NVLAP LAB CODE: 100275-0

FCC Certification Test Report

Product Evaluated

Nokia 9768 Compact Metro Radio Outdoor B25/B2 2x5W
(FCC ID: AS5BBTRX-29)

Customer

Nokia

Mobile Networks Business Group

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Murray Hill, New Jersey 07974-0636 USA

Test Laboratory

Global Product Compliance Laboratory
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Date: June 9, 2016

Revisions

Date	Revision	Section	Change
6/9/16	0		Initial Release

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Prepared By: Michael P. Farina

Signed: Michael P. Farina 6/9/2016

Compliance Engineer

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Technical Manager

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1. ATTESTATION OF TEST RESULTS

Company Name	Nokia
FCC ID	AS5BBTRX-29
Product Name	CMRO B25/B2 2x5W
Model Name	9768 Compact Metro Radio Outdoor B256/B2 2x5W
Part No	**3JR39054AAAA01**
Serial Number(s)	**LBALLU-RT161280673**
Test Standard(s)	47 CFR FCC Part 24
Reference(s)	• 47 CFR FCC Part 2 and Part 24 • FCC KDB 971168 D01 (October 17, 2014) • ANSI C63.4 - 2009 • 3GPP TS 36.104 v12.7.0 (2015-04)
Operating Frequency Band	PCS: Tx 1930 - 1995 MHz and Rx 1850 – 1915 MHz, E-UTRAN Band 25
Technology	LTE
Test Frequency Range	10 MHz – 20 GHz
Operation Mode(s)	2x2 MIMO
Submission Type	Original Equipment (Initial Filing)
FCC Part 15 Subpart B Compliance	Compliance with Class B
Test Date	May 12 – June 7, 2016
Test Laboratory	Global Product Compliance Laboratory 600-700 Mountain Avenue, Rm 5B-108 Murray Hill, New Jersey 07974-0636 USA

This is to certify that the above product has been evaluated and found to be in compliance with the Rules and Regulations set forth in the above standard(s). The data and the descriptions about the test setup, procedures and configuration presented in this report are accurate. The results of testing in this report apply only to the product/system which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Per the requirement of Section 2.911(d) Certification of Technical Test Data, I hereby certify that the technical test data are the results of tests either performed or supervised by me.

Michael P. Farina
Member of Technical Staff
Global Product Compliance Laboratory
Nokia

2. SUMMARY OF THE TEST RESULTS

47 CFR FCC Sections	Description of Tests	Compliance Results	Notes
2.1046	RF Power Output	Yes	
2.1047	Modulation Characteristics	Yes	
2.1049, 24.238	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes	
2.1051, 24.238	Spurious Emissions at Antenna Terminals	Yes	
2.1053, 24.238	Field Strength of Spurious Radiation	Yes	
2.1055, 24.235	Measurement of Frequency Stability	Yes	

NR: Not Required
NA: Not Applicable

2.1 Measurement Uncertainty

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Condition	Frequency MHz	Expanded Uncertainty (k=2)
a. Classical Emissions, (*e.g.*, ANSI C63.4, CISPR 11, 14, 22, *etc.*, using ESHS 30,	Conducted Emissions	0.009 - 30	±2.0 dB
	Radiated Emissions (AR-4 Semi-Anechoic Chamber)	30 MHz – 200MHz 200 MHz – 1000 MHz	±5.1 dB ±4.7 dB

2.2 Measurement uncertainty for Antenna Port Testing:

- 9 kHz to 20 MHz: Frequency = 10 Hz, Amplitude = 0.5 dB
- 20 MHz to 1 GHz: Frequency = 100Hz, Amplitude = 0.5 dB
- 1 GHz to 10 GHz: Frequency = 10 kHz, Amplitude = 0.5 dB

3. GENERAL INFORMATION

3.1 Product Descriptions

The equipment under test (EUT) has the following specifications.

Table 3.1.1 Product Specifications

Specification Items	Description
Product Type	CMRO B25/B2 2x5W
Radio Type	Intentional Transceiver
Power Type	AC
Modulation	QPSK, 16QAM, 64QAM
Operating Frequency Range	Tx 1930 - 1995 MHz/Rx 1850 - 1915 MHz
Channel Bandwidth	5, 10, 15 and 20 MHz
Max Conducted Power (Rated)	37dBm per carrier for single carrier operation, and 40 dBm total composite for 2x5W MIMO 2T2R operation
Min Conducted Power (Rated)	27dBm per chain
Max EIRP Power (Rated)	37 dBm per chain and 40 dBm total for 2 Tx
Min EIRP Power (Rated)	27 dBm per chain and 30 dBm total for 2 Tx
Software Version	FV-ENB_LR1501_D0300_E00934
Hardware Version	178134 - B25/B2 CMRO (AC version with machined Fingu filter) 2x5W for North America
Antenna(s)	Refer to Section 3.2

The EUT supports the following carrier configurations:

Table 3.1.2 EUT Supported Configurations

Carrier Bandwidth (MHz)	Maximum No of Carriers per Path	Technology	Supported?
5	1	LTE	√
10	1	LTE	√
15	1	LTE	√
20	1	LTE	√

The operating band consists of the following blocks and spectrum:

Table 3.1.3 EUTRAN 25, PCS Band

Blocks	Tx Frequency (MHz)	Rx Frequency (MHz)	Bandwidth (MHz)
A	1930 – 1945	1850 – 1865	15
D	1945 – 1950	1865 – 1870	5
B	1950 – 1965	1870 – 1885	15
E	1965 – 1970	1885 – 1890	5
F	1970 – 1975	1890 – 1895	5
C	1975 – 1990	1895 – 1910	15
G	1990 – 1995	1910 – 1915	5

3.2 Antenna Information

The product does not incorporate integrated antennas.

4. REQUIRED MEASUREMENTS AND RESULTS

This is an Initial, Original Equipment application for FCC authorization. Per 47CFR FCC Section 2.1033(c)(14), the following certification tests are required by Section 2.1046 through Section 2.1057. The measurement was conducted in accordance with the procedures set out in Section 2.1041.

47 CFR FCC Sections	Description of Tests	Required	Notes
2.1046	**RF Power Output**	**Yes**	
2.1047	**Modulation Characteristics**	**Yes**	
2.1049, 24.238	**(a) Occupied Bandwidth** **(b) Out-of-Band Emissions**	**Yes**	
2.1051, 24.238	**Spurious Emissions at Antenna Terminals**	**Yes**	
2.1053, 24.238	**Field Strength of Spurious Radiation**	**Yes**	
2.1055, 24.238	**Measurement of Frequency Stability**	**Yes**	

NR = Not Required

4.1 Section 2.1046 MEASUREMENT REQUIRED: RF POWER OUTPUT

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal, as shown in the accompanying test set-up diagram. The radio was tuned to a channel which is transmitting continuously in its operating frequency band. The power level of the base station was calibrated to allow the base station to operate at the manufacturer's maximum rated mean power level, i.e., +37 dBm (5 W) per LTE antenna-transmitting terminal and per single carrier.

4.1.1 RF Power Output Measurement

Power measurements were conducted with a broadband Power Meter in the average mode per KDB 971168 D01. Before the testing was started, the Base Station was given a sufficient "warm-up" period as required.

The maximum rated mean power per carrier, per port and per unit at the antenna transmitting terminal was measured for LTE carriers at the carrier bandwidths 5 MHz, 10 MHz, 15 MHz and 20 MHz with QPSK + 16QAM combined and with 64QAM modulation across the entire operating frequency band, respectively.

The maximum rated mean RF power outputs of the EUT measured are given in Table 4.1.1. The RF power output measured for each configuration was also shown as "Ref Lvl" in the plots provided in Sections 4.3 and 4.4.

Table 4.1.1 The Maximum Average RF Output Power of the EUT- Measured

Transmit Configuration	Measurement Configuration	Maximum Average RF Output Power		Maximum Derivation
		Watts	dBm	dB
2xMIMO	Per Carrier	5	37	≤ ±1
2xMIMO	Per Antenna Port	5	37	
2xMIMO	Per Unit	10	40	

4.1.1.1 RF Power Output Results:

The maximum mean RF power outputs of the EUT measured at its antenna transmitting terminals were measured in full compliance with the Rules of the Commission and are listed above.

4.1.2 Peak-to-Average Power Ratio Measurement

The Peak-to-Average Power Ratio (PAPR) of the EUT has also been measured per KDB 971168 D01 procedures for 5 MHz, 10 MHz, 15 MHz and 20 MHz carriers at the lowest settable, middle and highest settable channels of the operating band, with QPSK+16QAM and 64QAM, respectively. The PAPR values (0.1% probability) of the EUT measured are all below 13dB. The maximum PAPR value measured is given in Table 4.1.2 and the plot below.

Table 4.1.2 The Maximum PAPR Value at 0.1% probability of the EUT
Lowest and Highest Settable Carriers/Fundamentals for QPSK+16QAM and 64QAM Test Modulations

Configuration	Maximum PAPR Value at 0.1% probability (dB)
Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz	< 8dB
Ch 1992.5 MHz, 64QAM, BW 5 MHz	< 8dB
Ch 1935 MHz, QPSK+16QAM, BW 10 MHz	< 8dB
CH 1990 MHz, 64QAM, BW 10 MHz	< 8dB
Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz	< 8dB
Ch 1987.5 MHz, 64QAM, BW 15 MHz	< 8dB
Ch 1940 MHz, QPSK+16QAM, BW 20 MHz	< 8dB
Ch 1985 MHz, 64QAM, BW 20 MHz	< 8dB

4.1.2.1 Peak-to-Average Power Ratio Results:

The maximum Peak-to-Average Power Ratio (PAPR) of the EUT measured at its antenna transmitting terminals were measured to be in full compliance with the ≤13 dB Rules of the Commission and are listed above.

As stated in KDB 971168 D01 *Power Meas License Digital Systems v02r02*, the peak power of a digitally-modulated signal is predictable only on a statistical basis. Thus, for these types of signals, a statistical measurement of the peak power is necessary. The power complementary cumulative distribution function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument’s resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.

Plots of the CCDF curves are shown in the following **Fig. 4.1.2**

Figure 4.1.1 Test Set-Up for Measurement of Radio Frequency Power Output

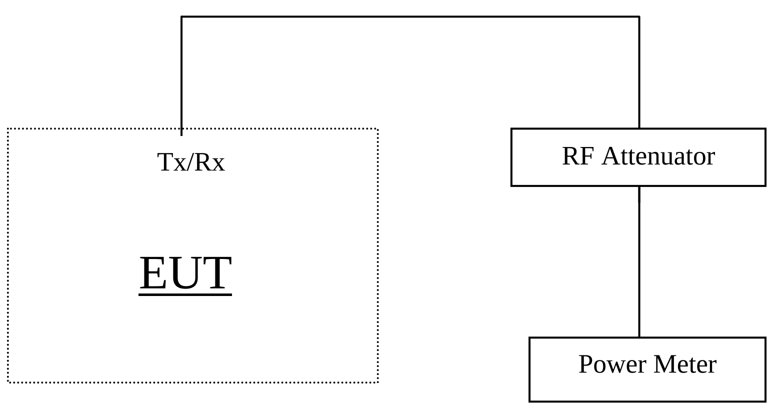
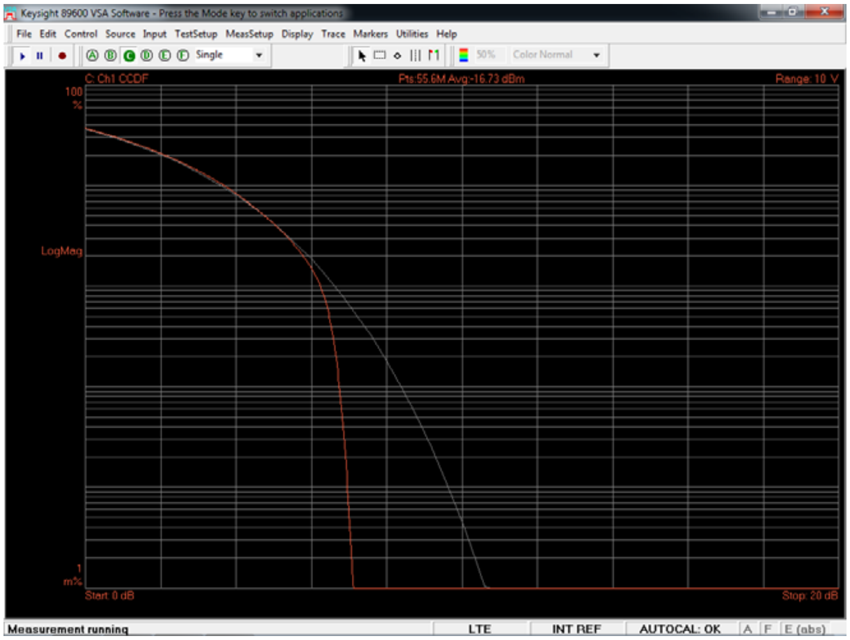
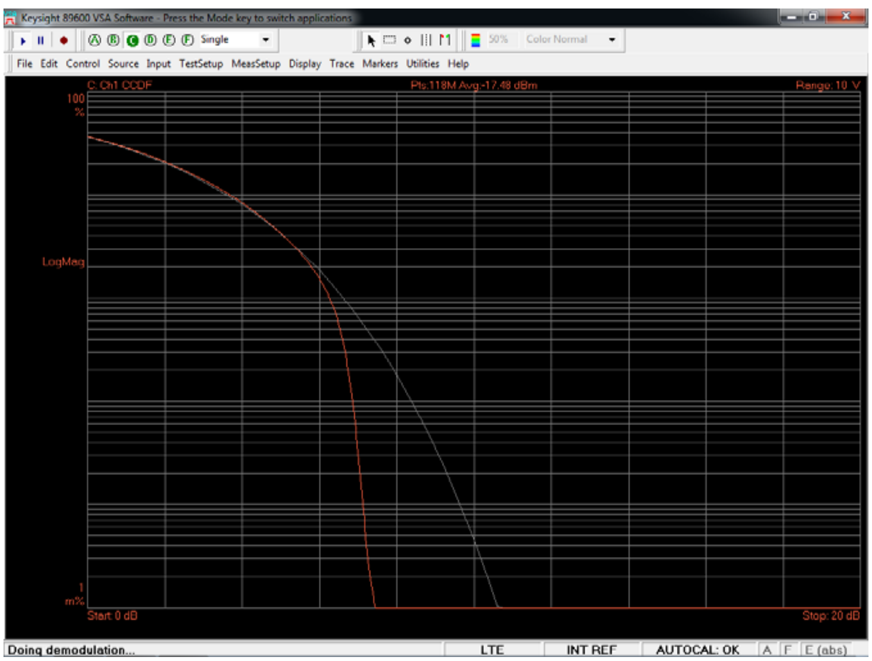


Figure 4.1.2 PAPR Plot Measured with the Maximum Value

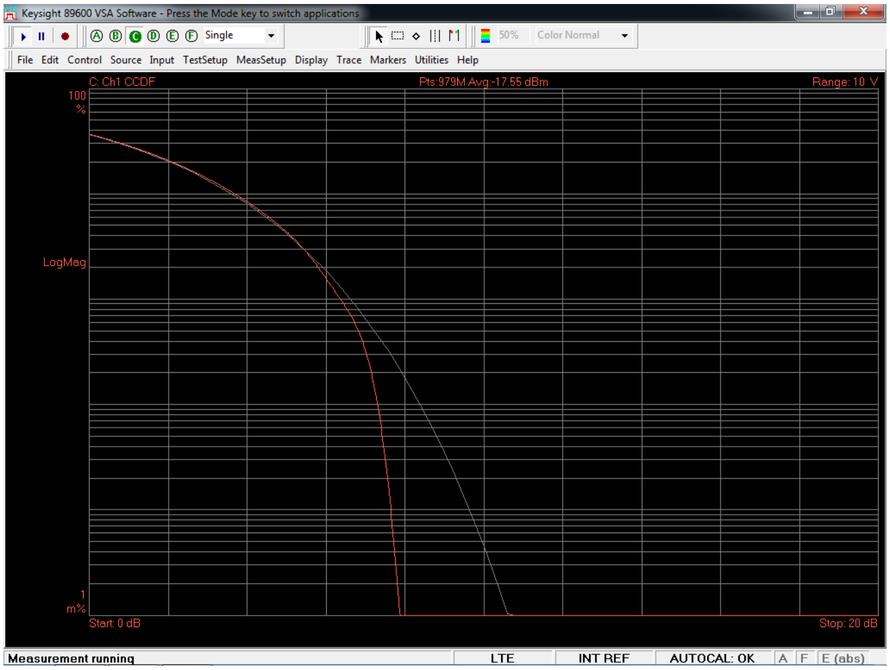
Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz



