FCC PART 15, SUBPART C
ISEDC RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Roku, Inc.

1155 Coleman Ave., San Jose, CA 95110, USA

FCC ID: TC2-R1038
IC: 5959A-R1035

Report Type:	**Model:**
Original Report	9102X

Prepared By:	Matthew Riego de Dios Test Technician
Report Number:	R2005041-DSS
Report Date:	2020-09-17
Reviewed By:	Simon Ma RF Supervisor

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162, Fax: (408) 732-9164

ACCREDITED
CERTIFICATE #3297.02

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2005041-DSS	Original Report	2020-07-20
1	R2005041-DSS	Updated 17065 reviewer comments	2020-09-17

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *Roku, Inc.*, and their product model: *9102X*, FCC ID: TC2-R1038, IC: 5959A-R1035 or the "EUT" as referred to in this report. It is a Speaker Built-in Set-top-box.

1.2 Objective

This report was prepared on behalf of *Roku, Inc,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules and ISEDC RSS-247 Issue 2, February 2017.

The objective was to determine compliance with FCC Part 15.247 and ISEDC RSS-247 rules for Output Power, Antenna Requirements, 20 dB Bandwidth, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions, Number of Hopping Channels, Dwell Time, and Hopping Channel Separation.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-R1038, IC: 5959A-R1035
FCC Part 15, Subpart E, Equipment NII with FCC ID: TC2-R1038, IC: 5959A-R1035

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.5 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 %

1.6 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.

1.7 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 System Test Configuration

2.1 Justification

The EUT was configured for testing in accordance to ANSI C63.10-2013

The worst-case data rates are determined by measuring the peak power across all data rates.

2.2 EUT Exercise Software

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

Modulation	Frequency (MHz)	Power Setting
GFSK	2402	0x42
	2441	0x42
	2480	0x42
π/4-DQPSK	2402	0x42
	2441	0x42
	2480	0x42
8PSK	2402	0x42
	2441	0x42
	2480	0x42

2.3 Duty Cycle Correction Factor

According to ANSI C63.10-2013 section 7.5:

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms). In cases where the pulse train exceeds 0.1 s, the measured field strength shall be determined during a 0.1 s interval. The following procedure is an example of how the average value may be determined. The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in following equation:

$\delta(dB) = 20\log(\Delta)$

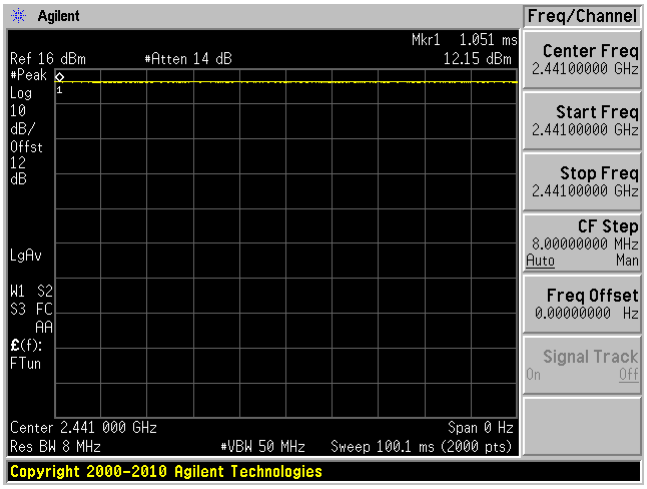
where
δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

Radio Mode	On Time (µs)	Period (µs)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
GFSK	100	100	100	0
π/4-DQPSK	100	100	100	0
8DPSK	100	100	100	0

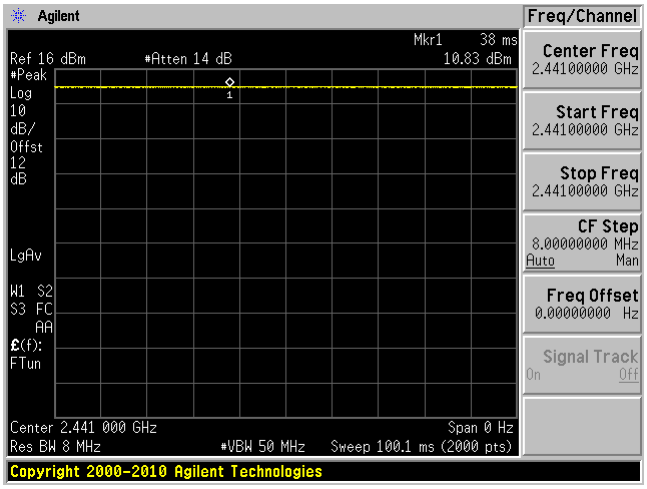
Duty Cycle = On Time (ms)/ Period (ms)

Please refer to the following plots.

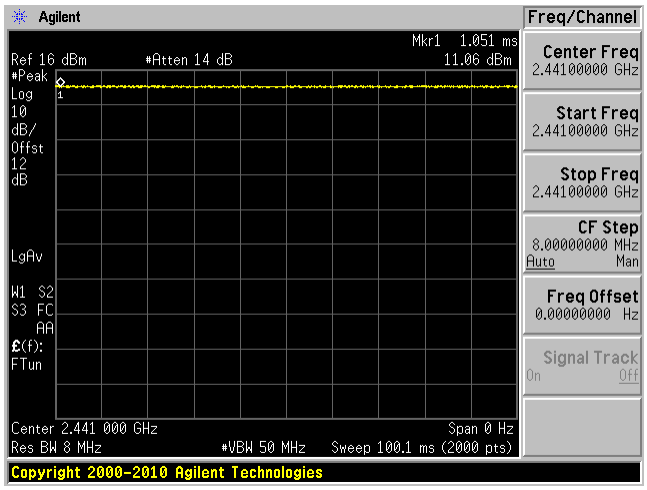
GFSK Mode



π/4-DQPSK Mode



8DPSK Mode



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.6 Support Equipment

Manufacturer	Description	Model
Roku, Inc.	Debug Board	-

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1091, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant[1]
FCC §2.1051, §15.247 (d) ISEDC RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant
FCC §2.1053, §15.205, §15.209, §15.247(d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9, §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1 (1)	20 dB and 99% Emission Bandwidth	Compliant
FCC §15.247(b)(1) ISEDC RSS-247 §5.1(2)	Maximum Peak Output Power	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1(4)	Number of Hopping Channels	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1 (2)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1 (4)	Dwell Time	Compliant

4 FCC §15.203 & ISEDC RSS-Gen §6.8 - Antenna Requirements

4.1 Applicable Standards

According to FCC §15.203:

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.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.

Radio	Antenna	Manufacturer/PN	Frequency Range (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
Bluetooth	Single Antenna	N/A	2400-2500	PCB	2.3
Wi-Fi 2 2.4 GHz	Ant A	WC0D-15/GSD	2400-2500	PIFA	4
	Ant B	WC0D-15/GSD	2400-2500	PIFA	4
Wi-Fi 2 5 GHz	Ant A	WC0D-15/GSD	5150-5850	PIFA	4.5
	Ant B	WC0D-15/GSD	5150-5850	PIFA	4.5
Wi-Fi 1 2.4 GHz	Single Antenna	WC0D-15/GSD	2400-2500	PIFA	4
Wi-Fi 1 5 GHz	Single Antenna	WC0D-15/GSD	5150-5850	PIFA	4.5

5 FCC §2.1091, §15.247(i) & ISEDC RSS-102 - RF Exposure

5.1 Applicable Standards

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to KDB 447 498 Section (7.2), "simultaneous transmission of MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum *test separation distance* required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field.

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

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

BT Radio

Worst Case: GFSK, Mid Channel 2441 MHz

Maximum peak output power at antenna input terminal (dBm):	11.81
Maximum peak output power at antenna input terminal (mW):	15.17
Prediction distance (cm):	20
Prediction frequency (MHz):	2441
Maximum Antenna Gain, typical (dBi):	2.3
Maximum Antenna Gain (numeric):	1.6982
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0051
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE Ratio (numeric):	0.0051

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0051 mW/cm^2. Limit is 1.0 mW/cm^2.

Radio Co-location

The device supports the following radio co-location configurations.

	Wi-Fi Radio 2 2.4G	Wi-Fi Radio 2 UNII-1	Wi-Fi Radio 2 UNII-3
BT	X	X	X
Wi-Fi Radio 1 2.4G		X	X
Wi-Fi Radio 1 UNII-1	X		X
Wi-Fi Radio 1 UNII-3	X	X	

Worst Case Colocation 2.4 GHz Classic Bluetooth and 2.4 GHz Wi-Fi Radio 2 (MIMO):

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm^2)	MPE Limit (mW/cm^2)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
2.4 GHz Classic Bluetooth	11.81	20	0.0051	1.0	0.51%	42.36%	100%
2.4 Wi-Fi Radio 2	26.23	20	0.4185	1.0	41.85%		

Worst Case Colocation 2.4 GHz Classic Bluetooth and 5.8 GHz Wi-Fi Radio 2 (MIMO):

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm^2)	MPE Limit (mW/cm^2)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
2.4 GHz Classic Bluetooth	11.81	20	0.0051	1.0	0.51%	22.95%	100%
5.8 GHz Wi-Fi Radio 2	23.02	20	0.2244	1.0	22.44%		

5.4 RF exposure evaluation exemption for IC

BT Radio

Worst Case: GFSK, Mid Channel 2441 MHz

Maximum EIRP power = 11.81dBm + 2.3 dBi = 14.11 dBm which is less than $1.31\times10^{-2}f^{0.6834}$ = 2.71 W = 34.33 dBm

6 FCC §15.207 & ISEDC RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and ISEDC RSS-Gen §8.8 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 and ISEDC RSS-Gen §8.8 limits.

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data were recorded in the peak detection mode, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

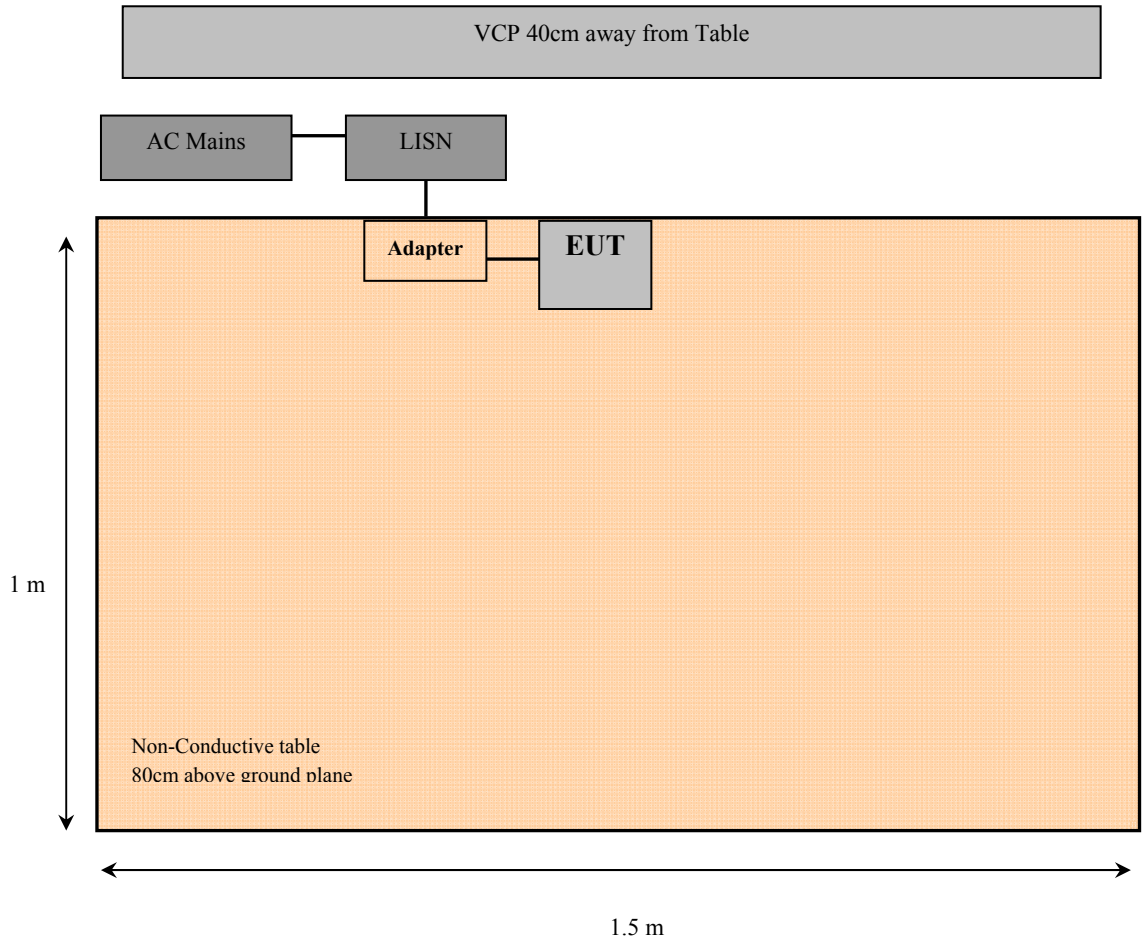
CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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 Amplitude – Limit

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2019-07-31	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2020-02-27	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2019-07-11	14 months
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.7 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	43 %
ATM Pressure:	101.8 kPa

The testing was performed by Matthew Riego de Dios on 2020-06-23 in the Ground Plane test site.

6.8 Summary of Test Results

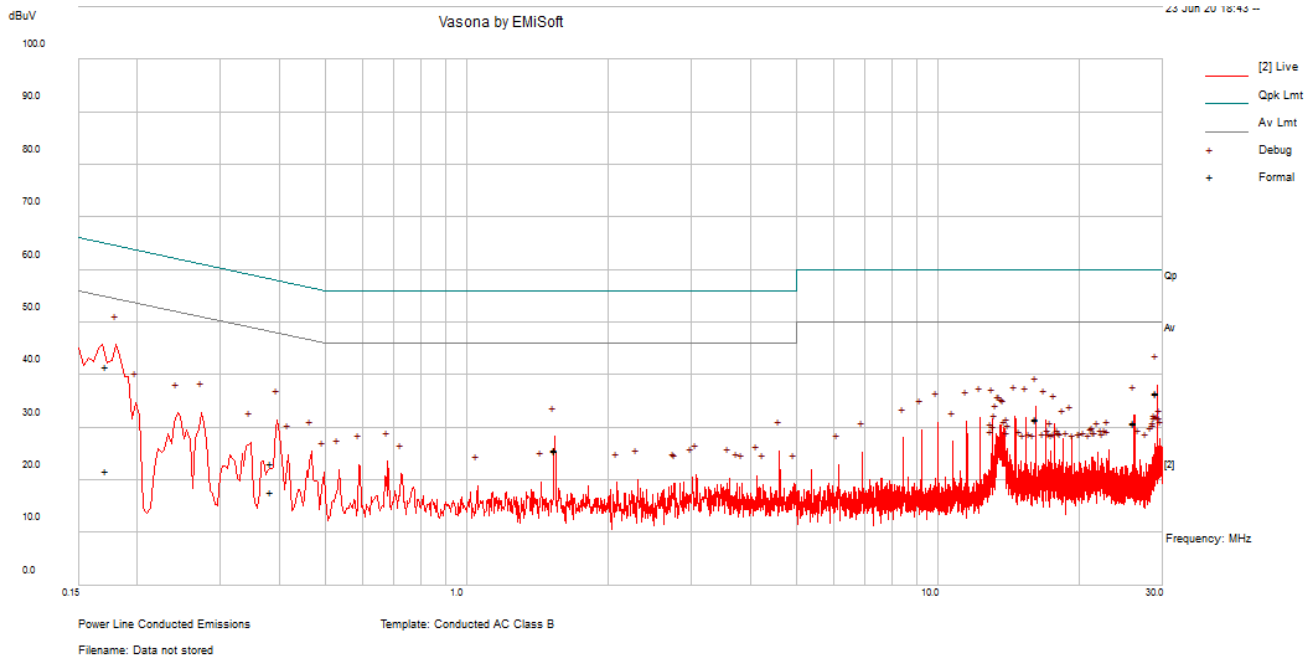
According to the recorded data in following table, the EUT complied with the FCC 15C and ISEDC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-13.56	29.1845	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Worst Case: GFSK - High Channel

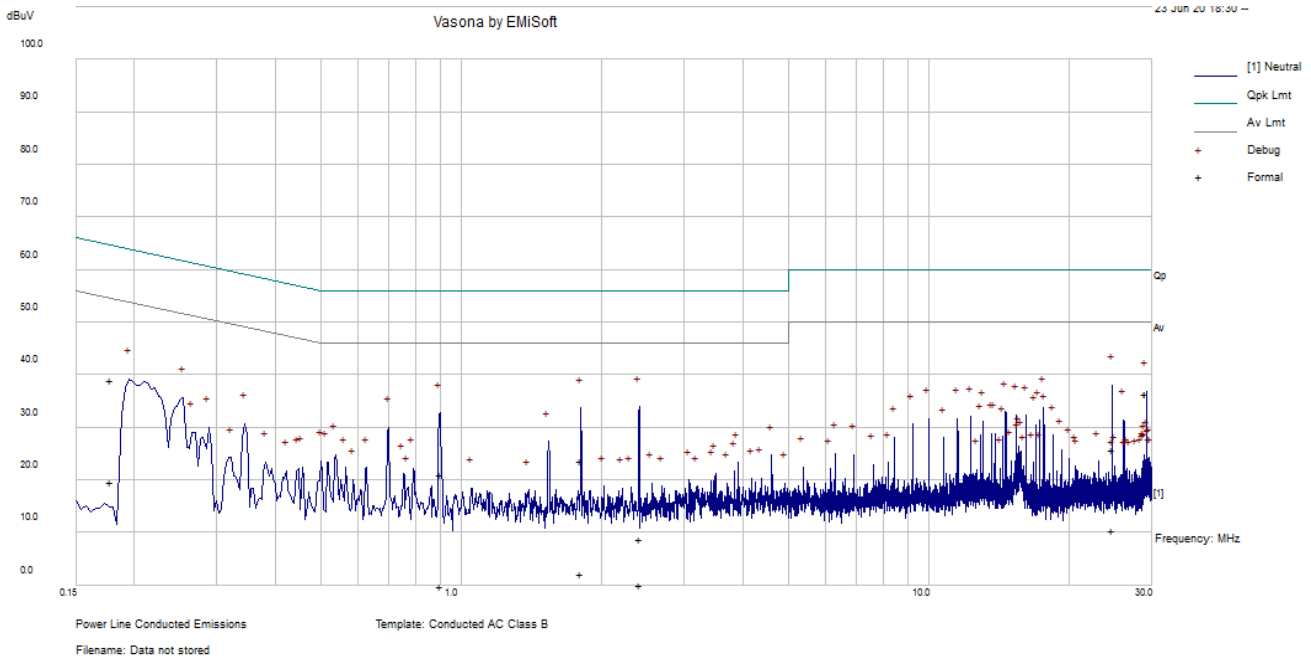
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.171734	41.5	Line	64.88	-23.38	QP
29.1845	36.62	Line	60	-23.38	QP
16.127499	31.57	Line	60	-28.43	QP
0.385281	23.27	Line	58.16	-34.89	QP
26.111781	31.07	Line	60	-28.93	QP
1.535647	25.43	Line	56	-30.57	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.171734	21.66	Line	54.88	-33.22	Ave.
29.1845	36.44	Line	50	-13.56	Ave.
16.127499	31.37	Line	50	-18.63	Ave.
0.385281	17.85	Line	48.16	-30.32	Ave.
26.111781	30.83	Line	50	-19.17	Ave.
1.535647	25.7	Line	46	-20.3	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.699977	25.87	Neutral	60	-34.13	QP
2.408591	8.72	Neutral	56	-47.28	QP
1.802101	23.61	Neutral	56	-32.39	QP
29.184086	36.29	Neutral	60	-23.71	QP
0.90113	21.03	Neutral	56	-34.97	QP
0.177876	39.02	Neutral	64.58	-25.56	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.699977	10.31	Neutral	50	-39.69	Ave.
2.408591	-0.04	Neutral	46	-46.04	Ave.
1.802101	2.08	Neutral	46	-43.92	Ave.
29.184086	36.35	Neutral	50	-13.65	Ave.
0.90113	-0.1	Neutral	46	-46.1	Ave.
0.177876	19.53	Neutral	54.58	-35.06	Ave.

