FCC Report (LTE)

Applicant:	Connected Holdings LLC
Address of Applicant:	4740 Von Karman Avenue, Suite 120, Newport Beach, California 92660, United States
Manufacturer:	Gemtek Technology Co., Ltd.
Address of Manufacturer:	No. 15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, 30352
Equipment Under Test (EUT)	
Product Name:	GPS Tracker
Model No.:	AR-4LH
Marketing Name:	Arrow-L
FCC ID:	2AEB4ALT01
Applicable standards:	FCC CFR Title 47 Part 2: 2017 FCC CFR Title 47 Part 24: 2017 FCC CFR Title 47 Part 27: 2017
Date of sample receipt:	July 03, 2017
Date of Test:	July 03-07, 2017
Date of report issued:	July 07, 2017
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.

1 Version

Version No.	Date	Description
00	*July 07, 2017*	*Original*

Prepared By:		***Date:***	*July 07, 2017*
	Project Engineer		
Check By:		***Date:***	*July 07, 2017*
	Reviewer		

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3 Test Summary

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass*
RF Output Power	Part 2.1046 Part 24.232 (c) Part 27.50(c)(10)/(d)(4)	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 General Information

4.1 General Description of EUT

Product Name:	GPS Tracker
Model No.:	AR-4LH
Hardware Version:	P1.1
Software Version:	01.01.00.999
Support Networks:	LTE
Support Bands:	LTE Band 2, LTE Band 4, LTE Band 12
Channel Bandwidth:	LTE Band 2: 5MHz; 10MHz; 15MHz; 20MHz LTE Band 4: 5MHz; 10MHz; 15MHz; 20MHz LTE Band 12: 5MHz; 10MHz
TX Frequency:	LTE Band 2: 1850.70MHz-1909.30MHz LTE Band 4: 1710.70MHz-1754.30MHz LTE Band 12: 698.70MHz-715.30MHz
Modulation type:	LTE Band 2/4/12: QPSK, 16QAM
Antenna type:	Integral antenna
Antenna gain:	2.5dBi(Band 2), 2.5dBi(Band 4), 0.4dBi(Band 12)
Power supply:	Battery: DC3.7V, 296mWh Input: DC12V

4.2 Related Submittal(s) / Grant (s)

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

4.3 Test Methodology

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

4.4 Test Facility

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

● **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 22, 2016.

● **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.

4.5 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

5 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	9.0(L)*6.0(W)* 6.0(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	Spectrum Analyzer	Agilent	E4440A	GTS533	Jun. 29 2017	Jun. 28 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jun. 29 2017	Jun. 28 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Jun. 29 2017	Jun. 28 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	Jun. 29 2017	Jun. 28 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 25 2017	Mar. 24 2018
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	Mar. 25 2017	Mar. 24 2018
10	Coaxial Cable	GTS	N/A	GTS211	Mar. 25 2017	Mar. 24 2018
11	Coaxial cable	GTS	N/A	GTS210	Mar. 25 2017	Mar. 24 2018
12	Coaxial Cable	GTS	N/A	GTS212	Mar. 25 2017	Mar. 24 2018
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jun. 29 2017	Jun. 28 2018
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jun. 29 2017	Jun. 28 2018
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	Jun. 29 2017	Jun. 28 2018
16	Band filter	Amindeon	82346	GTS219	Mar. 25 2017	Mar. 24 2018
17	Universal Radio Communication tester	ROHDE&SCHWARZ	CMU 200	GTS538	Jun. 29 2017	Jun. 28 2018
18	Wideband Radio Communication Tester	ROHDE&SCHWARZ	CMW 500	GTS539	Jun. 29 2017	Jun. 28 2018

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Barometer	ChangChun	DYM3	GTS257	Jun. 29 2017	Jun. 28 2018

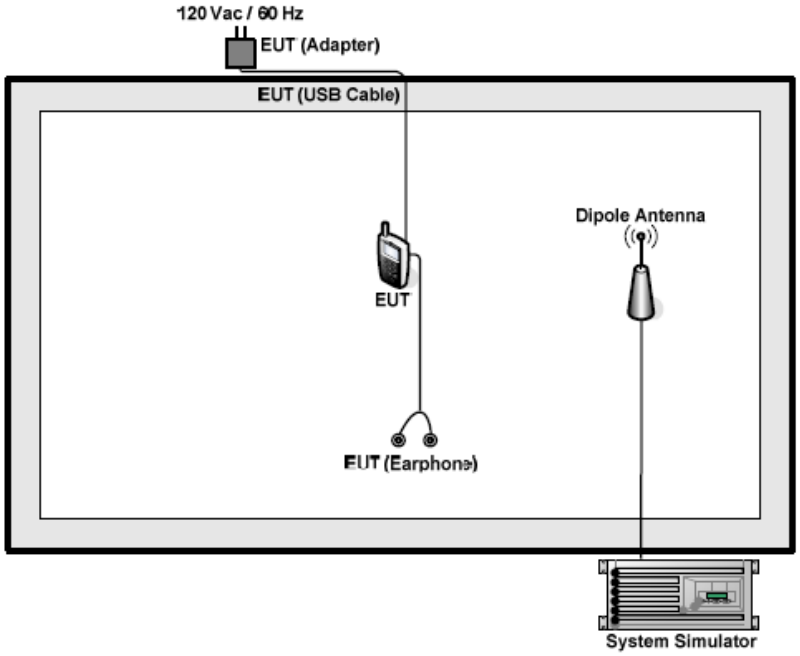
6 System test configuration

6.1 Test mode

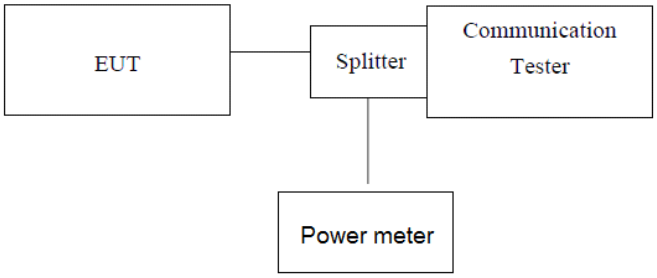
During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Test modes		
Band	Radiated	Conducted
LTE Band 2	■ QPSK and 16QAM link	■ QPSK and 16QAM link
LTE Band 4	■ QPSK and 16QAM link	■ QPSK and 16QAM link
LTE Band 12	■ QPSK and 16QAM link	■ QPSK and 16QAM link

6.2 Configuration of Tested System



6.3 Conducted Peak Output Power

Test Requirement:	Part 24.232 (c); Part 27.50(c)(10)/(d)(4)
Test Method:	FCC part2.1046
Limit:	LTE Band 2: 2W LTE Band 4: 1W LTE Band 12: 3W
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 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

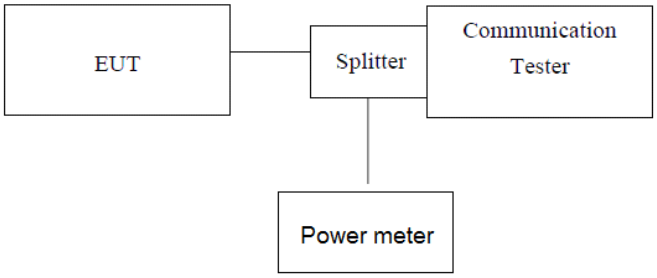
Band 2						
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 18625 1852.5MHz	Channel 18900 1880.0MHz	Channel 19175 1907.5MHz
5MHz	QPSK	1	0	21.56	21.54	21.33
		1	13	21.89	22.92	20.06
		1	24	21.95	21.37	20.90
		12	0	20.06	22.89	21.23
		12	6	20.11	21.22	20.36
		12	13	22.63	21.32	20.72
		25	0	20.87	20.40	22.96
	16QAM	1	0	21.83	21.56	21.36
		1	13	20.33	23.02	22.02
		1	24	20.61	23.03	23.02
		12	0	20.35	21.26	21.93
		12	6	22.63	22.73	22.93
		12	13	21.12	21.65	22.94
		25	0	21.73	21.80	20.43
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 18650 1855.0MHz	Channel 18900 1880.0MHz	Channel 19150 1905.0MHz
10MHz	QPSK	1	0	20.96	22.01	22.36
		1	25	20.13	21.84	22.52
		1	49	21.34	22.50	21.36
		25	0	21.14	22.84	21.54
		25	13	22.31	21.56	21.81
		25	25	21.39	23.05	21.63
		50	0	22.75	20.15	20.47
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 18675 1857.5MHz	Channel 18900 1880.0MHz	Channel 19125 1902.5MHz
15MHz	QPSK	1	0	21.20	21.64	20.28
		1	38	22.01	21.47	22.07
		1	74	22.56	23.04	21.48
		36	0	21.44	20.29	21.85
		36	18	22.36	20.37	21.43
		36	39	22.84	23.02	22.03
		75	0	20.77	22.42	20.49

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 18700 1860.0MHz	Channel 18900 1880.0MHz	Channel 19100 1900.0MHz
20MHz	QPSK	1	0	22.86	20.63	21.93
		1	50	21.01	21.83	21.38
		1	99	22.06	22.72	21.52
		50	0	20.52	21.51	21.79
		50	25	20.19	22.08	20.29
		50	50	22.50	21.03	22.83
		100	0	20.78	22.70	20.83
Band 4						
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	20.16	22.46	20.93
		1	13	21.06	22.49	22.12
		1	24	20.74	22.24	20.26
		12	0	23.00	22.82	22.53
		12	6	20.86	20.33	22.72
		12	13	21.15	22.80	21.43
		25	0	20.74	20.22	22.89
	16QAM	1	0	22.47	21.24	20.13
		1	13	21.26	20.54	20.91
		1	24	21.44	22.98	20.49
		12	0	22.70	22.44	22.71
		12	6	21.07	20.75	20.82
		12	13	22.92	22.65	20.67
		25	0	21.66	20.97	21.92
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	22.34	22.10	21.87
		1	25	22.16	22.06	21.06
		1	49	20.39	20.63	20.21
		25	0	20.23	21.22	20.35
		25	13	21.65	22.90	20.33
		25	25	22.04	20.53	21.63
		50	0	20.78	22.06	22.90

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	22.39	22.18	22.92
		1	38	21.71	22.90	22.01
		1	74	20.88	21.85	21.93
		36	0	22.19	22.01	21.06
		36	18	21.67	20.78	20.26
		36	39	21.64	21.37	22.89
		75	0	21.39	21.55	22.57
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	22.93	20.98	22.14
		1	50	20.33	21.88	22.33
		1	99	22.93	21.37	20.41
		50	0	21.56	20.84	22.80
		50	25	22.86	21.53	22.31
		50	50	21.78	21.13	21.17
		100	0	20.49	22.48	21.28
Band 12						
Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 23035 701.5MHz	Channel 23095 707.5MHz	Channel 23155 713.5MHz
5MHz	QPSK	1	0	22.69	22.53	21.78
		1	13	20.85	20.97	20.35
		1	24	20.84	21.00	22.11
		12	0	21.23	23.05	21.50
		12	6	22.35	20.39	22.98
		12	13	20.71	21.13	21.61
		25	0	20.17	22.16	20.80
	16QAM	1	0	21.03	20.81	22.03
		1	13	21.54	22.72	22.36
		1	24	22.37	22.60	20.60
		12	0	20.92	20.30	21.00
		12	6	22.14	20.24	21.49
		12	13	22.90	22.86	22.37
		25	0	21.11	21.96	21.71

Bandwidth	Mode	RB Size	RB Offset	Actual output power(dBm)		
				Channel 23060 704.0MHz	Channel 23095 707.5MHz	Channel 23130 711.0MHz
10MHz	QPSK	1	0	22.66	22.94	20.96
		1	25	21.00	21.23	21.45
		1	49	20.86	22.14	20.40
		25	0	22.60	20.39	20.41
		25	13	21.06	20.16	22.65
		25	25	21.79	20.36	20.99
		50	0	21.74	22.79	21.67

6.4 Peak-to-Average Ratio

Test Requirement:	FCC part24.232(d)
Test Method:	FCC part2.1046
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 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

QPSK mode:

Test Band	Test mode	Peak to Average Ratio (dB)			Limit (dB)	Result
		Low Ch.	Middle Ch.	High Ch.		
LTE Band 2	LTE 5MHz Bandwidth	4.66	4.82	3.85	13	PASS
	LTE 10MHz Bandwidth	4.75	5.11	4.91	13	PASS
	LTE 15MHz Bandwidth	5.37	5.57	5.70	13	PASS
	LTE 20MHz Bandwidth	6.12	6.24	6.27	13	PASS
LTE Band 4	LTE 5MHz Bandwidth	5.14	5.17	4.90	13	PASS
	LTE 10MHz Bandwidth	4.94	5.16	4.96	13	PASS
	LTE 15MHz Bandwidth	5.56	5.53	5.58	13	PASS
	LTE 20MHz Bandwidth	6.06	6.06	6.14	13	PASS
LTE Band 12	LTE 5MHz Bandwidth	4.79	4.51	4.54	13	PASS
	LTE 10MHz Bandwidth	4.39	4.82	4.85	13	PASS

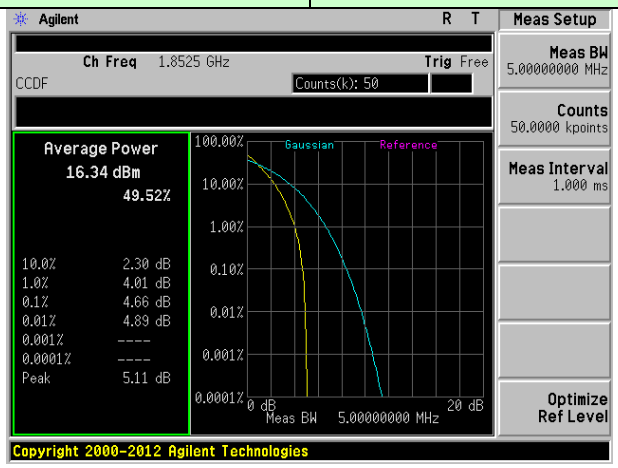
16QAM mode:

Test Band	Test mode	Peak to Average Ratio (dB)			Limit (dB)	Result
		Low Ch.	Middle Ch.	High Ch.		
LTE Band 2	LTE 5MHz Bandwidth	4.56	4.77	3.87	13	PASS
LTE Band 4	LTE 5MHz Bandwidth	5.18	5.17	4.84	13	PASS
LTE Band 12	LTE 5MHz Bandwidth	4.78	4.51	4.54	13	PASS

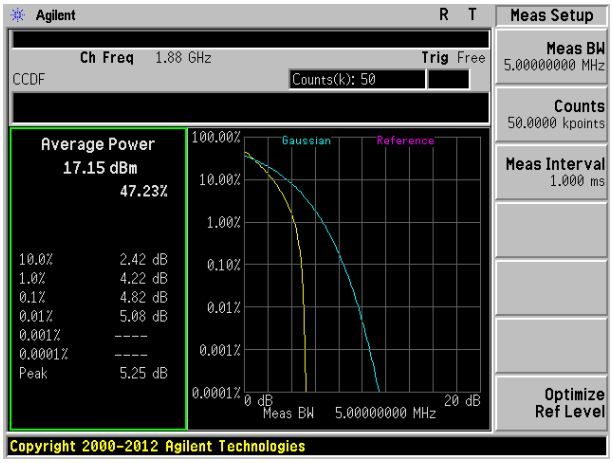
Test plot as follows:

QPSK mode:

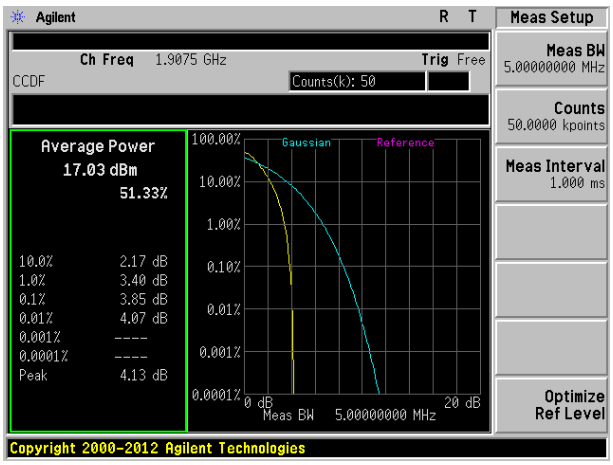
Test band: LTE Band 2	Channel Bandwidth: 5MHz



Lowest channel

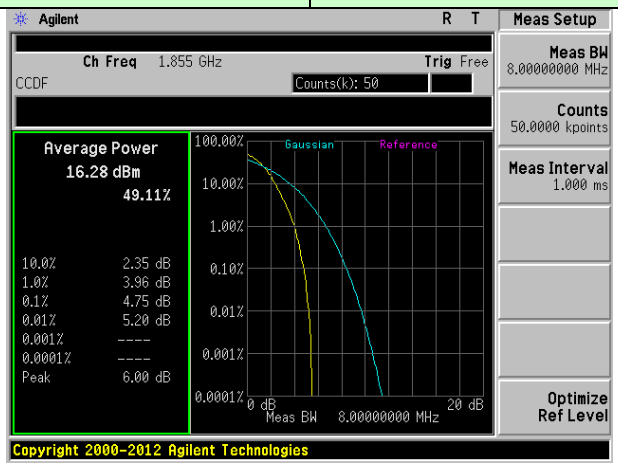


Middle channel

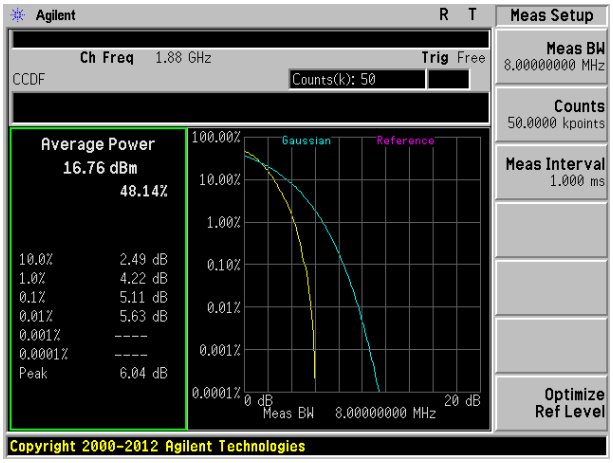


Highest channel

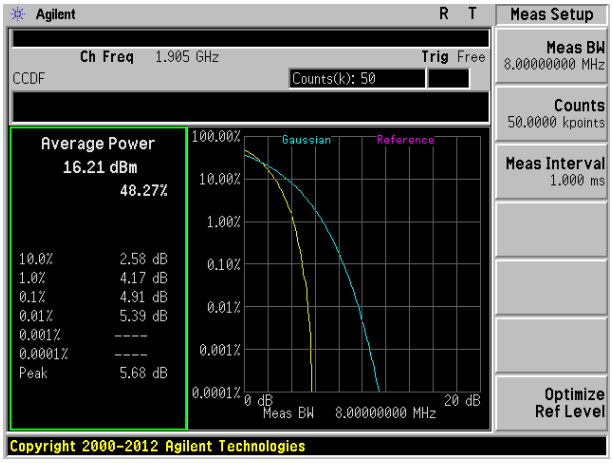
Test band: LTE Band 2	Channel Bandwidth: 10MHz



Lowest channel

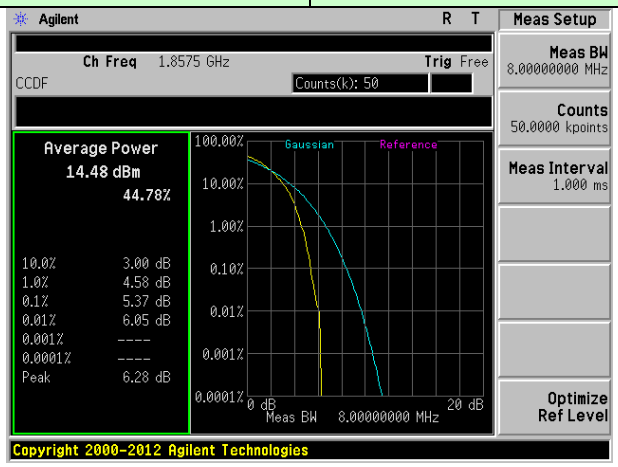


Middle channel

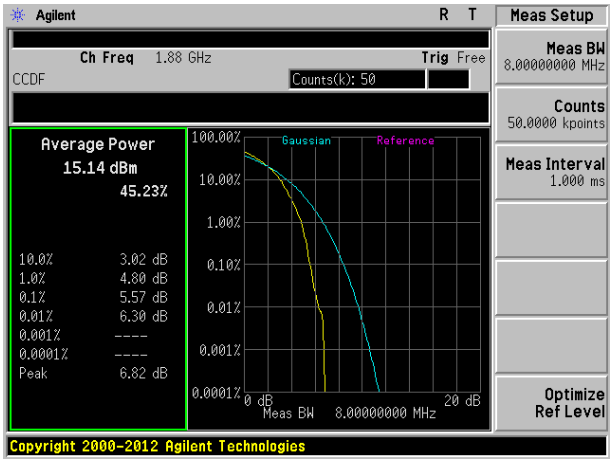


Highest channel

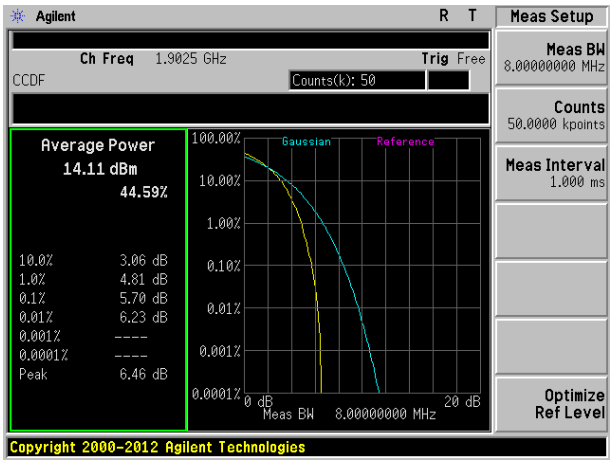
Test band: LTE Band 2	Channel Bandwidth: 15MHz



Lowest channel

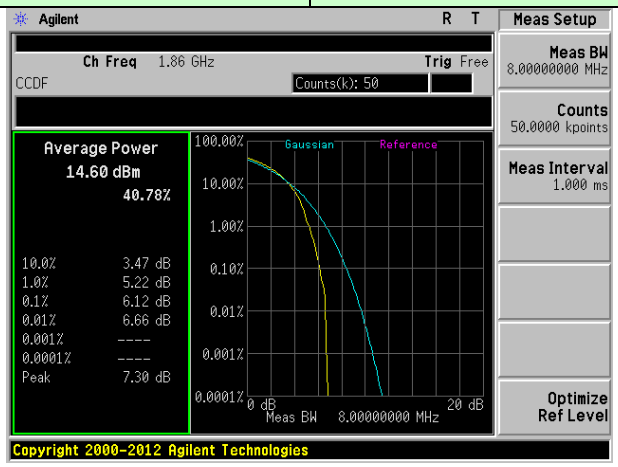


Middle channel

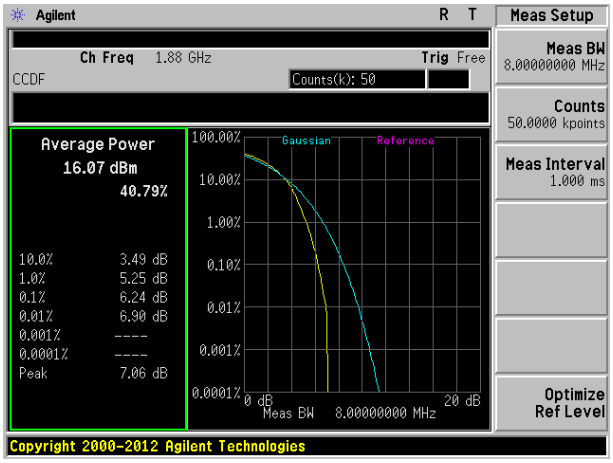


Highest channel

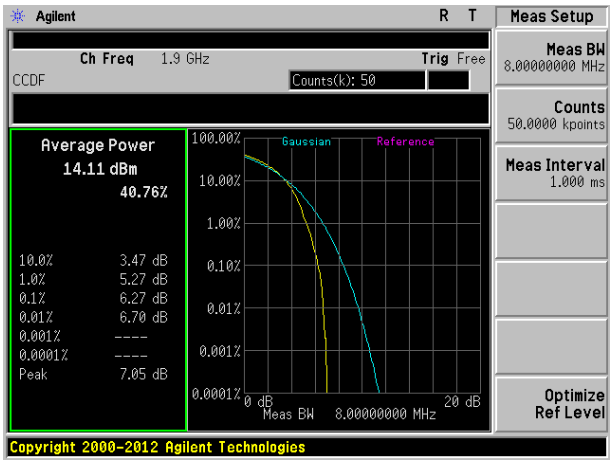
Test band: LTE Band 2	Channel Bandwidth: 20MHz



Lowest channel

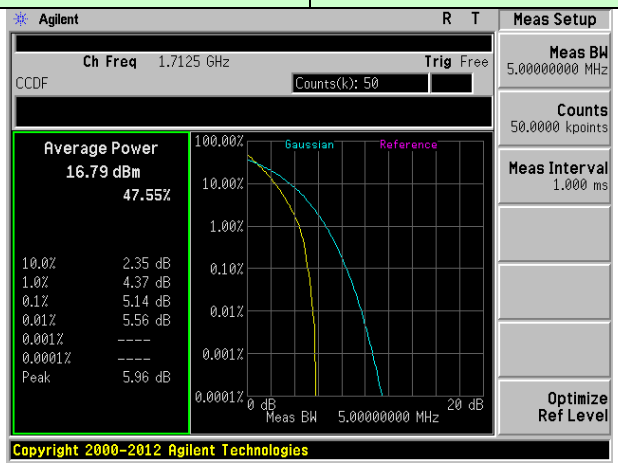


Middle channel

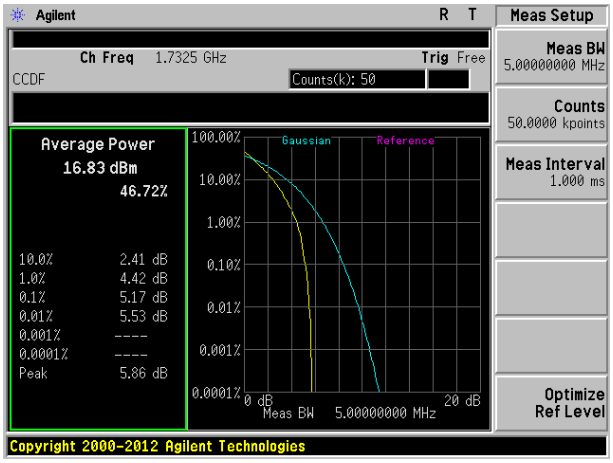


Highest channel

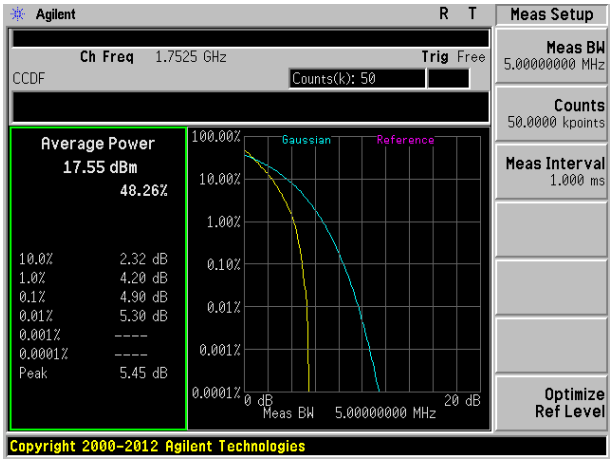
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

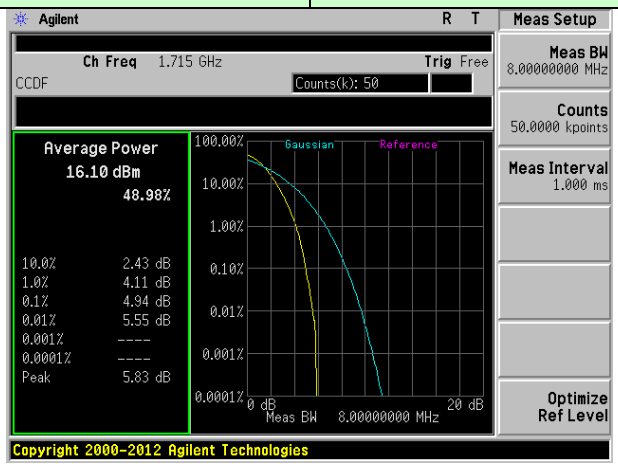


Middle channel

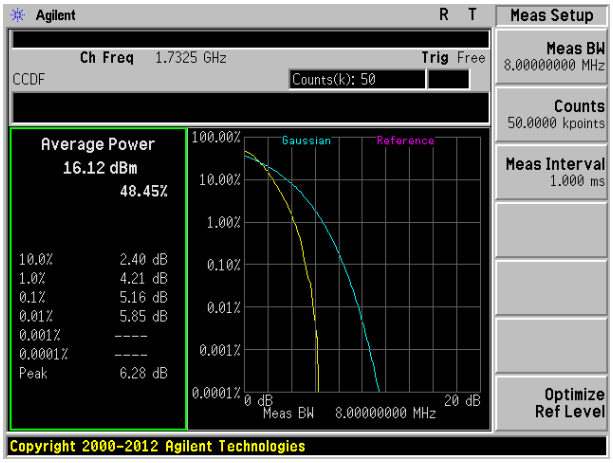


Highest channel

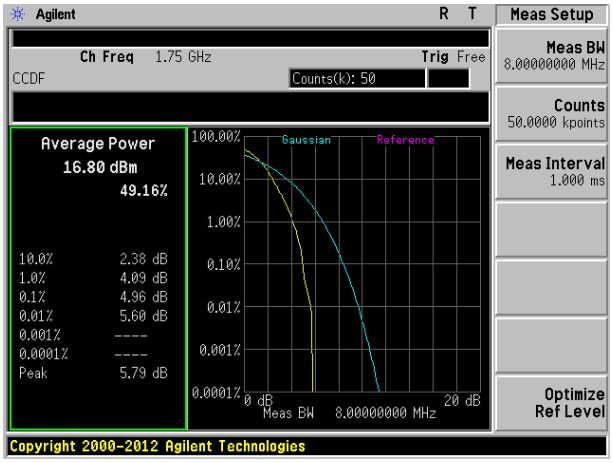
Test band: LTE Band 4	Channel Bandwidth: 10MHz



Lowest channel

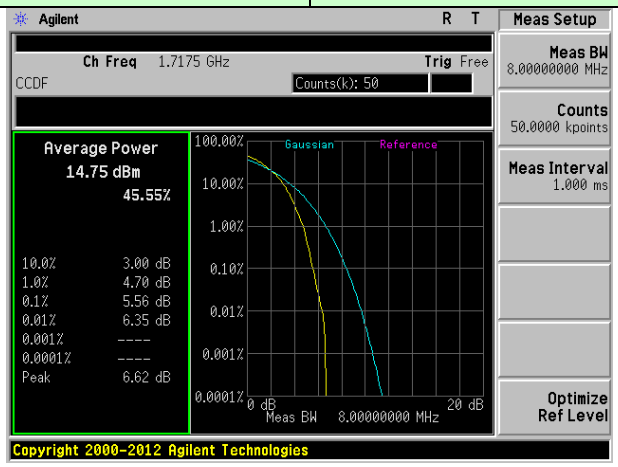


Middle channel

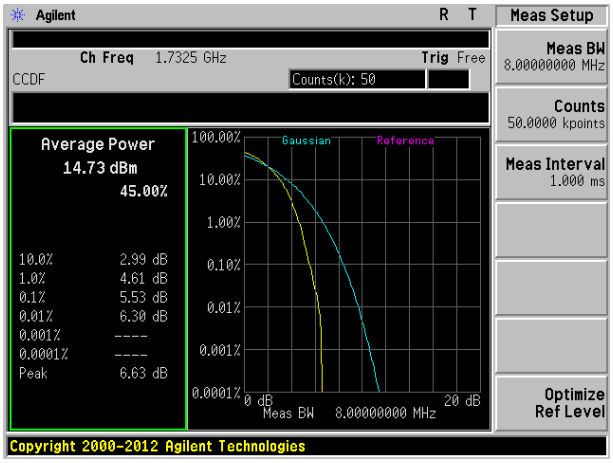


Highest channel

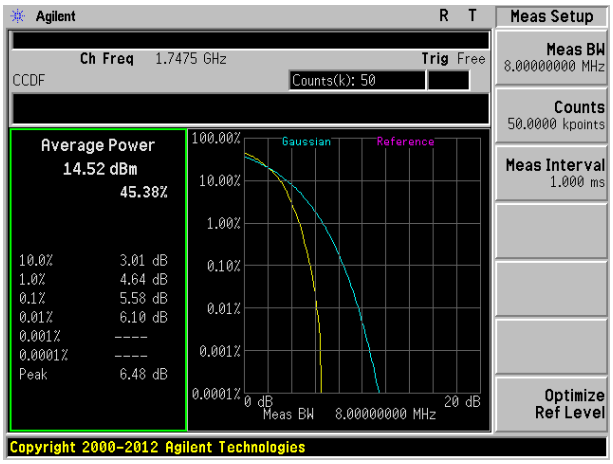
Test band: LTE Band 4	Channel Bandwidth: 15MHz



