Nemko Korea Co., Ltd.

159 Osan-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 16885, Republic of Korea
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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Anam Electronics Co., Ltd.
27, Digital-ro 27ga-gil, Guro-gu, Seoul,
08375, Republic of Korea.
Attn. : Byeong-Seob, Lee

Dates of Issue : September 05, 2017
Test Report No. : NK-17-R-205
Test Site : Nemko Korea Co., Ltd.

FCC **IC**	**MBBDSB250BT** **11657A-DSB250BT**
Brand Name	**DENON**
Contact Person	**Anam Electronics Co., Ltd.** **27, Digital-ro 27ga-gil, Guro-gu, Seoul,** **08375, Republic of Korea.** **Byeong-Seob, Lee** **Telephone No. : +82-2-6424-4881**

Applied Standard: FCC 47 CFR Part 15.247 and IC RSS-247 Issue 2
Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
EUT Type: BT SPEAKER

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

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

Sep. 05. 2017

Tested By : Seungyong Shin
Engineer

Deokha Ryu Sep 05 2017.

Reviewed By : Deokha Ryu
Technical Manager

TABLE OF CONTENTS

1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15 and IC RSS-247 Issue2.

Responsible Party :	Anam Electronics Co., Ltd. 27, Digital-ro 27ga-gil, Guro-gu, Seoul, 08375, Republic of Korea
Contact Person :	Byeong Seob, Lee
Manufacturer :	D&M HOLDINGS INC. D&M Building, 2-1 Nisshin-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa-ken, 210-8569, JAPAN

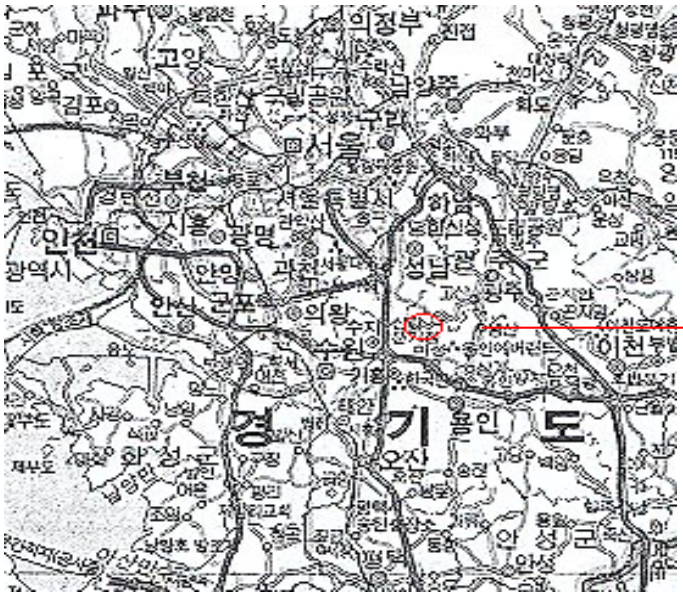
- FCC ID MBBDSB250BT
- IC : 11657A-DSB250BT
- Model: DSB250BT
- HVIN DSB250BT
- Brand Name: DENON
- EUT Type: BT SPEAKER
- Classification: Part 15 Spread Spectrum Transmitter (DSS)
- Applied Standard: FCC 47 CFR Part 15 subpart C and IC RSS-247 Issue 2
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: August 11, 2017 ~ September 04, 2017
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating from **Anam Electronics Co., Ltd. FCC ID : MBBDSB250BT** and **IC : 11657A-DSB250BT.**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address 159, Osan-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 16885, Republic of Korea.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014 according to §2.948.



Nemko Korea Co., Ltd.
EMC Lab.
159, Osan-ro, Mohyeon-myeon,
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16885, Republic of Korea.
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	KCC(RRL)Designated Lab.	Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the transceiver which is the Bluetooth 4.2 module supporting BDR/EDR/LE mode.
The Laptop was used to control the EUT to transmit the wanted TX channel by the testing program (Bluetest) which manufacturer supported. The Laptop was removed after controlling the EUT to transmit the wanted signal. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test power setting

Mode	Frequency Band	Power Setting Level	
GFSK/ π/4 DQPSK/ 8DPSK	2402 MHz ~ 2480 MHz	Ext. Power	255
		Int. Power	40

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
2.4 GHz	GFSK, π/4DQPSK, 8DPSK	0	2402
		39	2441
		78	2480

3.1.3 Antenna TX mode information

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	GFSK, π/4DQPSK, 8DPSK	■ 1TX, □ 2TX	□ Yes, ■ No

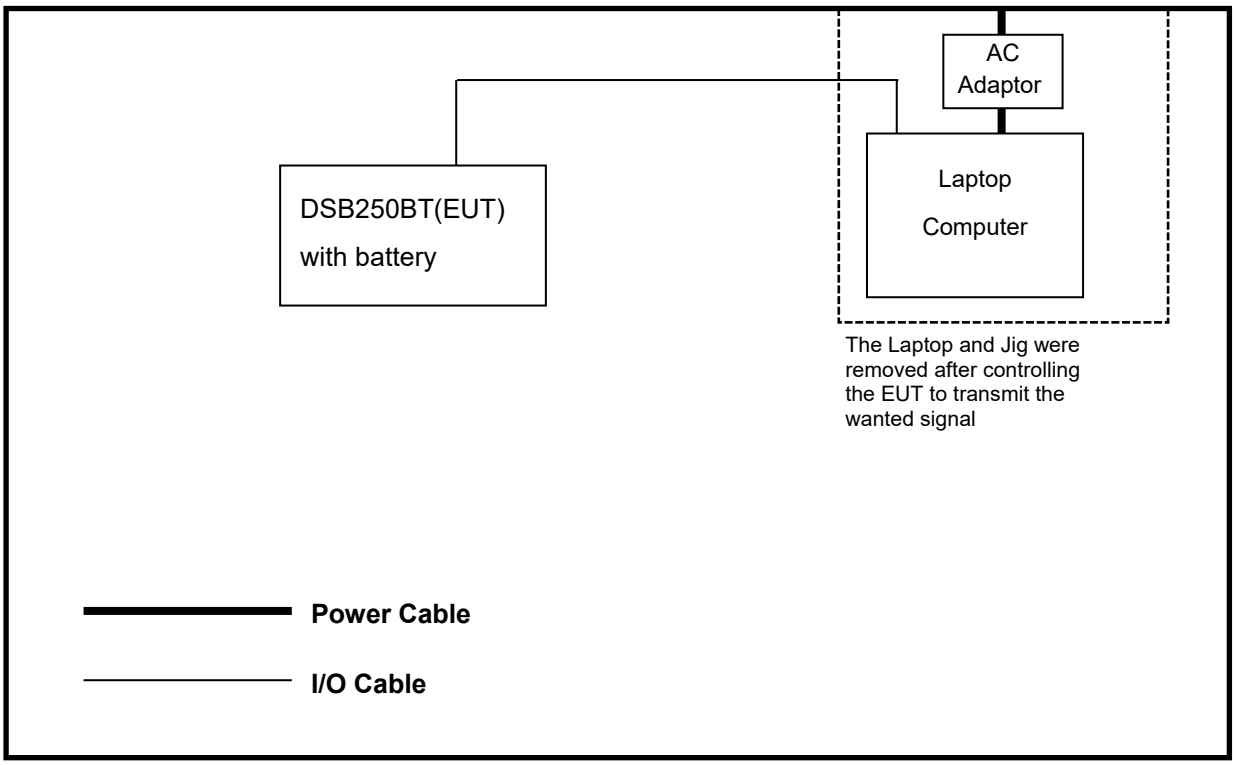
3.1.4. Additional Information Related to Testing

The cable and attenuator loss from 30MHz to 26.5GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

3.2 Support Equipment

EUT	Anam Electronics Co., Ltd. Model : DSB250BT	S/N: N/A
Laptop Computer	HP Model : G62-355TU 1.5 m shielded pin connector cable	FCC DOC S/N : CNF0489WDT
AC/DC Adapter	HP Model : PPP009D 1.5 m unshielded power cable	FCC DOC S/N : WBGSV0ACXZH162

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Anam BT SPEAKER FCC ID: MBBDSB250BT, IC: 11657A-DSB250BT.**
This unit supports full qualified Bluetooth 4.2 with EDR standard system.

Specifications:

EUT Type	BT SPEAKER
Model Name	DSB250BT
Brand Name	DENON
RF Frequency	2402 MHz ~ 2480 MHz
Peak Power Output (Conducted)	8.02 dBm
FCC Classification	FCC Part 15 Spread Spectrum Transmitter (DSS)
Method/System	Frequency Hopping Spread Spectrum (FHSS)
Channel Number	79 ch
Modulations	GFSK, π/4DQPSK, 8DPSK
Antenna Gain (peak)	3.74 dBi
Antenna Setup	1TX / 1RX
Voltage	Operating Voltage : 7.2 Vdc (Battery) Test Voltage : 7.2 Vdc
Temperature Range	-10℃ ~ +50 ℃
Size (H x W x D)	About 80.0 mm x 209.0 mm x 70.0 mm
Weight	About 756 g
HVIN (Hardware version number)	DSB250BT
FVIN (Firmware Version Identification Number)	FWV042
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Radiated Emission	15.209	RSS-GEN Issue 4 8.9	Complies	
20dB Bandwidth	15.247(a)(1)	RSS-247 Issue 2 5.1	Complies	
Carrier Frequency Separation	15.247(a)(1)	RSS-247 Issue 2 5.1	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	RSS-247 Issue 2 5.1	Complies	
Peak Output Power and E.I.R.P	15.247(b)(1)	RSS-247 Issue 2 5.4	Complies	
Conducted Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	RSS-247 Issue 2 5.1	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Anam BT SPEAKER FCC ID: MBBDSB250BT, IC: 11657A-DSB250BT** is in compliance with Part 15.247 of the FCC Rule and RSS-247 Issue 2 of the IC specification.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The antenna of the **Anam BT SPEAKER FCC ID: MBBDSB250BT, IC: 11657A-DSB250BT** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.

For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0˚ to 360˚ and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

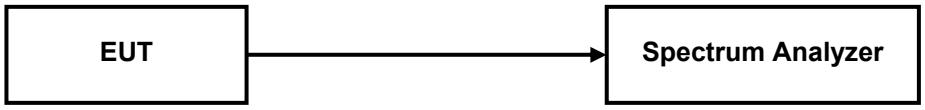
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI C63.10-2013. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 1 kHz, Detector = Peak, Trace mode = max hold.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Radiated Emissions Limits per 47 CFR 15.209(a) and RSS-GEN Issue 4 8.9

7.2 20 dB Bandwidth

Test Setup



Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 1% to 5% of the OBW

VBW = approximately 3 x RBW

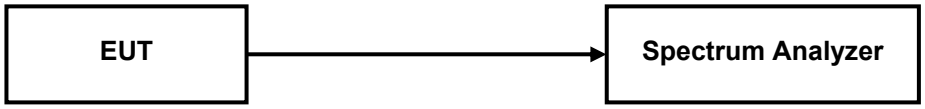
Sweep = auto

Detector function = peak

Trace = max hold

7.3 Carrier Frequency Separation

Test Setup



Test Procedure

The EUT must have its hopping function enabled. The following spectrum analyzer setting is used.

Span = wide enough to capture the peaks of two adjacent channels

RBW ≥ approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel

VBW ≥ RBW

Sweep = auto

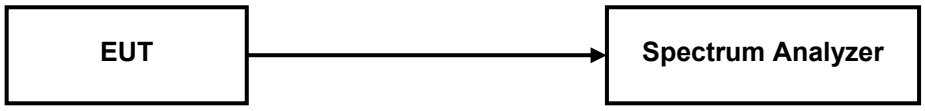
Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

7.4 Transmitter Average Time of Occupancy

Test Setup



Test Procedure

The transmitter output is connected to a spectrum analyzer. The following spectrum analyzer setting is used.

Span = Zero span, centered on a hopping channel

RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / *T*, where *T* is the expected dwell time per channel.

VBW ≥ RBW

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

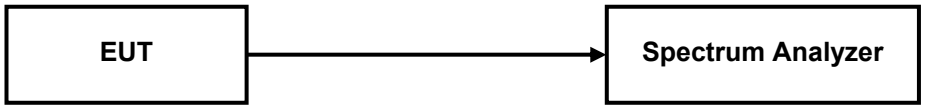
Detector function = Peak

Trace = Single sweep

Use the marker-delta function to determine the width of pulse

7.5 Number of Hopping Channels

Test Setup



Test Procedure

Span = The frequency band of operation.

RBW = less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW ≥ RBW

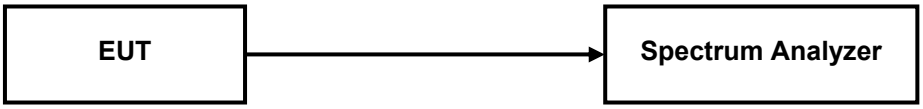
Sweep = Auto

Detector function = Peak

Trace = Max hold

7.6 Peak Output Power

Test Setup



Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > 20 dB bandwidth of the emission being measured

VBW ≥ RBW

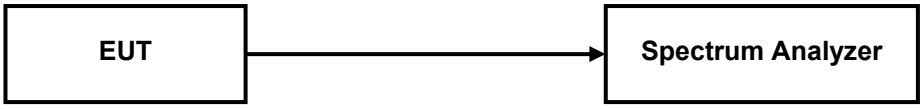
Sweep = auto

Detector function = peak

Trace = max hold

7.7 Conducted Spurious Emission

Test Setup



Test Procedure

Measurements are made over the 30 MHz to 26.5 GHz range with the transmitter set to the Lowest, middle and highest channels.

RBW = 100kHz

VBW = 300kHz

Sweep = auto

Detector function = peak

Trace = max hold

8. TEST DATA

8.1 Radiated Emissions

FCC §15.209, IC RSS-GEN Issue 4 8.9

Result

Frequency (MHz)	Reading ($dB_{\mu}V/m$)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
131.90	64.40	H	230	188	-26.7	37.7	43.5	5.8
143.98	67.60	H	170	183	-27.4	40.2	43.5	3.3
156.00	66.10	H	209	30	-26.9	39.2	43.5	4.3
167.98	62.90	H	170	15	-26.4	36.5	43.5	7.0
833.31	51.20	H	100	92	-9.9	41.3	46.0	4.7
999.13	43.50	H	100	23	-8.6	34.9	54.0	19.1

Radiated Measurements at 3 meters

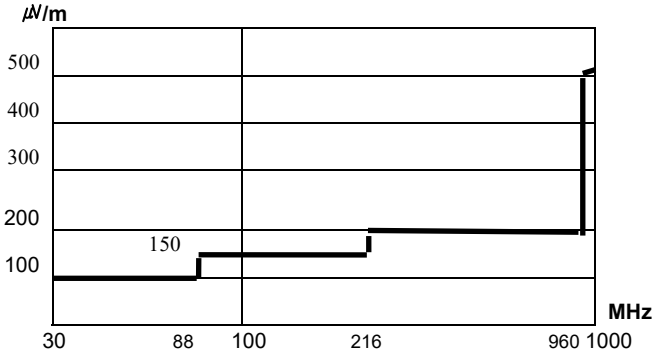


Fig. 3. Limits at 3 meters

Notes:

1. All modes were measured and the worst-case emission was reported.

2 The radiated limits are shown on Figure 3. Above 1GHz the limit is 500 µV /m.

*3. *Pol. H = Horizontal, V = Vertical*

*4. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

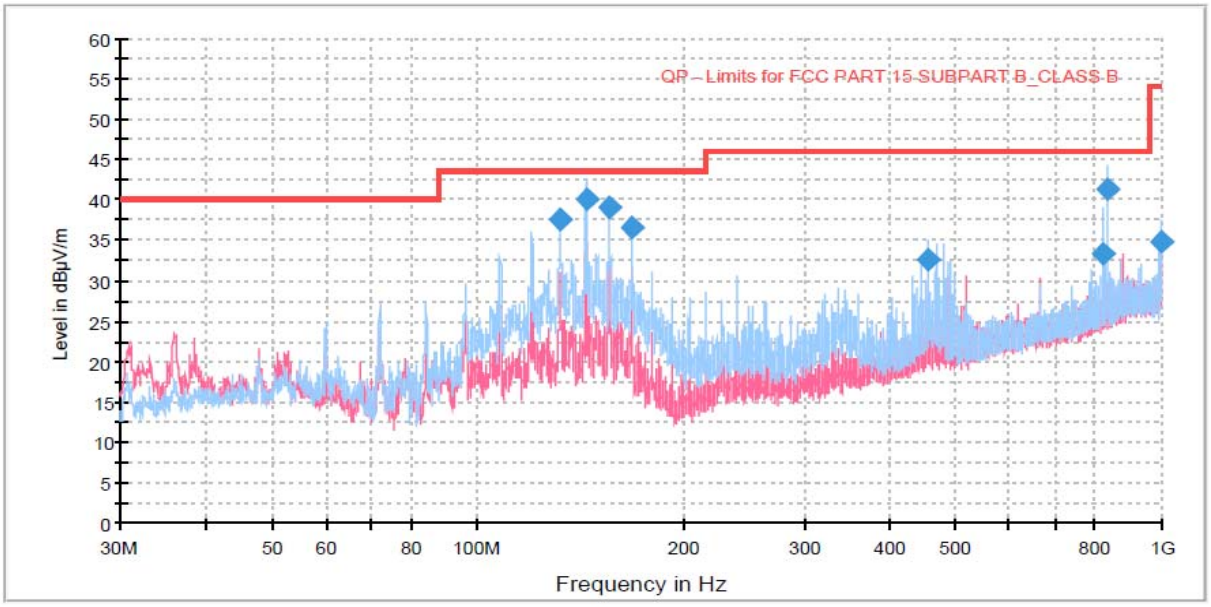
5. Measurements using CISPR quasi-peak mode below 1 GHz.

6. The radiated emissions testing were made by rotating the receive antenna with horizontal, Vertical polarization. The worst date was recorded.

7. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

PLOTS OF EMISSIONS

Worst Case : 2441MHz (below 1GHz) GFSK modulation



8.2 20 dB Modulated Bandwidth

FCC §15.247(a)(1)(iii), IC RSS-247 Issue 2, 5.1

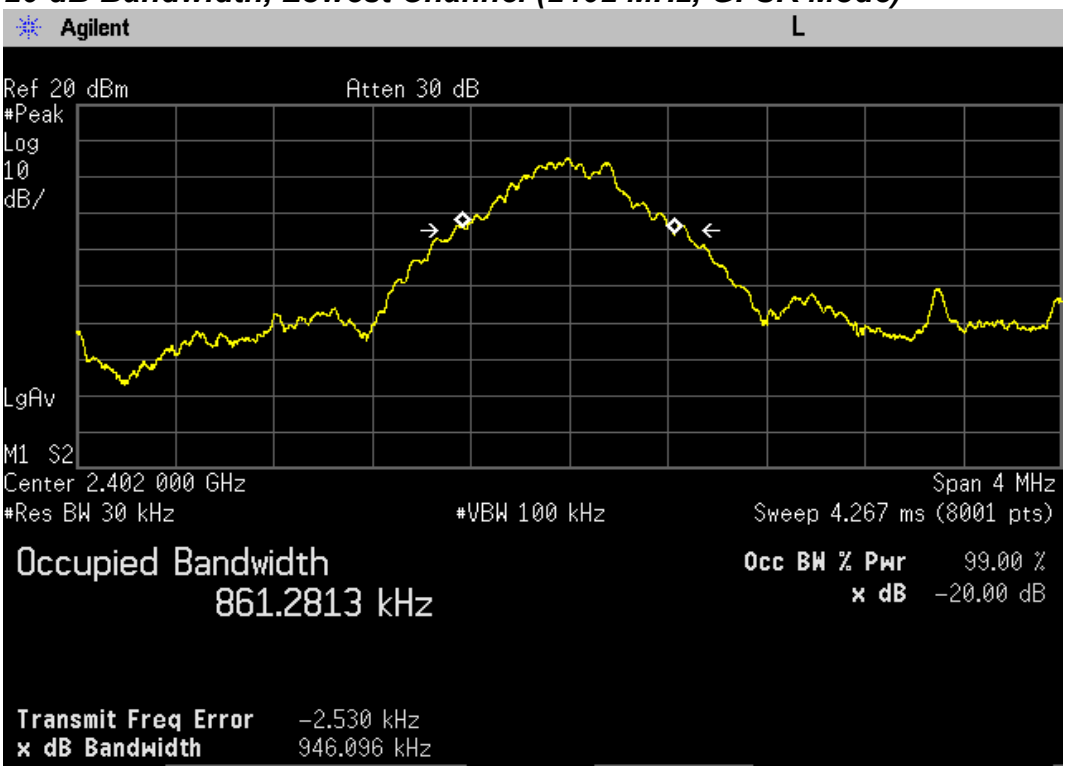
Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

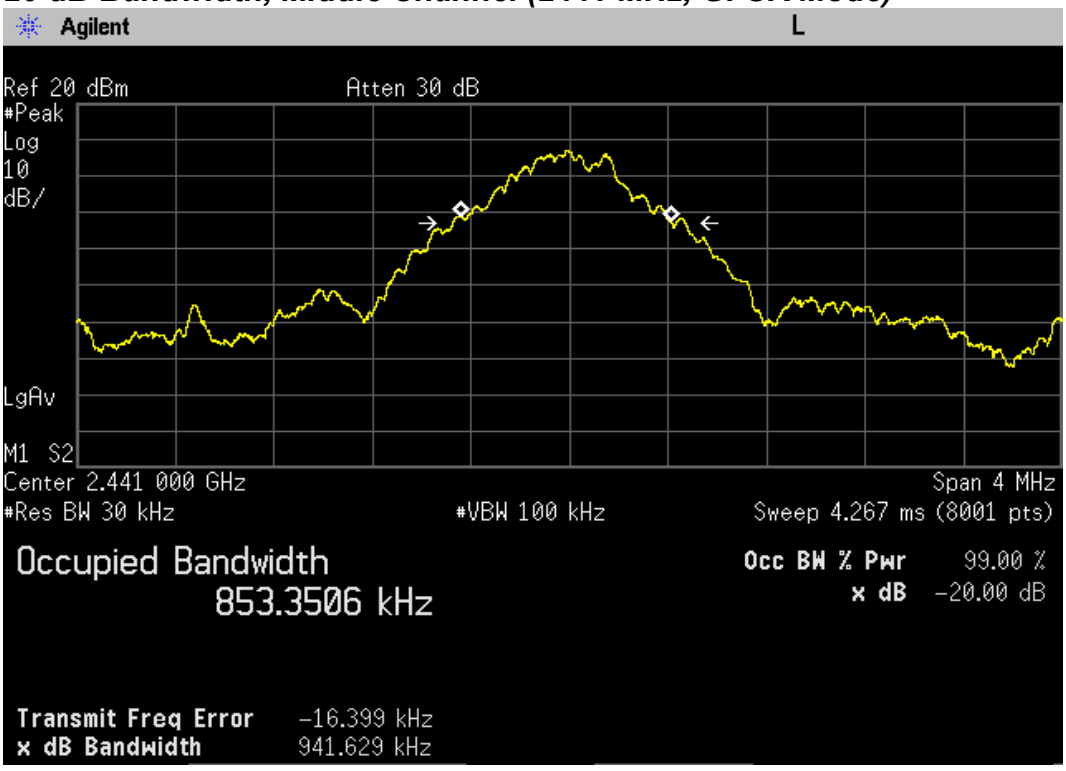
Modulation Mode	Frequency (MHz)	Result (kHz)	Limit (kHz)
GFSK	2402	946.1	Non specified
GFSK	2441	941.6	Non specified
GFSK	2480	940.8	Non specified
π/4DQPSK	2402	1230.0	Non specified
π/4DQPSK	2441	1227.0	Non specified
π/4DQPSK	2480	1229.0	Non specified
8DPSK	2402	1258.0	Non specified
8DPSK	2441	1258.0	Non specified
8DPSK	2480	1259.0	Non specified

PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, GFSK Mode)

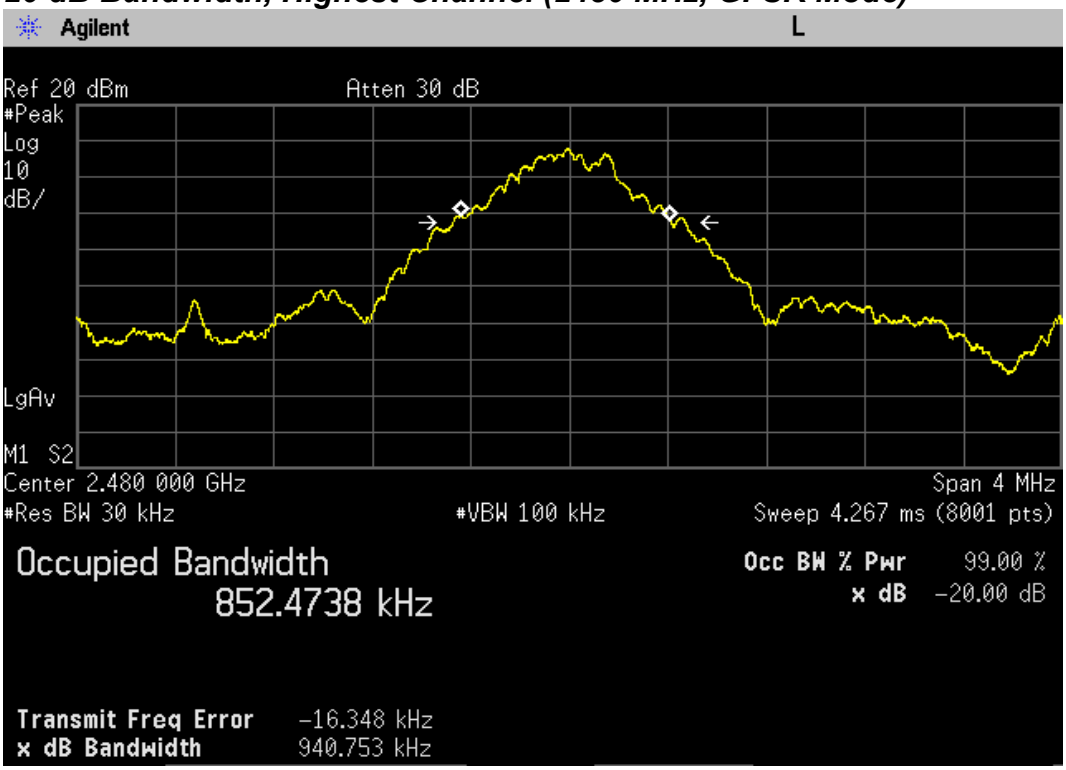


20 dB Bandwidth, Middle Channel (2441 MHz, GFSK Mode)

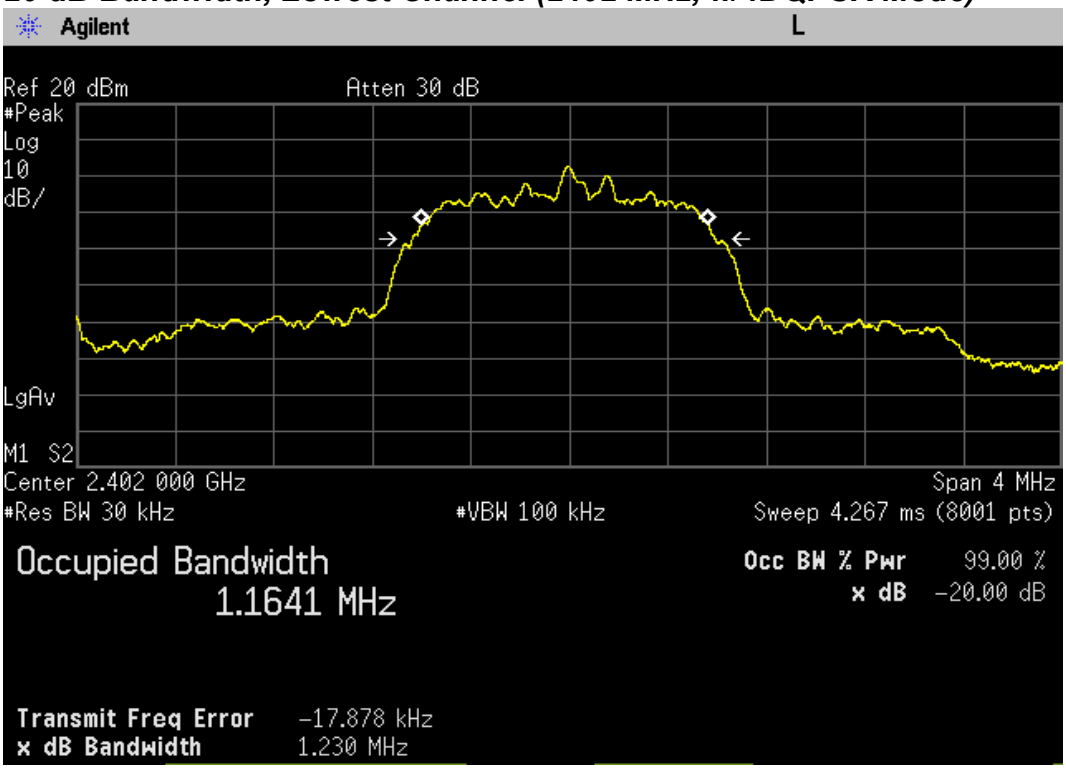


PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, GFSK Mode)

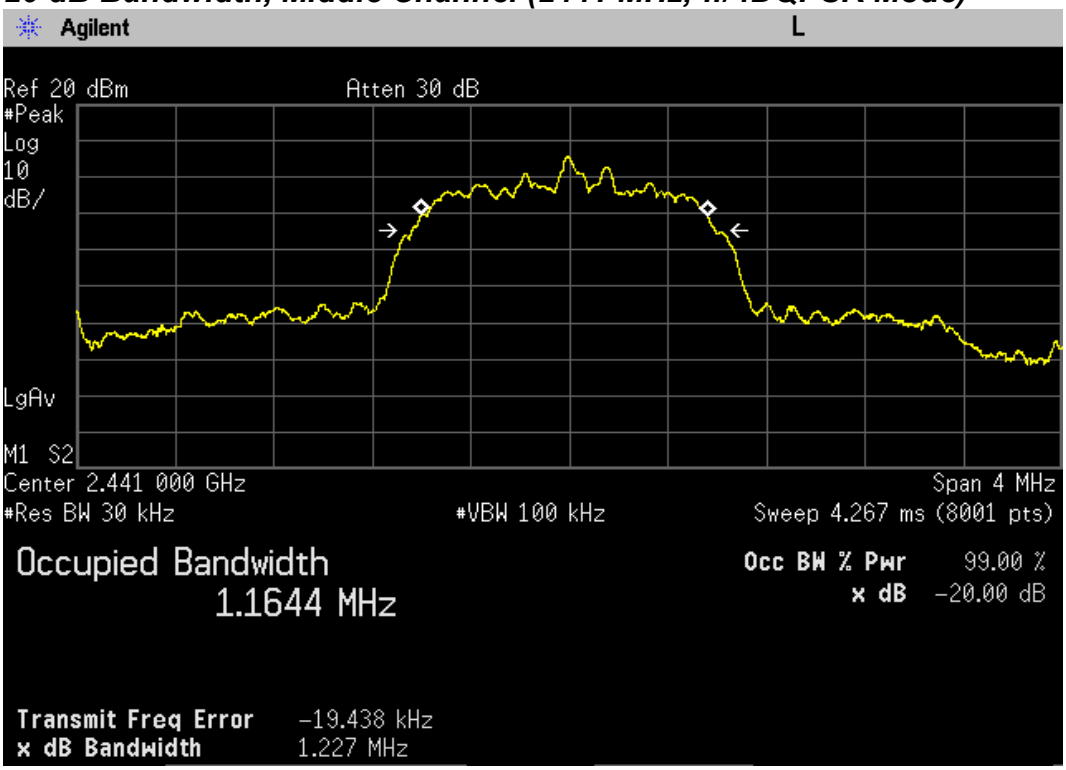


20 dB Bandwidth, Lowest Channel (2402 MHz, π/4DQPSK Mode)

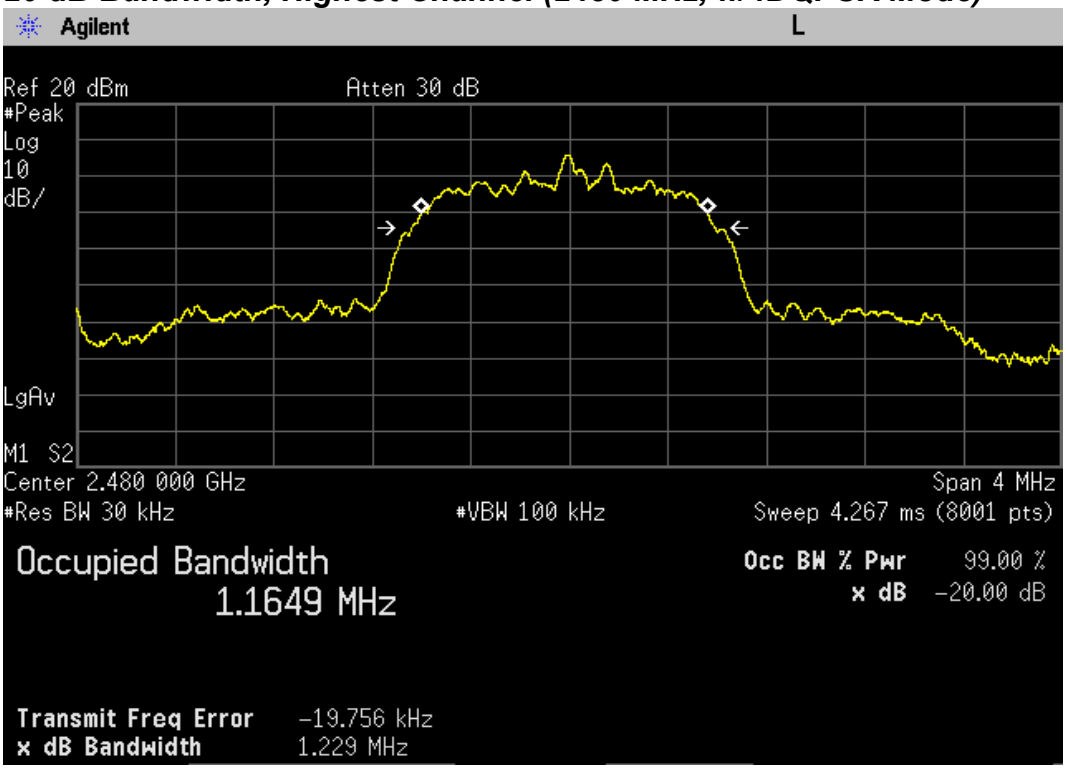


PLOTS OF EMISSIONS

20 dB Bandwidth, Middle Channel (2441 MHz, π/4DQPSK Mode)

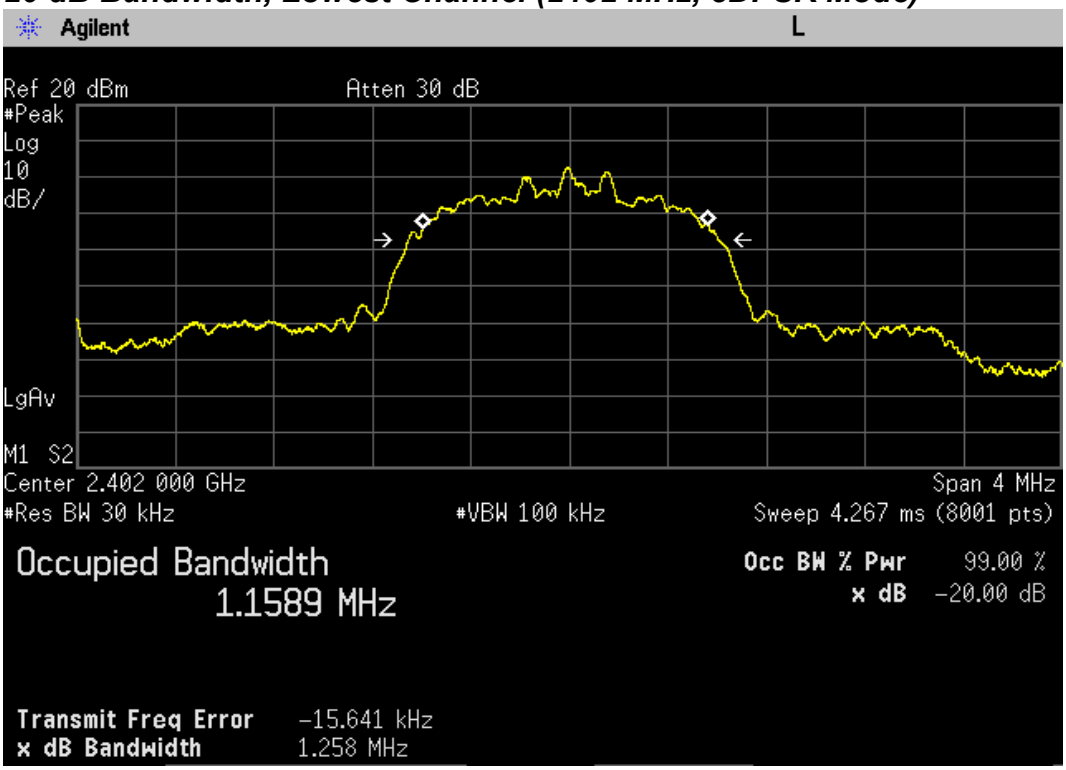


20 dB Bandwidth, Highest Channel (2480 MHz, π/4DQPSK Mode)

