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FCC 5G mmWave 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:
January 14, 2022

Test Site/Location:
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA

Report No.: HCT-RF-2112-FC055-R1

FCC ID:	**A3LSMA536V**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**
Model:	SM-A536V
EUT Type:	Mobile phone
Frequency Range:	27.5 GHz ~ 28.35 GHz, 37 GHz ~ 40 GHz
Modulation type:	PI/2 BPSK(DFT-s Only), QPSK, 16QAM, 64QAM
FCC Classification:	Part 30 Mobile Transmitter (5GM)
FCC Rule Part(s):	Part 30
Test Procedure(s):	ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 842590 D01 V01r02

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

REVIEWED BY

Report prepared by : Beom Jin Cho 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-2112-FC055	January 05, 2022	- First Approval Report
HCT-RF-2112-FC055-R1	January 14, 2022	- Revised the test results table on page 44~45.

Table of Contents

1. EUT DESCRIPTION

Model	SM-A536V
Additional Model	-
EUT Type	Mobile phone
Power Supply	DC 4.20 V
Date(s) of Tests	December 01, 2021 ~ December 29, 2021
Band	n261: 27,500 MHz ~ 28,350 MHz(TDD) n260: 37,000 MHz ~ 40,000 MHz(TDD)
Channel Bandwidths	50 MHz/100 MHz
Carrier Specification	1CC
Multiple transmit	SISO, SISO Dual, MIMO
Channel	Low, Mid, High
SCS	120 kHz
OFDM	CP-OFDM, DFT-s-OFDM
RB size	1 RB(Offset: low, mid, high), half RB, Full RB
Modulation	PI/2 BPSK(DFT-s Only), QPSK, 16QAM, 64QAM
Antenna Specification	Antenna Designation - L patch: module 0 Antenna Size - 23.8 mm x 3.5 mm x 2.05 mm Antenna Gain - L Patch antennas are 1x5 dual-polarized element array patch antennas with a maximum array gain of 9.98 dBi on n261. - L Patch antennas are 1x5 dual-polarized element array patch antennas with a maximum array gain of 9.01 dBi on n260.

1.1 MAXIMUM EIRP POWER

n261 Band								
Mode	Antenna	Bandwidth (MHz)	CCs Active	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
					(W)	(dBm)		
SISO	L patch: module 0	50	1	27500 - 28350	1.028	30.12	47M2G7D	BPSK
SISO	L patch: module 0	50	1	27500 - 28350	0.991	29.96	46M9G7D	QPSK
SISO	L patch: module 0	50	1	27500 - 28350	0.611	27.86	47M1W7D	16QAM
SISO	L patch: module 0	50	1	27500 - 28350	0.378	25.78	46M9W7D	64QAM
SISO Dual	L patch: module 0	50	1	27500 - 28350	1.401	31.47	46M2G7D	BPSK
SISO Dual	L patch: module 0	50	1	27500 - 28350	1.303	31.15	46M1G7D	QPSK
SISO Dual	L patch: module 0	50	1	27500 - 28350	0.791	28.98	46M2W7D	16QAM
SISO Dual	L patch: module 0	50	1	27500 - 28350	0.560	27.48	46M0W7D	64QAM
SISO	L patch: module 0	100	1	27500 - 28350	1.007	30.03	92M1G7D	BPSK
SISO	L patch: module 0	100	1	27500 - 28350	1.127	30.52	92M1G7D	QPSK
SISO	L patch: module 0	100	1	27500 - 28350	0.569	27.55	92M0W7D	16QAM
SISO	L patch: module 0	100	1	27500 - 28350	0.368	25.66	92M1W7D	64QAM
SISO Dual	L patch: module 0	100	1	27500 - 28350	1.432	31.56	91M5G7D	BPSK
SISO Dual	L patch: module 0	100	1	27500 - 28350	1.397	31.45	91M6G7D	QPSK
SISO Dual	L patch: module 0	100	1	27500 - 28350	0.887	29.48	91M5W7D	16QAM
SISO Dual	L patch: module 0	100	1	27500 - 28350	0.599	27.77	91M6W7D	64QAM

n260 Band								
Mode	Antenna	Bandwidth (MHz)	CCs Active	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
					(W)	(dBm)		
SISO	L patch: module 0	50	1	37000 - 40000	0.615	27.89	46M2G7D	BPSK
SISO	L patch: module 0	50	1	37000 - 40000	0.504	27.02	46M1G7D	QPSK
SISO	L patch: module 0	50	1	37000 - 40000	0.273	24.36	46M2W7D	16QAM
SISO	L patch: module 0	50	1	37000 - 40000	0.207	23.16	46M2W7D	64QAM
SISO Dual	L patch: module 0	50	1	37000 - 40000	1.069	30.29	46M3G7D	BPSK
SISO Dual	L patch: module 0	50	1	37000 - 40000	0.889	29.49	46M5G7D	QPSK
SISO Dual	L patch: module 0	50	1	37000 - 40000	0.494	26.94	46M7W7D	16QAM
SISO Dual	L patch: module 0	50	1	37000 - 40000	0.368	25.66	46M9W7D	64QAM
SISO	L patch: module 0	100	1	37000 - 40000	0.438	26.41	91M6G7D	BPSK
SISO	L patch: module 0	100	1	37000 - 40000	0.460	26.63	91M7G7D	QPSK
SISO	L patch: module 0	100	1	37000 - 40000	0.265	24.23	91M7W7D	16QAM
SISO	L patch: module 0	100	1	37000 - 40000	0.155	21.89	92M0W7D	64QAM
SISO Dual	L patch: module 0	100	1	37000 - 40000	0.722	28.59	91M8G7D	BPSK
SISO Dual	L patch: module 0	100	1	37000 - 40000	0.756	28.79	92M0G7D	QPSK
SISO Dual	L patch: module 0	100	1	37000 - 40000	0.441	26.45	92M1W7D	16QAM
SISO Dual	L patch: module 0	100	1	37000 - 40000	0.329	25.17	92M9W7D	64QAM

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-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. The site is constructed in conformance with the requirements of ANSI C63.4 (Version: 2014) and CISPR Publication 22.

Seoicheon-ro
■ Semi Chamber 1
□ Semi Chamber 2
□ Semi Chamber 3
■ mmWave Chamber

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary for radiated emissions measurements in the spurious domain. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its fuction as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the table to bring the total table height to 1.5m for measurements above 1GHz.
Radiated spurious emission measurements from 30MHz - 18GHz were performed in a semi anechoic chamber (SAC) conforming to the site validation requirements.
Radiated power (EIRP) measurements were performed according to ANSI C63.26_2015 in a full anechoic chamber (FAC).

The test facility has been recognised by the FCC under registration number KR0032. The full scope of recognition can be viewed at https://apps.fcc.gov/oetcf/eas/reports/ViewTestFirmAccredScopes.cfm?calledFromFrame=N&RequestTimeout=500&regnum_specified=N&test_firm_id=5749.

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

3. TEST SPECIFICATIONS

FCC Rule Parts	47 CFR FCC Part2, Part 30
Measurement standards	ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 662911 D01 v02r01, KDB 662911 D02 v01, KDB 842590 D01 v01r02

Note:

The EUT was tested per the guidance of ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 842590 D01 v01r02

EIRP Simulation data for all Beam IDs was used to determine the worst case Beam ID for SISO operation and Beam ID pair for SISO Dual operation. These Beam ID's was used for final measurements.

All testing was performed using FTM software at continuous Tx operation(100 % duty cycle).
In case of RSE for EN-DC mode, we used 5G NR call simulator.

Each of the patch antennas is comprised of two separate antenna feeds(H/V).

All modulations, RB size, CP-OFDM, DFT-s-OFDM and SCS were investigated and the worst case configuration results are reported.

In cases of SISO, SISO Dual, MIMO, CP-OFDM is supported.
In cases of SISO, SISO Dual, DFT-s-OFDM mode is supported.
Both CP-OFDM and DFT-s-OFDM were invegtiged for the Occupied Bandwidth, EIRP, Band Edge, RSE and the DFT-s-OFDM was worst case of NR Modulations in all test cases.

Per 2.1057(a)(2), spurious emissions were investigated up to 200 GHz.(up to 100 GHz for n261 band)

The radiated RF output power, band edge and all out-of-band emissions in the spurious domain are evaluated to the EIRP limits.

In case of band edge, if the band edge results does not comply the EIRP limit, the band edge results are converted to an equivalent conductive power by subtracting the known antenna gain from the EIRP measured at each frequency of interest. These emissions are compared to the 30.203 spurious emission limits as conductive power levels.

Beam IDs were selected based on which Beam ID produces the highest EIRP during EIRP simulation.

The radiated spurious emission was investigated in three orthogonal orientation x, y and z.
(worst case: y for n261, y for n260)

3.1. STANDARDS & TEST SUMMARY

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 30

Description	Test Limit	Reference	Results
Occupied Bandwidth	N/A	§2.1049	Compliant
Equivalent Isotropic Radiated Power	43 dBm	§30.202 §30.202	Compliant
Out-of-Band Emissions at the Band Edge	-13 dBm/MHz for all out-of-band emissions, -5 dBm/MHz from the band edge up to 10 % of the channel BW	§2.1051, §30.203	Compliant
Radiated Spurious Emissions	-13 dBm/MHz for all out-of-band emissions	§2.1051, §30.203	Compliant
Frequency Stability	Fundamental emissions stay within authorized frequency block	§2.1055	Compliant

3.2. HIGHEST E.I.R.P POSITION

L patch: module 0 SISO

Band	CH	Beam ID	SISO - H	Beam ID	SISO - V
n261	Low	10	H / Azi : 74 Roll : 181	3	V / Azi : 62 Roll : 179
	Mid	10	H / Azi : 91 Roll : 183	3	V / Azi : 46 Roll : 182
	High	10	H / Azi : 72 Roll : 181	3	V / Azi : 63 Roll : 178
n260	Low	10	H / Azi : 74 Roll : 181	3	V / Azi : 28 Roll : 179
	Mid	10	H / Azi : 73 Roll : 183	3	V / Azi : 73 Roll : 177
	High	10	H / Azi : 74 Roll : 183	5	V / Azi : 77 Roll : 149

L patch: module 0 SISO Dual, MIMO

Band	CH	Beam ID	SISO Dual - H	Beam ID	SISO Dual - V
n261	Low	12	H / Azi : 91 Roll : 148	12	V / Azi : 43 Roll : 243
		5	H / Azi : 31 Roll : 104	5	V / Azi : 62 Roll : 133
	Mid	9	H / Azi : 88 Roll : 211	9	V / Azi : 62 Roll : 223
		2	H / Azi : 17 Roll : 253	2	V / Azi : 61 Roll : 194
	High	9	H / Azi : 74 Roll : 196	9	V / Azi : 73 Roll : 254
		2	H / Azi : 14 Roll : 268	2	V / Azi : 76 Roll : 193
n260	Low	10	H / Azi : 74 Roll : 181	10	V / Azi : 43 Roll : 134
		3	H / Azi : 3 Roll : 284	3	V / Azi : 28 Roll : 179
	Mid	10	H / Azi : 73 Roll : 183	10	V / Azi : 13 Roll : 227
		3	H / Azi : 2 Roll : 283	3	V / Azi : 73 Roll : 177
	High	11	H / Azi : 88 Roll : 163	11	V / Azi : 2 Roll : 228
		4	H / Azi : 17 Roll : 103	4	V / Azi : 74 Roll : 166

3.3. MAXIMUM MEASUREMENT UNCERTAINTY

The value of the measurement uncertainty for the measurement of each parameter.

Coverage factor k = 2, Confidence levels of 95 %

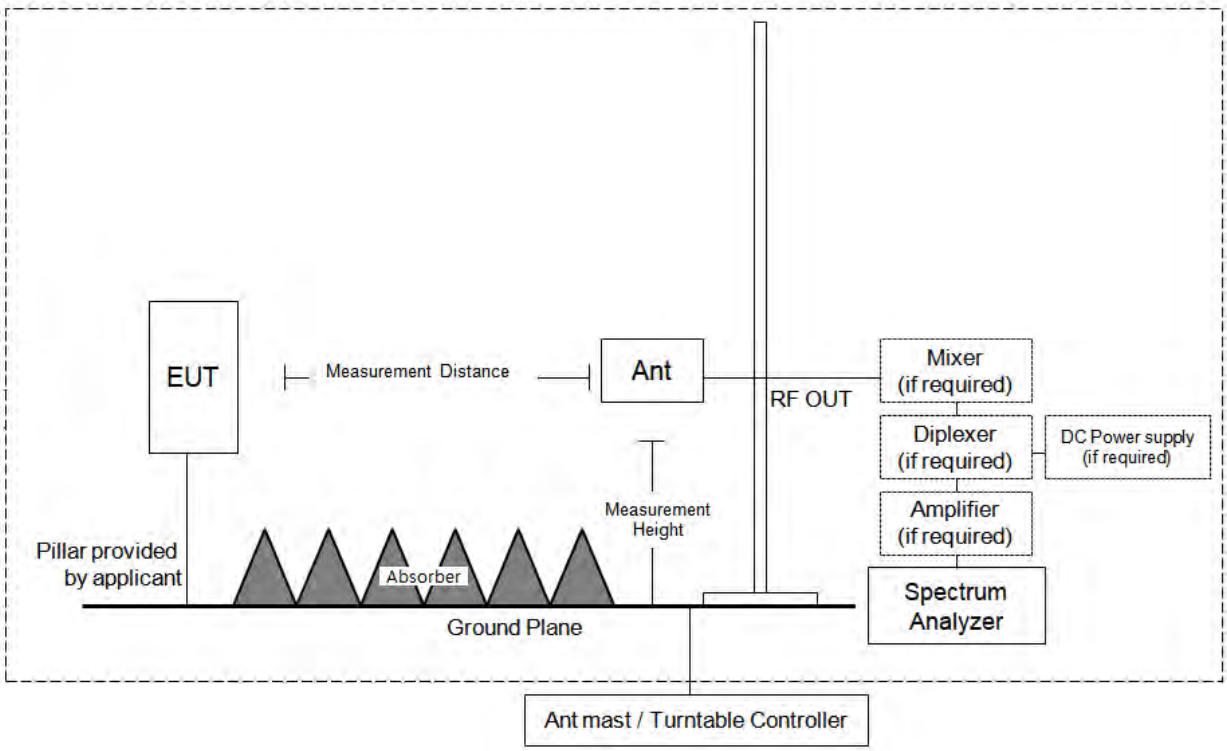
Description	Condition	Uncertainty
Occupied Bandwidth	-	± 0.31 MHz
Equivalent Isotropic Radiated Power	27.48 GHz ~ 28.37 GHz, 36.98 GHz ~ 40.02 GHz	± 5.05 dB
Band Edge		
Radiated Spurious Emissions	9 kHz ~ 30 MHz	± 3.40 dB
	30 MHz ~ 1 GHz	± 4.80 dB
	1 GHz ~ 18 GHz	± 5.70 dB
	18 GHz ~ 40 GHz	± 5.05 dB
	40 GHz ~ 200 GHz	± 4.59 dB
Frequency Stability	-	69.61 kHz

3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

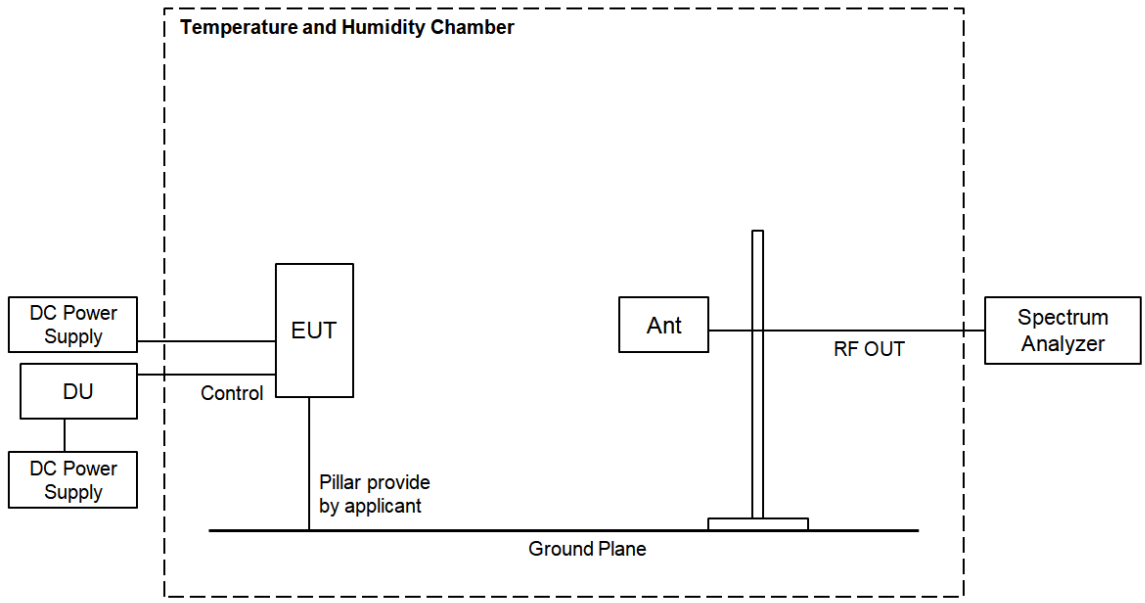
Temperature:	+15 ℃ to +35 ℃
Relative humidity:	30 % to 60 %
Air pressure:	860 mbar to 1 060 mbar

3.5. TEST DIAGRAMS

Occupied Bandwidth / EIRP / Band Edge / RSE



Frequency stability



3.6. ADDITIONAL DESCRIPTIONS ABOUT TEST

- All tests is performed by radiated measurement and applied below conditions.

: Used measurement distance with far field of test such as EIRP, OBW and Band edge are as follow.

Wavelength = Speed of light / Measurement frequency = 30 / 4 000 = 0.0075

(2 X (Max measured antenna dimension) ^{2}) / Wavelength = (2 X (0.09604686)^2)/ 0.0075= ***2.46 m***

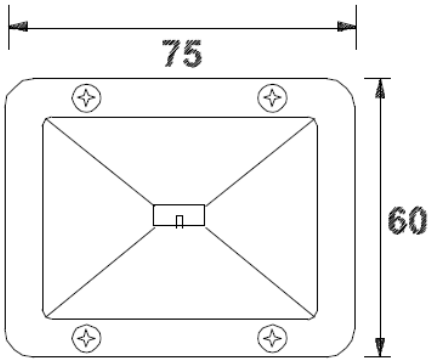
: Spurious emissions measurement distance is shown in table below(Reference : Measurement Antenna Dimension).

Frequency Rage (GHz)	Wavelength (cm)	Far Field Distance (m)	Measurement Distance(m)
18 ~ 40	0.75	2.46	3.00
40 ~ 60	0.50	1.354	3.00
60 ~90	0.33	0.856	1
90 ~ 140	0.214	0.572	1
140 ~ 200	0.15	0.332	0.5

- Unwanted radiated emissions test was performed on state of all EUT antenna path is operated with a maximum output power level.

- In case of far-field distance for fundamental, we applied the measured antenna dimension because the measured antenna is bigger than the antenna of EUT.

- Dimension of measured(BBHA 9170) antenna: 0.096046 m



- Dimension of EUT antenna : 0.024143 m

- Below 18 GHz, measurement distance is 3.00 m.

4. TEST EQUIPMENTS

Manufacturer	Model / Equipment	Due to Calibration	Calibration Interval	Serial No.
Agilent	N9030B / PXA Signal Analyzer	06/02/2022	Annual	MY55480167
Schwarzbeck	BBHA 9170 / Horn Antenna	11/16/2022	Biennial	BBHA9170541
KIKUSUI	PWR800L / DC Power Supply	07/13/2022	Annual	RE002047
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Rohde&Schwarz	FSW / Spectrum Analyzer	11/11/2022	Annual	101256
Rohde&Schwarz	FSP / Spectrum Analyzer	09/13/2022	Annual	836650/016
Schwarzbeck	Loop Antenna	06/04/2023	Biennial	1513-175
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Schwarzbeck	VULB 9168 / Hybrid Antenna	09/04/2022	Biennial	9168-0895
Schwarzbeck	BBHA 9120D / Horn Antenna	06/23/2022	Biennial	9120D-1300
OML INC.	WR-19 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M19RH-160419-2
OML INC.	WR-19 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M19RH-160419-1
OML INC.	WR-12 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M12RH-160419-1
OML INC.	WR-12 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M12RH-160419-2
OML INC.	WR-08 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M08RH-160419-2
OML INC.	WR-08 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M08RH-160419-1
OML INC.	WR-05 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M05RH-160419-1
OML INC.	WR-05 Horn Antenna / Horn Antenna	04/23/2022	Biennial	M05RH-160419-2
OML INC.	OML WR19 / Harmonic Mixer	11/18/2022	Annual	M19HWD
OML INC.	OML WR12 / Harmonic Mixer	11/18/2022	Annual	M12HWD
OML INC.	OML WR08 / Harmonic Mixer	11/18/2022	Annual	M08HWD
OML INC.	OML WR05 / Harmonic Mixer	09/09/2022	Annual	M05HWD
OML INC.	WR-19 / Source Module	09/02/2022	Annual	S19MS-A-160516-1
OML INC.	WR-12 / Source Module	09/02/2022	Annual	S12MS-A-160419-1
OML INC.	WR-08 / Source Module	09/02/2022	Annual	S08MS-A-160419-1
OML INC.	WR-05 / Source Module	09/07/2022	Annual	S05MS-A-160419-1
NANGYEUL CO., LTD.	NY-THR18750 / Temperature and Humidity Chamber	01/14/2022	Annual	NY-200912201A
Rohde & Schwarz	SMV100A / Signal Generator	07/05/2022	Annual	177633
Keysight	E7515B / UXM 5G Wireless Test Platform	01/07/2022	Annual	MY58300756
T&M SYSTEM	FBSR-04C / LNA1 thru(100M-18G)	09/16/2022	Annual	NONE

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.

2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

5. TEST RESULT

5.1. OCCUPIED BANDWIDTH

FCC Rules

Test Requirements:

§ 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedures:

The measurement is performed in accordance with Section 5.4.3 and 5.4.4 of ANSI C63.26.

5.4.3 Occupied bandwidth—Relative measurement procedure

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.

b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “−X dB” requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.

e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

f) Determine the reference value by either of the following:

1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.

g) Determine the “−X dB amplitude” as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.

h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).

i) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “−X dB amplitude” determined in step f). If a marker is below this “−X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the “−X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “−X dB amplitude.”

j) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

5.4.4 Occupied bandwidth—Power bandwidth (99%) measurement procedure

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The

frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

Test Results:

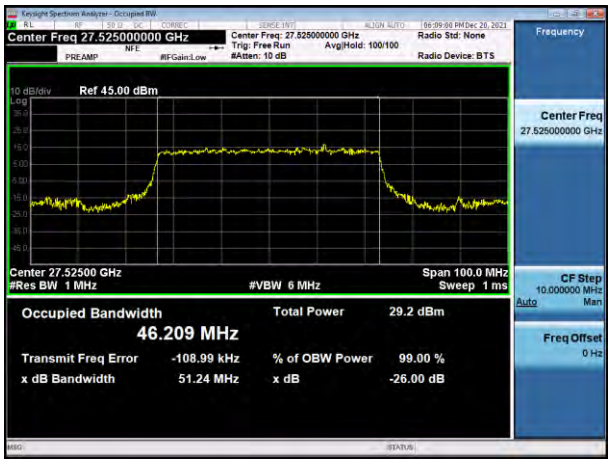
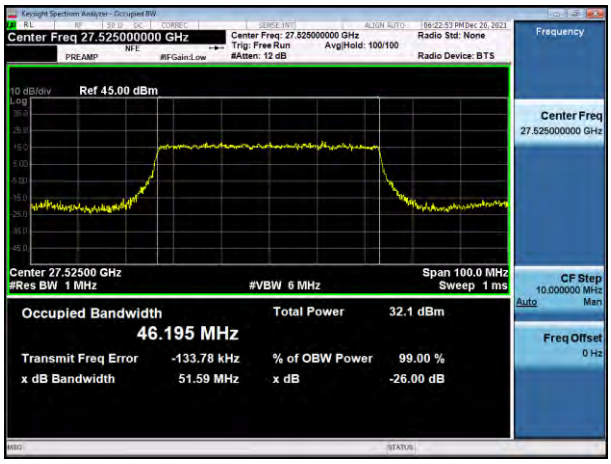
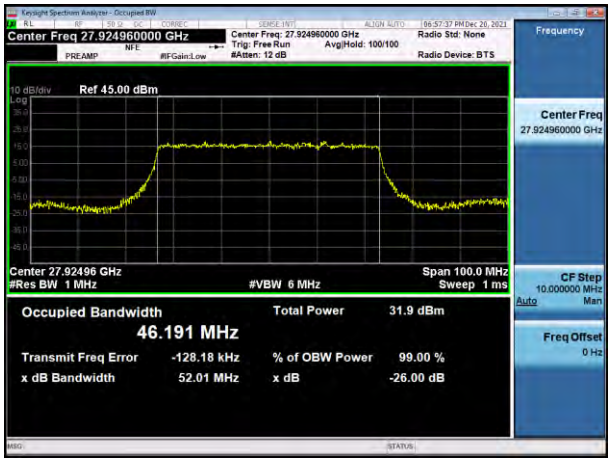
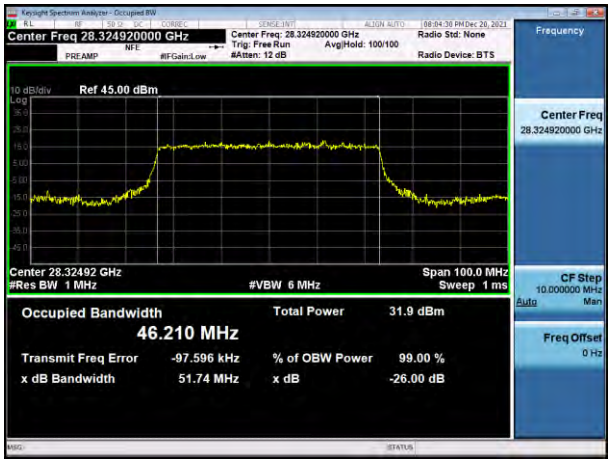
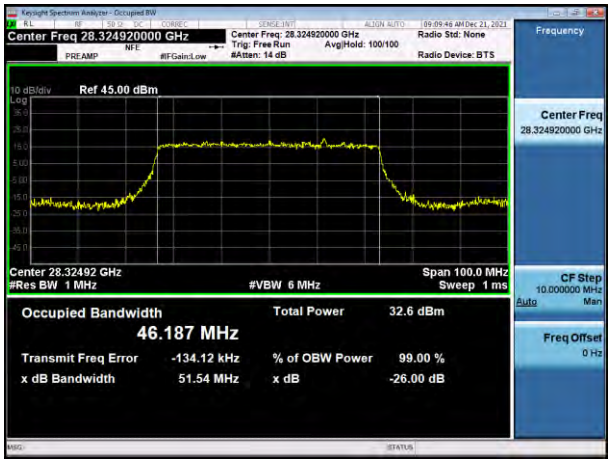
Tabular Data of Occupied Bandwidth

