FCC PART 30

TEST REPORT

For

Corning Optical Communication LLC

475 Sycamore Dr., Milpitas, CA 95035, USA

FCC ID: OJFRN530

Report Type:	**Product Type:**
Original Report	5G mmWave Small Cell Radio Node

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Report Number:	R2107125
Report Date:	2021-08-09
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CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2107125	Original Report	2021-08-05
1	R2107125	Updated 17065 Technical comments.	2021-08-09

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *Corning Optical Communications LLC*, and their product model: SCRN-530-39, FCC ID: OJFRN530 or the "EUT" as referred to in this report. It is a 5G mmWave Small Cell Radio Node support 2x2 MIMO operating in NR band n260 (37-40 GHz). The device is a Fixed Base Station Device.

1.2 Mechanical Description of EUT

SCRN-530-39 measures approximately 279 mm (Length) x 279 mm (Width) x 80 mm (High), and weighs approximately 4.6kg.

The data gathered are from two production samples provided by Corning Optical Communication SN: 222120114D and 22212010AE

1.3 Objective

This report was prepared on behalf of Corning Optical Communications in accordance with FCC Part 30.

The objective was to determine compliance with FCC Part 30 rules for EIRP, RF Exposure, 99% Bandwidth, Frequency Stability, Out of Band Emissions at the Band-edge, Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, and FCC KDB 842590 D01 Upper Microwave Flexible Use Service v01r01.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02)*****,** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  2 All Scope 2-Licensed Personal Mobile Radio Services;
  3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  5 All Scope 5-Licensed Fixed Microwave Radio Services
  6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  1 All Radio Equipment, per KHCA 10XX-series Specifications;
  2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
  - for Telephony (ver. 3.0)
  - for Audio/Video (ver. 3.0)
  - for Battery Charging Systems (ver. 1.1)
  - for Set-top Boxes & Cable Boxes (ver. 4.1)
  - for Televisions (ver. 6.1)
  - for Computers (ver. 6.0)
  - for Displays (ver. 6.0)
  - for Imaging Equipment (ver. 2.0)
  - for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
  - for Commercial Dishwashers (ver. 2.0)

- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.26-2015, FCC KDB 971168 D01 v03r01 and KDB 842590 D01 v01r01.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test software used was QRCT. The software is compliant with the standard requirements being tested against.

Beam ID tested was selected based on customer's declaration for worst case. Please refer to the following power setting table. Please refer to the following power setting table.

Bandwidth (MHz)	Polarity	Beam ID	Mode	Channel No.	Frequency (MHz)	Power Settings
100 (1CC)	Vertical	11	QPSK	2229999	37050	450
				2254166	38500	450
				2278332	39950	450
			16QAM	2229999	37050	450
				2254166	38500	450
				2278332	39950	450
			64QAM	2229999	37050	450
				2254166	38500	450
				2278332	39950	450
	Horizontal	139	QPSK	2229999	37050	450
				2254166	38500	450
				2278332	39950	450
			16QAM	2229999	37050	450
				2254166	38500	450
				2278332	39950	450
			64QAM	2229999	37050	450
				2254166	38500	450
				2278332	39950	450

Bandwidth (MHz)	Polarity	Beam ID	Mode	Channel No.	Frequency (MHz)	Power Settings
200 (2CC)	Vertical	11	QPSK	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
			16QAM	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
			64QAM	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
	Horizontal	139	QPSK	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
			16QAM	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
			64QAM	2230832	37100	450
				2254166	38500	450
				2277499	39900	450
300 (3CC)	Vertical	11	QPSK	2231666	37150	450
				2254999	38550	450
				2276666	39850	450
			16QAM	2231666	37150	450
				2254999	38550	450
				2276666	39850	450
			64QAM	2231666	37150	450
				2254999	38550	450
				2276666	39850	450
	Horizontal	139	QPSK	2231666	37150	450
				2254999	38550	450
				2276666	39850	450
			16QAM	2231666	37150	450
				2254999	38550	450
				2276666	39850	450
			64QAM	2231666	37150	450
				2254999	38550	450
				2276666	39850	450

Bandwidth (MHz)	Polarity	Beam ID	Mode	Channel No.	Frequency (MHz)	Power Settings
400 (4CC)	Vertical	11	QPSK	2232499	37200	450
				2254166	38500	450
				2275832	39800	450
			16QAM	2232499	37200	450
				2254166	38500	450
				2275832	39800	450
			64QAM	2232499	37200	450
				2254166	38500	450
				2275832	39800	450
	Horizontal	139	QPSK	2232499	37200	450
				2254166	38500	450
				2275832	39800	450
			16QAM	2232499	37200	450
				2254166	38500	450
				2275832	39800	450
			64QAM	2232499	37200	450
				2254166	38500	450
				2275832	39800	450

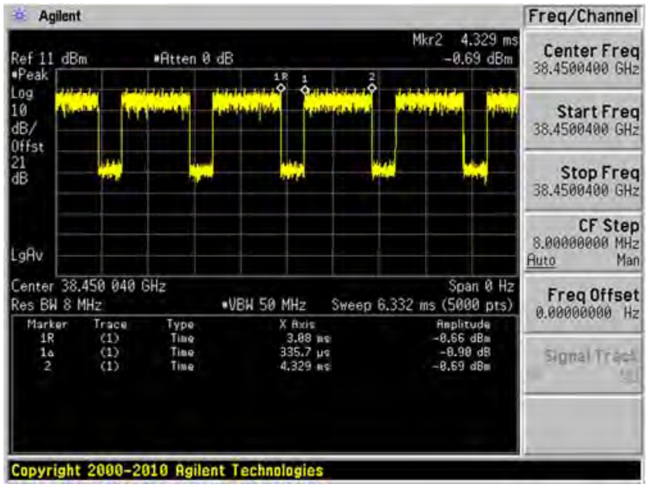
2.3 Duty Cycle Correction Factor

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1CC-QPSK	0.9133	1.249	73.12	1.35949
1CC-16QAM	0.9224	1.250	73.79	1.319907
1CC-64QAM	0.9219	1.250	73.75	1.322262
2CC-QPSK	0.9280	1.251	74.18	1.297093
2CC-16QAM	0.9250	1.249	74.05	1.304207
2CC-64QAM	0.8998	1.225	73.45	1.339901
3CC-QPSK	0.9262	1.249	74.15	1.298577
3CC-16QAM	0.9262	1.249	74.15	1.298577
3CC-64QAM	0.9190	1.249	73.57	1.332469
4CC-QPSK	0.9248	1.250	73.98	1.308622
4CC-16QAM	0.9272	1.250	74.17	1.297366
4CC-64QAM	0.9258	1.257	73.65	1.328181

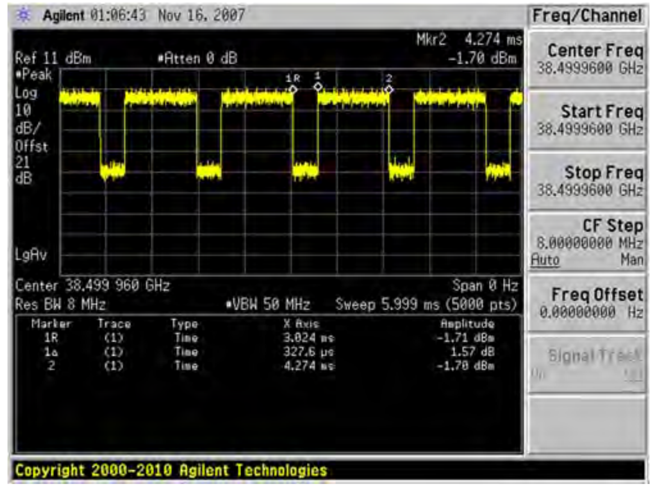
Note: Duty Cycle = On Time (ms)/ Period (ms)
Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

Please refer to the following plots.

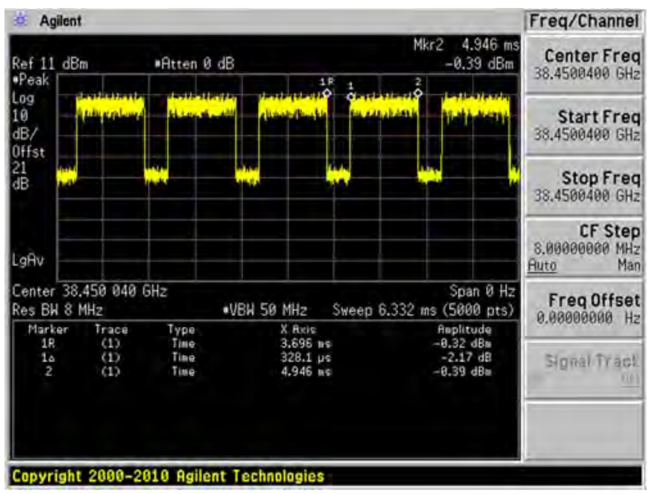
1CC-QPSK



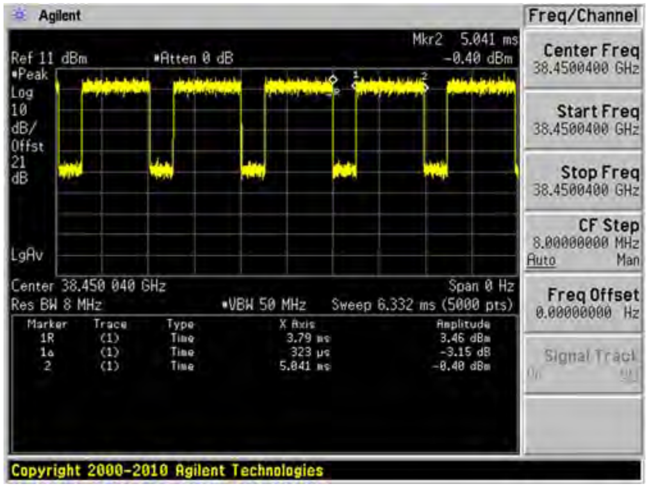
1CC – 16QAM



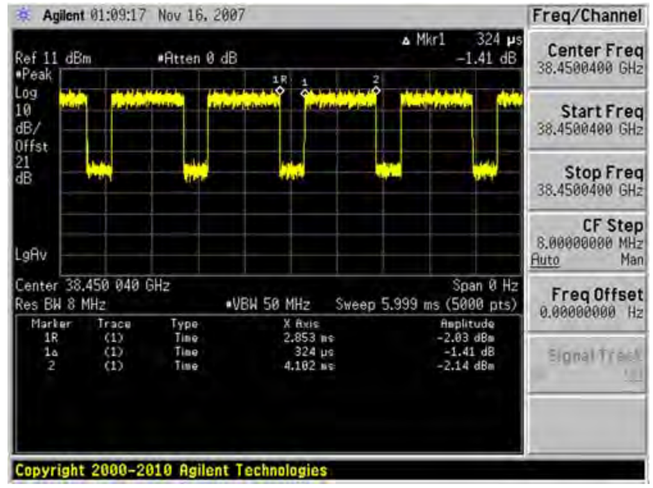
1CC- 64QAM



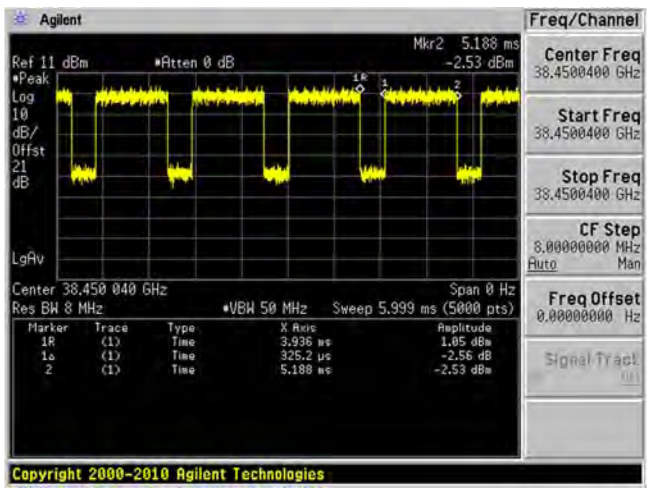
2CC-QPSK



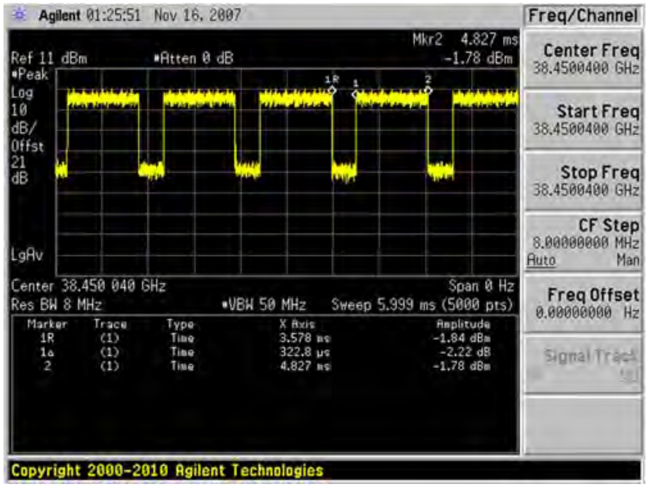
2CC – 16QAM

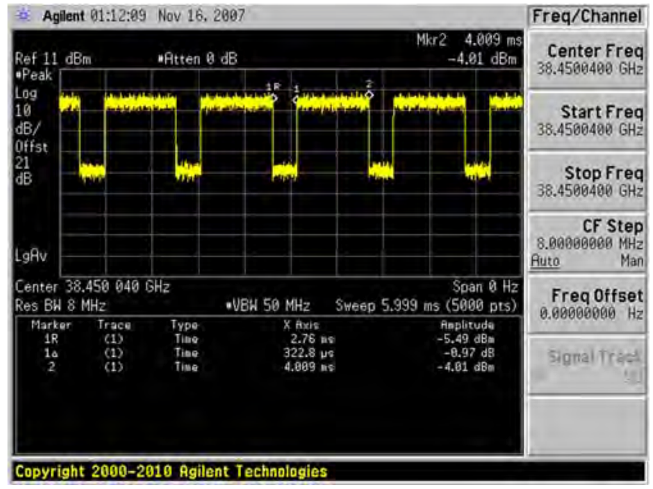


2CC-64QAM

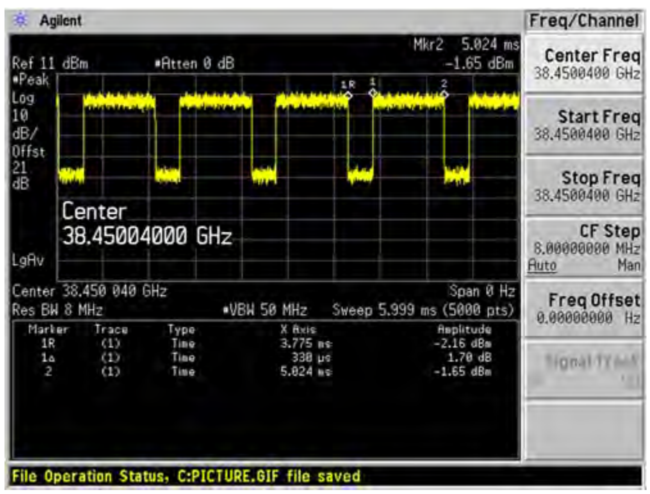


3CC-QPSK **3CC-16QAM**

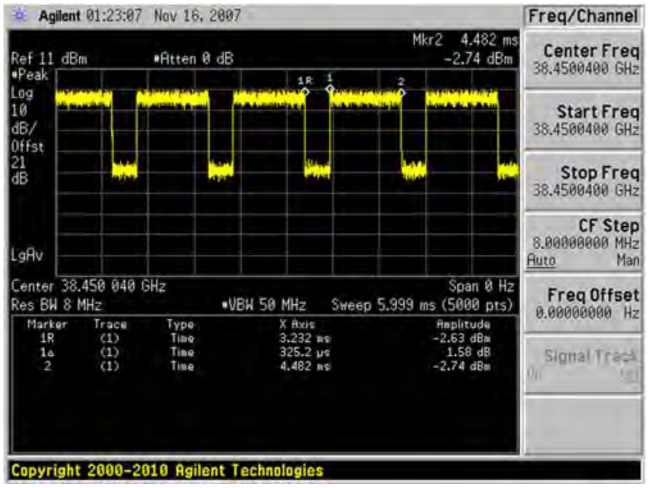




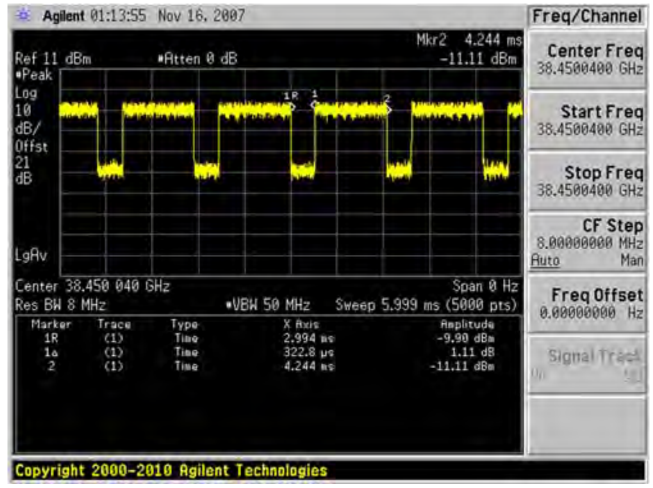
3CC-64QAM



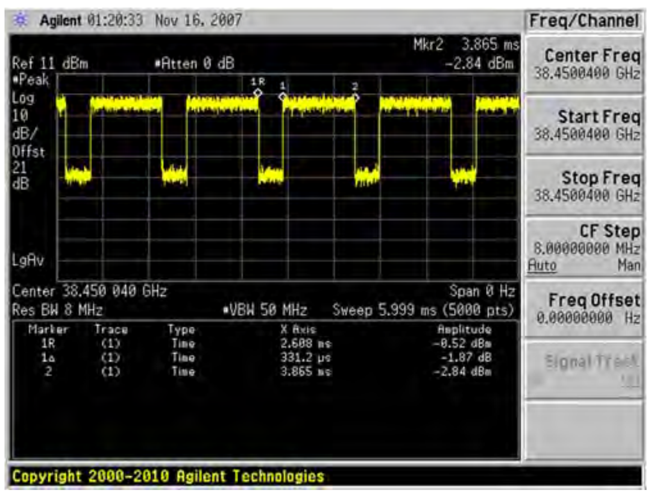
4CC-QPSK



4CC-16QAM



4CC-64QAM



2.4 Equipment Modifications

None

2.5 Remote Support Equipment

Manufacturer	Description	Model
Dell	Laptop	E5520
MikroTik	Switch	CRS305-1G-4S+IN
CullPower	Switch AC Adapter	SAW30-240-0800U

2.6 Local Support Equipment

None

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Fiber Optic Cable	10.0	EUT	Switch
RJ45 Ethernet Cable	1.0	Switch	Laptop
Micro USB to USB Cable	2.0	EUT	Laptop
Power Cable	0.8	EUT	AC/DC Power adapter
Power Cable	1.5	AC/DC Power Adapter	AC Power

