Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-852 KOREA, REPUBLIC OF
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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea
(Post code : 443-742)
Attn. : Mr. Jaywoo. Lee

Dates of Issue : December 12, 2012
Test Report No. : NK-12-R-208
Test Site : Nemko Korea Co., Ltd.

FCC ID	**A3LWIBT40A**
IC	**649E-WIBT40A**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu,** **Suwon-si, Gyeonggi-do, Korea 443-742** **Mr. Jaywoo. Lee** **Telephone No. : +82-31-277-2569**

Applied Standard: FCC 47 CFR Part 15C and IC RSS-210
Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
EUT Type: Bluetooth Module

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 C63.4-2003, ANSI C63.10. 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.

Dec. 12. 2012
Tested By : Jin-ha, Ko
Engineer

Deokha Ryu Dec 12. 2012
Reviewed By : Deokha Ryu
Manager & Chief Engineer

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-210.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Jaywoo. Lee
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 443-742

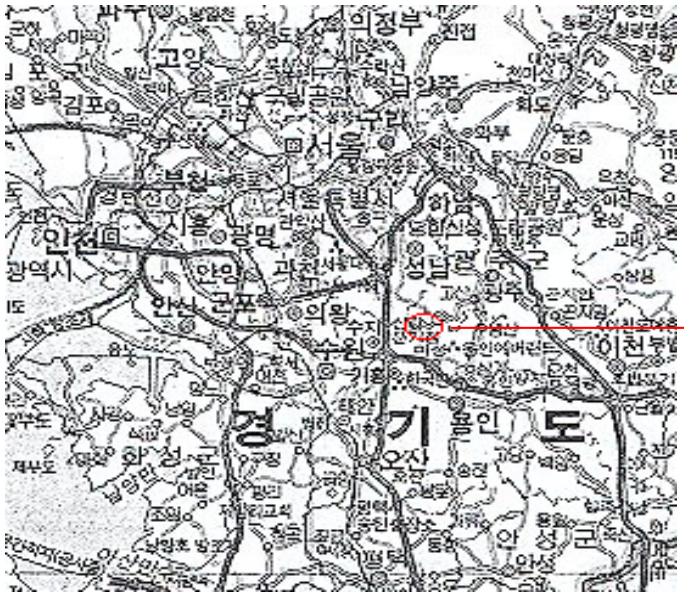
- FCC ID: A3LWIBT40A
- Model: WIBT40A
- Brand Name: SAMSUNG
- EUT Type: Bluetooth Module
- Classification: 15C Intentional Radiator
- Applied Standard: FCC 47 CFR Part 15 subpart C and IC RSS-210
- Test Procedure(s): ANSI C63.4-2003, ANSI C63.10 and FCC Public Notice DA 00-705 dated March 30, 2000 entitled “Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems”
- Dates of Test: November 15, 2012 ~ November 26, 2012
- 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 C63.4-2003)), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) were used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.** FCC ID : **A3LWIBT40A** and **IC : 649E-WIBT40A**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory***.
The site address is 155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-852 KOREA, REPUBLIC OF.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilo-meters (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18 miles) 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 §2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.
EMC Lab.

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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
FC	FCC part 15/18 Filing site	Registration No. 97992
	CAB Accreditation for DOC	Designation No. KR0026
KOLAS	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E-1
VCCI	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
IECEE CB SCHEME	EMC CBTL	-
방송통신위원회	KCC(RRL)Designated Lab.	Registration No. KR0026
	SASO registered Lab and Certification Body	Registration No. 2008-15

3. TEST CONDITIONS & EUT INFORMATION

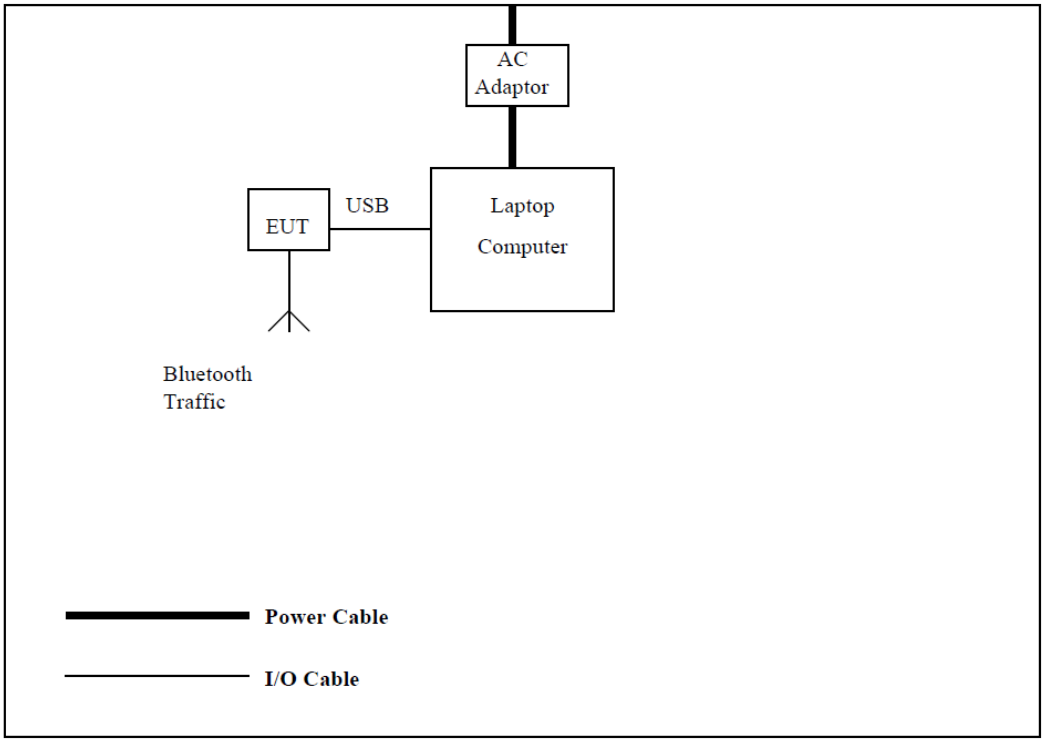
3.1 Operation During Test

The Laptop and Test Jig were used to control the EUT to transmit the wanted TX channel by the Bluetool testing program which manufacturer supported. The EUT was measured at three X, Y, Z-Axis in Bluetooth Traffic mode with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.2 Support Equipment

Bluetooth Module (EUT)	Samsung Electronics Co., Ltd. Model: WIBT40A FCC ID : A3LWIBT40A	S/N: N/A
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-R520 0.3 m shielded USB cable	FCC DOC S/N: ZK6V93FS800012Y
AC/DC Adaptor for Laptop	Chicony Power Technology Co., Ltd. Model : AD-6019R 1.5 m unshielded power cable	FCC DOC S/N: CNBA440024ADON897I2602

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Bluetooth Module FCC ID: A3LWIBT40A, IC: 649E-WIBT40A.** This unit supports full qualified Bluetooth 2.1 with EDR standard system.

Specifications:

EUT Type	Bluetooth Module
Model Name	WIBT40A
Brand Name	SAMSUNG
RF Frequency	2402 MHz ~ 2480 MHz
Peak Power Output (Conducted)	9.59 dBm
FCC Classification	FCC Part 15 Spread Spectrum Transmitter (DSS)
Method/System	Frequency Hopping Spread Spectrum (FHSS)
Channel Number	79
Modulation	GFSK, π/4DQPSK, 8DPSK
Antenna Gain	4.5 dBi (Peak)
Power	5 Vdc
Size (W x H x D)	32 mm x 29 mm x 8 mm
Weight	4 g

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
Conducted Emission	15.207	RSS-GEN 7.2.4	Complies	
Radiated Emission	15.209	RSS-210 A8.5	Complies	
20dB Bandwidth and Carrier Frequency Separation	15.247(a)(1)(iii)	RSS-210 A8.1	Complies	
Carrier Frequency Separation	15.247(a)(1)	RSS-210 A8.1(2)	Complies	
Transmitter Average Time of Occupancy	15.247(a)(1)(iii)	RSS-210 A8.1(4)	Complies	
Peak Power Output	15.247(b)(1)	RSS-210 A8.4(2)	Complies	
Conducted Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Number of Hopping channels	15.247(a)(1)(iii)	RSS-210 A8.1(4)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Bluetooth Module FCC ID: A3LWIBT40A, IC: 649E-WIBT40A** is in compliance with Part 15 Subpart C 15.247 of the FCC Rules.

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 **Samsung Bluetooth Module FCC ID: A3LWIBT40A, IC: 649E-WIBT40A** 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 Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 meter shielded enclosure. It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room Rohde & Schwarz (ESH3-Z5) and (ESH2-Z5) of the 50 ohm/50 μH Line Impedance Stabilization Network (LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN (ESH3-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH2-Z5). Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ". If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs, All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentinefashion) to a 1 meter length. Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150 kHz to 30 MHz with 200 msec sweep time. The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30). The detector functions were set to CISPR quasi-peak mode & average mode. The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; whichever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

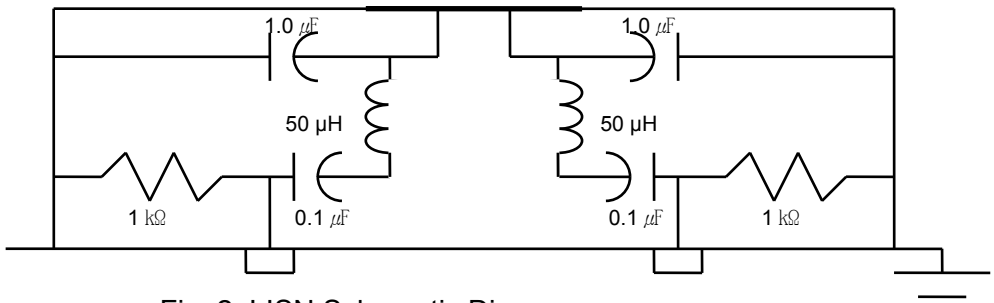


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.4-2003 and ANCI C63.10-2009.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Bi-conical log Antenna(ARA, LPB-2520/A). Above 1 GHz, Horn antenna (Scwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.

The test equipment was placed on turntable with 0.8 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 receiver (ESCS30 & FSP40) bandwidth was set to 120 kHz for measurements below 1 GHz, and 1 MHz for measurements above 1 GHz. A peak detector is used to detect an emission; a quasi-peak detector may be used to record a final measurement below 1 GHz and an average detector may be used above 1 GHz.

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)

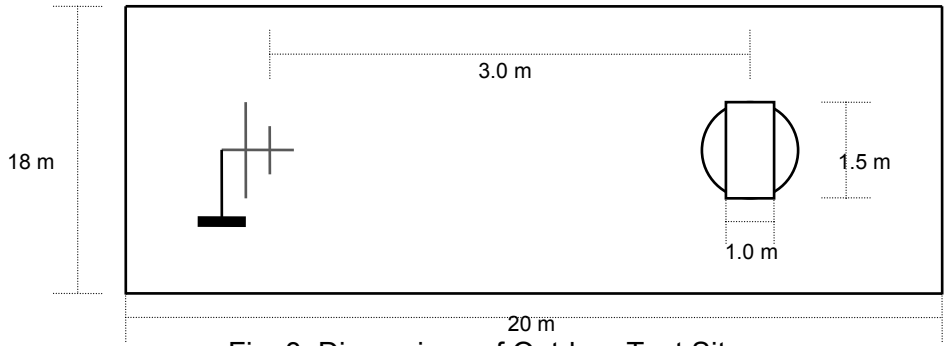
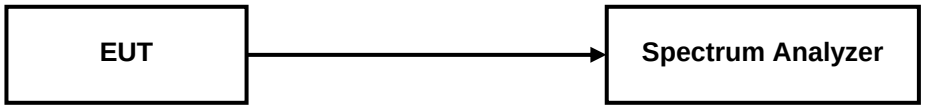


Fig. 3. Dimensions of Outdoor Test Site

7.3 20 dB Bandwidth and Carrier Frequency Separation

Test Setup

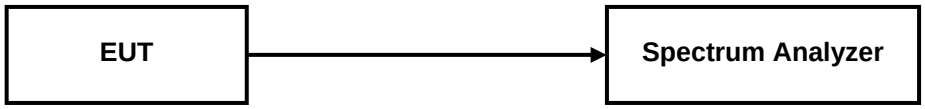


Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

7.4 Transmitter Average Time of Occupancy

Test Setup

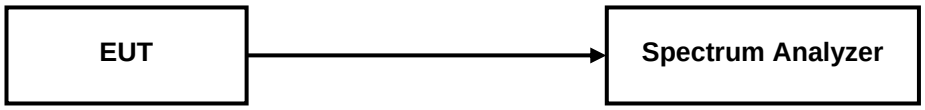


Test Procedure

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 = 1 MHz, 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

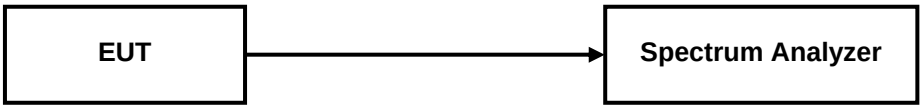


Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, In either a single sweep or in multiple continuous sweeps. The RBW is set to 1 % of the span.
The spectrum analyzer is set to Max Hold.

7.6 Maximum Peak Output Power

Test Setup

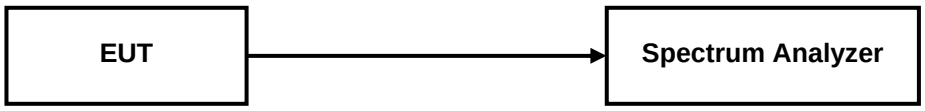


Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer. The RBW of spectrum analyzer is set to 3 MHz and VBW is set to the 3 MHz. The sweep time is coupled.

7.7 Conducted Spurious Emission

Test Setup



Test Procedure

The transmitter is connected to the spectrum analyzer.
The RBW of spectrum analyzer is set to 100 kHz and VBW is set to the 300 kHz.
Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the Lowest, middle and highest channels.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen 7.2.4

Frequency	Level(dBµV)		*)Factor	**) Line	Limit(dBµV)		Margin(dB)	
(MHz)	Q-Peak	Average	(dB)		Q-Peak	Average	Q-Peak	Average
0.17	55.4	35.1	0.2	N	65.0	55.0	9.6	19.9
0.23	47.0	29.7	0.2	N	62.4	52.4	15.4	22.7
0.29	39.9	23.2	0.2	L	60.5	50.5	20.6	27.3
0.45	34.4	19.4	0.2	N	56.9	46.9	22.5	27.5
3.18	29.4	17.2	0.2	L	56.0	46.0	26.6	28.8
20.46	31.6	26.2	1.7	L	60.0	50.0	28.4	23.8

Line Conducted Emissions Tabulated Data

NOTES:

1. ***Measurements using CISPR quasi-peak mode & average mode.***
2. ***All modes of operation were investigated and the worst -case emission were reported. See attached Plots.***
3. ****) Factor = LISN + Cable Loss***
4. *****) LINE : L = Line , N = Neutral***
5. ***The limit is on the FCC Part section 15.207(a).***

PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line)***

NEMKO KOREA (NK-12-R-208) 22 Nov 2012 22:56

Conducted Emissions

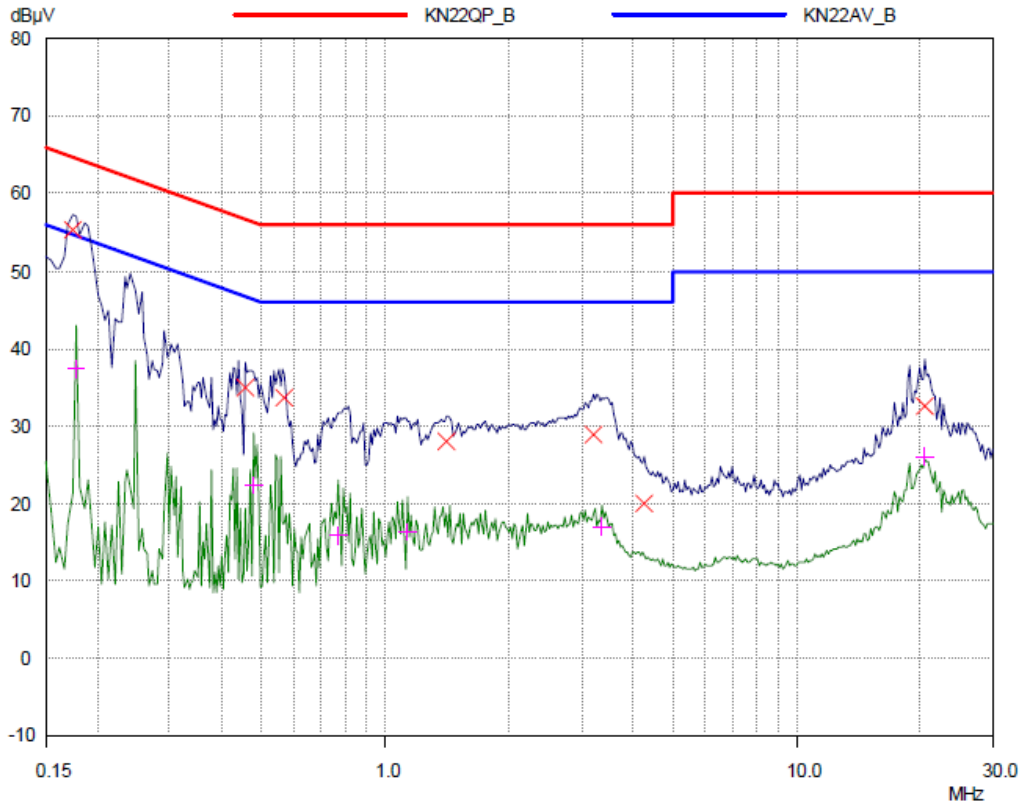
EUT:	Bluetooth module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz (GFSK TX mode)
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : WIBT40A
	LINE : L1