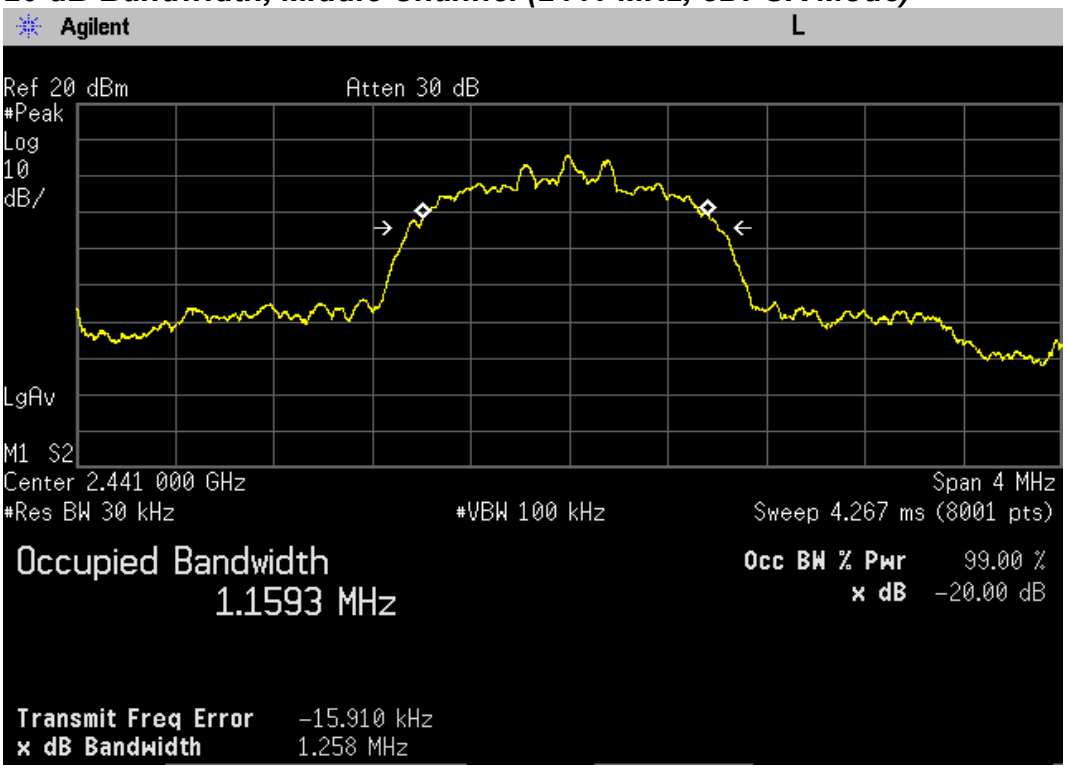


PLOTS OF EMISSIONS

20 dB Bandwidth, Lowest Channel (2402 MHz, 8DPSK Mode)

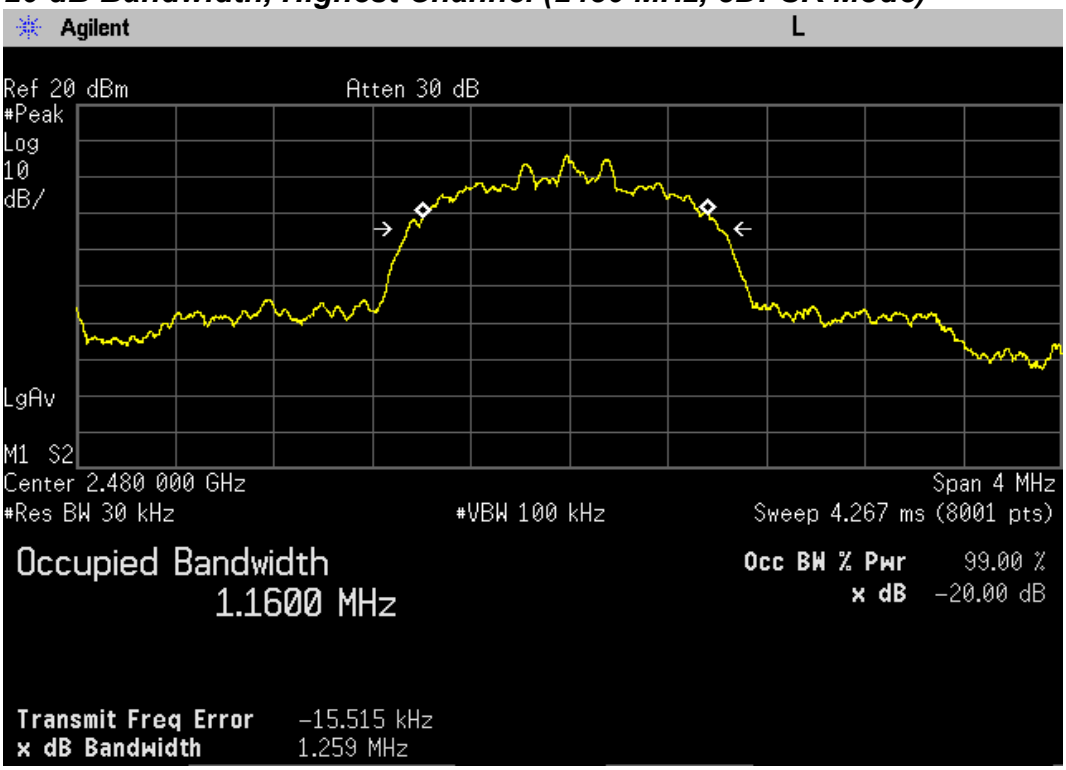


20 dB Bandwidth, Middle Channel (2441 MHz, 8DPSK Mode)



PLOTS OF EMISSIONS

20 dB Bandwidth, Highest Channel (2480 MHz, 8DPSK Mode)



8.3 Carrier Frequency Separation

FCC §15.247(a)(1), IC RSS-247 Issue 2, 5.1

Test Mode : Set to Hopping mode

Result

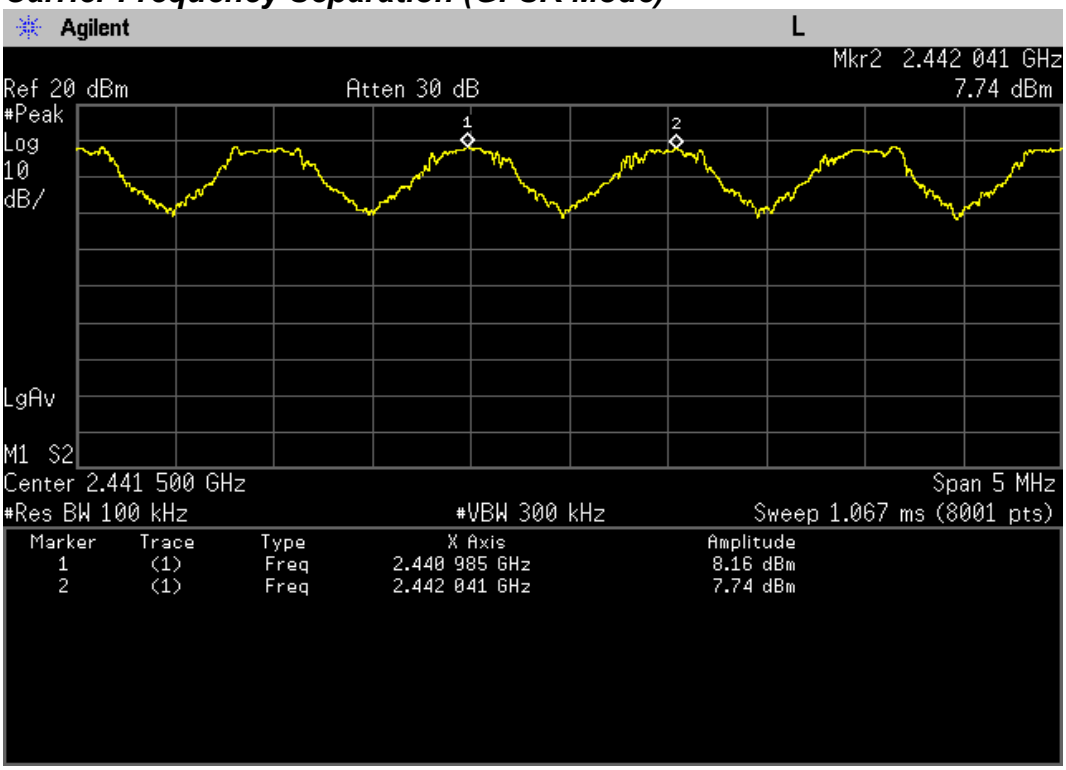
Modulation Mode	Carrier Frequency Separation (kHz)	Limit (2 / 3 of 20dB Bandwidth) (kHz)	Margin (kHz)
GFSK	1056.00	630.73	425.27
π/4DQPSK	1007.00	820.00	187.00
8DPSK	1005.00	839.33	165.67

Note:

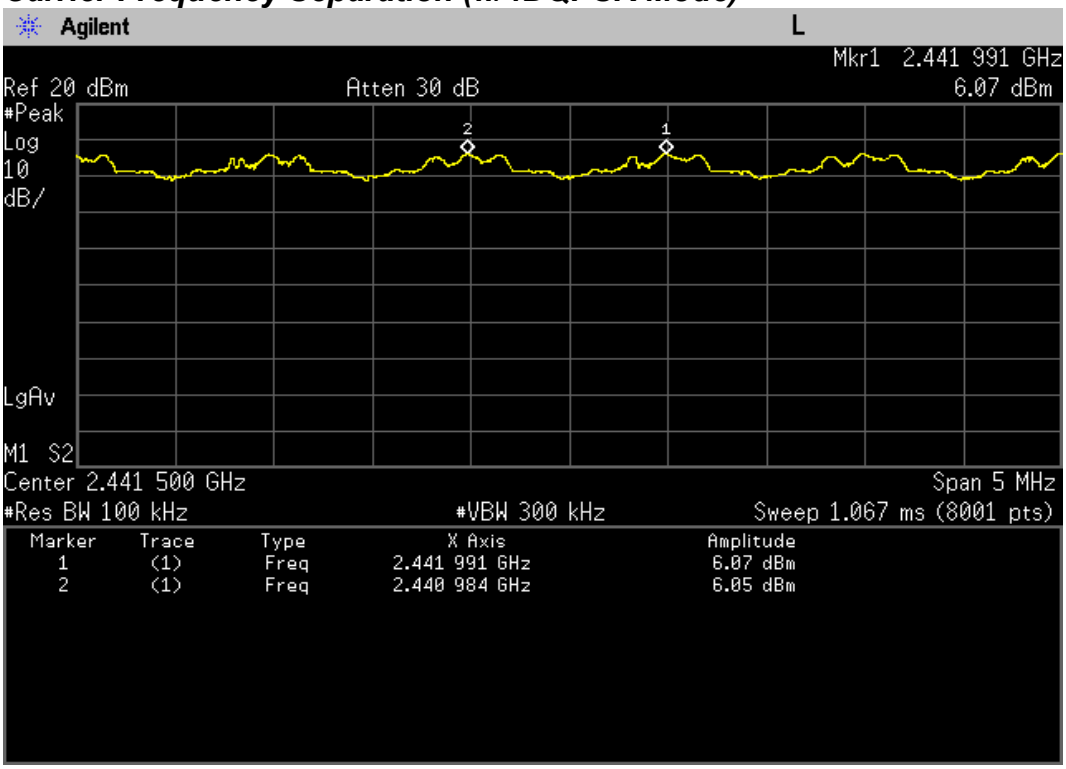
The EUT complies with the minimum channel separation requirement when it is operating ***1x/EDR mode using 79 channels*** *and when operating in* ***AFH mode using 20 channels****.*

PLOTS OF EMISSIONS

Carrier Frequency Separation (GFSK Mode)

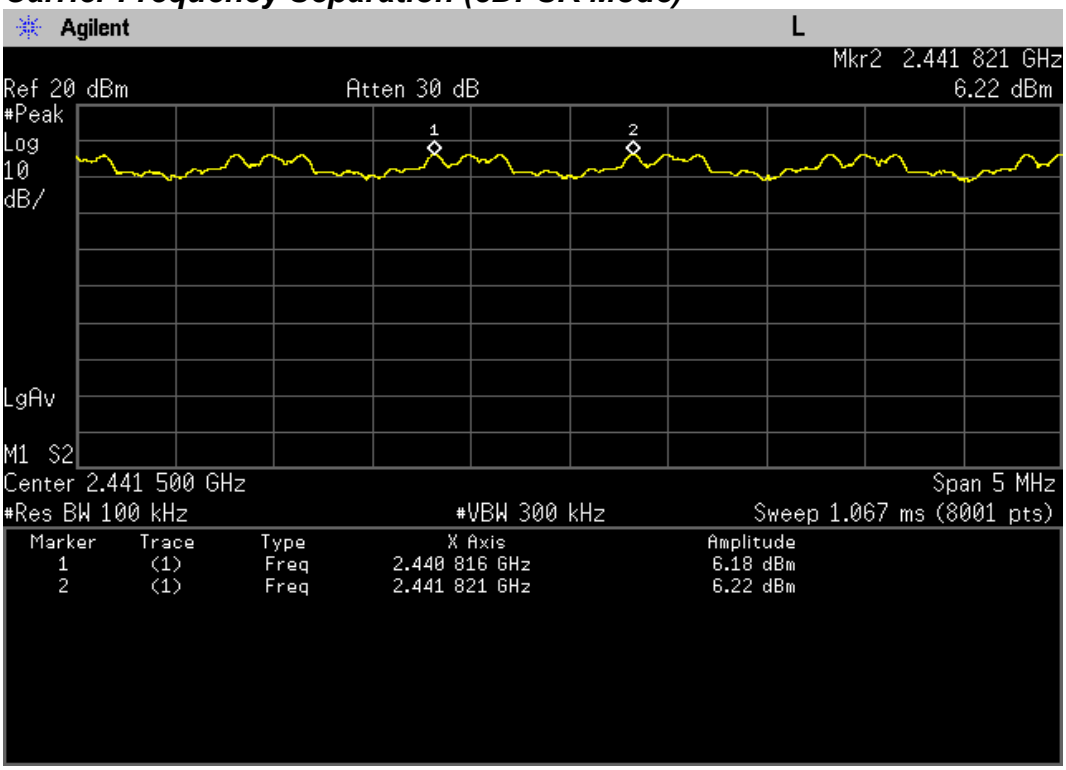


Carrier Frequency Separation (π/4DQPSK Mode)



PLOTS OF EMISSIONS

Carrier Frequency Separation (8DPSK Mode)



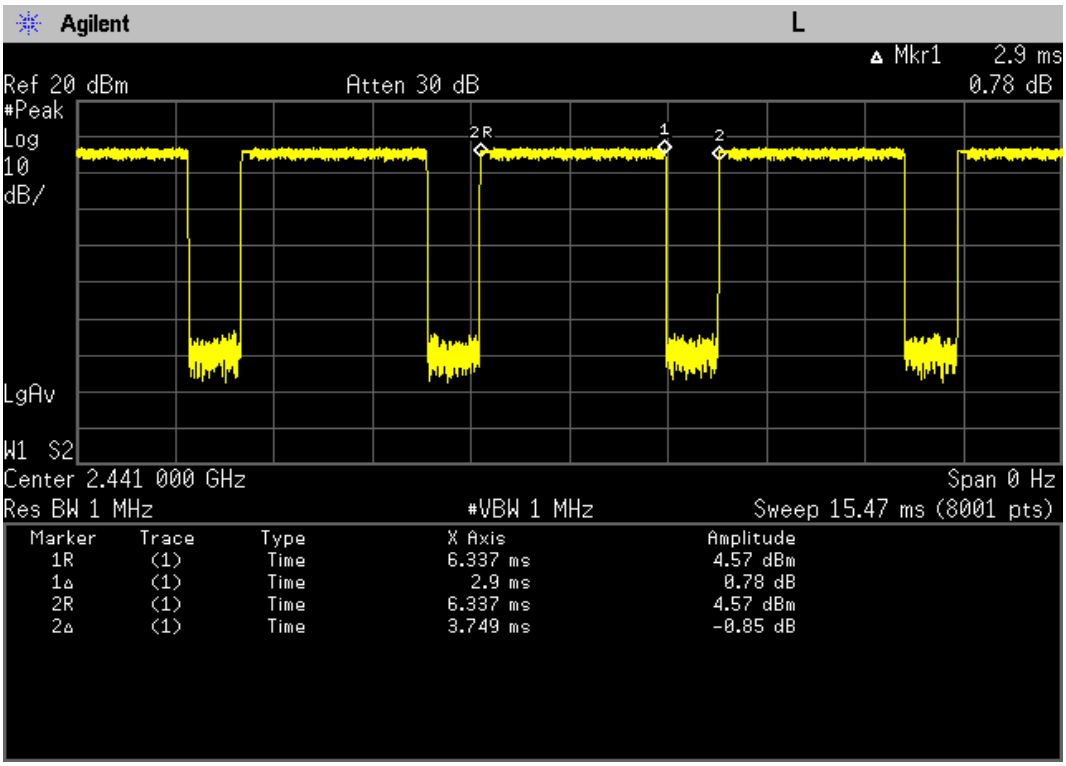
8.4 Transmitter Average Time of Occupancy

FCC §15.247(a)(1), IC RSS-247 Issue 2, 5.1

Test mode : Set to Hopping mode

Result

Mode	Pulse width (ms)	*)Numbers of slots	**) Average time of Occupancy (ms)	Limit (ms)	Margin (ms)
1x/EDR	2.90	106.67	309.33	400	90.67
AFH	2.90	53.33	154.67	400	245.33