Lowest channel

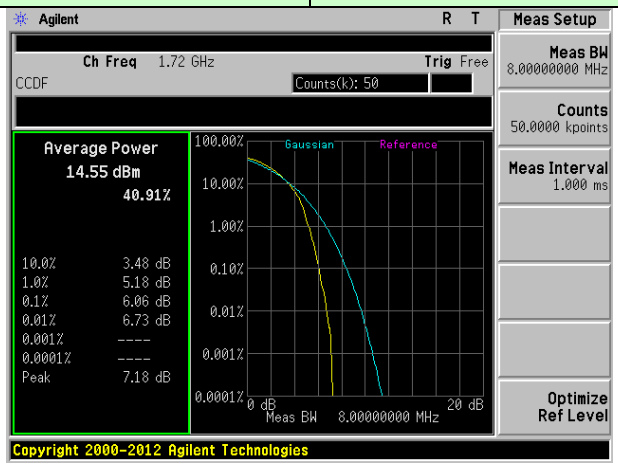


Middle channel

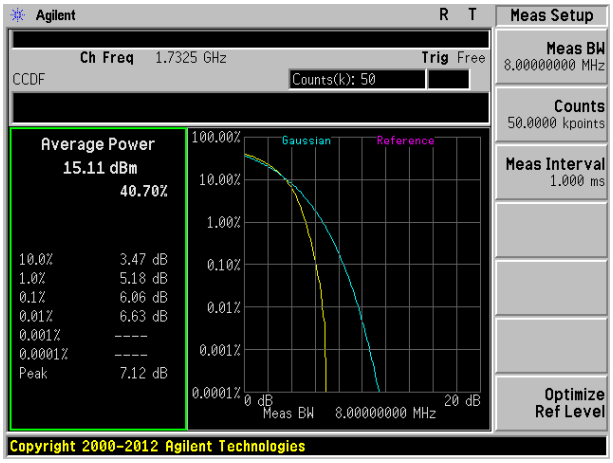


Highest channel

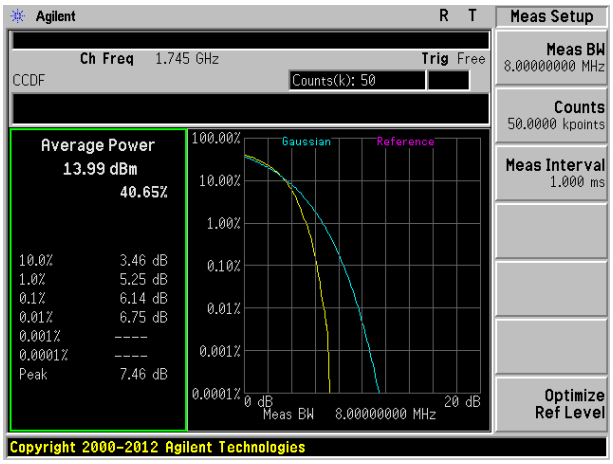
Test band: LTE Band 4	Channel Bandwidth: 20MHz



Lowest channel

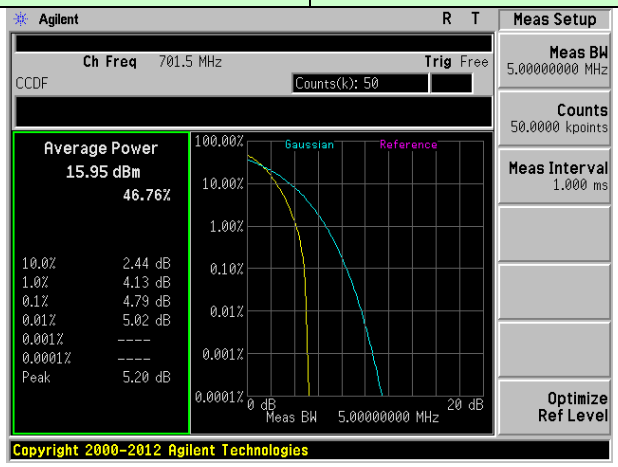


Middle channel

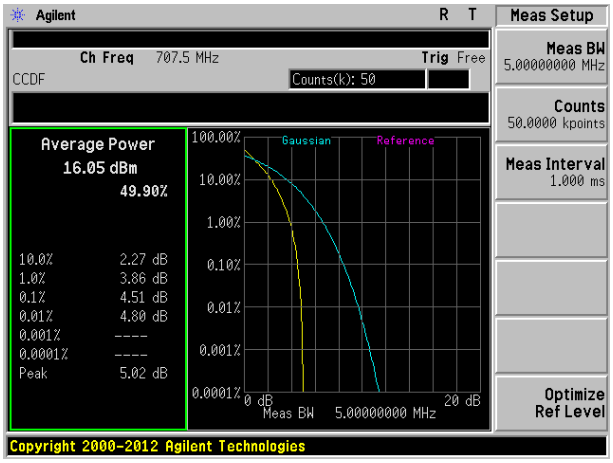


Highest channel

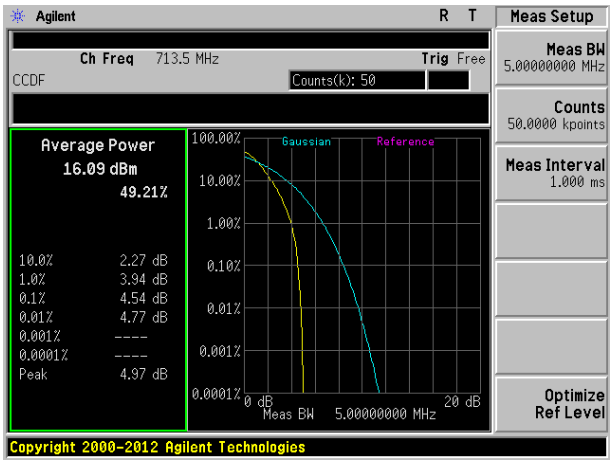
Test band: LTE Band 12	Channel Bandwidth: 5MHz



Lowest channel

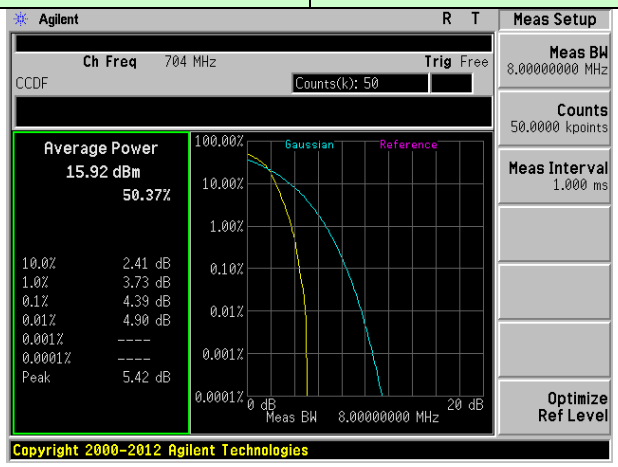


Middle channel

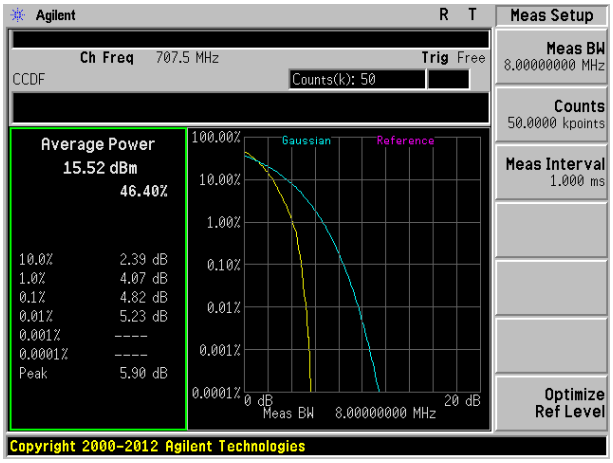


Highest channel

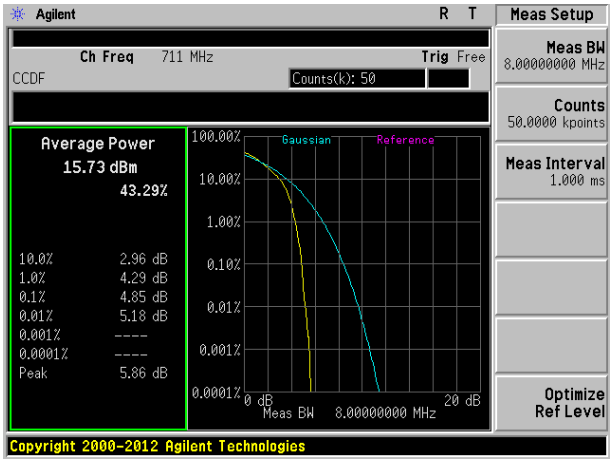
Test band: LTE Band 12	Channel Bandwidth: 10MHz



Lowest channel



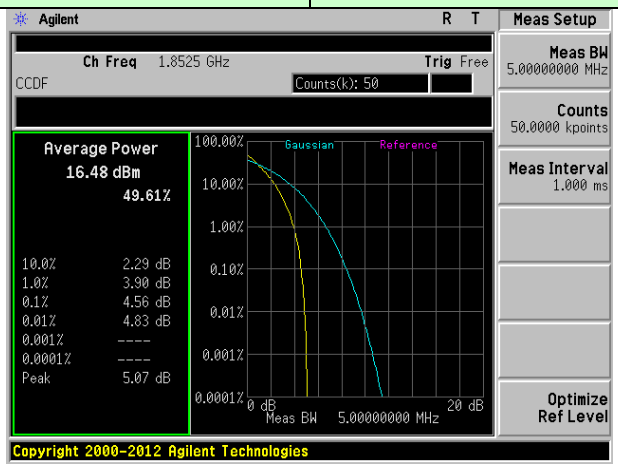
Middle channel



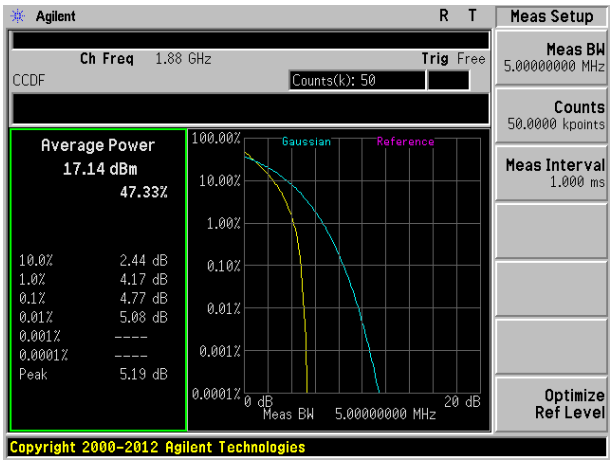
Highest channel

16QAM mode:

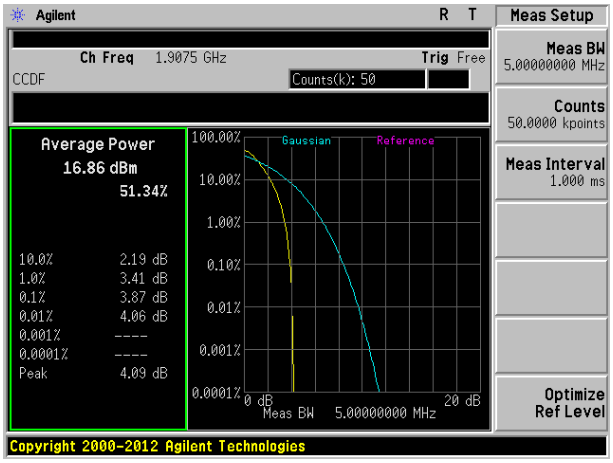
Test band: LTE Band 2	Channel Bandwidth: 5MHz



Lowest channel

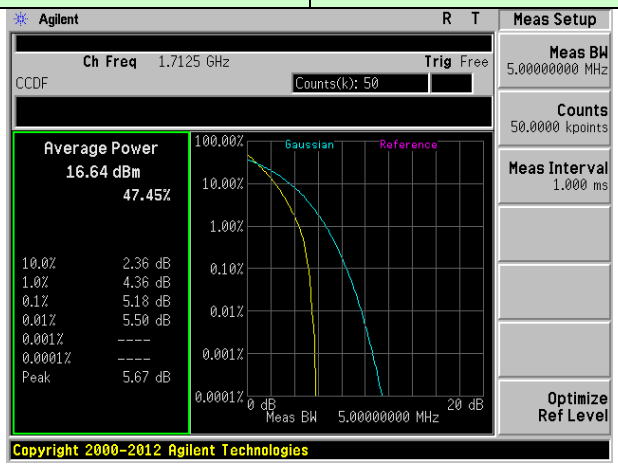


Middle channel

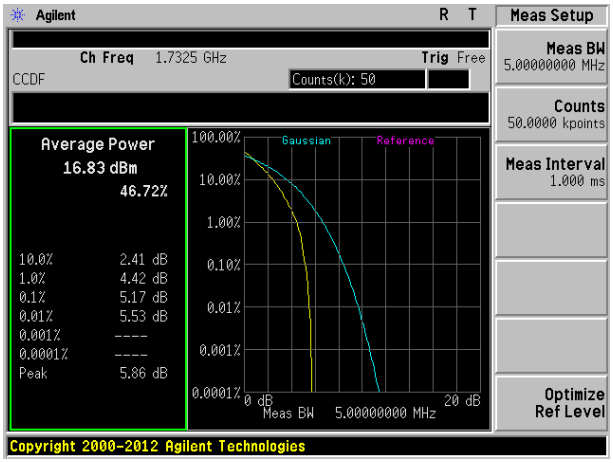


Highest channel

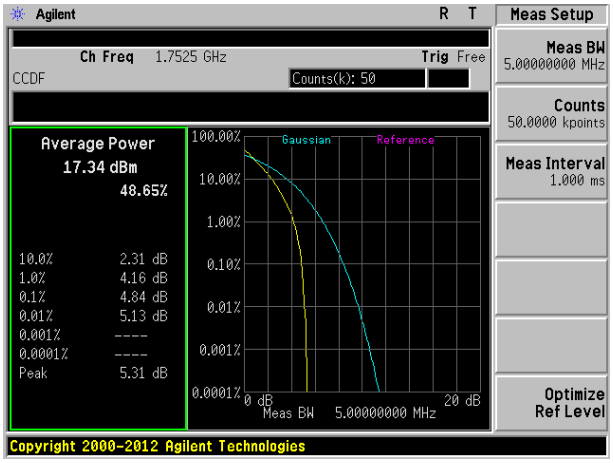
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

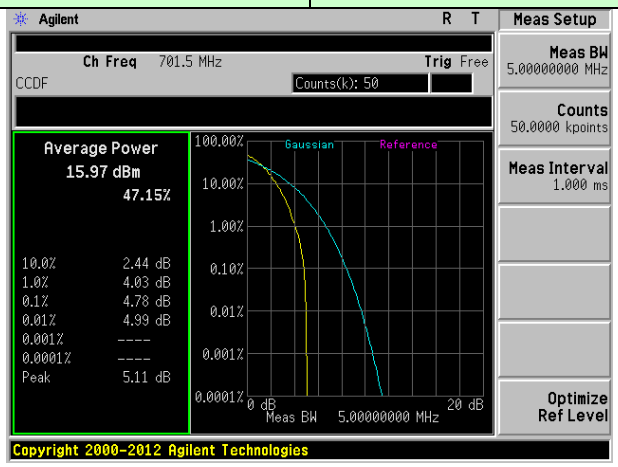


Middle channel

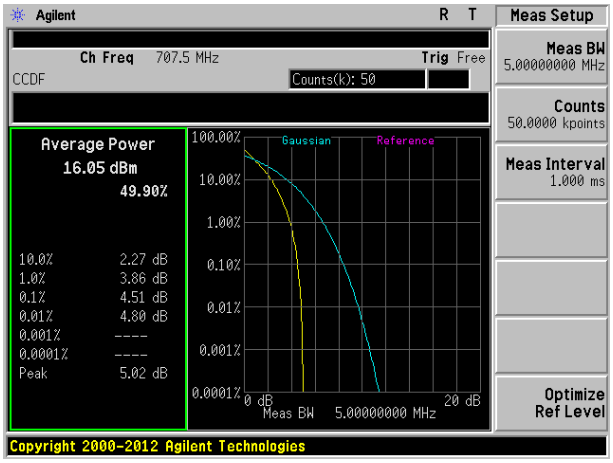


Highest channel

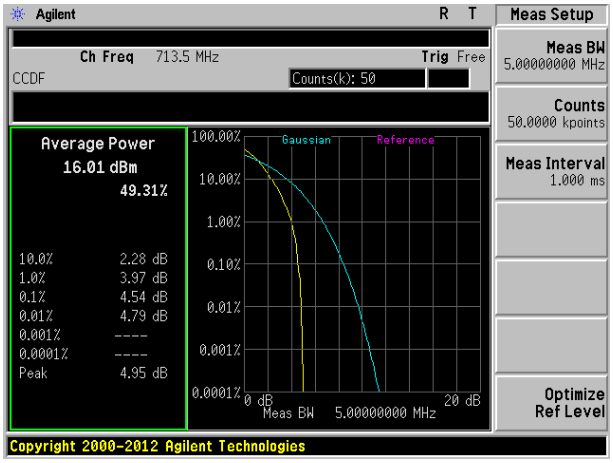
Test band: LTE Band 12	Channel Bandwidth: 5MHz



Lowest channel

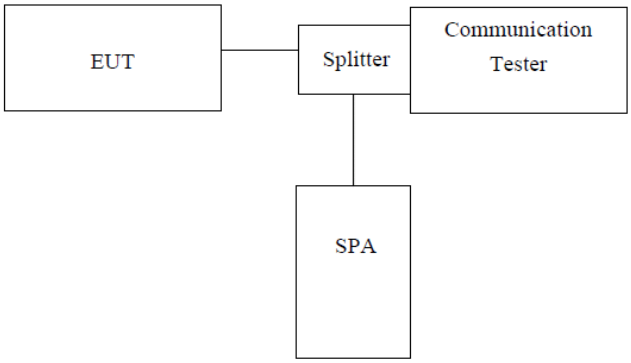


Middle channel



Highest channel

6.5 Occupy Bandwidth

Test Requirement:	Part 24.238; FCC Part 27.53(h)/(g)
Test Method:	FCC part2.1049
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 6.0 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 2	5MHz	Low range	25	0	4514.20	4863.00
		Mid range	25	0	4519.00	5052.00
		High range	25	0	4525.00	5297.00
	10MHz	Low range	50	0	8931.70	9693.00
		Mid range	50	0	8942.50	9642.00
		High range	50	0	8930.60	9677.00
	15MHz	Low range	75	0	13458.80	14803.00
		Mid range	75	0	13368.10	14595.00
		High range	75	0	13436.80	14681.00
	20MHz	Low range	100	0	17879.60	19282.00
		Mid range	100	0	17807.70	19019.00
		High range	100	0	17924.50	19480.00
EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 4	5MHz	Low range	25	0	4503.50	5012.00
		Mid range	25	0	4517.70	4959.00
		High range	25	0	4512.60	4905.00
	10MHz	Low range	50	0	8907.80	9599.00
		Mid range	50	0	8951.50	9793.00
		High range	50	0	8925.60	9677.00
	15MHz	Low range	75	0	13393.60	14670.00
		Mid range	75	0	13441.30	14757.00
		High range	75	0	13417.50	14569.00
	20MHz	Low range	100	0	17823.30	19119.00
		Mid range	100	0	17856.80	19329.00
		High range	100	0	17850.80	19243.00
EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 12	5MHz	Low range	25	0	4502.70	4956.00
		Mid range	25	0	4534.90	5080.00
		High range	25	0	4487.60	4955.00
	10MHz	Low range	50	0	8851.70	9538.00
		Mid range	50	0	8969.80	9751.00
		High range	50	0	8957.80	9582.00

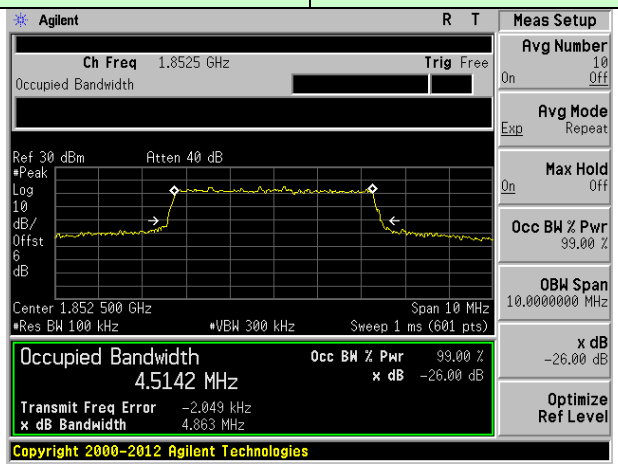
16QAM mode：

EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 2	5MHz	Low range	25	0	4509.80	5050.00
		Mid range	25	0	4515.50	5042.00
		High range	25	0	4521.00	5761.00
EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 4	5MHz	Low range	25	0	4507.10	5017.00
		Mid range	25	0	4520.90	4874.00
		High range	25	0	4501.60	4999.00
EUT Mode	Channel Bandwidth	Channel	RB Configure		99% Occupy bandwidth (KHz)	-26dB bandwidth (KHz)
			RB Size	RB Offset		
LTE Band 12	5MHz	Low range	25	0	4506.90	4994.00
		Mid range	25	0	4532.20	5015.00
		High range	25	0	4481.10	4956.00

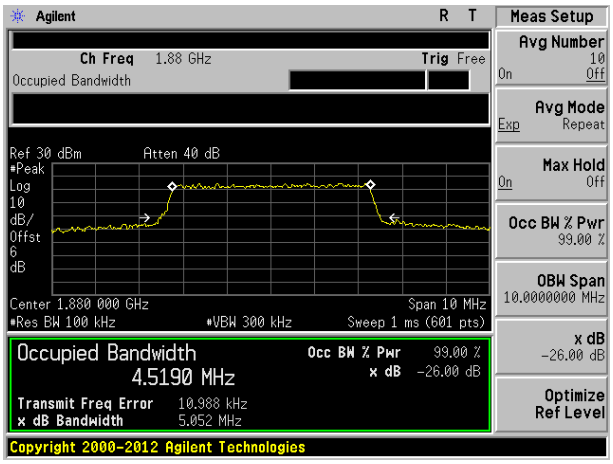
Test plot as follows:

QPSK mode:

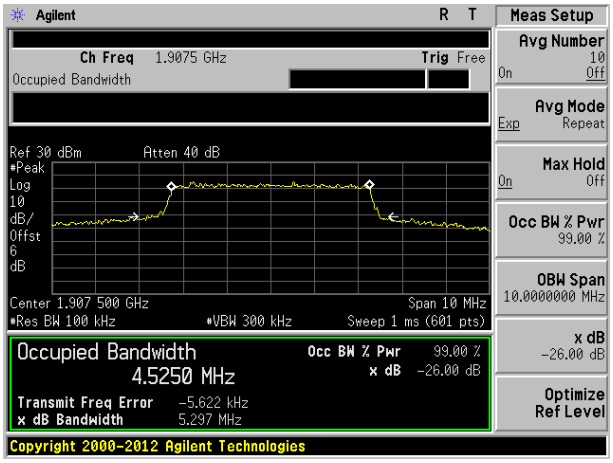
Test band: LTE Band 2	Channel Bandwidth: 5MHz



Lowest channel

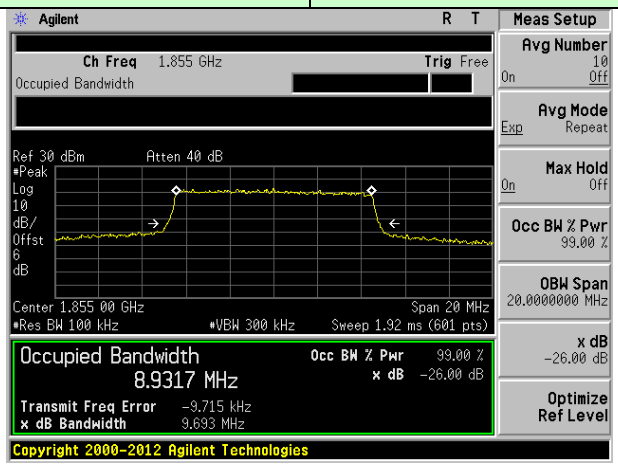


Middle channel

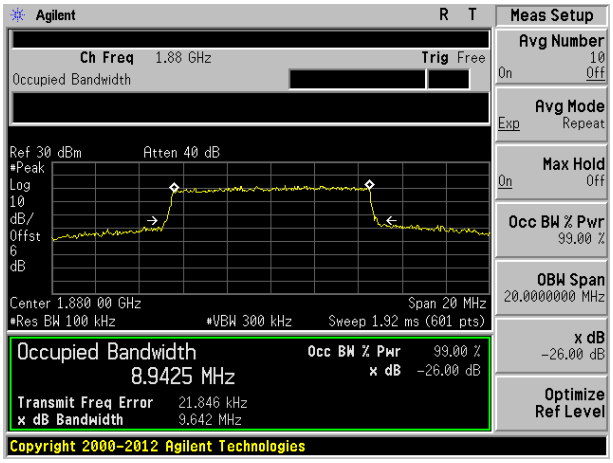


Highest channel

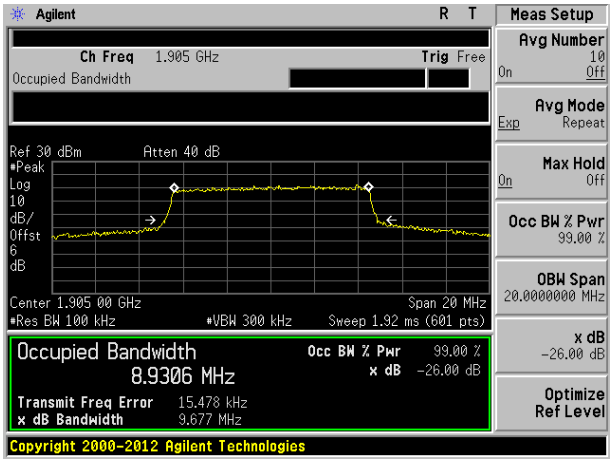
Test band: LTE Band 2	Channel Bandwidth: 10MHz



Lowest channel

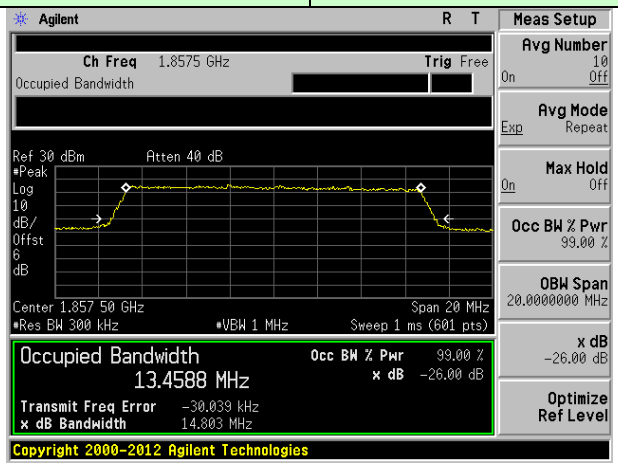


Middle channel

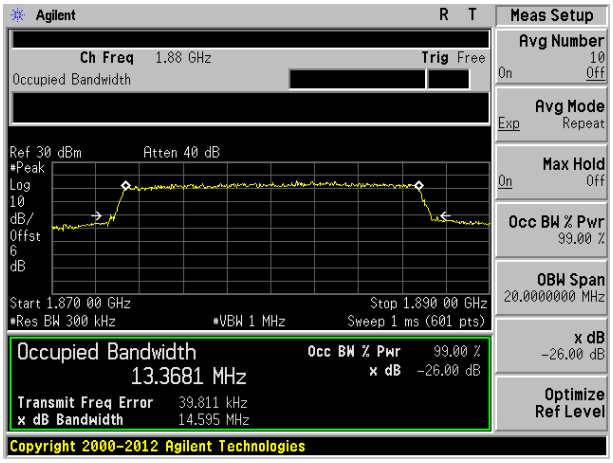


Highest channel

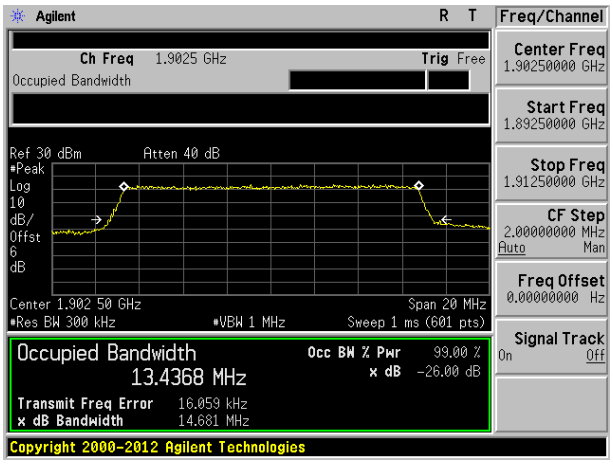
Test band: LTE Band 2	Channel Bandwidth: 15MHz



Lowest channel

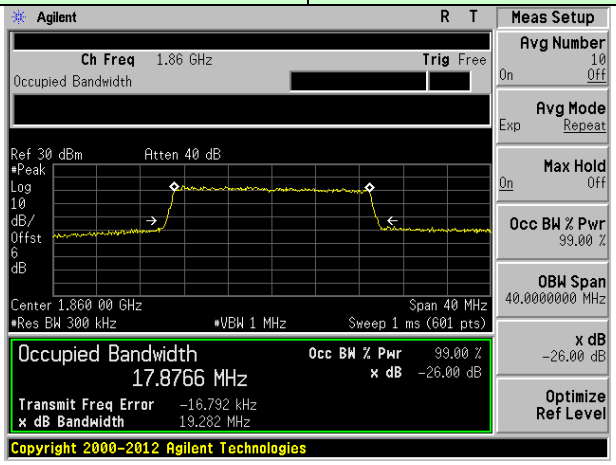


Middle channel

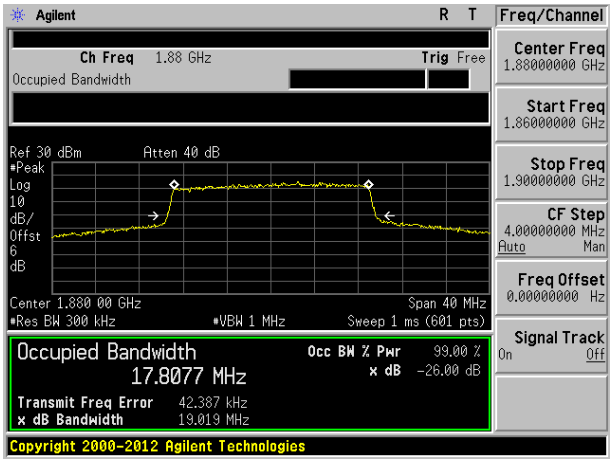


Highest channel

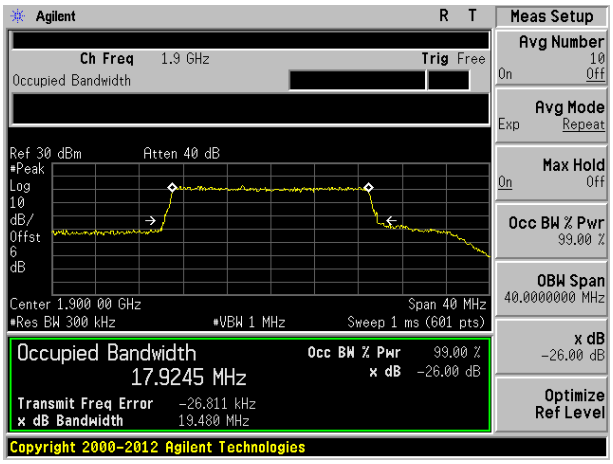
Test band: LTE Band 2	Channel Bandwidth: 20MHz



