HCT CO., LTD.

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CERTIFICATE OF COMPLIANCE

Applicant Name:

SAMSUNG Electronics Co., Ltd.
416, Maetan-3dong, Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea

Date of Issue: April 17, 2012
Test Site/Location:
HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,
Icheon-si, Kyunggi-Do, Korea
Test Report No.: HCTR1204FR15

FCC ID	:	**A3LSMM-BMAA022000**
APPLICANT	:	**SAMSUNG Electronics Co., Ltd.**

EUT Type	: Smart MBS (Smart Multi-modal Base Station)
Manufacturer	: SAMSUNG Electronics Co., Ltd
Model name	: SMM-BMAA022000
Frequency of Operation	: 2130 MHz ~ 2140 MHz
TX Output Power	: 120 W (60 W + 60 W)
FCC Rule Part(s)	: FCC Part 27
Emission Designator	: 1M25F9W, 1M25G7W, 4M50W7W
Test Procedure(s)	: ANSI/TIA-603C-2004
Application Type	: Original Equipment
Data of issue	: April 3, 2012

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of FCC Part 27 of the FCC Rules under normal use and maintenance.

Chang Seok Choi

Report prepared by
: Chang Seok Choi
Test engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

Revision

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1204FR15	April 17, 2012	First Approval Report

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1. GENERAL INFORMATION

1.1. CLIENT INFORMATION

Company	**Samsung Electronics Co., Ltd.**
Contact Point	**416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea**
Contact person	**Name: Hwan-Chul Ryu / Principal Research Engineer** **E-mail : ryu0022@samsung.com** **Tel: +82-31-279-1023** **Fax: +82-31-279-7676**

1.2. PRODUCT INFORMATION

EUT TYPE	Smart MBS (Smart Multi-modal Base Station)
EMISSION DESIGNATOR	CDMA : 1M25F9W (BPSK, QPSK), 1M25G7W (16QAM)
	LTE : 4M50W7W (QPSK, 16QAM, 64QAM)
OPERATING FREQUENCY	2130 MHz ~ 2140 MHz
TX OUTPUT POWER	120 W (60 W + 60 W)
CHANNEL BANDWIDTH	CDMA : 1.25 MHz, LTE : 5 MHz
MODULATION TYPE	BPSK, QPSK, 16QAM
MAXIMUM NUMBER OF CARRIERS/SECTORS	CDMA : 2 Carrier / 3 Sector, LTE : 1 Carrier / 6 Sector
SYSTEM INPUT VOLTAGE	AC 220 V

1.3. INTRODUCTION OF EUT

Smart MBS is the Samsung Multi-Modal system. It is managed by packet core (BSC, EPC), and makes call to terminal to create CDMA/LTE links. It is controlled by the BSC(CDMA), DPC(LTE)for connecting CDMA/LTE calls to the mobile terminal.

To this end, the Smart MBS provides the following functions:
modulation/demodulation of packet traffic signal, scheduling and radio bandwidth allocation to manage air resources efficiently and ensure Quality of Service (QoS), Automatic Repeat request (ARQ) processing, ranging function, connection control function to transmit the information on the Smart MBS and set/hold/disconnect the packet call connection, handover control, control station such as BSC/EPC interface function, power control function and system operation management function.

The Smart MBS securely and rapidly transmits various control signals and traffic signals by interfacing with the BSC/EPC via the Fast Ethernet/Gigabit Ethernet backhaul.

Physically, the Smart MBS consists of an Universal platform type A Digital Unit (UADU), which is a DU, and Local Radio Unit (LRU), which is a combined RF unit. UADU and LRU are mounted on the outdoor cabinet with rectifier. UADU is a digital part, which is a type of 19 in. shelf. It can be mounted onto outdoor 19 inch commercial rack, and one UADU can provide the following maximum capacity. Based on operator's setup, it can be operated as omni type or sector type.

- CDMA 1X/EV-DO
  - 1X : 2 Carrier b3 Sector(2br)
  - 1x EV-DO : 2 Carrier /3 Sector(2br)
- LTE: 5 MHz 1 Carrier /6 Sector

LRU can be operated as follows as RF part.

- Advanced Wireless Services (AWS) band, 2Tx/2Rx RF path

Smart MBS also provided the following features:

Common Platform

Digital boards of each wireless technology, to be mounted in Smart MBS, share the common DU platform. Therefore, different boards (for multiple technologies) may be mounted in a single DU, and operator can mount up to 2 UADUs in outdoor cabinet to implement various configurations.

LRU of Smart MBS can simultaneously support multiple technologies in the same duplexing type with the same bandwidth.

Loopback Test

Smart MBS provides the loopback test function to check whether communication is normal on the baseband I/Q interface line between the UADU and LRU.

Remote Firmware Downloading

The operator can upgrade the LRU and its service by replacing its firmware. Without visiting the field station, the operator can download firmware to the LRU remotely using a simple command from the BSM/LSM-R. In this way, operators can minimize the number of visits to the field station, reducing maintenance costs and allowing the system to be operated with greater ease.

Monitoring Port

Operators can monitor the information for an LRU using its debug port.

Smooth Migration

The UADU of the Smart MBS supports migration from CDMA to 4G mobile communication such as LTE by adding traffic processor card/channel cards and upgrading the software.

The LRU of the Smart MBS, on the other hand, only requires software upgrade for evolving into 4G mobile communication in the same frequency range or even simultaneous operation of 3G and 4G mobile communications.

2. TEST SUMMARY

2.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90.

SECTION	TEST ITEMS	RESULTS
2.1046, 27.50	Conducted Output Power	Compliant
2.1049, 27.53	Occupied Bandwidth	Compliant
2.1051, 27.53	Spurious Emissions at Antenna Terminals	Compliant
2.1055, 27.54	Frequency Stability over Temperature variation	Compliant
2.1055, 27.54	Frequency stability over Voltage variation	Compliant

2.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.
During all testing, system components were manipulated within the confines of typical usage to maximize each emission. All Modulation (BPSK, QPSK, and 16QAM) modes were tested.
The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	**+ 15 ℃ to + 35 ℃**
Relative humidity:	**30 % to 60 %**
Air pressure	**860 mbar to 1060 mbar**

4. TEST EQUIPMENT

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	147	04/13/2012
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	02/19/2013
HD	MA240 / Antenna Position Tower	556	N/A
EMCO	1050 / Turn Table	114	N/A
HD GmbH	HD 100 / Controller	13	N/A
HD GmbH	KMS 560 / SlideBar	12	N/A
MITEQ	AMF-6D-001180-35-20P/AMP	990893	05/02/2012
EMCO	6502/Loop Antenna	9009-2536	01/14/2014
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012

5. CONDUCTED OUTPUT POWER

5.1. Applicable Standard

According to FCC §2.1046 & 27.50

(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:

(1) The power of each fixed or base station transmitting in the 2110–2155 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:

(A) an equivalent isotropically radiated power (EIRP) of 3280 watts when transmitting with an emission bandwidth of 1 MHz or less;

(B) an EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(2) The power of each fixed or base station transmitting in the 2110–2155 MHz band and situated in any geographic location other than that described in paragraph (d)(1) is limited to:

(A) an equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;

(B) an EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(3) A licensee operating a base or fixed station in the 2110–2155 MHz band utilizing a power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025–2110 MHz band. Operations with power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must be coordinated in advance with the following licensees authorized to operate within 120 kilometers (75 miles) of the base or fixed station operating in this band: all Broadband Radio Service (BRS) licensees authorized under part 27 in the 2155–2160 MHz band and all advanced wireless services (AWS) licensees authorized to operate on adjacent frequency blocks in the 2110–2155 MHz band.

5.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

5.3. Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation. According to FCC §2.1046 (a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

1) The radio frequency load attached to the EUT antenna terminal was 50 Ohm. The lost of the cables the test system is calibrated to correct the reading.
2) The spectrum analyzer was set to RMS Detector function and Average mode.
3) The resolution banswidth of the spectrum analyzer was comparable to the emission bandwidth. (Based on KDB971168 D01 Power Meas License Digital Systems v01)

5.4. Test Result

: PASS

[Port 1 – Single Carrier]

	Frequency (MHz)	Measured Data (dBm)		
		QPSK	16QAM	64QAM
1x	2131.25	43.55	-	-
1x	2132.5	40.70	-	-
LTE	2137.5	43.54	43.61	43.51

[Port 2 – Single Carrier]

	Frequency (MHz)	Measured Data (dBm)		
		QPSK	16QAM	64QAM
1x	2132.5	40.62	-	-
EV-DO	2133.75	43.66	43.65	-
LTE	2137.5	43.54	43.26	43.62

[Port 1 , Port 2 – Three Carriers]

	Frequency (MHz)	Measured Data (dBm)		
		QPSK	16QAM	64QAM
Port 1	2135	47.46	47.46	47.46
Port 2	2135	47.42	47.42	47.41
Port 1 & Port 2	2135	50.45	50.45	50.44

※ Test Data for Port1 & Port2 is calculated by measure-and-sum method.

[Port 1 , Port 2 – Three Carriers]

	Frequency (MHz)	Measured Data (dBm/MHz)		
		QPSK	16QAM	64QAM
Port 1	2135	37.46	37.46	37.46
Port 2	2135	37.42	37.42	37.41
Port 1 & Port 2	2135	40.45	40.45	40.44

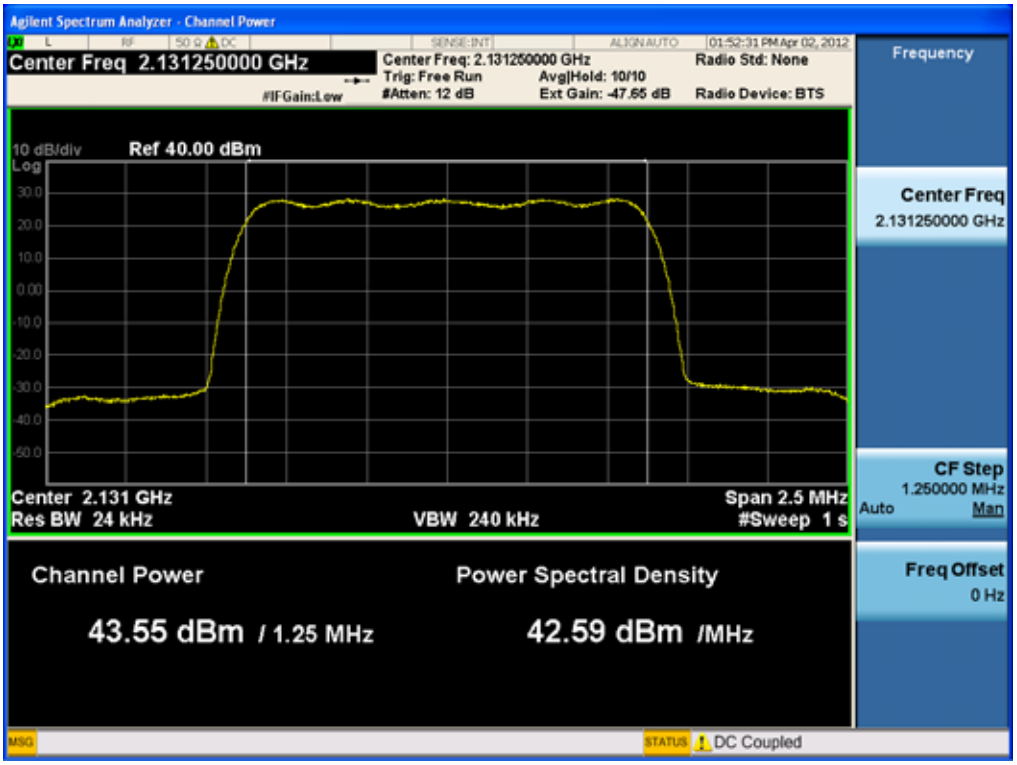
※ EIRP_Port1 = 37.46 dBm/MHz + 20.7 dBi (Antenna Gain) = 654.6 W/MHz

EIRP_Port2 = 37.42 dBm/MHz + 20.7 dBi (Antenna Gain) = 648.6 W/MHz

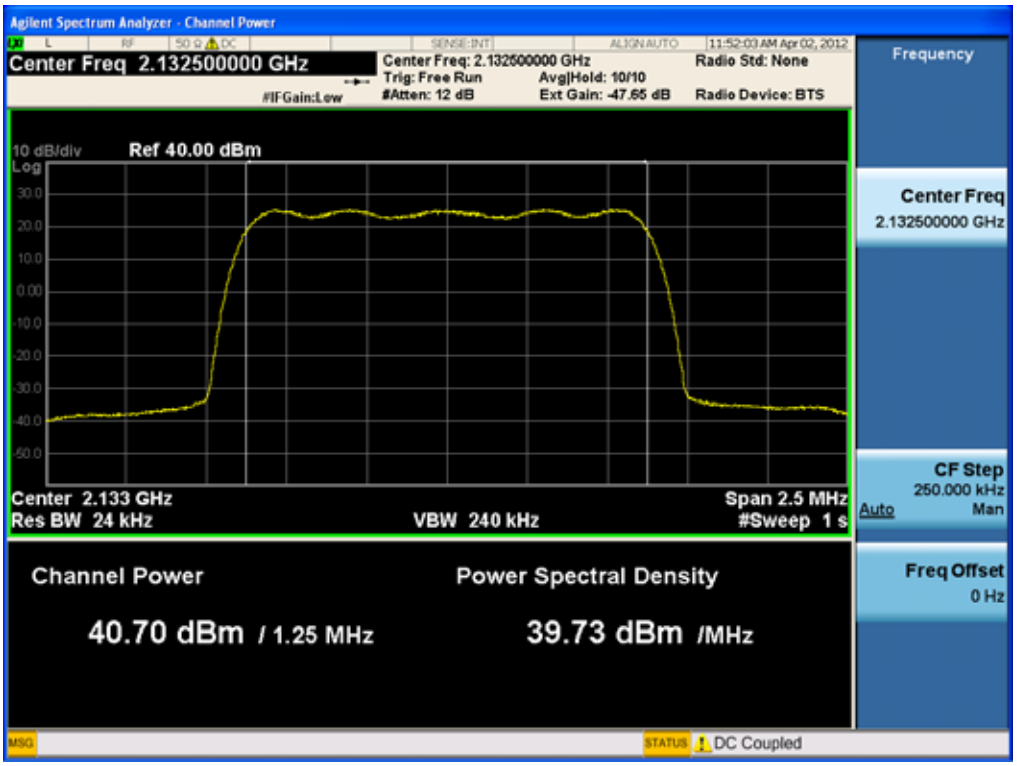
So, EIRP = 1303.2 W/MHz < 1640 W/MHz

5.4.1. Plot Data for Port1 (Single Carrier)

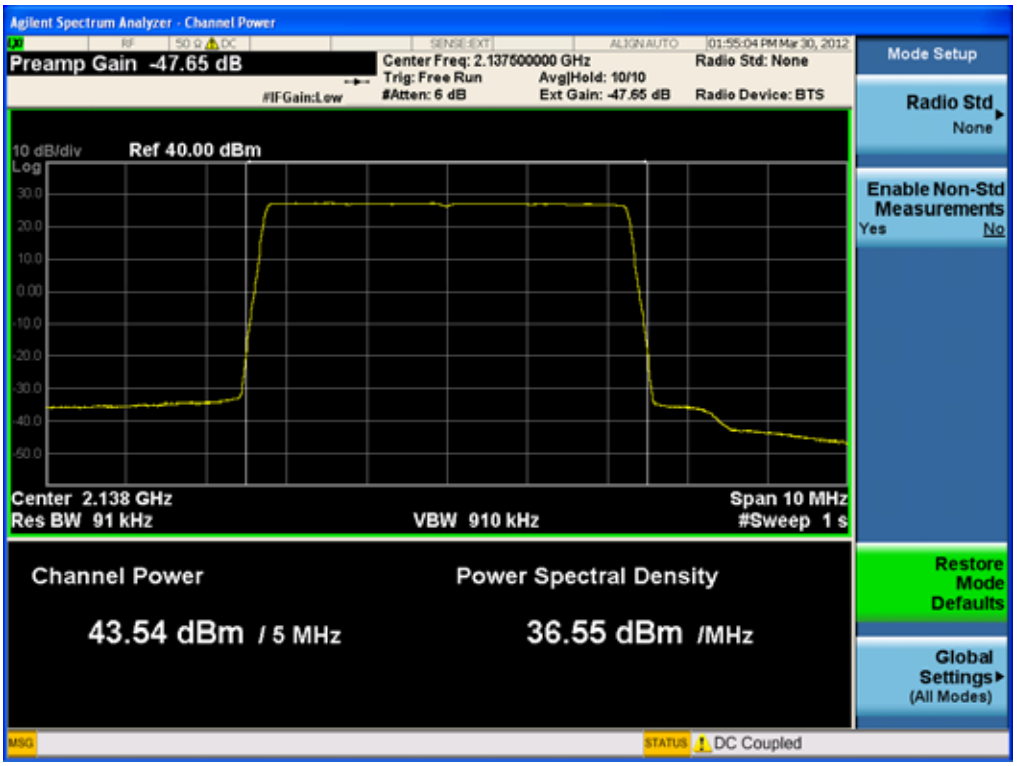
(QPSK Low Channel)



