

REPORT

FCC Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea

Date of Issue:
December 30, 2014

Test Site/Location:
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

Report No.: HCT-R-1412-F054-1

HCT FRN: 0005866421

FCC ID: A3LSME7009

APPLICANT: SAMSUNG Electronics Co., Ltd.

FCC Model(s): SM-E7009

EUT Type: Mobile Phone

FCC Classification: Licensed Portable Transmitter Held to Ear (PCE)

FCC Rule Part(s): §2 , §27

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band41(5)	2555.0 – 2655.0	4M50G7D	QPSK	0.308	24.89
		4M49W7D	16QAM	0.309	24.90
LTE – Band41(10)		8M99G7D	QPSK	0.275	24.39
		8M98W7D	16QAM	0.263	24.20
LTE – Band41(15)		13M5G7D	QPSK	0.221	23.44
		13M5W7D	16QAM	0.212	23.27
LTE – Band41(20)		18M0G7D	QPSK	0.190	22.78
		17M9W7D	16QAM	0.190	22.78

The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S. C.853(a)



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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1412-F054	December 23, 2014	- First Approval Report
HCT-R-1412-F054-1	December 30, 2014	- Retest Batt.endpoint for Frequency stability

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name: SAMSUNG Electronics Co., Ltd.

Address: 129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea

FCC ID: A3LSME7009

Application Type: Certification

FCC Classification: Licensed Portable Transmitter Held to Ear (PCE)

FCC Rule Part(s): §2 , §27

EUT Type: Mobile Phone

FCC Model(s): SM-E7009

Tx Frequency: 2555.0 MHz – 2655.0 MHz (LTE – Band 41)

Max. RF Output Power:

Band 41 (5 MHz) :	0.308 W (QPSK) (24.89 dBm)
	0.309 W (16-QAM) (24.90 dBm)
Band 41 (10 MHz) :	0.275 W (QPSK) (24.39 dBm)
	0.263 W (16-QAM) (24.20 dBm)
Band 41 (15 MHz) :	0.221 W (QPSK) (23.44 dBm)
	0.212 W (16-QAM) (23.27 dBm)
Band 41 (20 MHz) :	0.190 W (QPSK) (22.78 dBm)
	0.190 W (16-QAM) (22.78 dBm)

Emission Designator(s):

Band 41 (5 MHz) :	4M50G7D (QPSK) / 4M49W7D (16-QAM)
Band 41 (10 MHz) :	8M99G7D (QPSK) / 8M98W7D (16-QAM)
Band 41 (15 MHz) :	13M5G7D (QPSK) / 13M5W7D (16-QAM)
Band 41 (20 MHz) :	18M0G7D (QPSK) / 17M9W7D (16-QAM)

Date(s) of Tests: December 05, 2014 ~ December 23, 2014

Antenna Specification

Manufacturer: EMW Co., Ltd.

Antenna type: PIFA (Planar Inverted F) Antenna

Peak Gain: LTE Band 41 : -0.94 dBi

2. INTRODUCTION

2.1. EUT DESCRIPTION

The SAMSUNG Electronics Co., Ltd. SM-E7009 Mobile Phone consists of LTE 41.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea.**

3. DESCRIPTION OF TESTS

3.1 EIRP RADIATED POWER AND RADIATED SPURIOUS EMISSIONS

ERP/EIRP

Note: ERP(Effective Radiated Power), EIRP(Equivalent Isotropic Radiated Power)

Test Procedure

Radiated emission measurements are performed in the Fully-anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-C-2004 Clause 2.2.17. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using a positive peak detector.

A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_{d(dBm)} = P_{g(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dB)}$$

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

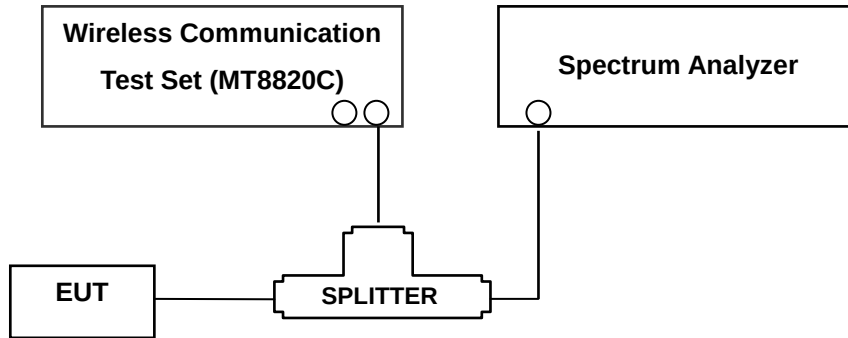
The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

Radiated spurious emissions

1. Frequency Range : 30 MHz ~ 10th Harmonics of highest channel fundamental frequency.
2. Measured distance : 30 MHz ~ 11 GHz at 3 m
11 GHz ~ 27 GHz at 1m
3. The EUT was setup to maximum output power.
4. The high, low and a middle channel were tested for out of band measurements.

3.2 OCCUPIED BANDWIDTH.

Test set-up



(Configuration of conducted Emission measurement)

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

Test Procedure

OBW is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v02r02, October 17, 2014, Section 4.2.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

3.3 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL.

Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer.

The EUT was setup to maximum output power. The 1 MHz RBW was used to scan from 30 MHz to 26.5 GHz. And limit is -25 dBm. The high, low and a middle channel were tested for out of band measurements.

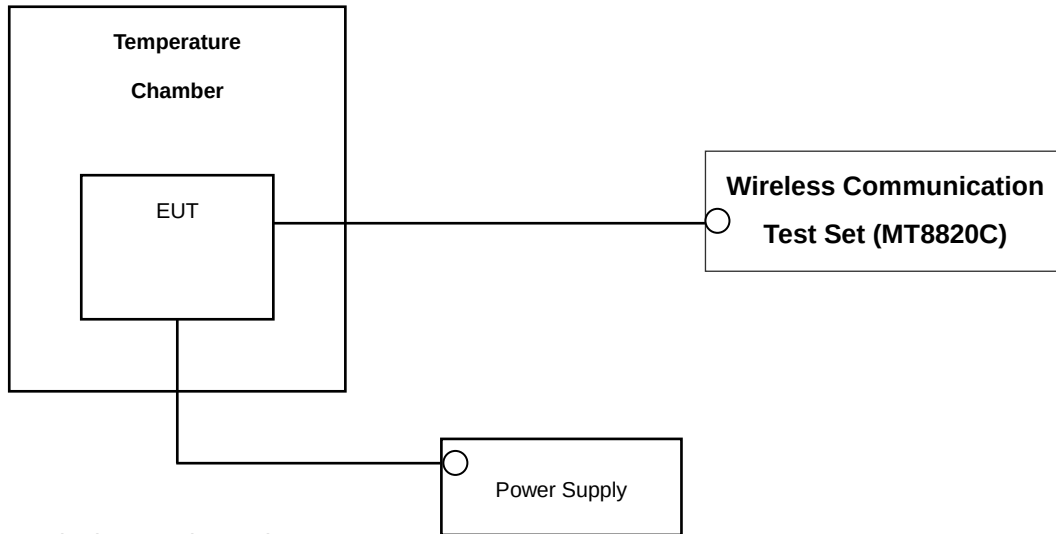
- Channel Edge Requirement : In the 1MHz bands immediately outside and adjacent to the channel, a resolution bandwidth of at least 2 % of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions. Limit is -10 dBm on all frequencies between the channel edge and 5 MHz from the channel edge, -13 dBm on all frequencies between 5 MHz and X MHz from the channel edge, -25 dBm on all frequencies more than X MHz from channel edge, where X is the greater of 6 MHz or the actual emission bandwidth. In addition, the attenuation factor shall not be less than -13 dBm on all frequencies between 2490.5 MHz and 2496 MHz and -25 dBm at below 2490.5 MHz.

NOTES: The analyzer plot offsets were determined by below conditions.

- For LTE Band 41, total offset 27.1 dBm = 20 dBm attenuator + 6 dBm Divider + 1.1 dBm RF cables.

3.4 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

Test Set-up



* Nominal Operating Voltage

Test Procedure

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification — the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Time Period and Procedure:

The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).

1. The equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Interval	Calibration Due
Agilent	N1921A/ Power Sensor	MY45241059	Annual	07/09/2015
Agilent	N1911A/ Power Meter	MY45100523	Annual	01/24/2015
MITEQ	AMF-6D-001180-35-20P/AMP	1081666	Annual	09/04/2015
Wainwright	WHK1.2/15G-10EF/H.P.F	4	Annual	06/17/2015
Wainwright	WRCJV2400/2483.5-2370/2520-60/12SS / B.R.F.	1	Annual	06/17/2015
Wainwright	WHK3.3/18G-10EF/H.P.F	2	Annual	06/17/2015
Hewlett Packard	11667B / Power Splitter	10545	Annual	02/22/2015
Hewlett Packard	11667B / Power Splitter	11275	Annual	05/19/2015
Digital	EP-3010/ Power Supply	3110117	Annual	10/29/2015
Schwarzbeck	UHAP/ Dipole Antenna	557	Biennial	03/05/2015
Schwarzbeck	UHAP/ Dipole Antenna	558	Biennial	05/03/2015
Korea Engineering	KR-1005L / Chamber	KRAC05063-3CH	Annual	10/29/2015
Schwarzbeck	BBHA 9120D/ Horn Antenna	147	Biennial	09/01/2016
Schwarzbeck	BBHA 9120D/ Horn Antenna	1151	Biennial	10/05/2015
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170541	Biennial	07/05/2015
Agilent	E4440A/Spectrum Analyzer	US45303008	Annual	04/09/2015
WEINSCHTEL	ATTENUATOR	BR0592	Annual	10/22/2015
REOHDE&SCHWARZ	FSV40/Spectrum Analyzer	1307.9002K40-100931-NK	Annual	06/09/2015
Agilent	8960 (E5515C)/ Base Station	MY48360222	Annual	08/26/2015
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6200863156	Annual	04/01/2015

5. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS
2.1051, 27.53(m)(4)	Band Edge / Conducted Spurious Emissions.	$< 40 + 10\log_{10} (P[\text{Watts}])$ at Channel edges $< 43 + 10\log_{10} (P[\text{Watts}])$ between 5 and X MHz from Channel edges $< 55 + 10\log_{10} (P[\text{Watts}])$ beyond X MHz beyond from Channel edges		PASS
*2.1046	Conducted Output Power	N/A		PASS
2.1055, 27.54	Frequency stability	Fundamental emissions stay within authorized frequency block (Part 27)		PASS
27.50(h)(2)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP	RADIATED	PASS
2.1053, 27.53(m)(4)	Undesirable Emissions	$< 40 + 10\log_{10} (P[\text{Watts}])$ at Channel edges $< 43 + 10\log_{10} (P[\text{Watts}])$ between 5 and X MHz from Channel edges $< 55 + 10\log_{10} (P[\text{Watts}])$ beyond X MHz beyond from Channel edges		PASS

*See SAR Report

6. SAMPLE CALCULATION

A. EIRP Sample Calculation

Mode	Ch./ Freq.		Measured Level(dBm)	Substitute LEVEL(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
	channel	Freq.(MHz)						W	dBm
LTE Band 41	40740.0	2,605.0	-16.35	18.26	10.72	1.38	V	0.575	27.60

EIRP = SubstituteLEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a wooden tripod is 0.8 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of Equivalent Isotropic Radiated Power (**EIRP**).

B. Emission Designator

QPSK Modulation

5 MHz Bandwidth

Emission Designator = 4M50G7D

LTE BW = 4.50 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

10 MHz Bandwidth

Emission Designator = 8M95G7D

LTE BW = 8.95 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

15 MHz Bandwidth

Emission Designator = 13M5G7D

LTE BW = 13.47 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

20 MHz Bandwidth

Emission Designator = 18M0G7D

LTE BW = 18.03 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

16QAM Modulation

5 MHz Bandwidth

Emission Designator = 4M51W7D

LTE BW = 4.51 MHz

W = main carrier modulated in a combination of two
or more of the following modes;
amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

10 MHz Bandwidth

Emission Designator = 8M94W7D

LTE BW = 8.94 MHz

W = main carrier modulated in a combination of two
or more of the following modes;
amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

15 MHz Bandwidth

Emission Designator = 13M5W7D

LTE BW = 13.47MHz

W = main carrier modulated in a combination of two
or more of the following modes;
amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

20 MHz Bandwidth

Emission Designator = 18M0W7D

LTE BW = 18.03 MHz

W = main carrier modulated in a combination of two
or more of the following modes;
amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

7. TEST DATA

7.1 EQUIVALENT ISOTROPIC RADIATED POWER OUTPUT

Equivalent Isotropic Radiated Power Data (Band 41 _ 5 MHz)

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	EIRP	
								W	dBm
2555.0	5 MHz	QPSK	-22.82	14.03	10.63	2.16	H	0.178	22.50
		16-QAM	-22.59	14.26	10.63	2.16	H	0.187	22.73
2605.0		QPSK	-22.10	14.89	10.72	2.21	H	0.219	23.40
		16-QAM	-21.95	15.04	10.72	2.21	H	0.226	23.55
2655.0		QPSK	-20.90	16.42	10.73	2.26	H	0.308	24.89
		16-QAM	-20.89	16.43	10.73	2.26	H	0.309	24.90

Note: Worst case is 1 resource block.

Equivalent Isotropic Radiated Power Data (Band 41 _ 10 MHz)

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	EIRP	
								W	dBm
2555.0	10 MHz	QPSK	-23.22	13.63	10.63	2.16	H	0.162	22.10
		16-QAM	-23.15	13.70	10.63	2.16	H	0.165	22.17
2605.0		QPSK	-22.35	14.64	10.72	2.21	H	0.207	23.15
		16-QAM	-22.22	14.77	10.72	2.21	H	0.213	23.28
2655.0		QPSK	-21.11	15.92	10.73	2.26	H	0.275	24.39
		16-QAM	-21.30	15.73	10.73	2.26	H	0.263	24.20

Note: Worst case is 1 resource block.

Equivalent Isotropic Radiated Power Data (Band 41 _ 15 MHz)

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	EIRP	
								W	dBm
2555.0	15 MHz	QPSK	-23.88	12.97	10.63	2.16	H	0.139	21.44
		16-QAM	-23.93	12.92	10.63	2.16	H	0.138	21.39
2605.0		QPSK	-22.77	14.22	10.72	2.21	H	0.187	22.73
		16-QAM	-22.55	14.44	10.72	2.21	H	0.197	22.95
2655.0		QPSK	-21.76	14.95	10.74	2.25	H	0.221	23.44
		16-QAM	-21.93	14.78	10.74	2.25	H	0.212	23.27

Note: Worst case is 1 resource block.

Equivalent Isotropic Radiated Power Data (Band 41 _ 20 MHz)

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	EIRP	
								W	dBm
2555.0	20 MHz	QPSK	-23.98	12.64	10.64	2.16	H	0.129	21.12
		16-QAM	-24.50	12.12	10.64	2.16	H	0.115	20.60
2605.0		QPSK	-23.57	13.42	10.72	2.21	H	0.156	21.93
		16-QAM	-23.20	13.79	10.72	2.21	H	0.170	22.30
2655.0		QPSK	-22.42	14.29	10.74	2.25	H	0.190	22.78
		16-QAM	-22.42	14.29	10.74	2.25	H	0.190	22.78

Note: Worst case is 1 resource block.

NOTES:

Equivalent Isotropic Radiated Power Measurements by Substitution Method

according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. Turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For LTE signals, a peak detector is used, with $RBW \geq OBW$, $VBW \geq 3 \times RBW$. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is x plane in LTE mode. Also worst case of detecting Antenna is horizontal polarization in LTE mode.

7.2 RADIATED SPURIOUS EMISSIONS

7.2.1 RADIATED SPURIOUS EMISSIONS (LTE Band 41_5 MHz)

■ OPERATING FREQUENCY : 2655.0 MHz
 ■ MEASURED OUTPUT POWER: 24.90 dBm = 0.309 W
 ■ MODULATION SIGNAL: 5 MHz 16-QAM
 ■ DISTANCE: 3 meters
 ■ LIMIT: $43 + 10 \log_{10}(W) =$ 37.90 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40240.0 (2555.0)	5,110.0	-50.45	12.41	-47.24	3.15	H	-37.98	62.88
	7,665.0	-58.82	11.67	-46.73	4.62	H	-39.68	64.58
	10,220.0	-57.89	11.67	-41.67	4.63	H	-34.63	59.53
40740.0 (2605.0)	5,210.0	-51.71	12.57	-48.01	3.26	H	-38.70	63.60
	7,815.0	-59.69	11.36	-48.09	4.03	V	-40.76	65.66
	10,420.0	-58.34	11.25	-39.86	4.74	V	-33.35	58.25
41240.0 (2655.0)	5,310.0	-53.44	13.00	-50.08	3.31	H	-40.39	65.29
	7,965.0	-59.00	11.10	-45.12	4.16	H	-38.18	63.08
	10,620.0	-59.32	11.03	-40.51	4.56	H	-34.04	58.94

- NOTES:**
1. Radiated Spurious Emission Measurements at 1 meter and 3 meter by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. We are performed all frequency to 10th harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 1 resource block.

7.2.2 RADIATED SPURIOUS EMISSIONS (LTE Band 41_10 MHz)

■ OPERATING FREQUENCY : 2655.0 MHz
 ■ MEASURED OUTPUT POWER: 24.39 dBm = 0.275 W
 ■ MODULATION SIGNAL: 10 MHz QPSK
 ■ DISTANCE: 3 meters
 ■ LIMIT: $43 + 10 \log_{10}(W) =$ 37.39 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40240.0 (2555.0)	5,110.0	-52.20	12.41	-48.99	3.15	H	-39.73	64.12
	7,665.0	-58.85	11.67	-46.76	4.62	H	-39.71	64.10
	10,220.0	-59.14	11.67	-42.92	4.63	H	-35.88	60.27
40740.0 (2605.0)	5,210.0	-52.66	12.57	-48.96	3.26	H	-39.65	64.04
	7,815.0	-58.46	11.36	-46.86	4.03	H	-39.53	63.92
	10,420.0	-60.21	11.25	-41.73	4.74	H	-35.22	59.61
41240.0 (2655.0)	5,310.0	-54.62	13.00	-51.26	3.31	H	-41.57	65.96
	7,965.0	-58.90	11.10	-45.02	4.16	H	-38.08	62.47
	10,620.0	-59.30	11.03	-40.49	4.56	H	-34.02	58.41

- NOTES:**
1. Radiated Spurious Emission Measurements at 1 meter and 3 meter by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. We are performed all frequency to 10th harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 1 resource block.

