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TEST REPORT For FCC

FCC Standards : FCC 47CFR part 15 subpart C

Test Report No. : CTK-2015-00538
Date of Issue : 2015-05-10
FCC ID : 2AAJPB100S
Basic Model/Type No. : B100S
Kind of Product : Bluetooth Speaker
Applicant : Hansol Technics Co., Ltd.
Applicant Address : 55, Hansam-ro, Deoksan-myeon, Jincheon-gun, Chungcheongbuk-do, Korea
Manufacturer : Hansol Technics Co., Ltd.
Manufacturer Address : 55, Hansam-ro, Deoksan-myeon, Jincheon-gun, Chungcheongbuk-do, Korea
Contact Person : Weon-Seo Lee / Senior Engineer
Telephone : +82-43-530-8554
Received Date : 2015-03-27
Test period : Start : 2015-04-14 End : 2015-04-30
Test Results : ☒ In Compliance ☐ Not in Compliance

The test results presented in this report relate only to the object tested.

Tested by

Y. T. Lee

Young-taek Lee
Test Engineer
Date: 2015-05-10

Reviewed by

Y. J. Park

Young-Joon, Park
Technical Manager
Date: 2015-05-10



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REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|-------------------------|---------|
| 2015-05-10 | Issued (CTK-2015-00538) | All |
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1.0 General Product Description

| | |
|-------------------------|--|
| Equipment model name | B100S |
| Serial number | Prototype |
| EUT condition | Pre-production, not damaged |
| Antenna type | Chip antenna Gain 3.4 dBi |
| Frequency Range | 2402 MHz - 2480 MHz |
| RF power | -3.130 dBm Peak Conducted (GFSK) -3.318 dBm Peak Conducted ($\pi/4$ DQPSK) -2.872 dBm Peak Conducted (8-DPSK) |
| Type of Modulation | Frequency Hopping Spread Spectrum |
| Number of channels | 79 |
| Channel Spacing | 1 MHz |
| Channel Access Protocol | Frequency Hopping |
| Type of Modulation | GFSK(1Mbps), DQPSK(2Mbps), 8-DPSK(3Mbps) |
| Power Source | DC 3.7 V (Rechargeable Lithium Polymer Battery) |

1.1 Tested Frequency

| | LOW | MID | HIGH |
|-----------------|------|------|------|
| Frequency (MHz) | 2402 | 2441 | 2480 |

1.2 Tested Mode

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

- Following mode was (were) selected for the final test as listed below.

| Tested Ch | Modulation Technology | Modulation Type | Packet Type |
|-----------------------------|-----------------------|-----------------|-------------|
| Low, Mid, High | FHSS | GFSK | DH5 |
| Low, Mid, High | FHSS | 8-DPSK | 3-DH5 |
| Power Supply type | | | Remark |
| Battery only | | | Worst case |
| Battery & Wireless Charging | | | |



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1.3 Model Differences

The following modifications were necessary for compliance:

Not applicable

1.4 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.5 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|------------------|--------------|-----------|-------------|
| BLUETOOTH TESTER | TESCOM | TC-3000C | 3000C000377 |

1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.7 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.






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1.8 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation | Registration Number | Logo |
|---------|--------|--|------------------------------------|---|
| USA | FCC | FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission) | 805871 |  |
| JAPAN | VCCI | VCCI V-3 EMI (Electromagnetic Interference / Emission) | C-986 T-1843 R-3627 G-387 |  |
| KOREA | MSIP | EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity) | KR0025 |  |



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2.0 Summary of tests

| FCC Part Section(s) | Parameter | Limit | Test Condition | Status (note 1) |
|---------------------|-------------------------------|---------------|----------------|-----------------|
| 15.247(a) | Carrier Frequency Separation | > 25 kHz | Conducted | C |
| 15.247(a) | Number of Hopping Frequencies | > 15 hops | | C |
| 15.247(a) | 20 dB Bandwidth | NA | | C |
| 15.247(a) | Dwell Time | < 0.4 seconds | | C |
| 15.247(b) | Transmitter Output Power | < 0.125 Watts | | C |
| 15.247(d) | Conducted Spurious emission | > 20 dBc | | C |
| 15.247(d) | Band Edge | > 20 dBc | | C |
| 15.209 | Field Strength of Harmonics | 15.209(a) | Radiated | C |
| 15.207 | AC Conducted Emissions | 15.207(a) | Line Conducted | C |

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.4-2009

The tests were performed according to the method of measurements prescribed in DA 00-705.

2.1 Transmitter Requirements

2.1.1 Carrier Frequency Separation

Test Location

RF Test Room

Test Procedures

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 30 kHz ($\geq 1\%$ of the span) Sweep = auto

VBW = 30 kHz (\geq RBW) Detector function = peak

Trace = max hold

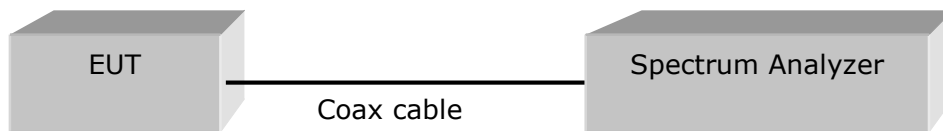


Figure 1 : Measurement setup for the carrier frequency separation

Limit

§15.247(a)(1) Frequency hopping system operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-third of 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Results

Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Channel | Adjacent Hopping Channel Separation (kHz) | Two-third of 20dB bandwidth (kHz) | Minimum Bandwidth (kHz) | Result |
|---------|---|-----------------------------------|-------------------------|----------|
| 2441MHz | 990.0 | 626.3 | 25 | Complies |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Channel | Adjacent Hopping Channel Separation (kHz) | Two-third of 20dB bandwidth (kHz) | Minimum Bandwidth (kHz) | Result |
|---------|---|-----------------------------------|-------------------------|----------|
| 2441MHz | 990.0 | 840.0 | 25 | Complies |

See next pages for actual measured spectrum plots.



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Carrier Frequency Separation

Test mode : GFSK



Test mode : 8-DPSK



2.1.2 Number of Hopping Frequencies

Test Location

RF Test Room

Test Procedures

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Frequency range 1: Start = 2389.5 MHz, Stop = 2439.5 MHz
 2: Start = 2439.5 MHz, Stop = 2489.5 MHz

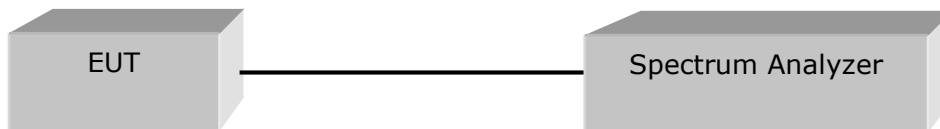
RBW = 300 kHz ($\geq 1\%$ of the span)

VBW = 300 kHz (\geq RBW)

Trace = max hold

Sweep = auto

Detector function = peak



Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5 MHz band shall use at least 15 hopping frequencies.

Test Results

Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Total number of Hopping Channels | Result |
|----------------------------------|----------|
| 79 | Complies |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Total number of Hopping Channels | Result |
|----------------------------------|----------|
| 79 | Complies |

See next pages for actual measured spectrum plots.



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Number of Hopping Frequencies(GFSK)



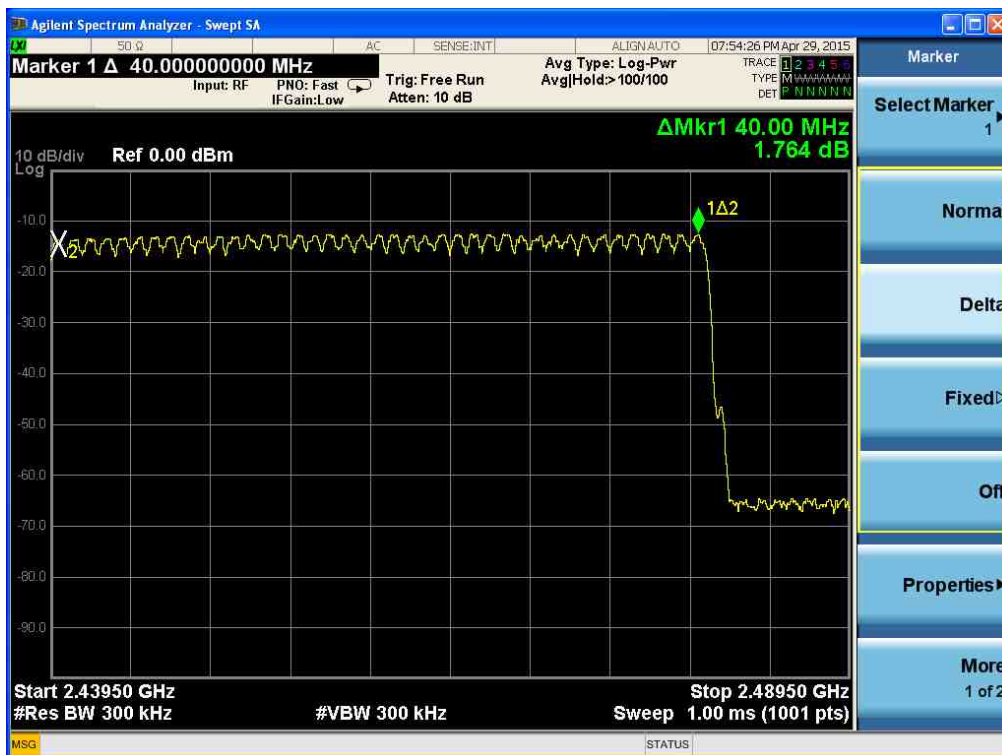
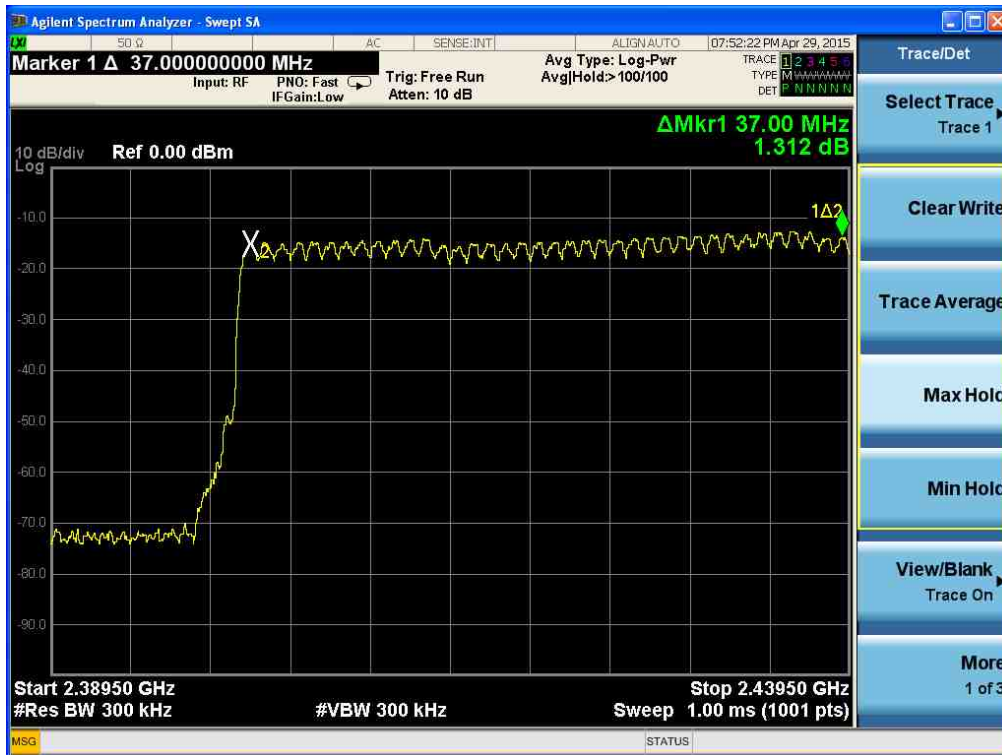


