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TEST REPORT

FCC Standards : FCC 47CFR part 15 subpart C
Industry Canada Standards :RSS-210 Issue 8 & RSS-GEN Issue 4

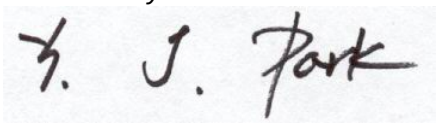
Test Report No.	:	CTK-2016-00002
Date of Issue	:	2016-01-02
FCC ID	:	A3LWCK720Q
Certification Number IC	:	649E-WCK720Q
Model/Type No.	:	WCK720Q
Kind of Product	:	Wi-Fi/BT Transceiver
Applicant	:	Samsung Electronics Co., Ltd.
Applicant Address	:	129, Samsung-ro Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea, 16677
Manufacturer	:	Samsung Electronics Co., Ltd.
Manufacturer Address	:	19 Chapin Rd., Building D Pine Brook, New Jersey, United States, 07058
Factory #1	:	WISOL CO., LTD.
Factory Address	:	531-7 Gajang-ro, Osan-si, Gyeonggi-do, Korea
Factory #2	:	WISOL HANOI CO., LTD.
Factory Address	:	26, ROAD 05, VSIP, PHU CHAN COMMUNE, TU SON DISTRICT, BAC NINH PROVINCE, VIETNAM
Contact Person	:	Minhyung Cho
Telephone	:	+82-31-277-2688
Received Date	:	2015-12-09
Test period	:	Start : 2015-12-20 End : 2016-01-02
Test Results	:	☒ In Compliance ☐ Not in Compliance

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

Tested by

Won-Jae, Hwang
Test Engineer
Date: 2016-01-02

Reviewed by



Young-Joon, Park
Technical Manager
Date: 2016-01-02

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REPORT REVISION HISTORY

Date	Revision	Page No
2016-01-02	Issued (CTK-2016-00002)	All

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1.0 General Product Description

Basic Model/Type No.	WCK720Q
Serial number	Prototype
EUT condition	Pre-production, not damaged
Antenna type	Metal Invertes F antenna Gain 1.9 dBi
Frequency Range	2402 MHz - 2480 MHz
RF power	9.188 dBm Peak Conducted (GFSK) 9.766 dBm Peak Conducted (8-DPSK)
Number of channels	79
Channel Spacing	1 MHz
Channel Access Protocol	Frequency Hopping
Type of Modulation	GFSK(1 Mbps), DQPSK(2 Mbps), 8-DPSK(3 Mbps)
Power Source	DC 5 V

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 channel(s) was (were) selected for the final test as listed below.

Tested Ch	Modulation Technology	Modulation Type	Packet Type
Low, Mid, High	FHSS	GFSK	DH 5
Low, Mid, High	FHSS	8-DPSK	3DH 5

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1.3 Device Modifications

The following modifications was applied by the applicant:

Not applicable

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	Hp	-	-
AC Adapter	Hp	PPP012D-S	-

1.5 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.

1.6 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

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1.7 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	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

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.10 -2013

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

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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 (≥ 1% of the span) Sweep = auto
VBW = 30 kHz (≥ RBW) Detector function = peak
Trace = max hold

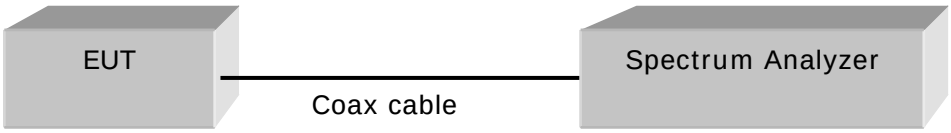

Figure 1 : Measurement setup for the carrier frequency separation

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	1005	633	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	1000	860.7	25	Complies

See next pages for actual measured spectrum plots.

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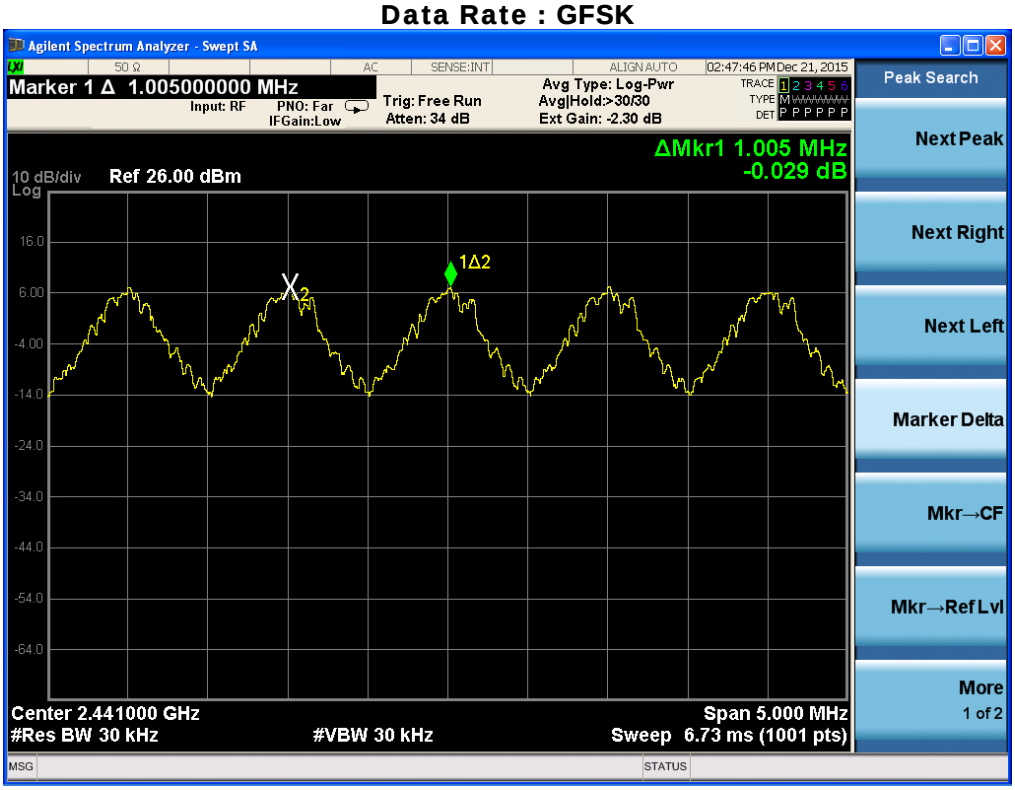
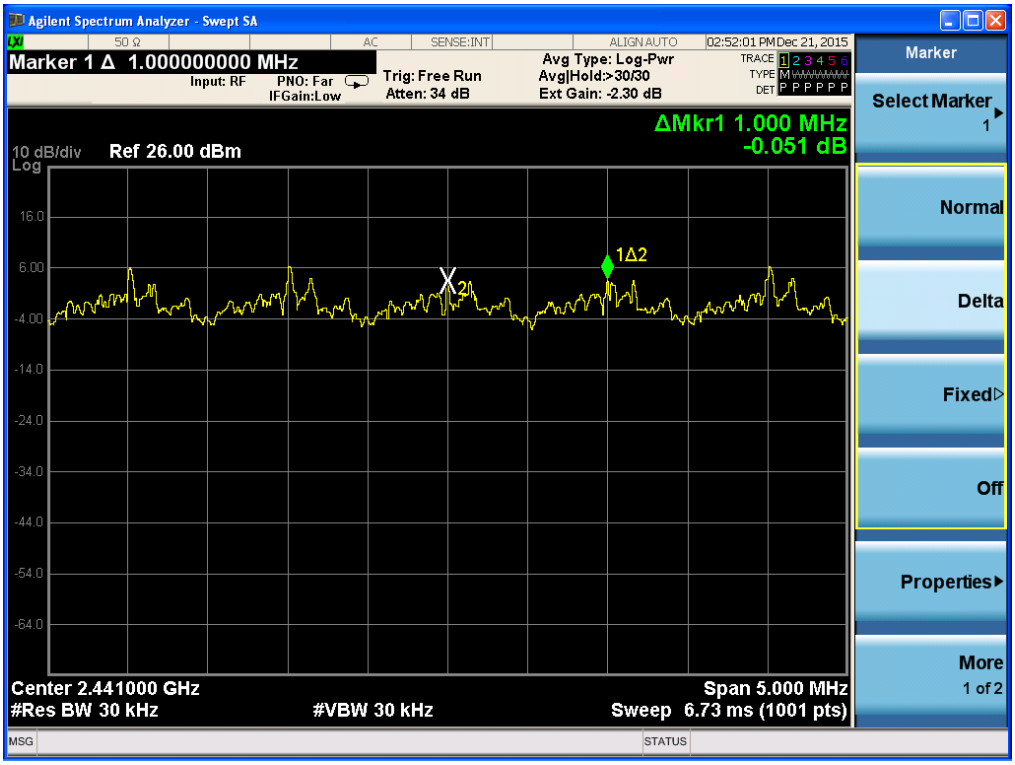
Carrier Frequency Separation

Data Rate : GFSK



Data Rate : 8-DPSK



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2.1.2 Number of Hopping Frequencies

Test Location

RF Test Room

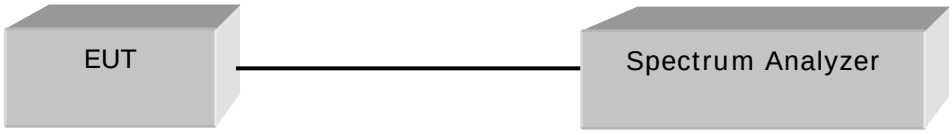
Test Procedures

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

Span = 50 MHz
RBW = 300 kHz (≥ 1% of the span) Sweep = auto
VBW = 300 kHz (≥ RBW) Detector function = peak
Trace = max hold



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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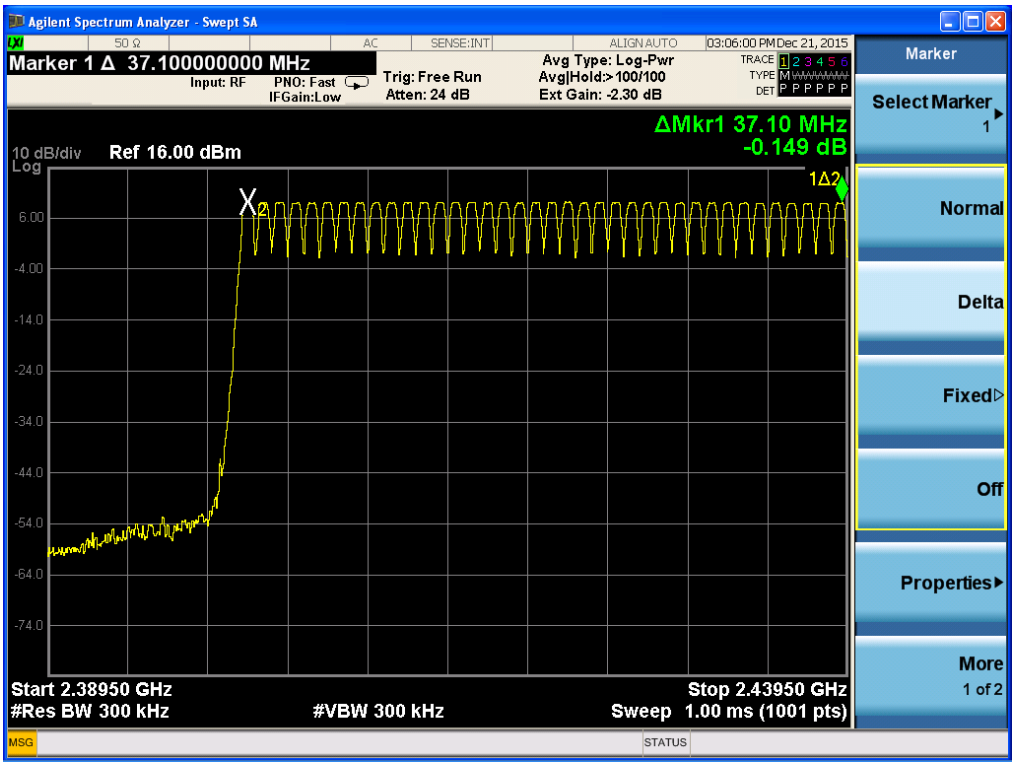
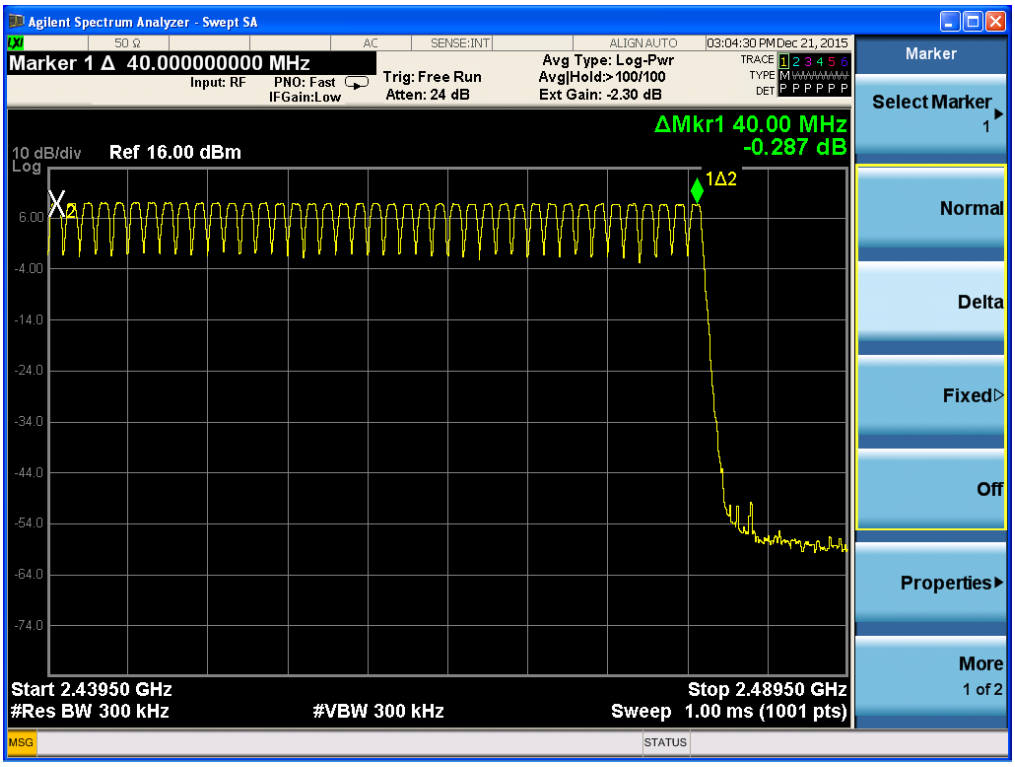
Number of Hopping Frequencies(GFSK)





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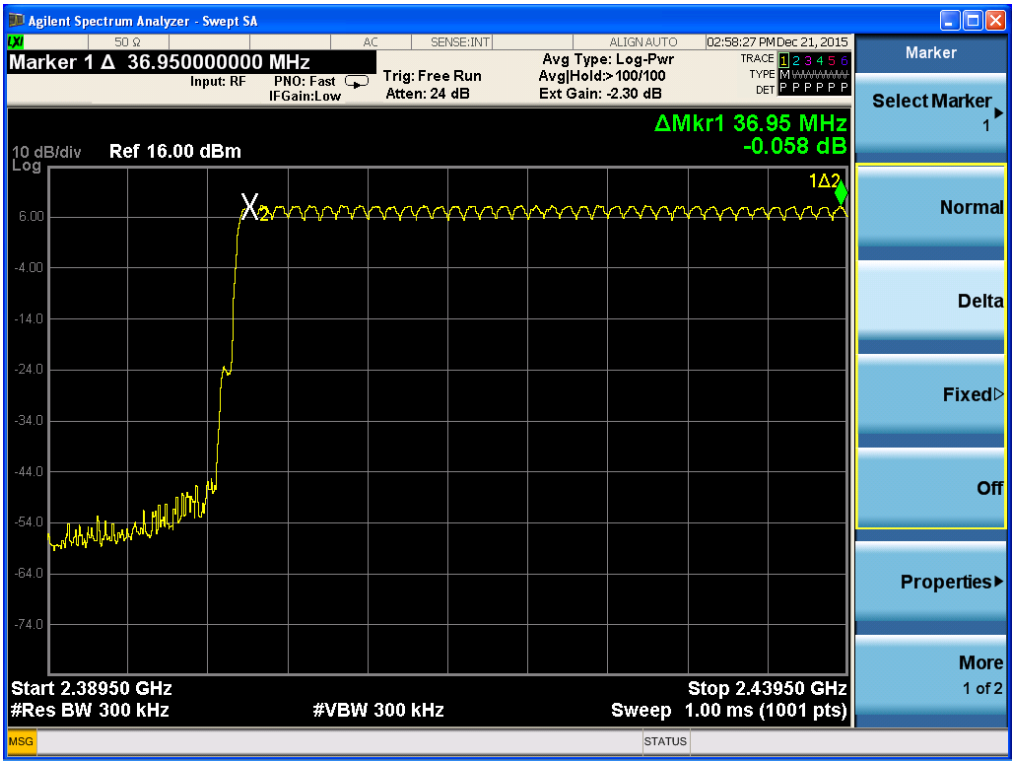
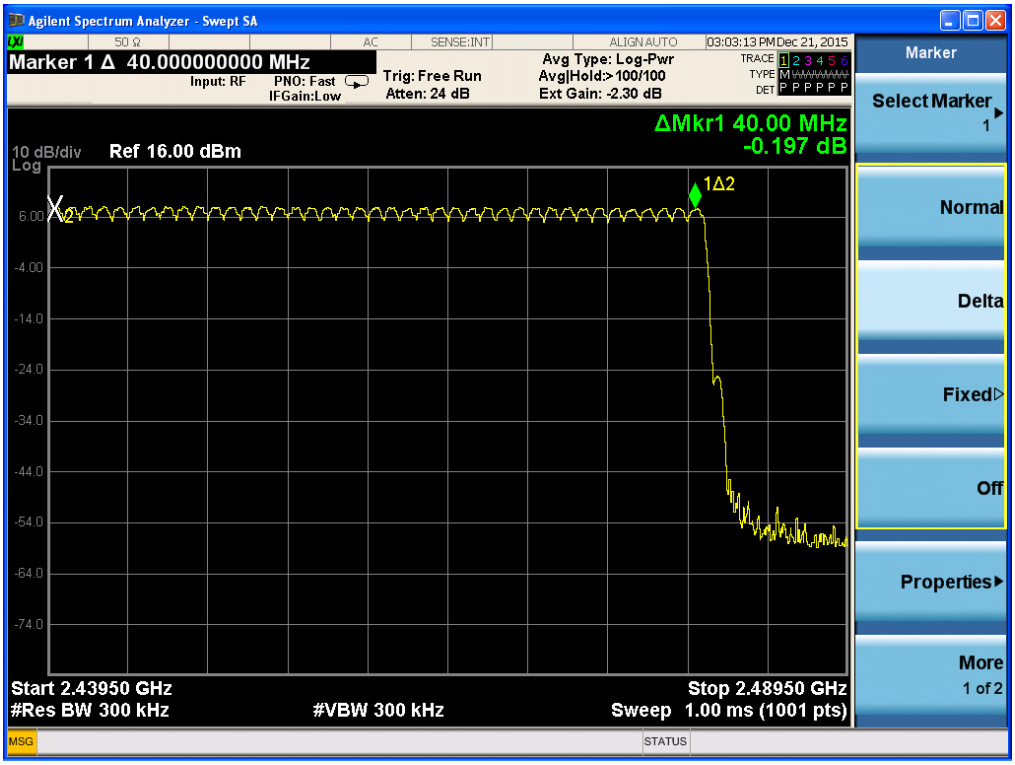
Number of Hopping Frequencies(8-DPSK)





