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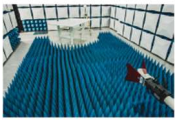

MEASUREMENT REPORT
FCC PART 15.247 / ISED RSS-247 Bluetooth

Applicant Name:
Apple Inc.
1 Infinite Loop
Cupertino, CA 95014
United States

Date of Testing:
10/31-2/15/2018
Test Site/Location:
PCTEST Lab. Morgan Hill, CA, USA
Test Report Serial No.:
1C1710060006-09.BCG

FCC ID:	**BCGA1954**
IC:	**579C-A1954**
APPLICANT:	**Apple Inc.**

Application Type:	Certification
Model/HVIN:	A1954
EUT Type:	Tablet Device
Max. RF Output Power:	56.833 mW (17.55 dBm) Peak Conducted
Frequency Range:	2402 – 2480MHz
Type of Modulation:	GFSK, π/4-DQPSK, 8DPSK
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
ISED Specification:	RSS-247 Issue 2
Test Procedure(s):	ANSI C63.10-2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Morgan Hill, CA 95037, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA1954**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
  - A) The hopping sequence is pseudorandom
  - B) All channels are used equally on average
  - C) The receiver input bandwidth equals the transmit bandwidth
  - D) The receiver hops in sequence with the transmit signal
- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

Test Device Serial No.: F9FVT02RJM50, F9FVT00QJM4W

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE),

Ch.	Frequency (MHz)
00	2402
:	:
39	2441
:	:
78	2480

Table 2-1. Frequency/ Channel Operations

Note: This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 79 different channels in the 2400 – 2483.5MHz band. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of ANSI C63.10-2013 and KDB 558074 D01 v04. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Maximum Achievable Duty Cycles		
Bluetooth Mode		Duty Cycle [%]
GFSK	ePA	100.0
	iPA	100.0
8DPSK	ePA	100.0
	iPA	100.0

Table 2-2. Measured Duty Cycles

2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain (dBi)
2.4	1.91

Table 2-3. Antenna Peak Gain

Note: This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 79 different channels in the 2400 – 2483.5MHz band.

2.4 Test Support Equipment

1	Apple MacBook	Model:	A1502	S/N:	C02P4004G1R8
	w/ AC/DC Adapter	Model:	A1435	S/N:	C04325505K1F288BG
2	Apple USB Cable	Model:	Kanzi	S/N:	3251F5
3	Apple Earphone	Model:	N/A	S/N:	N/A
4	USB Lightning Cable	Model:	N/A	S/N:	N/A
5	w/ 12 W AC Adapter	Model:	A1401	S/N:	N/A
6	DC Power Supply	Model:	EP20571-110V	S/N:	N/A

Table 2-4. Test Support Equipment Used

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was also used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, and 7.8 for antenna port conducted emissions test setups. The worst case radiated emissions data is shown in this report.

There are two vendors of the WiFi/Bluetooth radio modules, variant 1 and variant 2. Both radio modules have the same mechanical outline, same on-board antenna matching circuit, identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances. The worst case configuration was found between the two variants. The EUT was also investigated with and without charger.

The emissions below 1GHz and above 18GHz were tested with the highest transmitting power channel and the worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report. The worst orientation was found to be Y-orientation (landscape).

For AC line conducted and radiated test below 1GHz, following configuration were investigated and EUT powered by AC/DC was the worst case.

- EUT powered by AC/DC adaptor via USB cable with wire charger
- EUT powered by host PC via USB cable with wire charger

π/4-DQPSK has been investigated and confirmed as not the worst case.

2.6 Software and Firmware

The test was conducted with firmware version 15E61570I installed on the EUT.

For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that the cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.14. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.20.01.

3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antennas of the EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	AM WN25	WLAN Cable Set	3/17/2017	Annual	3/17/2018	AM WN25
-	EMI 3117-ESW1	Radiated Cable Set	3/1/2017	Biennial	3/1/2018	N/A
-	EMI HL562E-ESW1	Radiated Cable Set	2/28/2017	Biennial	2/28/2018	N/A
Anritsu	MA2411B	Pulse Power Sensor	11/28/2017	Biennial	11/28/2018	1027293
Anritsu	ML2495A	Power Meter	11/28/2017	Biennial	11/28/2018	1039008
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna(18 -40GHz)	2/24/2017	Annual	2/24/2018	T058701-03
COM-POWER	LIN-120A	LISN	2/22/2017	Annual	2/22/2018	241296
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	3/13/2017	Annual	3/13/2018	MY49430244
Rohde & Schwarz	ESW26	ESW26 EMI Test Receiver	7/15/2017	Annual	7/15/2018	101299
Rohde & Schwarz	FSW43	Signal & Spectrum Analyzer	4/24/2017	Annual	4/24/2018	104093
Rohde & Schwarz	ESW44	EMI Test Receiver	11/14/2017	Annual	11/14/2018	101570
Rohde & Schwarz	HL562E	Bi-Log Antenna (30MHz - 6GHz)	3/27/2017	Annual	3/27/2018	100810
Rohde & Schwarz	SFUNIT-RX	TS-SFUNIT SHIELDED FILTER UNIT	9/11/2017	Annual	9/11/2018	102132
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	2/3/2017	Annual	2/3/2018	101639
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	1/3/2017	Annual	1/3/2018	100052
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	2/3/2017	Annual	2/3/2018	102325
Rohde & Schwarz	TC-TA18	CROSS POL. VIVALDI ANT (400MHz - 18GHz)	11/13/2017	Annual	11/13/2018	101056-AE
Traceable	1208T91	Humidity/Temperature/Dew Point Meter	9/27/2017	Biennial	9/27/2018	160838829

Table 6-1. Annual Test Equipment Calibration Schedule

Notes:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.

FCC ID: BCGA1954

Method/System: Frequency Hopping Spread Spectrum (FHSS)

Number of Channels: 79

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)(iii)	RSS-247 [5.1(a)]	20dB Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.247(b)(1)	RSS-247 [5.4(b)]	Peak Transmitter Output Power	< 1 Watt if ≥ 75 non-overlapping channels used		PASS	Section 7.3
15.247(a)(1)	RSS-247 [5.1(c)]	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		PASS	Section 7.5
15.247(a)(1)(iii)	RSS-247 [5.1(d)]	Number of Channels	> 15 Channels		PASS	Section 7.7
15.247(a)(1)(iii)	RSS-247 [5.1(d)]	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS	Section 7.6
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	Conducted > 20dBc		PASS	Section 7.4, Section 7.8
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-247 limits)	RADIATED	PASS	Section 7.9, Section 7.10, Section 7.13
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen [8.8] limits)	LINE CONDUCTED	PASS	Section 7.14

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "BT Auto," Version 3.3.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.1.5.