Band	Antenna	CCs Active	Bandwidth	Modulation	Beam Pol	RB Size/Offset	Channel	Frequency [MHz]	OBW [MHz]
n261	L patch: module 0	1	50 MHz	BPSK	H	32/0	Low	27525.00	46.209
					V				46.195
					H		Mid	27924.96	46.183
					V				46.191
					H		High	28324.92	46.210
					V				46.187
			100 MHz	BPSK	H	64/0	Low	27550.08	91.394
					V				91.416
					H		Mid	27924.96	91.632
					V				91.637
					H		High	28299.96	91.502
					V				91.497

Band	Antenna	CCs Active	Bandwidth	Modulation	Beam Pol	RB Size/Offset	Channel	Frequency [MHz]	OBW [MHz]
n260	L patch: module 0	1	50 MHz	BPSK	H	32/0	Low	37025.04	47.529
					V				47.410
					H		Mid	38499.96	46.294
					V				46.225
					H		High	39975.00	46.767
					V				46.772
			100 MHz	BPSK	H	64/0	Low	37050.00	91.716
					V				91.665
				QPSK	H		Mid	38499.96	92.047
					V				91.728
				BPSK	H		High	39949.92	95.756
					V				96.004

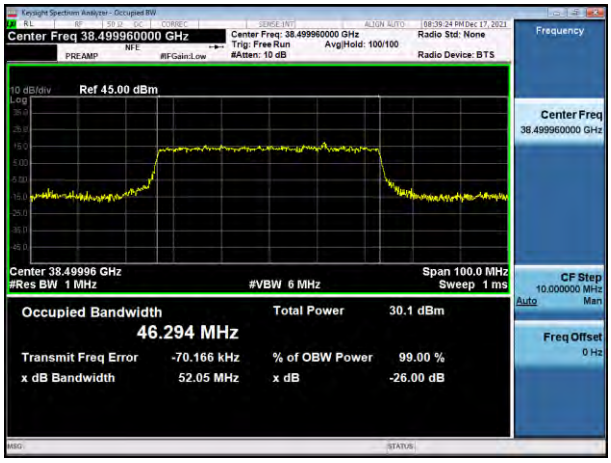
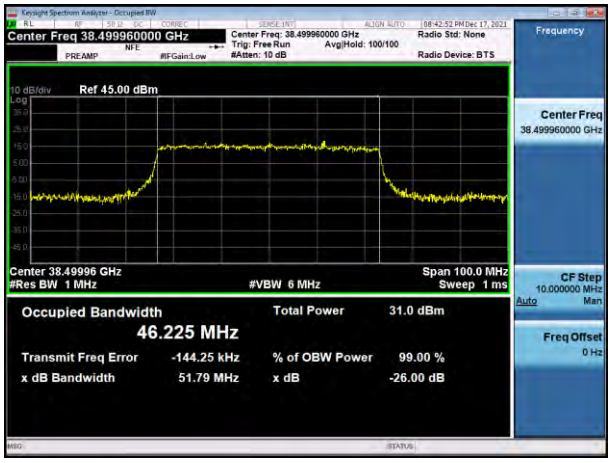
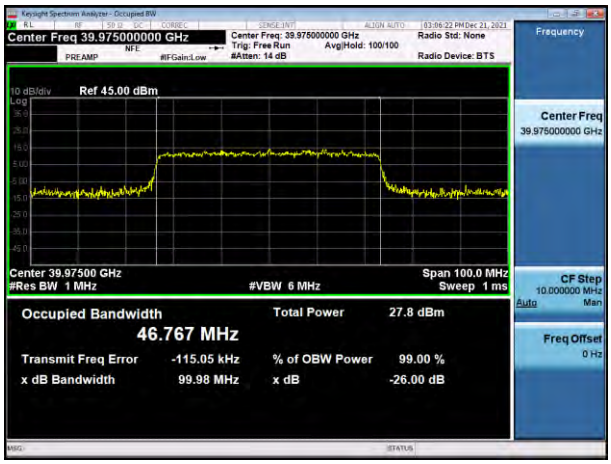
Plot Data of RF Occupied Bandwidth

1. L patch: module 0, n261

50 MHz, 1CC	
	
	
	

100 MHz, 1CC	
 Center Freq 27.550080000 GHz Ref 45.00 dBm Center 27.5501 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.394 MHz Total Power 29.5 dBm Transmit Freq Error -1.3296 MHz % of OBW Power 99.00 % x dB Bandwidth 99.95 MHz x dB -26.00 dB	 Center Freq 27.550080000 GHz Ref 45.00 dBm Center 27.5501 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.416 MHz Total Power 32.7 dBm Transmit Freq Error -1.2455 MHz % of OBW Power 99.00 % x dB Bandwidth 99.70 MHz x dB -26.00 dB
 Center Freq 27.924960000 GHz Ref 45.00 dBm Center 27.9250 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.632 MHz Total Power 30.0 dBm Transmit Freq Error -1.2445 MHz % of OBW Power 99.00 % x dB Bandwidth 100.5 MHz x dB -26.00 dB	 Center Freq 27.924960000 GHz Ref 45.00 dBm Center 27.9250 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.637 MHz Total Power 31.7 dBm Transmit Freq Error -1.1942 MHz % of OBW Power 99.00 % x dB Bandwidth 100.5 MHz x dB -26.00 dB
 Center Freq 28.299960000 GHz Ref 45.00 dBm Center 28.3000 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.502 MHz Total Power 31.4 dBm Transmit Freq Error -1.4307 MHz % of OBW Power 99.00 % x dB Bandwidth 99.09 MHz x dB -26.00 dB	 Center Freq 28.299960000 GHz Ref 45.00 dBm Center 28.3000 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.497 MHz Total Power 32.7 dBm Transmit Freq Error -1.5334 MHz % of OBW Power 99.00 % x dB Bandwidth 102.6 MHz x dB -26.00 dB

2. L patch: module 0, n260

50 MHz, 1CC	
	
	
	

100 MHz, 1CC	
 Center Freq 37.050040000 GHz Ref 45.00 dBm Center 37.0500 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.716 MHz Total Power 28.1 dBm Transmit Freq Error -1.4268 MHz % of OBW Power 99.00 % x dB Bandwidth 101.3 MHz x dB -26.00 dB	 Center Freq 37.050040000 GHz Ref 45.00 dBm Center 37.0500 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.665 MHz Total Power 29.4 dBm Transmit Freq Error -1.5228 MHz % of OBW Power 99.00 % x dB Bandwidth 100.8 MHz x dB -26.00 dB
 Center Freq 38.499960000 GHz Ref 45.00 dBm Center 38.5000 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 92.047 MHz Total Power 29.7 dBm Transmit Freq Error -1.6391 MHz % of OBW Power 99.00 % x dB Bandwidth 199.4 MHz x dB -26.00 dB	 Center Freq 38.499960000 GHz Ref 45.00 dBm Center 38.5000 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 91.728 MHz Total Power 30.5 dBm Transmit Freq Error -1.6929 MHz % of OBW Power 99.00 % x dB Bandwidth 124.1 MHz x dB -26.00 dB
 Center Freq 39.949920000 GHz Ref 45.00 dBm Center 39.9499 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 95.756 MHz Total Power 27.9 dBm Transmit Freq Error -170.16 kHz % of OBW Power 99.00 % x dB Bandwidth 200.0 MHz x dB -26.00 dB	 Center Freq 39.949920000 GHz Ref 45.00 dBm Center 39.9499 GHz #Res BW 1 MHz #VBW 6 MHz Span 200.0 MHz Sweep 1 ms Occupied Bandwidth 96.004 MHz Total Power 27.6 dBm Transmit Freq Error -62.905 kHz % of OBW Power 99.00 % x dB Bandwidth 200.0 MHz x dB -26.00 dB

5.2. EQUIVALENT ISOTROPIC RADIATED POWER

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using broadband horn antennas. 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.

The average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

FCC Rules

Test Requirements:

§ 30.202 Power limits.

(b) For mobile stations, the average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

Test Procedures:

The measurement is performed in accordance with Section 5.2.4.4.2 of ANSI C63.26.

a) Set span to 2 × to 3 × the OBW.

b) Set RBW = 1% to 5% of the OBW.

c) Set VBW ≥ 3 × RBW.

d) Set number of measurement points in sweep ≥ 2 × span / RBW.

e) Sweep time:

1) Set = auto-couple, or

2) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.

f) Detector = power averaging (rms).

g) Set sweep trigger to “free run.”

h) 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 time 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.

i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band or channel power measurement function with band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

j) Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission.

Note:

1. The EUT was tested under rotating conditions 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 tables below.
2. Elements within the same antenna array are correlated to produce beamforming array gain. Antenna arrays cannot be correlated with another antenna array. During testing, only one antenna array was active.
3. Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning. It was determined that H=0 degree and V=90 degree are the worst case positions when the EUT was transmitting horizontally and vertically polarized beams, respectively.

Test Results:

L patch: module 0, n261

SISO

CCs active	BW	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	EIRP [dBm]
1	50 MHz	27525.00	Low	V	QPSK	V	1/16	29.96
		27924.96	Mid	V	BPSK	V	1/16	29.64
		28324.92	High	V	BPSK	V	1/16	30.12
		28324.92	High	V	QPSK	V	1/16	29.67
		28324.92	High	V	16QAM	V	1/16	27.86
		28324.92	High	V	64QAM	V	1/16	25.78
	100 MHz	27550.08	Low	V	QPSK	V	1/33	30.52
		27924.96	Mid	V	BPSK	V	1/33	29.96
		28299.96	High	V	QPSK	V	1/33	30.31
		27550.08	Low	V	BPSK	V	1/33	30.03
		27550.08	Low	V	16QAM	V	1/33	27.55
		27550.08	Low	V	64QAM	V	1/33	25.66

SISO Dual

CCs active	BW	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	EIRP [dBm]	SUM [dBm]
1	50 MHz	27525.00	Low	H	BPSK	H	1/11	25.74	30.52
				V		V		28.77	
		27924.96	Mid	H	BPSK	H	1/11	25.93	29.90
				V		V		27.68	
		28324.92	High	H	BPSK	H	1/11	27.57	31.47
				V		V		29.19	
		28324.92	High	H	QPSK	H	1/11	27.29	31.15
				V		V		28.85	
		28324.92	High	H	16QAM	H	1/11	24.94	28.98
				V		V		26.80	
		28324.92	High	H	64QAM	H	1/11	23.89	27.48
				V		V		24.98	
	100 MHz	27550.08	Low	H	BPSK	H	1/22	25.30	30.65
				V		V		29.15	
		27924.96	Mid	H	BPSK	H	1/22	25.64	29.89
				V		V		27.84	
		28299.96	High	H	BPSK	H	1/22	27.67	31.56
				V		V		29.28	
		28299.96	High	H	QPSK	H	1/22	27.69	31.45
				V		V		29.08	
		28299.96	High	H	16QAM	H	1/22	24.90	29.48
				V		V		27.62	
		28299.96	High	H	64QAM	H	1/22	24.41	27.77
				V		V		25.09	

L patch: module 0, n260

SISO

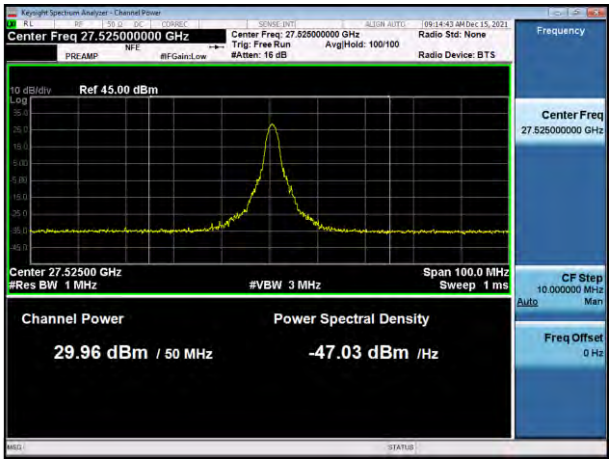
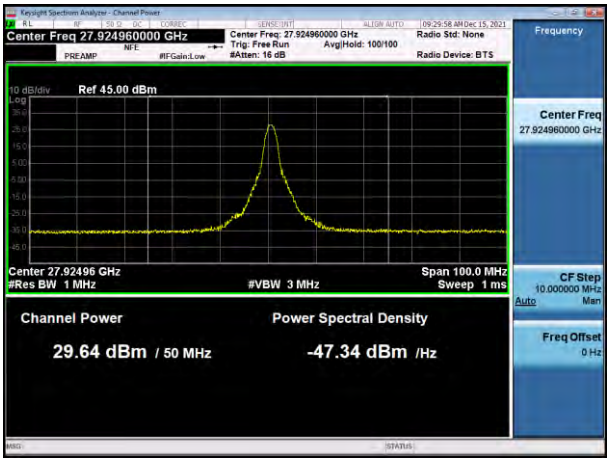
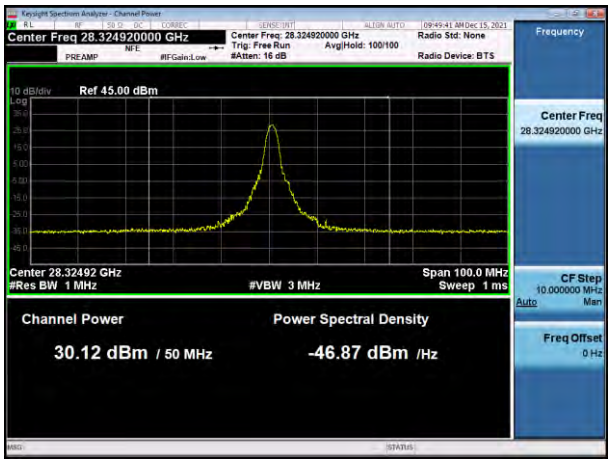
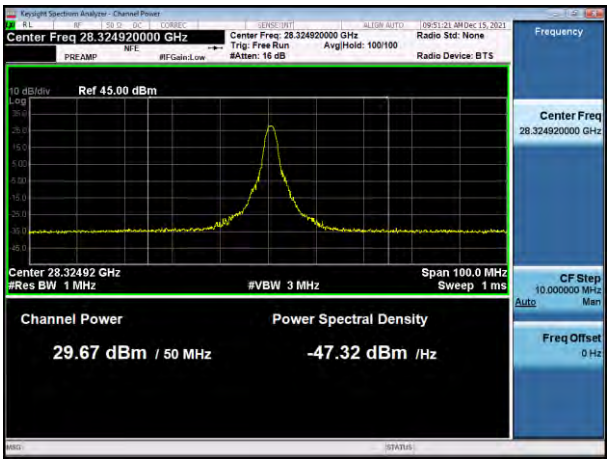
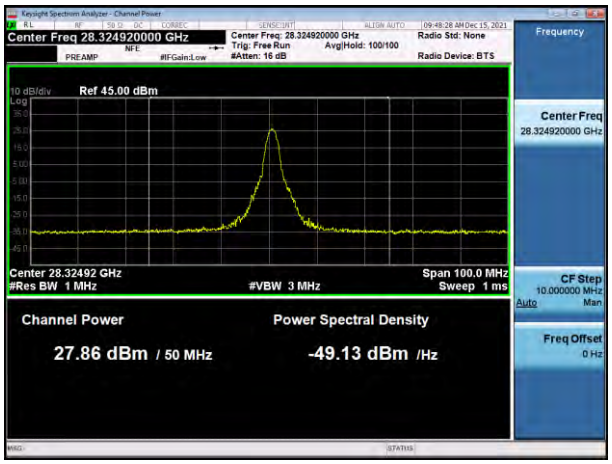
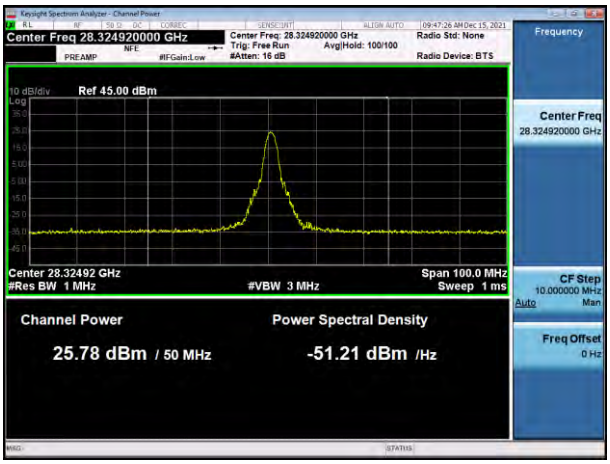
CCs active	BW	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	EIRP [dBm]
1	50 MHz	37025.04	Low	V	BPSK	V	1/21	27.10
		38499.96	Mid	V	BPSK	V	1/21	27.89
		39975.00	High	H	BPSK	H	1/21	25.64
		38499.96	Mid	V	QPSK	V	1/21	27.02
		38499.96	Mid	V	16QAM	V	1/21	24.36
		38499.96	Mid	V	64QAM	V	1/21	23.16
	100 MHz	37050.00	Low	V	BPSK	V	1/43	25.68
		38499.96	Mid	V	QPSK	V	1/43	26.63
		39949.92	High	H	BPSK	H	1/43	25.43
		38499.96	Mid	V	BPSK	V	1/43	26.41
		38499.96	Mid	V	16QAM	V	1/43	24.23
		38499.96	Mid	V	64QAM	V	1/43	21.89

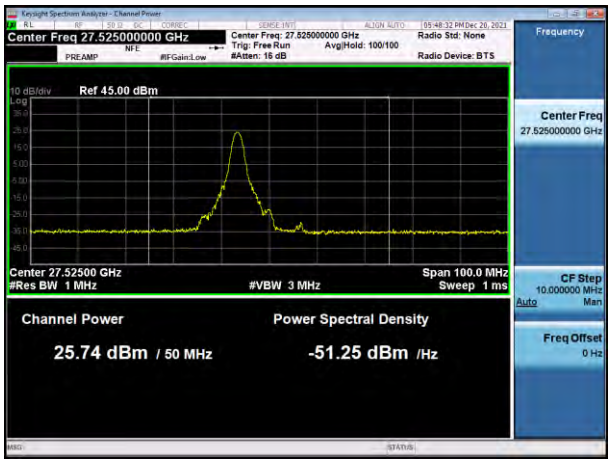
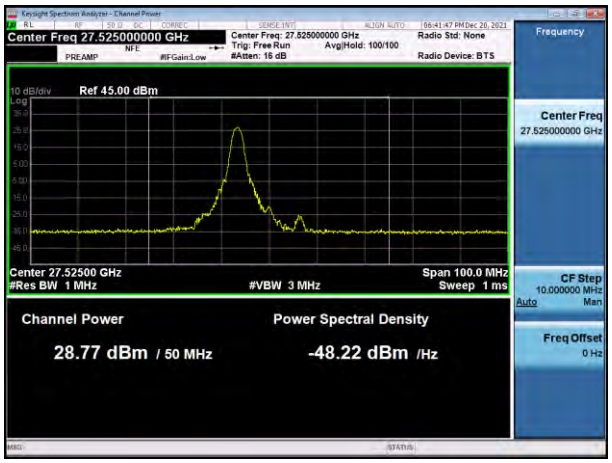
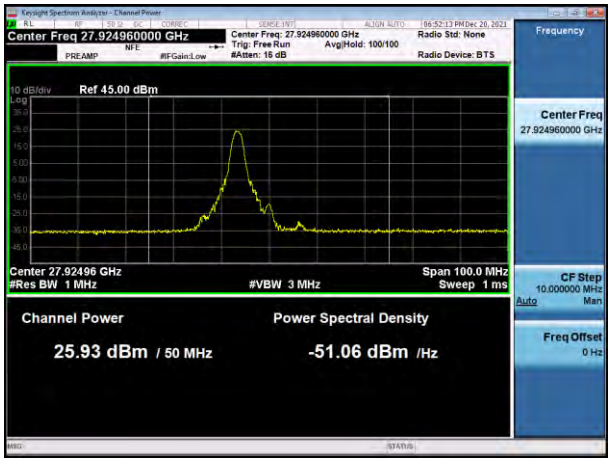
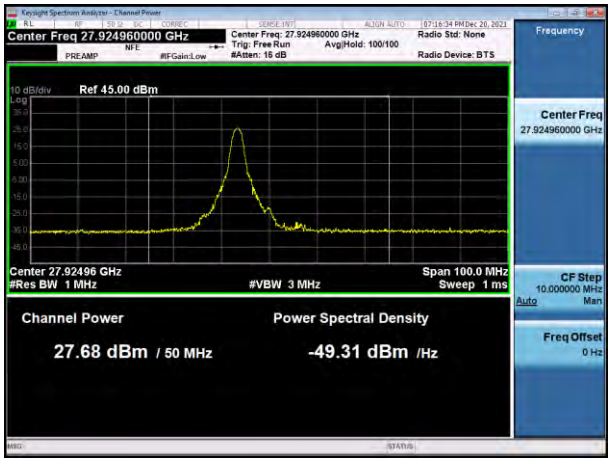
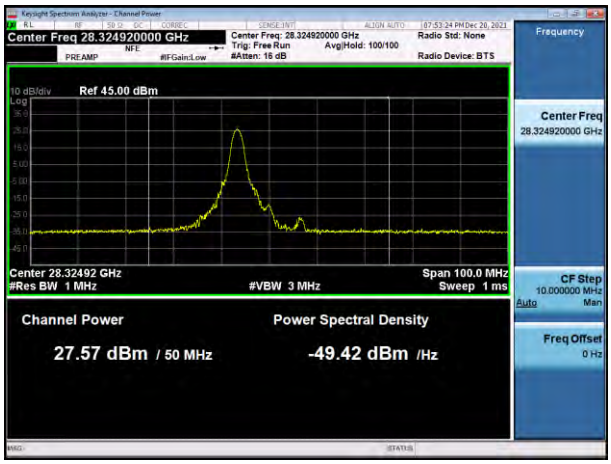
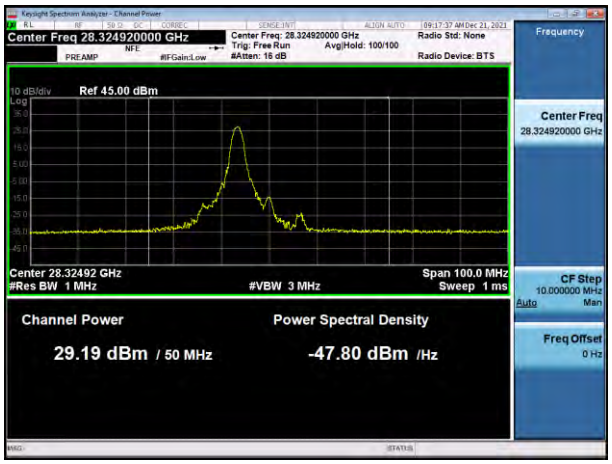
SISO Dual

CCs active	BW	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	EIRP [dBm]	SUM [dBm]
1	50 MHz	37025.04	Low	H	BPSK	H	1/21	24.54	29.02
				V		V		27.10	
		38499.96	Mid	H	BPSK	H	1/21	26.57	30.29
				V		V		27.89	
		39975.00	High	H	BPSK	H	1/21	24.08	26.91
				V		V		23.72	
		38499.96	Mid	H	QPSK	H	1/21	25.86	29.49
				V		V		27.02	
		38499.96	Mid	H	16QAM	H	1/21	23.45	26.94
				V		V		24.36	
		38499.96	Mid	H	64QAM	H	1/21	22.06	25.66
				V		V		23.16	
	100 MHz	37050.00	Low	H	BPSK	H	1/43	24.66	28.21
				V		V		25.68	
		38499.96	Mid	H	QPSK	H	1/43	24.71	28.79
				V		V		26.63	
		39949.92	High	H	BPSK	H	1/43	24.22	27.14
				V		V		24.03	
		38499.96	Mid	H	BPSK	H	1/43	24.54	28.59
				V		V		26.41	
		38499.96	Mid	H	16QAM	H	1/43	22.47	26.45
				V		V		24.23	
		38499.96	Mid	H	64QAM	H	1/43	22.41	25.17
				V		V		21.89	

Plot Data of EIRP

1. L patch: module 0, n261

50 MHz, 1CC SISO	
	
	
	

50 MHz, 1CC SISO Dual	
	
	
	

