

FCC BT REPORT

Certification

Applicant Name: HYUNDAI MOBIS CO., LTD. Date of Issue: October 26, 2018

Address:

Model:

203, Teheran-ro, Gangnam-gu, Seoul, 135-977, South Korea

Test Site/Location:

HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majangmyeo, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1809-FC077-R2

FCC ID: TQ8-ATC40S9AN

APPLICANT: HYUNDAI MOBIS CO., LTD.

ATC40S9AN

| EUT Type: | Car Audio System |
|-----------------------|--------------------------------------------|
| Max. RF Output Power: | 3.489 dBm (2.23 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 |

The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

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Approved by : Jong Seok Lee Manager of Telecommunication testing center

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Version

| TEST REPORT NO. | DATE | DESCRIPTION | |
|----------------------|--------------------|---------------------------------------------------|--|
| HCT-RF-1809-FC077 | September 14, 2018 | - First Approval Report | |
| HCT-RF-1809-FC077-R1 | October 24, 2018 | - Revised the Worst case configuration on page 23 | |
| HCT-RF-1809-FC077-R2 | October 26, 2018 | - Added the AFH mode calculation. | |
| | | - Revised the band edges. | |
| | | | |



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1. EUT DESCRIPTION

| Model | ATC40S9AN |
|-----------------------|-----------------------------------------------------------------------------------------------------------|
| ЕИТ Туре | Car Audio System |
| Power Supply | DC 14.40 V |
| Frequency Range | 2402 MHz - 2480 MHz |
| Max. RF Output Power | 3.489 dBm (2.23 mW) |
| BT Operating Mode | Normal, EDR, AFH |
| Modulation Type | GFSK(Normal), π/4DQPSK and 8DPSK(EDR) |
| Modulation Technique | FHSS |
| Bluetooth Version | 4.0 |
| Number of Channels | 79Channels, Minimum 20 Channels(AFH) |
| Antenna Specification | Manufacturer: LG Innotek, Co. Ltd. Antenna type: Bluetooth Single Band Antenna Peak Gain : 0.29 dBi |
| Date(s) of Tests | July 02, 2018 ~ September 10, 2018 |



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.



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) 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 3.75 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 8 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).

Conducted Antenna Terminal

See Section from 7.8.2 to 7.8.8.(ANSI 63.10-2013)

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 guasi-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."

* The antennas of this E.U.T are permanently attached.

* 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) | 5.71 |



8. DESCRIPTION OF TESTS

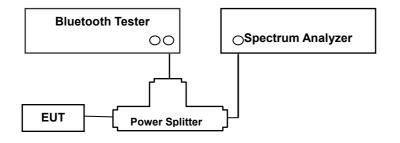
8.1. Conducted Maximum Peak Output Power

<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)

- 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

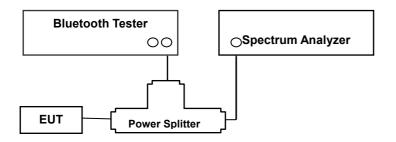


8.2. Conducted Band Edge(Out of Band Emissions)

<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)

- 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

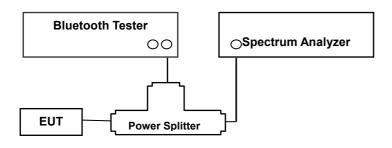


8.3. Frequency Separation & 20 dB Bandwidth

<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

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)

- 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.

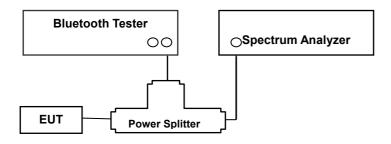


8.4. Number of Hopping Frequencies

<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)

- 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.

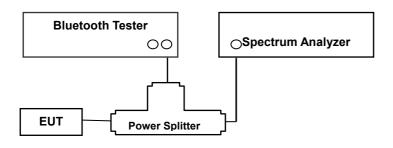


8.5. Time of Occupancy

<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)

- 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.

* Mon-AFH Mode

- DH 5 (GFSK) : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)
- 2-DH 5 (π/4DQPSK) : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)
- 3-DH 5 (8DPSK) : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)

* AFH Mode

- DH 5 (GFSK) : 2.890 * (800/6)/20 * 8.0 = 154.13 (ms)
- 2-DH 5 (π/4DQPSK) : 2.890 * (800/6)/20 * 8.0 = 154.13 (ms)
- 3-DH 5 (8DPSK) : 2.890 * (800/6)/20 * 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 * 106.667 = 308.27 (ms)

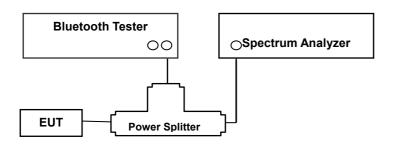


8.6. Conducted Spurious Emissions

<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)