1x/EDR mode

1) This result was measured at DH5 mode in **1x/EDR mode**, which has longest time in one transmission burst.
2) Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s and 79 hopping channels.
3) The average time of occupancy in the specified 31.6 second period (79 channels x 0.4 s) is equal to pulse width x (hopping rate / 6) / 79 x (0.4 x hopping channels).
4) *) Numbers of slots in 31.6 sec = (1600 / 6) / 79 x 31.6
5) **) Average time of Occupancy = 2.90 ms x 106.67 = 309.33 ms

AFH mode

1) This result was measured at DH5 mode in **AFH mode**, which has longest time in one transmission burst.
2) Bluetooth AFH mode has a channel hopping rate of 800 hops/s and 20 hopping channels.
3) The average time of occupancy in the specified 8 second period (20 channels x 0.4 s) is equal to pulse width x (hopping rate / 6) / 20 x (0.4 x hopping channels).
4) *) Numbers of slots in 20 sec = (800 / 6) / 20 x 8
5) **) Average time of Occupancy = 2.90 ms x 53.33 = 154.67 ms

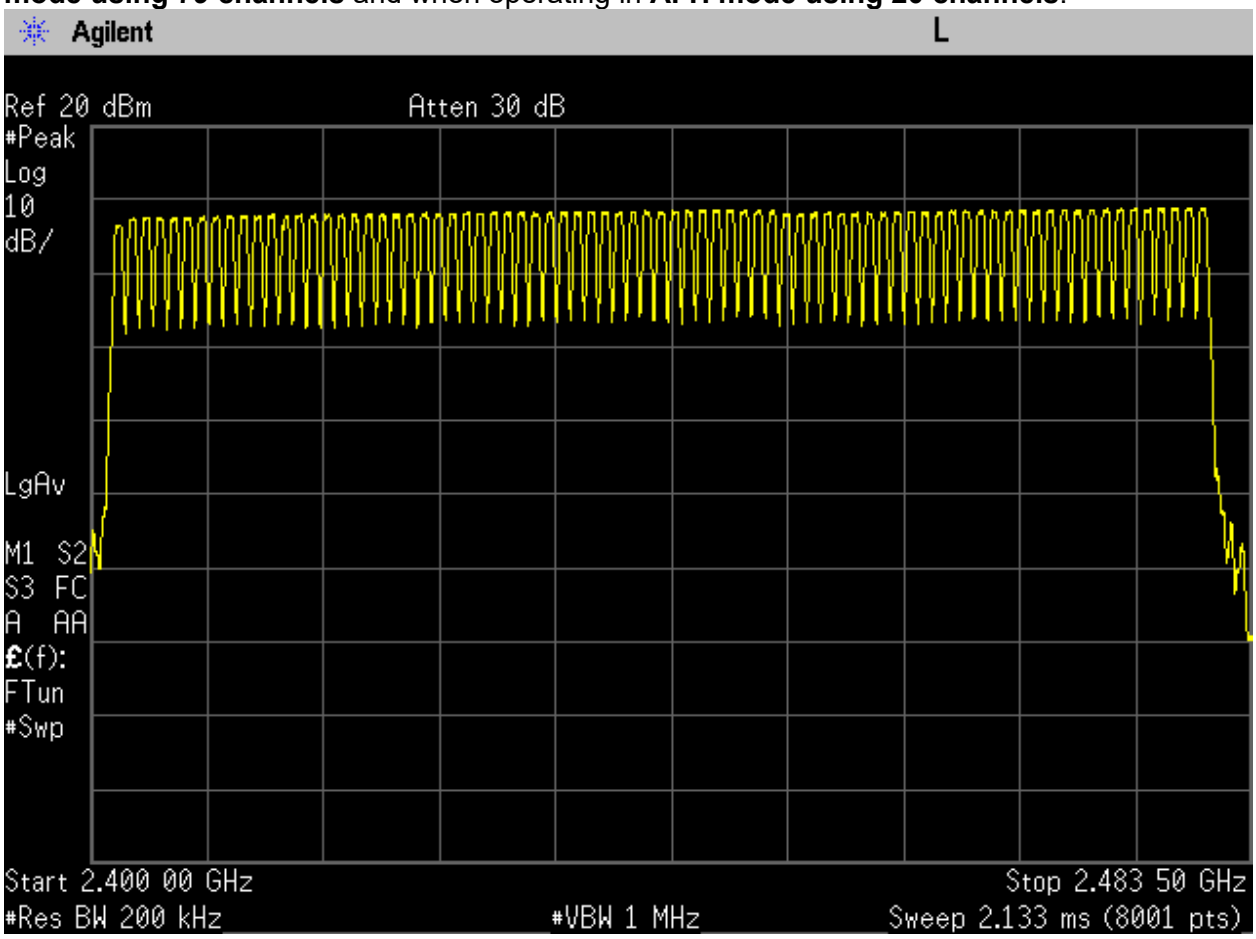
8.5 Number of Hopping Channels

FCC §15.247(a)(1)(iii), IC RSS-247 Issue 2, 5.1

Test mode : Set to Hopping mode

Result

The EUT complies with the minimum number of hopping channels when it is operating **1x/EDR mode using 79 channels** and when operating in **AFH mode using 20 channels**.



8.6 Peak Output Power and E.I.R.P

FCC §15.247(b)(1), IC RSS-247 Issue 2, 5.4

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Modulation	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	E.I.R.P* (dBm)	E.I.R.P Limit (dB)	Result
GFSK	2402	6.62	30.00	10.36	36.00	Complies
GFSK	2441	7.47	30.00	11.21	36.00	Complies
GFSK	2480	7.91	30.00	11.65	36.00	Complies
π/4DQPSK	2402	4.76	30.00	8.50	36.00	Complies
π/4DQPSK	2441	7.26	30.00	11.00	36.00	Complies
π/4DQPSK	2480	7.70	30.00	11.44	36.00	Complies
8DPSK	2402	5.05	30.00	8.79	36.00	Complies
8DPSK	2441	7.58	30.00	11.32	36.00	Complies
8DPSK	2480	8.02	30.00	11.76	36.00	Complies

Note:

The following formular was used for spectrum offset:

Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

***)** *E.I.R.P was calculated by following equation according to KDB412172 D01 Determining ERP and EIRP v01r01.*

$E.I.R.P = P_T + G_T - Lc$

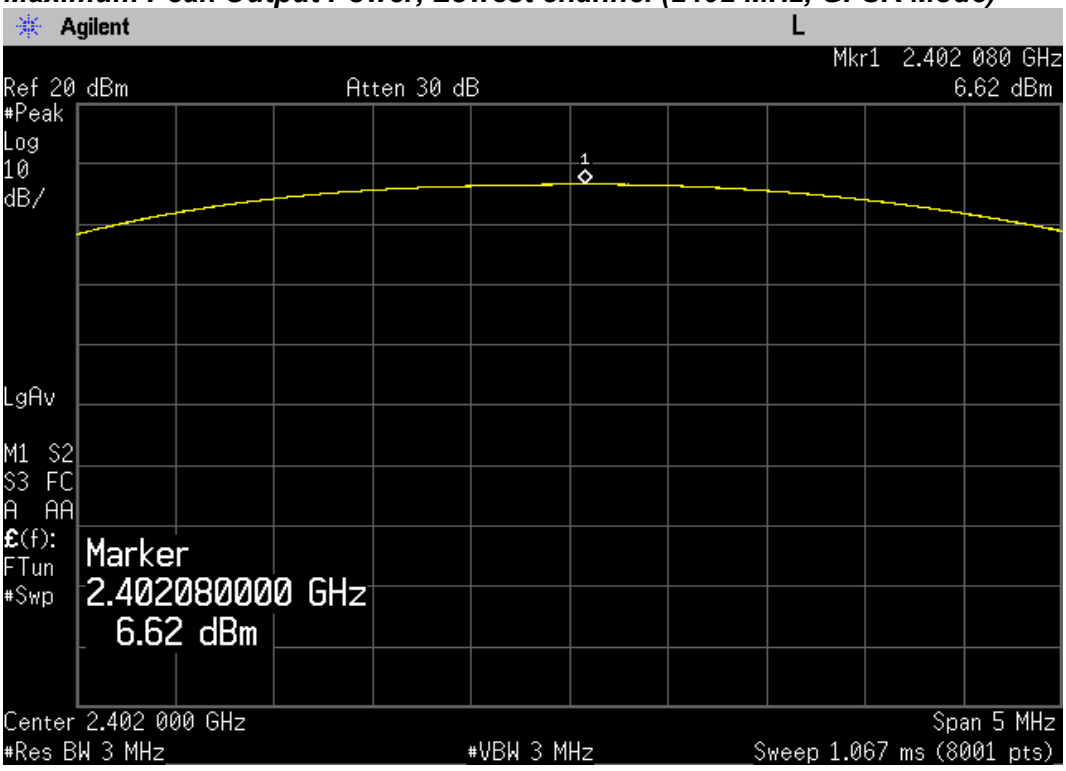
P_T = *Peak outputpower (dBm)*

G_T = *Gain of the transmitting antenna in dBi, Peak antenna gain is 3.74 dBi.*

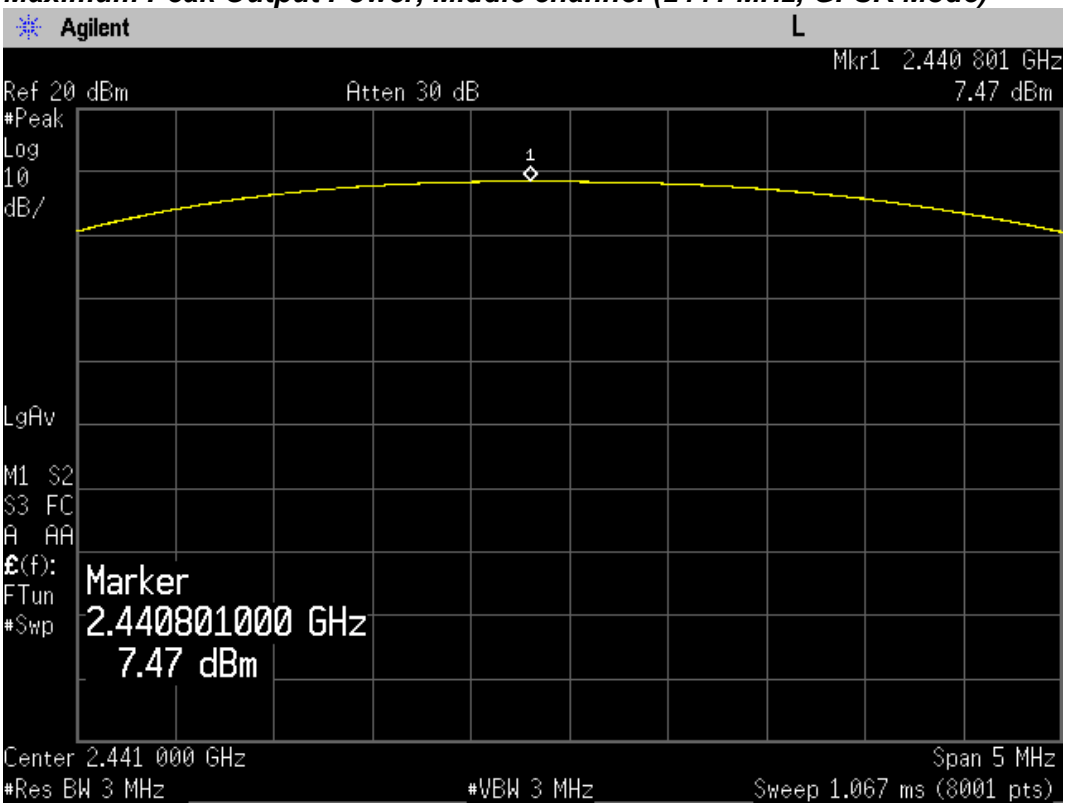
L_C = *Signal attenuation in the connecting cable between the transmitter and antenna in dB. This factor of an integral antenna is negligible.*

PLOT OF TEST DATA

Maximum Peak Output Power, Lowest channel (2402 MHz, GFSK Mode)

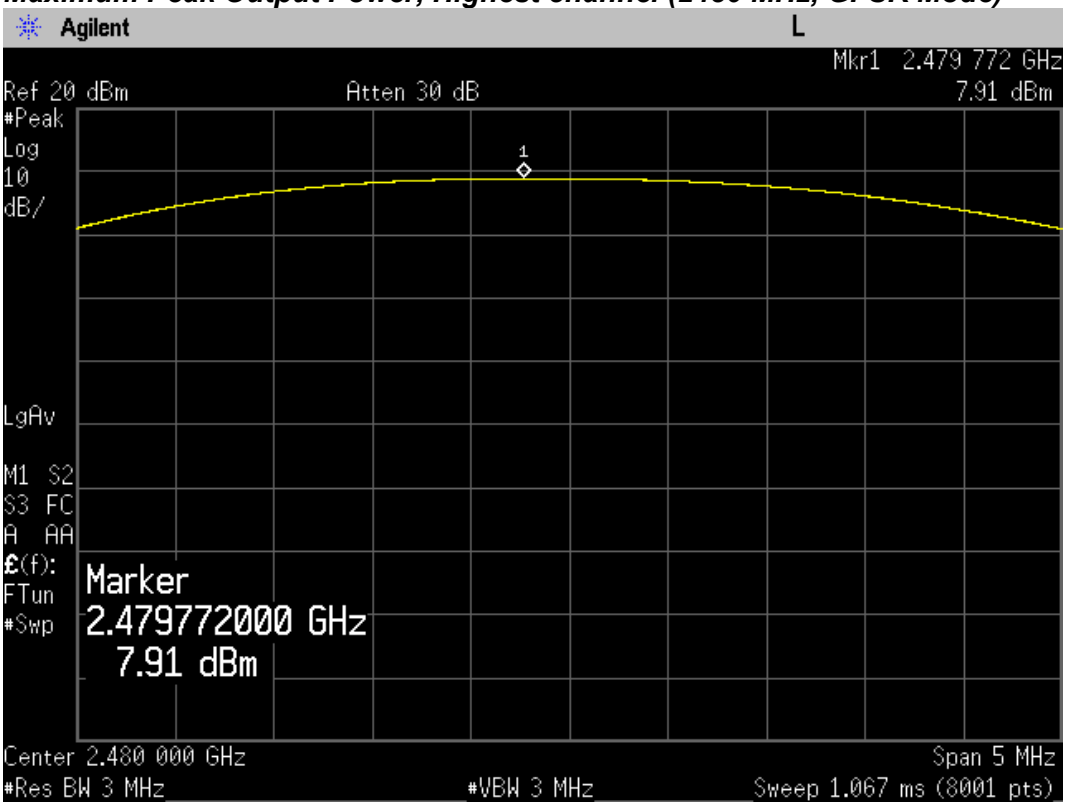


Maximum Peak Output Power, Middle channel (2441 MHz, GFSK Mode)

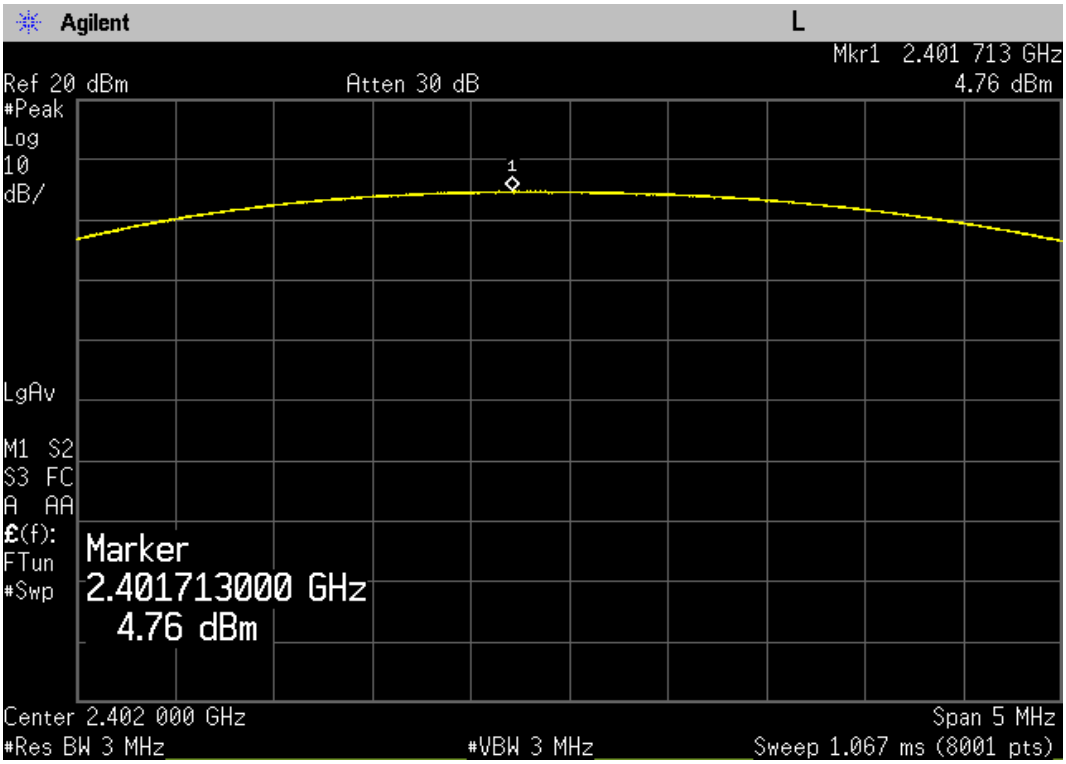


PLOT OF TEST DATA

Maximum Peak Output Power, Highest channel (2480 MHz, GFSK Mode)

