**HCT CO., LTD.**

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# CERTIFICATE OF COMPLIANCE

| | |
|---|---|
| **Applicant Name:**<br>SAMSUNG Electronics Co., Ltd.<br>416, Maetan-3dong, Yeongtong-gu, Suwon-si,<br>Gyeonggi-do, Korea | **Date of Issue:**<br>June 13, 2012<br>**Test Site/Location:**<br>HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,<br>Icheon-si, Kyunggi-Do, Korea<br>**Test Report No.:** HCTR1206FR05 |

**FCC ID : A3LSMM-BMAA022001**

**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 | : 2135 MHz ~ 2140 MHz |
| TX Output Power | : 60 W |
| FCC Rule Part(s) | : FCC Part 27 |
| Emission Designator | : 4M48W7W |
| Test Procedure(s) | : ANSI/TIA-603C-2004 |
| Application Type | : Original Equipment |
| Data of issue | : June 13, 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 |
|---|---|---|
| HCTR1206FR05 | June 13, 2012 | First Approval Report |
| | | |
| | | |
| | | |
| | | |

# C O N T E N T S

# 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**<br>**E-mail : ryu0022@samsung.com**<br>**Tel: +82-31-279-1023**<br>**Fax: +82-31-279-7676** |

## 1.2. PRODUCT INFORMATION

| | |
|---|---|
| EUT TYPE | Smart MBS (Smart Multi-modal Base Station) |
| EMISSION DESIGNATOR | 4M48W7W (QPSK, 16QAM, 64QAM) |
| OPERATING FREQUENCY | 2135 MHz ~ 2140 MHz |
| TX OUTPUT POWER | 60 W |
| CHANNEL BANDWIDTH | 5 MHz |
| MODULATION TYPE | QPSK, 16QAM, 64QAM |
| MAXIMUM NUMBER OF CARRIERS/SECTORS | 1 Carrier / 6 Sector |
| SYSTEM INPUT VOLTAGE | AC 220 V |

## 1.3. INTRODUCTION OF EUT

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

- LTE: 5 MHz 1 Carrier/6 Sector

LRU cab be operated as follows as RF part.

- Advanced Wireless Services (AWS) band, 1Tx/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 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 (QPSK, 16QAM, 64QAM) 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 | 937 | 10/17/2013 |
| Schwarzbeck | BBHA 9120D / Double Ridged Horn Antenna | 296 | 02/20/2014 |
| 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 | 12/26/2012 |
| Agilent | N9020A /Signal Analyzer | US46220219 | 05/02/2013 |
| HP | 83640B/Signal Generator | 3614A00105 | 11/07/2012 |
| DaeYoung | DFSS60/ Frequency Converter | 1003030-1 | 05/03/2013 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 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 | 05/02/2013 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 11/07/2012 |
| WEINSCHEL | AF9003-69-31 / Attenuator | 5701 | 11/07/2012 |
| DaeYoung | DFSS60/ Frequency Converter | 1003030-1 | 05/03/2013 |

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)

