SGS Korea Co., Ltd.
4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
Tel. +82 31 428 5700 / Fax. +82 31 427 2370
http://www.sgsgroup.kr

TEST REPORT

of

FCC Part 15 Subpart C §15.247
IC RSS-247 Issue 2 and RSS-Gen Issue 5

FCC ID: A3LSMT870
IC Certification: 649E-SMT870

1. Equipment Under Test	:	Portable Tablet
2. Model Name	:	SM-T870
3. Variant Model Name(s)	:	-
4. Applicant	:	Samsung Electronics Co., Ltd.
5. Date of Receipt	:	2020.06.12
6. Date of Test(s)	:	2020.06.05 ~ 2020.07.16
7. Date of Issue	:	2020.07.27

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Tested by: **Jinhyoung Cho**

Technical Manager: **Jungmin Yang**

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.
Phone No. : +82 31 688 0901
Fax No. : +82 31 688 0921

1.2. Details of Applicant

Applicant : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Contact Person : Seo, Deok-ho
Phone No. : +82 10 3955 6246

1.3. Description of EUT

Kind of Product		Portable Tablet
Model Name		SM-T870
Serial Number		R32N60011ZB, R32N60012YN
Power Supply		DC 3.86 V
Frequency Range		2 402 ㎒ ~ 2 480 ㎒ (Bluetooth)
Modulation Technique		GFSK, π/4DQPSK, 8DPSK
Number of Channels		79 channels (Bluetooth)
Antenna Type		Metal Frame Antenna
Antenna Gain	**Ant.1**	-5.10 ㏈i
	Ant.2	-4.80 ㏈i
H/W Version		REV1.0
S/W Version		T870.001
Test S/W Version		T870XXE0ATF7

1.4. Declaration by the Manufacturer

- Adaptive Frequency Hopping is supported and use at least 20 channels.
- The EUT can operate Bluetooth both Ant.1 and Ant.2, but it can't operate at the same time.

1.5. Introduction of Test Data Reuse

This report referenced from the FCC ID: A3LSMT875 BT.
The applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.6. Difference

The FCC ID: A3LSMT870 shares the same enclosure and circuit board as FCC ID: A3LSMT875.
The BT antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions and conducted power that the performance of the FCC ID: A3LSMT875 remains representative of FCC ID: A3LSMT870.
The test data of FCC ID: A3LSMT875 being submitted for this application to cover BT features.

1.7. Spot Check Data

Band	Test item	Mode	Frequency (㎒)	Limit	Original model	Spot check model	Deviation (㏈)	Remark
					SM-T875	SM-T870		
					FCC ID: A3LSMT875	FCC ID: A3LSMT870 IC Certification: 649E-SMT870		
BT	Conducted power	8DPSK_Ant.1	2 441	20.97 ㏈m	17.87 ㏈m	17.79 ㏈m	-0.08	-
	Band edge	8DPSK_Ant.1	2 480	74 ㏈㎶/m	68.08 ㏈㎶/m	67.04 ㏈㎶/m	-1.04	-
	Spurious	8DPSK_Ant.1	2 480	74 ㏈㎶/m	31.03 ㏈㎶/m	30.85 ㏈㎶/m	-0.18	Noise floor level

Note;

Comparison of two models, upper deviation is within 3 ㏈ range and all test results are under FCC/IC technical limits.

1.8. Reference Detail

Reference applicant that contains the reused reference data in the individual test reports:

Equipment class	Reference FCC ID	Application type	Reference test report number	Exhibit type	Variant test report number	Data reuse
DSS	A3LSMT875	Original grant	F690501-RF-RTL000913 (BT)	Test report	F690501-RF-RTL000959	All
DTS			F690501-RF-RTL000914 (LE)		F690501-RF-RTL000960	
			F690501-RF-RTL000916 (802.11b/g/n/ac)		F690501-RF-RTL000961	
			F690501-RF-RTL000917 (802.11ax)		F690501-RF-RTL000962	
NII			F690501-RF-RTL000919 (802.11a/n/ac)		F690501-RF-RTL000963	
			F690501-RF-RTL000921 (802.11ax)		F690501-RF-RTL000964	
			F690501-RF-RTL000922 (802.11a/n/ac/ax_DFS)		F690501-RF-RTL000965	
DCD			F690501-RF-RTL000925 (WPT)		F690501-RF-RTL000966	

1.9. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMR40	100272	Jun. 18, 2020	Annual	Jun. 18, 2021
Signal Generator	R&S	SMBV100A	255834	Jun. 03, 2020	Annual	Jun. 03, 2021
Spectrum Analyzer	R&S	FSV30	103210	Nov. 05, 2019	Annual	Nov. 05, 2020
Spectrum Analyzer	Agilent	N9030A	US51350132	Nov. 15, 2019	Annual	Nov. 15, 2020
Bluetooth Tester	TESCOM	TC-3000C	3000C000296	Jun. 01, 2020	Annual	Jun. 01, 2021
Directional Coupler	KRYTAR	152613	140972	Jun. 11, 2020	Annual	Jun. 11, 2021
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	May 18, 2020	Annual	May 18, 2021
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	Jun. 05, 2020	Annual	Jun. 05, 2021
Low Pass Filter	Mini-Circuits	NLP-1200+	V 9500401023-2	Jun. 01, 2020	Annual	Jun. 01, 2021
Power Sensor	R&S	NRP-Z81	101421	Dec. 26, 2019	Annual	Dec. 26, 2020
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 03, 2020	Annual	Mar. 03, 2021
Preamplifier	H.P.	8447F	2944A03909	Aug. 07, 2019	Annual	Aug. 07, 2020
Signal Conditioning Unit	R&S	SCU-18	10117	Jun. 10, 2020	Annual	Jun. 10, 2021
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 08, 2020	Annual	May 08, 2021
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Horn Antenna	R&S	HF906	100326	Feb. 14, 2020	Annual	Feb. 14, 2021
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	BBHA9170431	Sep. 10, 2018	Biennial	Sep. 10, 2020
Test Receiver	R&S	ESU26	100109	Feb. 18, 2020	Annual	Feb. 18, 2021
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	PL520-NMNM-4M (4 m)	20200324001	May 06, 2020	Semi-annual	Nov. 06, 2020
Coaxial Cable	RFONE	PL520-NMNM-10M (10 m)	20200324001	May 06, 2020	Semi-annual	Nov. 06, 2020
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 01/20	Feb. 23, 2020	Semi-annual	Aug. 23, 2020
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 05/20	Feb. 23, 2020	Semi-annual	Aug. 23, 2020
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 10/20	Feb. 23, 2020	Semi-annual	Aug. 23, 2020
Test Receiver	R&S	ESCI 7	100911	Feb. 19, 2020	Annual	Feb. 19, 2021
Two-Line V-Network	R&S	ENV216	100190	May 08, 2020	Annual	May 08, 2021
Shield Room	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

1.10. Information about the FHSS characteristics:

1.10.1. Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

1.10.2. Equal Hopping Frequency Use

The channels of this system will be used equally over the long-term distribution of the hopsets.

1.10.3. Example of a 79 hopping sequence in data mode:

02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 16, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 05, 16, 68, 74, 59, 63, 55

1.10.4. System Receiver Input Bandwidth

Each channel bandwidth is 1 ㎒.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.10.5. Equipment Description

15.247(a)(1) that the Rx input bandwidths shift frequencies in synchronization with the transmitted signals.

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

1.11. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C, IC RSS-247 Issue 2 and RSS-Gen Issue 5			
Section in FCC	**Section in IC**	**Test Item(s)**	**Result**
15.205(a) 15.209 15.247(d)	RSS-247 Issue 2 5.5 RSS-Gen Issue 5 8.9	Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	Complied
15.247(a)(1)	RSS-247 Issue 2 5.1(b) RSS-Gen Issue 5 6.7	20 dB Bandwidth & 99 % Bandwidth	Complied
15.247(a)(1) 15.247(b)(1)	RSS-247 Issue 2 5.1(b) 5.4(b)	Maximum Peak Conducted Output Power	Complied
15.247(a)(1)	RSS-247 Issue 2 5.1(b)	Carrier Frequency Separation	Complied
15.247(a)(1)(iii)	RSS-247 Issue 2 5.1(d)	Number of Hopping Frequencies	Complied
15.247(a)(1)(iii)	RSS-247 Issue 2 5.1(d)	Time of Occupancy (Dwell Time)	Complied
15.207	RSS-Gen Issue 5 8.8	AC Power Line Conducted Emission	Complied

1.12. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 15.247 Meas Guidance v05r02 were used in the measurement of the DUT.

1.13. Sample Calculation

Where relevant, the following sample calculation is provided:

1.13.1. Conducted Test

Offset value (dB) = Directional coupler (dB) + Cable loss (dB)

1.13.2. Radiation Test

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB) + Duty Factor (dB)

1.14. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000959	2020.07.17	Initial
1	F690501-RF-RTL000959-1	2020.07.27	Modified reference test report number of 1.8. reference detail.

1.15. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Conducted Disturbance	± 3.45 dB
Radiated Emission, 9 ㎑ to 30 ㎒	± 3.59 dB
Radiated Emission, below 1 ㎓	± 5.88 dB
Radiated Emission, above 1 ㎓	± 5.94 dB

Uncertainty figures are valid to a confidence level of 95 %.

1.16. Descriptions of Test Mode

Preliminary tests were performed in different data rates and recorded the RF output power in the following table:

Operation Mode	Data Rate (Mbps)	Frequency (㎒)	Packet type	RF Peak Power (㏈m)	
				Ant. 1	Ant. 2
GFSK	1	2 480	DH1	16.60	16.12
			DH3	16.21	15.76
			DH5	16.04	15.63
π/4DQPSK	2	2 480	DH1	17.77	17.32
			DH3	17.49	16.97
			DH5	17.19	16.82
8DPSK	3	2 480	DH1	18.23	17.73
			DH3	17.84	17.42
			DH5	17.64	17.21

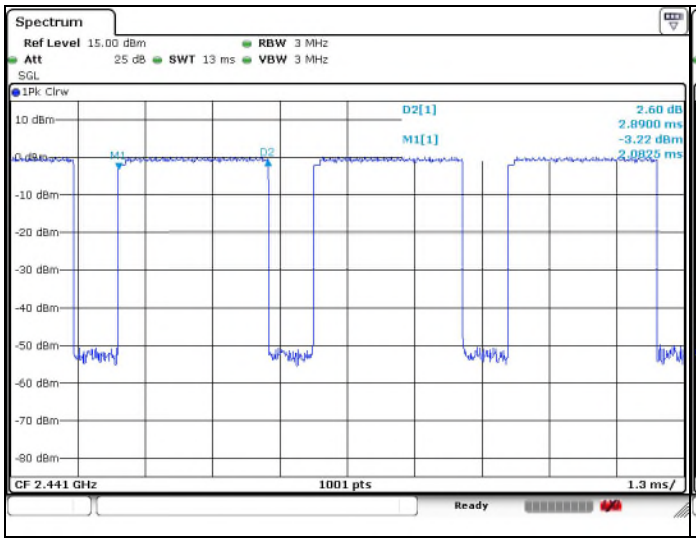
Note;

1. For transmitter radiated spurious emissions, conducted spurious emission, carrier frequency separation and number of hopping frequencies, GFSK / DH1 and 8DPSK / 3DH1 are tested as worst condition.
2. For 20 ㏈ bandwidth and maximum peak conducted output power, GFSK / DH1, π/4DQPSK / 2DH1 and 8DPSK / 3DH1 are tested as worst condition.
3. For Time of Occupancy, GFSK / DH1, DH3, DH5 and 8DPSK / 3DH1, 3DH3, 3DH5 are tested as worst condition.

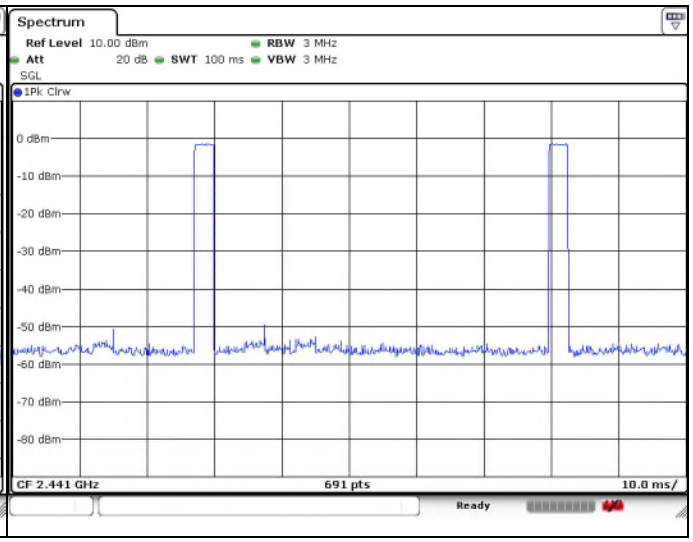
1.17. Duty Cycle Correction Factor of EUT

According to KDB 558074 D01 15.247 Meas Guidance v05r02, 9, as a “duty cycle correction factor”, pulse averaging with 20 log (worst case dwell time / 100 ㎳) has to be used for average result.

3DH5 on time (One Pulse) Plot on Channel 39



3DH5 on time (Count Pulses) Plot on Channel 39



In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time 3DH5 packet is observed;
the period to have 3DH5 packet completing one hopping sequence is 2.89 ㎳ x 20 channels = 57.80 ㎳

There cannot be 2 complete hopping sequences within 100 ㎳ period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ㎳ / 57.80 ㎳] = 2 hops

Thus, the maximum possible ON time:

2.89 ㎳ x 2 = 5.78 ㎳

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time:

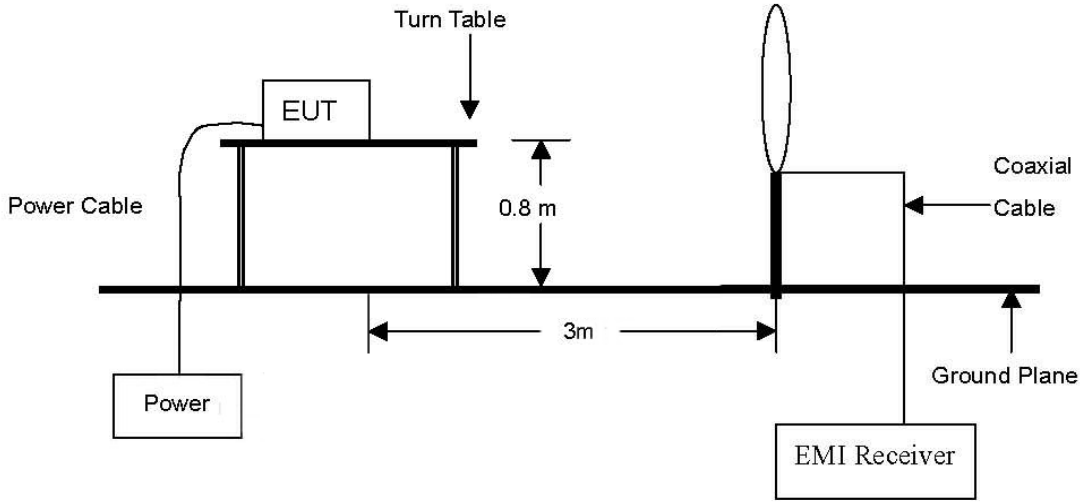
20 x log (5.78 ㎳/100 ㎳) = -24.76 ㏈

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

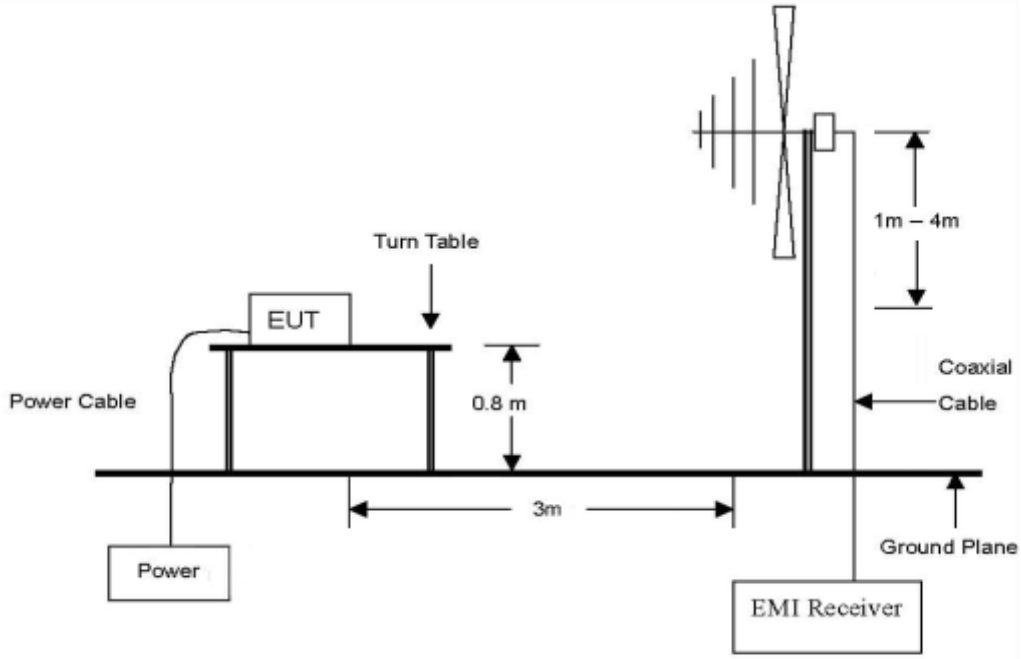
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

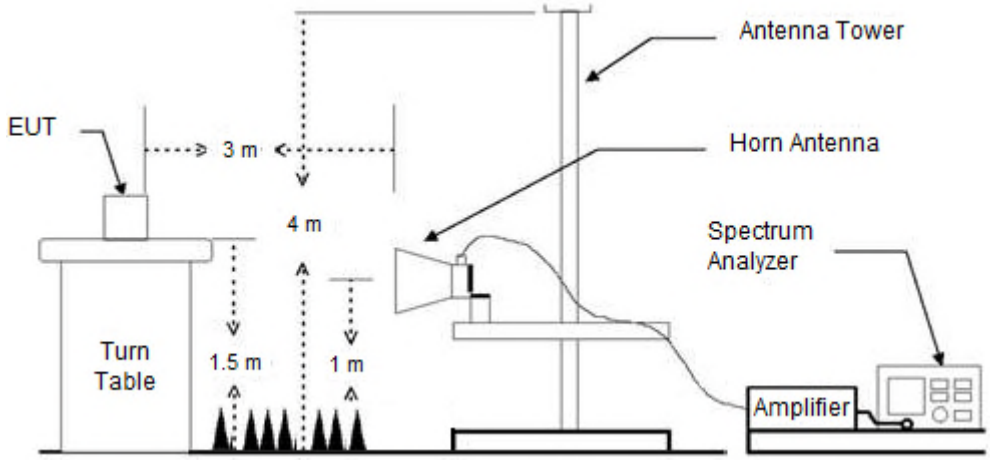
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.



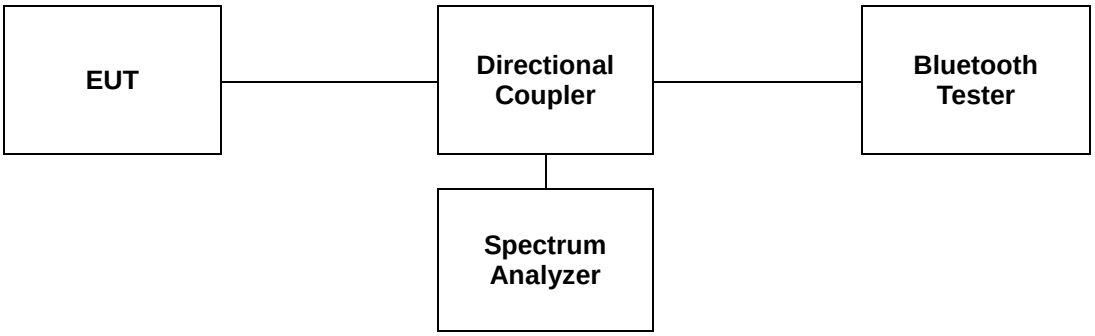
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.1.2. Conducted Spurious Emissions



2.2. Limit

2.2.1. FCC

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Frequency (㎒)	Field Strength (㎶/m)	Measurement Distance (Meters)
0.009-0.490	2 400/F(㎑)	300
0.490-1.705	24 000/F(㎑)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

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

2.2.2. IC

According to RSS-247 Issue 2, 5.5, in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen Issue 5, 8.9, except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General Field Strength Limits at frequencies above 30 ㎒

Frequency (㎒)	Field Strength (㎶/m at 3 m)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 6 – General Field Strength Limits at frequencies below 30 ㎒

Frequency	Magnetic Field Strength (H-Field) (㎂/m)	Measurement Distance (meters)
9-490 ㎑ [1]	6.37/F (F in ㎑)	300
490-1 705 ㎑	63.7/F (F in ㎑)	30
1.705-30 ㎒	0.08	30

Note[1]: The emission limits for the ranges 9-90 ㎑ and 110-490 ㎑ are based on measurements employing a linear average detector.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then Antenna is a loop Antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the Antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

Note;

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788 D01 Radiated Test Site v01r01.

2.3.2. Test Procedures for emission from above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 ㎓ and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving Antenna, which was mounted on the top of a variable-height Antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving Antenna.
3. The Antenna is a bi-log Antenna, a horn Antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the Antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the Antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. For frequency above 1 ㎓, set spectrum analyzer detector to peak, and resolution bandwidth is 1 ㎒ and video bandwidth is 3 ㎒.
3. Definition of DUT Axis.
   Definition of the test orthogonal plan for EUT was described in the test setup photo.
   The test orthogonal plan of EUT is **Z – axis** during radiation test.

2.3.3. Test Procedures for Conducted Spurious Emissions

2.3.3.1. Band-edge Compliance of RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.
Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
RBW ≥ 100 ㎑
VBW = 300 ㎑
Sweep = auto
Detector function = peak
Trace = max hold

2.3.3.2. Spurious RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.
RBW = 1 ㎒
VBW = 3 ㎒
Sweep = auto
Detector function = peak
Trace = max hold

2.3.3.3. TDF function

- For plots showing conducted spurious emissions from 9 ㎑ to 25 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.
So, the reading values shown in plots were final result.