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Line

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***

NEMKO KOREA (NK-12-R-208) 22 Nov 2012 22:45

Conducted Emissions

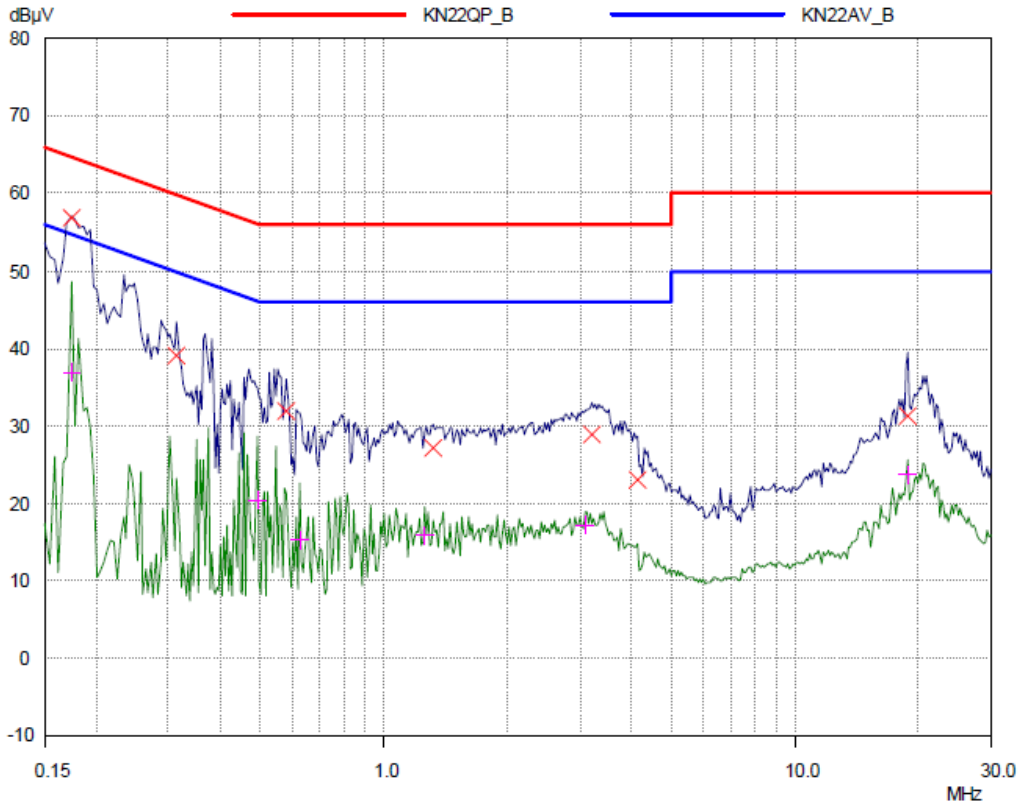
EUT:	Bluetooth module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz (GFSK TX mode)
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : WIBT40A
	LINE : Neutral

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Neutral

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



8.2 Radiated Emissions

FCC §15.209, IC RSS-210 A8.5

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
59.40	46.00	V	106	267	-16.6	29.4	40.0	10.6
131.89	47.77	H	134	342	-17.1	30.7	43.5	12.8
144.00	50.37	H	105	340	-17.1	33.3	43.5	10.2
152.94	45.29	H	113	149	-15.5	29.8	43.5	13.7
192.01	46.91	H	182	339	-16.2	30.7	43.5	12.8
435.72	41.50	H	105	249	-11.1	30.4	46.0	15.6

Radiated Measurements at 3 meters

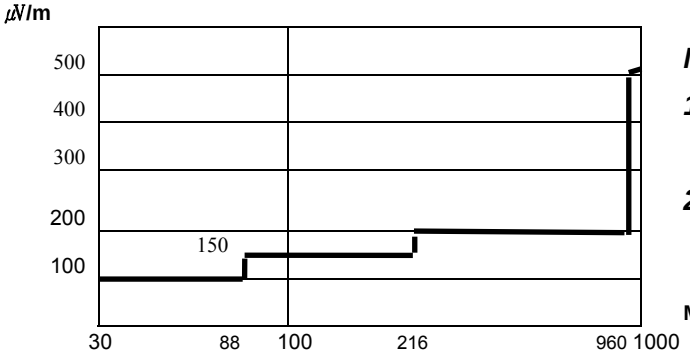


Fig. 4. Limits at 3 meters

NOTES:

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

2 The radiated limits are shown on Figure 4.

Above 1GHz the limit is 500 µV /m.

NOTES:

1. *Pol. H = Horizontal V = Vertical

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

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

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst date was recorded.

5. The limit is on the FCC Part section 15.209(a).

8.3 20 dB Modulated Bandwidth

FCC §15.247(a)(1)(iii), RSS-210 A8.1

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

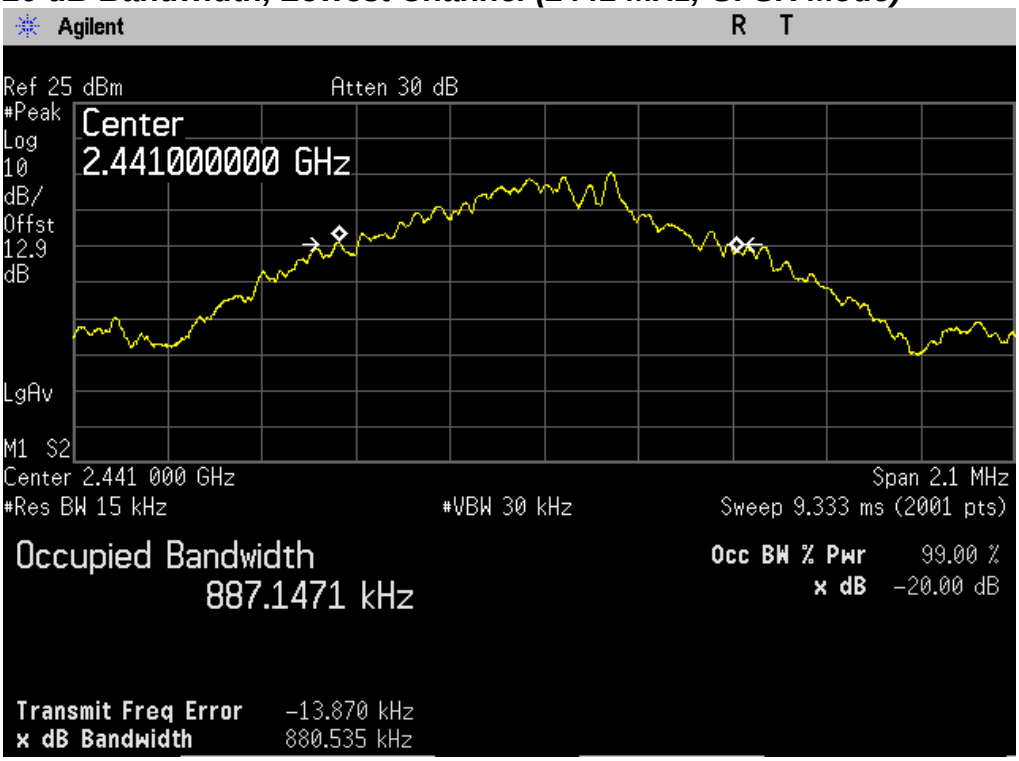
Result:

Modulation Mode	Frequency(MHz)	Result(kHz)	Limit(kHz)
GFSK	2402	880.9	Non specified
GFSK	2441	880.5	Non specified
GFSK	2480	880.5	Non specified
8DPSK	2402	1228.0	Non specified
8DPSK	2441	1230.0	Non specified
8DPSK	2480	1232.0	Non specified

PLOTS OF EMISSIONS

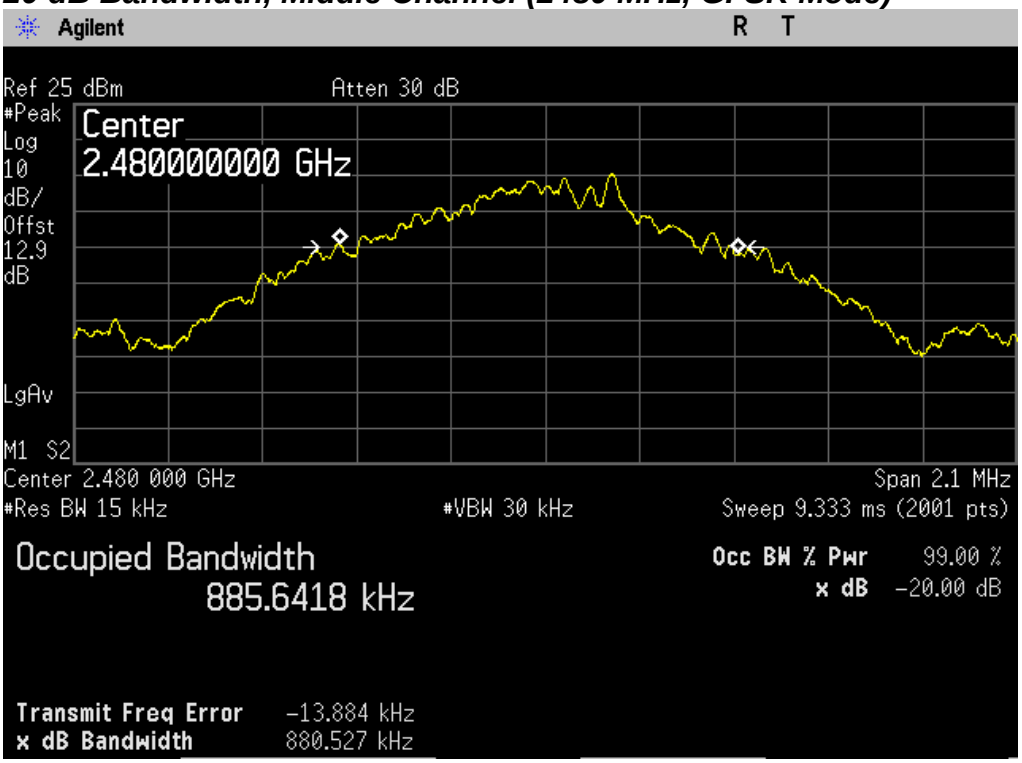
20 dB Bandwidth, Lowest Channel (2402 MHz, GFSK Mode)

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

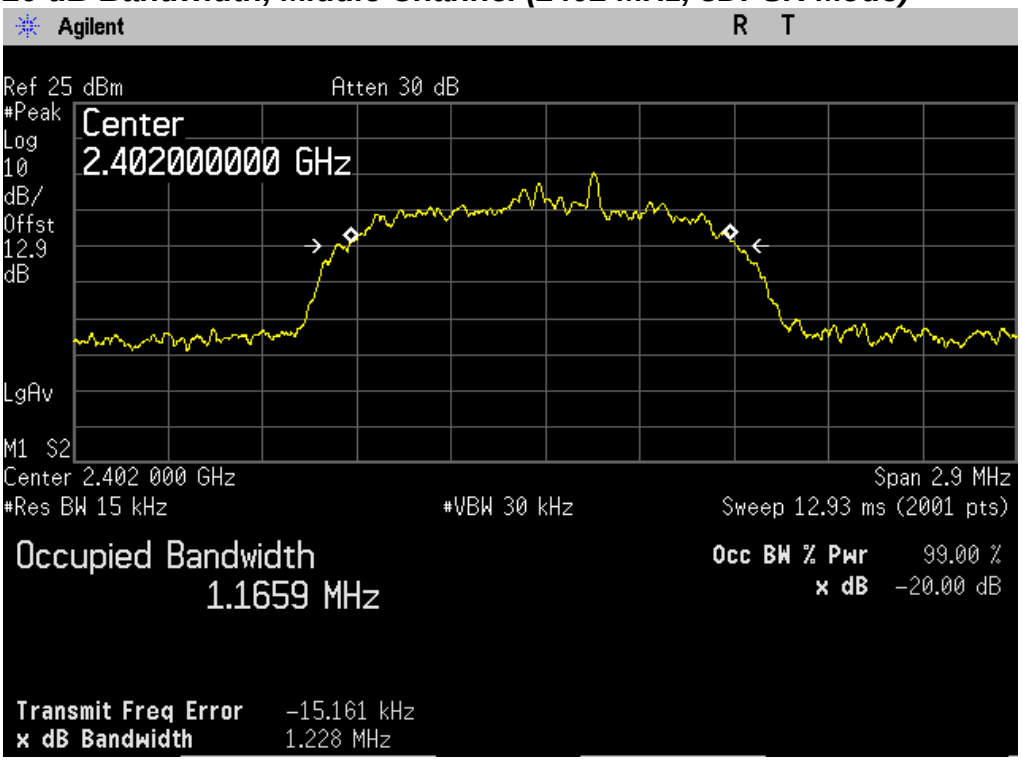


PLOTS OF EMISSIONS

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

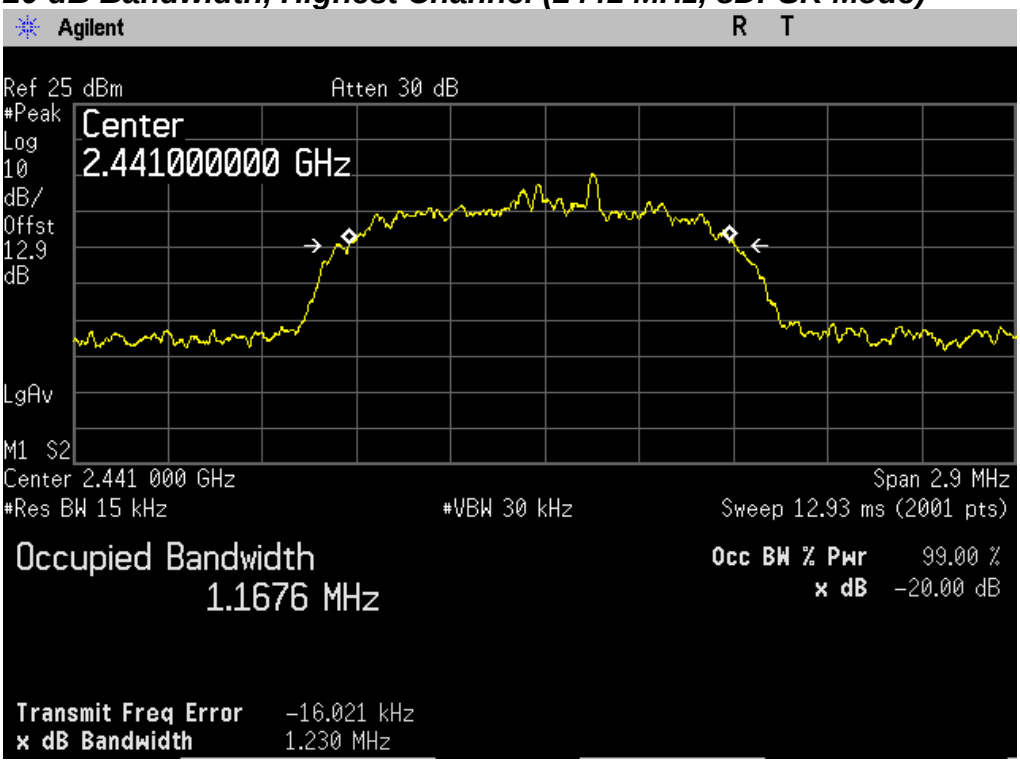


20 dB Bandwidth, Middle Channel (2402 MHz, 8DPSK Mode)

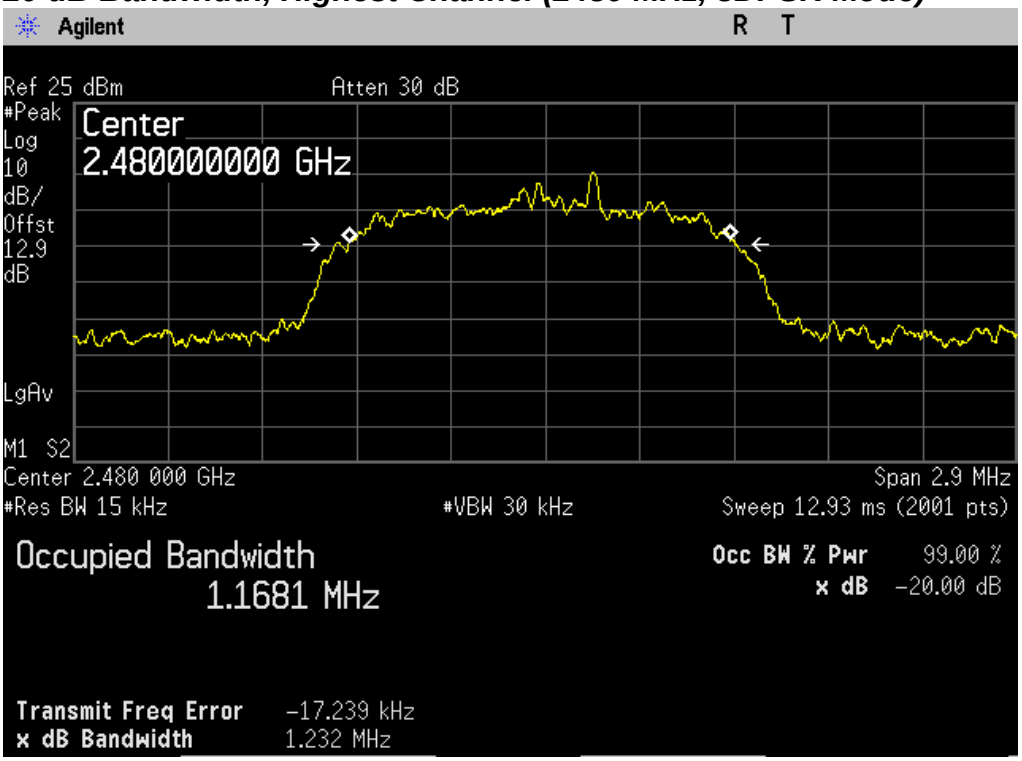


PLOTS OF EMISSIONS

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



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



8.4 Carrier Frequency Separation

FCC §15.247(a)(1), RSS-210 A8.1(2)

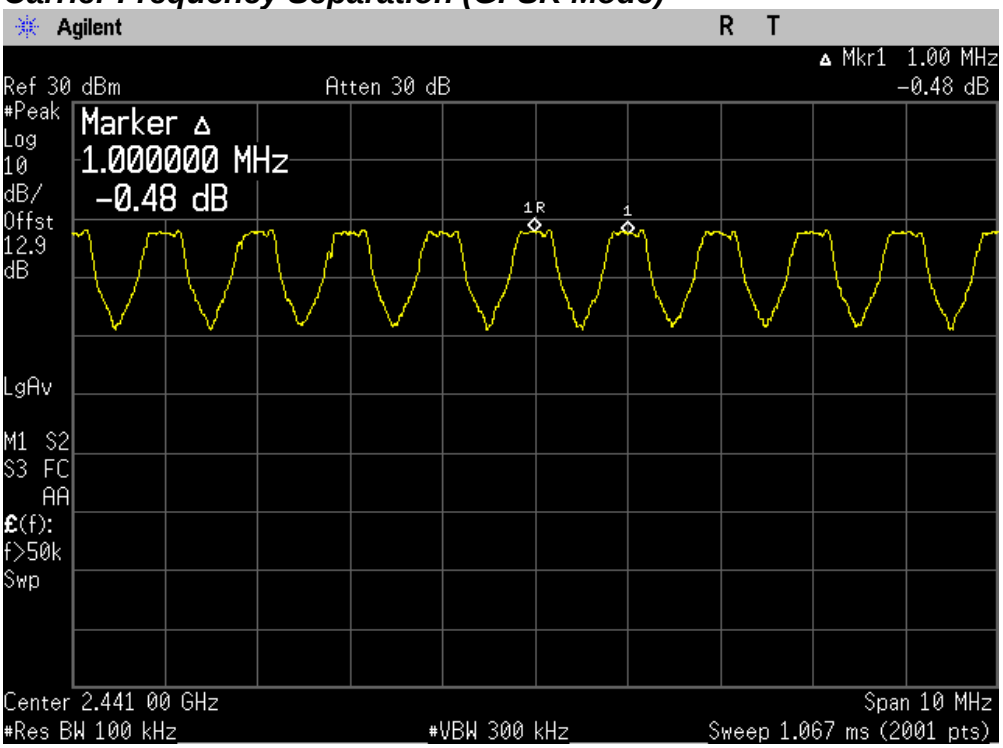
Test Mode : Set to Hopping mode

Result:

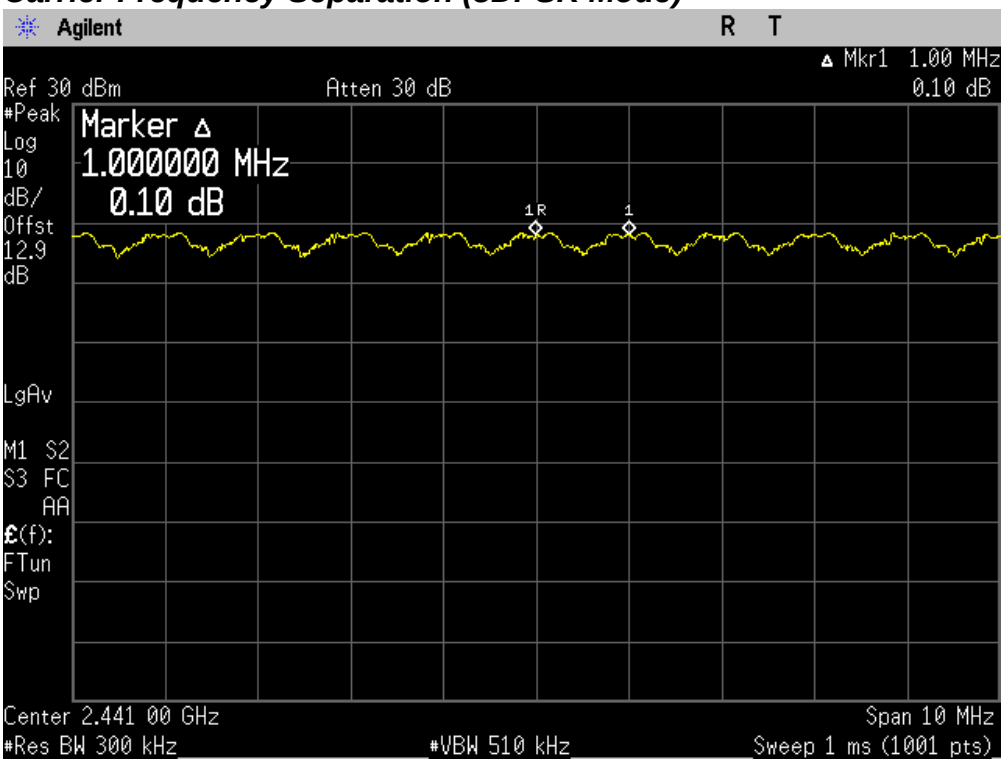
Modulation Mode	Carrier Frequency Separation (kHz)	Limit (2 / 3 of 20dB Bandwidth) (kHz)	Margin (kHz)
GFSK	1000	587.3	412.7
8DPSK	1000	821.3	178.7

PLOTS OF EMISSIONS

Carrier Frequency Separation (GFSK Mode)



Carrier Frequency Separation (8DPSK Mode)



8.5 Transmitter Average Time of Occupancy

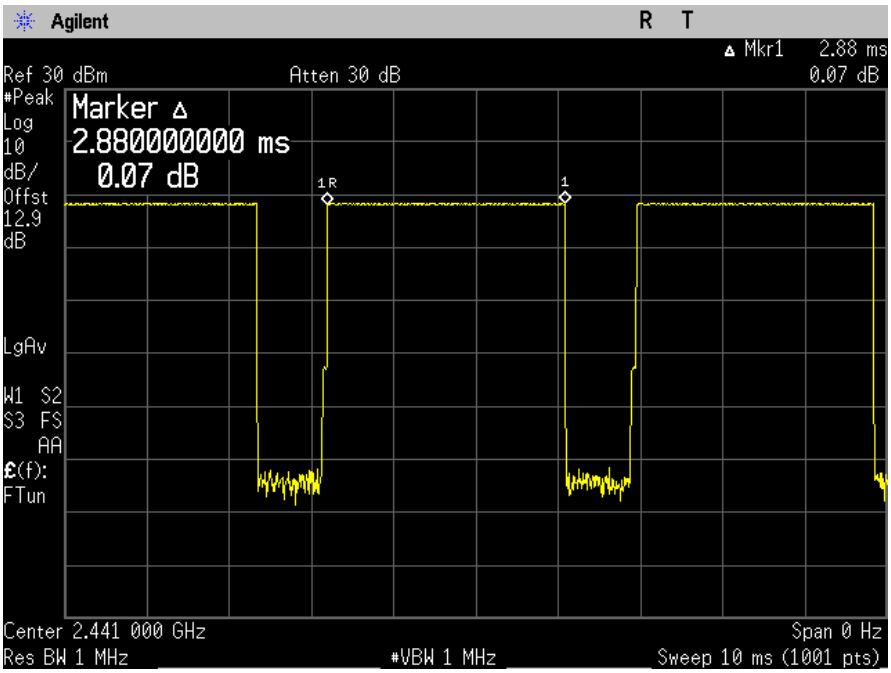
FCC §15.247(a)(1)(iii), RSS-210 A8.1(4)

Test mode : Set to Hopping mode

Result:

The average time of occupancy in the specified 31.6 second period (79 channels x 0.4 s) is equal to pulse width x (1600 / 6) / 79 x 31.6 second.

Pulse width (ms)	*)Numbers of slots in 31.6 sec	**) Average time of Occupancy(ms)	Limit (ms)	Margin (ms)
2.88	106.7	307.30	≤400	92.70



Notes:

The result was measured at DH5 mode in GFSK modulation, which has longest time in one transmission burst.

*)Numbers of slots in 31.6 sec = (1600 / 6) / 79 x 31.6

**)Average time of Occupancy = pulse width x Numbers of slots in 31.6 sec

8.6 Number of Hopping Channels

FCC §15.247(a)(1)(iii), RSS-210 A8.1(4)

Test mode : Set to Hopping mode

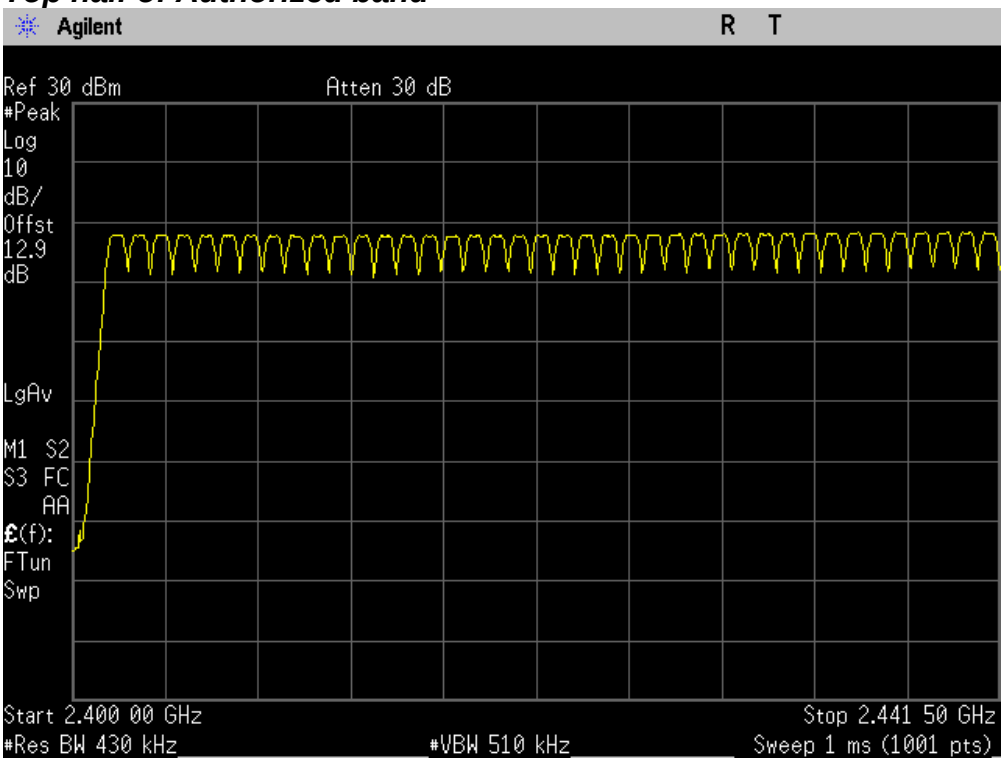
Result:

Total Hopping Channels = 40 + 39 = 79

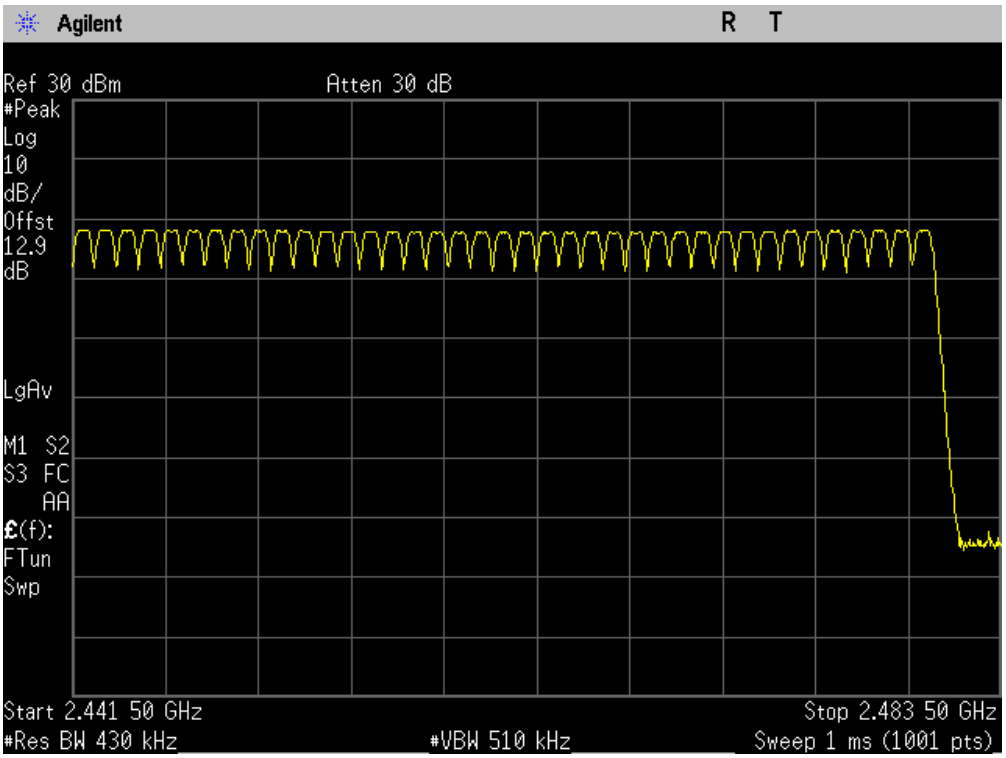
The EUT meets the specifications of Section 15.247(a)(1)(iii) for Number of Hopping Channels.

PLOT OF TEST DATA

Top half of Authorized band



Bottom half of Authorized band



8.7 Peak Power Output

FCC §15.247(b)(1), RSS-210 A8.4(2)

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

Result:

Modulation	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
GFSK	2402	8.25	30.00	21.75
GFSK	2441	8.47	30.00	21.53
GFSK	2480	8.39	30.00	21.61
8DPSK	2402	9.38	30.00	20.62
8DPSK	2441	9.59	30.00	20.41
8DPSK	2480	9.52	30.00	20.48

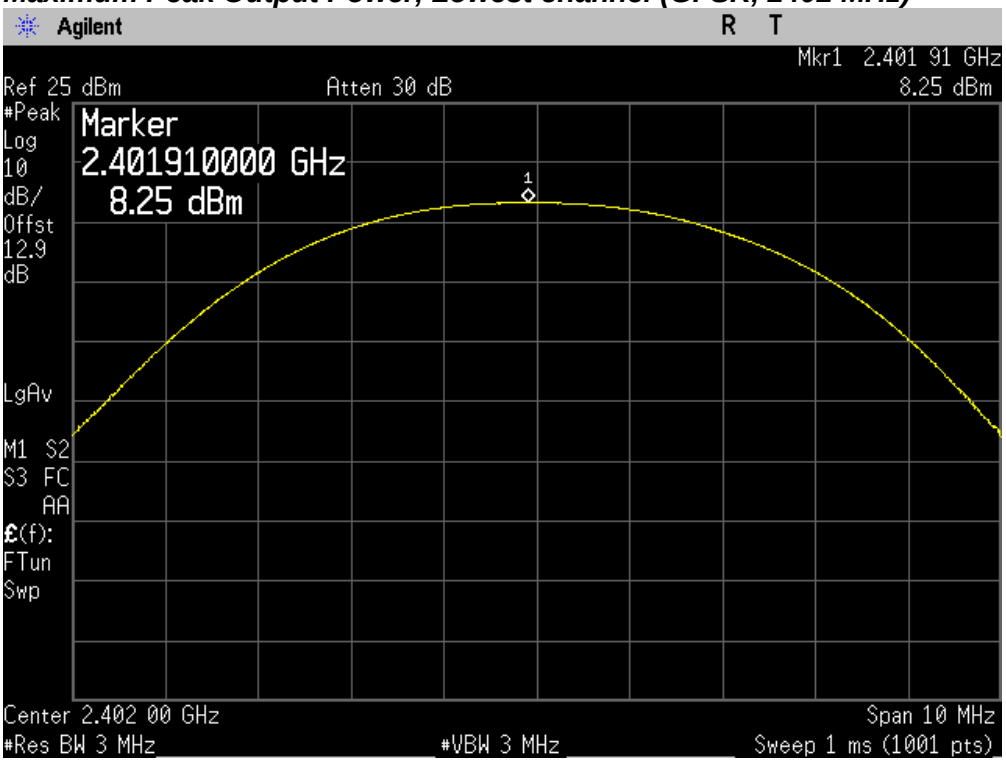
Note:

The following formular was used for spectrum offset:

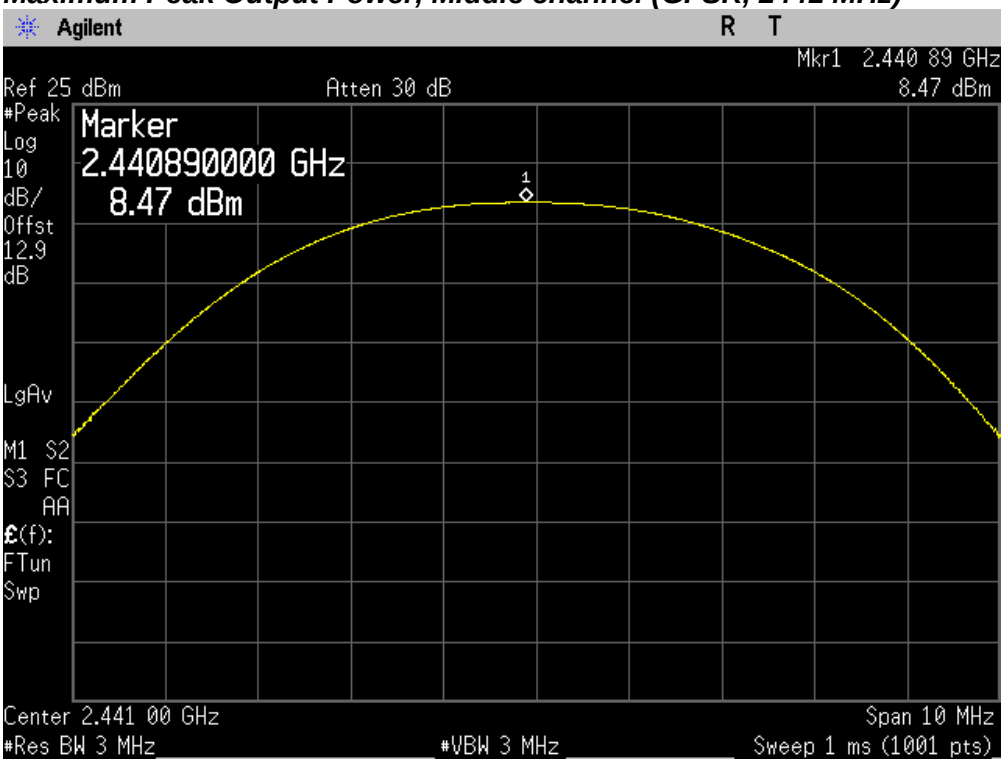
Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

PLOT OF TEST DATA

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

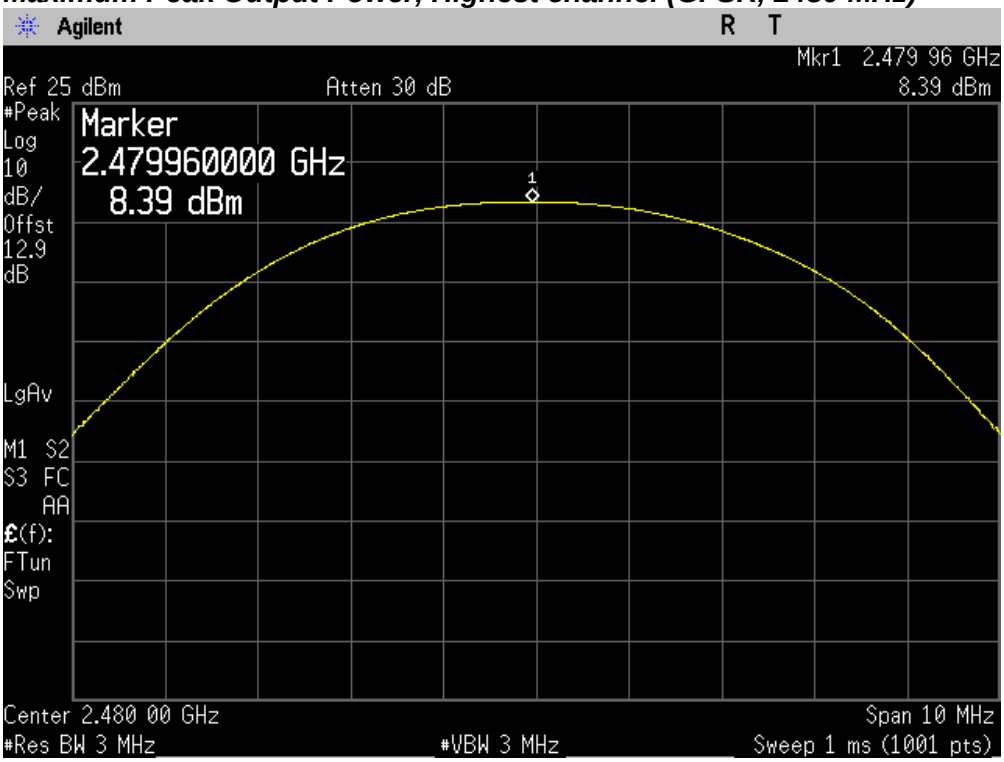


Maximum Peak Output Power, Middle channel (GFSK, 2441 MHz)