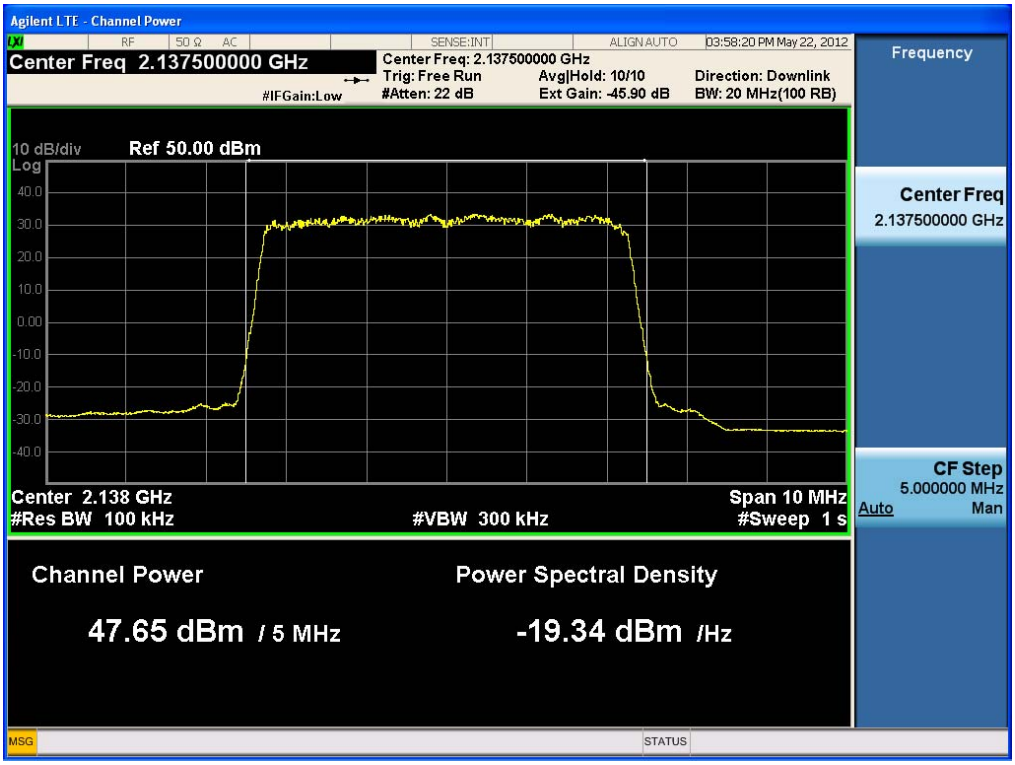
5.4. Test Result

: PASS

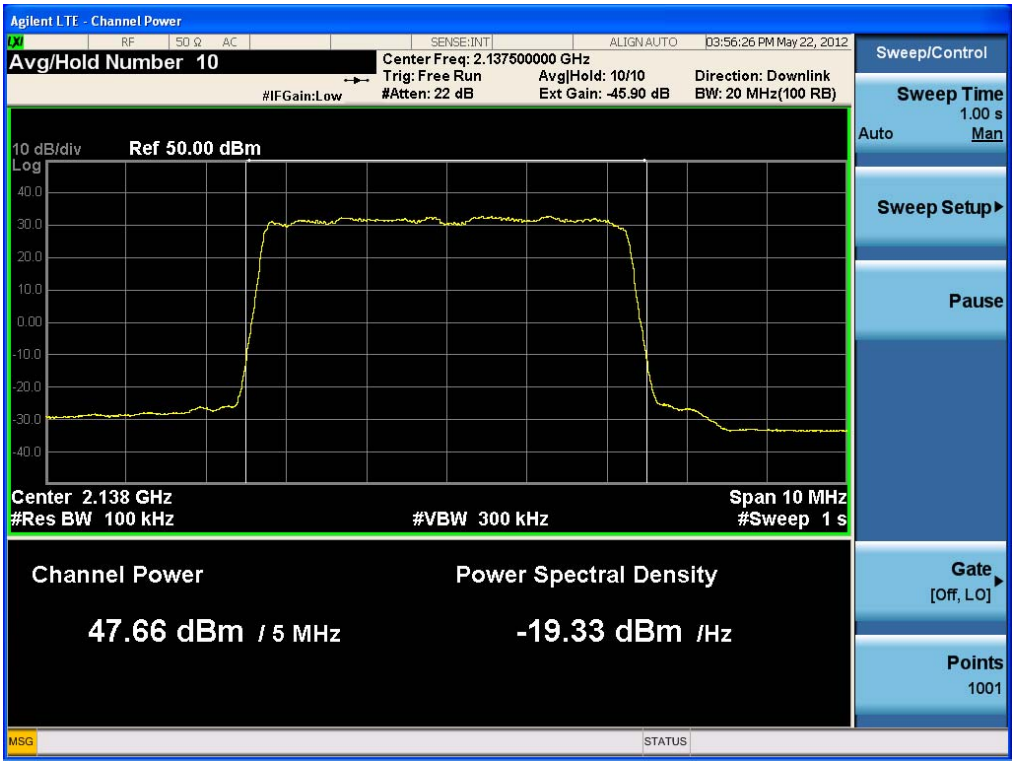
| | Frequency (MHz) | Measured Data (dBm) | | |
|---|---|---|---|---|
| | | QPSK | 16QAM | 64QAM |
| LTE | 2137.5 | 47.65 | 47.66 | 47.62 |

5.4.1. Plot Data

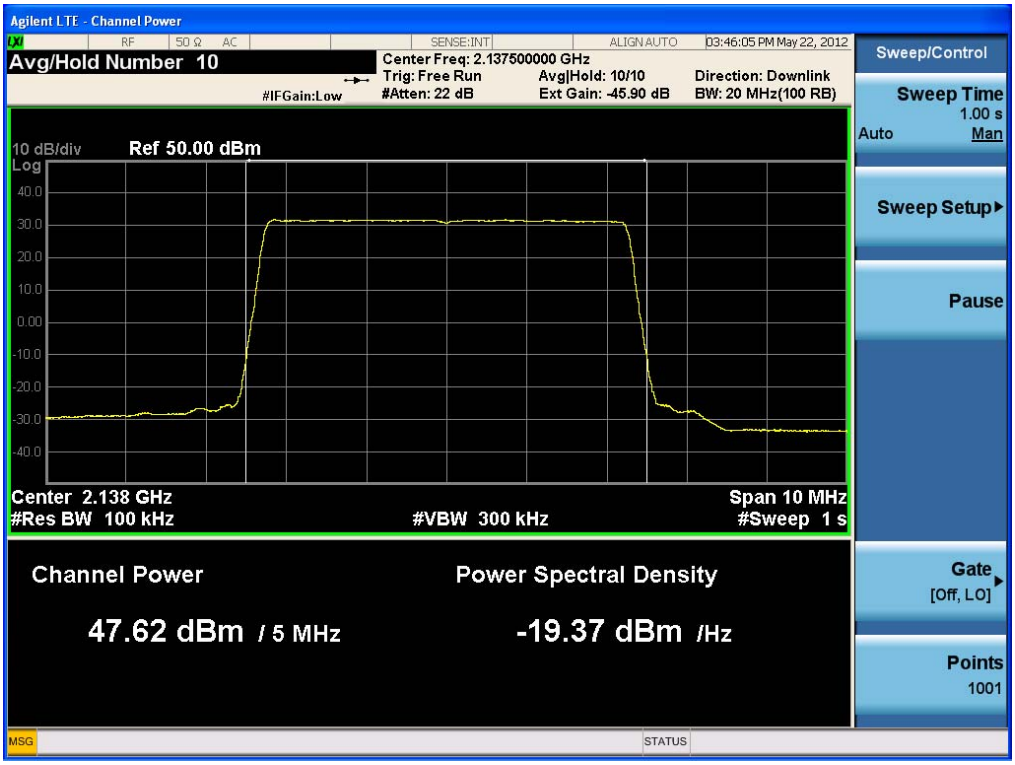
**(QPSK)**




**(16QAM)**



**(64QAM)**


Agilent LTE - Channel Power
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
03:46:05 PM May 22, 2012
Avg/Hold Number 10
#IFGain:Low
Center Freq: 2.137500000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 22 dB
Ext Gain: -45.90 dB
Direction: Downlink
BW: 20 MHz(100 RB)
10 dB/div
Log
Ref 50.00 dBm
40.0
30.0
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
Center 2.138 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10 MHz
#Sweep 1 s
Channel Power
47.62 dBm / 5 MHz
Power Spectral Density
-19.37 dBm /Hz
MSG
STATUS
Sweep/Control
Sweep Time
1.00 s
Auto
Man
Sweep Setup
Pause
Gate
[Off, LO]
Points
1001

# 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 | 05/02/2013 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 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.

