# Exhibit 11 Listing of Required Measurements

## SECTION 2.1033(c)(14)

**The data required by Section 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.**

Response:
The lowest clock frequency in the **AWS Base Station System** is the 10 MHz rubidium reference oscillator. Conducted spurious measurements were performed over the range of 10 MHz to 21.75 GHz which is above the tenth harmonic of the transmit frequency range.

The following pages include the data required for the Product Certification authorization of the **AWS Base Station System / FCC ID: AS5ONEBTS-16**, measured in accordance with the procedures set out in Section 2.1041 of the Rules.

Each required measurement and its corresponding exhibit number are:

| | | |
|---|---|---|
| Exhibit 12 | Section 2.1046 | Measurement of Radio Frequency Power Output |
| Exhibit 13 | Section 2.1047 | Measurement of Modulation Characteristics |
| Exhibit 14 | Section 2.1049 | Measurement of Occupied Bandwidth |
| Exhibit 15 | Section 2.1051 | Measurement of Spurious Emissions at Antenna |
| Exhibit 16 | Section 2.1053 | Field Strength of Spurious Radiation |
| Exhibit 17 | Section 2.1055 | Measurement of Frequency Stability |

# Exhibit 12 Measurement Of Radio Frequency Power Output

## SECTION 2.1046 Measurements required: RF power output.

The test arrangements used to measure the radio frequency power output of the **AWS Base Station System/ AS5ONEBTS-16** is on the following page. Measurements were made respectively at each frequency where Occupied Bandwidth measurements were performed. This Class II Change is for use of the **AWS Base Station System** with singular or multiple 60W IPAM amplifier modules supporting single or multiple 1M40F9W LTE carriers at 24 Watts per amplifier. Demonstration of compliance with the operation using the 24 Watts per carrier (when using one amplifier) was demonstrated for AWS Blocks A through F, as identified in this application. There is no retuning or change in hardware necessary for operation in any AWS Block. This testing requires that the J4 power level be calibrated for the specific channel of use. The test configuration, Figure 12a, allowed the measurement of output power for each channel investigated for Occupied Bandwidth. These included the upper and lower Block edges for each Block.

In this application the **AWS Base Station System** providing 1M40F9W LTE carriers has a maximum power output of 24 Watts per carrier (when using one amplifier) at the antenna terminals (43.8 dBm/carrier +2/-4 dB for each carriers). It also has a minimum power output at the antenna terminals of 0.024 Watts/carrier (13.8 dBm +2 / -4 dB), across the AWS C Block (2110 - 2155 MHz). The signal supplied by the **AWS Base Station System** is defined in **3GPP TS 36.211 V9.1.0 (2010-03) titled:** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9).

The power was set to the specified 24 W/carrier maximum at each measurement frequency to verify the spectral performance at that power level at each specific frequency of interest. Power was also verified for the QPSK, 16QAM and 64QAM modulation configurations. The Peak to Average Ratio, PAR was also measured to be less than 13 dB and is documented in Exhibit 13 Modulation. There was no measurable change in power settings or output power during modulation changes.

The attenuation range was also verified. The specific Frequencies and channels and set power level was documented on each "Occupied Bandwidth" sheet.

The applied signal, from an **AWS Base Station System/ AS5ONEBTS-16**, met the recommended characteristics per **3GPP TS 36.211 V9.1.0 (2010-03)** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9).

## Exhibit 12 RF Power Test Configuration

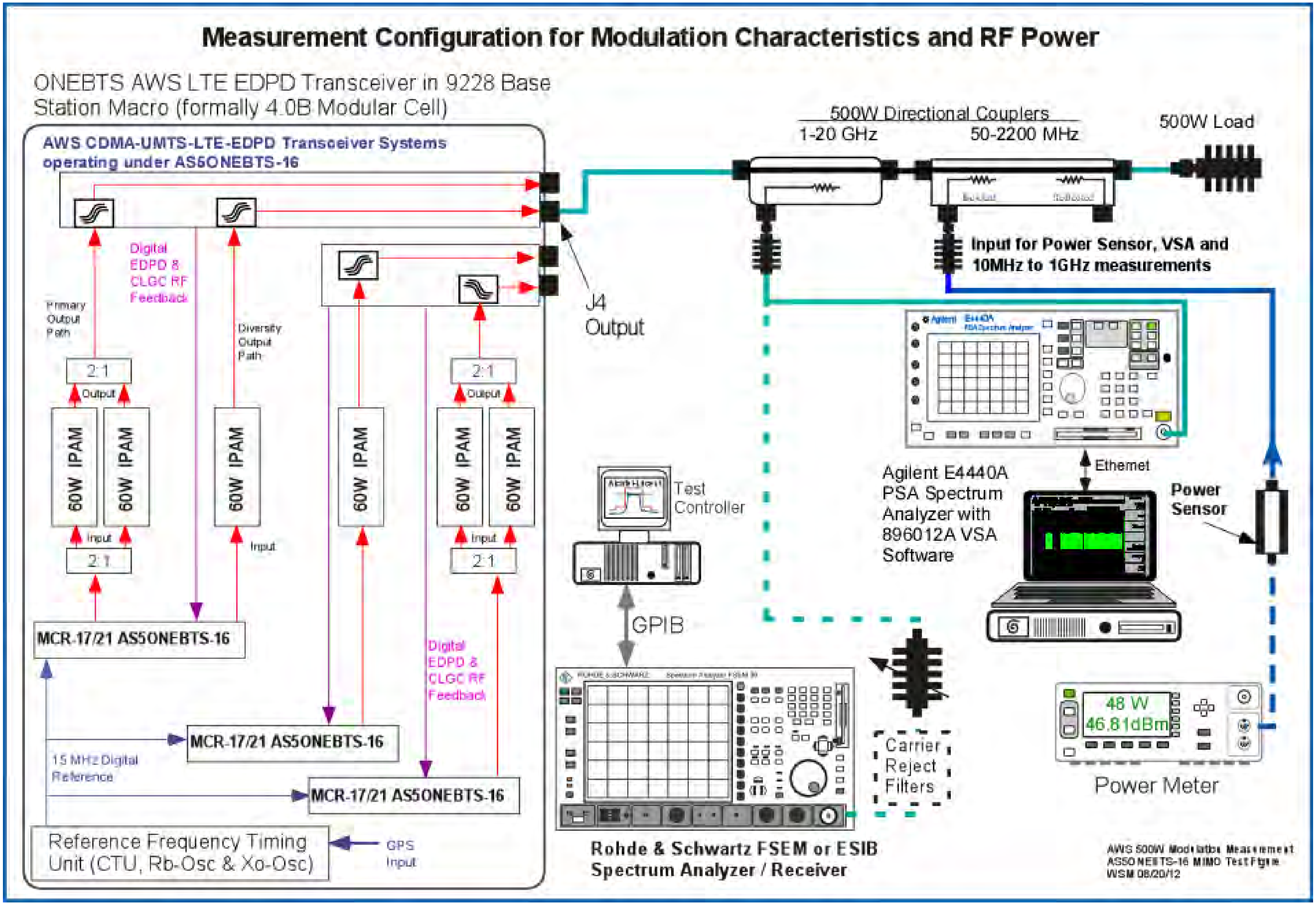


**Exhibit 12 *continued*** **Table 12.1 Test Equipment**

The following Equipment used for RF Power, Modulation, Occupied bandwidth and Conducted Spurious Measurements

| Equipment | Description | Calibration Reference Number | Verification date or Calibration |
|---|---|---|---|
| **Power Meter:** | Agilent N1912A P Series Power Meter | E915 | 02/08/2011, |
| **Power Head** | Agilent N1921A 0.05-18 GHz Wideband Power Sensor | E914 | 02/11/2011 |
| **EMC Analyzer** | Rohde & Schwarz FSEM-30 | E167438 | 04/22/2011 |
| **Code Domain Analyzer** | Agilent E4440A PSA Transmitter Tester | E1055 | 03/19/2011 |
| **Computer Controller:** | Lenova T61, Intel Centrino V5 PC w/WIN EP OS & Agilent VSA Software | | N/A |
| **Computer Controller:** | EG Technology, Intel Core 2 Duo w/Win XPpro OS | POR-2, | N/A |
| **Low Pass Filter:** | 10 MHz-1.93 GHz, Custom manufactured | PCSLPF-10 | 02/24/11 |
| **High Pass Filters:** | 1.99-20 GHz, Custom manufactured \| | PCSHPF-10 | 03/01/11 |

**Multi Use Laboratory Equipment (MULE)**

| RF Test coupler | The equipment below is maintained and verified as a unit as: | Purple 500W-Mule-Lim | 19 July 2012 |
|---|---|---|---|
| **Directional Coupler:** | Narda 500W 1-20 GHz | s/n 0430 | |
| **Directional Coupler:** | Narda 500W 0.05-1 GHz | s/n 42790 | |
| **Attenuator, Variable** | HP 8494B DC-18 GHz digital attenuator | MY42140028 | |
| **Attenuator, Variable** | HP 8495B DC-18 GHz digital attenuator | MY42140034 | |
| **Attenuator, Fixed** | Narda 500W 1-18 GHz, | s/n 0823 | |
| **Attenuator, Fixed** | Weinschel 46-10-34 LIM and 46-20-34LIM | BH9326 | |
| **Attenuator, Fixed** | Weinschel 46-20-34 LIM and 46-20-34LIM | BH3132 | |
| **Attenuator, Fixed** | Weinschel 46-10-34 | BH3118 | |
| **Test Cables:** | Low loss test cables custom mfg. | | |

## The following equipment was used for Radiated Spurious Measurements

| Description | Manufacturer-Model | Serial # | Last Cal Date |
|---|---|---|---|
| Spectrum Analyzer 9kHz-22GHz | Hewlett Packard 8593E | 82-11295726 | 2/23/2011 |
| Amplifier 9kHz-1GHz | Sonoma Instrument Co. 310N | E812 | 7/26/2011 |
| 6 dB Attenuator DC-18GHz 2 Watt | Weinschel 2-6 | E891 | 1/23/2012 |
| EMI Test Receiver (20Hz to 40GHz) | Rohde & Schwarz ESIB40 | E704 | 8/14/2011 |
| Preamplifier 1-26.5GHz 30dB | Agilent 8449B | E377 | 7/21/2011 |
| High Pass Filter 2850-18050MHz | Trilithic Inc. 5HC2850/18050-1.8-KK | E988 / PCS-HPF-11 | Verified 02/24/2011 |
| Bilogical Antenna 25-2000MHz | A.H. Systems, SAS-521-2 | E766 | 11/8/2011 |
| Double Ridged Horn 1-18GHz | EMCO 3115 | E393 | 1/17/2012 |
| Double Ridged Horn 18-40GHz | EMC Test Systems 3116 | E520 | 9/27/2011 |
| Active Rod & Field Antenna 30Hz-50MHz | EMC Test Systems 3301B | E521 | 12/8/2011 |
| Passive Loop 10kHz-30MHz | EMC Test Systems 6512 | E394 | 1/19/2012 |
| Loop Antenna .020-100kHz | Electro-Metrics ALP-11 | E443 | 10/5/2011 |

# Exhibit 12 *continued* Measurements required: RF power output.

| AWS - Block | AWS Channel # | Number of carriers | Sub-Carrier Modulation | # of amplifiers in MCA | Power per Carrier, W/c | Total Power Watts | Results RF Power |
|---|---|---|---|---|---|---|---|
| A | 14 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| A | 14 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| A | 14 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |
| A | 186 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| B | 214 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| B | 214 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| B | 214 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |
| B | 386 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| C | 414 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| C | 414 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| C | 414 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |
| C | 486 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| D | 514 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| D | 514 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| D | 514 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |
| D | 586 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| E | 614 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| E | 614 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| E | 614 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |
| E | 686 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| F | 714 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| F | 884 | 1 | QPSK | 1 & 2 | 24 | 24 | Compliant |
| F | 884 | 1 | 16QAM | 1 & 2 | 24 | 24 | Compliant |
| F | 884 | 1 | 64QAM | 1 & 2 | 24 | 24 | Compliant |

**RESULTS:**
The **AWS Base Station System/ AS5ONEBTS-16** was configured in the test setup shown in Figure 12A. For the channel configuration identified above the **AWS Base Station System/ AS5ONEBTS-16** delivered a minimum of 24.0 Watts/carrier 43.8 dBm +2/-0 dB when measured at the J4 output connection. This data is recorded on the Occupied Bandwidth Data Sheets for "Left edge" and "Right Edge" of each frequency Block.
Note: The **AWS Base Station System/ AS5ONEBTS-16** is a multi channel linear amplifier and its maximum power level is verified at each cell site during setup of the Alcatel-Lucent 9228 Macro (Formally Modular Cell 4.0B)

# Exhibit 13 Measurement Of Modulation And Signal Characteristics

## SECTION 2.1047 Measurement Of Modulation Characteristics

The modulation characteristics and accuracy of the **AWS Base Station System/ AS5ONEBTS-16** output signal is a function of the input signal which is provided by the AWS Multi Carrier Radio (**MCR-1721**) which was authorized by the Federal Communications Commission under **FCC ID: AS5ONEBTS-16** and granted 14 September 2007 for all AWS Blocks.

### 13.1 - Modulation Description

The LTE spectrum while appearing similar to CDMA differs greatly in complexity . The modulation used in evaluating the **AWS Transceiver's** Multi Carrier Radio **MCR-1721 / AS5ONEBTS-16** are described in the pertinent standards documents which include **3GPP TS 36.211 V9.1.0 (2010-03) titled:** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9). The modulation is Orthogonal Frequency Division Multiple Access (OFDMA) which is processed into an uplink IF signal. The input data stream is divided into several parallel sub-streams of reduced data rate and each sub-stream is transmitted on a separate orthogonal sub-carrier. The sub-carriers are modulated using either QPSK, 16QAM or 64QAM. There is no single measure of the modulation quality other than to verify that the subcarrier modulation constellations visual orientation match the symbol and amplitude criteria is consistent with QPSK, 16QAM and 64QAM.

### 13.2 Results

The **AWS Base Station System** was configured in the test setup shown in Figure 13A. The antenna connection J4 output was evaluated with an Agilent Transmitter Analyzer consisting of an Agilent E4440A PSA Spectrum Analyzer with 896012A VSA Software. Measurements were performed at the AWS Channels shown in table 13.2.

### 13.2.1 Results Summary

For each of the AWS channels tested, the **AWS Base Station System's** modulated sub-carriers constellations were consistent for the modulation type. All of the modulation plots include the CCDF plot which indicates the Peak to Average Ratio (PAR) of the transmitted signal. For all measurements the PAR was between 8 and 11 dB which is compliant with the CFR which specifies that the PAR be less than 13 dB. The **AWS Base Station System's** transmit signal modulation parameters and constellation for AWS channel 650 is shown in Figures 13B, 13C and 13D below for QPSK, 16QAM and 64QAM. A complete copy of all of the modulation data is attached in the Appendix.

## Exhibit 13 *continued*

| AWS - Block | AWS - Channels | Sub-Carrier Modulation | Results Modulation |
|---|---|---|---|
| A | 14 | QPSK | Compliant |
| A | 14 | 16QAM | Compliant |
| A | 14 | 64QAM | Compliant |
| A | 186 | QPSK | Compliant |
| B | 214 | QPSK | Compliant |
| B | 214 | 16QAM | Compliant |
| B | 214 | 64QAM | Compliant |
| B | 386 | QPSK | Compliant |
| C | 414 | QPSK | Compliant |
| C | 414 | 16QAM | Compliant |
| C | 414 | 64QAM | Compliant |
| C | 486 | QPSK | Compliant |
| D | 514 | QPSK | Compliant |
| D | 514 | 16QAM | Compliant |
| D | 514 | 64QAM | Compliant |
| D | 586 | QPSK | Compliant |
| E | 614 | QPSK | Compliant |
| E | 614 | 16QAM | Compliant |
| E | 614 | 64QAM | Compliant |
| E | 686 | 16QAM | Compliant |
| F | 714 | QPSK | Compliant |
| F | 884 | QPSK | Compliant |
| F | 884 | 16QAM | Compliant |
| F | 884 | 64QAM | Compliant |

**TABLE 13.2 Channels and Modulation Characteristics Measurement**

**Figure 13A; Test Setup for Antenna Port Measurement of Modulation Characteristics and Code Domain**

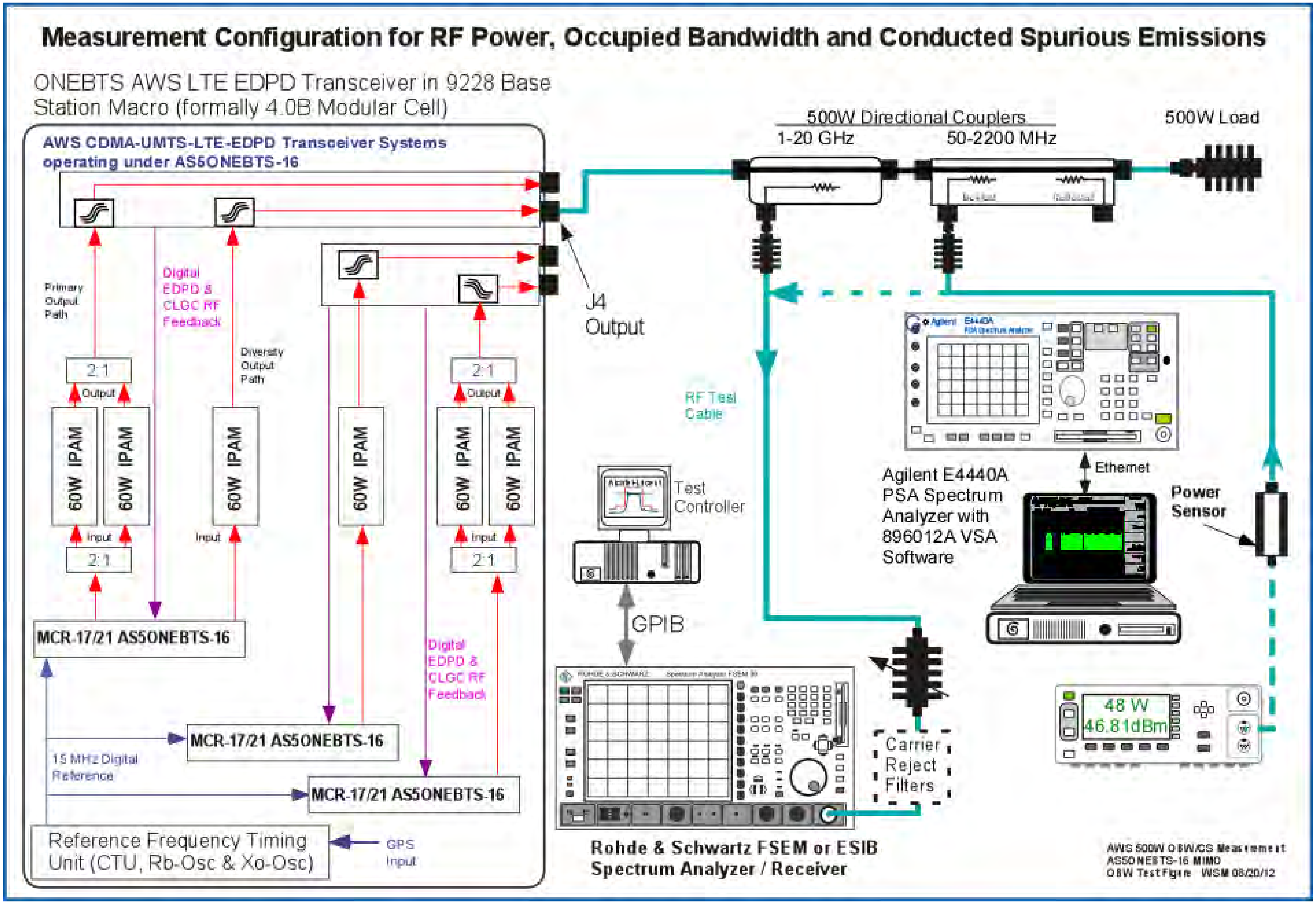


**Figure 13B QPSK Modulation, Channel 414 Tx Output 2 Amplifier**

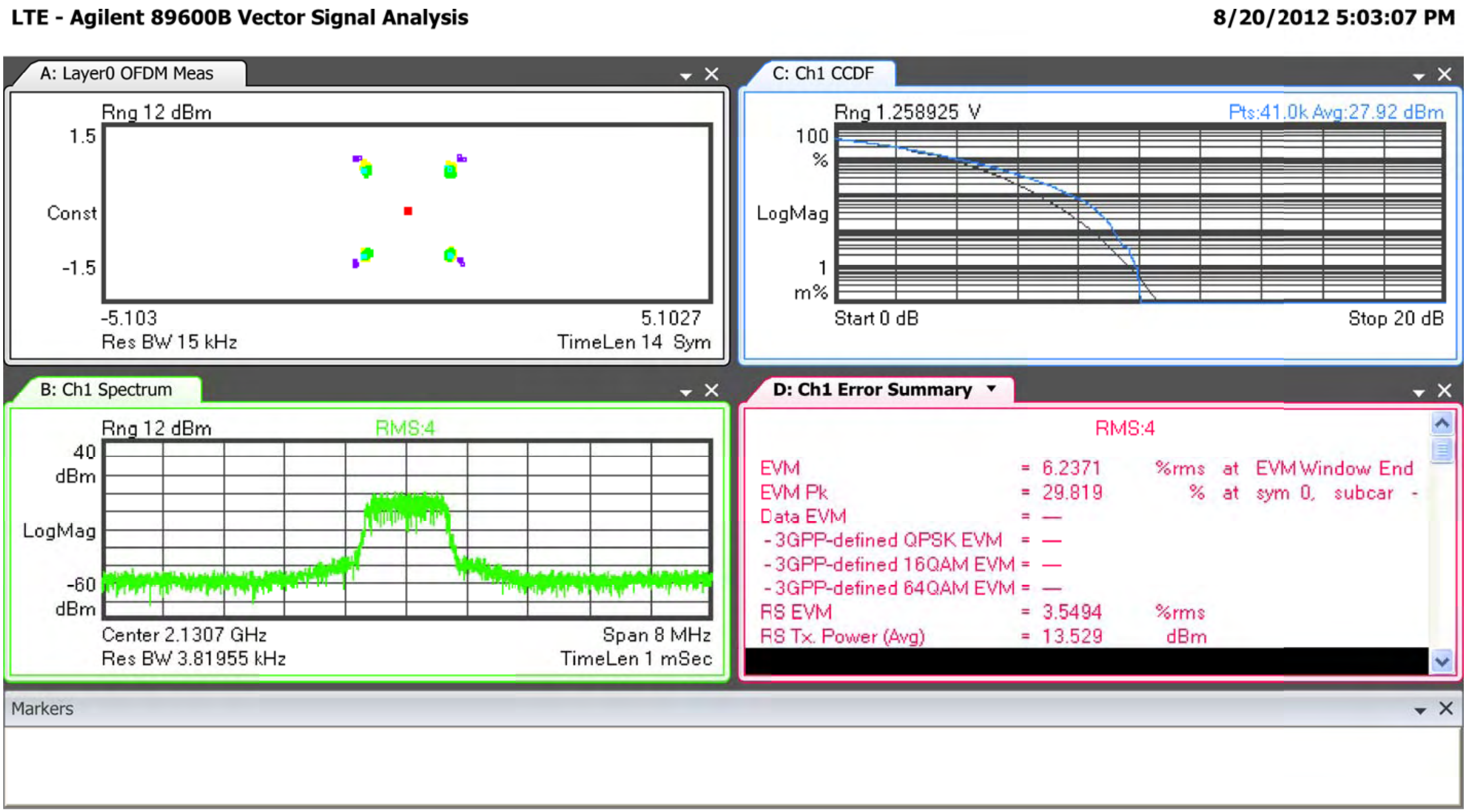


**Figure 13C 16QAM Modulation, Channel 414 Tx Output 2 Amplifier**

**LTE - Agilent 89600B Vector Signal Analysis** **8/23/2012 1:03:24 PM**

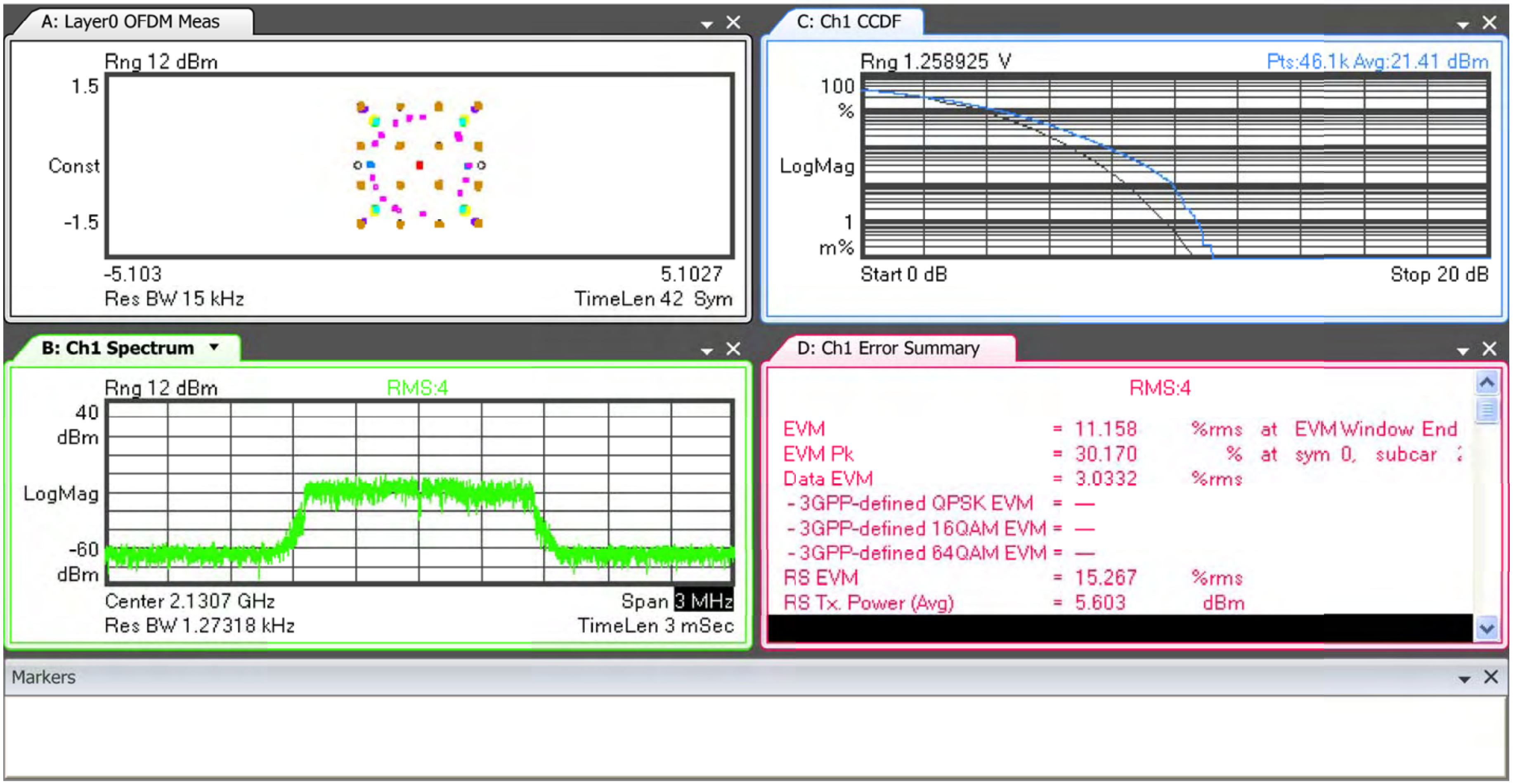
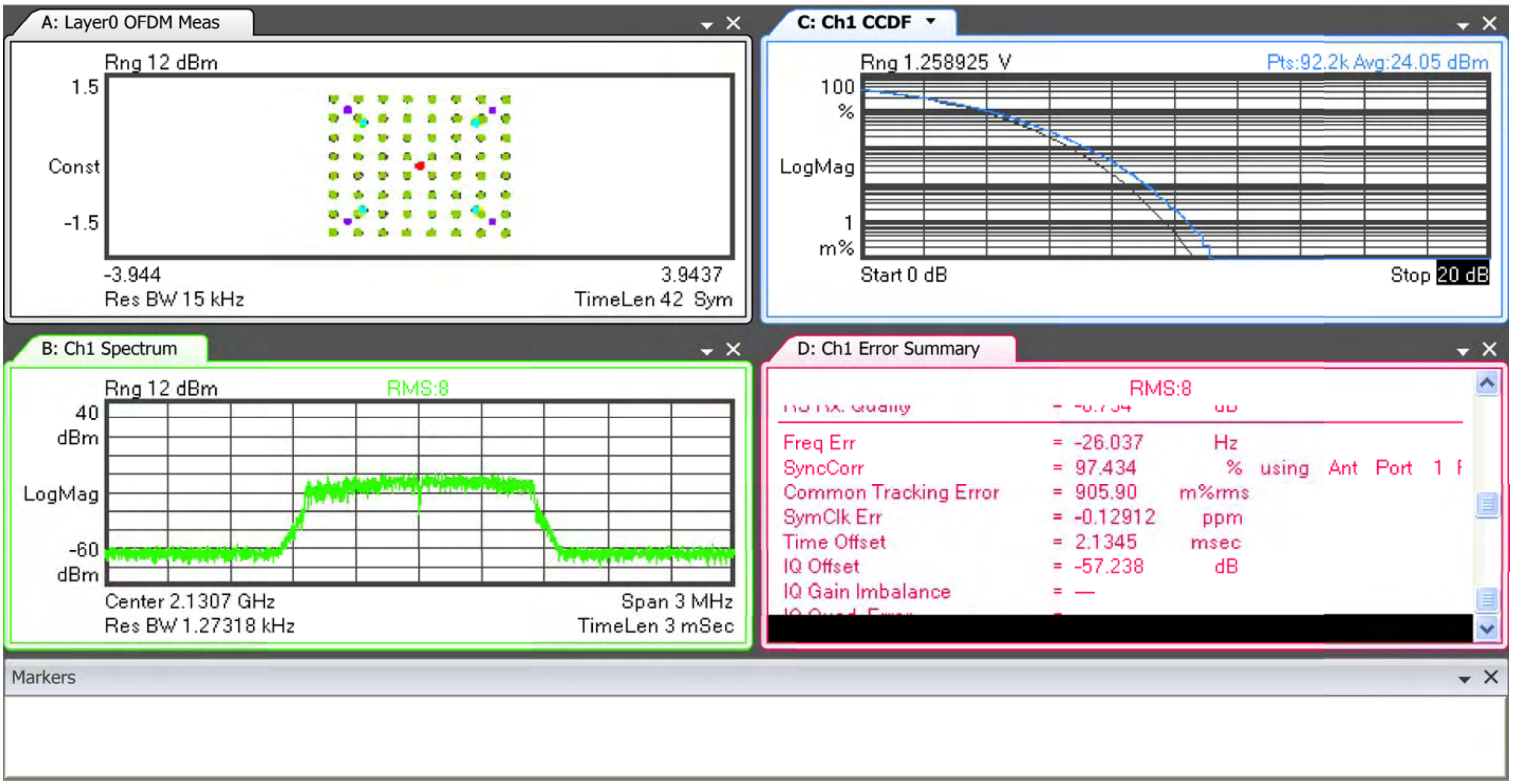


**Figure 13D 64QAM Modulation, Channel 486 Tx Output 2 Amplifier**

**LTE - Agilent 89600B Vector Signal Analysis** **8/23/2012 11:23:14 AM**



# Exhibit 14 Measurement Of Occupied Bandwidth

## SECTION 2.1049 Measurement of Occupied Bandwidth

Occupied bandwidth measurements of the **AWS Base Station System** were performed while configured in all three of the defined subcarrier modulations defined in Exhibit 13. These measurements were performed with the **AWS Base Station System** operating in all AWS Blocks. This documents the typical performance of the **AWS Base Station System** while operating with the 1M40F9W LTE emissions designator at 24W per carrier. All power adjustments were performed via the **MCR-1721 / AS5ONEBTS-16** and as described below.

