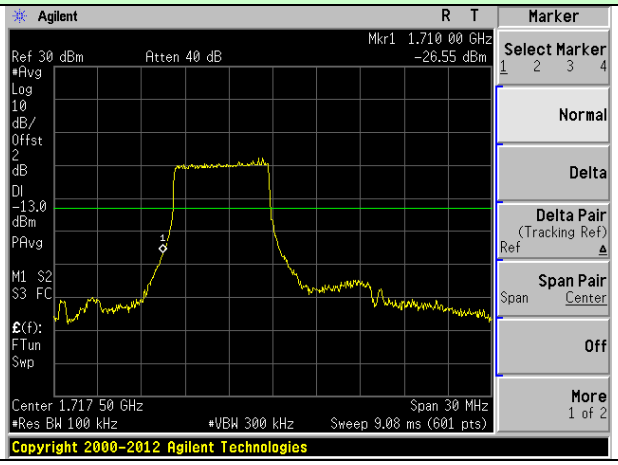
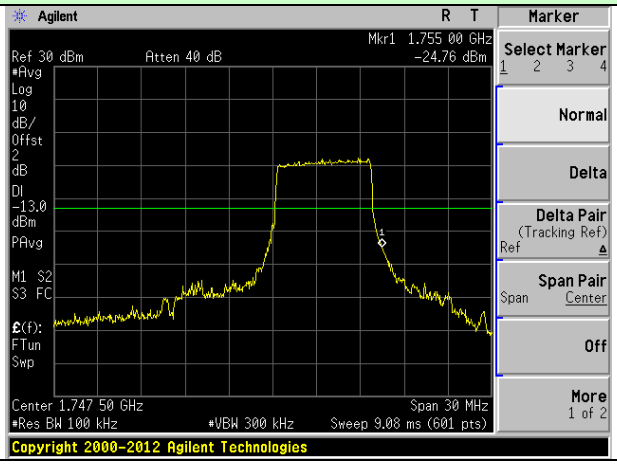
5MHz Bandwidth (RB size:25# RB offset:0#)	5MHz Bandwidth (RB size:25# RB offset:0#)
	
Lowest channel	Highest channel

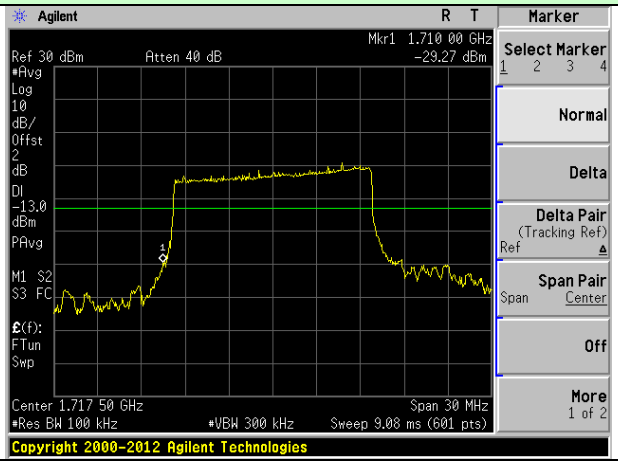
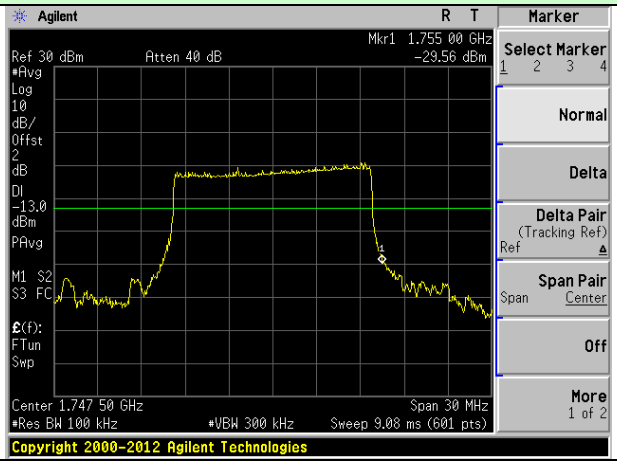
10MHz Bandwidth (RB size:1# RB offset:0#)	10MHz Bandwidth (RB size:1# RB offset:49#)
	
Lowest channel	Highest channel

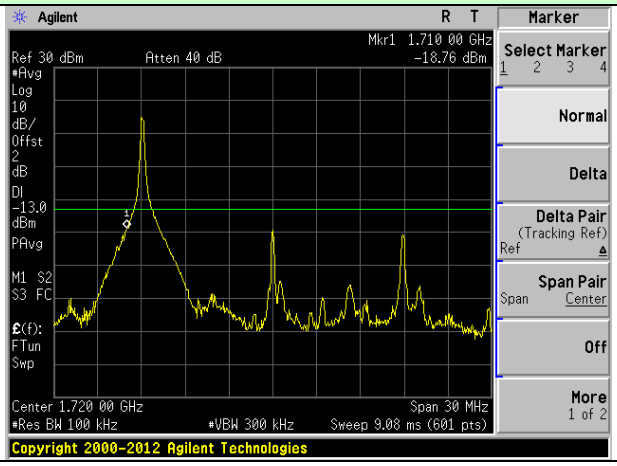
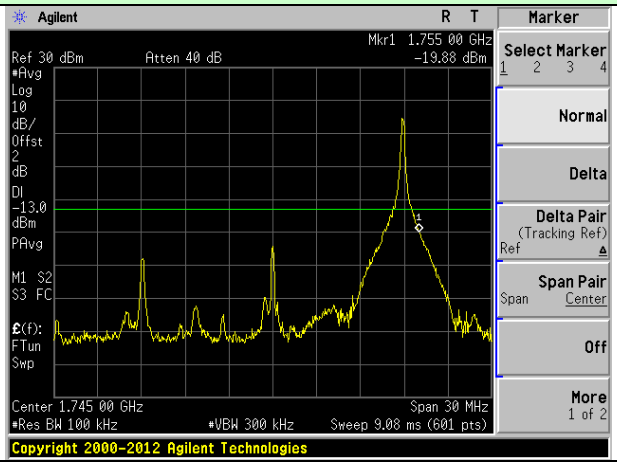
10MHz Bandwidth (RB size:25# RB offset:0#)	10MHz Bandwidth (RB size:25# RB offset:25#)
	
