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TEST REPORT

FCC Carrier Aggregation Test for TFGMEIBBCD4
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2310-FC004

DATE OF ISSUE
October 5, 2023

Tested by
Jung Ki Lim

Technical Manager
Jong Seok Lee

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Additional Model
TFGMEIBBCD5, TFGMEIBBCD6, TFGMEIBBCD7, TFGMEIBBCD8, TFGMEIBBCD9, TFGMEIBBCDA, TFGMEIBBCDB, TFGMEIBBCDC

Applicant	**LG Electronics Inc.** 10, MagokJungang-ro, Gangseo-gu, Seoul 07796, Republic of Korea
Eut Type Model Name	GM Onstar Gen12 ROW TFGMEIBBCD4
FCC ID	BEJTFGMEIBBCD4
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 22, § 2

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard.

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	October 05, 2023	Initial Release

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)

Test Report Statement:
The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme) / A2LA(American Association for Laboratory Accreditation), which signed the ILAC-MRA.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	LG Electronics Inc.
Address:	10, Magok Jungang-ro, Gangseo-gu, Seoul 07796, Republic of Korea
FCC ID:	BEJTFGMEIBBCD4
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 22, § 2
EUT Type:	GM Onstar Gen12 ROW
Model(s):	TFGMEIBBCD4
Additional Model:	TFGMEIBBCD5,TFGMEIBBCD6,TFGMEIBBCD7,TFGMEIBBCD8, TFGMEIBBCD9, TFGMEIBBCDA, TFGMEIBBCDB, TFGMEIBBCDC
Tx Frequency:	825.6 - 846.5: 3 MHz+5 MHz 825.6 - 847.4: 5 MHz+3 MHz 826.8 - 844.0: 5 MHz+10 MHz 829.0 - 846.2: 10 MHz+5 MHz 829.0 - 844.0: 10 MHz+10 MHz
Date(s) of Tests:	February 27, 2023 ~ October 05, 2023
Serial number:	Radiated : EBR36018942_#30 Conducted : EBR36018829_#75
External Antenna Information	ANT5 : 86531607 ANT4 : 86575530 DUT4 : 85608774

1.1. MAXIMUM OUTPUT POWER

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP External Antenna		ERP Internal Antenna	
				Max. Power (dBm)	Max. Power (W)	Max. Power (W)	Max. Power (dBm)
3 MHz+5 MHz	825.6 - 846.5	7M47G7D	QPSK	23.79	0.239	24.77	0.300
		7M43W7D	16QAM	23.10	0.204	23.75	0.237
		7M50W7D	64QAM	22.09	0.162	22.60	0.182
		7M47W7D	256QAM	20.97	0.125	21.59	0.144
5 MHz+3 MHz	825.6 - 847.4	7M49G7D	QPSK	24.14	0.259	24.82	0.303
		7M48W7D	16QAM	23.06	0.202	24.49	0.281
		7M47W7D	64QAM	21.99	0.158	23.47	0.222
		7M47W7D	256QAM	20.68	0.117	22.28	0.169
5 MHz+10 MHz	826.8 - 844.0	13M9G7D	QPSK	26.14	0.411	26.39	0.436
		13M8W7D	16QAM	25.58	0.361	25.69	0.371
		13M9W7D	64QAM	22.53	0.179	23.32	0.215
		13M8W7D	256QAM	21.49	0.141	21.59	0.144
10 MHz+5 MHz	829.0 - 846.2	13M9G7D	QPSK	26.03	0.401	25.12	0.325
		13M9W7D	16QAM	25.36	0.344	24.64	0.291
		13M9W7D	64QAM	22.27	0.169	21.79	0.151
		13M9W7D	256QAM	20.98	0.125	20.77	0.119
10 MHz+10 MHz	829.0 - 844.0	18M7G7D	QPSK	26.08	0.406	25.15	0.327
		18M7W7D	16QAM	25.57	0.361	24.60	0.288
		18M7W7D	64QAM	22.72	0.187	21.77	0.150
		18M7W7D	256QAM	21.23	0.133	20.79	0.120

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a GM Onstar Gen12 ROW with GSM/GPRS/EGPRS/UMTS and LTE, Sub6.

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

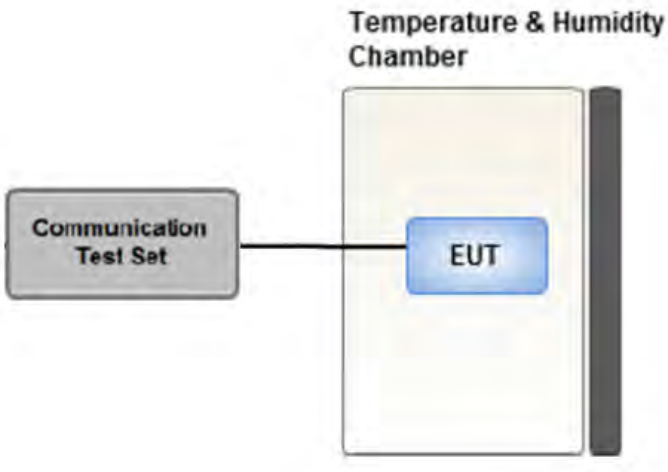
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.**

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
Conducted Output Power	- KDB 971168 D01 v03r01 - Section 5.2.4 - ANSI C63.26-2015 - Section 5.2.1 & 5.2.4.2
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4
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 CONDUCTED OUTPUT POWER



Test setup

Test Overview

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum output power level applies.

Conducted Output Power was tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03r01, Section 5.2.

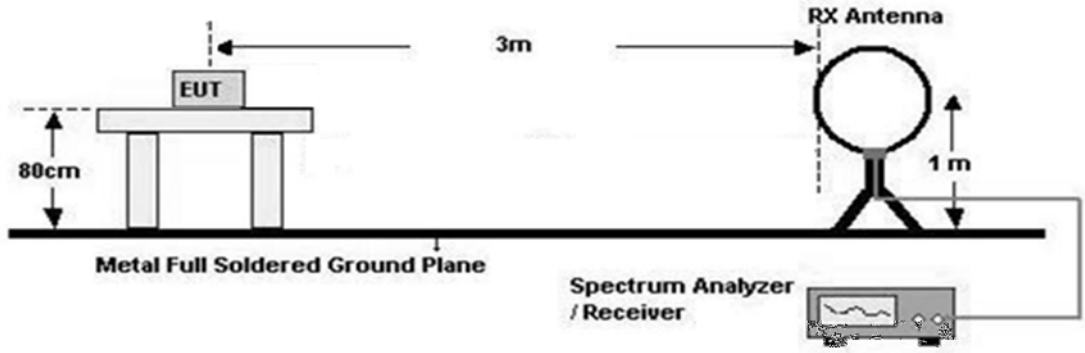
3.3 RADIATED TEST

Test Overview

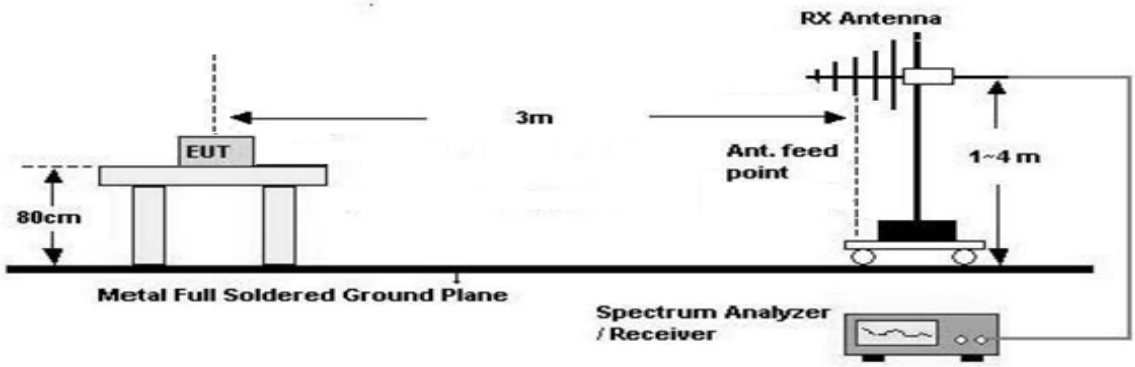
Radiated tests are performed in the semi-anechoic chamber. The equipment under test is placed on a non-conductive table on semi-anechoic chamber.

Test Configuration

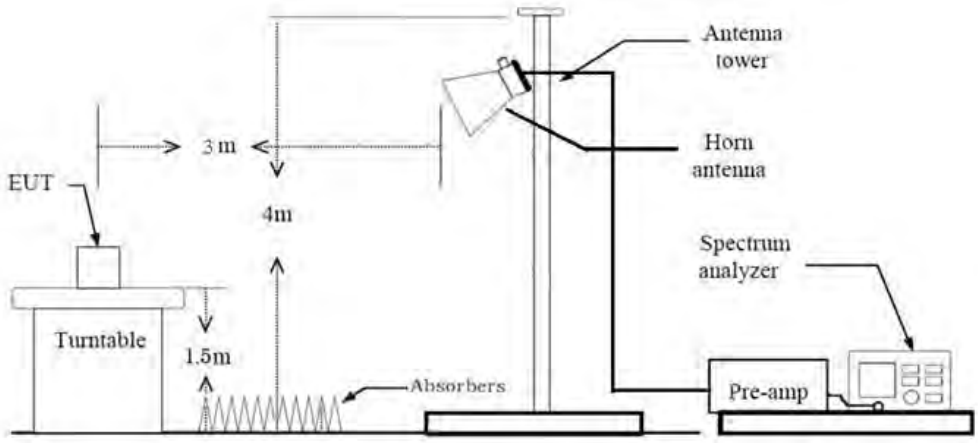
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



3.3.1 RADIATED POWER

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 EUT is placed on a turntable, which is 0.8 m above ground plane. (Below 1 GHz)
2. The EUT is placed on a turntable, which is 1.5 m above ground plane. (Above 1 GHz)
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
6. 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.
7. Total(dBμV/m) = Measured Value(dBμV) + Cable Loss(dB) + Antenna Factor(dB/m) + Distance Factor(D.F)
8. EIRP (dBm)
   = Total (dBμV/m) + 20 log D − 104.8 (where D is the measurement distance in meters. D=3)
   = Total (dBμV/m) - 95.2(dB)
9. ERP(dBm) = EIRP(dBm) - 2.15(dB)

3.3.2 RADIATED SPURIOUS EMISSIONS

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 10th harmonics from 9 kHz.

Test Note

1. 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
2. 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.

Below 30 MHz

1. The loop antenna was placed at a location 3 m from the EUT
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Distance Correction Factor(0.009 MHz – 0.490 MHz) = 40log(3 m/300 m) = - 80 dB
   Measurement Distance : 3 m
6. Distance Correction Factor(0.490 MHz – 30 MHz) = 40log(3 m/30 m) = - 40 dB
   Measurement Distance : 3 m
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
8. EIRP (dBm)
   = Total (dBμV/m) + 20 log D − 104.8 (where D is the measurement distance in meters. D=3)
   = Total (dBμV/m) - 95.2(dB)
9. ERP(dBm) = EIRP(dBm) - 2.15(dB)

KDB 414788 OFS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

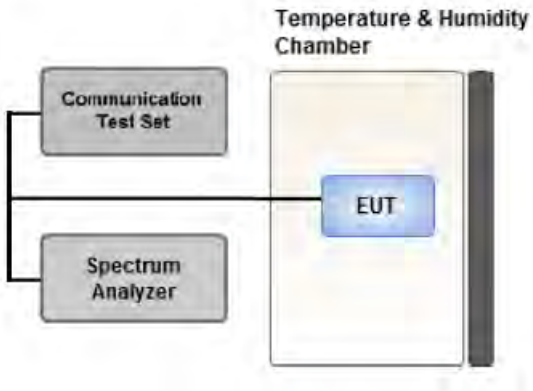
Below 1 GHz

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. Total(dBμV/m) = Measured Value(dBμV) + Cable Loss(dB) + Antenna Factor(dB/m) + Distance Factor(D.F)
8. EIRP (dBm)
   = Total (dBμV/m) + 20 log D − 104.8 (where D is the measurement distance in meters. D=3)
   = Total (dBμV/m) - 95.2(dB)
9. ERP(dBm) = EIRP(dBm) - 2.15(dB)

Above 1 GHz

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Total(dBμV/m) = Measured Value(dBμV) + Cable Loss(dB) + Antenna Factor(dB/m) + Distance Factor(D.F)
   + H.P.F(dB) - Amp Gain(dB)
8. EIRP (dBm)
   = Total (dBμV/m) + 20 log D − 104.8 (where D is the measurement distance in meters. D=3)
   = Total (dBμV/m) - 95.2(dB)