(QPSK Middle Channel)



(QPSK High Channel)

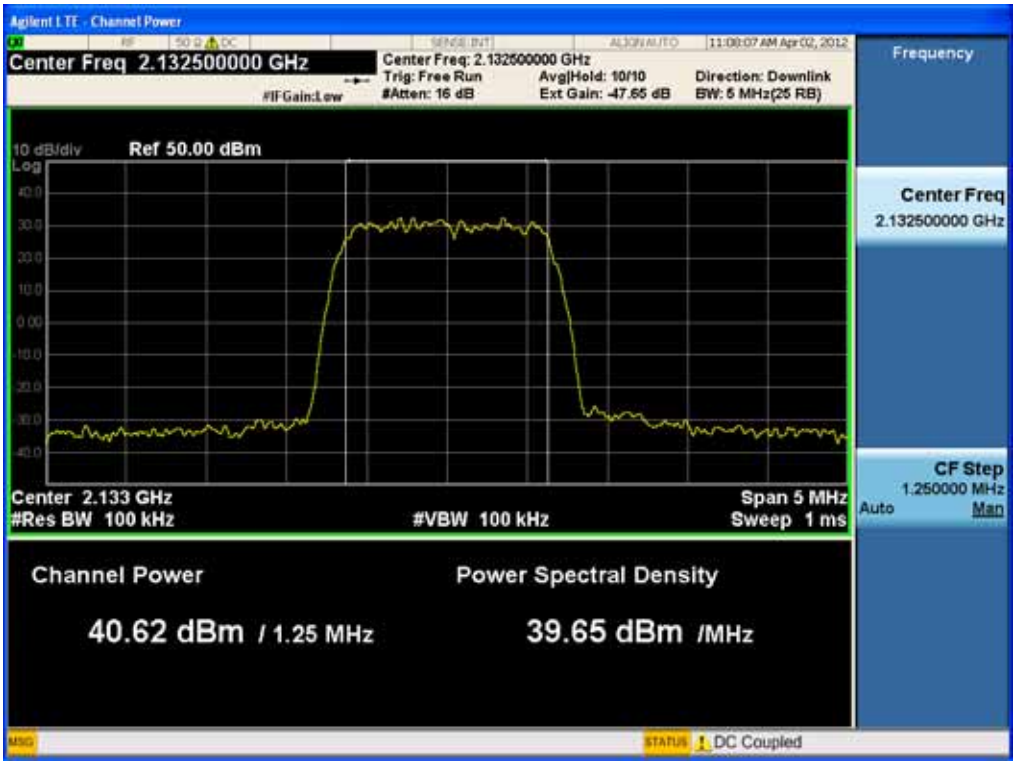


(16QAM High Channel)

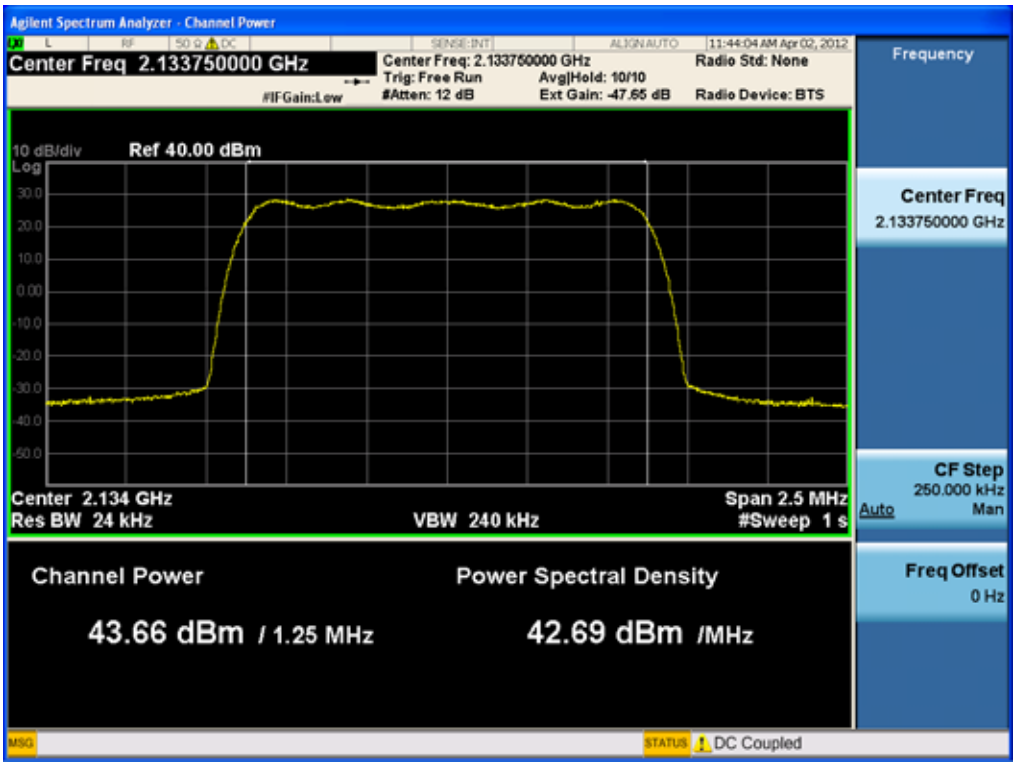
(64QAM High Channel)

5.4.2. Plot Data for Port2 (Single Carrier)

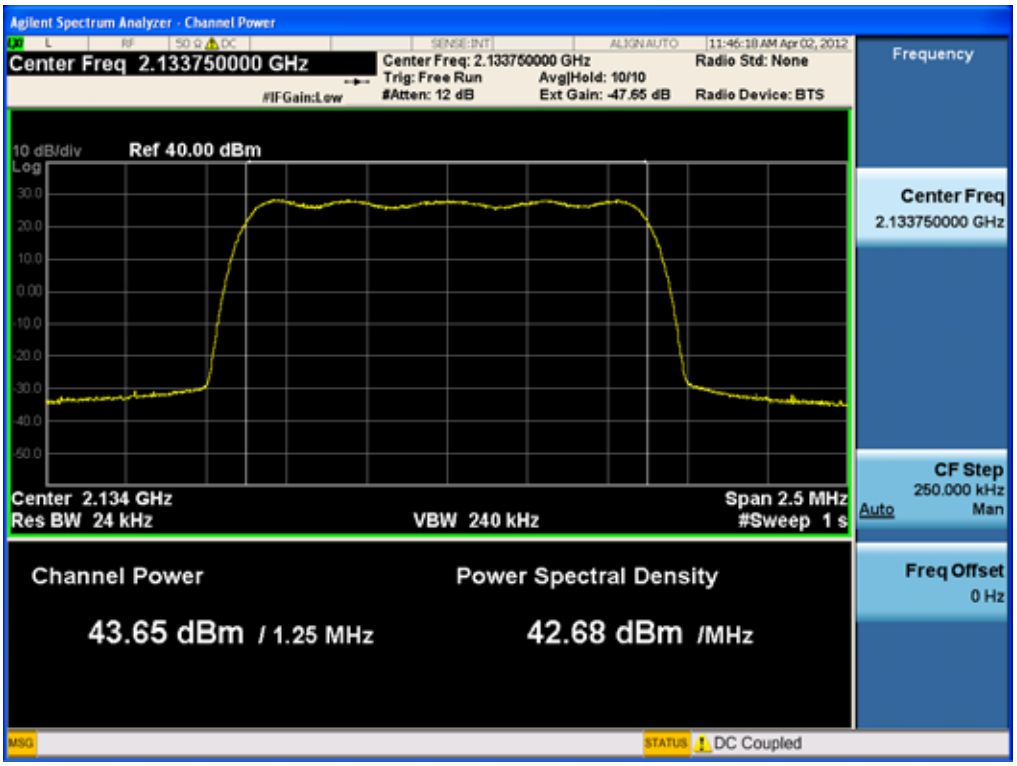
(QPSK Low Channel)



(QPSK Middle Channel)



(16QAM Middle Channel)



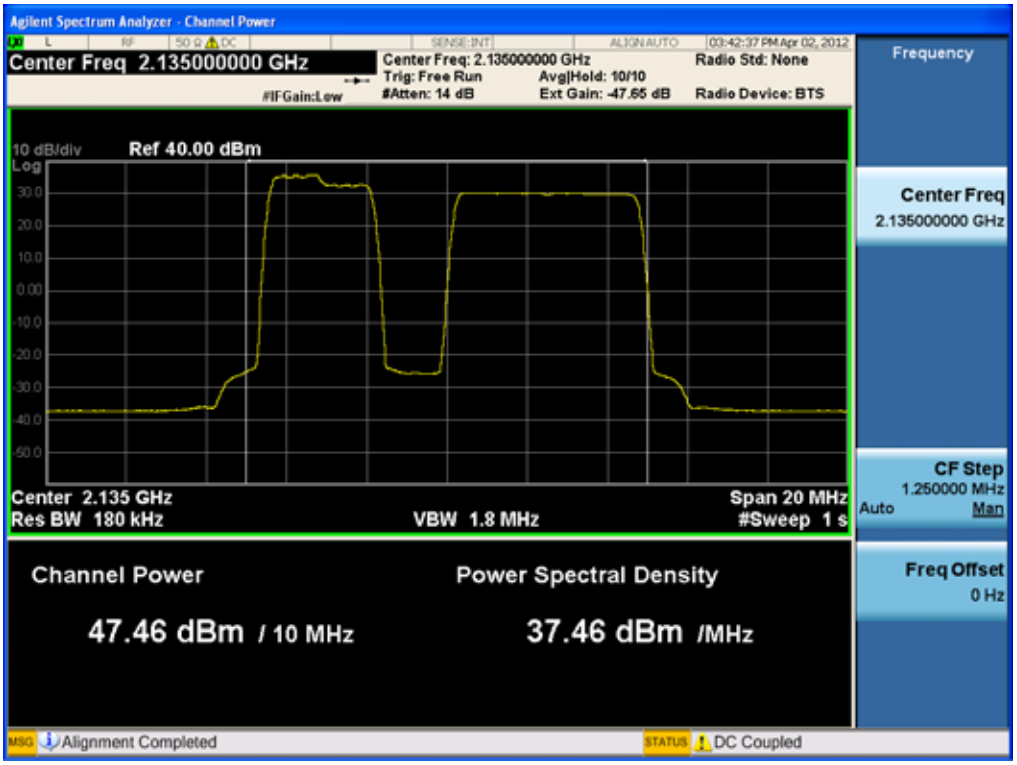
(QPSK High Channel)

(16QAM High Channel)

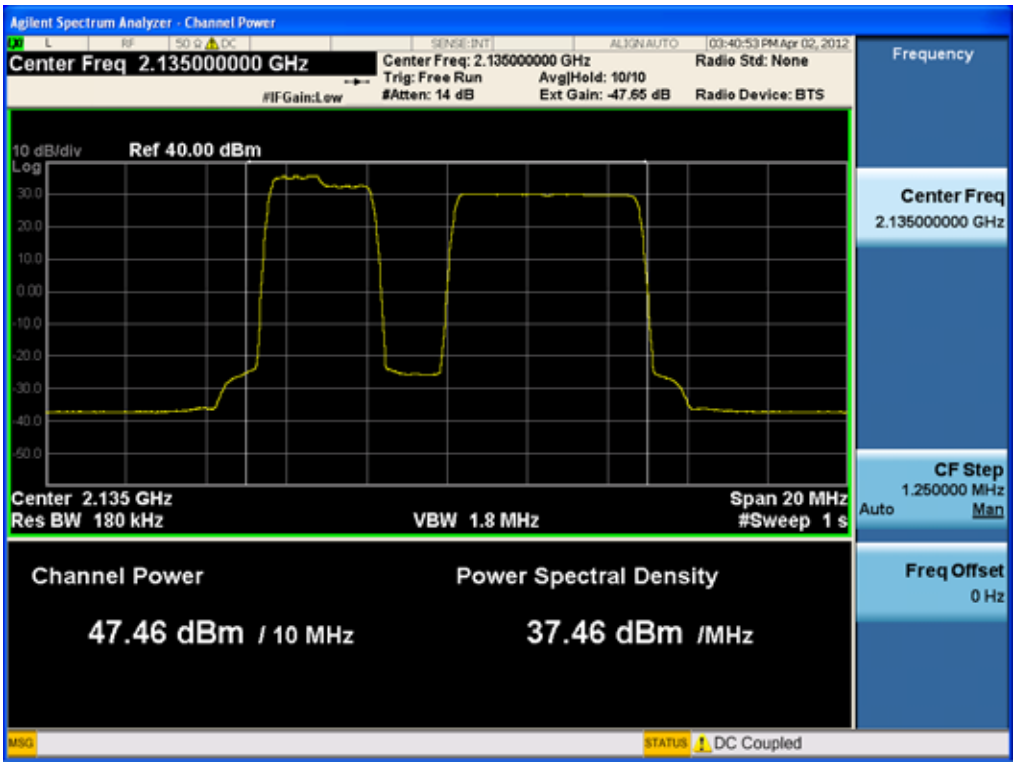
(64QAM High Channel)