Lowest channel	Highest channel

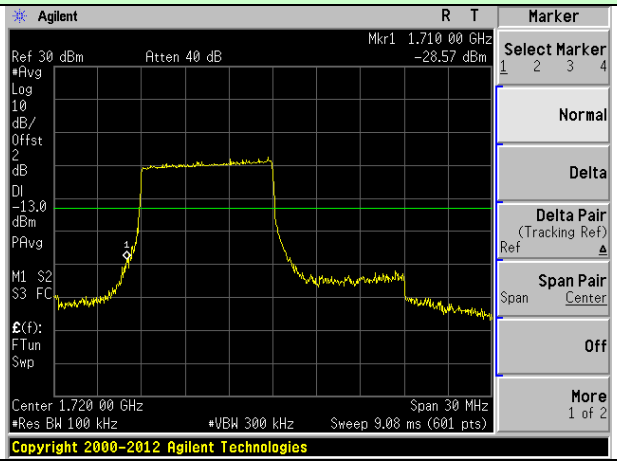
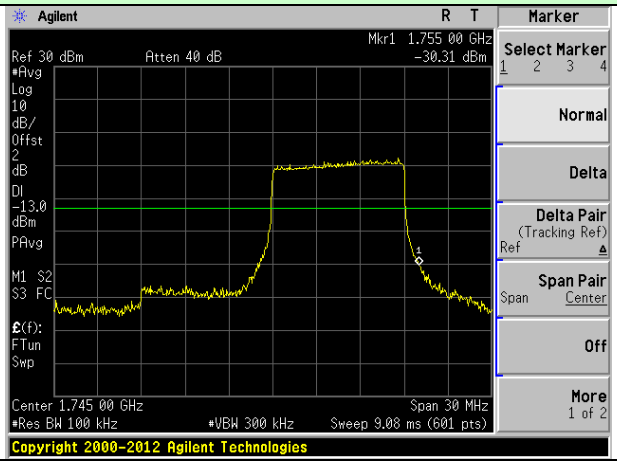
10MHz Bandwidth (RB size:50# RB offset:0#)	10MHz Bandwidth (RB size:50# RB offset:0#)
	
Lowest channel	Highest channel

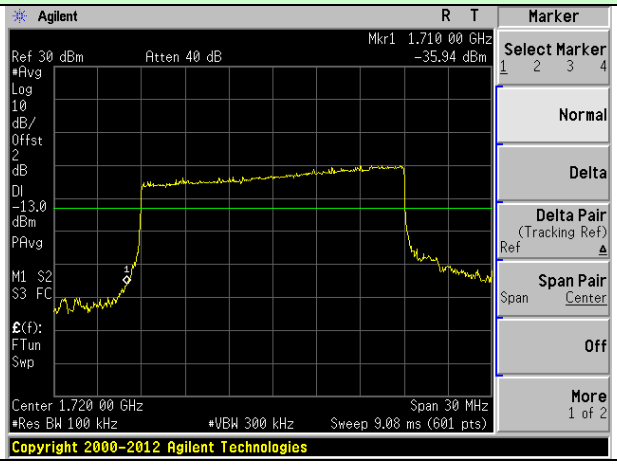
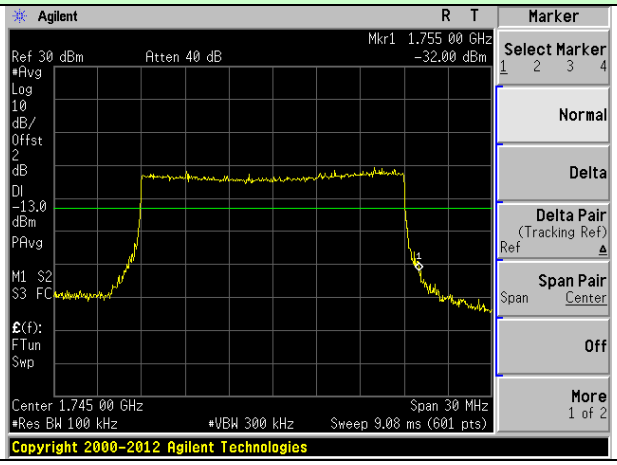
15MHz Bandwidth (RB size:1# RB offset:0#)	15MHz Bandwidth (RB size:1# RB offset:74#)
	
Lowest channel	Highest channel

15MHz Bandwidth (RB size:36# RB offset:0#)	15MHz Bandwidth (RB size:36# RB offset:39#)
	
Lowest channel	Highest channel

15MHz Bandwidth (RB size:75# RB offset:0#)	15MHz Bandwidth (RB size:75# RB offset:0#)
	