3.4 OCCUPIED BANDWIDTH.



Test setup

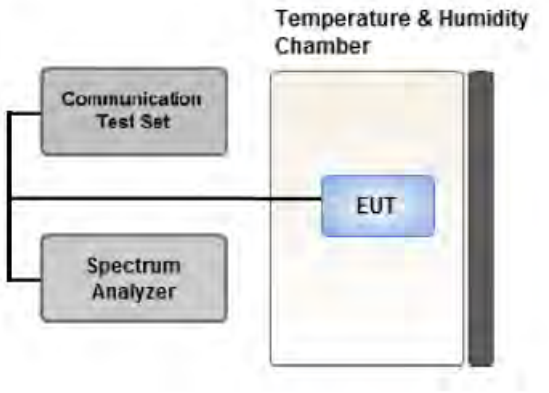
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

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

3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

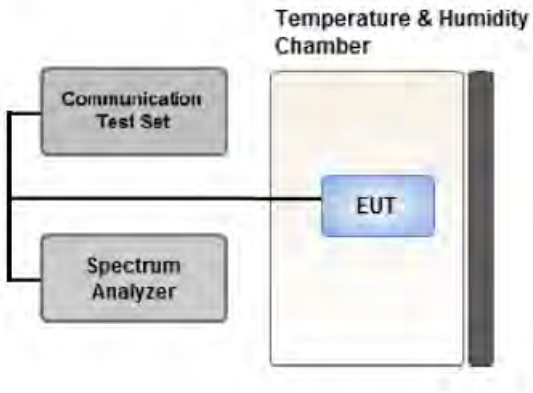
Test Overview

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 = Average
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

3.6 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 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

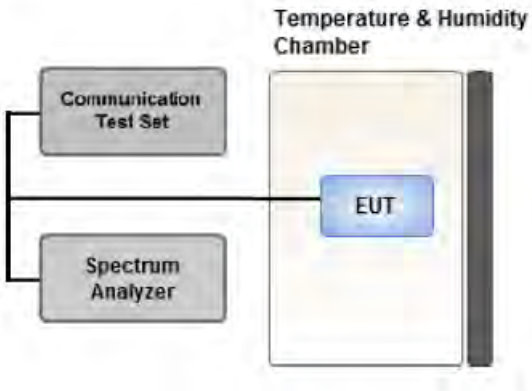
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. Within 1 MHz of the channel edge the RBW should be 2 % of EBW, then 1 MHz after that.
4. VBW > 3 x RBW
5. 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.

Where Margin < 1 dB the emission level is either corrected by 10 log(1 MHz/ RB) or the emission is integrated over a 1 MHz bandwidth to determine the final result. When using the integration method the integration window is either centered on the emission or, for emissions at the band edge, centered by an offset of 500 kHz from the block edge so that the integration window is the 1 MHz adjacent to the block edge.

3.7 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
Antenna Position Tower	MA4640/800-XP-ET	Innco systems	N/A	N/A	N/A
Turn Table	DS2000-S	Innco systems	N/A	N/A	N/A
Turn Table	Turn Table	Ets	N/A	N/A	N/A
Controller (Antenna mast & Turn Table)	CO3000	Innco systems	CO3000/1251/48920320/P	N/A	N/A
Amp & Filter Bank Switch Controller	FBSM-01B	TNM system	TM20090002	N/A	N/A
RF Switch System	TMX0132C	TNM System	TM21100002	N/A	N/A
RF Switch System	FBSR-04C(3G HPF+LNA)	TNM System	S4L1	08/18/2024	Annual
RF Switch System	FBSR-04C(LNA)	TNM System	S4L4	08/18/2024	Annual
RF Switch System	FBSR-04C(Thru)	TNM System	S4L6	08/18/2024	Annual
HIGHPASS FILTER	WHKX10-900-1000-15000-40SS	WAINWRIGHT INSTRUMENTS	16	08/01/2024	Annual
HIGHPASS FILTER	WHNX6.0/26.5G-6SS	WAINWRIGHT INSTRUMENTS	1	01/19/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/01/2023	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/02/2024	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120	Schwarzbeck	937	02/13/2025	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/09/2025	Biennial
Hybrid Antenna	VULB9160	Schwarzbeck	760	02/24/2025	Biennial
Trilog Broadband Antenna	VULB 9168	Schwarzbeck	895	08/16/2024	Biennial
Chamber	SU-642	ESPEC	93008124	02/22/2024	Annual
Power Splitter(DC~26.5 GHz)	11667B	Hewlett Packard	11275	03/02/2024	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/23/2024	Annual
4-Way Divider	ZC4PD-K1844+	Mini-Circuits	942907	09/27/2023	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/19/2024	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	101436	02/22/2024	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/10/2024	Annual
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262287701	05/22/2024	Annual
Wideband Radio Communication Tester	MT8000A	Anritsu Corp.	6262302511	05/23/2024	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	06/22/2024	Annual

Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	04/20/2024	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/24/2024	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)	1.90 (Confidence level about 95 %, k=2)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.14 (Confidence level about 95 %, k=2)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.82 (Confidence level about 95 %, k=2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.74 (Confidence level about 95 %, k=2)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.76 (Confidence level about 95 %, k=2)
Radiated Disturbance (Above 40 GHz)	5.52 (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, § 22.917(a)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§ 2.1046	N/A	PASS
Peak- to- Average Ratio	§ 22.913(d)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§ 2.1055, § 22.355	< 2.5 ppm	PASS

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§ 22.913(a)(5)	< 7 Watts max. ERP	PASS
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 22.917(a)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS

7. 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)
3	5	8
5	3	8
5	10	15
10	5	15
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 ERP.
 - Worst case(OBW, Frequency stability)
  : All modes of operation were investigated and the worst case configuration results are reported.
4. ERP, Radiated Spurious Emissions

   Mode : Internal Antenna, External Antenna (ANT 5, ANT 4, DUT 4)

   Worst case : Internal Antenna, External Antenna (ANT 5)
5. 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	829.0	20450	1	49	10	838.9	20549	1	0
	QPSK	Mid	10	831.6	20476	1	49	10	841.5	20575	1	0
	QPSK	High	10	834.1	20501	1	49	10	844.0	20600	1	0
	QPSK	Low	10	829.0	20450	1	0	10	838.9	20549	1	49
	QPSK	Mid	10	831.6	20476	1	0	10	841.5	20575	1	49
	QPSK	High	10	834.1	20501	1	0	10	844.0	20600	1	49
	QPSK	Low	3	825.6	20416	15	0	5	829.5	20455	25	0
	QPSK	Mid	3	834.1	20501	15	0	5	838.0	20540	25	0
	QPSK	High	3	842.6	20586	15	0	5	846.5	20625	25	0
	QPSK	Low	10	829.0	20450	50	0	10	838.9	20549	50	0
	QPSK	Mid	10	831.6	20476	50	0	10	841.5	20575	50	0
	QPSK	High	10	834.1	20501	50	0	10	844.0	20600	50	0
Radiated Spurious Emissions (External Ant)	QPSK	Low	5	826.8	20428	1	24	10	834.0	20500	1	0
	QPSK	Mid	5	831.8	20478	1	24	10	839.0	20550	1	0
	QPSK	High	5	836.8	20528	1	24	10	844.0	20600	1	0
Radiated Spurious Emissions (Internal Ant)	QPSK	Low	5	826.8	20428	1	24	10	834.0	20500	1	0
	QPSK	Mid	5	831.8	20478	1	24	10	839.0	20550	1	0
	QPSK	High	5	836.8	20528	1	24	10	844.0	20600	1	0
OBW, PAR	QPSK, 16QAM, 64QAM, 256QAM	Mid	3	834.1	20501	15	0	5	838.0	20540	25	0
			5	835.0	20510	25	0	3	838.9	20549	15	0
			5	831.8	20478	25	0	10	839.0	20550	50	0
			10	834.0	20500	50	0	5	841.2	20572	25	0
			10	831.6	20476	50	0	10	841.5	20575	50	0
Frequency stability	QPSK	Mid	3	834.1	20501	15	0	5	838.0	20540	25	0
			5	835.0	20510	25	0	3	838.9	20549	15	0
			5	831.8	20478	25	0	10	839.0	20550	50	0
			10	834.0	20500	50	0	5	841.2	20572	25	0
			10	831.6	20476	50	0	10	841.5	20575	50	0

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	3	825.6	20416	1	14	5	829.5	20455	1	0	23.90
	5	826.5	20425	1	24	3	830.4	20464	1	0	23.79
	5	826.8	20428	1	24	10	834.0	20500	1	0	24.46
	10	829.0	20450	1	49	5	836.2	20522	1	0	24.40
	10	***829.0***	***20450***	***1***	***49***	***10***	***838.9***	***20549***	***1***	***0***	***24.47***
Mid	3	834.1	20501	1	14	5	838.0	20540	1	0	23.38
	5	835.0	20510	1	24	3	838.9	20549	1	0	23.71
	5	831.8	20478	1	24	10	839.0	20550	1	0	24.36
	10	834.0	20500	1	49	5	841.2	20572	1	0	24.44
	10	***831.6***	***20476***	***1***	***49***	***10***	***841.5***	***20575***	***1***	***0***	***24.47***
High	3	842.6	20586	1	14	5	846.5	20625	1	0	22.64
	5	843.5	20595	1	24	3	847.4	20634	1	0	22.52
	5	836.8	20528	1	24	10	844.0	20600	1	0	24.45
	10	839.0	20550	1	49	5	846.2	20622	1	0	24.50
	10	***834.1***	***20501***	***1***	***49***	***10***	***844.0***	***20600***	***1***	***0***	***24.53***

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	***3***	***825.6***	***20416***	***15***	***0***	***5***	***829.5***	***20455***	***25***	***0***	***23.96***
	5	826.5	20425	25	0	3	830.4	20464	15	0	23.89
	5	826.8	20428	25	0	10	834.0	20500	50	0	22.53
	10	829.0	20450	50	0	5	836.2	20522	25	0	22.50
	10	829.0	20450	50	0	10	838.9	20549	50	0	22.48
Mid	***3***	***834.1***	***20501***	***15***	***0***	***5***	***838.0***	***20540***	***25***	***0***	***23.62***
	5	835.0	20510	25	0	3	838.9	20549	15	0	23.61
	5	831.8	20478	25	0	10	839.0	20550	50	0	22.45
	10	834.0	20500	50	0	5	841.2	20572	25	0	22.51
	10	831.6	20476	50	0	10	841.5	20575	50	0	22.47
High	***3***	***842.6***	***20586***	***15***	***0***	***5***	***846.5***	***20625***	***25***	***0***	***23.06***
	5	843.5	20595	25	0	3	847.4	20634	15	0	22.73
	5	836.8	20528	25	0	10	844.0	20600	50	0	22.52
	10	839.0	20550	50	0	5	846.2	20622	25	0	22.49
	10	834.1	20501	50	0	10	844.0	20600	50	0	22.53

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	829.0	20450	1	49	10	838.9	20549	1	0	23.73
Mid	10	831.6	20476	1	49	10	841.5	20575	1	0	23.68
High	10	834.1	20501	1	49	10	844.0	20600	1	0	24.15
Low	3	825.6	20416	15	0	5	829.5	20455	25	0	23.10
Mid	3	834.1	20501	15	0	5	838.0	20540	25	0	22.63
High	3	842.6	20586	15	0	5	846.5	20625	25	0	22.12

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	829.0	20450	1	49	10	838.9	20549	1	0	21.80
Mid	10	831.6	20476	1	49	10	841.5	20575	1	0	21.77
High	10	834.1	20501	1	49	10	844.0	20600	1	0	21.66
Low	3	825.6	20416	15	0	5	829.5	20455	25	0	22.04
Mid	3	834.1	20501	15	0	5	838.0	20540	25	0	21.67
High	3	842.6	20586	15	0	5	846.5	20625	25	0	21.18

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	829.0	20450	1	49	10	838.9	20549	1	0	19.72
Mid	10	831.6	20476	1	49	10	841.5	20575	1	0	19.67
High	10	834.1	20501	1	49	10	844.0	20600	1	0	19.62
Low	3	825.6	20416	15	0	5	829.5	20455	25	0	20.69
Mid	3	834.1	20501	15	0	5	838.0	20540	25	0	20.66
High	3	842.6	20586	15	0	5	846.5	20625	25	0	20.25

Note:

Modulation : 256QAM

8.2 EFFECTIVE RADIATED POWER

8.2.1 External Antenna

	PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
	BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
Low	3	20416	1/14	5	20455	1/0	91.10	30.04	121.14	H	0.239	23.79
	5	20425	1/24	3	20464	1/0	91.05	30.04	121.09	H	0.237	23.74
	5	20428	1/24	10	20500	1/0	93.09	30.09	123.18	H	0.383	25.83
	10	20450	1/49	5	20522	1/0	92.85	30.04	122.89	H	0.358	25.54
	10	20450	1/49	10	20549	1/0	92.93	29.99	122.92	H	0.361	25.57
Mid	3	20501	1/14	5	20540	1/0	90.90	29.98	120.88	H	0.225	23.53
	5	20510	1/24	3	20549	1/0	91.51	29.98	121.49	H	0.259	24.14
	5	20478	1/24	10	20550	1/0	93.10	29.98	123.08	H	0.374	25.73
	10	20500	1/49	5	20572	1/0	93.40	29.98	123.38	H	0.401	26.03
	10	20476	1/49	10	20575	1/0	93.01	29.98	122.99	H	0.366	25.64
High	3	20586	1/14	5	20625	1/0	91.00	30.07	121.07	H	0.236	23.72
	5	20595	1/24	3	20634	1/0	90.90	30.07	120.97	H	0.230	23.62
	5	20528	1/24	10	20600	1/0	93.51	29.98	123.49	H	0.411	26.14
	10	20550	1/49	5	20622	1/0	92.90	30.03	122.93	H	0.361	25.58
	10	20501	1/49	10	20600	1/0	93.45	29.98	123.43	H	0.406	26.08

Note:

1. Modulation : QPSK
2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
5	20428	1/24	10	20500	1/0	92.37	30.09	122.46	H	0.324	25.11
10	20500	1/49	5	20572	1/0	92.73	29.98	122.71	H	0.344	25.36
3	20586	1/14	5	20625	1/0	90.38	30.07	120.45	H	0.204	23.10
5	20595	1/24	3	20634	1/0	90.34	30.07	120.41	H	0.202	23.06
5	20528	1/24	10	20600	1/0	92.95	29.98	122.93	H	0.361	25.58
10	20550	1/49	5	20622	1/0	92.38	30.03	122.41	H	0.321	25.06
10	20501	1/49	10	20600	1/0	92.94	29.98	122.92	H	0.361	25.57

Note:

1. Modulation : 16QAM

2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
5	20428	1/24	10	20500	1/0	89.60	30.09	119.69	H	0.171	22.34
10	20500	1/49	5	20572	1/0	89.59	29.98	119.57	H	0.167	22.22
3	20586	1/14	5	20625	1/0	89.37	30.07	119.44	H	0.162	22.09
5	20595	1/24	3	20634	1/0	89.27	30.07	119.34	H	0.158	21.99
5	20528	1/24	10	20600	1/0	89.90	29.98	119.88	H	0.179	22.53
10	20550	1/49	5	20622	1/0	89.59	30.03	119.62	H	0.169	22.27
10	20501	1/49	10	20600	1/0	90.09	29.98	120.07	H	0.187	22.72

Note:

1. Modulation : 64QAM

2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
5	20428	1/24	10	20500	1/0	88.23	30.09	118.32	H	0.125	20.97
10	20500	1/49	5	20572	1/0	88.35	29.98	118.33	H	0.125	20.98
3	20586	1/14	5	20625	1/0	88.25	30.07	118.32	H	0.125	20.97
5	20595	1/24	3	20634	1/0	87.96	30.07	118.03	H	0.117	20.68
5	20528	1/24	10	20600	1/0	88.86	29.98	118.84	H	0.141	21.49
10	20550	1/49	5	20622	1/0	88.20	30.03	118.23	H	0.122	20.88
10	20501	1/49	10	20600	1/0	88.60	29.98	118.58	H	0.133	21.23

Note:

1. Modulation : 256QAM

2. Limit : < 7 Watts

8.2.2 Internal Antenna

	PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
	BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
Low	3	20416	1/14	5	20455	1/0	92.08	30.04	122.12	H	0.300	24.77
	5	20425	1/24	3	20464	1/0	92.13	30.04	122.17	H	0.303	24.82
	5	20428	1/24	10	20500	1/0	93.65	30.09	123.74	H	0.436	26.39
	10	20450	1/49	5	20522	1/0	92.43	30.04	122.47	H	0.325	25.12
	10	20450	1/49	10	20549	1/0	92.49	29.99	122.48	H	0.326	25.13
Mid	3	20501	1/14	5	20540	1/0	90.10	29.98	120.08	H	0.187	22.73
	5	20510	1/24	3	20549	1/0	90.33	29.98	120.31	H	0.198	22.96
	5	20478	1/24	10	20550	1/0	92.52	29.98	122.50	H	0.327	25.15
	10	20500	1/49	5	20572	1/0	92.47	29.98	122.45	H	0.324	25.10
	10	20476	1/49	10	20575	1/0	91.65	29.98	121.63	H	0.268	24.28
High	3	20586	1/14	5	20625	1/0	88.65	30.07	118.72	H	0.137	21.37
	5	20595	1/24	3	20634	1/0	87.70	30.07	117.77	H	0.110	20.42
	5	20528	1/24	10	20600	1/0	92.62	29.98	122.60	H	0.335	25.25
	10	20550	1/49	5	20622	1/0	90.75	30.03	120.78	H	0.220	23.43
	10	20501	1/49	10	20600	1/0	92.52	29.98	122.50	H	0.327	25.15

Note:

1. Modulation : QPSK
2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
3	20416	1/14	5	20455	1/0	91.06	30.04	121.10	H	0.237	23.75
5	20425	1/24	3	20464	1/0	91.80	30.04	121.84	H	0.281	24.49
5	20428	1/24	10	20500	1/0	92.95	30.09	123.04	H	0.371	25.69
10	20450	1/49	5	20522	1/0	91.95	30.04	121.99	H	0.291	24.64
10	20450	1/49	10	20549	1/0	91.96	29.99	121.95	H	0.288	24.60
5	20478	1/24	10	20550	1/0	91.82	29.98	121.80	H	0.279	24.45
5	20528	1/24	10	20600	1/0	91.94	29.98	121.92	H	0.286	24.57

Note:

1. Modulation : 16QAM

2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
3	20416	1/14	5	20455	1/0	89.91	30.04	119.95	H	0.182	22.60
5	20425	1/24	3	20464	1/0	90.78	30.04	120.82	H	0.222	23.47
5	20428	1/24	10	20500	1/0	90.58	30.09	120.67	H	0.215	23.32
10	20450	1/49	5	20522	1/0	89.10	30.04	119.14	H	0.151	21.79
10	20450	1/49	10	20549	1/0	89.13	29.99	119.12	H	0.150	21.77
5	20478	1/24	10	20550	1/0	89.00	29.98	118.98	H	0.146	21.63
5	20528	1/24	10	20600	1/0	88.80	29.98	118.78	H	0.139	21.43

Note:

1. Modulation : 64QAM

2. Limit : < 7 Watts

PCC			SCC			Measured Level (dBμV)	C.L+A.F+D.F (dB/m)	Total (dBμV/m)	Pol.	E.R.P	
BW [MHz]	Channel	RB/ Offset	BW [MHz]	Channel	RB/ Offset					W	dBm
3	20416	1/14	5	20455	1/0	88.90	30.04	118.94	H	0.144	21.59
5	20425	1/24	3	20464	1/0	89.59	30.04	119.63	H	0.169	22.28
5	20428	1/24	10	20500	1/0	88.85	30.09	118.94	H	0.144	21.59
10	20450	1/49	5	20522	1/0	88.08	30.04	118.12	H	0.119	20.77
10	20450	1/49	10	20549	1/0	88.15	29.99	118.14	H	0.120	20.79
5	20478	1/24	10	20550	1/0	87.99	29.98	117.97	H	0.115	20.62
5	20528	1/24	10	20600	1/0	87.66	29.98	117.64	H	0.107	20.29

Note:

1. Modulation : 256QAM

2. Limit : < 7 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	20450	829.0	1/49	10	20549	838.9	1/0	7.9866	28.591	-76.45	-47.85
Mid	10	20476	831.6	1/49	10	20575	841.5	1/0	8.2562	28.591	-75.83	-47.24
High	10	20501	834.1	1/49	10	20600	844.0	1/0	3.8286	27.976	-76.03	-48.06
Low	10	20450	829.0	1/0	10	20549	838.9	1/49	9.1351	28.591	-76.52	-47.93
Mid	10	20476	831.6	1/0	10	20575	841.5	1/49	8.2847	28.591	-75.86	-47.27
High	10	20501	834.1	1/0	10	20600	844.0	1/49	8.2418	28.591	-76.11	-47.51
Low	3	20416	825.6	15/0	5	20455	829.5	25/0	8.2797	28.591	-75.56	-46.97
Mid	3	20501	834.1	15/0	5	20540	838.0	25/0	8.8684	28.591	-75.78	-47.19
High	3	20586	842.6	15/0	5	20625	846.5	25/0	8.2802	28.591	-76.10	-47.51
Low	10	20450	829.0	50/0	10	20549	838.9	50/0	8.3026	28.591	-75.39	-46.80
Mid	10	20476	831.6	50/0	10	20575	841.5	50/0	4.9502	27.976	-76.09	-48.11
High	10	20501	834.1	50/0	10	20600	844.0	50/0	3.7578	27.976	-75.26	-47.28

Note:

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

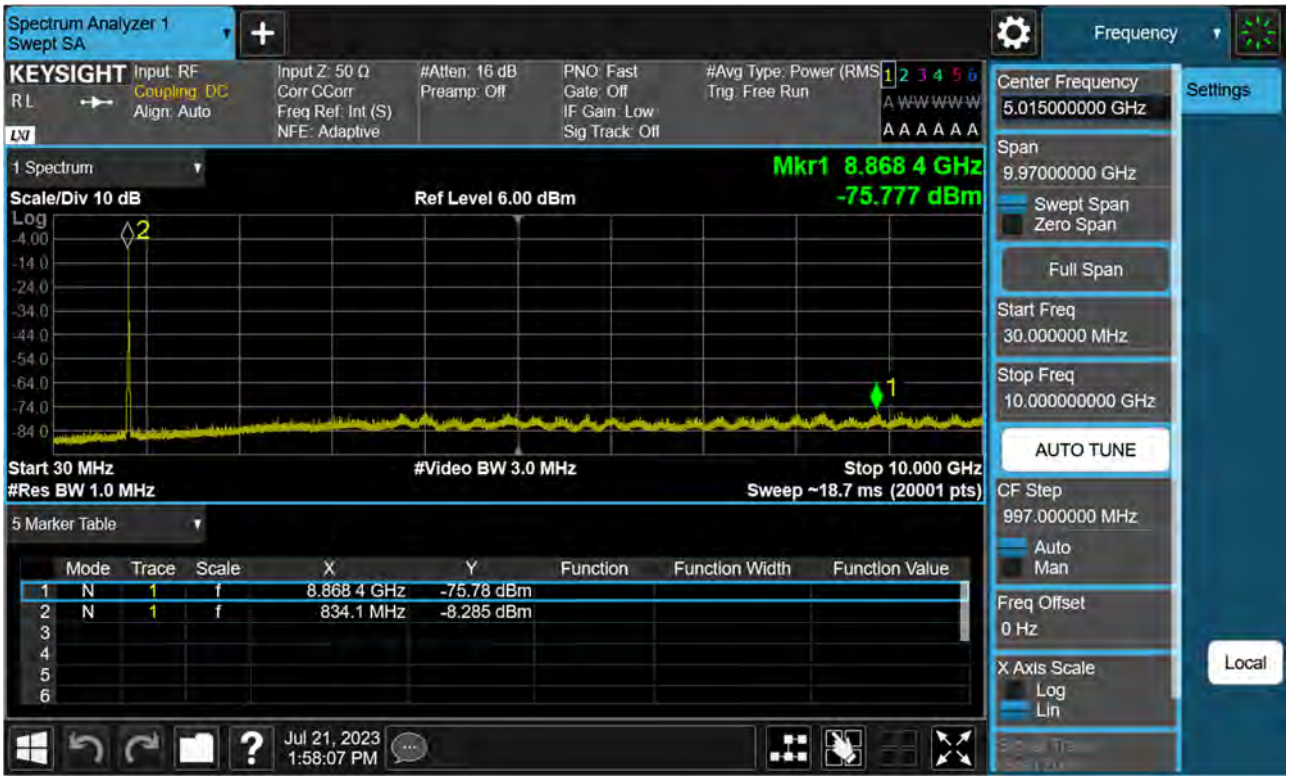
Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20(26.5)	30.131