- 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 | 7.18 |
| 100 | 6.35 |
| 200 | 7.04 |
| 300 | 6.58 |
| 400 | 6.26 |
| 500 | 5.95 |
| 600 | 6.17 |
| 700 | 6.34 |
| 800 | 6.72 |
| 900 | 7.08 |
| 1000 | 7.38 |
| 2000 | 7.21 |
| 2400* | 7.40 |
| 2500* | 7.44 |
| 3000 | 7.88 |
| 4000 | 8.95 |
| 5000 | 9.57 |
| 6000 | 6.68 |
| 7000 | 9.99 |
| 8000 | 8.34 |
| 9000 | 9.61 |
| 10000 | 10.47 |
| 11000 | 8.96 |
| 12000 | 9.73 |
| 13000 | 8.84 |
| 14000 | 9.50 |
| 15000 | 11.54 |
| 16000 | 8.14 |
| 17000 | 11.73 |
| 18000 | 9.71 |
| 19000 | 10.40 |
| 20000 | 11.69 |
| 21000 | 10.72 |
| 22000 | 12.31 |
| 23000 | 9.85 |
| 24000 | 12.52 |
| 25000 | 11.07 |
| 26000 | 10.50 |

Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Splitter loss



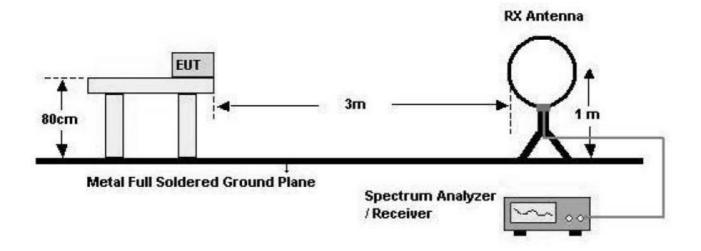
8.7. Radiated Test

|--|

| 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 |

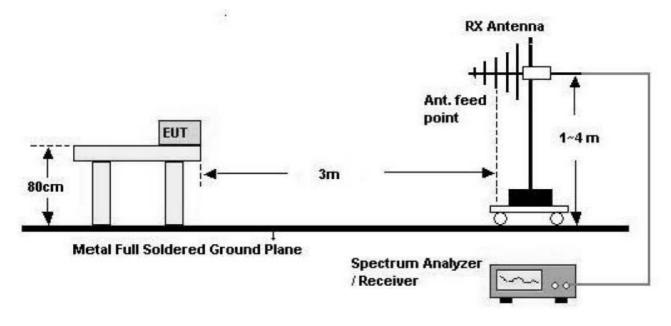
Test Configuration

Below 30 MHz

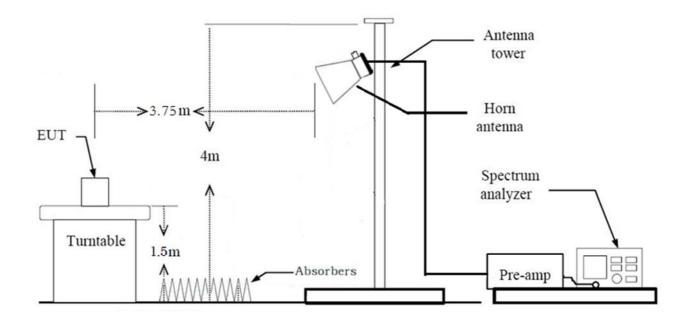




30 MHz - 1 GHz



Above 1 GHz





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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 6. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
 *Distance extrapolation factor = 20*log (test distance / specific distance) (dB)
- 7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 8. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 9. The unit was tested with its standard battery.
- 10. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 1 GHz 25 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW ≥ 3*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
- 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.
- 12. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) Amp Gain(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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 6. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
 *Distance extrapolation factor = 20*log (test distance / specific distance) (dB)
- 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):
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW ≥ 3*RBW
 - (2) Measurement Type(Average):
 - We performed using a reduced video BW method was done with the analyzer in linear mode
 - 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. Total
 - = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)



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).

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

*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.
- 2. EUT Axis
 - Radiated Spurious Emissions : X
 - Radiated Restricted Band Edge : X
- 3. We applied DCCF in the test result which hopping channel number is 20.
- 4. 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

AC Power line Conducted Emissions

1. We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

Conducted test

- 1. The EUT was configured with data rate of highest power.
 - GFSK : DH5
 - π/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) ≥ 2 | | Conducted | PASS |
| 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) | | | PASS |
| Radiated Spurious Emissions | §15.247(d),Radiated Spurious Emissions15.205,cf. Section 8.15.209 | | Dodietad | 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

| Channel | Frequency | Output Power (GFSK) | | Limit |
|---------|-----------|------------------------|------|-------|
| | (MHz) | (dBm) | (mW) | (mW) |
| Low | 2402 | 3.408 | 2.19 | |
| Mid | 2441 | 3.489 | 2.23 | 125 |
| High | 2480 | 2.822 | 1.92 | |

| Channel | Frequency | Output Power (8DPSK) | | Limit |
|---------|-----------|-------------------------|------|-------|
| | (MHz) | (dBm) | (mW) | (mW) |
| Low | 2402 | 1.535 | 1.42 | |
| Mid | 2441 | 1.672 | 1.47 | 125 |
| High | 2480 | 1.070 | 1.28 | |

| Channel | Frequency | | Output Power (π/4DQPSK) | | | | | |
|---------|-----------|------------------|----------------------------|-----|--|--|--|--|
| | (MHZ) | (MHz) (dBm) (mW) | | | | | | |
| Low | 2402 | 1.106 | 1.29 | | | | | |
| Mid | 2441 | 1.250 | 1.33 | 125 | | | | |
| High | 2480 | 0.571 | 1.14 | | | | | |

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 7.36 dB at 2402 MHz and is 7.44 dB at 2480 MHz.