Lowest channel	Highest channel

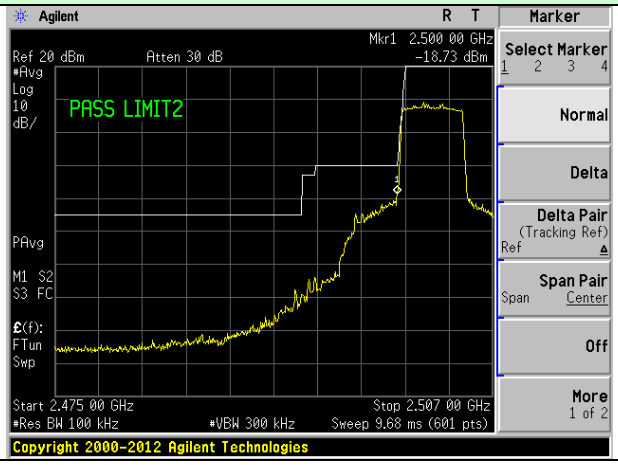
20MHz Bandwidth (RB size:1# RB offset:0#)	20MHz Bandwidth (RB size:1# RB offset:99#)
	
Lowest channel	Highest channel

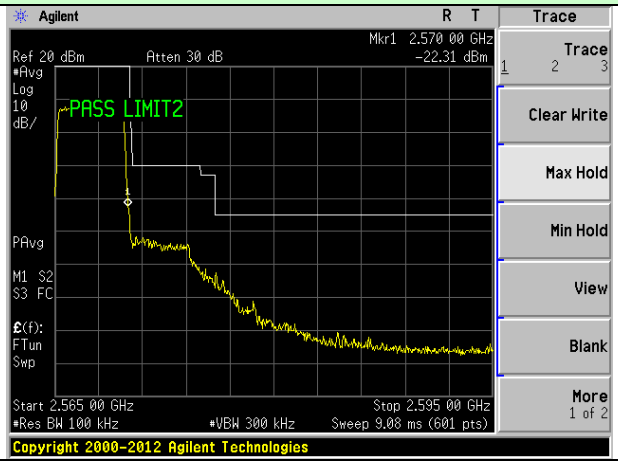
20MHz Bandwidth (RB size:50# RB offset:0#)	20MHz Bandwidth (RB size:50# RB offset:50#)
	
Lowest channel	Highest channel

20MHz Bandwidth (RB size:100# RB offset:0#)	20MHz Bandwidth (RB size:100# RB offset:0#)
	
Lowest channel	Highest channel

LTE Band 7(16QAM mode):

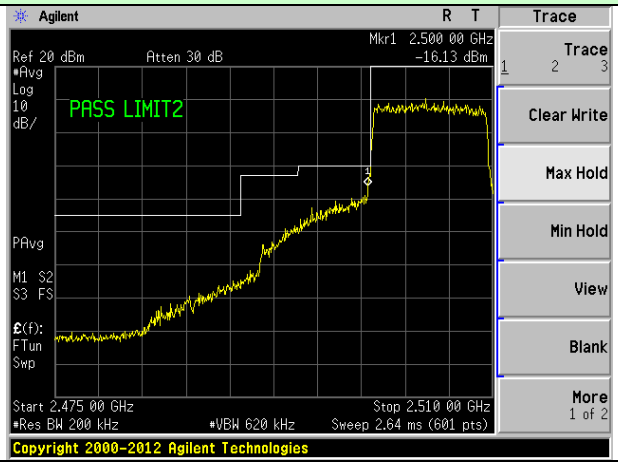
Test Mode: LTE Band 7	Channel Bandwidth: 5MHz





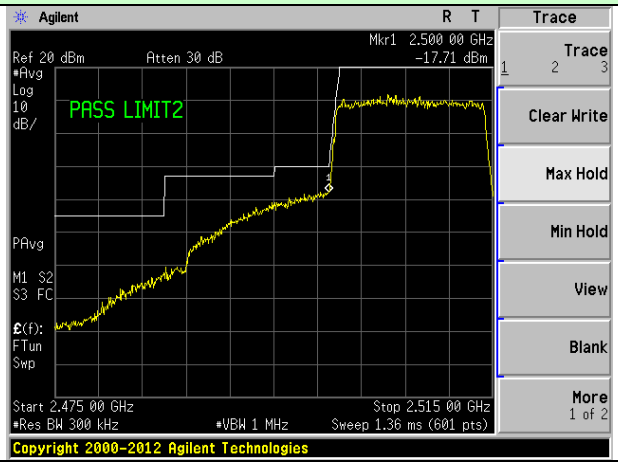
Lowest channel | Highest channel

Test Mode: LTE Band 7	Channel Bandwidth: 10MHz

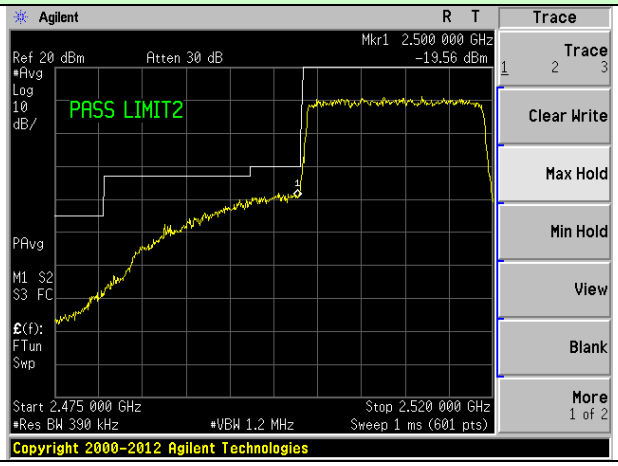
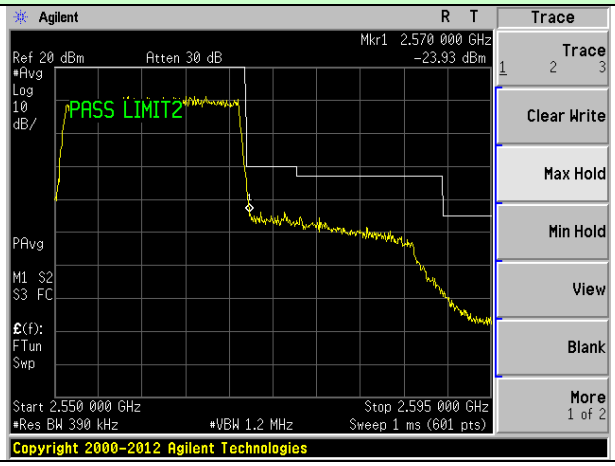