The occupied bandwidth of the **AWS Base Station System/ FCC ID: AS5ONEBTS-16** was measured using a Rohde & Schwarz FSEM-30 Spectrum Analyzer, a PC based instrumentation controller using TILE™ software and a calibrated RF attenuation and coupled signal path. The RF power level was measured and adjusted via the test setup in Figure 14A. The set RF output from the transmitter was reduced by calibrated broadband RF Couplers and attenuators to amplitudes usable by the spectrum analyzer and power meter. The attenuation factors are reflected in the displayed values of the charts which are documented in absolute dBm. The typical occupied bandwidth measurement, Figure 14B, displays the signal adjusted to the -16.69 dBc level corresponding to the corrected RF power level for a 30 kHz resolution bandwidth (RBW) measurement of a 1.4 MHz signal (-16.69dB=10LOG(30kHz/1.4MHz). This set-point was performed as follows:

For each test the power calibration was individually verified at the transmitter antenna connection (J4) with a power meter by using the test setup depicted in Figure 14A. The power calibration was performed to calibrate the setting to the power meter measurement as a reference for both the measured 30 kHz Occupied Bandwidth signal at the -16.69 dBc (27.3 dBm) line and a 3 MHz RBW measurement against the “Top of Mask” limit as depicted in Figure 14B. The “Top of Mask” limit corresponds to a single carrier signal at the specified power level of 24 W/c as measured with an RBW of 3 MHz. Since the transmitter J4 output has a bandwidth of 1.4 MHz and the maximum analyzer resolution bandwidth is 3 MHz the power calibration reference line is the top of mask. The Top of Mask is +43.8 dBm and the power calibration line is thus 43.8 dBm. For power verification, the measurement made with an RBW setting of 3 MHz should align the spectrum analyzer measurement with the measurement performed using a power meter. The power meter has greater power accuracy and is thus used as the standard. The power level verifications using a power meter were first performed as part of each Occupied Bandwidth measurement. The signals, measured by the analyzer at RBW’s of 3 MHz and 30 kHz, were corrected for path loss and were plotted against the mask limit. As part of the correlation between the power meter measurement and the test analyzer, software was used to place the 3 MHz RBW signal at the carrier power calibration line for the LTE 1.4 MHz bandwidth signals. The carrier as measured with 3 MHz and 30 kHz RBW were corrected with the same attenuation factors and the two measurements were co-plotted on the same graph. A typical single carrier example is shown in Figure 14B which depicts a single carrier (414 C Block) inside the mask appropriate for a single 1.4 MHz carrier in C Block.

The test procedure described above, references the carrier power and accurately places the 30 kHz RBW measured carrier at the –16.69 dBc reference line. All of the plots are presented with a sufficiently wide frequency span for the specific signals or Block of interest and again for the entire AWS Band. This allows for ease of comparison of the broadband carriers performance. This data was recorded for all AWS blocks using the TILE™ software and placed in the Occupied Bandwidth Data Sheets.

**Block Organization and Tests Performed**

The **AWS Base Station System** product line allows the use of transmit filters with bandwidths of 20 MHz to as wide as 45 MHz. The use of Enhanced Digital Pre Distortion provides the spurious control which allows the use of wide bandwidth AWS Band filters. These wideband filters provide for the least spurious reduction at “edge of block” and “edge of band” and thus represent the most difficult compliance configuration. The filters do not provide for any spurious reduction at the internal block edges inside the band. The testing of the product documented herein was performed with 45 MHz AWS band filters. These test configurations are the most difficult for compliance demonstration.

The demonstration of compliance for the **LTE AWS Base Station System** transmit configurations were performed for operation in AWS Block C. The presented data for this Class II change demonstrates the **LTE AWS Base Station System** products conformance.

## **Exhibit 14** *continued*

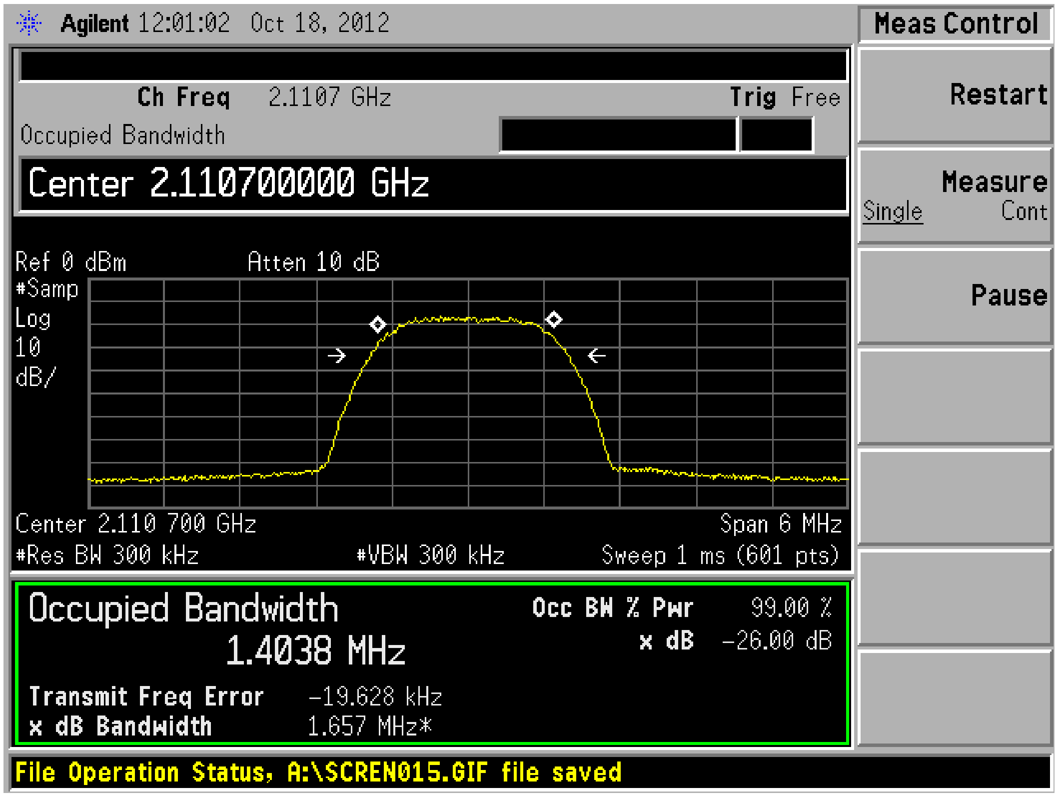
**Applied Signal Characteristics**
In order to adequately evaluate performance the occupied bandwidth was measured with each of the sub-carrier modulation factors and co-plotted. The applied signal from an **AWS Base Station System/ FCC ID: AS5ONEBTS-16**, met the recommended characteristics as defined in **3GPP TS 36.211 V9.1.0 (2010-03) titled:** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9).

The power was set to the specified 24 W/carrier maximum at each measurement frequency to verify the spectral performance at that power level at each specific frequency of interest. Power was also verified for the QPSK, 16QAM and 64QAM modulation configurations. The 99%/-26dB signal bandwidth was measured using the setup of Figure 14A for channels 414 and 486. The measurement performed with a resolution bandwidth of 300 kHz verified the signal is within the parameters of the emissions designator and is documented below.

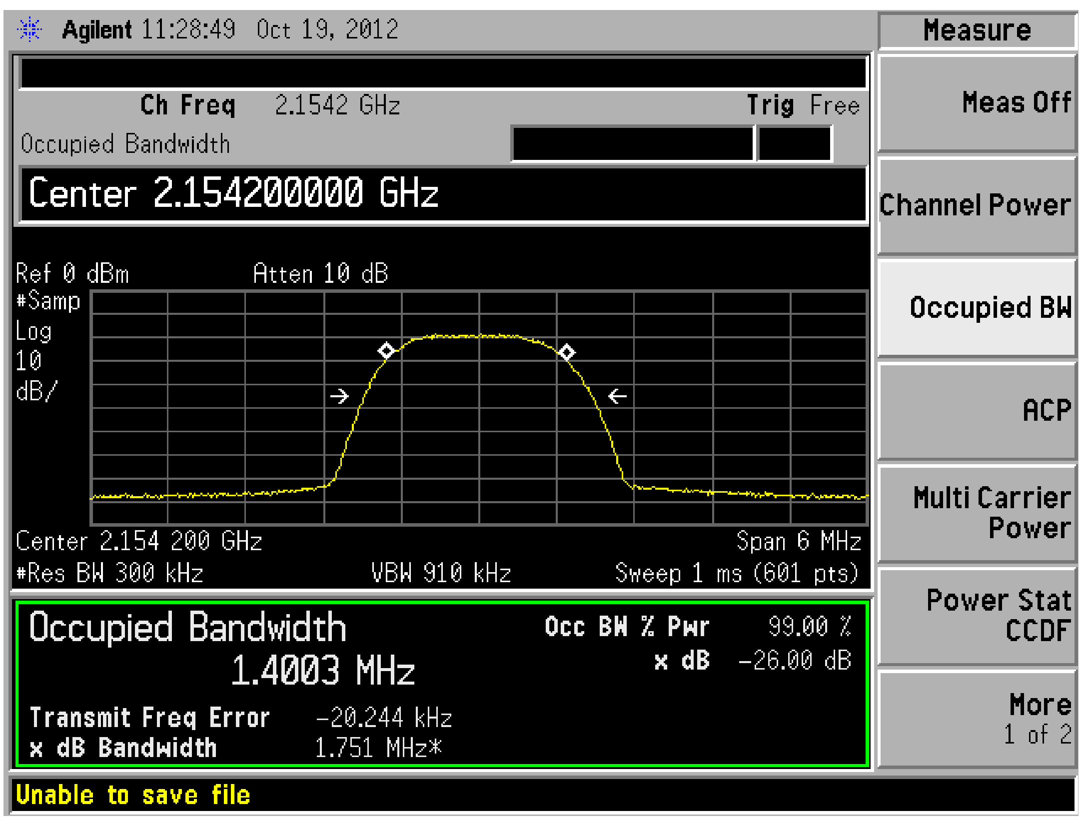
The attenuation range was also verified. The specific Frequencies and channels and set power level was documented on each "Occupied Bandwidth" sheet.

The FCC limits contained in **47CFR 27.53 1-Oct-2010** were followed.

**Signal Bandwidth Channel 14**




**Signal Bandwidth Channel 884**



## Measurement Offset

The spectrum analysis output plots shows the peak of the 1.4 MHz LTE channel signal -16.69 dB below the Mask reference / “zero dBc line” of the spectrum analyzer for the following reason: For the OFDM system there is no carrier without modulation. Since the LTE signal is broadband and 1.4 MHz wide, all measurements performed at narrower resolution bandwidths need be adjusted for the reduction in signal energy. The following relationship was used to provide the correct level for an unmodulated carrier vs. the modulated signal.

10*log (Resolution Bandwidth/ Transmit Bandwidth) = Signal Offset (1)

For the peak of the 1.4 MHz LTE signal measured with a RBW of 30 kHz the signal offset is:

Signal Offset = 10*log (30 kHz /1.4 MHz) = -16.69 dB

Limits which are specified as appropriate at a given RBW can be measured and evaluated at other RBW’s if the limit is adjusted per equation (1). To account for a worst case summation of multiple transmit signals, per KDB 662911 D01 Multiple Transmitter Output v01r0, the level needs be adjusted by 10LOG(N) where N= number of outputs. The adjustment is

Additional offset dB = 10* log(N) (2)

Limits adjusted per equation (1) need to account for multiple identical transmit outputs per equation (2).

## Required Levels

Unlike CDMA there is no requirement in 3GPP TS 36.211 V9.1.0(2010-03) for Suppression inside the Licensee’s Frequency Block(s). Masks are therefore defined only by 47 CFR 27.53(h)(1)(2)(3)

The Limit in 47 CFR 27.53 (h)(1)(2)(3) for emissions in the 1 MHz band immediately outside and adjacent to a licensees frequency block is:

Emissions ≤1 MHz outside the Block *when measured with a RBW of 1%* of the emissions Bandwidth shall be attenuated by :

-{43+10log (mean power output in watts)} = -13 dBm

The Limit in 47 CFR 24.53(h) for emissions outside a licensees frequency block is:

Emissions >1 MHz outside the Block, *when measured with a RBW of 1 MHz*, shall be attenuated by :

-{43+10log (mean power output in watts)} = -13 dBm.

Measurement at a Resolution Bandwidth of 30 kHz is based on our experience with 47CFR 27.53(h) and lacking other guidance.

## Adjusted Levels

The following levels apply when measurement of the above limits are performed with an RBW of 30 kHz. Measurement at a Resolution Bandwidth of 30 kHz is based on our experience with 47 CFR 27.53(h) and lacking other guidance.

1. On any frequency from the block edge to 1MHz above or below the Block edge the level shall not exceed -12.70 dBm when measured with a 30 kHz resolution bandwidth (Note 2 below).
   ***For 24 Watts*** the required level is **-12.7 dBm/ –56.5 dBc**.

2. On any frequency greater than 1MHz above or below the Block edge the level shall not exceed -31.24 dBm when measured in a 30 kHz resolution bandwidth (Note 2 below).
   ***For 24 Watts*** the required level is **-31.24 dBm/ – 75.04 dBc** as measured with a 30 kHz resolution bandwidth (see Note 3). This is equal to -13 dBm measured with a 1 MHz resolution bandwidth. and

3. From the edge of the Block to the 10th harmonic of the carrier at least
   -{43+10log (mean power output in watts)} = -13 dBm.
   When measured with a 1 MHz resolution bandwidth.

**Exhibit 14** *continued*

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**Note 2:** The -12.7 dBm/ –56.5 dBc level was computed as follows: The limit is specified as

-{43+10log (mean power output in watts) } dB = -13 dBm

When measured in a resolution bandwidth not less than 1% of the signal bandwidth.
Since the carrier is a 1.4 MHz bandwidth signal, the limit is adjusted to

-13 + 10LOG(30kHz/14 kHz) dBm = -9.69 dBm

When accounting for a 2x MIMO signal, ( per KDB 662911 D01 Multiple Transmitter Output v01r01), the level needs be adjusted by 10LOG(n) where n= number of outputs. The adjustment for n=2 is:
3.01 dB = 10LOG(2)

The resultant limit for MIMO operation is -9.69 dBm – 3.01 dB = -12.7 dBm **;**
which given a 43.8 dBm carrier (24W) equals – 56.5 dBc

**Note 3:** The -31.24 dBm / -75.04 dBc level is computed from -13 dBm measured with a 1 MHz resolution bandwidth adjusted by :

-13 + 10LOG(30kHz/1.0 MHz) dBm = -28.23 dBm

When accounting for a 2x MIMO signal, ( per KDB 662911 D01 Multiple Transmitter Output v01r01), the level needs be adjusted by 10LOG(n) where n= number of transmitter outputs. The adjustment for n=2 is:
3.01 dB = 10LOG(2)

The resultant limit for MIMO operation is -28.23 dBm – 3.01 dB = -31.24 dBm **;**
which given a 43.8 dBm carrier (24W) equals – 75.04 dBc

**Exhibit 14** *continued*

## Mask Description for a Single Carrier in a 24 Watts per carrier multi-carrier application.

The Mask limits are identical for the left and right side of the AWS Blocks and are as follows:

Figure 14B shows the 1.4 MHz LTE Mask limit for AWS Block C (2130-2135 MHz) for AWS channel 414. The horizontal line from a to aa (a-aa) is the 43.8 dBm/ 0 dBc reference level. The Power Calibration reference line g-gg is the top of mask reference line as the 3 MHz power calibration resolution bandwidth exceeds the 1.4 MHz signal bandwidth.

The top of a typical 43.8 dBm single 1.4 MHz LTE QPSK carrier signal viewed at a resolution bandwidth of 30 kHz is shown at the 27.11 dBm/ -16.69 dBc line t-tt. This line is based on equations 1 and 2, and the ratio of the 1.4 MHz signal bandwidth and the 30 kHz resolution bandwidth of the spectrum analyzer.

The vertical line from a to b (i.e. a-b) and aa-bb are at the block edge for C Block. The horizontal lines c-b and bb-cc represent the limit for the 1st MHz outside the block. The placement of lines c-b and bb-cc is derived from evaluation of 1% of the signal bandwidth, the 30 kHz resolution bandwidth and adjustments for MIMO using the suggested value in of the rules.
Per Note 2 above, the limit for the 1st MHz outside the band with MIMO operation is **-12.7 dBm / – 56.5 dBc**
The vertical line, c-d and cc-dd are the transitions at 1MHz outside the specified Block.

The horizontal line d-e and dd-ee are placed at the **-31.24 dBm / -75.04 dBc** below the 0 dBc / 43.8 dBm reference per Note 3 above. The rules require a 1 MHz resolution bandwidth for measurements 1 MHz or greater outside the AWS band. Again, equation (1) and the ratio of 1 MHz to 1.4 MHz provides this value. The same logic was used in determining the other block and band edge tolerances.

## Trace Description and Power Calibration

Figure 14B shows the 1.4 MHz carrier, Block C channel 414 LTE signal, measured with two different resolution bandwidths. The upper magenta trace displays the signal as measured with a resolution bandwidth of 3 MHz. The lower black trace is the same signal as measured with a 30 kHz resolution bandwidth and this is the appropriate trace for the mask evaluation. The wider resolution bandwidth allows for a true power calibration of the measured signal against the top of mask. The top of the mask is appropriate for a single carrier power calibration as it represents the true power level of a single carrier as measured with a power meter. For a LTE 1.4 MHz carrier signal the total power is the same as the trace as the analyzers maximum resolution bandwidth is 3 MHz and captures all of the signal. There is therefore no bandwidth correction factor for the 3 MHz carrier signal measured with a 3 MHz resolution bandwidth. Specifically:

For a 24W / 43.8 dBm signal the Power calibration reference line is: 43.8 dBm

The power calibration value for the 1.4 MHz carrier configurations at 24 W/c is 43.8 dBm which is the top of mask. These values are depicted on the occupied bandwidth charts as the dashed magenta Power Calibration Line gh-gg on each chart and as shown on example Chart 14B.

# Exhibit 14 *continued*

**Measurement of the 1.4 MHz Carrier Configuration**

All of the tolerance lines for the output are referenced to the top of the Occupied Bandwidth mask, which is defined as 43.8 dBm/ zero dBc. For all measurements of the **AWS Base Station System/ FCC ID: AS5ONEBTS-16** Occupied Bandwidth, the output power was measured / adjusted individually to the 24 W level for each carrier and this is the 43.8 dBm value at the 0 dBc reference line.

In order to depict the tolerance lines that are required by Sec 27.53 of the FCC Rules all measurements were made with a resolution bandwidth of 30 kHz and the limits were adjusted using equation (1). A sample detector was employed using minimum of 25 sweeps averaging per trace.

| AWS - Block | AWS - Channels | Number of carriers | Sub-Carrier Modulation | Total Power Watts | Results Occupied Bandwidth |
|---|---|---|---|---|---|
| A | 14 | 1 | QPSK | 24 | Compliant |
| A | 14 | 1 | 16QAM | 24 | Compliant |
| A | 14 | 1 | 64QAM | 24 | Compliant |
| A | 186 | 1 | QPSK | 24 | Compliant |
| B | 214 | 1 | QPSK | 24 | Compliant |
| B | 214 | 1 | 16QAM | 24 | Compliant |
| B | 214 | 1 | 64QAM | 24 | Compliant |
| B | 386 | 1 | QPSK | 24 | Compliant |
| C | 414 | 1 | QPSK | 24 | Compliant |
| C | 414 | 1 | 16QAM | 24 | Compliant |
| C | 414 | 1 | 64QAM | 24 | Compliant |
| C | 486 | 1 | QPSK | 24 | Compliant |
| D | 514 | 1 | QPSK | 24 | Compliant |
| D | 514 | 1 | 16QAM | 24 | Compliant |
| D | 514 | 1 | 64QAM | 24 | Compliant |
| D | 586 | 1 | QPSK | 24 | Compliant |
| E | 614 | 1 | QPSK | 24 | Compliant |
| E | 614 | 1 | 16QAM | 24 | Compliant |
| E | 614 | 1 | 64QAM | 24 | Compliant |
| E | 686 | 1 | QPSK | 24 | Compliant |
| F | 714 | 1 | QPSK | 24 | Compliant |
| F | 884 | 1 | QPSK | 24 | Compliant |
| F | 884 | 1 | 16QAM | 24 | Compliant |
| F | 884 | 1 | 64QAM | 24 | Compliant |

**TABLE 14.2 AWS Occupied Bandwidth Compliance Tabulation**

## Exhibit 14 *Results*

*The Block designation, AWS channels, frequencies and Measured RF Power are tabulated on each plot. The transmitter output signals are plotted for each frequency, modulation and channel of interest. Plots are provided for the AWS Block evaluated and two plots showing the three different modulations co-plotted together. This shows that the occupied bandwidth in the AWS Blocks in which this product can be operated, is in compliance with Section 27.53(h)(1)(2)(3) of the Commission code. The signal used to show the occupied bandwidth is as defined and recommended in* ***3GPP TS 36.211 V9.1.0 (2010-03)****. The power output level was adjusted to provide the documented value on each chart.*

**RESULTS: The following exhibits illustrate the spectrums investigated and document compliance.**

***W. Steve Majkowski NCE***

**Figure 14A Test Setup for Antenna Port Measurement of Transmit Power, Occupied Bandwidth and Conducted Spurious Emissions**