7.2.3 RADIATED SPURIOUS EMISSIONS (LTE Band 41_15 MHz)

☒ OPERATING FREQUENCY : 2655.0 MHz
☒ MEASURED OUTPUT POWER: 23.44 dBm = 0.221 W
☒ MODULATION SIGNAL: 15 MHz QPSK
☒ DISTANCE: 3 meters
☒ LIMIT: $43 + 10 \log_{10}(W) =$ 36.44 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40240.0 (2555.0)	5,110.0	-53.30	12.41	-50.09	3.15	H	-40.83	64.27
	7,665.0	-59.71	11.67	-47.62	4.62	H	-40.57	64.01
	10,220.0	-58.17	11.67	-41.95	4.63	H	-34.91	58.35
40740.0 (2605.0)	5,210.0	-53.45	12.57	-49.75	3.26	H	-40.44	63.88
	7,815.0	-61.05	11.36	-49.45	4.03	H	-42.12	65.56
	10,420.0	-57.41	11.25	-38.93	4.74	H	-32.42	55.86
41240.0 (2655.0)	5,310.0	-56.95	13.00	-53.59	3.31	H	-43.90	67.34
	7,965.0	-61.75	11.10	-47.87	4.16	H	-40.93	64.37
	10,620.0	-59.60	11.03	-40.79	4.56	H	-34.32	57.76

- NOTES:**
1. Radiated Spurious Emission Measurements at 1 meter and 3 meter by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. We are performed all frequency to 10th harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 1 resource block.

7.2.4 RADIATED SPURIOUS EMISSIONS (LTE Band 41_20 MHz)

☒ OPERATING FREQUENCY : 2655.00 MHz
☒ MEASURED OUTPUT POWER: 22.78 dBm = 0.190 W
☒ MODULATION SIGNAL: 20 MHz QPSK
☒ DISTANCE: 3 meters
☒ LIMIT: $43 + 10 \log_{10}(W) =$ 35.78 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40240.0 (2555.0)	5,110.0	-53.38	12.41	-50.17	3.15	H	-40.91	63.69
	7,665.0	-59.59	11.67	-47.50	4.62	H	-40.45	63.23
	10,220.0	-57.60	11.67	-41.38	4.63	H	-34.34	57.12
40740.0 (2605.0)	5,210.0	-53.56	12.57	-49.86	3.26	H	-40.55	63.33
	7,815.0	-60.86	11.36	-49.26	4.03	H	-41.93	64.71
	10,420.0	-60.49	11.25	-42.01	4.74	H	-35.50	58.28
41240.0 (2655.0)	5,310.0	-60.11	13.00	-56.75	3.31	H	-47.06	69.84
	7,965.0	-60.94	11.10	-47.06	4.16	H	-40.12	62.90
	10,620.0	-59.96	11.03	-41.15	4.56	H	-34.68	57.46

- NOTES:**
1. Radiated Spurious Emission Measurements at 1 meter and 3 meter by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. We are performed all frequency to 10th harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 1 resource block.

7.3 OCCUPIED BANDWIDTH

Band	Band Width (MHz)	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
Band 41	5	2605.0	QPSK	25	0	4.4979
			16-QAM	25	0	4.4912
	10		QPSK	50	0	8.9898
			16-QAM	50	0	8.9843
	15		QPSK	75	0	13.4760
			16-QAM	75	0	13.4880
	20		QPSK	100	0	17.9700
			16-QAM	100	0	17.9110

- Plots of the EUT's Occupied Bandwidth are shown Page 28 ~ 31.

7.4 CONDUCTED SPURIOUS EMISSIONS

Band	Band Width (MHz)	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Frequency of Maximum Harmonic (GHz)	Maximum Data [dBm]
Band 41	5	2555.0	QPSK	1	0	10.307150	-25.15
		2605.0		1	0	14.973800	-25.19
		2655.0		1	0	14.610530	-25.78
	10	2555.0		1	0	10.283200	-25.41
		2605.0		1	0	14.570610	-25.72
		2655.0		1	0	14.315620	-25.84
	15	2555.0		1	0	14.648450	-25.93
		2605.0		1	0	10.272720	-25.63
		2655.0		1	0	14.985280	-25.43
	20	2555.0		1	0	14.944860	-25.61
		2605.0		1	0	10.286700	-25.68
		2655.0		1	0	10.281710	-25.89

- Plots of the EUT's Conducted Spurious Emissions are shown Page 38 ~ 49.

7.4.1 BAND EDGE

Band	Band Width (MHz)	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Channel Edge Data [dBm]					
						Channel Edge (Limit: -10dBm)		5 MHz ~ X MHz from the Channel Edge (Limit: -13dBm)		X MHz ~ from the Channel Edge (Limit: -25dBm)	
						Lower	Upper	Lower	Upper	Lower	Upper
Band 41	5	2555.0	QPSK	25	0	-17.23	-16.80	-33.97	-31.80	-35.71	-33.54
		2605.0		25	0	-17.21	-16.92	-30.83	-31.06	-32.93	-33.15
		2655.0		25	0	-19.45	-19.32	-31.57	-32.70	-33.74	-34.83
	10	2555.0		50	0	-20.59	-21.03	-25.74	-26.31	-41.32	-33.65
		2605.0		50	0	-21.22	-23.10	-24.65	-27.26	-34.04	-34.53
		2655.0		50	0	-24.57	-26.94	-27.72	-31.76	-34.75	-37.37
	15	2555.0		75	0	-22.80	-23.15	-27.55	-27.34	-53.19	-36.03
		2605.0		75	0	-22.23	-24.92	-24.77	-29.06	-35.73	-36.54
		2655.0		75	0	-25.76	-28.89	-27.75	-32.48	-35.16	-42.67
	20	2555.0		100	0	-17.83	-15.63	-25.49	-20.88	-46.73	-27.32
		2605.0		100	0	-15.48	-18.18	-19.89	-23.25	-28.09	-29.32
		2655.0		100	0	-14.02	-20.02	-21.27	-23.40	-29.23	-44.75

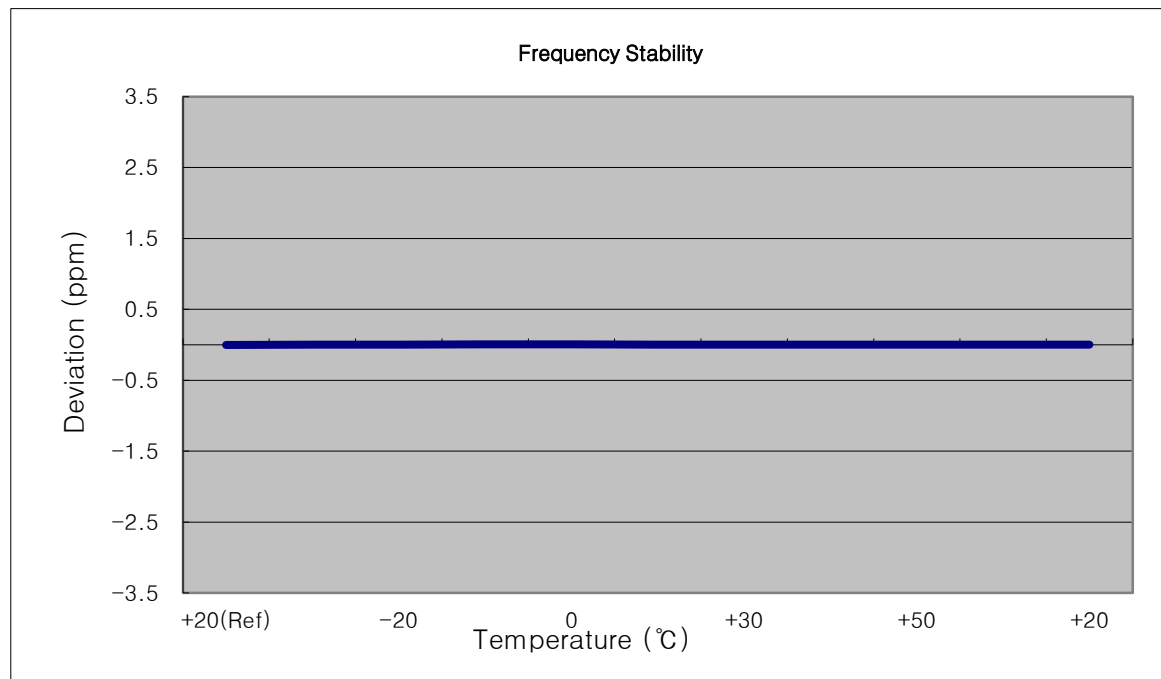
- Plots of the EUT's Band Edge are shown Page 32~37.

7.5 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

7.5.1 FREQUENCY STABILITY (LTE Band 41_5 MHz)

☐ OPERATING FREQUENCY: 2605.000,000 Hz
☐ CHANNEL: 40740 (5 MHz)
☐ REFERENCE VOLTAGE: 3.8 VDC
☐ DEVIATION LIMIT: -

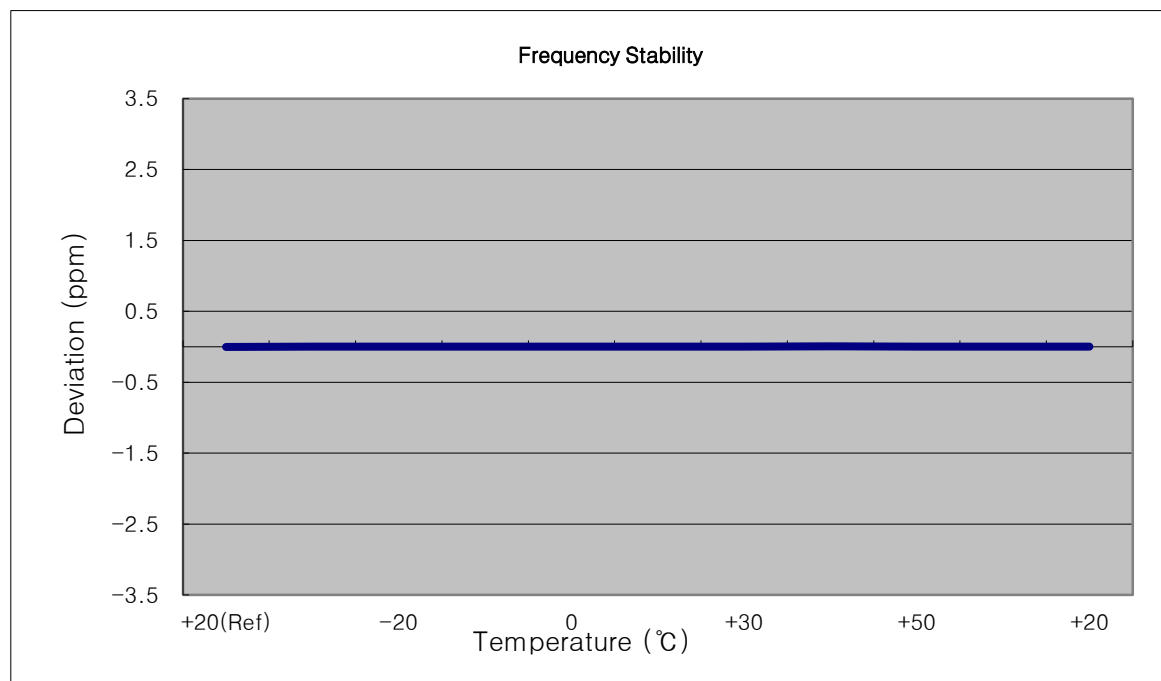
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.80	+20(Ref)	2605 999 991	0	0.000 000	0.000
100%		-30	2605 999 997	6.4	0.000 000	0.002
100%		-20	2605 000 000	9.1	0.000 000	0.004
100%		-10	2605 000 014	22.8	0.000 001	0.009
100%		0	2605 000 003	11.8	0.000 000	0.005
100%		+10	2605 999 997	6.6	0.000 000	0.003
100%		+30	2605 999 999	8.2	0.000 000	0.003
100%		+40	2605 999 999	8.6	0.000 000	0.003
100%		+50	2605 000 001	10.0	0.000 000	0.004
115%	4.35	+20	2605 999 997	6.1	0.000 000	0.002
Batt. Endpoint	2.75	+20	2604 999 999	7.9	0.000 000	0.003



7.5.2 FREQUENCY STABILITY (LTE Band 41_10 MHz)

☒ OPERATING FREQUENCY: 2605.000,000 Hz
☒ CHANNEL: 40740 (10 MHz)
☒ REFERENCE VOLTAGE: 3.8 VDC
☒ DEVIATION LIMIT: -

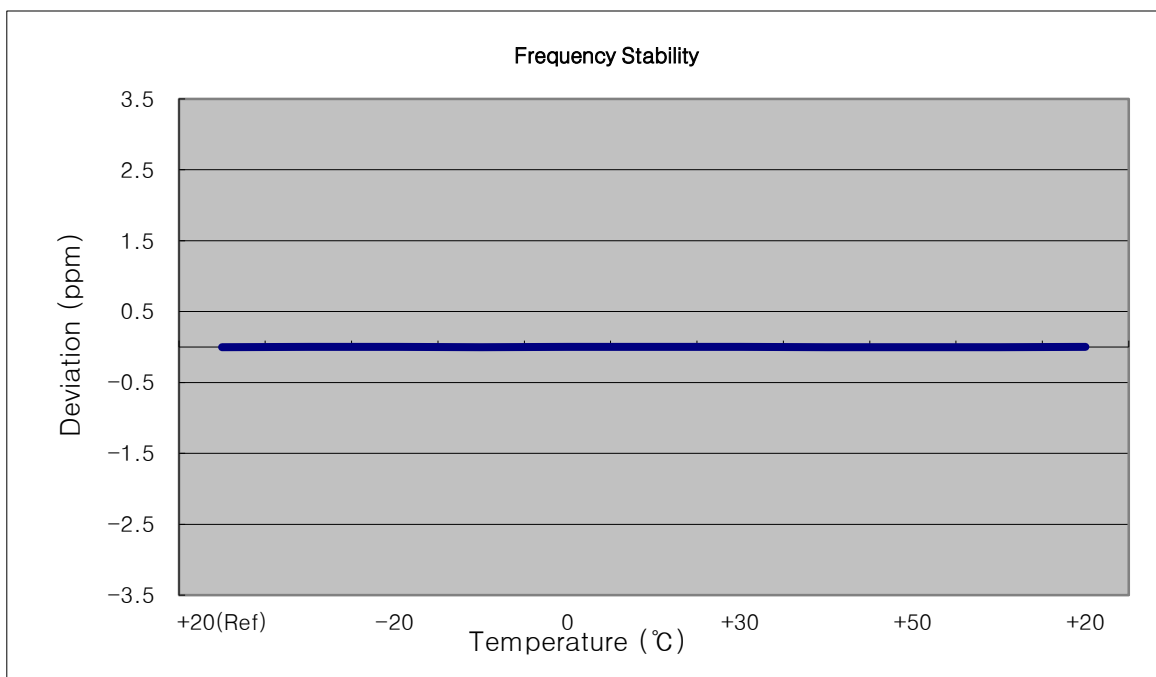
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.80	+20(Ref)	2605 999 991	0	0.000 000	0.000
100%		-30	2605 999 998	7.0	0.000 000	0.003
100%		-20	2605 000 000	8.8	0.000 000	0.003
100%		-10	2605 999 996	4.6	0.000 000	0.002
100%		0	2605 999 994	3.0	0.000 000	0.001
100%		+10	2605 999 998	7.1	0.000 000	0.003
100%		+30	2605 999 999	7.3	0.000 000	0.003
100%		+40	2605 000 003	11.9	0.000 000	0.005
100%		+50	2605 999 999	7.8	0.000 000	0.003
115%	4.35	+20	2605 000 000	9.1	0.000 000	0.004
Batt. Endpoint	2.75	+20	2605 000 002	10.9	0.000 000	0.004