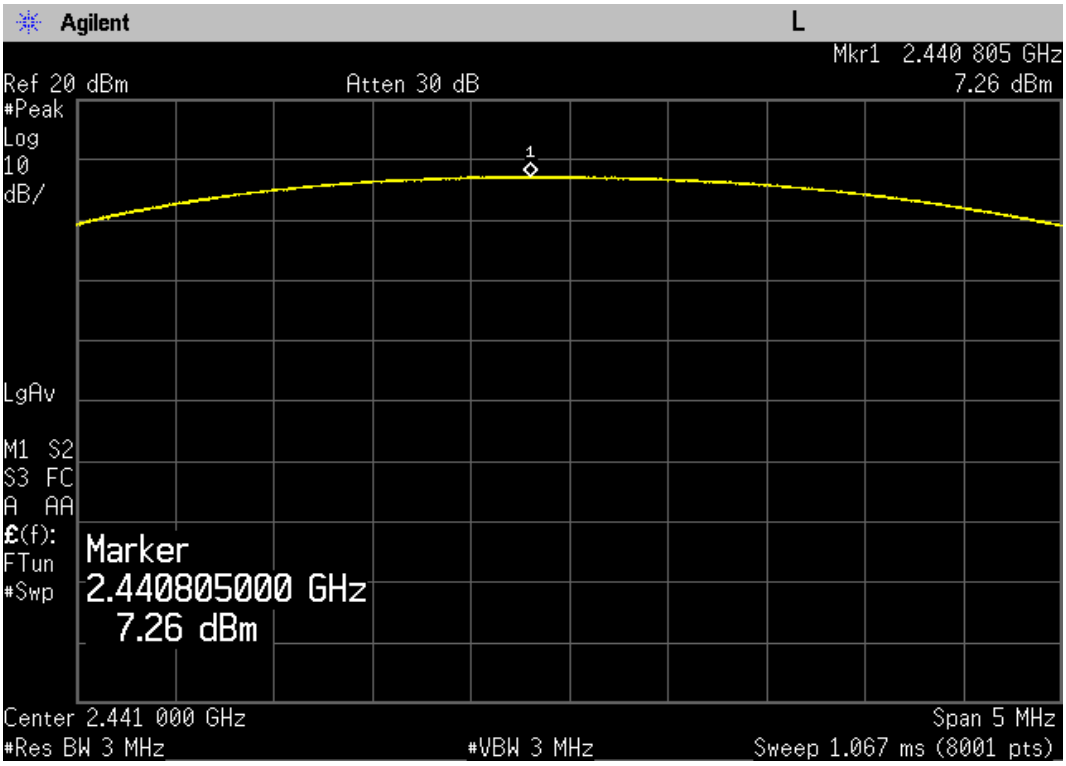


Maximum Peak Output Power, Lowest channel (2402 MHz,π/4DQPSK Mode)

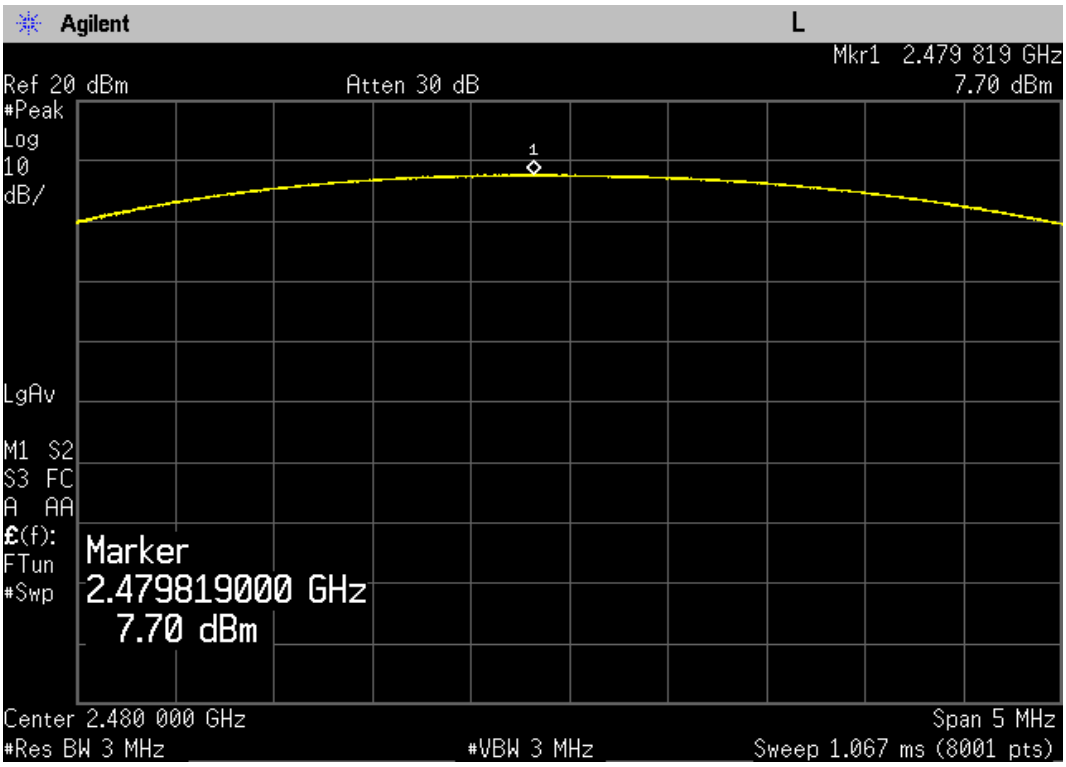


PLOT OF TEST DATA

Maximum Peak Output Power, Middle channel (2441 MHz,π/4DQPSK Mode)

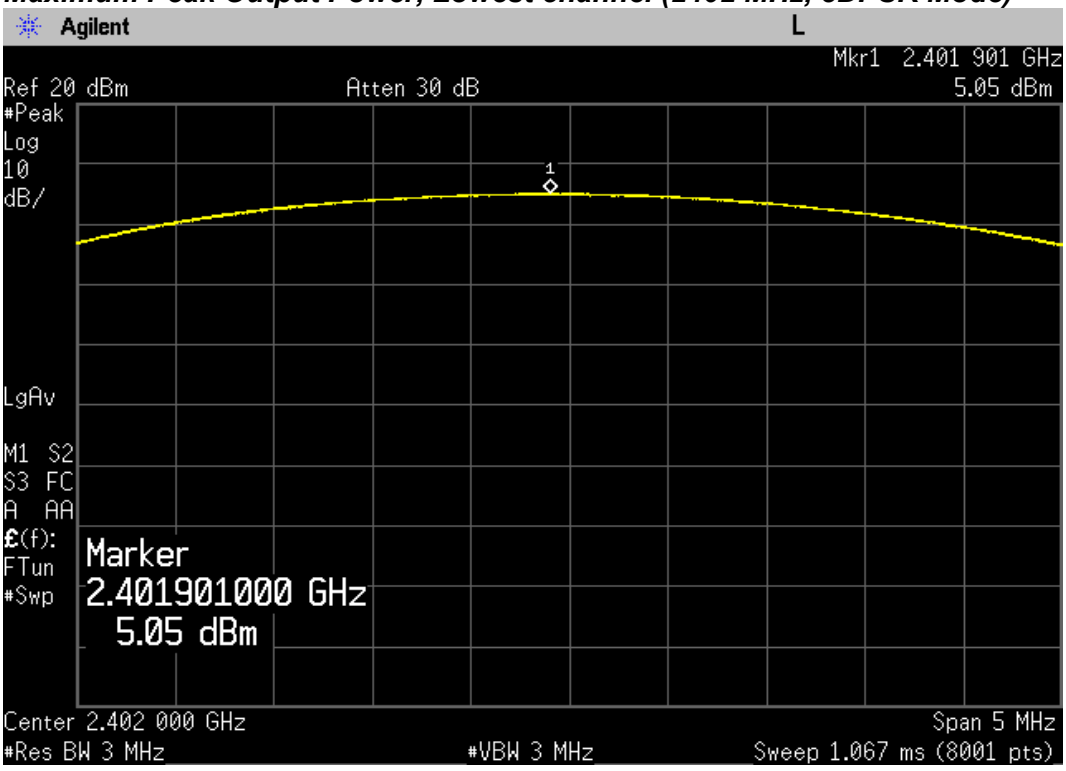


Maximum Peak Output Power, Highest channel (2480 MHz,π/4DQPSK Mode)

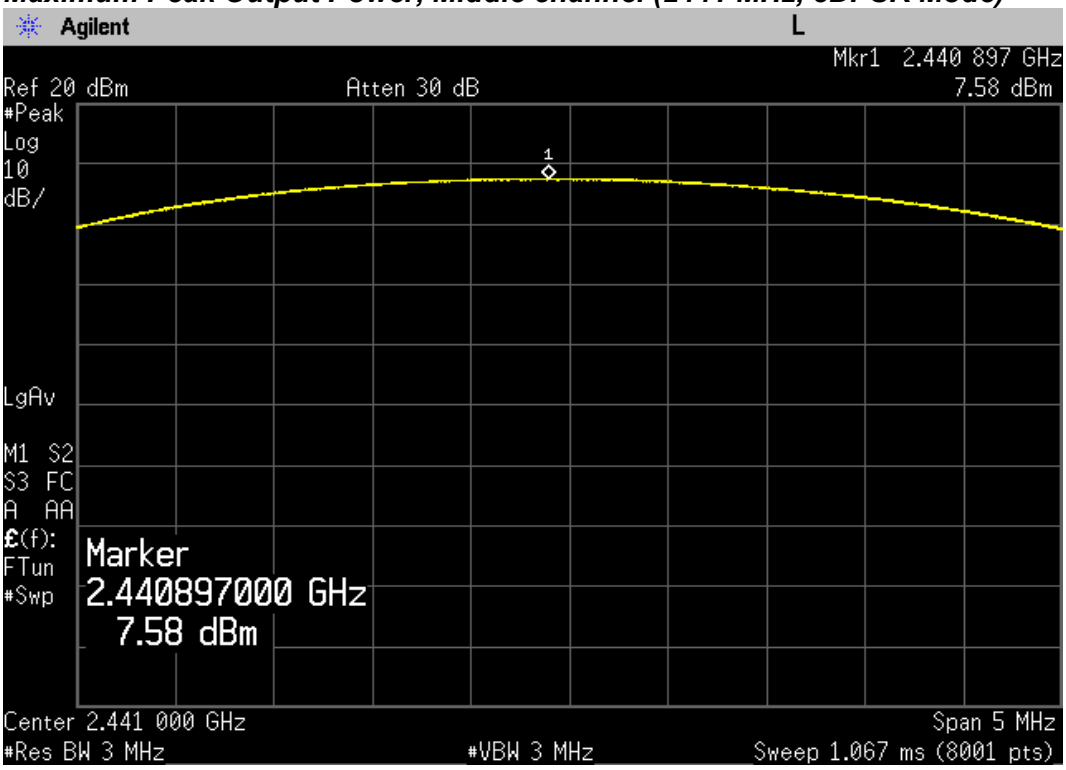


PLOT OF TEST DATA

Maximum Peak Output Power, Lowest channel (2402 MHz, 8DPSK Mode)

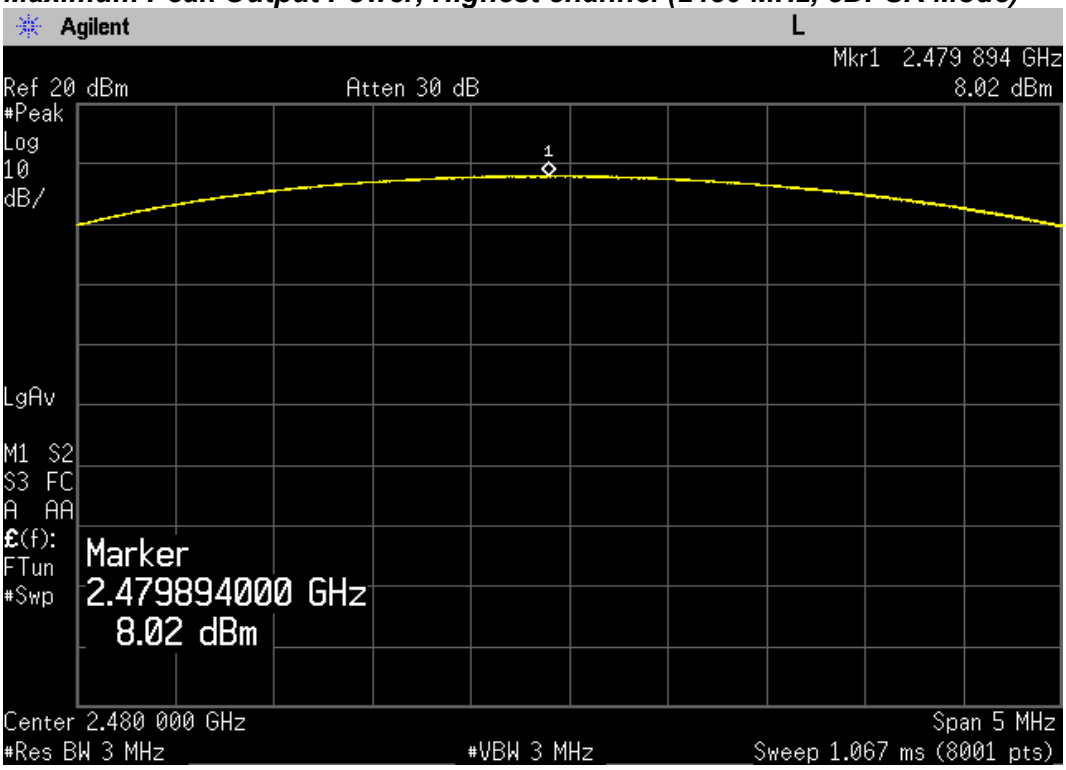


Maximum Peak Output Power, Middle channel (2441 MHz, 8DPSK Mode)



PLOT OF TEST DATA

Maximum Peak Output Power, Highest channel (2480 MHz, 8DPSK Mode)



8.7 Conducted Spurious Emission

FCC §15.247(d), IC RSS-247 Issue 2, 5.5

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Modulation Mode	Frequency (MHz)	Result	Limit (dBc)
GFSK	2402	More than 20 dBc	20
GFSK	2441	More than 20 dBc	20
GFSK	2480	More than 20 dBc	20
π/4DQPSK	2402	More than 20 dBc	20
π/4DQPSK	2441	More than 20 dBc	20
π/4DQPSK	2480	More than 20 dBc	20
8DPSK	2402	More than 20 dBc	20
8DPSK	2441	More than 20 dBc	20
8DPSK	2480	More than 20 dBc	20

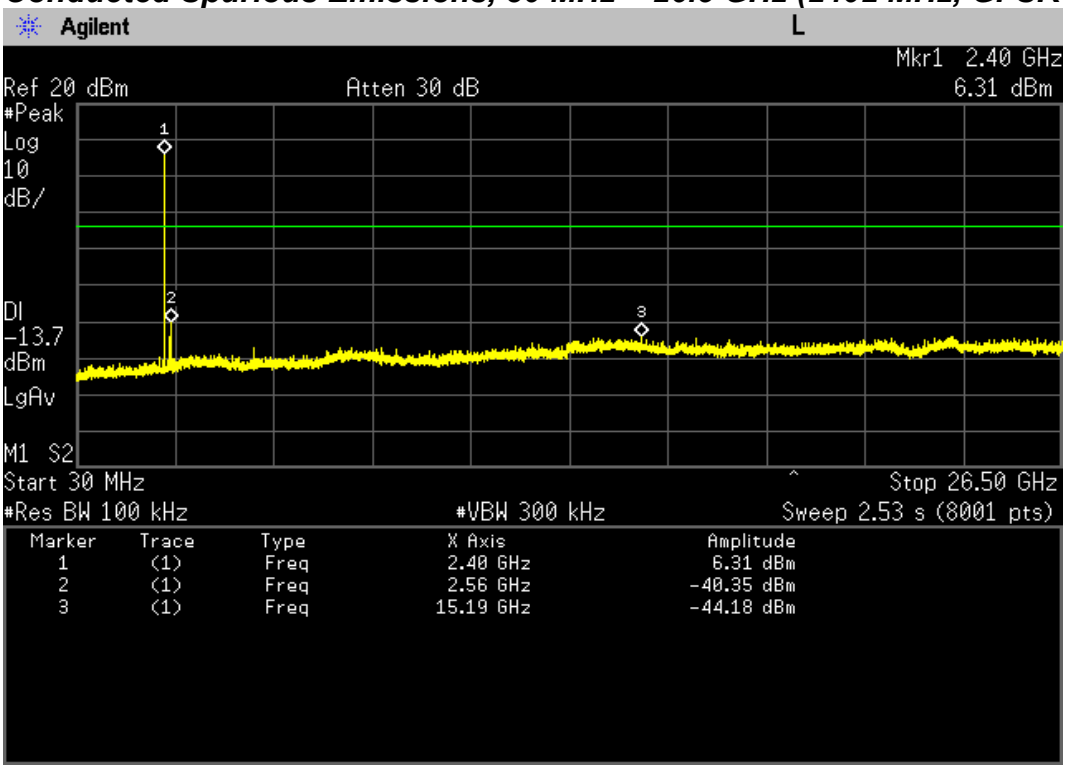
Note:

1. The cable and attenuator loss from 30 MHz to 26.5 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.

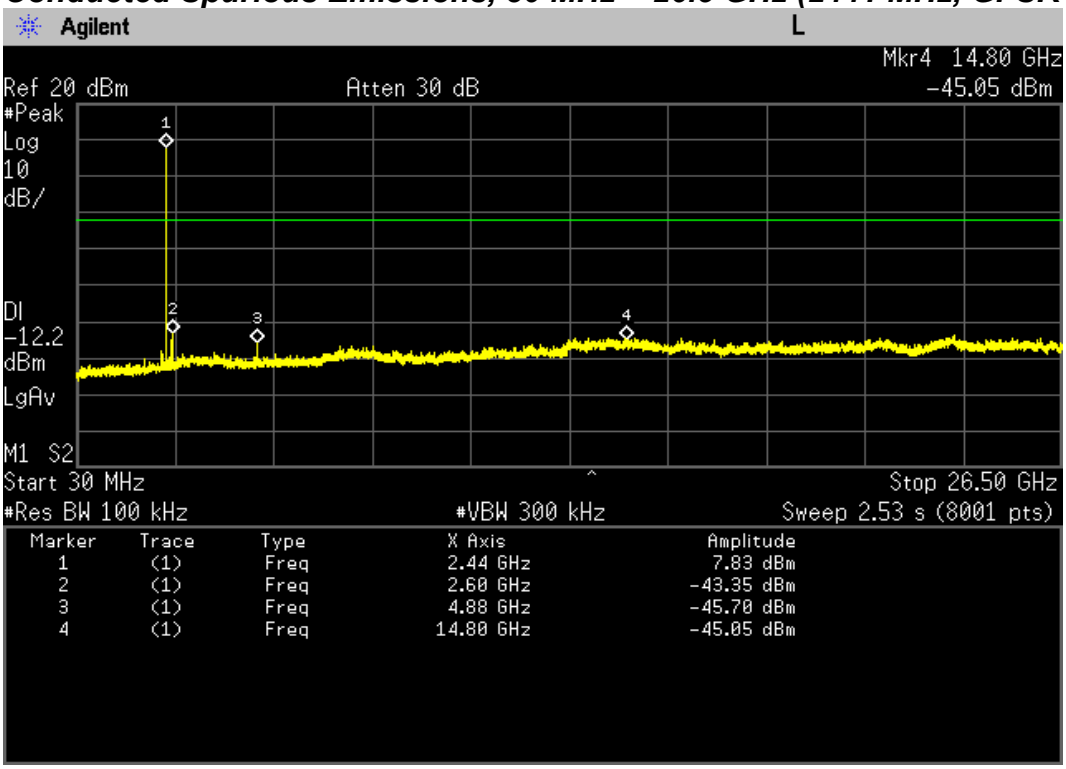
2. The spurious limit is determined by peak fundamental level of bandedge.