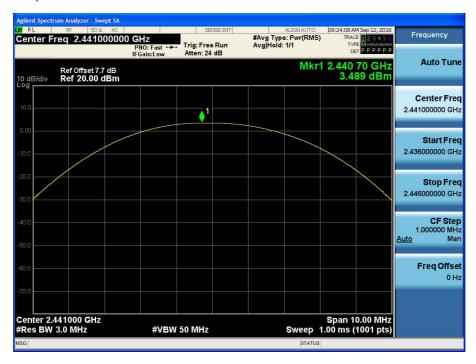
So, 7.7 dB is offset.(Includes Eut cable loss) And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.



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

| RL | RF 50 Ω AC | | SENSE:INT | ALIGN AUT | | Frequency |
|----------|------------------------------------|----------------------------|--------------------------------|------------------------------------|---------------------------------------------------|---------------------------------------|
| ienter F | req 2.40200000 | PNO: Fast ++ IFGain:Low | Trig: Free Run Atten: 24 dB | #Avg Type: Pwr(Rl Avg Hold: 1/1 | MS) TRACE 1 2 3 4 5 6 TYPE MWWWWW DET PPPPP | |
| 0 dB/div | Ref Offset 7.7 dB Ref 20.00 dBm | | | MI | kr1 2.402 01 GHz 3.408 dBm | |
| 10.0 | | | 1 | | | Center Fre 2.402000000 GI |
| 0.0 | | | | | | Start Fr 2.397000000 G |
| | | | | | | Stop Fr 2.407000000 G |
| D.O | | | | | | CF Sto 1.000000 M <u>Auto</u> M |
| 0.0 | | | | | | Freq Offs 0 |
| | 102000 GHz | | | | Span 10.00 MHz | |
| Res BW | 3.0 MHz | #VBW | 50 MHz | Sweep | o 1.00 ms (1001 pts) | |

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





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

| RL | RF 50 Ω AC | | SENSE:INT | ALIGNAUTO | 09:24:20 AM Sep 12, 2018 | Barren unter an |
|-------------------------|------------------------------------|--------------------|--------------------------------|--------------------------------------|------------------------------------------|---------------------------------------|
| enter Fre | q 2.4800000 | 0 GHz PNO: Fast | Trig: Free Run Atten: 24 dB | #Avg Type: Pwr(RMS) Avg Hold: 1/1 | TRACE 123456 TYPE MWWWWW DET PPPPP | Frequency |
| | Ref Offset 7.7 dB Ref 20.00 dBm | I Sumeow | | Mkr1 | 2.479 95 GHz 2.822 dBm | Auto Tur |
| 0.0 | | | 1 | | | Center Fre 2.480000000 GI |
| 0.0 | | | | | | Start Fr 2.475000000 G |
| | | | | | | Stop Fr 2.485000000 G |
|).0).0 | | | | | | CF Sto 1.000000 M <u>Auto</u> M |
| .0 | | | | | | Freq Offs 0 |
| enter 2.48 Res BW 3. | | #VBW | 50 MHz | Sweep 1 | Span 10.00 MHz .00 ms (1001 pts) | |

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





Test Plots (8DPSK)

Peak Power (CH.39)

| Ref Offset 7.7 dB Ref 20.00 dBm | PNO: Fast ↔ IFGain:Low | Atten: 24 dB | Mkr1 | 2.440 | 88 GHz 72 dBm | Auto Tun Center Fre |
|------------------------------------|---------------------------|--------------|---------|---------------------------------------|-----------------------------------|--------------------------------------------|
| | | ↓ 1 | | | | Center Fre |
| | | | | | | 2.441000000 GH |
| | | | | | | Start Fr 2.436000000 G |
| | | | | | - A | Stop Fr 2.446000000 G |
| | | | | | | CF Sto 1.000000 M <u>Auto</u> M |
| | | | | | | Freq Offs 0 |
| 1000 GHz .0 MHz | #VBM | / 50 MHz | Sweep 1 | Span 1 .00 ms (| 0.00 MHz 1001 pts) | |
| | | | | 1000 GHz 0 MHz #VBW 50 MHz Sweep 1 | 0 MHz #VBW 50 MHz Sweep 1.00 ms (| 0 MHz #VBW 50 MHz Sweep 1.00 ms (1001 pts) |

