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FCC Carrier Aggregation REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
November 12, 2020

Location:
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-2011-FC013-R1

FCC ID:	**A3LSMG991U**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-G991U
Additional Model(s):	SM-G991U1
EUT Type:	Mobile Phone
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2

Mode (PCC+SCC)	Tx Frequency (MHz)	Modulation	Emission Designator	EIRP	
				Max. Power (dBm)	Max. Power (W)
5MHz+5MHz	1712.5 - 1777.5	QPSK	9M25G7D	23.48	0.223
		16QAM	9M24W7D	23.09	0.204
		64QAM	9M28W7D	20.12	0.103
		256QAM	9M28W7D	18.98	0.079
5MHz+10MHz	1712.8 - 1775.0	QPSK	13M9G7D	23.58	0.228
		16QAM	13M9W7D	23.21	0.209
		64QAM	13M9W7D	22.03	0.160
		256QAM	13M9W7D	19.84	0.096
10MHz+5MHz	1715.0 - 1777.2	QPSK	13M9G7D	23.48	0.223
		16QAM	13M9W7D	23.08	0.203
		64QAM	13M9W7D	20.46	0.111
		256QAM	13M9W7D	19.20	0.083
5MHz+15MHz	1713.0 - 1772.5	QPSK	18M3G7D	23.47	0.222
		16QAM	18M3W7D	22.83	0.192
		64QAM	18M3W7D	20.23	0.105
		256QAM	18M2W7D	19.06	0.081
15MHz+5MHz	1717.5 - 1777.0	QPSK	18M3G7D	23.44	0.221
		16QAM	18M3W7D	22.63	0.183
		64QAM	18M2W7D	20.56	0.114
		256QAM	18M3W7D	19.46	0.088
10MHz+10MHz	1715.0 - 1775.0	QPSK	18M8G7D	23.33	0.215
		16QAM	18M8W7D	22.93	0.196
		64QAM	18M9W7D	20.03	0.101
		256QAM	18M8W7D	18.86	0.077

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §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)

REVIEWED BY

Report prepared by : Jae Ryang Do **Engineer of Telecommunication Testing Center**	**Report approved by : Jong Seok Lee** **Manager of Telecommunication Testing Center**

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2011-FC013	November 02, 2020	- First Approval Report
HCT-RF-2011-FC013-R1	November 12, 2020	- Revised the Max power table on 1 page.

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

Table of Contents

MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG991U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile Phone
Model(s):	SM-G991U
Additional Model(s):	SM-G991U1
Tx Frequency:	1712.5 - 1777.5: 5MHz+5MHz 1712.8 - 1775.0: 5MHz+10MHz 1715.0 - 1777.2: 10MHz+5MHz 1713.0 - 1772.5: 5MHz+15MHz 1717.5 - 1777.0: 15MHz+5MHz 1715.0 - 1775.0: 10MHz+10MHz
Date(s) of Tests:	September 23, 2020 ~ October 31, 2020
LTE CA :	CA 66B (Uplink)

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS, CDMA(BC0, 1, 10) and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, NFC, WPT, mmWave(n260/261).

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, 17383, Rep. of KOREA.**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests 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-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. 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;

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

   Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.
3. The maximum value 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
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10^{th} harmonics from 9 kHz.

Test Note

1. Measurements value 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.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious 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 spurious emissions is calculated by the following formula;

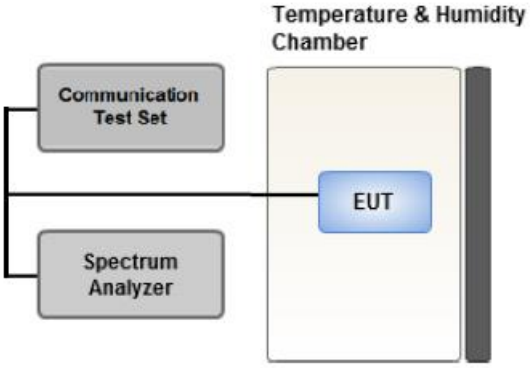
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   Where: $P_g$is the generator output power into the substitution antenna.

   If the fundalmatal frequency is below 1GHz, RF output power has been converted to EIRP.

$$EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$$

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:

.- for continuous transmissions, set to 1 ms,

.- or burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.

4. Record the maximum PAPR level associated with a probability of 0.1%.

② **Alternate Procedure for PAPR**

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{Pk}.

Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{Avg}. Determine the P.A.R. from:

$$P.A.R_{(dB)} = P_{Pk\ (dBm)} - P_{Avg\ (dBm)}\ (P_{Avg} = \text{Average Power} + \text{Duty cycle Factor})$$

Test Settings(Peak Power)

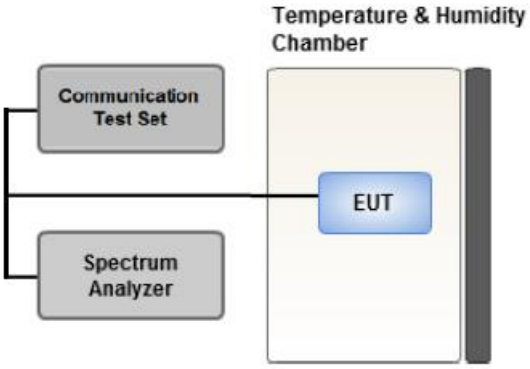
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

1. Set the RBW ≥ OBW.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 2 × OBW.
4. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

Test Settings(Average Power)

1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to “free run.”
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

3.5 OCCUPIED BANDWIDTH.



Test setup

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.

The EUT makes a call to the communication simulator.

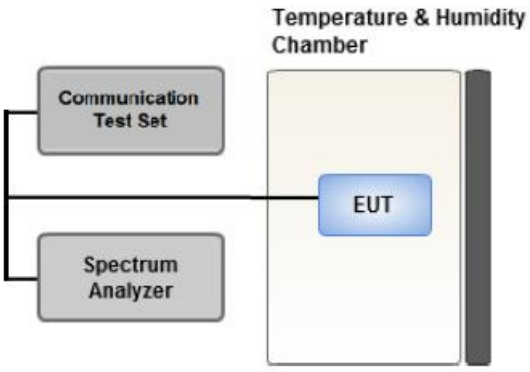
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic.

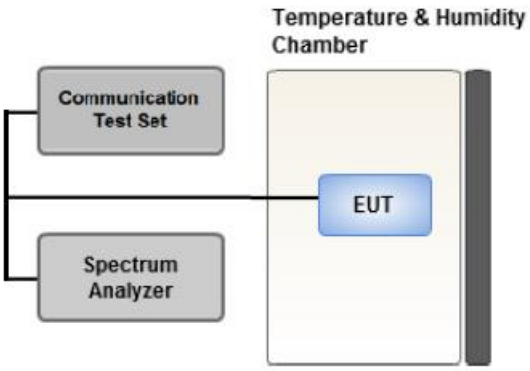
All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

3.7 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

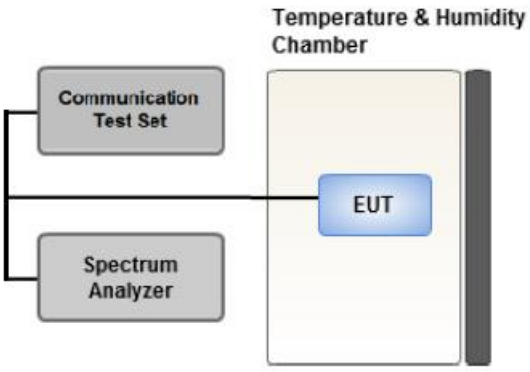
Test Notes

According to FCC 22.917, 24.238, 27.53 specified that 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. 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.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

   The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

2. Primary Supply Voltage:

   .- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

   .- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes 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.
3. 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 Date	Calibration Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/27/2020	Annual	04/27/2021
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93008124	03/18/2020	Annual	03/18/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	04/27/2020	Annual	04/27/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2020	Annual	06/04/2021
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2020	Annual	10/14/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	04/26/2019	Biennial	04/26/2021
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/12/2019	Biennial	03/12/2021
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/22/2020	Annual	01/22/2021
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).
3. Model : FSV40/Spectrum
   - Use date of equipment: September 23, 2020 ~ October 12, 2020, October 14, 2020 ~

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(h)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Peak- to- Average Ratio	27.50(d)(5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, § 27.54	Emission must remain in band	PASS

Note:

1. The same samples were used for SAR and EMC

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	27.50(d)(4)	< 1 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(h)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 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 effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

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

1) The EUT mounted on a non-conductive turntable is 2.5 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.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Note

1. All tests were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth.
2. Channel bandwidth is shown in the tables below based only on the channel bandwidths that were supported in this device.

Channel Bandwidth (PCC)	Channel Bandwidth (SCC)	Maximum aggregated bandwidth (MHz)
5	5	10
5	10	15
10	5	15
5	15	20
15	5	20
10	10	20

3. All modes of operation were investigated and the worst case configuration results are reported in this section.

Please refer to the table below.

- Worst case(Conducted Spurious Emissions, Band Edge)

: We have selected higher of the Conduction Output Power.

- Worst case(Radiated Spurious Emissions) : We have selected higher of the EIRP.

- Worst case(OBW, PAR, Frequency stability)

: All modes of operation were investigated and the worst case configuration results are reported.

[Worst case]

Test Description	Mod	Operating frequency	PCC					SCC				
			BW (MHz)	Freq. (MHz)	Ch.	RB	RB Offset	BW (MHz)	Freq. (MHz)	Ch.	RB	RB Offset
Conducted Spurious Emissions/ Band Edge	QPSK	Low	15	1717.5	132047	1	74	5	1726.8	132140	1	0
	QPSK	Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0
	QPSK	High	5	1767.8	132550	1	24	10	1775.0	132622	1	0
	QPSK	Low	15	1717.5	132047	1	0	5	1726.8	132140	1	24
	QPSK	Mid	5	1752.6	132398	1	0	5	1757.4	132446	1	24
	QPSK	High	5	1767.8	132550	1	0	10	1775.0	132622	1	49
	QPSK	Low	15	1717.5	132047	75	0	5	1726.8	132140	25	0
	QPSK	Mid	15	1752.6	132398	75	0	5	1761.9	132491	25	0
	QPSK	High	5	1767.8	132550	25	0	10	1775.0	132622	50	0
	QPSK	Low	10	1715.0	132022	50	0	10	1724.9	132121	50	0
	QPSK	Mid	10	1750.1	132373	50	0	10	1760.0	132472	50	0
	QPSK	High	10	1765.1	132523	50	0	10	1775.0	132622	50	0
Radiated Spurious Emissions	QPSK	Low	5	1712.5	131997	1	24	5	1717.3	132045	1	0
	QPSK	Mid	5	1750.3	132375	1	24	10	1757.5	132447	1	0
	QPSK	High	5	1767.8	132550	1	21	10	1775.0	132622	1	0

[Worst case]

Test Description	Mod	Operating frequency	PCC					SCC				
			BW (MHz)	Freq. (MHz)	Ch.	RB	RB Offset	BW (MHz)	Freq. (MHz)	Ch.	RB	RB Offset
OBW, PAR	QPSK, 16QAM, 64QAM 256QAM	Mid	5	1752.6	132398	25	0	5	1757.4	132446	25	0
			5	1750.3	132375	25	0	10	1757.5	132447	50	0
			10	1752.5	132397	50	0	5	1759.7	132469	25	0
			5	1748.1	132353	25	0	15	1757.4	132446	75	0
			15	1752.6	132398	75	0	5	1761.9	132491	25	0
			10	1750.1	132373	50	0	10	1760.0	132472	50	0
Frequency stability	QPSK	Low	5	1712.5	131997	25	0	5	1717.3	132045	25	0
			10	1715.0	132022	50	0	5	1722.2	132094	25	0
			15	1717.5	132047	75	0	5	1726.8	132140	25	0
		High	5	1772.7	132599	25	0	5	1777.5	132647	25	0
			10	1770.0	132572	50	0	5	1777.2	132644	25	0
			15	1767.7	132549	75	0	5	1777.0	132642	25	0

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8.1 Conducted Power

Operating frequency	PCC					SCC					Conducted. Power [dBm]
	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	
Low	5	1712.5	131997	1	24	5	1717.3	132045	1	0	23.56
	5	1712.8	132000	1	24	10	1720.0	132072	1	0	23.73
	10	1715.0	132022	1	49	5	1722.2	132094	1	0	23.23
	5	1713.0	132002	1	24	15	1722.3	132095	1	0	23.61
	15	***1717.5***	***132047***	***1***	***74***	***5***	***1726.8***	***132140***	***1***	***0***	***23.95***
	10	1715.0	132022	1	49	10	1724.9	132121	1	0	23.68
Mid	***5***	***1752.6***	***132398***	***1***	***24***	***5***	***1757.4***	***132446***	***1***	***0***	***24.15***
	5	1750.3	132375	1	24	10	1757.5	132447	1	0	24.07
	10	1752.5	132397	1	49	5	1759.7	132469	1	0	23.94
	5	1748.1	132353	1	24	15	1757.4	132446	1	0	24.06
	15	1752.6	132398	1	74	5	1761.9	132491	1	0	24.09
	10	1750.1	132373	1	49	10	1760.0	132472	1	0	23.95
High	5	1772.7	132599	1	24	5	1777.5	132647	1	0	23.91
	5	***1767.8***	***132550***	***1***	***24***	***10***	***1775.0***	***132622***	***1***	***0***	***23.98***
	10	1770.0	132572	1	49	5	1777.2	132644	1	0	23.76
	5	1763.2	132504	1	24	15	1772.5	132597	1	0	23.90
	15	1767.7	132549	1	74	5	1777.0	132642	1	0	23.83
	10	1765.1	132523	1	49	10	1775.0	132622	1	0	23.75

Note:

Modulation : QPSK(1RB)

Operating frequency	PCC					SCC					Conducted. Power [dBm]
	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	
Low	5	1712.5	131997	25	0	5	1717.3	132045	25	0	23.38
	5	1712.8	132000	25	0	10	1720.0	132072	50	0	23.43
	10	1715.0	132022	50	0	5	1722.2	132094	25	0	23.46
	5	1713.0	132002	25	0	15	1722.3	132095	75	0	23.44
	15	***1717.5***	***132047***	***75***	***0***	***5***	***1726.8***	***132140***	***25***	***0***	***23.47***
	10	1715.0	132022	50	0	10	1724.9	132121	50	***0***	23.45
Mid	5	1752.6	132398	25	0	5	1757.4	132446	25	0	23.63
	5	1750.3	132375	25	0	10	1757.5	132447	50	0	23.60
	10	1752.5	132397	50	0	5	1759.7	132469	25	0	24.22
	5	1748.1	132353	25	0	15	1757.4	132446	75	0	23.63
	15	***1752.6***	***132398***	***75***	***0***	***5***	***1761.9***	***132491***	***25***	***0***	***23.64***
	10	1750.1	132373	50	*0*	10	1760.0	132472	50	***0***	23.55
High	5	1772.7	132599	25	0	5	1777.5	132647	25	0	23.33
	5	***1767.8***	***132550***	***25***	***0***	***10***	***1775.0***	***132622***	***50***	***0***	***23.46***
	10	1770.0	132572	50	0	5	1777.2	132644	25	0	23.43
	5	1763.2	132504	25	0	15	1772.5	132597	75	0	23.42
	15	1767.7	132549	75	0	5	1777.0	132642	25	0	23.44
	10	1765.1	132523	50	*0*	10	1775.0	132622	50	***0***	23.33

Note:

Modulation : QPSK(Full RB)

Operating frequency	PCC					SCC					Conducted. Power [dBm]
	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	
Low	15	1717.5	132047	1	74	5	1726.8	132140	1	0	22.71
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	24.02
High	5	1767.8	132550	1	24	10	1775.0	132622	1	0	23.95
Low	15	1717.5	132047	75	0	5	1726.8	132140	25	0	22.49
Mid	15	1752.6	132398	75	0	5	1761.9	132491	25	0	22.58
High	5	1767.8	132550	25	0	10	1775.0	132622	50	0	22.37

Note:

Modulation : 16QAM

Operating frequency	PCC					SCC					Conducted. Power [dBm]
	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	
Low	15	1717.5	132047	1	74	5	1726.8	132140	1	0	19.81
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	21.74
High	5	1767.8	132550	1	24	10	1775.0	132622	1	0	23.14
Low	15	1717.5	132047	75	0	5	1726.8	132140	25	0	22.18
Mid	15	1752.6	132398	75	0	5	1761.9	132491	25	0	22.47
High	5	1767.8	132550	25	0	10	1775.0	132622	50	0	22.30

Note:

Modulation : 64QAM

Operating frequency	PCC					SCC					Conducted. Power [dBm]
	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	Bandwidth [MHz]	Freq. (MHz)	Channel	RB	RB Offset	
Low	15	1717.5	132047	1	74	5	1726.8	132140	1	0	18.37
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	20.85
High	5	1767.8	132550	1	24	10	1775.0	132622	1	0	20.87
Low	15	1717.5	132047	75	0	5	1726.8	132140	25	0	20.50
Mid	15	1752.6	132398	75	0	5	1761.9	132491	25	0	20.59
High	5	1767.8	132550	25	0	10	1775.0	132622	50	0	20.49

Note:

Modulation : 256QAM

8.2 Equivalent Isotropic Radiated Power

	PCC			SCC			Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol.	E.I.R.P	
	BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset						W	dBm
Low	***5***	***131997***	***1/24***	***5***	***132045***	***1/0***	***-17.87***	***15.46***	***9.90***	***1.88***	***H***	***0.22***	***23.48***
	5	132000	1/24	10	132072	1/0	-18.34	14.99	9.90	1.88	H	0.20	23.01
	10	132022	1/49	5	132094	1/0	-18.92	14.41	9.90	1.88	H	0.17	22.43
	5	132002	1/24	15	132095	1/0	-18.43	14.90	9.90	1.88	H	0.20	22.92
	15	132047	1/74	5	132140	1/0	-18.88	14.45	9.90	1.88	H	0.18	22.47
	10	132022	1/49	10	132121	1/0	-18.63	14.70	9.90	1.88	H	0.19	22.72
Mid	5	132398	1/24	5	132446	1/0	-18.11	15.19	10.02	1.91	H	0.21	23.30
	5	***132375***	***1/24***	***10***	***132447***	***1/0***	***-17.83***	***15.47***	***10.02***	***1.91***	***H***	***0.23***	***23.58***
	10	132397	1/49	5	132469	1/0	-17.93	15.37	10.02	1.91	H	0.22	23.48
	5	132353	1/24	15	132446	1/0	-17.94	15.36	10.02	1.91	H	0.22	23.47
	15	132398	1/74	5	132491	1/0	-17.97	15.33	10.02	1.91	H	0.22	23.44
	10	132373	1/49	10	132472	1/0	-18.08	15.22	10.02	1.91	H	0.22	23.33
High	5	132599	1/24	5	132647	1/0	-18.46	14.91	10.02	1.92	H	0.20	23.01
	5	***132550***	***1/24***	***10***	***132622***	***1/0***	***-18.26***	***15.11***	***10.02***	***1.92***	***H***	***0.21***	***23.21***
	10	132572	1/49	5	132644	1/0	-18.52	14.85	10.02	1.92	H	0.20	22.95
	5	132504	1/24	15	132597	1/0	-18.27	15.10	10.02	1.92	H	0.21	23.20
	15	132549	1/74	5	132642	1/0	-18.45	14.92	10.02	1.92	H	0.20	23.02
	10	132523	1/49	10	132622	1/0	-18.34	15.03	10.02	1.92	H	0.21	23.13

Note:

1. Modulation : QPSK

2. Limit : < 2 Watts

PCC			SCC			Measured	Substitute	Ant.			E.I.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset	Level (dBm)	Level (dBm)	Gain (dBi)	C.L	Pol.	W	dBm
5	132398	1/24	5	132446	1/0	-18.32	14.46	10.98	2.35	H	0.20	23.09
5	132375	1/24	10	132447	1/0	-18.20	14.58	10.98	2.35	H	0.21	23.21
10	132397	1/49	5	132469	1/0	-18.33	14.45	10.98	2.35	H	0.20	23.08
5	132353	1/24	15	132446	1/0	-18.58	14.20	10.98	2.35	H	0.19	22.83
15	132398	1/74	5	132491	1/0	-18.78	14.00	10.98	2.35	H	0.18	22.63
10	132373	1/49	10	132472	1/0	-18.48	14.30	10.98	2.35	H	0.20	22.93
5	131997	1/24	5	132045	1/0	-19.06	13.86	10.75	2.32	H	0.17	22.29
5	132550	1/24	10	132622	1/0	-18.71	14.05	11.10	2.39	H	0.19	22.76

Note:

1. Modulation : 16QAM

2. Limit : < 2 Watts

PCC			SCC			Measured	Substitute	Ant.			E.I.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset	Level (dBm)	Level (dBm)	Gain (dBi)	C.L	Pol.	W	dBm
5	132398	1/24	5	132446	1/0	-21.29	11.49	10.98	2.35	H	0.10	20.12
5	132375	1/24	10	132447	1/0	-21.20	11.58	10.98	2.35	H	0.10	20.21
10	132397	1/49	5	132469	1/0	-20.95	11.83	10.98	2.35	H	0.11	20.46
5	132353	1/24	15	132446	1/0	-21.18	11.60	10.98	2.35	H	0.11	20.23
15	132398	1/74	5	132491	1/0	-20.85	11.93	10.98	2.35	H	0.11	20.56
10	132373	1/49	10	132472	1/0	-21.38	11.40	10.98	2.35	H	0.10	20.03
5	131997	1/24	5	132045	1/0	-22.30	10.62	10.75	2.32	H	0.08	19.05
5	132550	1/24	10	132622	1/0	-19.44	13.32	11.10	2.39	H	0.16	22.03

