

74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA TEL: +82-31-645-6300 FAX: +82-31-645-6401

FCC BT REPORT Certification

Applicant Name: SAMSUNG Electronics Co., Ltd.

Address:

129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea Date of Issue: August 14, 2020

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

Report No.: HCT-RF-2008-FC032

FCC ID: A3LSMG781V **APPLICANT:** SAMSUNG Electronics Co., Ltd. Model: SM-G781V EUT Type: Mobile Phone Ant.1: 17.812 dBm (60.42 mW) Max. RF Output Power: Ant.2: 17.174 dBm (52.17 mW) **Frequency Range:** 2402 MHz - 2480 MHz (Bluetooth) Modulation type GFSK(Normal), π/4DQPSK and 8DPSK(EDR) **FCC Classification:** FCC Part 15 Spread Spectrum Transmitter

FCC Rule Part(s): Part 15 subpart C 15.247

Engineering Statement:

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



REVIEWED BY

AD

Report prepared by : Jung Ki Lim Engineer of Telecommunication Testing Center Report approved by : Jong Seok Lee Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *. The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2008-FC032	August 14, 2020	- First Approval Report



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FCC ID: A3LSMG781V

1. EUT DESCRIPTION

Model	SM-G781V				
Additional Model	-				
ЕИТ Туре	Mobile Phone				
Power Supply	DC 3.85 V				
Battery Information	Model: EB-BG781ABY Type: Li-ion Battery				
Travel Adapter Information (15W)	Model : EP-TA200 Manufacture: DONGYANG E&	P			
Travel Adapter Information (25W)	Model : EP-TA800 Manufacture: DONGYANG E&	Р			
Data Cable Information (15W)	Model : EP-DG780BWE Manufacture: KSD				
Data Cable Information (25W)	Model : EP-DG980BBE Manufacture: KSD				
Ear-jack Information	Model : GH59-15252A Manufacture: CRESYN				
Frequency Range	2 402 MHz ~ 2 480 MHz				
Max. RF Output Power	Ant.1: 17.812 dBm (60.42 mW) Ant.2: 17.174 dBm (52.17 mW)				
BT Operating Mode	Normal, EDR, AFH				
Modulation Type	GFSK(Normal), π/4DQPSK and 8DPSK(EDR)				
Modulation Technique	FHSS				
Number of Channels	79 Channels, Minimum 20 Channels(AFH)				
Antenna Specification	Ant.1Ant.2Antenna type: MetalAntenna type: LDS+ metalPeak Gain: -2.00 dBiPeak Gain: -8.02 dBi				
Date(s) of Tests July 08, 2020 ~ August 13, 2020					



ANTENNA CONFIGURATIONS for Bluetooth

1. The device employs 2 BT Antenna. Below are the possible configurations

Configurations	SISO				
Configurations	Ant1 (=Ant0 iPA)	Ant2 (=Ant1 iPA)			
Bluetooth	0	0			

Note:

- (1) O = Support, X = Not Support
- (2) SISO = Single Input Single Output
- 2. This device supports simultaneous transmission operation, which allows for two channels to operate independent of one another in the 2.4 GHz and 5 GHz bands simultaneously on each antenna.

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Bluetooth Ant.2
2.4 GHz WiFi MIMO + 5GHz WiFi	On	On	On			
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO	On	On	On	On		
2.4 GHz WiFi + 5GHz WiFi + Bluetooth		On	On		On	
2.4 GHz WiFi + 5GHz WiFi MIMO + Bluetooth		On	On	On	On	

Non-DBS	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Bluetooth Ant.2
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO + Bluetooth			On	On	On	
			On	On		On



2. Requirements for Bluetooth transmitter(15.247)

This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:

- 1) This system is hopping pseudo-randomly.
- 2) Each frequency is used equally on the average by each transmitter.
- 3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters
- 4) The receiver shifts frequencies in synchronization with the transmitted signals.

• 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.

• 15.247(h): The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.



3. TEST METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device (ANSI C63.10-2013, KDB 558074) is used in the measurement of the test device.

EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013). To record the final measurements, the analyzer detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 120 kHz for frequencies below 1 GHz or 1 MHz for frequencies above 1 GHz. For average measurements above 1 GHz, the analyzer was set to peak detector with a reduced VBW setting(RBW = 1 MHz, VBW = 1/T Hz, where T = Pulse width).

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.



4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

Espectially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil,

Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

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

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

EQUIPMENT

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

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

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

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

"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."

- (1) The antennas of this E.U.T are permanently attached.
- (2) The E.U.T Complies with the requirement of §15.203



7. 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 data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05



8. DESCRIPTION OF TESTS

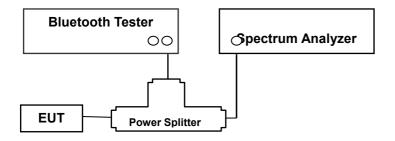
8.1. Conducted Maximum Peak Output Power

<u>Limit</u>

The maximum peak output power of the intentional radiator shall not exceed the following:

- 1. For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 nonoverlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 W. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 W.
- 2. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak detector mode. This test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.5 in ANSI 63.10-2013 & Procedure 10(b)(6)(i) in KDB 558074 v05r02)

- 1) Span: approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- 2) RBW > the 20 dB bandwidth of the emission being measured
- 3) VBW ≥ RBW
- 4) Sweep = Auto
- 5) Detector = Peak
- 6) Trace = Max hold

Sample Calculation

Output Power = Spectrum Reading Power + Power Splitter loss + Cable loss(2 ea)

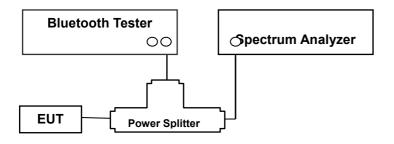
= 10 dBm + 6 dB + 1.5 dB = 17.5 dBm

8.2. Conducted Band Edge(Out of Band Emissions)

<u>Limit</u>

According to §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.

Test Configuration



Test Procedure

This test is performed with hopping off and hopping on.

The Spectrum Analyzer is set to (6.10.4 in ANSI 63.10-2013 & Procedure 8.5 and 8.6 in KDB 558074 v05r02)

- 1) 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
- Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
- 3) Attenuation: Auto (at least 10 dB preferred).
- 4) Sweep time: Coupled.
- 5) RBW: 100 kHz
- 6) VBW: 300 kHz
- 7) Detector: Peak
- 8) Trace: Max hold

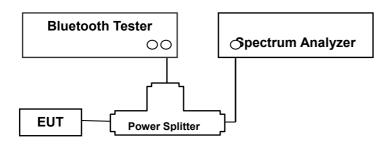


8.3. Frequency Separation & 20 dB Bandwidth

<u>Limit</u>

According to §15.247(a)(1), 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.

