



FCC RADIO TEST REPORT

Applicant : Benq Corporation

Address : 16 Jihu Road, Neihu, Taipei 114, Taiwan

Equipment : BenQ Wireless Dongle

Model No. : WDR02U

Trademark : BenQ

FCC ID : JVPWDR02U

I HEREBY CERTIFY THAT :

The sample was received on Jul. 25, 2018 and the testing was carried out on Dec. 05, 2018 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Tested by:

Mark Liao / Assistant Manager

Amos Zhang/ Engineer

Laboratory Accreditation:



Cerpass Technology Corporation Test Laboratory

TAF LAB Code:

1439



Contents

1. Report of Measurements and Examinations	5
1.1 List of Measurements and Examinations	5
2. Test Configuration of Equipment under Test	6
2.1 Feature of Equipment under Test	6
2.2 Carrier Frequency of Channels	6
2.3 Test Mode & Test Software	7
2.4 Description of Test System	7
2.5 General Information of Test	8
2.6 Measurement Uncertainty	8
3. Test Equipment and Ancillaries Used for Tests	9
4. Antenna Requirements	10
4.1 Standard Applicable	10
4.2 Antenna Construction and Directional Gain	10
5. Test of Conducted Emission	11
5.1 Test Limit	11
5.2 Test Procedures	11
5.3 Typical Test Setup	12
5.4 Test Result and Data	13
6. Test of Radiated Emission	15
6.1 Test Limit	15
6.2 Test Procedures	16
6.3 Typical Test Setup	17
6.4 Test Result and Data	18
7. 20dB Bandwidth Measurement Data	38
7.1 Test Limit	38
7.2 Test Procedures	38
7.3 Test Setup Layout	38
7.4 Test Result and Data	38
8. Frequencies Separation	44
8.1 Test Limit	44
8.2 Test Procedures	44
8.3 Test Setup Layout	44
8.4 Test Result and Data	44
9. Dwell Time on each channel	47
9.1 Test Limit	47
9.2 Test Procedures	47
9.3 Test Setup Layout	47
9.4 Test Result and Data	48
10. Number of Hopping Channels	55
10.1 Test Limit	55
10.2 Test Procedures	55
10.3 Test Setup Layout	55
10.4 Test Result and Data	55
11. Maximum Peak Output Power	58



11.1	Test Limit	58
11.2	Test Procedures	58
11.3	Test Setup Layout	58
11.4	Test Result and Data	58
12.	Band Edges Measurement	64
12.1	Test Limit	64
12.2	Test Procedure	64
12.3	Test Setup Layout	64
12.4	Test Result and Data	65
12.5	Restrict band emission Measurement Data	70
13.	Restricted Bands of Operation	82
13.1	Labeling Requirement	82



■ ORIGINAL

☐ Additional attachment as following record:

[illegible]



1. Report of Measurements and Examinations

1.1 List of Measurements and Examinations

ANSI C63.10: 2013

KDB 558074 D01 DTS Meas Guidance v03r05

FCC Rules and Regulations Part 15 Subpart C §15.247

FCC Rule	Description of Test	Result
§ 15.203	Antenna Requirement	Pass
§ 15.207(a)	Conducted Emission	Pass
§ 15.209(a)	Radiated Emission	Pass
§ 15.247(a)(1)	Channel Carrier Frequencies Separation	Pass
§ 15.247(a)(1)	20dB Bandwidth Measurement	Pass
§ 15.247(a)(1)	Dwell Time	Pass
§ 15.247(b)	Number of Hopping Channels	Pass
§ 15.247(b)	Peak Output Power Measurement Data	Pass
§ 15.247(d)	Band Edges Measurement Data	Pass



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Product	BenQ Wireless Dongle
Test Model	WDR02U
Frequency Range	2402~2480MHz
Number of Channels	79
Modulation	GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps) for Bluetooth
Data Rates	Bluetooth: 1, 2, 3Mbps
Antenna Type	PCB antenna
Power Supply Rating	DC 5V

Note: for more details, please refer to the User's manual of the EUT.

