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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:
July 22, 2020

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

Report No.: HCT-RF-2007-FC038

FCC ID:	**A3LSMT878U**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-T878U
EUT Type:	Tablet
FCC Classification:	PCS Licensed Transmitter (PCB)
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	9M21G7D	25.13	0.33
		16QAM	9M24W7D	24.54	0.28
		64QAM	9M19W7D	22.51	0.18
		256QAM	9M23W7D	20.51	0.11
5MHz+10MHz	1712.8 - 1775.0	QPSK	13M8G7D	25.15	0.33
		16QAM	13M9W7D	24.67	0.29
		64QAM	13M8W7D	23.27	0.21
		256QAM	13M8W7D	20.44	0.11
10MHz+5MHz	1715.0 - 1777.2	QPSK	13M8G7D	24.99	0.32
		16QAM	13M9W7D	24.66	0.29
		64QAM	13M9W7D	22.51	0.18
		256QAM	13M9W7D	20.38	0.11
5MHz+15MHz	1713.0 - 1772.5	QPSK	18M1G7D	25.13	0.33
		16QAM	18M2W7D	24.67	0.29
		64QAM	18M1W7D	22.55	0.18
		256QAM	18M1W7D	20.38	0.11
15MHz+5MHz	1717.5 - 1777.0	QPSK	18M3G7D	25.08	0.32
		16QAM	18M3W7D	24.72	0.30
		64QAM	18M2W7D	22.49	0.18
		256QAM	18M2W7D	20.37	0.11
10MHz+10MHz	1715.0 - 1775.0	QPSK	18M7G7D	25.27	0.34
		16QAM	18M8W7D	24.81	0.30
		64QAM	18M7W7D	22.27	0.17
		256QAM	18M7W7D	20.57	0.11

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 : Kwon Jeong Engineer of Telecommunication Testing Center	Report approved by : Jong Seok Lee Manager of Telecommunication Testing Center

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

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 KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2007-FC038	July 22, 2020	- First Approval Report

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

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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, 16677, Rep. of Korea
FCC ID:	A3LSMT878U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§27, §2
EUT Type:	Tablet
Model(s):	SM-T878U
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:	June 07, 2020 ~ July 17, 2020
LTE CA :	CA 66B (Uplink)

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Tablet with UMTS and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, 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 10th 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;

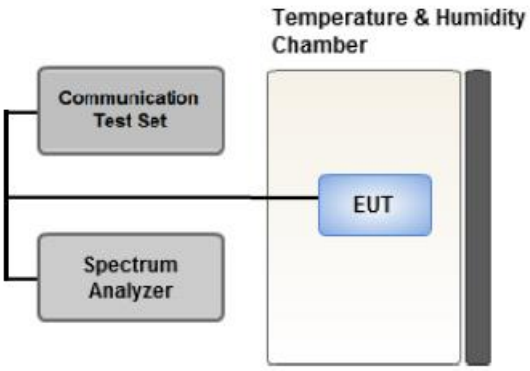
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   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:

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

Test Settings(Peak Power)

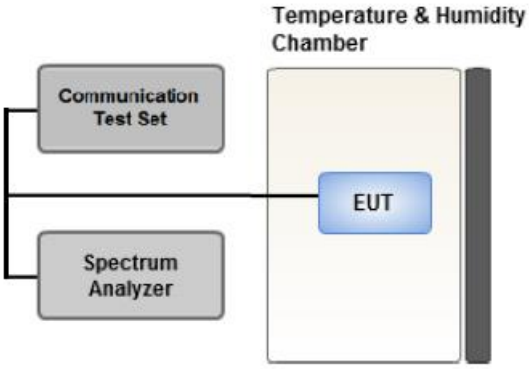
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

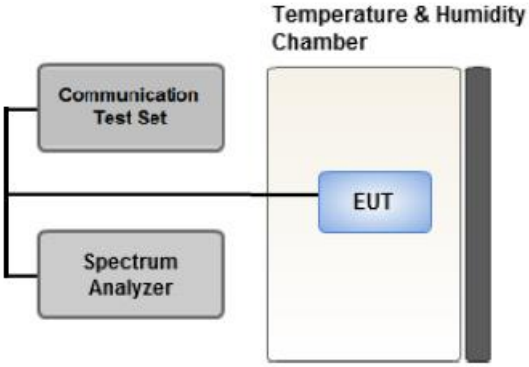
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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.

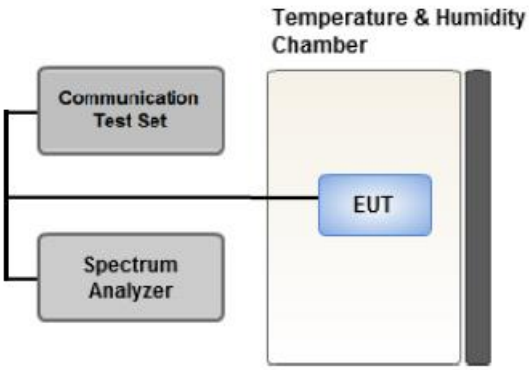
All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

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

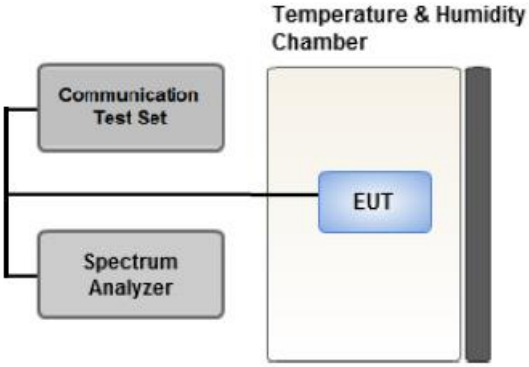
Test Notes

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
WAINWRIGHT INSTRUMENT	WHNX6.0/26.5G-6SS/H.P.F	1	03/19/2020	Annual	03/19/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/27/2020	Annual	04/27/2021
Hewlett Packard	E3632A/DC Power Supply	MY4004427	09/27/2019	Annual	09/27/2020
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	93000717	08/14/2019	Annual	08/14/2020
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	10/14/2019	Annual	10/14/2020
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/27/2019	Annual	08/27/2020
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	04/26/2019	Biennial	04/26/2021
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/09/2019	Annual	08/09/2020
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	E7515B / 5G Wireless Tester	MY58300756	01/07/2020	Annual	01/07/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
Mini-Circuits	ZC4PD-K1844+ / 4-Way Divider	942907	09/05/2019	Annual	09/05/2020
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 : SMB100A (S/N: 177633)
   - Use date of Equipment : June 07, 2020 ~ July 12, 2020/ July 14, 2020 ~ July 17, 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	Substitute	Ant. Gain	C.L	Pol.	ERP	
channel	Freq.(MHz)	Level(dBm)	Level(dBm)	(dBd)			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	Substitute	Ant. Gain	C.L	Pol.	EIRP	
channel	Freq.(MHz)	Level(dBm)	Level(dBm)	(dBi)			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

16QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

64QAM 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	10	1715.0	132022	1	49	10	1724.9	132121	1	0
	QPSK	Mid	10	1750.1	132373	1	49	10	1760.0	132472	1	0
	QPSK	High	10	1765.1	132523	1	49	10	1775.0	132622	1	0
	QPSK	Low	10	1715.0	132022	1	0	10	1724.9	132121	1	49
	QPSK	Mid	10	1750.1	132373	1	0	10	1760.0	132472	1	49
	QPSK	High	10	1765.1	132523	1	0	10	1775.0	132622	1	49
	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	15	1717.5	132047	1	74	5	1726.8	132140	1	0
	QPSK	Mid	15	1752.6	132398	1	74	5	1761.9	132491	1	0
	QPSK	High	5	1767.8	132550	1	24	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	24.28
	5	1712.8	132000	1	24	10	1720.0	132072	1	0	24.29
	10	1715.0	132022	1	49	5	1722.2	132094	1	0	24.25
	5	1713.0	132002	1	24	15	1722.3	132095	1	0	24.36
	15	1717.5	132047	1	74	5	1726.8	132140	1	0	24.18
	10	***1715.0***	***132022***	***1***	***49***	***10***	***1724.9***	***132121***	***1***	***0***	***24.45***
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	24.35
	5	1750.3	132375	1	24	10	1757.5	132447	1	0	24.34
	10	1752.5	132397	1	49	5	1759.7	132469	1	0	24.34
	5	1748.1	132353	1	24	15	1757.4	132446	1	0	24.34
	15	1752.6	132398	1	74	5	1761.9	132491	1	0	24.29
	10	***1750.1***	***132373***	***1***	***49***	***10***	***1760.0***	***132472***	***1***	***0***	***24.36***
High	5	1772.7	132599	1	24	5	1777.5	132647	1	0	24.31
	5	1767.8	132550	1	24	10	1775.0	132622	1	0	24.31
	10	1770.0	132572	1	49	5	1777.2	132644	1	0	24.22
	5	1763.2	132504	1	24	15	1772.5	132597	1	0	24.29
	15	1767.7	132549	1	74	5	1777.0	132642	1	0	24.28
	10	***1765.1***	***132523***	***1***	***49***	***10***	***1775.0***	***132622***	***1***	***0***	***24.32***

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	22.34
	5	1712.8	132000	25	0	10	1720.0	132072	50	0	22.37
	10	1715.0	132022	50	0	5	1722.2	132094	25	0	22.38
	5	1713.0	132002	25	0	15	1722.3	132095	75	0	22.30
	15	1717.5	132047	75	0	5	1726.8	132140	25	0	22.36
	10	***1715.0***	***132022***	***50***	***0***	***10***	***1724.9***	***132121***	***50***	***0***	***22.39***
Mid	5	1752.6	132398	25	0	5	1757.4	132446	25	0	22.33
	5	1750.3	132375	25	0	10	1757.5	132447	50	0	22.40
	10	1752.5	132397	50	0	5	1759.7	132469	25	0	22.40
	5	1748.1	132353	25	0	15	1757.4	132446	75	0	22.25
	15	1752.6	132398	75	0	5	1761.9	132491	25	0	22.38
	10	***1750.1***	***132373***	***50***	***0***	***10***	***1760.0***	***132472***	***50***	***0***	***22.41***
High	5	1772.7	132599	25	0	5	1777.5	132647	25	0	22.22
	5	1767.8	132550	25	0	10	1775.0	132622	50	0	22.32
	10	1770.0	132572	50	0	5	1777.2	132644	25	0	22.34
	5	1763.2	132504	25	0	15	1772.5	132597	75	0	22.28
	15	1767.7	132549	75	0	5	1777.0	132642	25	0	22.35
	10	***1765.1***	***132523***	***50***	***0***	***10***	***1775.0***	***132622***	***50***	***0***	***22.35***

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	10	1715.0	132022	1	49	10	1724.9	132121	1	0	23.75
Mid	10	1750.1	132373	1	49	10	1760.0	132472	1	0	23.77
High	10	1765.1	132523	1	49	10	1775.0	132622	1	0	23.95
Low	10	1715.0	132022	50	0	10	1724.9	132121	50	0	21.44
Mid	10	1750.1	132373	50	0	10	1760.0	132472	50	0	21.38
High	10	1765.1	132523	50	0	10	1775.0	132622	50	0	21.41

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	10	1715.0	132022	1	49	10	1724.9	132121	1	0	21.94
Mid	10	1750.1	132373	1	49	10	1760.0	132472	1	0	21.79
High	10	1765.1	132523	1	49	10	1775.0	132622	1	0	21.73
Low	10	1715.0	132022	50	0	10	1724.9	132121	50	0	21.43
Mid	10	1750.1	132373	50	0	10	1760.0	132472	50	0	21.37
High	10	1765.1	132523	50	0	10	1775.0	132622	50	0	21.39

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	10	1715.0	132022	1	49	10	1724.9	132121	1	0	19.78
Mid	10	1750.1	132373	1	49	10	1760.0	132472	1	0	19.56
High	10	1765.1	132523	1	49	10	1775.0	132622	1	0	19.66
Low	10	1715.0	132022	50	0	10	1724.9	132121	50	0	19.47
Mid	10	1750.1	132373	50	0	10	1760.0	132472	50	0	19.42
High	10	1765.1	132523	50	0	10	1775.0	132622	50	0	19.41

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	132002	1/24	15	132095	1/0	-18.27	15.06	9.90	1.88	H	0.20	23.08
	5	132000	1/24	10	132072	1/0	-18.07	15.26	9.90	1.88	H	0.21	23.28
	5	131997	1/24	5	132045	1/0	-18.05	15.28	9.90	1.88	H	0.21	23.30
	10	132022	1/49	10	132121	1/0	-17.82	15.51	9.90	1.88	H	0.23	23.53
	10	132022	1/49	5	132094	1/0	-17.81	15.52	9.90	1.88	H	0.23	23.54
	15	***132047***	***1/74***	***5***	***132140***	***1/0***	***-17.49***	***15.84***	***9.90***	***1.88***	***H***	***0.24***	***23.86***
Mid	5	132353	1/24	15	132446	1/0	-16.36	16.94	10.02	1.91	H	0.32	25.05
	5	132375	1/24	10	132447	1/0	-16.40	16.90	10.02	1.91	H	0.32	25.01
	5	132398	1/24	5	132446	1/0	-16.42	16.88	10.02	1.91	H	0.32	24.99
	10	132373	1/49	10	132472	1/0	-16.38	16.92	10.02	1.91	H	0.32	25.03
	10	132397	1/49	5	132469	1/0	-16.33	16.97	10.02	1.91	H	0.32	25.08
	15	***132398***	***1/74***	***5***	***132491***	***1/0***	***-16.14***	***17.16***	***10.02***	***1.91***	***H***	***0.34***	***25.27***
High	5	132504	1/24	15	132597	1/0	-16.34	17.03	10.02	1.92	H	0.33	25.13
	5	***132550***	***1/24***	***10***	***132622***	***1/0***	***-16.32***	***17.05***	***10.02***	***1.92***	***H***	***0.33***	***25.15***
	5	132599	1/24	5	132647	1/0	-17.07	16.30	10.02	1.92	H	0.28	24.40
	10	132523	1/49	10	132622	1/0	-16.34	17.03	10.02	1.92	H	0.33	25.13
	10	132572	1/49	5	132644	1/0	-16.42	16.95	10.02	1.92	H	0.32	25.05
	15	132549	1/74	5	132642	1/0	-16.42	16.95	10.02	1.92	H	0.32	25.05

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	132353	1/24	15	132446	1/0	-16.87	15.91	10.98	2.35	H	0.28	24.54
5	132375	1/24	10	132447	1/0	-16.74	16.04	10.98	2.35	H	0.29	24.67
5	132398	1/24	5	132446	1/0	-16.75	16.03	10.98	2.35	H	0.29	24.66
10	132373	1/49	10	132472	1/0	-16.74	16.04	10.98	2.35	H	0.29	24.67
10	132397	1/49	5	132469	1/0	-16.69	16.09	10.98	2.35	H	0.30	24.72
15	132398	1/74	5	132491	1/0	-16.60	16.18	10.98	2.35	H	0.30	24.81
15	132047	1/74	5	132140	1/0	-18.07	14.85	10.75	2.32	H	0.21	23.28
5	132550	1/24	10	132622	1/0	-16.82	15.94	11.10	2.39	H	0.29	24.65

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	132353	1/24	15	132446	1/0	-18.90	13.88	10.98	2.35	H	0.18	22.51
5	132375	1/24	10	132447	1/0	-18.14	14.64	10.98	2.35	H	0.21	23.27
5	132398	1/24	5	132446	1/0	-18.90	13.88	10.98	2.35	H	0.18	22.51
10	132373	1/49	10	132472	1/0	-18.86	13.92	10.98	2.35	H	0.18	22.55
10	132397	1/49	5	132469	1/0	-18.92	13.86	10.98	2.35	H	0.18	22.49
15	132398	1/74	5	132491	1/0	-19.14	13.64	10.98	2.35	H	0.17	22.27
15	132047	1/74	5	132140	1/0	-21.33	11.59	10.75	2.32	H	0.10	20.02
5	132550	1/24	10	132622	1/0	-18.87	13.89	11.10	2.39	H	0.18	22.60

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	132353	1/24	15	132446	1/0	-20.90	11.88	10.98	2.35	H	0.11	20.51
5	132375	1/24	10	132447	1/0	-20.97	11.81	10.98	2.35	H	0.11	20.44
5	132398	1/24	5	132446	1/0	-21.03	11.75	10.98	2.35	H	0.11	20.38
10	132373	1/49	10	132472	1/0	-21.03	11.75	10.98	2.35	H	0.11	20.38
10	132397	1/49	5	132469	1/0	-21.04	11.74	10.98	2.35	H	0.11	20.37
15	132398	1/74	5	132491	1/0	-20.84	11.94	10.98	2.35	H	0.11	20.57
15	132047	1/74	5	132140	1/0	-22.59	10.33	10.75	2.32	H	0.08	18.76
5	132550	1/24	10	132622	1/0	-21.07	11.69	11.10	2.39	H	0.11	20.40

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	10	132022	1715.0	1/49	10	132121	1724.9	1/0	7.9791	28.591	-76.06	-47.47
Mid	10	132373	1750.1	1/49	10	132472	1760.0	1/0	3.4507	27.976	-76.62	-48.64
High	10	132523	1765.1	1/49	10	132622	1775.0	1/0	8.3021	28.591	-76.57	-47.98
Low	10	132022	1715.0	1/0	10	132121	1724.9	1/49	3.7503	27.976	-76.48	-48.51
Mid	10	132373	1750.1	1/0	10	132472	1760.0	1/49	8.0100	28.591	-76.28	-47.69
High	10	132523	1765.1	1/0	10	132622	1775.0	1/49	3.9946	27.976	-75.92	-47.94
Low	10	132022	1715.0	50/0	10	132121	1724.9	50/0	2.7274	27.976	-76.75	-48.77
Mid	10	132373	1750.1	50/0	10	132472	1760.0	50/0	8.0234	28.591	-79.18	-50.59
High	10	132523	1765.1	50/0	10	132622	1775.0	50/0	8.0404	28.591	-74.89	-46.30