Lowest channel | Highest channel

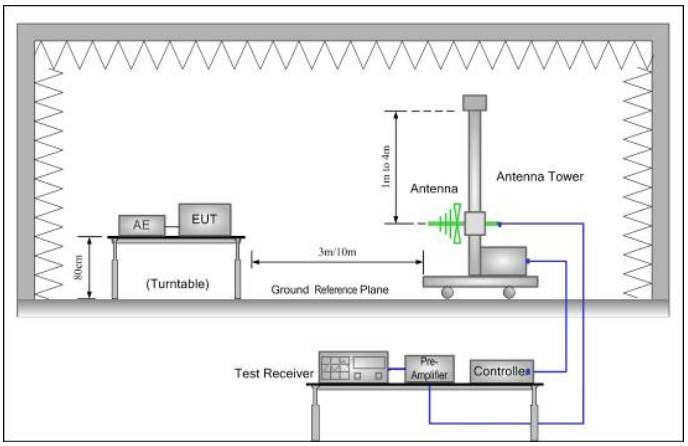
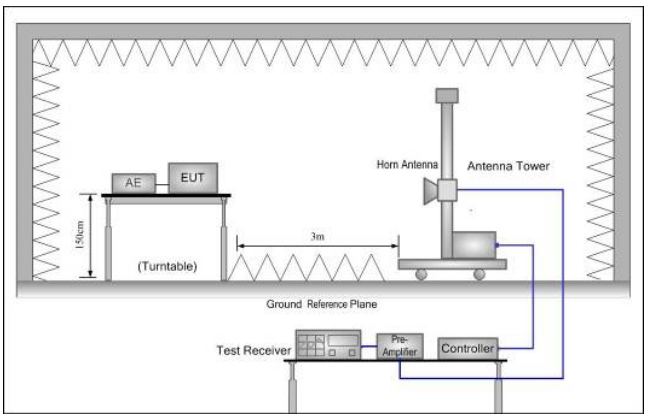
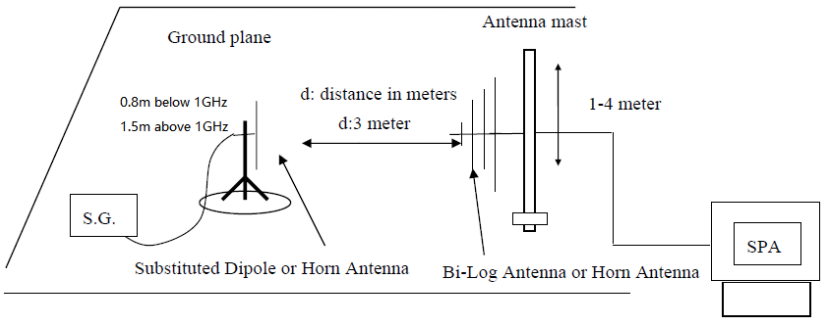
Test Mode: LTE Band 7	Channel Bandwidth: 15MHz



Lowest channel | Highest channel

Test Mode: LTE Band 7	Channel Bandwidth: 20MHz
	
Lowest channel	Highest channel

7.8 ERP, EIRP Measurement

Test Requirement for FCC:	Part 24.238 (a); Part 27.50(c)(10)/(d)(4)
Limit for FCC:	LTE Band 4: 1W (EIRP) LTE Band 7: 2W (ERP)
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 
Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI

	spectrum analyzer. 2. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated. 3. ERP in frequency band 777–787MHz were measured using a substitution method. The EUT was replaced by dipole antenna connected, the S.G. output was recorded and ERP was calculated asfollows: ERP = S.G. output (dBm) + Antenna Gain (dBd) – Cable Loss (dB) 4. EIRP in frequency band 1710–1755MHz were measured using a substitution method. The EUT was replaced by or horn antenna connected, the S.G. output was recorded and EIRP was calculated as follows: EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable Loss (dB)					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar
Test Instruments:	Refer to section 5.0 for details					
Test mode:	Refer to section 6.1 for details					
Test results:	Pass					