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2402 MHz, GFSK Mode)

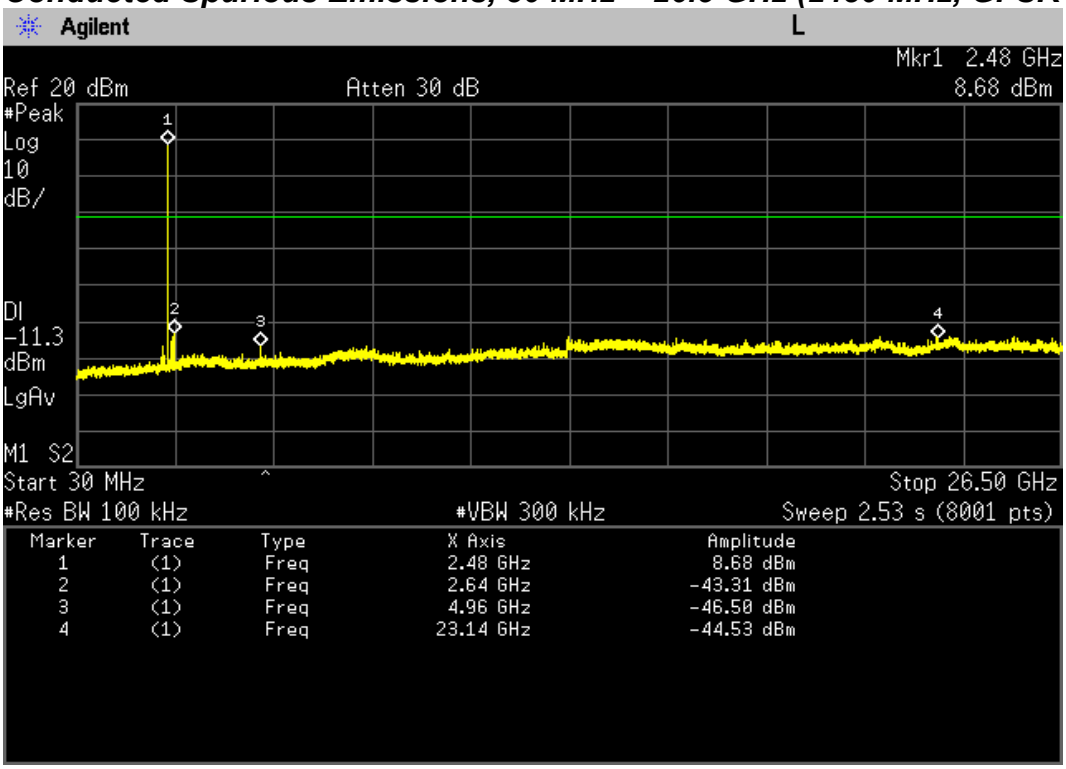


Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2441 MHz, GFSK Mode)

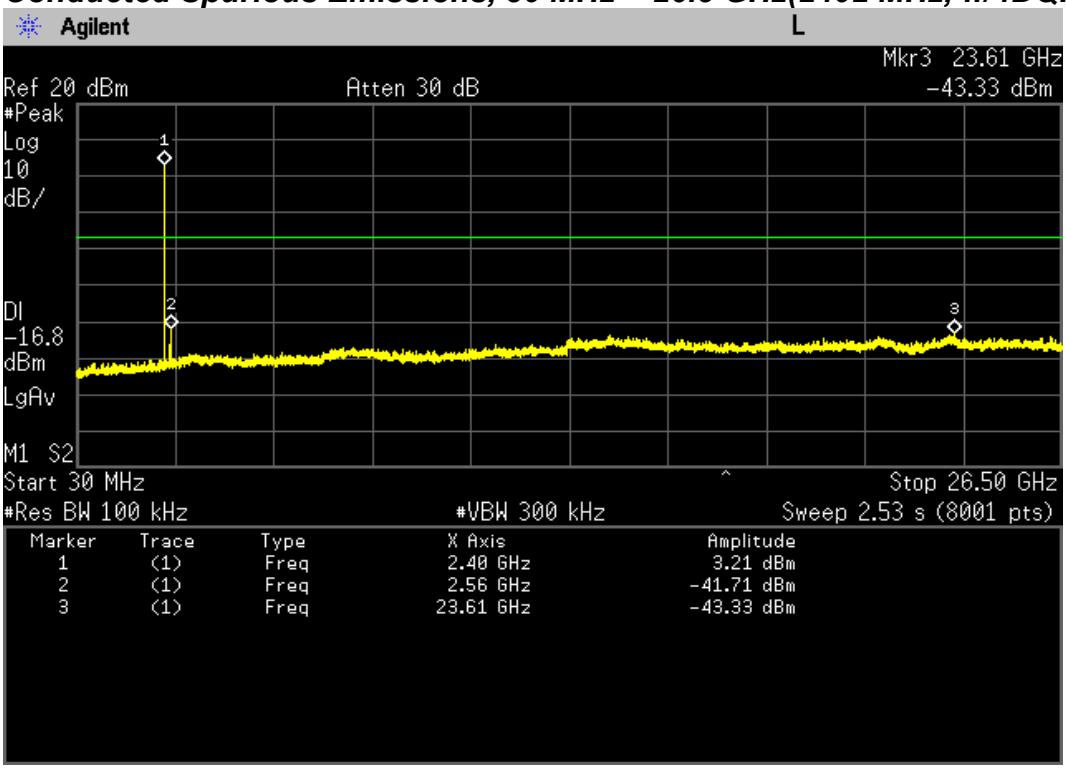


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2480 MHz, GFSK Mode)

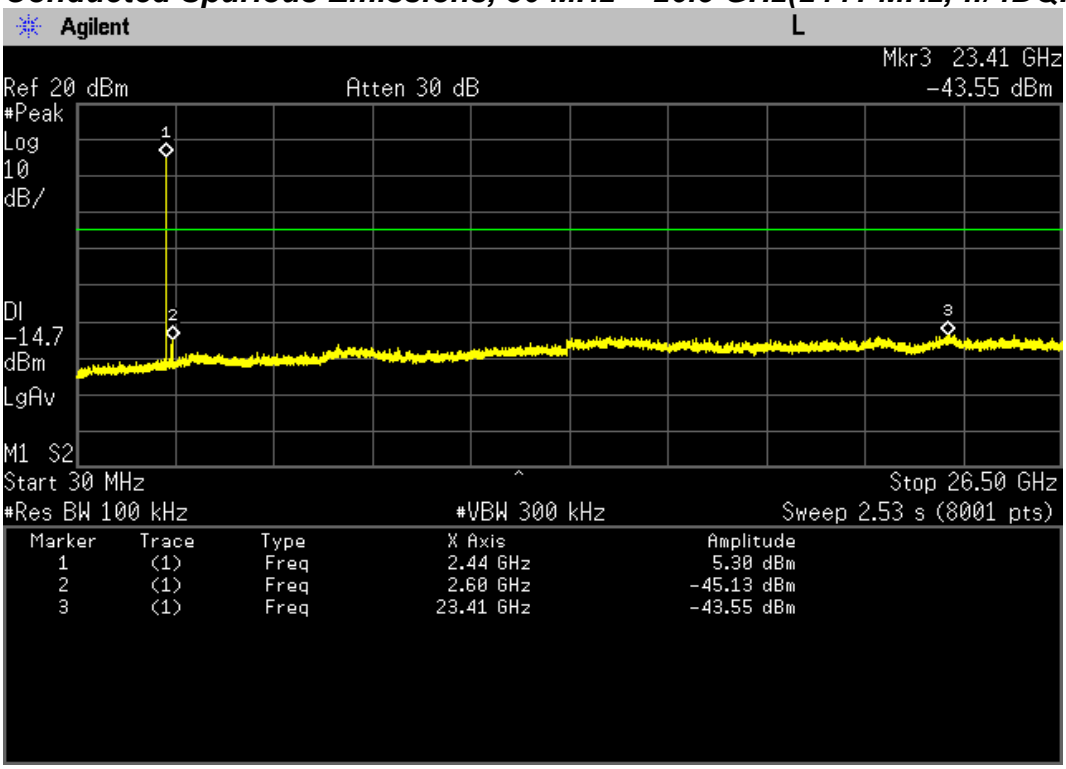


Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz(2402 MHz, π/4DQPSK Mode)

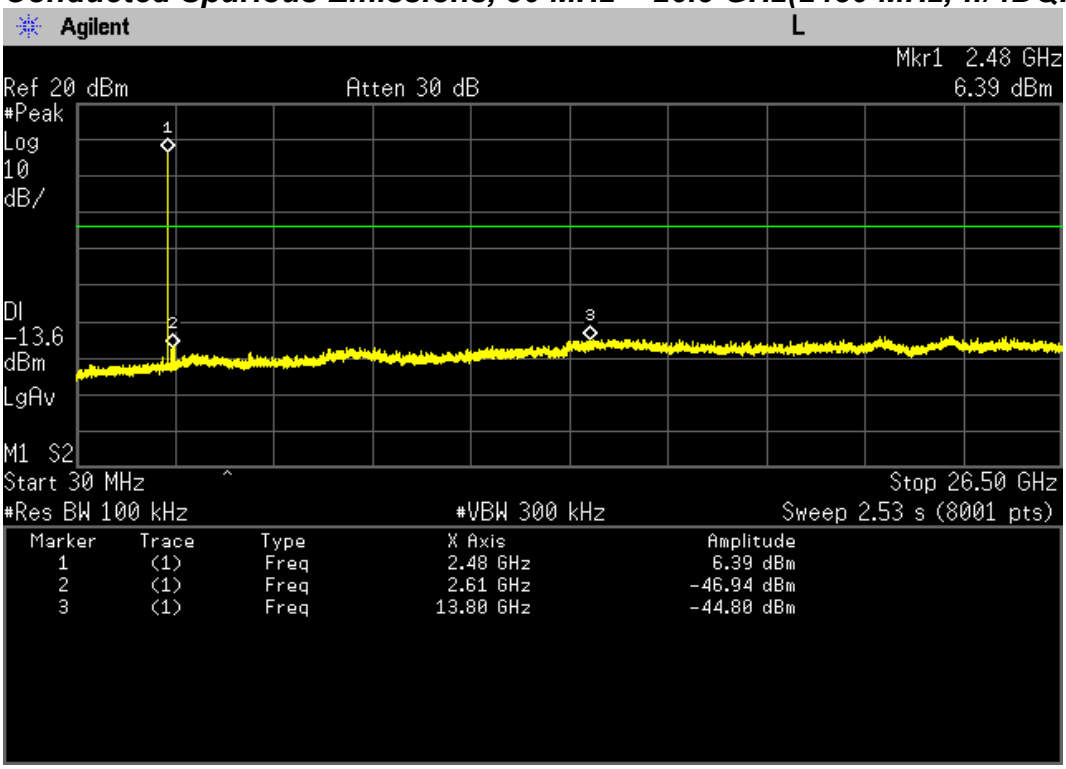


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz(2441 MHz, π/4DQPSK Mode)

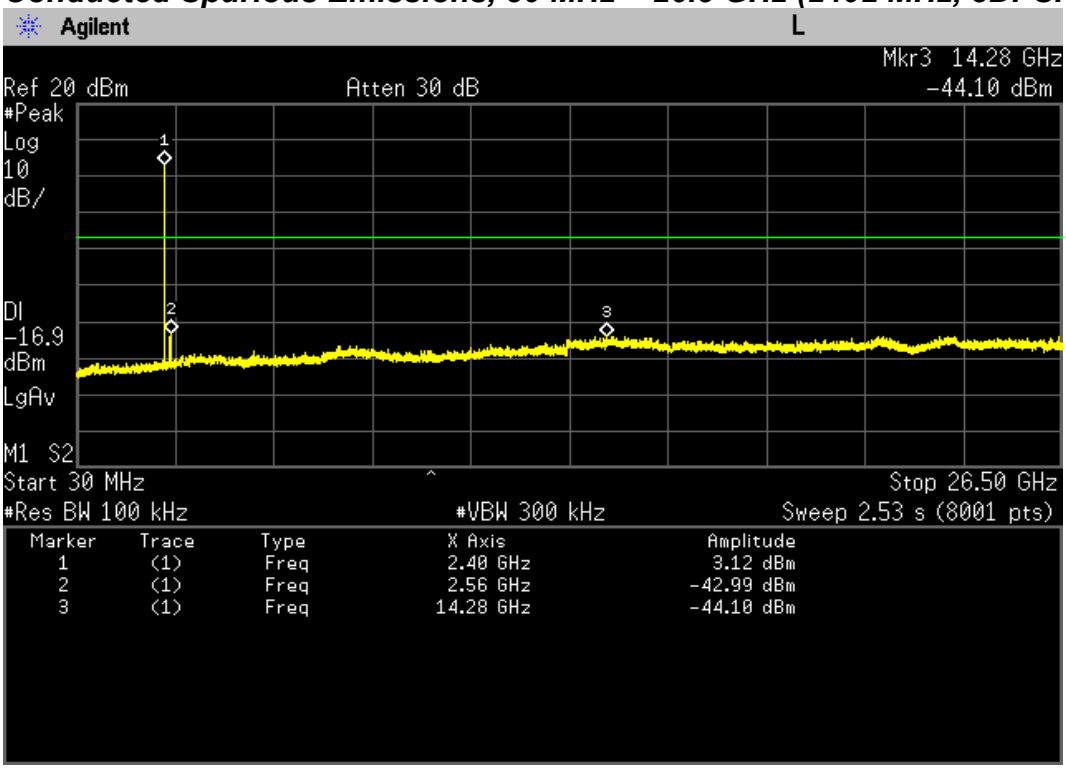


Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz(2480 MHz, π/4DQPSK Mode)

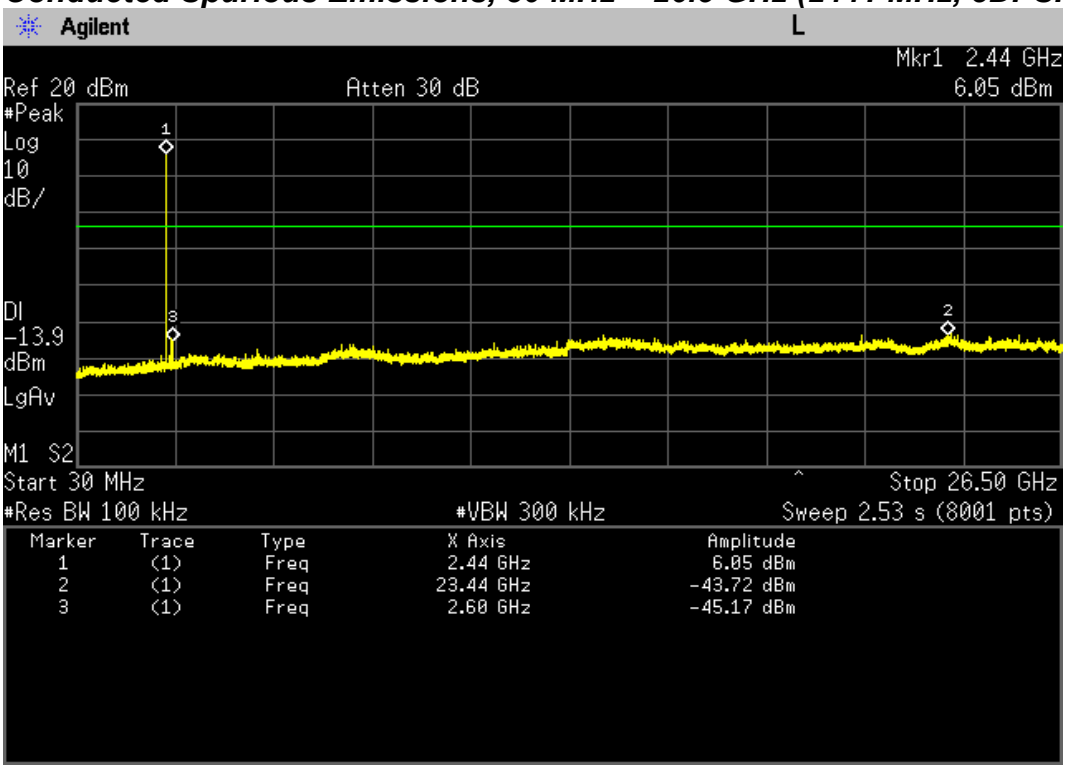


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2402 MHz, 8DPSK Mode)

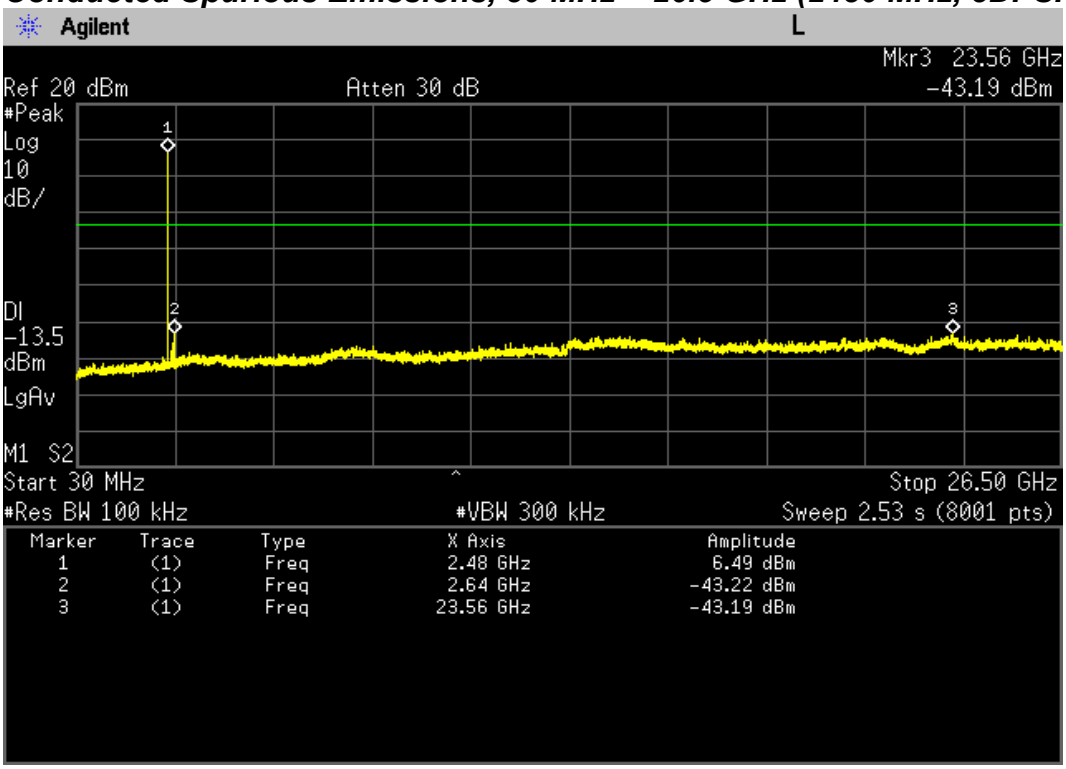


Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2441 MHz, 8DPSK Mode)