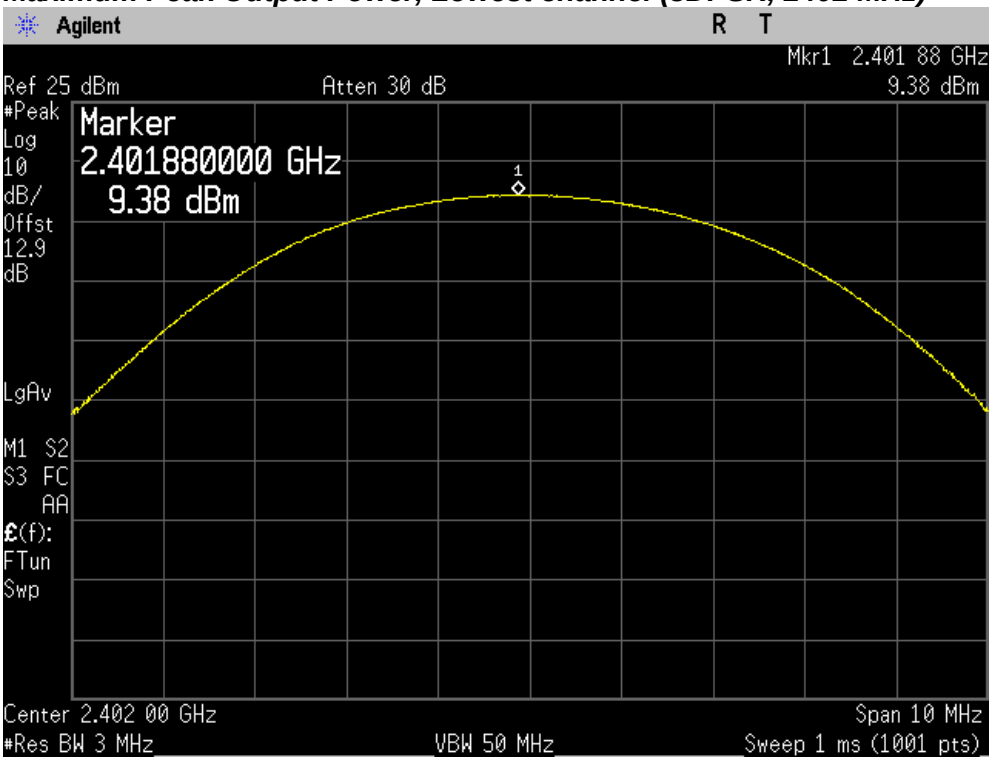


PLOT OF TEST DATA

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

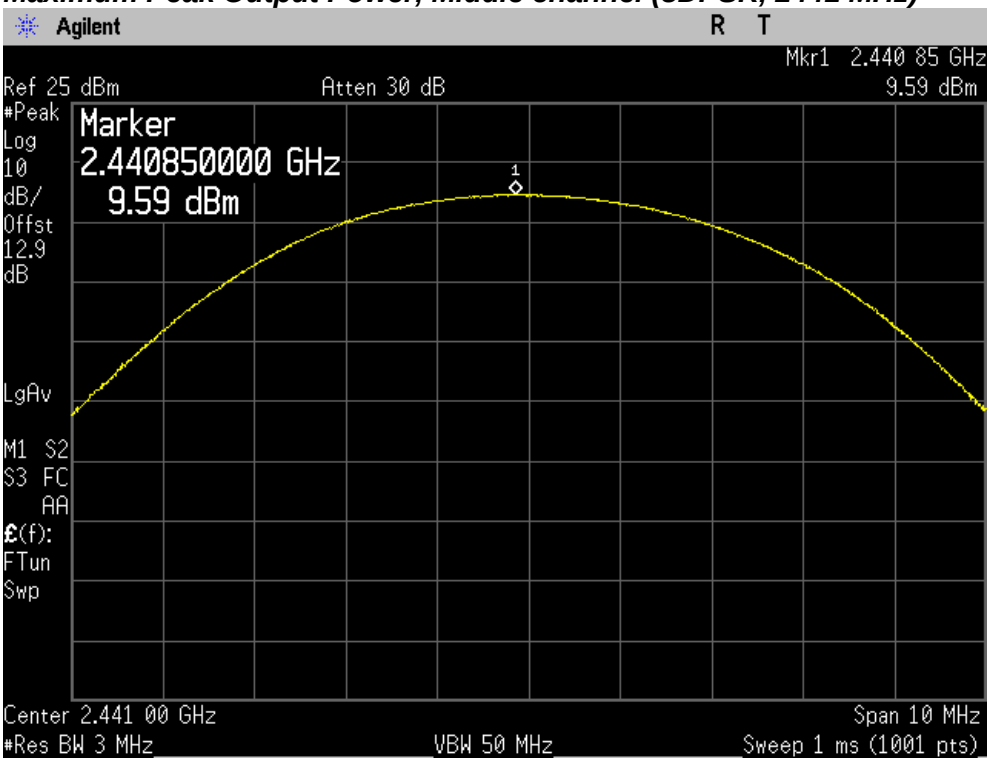


Maximum Peak Output Power, Lowest channel (8DPSK, 2402 MHz)

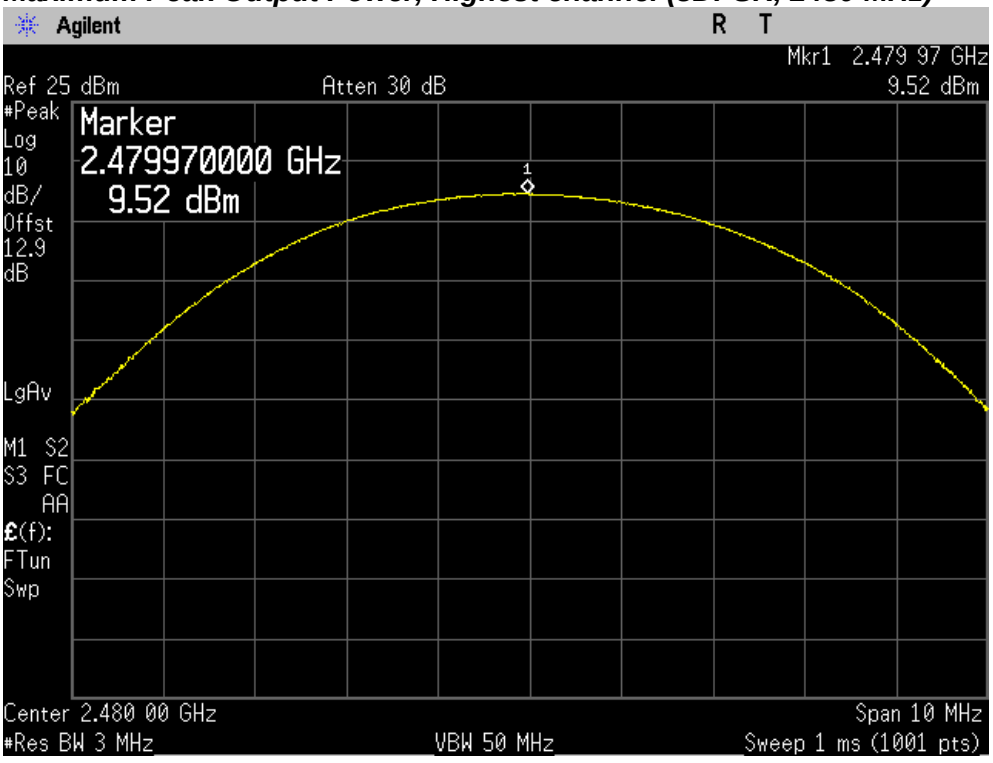


PLOT OF TEST DATA

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



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



8.8 Conducted Spurious Emission

FCC §15.247(d), RSS-210 A8.5

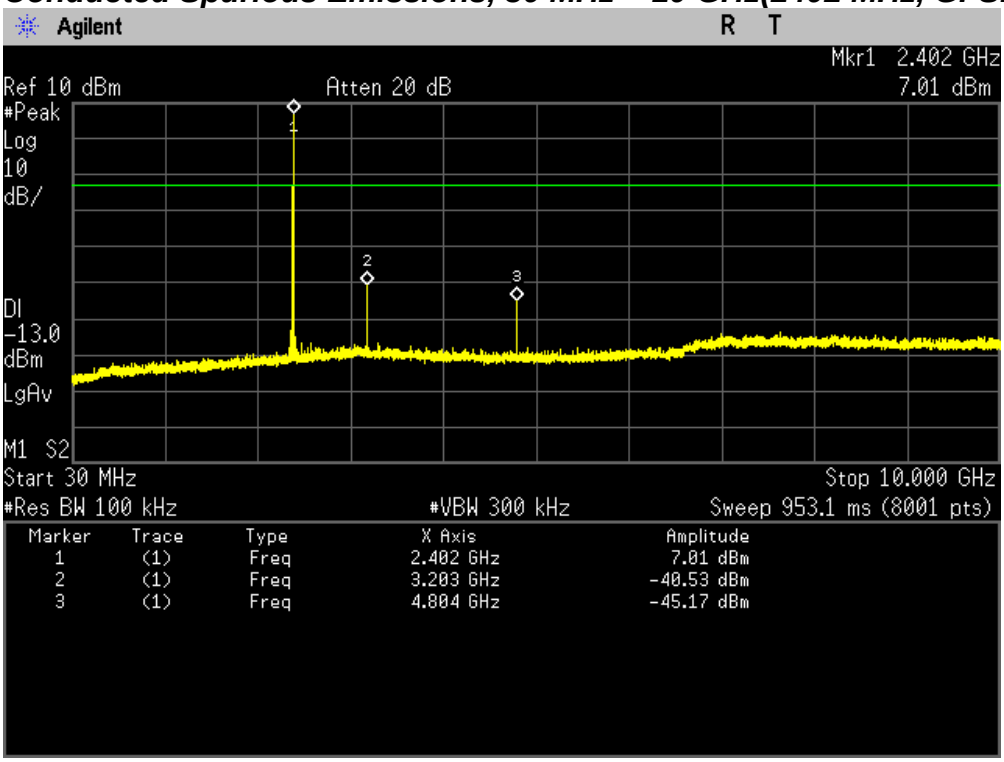
Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result:

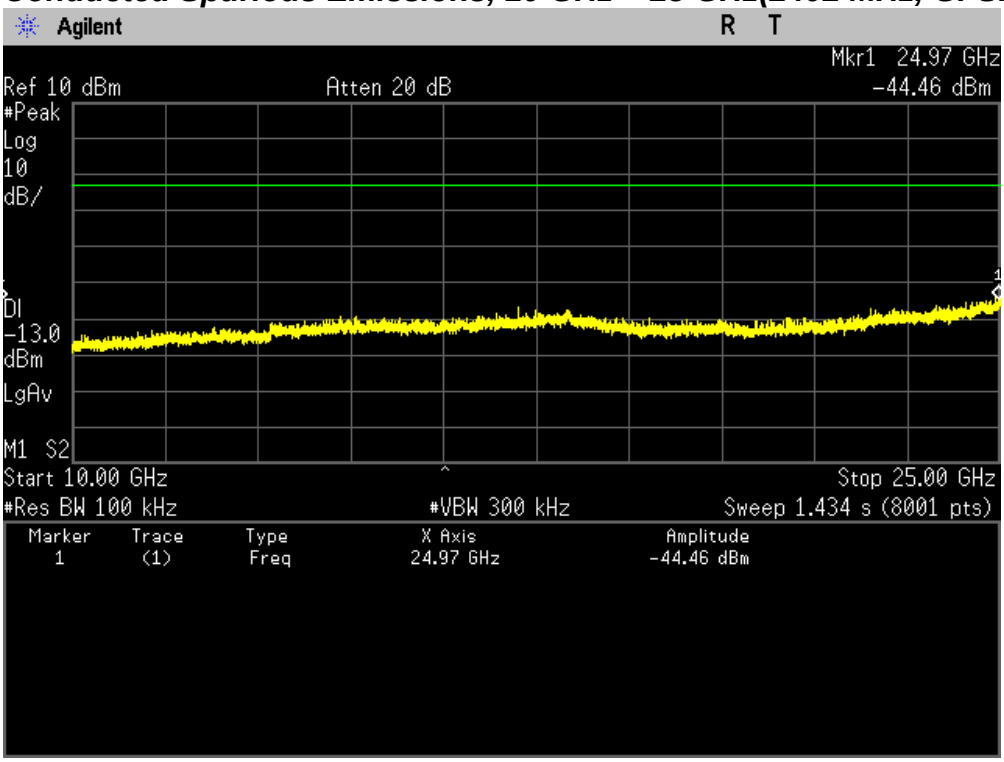
Modulation Mode	Frequency(MHz)	Result	Limit(dBc)
GFSK	2402	More than 30 dBc	20
GFSK	2441	More than 30 dBc	20
GFSK	2480	More than 30 dBc	20
8DPSK	2402	More than 30 dBc	20
8DPSK	2441	More than 30 dBc	20
8DPSK	2480	More than 30 dBc	20

PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2402 MHz, GFSK Mode)

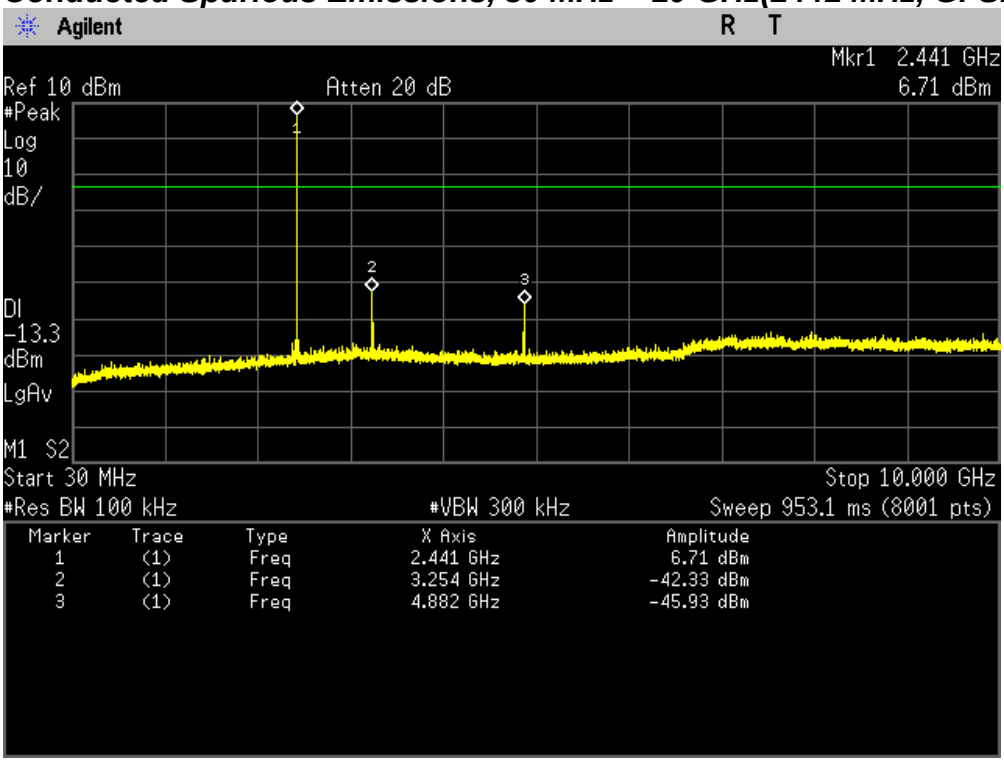


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2402 MHz, GFSK Mode)

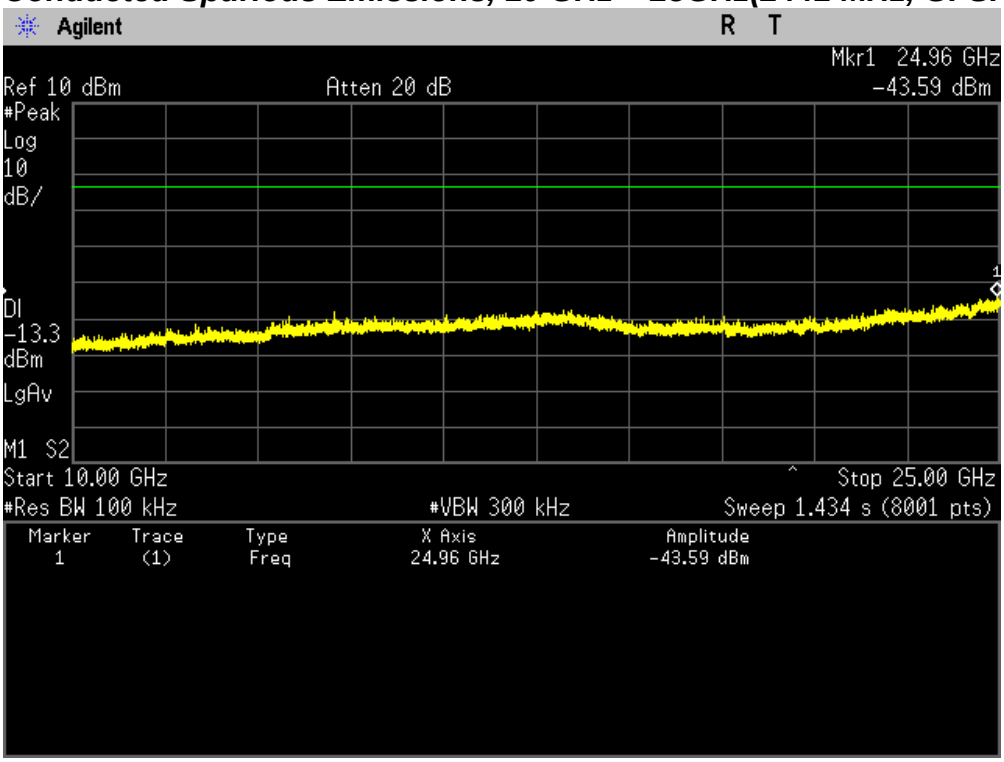


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2441 MHz, GFSK Mode)

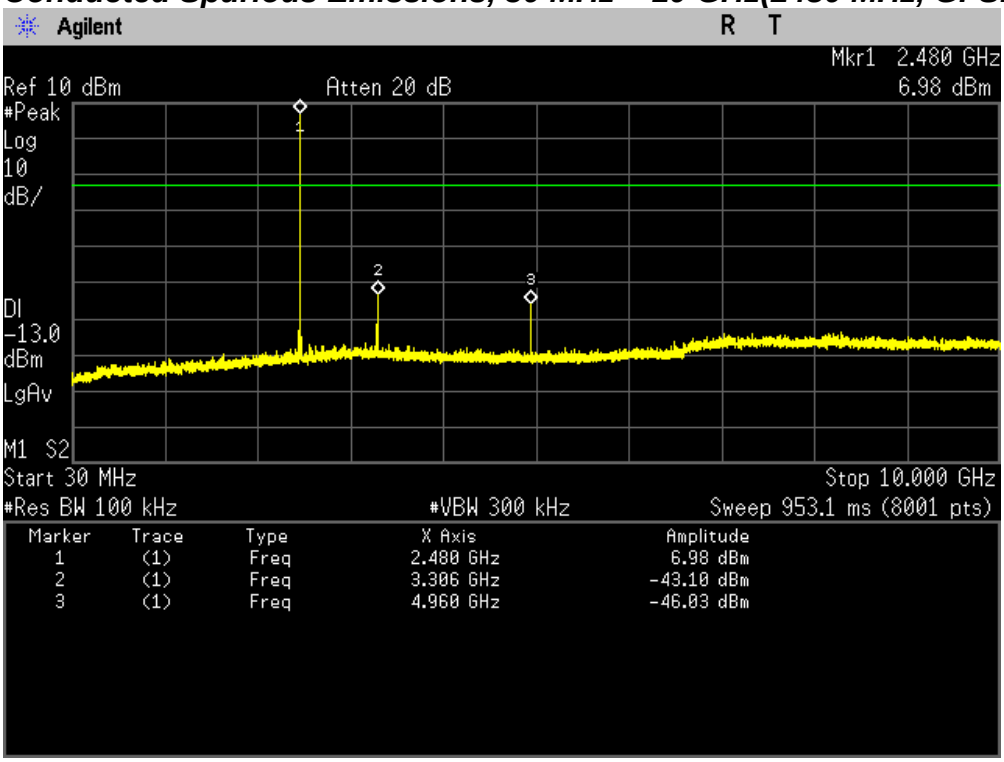


Conducted Spurious Emissions, 10 GHz ~ 25GHz(2441 MHz, GFSK Mode)