Measurement Data

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (1.4M)	Lowest	QPSK	H	22.1	-2.74	1.71	21.07	30.00	Pass
	Middle	QPSK	H	21.58	-2.74	1.73	20.57	30.00	Pass
	Highest	QPSK	H	22.66	-2.74	1.81	21.73	30.00	Pass
	Lowest	16-QAM	H	21.29	-2.74	1.71	20.26	30.00	Pass
	Middle	16-QAM	H	22.35	-2.74	1.73	21.34	30.00	Pass
	Highest	16-QAM	H	22.46	-2.74	1.81	21.53	30.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (3M)	Lowest	QPSK	H	22.65	-2.74	1.71	21.62	30.00	Pass
	Middle	QPSK	H	21.89	-2.74	1.73	20.88	30.00	Pass
	Highest	QPSK	H	22.13	-2.74	1.81	21.2	30.00	Pass
	Lowest	16-QAM	H	21.63	-2.74	1.71	20.6	30.00	Pass
	Middle	16-QAM	H	22.46	-2.74	1.73	21.45	30.00	Pass
	Highest	16-QAM	H	21.46	-2.74	1.81	20.53	30.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (5M)	Lowest	QPSK	H	22.39	-2.74	1.71	21.36	30.00	Pass
	Middle	QPSK	H	22.65	-2.74	1.73	21.64	30.00	Pass
	Highest	QPSK	H	21.43	-2.74	1.81	20.5	30.00	Pass
	Lowest	16-QAM	H	21.29	-2.74	1.71	20.26	30.00	Pass
	Middle	16-QAM	H	21.12	-2.74	1.73	20.11	30.00	Pass
	Highest	16-QAM	H	22.4	-2.74	1.81	21.47	30.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (10M)	Lowest	QPSK	H	22.94	-2.74	1.71	21.91	30.00	Pass
	Middle	QPSK	H	21.64	-2.74	1.73	20.63	30.00	Pass
	Highest	QPSK	H	22.71	-2.74	1.81	21.78	30.00	Pass
	Lowest	16-QAM	H	22.84	-2.74	1.71	21.81	30.00	Pass
	Middle	16-QAM	H	21.96	-2.74	1.73	20.95	30.00	Pass
	Highest	16-QAM	H	22.52	-2.74	1.81	21.59	30.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (15M)	Lowest	QPSK	H	22.26	-2.74	1.71	21.23	30.00	Pass
	Middle	QPSK	H	22.45	-2.74	1.73	21.44	30.00	Pass
	Highest	QPSK	H	22.47	-2.74	1.81	21.54	30.00	Pass
	Lowest	16-QAM	H	21.27	-2.74	1.71	20.24	30.00	Pass
	Middle	16-QAM	H	21.03	-2.74	1.73	20.02	30.00	Pass
	Highest	16-QAM	H	21.9	-2.74	1.81	20.97	30.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	EIRP (dBm)	Limit (dBm)	Result
LTE Band 4 (20M)	Lowest	QPSK	H	22.08	-2.74	1.71	21.05	30.00	Pass
	Middle	QPSK	H	21.91	-2.74	1.73	20.9	30.00	Pass
	Highest	QPSK	H	21.15	-2.74	1.81	20.22	30.00	Pass
	Lowest	16-QAM	H	21.62	-2.74	1.71	20.59	30.00	Pass
	Middle	16-QAM	H	22.8	-2.74	1.73	21.79	30.00	Pass
	Highest	16-QAM	H	22.79	-2.74	1.81	21.86	30.00	Pass

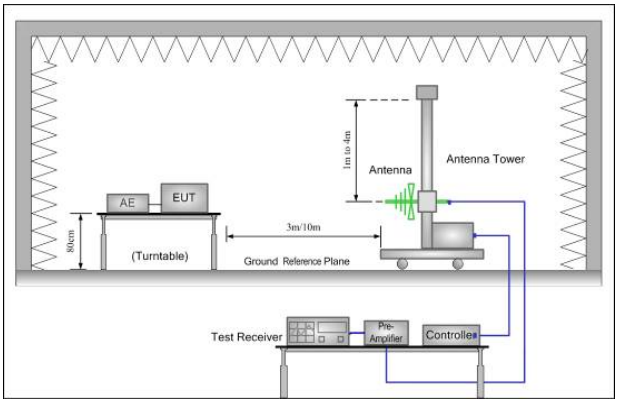
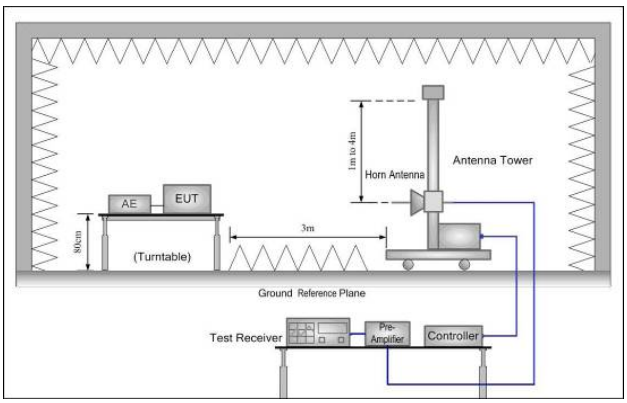
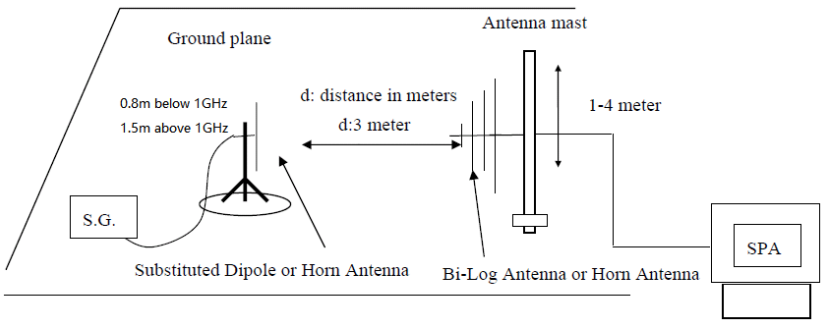
EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	ERP (dBm)	Limit (dBm)	Result
LTE Band 7 (5M)	Lowest	QPSK	H	22.09	-4.73	5.49	22.85	33.00	Pass
	Middle	QPSK	H	22.76	-4.73	5.52	23.55	33.00	Pass
	Highest	QPSK	H	22.85	-4.73	5.55	23.67	33.00	Pass
	Lowest	16-QAM	H	22.81	-4.73	5.49	23.57	33.00	Pass
	Middle	16-QAM	H	21.8	-4.73	5.52	22.59	33.00	Pass
	Highest	16-QAM	H	21.23	-4.73	5.55	22.05	33.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	ERP (dBm)	Limit (dBm)	Result
LTE Band 7 (10M)	Lowest	QPSK	H	22.5	-4.73	5.49	23.26	33.00	Pass
	Middle	QPSK	H	22.79	-4.73	5.52	23.58	33.00	Pass
	Highest	QPSK	H	22.97	-4.73	5.55	23.79	33.00	Pass
	Lowest	16-QAM	H	21.09	-4.73	5.49	21.85	33.00	Pass
	Middle	16-QAM	H	21.25	-4.73	5.52	22.04	33.00	Pass
	Highest	16-QAM	H	22.95	-4.73	5.55	23.77	33.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	ERP (dBm)	Limit (dBm)	Result
LTE Band 7 (15M)	Lowest	QPSK	H	22.3	-4.73	5.49	23.06	33.00	Pass
	Middle	QPSK	H	22.4	-4.73	5.52	23.19	33.00	Pass
	Highest	QPSK	H	22.36	-4.73	5.55	23.18	33.00	Pass
	Lowest	16-QAM	H	21.16	-4.73	5.49	21.92	33.00	Pass
	Middle	16-QAM	H	21.99	-4.73	5.52	22.78	33.00	Pass
	Highest	16-QAM	H	22.91	-4.73	5.55	23.73	33.00	Pass