Note:

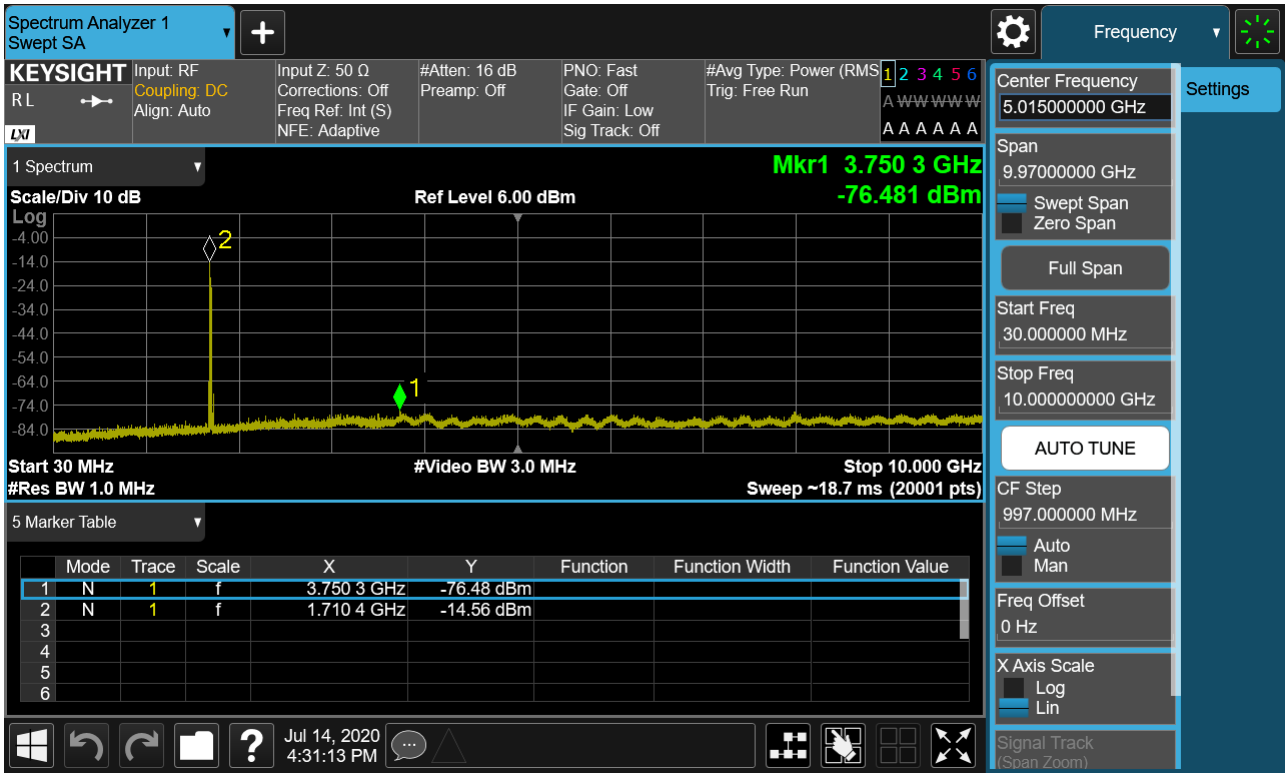
1. Modulation : QPSK
2. Factor(dB) = Cable Loss + Ext. Attenuator + Power Splitter
3. Factors for frequency :

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

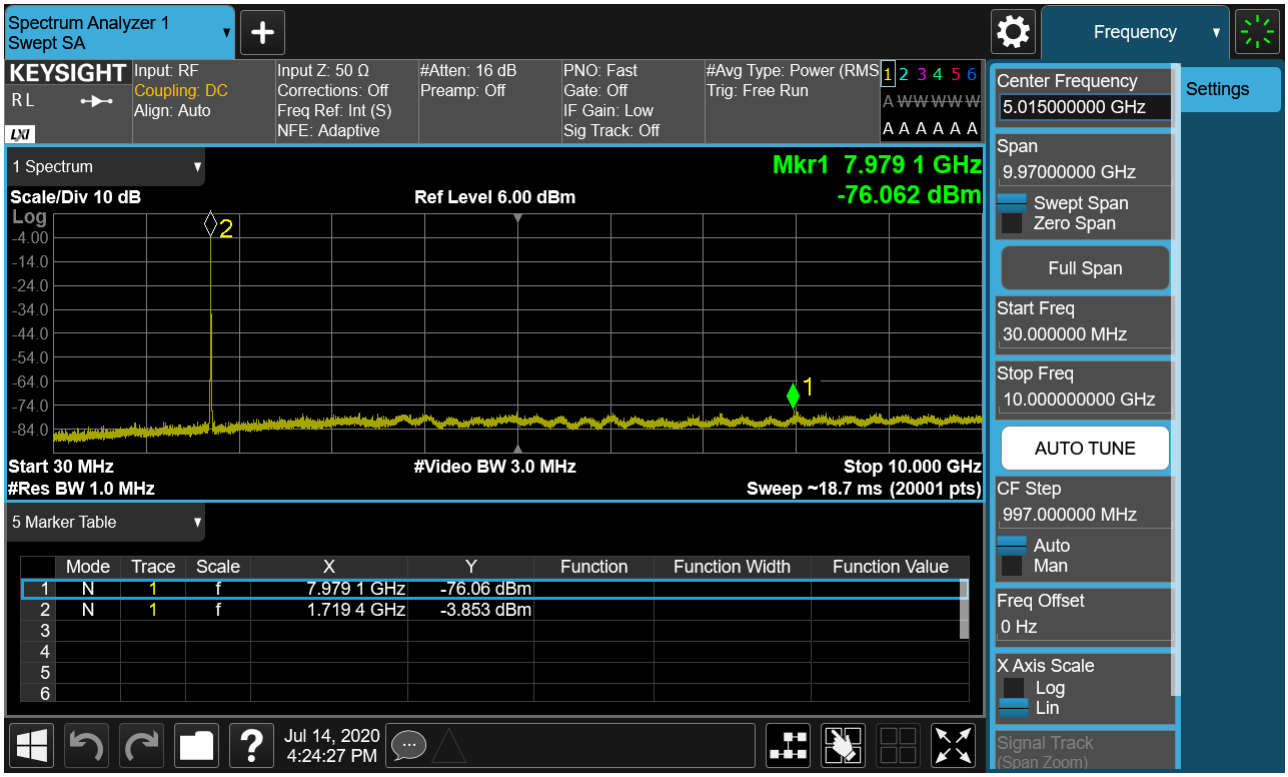
4. Limit : -13.0 dBm

Frequency Range : 30MHz ~ 10GHz

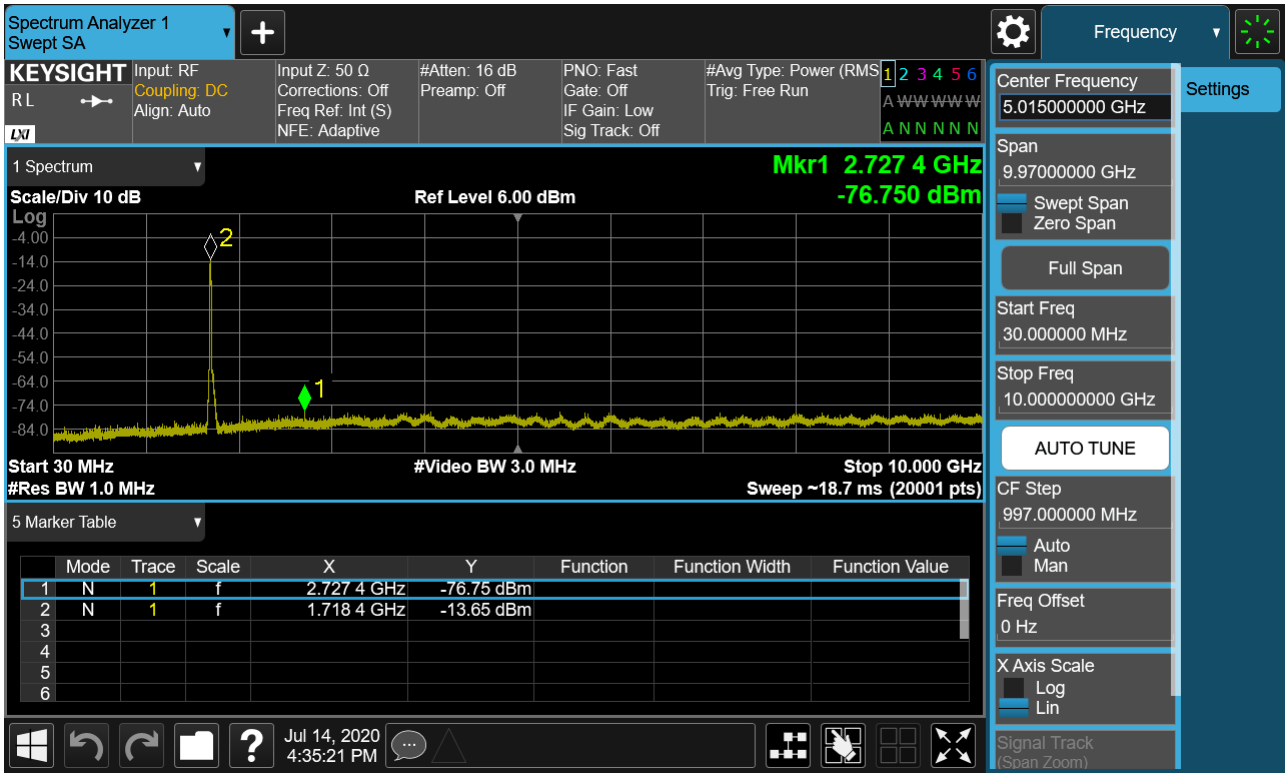
PCC 10MHz Ch132022 RB1 Offset0 SCC 10MHz Ch132121 RB1 Offset49



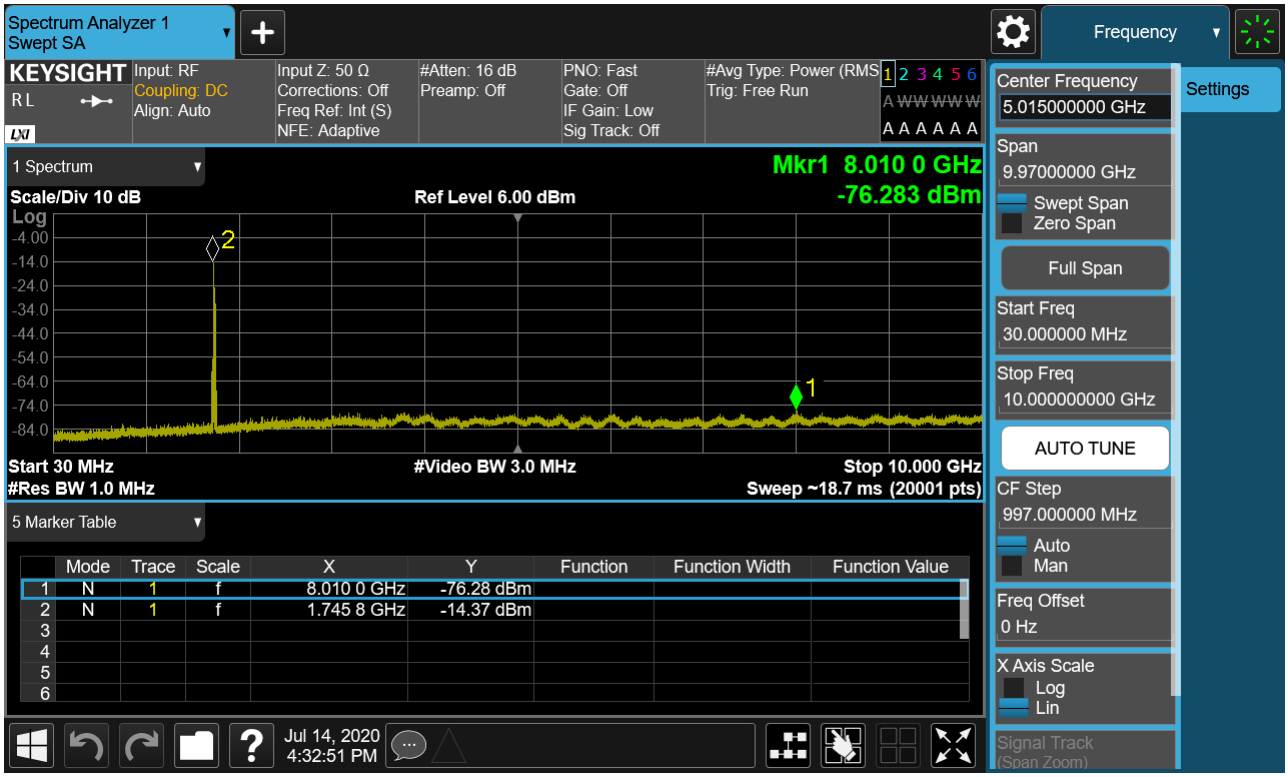
PCC 10MHz Ch132022 RB1 Offset49 SCC 10MHz Ch132121 RB1 Offset0



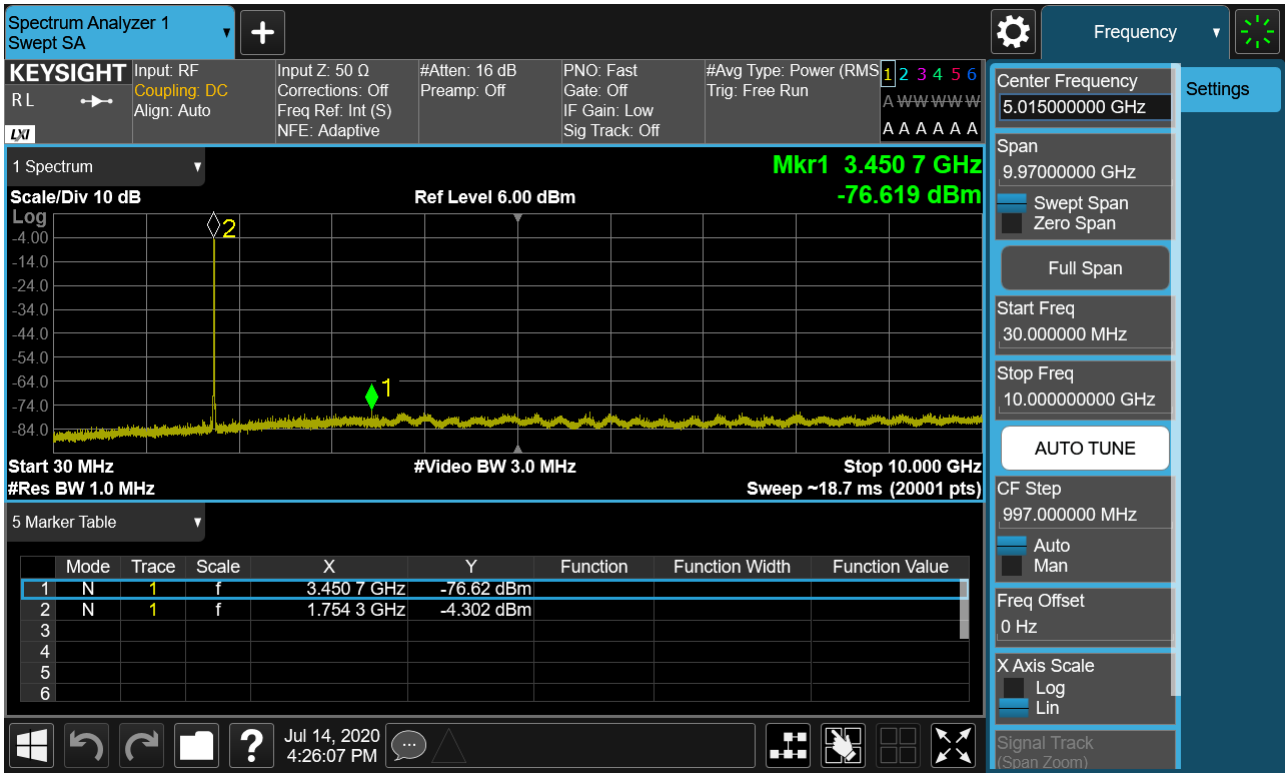
PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0



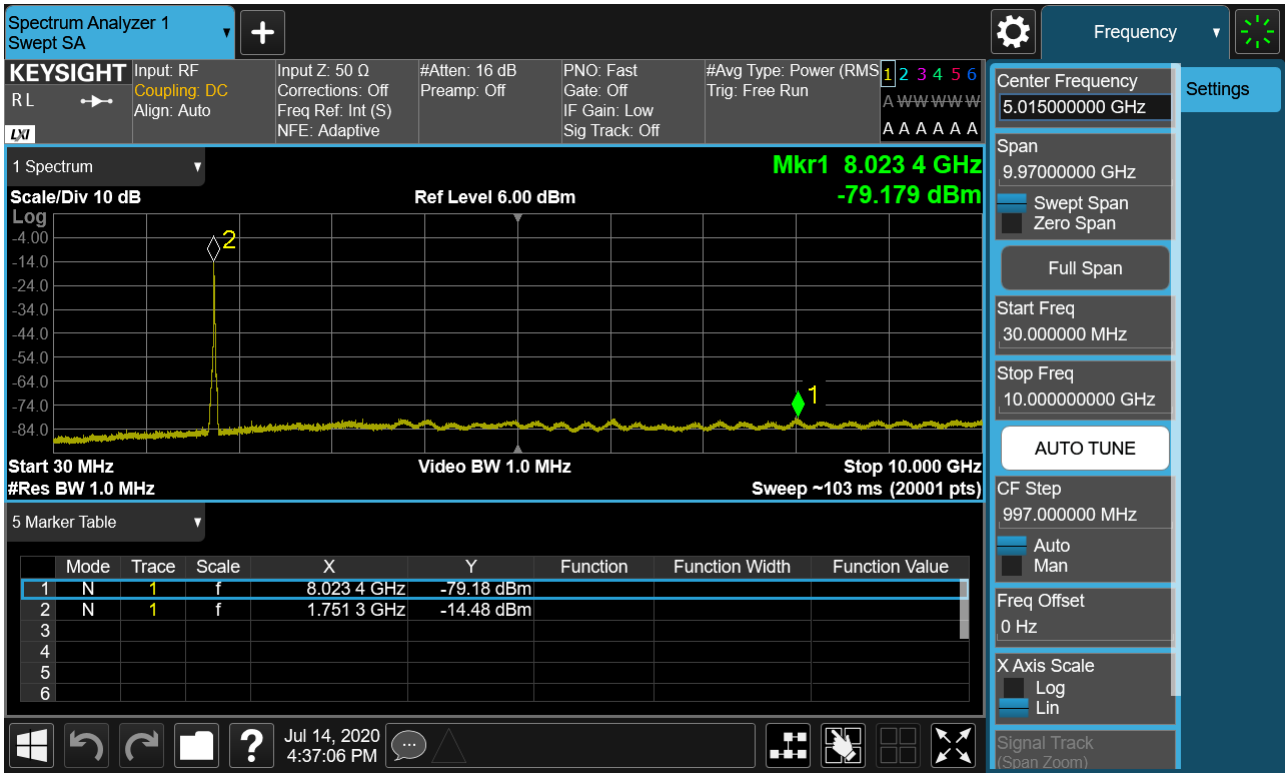
PCC 10MHz Ch132373 RB1 Offset0 SCC 10MHz Ch132472 RB1 Offset49