2.2 Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	---	---



2.3 Test Mode & Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10
- b. The complete test system included support units and EUT for RF test.
- c. Run the test software "WCN_Combo_Tool_Setup_customer.exe", input RF test command and set the test mode and channel, then press OK to start continue transmit.
- d. The following test mode was performed for conduction and radiation test:
Test Mode 1: GFSK: CH 00: 2402MHz, CH 39: 2441MHz, CH 78: 2480MHz.
Test Mode 2: $\pi/4$ DQPSK : CH 00: 2402MHz, CH 39: 2441MHz, CH 78: 2480MHz.
Test Mode 3: 8DPSK: CH 00: 2402MHz, CH 39: 2441MHz, CH 78: 2480MHz.

2.4 Description of Test System

No	Device	Manufacturer	Model No.	Description
1	Notebook	SONY	PCG-71811P	R33021

Use Cable:

No.	Cable	Quantity	Description
-----	-------	----------	-------------



2.5 General Information of Test

☒	Test Site	Cerpass Technology Corporation Test Laboratory Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881 Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C. Tel: +886-2-2663-8582
	FCC	TW1079, TW1061, TW1439
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication Test C-4663 for Conducted emission test R-4399,R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:		Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 25000MHz
Test Distance:		The test distance of radiated emission from antenna to EUT is 3 M.

2.6 Measurement Uncertainty

Measurement Item	Measurement Uncertainty
Conducted Emission	±2.71 dB
Radiation test (10m) below 1GHz	Vertical : ±3.89 dB
	Horizontal: ±4.11 dB
Radiation test (3m) below 1GHz	Vertical : ±4.11 dB
	Horizontal: ±4.10 dB
20 dB Bandwidth	7500 Hz
Maximum Peak Output Power	±1.4 dB
100kHz Bandwidth of Frequency Band Edges	±2.2 dB
Power Spectral Density	±1.3870 dB



3. Test Equipment and Ancillaries Used for Tests

Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
EMI Receiver	R&S	ESCI3	100443	2018/03/15	2019/03/14
LISN	Schwarzbeck	NSLK 8127	8127-568	2018/02/26	2019/02/25
Pulse Limiter	R&S	ESH3-Z2	101934	2018/02/22	2019/02/21
Bilog Antenna	Schwarzbeck	VULB9168	275	2018/09/17	2019/09/16
Active Loop Antenna	EMCO	6507	40855	2018/05/22	2019/05/21
Horn Antenna	EMCO	3115	31601	2018/09/26	2019/09/25
Horn Antenna	EMCO	3116	31970	2018/03/23	2019/03/22
Preamplifier	EM	EM330	60660	2018/03/08	2019/03/07
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2018/09/18	2019/09/17
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2018/10/31	2019/10/30
MXG MW Analog Signal Generator	KEYSIGHT	N5183A	MY50142931	2018/04/10	2019/04/09
Spectrum Analyzer	R&S	FSP40	100219	2018/07/03	2019/07/02
BLUETOOTH TESTER	R&S	CBT	101133	2018/04/02	2019/04/01
Attenuator	KEYSIGHT	8491B	MY39250705	2018/09/04	2019/09/03
Rotary Attenuator	Agilent	8495B	MY42146680	2018/03/29	2019/03/28
Temp & Humi chamber	T-MACHINE	TMJ-9712	T-12-040111	2018/08/30	2019/08/29
Series Power Meter	Anritsu	ML2495A	1224005	2018/03/23	2019/03/22
Power Sensor	Anritsu	MA2411B	1207295	2018/03/23	2019/03/22
Software	Farad	Ez-EMC	ver.ct3a1	N/A	N/A
Software	AUDIX	E3	V8.2014-8-6	N/A	N/A
Software	Keysight	N7607B Signal Studio	V3.0.0.0	N/A	N/A
Software	Keysight	Inservice MonitorUtility	N/A	N/A	N/A



4. Antenna Requirements

4.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.2 Antenna Construction and Directional Gain