Test Configuration



Test Procedure(Frequency Separation)

The Channel Separation test is performed with hopping on.

And the 20 dB Bandwidth test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.2 in ANSI 63.10-2013 & Procedure 10(b)(6)(iii) in KDB 558074 v05r02)

- 1) Span: Wide enough to capture the peaks of two adjacent channels
- 2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- 3) VBW ≥ RBW
- 4) Sweep: Auto
- 5) Detector: Peak
- 6) Trace: Max hold
- 7) All the trace to stabilize.
- 8) Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.



Test Procedure (20 dB Bandwidth)

And the 20 dB Bandwidth test is performed with hopping off.

The Spectrum Analyzer is set to (6.9.2 in ANSI 63.10-2013)

- 1) Span: Set between two times and five times the OBW
- 2) RBW: 1% to 5% of the OBW.
- 3) VBW \ge 3 x RBW
- 4) Sweep: Auto
- 5) Detector: Peak
- 6) Trace: Max hold
- 7) All the trace to stabilize.

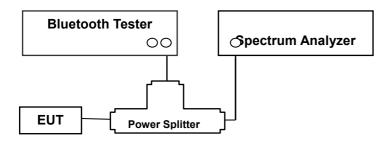


8.4. Number of Hopping Frequencies

<u>Limit</u>

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration



Test Procedure

The Bluetooth frequency hopping function of the EUT was enabled.

The Spectrum Analyzer is set to (7.8.3 in ANSI 63.10-2013 & Procedure 10(b)(4) in KDB 558074 v05r02)

- 1) Span: the frequency band of operation
- 2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- 3) VBW ≥ RBW
- 4) Sweep: Auto
- 5) Detector: Peak
- 6) Trace: Max hold
- 7) Allow the trace to stabilize.

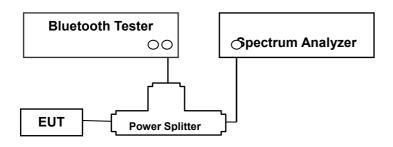


8.5. Time of Occupancy

<u>Limit</u>

According to \$15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

Test Configuration



Test Procedure

This test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.4 in ANSI 63.10-2013 & Procedure 10(b)(6)(iv) in KDB 558074 v05r02)

- 1) Span: Zero span, centered on a hopping channel
- RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- 3) Sweep = as necessary to capture the entire dwell time per hopping channel
- 4) Detector: Peak
- 5) Trace: Max hold

The marker-delta function was used to determine the dwell time.



Sample Calculation

The following calculation process is not relevant to our measurement results. It is just an example.

- (1) Non-AFH Mode
- DH 5 (GFSK) : 2.890 x (1600/6)/79 x 31.6 = 308.27 (ms)
- 2-DH 5 (π/4DQPSK) : 2.890 x (1600/6)/79 x 31.6 = 308.27 (ms)
- 3-DH 5 (8DPSK) : 2.890 x (1600/6)/79 x 31.6 = 308.27 (ms)
- (2) AFH Mode
- DH 5 (GFSK) : 2.890 x (800/6)/20 x 8.0 = 154.13 (ms)
- 2-DH 5 (π/4DQPSK) : 2.890 x (800/6)/20 x 8.0 = 154.13 (ms)
- 3-DH 5 (8DPSK) : 2.890 x (800/6)/20 x 8.0 = 154.13 (ms)

Note :

DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving.

Then the system makes worst case 1600/6 hops per second with 79 channels. So the system have each channel 3.3755 times per second and so for 31.6 seconds the system have 106.667 times of appearance. Each tx-time per appearance of DH5 is 2.890 ms.

Dwell time = Tx-time x 106.667 = 308.27 (ms)

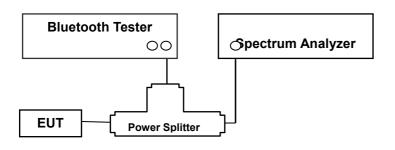


8.6. Conducted Spurious Emissions

<u>Limit</u>

Conducted > 20 dBc

Test Configuration



Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer.

The Spectrum Analyzer is set to (7.8.8 in ANSI 63.10-2013 & Procedure 8.5 and 8.6 in KDB 558074 v05r02)

- 1) Span: 30 MHz to 10 times the operating frequency in GHz.
- 2) RBW: 100 kHz
- 3) VBW: 300 kHz
- 4) Sweep: Coupled
- 5) Detector: Peak

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

This test is performed with hopping off.



Factors for frequency

Freq(MHz)	Factor(dB)
30	6.14
100	6.22
200	6.30
300	6.40
400	6.46
500	6.49
600	6.49
700	6.53
800	6.55
900	6.59
1000	6.61
2000	6.88
2400	6.97
2500	6.99
3000	7.09
4000	7.25
5000	7.44
6000	7.51
7000	7.66
8000	7.78
9000	7.90
10000	8.04
11000	8.12
12000	8.28
13000	8.47
14000	8.41
15000	8.51
16000	8.56
17000	8.63
18000	8.75
19000	8.81
20000	8.89
21000	9.18
22000	9.24
23000	9.27
24000	9.35
25000	9.48
26000	9.58

Note : 1. 2400 ~ 2500 MHz is fundamental frequency range.