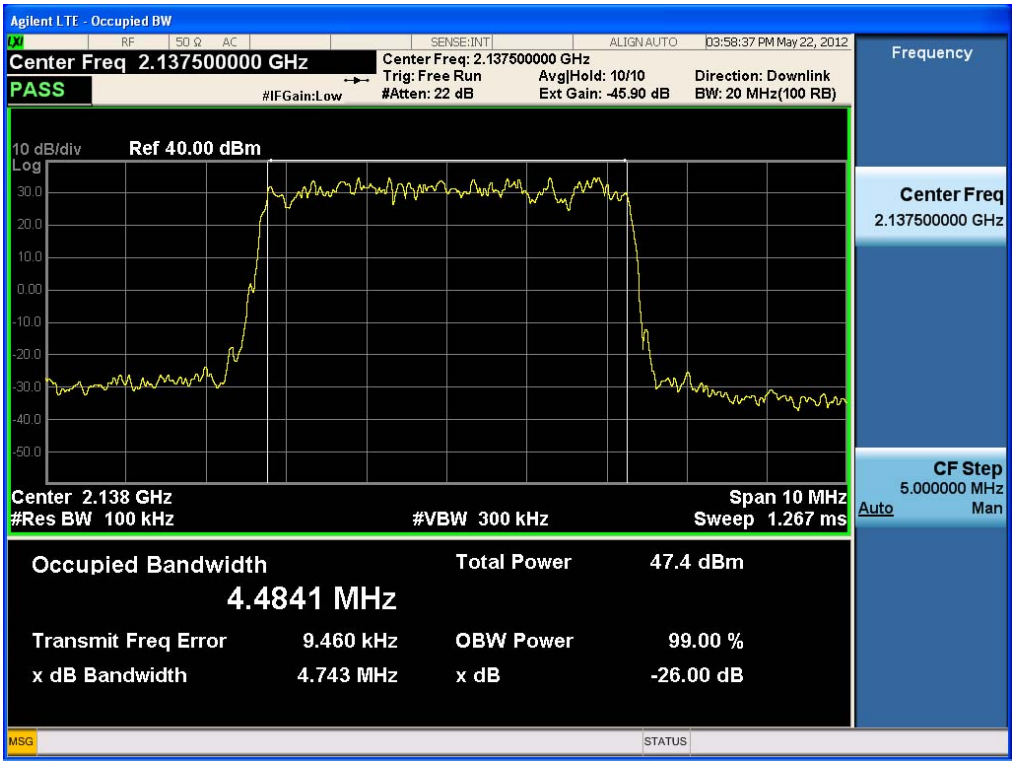
6.4. Test Result

: PASS

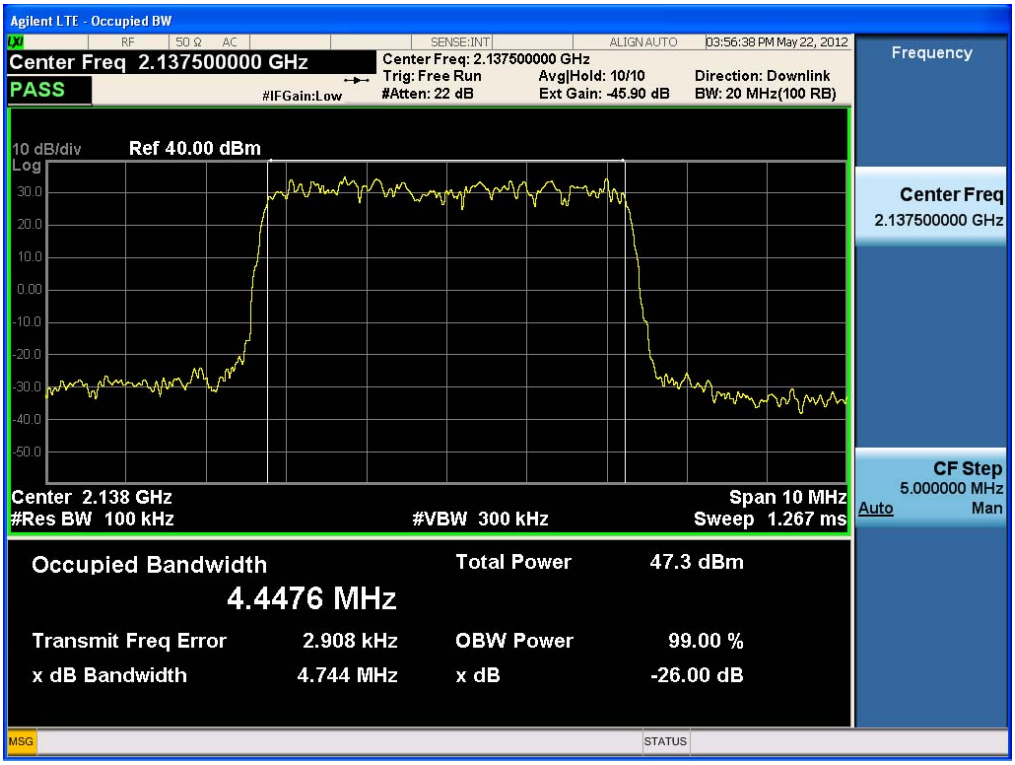
| | Frequency (MHz) | Measured Data (MHz) | | |
|---|---|---|---|---|
| | | QPSK | 16QAM | 64QAM |
| LTE | 2137.5 | 4.4841 | 4.4476 | 4.4871 |