5.4.3. Plot Data for Port1 (Three Carriers)

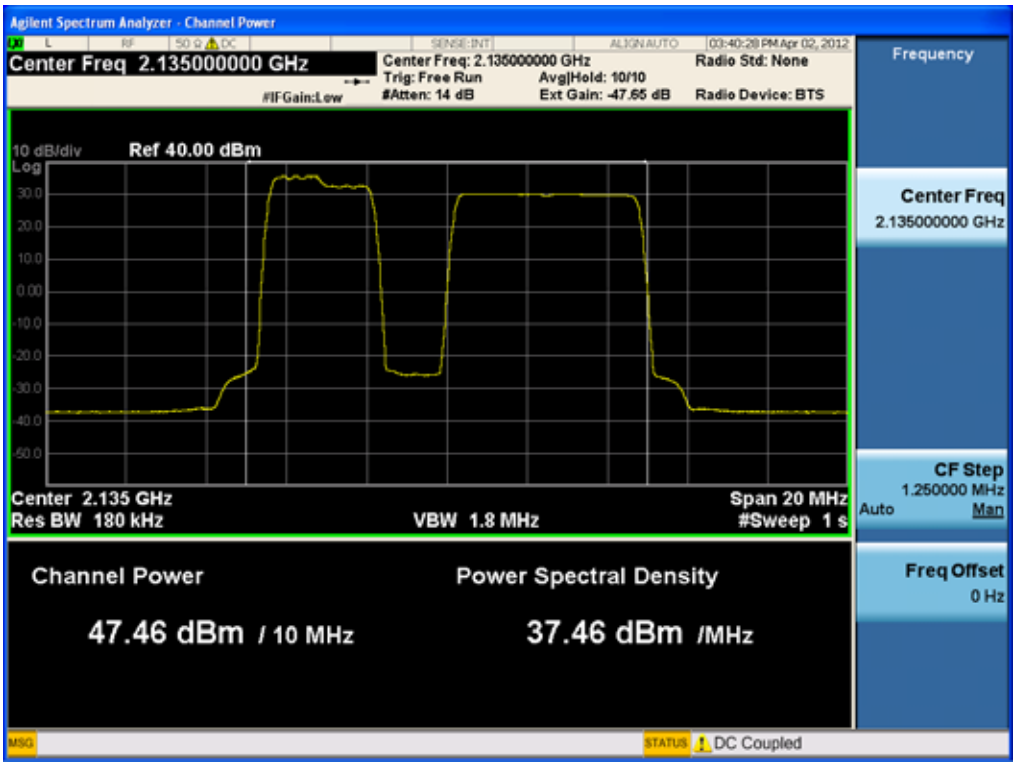
(QPSK)



(16QAM)



(64QAM)

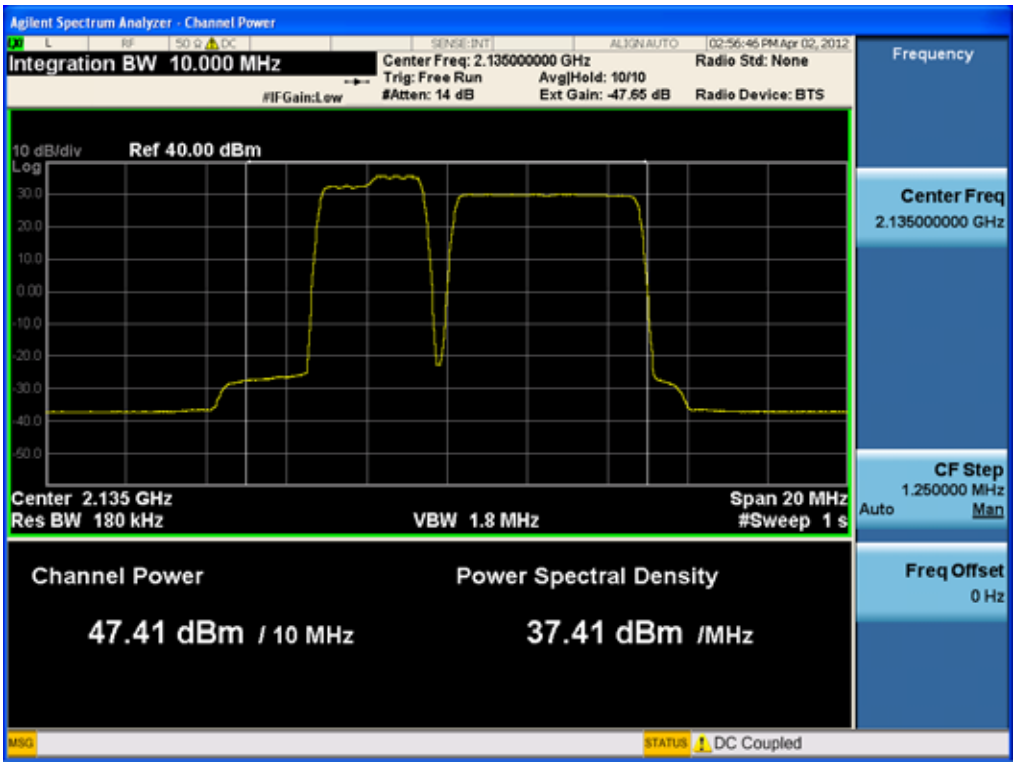

Agilent Spectrum Analyzer - Channel Power
Center Freq 2.135000000 GHz
Center Freq: 2.135000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#IFGain:Low
#Atten: 14 dB
Ext Gain: -47.65 dB
Radio Std: None
Radio Device: BTS
03:40:28 PM Apr 02, 2012
Frequency
10 dB/div
Log
Ref 40.00 dBm
30.0
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
Center Freq
2.135000000 GHz
Center 2.135 GHz
Res BW 180 kHz
VBW 1.8 MHz
Span 20 MHz
#Sweep 1 s
CF Step
1.250000 MHz
Auto
Man
Channel Power
47.46 dBm / 10 MHz
Power Spectral Density
37.46 dBm /MHz
Freq Offset
0 Hz
MSG
STATUS
DC Coupled

5.4.4. Plot Data for Port2 (Three Carriers)

(QPSK)

(16QAM)

(64QAM)


Agilent Spectrum Analyzer - Channel Power
Integration BW 10.000 MHz
Center Freq: 2.135000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#IFGain:Low
#Atten: 14 dB
Ext Gain: -47.65 dB
Radio Std: None
Radio Device: BTS
02:56:46 PM Apr 02, 2012
Frequency
10 dB/div
Log
Ref 40.00 dBm
Center Freq
2.135000000 GHz
Center 2.135 GHz
Res BW 180 kHz
VBW 1.8 MHz
Span 20 MHz
#Sweep 1 s
CF Step
1.250000 MHz
Auto
Man
Channel Power
47.41 dBm / 10 MHz
Power Spectral Density
37.41 dBm /MHz
Freq Offset
0 Hz
MSG
STATUS
DC Coupled

6. OCCUPIED BANDWIDTH

6.1. Applicable Standard

According to FCC §2.1049

The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0. 5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(g) Transmitter in which the modulating baseband comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer ’s maximum rated condition

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user

6.2.Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

6.3. Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The EUT was connected to a spectrum analyzer enabled with an occupied bandwidth function via its antenna port. Measurements were performed to determine the occupied bandwidth in accordance with FCC Part 2.1049. The occupied bandwidth was measured from the fundamental emission at the bottom, middle and top channels. The occupied bandwidth was measured using the built in occupied bandwidth function of the spectrum analyzer. It was set to measure the bandwidth where 99% of the signal power was contained. The analyzer automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

6.4. Test Result

: PASS

[Port 1 – Single Carrier]

	Frequency (MHz)	Measured Data (MHz)		
		QPSK	16QAM	64QAM
1x	2131.25	1.394	-	-
1x	2132.5	1.396	-	-
LTE	2137.5	4.805	4.837	4.817

[Port 2 – Single Carrier]

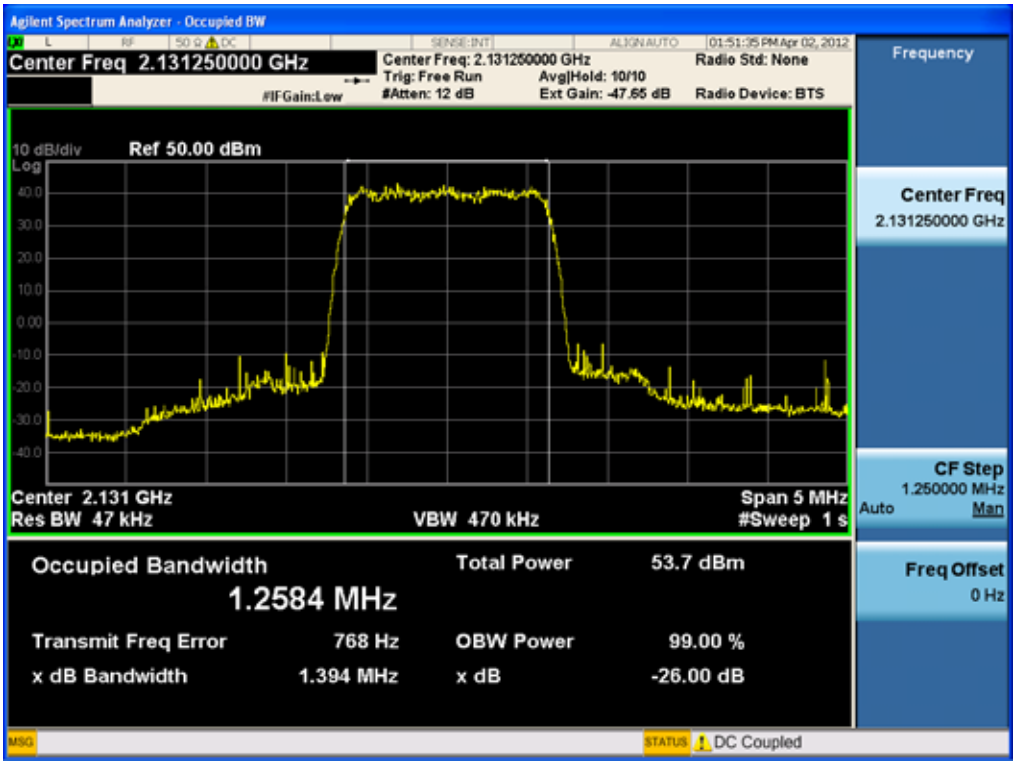
	Frequency (MHz)	Measured Data (MHz)		
		QPSK	16QAM	64QAM
1x	2132.5	1.390	-	-
EV-DO	2133.75	1.392	1.402	-
LTE	2137.5	4.738	4.741	4.781

[Port 1 , Port 2 – Three Carriers]

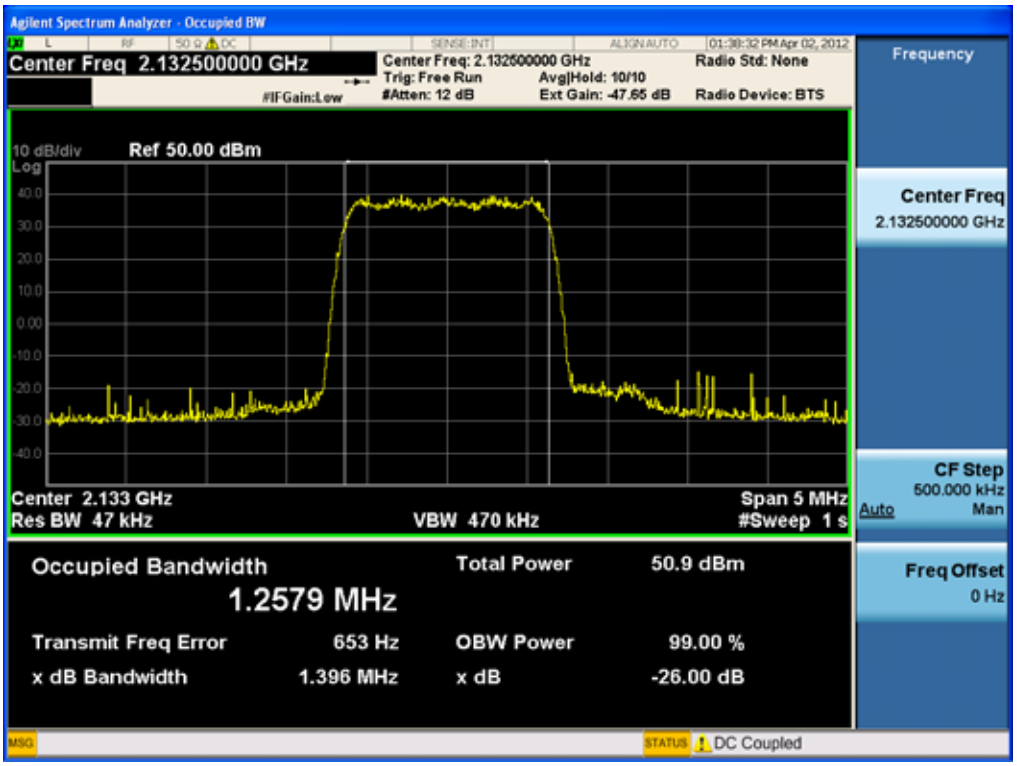
	Frequency (MHz)	Measured Data (MHz)		
		QPSK	16QAM	64QAM
Port 1	2135	9.524	9.535	9.552
Port 2	2135	8.275	8.283	8.274

6.4.1. Plot Data for Port1 (Single Carrier)

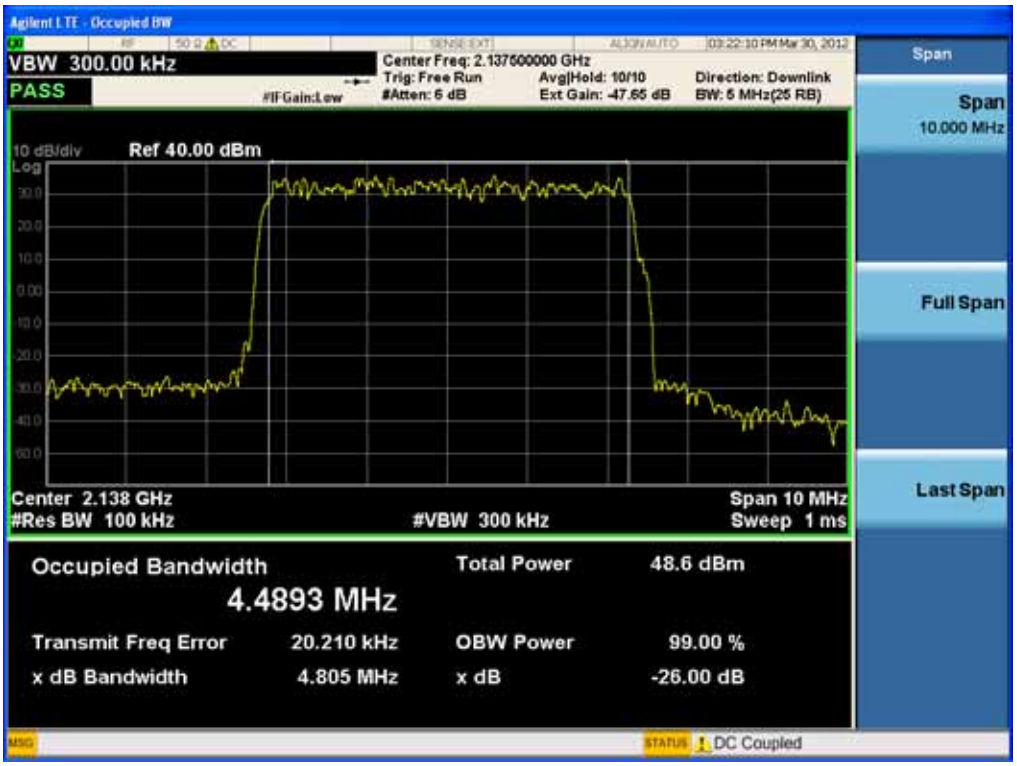
(1x QPSK Low Channel)