7.2 20dB Bandwidth Measurement

§15.247 (a.1.iii); RSS-247 [5.1(a)]

Test Overview and Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

Test Procedure Used

ANSI C63.10-2013 – Section 6.9.2

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 20. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% OBW
3. VBW ≥ 3 x RBW
4. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

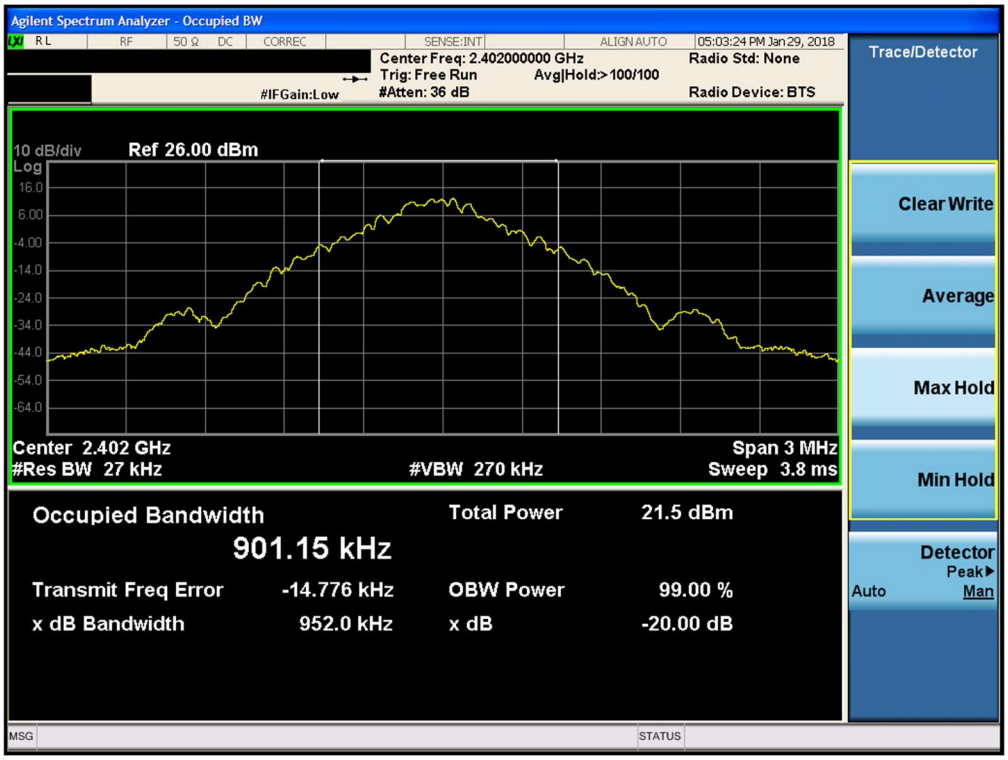
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

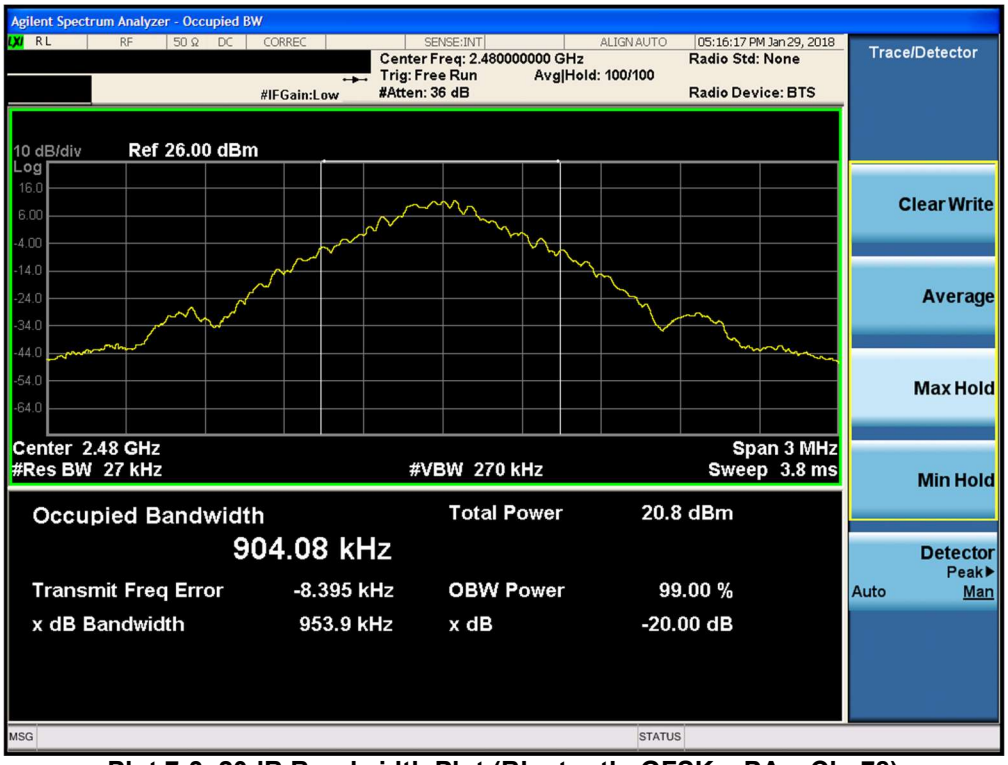
Frequency [MHz]	Modulation	Power Scheme	Channel No.	20dB Bandwidth Test Result	
				Measured Bandwidth [kHz]	Pass/Fail
2402	GFSK	ePA	0	952.00	Pass
2441	GFSK	ePA	39	950.40	Pass
2480	GFSK	ePA	78	953.90	Pass
2402	GFSK	iPA	0	951.50	Pass
2441	GFSK	iPA	39	955.60	Pass
2480	GFSK	iPA	78	952.70	Pass
2402	8DPSK	ePA	0	1362.00	Pass
2441	8DPSK	ePA	39	1366.00	Pass
2480	8DPSK	ePA	78	1357.00	Pass
2402	8DPSK	iPA	0	1385.00	Pass
2441	8DPSK	iPA	39	1385.00	Pass
2480	8DPSK	iPA	78	1379.00	Pass