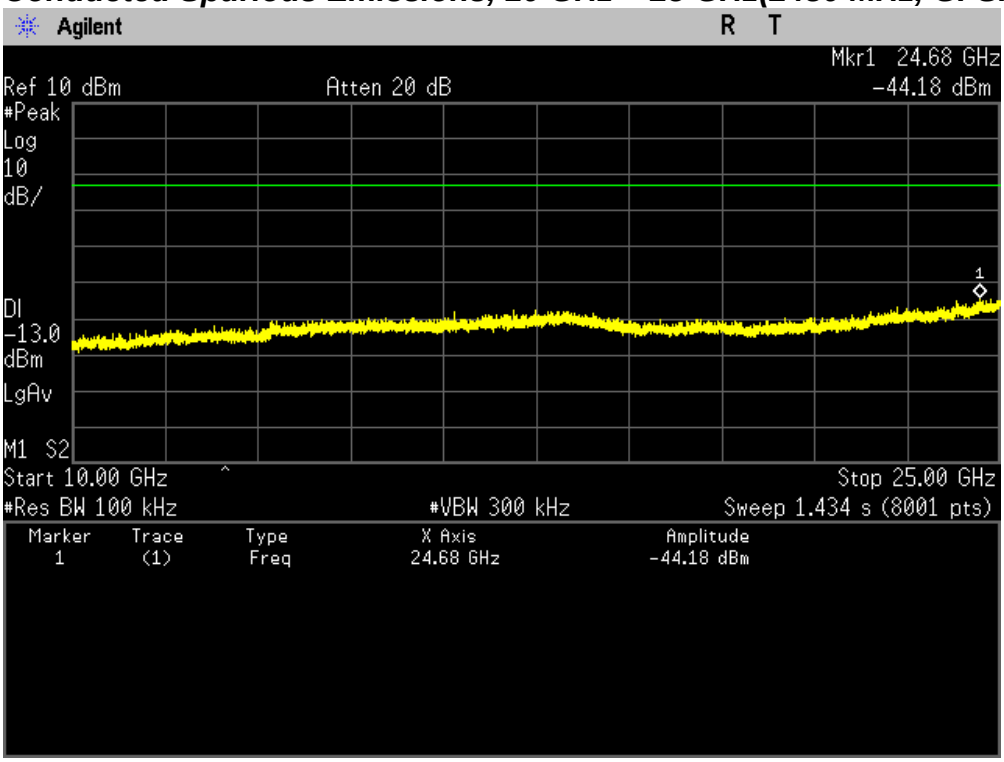


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2480 MHz, GFSK Mode)

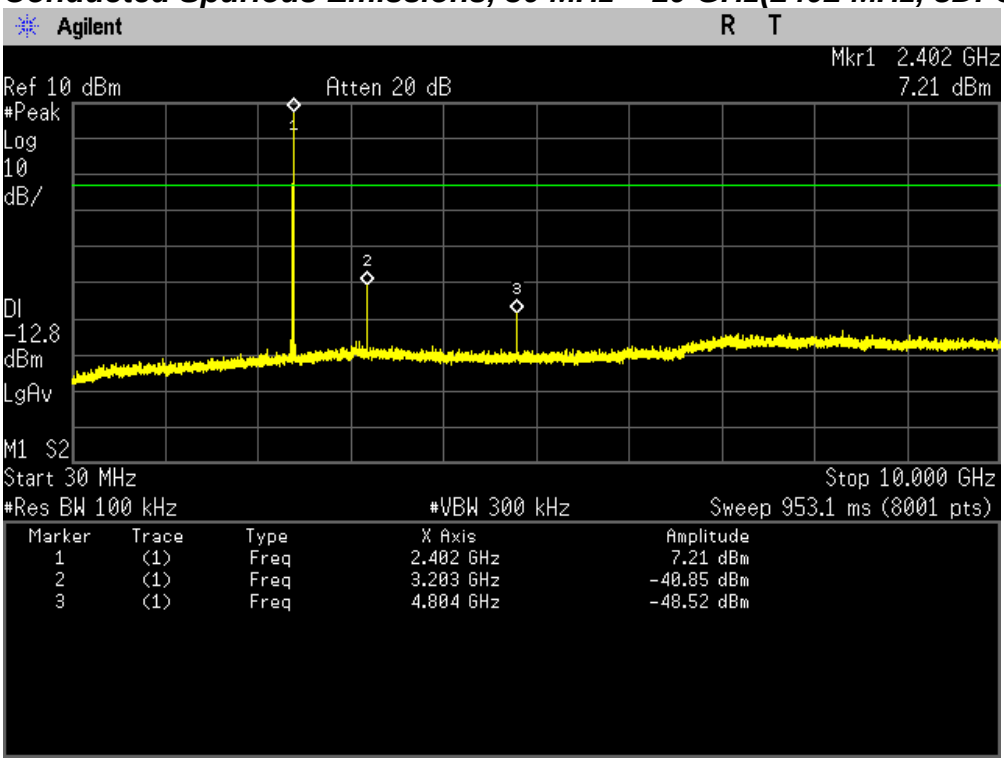


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2480 MHz, GFSK Mode)

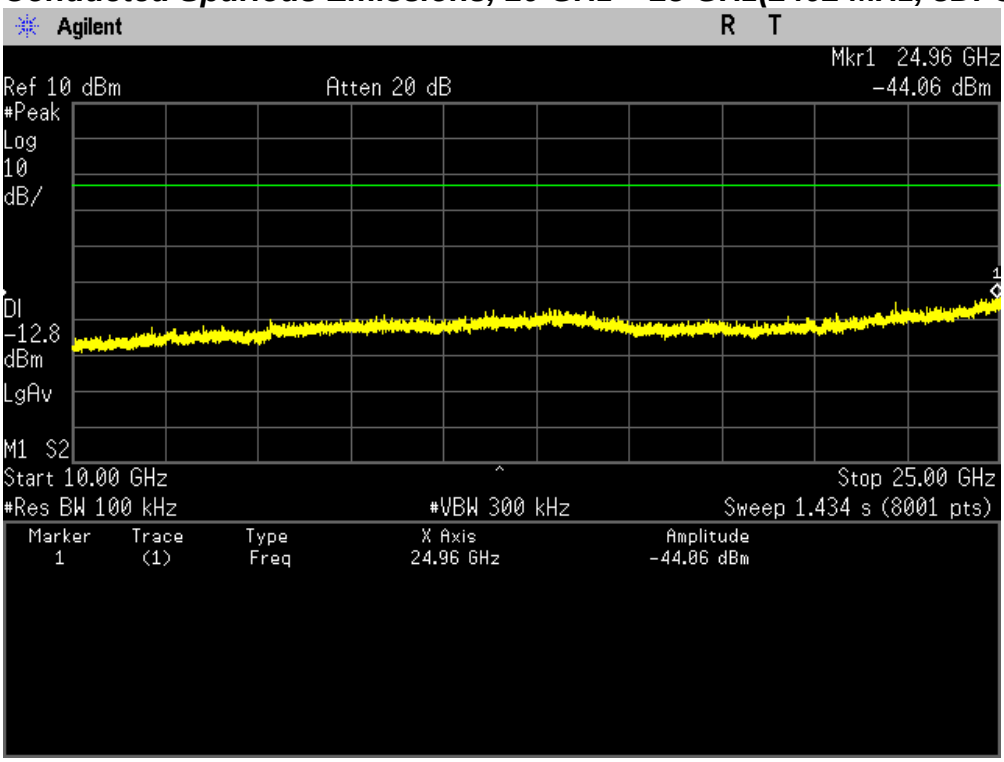


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2402 MHz, 8DPSK Mode)

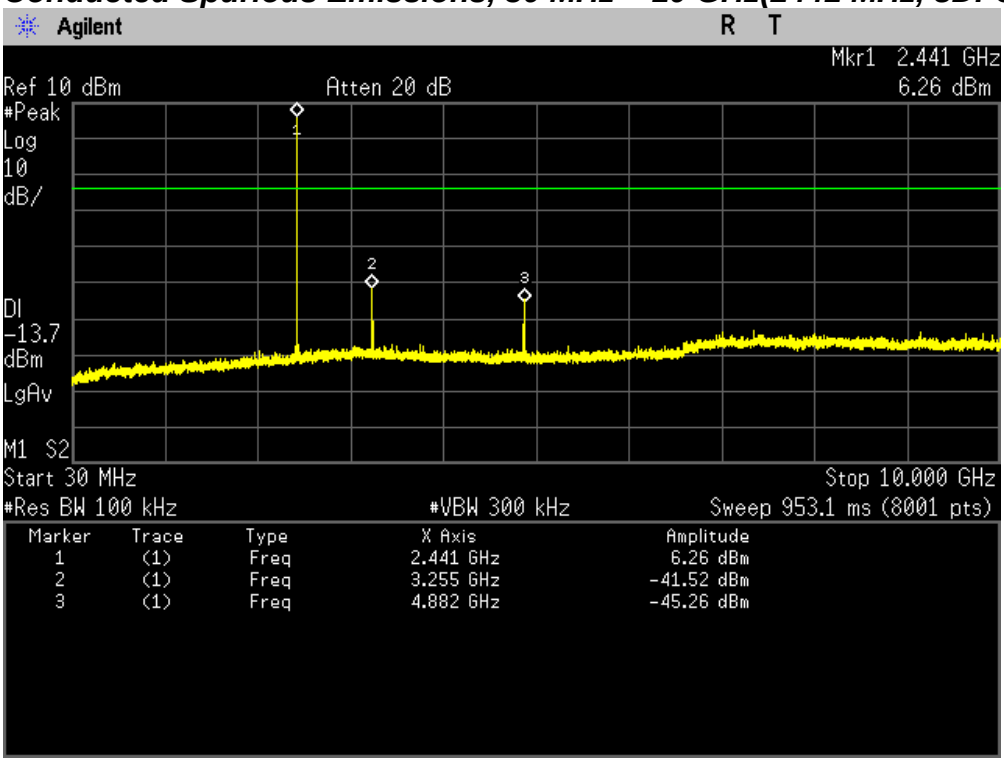


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2402 MHz, 8DPSK Mode)

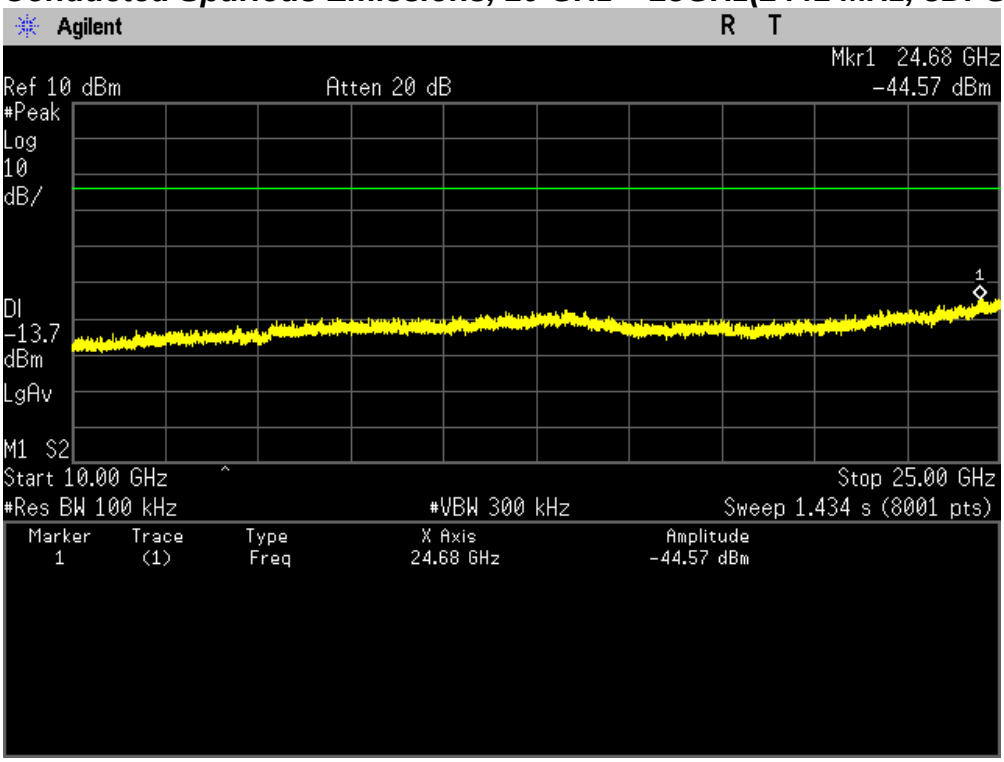


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2441 MHz, 8DPSK Mode)

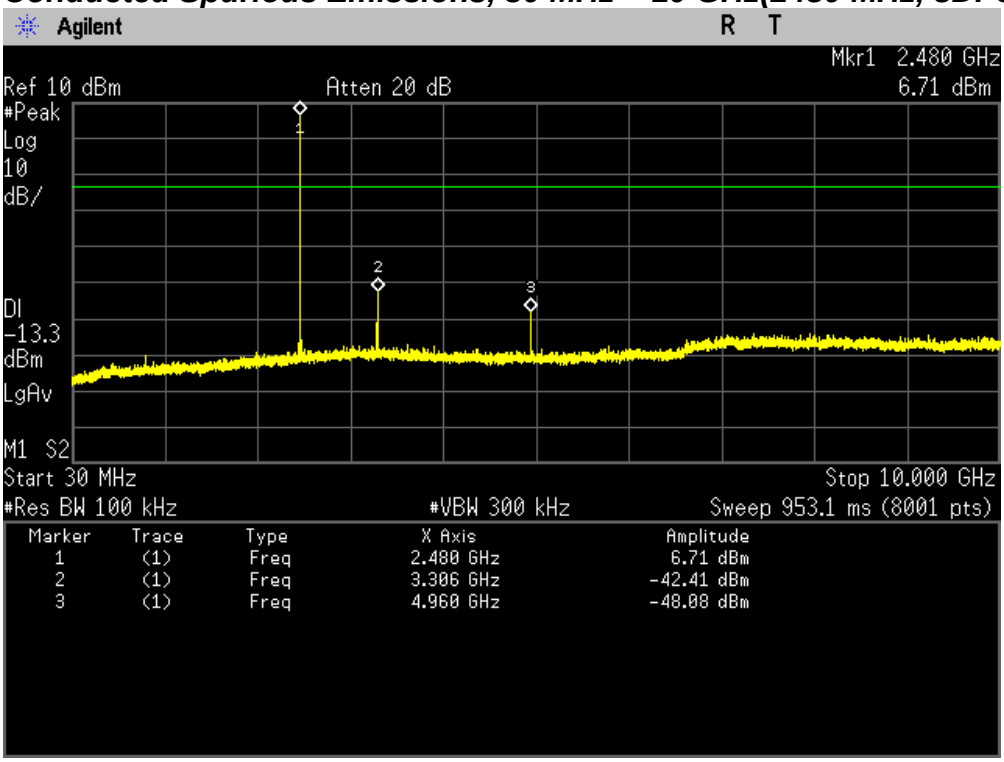


Conducted Spurious Emissions, 10 GHz ~ 25GHz(2441 MHz, 8DPSK Mode)

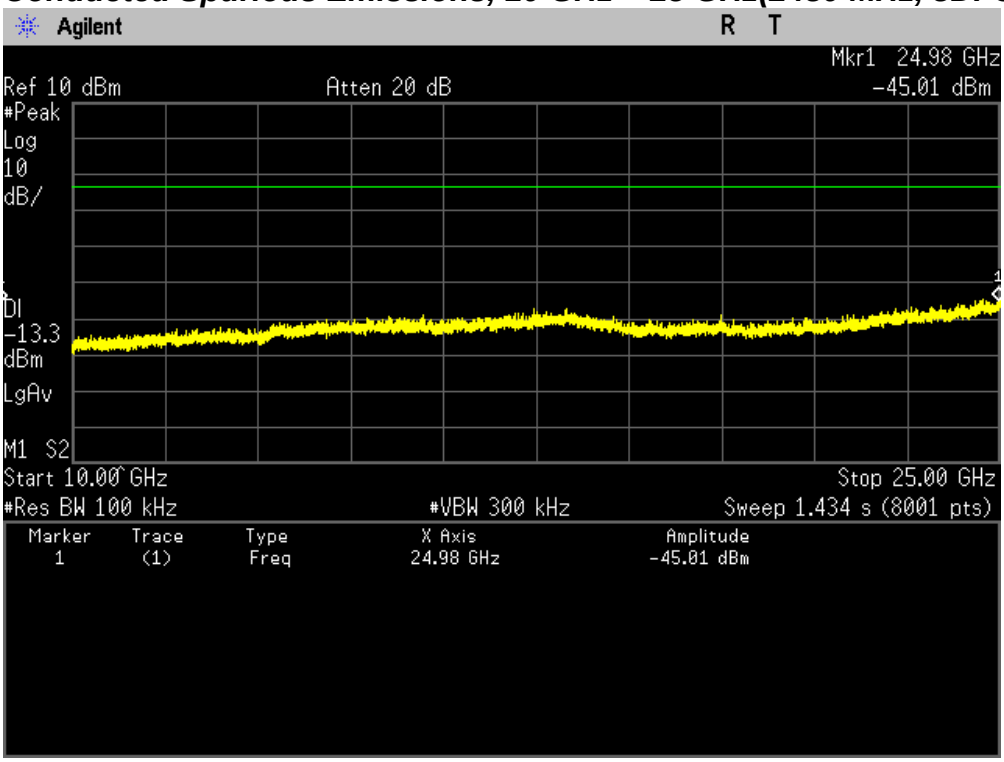


PLOT OF TEST DATA

Conducted Spurious Emissions, 30 MHz ~ 10 GHz(2480 MHz, 8DPSK Mode)