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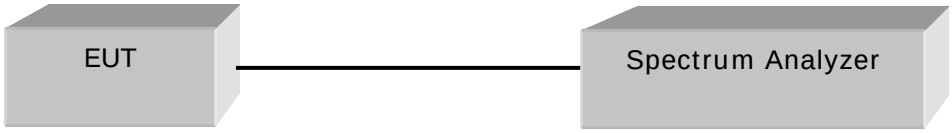
2.1.3 20 dB bandwidth

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 = 3 MHz (approximately 2 or 3 times of the 20 dB bandwidth)
RBW = 30 kHz (≥ 1% of the span) Sweep = auto
VBW = 30 kHz (≥ RBW) Detector function = peak
Trace = max hold



Limit

Limit : N/A

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Test Results (20 dB bandwidth)

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

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2402	0	0.949	Complies
2441	39	0.950	Complies
2480	78	0.946	Complies

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

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2402	0	1.291	Complies
2441	39	1.291	Complies
2480	78	1.288	Complies

Test Results (Occupied Bandwidth)

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

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2402	0	0.913	Complies
2441	39	0.913	Complies
2480	78	0.899	Complies

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

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2402	0	1.188	Complies
2441	39	1.190	Complies
2480	78	1.188	Complies

See next pages for actual measured spectrum plots.

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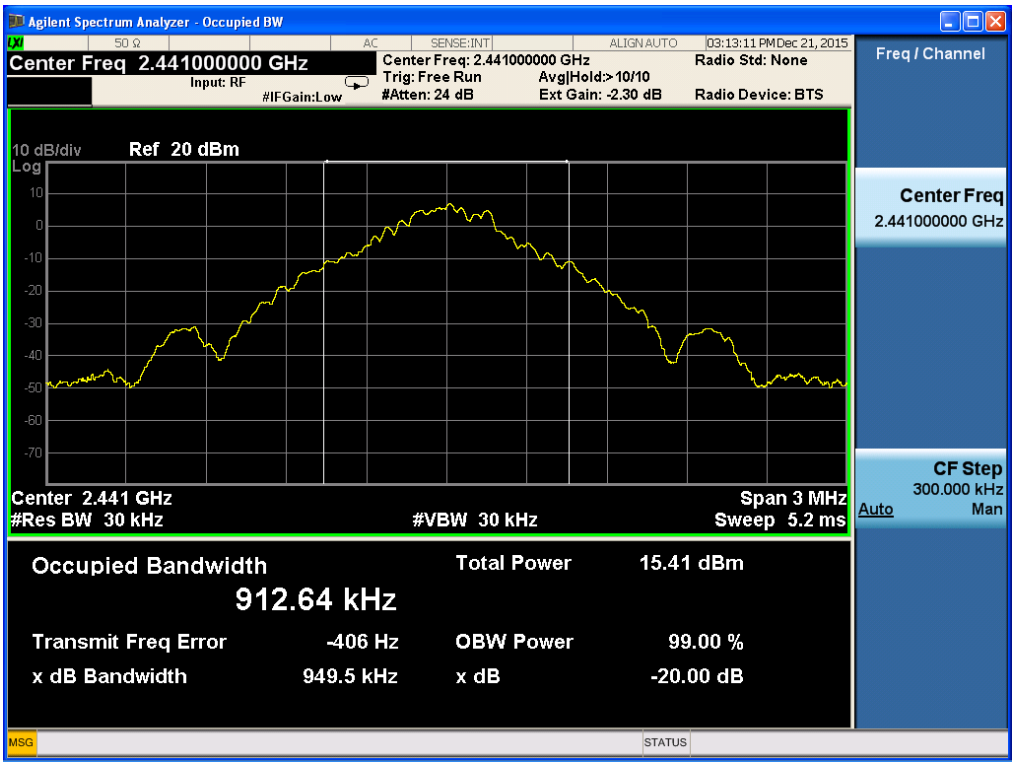
20 dB Bandwidth, Occupied Bandwidth - GFSK



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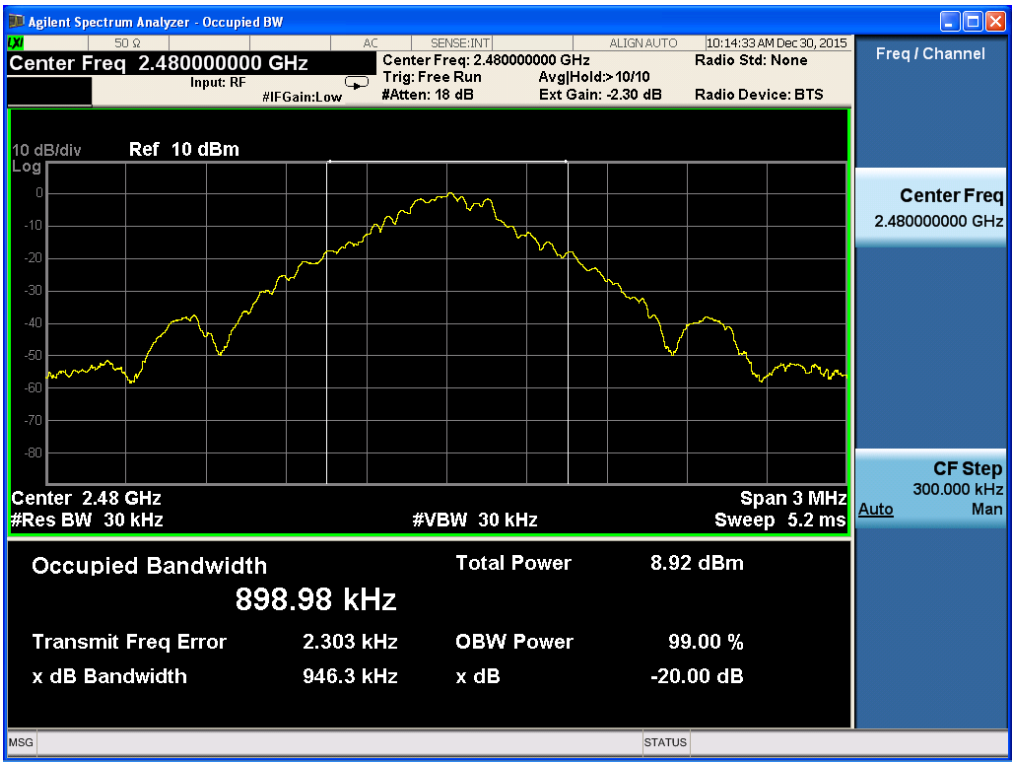

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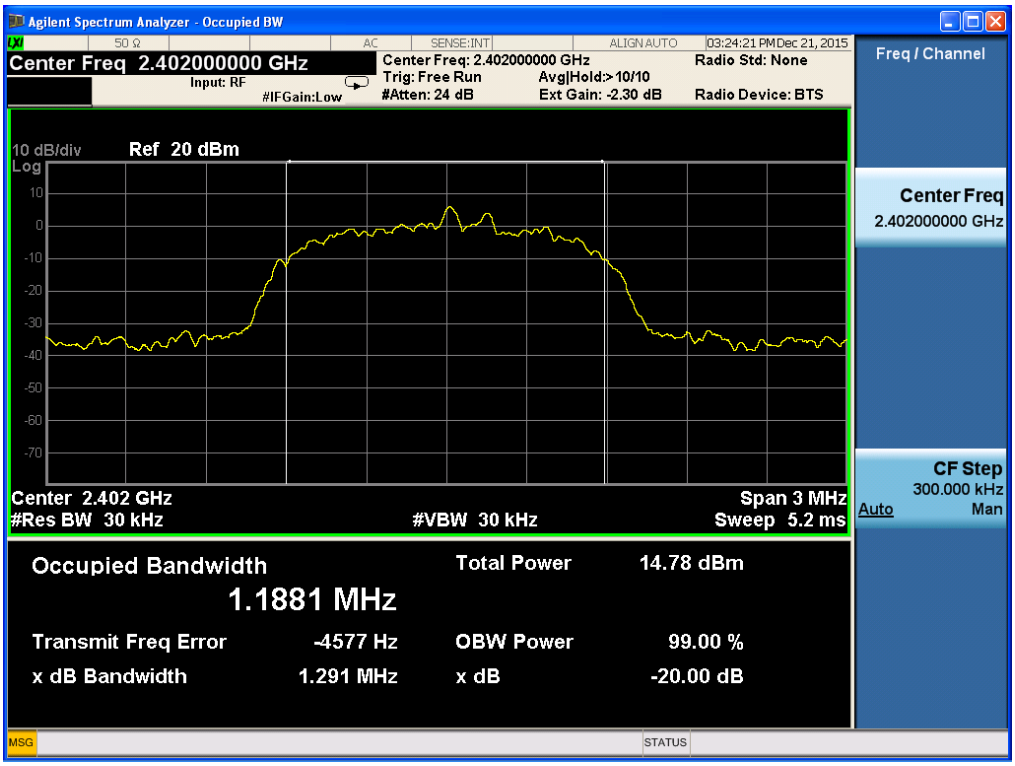
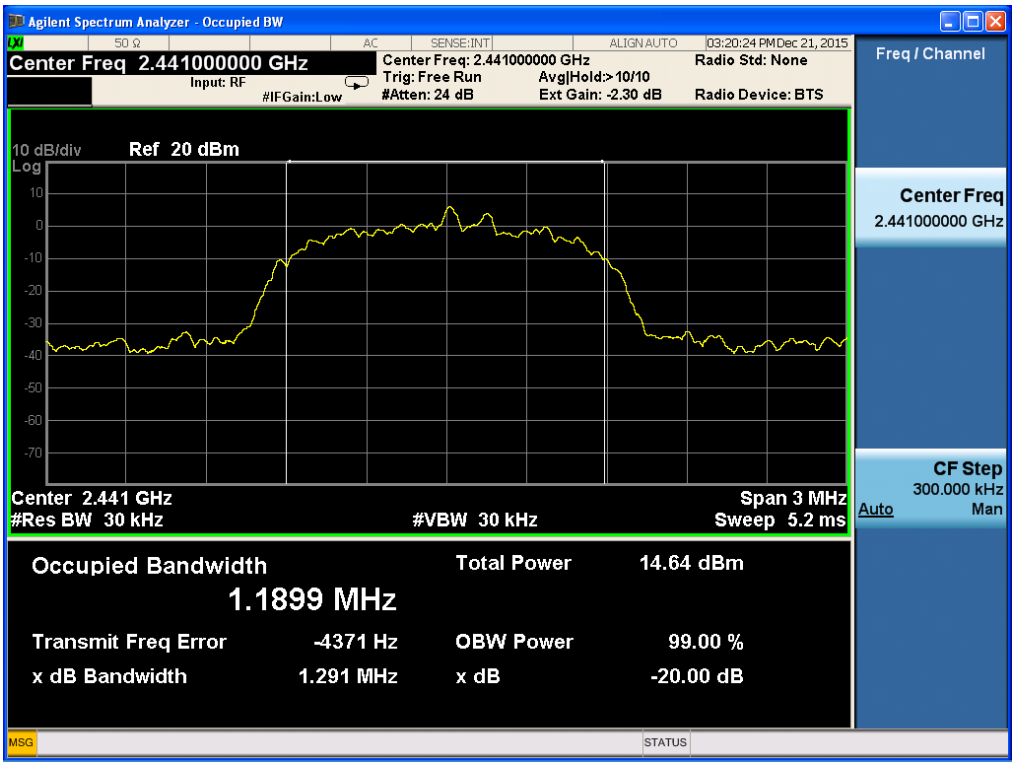
20 dB Bandwidth, Occupied Bandwidth – 8-DPSK





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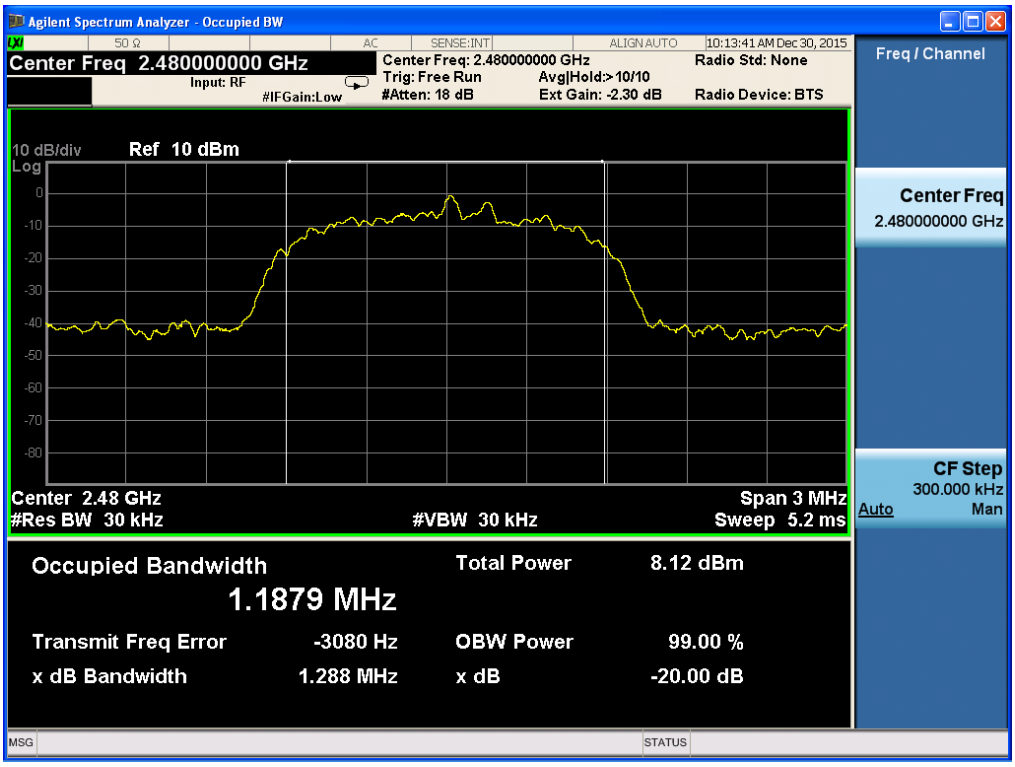

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2.1.4 Time of Occupancy (Dwell Time)

Test Location

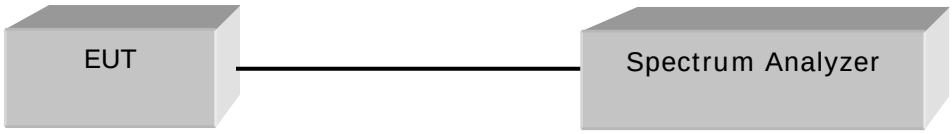
RF Test Room

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 MDR-XB650BT 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 (≥ 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
2441	DH 1	0.381	121.9	Complies
	DH 3	1.635	261.6	Complies
	DH 5	2.878	307.0	Complies

DH1 Dwell time = 0.381 ms × (1600÷2) ÷ 79 × 31.6 = 121.9 ms
DH3 Dwell time = 1.635 ms × (1600÷4) ÷ 79 × 31.6 = 261.6 ms
DH5 Dwell time = 2.878 ms × (1600÷6) ÷ 79 × 31.6 = 307.0 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
2441	3DH 1	0.384	122.9	Complies
	3DH 3	1.630	260.8	Complies
	3DH 5	2.885	307.7	Complies

3DH1 Dwell time = 0.384 ms × (1600÷2) ÷ 79 × 31.6 = 122.9 ms
3DH3 Dwell time = 1.630 ms × (1600÷4) ÷ 79 × 31.6 = 260.8 ms
3DH5 Dwell time = 2.885 ms × (1600÷6) ÷ 79 × 31.6 = 307.7 ms

See next pages for actual measured spectrum plots.