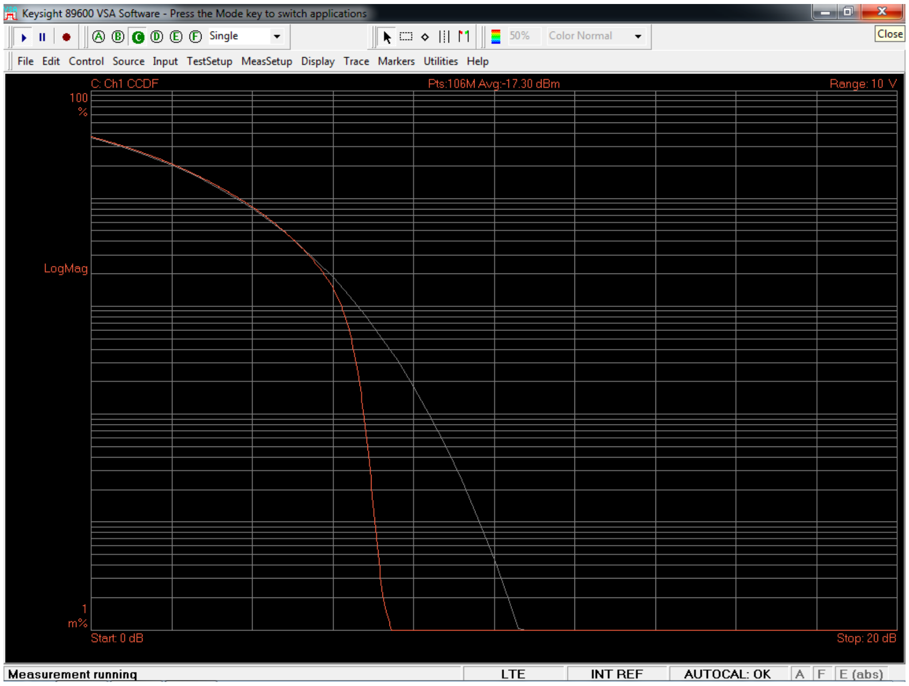
Ch 1992.5 MHz, 64QAM, BW 5 MHz



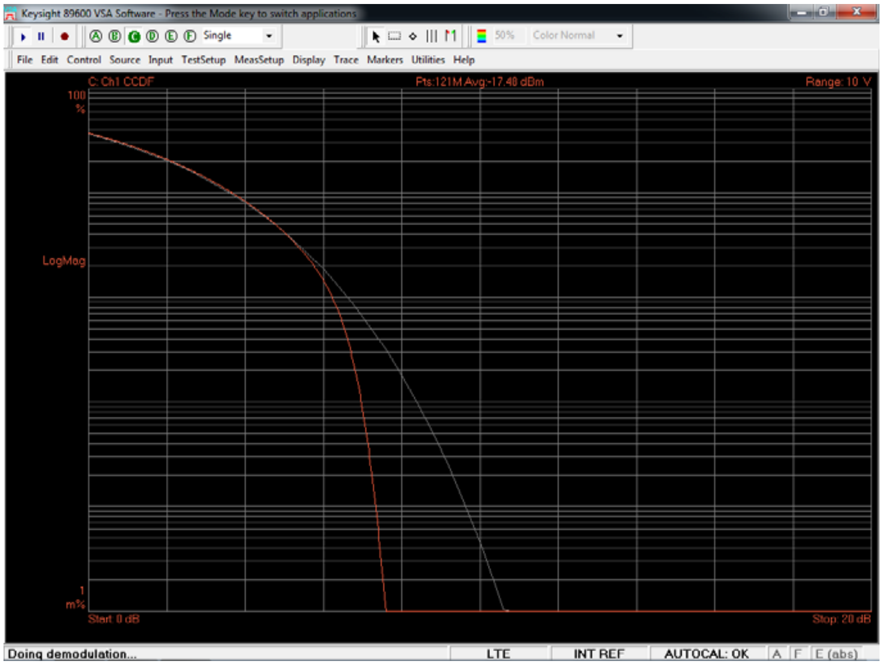
Ch 1935 MHz, QPSK+16QAM, BW 10 MHz



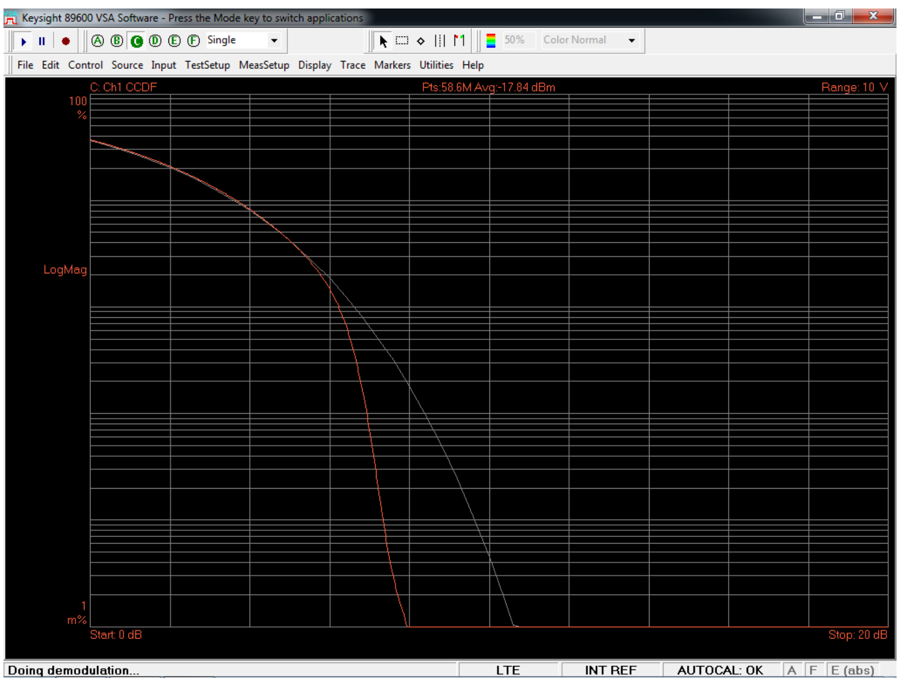
CH 1990 MHz, 64QAM, BW 10 MHz



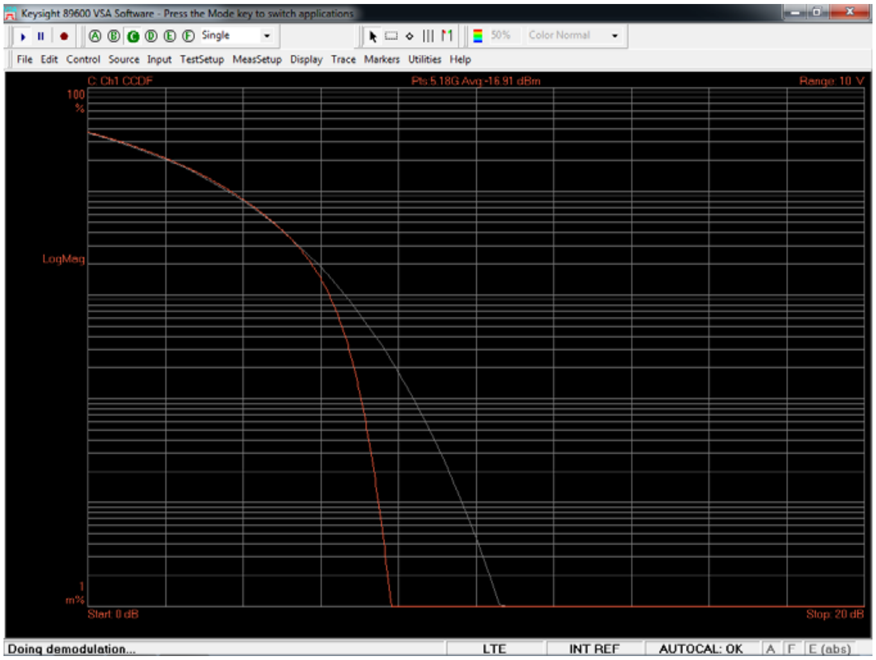
Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz



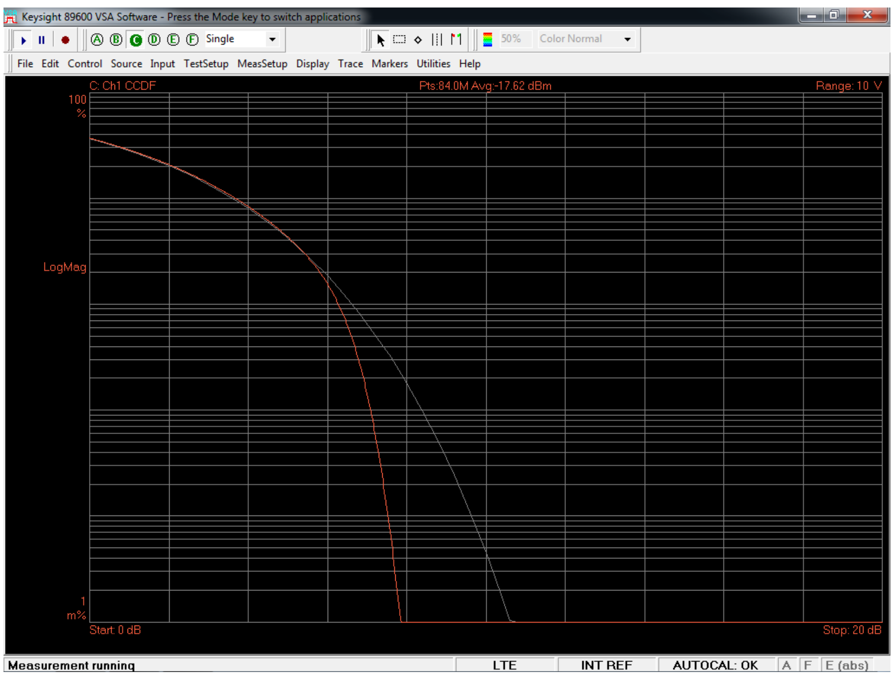
Ch 1987.5 MHz, 64QAM, BW 15 MHz



Ch 1940 MHz, QPSK+16QAM, BW 20 MHz



Ch 1985 MHz, 64QAM, BW 20 MHz



4.2 Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

The EUT supports LTE technology only. The LTE utilizes Orthogonal Frequency Division Multiplexing (OFDM) which splits the carrier frequency bandwidth into many small subcarriers. Each individual subcarrier is modulated with QPSK, 16QAM and 64QAM digital modulation formats.

In QPSK, there are 4 possible symbol states and each symbol carries 2 bits of information. In 16QAM, there are 16 possible symbol states and each 16-QAM symbol carries 4 bits of information. While in 64QAM, there are 64 possible symbol states and each 64-QAM symbol carries 6 bits of information. Higher-order modulation, where the constellations become more dense, is more sensitive to poor channel conditions than the lower-order modulation.

The modulation characteristics measurement of LTE carriers measures the difference between the ideal symbols and the measured symbols after the equalization. The measurement was performed for QPSK, 16QAM and 64QAM, respectively, where the carrier power level was adjusted to the maximum rated mean power at the antenna terminal.

4.2.1 Modulation Characteristics Measurement

The measurements were performed at the antenna transmitting terminal of the base station system with a signal analyzer, which was calibrated in accordance with ISO 9001 process. The test set-up diagram is given in the Figure 4.2.1, where the signal analyzer used the external signals from the base station as its trigger source and time reference. Figures 4.2.2, 4.2.3, 4.2.4 and 4.2.5 show representative screen plots of the modulation measurement for 5 MHz,10 MHz, 15 MHz and 20 MHz LTE carriers, respectively, in QPSK+16QAM combined and 64QAM modulations.

4.2.1.1 Modulation Measurements Results

The modulation characteristics of the EUT measured are in full compliance with the Rules of the Commission.

Figure 4.2.1 Test Set-Up for Measurement of Modulation Characteristics, Occupied Bandwidth and Out-of-Band Emissions

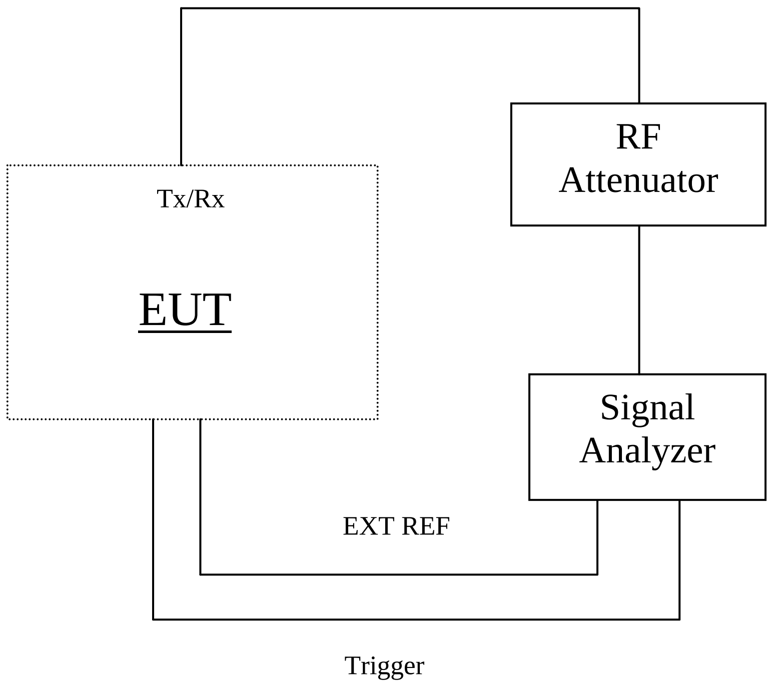
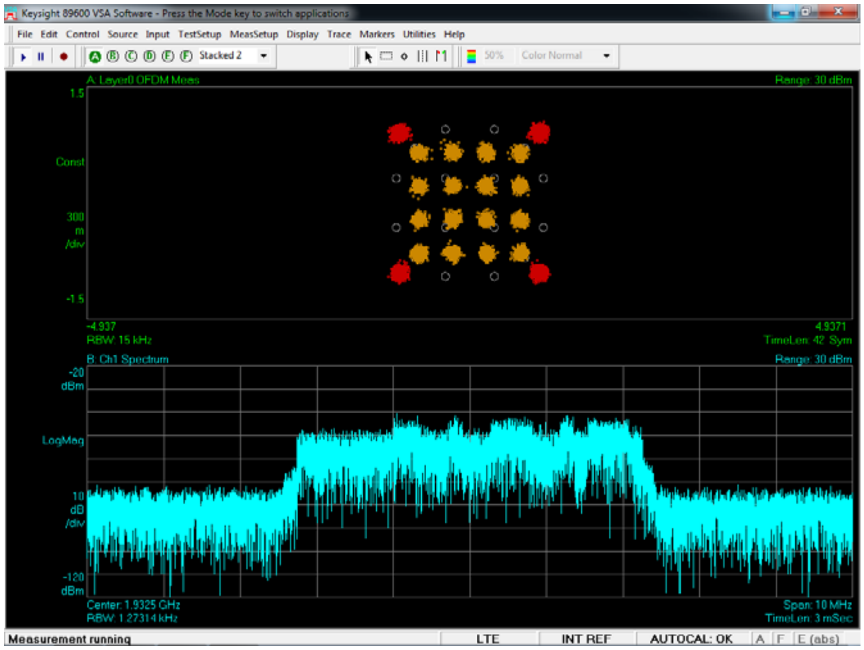


FIGURE 4.2.2 Modulation Measurement for a 5 MHz LTE Carrier with QPSK+16QAM and 64QAM

Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz (Lowest Settable)



Ch 1992.5 MHz, 64QAM, BW 5 MHz (Highest Settable)

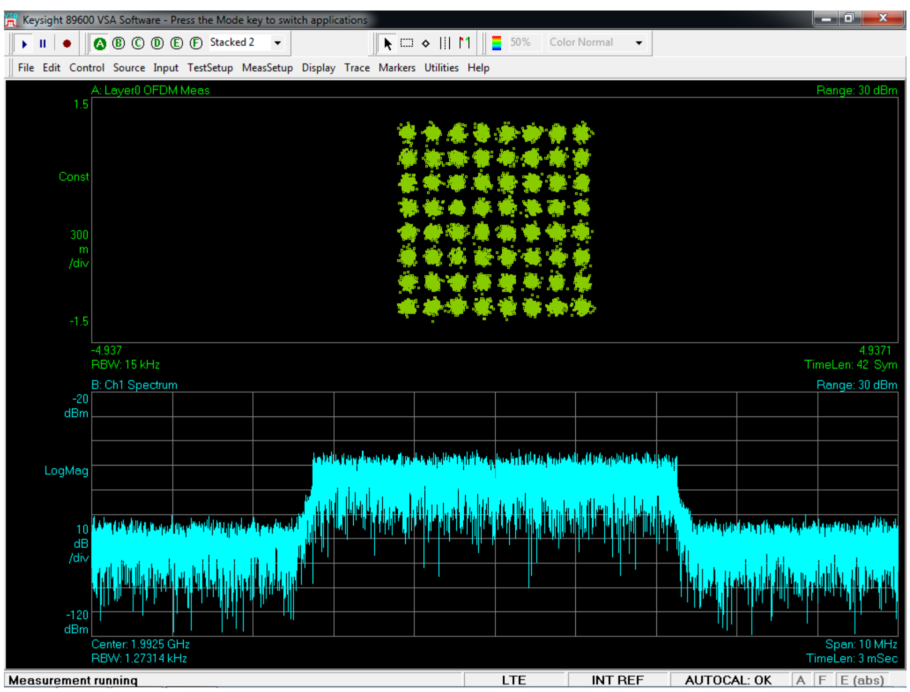
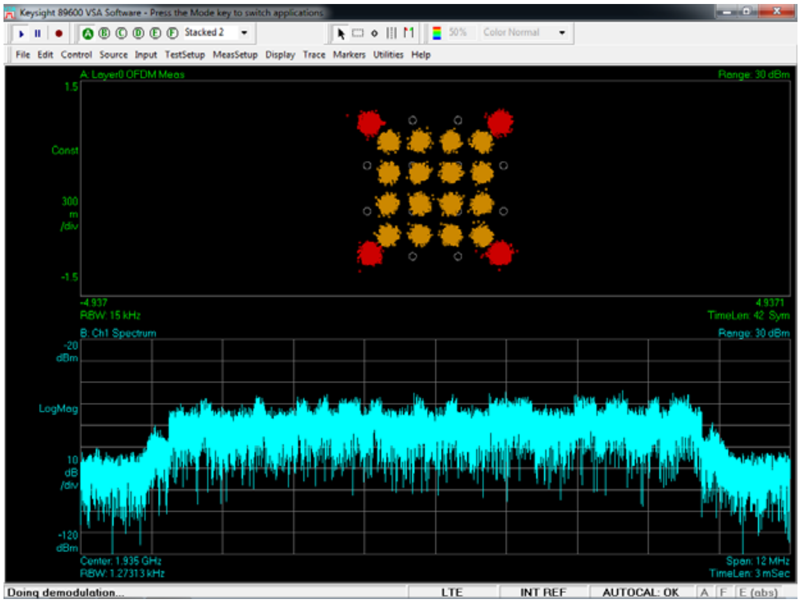


FIGURE 4.2.3 Modulation Measurement for a 10 MHz LTE Carrier with QPSK+16QAM and 64QAM Modulations

Ch 1935 MHz, QPSK+16QAM, BW 10 MHz (Lowest Settable)



CH 1990 MHz, 64QAM, BW 10 MHz (Highest Settable)

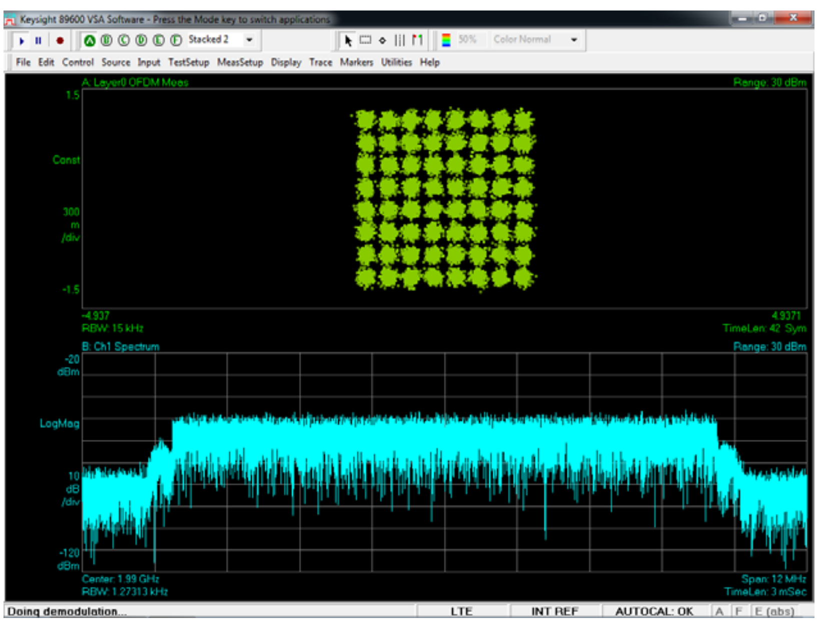
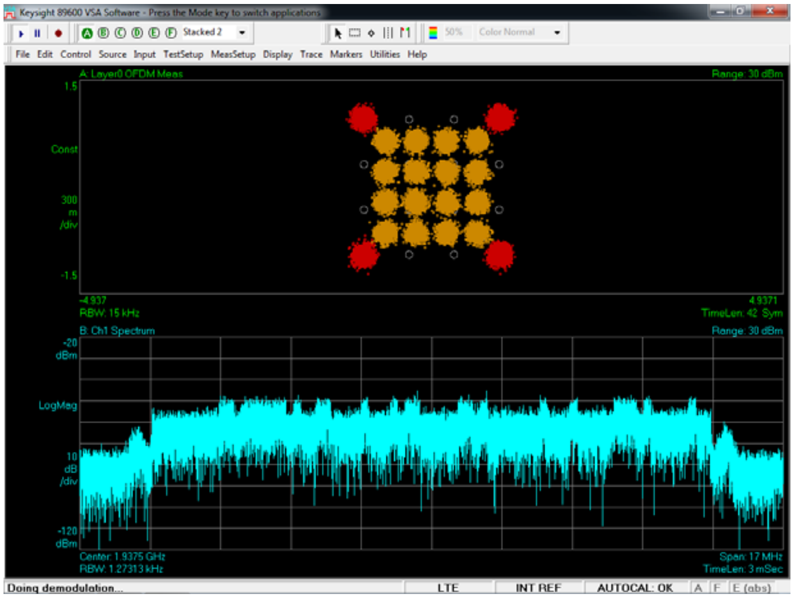


FIGURE 4.2.4 Modulation Measurement for a 15 MHz LTE Carrier with QPSK+16QAM and 64QAM Modulations

Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz (Lowest Settable)



Ch 1987.5 MHz, 64QAM, BW 15 MHz (Highest Settable)