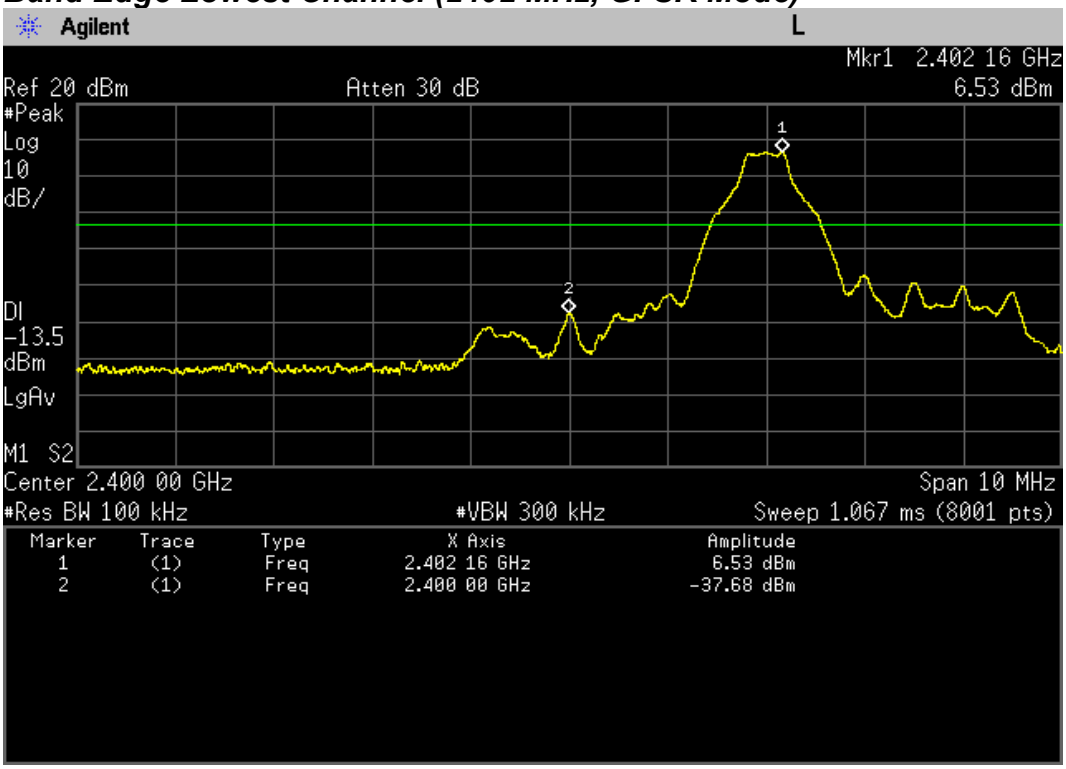
PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 26.5 GHz (2480 MHz, 8DPSK Mode)

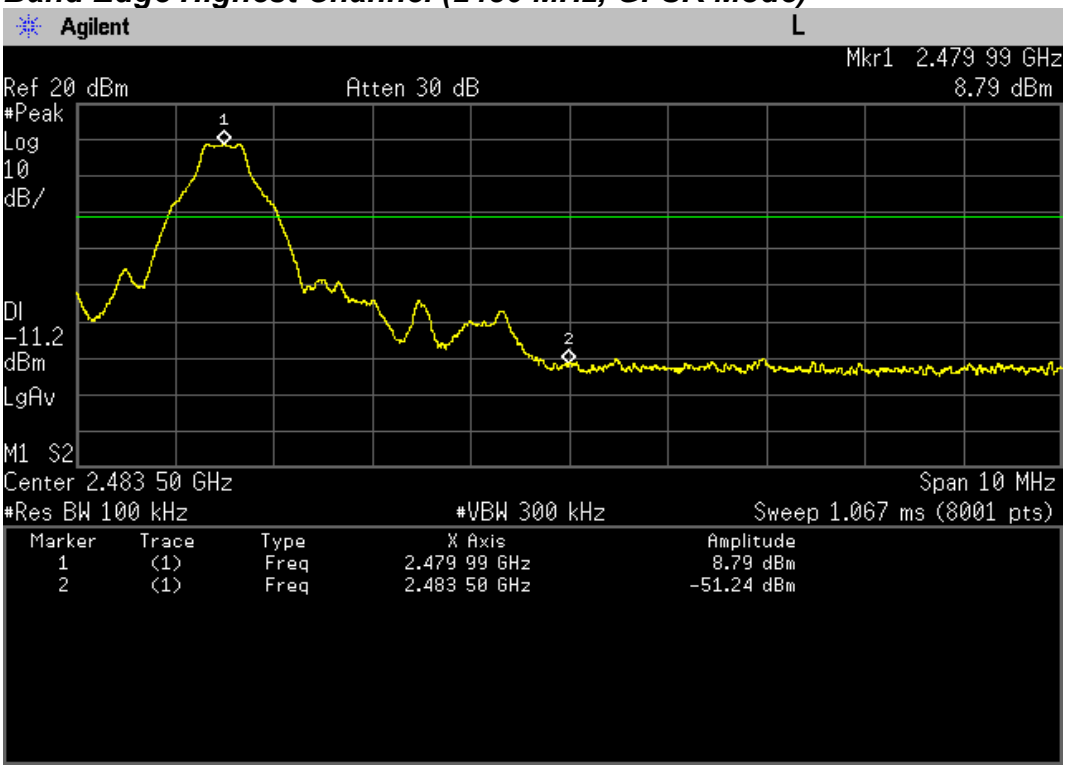


PLOT OF TEST DATA

Band Edge Lowest Channel (2402 MHz, GFSK Mode)

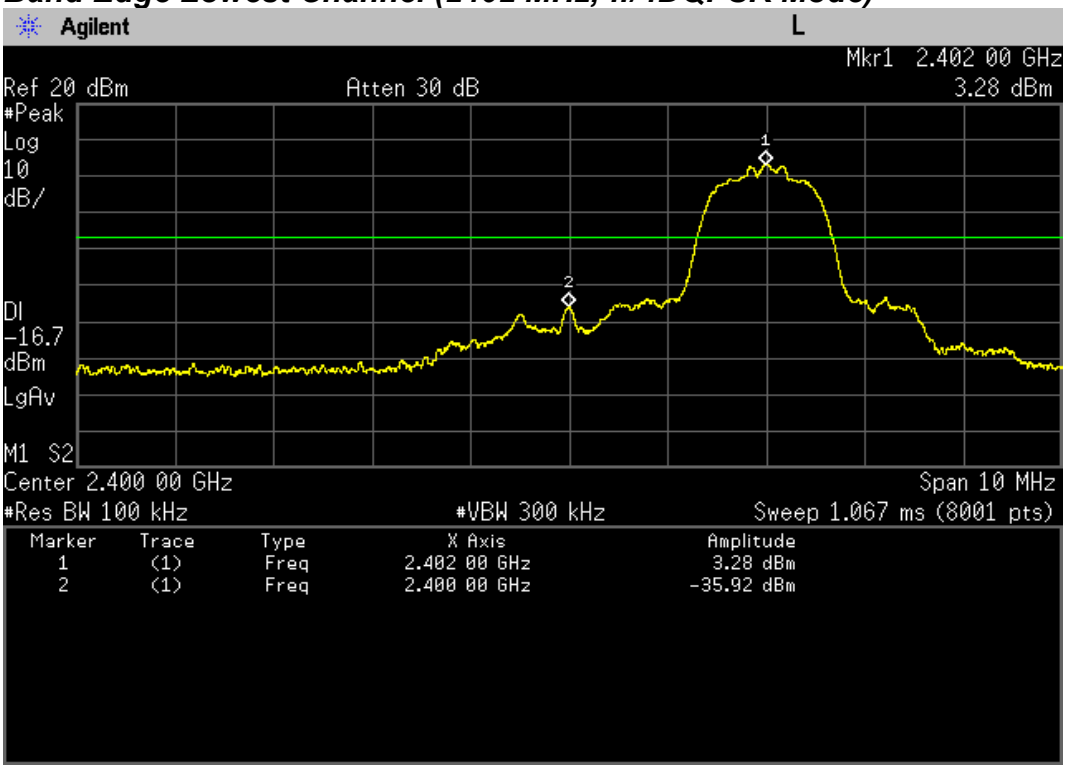


Band Edge Highest Channel (2480 MHz, GFSK Mode)

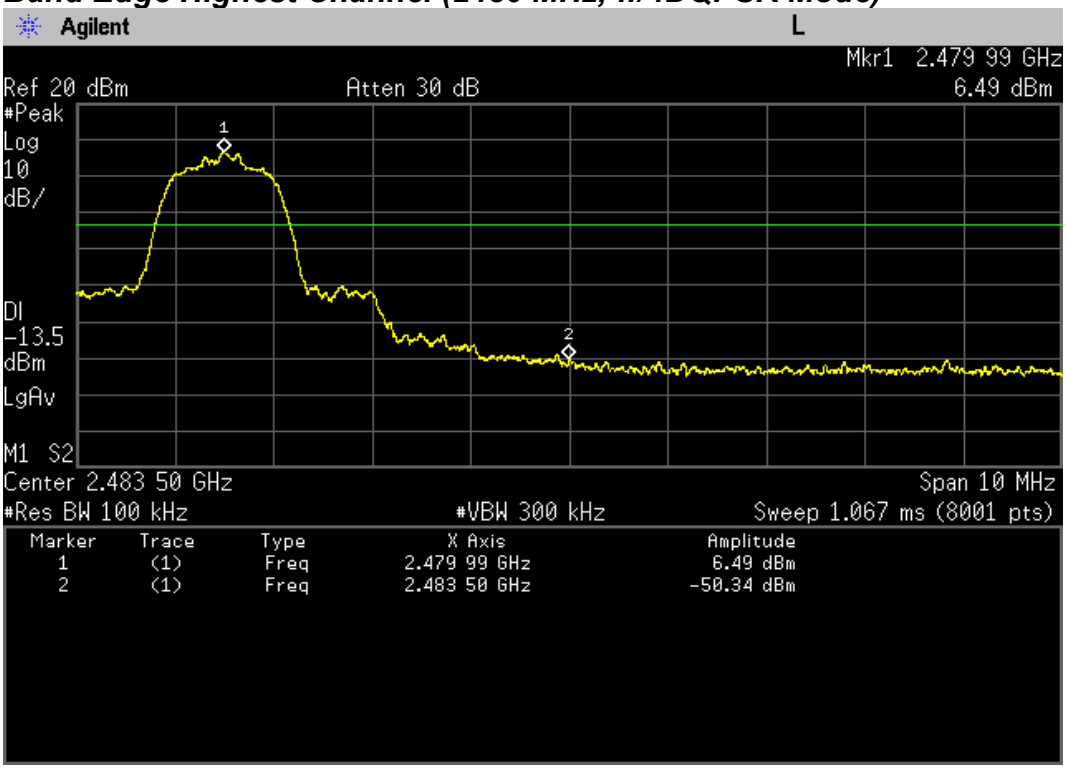


PLOT OF TEST DATA

Band Edge Lowest Channel (2402 MHz, π/4DQPSK Mode)

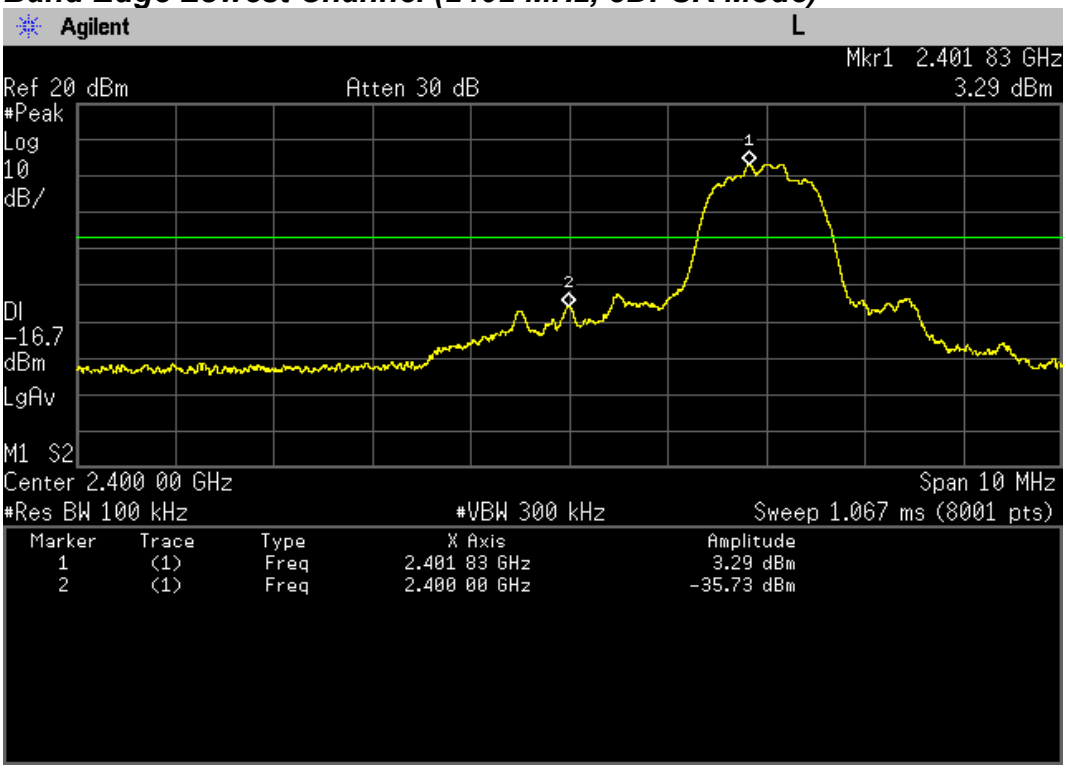


Band Edge Highest Channel (2480 MHz, π/4DQPSK Mode)

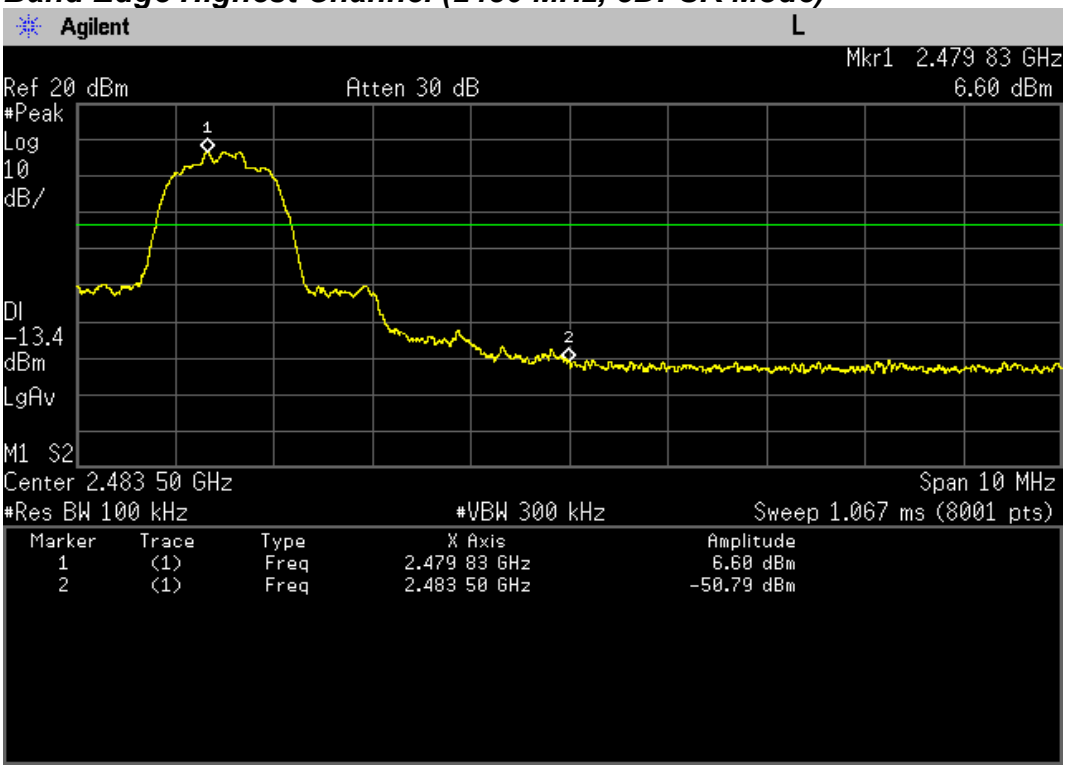


PLOT OF TEST DATA

Band Edge Lowest Channel (2402 MHz, 8DPSK Mode)



Band Edge Highest Channel (2480 MHz, 8DPSK Mode)



8.8 Radiated Spurious Emission

FCC §15.247(d), IC RSS-247 Issue 2, 5.5

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7205.46***	40.5	V	peak	8.4	48.9	54.0	5.1

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7323.17	53.0	V	peak	8.4	61.4	74.0	12.6
7322.99	35.2	V	average	8.4	49.7	54.0	4.3