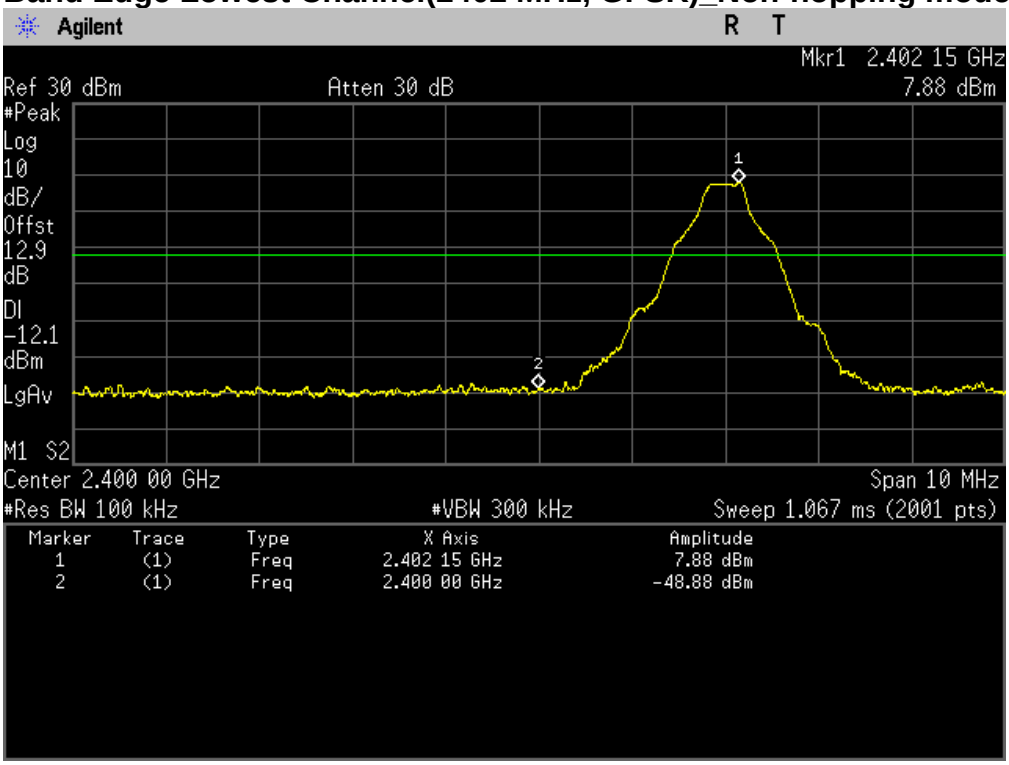


Conducted Spurious Emissions, 10 GHz ~ 25 GHz(2480 MHz, 8DPSK Mode)

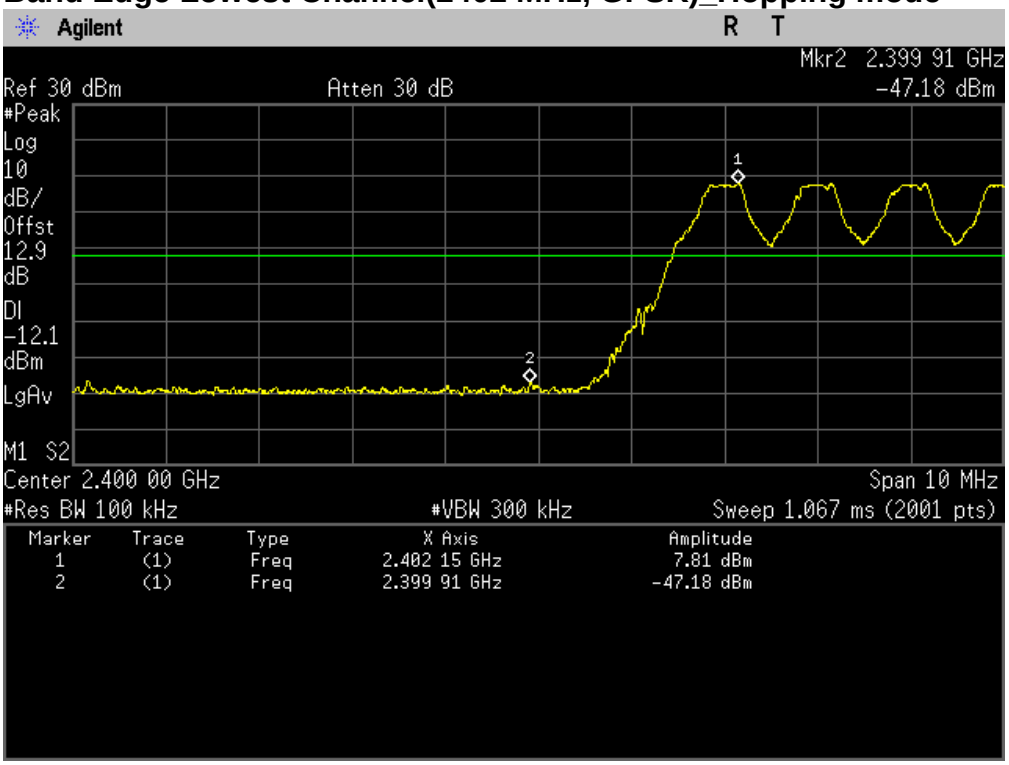


PLOT OF TEST DATA

Band Edge Lowest Channel(2402 MHz, GFSK)_Non-hopping mode

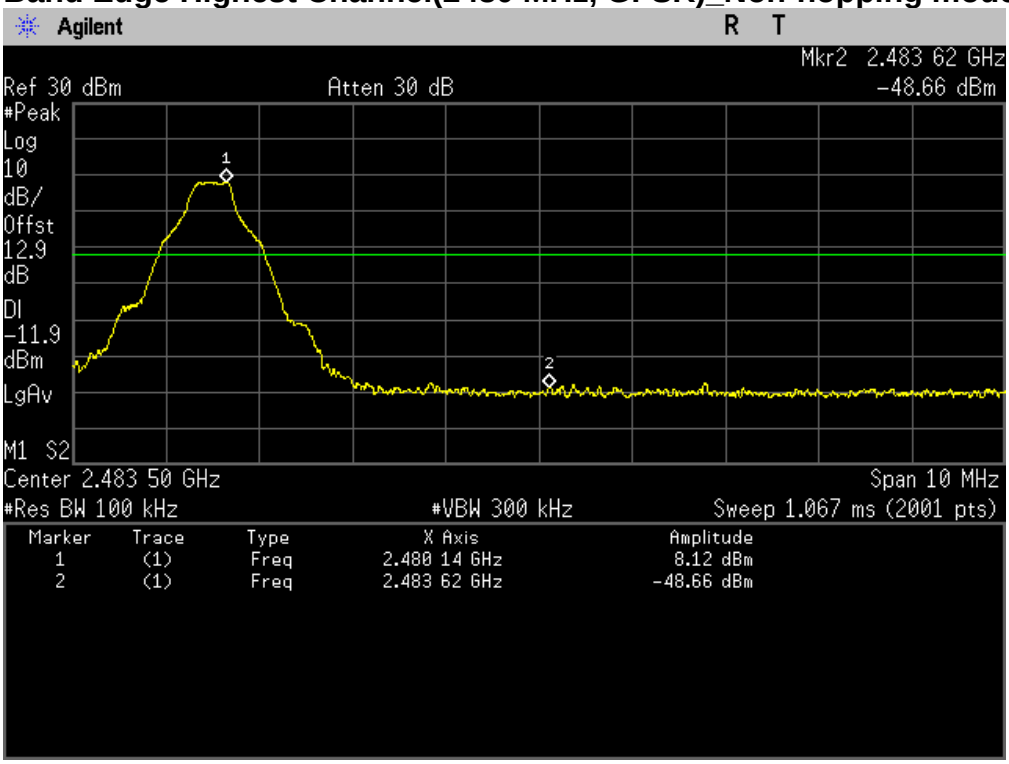


Band Edge Lowest Channel(2402 MHz, GFSK)_Hopping mode

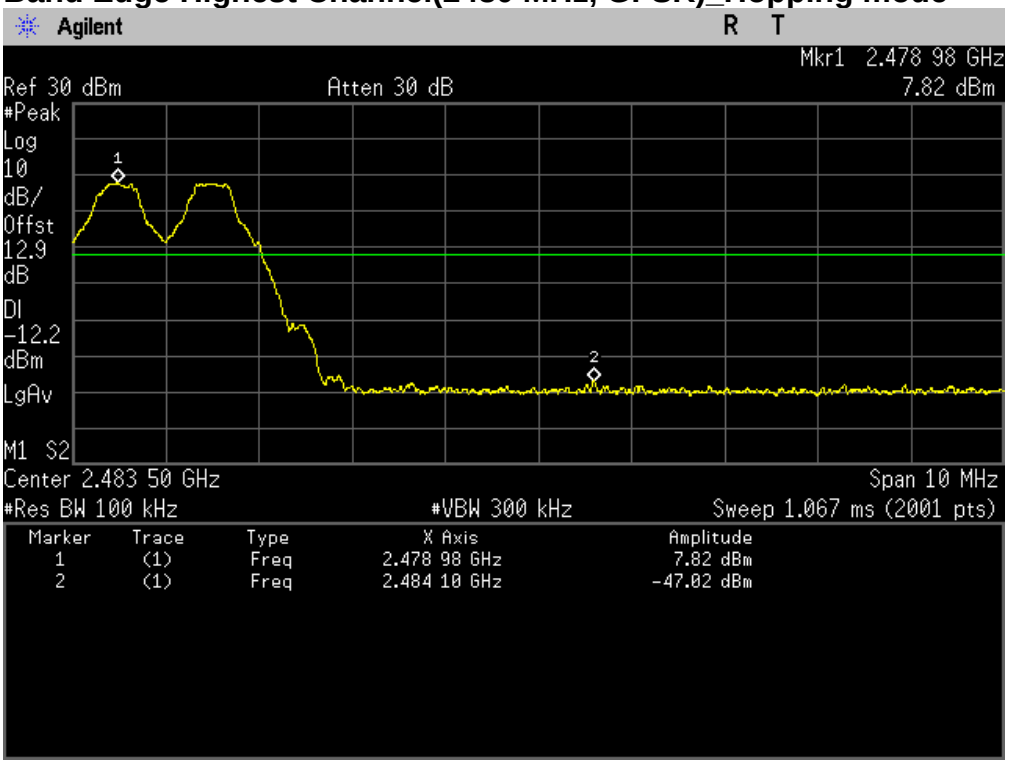


PLOT OF TEST DATA

Band Edge Highest Channel(2480 MHz, GFSK)_Non-hopping mode

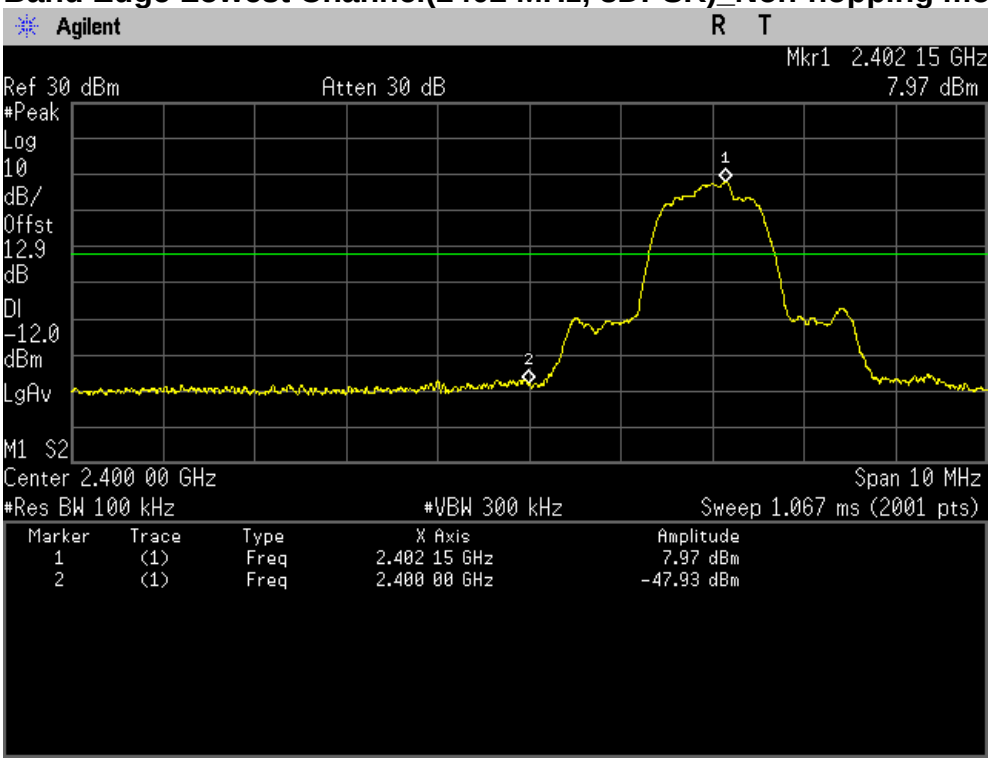


Band Edge Highest Channel(2480 MHz, GFSK)_Hopping mode

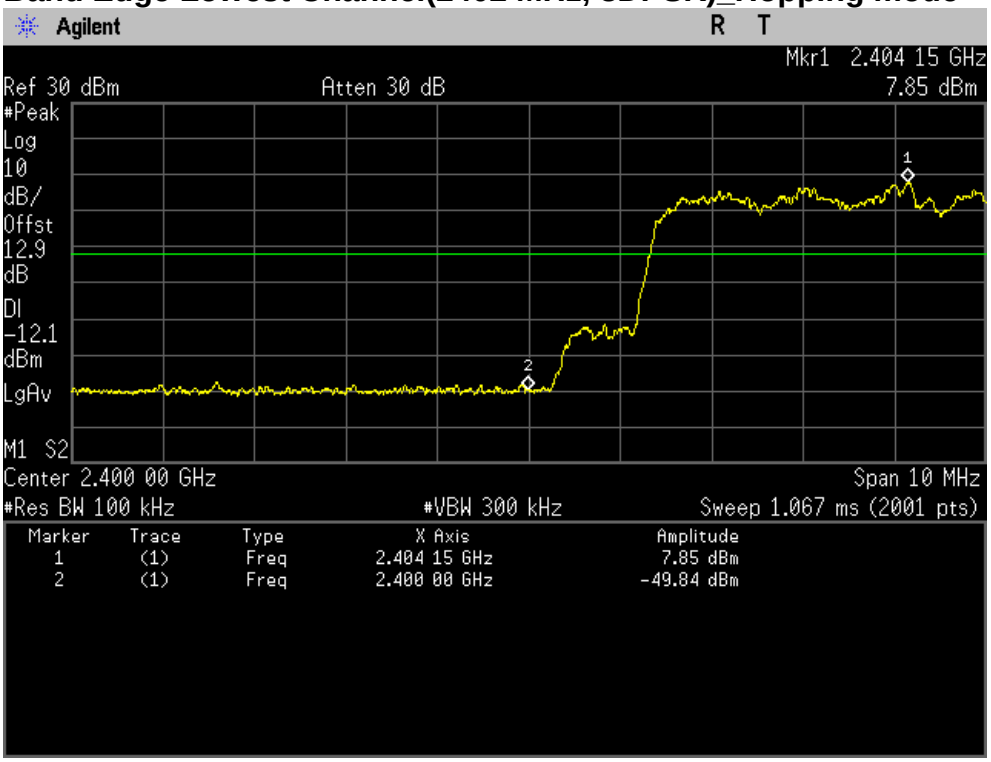


PLOT OF TEST DATA

Band Edge Lowest Channel(2402 MHz, 8DPSK)_Non-hopping mode

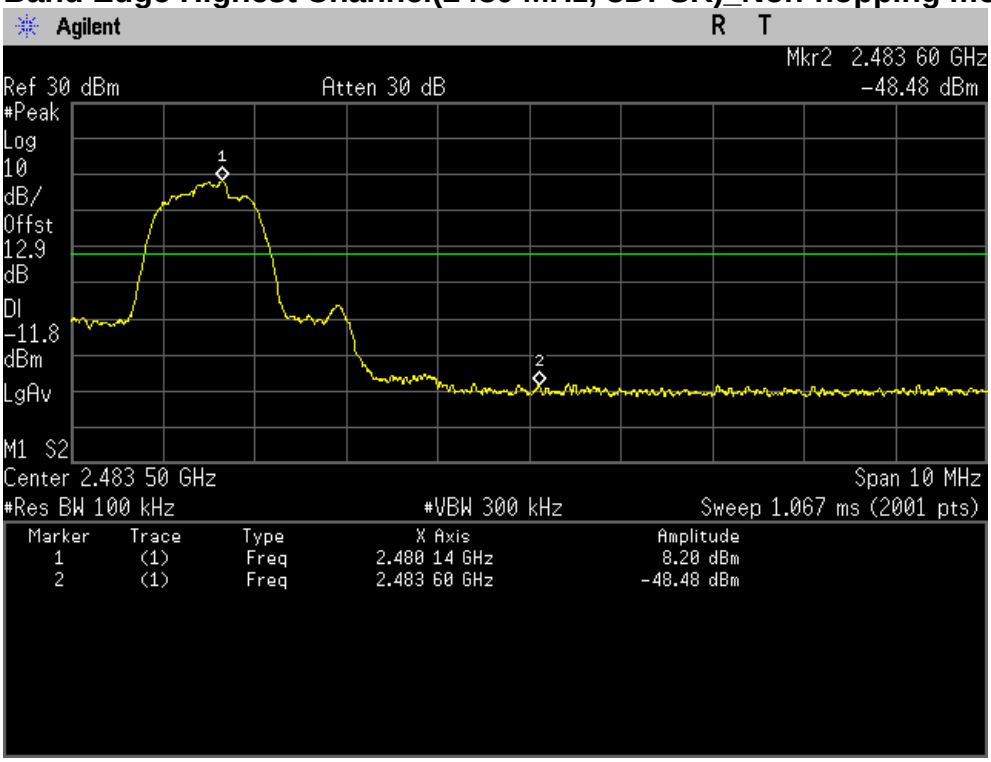


Band Edge Lowest Channel(2402 MHz, 8DPSK)_Hopping mode

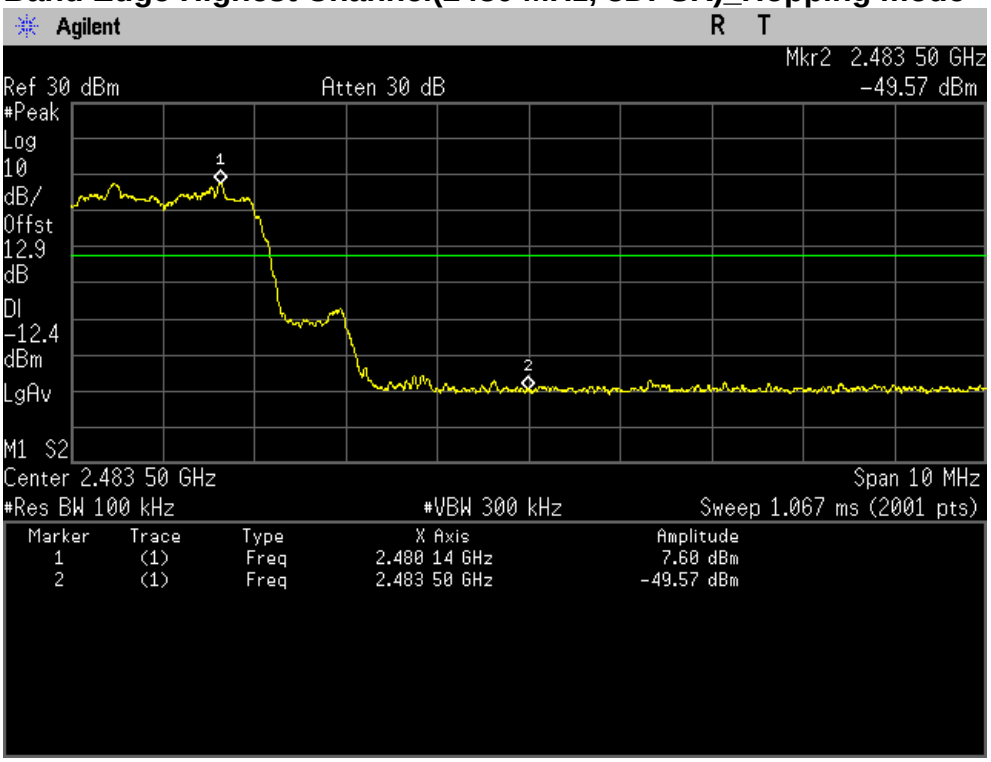


PLOT OF TEST DATA

Band Edge Highest Channel(2480 MHz, 8DPSK)_Non-hopping mode



Band Edge Highest Channel(2480 MHz, 8DPSK)_Hopping mode



8.9 Radiated Spurious Emission

FCC §15.247(d), RSS-210 A8.5

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)
1152.50	42.2	H	peak	-4.4	37.8	74.0	36.2
1152.50	35.0	H	average	-4.4	30.6	54.0	23.4
1333.25	43.1	H	peak	-3.8	39.3	74.0	34.7
1333.25	34.8	H	average	-3.8	31.0	54.0	23.0
1452.50	42.4	H	peak	-3.7	38.7	74.0	35.3
1452.50	35.0	H	average	-3.7	31.3	54.0	22.7
1496.50	45.4	V	peak	-3.5	41.9	74.0	32.1
1496.50	36.3	V	average	-3.5	32.8	54.0	21.2
1664.25	45.7	V	peak	-2.9	42.8	74.0	31.2
1664.25	34.5	V	average	-2.9	31.6	54.0	22.4
2242.50	46.4	V	peak	-1.3	45.1	74.0	28.9
2242.50	36.0	V	average	-1.3	34.7	54.0	19.3
4803.75	38.2	H	peak	9.0	47.2	74.0	26.8
4803.75	31.6	H	average	9.0	40.6	54.0	13.4