2.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission below 1 000 ㎒

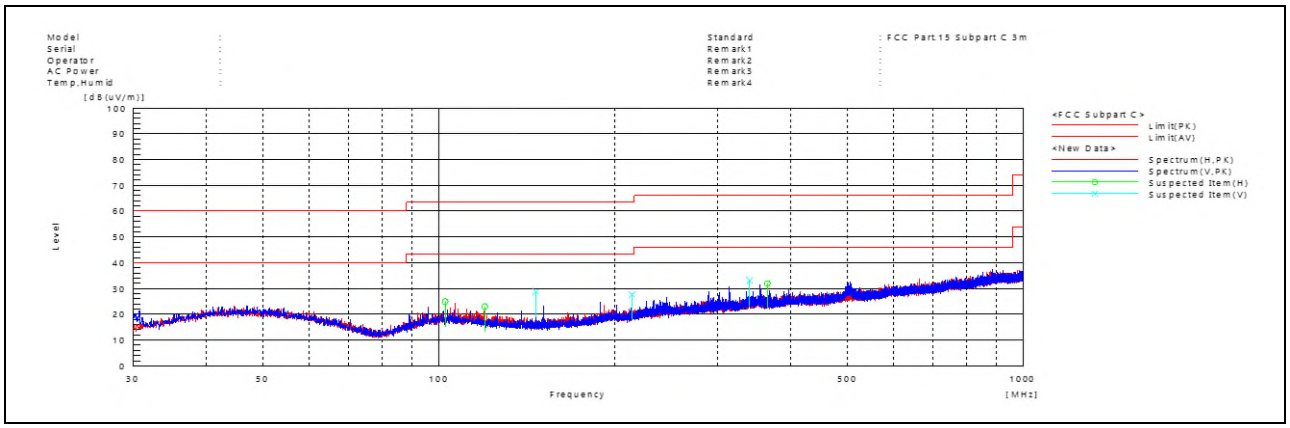
The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated. All reading values are peak values.

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
39.05	29.20	Peak	V	19.62	-27.49	21.33	40.00	18.67
41.96	30.30	Peak	H	20.30	-27.48	23.12	40.00	16.88
761.50	31.40	Peak	H	26.67	-25.02	33.05	46.00	12.95
Above 800.00	Not detected	-	-	-	-	-	-	-

Remark;

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **EDR(Ant.1) / 3DH1 / High channel** as worst case among other modes.
3. Radiated spurious emission measurement as below.
   (Actual = Reading + AF + AMP + CL)
4. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

- Test plot



2.4.2. Radiated Spurious Emission above 1 000 ㎒

The frequency spectrum above 1 000 ㎒ was investigated. All reading values are peak values.

Operating Mode: GFSK (1 Mbps)_Ant.1

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 310.00	29.37	Peak	H	27.96	8.64	-	65.97	74.00	8.03
*2 310.00	-	-	-	-	-	-24.76	41.21	54.00	12.79
*2 340.23	31.76	Peak	H	27.84	8.03	-	67.63	74.00	6.37
*2 340.23	-	-	-	-	-	-24.76	42.87	54.00	11.13
*2 390.00	29.69	Peak	H	28.20	7.04	-	64.93	74.00	9.07
*2 390.00	-	-	-	-	-	-24.76	40.17	54.00	13.83

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	30.99	Peak	H	28.37	6.50	-	65.86	74.00	8.14
*2 483.50	-	-	-	-	-	-24.76	41.10	54.00	12.90
*2 496.28	32.97	Peak	H	28.31	6.38	-	67.66	74.00	6.34
*2 496.28	-	-	-	-	-	-24.76	42.90	54.00	11.10
*2 500.00	29.46	Peak	H	28.30	6.35	-	64.11	74.00	9.89
*2 500.00	-	-	-	-	-	-24.76	39.35	54.00	14.65

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Operating Mode: 8DPSK (3 Mbps)_Ant.1

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	29.69	Peak	H	27.96	8.64	-	66.29	74.00	7.71
*2 310.00	-	-	-	-	-	-24.76	41.53	54.00	12.47
*2 381.87	31.87	Peak	H	28.12	7.09	-	67.08	74.00	6.92
*2 381.87	-	-	-	-	-	-24.76	42.32	54.00	11.68
*2 390.00	29.58	Peak	H	28.20	7.04	-	64.82	74.00	9.18
*2 390.00	-	-	-	-	-	-24.76	40.06	54.00	13.94

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	29.75	Peak	H	28.37	6.50	-	64.62	74.00	9.38
*2 483.50	-	-	-	-	-	-24.76	39.86	54.00	14.14
*2 483.90	33.22	Peak	H	28.36	6.50	-	68.08	74.00	5.92
*2 483.90	-	-	-	-	-	-24.76	43.32	54.00	10.68
*2 500.00	29.15	Peak	H	28.30	6.35	-	63.80	74.00	10.20
*2 500.00	-	-	-	-	-	-24.76	39.04	54.00	14.96

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Operating Mode: GFSK (1 Mbps)_Ant.2

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	28.78	Peak	H	27.96	8.64	-	65.38	74.00	8.62
*2 310.00	-	-	-	-	-	-24.76	40.62	54.00	13.38
*2 377.78	31.89	Peak	H	28.08	7.12	-	67.09	74.00	6.91
*2 377.78	-	-	-	-	-	-24.76	42.33	54.00	11.67
*2 390.00	29.32	Peak	H	28.20	7.04	-	64.56	74.00	9.44
*2 390.00	-	-	-	-	-	-24.76	39.80	54.00	14.20

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	30.46	Peak	H	28.37	6.50	-	65.33	74.00	8.67
*2 483.50	-	-	-	-	-	-24.76	40.57	54.00	13.43
*2 492.15	32.47	Peak	H	28.33	6.42	-	67.22	74.00	6.78
*2 492.15	-	-	-	-	-	-24.76	42.46	54.00	11.54
*2 500.00	30.16	Peak	H	28.30	6.35	-	64.81	74.00	9.19
*2 500.00	-	-	-	-	-	-24.76	40.05	54.00	13.95

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Operating Mode: 8DPSK (3 Mbps)_Ant.2

Low Channel (2 402 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	29.00	Peak	H	27.96	8.64	-	65.60	74.00	8.40
*2 310.00	-	-	-	-	-	-24.76	40.84	54.00	13.16
*2 387.75	31.63	Peak	H	28.18	7.05	-	66.86	74.00	7.14
*2 387.75	-	-	-	-	-	-24.76	42.10	54.00	11.90
*2 390.00	28.97	Peak	H	28.20	7.04	-	64.21	74.00	9.79
*2 390.00	-	-	-	-	-	-24.76	39.45	54.00	14.55

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (2 480 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	30.39	Peak	H	28.37	6.50	-	65.26	74.00	8.74
*2 483.50	-	-	-	-	-	-24.76	40.50	54.00	13.50
*2 488.44	32.87	Peak	H	28.35	6.46	-	67.68	74.00	6.32
*2 488.44	-	-	-	-	-	-24.76	42.92	54.00	11.08
*2 500.00	29.32	Peak	H	28.30	6.35	-	63.97	74.00	10.03
*2 500.00	-	-	-	-	-	-24.76	39.21	54.00	14.79

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

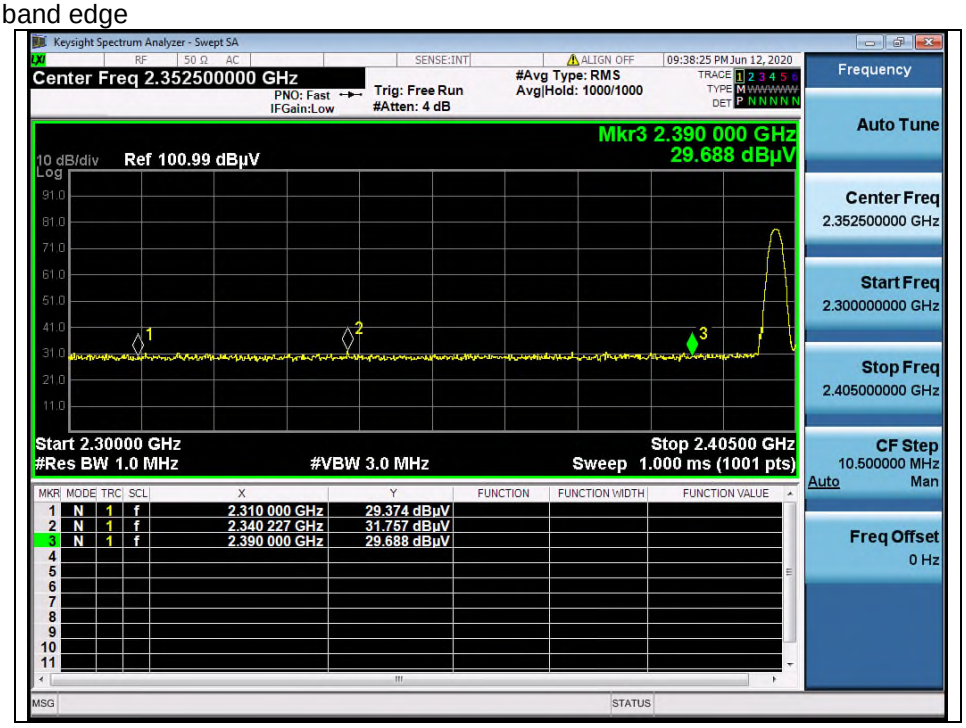
Remark;

1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL + (DF) or Reading + AF + AMP + CL + (DF).
5. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 ㏈.
6. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.
7. AF = Antenna Factor, CL = Cable Loss, DF = Duty Correction Factor.