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Number of Hopping Frequencies(8-DPSK)



2.1.3 20 dB bandwidth

Test Location

RF Test Room

Test Procedures

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

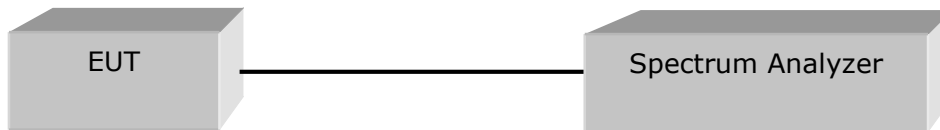
Center frequency = the highest, middle and the lowest channels

Span = approximately 2 or 3 times of the 20 dB bandwidth

RBW = 30 kHz ($\geq 1\%$ of the 20 dB bandwidth) Sweep = auto

VBW = 30 kHz (\geq RBW) Detector function = peak

Trace = max hold



Limit

Limit : N/A



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Test Results

Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency (MHz) | Channel Number. | Measured Bandwidth (MHz) | Result |
|-----------------|-----------------|--------------------------|----------|
| 2402 | 0 | 0.948 | Complies |
| 2441 | 39 | 0.939 | Complies |
| 2480 | 78 | 0.937 | Complies |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency (MHz) | Channel Number. | Measured Bandwidth (MHz) | Result |
|-----------------|-----------------|--------------------------|----------|
| 2402 | 0 | 1.261 | Complies |
| 2441 | 39 | 1.260 | Complies |
| 2480 | 78 | 1.261 | Complies |

See next pages for actual measured spectrum plots.



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20 dB Bandwidth - GFSK

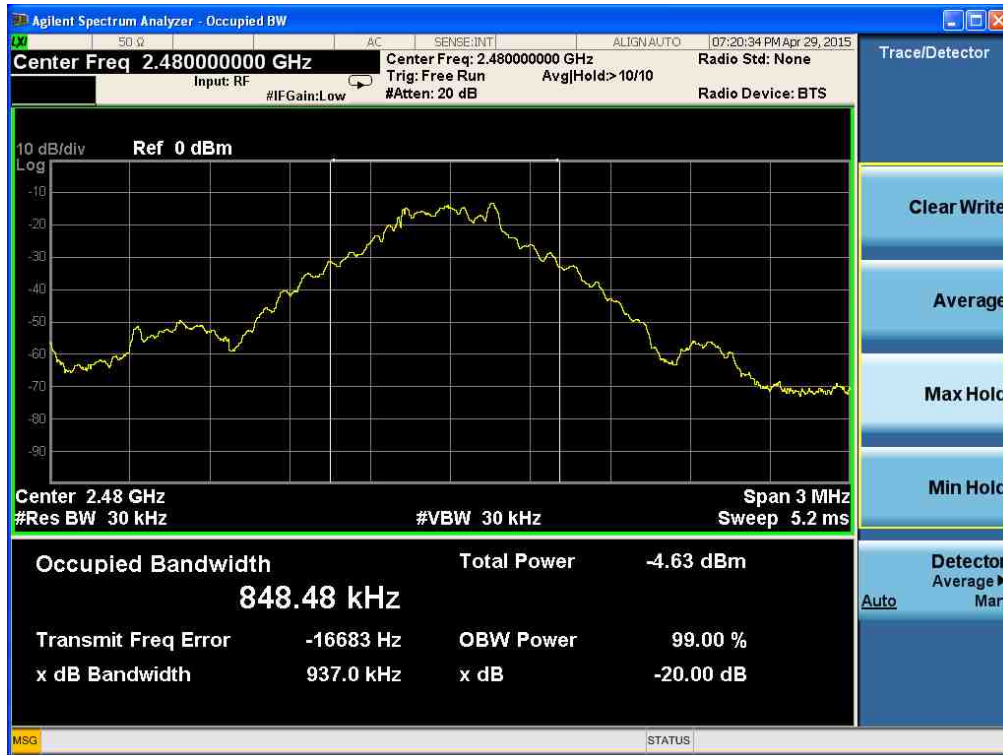




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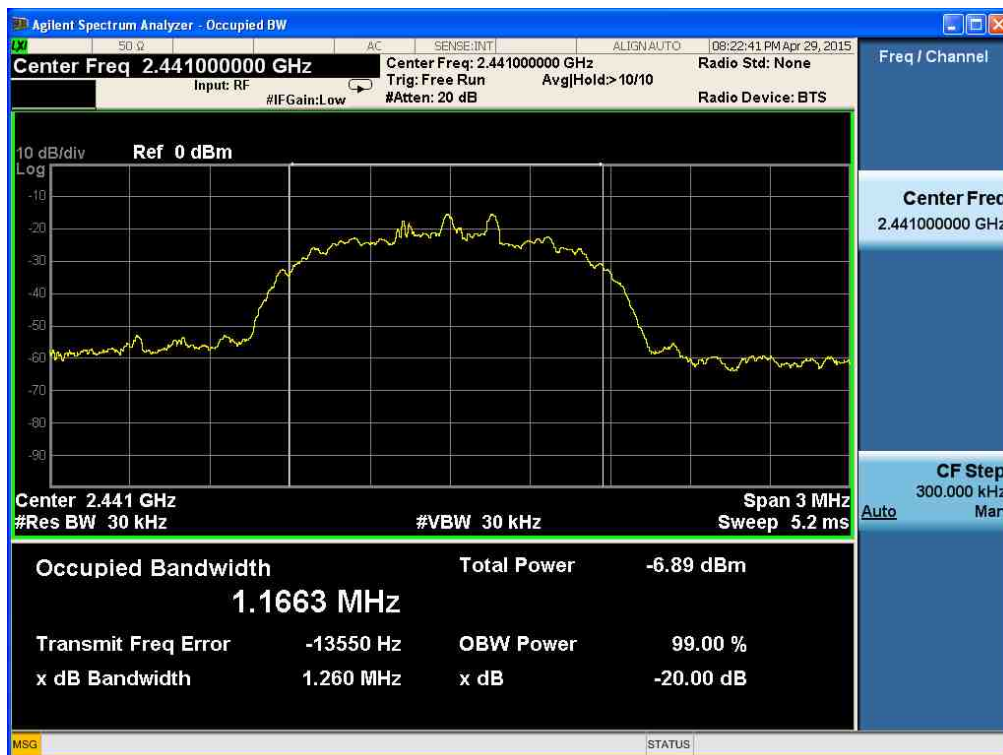
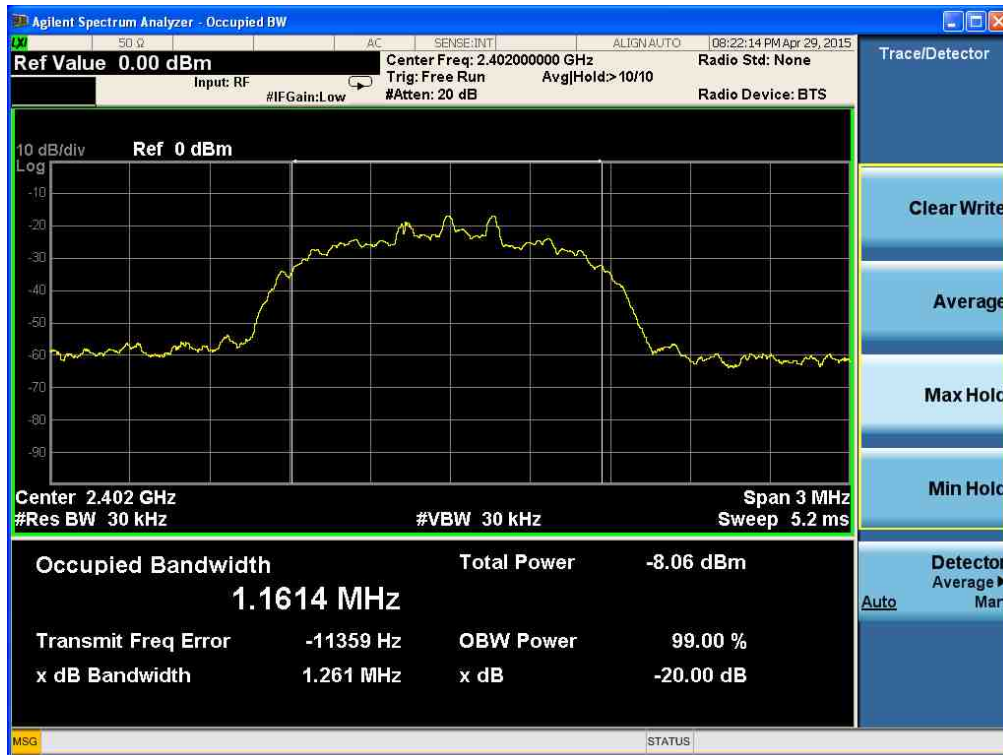
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20 dB Bandwidth - 8-DPSK