7.5.3 FREQUENCY STABILITY (LTE Band 41_15 MHz)

☒ OPERATING FREQUENCY: 2605.000,000 Hz
☒ CHANNEL: 40740 (15 MHz)
☒ REFERENCE VOLTAGE: 3.8 VDC
☒ DEVIATION LIMIT: -

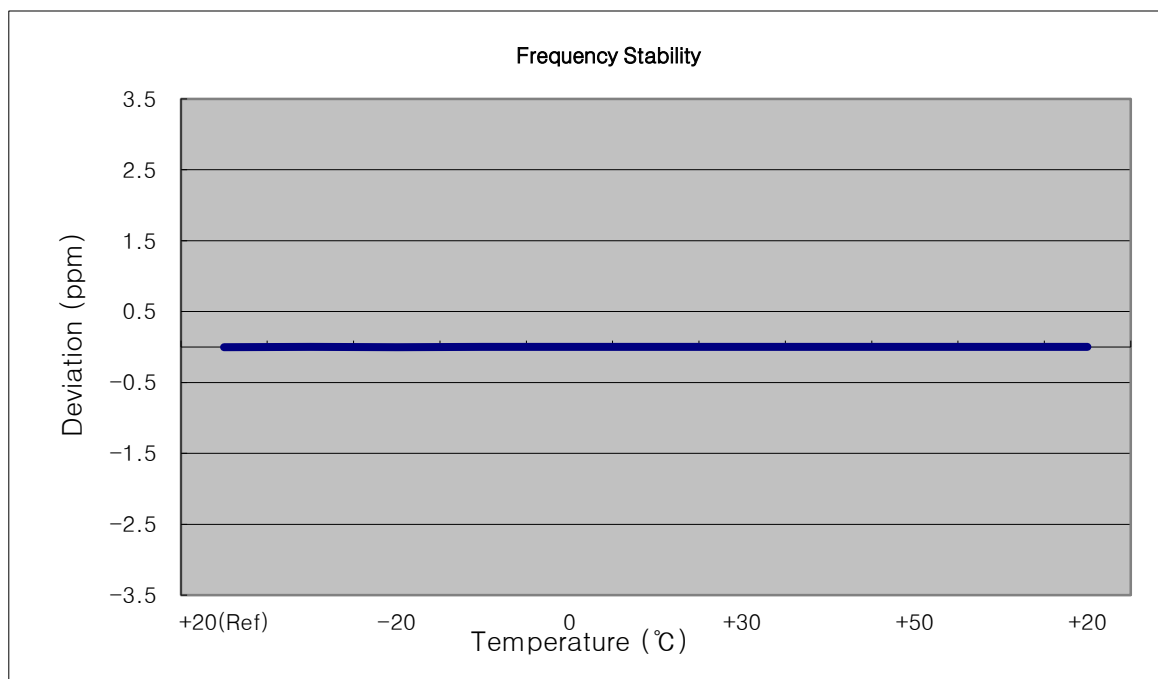
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.80	+20(Ref)	2605 999 992	0	0.000 000	0.000
100%		-30	2605 000 000	8.3	0.000 000	0.003
100%		-20	2605 999 999	7.7	0.000 000	0.003
100%		-10	2605 999 986	-5.7	0.000 000	-0.002
100%		0	2605 999 999	7.0	0.000 000	0.003
100%		+10	2605 999 999	7.6	0.000 000	0.003
100%		+30	2605 999 997	5.6	0.000 000	0.002
100%		+40	2605 999 988	-4.0	0.000 000	-0.002
100%		+50	2605 999 983	-8.6	0.000 000	-0.003
115%	4.35	+20	2605 999 981	-10.9	0.000 000	-0.004
Batt. Endpoint	2.75	+20	2605 000 003	11.0	0.000 000	0.004



7.5.4 FREQUENCY STABILITY (LTE Band 41_20 MHz)

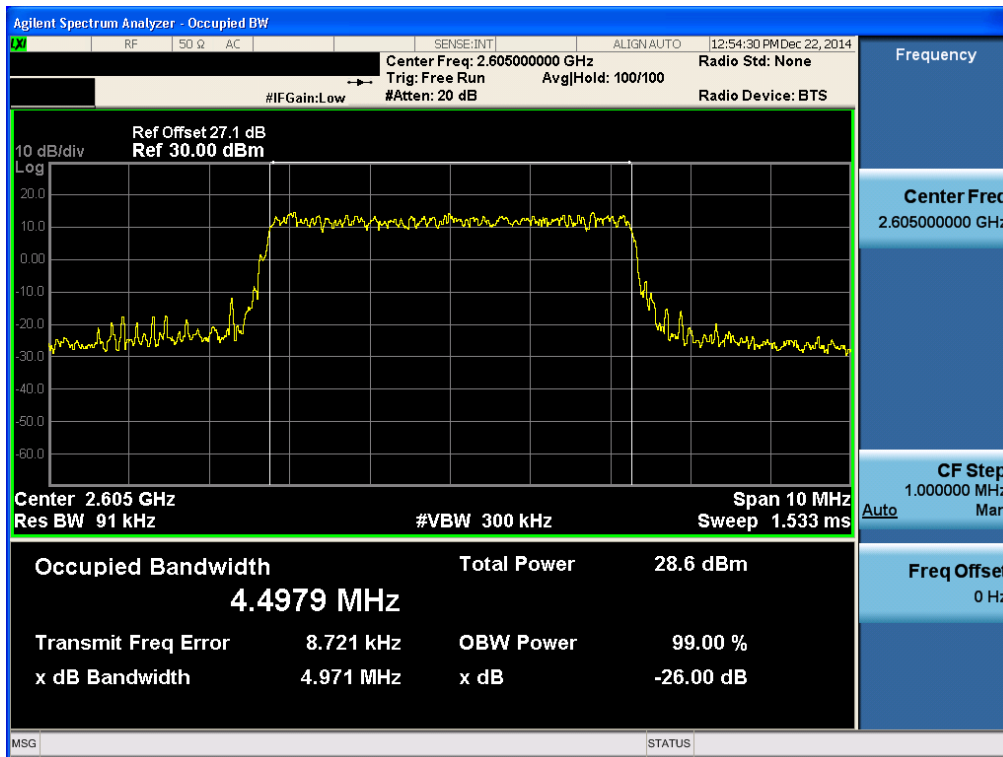
☒ OPERATING FREQUENCY: 2605.000,000 Hz
☒ CHANNEL: 40740 (20 MHz)
☒ REFERENCE VOLTAGE: 3.8 VDC
☒ DEVIATION LIMIT: -

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.80	+20(Ref)	2605 999 992	0	0.000 000	0.000
100%		-30	2605 999 999	7.4	0.000 000	0.003
100%		-20	2605 999 983	-8.5	0.000 000	-0.003
100%		-10	2605 000 000	7.8	0.000 000	0.003
100%		0	2605 000 002	10.6	0.000 000	0.004
100%		+10	2605 000 002	10.3	0.000 000	0.004
100%		+30	2605 000 000	8.3	0.000 000	0.003
100%		+40	2605 000 003	11.6	0.000 000	0.004
100%		+50	2605 000 002	10.1	0.000 000	0.004
115%	4.35	+20	2605 000 001	8.7	0.000 000	0.003
Batt. Endpoint	2.75	+20	2605 000 002	10.4	0.000 000	0.004

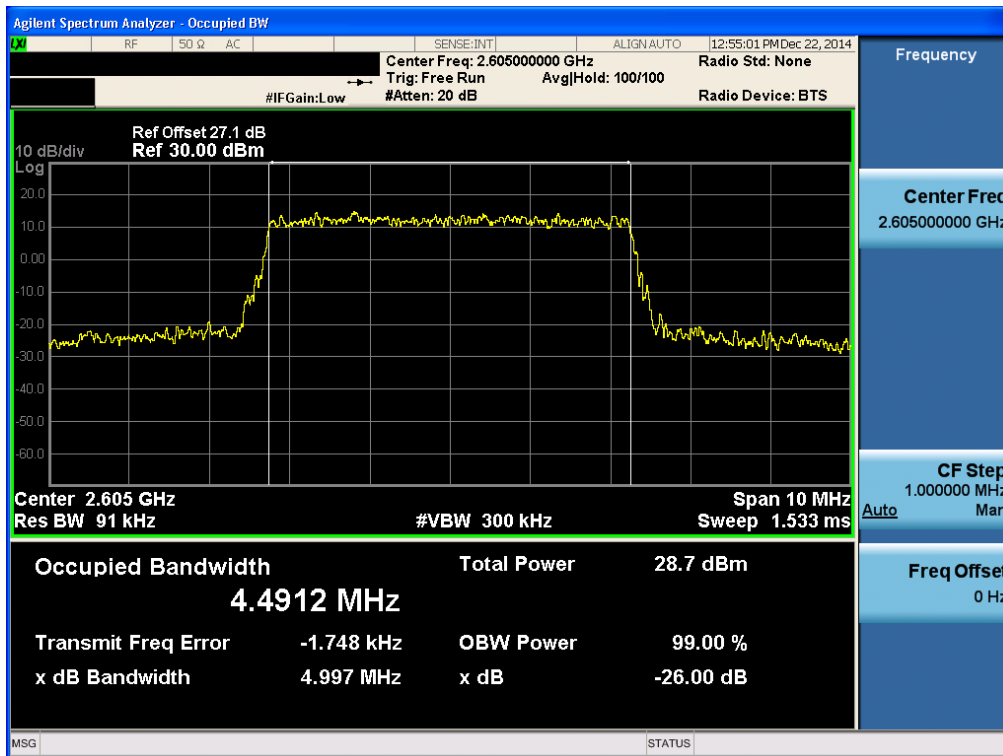


8. TEST PLOTS

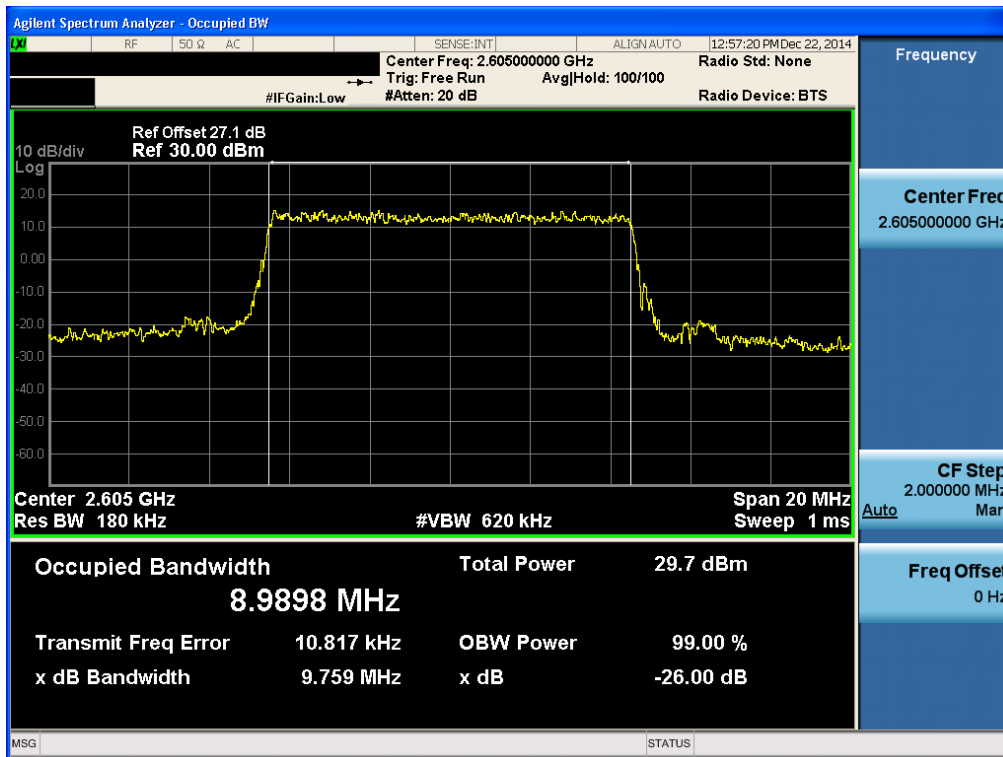
Occupied Bandwidth Plot (5M BW Ch.40740 QPSK_RB25)



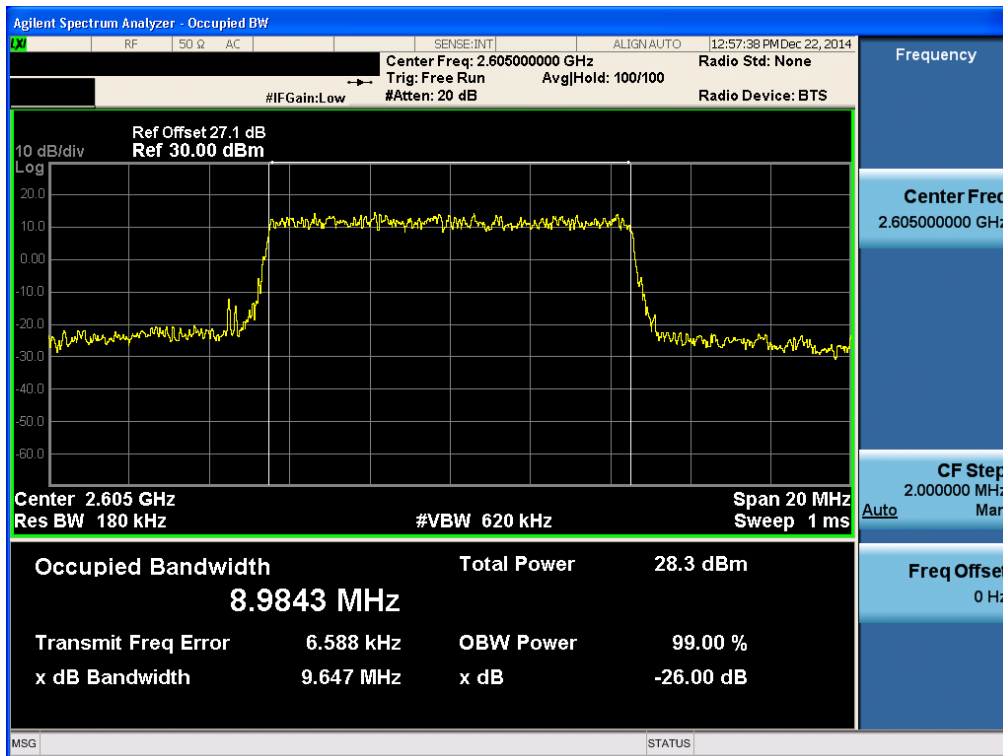
Occupied Bandwidth Plot (5M BW Ch.40740 16QAM_RB25)



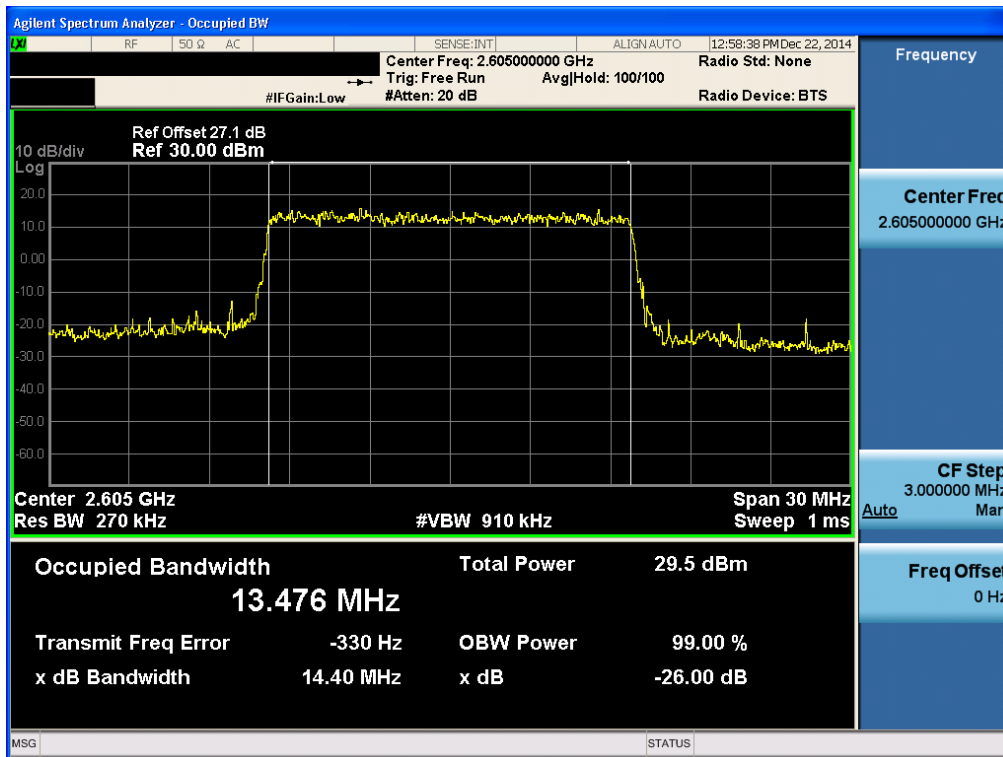
Occupied Bandwidth Plot (10M BW Ch.40740 QPSK_RB50)



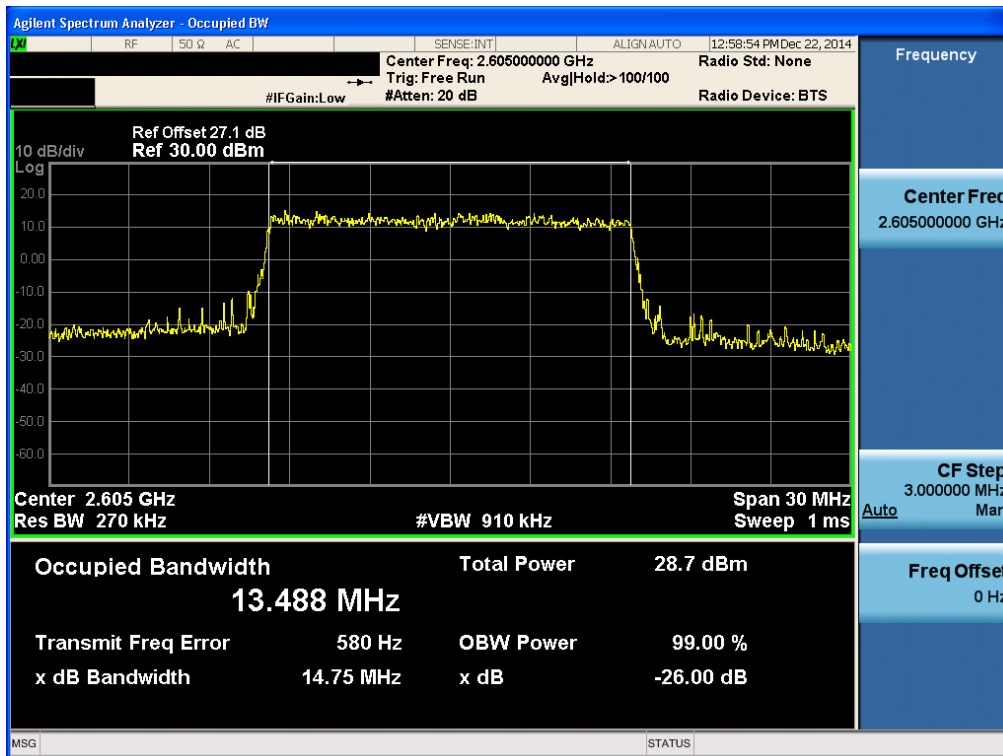
Occupied Bandwidth Plot (10M BW Ch.40740 16QAM_RB50)