Lowest channel

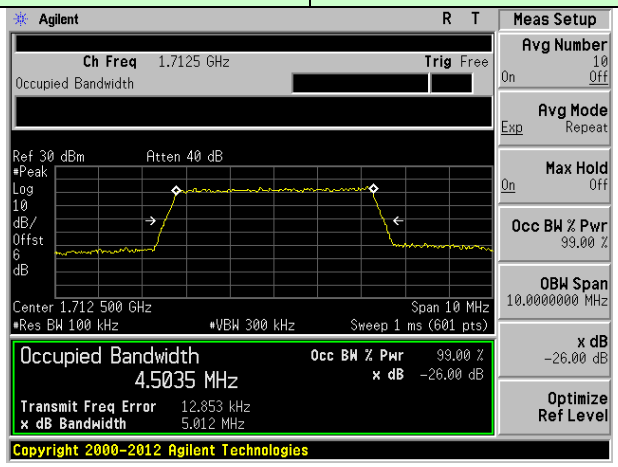


Middle channel

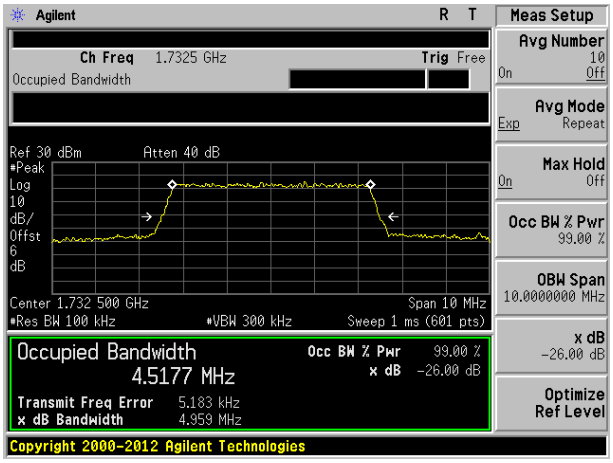


Highest channel

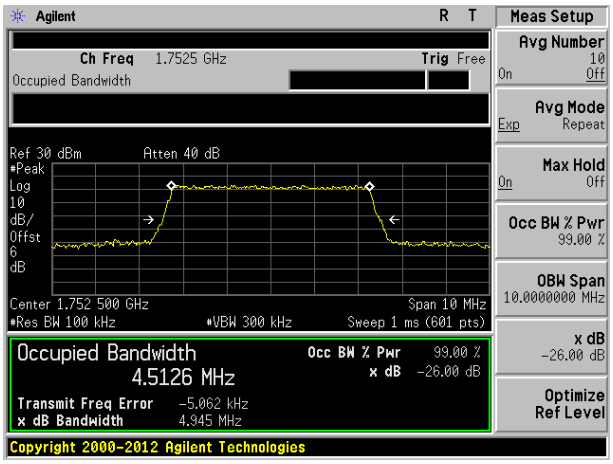
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

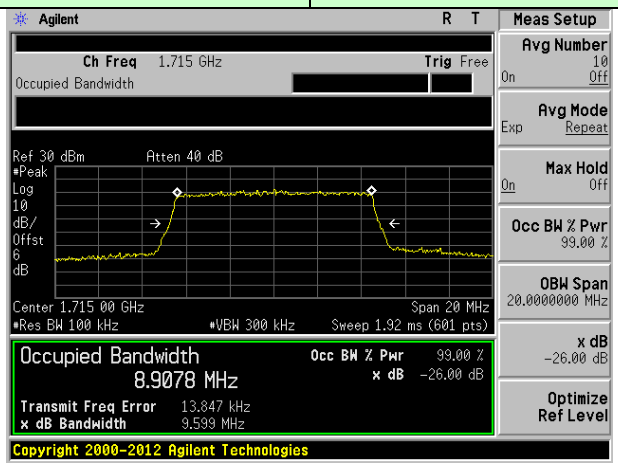


Middle channel

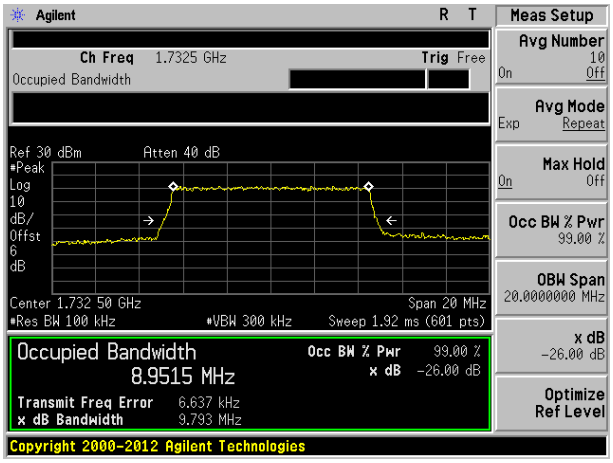


Highest channel

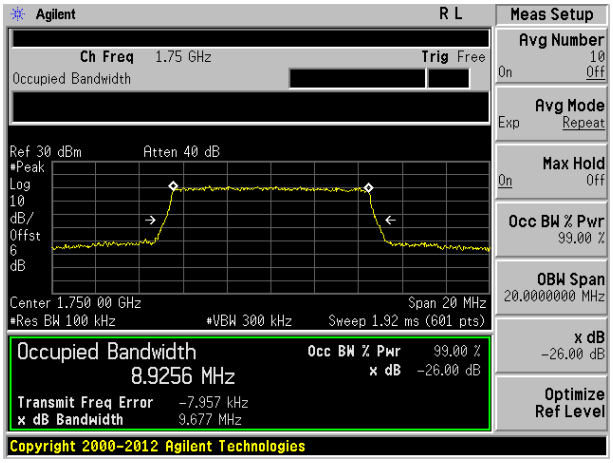
Test band: LTE Band 4	Channel Bandwidth: 10MHz



Lowest channel

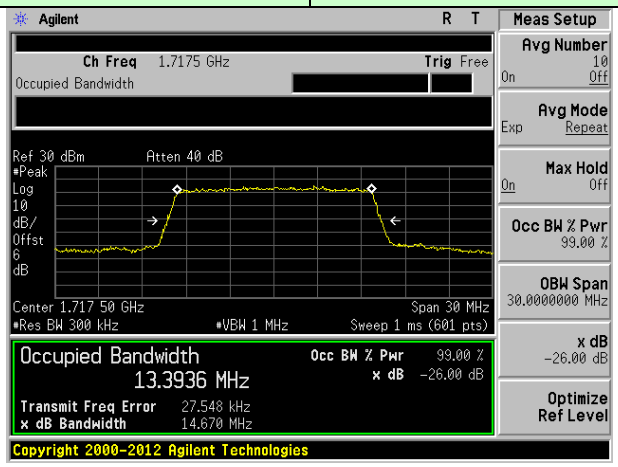


Middle channel

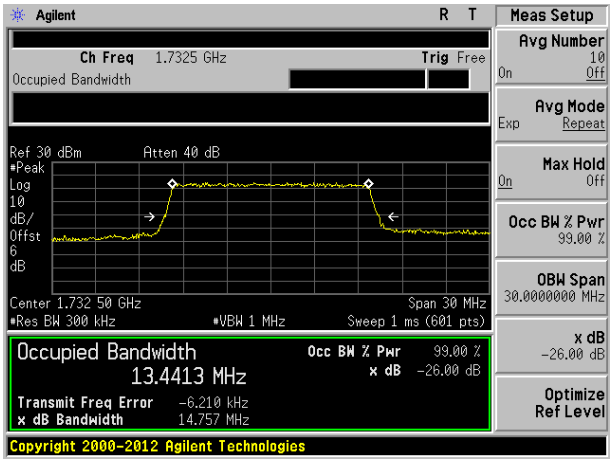


Highest channel

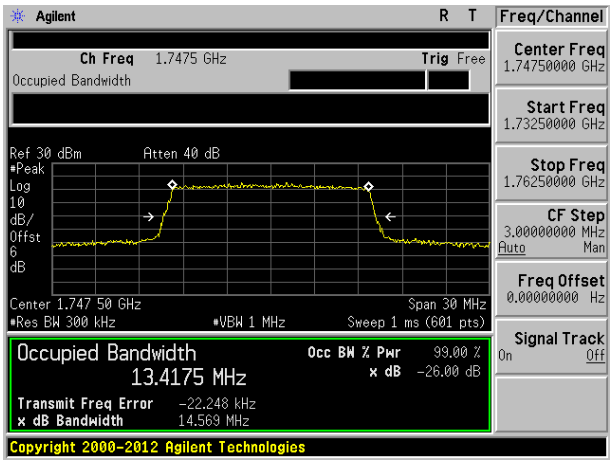
Test band: LTE Band 4	Channel Bandwidth: 15MHz



Lowest channel

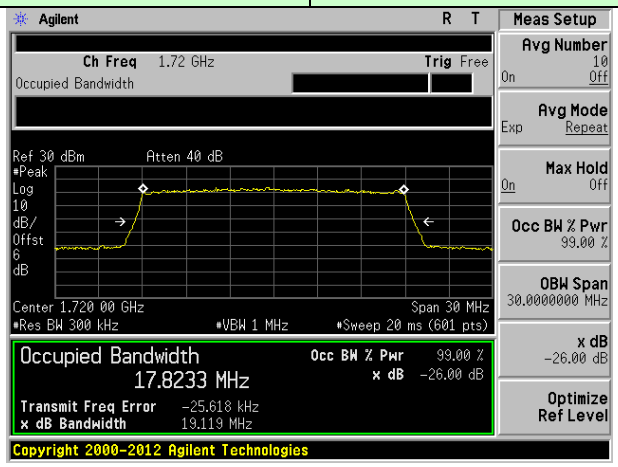


Middle channel

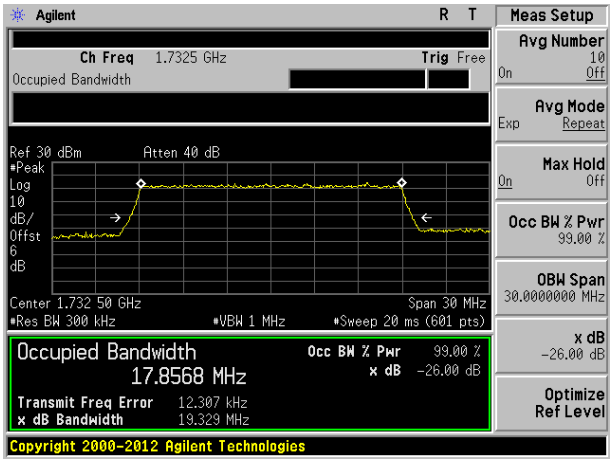


Highest channel

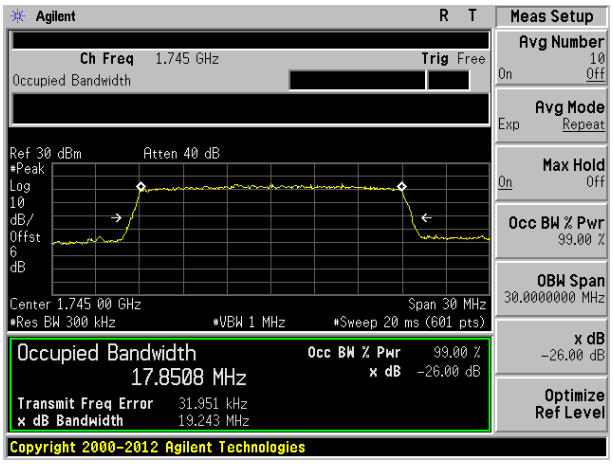
Test band: LTE Band 4	Channel Bandwidth: 20MHz



Lowest channel

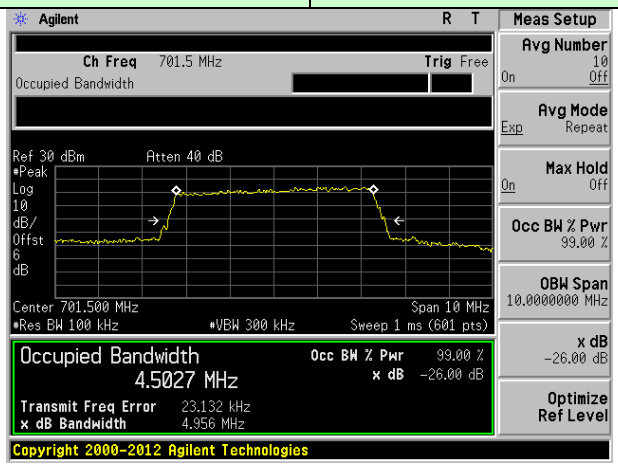


Middle channel

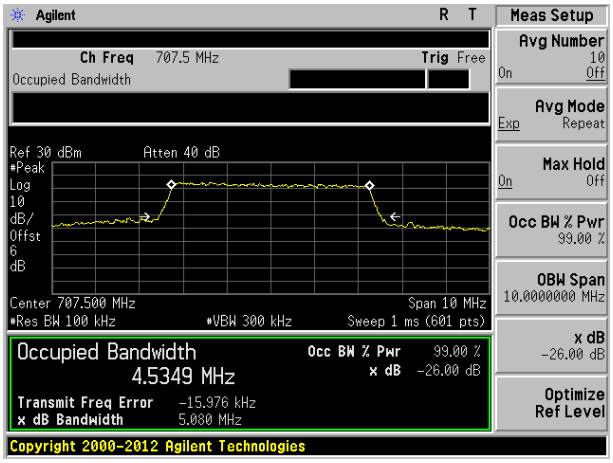


Highest channel

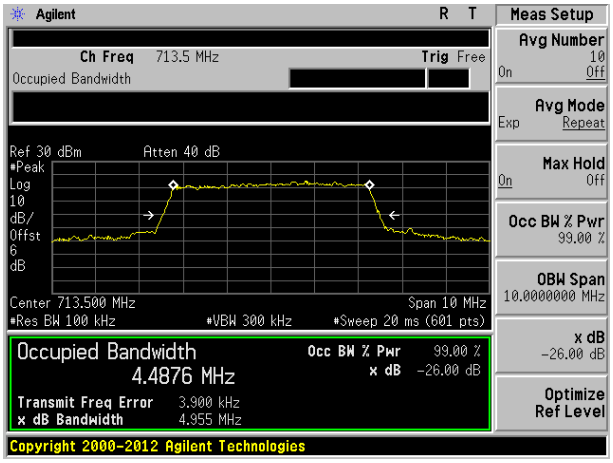
Test band: LTE Band 12	Channel Bandwidth: 5MHz



Lowest channel

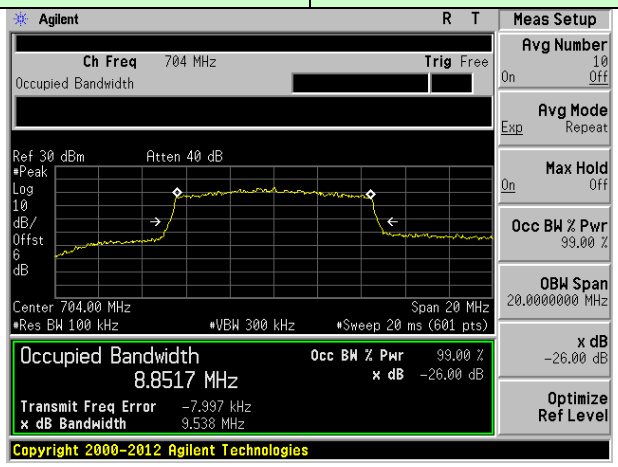


Middle channel

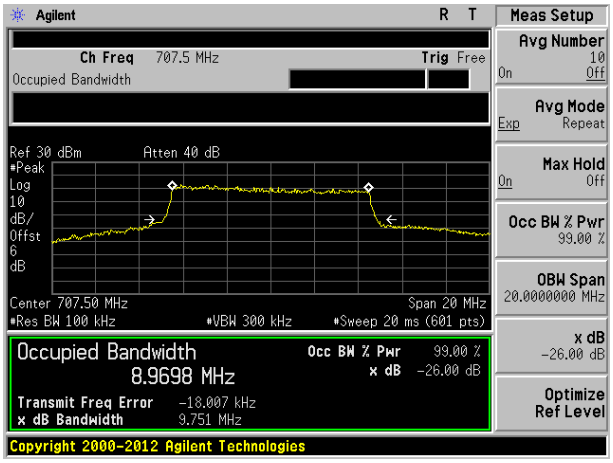


Highest channel

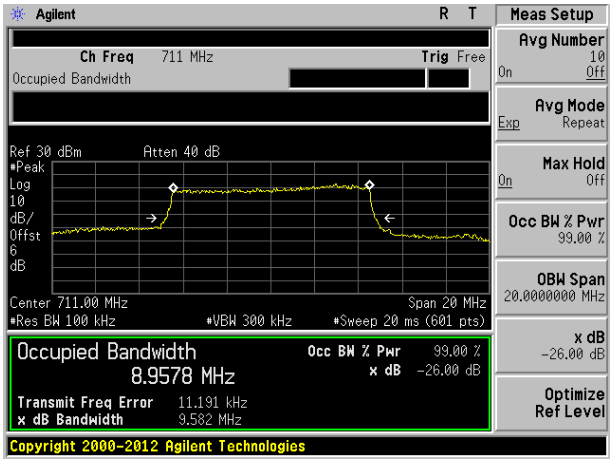
Test band: LTE Band 12	Channel Bandwidth: 10MHz



Lowest channel



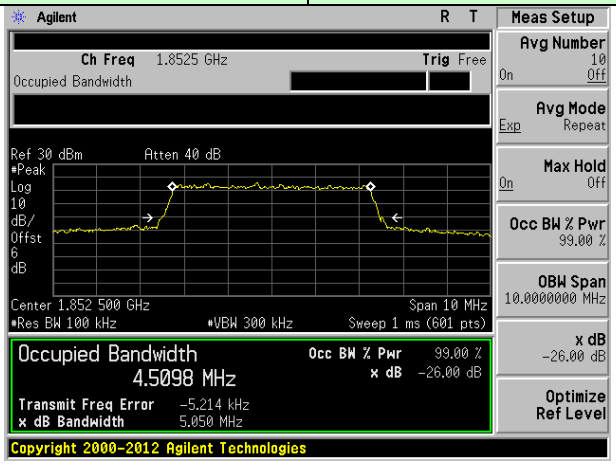
Middle channel



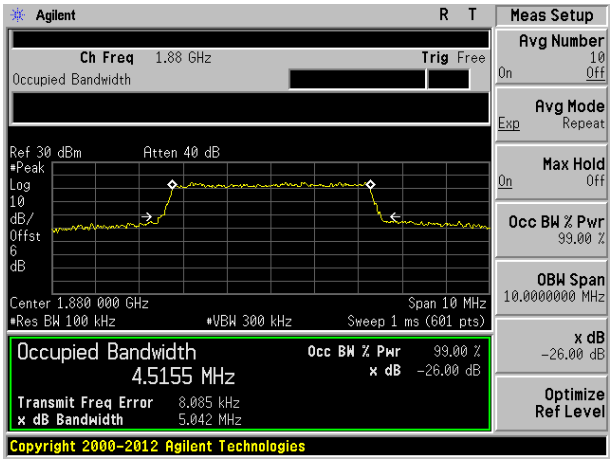
Highest channel

16QAM mode:

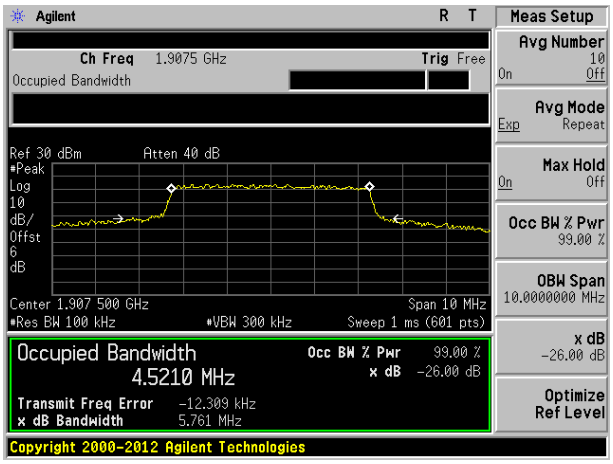
Test band: LTE Band 2	Channel Bandwidth: 5MHz



Lowest channel

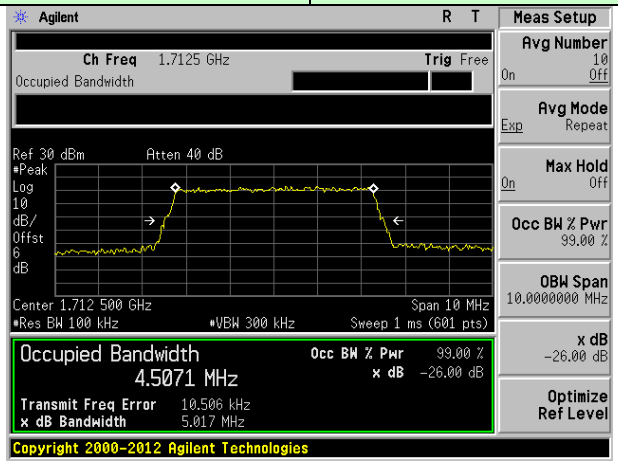


Middle channel

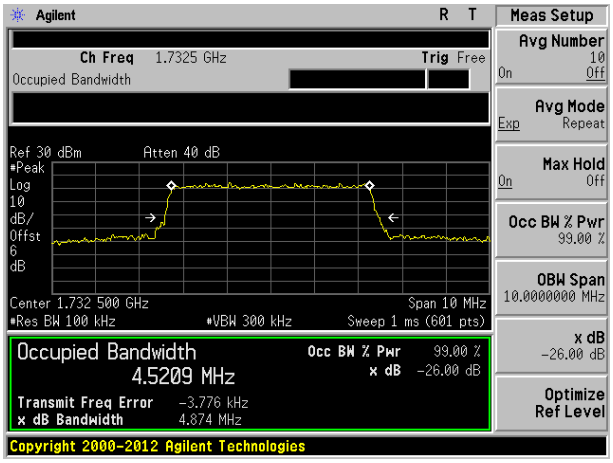


Highest channel

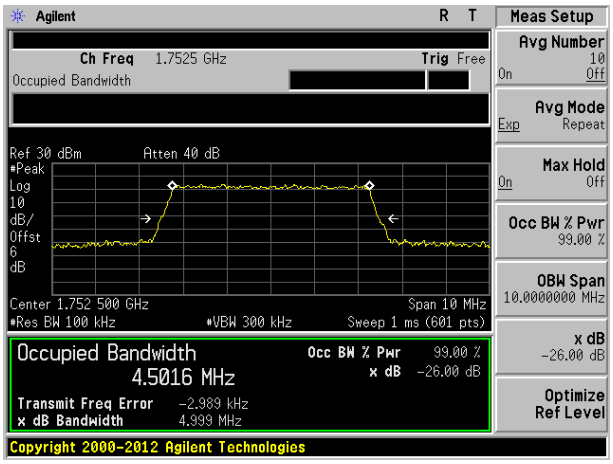
Test band: LTE Band 4	Channel Bandwidth: 5MHz



Lowest channel

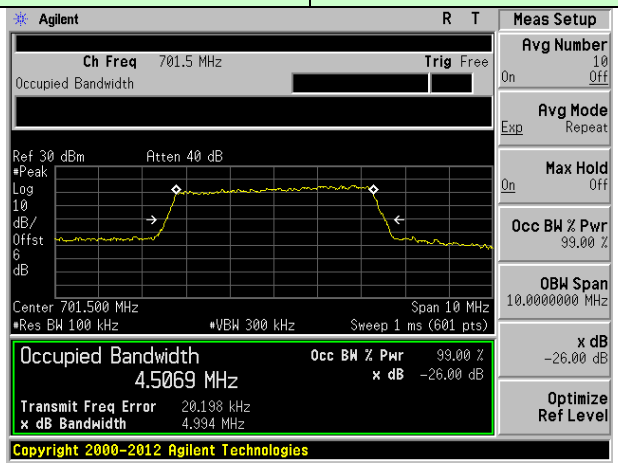


Middle channel

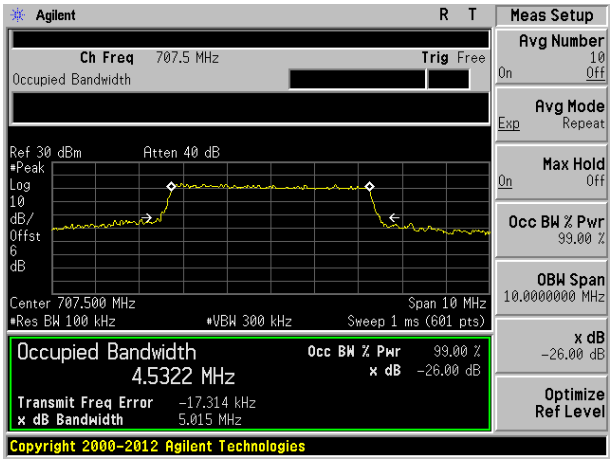


Highest channel

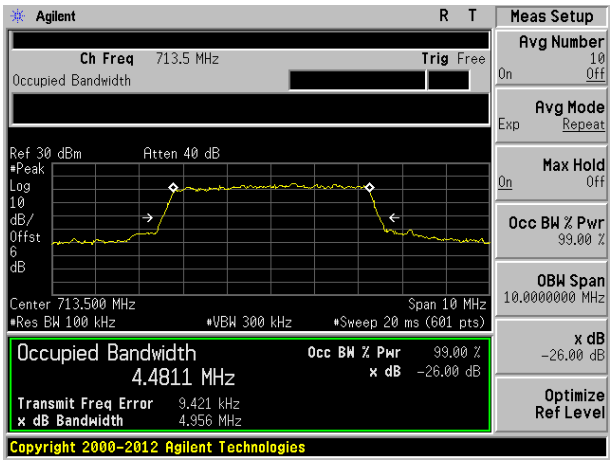
Test band: LTE Band 12	Channel Bandwidth: 5MHz



Lowest channel



Middle channel

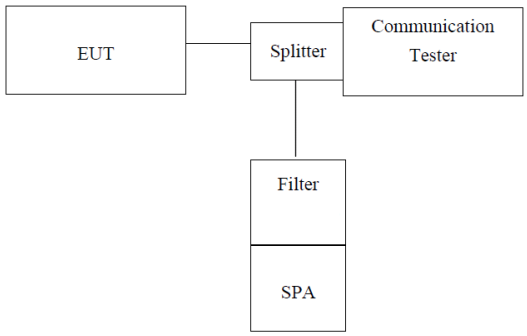


Highest channel

6.6 MODULATION CHARACTERISTIC

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

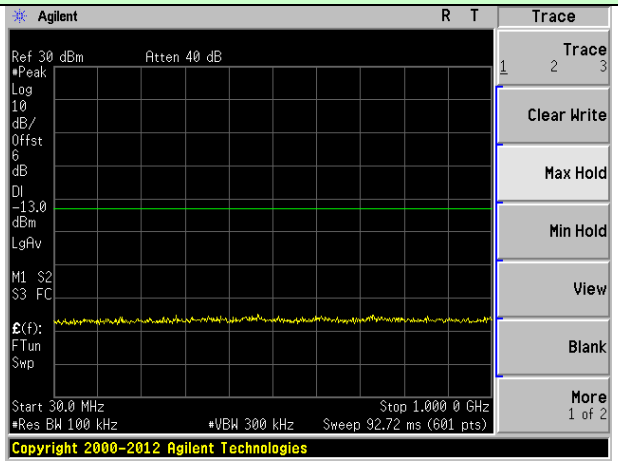
6.7 Out of band emission at antenna terminals

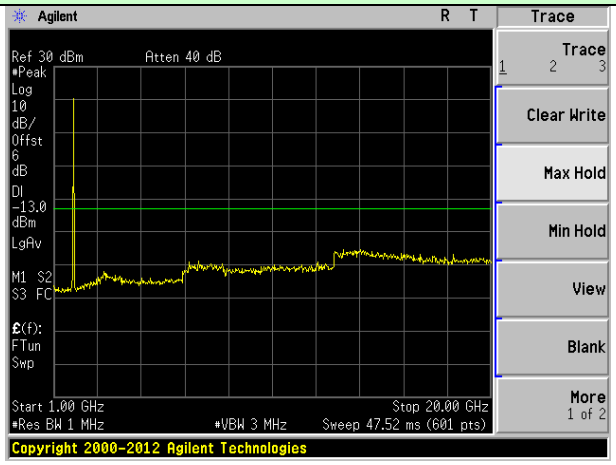
Test Requirement:	Part 24.238 (a); FCC Part 27.53(h)/(g)
Test Method:	FCC part2.1051
Limit:	-13dBm
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
Test Procedure:	1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 The resolution 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 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Test plot as follows:

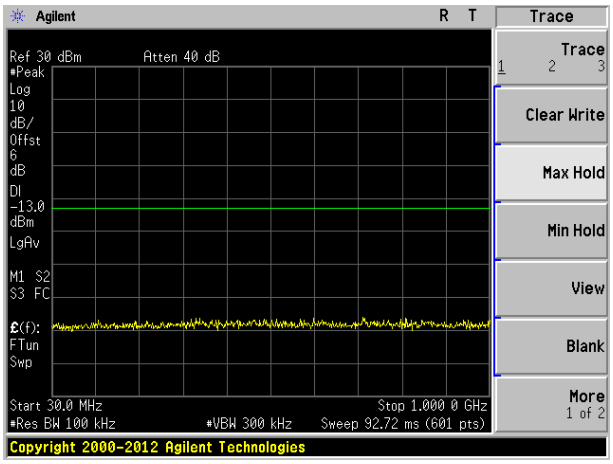
QPSK mode:

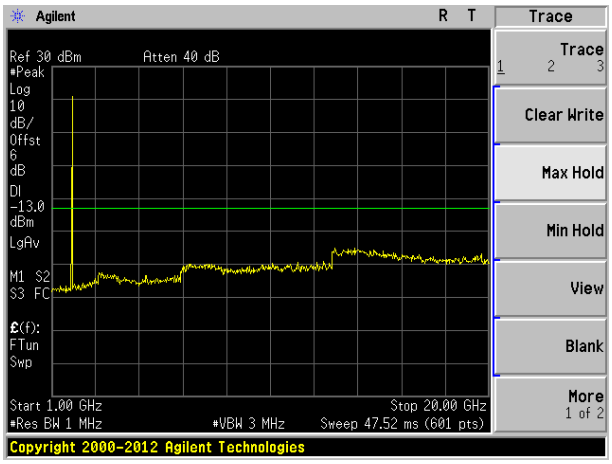
Test Mode: LTE Band 2	Channel Bandwidth: 5MHz