Table 7-2. Conducted 20dB Bandwidth Measurements



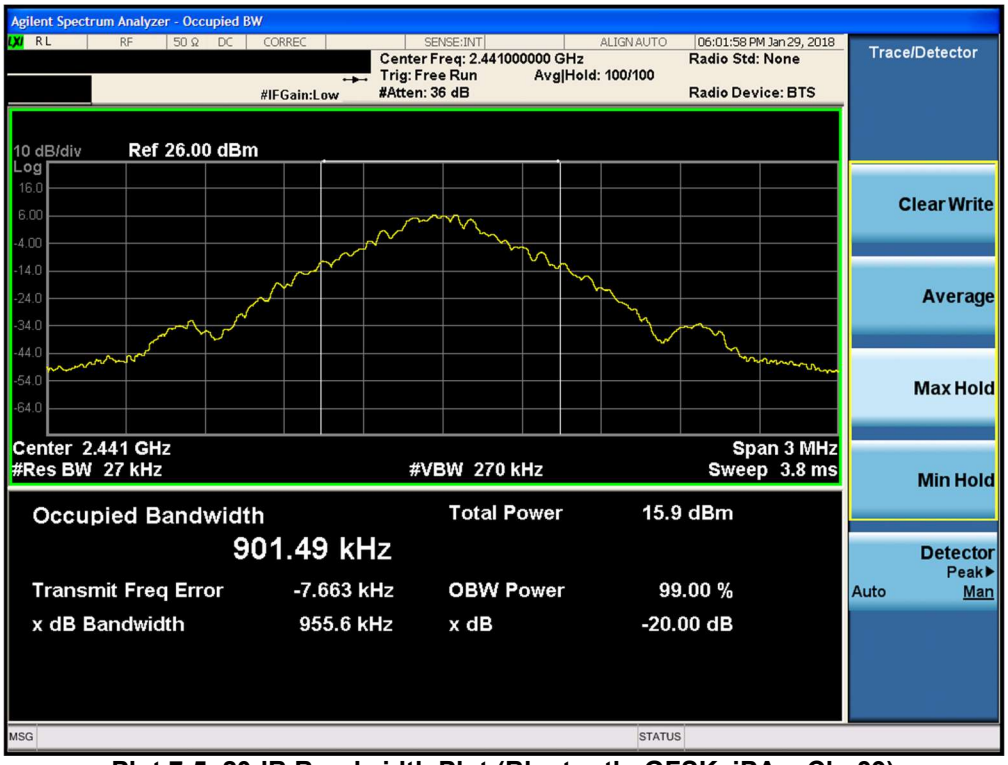
Plot 7-1. 20dB Bandwidth Plot (Bluetooth, GFSK, ePA – Ch. 0)

Plot 7-2. 20dB Bandwidth Plot (Bluetooth, GFSK, ePA – Ch. 39)



Plot 7-3. 20dB Bandwidth Plot (Bluetooth, GFSK, ePA – Ch. 78)

Plot 7-4. 20dB Bandwidth Plot (Bluetooth, GFSK, iPA – Ch. 0)



Plot 7-5. 20dB Bandwidth Plot (Bluetooth, GFSK, iPA – Ch. 39)

Plot 7-6. 20dB Bandwidth Plot (Bluetooth, GFSK, iPA – Ch. 78)

Plot 7-7. 20dB Bandwidth Plot (Bluetooth, 8DPSK, ePA – Ch. 0)

Plot 7-8. 20dB Bandwidth Plot (Bluetooth, 8DPSK, ePA – Ch. 39)

Plot 7-9. 20dB Bandwidth Plot (Bluetooth, 8DPSK, ePA – Ch. 78)

Plot 7-10. 20dB Bandwidth Plot (Bluetooth, 8DPSK, iPA – Ch. 0)

Plot 7-11. 20dB Bandwidth Plot (Bluetooth, 8DPSK, iPA – Ch. 39)

Plot 7-12. 20dB Bandwidth Plot (Bluetooth, 8DPSK, iPA – Ch. 78)

7.3 Output Power Measurement

§15.247 (b.1); RSS-247 [5.4(b)]

Test Overview and Limits

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below were measured using a spectrum analyzer with a Bluetooth signaling test set (Agilent Model: N4010A) used only to maintain a Bluetooth link with the EUT. Average power measurements are performed using the analyzer's "burst power" function with RBW = 3MHz. The burst power function triggers on a single set burst set to maximum power and measures the maximum average power on the on-time.

The maximum permissible output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.5

Test Settings

Peak Power Measurement

1. Span = approximately 5x 20dB bandwidth, centered on hopping channel
2. RBW > 20dB bandwidth of emission being measured
3. VBW ≥ RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-2. Test Instrument & Measurement Setup for Peak Power Measurement

Figure 7-3. Test Instrument & Measurement Setup for Average Power Measurement

Note

1. This unit was tested with all possible data rates and the highest peak power is reported with the unit transmitting at GFSK and 8DPSK.
2. The EUT was tested for the average power with a broadband power meter for reporting purposes only.

3. Final results were obtained using calibrated couplers, attenuators and cables. The following formula was used:

   Output Power (dBm) = Raw Analyzer Level (dBm) + Cable Loss (dB) + Loss in Directional Coupler/Insertion Loss (dB)

7.3.1 Peak Output Power Measurement

§15.247 (b.1); RSS-247 [5.4(b)]

Frequency [MHz]	Modulation	Power Scheme	Channel No.	Peak Conducted Power	
				[dBm]	[mW]
2402	GFSK	ePA	0	15.88	38.681
2441	GFSK	ePA	39	15.74	37.532
2480	GFSK	ePA	78	17.55	56.833
2402	GFSK	iPA	0	9.06	8.050
2441	GFSK	iPA	39	9.43	8.774
2480	GFSK	iPA	78	8.95	7.847
2402	8DPSK	ePA	0	15.08	32.203
2441	8DPSK	ePA	39	15.26	33.574
2480	8DPSK	ePA	78	15.22	33.235
2402	8DPSK	iPA	0	8.30	6.767
2441	8DPSK	iPA	39	8.46	7.015
2480	8DPSK	iPA	78	8.33	6.812

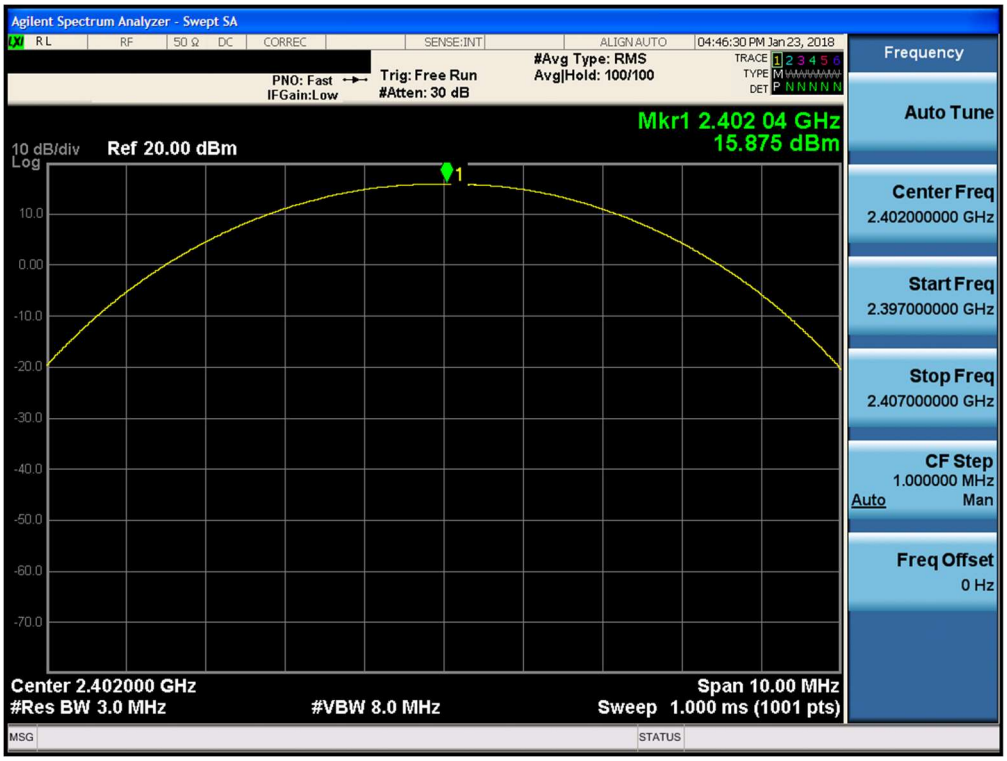
Table 7-3. Peak Conducted Output Power Measurements