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





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

| a RL Center Fi | RF 50Ω AC req 2.40200000 | 00 GHz | SENSE:INT | ALIGNAUTO #Avg Type: Pwr(RMS) | 09:24:32 AM Sep 12, 2018 TRACE 1 2 3 4 5 6 | Frequency |
|---------------------|------------------------------------|---------------------------|-----------------------------------------------------|----------------------------------|-----------------------------------------------|-------------------------------|
| | | PNO: Fast ↔ IFGain:Low | Trig: Free Run Atten: 24 dB | Avg Hold: 1/1 | TYPE MWWWWW DET PPPPP | |
| 0 dB/div | Ref Offset 7.7 dB Ref 20.00 dBm | | | Mkr1 | 2.401 97 GHz 1.106 dBm | Auto Tun |
| 10.0 | | | | | | Center Fre 2.402000000 GH |
| 0.00 | | | 1 | | | 2.402000000 61 |
| 10.0 | | | | | | Start Fre 2.397000000 GH |
| 20.0 | | | | | | |
| 0.0 | | | | | | Stop Fre 2.407000000 GH |
| io.o | | | | | | CF Ste |
| i0.0 | | | | | | 1.000000 Mi <u>Auto</u> Ma |
| 0.0 | | | | | | Freq Offs |
| 0.0 | | | | | | 01 |
| | | | | | Out 40.00 Mile | |
| enter 2.4 Res BW | 402000 GHz 3.0 MHz | #VB | N 50 MHz | Sweep 1 | Span 10.00 MHz .00 ms (1001 pts) | |

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





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

| Center F | RF 50Ω AC req 2.480000000 |) GHz | SENSE:INT | ALIGNAUTO #Avg Type: Pwr(RM: | TRACE 12345 | Frequency |
|-----------|------------------------------------|---------------------------|---------------------------------------|---------------------------------|-----------------------------|----------------------|
| | | PNO: Fast 🔸 IFGain:Low | . Trig: Free Run Atten: 24 dB | Avg[Hold: 1/1 | | |
| 10 dB/div | Ref Offset 7.7 dB Ref 20.00 dBm | | | Mk | 1 2.479 88 GHz 0.571 dBm | Auto Tun |
| -09 | | | | | | Center Fre |
| 10.0 | | | 1 | | | 2.480000000 GH |
| 0.00 | | | · · · · · · · · · · · · · · · · · · · | | | |
| | | | | | | Start Fre |
| 10.0 | | | | | | 2.475000000 GI |
| 20.0 | | | | | | Stop Fre |
| / | | | | | | 2.485000000 Gł |
| 30.0 | | | | | | |
| 40.0 | | | | | | CF Ste 1.000000 M |
| 50.0 | | | | | | Auto Ma |
| 30.0 | | | | | | |
| 60.0 | | | | | | Freq Offs |
| 70.0 | | | | | | U |
| | | | | | | |
| | 480000 GHz | | | | Span 10.00 MHz | |
| ≉Res BW | 3.0 MHz | #VBN | 50 MHz | Sweep | 1.00 ms (1001 pts) | £ |



10.2 BAND EDGES

Without hopping

| Outside Frequency Band | GFSK | 8DPSK | π/4DQPSK | Limit |
|------------------------|--------|--------|----------|-------|
| Outside Frequency Band | (dB) | (dB) | (dB) | (dBc) |
| Lower | 58.920 | 55.145 | 54.285 | 20 |
| Upper | 59.525 | 54.159 | 54.529 | 20 |

With hopping

| Outside Frequency Band | GFSK | 8DPSK | π/4DQPSK | Limit |
|------------------------|--------|--------|----------|-------|
| Outside Frequency Band | (dB) | (dB) | (dB) | (dBc) |
| Lower | 59.352 | 54.373 | 54.151 | 20 |
| Upper | 55.665 | 53.641 | 54.275 | 20 |

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 7.36 dB at 2402 MHz and is 7.44 dB at 2480 MHz.

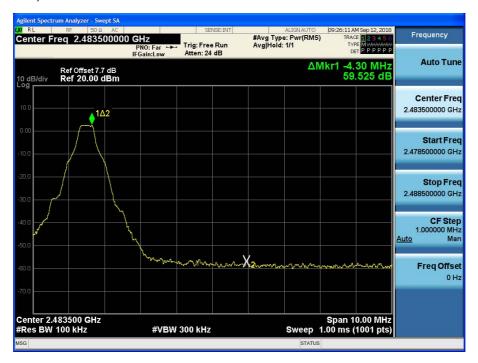
So, 7.7 dB is offset.(Includes Eut cable loss) And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result.