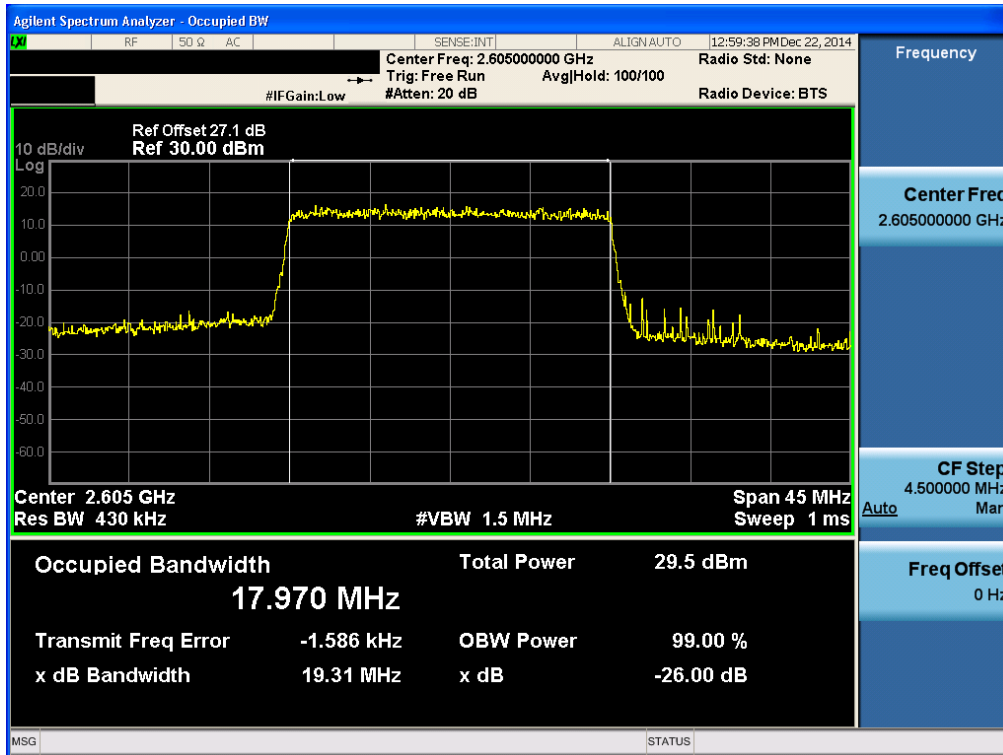
Occupied Bandwidth Plot (15M BW Ch.40740 QPSK_RB75)



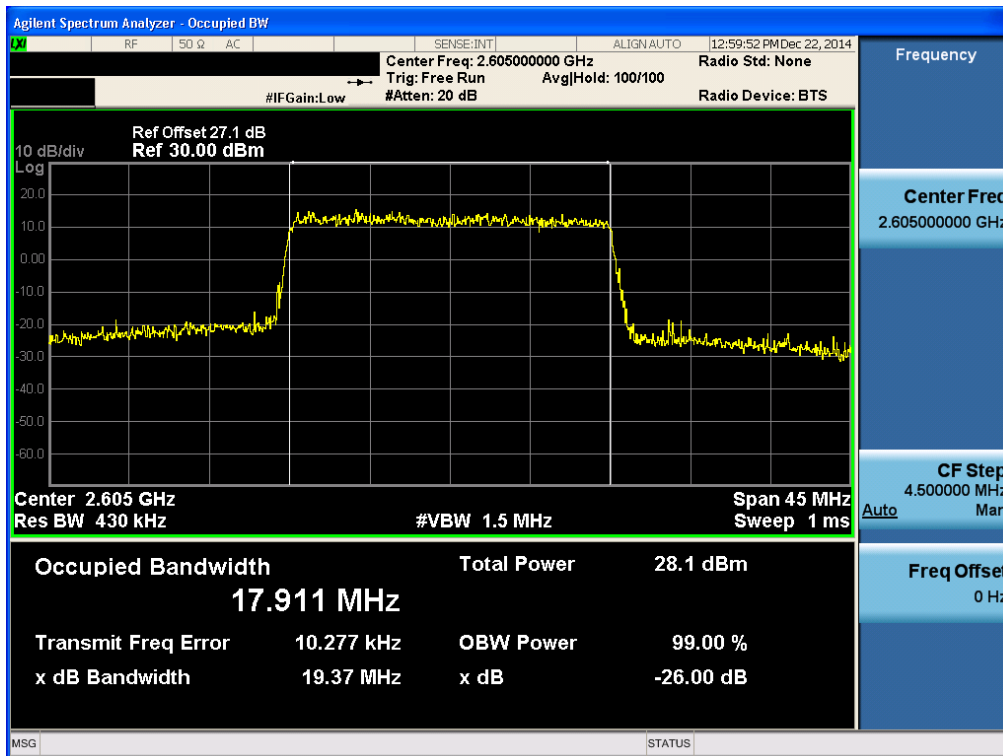
Occupied Bandwidth Plot (15M BW Ch.40740 16QAM_RB75)



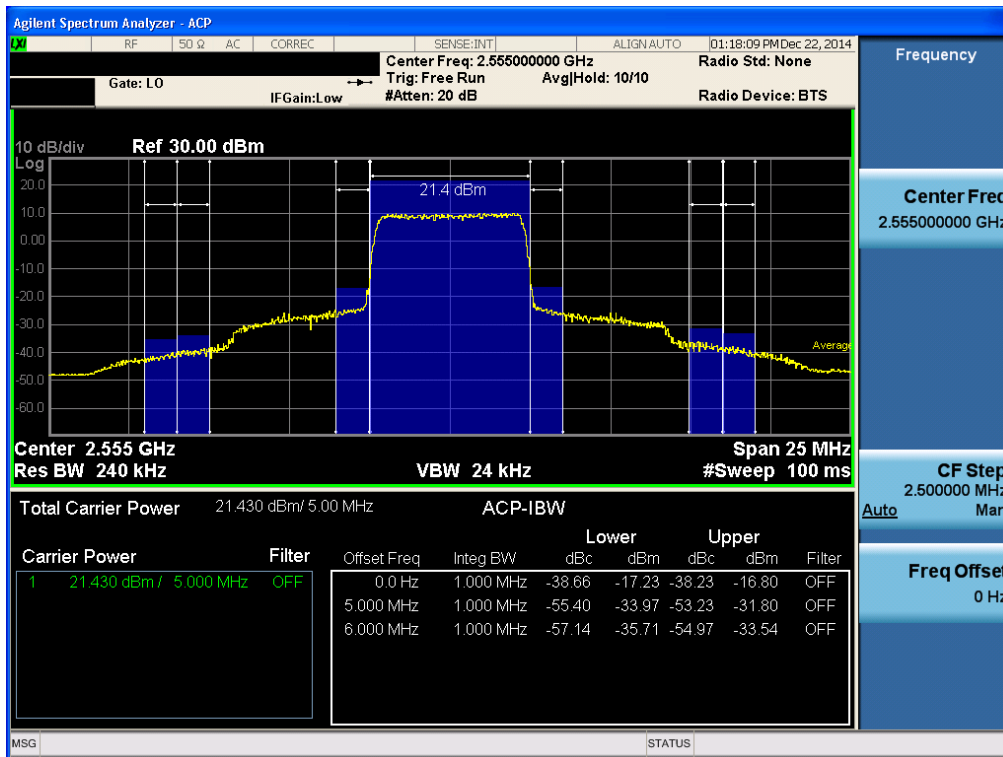
Occupied Bandwidth Plot (20M BW Ch.40740 QPSK_RB100)



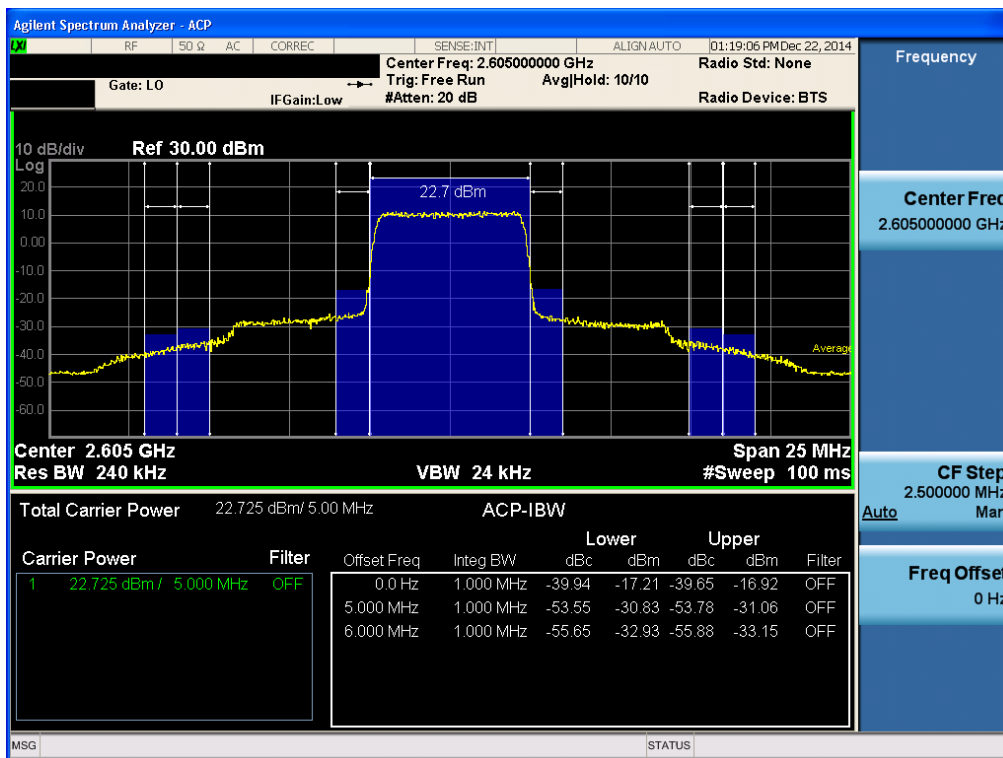
Occupied Bandwidth Plot (20M BW Ch.40740 16QAM_RB100)



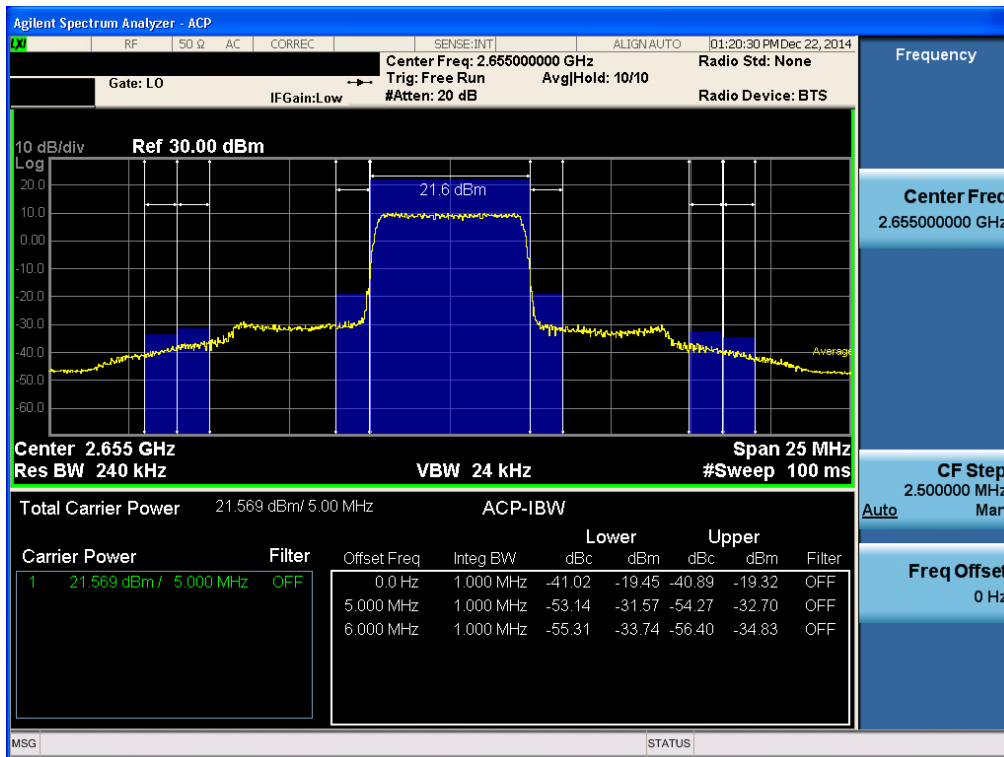
Lower ACP Plot (5MHz Ch.40240 QPSK RB 25)-1



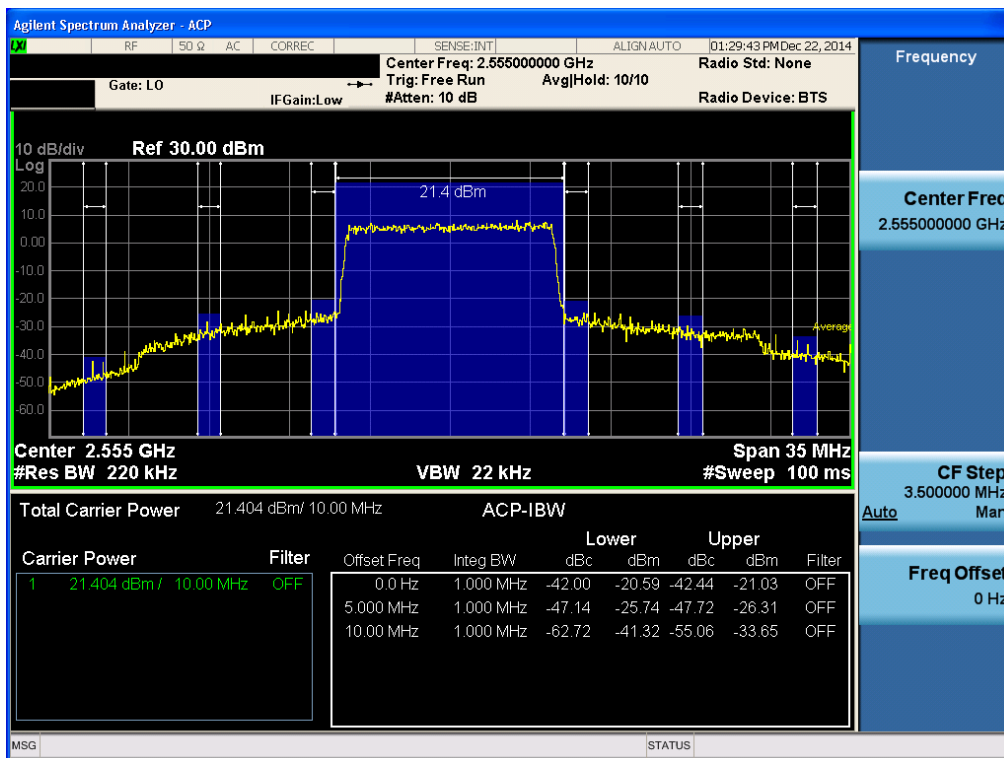
Middle ACP Plot (5MHz Ch.40740 QPSK RB 25)-2



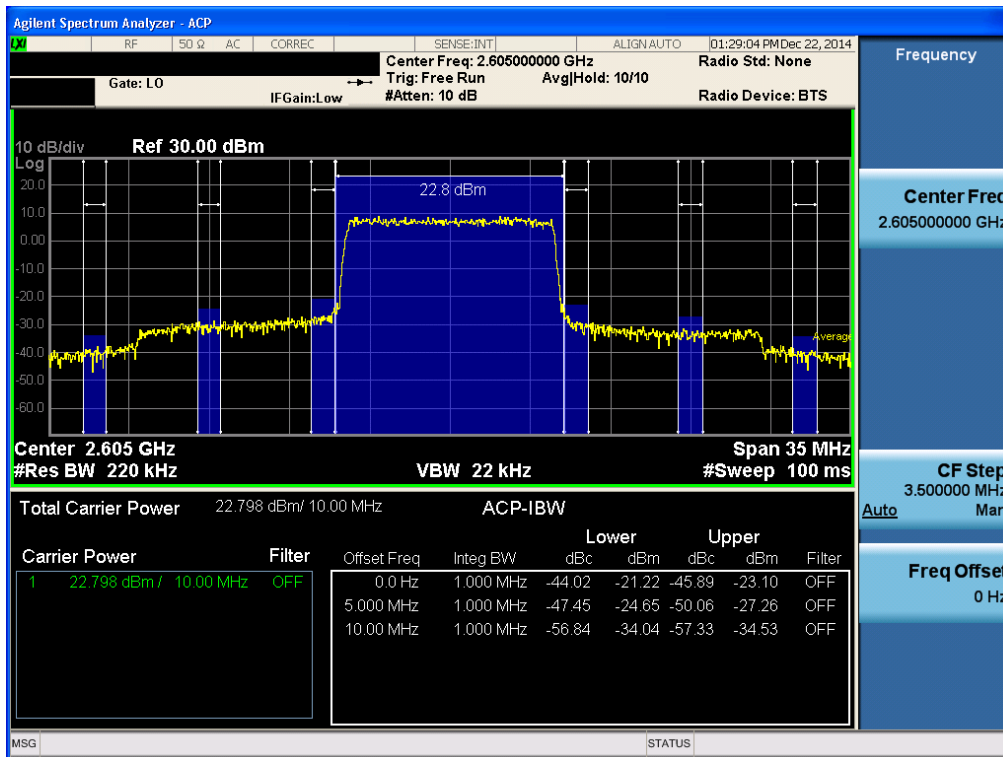
High ACP Plot (5MHz Ch.41240 QPSK RB 25))-3