2. Factor = Cable loss(2 EA) + Splitter loss(6 dB) + EUT Cable loss(1 EA)

3. Exten cable loss = 0.2 dB



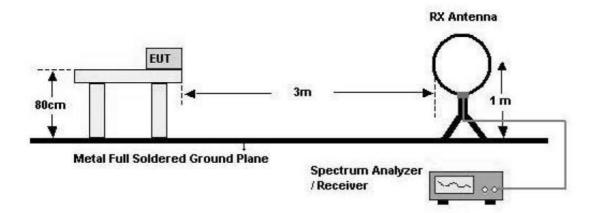
8.7. Radiated Test

<u>Limit</u>

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

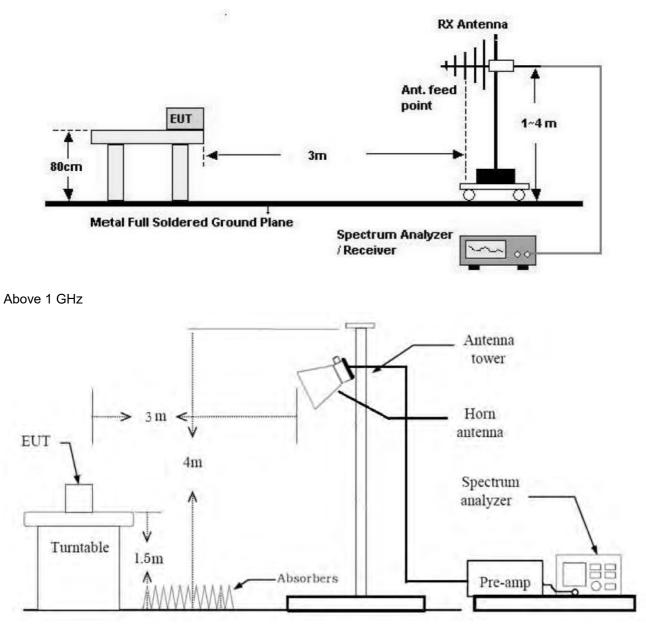
Test Configuration

Below 30 MHz





30 MHz - 1 GHz



Test Procedure of Radiated spurious emissions(Below 30 MHz)

- 1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
- 2. The loop antenna was placed at a location 3m from the EUT
- 3. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
- 5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 6. Distance Correction Factor(0.009 MHz 0.490 MHz) = 40log(3 m/300 m) = 80 dB Measurement Distance : 3 m
- 7. Distance Correction Factor(0.490 MHz 30 MHz) = 40log(3 m/30 m) = 40 dB Measurement Distance : 3 m



- 8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW ≥ 3 x RBW

9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

KDB 414788 OFS and Chamber Correlation Justification

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

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Test Procedure of Radiated spurious emissions(Below 1GHz)

- 1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
- 2. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
- 4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
- 5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW ≥ 3 x RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
 - % In general, (1) is used mainly
- 7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
- 8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.



Test Procedure of Radiated spurious emissions (Above 1 GHz)

- 1. Radiated test is performed with hopping off.
- 2. The EUT is placed on a turntable, which is 1.5 m above ground plane.
- 3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
- 4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 5. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 8. The unit was tested with its standard battery.
- 9. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 1 GHz 25 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW \ge 3 x RBW
 - (2) Measurement Type(Average):
 - We performed using a reduced video BW method was done with the analyzer in linear mode
 - Measured Frequency Range : 1 GHz 25 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW \ge 1/T Hz, where T = pulse width in seconds
 - The actual setting value of VBW = 1 kHz
- 10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
- 11. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
- 12. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) Amp Gain(A.G) + Distance Factor(D.F)



Test Procedure of Radiated Restricted Band Edge

- 1. Radiated test is performed with hopping off.
- 2. The EUT is placed on a turntable, which is 1.5 m above ground plane.
- 3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
- 4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 5. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out

the highest emissions.

- 6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7. The unit was tested with its standard battery.
- 8. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW \ge 3 x RBW
 - (2) Measurement Type(Average):
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW \ge 1/T Hz, where T = pulse width in seconds

The actual setting value of VBW = 1 kHz

- 9. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
- 10. Total

```
= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
```

11. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.



8.8. AC Power line Conducted Emissions

<u>Limit</u>

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dBµV)				
	Quasi-peak	Average			
0.15 to 0.50	66 to 56 ^(a)	56 to 46 ^(a)			
0.50 to 5	56	46			
5 to 30	60	50			

^(a)Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

Test Procedure

- 1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
- 2. The EUT is connected via LISN to a test power supply.
- 3. The measurement results are obtained as described below:
- 4. Detectors : Quasi Peak and Average Detector.
- 5. The EUT is the device operating below 30 MHz.
 - For unterminated the Antenna, the AC line conducted tests are performed with the antenna connected
 - For terminated the Antenna, the AC line conducted tests are performed with a dummy load connected to the EUT antenna output terminal.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor



8.9. Worst case configuration and mode

Radiated test

- 1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone, Stand alone + External accessories (Earphone, etc)
 - Worstcase : Stand alone
- 2. EUT Axis
 - Radiated Spurious Emissions : X,Y
 - Radiated Restricted Band Edge : X

3. All data rate of operation were investigated and the test results are worst case in highest datarate of each mode.

- GFSK : DH5
- π/4DQPSK : 2-DH5
- 8DPSK : 3-DH5
- 4. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
 - Position : Horizontal, Vertical, Parallel to the ground plane



Radiated test(DBS)

- 1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
 - Worstcase : Stand alone
- 2. EUT Axis
 - Radiated Spurious Emissions : Y
- 3. Test case

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Bluetooth Ant.2	Test case
2.4 GHz WiFi MIMO + 5GHz WiFi	On	On	On				-
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO	On	On	On	On			Case 1
2.4 GHz WiFi + 5GHz WiFi + Bluetooth		On	On		On		-
2.4 GHz WiFi + 5GHz WiFi MIMO + Bluetooth		On	On	On	On		Case 2

Non-DBS	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Bluetooth Ant.2	Test case
2.4 GHz WiFi MIMO + 5GHz WiFi			On	On	On		-
MIMO + Bluetooth			On	On		On	Case 3



4. The following tables show the worst case configurations determined during testing.
(Worst case: The lowest margin condition the channels and modes were selected for test.)
(Test case 1 Result : Please refer to the SM-G781V [DTS], [UNII] Test Report.)

Test case Bluetooth Emission Description 2.4 GHz Emission **5 GHz Emission** Ant 1 Ant 2 Ant All Antenna Channel 11 165 78 2 Data Rate 1 Mbps 6 Mbps 1 Mbps DH-5 Mode 802.11b 802.11a

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
	Antenna	-	Ant All	Ant 2
2	Channel	-	165	78
3	Data Rate	-	6 Mbps	1 Mbps
	Mode	-	802.11a	DH-5

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.