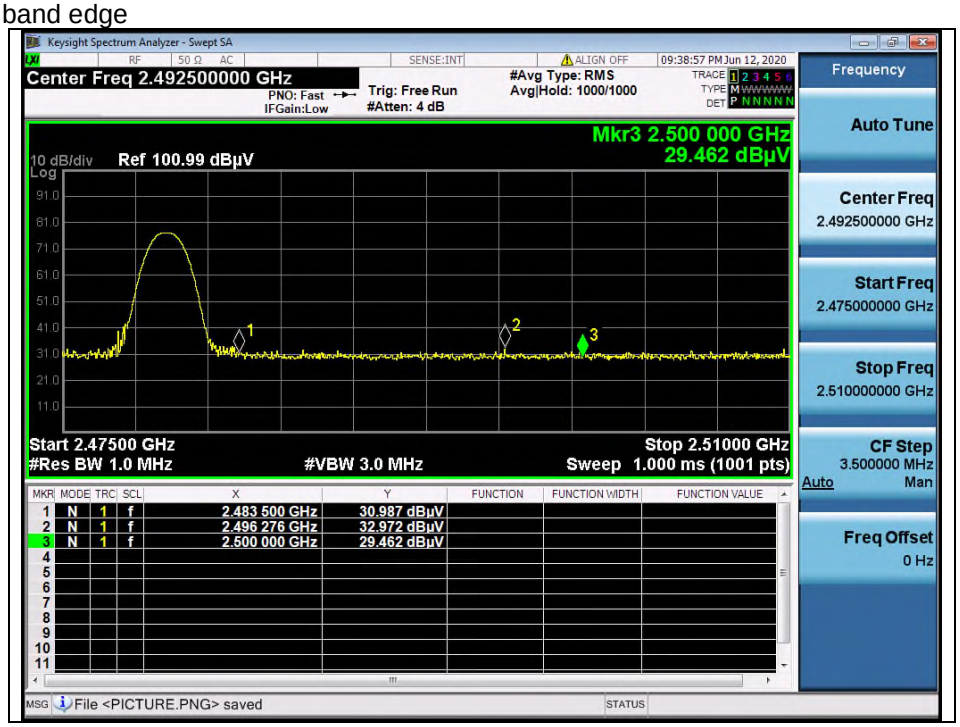
- Test plots

Operating Mode: GFSK (1 Mbps)_Ant.1

Low channel band edge

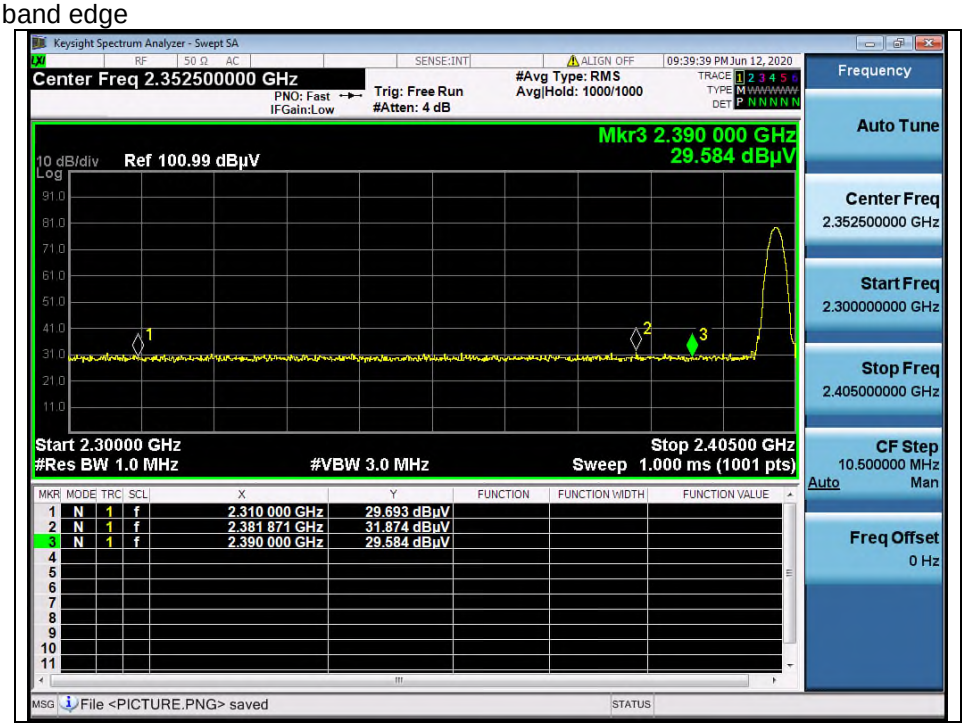


High channel band edge

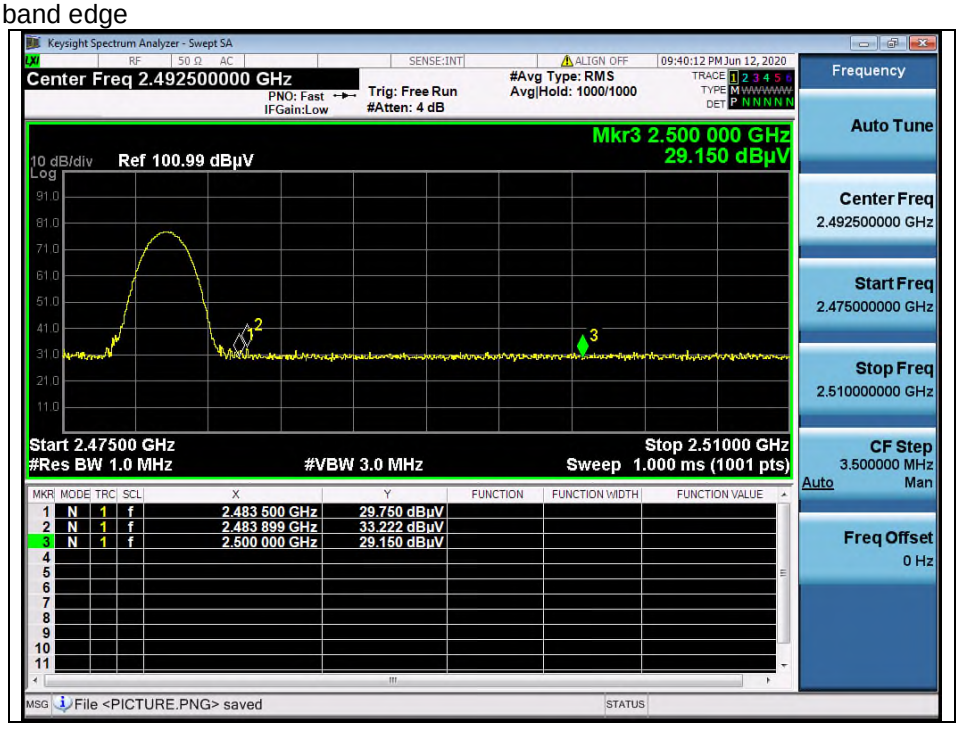


Operating Mode: 8DPSK (3 Mbps)_Ant.1

Low channel band edge

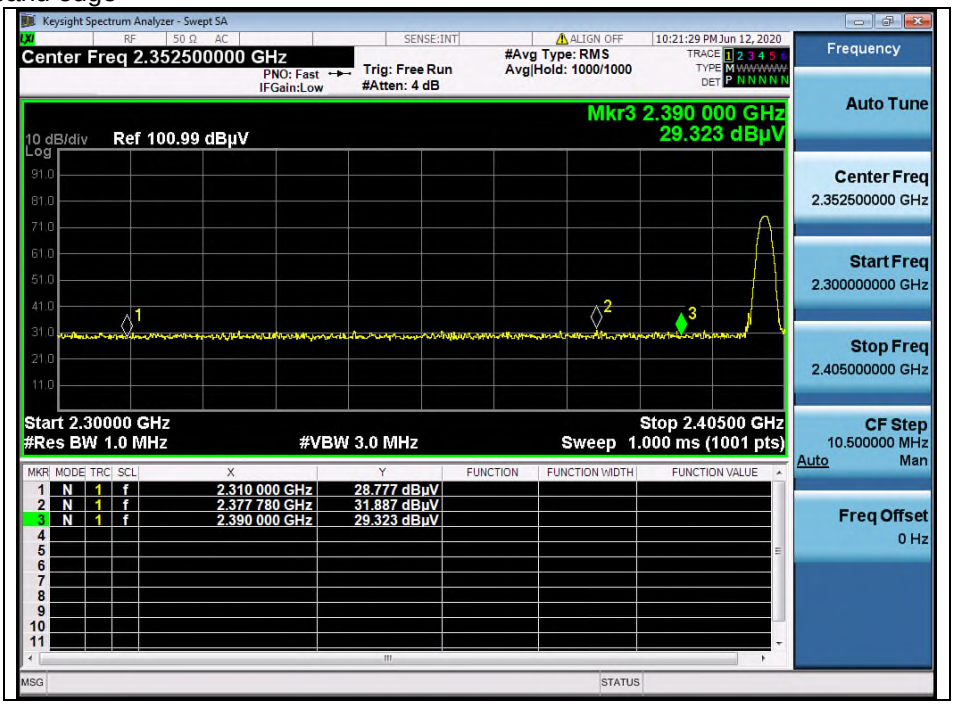


High channel band edge

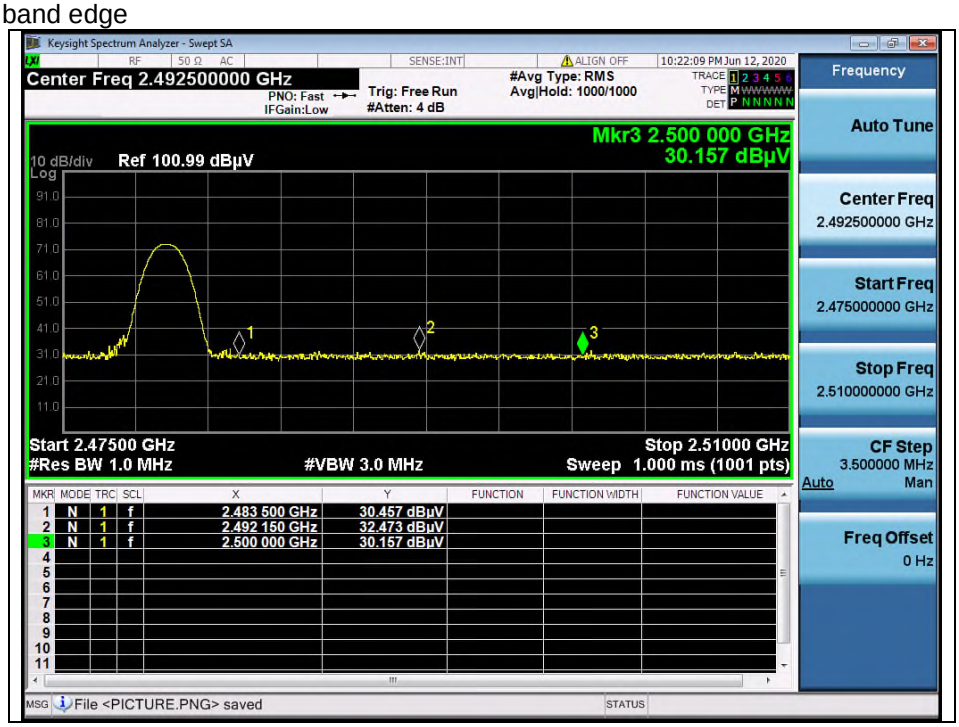


Operating Mode: GFSK (1 Mbps)_Ant.2

Low channel band edge

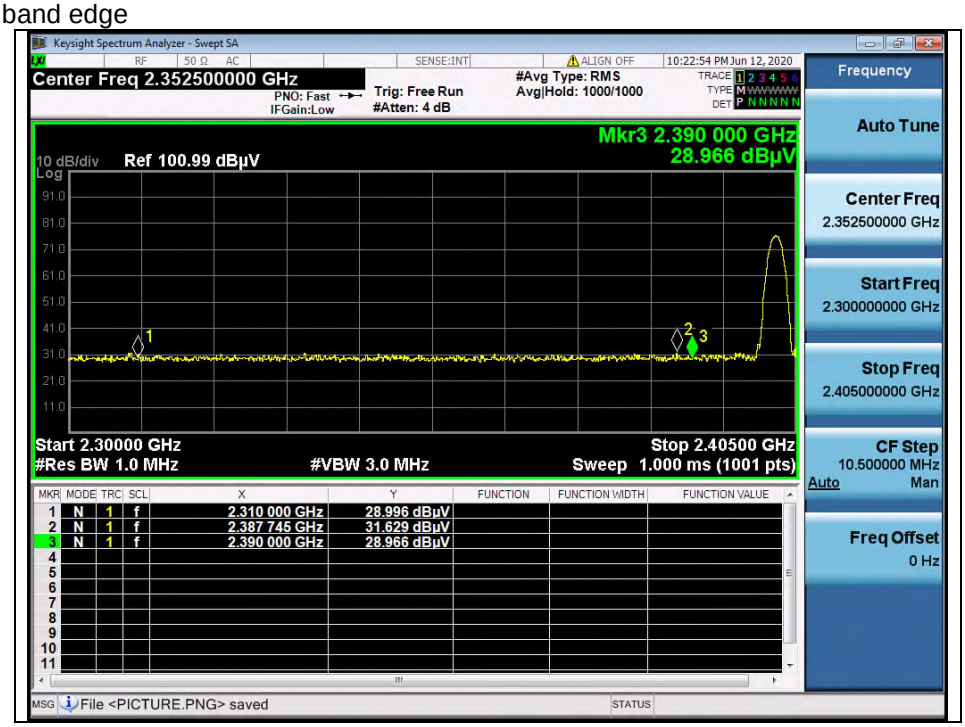


High channel band edge

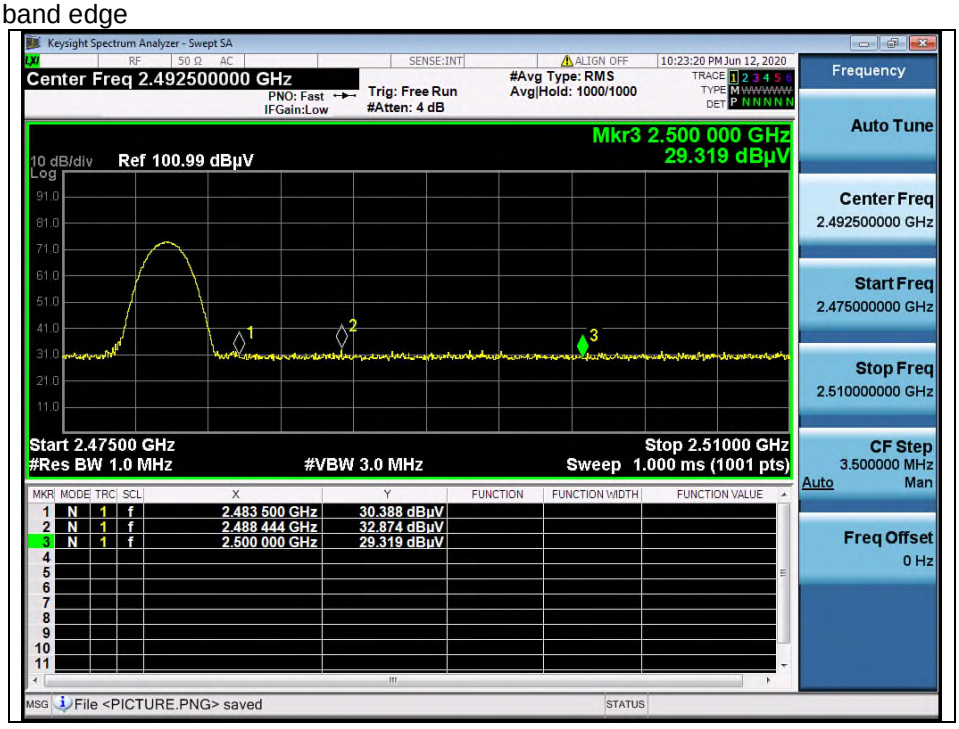


Operating Mode: 8DPSK (3 Mbps)_Ant.2

Low channel band edge



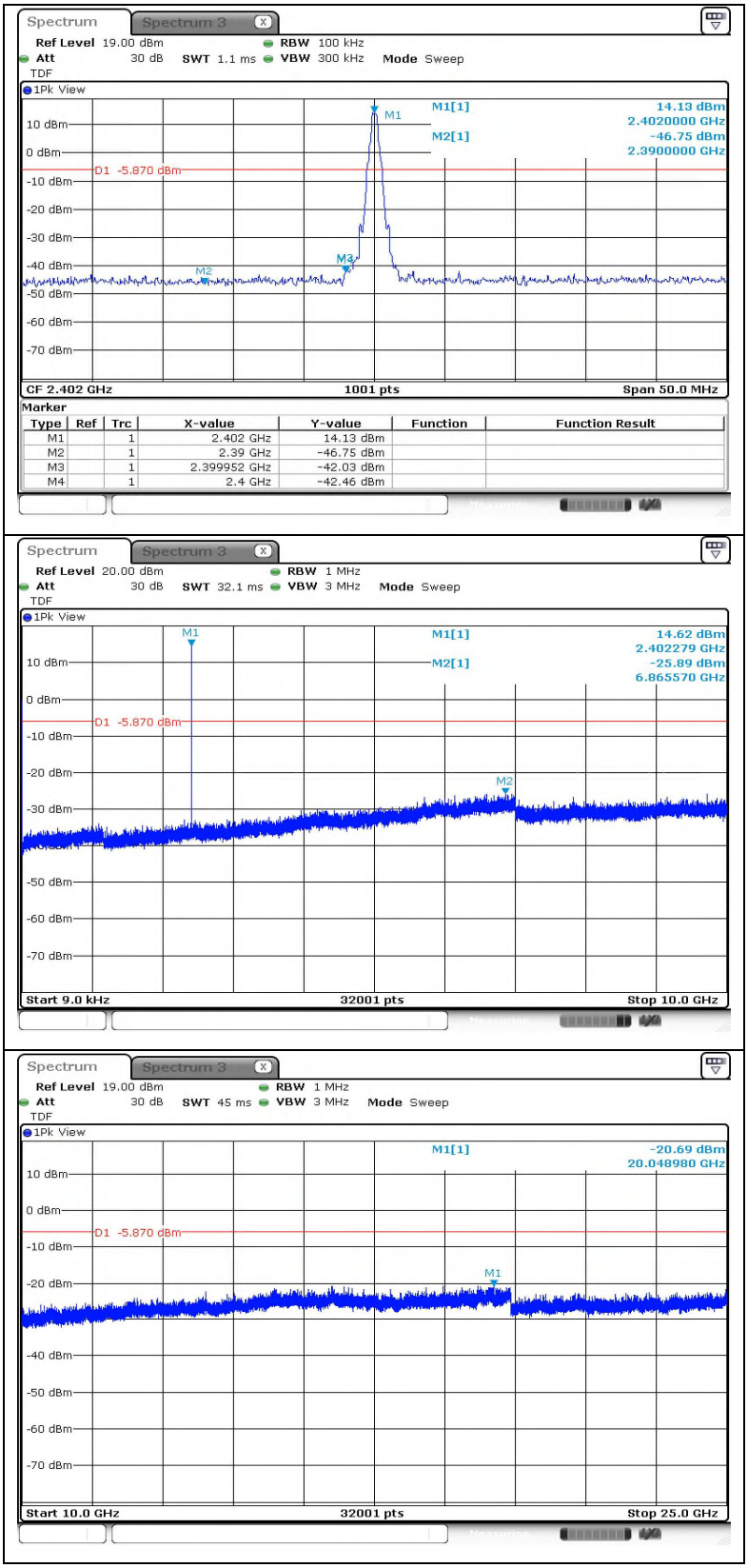
High channel band edge



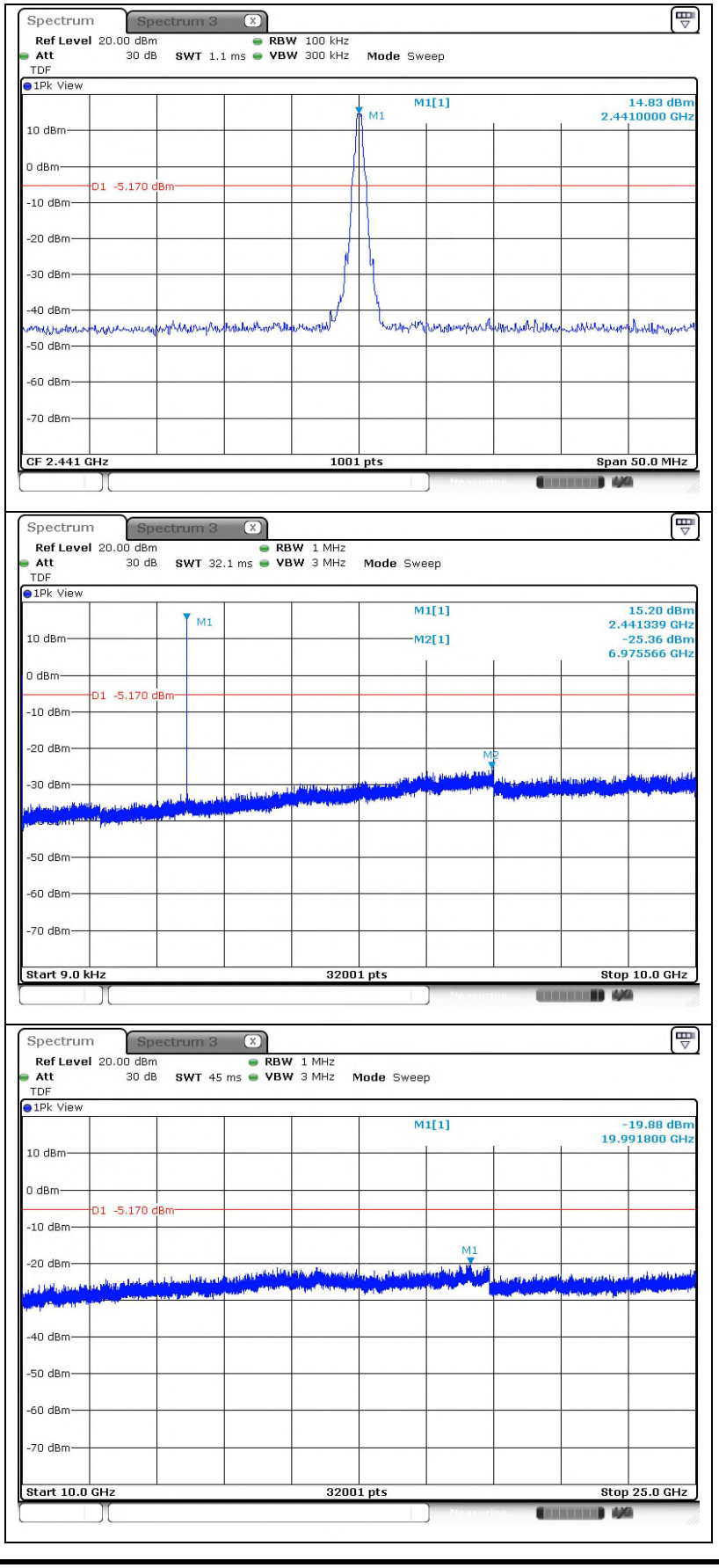
2.4.3. Plot of Spurious Conducted Emissions

Operating Mode: GFSK (1 Mbps)_Ant.1

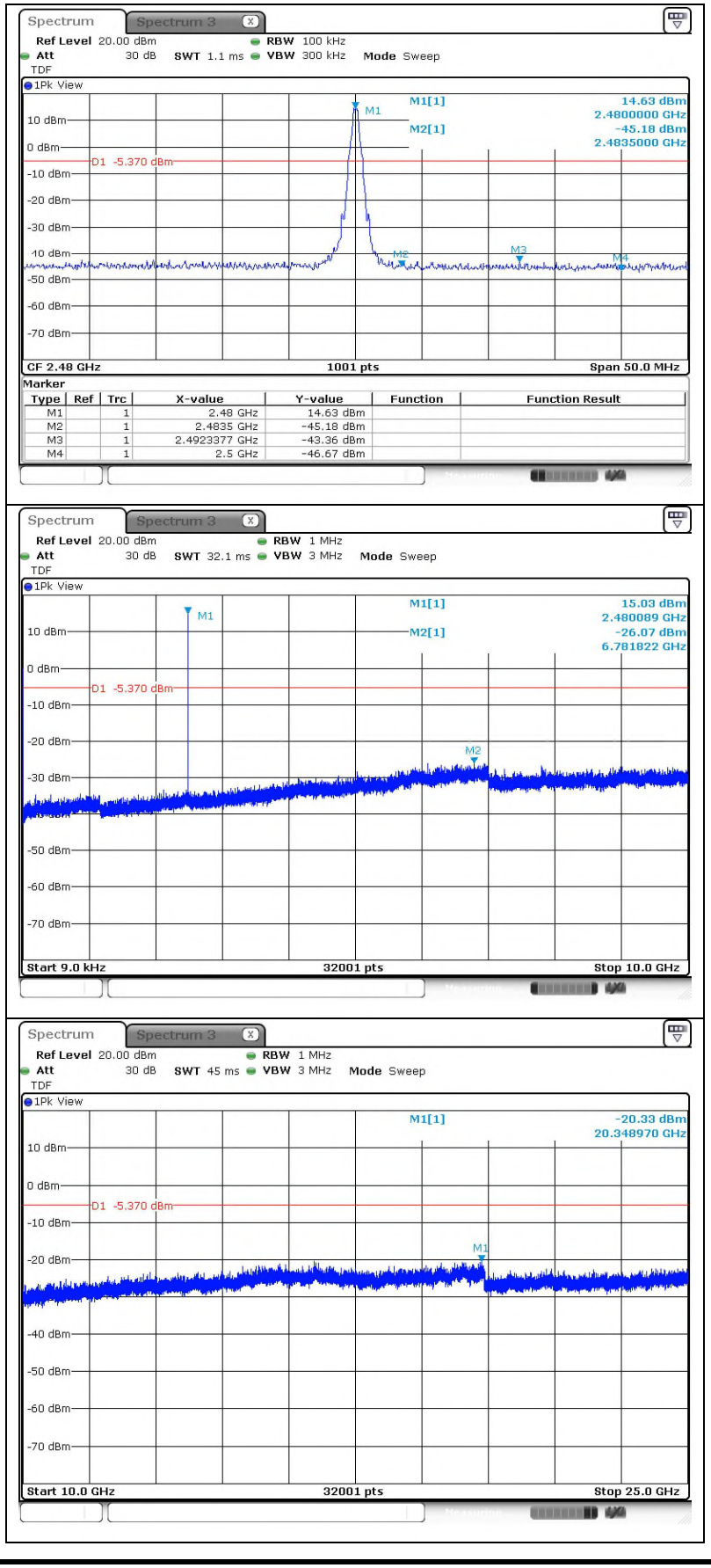
Low channel



Middle channel

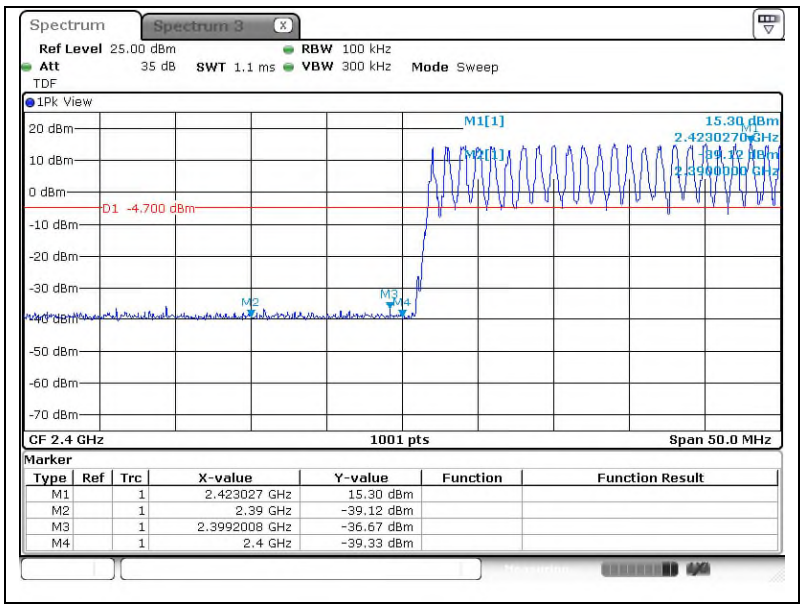


High channel

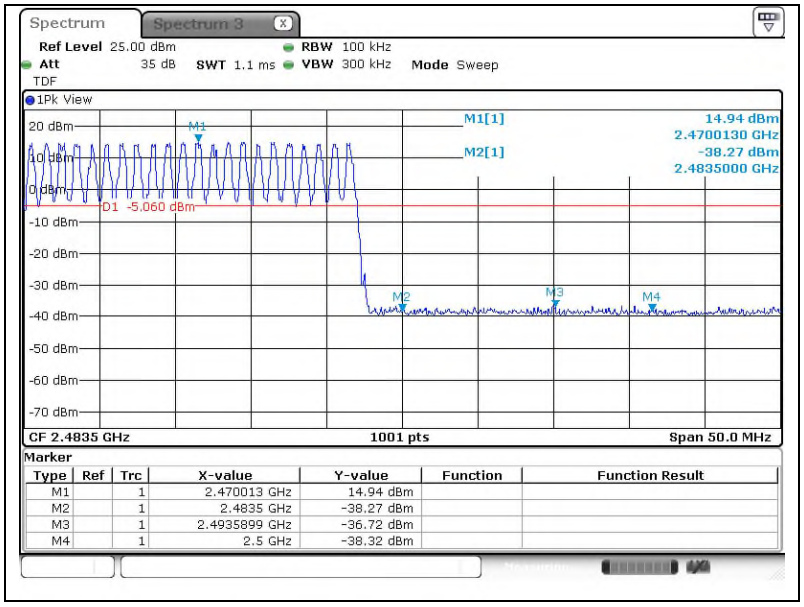


Band edge compliance with hopping enabled

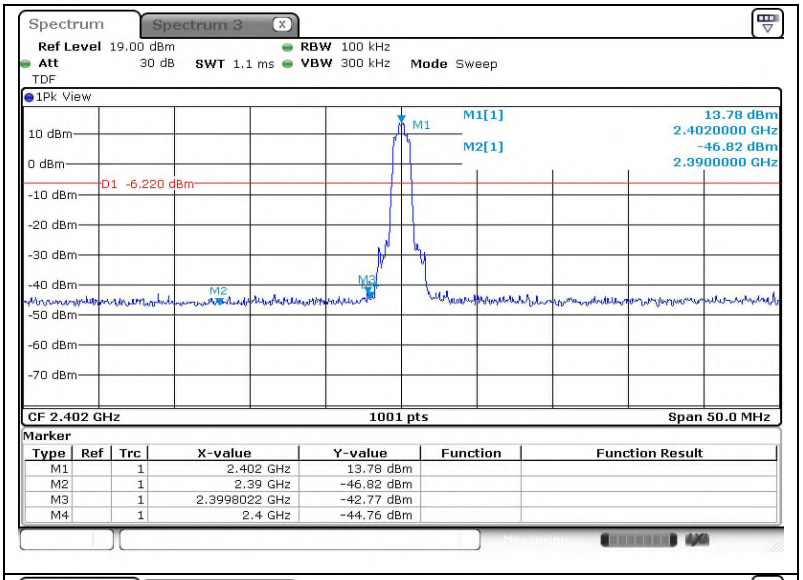
Low channel

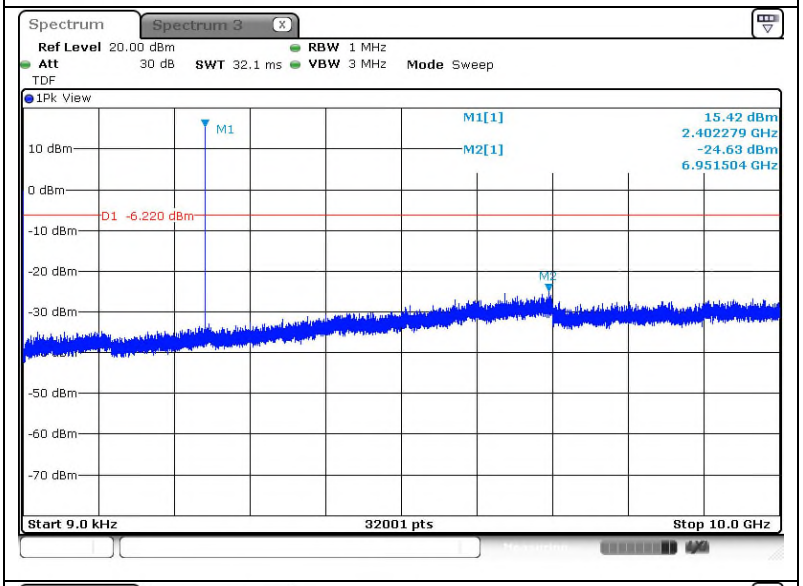


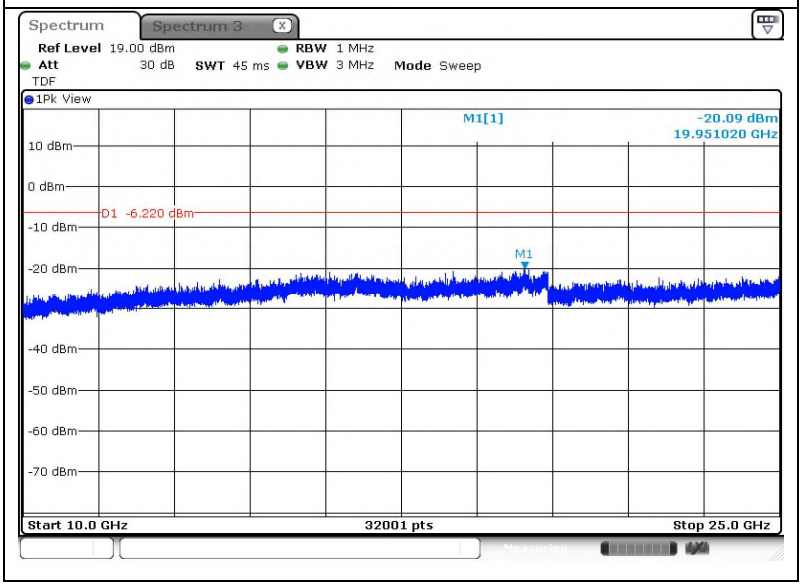
High channel



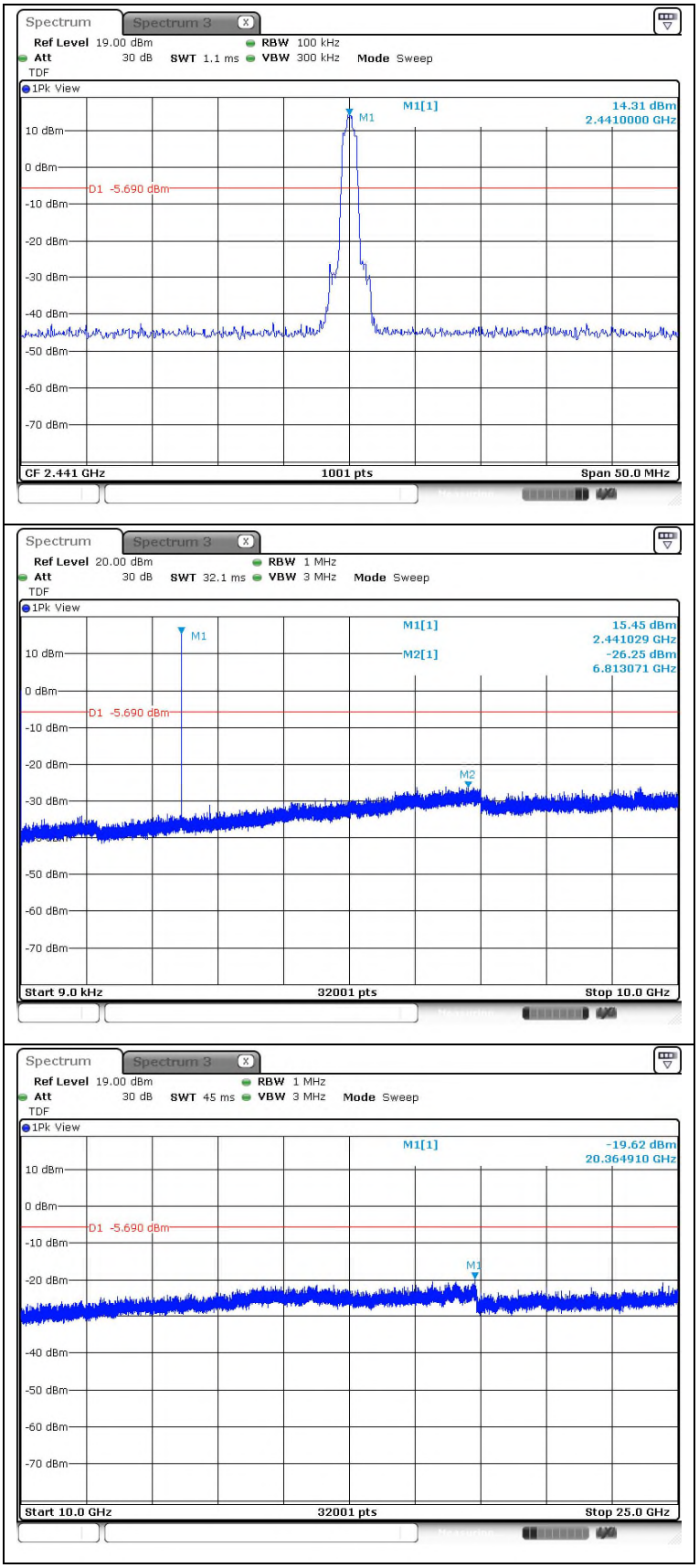
Operating Mode: 8DPSK (3 Mbps)_Ant.1
Low channel