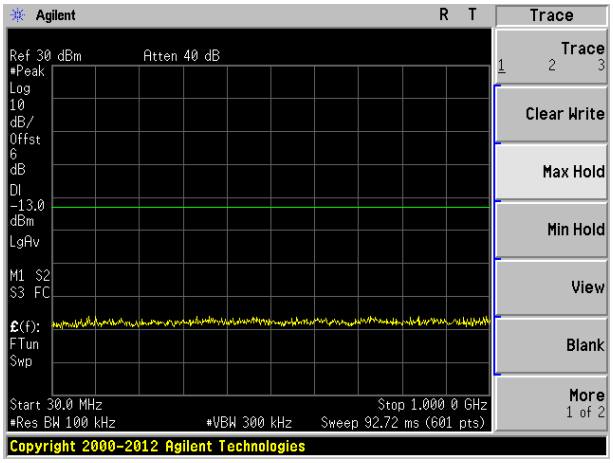


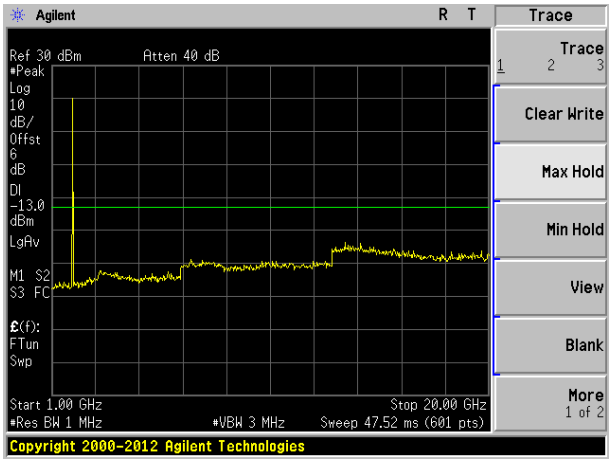
Lowest channel





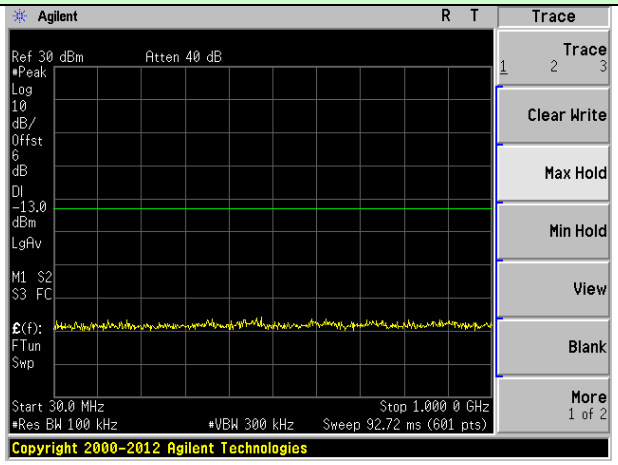
Middle channel

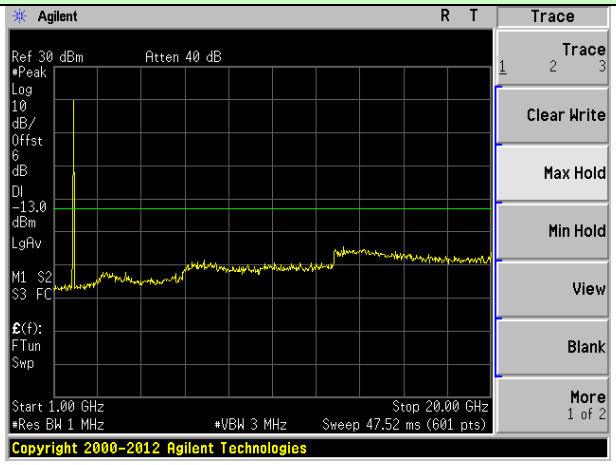




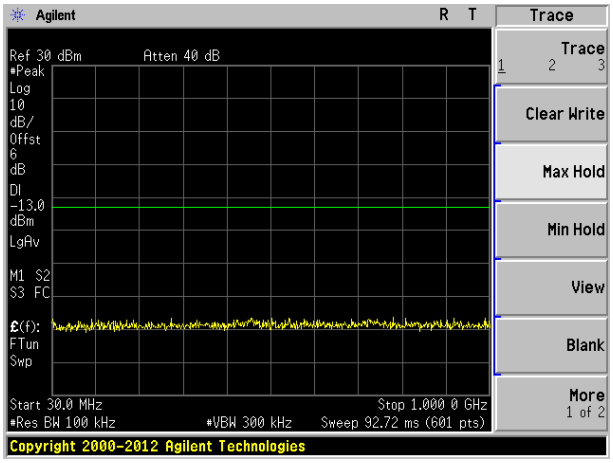
Highest channel

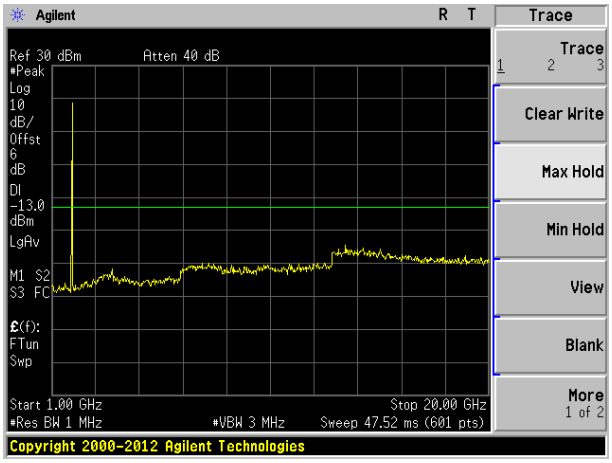
Test Mode: LTE Band 2	Channel Bandwidth: 10MHz



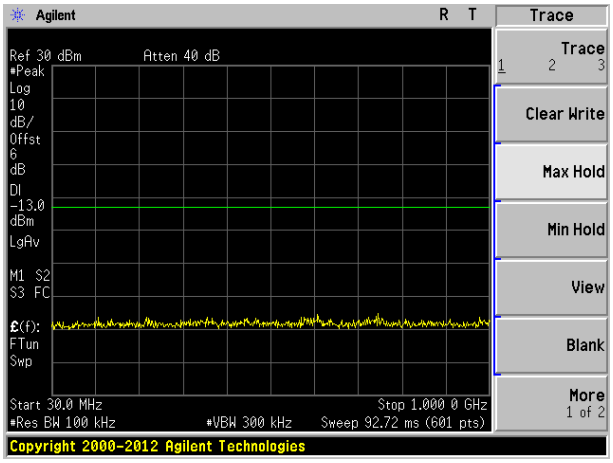


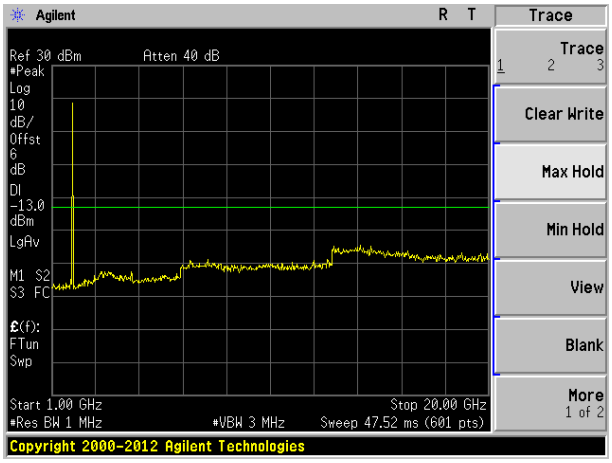
Lowest channel





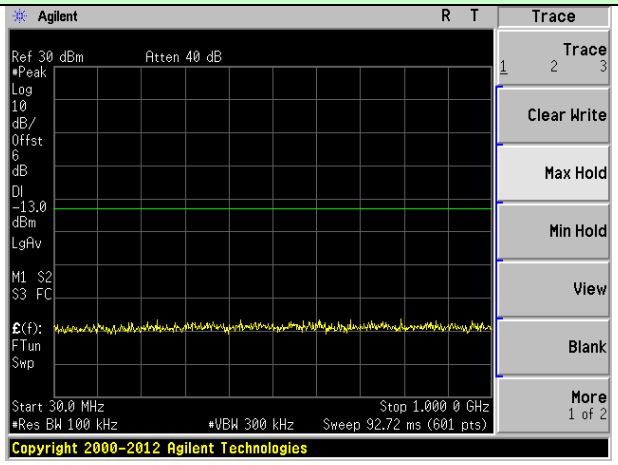
Middle channel

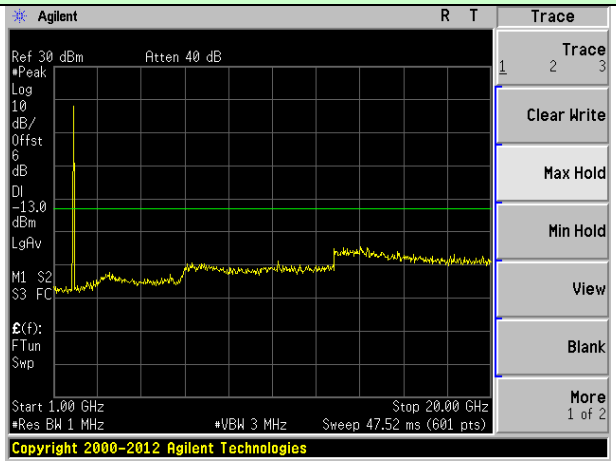




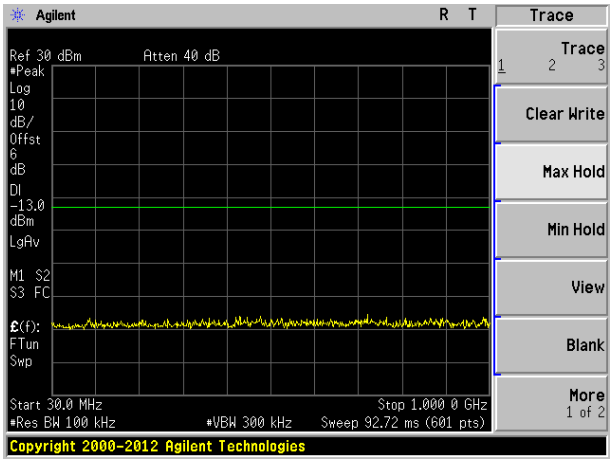
Highest channel

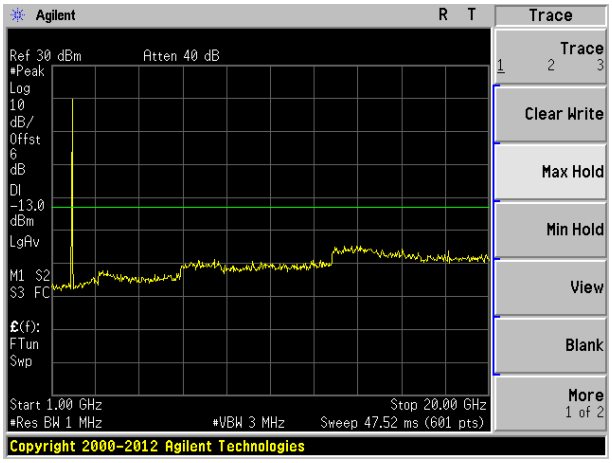
Test Mode: LTE Band 2	Channel Bandwidth: 15MHz



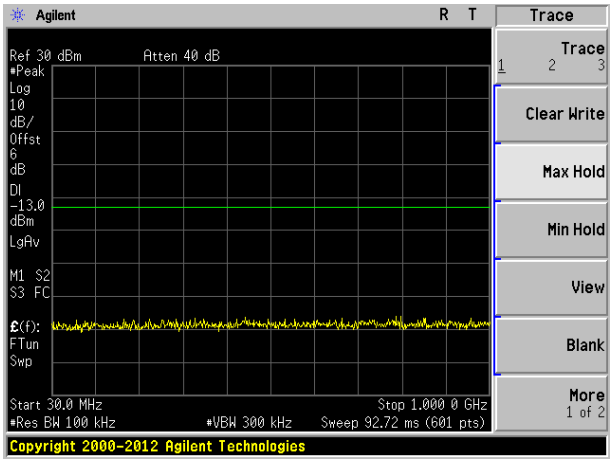


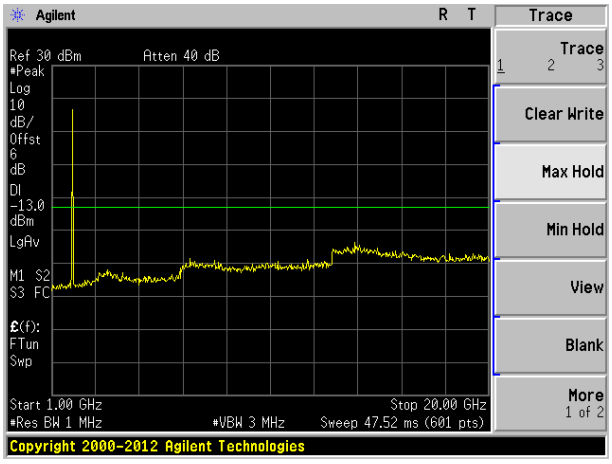
Lowest channel





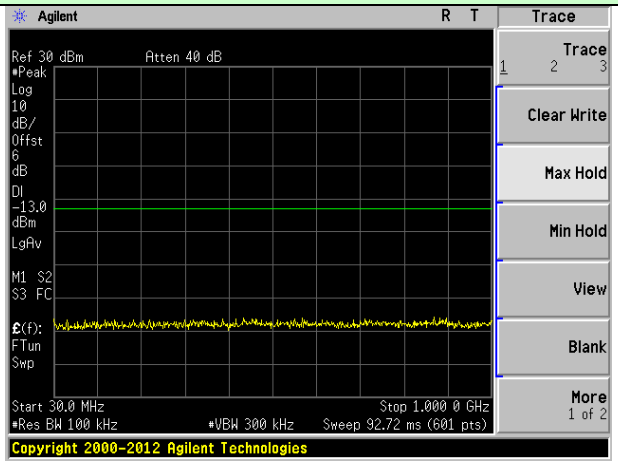
Middle channel

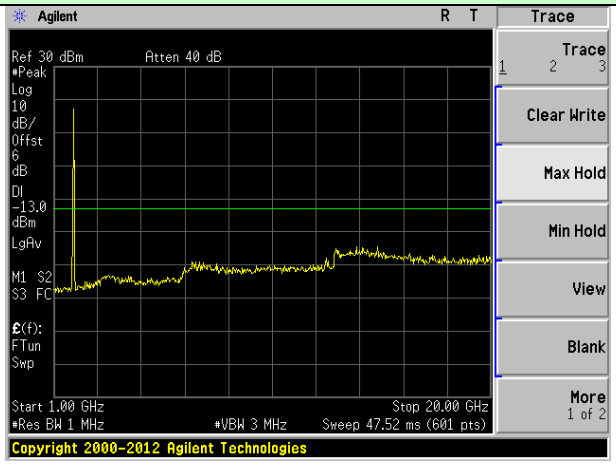




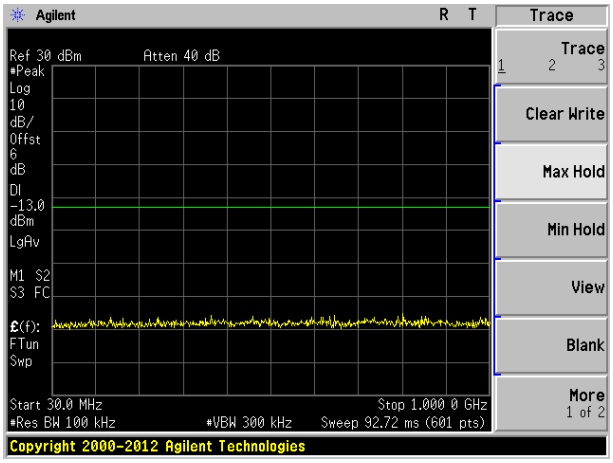
Highest channel

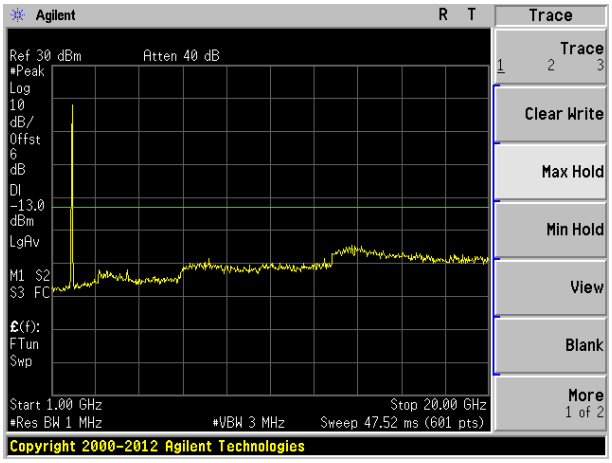
Test Mode: LTE Band 2	Channel Bandwidth: 20MHz



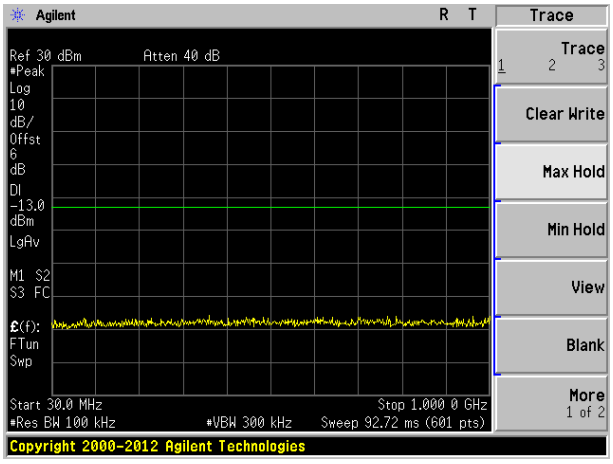


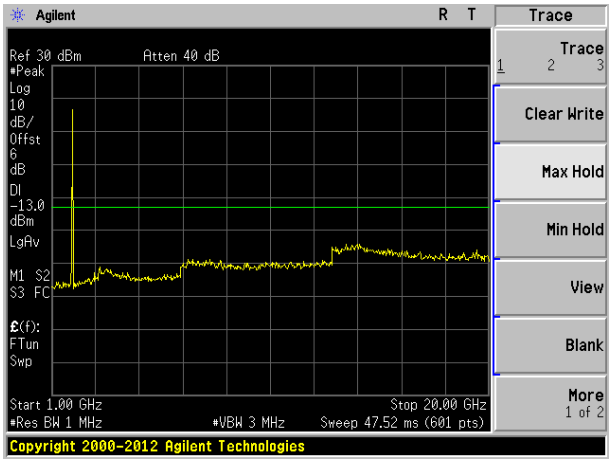
Lowest channel





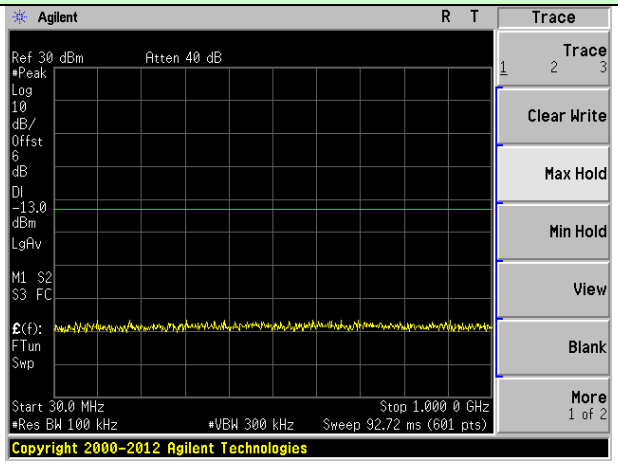
Middle channel

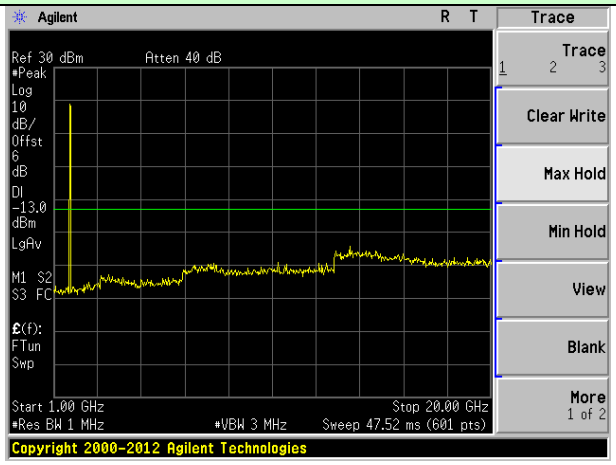




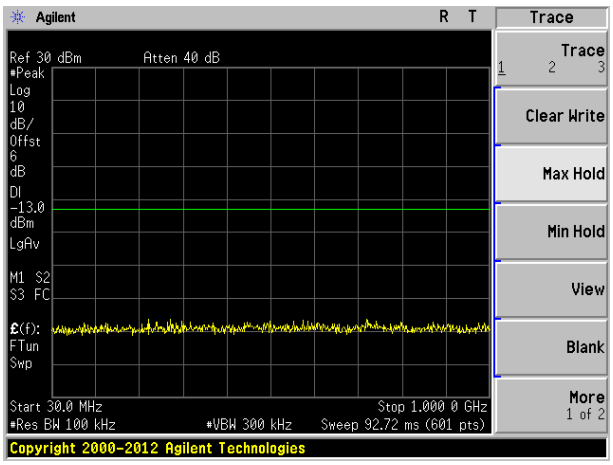
Highest channel

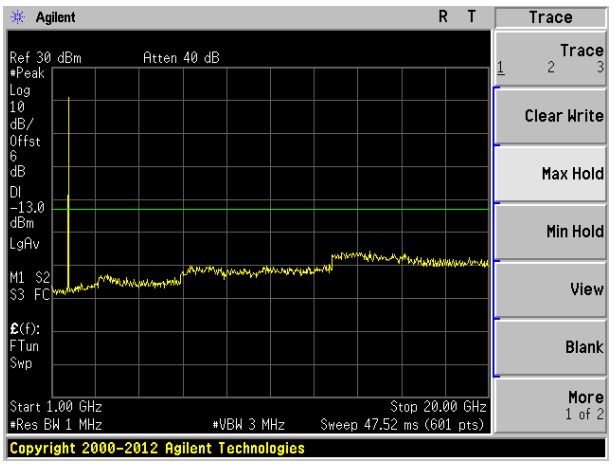
Test Mode: LTE Band 4	Channel Bandwidth: 5MHz



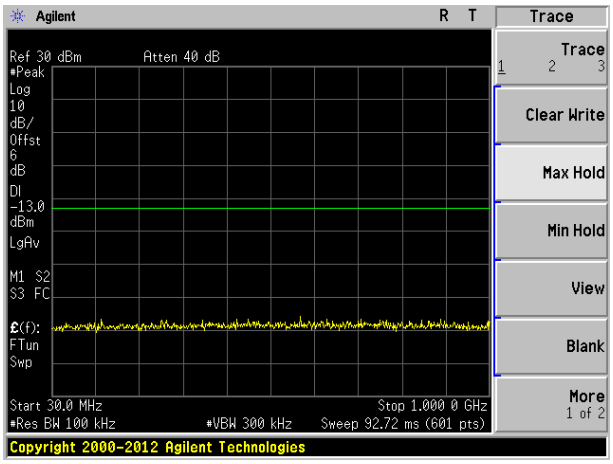


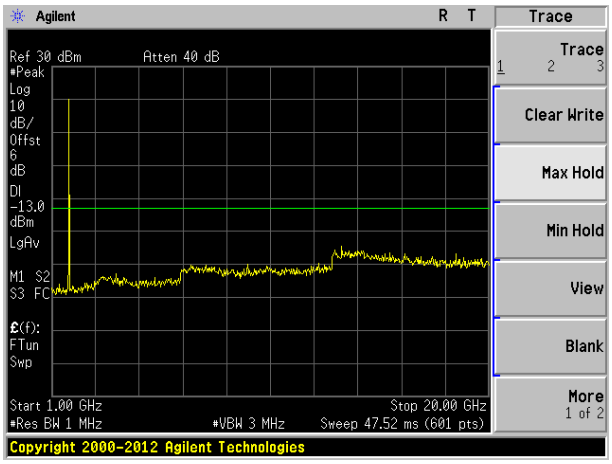
Lowest channel





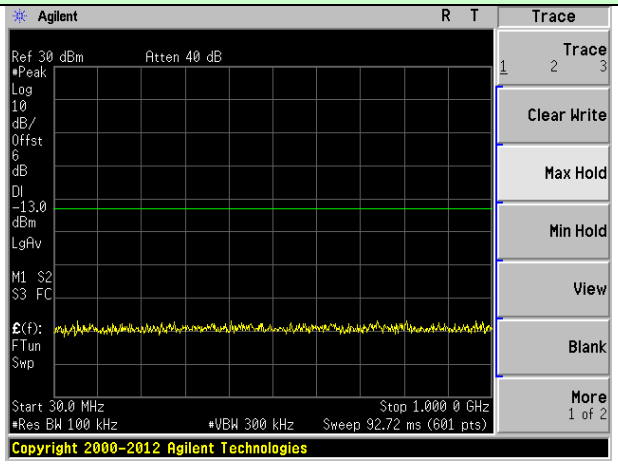
Middle channel

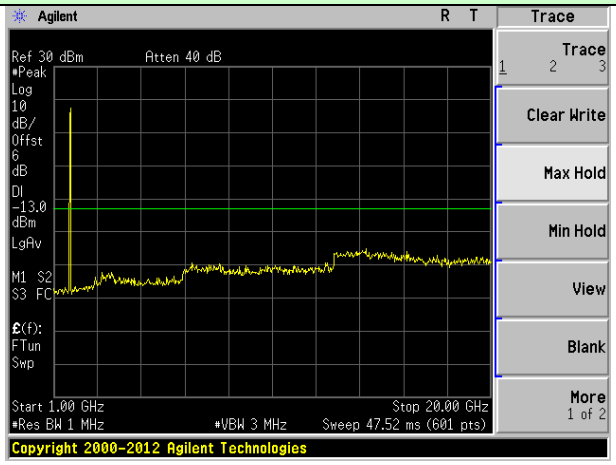




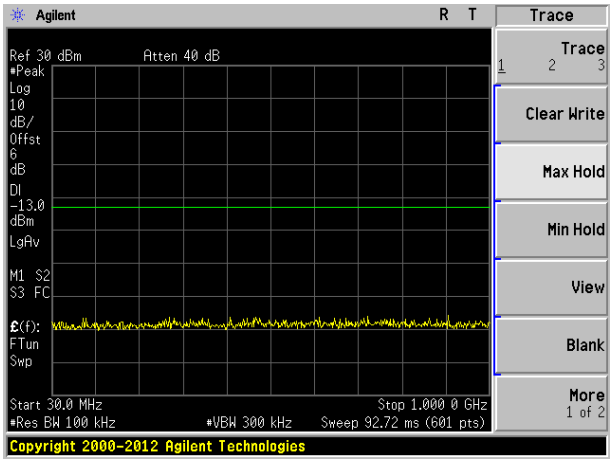
Highest channel

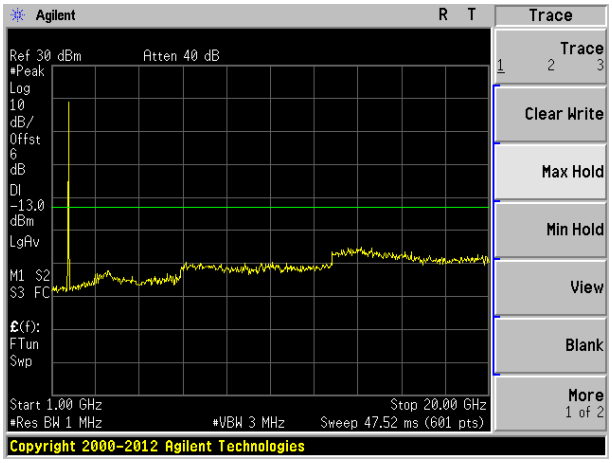
Test Mode: LTE Band 4	Channel Bandwidth: 10MHz



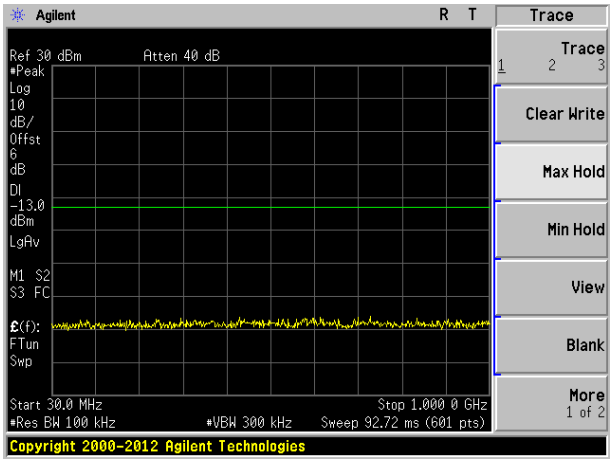


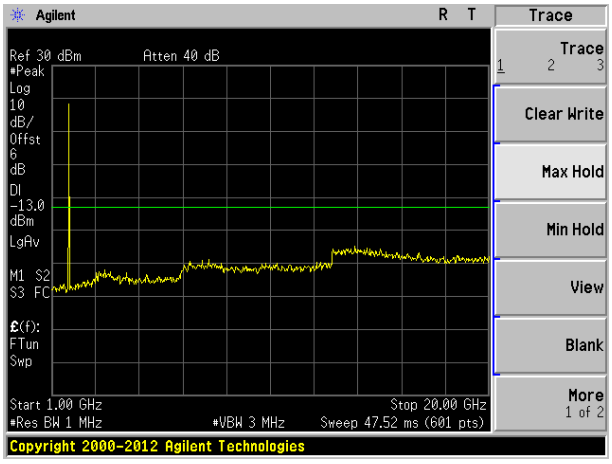
Lowest channel





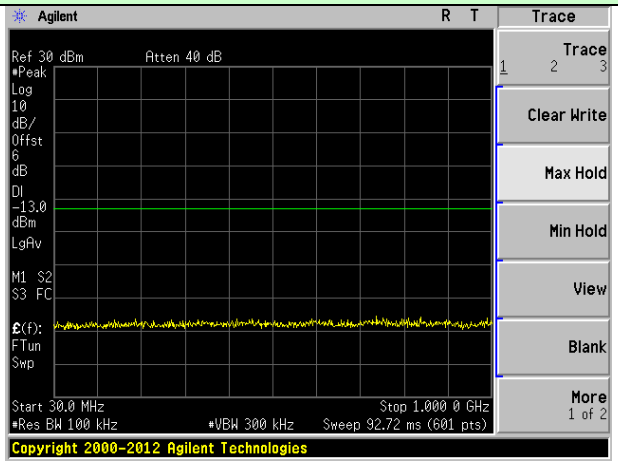
Middle channel

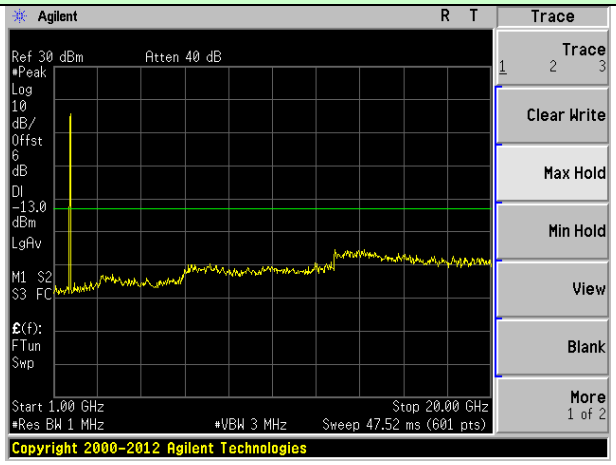




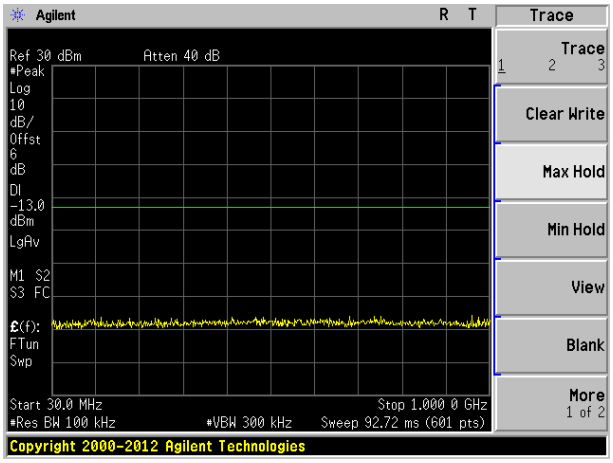
Highest channel

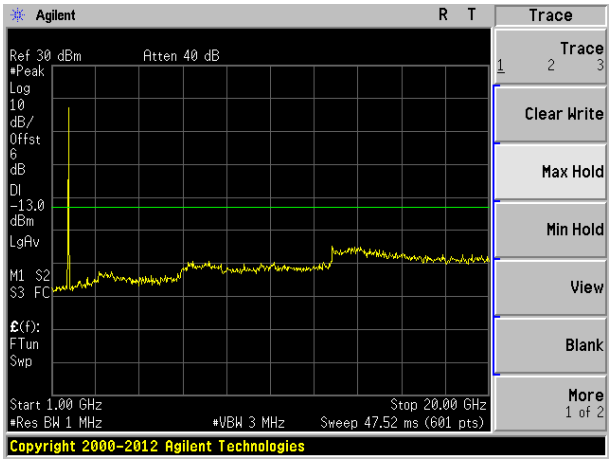
Test Mode: LTE Band 4	Channel Bandwidth: 15MHz