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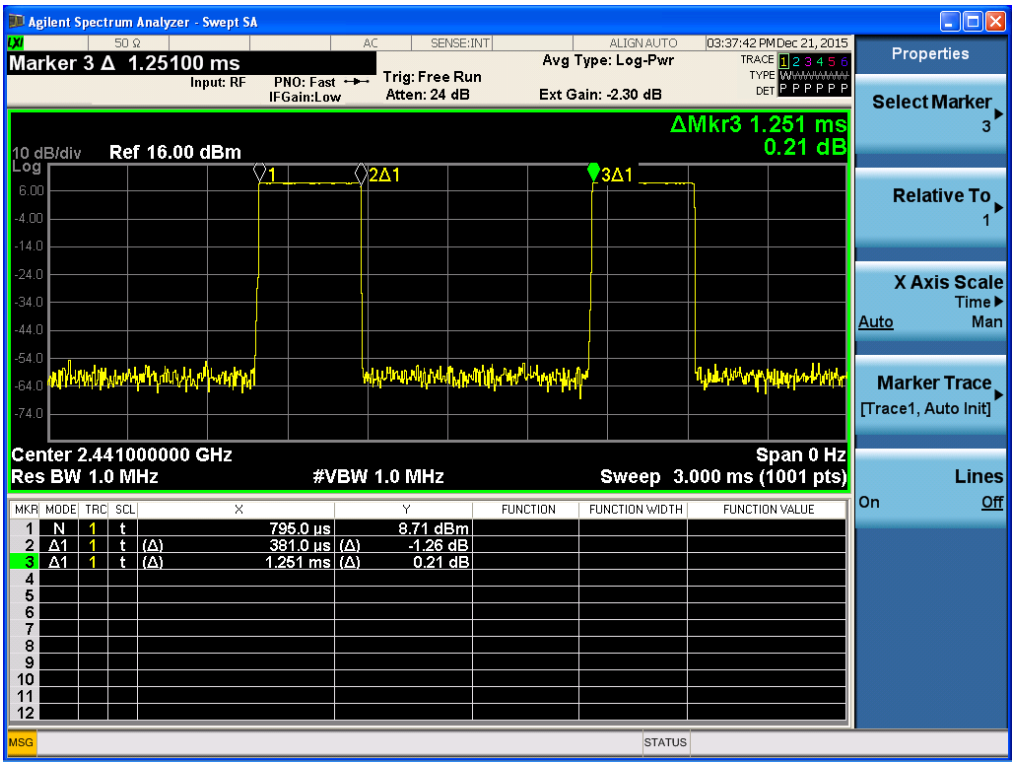
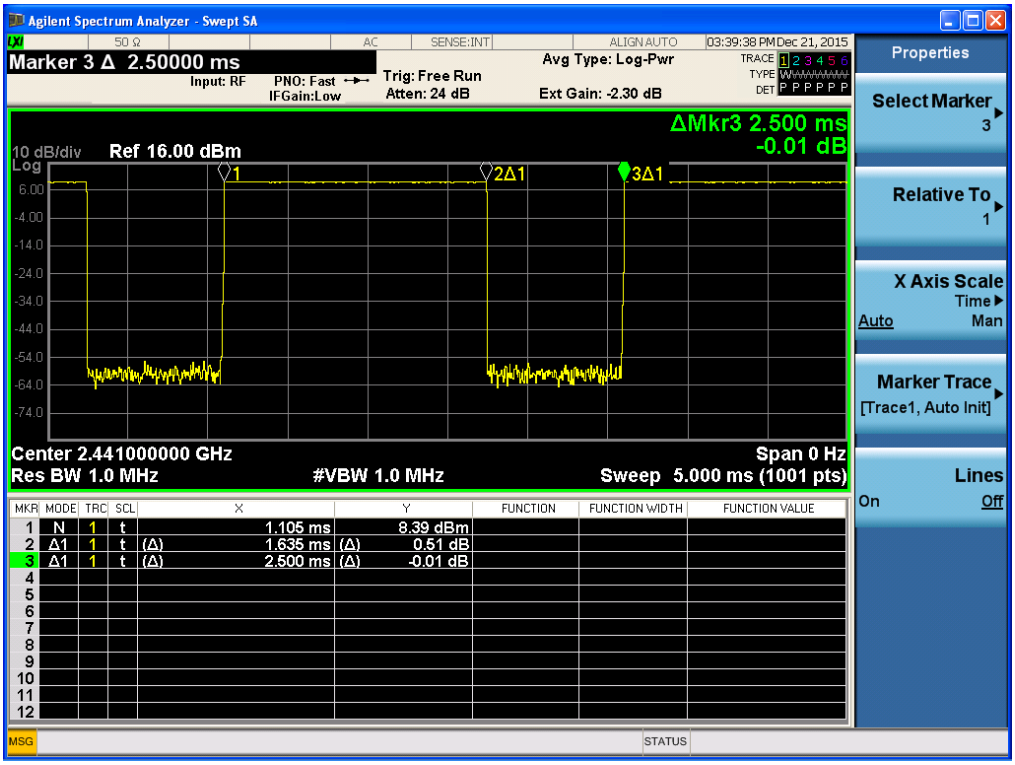
Time of Occupancy for PACKET Type DH1(GFSK)



Time of Occupancy for PACKET Type DH3(GFSK)



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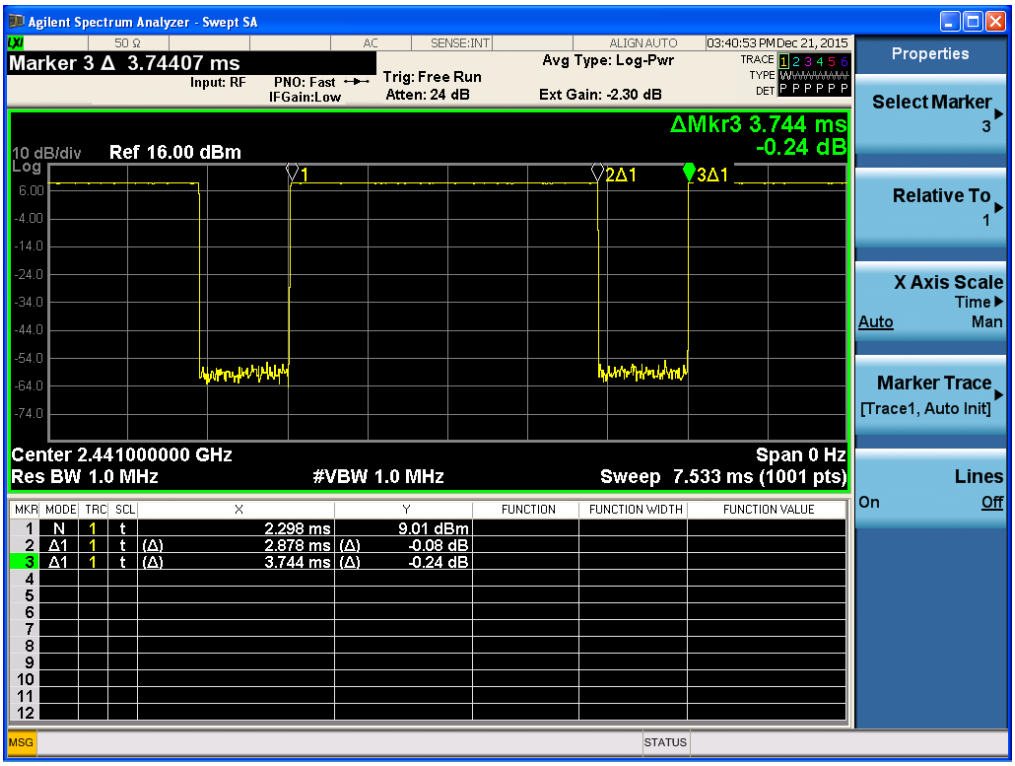
Time of Occupancy for PACKET Type DH5(GFSK)



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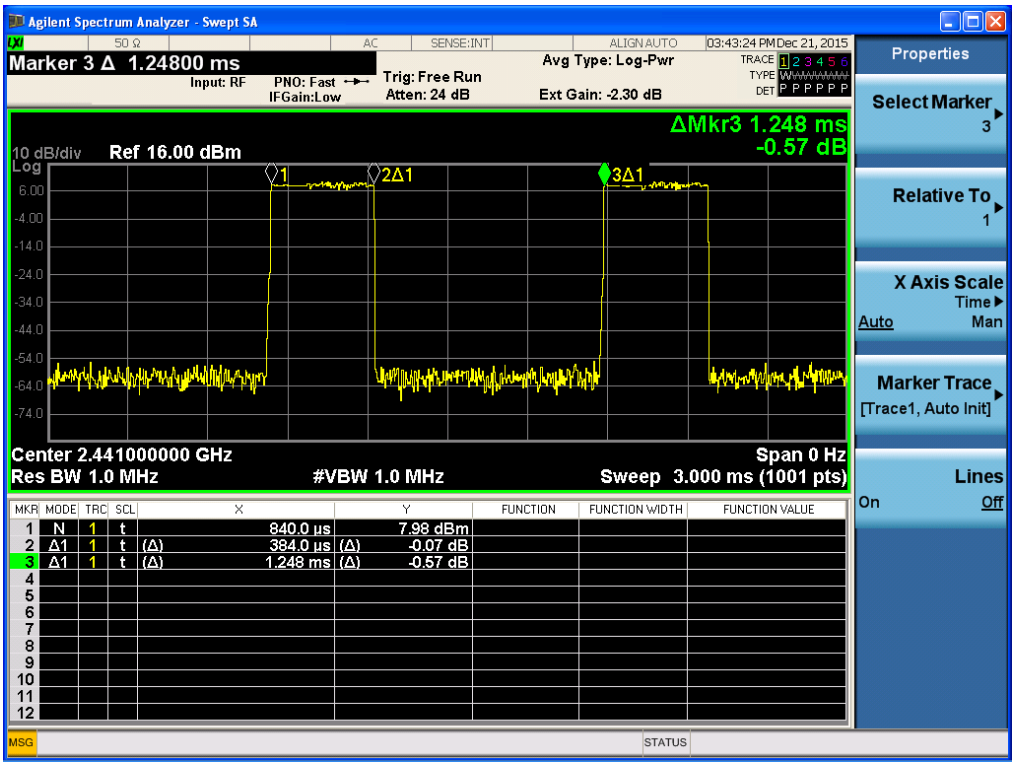
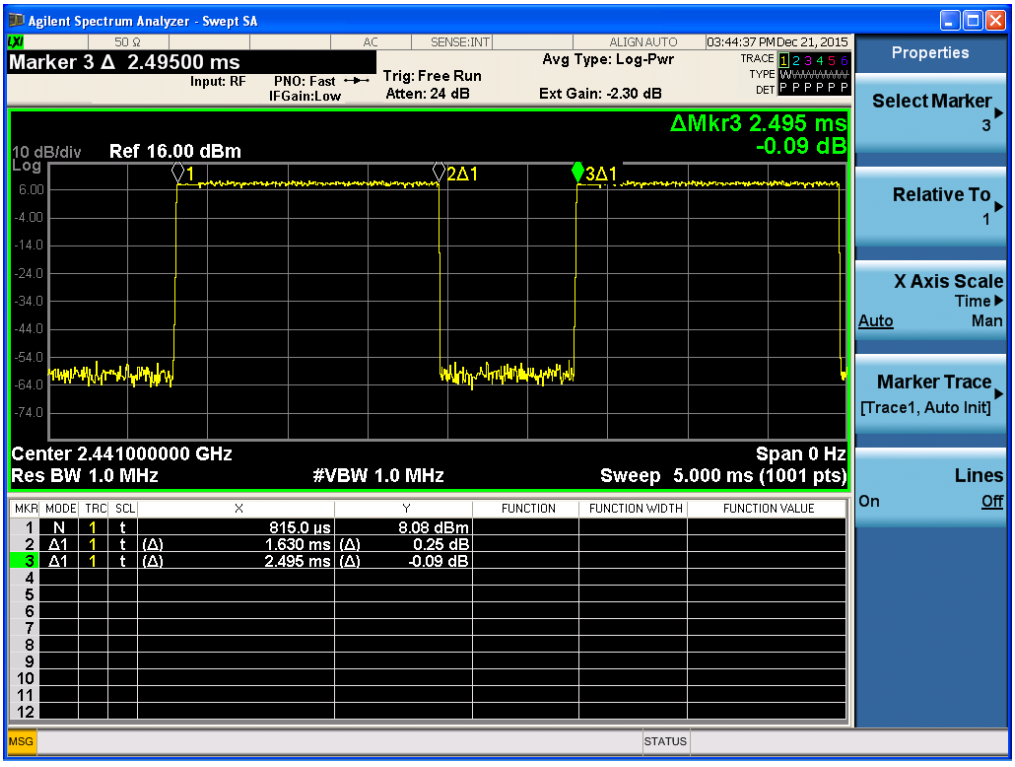
Time of Occupancy for PACKET Type 3DH1(8-DPSK)



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



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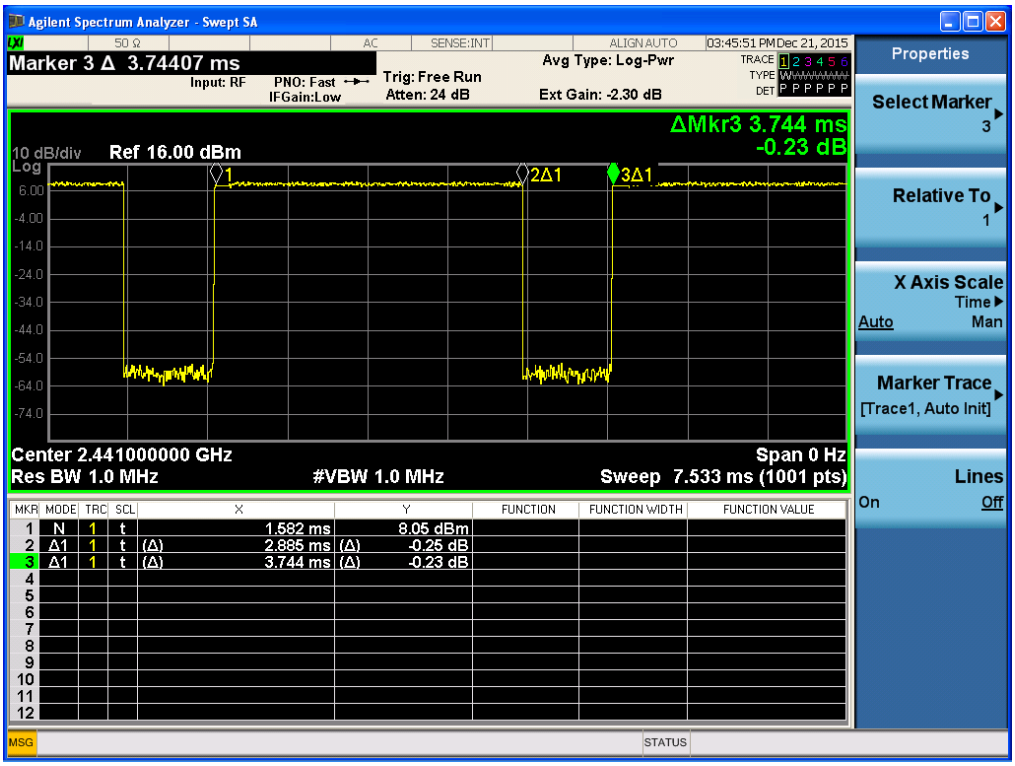
Time of Occupancy for PACKET Type 3DH5(8-DPSK)



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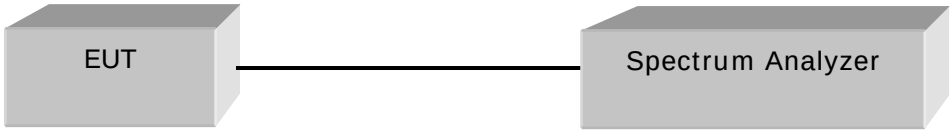
2.1.5 Maximum peak Conducted Output Power

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 = 5 MHz (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 (≥ RBW) Detector function = peak
Trace = max hold Sweep = auto



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.

Test Results

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

Frequency (MHz)	Channel No.	Peak output power(dBm)	Peak output power(mW)	Result
2402	0	9.188	8.29	Complies
2441	39	9.062	8.06	Complies
2480	78	0.367	1.09	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	9.766	9.48	Complies
2441	39	9.656	9.24	Complies
2480	78	3.205	2.09	Complies

See next pages for actual measured spectrum plots.