7 FCC §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions

7.1 Applicable Standards

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

As per ISEDC RSS-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per ISEDC RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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 15 Subpart C and ISEDC RSS-247 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 host, and all support equipment power cords was 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 was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, 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 is set as:

Below 1000 MHz:

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

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz or 1/T/ Sweep = Auto

7.4 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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 Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-07-26	1 year
Rhode & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2018-10-26	2 years
BACL	5m3 Sensitivity Box	1	2	2019-10-02	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2019-11-20	2 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2020-02-05	2 years
-	SMA cable	-	-	Each time[1]	N/A
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
IW Microwave	157 Series Cable Armored with 2.92mm Male Plugs on Both Sides	KPS-1571AN-2400	DC 1922	2019-07-07	1 year
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35\'	LMR400UF	BACL1904161	2020-05-20	1 year
AH Systems	Preamplifier	PAM 1840 VH	170	2019-09-24	1 year
Agilent	Preamplifier	8449B	3147A00400	2020-02-27	1 year
HP	Pre Amplifier	8447D	2443A04374	2019-08-13	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL *attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

7.6 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Matthew Riego de Dios from 2020-06-08 to 2020-06-29 in 5m chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISEDC RSS-247 standard's radiated emissions limits, and had the worst margin of:

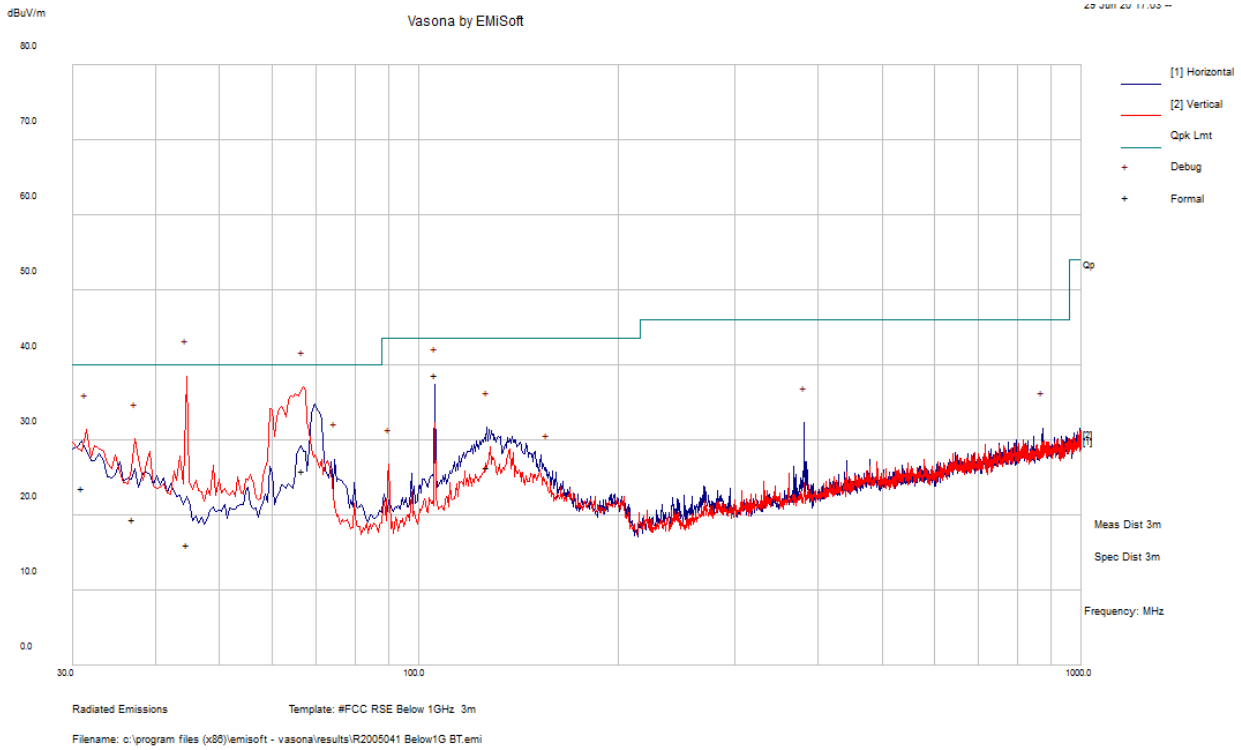
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-4.77	105.75175	Horizontal	GFSK, High Channel

Please refer to the following table and plots for specific test result details.

7.8 Radiated Emissions Test Results

1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters

Worst Case: GFSK Mode, High Channel



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
44.61	16.11	201	V	70	40	-23.89	QP
66.74475	25.9	165	V	50	40	-14.1	QP
105.75175	38.73	116	H	311	43.5	-4.77	QP
31.00375	23.57	102	V	264	40	-16.43	QP
37.01925	19.57	289	H	128	40	-20.43	QP
126.8865	26.38	241	H	7	43.5	-17.12	QP

2) 1–25 GHz Measured at 3 meters

GFSK mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
2390	50.35	320	240	V	32.6	6.33	36.34	52.94	74	-21.06	Peak
2390	49.97	360	265	H	32.6	6.33	36.34	52.56	74	-21.44	Peak
2390	41.39	320	240	V	32.6	6.33	36.34	43.98	54	-10.02	Ave
2390	42.26	360	265	H	32.6	6.33	36.34	44.85	54	-9.15	Ave
4804	47.44	0	100	V	35	9.89	35.43	56.9	74	-17.1	Peak
4804	47.15	0	100	H	35	9.89	35.43	56.61	74	-17.39	Peak
4804	34.47	0	100	V	35	9.89	35.43	43.93	54	-10.07	Ave
4804	34.32	0	100	H	35	9.89	35.43	43.78	54	-10.22	Ave
7206	46.48	0	100	V	36.1	9.83	35.82	56.59	74	-17.41	Peak
7206	46.29	0	100	H	36.1	9.83	35.82	56.4	74	-17.6	Peak
7206	33.78	0	100	V	36.1	9.83	35.82	43.89	54	-10.11	Ave
7206	33.85	0	100	H	36.1	9.83	35.82	43.96	54	-10.04	Ave
Middle Channel 2441 MHz											
4882	46.52	0	100	V	35.2	10.96	35.43	57.25	74	-16.75	Peak
4882	46.15	0	100	H	35.2	10.96	35.43	56.88	74	-17.12	Peak
4882	34.17	0	100	V	35.2	10.96	35.43	44.9	54	-9.1	Ave
4882	34.26	0	100	H	35.2	10.96	35.43	44.99	54	-9.01	Ave
7323	45	0	100	V	36.1	10.95	35.82	56.23	74	-17.77	Peak
7323	45.1	0	100	H	36.1	10.95	35.82	56.33	74	-17.67	Peak
7323	33.26	0	0	V	36.1	10.95	35.82	44.49	54	-9.51	Ave
7323	33.43	0	0	H	36.1	10.95	35.82	44.66	54	-9.34	Ave
High Channel 2480 MHz											
2483.5	49.16	160	220	V	33	5.65	36.34	51.47	74	-22.53	Peak
2483.5	48.58	360	275	H	33	5.65	36.34	50.89	74	-23.11	Peak
2483.5	41.95	160	220	V	33	5.65	36.34	44.26	54	-9.74	Ave
2483.5	41.6	360	275	H	33	5.65	36.34	43.91	54	-10.09	Ave
4960	46.38	0	100	V	35.4	11.07	35.43	57.42	74	-16.58	Peak
4960	46.73	0	100	H	35.4	11.07	35.43	57.77	74	-16.23	Peak
4960	34.84	0	100	V	35.4	11.07	35.43	45.88	54	-8.12	Ave
4960	34.22	0	100	H	35.4	11.07	35.43	45.26	54	-8.74	Ave
7440	45.09	0	100	V	36.1	12.73	35.9	58.02	74	-15.98	Peak
7440	46.15	0	100	H	36.1	12.73	35.9	59.08	74	-14.92	Peak
7440	33.48	0	100	V	36.1	12.73	35.9	46.41	54	-7.59	Ave
7440	34.71	0	100	H	36.1	12.73	35.9	47.64	54	-6.36	Ave

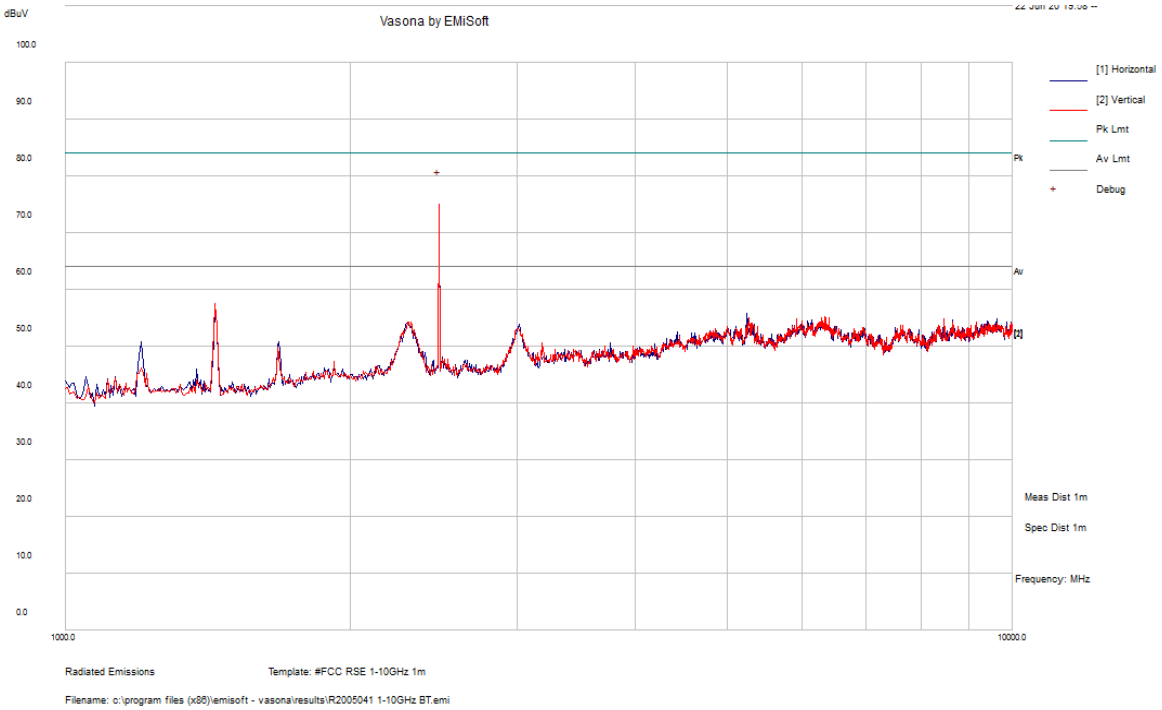
π/4-DQPSK mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
2390	51	120	160	V	32.6	6.33	36.34	53.59	74	-20.41	Peak
2390	50.73	260	300	H	32.6	6.33	36.34	53.32	74	-20.68	Peak
2390	41.88	120	160	V	32.6	6.33	36.34	44.47	54	-9.53	Ave
2390	42.49	260	300	H	32.6	6.33	36.34	45.08	54	-8.92	Ave
4804	46.9	0	100	V	35	9.89	35.43	56.36	74	-17.64	Peak
4804	46.66	0	100	H	35	9.89	35.43	56.12	74	-17.88	Peak
4804	35.4	0	100	V	35	9.89	35.43	44.86	54	-9.14	Ave
4804	34.95	0	100	H	35	9.89	35.43	44.41	54	-9.59	Ave
7206	45.61	0	100	V	36.1	9.83	35.82	55.72	74	-18.28	Peak
7206	46.33	0	100	H	36.1	9.83	35.82	56.44	74	-17.56	Peak
7206	34.32	0	100	V	36.1	9.83	35.82	44.43	54	-9.57	Ave
7206	34.48	0	100	H	36.1	9.83	35.82	44.59	54	-9.41	Ave
Middle Channel 2441 MHz											
4882	46.47	0	100	V	35.2	10.96	35.43	57.2	74	-16.8	Peak
4882	46.71	0	100	H	35.2	10.96	35.43	57.44	74	-16.56	Peak
4882	34.73	0	100	V	35.2	10.96	35.43	45.46	54	-8.54	Ave
4882	34.92	0	100	H	35.2	10.96	35.43	45.65	54	-8.35	Ave
7323	45.22	0	100	V	36.1	10.95	35.82	56.45	74	-17.55	Peak
7323	45.3	0	100	H	36.1	10.95	35.82	56.53	74	-17.47	Peak
7323	33.48	0	100	V	36.1	10.95	35.82	44.71	54	-9.29	Ave
7323	33.61	0	100	H	36.1	10.95	35.82	44.84	54	-9.16	Ave
High Channel 2480 MHz											
2483.5	49.15	170	160	V	33	5.65	36.34	51.46	74	-22.54	Peak
2483.5	49.61	20	200	H	33	5.65	36.34	51.92	74	-22.08	Peak
2483.5	40.46	170	160	V	33	5.65	36.34	42.77	54	-11.23	Ave
2483.5	40.19	20	200	H	33	5.65	36.34	42.50	54	-11.50	Ave
4960	47.04	0	100	V	35.4	11.07	35.43	58.08	74	-15.92	Peak
4960	47.21	0	100	H	35.4	11.07	35.43	58.25	74	-15.75	Peak
4960	34.91	0	100	V	35.4	11.07	35.43	45.95	54	-8.05	Ave
4960	34.99	0	100	H	35.4	11.07	35.43	46.03	54	-7.97	Ave
7440	45.72	0	100	V	36.1	12.73	35.9	58.65	74	-15.35	Peak
7440	45.66	0	100	H	36.1	12.73	35.9	58.59	74	-15.41	Peak
7440	34.32	0	100	V	36.1	12.73	35.9	47.25	54	-6.75	Ave
7440	34.47	0	100	H	36.1	12.73	35.9	47.4	54	-6.6	Ave