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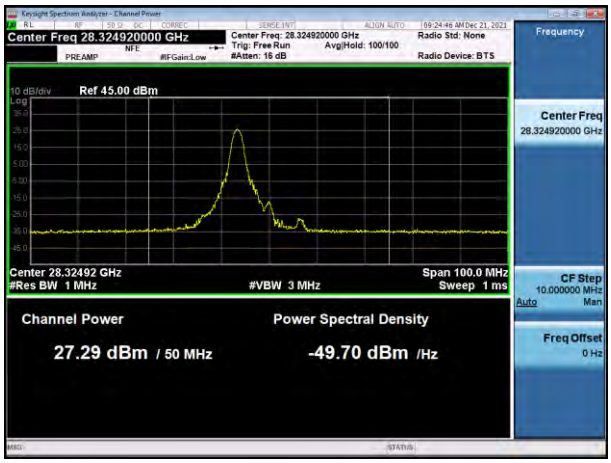
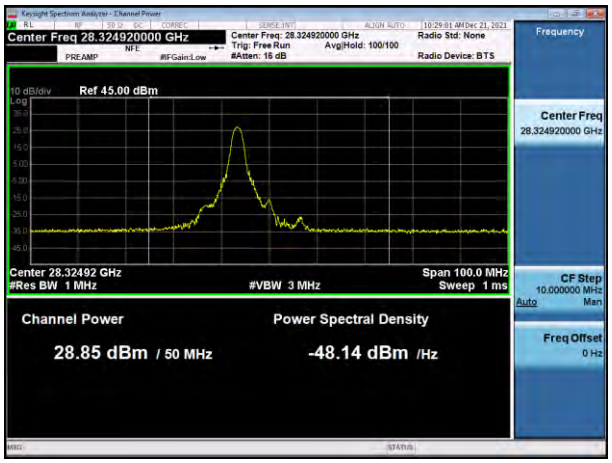
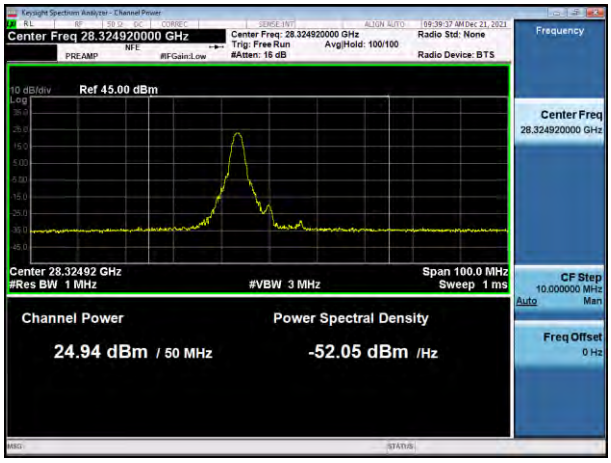
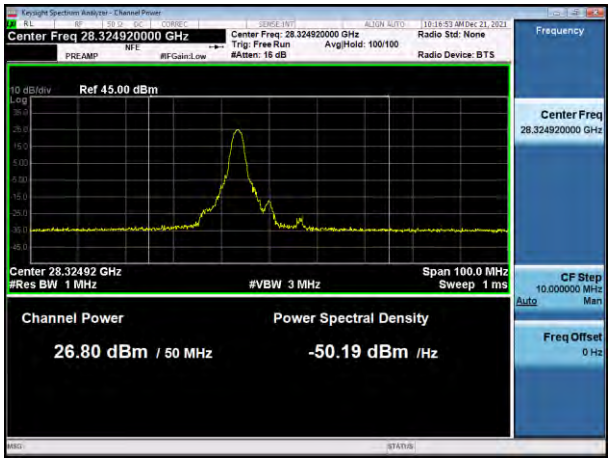
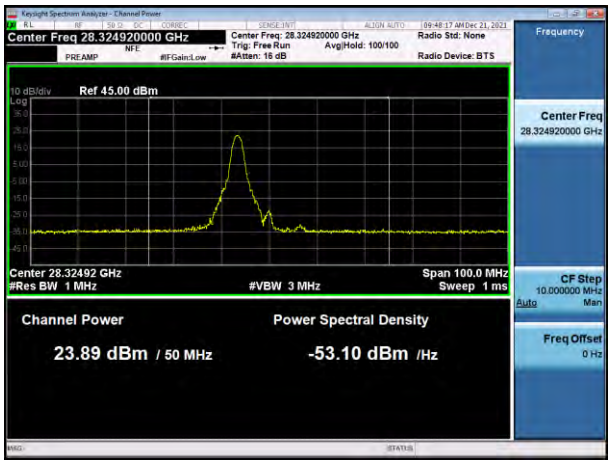
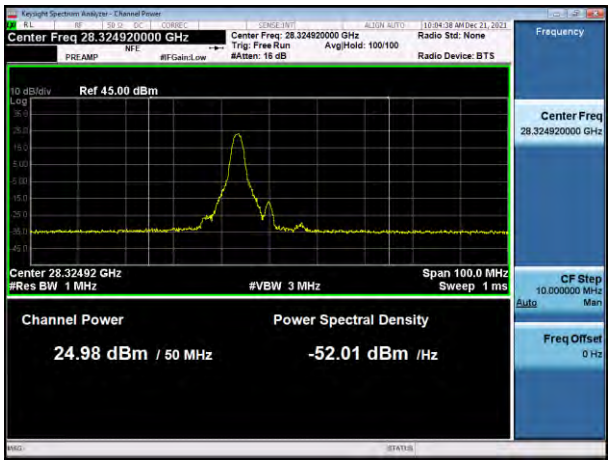
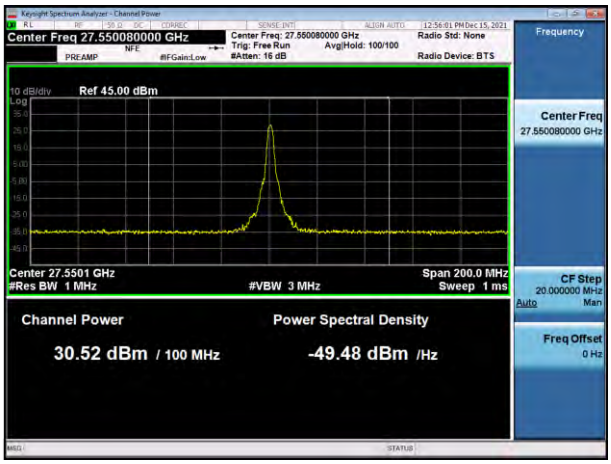
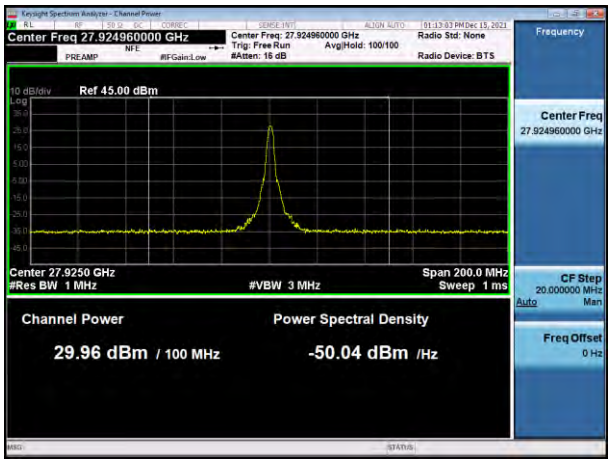
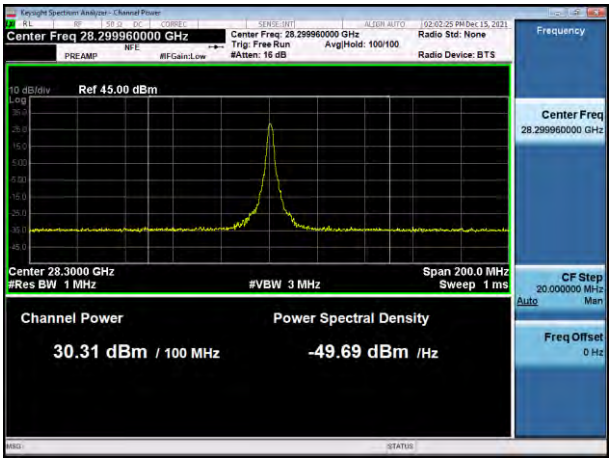
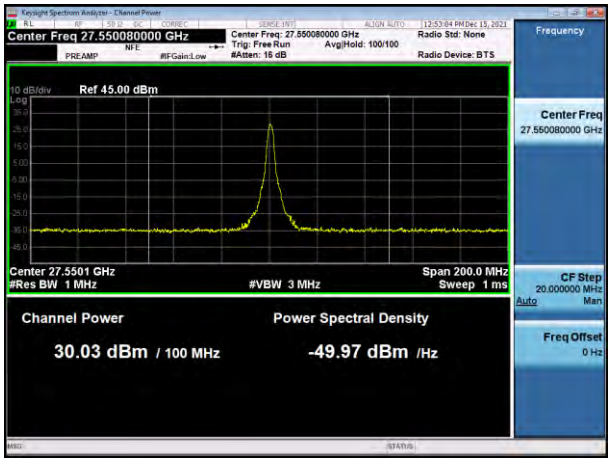
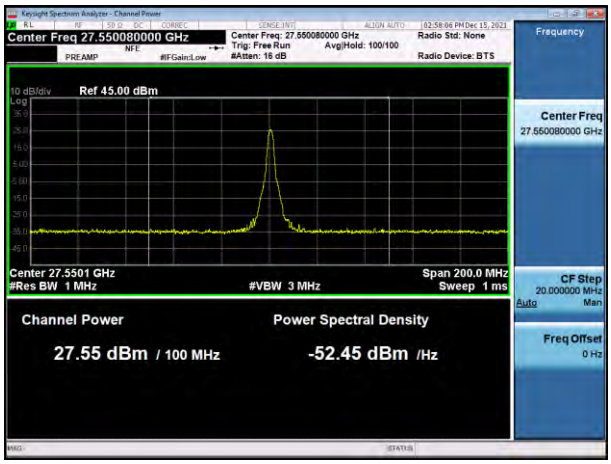
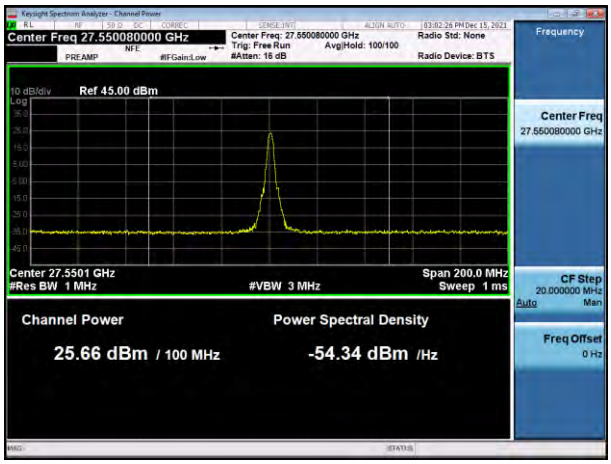
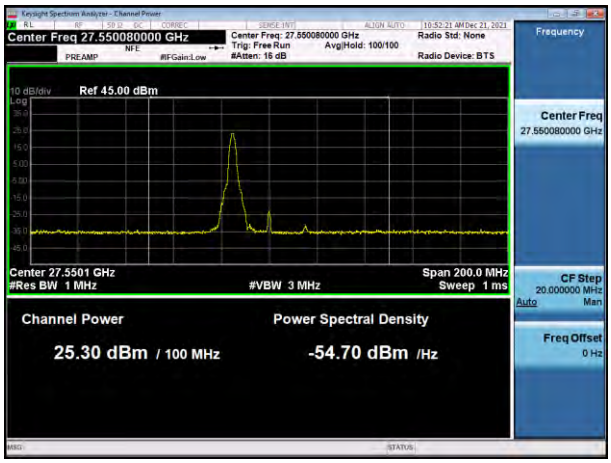
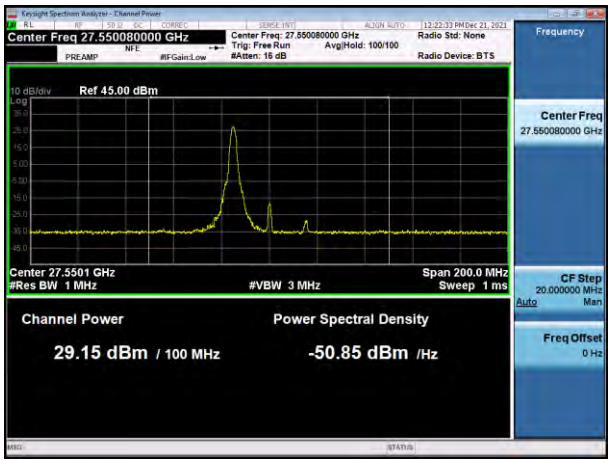
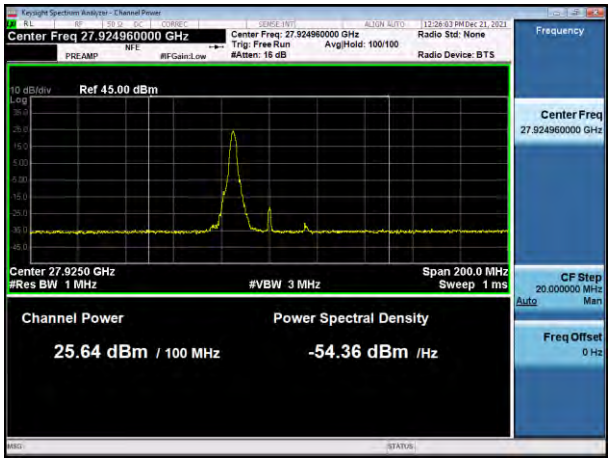
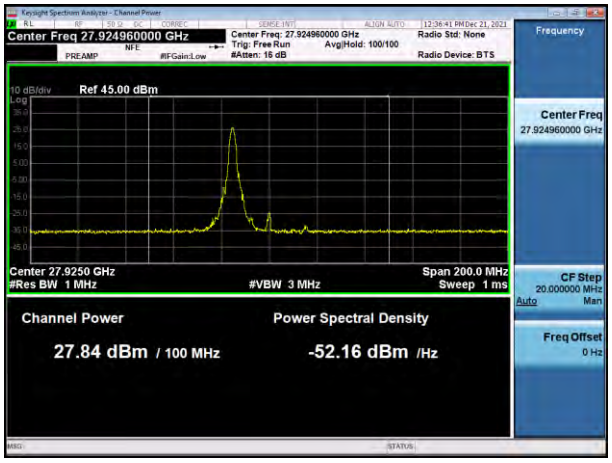
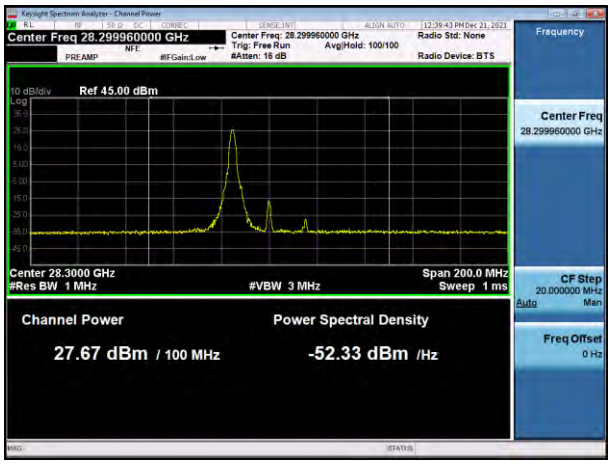
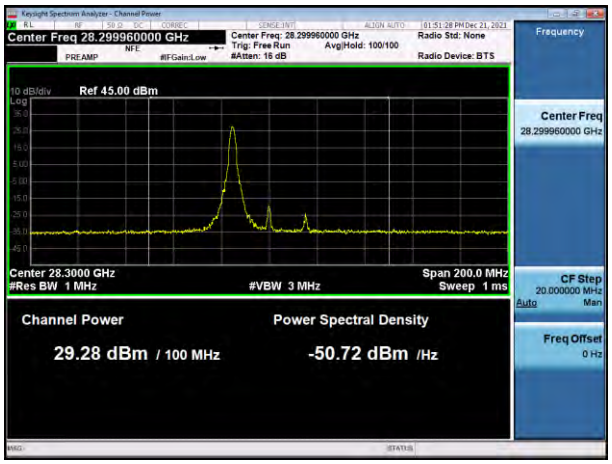
	
	
	

100 MHz, 1CC SISO	
	
	
	

100 MHz, 1CC SISO Dual	
	
	
	

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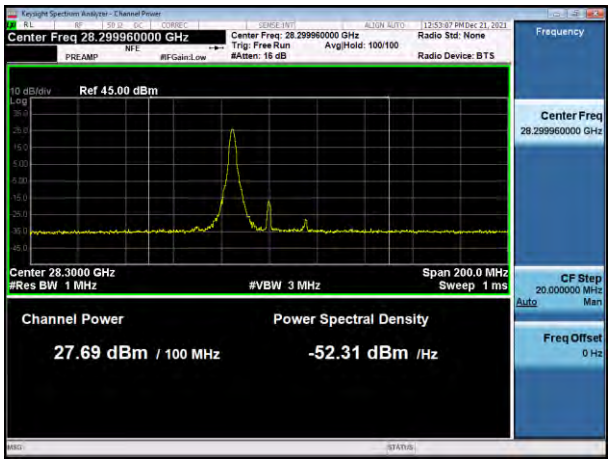	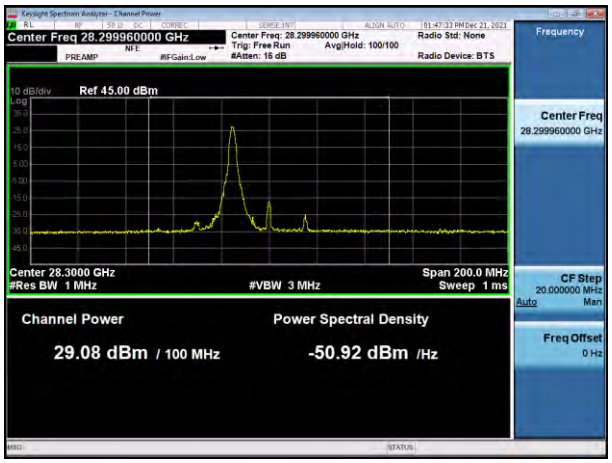
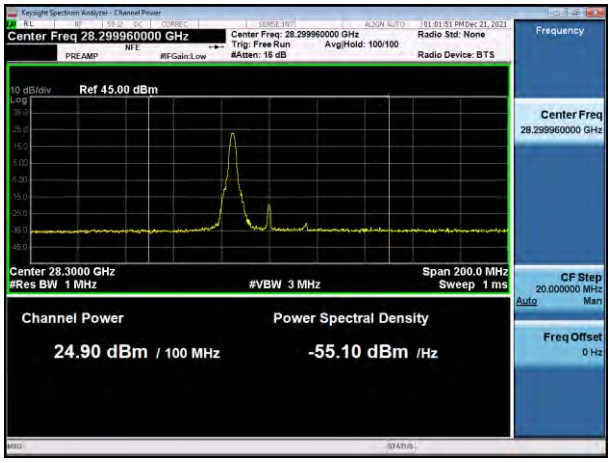	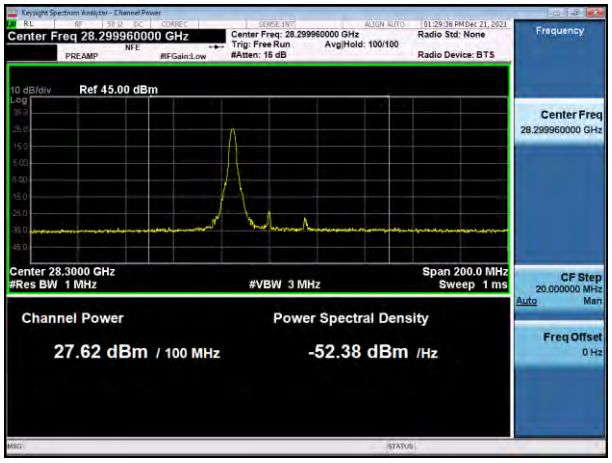
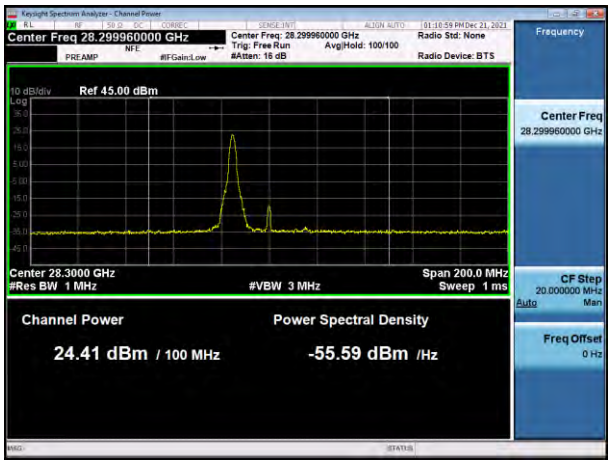	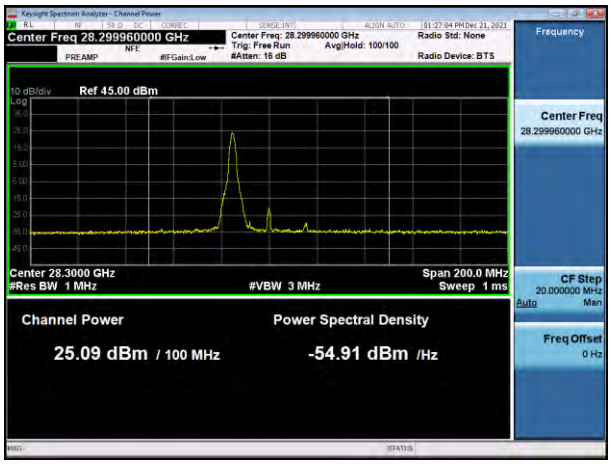

2. L patch: module 0, n260

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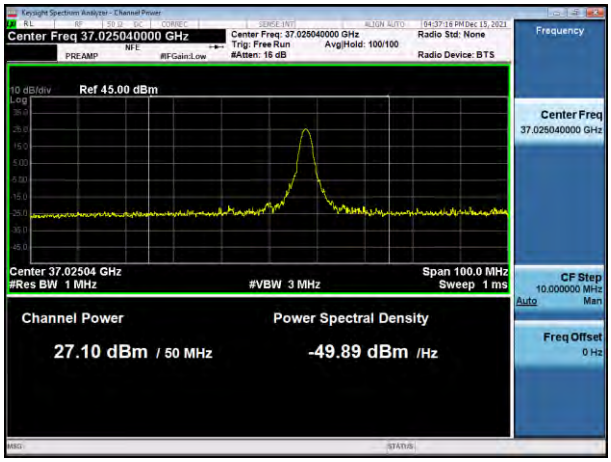
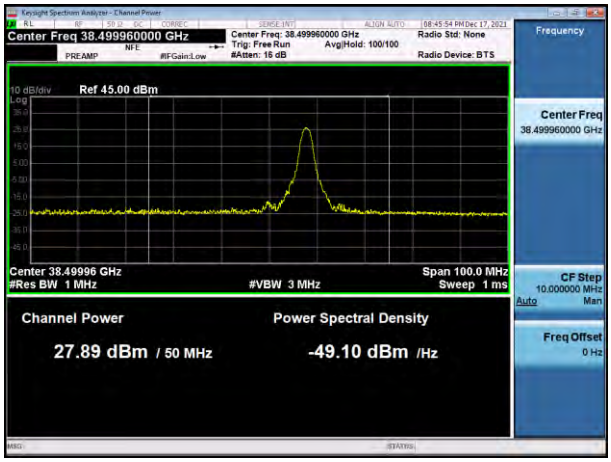
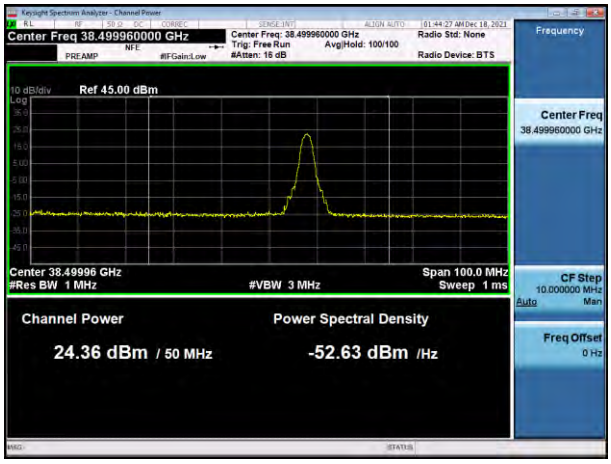
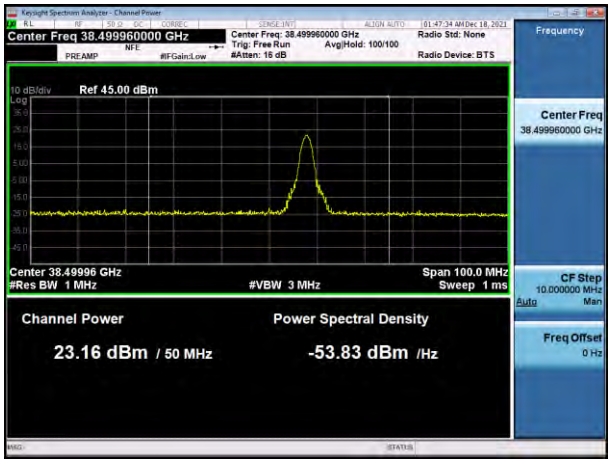
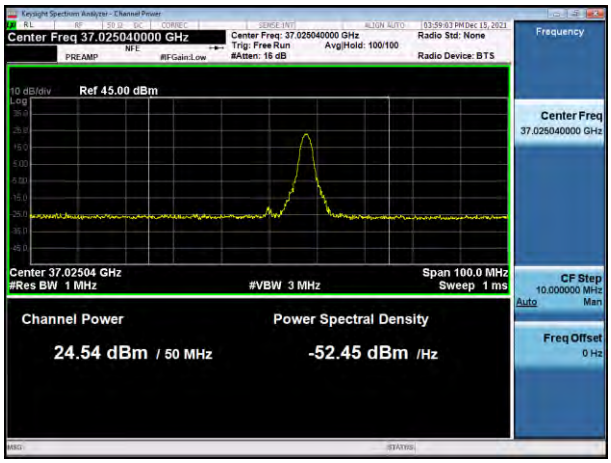
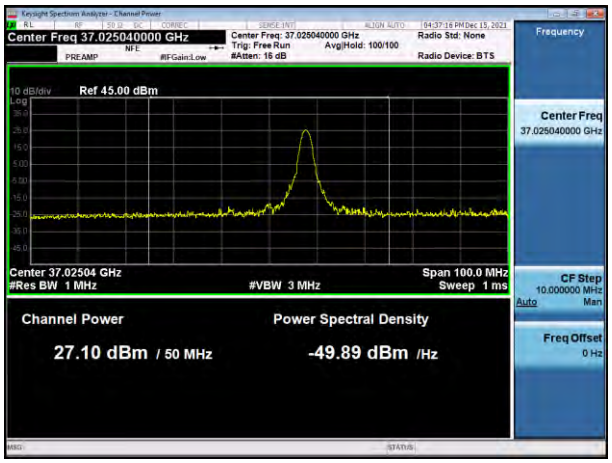
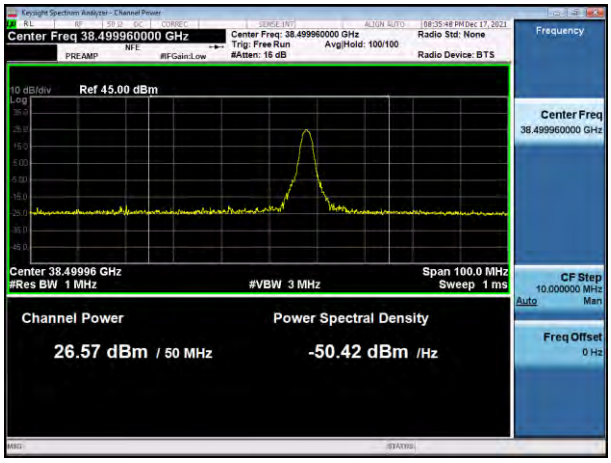
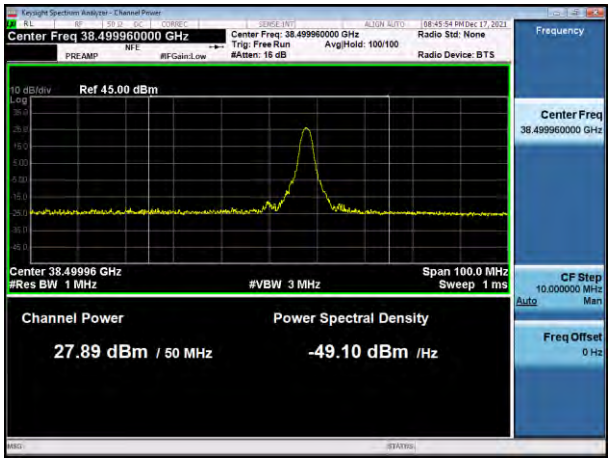
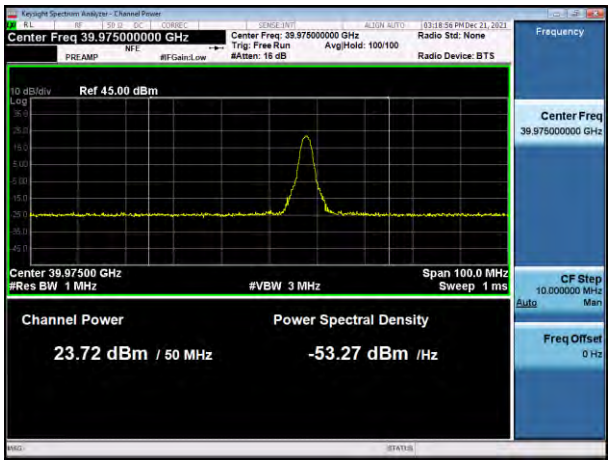
	