Antenna	Peak Gain
PCB Antenna	WiFi; Antenna 1:2.0dBi; Antenna 2:2.0dBi Bluetooth: 2dBi



5. Test of Conducted Emission

5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz on the 120 VAC power and return leads of the EUT according to the methods defined in ANSI C63.10-2013. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 6.2.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

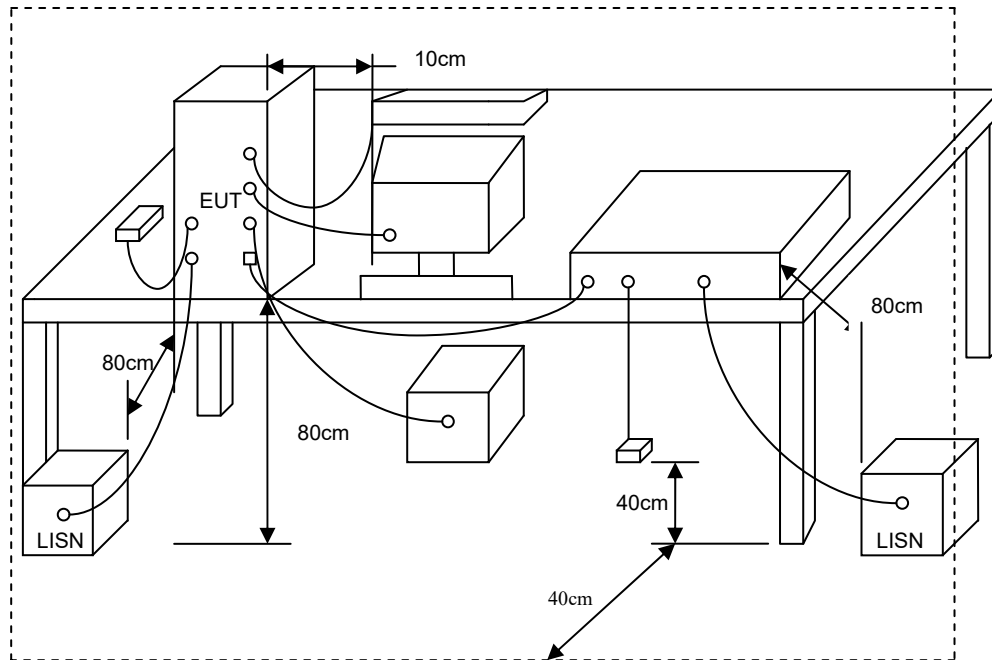
*Decreases with the logarithm of the frequency.

