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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:
May 13 , 2022

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

Report No.: HCT-RF-2205-FC044

FCC ID:	**A3LSMG990U2**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-G990U2
Additional Model(s):	SM-G990U3/DS
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)
5 MHz+5 MHz	1712.5 - 1777.5	QPSK	9M23G7D	23.32	0.215
		16QAM	9M22W7D	22.68	0.185
		64QAM	9M20W7D	20.83	0.121
		256QAM	9M27W7D	18.38	0.069
5 MHz+10 MHz	1712.8 - 1775.0	QPSK	13M9G7D	23.48	0.223
		16QAM	13M9W7D	22.96	0.198
		64QAM	13M8W7D	20.89	0.123
		256QAM	13M9W7D	18.58	0.072
10 MHz+5 MHz	1715.0 - 1777.2	QPSK	13M9G7D	23.14	0.206
		16QAM	13M9W7D	22.86	0.193
		64QAM	13M9W7D	20.84	0.121
		256QAM	13M9W7D	18.13	0.065
5 MHz+15 MHz	1713.0 - 1772.5	QPSK	18M3G7D	23.20	0.209
		16QAM	18M2W7D	22.73	0.187
		64QAM	18M2W7D	21.01	0.126
		256QAM	18M1W7D	18.81	0.076
15 MHz+5 MHz	1717.5 - 1777.0	QPSK	18M2G7D	23.17	0.207
		16QAM	18M3W7D	22.58	0.181
		64QAM	18M2W7D	20.49	0.112
		256QAM	18M2W7D	17.99	0.063
10 MHz+10 MHz	1715.0 - 1775.0	QPSK	18M8G7D	23.24	0.211
		16QAM	18M8W7D	22.71	0.187
		64QAM	18M8W7D	20.58	0.114
		256QAM	18M8W7D	18.60	0.072

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 Mun 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-2205-FC044	May 13 , 2022	- First Approval Report

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:	A3LSMG990U2
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Tablet
Model(s):	SM-G990U2
Additional Model(s):	SM-G990U3/DS
Tx Frequency:	1712.5 - 1777.5: 5 MHz+5 MHz 1712.8 - 1775.0: 5 MHz+10 MHz 1715.0 - 1777.2: 10 MHz+5 MHz 1713.0 - 1772.5: 5 MHz+15 MHz 1717.5 - 1777.0: 15 MHz+5 MHz 1715.0 - 1775.0: 10 MHz+10 MHz
Date(s) of Tests:	April 05, 2022 ~ May 10, 2022
Serial number:	Radiated: R3CT30Q0QPV Conducted: R3CT30Q0SAV
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 (20/40/80), Bluetooth, BT LE, NFC, AIT, 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 1 MHz
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 1 GHz, 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 = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
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 1 GHz, 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;

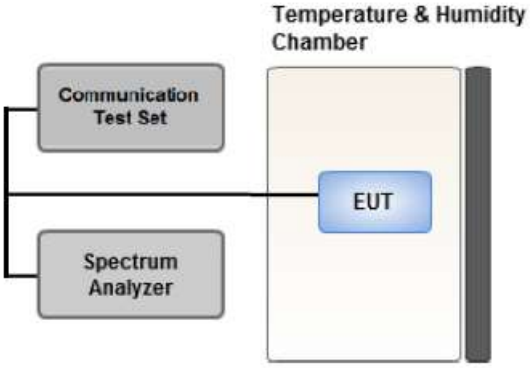
$$\text{Result}_{(dBm)} = \text{Pg}_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

$$\text{EIRP}_{(dBm)} = \text{ERP}_{(dBm)} + 2.15$$

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 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:

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

Test Settings(Peak Power)

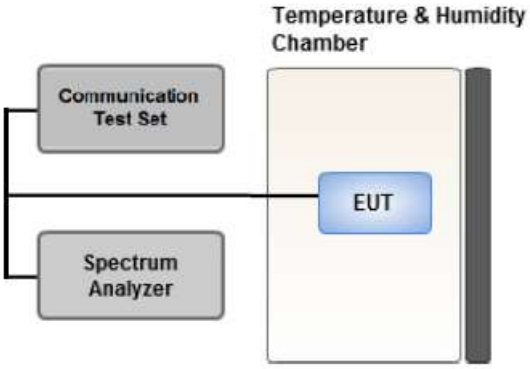
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

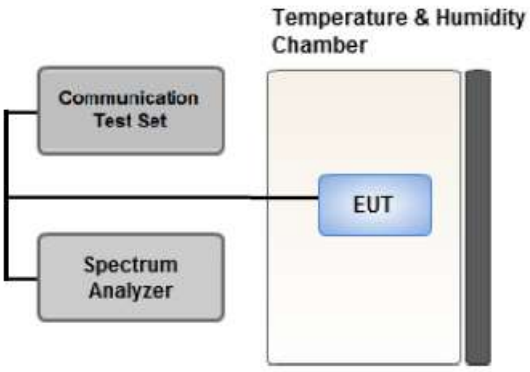
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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 26 dB 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

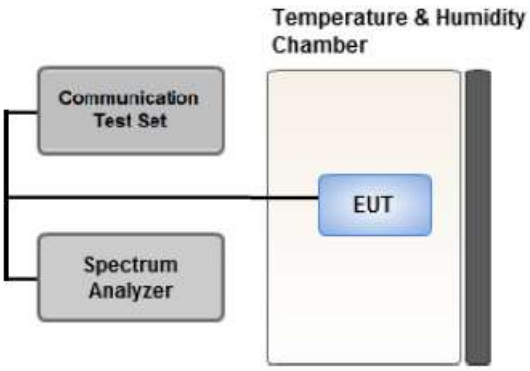
Test Overview

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

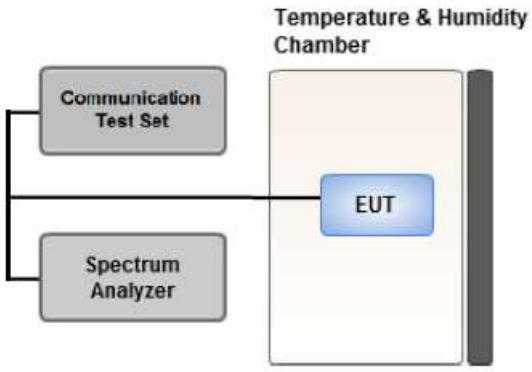
Test Notes

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

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
H.P.F	FBSR-02B(WHK1.2/15 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
H.P.F	FBSR-02B(WHK3.3/18 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	11275	03/11/2023	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/28/2022	Annual
Dipole Antenna	UHAP	Schwarzbeck	557	04/05/2023	Biennial
Dipole Antenna	UHAP	Schwarzbeck	558	04/05/2023	Biennial
Chamber	SU-642	ESPEC	93008124	03/04/2023	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/30/2022	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/15/2023	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	10/13/2022	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	04/12/2023	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	05/18/2022	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	06/01/2022	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	09/29/2022	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/18/2022	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/03/2023	Biennial
Hybrid Antenna	VULB9168	Schwarzbeck	760	02/22/2023	Biennial
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262116770	07/12/2022	Annual
Wideband Radio Communication Tester	MT8820C	Anritsu Corp.	6200863156	12/29/2022	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/05/2022	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	06/02/2022	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

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).

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)	2.00 (Confidence level about 95 %, k=2)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.40 (Confidence level about 95 %, k=2)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 (Confidence level about 95 %, k=2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.51 (Confidence level about 95 %, k=2)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.92 (Confidence level about 95 %, k=2)
Radiated Disturbance (Above 40 GHz)	5.48 (Confidence level about 95 %, k=2)

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

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.
4. All 3 channels(low/mid/high) of conducted power and radiated power were investigated
and the worst case channel 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
		Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0
		High	5	1763.2	132504	1	24	15	1772.5	132597	1	0
		Low	10	1715.0	132022	1	0	10	1724.9	132121	1	49
		Mid	5	1752.6	132398	1	0	5	1757.4	132446	1	24
		High	5	1763.2	132504	1	0	15	1772.5	132597	1	74
		Low	10	1715.0	132022	50	0	5	1722.2	132094	25	0
		Mid	5	1750.3	132375	25	0	10	1757.5	132447	50	0
		High	10	1770.0	132572	50	0	5	1777.2	132644	25	0
		Low	10	1715.0	132022	50	0	10	1724.9	132121	50	0
		Mid	10	1750.1	132373	50	0	10	1760.0	132472	50	0
		High	10	1765.1	132523	50	0	10	1775.0	132622	50	0
Radiated Spurious Emissions	QPSK	Low	5	1712.8	132000	1	24	10	1720.0	132072	1	0
		Mid	10	1750.1	132373	1	49	10	1760.0	132472	1	0
		High	5	1763.2	132504	1	24	15	1772.5	132597	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	23.80
	5	1712.8	132000	1	24	10	1720.0	132072	1	0	23.84
	10	1715.0	132022	1	49	5	1722.2	132094	1	0	23.68
	5	1713.0	132002	1	24	15	1722.3	132095	1	0	23.74
	15	1717.5	132047	1	74	5	1726.8	132140	1	0	23.71
	10	***1715.0***	***132022***	***1***	***49***	***10***	***1724.9***	***132121***	***1***	***0***	***23.87***
Mid	***5***	***1752.6***	***132398***	***1***	***24***	***5***	***1757.4***	***132446***	***1***	***0***	***24.48***
	5	1750.3	132375	1	24	10	1757.5	132447	1	0	24.31
	10	1752.5	132397	1	49	5	1759.7	132469	1	0	24.38
	5	1748.1	132353	1	24	15	1757.4	132446	1	0	24.25
	15	1752.6	132398	1	74	5	1761.9	132491	1	0	24.46
	10	1750.1	132373	1	49	10	1760.0	132472	1	0	24.43
High	5	1772.7	132599	1	24	5	1777.5	132647	1	0	24.40
	5	1767.8	132550	1	24	10	1775.0	132622	1	0	24.22
	10	1770.0	132572	1	49	5	1777.2	132644	1	0	24.00
	5	***1763.2***	***132504***	***1***	***24***	***15***	***1772.5***	***132597***	***1***	***0***	***24.48***
	15	1767.7	132549	1	74	5	1777.0	132642	1	0	23.88
	10	1765.1	132523	1	49	10	1775.0	132622	1	0	24.38

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	21.82
	5	1712.8	132000	25	0	10	1720.0	132072	50	0	21.84
	10	***1715.0***	***132022***	***50***	***0***	***5***	***1722.2***	***132094***	***25***	***0***	***21.88***
	5	1713.0	132002	25	0	15	1722.3	132095	75	0	21.73
	15	1717.5	132047	75	0	5	1726.8	132140	25	0	21.76
	10	1715.0	132022	50	0	10	1724.9	132121	50	0	21.78
Mid	5	1752.6	132398	25	0	5	1757.4	132446	25	0	22.38
	5	***1750.3***	***132375***	***25***	***0***	***10***	***1757.5***	***132447***	***50***	***0***	***22.50***
	10	1752.5	132397	50	0	5	1759.7	132469	25	0	22.45
	5	1748.1	132353	25	0	15	1757.4	132446	75	0	22.46
	15	1752.6	132398	75	0	5	1761.9	132491	25	0	22.40
	10	1750.1	132373	50	0	10	1760.0	132472	50	0	22.45
High	5	1772.7	132599	25	0	5	1777.5	132647	25	0	22.44
	5	1767.8	132550	25	0	10	1775.0	132622	50	0	22.48
	10	***1770.0***	***132572***	***50***	***0***	***5***	***1777.2***	***132644***	***25***	***0***	***22.55***
	5	1763.2	132504	25	0	15	1772.5	132597	75	0	22.43
	15	1767.7	132549	75	0	5	1777.0	132642	25	0	22.44
	10	1765.1	132523	50	0	10	1775.0	132622	50	0	22.46

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	23.30
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	23.48
High	5	1763.2	132504	1	24	15	1772.5	132597	1	0	23.44
Low	10	1715.0	132022	50	0	5	1722.2	132094	25	0	21.02
Mid	5	1750.3	132375	25	0	10	1757.5	132447	50	0	21.55
High	10	1770.0	132572	50	0	5	1777.2	132644	25	0	21.50

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	21.79
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	21.03
High	5	1763.2	132504	1	24	15	1772.5	132597	1	0	20.99
Low	10	1715.0	132022	50	0	5	1722.2	132094	25	0	20.88
Mid	5	1750.3	132375	25	0	10	1757.5	132447	50	0	20.65
High	10	1770.0	132572	50	0	5	1777.2	132644	25	0	20.48

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	19.24
Mid	5	1752.6	132398	1	24	5	1757.4	132446	1	0	19.49
High	5	1763.2	132504	1	24	15	1772.5	132597	1	0	19.48
Low	10	1715.0	132022	50	0	5	1722.2	132094	25	0	18.95
Mid	5	1750.3	132375	25	0	10	1757.5	132447	50	0	19.48
High	10	1770.0	132572	50	0	5	1777.2	132644	25	0	19.45