	
	

50 MHz, 1CC SISO Dual	
	
	
	

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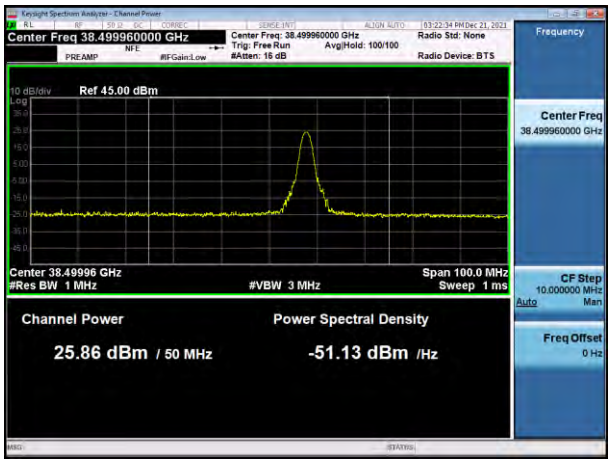	
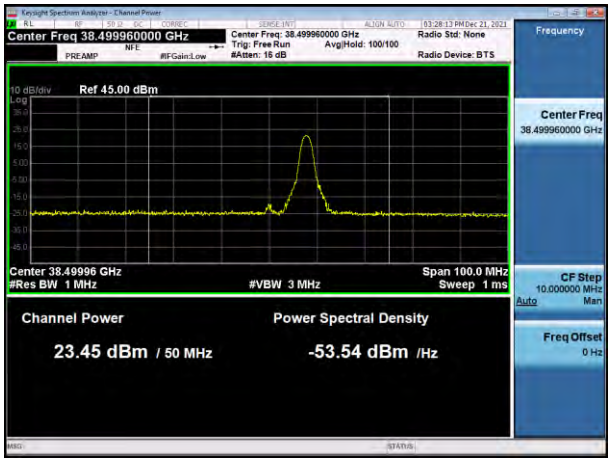	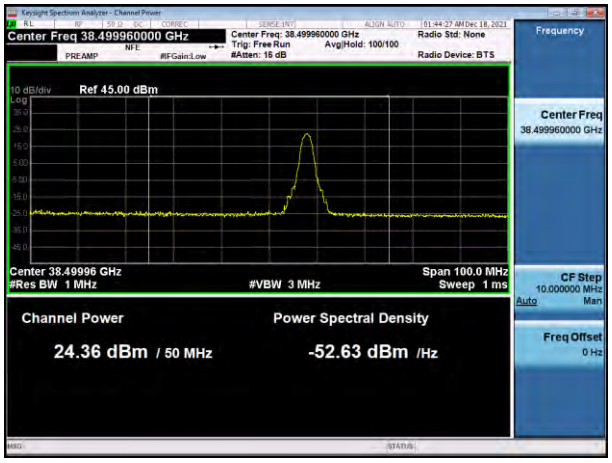
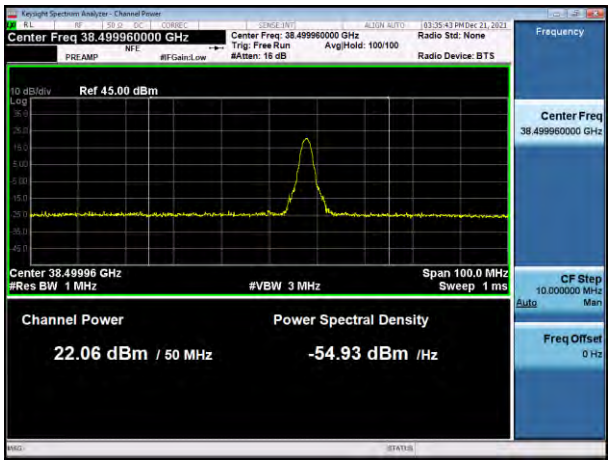	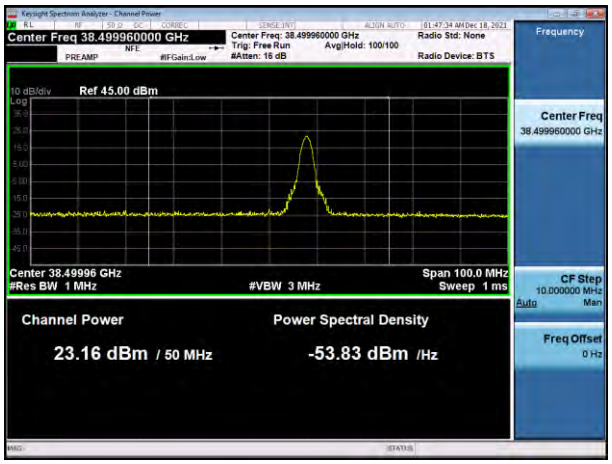

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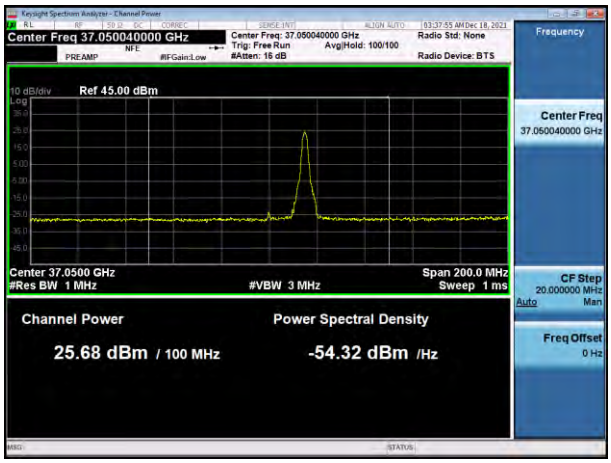	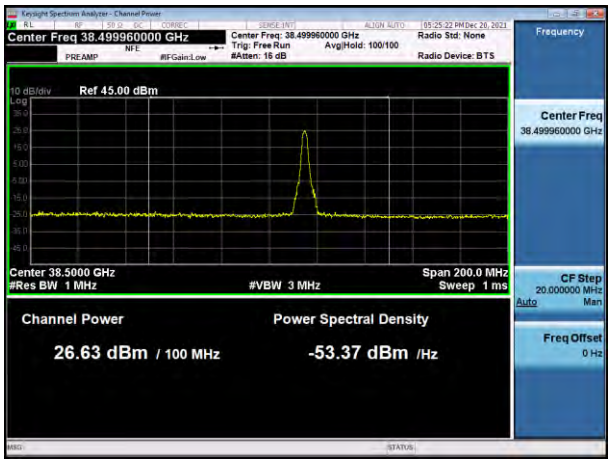
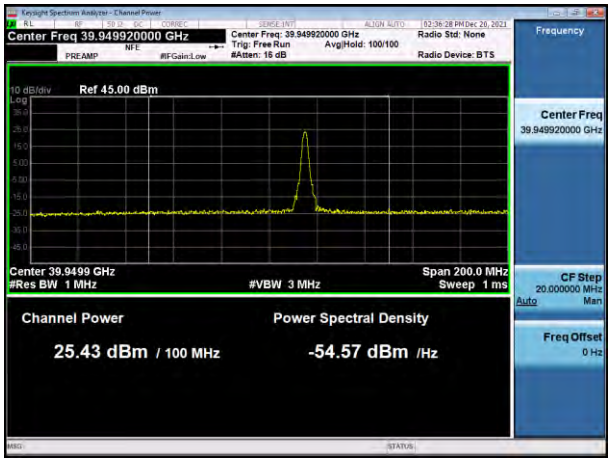	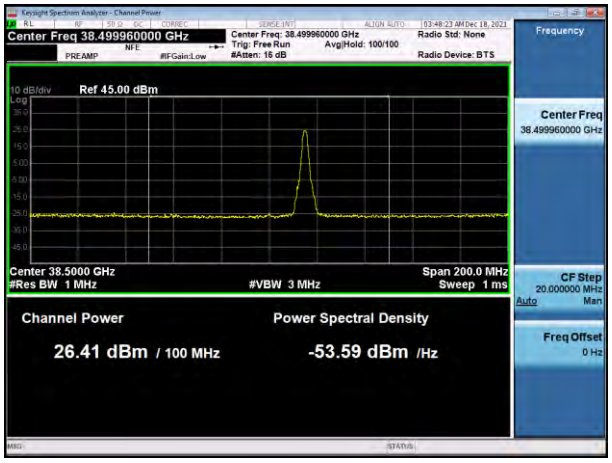
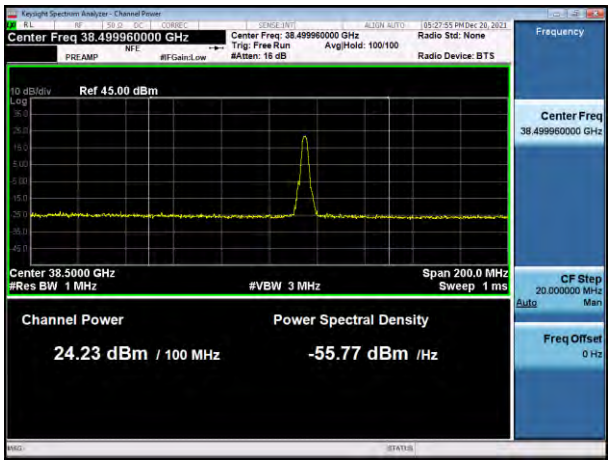	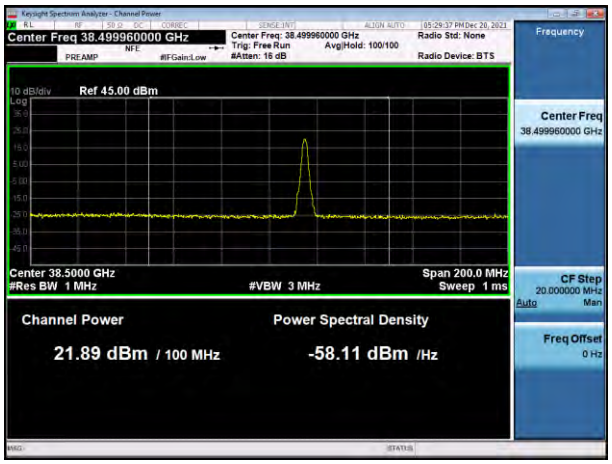

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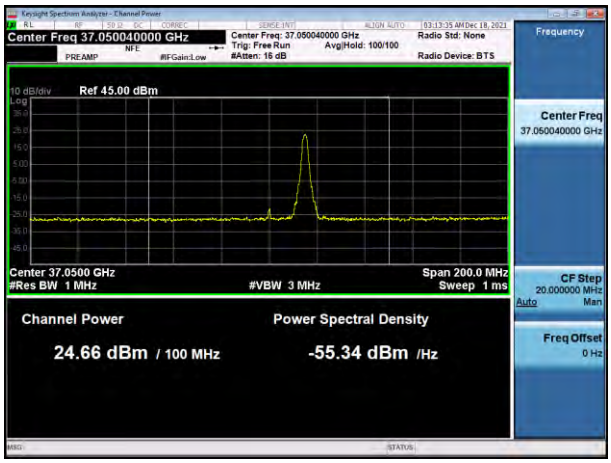
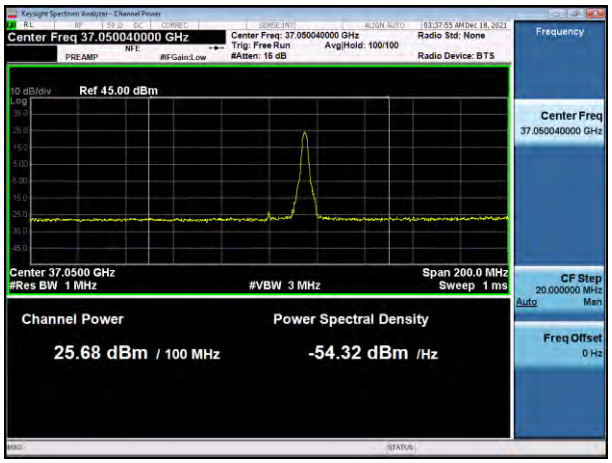
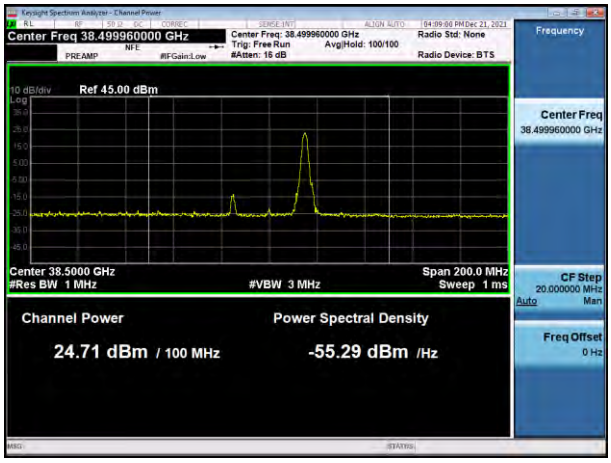
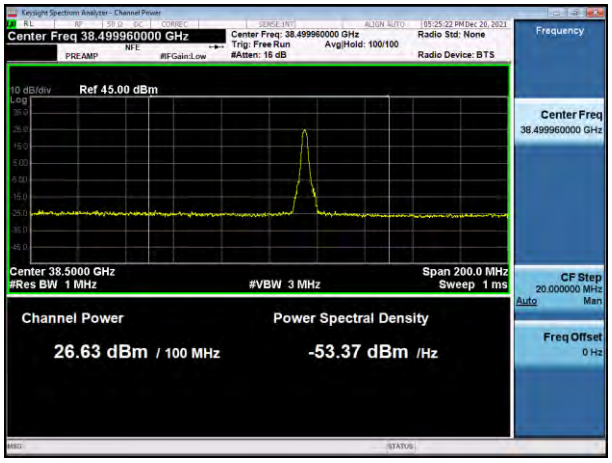
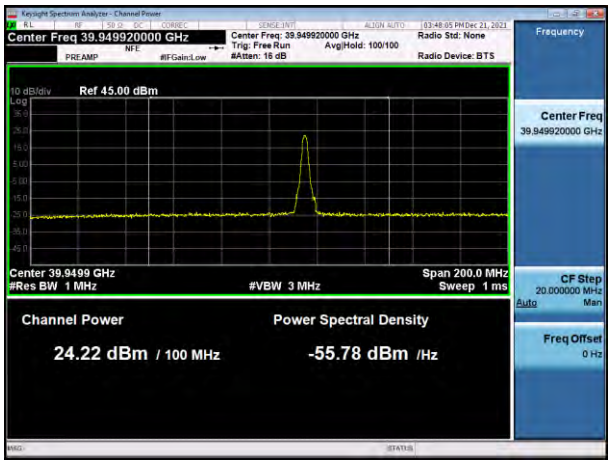
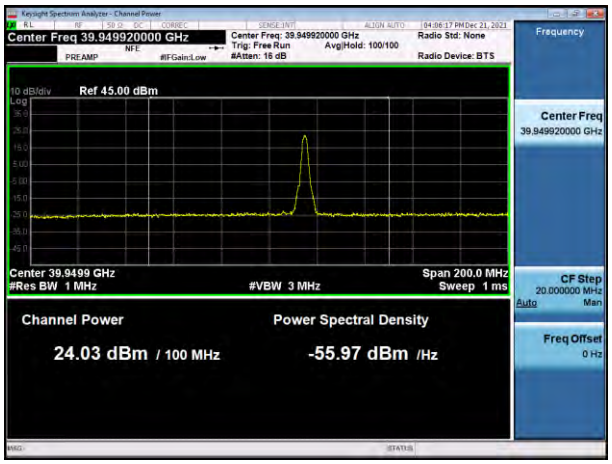
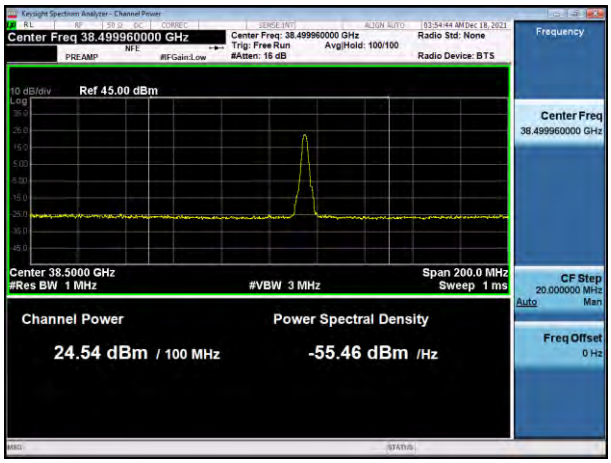
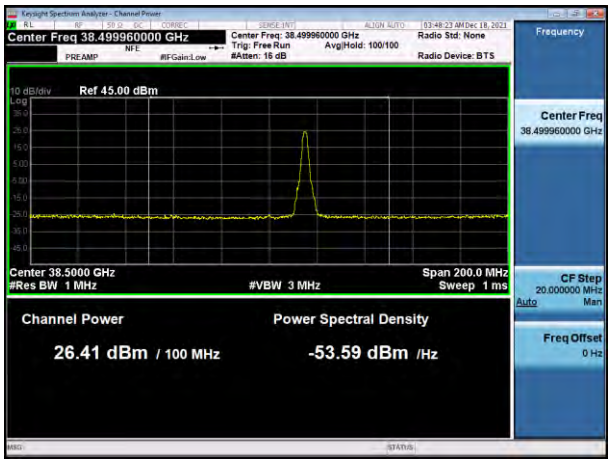
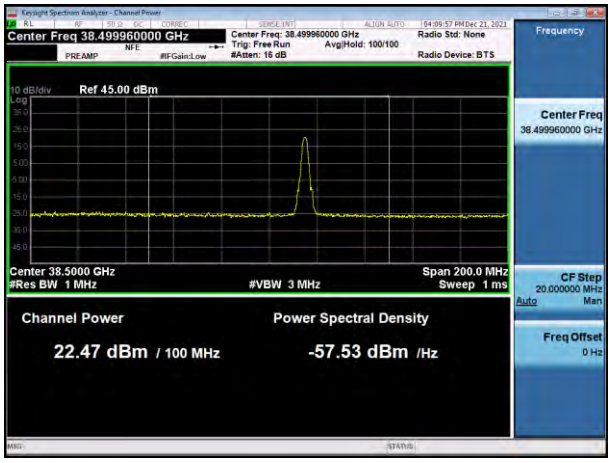
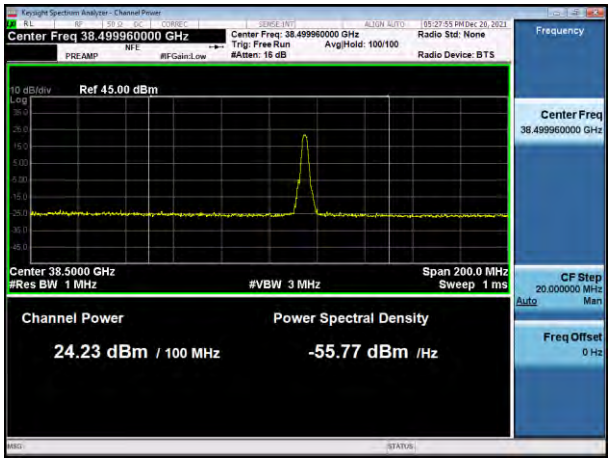
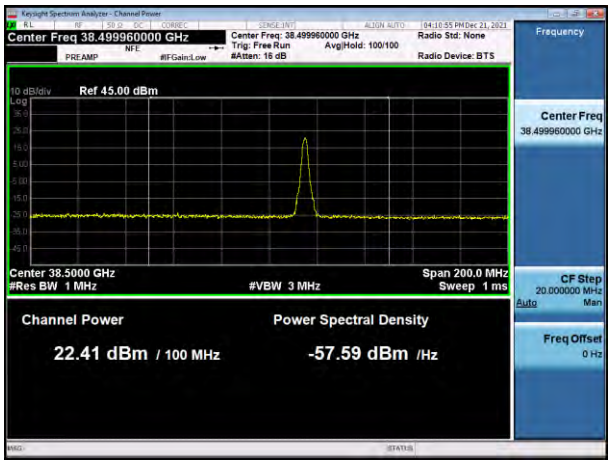
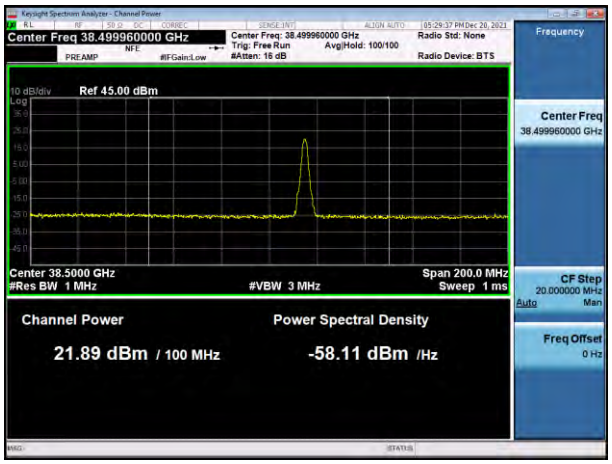
	
	
	

100 MHz, 1CC SISO Dual	
	
	
	

5.3. BAND EDGE

Test Overview

All out of band emissions are measured in a radiated setup while the EUT is operating at maximum power, and at the appropriate frequencies. All modulations 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.

The minimum permissible attenuation level of any spurious emission is -13dBm/1MHz. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

FCC Rules

Test Requirements:

§ 30.203 Emission limits.

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

Test Procedures:

The measurement is performed in accordance with Section 5.7.3 of ANSI C63.26.

5.7.3 Out-of-band unwanted emissions measurements

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range can be maintained.

c) Set the number of points in sweep ≥ 2 × span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1), 2) Omitted

3) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a free running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).

4) Omitted

e) The test report shall include the plots of the measuring instrument display and the measured data.

- The TRP measurement is performed in accordance with Section 4.4.2.4 of KDB 842590 v01r02 (2021-04).

4.4.2.4 Spherical Grid Method

a) Measure the antenna dimensions, i.e., depth (d), width (w), and height (h) (see Figure A.1 in Appendix A). If the antenna dimensions are not accessible use the mechanical dimensions of the entire device.

b) Calculate the spherical and cylindrical diameters (D and Dcyl) using Equations (A.1) and (A.2) in Appendix A in KDB 842590 v01r02.

c) For the highest frequency (smallest wavelength) of the frequency band measured, calculate the reference angular steps $\Delta\theta$ref and $\Delta\theta$ref using Equations (A.3) and (A.4) in Appendix A in KDB 842590 v01r02.

d) Set the grid spatial sampling step $\Delta\theta \leq \Delta\theta$ref for the vertical angle and $\Delta\theta \leq \Delta\theta$ref for the horizontal angle.

e) For each emission frequency, measure the total EIRP (sum of two orthogonal polarizations) on the selected grid.

f) For each emission frequency, calculate the TRP using weighted angular average value using numerical integration as described in Appendix B in KDB 842590 v01r02.

g) Compare measured TRP with the applicable TRP limit to make a pass/fail decision.