4. Limit : -13.0 dBm

Frequency Range : 30 MHz ~ 10 GHz

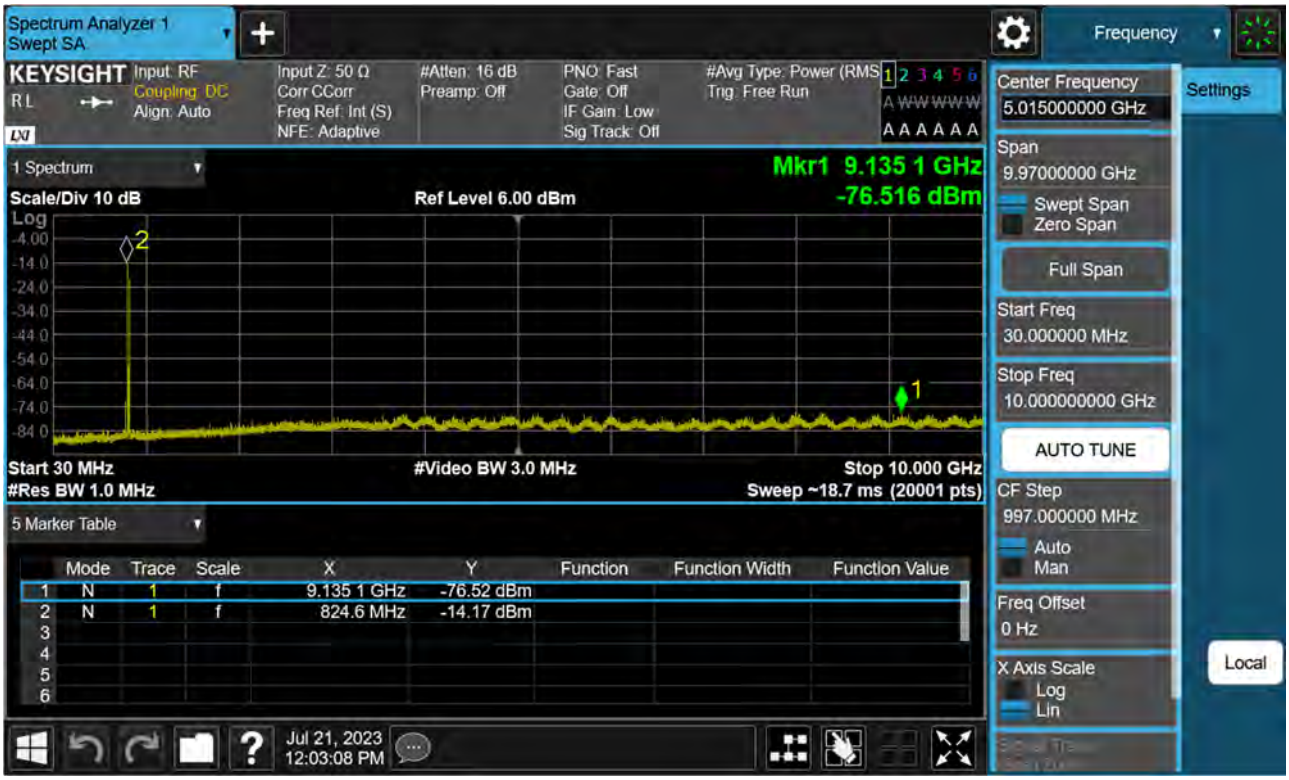
PCC 3 MHz Ch20416 RB15 Offset0 SCC 5 MHz Ch20455 RB25 Offset0

PCC 3 MHz Ch20501 RB15 Offset0 SCC 5 MHz Ch20540 RB25 Offset0

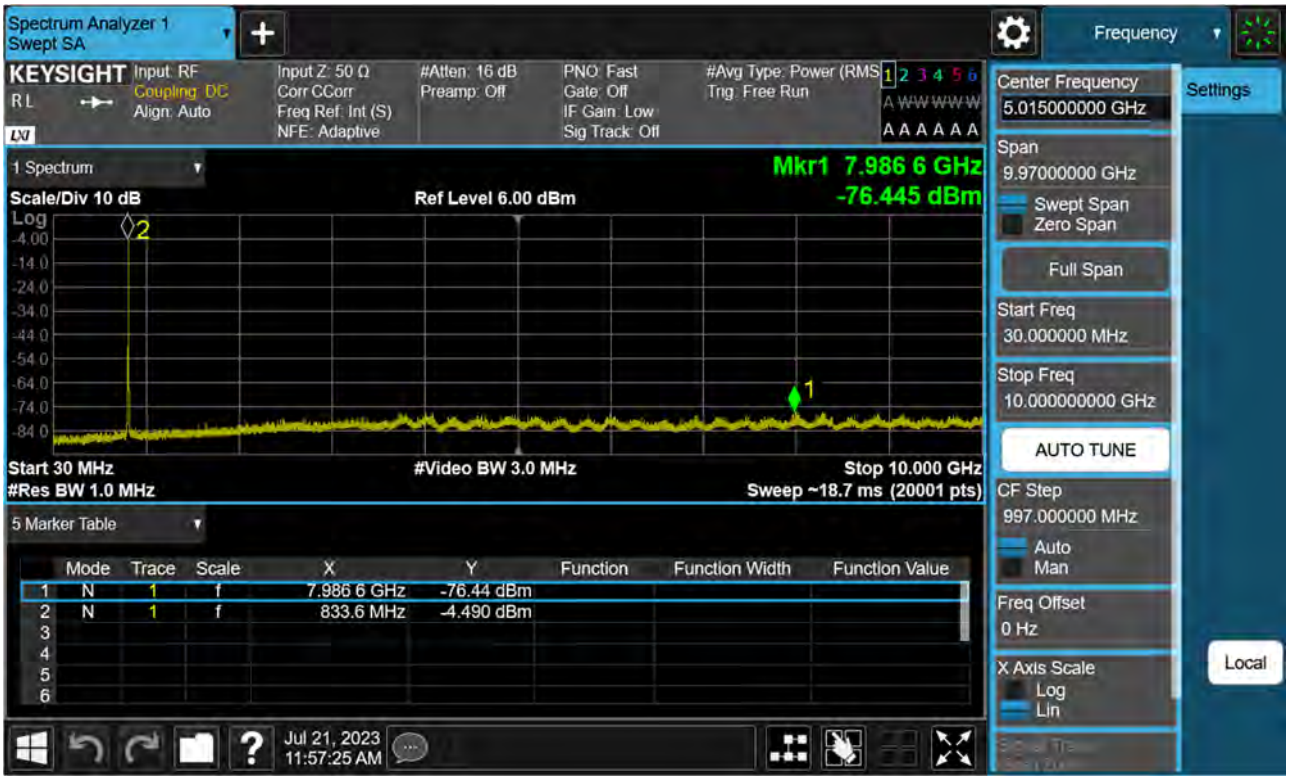


PCC 3 MHz Ch20586 RB15 Offset0 SCC 5 MHz Ch20625 RB25 Offset0

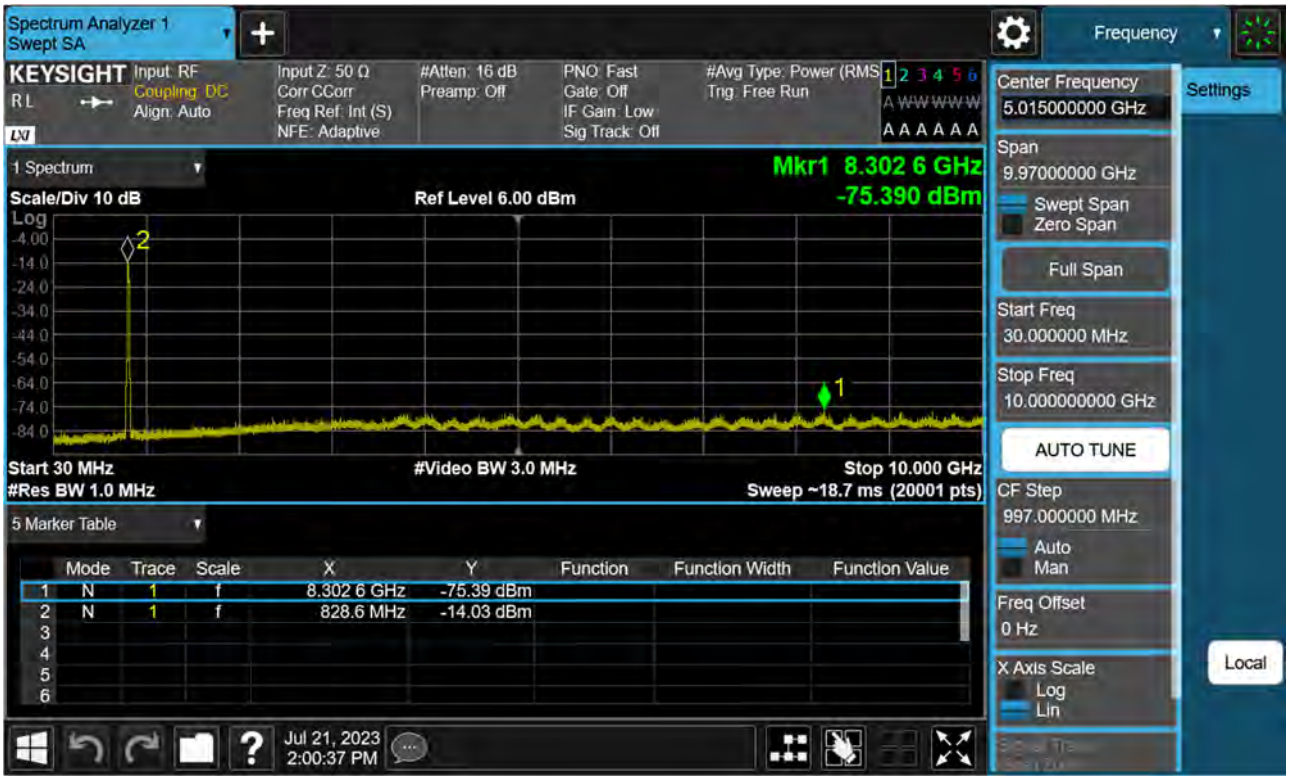
PCC 10 MHz Ch20450 RB1 Offset0 SCC 10 MHz Ch20549 RB1 Offset49



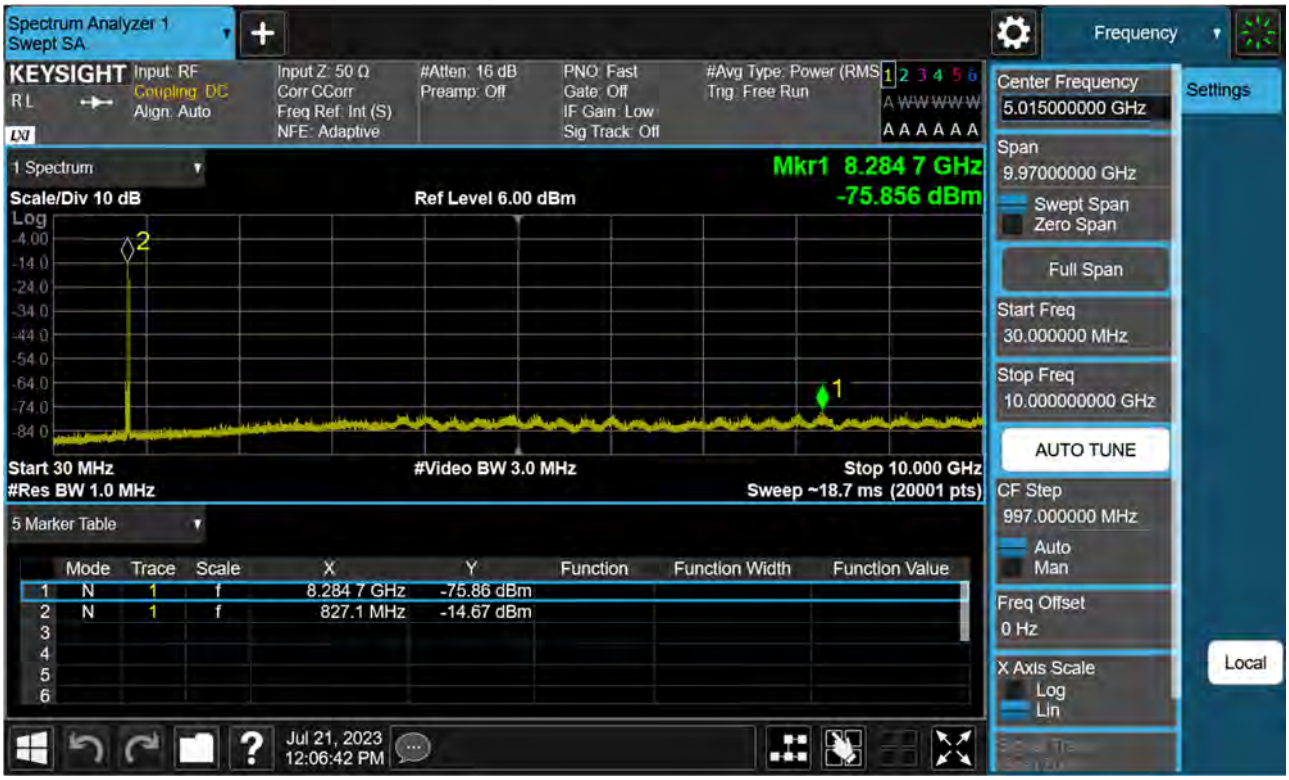
PCC 10 MHz Ch20450 RB1 Offset49 SCC 10 MHz Ch20549 RB1 Offset0