6.4.1. Plot Data

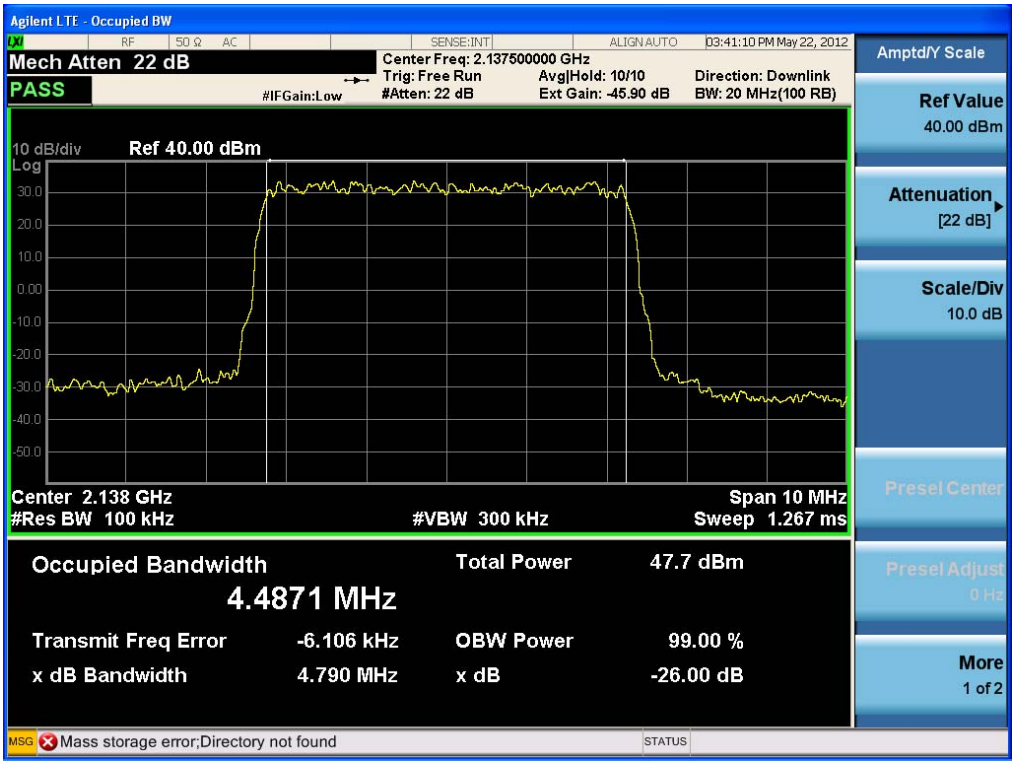
**(QPSK)**




**(16QAM)**



**(64QAM)**


Agilent LTE - Occupied BW
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
03:41:10 PM May 22, 2012
Mech Atten 22 dB
PASS
#IFGain:Low
Center Freq: 2.137500000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 22 dB
Ext Gain: -45.90 dB
Direction: Downlink
BW: 20 MHz(100 RB)
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 2.138 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10 MHz
Sweep 1.267 ms
Occupied Bandwidth
4.4871 MHz
Total Power
47.7 dBm
Transmit Freq Error
-6.106 kHz
OBW Power
99.00 %
x dB Bandwidth
4.790 MHz
x dB
-26.00 dB
MSG
Mass storage error;Directory not found
STATUS
Amptd/Y Scale
Ref Value
40.00 dBm
Attenuation
[22 dB]
Scale/Div
10.0 dB
Presel Center
Presel Adjust
0 Hz
More
1 of 2

# 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 | 05/02/2013 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 11/07/2012 |
| WEINSCHEL | AF9003-69-31 / Attenuator | 5701 | 11/07/2012 |
| DaeYoung | DFSS60/ Frequency Converter | 1003030-1 | 05/03/2013 |

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.