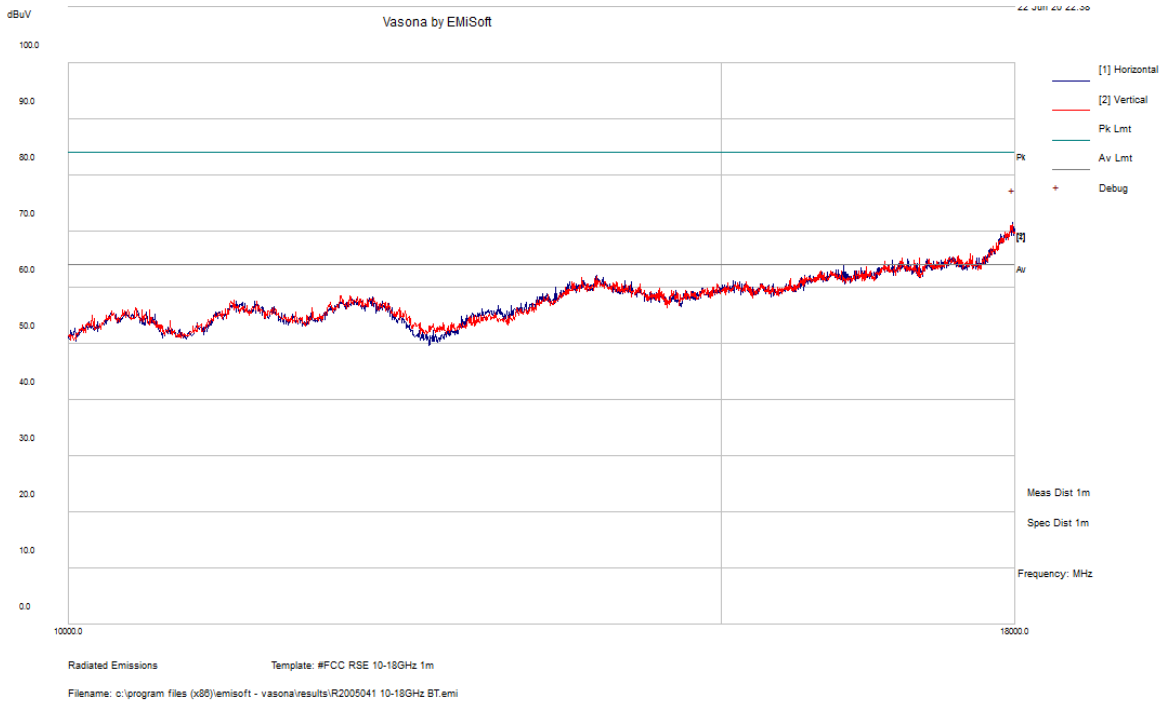
8DPSK mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
2390	51.13	225	215	V	32.6	6.33	36.34	53.72	74	-20.28	Peak
2390	50.38	10	260	H	32.6	6.33	36.34	52.97	74	-21.03	Peak
2390	43.48	225	215	V	32.6	6.33	36.34	46.07	54	-7.93	Ave
2390	42.07	10	260	H	32.6	6.33	36.34	44.66	54	-9.34	Ave
4804	46.33	0	100	V	35	9.89	35.43	55.79	74	-18.21	Peak
4804	46.34	0	100	H	35	9.89	35.43	55.8	74	-18.2	Peak
4804	34.98	0	100	V	35	9.89	35.43	44.44	54	-9.56	Ave
4804	35.14	0	100	H	35	9.89	35.43	44.6	54	-9.4	Ave
7206	46.07	0	100	V	36.1	9.83	35.82	56.18	74	-17.82	Peak
7206	45.48	0	100	H	36.1	9.83	35.82	55.59	74	-18.41	Peak
7206	34.21	0	100	V	36.1	9.83	35.82	44.32	54	-9.68	Ave
7206	34.23	0	100	H	36.1	9.83	35.82	44.34	54	-9.66	Ave
Middle Channel 2441 MHz											
4882	46	0	100	V	35.2	10.96	35.43	56.73	74	-17.27	Peak
4882	46.23	0	100	H	35.2	10.96	35.43	56.96	74	-17.04	Peak
4882	34.72	0	100	V	35.2	10.96	35.43	45.45	54	-8.55	Ave
4882	34.75	0	100	H	35.2	10.96	35.43	45.48	54	-8.52	Ave
7323	45.18	0	100	V	36.1	10.95	35.82	56.41	74	-17.59	Peak
7323	45.36	0	100	H	36.1	10.95	35.82	56.59	74	-17.41	Peak
7323	33.29	0	100	V	36.1	10.95	35.82	44.52	54	-9.48	Ave
7323	33.37	0	100	H	36.1	10.95	35.82	44.6	54	-9.4	Ave
High Channel 2480 MHz											
2483.5	48.75	225	215	V	33	5.65	36.34	51.06	74	-22.94	Peak
2483.5	49.45	10	260	H	33	5.65	36.34	51.76	74	-22.24	Peak
2483.5	40.15	225	215	V	33	5.65	36.34	42.46	54	-11.54	Ave
2483.5	39.44	10	260	H	33	5.65	36.34	41.75	54	-12.25	Ave
4960	46.02	0	100	V	35.4	11.07	35.43	57.06	74	-16.94	Peak
4960	46.79	0	100	H	35.4	11.07	35.43	57.83	74	-16.17	Peak
4960	33.89	0	100	V	35.4	11.07	35.43	44.93	54	-9.07	Ave
4960	35.03	0	100	H	35.4	11.07	35.43	46.07	54	-7.93	Ave
7440	45.82	0	100	V	36.1	12.73	35.9	58.75	74	-15.25	Peak
7440	46.14	0	100	H	36.1	12.73	35.9	59.07	74	-14.93	Peak
7440	32.99	0	100	V	36.1	12.73	35.9	45.92	54	-8.08	Ave
7440	34.28	0	100	H	36.1	12.73	35.9	47.21	54	-6.79	Ave

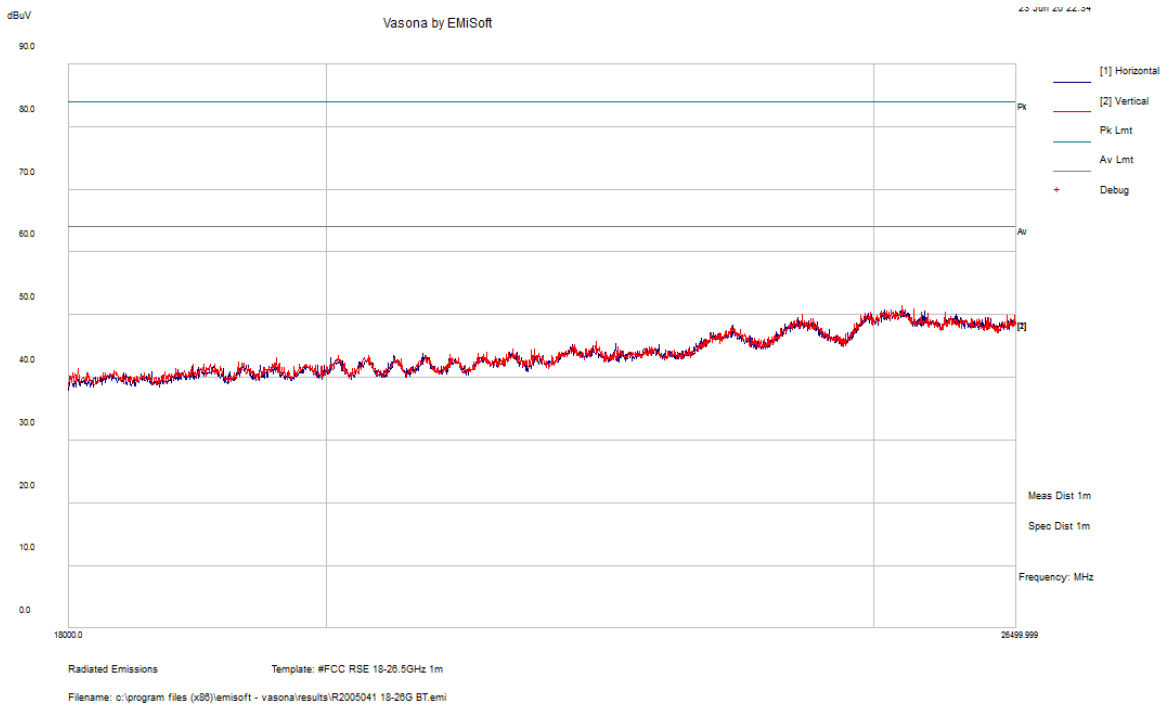
1 GHz – 10 GHz Worst Case Scan at 1 Meter



10 GHz – 18 GHz Worst Case Scan at 1 Meter



18 GHz – 26.5 GHz Worst Case Scan at 1 Meter



8 FCC §15.247(a) (1) & ISEDC RSS-247 §5.1, RSS-Gen §6.6 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (1) and ISEDC RSS-247 §5.1: the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Measurement Procedure

Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel

RBW = 1% to 5 % of the 99% occupied bandwidth or 100kHz

VBW = 3RBW

Sweep = auto

Detector function = peak

Trace = max hold

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

8.4 Test Environmental Conditions

Temperature:	22ºC
Relative Humidity:	42 %
ATM Pressure:	102.6 KPa

The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

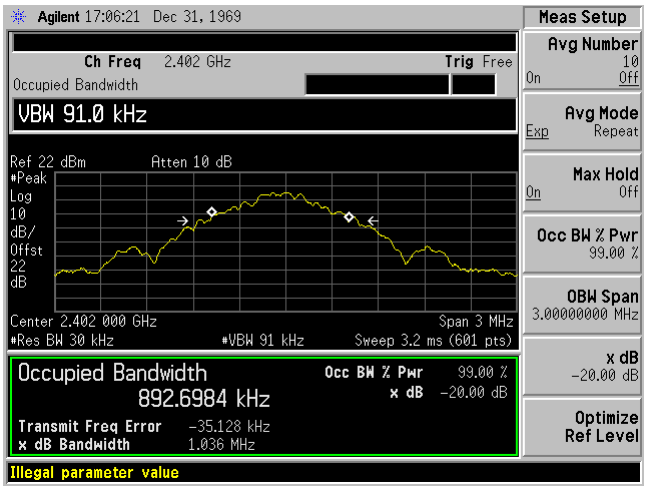
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	20 dB OBW (kHz)
GFSK			
Low	2402	892.7	1036
Middle	2441	892.9	1036
High	2480	886.0	1032
π/4-DQPSK			
Low	2402	1184.4	1342
Middle	2441	1184.7	1343
High	2480	1184.6	1343
8DPSK			
Low	2402	1225.2	1366
Middle	2441	1226.0	1367
High	2480	1226.1	1366

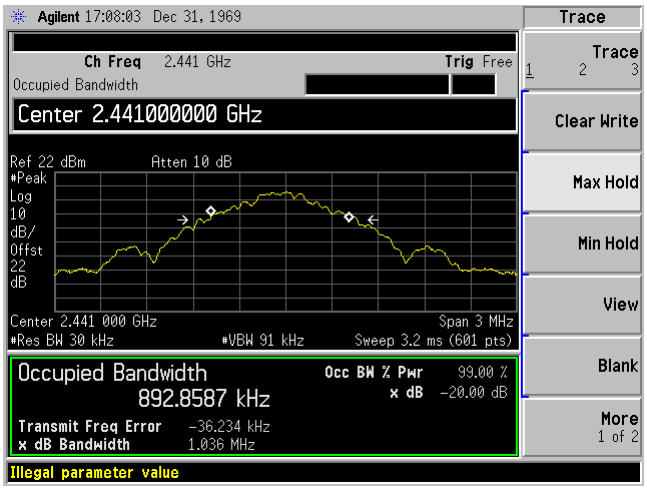
Please refer to the following plots for detailed test results.

GFSK

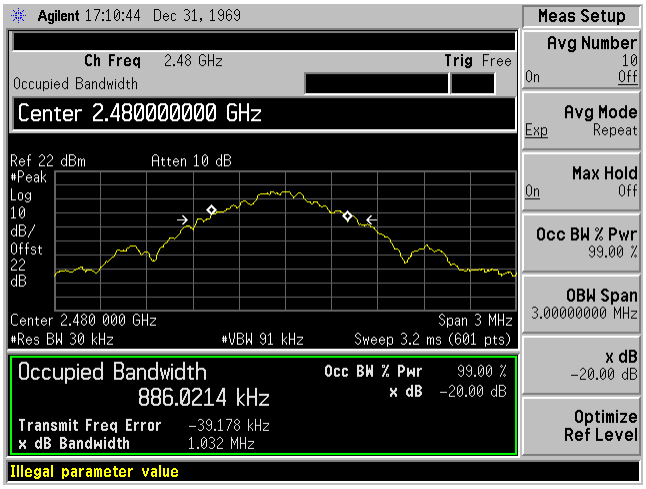
Low Channel 2402 MHz



Middle Channel 2441 MHz

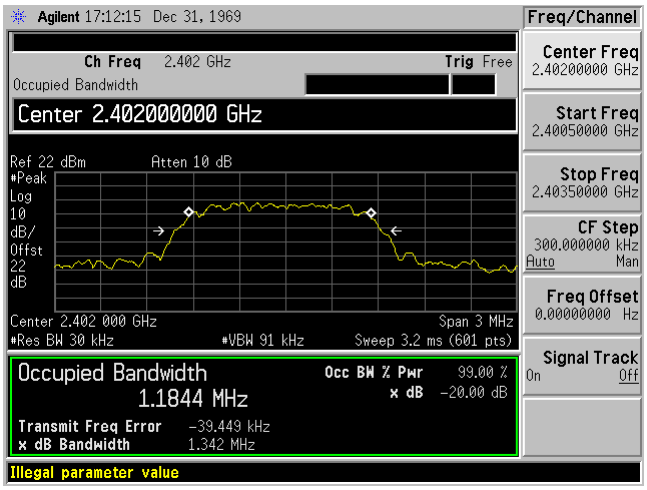


High Channel 2480 MHz

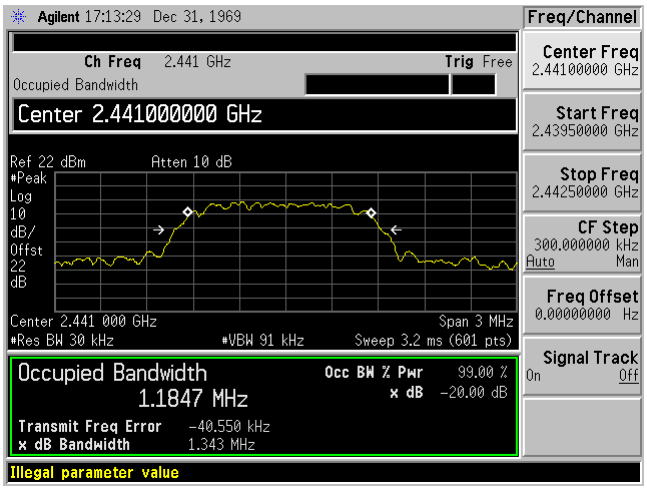


π/4-DQPSK

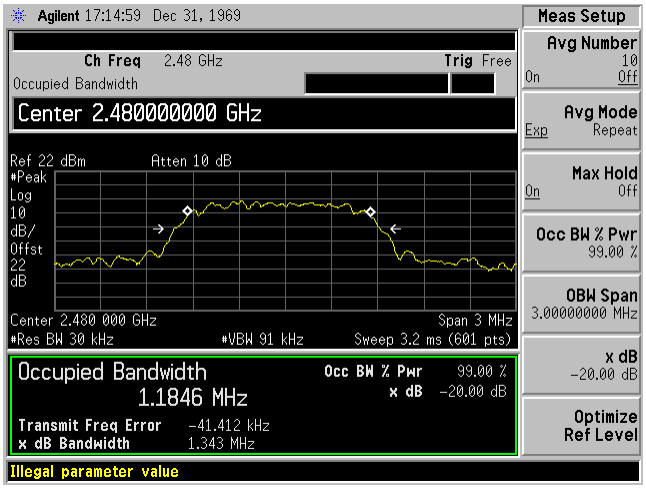
Low Channel 2402 MHz



Middle Channel 2441 MHz

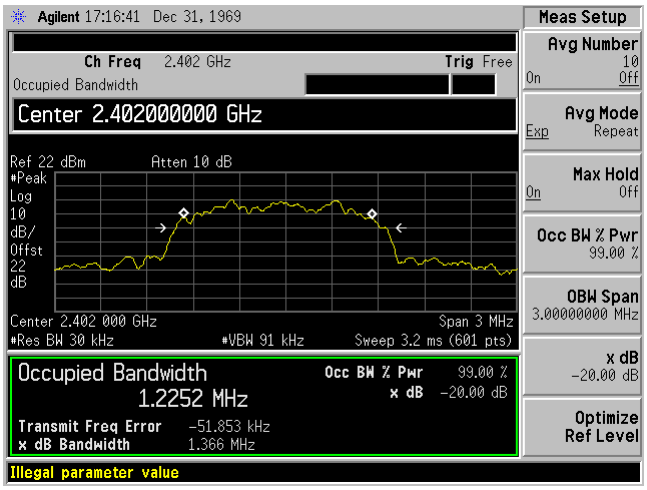


High Channel 2480 MHz

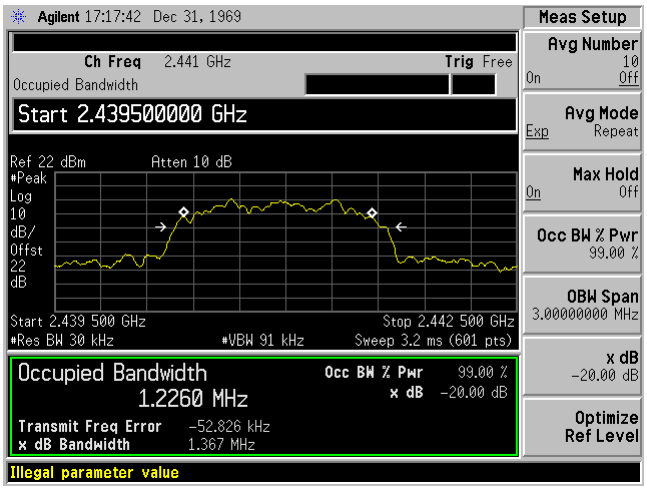


8DPSK

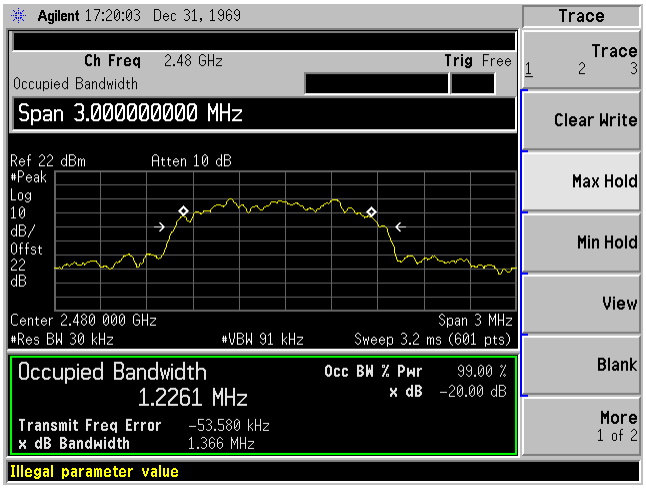
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



9 FCC §15.247(b) (1) & ISEDC RSS-247 §5.4 - Output Power

9.1 Applicable Standards

According to FCC §15.247(b) (1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

According to RSS-247 §5.4: For frequency hopping systems operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

9.2 Measurement Procedure

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

9.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.9 KPa

The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

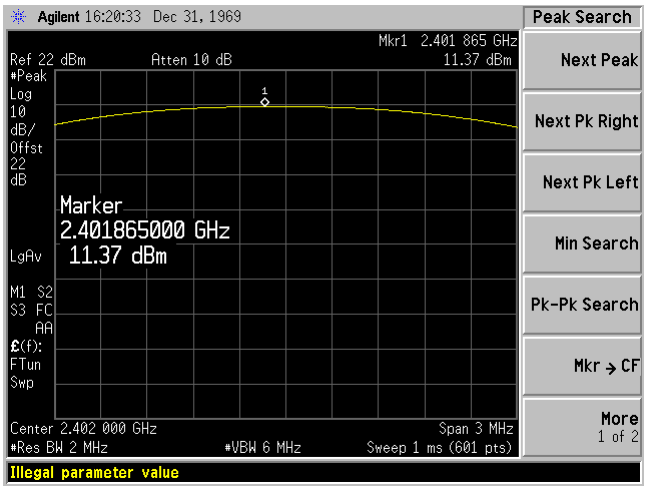
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
GFSK			
Low	2402	11.37	30
Middle	2441	11.81	30
High	2480	11.41	30
π/4-DQPSK			
Low	2402	9.96	30
Middle	2441	10.48	30
High	2480	10.08	30
8DPSK			
Low	2402	10.30	30
Middle	2441	10.80	30
High	2480	10.46	30

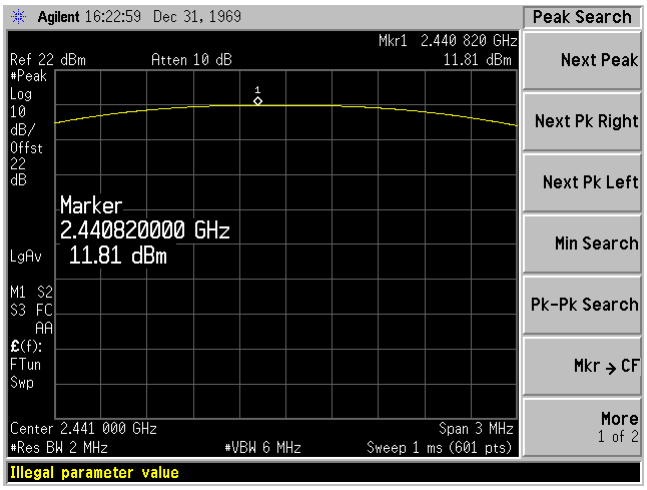
Please refer to the following plots for detailed test results.