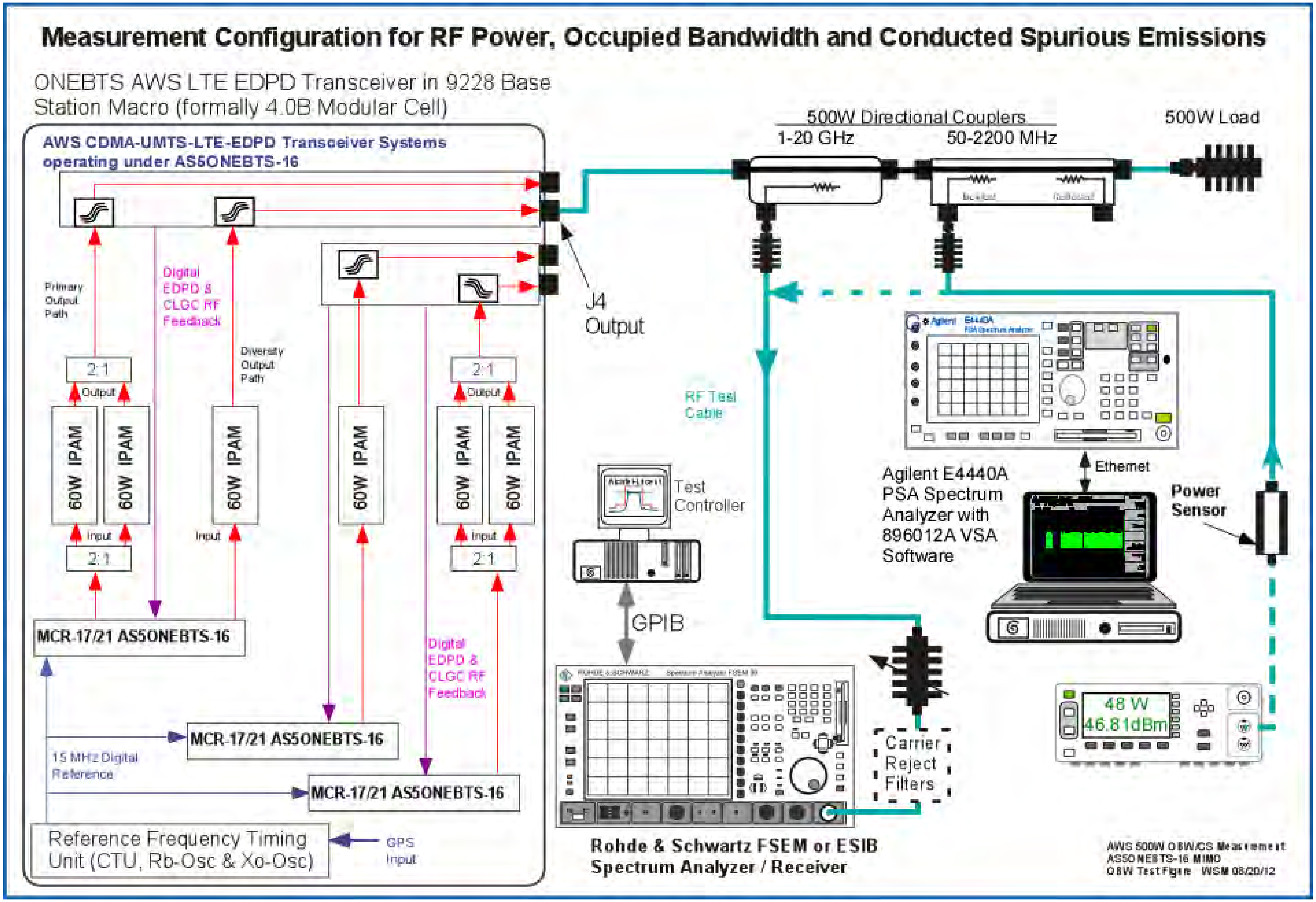
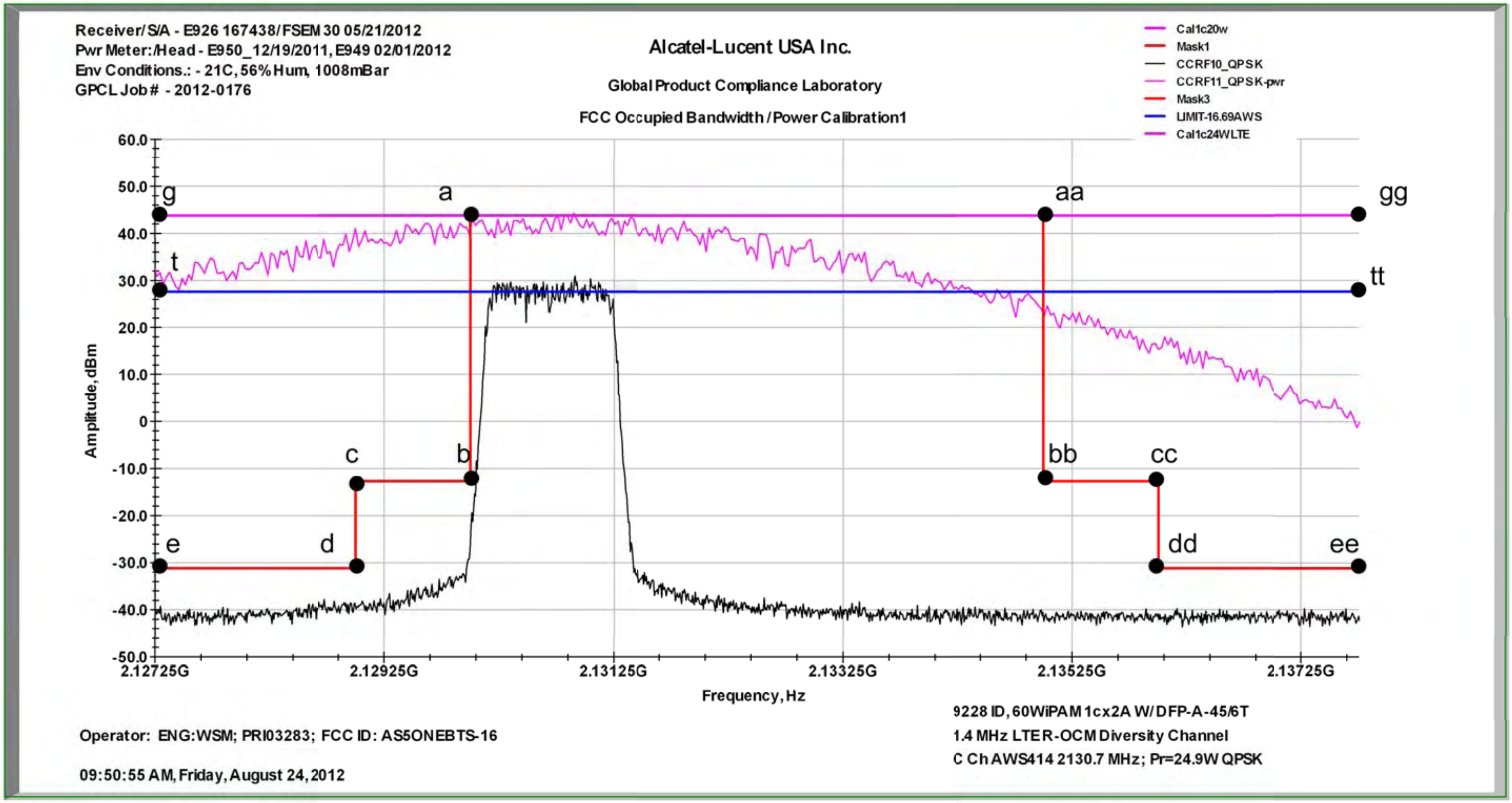


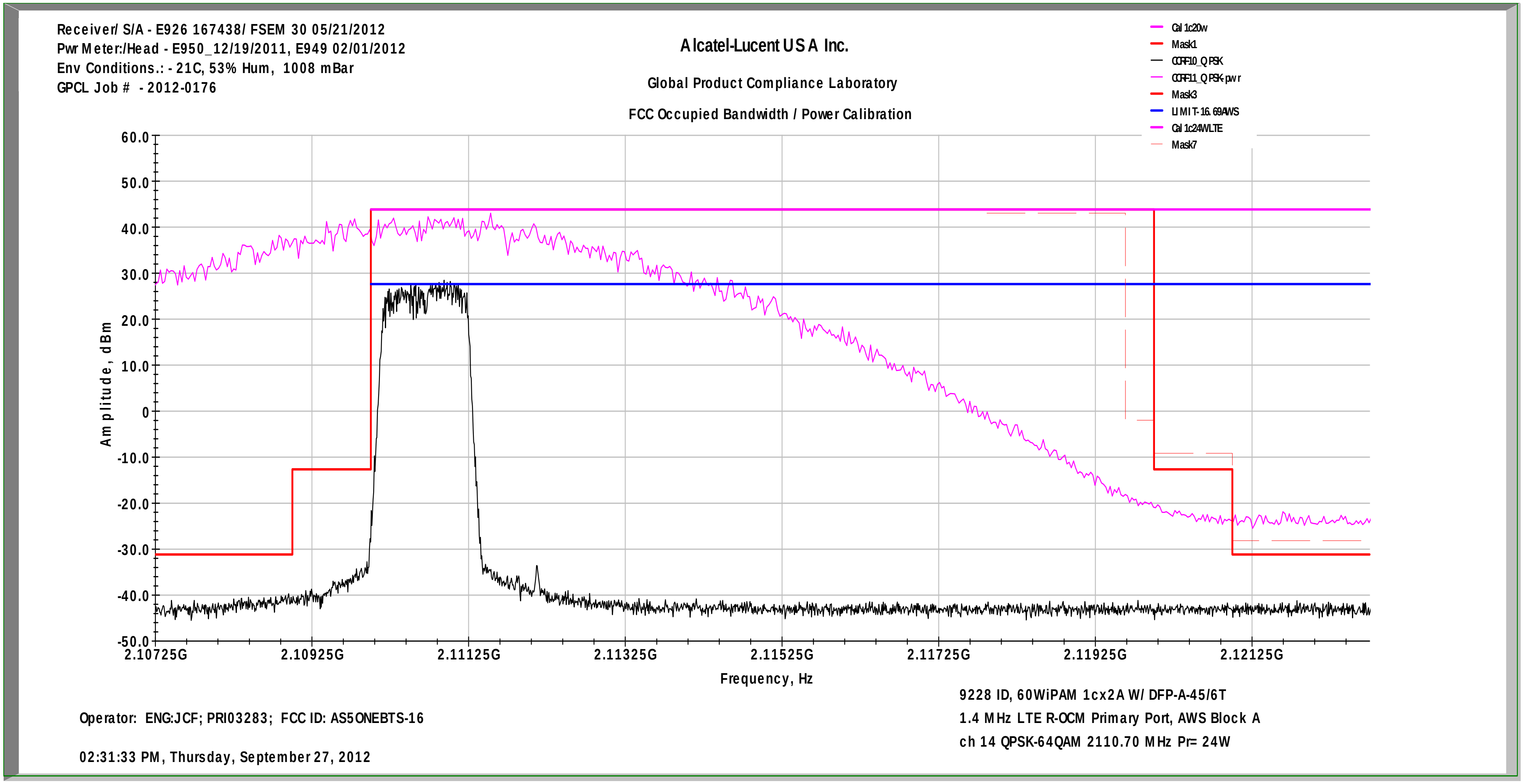
**Figure 14B Occupied Bandwidth Mask for AWS Block Operation at 24 W with Power Calibration (AWS C Block is depicted with a single 1.4 MHz LTE carrier signal showing use of the Power Calibration Trace )**



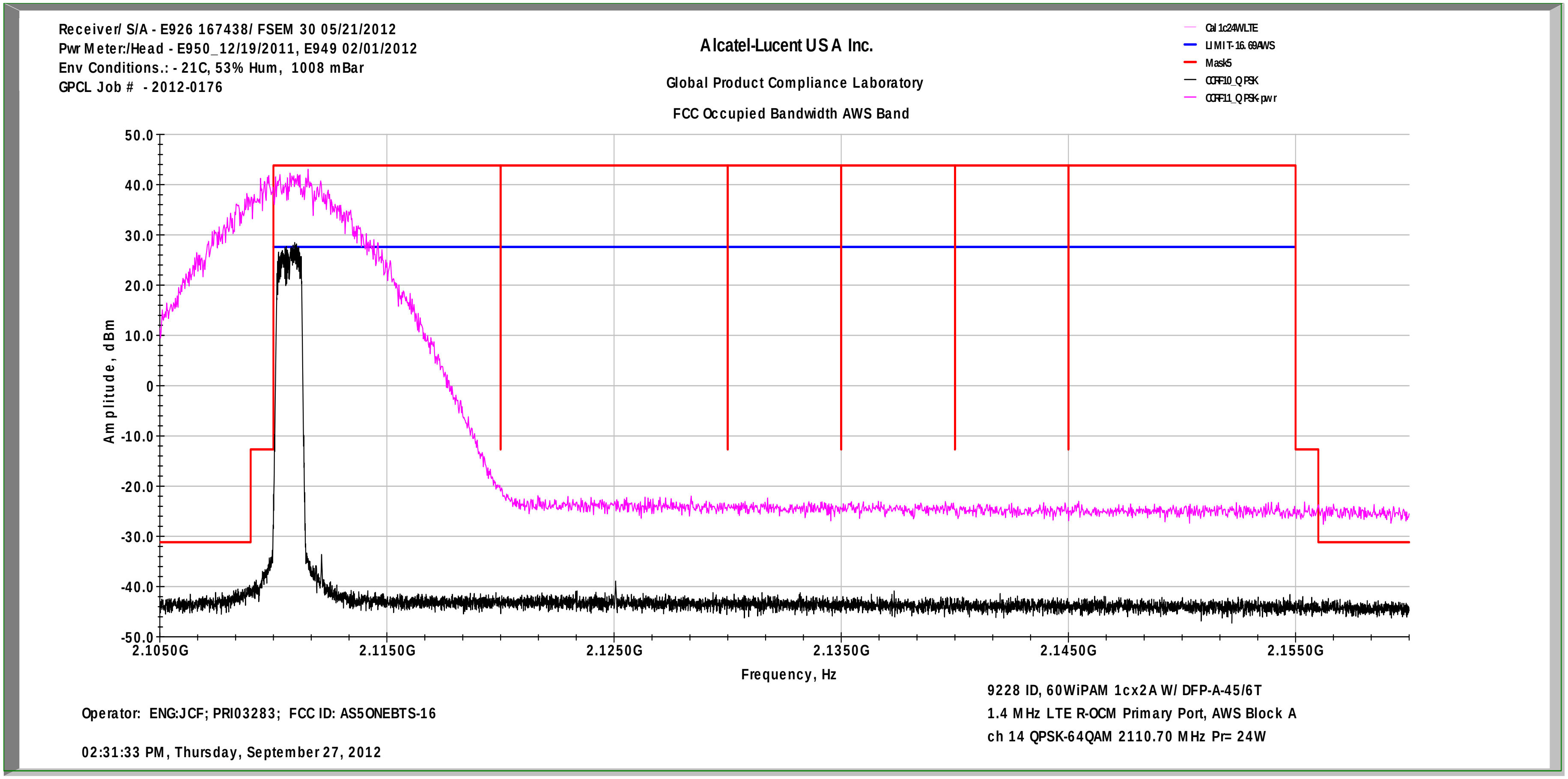
# Transmitter Measurements
# of
# FCC Occupied Bandwidth
# for
# Alcatel-Lucent USA Inc.
# AWS Base Station System
# FCC ID: AS5ONEBTS-16
# Installed in
# LTE AWS 9228 Base Station Macro
# Operational Configuration with
# 60W IPAMs at 24W/carrier

**W. Steve Majkowski NCE**
**FCC Wireless Compliance, CDMA Filing Lead**
**Alcatel-Lucent USA Inc.**
**Building 28-114J**
**600-700 Mountain Avenue, P.O. Box 636**
**New Providence, 07974-0636**
Office: 908-582-3782
Cell: 732.259.1458
email: steve.majkowski@alcatel-lucent.com

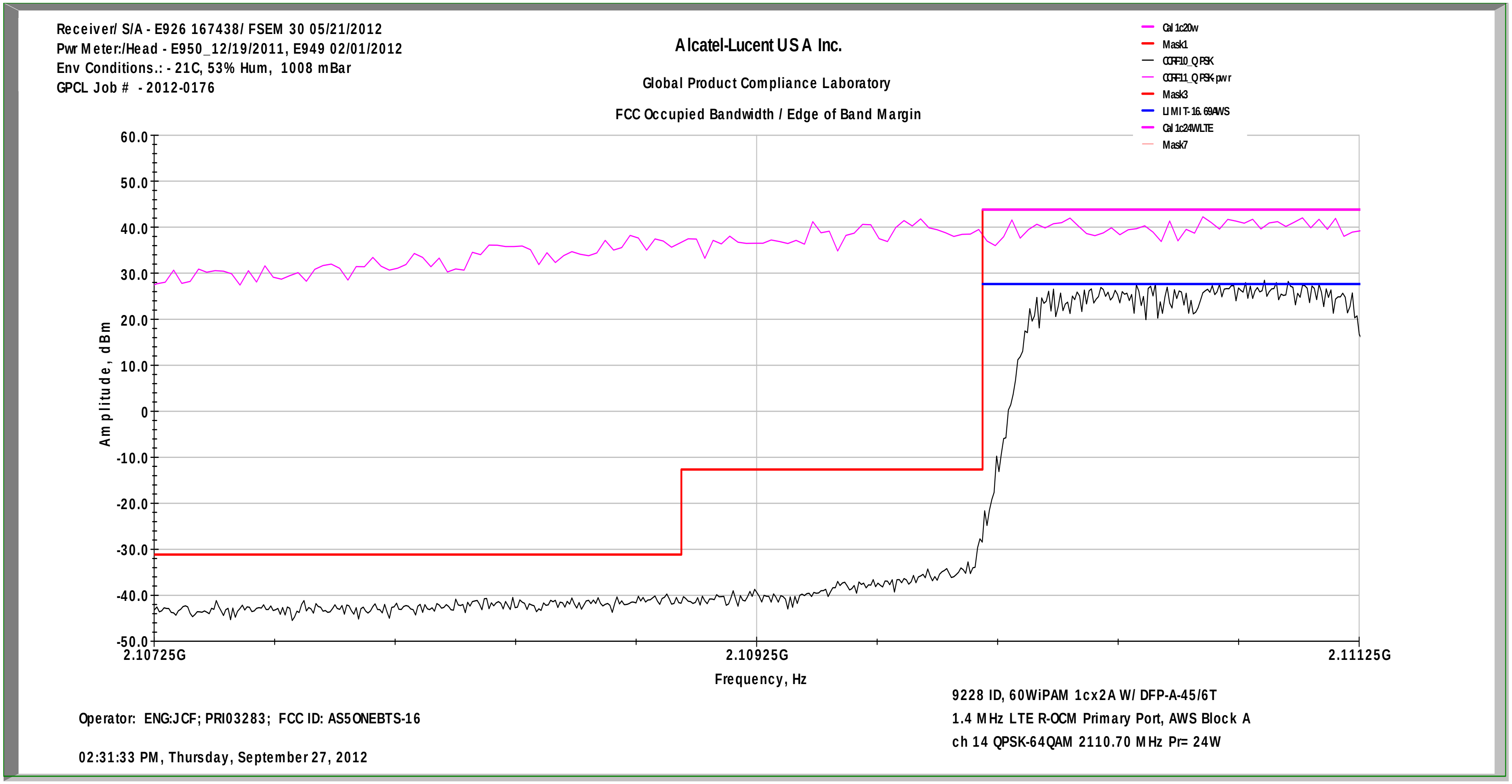
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch A-14 1cx2A 24W/c QPSK Primary Tx1



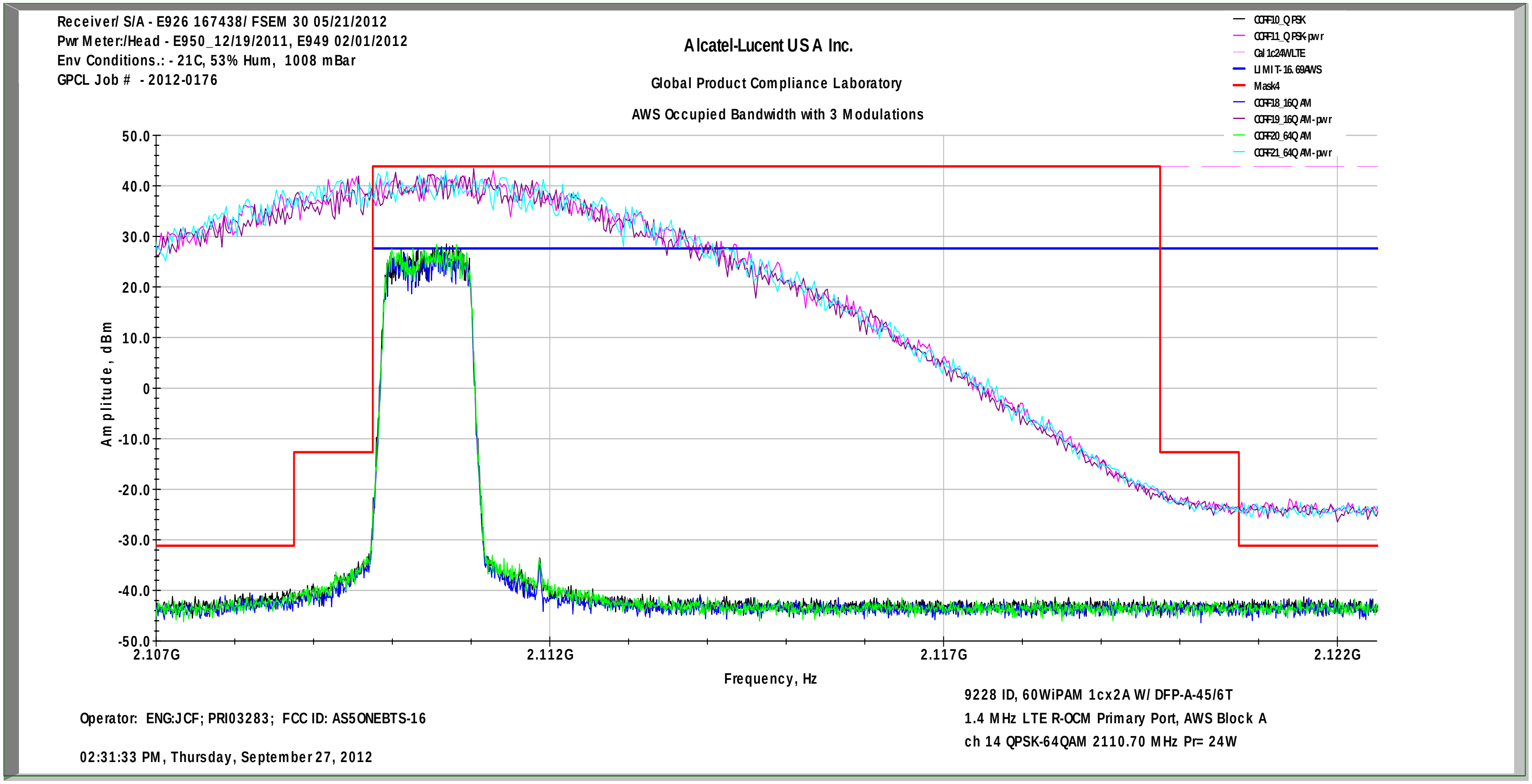
## In-Band Intermodulation Graph AWS 1.4 MHz Ch A-14 1cx2A 24W/c QPSK Primary Tx1



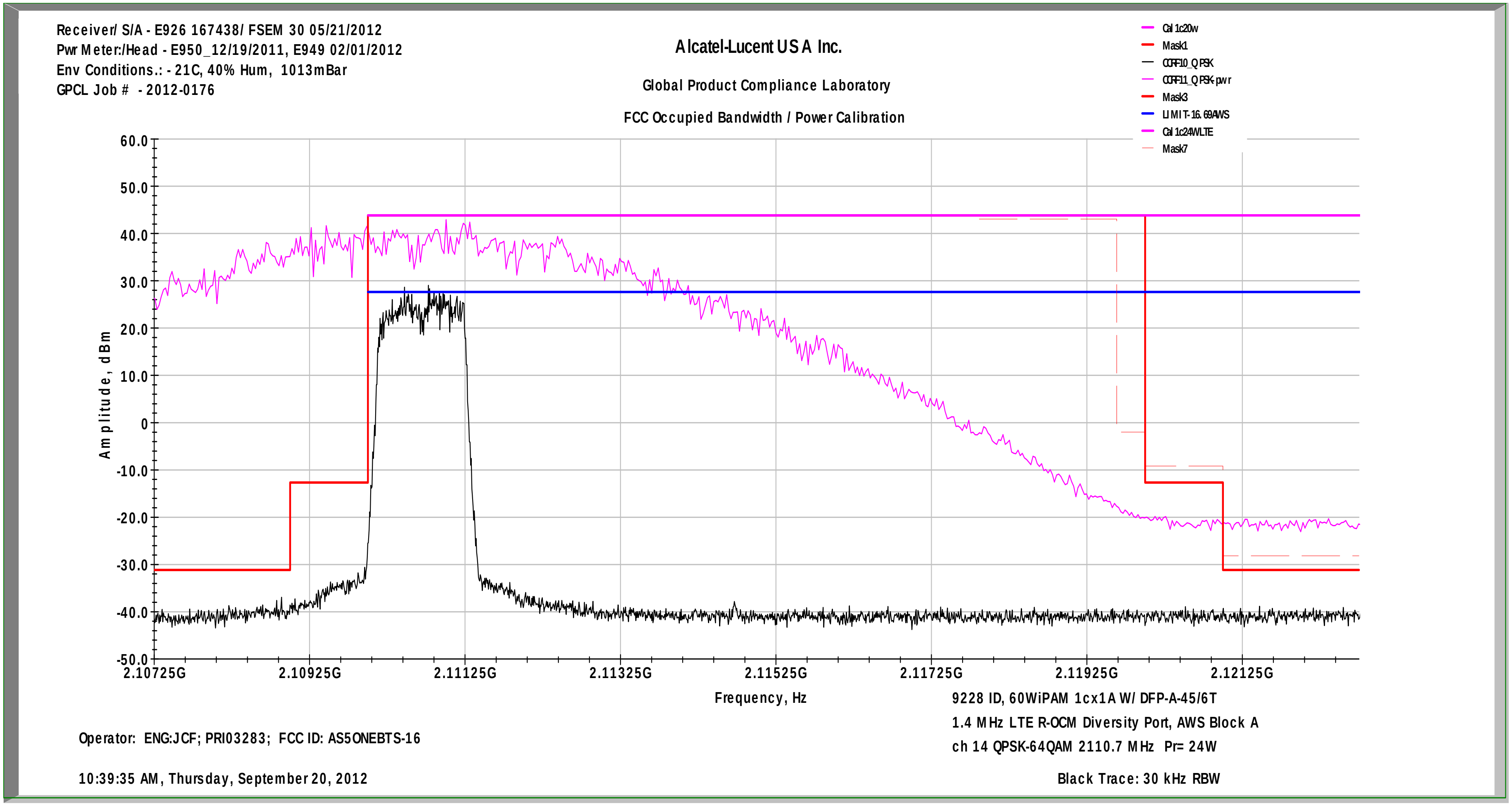
## FCC Edge of Block Margin AWS 1.4 MHz Ch A-14 1cx2A 24W/c QPSK Primary Tx1



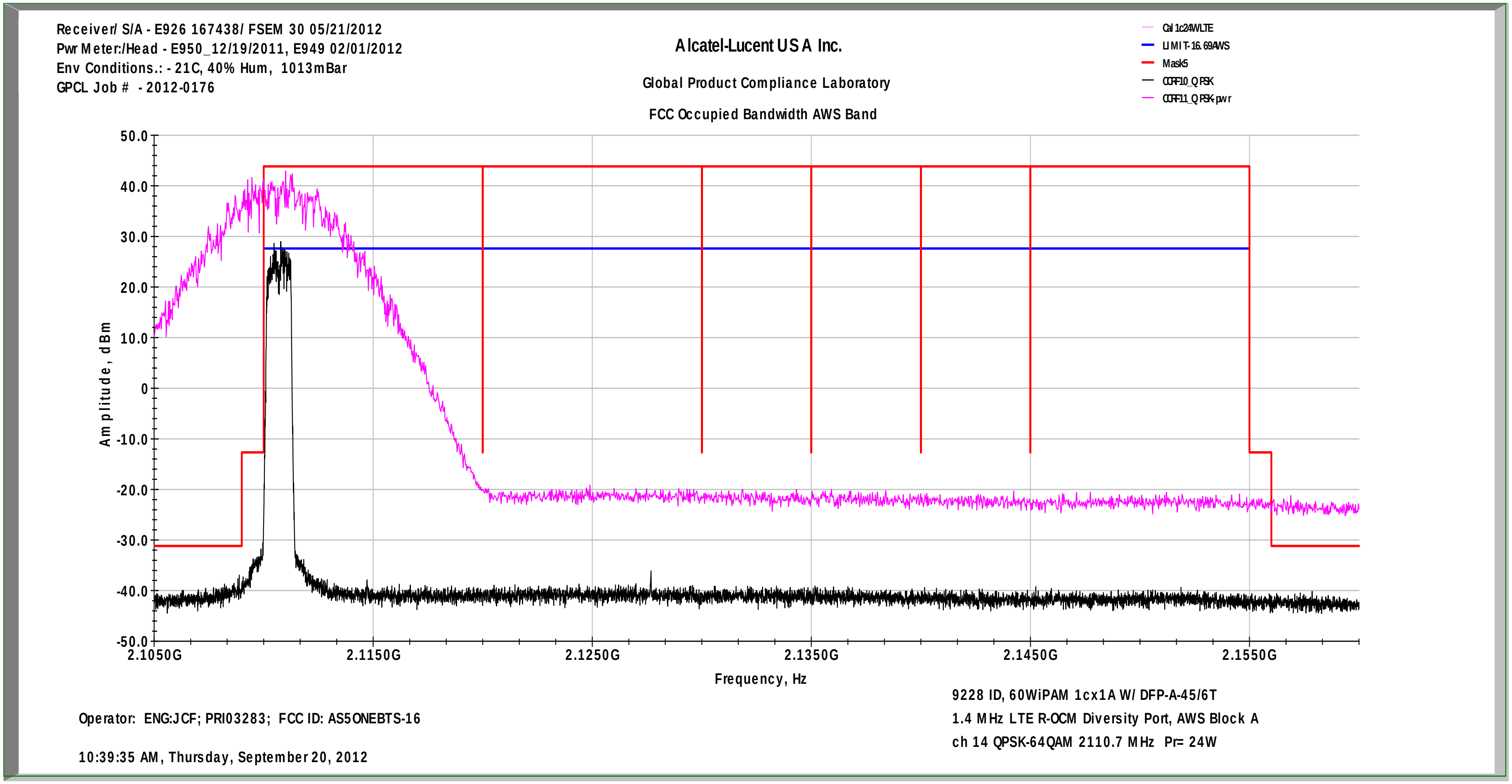
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch A-14 1cx2A 24.2W/c QPSK, 16QAM and 64QAM Primary Tx1