5.2 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



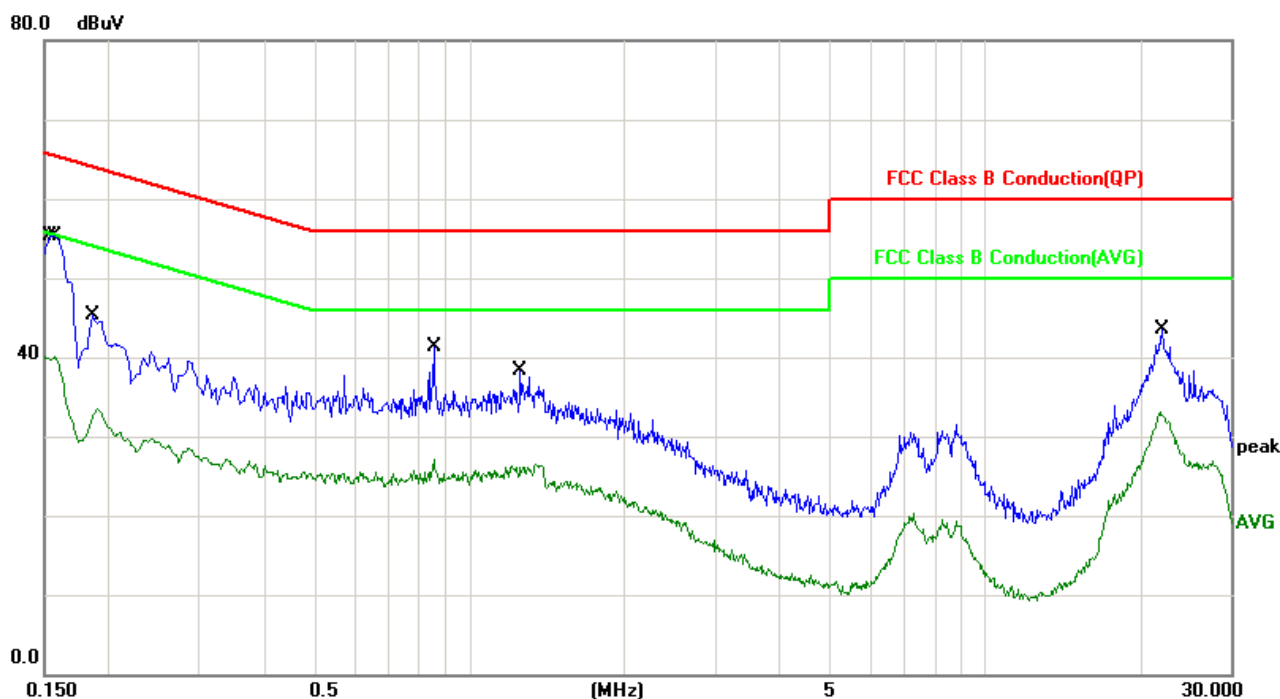
5.3 Typical Test Setup





5.4 Test Result and Data

Test Mode :	Normal Link	Phase :	Line
Temperature :	20°C	Humidity:	51%
Pressur(mbar) :	1002	Date:	Aug. 12, 2018