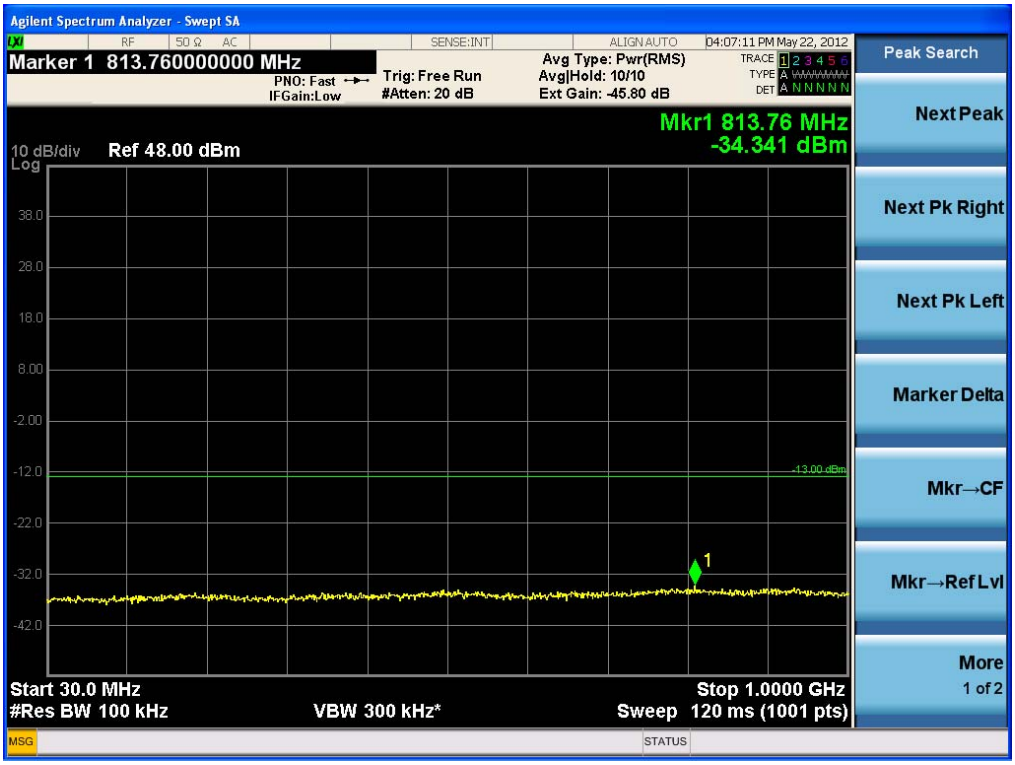
7.4. Test Result

: Pass

| | Data (dBm) | | |
|---|---|---|---|
| | **QPSK** | **16QAM** | **64QAM** |
| **Band Edge** | -17.697 | -18.746 | -18.949 |
| **Spurious Emission (30 MHz ~ 1 GHz)** | -34.341 | -34.616 | -34.619 |
| **Spurious Emission (1 GHz ~ 26.5 GHz)** | -14.037 | -14.123 | -14.191 |