Note:

1. Modulation : 64QAM

2. Limit : < 2 Watts

PCC			SCC			Measured	Substitute	Ant.			E.I.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset	Level (dBm)	Level (dBm)	Gain (dBi)	C.L	Pol.	W	dBm
5	132398	1/24	5	132446	1/0	-22.43	10.35	10.98	2.35	H	0.08	18.98
5	132375	1/24	10	132447	1/0	-22.44	10.34	10.98	2.35	H	0.08	18.97
10	132397	1/49	5	132469	1/0	-22.21	10.57	10.98	2.35	H	0.08	19.20
5	132353	1/24	15	132446	1/0	-22.35	10.43	10.98	2.35	H	0.08	19.06
15	132398	1/74	5	132491	1/0	-21.95	10.83	10.98	2.35	H	0.09	19.46
10	132373	1/49	10	132472	1/0	-22.55	10.23	10.98	2.35	H	0.08	18.86
5	131997	1/24	5	132045	1/0	-23.46	9.46	10.75	2.32	H	0.06	17.89
5	132550	1/24	10	132622	1/0	-21.63	11.13	11.10	2.39	H	0.10	19.84

Note:

1. Modulation : 256QAM

2. Limit : < 2 Watts

8.3 Conducted Spurious Emissions

Operating frequency	PCC				SCC				Measurement Maximum Frequency (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)
	BW [MHz]	Ch.	Freq. (MHz)	RB/ Offset	BW [MHz]	Ch.	Freq. (MHz)	RB/ Offset				
Low	15	132047	1717.5	1/74	5	132140	1726.8	1/0	8.0105	28.591	-75.35	-46.76
Mid	5	132398	1752.6	1/24	5	132446	1757.4	1/0	8.0025	28.591	-76.42	-47.83
High	5	132550	1767.8	1/24	10	132622	1775.0	1/0	8.0419	28.591	-75.45	-46.85
Low	15	132047	1717.5	1/0	5	132140	1726.8	1/24	8.0080	28.591	-76.09	-47.50
Mid	5	132398	1752.6	1/0	5	132446	1757.4	1/24	8.0150	28.591	-75.13	-46.54
High	5	132550	1767.8	1/0	10	132622	1775.0	1/49	8.0115	28.591	-75.60	-47.01
Low	15	132047	1717.5	75/0	5	132140	1726.8	25/0	6.0255	28.591	-75.17	-46.58
Mid	15	132398	1752.6	75/0	5	132491	1761.9	25/0	8.0344	28.591	-76.01	-47.42
High	5	132550	1767.8	25/0	10	132622	1775.0	50/0	8.0349	28.591	-75.29	-46.70
Low	10	132022	1715.0	50/0	10	132121	1724.9	50/0	8.0399	28.591	-75.48	-46.89
Mid	10	132373	1750.1	50/0	10	132472	1760.0	50/0	6.0399	28.591	-75.01	-46.42
High	10	132523	1765.1	50/0	10	132622	1775.0	50/0	7.9955	28.591	-75.67	-47.08

Note:

1. Modulation : QPSK

2. Factor(dB) = Cable Loss + Ext. Attenuator + Power Splitter

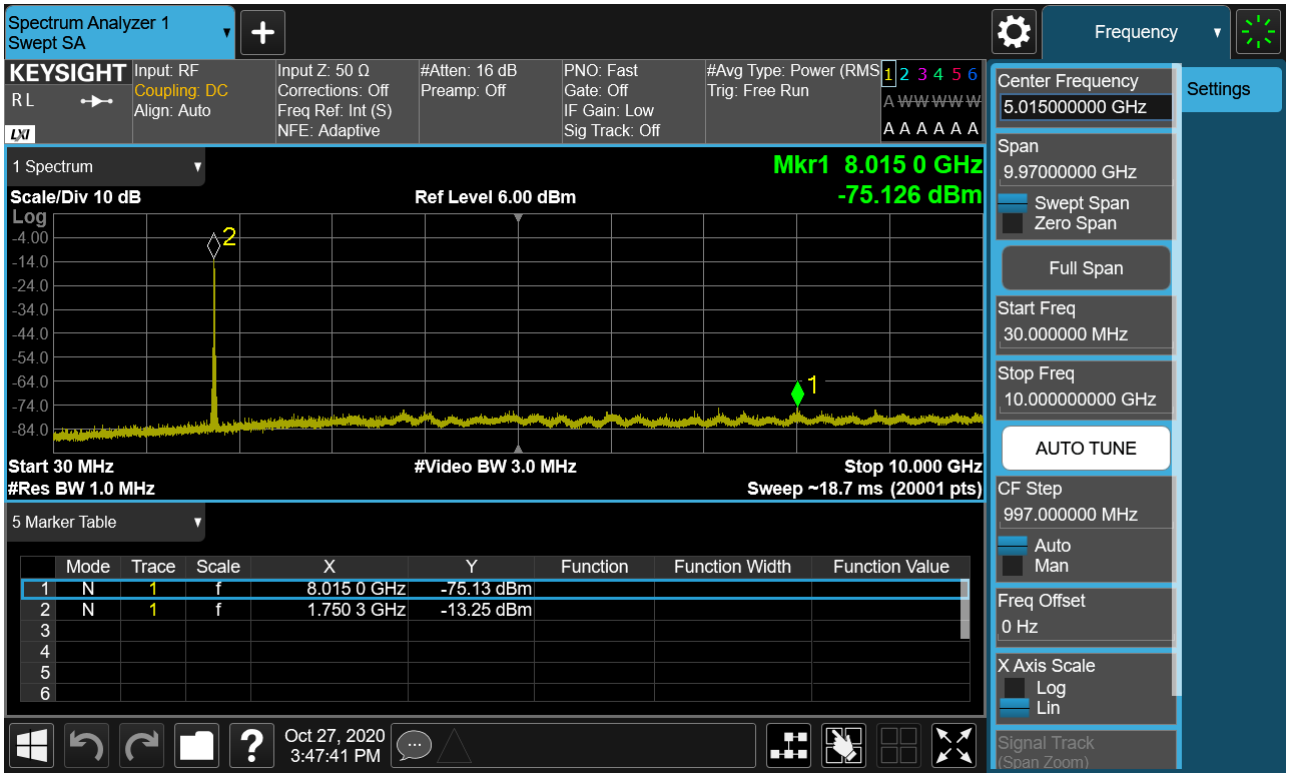
3. Factors for frequency :

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20(26.5)	30.131

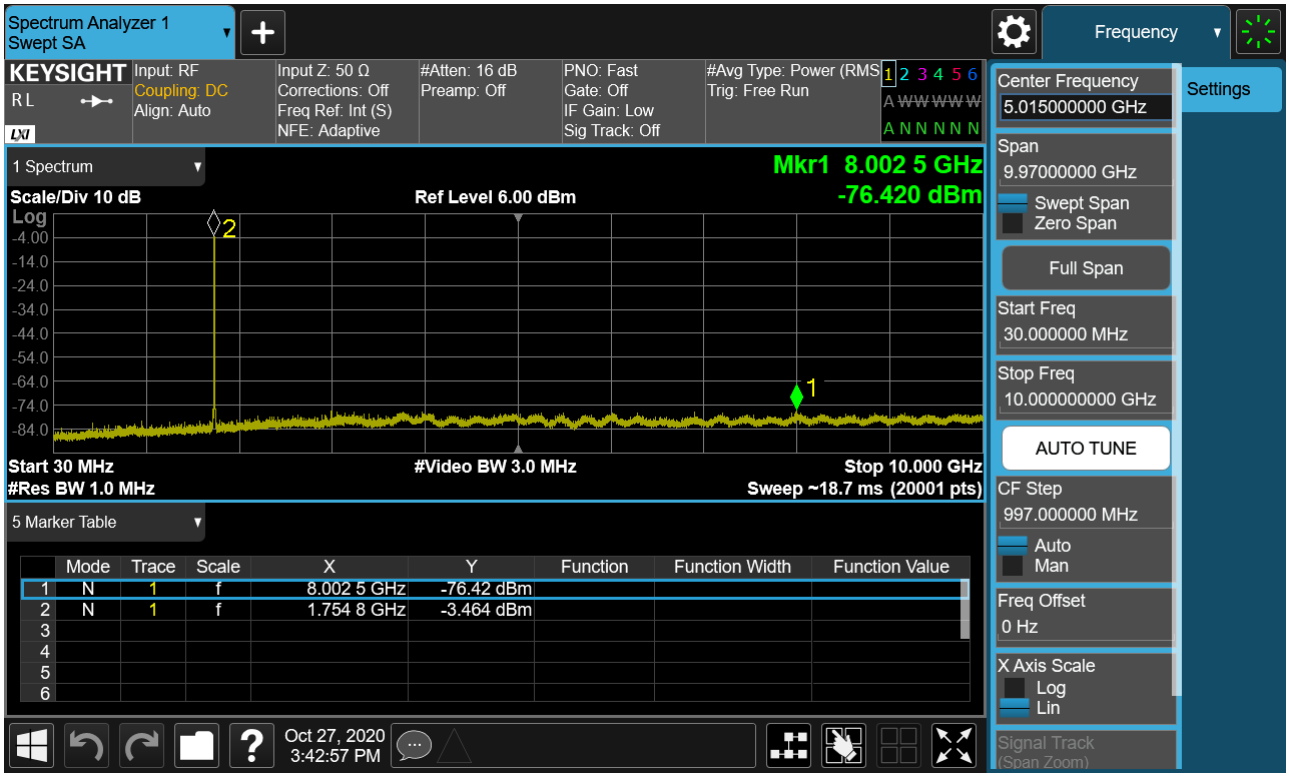
4. Limit : -13.0 dBm

Frequency Range : 30MHz ~ 10GHz

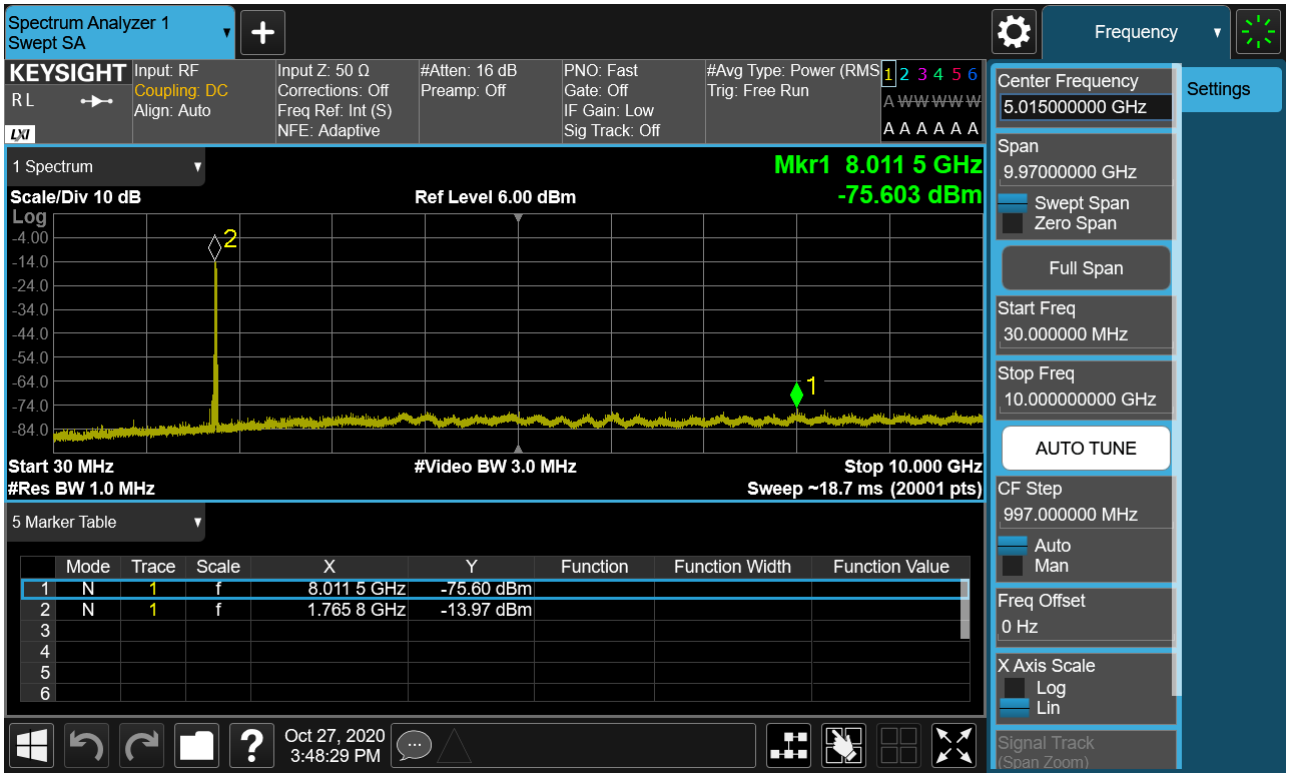
PCC 5MHz Ch132398 RB1 Offset0 SCC 5MHz Ch132446 RB1 Offset24



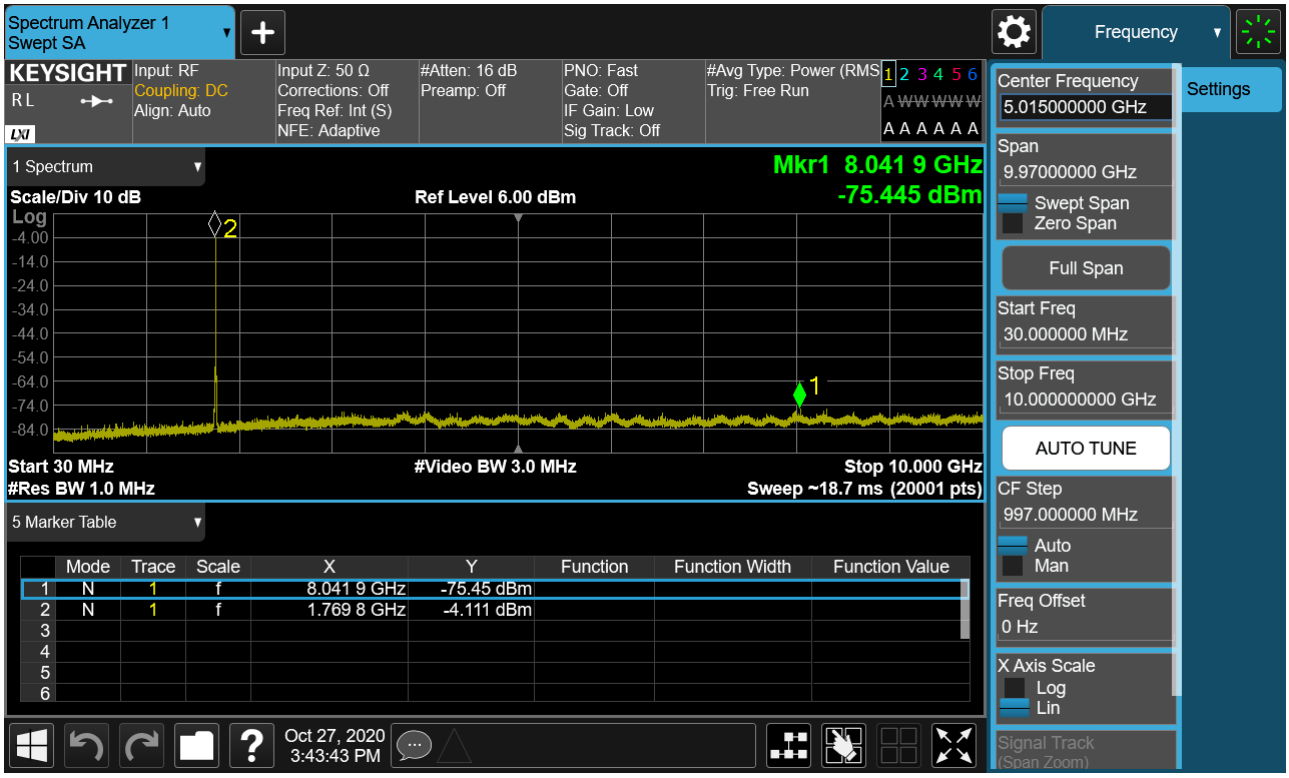
PCC 5MHz Ch132398 RB1 Offset24 SCC 5MHz Ch132446 RB1 Offset0



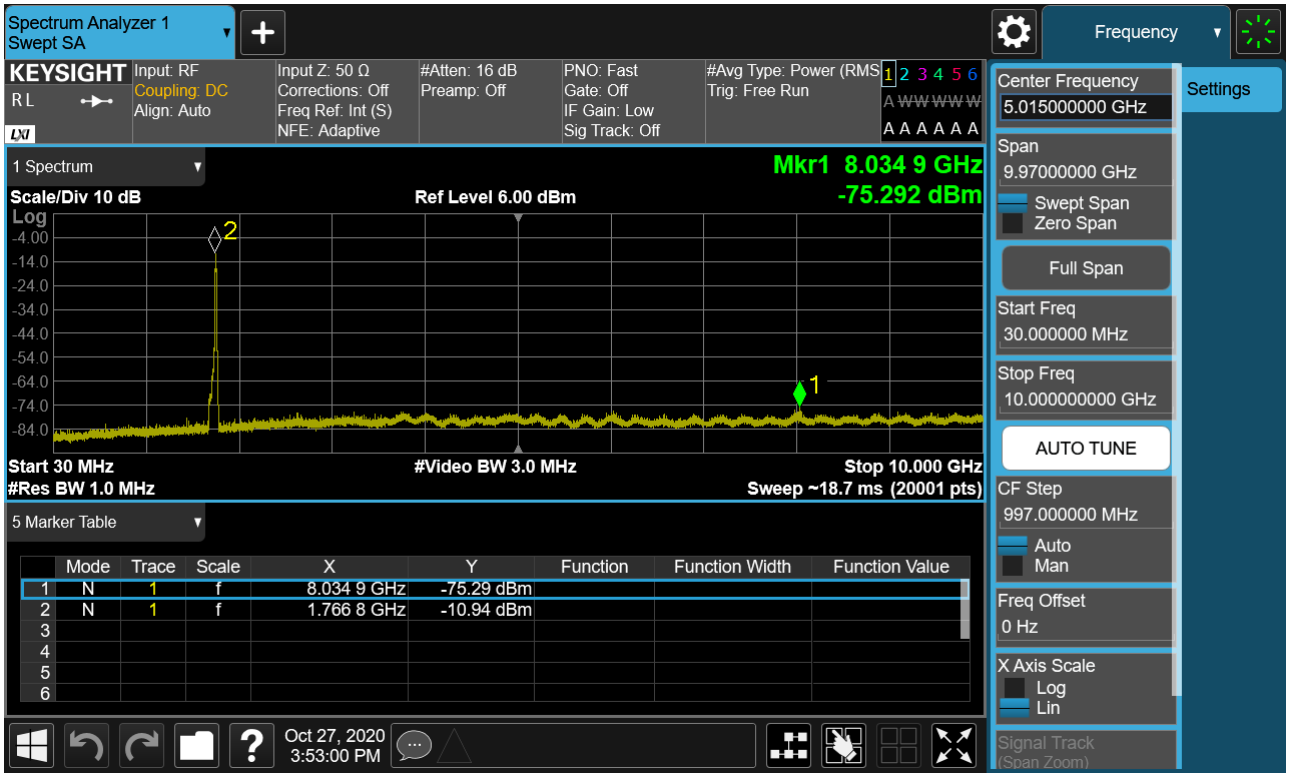
PCC 5MHz Ch132550 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49



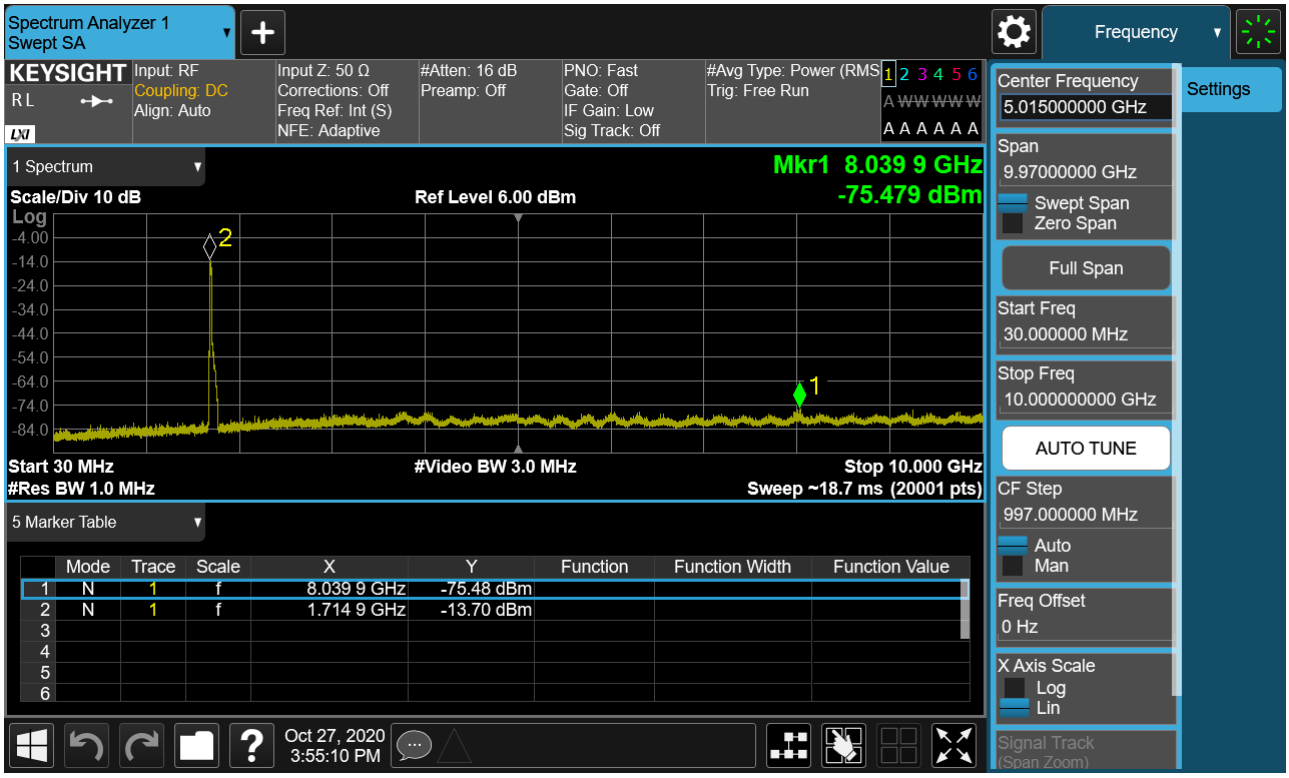
PCC 5MHz Ch132550 RB1 Offset24 SCC 10MHz Ch132622 RB1 Offset0