GFSK

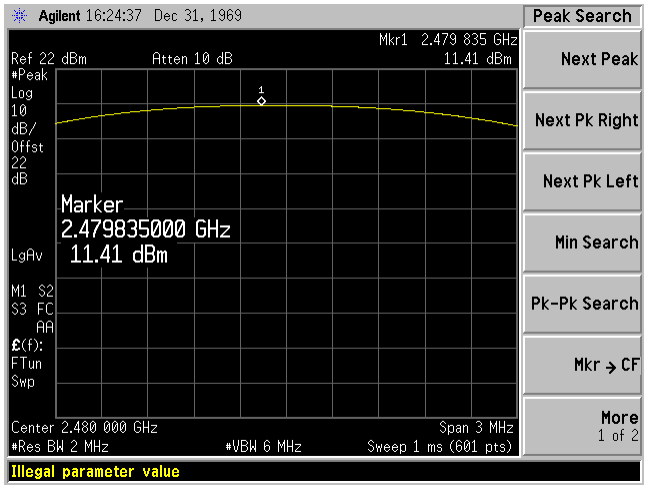
Low Channel 2402 MHz



Middle Channel 2441 MHz

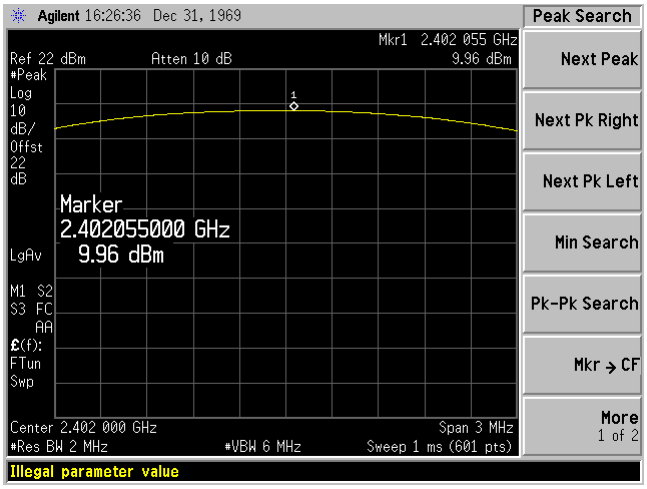


High Channel 2480 MHz

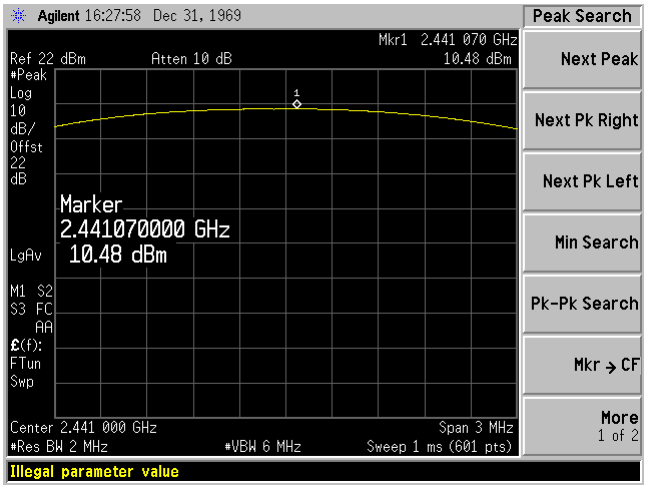


π/4-DQPSK

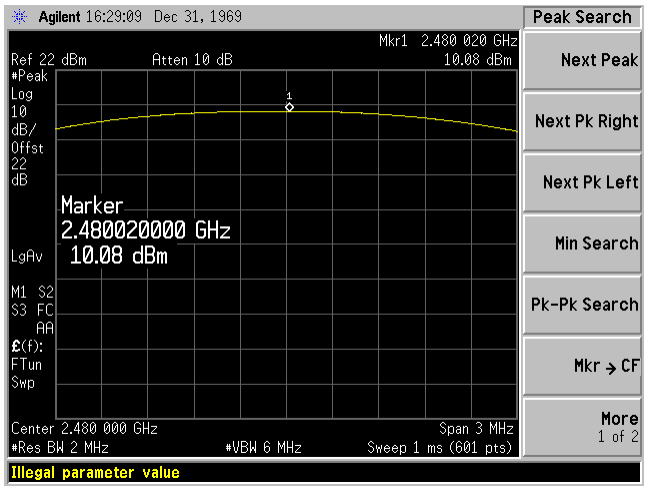
Low Channel 2402 MHz



Middle Channel 2441 MHz

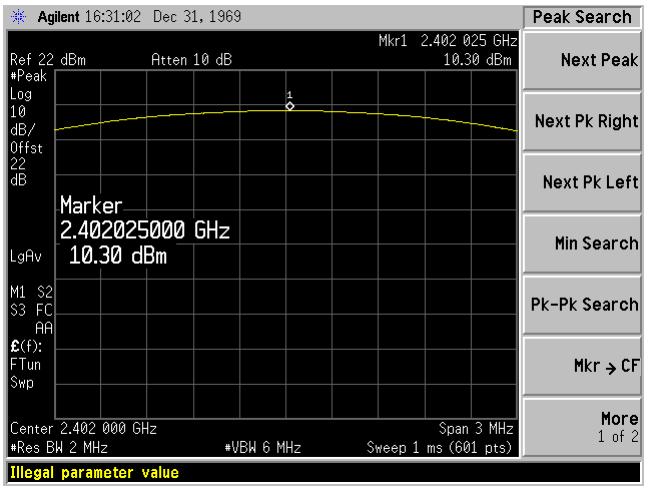


High Channel 2480 MHz

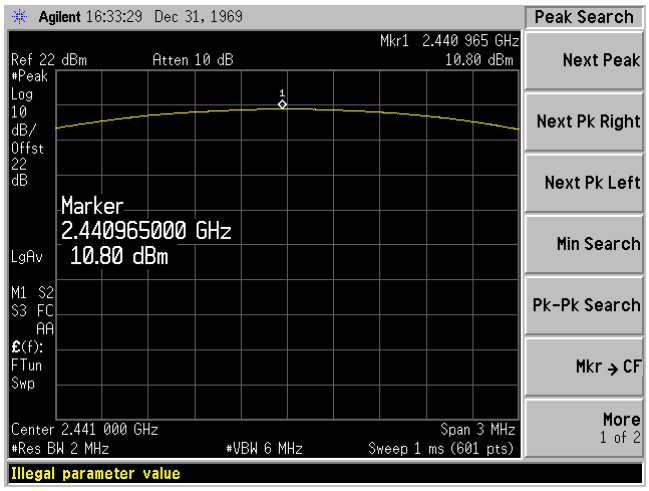


8DPSK

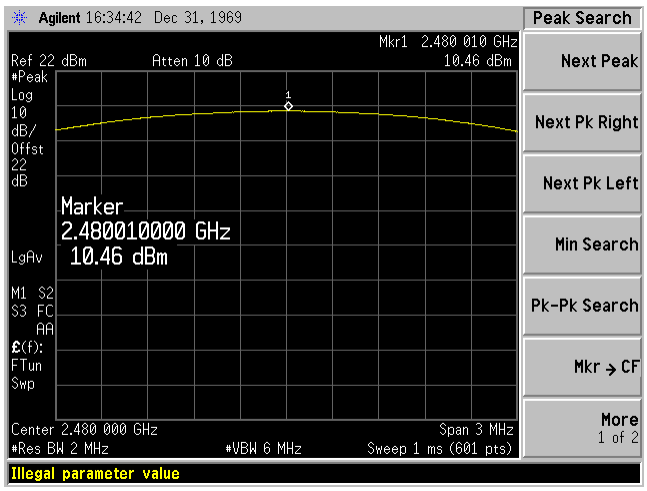
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



10 FCC §15.247(d) & ISEDC RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

10.1 Applicable Standards

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

According to ISEDC RSS-247 §5.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

10.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

10.4 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.6 KPa

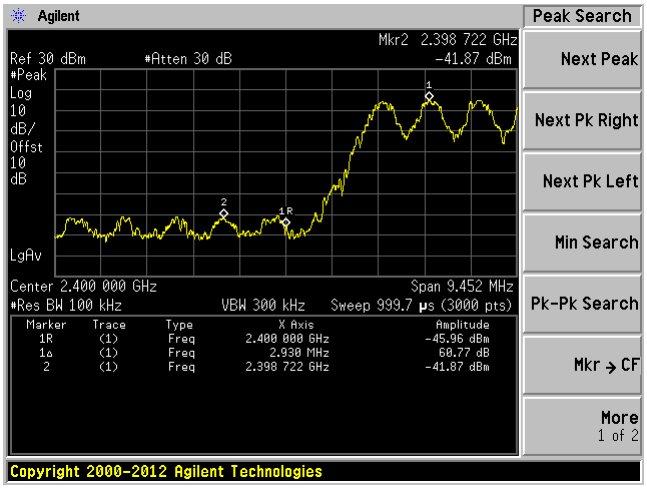
The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