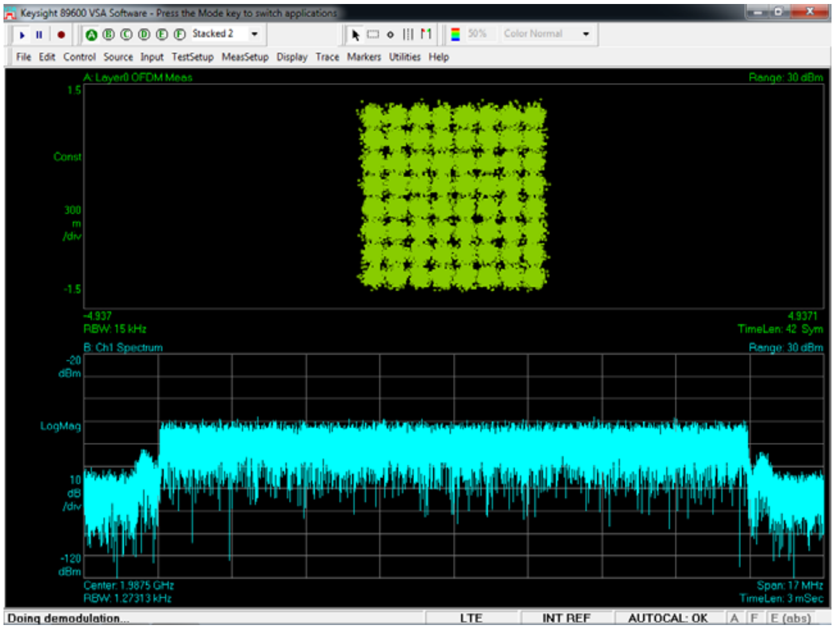
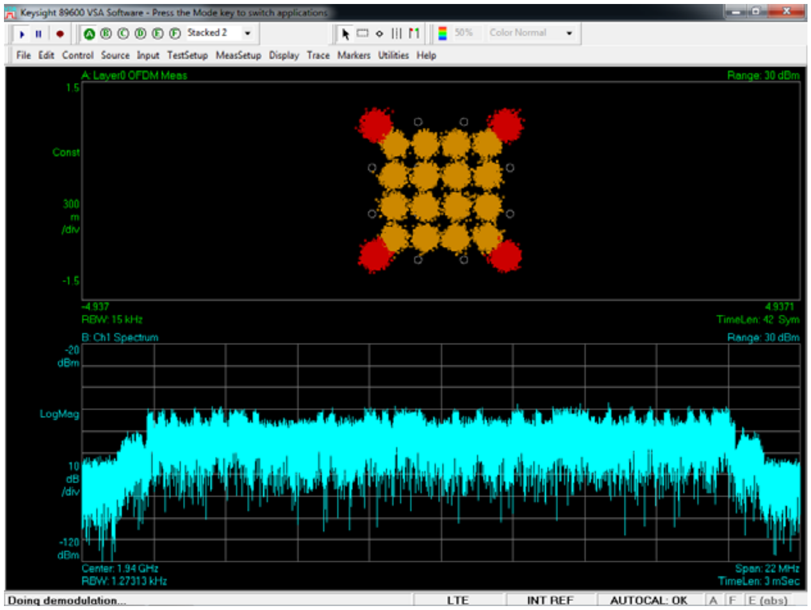
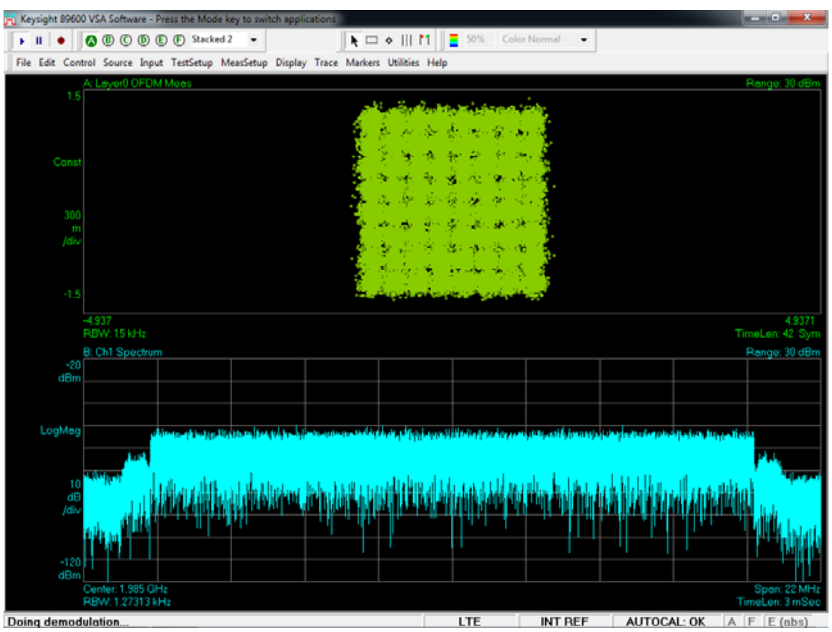


FIGURE 4.2.5 Modulation Measurement for a 20 MHz LTE Carrier with QPSK+16QAM and 64QAM Modulations

Ch 1940 MHz, QPSK+16QAM, BW 20 MHz (Lowest Settable)



Ch 1985 MHz, 64QAM, BW 20 MHz (Highest Settable)



4.3 Section 2.1049 MEASUREMENT REQUIRED: OCCUPIED BANDWIDTH AND OUT-OF-BAND EMISSIONS

This test measures the Occupied Bandwidth of the transmitting carrier and the Out-of Band Emissions in the frequency spectrum immediately outside and adjacent to the transmitting carrier(s).

The occupied bandwidth (OBW) is usually defined either as the 99% power OBW or a relative OBW. The 99% OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated or conducted are each equal to 0.5 percent of the total mean power radiated or conducted by a given emission. The relative OBW 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 by at least X dB below the transmitter power, where the value of X is typically specified as 26.

Per KDB 971168 D01 v02r02, the relative OBW must be measured and reported when it is specified in the applicable rule part; otherwise, the 99% OBW shall be measured and reported. The OBW shall be measured when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment is operated.

4.3.1 Measurement of Occupied Bandwidth

The operating blocks and carrier configurations supported are provided in Section 3.1 Product Descriptions. The EUT transmitting band for wireless communication is governed by the FCC rules in CFR 47, Part 24, Subpart E. The minimum emission requirements and the setting of measurement equipment for the out-of-band emissions measurement of carriers were specified in FCC Part 24.238. The FCC's requirements are tabulated in the following table:

Table 4.3.1 FCC Part 24.238 Transmitter Unwanted Emission Limits

Frequency	Required Minimum Attenuation below the Mean Carrier Power *P*	Measurement Resolution Bandwidth (RBW)** of Spectrum Analyzer
1MHz Bands Immediately Outside the Transmitting Frequency Band	(43 + 10 log P watts) dBc = -13dBm*	30 kHz for BW 5 MHz 100kHz for BW 10MHz 100kHz for BW 15MHz 100kHz for BW 20MHz
Outside the above Frequency Range	(43 + 10 log P watts) dBc = -13dBm*	1MHz

*For Nx MIMO, the limit is reduced by 10·*log*(N) dB.
** 3GPP TS 36.104, Table 6.6.3.3-2: Additional operating band unwanted emission limits for E-UTRA bands>1GHz

The above requirement was used as the required emission limit mask in the out-of-band emissions measurement. The occupied bandwidth and out-of-band emissions measurements were made at the antenna transmitting terminal for QPSK+16QAM and 64QAM modulations, respectively. The appropriate E-UTRA test model specified in 3GPP TS 36.141 and TS 36.104 was used for LTE carriers.

The measurements were performed with a spectrum analyzer, consistent with ANSI C63.26. The test set-up diagram is same as the one shown in the Figure 4.3.1.

The 99% occupied bandwidth measurement of an LTE carrier was measured per FCC KDB 971168, using an Agilent Technologies N9020A MXA Signal Analyzer. For the out-of-band emissions measurement, the spectrum analyzer is normally set with a resolution bandwidth which is equal to at least 1% of carrier bandwidth (Part 24.238) and a video bandwidth which is equal to at least 3xRBW as shown in the plots of the occupied bandwidth measurement attached in the following pages. The emissions outside the above spans were evaluated in Measurement Required: Out-of-Block Spurious Conducted Emissions. The top of the carrier measured with a resolution bandwidth which is equal to 1% of carrier bandwidth was 20 dB below the LTE carrier power measured with a resolution bandwidth greater than the carrier bandwidth (if available) or a wideband power meter. This 20dB offset was due to the fact that 10 log (BW/1% *BW) = 20 dB. The RMS average detector was used in all above measurements. The measurement met the requirements of ANSI C63.26 paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be > 2 × Span/RBW.

The CMRO operates with single 5W carriers that can be set to bandwidths (BW) of 5 MHz, 10 MHz, 15 MHz or 20 MHz. Measurements for BW 5 MHz were made at the lowest settable, mid-band and highest settable carriers for Blocks A, B and C; and at mid-band for Blocks D, E, F and G. Measurements of BW 10 MHz, 15 MHz and 20 MHz were made at the lowest settable, mid-band and highest settable carriers for the 1930 – 1995 MHz spectrum. To keep this test report to a manageable size, it is sufficient to display plots for the lowest settable and highest settable carriers for all four bandwidths, which is representative of the product.

The emission masks and measurement resolution bandwidths (RBW) were consistent with 3GPP TS 36.104 Table 6.6.3.3-2. The out-of-band emissions were measured using Total Integrated Laboratory Environment (TILE) EMI test software, by ETS-Lindgren. The carrier configurations displayed are tabulated below.

Table 4.3.2 Channels Tested for Occupied Bandwidth and Out-of-Band

Test Number	Configuration	Rational	Band	DL Carrier Center Frequencies (MHz)	Modulation
1	BW 5 MHz	Lowest Settable	A	1932.5	QPSK + 16QAM
2	BW 5 MHz	Highest Settable	G	1992.5	64QAM
3	BW 10 MHz	Lowest Settable	A	1935	QPSK + 16QAM
4	BW 10 MHz	Highest Settable	CG	1990	64QAM
5	BW 15 MHz	Lowest Settable	A	1937.5	QPSK + 16QAM
6	BW 15 MHz	Highest Settable	CG	1987.5	64QAM
7	BW 20 MHz	Lowest Settable	AD	1940	QPSK + 16QAM
8	BW 20 MHz	Highest Settable	CG	1985	64QAM

4.3.1.1 Mask Parameters

The emission mask parameters are specified in Part 24.238, as follows:

§24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). 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.

4.3.2 Results:

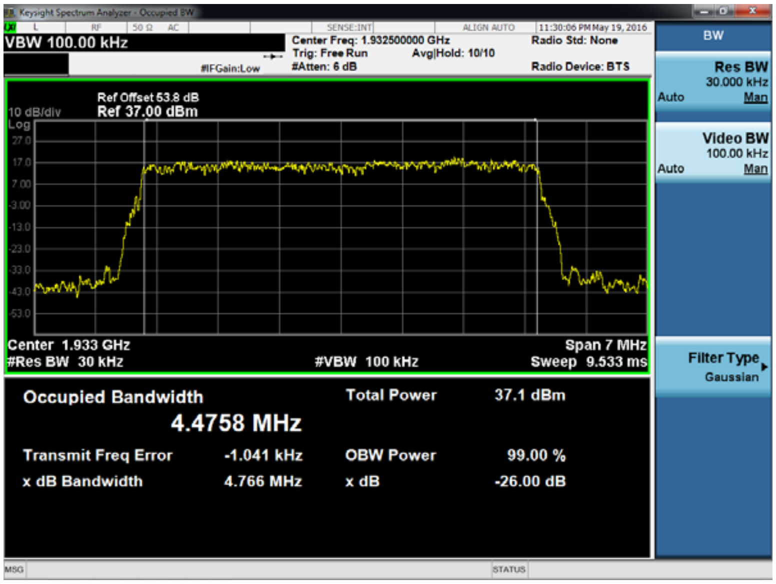
The occupied bandwidth plots which gave the widest occupied bandwidth for each carrier bandwidth with QPSK+16QAM and 64 QAM are displayed below. The results are tabulated below:

Table 4.3.3 Occupied Bandwidth Measurement Results (99% Power Occupied Bandwidth)

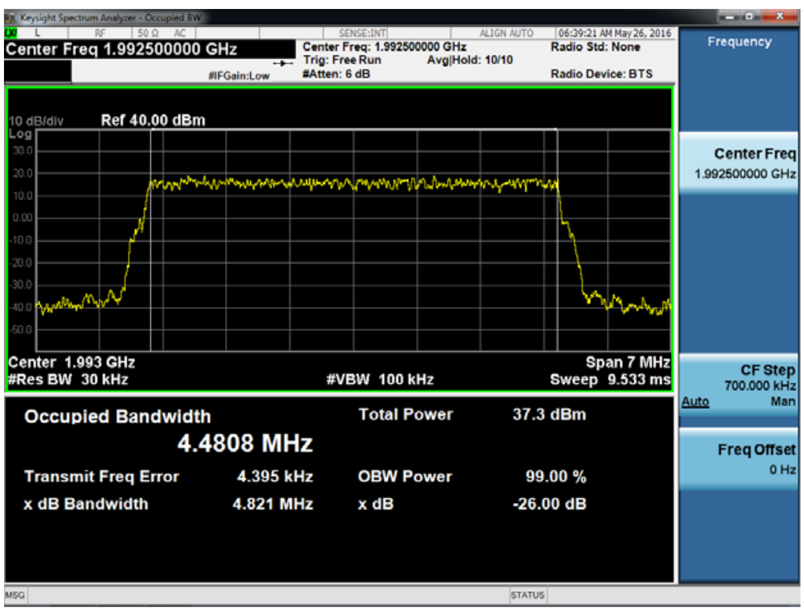
Test Number	Bandwidth (BW) MHz	Carrier Center Frequency (MHz)	Modulation	99% Power Occupied Bandwidth (MHz)
1	BW 5 MHz	1932.5	QPSK + 16QAM	**4.4758**
2	BW 5 MHz	1992.5	64QAM	**4.4808**
3	BW 10 MHz	1935	QPSK + 16QAM	**9.0159**
4	BW 10 MHz	1990	64QAM	**9.0229**
5	BW 15 MHz	1937.5	QPSK + 16QAM	**13.520**
6	BW 15 MHz	1987.5	64QAM	**13.451**
7	BW 20 MHz	1940	QPSK + 16QAM	**18.009**
8	BW 20 MHz	1985	64QAM	**18.222**

FIGURE 4.3.1 99% OCCUPIED BANDWIDTH PLOTS

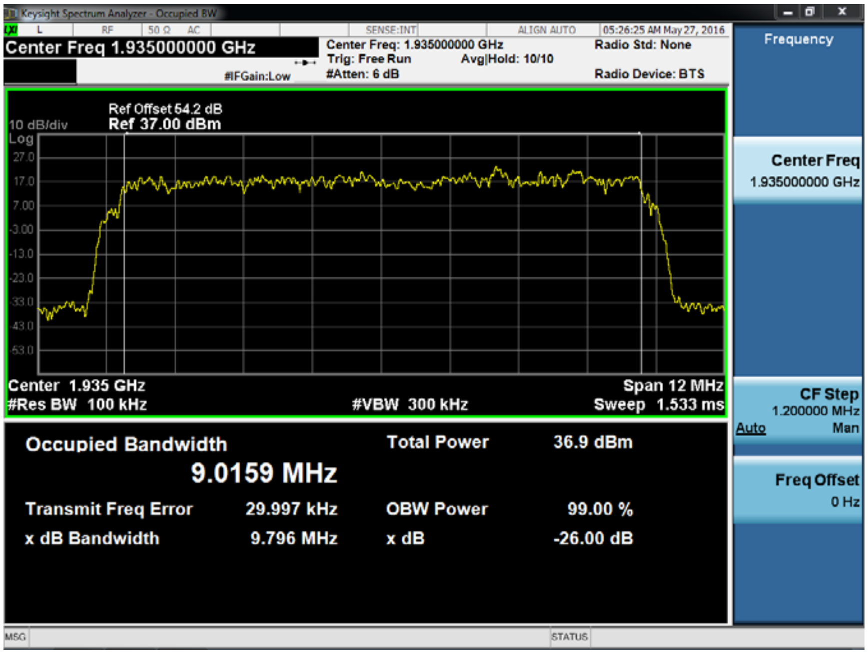
Test #1 Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz (Lowest Settable)



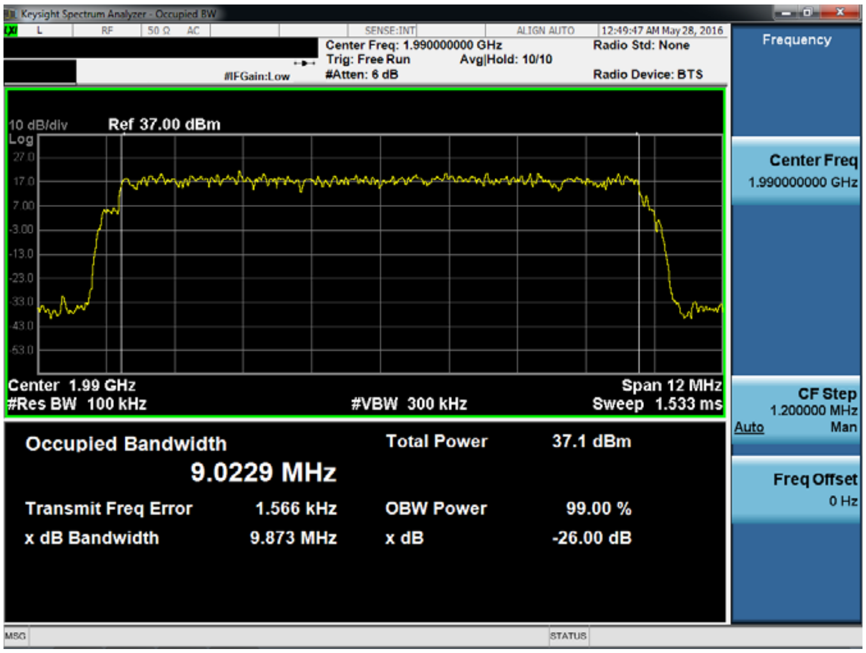
Test #2 Ch 1992.5 MHz, 64QAM, BW 5 MHz (Highest Settable)



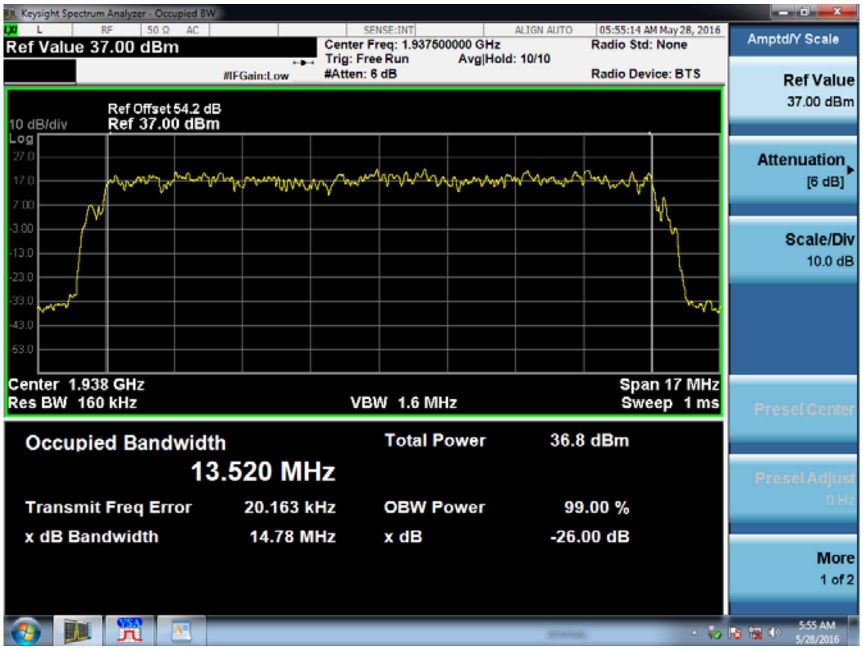
Test #3 Ch 1935 MHz, QPSK+16QAM, BW 10 MHz (Lowest Settable)



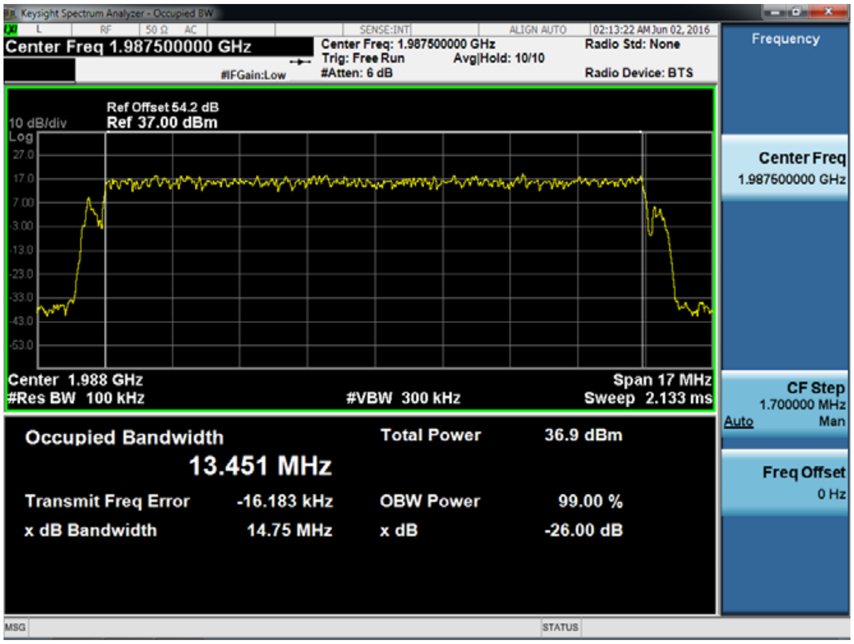
Test #4 CH 1990 MHz, 64QAM, BW 10 MHz (Highest Settable)