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	-18.44	15.31	10.06	2.05	H	0.215	23.32
	5	***132000***	***1/24***	***10***	***132072***	***1/0***	***-18.28***	***15.47***	***10.06***	***2.05***	***H***	***0.223***	***23.48***
	10	132022	1/49	5	132094	1/0	-18.60	15.11	10.08	2.05	H	0.206	23.14
	5	132002	1/24	15	132095	1/0	-18.62	15.09	10.08	2.05	H	0.205	23.12
	15	132047	1/74	5	132140	1/0	-18.84	14.87	10.08	2.05	H	0.195	22.90
	10	132022	1/49	10	132121	1/0	-18.63	15.08	10.08	2.05	H	0.205	23.11
Mid	5	132398	1/24	5	132446	1/0	-18.68	14.99	10.21	2.06	H	0.206	23.14
	5	132375	1/24	10	132447	1/0	-18.99	14.68	10.21	2.06	H	0.192	22.83
	10	132397	1/49	5	132469	1/0	-18.75	14.92	10.21	2.06	H	0.203	23.07
	5	132353	1/24	15	132446	1/0	-18.79	14.92	10.20	2.06	H	0.202	23.06
	15	132398	1/74	5	132491	1/0	-18.61	15.01	10.22	2.06	H	0.207	23.17
	10	***132373***	***1/49***	***10***	***132472***	***1/0***	***-18.58***	***15.09***	***10.21***	***2.06***	***H***	***0.211***	***23.24***
High	5	132599	1/24	5	132647	1/0	-18.75	14.94	10.25	2.07	H	0.205	23.12
	5	132550	1/24	10	132622	1/0	-18.98	14.71	10.24	2.07	H	0.194	22.88
	10	132572	1/49	5	132644	1/0	-18.80	14.89	10.24	2.07	H	0.202	23.06
	5	***132504***	***1/24***	***15***	***132597***	***1/0***	***-18.66***	***15.03***	***10.24***	***2.07***	***H***	***0.209***	***23.20***
	15	132549	1/74	5	132642	1/0	-18.94	14.75	10.24	2.07	H	0.196	22.92
	10	132523	1/49	10	132622	1/0	-18.93	14.76	10.24	2.07	H	0.196	22.93

Note:

1. Modulation : QPSK

2. Limit : < 1 Watts

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
5	131997	1/24	5	132045	1/0	-19.08	14.67	10.06	2.05	H	0.185	22.68
5	132000	1/24	10	132072	1/0	-18.80	14.95	10.06	2.05	H	0.198	22.96
10	132022	1/49	5	132094	1/0	-18.88	14.83	10.08	2.05	H	0.193	22.86
5	132002	1/24	15	132095	1/0	-19.01	14.70	10.08	2.05	H	0.187	22.73
15	132047	1/74	5	132140	1/0	-19.16	14.55	10.08	2.05	H	0.181	22.58
10	132022	1/49	10	132121	1/0	-19.15	14.56	10.08	2.05	H	0.182	22.59
10	132373	1/49	10	132472	1/0	-19.11	14.56	10.21	2.06	H	0.187	22.71
5	132504	1/24	15	132597	1/0	-19.34	14.35	10.24	2.07	H	0.179	22.52

Note:

1. Modulation : 16QAM

2. Limit : < 1 Watts

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
5	131997	1/24	5	132045	1/0	-20.93	12.82	10.06	2.05	H	0.121	20.83
5	132000	1/24	10	132072	1/0	-20.87	12.88	10.06	2.05	H	0.123	20.89
10	132022	1/49	5	132094	1/0	-20.90	12.81	10.08	2.05	H	0.121	20.84
5	132002	1/24	15	132095	1/0	-20.73	12.98	10.08	2.05	H	0.126	21.01
15	132047	1/74	5	132140	1/0	-21.25	12.46	10.08	2.05	H	0.112	20.49
10	132022	1/49	10	132121	1/0	-21.16	12.55	10.08	2.05	H	0.114	20.58
10	132373	1/49	10	132472	1/0	-21.70	11.97	10.21	2.06	H	0.103	20.12
5	132504	1/24	15	132597	1/0	-21.75	11.94	10.24	2.07	H	0.103	20.11

Note:

1. Modulation : 64QAM

2. Limit : < 1 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	131997	1/24	5	132045	1/0	-23.38	10.37	10.06	2.05	H	0.069	18.38
5	132000	1/24	10	132072	1/0	-23.18	10.57	10.06	2.05	H	0.072	18.58
10	132022	1/49	5	132094	1/0	-23.61	10.10	10.08	2.05	H	0.065	18.13
5	132002	1/24	15	132095	1/0	-23.20	10.51	10.08	2.05	H	0.071	18.54
15	132047	1/74	5	132140	1/0	-23.75	9.96	10.08	2.05	H	0.063	17.99
10	132022	1/49	10	132121	1/0	-23.16	10.55	10.08	2.05	H	0.072	18.58
10	132373	1/49	10	132472	1/0	-23.22	10.45	10.21	2.06	H	0.072	18.60
5	132504	1/24	15	132597	1/0	-23.05	10.64	10.24	2.07	H	0.076	18.81

Note:

1. Modulation : 256QAM

2. Limit : < 1 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	3.6820	27.976	-71.20	-43.22
Mid	5	132398	1752.6	1/24	5	132446	1757.4	1/0	3.7119	27.976	-71.40	-43.42
High	5	132504	1763.2	1/24	15	132597	1772.5	1/0	3.7074	27.976	-71.09	-43.11
Low	10	132022	1715.0	1/0	10	132121	1724.9	1/49	3.7039	27.976	-71.15	-43.17
Mid	5	132398	1752.6	1/0	5	132446	1757.4	1/24	3.6845	27.976	-71.38	-43.40
High	5	132504	1763.2	1/0	15	132597	1772.5	1/74	3.7015	27.976	-71.50	-43.52
Low	10	132022	1715.0	50/0	5	132094	1722.2	25/0	3.6960	27.976	-71.32	-43.35
Mid	5	132375	1750.3	25/0	10	132447	1757.5	50/0	3.7094	27.976	-71.29	-43.31
High	10	132572	1770.0	50/0	5	132644	1777.2	25/0	3.7054	27.976	-71.44	-43.47
Low	10	132022	1715.0	50/0	10	132121	1724.9	50/0	3.6915	27.976	-71.47	-43.49
Mid	10	132373	1750.1	50/0	10	132472	1760.0	50/0	3.7069	27.976	-71.37	-43.39
High	10	132523	1765.1	50/0	10	132622	1775.0	50/0	3.6970	27.976	-71.06	-43.09

Note:

1. Modulation : QPSK

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

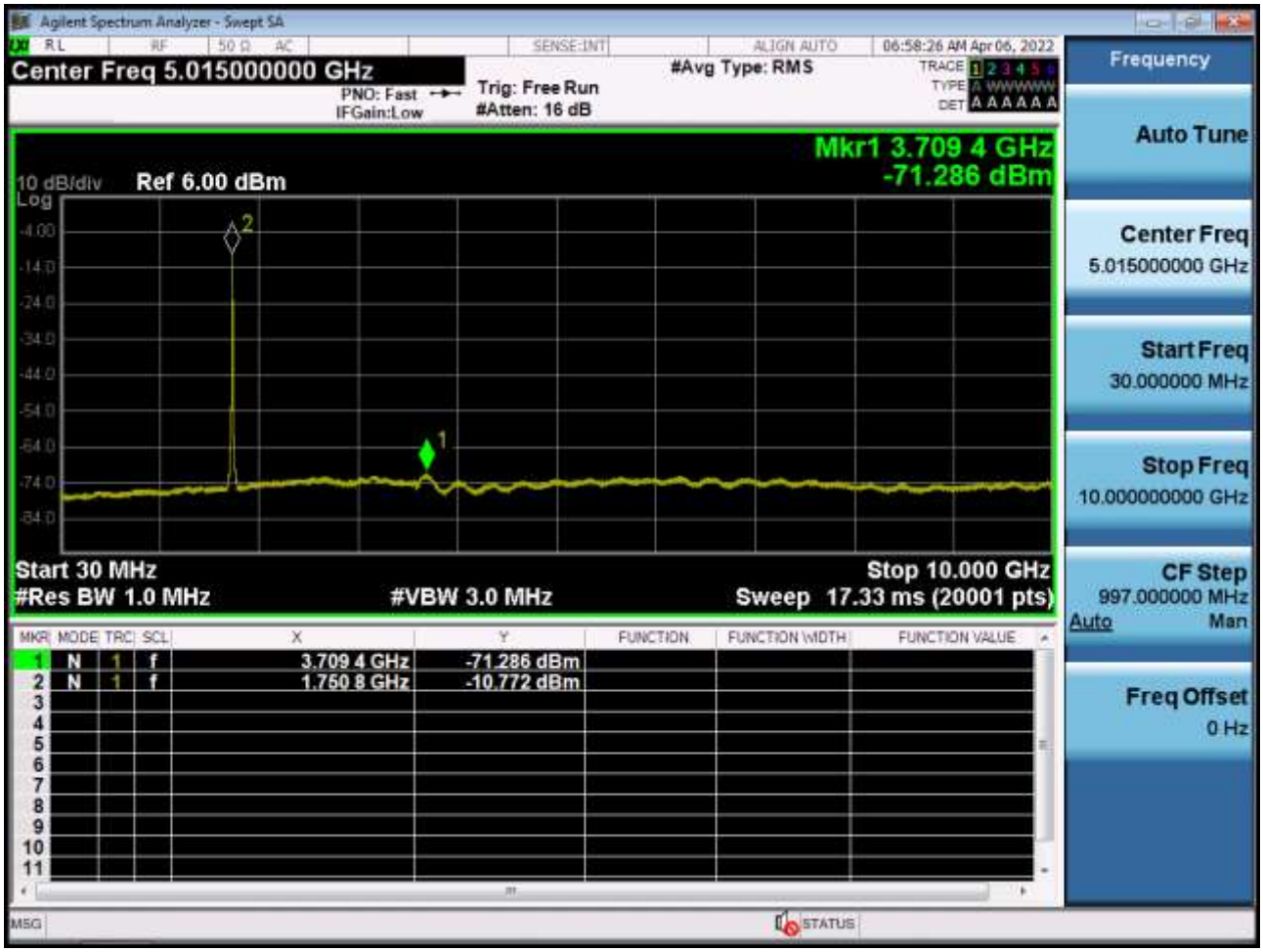
3. Factors for frequency :