10.5 Test Results

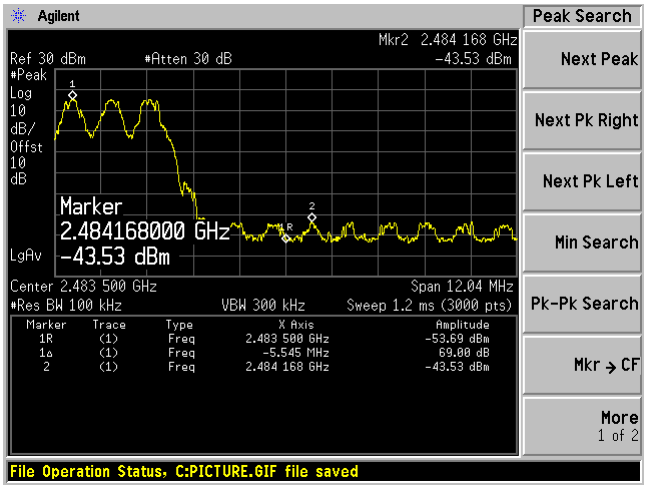
Hopping Mode

GFSK

Low Channel 2402 MHz

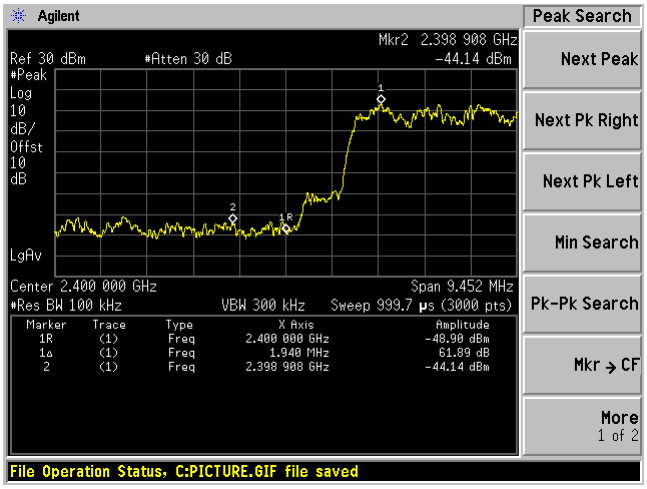


High Channel 2480 MHz

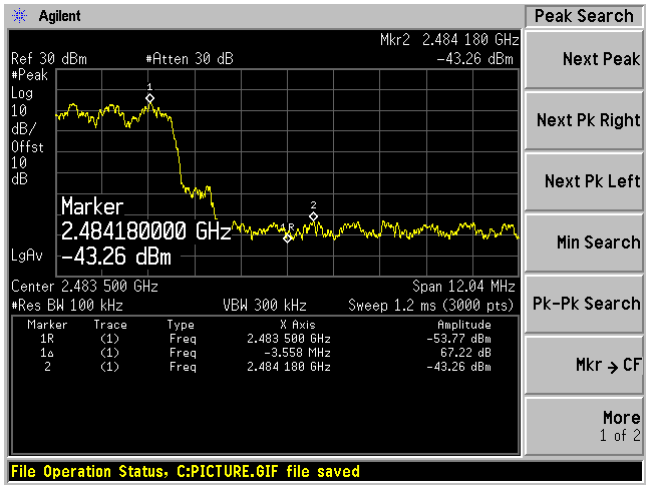


π/4-DQPSK

Low Channel 2402 MHz

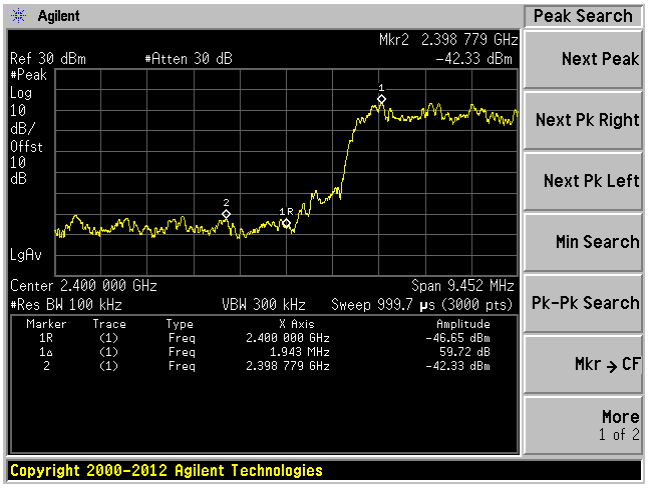


High Channel 2480 MHz

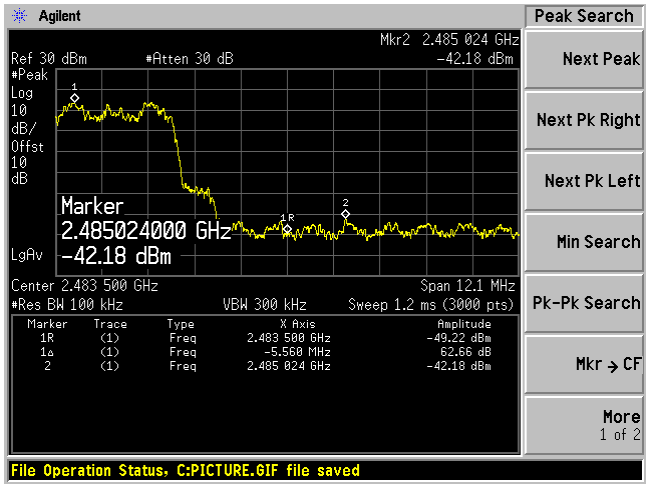


8DPSK

Low Channel 2402 MHz



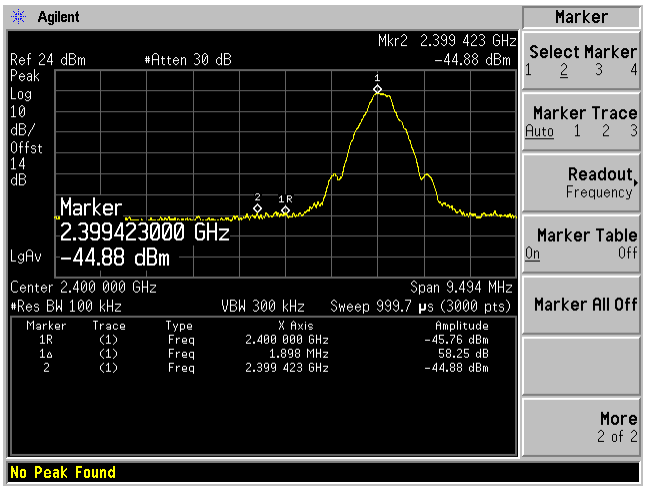
High Channel 2480 MHz



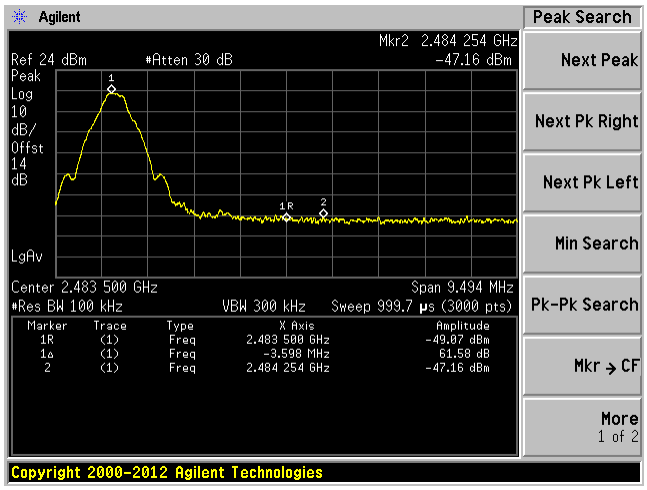
Hopping Mode OFF

GFSK

Low Channel 2402 MHz

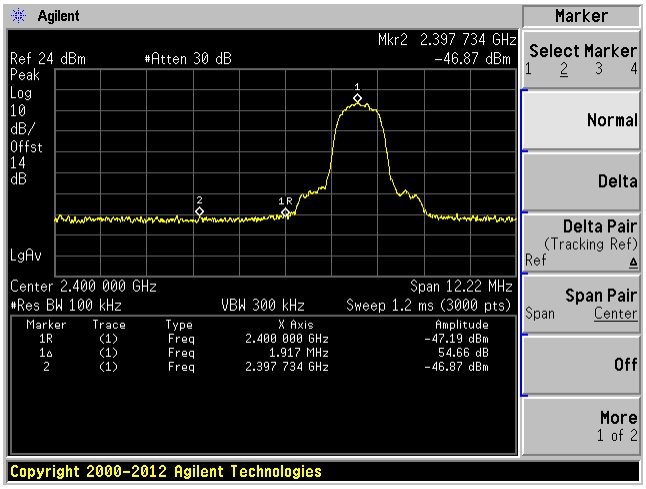


High Channel 2480 MHz

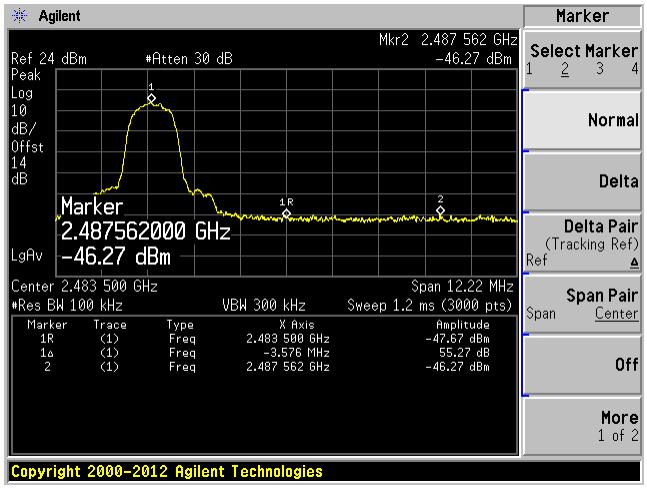


π/4-DQPSK

Low Channel 2402 MHz

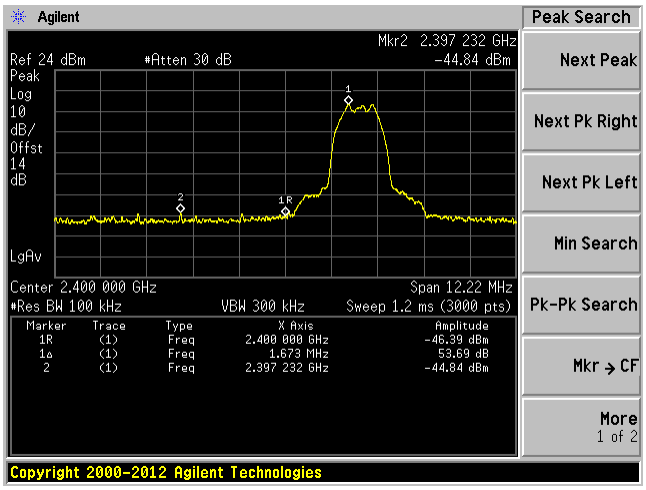


High Channel 2480 MHz

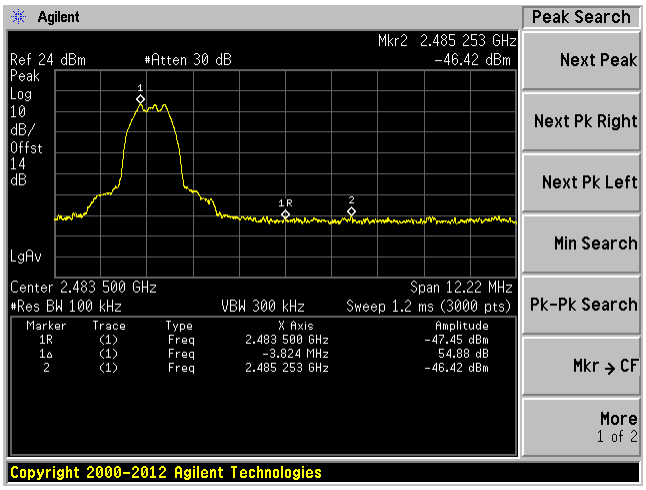


8DPSK

Low Channel 2402 MHz



High Channel 2480 MHz



11 FCC §15.247(a) (1) (iii) & ISEDC RSS-247 §5.1 (4) - Dwell Time

11.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

11.4 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

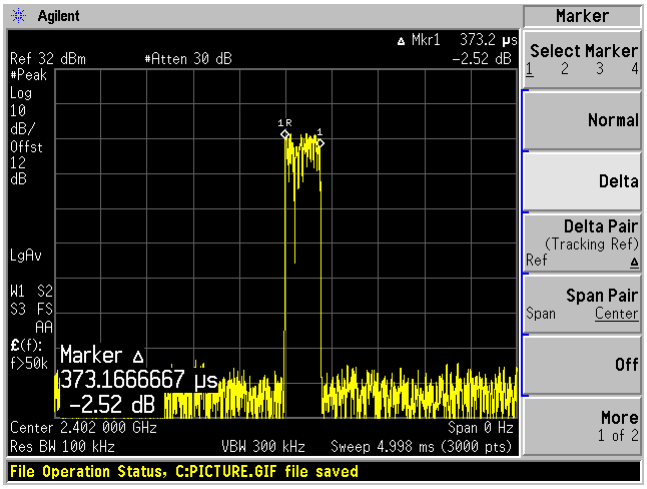
11.5 Test Results

Mode		Channel	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Result
BDR (GFSK)	DH1	Low	0.37	0.118	0.4	Pass
		Middle	0.37	0.118	0.4	Pass
		High	0.37	0.118	0.4	Pass
		Note: DH1: Dwell time = Pulse time*(1600/2/79)*31.6				
	DH3	Low	1.64	0.262	0.4	Pass
		Middle	1.64	0.262	0.4	Pass
		High	1.64	0.262	0.4	Pass
		Note: DH3 Dwell time = Pulse time*(1600/4/79) *31.6				
	DH5	Low	2.88	0.307	0.4	Pass
		Middle	2.88	0.307	0.4	Pass
		High	2.88	0.307	0.4	Pass
		Note: DH5: Dwell time = Pulse time*(1600/6/79) *31.6				
EDR (π/4-DQPSK)	2DH1	Low	0.39	0.125	0.4	Pass
		Middle	0.39	0.125	0.4	Pass
		High	0.39	0.125	0.4	Pass
		Note: DH1: Dwell time = Pulse time*(1600/2/79) *31.6				
	2DH3	Low	1.65	0.264	0.4	Pass
		Middle	1.65	0.264	0.4	Pass
		High	1.65	0.264	0.4	Pass
		Note: DH3: Dwell time = Pulse time*(1600/4/79) *31.6				
	2DH5	Low	2.9	0.309	0.4	Pass
		Middle	2.9	0.309	0.4	Pass
		High	2.9	0.309	0.4	Pass
		Note: DH5: Dwell time = Pulse time*(1600/6/79) *31.6				
EDR (8DPSK)	3DH1	Low	0.39	0.125	0.4	Pass
		Middle	0.39	0.125	0.4	Pass
		High	0.39	0.125	0.4	Pass
		Note: DH1: Dwell time = Pulse time*(1600/2/79) *31.6				
	3DH3	Low	1.65	0.264	0.4	Pass
		Middle	1.65	0.264	0.4	Pass
		High	1.65	0.264	0.4	Pass
		Note: DH3: Dwell time = Pulse time*(1600/4/79) *31.6				
	3DH5	Low	2.9	0.309	0.4	Pass
		Middle	2.9	0.309	0.4	Pass
		High	2.9	0.309	0.4	Pass
		Note: DH5: Dwell time = Pulse time*(1600/6/79) *31.6				

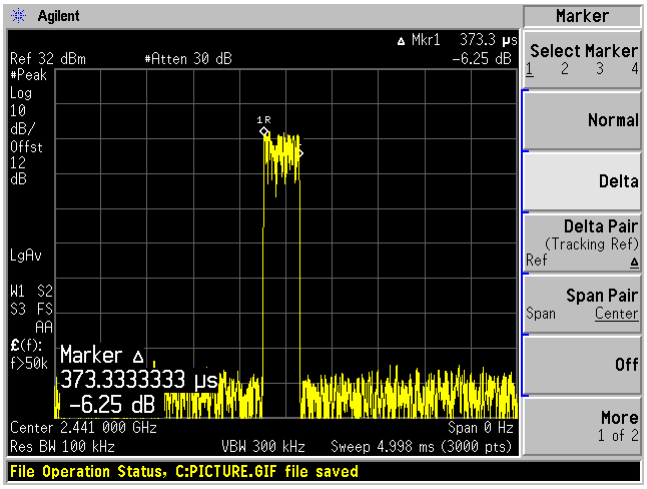
Please refer to the following plots for detailed test results.