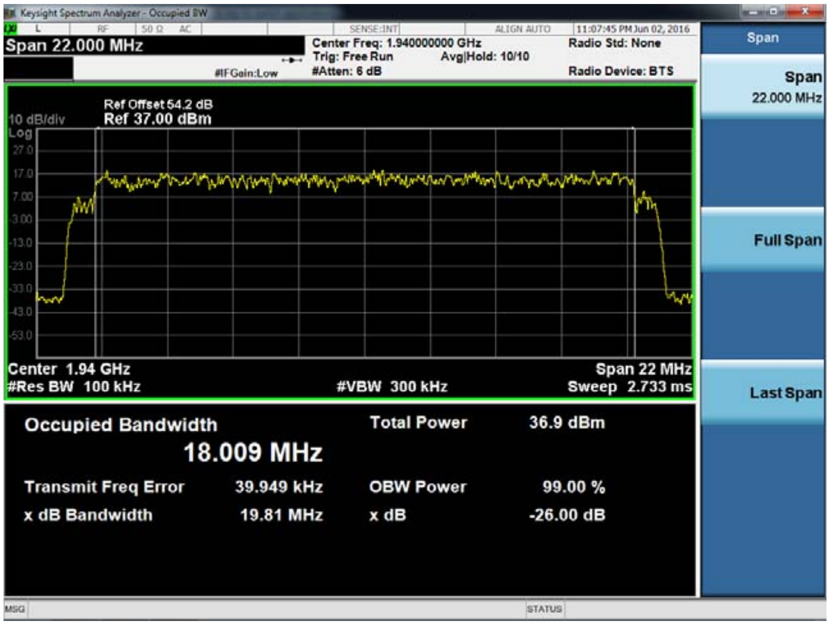
Test #5 Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz (Lowest Settable)



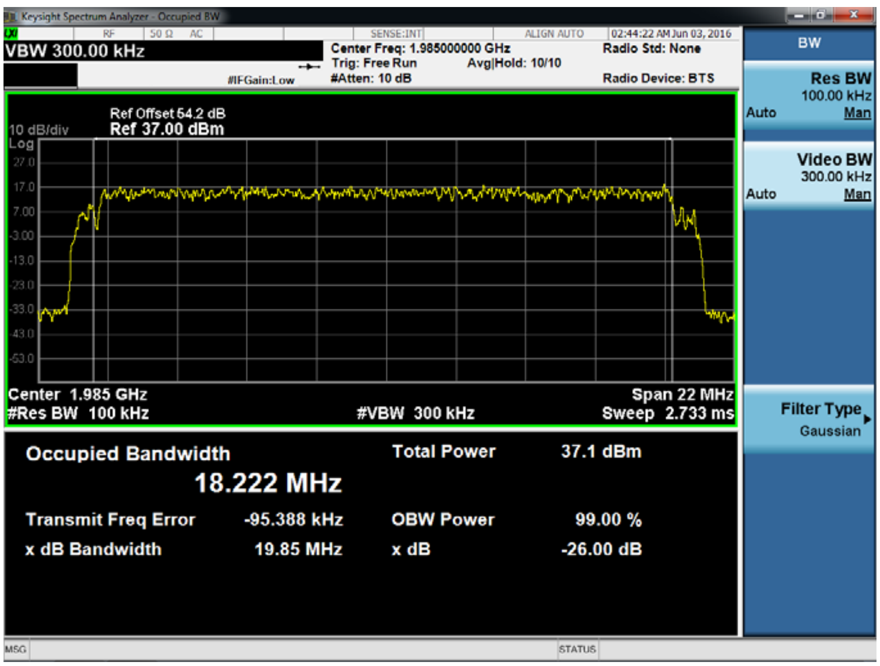
Test #6 Ch 1987.5 MHz, 64QAM, BW 15 MHz (Highest Settable)



Test #7 Ch 1940 MHz, QPSK+16QAM, BW 20 MHz (Lowest Settable)



Test #8 Ch 1985 MHz, 64QAM, BW 20 MHz (Highest Settable)



Out-of-Band Emission Mask Compliance

The emission mask limits are defined by:

For the 1 MHz adjacent to the upper and lower edge of the measurement block/band:

37 - [43 + 10 log 5W] – 10 log (Meas RBW/1% BW) – 10 log N

For greater than 1 MHz from the upper and lower edge of the measurement block/band:

37 - [43 + 10 log 5W] – 10 log (Meas RBW/1 MHz) – 10 log N

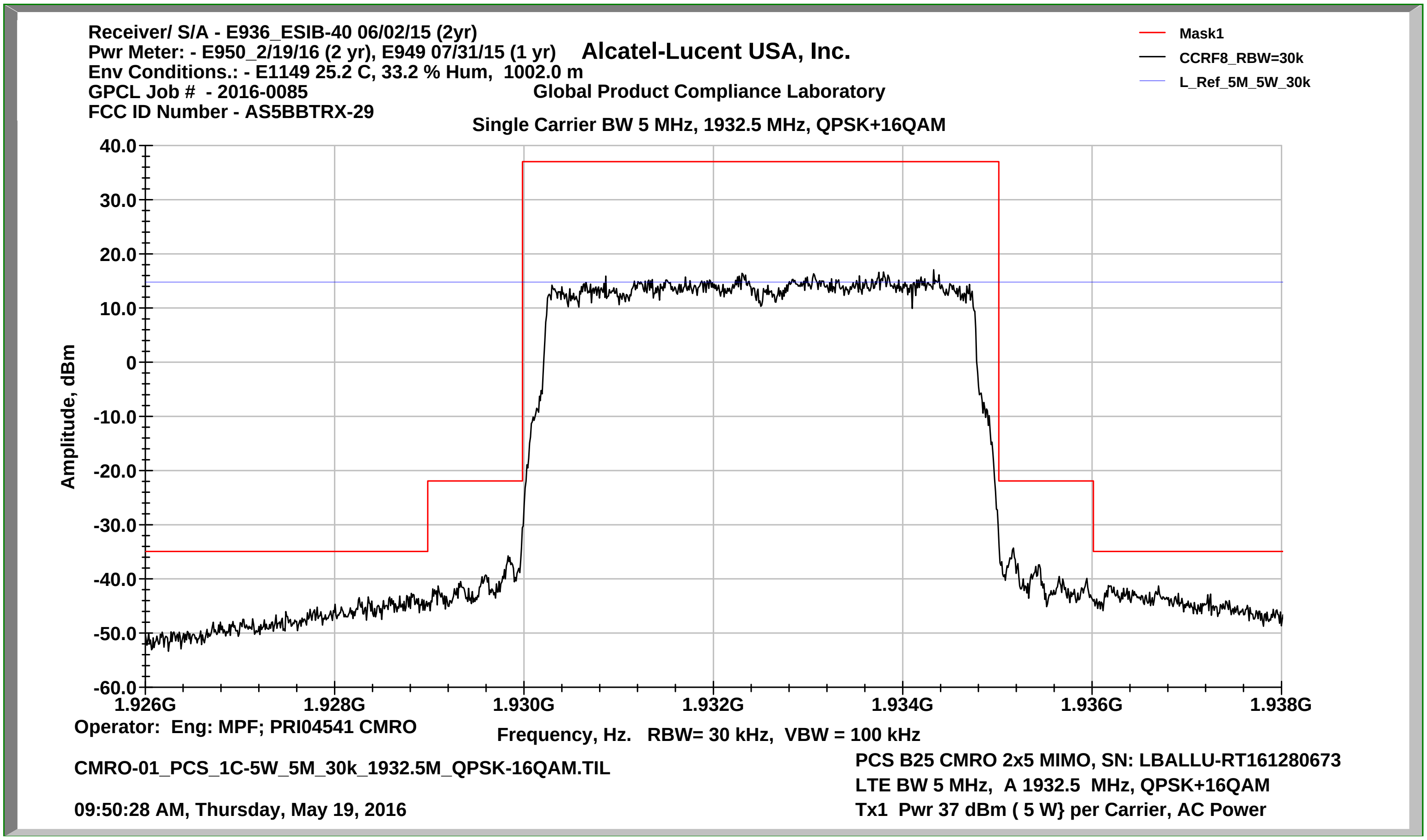
The carriers are offset from the top of the emission mask by:

37– 10 log (Meas RBW/ BW)

The data plots that follow show compliance for all four carrier bandwidths. From the out-of-band emissions plots attached below, it can be seen that all the emissions are under the required FCC emission masks for 2xMIMO operation.

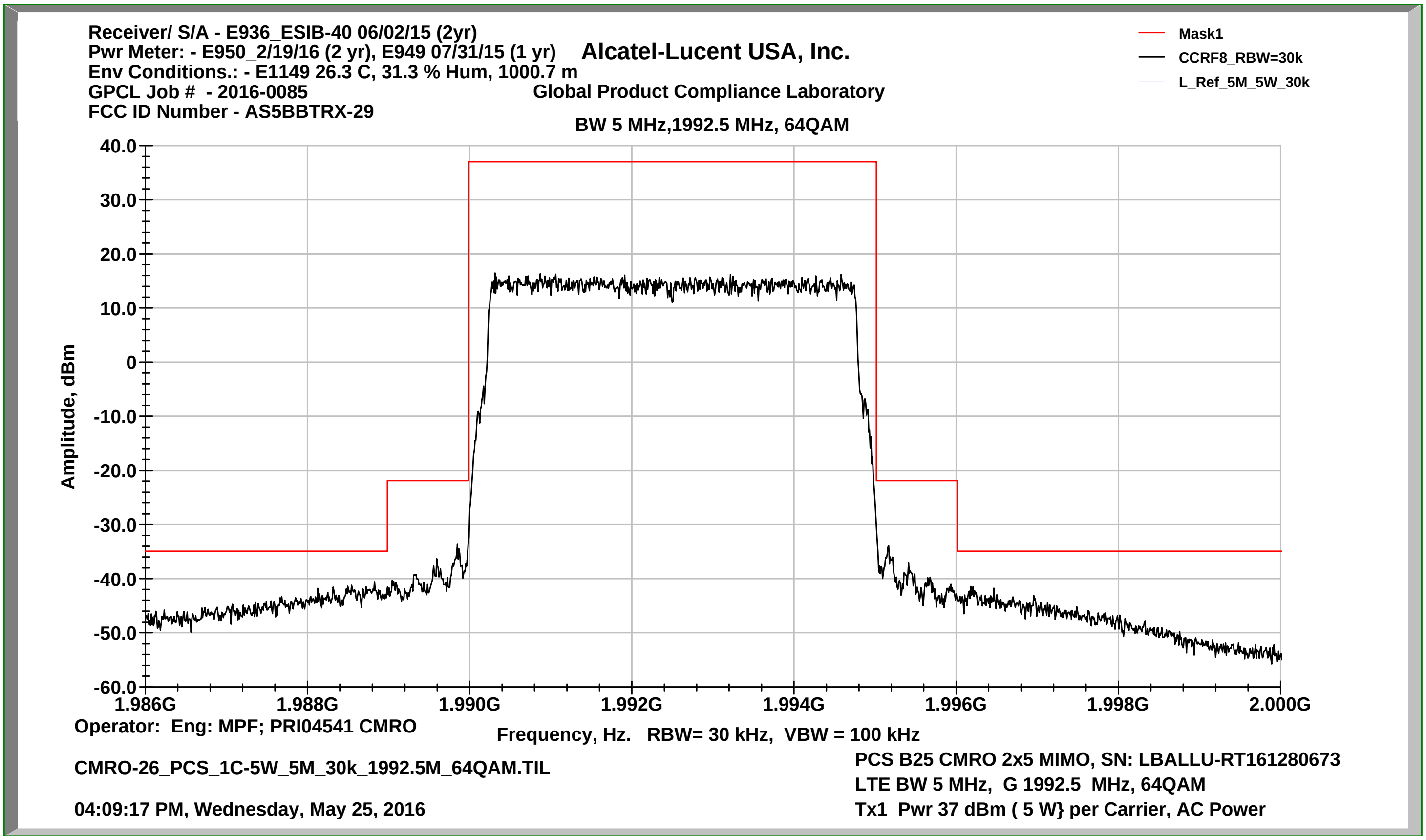
Test #1 Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz (Lowest Settable)

CMRO-01_PCS_1C-5W_5M_30k_1932.5M_QPSK+16QAM



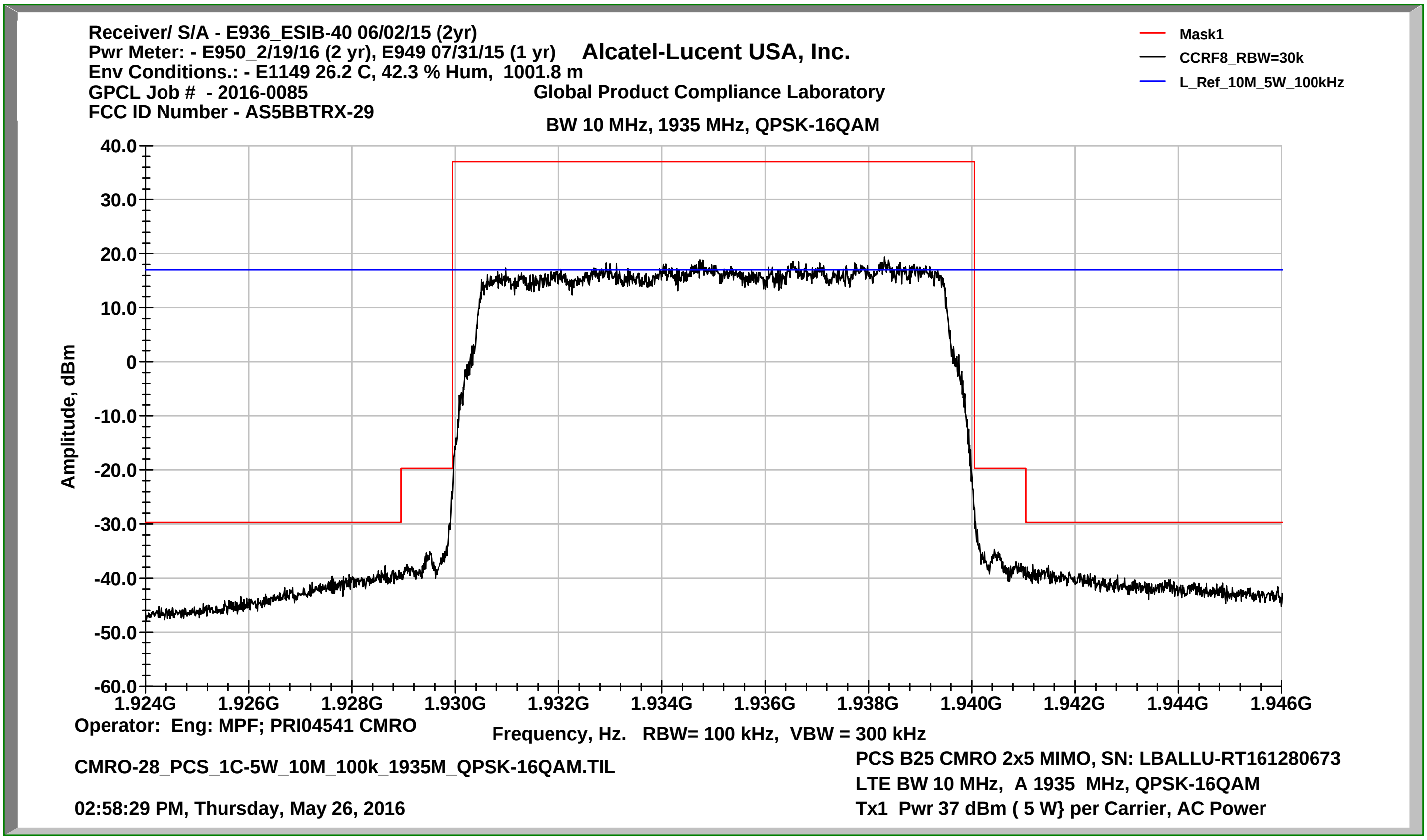
Test #2 Ch 1992.5 MHz, 64QAM, BW 5 MHz (Highest Settable)

CMRO-26_PCS_1C-5W_5M_30k_1992.5M_64QAM



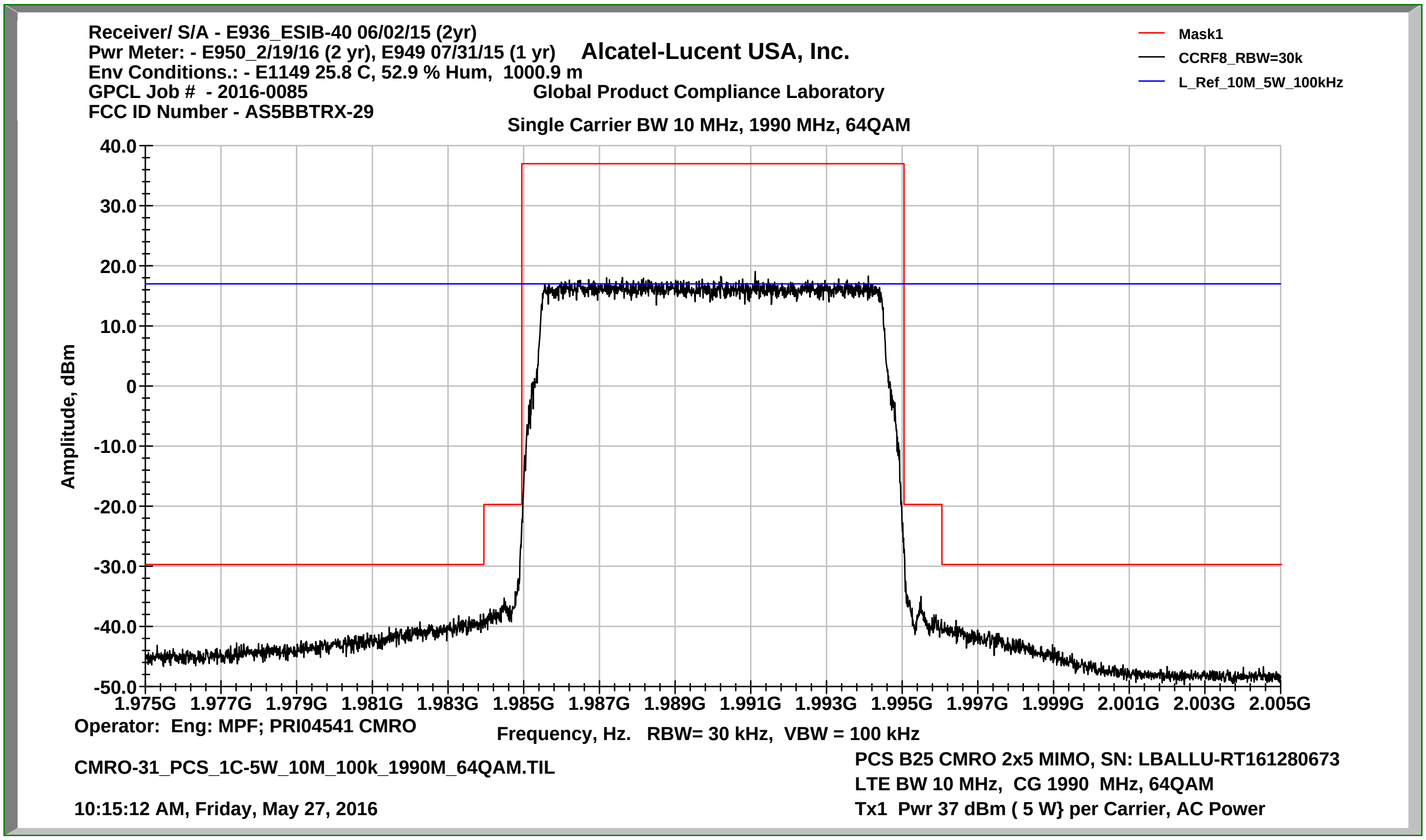
Test #3 Ch 1935 MHz, QPSK+16QAM, BW 10 MHz (Lowest Settable)