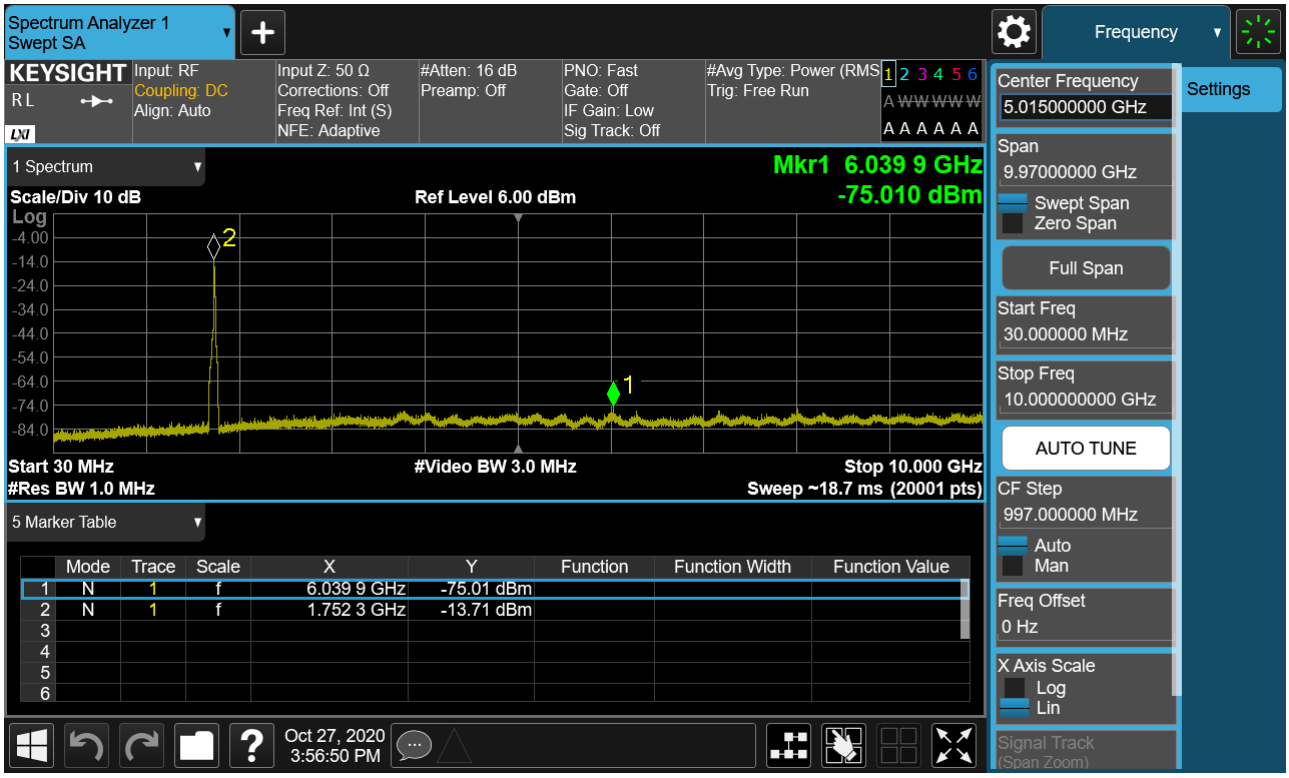
PCC 5MHz Ch132550 RB25 Offset0 SCC 10MHz Ch132622 RB50 Offset0



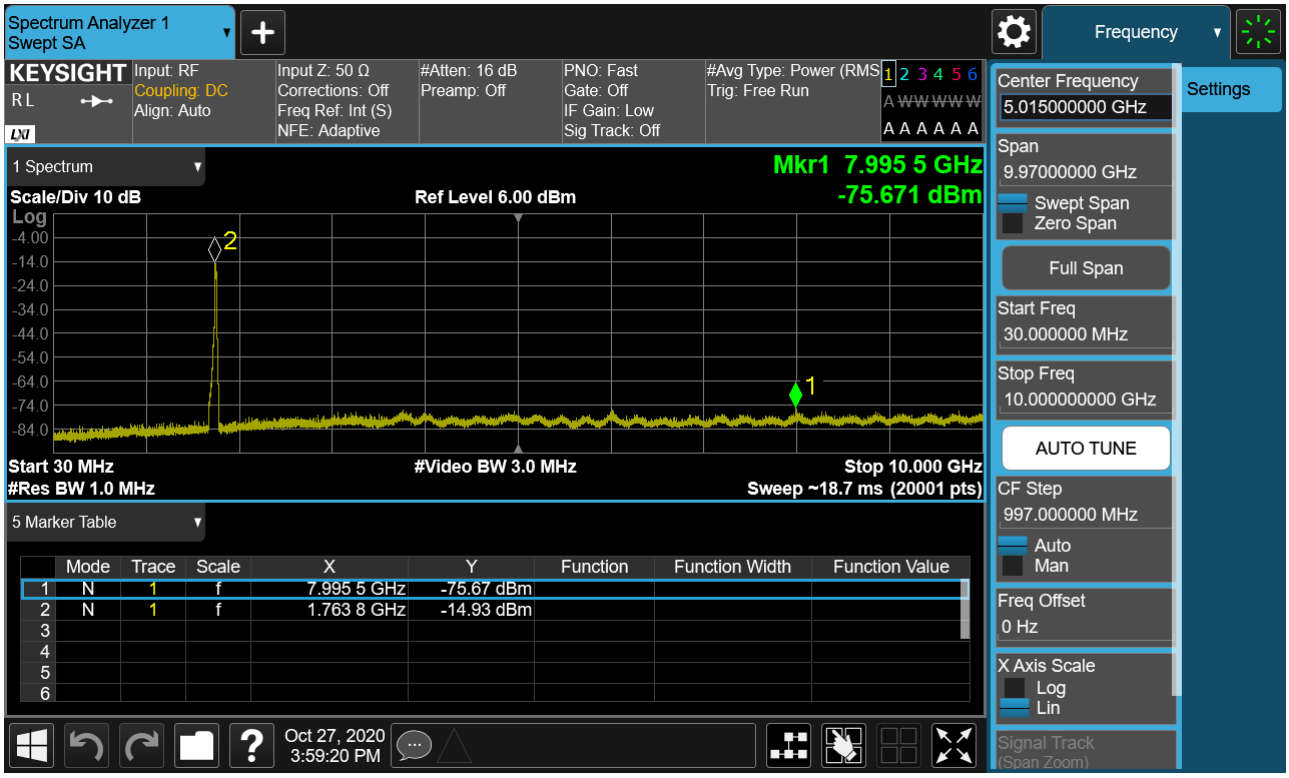
PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0



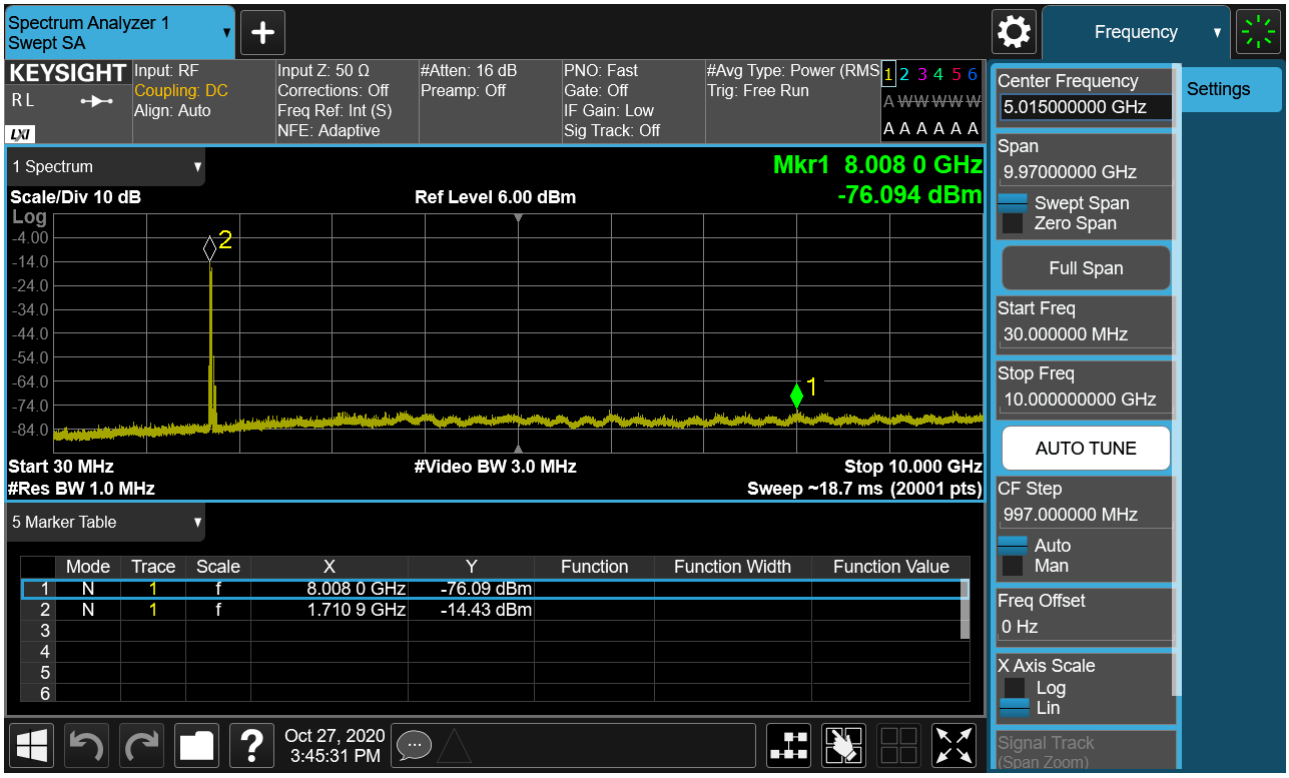
PCC 10MHz Ch132373 RB50 Offset0 SCC 10MHz Ch132472 RB50 Offset0



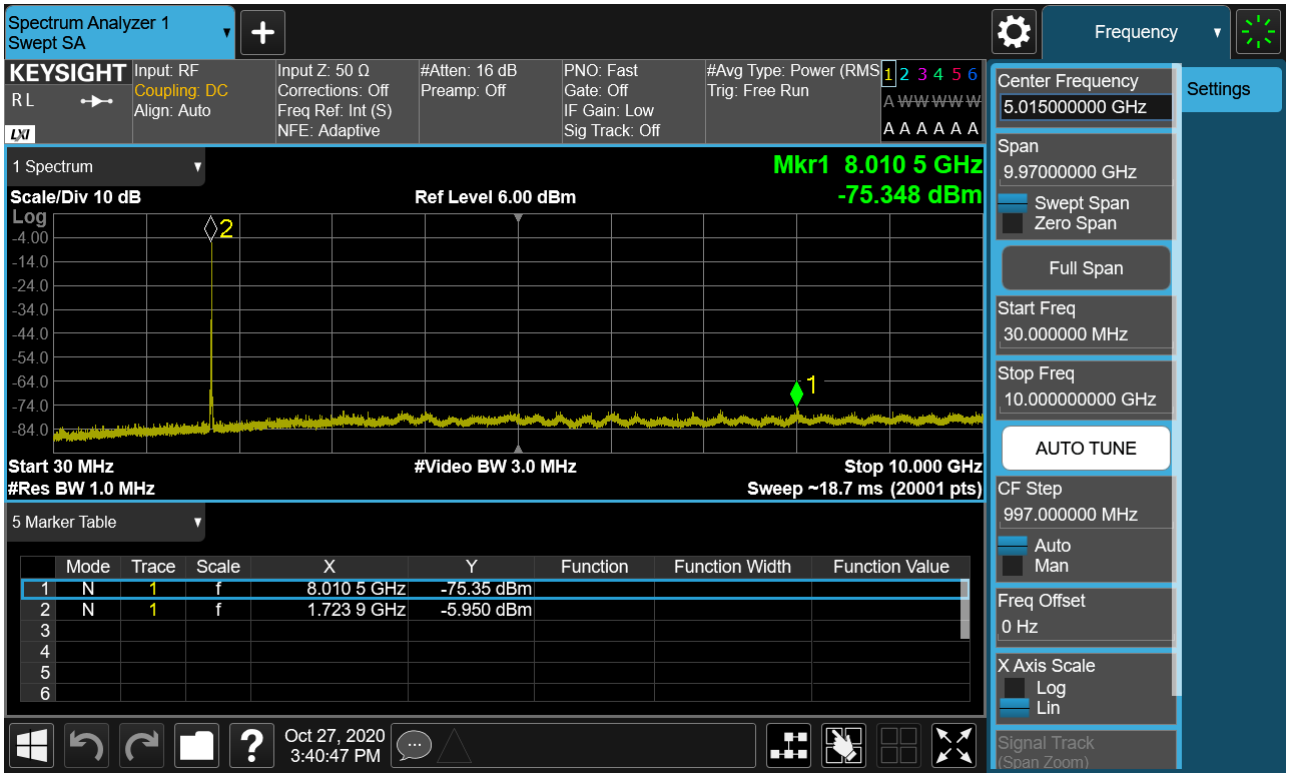
PCC 10MHz Ch132523 RB50 Offset0 SCC 10MHz Ch132622 RB50 Offset0



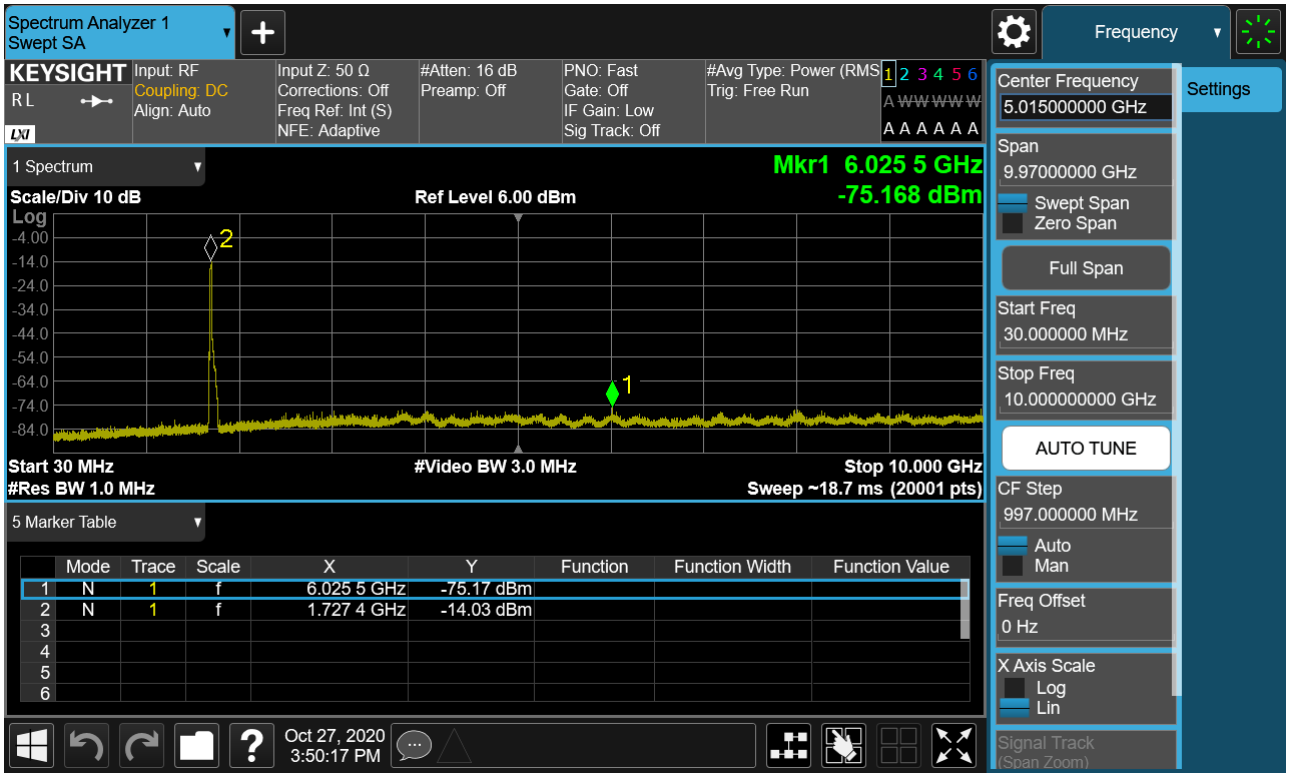
PCC 15MHz Ch132047 RB1 Offset0 SCC 5MHz Ch132140 RB1 Offset24



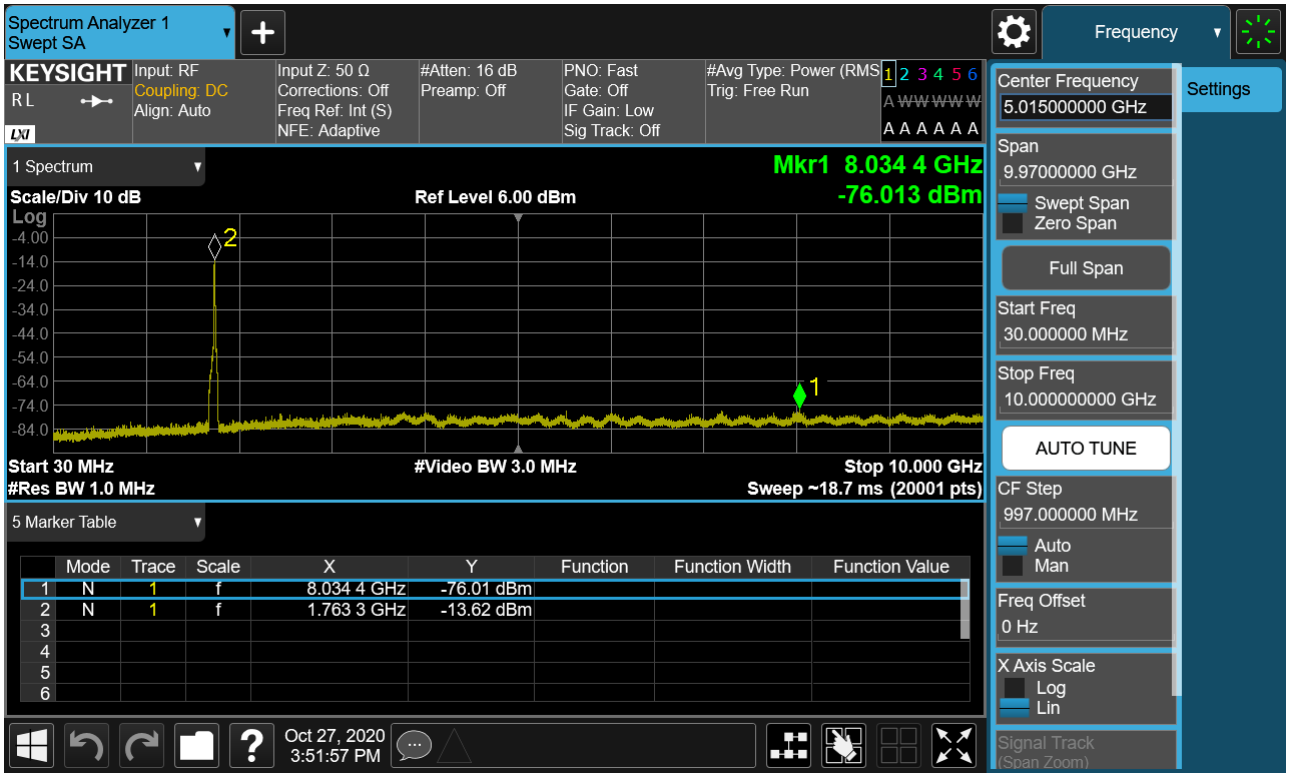
PCC 15MHz Ch132047 RB1 Offset74 SCC 5MHz Ch132140 RB1 Offset0