Highest Channel

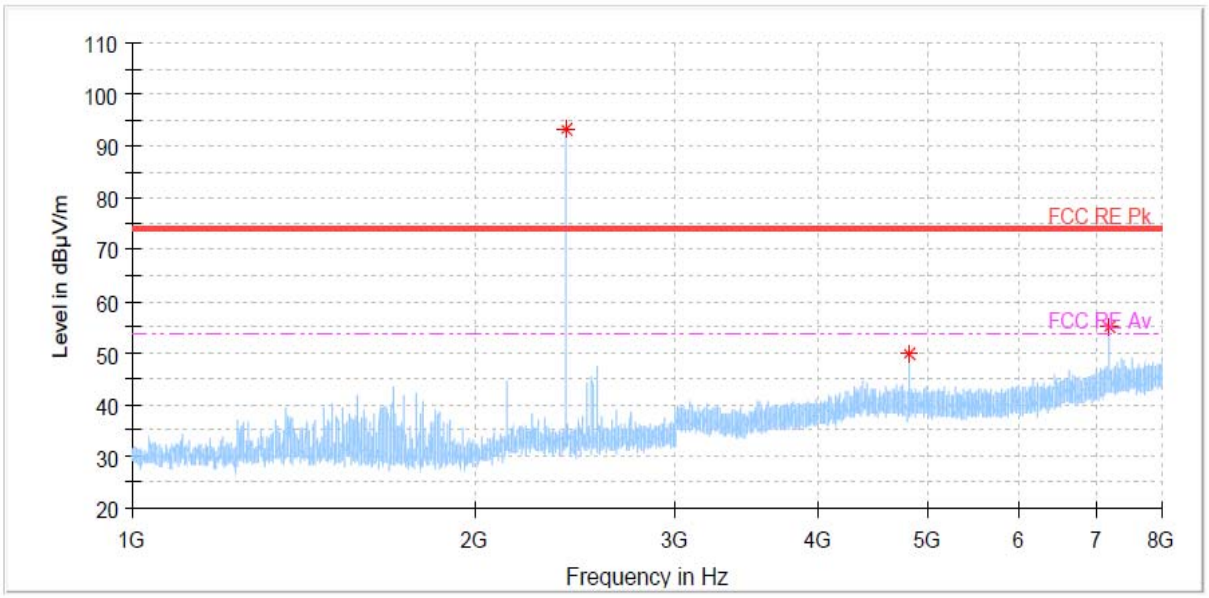
Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7439.50	51.9	H	peak	8.5	60.4	74.0	13.6
7439.89	36.7	H	average	8.5	46.2	54.0	7.8

Notes:

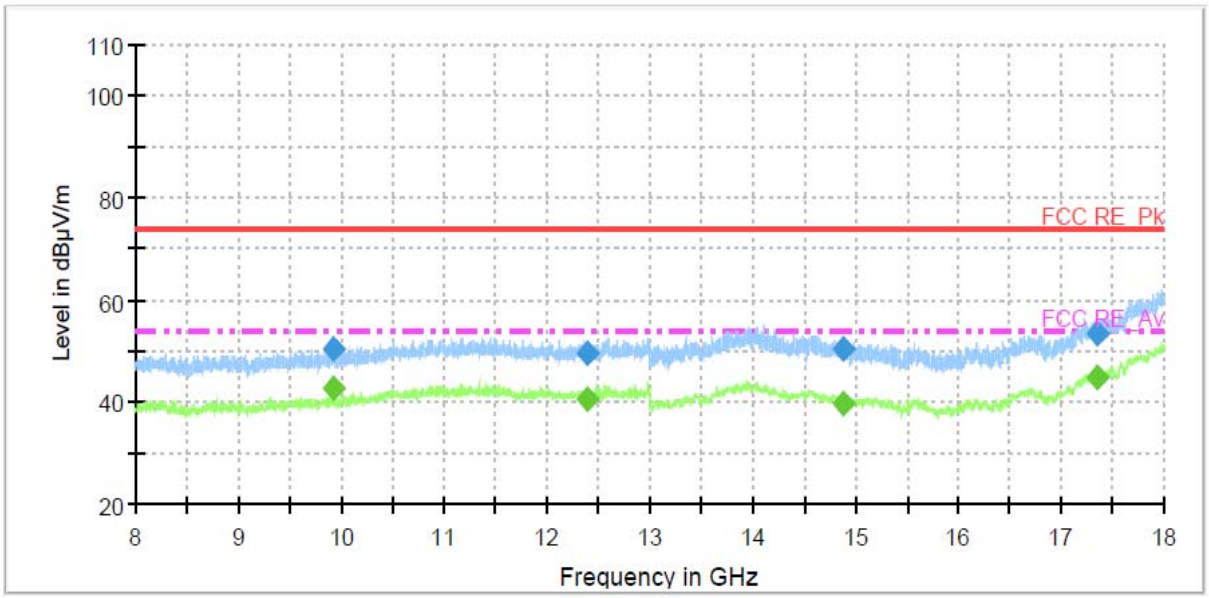
1. *Pol. H = Horizontal V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Other spurious was under 20 dB below Fundamental.
4. *** This result was measured with RBW 100kHz and peak detection because it is in non-restricted frequency band.
5. GFSK modulation mode was the worst condition.
6. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
7. Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
8. Average emissions were measured using RBW = 1 MHz, VBW = 1 kHz, Detector = Peak.
9. The spectrum was measured from 9 kHz to 10^{th} harmonic and the worst-case emissions were reported. No significant emissions were found beyond the 3nd harmonic for this device.

PLOTS OF EMISSIONS

Worst Case : 2441 MHz GFSK modulation : 1 GHz to 8 GHz

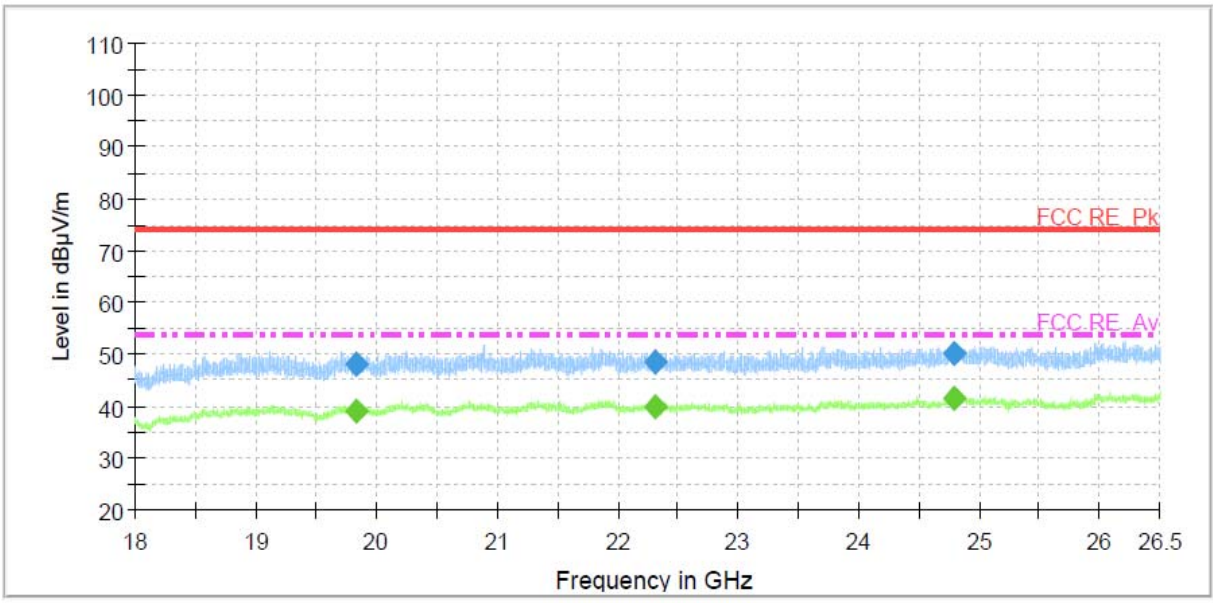


Worst Case : 2441 MHz GFSK modulation : 8 GHz to 18 GHz

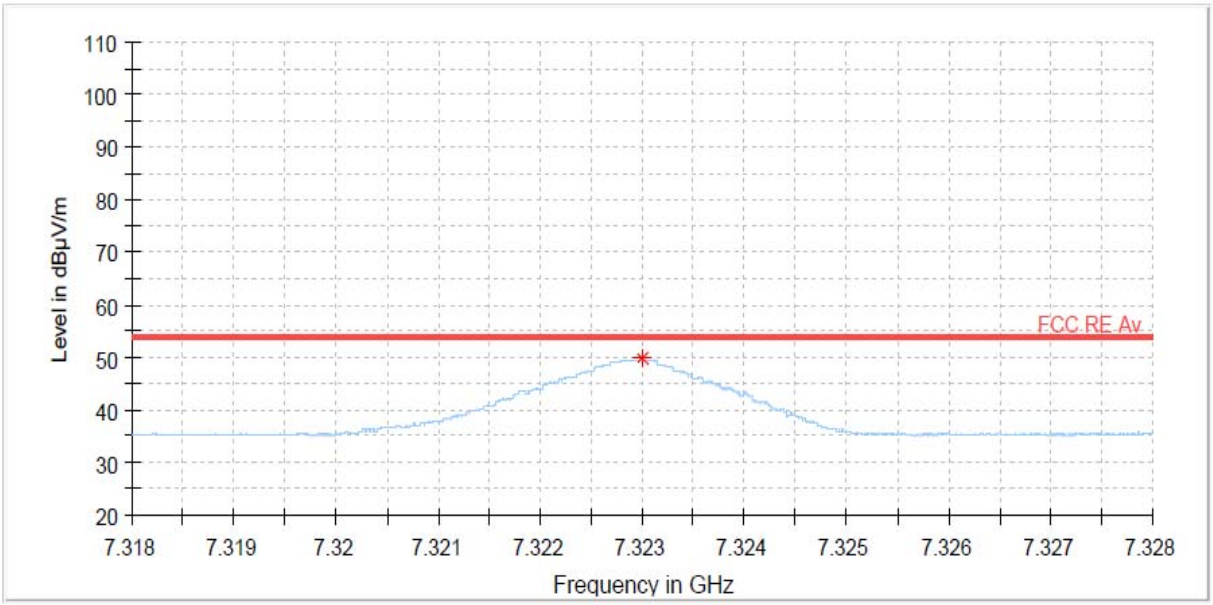


PLOTS OF EMISSIONS

Worst Case : 2441 MHz GFSK modulation : 18 GHz to 26.5 GHz



Worst Case : 2441 MHz GFSK modulation : 3rd Harmonic Av



8.9 Radiated Bandedge

FCC §15.247(d), IC RSS-247 Issue 2, 5.5

Test Mode : Set to Lowest channel, Highest channel

Result

Lowest and Highest Channels

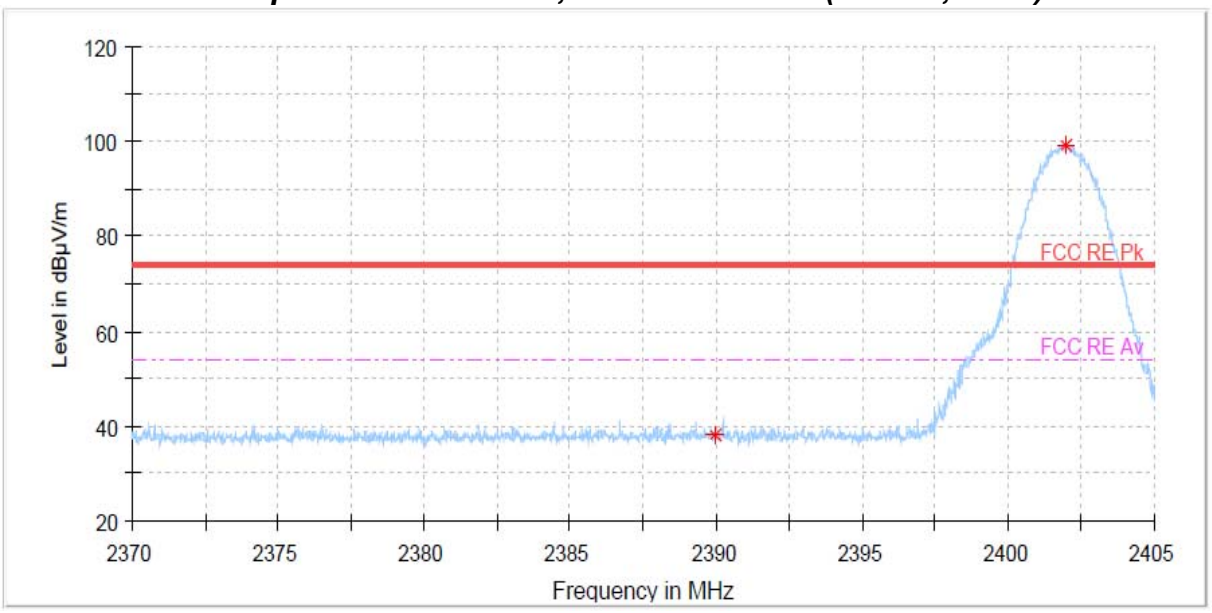
Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.0	46.7	H	peak	-8.5	38.2	74.0	35.9
2483.5	60.8	V	peak	-8.6	52.2	74.0	21.8

Note:

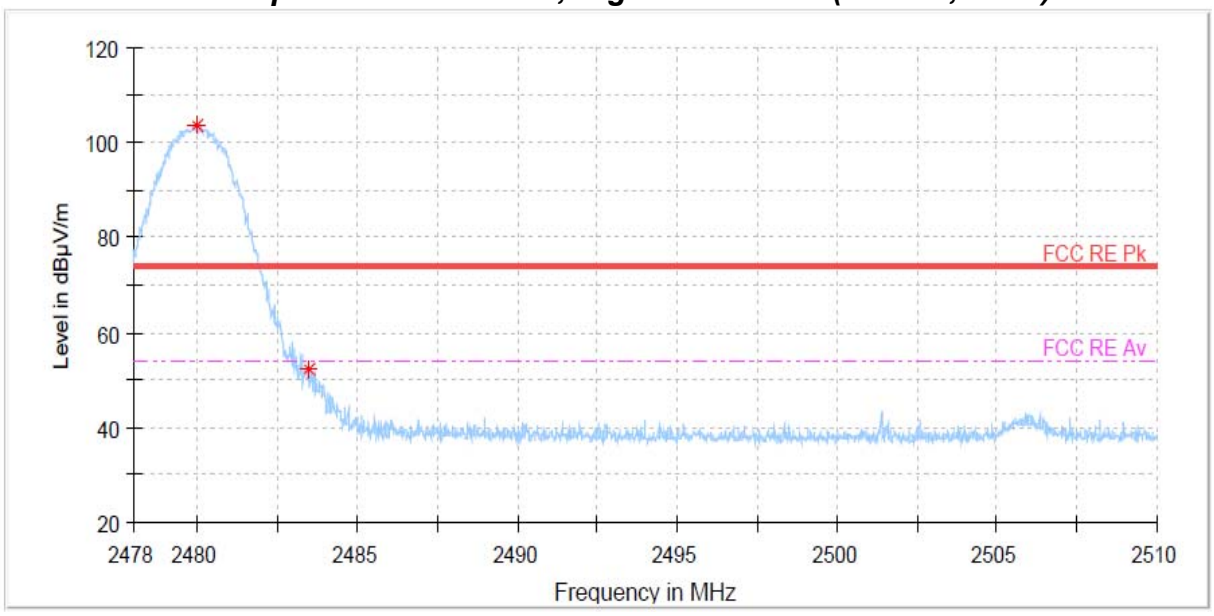
1. **Pol. H = Horizontal V = Vertical*
2. ***AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*
3. *These peak-detected results are shown to comply with the average limit, so it is not required to perform a separate average measurement.*
4. *Other spurious was under 20 dB below Fundamental.*
5. *8DPSK modulation mode was the worst condition.*
6. *The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.*
7. *Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.*
8. *Average emissions were measured using RBW = 1 MHz, VBW = 1kHz, Detector = Peak*

PLOT OF TEST DATA

Restricted Band Spurious Emissions, Lowest channel (8DPSK, Peak)



Restricted Band Spurious Emissions, Highest channel (8DPSK, Peak)



9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESU 40	100202	Apr. 04 2017	1 year
2	Test Receiver	R & S	ESCI	101041	Apr. 03 2017	1 year
3	*Attenuator	PASTERNACK	PE7395-10	1441-1	Jul. 13 2017	1 year
4	*Attenuator	FAIRVIEW	SA3N5W-06	N/A	Jan. 09 2017	1 year
5	*Attenuator	FAIRVIEW	SA3N5W-10	N/A	Apr. 03 2017	1 year
6	Attenuator	WEINSCHEL	56-10	58765	Oct. 09 2016	1 year
7	*Amplifier	R & S	SCU 01	10029	Apr. 03 2017	1 year
8	*Amplifier	R & S	SCU18F	180025	Apr. 03 2017	1 year
9	*Amplifier	R & S	SCU26D	1984522	Apr. 11 2017	1 year
10	Amplifier	R & S	SCU40	100380	Jul. 13 2017	1 year
11	Pre Amplifier	HP	8449B	3008A00107	Jan. 10 2017	1 year
12	Spectrum Analyzer	R & S	FSW43	100732	Apr. 11 2017	1 year
13	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Oct. 09 2016	1 year
14	*Spectrum Analyzer	R & S	FSW43	104084	Apr. 04 2017	1 year
15	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 22 2016	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	01615	May. 18 2017	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Aug. 01 2017	2 year
18	Horn Antenna	Q-par Angus	QSH22K20	8180	Aug. 02 2017	2 year
19	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 11 2016	2 year
20	Two-Line V-Network	R & S	ENV216	101156	Apr. 04 2017	1 year
21	*Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
22	*Controller	INNCO	CO3000	CO3000/937/38330516/L	N/A	N/A
23	*Turn Table	INNCO	DS1200S	N/A	N/A	N/A
24	*Turn Table	INNCO	DT2000-2t	N/A	N/A	N/A
25	*Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
26	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
27	*Open Switch And Control Unit	R & S	OSP-120	100081	N/A	N/A
28	*Open Switch And Control Unit	R & S	OSP-120	100015	N/A	N/A
29	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*WiFi Filter Bank	R & S	U083	N/A	N/A	N/A
32	*WiFi Filter Bank	R & S	U082	N/A	N/A	N/A

*) Test equipment used during the test

10. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	LAMN	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	dVSW	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dVPA	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dVPR	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dVNF	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	**RI**	0.34	normal 1	1.00	0.34	1	0.34
Receiver reading	**dVsw**	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	**dVpa**	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	**dVpr**	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	**dVnf**	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	**AF**	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	**CL**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	**AD**	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	**AH**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	**AP**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	**AI**	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	**SI**	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	**DV**	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	**Dbal**	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	**DCross**	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	**M**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.18
Mismatch	**M**	+ 0.98 - 1.11	U-Shaped	$\sqrt{2}$	0.74	1	0.74
EUT Volume Diameter	**M**	0.33	normal 1	1.00	0.33	1	0.11
Remark							
Combined Standard Uncertainty	Normal						
Expended Uncertainty U	Normal (k = 2)						