CMRO-28_PCS_1C-5W_10M_100k_1935M_QPSK-16QAM



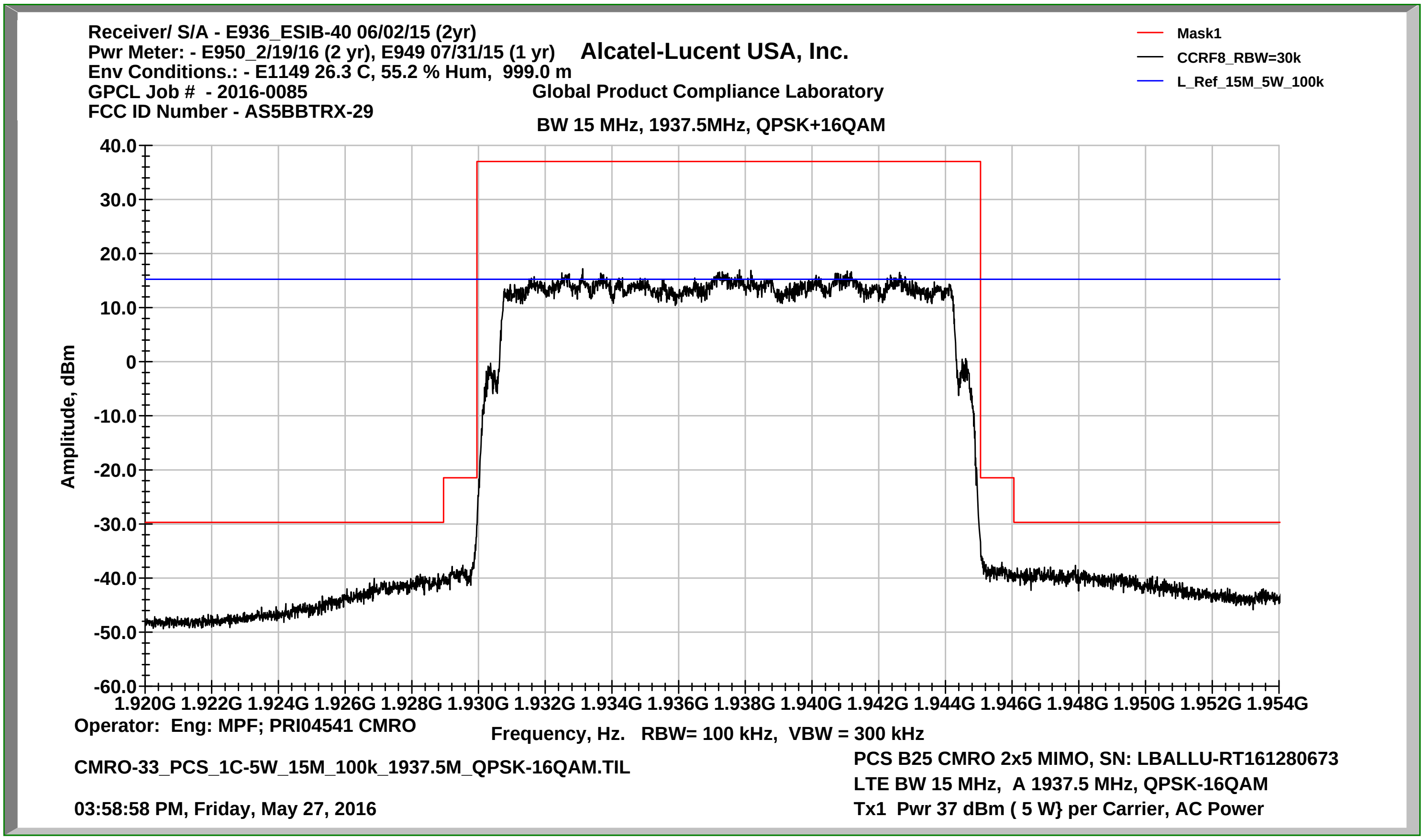
Test #4 CH 1990 MHz, 64QAM, BW 10 MHz (Highest Settable)

CMRO-31_PCS_1C-5W_10M_100k_1990M_64QAM



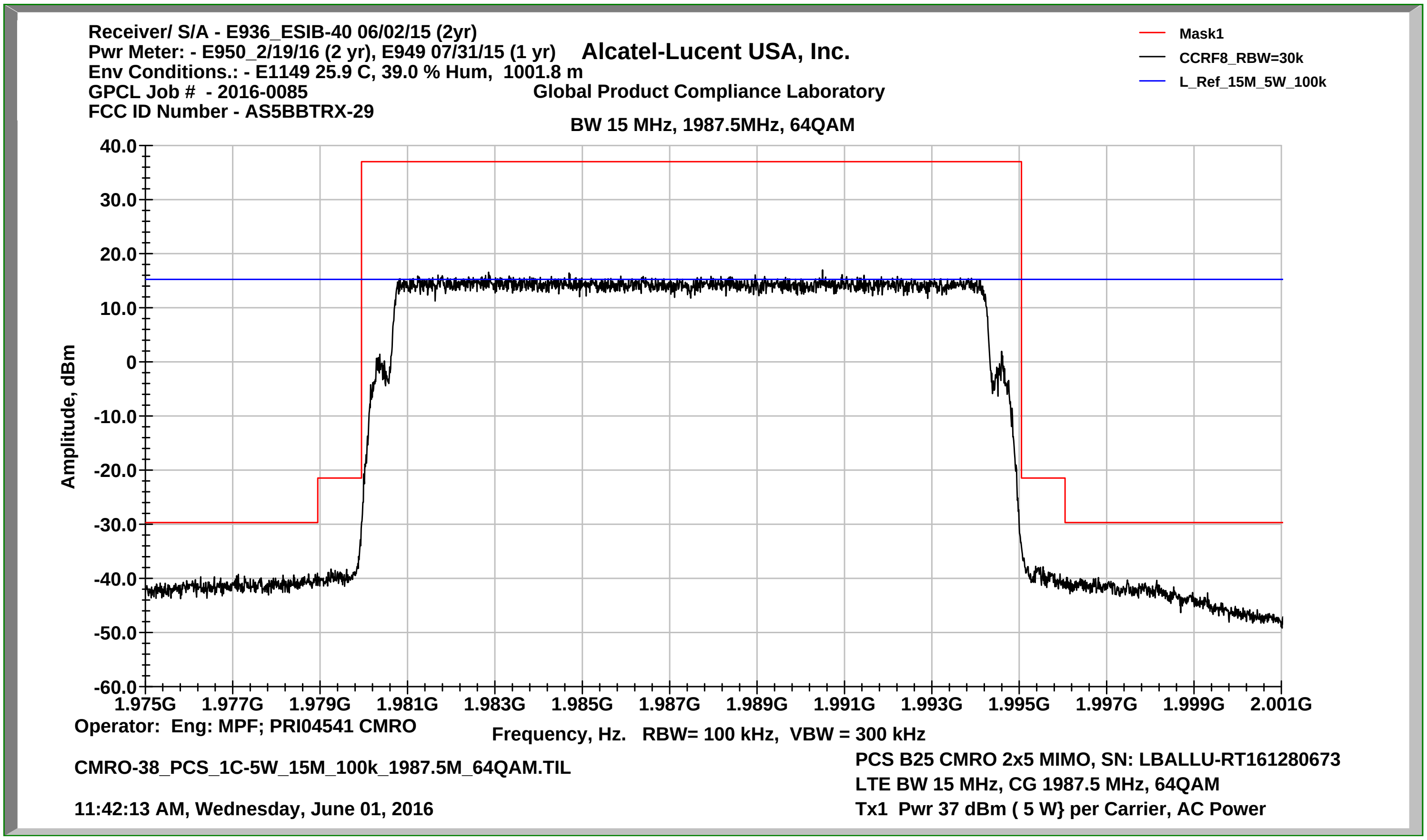
Test #5 Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz (Lowest Settable)

CMRO-33_PCS_1C-5W_15M_100k_1937.5M_QPSK-16QAM



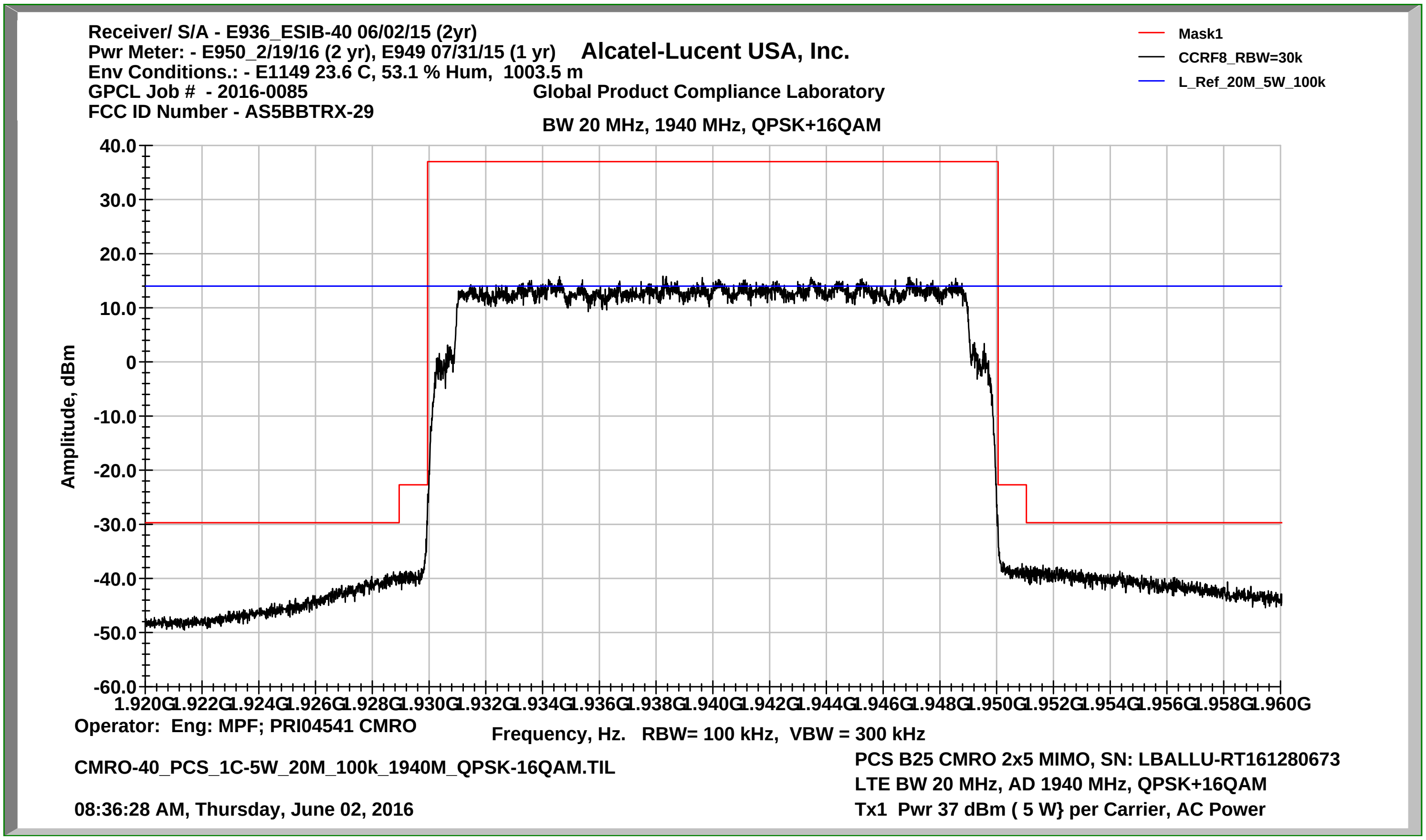
Test #6 Ch 1987.5 MHz, 64QAM, BW 15 MHz (Highest Settable)

CMRO-38_PCS_1C-5W_15M_100k_1987.5M_64QAM



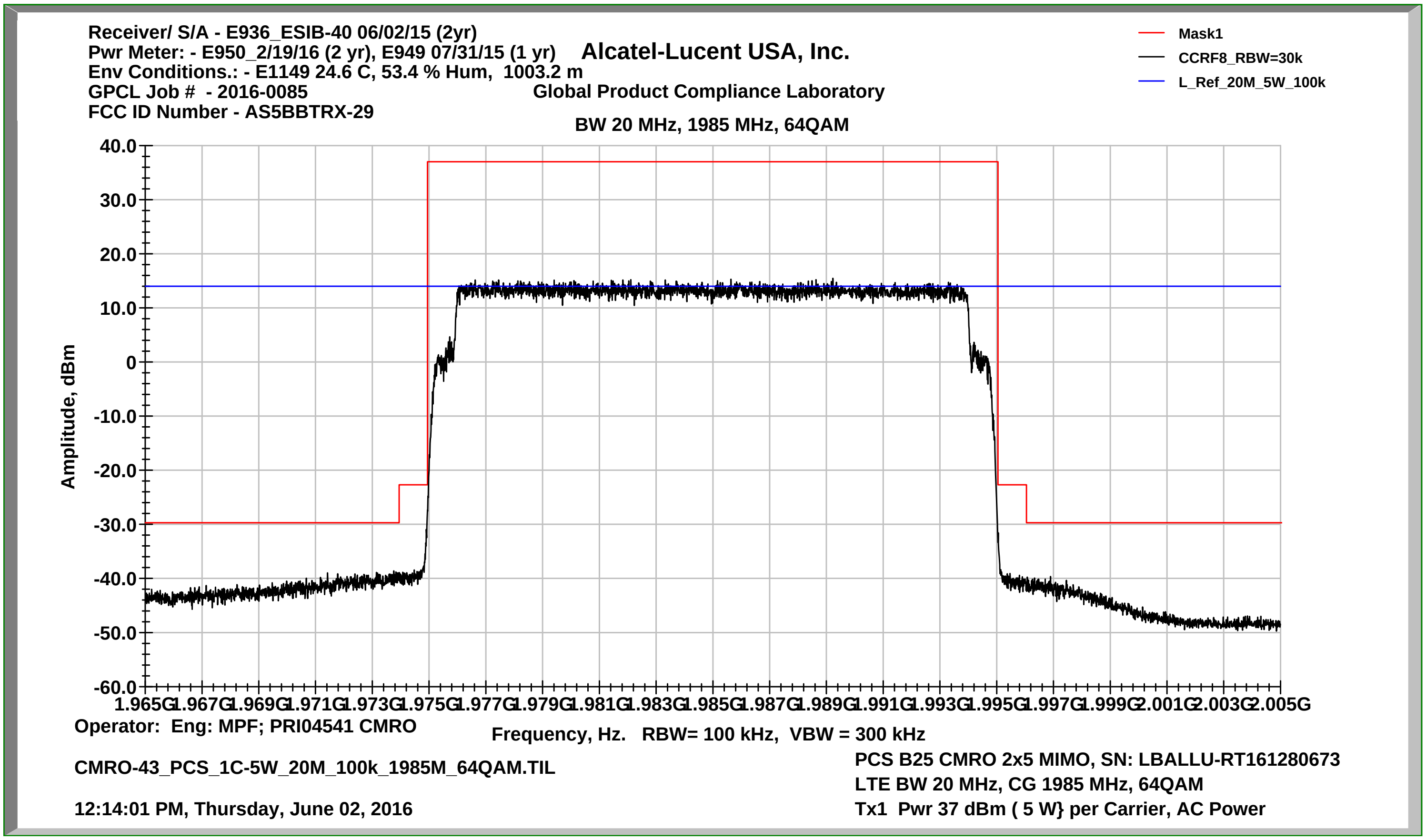
Test #7 Ch 1940 MHz, QPSK+16QAM, BW 20 MHz (Lowest Settable)

CMRO-40_PCS_1C-5W_20M_100k_1940M_QPSK-16QAM



Test #8 Ch 1985 MHz, 64QAM, BW 20 MHz (Highest Settable)

CMRO-43_PCS_1C-5W_20M_100k_1985M_64QAM



4.4 Section 2.1051 MEASUREMENT REQUIRED: SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

This test measures the emissions of spurious signals which may come from harmonic, parasitic, intermodulation and frequency conversion products and are outside the necessary bandwidth but exclude out-of-band emissions. The spurious emissions at the transmit antenna terminal were investigated from 10 MHz to the 10^{th} harmonic of the carrier, per Section 2.1057(a)(1). The emission limit is as previously stated in Part 24.238, as :

For greater than 1 MHz from the upper and lower edge of the measurement block/band:

37- [43 + 10 log 5W] – 10 log (Meas RBW/1 MHz) – 10 log N
Where, Meas RBW = 1 MHz and N = 2

The measurement configurations and carrier setup were same as in Section 4.3. The out-of-band emissions were measured using Total Integrated Laboratory Environment (TILE) EMI test software, by ETS-Lindgren.

The emission limits and the setting of measurement equipment for the unwanted emissions measurement were given in Table 4.3.3 and provided in Table 4.4.1, where per FCC CFR 47, Sections 2.1051 and 2.1057(c), **the spurious emissions attenuated more than 20 dB below the permissible value need not be reported.**

Table 4.4.1 Conducted Spurious Emissions Limit

Frequency of Emission (MHz)	Required Limit (2x2 MIMO) (dBm)	Reportable Limit (dBm)	Detector/RBW
10-20,000	-16	-36	Average/1MHz

The measurements were performed with a spectrum analyzer, which was calibrated in accordance with ISO 9001 process. The carrier power level at the antenna transmitting terminal was calibrated before the conducted spurious emissions testing for each test. The spectrum analyzer was set to a 1MHz resolution bandwidth. The RMS average detector was used. The measurement met the requirements in ANSI C63.26 which requires in 5.2.4.4.1 and 5.7 that the number of points in the sweep be > 2 × Span/RBW. The measurement met the requirements of ANSI C63.26 paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be > 2 × Span/RBW.

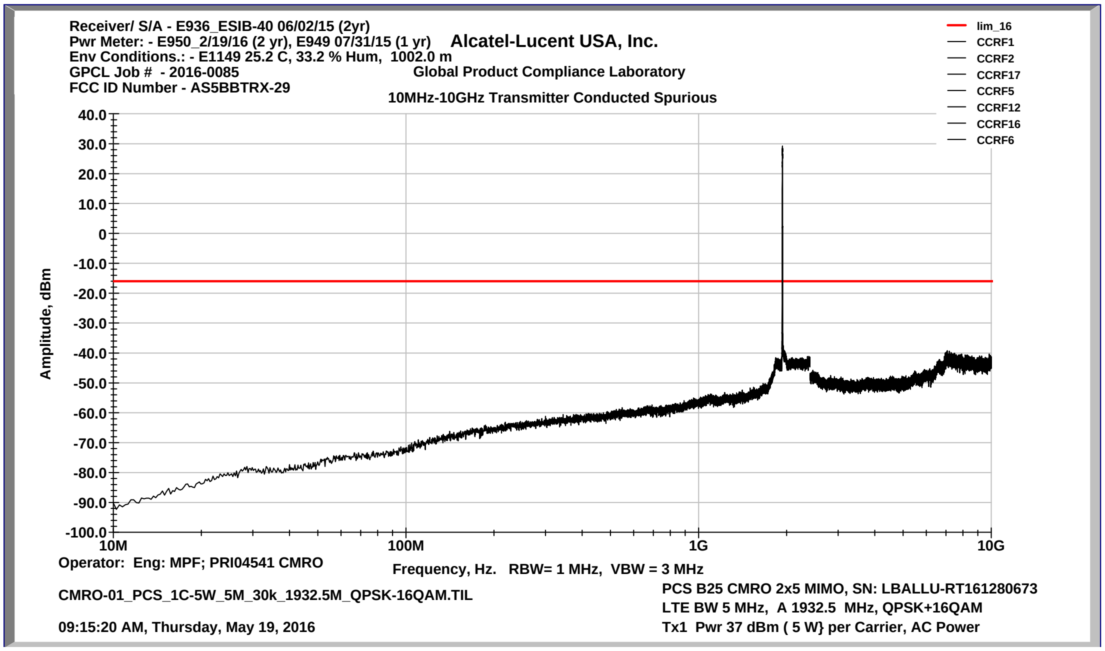
The spurious emissions in the frequency range measured are well under the required reportable emission limit for all carrier bandwidths with QPSK+16QAM and 64QAM modulations evaluated. Therefore, there are no reportable emissions.