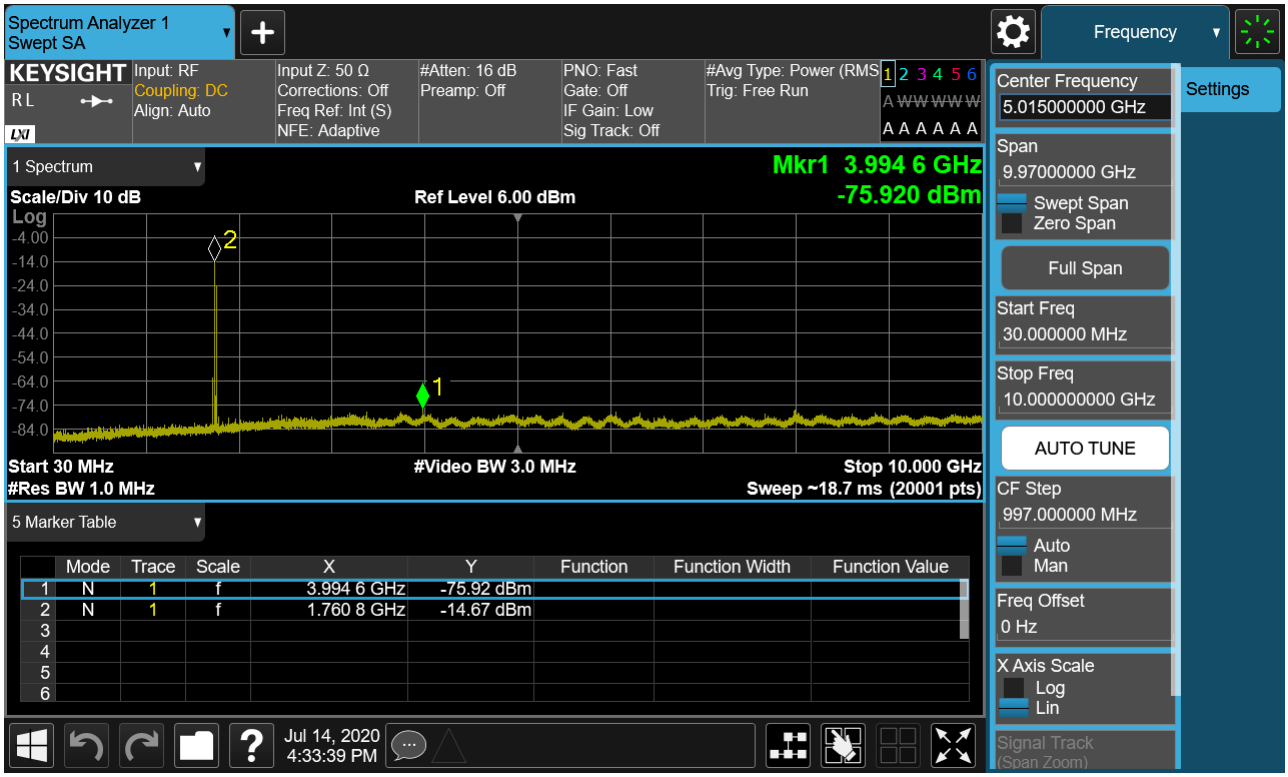
PCC 10MHz Ch132373 RB1 Offset49 SCC 10MHz Ch132472 RB1 Offset0



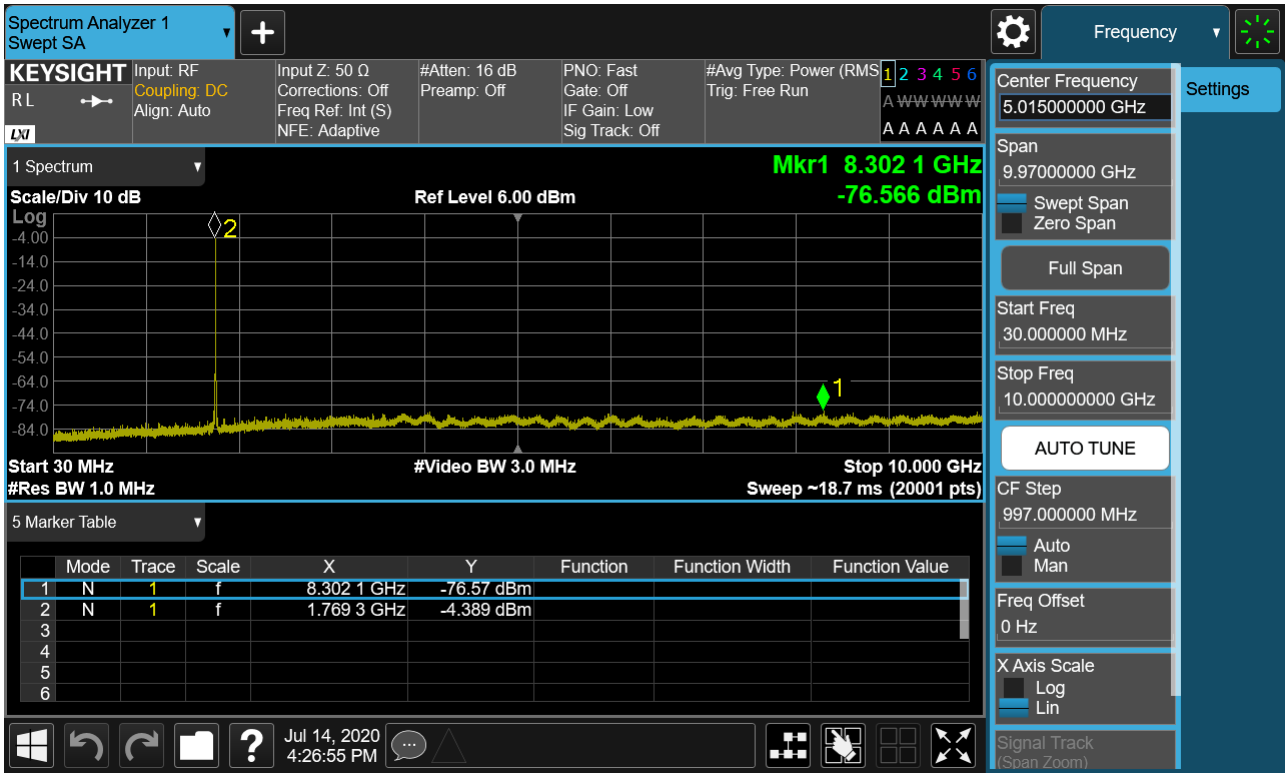
PCC 10MHz Ch132373 RB50 Offset0 SCC 10MHz Ch132472 RB50 Offset0



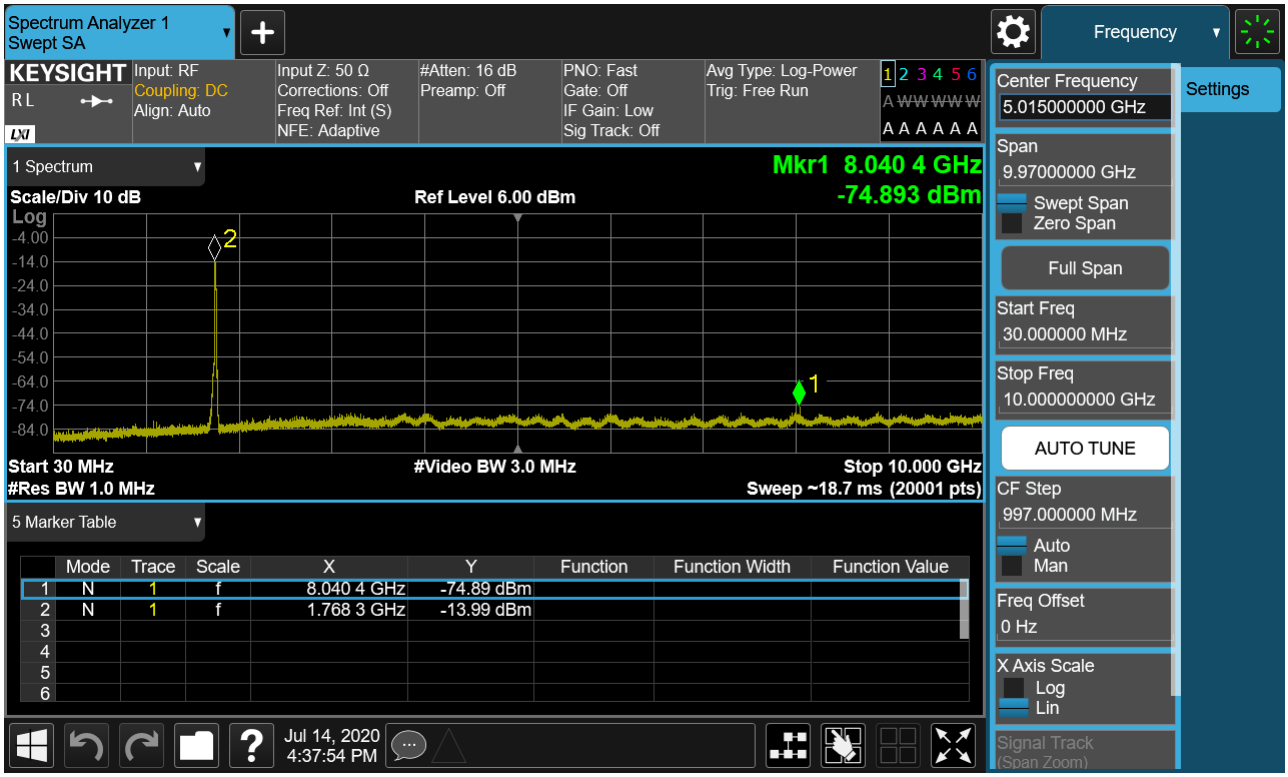
PCC 10MHz Ch132523 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49