2.8 EUT Power Supply List and Details

Manufacturer	Description	Model	Serial Number
MeanWell	AC/DC Power Adpater	GST120A48	EB9BG08372

3 Summary of Test Results

FCC Rules	Description of Test	Result
§2.1047	Modulation Characteristics	Compliant
§30.207, §1.1307, §1.1310	RF Exposure	Compliant
§2.1047	Antenna Requirement	Compliant
§2.1053, §30.203	Radiated Spurious Emissions	Compliant
§2.1049	99% Bandwidth	Compliant
§2.1046, §30.202	Power Limits	Compliant
§2.1053, §30.203	Out of Band Emission at the Band-edge	Compliant
§2.1055	Frequency Stability	Compliant

4 FCC §2.1047 - Modulation Characteristics

4.1 Applicable Standards

According to FCC §2.1047:
(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
(c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.
(d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

4.2 Test Results

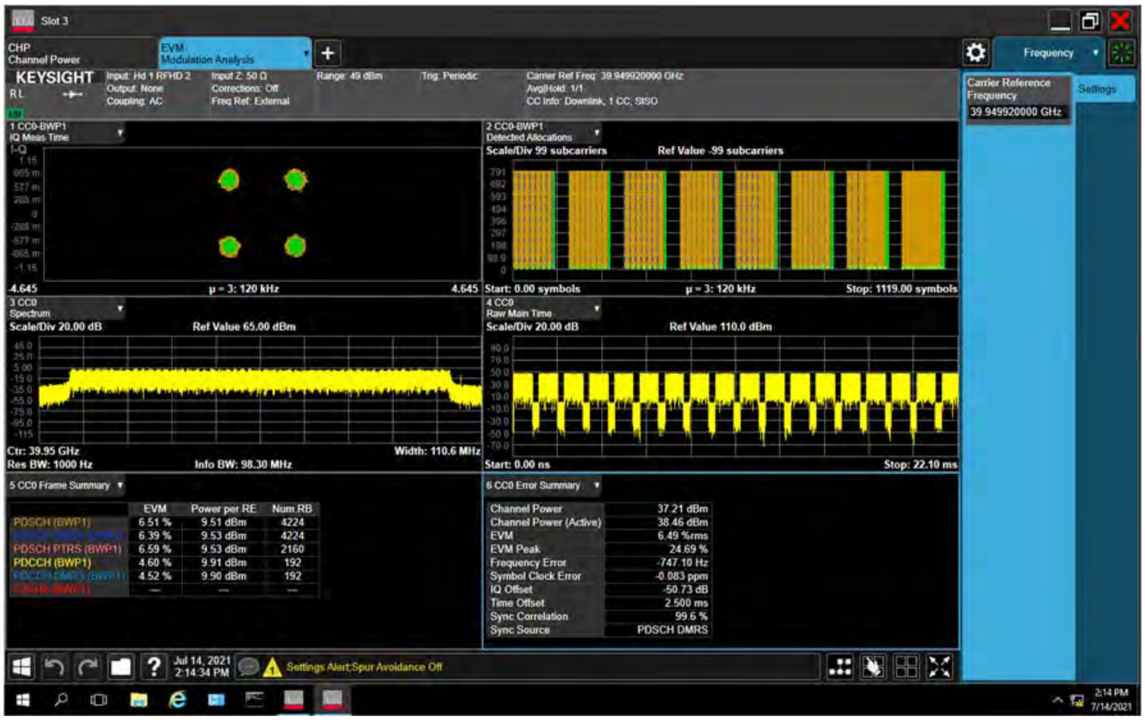
QPSK-Low Chanel Horizontal

QPSK-Low Chanel Vertical

QPSK-Mid Chanel Horizontal

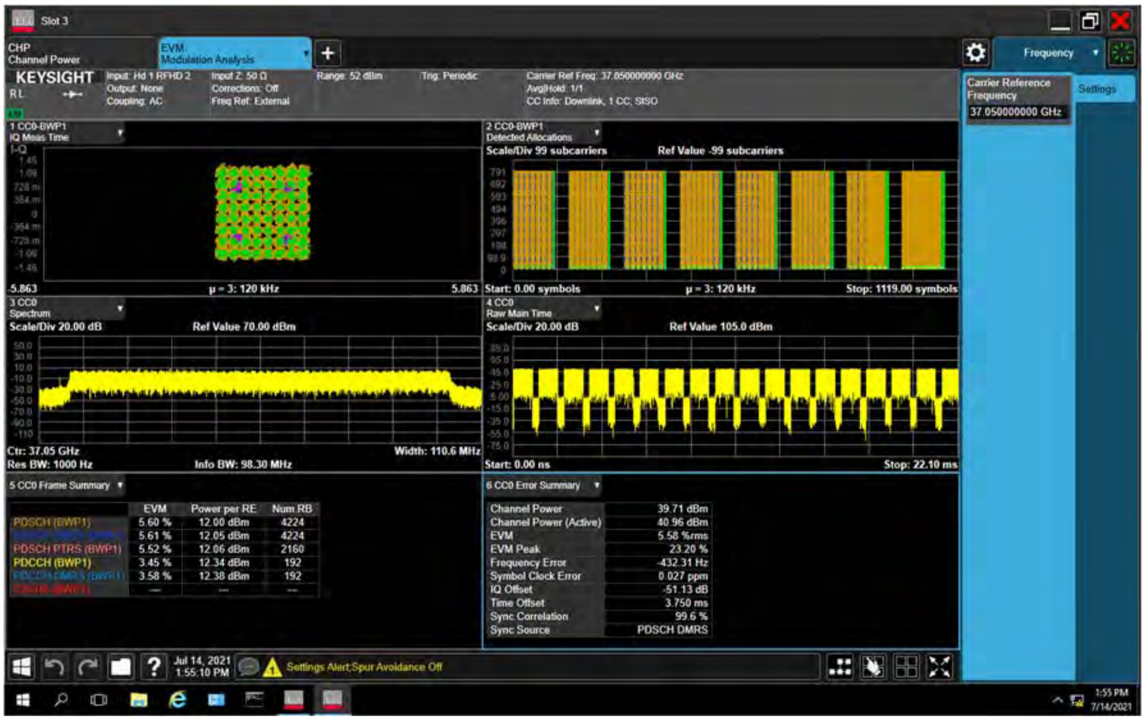
QPSK-Mid Chanel Vertical

QPSK-High Chanel Horizontal

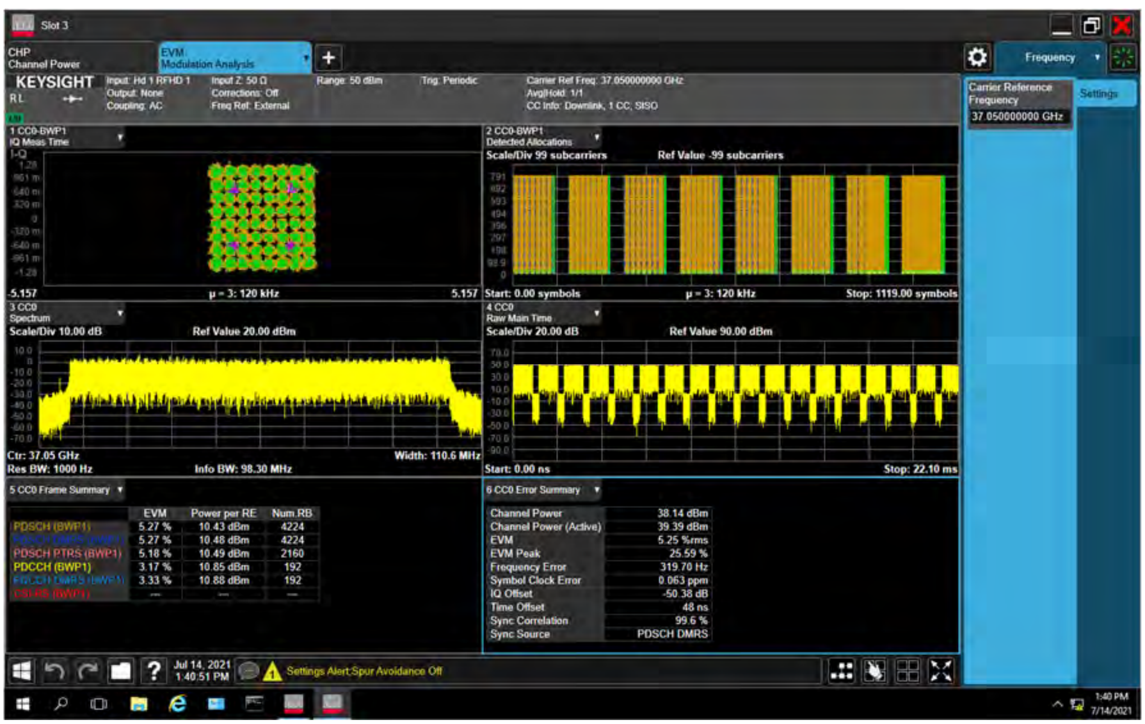


QPSK-High Chanel Vertical

64QAM-Low Chanel Horizontal



64QAM-Low Chanel Vertical



64QAM-Mid Chanel Horizontal

64QAM-Mid Chanel Vertical

64QAM-High Chanel Horizontal

64QAM-High Chanel Vertical

5 FCC §30.207, §1.1307 & §1.1310 - RF Exposure

5.1 Applicable Standards

FCC §1.1307 & §1.1310.

According to FCC §1.1310 (e)(1), the following table sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Where: f = frequency in MHz
* = Plane-wave equivalent power density

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

5.3 MPE Results

Maximum turn-up EIRP(dBm):	43.0
Maximum turn-up EIRP(mW):	20000
Prediction frequency (MHz):	37050
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
Prediction distance (cm):	39.90

In order to meet the RF exposure requirements for general population, the device must be installed to maintain separation distance of at least 39.90 cm. This device is clarified as fixed station.

6 FCC §2.1047 - Antenna Requirements

6.1 Applicable Standards

According to FCC §2.1047:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

Model No.	Frequency Range (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
QTM10039	37000-40000	Patch Array	22.5

Note: the antenna gain is provided by manufacturer.

7 FCC §2.1053 & §30.203 - Radiated Spurious Emissions

7.1 Applicable Standard

(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.

(c) For fixed point-to-point and point-to-multipoint limits see § 30.404.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC part 30 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.3 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = 100ms
(2) Average: RBW = 1MHz / VBW = 3MHz / Sweep = Auto

Record the measured emission amplitude level and frequency using the appropriate RBW. Repeat previeous steps for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

For emissions below 40 GHz, signal substitution method was used:

Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.

For each emission that was detected:

1. Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.

2. Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured.

3. Record the output power level of the signal generator when equivalence is achieved.

Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:

$$Pe = Ps(dBm) - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

where
Pe = equivalent isotropic emission power in dBm
Ps = source (signal generator) power in dBm

Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from: gain (dBd) = gain (dBi) − 2.15 dB. If necessary, the antenna gain can be calculated from calibrated antenna factor information.

For emissions above 40 GHz, field strength method was used:

EIRP (dBm) = E (dB μ V/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.

E (dBuV/m) is the corrected reading in field strength.
EIRP (dBm) is the corrected reading in power.
D is the measurement distance. (1meter in this test)

7.4 Corrected Amplitude and Margin Calculation

For emissions from 30 MHz to 40 GHz:

Using signal substitution method to measure the emission level, the "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit

Margin = Pe (Absolute Level) – Limit

For the emissions from 40 GHz to 44 GHz:

The Corrected Reading for field strength (CR dBuV/m) is calculated by adding the Correction Factor to the S.A. Reading. The basic equation is as follows:

CR = S.A. Reading + Antenna Factor

For example, a corrected amplitude of 40.3 dBuV/m = S.A. Reading (32.5 dBuV) + Antenna Factor (7.8 dB/m)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Reading – Limit

For the emission from 44 GHz and above

The Corrected Reading (CR) is calculated by adding the Conversion Factor (CF), Distance Factor (DF) and the basic equation is as follows:

CR (dBuV/m) = SA + CF
CR (dBm) =CR (dBuV/m) + 20log(d) – 104.7

For example, a corrected amplitude of -23.33 dBm = S.A. Reading (33.16 dBuV) + Conversion Factor (35.21 dB) + 20*log (1) – 104.7

d is the test distance. 1 meter was used in the example above.

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Reading – Limit

7.5 Far Field Distance Calculation

Note: Measurements were taken in the far field distance R based on the firmular R ≥ $2D^2/\lambda$, where D is the antenna length, λ is the wavelength. Wavelength = v/f, where v is the speed of light (3×10^9 m/s).

EUT antenna dimension 44mm, TX range: 37000 MHz – 40000 MHz
R range: 0.0478 m to 0.0516 m.

Receiving antenna frequency range and dimension are shown in the following table:

Frequency (GHz)	**Antenna Model**	**Dimension (Length) (mm)**	**Far Field Range (m)**
18 – 26.5	ARH-2823-01	93	0.104 – 0.153
26.5 – 40	ARH-2823-02	66	0.077 – 0.116
40-60	M19RH	47	0.059 - 0.088
60 – 90	M12RH	31	0.038 – 0.058
90 - 140	M08RH	20	0.024 – 0.027
140-200	M05RH	12.6	0.015-0.212

The test distance below 1 GHz is at 3 meters, the test distance above 1 GHz is at 1 meter.

7.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer 44 GHz	E4446A	US44300386	2021-04-27	1 year
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100337	2021-03-09	2 years
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2019-11-20	2 years
COM-POWER	Antenna, Dipole	AD-100 DB-4	721033DB1, 721033DB2, 721033DB3, 521921	2019-03-06	2.5 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2.5 years
EMCO	Antenna, Horn	3115	9511-4627	2020-10-12	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2020-02-27	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2020-02-27	2 years
Wisewave	Antenna, Horn	ARH-4223-01	10555-01	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-2823-01	10555-02	2020-02-05	2 years
OML	Harmonic Mixer	M03HWA; M05HWA; M08HWA; M12HWA; M19HWA	170615-1	N/R	N/A
AH Systems	Preamplifier	PAM 1840 VH	170	2020-11-09	1 year
Agilent	Preamplifier	8449B	3147A00400	2021-03-02	1 year
HP	Pre Amplifier	8447D	2944A07030	2020-08-17	1 year
Keysight	Signal Generator	E8257D	MY59140095	2021-06-25	1 year
Insulated Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2021-03-03	1 year
IW Microwave	157 Series Cable Armored with 2.92mm Male Plugs	KPS-1571AN-2400	DC 1922	2020-06-06	1.5 years
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35\'	LMR400UF	BACL1904161	2020-05-20	18 months
-	SMA cable	-	-	Each time[1]	N/A

Note[1]: cables and attenuators included in the test set-up will be checked each time before testing.

***Statement of Traceability: BACL Corp.** attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

7.7 Test Environmental Conditions

Temperature:	20-24 ºC
Relative Humidity:	40-44 %
ATM Pressure:	101.2-103.1 kPa

The testing was performed by Giriraj Gurjar from 2021-07-21 to 2021-07-30 in 5m chamber 3.

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 30 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.78	143.821	Horizontal	Low Channel, 1CC-QPSK, MIMO

7.9 Radiated Spurious Emissions Test Result Data

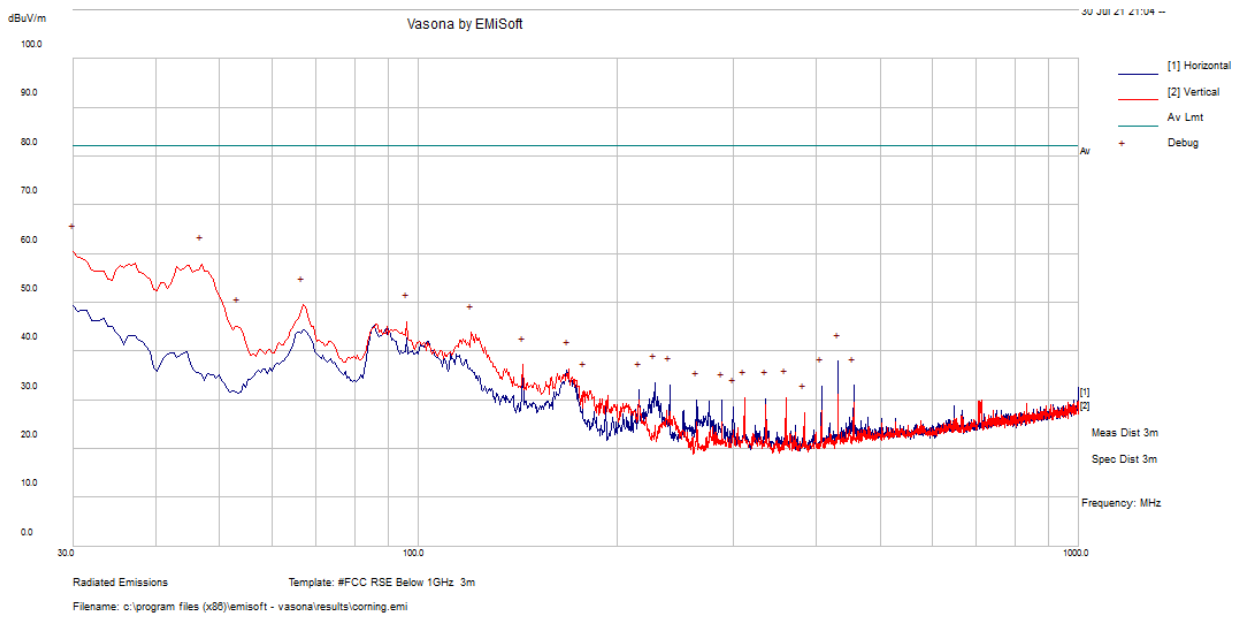
Note: After pre-scan, 1CC MIMO Low Channel QPSK configuration was selected for formal test.