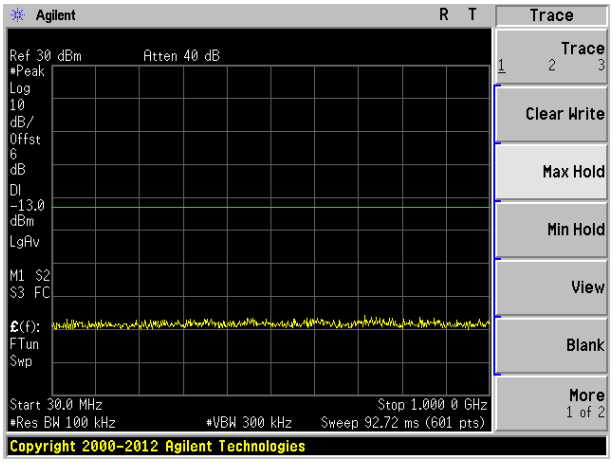


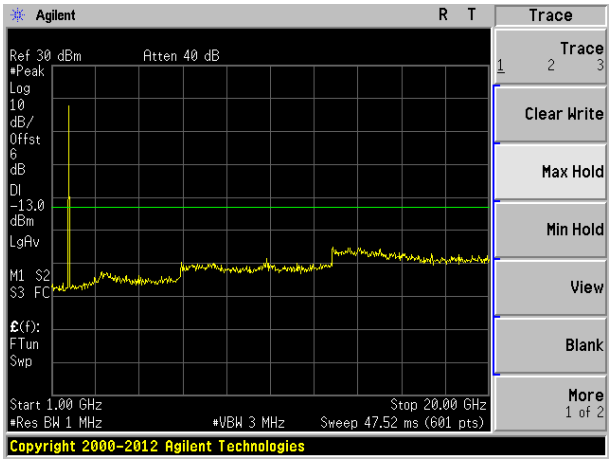
Lowest channel





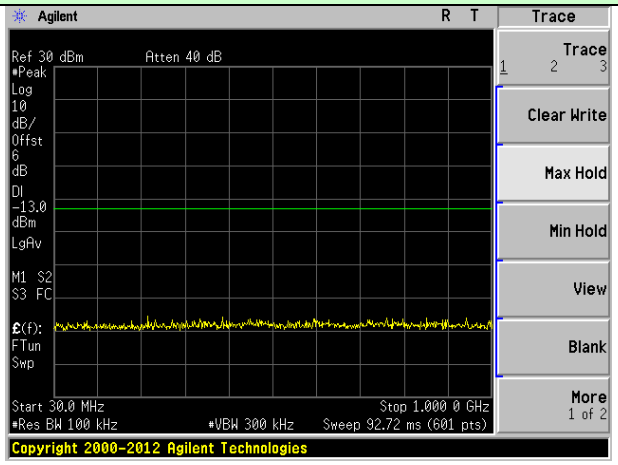
Middle channel

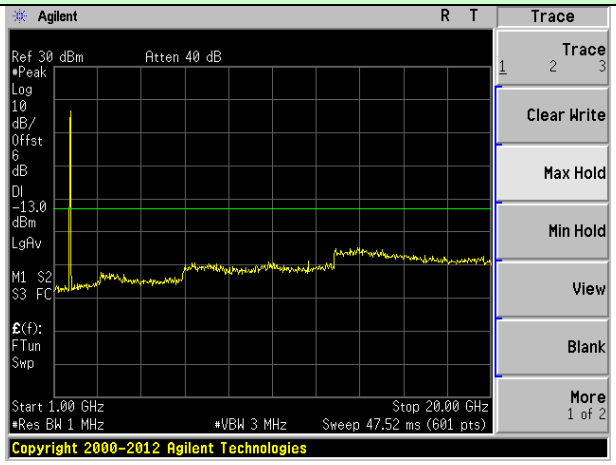




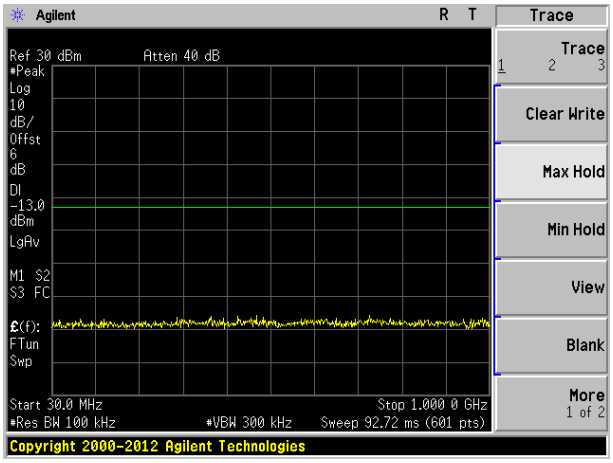
Highest channel

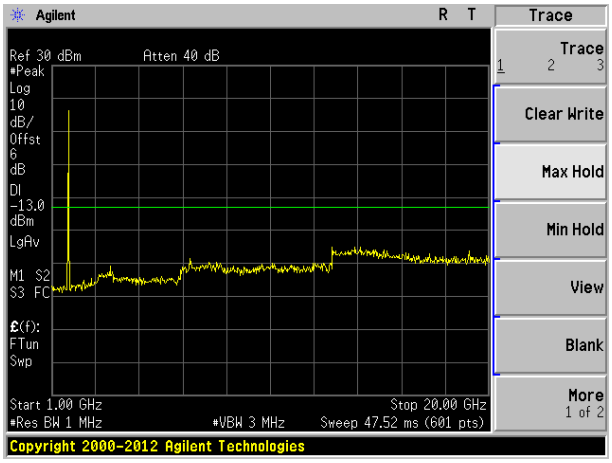
Test Mode: LTE Band 4	Channel Bandwidth: 20MHz



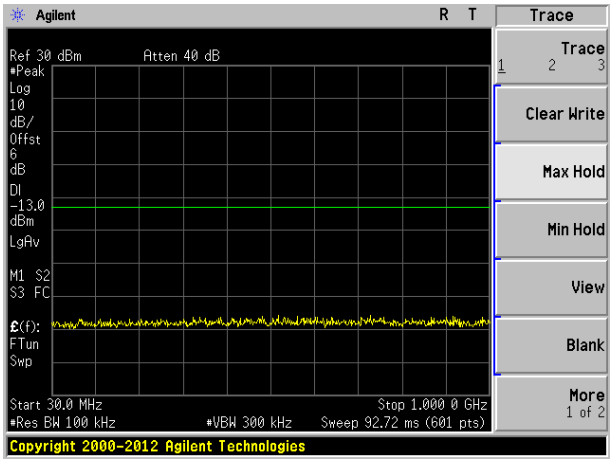


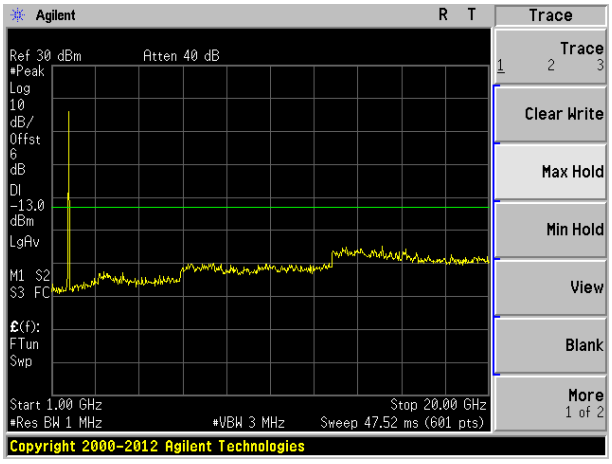
Lowest channel





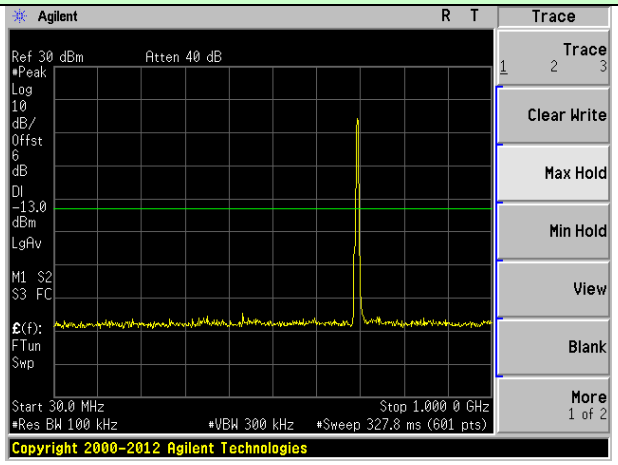
Middle channel

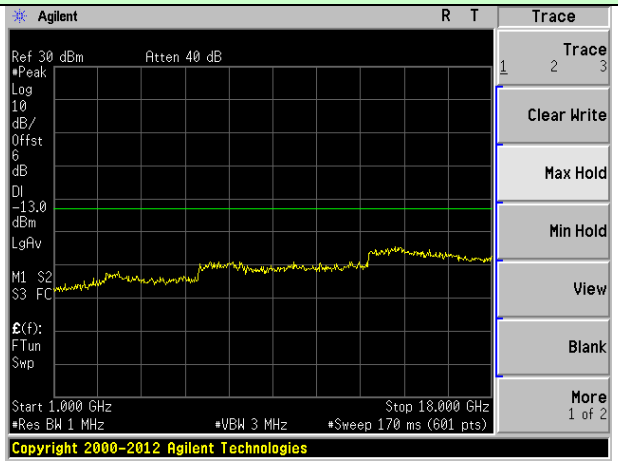




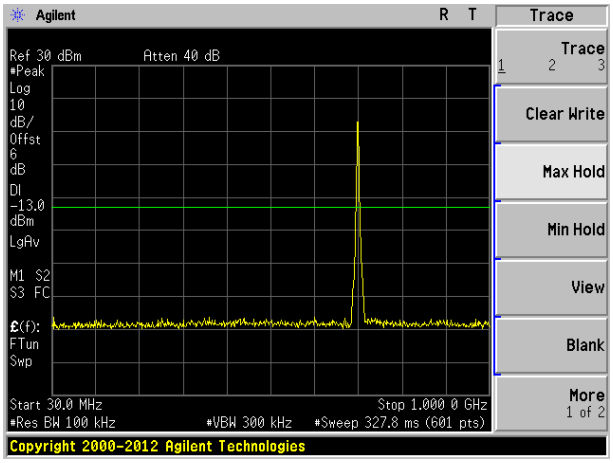
Highest channel

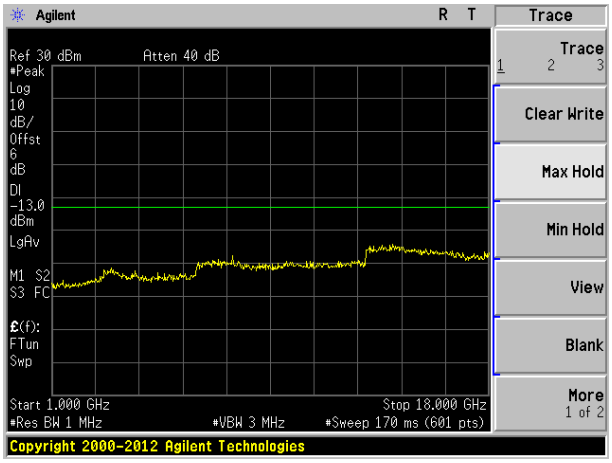
Test Mode: LTE Band 12	Channel Bandwidth: 5MHz



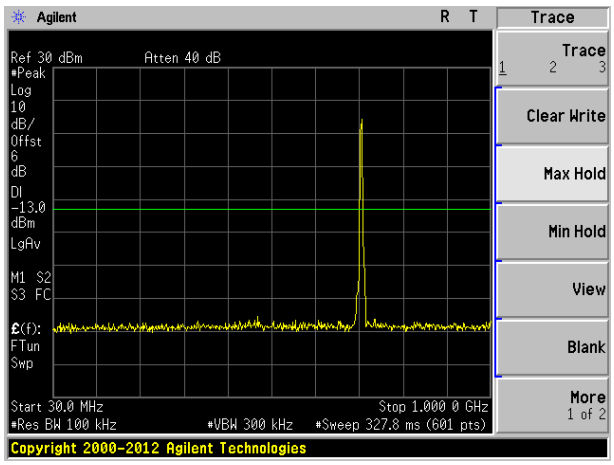


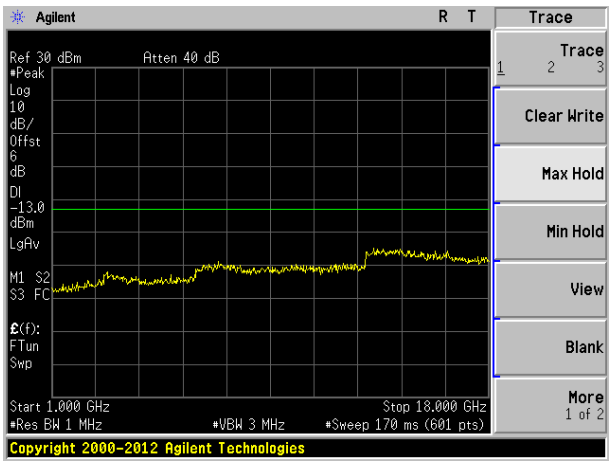
Lowest channel





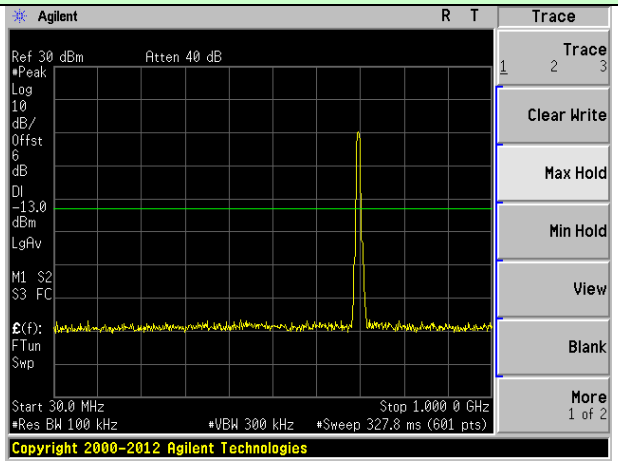
Middle channel

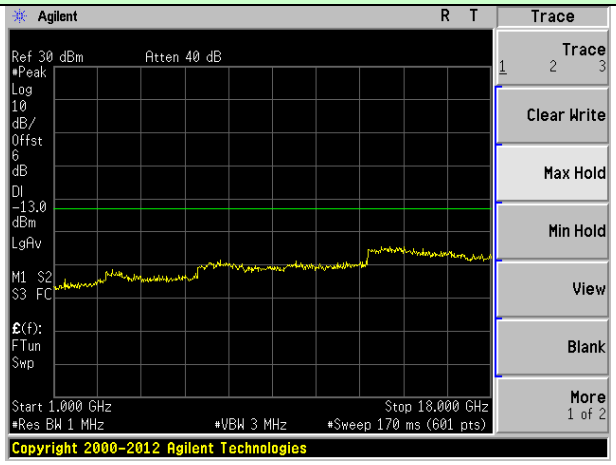




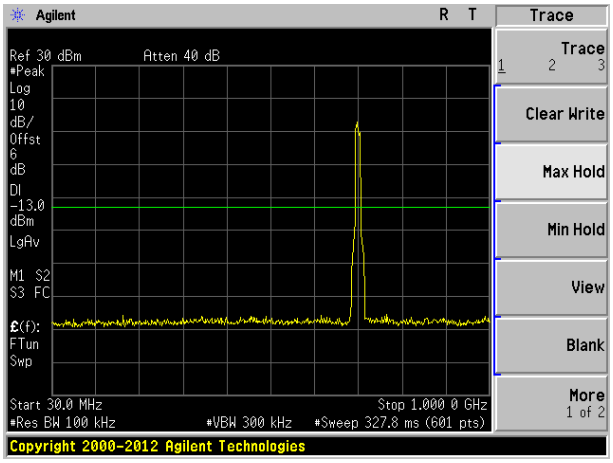
Highest channel

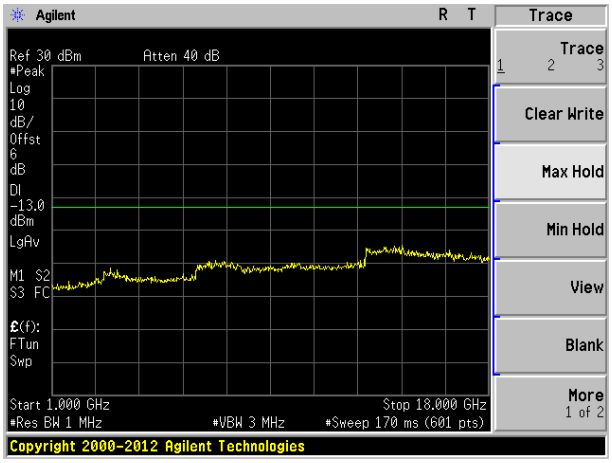
Test Mode: LTE Band 12	Channel Bandwidth: 10MHz



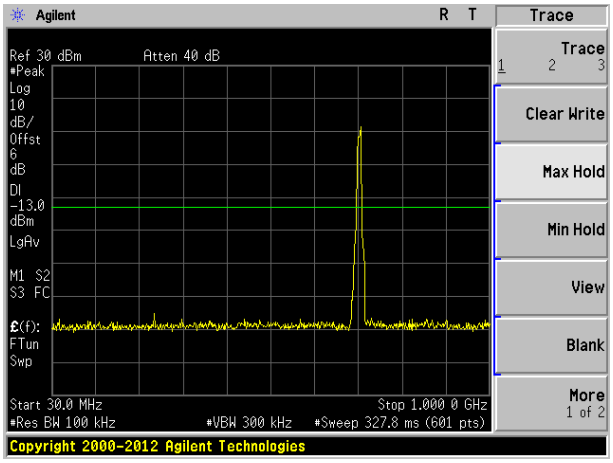


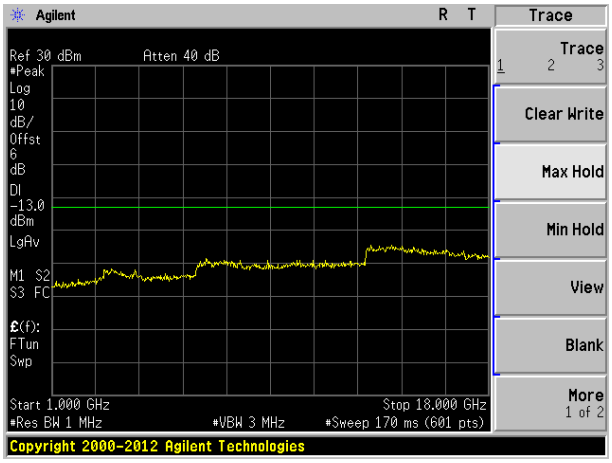
Lowest channel





Middle channel

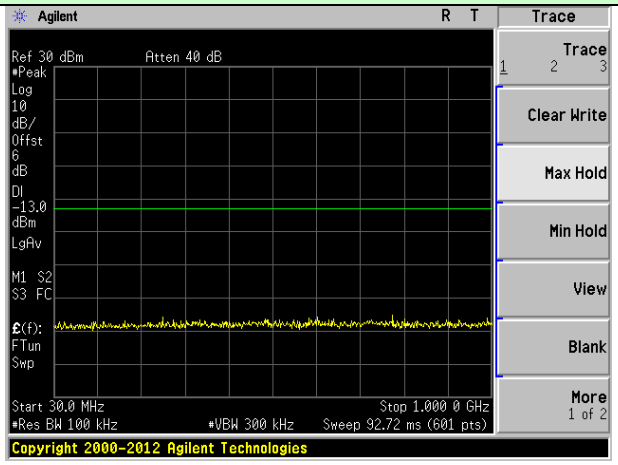


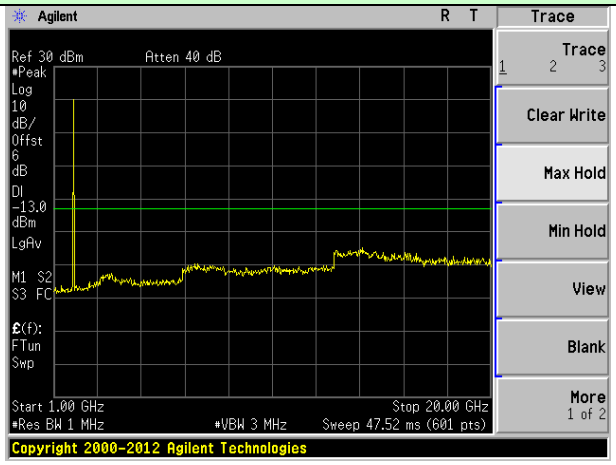


Highest channel

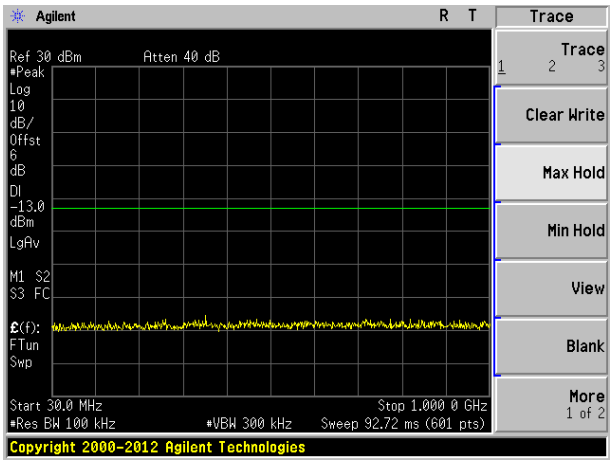
16QAM mode:

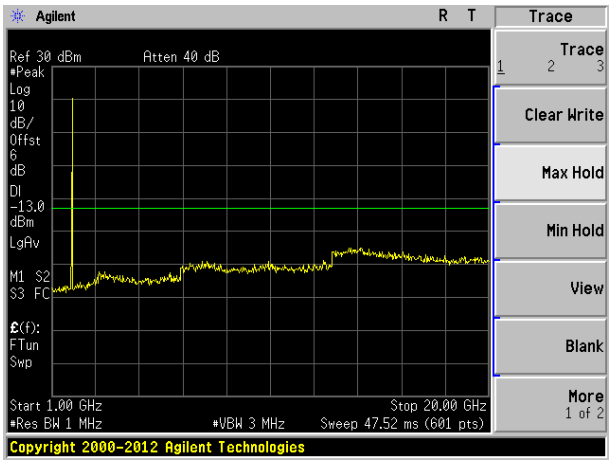
Test Mode: LTE Band 2	Channel Bandwidth: 5MHz



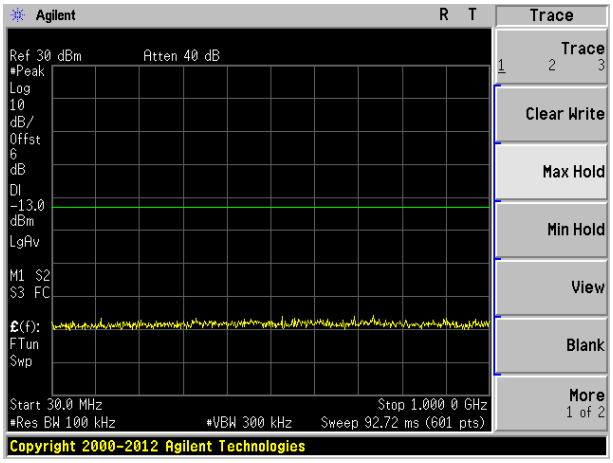


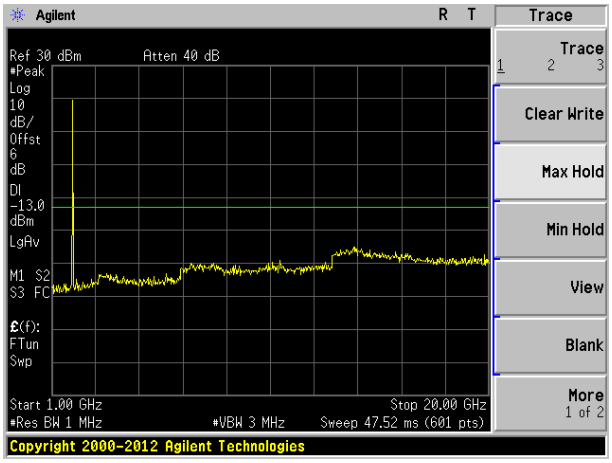
Lowest channel





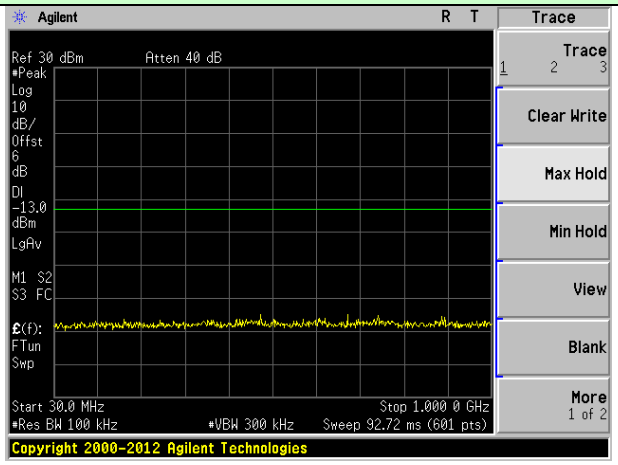
Middle channel

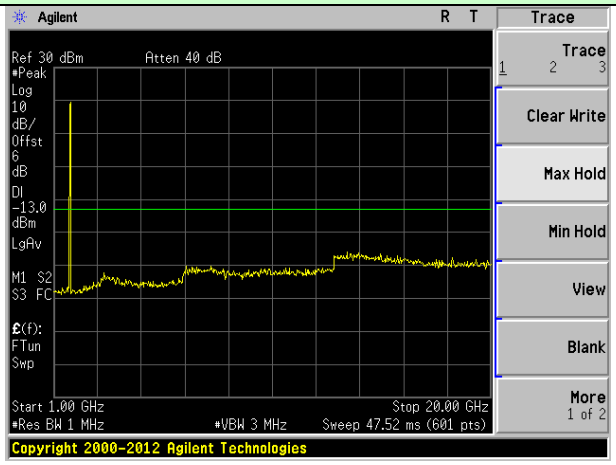




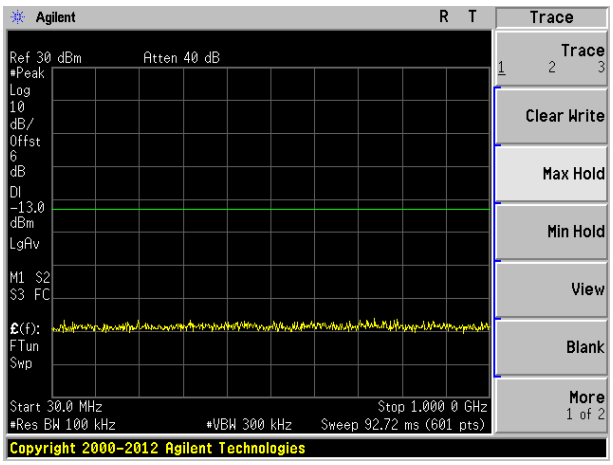
Highest channel

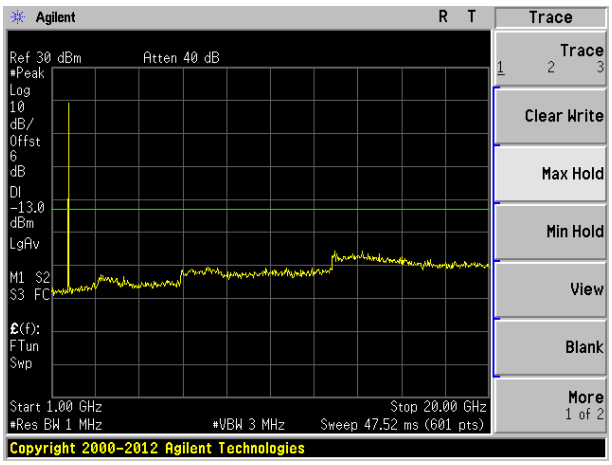
Test Mode: LTE Band 4	Channel Bandwidth: 5MHz



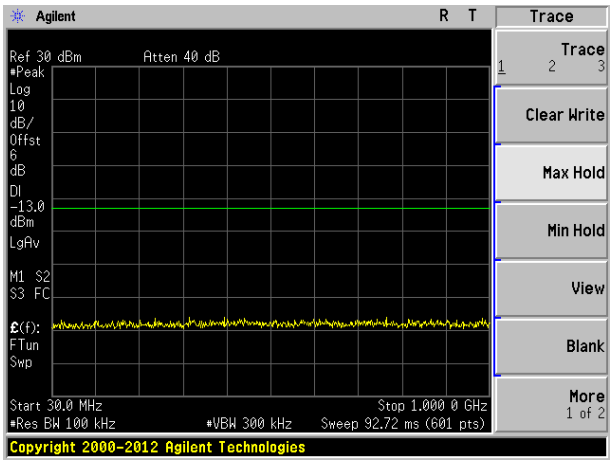


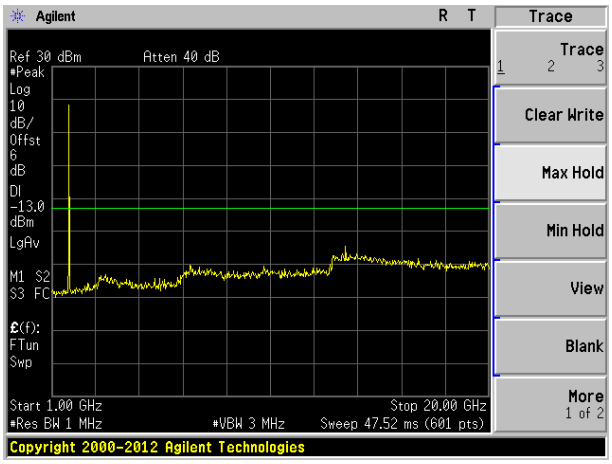
Lowest channel





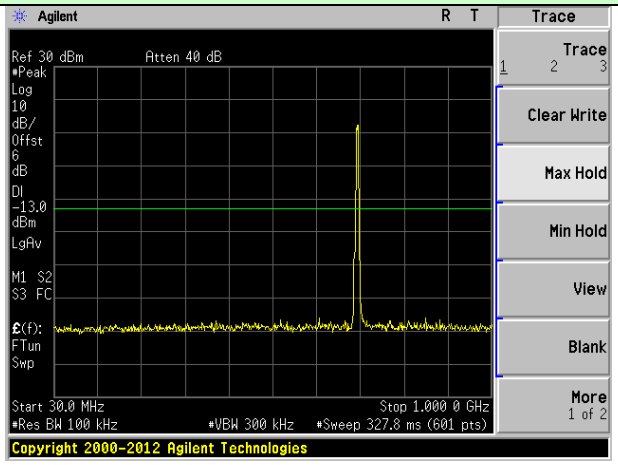
Middle channel

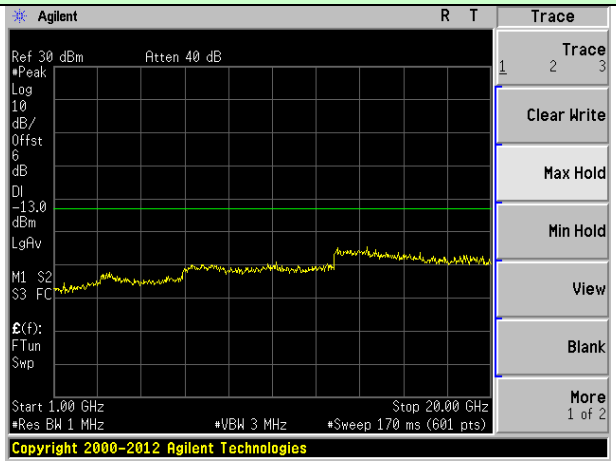




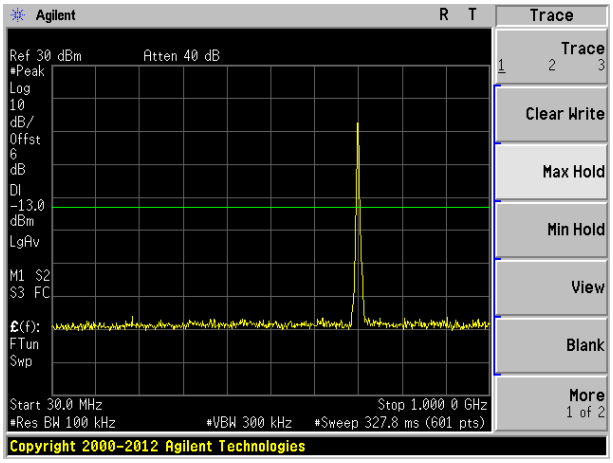
Highest channel

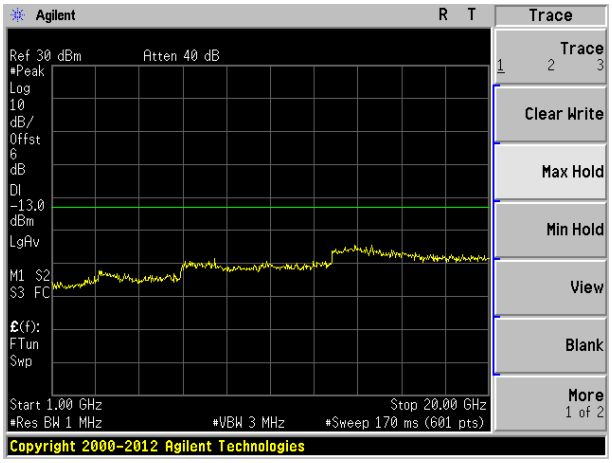
Test Mode: LTE Band 12	Channel Bandwidth: 5MHz