7.3.2 Average Output Power Measurement

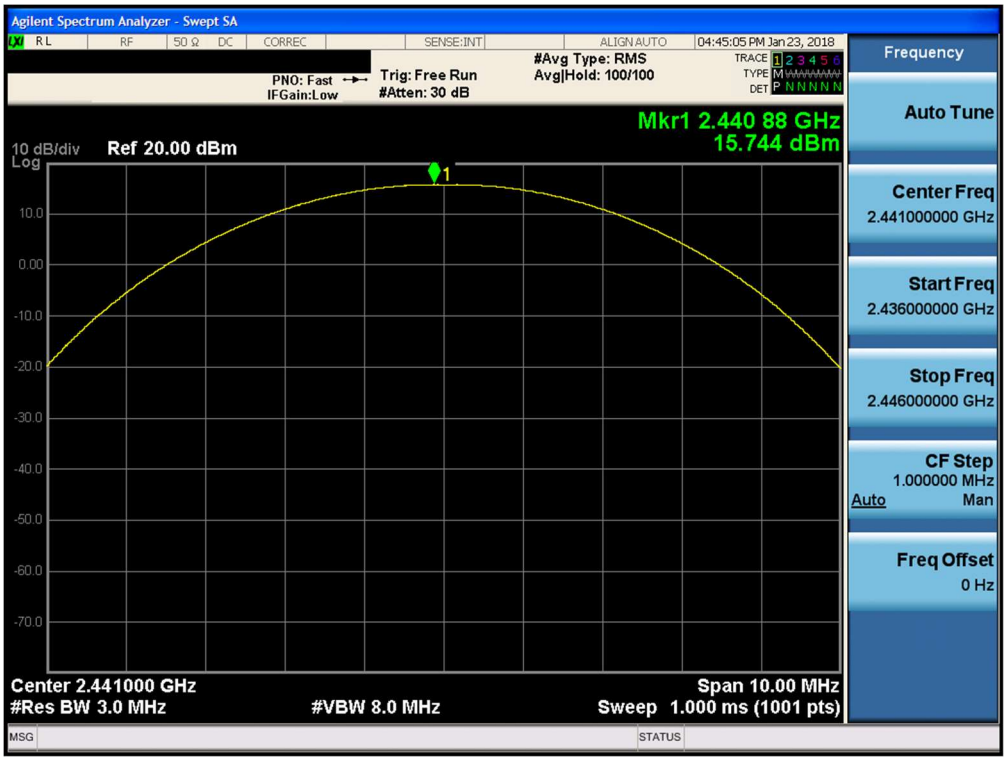
§15.247 (b.1); RSS-247 [5.4(b)]

Frequency [MHz]	Modulation	Power Scheme	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	ePA	0	15.62	36.459
2441	GFSK	ePA	39	15.53	35.703
2480	GFSK	ePA	78	17.00	50.119
2402	GFSK	iPA	0	8.94	7.825
2441	GFSK	iPA	39	9.25	8.410
2480	GFSK	iPA	78	8.78	7.544
2402	8DPSK	ePA	0	11.93	15.606
2441	8DPSK	ePA	39	11.93	15.592
2480	8DPSK	ePA	78	11.91	15.513
2402	8DPSK	iPA	0	5.60	3.633
2441	8DPSK	iPA	39	5.67	3.688
2480	8DPSK	iPA	78	5.64	3.663

Table 7-4. Average Conducted Output Power Measurements

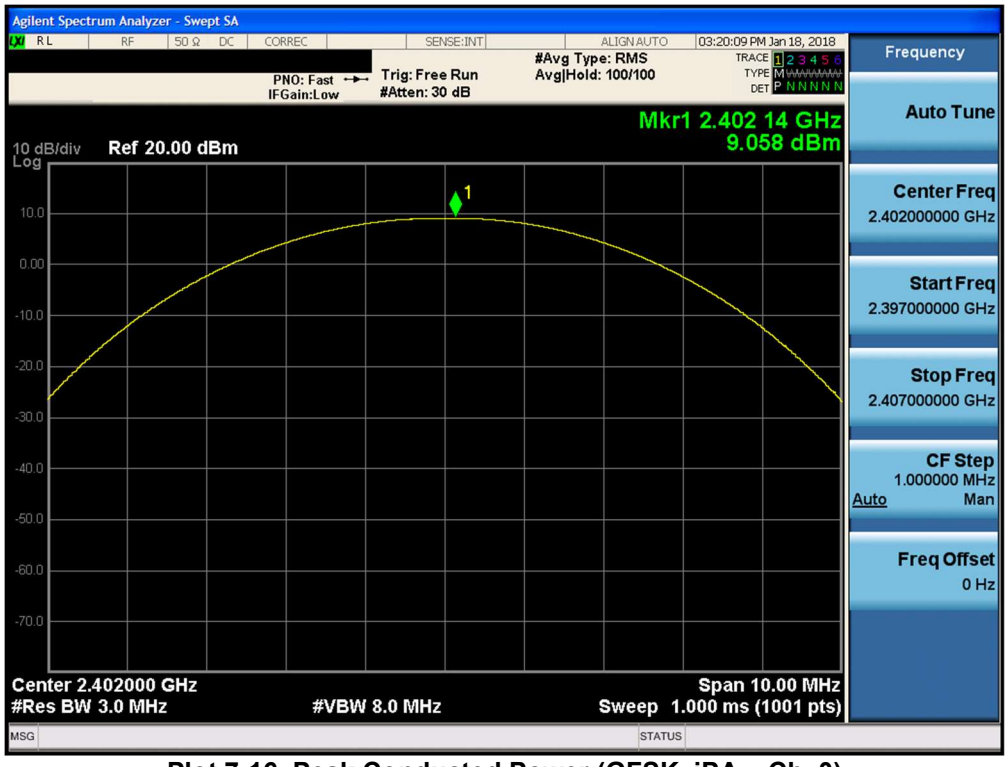


Plot 7-13. Peak Conducted Power (GFSK, ePA - Ch. 0)