PCC 15MHz Ch132047 RB75 Offset0 SCC 5MHz Ch132140 RB25 Offset0

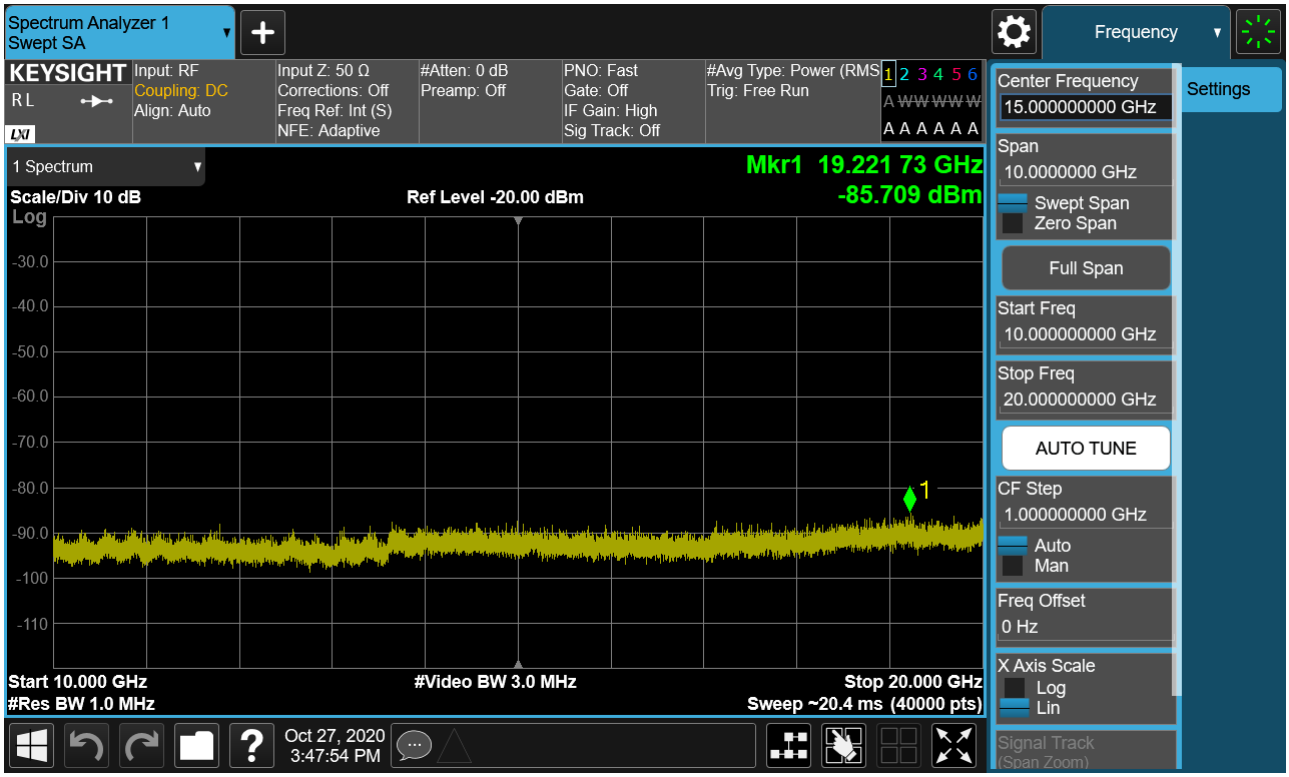


PCC 15MHz Ch132398 RB75 Offset0 SCC 5MHz Ch132491 RB25 Offset0

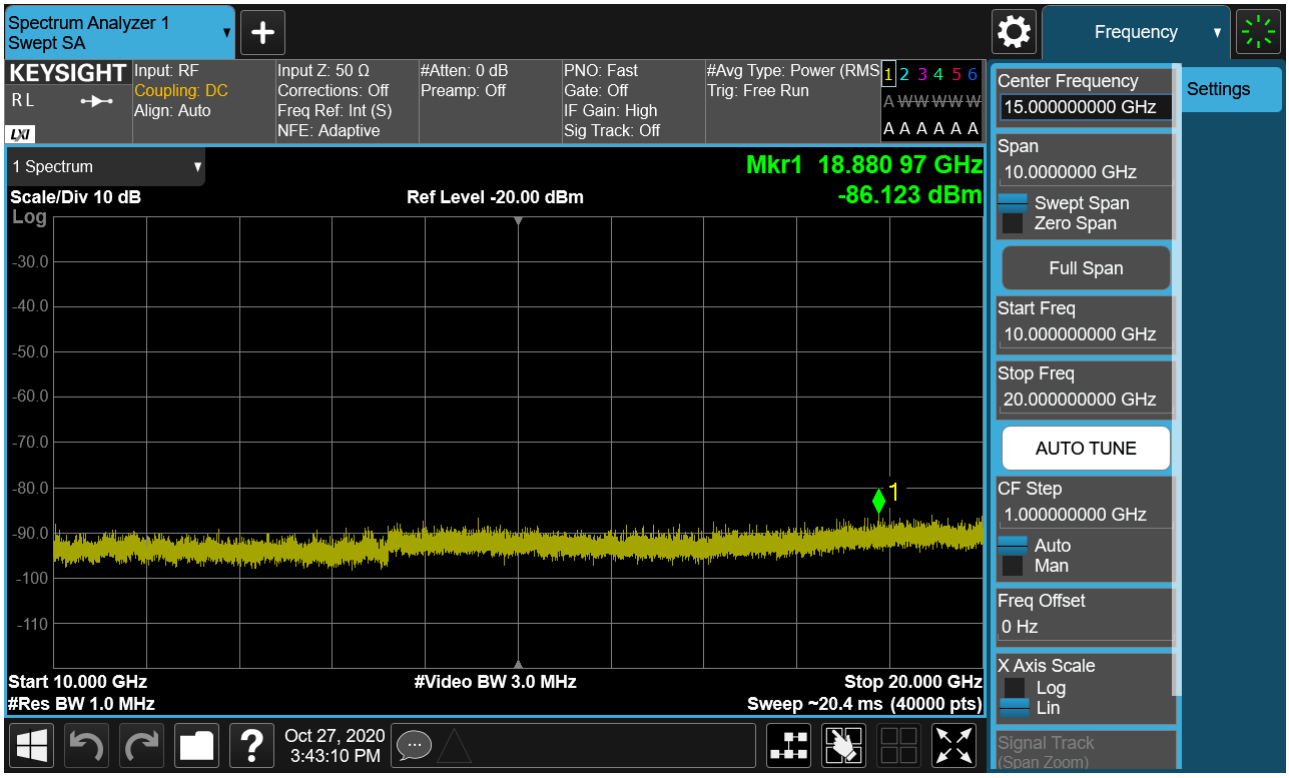


Frequency Range : 10GHz ~ 26.5GHz

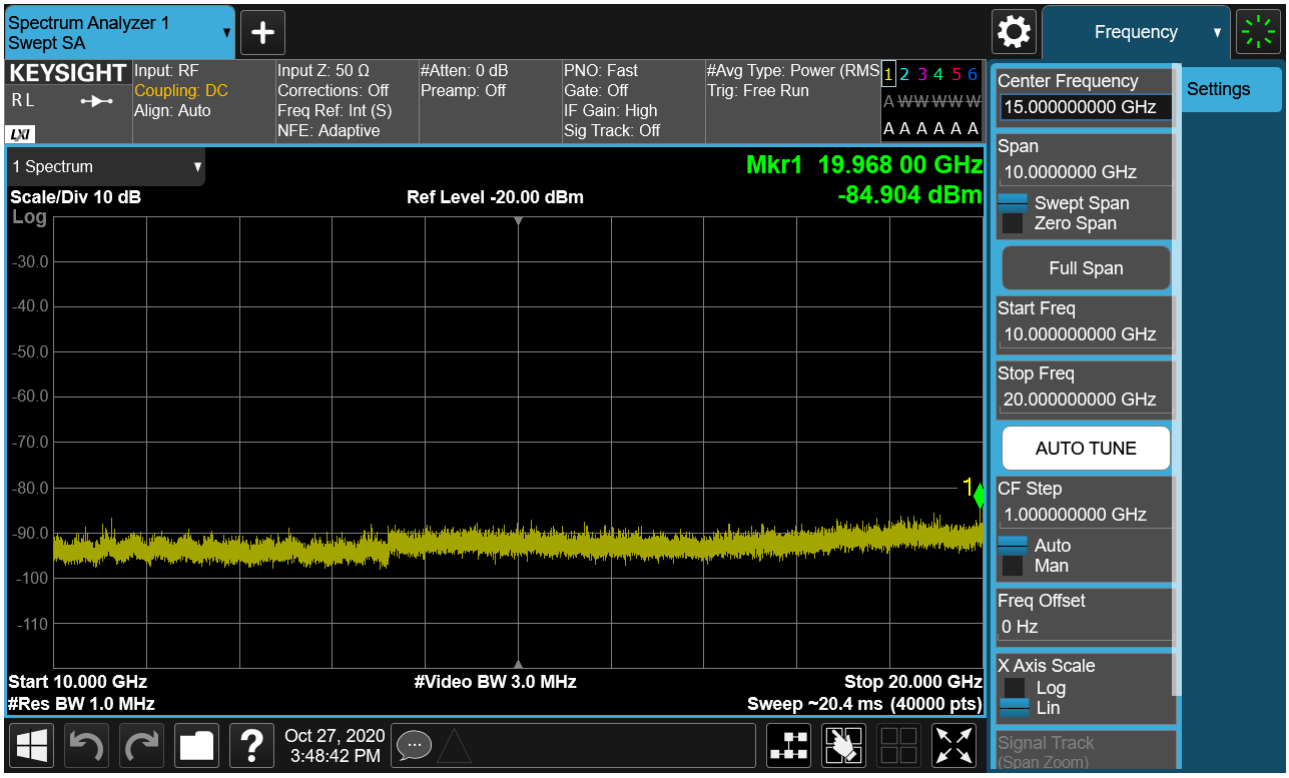
PCC 5MHz Ch132398 RB1 Offset0, SCC 5MHz Ch132446 RB1 Offset24



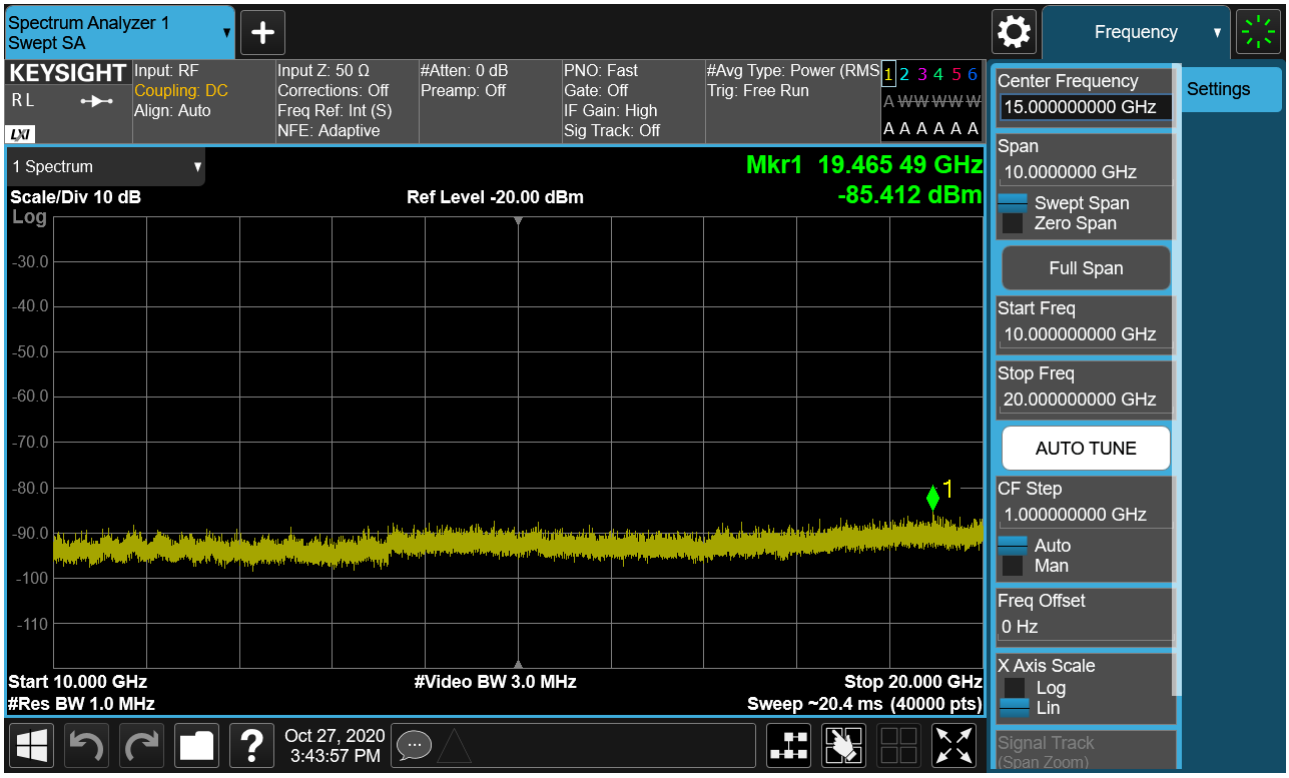
PCC 5MHz Ch132398 RB1 Offset24, SCC 5MHz Ch132446 RB1 Offset0



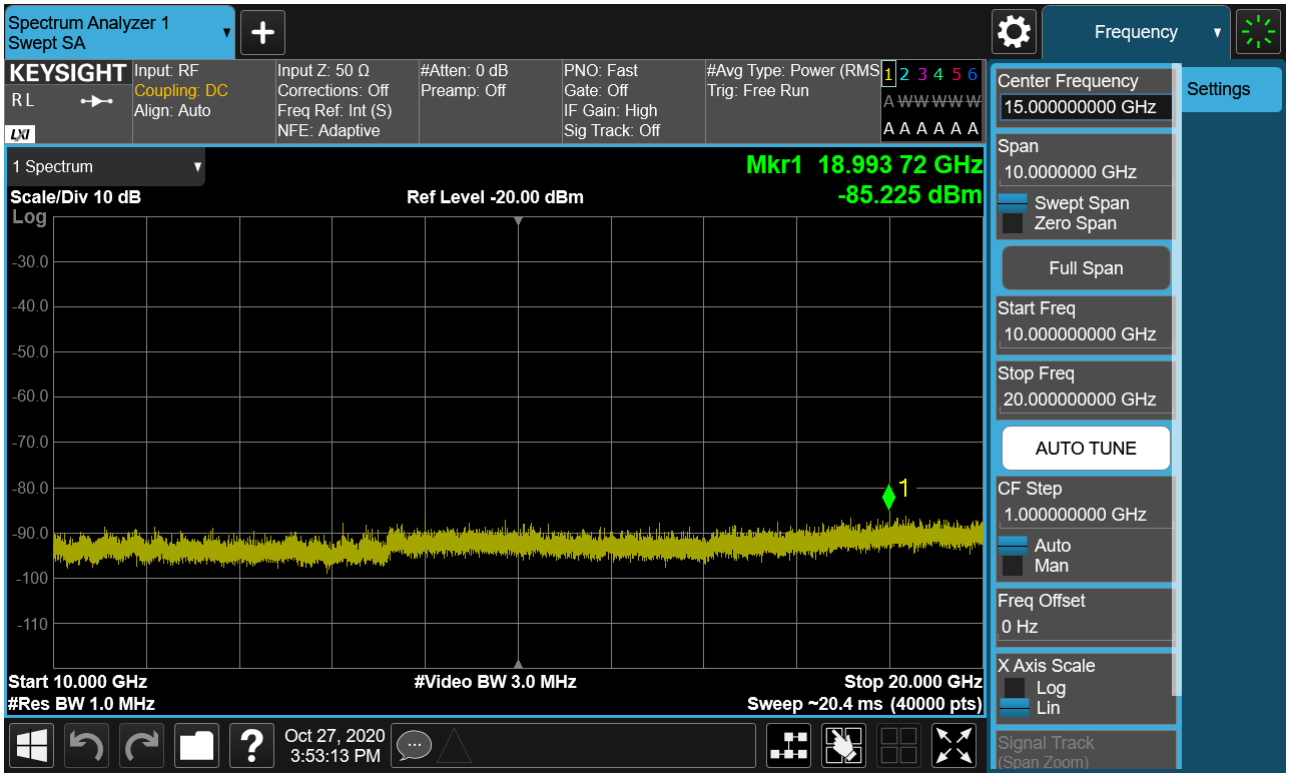
PCC 5MHz Ch132550 RB1 Offset0, SCC 10MHz Ch132622 RB1 Offset49



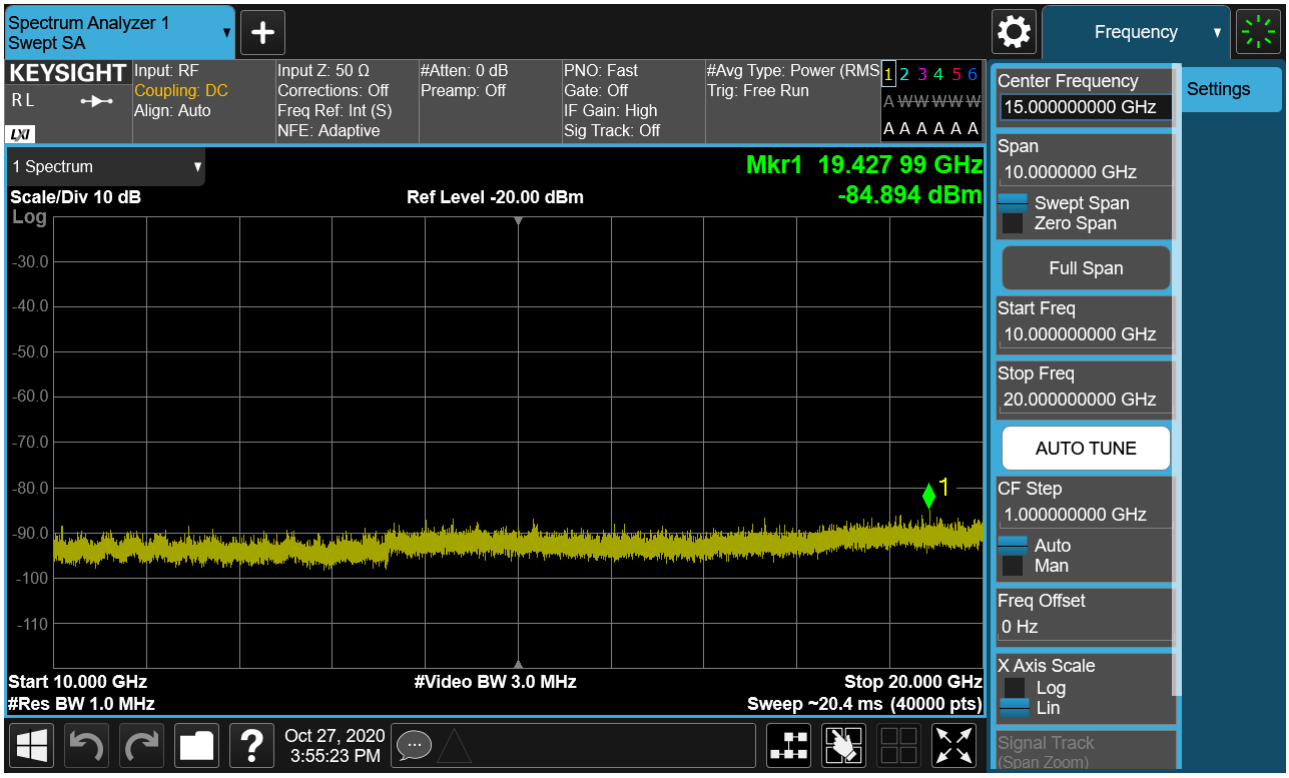
PCC 5MHz Ch132550 RB1 Offset24, SCC 10MHz Ch132622 RB1 Offset0



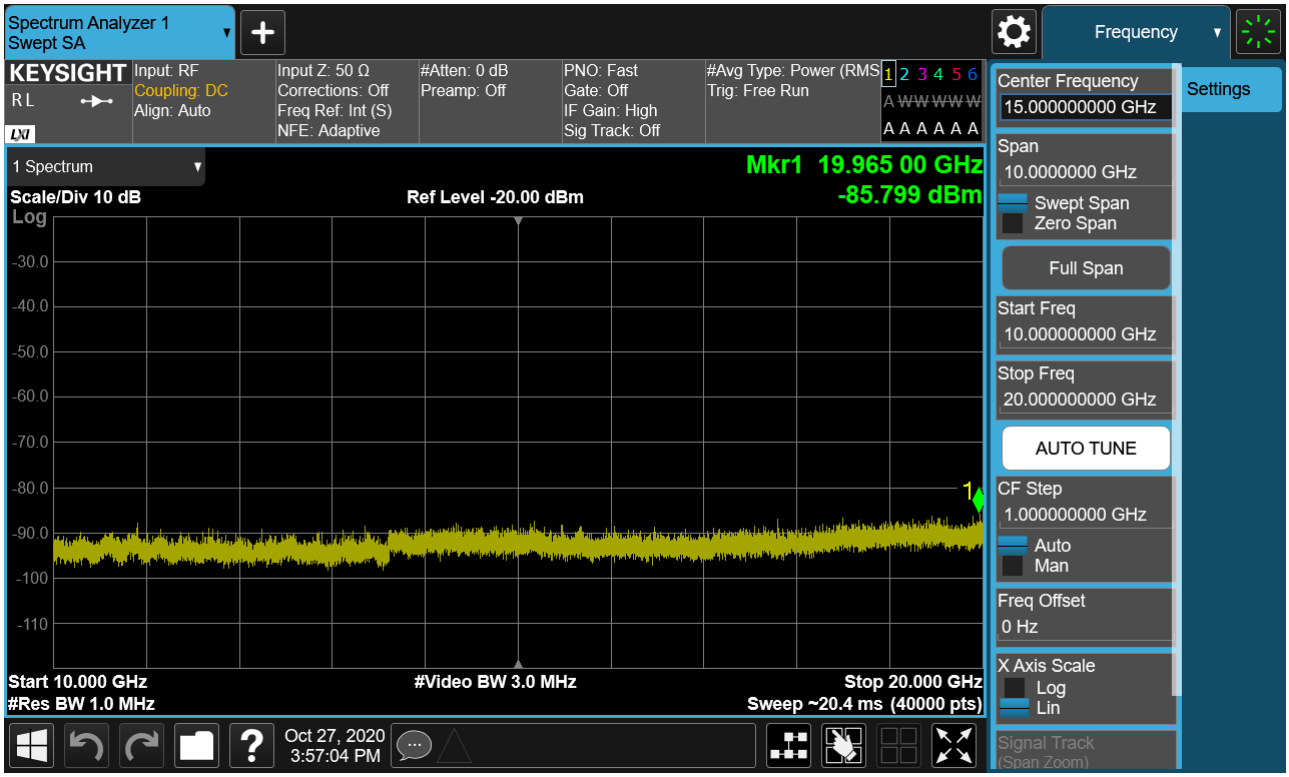
PCC 5MHz Ch132550 RB25 Offset0, SCC 10MHz Ch132622 RB50 Offset0