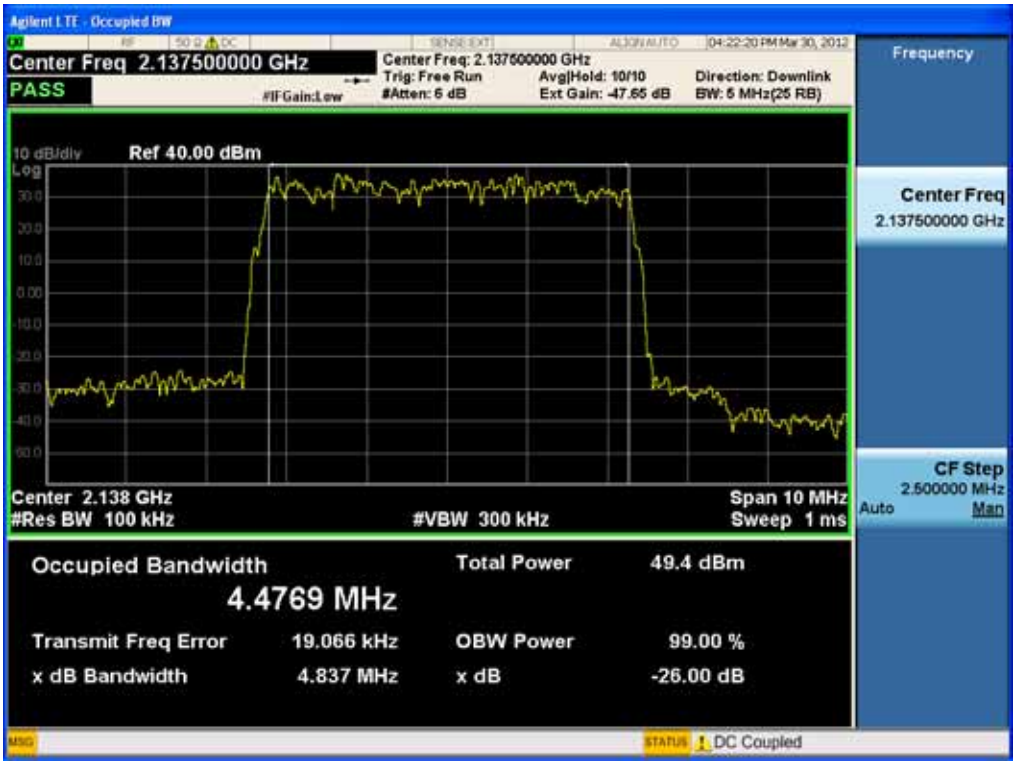
(1x QPSK Middle Channel)



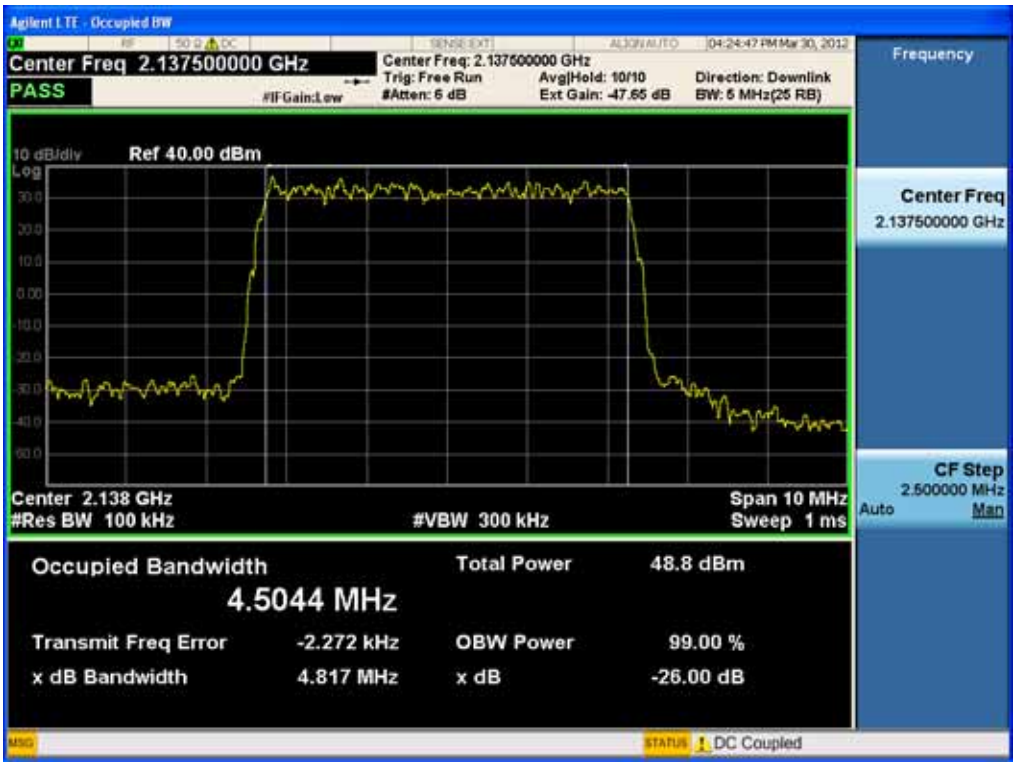
(LTE QPSK High Channel)



(LTE 16QAM High Channel)

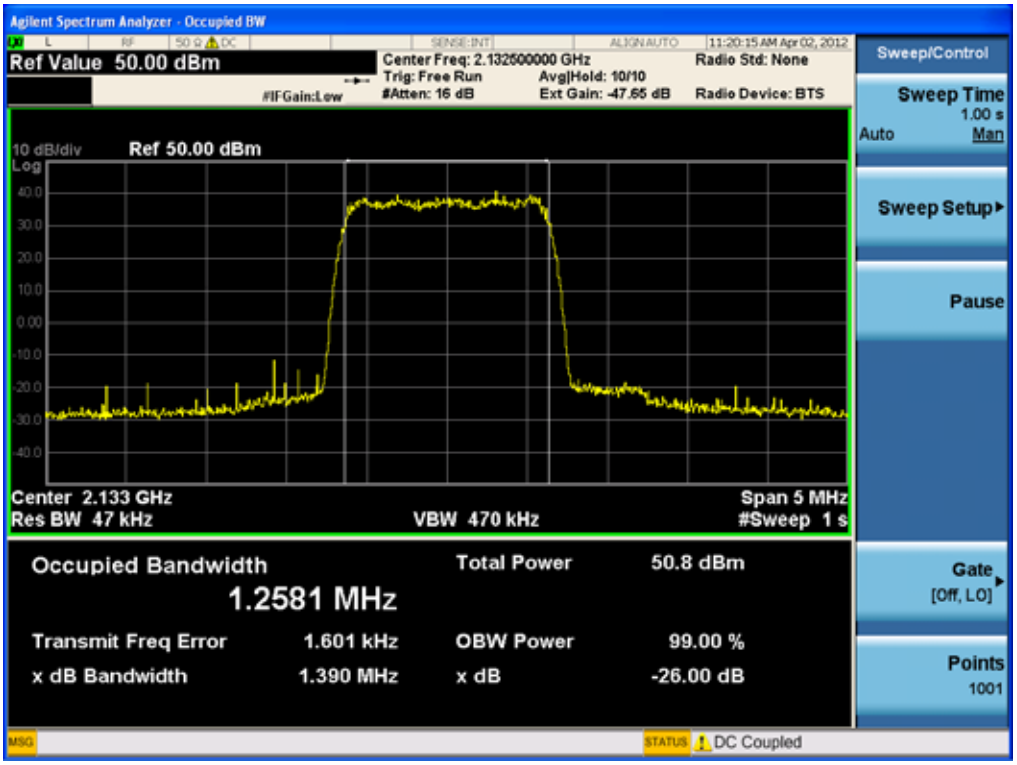


(LTE 64QAM High Channel)

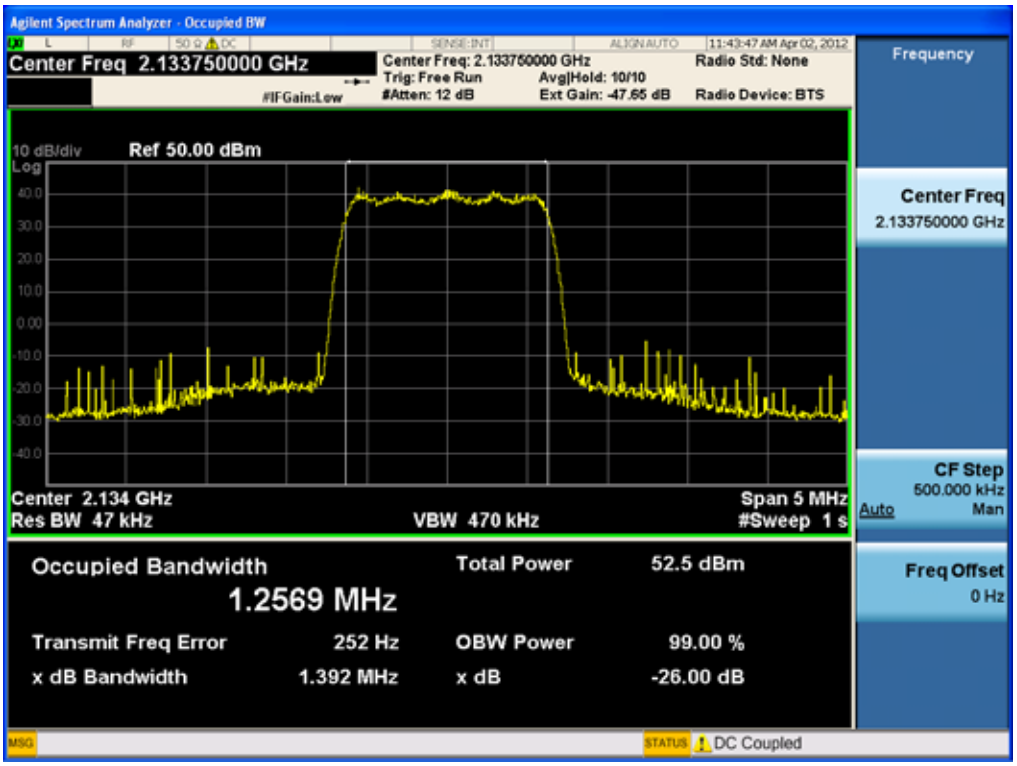


6.4.2. Plot Data for Port2 (Single Carrier)

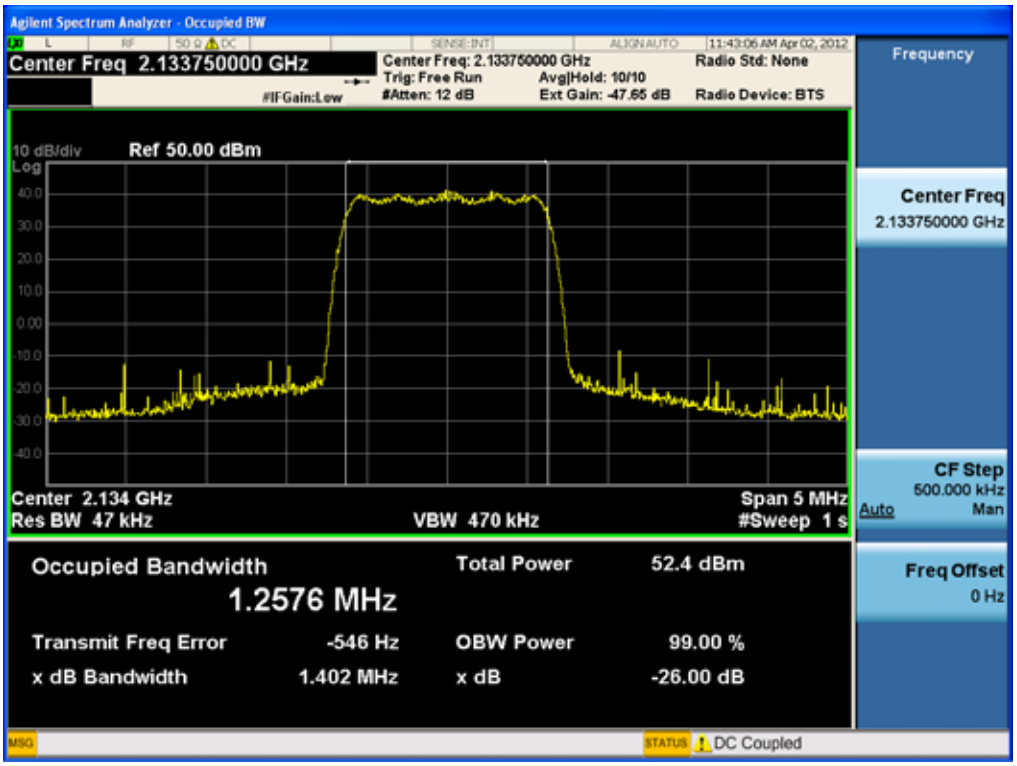
(1x QPSK Low Channel)



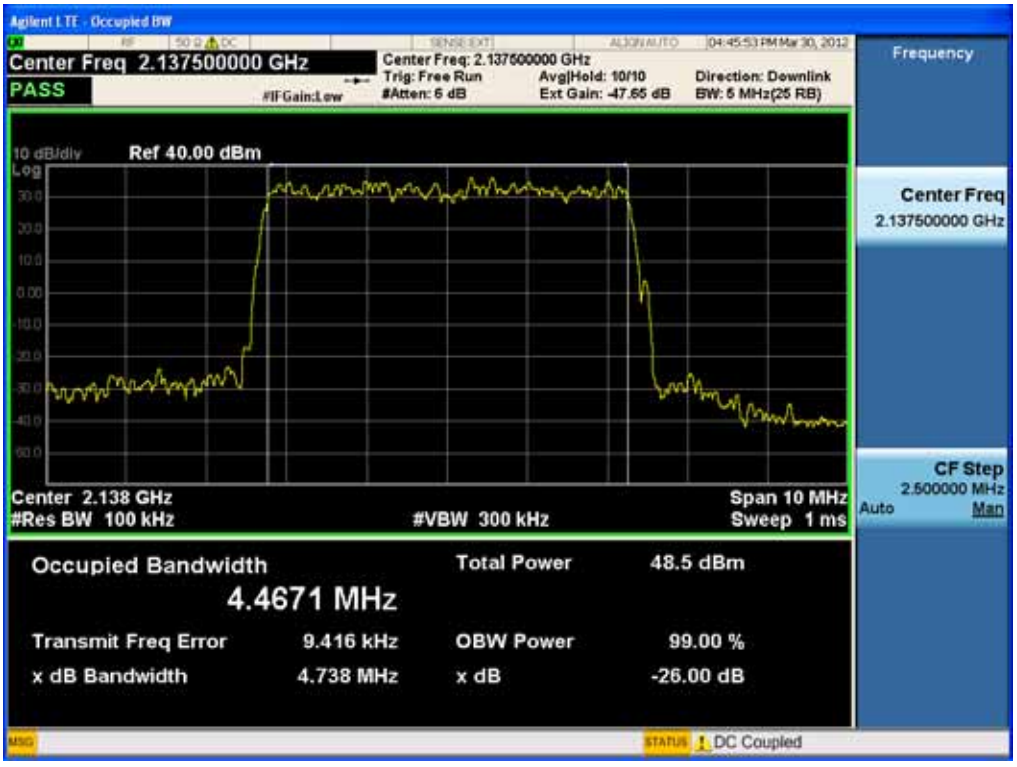
(EV-DO QPSK Middle Channel)