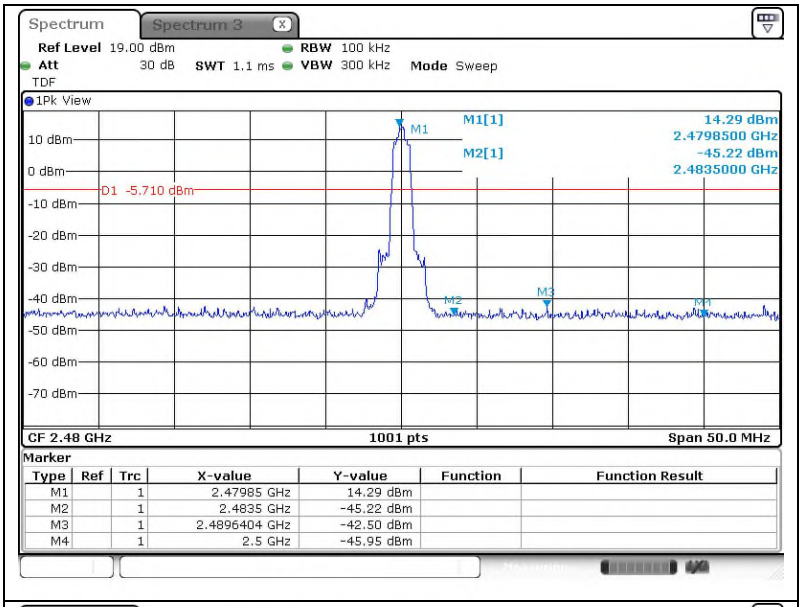


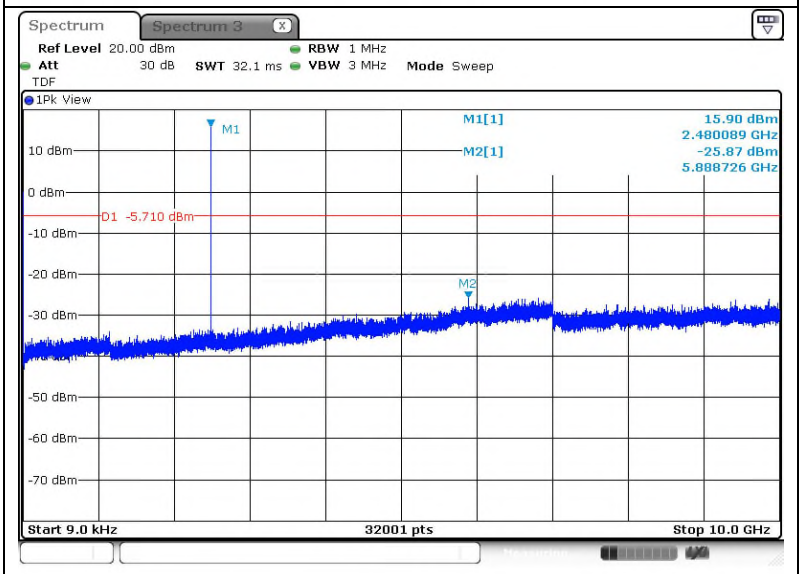


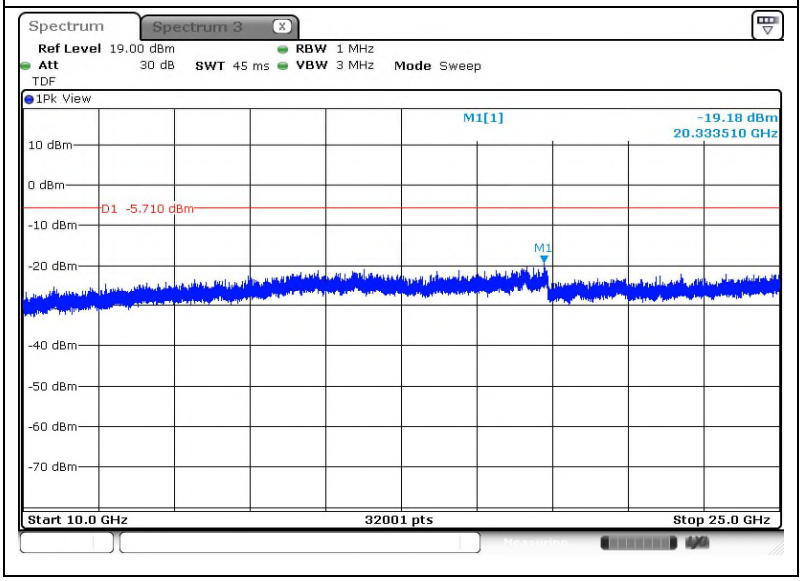
Middle channel



High channel

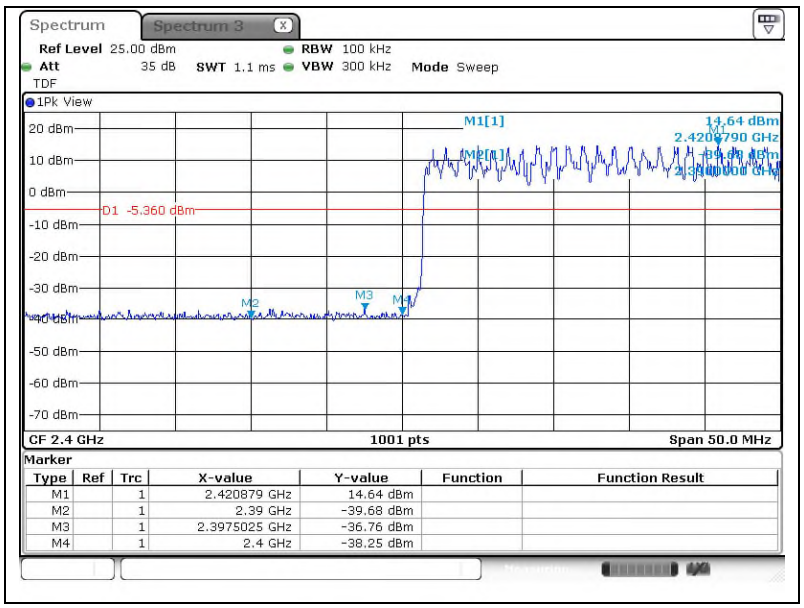




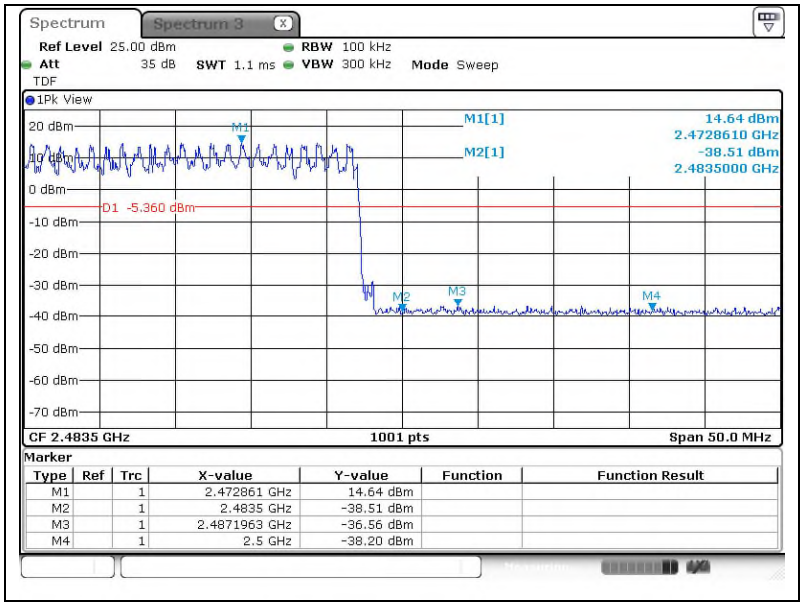


Band edge compliance with hopping enabled

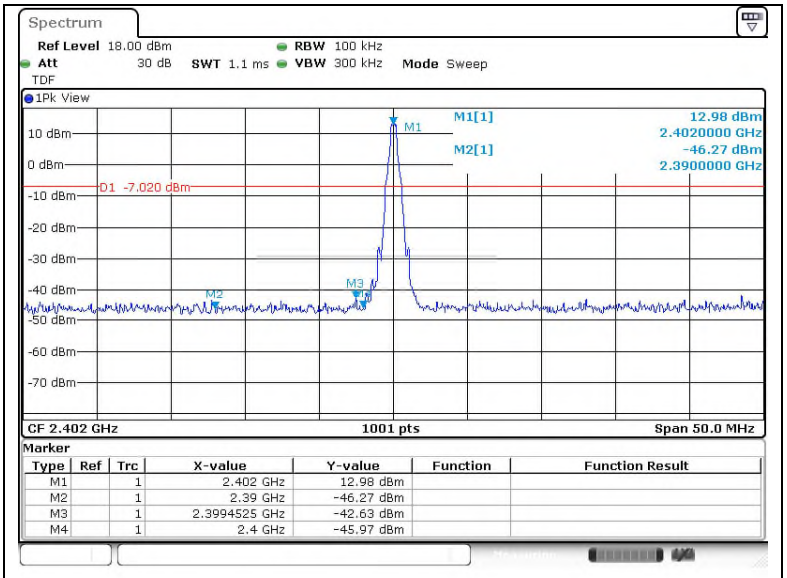
Low channel

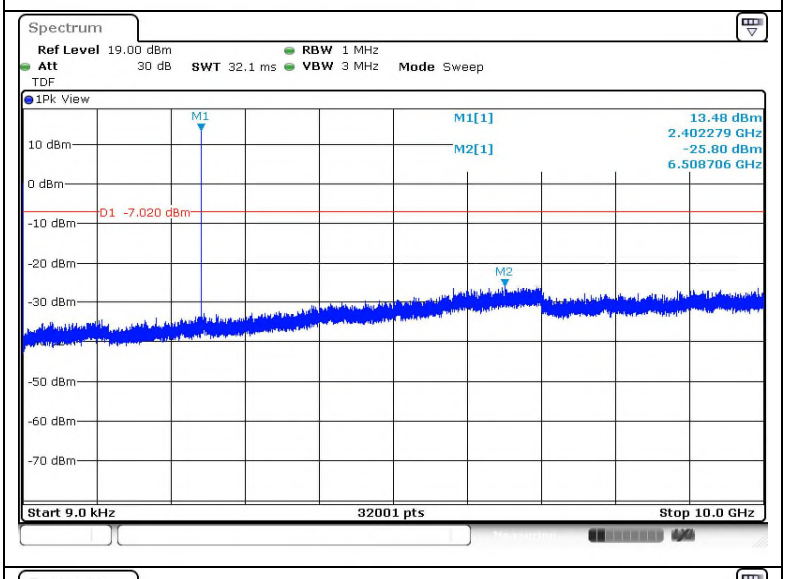


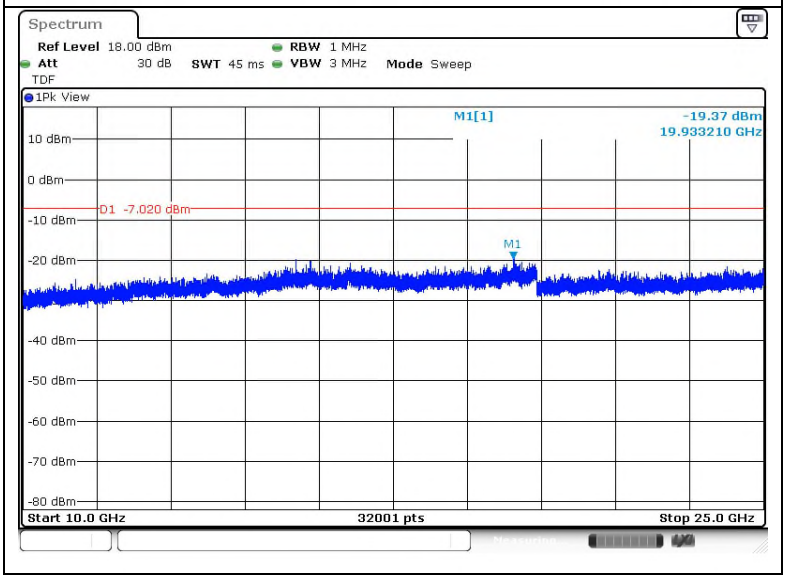
High channel



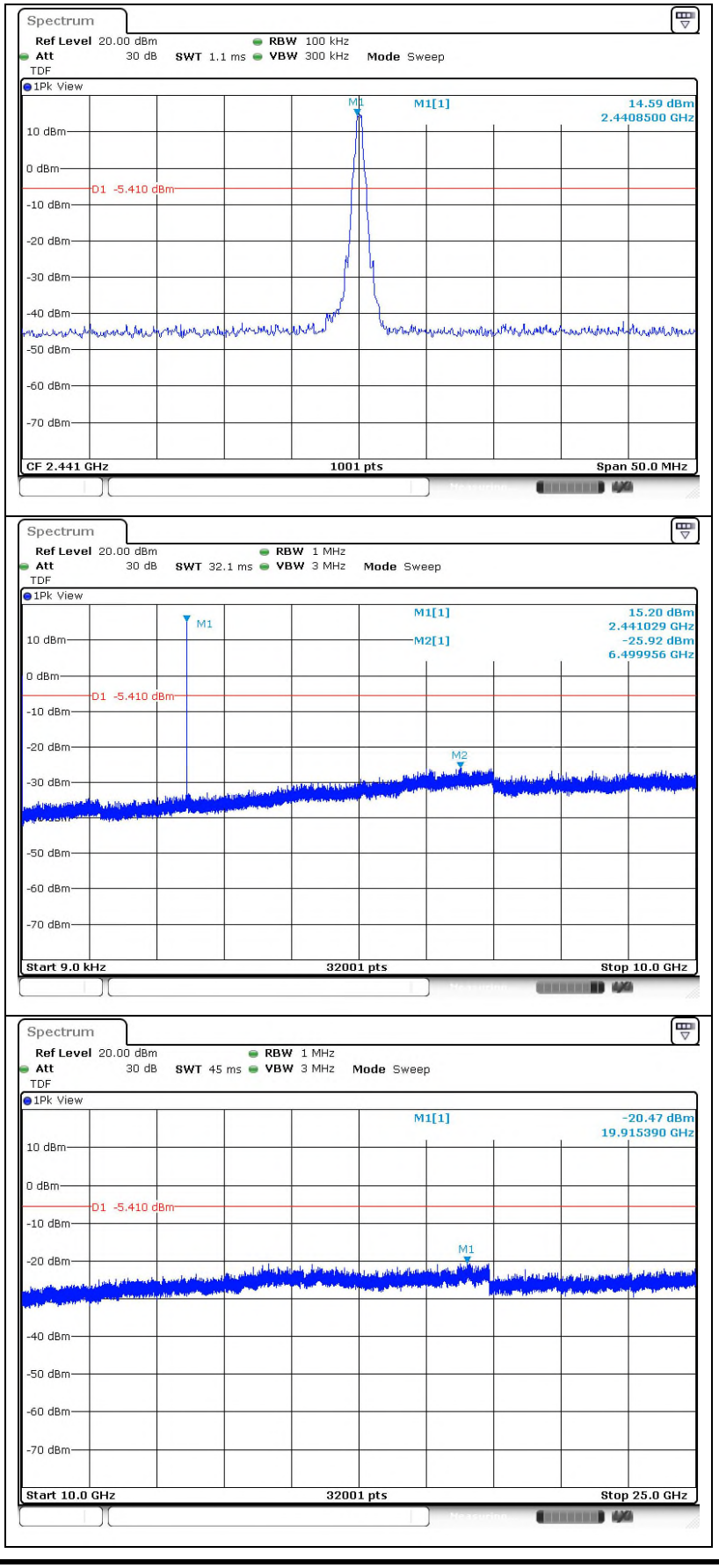
Operating Mode: GFSK (1 Mbps)_Ant.2
Low channel