PCC 10MHz Ch132523 RB1 Offset49 SCC 10MHz Ch132622 RB1 Offset0

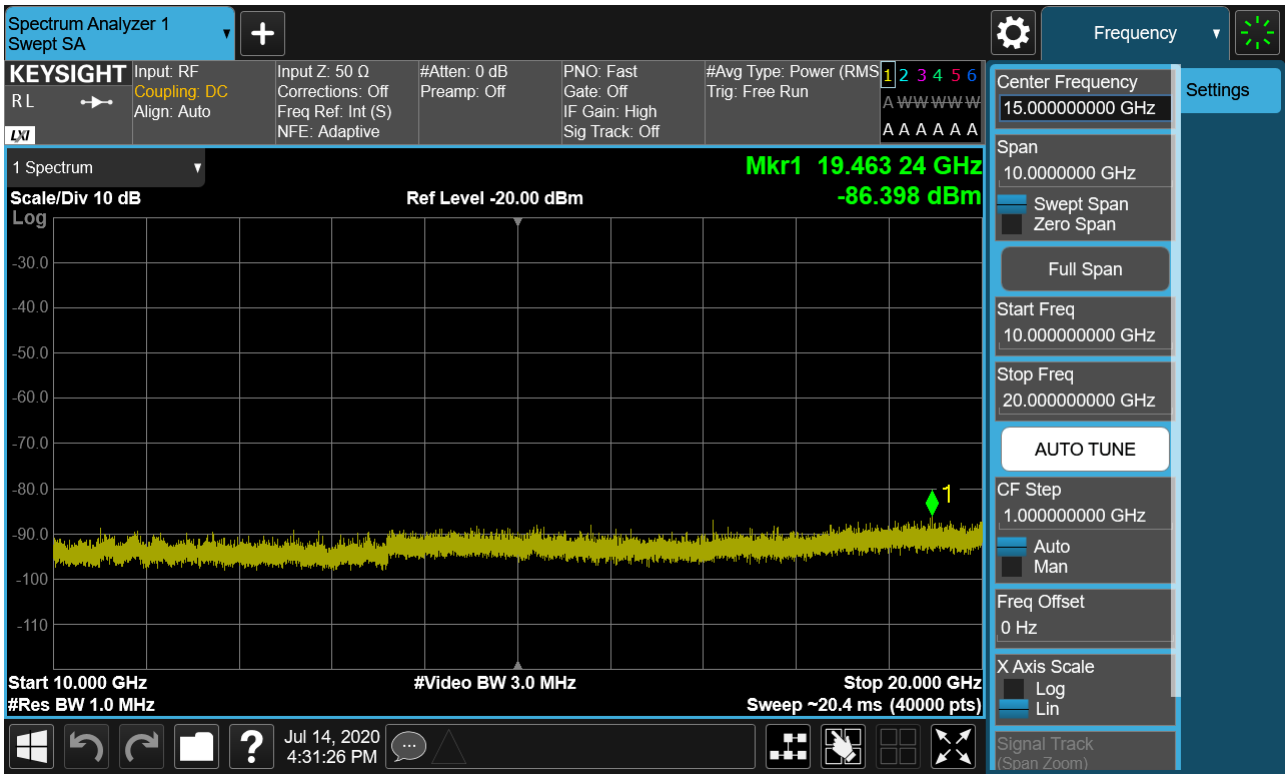


PCC 10MHz Ch132523 RB50 Offset0 SCC 10MHz Ch132622 RB50 Offset0

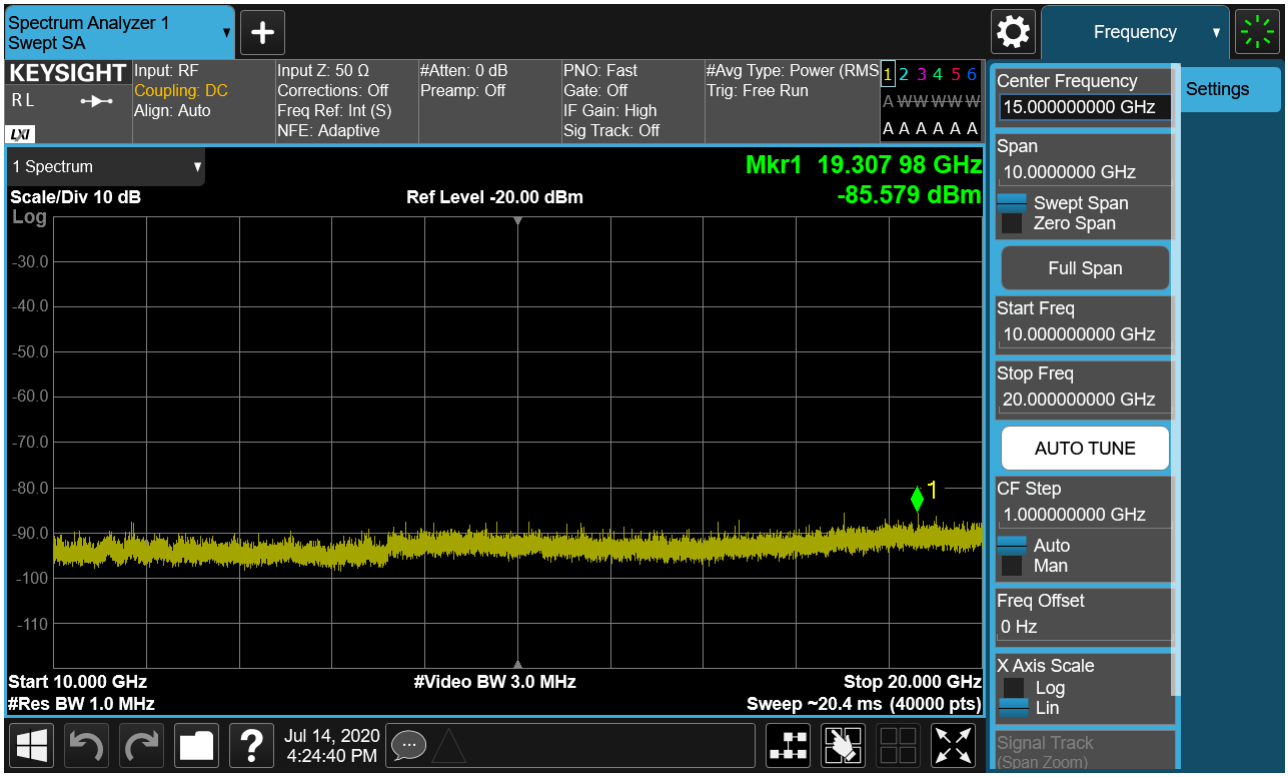


Frequency Range : 10GHz ~ 26.5GHz

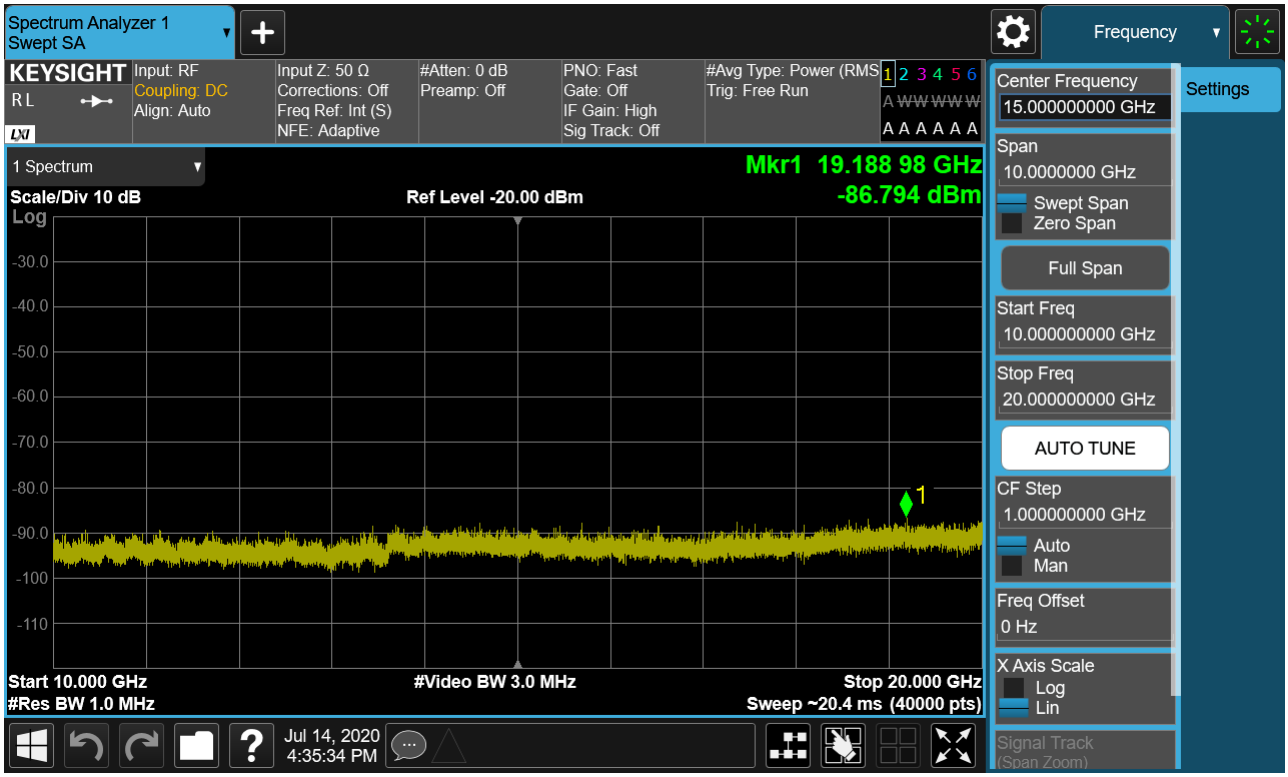
PCC 10MHz Ch132022 RB1 Offset0, SCC 10MHz Ch132121 RB1 Offset49



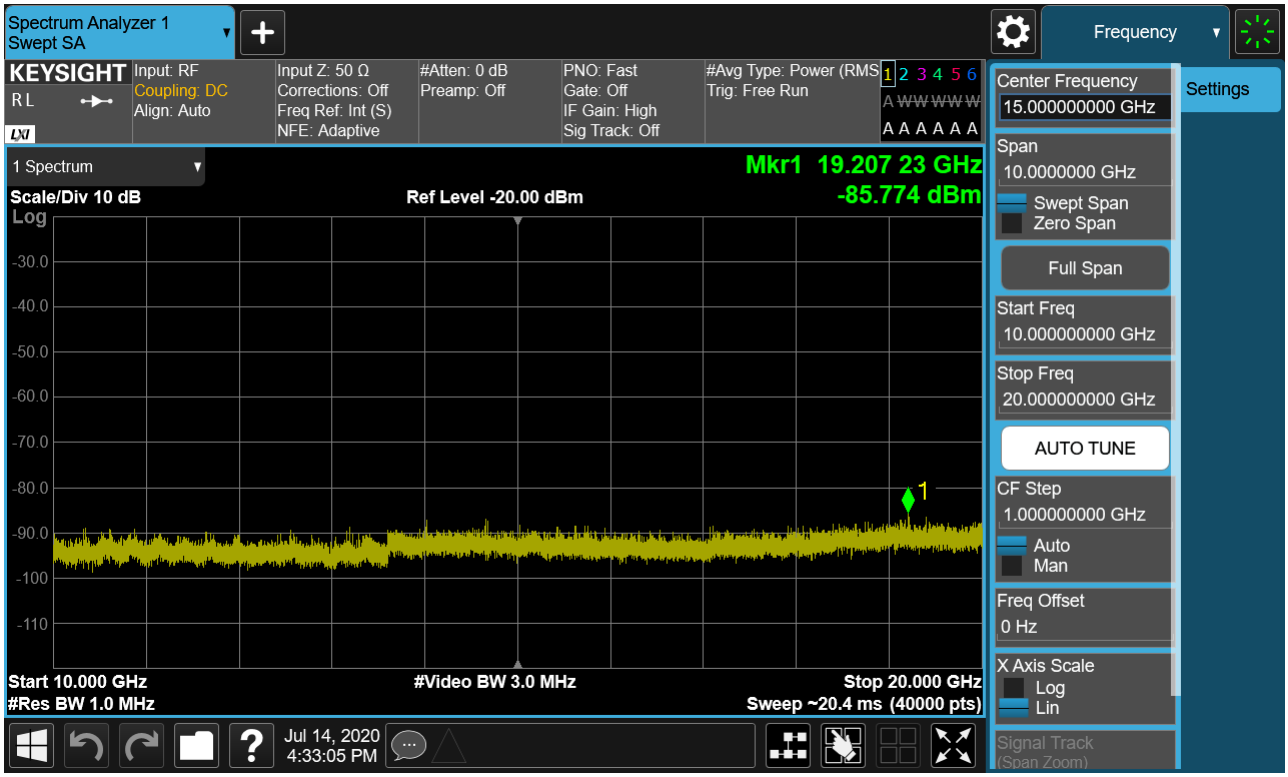
PCC 10MHz Ch132022 RB1 Offset49, SCC 10MHz Ch132121 RB1 Offset0



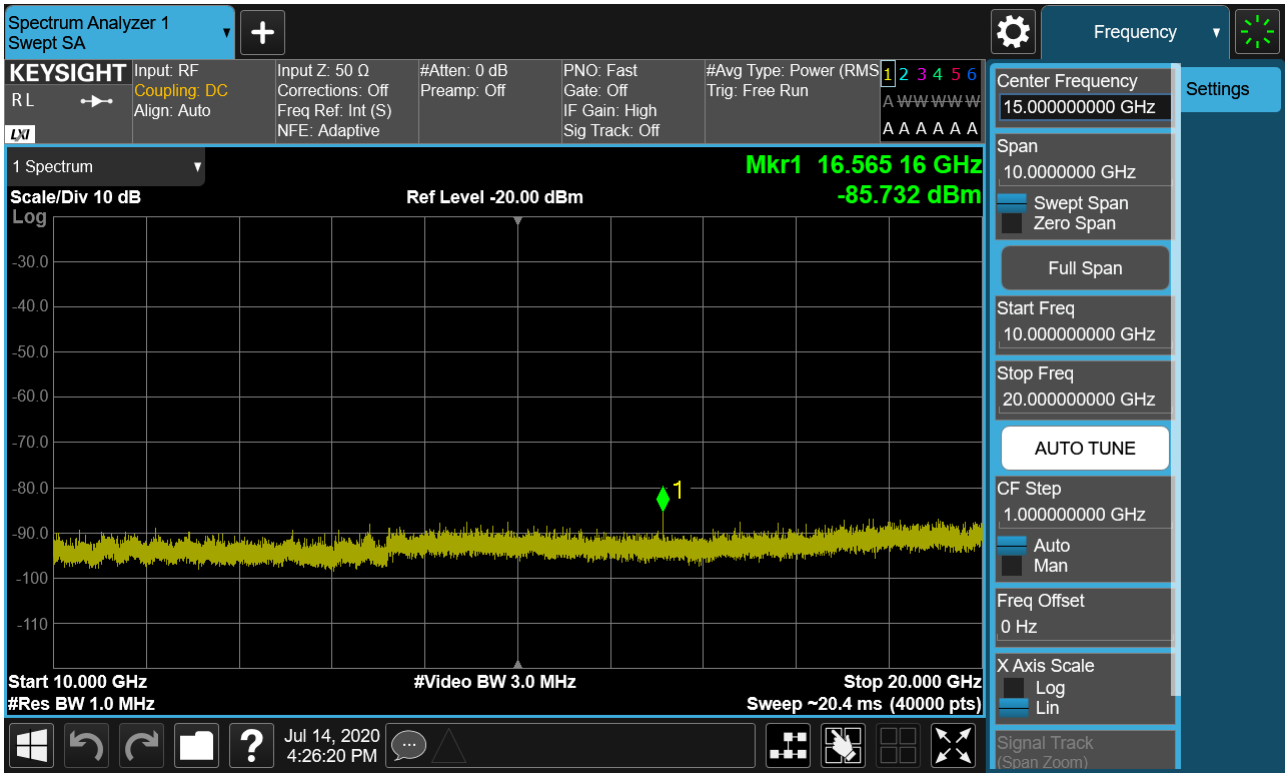
PCC 10MHz Ch132022 RB50 Offset0, SCC 10MHz Ch132121 RB50 Offset0



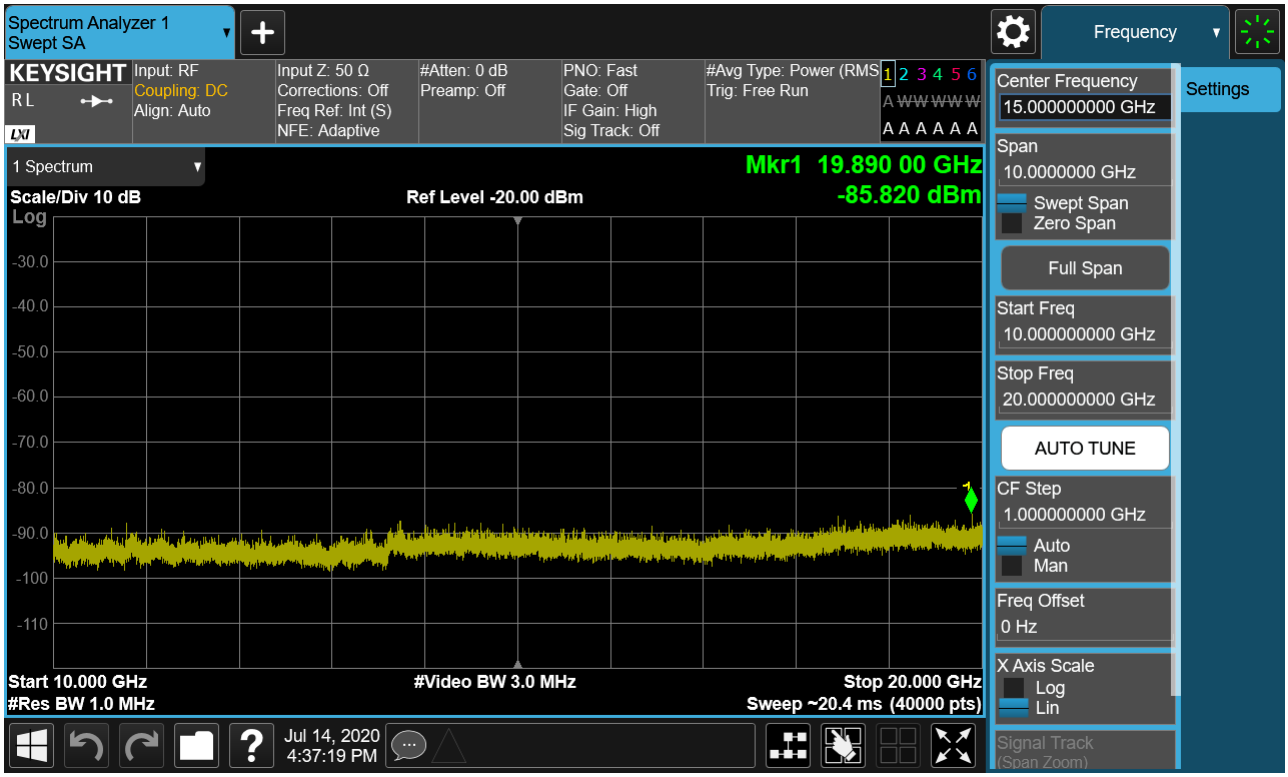
PCC 10MHz Ch132373 RB1 Offset0, SCC 10MHz Ch132472 RB1 Offset49



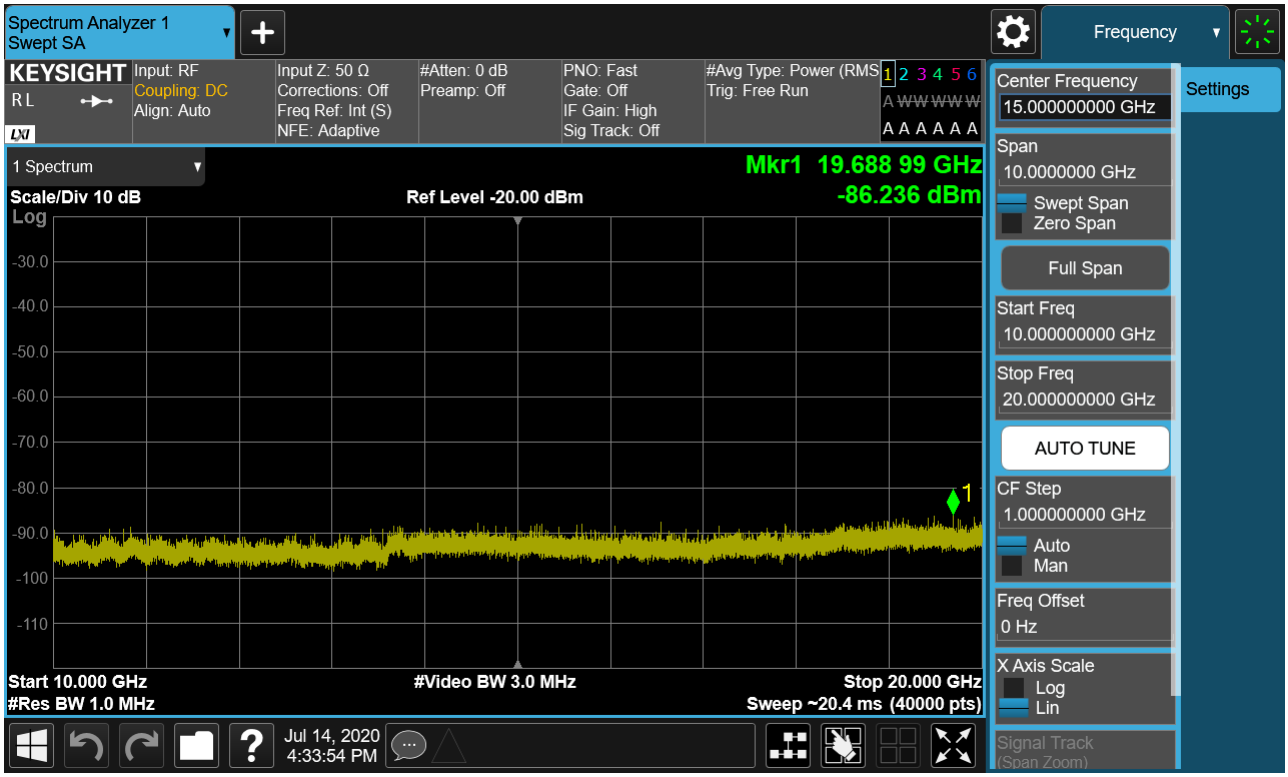
PCC 10MHz Ch132373 RB1 Offset49, SCC 10MHz Ch132472 RB1 Offset0



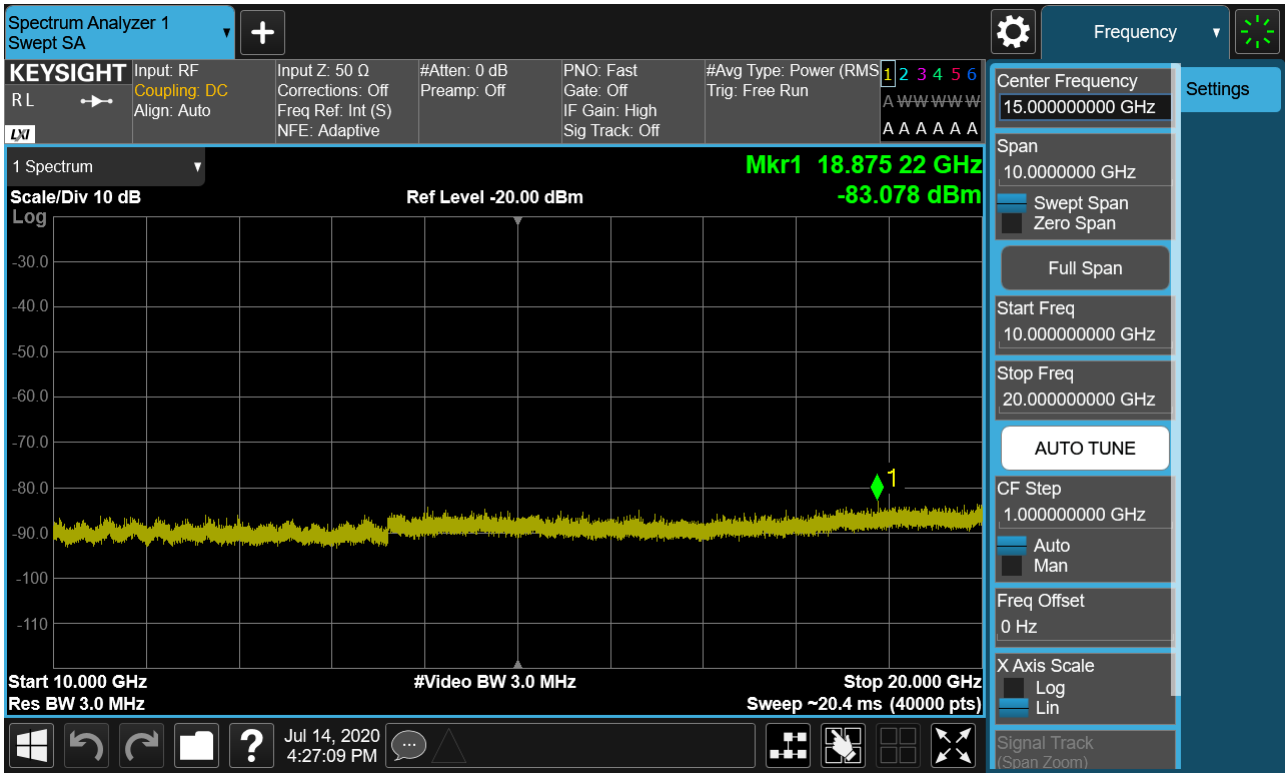
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0