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



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



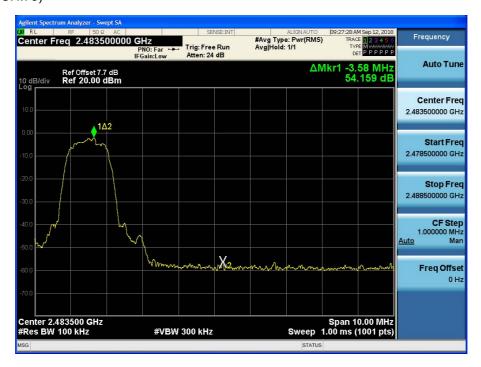


Test Plots without hopping (8DPSK)

Band Edges (CH.0)



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



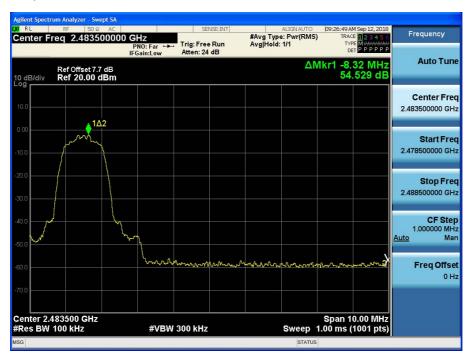


Test Plots without hopping (π /4DQPSK)

Band Edges (CH.0)

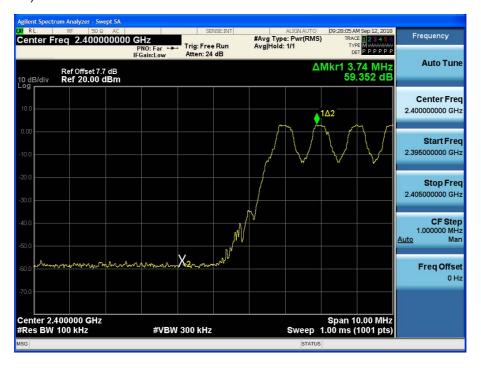


Test Plots without hopping (π /4DQPSK) Band Edges (CH.78)





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



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



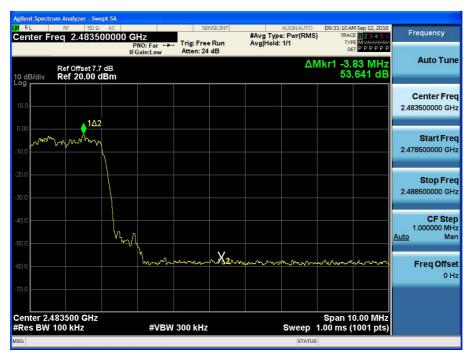


Test Plots with hopping (8DPSK)

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)

| 99% BW (kHz) | | | | | | | | | | |
|-----------------------------|--------|--------|--------|--|--|--|--|--|--|--|
| Channel GFSK 8DPSK π/4DQPSK | | | | | | | | | | |
| CH.0 | 899.31 | 1214.8 | 1209.7 | | | | | | | |
| CH.39 | 899.93 | 1215.8 | 1208.0 | | | | | | | |
| CH.78 | 904.42 | 1216.6 | 1207.4 | | | | | | | |

| | 20dB BW (kHz) | | | | | | | | | |
|-----------------------------|---------------|--------|--------|--|--|--|--|--|--|--|
| Channel GFSK 8DPSK π/4DQPSk | | | | | | | | | | |
| CH.0 | 999.1 | 1343.0 | 1353.0 | | | | | | | |
| CH.39 | 991.6 | 1339.0 | 1353.0 | | | | | | | |
| CH.78 | 997.2 | 1343.0 | 1354.0 | | | | | | | |

| | Channel Separation(kHz) | | Limit |
|------|-------------------------|-------|---------------------|
| GFSK | 8DPSK | (kHz) | |
| | | | >25 kHz |
| 998 | 994 | 998 | or |
| | | | >2/3 of the 20dB BW |



Test Plots (GFSK)