1) 30 MHz – 40 GHz measured at 3m

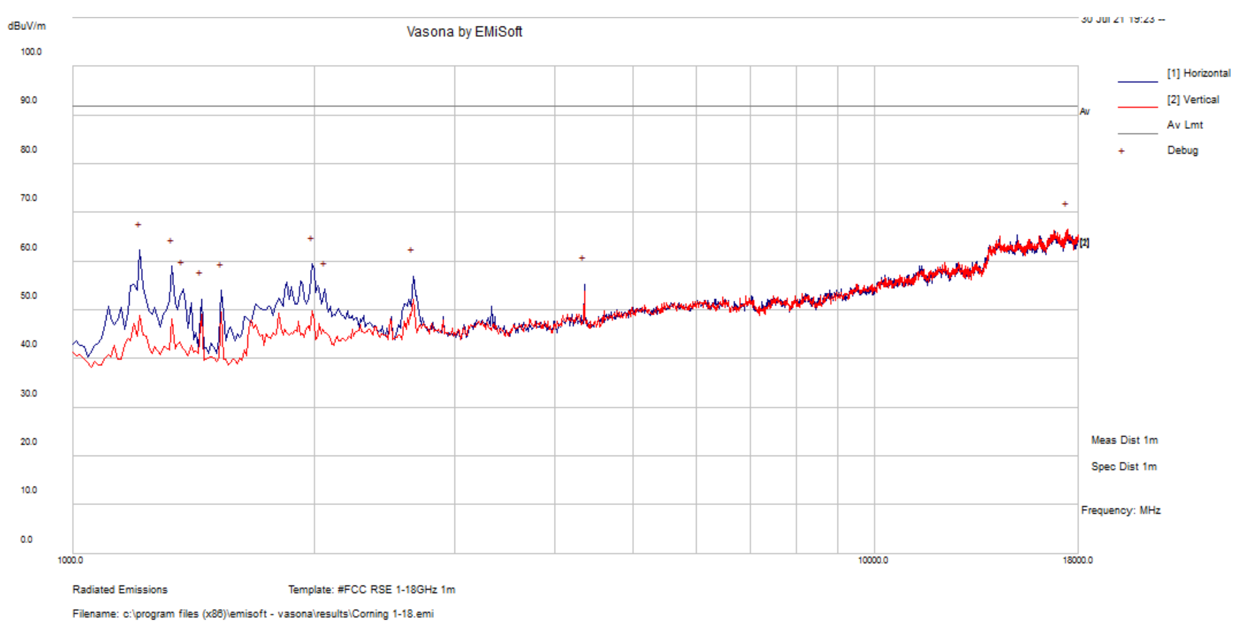
Freq. (MHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
48.4	41.03	207	192	H	48.4	-65.18	3.3	0.45	-62.33	-13	-49.33
48.4	52.12	320	114	V	48.4	-56.14	3.3	0.45	-53.29	-13	-40.29
96	51.23	77	198	H	96	-57.51	8.8	0.53	-49.24	-13	-36.24
96	47.96	0	150	V	96	-59.16	8.8	0.53	-50.89	-13	-37.89
120.3	46.52	52	150	H	120.3	-59.74	10.6	0.62	-49.76	-13	-36.76
120.3	40	105	234	V	120.3	-59.62	10.6	0.62	-49.64	-13	-36.64
228.1	56.21	136	150	H	228.1	-51.06	15.1	0.95	-36.91	-13	-23.91
228.1	44.85	0	216	V	228.1	-60.88	15.1	0.95	-46.73	-13	-33.73
215.5	51.6	106	112	H	215.5	-52.74	14.7	0.91	-38.95	-13	-25.95
215.5	45	32	145	V	215.5	-56.07	14.7	0.91	-42.28	-13	-29.28
311.6	41.4	0	254	H	311.6	-62.97	19	1.13	-45.1	-13	-32.1
311.6	37.27	182	150	V	311.6	-65.58	19	1.13	-47.71	-13	-34.71
1340	74.51	98	100	H	1340	-34.79	4.3	3	-33.49	-13	-20.49
1340	69.86	88	113	V	1340	-38.82	4.3	3	-37.52	-13	-24.52
1991	67.43	121	150	H	1991	-42.9	4.5	3.879	-42.279	-13	-29.279
1991	58	164	280	V	1991	-52.41	4.5	3.879	-51.789	-13	-38.789
2668	57.26	66	150	H	2668	-48.45	6	4.731	-47.181	-13	-34.181
2668	50.75	26	260	V	2668	-54.97	6	4.731	-53.701	-13	-40.701
1528	58.28	170	150	H	1528	-51.23	5.8	3.284	-48.714	-13	-35.714
1528	56.5	54	102	V	1528	-52.45	5.8	3.284	-49.934	-13	-36.934
4348	51.06	214	149	H	4348	-54.41	8.7	6.076	-51.786	-13	-38.786
4348	51.15	141	150	V	4348	-54.31	8.7	6.076	-51.686	-13	-38.686
24892	42.54	0	150	H	24892	-47.96	22.006	10.95	-36.904	-13	-23.904
24892	43.92	0	150	V	24892	-44.41	22.006	10.95	-33.354	-13	-20.354
33122	43.14	0	150	H	33122	-49.3	22.023	12.9	-40.177	-13	-27.177
33122	43.41	0	150	V	33122	-47.61	22.023	12.9	-38.487	-13	-25.487

Please refer to the following plots.

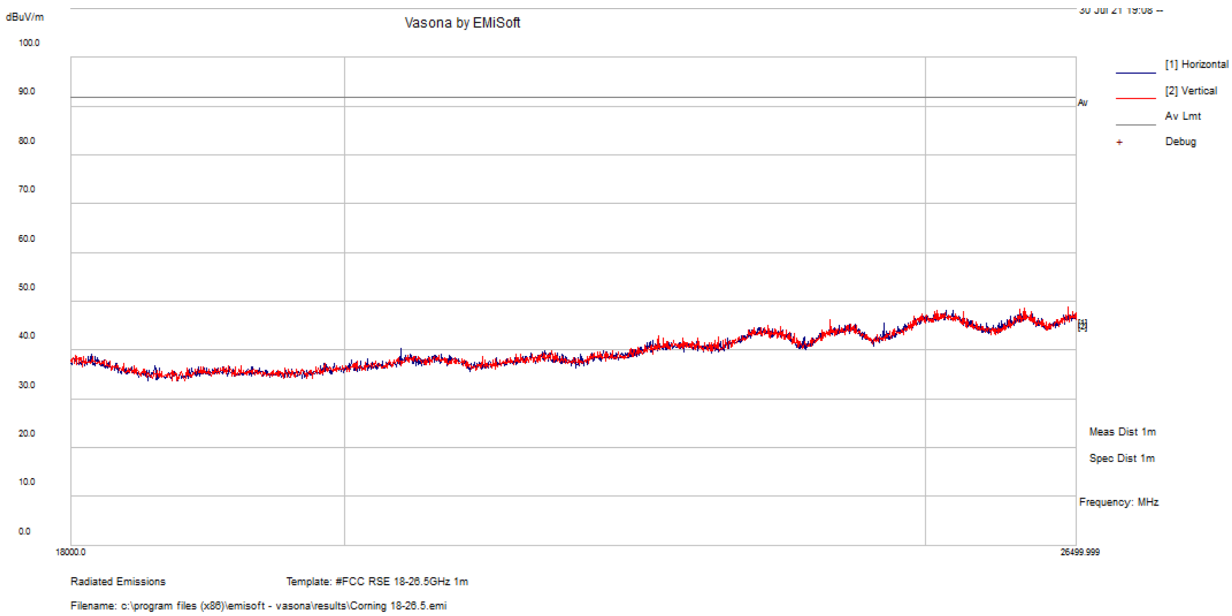
30 MHz – 1 GHz at 3 meters



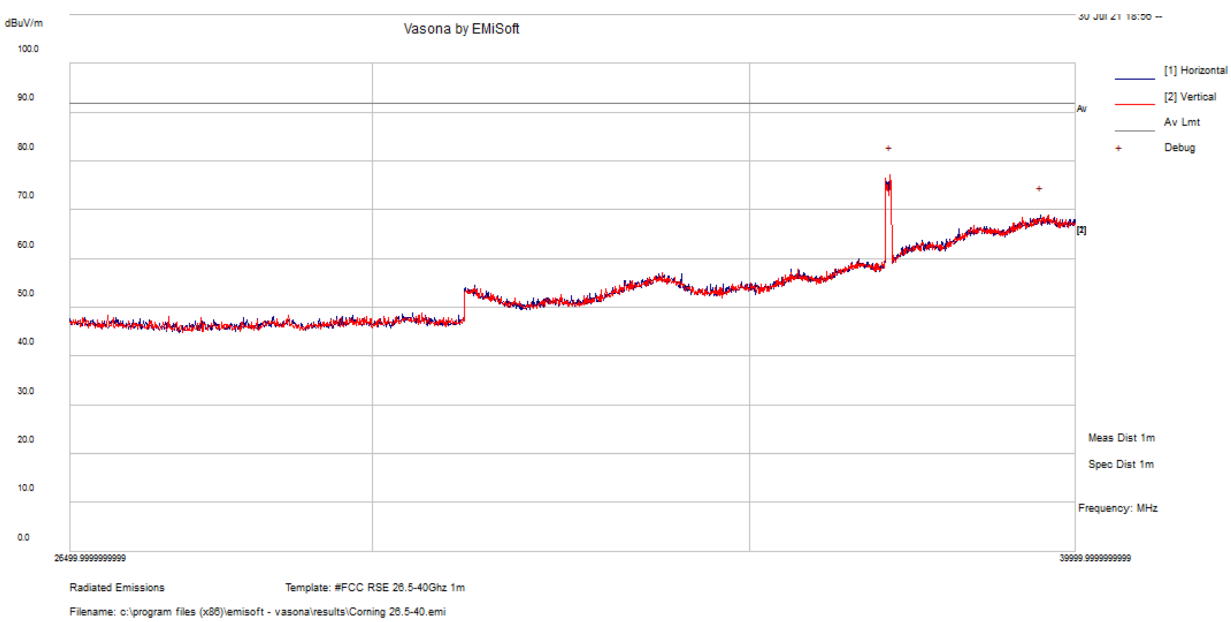
1 GHz – 18 GHz at 1 meter



18 GHz – 26.5 GHz at 1 meter



26.5 GHz – 40 GHz at 1 meter



Note: Cable loss, antenna factor, amplifier gain has been added in the plots.

Note: According to ANSI C63.26-2015 section 5.2.7 radiated power measurements EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8, the limit -13 dBm converted to field strength is 82.26 dBuV/m at 3 meters, and is 91.8 dBuV/m at 1 meter.

2) 40 GHz – 200 GHz measured at 1m

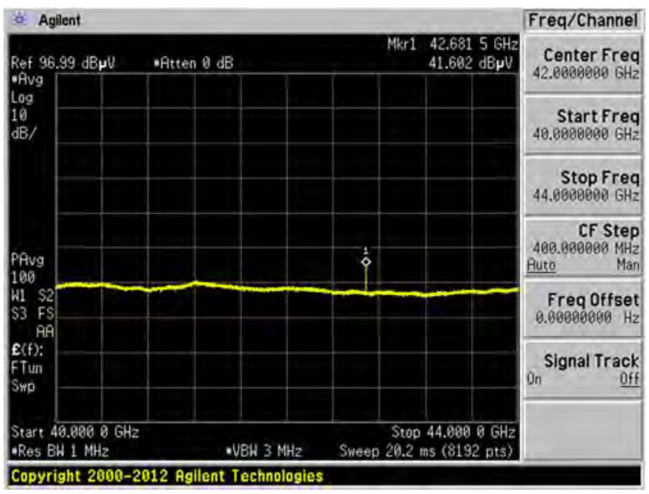
40 GHz – 44 GHz

Freq. (GHz)	S.A. Reading. (dBµV)	Table Azimuth (Degrees)	Test Antenna		Cable Loss (dB)	Antenna Factor (dB/m)	Cord Reading (dBuV/m)	Cord Reading (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)						
42.6815	41.602	0	100	H	1.4	40.2	83.202	-21.598	-13	-8.598
41.1896	37.475	0	100	V	1.4	40.2	79.075	-25.725	-13	-12.725

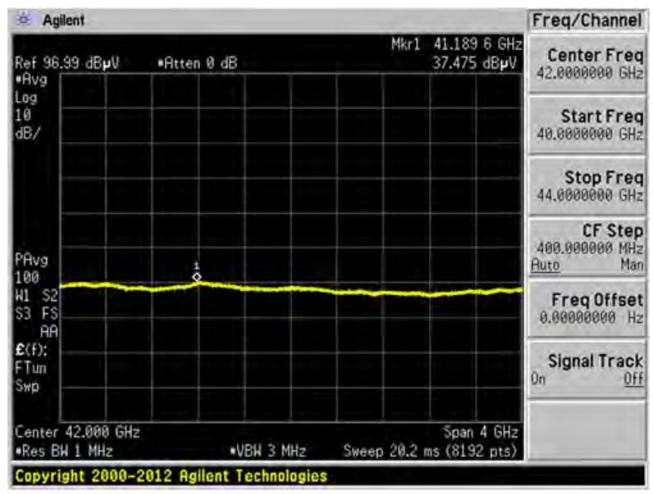
For the Frequency range 40 GHz to 44 GHz, the horn antenna was directely connected to the spectrum analyzer using a wave guide.

Note: According to ANSI C63.26-2015 section 5.2.7 radiated power measurements EIRP (dBm) = E (dBµV/m)+ 20log(D) − 104.8

44 GHz – 60 GHz Horizontal



44 GHz – 60 GHz Vertical



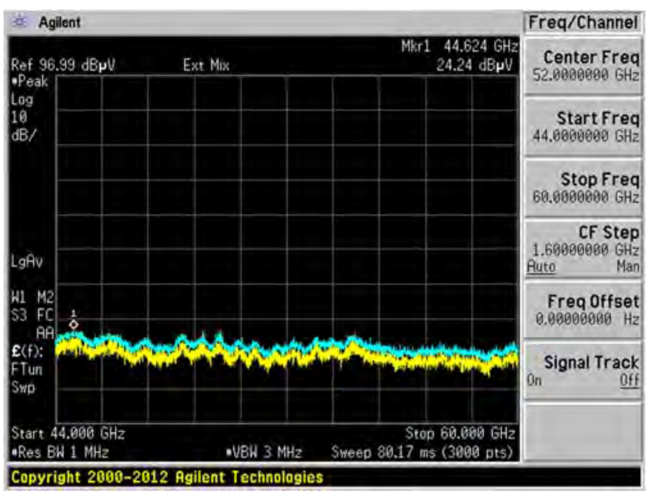
44 GHz – 200 GHz

Freq. (GHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Conv. Loss (dB)	Cord Reading (dBuV/m)	Cord Reading (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)					
44.624	24.24	0	100	H	43.12	67.36	-37.34	-13	-24.34
49.058	24.65	0	100	V	43.12	67.77	-36.93	-13	-23.93
64.662	26.45	0	100	H	47.78	74.23	-30.47	-13	-17.47
64.692	25.93	0	100	V	47.78	73.71	-30.99	-13	-17.99
92.317	29.21	0	100	H	51.24	80.45	-24.25	-13	-11.25
92.584	28.53	0	100	V	51.24	79.77	-24.93	-13	-11.93
143.821	27.72	0	100	H	63.20	90.92	-13.78	-13	-0.78
142.421	27.09	0	100	V	63.20	90.29	-14.41	-13	-1.41

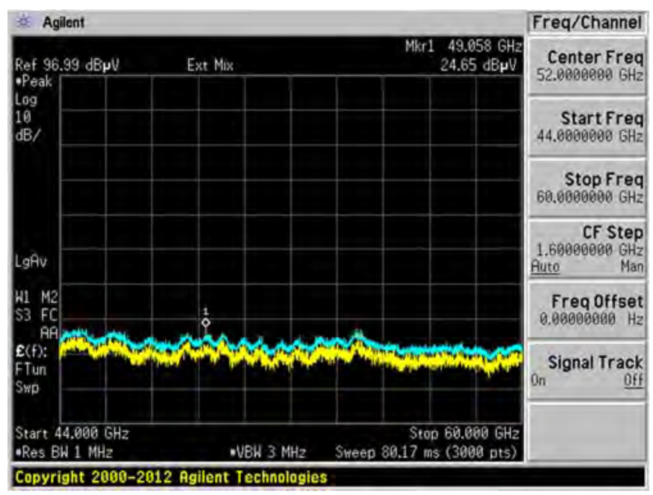
Note: The test distance was at 1 meter. Cord Reading (dBm) = Cord Reading (dBuV/m) + 20log(D) - 104.7, where D is the measurement distance (in the far field region) in m.

The conversion loss listed in the table above is the highest loss within each haomonic mixer frequency range. The S.A. Amp. is the highest uncorrected amplitude in each frequency range in dBuV as shown in the following plots. Then the S.A. Amp. was corrected with the highest loss factor in each frequency range, which results the worst case emission level. The margin equals corrected reading minus the limit.