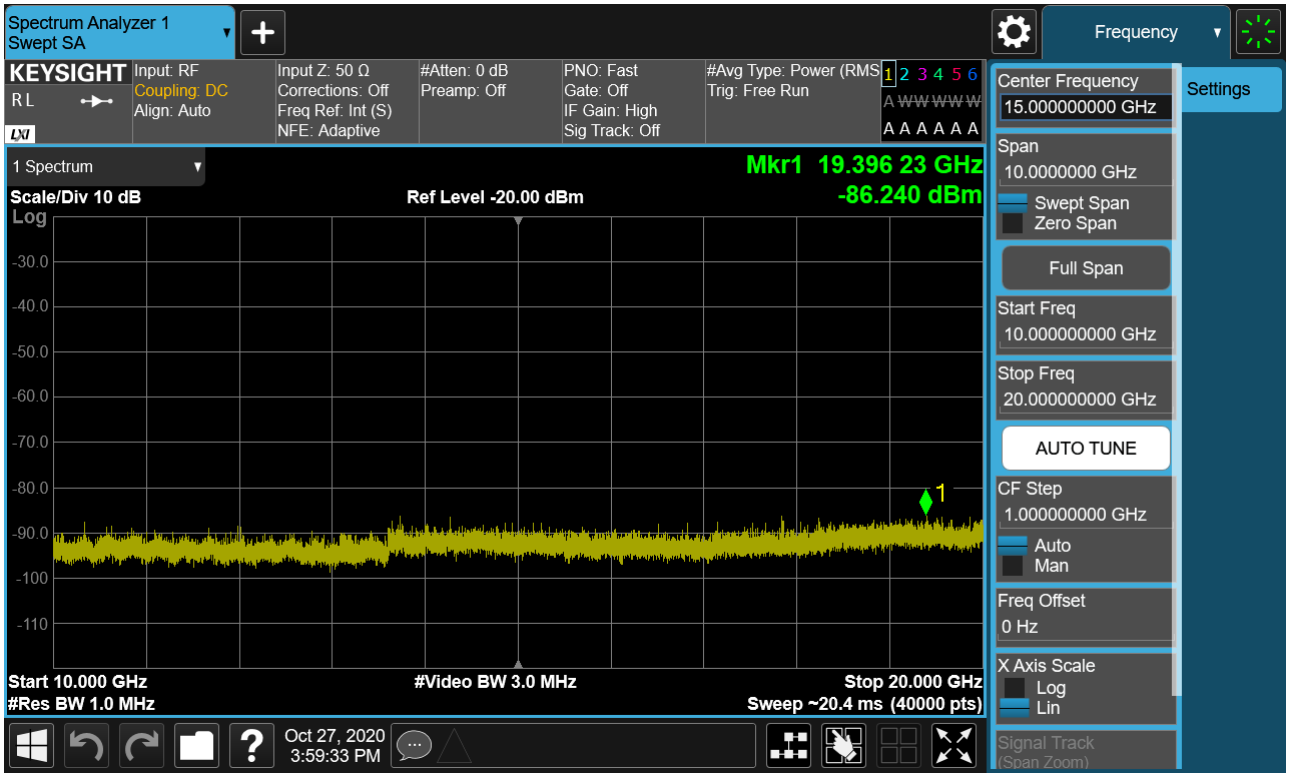
PCC 10MHz Ch132022 RB50 Offset0, SCC 10MHz Ch132121 RB50 Offset0



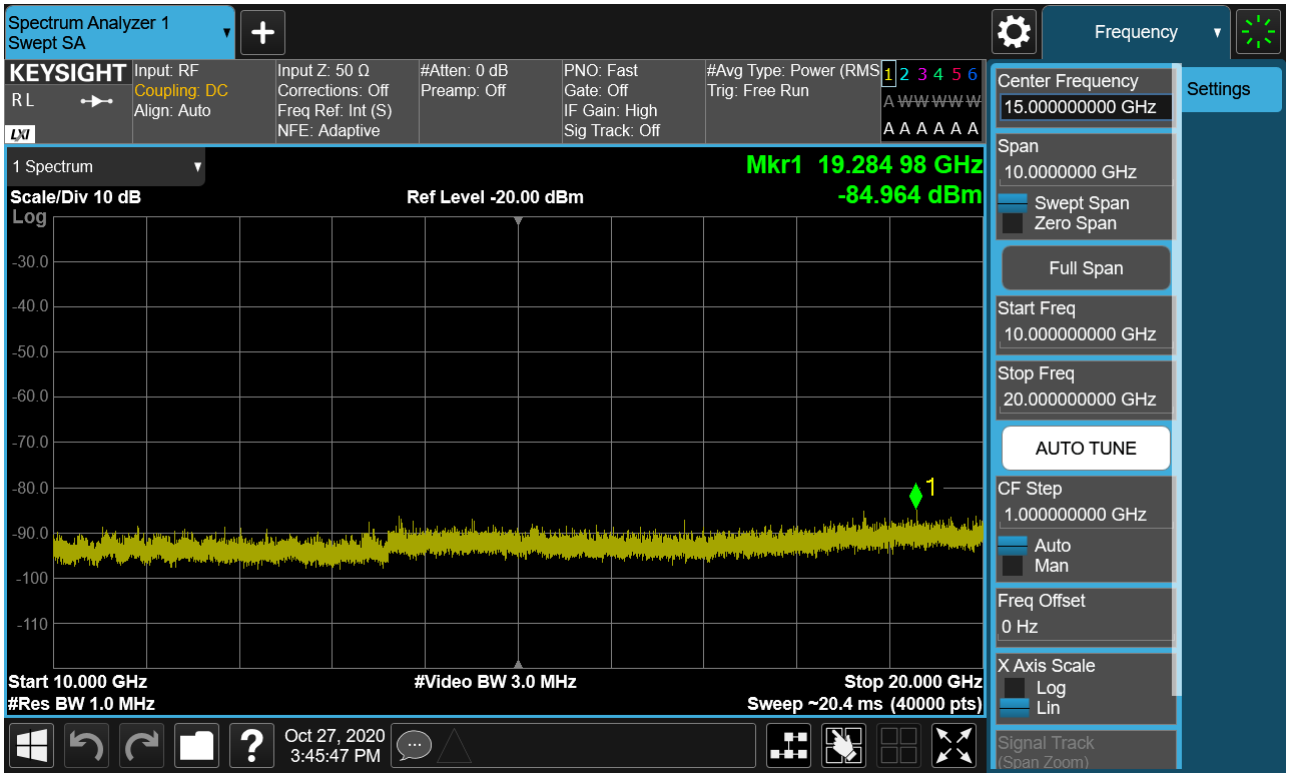
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0



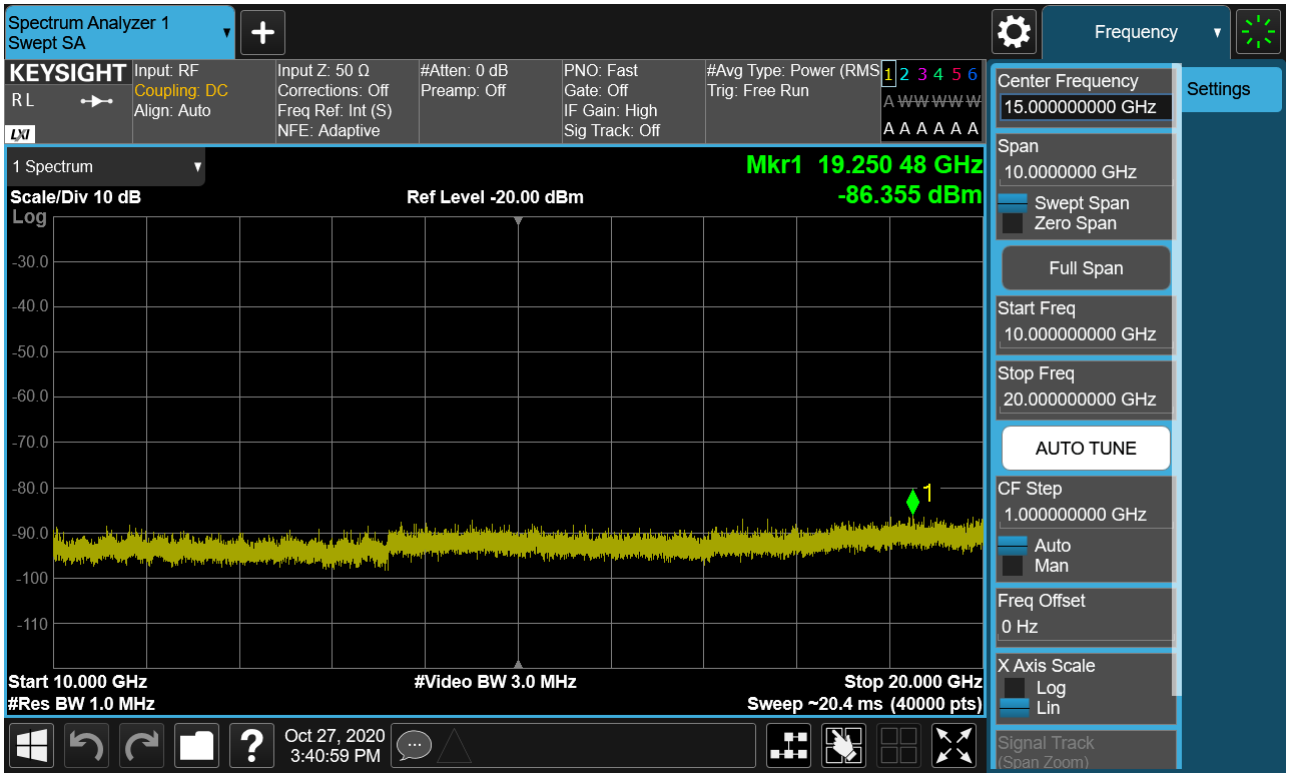
PCC 10MHz Ch132523 RB50 Offset0, SCC 10MHz Ch132622 RB50 Offset0



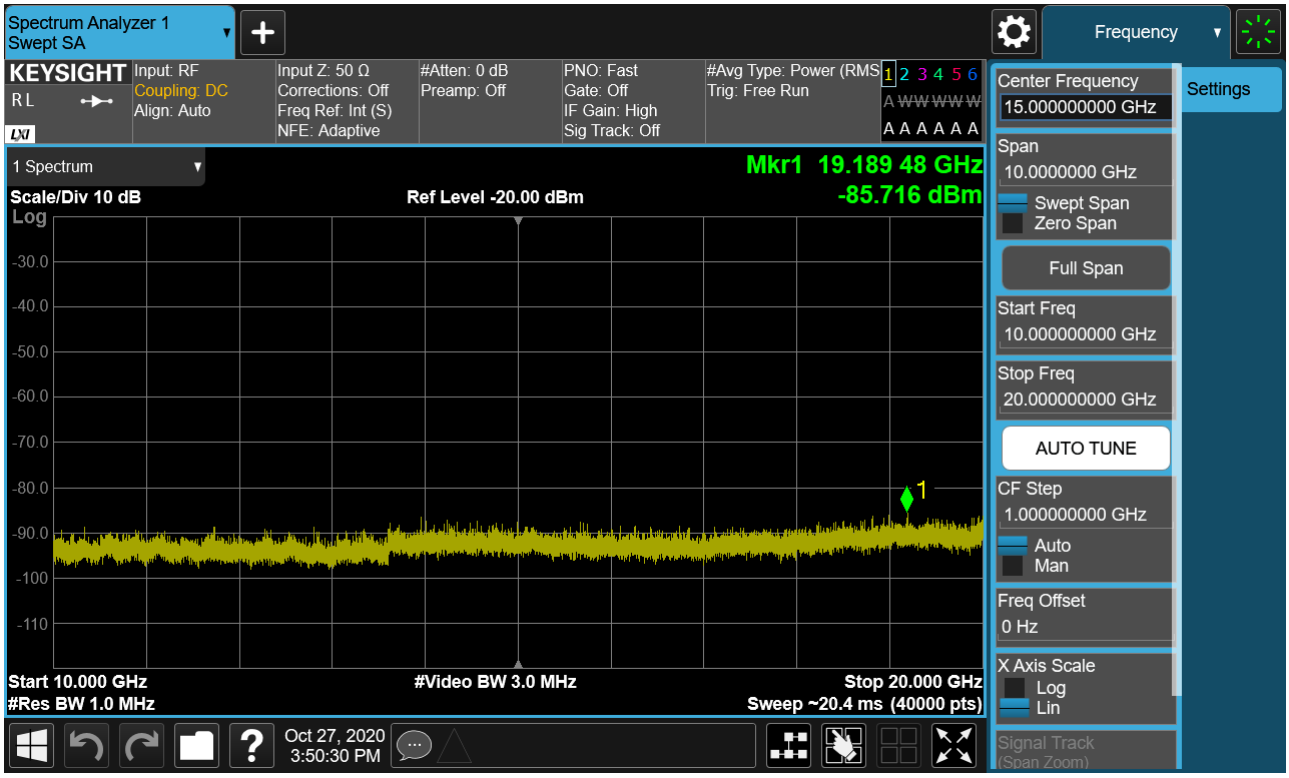
PCC 15MHz Ch132047 RB1 Offset0, SCC 5MHz Ch132140 RB1 Offset24



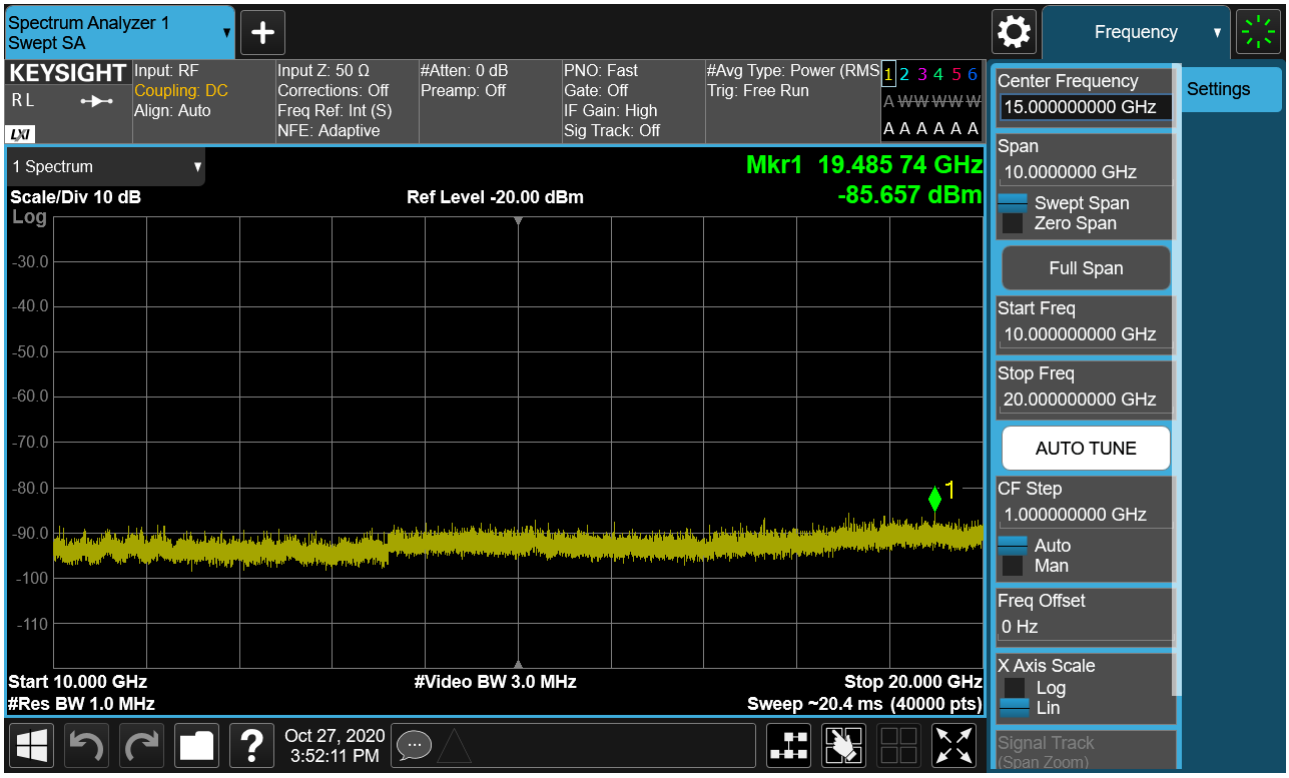
PCC 15MHz Ch132047 RB1 Offset74, SCC 5MHz Ch132140 RB1 Offset0