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

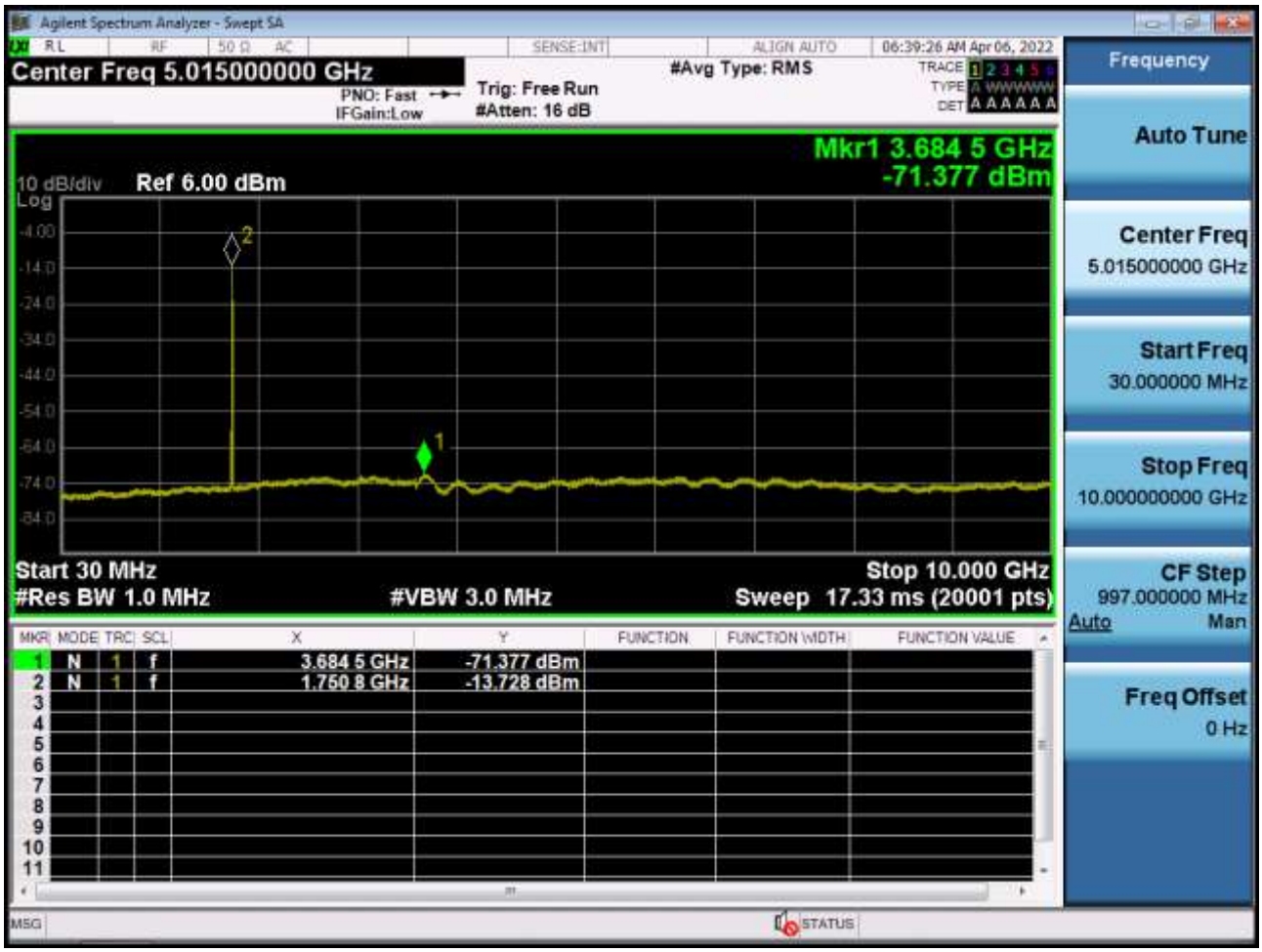
4. Limit : -13.0 dBm

Frequency Range : 30 MHz ~ 10 GHz

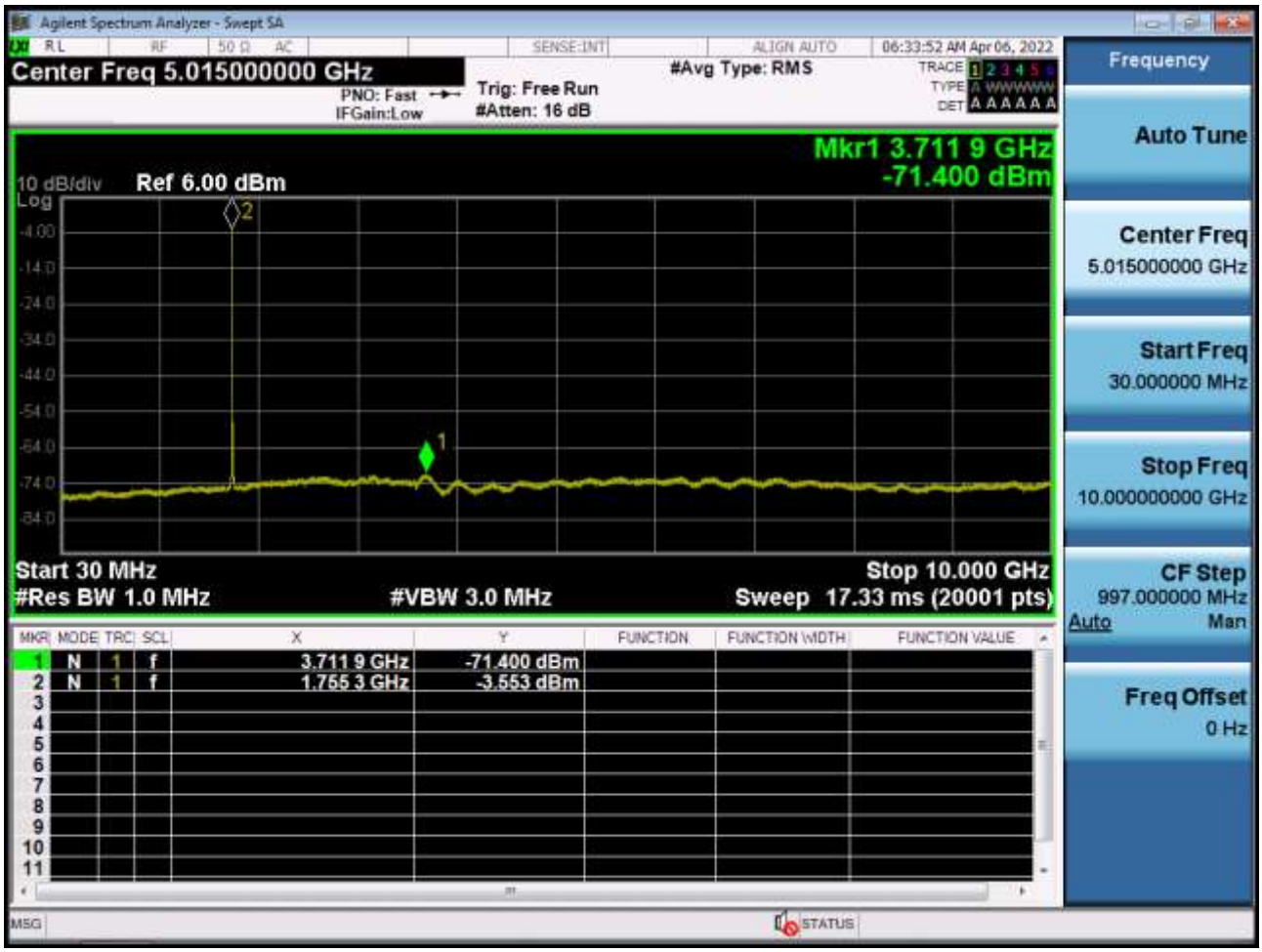
PCC 5 MHz Ch132375 RB25 Offset0 SCC 10 MHz Ch132447 RB50 Offset0



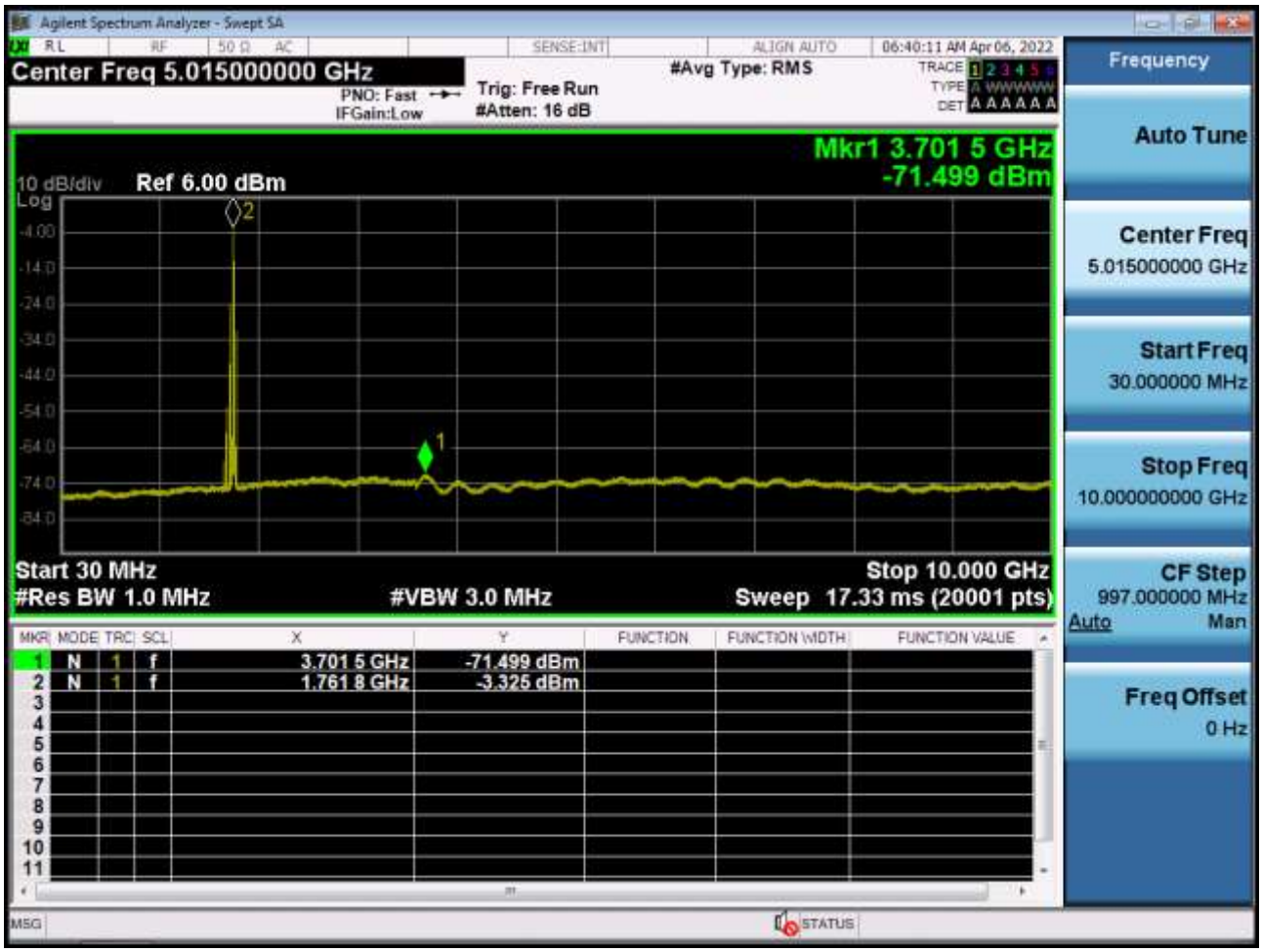
PCC 5 MHz Ch132398 RB1 Offset0 SCC 5 MHz Ch132446 RB1 Offset24



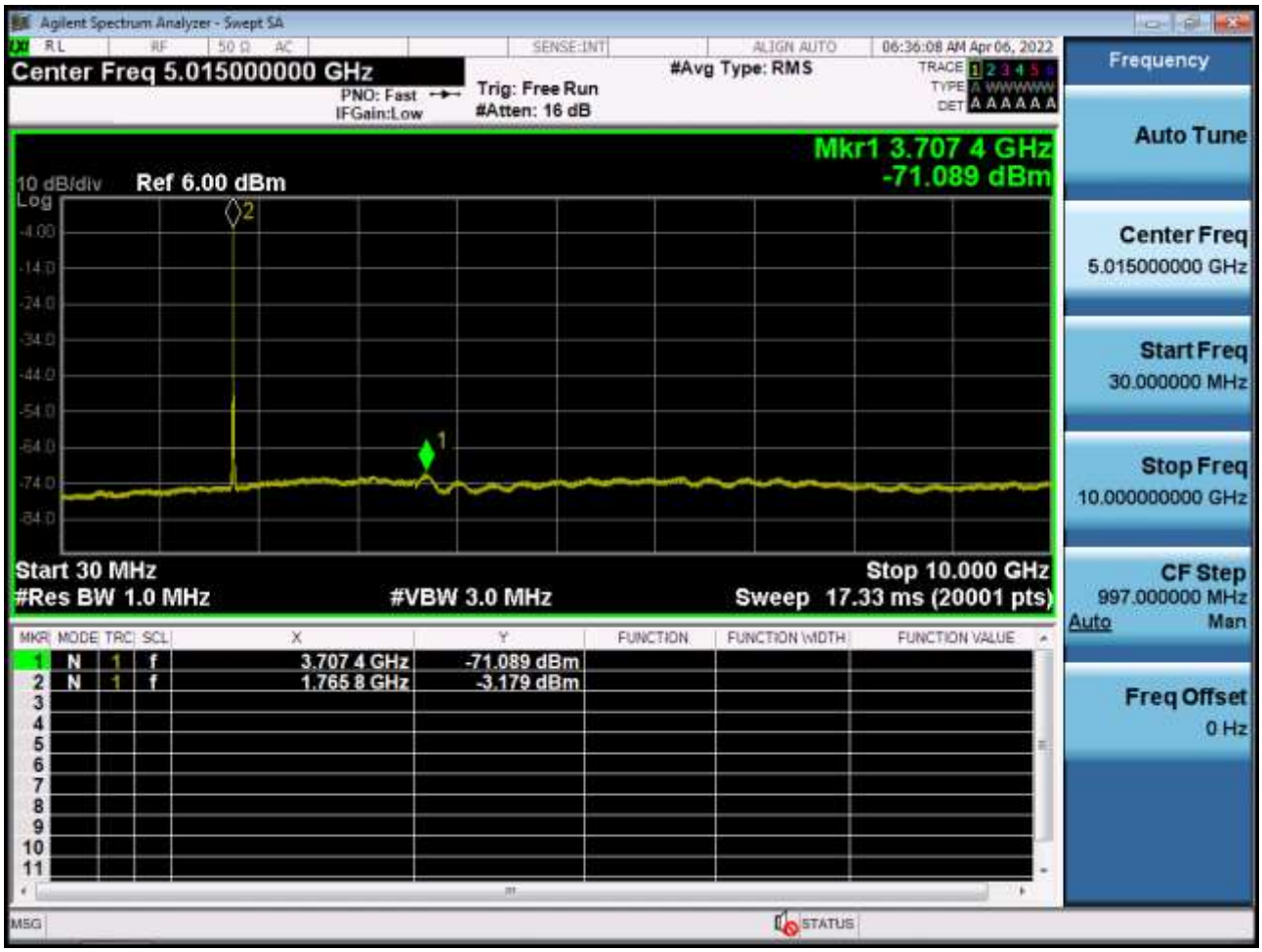
PCC 5 MHz Ch132398 RB1 Offset24 SCC 5 MHz Ch132446 RB1 Offset0



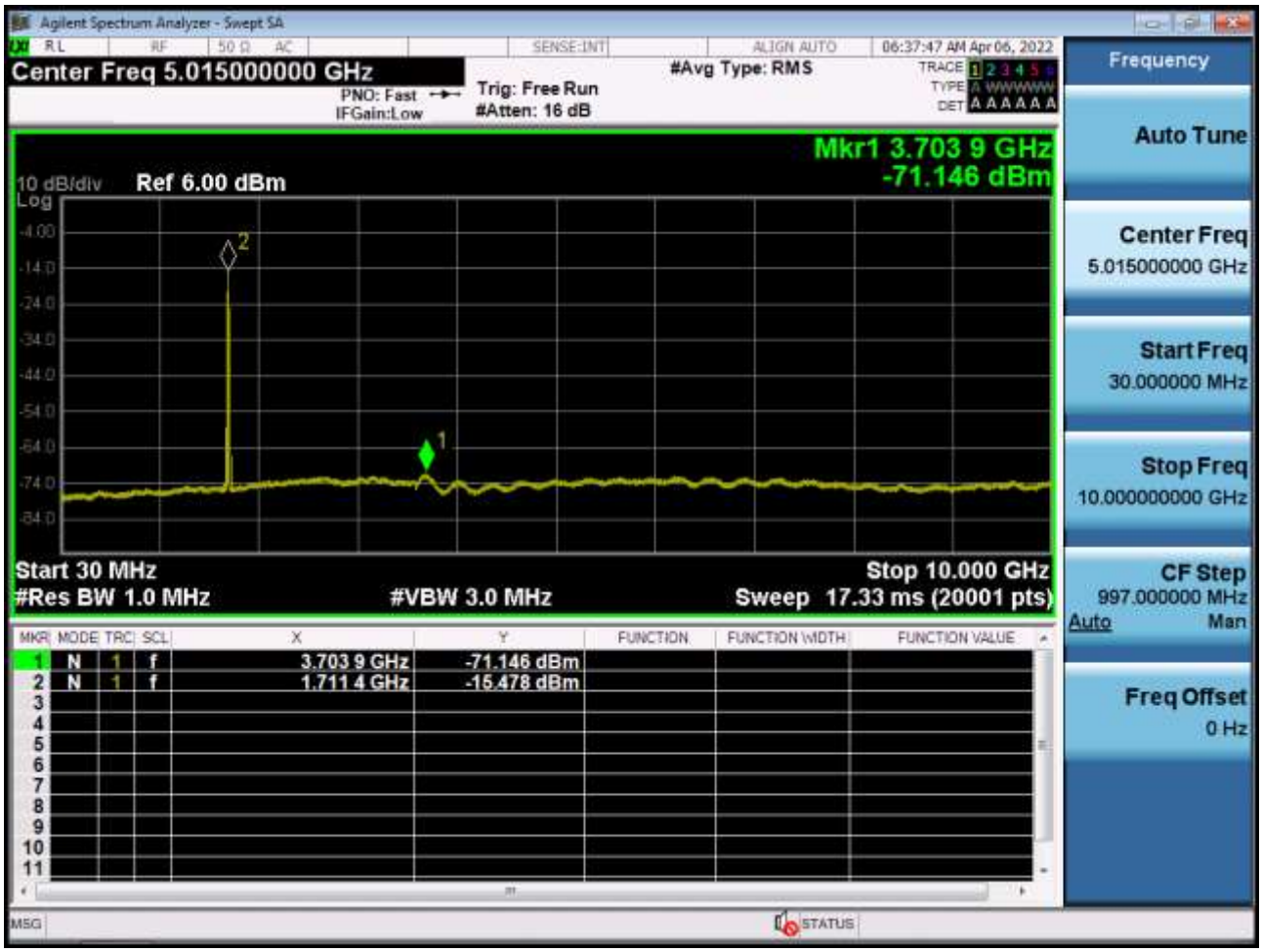
PCC 5 MHz Ch132504 RB1 Offset0 SCC 15 MHz Ch132597 RB1 Offset74