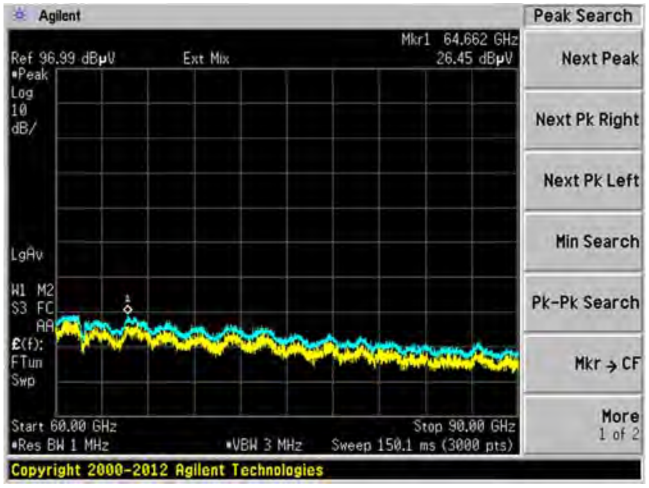
44 GHz – 60 GHz Horizontal



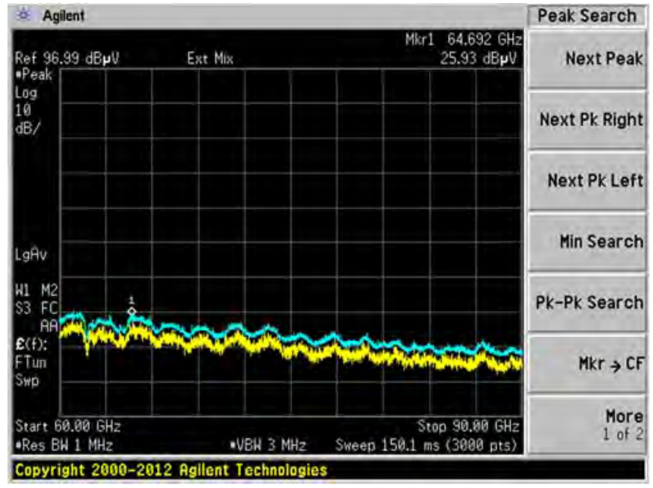
44 GHz – 60 GHz Vertical



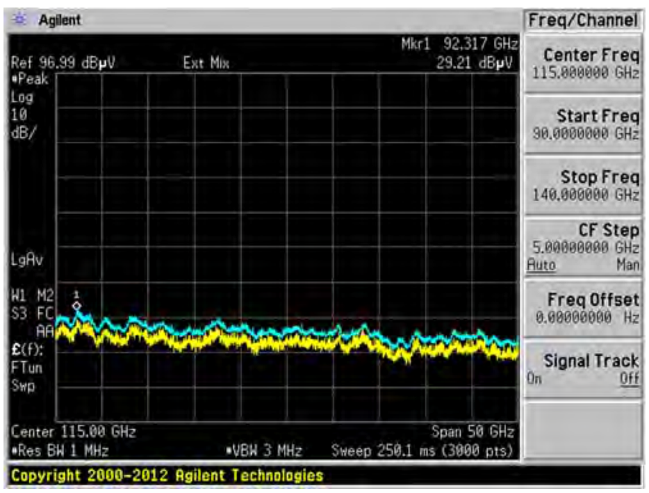
60 GHz – 90 GHz Horizontal



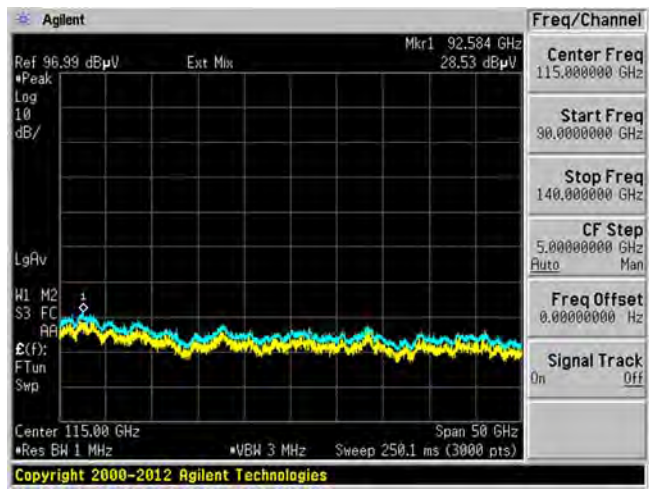
60 GHz – 90 GHz Vertical



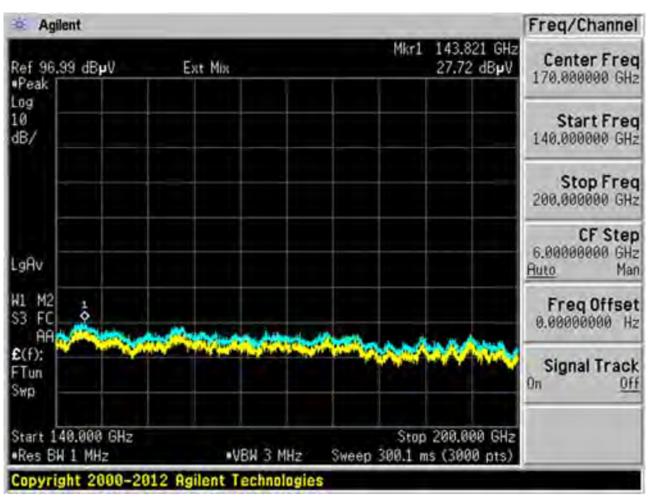
90 GHz – 140 GHz Horizontal



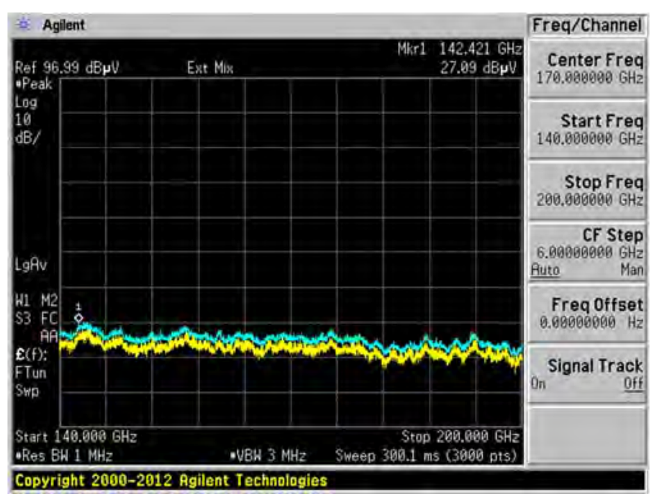
90 GHz – 140 GHz Vertical



140 GHz – 200 GHz Horizontal



140 GHz – 200 GHz Vertical



Conversion loss of the harmonic mixer with standard gain horn antenna:

Model M19HWA
Ser No. 170615-1
06/15/2017

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)	Frequency (GHz)	Conversion Loss (dB)	Frequency (GHz)	Conversion Loss (dB)
40.00	34.47	46.80	37.06	53.60	35.98
40.40	33.64	47.20	36.17	54.00	34.12
40.80	36.33	47.60	29.34	54.40	37.55
41.20	30.41	48.00	37.51	54.80	31.48
41.60	32.89	48.40	38.89	55.20	38.76
42.00	40.94	48.80	31.62	55.60	34.31
42.40	29.52	49.20	31.53	56.00	35.21
42.80	30.29	49.60	39.27	56.40	33.28
43.20	31.82	50.00	38.21	56.80	37.60
43.60	32.32	50.40	32.28	57.20	38.04
44.00	29.52	50.80	32.52	57.60	41.61
44.40	32.43	51.20	40.05	58.00	35.09
44.80	30.22	51.60	35.21	58.40	36.96
45.20	29.70	52.00	34.10	58.80	37.42
45.60	41.65	52.40	31.02	59.20	35.63
46.00	35.48	52.80	43.12	59.60	39.90
46.40	30.56	53.20	33.49	60.00	35.76

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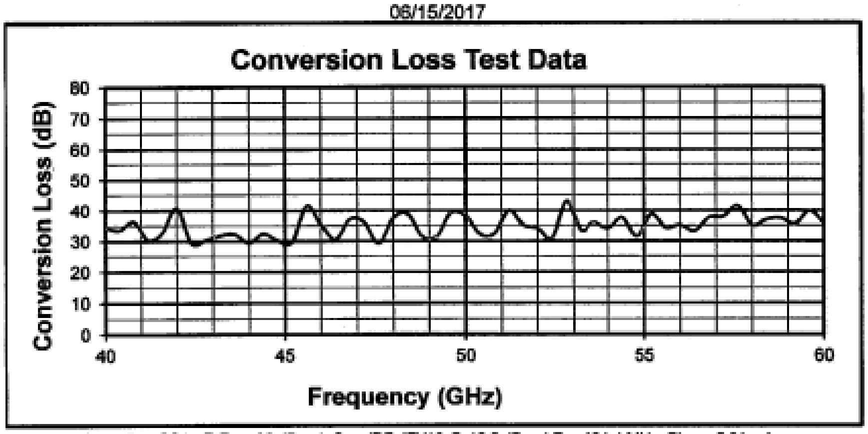
Model M19HWA
Ser No. 170615-1
06/15/2017



Optimized for Agilent PSA: R.F. = -30 dBm, L.O. = (RF+IF)/10 @ 15.5 dBm, I.F. = 321.4 MHz, Bias = 5.61 mA

OML INC. 4208417A
Morgan Hill, CA 95037

Model M12HWA
Ser No. 170615-1
06/15/2017

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)
60.00	**45.62**
60.60	43.98
61.20	44.88
61.80	44.14
62.40	47.13
63.00	45.47
63.60	44.18
64.20	44.54
64.80	40.52
65.40	39.33
66.00	39.95
66.60	39.80
67.20	39.21
67.80	39.19
68.40	38.03
69.00	37.92
69.60	38.08

Frequency (GHz)	Conversion Loss (dB)
70.20	37.76
70.80	37.45
71.40	38.92
72.00	38.78
72.60	38.96
73.20	40.92
73.80	36.79
74.40	36.38
75.00	**40.58**
75.60	36.67
76.20	37.10
76.80	36.47
77.40	37.94
78.00	38.47
78.60	39.23
79.20	37.29
79.80	40.49

Frequency (GHz)	Conversion Loss (dB)
80.40	42.94
81.00	37.51
81.60	36.76
82.20	39.56
82.80	40.29
83.40	47.78
84.00	38.09
84.60	39.98
85.20	38.74
85.80	38.00
86.40	39.55
87.00	40.63
87.60	44.74
88.20	39.58
88.80	40.39
89.40	47.32
90.00	**40.59**

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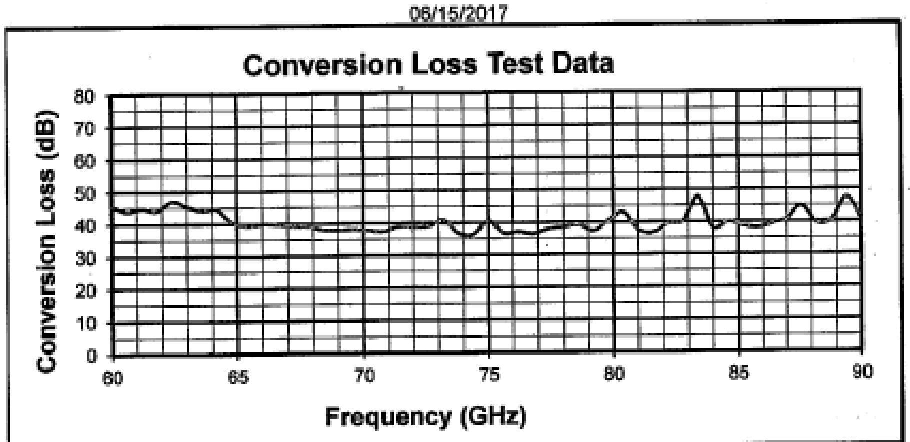
Morgan Hill, CA 95037

Model M12HWA
Ser No. 170615-1
06/15/2017



Optimized for Agilent PSA: R.F. = -30 dBm, L.O. = (RF+IF)/16 @ 15.5 dBm, I.F. = 321.4 MHz, Bias = 2.88 mA

OML INC. 4208417B
Morgan Hill, CA 95037

Model M08HWA

Ser No. 170615-1

06/15/2017

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)
90.00	**50.07**
91.00	45.08
92.00	51.24
93.00	47.52
94.00	45.81
95.00	43.92
96.00	46.92
97.00	50.86
98.00	50.76
99.00	49.62
100.00	48.33
101.00	45.48
102.00	44.71
103.00	46.00
104.00	48.29
105.00	53.79
106.00	49.64

Frequency (GHz)	Conversion Loss (dB)
107.00	45.03
108.00	43.86
109.00	43.55
110.00	49.23
111.00	47.12
112.00	47.27
113.00	43.52
114.00	44.86
115.00	**42.97**
116.00	43.89
117.00	45.27
118.00	47.93
119.00	49.08
120.00	46.86
121.00	45.43
122.00	50.21
123.00	45.17

Frequency (GHz)	Conversion Loss (dB)
124.00	49.80
125.00	49.58
126.00	50.20
127.00	46.09
128.00	45.44
129.00	45.54
130.00	50.08
131.00	46.72
132.00	46.50
133.00	51.03
134.00	50.75
135.00	51.38
136.00	51.18
137.00	53.89
138.00	49.28
139.00	49.92
140.00	**49.78**

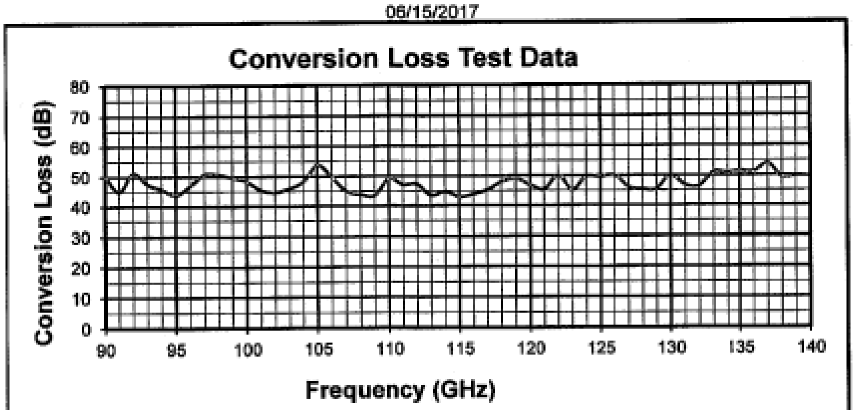
OML INC. Traceability only available ≤ 110 GHz 4208417C

Morgan Hill, CA 95037

Model M08HWA

Ser No. 170615-1

06/15/2017



Optimized for Agilent PSA: R.F. = -30 dBm, L.O. = (RF+IF)/22 @ 15.5 dBm, I.F. = 321.4 MHz, Bias = 1.99 mA

OML INC. 4208417C

Morgan Hill, CA 95037

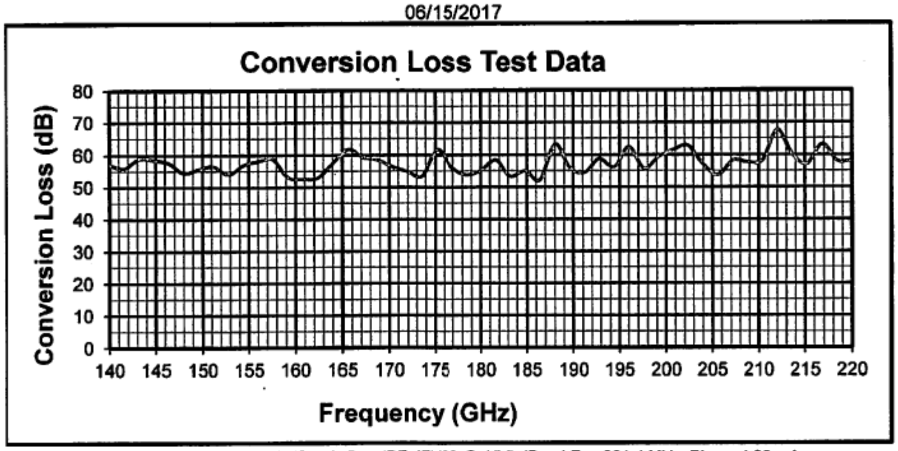
Model M05HWA
Ser No. 170615-1
06/15/2017

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)	Frequency (GHz)	Conversion Loss (dB)	Frequency (GHz)	Conversion Loss (dB)
140.00	**57.02**	167.20	59.35	194.40	56.26
141.60	55.99	168.80	58.45	196.00	62.40
143.20	58.97	170.40	56.28	197.60	55.80
144.80	58.57	172.00	54.80	199.20	59.42
146.40	57.57	173.60	53.46	200.80	61.54
148.00	54.52	175.20	61.58	202.40	62.76
149.60	55.76	176.80	56.33	204.00	57.03
151.20	56.58	178.40	53.81	205.60	53.70
152.80	54.09	**180.00**	**55.14**	207.20	58.29
154.40	56.96	181.60	58.39	208.80	57.69
156.00	58.17	183.20	53.37	210.40	58.40
157.60	58.76	184.80	55.05	212.00	67.67
159.20	53.05	186.40	52.17	213.60	60.17
160.80	52.60	188.00	63.20	215.20	57.10
162.40	53.04	189.60	55.95	216.80	63.21
164.00	57.59	191.20	54.54	218.40	58.13
165.60	61.74	192.80	58.79	**220.00**	**58.13**

OML INC. Traceability only available ≤ 110 GHz 4208417D
Morgan Hill, CA 95037

Model M05HWA
Ser No. 170615-1
06/15/2017



Optimized for Agilent PSA: R.F. = -30 dBm, L.O. = (RF+IF)/32 @ 15.5 dBm, I.F. = 321.4 MHz, Bias = 4.98 mA

OML INC. 4208417D
Morgan Hill, CA 95037

8 FCC §2.1049 - Occupied Bandwidth

8.1 Applicable Standards

As per FCC §2.1049, Occupied bandwidth of tranmissions falls within authorized bands

8.2 Measurement Procedure

1. The spectrum analyzer's automatic bandwidth measurement function was used to perform the 99% occupied bandwidth measurement.

2. Set the RBW =1~5% of the anticipated OBW, and the VBW≥3 x RBW.

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

4. Sweep = auto couple.

5. Record the test plots and test results.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer 44 GHz	E4446A	US44300386	2021-04-27	1 year
-	RF Cable	-	-	Each Time	-
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2020-02-27	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

8.4 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-43 %
ATM Pressure:	102.1-103.1 kPa

The testing was performed by Giriraj Gurjar on 2021-07-20 at 5m3 chamber.

8.5 Test Results

Please refer to the following tables and plots.

Beam ID: 11 (Vertical)

Band	Component Carriers	Modulation	Channel	Occupied Bandwidth (MHz)
n260	1CC	16QAM	Low	94.9575
			Middle	95.3590
			High	96.2146
		64QAM	Low	95.4427
			Middle	95.4728
			High	96.2982
		QPSK	Low	95.0895
			Middle	95.3443
			High	96.2448
	2CC	16QAM	Low	195.7479
			Middle	194.6454
			High	194.3166
		64QAM	Low	195.1359
			Middle	195.1659
			High	194.0356
		QPSK	Low	195.0508
			Middle	194.9277
			High	194.1835
	3CC	16QAM	Low	291.6669
			Middle	291.7795
			High	291.3762
		64QAM	Low	291.5149
			Middle	291.4429
			High	291.4247
		QPSK	Low	291.6335
			Middle	291.4694
			High	291.6100
	4CC	16QAM	Low	392.7401
			Middle	392.5385
			High	391.0602
		64QAM	Low	392.7875
			Middle	392.6555
			High	391.2225
		QPSK	Low	392.7557
			Middle	392.9036
			High	391.0811

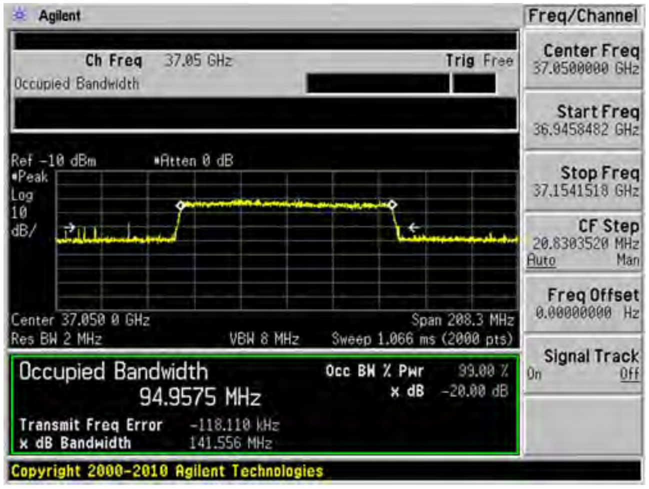
Beam ID: 139 (Horizontal)

Band	Component Carriers	Modulation	Channel	Occupied Bandwidth (MHz)
n260	1CC	16QAM	Low	95.1335
			Middle	94.9270
			High	95.1752
		64QAM	Low	95.2410
			Middle	94.6397
			High	95.0643
		QPSK	Low	95.0415
			Middle	94.6974
			High	94.9719
	2CC	16QAM	Low	194.8151
			Middle	195.1465
			High	194.6841
		64QAM	Low	195.1257
			Middle	195.2019
			High	194.7234
		QPSK	Low	195.2424
			Middle	195.7272
			High	194.8263
	3CC	16QAM	Low	292.5538
			Middle	292.1753
			High	291.7797
		64QAM	Low	292.5337
			Middle	292.2288
			High	291.6172
		QPSK	Low	292.2092
			Middle	292.0221
			High	291.7950
	4CC	16QAM	Low	393.6419
			Middle	393.7249
			High	391.4799
		64QAM	Low	393.7296
			Middle	393.8689
			High	391.4537
		QPSK	Low	395.5823
			Middle	394.0352
			High	391.4435