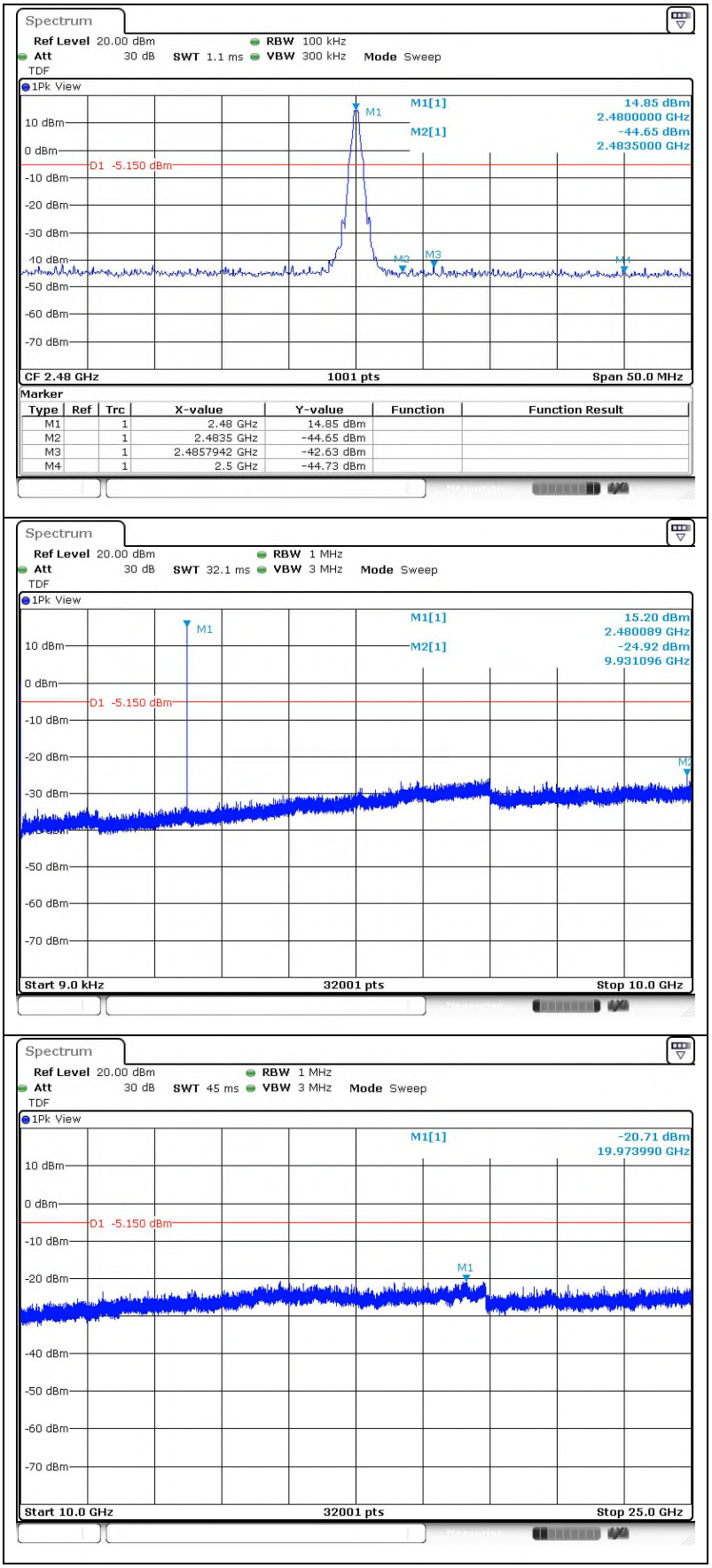




Middle channel

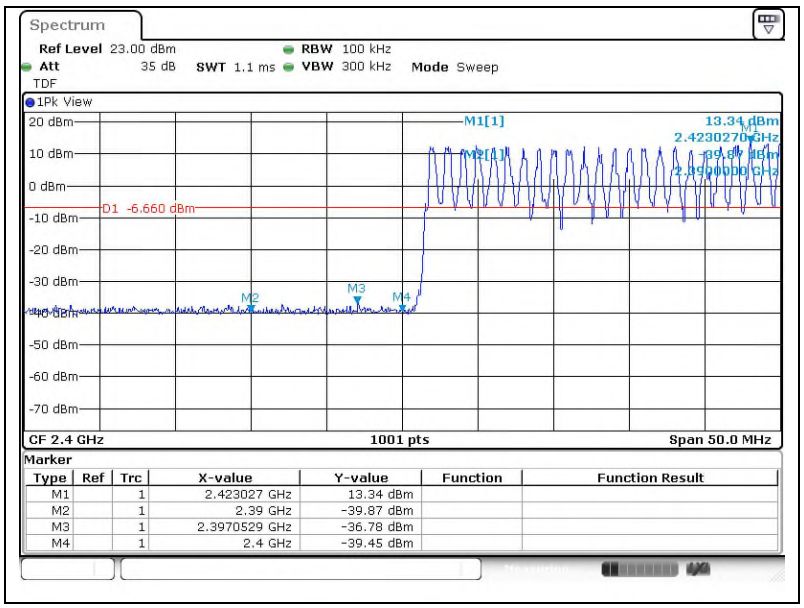


High channel

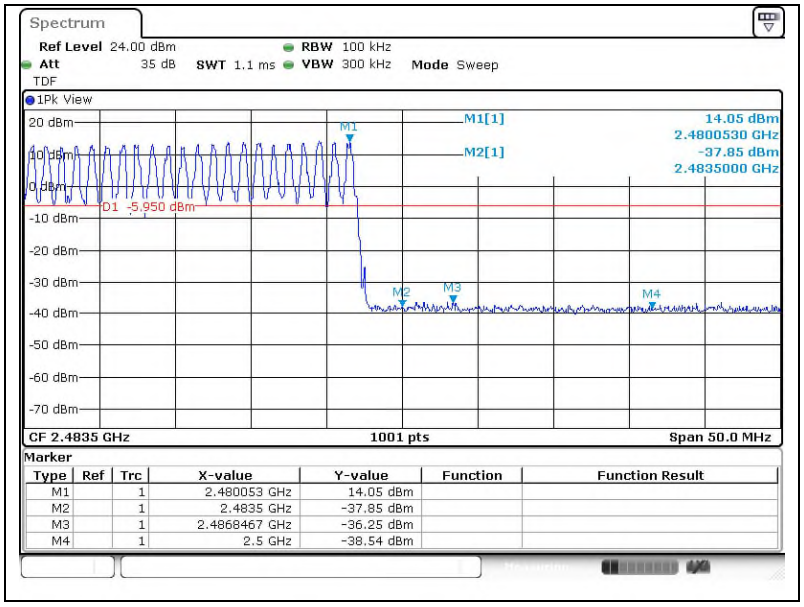


Band edge compliance with hopping enabled

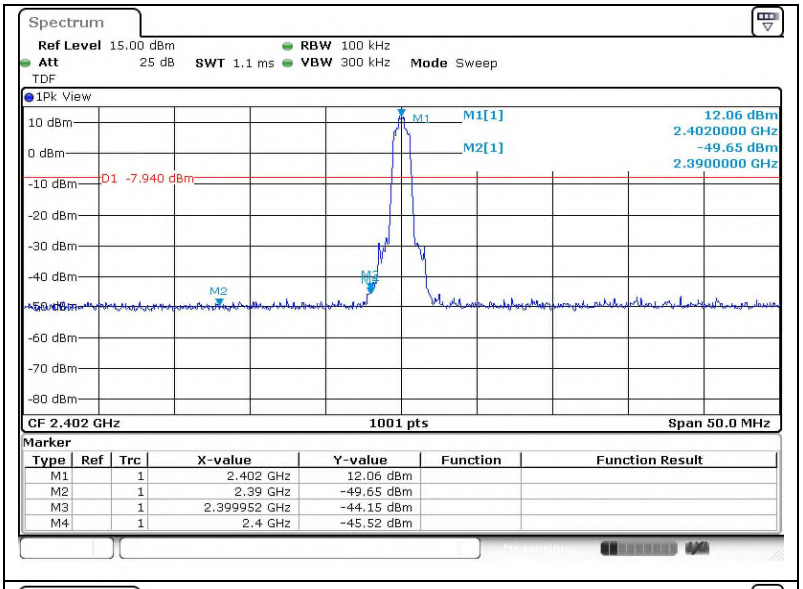
Low channel

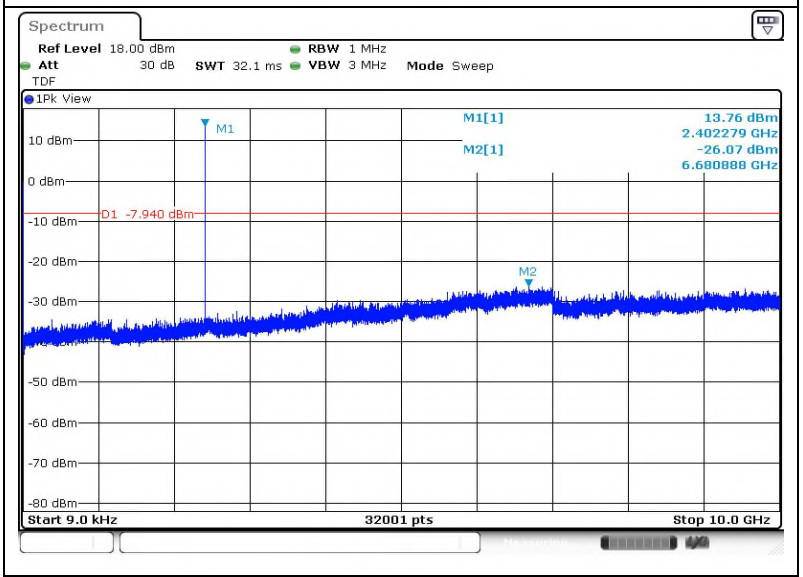


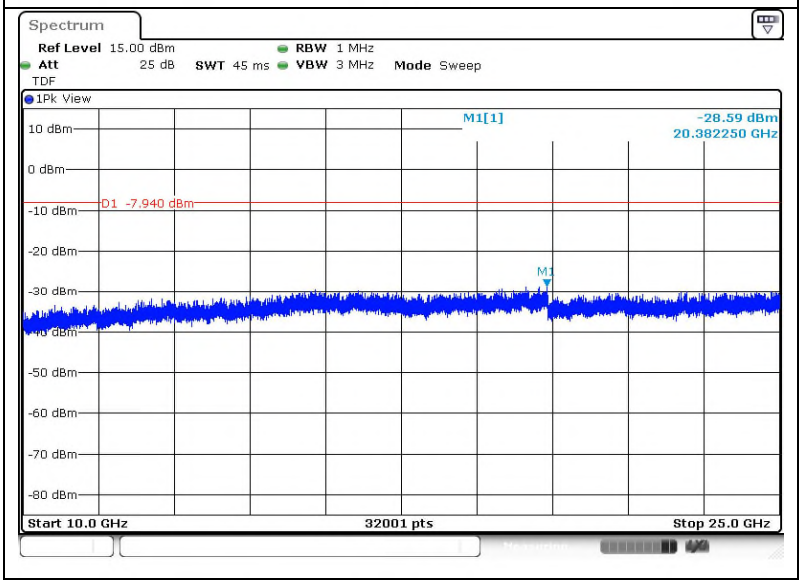
High channel



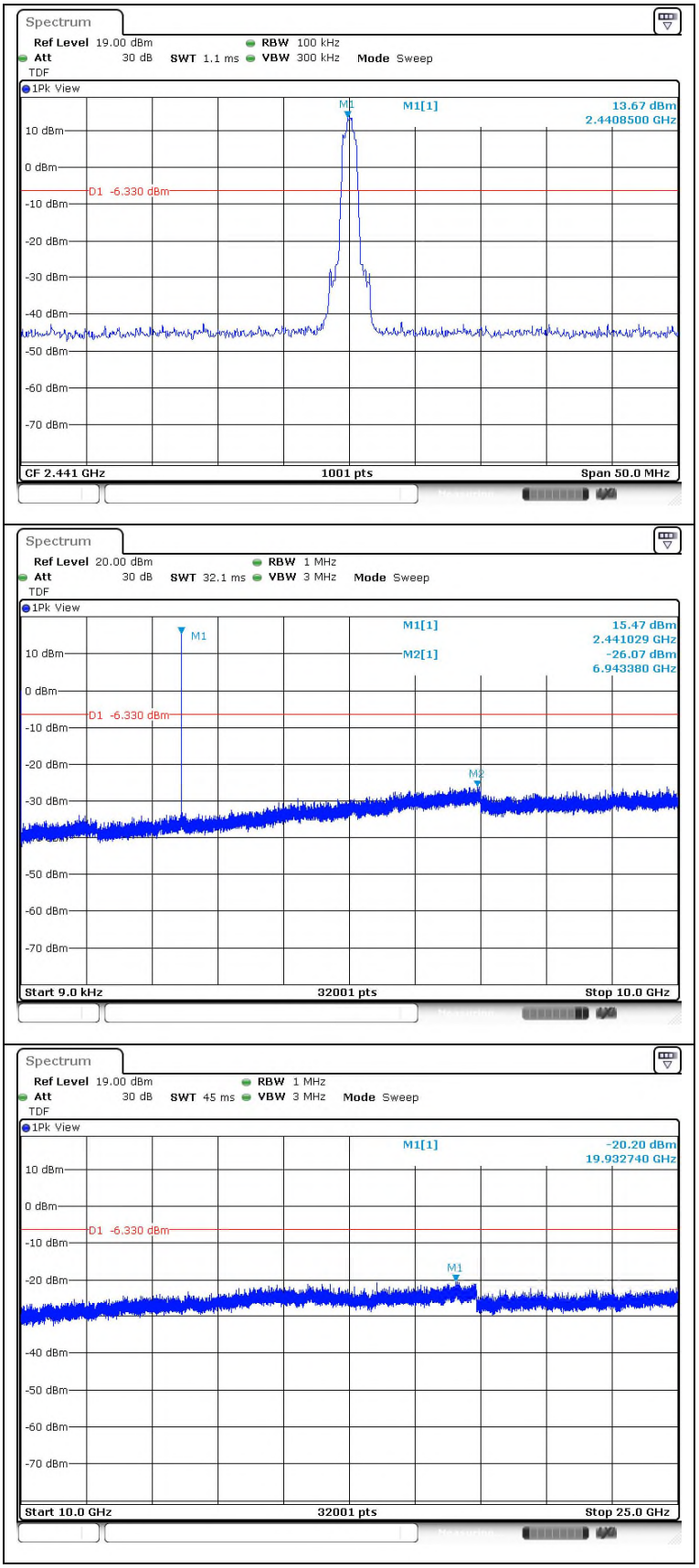
Operating Mode: 8DPSK (3 Mbps)_Ant.2
Low channel



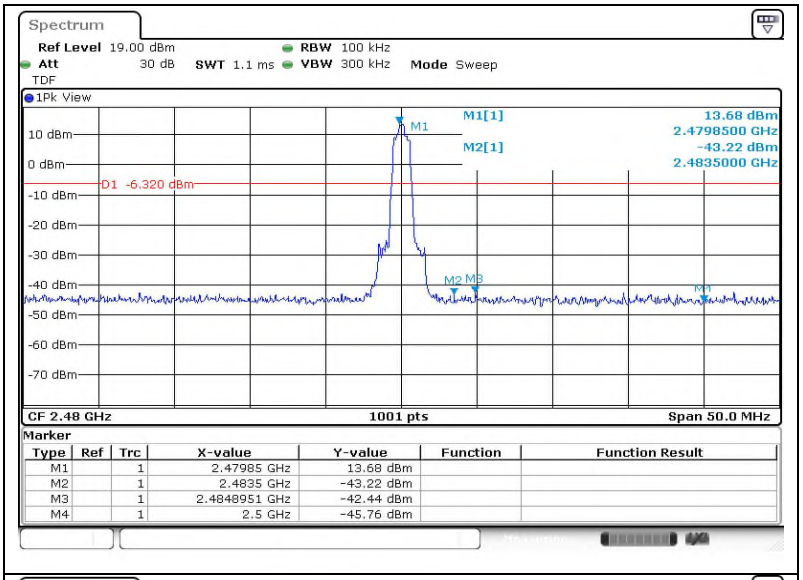


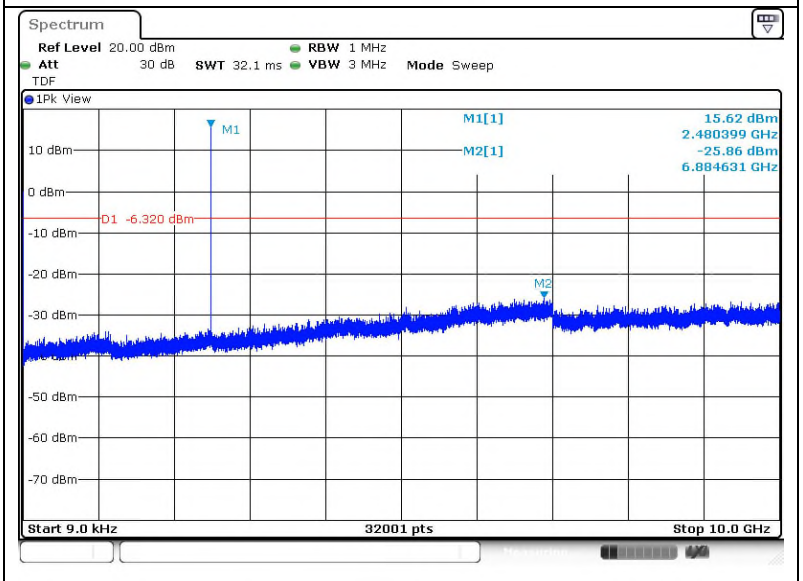


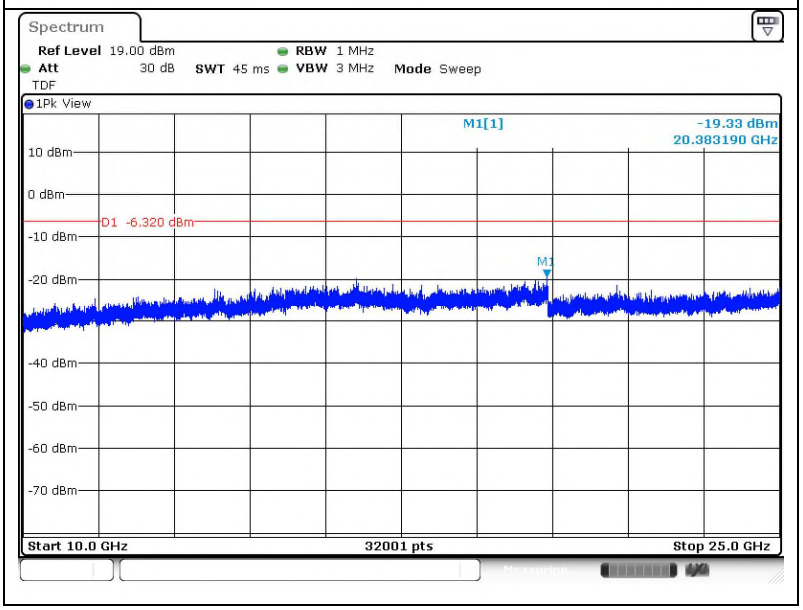
Middle channel



High channel

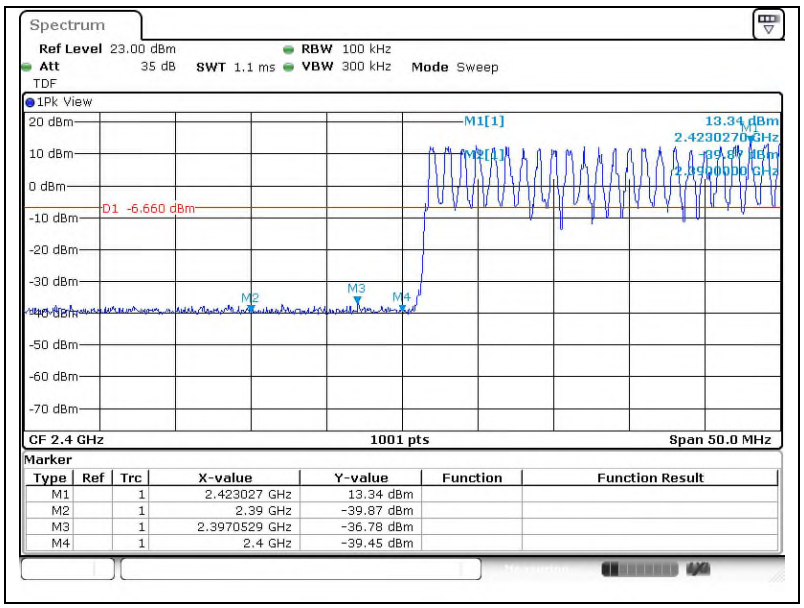




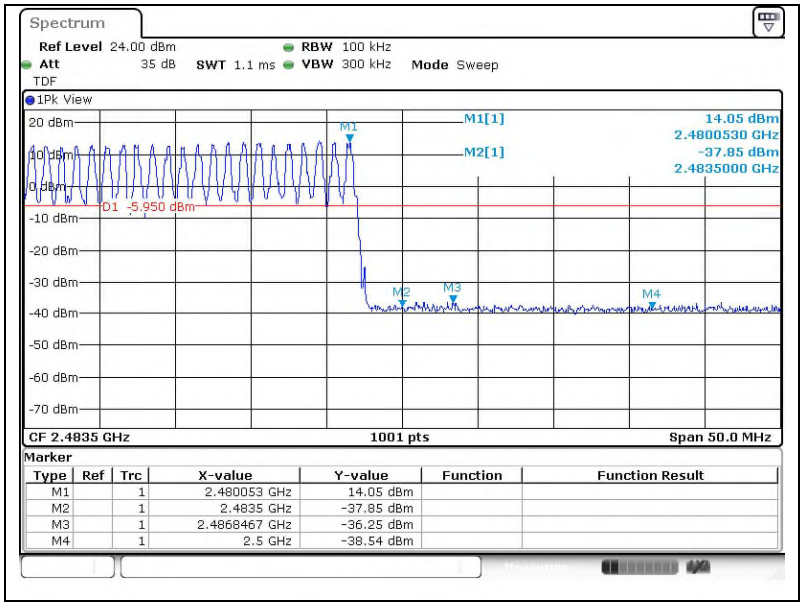


Band edge compliance with hopping enabled

Low channel

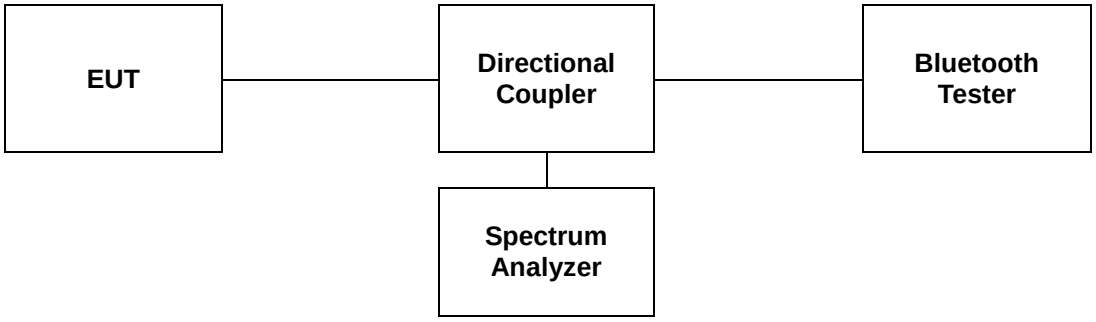


High channel



3. 20 dB Bandwidth & 99 % Bandwidth

3.1. Test Setup



3.2. Limit

Limit: Not Applicable

3.3. Test Procedure

3.3.1. 20 dB Bandwidth

The test follows ANSI C63.10-2013.

The 20 dB bandwidth was measured with a spectrum analyzer connected to RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Use the following spectrum analyzer setting:

1. Span = approximately 2 to 5 times the 20 dB bandwidth.
2. RBW ≥ 1 % to 5 % of the 20 dB bandwidth.
3. VBW ≥ 3 x RBW
4. Sweep = auto
5. Detector = peak
6. Trace = max hold

The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the 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 20 dB bandwidth of the emission.

3.3.2. 99 % Bandwidth

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

● The transmitter shall be operated at its maximum carrier power measured under normal test condition.

● The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

● The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

● The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Operation Mode	Data Rate (Mbps)	Channel	Frequency (㎒)	20 ㏈ Bandwidth (㎒)	
				Ant.1	Ant.2
GFSK	1	Low	2 402	0.932	0.932
		Middle	2 441	0.929	0.929
		High	2 480	0.932	0.929
π/4DQPSK	2	Low	2 402	1.328	1.325
		Middle	2 441	1.325	1.322
		High	2 480	1.325	1.325
8DPSK	3	Low	2 402	1.274	1.274
		Middle	2 441	1.274	1.274
		High	2 480	1.277	1.277

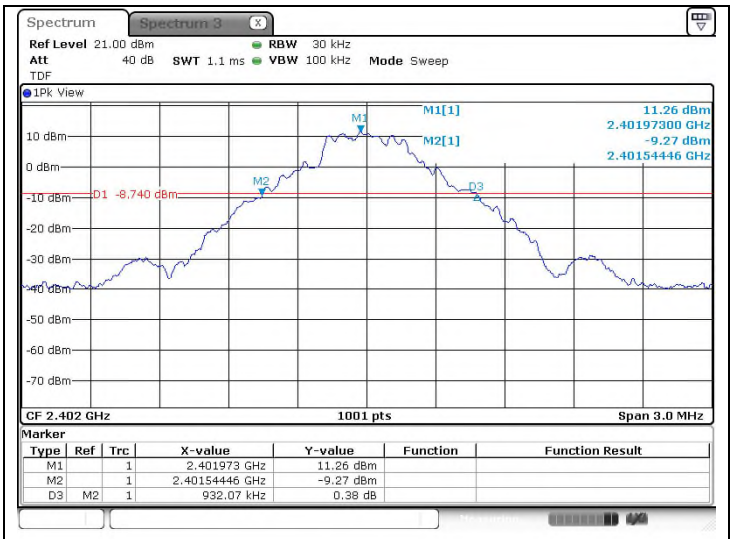
Operation Mode	Data Rate (Mbps)	Channel	Frequency (㎒)	99 % Bandwidth (㎒)	
				Ant.1	Ant.2
GFSK	1	Low	2 402	0.827	0.827
		Middle	2 441	0.827	0.827
		High	2 480	0.827	0.824
π/4DQPSK	2	Low	2 402	1.163	1.163
		Middle	2 441	1.163	1.160
		High	2 480	1.163	1.163
8DPSK	3	Low	2 402	1.145	1.145
		Middle	2 441	1.148	1.145
		High	2 480	1.145	1.148