Channel Separation

| | | | 0000 | GHZ | Far↔ | . Trig: F | ree Run | | Avg Hol | pe: Pwr(RMS) d: 1/1 | TYP | E 1 2 3 4 5 6 E MWWWWW | | equency |
|------|-----|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | | | | #Atten | : 20 dB | | | ΔN | kr3 1.0 | | | Auto Tun |
| کمر | ~ | -X ₂ | | ~~~ | | ~~ | | 2 ^ | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | 3∆4 | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | Center Fre 1000000 G⊦ |
| | | | | | | | | | | | | | 2.43 | Start Fre |
| | | | | | | | | | | | | | 2.44 | Stop Fr 2500000 GI |
| V 30 | kHz | GHz | | | #VBW | | lz | FUNC | TION | | 3.18 ms | (900 pts) | Auto | CF Ste 300.000 kl |
| | | | <u>2.440</u> 1 | 001 G | Hz Hz (Δ) | -0.0 1.092 0.0 | dBm 26 dB | FONG | | UNCTION WIDTH | FONCTIO | IN VALUE | | Freq Offs |
| | | | | | | | | | | | | | | |
| | R | Ref 17 2.441000 μ 30 kHz TRC SCL 1 f | Ref 17.70 d 2.441000 GHz V 30 kHz TRC SCL 1 f | V 30 kHz TRC SCL × 1 f (Δ) 1 f (Δ) 1 f (Δ) 1 | Ref Offset 7.7 dB Ref 17.70 dBm | Ref 17.70 dBm 4 4 2.441000 GHz #VBW V 30 kHz #VBW TRC SCL × 1 f 2.440 001 GHz × | Ref Offset 7.7 dB Ref 17.70 dBm 4.441000 GHz 8.441000 GHz 8.00 KHz #VBW 100 kH TRC SCL X F (Δ) 2.998 kHz (Δ) -0.00 1 f (Δ) -1.090 MHz (Δ) -0.00 1 f (Δ) -0.00 HHz (Δ) -0.00 HZ (Δ) Hz (Δ) -0.00 HZ (Δ) Hz (Δ) + | Ref Offset 7.7 dB Ref 17.70 dBm 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10 | Ref Offset 7.7 dB Ref 17.70 dBm 1Δ2 441000 GHz W 30 kHz #VBW 100 kHz TRC SCI X Y FUNC 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Ref Offset 7.7 dB Ref 17.70 dBm 1Δ2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 <td>Ref Offset 7.7 dB Ref 17.70 dBm ΔM 4 1Δ2 1Δ2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 5 4 4 6 4 4 6 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4</td> <td>Ref Offset 7.7 dB AMkr3 1.0 Ref 17.70 dBm 0 1000000000000000000000000000000000000</td> <td>Ref Offset 7.7 dB ΔMkr3 1.004 MHz Ref Offset 7.7 dB 0.026 dB 441000 GHz 1Δ2 441000 GHz Span 3.000 MHz 8000 KHz Span 3.000 MHz 8000 KHz Span 3.000 MHz 998 KHz 1002 dB 1 f 102 dB</td> <td>Ref Offset 7.7 dB AMkr3 1.004 MHz 0.026 dB AMkr3 1.004 MHz 0.026 dB 0.026</td> | Ref Offset 7.7 dB Ref 17.70 dBm ΔM 4 1Δ2 1Δ2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 5 4 4 6 4 4 6 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Ref Offset 7.7 dB AMkr3 1.0 Ref 17.70 dBm 0 1000000000000000000000000000000000000 | Ref Offset 7.7 dB ΔMkr3 1.004 MHz Ref Offset 7.7 dB 0.026 dB 441000 GHz 1Δ2 441000 GHz Span 3.000 MHz 8000 KHz Span 3.000 MHz 8000 KHz Span 3.000 MHz 998 KHz 1002 dB 1 f 102 dB | Ref Offset 7.7 dB AMkr3 1.004 MHz 0.026 dB AMkr3 1.004 MHz 0.026 dB 0.026 |

Test Plots (8DPSK) Channel Separation





Test Plots (π/4DQPSK)

Channel Separation

| Ref Offset 7.7 Ref 17.70 d | dB | ain:Low | #Atten: 20 | 1 <u>Δ2</u> | | | 10 Mkr3 9 -0. | 98 kHz 133 dB | Aut | o Tune |
|-------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>∕</u> √X2∖_ | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | Â | 1Δ2 | | | | | | |
| | | | \sim | *~~~~ | | ~~~~~ | 304 | | Cent 2.441000 | er Fre 000 GH |
| | | | | | | | | | Sta 2.439500 | art Fre 000 G⊦ |
| | | | | | | | | | | op Fre |
| 1000 GHz kHz | × | #VBW | / 100 kHz | FU | NCTION | | 3.18 ms | (900 pts) | 300 | CF Ste |
| f (Δ) f f (Δ) f | 2.439 934 998 | GHz 3 kHz (∆) | -3.298 dE -0.133 | 3m dB | | | | | Fred | Offs 0 H |
| | | | | | | | | | | |
| | SCL f (Δ) f f (Δ) f f | KHZ × f (Δ) 1.041 f 2.439.934 f f 2.439.935 f f 2.430.975 984 | KHz #VBW SCL × f (Δ) 1.041 MHz f 2.439 934 GHz | KHz #VBW 100 kHz ScLi × Υ f (Δ) -0.399 f 2.439 934 GHz -3.298 df f (Δ) 999 kHz (Δ) f 2.440 975 GHz -3.697 df | KHz #VBW 100 kHz ScL X Y FU f (Δ) -0.399 dB FU -2.298 dBm f 2.439 334 GHz -3.298 dBm -0.133 dB -0.133 dB f 2.440 975 GHz -3.697 dBm -0.133 dB -0.133 dB | x Y FUNCTION f (Δ) 1.041 MHz (Δ) 0.399 dB f 2.439 934 GHz 3.298 dBm f f 2.439 934 GHz 0.313 dB f f 2.440 975 GHz -3.697 dBm - | X Y FUNCTION FUNCTION f (Δ) -0.399 dB FUNCTION f 2.439 934 GHz -3.299 dB FUNCTION f 2.439 934 GHz -3.298 dBm FUNCTION f 2.440 975 GHz -3.697 dBm FUNCTION | V HHz #V BW 100 kHz Sweep 3.18 ms SCL X Y FUNCTION FUNCTION FUNCTION f (Δ) 1.041 MHz (Δ) 0.399 dB f f 2.439 934 GHz 3.298 dBm f f (Δ) 998 kHz (Δ) 0.133 dB f f 2.440 975 GHz -3.697 dBm f 1.440 975 GHz -3.697 dBm 1.440 975 GHz -3.697 GHz -3.697 GHz -3.697 GHz -3.697 GHz -3.697 GHz <t< td=""><td>X HZ ¥VBW 100 kHz Sweep 3.18 ms (900 pts) SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VIDTH f (Δ) 1.041 MHz C399 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.439 934 GHz -3.299 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.439 934 GHz -3.299 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.430 975 GHz -3.697 dBm FUNCTION VIDTH FUNCTION VIDTH FUNCTION VIDTH</td><td>X Y FUNCTION FUNCTION V/DTH FUNCTI</td></t<> | X HZ ¥VBW 100 kHz Sweep 3.18 ms (900 pts) SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VIDTH f (Δ) 1.041 MHz C399 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.439 934 GHz -3.299 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.439 934 GHz -3.299 dB FUNCTION FUNCTION VIDTH FUNCTION VIDTH f 2.430 975 GHz -3.697 dBm FUNCTION VIDTH FUNCTION VIDTH FUNCTION VIDTH | X Y FUNCTION FUNCTION V/DTH FUNCTI |