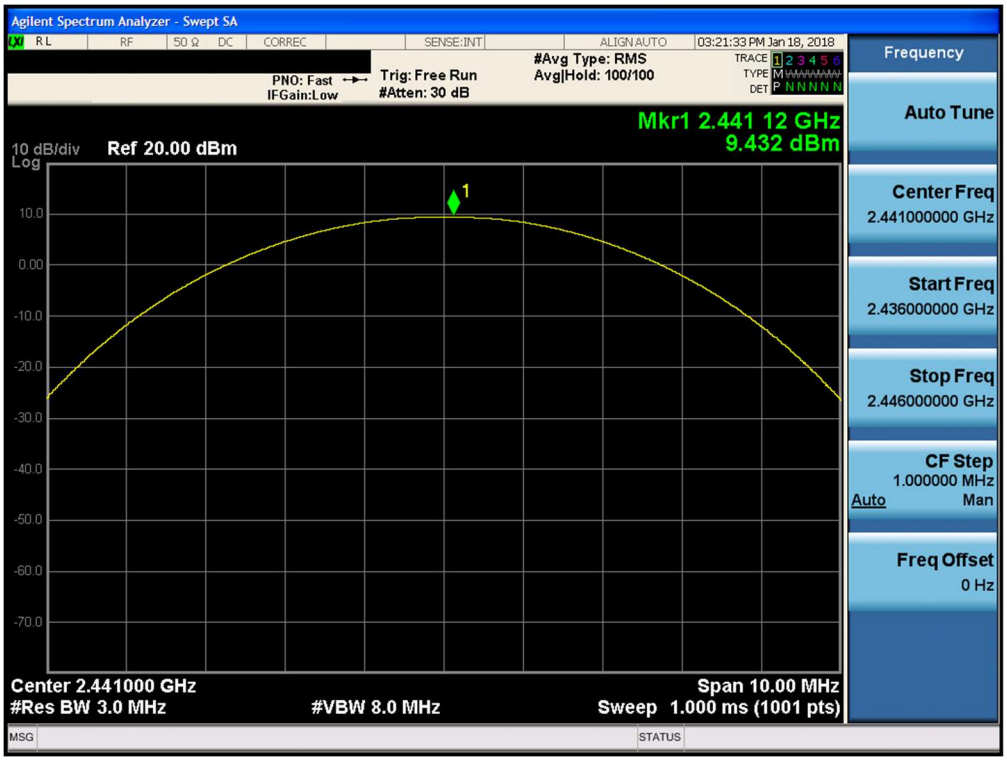


Plot 7-14. Peak Conducted Power (GFSK, ePA – Ch. 39)

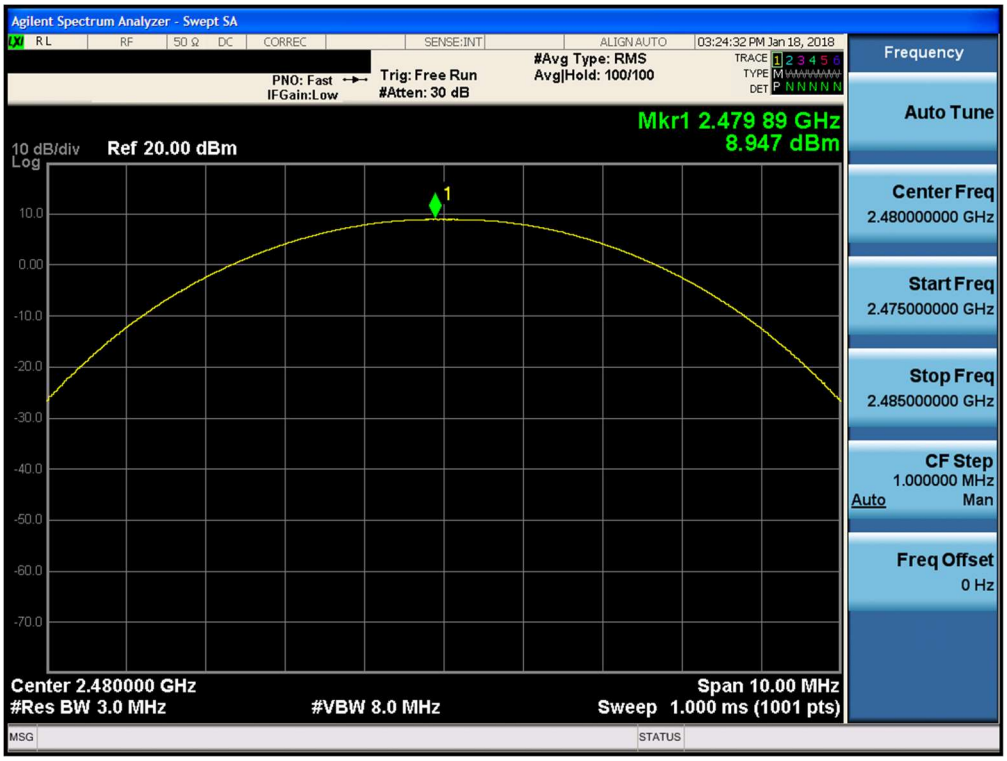
Plot 7-15. Peak Conducted Power (GFSK, ePA – Ch. 78)



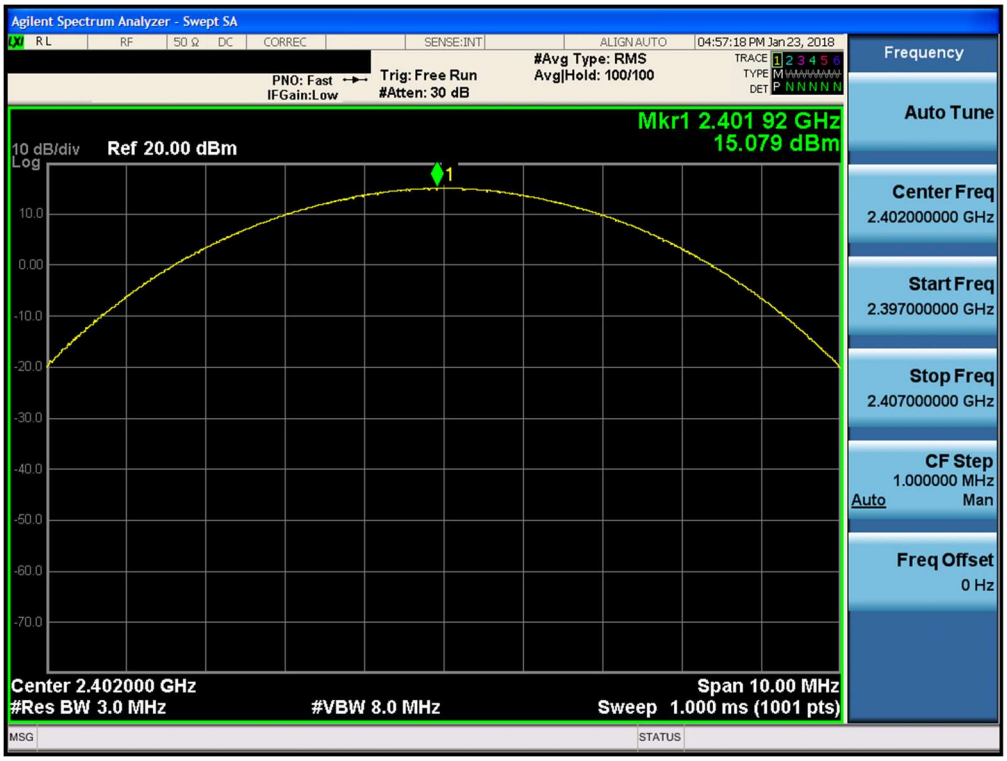
Plot 7-16. Peak Conducted Power (GFSK, iPA – Ch. 0)