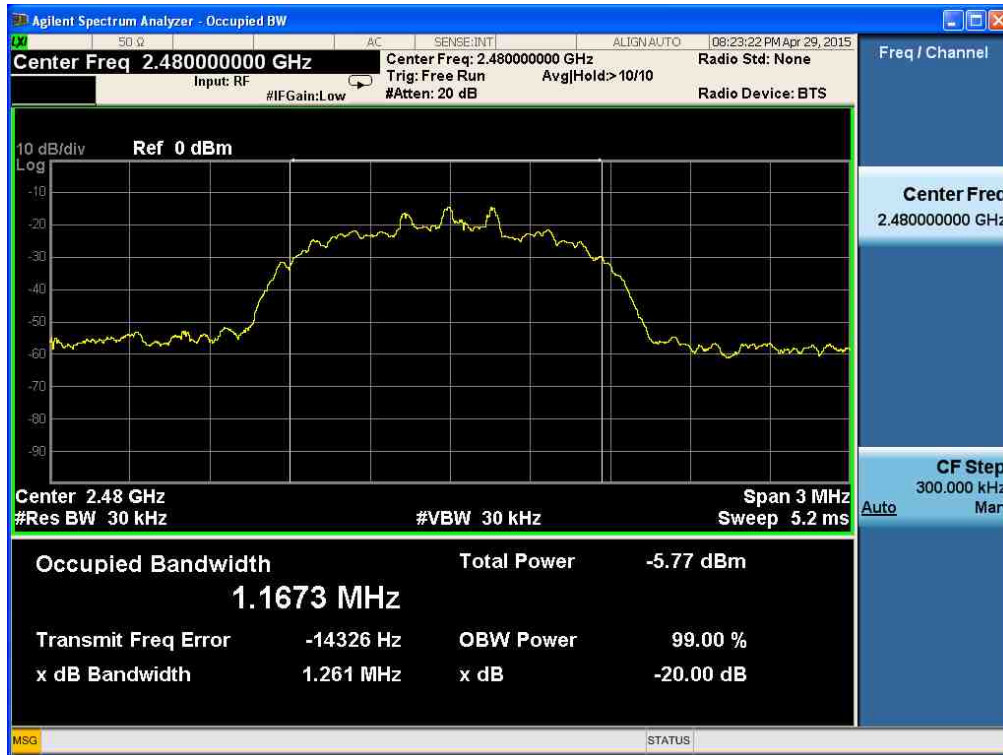




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2.1.4 Time of Occupancy (Dwell Time)

Test Location

RF Test Room

Test Procedures

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.
6. The B100S has 3 type of payload, DH1, DH3, DH5. The hopping rate is 1600 per second.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = zero

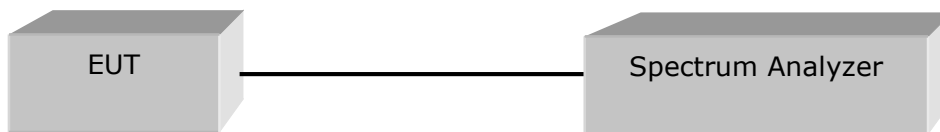
RBW = 1 MHz

Trace = max hold

VBW = 1 MHz (\geq RBW)

Detector function = peak

Sweep = as necessary to capture the entire dwell time per hopping channel



Limit

§15.247(a)(1)(iii) For frequency hopping system operating in 2400-2483.5 MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



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Test Results

Time of occupancy on the TX channel in 31.6 sec = time domain slot length × hop rate ÷
number of hop per channel × 31.6

Test mode : GFSK

| Channel Frequency (MHz) | Packet Type | Dwell Time (ms) | Test Results | |
|-------------------------|-------------|-----------------|---|----------|
| | | | Time of occupancy on the TX channel in 31.6sec (ms) | Result |
| 2402 | DH 1 | 0.380 | 121.6 | Complies |
| | DH 3 | 1.635 | 261.6 | Complies |
| | DH 5 | 2.880 | 307.2 | Complies |

DH1 Dwell time = $0.380 \text{ ms} \times (1600 \div 2) \div 79 \times 31.6 = 121.6 \text{ ms}$

DH3 Dwell time = $1.635 \text{ ms} \times (1600 \div 4) \div 79 \times 31.6 = 261.6 \text{ ms}$

DH5 Dwell time = $2.880 \text{ ms} \times (1600 \div 6) \div 79 \times 31.6 = 307.2 \text{ ms}$

Test mode : 8-DPSK

| Channel Frequency (MHz) | Packet Type | Dwell Time (ms) | Test Results | |
|-------------------------|-------------|-----------------|---|----------|
| | | | Time of occupancy on the TX channel in 31.6sec (ms) | Result |
| 2480 | 3DH 1 | 0.400 | 128.0 | Complies |
| | 3DH 3 | 1.650 | 264.0 | Complies |
| | 3DH 5 | 2.880 | 307.2 | Complies |

DH1 Dwell time = $0.400 \text{ ms} \times (1600 \div 2) \div 79 \times 31.6 = 128.0 \text{ ms}$

DH3 Dwell time = $1.650 \text{ ms} \times (1600 \div 4) \div 79 \times 31.6 = 264.0 \text{ ms}$

DH5 Dwell time = $2.880 \text{ ms} \times (1600 \div 6) \div 79 \times 31.6 = 307.2 \text{ ms}$

See next pages for actual measured spectrum plots.



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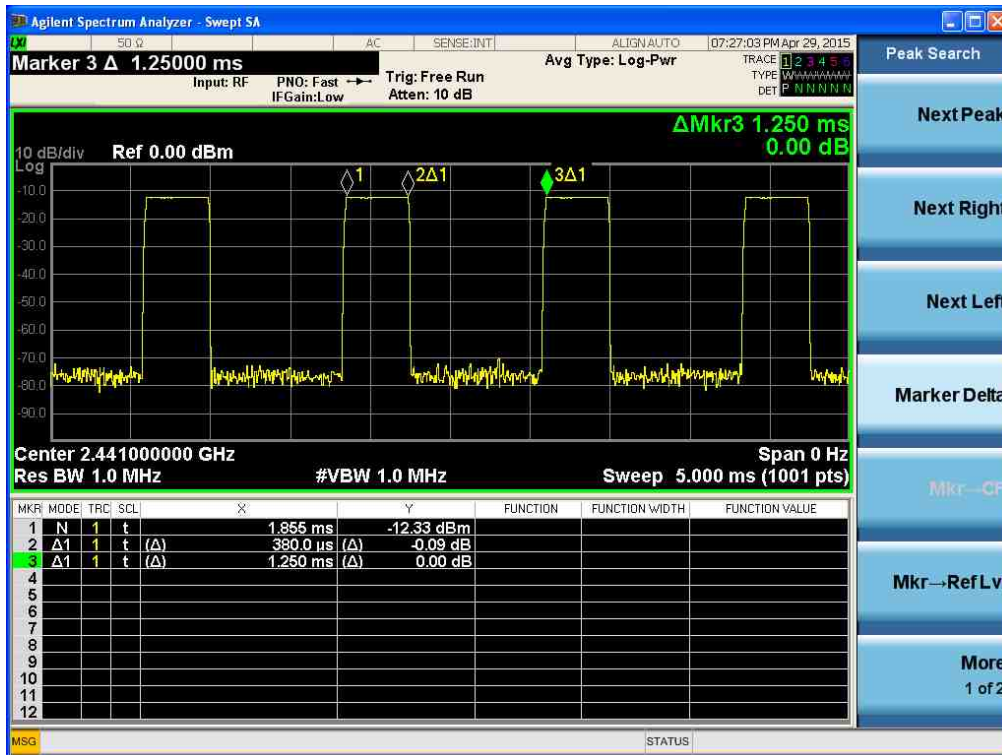
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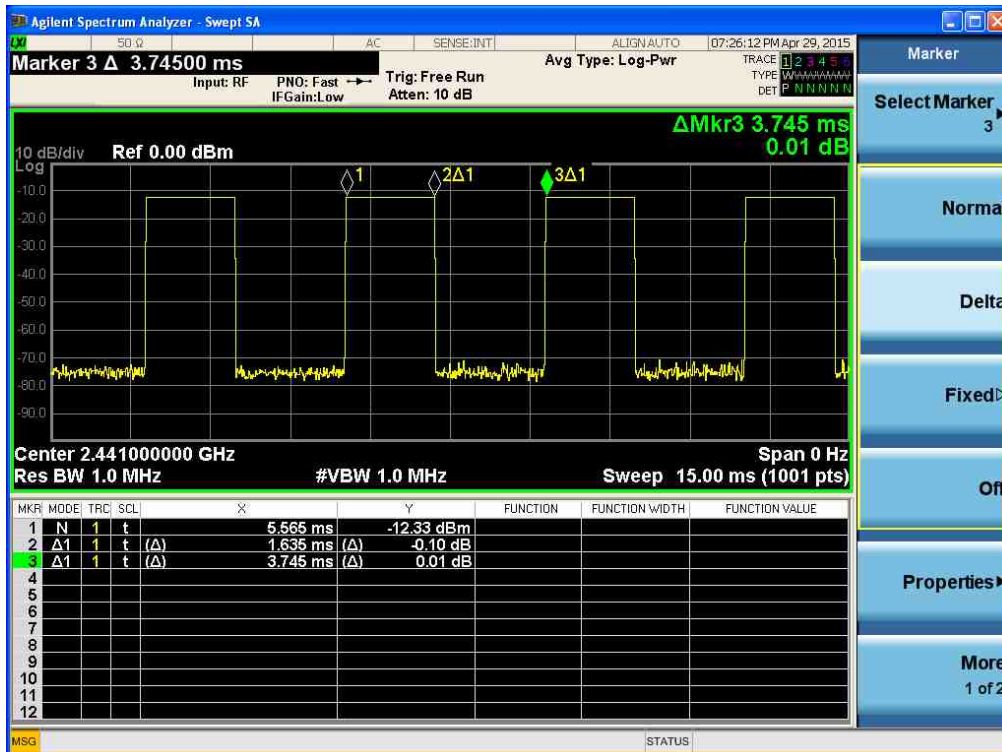
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Time of Occupancy for PACKET Type DH1(GFSK)



Time of Occupancy for PACKET Type DH3(GFSK)