- Mode : Stand alone + External accessories(Earphone, etc)+Travel Adapter

Stand alone + Travel Adapter

- Worstcase : Stand alone + Travel Adapter

Conducted test

- 1. The EUT was configured with data rate of highest power.
 - GFSK : DH5
 - $\pi/4DQPSK$: 2-DH5
 - 8DPSK : 3-DH5
- 2. AFH & Non-AFH were tested and the worst case results are reported. (Worst case : Non-AFH)



9. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	§15.247(a)(1)	N/A		PASS
Occupied Bandwidth	N/A	N/A		N/A
Conducted Maximum Peak Output Power	§15.247(b)(1)	< 0.125 W		PASS
Carrier Frequency Separation	§15.247(a)(1)	> 25 kHz or >2/3 of the 20dB BW	-	PASS
Number of Hopping Frequencies	§15.247(a)(1)(iii)		5 Conducted	
Time of Occupancy	§15.247(a)(1)(iii)	< 400 ms		PASS
Conducted Spurious Emissions	§15.247(d)	> 20 dB for all out-of band emissions		PASS
Band Edge (Out of Band Emissions)	§15.247(d)	> 20 dB for all out-of band emissions		PASS
AC Power line Conducted Emissions	§15.207(a)	cf. Section 8.8		PASS
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 8.7	Dedicted	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.7	- Radiated	PASS



10. TEST RESULT

10.1 PEAK POWER

[Ant.1]

Channel	Frequency (MHz)	Outpu (Gl	Limit (mW)	
	(141112)	(dBm)	(mW)	(11100)
Low	2402	15.526	35.69	
Mid	2441	17.399	54.94	125
High	2480	14.886	30.80	

Channel	Frequency	Outpu (8D	Limit	
	(MHz)	(dBm)	(mW)	(mW)
Low	2402	15.973	39.56	
Mid	2441	17.812	60.42	125
High	2480	15.302	33.90	

Channel	Frequency	Output Power (π/4DQPSK)		Limit
	(MHz)	(dBm)	(mW)	(mW)
Low	2402	15.526	35.69	
Mid	2441	17.422	55.23	125
High	2480	14.886	30.80	



[Ant.2]

Channel (MHz)		Outpu (GF	Limit (mW)	
	()	(dBm)	(mW)	()
Low	2402	15.338	34.18	
Mid	2441	16.813	48.01	125
High	2480	14.329	27.10	

Channel	Frequency	Outpu (8D	Limit	
	(MHz)	(dBm)	(mW)	(mW)
Low	2402	15.816	38.16	
Mid	2441	17.174	52.17	125
High	2480	14.717	29.63	

Channel	Frequency	Outpu (π/4D	Limit	
	(MHz)	(dBm)	(mW)	(mW)
Low	2402	15.347	34.25	
Mid	2441	16.794	47.80	125
High	2480	14.341	27.17	

Note:

1. Spectrum reading values are not plot data.

The power results in plot is already including the actual values of loss for the splitter and cable combination.

2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.

Actual value of loss for the splitter and cable combination is 7.17 dB at 2400 MHz and is 7.19 dB at 2500 MHz.

So, 7.19 dB is offset. And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.



[Ant.1]

Test Plots (GFSK) Peak Power (CH.0)

	ectrum Analyzer - Swept SA					
Center F	RF 50 Ω DC req 2.402000000	GHz	SENSE:INT	#Avg Type: RM	S TRACE	456 Frequency
		PNO: Fast ++ IFGain:Low	Trig: Free Run Atten: 24 dB	Avg Hold: 1/1		PPP
10 dB/div Log	Ref Offset 7.19 dB Ref 20.00 dBm				Mkr1 2.401 98 0 15.526 d	3 1 2
10.0						Center Freq 2.402000000 GHz
-10.0						Start Freq 2.397000000 GHz
-20.0						Stop Freq 2.407000000 GHz
-40.0						CF Step 1.000000 MHz <u>Auto</u> Man
-60.0						Freq Offset 0 Hz
-70.0						Scale Type
Center 2./ #Res BW	402000 GHz 3.0 MHz	#VBW	50 MHz	Swee	Span 10.00 p 1.000 ms (1001	MHz ^{Log <u>Lin</u> pts)}
MSG					STATUS	

Test Plots (GFSK) Peak Power (CH.39)

Keysight Spectrum Analyzer - Swept SA					- đ 🗙
RL RF 50 Ω DC Center Freq 2.441000000	GHz	#Avg Type	: RMS TRAC	M Aug 03, 2020 DE 1 2 3 4 5 6 DE M WWWWW	Frequency
	PNO: Fast +++ Trig: Free IFGain:Low Atten: 24			PPPPP	
Ref Offset 7.19 dB 10 dB/div Ref 20.00 dBm			Mkr1 2.441 17.3	02 GHz 99 dBm	Auto Tune
10.0		1		2	Center Freq .441000000 GHz
-10.0				2	Start Freq 436000000 GHz
-20.0					Stop Freq 446000000 GHz
-30.0					
-40.0				Aut	CF Step 1.000000 MHz <u>o</u> Man
-60.0					Freq Offset
-70.0					0 Hz
					Scale Type
Center 2.441000 GHz #Res BW 3.0 MHz	#VBW 50 MHz	9	Span 1 weep 1.000 ms (0.00 MHz Log 1001 pts)	y <u>Lin</u>
MSG			STATUS		



Test Plots (GFSK) Peak Power (CH.78)

Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω DC Center Freq 2.480000000 Center Freq 2.480000000 Center Freq 2.480000000 Center Freq 2.4800000000 Center Freq 2.4800000000 Center Freq 2.48000000000 Center Freq 2.4800000000 Center Freq 2.48000000000 Center Freq 2.48000000000 Center Freq 2.48000000000000000000 Center Freq 2.48000000000000000000000000000000000000		ALIGN AUTO #Avg Type: RMS Avg Hold: 1/1	02:05:29 PM Aug 03, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
Ref Offset 7.19 dB 10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 24 dB	-	¹ 2.479 98 GHz 14.886 dBm	Auto Tune
10.0				Center Freq 2.480000000 GHz
-10.0				Start Freq 2.475000000 GHz
-20.0				Stop Fred 2.485000000 GHz
-40.0				CF Step 1.000000 MH: <u>Auto</u> Mar
-60.0				Freq Offse 0 H:
-70.0				Scale Type
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW 50 MHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	Log <u>Lin</u>
MSG		STATU		

Test Plots (8DPSK) Peak Power (CH.0)





Test Plots (8DPSK)

Peak Power (CH.39)



Test Plots (8DPSK) Peak Power (CH.78)