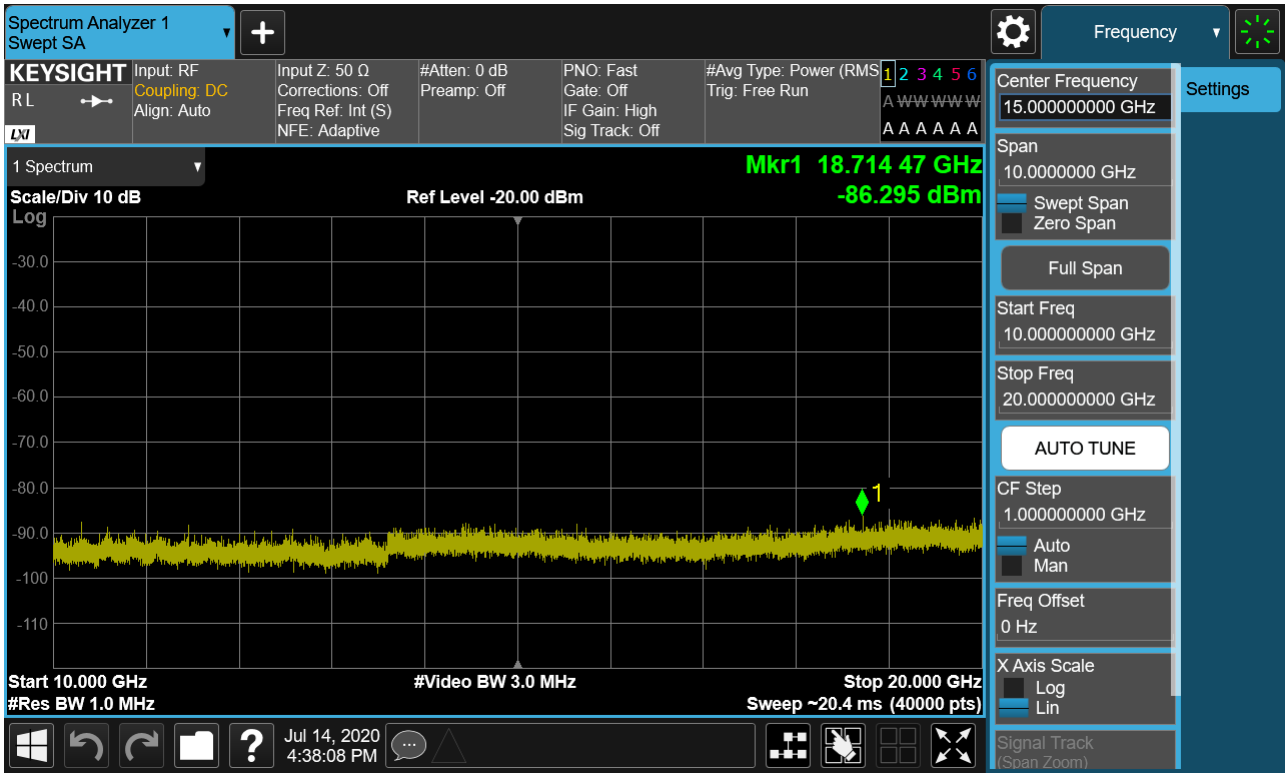
PCC 10MHz Ch132523 RB1 Offset0, SCC 10MHz Ch132622 RB1 Offset49



PCC 10MHz Ch132523 RB1 Offset49, SCC 10MHz Ch132622 RB1 Offset0

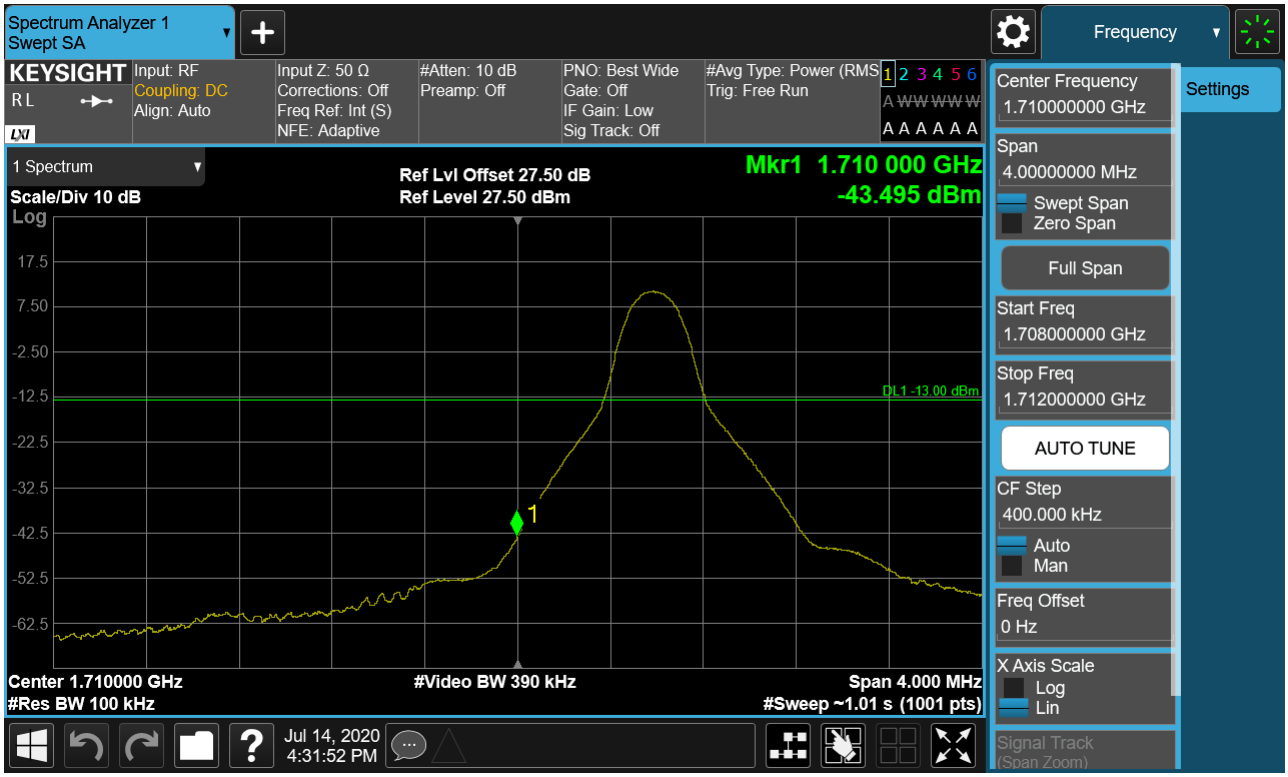


PCC 10MHz Ch132523 RB50 Offset0, SCC 10MHz Ch132622 RB50 Offset0

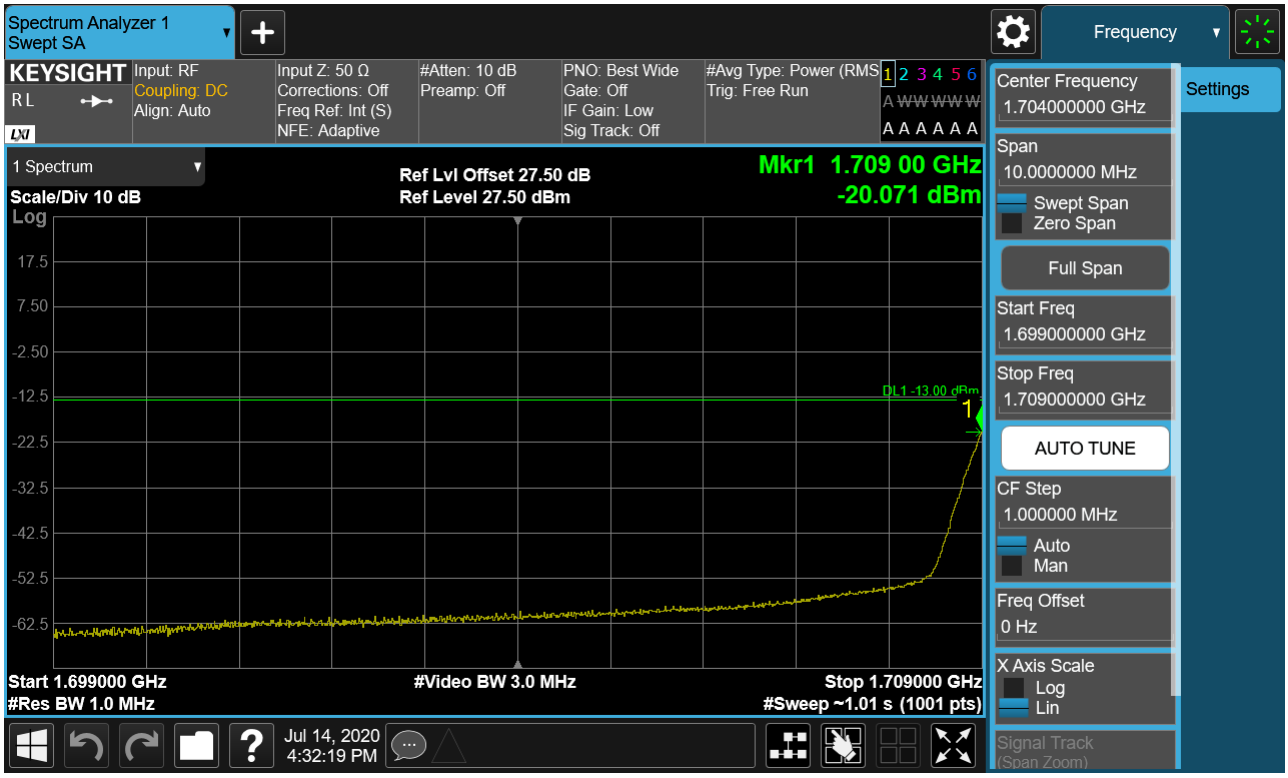


8.4 Channel Edge

Lowest Channel_PCC 10MHz Ch132022 RB1 Offset0 SCC 10MHz Ch132121 RB1 Offset49(1)

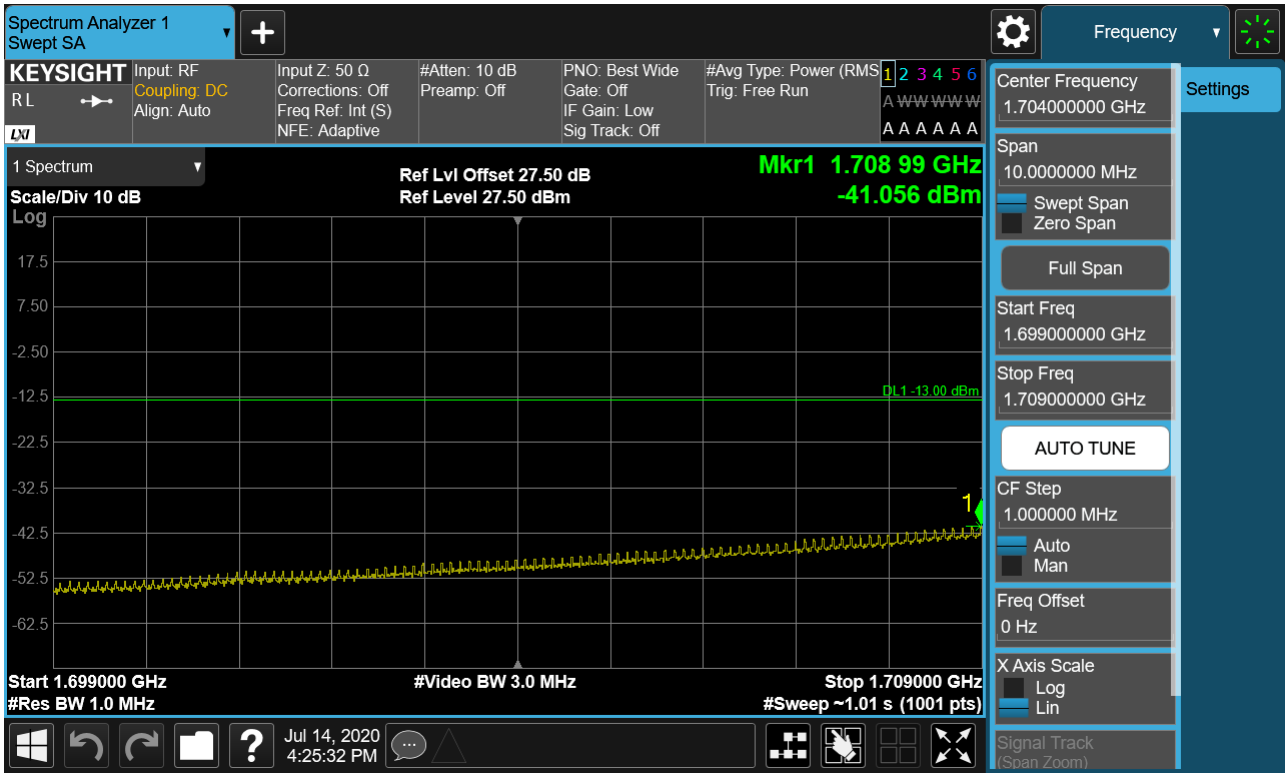


Lowest Channel_PCC 10MHz Ch132022 RB1 Offset0 SCC 10MHz Ch132121 RB1 Offset49(2)

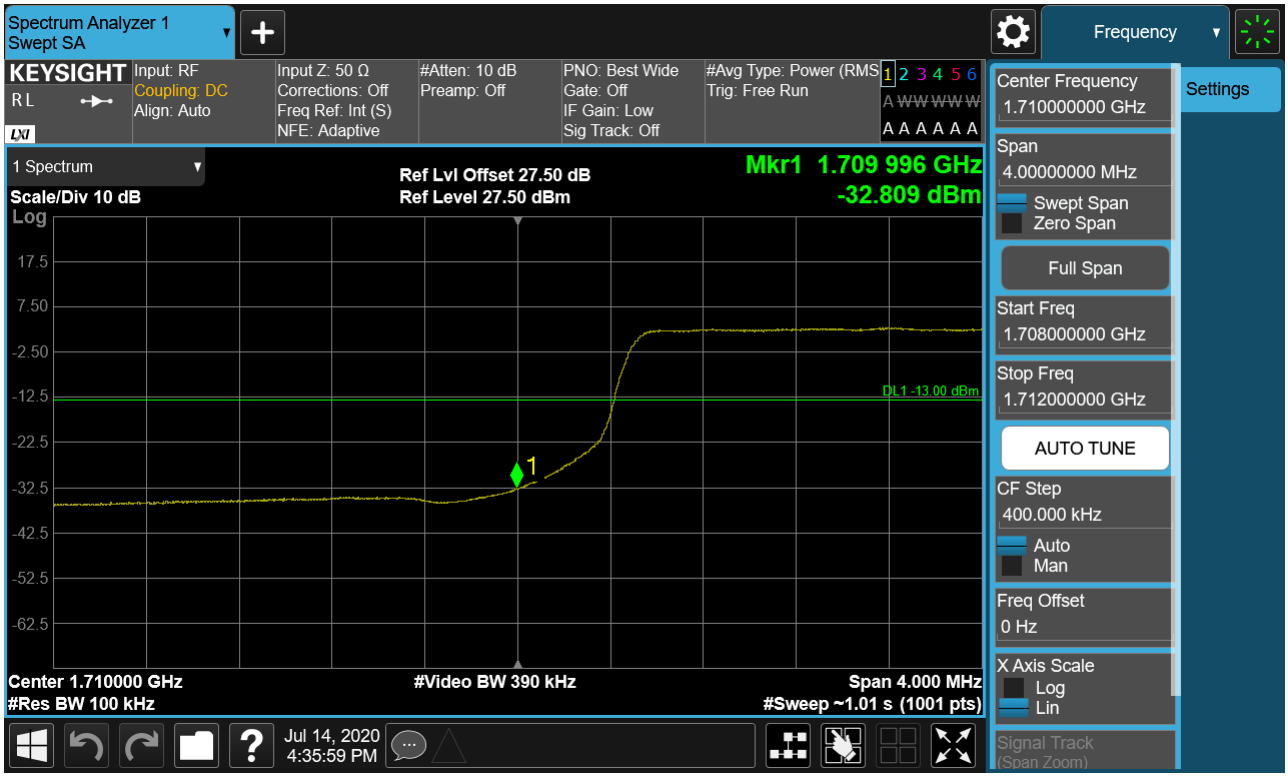


Lowest Channel_PCC 10MHz Ch132022 RB1 Offset49 SCC 10MHz Ch132121 RB1 Offset0(1)