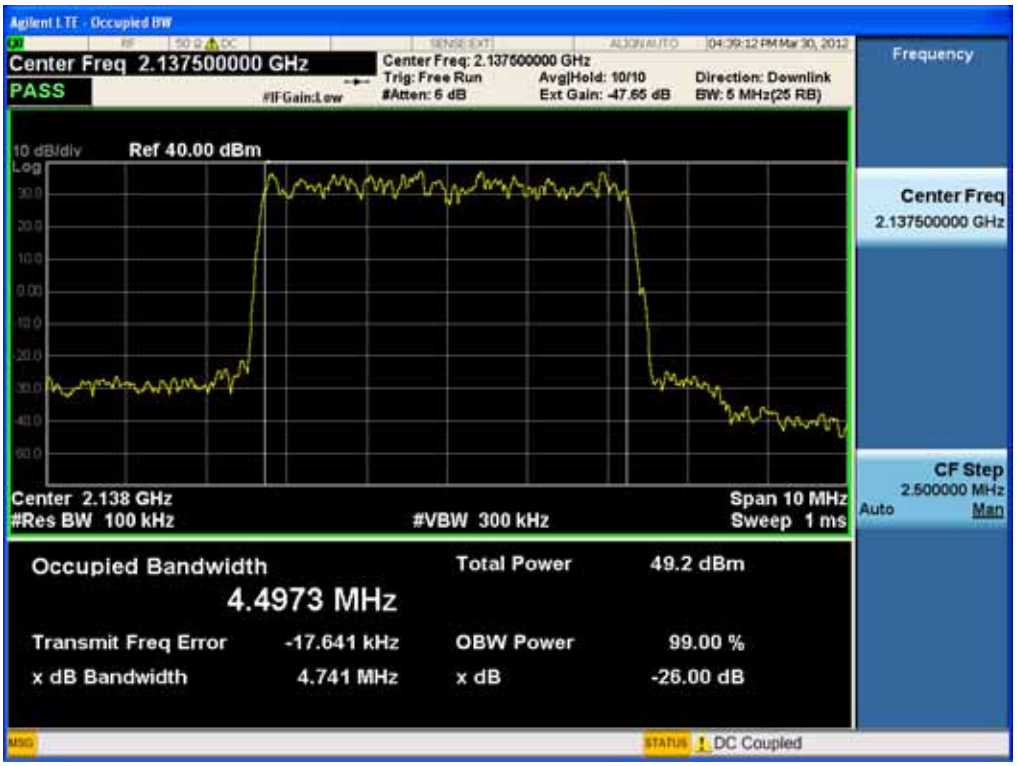
(EV-DO 16QAM Middle Channel)



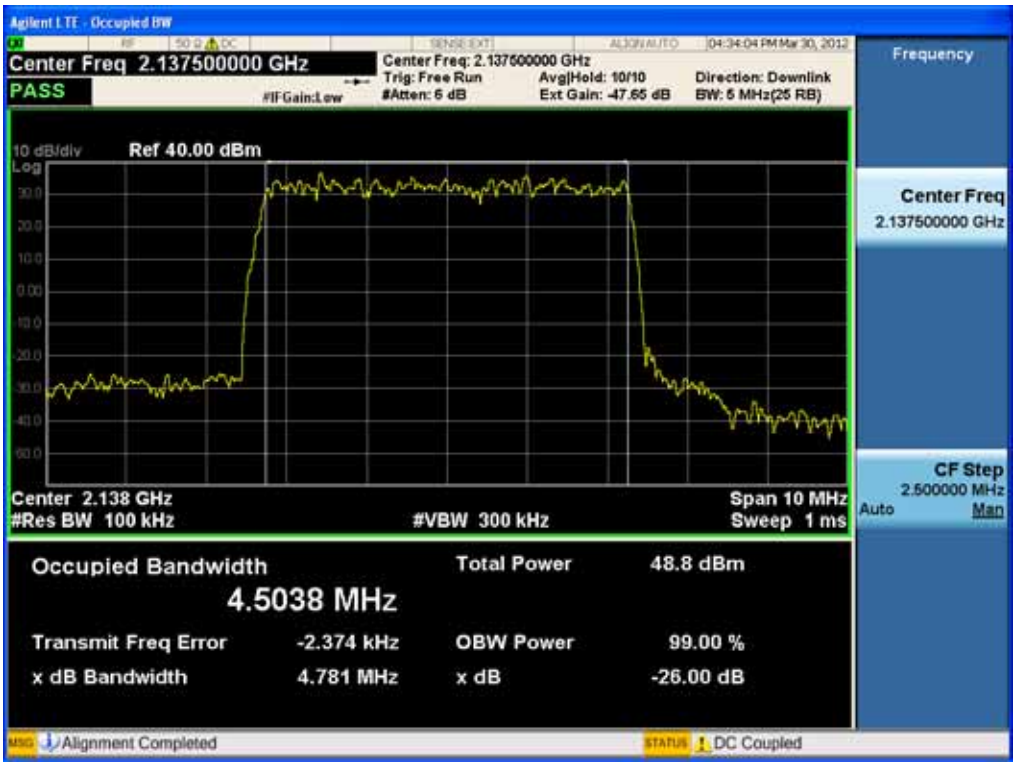
(LTE QPSK High Channel)



(LTE 16QAM High Channel)

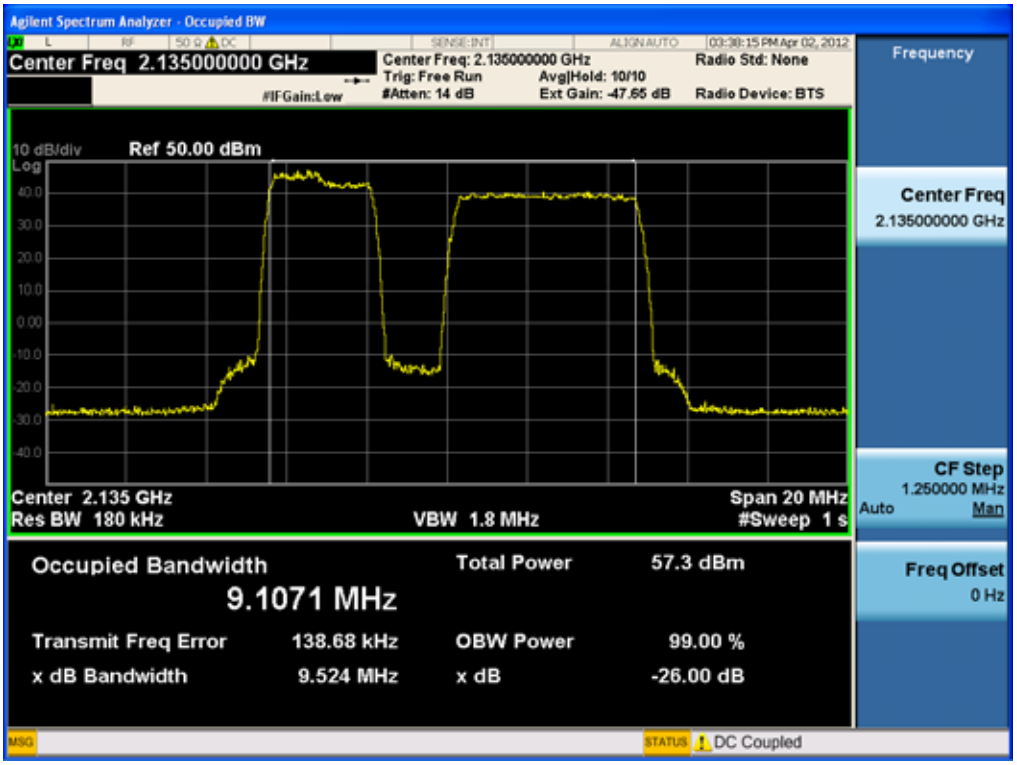


(LTE64QAM High Channel)

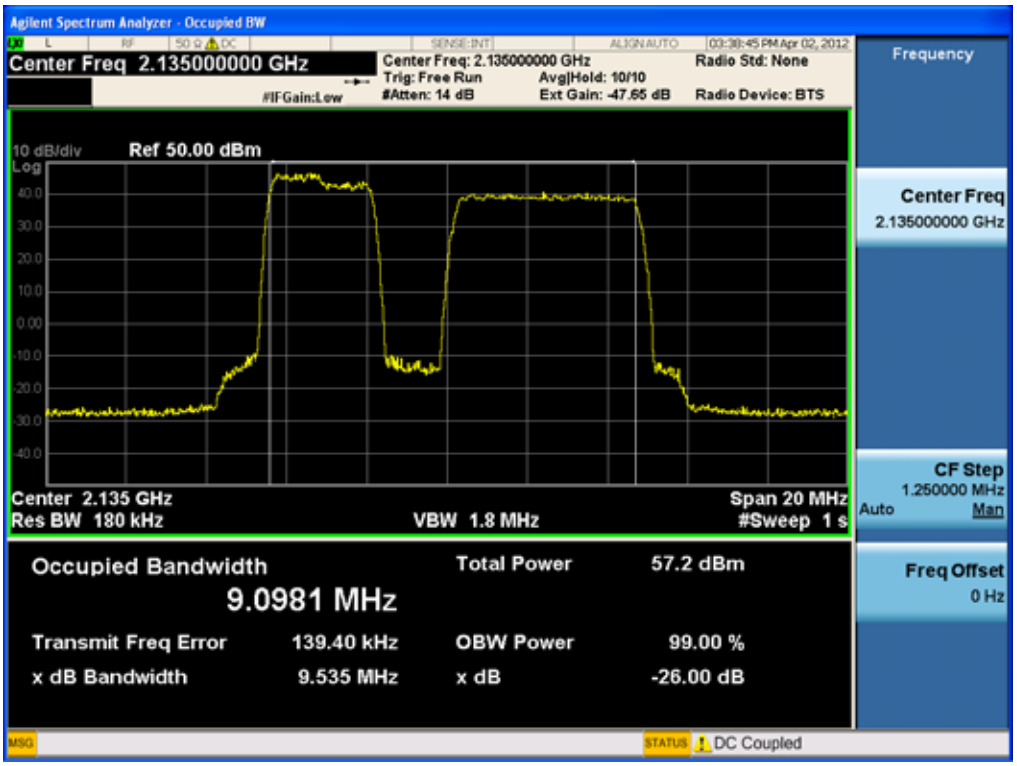


6.4.3. Plot Data for Port1 (Three Carriers)

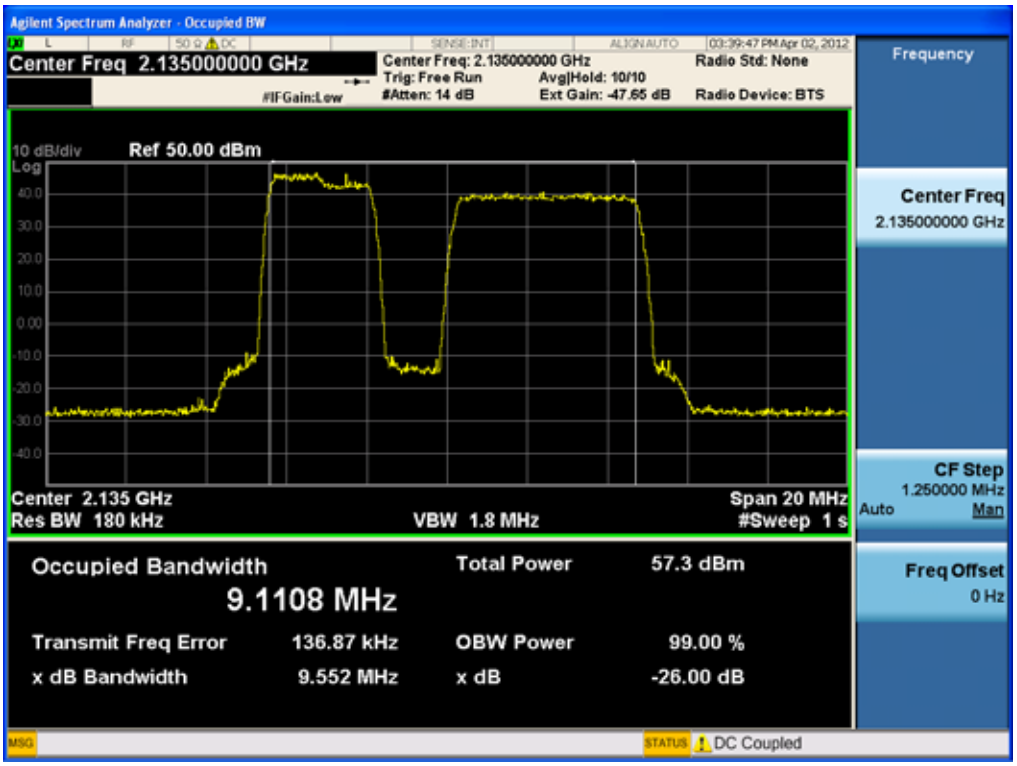
(QPSK)



(16QAM)

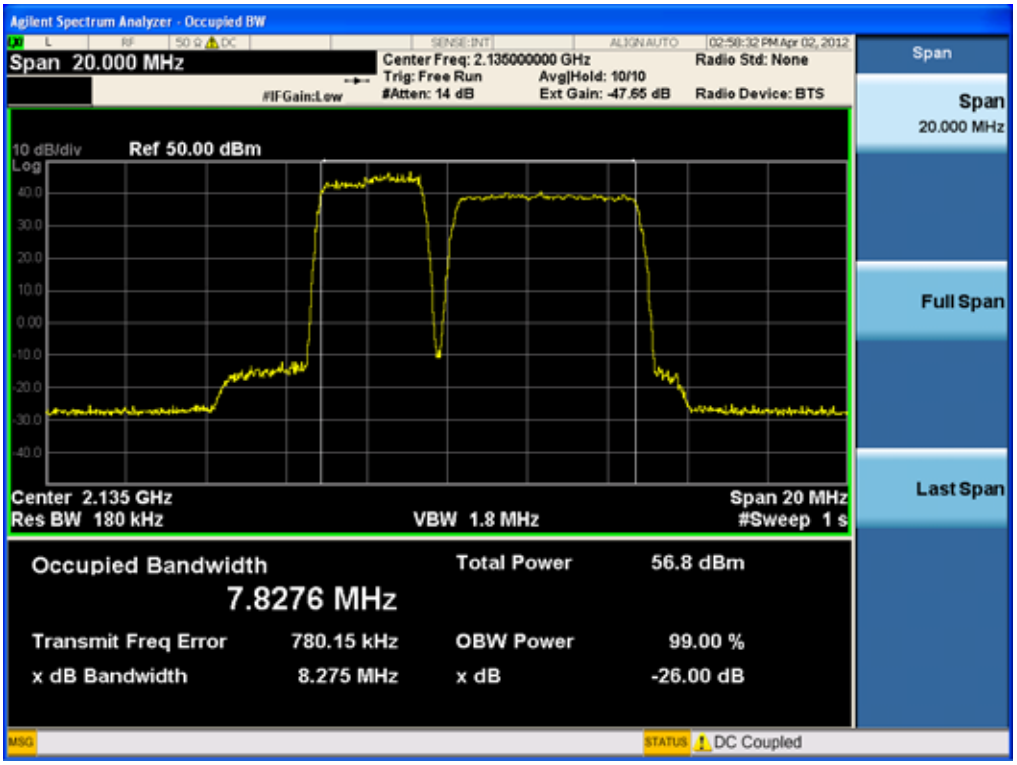


(64QAM)