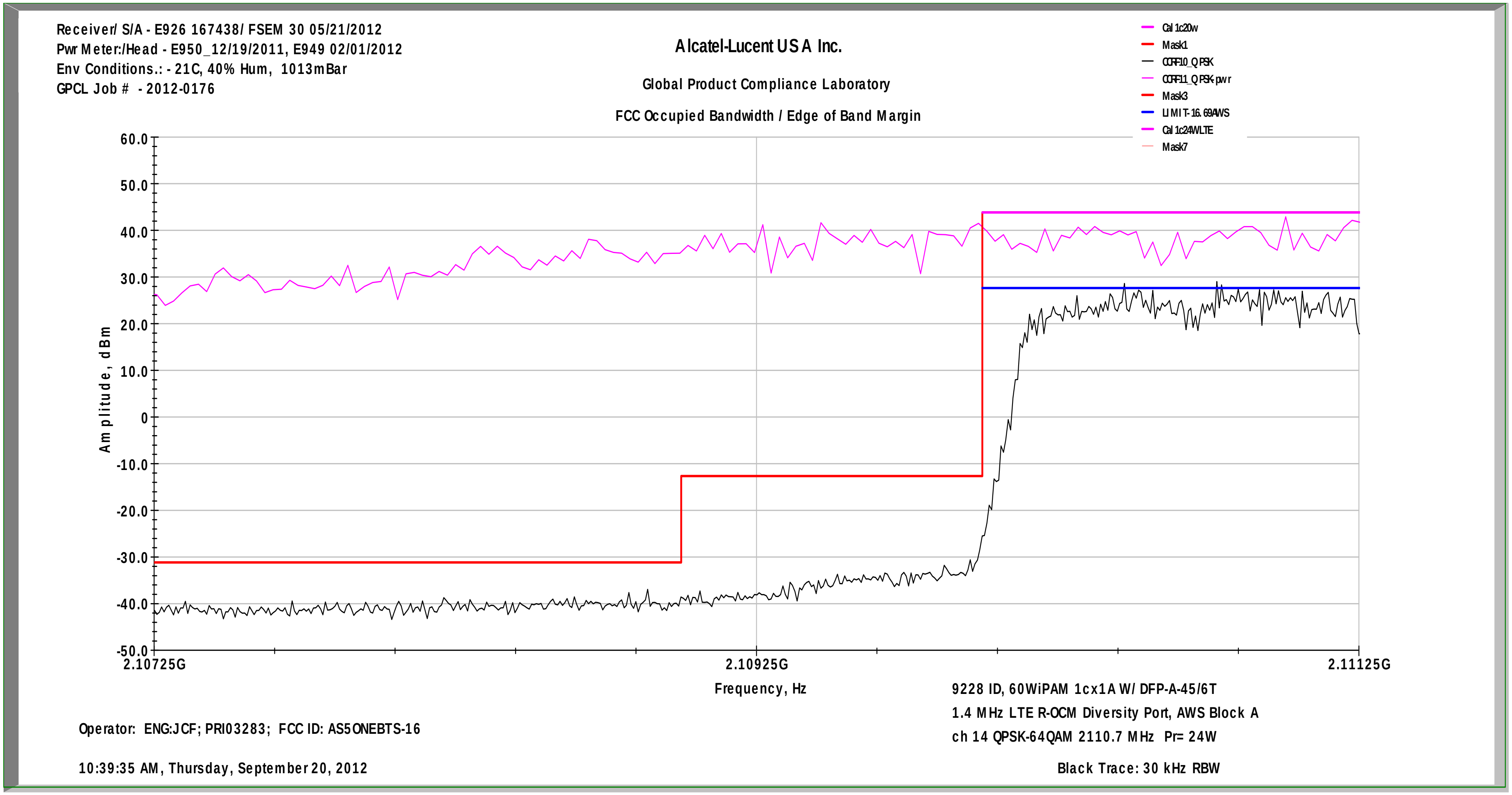
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch A-14 1cx1A 24W/c QPSK Diversity Tx2



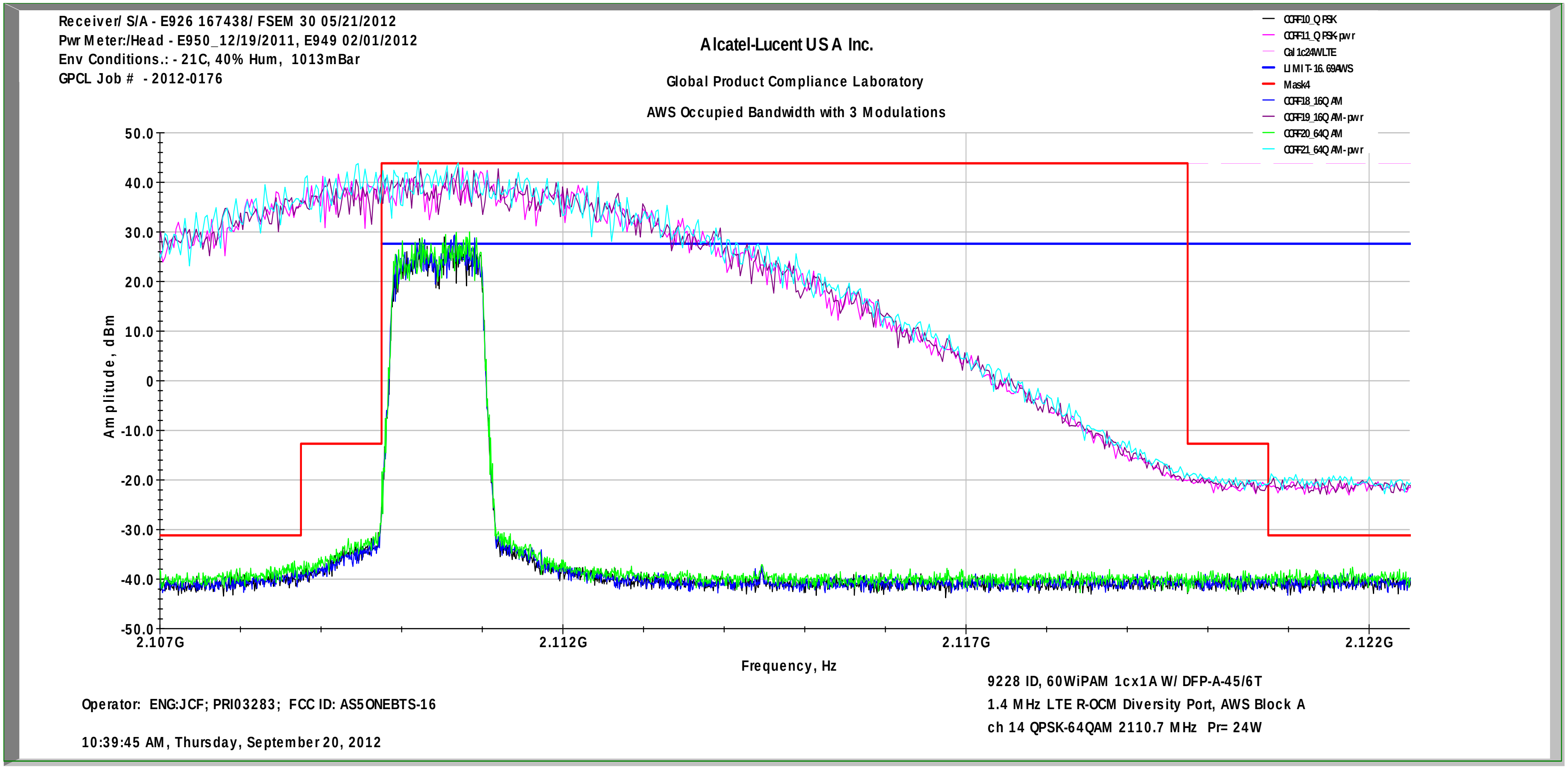
## In-Band Intermodulation Graph AWS 1.4 MHz Ch A-14 1cx1A 24W/c QPSK Diversity Tx2



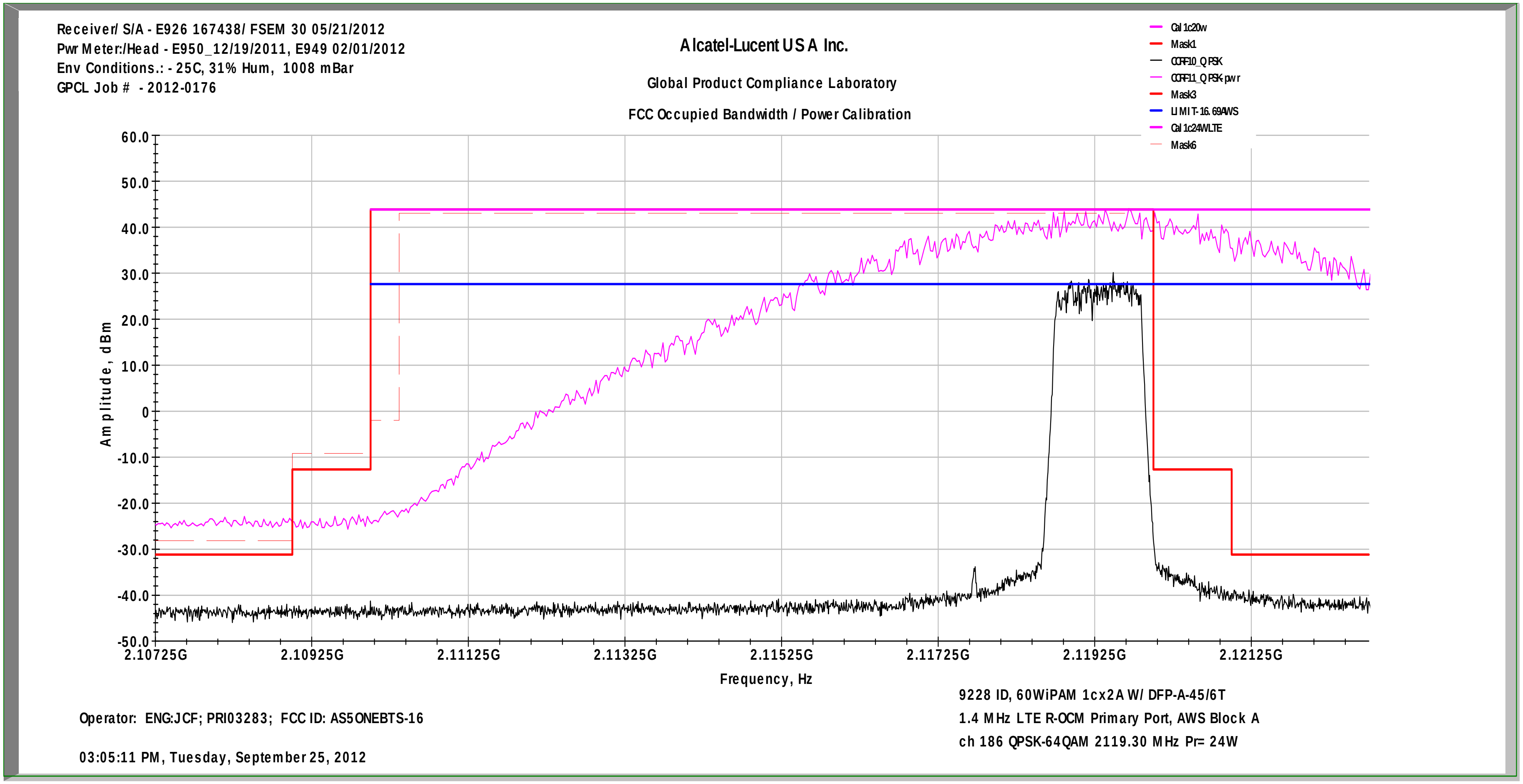
## FCC Edge of Block Margin AWS 1.4 MHz Ch A-14 1cx1A 24W/c QPSK Diversity Tx2



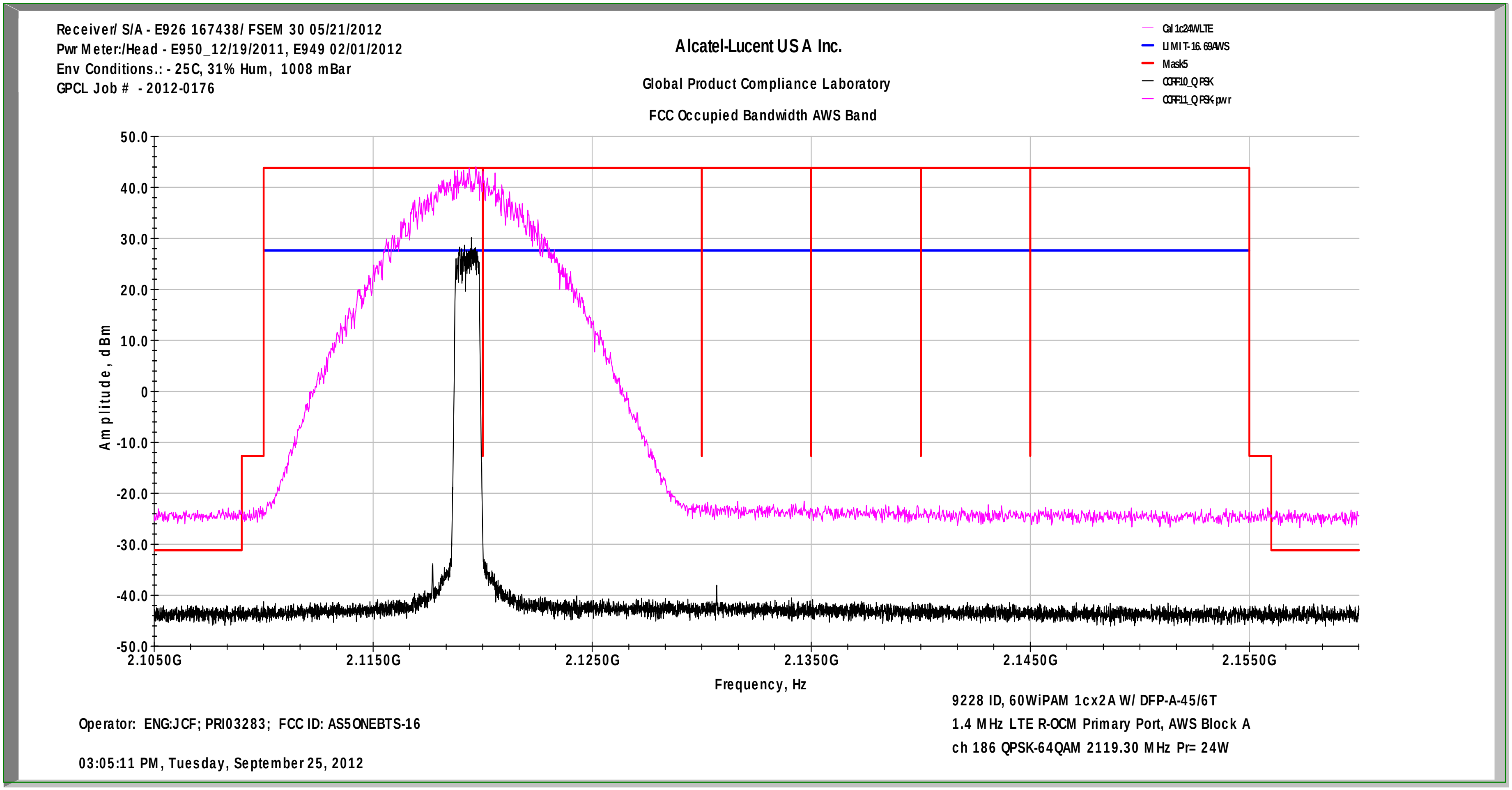
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch A-14 1cx1A 24.2W/c QPSK, 16QAM and 64QAM Diversity Tx2



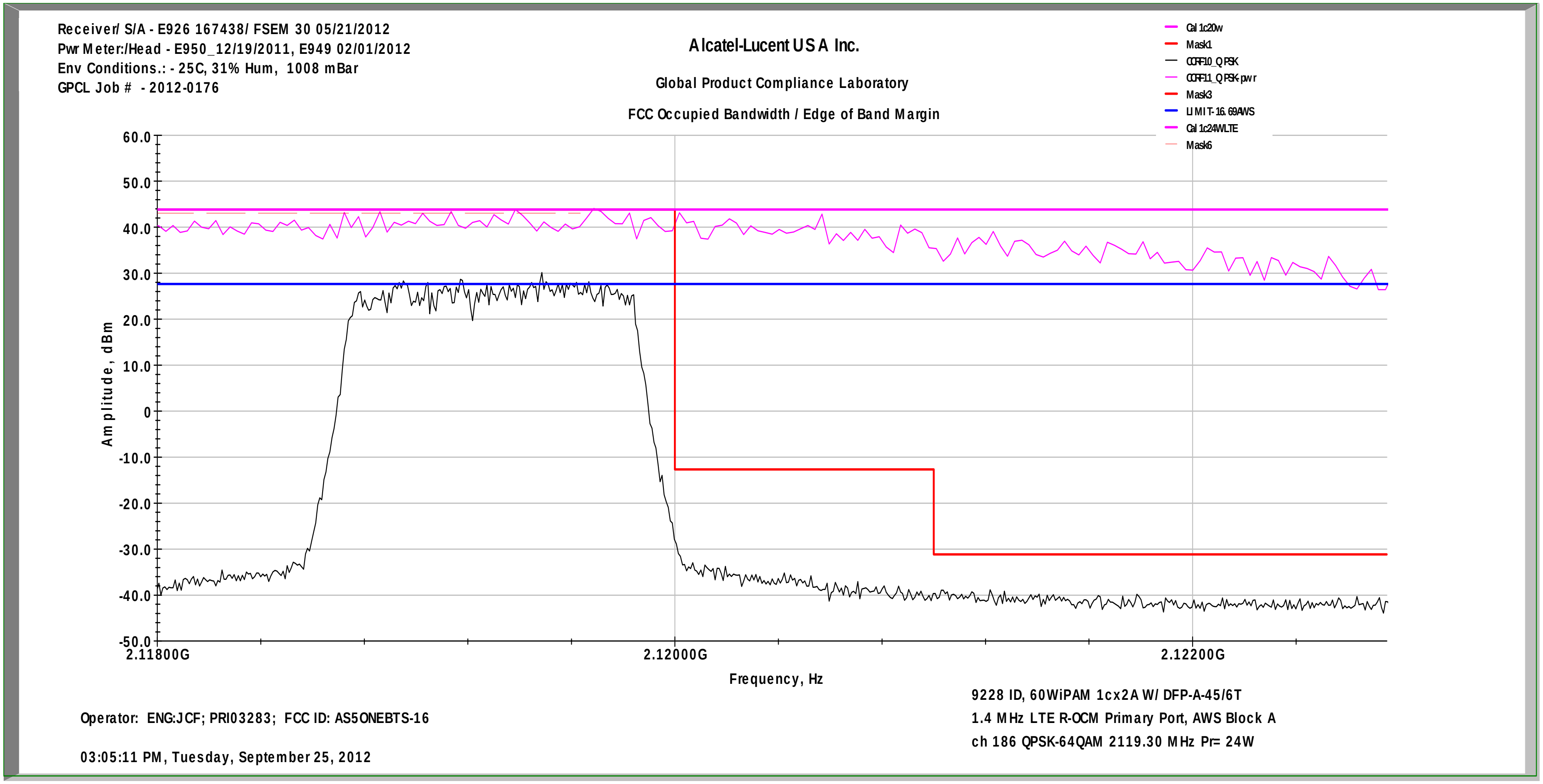
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch A-186 1cx2A 24W/c QPSK Primary Tx1



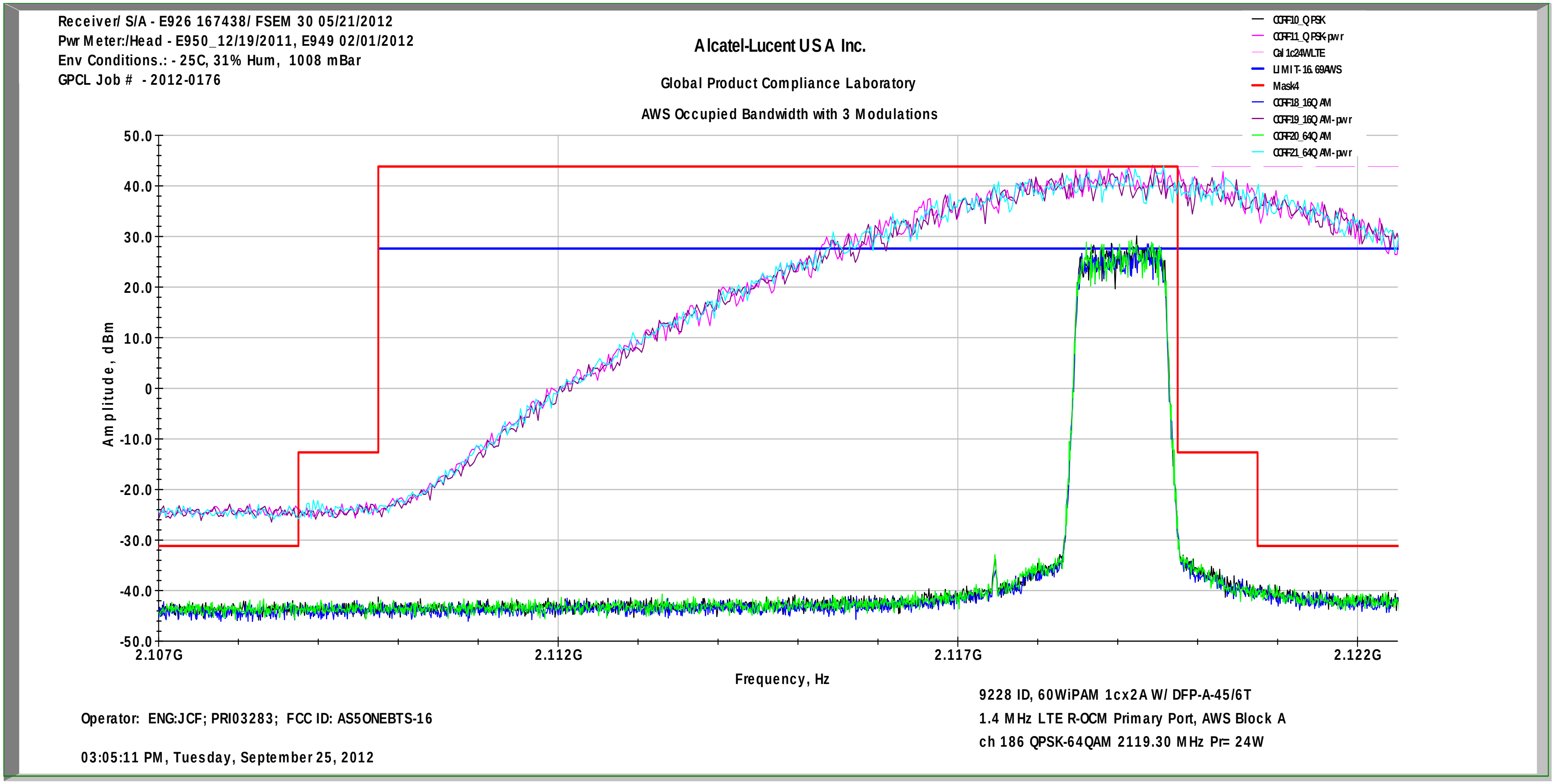
## In-Band Intermodulation Graph AWS 1.4 MHz Ch A-186 1cx2A 24W/c QPSK Primary Tx1



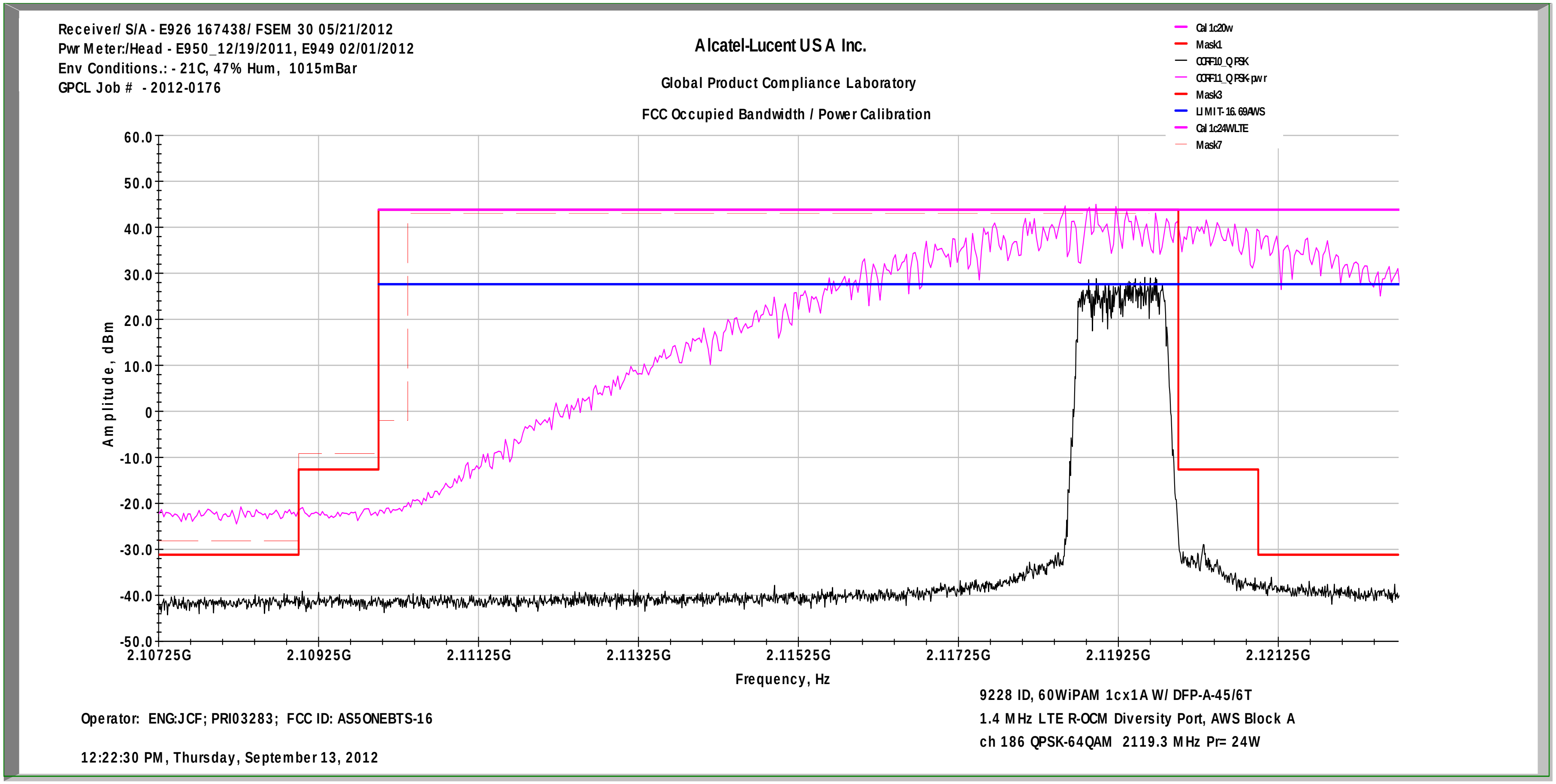
## FCC Edge of Block Margin AWS 1.4 MHz Ch A-186 1cx2A 24W/c QPSK Primary Tx1