GFSK, DH1 Pulse Width

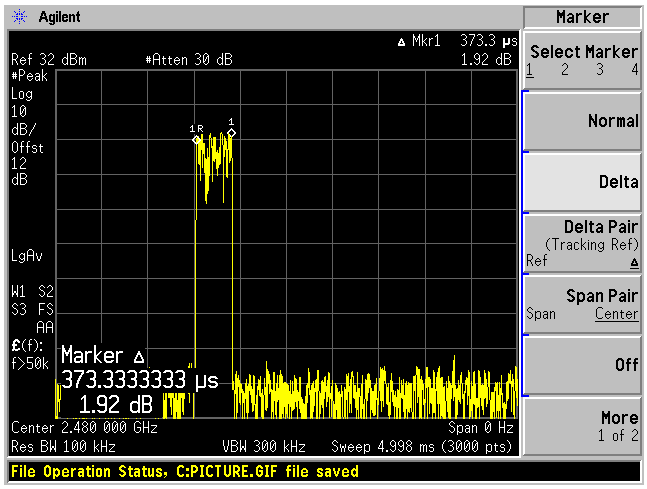
Low Channel 2402 MHz



Middle Channel 2441 MHz

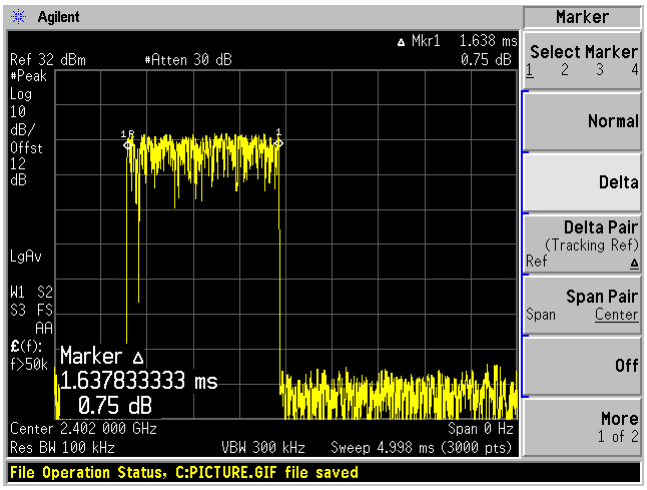


High Channel 2480 MHz

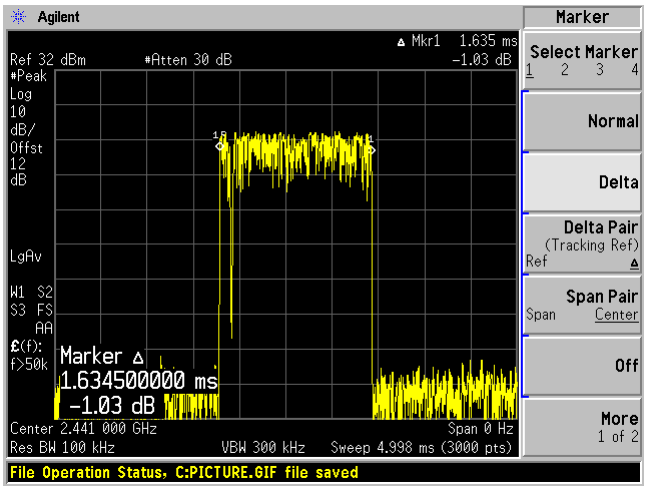


GFSK, DH3 Pulse Width

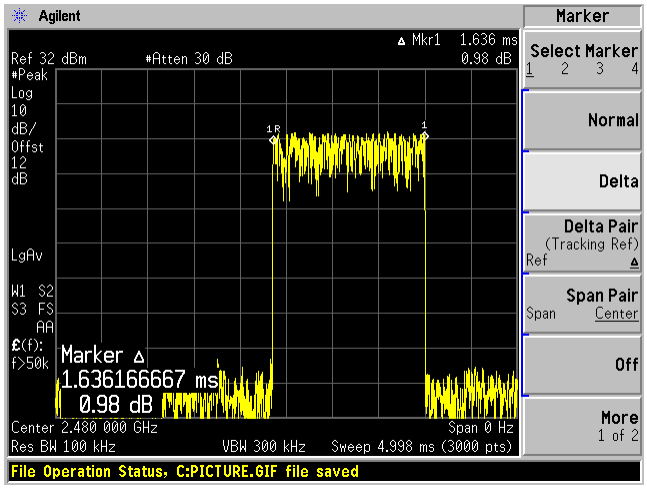
Low Channel 2402 MHz



Middle Channel 2441 MHz

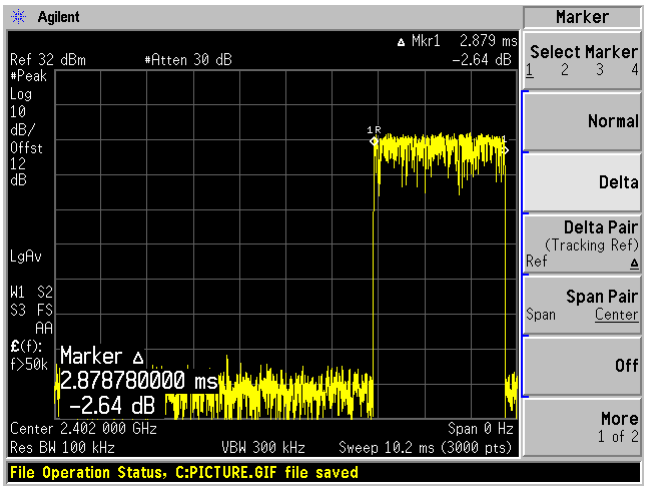


High Channel 2480 MHz

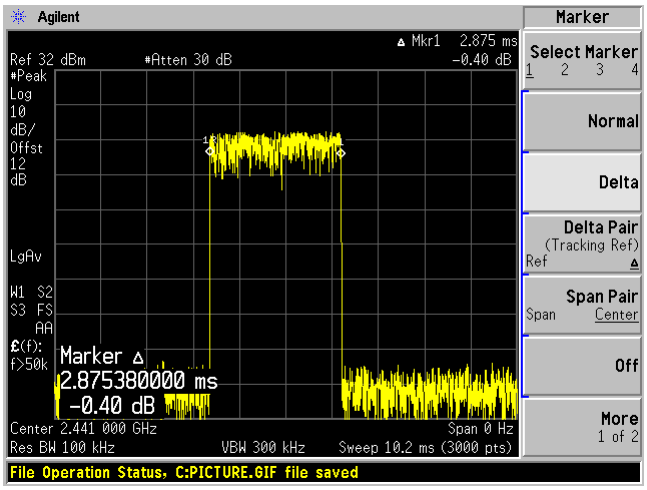


GFSK, DH5 Pulse Width

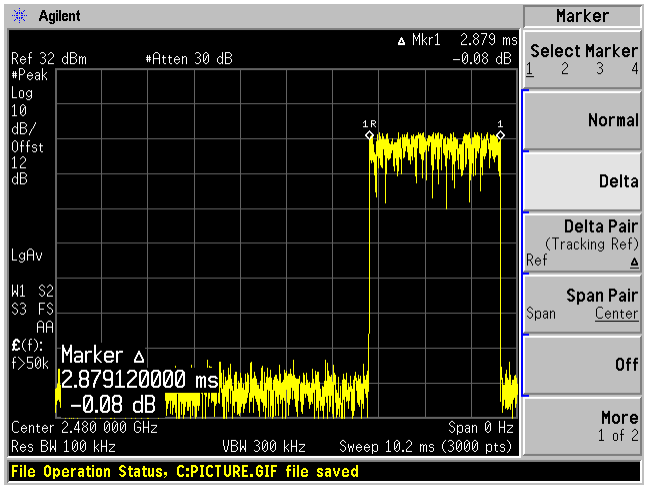
Low Channel 2402 MHz



Middle Channel 2441 MHz

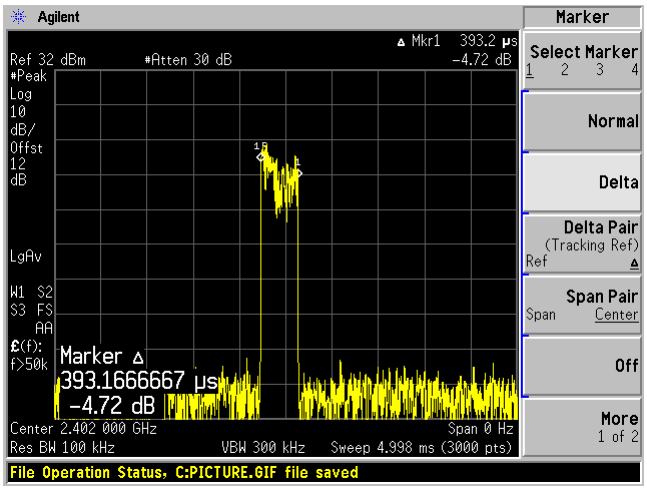


High Channel 2480 MHz

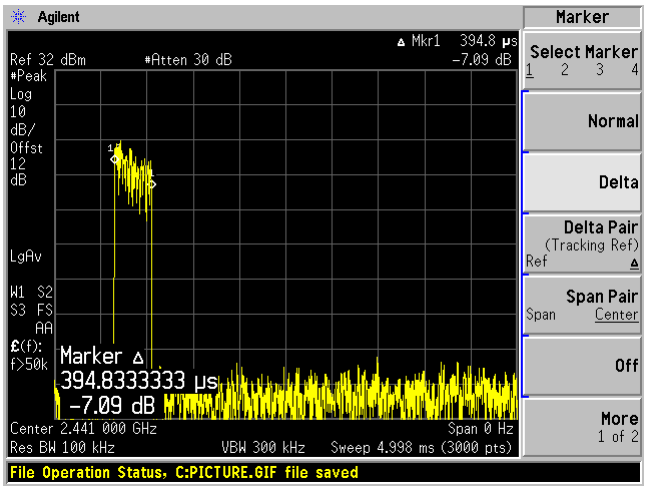


π/4-DQPSK, DH1 Pulse Width

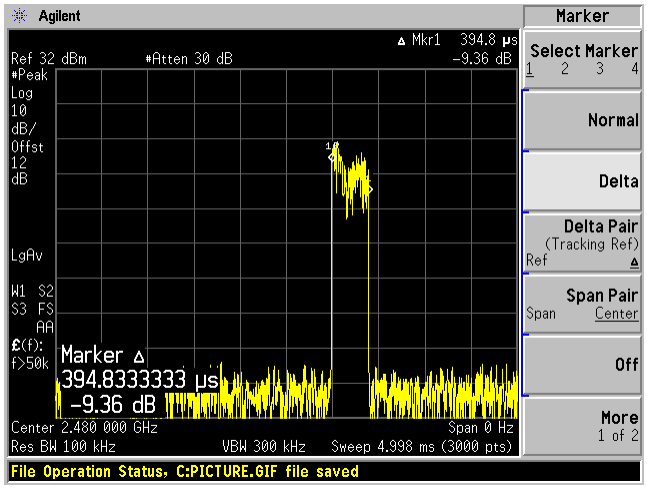
Low Channel 2402 MHz



Middle Channel 2441 MHz

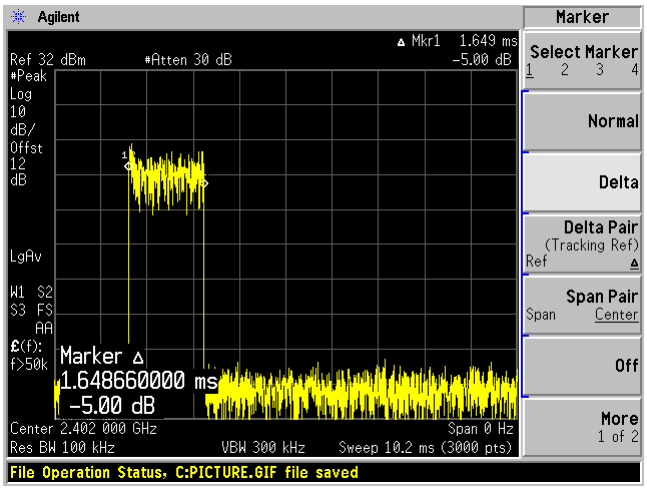


High Channel 2480 MHz

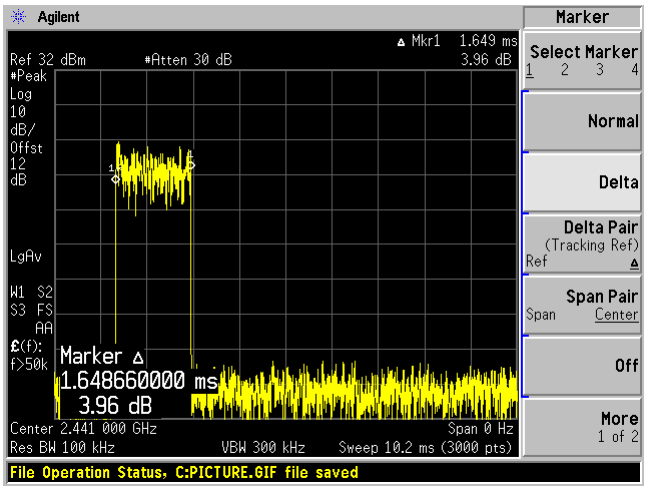


π/4-DQPSK, DH3 Pulse Width

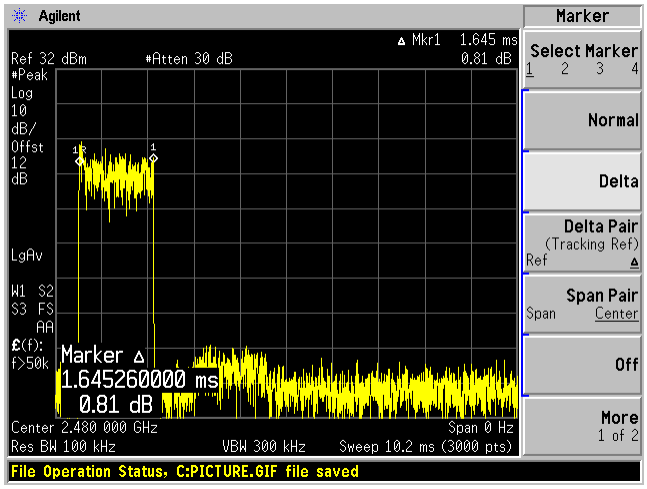
Low Channel 2402 MHz



Middle Channel 2441 MHz

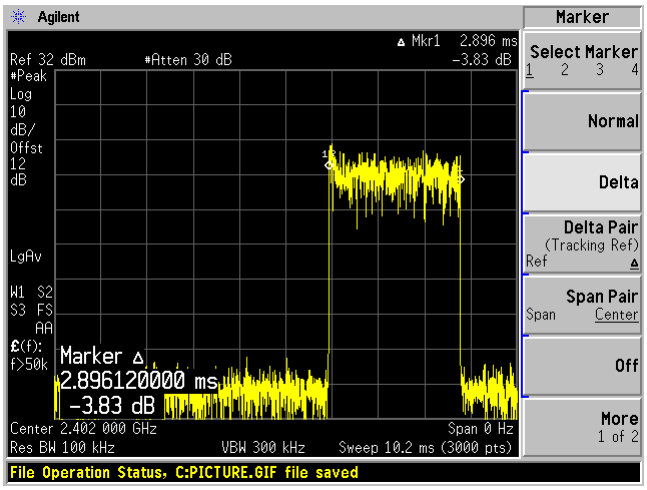


High Channel 2480 MHz

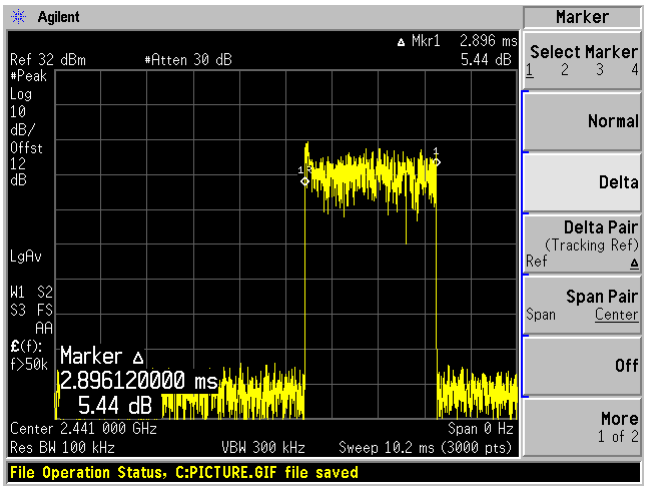


π/4-DQPSK, DH5 Pulse Width

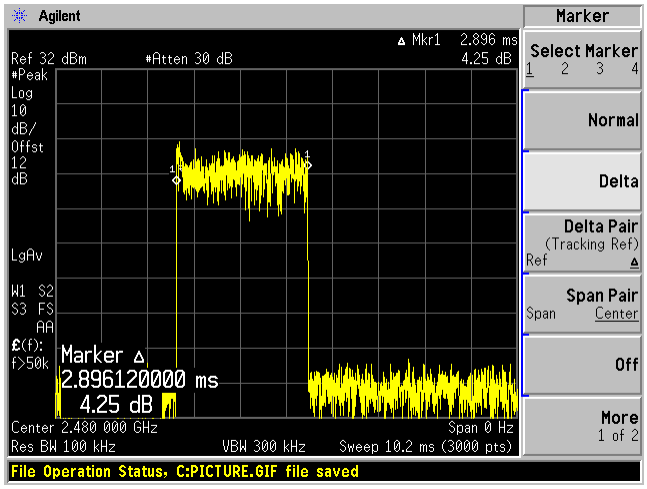
Low Channel 2402 MHz



Middle Channel 2441 MHz

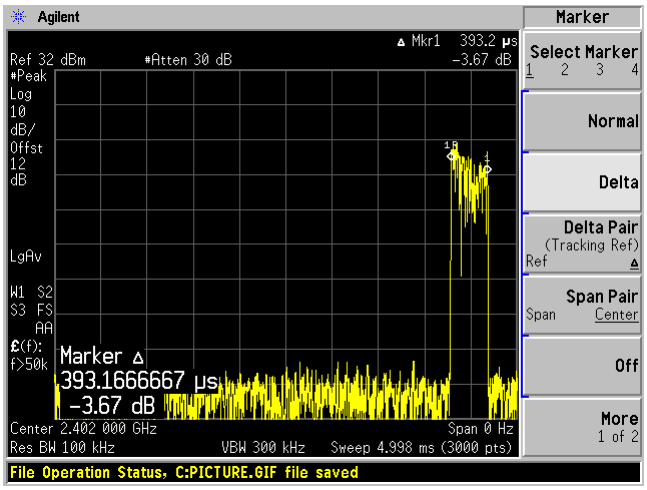


High Channel 2480 MHz

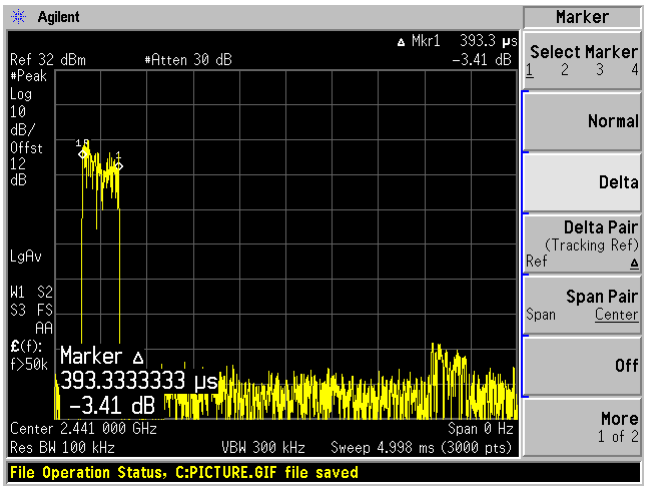


8DPSK, DH1 Pulse Width

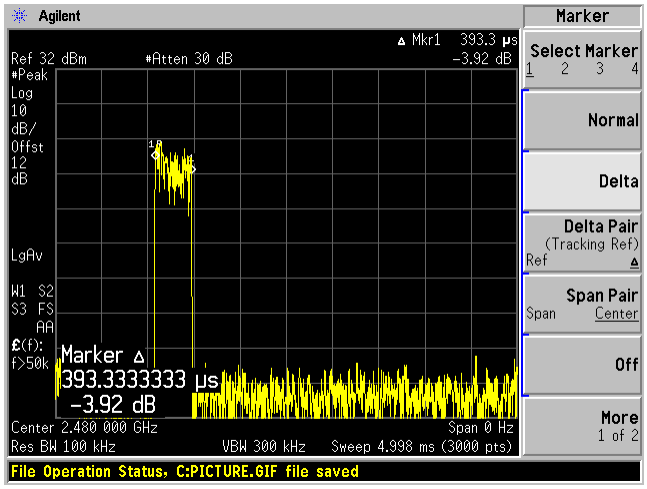
Low Channel 2402 MHz



Middle Channel 2441 MHz

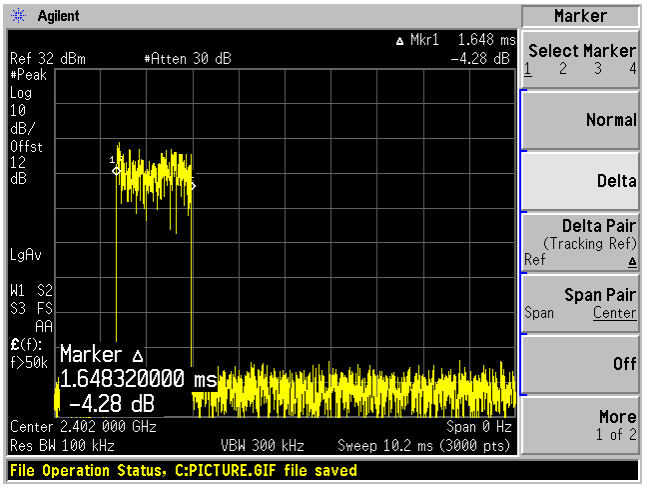


High Channel 2480 MHz

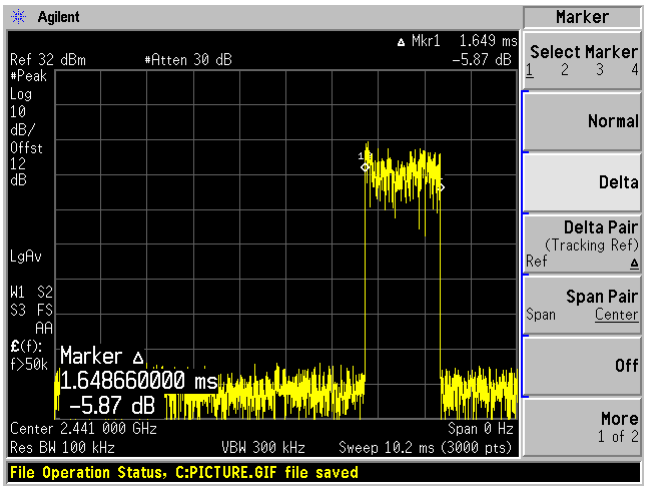


8DPSK, DH3 Pulse Width

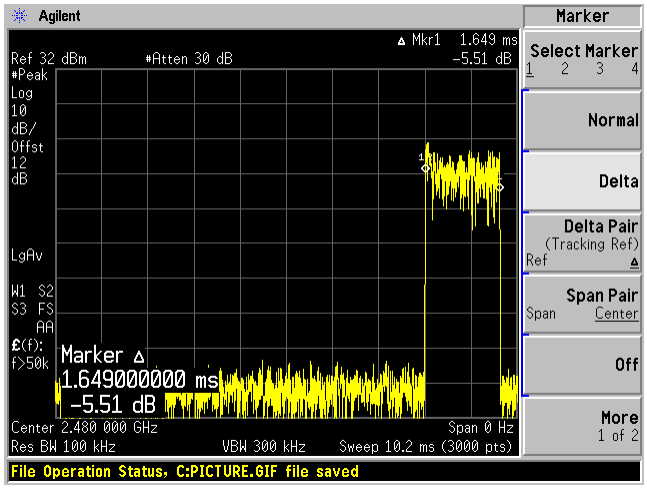
Low Channel 2402 MHz



Middle Channel 2441 MHz

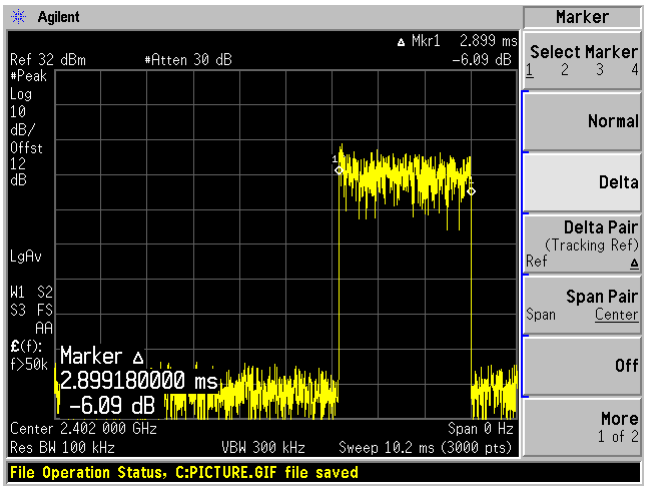


High Channel 2480 MHz

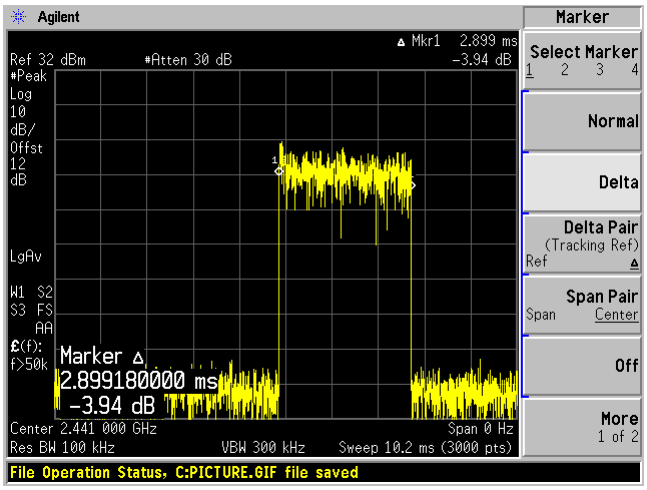


8DPSK, DH5 Pulse Width

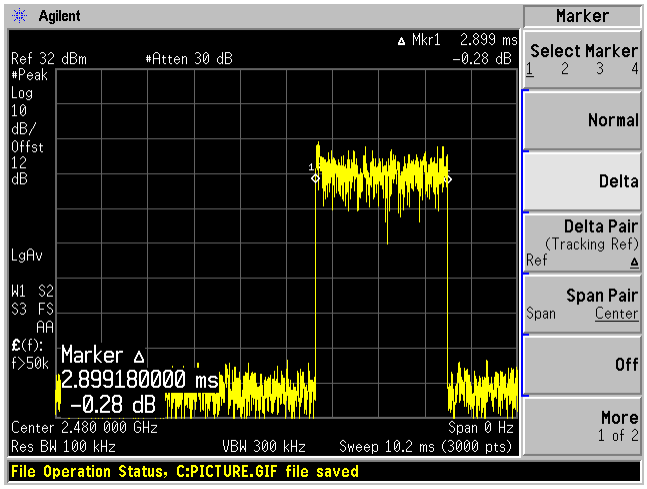
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



12 FCC §15.247(a)(1)(iii) & ISEDC RSS-247 §5.1(4) - Number of Hopping Channels

12.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

12.2 Test Procedure

Span = the frequency band of operation
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

12.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

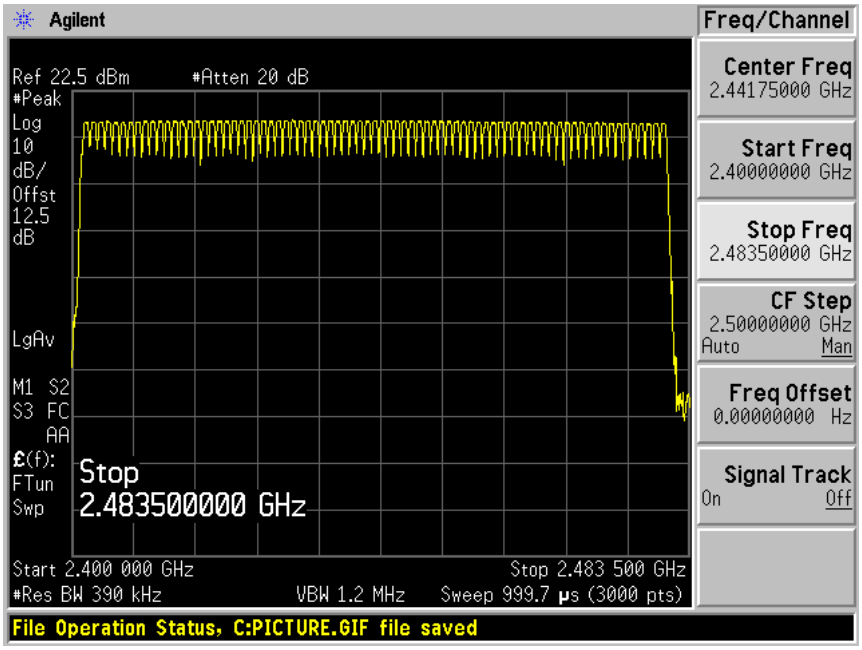
The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

12.5 Test Results

Total 79 channels; please refer to the plots hereinafter.