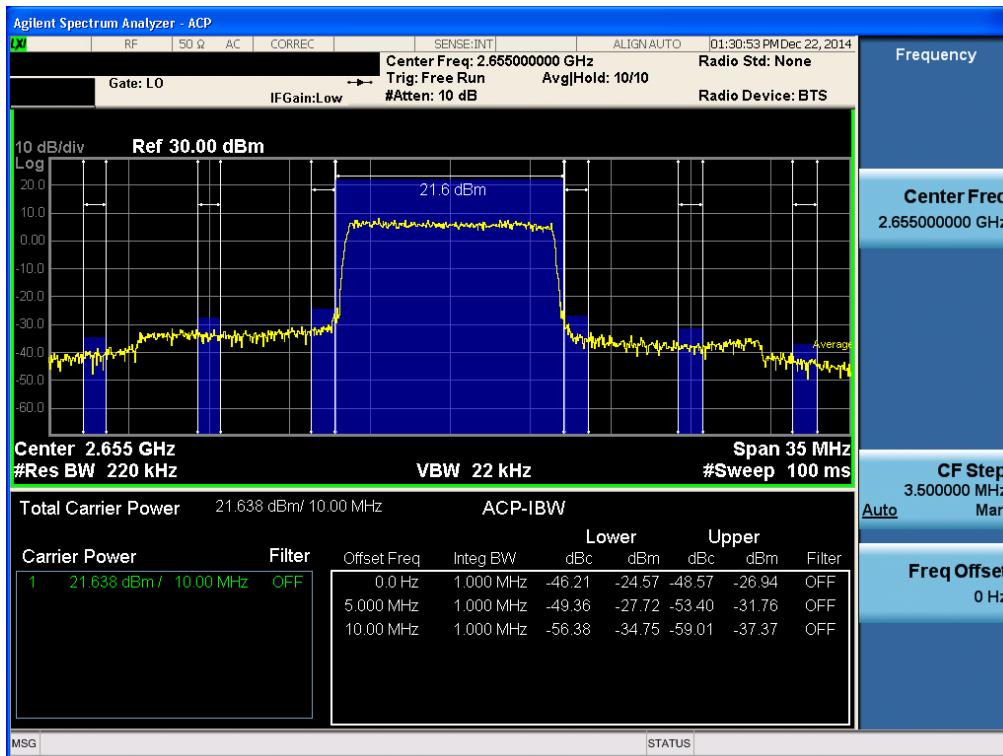
Lower ACP Plot ACP(10MHz Ch.40240 QPSK RB 50)-1



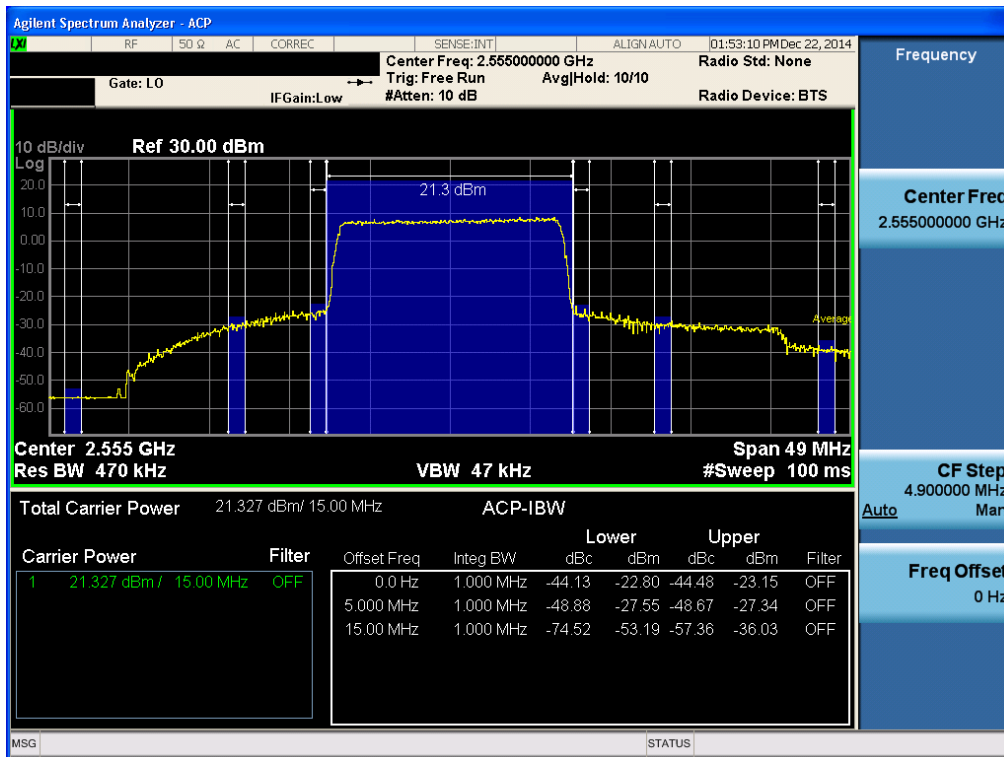
Middle ACP Plot (10MHz Ch.40740 QPSK RB 50)-2



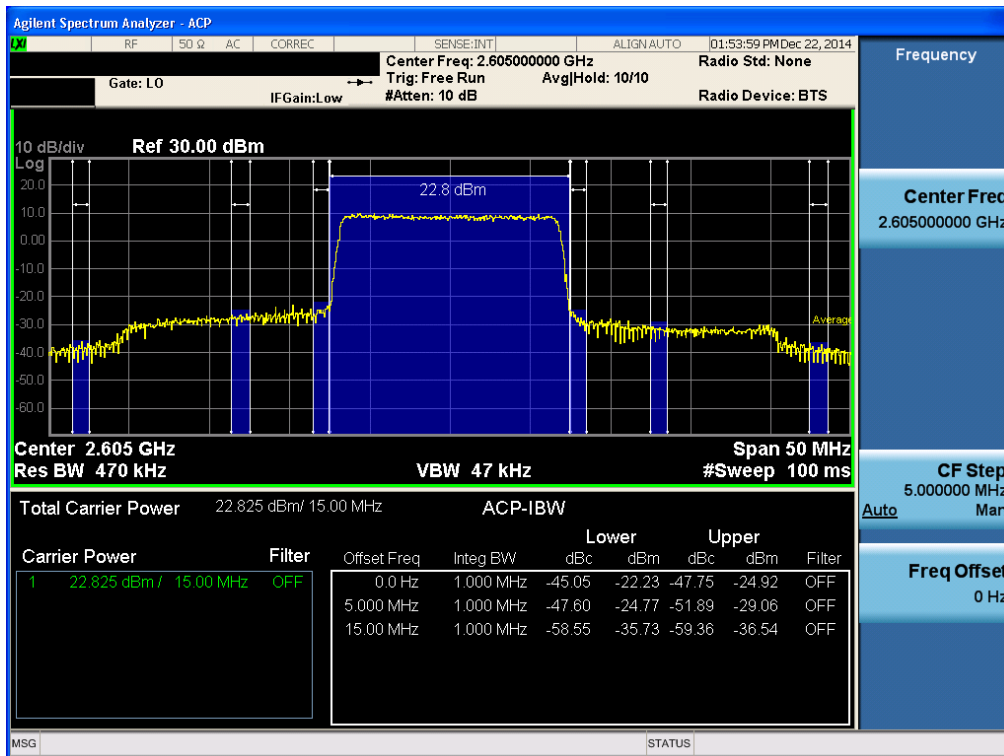
High ACP Plot (10MHz Ch.41240 QPSK RB 50)-3



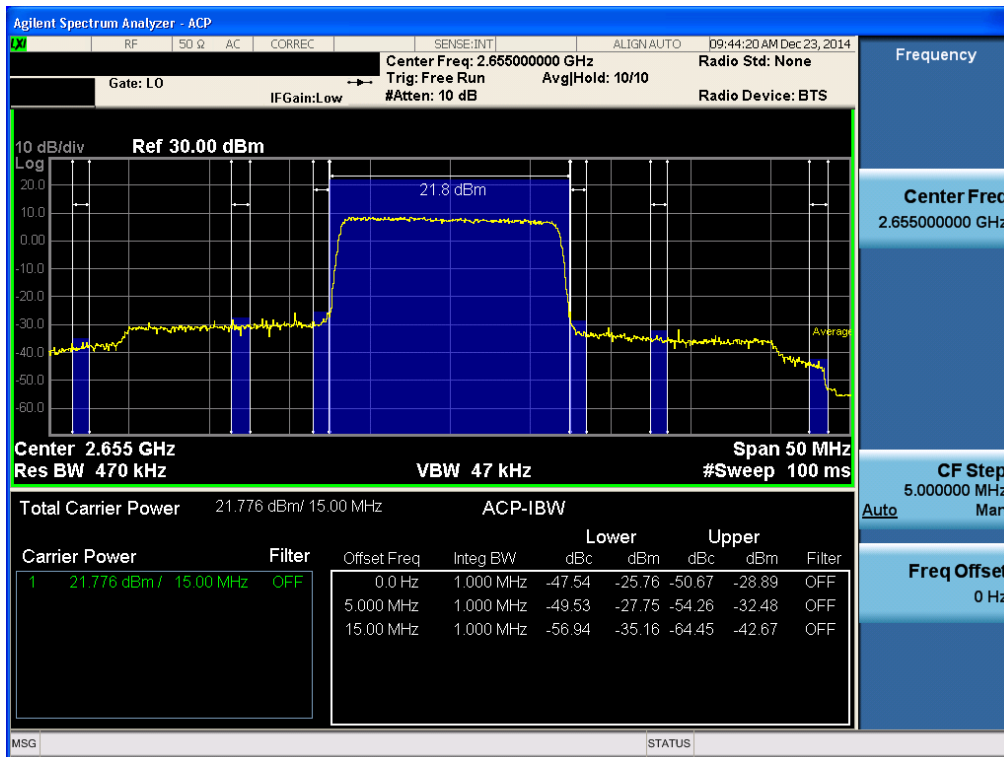
Lower ACP Plot (15MHz Ch.40240 QPSK RB 75)-1



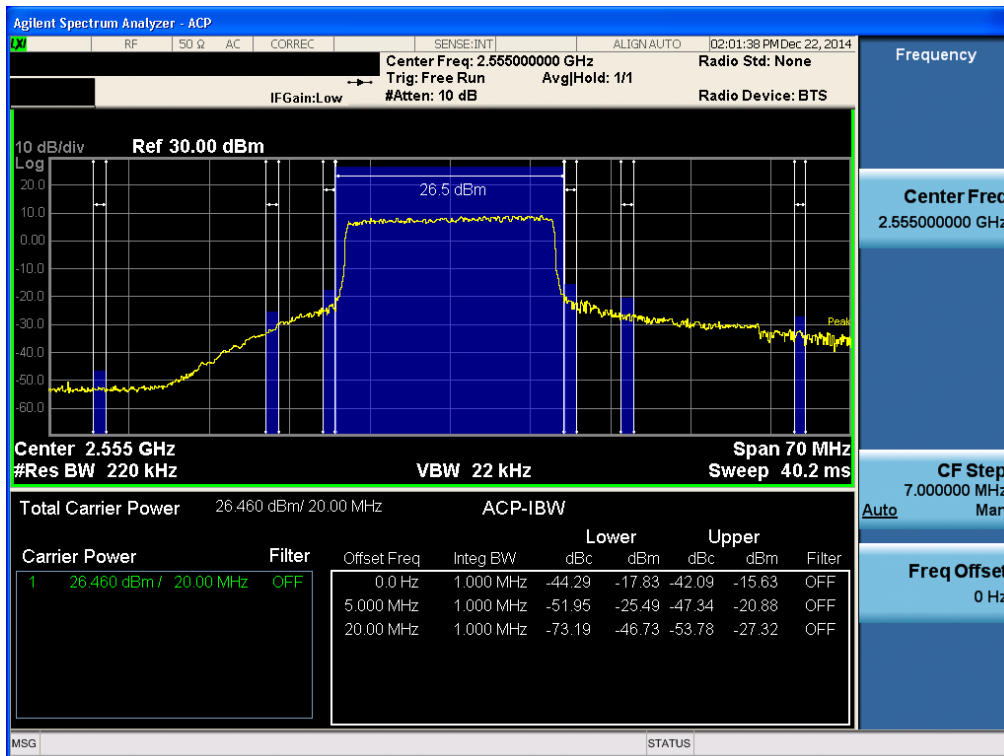
Middle ACP Plot (15MHz Ch.40740 QPSK RB 75)-2



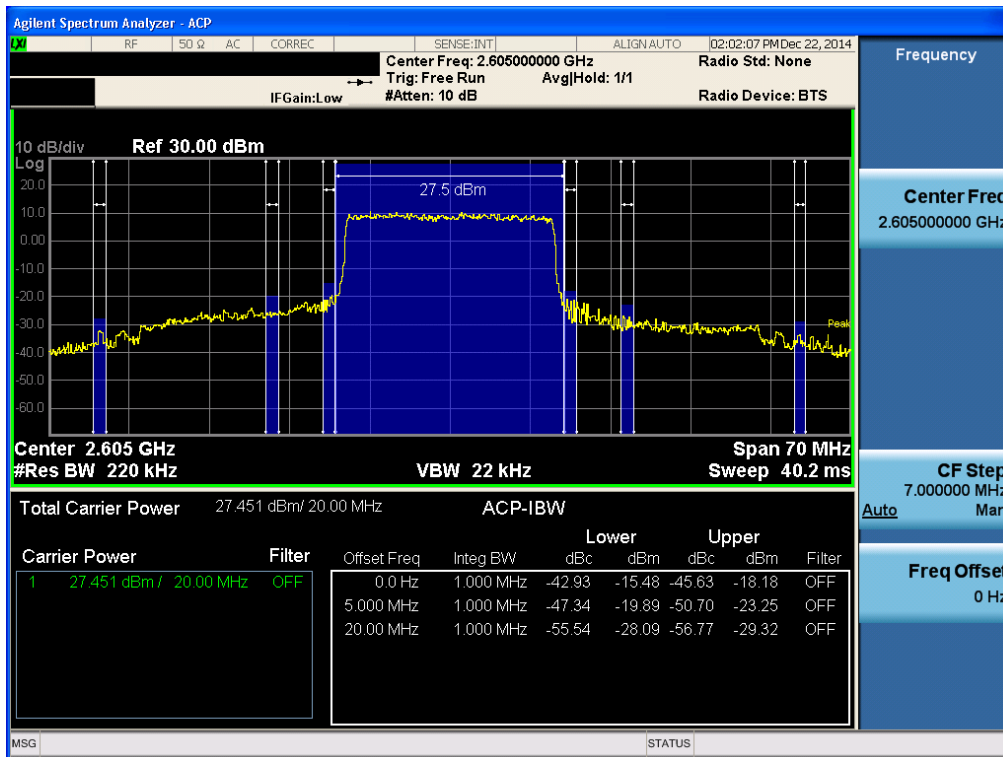
High ACP Plot (15MHz Ch.41240 QPSK RB 75)-3



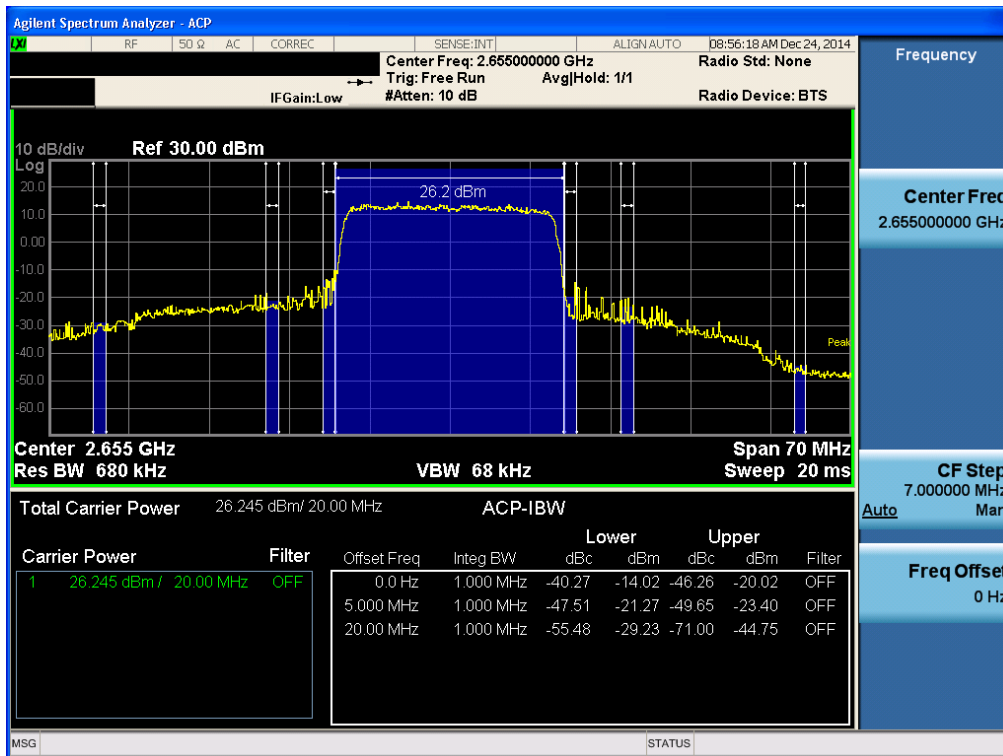
Lower ACP Plot (20MHz Ch.40240 QPSK RB 100)-1



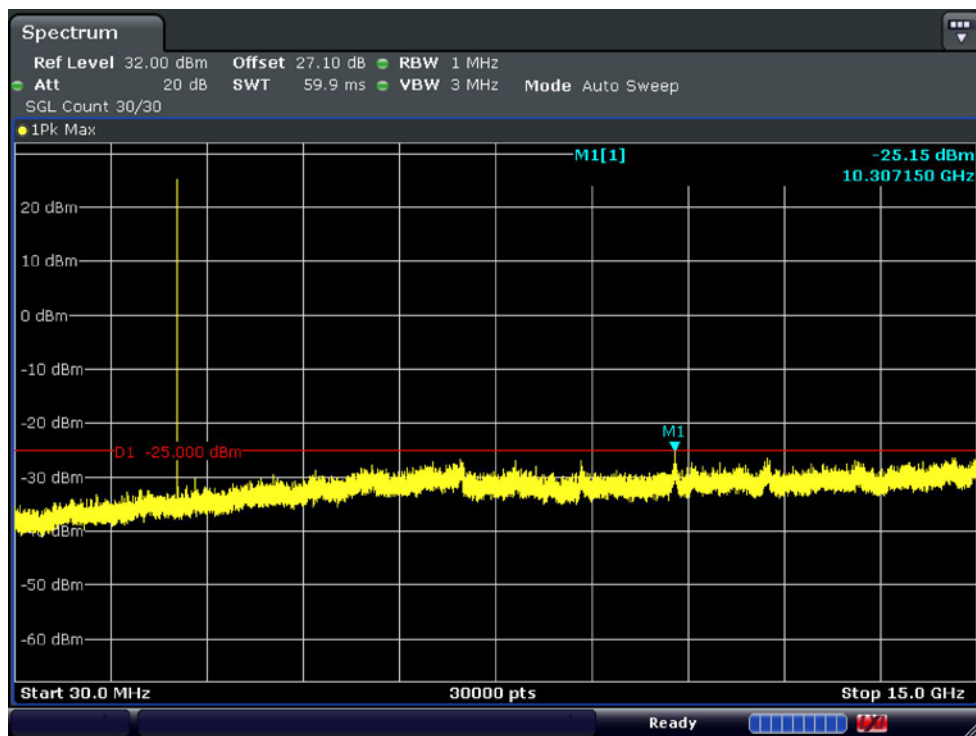
Middle ACP Plot (20MHz Ch.40740QPSK RB 100)-2