- Test plots

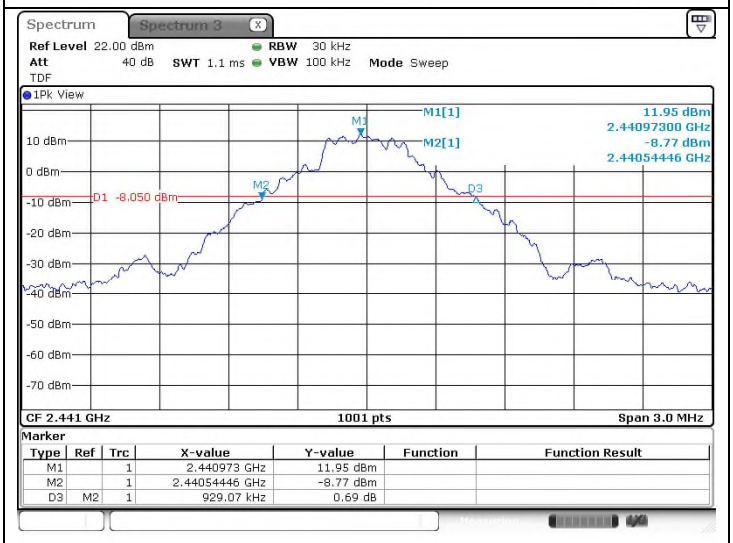
- 20 dB Bandwidth

Operating Mode: GFSK_Ant.1

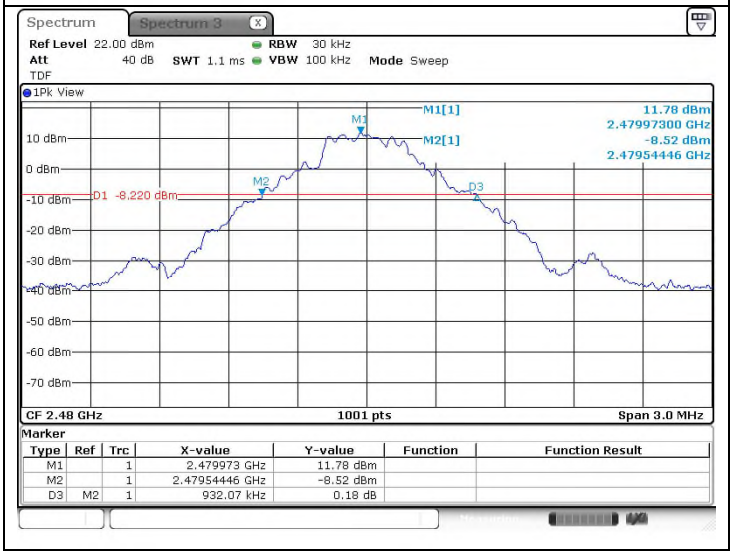
Low Channel



Middle Channel

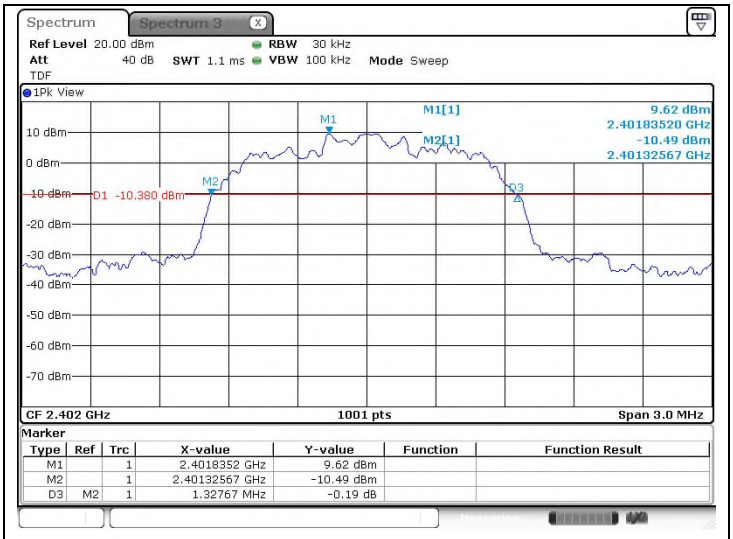


High Channel

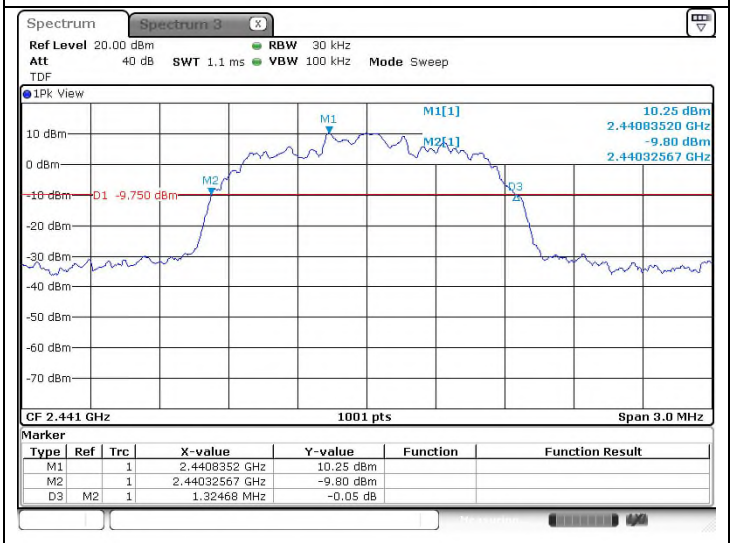


Operating Mode: π/4DQPSK_Ant.1

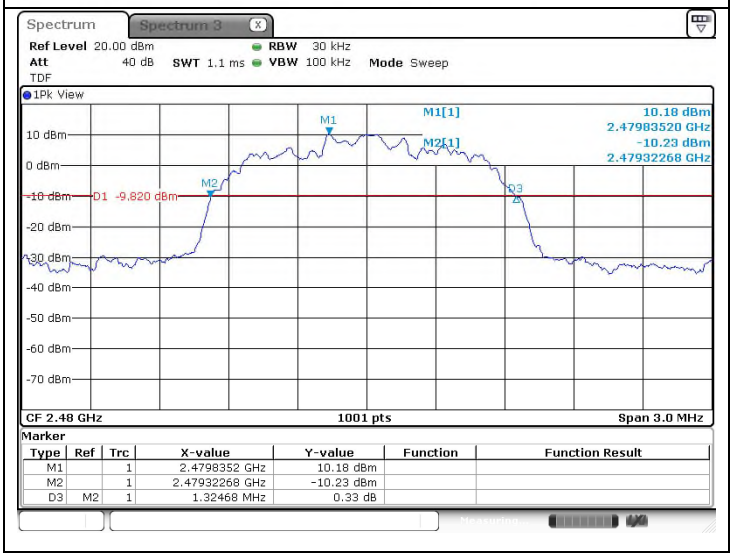
Low Channel



Middle Channel

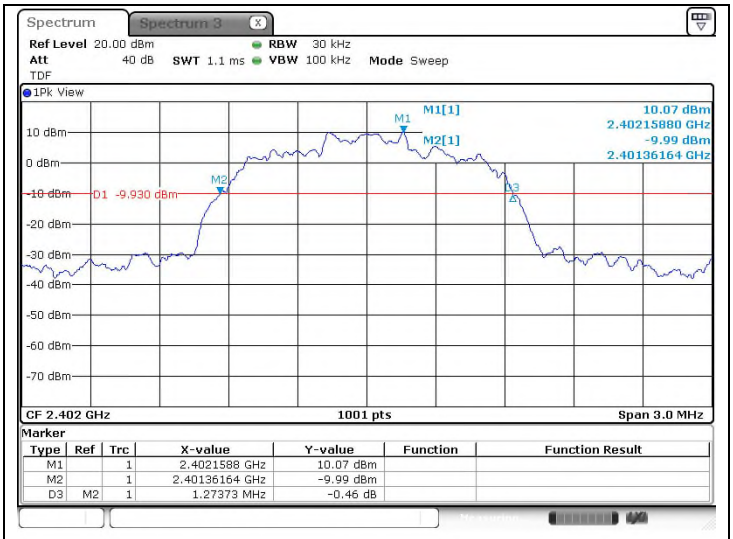


High Channel

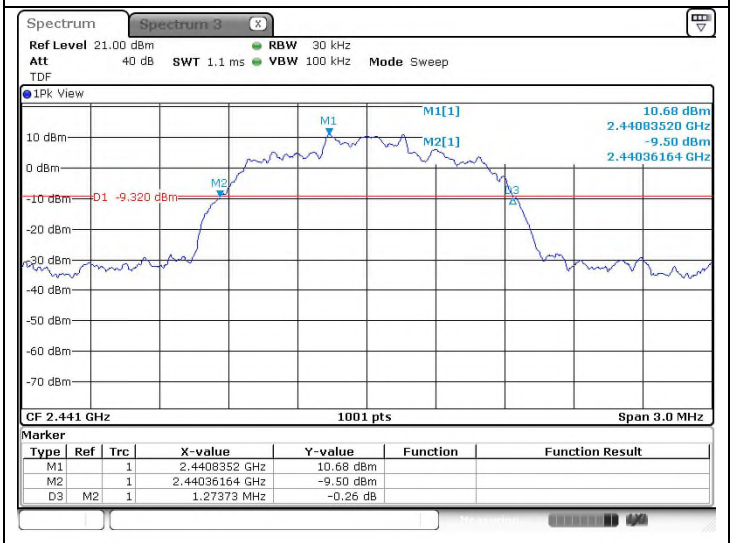


Operating Mode: 8DPSK_Ant.1

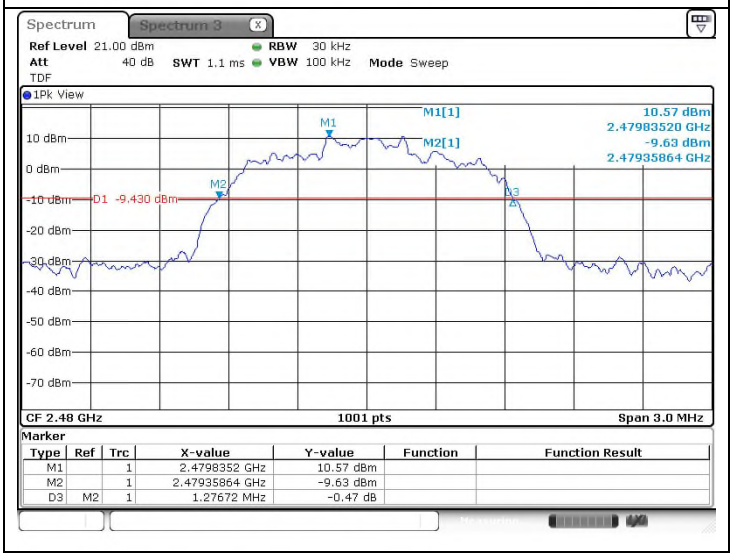
Low Channel



Middle Channel

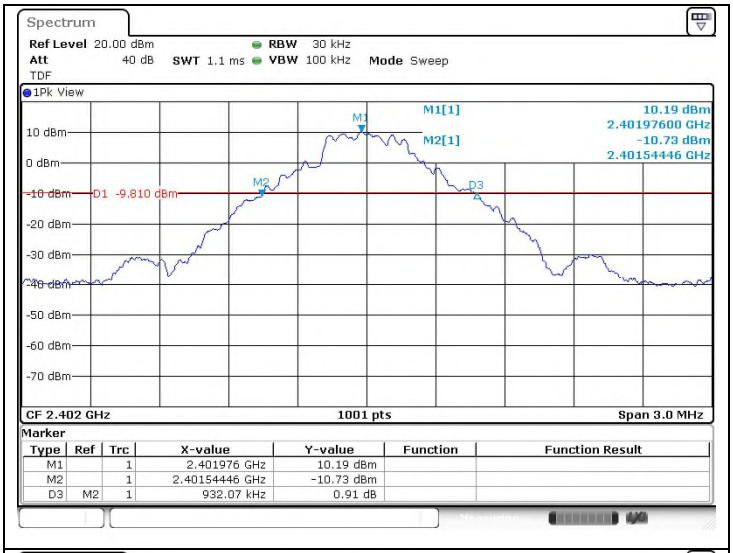


High Channel

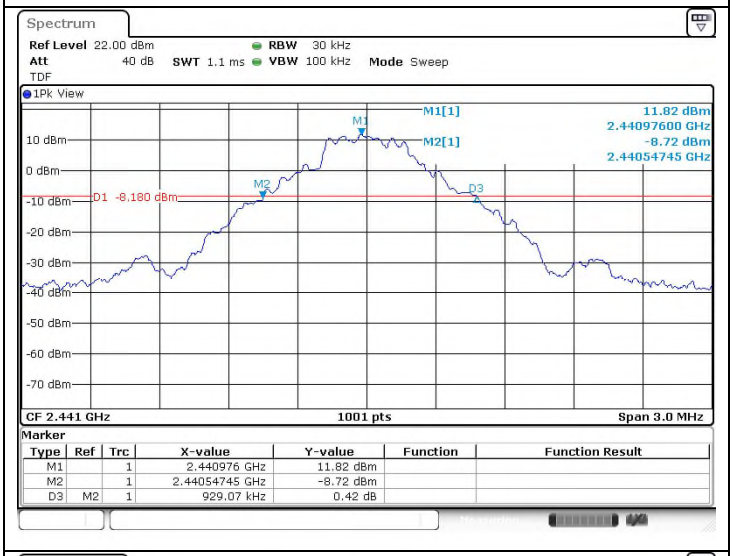


Operating Mode: GFSK_Ant.2

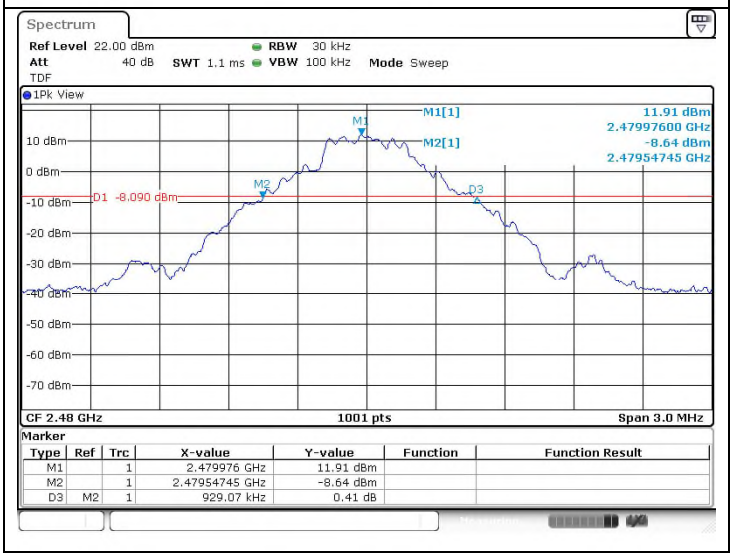
Low Channel



Middle Channel

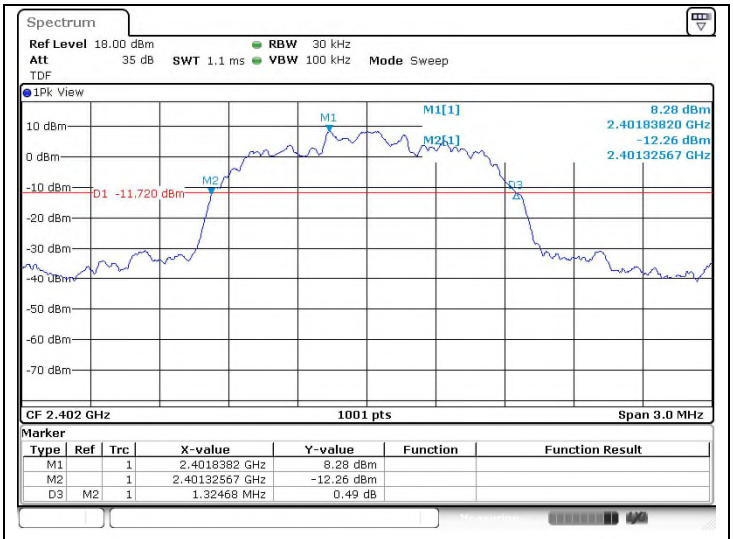


High Channel

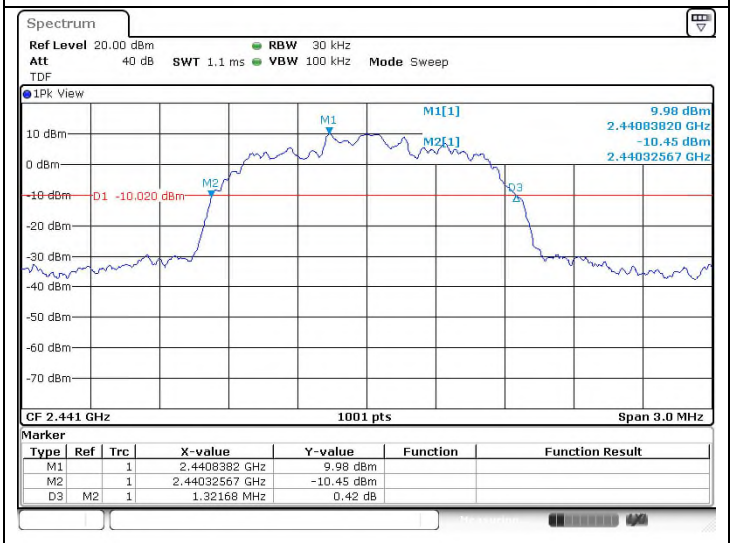


Operating Mode: π/4DQPSK_Ant.2

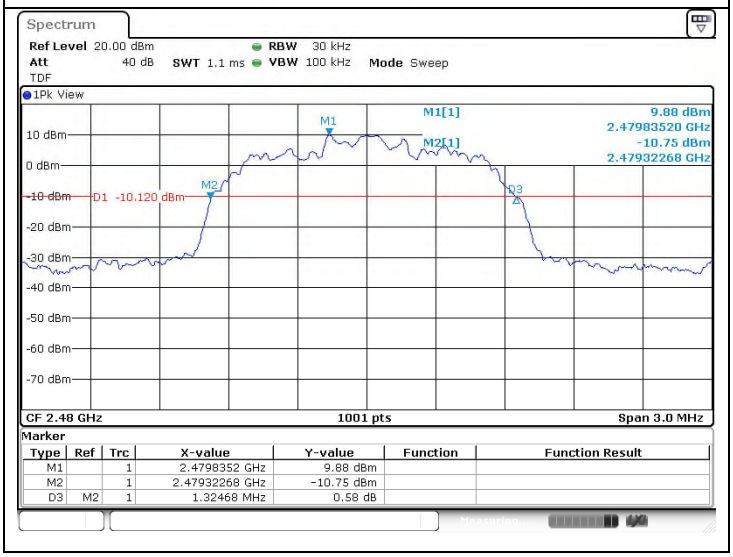
Low Channel



Middle Channel

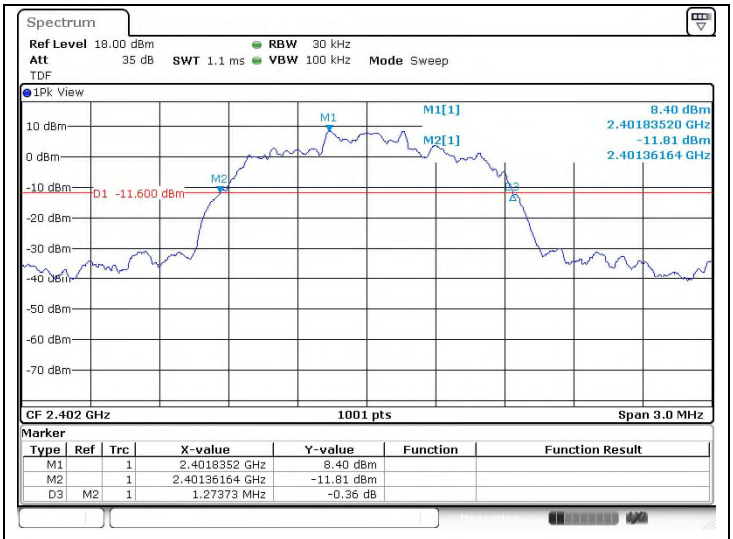


High Channel

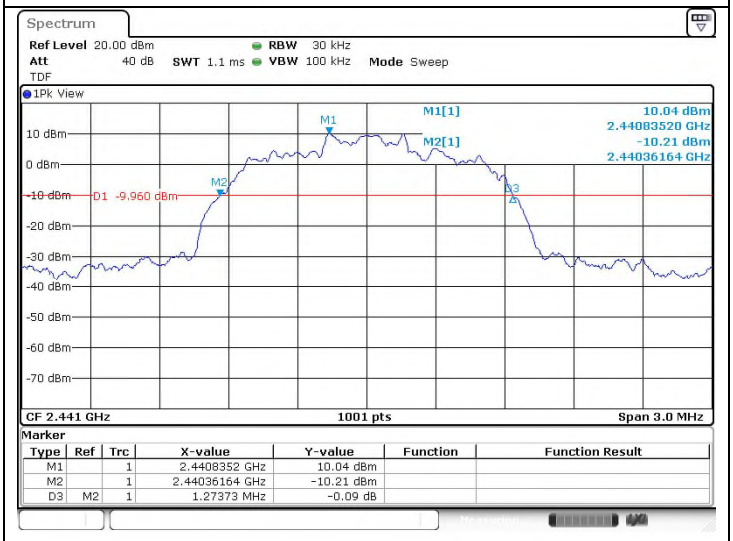


Operating Mode: 8DPSK_Ant.2

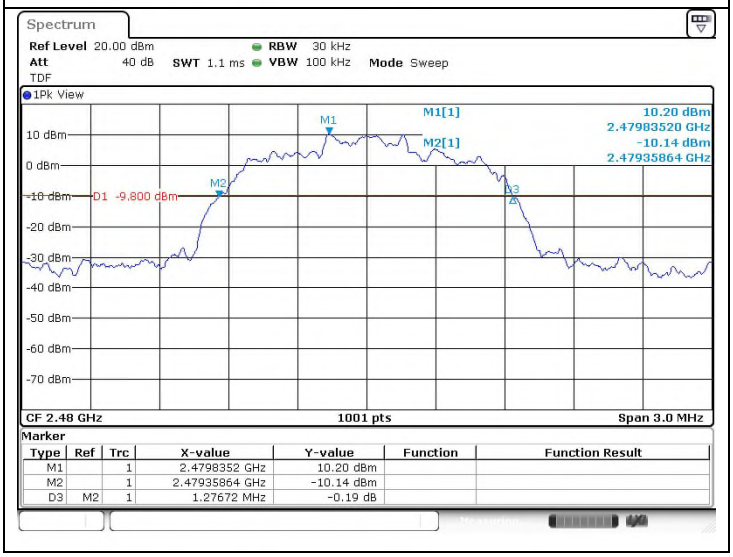
Low Channel



Middle Channel



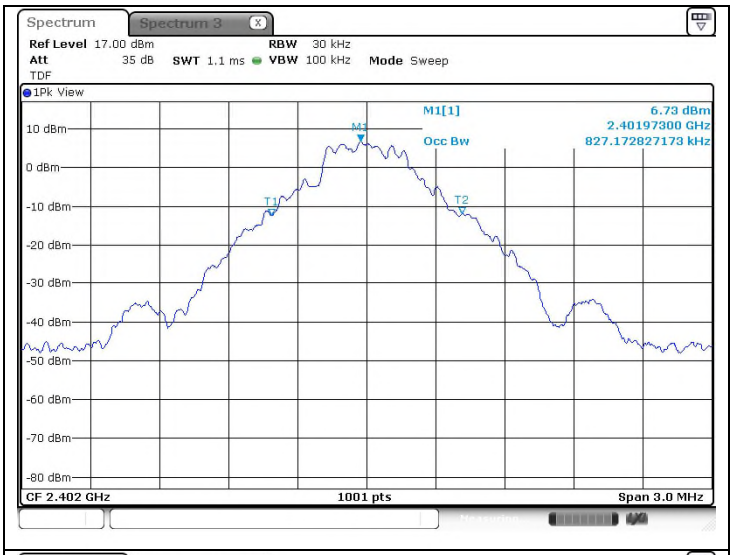
High Channel



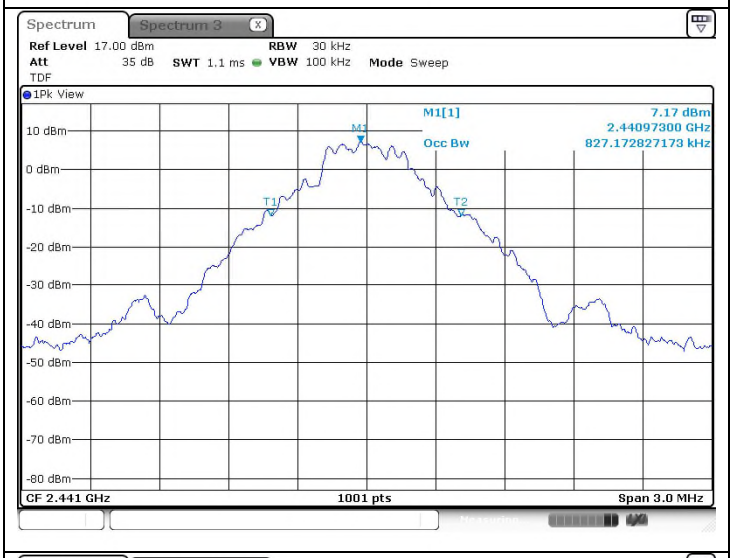
- 99 % Bandwidth

Operating Mode: GFSK_Ant.1

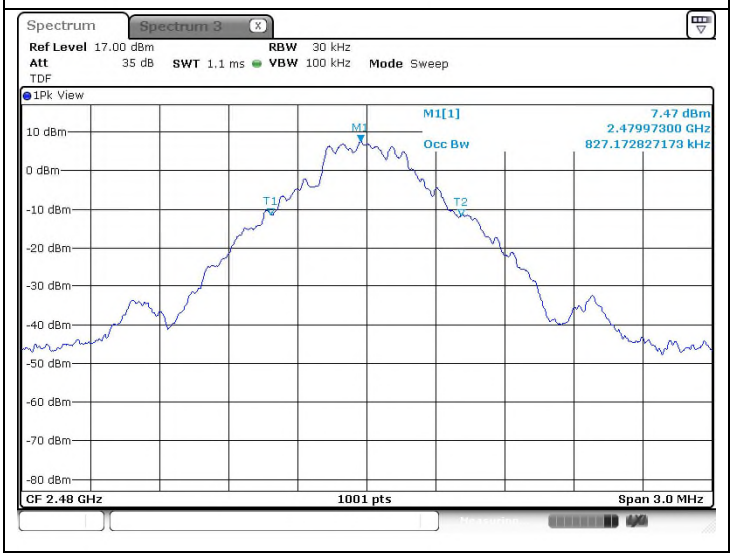
Low Channel



Middle Channel