EUT mode	Channel	Modulation	Polarization	SGP [dBm]	Substitution Gain[dBi]	Cable loss[dB]	ERP (dBm)	Limit (dBm)	Result
LTE Band 7 (20M)	Lowest	QPSK	H	21.16	-4.73	5.49	21.92	33.00	Pass
	Middle	QPSK	H	22.62	-4.73	5.52	23.41	33.00	Pass
	Highest	QPSK	H	22.52	-4.73	5.55	23.34	33.00	Pass
	Lowest	16-QAM	H	21.82	-4.73	5.49	22.58	33.00	Pass
	Middle	16-QAM	H	21.63	-4.73	5.52	22.42	33.00	Pass
	Highest	16-QAM	H	21.04	-4.73	5.55	21.86	33.00	Pass

7.9 Field strength of spurious radiation measurement

Test Requirement for FCC:	Part 24.238 (a); FCC Part 27.53(h)/(g)
Limit:	-13dBm
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 

Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations. 3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method. 4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. ERP / EIRP = S.G. output (dBm) + Antenna Gain(dB/dBi) – Cable Loss (dB)					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar
Test Instruments:	Refer to section 5.0 for details					
Test mode:	Refer to section 6.1 for details					
Test results:	Pass					

Measurement Data
Remark：
1. The emission behavior belongs to narrowband spurious emission.
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

QPSK mode:

Test mode:	LTE Band 4(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3425.00	Vertical	-44.83	-13.00	Pass
5137.50	V	-45.99		
6850.00	V	-46.50		
8562.50	V	-43.44		
10275.00	V	-45.81		
3425.00	Horizontal	-44.32	-13.00	Pass
5137.50	H	-43.29		
6850.00	H	-45.60		
8562.50	H	-44.83		
10275.00	H	-43.14		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-45.79	-13.00	Pass
5197.50	V	-47.13		
6930.00	V	-46.89		
8662.50	V	-45.40		
10395.00	V	-45.16		
3465.00	Horizontal	-43.42	-13.00	Pass
5197.50	H	-44.75		
6930.00	H	-44.99		
8662.50	H	-46.98		
10395.00	H	-45.86		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3505.00	Vertical	-45.48	-13.00	Pass
5257.50	V	-47.33		
7010.00	V	-46.72		
8762.50	V	-45.75		
10515.00	V	-45.36		
3505.00	Horizontal	-43.06	-13.00	Pass
5257.50	H	-44.47		
7010.00	H	-44.89		
8762.50	H	-46.08		
10515.00	H	-45.93		

Test mode:	LTE Band 4(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3440.00	Vertical	-45.72	-13.00	Pass
5160.00	V	-47.88		
6880.00	V	-46.88		
8600.00	V	-45.68		
10320.00	V	-45.33		
3440.00	Horizontal	-43.02	-13.00	Pass
5160.00	H	-44.20		
6880.00	H	-44.86		
8600.00	H	-46.94		
10320.00	H	-45.13		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-45.07	-13.00	Pass
5197.50	V	-47.28		
6930.00	V	-46.66		
8662.50	V	-45.08		
10395.00	V	-45.28		
3465.00	Horizontal	-43.35	-13.00	Pass
5197.50	H	-44.56		
6930.00	H	-44.71		
8662.50	H	-46.37		
10395.00	H	-45.61		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3490.00	Vertical	-45.45	-13.00	Pass
5235.00	V	-47.22		
6980.00	V	-46.55		
8725.00	V	-45.49		
10470.00	V	-45.44		
3490.00	Horizontal	-43.76	-13.00	Pass
5235.00	H	-44.30		
6980.00	H	-44.02		
8725.00	H	-46.46		
10470.00	H	-45.16		