Test Results:

L patch: module 0, n261

CCs active	BW	Frequency [MHz]	Channel	Mode	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Band Edge [dBm]	SUM [dBm]
1	50 MHz	27525.00	Low	SISO dual	H	BPSK	H	1/0	-7.359	-3.46※2
					V		V		-5.738	
				SISO dual	H	BPSK	H	32/0	-18.097	-13.46※1
					V		V		-15.283	
		28324.92	High	SISO dual	H	BPSK	H	1/31	-7.834	-3.71※3
					V		V		-5.832	
				SISO dual	H	BPSK	H	32/0	-15.107	-12.19※1
					V		V		-15.286	
	100 MHz	27550.08	Low	SISO	V	BPSK	V	1/0	-9.655※1	-
				SISO	V	QPSK	V	64/0	-16.302	-
		28299.96	High	SISO	H	BPSK	H	1/65	-10.364※1	-
				SISO dual	H	QPSK	H	64/0	-18.229	-16.54
					V		V		-21.466	

※1 **Note:** Limit: -5 dBm

※2 **Note:** Limit: -5 dBm, For Band Edge used uncorrelated gain to comply conductive limit.
H beam pol. - Peak Ant. Gain
-7.359 (dBm) - 9.36 (dBi) = -16.719 dBm
V beam pol. - Peak Ant. Gain
-5.738 (dBm) - 5.35 (dBi) = -11.088 dBm
H+V Sum(dBm)= -10.038 dBm

※3 **Note:** Limit: -5 dBm, For Band Edge used uncorrelated gain to comply conductive limit.
H beam pol. - Peak Ant. Gain
-7.834 (dBm) - 9.98 (dBi) = -17.814 dBm
V beam pol. - Peak Ant. Gain
-5.832 (dBm) - 5.59 (dBi) = -11.422 dBm
H+V Sum(dBm)= -10.525 dBm

L patch: module 0, n260

CCs active	BW	Frequency [MHz]	Channel	Mode	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Band Edge [dBm]	SUM [dBm]
1	50 MHz	37025.04	Low	SISO dual	H	BPSK	H	1/0	-11.357	-5.52※2
					V		V		-6.828	
				SISO dual	H	BPSK	H	32/0	-22.901	-17.56
					V		V		-19.059	
		39975.00	High	SISO dual	H	BPSK	H	1/31	-11.663	-8.01※1
					V		V		-10.467	
				SISO	H	BPSK	H	32/0	-13.439※1	-
	100 MHz	37050.00	Low	SISO dual	H	BPSK	H	1/0	-9.033	-6.90※3
					V		V		-11.020	
				SISO dual	H	BPSK	H	64/0	-24.443	-19.93
					V		V		-21.823	
		39949.92	High	SISO dual	H	BPSK	H	1/65	-14.984	-13.04※1
					V		V		-17.454	
				SISO dual	H	BPSK	H	64/0	-20.237	-17.39
					V		V		-20.579	

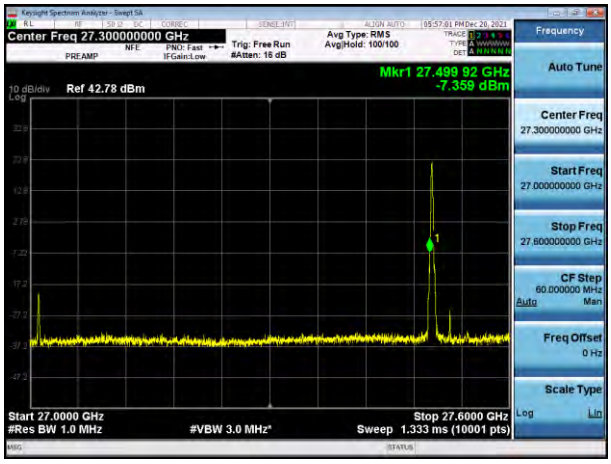
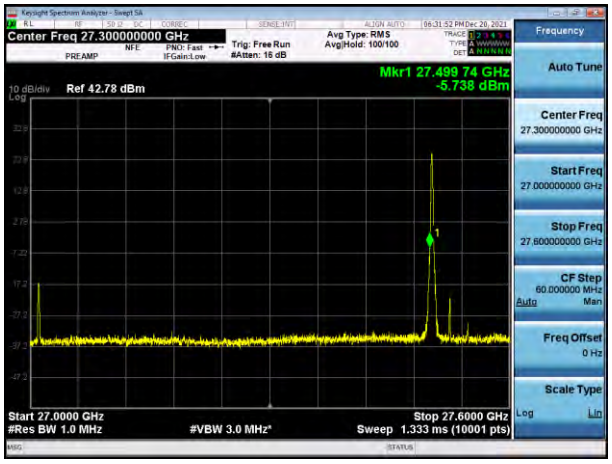
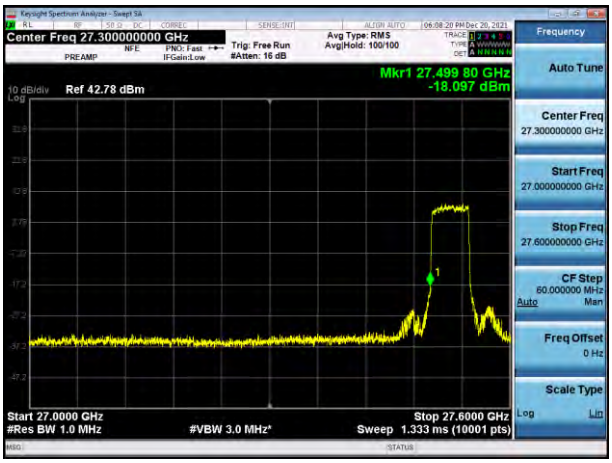
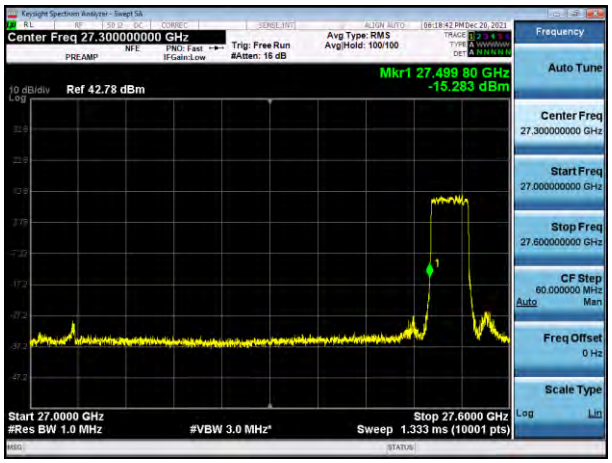
※1 **Note:** Limit: -5 dBm

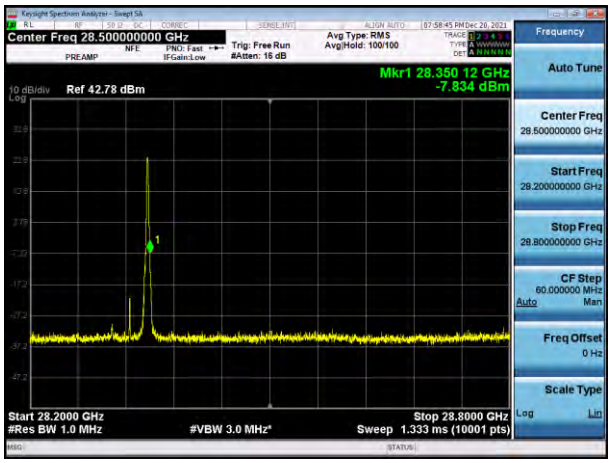
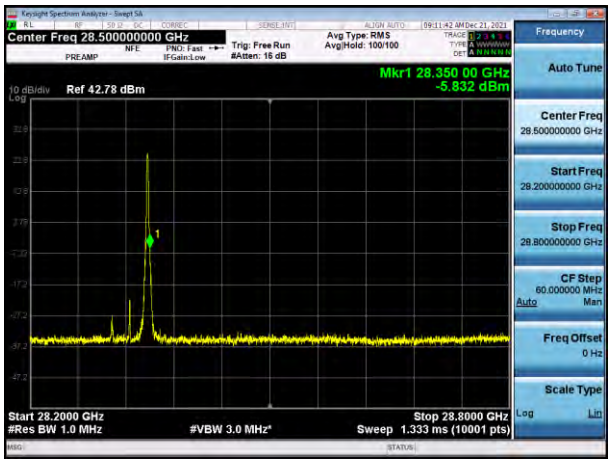
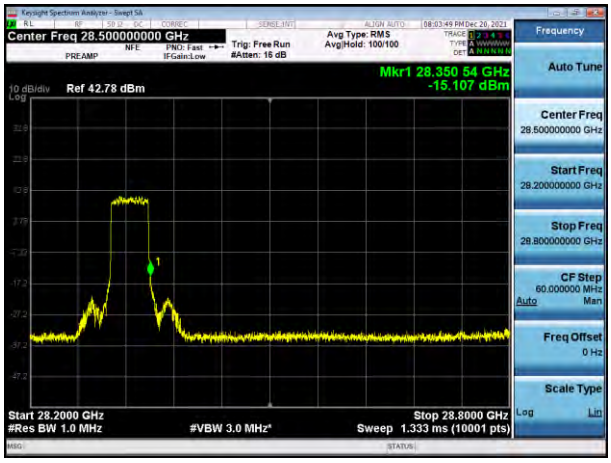
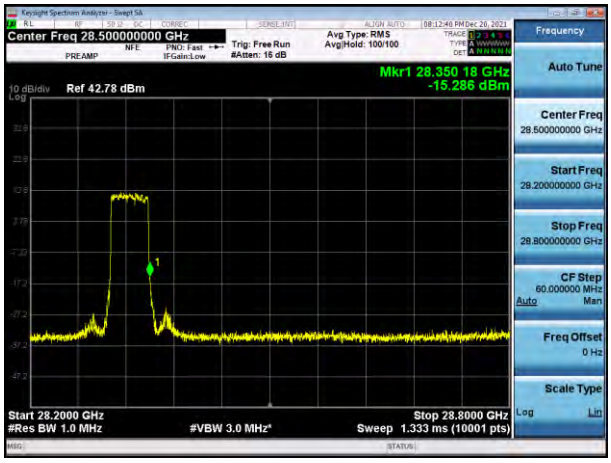
※2 **Note:** Limit: -5 dBm, For Band Edge used uncorrelated gain to comply conductive limit.
H beam pol. - Peak Ant. Gain
-11.357 (dBm) - 9.01 (dBi) = -20.367 dBm
V beam pol. - Peak Ant. Gain
-6.828 (dBm) - 8.72 (dBi) = -15.548 dBm
H+V Sum(dBm)= -14.311 dBm

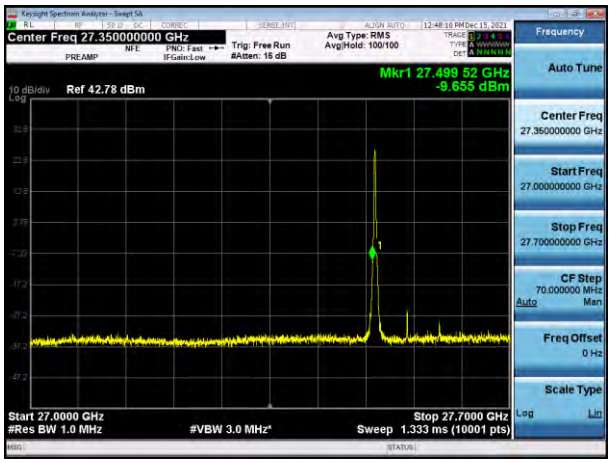
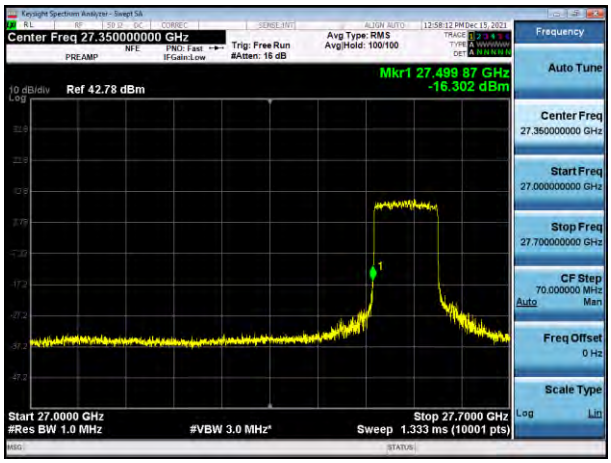
※3 **Note:** Limit: -5 dBm, For Band Edge used uncorrelated gain to comply conductive limit.
H beam pol. - Peak Ant. Gain
-9.033 (dBm) - 9.01 (dBi) = -18.043 dBm
V beam pol. - Peak Ant. Gain
-11.020 (dBm) - 8.72 (dBi) = -19.740 dBm
H+V Sum(dBm)= -15.799 dBm

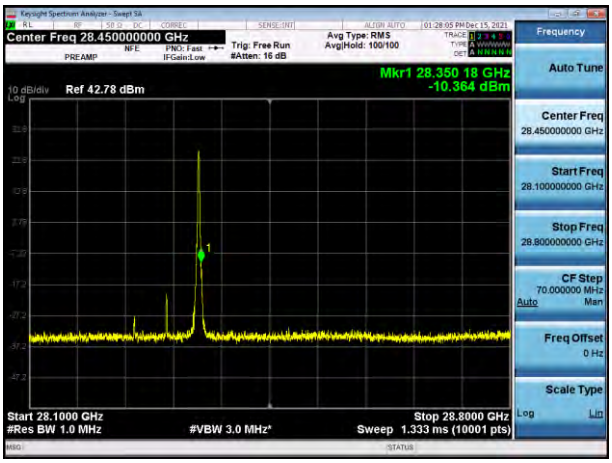
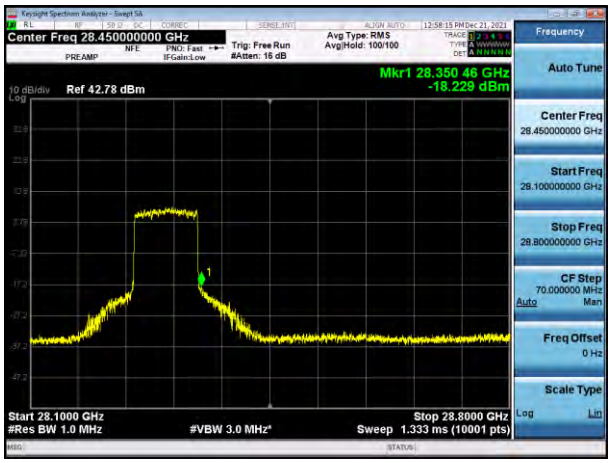
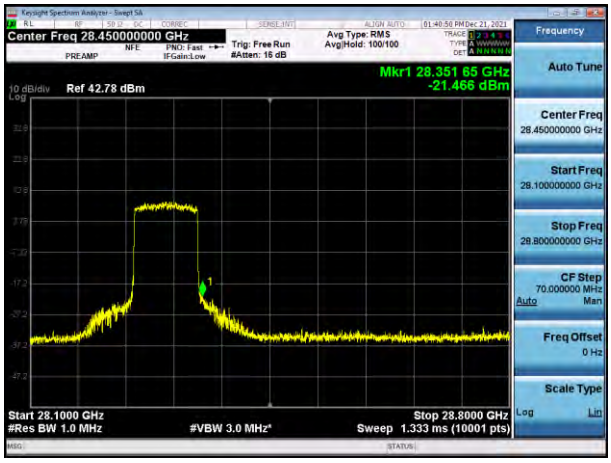
Plot data of Band Edge

1. L patch: module 0, n261

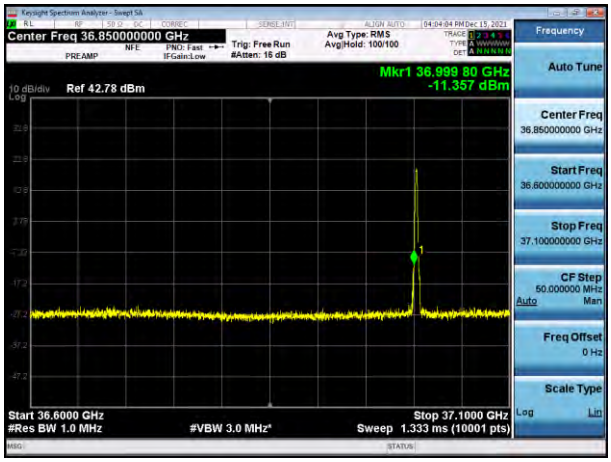
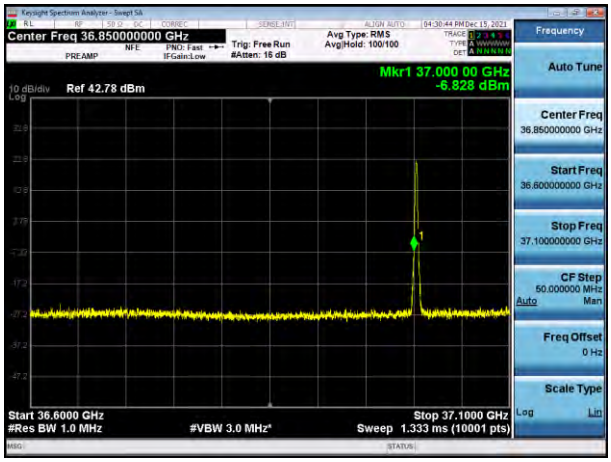
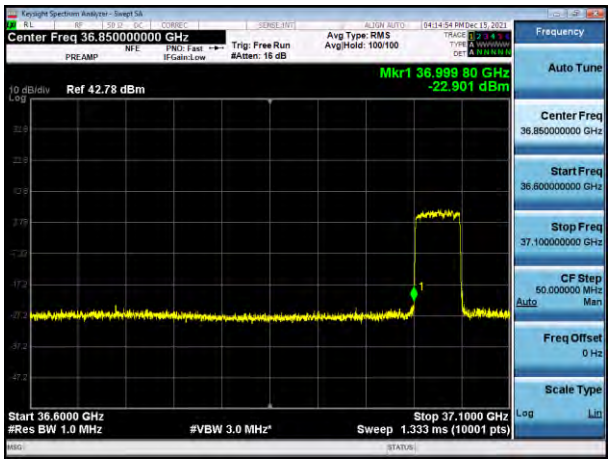
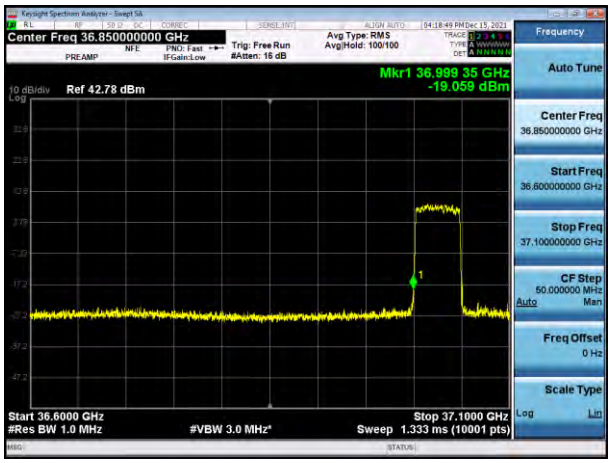
50 MHz, 1CC Low	
	
	

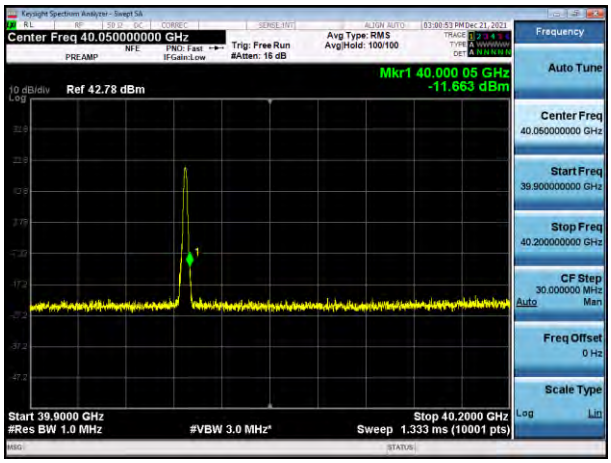
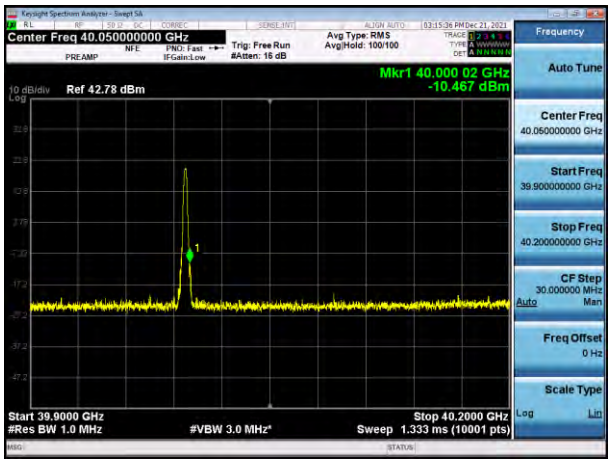
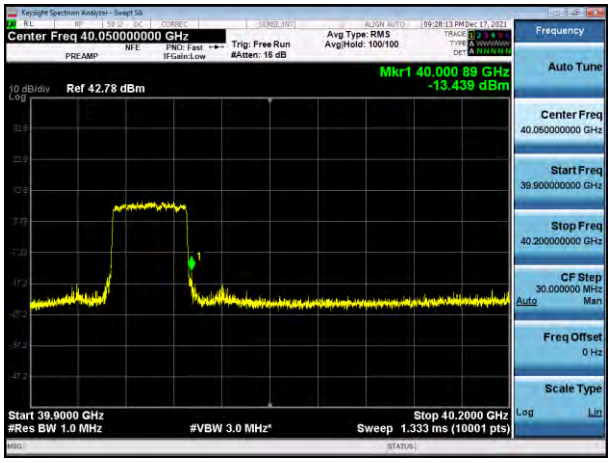
50 MHz, 1CC High	
	
	

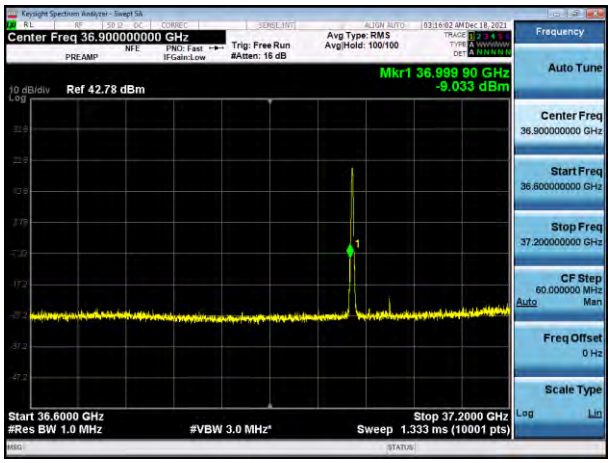
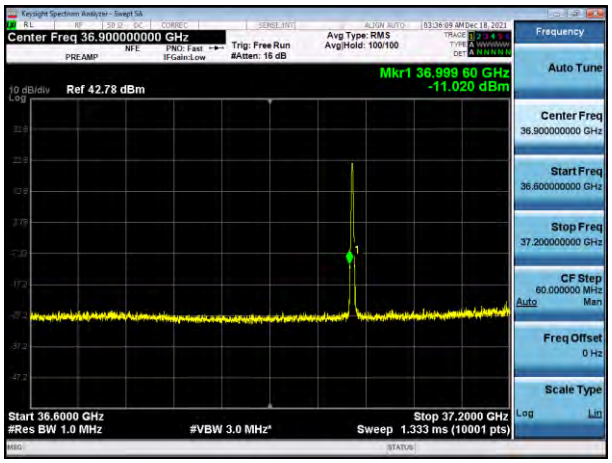
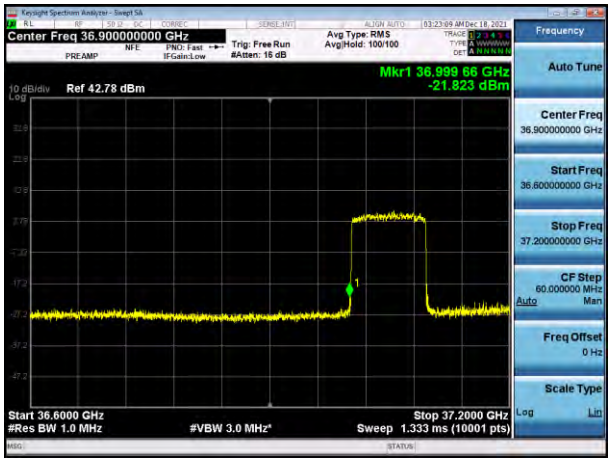
100 MHz, 1CC Low	
	

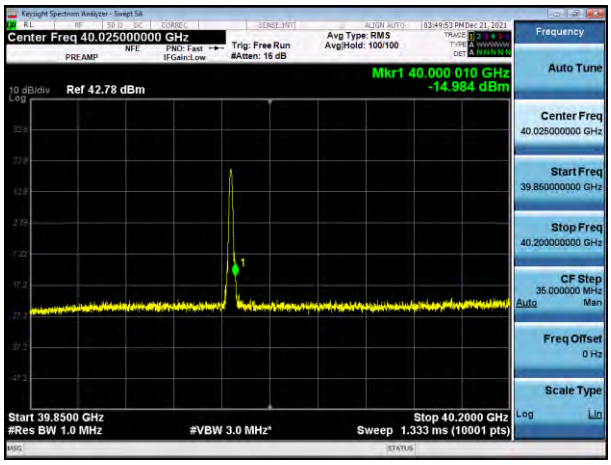
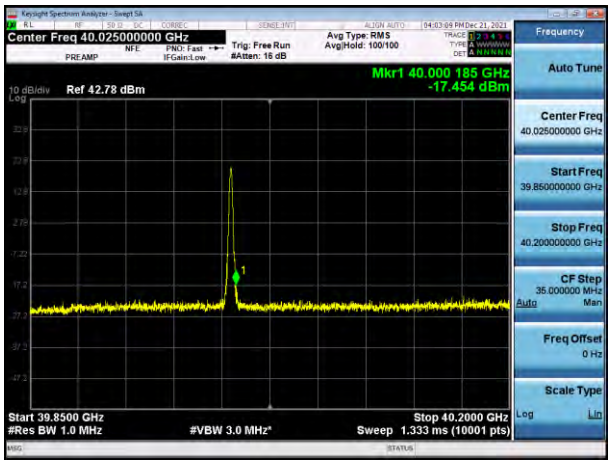
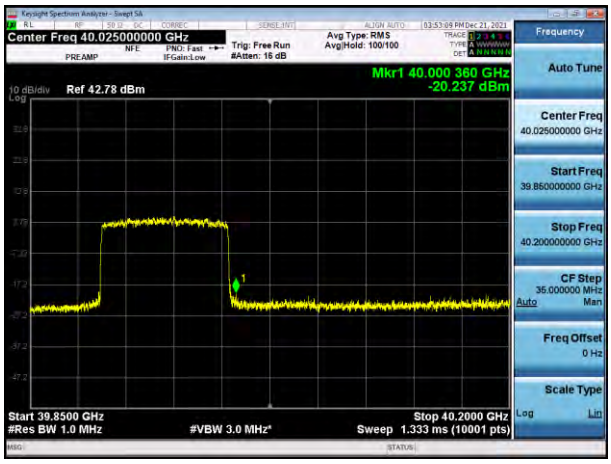
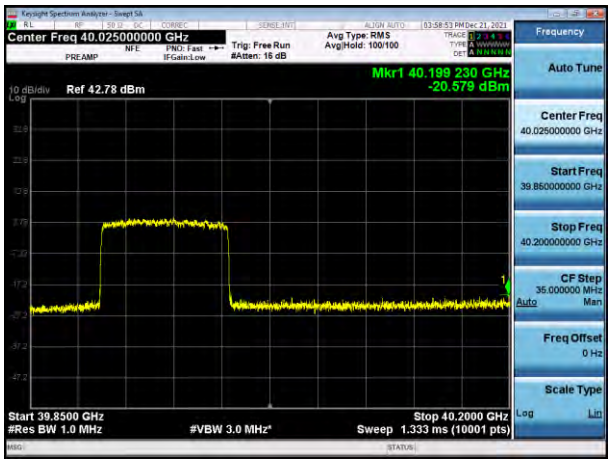
100 MHz, 1CC High	
	
	

3. L patch: module 0, n260

50 MHz, 1CC Low	
	
	

50 MHz, 1CC High	
	
	

100 MHz, 1CC Low	
	
	

100 MHz, 1CC High	
	
	

5.4. RADIATED SPURIOUS EMISSIONS

Test Overview

The test frequency range is from 9 kHz to 200GHz. All out of band emissions are measured in a radiated test setup while the EUT is operating at maximum power, and at the appropriate frequencies. All modulations 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.