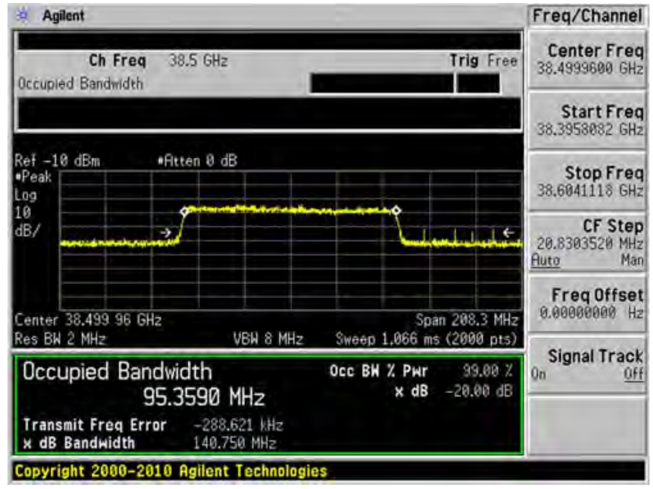
Beam ID: 11 (Vertical)

1CC – 16QAM

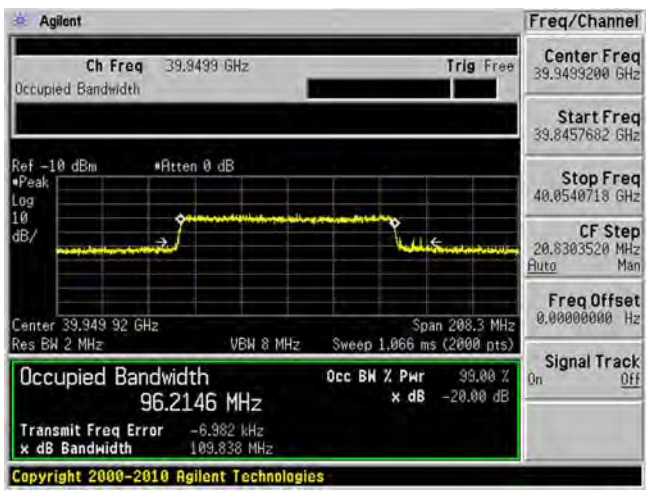
Low Channel



Middle Channel



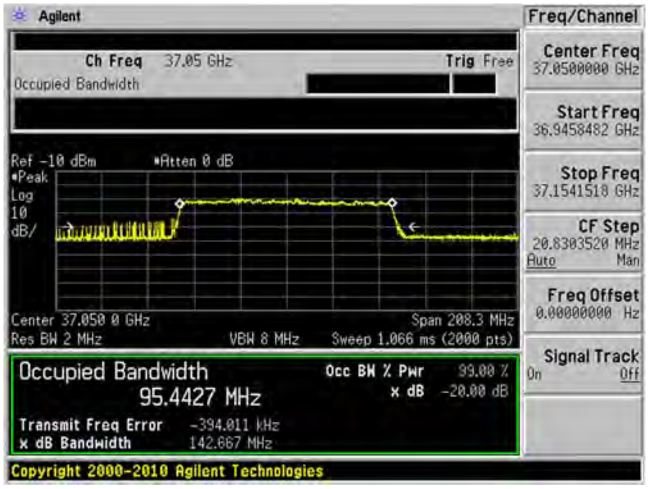
High Channel



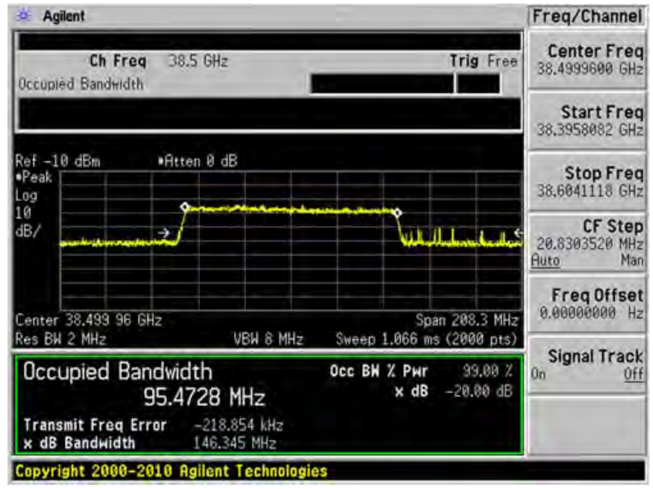
Beam ID: 11 (Vertical)

1CC – 64QAM

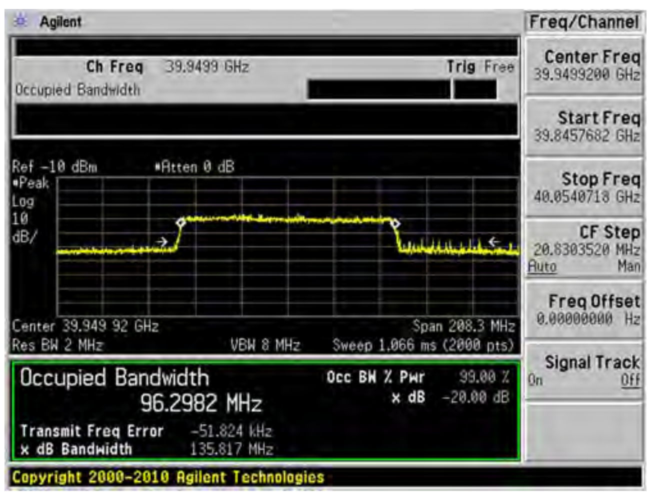
Low Channel



Middle Channel



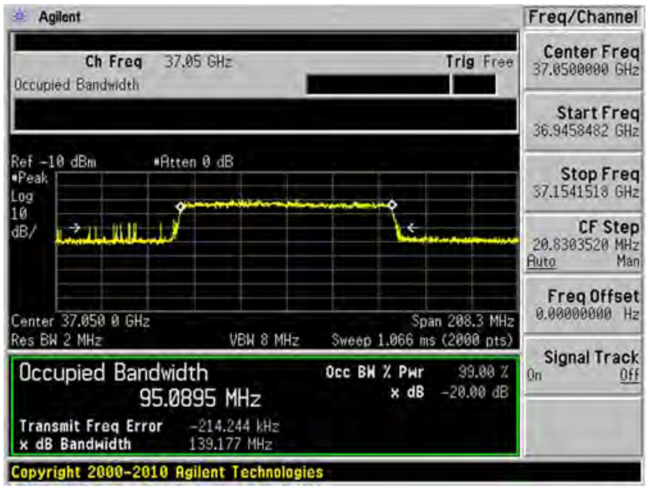
High Channel



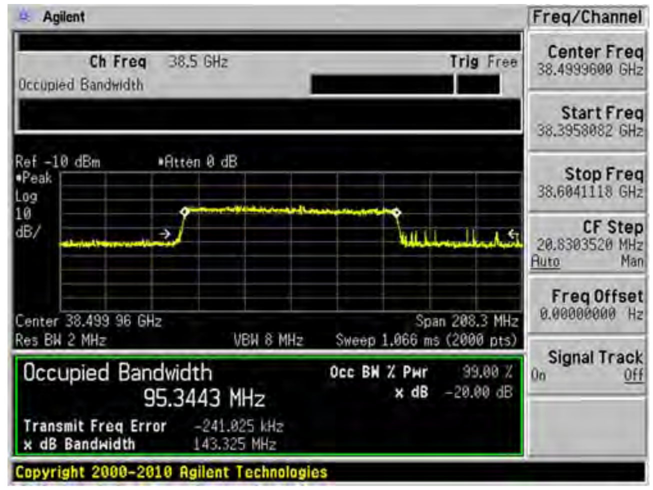
Beam ID: 11 (Vertical)

1CC – QPSK

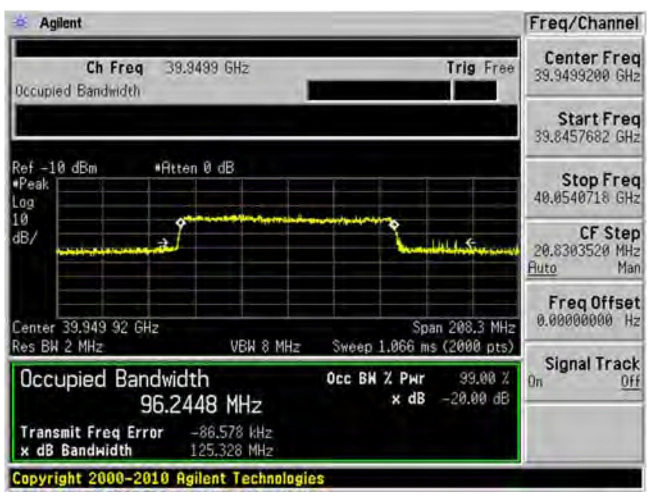
Low Channel



Middle Channel



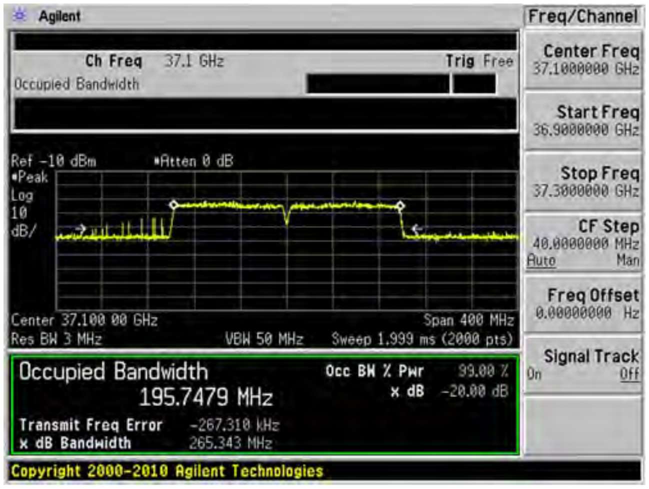
High Channel



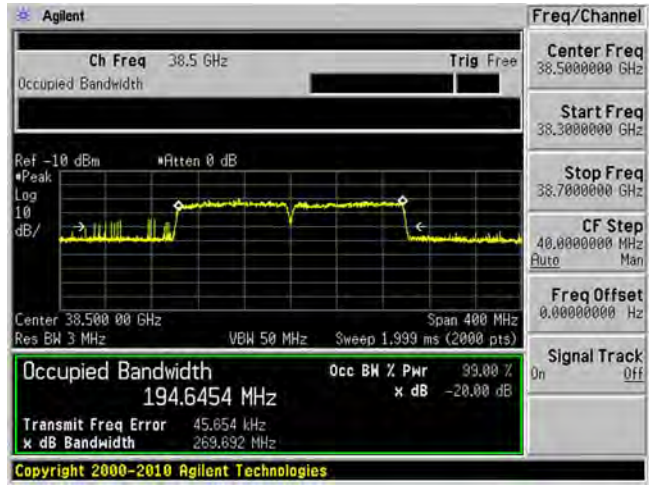
Beam ID: 11 (Vertical)

2CC – 16QAM

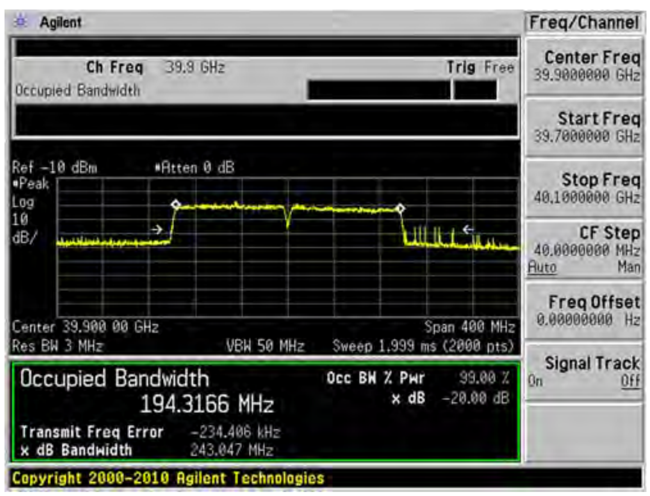
Low Channel



Middle Channel



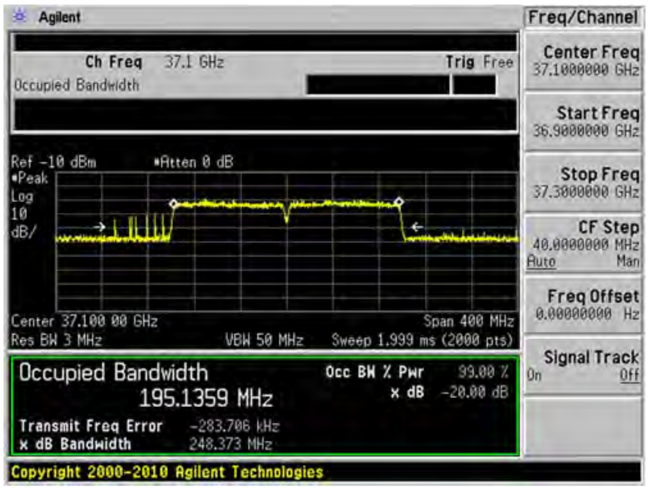
High Channel



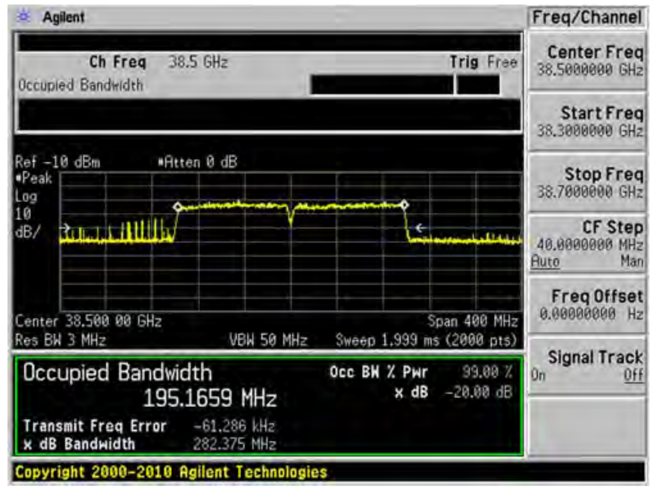
Beam ID: 11 (Vertical)

2CC – 64QAM

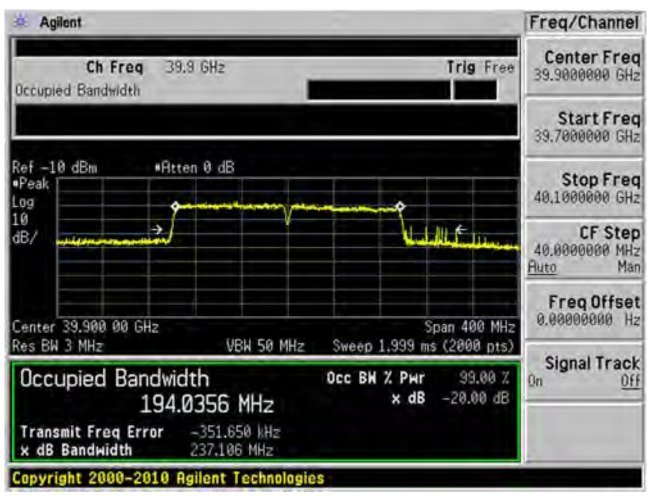
Low Channel



Middle Channel



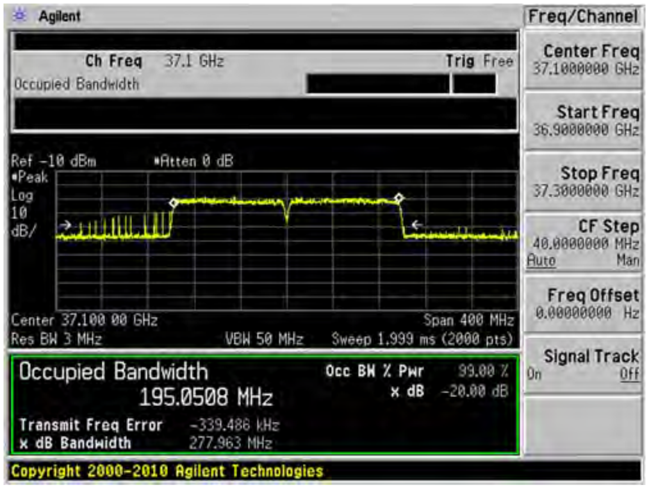
High Channel



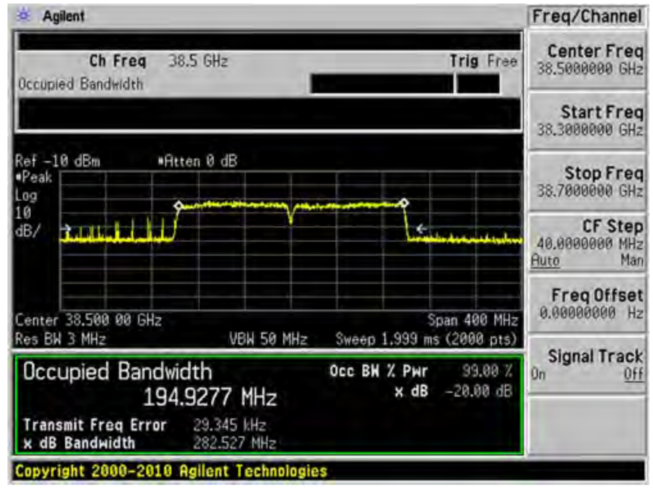
Beam ID: 11 (Vertical)

2CC – QPSK

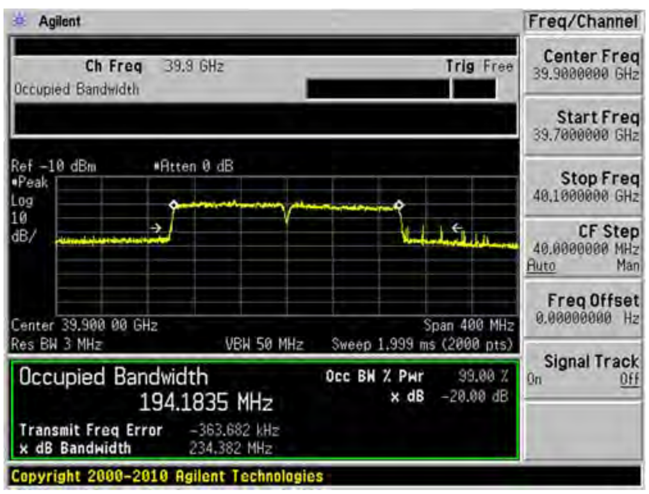
Low Channel



Middle Channel



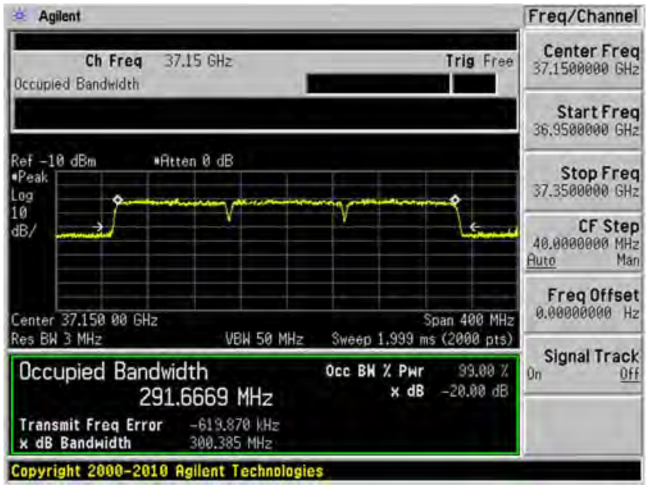
High Channel



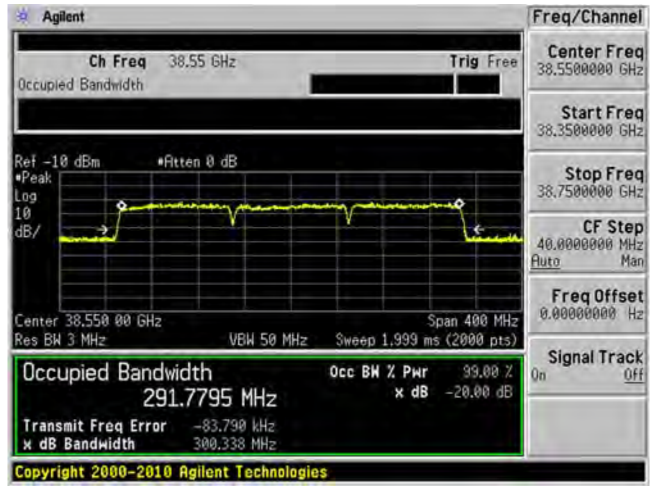
Beam ID: 11 (Vertical)