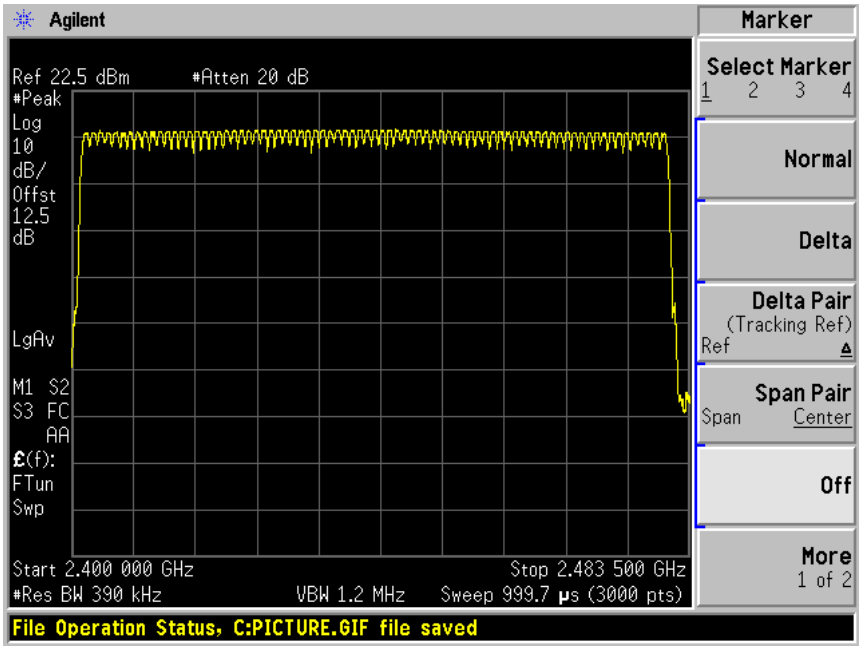
GFSK

79 Channels between 2400 to 2483.5 MHz



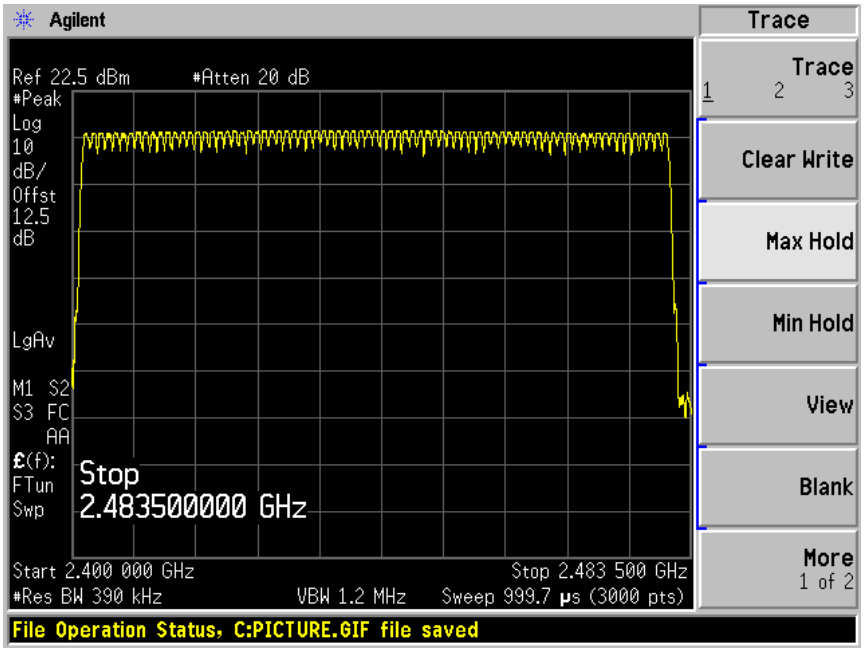
π/4-DQPSK

79 Channels between 2400 to 2483.5 MHz



8DPSK

79 Channels between 2400 to 2483.5 MHz



13 FCC §15.247(a) (1) & ISEDC RSS-247 §5.1(2) - Hopping Channel Separation

13.1 Applicable Standards

According to FCC §15.247(a) (1) and RSS-247 §5.1(2): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

13.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel
Video (or Average) Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

13.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

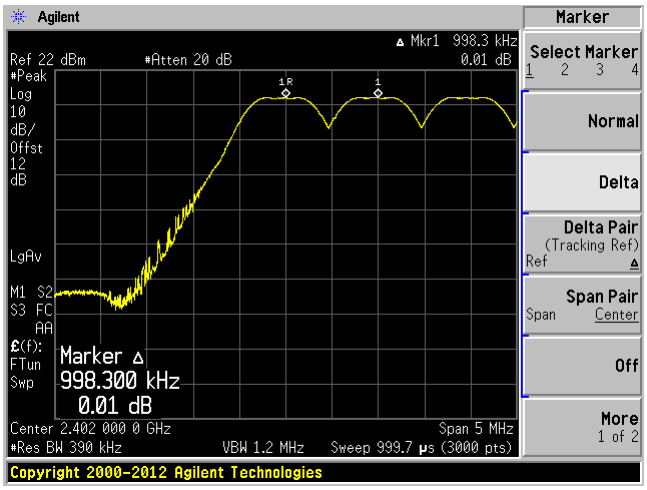
13.5 Test Results

Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB OBW (kHz)
GFSK			
Low	2402	998	690.67
Middle	2441	998	690.67
High	2480	997	688
π/4-DQPSK			
Low	2402	1080	894.67
Middle	2441	997	895.33
High	2480	993	895.33
8DPSK			
Low	2402	1002	910.67
Middle	2441	1007	911.33
High	2480	998	910.67

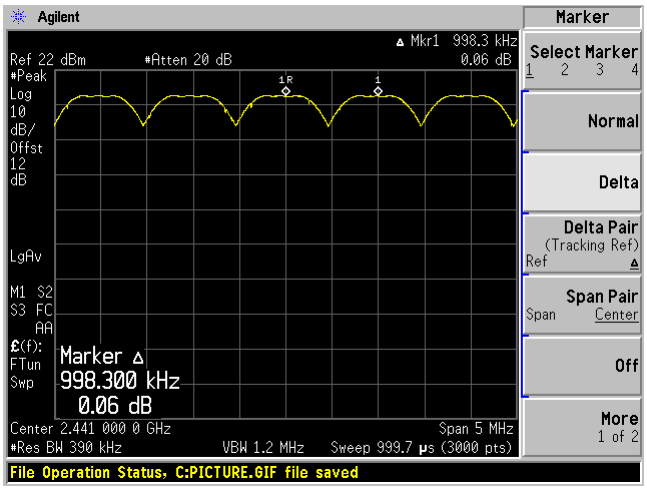
Please refer to following plots.

GFSK

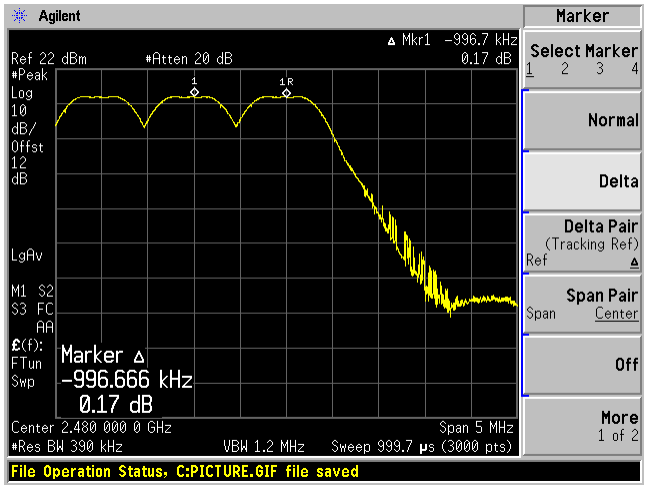
Low Channel 2402 MHz



Middle Channel 2441 MHz

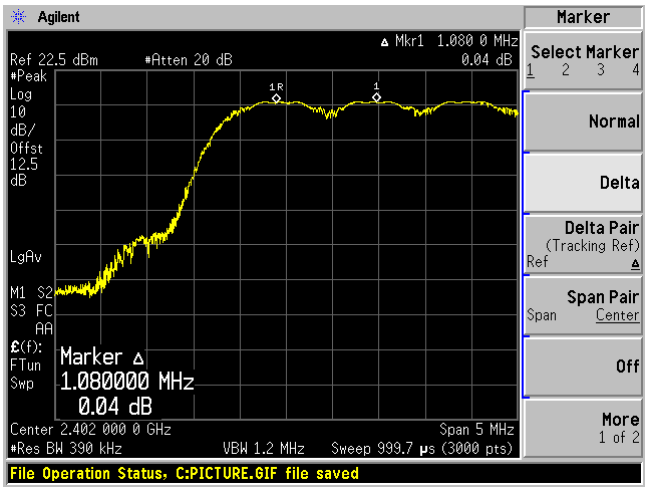


High Channel 2480 MHz

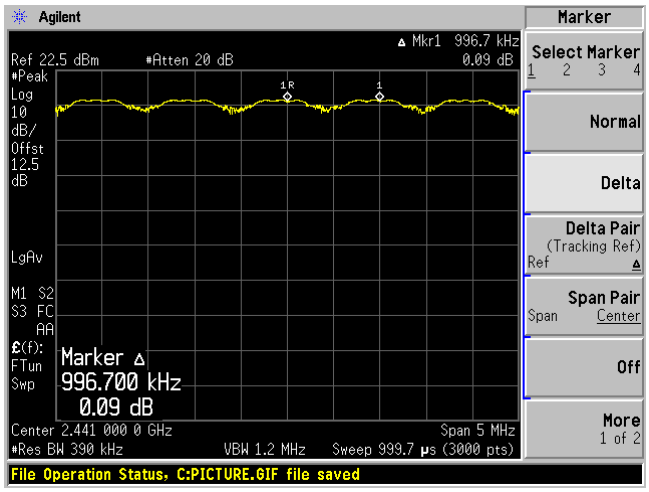


π/4-DQPSK

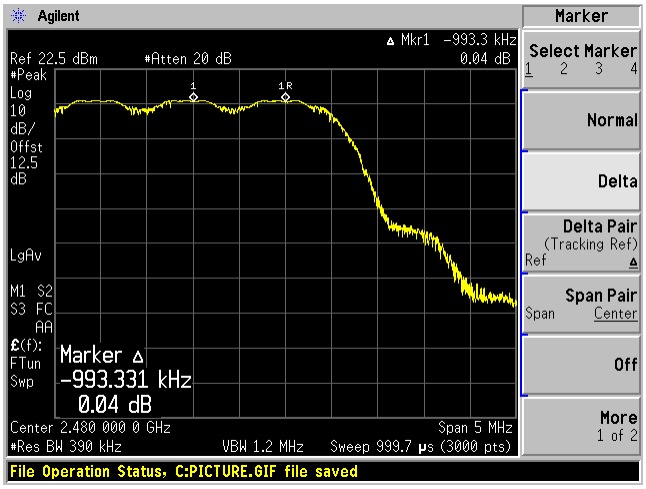
Low Channel 2402 MHz



Middle Channel 2441 MHz

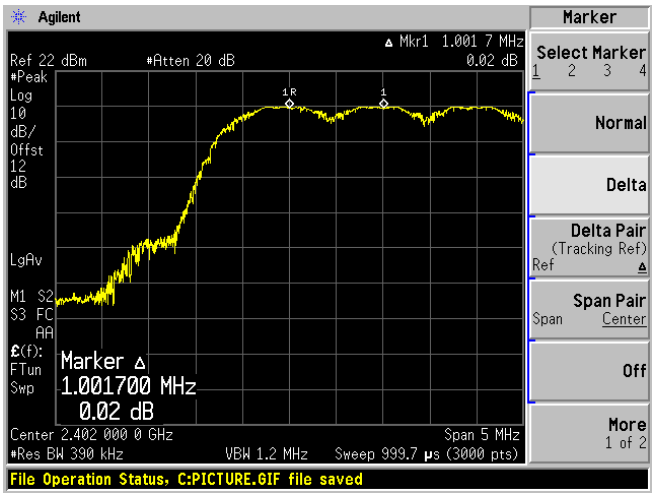


High Channel 2480 MHz

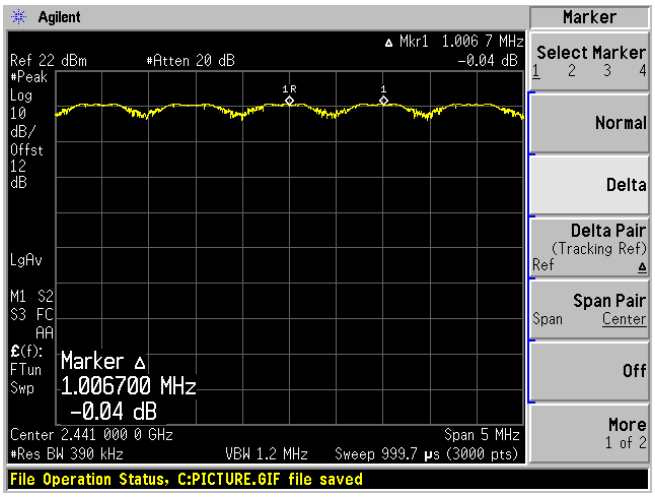


8DPSK

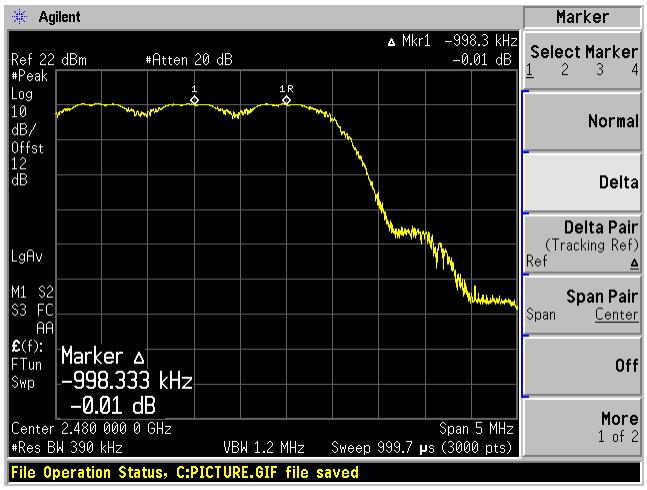
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



14 FCC §15.247(d) & ISEDC RSS-247 §5.5 - Spurious Emissions at Antenna Terminals

14.1 Applicable Standards

For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

As per ISEDC RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

14.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

14.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

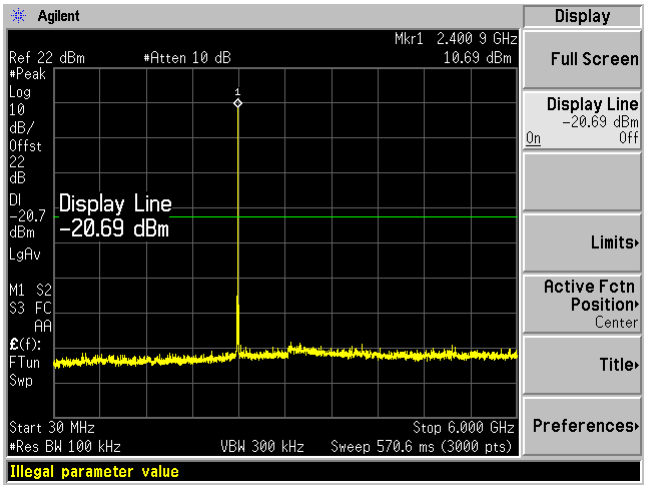
The testing was performed by Tri Pham & Christian McCaig from 2020-05-13 to 2020-05-22 in RF site.

14.5 Test Results

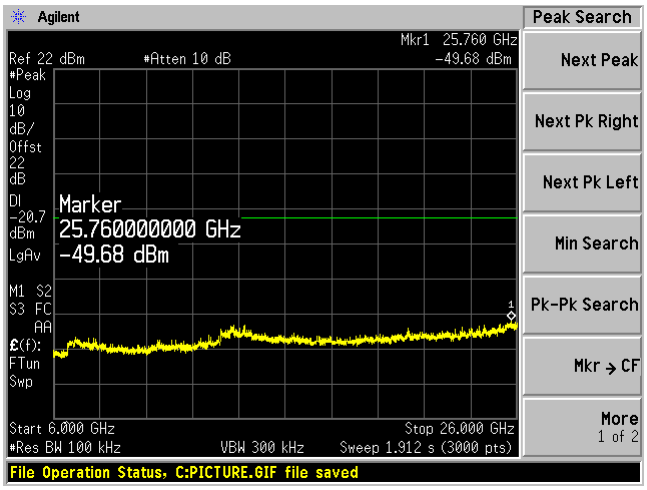
Please refer to following plots.