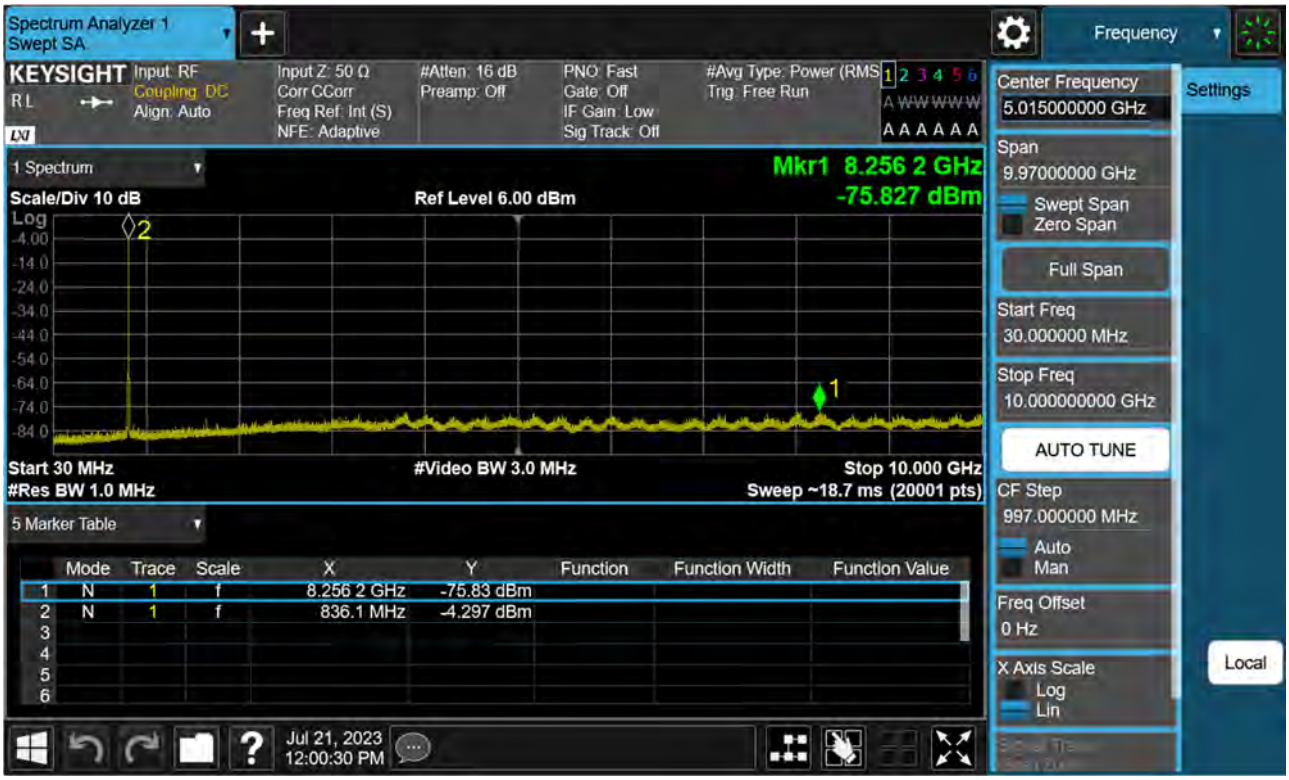
PCC 10 MHz Ch20450 RB50 Offset0 SCC 10 MHz Ch20549 RB50 Offset0



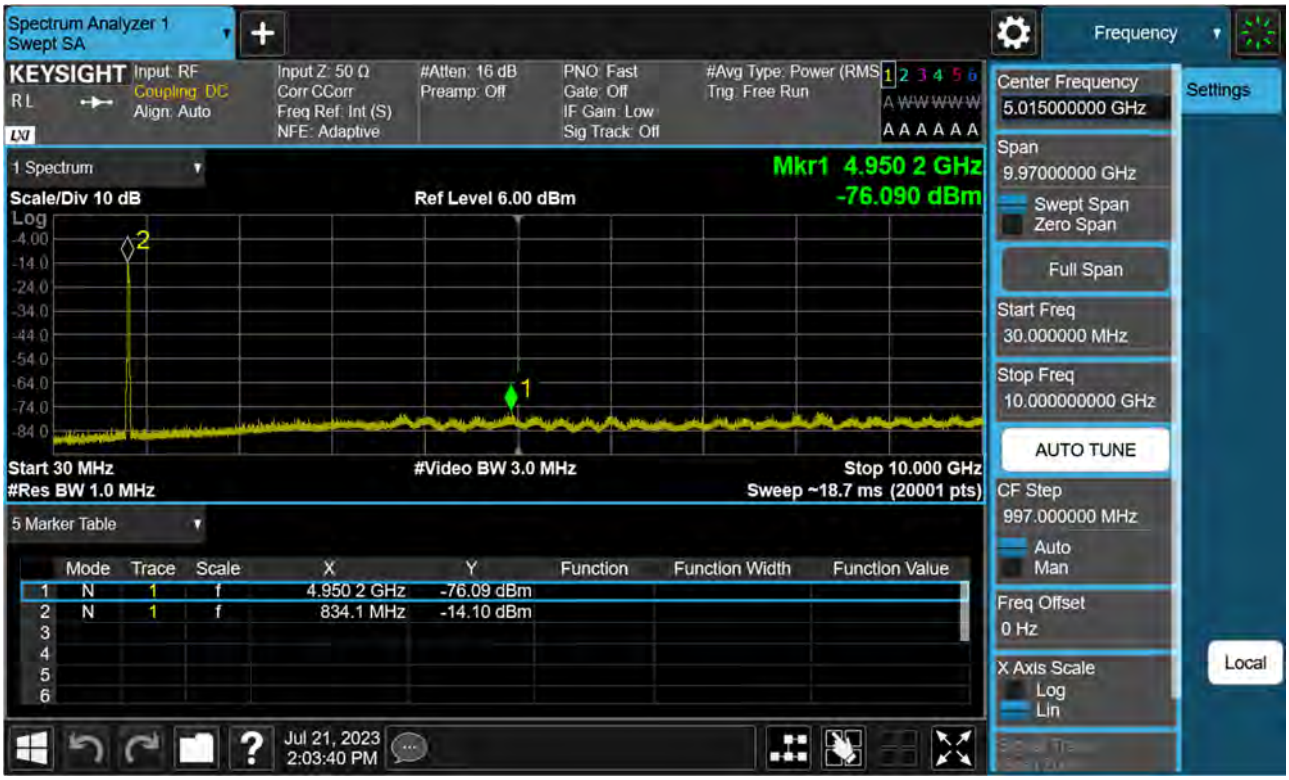
PCC 10 MHz Ch20476 RB1 Offset0 SCC 10 MHz Ch20575 RB1 Offset49