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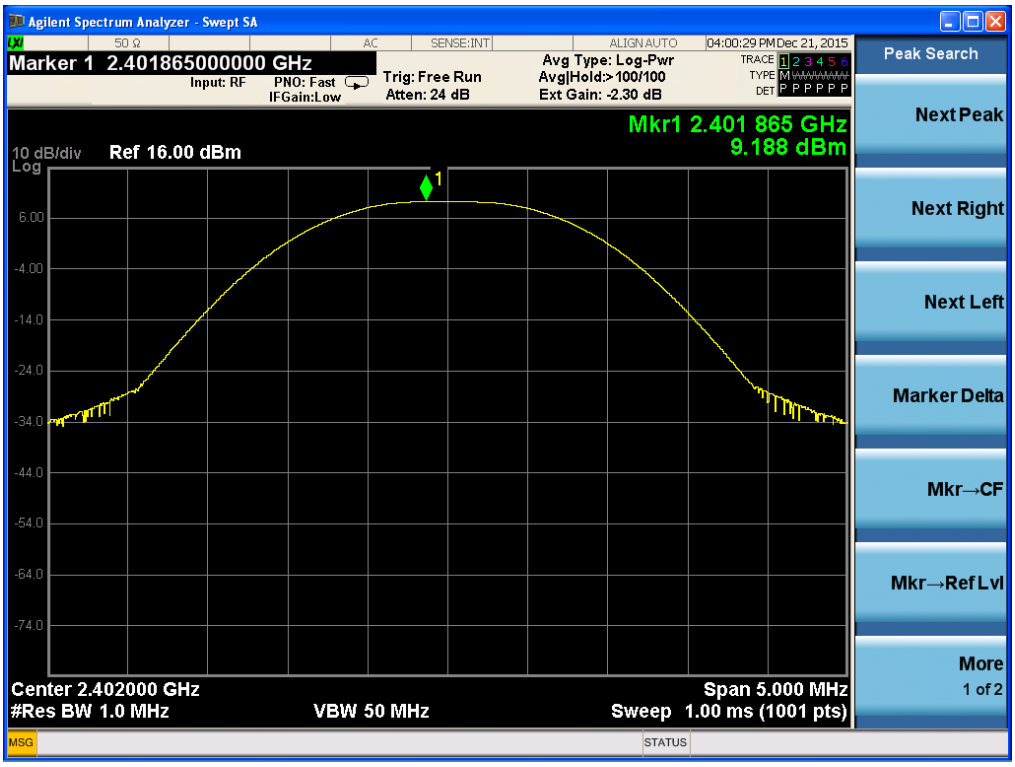
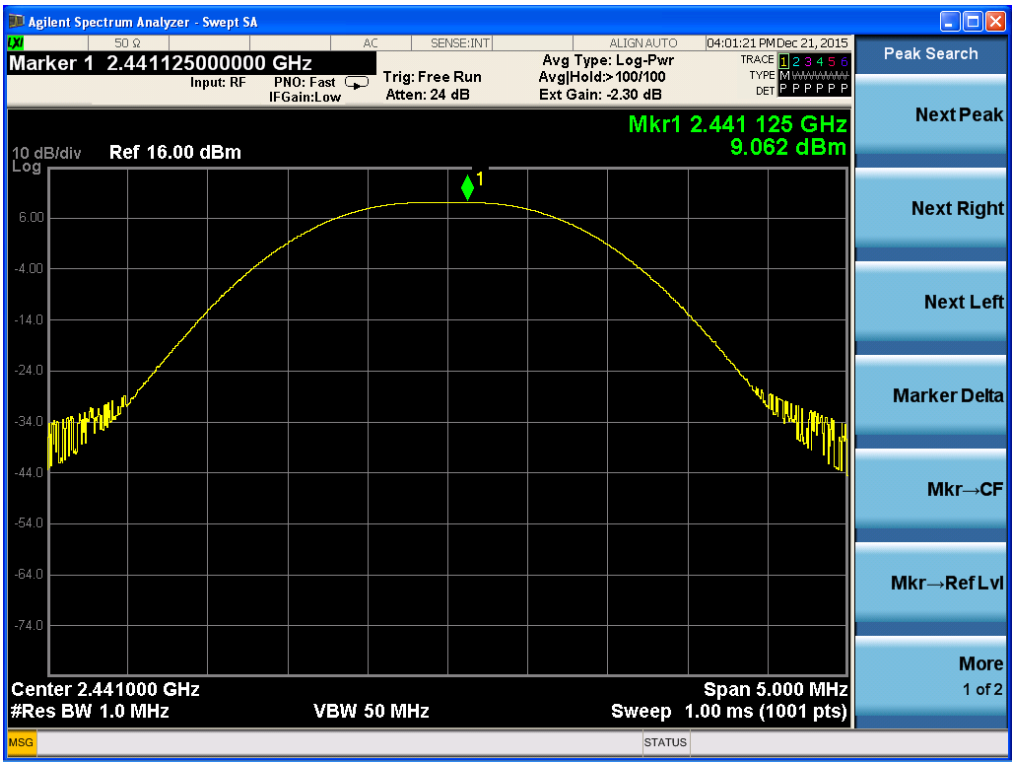
Maximum peak Conducted Output Power - GFSK





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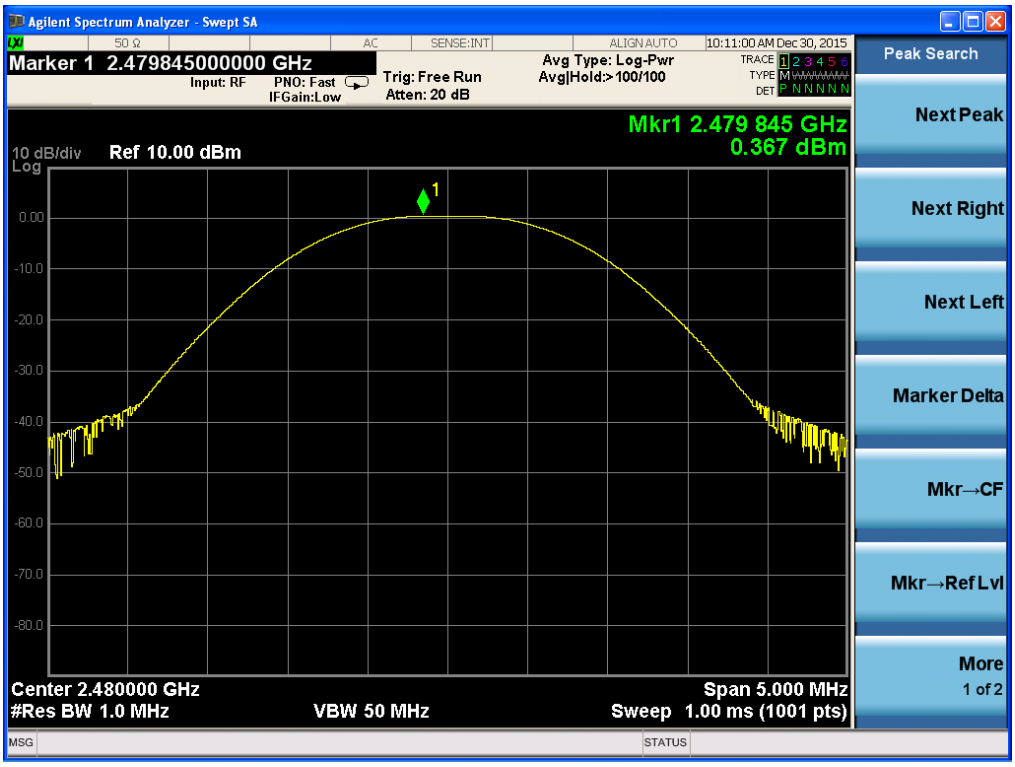
Form No.: CTK-RF-EF-Part15 SubpartC(Rev.2)



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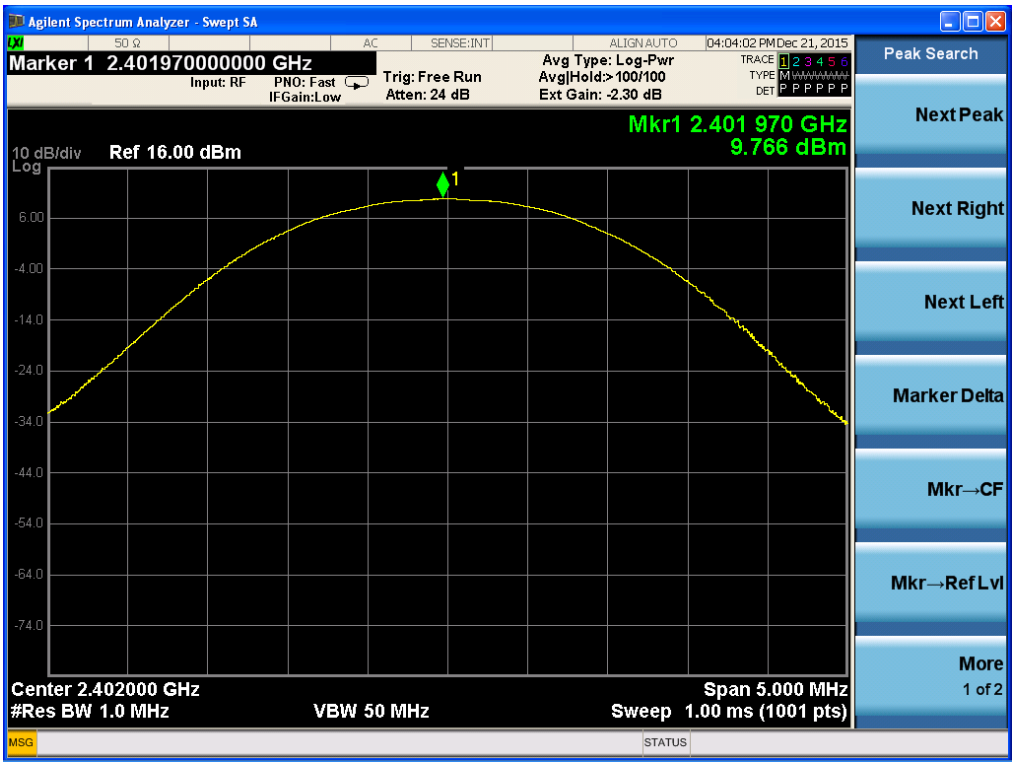
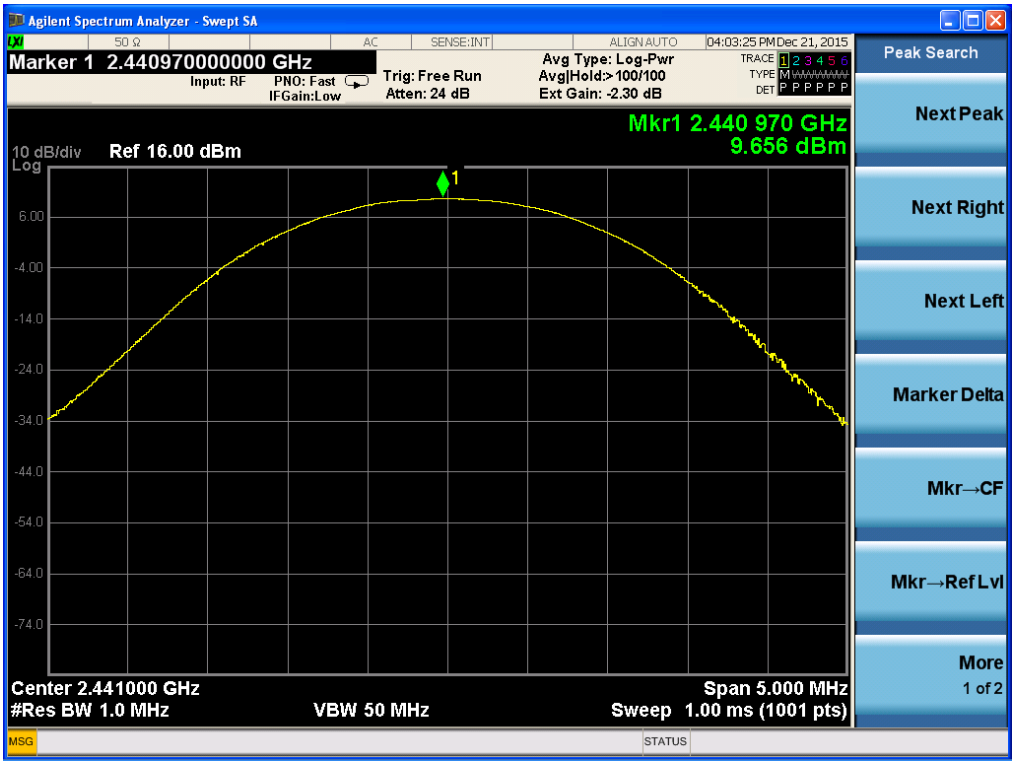
Maximum peak Conducted Output Power – 8-DPSK





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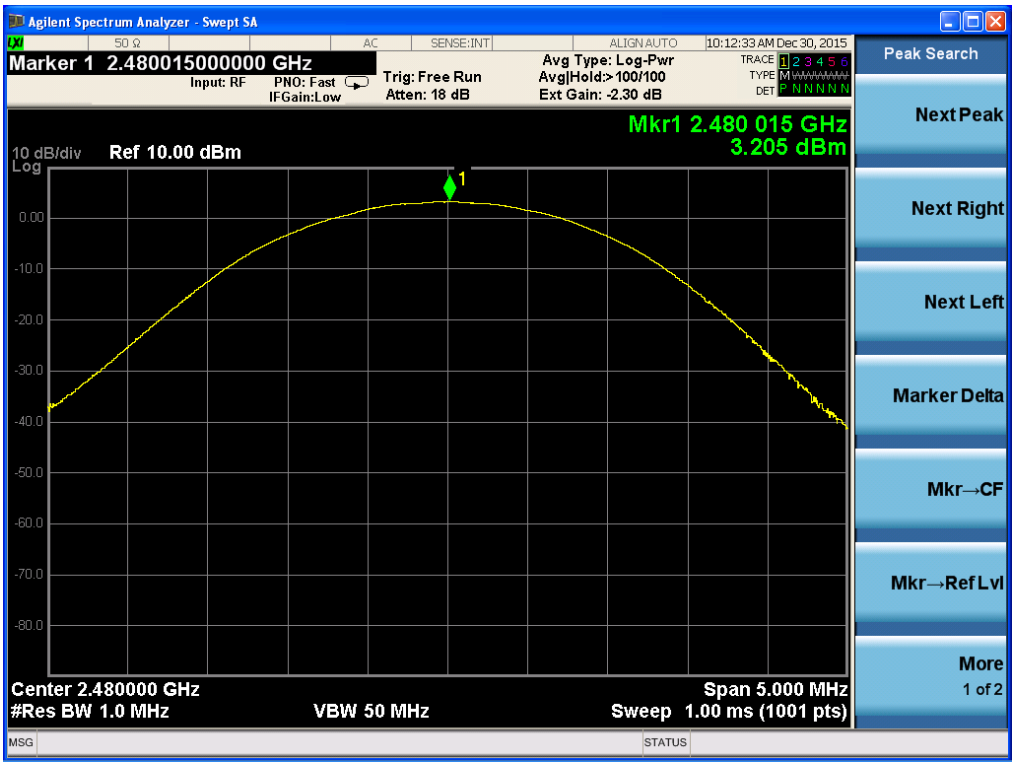
Form No.: CTK-RF-EF-Part15 SubpartC(Rev.2)



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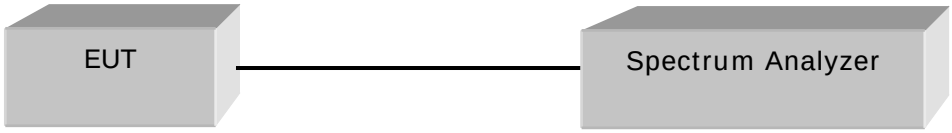
2.1.6 Band-edge

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 (≥ RBW)
Span = 10 MHz
Detector function = peak
Trace = max hold
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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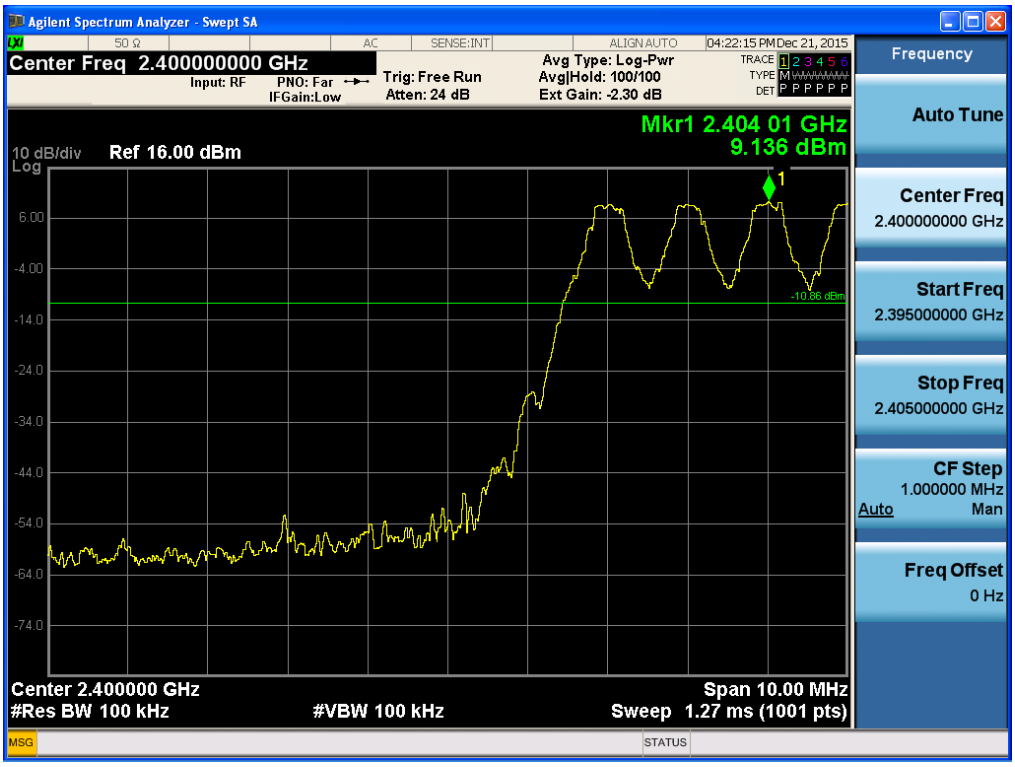
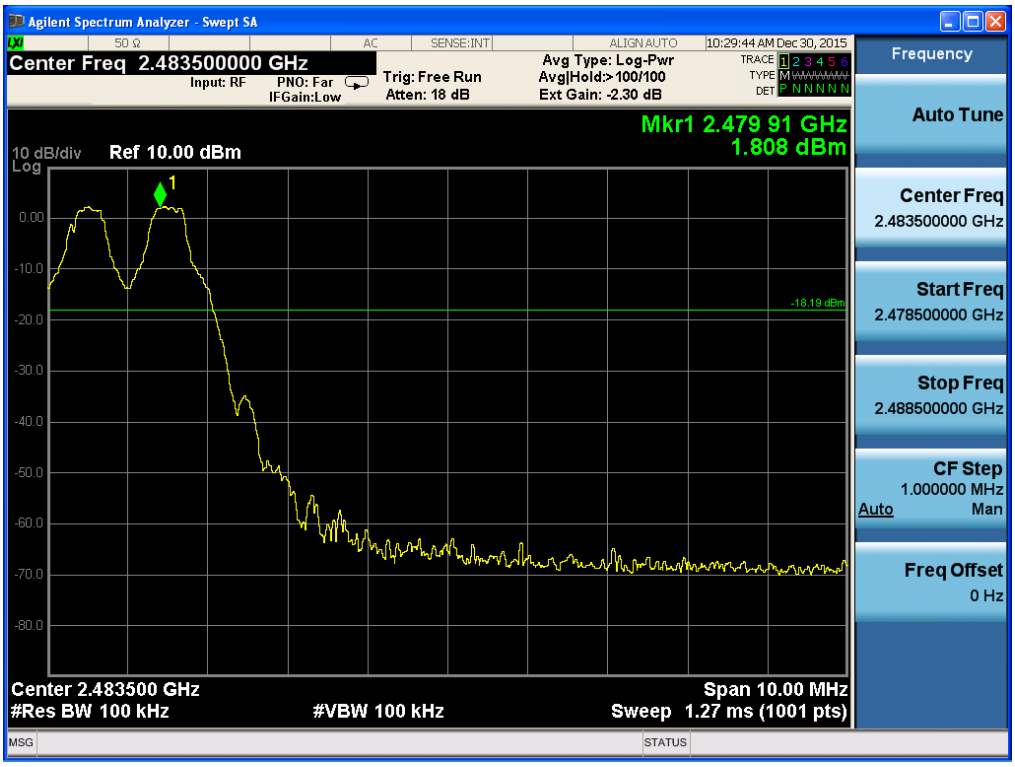
Band – edge (with Hopping) - GFSK