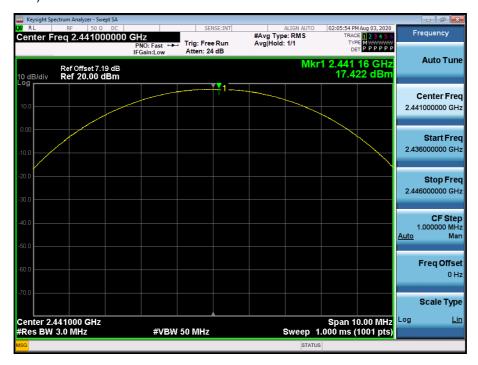




Test Plots (π/4DQPSK) Peak Power (CH.0)

	ectrum Analyzer - Swept SA					- 7
X RL Center F	RF 50 Ω DC req 2.402000000		Trig: Free Run	ALIGN AU #Avg Type: RMS Avg Hold: 1/1	TO 02:05:41 PM Aug 03, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW	Frequency
		PNO: Fast ++ IFGain:Low	Atten: 24 dB	Avg Hold: 1/1	DET	
10 dB/div Log	Ref Offset 7.19 dB Ref 20.00 dBm			N	18 1 2.402 04 GHz 15.526 dBm	Auto Tun
			1			Center Fre
10.0						2.402000000 GH
0.00						Start Fre 2.397000000 GH
-10.0						2.397000000 GF
20.0						Stop Fre 2.407000000 GH
30.0						2.407000000 GI
40.0						CF Ste 1.000000 MH
50.0						<u>Auto</u> Ma
60.0						Freq Offs
70.0						
						Scale Typ
Center 2.4 #Res BW	402000 GHz 3.0 MHz	#VBW	/ 50 MHz	Swee	Span 10.00 MHz p 1.000 ms (1001 pts)	Log <u>L</u>
ISG					TATUS	

Test Plots (π/4DQPSK) Peak Power (CH.39)





Test Plots (π/4DQPSK) Peak Power (CH.78)

Keysight Spectrum Analyzer - Swept SA						
Image: RL RF 50 Ω DC Center Freq 2.480000000	GHz	#Avg Type	RMS TRAC	M Aug 03, 2020 DE 1 2 3 4 5 6 PE M WWWWWW	Frequency	
	PNO: Fast +++ Trig: Free IFGain:Low Atten: 24			PPPPP		
Ref Offset 7.19 dB 10 dB/div Ref 20.00 dBm			Mkr1 2.479 14.8	78 GHz 86 dBm	Auto Tune	
	↓ 1				Center Freq	
10.0					2.480000000 GHz	
0.00						
					Start Freq 2.475000000 GHz	
-10.0					2.47000000000112	
-20.0					Stop Freq	
-30.0					2.485000000 GHz	
					CF Step	
-40.0					1.000000 MHz	
-50.0					<u>Auto</u> Man	
					Freq Offset	
-60.0					0 Hz	
-70.0				!	Scale Type	
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW 50 MHz		Span 1 Sweep 1.000 ms (0.00 MHz (1001 pts)	Log <u>Lin</u>	
MSG						



[Ant.2]

Test Plots (GFSK) Peak Power (CH.0)

	ectrum Analyzer - Swept SA					
Center F	RF 50 Ω DC req 2.402000000	GHz	SENSE:INT	ALIGN AL #Avg Type: RMS	TRACE 1 2 3 4 5 6	Frequency
Conton	100 2.40200000	PNO: Fast ++ IFGain:Low	 Trig: Free Run Atten: 24 dB 	Avg Hold: 1/1		Auto Tune
10 dB/div Log	Ref Offset 7.19 dB Ref 20.00 dBm			N	lkr1 2.402 07 GHz 15.338 dBm	Auto Tune
10.0			<u> </u>			Center Freq 2.402000000 GHz
-10.0						Start Freq 2.397000000 GHz
-20.0						Stop Freq 2.407000000 GHz
-40.0						CF Step 1.000000 MHz <u>Auto</u> Man
-60.0						Freq Offset 0 Hz
-70.0						Scale Type
Center 2.4 #Res BW	402000 GHz 3.0 MHz	#VBW	50 MHz	Swee	Span 10.00 MHz p 1.000 ms (1001 pts)	Log <u>Lin</u>
MSG				ST	TATUS	

Test Plots (GFSK) Peak Power (CH.39)

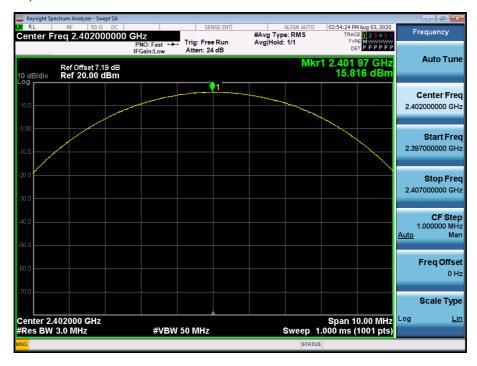
Keysight Spectrum Analyzer - Swept SA					
RL RF 50 Ω DC Center Freq 2.441000000	GHz	#Avg Type	e: RMS TRAC	M Aug 03, 2020 CE 1 2 3 4 5 6 PE M WWWWW	Frequency
Ref Offset 7.19 dB	PNO: Fast +++ Trig: Free IFGain:Low Atten: 24		Mkr1 2.441	T P P P P P	Auto Tune
10.0		1			Center Freq 2.441000000 GHz
-10.0					Start Freq 2.436000000 GHz
-20.0					Stop Freq 2.446000000 GHz
-40.0				Α	CF Step 1.000000 MHz uto Man
-60.0					Freq Offset 0 Hz
-70.0					Scale Type
Center 2.441000 GHz #Res BW 3.0 MHz	#VBW 50 MHz		Span 1 Sweep 1.000 ms (0.00 MHz	og <u>Lin</u>
MSG			STATUS		



Test Plots (GFSK) Peak Power (CH.78)

Keysight Spectrum Analyzer - Swept SA					- J J
RL RF 50Ω DC Center Freq 2.480000000	GHz	#Avg Typ	e: RMS TRA	M Aug 03, 2020 CE 1 2 3 4 5 6	Frequency
Ref Offset 7.19 dB	PNO: Fast +++ Trig: Free IFGain:Low Atten: 24		Mkr1 2.480		Auto Tune
10 dB/div Ref 20.00 dBm			14.3	29 dBm	
10.0					Center Freq 2.48000000 GHz
0.00					Start Freq 2.475000000 GHz
-20.0					Stop Freq 2.485000000 GHz
-40.0					CF Step 1.000000 MH; uto Mar
-50.0					Freq Offse
-70.0					0 H: Scale Type
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW 50 MHz		Span 1 Sweep 1.000 ms	10.00 MHz (1001 pts)	
ISG .			STATUS		