3CC – 16QAM

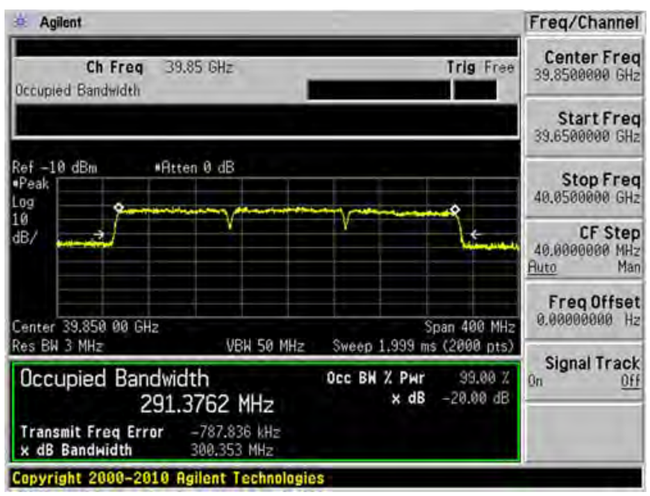
Low Channel



Middle Channel



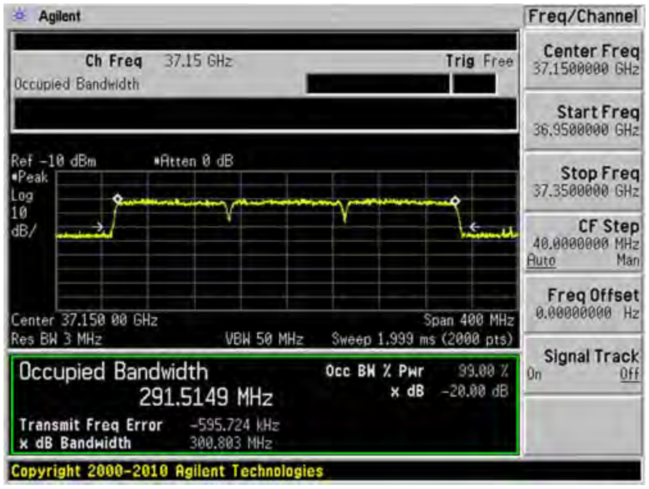
High Channel



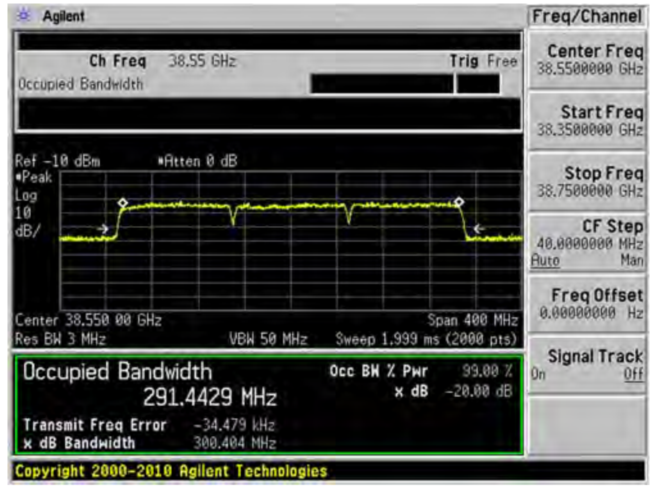
Beam ID: 11 (Vertical)

3CC – 64QAM

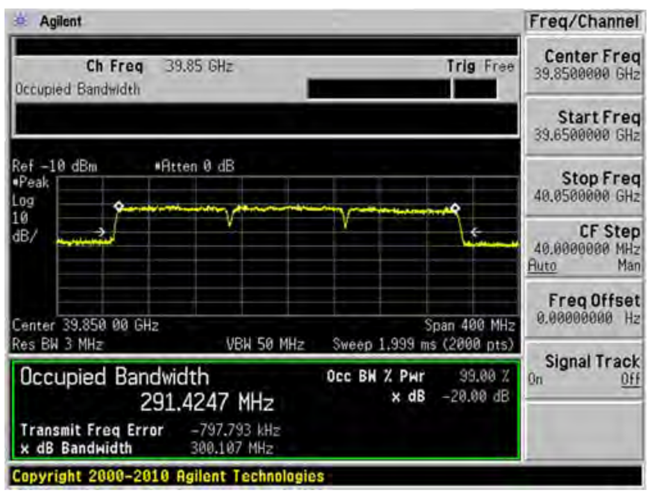
Low Channel



Middle Channel



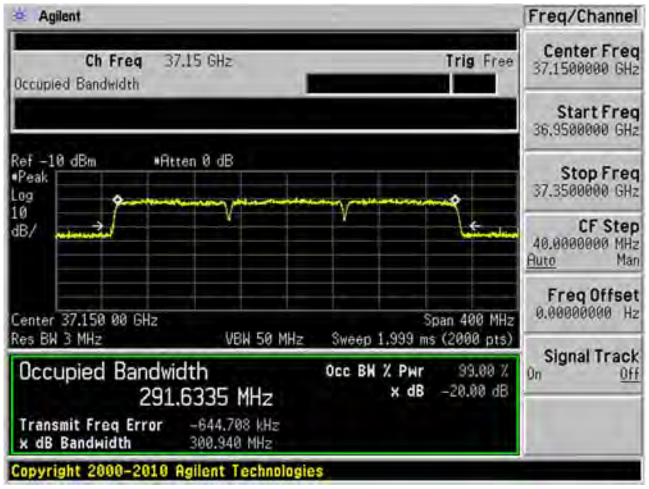
High Channel



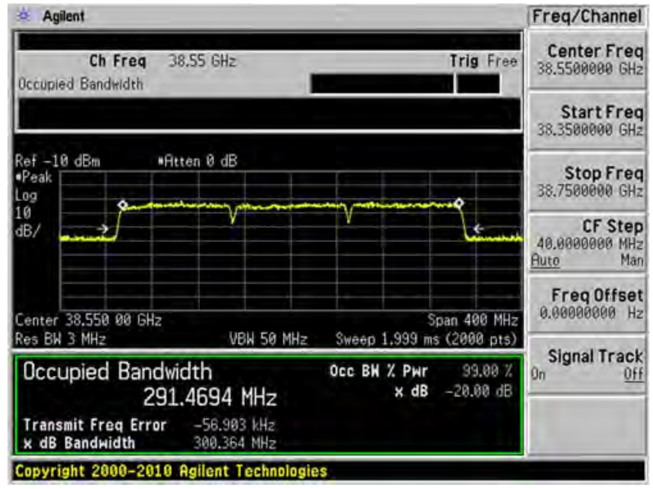
Beam ID: 11 (Vertical)

3CC – QPSK

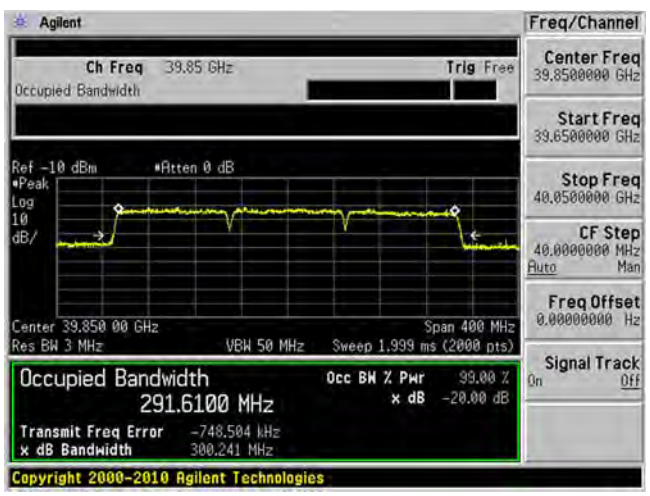
Low Channel



Middle Channel



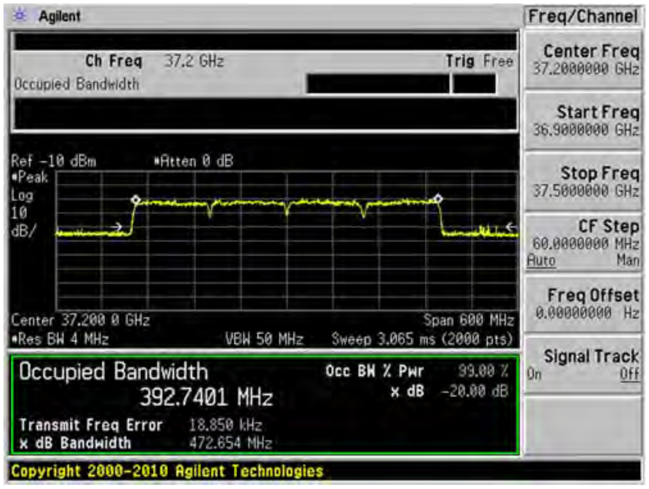
High Channel



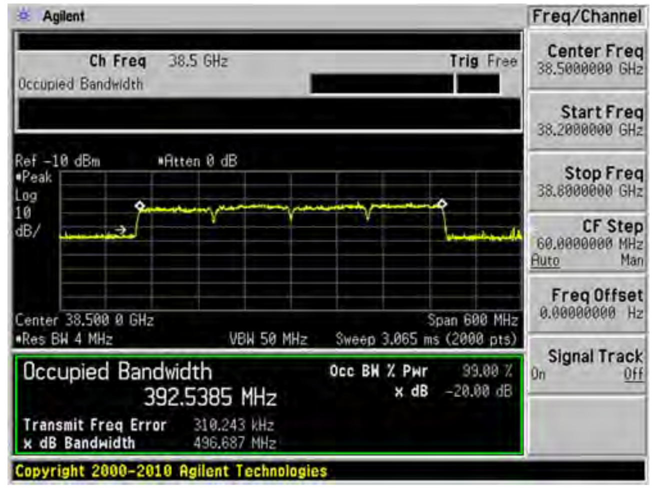
Beam ID: 11 (Vertical)

4CC – 16QAM

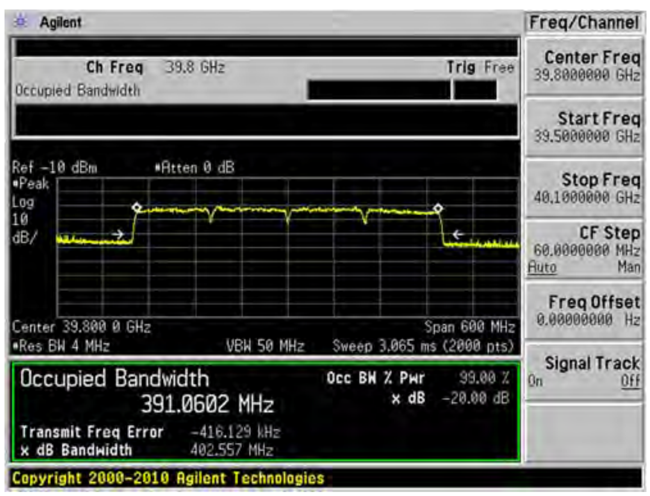
Low Channel



Middle Channel



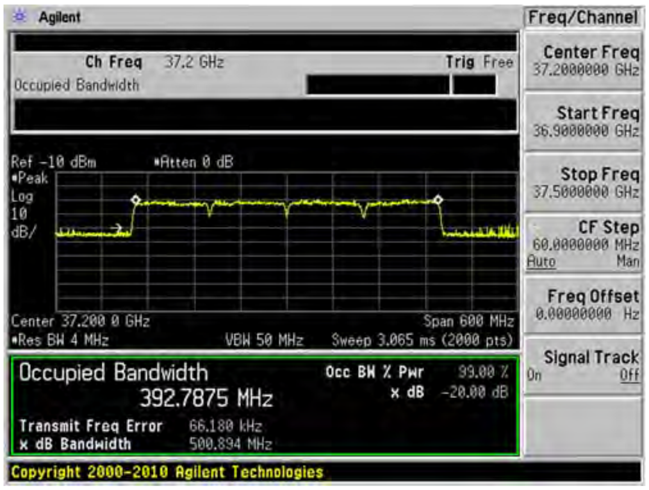
High Channel



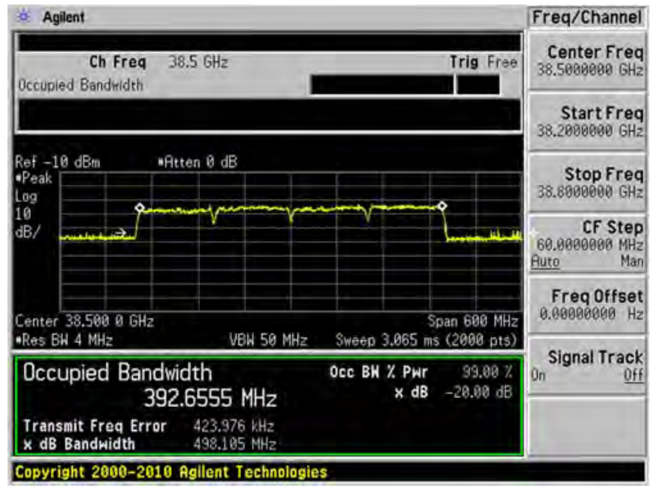
Beam ID: 11 (Vertical)

4CC – 64QAM

Low Channel



Middle Channel



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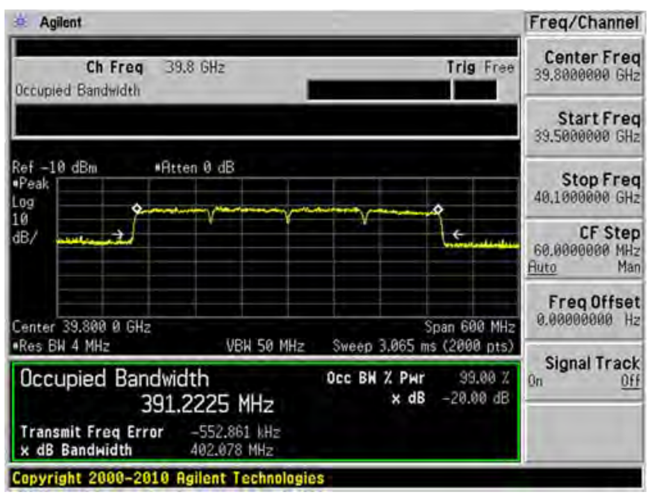
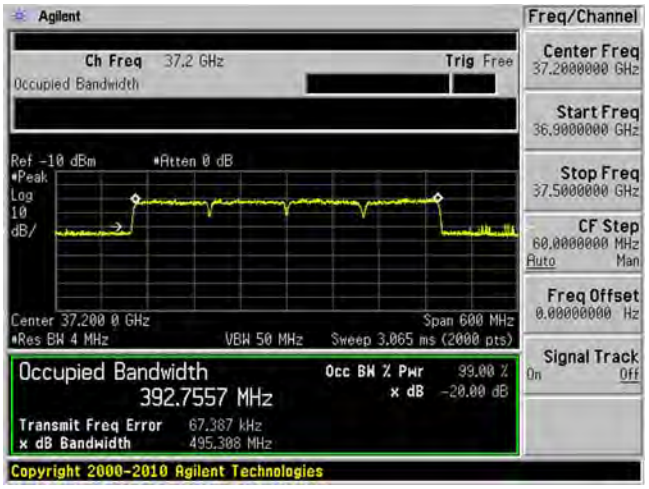


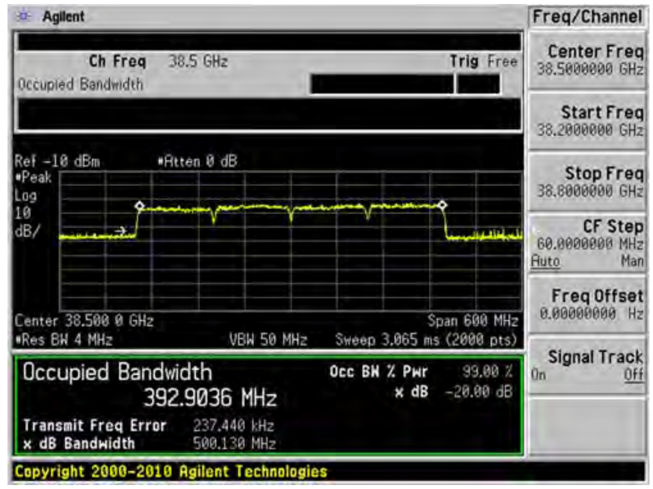
Beam ID: 11 (Vertical)