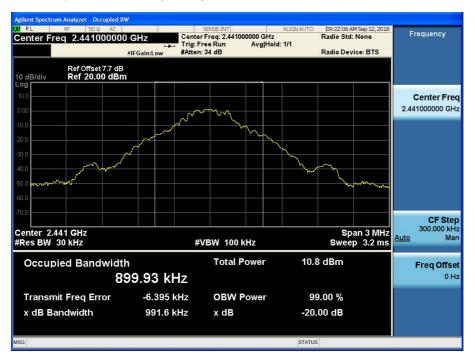


Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



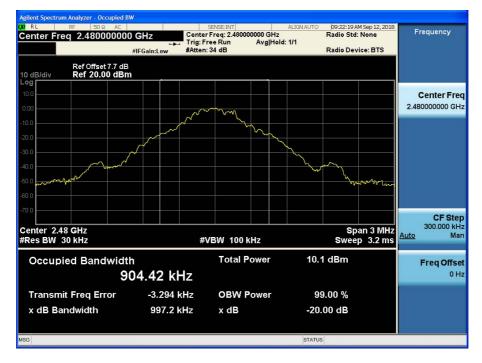
Test Plots (GFSK) 20 dB Bandwidth & Occupied Bandwidth (CH.39)



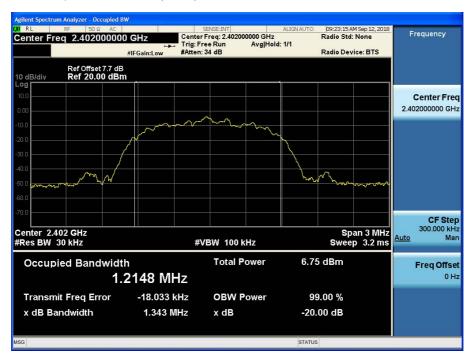


Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)



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





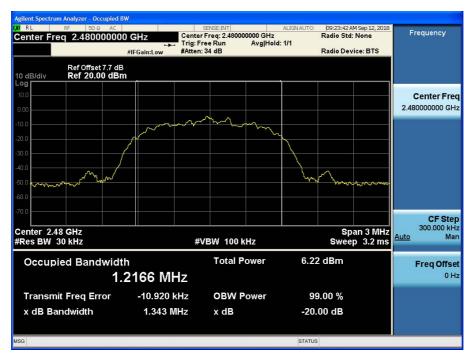
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)



Test Plots (8DPSK)

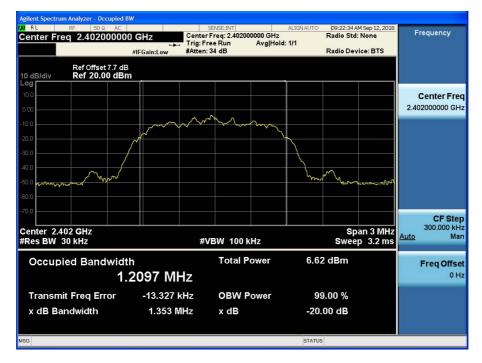
20 dB Bandwidth & Occupied Bandwidth (CH.78)





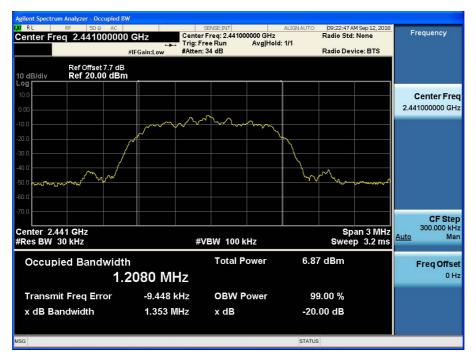
Test Plots (π /4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (π/4DQPSK)

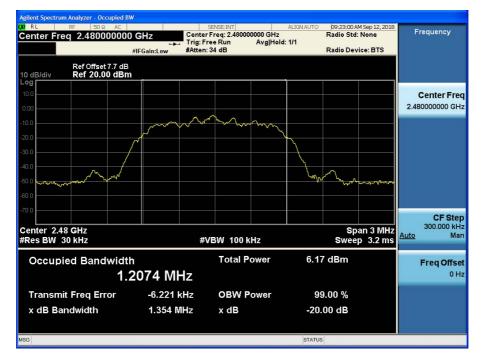
20 dB Bandwidth & Occupied Bandwidth (CH.39)





Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)





10.4 NUMBER OF HOPPING FREQUENCY

| | Result (No. of CH) | | | | | | |
|------|--------------------|----------|---------|--|--|--|--|
| GFSK | 8DPSK | π/4DQPSK | – Limit | | | | |
| 79 | 79 | 79 | >15 | | | | |

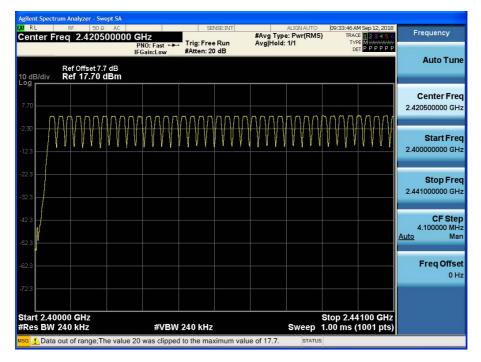
Note :

In case of AFH mode, minimum number of hopping channels is 20.



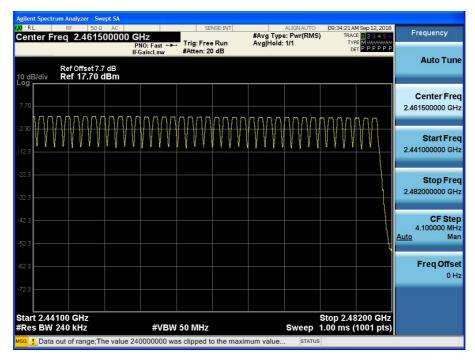
Test Plots (GFSK)

Number of Channels (2.4 GHz - 2.441 GHz)



Test Plots (GFSK)

Number of Channels (2.441 GHz - 2.4835 GHz)





Test Plots (8DPSK)

Number of Channels (2.4 GHz - 2.441 GHz)

| RL RF 50 Ω AC Center Freq 2.420500000 | PNO: Fast +> | Trig: Free | | | ALIGNAUTO : Pwr(RMS >1/1 |) TRAC | M Sep 12, 2018 E 1 2 3 4 5 6 E MWWWWW T P P P P P P | Frequency |
|---------------------------------------------|--------------|------------|---------|-----------|--------------------------------|--------|--------------------------------------------------------------|----------------------------------|
| Ref Offset 7.7 dB 0 dB/div Ref 17.70 dBm | IFGain:Low | #Atten: 20 | dB | | | De | | Auto Tune |
| •g | | | | | | | | Center Free 2.420500000 GH |
| | | ᡃᠰ᠊ᢉᡗ᠆ᡎᡃᠬ | ᢣᢉ᠇ᠬᡃᠬᠭ | Mar Jarry | ᡊᢦ᠆ᡎ᠕ᡊ | ᡊ᠕ᠬᡘᡧᠬ | ᠬᢩ᠆ᡝ᠕᠕ | Start Fre 2.400000000 GH |
| 32.3 | | | | | | | | Stop Fre 2.441000000 G⊢ |
| 2.3 | | | | | | | | CF Ste 4.100000 MH Auto Ma |
| 23 | | | | | | | | Freq Offse 0 ⊦ |
| tart 2.40000 GHz Res BW 240 kHz | #VBW | / 240 kHz | | | | | 100 GHz 1001 pts) | |

Test Plots (8DPSK)

Number of Channels (2.441 GHz - 2.4835 GHz)

| enter Freq 2.46 | Р | HZ NO: Fast ↔ Gain:Low | | | #Avg Type Avg Hold: | ALIGNAUTO e: Pwr(RMS) 1/1 | TRAC | M Sep 12, 2018 E 1 2 3 4 5 6 PE M W W W W W | Frequency |
|-------------------------------------------------|------------|------------------------------|----------------------|---------|------------------------|---------------------------------|------|---------------------------------------------------|---------------------------------------|
| Ref Offset dB/div Ref 17.7 | 7.7 dB | Sam.Low | and contractions and | | | | | | Auto Tur |
| .70 | | | | | | | | | Center Fre 2.461500000 GH |
| .30 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | ᠬᢞᠬᢞ᠕᠆ᠰ᠕᠆ᠰ | ᡃᡁᢉᢦᡘᢇᠾᢦᡇᠬ | ᡐ᠆ᡣᡢᡢ᠆ᡝ | and the | ᡏ᠆ᡝ᠆ᠬ | ᠂᠂ᠰ᠕᠕᠂᠂ | | | Start Fr 2.441000000 G |
| 2.3 | | | | | | | | | Stop Fr 2.482000000 G |
| 2.3 | | | | | | | | | CF Sto 4.100000 M <u>Auto</u> M |
| 2.3 | | | | | | | | | Freq Offs 0 |
| tart 2.44100 GHz Res BW 240 kHz | | #VBW | 50 MHz | | | | | 3200 GHz 1001 pts) | |