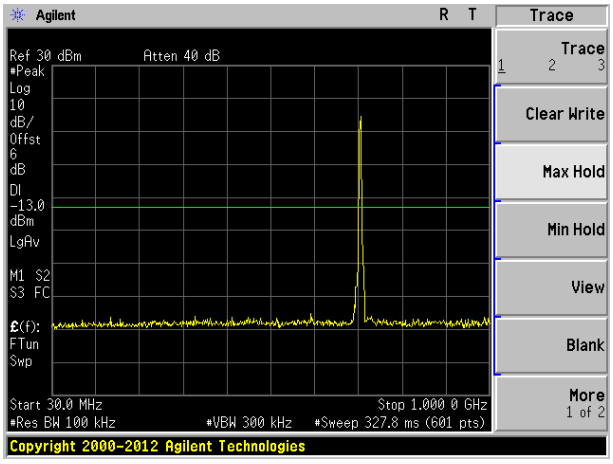


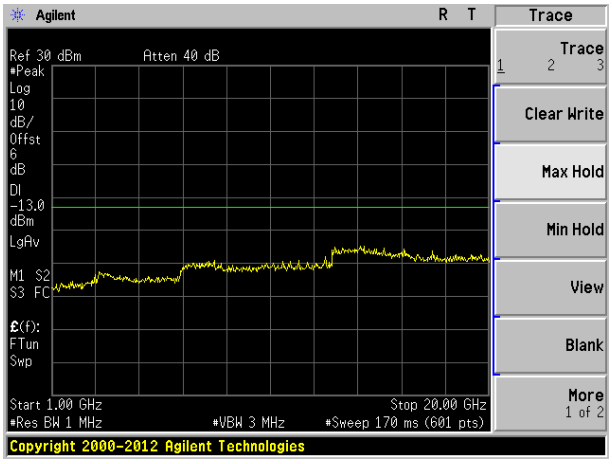
Lowest channel





Middle channel



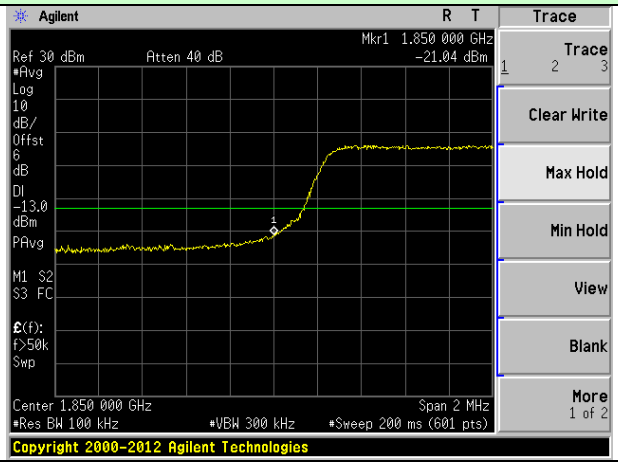


Highest channel

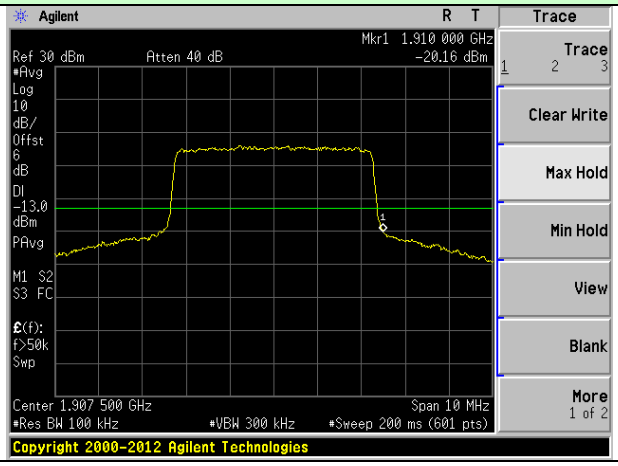
Band Edge:

QPSK mode:

Test Mode: LTE Band 2	Channel Bandwidth: 5MHz

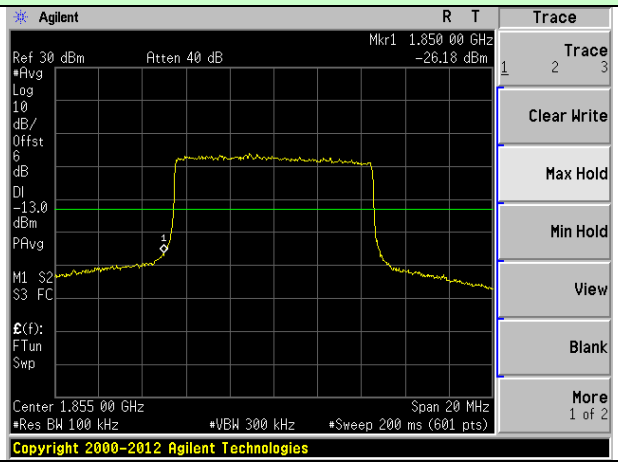


Lowest channel

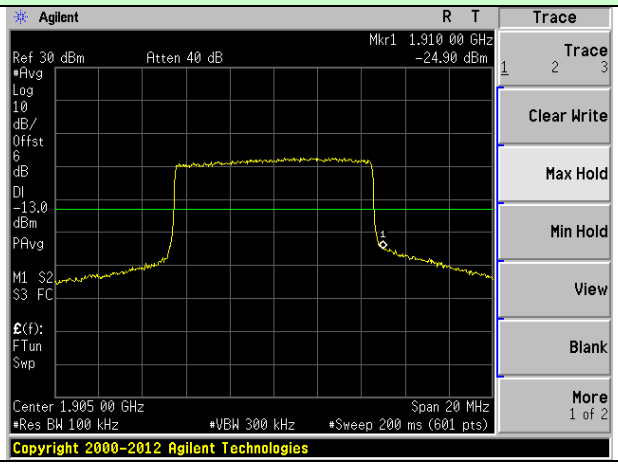


Highest channel

Test Mode: LTE Band 2	Channel Bandwidth: 10MHz

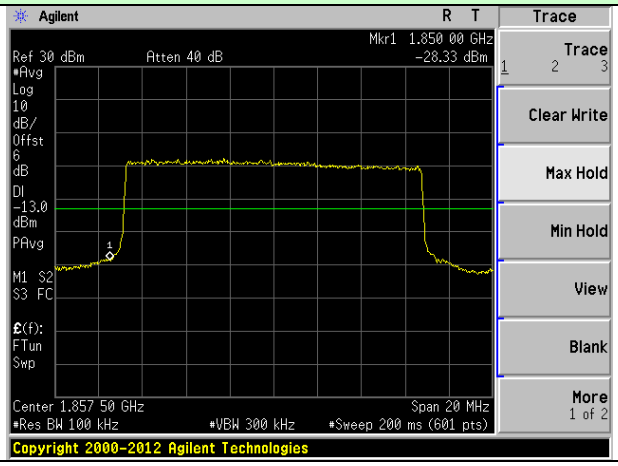


Lowest channel

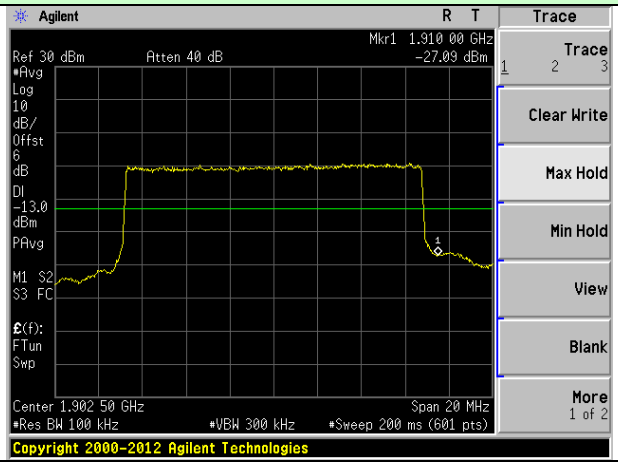


Highest channel

Test Mode: LTE Band 2	Channel Bandwidth: 15MHz

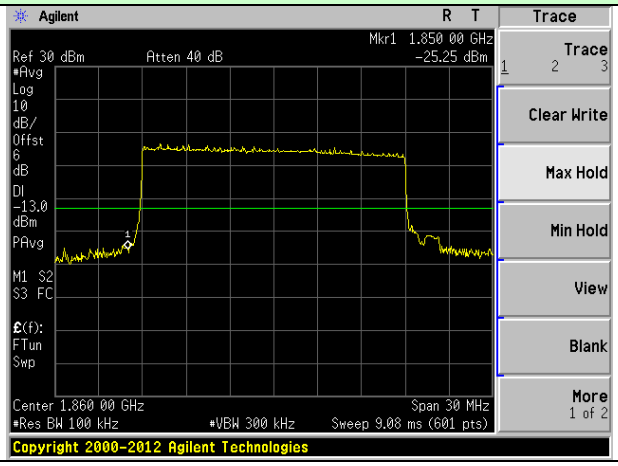


Lowest channel

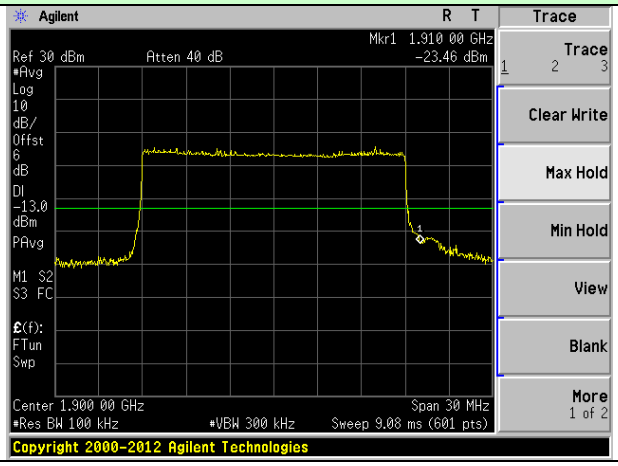


Highest channel

Test Mode: LTE Band 2	Channel Bandwidth: 20MHz

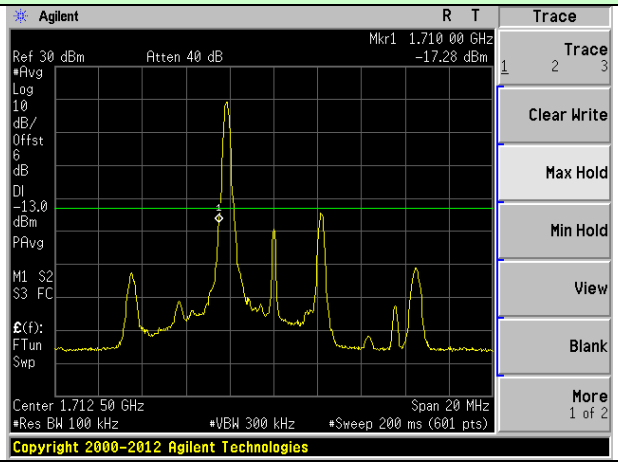
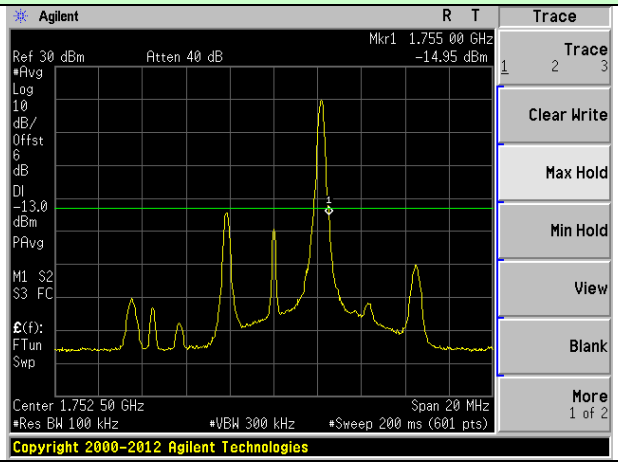


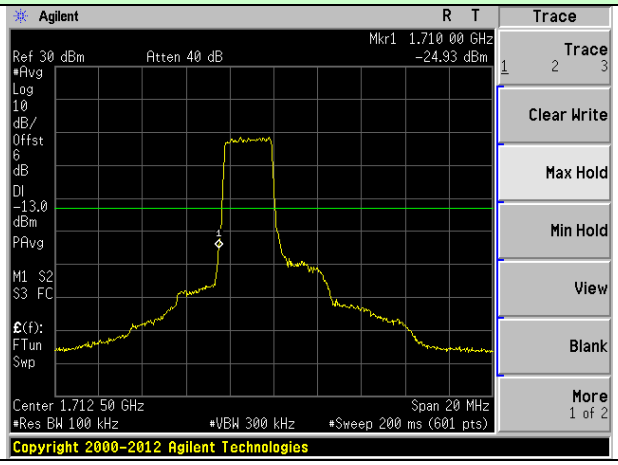
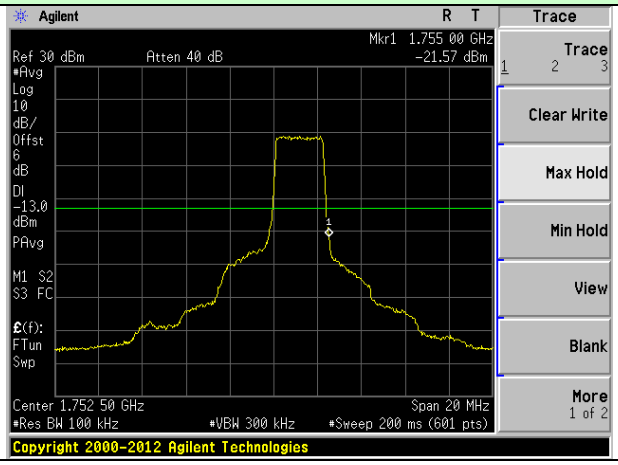
Lowest channel

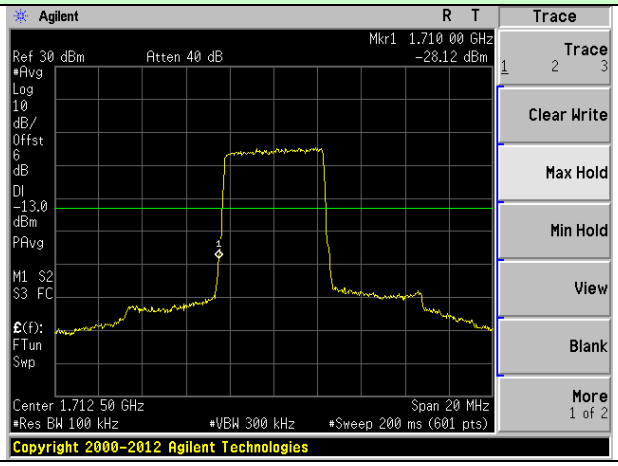
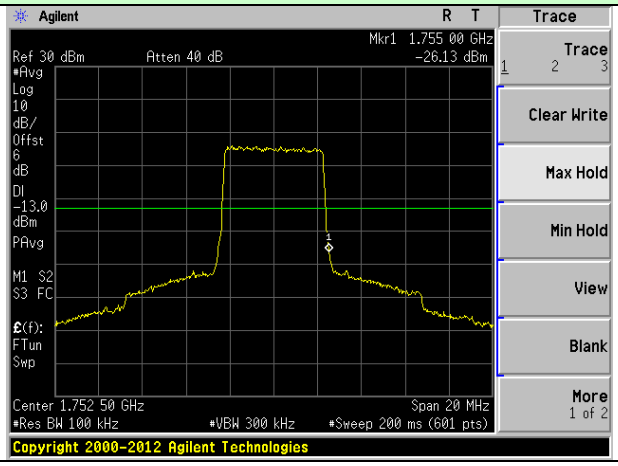


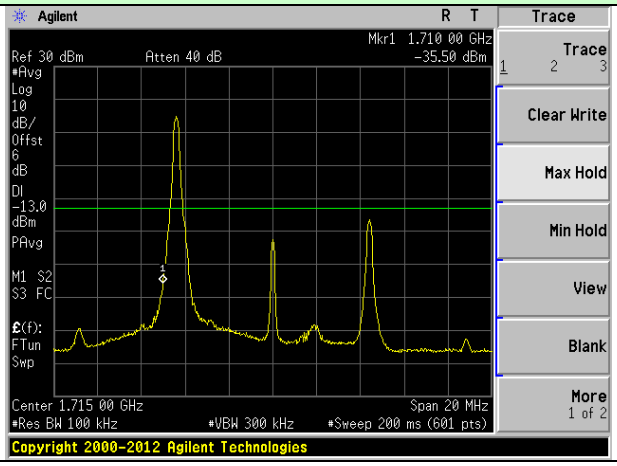
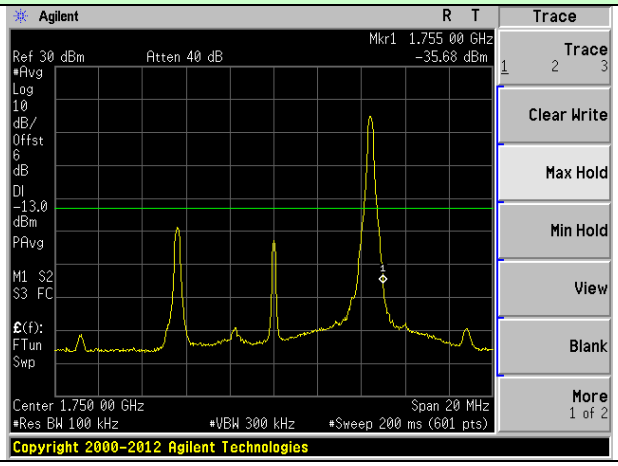
Highest channel

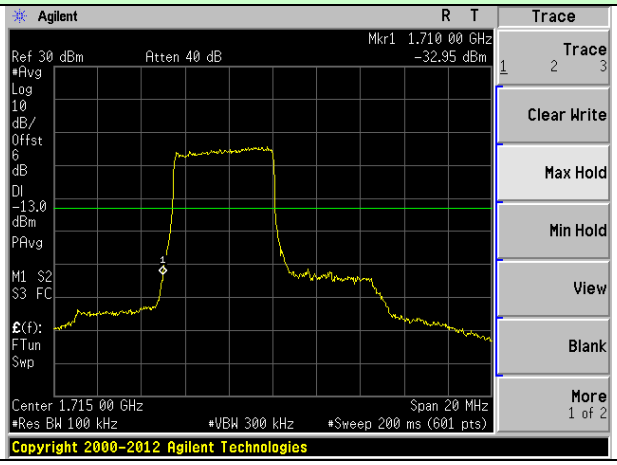
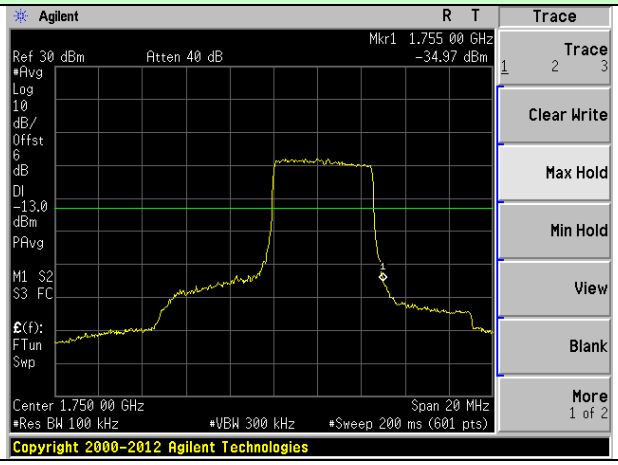
LTE Band 4

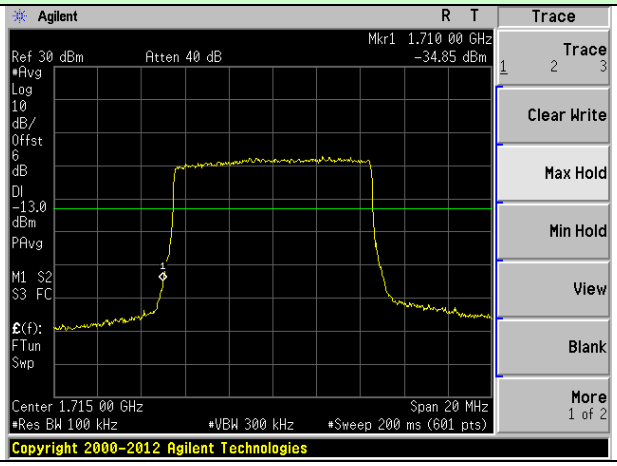
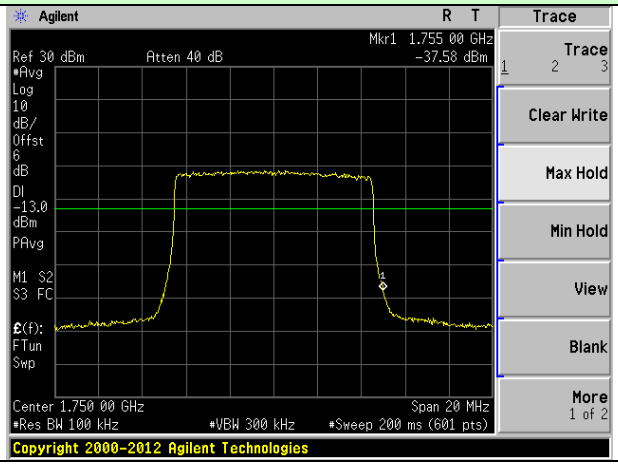
5MHz Bandwidth (RB size:1# RB offset:0#)	5MHz Bandwidth (RB size:1# RB offset:24#)
	
Lowest channel	Highest channel

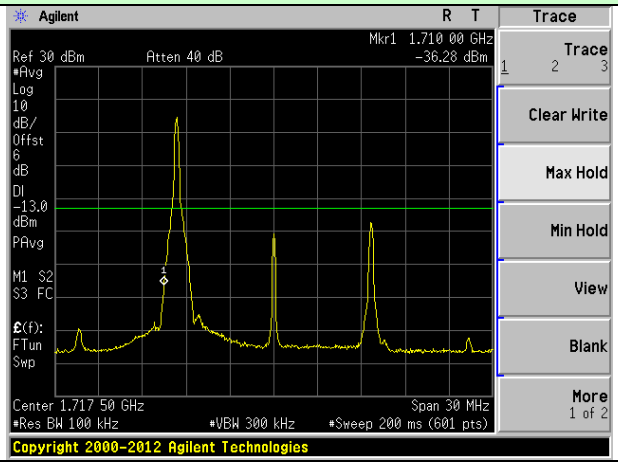
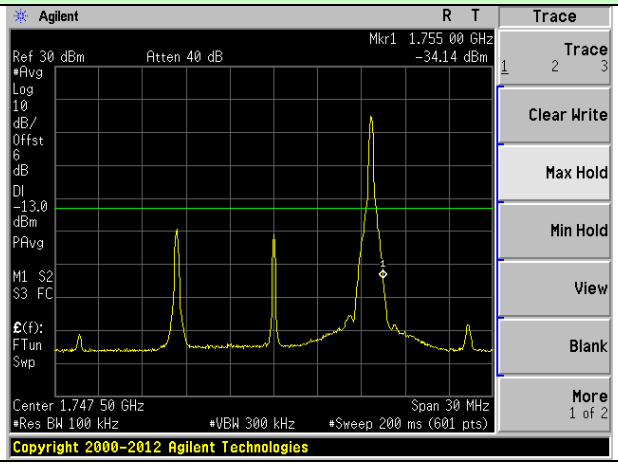
5MHz Bandwidth (RB size:12# RB offset:0#)	5MHz Bandwidth (RB size:12# RB offset:13#)
	
Lowest channel	Highest channel

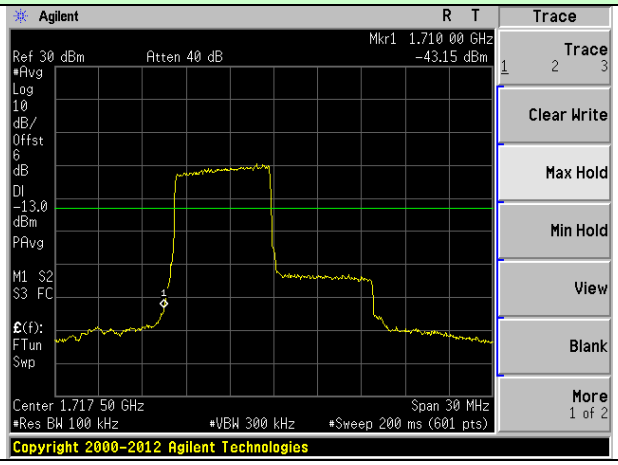
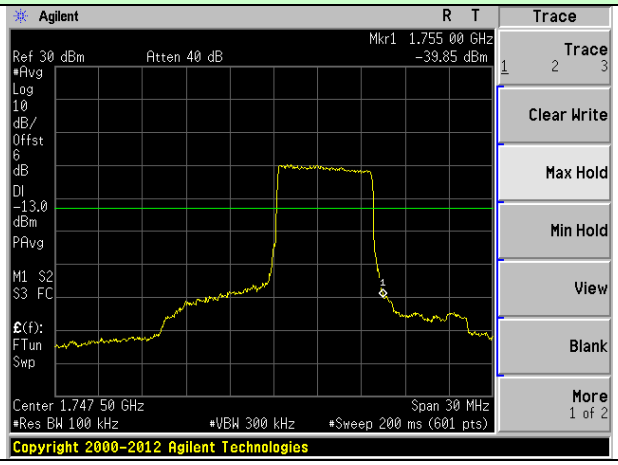
5MHz Bandwidth (RB size:25# RB offset:0#)	5MHz Bandwidth (RB size:25# RB offset:0#)
	
Lowest channel	Highest channel

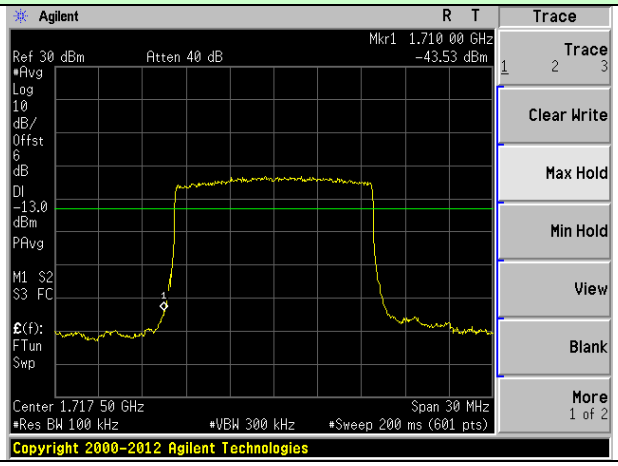
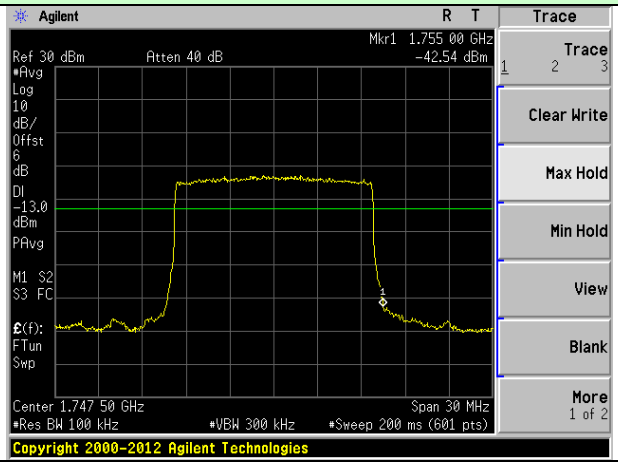
10MHz Bandwidth (RB size:1# RB offset:0#)	10MHz Bandwidth (RB size:1# RB offset:49#)
	
Lowest channel	Highest channel

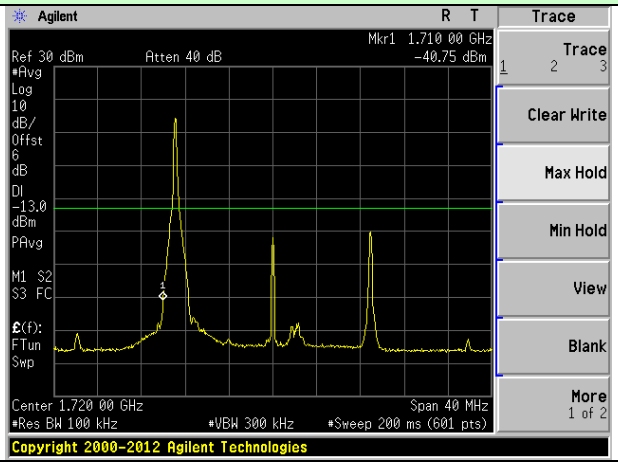
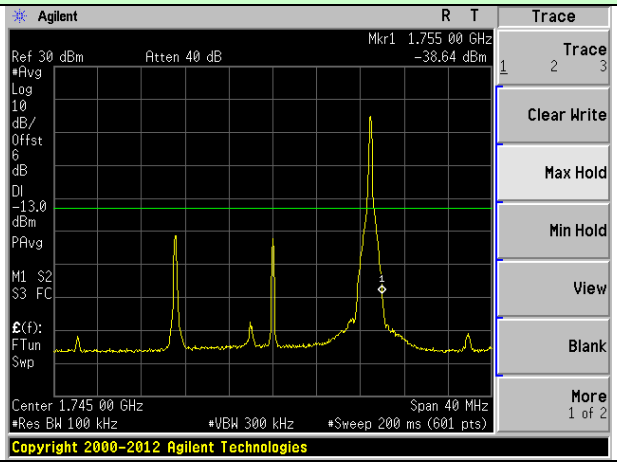
10MHz Bandwidth (RB size:25# RB offset:0#)	10MHz Bandwidth (RB size:25# RB offset:25#)
	
Lowest channel	Highest channel

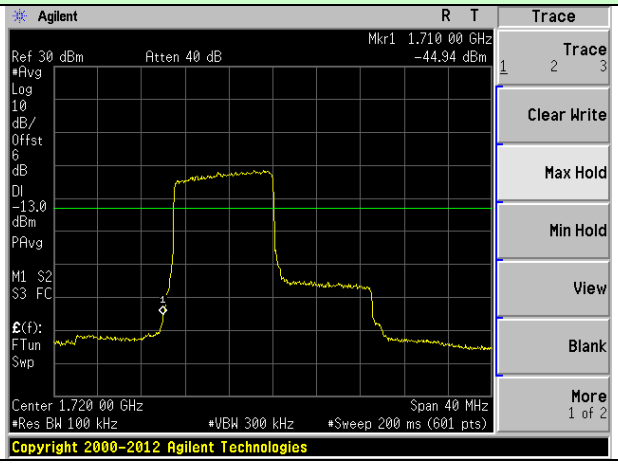
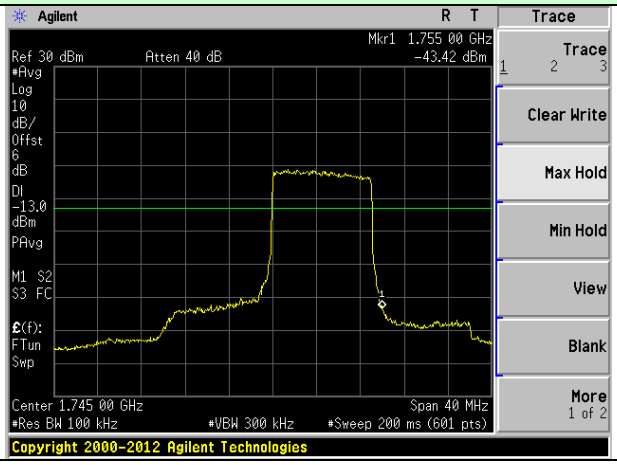
10MHz Bandwidth (RB size:50# RB offset:0#)	10MHz Bandwidth (RB size:50# RB offset:0#)
	