4CC – QPSK

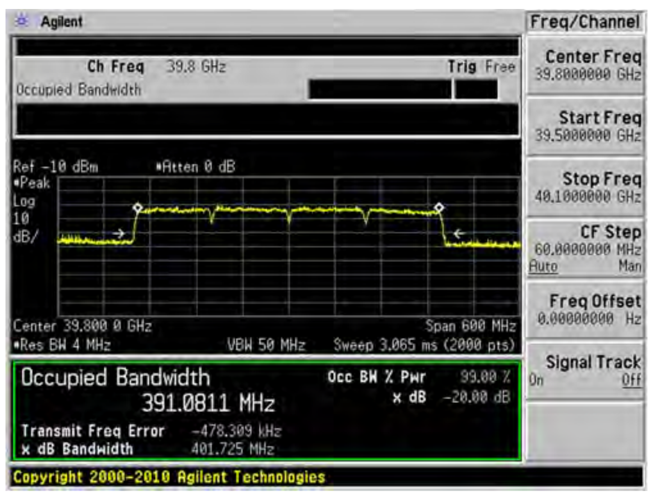
Low Channel



Middle Channel



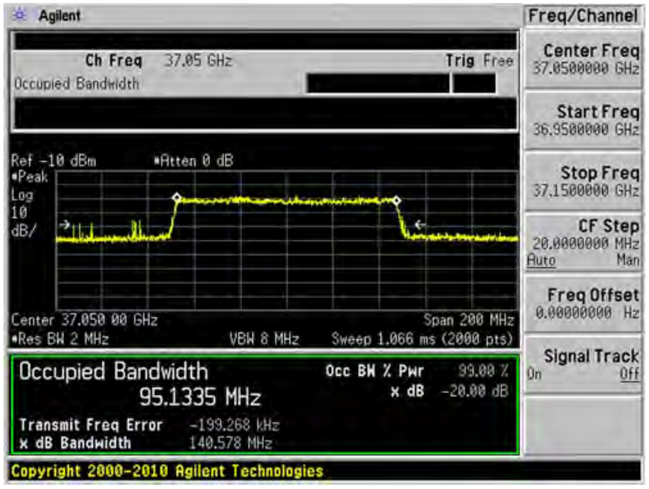
High Channel



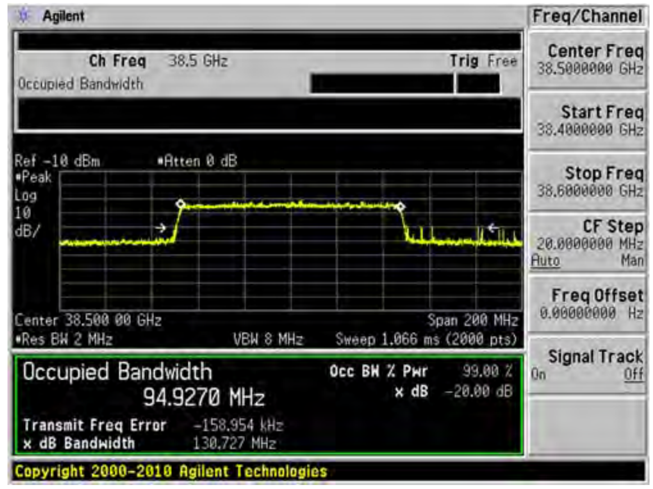
Beam ID: 139 (Horizontal)

1CC – 16QAM

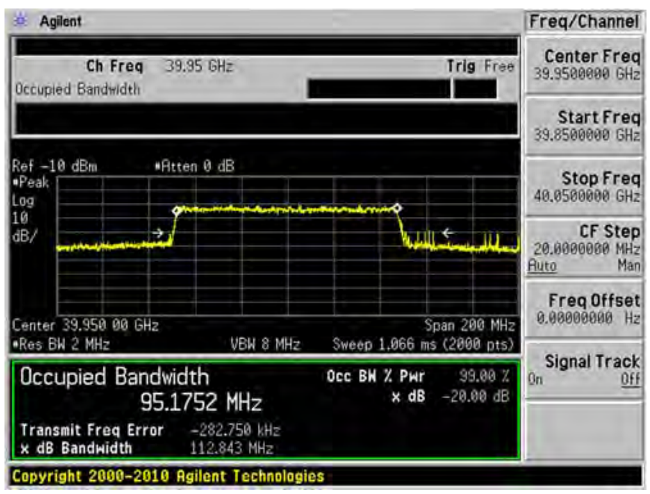
Low Channel



Middle Channel



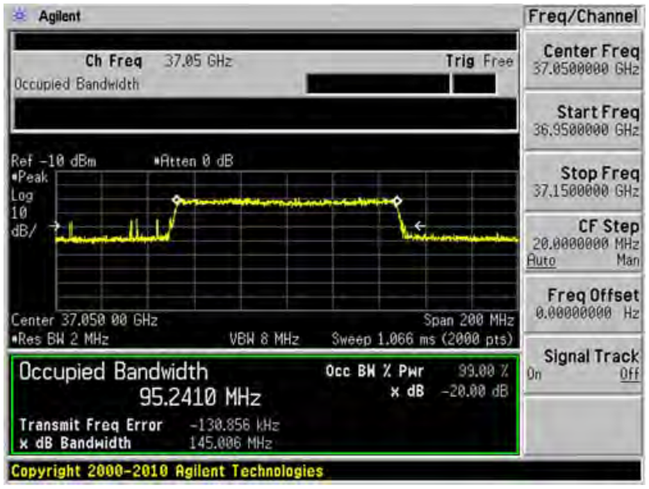
High Channel



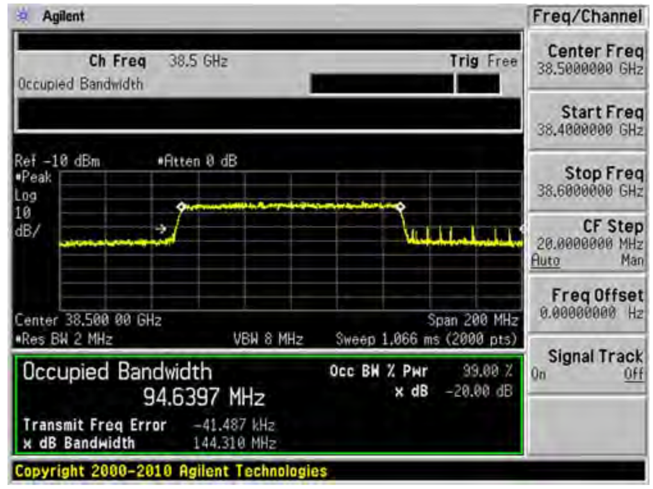
Beam ID: 139 (Horizontal)

1CC – 64QAM

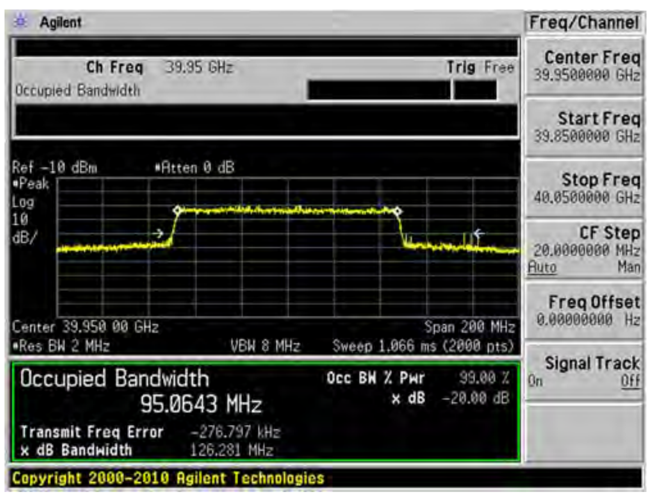
Low Channel



Middle Channel



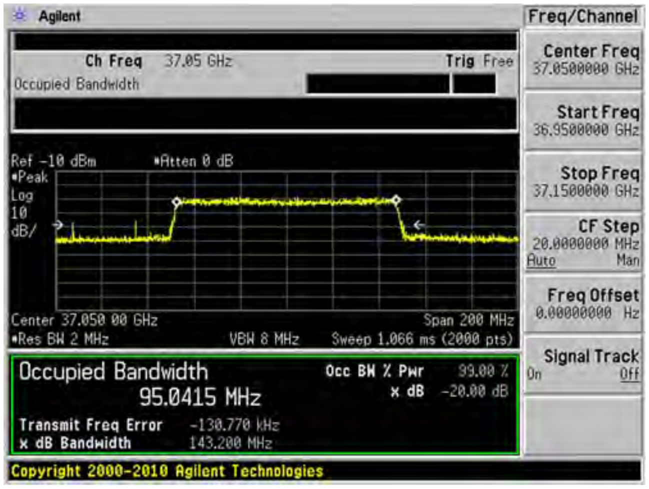
High Channel



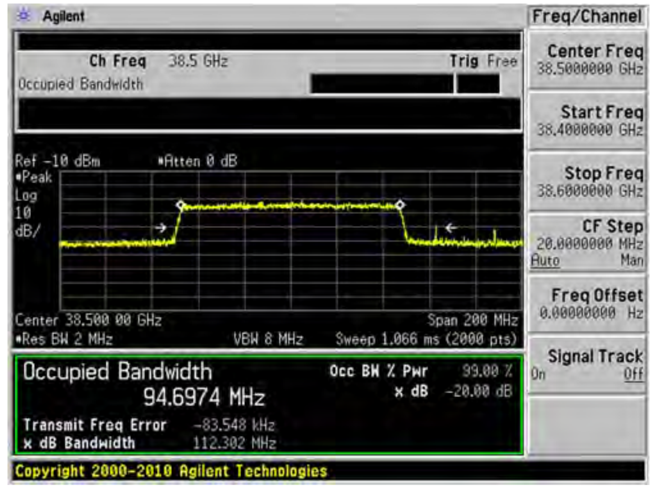
Beam ID: 139 (Horizontal)

1CC – QPSK

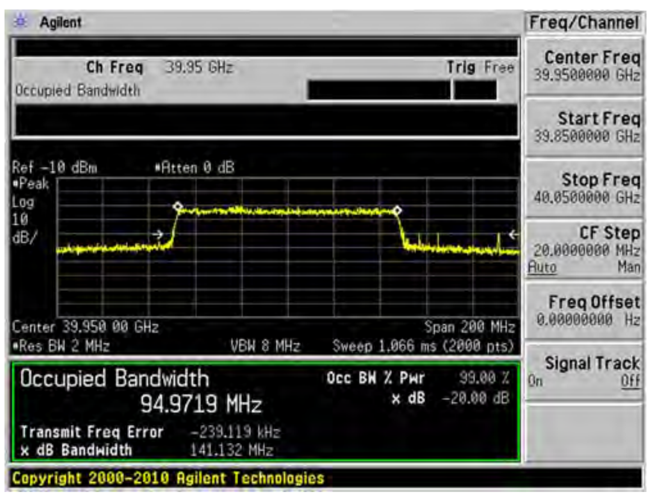
Low Channel



Middle Channel



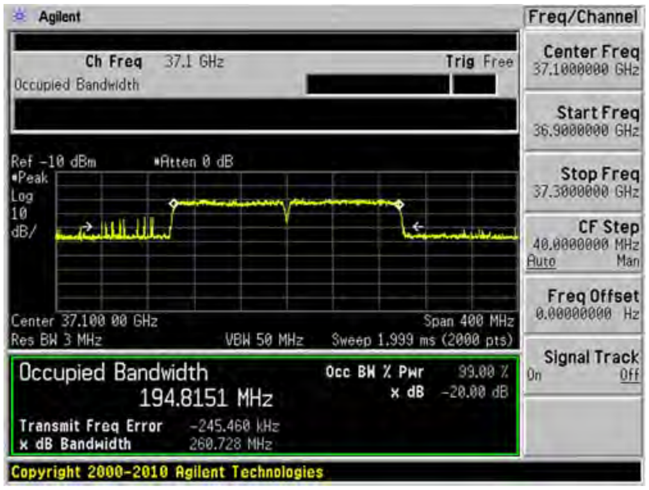
High Channel



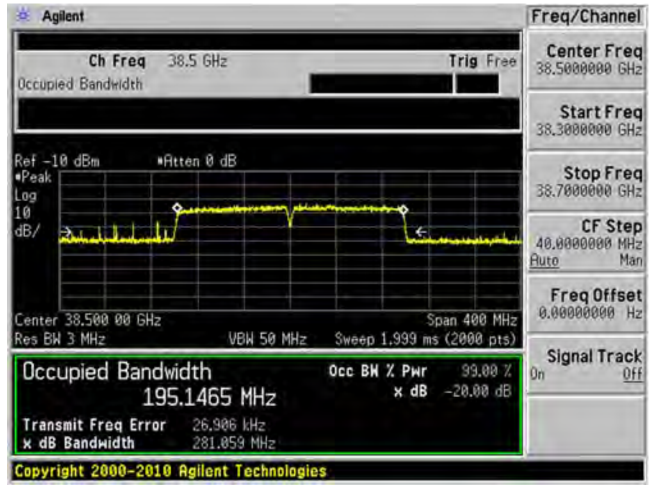
Beam ID: 139 (Horizontal)

2CC – 16QAM

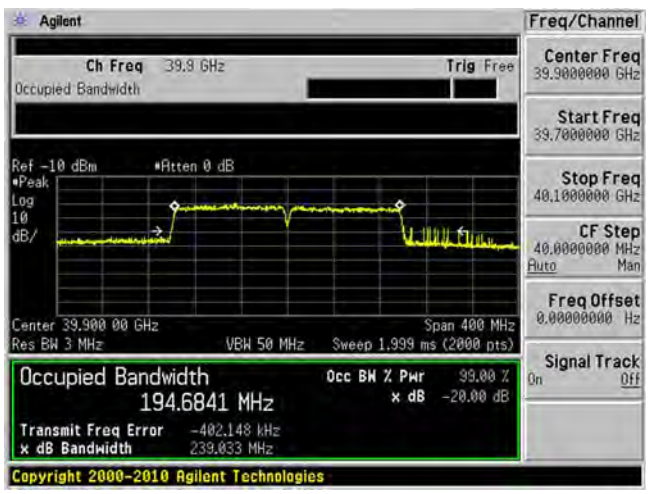
Low Channel



Middle Channel



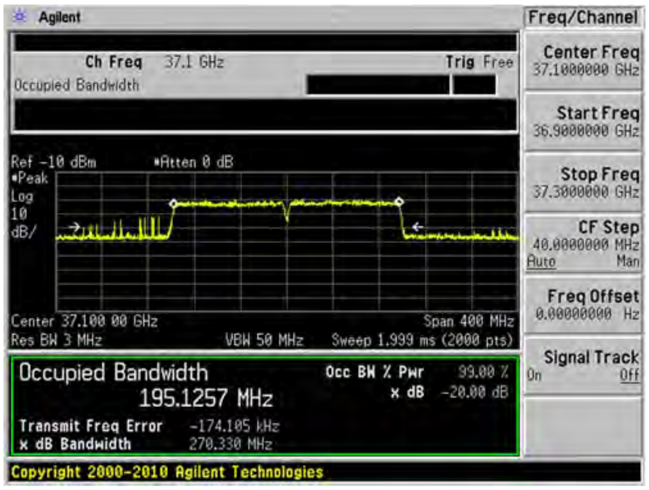
High Channel



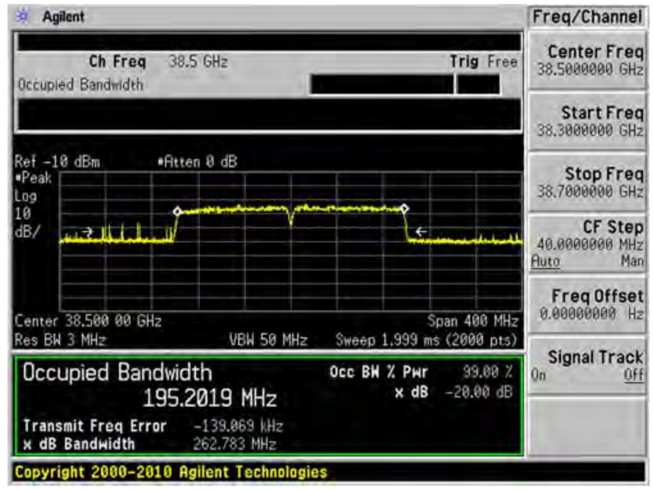
Beam ID: 139 (Horizontal)

2CC – 64QAM

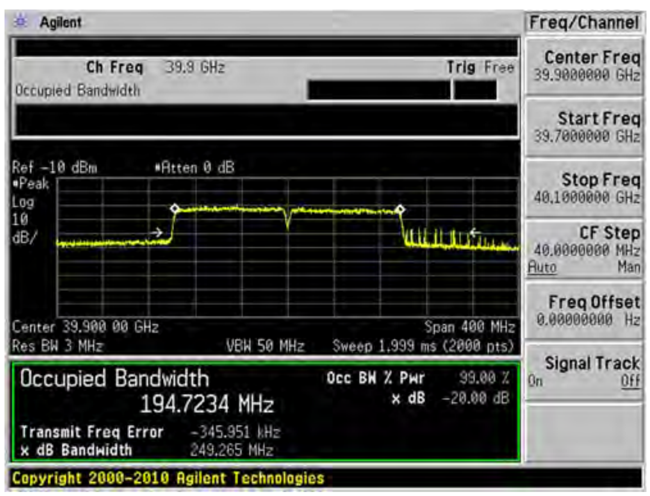
Low Channel



Middle Channel



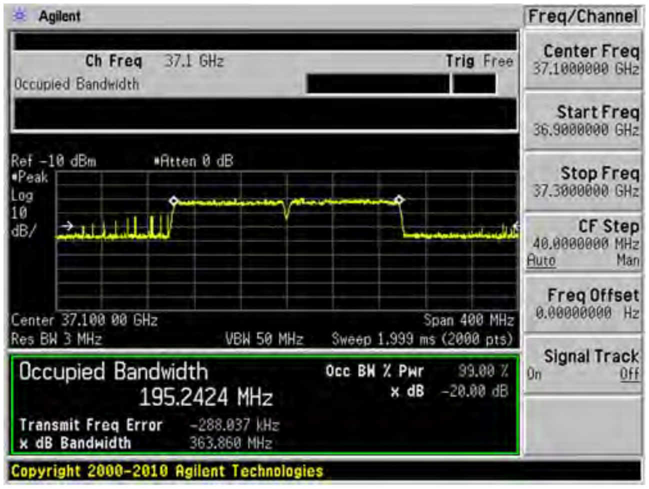
High Channel



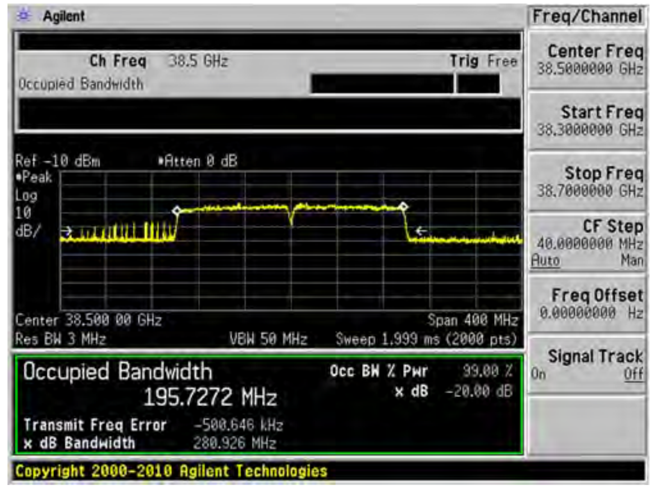
Beam ID: 139 (Horizontal)