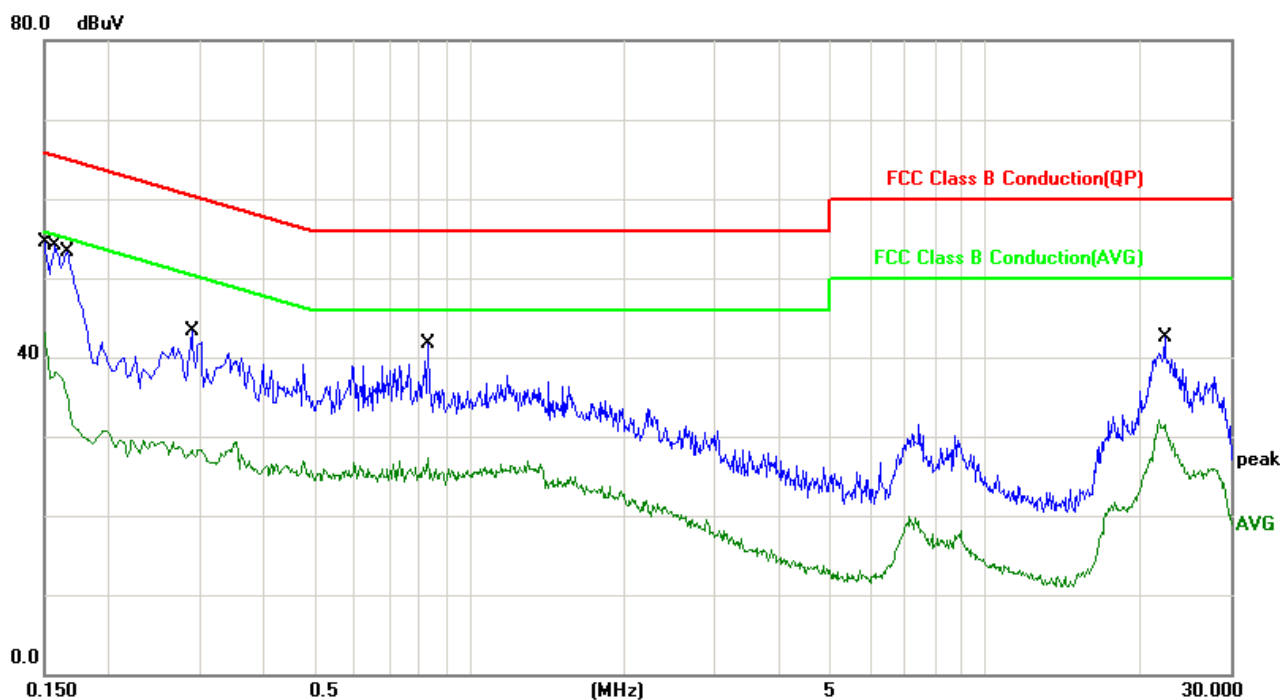


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1539	10.06	42.05	52.11	65.78	-13.67	QP
2	0.1539	10.06	27.72	37.78	55.78	-18.00	AVG
3	0.1582	10.06	41.14	51.20	65.55	-14.35	QP
4	0.1582	10.06	26.02	36.08	55.55	-19.47	AVG
5	0.1860	10.06	30.39	40.45	64.21	-23.76	QP
6	0.1860	10.06	21.47	31.53	54.21	-22.68	AVG
7	0.8540	10.10	20.81	30.91	56.00	-25.09	QP
8	0.8540	10.10	14.56	24.66	46.00	-21.34	AVG
9	1.2579	10.37	20.25	30.62	56.00	-25.38	QP
10	1.2579	10.37	15.15	25.52	46.00	-20.48	AVG
11	22.0940	10.58	26.42	37.00	60.00	-23.00	QP
12	22.0940	10.58	21.45	32.03	50.00	-17.97	AVG

Note: Measurement Level = Reading Level + Correct Factor+ Attenuator



Test Mode :	Normal Link	Phase :	Neutral
Temperature :	20 °C	Humidity:	51%
Pressur(mbar) :	1002	Date:	Aug. 12, 2018



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	10.06	40.79	50.85	65.99	-15.14	QP
2	0.1500	10.06	29.41	39.47	55.99	-16.52	AVG
3	0.1580	10.06	39.67	49.73	65.56	-15.83	QP
4	0.1580	10.06	26.76	36.82	55.56	-18.74	AVG