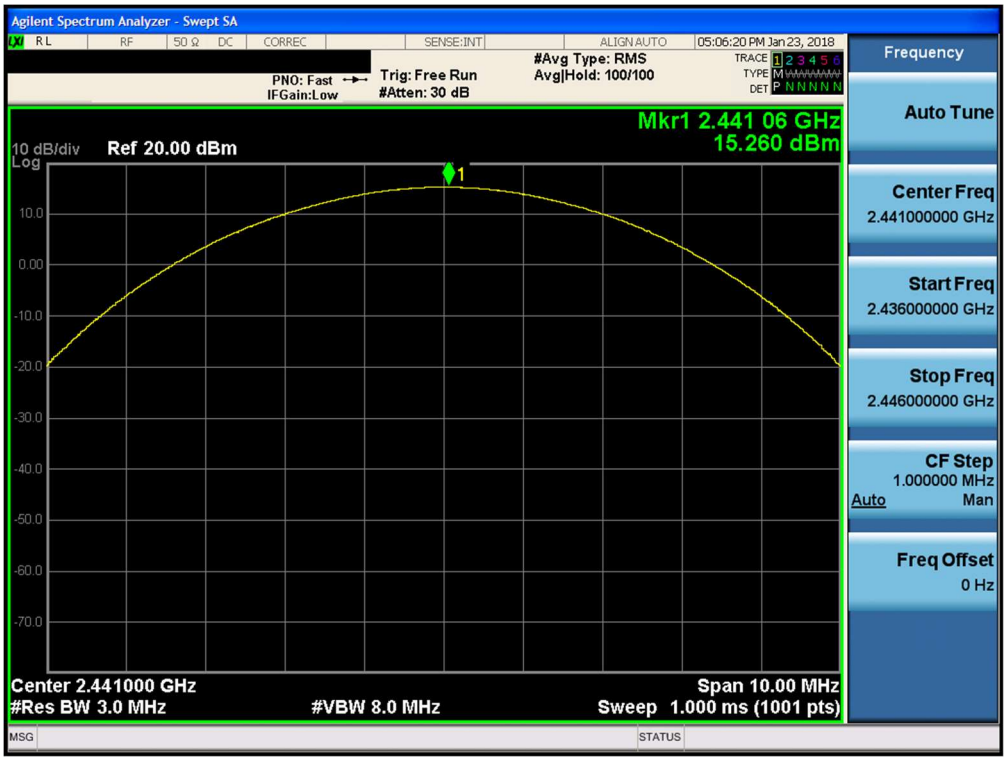
Plot 7-17. Peak Conducted Power (GFSK, iPA – Ch. 39)



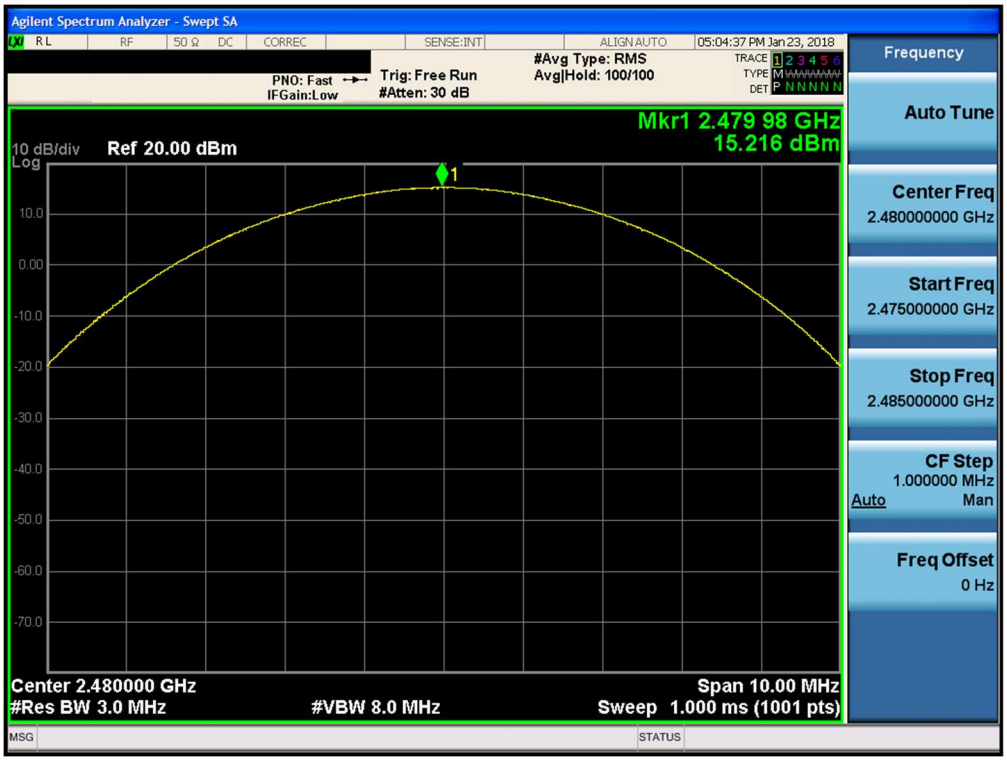
Plot 7-18. Peak Conducted Power (GFSK, iPA – Ch. 78)