PCC 15MHz Ch132047 RB75 Offset0, SCC 5MHz Ch132140 RB25 Offset0

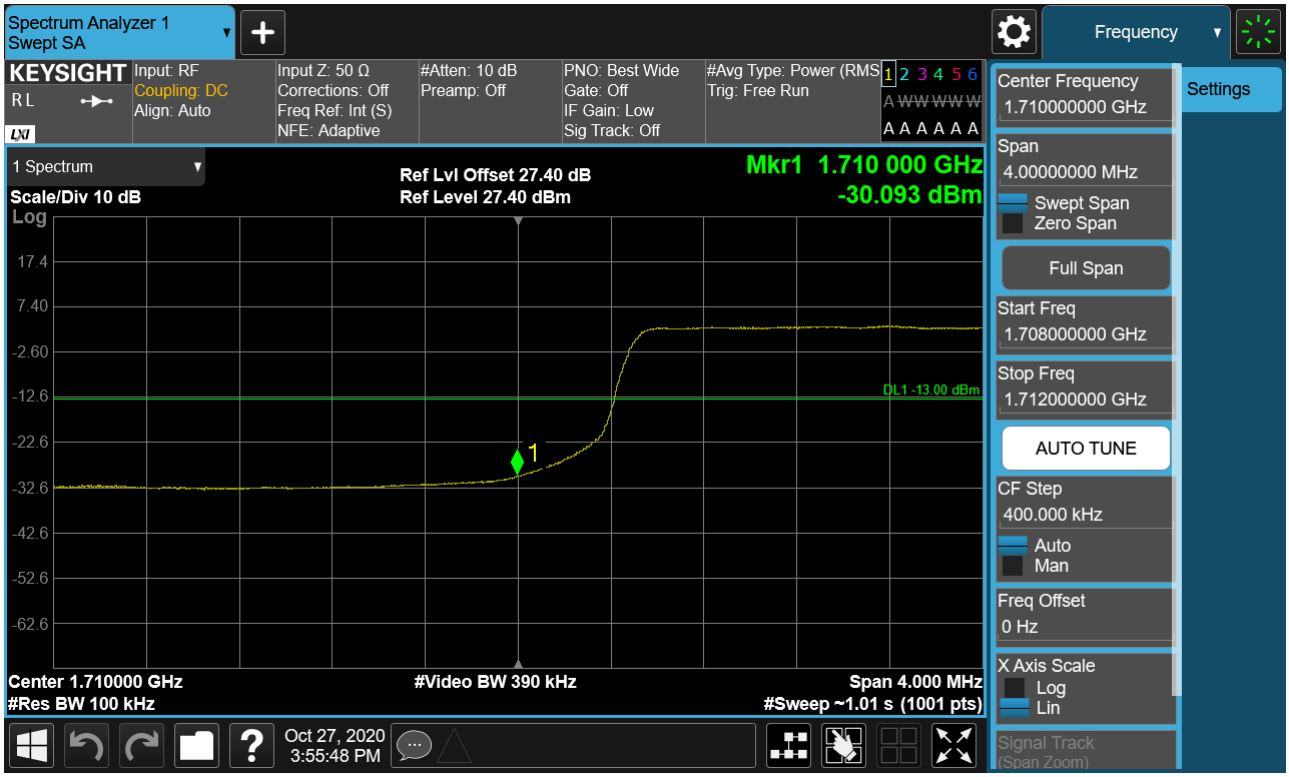


PCC 15MHz Ch132398 RB75 Offset0, SCC 5MHz Ch132491 RB25 Offset0

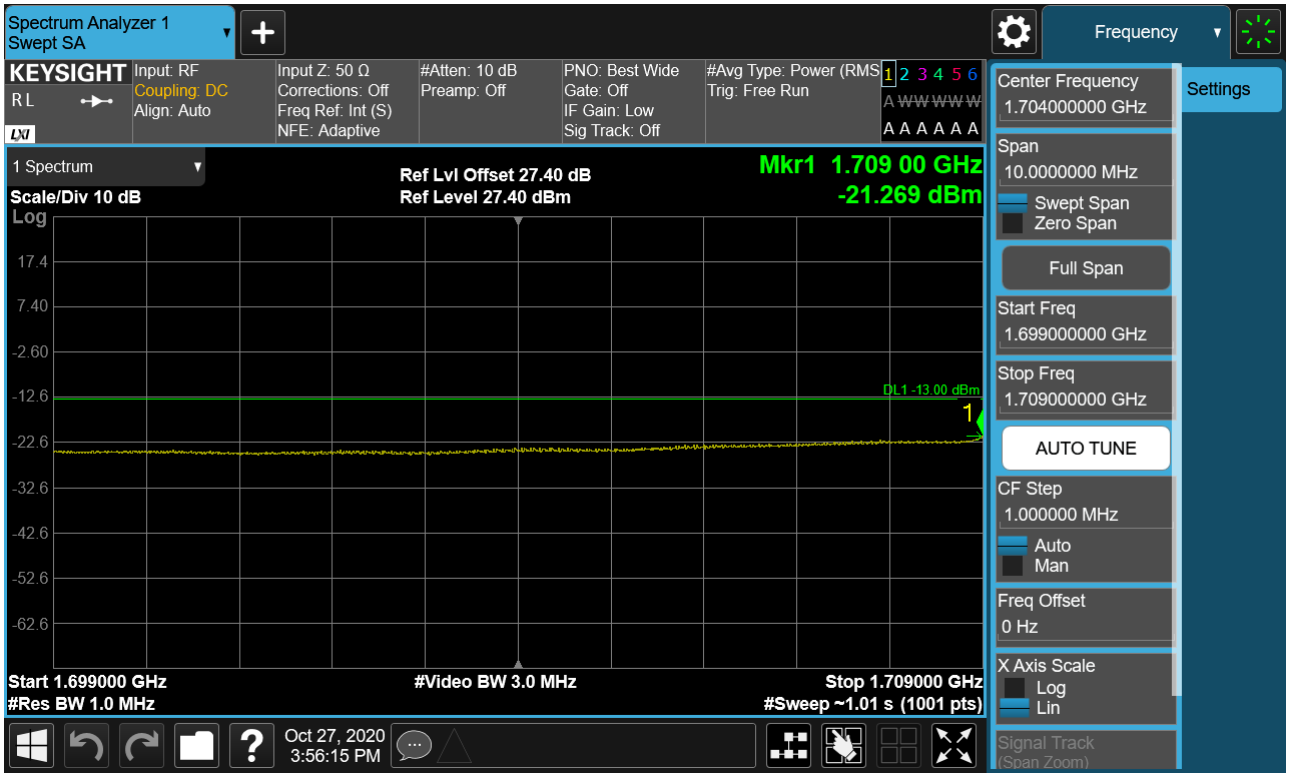


8.4 Channel Edge

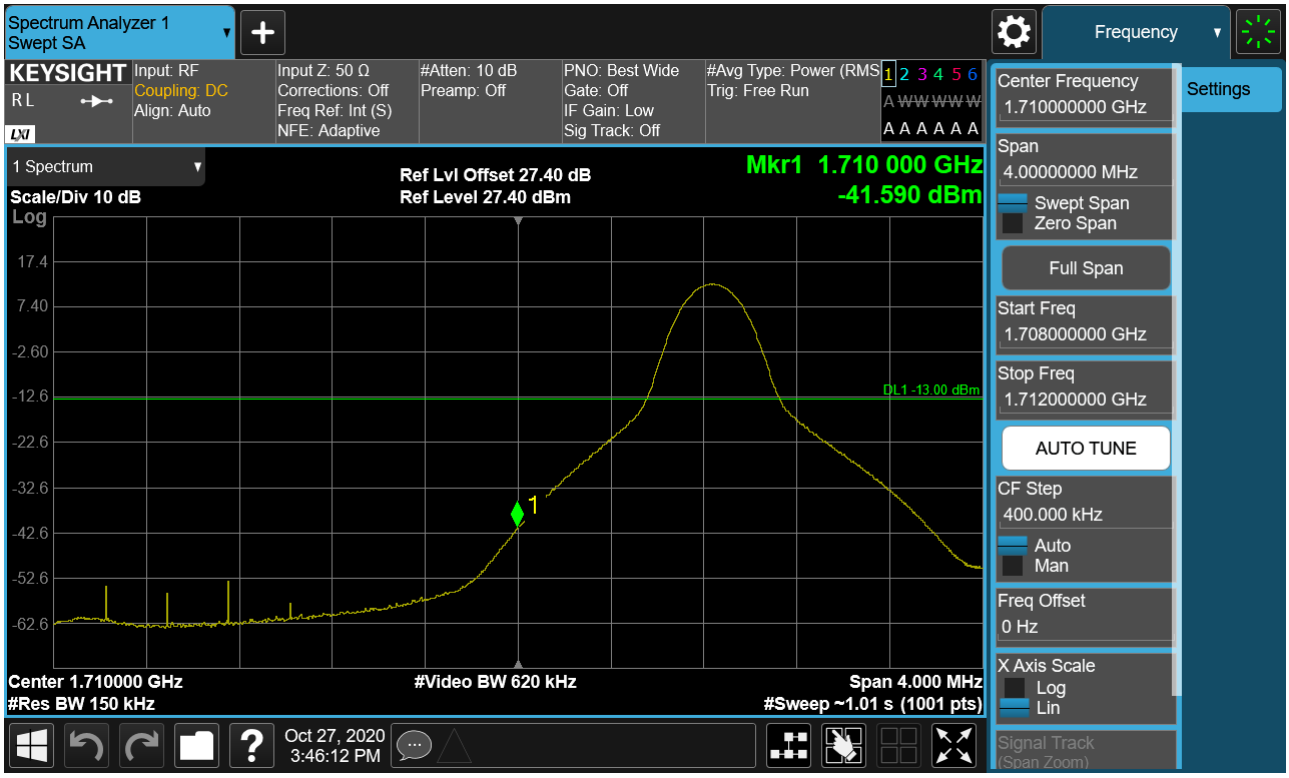
Lowest Channel_PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0(1)



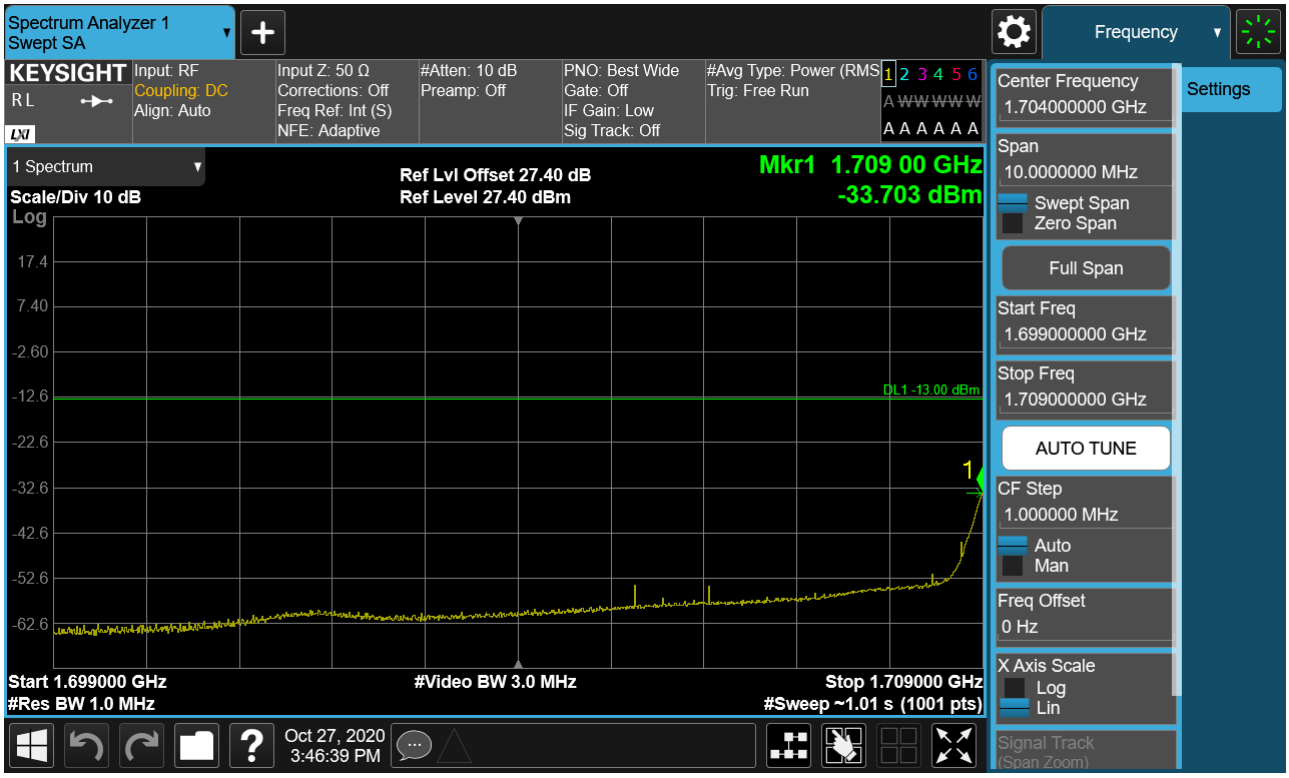
Lowest Channel_PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0(2)



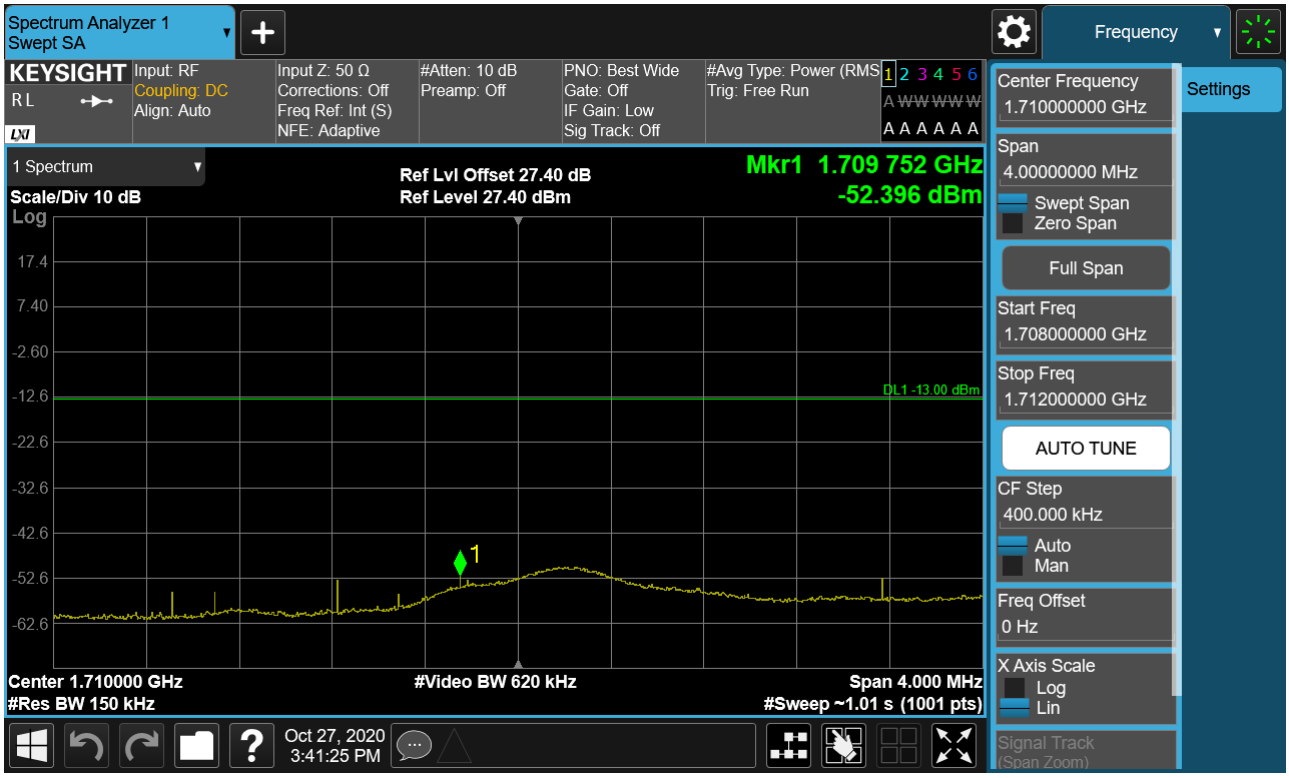
Lowest Channel_PCC 15MHz Ch132047 RB1 Offset0 SCC 5MHz Ch132140 RB1 Offset24(1)



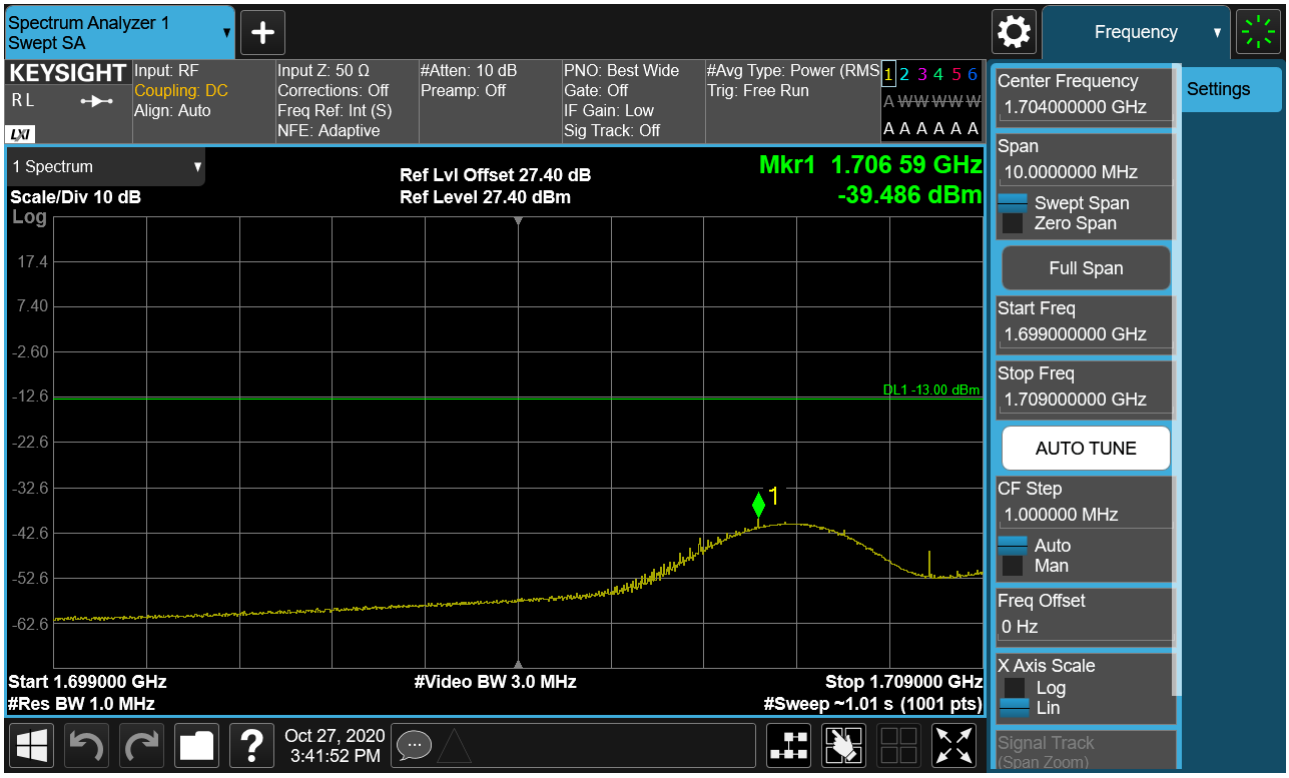
Lowest Channel_PCC 15MHz Ch132047 RB1 Offset0 SCC 5MHz Ch132140 RB1 Offset24(2)



Lowest Channel_PCC 15MHz Ch132047 RB1 Offset74 SCC 5MHz Ch132140 RB1 Offset0(1)

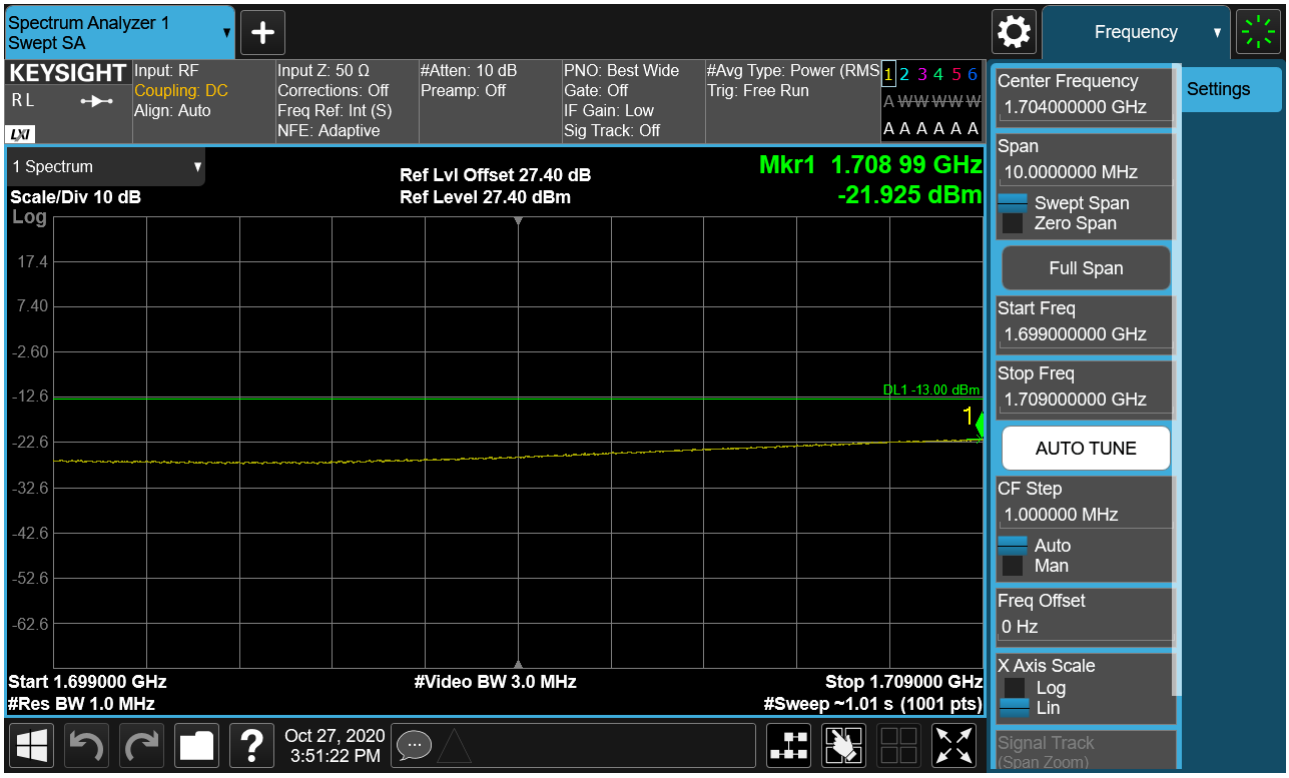


Lowest Channel_PCC 15MHz Ch132047 RB1 Offset74 SCC 5MHz Ch132140 RB1 Offset0(2)

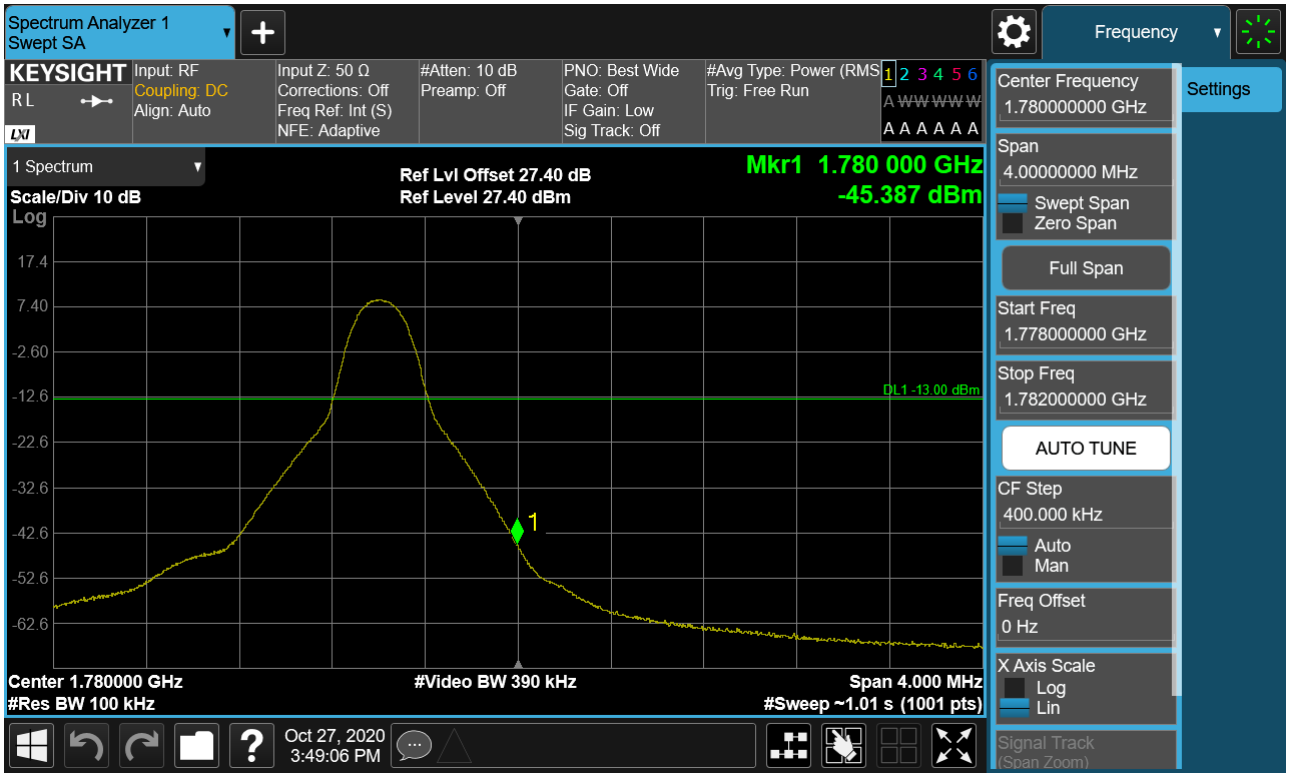


Lowest Channel_PCC 15MHz Ch132047 RB75 Offset0 SCC 5MHz Ch132140 RB25 Offset0(1)