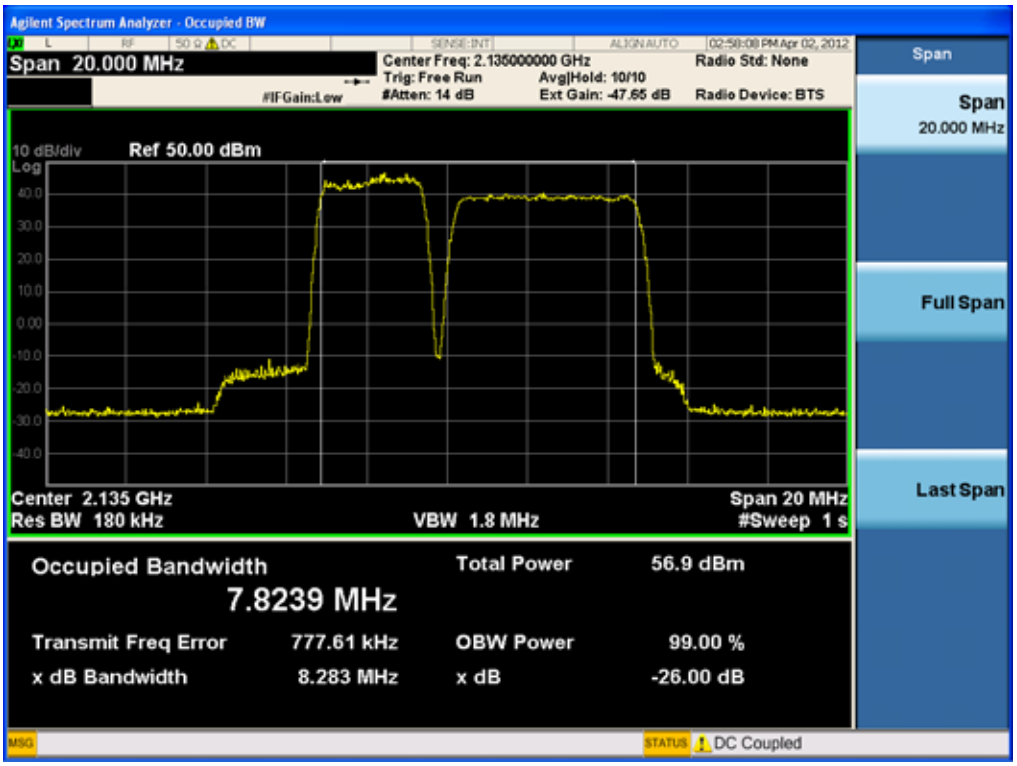

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.135000000 GHz
Center Freq: 2.135000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#IFGain:Low
#Atten: 14 dB
Ext Gain: -47.65 dB
Radio Std: None
Radio Device: BTS
03:39:47 PM Apr 02, 2012
Frequency
10 dB/div
Log
Ref 50.00 dBm
Center Freq
2.135000000 GHz
CF Step
1.250000 MHz
Auto
Man
Center 2.135 GHz
Res BW 180 kHz
VBW 1.8 MHz
Span 20 MHz
#Sweep 1 s
Occupied Bandwidth
9.1108 MHz
Total Power
57.3 dBm
Transmit Freq Error
136.87 kHz
OBW Power
99.00 %
x dB Bandwidth
9.552 MHz
x dB
-26.00 dB
Freq Offset
0 Hz
MSG
STATUS
DC Coupled

6.4.4. Plot Data for Port2 (Three Carriers)

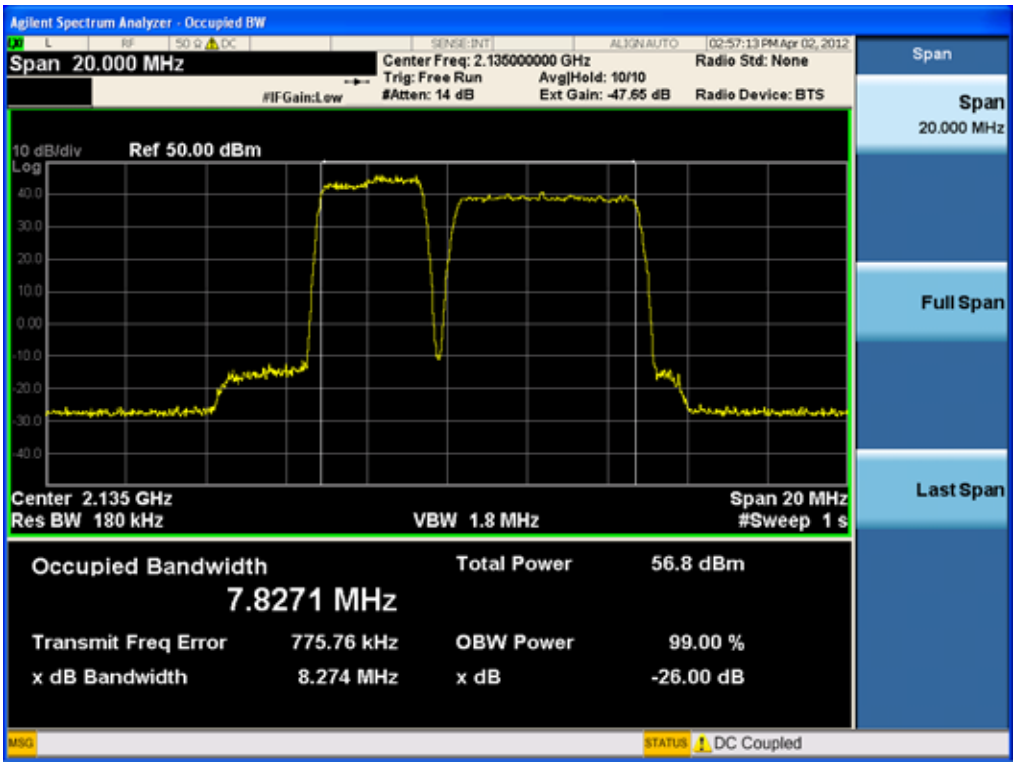
(QPSK)



(16QAM)



(64QAM)


Agilent Spectrum Analyzer - Occupied BW
Span 20.000 MHz
Center Freq: 2.135000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#IFGain:Low
#Atten: 14 dB
Ext Gain: -47.65 dB
Radio Std: None
Radio Device: BTS
02:57:13 PM Apr 02, 2012
10 dB/div
Log
Ref 50.00 dBm
Center 2.135 GHz
Res BW 180 kHz
VBW 1.8 MHz
Span 20 MHz
#Sweep 1 s
Occupied Bandwidth
7.8271 MHz
Total Power
56.8 dBm
Transmit Freq Error
775.76 kHz
OBW Power
99.00 %
x dB Bandwidth
8.274 MHz
x dB
-26.00 dB
MSG
STATUS
DC Coupled
Span
Span
20.000 MHz
Full Span
Last Span

7. SPURIOUS EMISSION AT ANTENNA TERMINAL

7.1. Applicable Standard

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1051

According to §27.53, (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

7.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

7.3. Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 KHz (Under 1 GHz), 1MHz (Above 1 GHz). Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.4. Test Result

: Pass

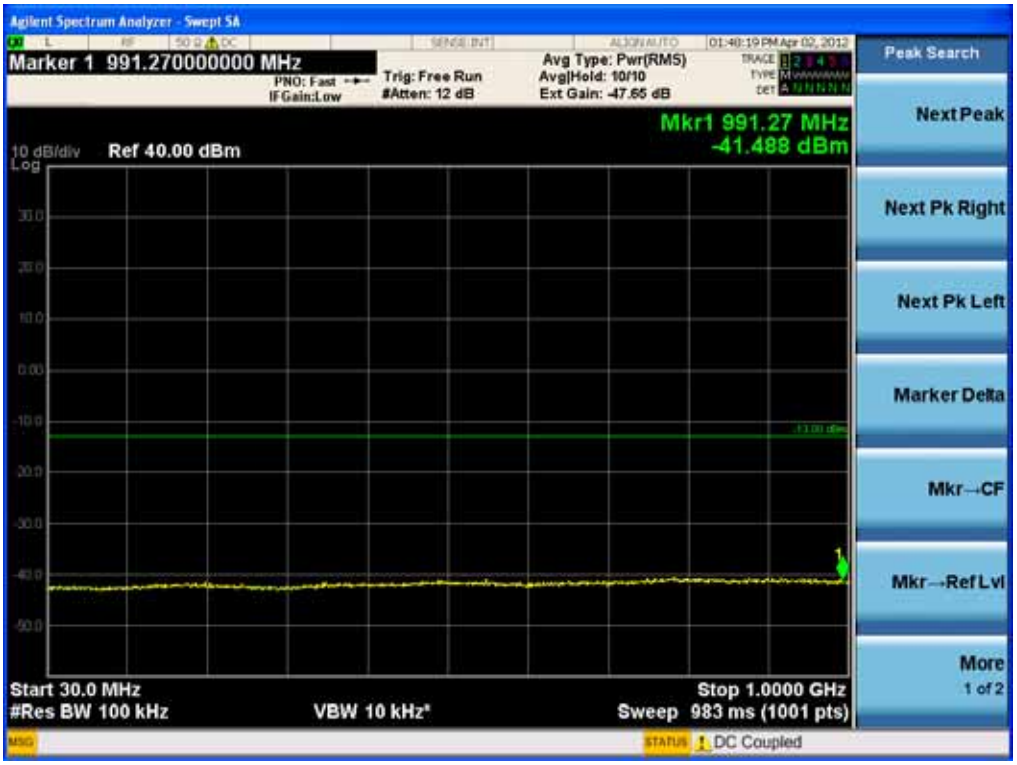
	Measure-and-sum Data (dBm)		
	QPSK	16QAM	64QAM
Band Edge	-25.232	-24.828	-24.828
Spurious Emission (30 MHz ~ 1 GHz)	-35.287	-35.591	-35.630
Spurious Emission (1 GHz ~ 26.5 GHz)	-14.992	-14.970	-14.984

※ Test Data for Port1 & Port2 is calculated by measure-and-sum method.
(N=2, so Calculated Data = Measured Data + 10log2 (=3 dB))

※ We tested for all cases of operating mode, but just recorded the worst case.
(CDMA low channel & LTE High channel)

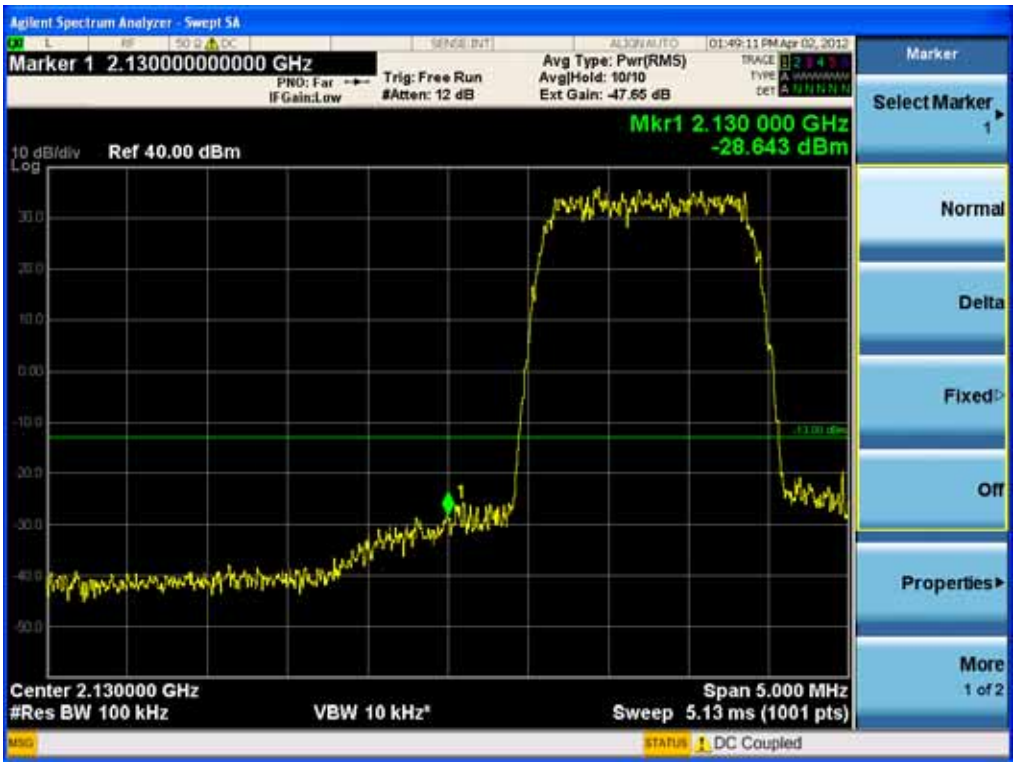
7.4.1. Plot Data for Port1 (Single Carrier)

(QPSK Low Channel_30MHz ~ 1GHz)

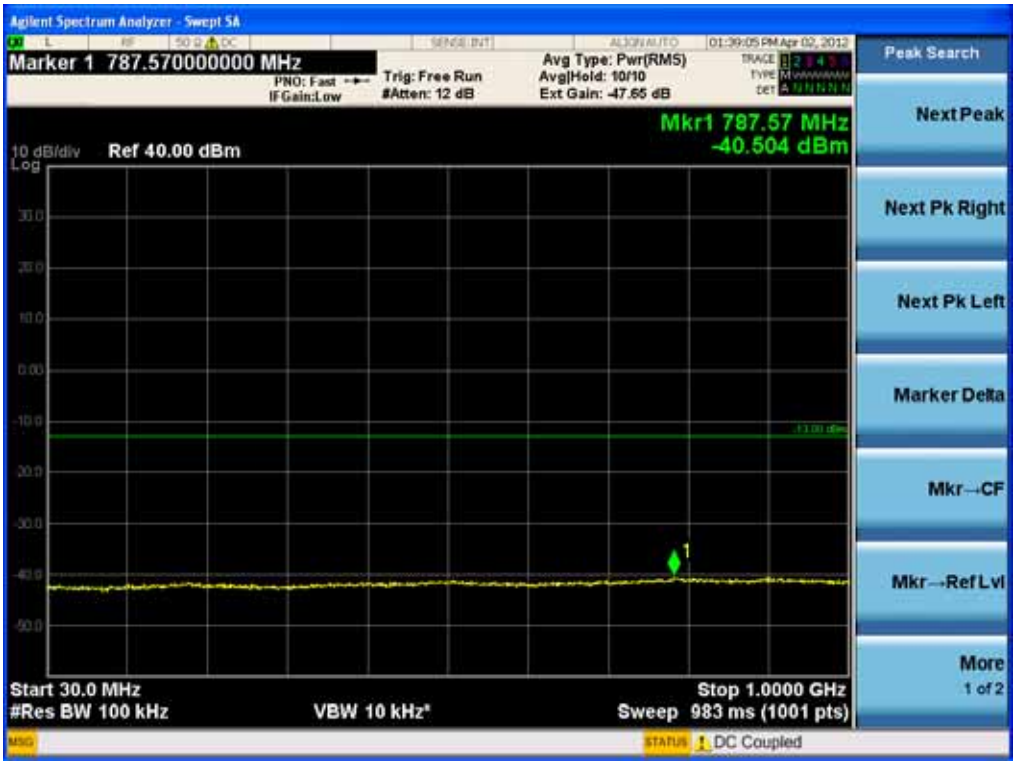


(QPSK Low Channel_1GHz ~ 26.5GHz)