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1331.00	44.9	H	peak	-3.8	41.1	74.0	32.9
1331.00	35.8	H	average	-3.8	32.0	54.0	22.0
1421.25	44.0	H	peak	-3.7	40.3	74.0	33.7
1421.25	34.8	H	average	-3.7	31.1	54.0	22.9
1496.25	46.2	H	peak	-3.5	42.7	74.0	31.3
1496.25	36.5	H	average	-3.5	33.0	54.0	21.0
1661.75	44.7	V	peak	-2.9	41.8	74.0	32.2
1661.75	34.1	V	average	-2.9	31.2	54.0	22.8
1696.25	45.4	V	peak	-2.9	42.5	74.0	31.5
1696.25	34.5	V	average	-2.9	31.6	54.0	22.4
2242.5	45.1	V	peak	-1.3	43.8	74.0	30.2
2242.5	35.1	V	average	-1.3	33.8	54.0	20.2
4881.75	38.6	V	peak	9.2	47.8	74.0	26.2
4881.75	31.1	V	average	9.2	40.3	54.0	13.7

Highest Channel

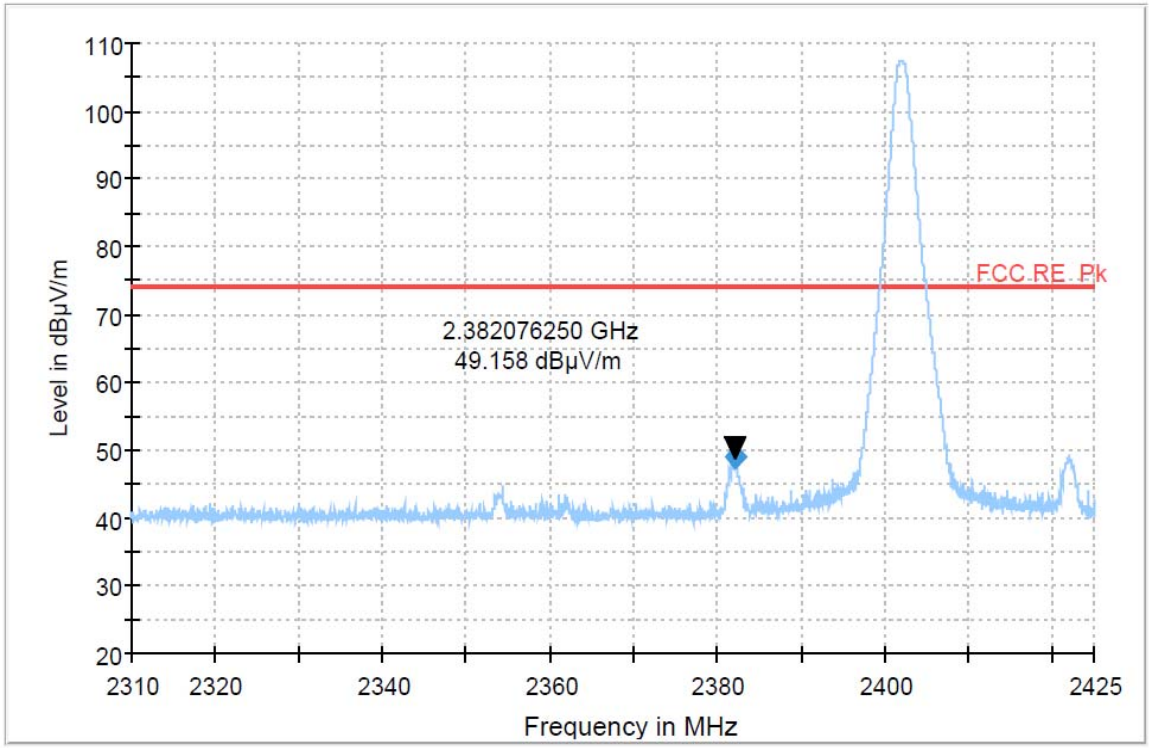
Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1330.50	43.0	H	peak	-3.8	39.2	74.0	34.8
1330.50	34.4	H	average	-3.8	30.6	54.0	23.4
1497.00	45.7	H	peak	-3.5	42.2	74.0	31.8
1497.00	36.4	H	average	-3.5	32.9	54.0	21.1
1593.75	43.3	V	peak	-3.2	40.1	74.0	33.9
1593.75	33.6	V	average	-3.2	30.4	54.0	23.6
1666.75	45.7	V	peak	-2.9	42.8	74.0	31.2
1666.75	34.2	V	average	-2.9	31.3	54.0	22.7
1694.75	43.6	H	peak	-2.9	40.7	74.0	33.3
1694.75	34.5	H	average	-2.9	31.6	54.0	22.4
2245.50	46.5	V	peak	-1.3	45.2	74.0	28.8
2245.50	37.0	V	average	-1.3	35.7	54.0	18.3
4960.12	37.7	H	peak	9.4	47.1	74.0	26.9
4960.12	30.0	H	average	9.4	39.4	54.0	14.6

Note:

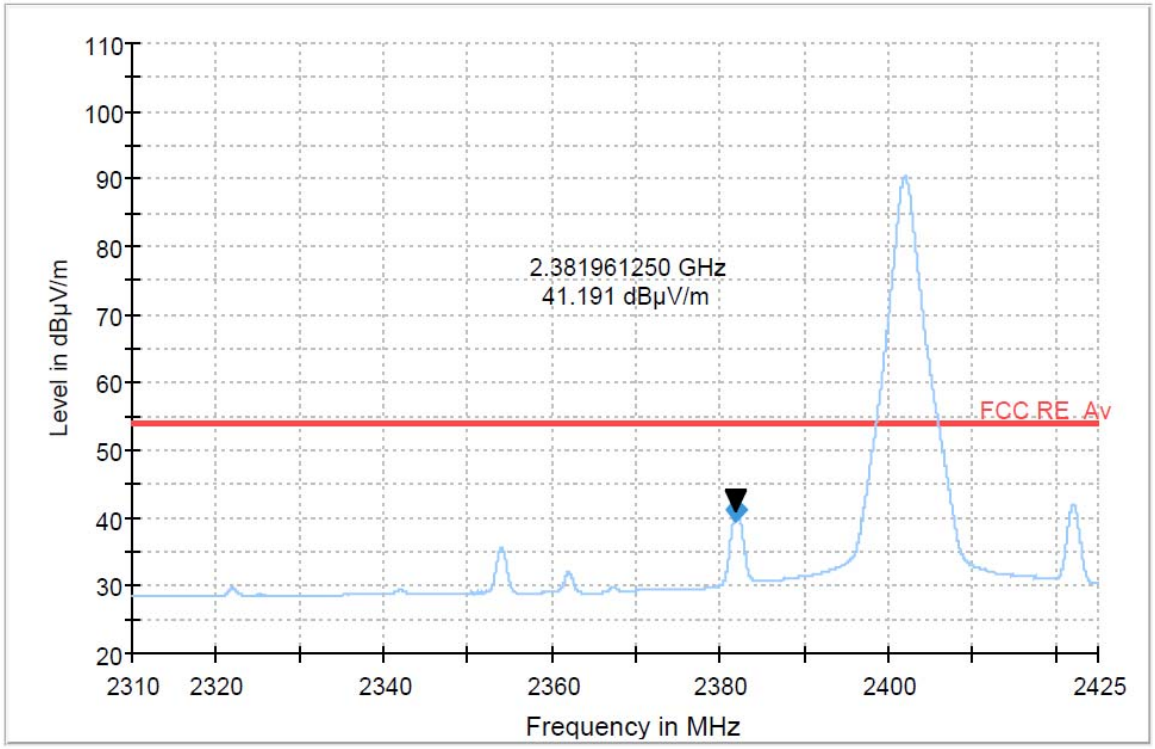
1. ***Pol. H = Horizontal V = Vertical***
2. *****AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.***
3. ***Other spurious was under 20 dB below Fundamental.***
4. ***The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.***
5. ***GFSK modulation mode was the worst condition.***
6. ***For measurements the resolution bandwidth was set to 1 MHz, and then the video bandwidth was set to 1 MHz for peak measurements and 10 Hz for average measurements.***
7. ***The spectrum was measured from 9 kHz to 10th harmonic and the worst-case emissions were reported. No significant emissions were found beyond the fifth harmonic for this device.***

PLOT OF TEST DATA

Restricted Band Spurious Emissions, Lowest channel(GFSK, Peak)

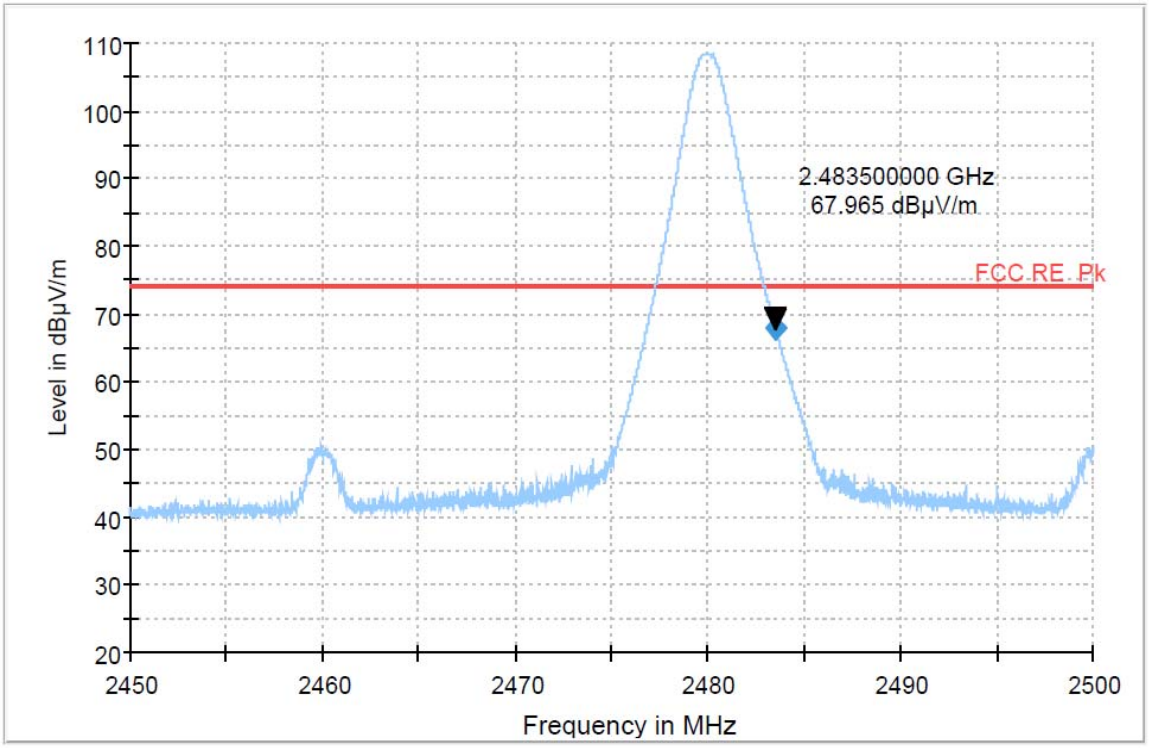


Restricted Band Spurious Emissions, Lowest channel(GFSK, Average)

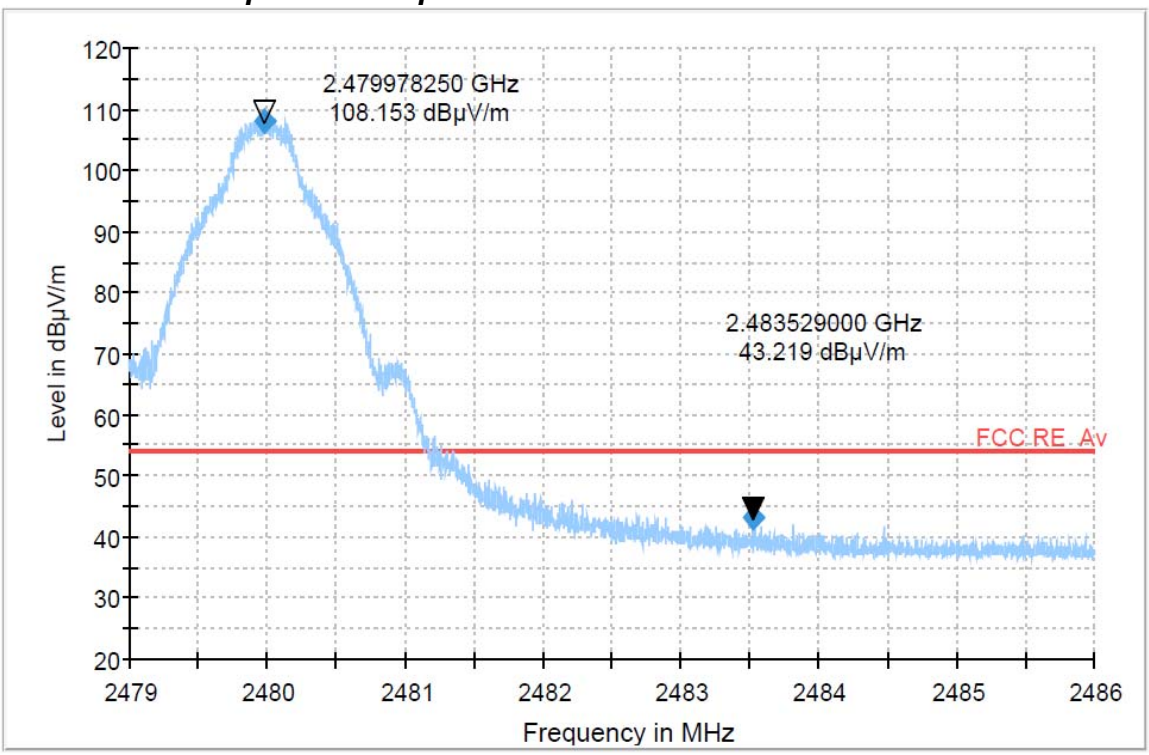


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel(GFSK, Peak)



Restricted Band Spurious Emissions, Highest channel
(GFSK, Peak, RBW/VBW: 100 kHz)
The result of Step2 on KDB publication No. 913591



PLOT OF TEST DATA

Table 1

Frequency (MHz)	Reading (dBμV)	Pol. H/V	Ant + Cl + Amp (dB)	Result (dBμV/m)
2480	109.7	H	-1.5	108.2
2483.5	44.7	H	-1.5	43.2

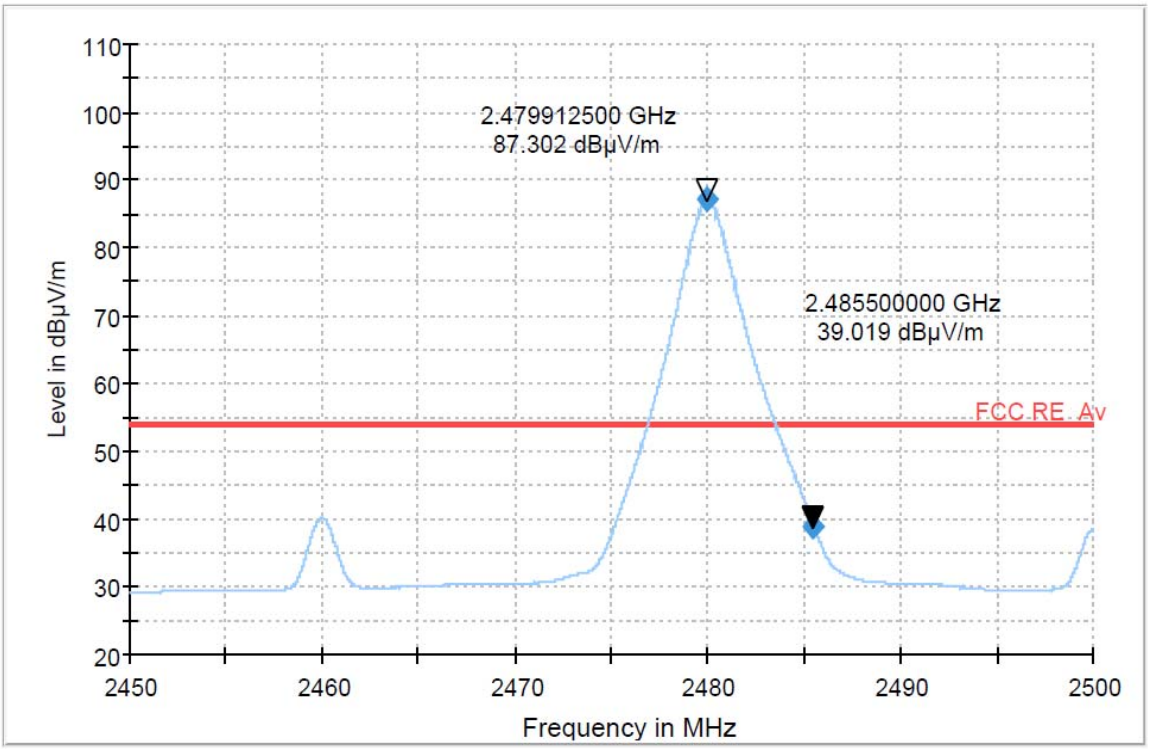
Equation 1

The amount of emission drop factor is,

108.2 – 43.2 = 65.0 dB

Restricted Band Spurious Emissions, Highest channel (GFSK, Average)