The conductive power or total radiated power of any emissions outside a licensee's frequency block shall be -13dBm/1MHz.

FCC Rules

Test Requirements:

§ 30.203 Emission limits.

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

EIRP Test Procedures:

The measurement is performed in accordance with Section 5.7.4 of ANSI C63.26.

5.7.4 Spurious unwanted emission measurements

a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the measurements previously performed in 5.7.3. As an alternative, the stop frequency can be set to the value specified in 5.1.1, depending on the EUT operating range, if the resulting plot can clearly demonstrate compliance for all frequencies not addressed by the out-of-band emissions measurements performed as per 5.7.3.

b) When using an average power (rms) detector, ensure that the number of points in the sweep ≥ 2 × (span / RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power is specified by the applicable regulation, a peak-

detector can be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) shall be further examined using a power averaging (rms) detector with the minimum number of measurement points as defined above.

c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time shall be set as described for out-of-band emissions measurements in item d) of 5.7.3.

d) Identify and measure the highest spurious emission levels in each frequency range. It is not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.

e) Repeat step b) through step d) for the upper spurious emission frequency range if not already captured by a wide span measurement performed as per the alternative provided in step a). The upper frequency for this measurement is defined in 5.1.1 as a function of the EUT operating range.

f) Compare the results with the corresponding limit in the applicable regulation.

g) The test report shall include the data plots of the measuring instrument display and the measured data.

TRP Test Procedures:

The measurement is performed in accordance with Section 4.4.3.3.2 of KDB 842590 v01r02 (2021-04).

a) Align the EUT with a chosen xy-plane and the xz-plane of the antenna measurement coordinate system.

NOTE 1 For harmonics and spurious emission frequencies which are beamforming as identified in exploratory scan, it may be required to align the orthogonal cuts to include the peak based on exploratory scans.

b) Measure the EUT dimensions, i.e., depth (d), width (w), and height (h); see Figure A.1 in Appendix A.

c) Calculate the spherical and cylindrical diameters (D and Dcyl) using Equations (A.1) and (A.2) (see Appendix A).

d) For the highest frequency (smallest wavelength) of the frequency band measured, calculate the reference angular steps $\Delta\theta$ref and $\Delta\phi$ref using Equations (A.3) and (A.4).

e) Set the grid spatial sampling step $\Delta\theta \leq \Delta\theta$ref for the vertical angle and $\Delta\phi \leq \Delta\phi$ref for the horizontal cut.

f) For each emission frequency, measure the EIRP (as a sum of two orthogonal polarizations) at each spatial sampling step on the selected grid.

g) For each emission frequency, calculate the average EIRP for both the cuts separately, and then take the average of these two average values.

h) Add 2 dB as a correction factor to the averaged value computed in step g).

i) If the TRP limit is exceeded, a third orthogonal cut in the yz-plane and using the $\Delta\theta$ angular step, can be added. Now, calculate the average values in all three cuts separately, and then take the average value of these three average values.

j) Add 1.5 dB as a correction factor to the averaged value computed in step i).

k) Evaluate the pass/fail decision by comparing TRP from step h) or step j) against the applicable TRP limit.

Note:

1. Spurious emission test is performed up to 200 GHz(up to 100 GHz for n261)
frequency according to section 5.1.1 of ANSI C63.26 -2015.
2. Measurement distance is applied far field condition on page 17.
3. Additionally, we were performed the RSE test in EN-DC mode. It was determined that there is no new emission introduced by EN-DC mode.
4. All RSE were measured with 1CC. The worst case is 1CC with QPSK or PI/2BPSK modulation.
5. All factors except spectrum analyzer level are applied as correction factor each band in the analyzer and calculated in tabular data.
In this test, AFCL factor consists of antenna factor, cable loss, mixer loss, amplifier gain and duty correction.
Emissions value is first converted by distance factor as follow.

Converted value (dBm) = Measured Value (dBuV) + 20 LOG(D)-104.77
Final spurious emissions result is calculated as follows.
Spurious Emissions = Converted Value (dBm) + AFCL

6. Measurement RBW correction factor(Reference RBW : 1 MHz)
The measured value in table is included the RBW correction factor.

10log(Reference RBW/Measured RBW)
In case of 1 kHz RBW, correction factor is 30 dB.
In case of 10 kHz RBW, correction factor is 20 dB.
In case of 100 kHz RBW, correction factor is 10 dB.

7. Calculations

The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses.

8. In case of 9 kHz to 30 MHz, the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

9. All modes of operation were investigated and the worst case configuration results are reported.
- Mode : 5G NR, 5G NR + WLAN 5GHz+ BT
- Worstcase : 5G NR

10. Corrction Factor

30MHz ~1GHz		1~18GHz		18~40GHz		40~200GHz	
Freq. (MHz)	AFCL	Freq. (GHz)	AFCL	Freq. (GHz)	AFCL	Freq. (GHz)	AFCL
30	18.56	1	-16.07	18	-12.92	40	20.49
80	15.96	1.5	-14.09	18.5	-12.60	45	34.19
100	15.89	2	-11.78	19	-12.81	50	26.78
150	20.76	2.5	-8.32	19.5	-12.41	55	28.89
200	17.48	3	-5.53	20	-12.15	60	25.98
250	19.57	3.5	-3.57	20.5	-12.05	60	41.01
300	21.36	4	-1.33	21	-11.50	65	40.16
350	22.53	4.5	0.34	21.5	-10.90	70	36.10
400	24.1	5	2.75	22	-10.68	75	33.87
450	25.53	5.5	3.92	22.5	-10.44	80	35.02
500	26.28	6	4.80	23	-9.48	85	39.27
550	27.22	6.5	6.35	23.5	-9.15	90	43.62
600	28.55	7	8.58	24	-9.09	90	36.80
650	29.46	7.5	10.39	24.5	-8.41	95	50.84
700	30.09	8	11.59	25	-7.83	100	43.88
750	31.01	8.5	11.60	25.5	-7.89	105	39.39
800	31.72	9	13.23	26	-7.88	110	42.81
850	32.14	9.5	14.84	26.5	-7.72	115	55.70
900	32.74	10	16.58	27	-8.02	120	42.37
950	33.55	10.5	18.44	27.5	-8.23	125	44.95
1000	34.16	11	18.65	28	-7.81	130	53.71
-	-	11.5	19.51	28.5	-7.76	135	48.91
-	-	12	18.97	29	-7.22	140	47.35
-	-	12.5	19.19	29.5	-7.49	140	51.96
-	-	13	20.28	30	-7.24	145	55.59
-	-	13.5	21.13	30.5	-7.11	150	62.28
-	-	14	20.44	31	-6.54	155	55.19
-	-	14.5	21.76	31.5	-7.04	160	54.60
-	-	15	21.54	32	-6.43	165	54.71
-	-	15.5	20.10	32.5	-6.73	170	60.44
-	-	16	19.65	33	-6.74	175	56.18
-	-	16.5	20.99	33.5	-6.55	180	57.49
-	-	17	23.04	34	-6.19	185	54.04
-	-	17.5	25.84	34.5	-6.92	190	52.76

30MHz ~1GHz		1~18GHz		18~40GHz		40~200GHz	
Freq. (MHz)	AFCL	Freq. (GHz)	AFCL	Freq. (GHz)	AFCL	Freq. (GHz)	AFCL
-	-	18	30.19	35	-6.49	195	54.82
-	-	-	-	35.5	-6.40	200	61.10
-	-	-	-	36	-6.43	-	-
-	-	-	-	36.5	-5.78	-	-
-	-	-	-	37	-4.93	-	-
-	-	-	-	37.5	-4.12	-	-
-	-	-	-	38	-3.85	-	-
-	-	-	-	38.5	-2.27	-	-
-	-	-	-	39	-0.15	-	-
-	-	-	-	39.5	1.40	-	-
-	-	-	-	40	1.11	-	-

*Correction Factor= Antenna Factor + Cable Loss – Amp. Gain + (Harmonic Mixer Conversion Loss)

Test Results: Tabular Data of Radiated Spurious Emissions

1. L patch: module 0, n261

DFT-s OFDM (SISO or SISO Dual)

30 MHz ~ 1 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	63.76	3	-28.47
		27924.96	Mid	V	BPSK	V	1/33	63.54	3	-31.69
		28299.96	High	H+V	BPSK	V	1/22	64.09	3	-28.14

1 GHz ~ 10 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	55.25	3	-36.98
		27924.96	Mid	V	BPSK	V	1/33	52.66	3	-42.57
		28299.96	High	H+V	BPSK	V	1/22	53.72	3	-38.51

10 GHz ~ 18 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	58.51	3	-33.72
		27924.96	Mid	V	BPSK	V	1/33	59.75	3	-35.48
		28299.96	High	H+V	BPSK	V	1/22	59.65	3	-32.58

18 GHz ~ 27 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	61.35	3	-30.88
		27924.96	Mid	V	BPSK	V	1/33	59.62	3	-35.61
		28299.96	High	H+V	BPSK	V	1/22	59.90	3	-32.33

28.8 GHz ~ 40 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	59.51	3	-32.72
		27924.96	Mid	V	BPSK	V	1/33	70.13	3	-25.10
		28299.96	High	H+V	BPSK	V	1/22	67.95	3	-24.28

40 GHz ~ 60 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	61.59	3	-30.64
		27924.96	Mid	V	BPSK	V	1/33	61.78	3	-33.45
		28299.96	High	H+V	BPSK	V	1/22	61.51	3	-30.72

60 GHz ~ 90 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	61.39	1	-40.38
		27924.96	Mid	V	BPSK	V	1/33	61.51	1	-43.26
		28299.96	High	H+V	BPSK	V	1/22	61.22	1	-40.55

90 GHz ~ 100 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	100	27550.08	Low	H+V	BPSK	V	1/22	79.23	1	-22.54
		27924.96	Mid	V	BPSK	V	1/33	79.13	1	-25.64
		28299.96	High	H+V	BPSK	V	1/22	79.19	1	-22.58

2. L patch: module 0, n260

DFT-s OFDM (SISO or SISO Dual)

30 MHz ~ 1 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	63.25	3	-28.98
		38499.96	Mid	H+V	BPSK	V	1/21	64.14	3	-28.09
	100	39949.92	High	H+V	BPSK	H	1/43	63.76	3	-28.47

1 GHz ~ 10 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	59.69	3	-32.54
		38499.96	Mid	H+V	BPSK	V	1/21	56.59	3	-35.64
	100	39949.92	High	H+V	BPSK	H	1/43	54.77	3	-37.46

10 GHz ~ 18 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	58.81	3	-33.42
		38499.96	Mid	H+V	BPSK	V	1/21	59.03	3	-33.20
	100	39949.92	High	H+V	BPSK	H	1/43	58.07	3	-34.16

18 GHz ~ 26.5 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	50.44	3	-41.79
		38499.96	Mid	H+V	BPSK	V	1/21	50.12	3	-42.11
	100	39949.92	High	H+V	BPSK	H	1/43	50.33	3	-41.90

26.5 GHz ~ 36.6 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	65.03	3	-27.20
		38499.96	Mid	H+V	BPSK	V	1/21	56.78	3	-35.45
	100	39949.92	High	H+V	BPSK	H	1/43	59.06	3	-33.17

40 GHz ~ 60 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	61.53	3	-30.70
		38499.96	Mid	H+V	BPSK	V	1/21	61.46	3	-30.77
	100	39949.92	High	H+V	BPSK	H	1/43	61.56	3	-30.67

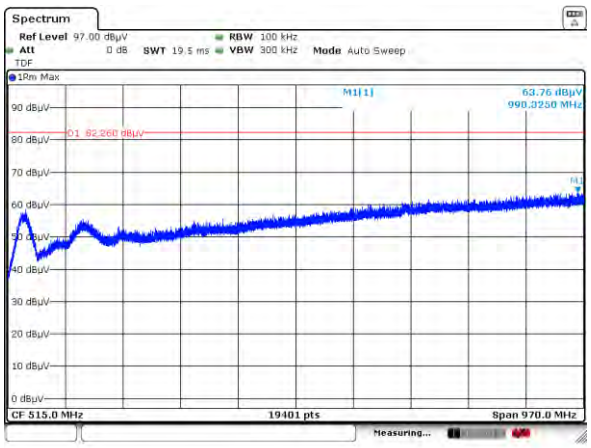
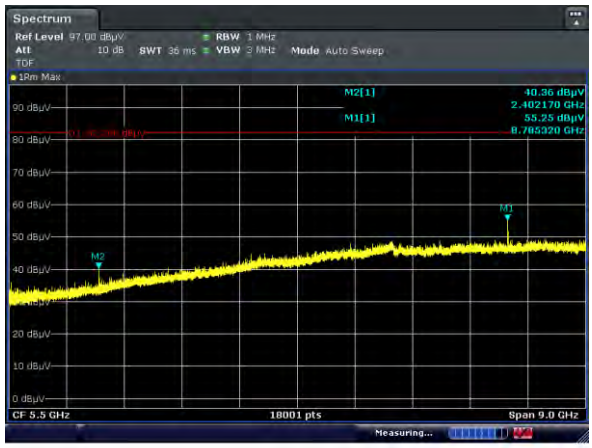
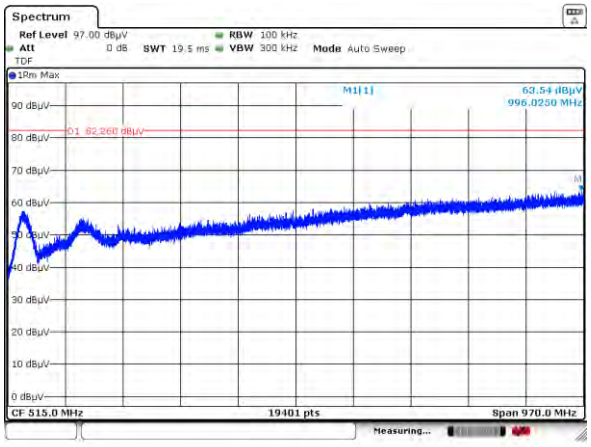
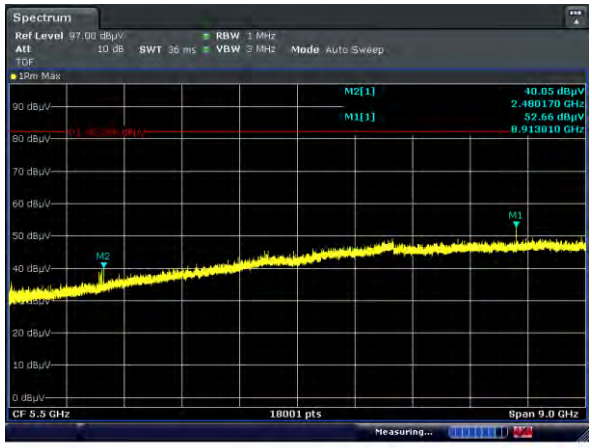
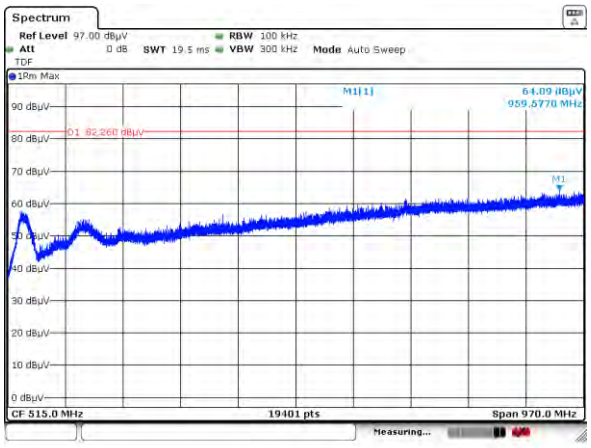
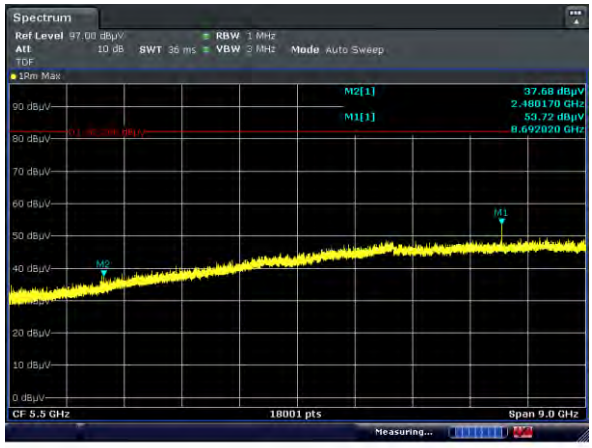
60 GHz ~ 90 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	61.46	1	-40.31
		38499.96	Mid	H+V	BPSK	V	1/21	61.29	1	-40.48
	100	39949.92	High	H+V	BPSK	H	1/43	61.24	1	-40.53

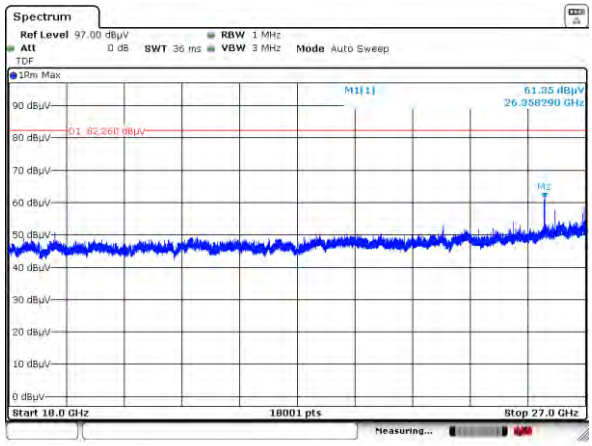
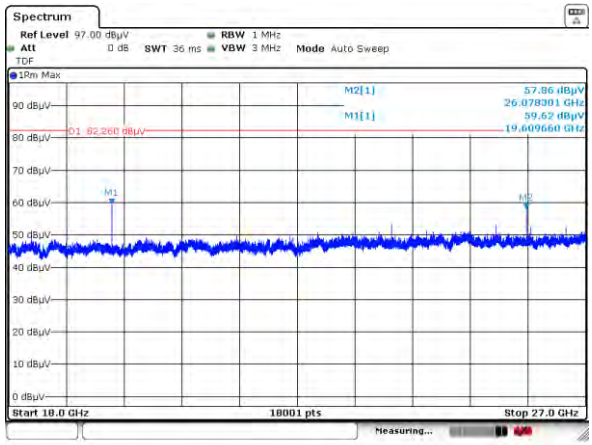
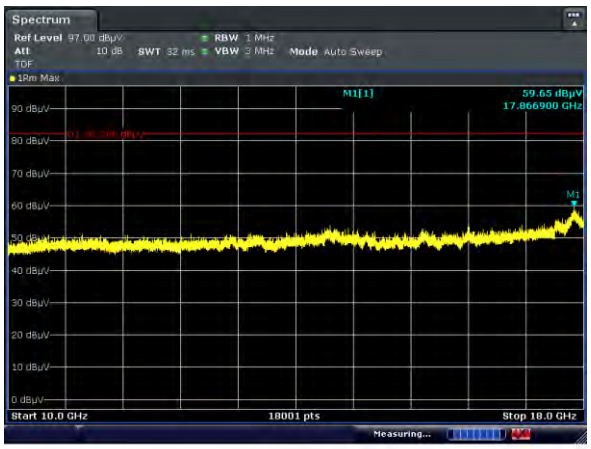
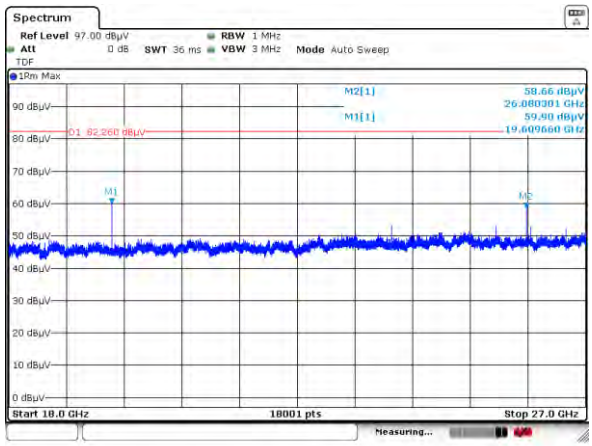
90 GHz ~ 140 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	85.19	1	-16.58
		38499.96	Mid	H+V	BPSK	V	1/21	85.02	1	-16.75
	100	39949.92	High	H+V	BPSK	H	1/43	85.18	1	-16.59

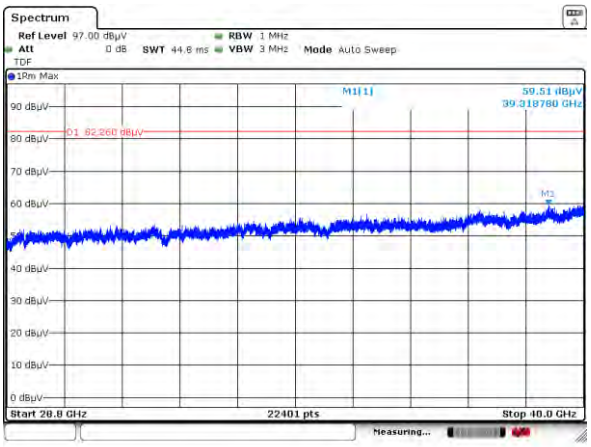
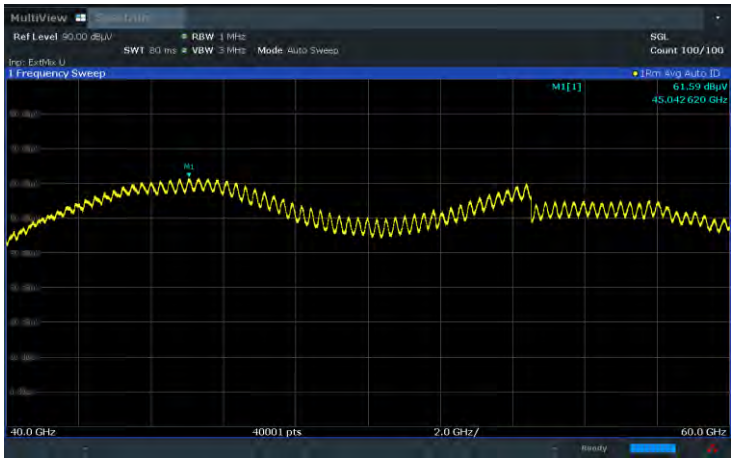
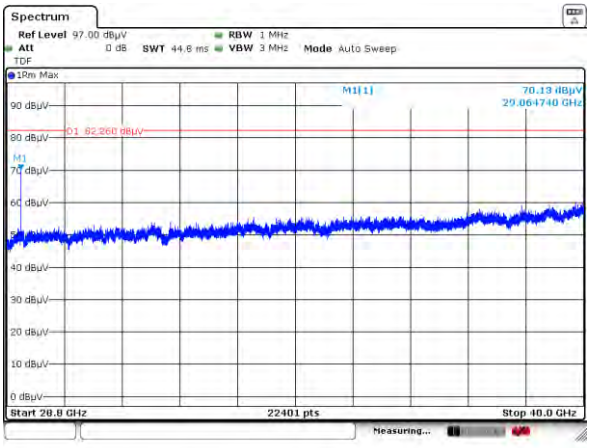
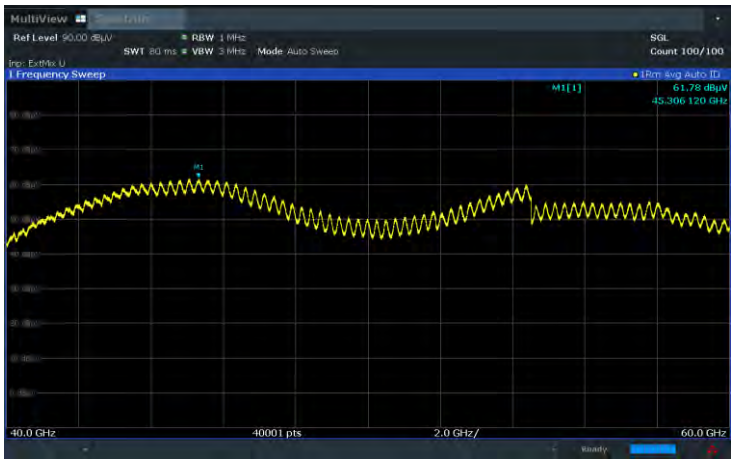
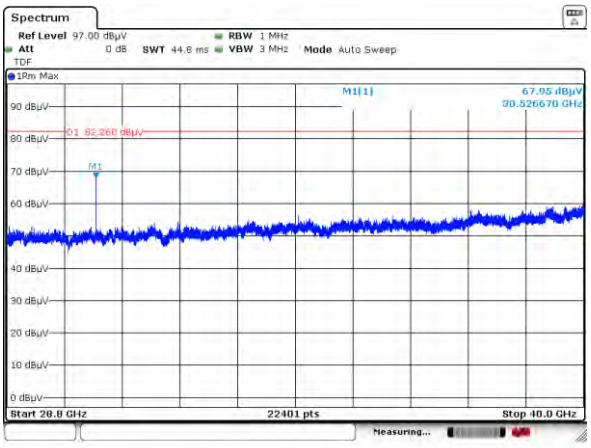
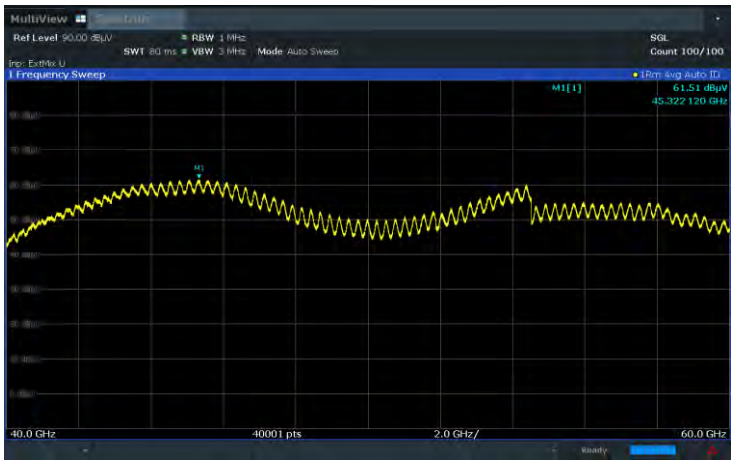
140 GHz ~ 170 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	80.42	0.5	-27.37
		38499.96	Mid	H+V	BPSK	V	1/21	80.50	0.5	-27.29
	100	39949.92	High	H+V	BPSK	H	1/43	80.50	0.5	-27.29