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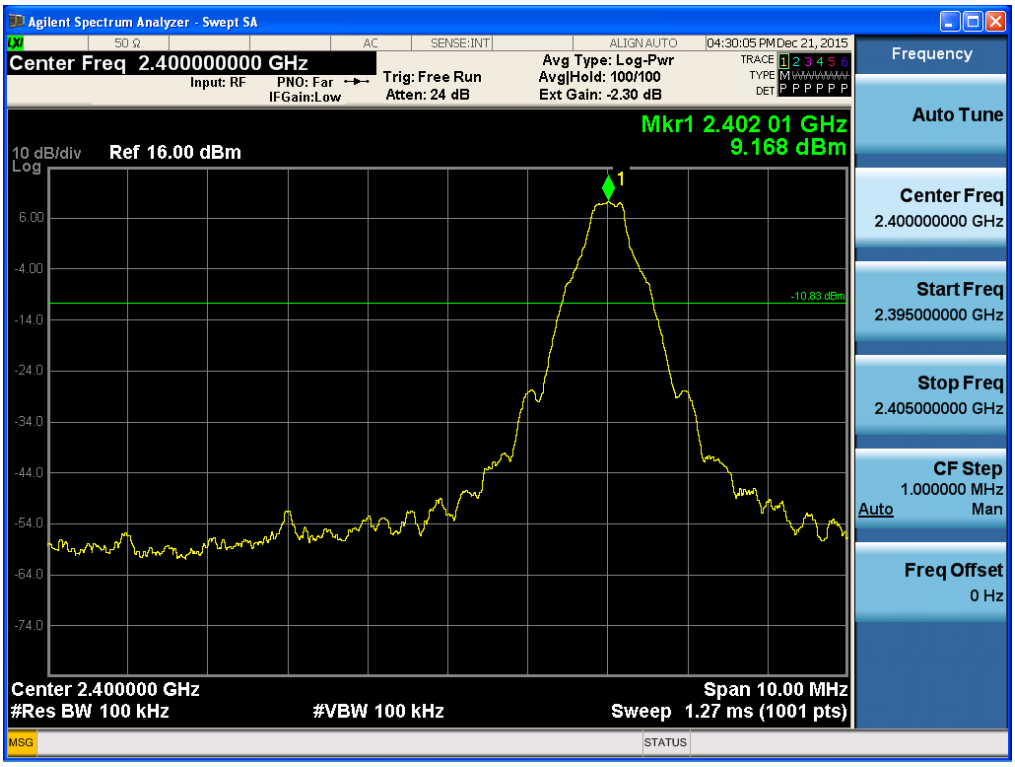
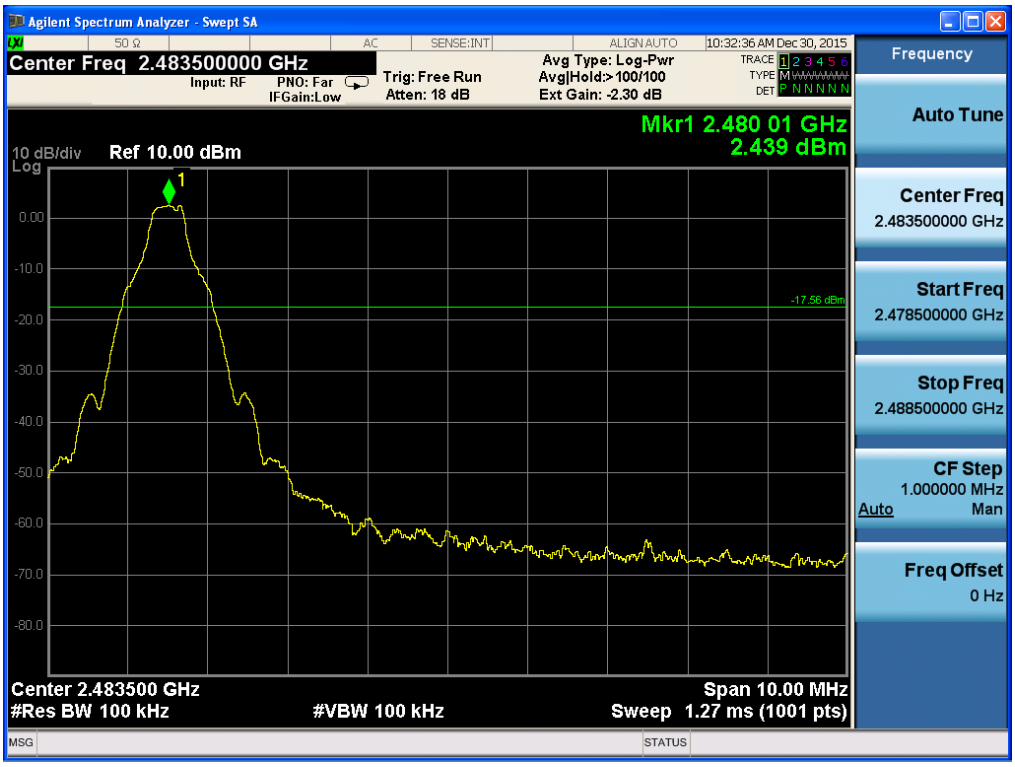
Band – edge (without Hopping) - GFSK





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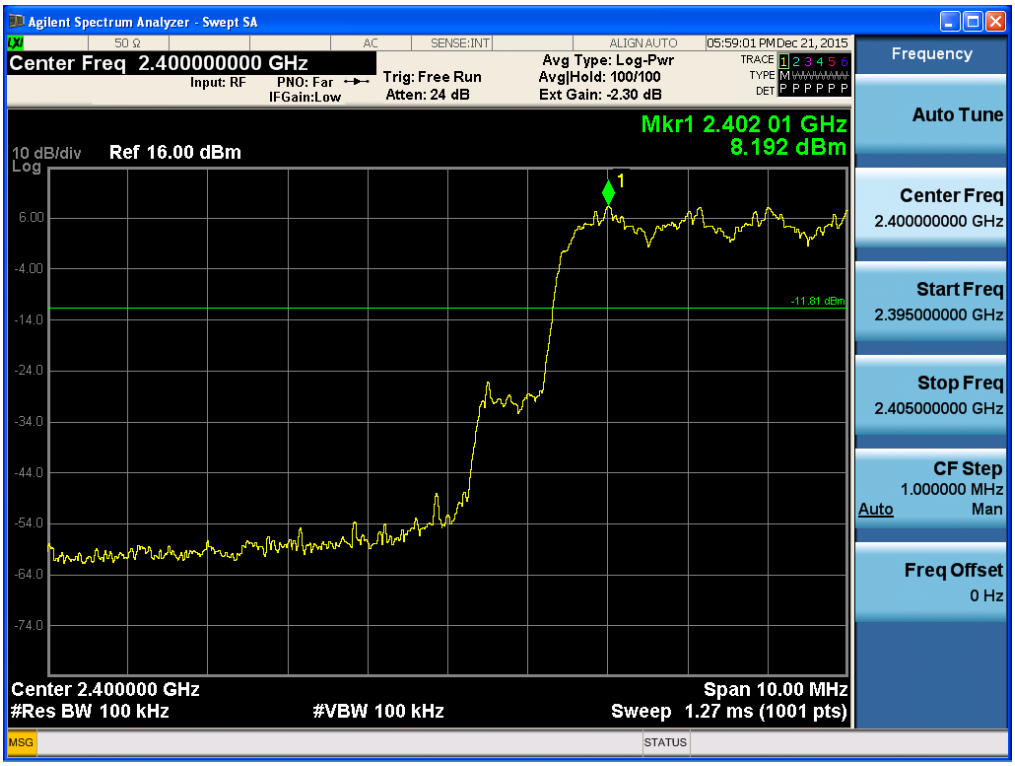
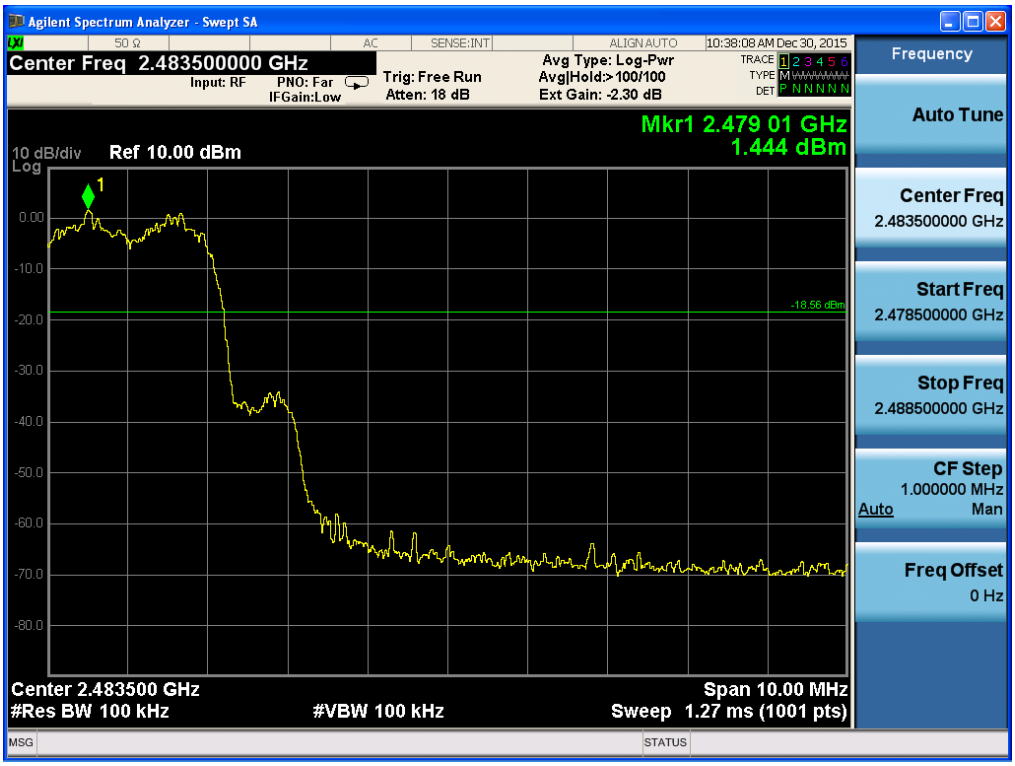
Band – edge (with Hopping) – 8-DPSK





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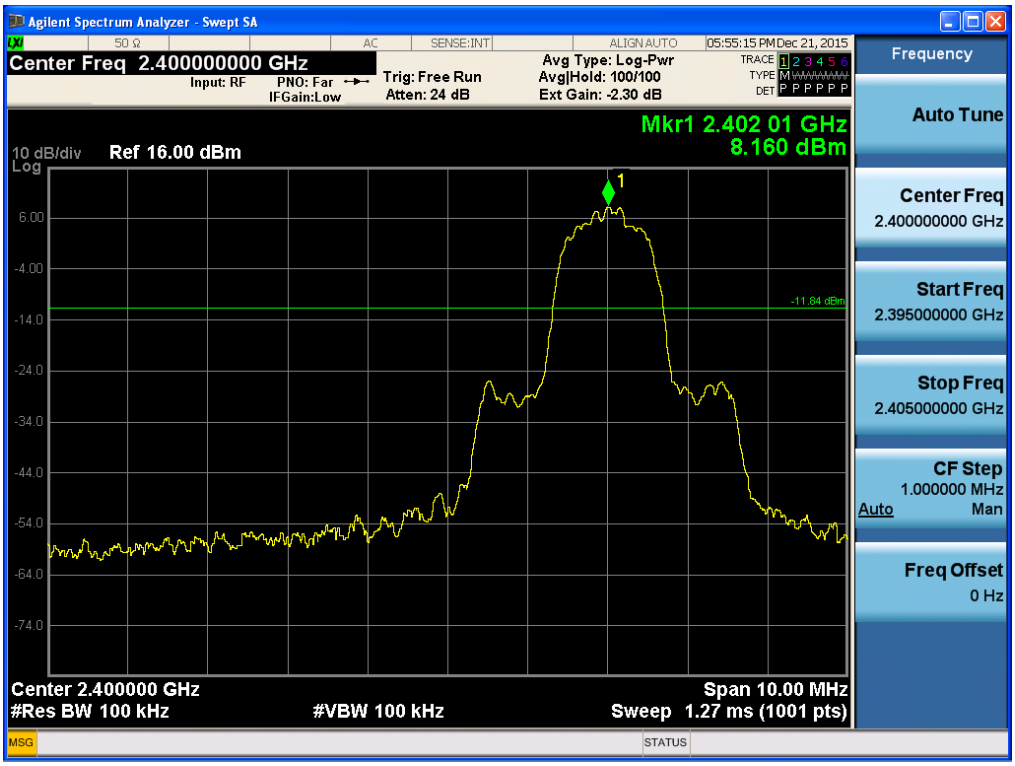
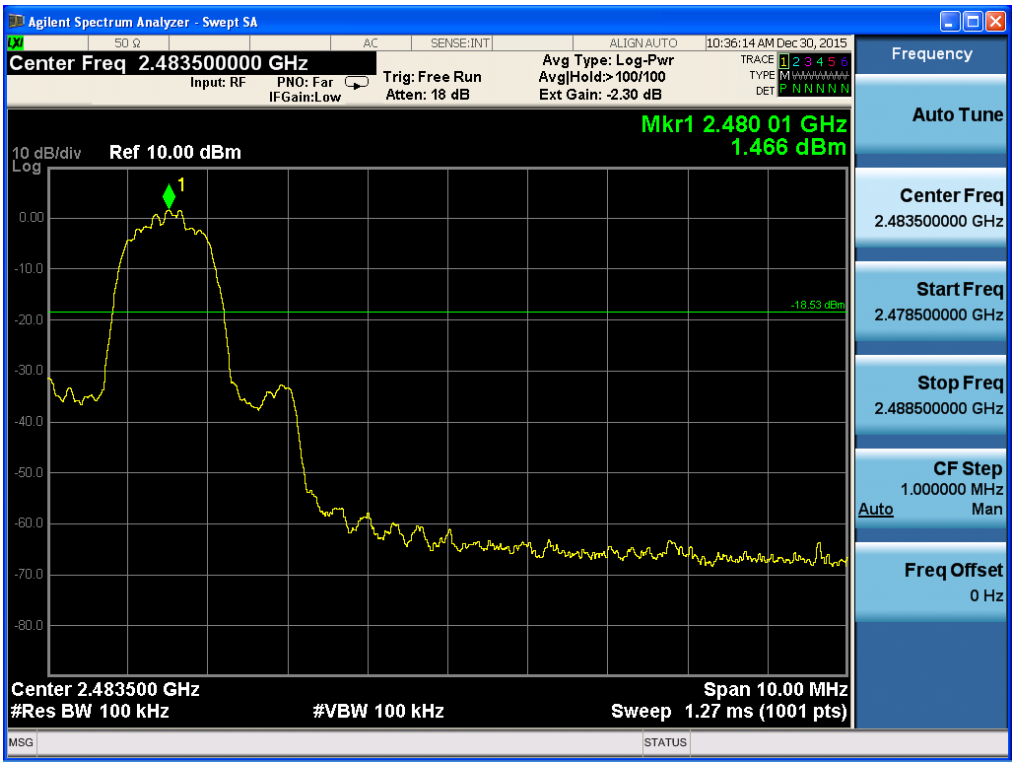
Band – edge (without Hopping) – 8-DPSK