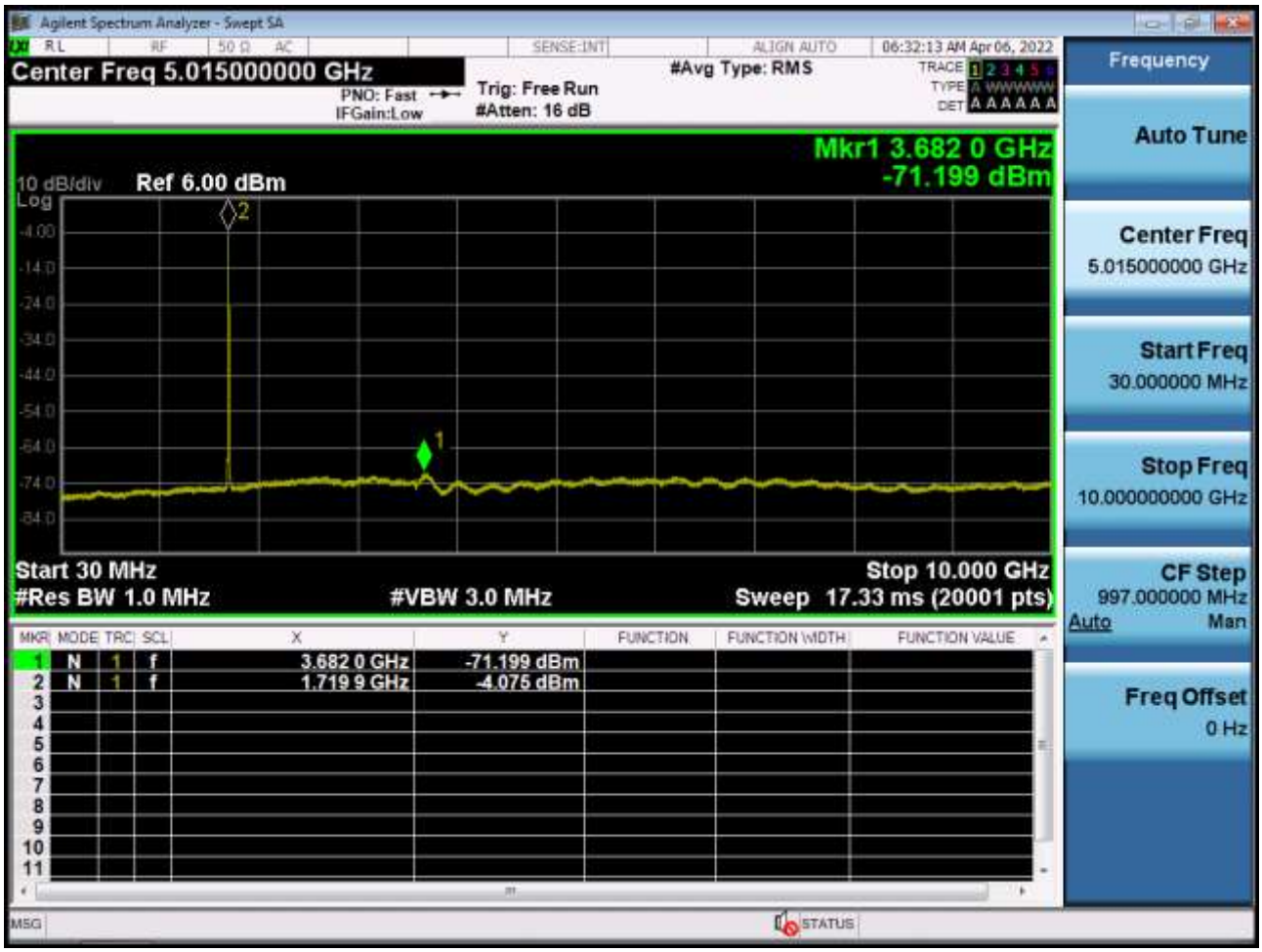
PCC 5 MHz Ch132504 RB1 Offset24 SCC 15 MHz Ch132597 RB1 Offset0



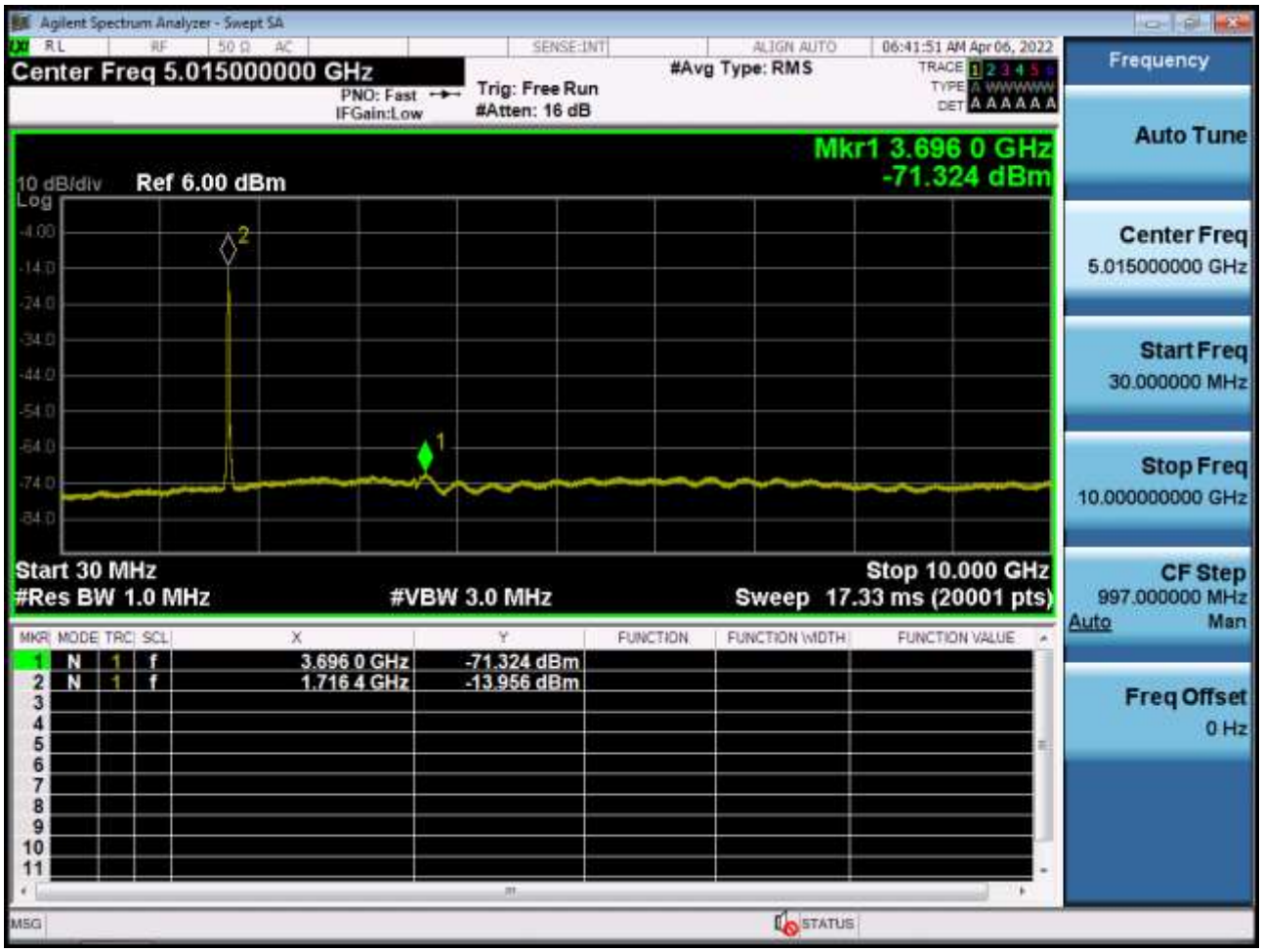
PCC 10 MHz Ch132022 RB1 Offset0 SCC 10 MHz Ch132121 RB1 Offset49



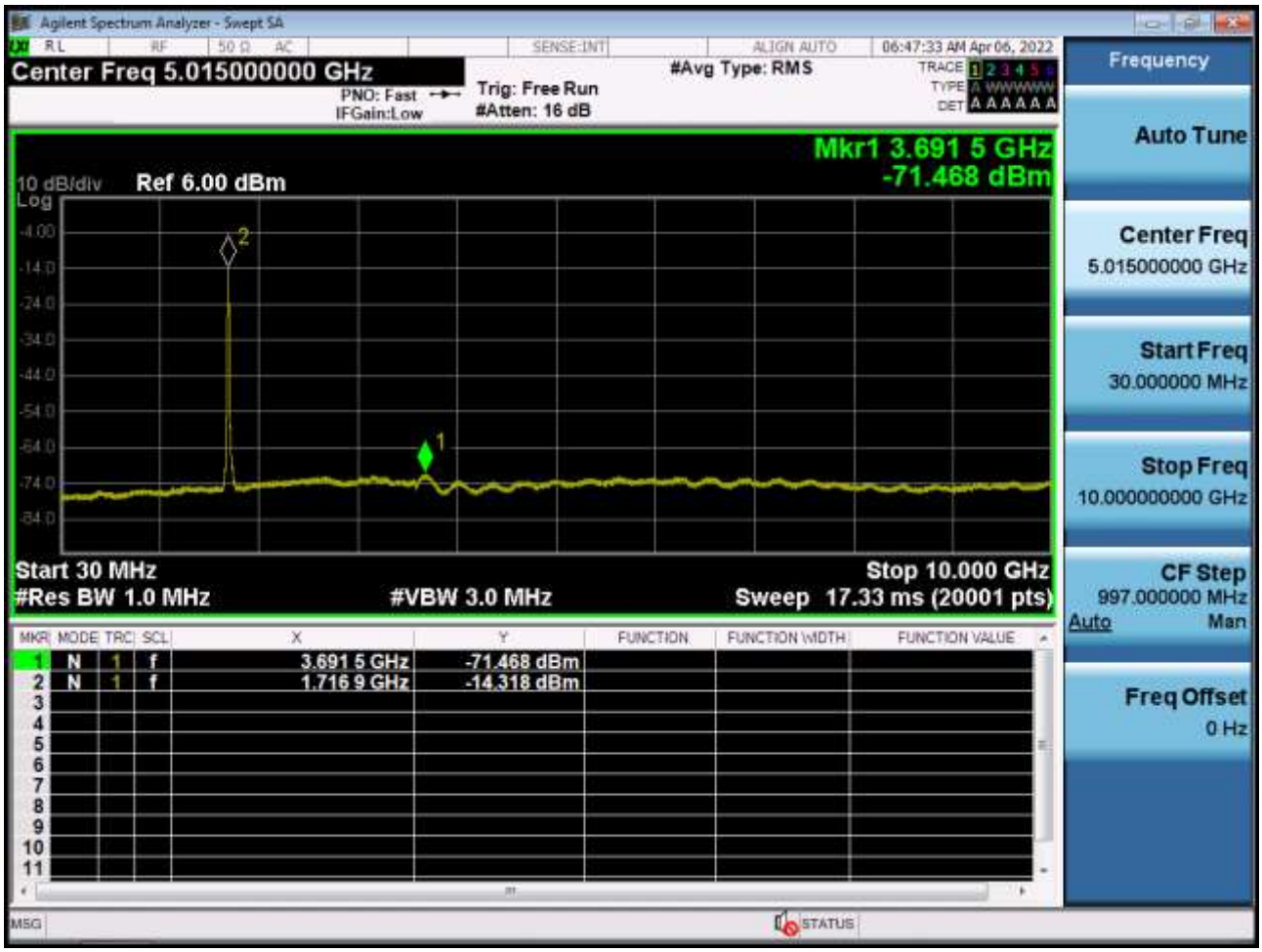
PCC 10 MHz Ch132022 RB1 Offset49 SCC 10 MHz Ch132121 RB1 Offset0