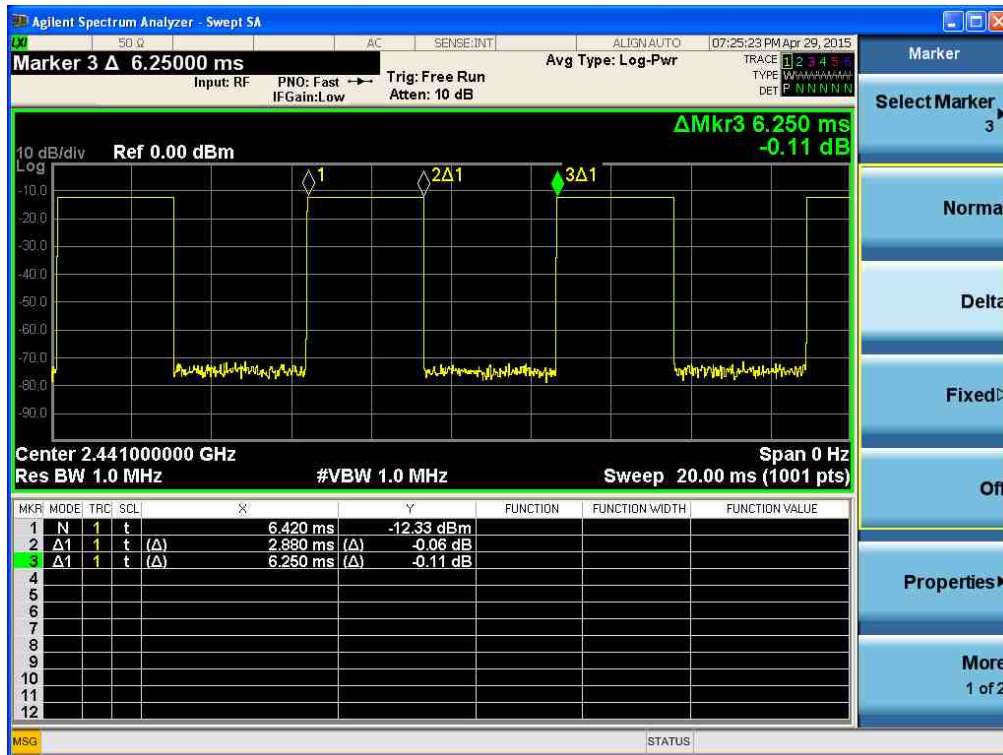


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Time of Occupancy for PACKET Type DH5(GFSK)



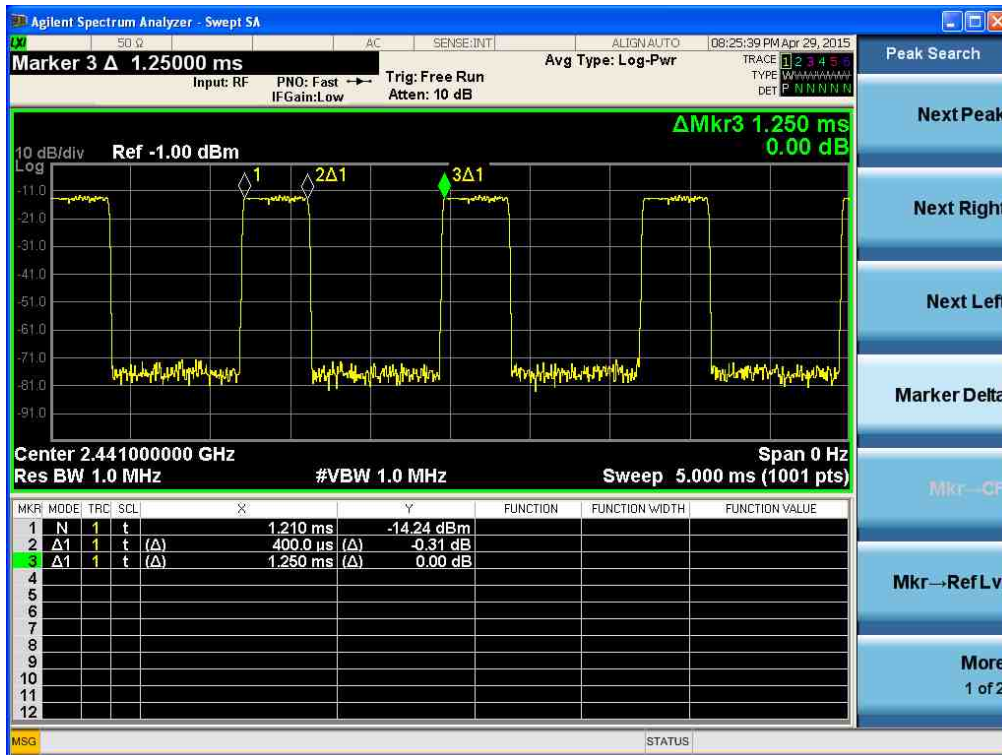


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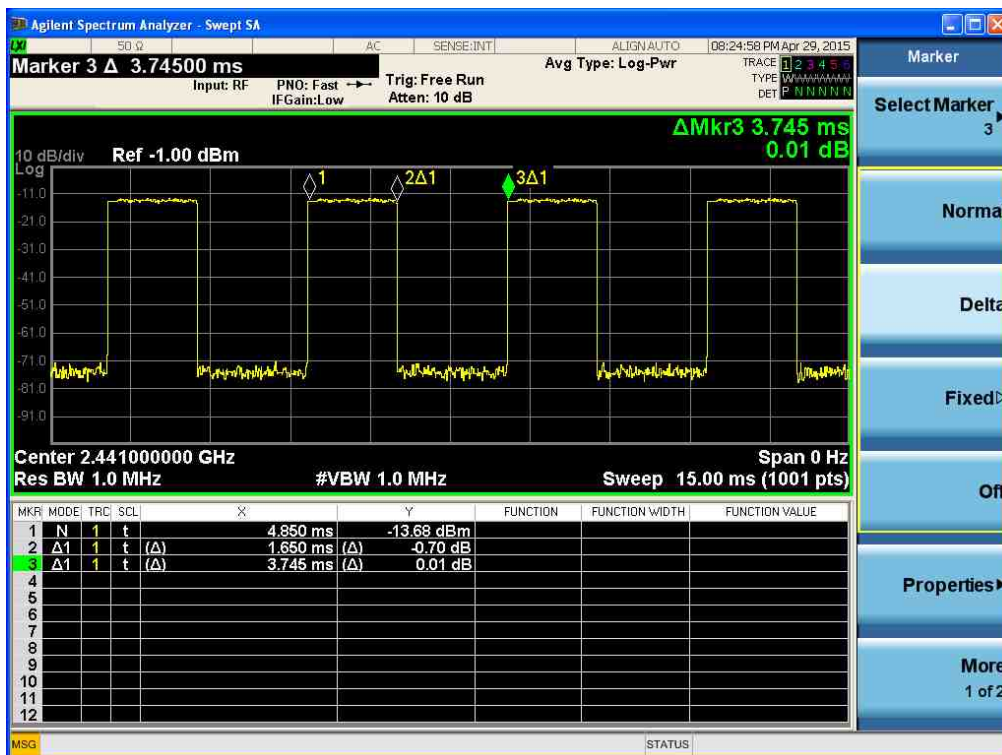
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Time of Occupancy for PACKET Type 3DH1(8-DPSK)



Time of Occupancy for PACKET Type 3DH3(8-DPSK)



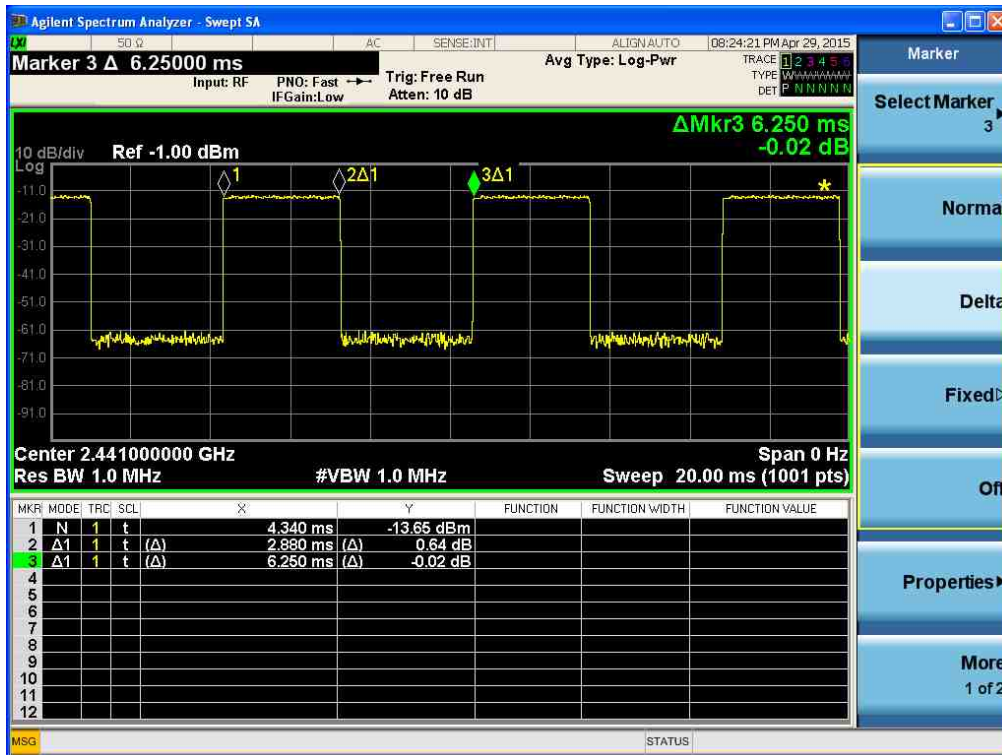


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Time of Occupancy for PACKET Type 3DH5(8-DPSK)



2.1.5 Maximum peak Conducted Output Power

Test Location

RF Test Room

Test Procedures

The maximum peak conducted output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = approximately 5 times of the 20 dB bandwidth

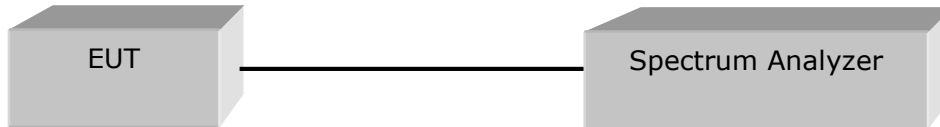
RBW = 1 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 1 MHz (\geq RBW)

Detector function = peak

Trace = max hold

Sweep = auto



Note:

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.

The RF output of EUT was connected to the spectrum analyzer by low loss cable.