(QPSK Low Channel_Band Edge)



(QPSK Middle Channel_30MHz~1GHz)



(QPSK Middle Channel_1GHz~26.5GHz)

(QPSK High Channel_30MHz~1GHz)

(QPSK High Channel_1GHz~26.5GHz)

(QPSK High Channel_Band Edge)

(16QAM High Channel_30MHz~1GHz)

(16QAM High Channel_1GHz~26.5GHz)

(16QAM High Channel_Band Edge)

(64QAM High Channel_30MHz~1GHz)

(64QAM High Channel_1GHz~26.5GHz)

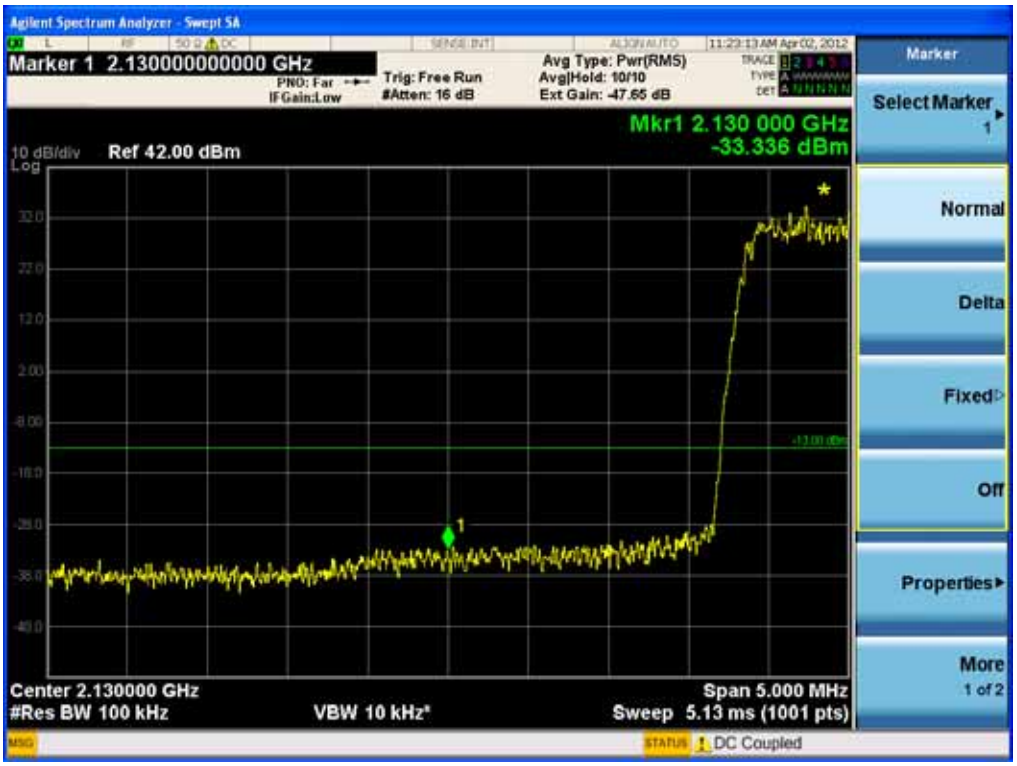
(64QAM High Channel_Band Edge)

7.4.2. Plot Data for Port2 (Single Carrier)

(QPSK Low Channel_30MHz ~ 1GHz)

(QPSK Low Channel_1GHz ~ 26.5GHz)

(QPSK Low Channel_Band Edge)



(QPSK Middle Channel_30MHz~1GHz)

(QPSK Middle Channel_1GHz~26.5GHz)

(16QAM Middle Channel_30MHz~1GHz)

(16QAM Middle Channel_1GHz~26.5GHz)

(QPSK High Channel_30MHz~1GHz)

(QPSK High Channel_1GHz~26.5GHz)

(QPSK High Channel_Band Edge)

(16QAM High Channel_30MHz~1GHz)

(16QAM High Channel_1GHz~26.5GHz)

(16QAM High Channel_Band Edge)

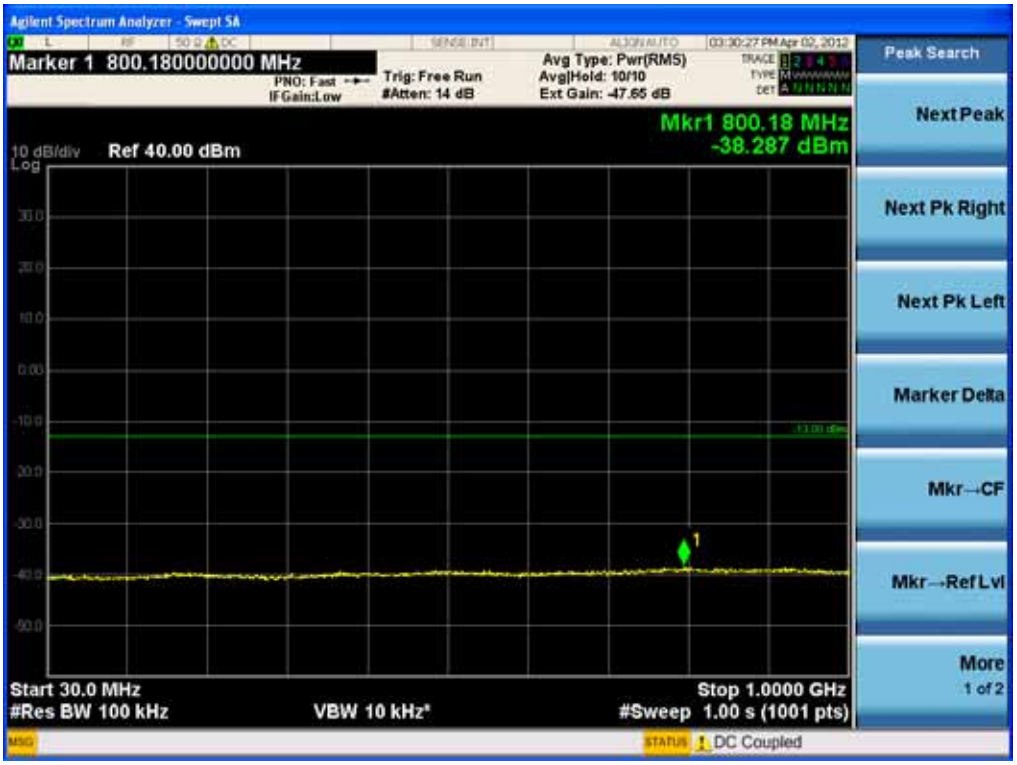
(64QAM High Channel_30MHz~1GHz)

(64QAM High Channel_1GHz~26.5GHz)

(64QAM High Channel_Band Edge)

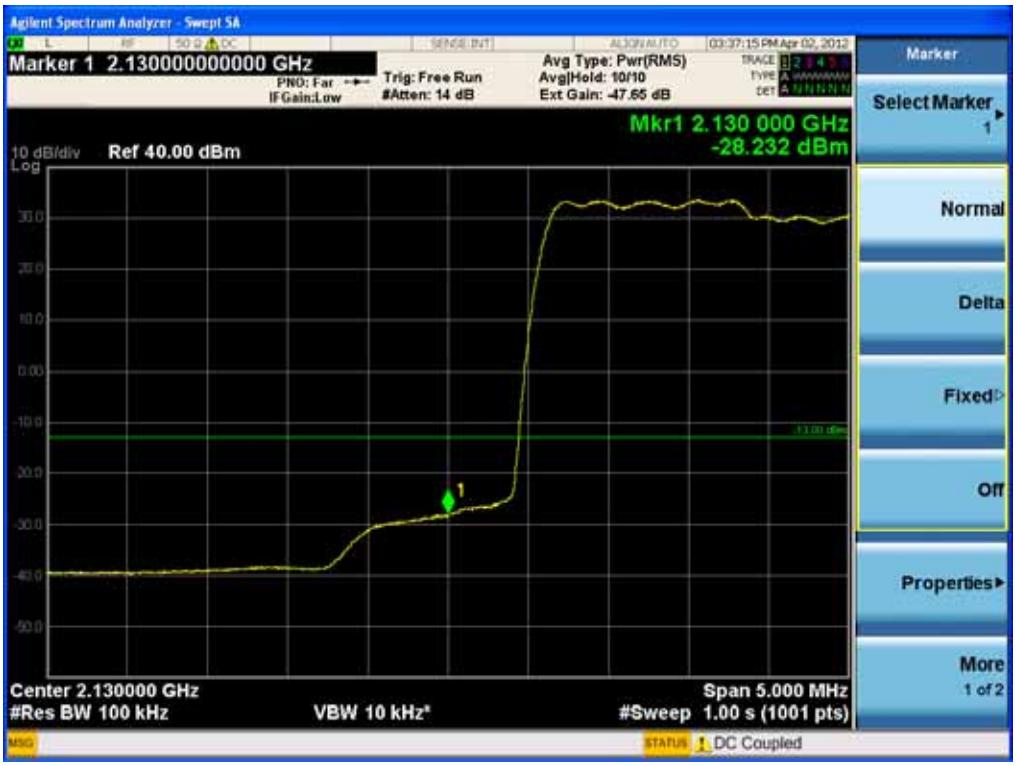
7.4.3. Plot Data for Port1 (Three Carriers)

(QPSK_30MHz~1GHz_1X&LTE)

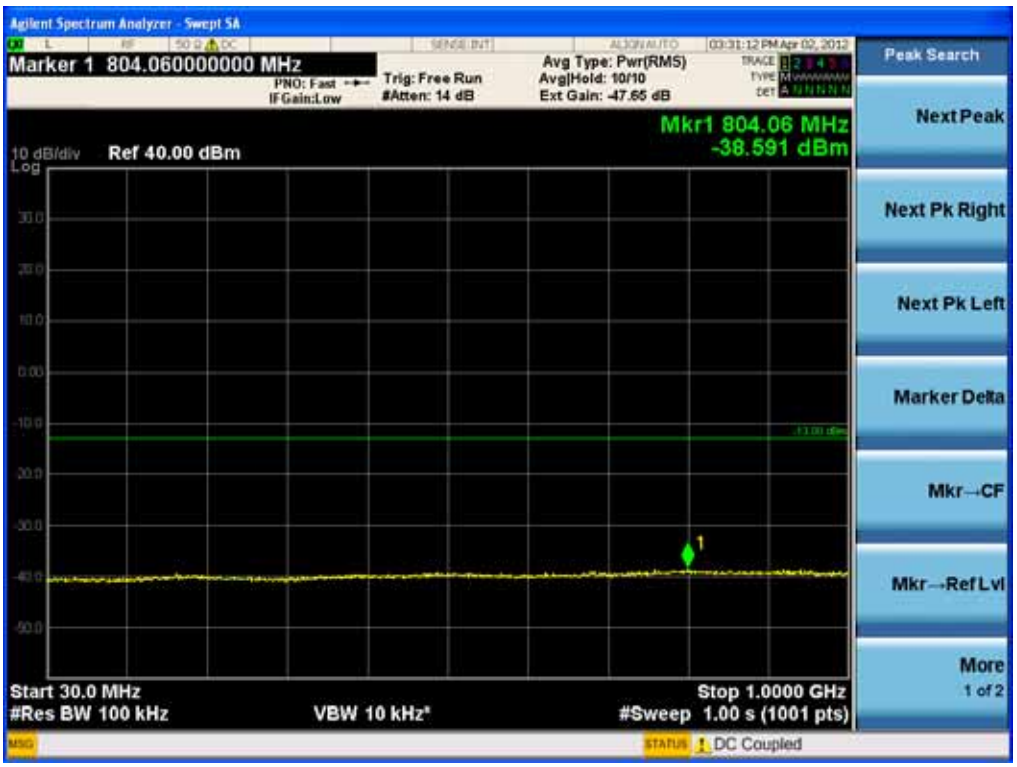


(QPSK_1GHz~26.5GHz_1X&LTE)

(QPSK_Band Edge_1X&LTE)



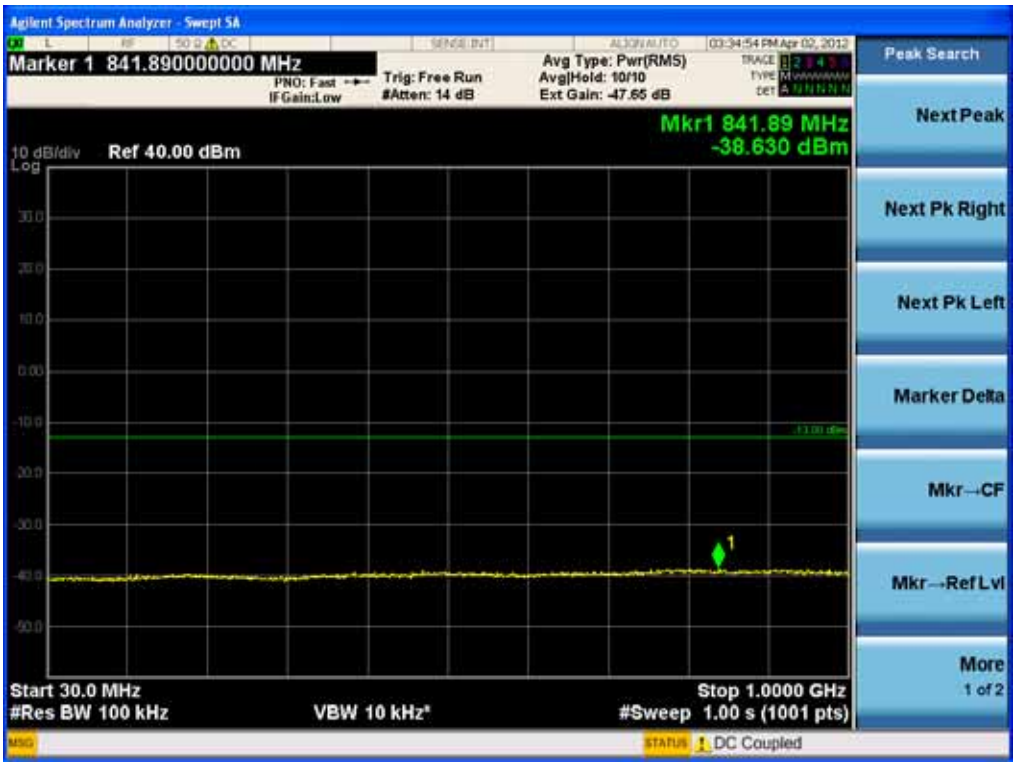
(16QAM_30MHz~1GHz_1X&LTE)



(16QAM_1GHz~26.5GHz_1X&LTE)