Test Plots (8DPSK) Peak Power (CH.0)





Test Plots (8DPSK)

Peak Power (CH.39)



Test Plots (8DPSK) Peak Power (CH.78)





Test Plots (π/4DQPSK) Peak Power (CH.0)

	ectrum Analyzer - Swept SA							- J -
XI RL Center F	RF 50 Ω DC	0 GHz	Trig: Free R	#Avg T	ALIGN AUTO	02:53:48 PM TRACE	123456	Frequency
10 dB/div	Ref Offset 7.19 dB Ref 20.00 dBm	PNO: Fast ↔ IFGain:Low	Atten: 24 dl			1 2.401	91 GHz 7 dBm	Auto Tune
10.0		~						Center Fre 2.402000000 GH
-10.0								Start Fre 2.397000000 GH
-20.0								Stop Fre 2.407000000 GH
-40.0								CF Ste 1.000000 M⊢ <u>Auto</u> Ma
60.0								Freq Offse 0 ⊢
-70.0								Scale Typ
Center 2.4 #Res BW	402000 GHz 3.0 MHz	#VBV	/ 50 MHz		Sweep 1	Span 10 000 ms (1.		Log <u>Li</u>
<mark>//SG</mark>					STATUS	5		

Test Plots (π/4DQPSK) Peak Power (CH.39)





Test Plots (π/4DQPSK) Peak Power (CH.78)

Keysight Spectrum Analyzer - Swept SA					
Center Freq 2.48000000	0 GHz	#Avg Type	: RMS TRAC	Aug 03, 2020 E 1 2 3 4 5 6 E M WWWWW	Frequency
	PNO: Fast +++ Trig: Free IFGain:Low Atten: 24		DE	ТРРРРР	Auto Tune
Ref Offset 7.19 dB 10 dB/div Ref 20.00 dBm			Mkr1 2.479 14.3	87 GHz 41 dBm	Auto Tune
					Center Freq
10.0					2.480000000 GHz
0.00					Start Freq
-10.0					2.475000000 GHz
-20.0					Stop Fred
-30.0					2.485000000 GHz
-30.0					
-40.0					CF Step 1.000000 MHz ito Mar
-50.0				Au	ito Man
-60.0					Freq Offset
					0 Hz
-70.0					Scale Type
Center 2.480000 GHz			Span 1	0.00 MHz Lº	g <u>Lin</u>
#Res BW 3.0 MHz	#VBW 50 MHz	9	weep 1.000 ms (1001 pts)	
MSG			STATUS		



10.2 BAND EDGES

[Ant.1]

Without hopping

Outside Frequency Band	GFSK	8DPSK	π/4DQPSK	Limit	
Outside Frequency Band	(dB)	(dB)	(dB)	(dBc)	
Lower	60.107	60.339	59.830	00	
Upper	68.044	67.786	68.553	- 20	

With hopping

Outside Frequency Band	GFSK	8DPSK	π/4DQPSK	Limit	
Outside Frequency Band	(dB)	(dB)	(dB)	(dBc)	
Lower	58.626	53.269	58.543	20	
Upper	59.639	58.802	58.587	- 20	



[Ant.2]

Without hopping

Outside Frequency Band	GFSK	8DPSK	π/4DQPSK	Limit	
Outside Frequency Band	(dB)	(dB)	(dB)	(dBc)	
Lower	59.632	60.195	59.653	00	
Upper	67.535	68.048	65.339	- 20	

With hopping

Outoido Eroqueney Pand	GFSK	8DPSK	π/4DQPSK	Limit	
Outside Frequency Band	(dB)	(dB)	(dB)	(dBc)	
Lower	58.791	59.375	57.529	- 20	
Upper	58.172	55.165	55.947		

Note :

1. Spectrum reading values are not plot data.

The power results in plot is already including the actual values of loss for the splitter and cable combination.

2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.

Actual value of loss for the splitter and cable combination is 7.17 dB at 2400 \mbox{MHz}

and is 7.19 dB at 2500 MHz.

So, 7.19 dB is offset. And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.

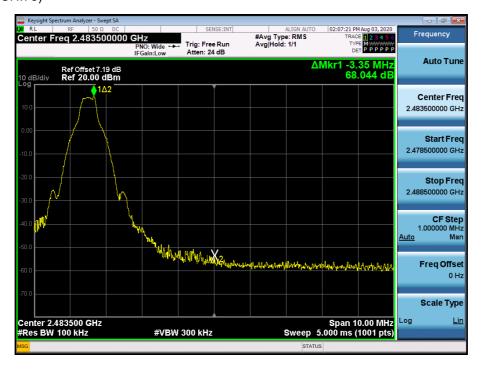


[Ant.1]

Test Plots without hopping (GFSK) Band Edges (CH.0)



Test Plots without hopping (GFSK) Band Edges (CH.78)



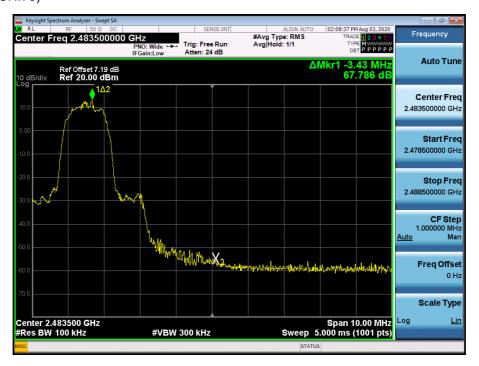


Test Plots without hopping (8DPSK)

Band Edges (CH.0)



Test Plots without hopping (8DPSK) Band Edges (CH.78)



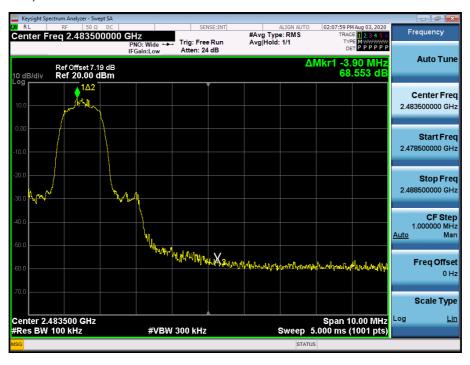


Test Plots without hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots without hopping (π /4DQPSK) Band Edges (CH.78)





Test Plots with hopping (GFSK) Band Edges (CH.0)



Test Plots with hopping (GFSK) Band Edges (CH.78)





Test Plots with hopping (8DPSK)