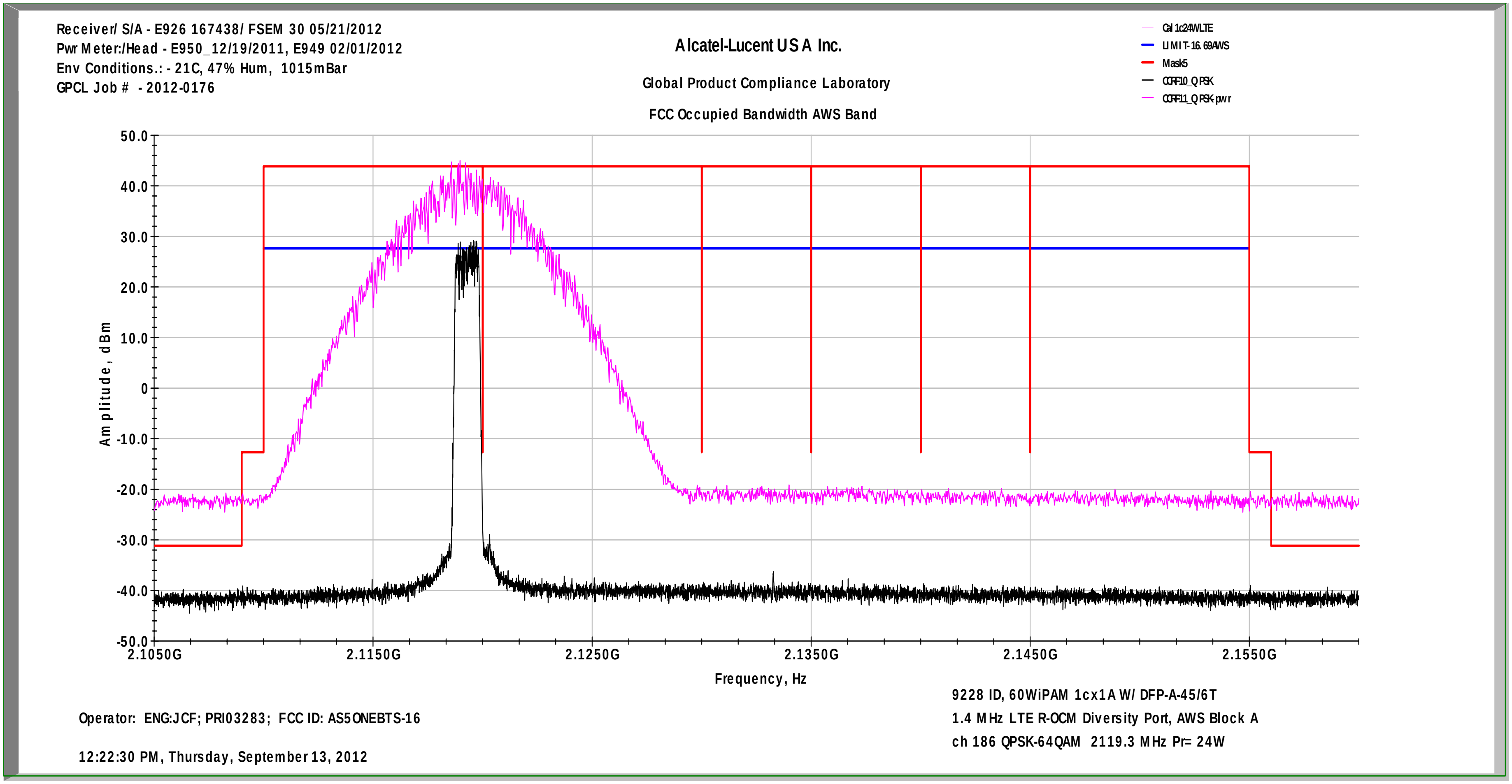
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch A-186 1cx2A 24W/c QPSK, 16QAM and 64QAM Primary Tx1



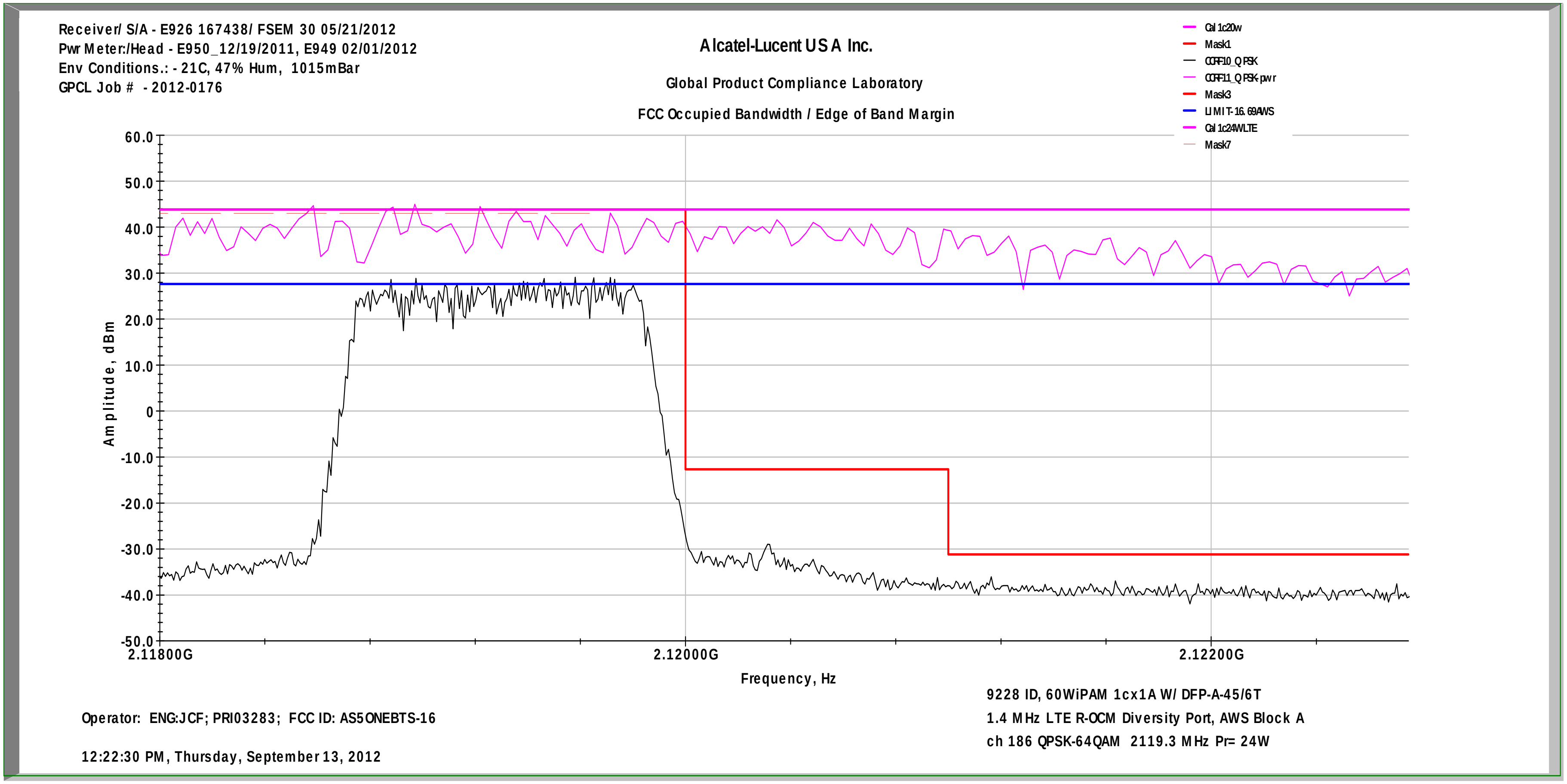
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch A-186 1cx1A 24W/c QPSK Diversity Tx2



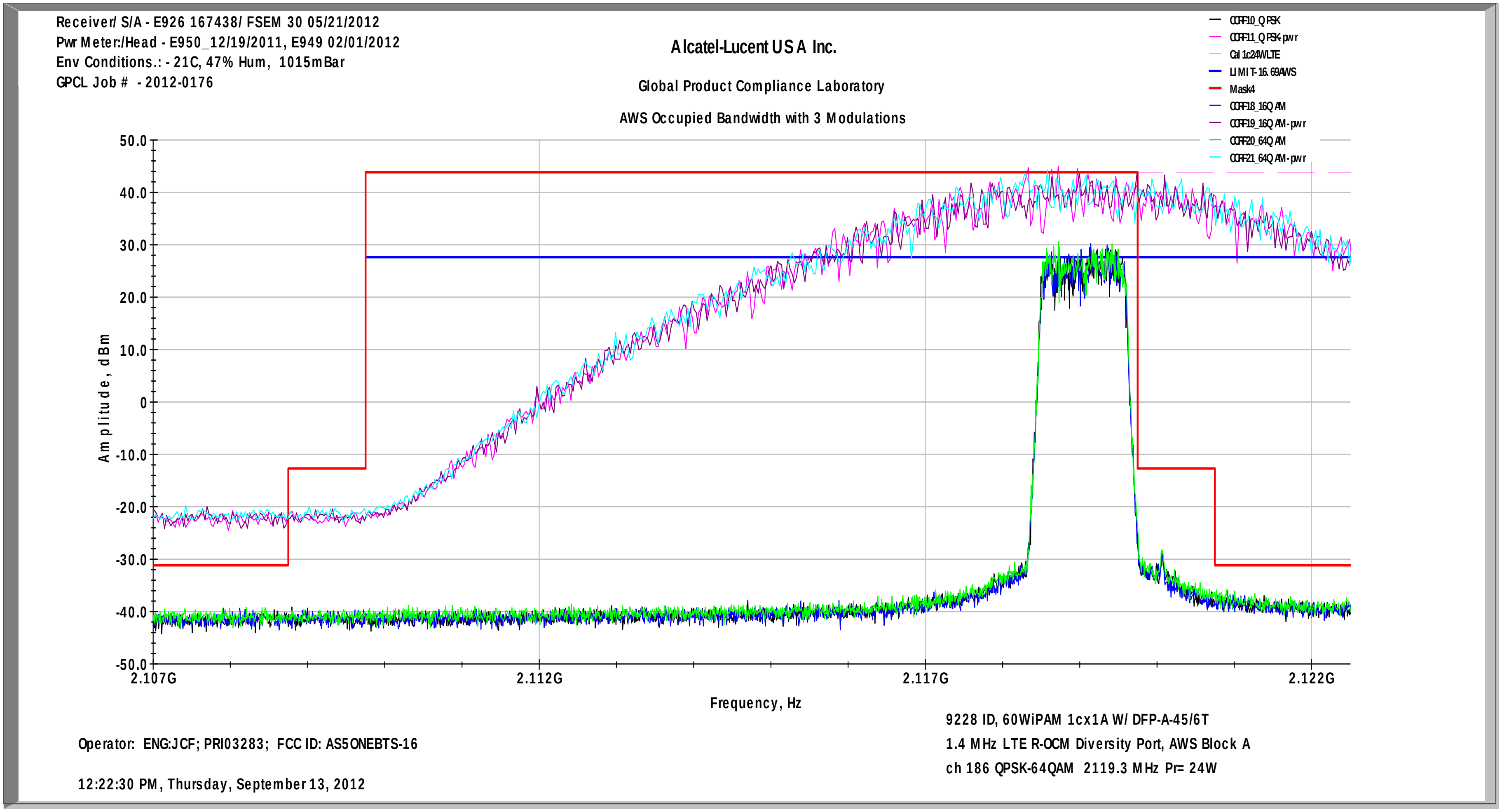
## In-Band Intermodulation Graph AWS 1.4 MHz Ch A-186 1cx1A 24W/c QPSK Diversity Tx2



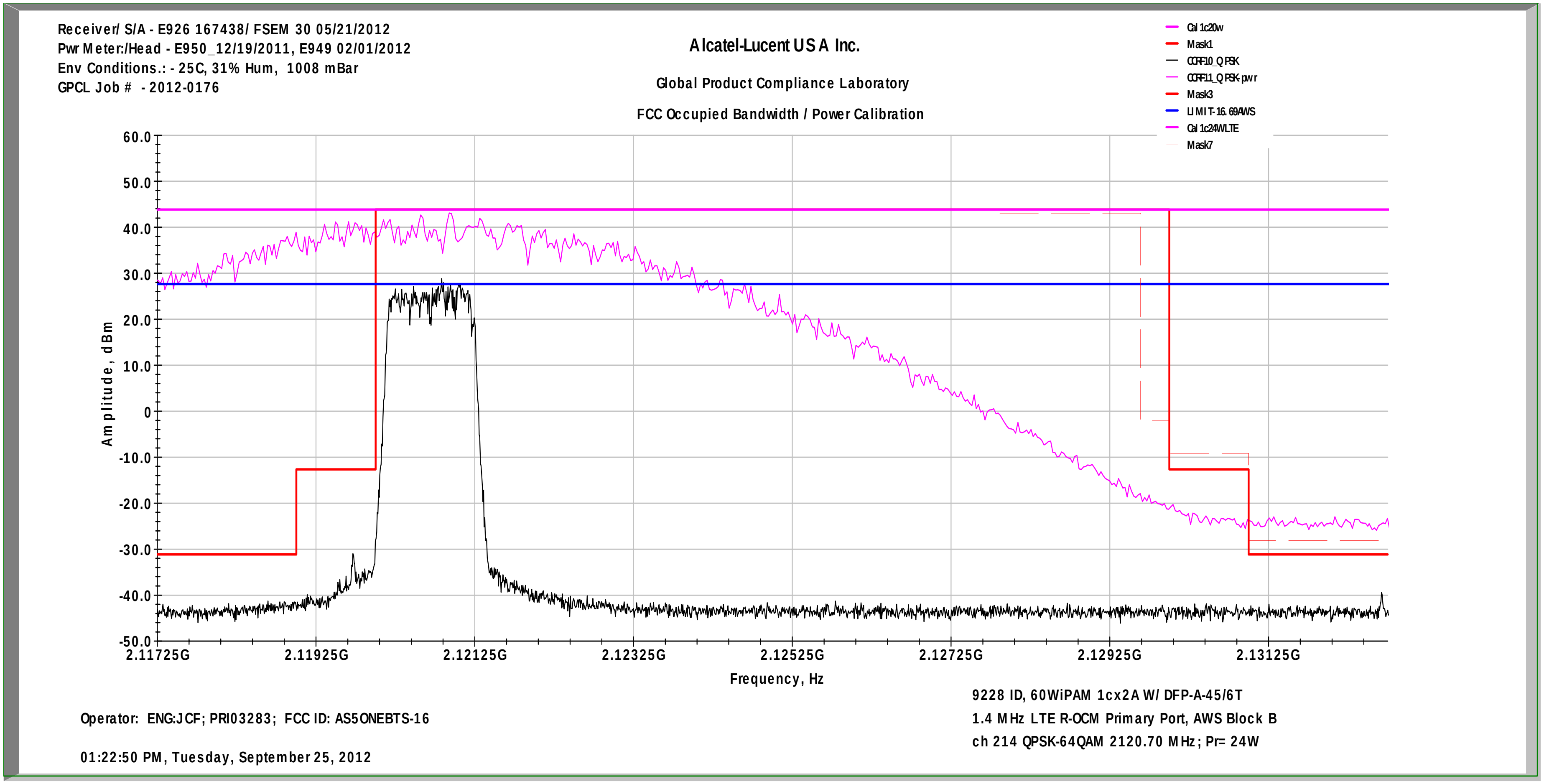
## FCC Edge of Block Margin AWS 1.4 MHz Ch A-186 1cx1A 24W/c QPSK Diversity Tx2



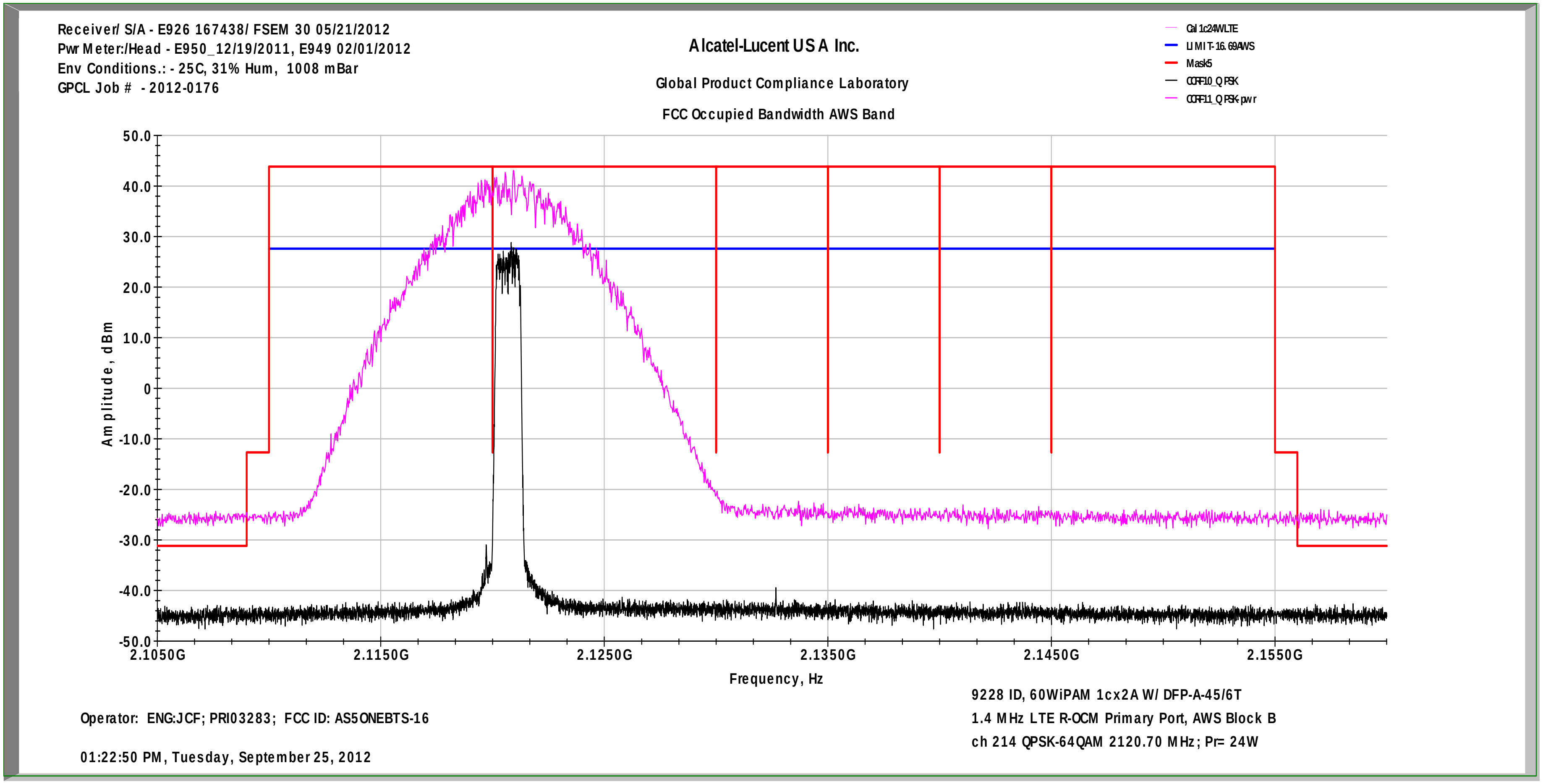
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch A-186 1cx1A 24W/c QPSK, 16QAM and 64QAM Diversity Tx2



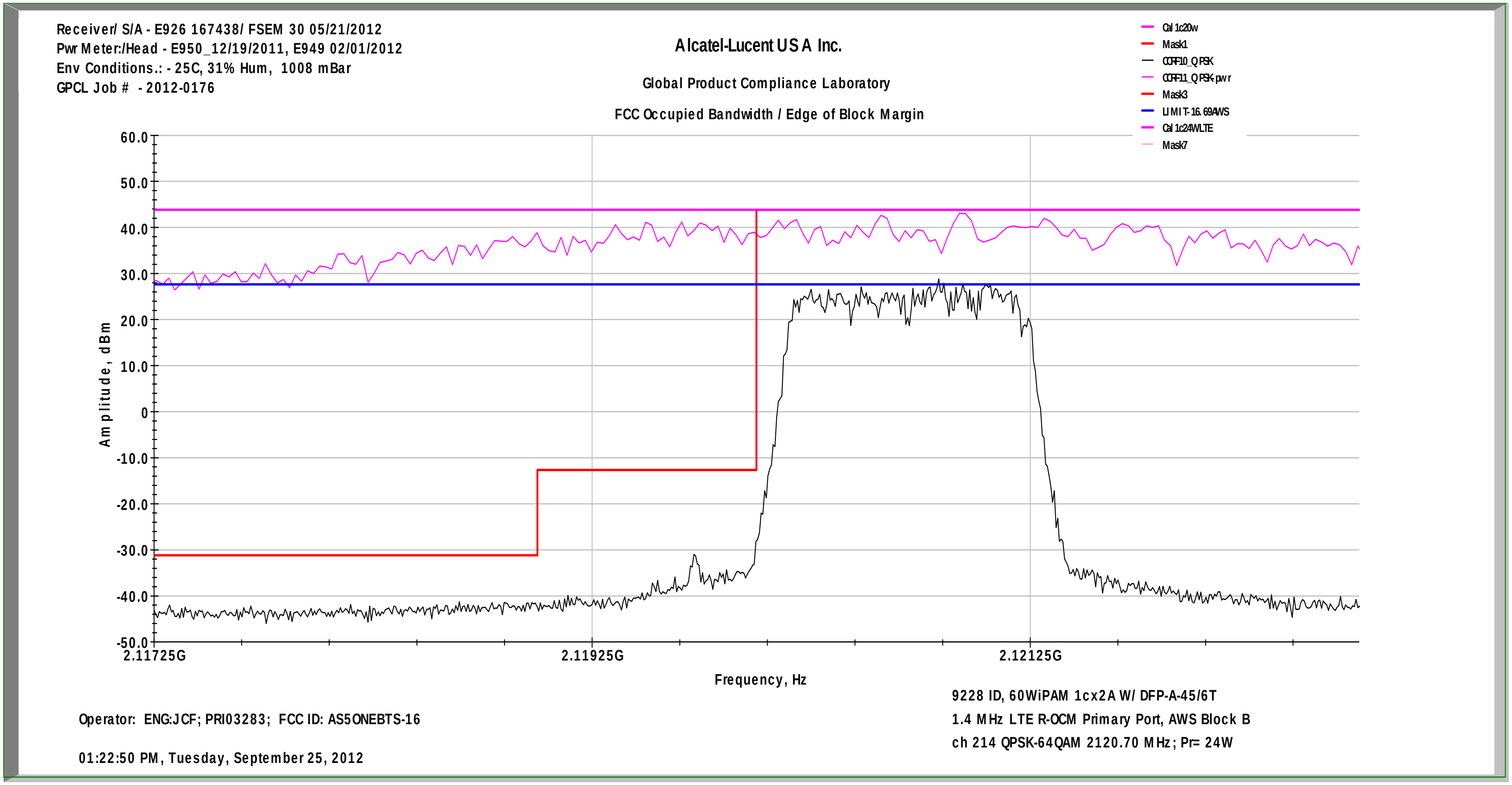
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch B-214 1cx2A 24W/c QPSK Primary Tx1



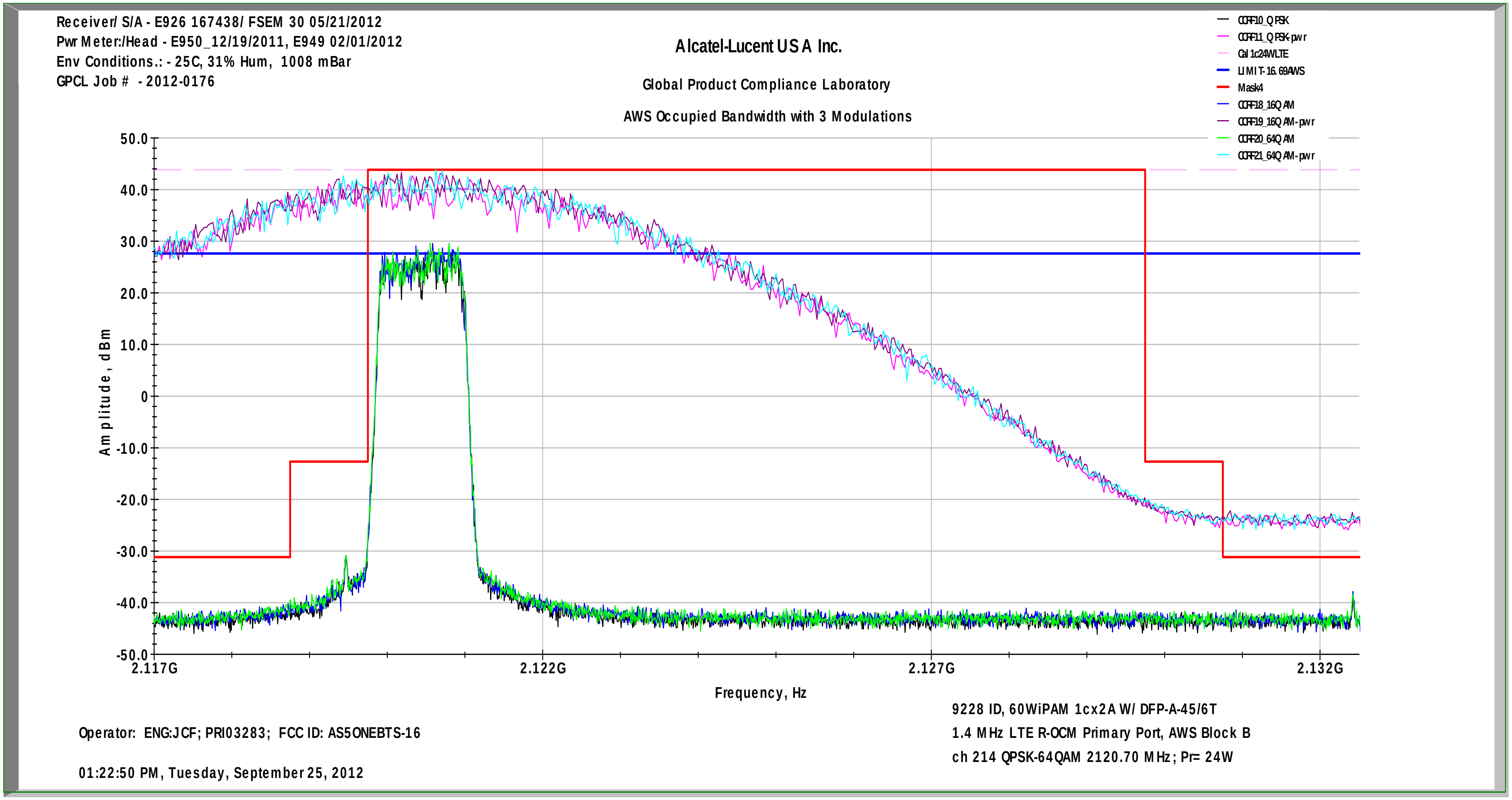
## In-Band Intermodulation Graph AWS 1.4 MHz Ch B-214 1cx2A 24W/c QPSK Primary Tx1