Lowest Channel_PCC 15MHz Ch132047 RB75 Offset0 SCC 5MHz Ch132140 RB25 Offset0(2)

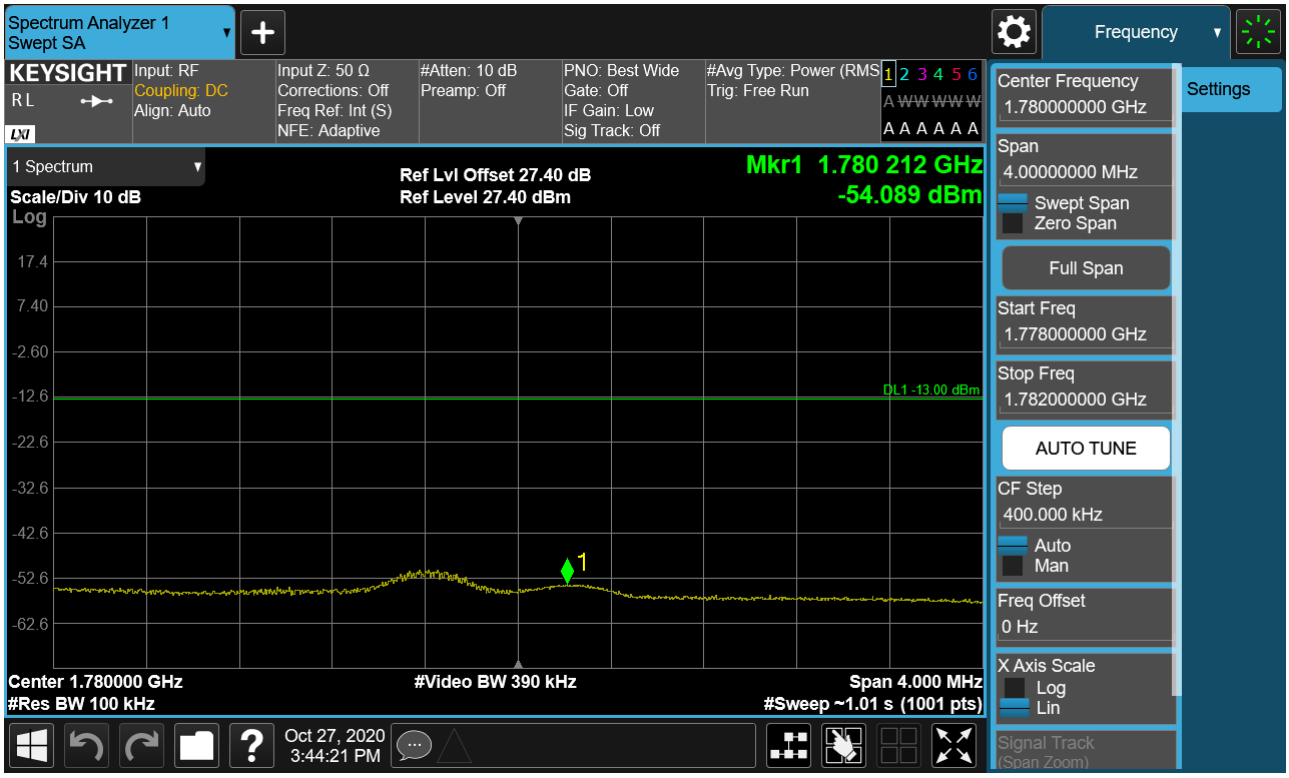


Highest Channel_PCC 5MHz Ch132550 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49(1)



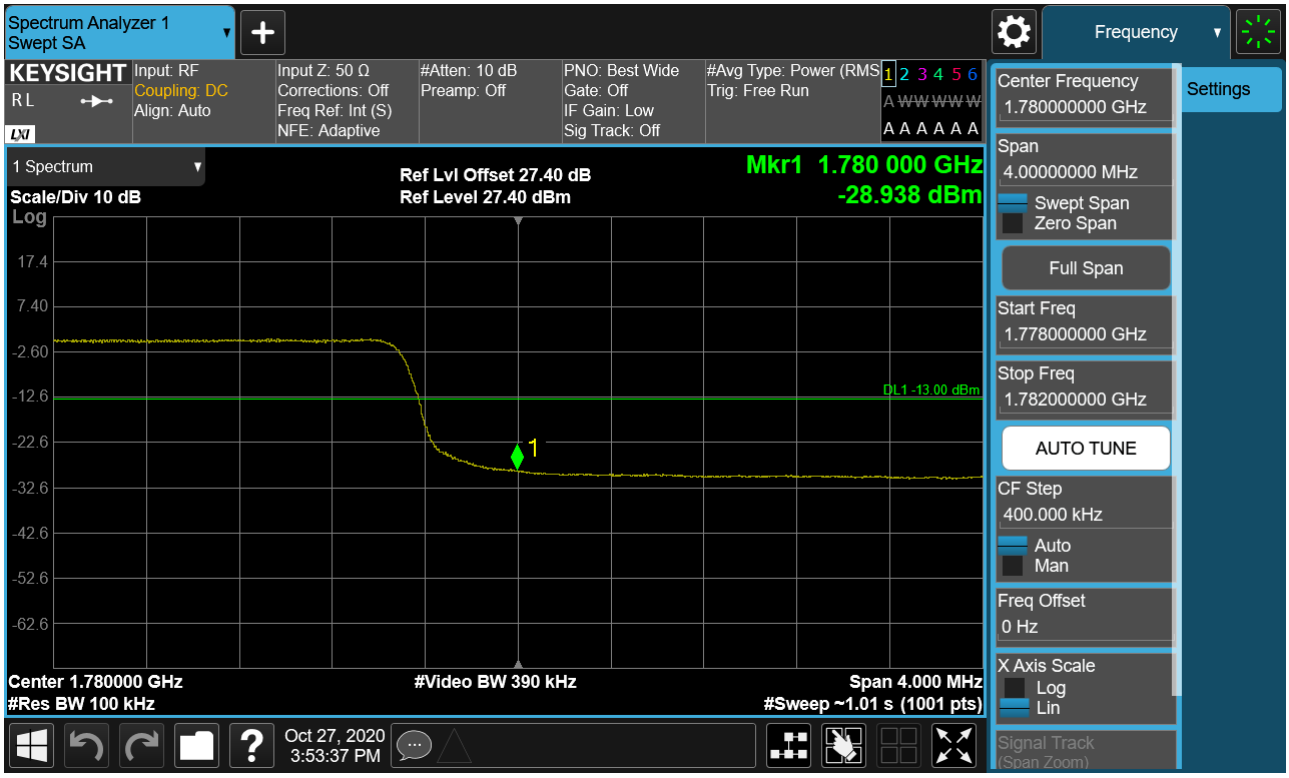
Highest Channel_PCC 5MHz Ch132550 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49(2)

Highest Channel_PCC 5MHz Ch132550 RB1 Offset24 SCC 10MHz Ch132622 RB1 Offset0(1)



Highest Channel_PCC 5MHz Ch132550 RB1 Offset24 SCC 10MHz Ch132622 RB1 Offset0(2)

Highest Channel_PCC 5MHz Ch132550 RB25 Offset0 SCC 10MHz Ch132622 RB50 Offset0(1)



Highest Channel_PCC 5MHz Ch132550 RB25 Offset0 SCC 10MHz Ch132622 RB50 Offset0(2)

Highest Channel_PCC 10MHz Ch132523 RB50 Offset0 SCC 10MHz Ch132622 RB50 Offset0(1)

Highest Channel_PCC 10MHz Ch132523 RB50 Offset0 SCC 10MHz Ch132622 RB50 Offset0(2)

8.5 Frequency Stability / Variation Of Ambient Temperature

▣ PCC Channel:	131997	
▣ PCC Frequency:	1712.5	MHz
▣ PCC BandWidth:	5	MHz
▣ SCC Channel:	132045	
▣ SCC Frequency:	1717.3	MHz
▣ SCC BandWidth:	5	MHz
▣ Voltage :	3.880	VDC
▣ LIMIT:	Emission must remain in band	

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.037	-0.028	1712.500	1717.29995
100%		-30	0.038	0.037	1712.500	1717.30006
100%		-20	-0.039	-0.035	1712.500	1717.29994
100%		-10	0.029	0.045	1712.500	1717.30008
100%		0	0.042	-0.039	1712.500	1717.29993
100%		10	-0.038	-0.036	1712.500	1717.29994
100%		30	0.037	0.035	1712.500	1717.30006
100%		40	-0.032	0.042	1712.500	1717.30007
100%		50	0.030	-0.040	1712.500	1717.29993
Batt. Endpoint	3.650	20	0.036	0.030	1712.500	1717.30005

▣ PCC Channel: 132022
▣ PCC Frequency: 1715.0 MHz
▣ PCC BandWidth: 10 MHz
▣ SCC Channel: 132094
▣ SCC Frequency: 1722.2 MHz
▣ SCC BandWidth: 5 MHz
▣ Voltage : 3.880 VDC
▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.044	0.027	1715.00008	1722.20005
100%		-30	0.031	0.028	1715.00005	1722.20005
100%		-20	0.028	-0.040	1715.00005	1722.19993
100%		-10	0.043	0.040	1715.00007	1722.20007
100%		0	0.036	0.031	1715.00006	1722.20005
100%		10	0.046	0.035	1715.00008	1722.20006
100%		30	0.041	0.037	1715.00007	1722.20006
100%		40	0.040	0.028	1715.00007	1722.20005
100%		50	0.044	-0.028	1715.00007	1722.19995
Batt. Endpoint	3.650	20	0.028	-0.028	1715.00005	1722.19995

▣ PCC Channel: 132047
▣ PCC Frequency: 1717.5 MHz
▣ PCC BandWidth: 15 MHz
▣ SCC Channel: 132140
▣ SCC Frequency: 1726.8 MHz
▣ SCC BandWidth: 5 MHz
▣ Voltage : 3.880 VDC
▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.036	0.033	1717.50006	1726.80006
100%		-30	0.045	0.043	1717.50008	1726.80007
100%		-20	-0.045	-0.047	1717.49992	1726.79992
100%		-10	0.028	-0.034	1717.50005	1726.79994
100%		0	-0.037	-0.040	1717.49994	1726.79993
100%		10	0.034	0.033	1717.50006	1726.80006
100%		30	0.046	0.046	1717.50008	1726.80008
100%		40	0.045	0.030	1717.50008	1726.80005
100%		50	-0.034	0.043	1717.49994	1726.80007
Batt. Endpoint	3.650	20	0.027	0.043	1717.50005	1726.80007

▣ PCC Channel: 132599
▣ PCC Frequency: 1772.7 MHz
▣ PCC BandWidth: 5 MHz
▣ SCC Channel: 132647
▣ SCC Frequency: 1777.5 MHz
▣ SCC BandWidth: 5 MHz
▣ Voltage : 3.880 VDC
▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.029	-0.034	1772.70005	1777.49994
100%		-30	0.047	0.045	1772.70008	1777.50008
100%		-20	0.033	0.044	1772.70006	1777.50008
100%		-10	-0.031	-0.040	1772.69994	1777.49993
100%		0	0.031	-0.027	1772.70005	1777.49995
100%		10	-0.038	0.045	1772.69993	1777.50008
100%		30	0.030	-0.028	1772.70005	1777.49995
100%		40	-0.032	0.047	1772.69994	1777.50008
100%		50	-0.040	0.037	1772.69993	1777.50007
Batt. Endpoint	3.650	20	0.031	-0.044	1772.70005	1777.49992

▣ PCC Channel: 132572
▣ PCC Frequency: 1770.0 MHz
▣ PCC BandWidth: 10 MHz
▣ SCC Channel: 132644
▣ SCC Frequency: 1777.2 MHz
▣ SCC BandWidth: 5 MHz
▣ Voltage : 3.880 VDC
▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.042	-0.028	1770.00007	1777.19995
100%		-30	0.038	-0.042	1770.00007	1777.19992
100%		-20	-0.041	0.044	1769.99993	1777.20008
100%		-10	0.033	-0.041	1770.00006	1777.19993
100%		0	-0.035	-0.045	1769.99994	1777.19992
100%		10	0.032	-0.042	1770.00006	1777.19993
100%		30	0.047	0.040	1770.00008	1777.20007
100%		40	0.030	0.036	1770.00005	1777.20006
100%		50	-0.033	-0.046	1769.99994	1777.19992
Batt. Endpoint	3.650	20	-0.042	0.034	1769.99993	1777.20006

▣ PCC Channel: 132549

▣ PCC Frequency: 1767.7 MHz

▣ PCC BandWidth: 15 MHz

▣ SCC Channel: 132642

▣ SCC Frequency: 1777.0 MHz

▣ SCC BandWidth: 5 MHz

▣ Voltage : 3.880 VDC

▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.880	+20(Ref)	0.031	0.037	1767.70006	1777.00007
100%		-30	-0.035	0.035	1767.69994	1777.00006
100%		-20	0.033	-0.043	1767.70006	1776.99992
100%		-10	-0.040	0.036	1767.69993	1777.00006
100%		0	-0.034	0.033	1767.69994	1777.00006
100%		10	-0.034	-0.041	1767.69994	1776.99993
100%		30	-0.029	-0.038	1767.69995	1776.99993
100%		40	-0.039	0.034	1767.69993	1777.00006
100%		50	-0.045	0.047	1767.69992	1777.00008
Batt. Endpoint	3.650	20	0.043	-0.041	1767.70008	1776.99993

8.6 Radiated Spurious Emissions

▣ PCC Channel : 131997 (1712.5MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 132045 (1717.3MHz)

▣ SCC BW(MHz) : 5

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,429.80	-53.86	12.60	-59.65	2.96	H	-50.01
5,144.70	-47.44	12.48	-44.73	3.66	V	-35.91
6,859.60	-56.40	12.18	-49.62	4.27	V	-41.71

▣ PCC Channel : 132375 (1750.3MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 132447 (1757.5MHz)

▣ SCC BW(MHz) : 10

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,507.80	-54.95	13.28	-61.73	2.98	H	-51.43
5,261.70	-49.29	13.25	-48.48	3.71	H	-38.94
7,015.60	-55.70	11.63	-47.38	4.32	H	-40.07

▣ PCC Channel : 132550 (1767.8MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 132622 (1775.0MHz)

▣ SCC BW(MHz) : 10

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,542.80	-53.37	12.15	-58.55	3.01	V	-49.41
5,314.20	-49.79	13.37	-48.75	3.74	H	-39.12
7,085.60	-56.87	11.38	-47.94	4.34	H	-40.90

8.7 Occupied Bandwidth

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	QPSK	25/ 0	5	132446	1757.4	QPSK	25/ 0	9.2470
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	13.934
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	13.911
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	18.272
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	18.278
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	18.787

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	16QAM	25/ 0	5	132446	1757.4	16QAM	25/ 0	9.2357
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	13.935
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	13.877
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	18.260
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	18.275
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	18.822

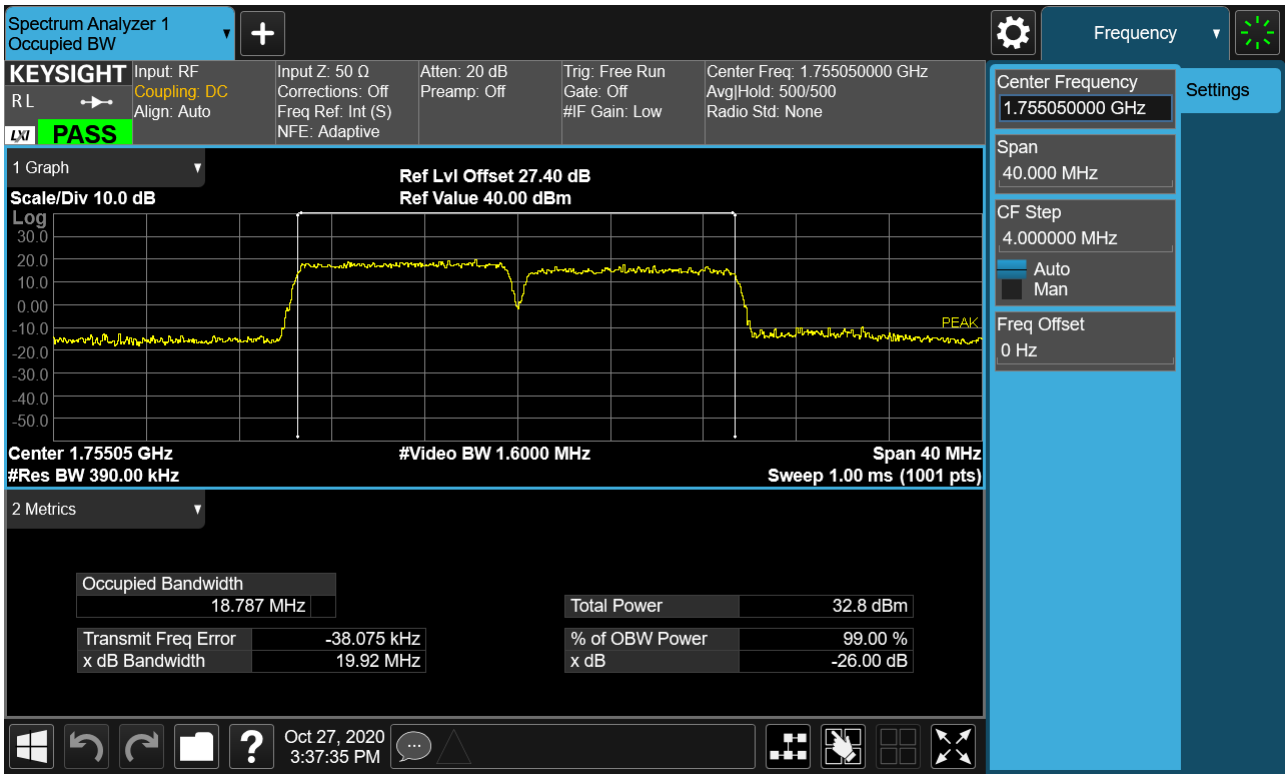
PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	64QAM	25/ 0	5	132446	1757.4	64QAM	25/ 0	9.2813
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	13.912
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	13.891
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	18.294
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	18.228
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	18.918

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	256QAM	25/ 0	5	132446	1757.4	256QAM	25/ 0	9.2757
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	13.918
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	13.895
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	18.218
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	18.266
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	18.821

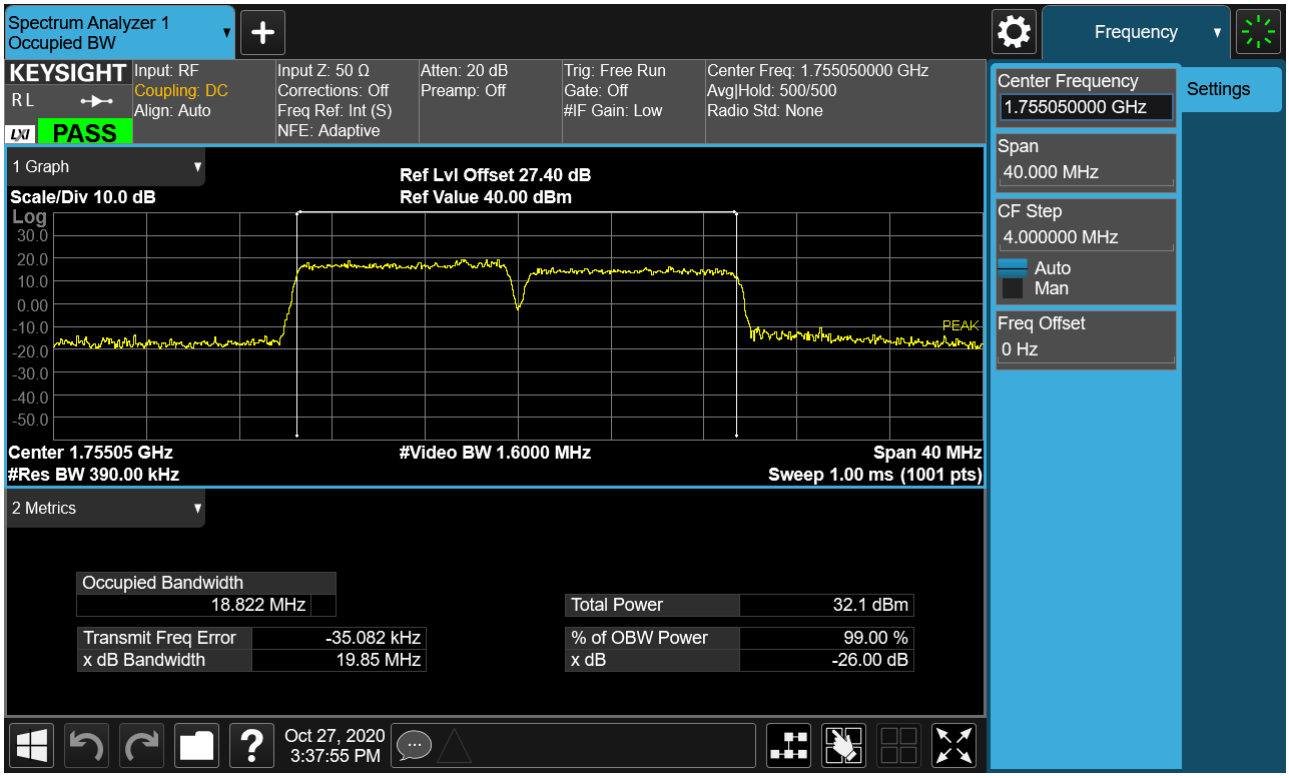
Note:

In order to simplify the report, attached plots were only Max.Bandwidth(10+10)

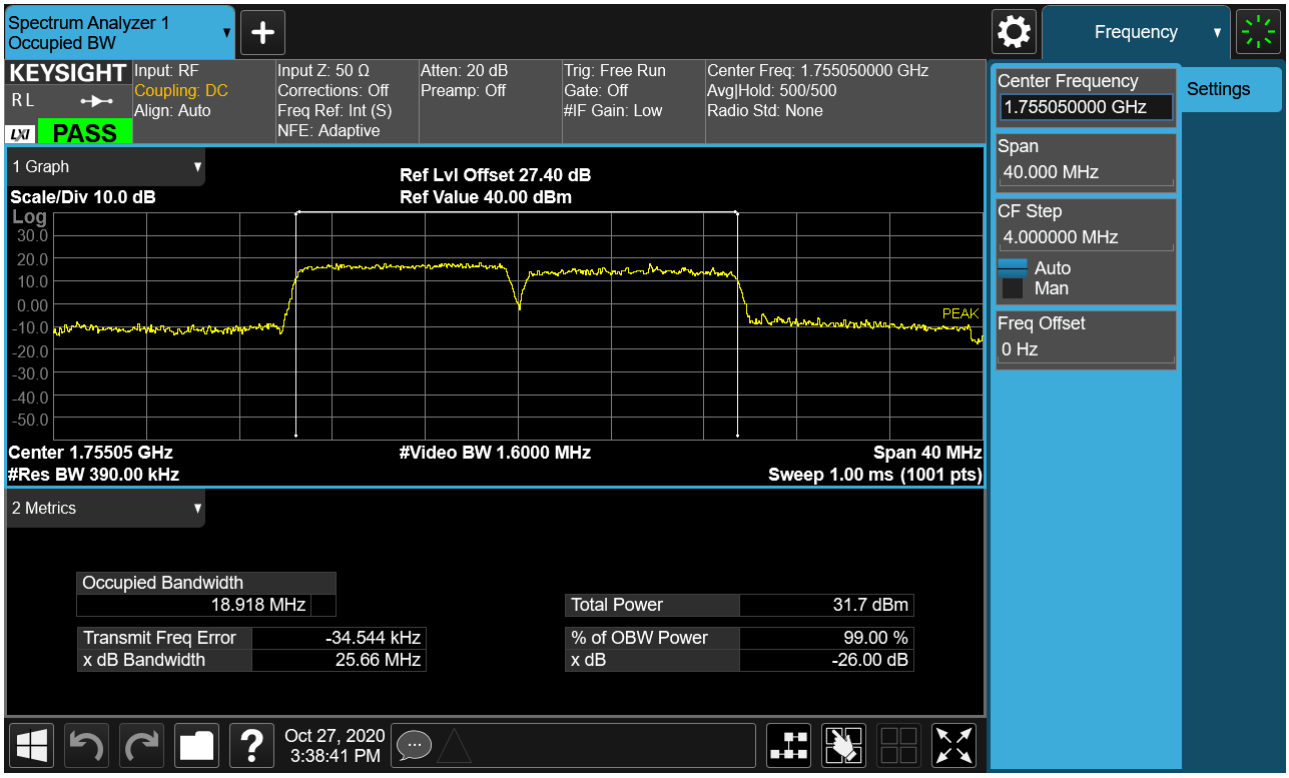
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(QPSK)



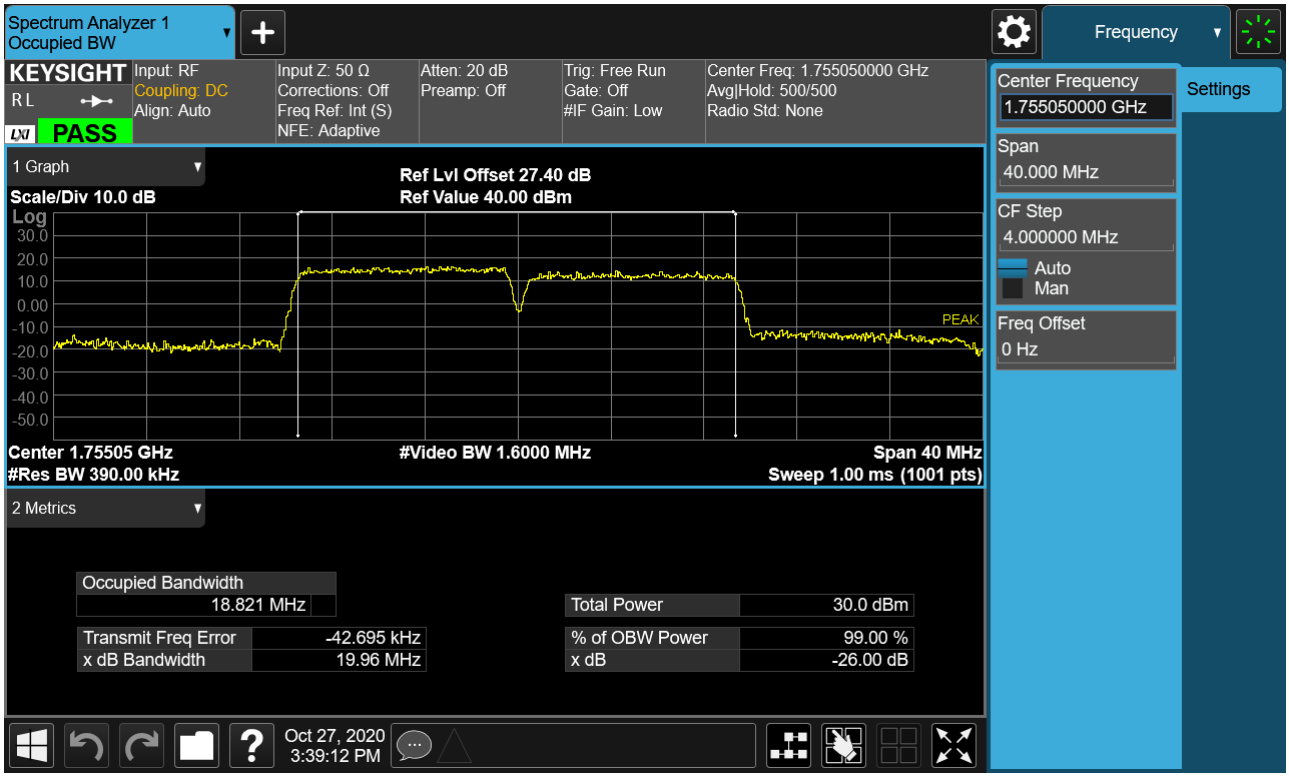
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(16QAM)



PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(64QAM)



PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(256QAM)



8.8 Peak- to- Average Ratio

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	QPSK	25/ 0	5	132446	1757.4	QPSK	25/ 0	6.07
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	6.08
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	6.12
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	5.98
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	6.05
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	6.17

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	16QAM	25/ 0	5	132446	1757.4	16QAM	25/ 0	6.82
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	6.77
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	6.85
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	6.68
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	6.79
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	6.81

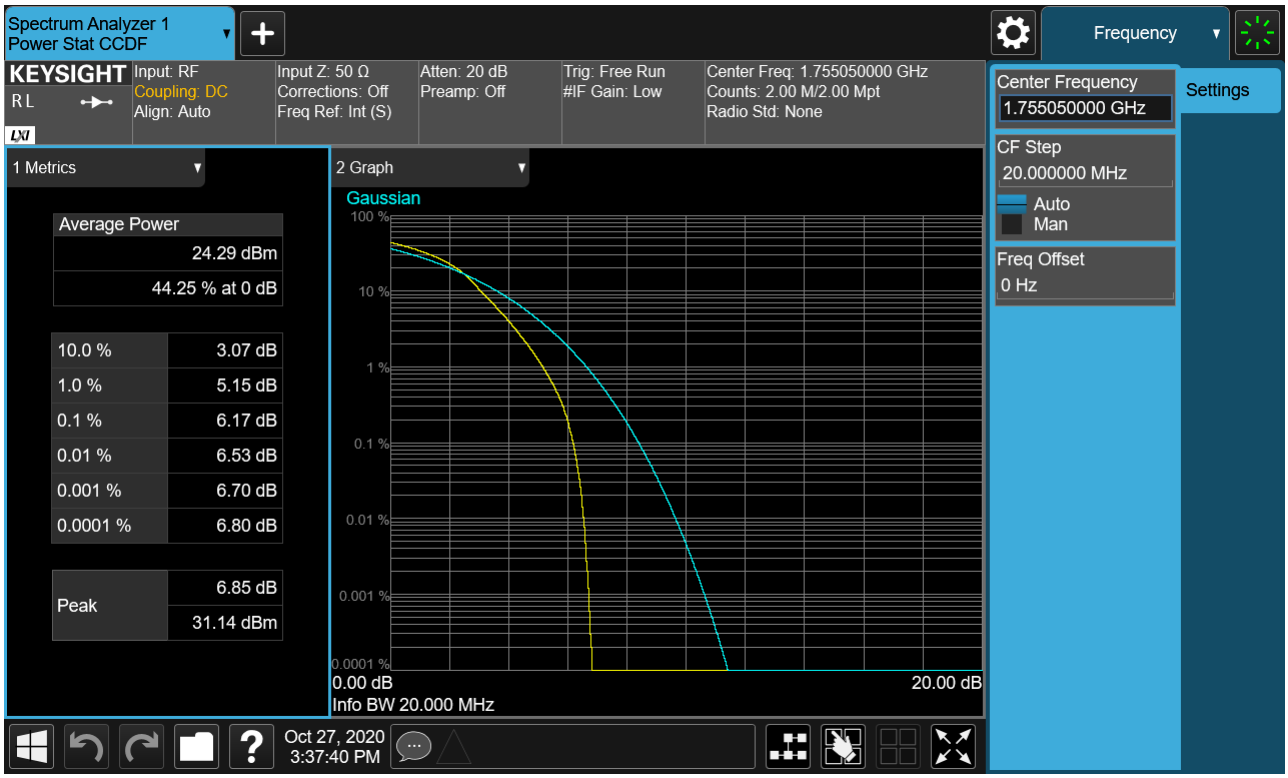
PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	64QAM	25/ 0	5	132446	1757.4	64QAM	25/ 0	7.53
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	7.07
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	7.14
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	7.03
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	7.14
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	7.64

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	256QAM	25/ 0	5	132446	1757.4	256QAM	25/ 0	8.36
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	7.22
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	7.17
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	7.12
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	7.14
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	8.39

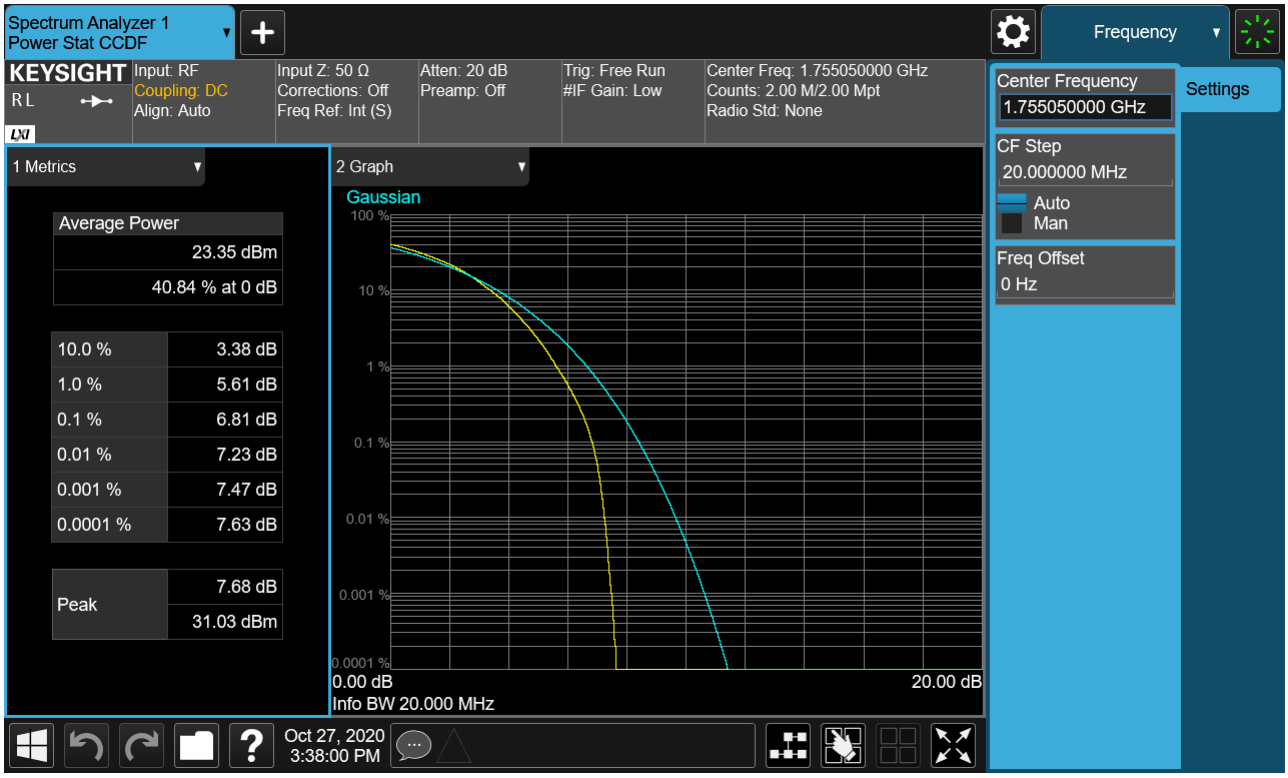
Note:

In order to simplify the report, attached plots were only Max.Bandwidth(10+10)

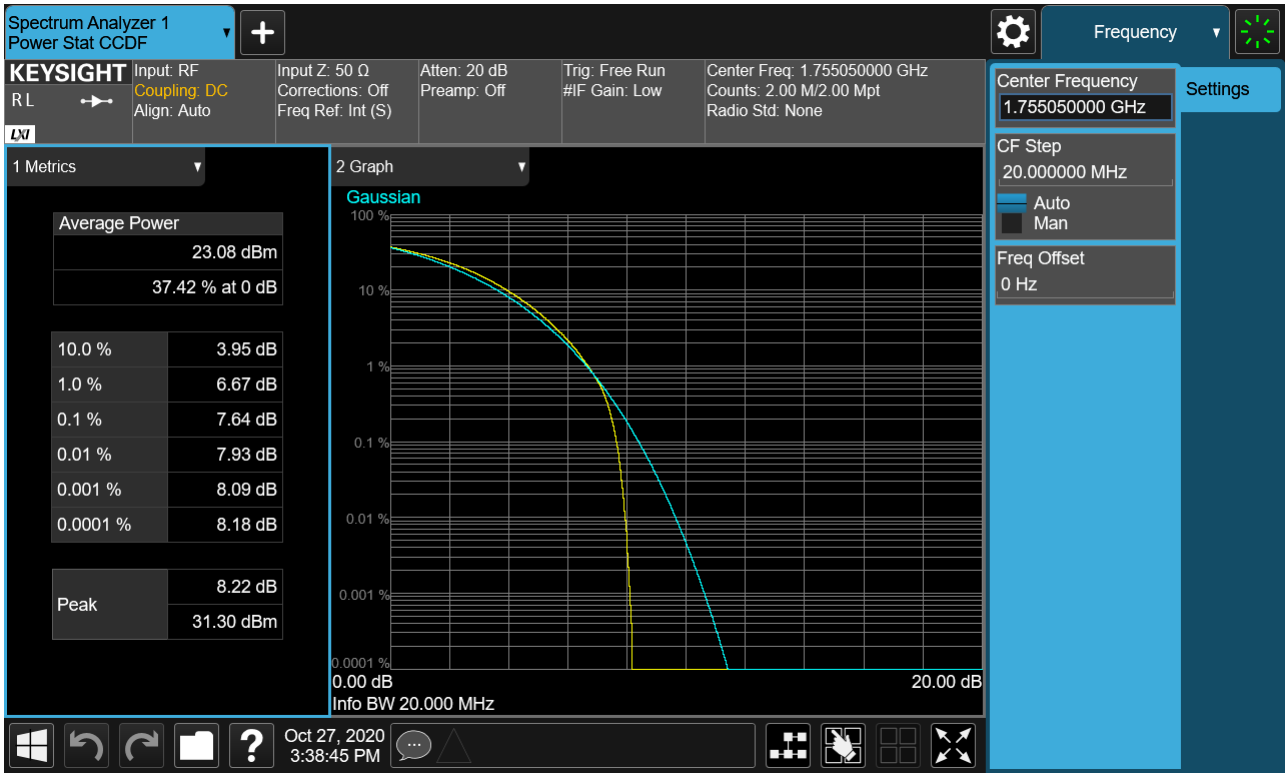
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(QPSK)



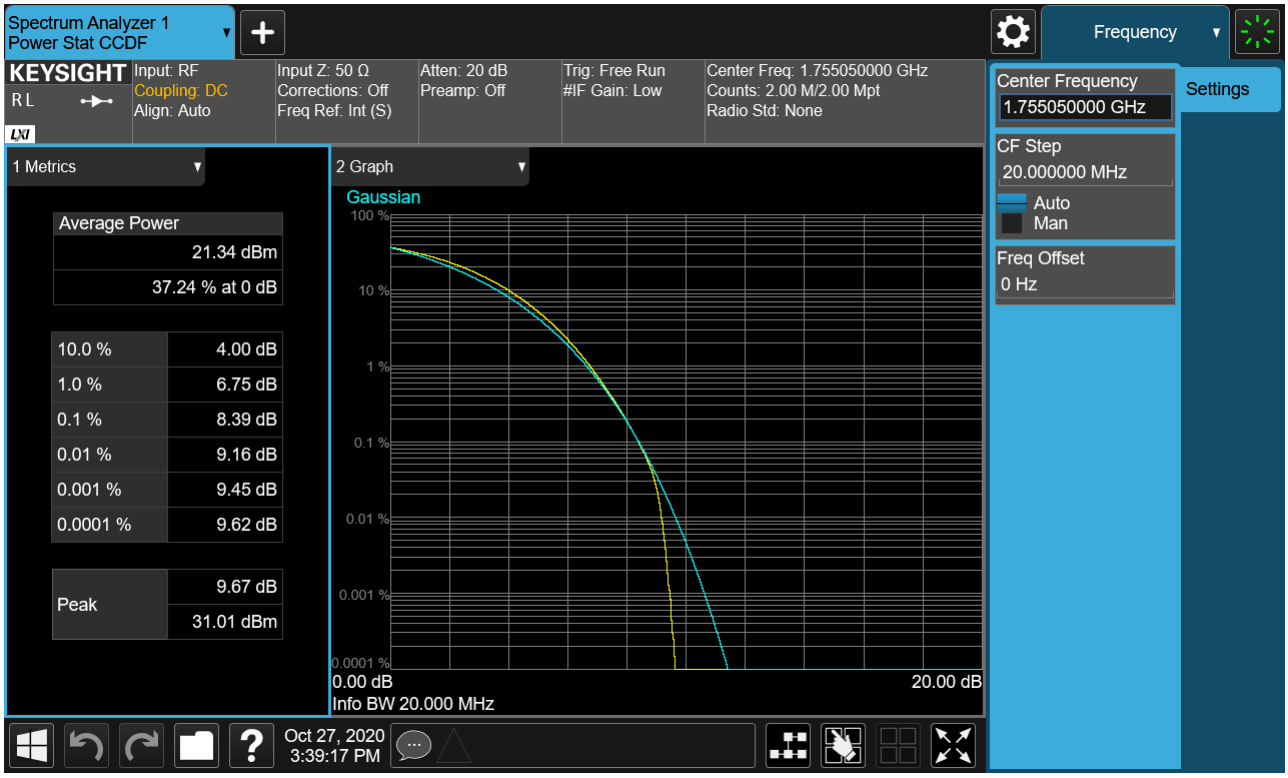
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(16QAM)



PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(64QAM)



FCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(256QAM)



9. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2011-FC013-P