Test mode:	LTE Band 7(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5005.00	Vertical	-45.58	-13.00	Pass
7507.50	V	-47.60		
10010.00	V	-46.63		
12512.50	V	-45.59		
15015.00	V	-45.87		
5005.00	Horizontal	-43.01	-13.00	Pass
7507.50	H	-44.09		
10010.00	H	-44.79		
12512.50	H	-46.06		
15015.00	H	-45.71		
Test mode:	**LTE Band 7(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5070.00	Vertical	-44.56	-13.00	Pass
7605.00	V	-44.71		
10140.00	V	-46.37		
12675.00	V	-45.61		
15210.00	V	-44.89		
5070.00	Horizontal	-45.66	-13.00	Pass
7605.00	H	-46.38		
10140.00	H	-43.16		
12675.00	H	-45.63		
15210.00	H	-44.40		
Test mode:	**LTE Band 7(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5135.00	Vertical	-44.20	-13.00	Pass
7702.50	V	-44.86		
10270.00	V	-46.94		
12837.50	V	-45.13		
15405.00	V	-44.64		
5135.00	Horizontal	-45.75	-13.00	Pass
7702.50	H	-46.54		
10270.00	H	-43.64		
12837.50	H	-45.56		
15405.00	H	-44.74		

Test mode:	LTE Band 7(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5020.00	Vertical	-45.76	-13.00	Pass
7530.00	V	-47.45		
10040.00	V	-46.08		
12550.00	V	-45.12		
15060.00	V	-45.64		
5020.00	Horizontal	-43.76	-13.00	Pass
7530.00	H	-44.13		
10040.00	H	-44.93		
12550.00	H	-46.70		
15060.00	H	-45.40		
Test mode:	**LTE Band 7(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5070.00	Vertical	-45.02	-13.00	Pass
7605.00	V	-47.58		
10140.00	V	-46.72		
12675.00	V	-45.45		
15210.00	V	-45.31		
5070.00	Horizontal	-43.66	-13.00	Pass
7605.00	H	-44.45		
10140.00	H	-44.99		
12675.00	H	-46.56		
15210.00	H	-45.58		
Test mode:	**LTE Band 7(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5120.00	Vertical	-45.36	-13.00	Pass
7680.00	V	-47.33		
10240.00	V	-46.40		
12800.00	V	-45.40		
15360.00	V	-45.13		
5120.00	Horizontal	-43.07	-13.00	Pass
7680.00	H	-44.61		
10240.00	H	-44.89		
12800.00	H	-46.65		
15360.00	H	-45.93		

16QAM mode:

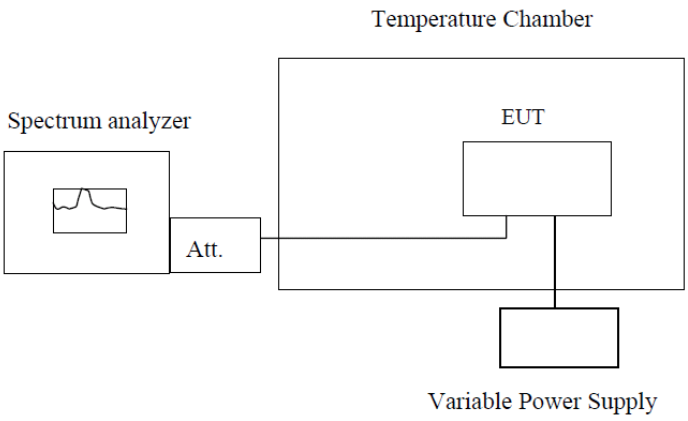
Test mode:	LTE Band 4(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3425.00	Vertical	-44.67	-13.00	Pass
5137.50	V	-45.79		
6850.00	V	-46.55		
8562.50	V	-43.40		
10275.00	V	-45.77		
3425.00	Horizontal	-44.06	-13.00	Pass
5137.50	H	-43.89		
6850.00	H	-45.44		
8562.50	H	-44.05		
10275.00	H	-43.27		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-45.66	-13.00	Pass
5197.50	V	-47.82		
6930.00	V	-46.22		
8662.50	V	-45.39		
10395.00	V	-45.37		
3465.00	Horizontal	-43.48	-13.00	Pass
5197.50	H	-44.81		
6930.00	H	-44.41		
8662.50	H	-46.22		
10395.00	H	-45.78		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3505.00	Vertical	-45.65	-13.00	Pass
5257.50	V	-47.56		
7010.00	V	-46.05		
8762.50	V	-45.87		
10515.00	V	-45.67		
3505.00	Horizontal	-43.65	-13.00	Pass
5257.50	H	-44.16		
7010.00	H	-44.73		
8762.50	H	-46.54		
10515.00	H	-45.24		

Test mode:	LTE Band 4(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3440.00	Vertical	-45.79	-13.00	Pass
5160.00	V	-47.97		
6880.00	V	-46.03		
8600.00	V	-44.80		
10320.00	V	-43.27		
3440.00	Horizontal	-44.65	-13.00	Pass
5160.00	H	-45.49		
6880.00	H	-44.22		
8600.00	H	-46.93		
10320.00	H	-43.16		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-45.92	-13.00	Pass
5197.50	V	-47.56		
6930.00	V	-46.62		
8662.50	V	-44.62		
10395.00	V	-43.83		
3465.00	Horizontal	-44.55	-13.00	Pass
5197.50	H	-45.15		
6930.00	H	-44.01		
8662.50	H	-46.95		
10395.00	H	-43.23		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3490.00	Vertical	-45.27	-13.00	Pass
5235.00	V	-47.07		
6980.00	V	-46.68		
8725.00	V	-44.28		
10470.00	V	-43.40		
3490.00	Horizontal	-44.62	-13.00	Pass
5235.00	H	-45.68		
6980.00	H	-44.08		
8725.00	H	-46.89		
10470.00	H	-43.51		