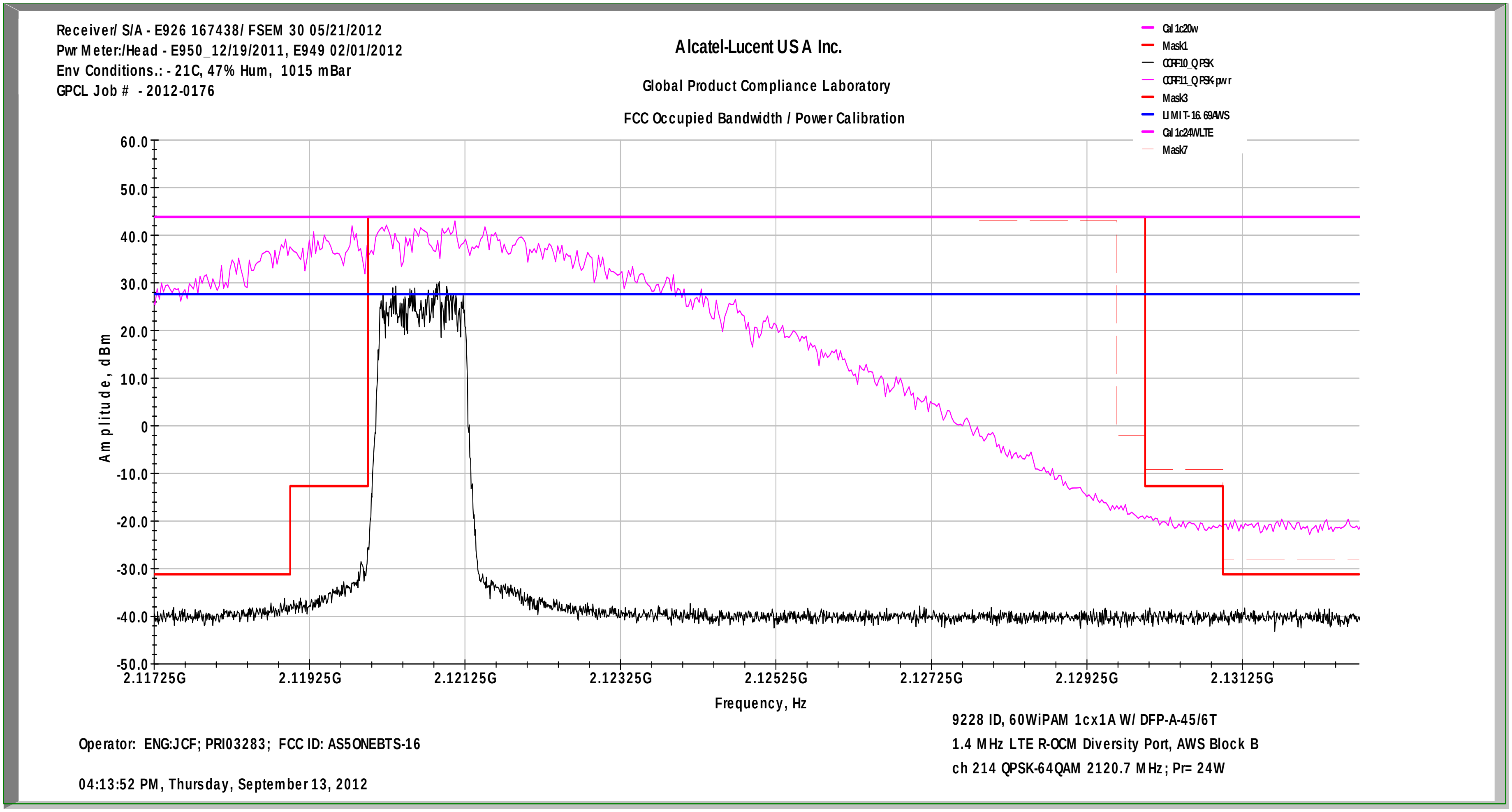
## FCC Edge of Block Margin AWS 1.4 MHz Ch B-214 1cx2A 24W/c QPSK Primary Tx1



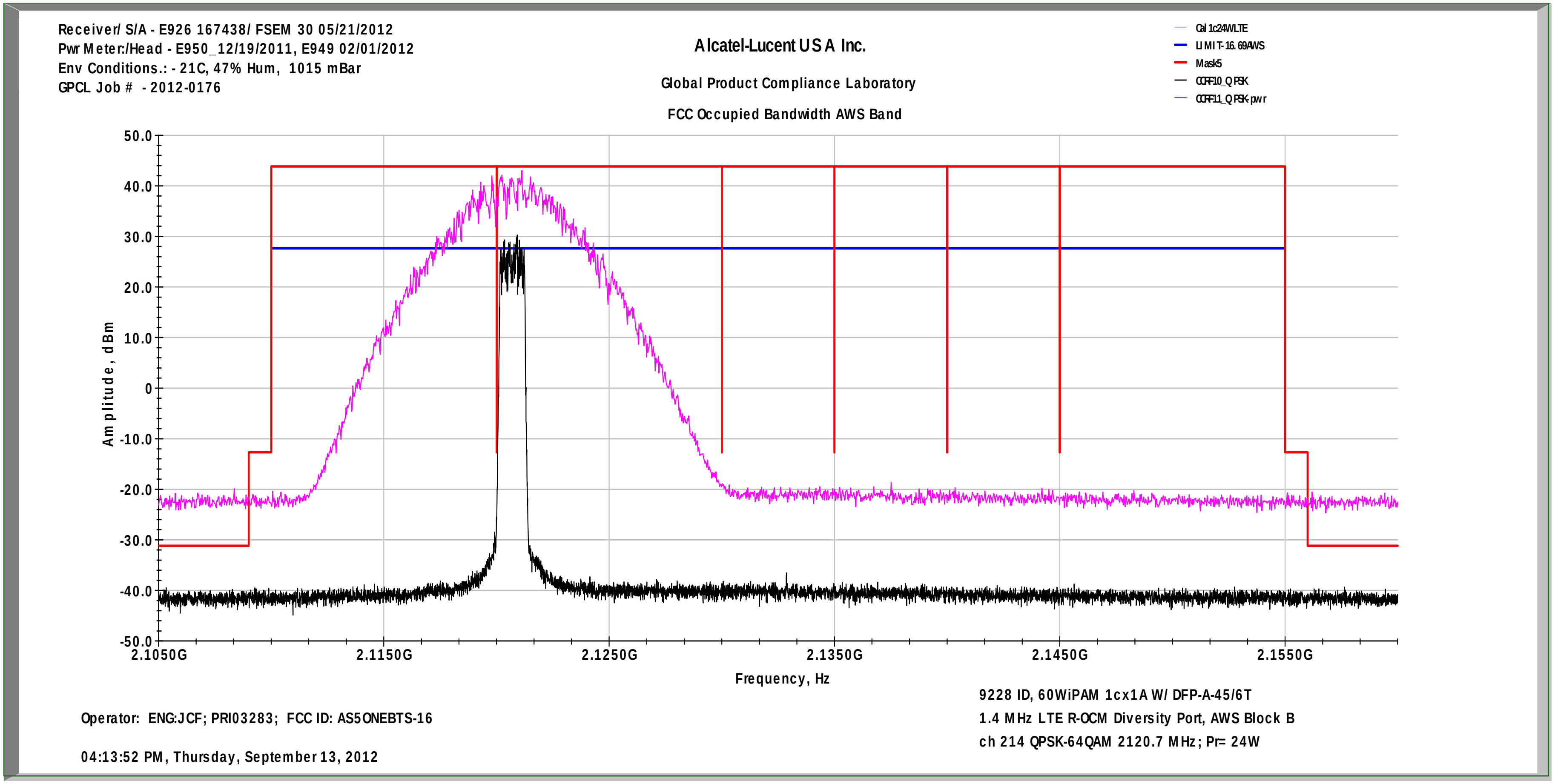
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch B-214 1cx2A 24W/c QPSK, 16QAM and 64QAM Primary Tx1



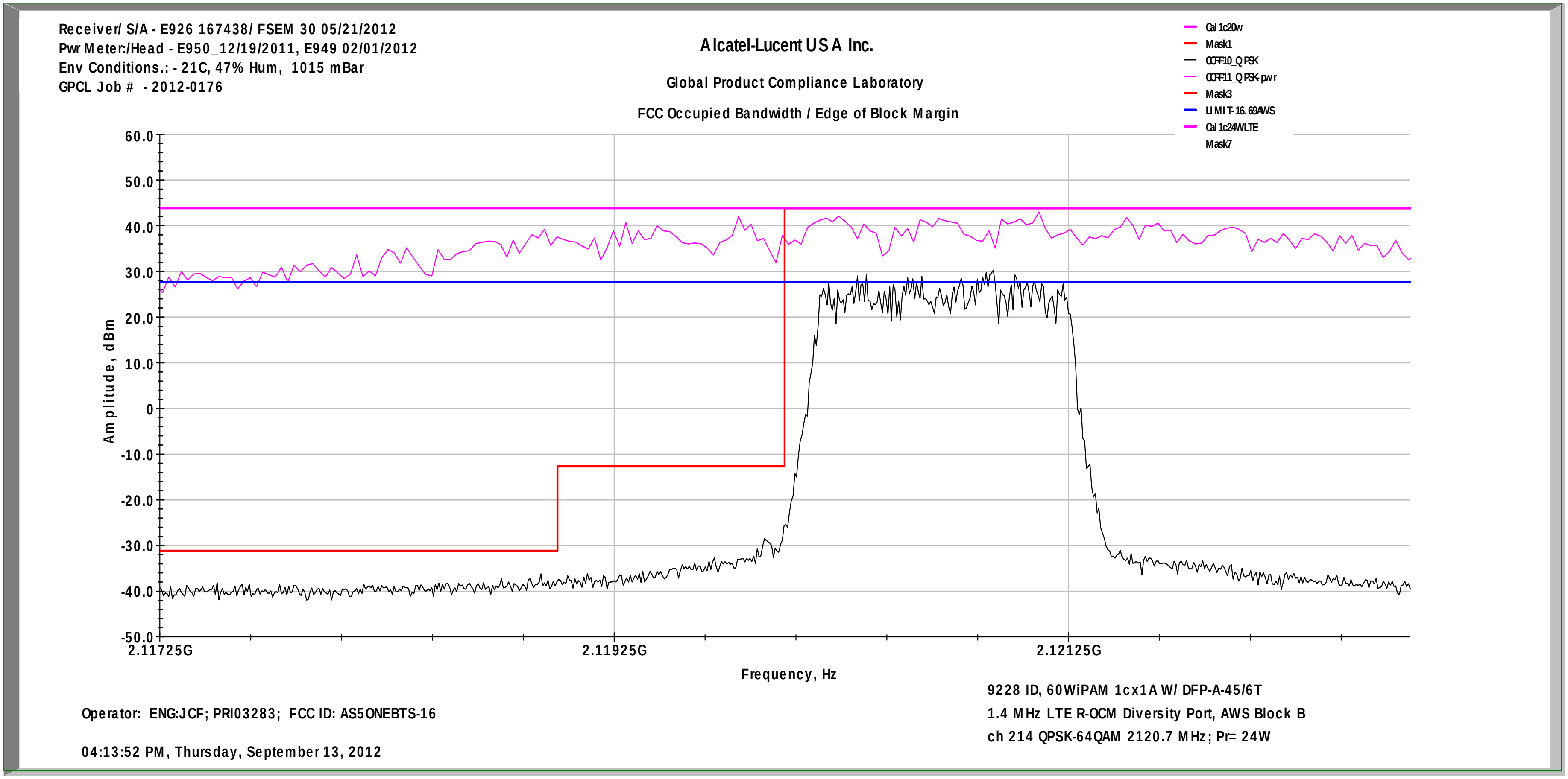
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch B-214 1cx1A 24W/c QPSK Diversity Tx2



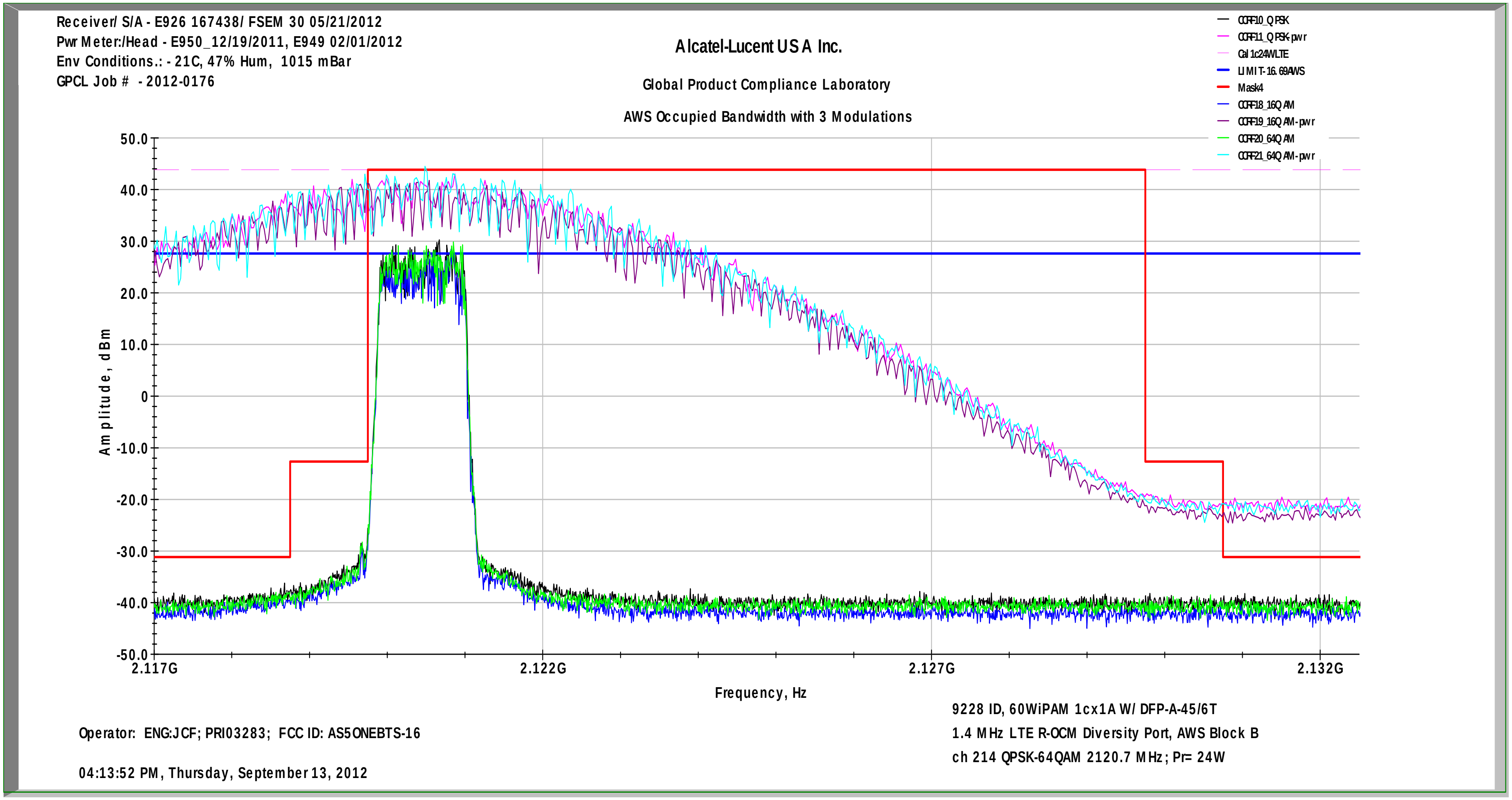
## In-Band Intermodulation Graph AWS 1.4 MHz Ch B-214 1cx1A 24W/c QPSK Diversity Tx2



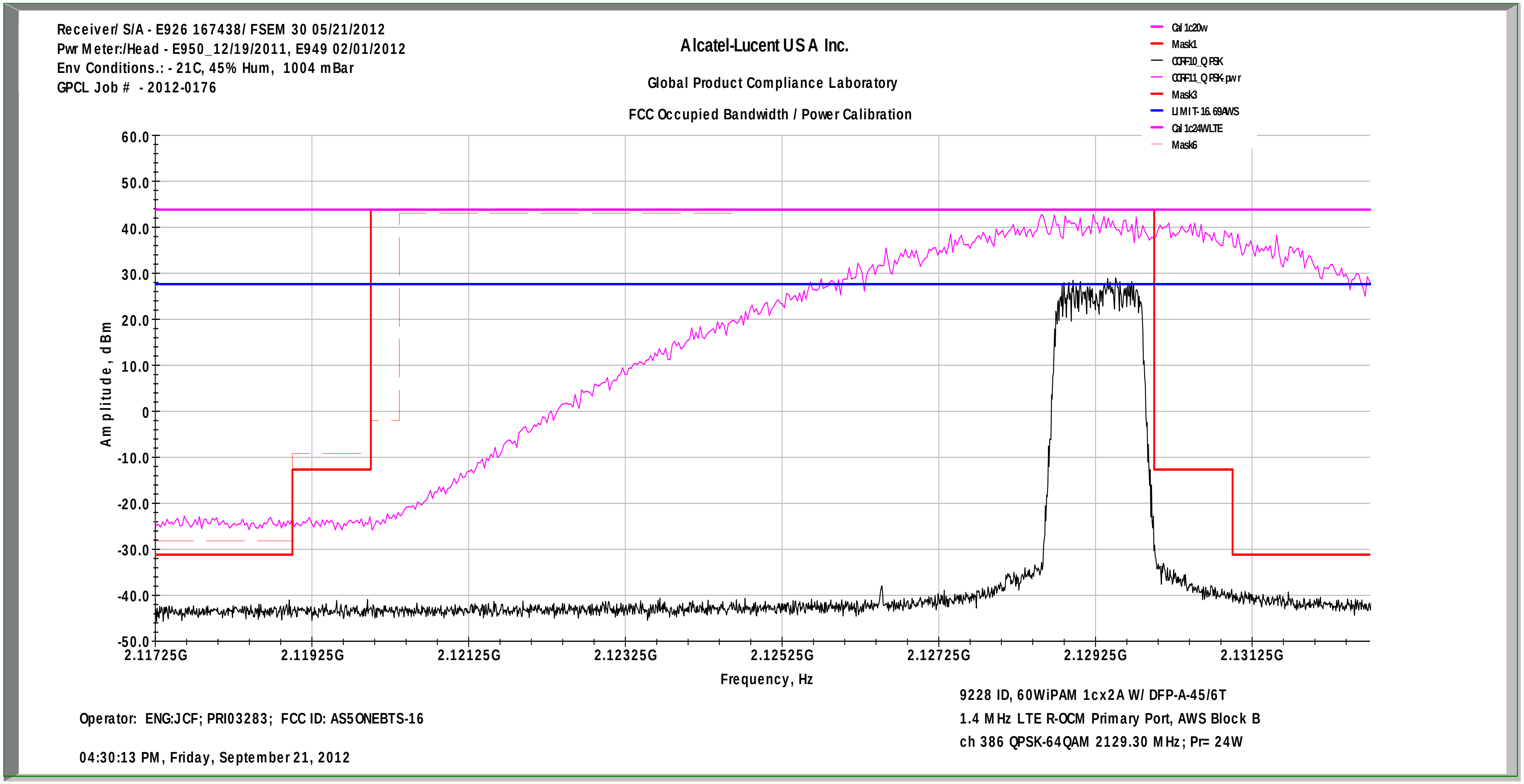
## FCC Edge of Block Margin AWS 1.4 MHz Ch B-214 1cx1A 24W/c QPSK Diversity Tx2



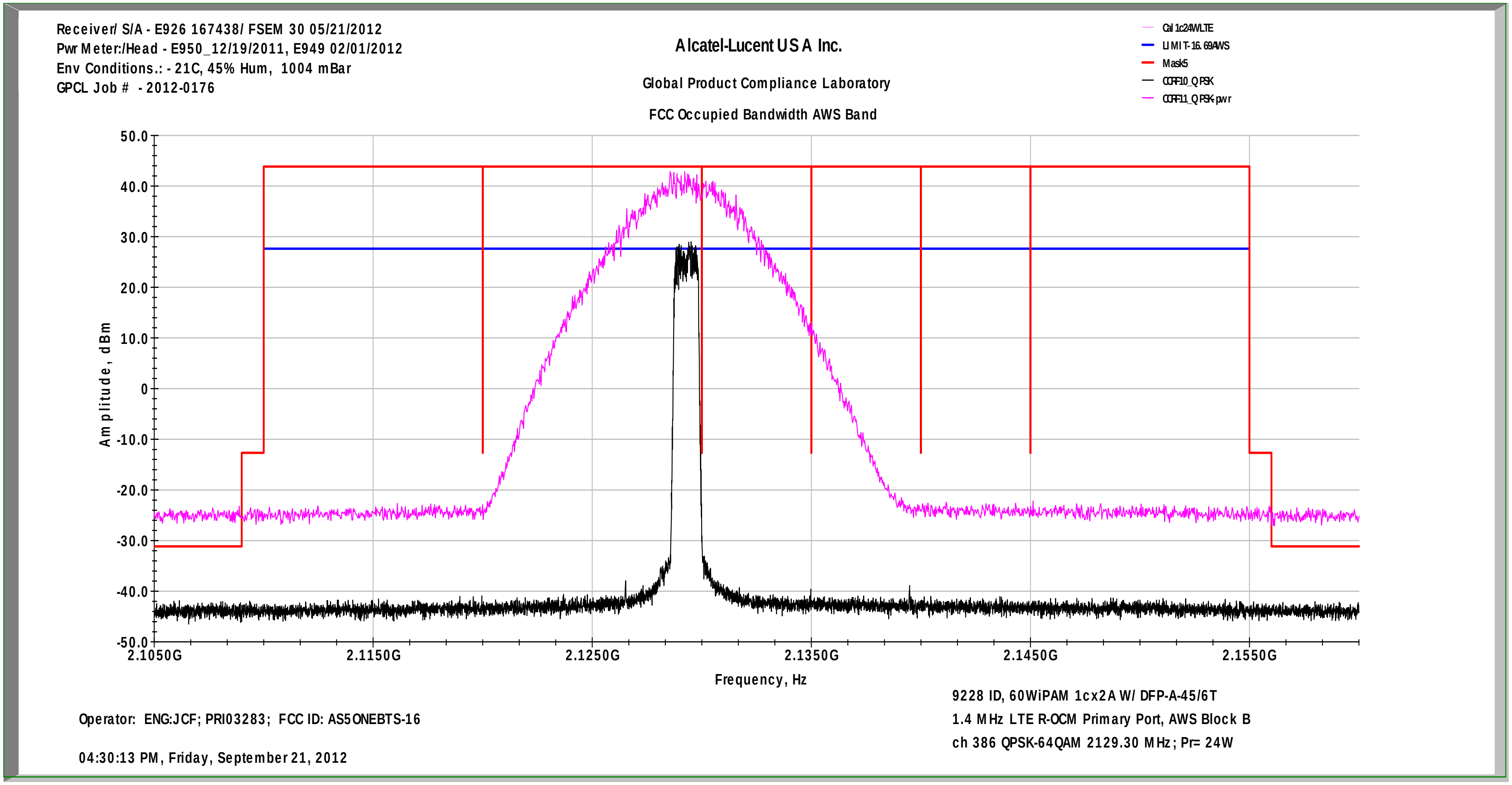
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch B-214 1cx1A 24W/c QPSK, 16QAM and 64QAM Diversity Tx2



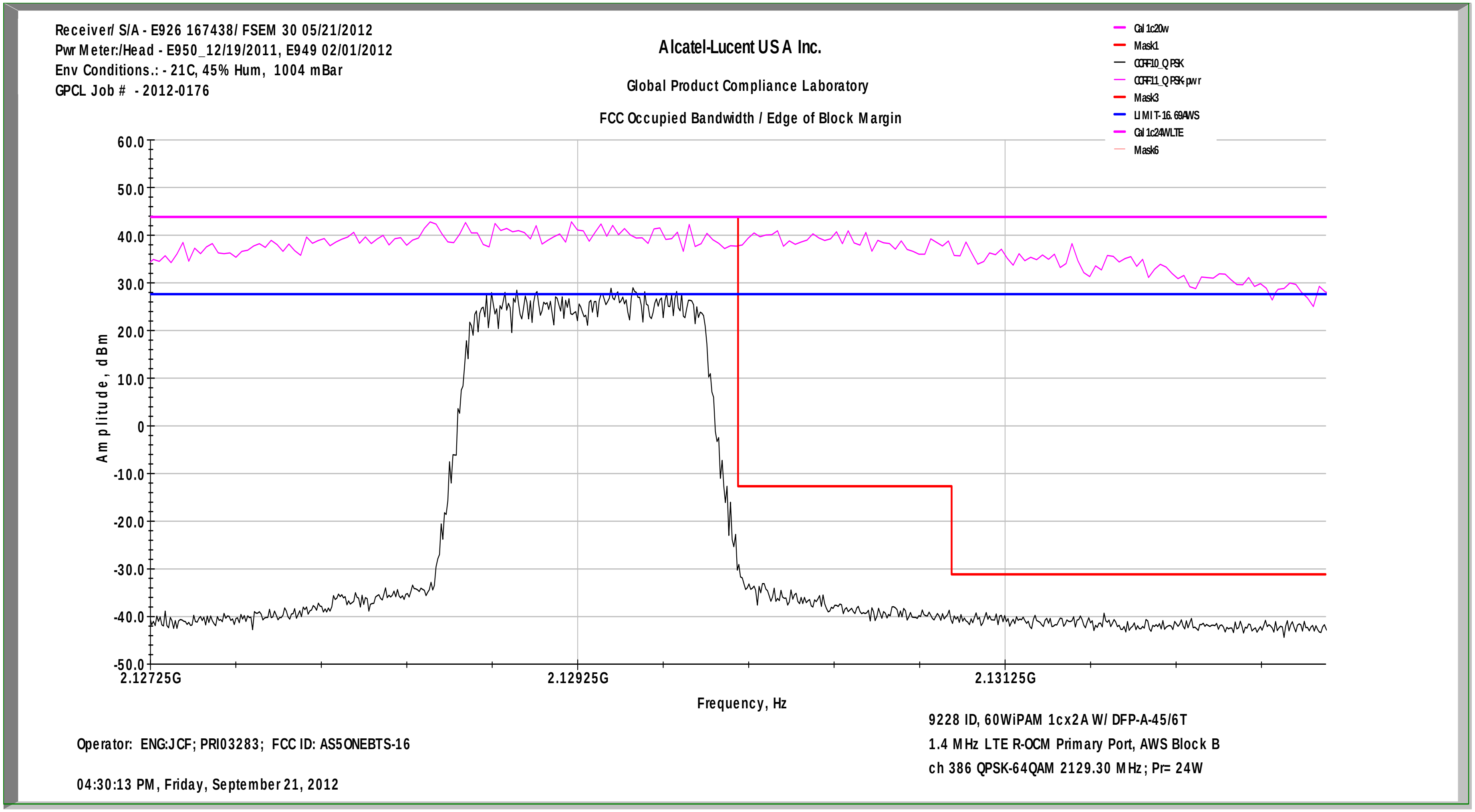
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch B-386 1cx2A 24W/c QPSK Primary Tx1



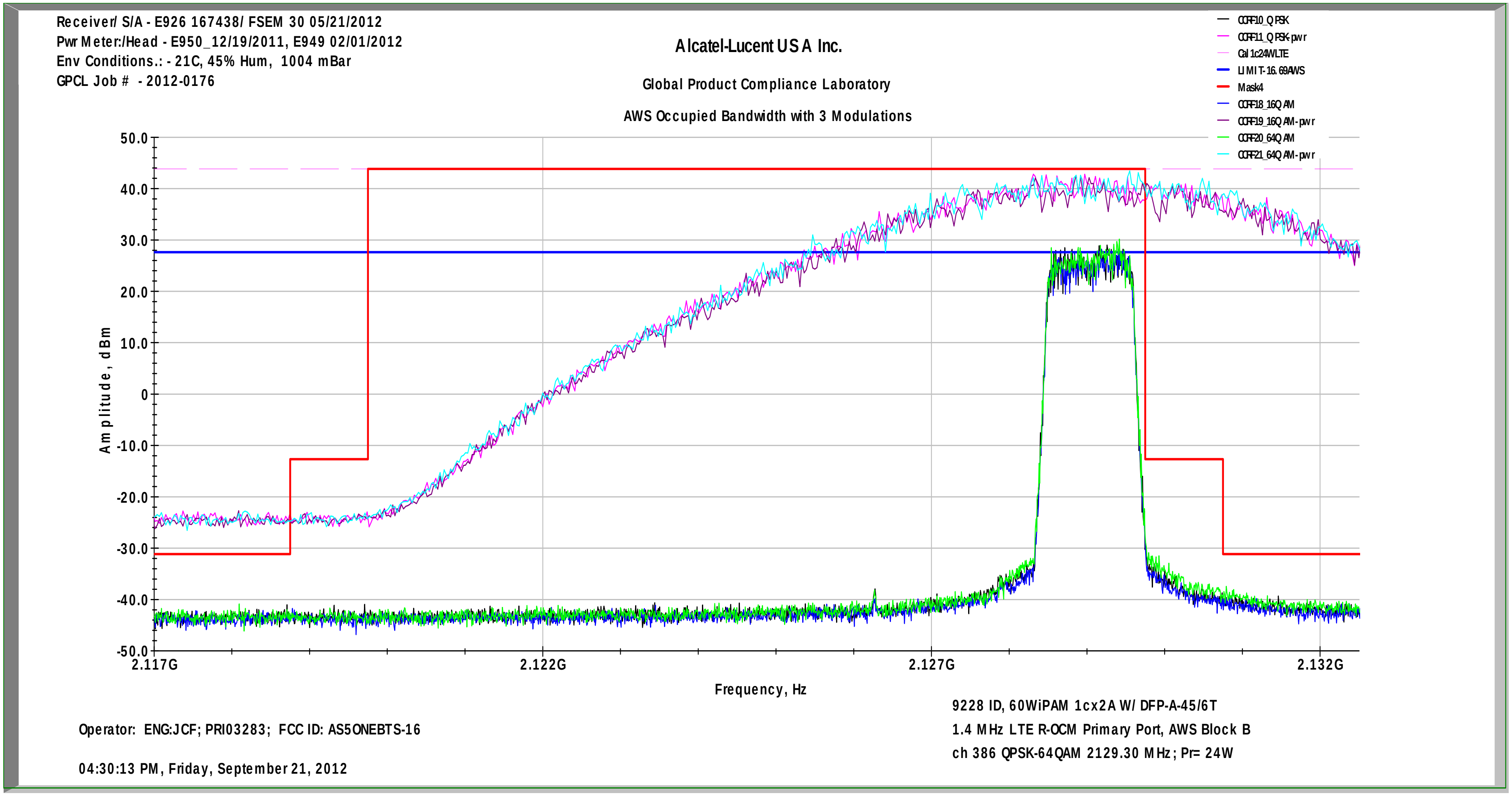
## In-Band Intermodulation Graph AWS 1.4 MHz Ch B-386 1cx2A 24W/c QPSK Primary Tx1