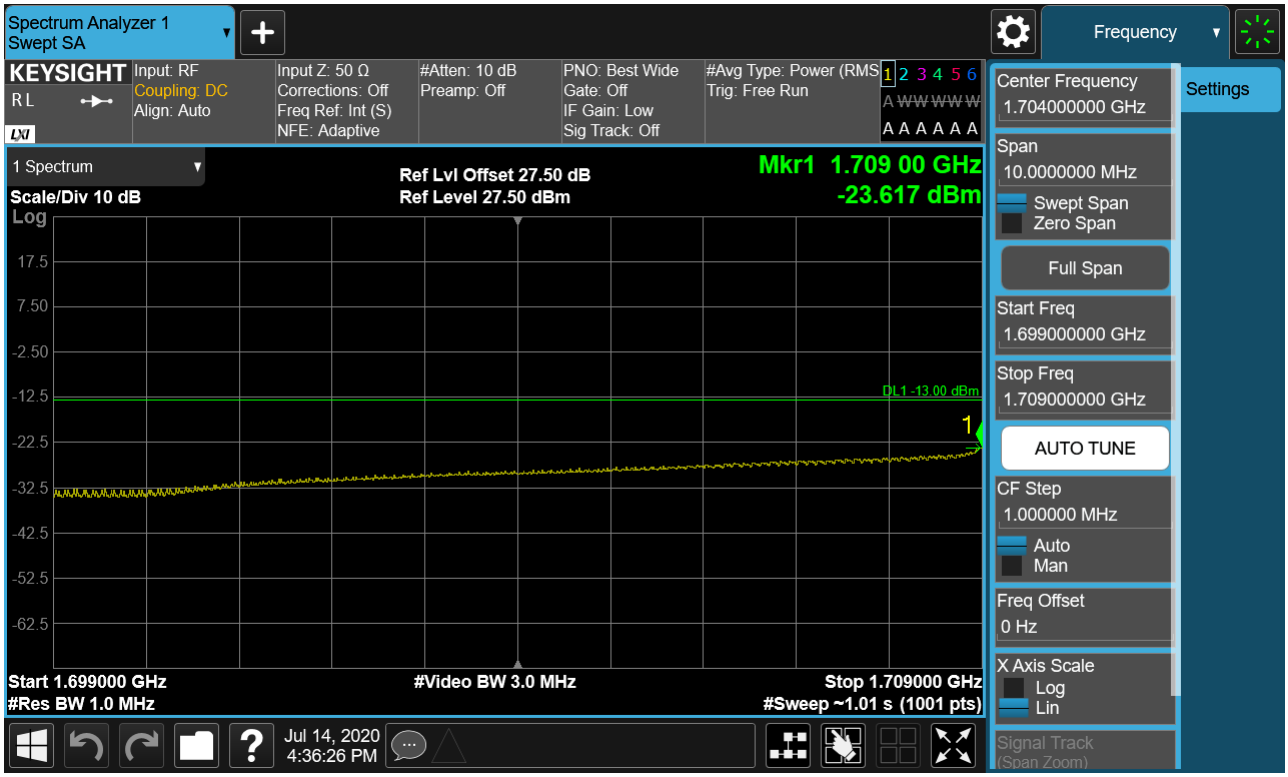
Lowest Channel_PCC 10MHz Ch132022 RB1 Offset49 SCC 10MHz Ch132121 RB1 Offset0(2)



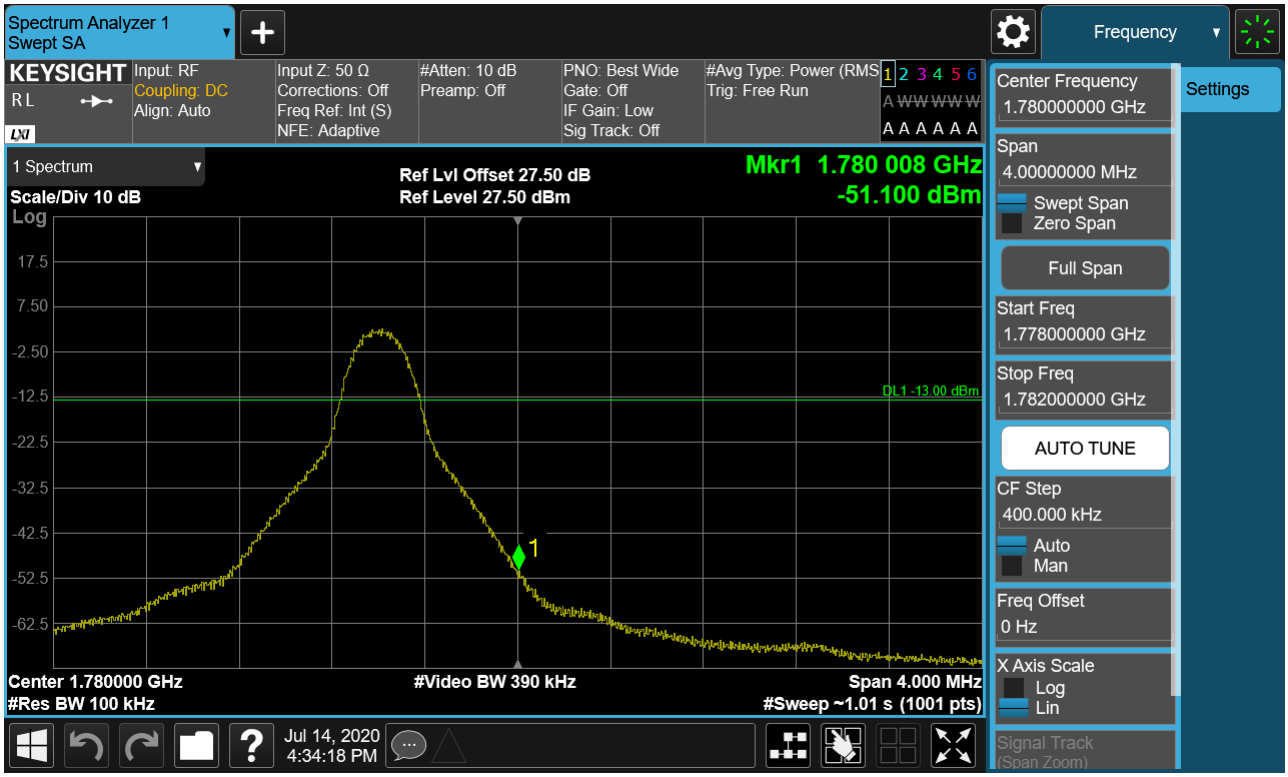
Lowest Channel_PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0(1)



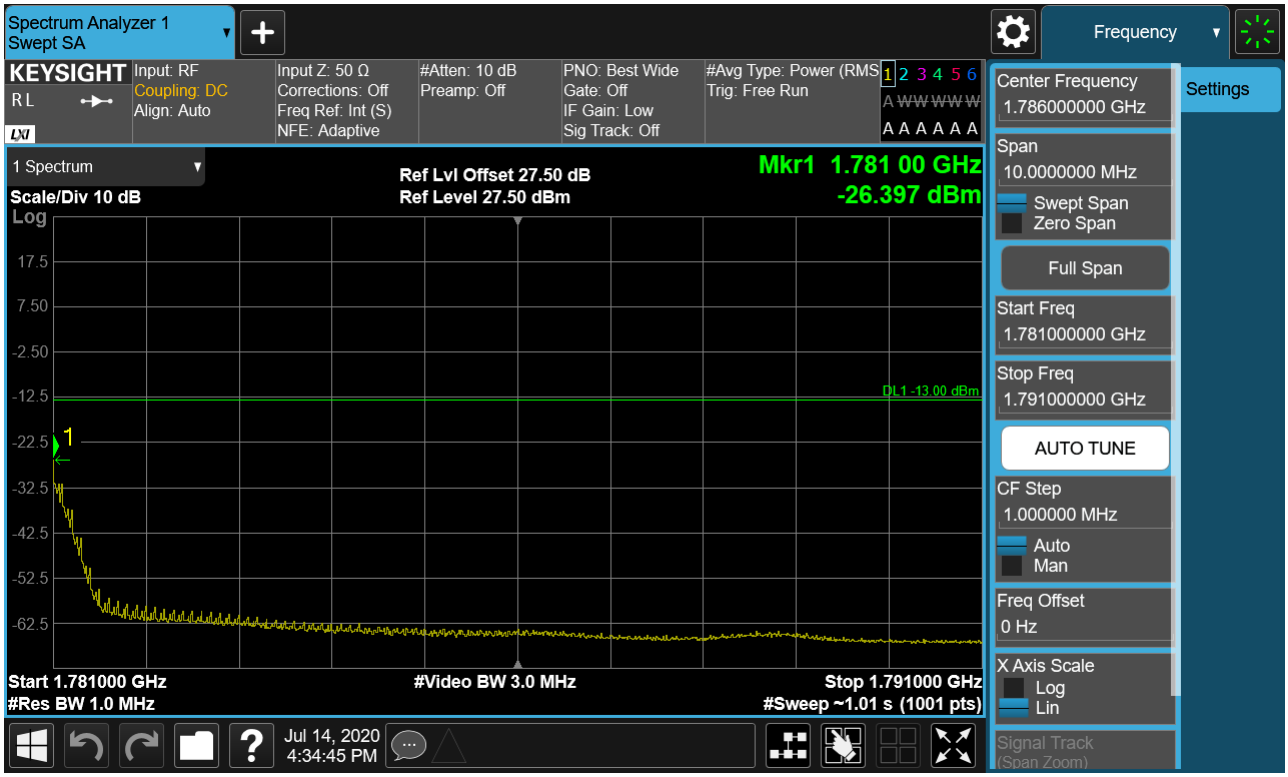
Lowest Channel_PCC 10MHz Ch132022 RB50 Offset0 SCC 10MHz Ch132121 RB50 Offset0(2)



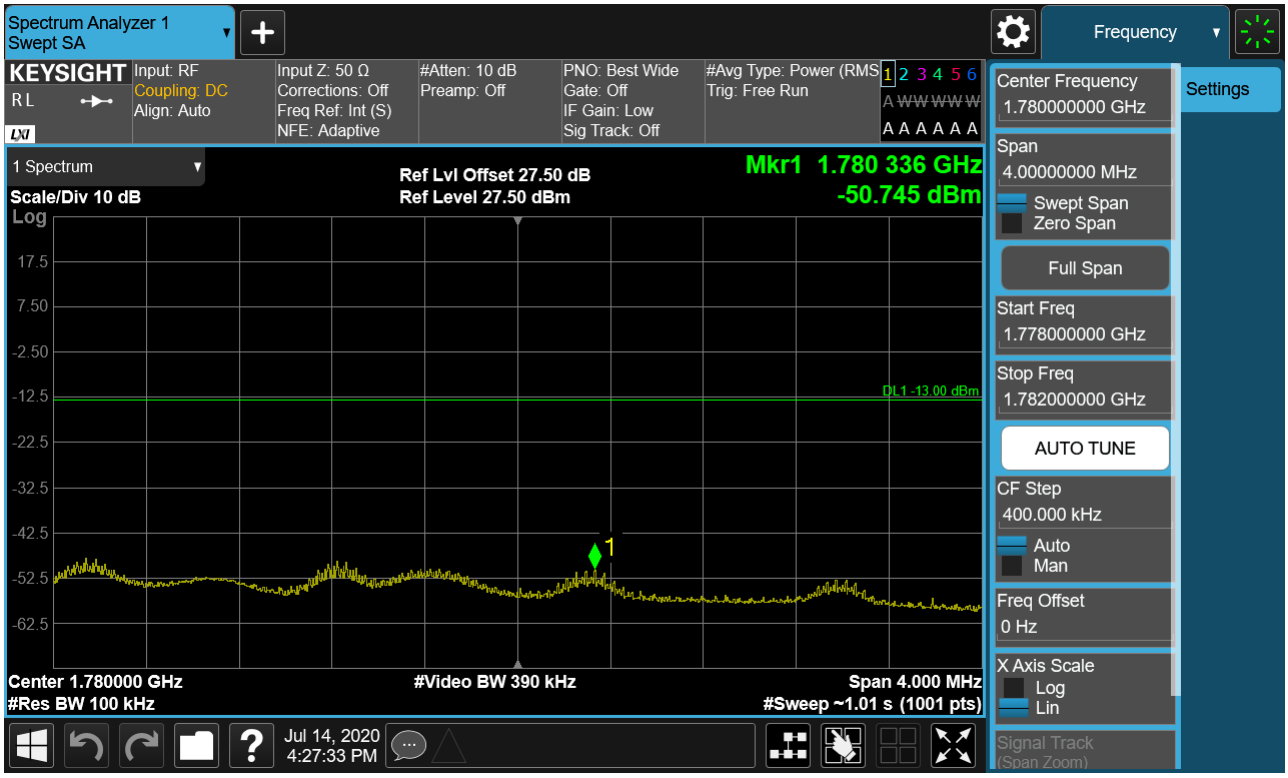
Highest Channel_PCC 10MHz Ch132523 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49(1)



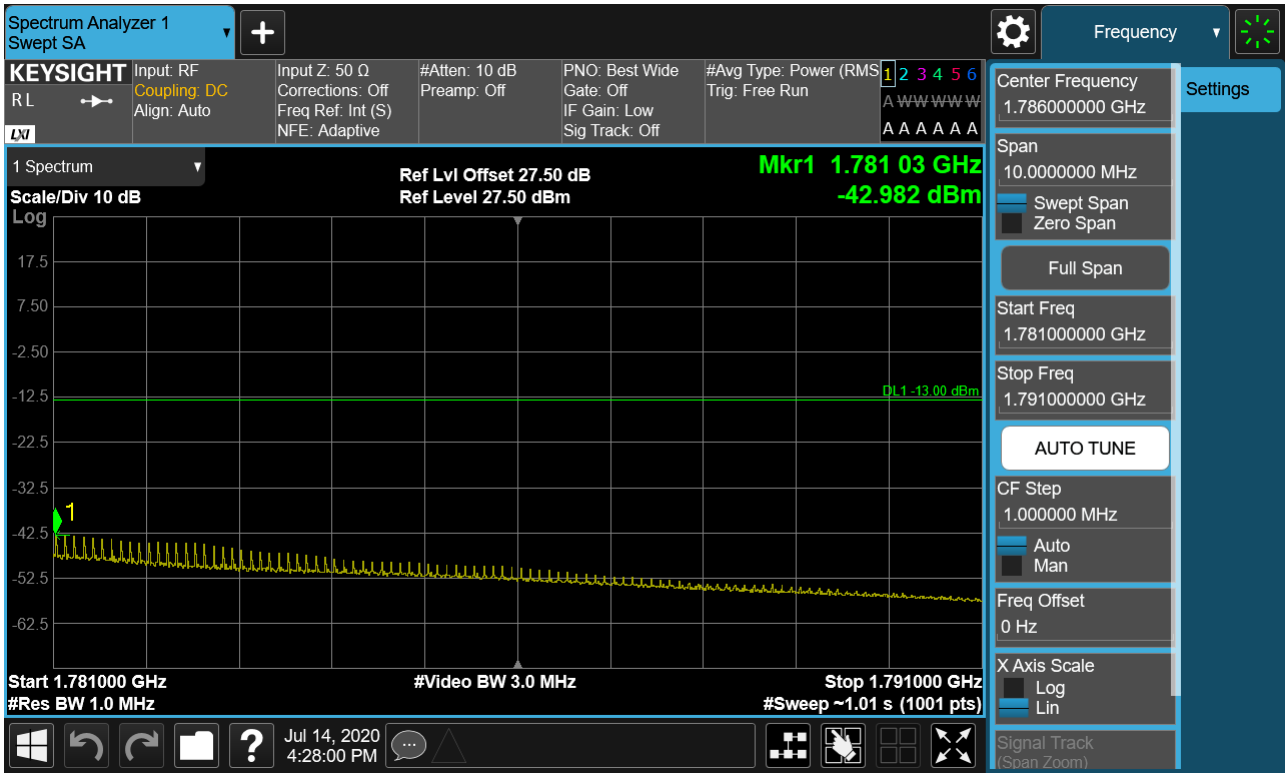
Highest Channel_PCC 10MHz Ch132523 RB1 Offset0 SCC 10MHz Ch132622 RB1 Offset49(2)



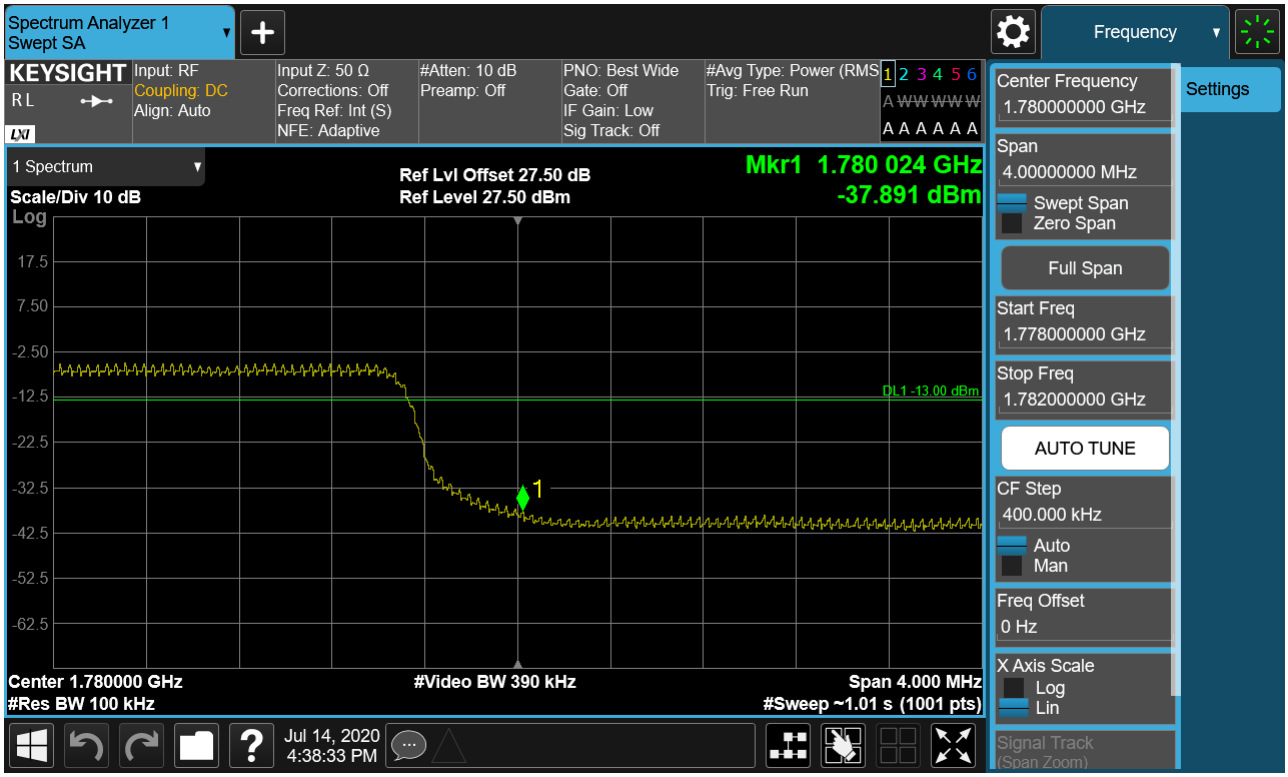
Highest Channel_PCC 10MHz Ch132523 RB1 Offset49 SCC 10MHz Ch132622 RB1 Offset0(1)