Band Edges (CH.0)



Test Plots with hopping (8DPSK) Band Edges (CH.78)





Test Plots with hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots with hopping (π /4DQPSK) Band Edges (CH.78)



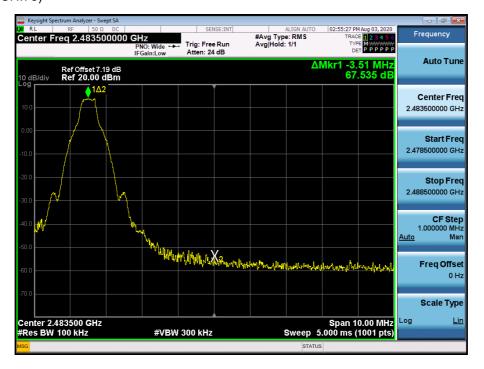


[Ant.2]

Test Plots without hopping (GFSK) Band Edges (CH.0)



Test Plots without hopping (GFSK) Band Edges (CH.78)





Test Plots without hopping (8DPSK)

Band Edges (CH.0)



Test Plots without hopping (8DPSK) Band Edges (CH.78)





Test Plots without hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots without hopping (π /4DQPSK) Band Edges (CH.78)





Test Plots with hopping (GFSK) Band Edges (CH.0)



Test Plots with hopping (GFSK) Band Edges (CH.78)





Test Plots with hopping (8DPSK)

Band Edges (CH.0)



Test Plots with hopping (8DPSK) Band Edges (CH.78)





Test Plots with hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots with hopping (π /4DQPSK) Band Edges (CH.78)





10.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)

[Ant.1]

99% BW (kHz)					
Channel	GFSK	8DPSK	π/4DQPSK		
CH.0	830.00	1178.1	1173.4		
CH.39	831.97	1177.4	1177.1		
CH.78	832.16	1179.0	1174.2		

20dB BW (kHz)						
Channel	GFSK	8DPSK	π/4DQPSK			
CH.0	944.7	1305	1319			
CH.39	944.6	1305	1321			
CH.78	944.6	1305	1321			

	Limit		
GFSK	8DPSK	π/4DQPSK	(kHz)
			>25 kHz
998	993	999	or
			>2/3 of the 20dB BW



[Ant.2]

99% BW (kHz)										
ChannelGFSK8DPSKπ/4DQPSK										
CH.0	833.27	1177.6	1174.6							
CH.39	833.48	1178.1	1179.5							
CH.78	832.64	1179.1	1175.1							

20dB BW (kHz)											
Channel GFSK 8DPSK π/4DQPSK											
CH.0	944.7	1304	1321								
CH.39	944.2	1305	1320								
CH.78	943.5	1305	1321								

	Limit					
GFSK	GFSK 8DPSK π/4DQPSK					
			>25 kHz			
998	961	961	or			
			>2/3 of the 20dB BW			



[Ant.1]

Test Plots (GFSK)

Channel Separation

Keysight Spectrum Analyzer - Swept SA				- 8 💌
Center Freq 2.441000000	GHz PNO: Wide ↔ Trig: Free Run	ALIGN AUTO #Avg Type: RMS Avg Hold: 1/1	09:17:46 AM Aug 04, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P P P P P P	Frequency
Ref Offset 7.19 dB 10 dB/div Ref 27.19 dBm	IFGain:Low #Atten: 30 dB		ΔMkr3 998 kHz -0.068 dB	Auto Tune
17.2 7.19 -2.81	1Δ: 		3∆4 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Center Fred 2.441000000 GH
-12.8 -22.8 -32.8				Start Free 2.439500000 GH
-42.8				Stop Fre 2.442500000 GH
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kHz		Span 3.000 MHz 1.558 ms (900 pts)	CF Ste 300.000 kH <u>Auto</u> Ma
2 F 1 f 2.439 3 Δ4 1 f (Δ)	1.038 MHz (Δ) -0.029 dB 9 984 GHz 14.457 dBm 998 kHz (Δ) -0.068 dB 1 022 GHz 14.428 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse 0 H
7 8 9 9 9 9 10 11 1 1 1 1 1 1 1 1 1 1 1 1 1				Scale Type
 Isg File <aaa.png> saved</aaa.png> 	III	STATUS	3	

Test Plots (8DPSK) Channel Separation

🔤 Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω DC Center Freg 2.441000000 G	SENSE:INT	#Avg Type: RMS	9:26:28 AM Aug 04, 2020 TRACE 1 2 3 4 5 6	Frequency
•	PNO: Wide ↔ Trig: Free Run IFGain:Low #Atten: 30 dB	Avg Hold: 1/1	TYPE MWWWWW DET P P P P P P	Auto Tune
10 dB/div Ref 27.19 dBm			0.502 dB	
17.2 7.19 -2.81	11 <u>2</u> 2	mmmm	304	Center Freq 2.441000000 GHz
-12.8 -22.8 -32.8				Start Freq 2.439500000 GHz
-42.8 -52.8 -62.8				Stop Freq 2.442500000 GHz
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kHz	Sweep 1.5	pan 3.000 MHz 58 ms (900 pts)	CF Step 300.000 kHz Auto Man
MKR MODE TRC SCL X	Y FUNC 001 MHz (Δ) -0.108 dB	TION FUNCTION WIDTH	FUNCTION VALUE	<u>rato</u> mari
2 F 1 f 2.4399 $3 \Delta 4 1 f (\Delta)$	997 GHz 12.513 dBm 993 kHz (Δ) 0.502 dB 000 GHz 11.899 dBm			Freq Offset 0 Hz
7 8 9 9 10				Scale Type
MSG		STATUS		



Test Plots (π/4DQPSK)