5	0.1660	10.06	37.89	47.95	65.15	-17.20	QP
6	0.1660	10.06	23.17	33.23	55.15	-21.92	AVG
7	0.2900	10.01	23.98	33.99	60.52	-26.53	QP
8	0.2900	10.01	17.69	27.70	50.52	-22.82	AVG
9	0.8340	10.10	20.94	31.04	56.00	-24.96	QP
10	0.8340	10.10	14.92	25.02	46.00	-20.98	AVG
11	22.3860	10.58	24.14	34.72	60.00	-25.28	QP
12	22.3860	10.58	19.09	29.67	50.00	-20.33	AVG

Note: Measurement Level = Reading Level + Correct Factor+ Attenuator



6. Test of Radiated Emission

6.1 Test Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

FREQUENCIES(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

For unintentional device, according to CISPR PUB.22, for Class B digital devices, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 10 meters shall not exceed the above table.

Frequency (MHz)	Distance Meters	Radiated (dB μ V/ M)
30-230	10	30
230-1000	10	37



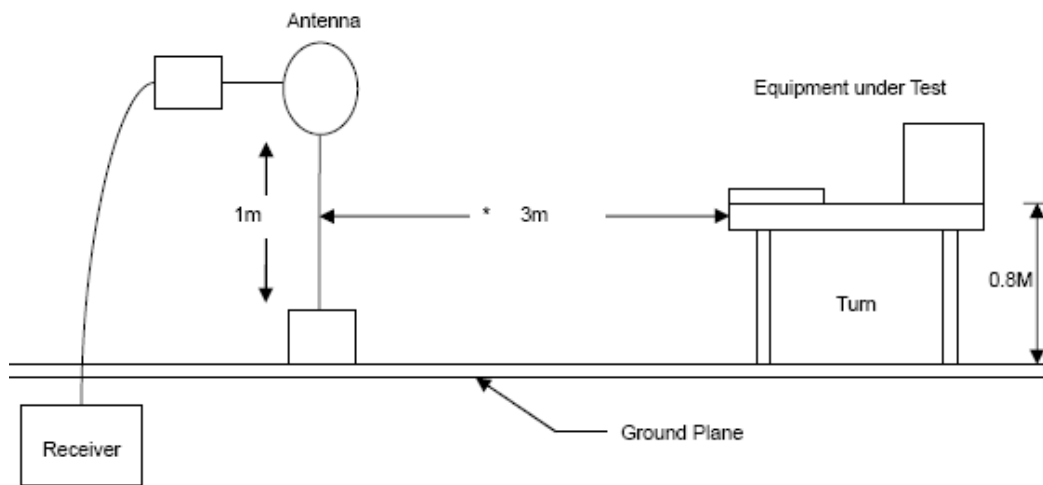
6.2 Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground; above 1GHz, the height was 1.5m.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