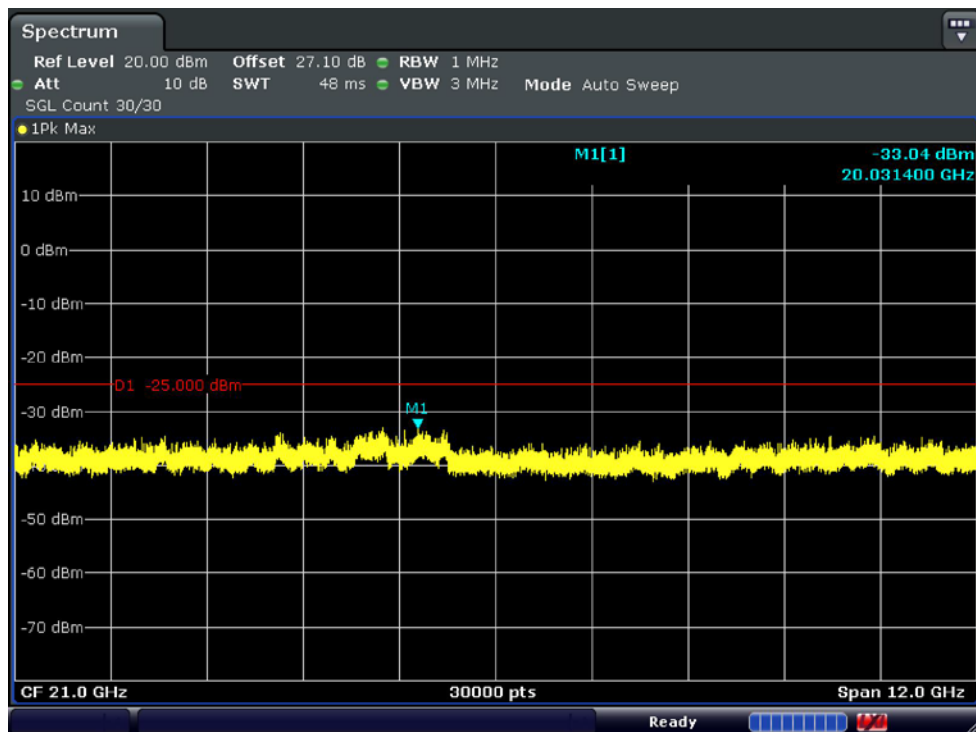
High ACP Plot (20MHz Ch.41240 QPSK RB 100)-3



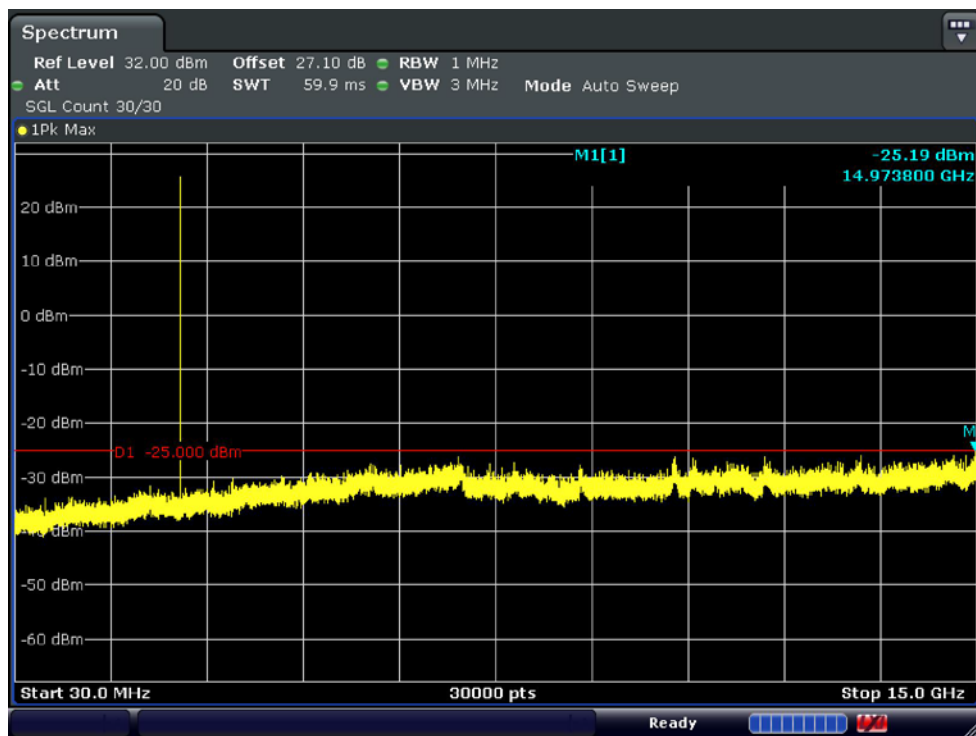
Conducted Spurious Plot_1 (Low ch_5 MHz_QPSK_RB 1_0)-1



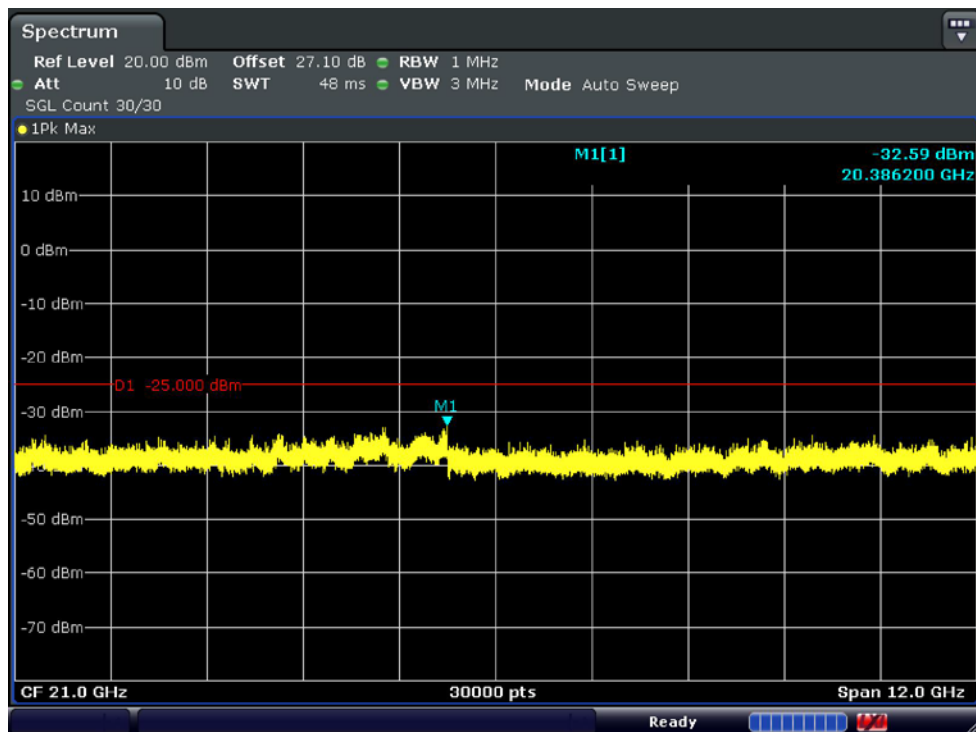
Conducted Spurious Plot_2 (Low ch_5 MHz_QPSK_RB 1_0)-2



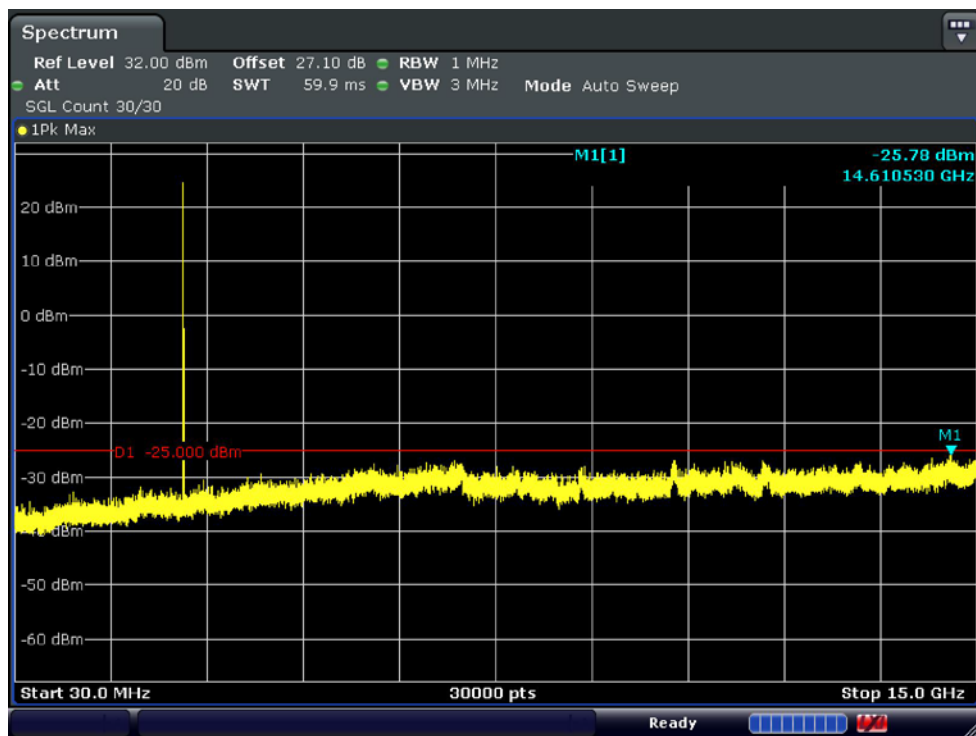
Conducted Spurious Plot_1 (Mid ch_5 MHz_QPSK_RB 1_0)-1



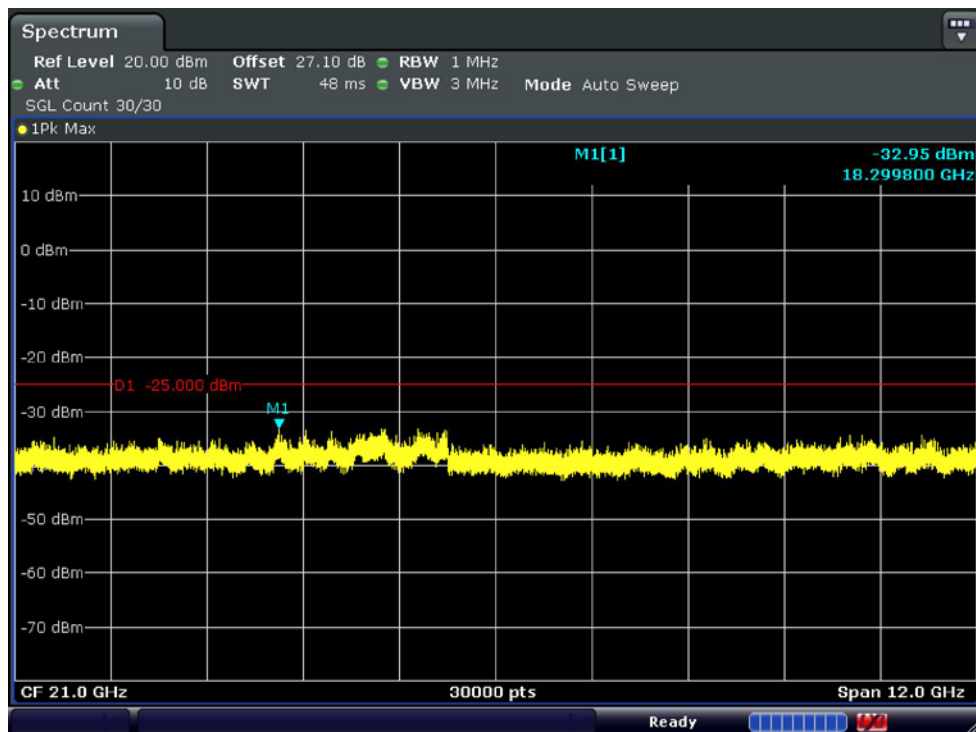
Conducted Spurious Plot_2 (Mid ch_5 MHz_QPSK_RB 1_0)-2



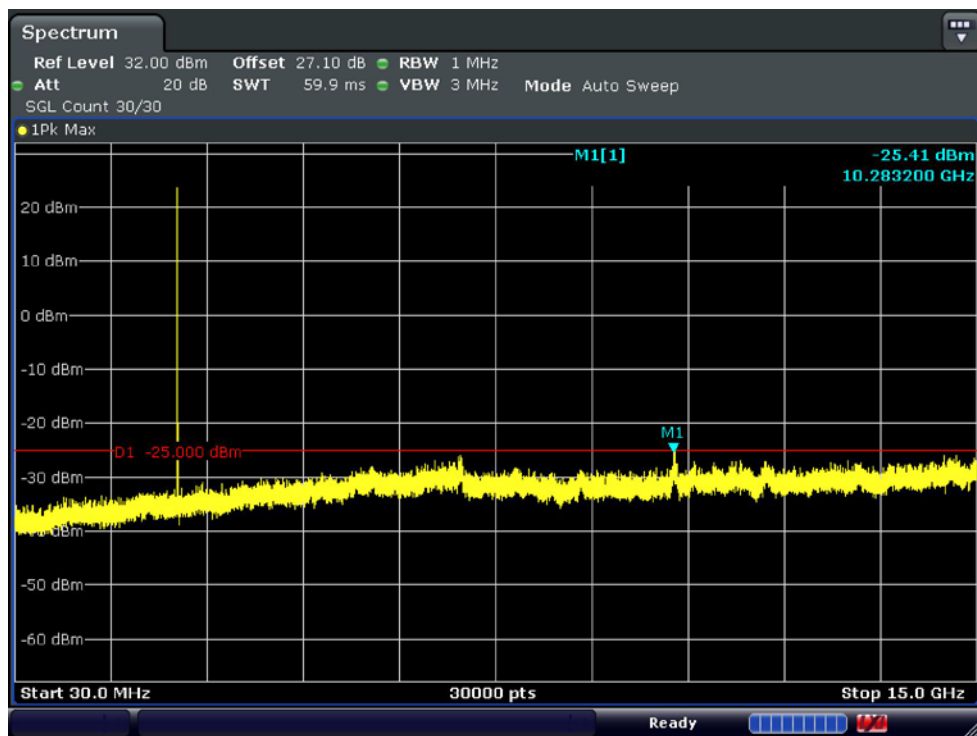
Conducted Spurious Plot_1 (High ch_5 MHz_QPSK_RB 1_0)-1



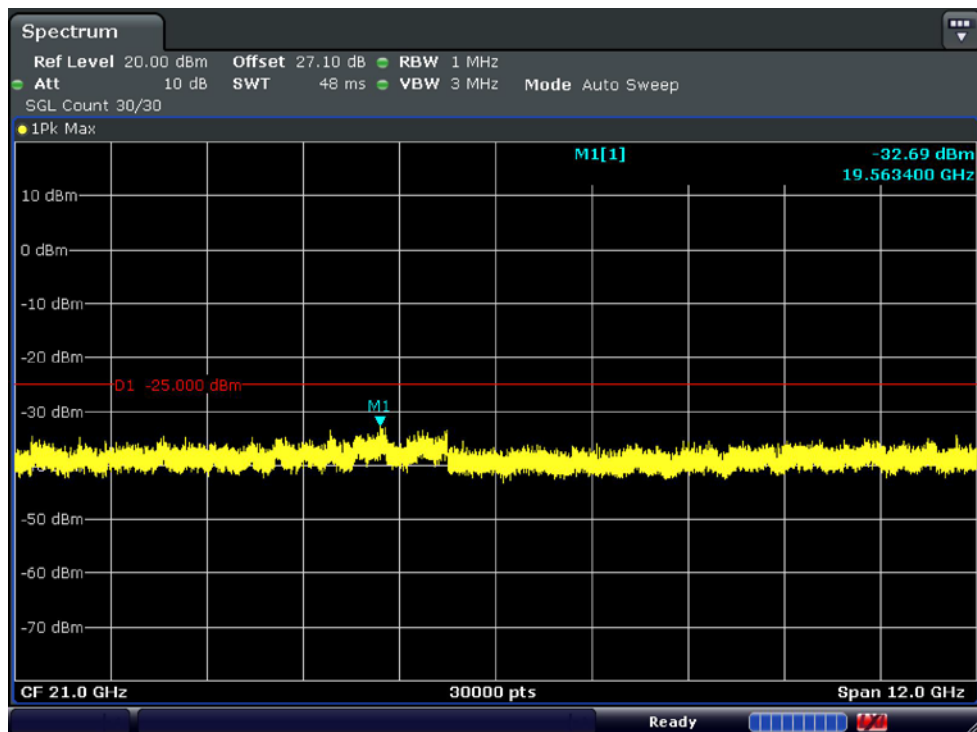
Conducted Spurious Plot_2 (High ch_5 MHz_QPSK_RB 1_0)-2