Limit

§5.247(b)(1) The Maximum Peak Output Power Measurement is 0.125 Watts for frequency hopping system operating in 2400-2483.5 MHz employing at least 15 Hopping channels.



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Test Results

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402 | 0 | -5.247 | 0.299 | Complies |
| 2441 | 39 | -4.003 | 0.398 | Complies |
| 2480 | 78 | -3.130 | 0.486 | Complies |

Test mode : $\pi/4$ DQPSK, CFG PKT Packet Type : 30 Packet Size : 679(2DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402 | 0 | -5.678 | 0.271 | Complies |
| 2441 | 39 | -4.218 | 0.379 | Complies |
| 2480 | 78 | -3.318 | 0.466 | Complies |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402 | 0 | -5.165 | 0.304 | Complies |
| 2441 | 39 | -3.737 | 0.423 | Complies |
| 2480 | 78 | -2.872 | 0.516 | Complies |

See next pages for actual measured spectrum plots.



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Maximum peak Conducted Output Power - GFSK

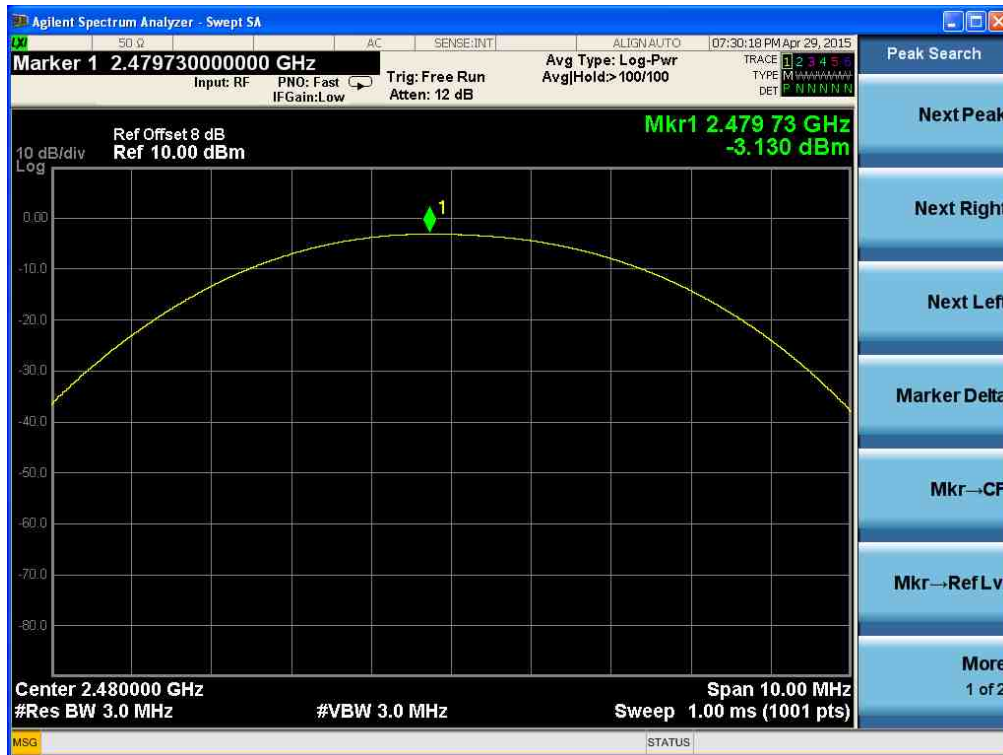




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Maximum peak Conducted Output Power - $\pi/4$ DQPSK

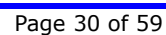




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Maximum peak Conducted Output Power - 8-DPSK





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2.1.6 RF Conducted Emissions

Test Location

RF Test Room

Test Procedures

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

RBW = 100 kHz

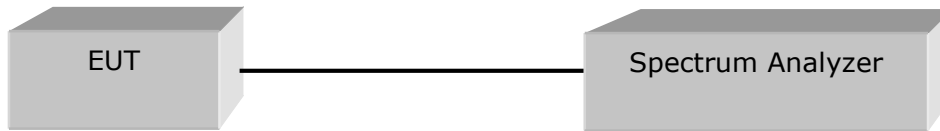
VBW = 100 kHz (\geq RBW)

Span = 10 MHz

Trace = max hold

Detector function = peak

Sweep = auto



Limit

> 20 dBc

Test Results

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the inband spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



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Band – edge (Hopping mode) - GFSK





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Band - edge (Hopping mode) - 8-DPSK





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Band - edge (Non-Hopping mode) - GFSK





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Band - edge (Non-Hopping mode) - 8-DPSK





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Spurious (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic
(Test mode : GFSK)





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Spurious (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10th harmonic (Test mode : GFSK)





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Spurious (at 20 dB blow) – High channel
Frequency Range = 30 MHz ~ 10th harmonic
(Test mode : GFSK)





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Spurious (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic
(Test mode : 8-DPSK)





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Spurious (at 20 dB blow) – Mid channel
Frequency Range = 30 MHz ~ 10th harmonic
(Test mode : 8-DPSK)





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Spurious (at 20 dB blow) – High channel
Frequency Range = 30 MHz ~ 10th harmonic
(Test mode : 8-DPSK)





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2.1.7 Other requirements Frequency Hopping Spread Spectrum System

Test Requirement : 47 CFR Part 15C Section 15.247 (a)(1), (h) requirement :

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidth of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is 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.

Example of a 79 hopping sequence in data mode:

| | | | | | | | | | | | | | |
|----|----|----|----|--|---|----|--|---|----|--|----|----|---|
| 20 | 62 | 46 | 77 | | 7 | 64 | | 8 | 73 | | 16 | 75 | 1 |
| | | | | | | | | | | | | | |



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2.1.8 Field Strength of Emissions

Test Location

- ☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10th harmonic)

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz

VBW \geq RBW

Sweep = auto

Limit

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | MHz | MHz | GHz |
|--------------------------|-------------------|---------------------|---------------|-------------|-------------------------|
| 0.09-0.11 | 8.37626-8.38675 | 73-74.6 | 399.9-410 | 2690-2900 | 10.6-12.7 |
| ¹ 0.495-0.505 | 8.41425-8.41475 | 74.8-75.2 | 608-614 | 3260-3267 | 13.25-13.4 |
| 2.1735-2.1905 | 12.29-12.293 | 108-121.94 | 960-1240 | 3332-3339 | 14.47-14.5 |
| 4.125-4.128 | 12.51975-12.52025 | 123-138 | 1300-1427 | 3345.8-3358 | 15.35-16.2 |
| 4.17725-4.17775 | 12.57675-12.57725 | 149.9-150.05 | 1435-1626.5 | 3600-4400 | 17.7-21.4 |
| 4.20725-4.20775 | 13.36-13.41 | 156.52475-156.52525 | 1645.5-1646.5 | 4500-5150 | 22.01-23.12 |
| 6.215-6.218 | 16.42-16.423 | 156.7-156.9 | 1660-1710 | 5350-5460 | 23.6-24 |
| 6.26775-6.26825 | 16.69475-16.69525 | 162.0125-167.17 | 1718.8-1722.2 | 7250-7750 | 31.2-31.8 |
| 6.31175-6.31225 | 16.80425-16.80475 | 167.72-173.2 | 2200-2300 | 8025-8500 | 36.43-36.5 |
| 8.291-8.294 | 25.5-25.67 | 240-285 | 2310-2390 | 9000-9200 | ² Above 38.6 |
| 8.362-8.366 | 37.5-38.25 | 322-335.4 | 2483.5-2500 | 9300-9500 | |

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



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

| Frequency(MHz) | Field Strength uV/m@3m | Field Strength dBuV/m@3m | Deasurement Distance (meters) |
|----------------|---------------------------|-----------------------------|----------------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705-30 | 30 | - | 30 |
| 30-88 | 100** | 40 | 3 |
| 88-216 | 150** | 43.5 | 3 |
| 216-960 | 200** | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

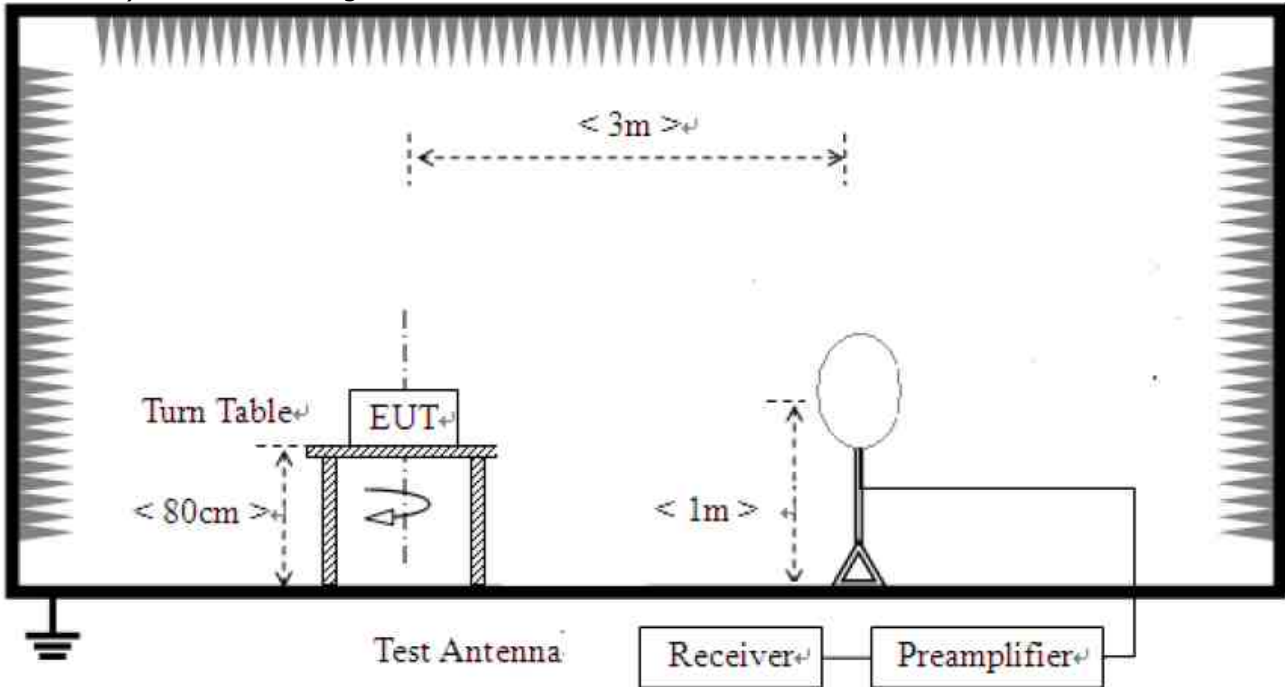
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