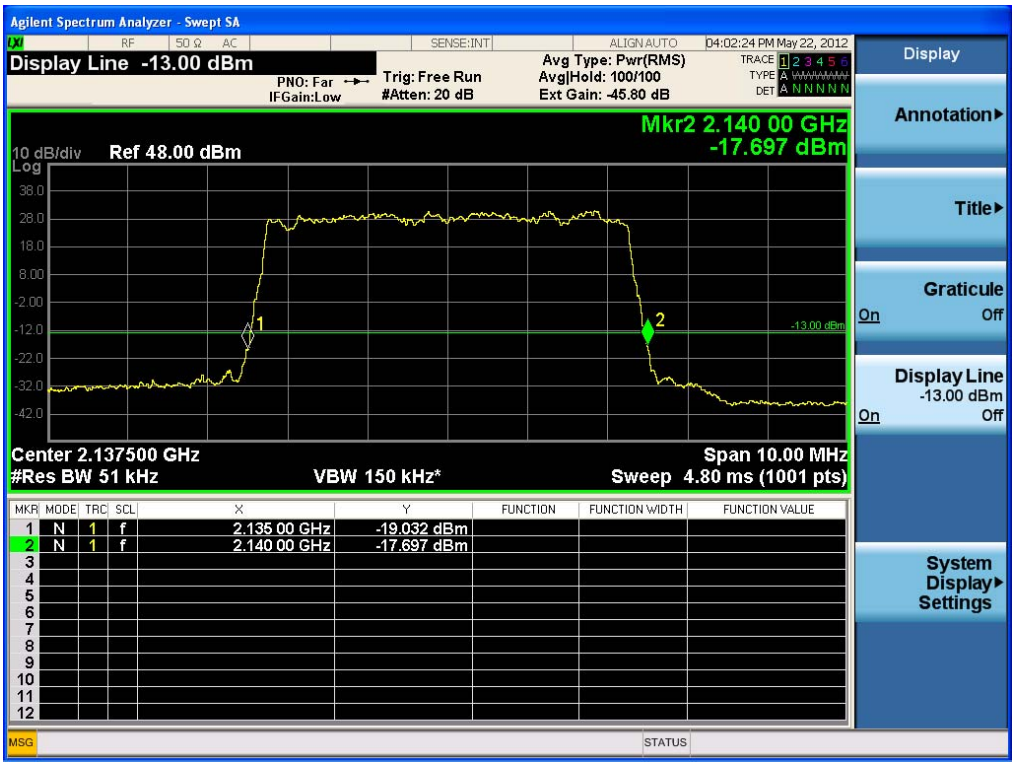
7.4.1. Plot Data

**(QPSK_30MHz ~ 1GHz)**

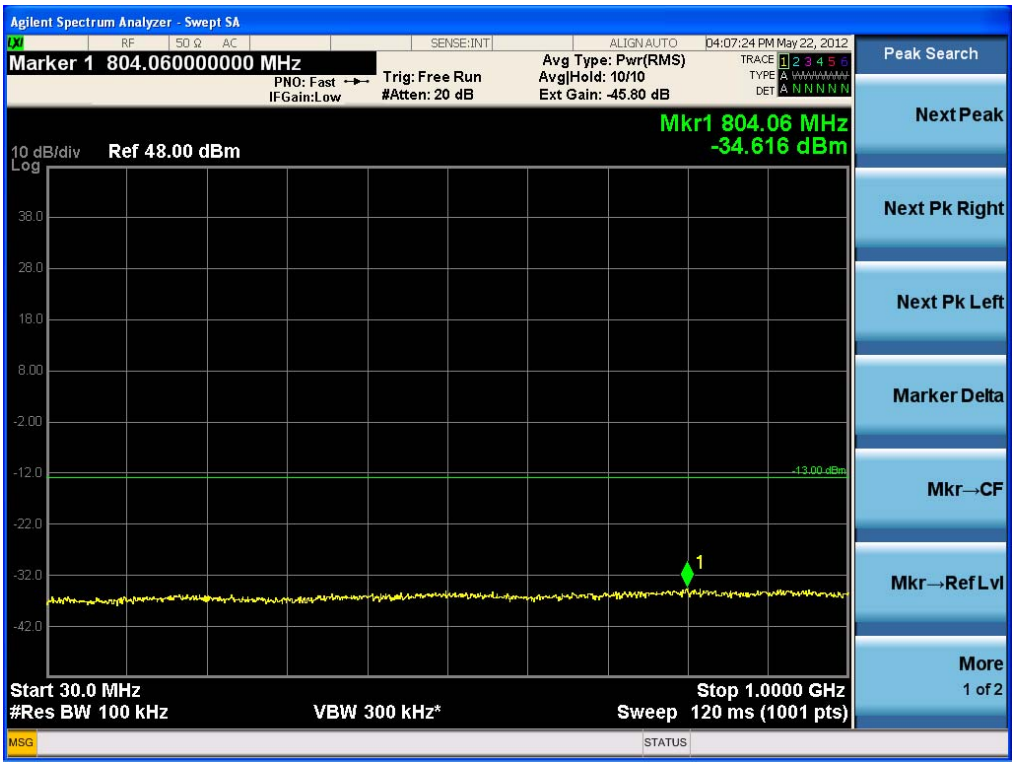



**(QPSK_1GHz ~ 26.5GHz)**

## (QPSK_Band Edge)

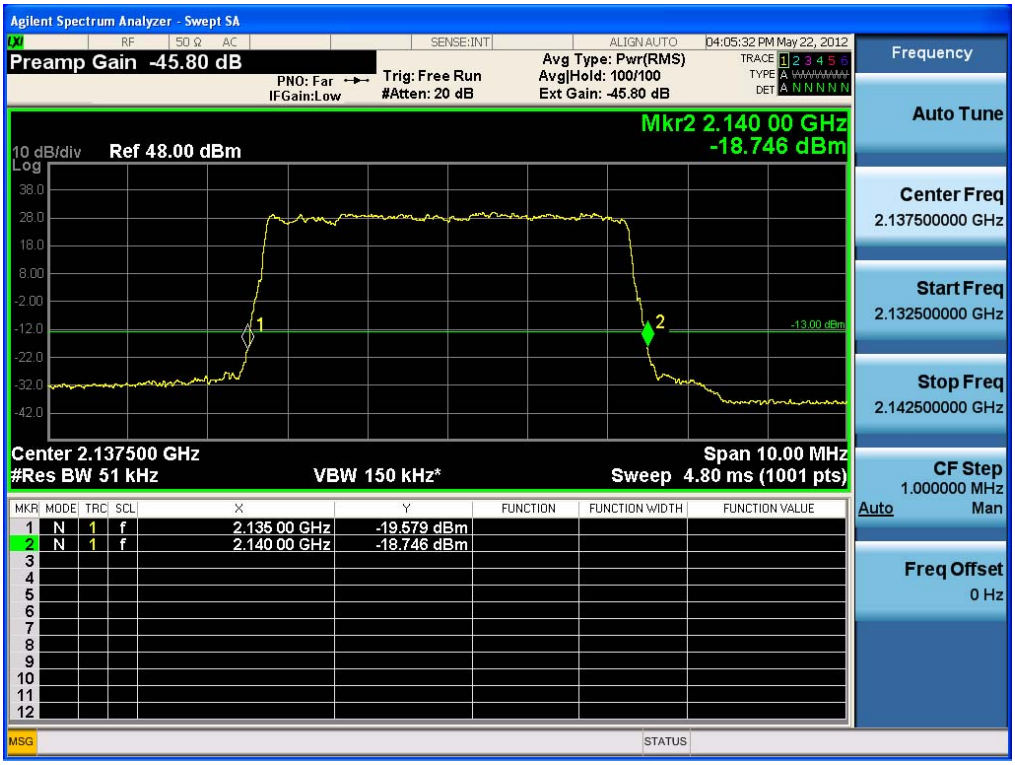


## (16QAM_30MHz~1GHz)

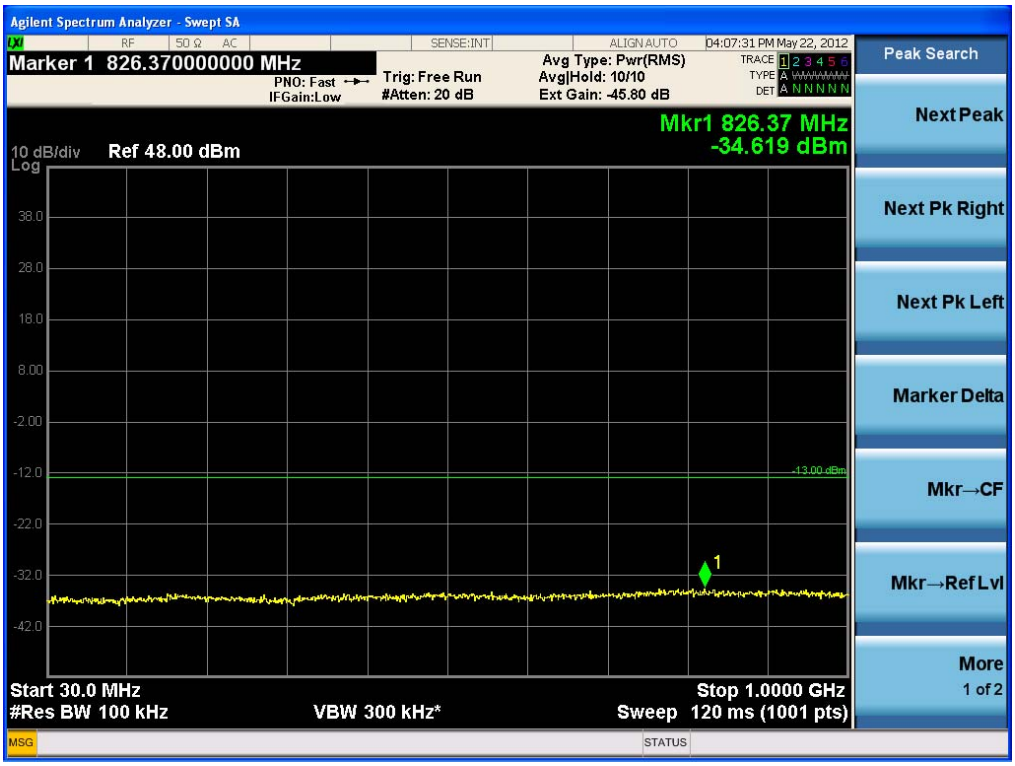



## (16QAM_1GHz~26.5GHz)

## (16QAM_Band Edge)

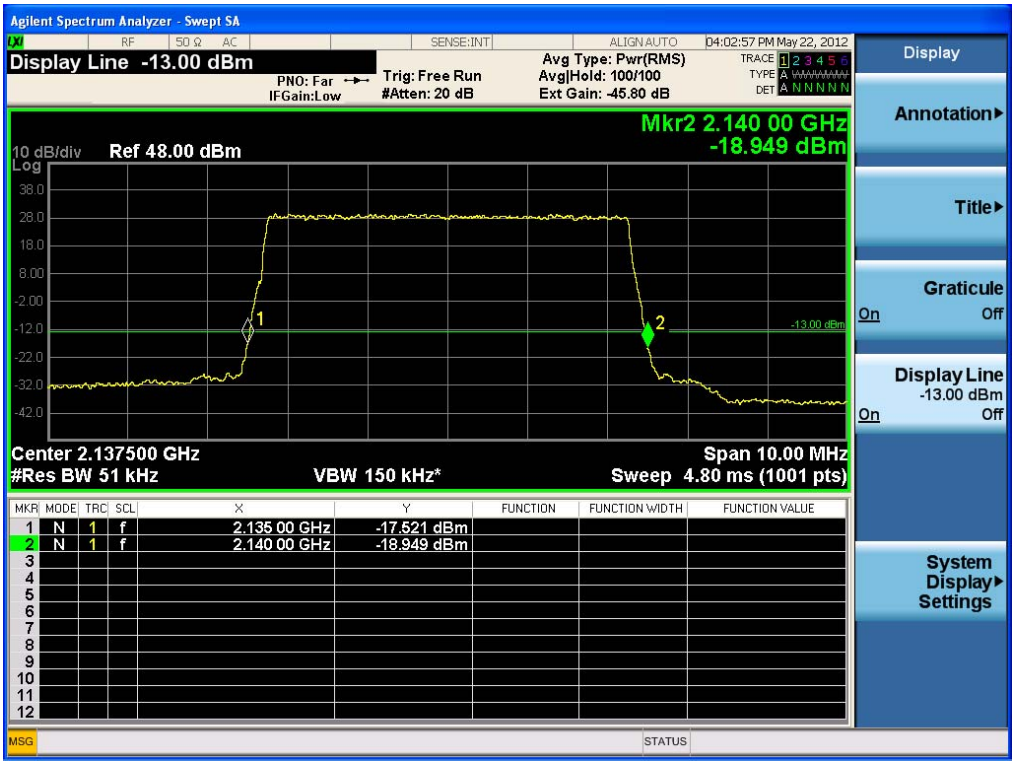


## (64QAM_30MHz~1GHz)




## (64QAM_1GHz~26.5GHz)

## (64QAM_Band Edge)



# 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.

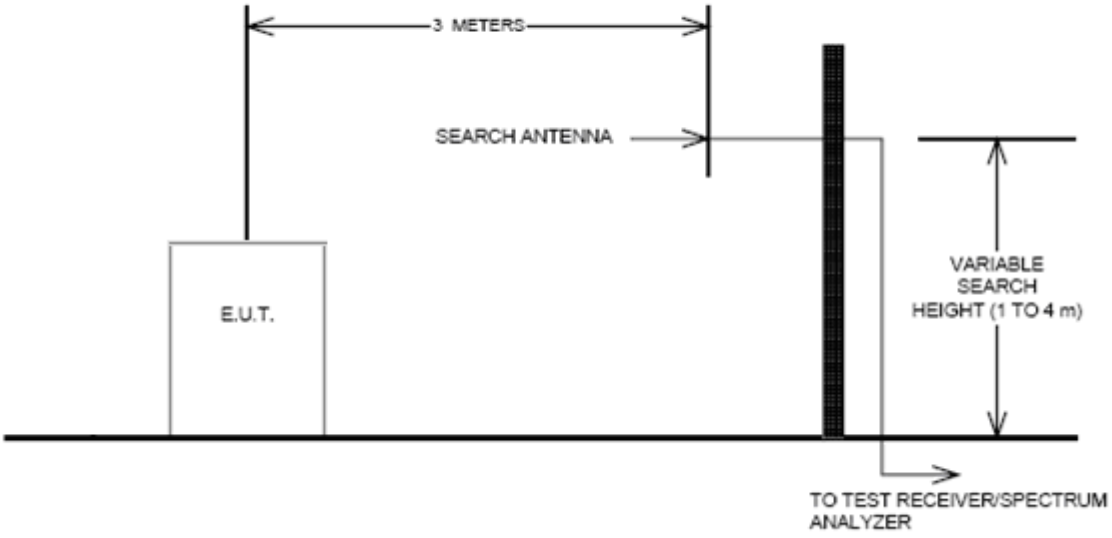
8.2 Test Equipment List and Details

| Manufacturer | Model / Equipment | Serial No. | Calibration Due |
|---|---|---|---|
| Schwarzbeck | BBHA 9120D / Double Ridged Horn Antenna | 937 | 10/17/2013 |
| Schwarzbeck | BBHA 9120D / Double Ridged Horn Antenna | 296 | 02/20/2014 |
| 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 | 12/26/2012 |
| Agilent | N9020A /Signal Analyzer | US46220219 | 05/02/2013 |
| HP | 83640B/Signal Generator | 3614A00105 | 11/07/2012 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 11/07/2012 |
| WEINSCHEL | AF9003-69-31 / Attenuator | 5701 | 11/07/2012 |

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 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.
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

| Frequency | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBd) | C.L | SigGen Level [dBm] | Pol. | ERP (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 2137.5 | 4275.00 | -74.20 | 10.59 | 8.72 | -37.25 | H | -35.38 | -22.38 |