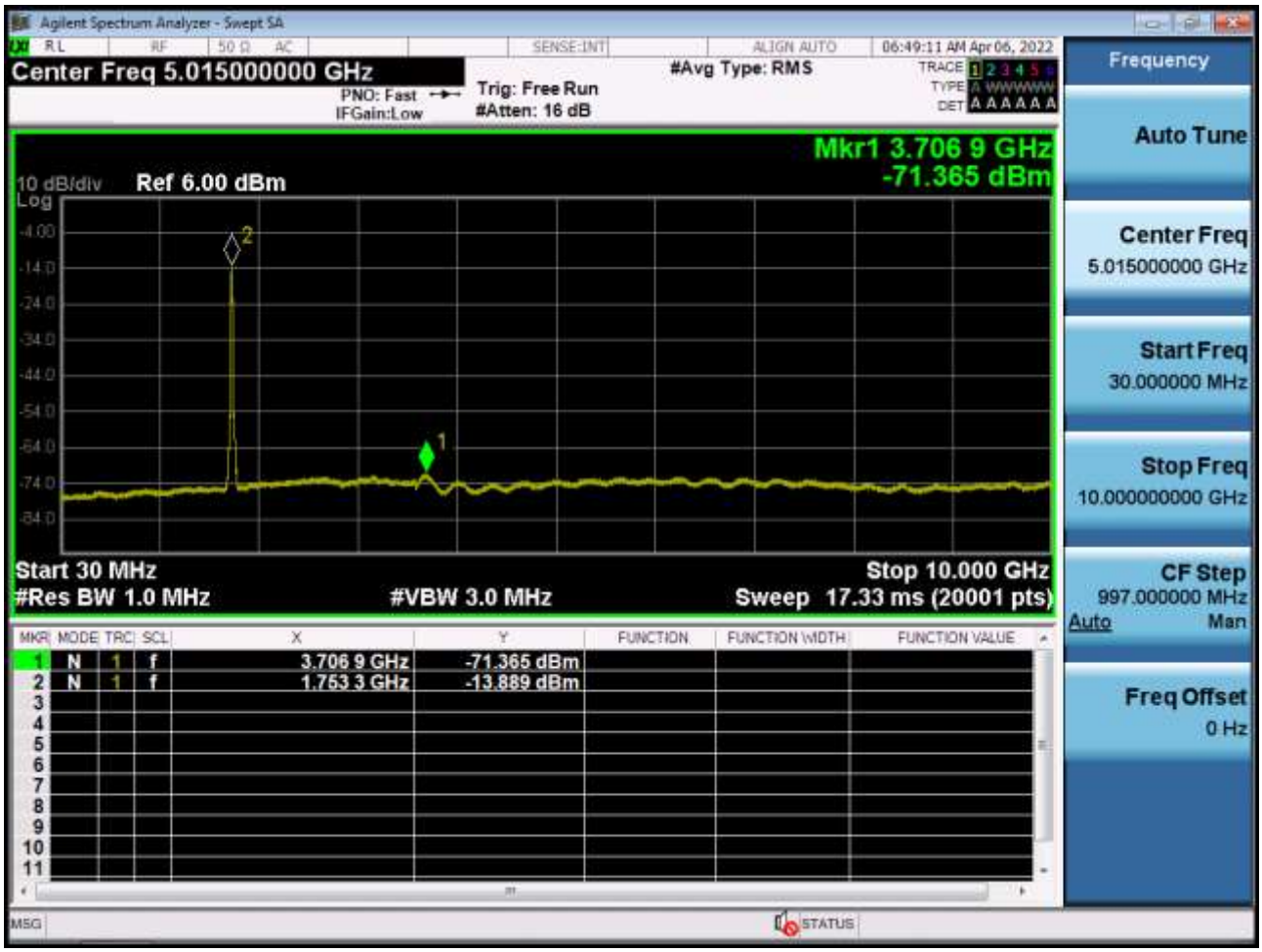
PCC 10 MHz Ch132022 RB50 Offset0 SCC 5 MHz Ch132094 RB25 Offset0



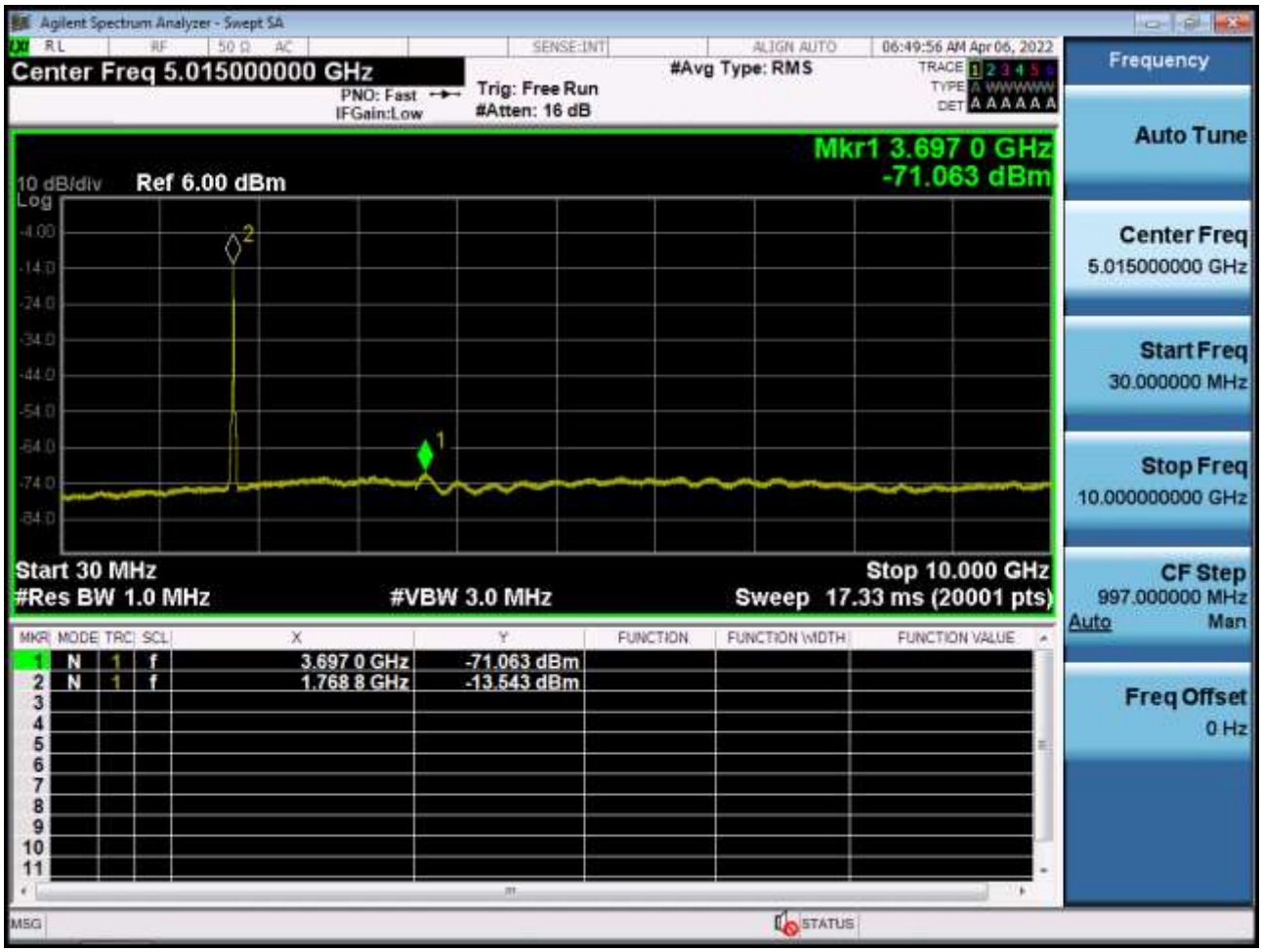
PCC 10 MHz Ch132022 RB50 Offset0 SCC 10 MHz Ch132121 RB50 Offset0



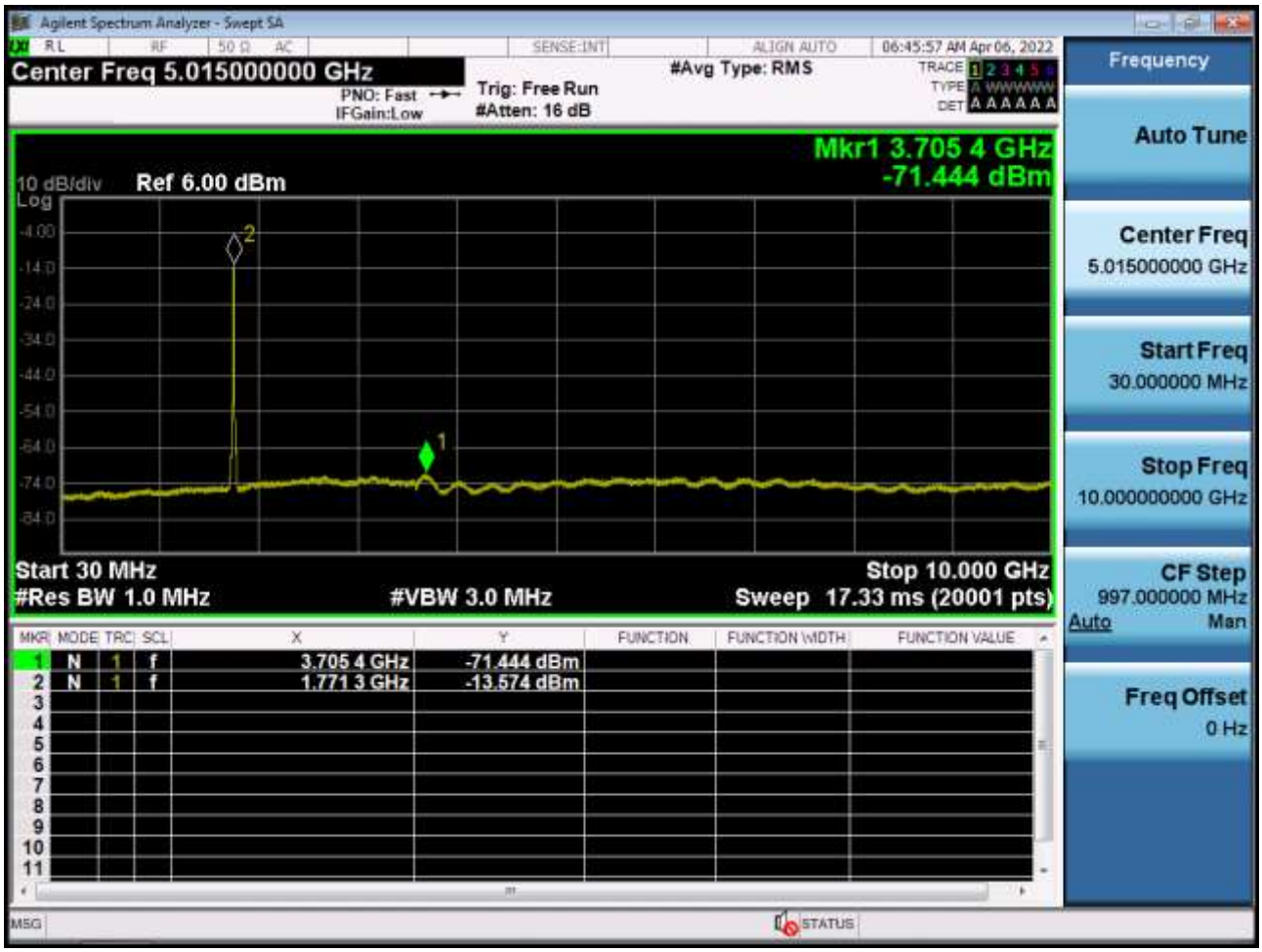
PCC 10 MHz Ch132373 RB50 Offset0 SCC 10 MHz Ch132472 RB50 Offset0



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



PCC 10 MHz Ch132572 RB50 Offset0 SCC 5 MHz Ch132644 RB25 Offset0



Frequency Range : 10 GHz ~ 26.5 GHz

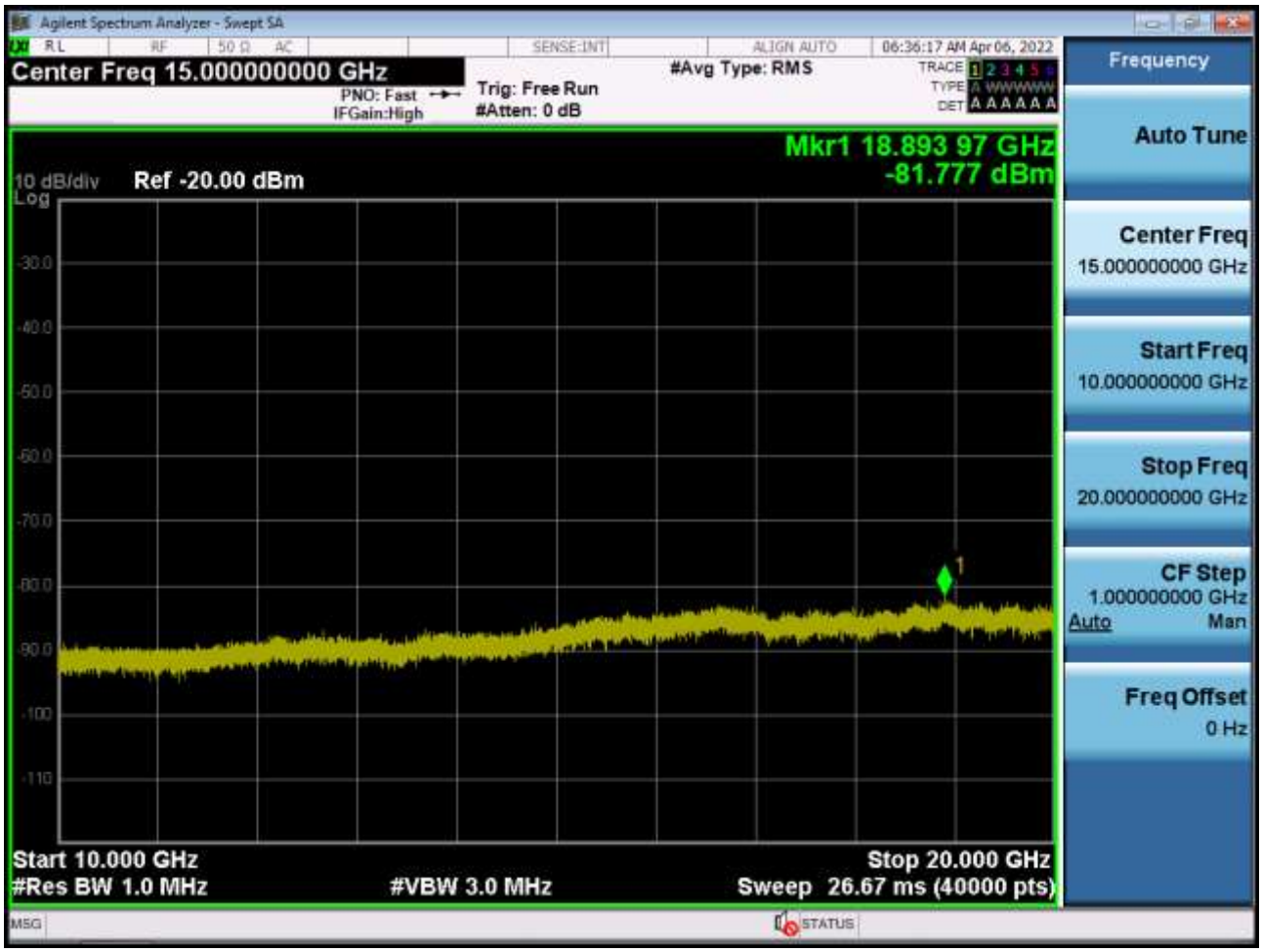
PCC 5 MHz Ch132375 RB25 Offset0, SCC 10 MHz Ch132447 RB50 Offset0