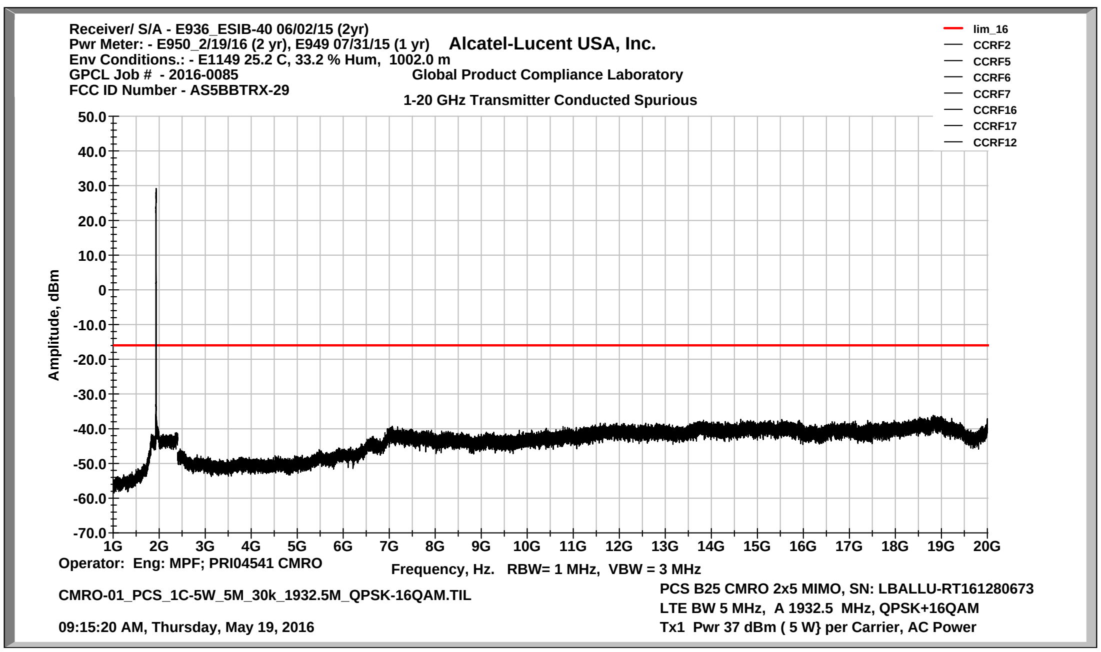
4.4.1 Results:

Over the required frequency spectrum investigated for the EUT, no reportable out-of-block spurious emissions were detected. The out-of-block spurious emissions in the entire spectrum investigated are under the required reportable emission limit. The measurement results demonstrate that the subject of the application is in full compliance with the Rules of the Commission. Sample measurements are displayed in the following data plot.

Test #1 Ch 1932.5 MHz, QPSK+16QAM, BW 5 MHz (Lowest Settable)

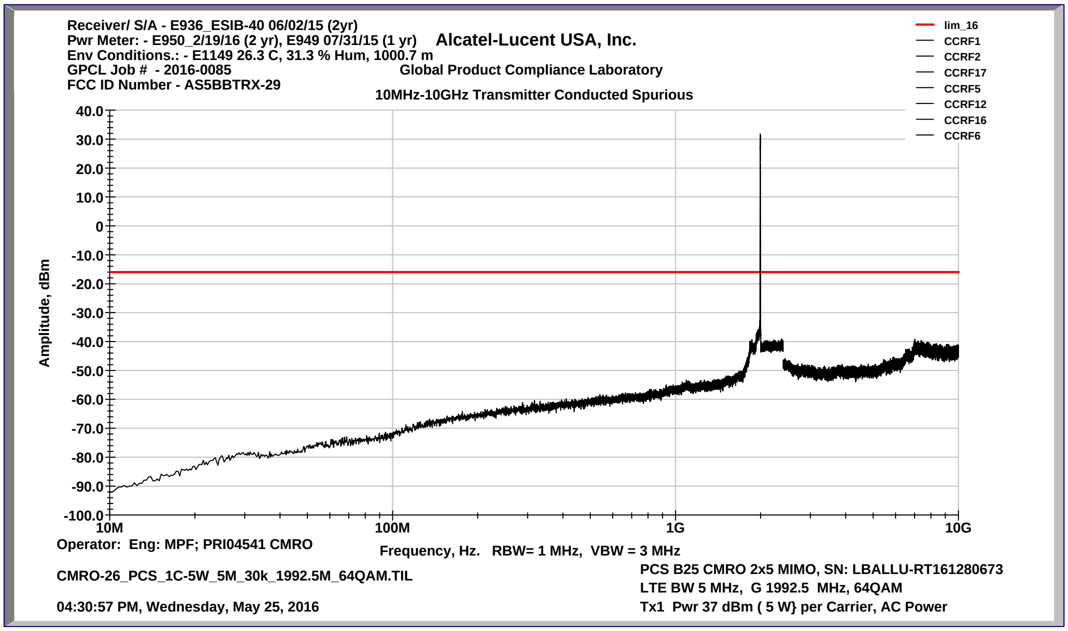
CMRO-01_PCS_1C-5W_5M_30k_1932.5M_QPSK-16QAM

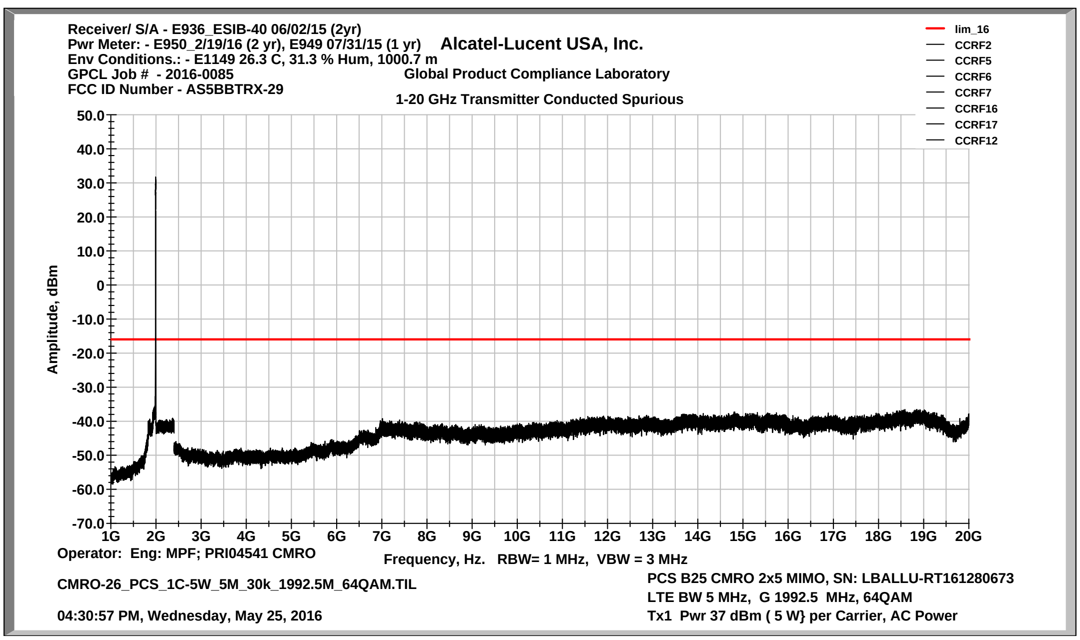




Test #2 Ch 1992.5 MHz, 64QAM, BW 5 MHz (Highest Settable)

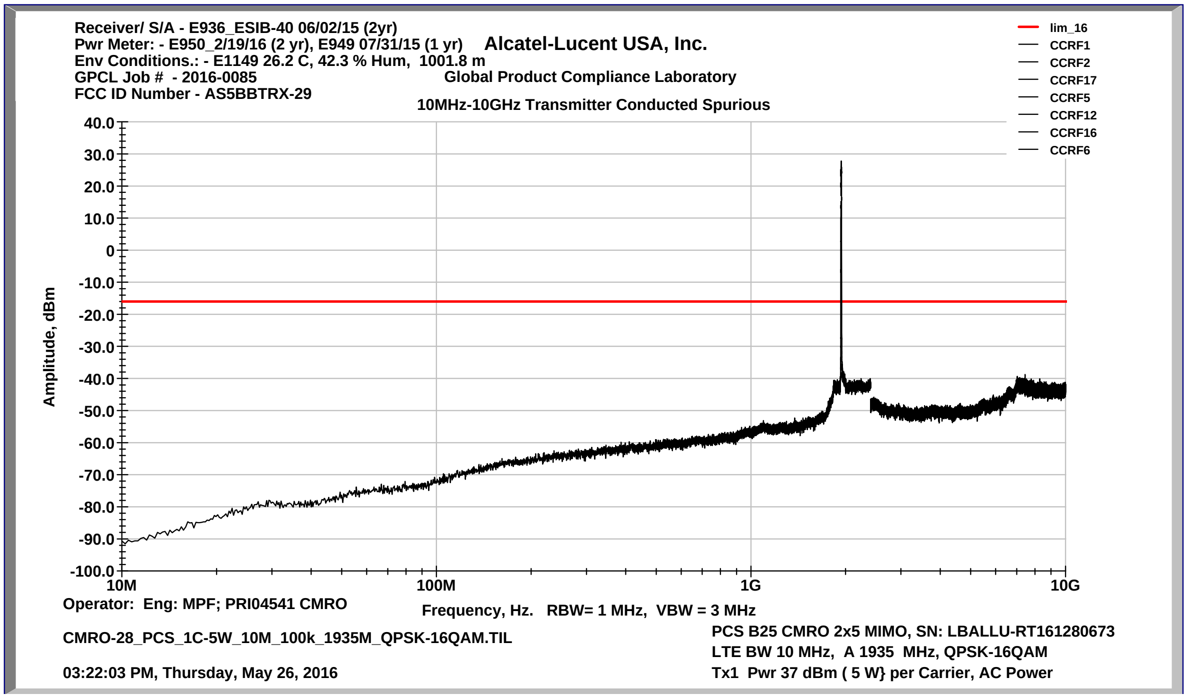
CMRO-26_PCS_1C-5W_5M_30k_1992.5M_64QAM

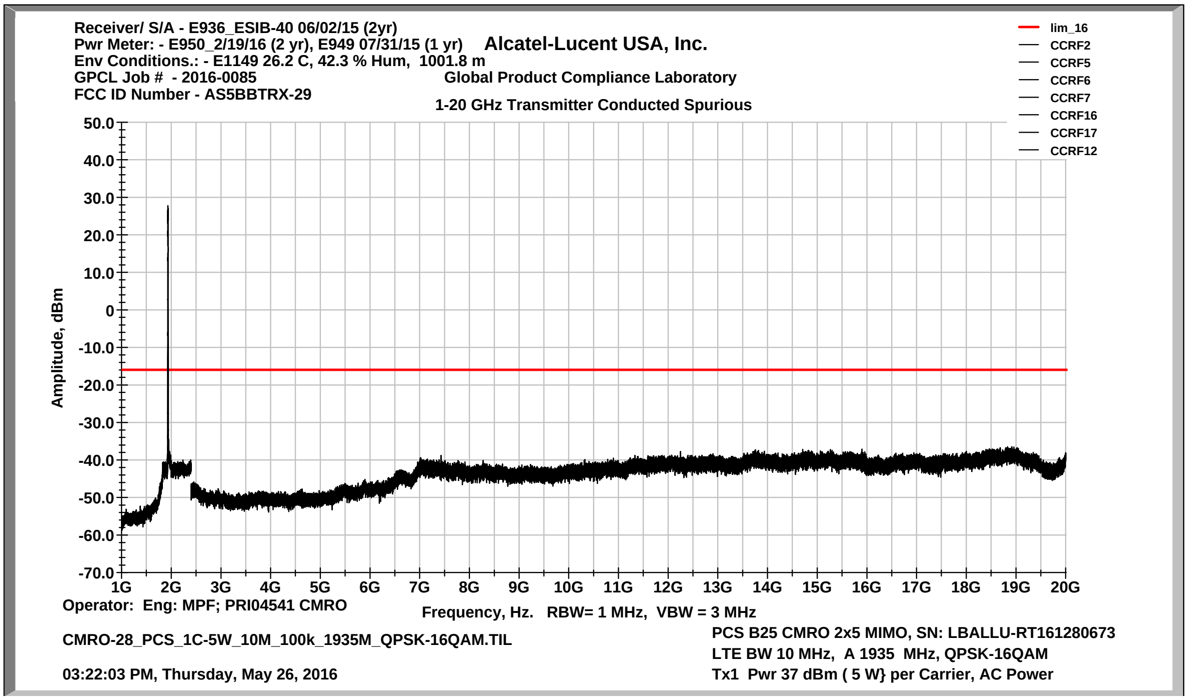




Test #3 Ch 1935 MHz, QPSK+16QAM, BW 10 MHz (Lowest Settable)

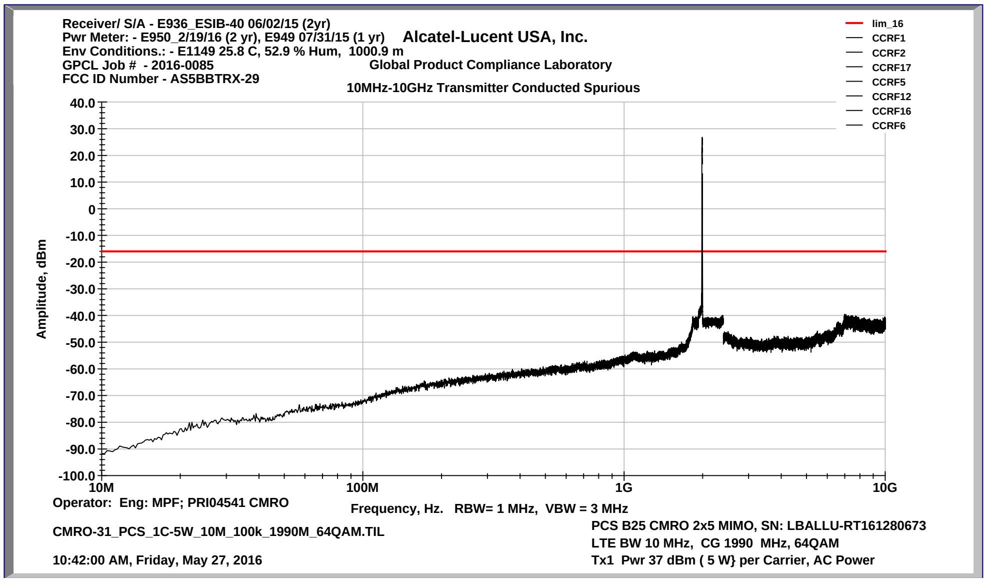
CMRO-28_PCS_1C-5W_10M_100k_1935M_QPSK-16QAM

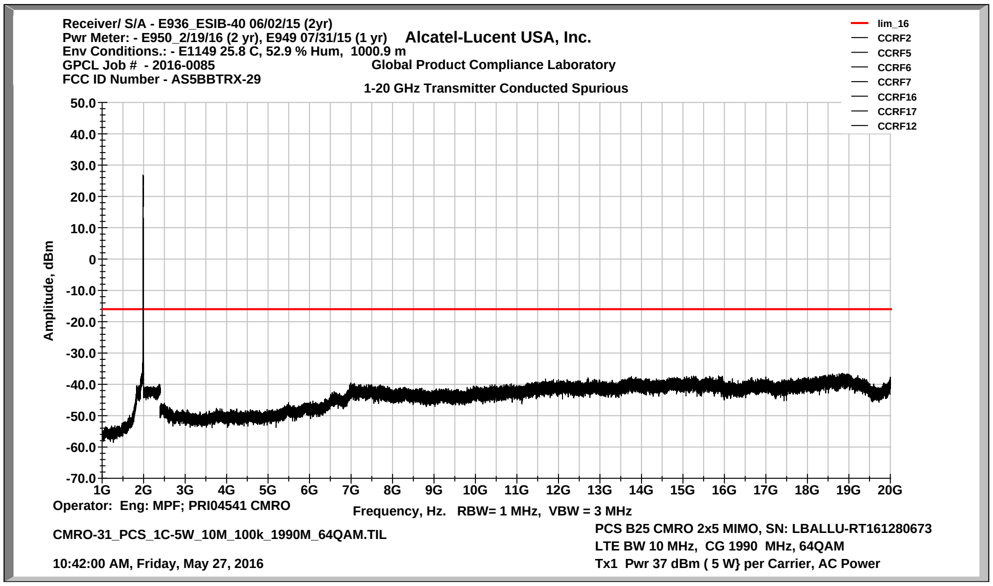




Test #4 CH 1990 MHz, 64QAM, BW 10 MHz (Highest Settable)

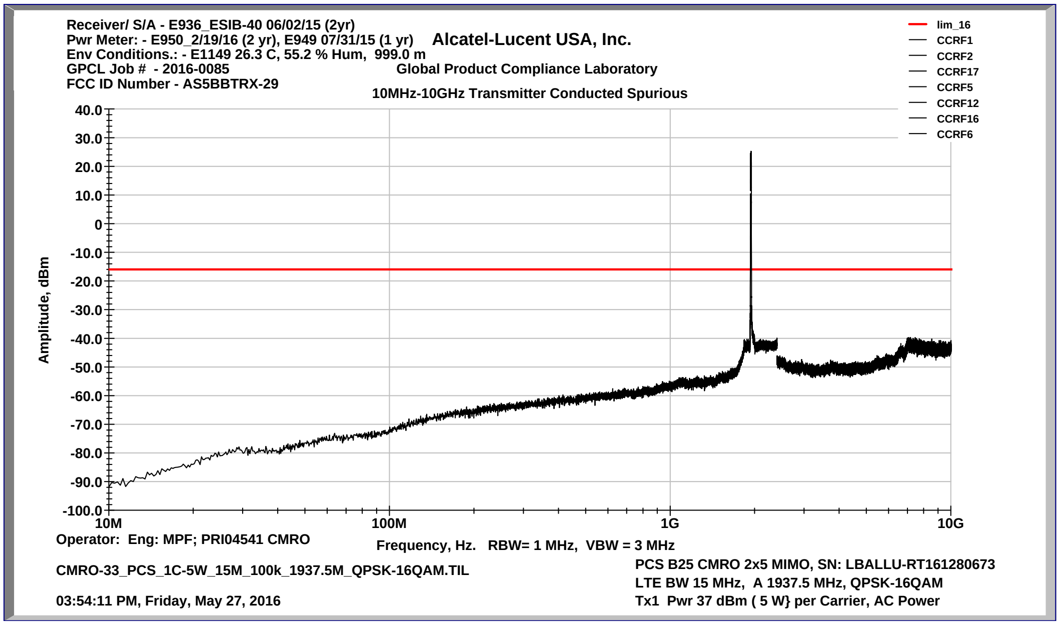
CMRO-31_PCS_1C-5W_10M_100k_1990M_64QAM

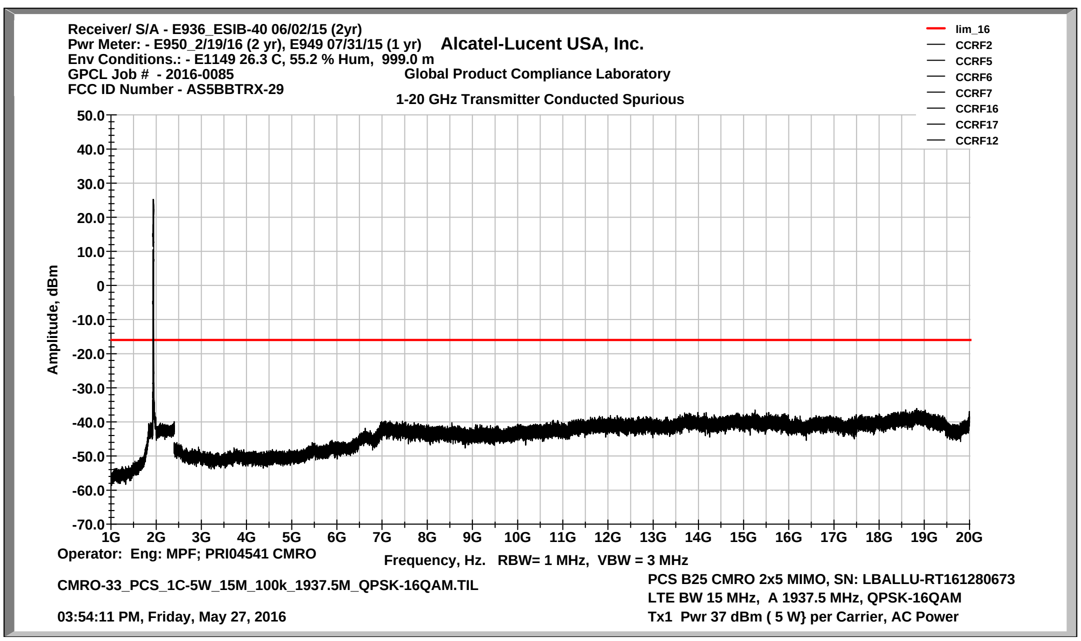




Test #5 Ch 1937.5 MHz, QPSK+16QAM, BW 15 MHz (Lowest Settable)