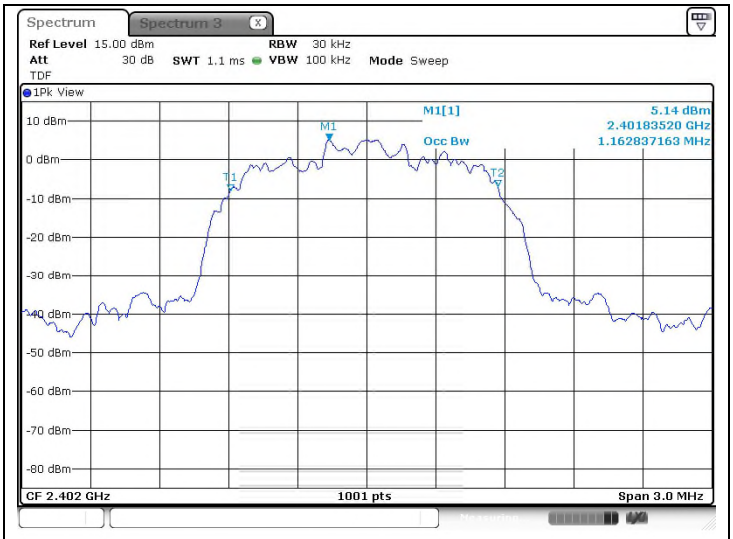


High Channel

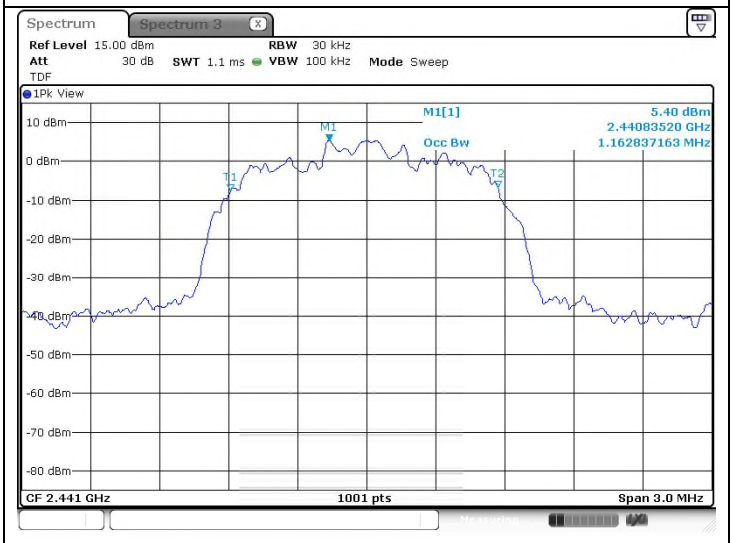


Operating Mode: π/4DQPSK_Ant.1

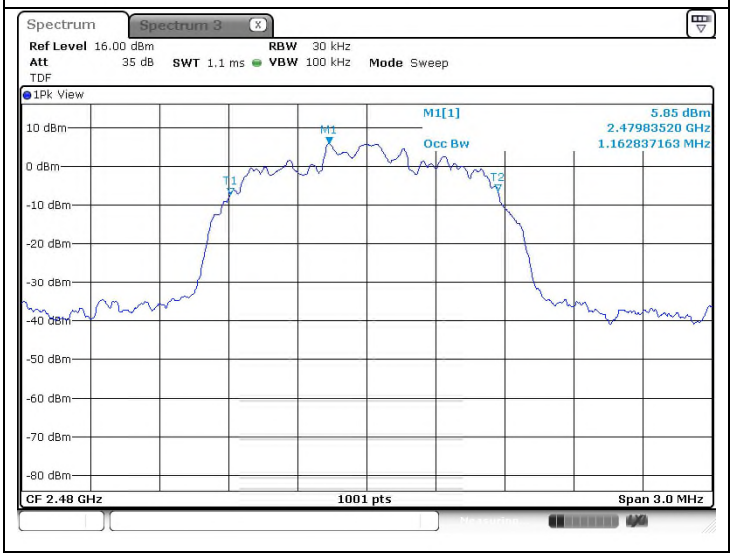
Low Channel



Middle Channel

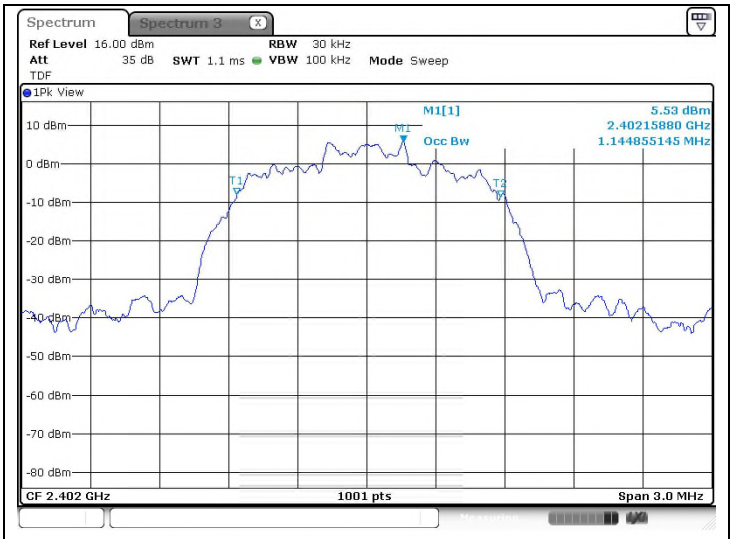


High Channel

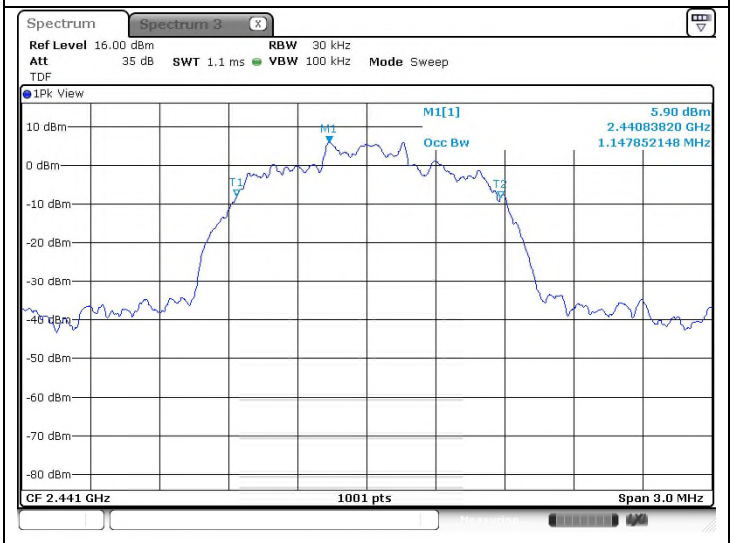


Operating Mode: 8DPSK_Ant.1

Low Channel



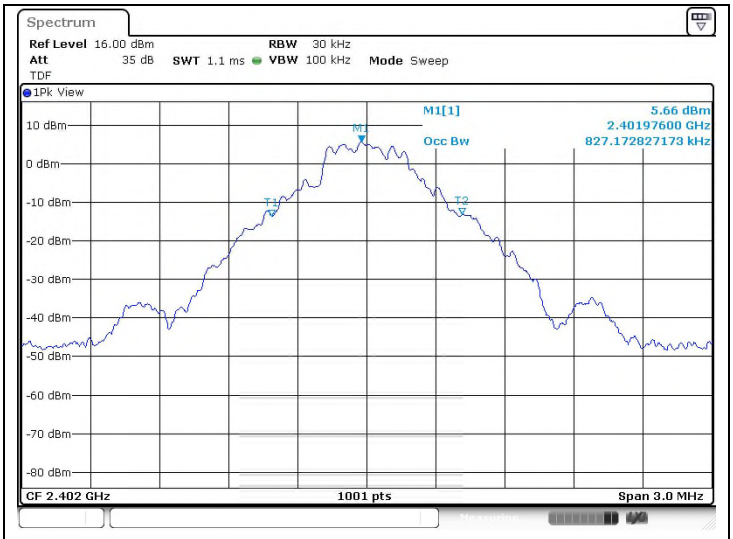
Middle Channel



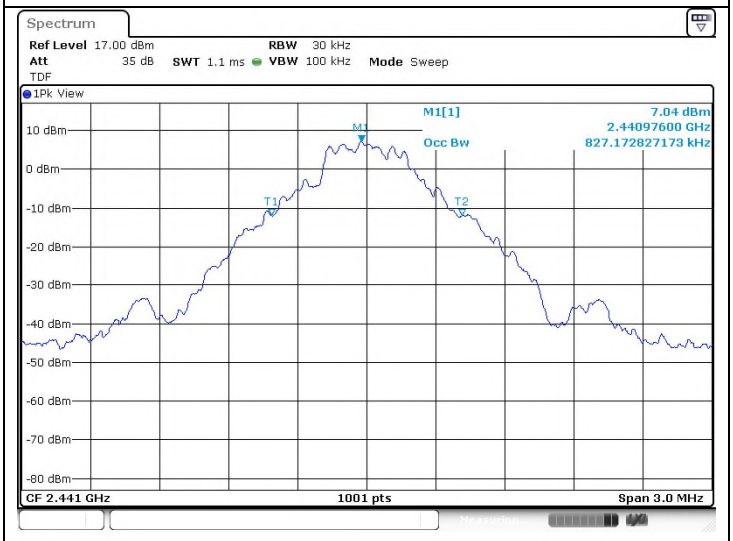
High Channel

Operating Mode: GFSK_Ant.2

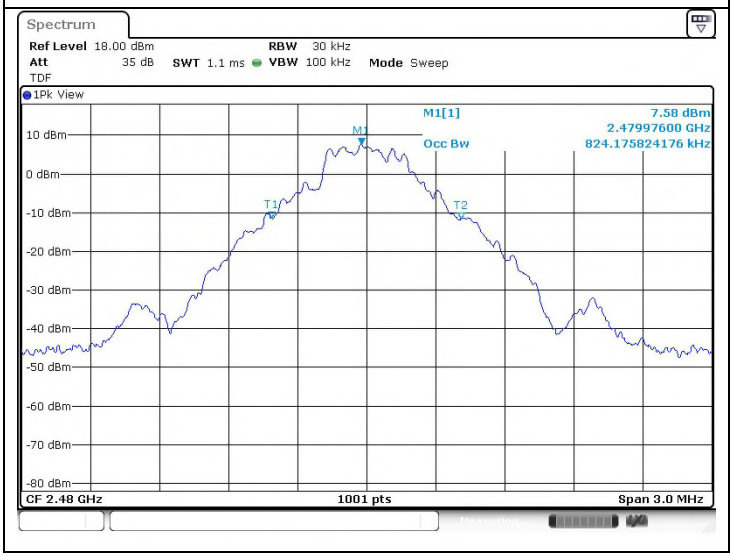
Low Channel



Middle Channel

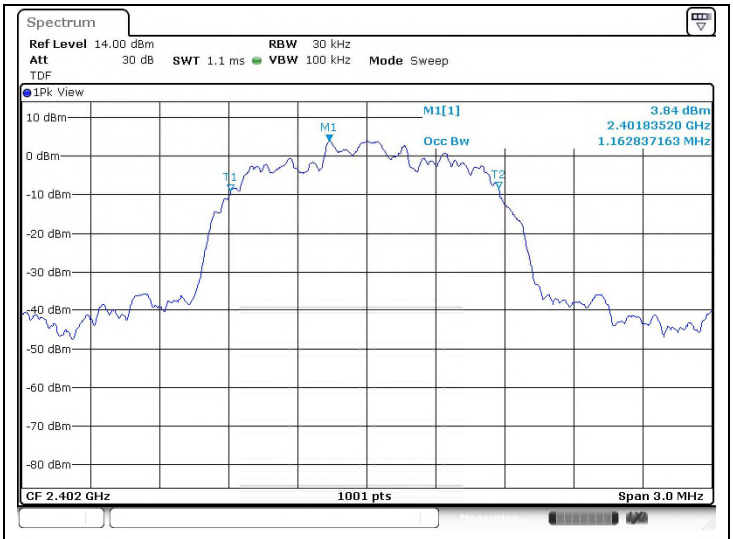


High Channel

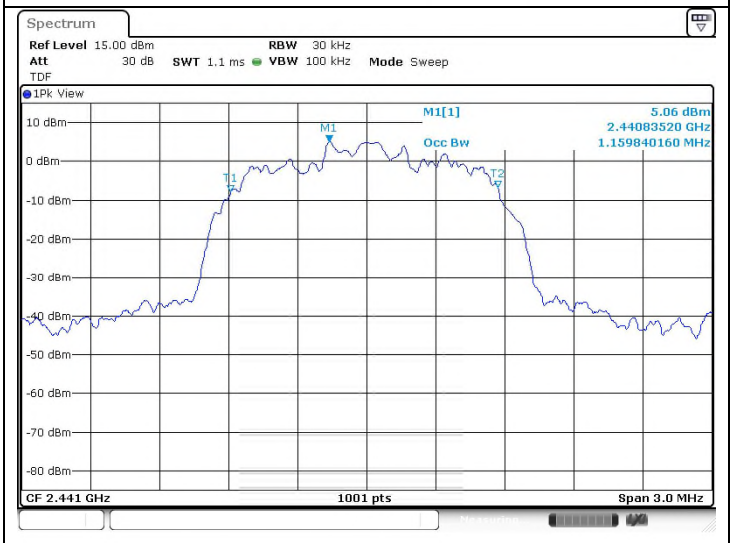


Operating Mode: π/4DQPSK_Ant.2

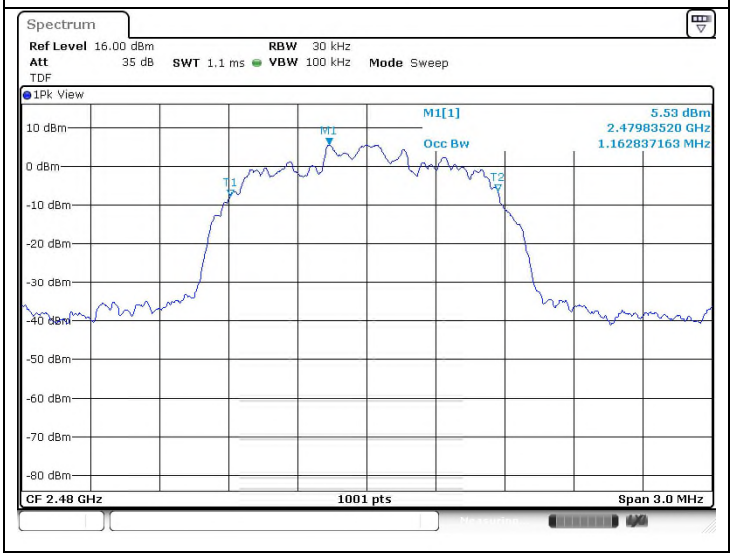
Low Channel



Middle Channel

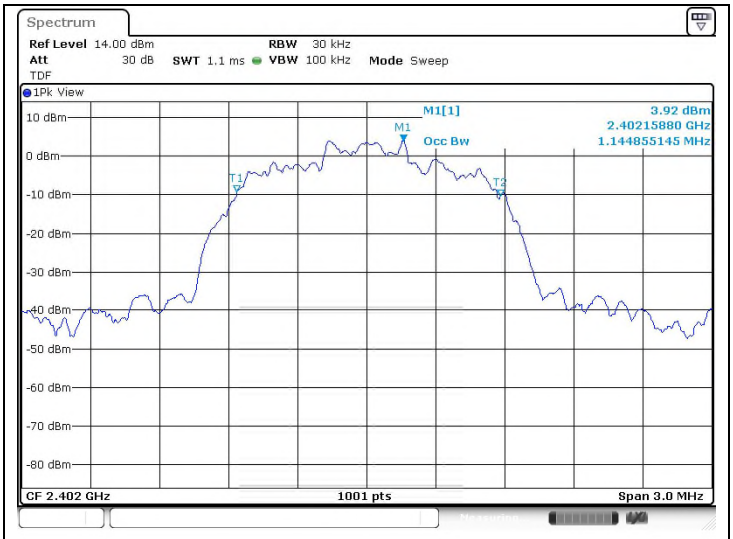


High Channel

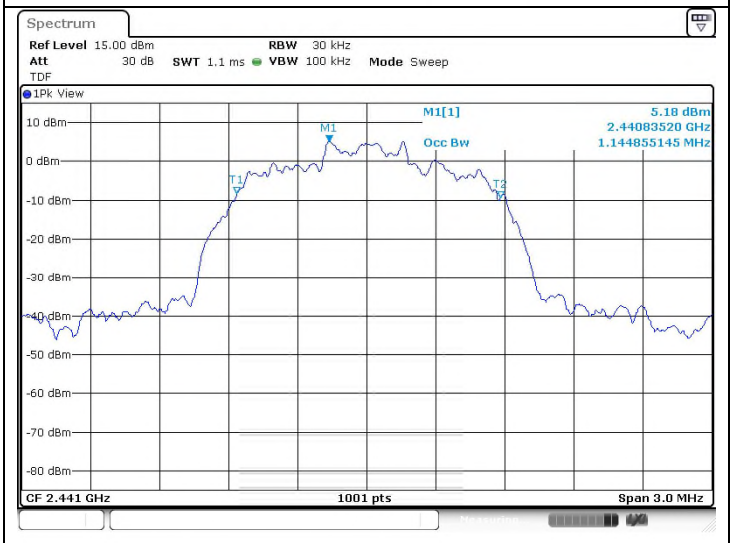


Operating Mode: 8DPSK_Ant.2

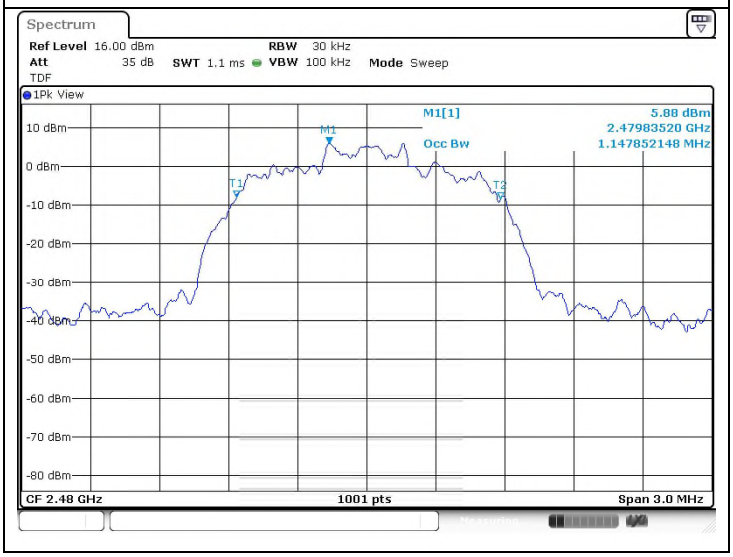
Low Channel



Middle Channel

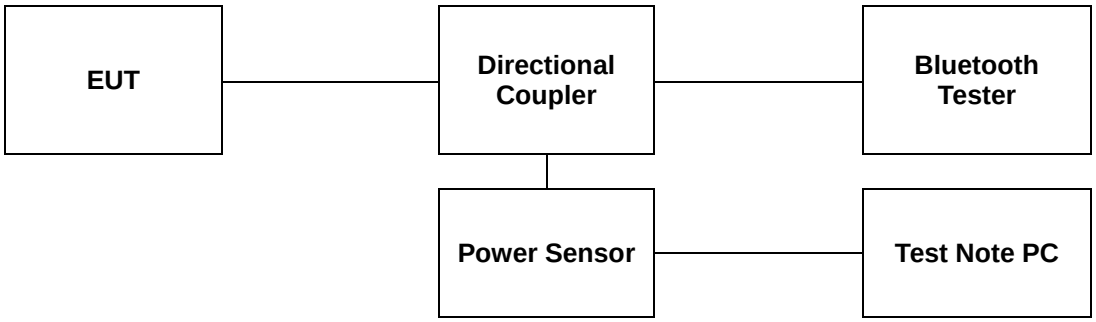


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

4.2.1. FCC

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 ㎒ band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.
2. §15.247(b)(1), For frequency hopping systems operating in the 2 400-2 483.5 ㎒ band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 ㎒ band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 ㎒ band: 0.125 watts.