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

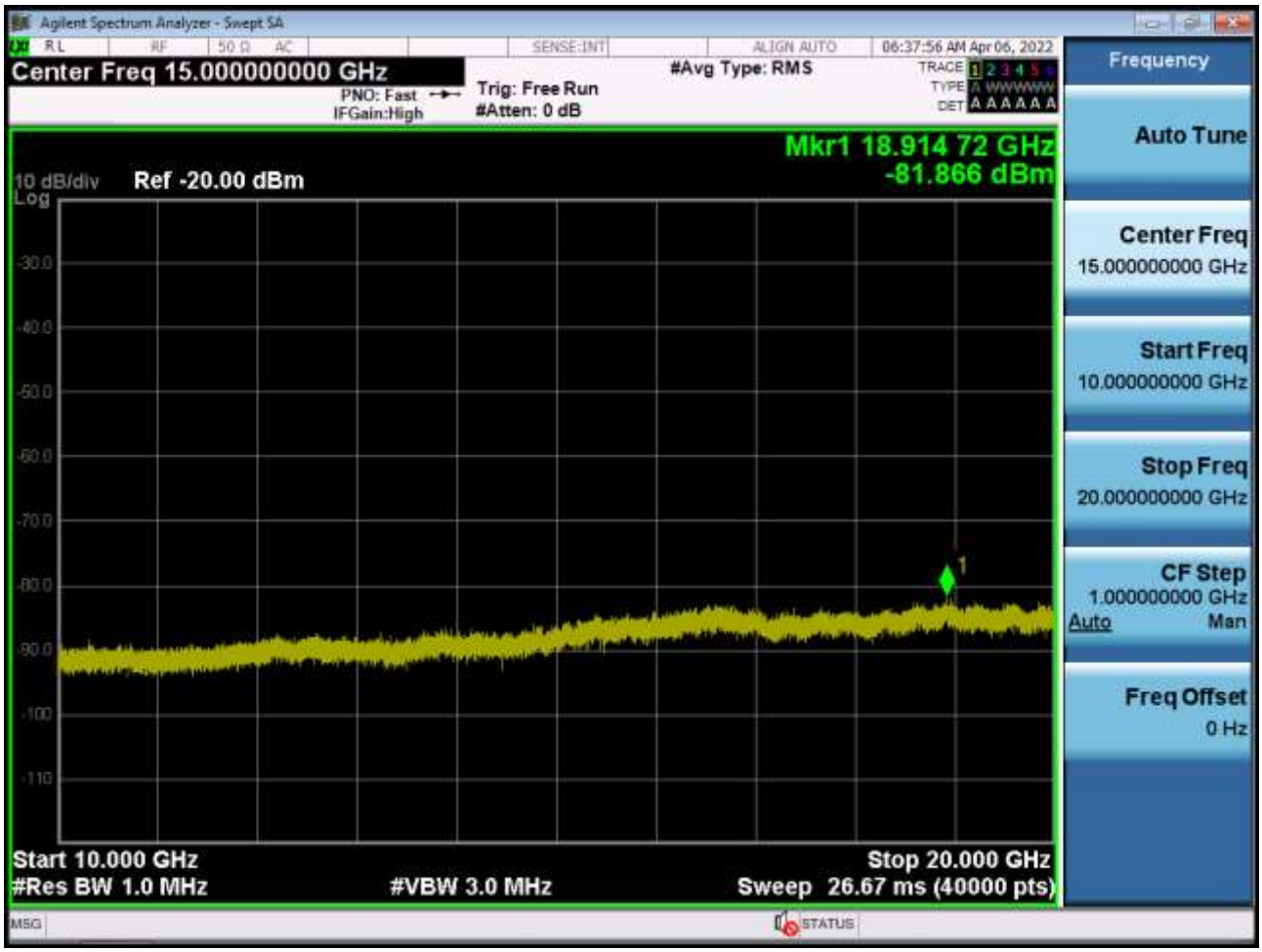
PCC 5 MHz Ch132398 RB1 Offset24, SCC 5 MHz Ch132446 RB1 Offset0

PCC 5 MHz Ch132504 RB1 Offset0, SCC 15 MHz Ch132597 RB1 Offset74

PCC 5 MHz Ch132504 RB1 Offset24, SCC 15 MHz Ch132597 RB1 Offset0



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



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

PCC 10 MHz Ch132022 RB50 Offset0, SCC 5 MHz Ch132094 RB25 Offset0

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

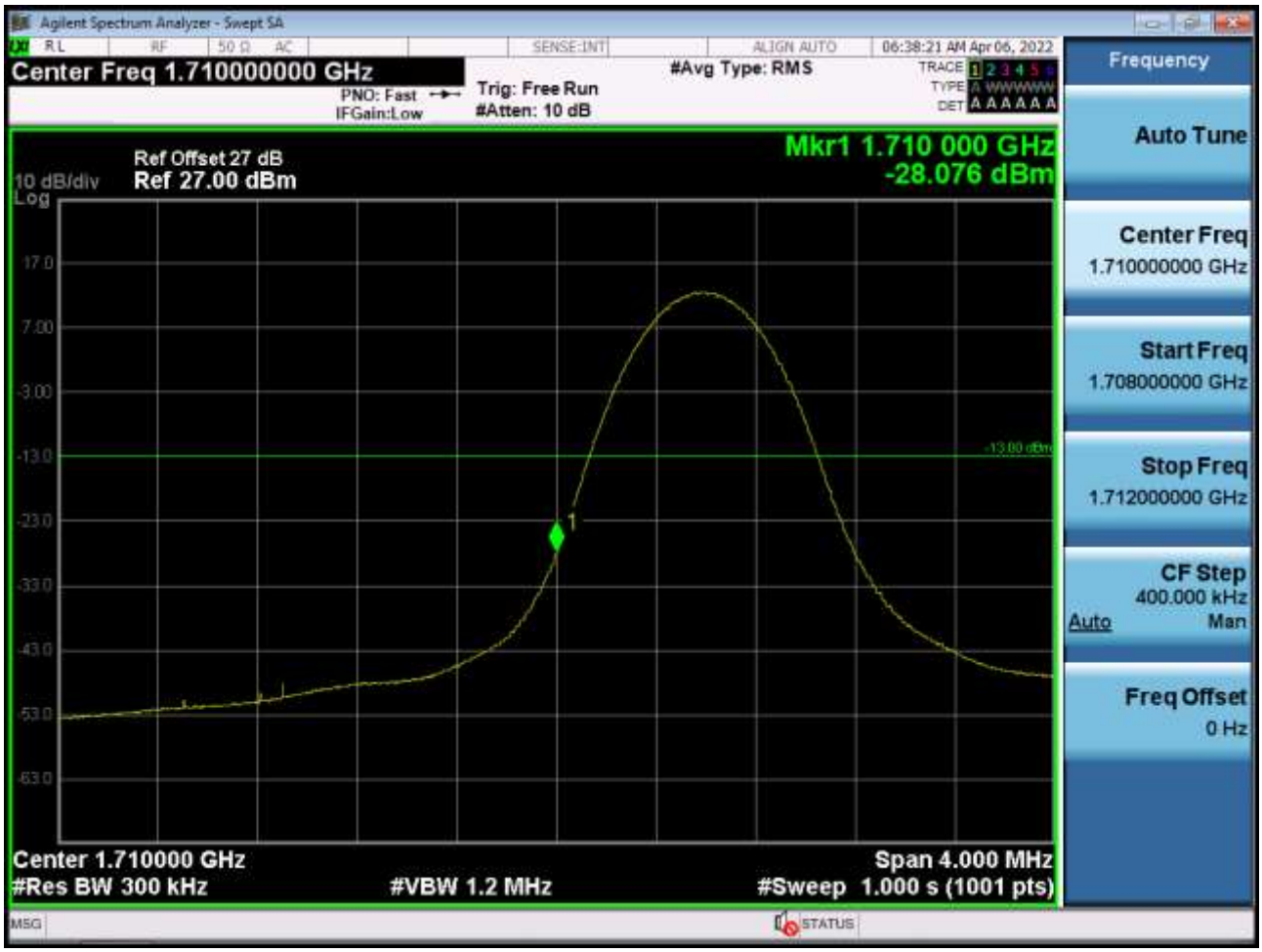
PCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz Ch132472 RB50 Offset0

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

PCC 10 MHz Ch132572 RB50 Offset0, SCC 5 MHz Ch132644 RB25 Offset0

8.4 Channel Edge

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



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

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

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

Lowest Channel_PCC 10 MHz Ch132022 RB50 Offset0 SCC 5 MHz Ch132094 RB25 Offset0(1)

Lowest Channel_PCC 10 MHz Ch132022 RB50 Offset0 SCC 5 MHz Ch132094 RB25 Offset0(2)

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

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

Highest Channel_PCC 5 MHz Ch132504 RB1 Offset0 SCC 15 MHz Ch132597 RB1 Offset74(1)

Highest Channel_PCC 5 MHz Ch132504 RB1 Offset0 SCC 15 MHz Ch132597 RB1 Offset74(2)

Highest Channel_PCC 5 MHz Ch132504 RB1 Offset24 SCC 15 MHz Ch132597 RB1 Offset0(1)

Highest Channel_PCC 5 MHz Ch132504 RB1 Offset24 SCC 15 MHz Ch132597 RB1 Offset0(2)

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

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

Highest Channel_PCC 10 MHz Ch132572 RB50 Offset0 SCC 5 MHz Ch132644 RB25 Offset0(1)

Highest Channel_PCC 10 MHz Ch132572 RB50 Offset0 SCC 5 MHz Ch132644 RB25 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)	-0.003	-0.064	1712.50004	1717.29984
100 %		-30	0.033	0.019	1712.50002	1717.29999
100 %		-20	-0.065	-0.057	1712.49984	1717.29987
100 %		-10	-0.002	0.034	1712.49993	1717.29996
100 %		0	0.041	-0.082	1712.49999	1717.29987
100 %		10	-0.076	-0.046	1712.49990	1717.29982
100 %		30	0.014	-0.001	1712.49997	1717.29998
100 %		40	-0.059	0.011	1712.49986	1717.30005
100 %		50	0.002	-0.052	1712.49994	1717.29988
Batt. Endpoint	3.650	20	0.011	-0.026	1712.49996	1717.29998

▣ 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)	0.004	-0.017	1715.00002	1722.19993
100 %		-30	-0.018	0.007	1715.00000	1722.19994
100 %		-20	-0.026	-0.087	1714.99995	1722.19984
100 %		-10	0.001	0.010	1715.00001	1722.19999
100 %		0	0.028	-0.020	1714.99998	1722.20000
100 %		10	0.012	0.015	1714.99997	1722.19995
100 %		30	0.011	0.025	1715.00001	1722.19997
100 %		40	0.023	0.009	1714.99996	1722.19992
100 %		50	-0.007	-0.070	1714.99997	1722.19981
Batt. Endpoint	3.650	20	-0.002	-0.068	1715.00002	1722.19988

▣ 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)	0.024	0.003	1717.50000	1726.79996
100 %		-30	0.028	0.005	1717.49997	1726.80001
100 %		-20	-0.057	-0.063	1717.49985	1726.79981
100 %		-10	0.005	-0.060	1717.50000	1726.79986
100 %		0	-0.071	-0.046	1717.49983	1726.79990
100 %		10	0.013	-0.004	1717.49999	1726.79993
100 %		30	0.007	0.007	1717.50000	1726.79999
100 %		40	0.017	-0.028	1717.50003	1726.80000
100 %		50	-0.042	0.009	1717.49988	1726.80003
Batt. Endpoint	3.650	20	0.022	0.014	1717.49995	1726.80003

▣ 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)	-0.016	-0.048	1772.69993	1777.49982
100 %		-30	0.028	0.011	1772.69998	1777.50005
100 %		-20	0.010	0.022	1772.69994	1777.50006
100 %		-10	-0.047	-0.048	1772.69992	1777.49981
100 %		0	0.009	-0.060	1772.69998	1777.49991
100 %		10	-0.077	-0.006	1772.69982	1777.50003
100 %		30	0.012	-0.065	1772.70001	1777.49992
100 %		40	-0.078	0.013	1772.69987	1777.49999
100 %		50	-0.052	0.026	1772.69987	1777.49998
Batt. Endpoint	3.650	20	0.000	-0.089	1772.69995	1777.49983

▣ 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)	0.032	-0.084	1770.00000	1777.19988
100 %		-30	-0.012	-0.070	1770.00001	1777.19985
100 %		-20	-0.074	-0.011	1769.99983	1777.19998
100 %		-10	0.028	-0.062	1769.99994	1777.19988
100 %		0	-0.078	-0.088	1769.99988	1777.19988
100 %		10	0.001	-0.081	1769.99996	1777.19985
100 %		30	0.013	0.035	1769.99997	1777.20006
100 %		40	-0.006	0.027	1770.00001	1777.19997
100 %		50	-0.057	-0.062	1769.99991	1777.19986
Batt. Endpoint	3.650	20	-0.082	-0.017	1769.99980	1777.20003