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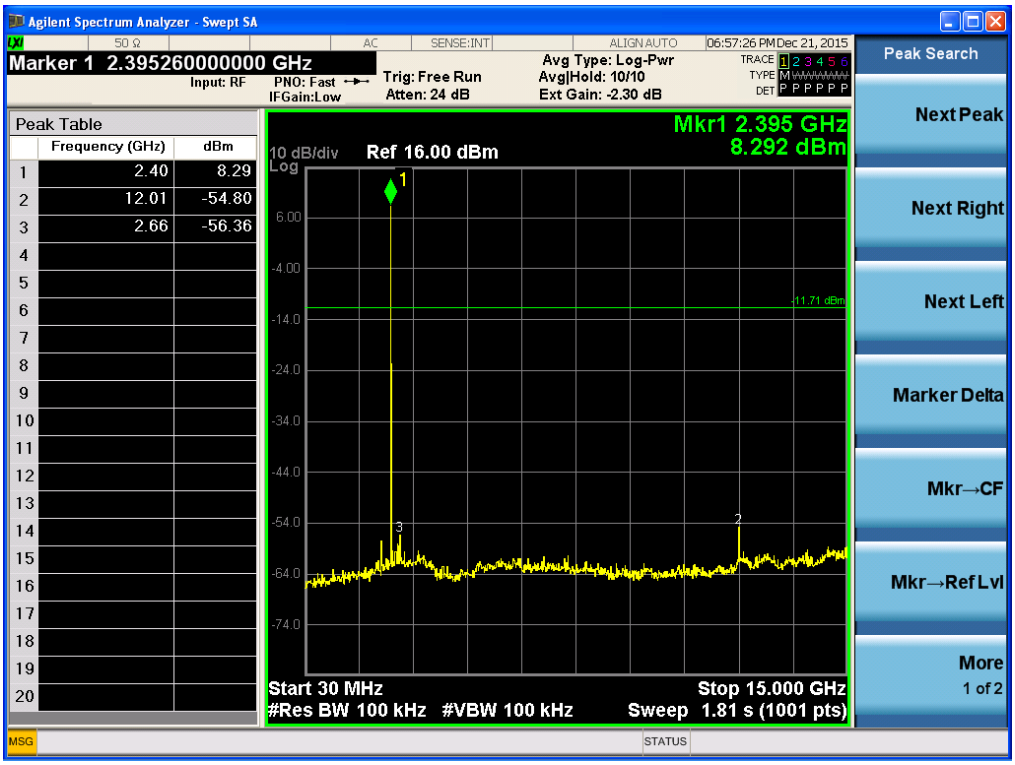
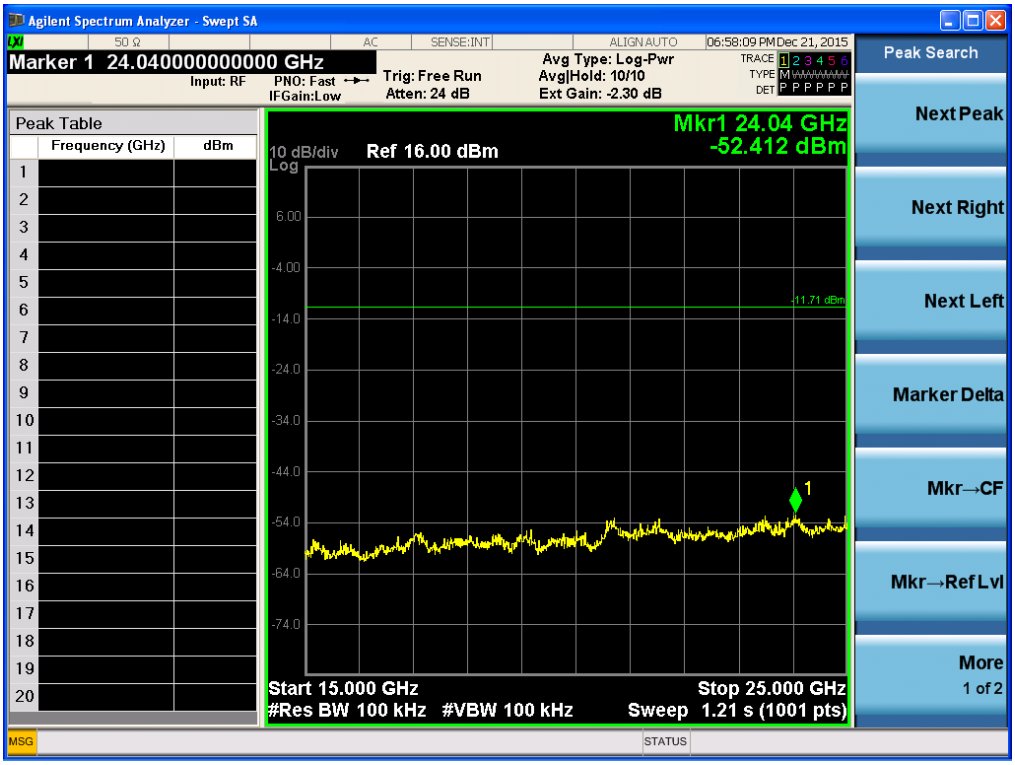
Band – edge (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic
(GFSK : Worst-Case)





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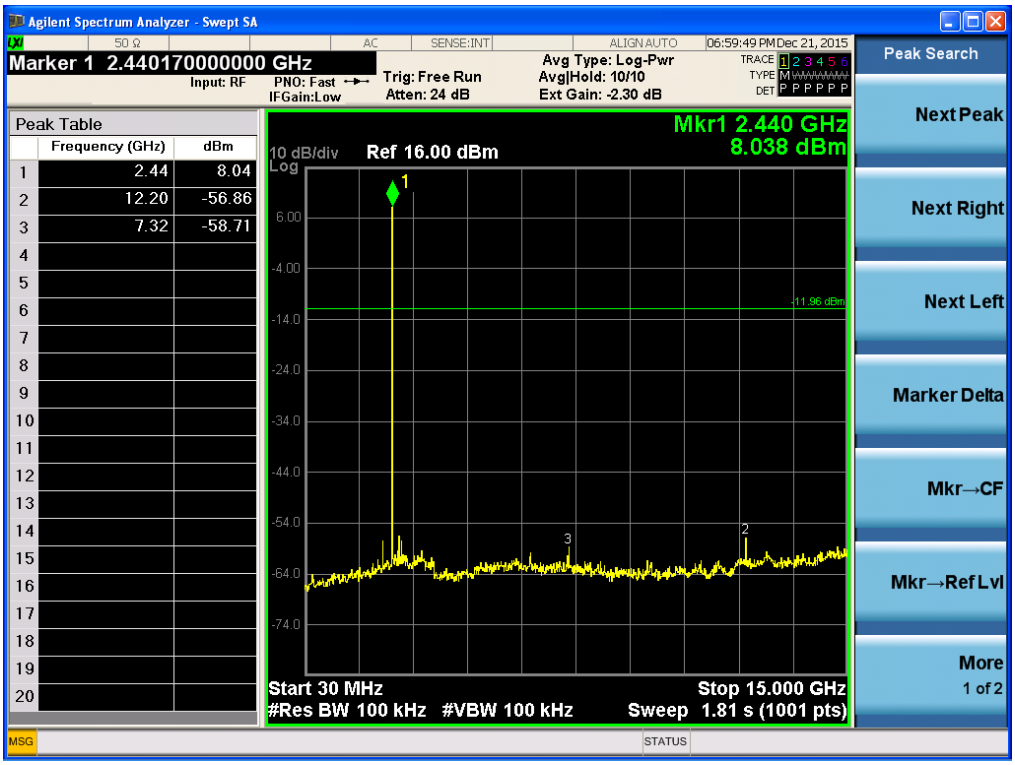
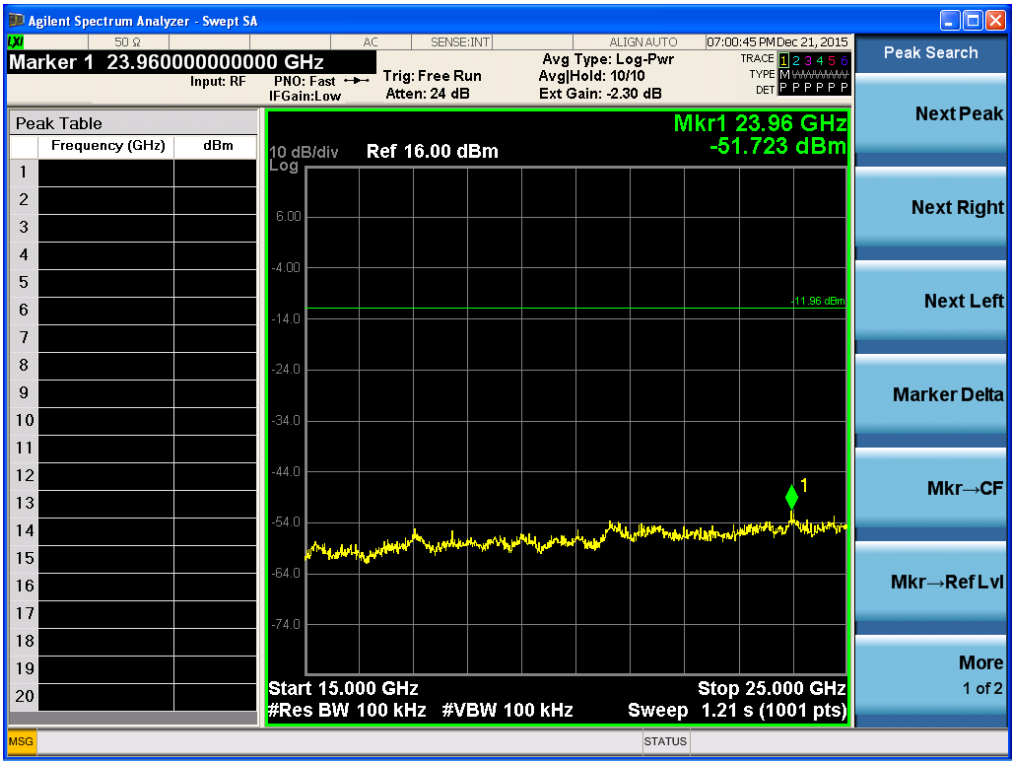
Band – edge (at 20 dB blow) – Mid channel
Frequency Range = 30 MHz ~ 10th harmonic
(GFSK : Worst-Case)





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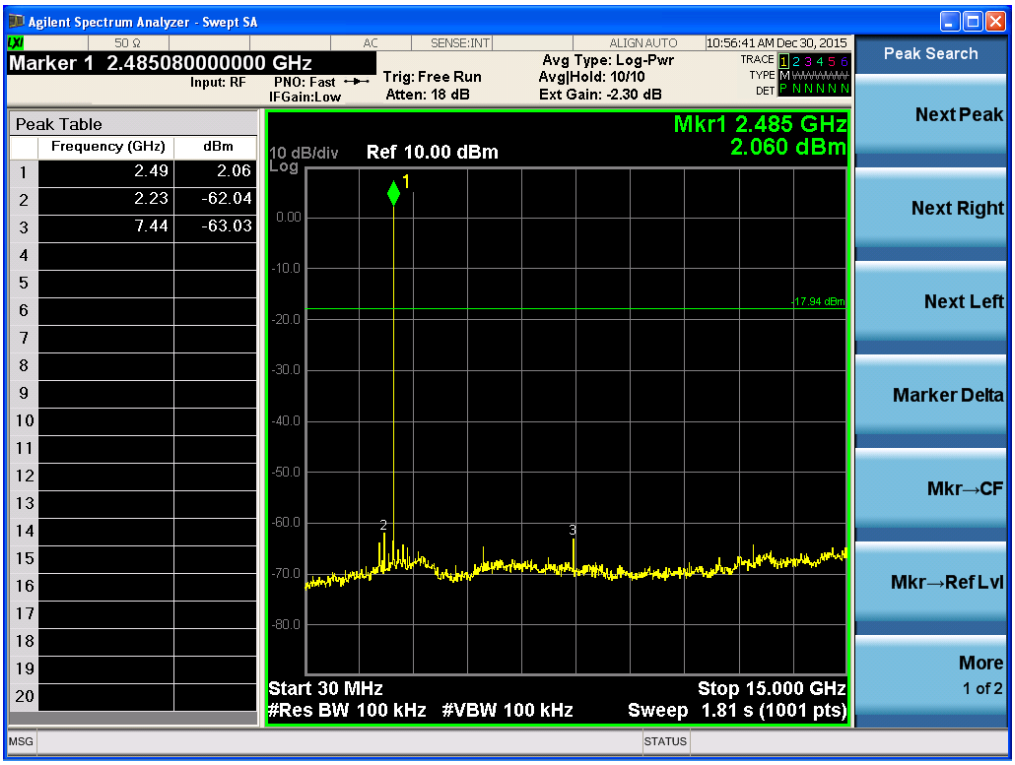
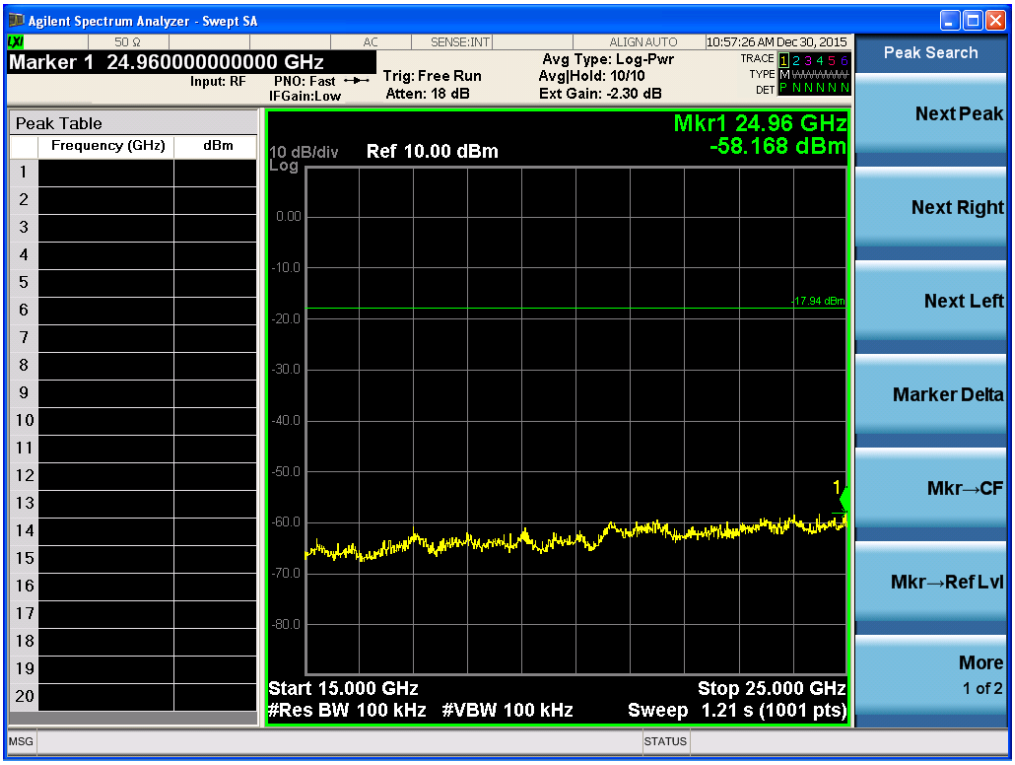
Band – edge (at 20 dB blow) – High channel
Frequency Range = 30 MHz ~ 10th harmonic
(GFSK : Worst-Case)





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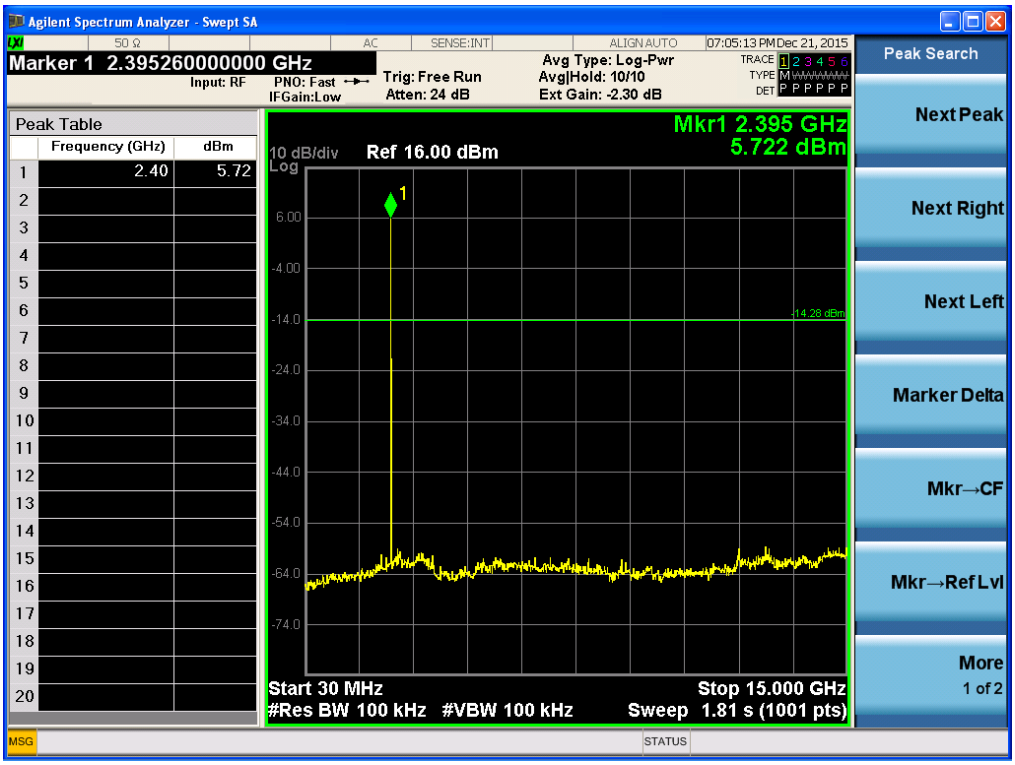
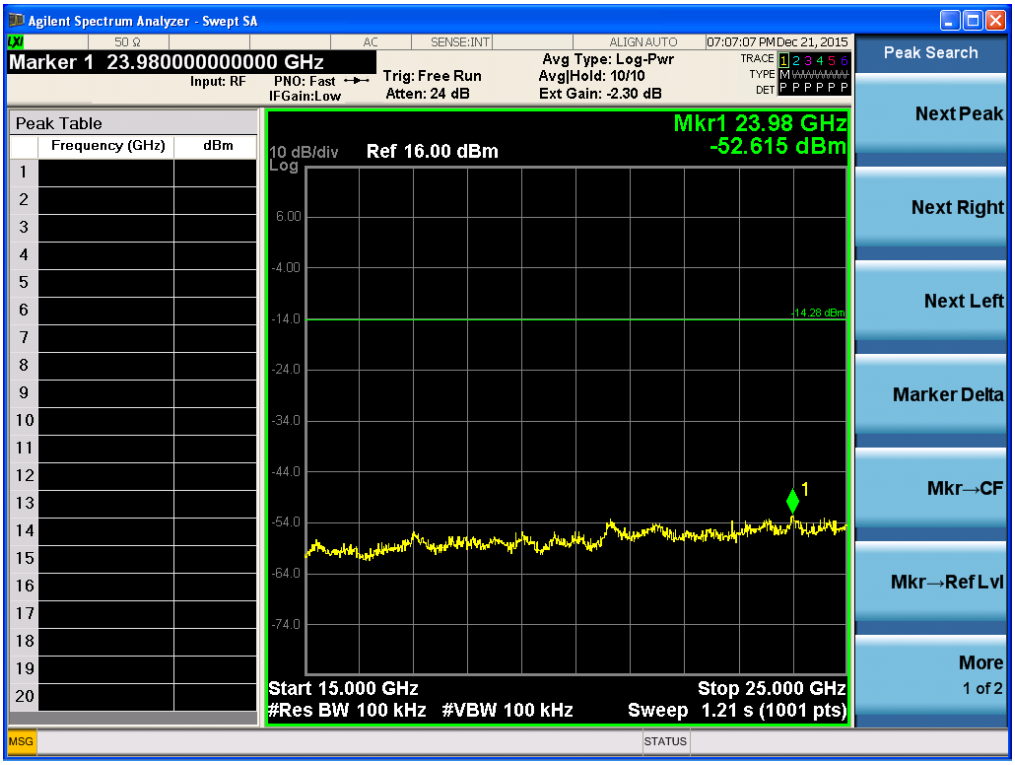
Band – edge (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic
(8-DPSK : Worst-Case)