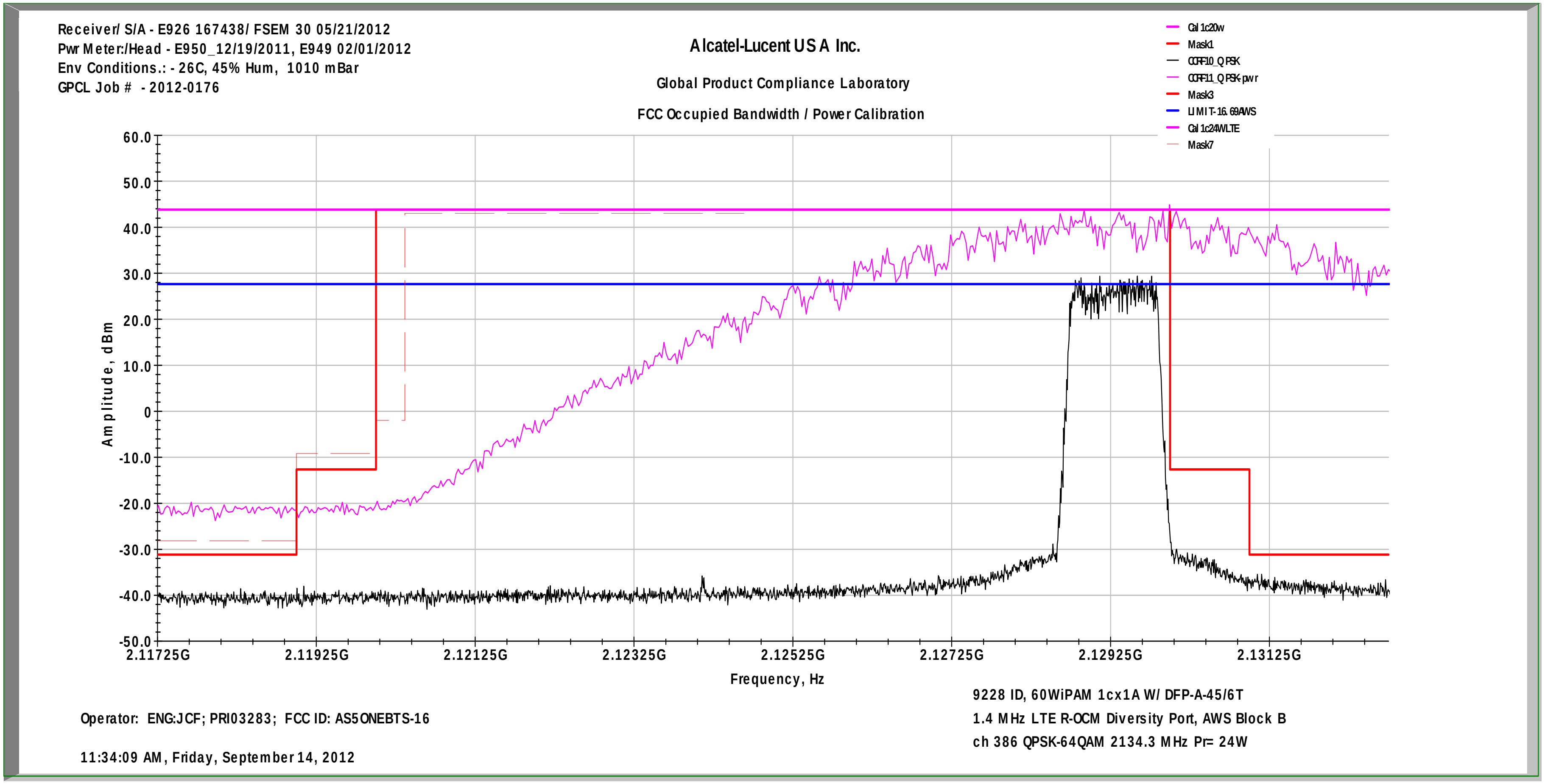
## FCC Edge of Block Margin AWS 1.4 MHz Ch B-386 1cx2A 24W/c QPSK Primary Tx1



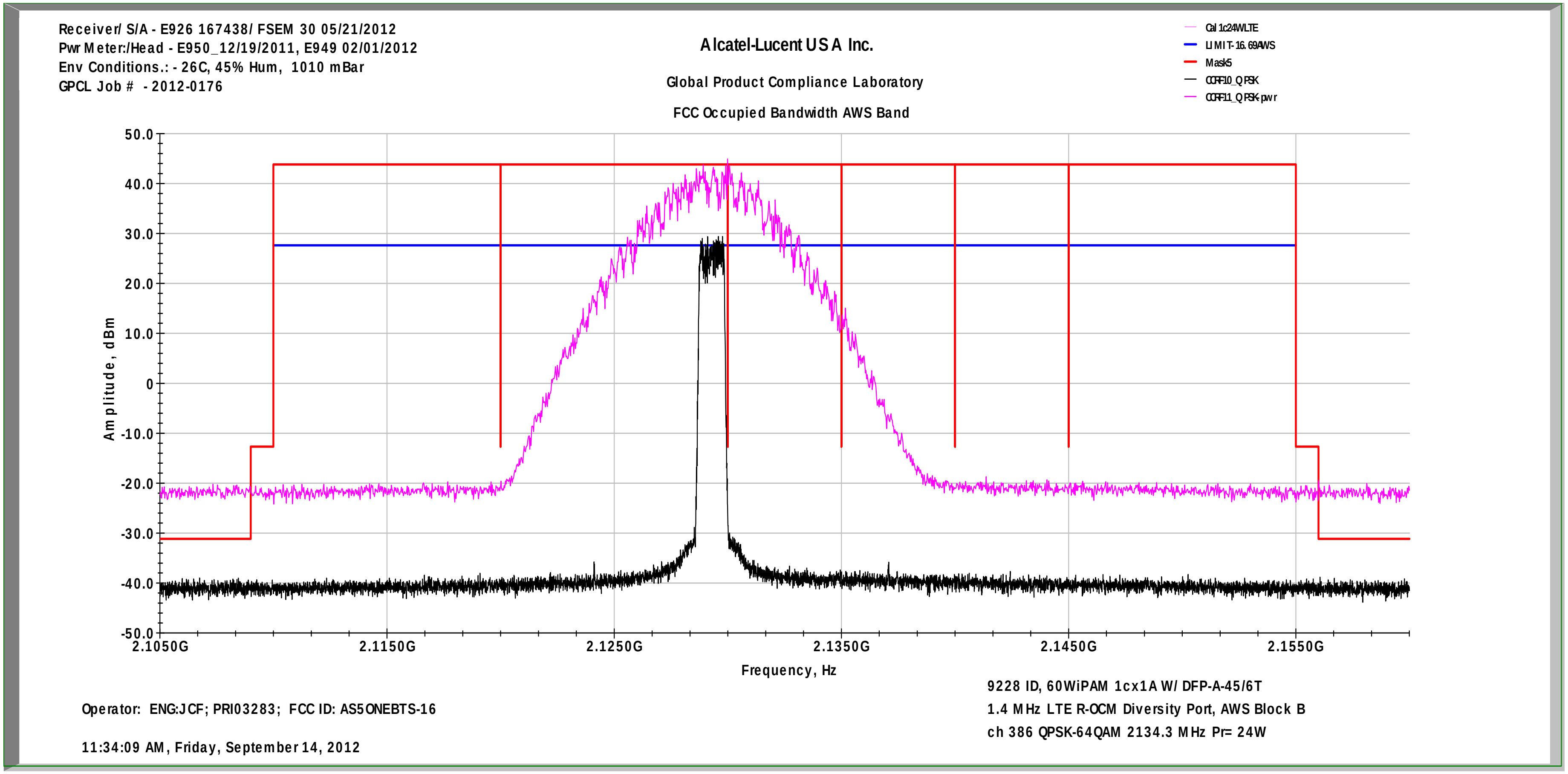
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch B-386 1cx2A 24W/c QPSK, 16QAM and 64QAM Primary Tx1



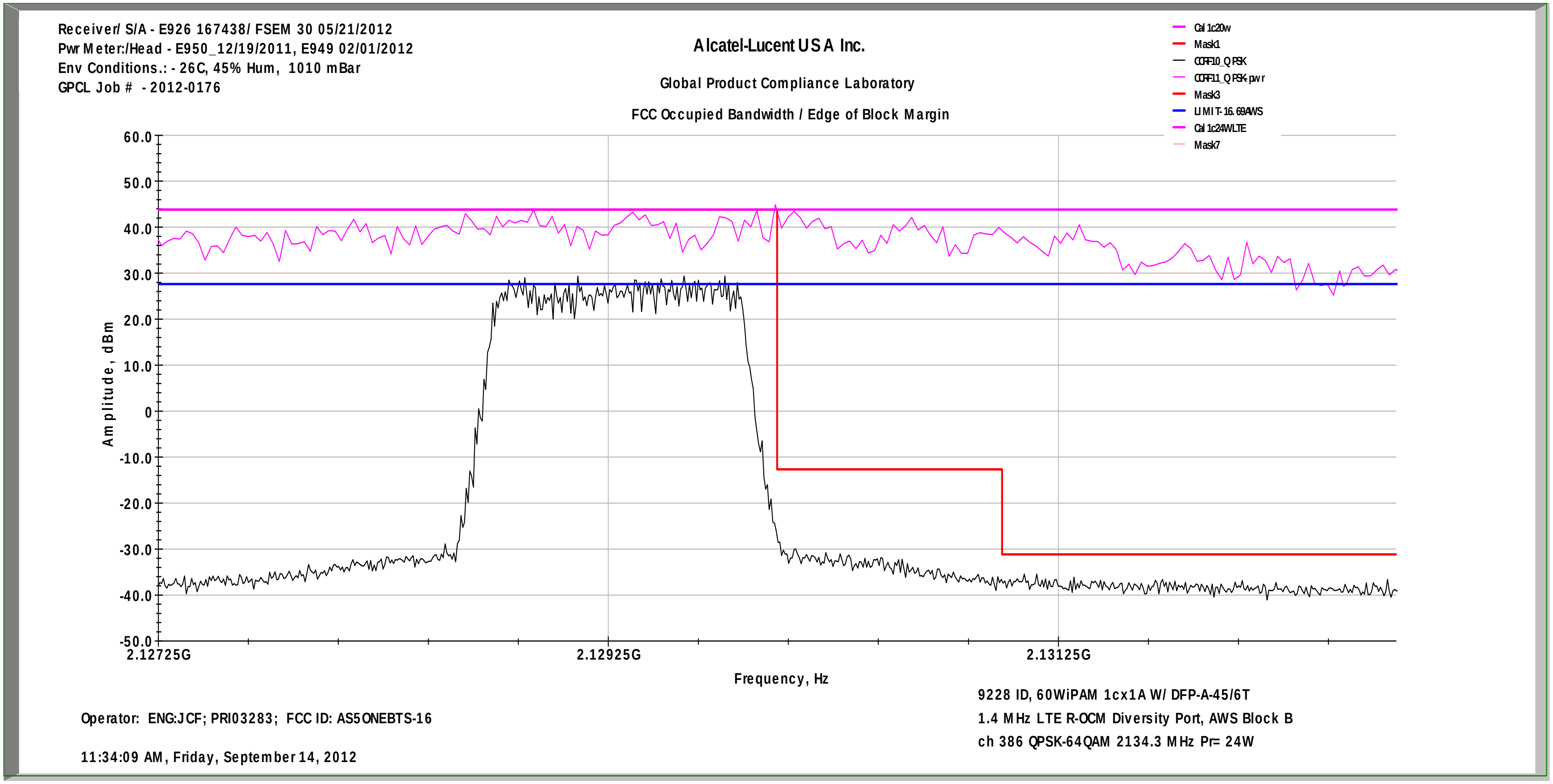
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch B-386 1cx1A 24W/c QPSK Diversity Tx2



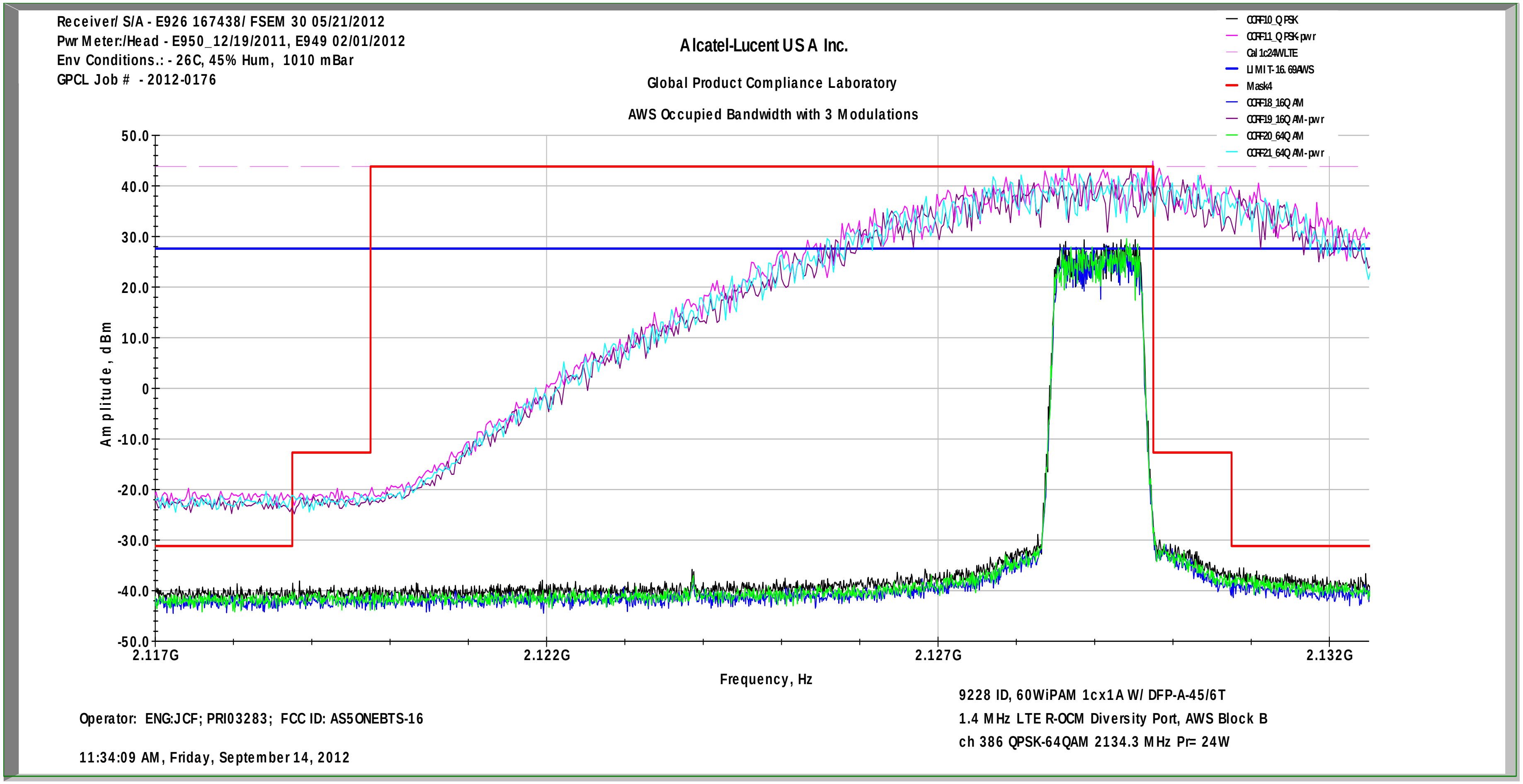
## In-Band Intermodulation Graph AWS 1.4 MHz Ch B-386 1cx1A 24W/c QPSK Diversity Tx2



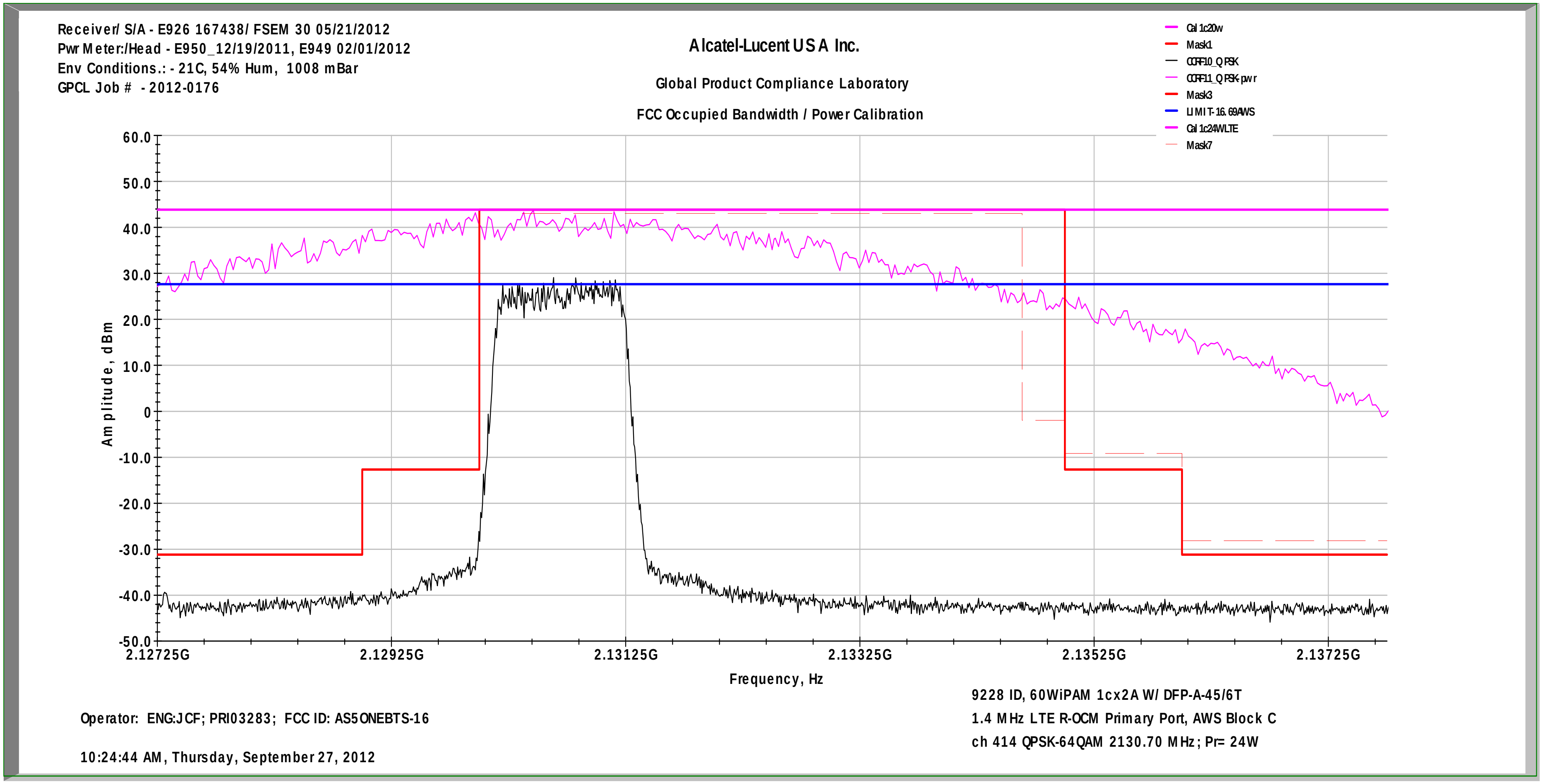
## FCC Edge of Block Margin AWS 1.4 MHz Ch B-386 1cx1A 24W/c QPSK Diversity Tx2



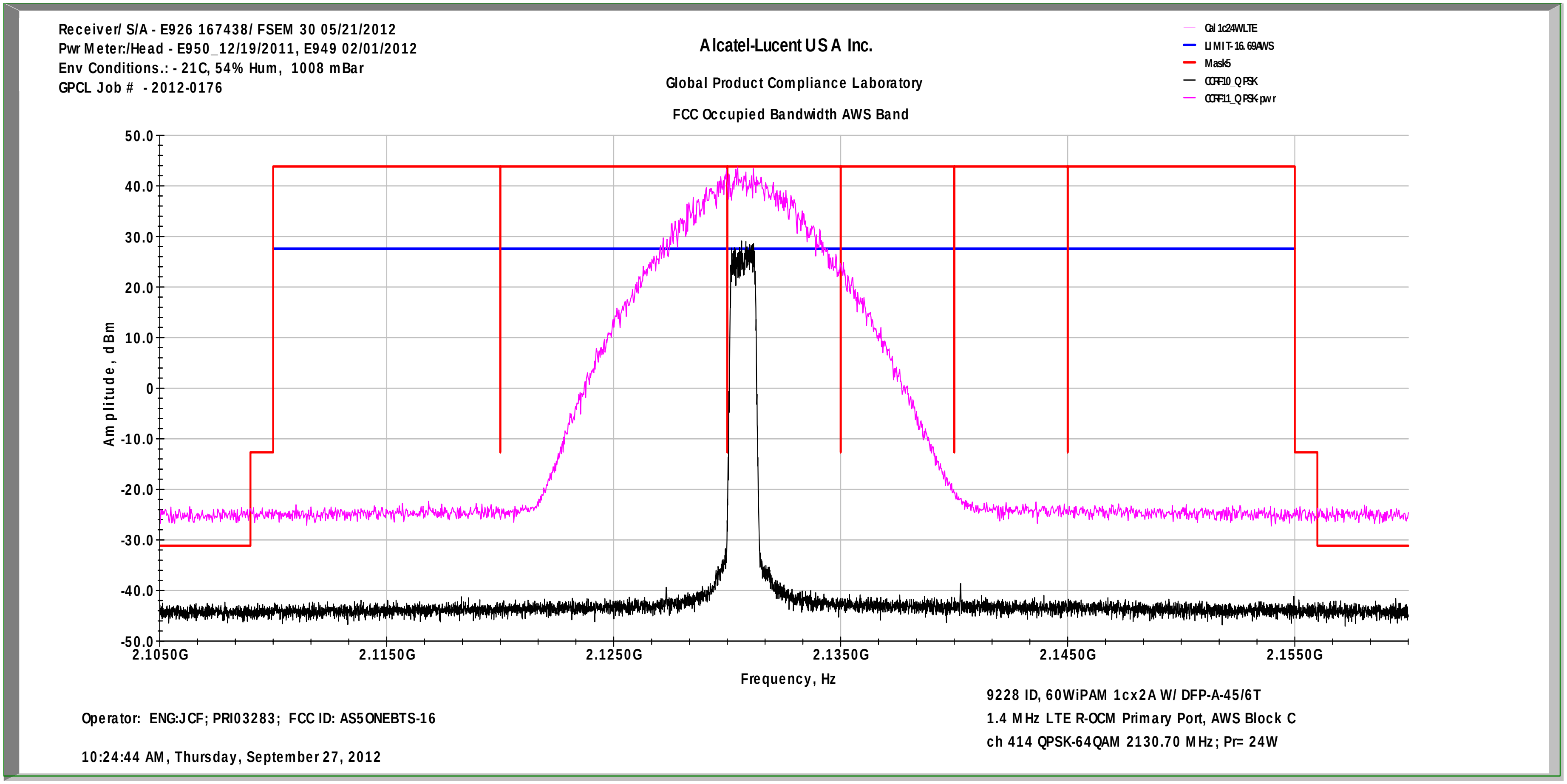
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch B-386 1cx1A 24W/c QPSK, 16QAM and 64QAM Diversity Tx2



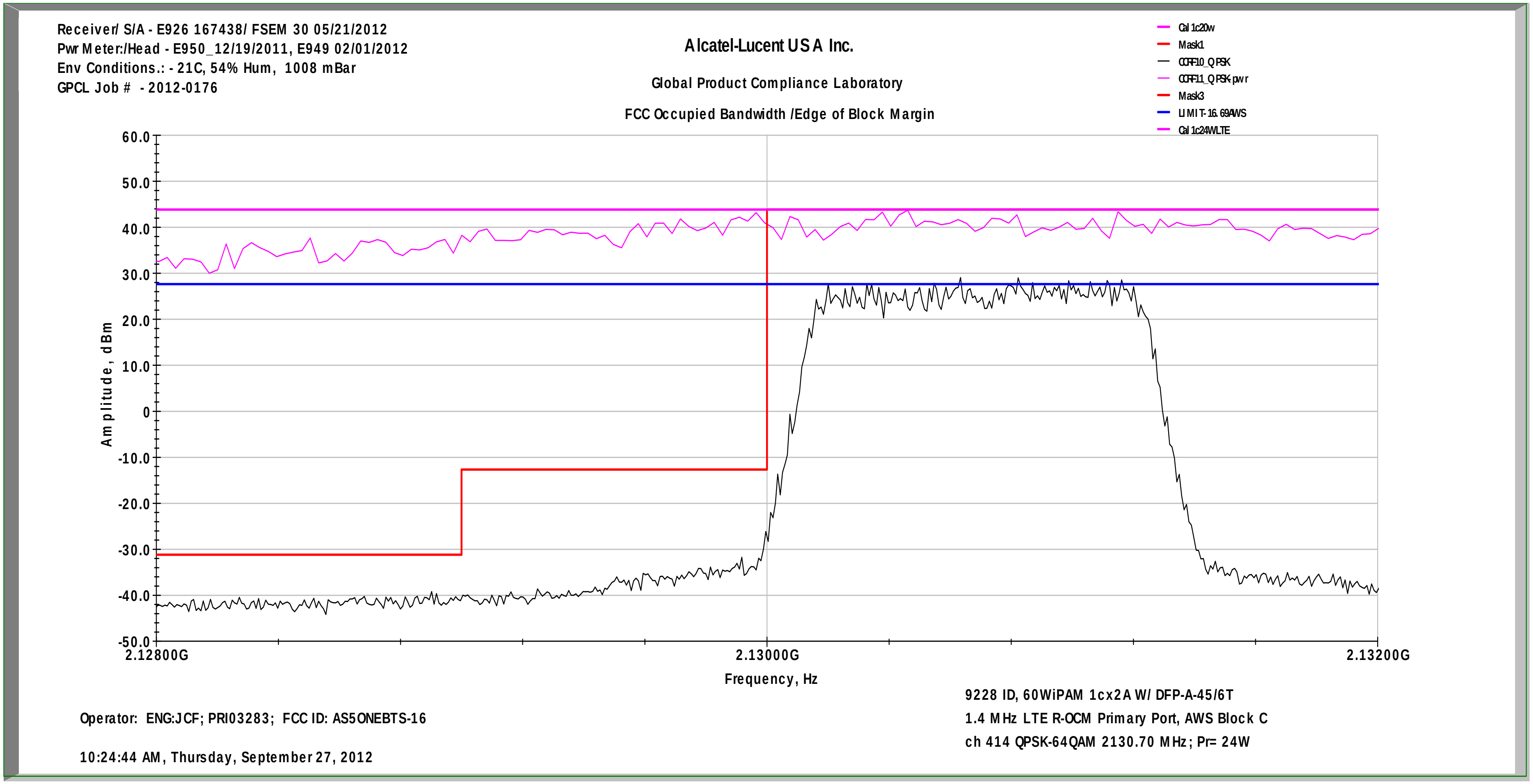
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch C-414 1cx2A 24.9W/c QPSK PrimaryTx1