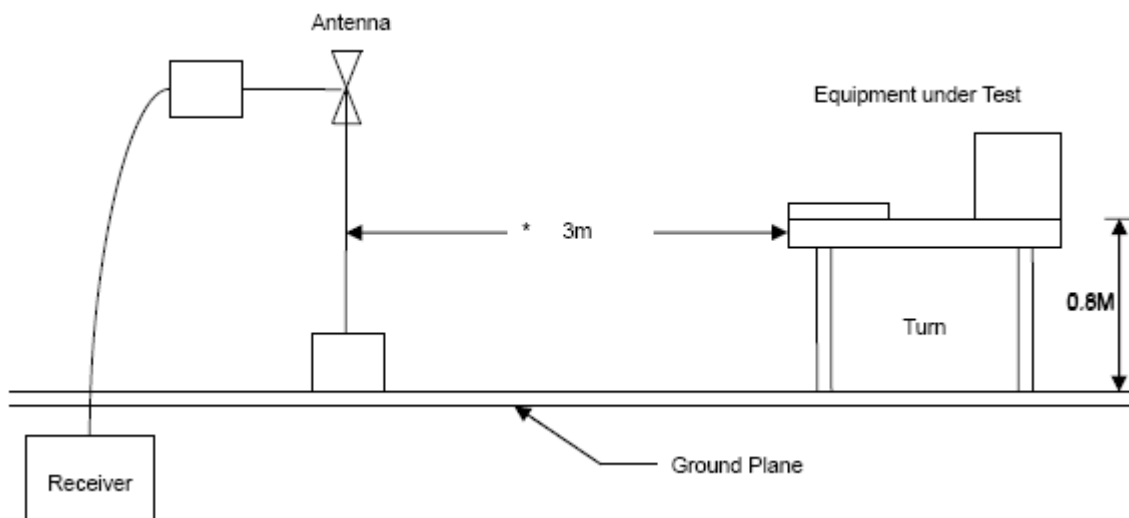


6.3 Typical Test Setup

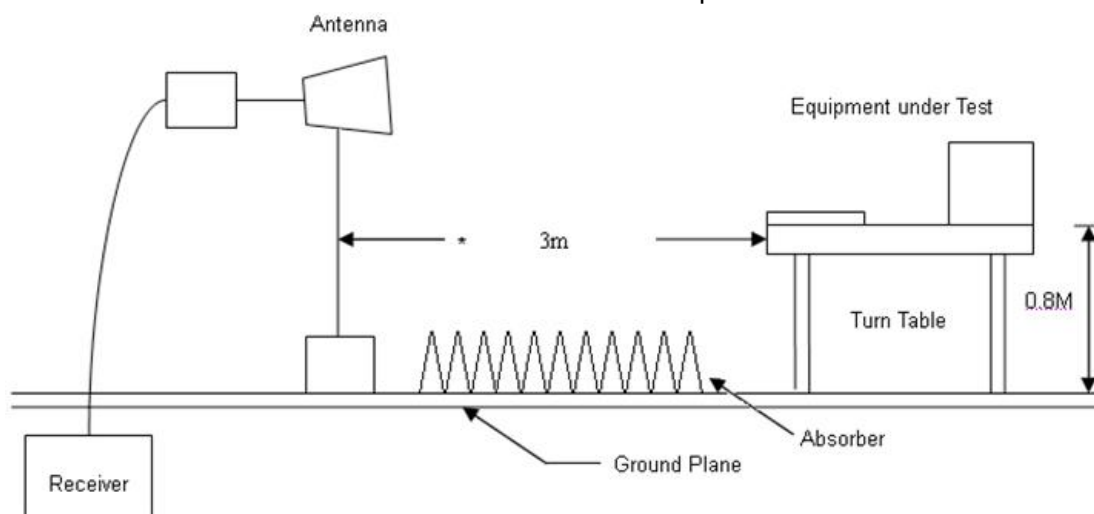
Below 30MHz Test Setup



30M - 1GHz Test Setup



Above 1GHz Test Setup





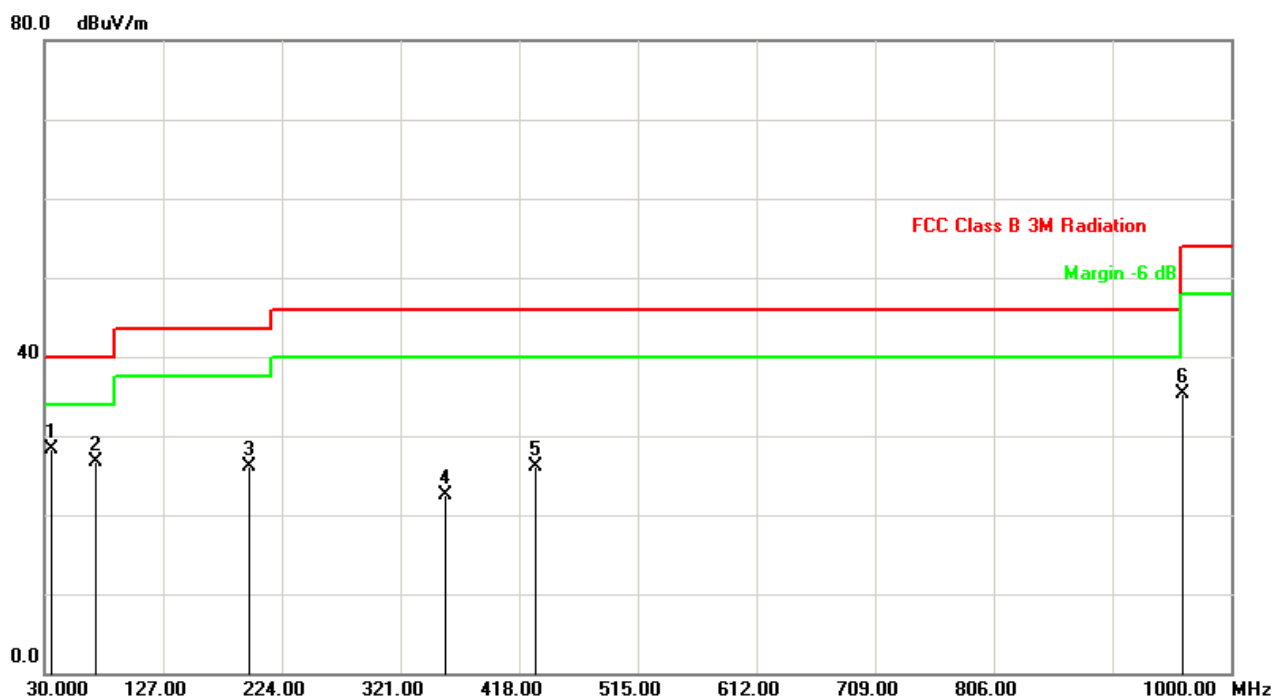
6.4 Test Result and Data

The 9kHz-30MHz spurious emission is under limit 20dB more.