PCC 10 MHz Ch20476 RB1 Offset49 SCC 10 MHz Ch20575 RB1 Offset0

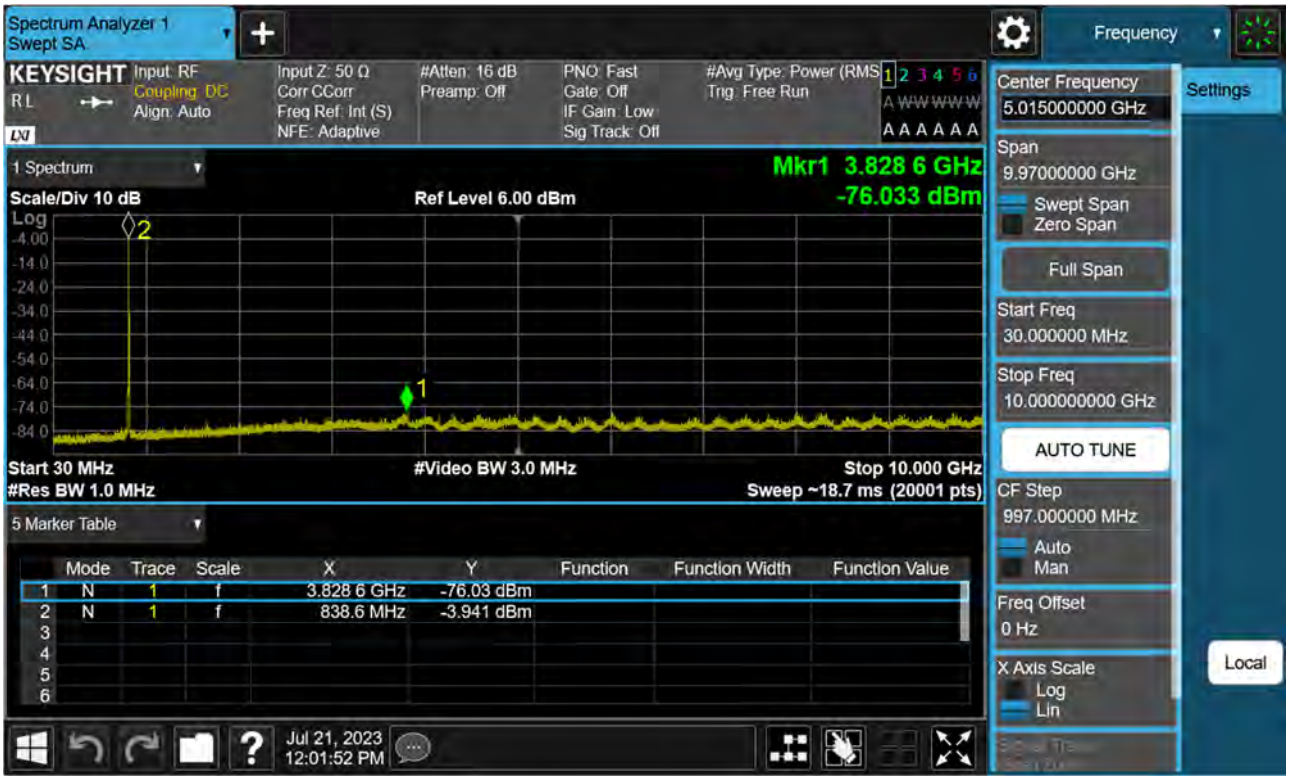


PCC 10 MHz Ch20476 RB50 Offset0 SCC 10 MHz Ch20575 RB50 Offset0

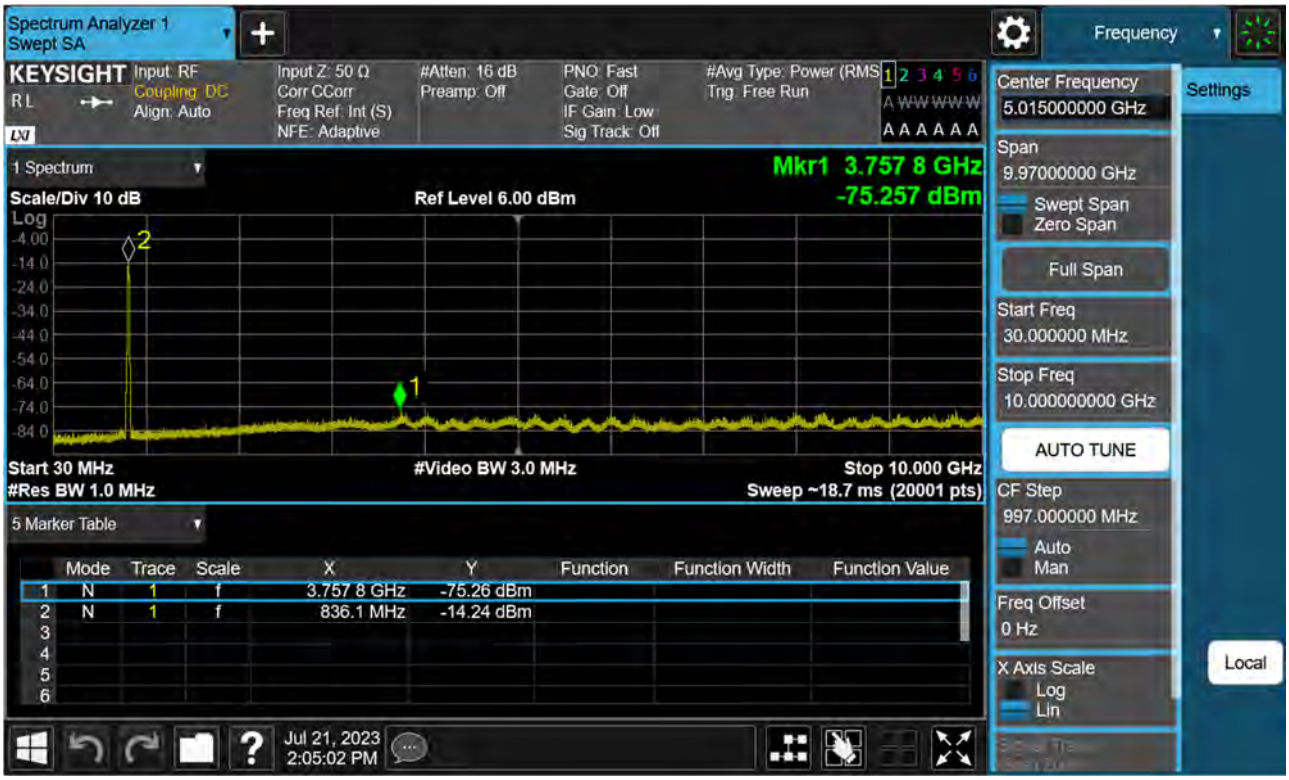


PCC 10 MHz Ch20501 RB1 Offset0 SCC 10 MHz Ch20600 RB1 Offset49

PCC 10 MHz Ch20501 RB1 Offset49 SCC 10 MHz Ch20600 RB1 Offset0



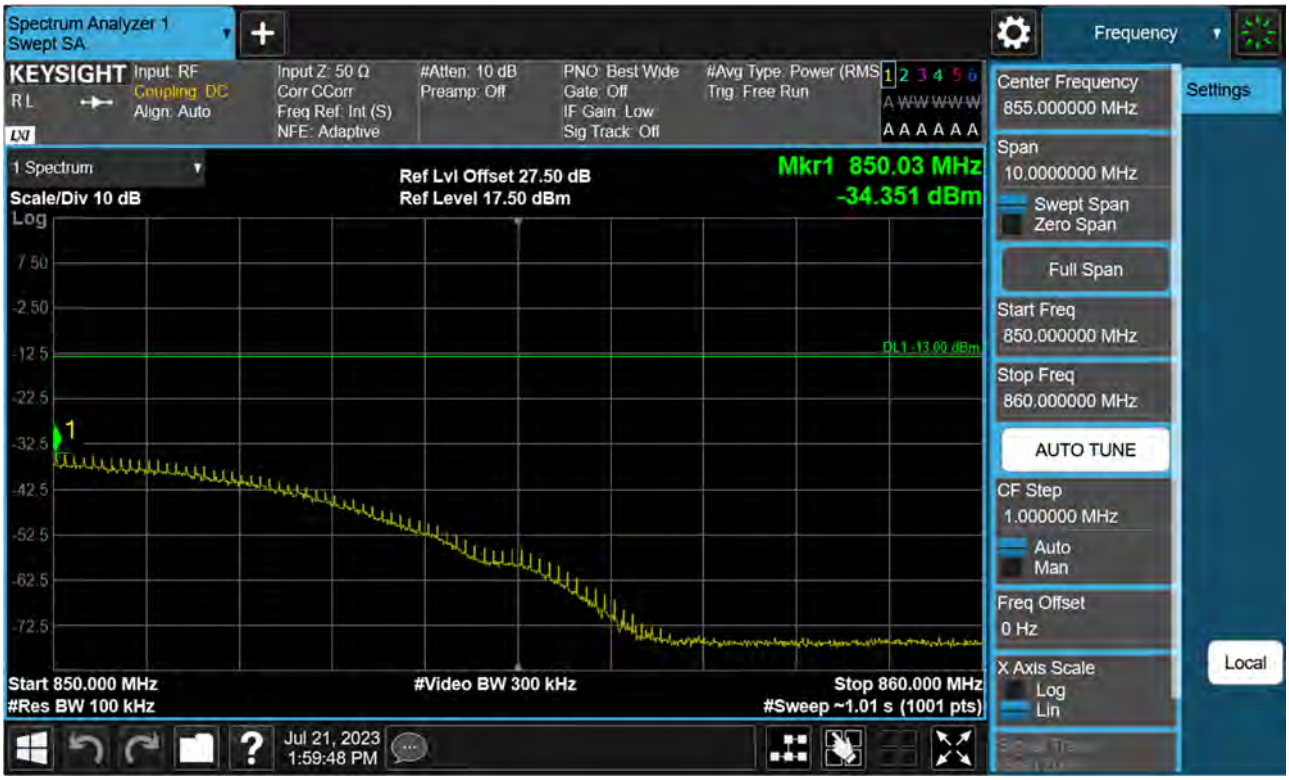
PCC 10 MHz Ch20501 RB50 Offset0 SCC 10 MHz Ch20600 RB50 Offset0



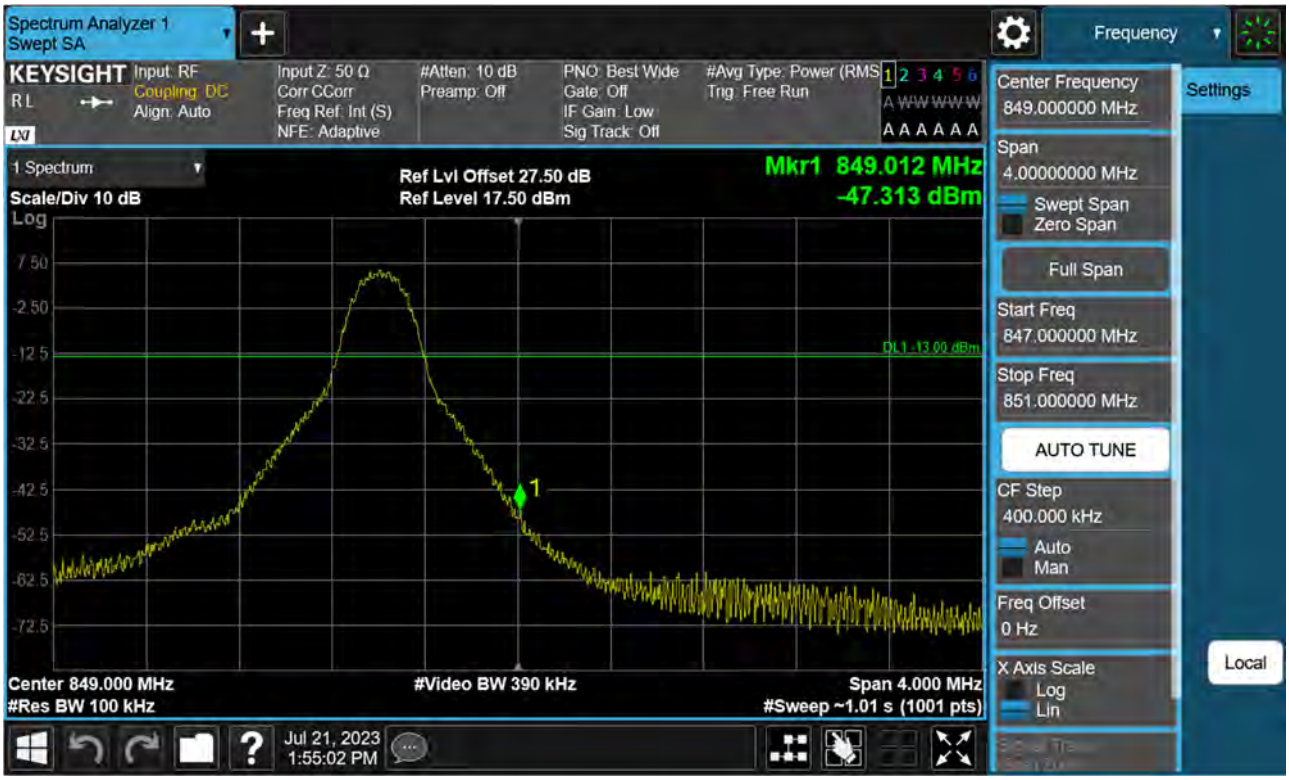
8.4 Band Edge

Highest Channel_PCC 3 MHz Ch20586 RB15 Offset0 SCC 5 MHz Ch20625 RB25 Offset0(1)

Highest Channel_PCC 3 MHz Ch20586 RB15 Offset0 SCC 5 MHz Ch20625 RB25 Offset0(2)



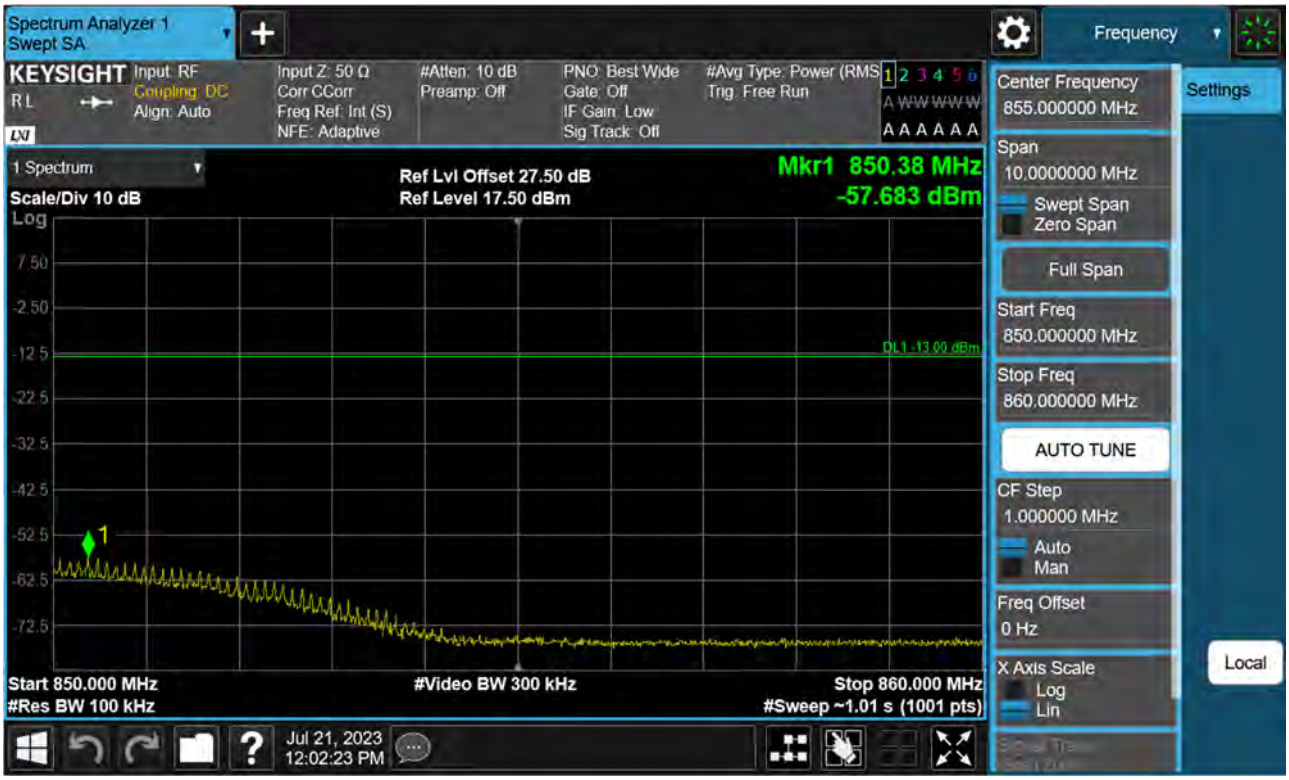
Highest Channel_PCC 10 MHz Ch20501 RB1 Offset0 SCC 10 MHz Ch20600 RB1 Offset49(1)



Highest Channel_PCC 10 MHz Ch20501 RB1 Offset0 SCC 10 MHz Ch20600 RB1 Offset49(2)