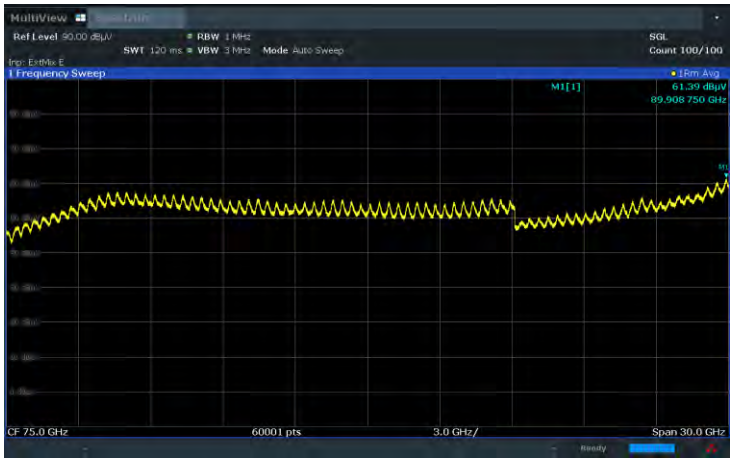
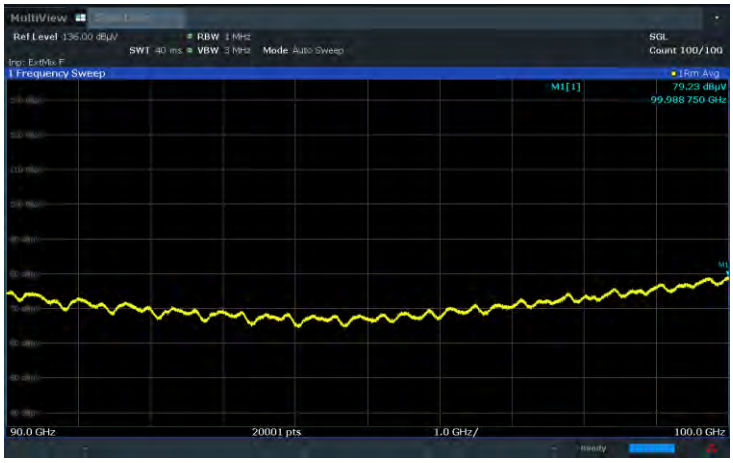
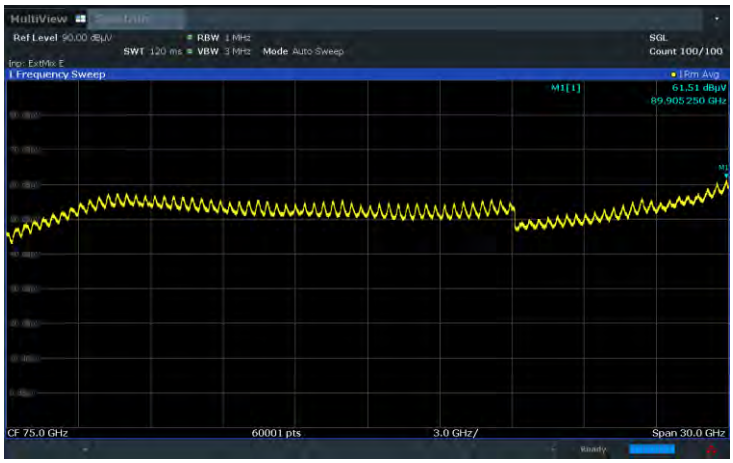
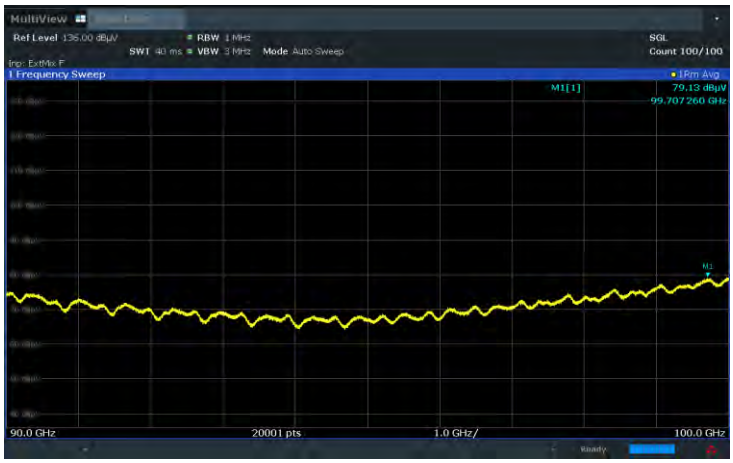
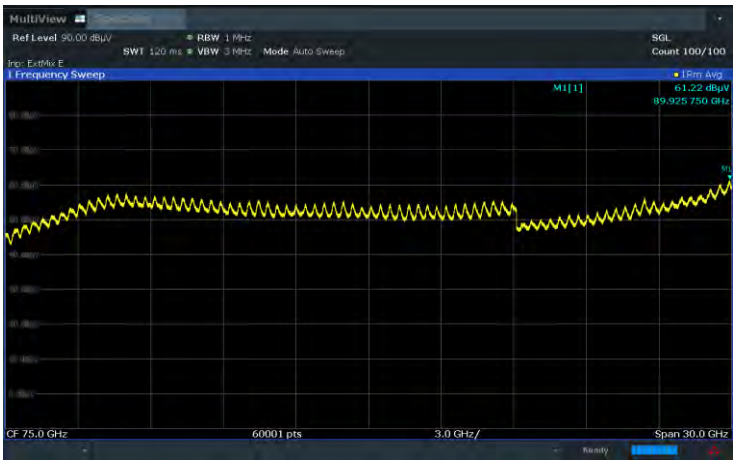
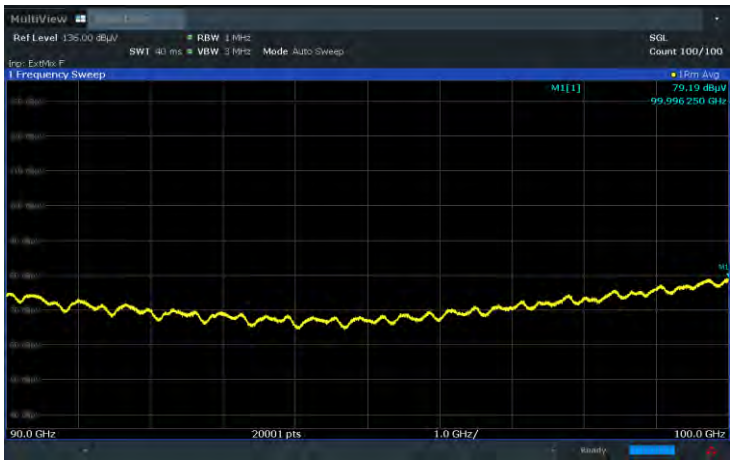
170 GHz ~ 200 GHz										
CCs active	BW [MHz]	Frequency [MHz]	Channel	Beam Pol.	Modulation	Ant. Pol. [H/V]	RB Size/Offset	Measured Value (dBuV)	Distance (m)	Conversion Value Result (dBm)
1	50	37025.04	Low	H+V	BPSK	V	1/21	75.57	0.5	-32.22
		38499.96	Mid	H+V	BPSK	V	1/21	74.58	0.5	-33.21
	100	39949.92	High	H+V	BPSK	H	1/43	74.52	0.5	-33.27

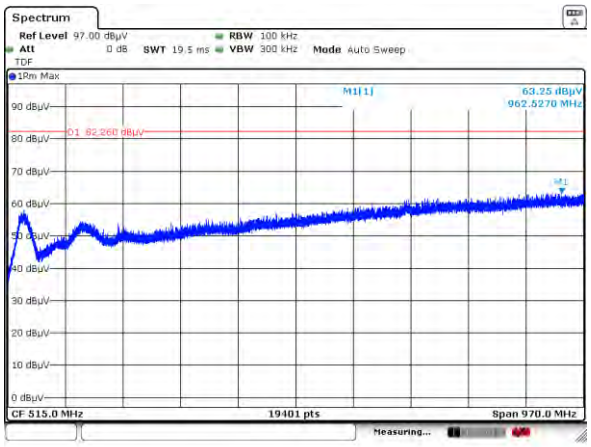
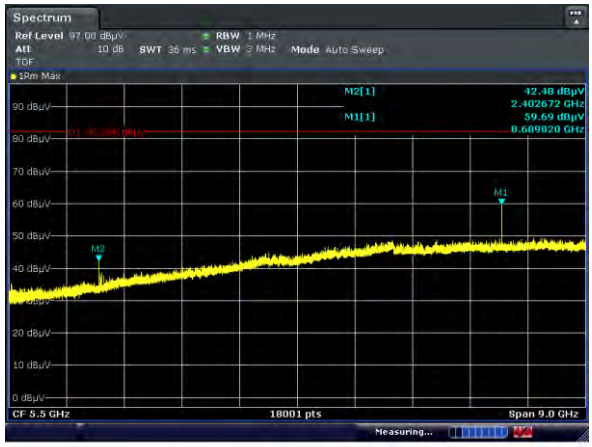
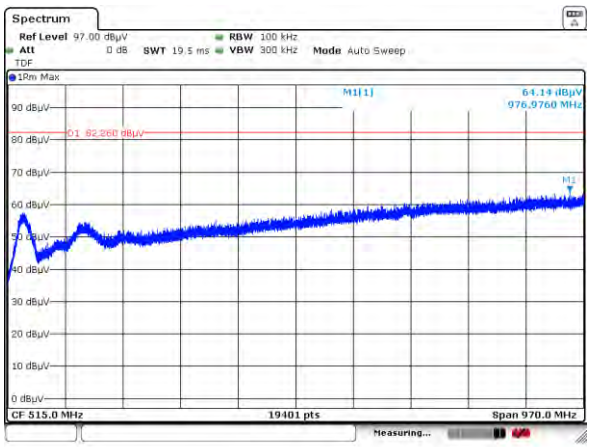
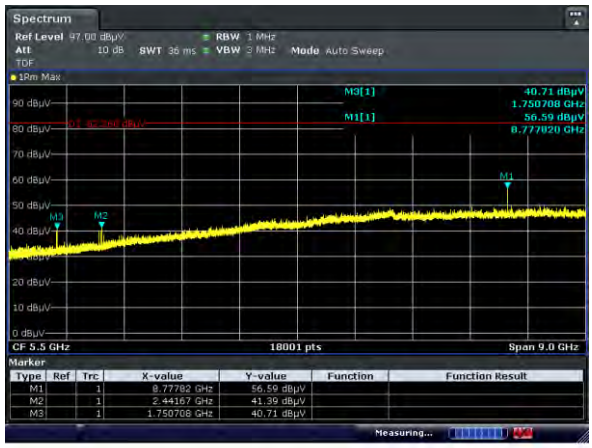
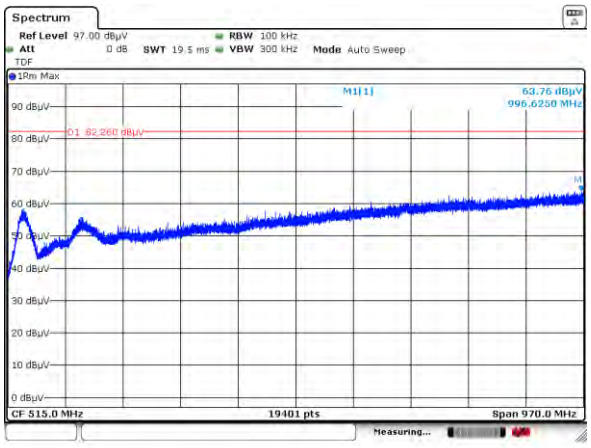
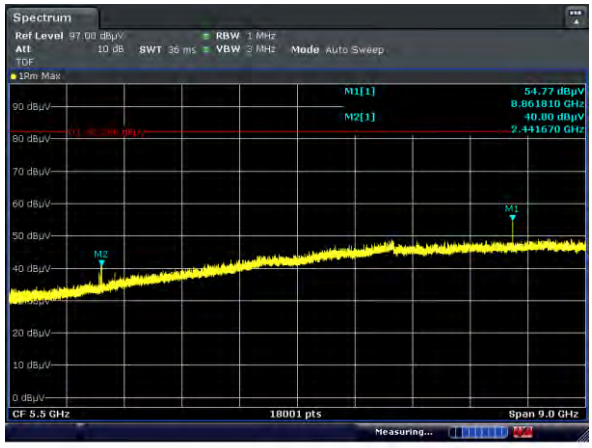
Plot data of Radiated Spurious Emissions

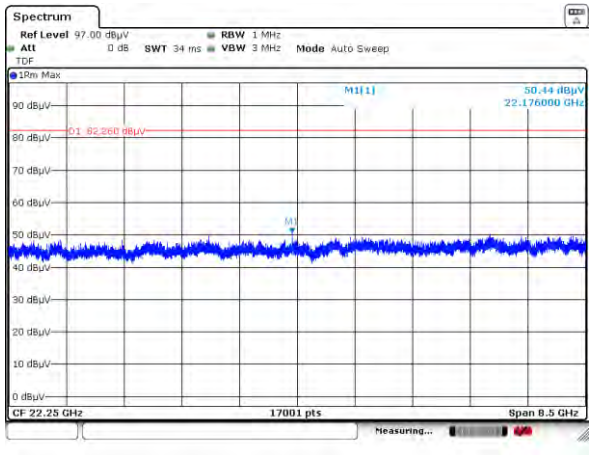
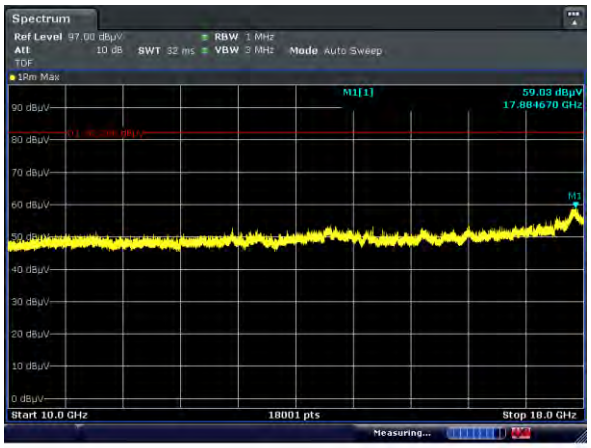
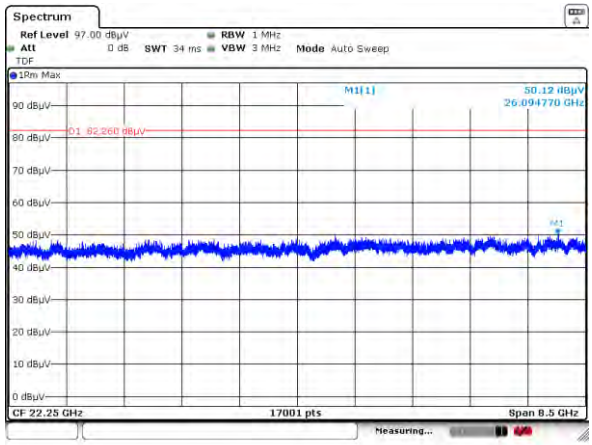
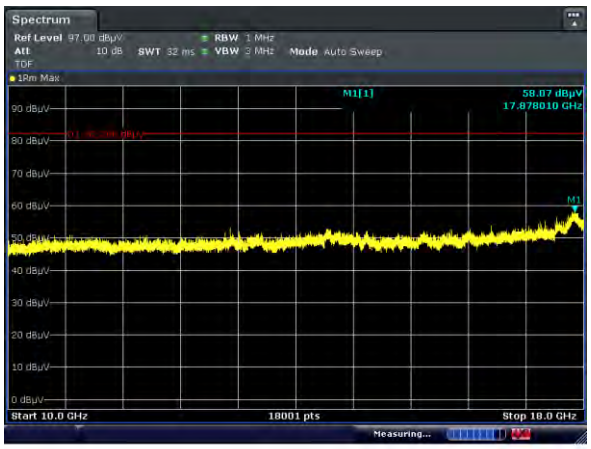
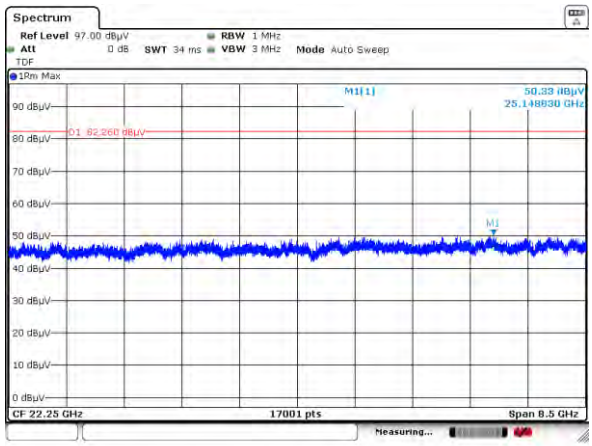
1 CC L patch: module 0	
n261 [30 MHz ~ 1 GHz]	**n261 [1 GHz ~ 10 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

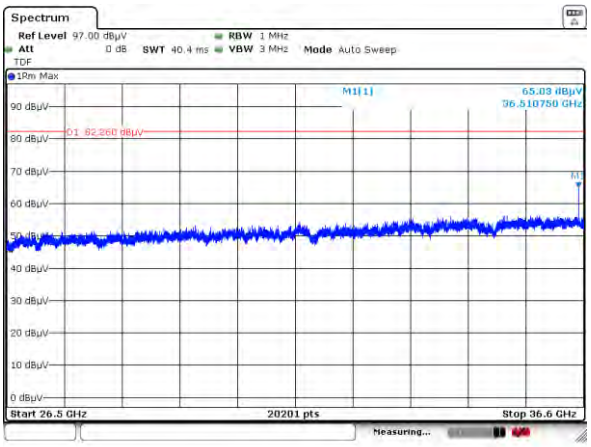
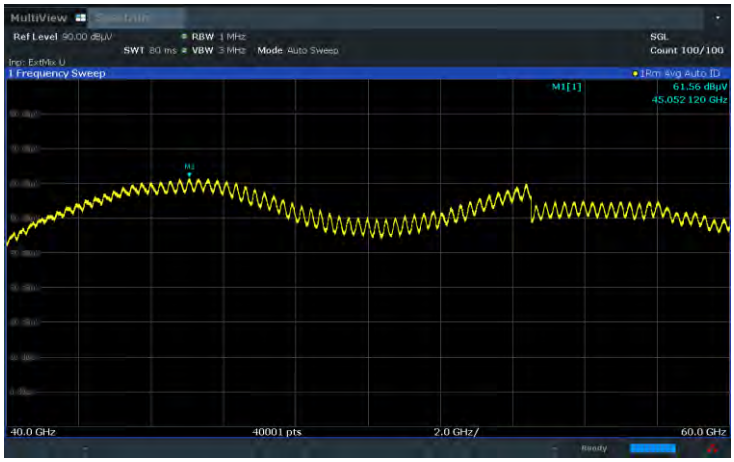
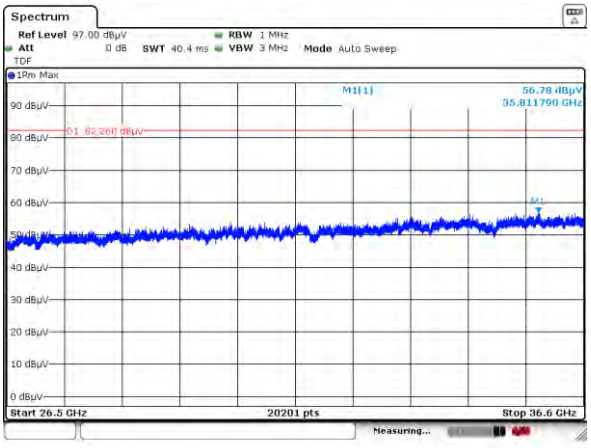
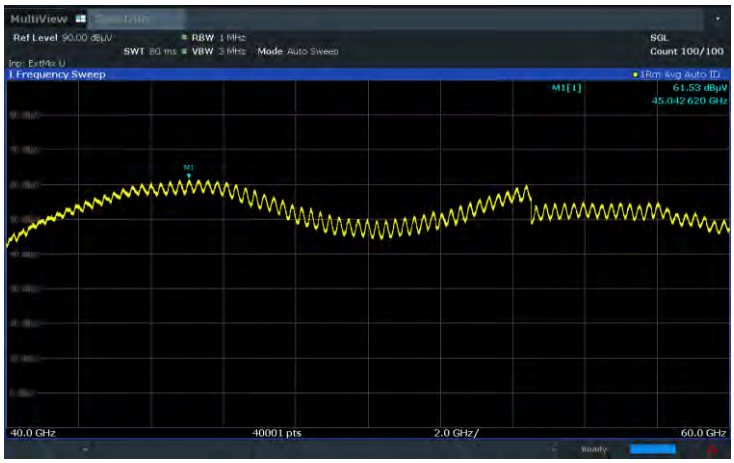
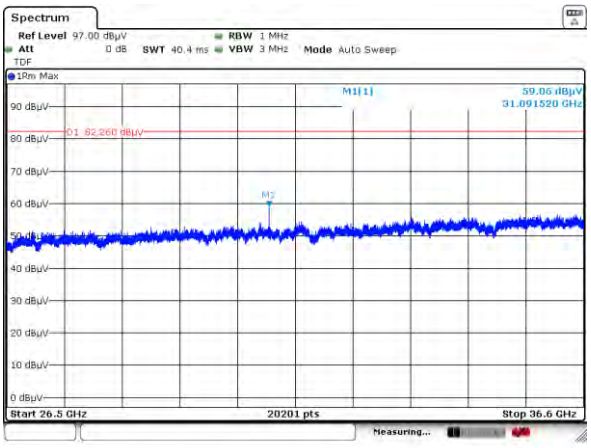
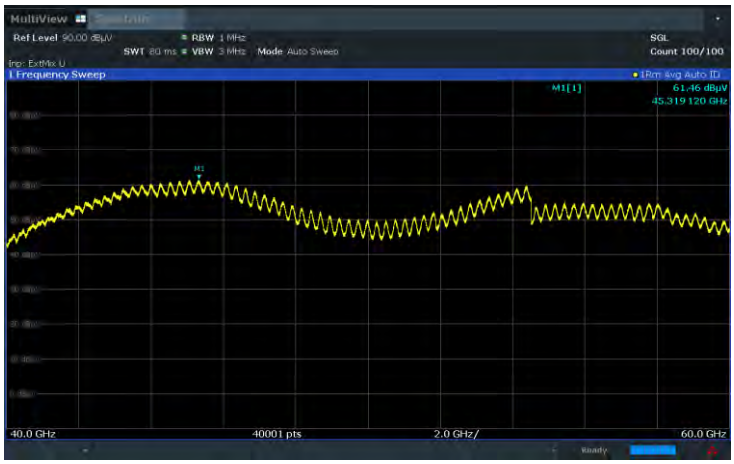
1 CC L patch: module 0	
n261 [10 GHz ~ 18 GHz]	**n261 [18 GHz ~ 27 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