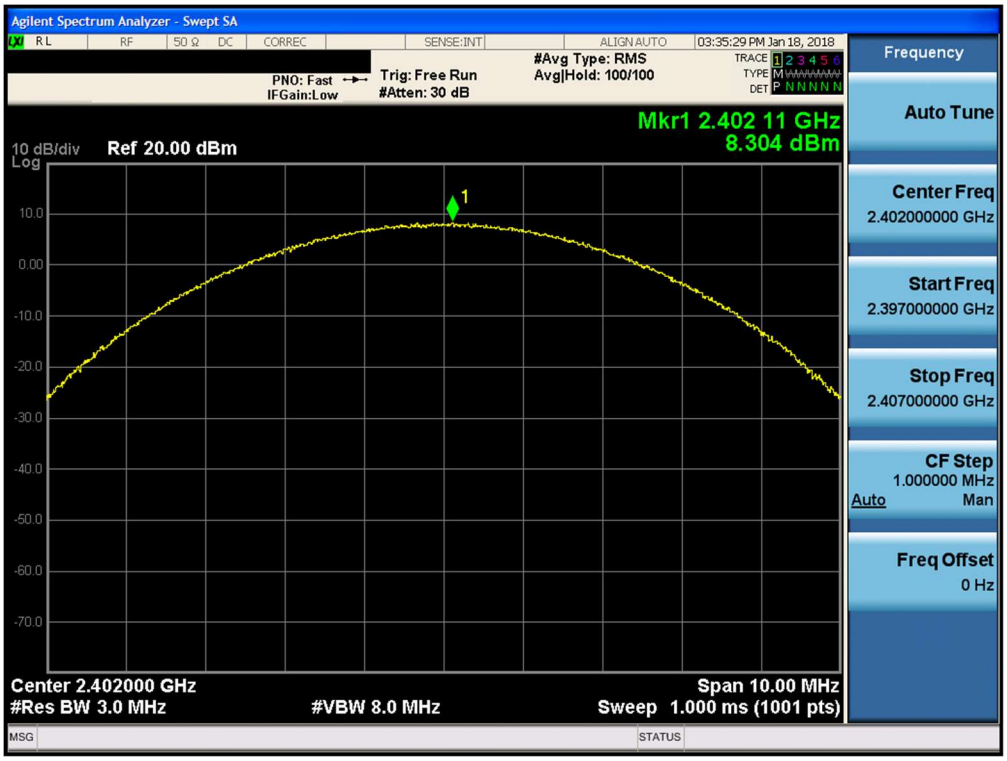
Plot 7-19. Peak Conducted Power (8DPSK, ePA – Ch. 0)



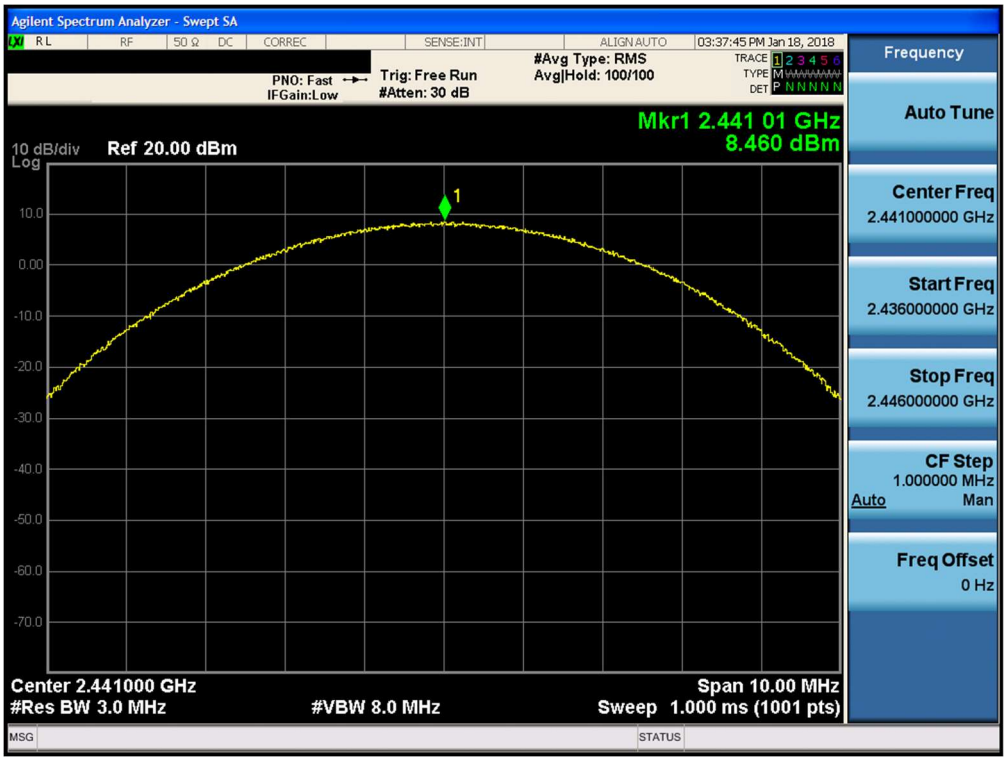
Plot 7-20. Peak Conducted Power (8DPSK, ePA – Ch. 39)



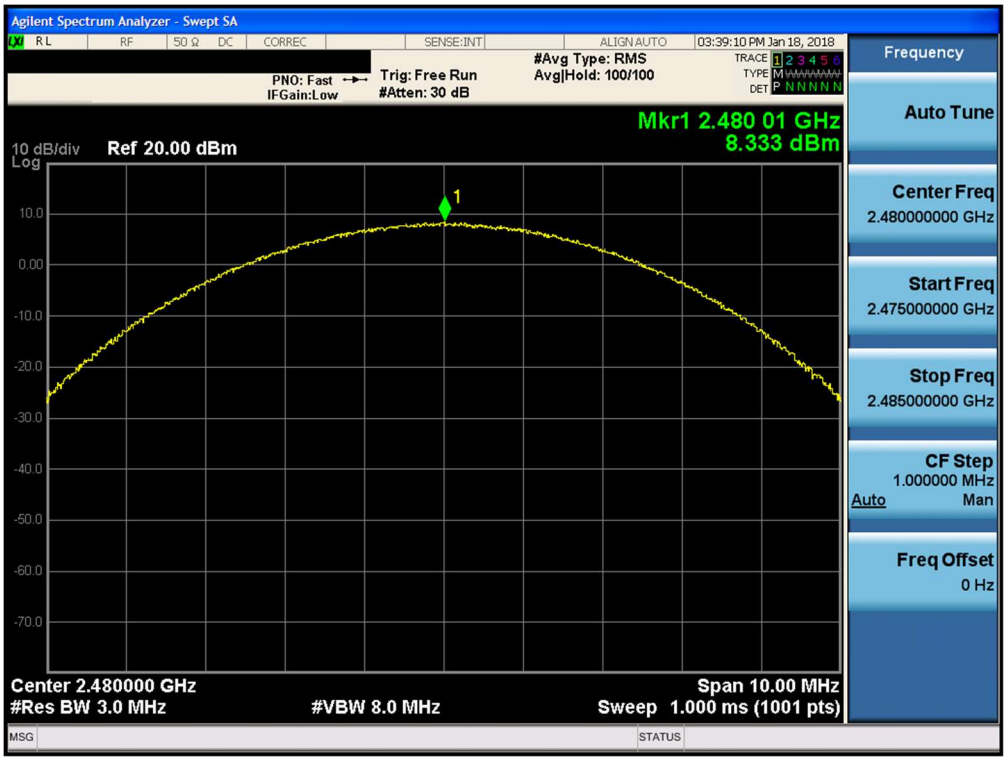
Plot 7-21. Peak Conducted Power (8DPSK, ePA – Ch. 78)