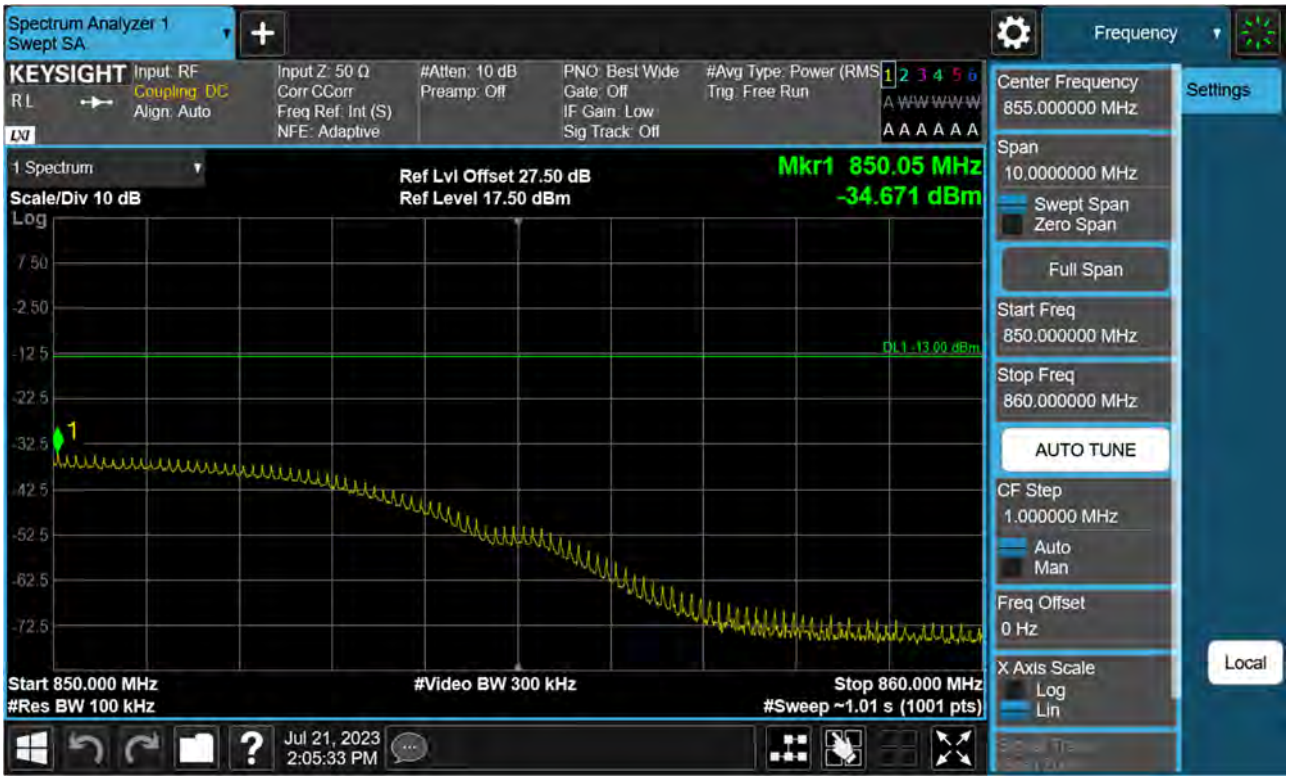
Highest Channel_PCC 10 MHz Ch20501 RB1 Offset49 SCC 10 MHz Ch20600 RB1 Offset0(1)

Highest Channel_PCC 10 MHz Ch20501 RB1 Offset49 SCC 10 MHz Ch20600 RB1 Offset0(2)



Highest Channel_PCC 10 MHz Ch20501 RB50 Offset0 SCC 10 MHz Ch20600 RB50 Offset0(1)

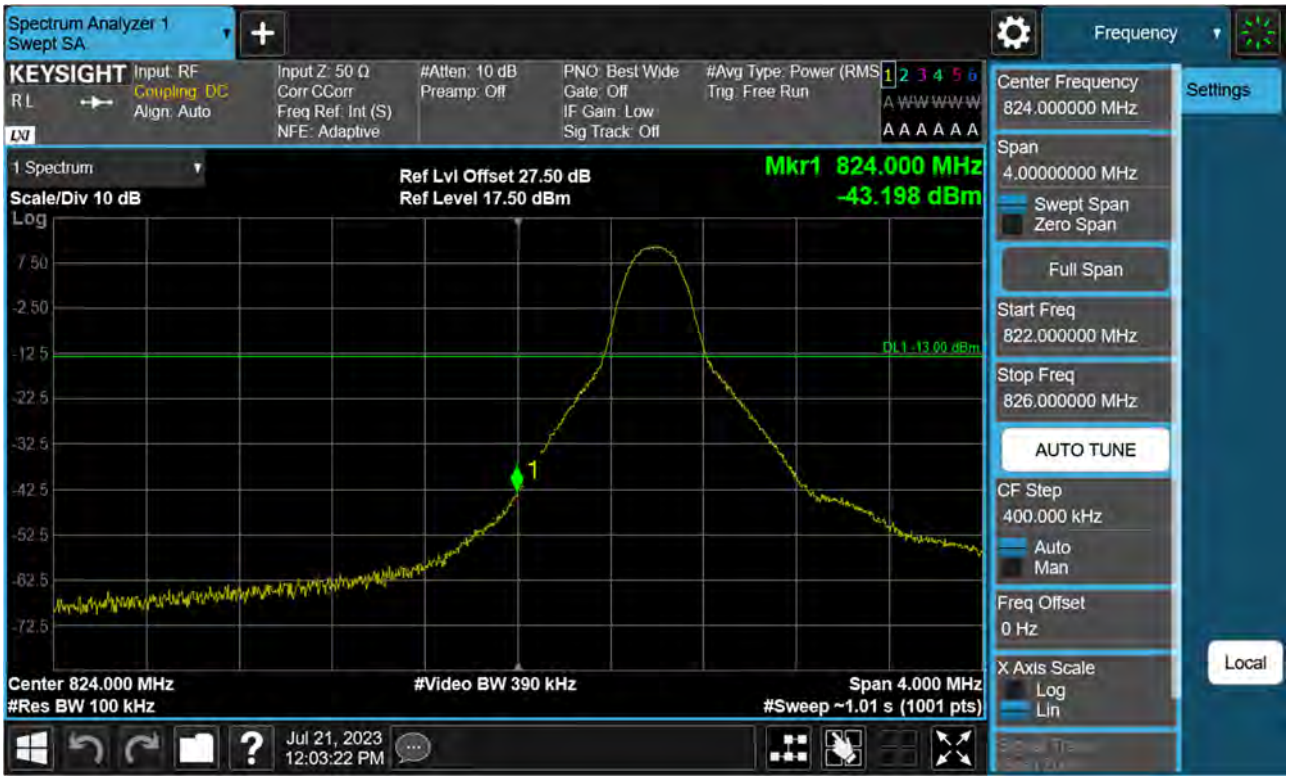
Highest Channel_PCC 10 MHz Ch20501 RB50 Offset0 SCC 10 MHz Ch20600 RB50 Offset0(2)



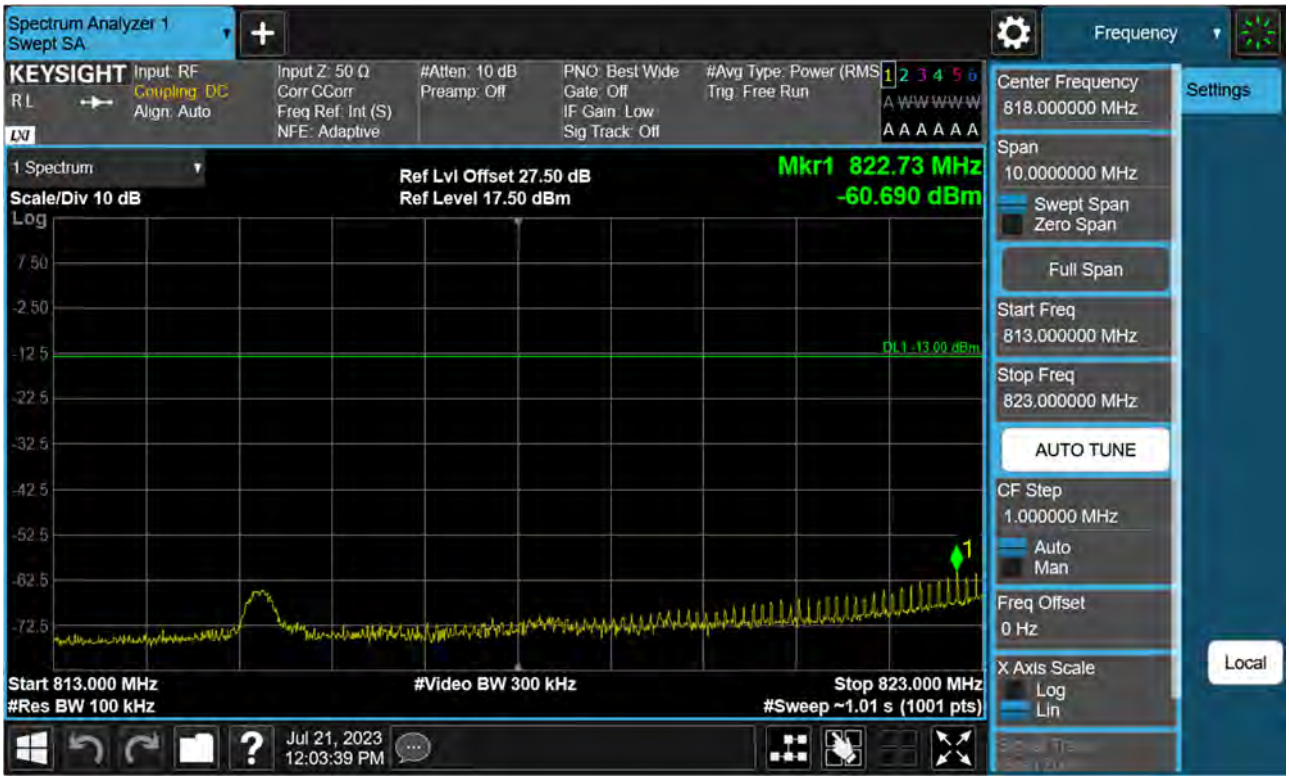
Lowest Channel_PCC 3 MHz Ch20416 RB15 Offset0 SCC 5 MHz Ch20455 RB25 Offset0(1)

Lowest Channel_PCC 3 MHz Ch20416 RB15 Offset0 SCC 5 MHz Ch20455 RB25 Offset0(2)

Lowest Channel_PCC 10 MHz Ch20450 RB1 Offset0 SCC 10 MHz Ch20549 RB1 Offset49(1)



Lowest Channel_PCC 10 MHz Ch20450 RB1 Offset0 SCC 10 MHz Ch20549 RB1 Offset49(2)



Lowest Channel_PCC 10 MHz Ch20450 RB1 Offset49 SCC 10 MHz Ch20549 RB1 Offset0(1)

Lowest Channel_PCC 10 MHz Ch20450 RB1 Offset49 SCC 10 MHz Ch20549 RB1 Offset0(2)

Lowest Channel_PCC 10 MHz Ch20450 RB50 Offset0 SCC 10 MHz Ch20549 RB50 Offset0(1)

Lowest Channel_PCC 10 MHz Ch20450 RB50 Offset0 SCC 10 MHz Ch20549 RB50 Offset0(2)

8.5 Frequency Stability / Variation Of Ambient Temperature

▣ PCC Channel:	20501	
▣ PCC Frequency:	834.1	MHz
▣ PCC BandWidth:	3	MHz
▣ SCC Channel:	20540	
▣ SCC Frequency:	838.0	MHz
▣ SCC BandWidth:	5	MHz
▣ Voltage :	13.500	VDC
▣ LIMIT:	± 0.000 25 % or 2.5 ppm	

Voltage (%)	Power (VDC)	Temp. (°C)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100 %	13.500	+20(Ref)	0.044	0.049	834.10000	838.00001
100 %		-30	-0.059	0.045	834.09987	837.99994
100 %		-20	0.046	0.048	834.09995	837.99995
100 %		-10	0.043	0.037	834.10002	837.99999
100 %		0	-0.038	-0.062	834.09995	837.99988
100 %		10	0.046	0.045	834.09996	838.00002
100 %		30	0.049	0.045	834.09995	837.99999
100 %		40	-0.057	-0.052	834.09991	837.99988
100 %		50	-0.057	-0.057	834.09988	837.99993
85%	11.475	20	0.023	-0.038	834.09998	837.99995
115%	15.525	20	0.043	-0.050	834.09997	837.99986