GFSK

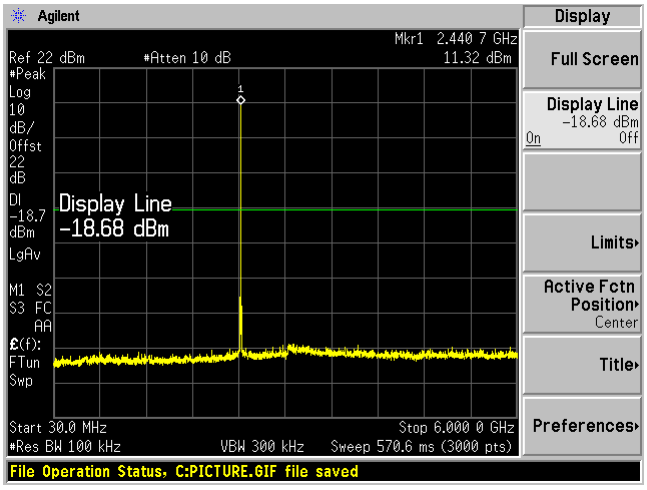
Low Channel 30 MHz – 6 GHz



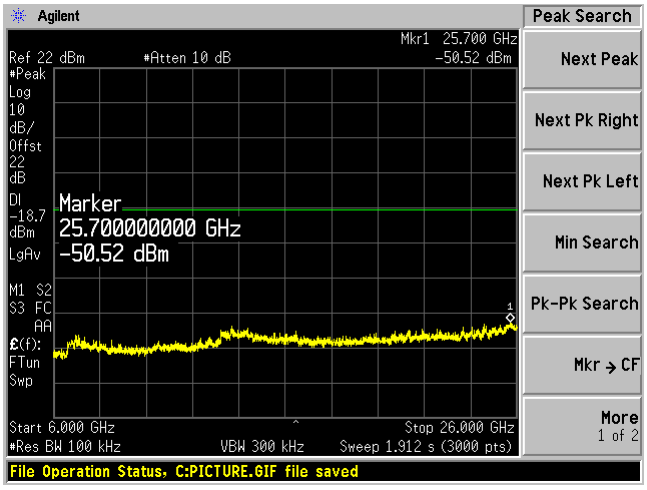
Low Channel 6 GHz – 26 GHz



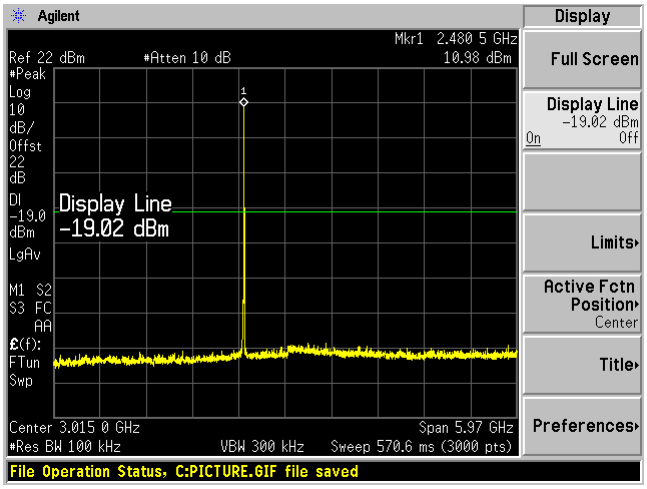
Middle Channel 30 MHz – 6 GHz



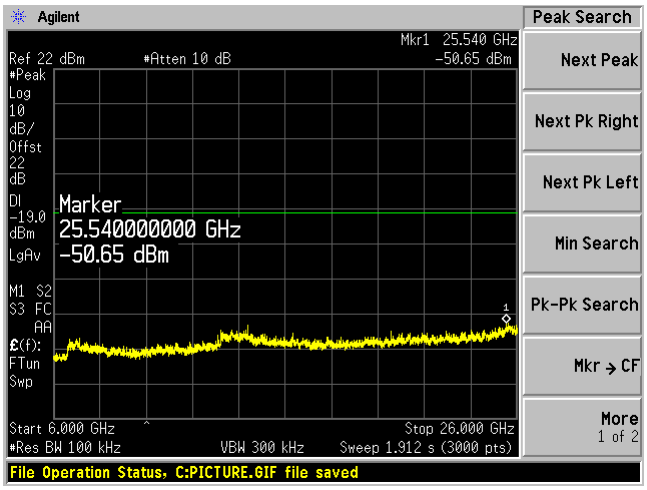
Middle Channel 6 GHz – 26 GHz



High Channel 30 MHz – 6 GHz

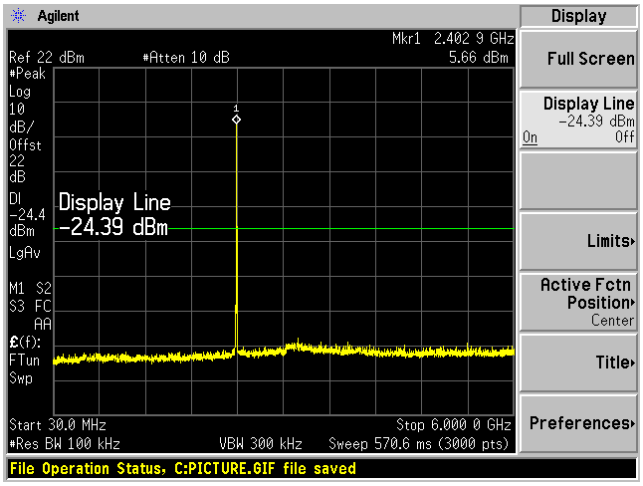


High Channel 6 GHz – 26 GHz

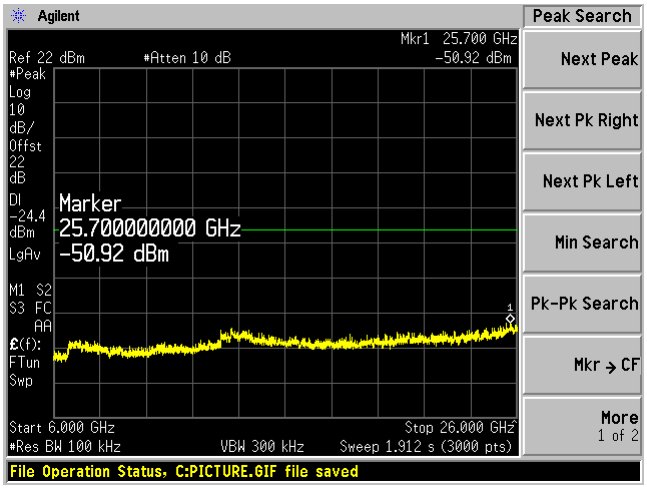


π/4-DQPSK

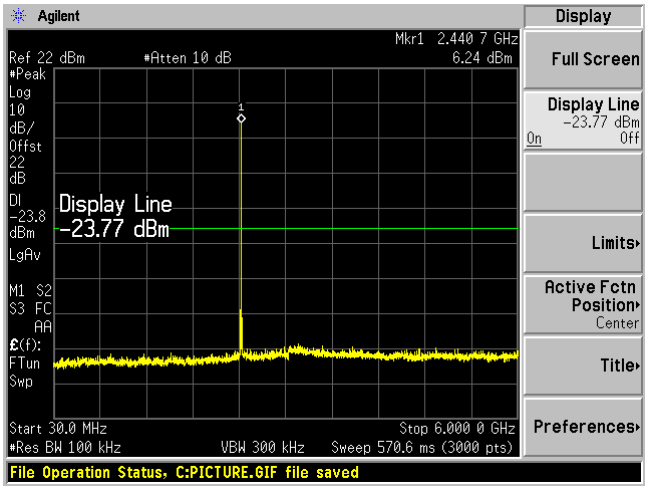
Low Channel 30 MHz – 6 GHz



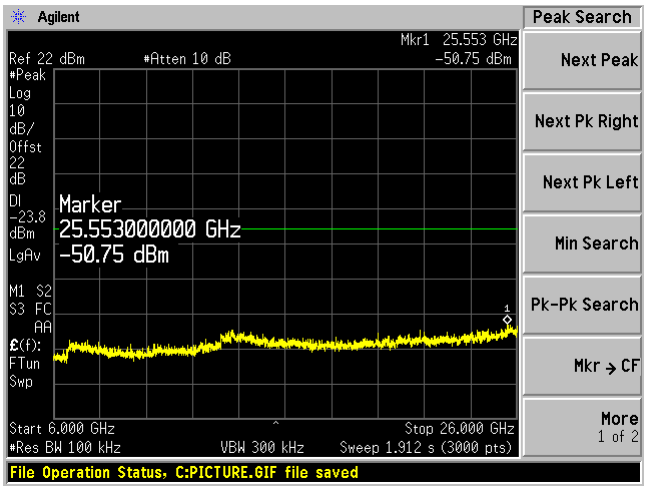
Low Channel 6 GHz – 26 GHz



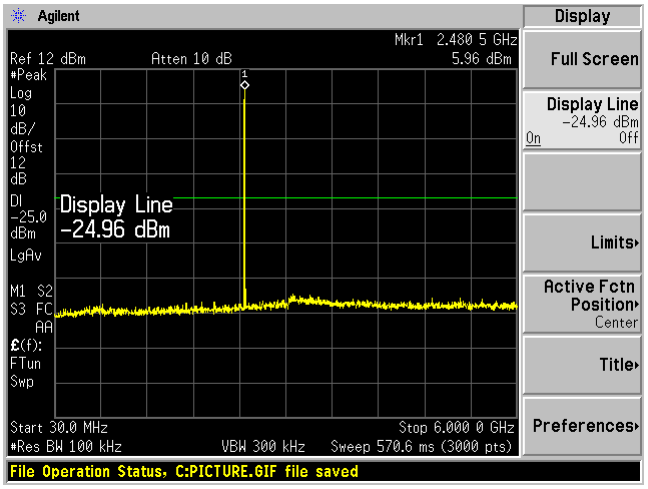
Middle Channel 30 MHz – 6 GHz



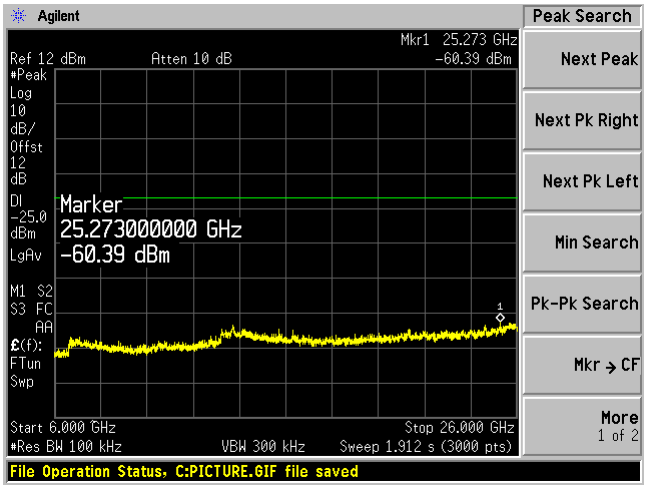
Middle Channel 6 GHz – 26 GHz



High Channel 30 MHz – 6 GHz

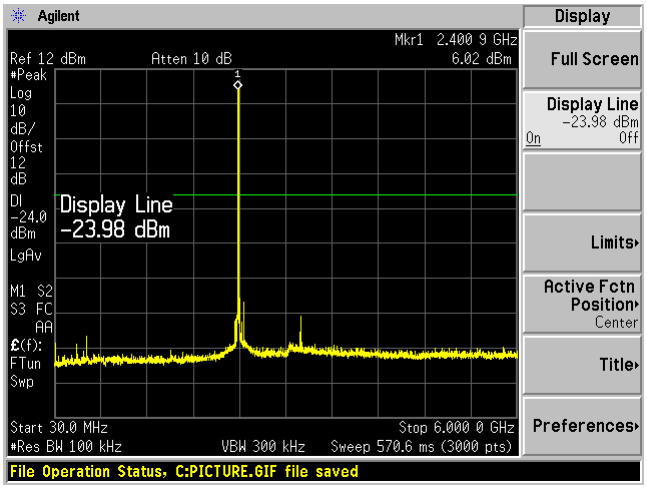


High Channel 6 GHz – 26 GHz

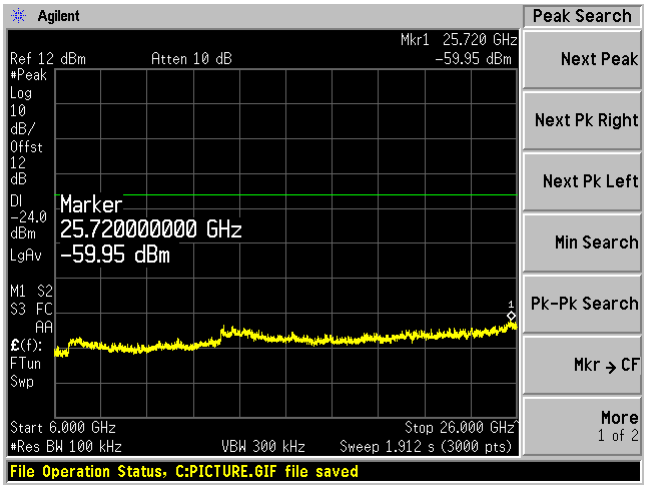


8DPSK

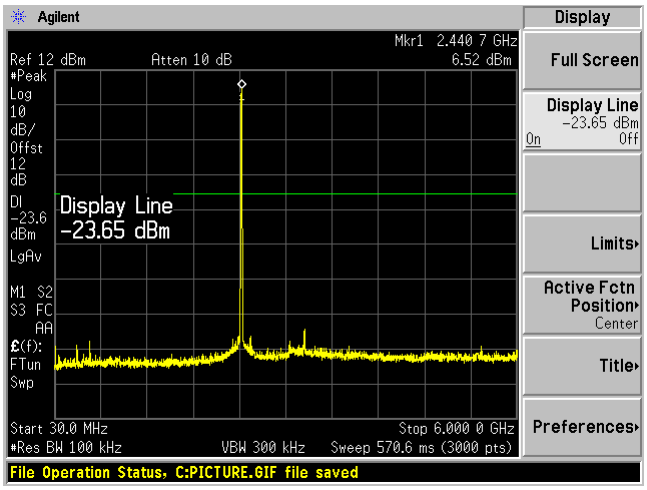
Low Channel 30 MHz – 6 GHz



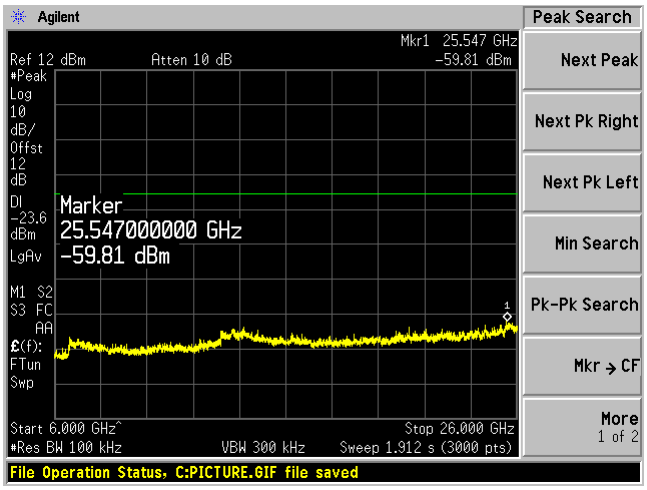
Low Channel 6 GHz – 26 GHz



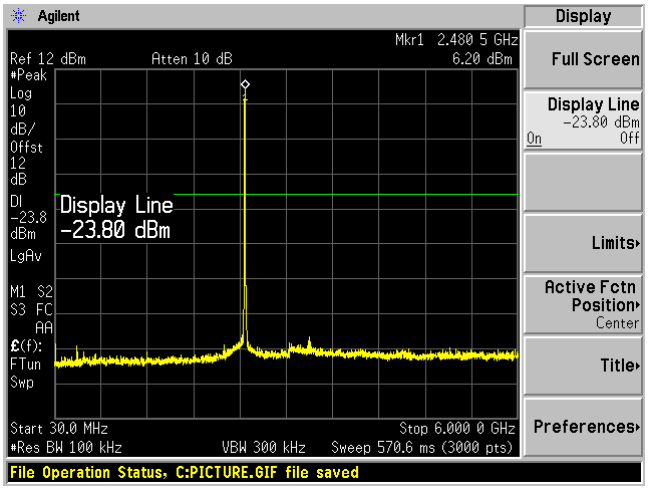
Middle Channel 30 MHz – 6 GHz



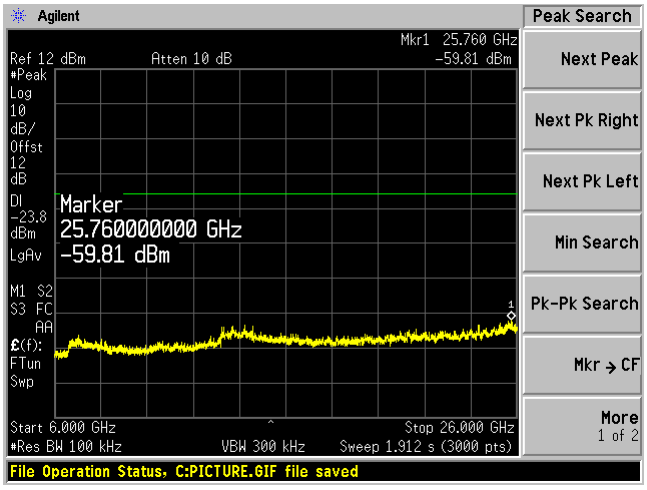
Middle Channel 6 GHz – 26 GHz



High Channel 30 MHz – 6 GHz



High Channel 6 GHz – 26 GHz



15 Annex A (Normative) - EUT Test Setup Photographs

Please refer to the attachment.

16 Annex B (Normative) - EUT External Photographs

Please refer to the attachment.

17 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment.

18 Annex D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA R222 - *Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 2nd day of October 2018.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised June 5, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---