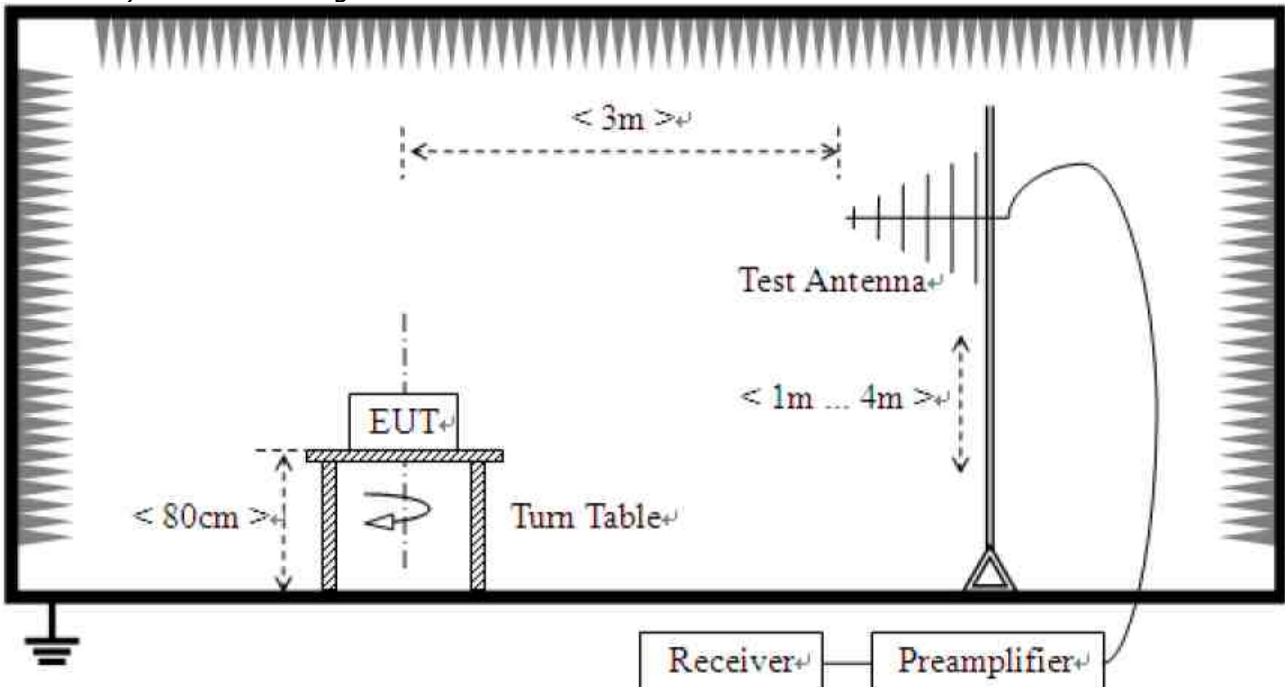
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.

Test Setup:

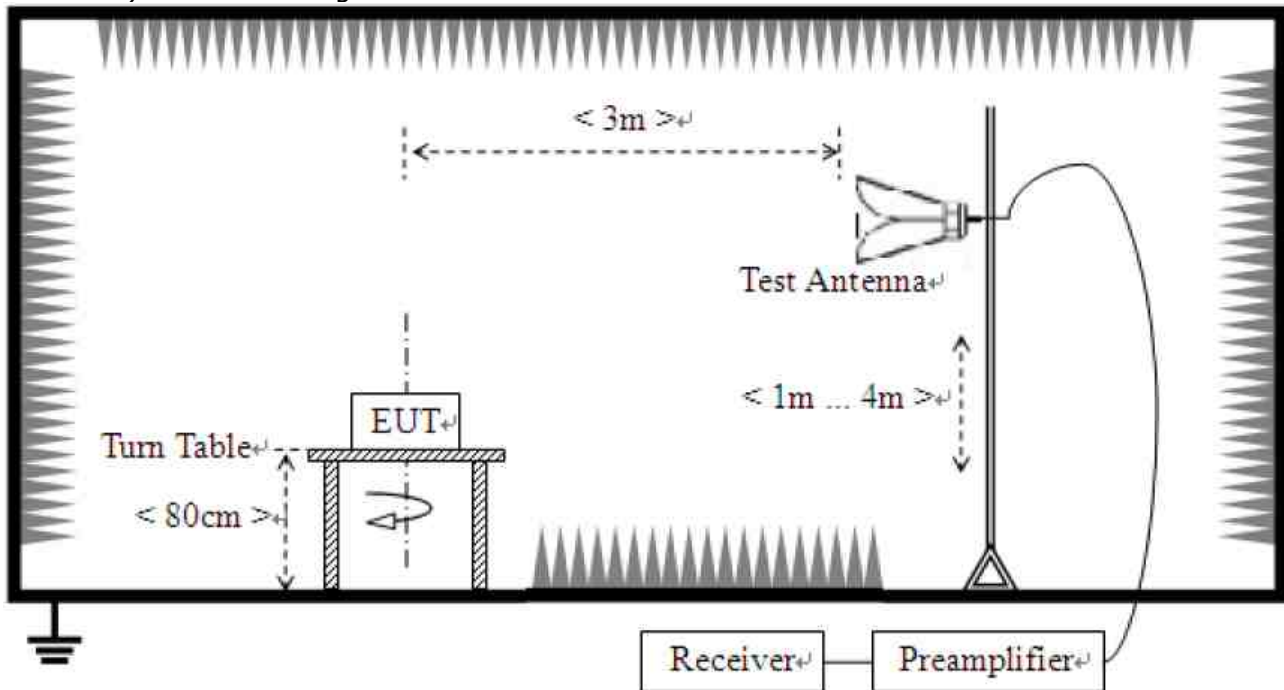
1) For field strength of emissions from 9 kHz to 30 MHz



2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test Results

1) 9 kHz to 30 MHz

| | | | |
|-----------------|---------------------|--------------------|------------|
| EUT | Bluetooth Speaker | Measurement Detail | |
| Frequency Range | | 9 kHz – 30 MHz | |
| Test mode | 8-DPSK (Worst case) | Detector function | Quasi-Peak |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|-----------------|------------------------|-------------|----------|
| - | - | - | See note |

Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)



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2) 30 MHz to 1 GHz

Test mode : Hopping(8DPSK), CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

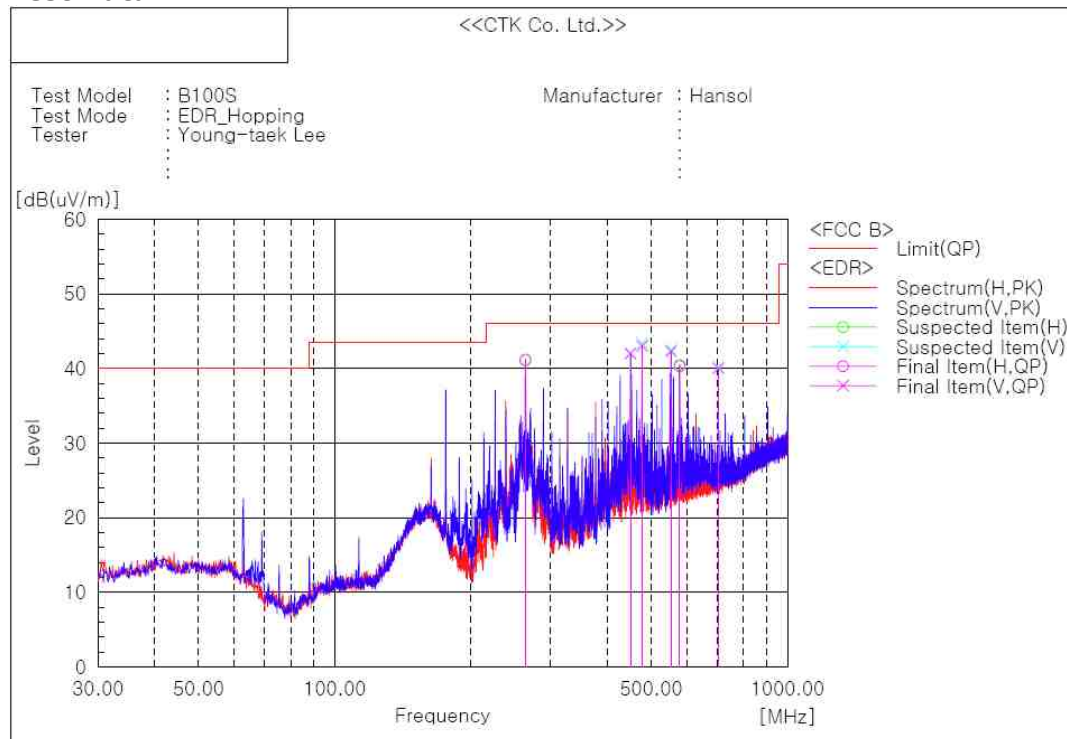
| | | | |
|-----------------|----------------------------|--------------------|------------|
| EUT | Bluetooth Speaker | Measurement Detail | |
| Frequency Range | | Below 1000MHz | |
| Test mode | 8-DPSK_Hopping(Worst case) | Detector function | Quasi-Peak |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|-----------------|------------------------|-------------|------------|
| 477.655 | 43.0 | 3.0 | Quasi-Peak |

Test Data



Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(uV)] | c.f [dB(1/m)] | Result QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1 | 263.891 | H | 51.7 | -10.6 | 41.1 | 46.0 | 4.9 | 309.0 | 238.0 |
| 2 | 450.010 | V | 46.6 | -4.6 | 42.0 | 46.0 | 4.0 | 100.0 | 235.0 |
| 3 | 477.655 | V | 46.8 | -3.8 | 43.0 | 46.0 | 3.0 | 100.0 | 235.0 |
| 4 | 553.073 | V | 44.2 | -1.9 | 42.3 | 46.0 | 3.7 | 100.0 | 235.0 |
| 5 | 578.171 | H | 41.6 | -1.3 | 40.3 | 46.0 | 5.7 | 100.0 | 275.0 |
| 6 | 703.908 | V | 38.9 | 1.1 | 40.0 | 46.0 | 6.0 | 100.0 | 235.0 |

Remark :