▣ PCC Channel: 20510
▣ PCC Frequency: 835.0 MHz
▣ PCC BandWidth: 5 MHz
▣ SCC Channel: 20549
▣ SCC Frequency: 838.9 MHz
▣ SCC BandWidth: 3 MHz
▣ Voltage : 13.500 VDC
▣ LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage	Power	Temp.	PPM		Frequency Error (MHz)	
(%)	(VDC)	(°C)	PCC	SCC	PCC	SCC
100 %	13.500	+20(Ref)	0.046	0.038	835.00001	838.90002
100 %		-30	0.049	-0.052	835.00001	838.89987
100 %		-20	0.036	0.027	834.99998	838.90003
100 %		-10	0.047	0.047	835.00001	838.89996
100 %		0	0.043	0.036	834.99998	838.89995
100 %		10	0.041	-0.049	835.00000	838.89993
100 %		30	0.043	-0.055	835.00000	838.89992
100 %		40	0.038	0.050	834.99995	838.90003
100 %		50	0.032	0.026	834.99995	838.89997
85%	11.475	20	0.031	0.025	834.99997	838.89996
115%	15.525	20	0.030	0.045	834.99998	838.89994

▣ PCC Channel: 20478
▣ PCC Frequency: 831.8 MHz
▣ PCC BandWidth: 5 MHz
▣ SCC Channel: 20550
▣ SCC Frequency: 839.0 MHz
▣ SCC BandWidth: 10 MHz
▣ Voltage : 13.500 VDC
▣ LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage	Power	Temp.	PPM		Frequency Error (MHz)	
(%)	(VDC)	(°C)	PCC	SCC	PCC	SCC
100 %	13.500	+20(Ref)	-0.055	0.051	831.79991	839.00002
100 %		-30	0.049	0.035	831.80003	838.99998
100 %		-20	0.029	-0.045	831.79997	838.99991
100 %		-10	-0.051	-0.046	831.79987	838.99991
100 %		0	0.047	0.034	831.79995	839.00001
100 %		10	-0.042	0.046	831.79995	839.00001
100 %		30	0.047	0.033	831.80001	838.99994
100 %		40	-0.052	-0.050	831.79994	838.99997
100 %		50	0.033	-0.063	831.79994	838.99992
85%	11.475	20	0.030	-0.025	831.79995	838.99994
115%	15.525	20	0.038	-0.045	831.79994	838.99987

▣ PCC Channel: 20500
▣ PCC Frequency: 834.0 MHz
▣ PCC BandWidth: 10 MHz
▣ SCC Channel: 20572
▣ SCC Frequency: 841.2 MHz
▣ SCC BandWidth: 5 MHz
▣ Voltage : 13.500 VDC
▣ LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100 %	13.500	+20(Ref)	-0.043	-0.045	833.99989	841.19990
100 %		-30	0.042	0.046	834.00000	841.19997
100 %		-20	0.052	-0.059	833.99997	841.19994
100 %		-10	0.026	0.043	833.99993	841.20002
100 %		0	0.033	0.035	834.00002	841.20001
100 %		10	-0.045	0.052	833.99992	841.19998
100 %		30	-0.048	0.047	833.99997	841.20001
100 %		40	-0.046	0.044	833.99996	841.19995
100 %		50	-0.043	-0.056	833.99995	841.19991
85%	11.475	20	-0.045	-0.013	833.99994	841.19995
115%	15.525	20	-0.048	0.036	833.99989	841.20003

▣ PCC Channel: 20476
▣ PCC Frequency: 831.6 MHz
▣ PCC BandWidth: 10 MHz
▣ SCC Channel: 20575
▣ SCC Frequency: 841.5 MHz
▣ SCC BandWidth: 10 MHz
▣ Voltage : 13.500 VDC
▣ LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	PPM		Frequency Error (MHz)	
			PCC	SCC	PCC	SCC
100 %	13.500	+20(Ref)	0.041	-0.038	831.59996	841.49989
100 %		-30	-0.054	-0.039	831.59995	841.49996
100 %		-20	0.045	0.040	831.60000	841.49998
100 %		-10	0.031	0.033	831.60000	841.49998
100 %		0	0.039	0.038	831.59999	841.50001
100 %		10	0.033	0.042	831.59994	841.49998
100 %		30	0.037	0.038	831.59994	841.49998
100 %		40	0.038	0.037	831.60001	841.49994
100 %		50	0.028	-0.039	831.60003	841.49987
85%	11.475	20	0.012	0.024	831.60001	841.50001
115%	15.525	20	0.034	0.045	831.59999	841.50003

8.6 Radiated Spurious Emissions

8.6.1 External Antenna

- ▣ PCC Channel : 20428 (826.8 MHz)
- ▣ PCC BW(MHz) : 5
- ▣ PCC RB/ RB Offset : 1/ 24
- ▣ SCC Channel : 20500 (834.0 MHz)
- ▣ SCC BW(MHz) : 10
- ▣ SCC RB/ RB Offset : 1/ 0
- ▣ DISTANCE: 3 meters
- ▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 660.80	55.63	-18.56	37.07	V	-58.13
2 491.20	54.03	-15.04	38.99	V	-56.21
3 321.60	56.82	-13.49	43.33	V	-51.87
4 152.00	56.40	-11.02	45.38	V	-49.82
4 982.40	52.00	-7.97	44.03	V	-51.17

▣ PCC Channel : 20500 (834.0 MHz)

▣ PCC BW(MHz) : 10

▣ PCC RB/ RB Offset : 1/ 49

▣ SCC Channel : 20572 (841.2 MHz)

▣ SCC BW(MHz) : 5

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 675.20	54.83	-18.57	36.26	V	-58.94
2 512.80	54.71	-14.87	39.84	V	-55.36
3 350.40	55.57	-13.55	42.02	V	-53.18
4 188.00	54.38	-10.81	43.57	V	-51.63
5 025.60	52.92	-7.78	45.14	V	-50.06

▣ PCC Channel : 20528 (836.8 MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 20600 (844.0 MHz)

▣ SCC BW(MHz) : 10

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 680.80	54.98	-18.55	36.43	V	-58.77
2 521.20	54.59	-14.85	39.75	V	-55.46
3 361.60	56.80	-13.55	43.25	V	-51.95
4 202.00	53.84	-10.63	43.21	V	-51.99
5 042.40	52.09	-7.72	44.37	V	-50.83

8.6.2 Internal Antenna

- ▣ PCC Channel : 20428 (826.8 MHz)
- ▣ PCC BW(MHz) : 5
- ▣ PCC RB/ RB Offset : 1/ 24
- ▣ SCC Channel : 20500 (834.0 MHz)
- ▣ SCC BW(MHz) : 10
- ▣ SCC RB/ RB Offset : 1/ 0
- ▣ DISTANCE: 3 meters
- ▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 660.80	58.97	-18.32	40.65	V	-54.55
2 491.20	54.57	-14.64	39.93	H	-55.27
3 321.60	53.54	-12.05	41.49	H	-53.71
4 152.00	53.23	-9.51	43.72	H	-51.48
4 982.40	53.23	-5.63	47.60	V	-47.60

▣ PCC Channel : 20478 (831.8 MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 20550 (839.0 MHz)

▣ SCC BW(MHz) : 10

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 670.80	61.01	-18.59	42.42	V	-52.78
2 506.20	54.05	-14.64	39.41	V	-55.79
3 341.60	52.37	-12.03	40.34	V	-54.86
4 177.00	57.69	-9.33	48.36	V	-46.84
5 012.40	52.43	-5.41	47.02	V	-48.18

▣ PCC Channel : 20528 (836.8 MHz)

▣ PCC BW(MHz) : 5

▣ PCC RB/ RB Offset : 1/ 24

▣ SCC Channel : 20600 (844.0 MHz)

▣ SCC BW(MHz) : 10

▣ SCC RB/ RB Offset : 1/ 0

▣ DISTANCE: 3 meters

▣ LIMIT: -13.0 dBm

Freq.(MHz)	Measured Level (dBμV)	A.F+C.L+D.F+H.P.F-A.G (dB/m)	Total (dBμV/m)	Pol.	Result (dBm)
1 680.80	57.54	-18.60	38.94	V	-56.26
2 521.20	55.01	-14.72	40.29	V	-54.91
3 361.60	52.91	-12.03	40.88	V	-54.32
4 202.00	52.11	-9.15	42.96	V	-52.24
5 042.40	51.45	-5.52	45.93	V	-49.27

8.7 Occupied Bandwidth

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	QPSK	15/ 0	5	20540	838.0	QPSK	25/ 0	7.4651
5	20510	835.0	QPSK	25/ 0	3	20549	838.9	QPSK	15/ 0	7.4861
5	20478	831.8	QPSK	25/ 0	10	20550	839.0	QPSK	50/ 0	13.850
10	20500	834.0	QPSK	50/ 0	5	20572	841.2	QPSK	25/ 0	13.918
10	20476	831.6	QPSK	50/ 0	10	20575	841.5	QPSK	50/ 0	18.657

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	16QAM	15/ 0	5	20540	838.0	16QAM	25/ 0	7.4277
5	20510	835.0	16QAM	25/ 0	3	20549	838.9	16QAM	15/ 0	7.4780
5	20478	831.8	16QAM	25/ 0	10	20550	839.0	16QAM	50/ 0	13.786
10	20500	834.0	16QAM	50/ 0	5	20572	841.2	16QAM	25/ 0	13.871
10	20476	831.6	16QAM	50/ 0	10	20575	841.5	16QAM	50/ 0	18.652

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	64QAM	15/ 0	5	20540	838.0	64QAM	25/ 0	7.4985
5	20510	835.0	64QAM	25/ 0	3	20549	838.9	64QAM	15/ 0	7.4721
5	20478	831.8	64QAM	25/ 0	10	20550	839.0	64QAM	50/ 0	13.854
10	20500	834.0	64QAM	50/ 0	5	20572	841.2	64QAM	25/ 0	13.882
10	20476	831.6	64QAM	50/ 0	10	20575	841.5	64QAM	50/ 0	18.683

PCC					SCC					Data (MHz)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	256QAM	15/ 0	5	20540	838.0	256QAM	25/ 0	7.4645
5	20510	835.0	256QAM	25/ 0	3	20549	838.9	256QAM	15/ 0	7.4706
5	20478	831.8	256QAM	25/ 0	10	20550	839.0	256QAM	50/ 0	13.818
10	20500	834.0	256QAM	50/ 0	5	20572	841.2	256QAM	25/ 0	13.878
10	20476	831.6	256QAM	50/ 0	10	20575	841.5	256QAM	50/ 0	18.702

Note:

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

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(QPSK)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(16QAM)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(64QAM)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 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	
3	20501	834.1	QPSK	15/ 0	5	20540	838.0	QPSK	25/ 0	5.59
5	20510	835.0	QPSK	25/ 0	3	20549	838.9	QPSK	15/ 0	5.64
5	20478	831.8	QPSK	25/ 0	10	20550	839.0	QPSK	50/ 0	6.15
10	20500	834.0	QPSK	50/ 0	5	20572	841.2	QPSK	25/ 0	6.18
10	20476	831.6	QPSK	50/ 0	10	20575	841.5	QPSK	50/ 0	6.14

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	16QAM	15/ 0	5	20540	838.0	16QAM	25/ 0	6.39
5	20510	835.0	16QAM	25/ 0	3	20549	838.9	16QAM	15/ 0	6.38
5	20478	831.8	16QAM	25/ 0	10	20550	839.0	16QAM	50/ 0	6.72
10	20500	834.0	16QAM	50/ 0	5	20572	841.2	16QAM	25/ 0	6.79
10	20476	831.6	16QAM	50/ 0	10	20575	841.5	16QAM	50/ 0	6.75

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	64QAM	15/ 0	5	20540	838.0	64QAM	25/ 0	6.94
5	20510	835.0	64QAM	25/ 0	3	20549	838.9	64QAM	15/ 0	6.93
5	20478	831.8	64QAM	25/ 0	10	20550	839.0	64QAM	50/ 0	6.97
10	20500	834.0	64QAM	50/ 0	5	20572	841.2	64QAM	25/ 0	6.97
10	20476	831.6	64QAM	50/ 0	10	20575	841.5	64QAM	50/ 0	6.98

PCC					SCC					Data (dBm)
BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	BW [MHz]	Ch	Freq [MHz]	Mod	RB/ Offset	
3	20501	834.1	256QAM	15/ 0	5	20540	838.0	256QAM	25/ 0	7.07
5	20510	835.0	256QAM	25/ 0	3	20549	838.9	256QAM	15/ 0	7.06
5	20478	831.8	256QAM	25/ 0	10	20550	839.0	256QAM	50/ 0	7.04
10	20500	834.0	256QAM	50/ 0	5	20572	841.2	256QAM	25/ 0	7.09
10	20476	831.6	256QAM	50/ 0	10	20575	841.5	256QAM	50/ 0	7.01

Note:

- In order to simplify the report, attached plots were only Max.Bandwidth(10+10)
- Peak- to- Average Ratio is not required. These values are reported for information only.

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(QPSK)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(16QAM)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(64QAM)

PCC 10 MHz Ch20476 RB50 Offset0, SCC 10 MHz Ch20575 RB50 Offset0_(256QAM)

9. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2310-FC004-P