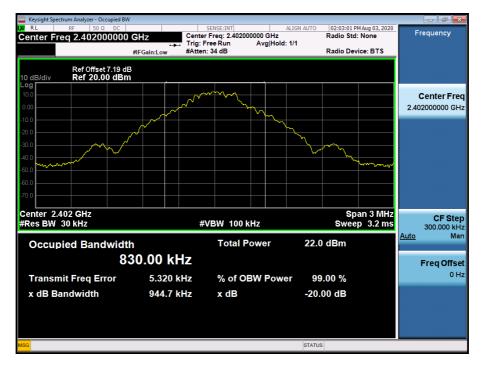
Channel Separation

Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω DC Center Freq 2.441000000		NSE:INT A #Avg Type		Aug 04, 2020 12 3 4 5 6 Frequency
	PNO: Wide +++ Trig: Fre IFGain:Low #Atten: 3	e Run Avg Hold:	1/1 TYP	
Ref Offset 7.19 dB 10 dB/div Ref 27.19 dBm Log				99 kHz 639 dB
17.2 7.19 -2.81	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	,1∆2 4	3∆4	2.441000000 GHz
-12.8 -22.8 -32.8				Start Freq 2.439500000 GHz
-42.8 -52.8 -62.8				Stop Freq 2.442500000 GHz
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kHz		Sweep 1.558 ms	Auto Man
3 Δ4 1 f (Δ)	Υ Υ 1.004 MHz (Δ) -0.128 39 994 GHz 12.456 d 999 kHz 999 kHz (Δ) 1.639 41 000 GHz 12.299 d 12.299 d	dB Bm dB	TION WIDTH FUNCTIO	NVALUE Freq Offset 0 Hz
6 7 8 9 10				Log Lin
MSG	m		STATUS	•



Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (GFSK) 20 dB Bandwidth & Occupied Bandwidth (CH.39)





Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)



Test Plots (8DPSK) 20 dB Bandwidth & Occupied Bandwidth (CH.0)





Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)



Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)





Test Plots (π /4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (π/4DQPSK)

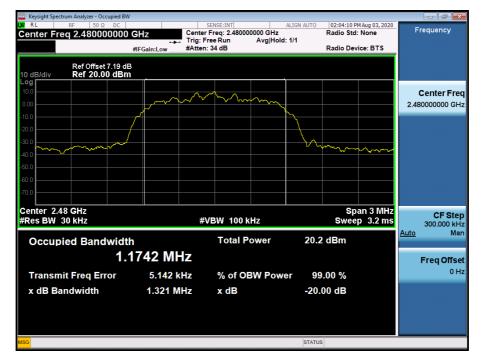
20 dB Bandwidth & Occupied Bandwidth (CH.39)





Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)





[Ant.2]

Test Plots (GFSK)

Channel Separation

Keysight Spectrum Analyzer - Swept SA				
X RL RF 50 Ω DC Center Freq 2.441000000	CHZ PNO: Wide ↔ Trig: Free Run	ALIGN AUTO #Avg Type: RMS Avg Hold: 1/1	05:15:00 PM Aug 03, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
Ref Offset 7.19 dB 10 dB/div Ref 27.19 dBm	IFGain:Low #Atten: 30 dB	Δι	DET PPPPPP Mkr3 1.001 MHz 0.043 dB	Auto Tune
Log 17.2 7.19 -2.81	1Δ2 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		3Δ4 	Center Freq 2.441000000 GHz
-12.8 -22.8 -32.8				Start Freq 2.439500000 GHz
-42.8 -52.8 -62.8				Stop Fred 2.442500000 GHz
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kHz	Sweep	Span 3.000 MHz 1.558 ms (900 pts)	CF Step 300.000 kHz <u>Auto</u> Man
3 Δ4 1 f (Δ)	998 kHz (Δ) 0.129 dB 0 024 GHz 12.936 dBm 1.001 MHz (Δ) 0.043 dB 1 022 GHz 13.065 dBm			Freq Offset 0 Hz
7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9				Scale Type
MSG	III.	STATU	s	

Test Plots (8DPSK) Channel Separation

Keysight Spectrum Analyzer - Swept SA				- 5 -
0// RL RF 50 Ω DC Center Freq 2.441000000	PNO: Wide +++ Trig: Free Run	ALIGN AUTO #Avg Type: RMS Avg Hold: 1/1	05:16:15 PM Aug 03, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	Frequency
Ref Offset 7.19 dB 10 dB/div Ref 27.19 dBm	FGain:Low #Atten: 30 dB	L	Mkr3 961 kHz 0.091 dB	Auto Tune
Log 17.2 7.19 -2.81	1Δ2 	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	3Δ4 ^	Center Freq 2.441000000 GHz
-12.8 -22.8 -32.8				Start Freq 2.439500000 GHz
-42.8 -52.8 -62.8				Stop Freq 2.442500000 GHz
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kHz	Sweep 1	Span 3.000 MHz .558 ms (900 pts)	CF Step 300.000 kHz <u>Auto</u> Man
2 F 1 f 2.439 3 Δ4 1 f (Δ)	1.001 MHz (Δ) 0.315 dB 9 994 GHz 10.850 dBm 961 kHz (Δ) 0.091 dB 0 995 GHz 11.165 dBm		E	Freq Offset 0 Hz
7 8 9 9 9 9 10 11 11 1 1 1 1 1 1 1 1 1 1 1				Scale Type
MSG	III	STATUS	►	



Test Plots (π/4DQPSK)

Channel Separation

	Spectru		yzer - Swe			_							_	
Center	Fred	RF 1 2 4	50 Ω		GHz			SE:INT		ALIGN AUTO Type: RMS		MAug 03, 2020 CE 1 2 3 4 5 6	F	requency
					PNO: Wid IFGain:Lo		. Trig: Free #Atten: 30		Avg	Hold: 1/1	T) C			Auto Tune
10 dB/div Log			fset 7.1 7.19 d									961 kHz .390 dB		
17.2 7.19	~~~	\sim	, X ₂	A	~~~~	~~	~~~~	1∆2 4,~~~~	m	~~~~^^	3Δ4	```		Center Freq 11000000 GHz
-12.8 -22.8 -32.8													2.43	Start Freq 39500000 GHz
-42.8 -52.8 -62.8													2.44	Stop Freq 12500000 GHz
Center∶ #Res B\	N 30	kHz			#`	VBW	100 kHz			Sweep	1.558 ms	3.000 MHz s (900 pts)	Auto	CF Step 300.000 kHz Man
MKR MODE		f (A)	× 1	004 MHz	(A)	۲ 0.403 o		ICTION	FUNCTION WIDTH	FUNCT	ION VALUE		
2 F 3 Δ4 4 F 5	1	f f (A f)		994 GHz 961 kHz 998 GHz	<u>(Δ)</u>	10.793 dE -1.390 d 11.196 dE	IB						Freq Offset 0 Hz
7 8 9														Scale Type
11												-	Log	<u>Lin</u>
MSG							m			STATL	IS	•		
		_				_							_	



Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (GFSK) 20 dB Bandwidth & Occupied Bandwidth (CH.39)





Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)



Test Plots (8DPSK) 20 dB Bandwidth & Occupied Bandwidth (CH.0)





Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)



Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)





Test Plots (π /4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (π /4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)