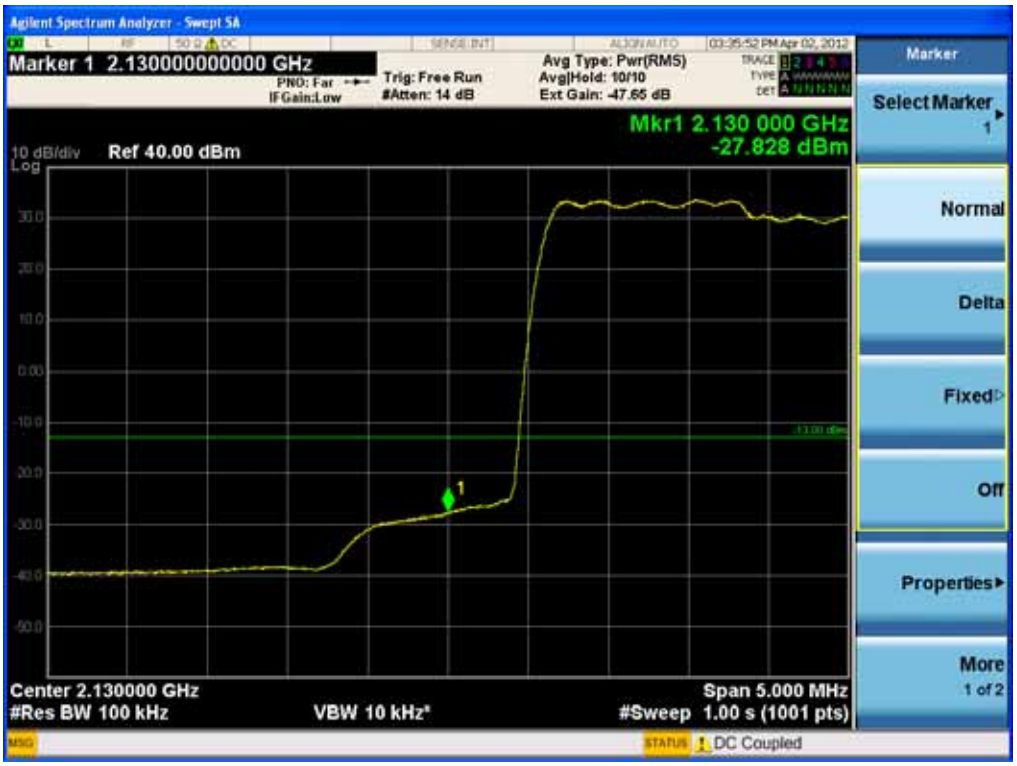
(16QAM_Band Edge_1X&LTE)

(64QAM_30MHz~1GHz_1X&LTE)



(64QAM_1GHz~26.5GHz_1X&LTE)

(64QAM_Band Edge_1X&LTE)



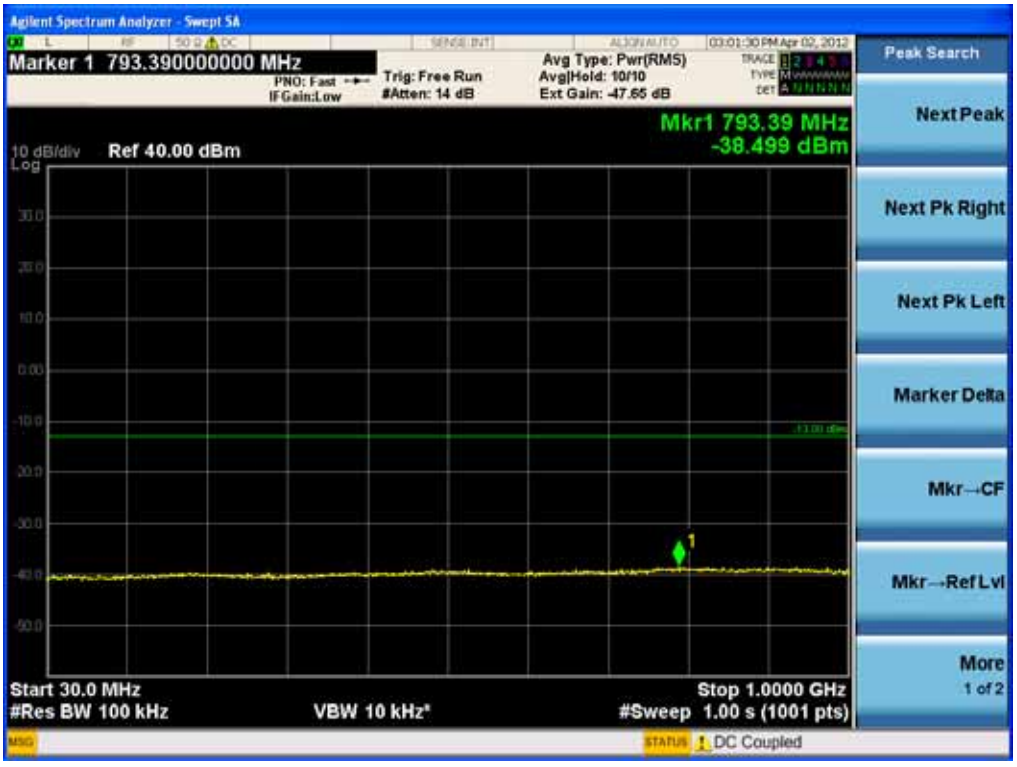
7.4.4. Plot Data for Port2 (Three Carriers)

(QPSK_30MHz~1GHz_1X&EV-DO&LTE)

(QPSK_1GHz~26.5GHz_1X&EV-DO&LTE)

(QPSK_Band Edge_1X&EV-DO&LTE)

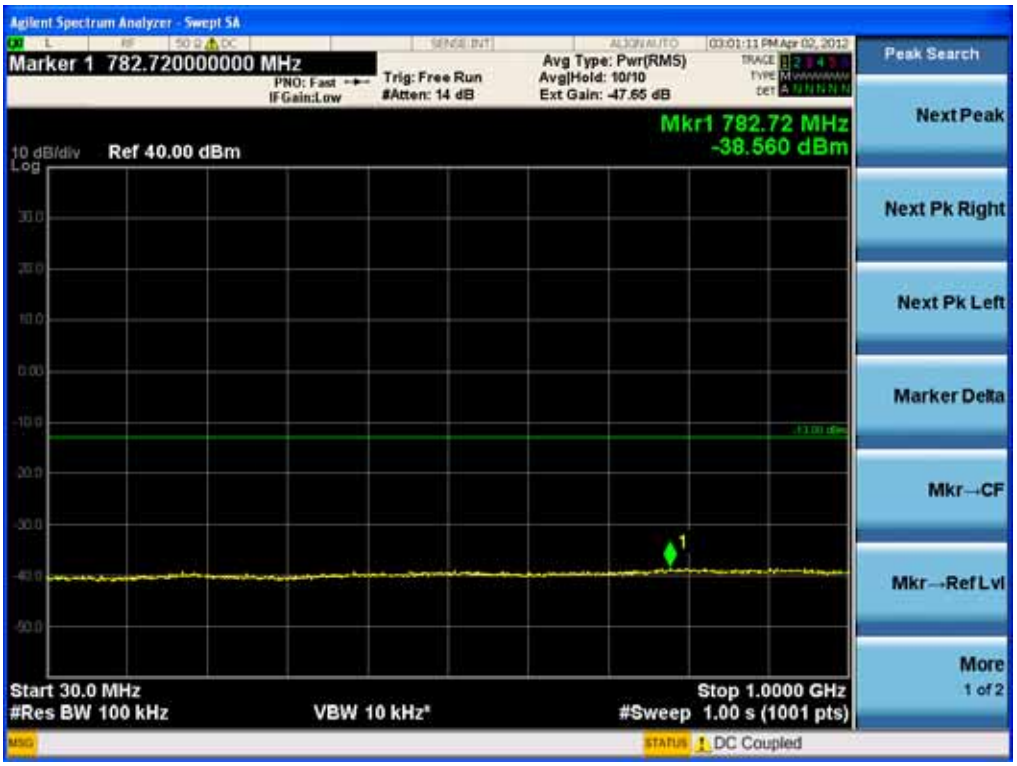
(16QAM_30MHz~1GHz_1X&EV-DO&LTE)



(16QAM_1GHz~26.5GHz_1X&EV-DO&LTE)

(16QAM_Band Edge_1X&EV-DO&LTE)

(64QAM_30MHz~1GHz_1X&EV-DO&LTE)



(64QAM_1GHz~26.5GHz_1X&EV-DO&LTE)

(64QAM_Band Edge_1X&EV-DO&LTE)

8. RADIATED SPURIOUS EMISSION

8.1 Applicable Standard

According to FCC § 27.53

(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

8.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	147	04/13/2012
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	02/19/2013
HD	MA240 / Antenna Position Tower	556	N/A
EMCO	1050 / Turn Table	114	N/A
HD GmbH	HD 100 / Controller	13	N/A
HD GmbH	KMS 560 / SlideBar	12	N/A
MITEQ	AMF-6D-001180-35-20P/AMP	990893	05/02/2012
EMCO	6502/Loop Antenna	9009-2536	01/14/2014
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

8.3 Test Procedure

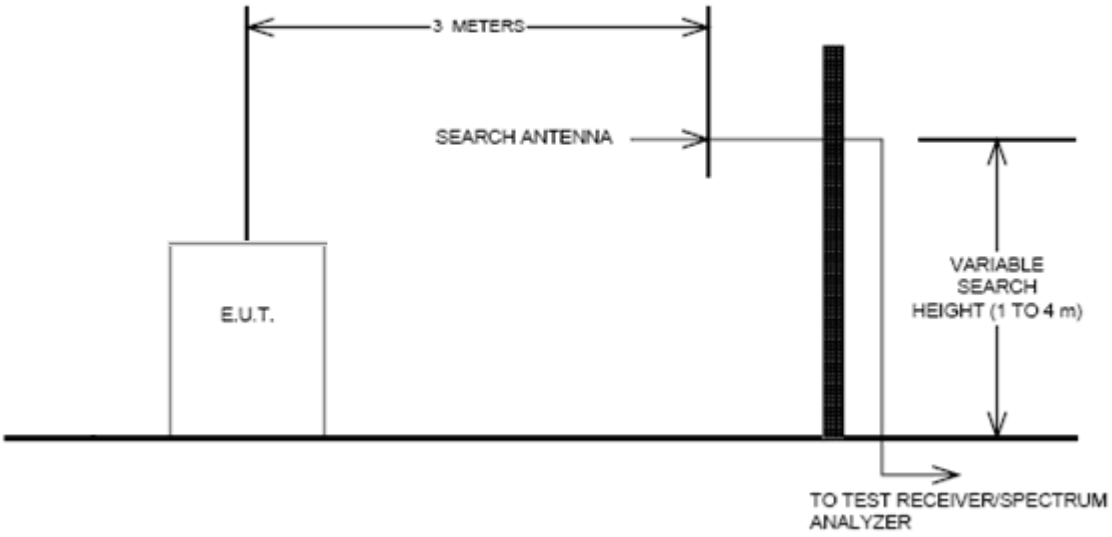
Radiated emission measurements were performed at an semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission.

A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated.

The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

8.3.1 Radiated Spurious Emissions Test Setup



8.4 Test Result

: PASS (There were no emissions detected above the noise floor which was at least 20 dB below the limit.)

Test Frequency	Freq.(MHz)	Substitute Level [dBm]	Ant. Gain (dBd)	C.L	Pol.	ERP (dBm)	Margin (dB)
2135.0	800.5	-43.97	3.95	3.90	V	-44.02	-34.02
	3043.2	-40.68	11.09	5.95	V	-35.54	-22.54
	3556.2	-45.03	12.35	8.66	V	-41.34	-28.34
	4269.2	-42.17	12.74	7.42	V	-36.85	-23.85

※ Test was operated with 4 Carriers transmitted simultaneously.

(1X : 2 Carriers, EV-DO : 1 Carrier, LTE : 1 Carrier)

9. FREQUECNY STABILITY

9.1 Applicable Standard

Requirements: FCC § 2.1055 (a), §27.54 following: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

9.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

9.3 Test Procedure

Frequency Stability over Temperature variation:

The equipment under test was connected to an external AC power supply and the RF output was connected to a Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 30 minutes, the frequency output was recorded from the VSA8960 S/W via MXA Signal Analyzer.

Frequency stability over Voltage variation: An external variable AC power supply Source. The voltage was set to 85% and 115% of the nominal value. The output frequency was recorded for each voltage.

9.4. Test Result

: Pass

9.4.1. Frequency Stability over Temperature and Voltage variation

Modulation: QPSK

Reference: 220Vac at 20°C **Freq.** = 2131.25 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2131 249 957	-43.2	0.0	0.0000
	-30	2131 249 955	-44.6	-1.4	-0.0007
	-20	2131 249 957	-42.9	0.3	0.0001
	-10	2131 249 955	-45.2	-2.0	-0.0009
	0	2131 249 956	-43.8	-0.6	-0.0003
	+10	2131 249 960	-39.9	3.3	0.0015
	+30	2131 249 957	-42.7	0.5	0.0002
	+40	2131 249 954	-46.5	-3.3	-0.0015
	+50	2131 249 956	-43.7	-0.5	-0.0002
115%	+20	2131 249 958	-42.3	0.9	0.0004
85%	+20	2131 249 956	-44.3	-1.1	-0.0005

Modulation: 16QAM

Reference: 220Vac at 20°C **Freq.** = 2132.5MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2132 499 966	-34.4	0.0	0.0000
	-30	2132 499 958	-42.1	-7.7	-0.0036
	-20	2132 499 961	-38.6	-4.2	-0.0020
	-10	2132 499 963	-36.6	-2.2	-0.0010
	0	2132 499 964	-36.1	-1.7	-0.0008
	+10	2132 499 965	-34.9	-0.5	-0.0002
	+30	2132 499 965	-35.4	-1.0	-0.0005
	+40	2132 499 966	-33.9	0.5	0.0003
	+50	2132 499 965	-34.7	-0.3	-0.0001
115%	+20	2132 499 965	-35.2	-0.8	-0.0004
85%	+20	2132 499 963	-36.6	-2.2	-0.0010

Modulation: 64QAM

Reference: 220Vac at 20°C **Freq.** = 2137.5MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2137 499 081	-919.2	0.0	0.0000
	-30	2137 499 090	-909.6	9.5	0.0045
	-20	2137 499 092	-908.1	11.1	0.0052
	-10	2137 499 089	-911.5	7.7	0.0036
	0	2137 499 091	-909.5	9.7	0.0045
	+10	2137 499 078	-921.6	-2.5	-0.0012
	+30	2137 499 083	-916.6	2.5	0.0012
	+40	2137 499 084	-916.4	2.8	0.0013
	+50	2137 499 082	-918.5	0.7	0.0003
115%	+20	2137 499 083	-917.5	1.7	0.0008
85%	+20	2137 499 084	-916.5	2.7	0.0013

10. RF EXPOSURE STATEMENT

1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

(B) Limits for General Population/Uncontrolled Exposures

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
0.3 - 1.34.....	614	1.63	*(100)	30
1.34 - 30.....	824/f	2.19/f	*(180/ f^2)	30
30 - 300.....	27.5	0.073	0.2	30
300 - 1500.....	.....	.....	f/1500	30
1500 - 100.000.....	.....	.....	1.0	30

F = frequency in MHz

* = Plane-wave equivalent power density

2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

3. RESULTS

Max Peak output Power at antenna input terminal	50.45000	dBm
Max Peak output Power at antenna input terminal	110.91748	W
Prediction distance	1100.00000	cm
Prediction frequency	2135.00000	MHz
Antenna Gain(typical)	20.70000	dBi
Antenna Gain(numeric)	117.48976	-
Power density at prediction frequency (S)	0.85705	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm^2

The power density level at 1100 cm is 0.85705 mW/cm^2, which is below the uncontrolled exposure limit of 1.0 mW/cm^2 at 2135 MHz.