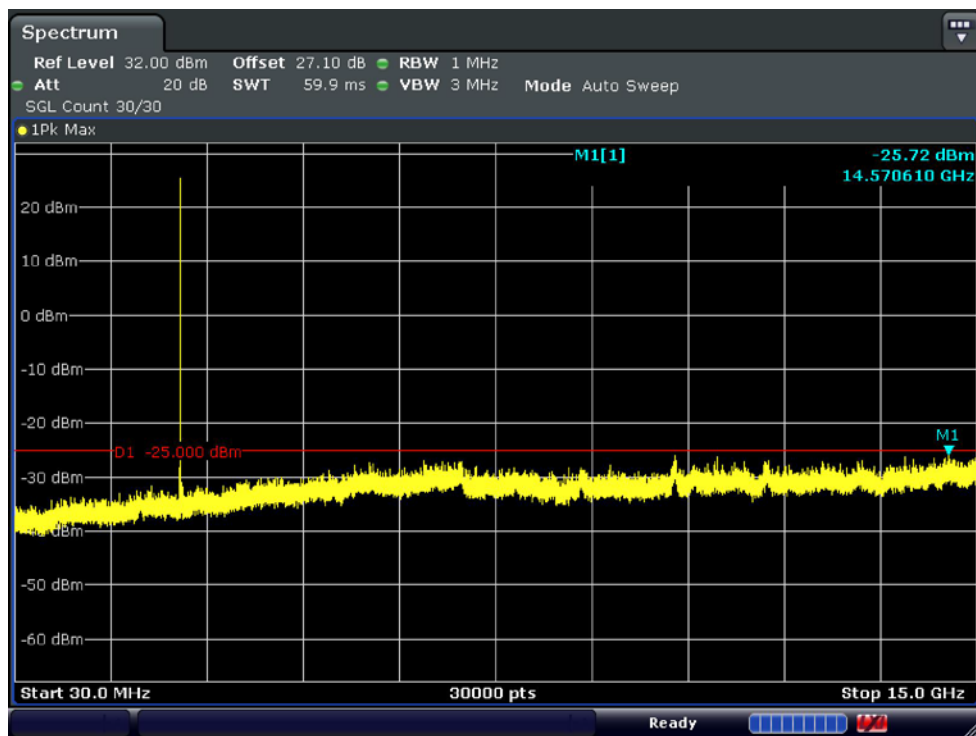
Conducted Spurious Plot_1 (Low ch_10 MHz_QPSK_RB 1_0)-1



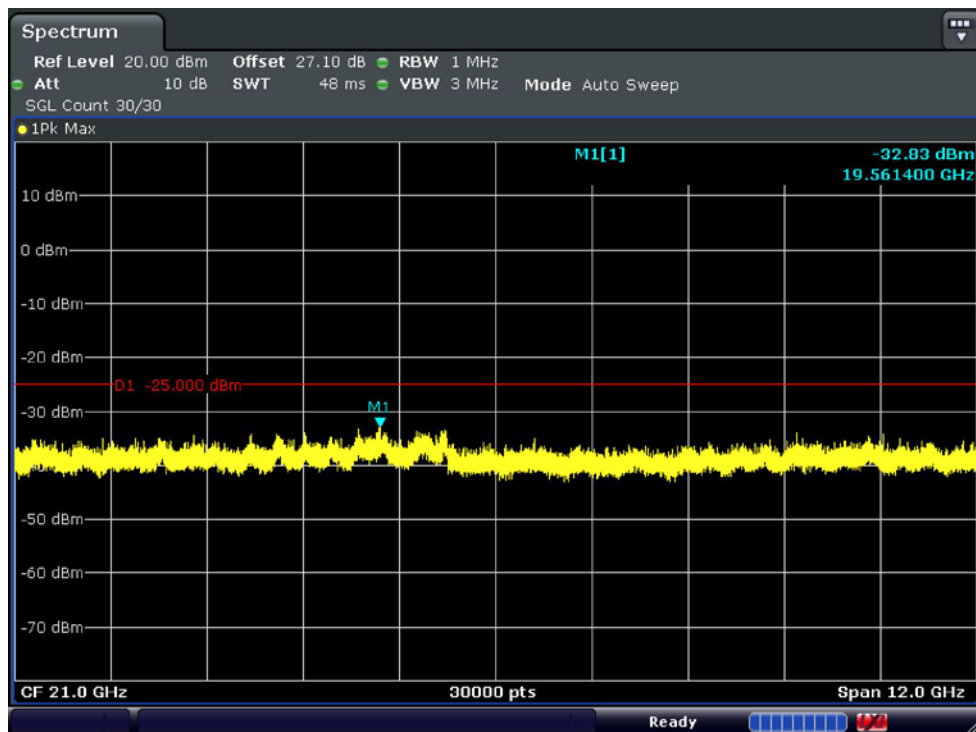
Conducted Spurious Plot_2 (Low ch_10 MHz_QPSK_RB 1_0)-2



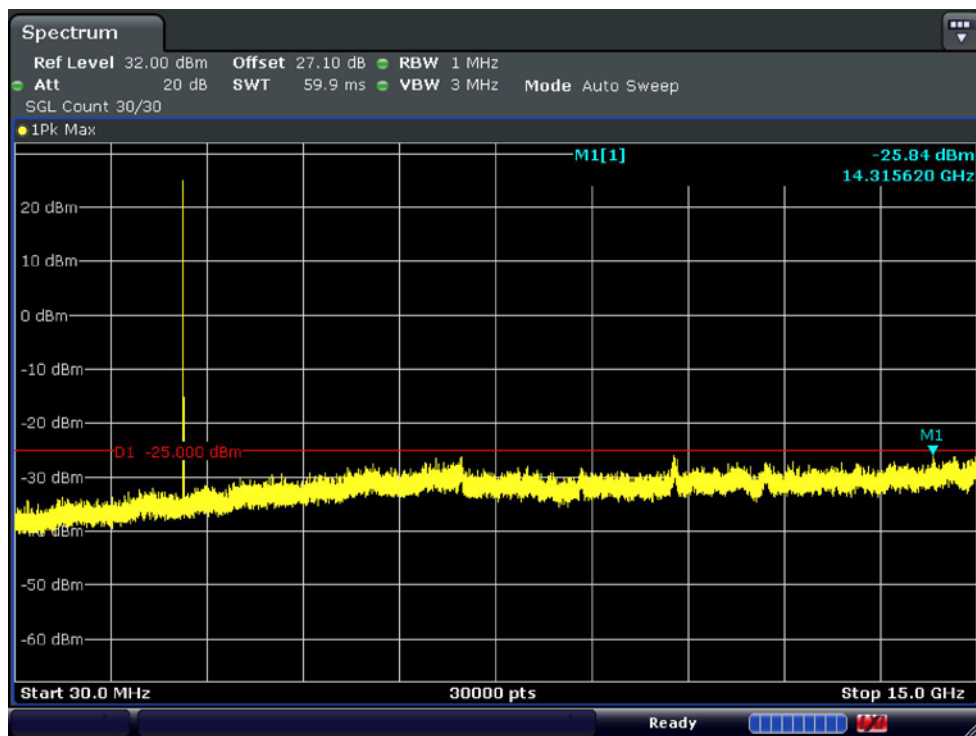
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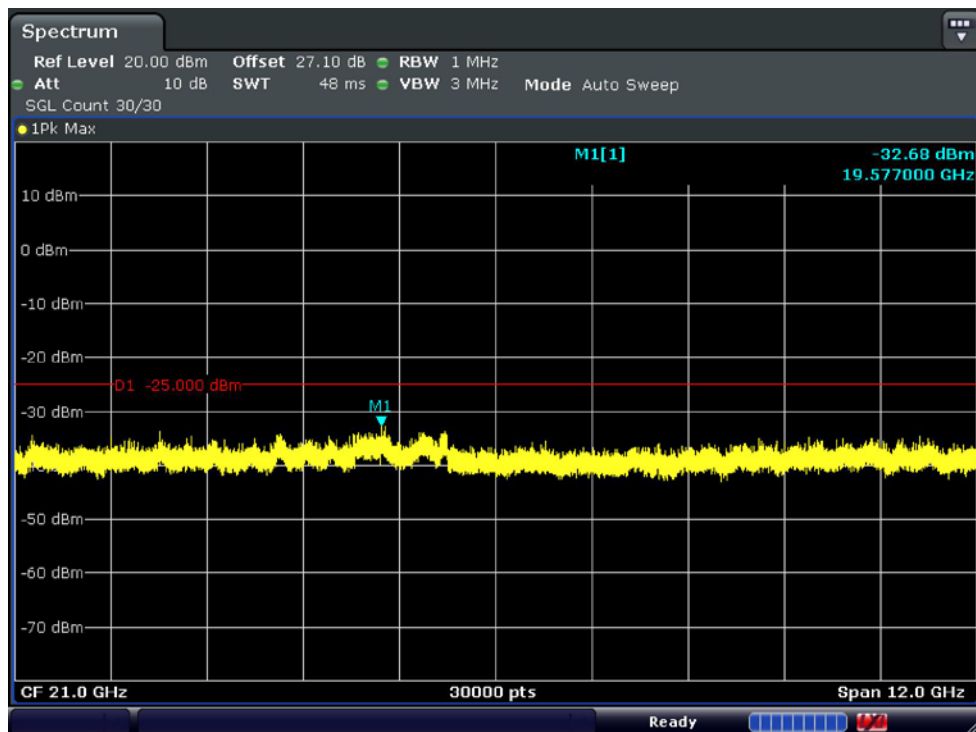
Conducted Spurious Plot_2 (Mid ch_10 MHz_QPSK_RB 1_0)-2



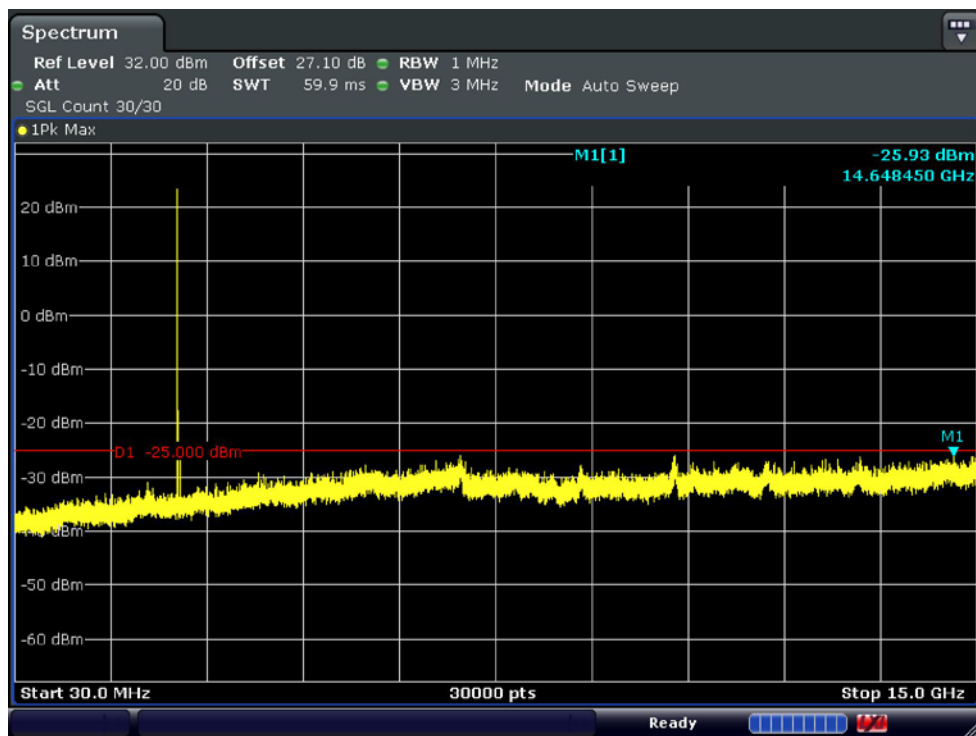
Conducted Spurious Plot_1 (High ch_10 MHz_QPSK_RB 1_0)-1



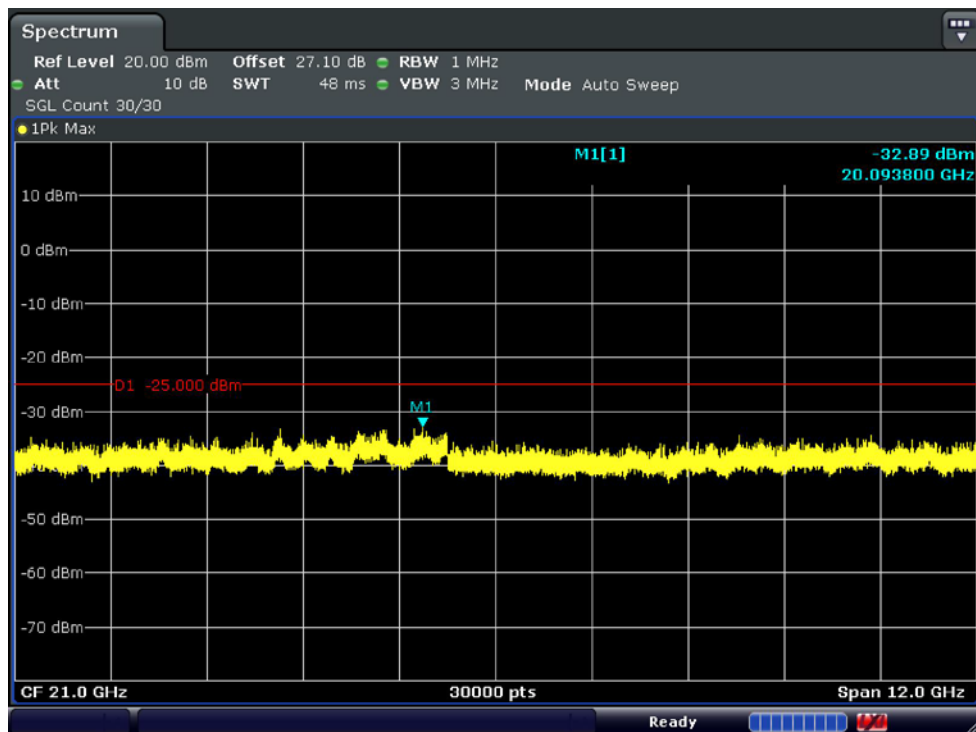
Conducted Spurious Plot_2 (High ch_10 MHz_QPSK_RB 1_0)-2



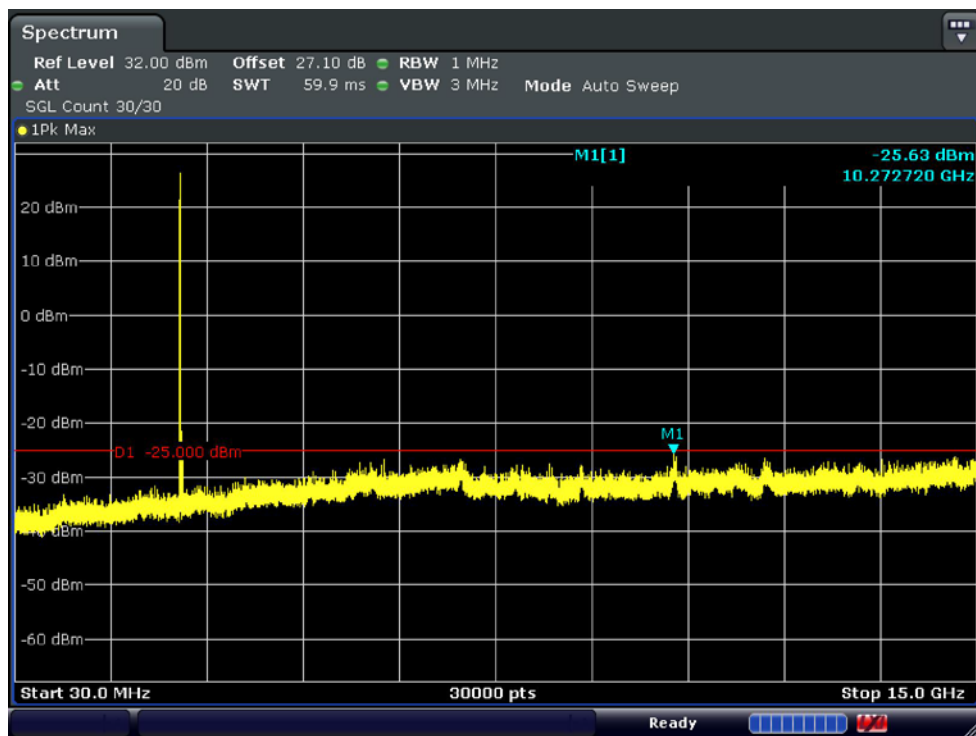
Conducted Spurious Plot_1 (Low ch_15 MHz_QPSK_RB 1_0)-1



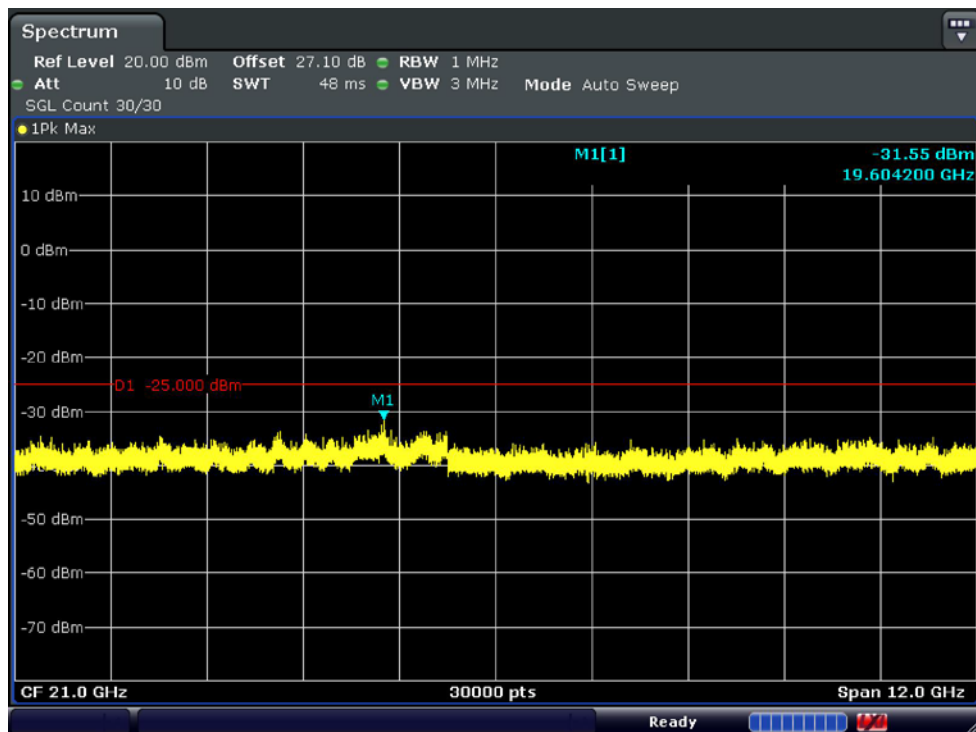
Conducted Spurious Plot_2 (Low ch_15 MHz_QPSK_RB 1_0)-2