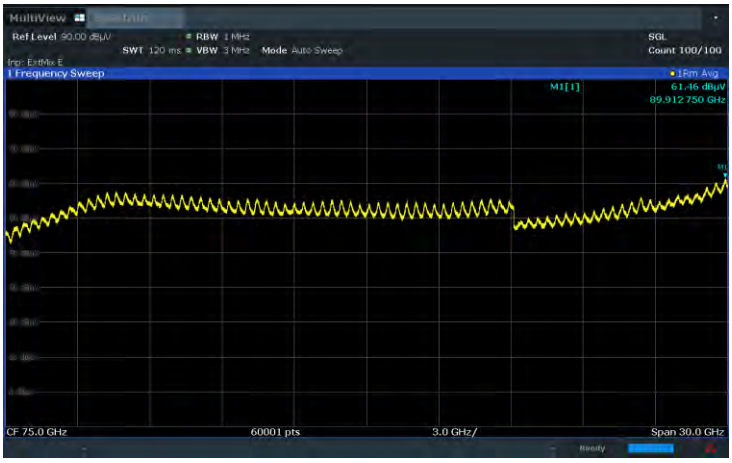
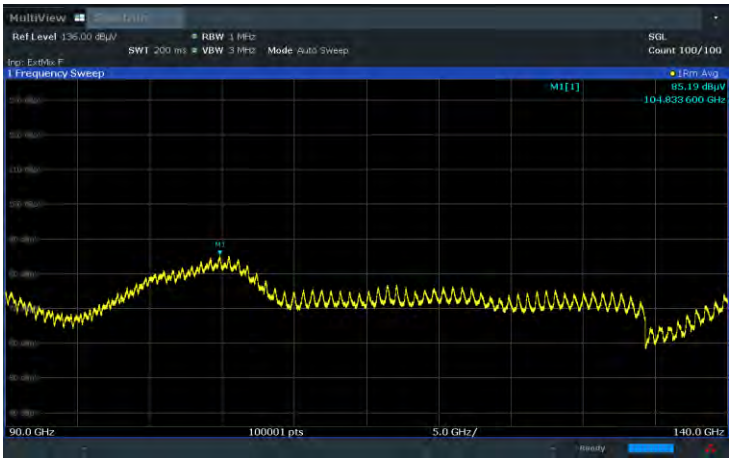
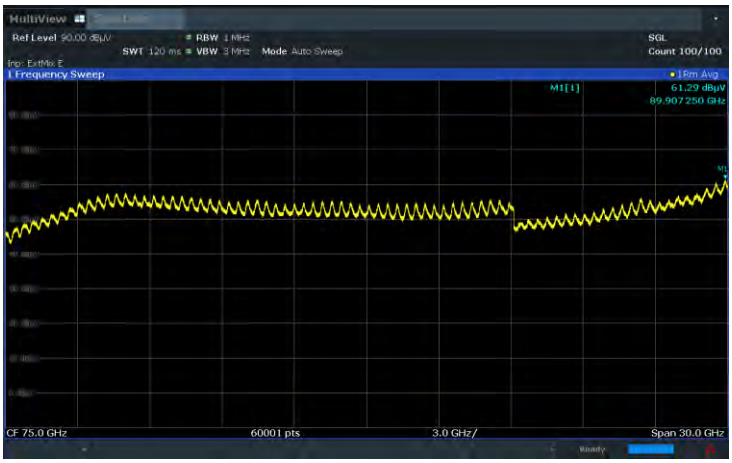
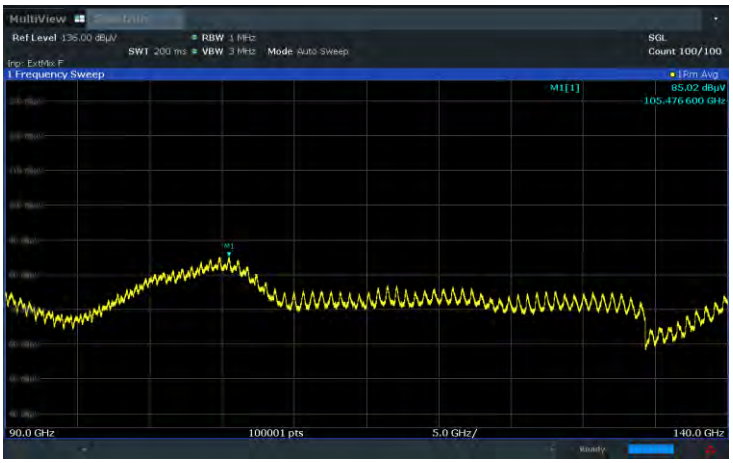
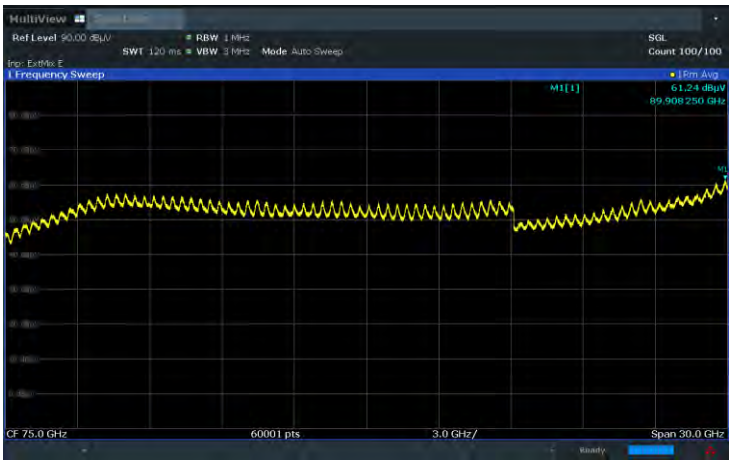
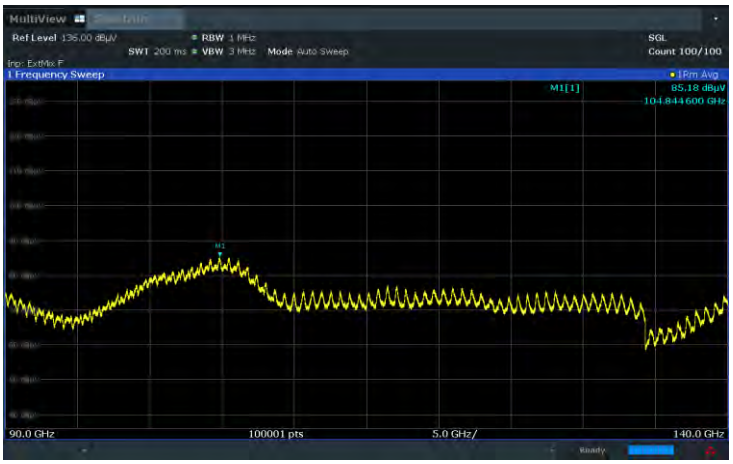
1 CC L patch: module 0	
n261 [28.8 GHz ~ 40 GHz]	**n261 [40 GHz ~ 60 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

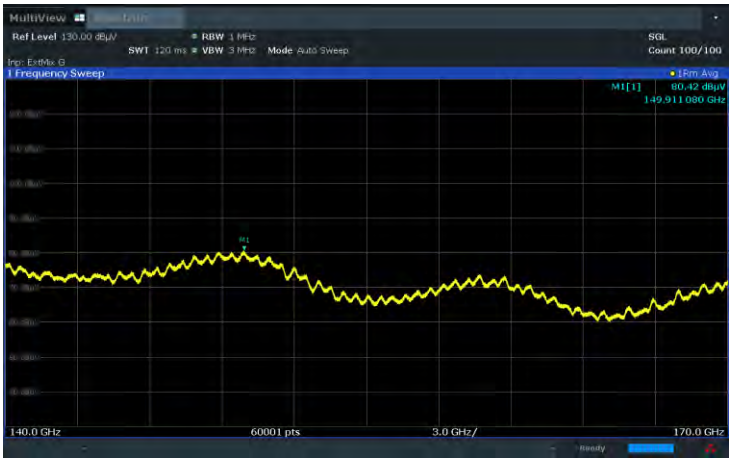
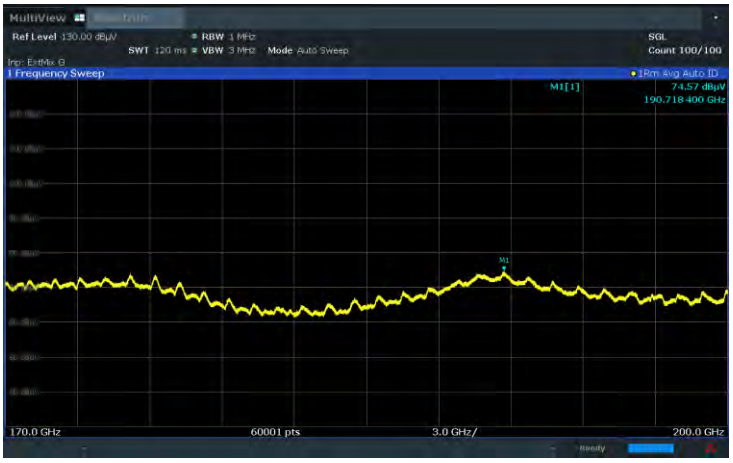
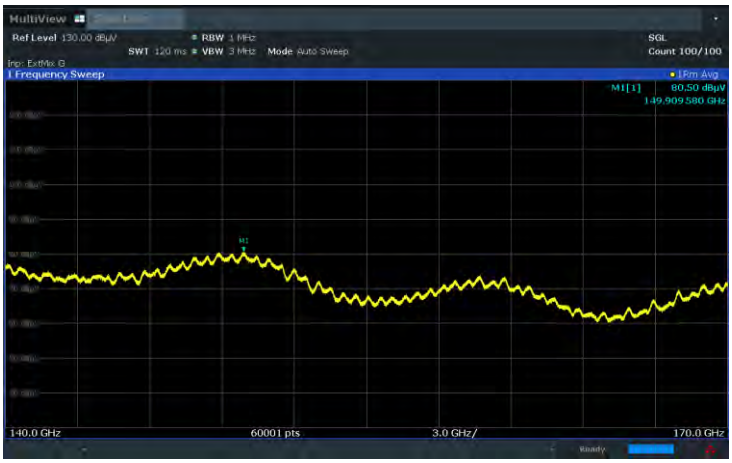
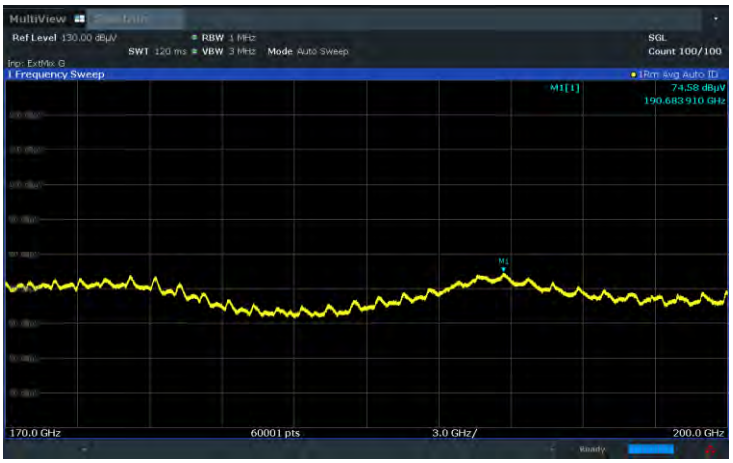
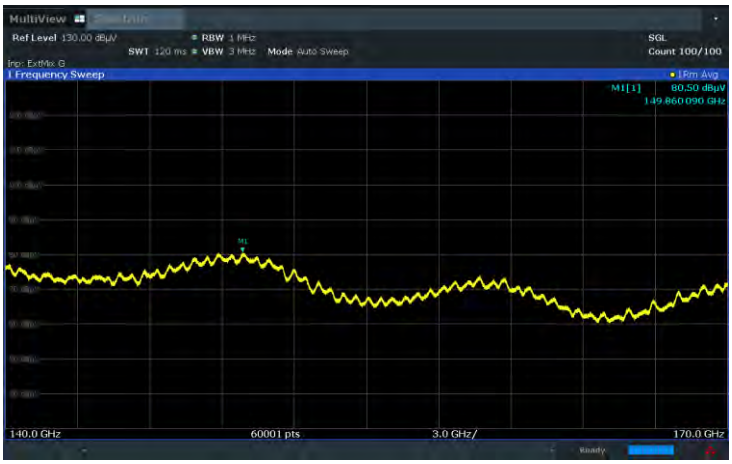
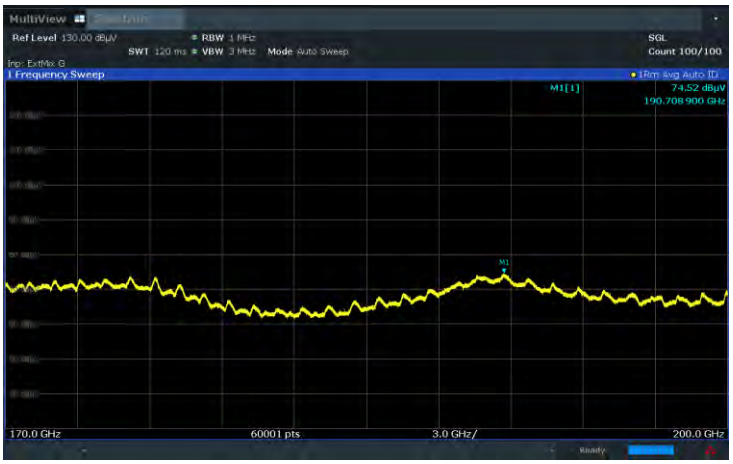
1 CC L patch: module 0	
n261 [60 GHz ~ 90 GHz]	**n261 [90 GHz ~ 100 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

1 CC L patch: module 0	
n260 [30 MHz ~ 1 GHz]	**n260 [1 GHz ~ 10 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

1 CC L patch: module 0	
n260 [10 GHz ~ 18 GHz]	**n260 [18 GHz ~ 26.5 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

1 CC L patch: module 0	
n260 [26.5 GHz ~ 36.6 GHz]	**n260 [40 GHz ~ 60 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

1 CC L patch: module 0	
n260 [60 GHz ~ 90 GHz]	**n260 [90 GHz ~ 140 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

1 CC L patch: module 0	
n260 [140 GHz ~ 170 GHz]	**n260 [170 GHz ~ 200 GHz]**
Low Channel	**Low Channel**
	
Middle Channel	**Middle Channel**
	
High Channel	**High Channel**
	

5.5. FREQUENCY STABILTY

FCC Rules

Test Requirements:

§ 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

Test Procedures:

The measurement is performed in accordance with Section 5.6.4 and 5.6.5 of ANSI C63.26.

5.6.4 Frequency stability over variations in temperature

a) Supply the EUT with a nominal 60 Hz ac voltage, dc voltage, or install a new or fully charged battery in the EUT.

b) If possible a dummy load should be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible.

c) Turn on the EUT, and tune it to the center frequency of the operating band.

d) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible, make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away).

NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.

e) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.

f) Turn the EUT off, and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

g) Set the temperature control on the chamber to the highest temperature specified in the regulatory requirements for the type of device, and allow the oscillator heater and the chamber temperature to stabilize. Unless otherwise instructed by the regulatory authority, this temperature should be 50 °C.

h) While maintaining a constant temperature inside the environmental chamber, turn on the EUT and allow sufficient time for the EUT temperature to stabilize.

i) Measure the frequency.

j) Switch off the EUT, but do not switch off the oscillator heater.

k) Lower the chamber temperature to the next level that is required by the standard and allow the temperature inside the chamber to stabilize. Unless otherwise instructed by the regulators, this temperature step should be 10 °C.

l) Repeat step h) through step k) down to the lowest specified temperature. Unless otherwise instructed by the regulators, this temperature should be −30 °C. When the frequency stability limit is stated as being sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point shall be established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation shall be identified as f_L and f_H respectively. The worst-case frequency offset determined in the above methods shall be added or subtracted from the values of f_L and f_H and the resulting frequencies must remain within the band.

m) Omitted

5.6.5 Frequency stability when varying supply voltage

a) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away)

b) Supply the EUT with nominal ac or dc voltage. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

c) Turn on the EUT, and couple its output to a frequency counter or other frequency-measuring instrument.

d) Tune the EUT to the center frequency of the operating band. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.

NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.

e) Measure the frequency.

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

g) 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.

h) Repeat the frequency measurement.

NOTE—For band-edge compliance, it can be required to make these measurements at the low and high channel of the operating band.

Note:

1) The results of the frequency stability test shown above the frequency deviation measured values are very small and similar trend for each path, so we are attached only the worst case data.
2) We were performed the test using call simulator

Test Results:

Reference: Voltage = DC 4.20 V

L patch: module 0, n261

Low Frequency = 27 525.00 MHz

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	4.20	+20(Ref)	27534 840 000	4.882	0.000	0.00000
		-30	27534 840 009	9.467	4.585	0.00607
		-20	27534 840 007	6.747	1.865	0.00247
		-10	27534 840 005	4.689	-0.193	-0.00025
		0	27534 840 008	8.344	3.462	0.00458
		+10	27534 840 004	4.157	-0.725	-0.00096
		+30	27534 840 008	8.248	3.366	0.00445
		+40	27534 840 001	0.807	-4.074	-0.00539
		+50	27534 840 002	2.030	-2.852	-0.00377
HIGH	4.40	+20	27534 840 002	1.590	-3.292	-0.00436
LOW	3.80	+20	27534 840 000	0.460	-4.421	-0.00585

High Frequency = 28 324.92 MHz

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	4.20	+20(Ref)	28319 520 000	9.790	0.000	0.00000
		-30	28319 520 005	4.803	-4.987	-0.00660
		-20	28319 520 006	6.026	-3.765	-0.00498
		-10	28319 520 009	9.299	-0.491	-0.00065
		0	28319 520 001	0.630	-9.160	-0.01212
		+10	28319 520 002	2.461	-7.329	-0.00970
		+30	28319 520 007	6.545	-3.245	-0.00429
		+40	28319 520 003	3.099	-6.692	-0.00885
		+50	28319 520 006	6.262	-3.528	-0.00467
HIGH	4.40	+20	28319 520 001	0.684	-9.106	-0.01205
LOW	3.80	+20	28319 520 000	0.397	-9.393	-0.01243

L patch: module 0, n260

Low Frequency = 37 025.04 MHz

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	4.20	+20(Ref)	37027 320 000	5.122	0.000	0.00000
		-30	37027 320 007	6.736	1.614	0.00214
		-20	37027 320 005	5.053	-0.069	-0.00009
		-10	37027 320 009	9.321	4.199	0.00556
		0	37027 320 001	1.282	-3.840	-0.00508
		+10	37027 320 007	7.436	2.314	0.00306
		+30	37027 320 006	5.739	0.617	0.00082
		+40	37027 320 005	5.148	0.026	0.00003
		+50	37027 320 008	7.859	2.737	0.00362
HIGH	4.40	+20	37027 320 001	1.492	-3.630	-0.00480
LOW	3.80	+20	37027 320 001	0.882	-4.240	-0.00561

High Frequency = 39 975.00 MHz

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	4.20	+20(Ref)	39966 240 000	4.016	0.000	0.00000
		-30	39966 240 008	7.747	3.730	0.00494
		-20	39966 240 009	9.442	5.425	0.00718
		-10	39966 240 006	6.322	2.306	0.00305
		0	39966 240 003	3.212	-0.805	-0.00106
		+10	39966 240 006	5.881	1.865	0.00247
		+30	39966 240 006	5.666	1.650	0.00218
		+40	39966 240 010	9.917	5.901	0.00781
		+50	39966 240 010	9.996	5.980	0.00791
HIGH	4.40	+20	39966 240 001	0.631	-3.385	-0.00448
LOW	3.80	+20	39966 240 002	2.371	-1.645	-0.00218

6. MIXER VERIFICATION CERTIFICATE & CHECK

교 정 성 적 서
CALIBRATION CERTIFICATE

경기도 이천시 마장면 서이천로 578번길 74
TEL : 031-645-6900, FAX : 031-645-6969

성적서발급번호(Certificate No) : IC-2021-89427
교 정 번 호(Calibration No) : C-2021-109162

1. 의뢰자 (Client)
- 기관명 (Name) : (주)에이치시티
- 주 소 (Address) : 경기도 이천시 마장면 서이천로 578번길 74

2. 측정기 (Calibration Subject) ◇ 등록번호 : 288234
- 기기명 (Description) : WR-19 HARMONIC MIXER
- 제작회사 및 형식(Manufacturer and Model Name) : OML / M19HWD
- 기기번호 (Serial Number) : 160429-1

3. 교정일자 (Date of Calibration) : 2021.11.18 **차기교정예정일자** : 2022.11.18 (The due date of next Calibration)

4. 교정환경 (Environment)
- 온도(Temperature) : (22.6 ± 0.1) ℃ - 습도(Humidity) : (46 ± 1) % R.H.
- 교정장소 (Location) : 고정표준실(Permanent Calibration Lab) (주소: 경기도 이천시 마장면 서이천로 578번길 74)

5. 측정표준의 소급성 (Traceability) ◇Field code : 40641(RF SPECTRUM ANALYZER)

교정방법 및 소급성 서술 (Calibration method and/or brief description)

상기 기기는 고주파 스펙트럼 분석기의 교정절차(HCT-CS-125-40641)에 따라 국가측정표준기관으로부터 측정의 소급성이 확보된 아래의 표준장비를 이용하여 교정 되었음.

교정에 사용한 표준장비 명세 (List of used standards/specifications)

기기명 (Description)	제작회사 / 형식 (Manufacturer and Model Name)	기기번호 (Serial Number)	차기교정예정일자 (The due date of next Calibration)	교정기관 (Calibration laboratory)
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT/N5173B	MY61252589	2022/10/15	(주)에이치시티
EPM-P SERIES POWER METER	AGILENT/E4417A	GB41291582	2022/06/04	(주)에이치시티
POWER SENSOR	AGILENT/8487A	MY41092450	2022/01/11	(주)에이치시티
POWER SENSOR	KEYSIGHT/V8486A	MY56330017	2022/01/25	Keysight Technologies
WR-19 MULTIPLIER SOURCE MODULE	OML/S19MS-A	160516-1	2022/09/07	(주)에이치시티

6. 교정결과 (Calibration result) : **교정결과 참조** (Refer to attachment)

7. 측정불확도 (Measurement uncertainty) : **교정결과 참조** (Refer to attachment)
신뢰수준 약 95 %, k = 2 (Confidence level about 95 %, k = 2)

확 인 (affirmation)	작성자 (Measurements performed by)	승인자 (Approved by)
	성명 (Name) 고 형 재 (서명)	직위 (Title) 기술책임자(Technical Cal. Manager) 성명 (Name) 김 광 철 (서명)

위 성적서는 국제시험기관인정협력체(International Laboratory Accreditation Cooperation) 상호인정협정(Mutual Recognition Arrangement)에 서명한 한국인정기구(KOLAS)로부터 공인 받은 분야의 교정결과입니다.

2021. 11. 18

한국인정기구 인정
Accredited by KOLAS, Republic of KOREA

㈜에이치시티 대표이사
President, HCT Co., Ltd.

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※ 성적서의 원본은 상단에 HCT홀로그램이 들어간 위변조 방지 용지에 인쇄되며 발급되며, 원본 복사시에는 복사본이라는 표시가 처리됩니다.

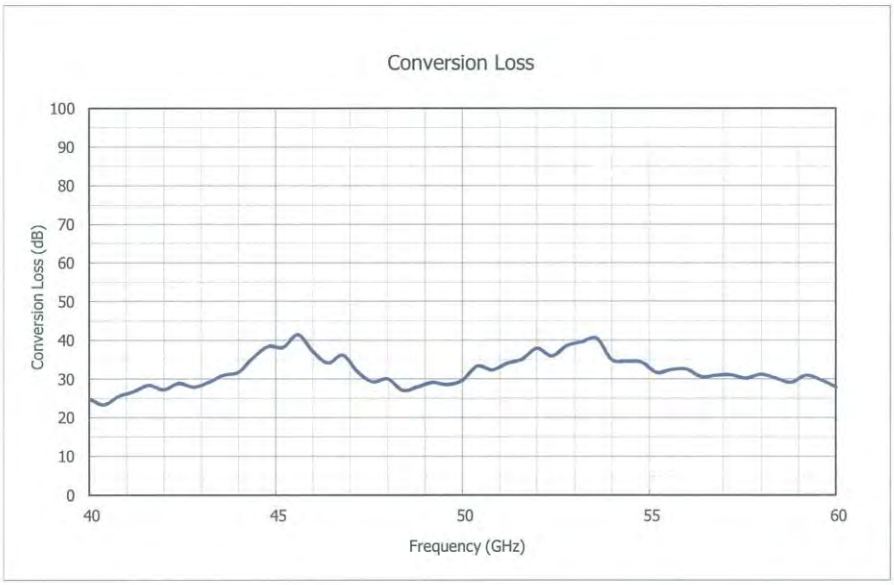
F-02P-02-008 (Rev.02)

교 정 결 과

CALIBRATION RESULT

성적서발급번호(Certificate No) : IC-2021-89427
교 정 번 호(Calibration No) : C-2021-109162

1. Conversion Loss Graph



Note) 측정 조건 : RF = -30 dBm, Harmonic Order = 4, L.O. Level = 15.5 dBm, IF = 1 330 MHz, Bias Value = 5.70 mA

F-02P-02-008 (Rev.02)

교 정 결 과
CALIBRATION RESULT

성적서발급번호(Certificate No) : IC-2021-89427
교 정 번 호(Calibration No) : C-2021-109162

2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
40.0	24.85	0.82	50.4	33.31	0.82
40.4	23.34	0.82	50.8	32.33	0.82
40.8	25.51	0.82	51.2	34.04	0.82
41.2	26.73	0.82	51.6	35.12	0.82
41.6	28.35	0.82	52.0	37.89	0.82
42.0	27.19	0.82	52.4	35.93	0.82
42.4	28.84	0.82	52.8	38.60	0.82
42.8	27.88	0.82	53.2	39.59	0.82
43.2	29.08	0.82	53.6	40.46	0.82
43.6	30.95	0.82	54.0	34.98	0.82
44.0	31.74	0.82	54.4	34.60	0.82
44.4	35.50	0.82	54.8	34.32	0.82
44.8	38.38	0.82	55.2	31.66	0.82
45.2	38.16	0.82	55.6	32.46	0.82
45.6	41.39	0.82	56.0	32.52	0.82
46.0	37.07	0.82	56.4	30.57	0.82
46.4	34.11	0.82	56.8	30.96	0.82
46.8	36.14	0.82	57.2	31.03	0.82
47.2	31.80	0.82	57.6	30.19	0.82
47.6	29.24	0.82	58.0	31.17	0.82
48.0	30.01	0.82	58.4	30.13	0.82
48.4	27.02	0.82	58.8	29.10	0.82
48.8	27.95	0.82	59.2	30.92	0.82
49.2	29.09	0.82	59.6	29.71	0.82
49.6	28.52	0.82	60.0	27.89	0.82
50.0	29.64	0.82	-	-	-

끝.

F-02P-02-008 (Rev.02)