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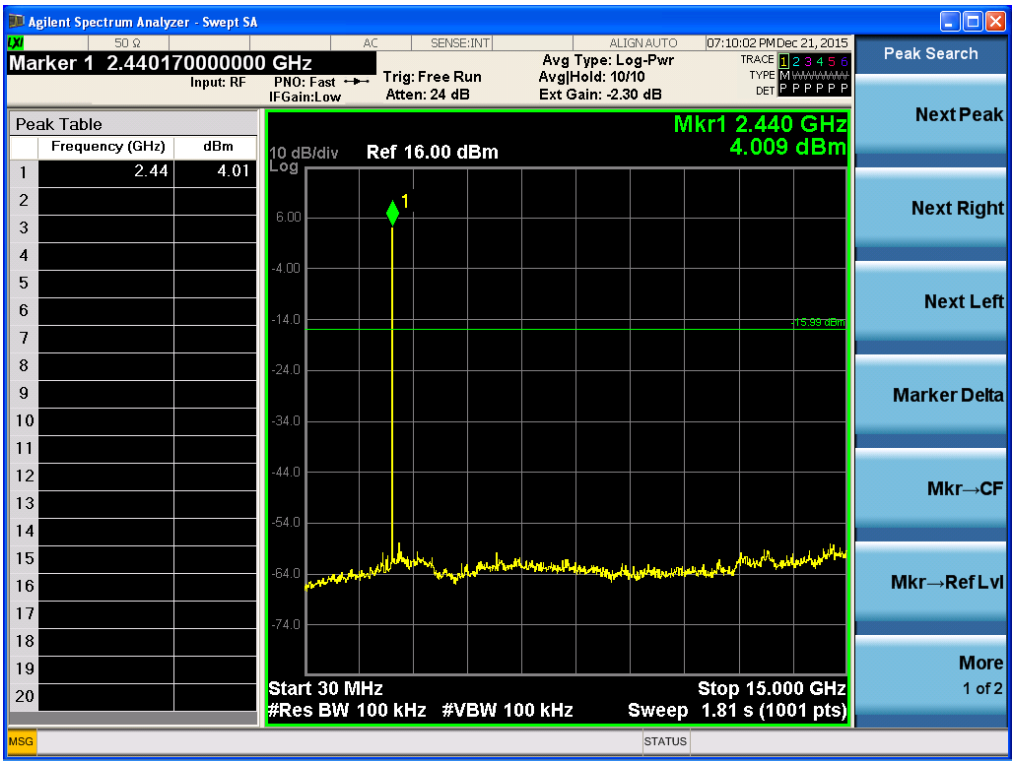
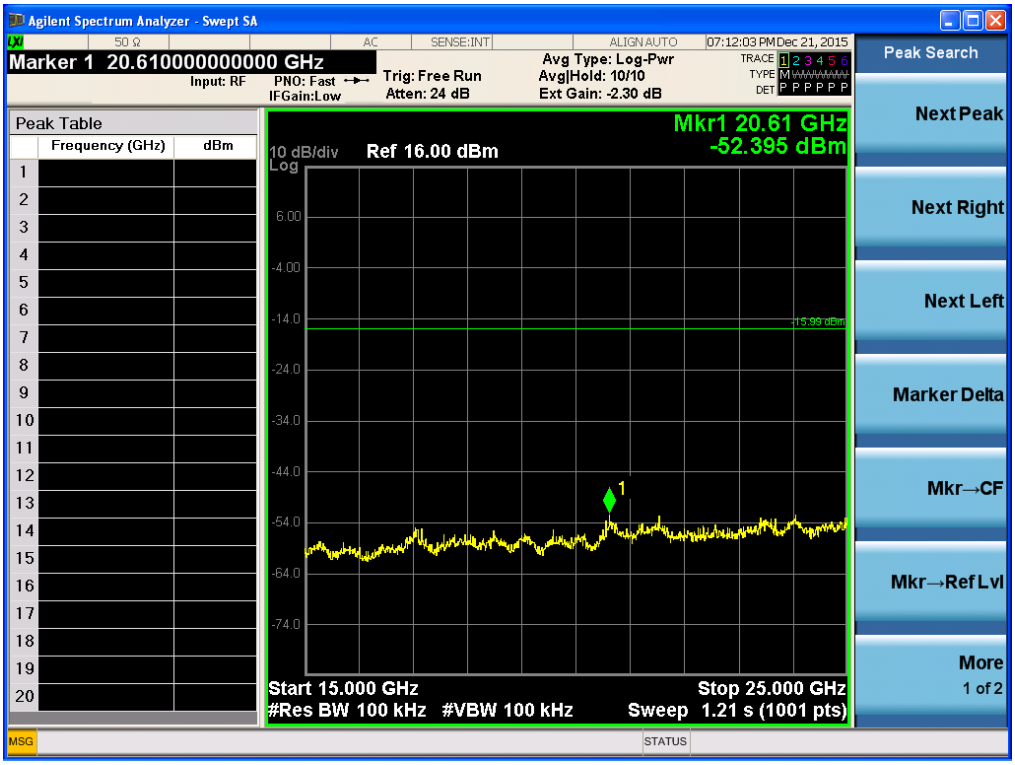
Band – edge (at 20 dB blow) – Mid channel
Frequency Range = 30 MHz ~ 10th harmonic
(8-DPSK : Worst-Case)





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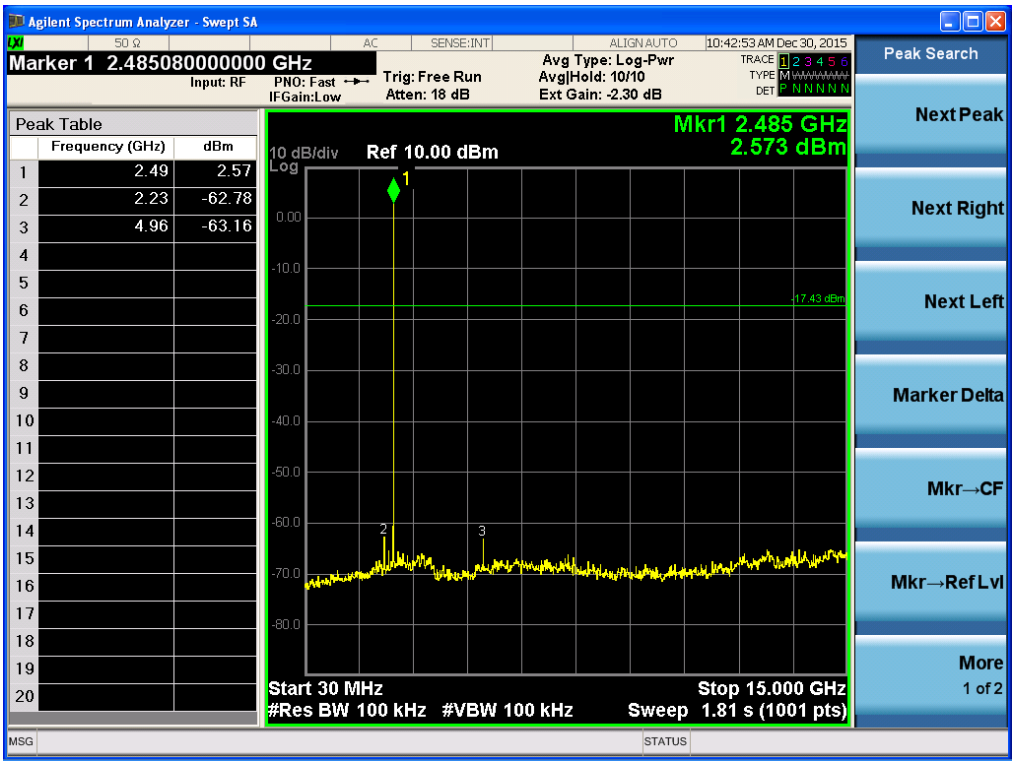
Band – edge (at 20 dB blow) – High channel
Frequency Range = 30 MHz ~ 10th harmonic
(8-DPSK : Worst-Case)



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2.1.7 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 rage 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 10^{th} harmonic)
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz
VBW ≥ RBW
Sweep = auto

Limit

- **15.209(a)**

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)

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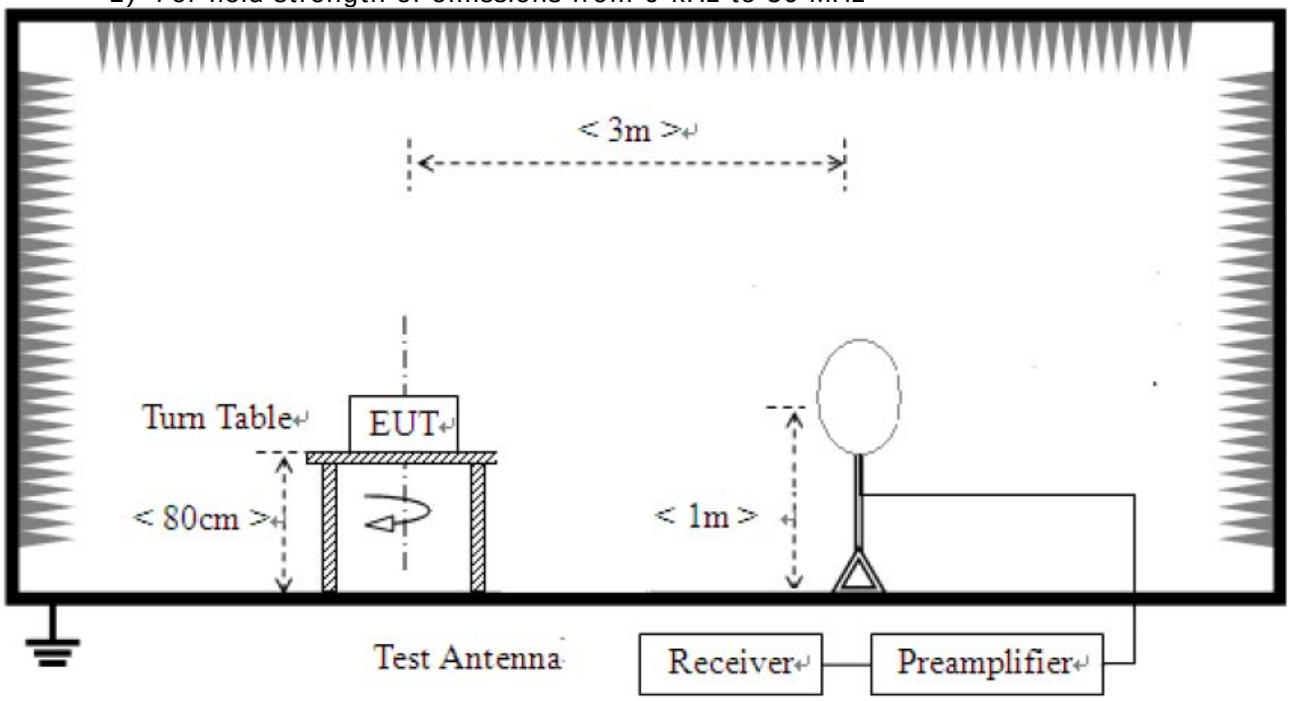
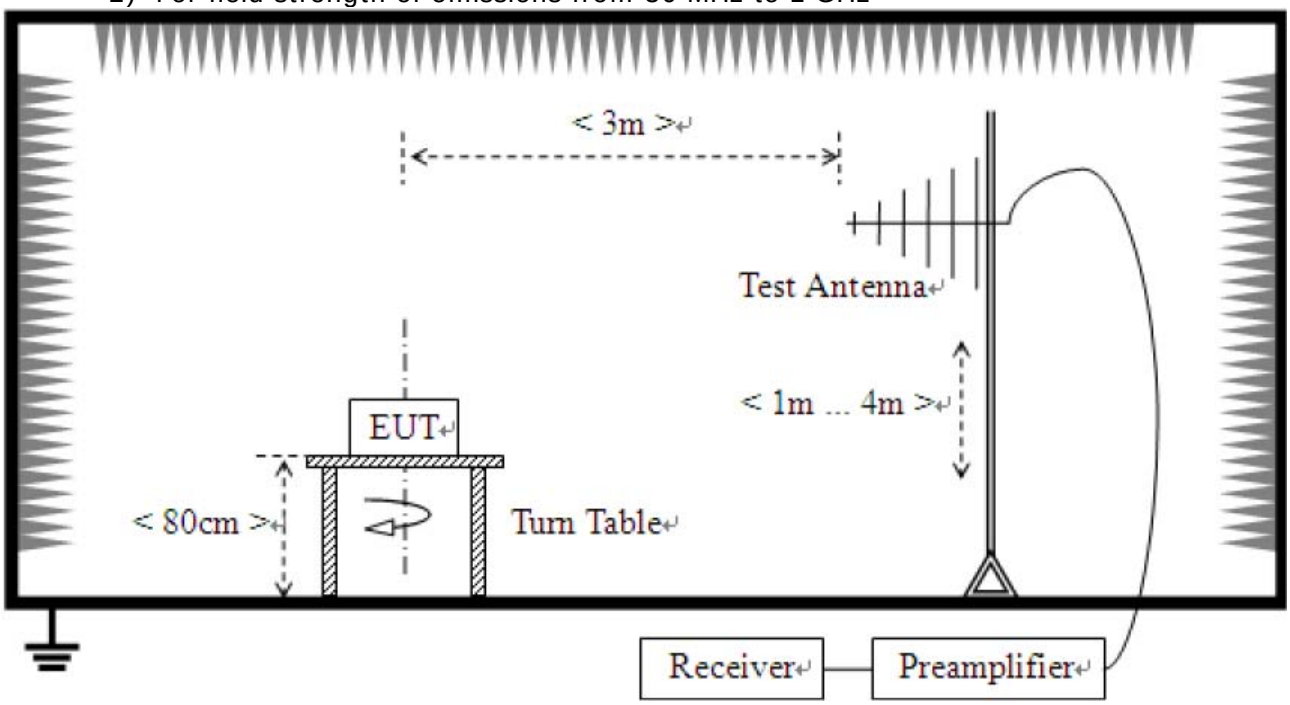
Test Setup:

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



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



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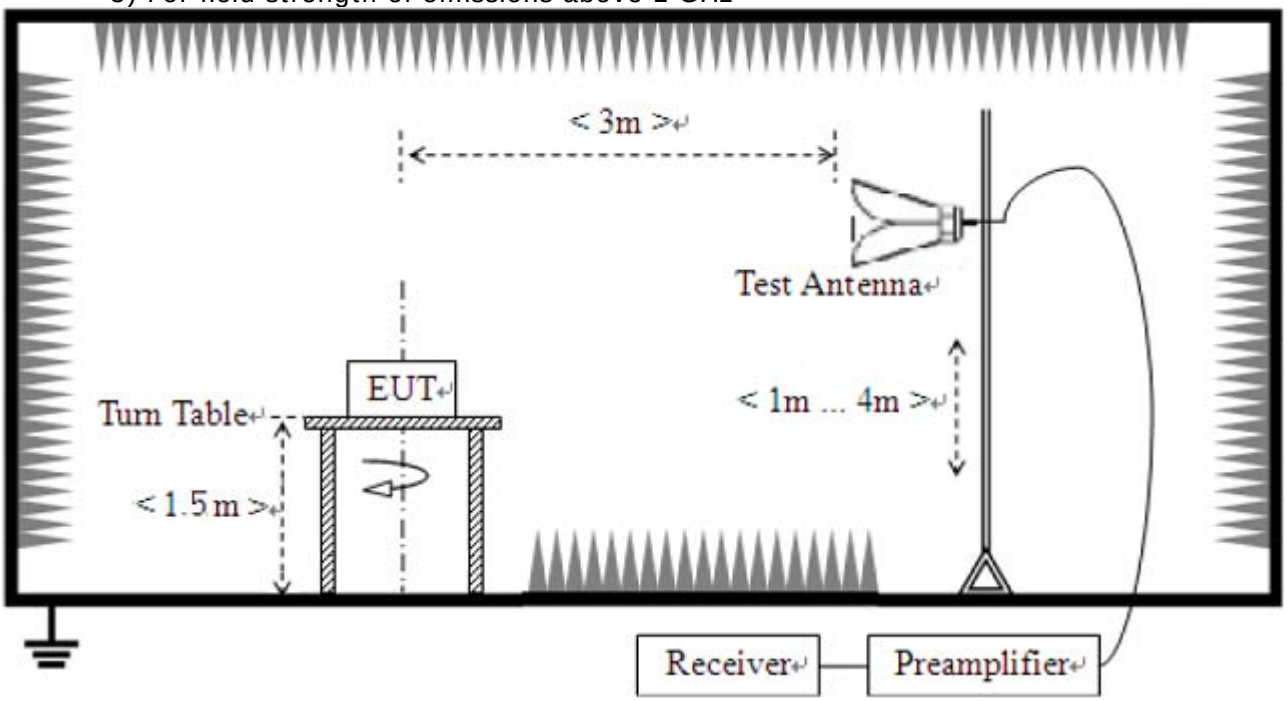
3) For field strength of emissions above 1 GHz



Test Results

1) 9 kHz to 30 MHz

Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)
Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	9 kHz – 30 MHz
Test mode	GFSK, 8-DPSK	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 (specific distance / test distance) (dB)