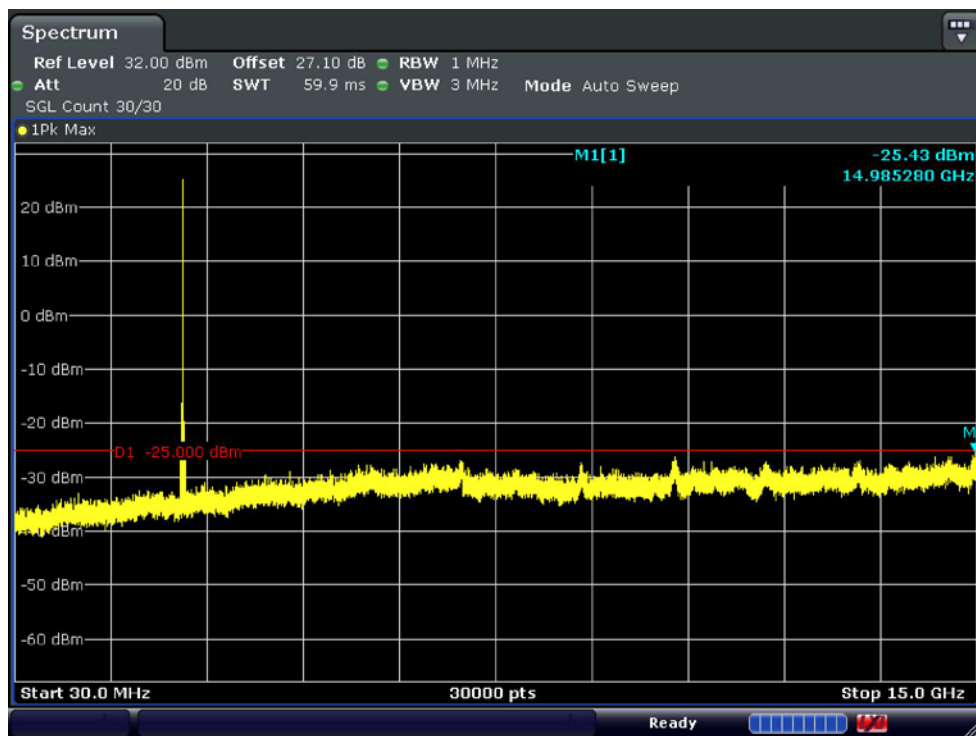
Conducted Spurious Plot_1 (Mid ch_15 MHz_QPSK_RB 1_0)-1



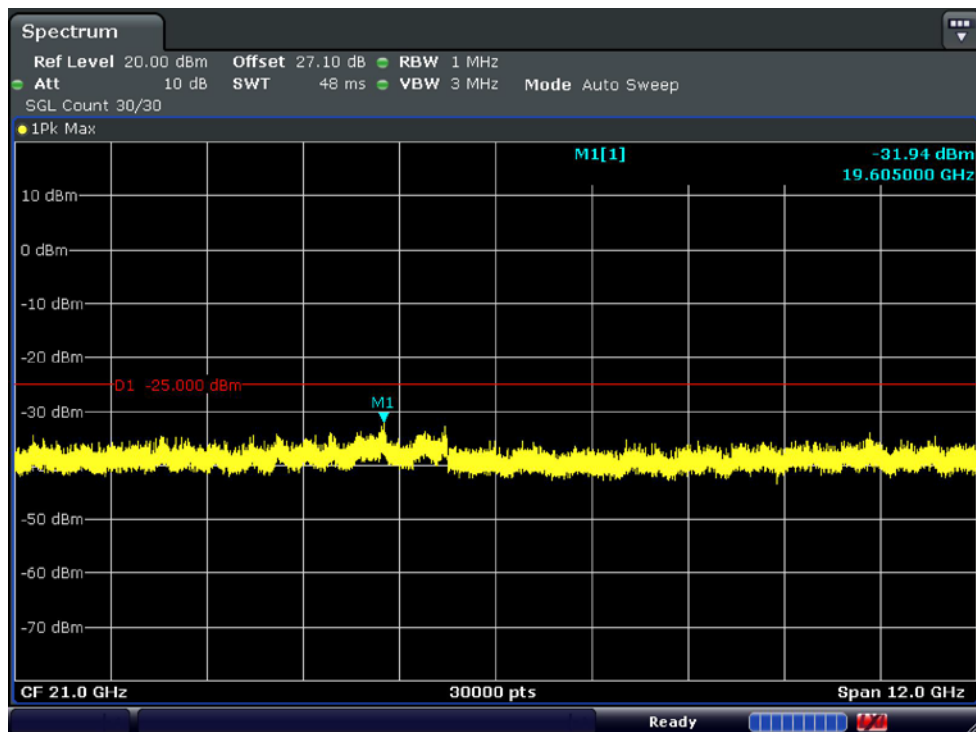
Conducted Spurious Plot_2 (Mid ch_15 MHz_QPSK_RB 1_0)-2



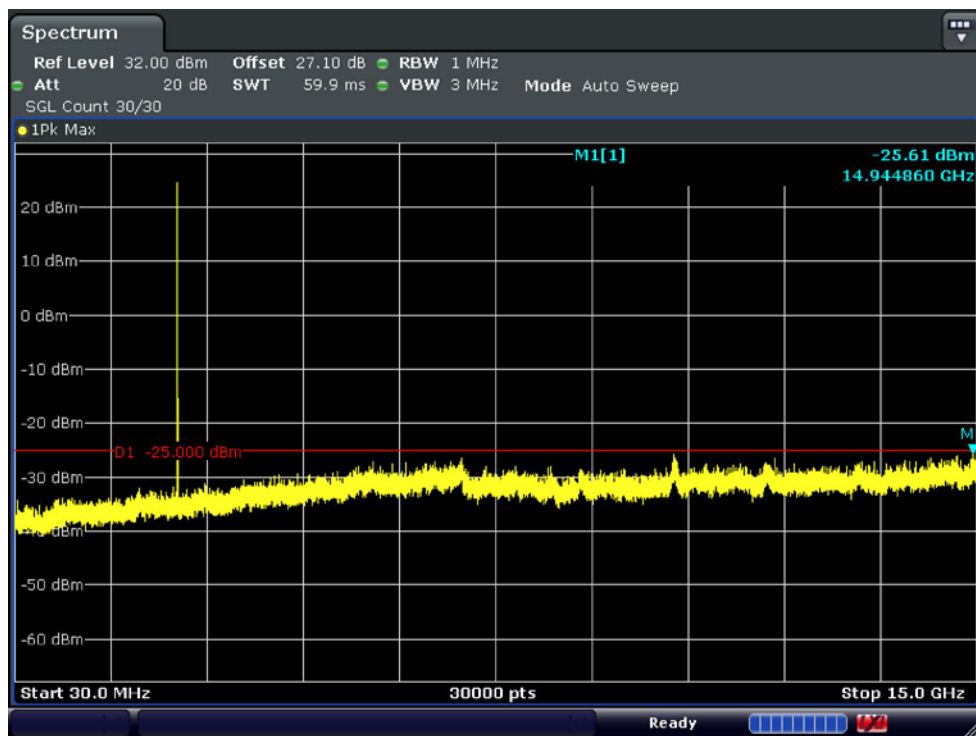
Conducted Spurious Plot_1 (High ch_15 MHz_QPSK_RB 1_0)-1



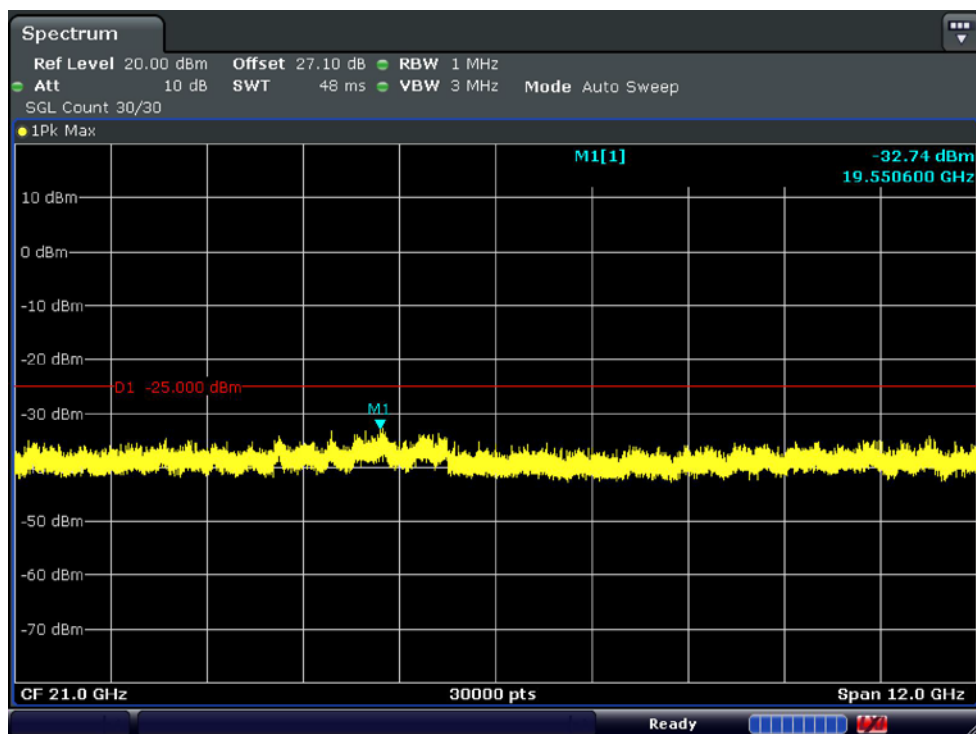
Conducted Spurious Plot_2 (High ch_15 MHz_QPSK_RB 1_0)-2



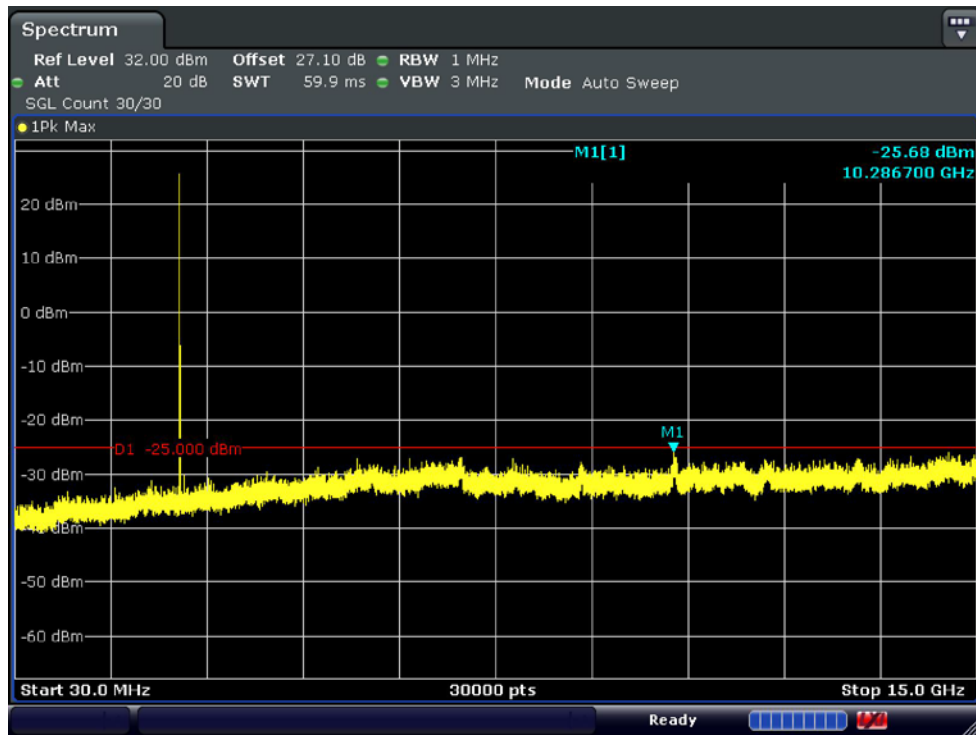
Conducted Spurious Plot_1 (Low ch_20 MHz_QPSK_RB 1_0)-1



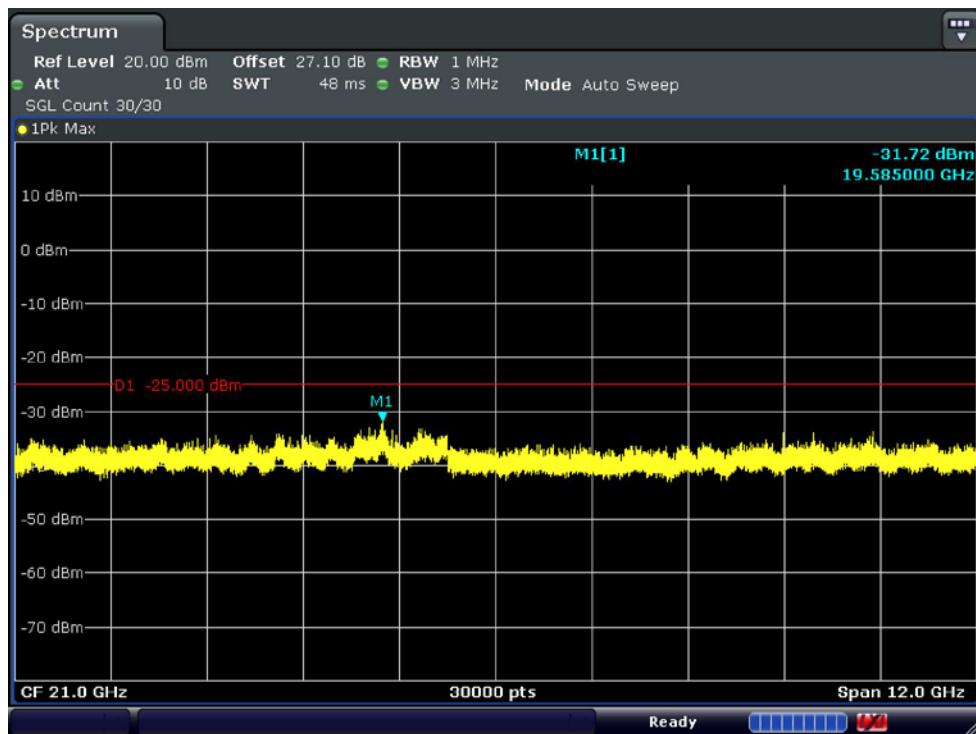
Conducted Spurious Plot_2 (Low ch_20 MHz_QPSK_RB 1_0)-2



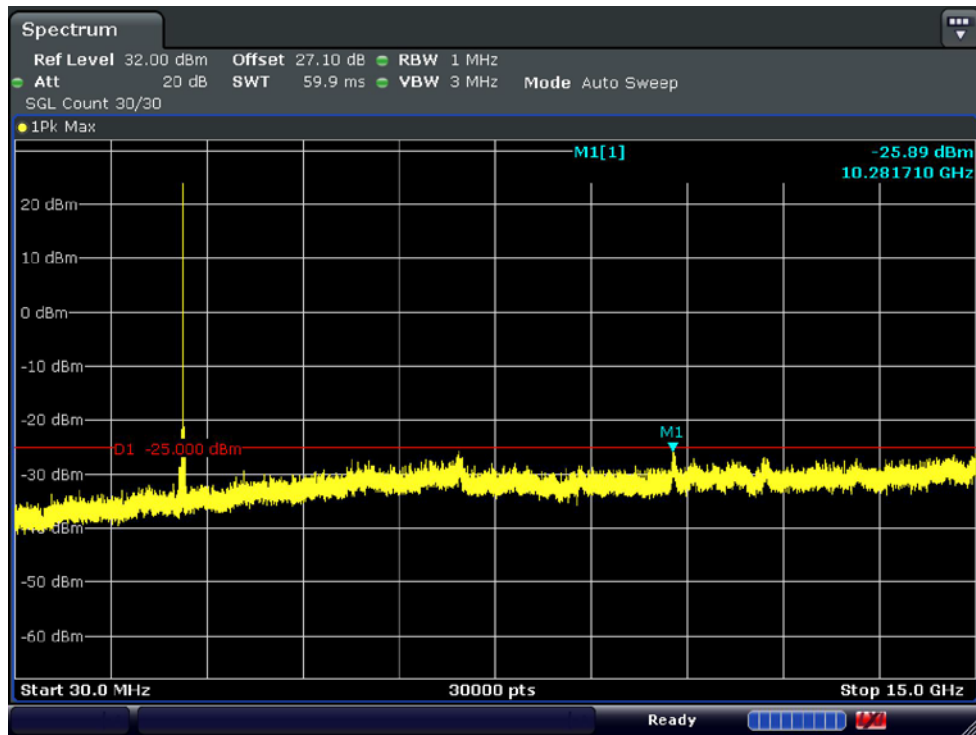
Conducted Spurious Plot_1 (Mid ch_20 MHz_QPSK_RB 1_0)-1



Conducted Spurious Plot_2 (Mid ch_20 MHz_QPSK_RB 1_0)-2



Conducted Spurious Plot_1 (High ch_20 MHz_QPSK_RB 1_0)-1



Conducted Spurious Plot_2 (High ch_20 MHz_QPSK_RB 1_0)-2