Plot 7-22. Peak Conducted Power (8DPSK, iPA – Ch. 0)



Plot 7-23. Peak Conducted Power (8DPSK, iPA – Ch. 39)



Plot 7-24. Peak Conducted Power (8DPSK, iPA – Ch. 78)

7.4 Band Edge Compliance

§15.247 (d); RSS-247 [5.5]

Test Overview and Limits

EUT operates in hopping and non-hopping transmission mode. Measurement is taken at the highest point located outside of the emission bandwidth. ***The maximum permissible out-of-band emission level is 20 dBc.***

Test Procedure Used

ANSI C63.10-2013 – Section 6.10.4

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 300kHz
5. Detector = Peak
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

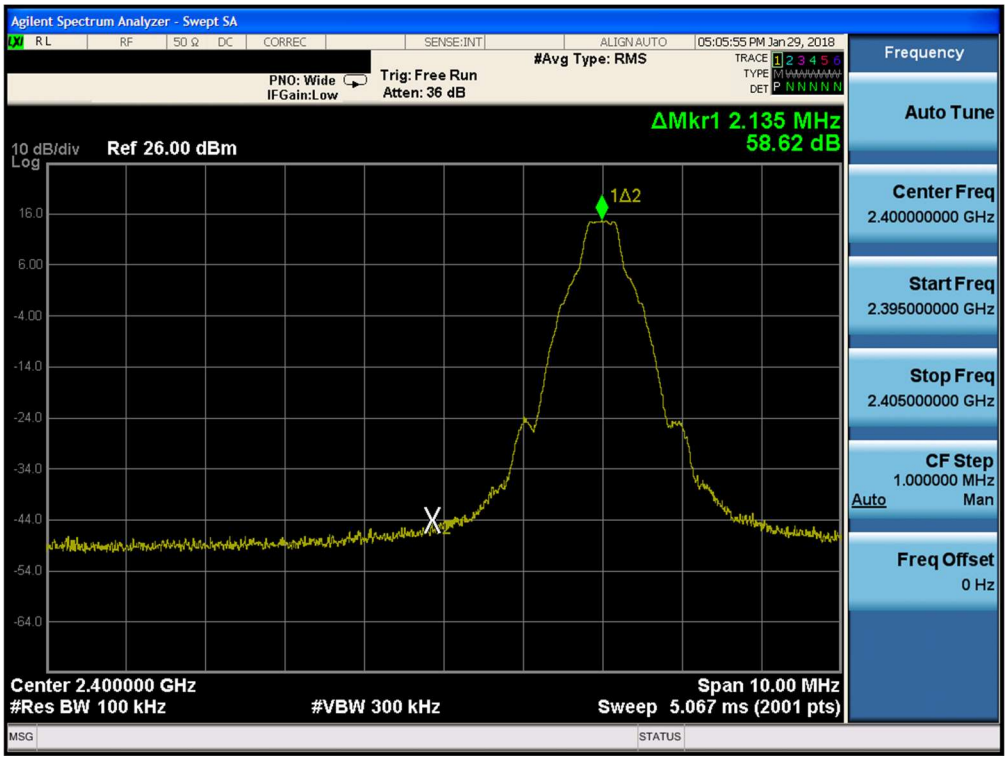
Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

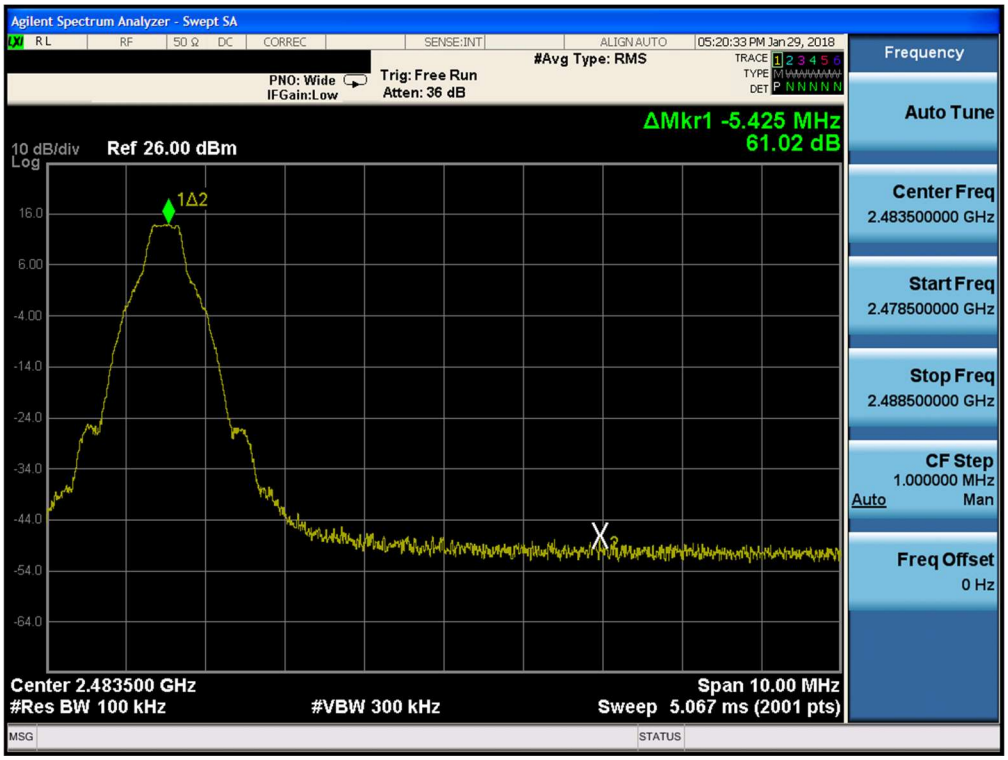
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

Out of band conducted spurious emissions at the band edge were investigated for all data rates in hopping and non-hopping modes. Band edge emissions were also investigated with the EUT transmitting in all data rates. Plots of the worst case emissions are shown below.



Plot 7-25. Band Edge Plot (Bluetooth with Hopping Disabled, GFSK, ePA – Ch. 0)



Plot 7-26. Band Edge Plot (Bluetooth with Hopping Disabled, GFSK, ePA – Ch. 78)