Test mode:	LTE Band 7(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5005.00	Vertical	-45.48	-13.00	Pass
7507.50	V	-47.18		
10010.00	V	-46.93		
12512.50	V	-44.31		
15015.00	V	-43.18		
5005.00	Horizontal	-44.47	-13.00	Pass
7507.50	H	-45.22		
10010.00	H	-44.91		
12512.50	H	-46.88		
15015.00	H	-43.22		
Test mode:	**LTE Band 7(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5070.00	Vertical	-44.17	-13.00	Pass
7605.00	V	-45.83		
10140.00	V	-46.84		
12675.00	V	-43.54		
15210.00	V	-45.41		
5070.00	Horizontal	-44.74	-13.00	Pass
7605.00	H	-43.67		
10140.00	H	-45.10		
12675.00	H	-44.37		
15210.00	H	-43.25		
Test mode:	**LTE Band 7(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5135.00	Vertical	-44.24	-13.00	Pass
7702.50	V	-45.79		
10270.00	V	-46.78		
12837.50	V	-43.45		
15405.00	V	-45.15		
5135.00	Horizontal	-44.46	-13.00	Pass
7702.50	H	-43.16		
10270.00	H	-45.77		
12837.50	H	-44.45		
15405.00	H	-43.51		

Test mode:	LTE Band 7(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5020.00	Vertical	-44.15	-13.00	Pass
7530.00	V	-45.96		
10040.00	V	-46.72		
12550.00	V	-43.48		
15060.00	V	-45.31		
5020.00	Horizontal	-44.34	-13.00	Pass
7530.00	H	-43.63		
10040.00	H	-45.01		
12550.00	H	-44.43		
15060.00	H	-43.56		
Test mode:	**LTE Band 7(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5070.00	Vertical	-44.11	-13.00	Pass
7605.00	V	-45.66		
10140.00	V	-46.07		
12675.00	V	-43.23		
15210.00	V	-45.78		
5070.00	Horizontal	-44.36	-13.00	Pass
7605.00	H	-43.34		
10140.00	H	-45.34		
12675.00	H	-44.78		
15210.00	H	-43.19		
Test mode:	**LTE Band 7(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
5120.00	Vertical	-45.47	-13.00	Pass
7680.00	V	-47.64		
10240.00	V	-46.51		
12800.00	V	-44.11		
15360.00	V	-43.41		
5120.00	Horizontal	-44.85	-13.00	Pass
7680.00	H	-45.53		
10240.00	H	-44.90		
12800.00	H	-46.35		
15360.00	H	-43.02		

7.10 Frequency stability V.S. Temperature measurement

Test Requirement for FCC:	FCC Part2.1055(a)(1)(b)
Limit:	2.5ppm
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test procedure:	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to –20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

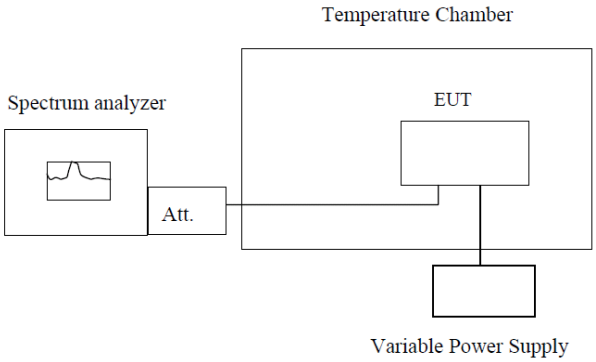
QPSK mode:

Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	38	0.0449	2.5	Pass
	-20	41	0.0494		
	-10	36	0.0427		
	0	32	0.0382		
	10	34	0.0404		
	20	30	0.0359		
	30	51	0.0606		
	40	43	0.0516		
	50	41	0.0494		
Reference Frequency: LTE Band 7 Middle channel=21100 channel=2535MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error			Result
		Hz	ppm		
12.0	-30	151	0.1806	2.5	Pass
	-20	174	0.2085		
	-10	146	0.1748		
	0	127	0.1522		
	10	142	0.1703		
	20	124	0.1485		
	30	209	0.2497		
	40	182	0.2176		
	50	172	0.2061		

16QAM mode:

Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	168	0.0896	2.5	Pass
	-20	150	0.0800		
	-10	130	0.0693		
	0	122	0.0650		
	10	112	0.0597		
	20	98	0.0522		
	30	122	0.0650		
	40	136	0.0725		
	50	130	0.0693		
Reference Frequency: LTE Band 7 Middle channel=21100 channel=2535MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error			Result
		Hz	ppm		
12.0	-30	50	0.0594	2.5	Pass
	-20	70	0.0841		
	-10	80	0.0953		
	0	36	0.0436		
	10	55	0.0661		
	20	61	0.0728		
	30	91	0.1088		
	40	85	0.1020		
	50	102	0.1223		

7.11 Frequency stability V.S. Voltage measurement

Test Requirement for FCC:	FCC Part2.1055(d)(1)(2)
Limit:	2.5ppm
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test procedure:	1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

QPSK mode:

Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	16.0	116	0.1392	2.5	Pass
	12.0	84	0.1003		
	8.0	95	0.1133		
Reference Frequency: LTE Band 7 Middle channel=21100 channel=2535MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	16.0	112	0.1343	2.5	Pass
	12.0	128	0.1533		
	8.0	144	0.1719		

16QAM mode:

Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	16.0	131	0.0699	2.5	Pass
	12.0	151	0.0802		
	8.0	152	0.0807		
Reference Frequency: LTE Band 7 Middle channel=21100 channel=2535MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	16.0	101	0.1210	2.5	Pass
	12.0	115	0.1377		
	8.0	129	0.1540		

8 Test Setup Photo

Reference to the appendix I for details.

9 EUT Constructional Details

Reference to the appendix II for details.

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