▣ 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)	0.002	0.014	1767.69993	1776.99997
100 %		-30	-0.050	0.014	1767.69988	1776.99995
100 %		-20	0.015	-0.096	1767.69997	1776.99984
100 %		-10	-0.054	0.029	1767.69982	1777.00002
100 %		0	-0.078	-0.014	1767.69986	1777.00002
100 %		10	-0.035	-0.089	1767.69989	1776.99982
100 %		30	-0.066	-0.069	1767.69990	1776.99987
100 %		40	-0.073	0.016	1767.69986	1776.99996
100 %		50	-0.074	-0.004	1767.69986	1777.00003
Batt. Endpoint	3.650	20	-0.001	-0.058	1767.69997	1776.99986

8.6 Radiated Spurious Emissions

▣ PCC Channel : 132000 (1712.8 MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 132072 (1720.0 MHz)

▣ 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)
3 432.80	-54.02	12.54	-60.47	2.96	V	-50.89
5 149.20	-56.75	12.30	-54.50	3.65	H	-45.85
6 865.60	-56.39	11.97	-49.86	4.27	H	-42.16

▣ PCC Channel : 132373 (1750.1 MHz)

▣ PCC BW(MHz) : 10

▣ PCC RB/ RB Offset : 1/ 49

▣ SCC Channel : 132472 (1760.0 MHz)

▣ 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)
3 510.10	-55.35	12.40	-61.30	2.98	H	-51.88
5 265.15	-56.49	12.86	-55.99	3.72	H	-46.85
7 020.20	-56.65	11.28	-48.04	4.32	V	-41.08

▣ PCC Channel : 132504 (1763.2 MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 132597 (1772.5 MHz)

▣ SCC BW(MHz) : 15

▣ 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)
3 535.70	-54.45	12.40	-60.31	3.01	H	-50.92
5 303.55	-56.41	13.00	-55.77	3.74	H	-46.51
7 071.40	-56.44	11.02	-47.28	4.31	H	-40.57

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	9.2299
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	13.846
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	13.862
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	18.250
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	18.176
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	18.760

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	9.2208
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	13.871
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	13.881
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	18.173
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	18.263
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	18.754

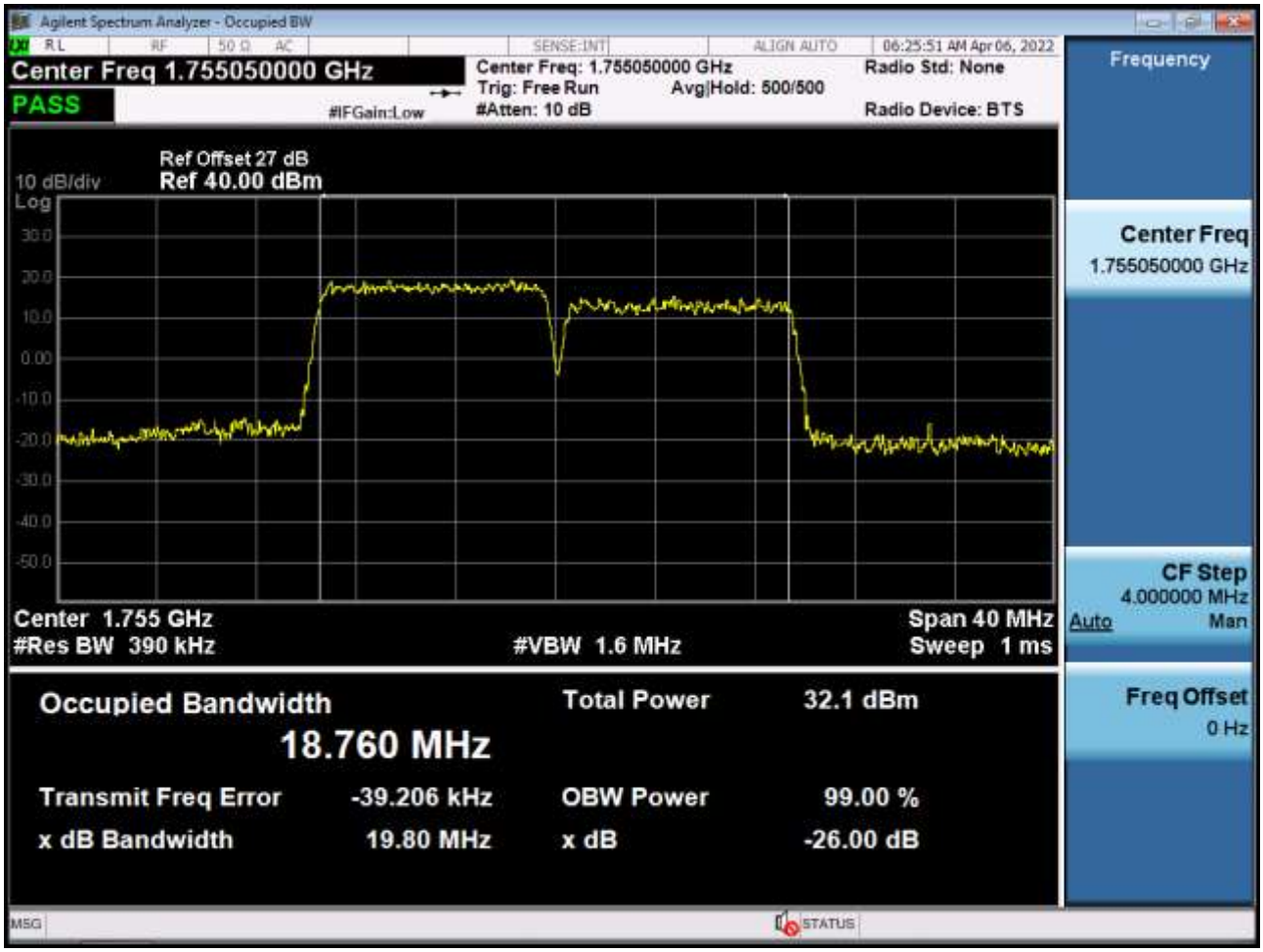
PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	64QAM	25/ 0	5	132446	1757.4	64QAM	25/ 0	9.2044
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	13.837
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	13.854
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	18.151
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	18.215
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	18.769

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	9.2706
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	13.851
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	13.892
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	18.133
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	18.204
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	18.801

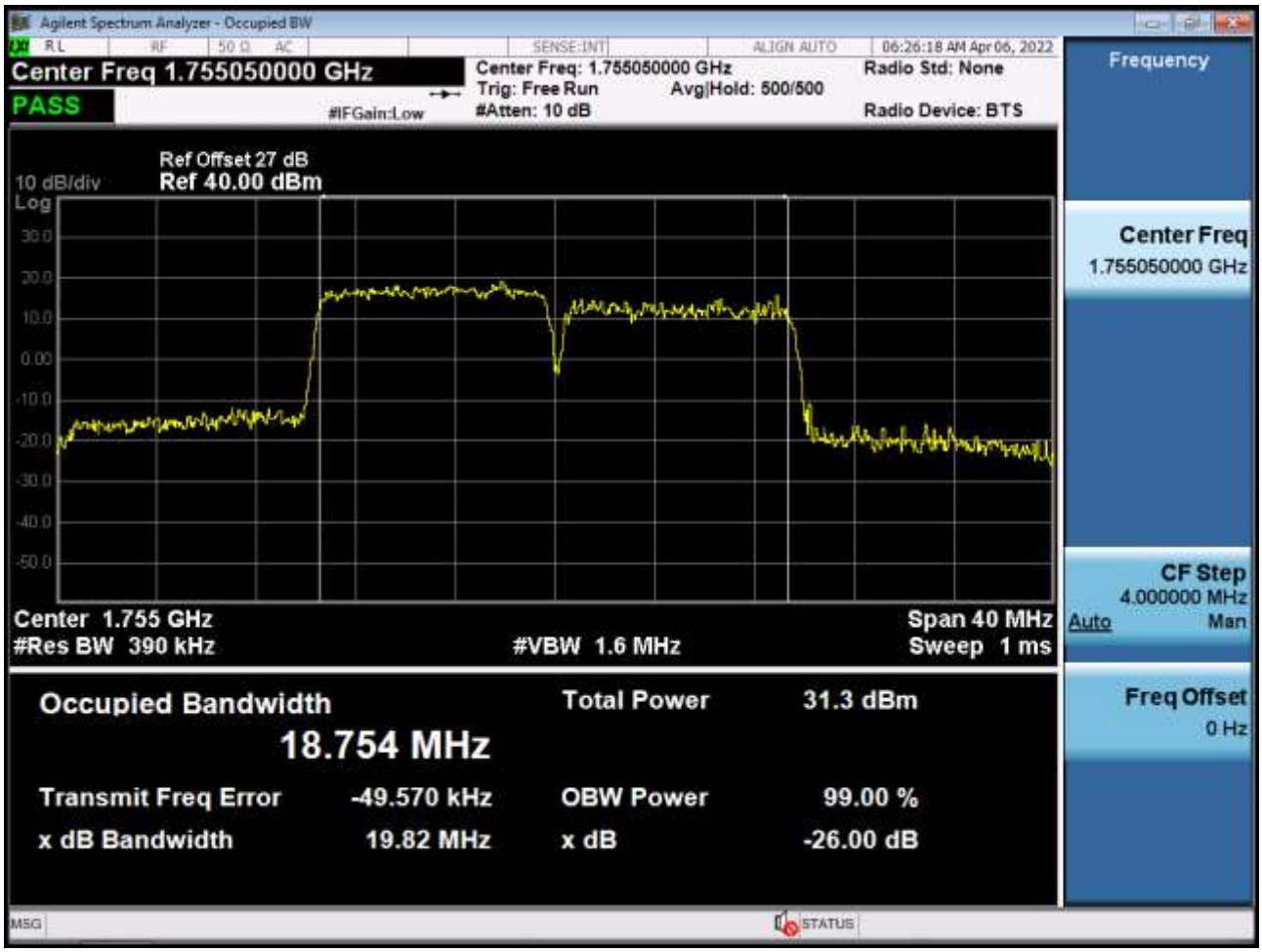
Note:

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

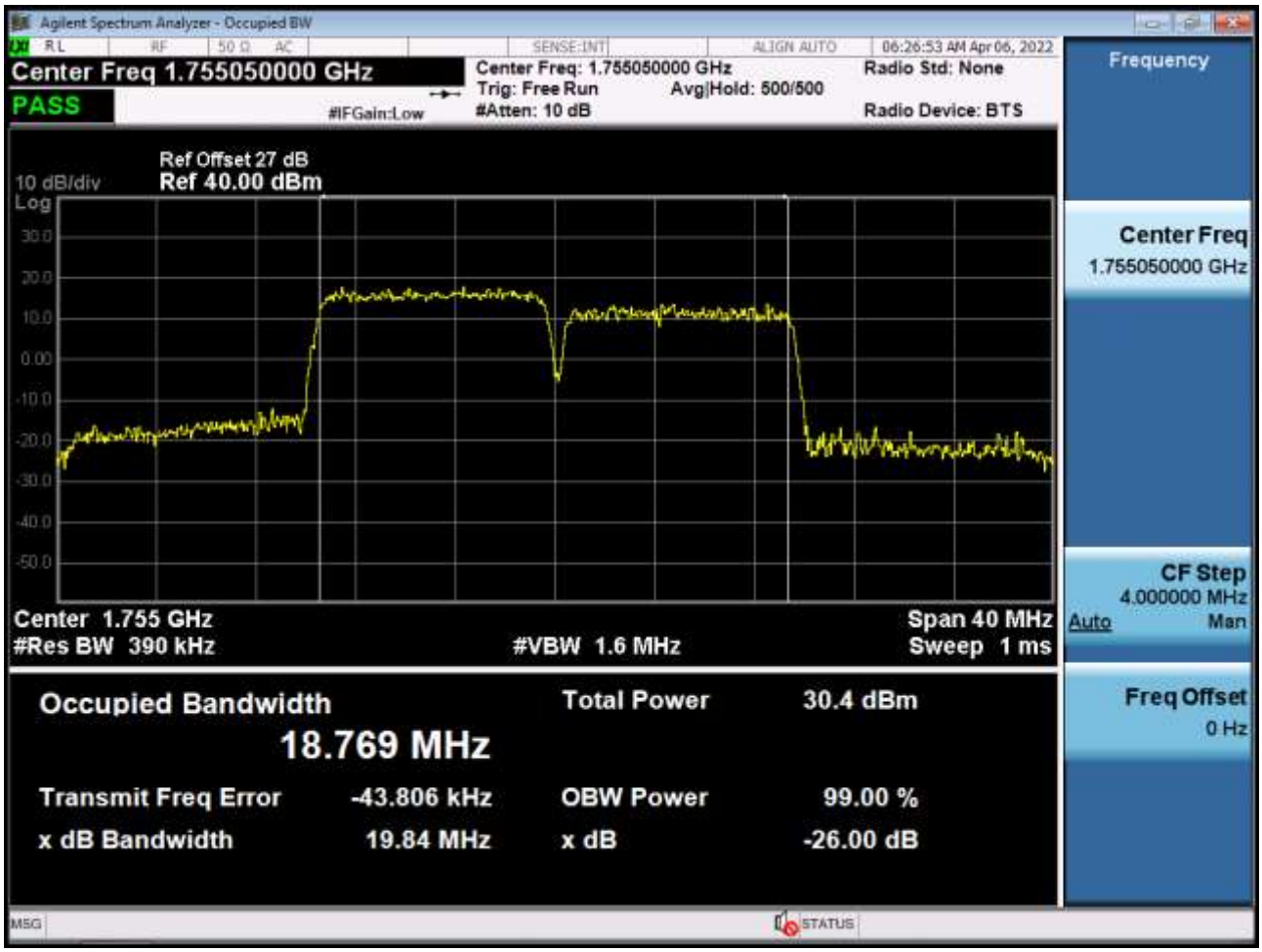
PCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz Ch132472 RB50 Offset0_(QPSK)