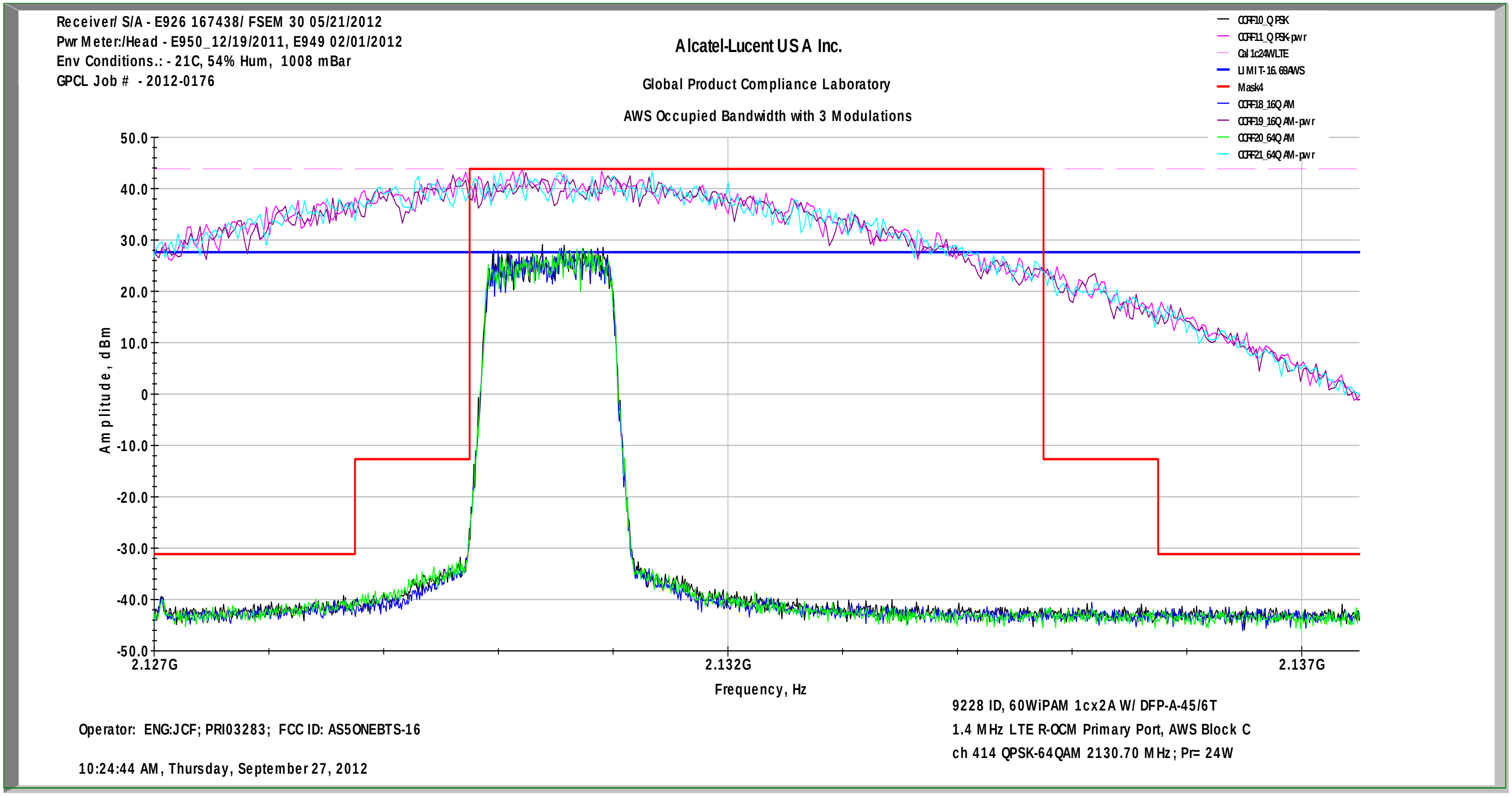
## In-Band Intermodulation Graph AWS 1.4 MHz Ch C-414 1cx2A 24.9W/c QPSK PrimaryTx1



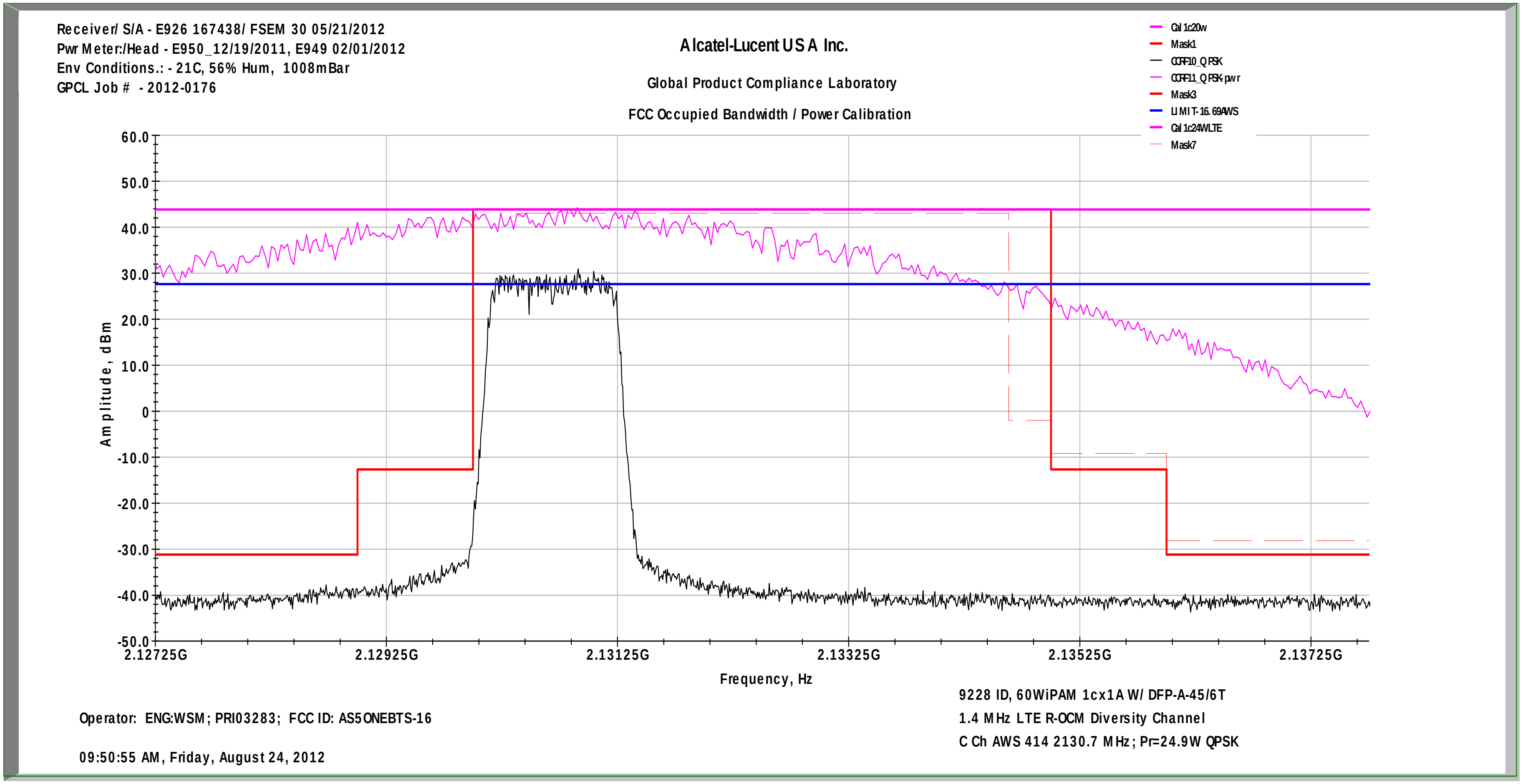
## FCC Edge of Block Margin AWS 1.4 MHz Ch C-414 1cx2A 24.2W/c QPSK PrimaryTx1



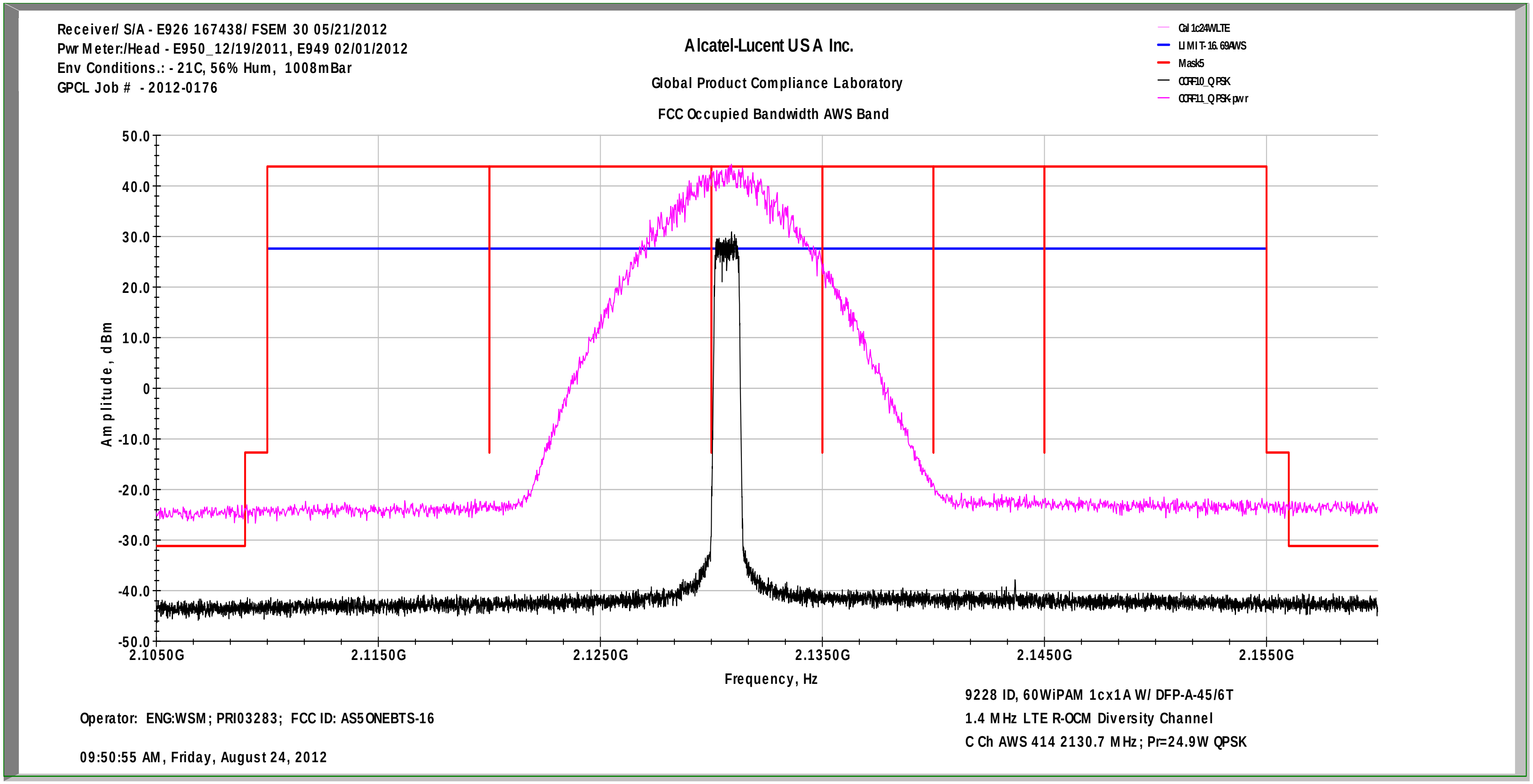
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch C-414 1cx2A 24.2W/c QPSK, 16QAM and 64QAM PrimaryTx1



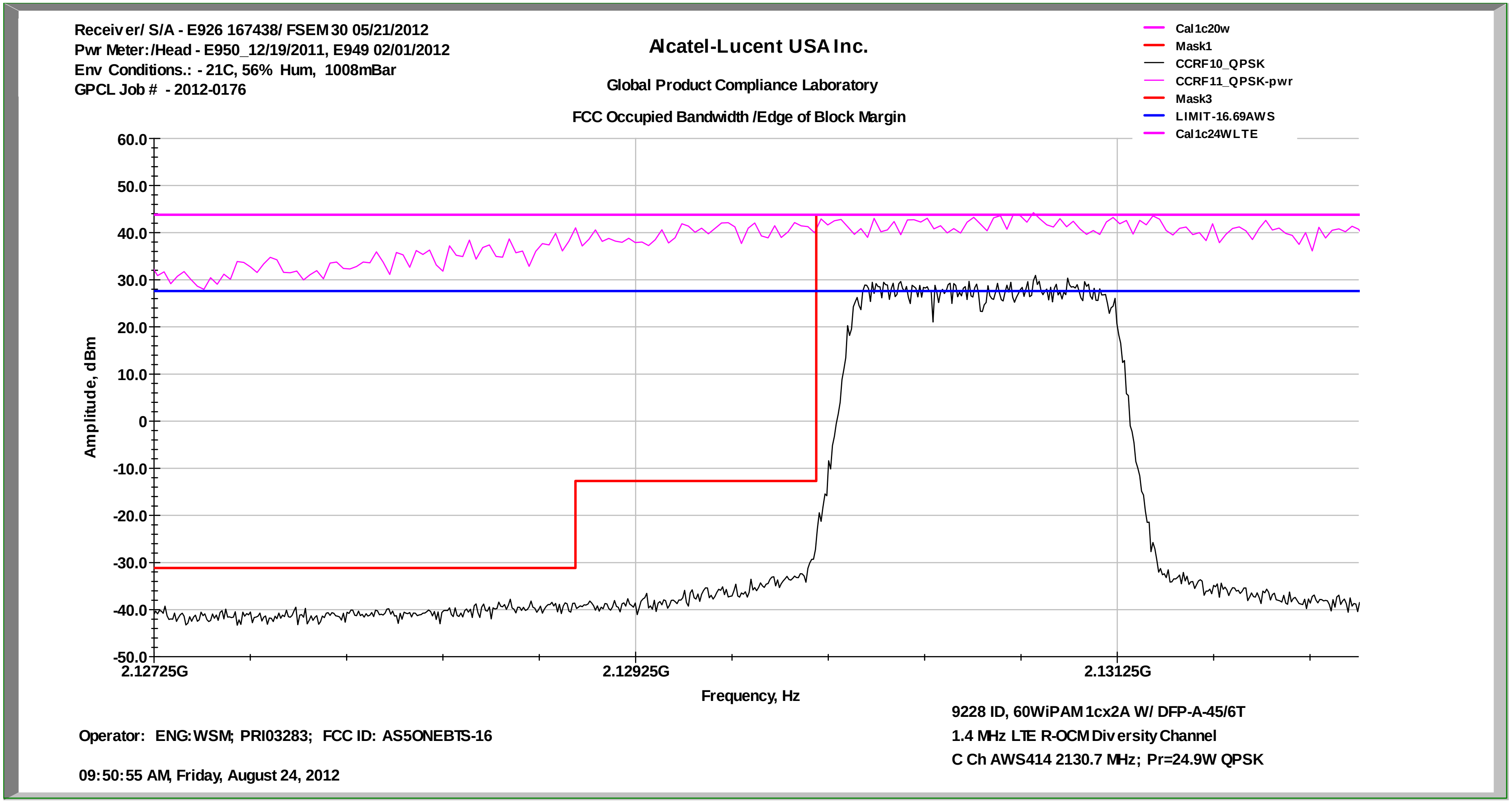
## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch C-414 1cx1A 24.9W/c QPSK Diversity Tx2



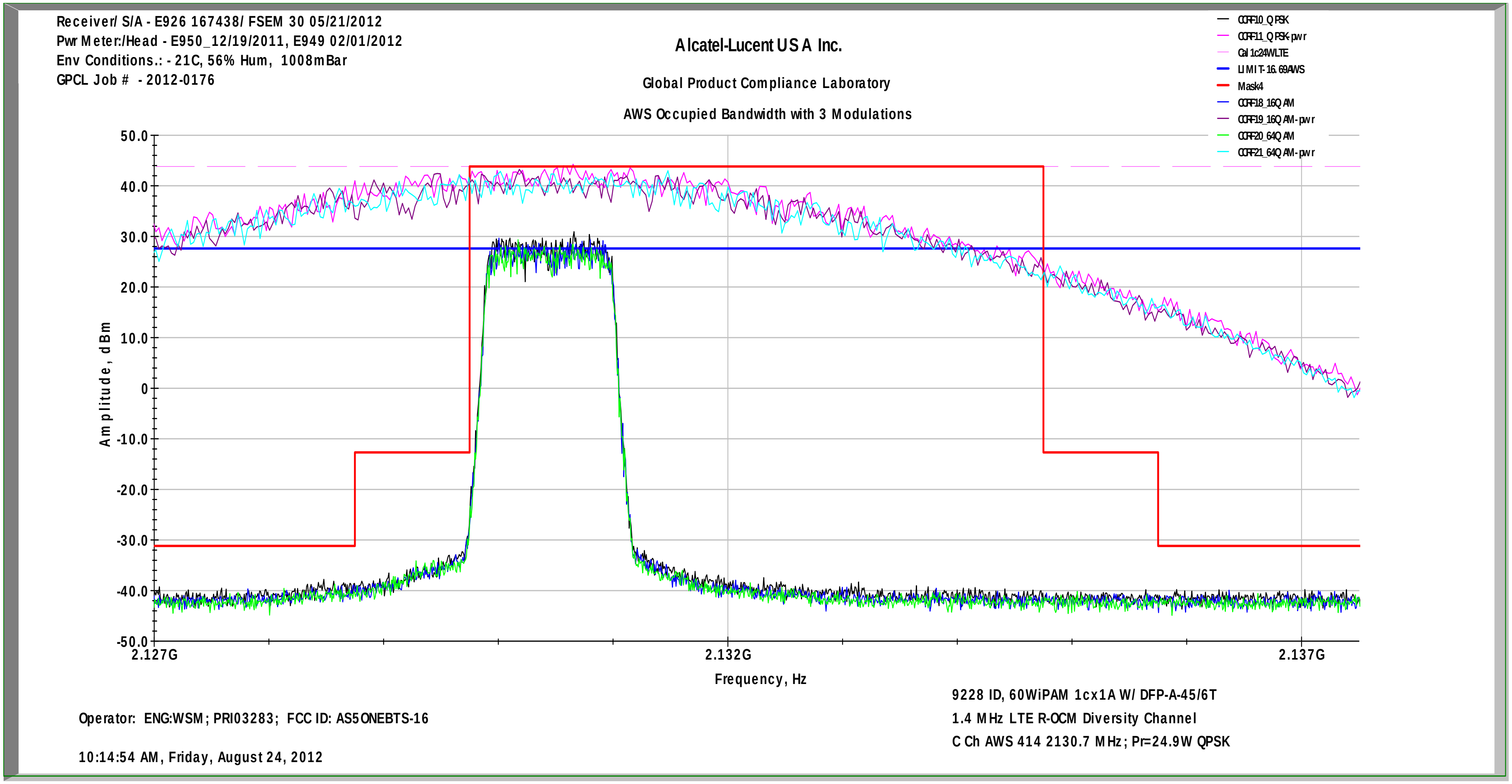
## In-Band Intermodulation Graph AWS 1.4 MHz Ch C-414 1cx1A 24.9W/c QPSK Diversity Tx2



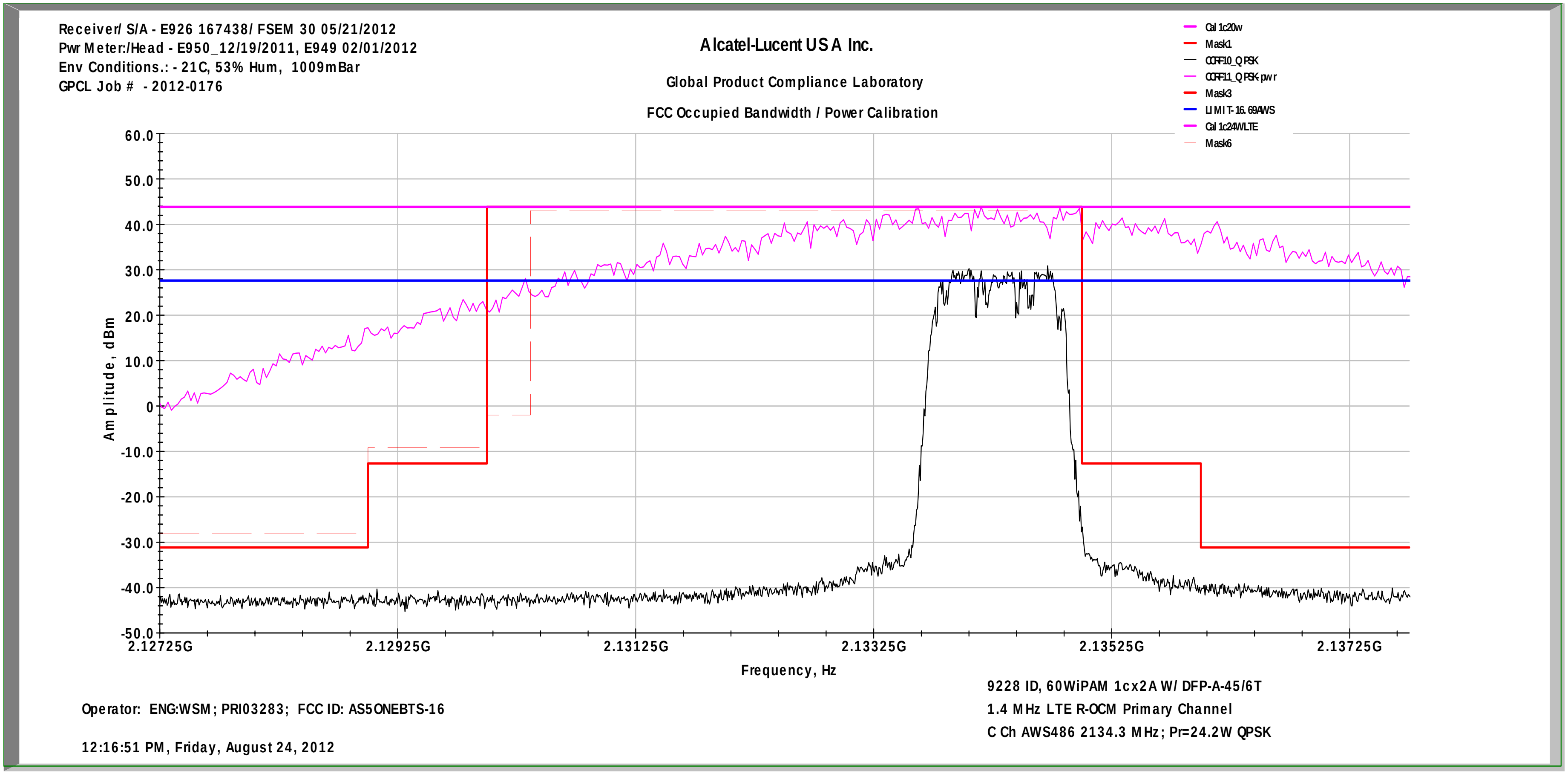
## FCC Edge of Block Margin AWS 1.4 MHz Ch C-414 1cx1A 24.2W/c QPSK Diversity Tx2



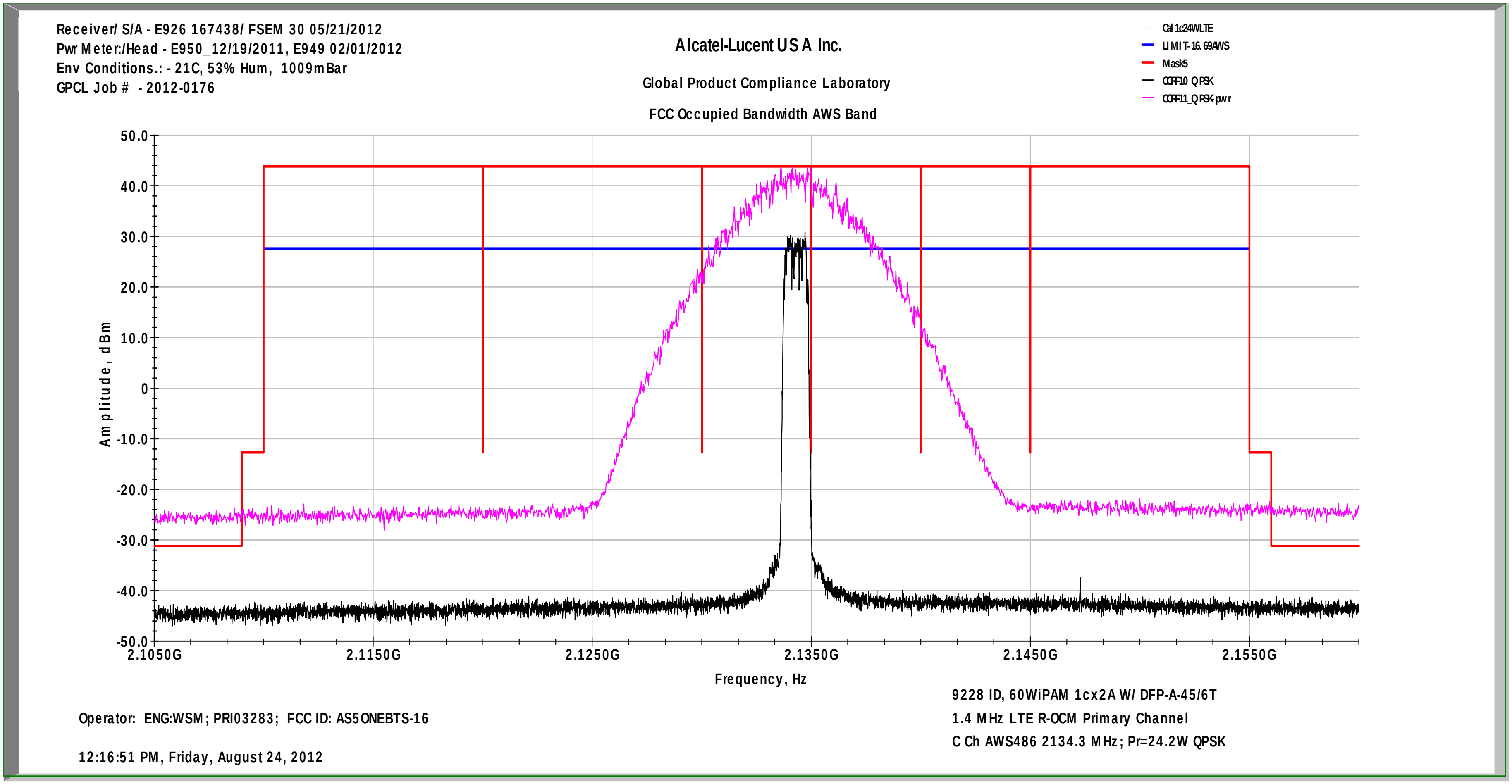
## FCC Occupied Bandwidth with 3 Modulations AWS 3 MHz Ch C-414 1cx1A 24.2W/c QPSK, 16QAM and 64QAM



## FCC Occupied Bandwidth Emissions AWS 1.4 MHz Ch C-486 1cx2A 24.2W/c QPSK Primary Tx1



## In-Band Intermodulation Graph AWS 1.4 MHz Ch C-486 1cx2A 24.2W/c QPSK Primary Tx1



## FCC Edge of Block Margin AWS 1.4 MHz Ch C-486 1cx2A 24.2W/c QPSK Primary Tx1