| | 6412.50 | -77.59 | 10.77 | 11.01 | -32.45 | V | -32.69 | -19.69 |
| | 8550.00 | -74.60 | 9.28 | 12.53 | -24.15 | V | -27.41 | -14.41 |

# 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 | 05/02/2013 |
| WEINSCHEL | 67-30-33 / Attenuator | BU5347 | 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.

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.** = 2137.5 MHz

| Voltage (%) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 2137 499 958 | -42.0 | 0.0 | 0.0000 |
| | -30 | 2137 499 952 | -48.5 | -6.4 | -0.0030 |
| | -20 | 2137 499 957 | -42.7 | -0.7 | -0.0003 |
| | -10 | 2137 499 958 | -41.7 | 0.3 | 0.0001 |
| | 0 | 2137 499 954 | -45.6 | -3.6 | -0.0017 |
| | +10 | 2137 499 957 | -43.2 | -1.2 | -0.0005 |
| | +30 | 2137 499 952 | -47.6 | -5.6 | -0.0026 |
| | +40 | 2137 499 956 | -43.9 | -1.9 | -0.0009 |
| | +50 | 2137 499 958 | -42.3 | -0.3 | -0.0001 |
| 115% | +20 | 2137 499 958 | -41.7 | 0.3 | 0.0002 |
| 85% | +20 | 2137 499 958 | -41.9 | 0.1 | 0.0001 |

**Modulation: 16QAM**

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

| Voltage (%) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 2137 499 958 | -41.6 | 0.0 | 0.0000 |
| | -30 | 2137 499 957 | -43.2 | -1.6 | -0.0007 |
| | -20 | 2137 499 956 | -44.4 | -2.8 | -0.0013 |
| | -10 | 2137 499 953 | -46.8 | -5.2 | -0.0024 |
| | 0 | 2137 499 954 | -45.7 | -4.1 | -0.0019 |
| | +10 | 2137 499 956 | -44.1 | -2.5 | -0.0012 |