4.2.2. IC

1. According to RSS-247 Issue 2, 5.1(b), FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2 400-2 483.5 ㎒ may have hopping channel carrier frequencies that are separated by 25 ㎑ or two thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.
2. According to RSS-247 Issue 2, 5.4(b), for FHSs operating in the band 2 400-2 483.5 ㎒, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

4.3. Test Procedure

The test follows ANSI C63.10-2013. Using the power sensor instead of a spectrum analyzer.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the Antenna from the EUT and then connect a low loss RF cable from the Antenna port to the Power sensor.
3. Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)
4. Measure peak power each channel.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

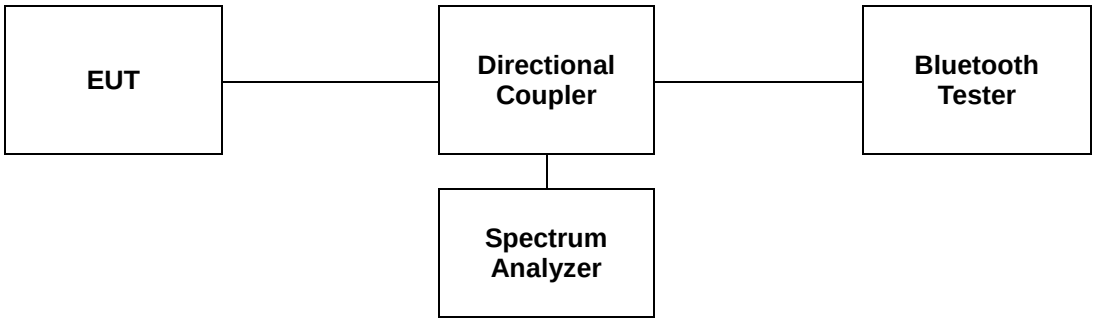
Operation Mode	Data Rate (Mbps)	Channel	Frequency (㎒)	Ant.1		Ant.2		Limit (㏈m)
				Average Power Result (㏈m)	Peak Power Result (㏈m)	Average Power Result (㏈m)	Peak Power Result (㏈m)	
GFSK	1	Low	2 402	14.50	15.88	12.79	14.20	30
		Middle	2 441	14.83	16.26	14.22	15.65	
		High	2 480	15.15	16.60	15.07	16.12	
π/4DQPSK	2	Low	2 402	13.85	17.10	12.09	15.33	20.97
		Middle	2 441	14.49	17.34	13.83	16.77	
		High	2 480	14.49	17.77	14.01	17.32	
8DPSK	3	Low	2 402	13.92	17.62	11.71	15.73	
		Middle	2 441	14.58	17.87	13.81	17.15	
		High	2 480	14.60	18.23	14.01	17.73	

Remark;

In the case of AFH, the limit for peak power is 0.125 W.
Directional coupler and cable offset compensate for test program (R&S Power Viewer) before measuring.

5. Carrier Frequency Separation

5.1. Test Setup



5.2. Limit

5.2.1. FCC

§15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 ㎒ band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

5.2.2. IC

According to RSS-247 Issue 2, 5.1(b), FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2 400-2 483.5 ㎒ may have hopping channel carrier frequencies that are separated by 25 ㎑ or two thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

5.3. Test Procedure

The test follows ANSI C63.10-2013.

The device is operating in hopping mode between 79 channels and also supporting Adaptive Frequency Hopping with hopping between 20 channels. As compared with each operating mode, 79 channels are chosen as a representative for test.
Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels
2. RBW: Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW ≥ RBW
4. Sweep: Auto
5. Detector: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

Use the marker-delta function to determine the between the peaks of the adjacent channels.

5.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Operation Mode	Frequency (㎒)	Adjacent Hopping Channel Separation (㎑)	20 dB Bandwidth (㎑)	
			Ant.1	Ant.2
GFSK	2 441	1 000	929	929

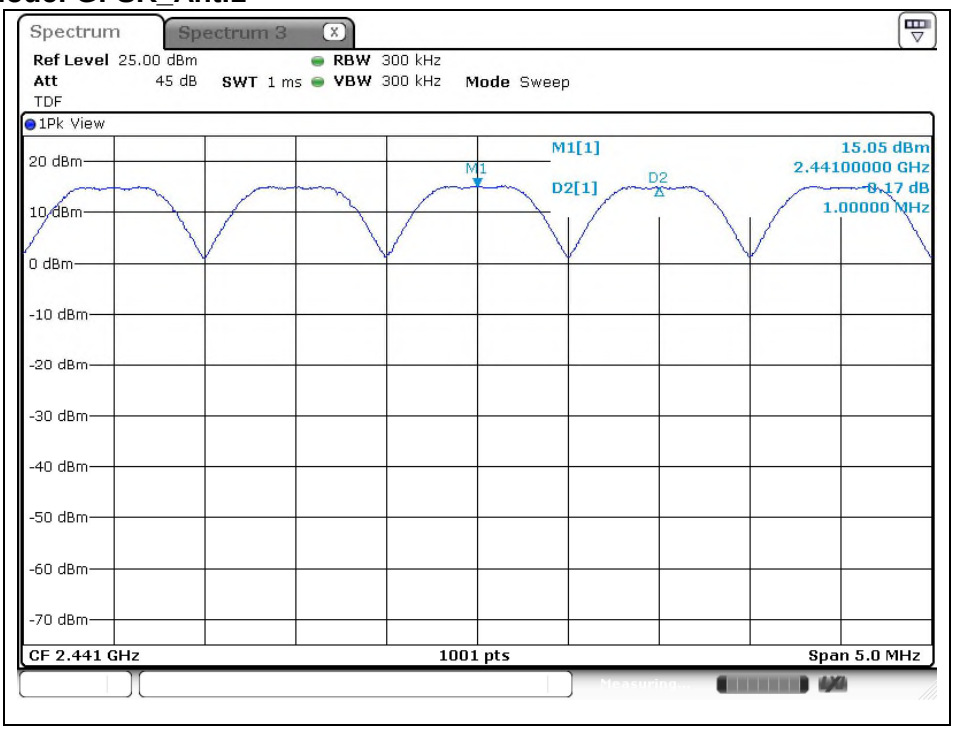
Operation Mode	Frequency (㎒)	Adjacent Hopping Channel Separation (㎑)	Two-third of 20 dB Bandwidth (㎑)	
			Ant.1	Ant.2
8DPSK	2 441	1 000	849	849

Remark;

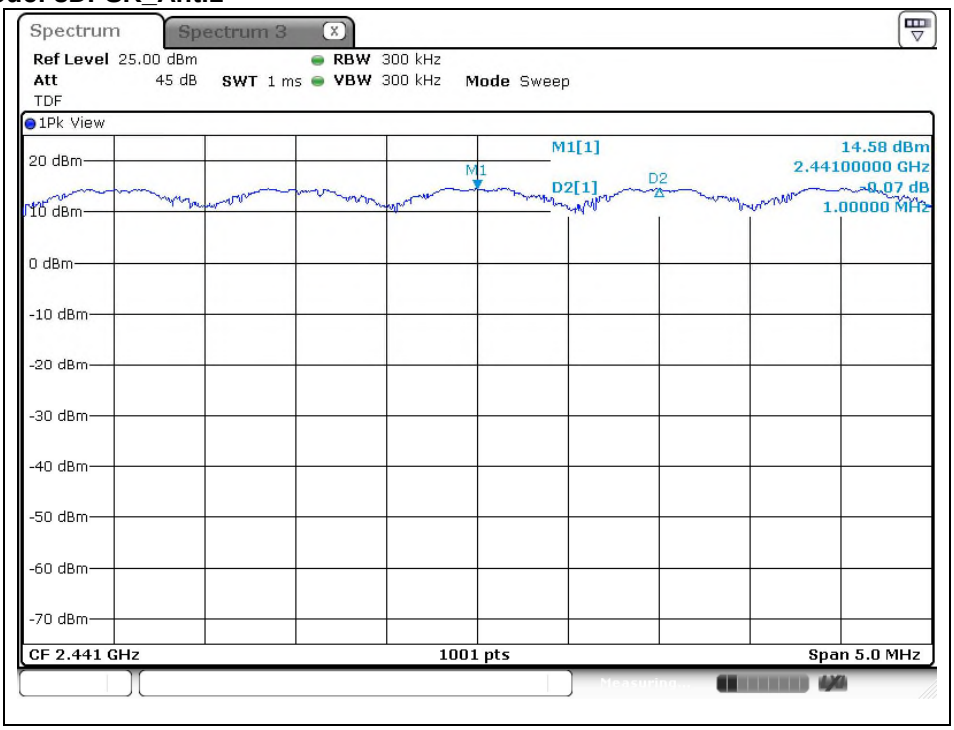
Measurement is made with EUT operating in hopping mode between 79 channels providing a worst case scenario as compared to AFH mode hopping between 20 channels.

- Test plots

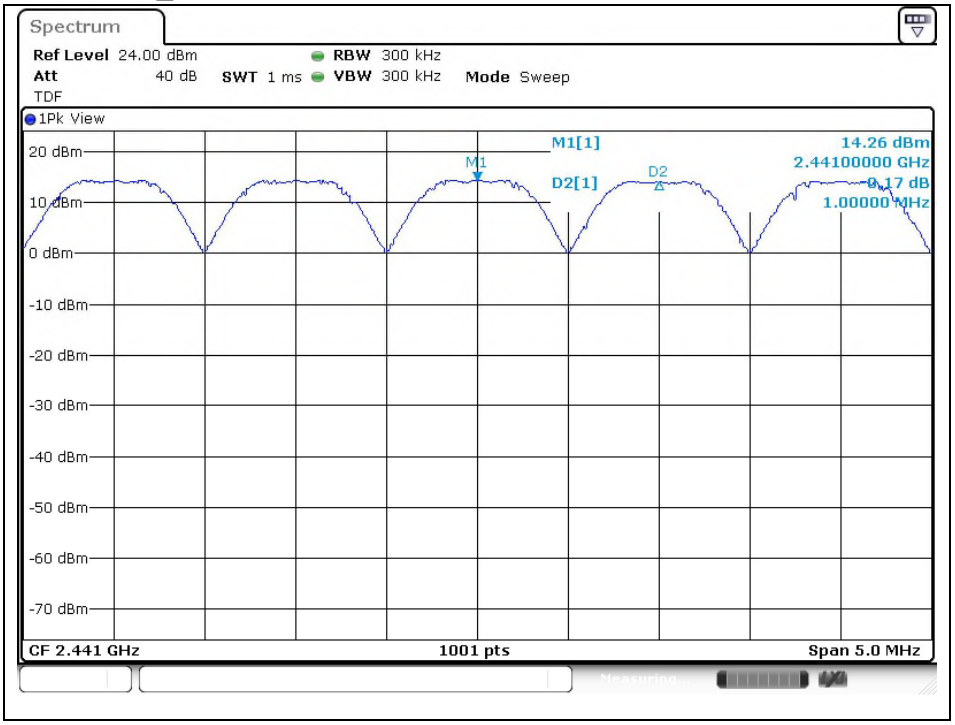
Operating Mode: GFSK_Ant.1



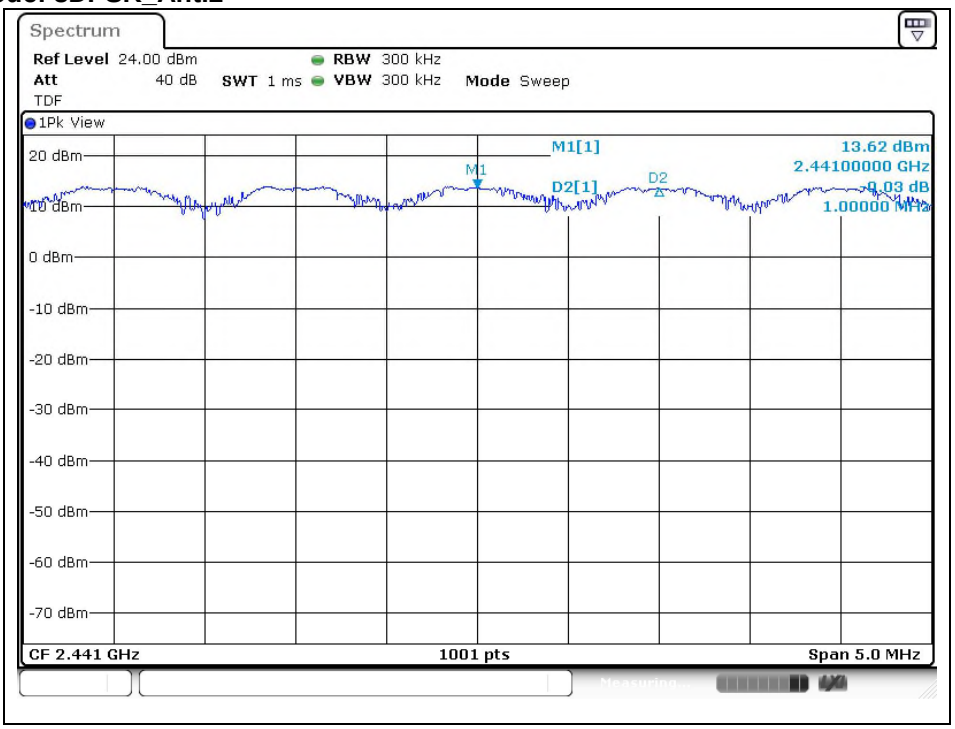
Operating Mode: 8DPSK_Ant.1



Operating Mode: GFSK_Ant.2

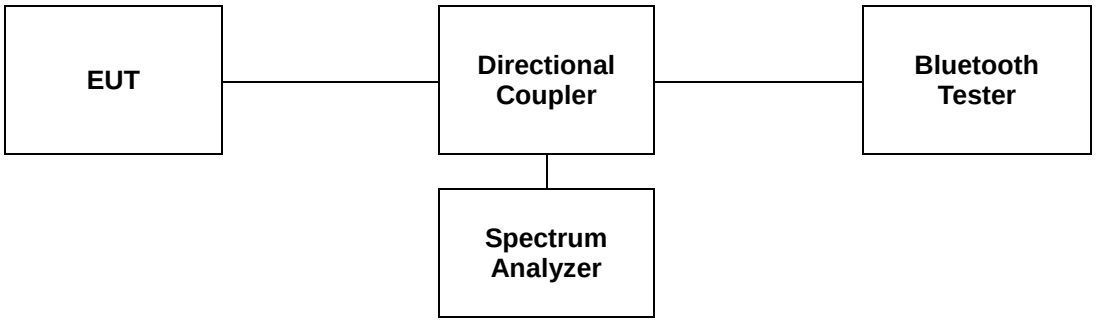


Operating Mode: 8DPSK_Ant.2



6. Number of Hopping Frequencies

6.1. Test Setup



6.2. Limit

6.2.1. FCC

§15.247(a)(1)(iii), Frequency hopping systems in the 2 400-2 483.5 ㎒ band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.2.2. IC

According to RSS-247 Issue 2, 5.1(d), FHSs operating in the band 2 400-2 483.5 ㎒ shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

6.3. Test Procedure

The test follows ANSI C63.10-2013.

The device supports Adaptive Frequency Hopping and will use a minimum of 20 channels of the 79 available channels.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30 % of the channel spacing or the 20 ㏈ bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep: Auto
5. Detector function: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

6.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

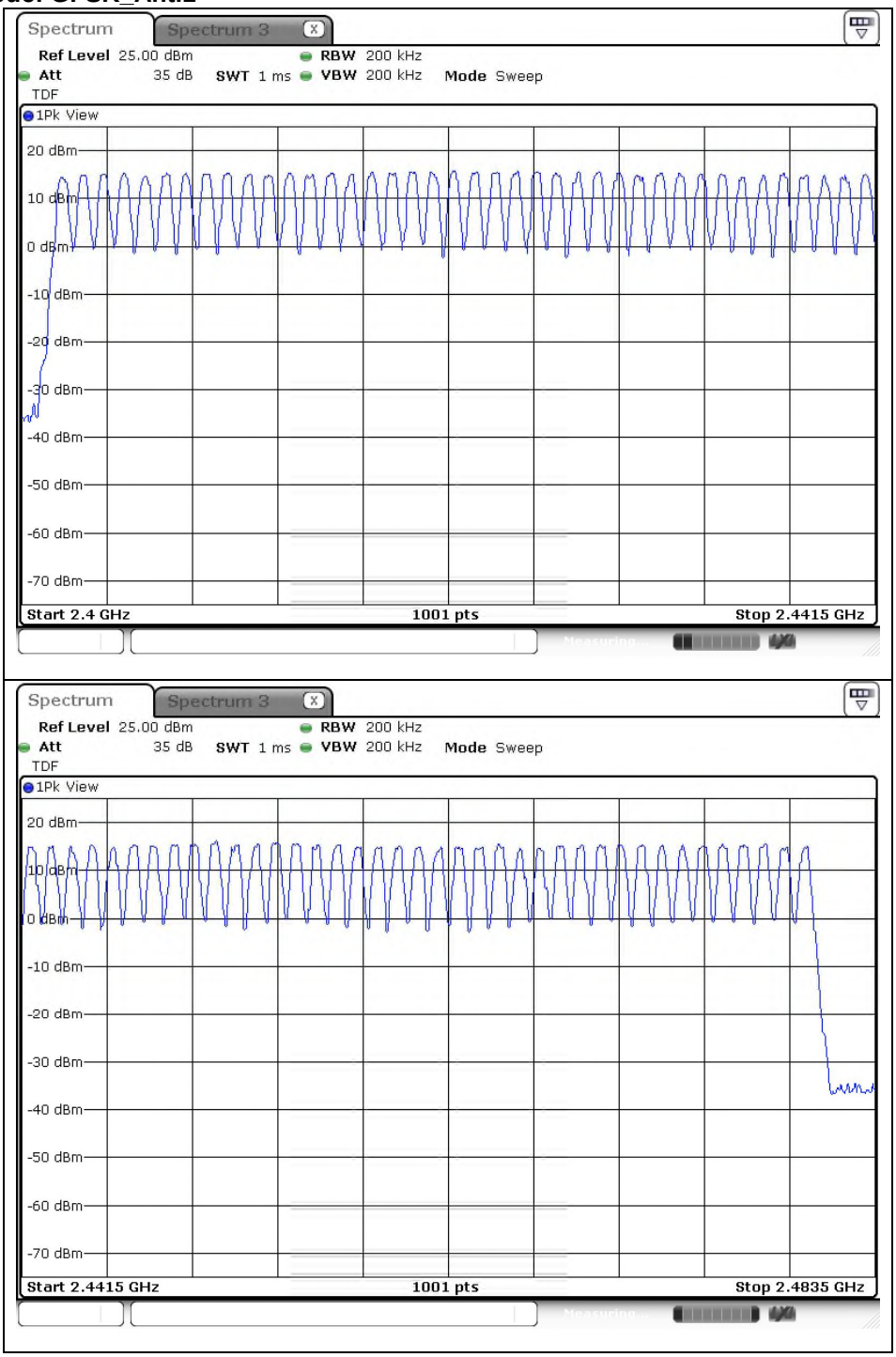
Operation Mode	Number of Hopping Frequency	Limit
GFSK	79	≥ 15
8DPSK	79	≥ 15

Remark;

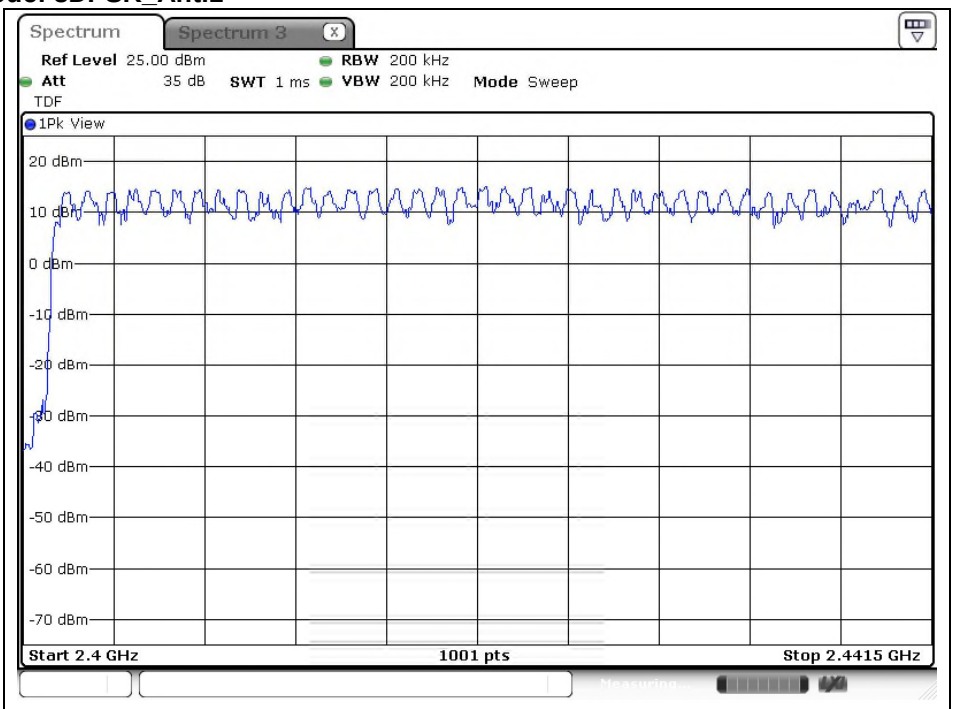
Measurement is made with EUT operating in hopping mode between 79 channels providing a worst case scenario as compared to AFH mode hopping between 20 channels.

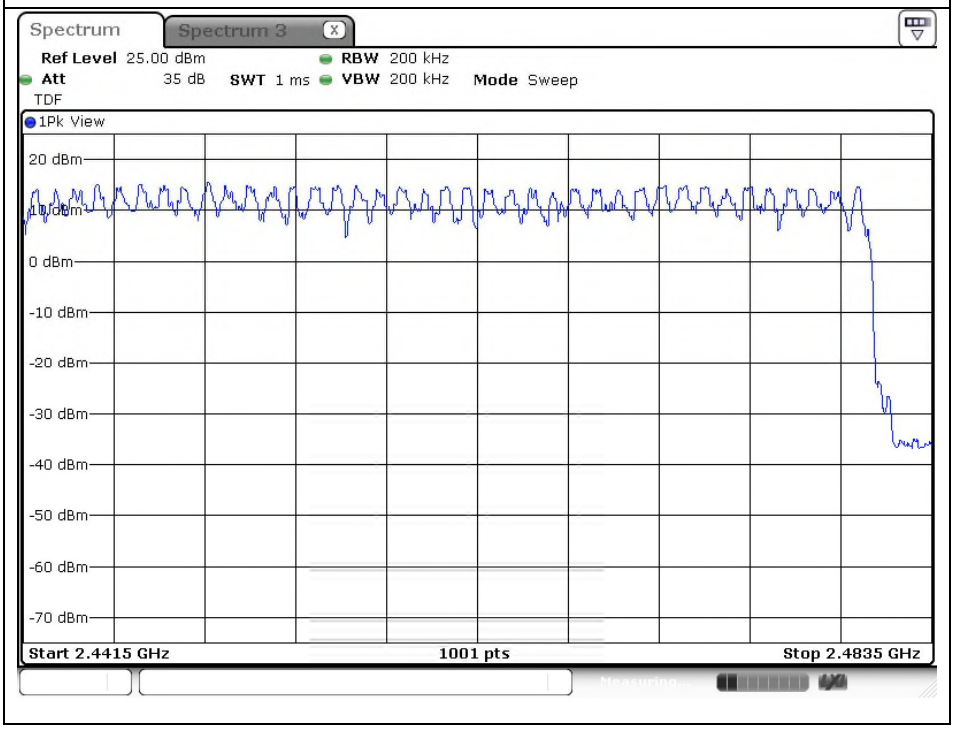
- Test plots

Operating Mode: GFSK_Ant.1



Operating Mode: 8DPSK_Ant.1





Operating Mode: GFSK_Ant.2