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2) 30 MHz to 1 GHz

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

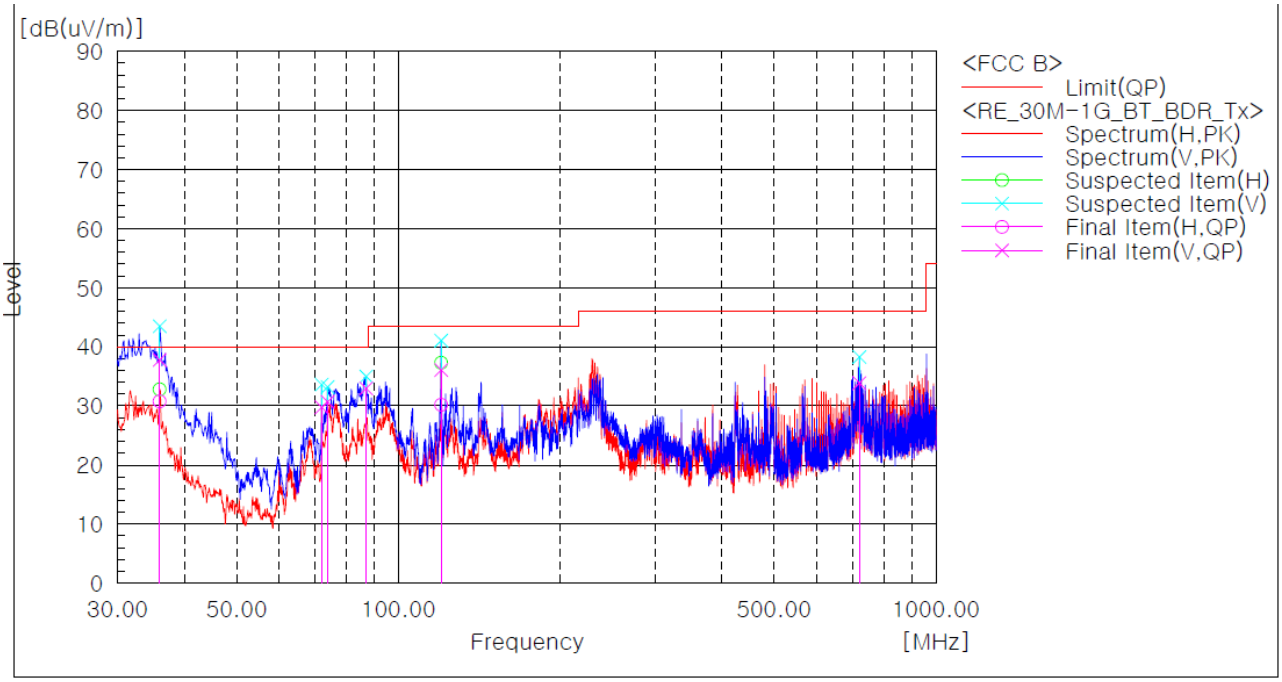
EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	Below 1000MHz
Test mode	GFSK Hopping	Detector function	Quasi-Peak / Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.941	37.8	2.2	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	35.941	V	53.6	-15.8	37.8	40.0	2.2	105.0	257.0
2	35.941	H	46.6	-15.8	30.8	40.0	9.2	107.0	303.8
3	71.953	V	48.3	-18.5	29.8	40.0	10.2	206.0	210.4
4	73.771	V	49.6	-18.9	30.7	40.0	9.3	189.0	225.9
5	86.988	V	51.2	-18.2	33.0	40.0	7.0	194.0	225.9
6	119.968	V	51.2	-15.1	36.1	43.5	7.4	106.0	225.9
7	119.968	H	45.3	-15.1	30.2	43.5	13.3	104.0	288.3
8	720.034	V	39.0	-5.1	33.9	46.0	12.1	214.0	148.5

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 lie-down position(X axis) and the worst case was recorded.

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3) above 1 GHz

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

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
		Detector function	Average / Peak

Remarks

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

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2483.50	51.00	3.00	Average

Test Data

Ch.0(Low Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.39(Mid Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.78(High Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

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Restricted band edge test data

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

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2385.00	H	39.69	51.74	-2.6	54.00	74.00	37.08	49.13	16.92	24.87
2385.00	V	39.59	48.18	-2.6	54.00	74.00	36.98	45.57	17.02	28.43
2385.00	H	37.72	49.83	-2.6	54.00	74.00	35.11	47.22	18.89	26.78
2385.00	V	36.76	48.46	-2.6	54.00	74.00	34.15	45.85	19.85	28.15
2354.00	H	37.11	49.33	-2.6	54.00	74.00	34.50	46.72	19.50	27.28
2483.50	H	53.52	61.88	-2.5	54.00	74.00	51.00	59.36	3.00	14.64
2385.00	V	38.16	48.14	-2.6	54.00	74.00	35.55	45.53	18.45	28.47
2483.50	V	49.26	57.56	-2.5	54.00	74.00	46.74	55.04	7.26	18.96

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

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
		Detector function	Average / Peak

Remarks

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

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2483.50	51.58	2.42	Average

Test Data

Ch.0(Low Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.39(Mid Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.78(High Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

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Restricted band edge test data

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

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2385.00	H	37.70	55.15	-2.6	54.00	74.00	35.09	52.54	18.91	21.46
2385.00	V	39.17	51.25	-2.6	54.00	74.00	36.56	48.64	17.44	25.36
2385.00	H	38.29	49.69	-2.6	54.00	74.00	35.68	47.08	18.32	26.92
2385.00	V	39.90	48.69	-2.6	54.00	74.00	37.29	46.08	16.71	27.92
2354.00	H	38.22	49.06	-2.6	54.00	74.00	35.61	46.45	18.39	27.55
2483.50	H	54.10	64.20	-2.5	54.00	74.00	51.58	61.68	2.42	12.32
2385.00	V	39.78	47.90	-2.6	54.00	74.00	37.17	45.29	16.83	28.71
2483.50	V	49.22	59.56	-2.5	54.00	74.00	46.70	57.04	7.30	16.96

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Test Results

1) 9 kHz to 30 MHz

Test mode : Receiver

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	9 kHz – 30 MHz
Test mode	Receiver	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 (specific distance / test distance) (dB)

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2) 30 MHz to 1 GHz

Test mode : Receiver

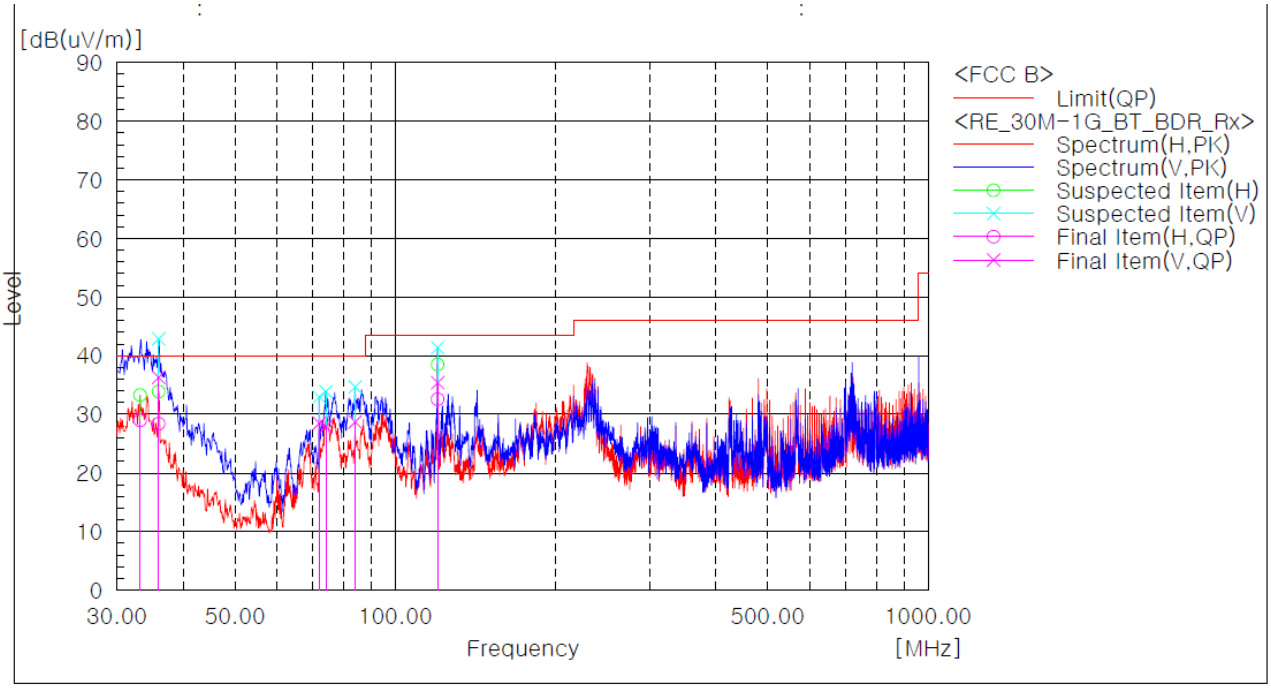
EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	Below 1000MHz
Test mode	Receiver	Detector function	Quasi-Peak / Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.941	36.3	3.7	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	33.153	H	45.1	-16.1	29.0	40.0	11.0	103.0	117.9
2	35.941	V	52.1	-15.8	36.3	40.0	3.7	97.0	4.0
3	35.941	H	44.2	-15.8	28.4	40.0	11.6	106.0	303.3
4	71.953	V	47.0	-18.5	28.5	40.0	11.5	197.0	226.4
5	74.014	V	46.9	-19.0	27.9	40.0	12.1	189.0	179.8
6	83.956	V	47.7	-19.0	28.7	40.0	11.3	205.0	226.4
7	119.968	V	50.5	-15.1	35.4	43.5	8.1	205.0	226.4
8	119.968	H	47.7	-15.1	32.6	43.5	10.9	201.0	303.3

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 lie-down position(X axis) and the worst case was recorded.

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3) above 1 GHz

Test mode : Receiver

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
		Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X 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

Ch.0(Low Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.39(Mid Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

Ch.78(High Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

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

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]

No emissions were detected at a level greater than 20dB below limit.

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2.1.8 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 : USB Charge

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.474	37.9	8.5	Average

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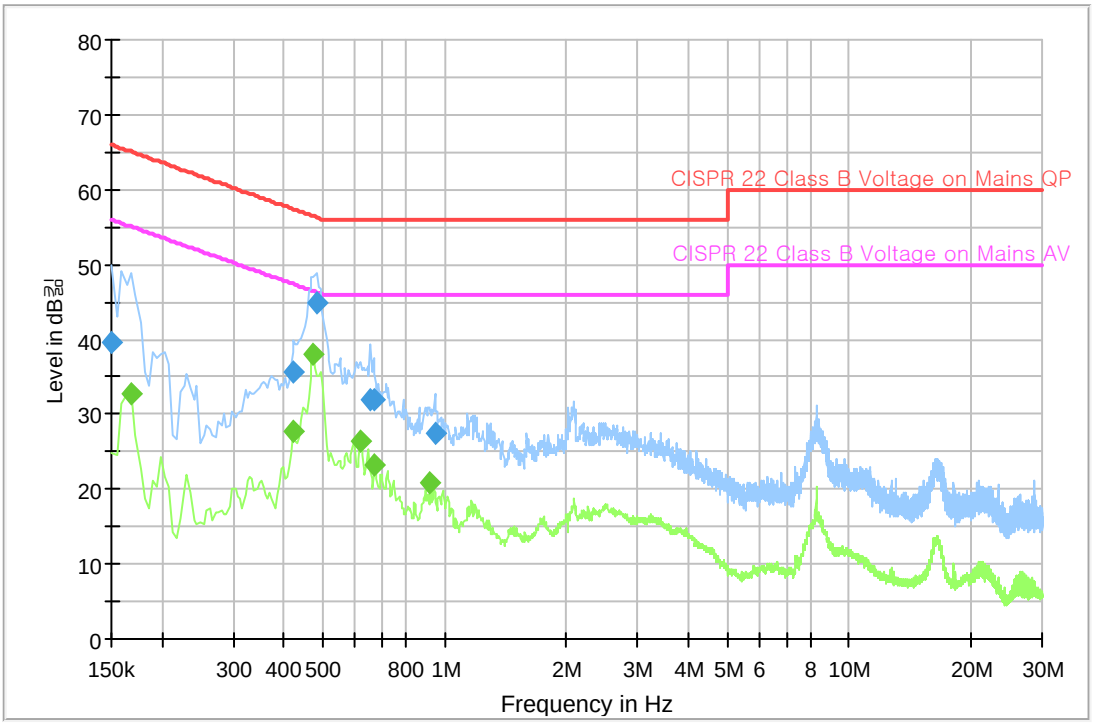
Test Data

[L1]

3CE_CISPR 22 Class B_L1



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	39.7	1000.0	9.000	On	L1	9.9	26.3	66.0
0.424500	35.7	1000.0	9.000	On	L1	10.1	21.6	57.4
0.483000	44.8	1000.0	9.000	On	L1	10.1	11.5	56.3
0.654000	32.0	1000.0	9.000	On	L1	10.1	24.0	56.0
0.667500	31.9	1000.0	9.000	On	L1	10.1	24.1	56.0
0.946500	27.4	1000.0	9.000	On	L1	10.0	28.6	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.168000	32.8	1000.0	9.000	On	L1	9.9	22.3	55.1
0.420000	27.8	1000.0	9.000	On	L1	10.1	19.7	47.4
0.474000	37.9	1000.0	9.000	On	L1	10.1	8.5	46.4
0.618000	26.4	1000.0	9.000	On	L1	10.1	19.6	46.0
0.672000	23.2	1000.0	9.000	On	L1	10.1	22.8	46.0
0.919500	21.0	1000.0	9.000	On	L1	10.0	25.0	46.0

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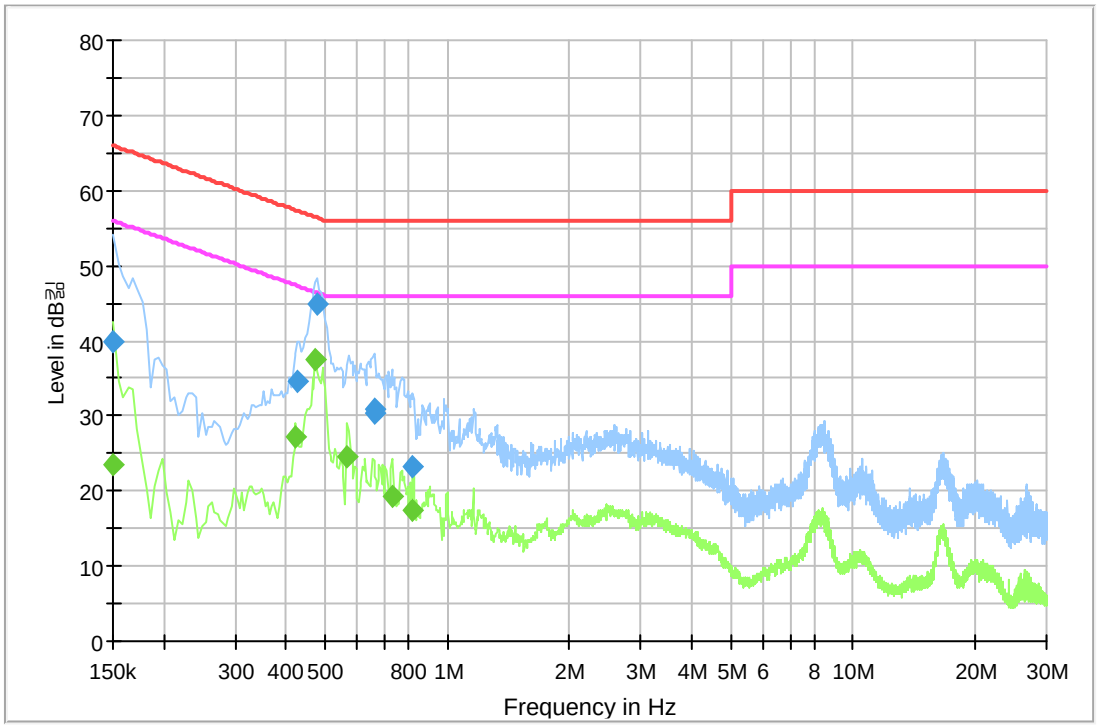
[NEUTRAL]

3CE_CISPR 22 Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	39.8	1000.0	9.000	On	N	9.8	26.2	66.0
0.429000	34.7	1000.0	9.000	On	N	10.0	22.6	57.3
0.478500	44.8	1000.0	9.000	On	N	10.0	11.6	56.4
0.658500	30.4	1000.0	9.000	On	N	10.0	25.6	56.0
0.663000	30.8	1000.0	9.000	On	N	10.0	25.2	56.0
0.820500	23.3	1000.0	9.000	On	N	9.9	32.7	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	23.5	1000.0	9.000	On	N	9.8	32.5	56.0
0.424500	27.1	1000.0	9.000	On	N	10.0	20.3	47.4
0.474000	37.4	1000.0	9.000	On	N	10.0	9.1	46.4
0.568500	24.6	1000.0	9.000	On	N	10.0	21.4	46.0
0.730500	19.4	1000.0	9.000	On	N	9.9	26.6	46.0
0.820500	17.4	1000.0	9.000	On	N	9.9	28.6	46.0

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APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2015-11-02	2016-11-02
2	Signal Generator	Rohde & Schwarz	SMBV100A	258008	2015-05-13	2016-05-13
3	EMI Test Receiver	Rohde & Schwarz	ESCI3	100032	2015-02-02	2016-02-02
4	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2015-11-02	2016-11-02
5	Trilog Broadband Antenna	SCHWARZBECK	VULB 9161 SE	9161-4133	2015-06-18	2017-06-18
6	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2014-05-19	2016-05-19
7	6dB Attenuator	R&S	DNF	272.4110.50-2	2015-11-03	2016-11-03
8	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2015-02-06	2016-02-06
9	LISN	Rohde & Schwarz	ENV216	101235	2015-05-14	2016-05-14
10	EMI Test Receiver	Rohde & Schwarz	ESCI7	100816	2015-11-02	2016-11-02
11	Horn Antenna	ETS-Lindgren	3115	00078894	2015-09-02	2017-09-02
12	Horn Antenna	ETS-Lindgren	3117	00154525	2015-09-02	2017-09-02
13	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2015-05-15	2016-05-15
14	PREAMPLIFIER	Agilent	8449B	3008A02307	2015-10-01	2016-10-01
15	SPECTRUM ANALYZER	Rohde & Schwarz	FSP-30	100994	2015-11-02	2016-11-02
16	Band Reject Filter	Wainwright Instruments GmbH	WRCGV 2400/2483 - 2375/2505 -50/10EE	2	2015-05-14	2016-05-14

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