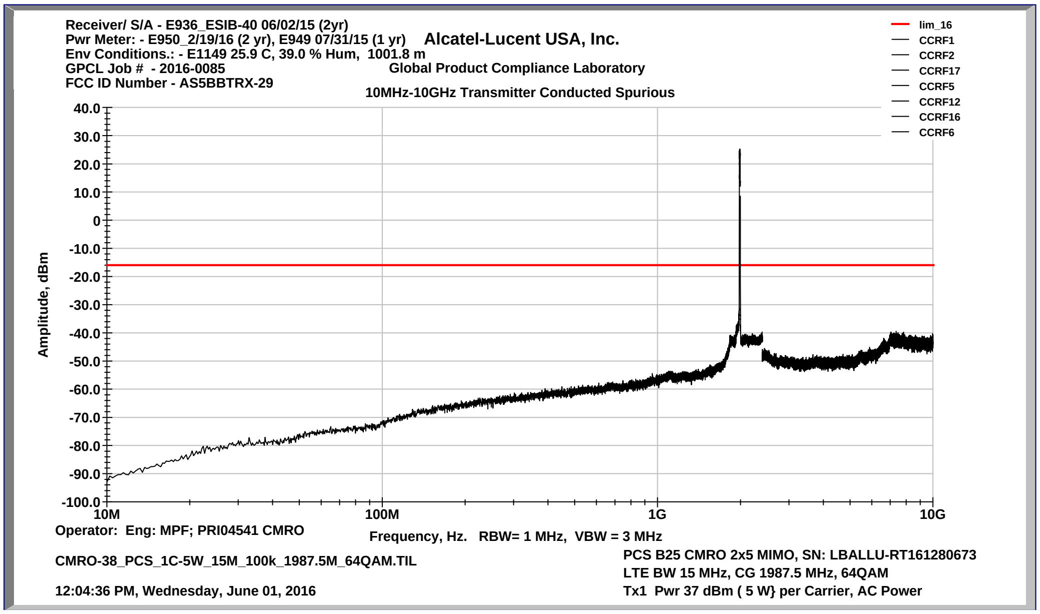
CMRO-33_PCS_1C-5W_15M_100k_1937.5M_QPSK-16QAM

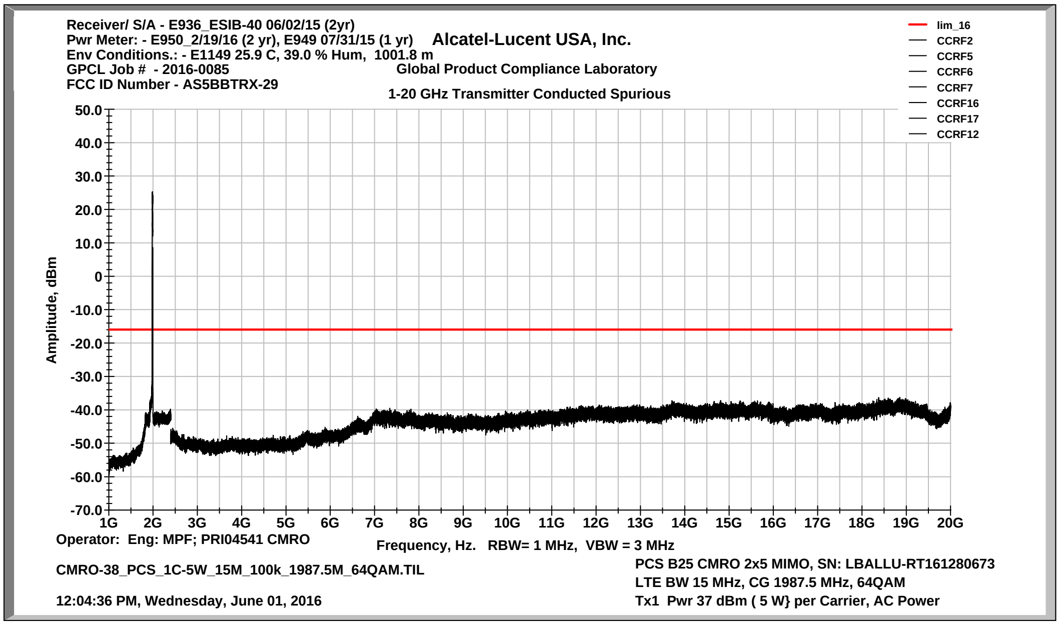




Test #6 Ch 1987.5 MHz, 64QAM, BW 15 MHz (Highest Settable)

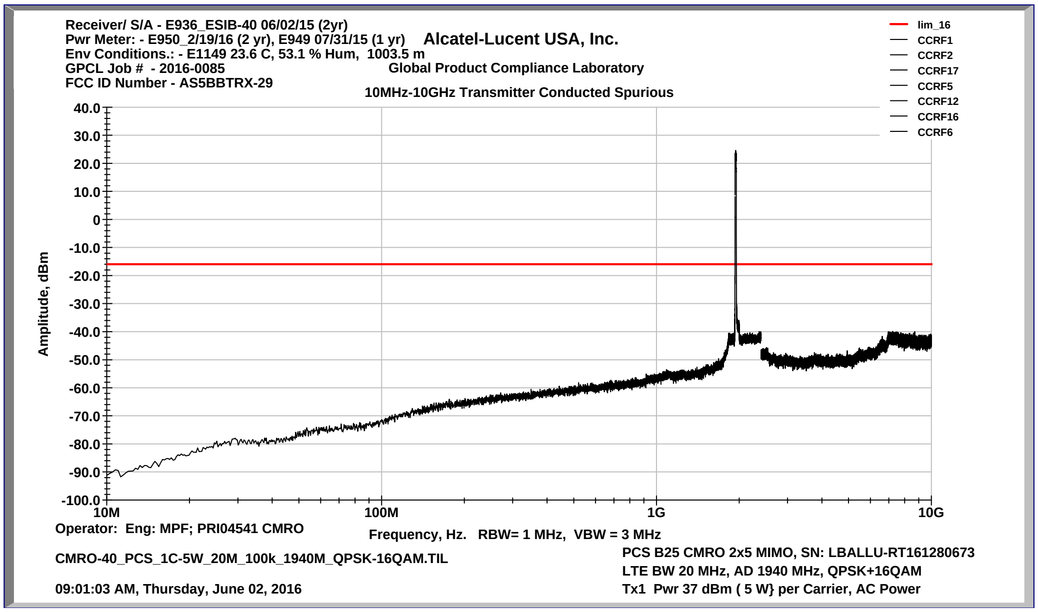
CMRO-38_PCS_1C-5W_15M_100k_1987.5M_64QAM

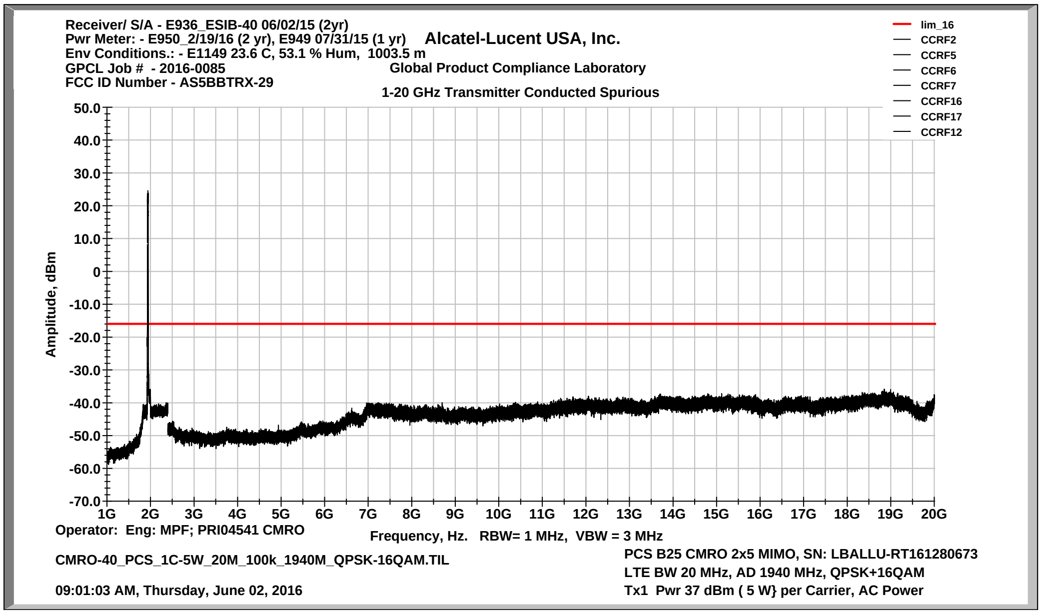




Test #7 Ch 1940 MHz, QPSK+16QAM, BW 20 MHz (Lowest Settable)

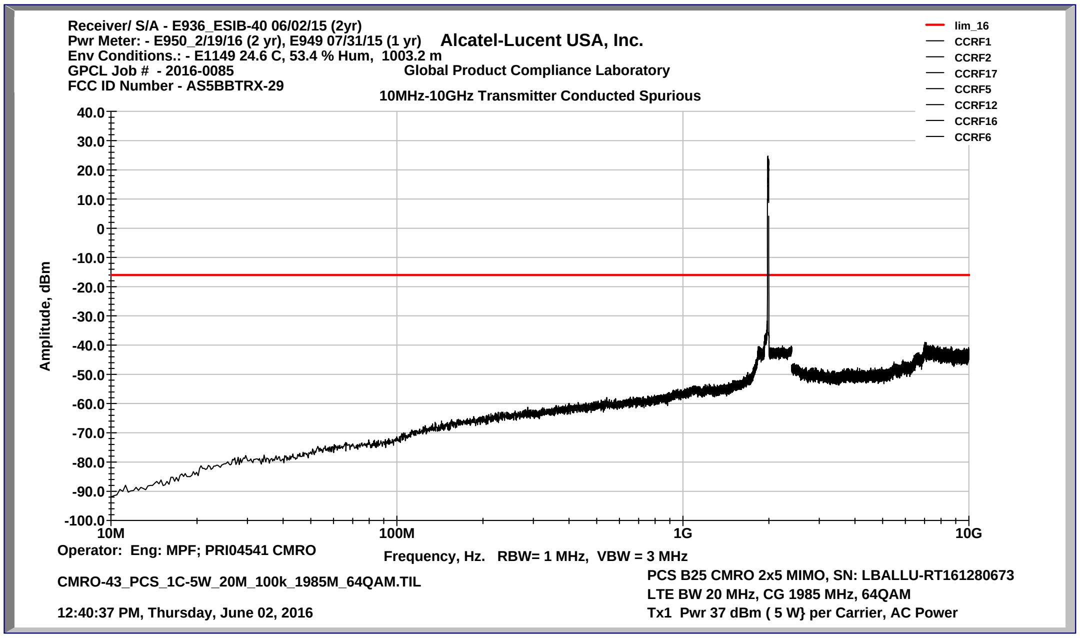
CMRO-40_PCS_1C-5W_20M_100k_1940M_QPSK+16QAM

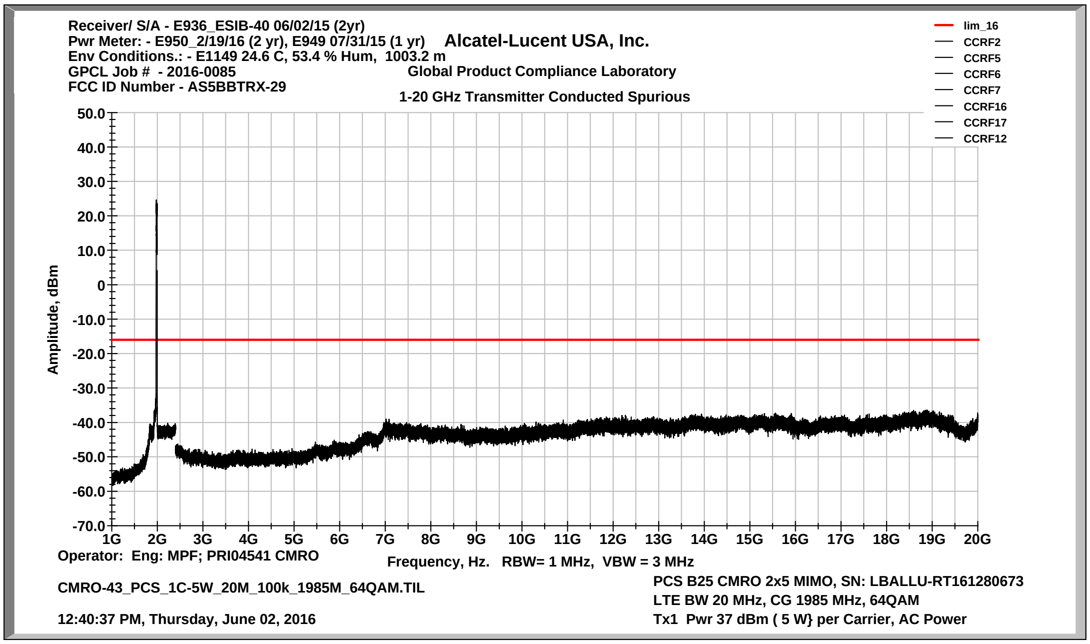




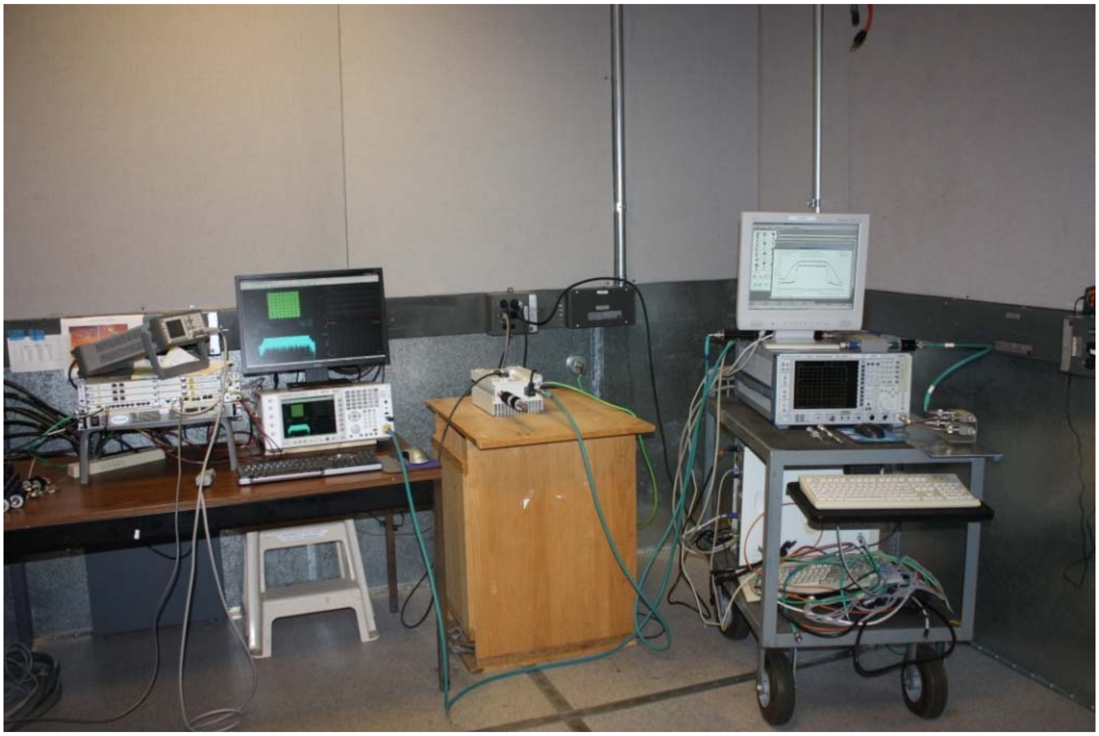
Test #8 Ch 1985 MHz, 64QAM, BW 20 MHz (Highest Settable)

CMRO-43_PCS_1C-5W_20M_100k_1985M_64QAM





Photograph of Test Setup for Occupied Bandwidth and Conducted Emissions Measurements



4.5 Section 2.1055 MEASUREMENT REQUIRED: FREQUENCY STABILITY

This measurement evaluates the frequency difference between the actual transmit carrier frequency and the specified transmit frequency assignment. Only the portion of the transmitter system containing the frequency determining and stabilizing circuitry need be put in an environmental chamber and subjected to the temperature variation test per FCC Section 2.1055. The unit which provides baseband signals, such as BBU (baseband unit), can be located outside the chamber if it is a separated unit.

The frequency stability testing was conducted on an outdoor AC version of the EUT. The outdoor system was designed for a wider temperature range than a comparable indoor product. The stability of the output frequency of the EUT was measured at its antenna transmitting terminal: 1) from −30 °C to +50 °C in 10 °C steps at the rated supply voltage; and 2) at 85% to 115% of the nominal primary supply voltage, per Section 2.1055.

The EUT was configured as in the normal mode of the installation and operation and was set to transmit one LTE carrier per chain at the maximum rated RF power. The carrier frequency was measured at one antenna terminal at each temperature and each supply voltage by a signal analyzer, respectively. All other carriers from unused antenna terminals were transmitting to non-radiating 50 Ω resistive loads. In addition, the transmit power was monitored by the power meter to ensure proper cell performance throughout the test interval.

The requirements of the frequency stability are provided below.

Table 4.5.1 Frequency Stability Requirements

Carrier Center Frequency 1962.5 MHz

Standards	Requirements	Max Frequency Deviation Limit (Hz)
FCC Part 24.235	the fundamental emissions stay within the authorized bands of operation	±98.125 Hz
3GPP TS 36.104	±0.050 ppm for LTE (observed over one period of one subframe (1 ms)) carrier	±98.125 Hz

The maximum frequency derivations (Δf) at the antenna terminal from the assigned carrier frequency at each temperature and supply voltage are summarized in the following measurement report.

4.5.1 Frequency Stability Results:

The maximum frequency deviations measured at the antenna terminal of the EUT due to temperature and primary supply voltage changes are within the ±0.05ppm requirement. The EUT demonstrated full compliance with the Rules of the Commission.

The content of the internal frequency stability test report follows:

4.5.1.1 Frequency Stability Testing

Frequency Stability Testing was completed on PRI04541 – 9768 CMRO B25/B2 2x5W AC with CF 1962.5 MHz using an external LTE BBU. The testing was performed from 06/01/2016 through 06/02/2016 on the B25/B2 CMRO, which was located in the T-16 Thermal chamber of the GPCL test facility located in Bldg 4, Room 4-280, Murray Hill, NJ, and witnessed by Joe Bordonaro from GPCL. The temperatures to which the UUT were subjected to comprised high temperature (+50ºC, system ambient) and low temperature (-30ºC system ambient). The system level Frequency Stability testing of the UUT yielded results in compliance with established design criteria.

Frequency Stability performance was verified by measuring Frequency Tolerance at EAC using an MXA Signal Analyzer. Frequency Tolerance is a measurement of the difference between the actual transmit frequency and the assigned frequency (1962.5MHz).

UUT: PRI04541 – 9768 B25/B2 CMRO 2x5W, SN: LBALLU-RT161280679.

Instrument Used for Measurement

Instrument Type	Serial Number	Vendor	Cal Due Date
MXA Signal Analyzer	MY5200375	AGILENT N9020A	11/17/2016
Power Meter	GB371700388	HP EPM-442A	01/07/2017
Power Sensor	US37291096	HP 8482A	03/02/2017
Power Sensor	3318A90689	HP 8481A	02/22/2017
Multimeter	JP35001820	HP 971A	06/08/2017
Thermal Logger	S5JC04069	YOKOGAWA MV2000	03/05/2017
GPS Receiver	KR93200773	SYMMETRICOM 58503B	No Cal Req.
Power supply	04243	BEHLMAN AC Source Model BL1350	No Cal Req.

Frequency Block Tested: ***PRI04541 - 9768 CMRO B25/B2 2x5W-AC (CF = 1962.50MHz)***

1. (a)Set the power supply to nominal Voltage. (b) Record the frequency at ~25°C. (c)Raise EUT operating temperature to 50°C. (d)Record the frequency difference. (e) Repeat step (d) at each 10°C step down to -30°C. Result will be 10 readings and take temperature readings to establish thermal stability at each point.

Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.365
0.5	0.556
1.0	0.481
1.5	0.801
2.0	0.514
2.5	0.490
3.0	0.530
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.441
0.5	0.862
1.0	0.315
1.5	0.178
2.0	0.201
2.5	1.082
3.0	0.340
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.846
0.5	0.448
1.0	0.387
1.5	0.608
2.0	0.214
2.5	0.199

3.0	0.423
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.692
0.5	0.468
1.0	0.750
1.5	0.182
2.0	0.301
2.5	0.820
3.0	0.531
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.422
0.5	0.321
1.0	0.759
1.5	0.303
2.0	0.655
2.5	0.512
3.0	0.181
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	0.662
0.5	0.430
1.0	0.476
1.5	0.721
2.0	0.258
2.5	0.491
3.0	0.584
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	0.646
0.5	0.463
1.0	0.553
1.5	0.344
2.0	1.012
2.5	0.238
3.0	0.475
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	0.510
0.5	0.303
1.0	0.436
1.5	0.399
2.0	0.583
2.5	0.204
3.0	0.171
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	0.307
0.5	0.268
1.0	0.932
1.5	0.543
2.0	0.489
2.5	0.775
3.0	0.803
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	0.531
0.5	0.214
1.0	0.977
1.5	0.369
2.0	0.713
2.5	0.460
3.0	0.570
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.227
0.5	0.362
1.0	0.659
1.5	0.301
2.0	0.573
2.5	0.441
3.0	0.924
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.267
0.5	0.532
1.0	0.428
1.5	0.566
2.0	1.127
2.5	0.863
3.0	0.505
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.499
0.5	0.512
1.0	0.642
1.5	0.161
2.0	0.250
2.5	0.318
3.0	0.420
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.682
0.5	0.405
1.0	0.552
1.5	0.225
2.0	0.616
2.5	0.192
3.0	0.238
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.447
0.5	0.250
1.0	0.357
1.5	0.665
2.0	0.533
2.5	0.406
3.0	0.528
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.493
0.5	0.606
1.0	0.368
1.5	0.545
2.0	0.180
2.5	0.475
3.0	0.507
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.231
0.5	0.462
1.0	0.711
1.5	0.212
2.0	0.584
2.5	0.785
3.0	0.321
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.298
0.5	0.457
1.0	0.912
1.5	0.469
2.0	1.308
2.5	0.917
3.0	1.021
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.017
0.5	0.897
1.0	0.771
1.5	0.268
2.0	0.513
2.5	0.661
3.0	0.924
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.817
0.5	1.012
1.0	0.318
1.5	0.162
2.0	0.724
2.5	0.411
3.0	0.573
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Upon return to +25°C.

2. At ambient, vary voltage to +15% and -15% of nominal VAC and record frequency difference.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 208VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.255
0.5	0.565
1.0	0.416
1.5	0.375
2.0	0.602
2.5	0.813
3.0	0.501
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at +15% of Nominal Voltage, 239.20VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.430
0.5	0.153
1.0	0.573
1.5	0.244
2.0	0.405
2.5	0.306
3.0	0.628
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, 176.80VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.346
0.5	0.260
1.0	0.641
1.5	0.279
2.0	0.459
2.5	0.187
3.0	0.218
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

Upon return to +25°C.

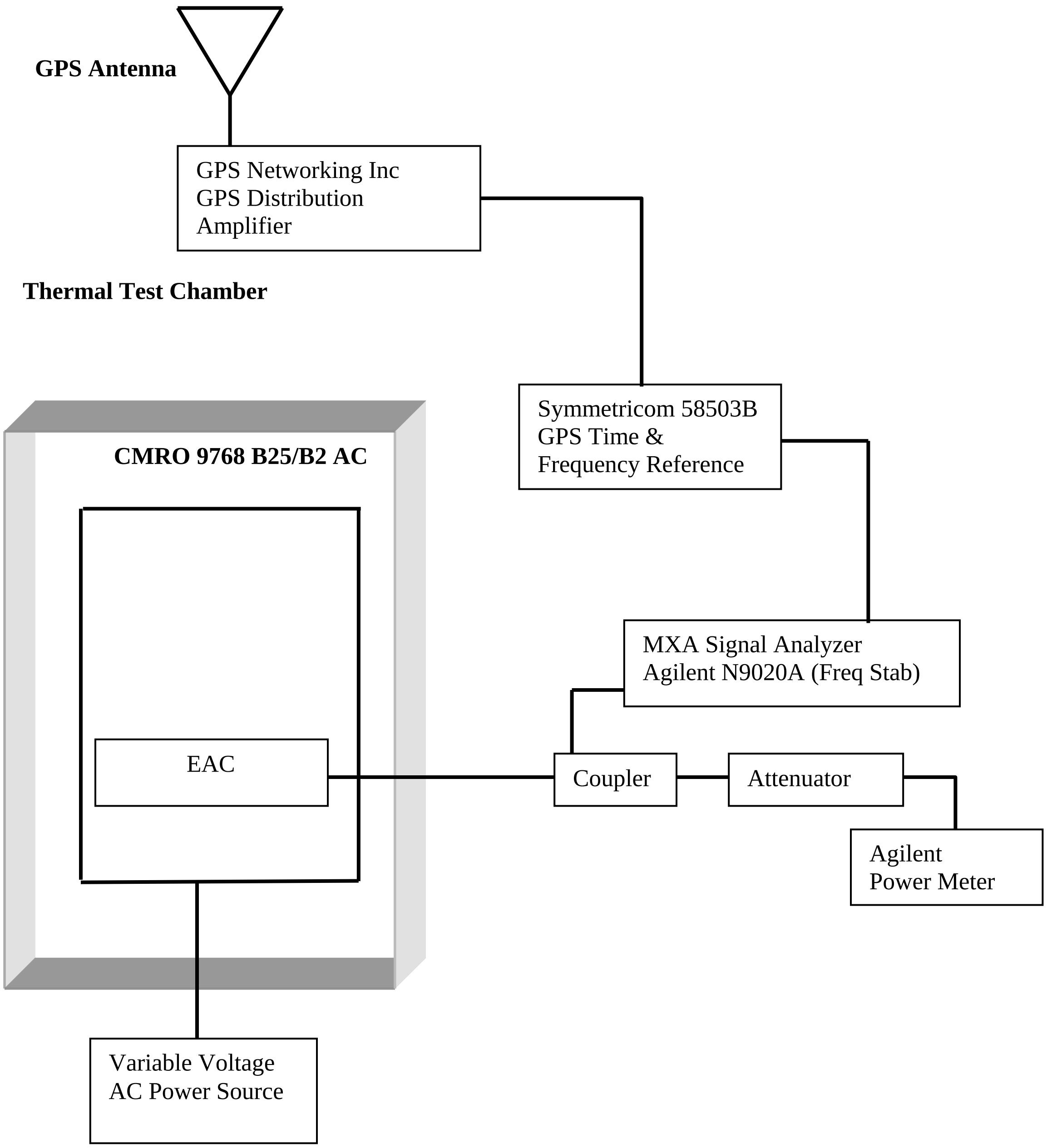
3. At ambient, vary voltage to +15% and -15% of nominal VAC and record frequency difference.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 115VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.872
0.5	0.737
1.0	0.245
1.5	0.431
2.0	0.235
2.5	0.174
3.0	0.708
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

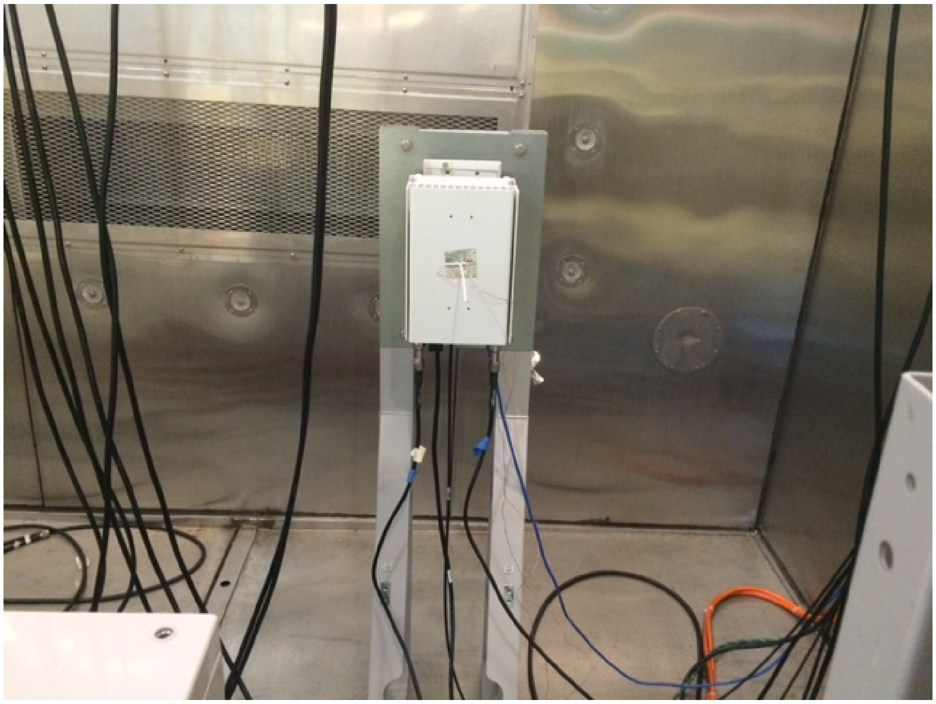
Transmit Frequency Deviation at +25°C at +15% of Nominal Voltage, 132.25VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.432
0.5	0.415
1.0	0.254
1.5	0.806
2.0	0.172
2.5	0.309
3.0	0.394
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

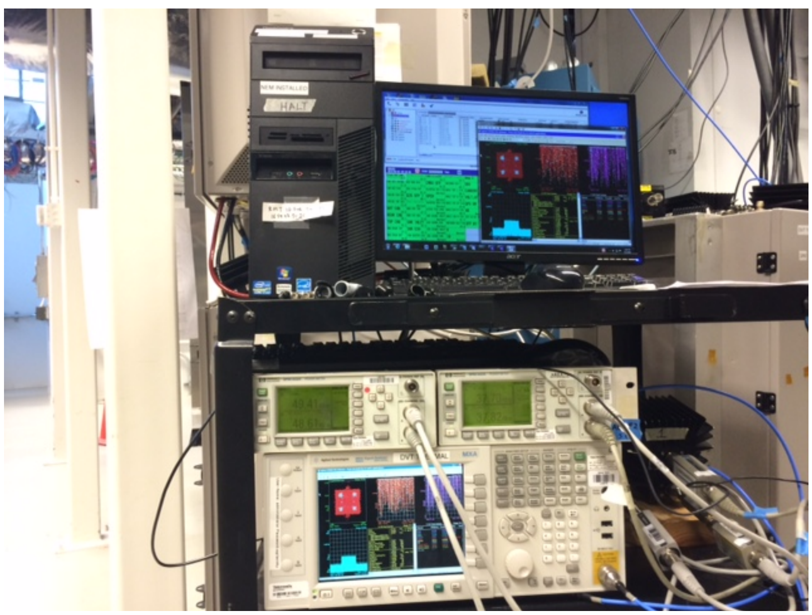
Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, 97.75VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.574
0.5	0.712
1.0	0.205
1.5	0.401
2.0	0.507
2.5	0.802
3.0	0.545
FCC SPECIFICATION	±1962.50 MHz (±0.05ppm) ±0.05ppm = ±98.125Hz
FCC RESULT	PASS

FIGURE 1: TEST SET-UP



Setup Photos:





4.6 Section 2.1053 MEASUREMENT REQUIRED: FIELD STRENGTH OF SPURIOUS RADIATION

This measurement evaluates the spurious emissions that may be radiated directly from the EUT cabinet, circuits or power leads under normal conditions of installation and operation. The EUT shall be investigated from 30 MHz to the 10th harmonic of the carrier, per Section 2.1057(a)(1).

The EUT transmits in the 1930 – 1995 MHz frequency band with LTE technology and 2x2 MIMO. It was configured as in the normal mode of the installation and operation with the maximum power output per Table 4.6.1. The test model used for configuring the LTE carrier was described in Section 4.3. All carriers were transmitting to non-radiating 50 Ω resistive loads.

Table 4.6.1 EUT Configurations

Config No	No of Carriers/Port	Tx1 (CH/freq)	Tx2 (CH/freq)	Power/c (dBm)	Carrier BW (MHz)	Modulations
1	1	1932.5 MHz	1932.5 MHz	37	5 MHz	QPSK

The emission limits and the setting of measurement equipment for the spurious emissions measurement were given in Section 4.3. FCC sections 2.1051 and 2.1057(c) specify that the **spurious emissions attenuated more than 20 dB below the permissible value need not be reported.** By using the relation between the electric field strength of an ideal dipole and its excitation power given in Reference Data for Radio Engineers, page 676, 4th edition, ITT Corp., the emission limit calculated for electric field strength and its reportable limit equal:

Table 4.6.2 Calculated Radiated Spurious Emission Limit in Electrical Field Strength

Frequency Range (MHz)	Measurement Distance (m)	Required E Limit (2x2 MIMO) (dBμV/m)	Reportable E Limit (dBμV/m)	Detector/RBW
10-20,000	3	81.1	61.1	Average/1MHz

The field strength of radiated spurious emissions measured was determined by

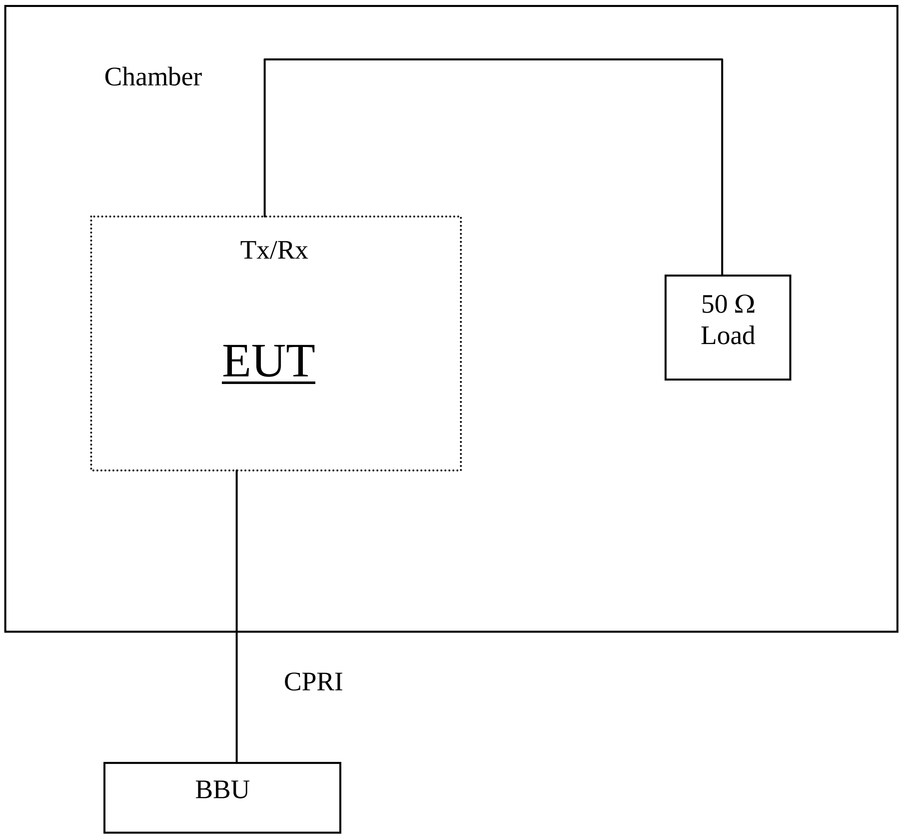
$$E\,(\text{dB}\mu\text{V/m}) = V_{meas}\,(\text{dB}\mu\text{V}) + \text{Cable Loss (dB)} + \text{Antenna Factor (dBi/m)}.$$

Field strength measurements of radiated spurious emissions were made at a semi anechoic room of Global Product Compliance Laboratories of Nokia Murray Hill, which was detailed in Section 6. The recommendations of ANSI C63.4 and ANSI C63.26 were followed for EUT testing setup, cabling, and measurement approach and procedures. All the measurement equipment used, including antennas, were calibrated in accordance with ISO 9001 process. The EUT setup diagram is given in the Figure 4.6.1. The minimum margin measured per Table 4.6.2 is more than 20dB below the required limit.

4.6.1 Field Strength of Radiated Emissions Results:

The smallest passing margin measured was for an emission frequency 279.339 MHz at 37.87 dBμV/m, which is more than 43 dB below the required limit. Therefore, over the frequency spectrum investigated **no reportable radiated spurious emissions** were detected. The measurement results of FDD RRH for Asset 1.0 AWS-3 Band with Cast DSBJ Enclosure and Cast Mobi Filter (LTE RFAssets)the EUT, subject of this application, demonstrate the full compliance with the Rules of the Commission.

Figure 4.6.1 Test Set-Up for Measurement of Radiated Spurious Emissions



4.7 LIST OF TEST EQUIPMENT

Table 5.1 List of Test Equipment Used

Antenna Port Measurement Equipment

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Extech	SD700	Q752757	Data Logger	Baro Humidity Temp Data Logger	E1149	10/3/2014	24	Active
Rohde & Schwarz	ESIB40	100119	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBM	E936	6/2/2015	24	Active
Agilent Technologies	N9020A	MY48011791	MXA Signal Analyzer	20Hz-26.5GHz	E831	2/23/2016	24	Active
Agilent Technologies	N1921A	MY45101984	Power Meter	P-Series	E950	2/19/2016	24	Active
Agilent Technologies	N1921A	MY45242502	Power Sensor	-35 - +20 dBm 50 MHz -18 GHz	E949	7/31/2015	12	Active
TDK	GEN-60-25	14H9764AA	Power Supply	DC Power Supply 60 Volts 25 Amps	E1203		0	Active
Agilent Technologies	N5230C	MY49000897	Network Analyzer	10 MHz - 40 GHz	E896	8/15/2014	24	Active

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Trilithic	5HC2850/18050-1.8-KK	PCS-HPF-10	High Pass Filter	PCS	E1132 E987		ICO	Active
Trilithic	10LC1790-3-AA	PCS-LPF-10	Low Pass Filter	PCS	E979		ICO	Active
Agilent Technologies	772D	MY29586115	Directional Coupler	Dual 2-18 GHz	E1003		ICO	Active
MCE/Weinschel	6530-6-34-LIM	BN3217	Attenuator DDC Test Port	6dB DC-18GHz 25 W	E1021		ICO	Active
Weinschel	66-30-34	BH6644	Attenuator DDC Input	30 dB DC-18GHz 150 W			ICO	Active
Hewlett Packard	8495B	MY41110681	Attenuator, Variable Step	Step DC-4GHz 0-100dB	E1045		ICO	Active
Hewlett Packard	8494B	MY42140030	Attenuator, Variable Step	Step DC-18GHz 0-11dB	E1046		ICO	Active
Weinschel	7003	CC0647	DC Block	9kHz - 18.6 GHz	E1101	3/4/2013	ICO	

ICO = Initial Calibration Only. These components are calibrated with a Network Analyzer before each test.

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Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Sonoma Instrument Co.	310N	185785	Amplifier	9kHz-1GHz	E494	12/3/2015	24	Active
Weinschel	2-6	BX3432	Attenuator	6 dB DC-18GHz 5 Watt	E891	4/18/2016	24	Active
A.H. Systems Inc.	SAS-521-2	457	Bilogical Antenna	25 - 2000 MHz	E766	12/29/2014	24	Active
Hewlett Packard	8449B	3008A01384	Pre-Amplifier	Preamplifier 1-26.5 GHz	E447	12/17/2015	24	Active
ETS Lindgren	3117	00135194	Horn Antenna	Double-Ridged Waveguide Horn 1-18 GHz	E1074	11/25/2014	24	Active
Trilithic	5HC2850/18050-1.8-KK	PCS-HPF-5	High Pass Filter	PCS	E986		12	Active
Rohde & Schwarz	ESIB40	100101	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBM	E907	9/22/2015	24	Active
EMC Test Systems	3116	2539	Horn Antenna	Double Ridged Horn 18-40 GHz	E513	3/19/2015	24	Active

4.8 FACILITIES AND ACCREDITATION

All measurement facilities at Alcatel-Lucent Global Product Compliance Laboratory (GPCL) used to collect the measurement data in the test report are located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA.

The field strength measurements of radiated spurious emissions are made in a FCC and IC registered three meter semi-anechoic chamber AR4 (FCC Site Registration Number: 647637, IC Filing Number: 6933F-7) which is maintained by Nokia in Murray Hill, New Jersey. The sites were constructed and are continuously in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.

Nokia Global Product Compliance Laboratory is accredited with the US Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 7 Code of Federal Regulations for offering test services for selected test methods in Electromagnetic Compatibility; Voluntary Control Council for Interference (VCCI), Japan; Australian Communications and Media Authority (ACMA). The laboratory is ISO 9001:2008 Certified.

United States Department of Commerce
National Institute of Standards and Technology

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Nokia, Global Product Compliance Lab

Murray Hill, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2015-09-14 through 2016-09-30
Effective Dates

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program