| | +30 | 2137 499 957 | -43.0 | -1.4 | -0.0007 |
| | +40 | 2137 499 954 | -45.6 | -4.0 | -0.0019 |
| | +50 | 2137 499 951 | -49.2 | -7.6 | -0.0036 |
| 115% | +20 | 2137 499 954 | -46.5 | -4.9 | -0.0023 |
| 85% | +20 | 2137 499 956 | -44.2 | -2.6 | -0.0012 |

**Modulation: 64QAM**

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

| Voltage (%) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100% | +20(Ref) | 2137 499 955 | -44.9 | 0.0 | 0.0000 |
| | -30 | 2137 499 956 | -43.7 | 1.2 | 0.0006 |
| | -20 | 2137 499 956 | -43.6 | 1.3 | 0.0006 |
| | -10 | 2137 499 956 | -44.2 | 0.7 | 0.0003 |
| | 0 | 2137 499 954 | -46.0 | -1.1 | -0.0005 |
| | +10 | 2137 499 957 | -42.8 | 2.1 | 0.0010 |
| | +30 | 2137 499 959 | -41.5 | 3.4 | 0.0016 |
| | +40 | 2137 499 958 | -42.3 | 2.6 | 0.0012 |
| | +50 | 2137 499 956 | -43.6 | 1.3 | 0.0006 |
| 115% | +20 | 2137 499 956 | -44.4 | 0.5 | 0.0002 |
| 85% | +20 | 2137 499 952 | -47.6 | -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 | 47.66000 | dBm |
| Max Peak output Power at antenna input terminal | 58.34451 | W |
| Prediction distance | 900.00000 | cm |
| Prediction frequency | 2137.50000 | MHz |
| Antenna Gain(typical) | 19.80000 | dBi |
| Antenna Gain(numeric) | 95.49926 | - |
| Power density at prediction frequency (S) | 0.54740 | $mW/cm^2$ |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00000 | $mW/cm^2$ |

The power density level at 900 cm is 0.5474 $mW/cm^2$, which is below the uncontrolled exposure limit of 1.0 $mW/cm^2$ at 2137.5 MHz.