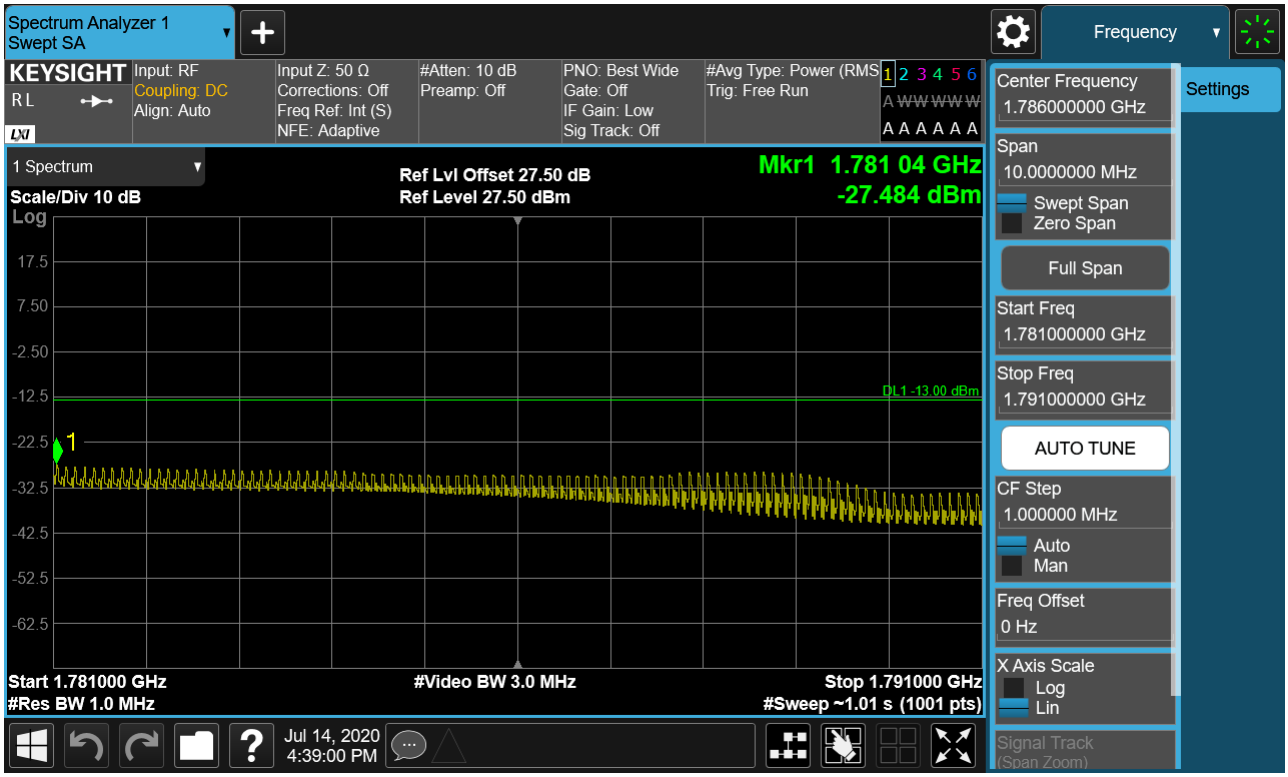
Highest Channel_PCC 10MHz Ch132523 RB1 Offset49 SCC 10MHz Ch132622 RB1 Offset0(2)



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 : 3.850 VDC
- ▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	-0.021	0.029	1712.49996	1717.30005
100%		-30	0.016	-0.031	1712.50003	1717.29995
100%		-20	0.021	0.030	1712.50004	1717.30005
100%		-10	0.015	0.021	1712.50003	1717.30004
100%		0	-0.015	0.013	1712.49997	1717.30002
100%		10	-0.015	-0.026	1712.49997	1717.29996
100%		30	0.017	0.021	1712.50003	1717.30004
100%		40	0.030	-0.028	1712.50005	1717.29995
100%		50	-0.030	0.020	1712.49995	1717.30003
Batt. Endpoint	3.400	20	0.014	-0.019	1712.50002	1717.29997

- ▣ 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 : 3.850 VDC
- ▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	0.023	0.020	1715.00004	1722.20003
100%		-30	0.015	-0.024	1715.00003	1722.19996
100%		-20	0.019	0.013	1715.00003	1722.20002
100%		-10	0.022	0.012	1715.00004	1722.20002
100%		0	-0.030	0.021	1714.99995	1722.20004
100%		10	0.026	0.025	1715.00005	1722.20004
100%		30	0.030	0.026	1715.00005	1722.20005
100%		40	-0.025	-0.028	1714.99996	1722.19995
100%		50	0.020	0.029	1715.00003	1722.20005
Batt. Endpoint	3.400	20	-0.021	-0.026	1714.99996	1722.19996

- ▣ 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 : 3.850 VDC
- ▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	0.019	0.016	1717.50003	1726.80003
100%		-30	-0.030	0.025	1717.49995	1726.80004
100%		-20	0.019	-0.021	1717.50003	1726.79996
100%		-10	0.015	0.025	1717.50003	1726.80004
100%		0	0.020	0.029	1717.50004	1726.80005
100%		10	-0.029	0.023	1717.49995	1726.80004
100%		30	-0.027	0.025	1717.49995	1726.80004
100%		40	-0.025	0.024	1717.49996	1726.80004
100%		50	-0.019	-0.016	1717.49997	1726.79997
Batt. Endpoint	3.400	20	-0.027	0.023	1717.49995	1726.80004

▣ 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 : 3.850 VDC
▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	-0.029	0.020	1772.69995	1777.50004
100%		-30	0.022	-0.024	1772.70004	1777.49996
100%		-20	0.024	0.012	1772.70004	1777.50002
100%		-10	-0.014	0.021	1772.69997	1777.50004
100%		0	0.017	0.026	1772.70003	1777.50005
100%		10	0.027	0.025	1772.70005	1777.50004
100%		30	-0.029	0.014	1772.69995	1777.50003
100%		40	0.027	0.013	1772.70005	1777.50002
100%		50	0.012	0.012	1772.70002	1777.50002
Batt. Endpoint	3.400	20	-0.030	0.020	1772.69995	1777.50004

- ▣ 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 : 3.850 VDC
- ▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	0.012	-0.023	1770.00002	1777.19996
100%		-30	-0.024	0.017	1769.99996	1777.20003
100%		-20	0.017	0.028	1770.00003	1777.20005
100%		-10	0.013	-0.015	1770.00002	1777.19997
100%		0	-0.031	0.023	1769.99995	1777.20004
100%		10	-0.015	-0.024	1769.99997	1777.19996
100%		30	0.015	0.013	1770.00003	1777.20002
100%		40	-0.017	0.028	1769.99997	1777.20005
100%		50	0.024	0.025	1770.00004	1777.20005
Batt. Endpoint	3.400	20	0.026	0.026	1770.00005	1777.20005

- ▣ 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 : 3.850 VDC
- ▣ LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100%	3.850	+20(Ref)	0.029	-0.030	1767.70005	1776.99995
100%		-30	-0.018	0.011	1767.69997	1777.00002
100%		-20	0.031	0.025	1767.70005	1777.00004
100%		-10	0.019	-0.028	1767.70003	1776.99995
100%		0	0.024	-0.015	1767.70004	1776.99997
100%		10	0.013	0.029	1767.70002	1777.00005
100%		30	-0.024	0.018	1767.69996	1777.00003
100%		40	0.024	0.026	1767.70004	1777.00005
100%		50	-0.013	-0.024	1767.69998	1776.99996
Batt. Endpoint	3.400	20	0.018	0.027	1767.70003	1777.00005

8.6 Radiated Spurious Emissions

▣ PCC Channel : 132047 (1717.5MHz)

▣ PCC BW(MHz) : 15

▣ PCC RB/ RB Offset : 1/ 74

▣ SCC Channel : 132140 (1726.8MHz)

▣ SCC BW(MHz) : 5

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 1 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,444.30	-53.50	12.53	-60.42	2.75	H	-50.64
5,166.45	-56.13	12.65	-54.56	3.43	H	-45.34
6,888.60	-54.47	12.13	-47.70	4.06	V	-39.63

▣ PCC Channel : 132398 (1752.6MHz)

▣ PCC BW(MHz) : 15

▣ PCC RB/ RB Offset : 1/ 74

▣ SCC Channel : 132491 (1761.9MHz)

▣ SCC BW(MHz) : 5

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 1 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,514.50	-51.73	12.23	-57.98	2.78	H	-48.53
5,271.75	-54.95	13.30	-54.69	3.48	V	-44.87
7,029.00	-55.96	11.60	-47.90	4.10	V	-40.40

▣ 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: 1 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)
3,542.80	-51.44	12.15	-57.46	2.79	H	-48.10
5,314.20	-54.77	13.37	-54.34	3.47	V	-44.45
7,085.60	-55.08	11.38	-46.79	4.13	V	-39.55

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	9.2067
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	13.829
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	13.847
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	18.101
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	18.263
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	18.695

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	9.2377
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	13.858
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	13.865
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	18.201
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	18.258
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	18.782

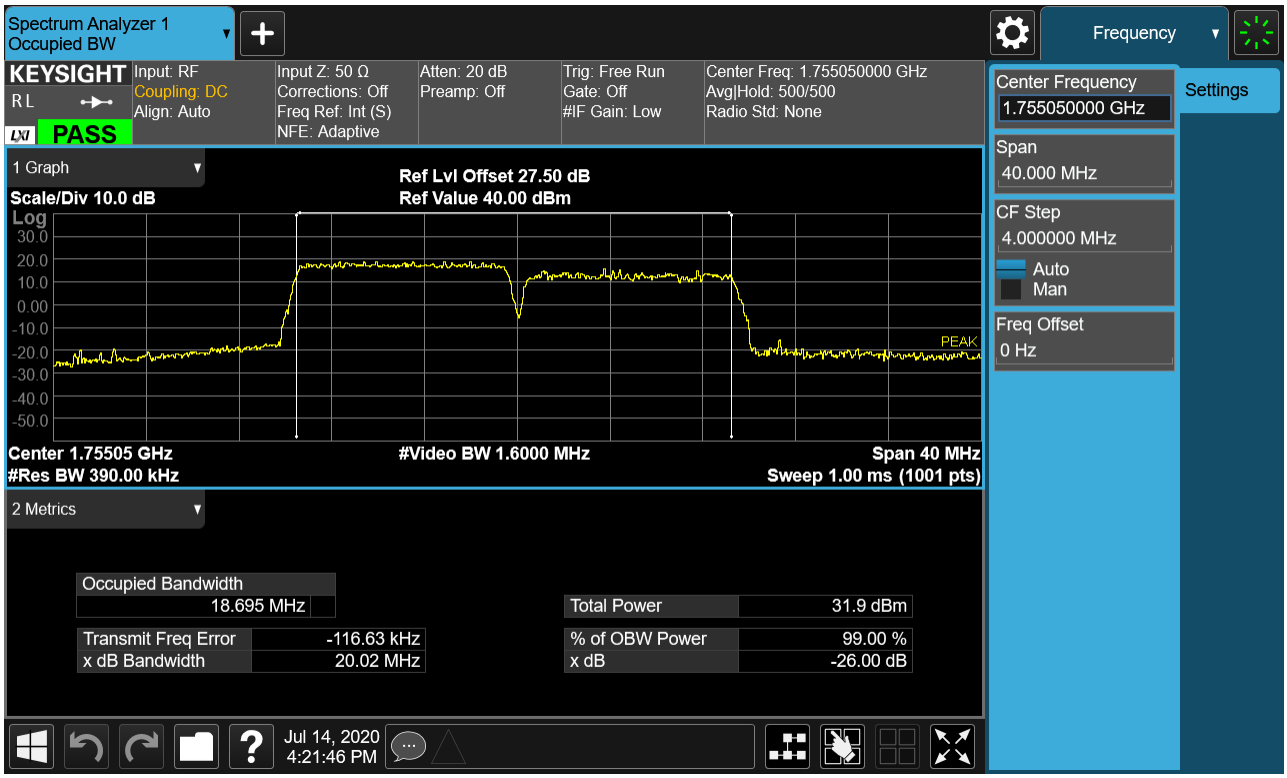
PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	64QAM	25/ 0	5	132446	1757.4	64QAM	25/ 0	9.1914
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	13.823
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	13.894
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	18.069
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	18.224
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	18.720

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	9.2329
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	13.826
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	13.927
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	18.104
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	18.206
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	18.692

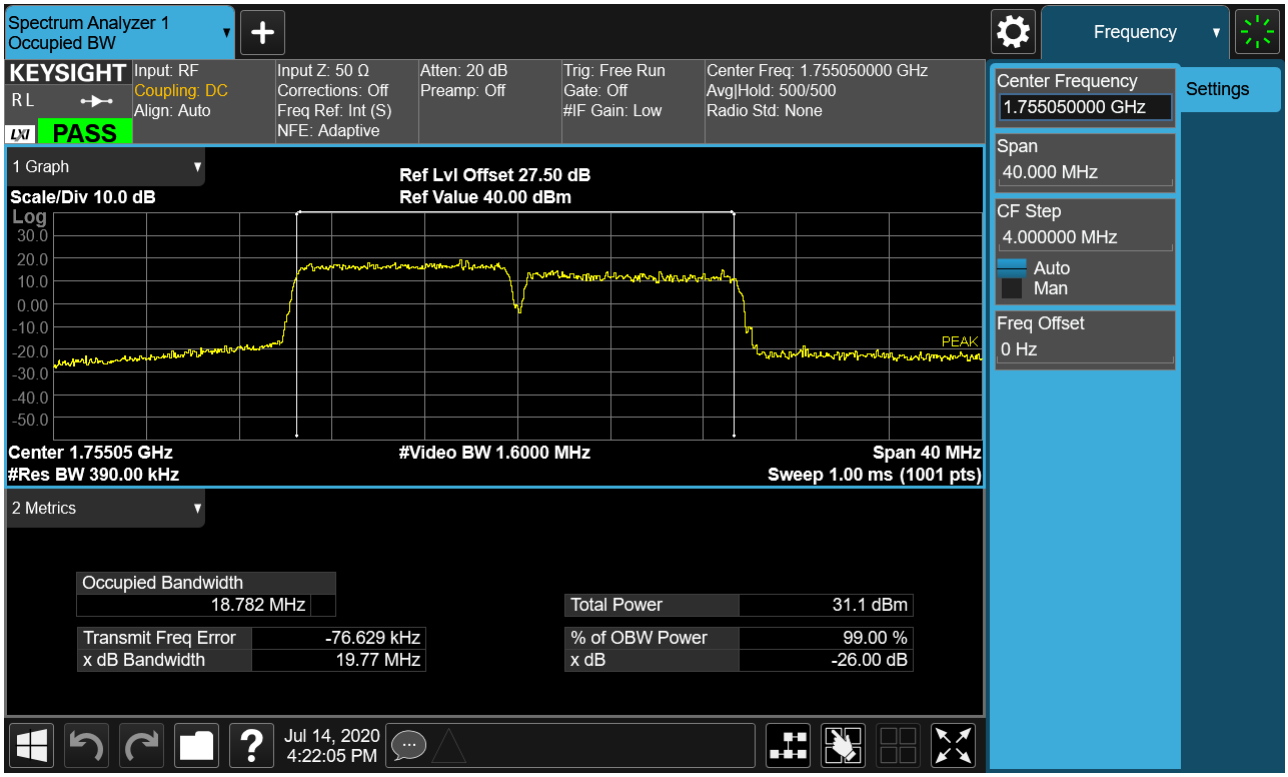
Note:

In order to simplify the report, attached plots were only Max.Bandwidth(20+20)