The result of Step3 & 4 on KDB publication No. 913591



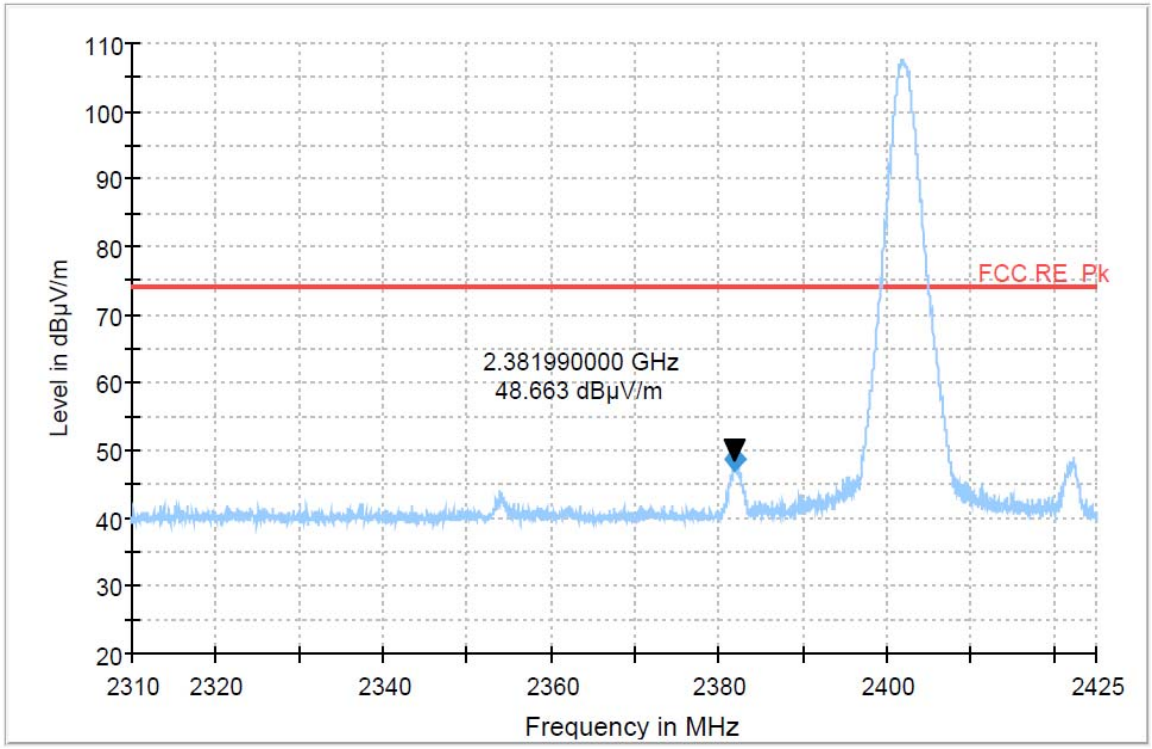
Equation 2

The band edge emission level is, (at 2483.5 MHz)

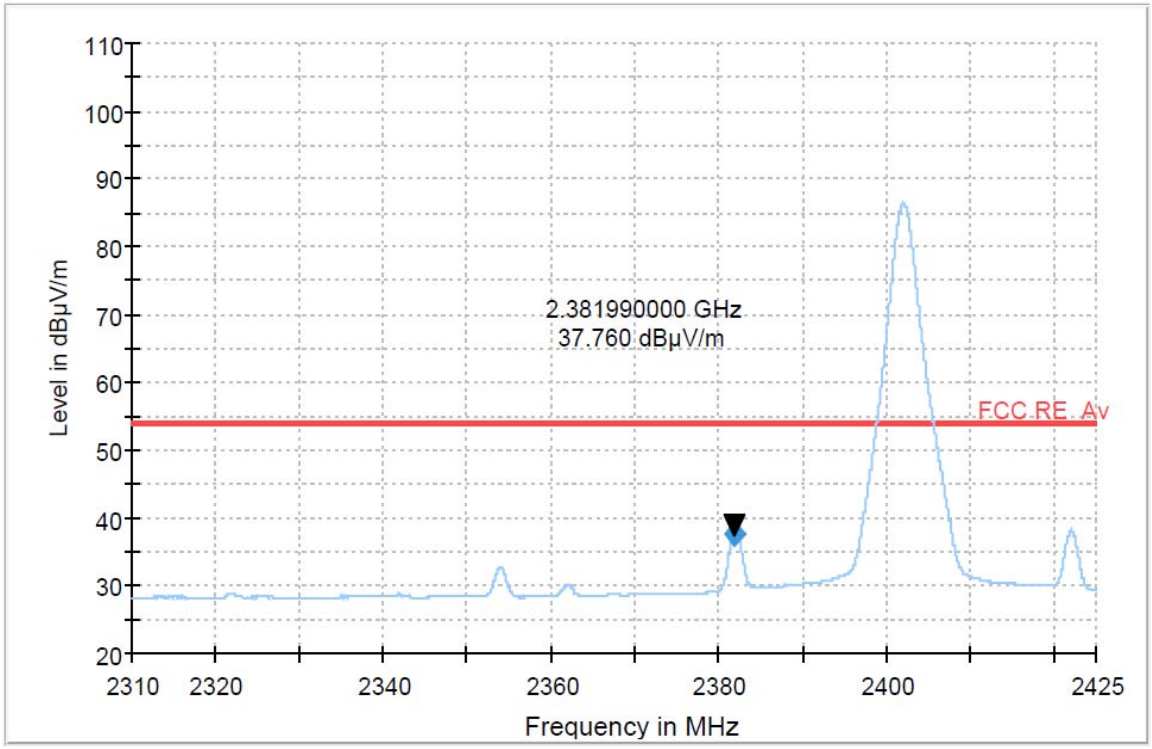
87.3 – 65.0 = 22.3 dBμV/m

PLOT OF TEST DATA

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

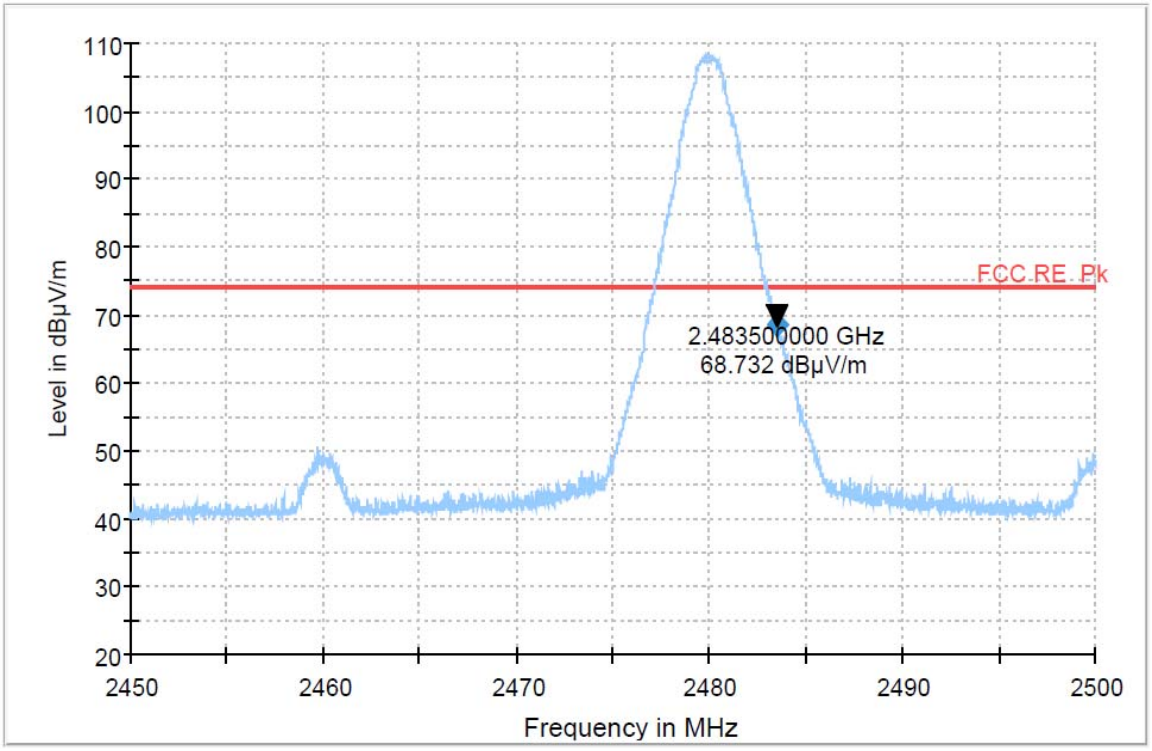


Restricted Band Spurious Emissions, Lowest channel(8DPSK, Average)

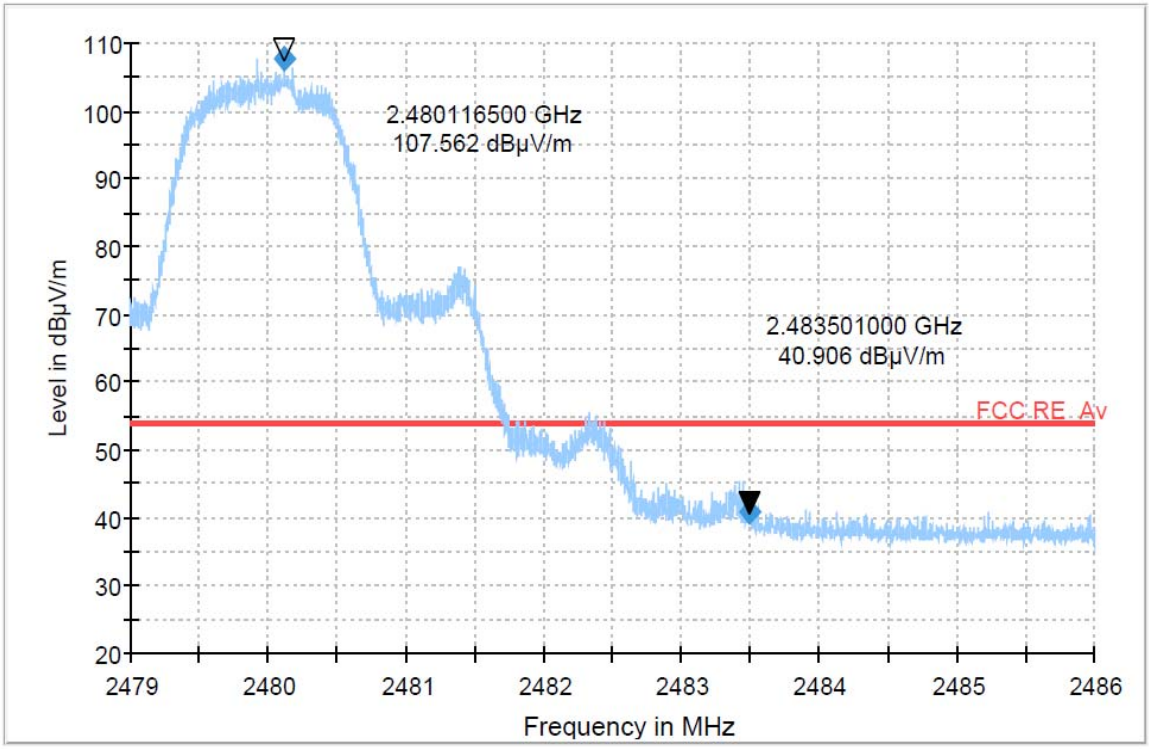


PLOT OF TEST DATA

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



Restricted Band Spurious Emissions, Highest channel
(8DPSK, Peak, RBW/VBW: 100 kHz)
The result of Step2 on KDB publication No. 913591



PLOT OF TEST DATA

Table 1

Frequency (MHz)	Reading (dBμV)	Pol. H/V	Ant + Cl + Amp (dB)	Result (dBμV/m)
2480.1	107.8	H	-0.2	107.6
2483.5	41.1	H	-0.2	40.9

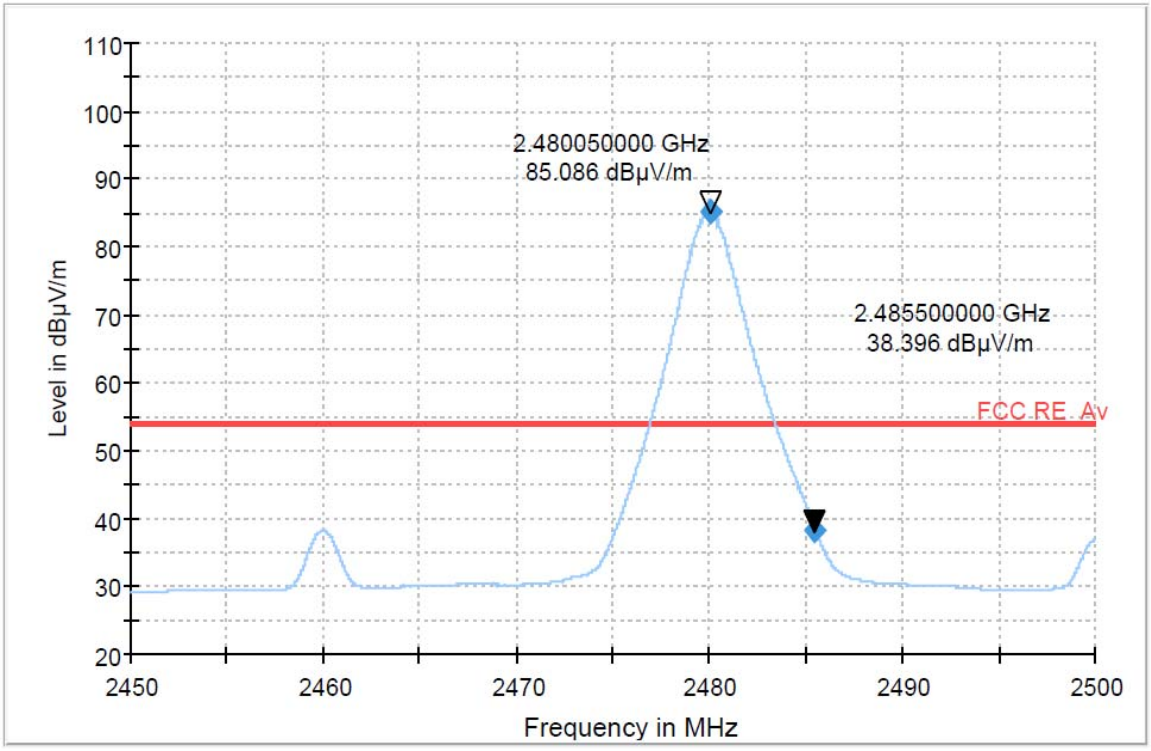
Equation 1

The amount of emission drop factor is,

107.6 – 40.9 = 66.7 dB

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

The result of Step3 & 4 on KDB publication No. 913591



Equation 2

The band edge emission level is, (at 2483.5 MHz)

85.1 – 66.7 = 18.4 dBμV/m

Note)

1. ***Pol. H = Horizontal V = Vertical**
2. ****AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.**
3. **The radiated emissions testing were made by rotating through three orthogonal axes. The worst date was recorded.**
4. **For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.**
5. **Band edge measurement has been performed according to Publication Number: 913591**

ANSI Standard C63.4-2003, which is incorporated into the FCC Rules by reference Section 15.31(a)(3), is the procedure the FCC uses for testing intentional radiators. See C63.4-2003 for guidance on the use of a spectrum analyzer.
In making radiated band edge measurements, there can be a problem obtaining meaningful data since a measurement instrument that is tuned to a band edge frequency may also capture some in-band signals when using the resolution bandwidth (RBW) as specified by measurement procedure ANSI C63.4-1992, unless precautions are followed. The following technique may be used for determining band edge compliance in an effort to ensure that the proper precautions are followed.

STEP 1 - Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function for the frequency being measured, as required by C63.4 and FCC Rules. For example, for a device operating in the 902-928 MHz band under Section 15.249, use a 120 kHz RBW with a CISPR Quasi-Peak detector. A peak detector with 100 kHz RBW may also be used. For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector (as required by Section 15.35). Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW). Note: For pulsed emissions, other factors (e.g., pulse desensitization correction factor) must be included in the calculations. Also, note that radiated measurements of the fundamental emission of a transmitter operating under 15.247 are not normally required, but they are necessary in connection with this procedure.

STEP 2 - Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.

STEP 3 - Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band edge compliance as required by Section 15.205.

STEP 4 - The above delta measurement technique may be used for measuring emissions that are up to two standard bandwidths away from the band edge, where a standard bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the delta technique for measuring emissions up to 2 MHz removed from the band edge. Radiated emissions that are removed by more than two standard bandwidths must be measured in the conventional manner.

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 12 2012	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 08 2012	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 17 2012	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 16 2012	1 year
5	*Amplifier	R & S	SCU18	10065	Apr. 05 2012	1 year
6	*Amplifier	R & S	SCU26	10011	Jun. 01 2012	1 year
7	Amplifier	R & S	SCU40	10008	Jun. 01 2012	1 year
8	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2012	1 year
9	*Pre Amplifier	HP	8447F	2805A03351	Jul. 17 2012	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 16 2012	1 year
11	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Apr. 05 2012	1 year
12	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 17 2012	1 year
13	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 21 2012	2 year
14	Wideband Power Sensor	R & S	NRP-Z81	100634	Apr. 05 2012	1 year
15	*Biconical Log Antenna	ARA	LPB-2520/A	1209	Dec. 21 2010	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 28 2011	2 year
18	Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 28 2011	2 year
19	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 year
20	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 26 2012	2 year
21	*LISN	R & S	ESH3-Z5	833874/006	Oct. 08 2012	1 year
22	*LISN	R & S	ESH2-Z5	100227	Apr. 04 2012	1 year
23	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
25	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
26	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
27	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
28	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
32	*Shielded Room	Seo-Young EMC	N/A	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				
Receiver reading	***RI***	± 0.10	normal 1	1.000	0.10	1	0.10
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***	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	***AF***	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	***CL***	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	***AD***	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	***AH***	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	***AP***	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	***AI***	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	***SI***	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	***DV***	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	***Dbal***	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	***DCross***	± 0.90	rectangular	1.732	0.52	1	0.52
ⓐ Mismatch	***M***	+ 0.25	U-Shaped	1.414	0.18	1	0.18
ⓑ Mismatch	***M***	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
ⓒ Mismatch	***M***	+ 0.98	U-Shaped	1.414	0.69	1	0.69
ⓓ Mismatch	***M***	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	***RS***	0.09	normal 1	1.000	0.09	1	0.09
Remark	ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) ⓒ: Log Periodic Antenna-receiver Mismatch : + (≧ 200 MHz) ⓓ: Log Periodic Antenna-receiver Mismatch : - (≧ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≧200 MHz)			
Expended Uncertainty U	Normal (*k* = 2)			± 5.26 (< 200 MHz) ± 5.48 (≧200 MHz)			