1. The field strength of spurious emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

2. Result = Reading + Correction factor

3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



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3) above 1 GHz

| | | | |
|---------|-------------------|--------------------|---------|
| EUT | Bluetooth Speaker | Measurement Detail | |
| Model | B100S | Frequency Range | 1-25GHz |
| Channel | Channel 0 | Detector function | Peak |

Remarks

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|-----------------|------------------------|-------------|---------|
| 2390 | 31.8 | 22.2 | Average |

Test Data

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] AV / Peak | | Pol. | Height [m] | Correction Factor | Limits [dBuV/m] AV / Peak | | Result [dBuV/m] AV / Peak | | Margin [dB] AV / Peak | |
|--------------------|----------------------------------|------|------|---------------|----------------------|---------------------------------|------|---------------------------------|------|-----------------------------|------|
| | Antenna + Amp. Gain + Cable | | | | | | | | | | |
| 2390.00 | 24.1 | 41.1 | V | 1.0 | 7.1 | 54.0 | 74.0 | 31.2 | 48.2 | 22.8 | 25.8 |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] AV / Peak | | Pol. | Height [m] | Correction Factor | Limits [dBuV/m] AV / Peak | | Result [dBuV/m] AV / Peak | | Margin [dB] AV / Peak | |
|--------------------|----------------------------------|------|------|---------------|----------------------|---------------------------------|------|---------------------------------|------|-----------------------------|------|
| | Antenna + Amp. Gain + Cable | | | | | | | | | | |
| 2390.00 | 24.7 | 39.2 | V | 1.0 | 7.1 | 54.0 | 74.0 | 31.8 | 46.3 | 22.2 | 27.7 |



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Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| | | | |
|---------|-------------------|--------------------|---------|
| EUT | Bluetooth Speaker | Measurement Detail | |
| Model | B100S | Frequency Range | 1-25GHz |
| Channel | Channel 39 | Detector function | Peak |

Remarks

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|--|---------------------------|----------------|--------|
| No emissions were detected at a level greater than 20dB below limit. | | | |

Test Data

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |



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Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| | | | |
|---------|-------------------|--------------------|---------|
| EUT | Bluetooth Speaker | Measurement Detail | |
| Model | B100S | Frequency Range | 1-25GHz |
| Channel | Channel 78 | Detector function | Peak |

Remarks

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|--------------------|---------------------------|----------------|---------|
| 2483.5 | 43.8 | 10.2 | Average |

Test Data

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] | Pol. | Height [m] | Correction Factor | | | Limits [dBuV/m] | Result [dBuV/m] | Margin [dB] |
|--|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
| | | | | Antenna | Amp. Gain | Cable | | | |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | |

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Height [m] | Correction Factor | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|---------------------|------|------|---------------|-----------------------------|--------------------|------|--------------------|------|----------------|------|
| | AV / Peak | | | | Antenna + Amp. Gain + Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 2483.50 | 23.9 | 38.1 | V | 1.0 | 7.5 | 54.0 | 74.0 | 31.4 | 45.6 | 22.6 | 28.4 |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Height [m] | Correction Factor | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|---------------------|------|------|---------------|-----------------------------|--|--------------------|------|--------------------|------|----------------|------|
| | AV / Peak | | | | Antenna + Amp. Gain + Cable | | AV / Peak | | AV / Peak | | AV / Peak | |
| 2483.50 | 36.3 | 39.0 | V | 1.0 | 7.5 | | 54.0 | 74.0 | 43.8 | 46.5 | 10.2 | 27.5 |



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2.1.9 AC Conducted Emissions

Test Location

Shielded Room

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- 15.207(a)

| Frequency (MHz) | Conducted Limit (dBuV) | |
|-----------------|------------------------|-----------|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56* | 56 to 46* |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Test Results

The requirements are:

☒ Complies

Test mode : Hopping(GFSK, DH5)

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|-----------------|------------------------|-------------|---------|
| 0.4425 | 33.8 | 13.2 | Average |

Test mode : Hopping(8-DPSK, 3DH5)

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|-----------------|------------------------|-------------|---------|
| 0.4425 | 33.0 | 14.1 | Average |



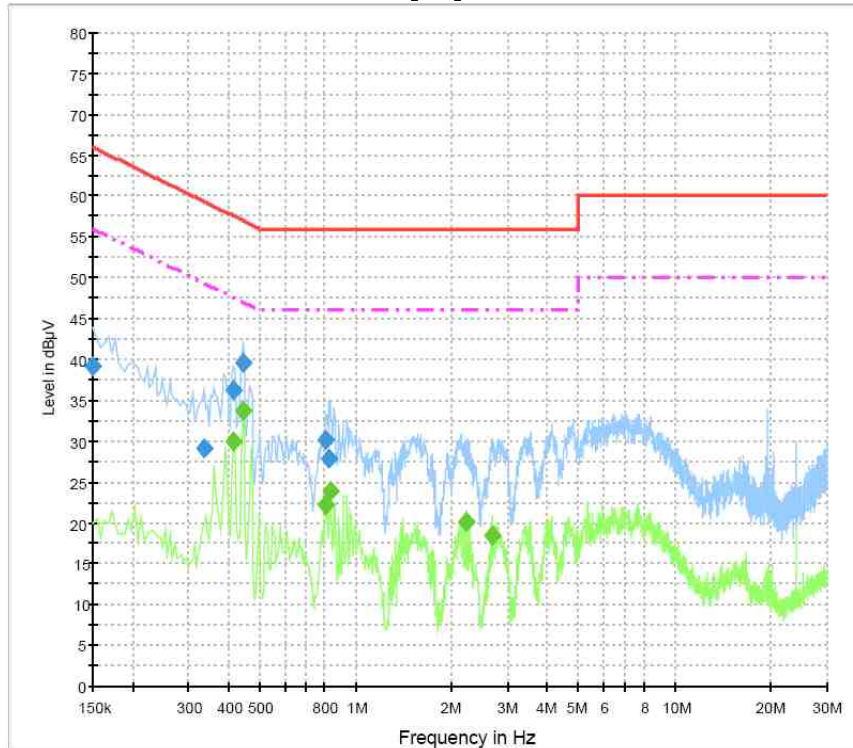
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Test Data_Hopping(GFSK)

[L1]



Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 39.2 | 1000.0 | 9.000 | On | L1 | 9.7 | 26.8 | 66.0 |
| 0.334500 | 29.1 | 1000.0 | 9.000 | On | L1 | 9.8 | 30.2 | 59.3 |
| 0.415500 | 36.2 | 1000.0 | 9.000 | On | L1 | 9.9 | 21.3 | 57.5 |
| 0.442500 | 39.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 17.5 | 57.0 |
| 0.807000 | 30.2 | 1000.0 | 9.000 | On | L1 | 9.8 | 25.8 | 56.0 |
| 0.825000 | 27.9 | 1000.0 | 9.000 | On | L1 | 9.8 | 28.1 | 56.0 |

Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.415500 | 30.0 | 1000.0 | 9.000 | On | L1 | 9.9 | 17.6 | 47.5 |
| 0.442500 | 33.8 | 1000.0 | 9.000 | On | L1 | 9.9 | 13.2 | 47.0 |
| 0.807000 | 22.3 | 1000.0 | 9.000 | On | L1 | 9.8 | 23.7 | 46.0 |
| 0.834000 | 23.8 | 1000.0 | 9.000 | On | L1 | 9.8 | 22.2 | 46.0 |
| 2.220000 | 20.2 | 1000.0 | 9.000 | On | L1 | 9.8 | 25.8 | 46.0 |
| 2.692500 | 18.5 | 1000.0 | 9.000 | On | L1 | 9.8 | 27.5 | 46.0 |

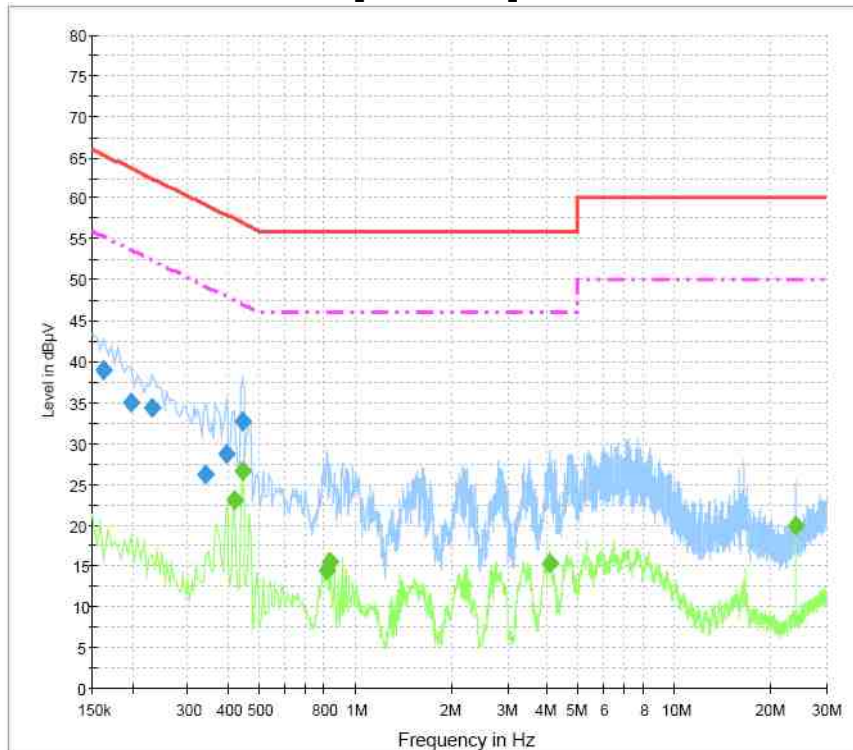


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Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.163500 | 38.9 | 1000.0 | 9.000 | On | N | 9.7 | 26.4 | 65.3 |
| 0.199500 | 34.9 | 1000.0 | 9.000 | On | N | 9.8 | 28.7 | 63.6 |
| 0.231000 | 34.3 | 1000.0 | 9.000 | On | N | 9.7 | 28.1 | 62.4 |
| 0.339000 | 26.2 | 1000.0 | 9.000 | On | N | 9.8 | 33.1 | 59.2 |
| 0.393000 | 28.7 | 1000.0 | 9.000 | On | N | 9.9 | 29.3 | 58.0 |
| 0.442500 | 32.7 | 1000.0 | 9.000 | On | N | 9.9 | 24.3 | 57.0 |