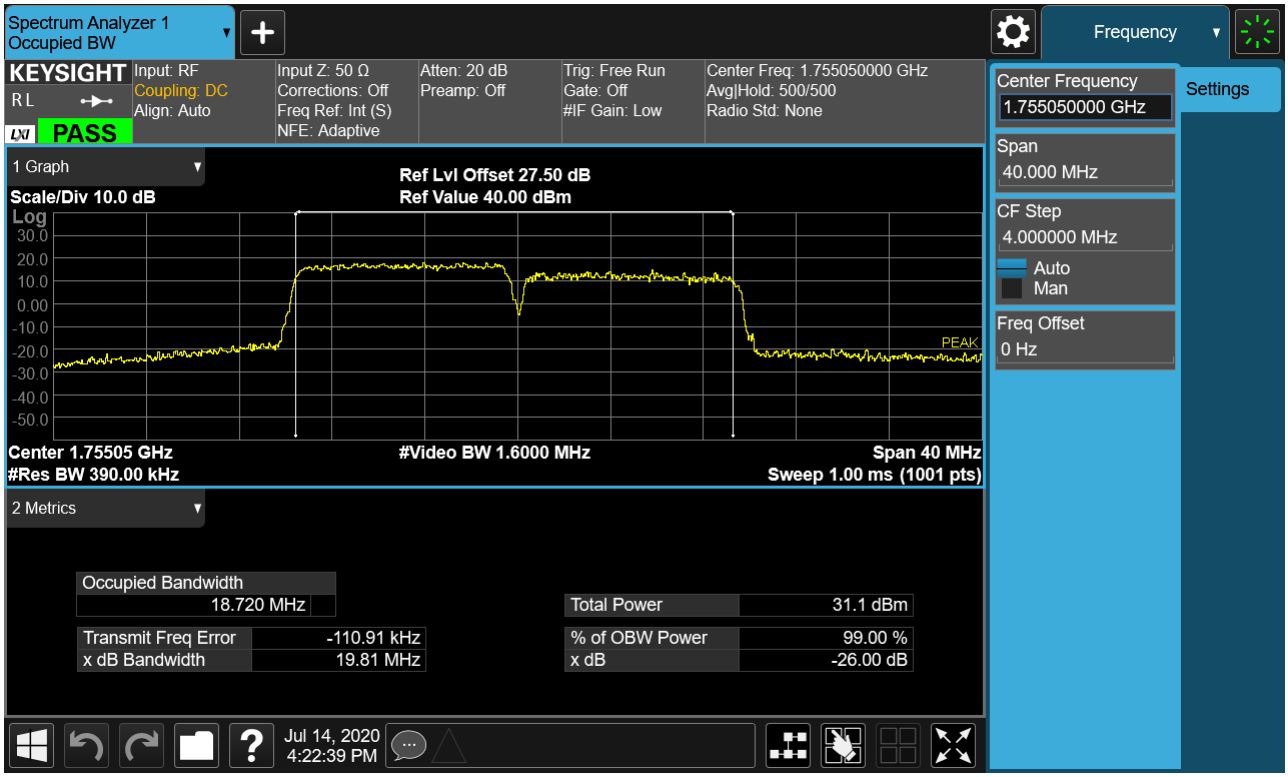
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(QPSK)



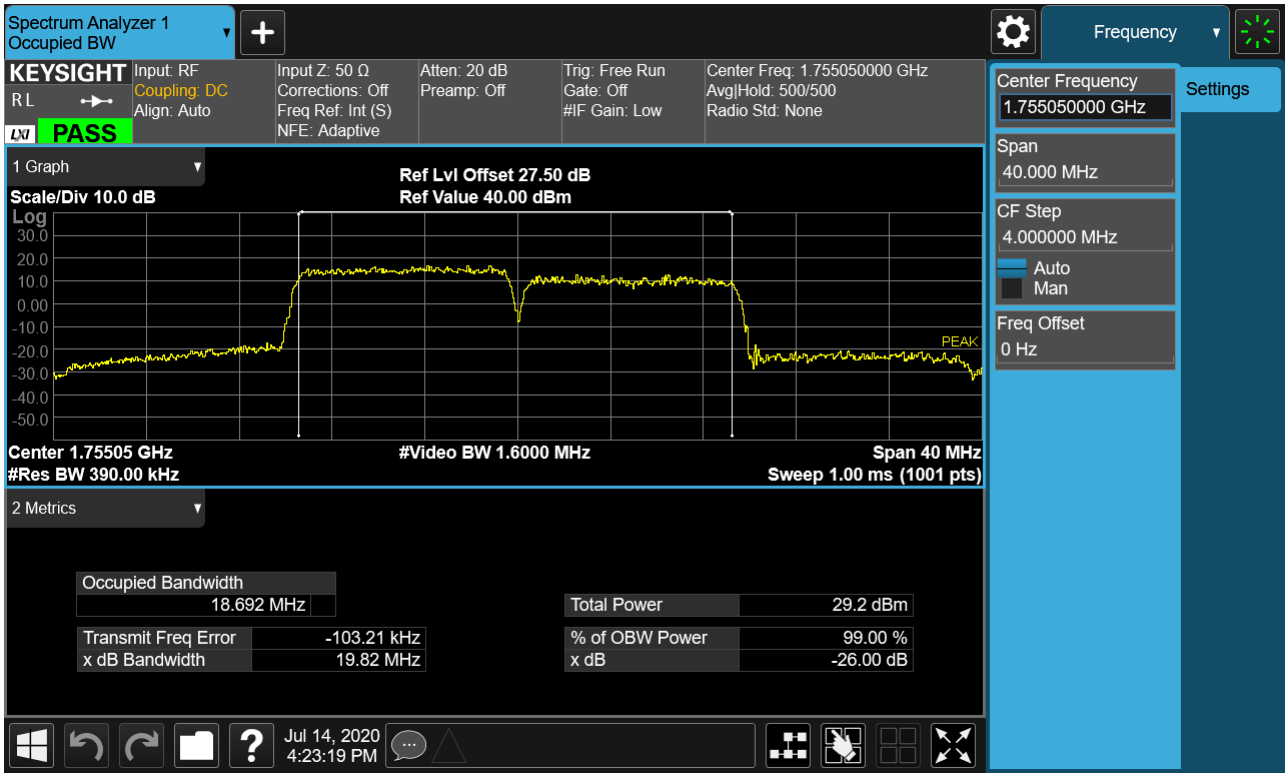
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(16QAM)



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	6.51
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	5.92
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	5.95
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	5.97
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	5.92
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	5.99

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	7.25
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	6.52
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	6.56
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	6.51
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	6.44
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	6.51

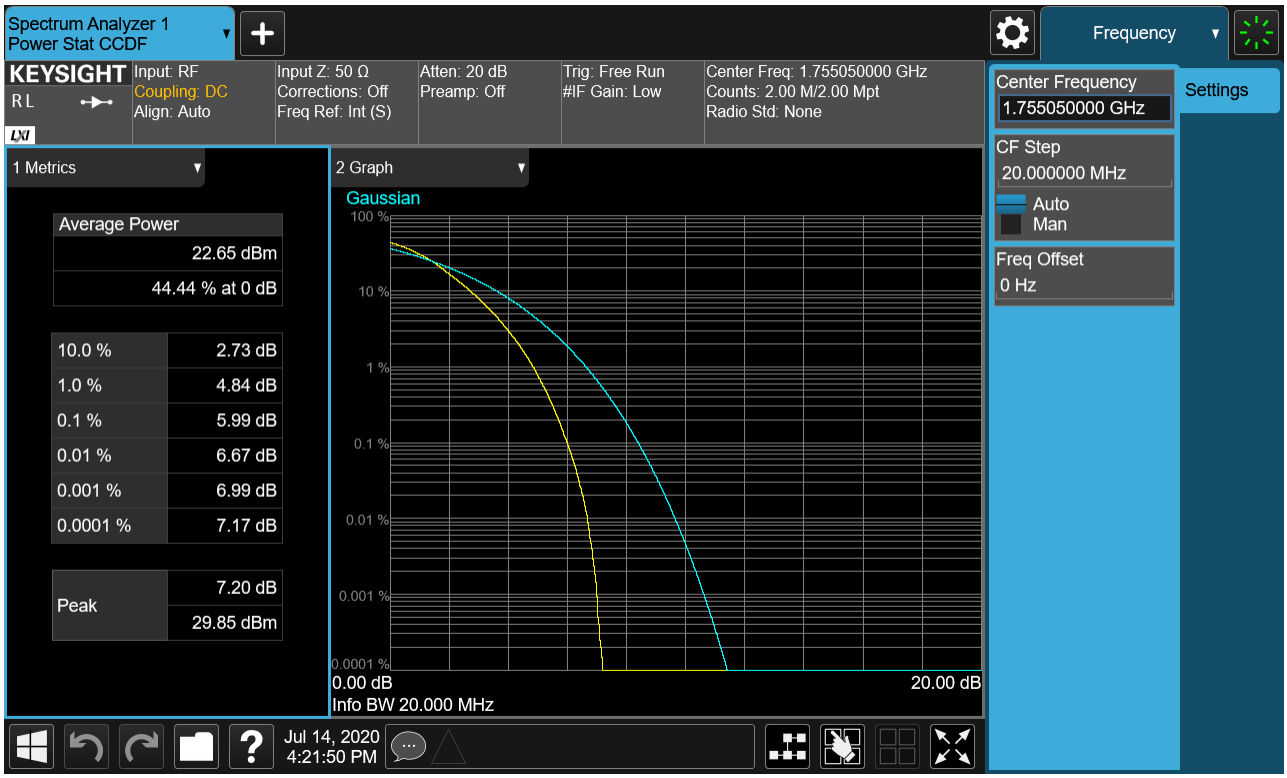
PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	64QAM	25/ 0	5	132446	1757.4	64QAM	25/ 0	6.86
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	6.88
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	6.84
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	6.91
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	6.76
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	6.90

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	7.84
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	6.96
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	6.93
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	6.98
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	6.87
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	7.79

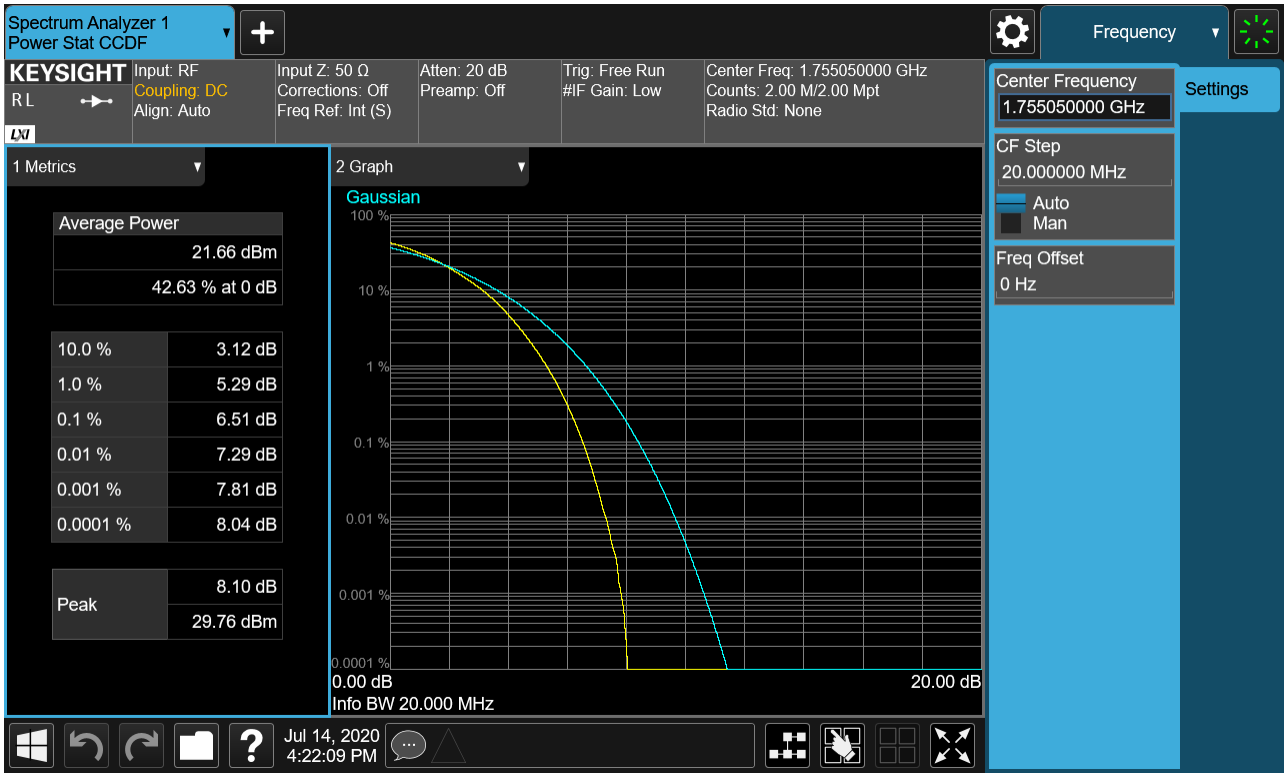
Note:

In order to simplify the report, attached plots were only Max.Bandwidth(20+20)

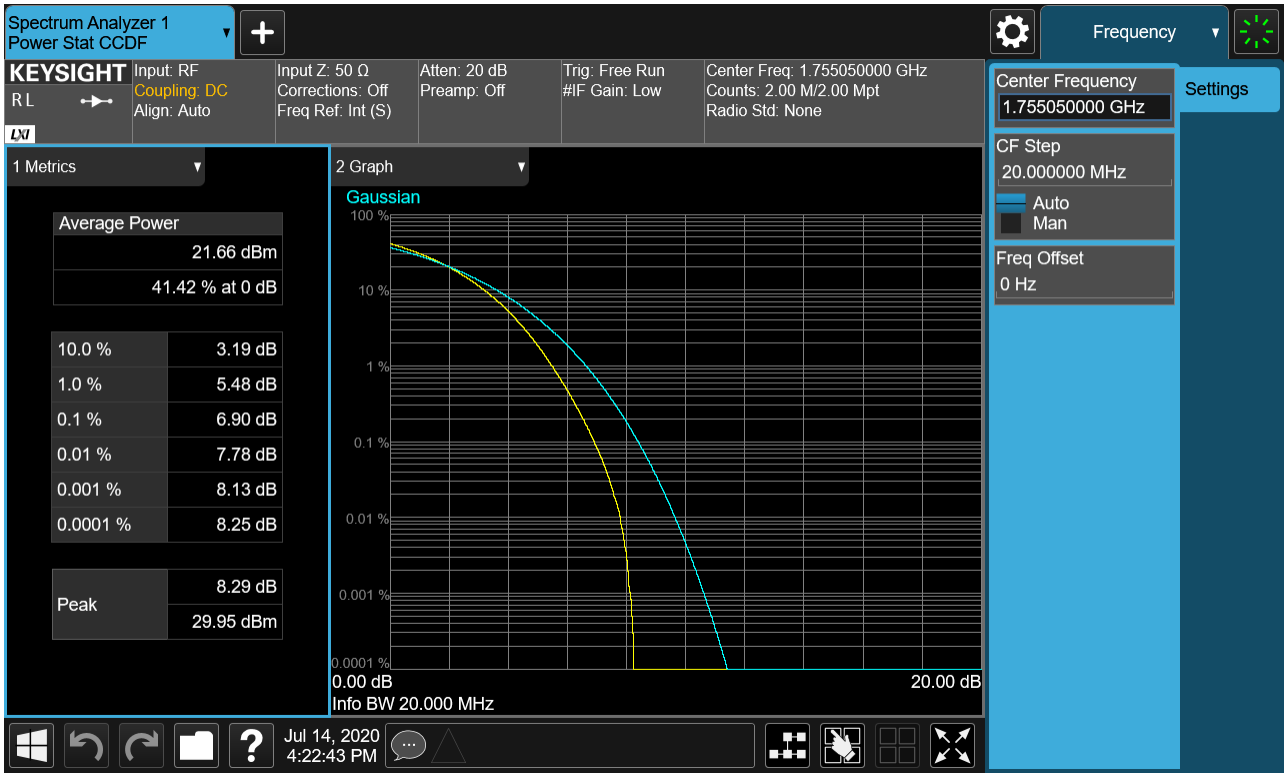
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(QPSK)



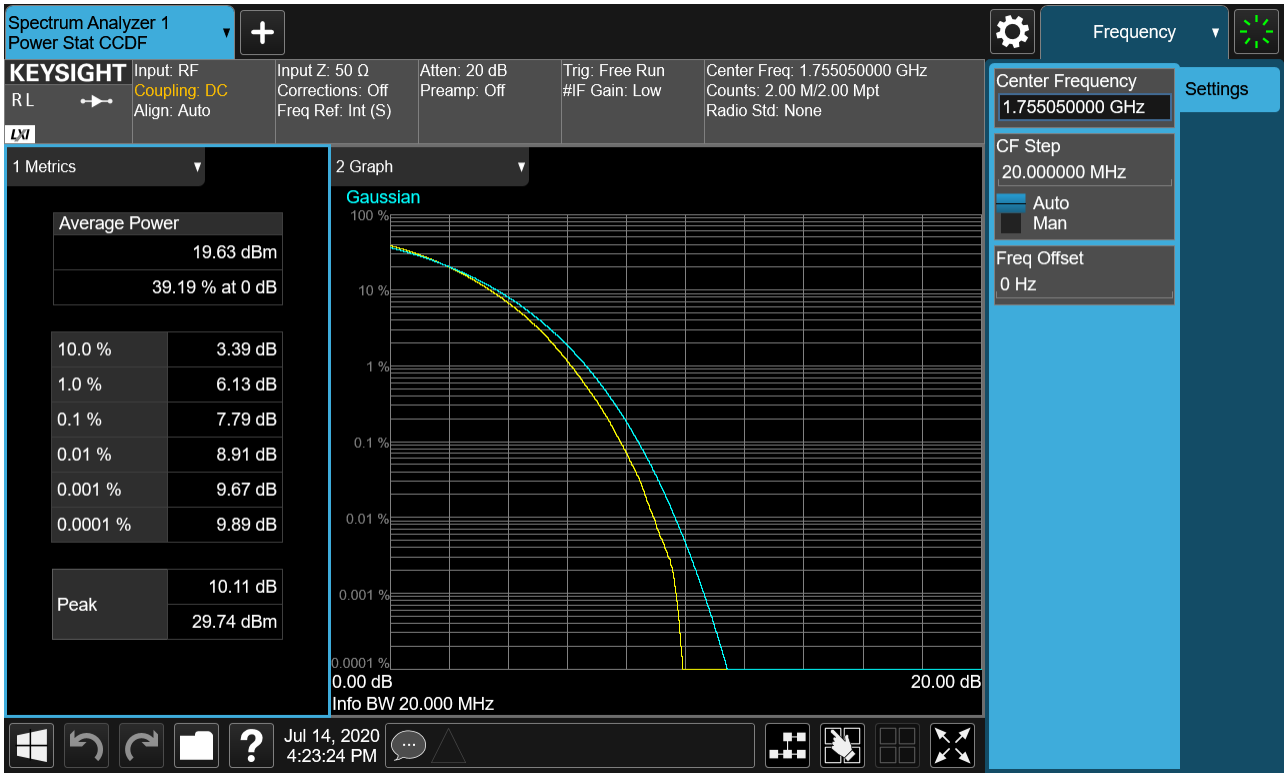
PCC 10MHz Ch132373 RB50 Offset0, SCC 10MHz Ch132472 RB50 Offset0_(16QAM)



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



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



9. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2007-FC038-P