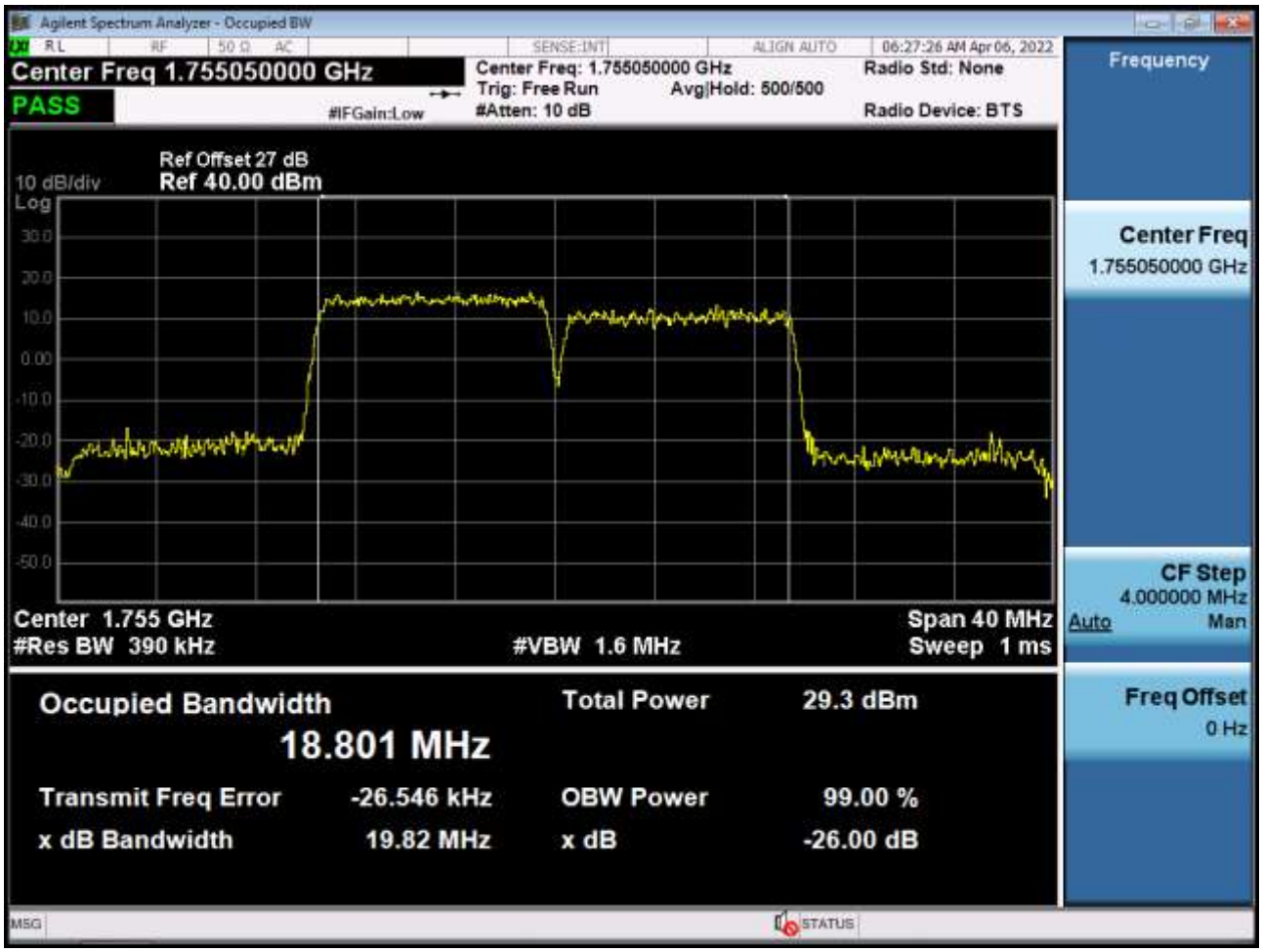
PCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz Ch132472 RB50 Offset0_(16QAM)



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



PCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz 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	5.97
5	132375	1750.3	QPSK	25/ 0	10	132447	1757.5	QPSK	50/ 0	5.62
10	132397	1752.5	QPSK	50/ 0	5	132469	1759.7	QPSK	25/ 0	5.68
5	132353	1748.1	QPSK	25/ 0	15	132446	1757.4	QPSK	75/ 0	5.61
15	132398	1752.6	QPSK	75/ 0	5	132491	1761.9	QPSK	25/ 0	5.63
10	132373	1750.1	QPSK	50/ 0	10	132472	1760.0	QPSK	50/ 0	5.66

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	6.86
5	132375	1750.3	16QAM	25/ 0	10	132447	1757.5	16QAM	50/ 0	6.42
10	132397	1752.5	16QAM	50/ 0	5	132469	1759.7	16QAM	25/ 0	6.44
5	132353	1748.1	16QAM	25/ 0	15	132446	1757.4	16QAM	75/ 0	6.39
15	132398	1752.6	16QAM	75/ 0	5	132491	1761.9	16QAM	25/ 0	6.39
10	132373	1750.1	16QAM	50/ 0	10	132472	1760.0	16QAM	50/ 0	6.89

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	7.34
5	132375	1750.3	64QAM	25/ 0	10	132447	1757.5	64QAM	50/ 0	6.91
10	132397	1752.5	64QAM	50/ 0	5	132469	1759.7	64QAM	25/ 0	6.87
5	132353	1748.1	64QAM	25/ 0	15	132446	1757.4	64QAM	75/ 0	6.84
15	132398	1752.6	64QAM	75/ 0	5	132491	1761.9	64QAM	25/ 0	6.85
10	132373	1750.1	64QAM	50/ 0	10	132472	1760.0	64QAM	50/ 0	7.48

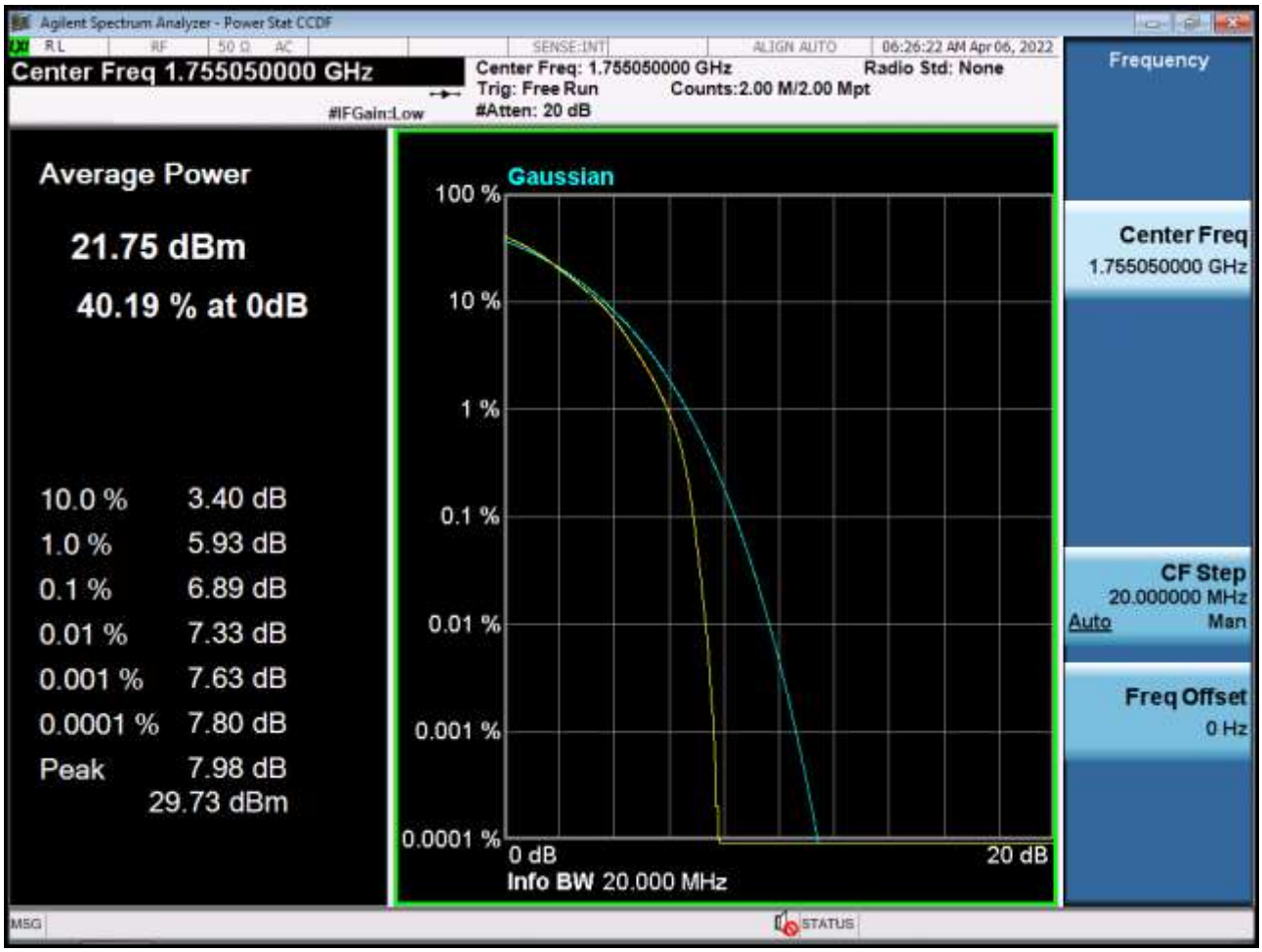
PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
5	132398	1752.6	256QAM	25/ 0	5	132446	1757.4	256QAM	25/ 0	7.71
5	132375	1750.3	256QAM	25/ 0	10	132447	1757.5	256QAM	50/ 0	6.97
10	132397	1752.5	256QAM	50/ 0	5	132469	1759.7	256QAM	25/ 0	6.93
5	132353	1748.1	256QAM	25/ 0	15	132446	1757.4	256QAM	75/ 0	6.96
15	132398	1752.6	256QAM	75/ 0	5	132491	1761.9	256QAM	25/ 0	6.89
10	132373	1750.1	256QAM	50/ 0	10	132472	1760.0	256QAM	50/ 0	7.81

Note:

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

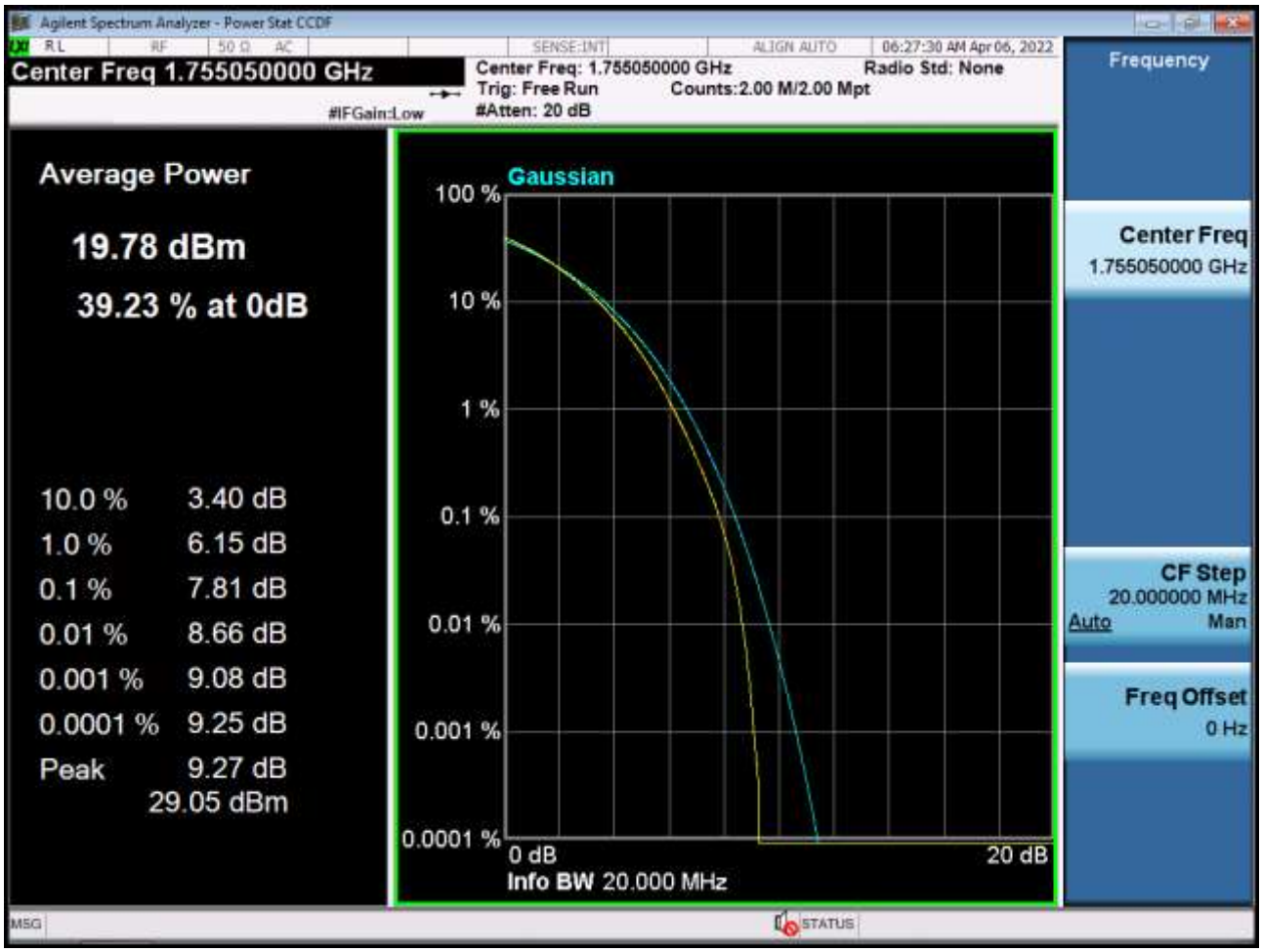
PCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz Ch132472 RB50 Offset0_(QPSK)

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



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

FCC 10 MHz Ch132373 RB50 Offset0, SCC 10 MHz 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-2205-FC044-P