Final Result 2

| Frequency (MHz) | CAverage (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.420000 | 23.0 | 1000.0 | 9.000 | On | N | 9.9 | 24.4 | 47.4 |
| 0.442500 | 26.5 | 1000.0 | 9.000 | On | N | 9.9 | 20.5 | 47.0 |
| 0.811500 | 14.5 | 1000.0 | 9.000 | On | N | 9.8 | 31.5 | 46.0 |
| 0.838500 | 15.6 | 1000.0 | 9.000 | On | N | 9.8 | 30.4 | 46.0 |
| 4.092000 | 15.3 | 1000.0 | 9.000 | On | N | 9.7 | 30.7 | 46.0 |
| 24.121500 | 19.9 | 1000.0 | 9.000 | On | N | 10.1 | 30.1 | 50.0 |



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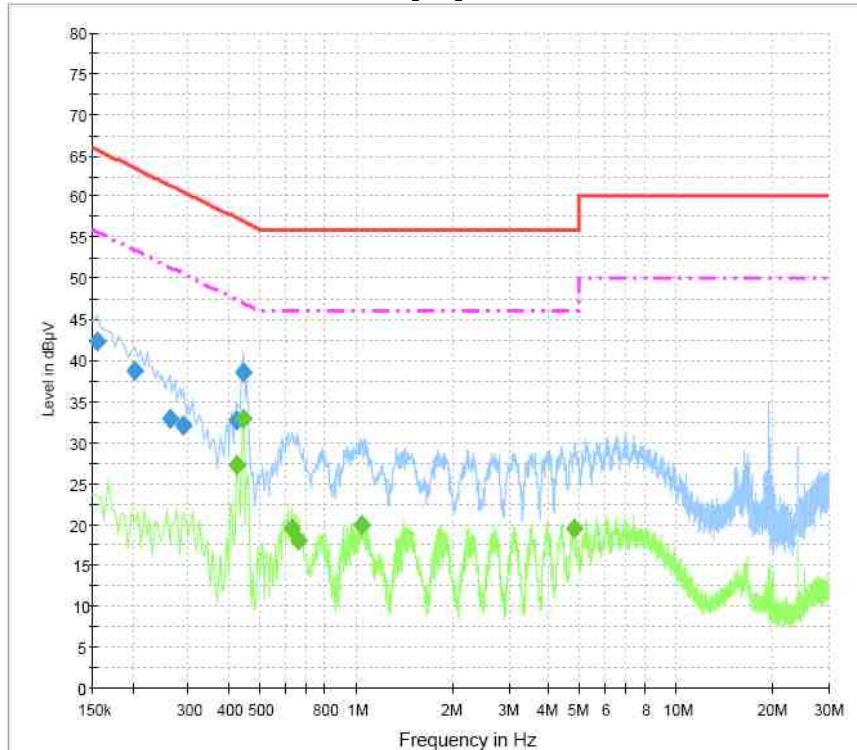
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Test Data_Hopping(8-DPSK)

[L1]



Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.154500 | 42.4 | 1000.0 | 9.000 | On | L1 | 9.7 | 23.3 | 65.8 |
| 0.204000 | 38.7 | 1000.0 | 9.000 | On | L1 | 9.8 | 24.8 | 63.4 |
| 0.262500 | 33.0 | 1000.0 | 9.000 | On | L1 | 9.6 | 28.4 | 61.4 |
| 0.289500 | 32.1 | 1000.0 | 9.000 | On | L1 | 9.7 | 28.5 | 60.5 |
| 0.424500 | 32.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 24.7 | 57.4 |
| 0.442500 | 38.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 18.5 | 57.0 |

Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.424500 | 27.2 | 1000.0 | 9.000 | On | L1 | 9.9 | 20.2 | 47.4 |
| 0.442500 | 33.0 | 1000.0 | 9.000 | On | L1 | 9.9 | 14.1 | 47.0 |
| 0.631500 | 19.5 | 1000.0 | 9.000 | On | L1 | 9.8 | 26.5 | 46.0 |
| 0.663000 | 18.1 | 1000.0 | 9.000 | On | L1 | 9.8 | 27.9 | 46.0 |
| 1.036500 | 19.8 | 1000.0 | 9.000 | On | L1 | 9.7 | 26.2 | 46.0 |
| 4.821000 | 19.4 | 1000.0 | 9.000 | On | L1 | 9.8 | 26.6 | 46.0 |

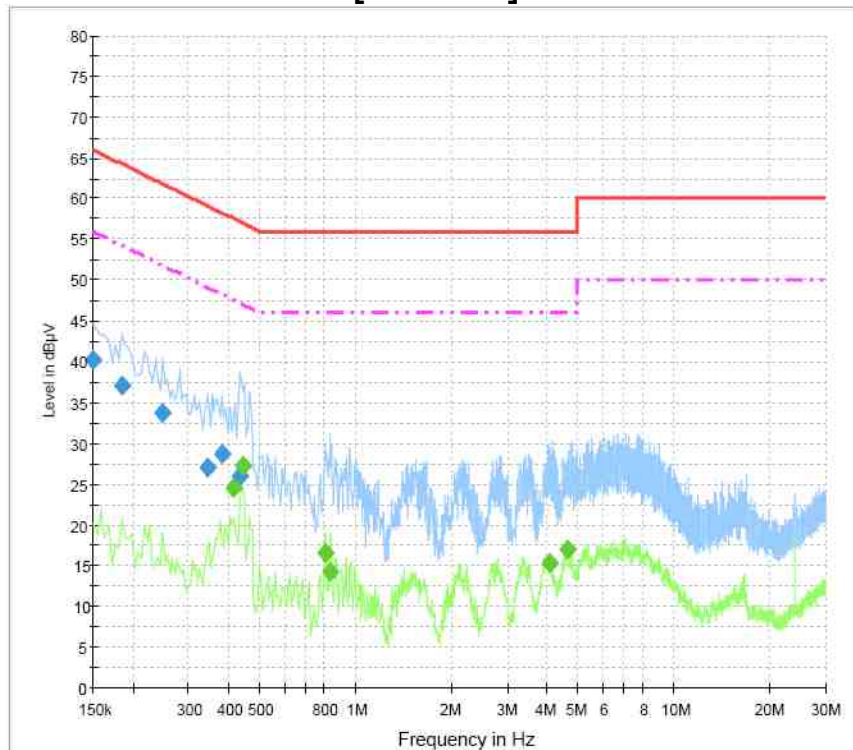


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Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 40.3 | 1000.0 | 9.000 | On | N | 9.7 | 25.7 | 66.0 |
| 0.186000 | 37.2 | 1000.0 | 9.000 | On | N | 9.8 | 27.1 | 64.2 |
| 0.249000 | 33.8 | 1000.0 | 9.000 | On | N | 9.6 | 28.0 | 61.8 |
| 0.343500 | 27.0 | 1000.0 | 9.000 | On | N | 9.8 | 32.1 | 59.1 |
| 0.379500 | 28.6 | 1000.0 | 9.000 | On | N | 9.9 | 29.7 | 58.3 |
| 0.433500 | 26.0 | 1000.0 | 9.000 | On | N | 9.9 | 31.2 | 57.2 |

Final Result 2

| Frequency (MHz) | CAverage (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.415500 | 24.4 | 1000.0 | 9.000 | On | N | 9.9 | 23.1 | 47.5 |
| 0.442500 | 27.2 | 1000.0 | 9.000 | On | N | 9.9 | 19.8 | 47.0 |
| 0.807000 | 16.6 | 1000.0 | 9.000 | On | N | 9.8 | 29.4 | 46.0 |
| 0.838500 | 14.3 | 1000.0 | 9.000 | On | N | 9.8 | 31.7 | 46.0 |
| 4.069500 | 15.4 | 1000.0 | 9.000 | On | N | 9.7 | 30.6 | 46.0 |
| 4.659000 | 16.9 | 1000.0 | 9.000 | On | N | 9.7 | 29.1 | 46.0 |



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APPENDIX A – Test Equipment Used For Tests

| | Name of Equipment | Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date |
|----|-----------------------------|---------------------------------------|--|---------------|---------------------|------------|
| 1 | Signal Analyzer | Agilent | N9020A | MY48011598 | 2014-11-07 | 2015-11-07 |
| 2 | EMI Test Receiver | Rohde & Schwarz | ESCI7 | 100814 | 2014-12-05 | 2015-12-05 |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESCI7 | 100816 | 2014-12-05 | 2015-12-05 |
| 4 | EMI Test Receiver | Rohde & Schwarz | ESU40 | 100336 | 2014-05-15 | 2015-05-15 |
| 5 | Bilog Antenna | Schaffner | CBL6111C | 2551 | 2014-05-08 | 2016-05-08 |
| 6 | Double Ridged Guide Antenna | ETS-Lindgren | 3117 | 00154525 | 2013-07-03 | 2015-07-03 |
| 7 | Double Ridged Guide Antenna | ETS-Lindgren | 3116 | 00062504 | 2014-05-27 | 2015-05-27 |
| 8 | Active Loop Antenna | SCHWARZBECK | FMZB 1513 | 1513-126 | 2014-05-19 | 2016-05-19 |
| 9 | Attenuator | Rohde & Schwarz | DNF | 272.4110.50-2 | 2014-11-07 | 2015-11-07 |
| 10 | PREAMPLIFIER | Agilent | 8449B | 3008A02307 | 2014-10-24 | 2015-10-24 |
| 11 | AMPLIFIER | Sonoma Instrument Co. | 310 | 291721 | 2015-02-02 | 2016-02-02 |
| 12 | Band Reject Filter | Wainwright Instruments GmbH | WRCGV 2400/2483- 2375/2505- 50/10EE | 2 | 2014-08-25 | 2015-08-25 |
| 13 | Signal Generator | Rohde & Schwarz | SMB100A | 175528 | 2015-01-19 | 2016-01-19 |
| 14 | LISN | Rohde & Schwarz | ENV216 | 101236 | 2014-07-30 | 2015-07-30 |
| 15 | LISN | Rohde & Schwarz | ENV216 | 101235 | 2014-07-30 | 2015-07-30 |
| 16 | DC Power Supply | Topward Electric Instruments Co.,Ltd. | 6303D | 666421 | 2015-02-03 | 2016-02-03 |
| 17 | DC Power Supply | Agilent | E3632A | MY40011638 | 2014-11-07 | 2015-11-07 |
| 18 | BLUETOOTH TESTER | TESCOM | TC-3000C | 3000C000377 | 2014-11-14 | 2015-11-14 |