Lowest channel	Highest channel

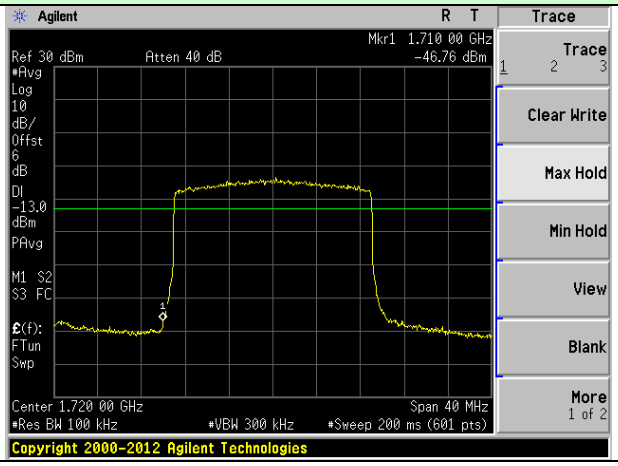
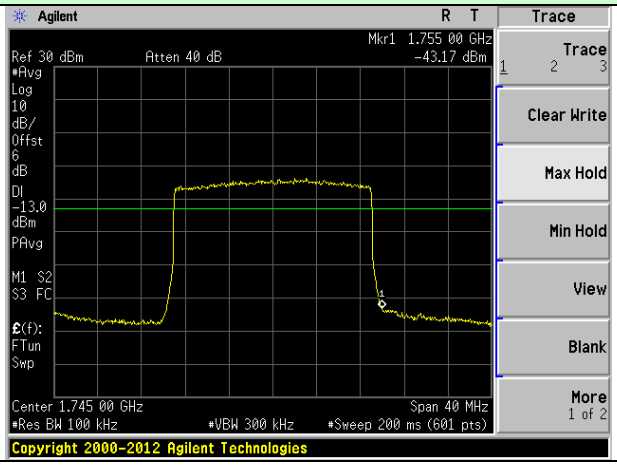
15MHz Bandwidth (RB size:1# RB offset:0#)	15MHz Bandwidth (RB size:1# RB offset:74#)
	
Lowest channel	Highest channel

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

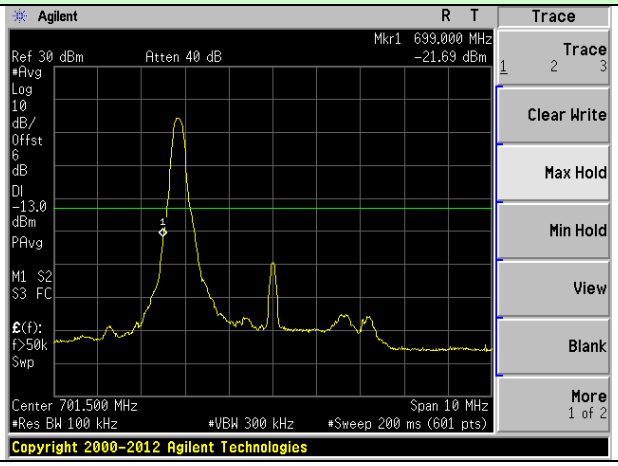
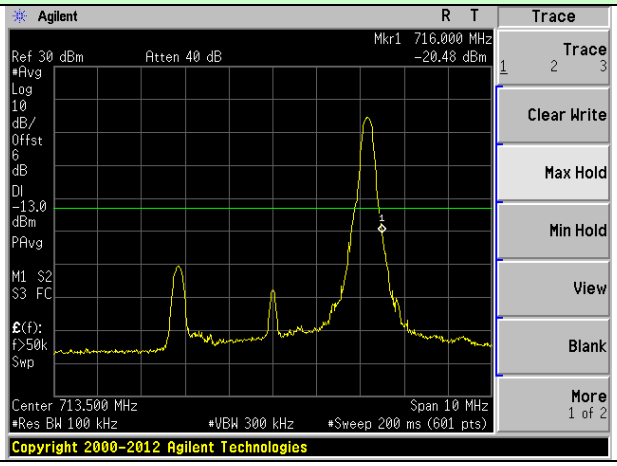
15MHz Bandwidth (RB size:75# RB offset:0#)	15MHz Bandwidth (RB size:75# RB offset:0#)
	
Lowest channel	Highest channel

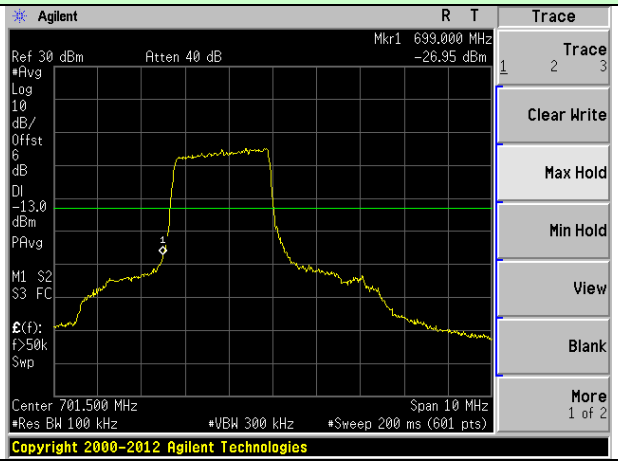
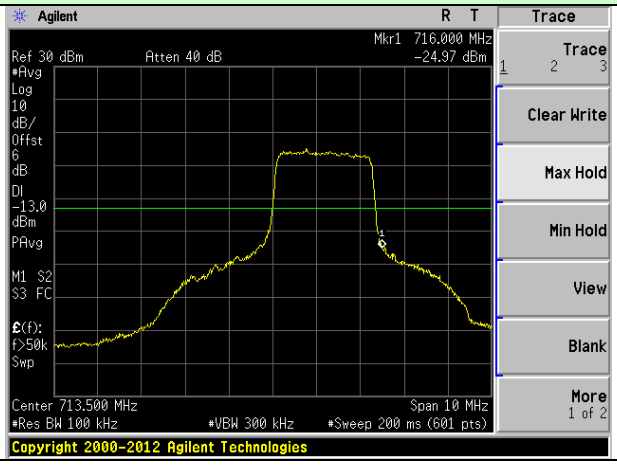
20MHz Bandwidth (RB size:1# RB offset:0#)	20MHz Bandwidth (RB size:1# RB offset:99#)
	
Lowest channel	Highest channel

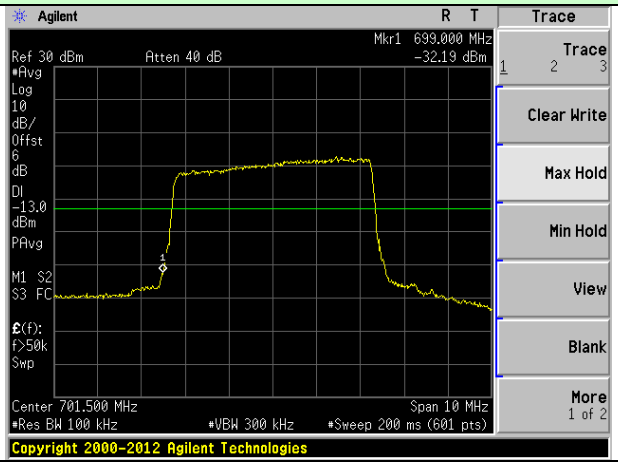
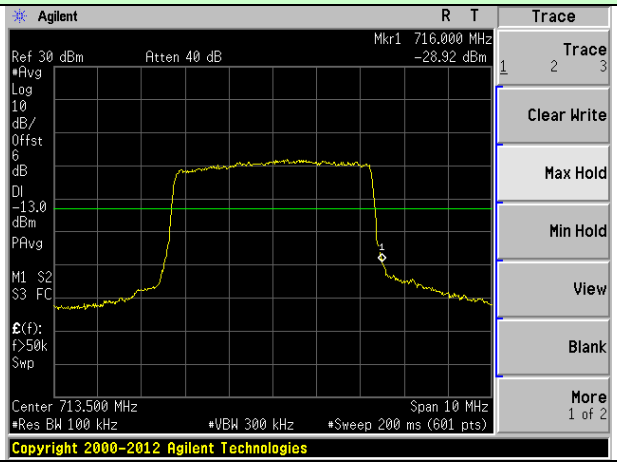
20MHz Bandwidth (RB size:50# RB offset:0#)	20MHz Bandwidth (RB size:50# RB offset:50#)
	
Lowest channel	Highest channel

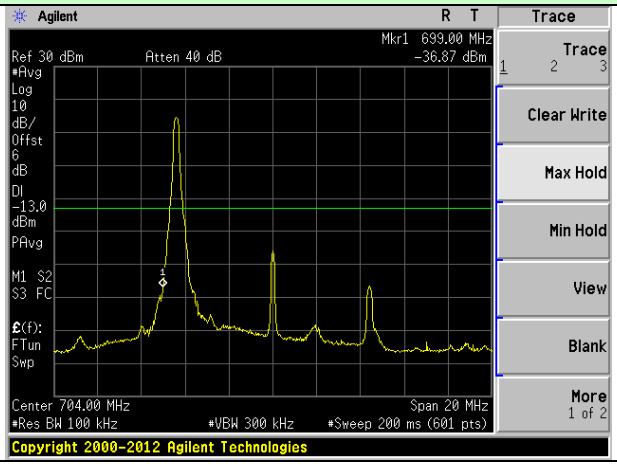
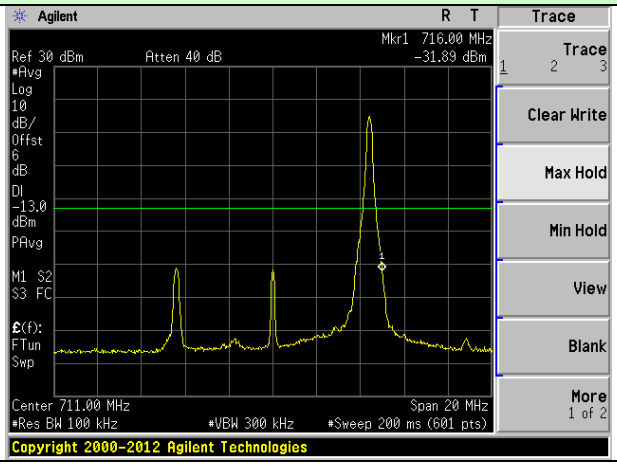
20MHz Bandwidth (RB size:100# RB offset:0#)	20MHz Bandwidth (RB size:100# RB offset:0#)
	
Lowest channel	Highest channel

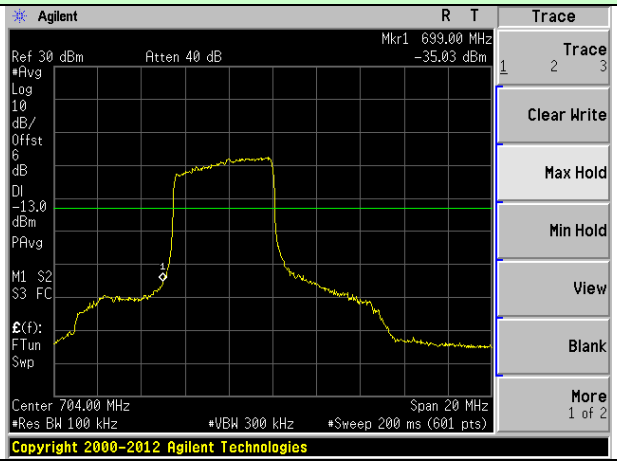
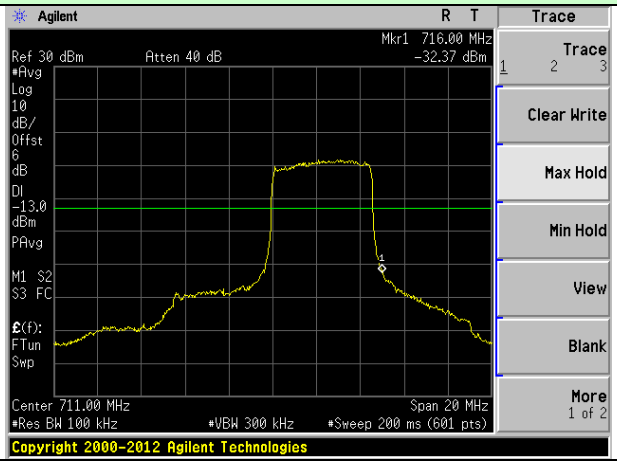
LTE Band 12(QPSK mode):

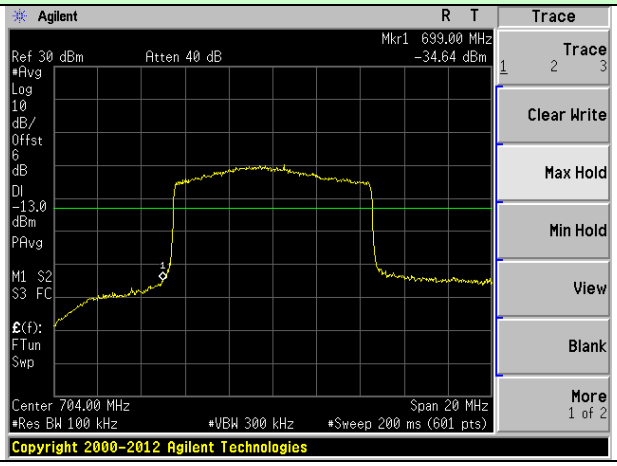
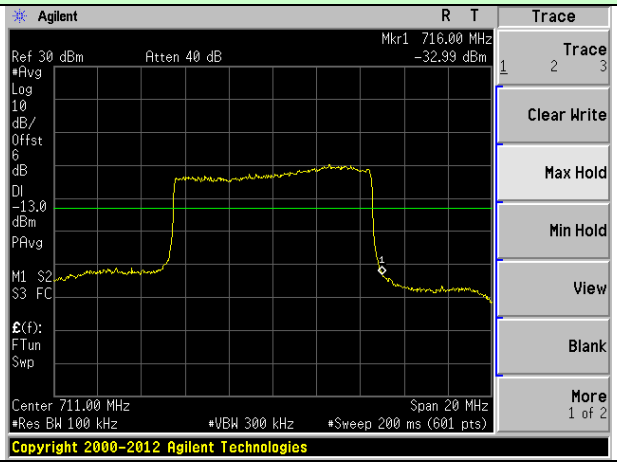
5MHz Bandwidth (RB size:1# RB offset:0#)	5MHz Bandwidth (RB size:1# RB offset:24#)
	
Lowest channel	Highest channel

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

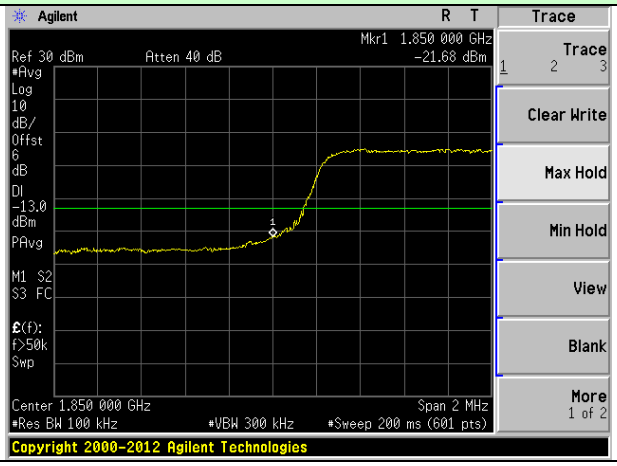
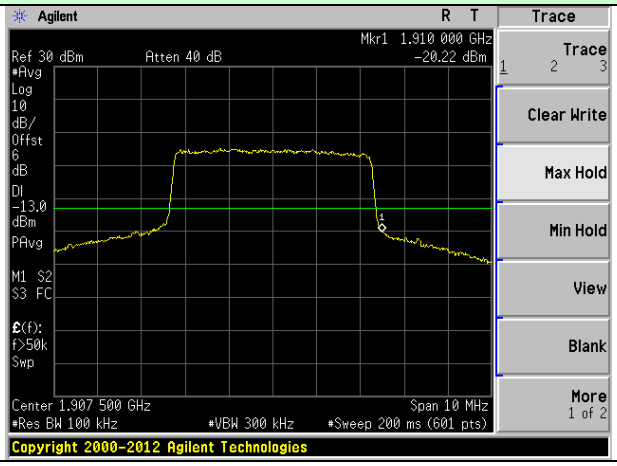
5MHz Bandwidth (RB size:25# RB offset:0#)	5MHz Bandwidth (RB size:25# RB offset:0#)
	
Lowest channel	Highest channel

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

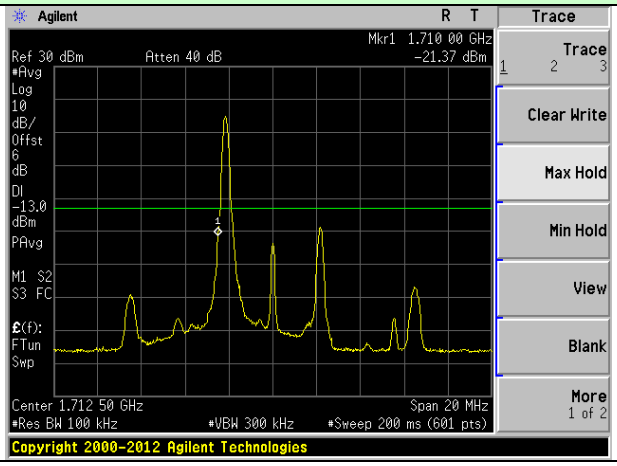
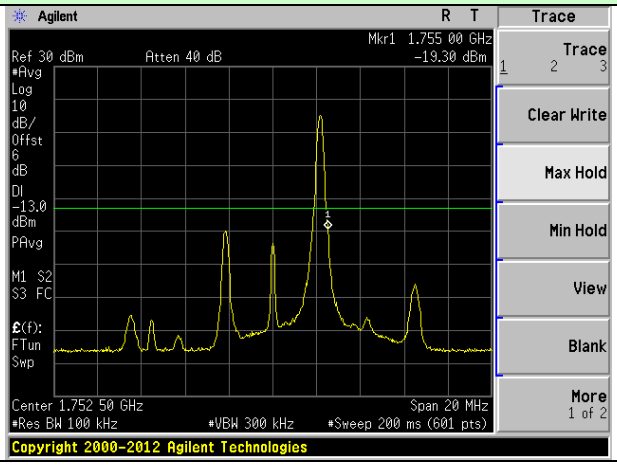
10MHz Bandwidth (RB size:25# RB offset:0#)	10MHz Bandwidth (RB size:25# RB offset:25#)
	
Lowest channel	Highest channel

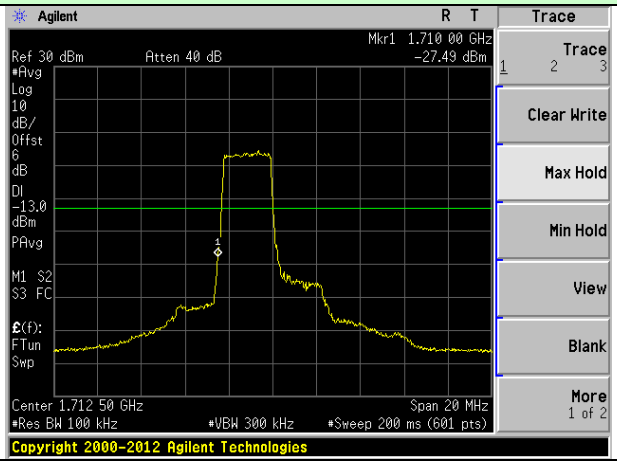
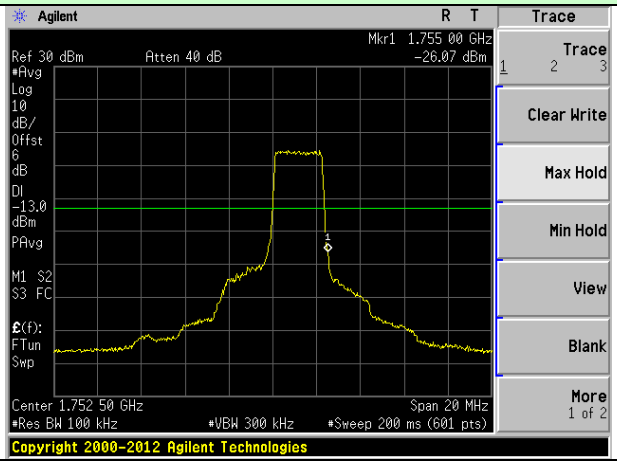
10MHz Bandwidth (RB size:50# RB offset:0#)	10MHz Bandwidth (RB size:50# RB offset:0#)
	
Lowest channel	Highest channel

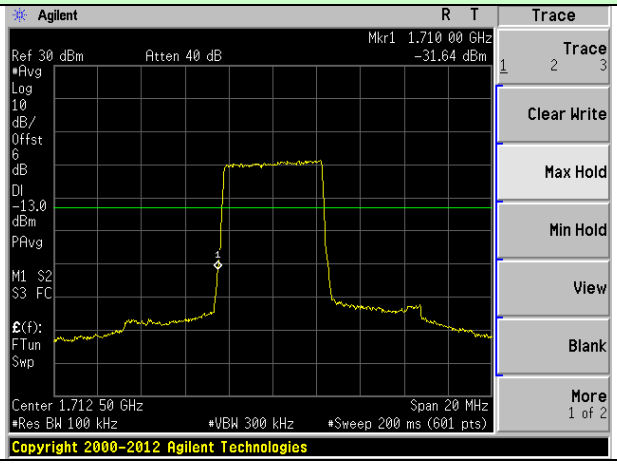
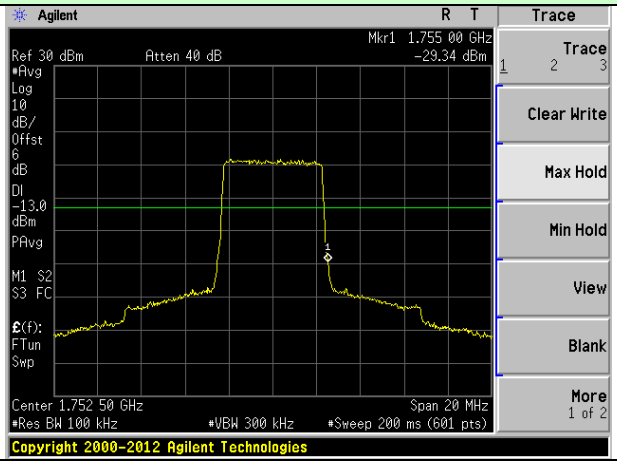
LTE Band 2(16QAM mode):

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

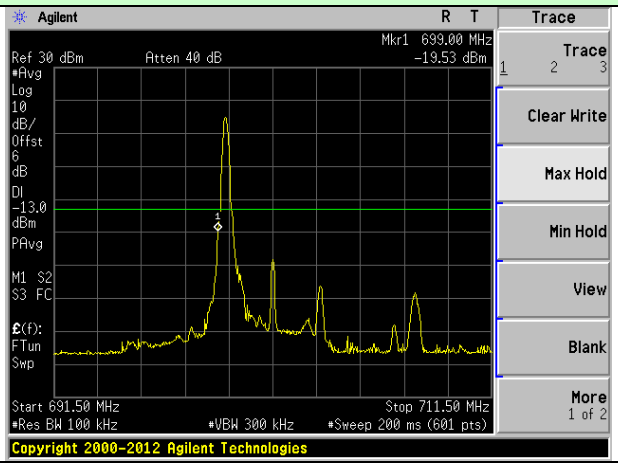
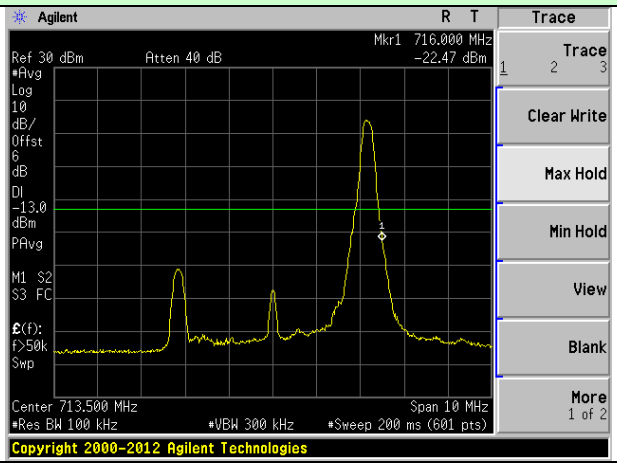
LTE Band 4(16QAM mode):

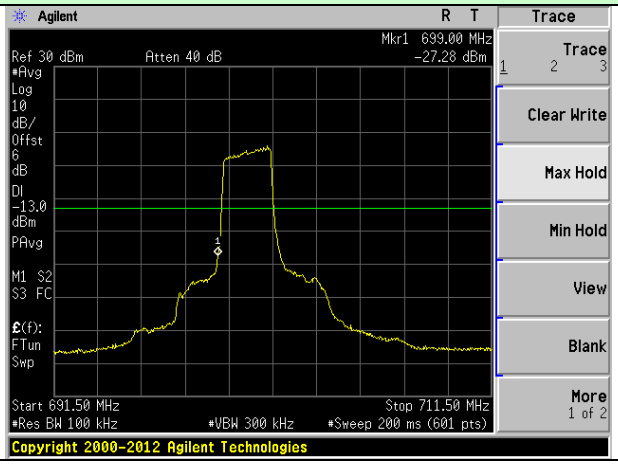
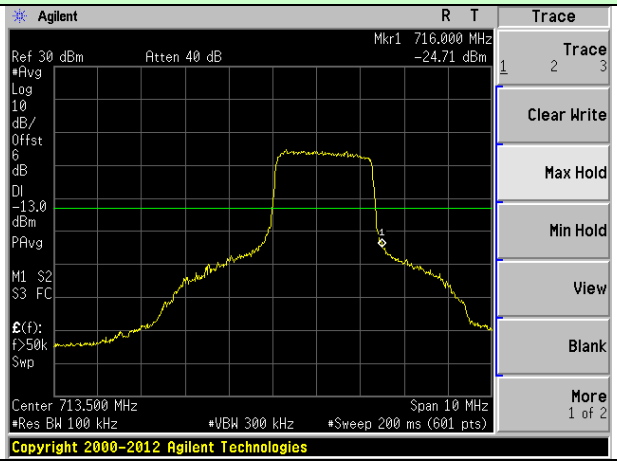
5MHz Bandwidth (RB size:1# RB offset:0#)	5MHz Bandwidth (RB size:1# RB offset:24#)
	
Lowest channel	Highest channel

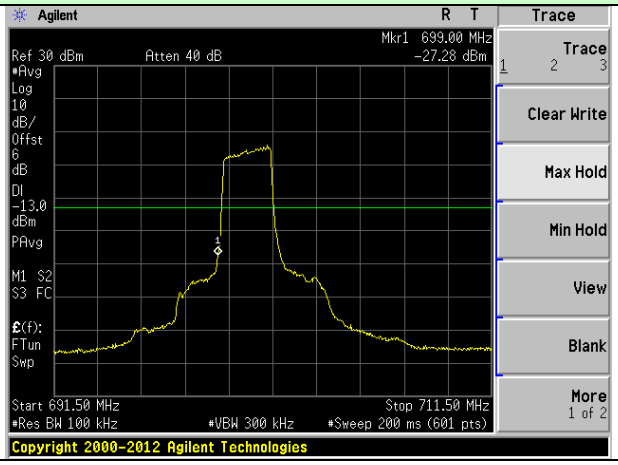
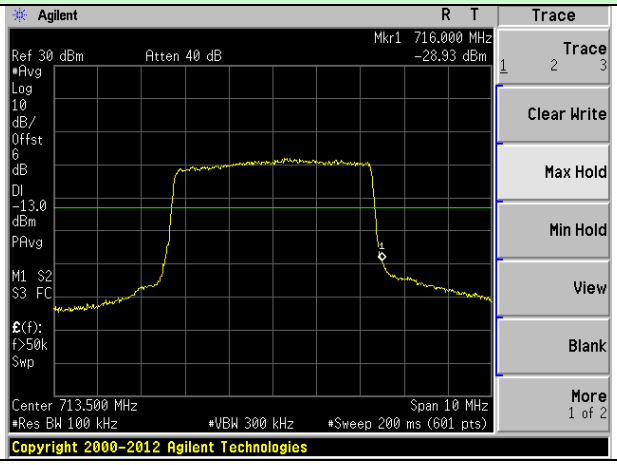
5MHz Bandwidth (RB size:12# RB offset:0#)	5MHz Bandwidth (RB size:12# RB offset:13#)
	
Lowest channel	Highest channel

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

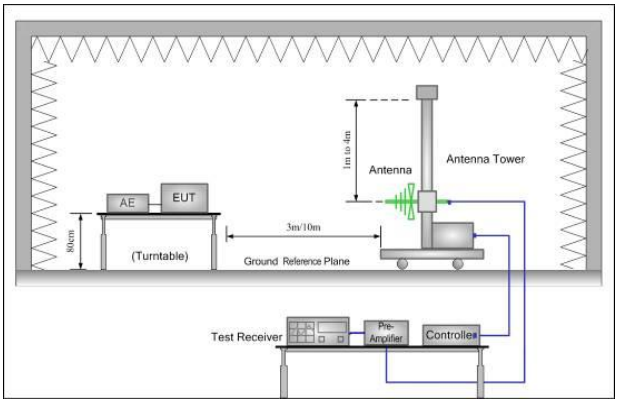
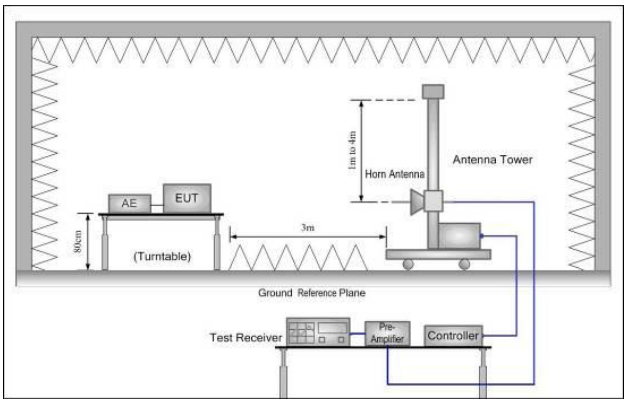
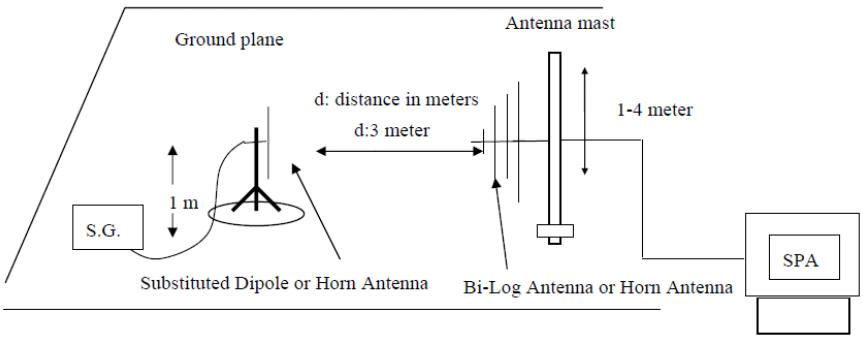
LTE Band 12(16QAM mode):

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

6.8 ERP, EIRP Measurement

Test Requirement:	Part 24.238 (a); Part 27.50(c)(10)/(d)(4)
Test Method:	FCC part2.1046
Limit:	LTE Band 2: 2W (EIRP) LTE Band 4: 1W (EIRP) LTE Band 12: 3W (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 Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

QPSK mode:

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 2 (5MHz)	Lowest	H	V	22.56	33.00	Pass
			H	20.52		
		E1	V	22.20		
			H	19.85		
		E2	V	21.44		
			H	18.59		
	Middle	H	V	22.57	33.00	Pass
			H	19.84		
		E1	V	22.08		
			H	19.63		
		E2	V	21.94		
			H	18.83		
	Highest	H	V	22.29	33.00	Pass
			H	20.01		
		E1	V	22.04		
			H	19.72		
		E2	V	21.80		
			H	19.22		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP (dBm)	Limit (dBm)	Result
LTE Band 2 (10MHz)	Lowest	H	V	22.66	33.00	Pass
			H	20.64		
		E1	V	22.34		
			H	19.99		
		E2	V	21.60		
			H	18.77		
	Middle	H	V	22.72	33.00	Pass
			H	20.02		
		E1	V	22.28		
			H	19.85		
		E2	V	22.13		
			H	19.02		
	Highest	H	V	22.44	33.00	Pass
			H	20.17		
		E1	V	22.22		
			H	19.91		
		E2	V	21.93		
			H	19.36		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP (dBm)	Limit (dBm)	Result
LTE Band 2 (15MHz)	Lowest	H	V	22.74	33.00	Pass
			H	20.73		
		E1	V	22.44		
			H	20.11		
		E2	V	21.72		
			H	18.90		
	Middle	H	V	22.84	33.00	Pass
			H	20.17		
		E1	V	22.43		
			H	20.01		
		E2	V	22.26		
			H	19.17		
	Highest	H	V	22.56	33.00	Pass
			H	20.29		
		E1	V	22.35		
			H	20.06		
		E2	V	22.03		
			H	19.47		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP (dBm)	Limit (dBm)	Result
LTE Band 2 (20MHz)	Lowest	H	V	22.81	33.00	Pass
			H	20.80		
		E1	V	22.52		
			H	20.19		
		E2	V	21.82		
			H	19.00		
	Middle	H	V	22.93	33.00	Pass
			H	20.27		
		E1	V	22.55		
			H	20.14		
		E2	V	22.37		
			H	19.28		
	Highest	H	V	22.64	33.00	Pass
			H	20.39		
		E1	V	22.45		
			H	20.17		
		E2	V	22.10		
			H	19.56		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 4 (5MHz)	Lowest	H	V	22.75	30.00	Pass
			H	20.74		
		E1	V	22.44		
			H	20.11		
		E2	V	21.73		
			H	18.91		
	Middle	H	V	22.84	30.00	Pass
			H	20.17		
		E1	V	22.44		
			H	20.02		
		E2	V	22.27		
			H	19.18		
	Highest	H	V	22.56	30.00	Pass
			H	20.30		
		E1	V	22.36		
			H	20.07		
		E2	V	22.03		
			H	19.48		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 4 (10MHz)	Lowest	H	V	22.63	30.00	Pass
			H	20.60		
		E1	V	22.30		
			H	19.95		
		E2	V	21.55		
			H	18.71		
	Middle	H	V	22.68	30.00	Pass
			H	19.97		
		E1	V	22.22		
			H	19.78		
		E2	V	22.07		
			H	18.96		
	Highest	H	V	22.40	30.00	Pass
			H	20.12		
		E1	V	22.16		
			H	19.86		
		E2	V	21.89		
			H	19.32		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 4 (15MHz)	Lowest	H	V	22.59	30.00	Pass
			H	20.56		
		E1	V	22.25		
			H	19.90		
		E2	V	21.49		
			H	18.65		
	Middle	H	V	22.62	30.00	Pass
			H	19.90		
		E1	V	22.15		
			H	19.70		
		E2	V	22.00		
			H	18.89		
	Highest	H	V	22.34	30.00	Pass
			H	20.06		
		E1	V	22.10		
			H	19.79		
		E2	V	21.84		
			H	19.27		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 4 (20MHz)	Lowest	H	V	21.21	30.00	Pass
			H	18.74		
		E1	V	21.54		
			H	18.50		
		E2	V	20.97		
			H	18.01		
	Middle	H	V	22.15	30.00	Pass
			H	19.71		
		E1	V	21.94		
			H	19.47		
		E2	V	21.48		
			H	18.25		
	Highest	H	V	21.94	30.00	Pass
			H	19.87		
		E1	V	21.88		
			H	19.38		
		E2	V	21.36		
			H	18.76		

EUT mode	Channel	EUT Pol.	Antenna Pol.	ERP(dBm)	Limit (dBm)	Result
LTE Band 12 (5MHz)	Lowest	H	V	22.79	34.77	Pass
			H	20.78		
		E1	V	22.49		
			H	20.16		
		E2	V	21.79		
			H	18.97		
	Middle	H	V	22.90	34.77	Pass
			H	20.24		
		E1	V	22.51		
			H	20.09		
		E2	V	22.33		
			H	19.25		
	Highest	H	V	22.62	34.77	Pass
			H	20.36		
		E1	V	22.42		
			H	20.13		
		E2	V	22.08		
			H	19.53		

EUT mode	Channel	EUT Pol.	Antenna Pol.	ERP(dBm)	Limit (dBm)	Result
LTE Band 12 (10MHz)	Lowest	H	V	22.73	34.77	Pass
			H	20.71		
		E1	V	22.42		
			H	20.08		
		E2	V	21.70		
			H	18.87		
	Middle	H	V	22.82	34.77	Pass
			H	20.14		
		E1	V	22.40		
			H	19.98		
		E2	V	22.23		
			H	19.14		
	Highest	H	V	22.53	34.77	Pass
			H	20.27		
		E1	V	22.32		
			H	20.03		
		E2	V	22.01		
			H	19.45		

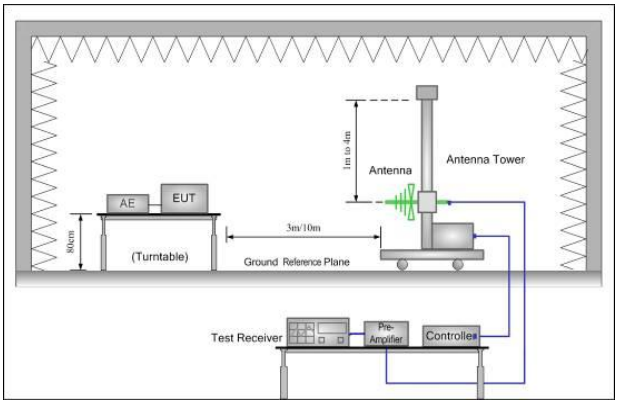
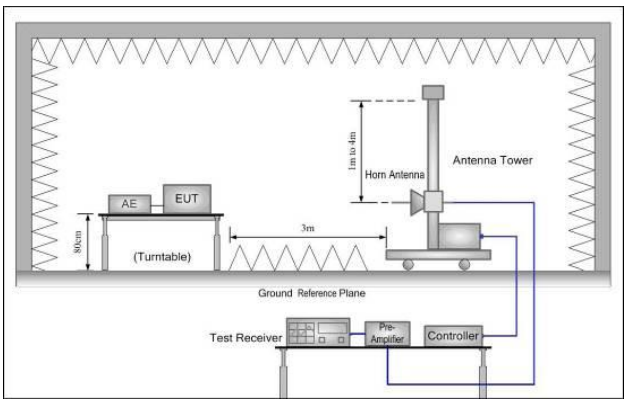
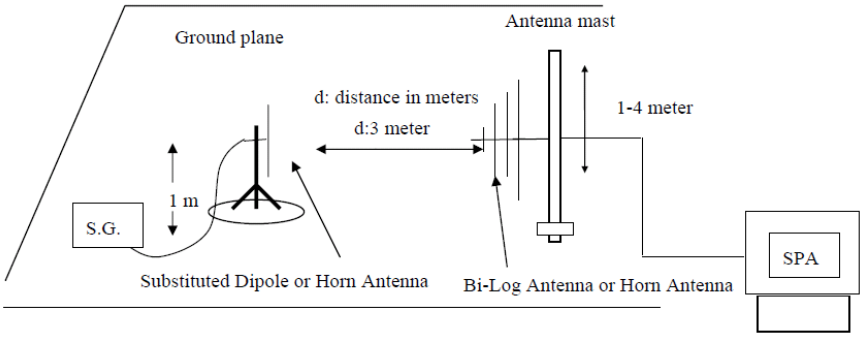
16QAM mode:

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 2 (5MHz)	Lowest	H	V	22.59	30.00	Pass
			H	20.56		
		E1	V	22.25		
			H	19.90		
		E2	V	21.50		
			H	18.65		
	Middle	H	V	22.62	30.00	Pass
			H	19.90		
		E1	V	22.15		
			H	19.71		
		E2	V	22.01		
			H	18.89		
	Highest	H	V	22.34	30.00	Pass
			H	20.06		
		E1	V	22.10		
			H	19.79		
		E2	V	21.84		
			H	19.27		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
LTE Band 4 (5MHz)	Lowest	H	V	22.73	30.00	Pass
			H	20.71		
		E1	V	22.42		
			H	20.08		
		E2	V	21.69		
			H	18.87		
	Middle	H	V	22.81	30.00	Pass
			H	20.13		
		E1	V	22.40		
			H	19.97		
		E2	V	22.23		
			H	19.14		
	Highest	H	V	22.53	30.00	Pass
			H	20.27		
		E1	V	22.32		
			H	20.02		
		E2	V	22.00		
			H	19.45		

EUT mode	Channel	EUT Pol.	Antenna Pol.	ERP(dBm)	Limit (dBm)	Result
LTE Band 12 (5MHz)	Lowest	H	V	22.77	34.77	Pass
			H	20.76		
		E1	V	22.47		
			H	20.14		
		E2	V	21.76		
			H	18.94		
	Middle	H	V	22.87	34.77	Pass
			H	20.20		
		E1	V	22.48		
			H	20.06		
		E2	V	22.30		
			H	19.21		
	Highest	H	V	22.59	34.77	Pass
			H	20.33		
		E1	V	22.39		
			H	20.10		
		E2	V	22.05		
			H	19.50		

6.9 Field strength of spurious radiation measurement

Test Requirement:	Part 24.238 (a); FCC Part 27.53(h)/(g)
Test Method:	FCC part2.1053
Limit:	Band 2/4/12:-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 Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

QPSK mode:

Test mode:	LTE Band 2(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3705.00	Vertical	-34.16	-13.00	Pass
5557.50	V	-36.51		
7410.00	V	-39.26		
9262.50	V	-42.37		
11115.00	V	---		
3705.00	Horizontal	-37.60	-13.00	Pass
5557.50	H	-39.86		
7410.00	H	-41.55		
9262.50	H	-47.87		
11115.00	H	---		
Test mode:	**LTE Band 2(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-36.04	-13.00	Pass
5640.00	V	-37.25		
7520.00	V	-40.97		
9400.00	V	-43.65		
11280.00	V	---		
3760.00	Horizontal	-38.55	-13.00	Pass
5640.00	H	-40.27		
7520.00	H	-45.26		
9400.00	H	-47.77		
11280.00	H	---		
Test mode:	**LTE Band 2(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3815.00	Vertical	-33.96	-13.00	Pass
5722.50	V	-37.60		
7630.00	V	-40.44		
9537.50	V	-38.18		
11445.00	V	---		
3815.00	Horizontal	-36.83	-13.00	Pass
5722.50	H	-39.34		
7630.00	H	-45.05		
9537.50	H	-48.80		
11445.00	H	---		

Test mode:	LTE Band 2(10MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3810.00	Vertical	-36.24	-13.00	Pass
5715.00	V	-38.81		
7620.00	V	-41.23		
9525.00	V	-43.50		
11430.00	V	---		
3810.00	Horizontal	-41.57	-13.00	Pass
5715.00	H	-45.08		
7620.00	H	-46.87		
9525.00	H	-49.78		
11430.00	H	---		
Test mode:	**LTE Band 2(10MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-36.65	-13.00	Pass
5640.00	V	-39.43		
7520.00	V	-42.04		
9400.00	V	-44.46		
11280.00	V	---		
3760.00	Horizontal	-42.39	-13.00	Pass
5640.00	H	-46.20		
7520.00	H	-48.12		
9400.00	H	-51.25		
11280.00	H	---		
Test mode:	**LTE Band 2(10MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3710.00	Vertical	-36.51	-13.00	Pass
5565.00	V	-39.42		
7420.00	V	-42.13		
9275.00	V	-44.67		
11130.00	V	---		
3710.00	Horizontal	-42.50	-13.00	Pass
5565.00	H	-46.50		
7420.00	H	-48.49		
9275.00	H	-51.74		
11130.00	H	---		

Test mode:	LTE Band 2(15MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3805.00	Vertical	-33.63	-13.00	Pass
5707.50	V	-35.84		
7610.00	V	-37.99		
9512.50	V	-39.97		
11415.00	V	---		
3805.00	Horizontal	-38.29	-13.00	Pass
5707.50	H	-41.32		
7610.00	H	-42.90		
9512.50	H	-45.46		
11415.00	H	---		
Test mode:	**LTE Band 2(15MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-32.71	-13.00	Pass
5640.00	V	-34.98		
7520.00	V	-37.18		
9400.00	V	-39.23		
11280.00	V	---		
3760.00	Horizontal	-37.50	-13.00	Pass
5640.00	H	-40.61		
7520.00	H	-42.24		
9400.00	H	-44.85		
11280.00	H	---		
Test mode:	**LTE Band 2(15MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3715.00	Vertical	-34.25	-13.00	Pass
5572.50	V	-36.48		
7430.00	V	-38.65		
9287.50	V	-40.64		
11145.00	V	---		
3715.00	Horizontal	-38.95	-13.00	Pass
5572.50	H	-42.00		
7430.00	H	-43.60		
9287.50	H	-46.17		
11145.00	H	---		

Test mode:	LTE Band 2(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3800.00	Vertical	-34.62	-13.00	Pass
5700.00	V	-36.51		
7600.00	V	-38.38		
9500.00	V	-40.09		
11400.00	V	---		
3800.00	Horizontal	-38.64	-13.00	Pass
5700.00	H	-41.19		
7600.00	H	-42.61		
9500.00	H	-44.85		
11400.00	H	---		
Test mode:	**LTE Band 2(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-35.84	-13.00	Pass
5640.00	V	-37.98		
7520.00	V	-39.63		
9400.00	V	-41.55		
11280.00	V	---		
3760.00	Horizontal	-39.80	-13.00	Pass
5640.00	H	-43.09		
7520.00	H	-44.56		
9400.00	H	-46.54		
11280.00	H	---		
Test mode:	**LTE Band 2(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3720.00	Vertical	-33.18	-13.00	Pass
5580.00	V	-35.84		
7440.00	V	-37.92		
9300.00	V	-40.21		
11160.00	V	---		
3720.00	Horizontal	-38.10	-13.00	Pass
5580.00	H	-42.12		
7440.00	H	-43.91		
9300.00	H	-46.42		
11160.00	H	---		

Test mode:	LTE Band 4(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3425.00	Vertical	-34.24	-13.00	Pass
5137.50	V	-36.86		
6850.00	V	-38.89		
8562.50	V	-41.16		
10275.00	V	---		
3425.00	Horizontal	-39.09	-13.00	Pass
5137.50	H	-43.04		
6850.00	H	-44.79		
8562.50	H	-47.23		
10275.00	H	---		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-36.33	-13.00	Pass
5197.50	V	-38.45		
6930.00	V	-40.07		
8662.50	V	-41.98		
10395.00	V	---		
3465.00	Horizontal	-40.25	-13.00	Pass
5197.50	H	-43.52		
6930.00	H	-44.96		
8662.50	H	-46.90		
10395.00	H	---		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3505.00	Vertical	-35.57	-13.00	Pass
5257.50	V	-37.49		
7010.00	V	-38.94		
8762.50	V	-40.67		
10515.00	V	---		
3505.00	Horizontal	-39.08	-13.00	Pass
5257.50	H	-42.06		
7010.00	H	-43.40		
8762.50	H	-45.15		
10515.00	H	---		

Test mode:	LTE Band 4(10MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3430.00	Vertical	-34.09	-13.00	Pass
5145.00	V	-36.41		
6860.00	V	-38.20		
8575.00	V	-40.23		
10290.00	V	---		
3430.00	Horizontal	-38.37	-13.00	Pass
5145.00	H	-41.90		
6860.00	H	-43.48		
8575.00	H	-45.63		
10290.00	H	---		
Test mode:	**LTE Band 4(10MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-32.58	-13.00	Pass
5197.50	V	-34.94		
6930.00	V	-36.76		
8662.50	V	-38.85		
10395.00	V	---		
3465.00	Horizontal	-36.95	-13.00	Pass
5197.50	H	-40.55		
6930.00	H	-42.15		
8662.50	H	-44.34		
10395.00	H	---		
Test mode:	**LTE Band 4(10MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3500.00	Vertical	-33.49	-13.00	Pass
5250.00	V	-35.79		
7000.00	V	-37.56		
8750.00	V	-39.59		
10500.00	V	---		
3500.00	Horizontal	-37.73	-13.00	Pass
5250.00	H	-41.25		
7000.00	H	-42.81		
8750.00	H	-44.94		
10500.00	H	---		

Test mode:	LTE Band 4(15MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3435.00	Vertical	-37.18	-13.00	Pass
5152.50	V	-40.14		
6870.00	V	-42.44		
8587.50	V	-45.01		
10305.00	V	---		
3435.00	Horizontal	-42.69	-13.00	Pass
5152.50	H	-47.13		
6870.00	H	-49.06		
8587.50	H	-51.83		
10305.00	H	---		
Test mode:	**LTE Band 4(15MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-37.48	-13.00	Pass
5197.50	V	-40.30		
6930.00	V	-42.48		
8662.50	V	-44.94		
10395.00	V	---		
3465.00	Horizontal	-42.72	-13.00	Pass
5197.50	H	-46.96		
6930.00	H	-48.82		
8662.50	H	-51.46		
10395.00	H	---		
Test mode:	**LTE Band 4(15MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3495.00	Vertical	-36.90	-13.00	Pass
5242.50	V	-39.52		
6990.00	V	-41.53		
8737.50	V	-43.83		
10485.00	V	---		
3495.00	Horizontal	-41.75	-13.00	Pass
5242.50	H	-45.70		
6990.00	H	-47.43		
8737.50	H	-49.86		
10485.00	H	---		

Test mode:	LTE Band 4(20MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3440.00	Vertical	-33.47	-13.00	Pass
5160.00	V	-37.19		
6880.00	V	-39.80		
8600.00	V	-37.48		
10320.00	V	---		
3440.00	Horizontal	-36.05	-13.00	Pass
5160.00	H	-38.96		
6880.00	H	-44.65		
8600.00	H	-48.12		
10320.00	H	---		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-35.57	-13.00	Pass
5197.50	V	-36.85		
6930.00	V	-40.34		
8662.50	V	-42.96		
10395.00	V	---		
3465.00	Horizontal	-37.79	-13.00	Pass
5197.50	H	-39.91		
6930.00	H	-44.87		
8662.50	H	-47.10		
10395.00	H	---		
Test mode:	**LTE Band 4(20MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3490.00	Vertical	-33.66	-13.00	Pass
5235.00	V	-36.08		
6980.00	V	-38.60		
8725.00	V	-41.65		
10470.00	V	---		
3490.00	Horizontal	-36.80	-13.00	Pass
5235.00	H	-39.46		
6980.00	H	-41.13		
8725.00	H	-47.18		
10470.00	H	---		

Remark：

1. The emission behaviour belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	LTE Band 12(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1403.00	Vertical	-36.92	-13.00	Pass
2104.50	V	-37.56		
2806.00	V	-38.81		
3507.50	V	-41.19		
4209.00	V	---		
1403.00	Horizontal	-39.83	-13.00	Pass
2104.50	H	-41.65		
2806.00	H	-42.82		
3507.50	H	-45.53		
4209.00	H	---		
Test mode:	**LTE Band 12(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1415.00	Vertical	-37.48	-13.00	Pass
2122.50	V	-39.55		
2830.00	V	-40.96		
3537.50	V	-45.20		
4245.00	V	---		
1415.00	Horizontal	-40.40	-13.00	Pass
2122.50	H	-41.44		
2830.00	H	-43.91		
3537.50	H	-46.78		
4245.00	H	---		
Test mode:	**LTE Band 12(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1427.00	Vertical	-34.80	-13.00	Pass
2140.50	V	-36.20		
2854.00	V	-38.12		
3567.50	V	-39.34		
4281.00	V	---		
1427.00	Horizontal	-40.37	-13.00	Pass
2140.50	H	-44.41		
2854.00	H	-46.77		
3567.50	H	-49.59		
4281.00	H	---		

Remark：
1. The emission behaviour belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	LTE Band 12(10MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1408.00	Vertical	-33.80	-13.00	Pass
2112.00	V	-36.13		
2816.00	V	-37.93		
3520.00	V	-39.97		
4224.00	V	---		
1408.00	Horizontal	-38.10	-13.00	Pass
2112.00	H	-41.65		
2816.00	H	-43.24		
3520.00	H	-45.41		
4224.00	H	---		
Test mode:	**LTE Band 12(10MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1415.00	Vertical	-32.36	-13.00	Pass
2122.50	V	-34.73		
2830.00	V	-36.56		
3537.50	V	-38.66		
4245.00	V	---		
1415.00	Horizontal	-36.75	-13.00	Pass
2122.50	H	-40.36		
2830.00	H	-41.97		
3537.50	H	-44.18		
4245.00	H	---		
Test mode:	**LTE Band 12(10MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1422.00	Vertical	-33.25	-13.00	Pass
2133.00	V	-35.56		
2844.00	V	-37.34		
3555.00	V	-39.37		
4266.00	V	---		
1422.00	Horizontal	-37.51	-13.00	Pass
2133.00	H	-41.04		
2844.00	H	-42.61		
3555.00	H	-44.76		
4266.00	H	---		

Remark：
1. The emission behaviour belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

16QAM mode:

Test mode:	LTE Band 2(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3705.00	Vertical	-32.05	-13.00	Pass
5557.50	V	-34.77		
7410.00	V	-36.94		
9262.50	V	-39.07		
11115.00	V	---		
3705.00	Horizontal	-37.10	-13.00	Pass
5557.50	H	-41.41		
7410.00	H	-42.81		
9262.50	H	-45.73		
11115.00	H	---		
Test mode:	**LTE Band 2(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-35.34	-13.00	Pass
5640.00	V	-37.51		
7520.00	V	-39.22		
9400.00	V	-40.96		
11280.00	V	---		
3760.00	Horizontal	-39.37	-13.00	Pass
5640.00	H	-42.93		
7520.00	H	-43.97		
9400.00	H	-46.32		
11280.00	H	---		
Test mode:	**LTE Band 2(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3815.00	Vertical	-33.59	-13.00	Pass
5722.50	V	-35.60		
7630.00	V	-37.18		
9537.50	V	-38.76		
11445.00	V	---		
3815.00	Horizontal	-37.28	-13.00	Pass
5722.50	H	-40.61		
7630.00	H	-41.59		
9537.50	H	-43.81		
11445.00	H	---		

Remark：

4. The emission behaviour belongs to narrowband spurious emission.
5. Remark”---“ means that the emission level is too low to be measured
6. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	LTE Band 4(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3425.00	Vertical	-33.38	-13.00	Pass
5137.50	V	-36.04		
6850.00	V	-38.15		
8562.50	V	-40.26		
10275.00	V	---		
3425.00	Horizontal	-38.33	-13.00	Pass
5137.50	H	-42.57		
6850.00	H	-43.90		
8562.50	H	-46.74		
10275.00	H	---		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3465.00	Vertical	-35.95	-13.00	Pass
5197.50	V	-38.09		
6930.00	V	-39.77		
8662.50	V	-41.51		
10395.00	V	---		
3465.00	Horizontal	-39.93	-13.00	Pass
5197.50	H	-43.45		
6930.00	H	-44.47		
8662.50	H	-46.78		
10395.00	H	---		
Test mode:	**LTE Band 4(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3505.00	Vertical	-34.79	-13.00	Pass
5257.50	V	-36.75		
7010.00	V	-38.28		
8762.50	V	-39.84		
10515.00	V	---		
3505.00	Horizontal	-38.40	-13.00	Pass
5257.50	H	-41.65		
7010.00	H	-42.58		
8762.50	H	-44.72		
10515.00	H	---		

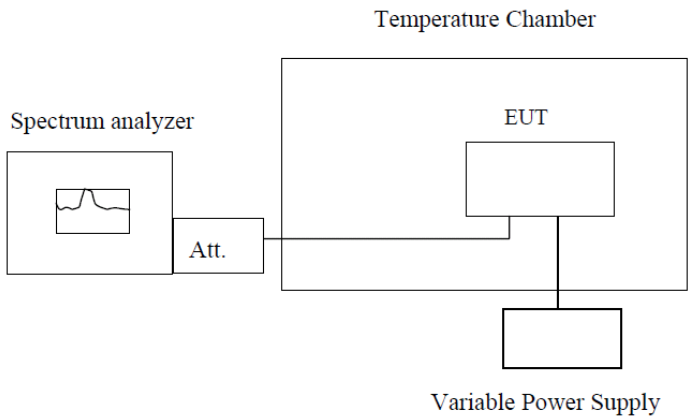
Remark：

7. The emission behaviour belongs to narrowband spurious emission.
8. Remark”---“ means that the emission level is too low to be measured
9. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	LTE Band 12(5MHz)		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1403.00	Vertical	-34.78	-13.00	Pass
2104.50	V	-35.52		
2806.00	V	-36.91		
3507.50	V	-39.14		
4209.00	V	---		
1403.00	Horizontal	-37.88	-13.00	Pass
2104.50	H	-40.07		
2806.00	H	-40.88		
3507.50	H	-44.07		
4209.00	H	---		
Test mode:	**LTE Band 12(5MHz)**		**Test channel:**	**Middle**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1415.00	Vertical	-35.28	-13.00	Pass
2122.50	V	-37.44		
2830.00	V	-39.00		
3537.50	V	-43.09		
4245.00	V	---		
1415.00	Horizontal	-38.39	-13.00	Pass
2122.50	H	-39.79		
2830.00	H	-41.92		
3537.50	H	-45.27		
4245.00	H	---		
Test mode:	**LTE Band 12(5MHz)**		**Test channel:**	**Highest**
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1427.00	Vertical	-32.22	-13.00	Pass
2140.50	V	-33.73		
2854.00	V	-35.82		
3567.50	V	-36.90		
4281.00	V	---		
1427.00	Horizontal	-38.01	-13.00	Pass
2140.50	H	-42.44		
2854.00	H	-44.47		
3567.50	H	-47.80		
4281.00	H	---		

Remark：
1. The emission behaviour belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

6.10 Frequency stability V.S. Temperature measurement

Test Requirement:	FCC Part2.1055(a)(1)(b)
Test Method:	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 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

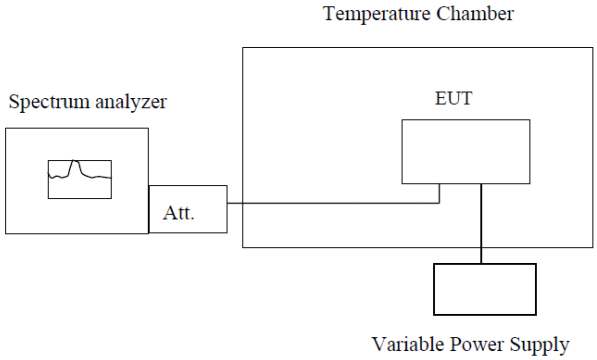
QPSK mode:

Reference Frequency: LTE Band 2 Middle channel=18900 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	35	0.0186	2.5	Pass
	-20	36	0.0191		
	-10	33	0.0176		
	0	29	0.0154		
	10	32	0.0170		
	20	30	0.0160		
	30	40	0.0213		
	40	37	0.0197		
	50	38	0.0202		
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	33	0.0190	2.5	Pass
	-20	32	0.0185		
	-10	31	0.0179		
	0	28	0.0162		
	10	29	0.0167		
	20	28	0.0162		
	30	39	0.0225		
	40	34	0.0196		
	50	34	0.0196		
Reference Frequency: LTE Band 12 Middle channel=23095 channel=707.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error			Result
		Hz	ppm		
12.0	-30	56	0.0792	2.5	Pass
	-20	62	0.0876		
	-10	53	0.0749		
	0	46	0.0650		
	10	51	0.0721		
	20	45	0.0636		
	30	75	0.1060		
	40	65	0.0919		
	50	63	0.0890		

16QAM mode:

Reference Frequency: LTE Band 2 Middle channel=18900 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	33	0.0176	2.5	Pass
	-20	34	0.0181		
	-10	31	0.0165		
	0	27	0.0144		
	10	30	0.0160		
	20	28	0.0149		
	30	38	0.0202		
	40	35	0.0186		
	50	36	0.0191		
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	26	0.0150	2.5	Pass
	-20	25	0.0144		
	-10	24	0.0139		
	0	22	0.0127		
	10	23	0.0133		
	20	22	0.0127		
	30	29	0.0167		
	40	25	0.0144		
	50	27	0.0156		
Reference Frequency: LTE Band 13 Middle channel=23095 channel=707.5MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error			Result
		Hz	ppm		
12.0	-30	54	0.0763	2.5	Pass
	-20	59	0.0834		
	-10	51	0.0721		
	0	44	0.0622		
	10	49	0.0693		
	20	44	0.0622		
	30	72	0.1018		
	40	62	0.0876		
	50	61	0.0862		

6.11 Frequency stability V.S. Voltage measurement

Test Requirement:	FCC Part2.1055(d)(1)(2)
Test Method:	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 6.0 for details
Test mode:	Refer to section 6.1 for details
Test results:	Pass

Measurement Data

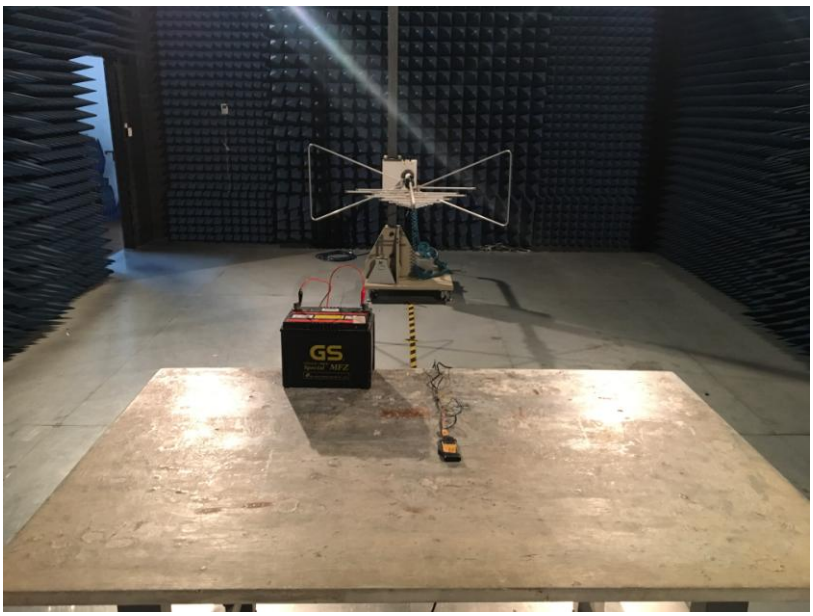
QPSK mode:

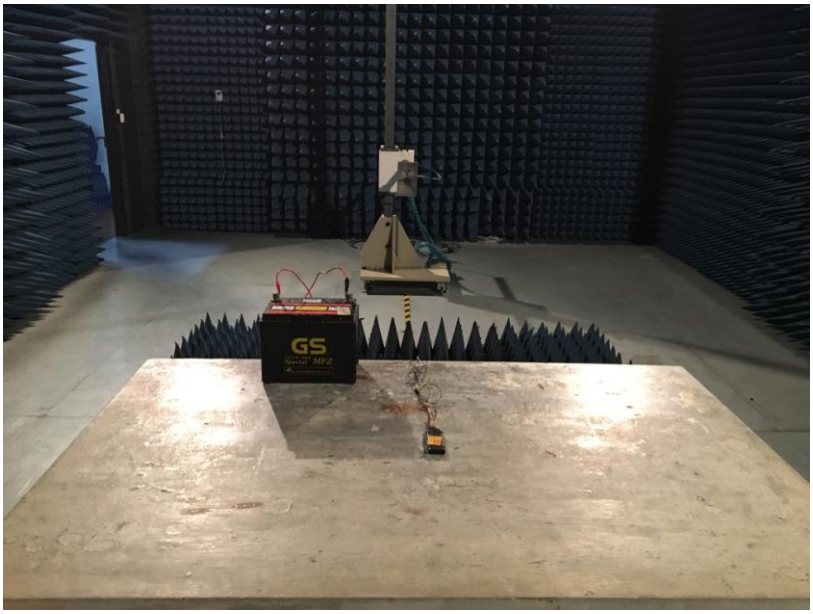
Reference Frequency: LTE Band 2 Middle channel=18900 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	19	0.0101	2.5	Pass
	12.00	19	0.0101		
	10.80	23	0.0122		
Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	21	0.0121	2.5	Pass
	12.00	14	0.0081		
	10.80	19	0.0110		
Reference Frequency: LTE Band 12 Middle channel=23095 channel=707.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	21	0.0297	2.5	Pass
	12.00	27	0.0382		
	10.80	29	0.0410		

16QAM mode:

Reference Frequency: LTE Band 2 Middle channel=18900 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	18	0.0096	2.5	Pass
	12.00	22	0.0117		
	10.80	24	0.0128		
Reference Frequency: LTE Band 4 Middle channel=20175 channel=1732.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	22	0.0127	2.5	Pass
	12.00	16	0.0092		
	10.80	18	0.0104		
Reference Frequency: LTE Band 13 Middle channel=23095 channel=707.5MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	13.20	18	0.0254	2.5	Pass
	12.00	26	0.0367		
	10.80	27	0.0382		

7 Test Setup Photo





8 EUT Constructional Details

Reference to the test report No. : GTS201708000110F01

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