2CC – QPSK

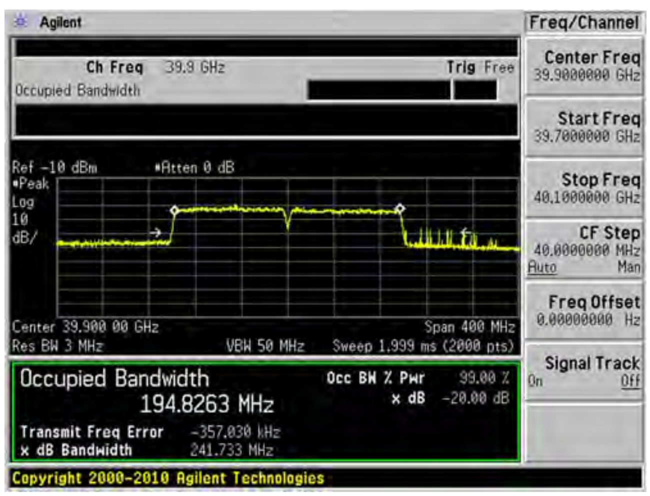
Low Channel



Middle Channel



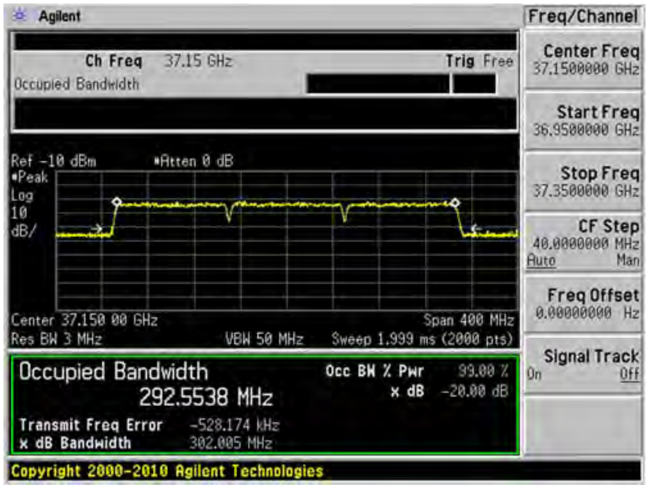
High Channel



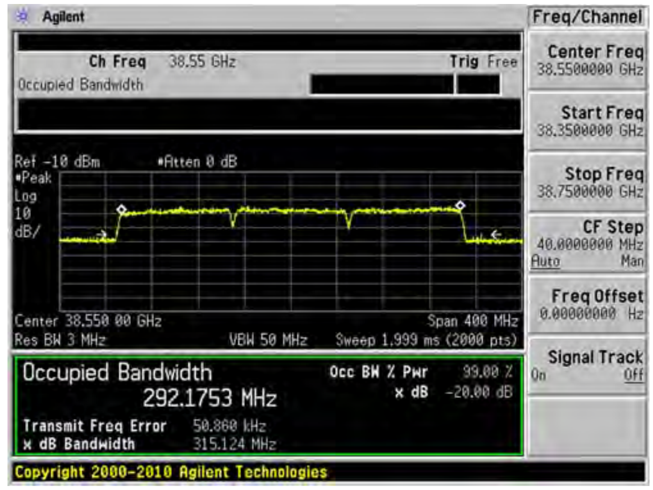
Beam ID: 139 (Horizontal)

3CC – 16QAM

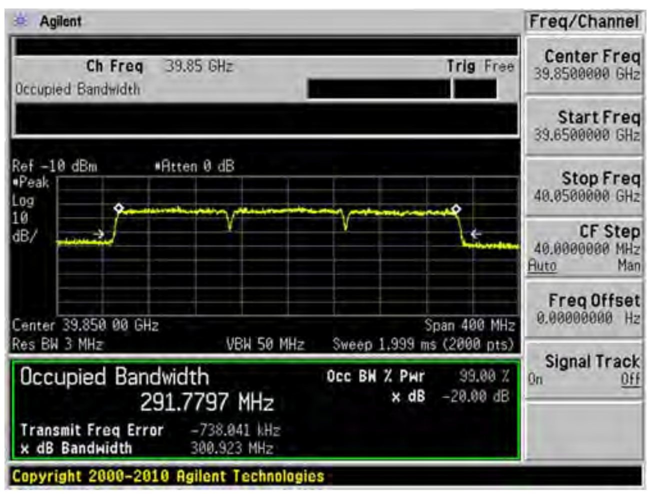
Low Channel



Middle Channel



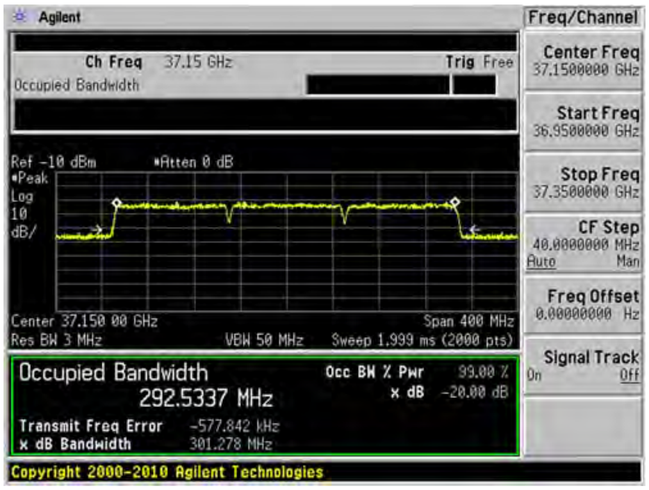
High Channel



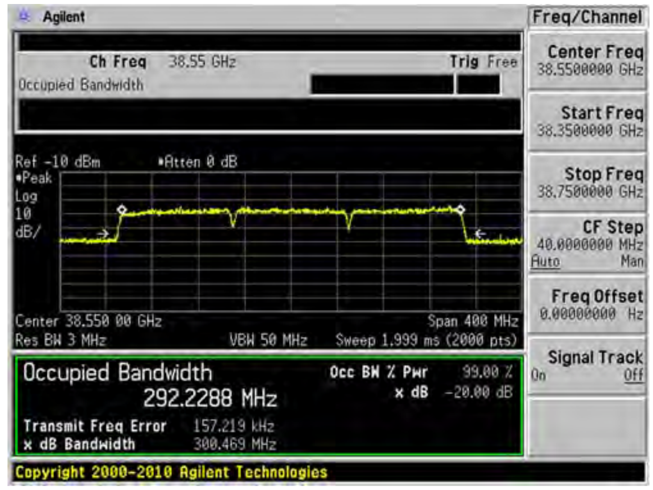
Beam ID: 139 (Horizontal)

3CC – 64QAM

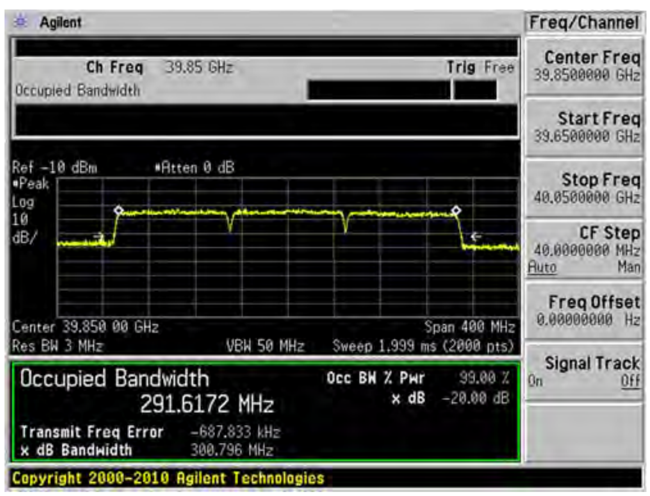
Low Channel



Middle Channel



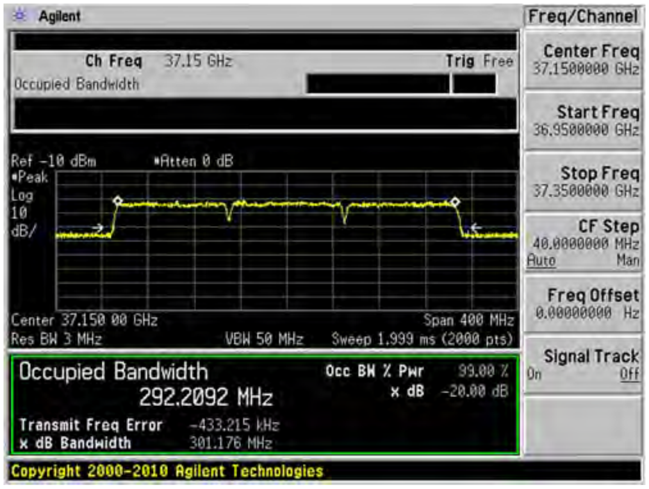
High Channel



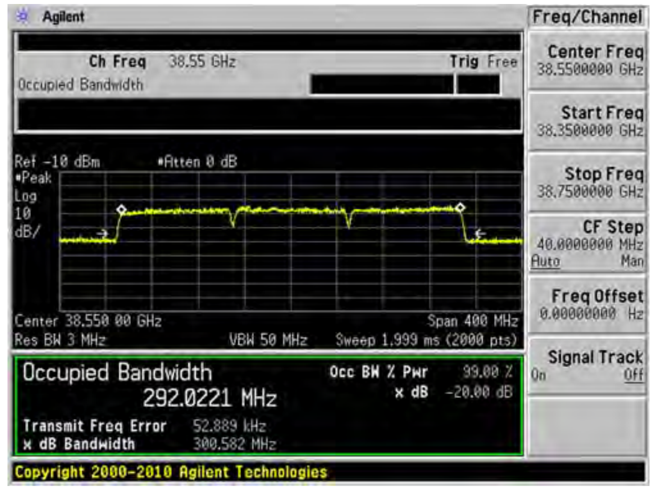
Beam ID: 139 (Horizontal)

3CC – QPSK

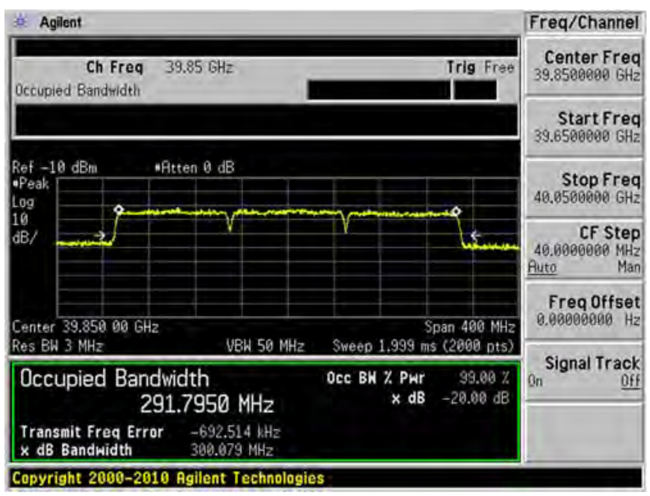
Low Channel



Middle Channel



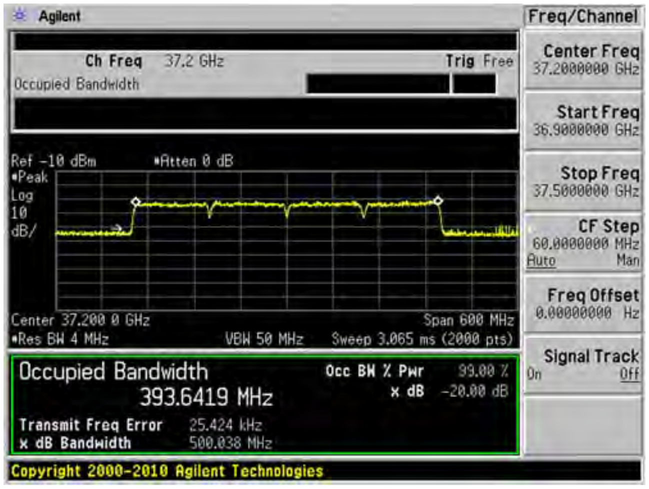
High Channel



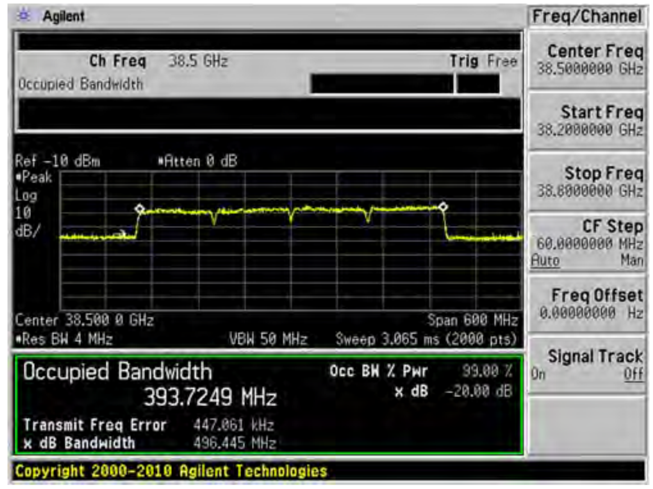
Beam ID: 139 (Horizontal)

4CC – 16QAM

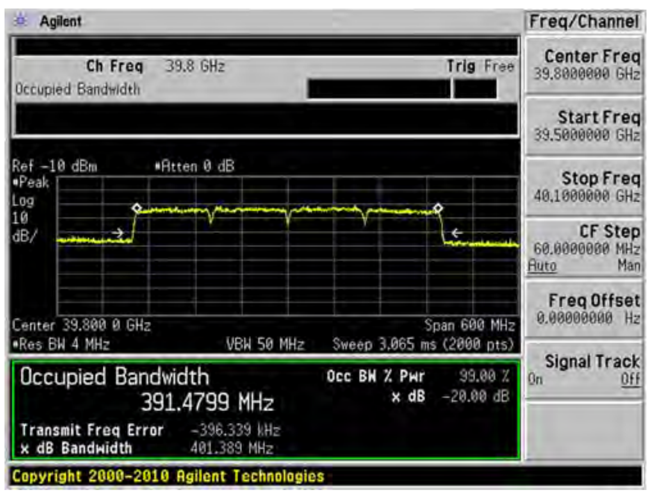
Low Channel



Middle Channel



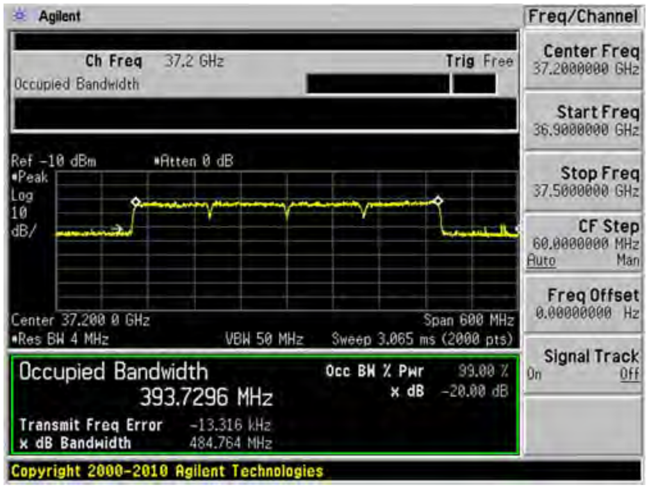
High Channel



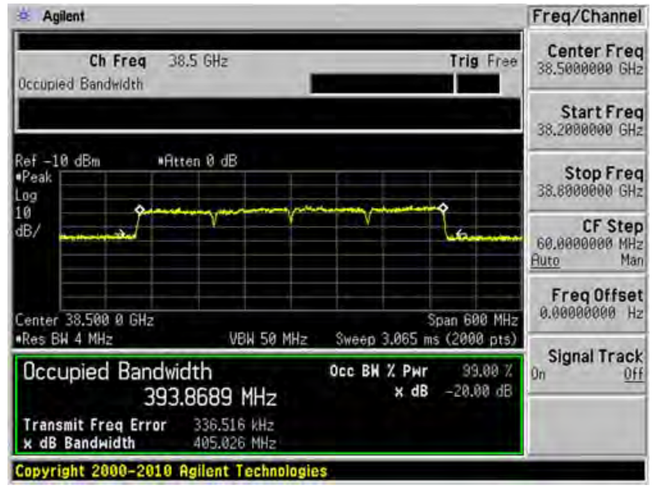
Beam ID: 139 (Horizontal)

4CC – 64QAM

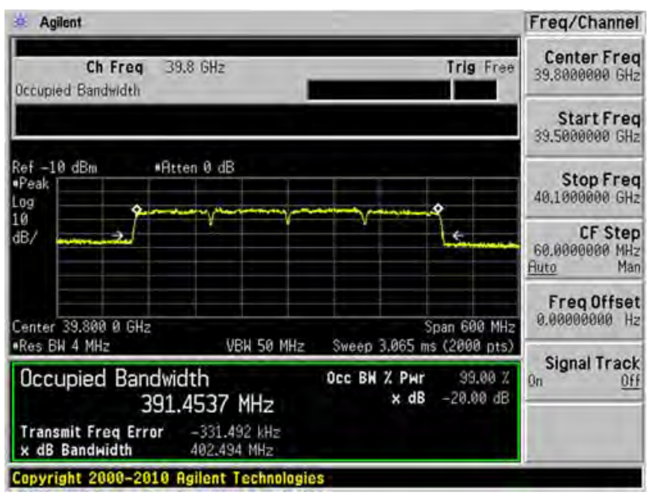
Low Channel



Middle Channel



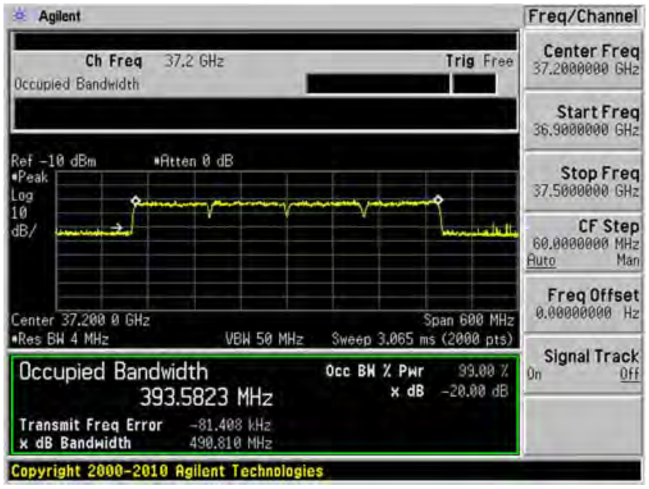
High Channel



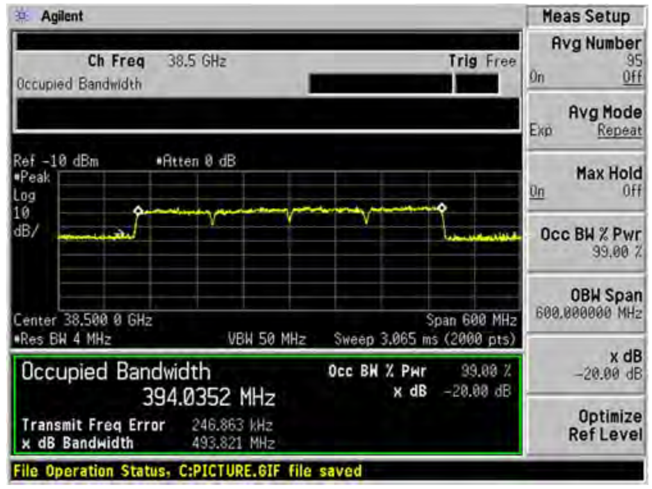
Beam ID: 139 (Horizontal)

4CC – QPSK

Low Channel



Middle Channel



High Channel