6.4.1 Test Result and Data of Transmitter

Below 1GHz

Power	:	AC 120V	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1	Temperature	:	18 °C
Test Date	:	Nov. 01, 2018	Humidity	:	49 %
Memo	:	CH 00	Atmospheric Pressure	:	1008 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	35.8200	-6.56	34.93	28.37	40.00	-11.63	peak	100	31
2	71.7099	-14.83	41.49	26.66	40.00	-13.34	peak	100	201
3	197.8100	-9.77	35.82	26.05	43.50	-17.45	peak	100	54
4	357.8599	-4.37	26.86	22.49	46.00	-23.51	peak	100	118
5	431.5799	-4.60	30.73	26.13	46.00	-19.87	peak	100	27
6	960.2300	3.17	32.06	35.23	54.00	-18.77	peak	100	305

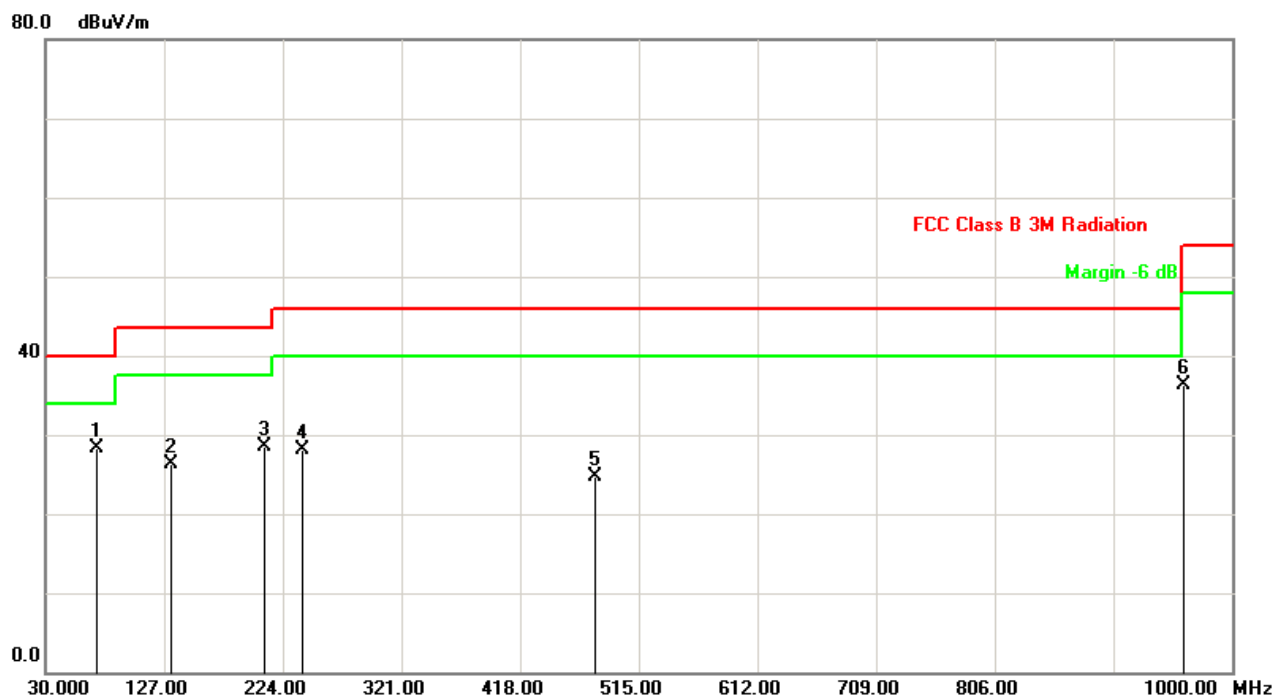
Note: Level = Reading + Factor

Margin = Level - Limit

Factor = Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 18 °C
Test Date	: Nov. 01, 2018	Humidity	: 49 %
Memo	: CH 00	Atmospheric Pressure	: 1008 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	71.7099	-14.83	43.17	28.34	40.00	-11.66	peak	100	11
2	132.8199	-9.28	35.49	26.21	43.50	-17.29	peak	100	349
3	209.4499	-9.50	37.92	28.42	43.50	-15.08	peak	200	18
4	239.5200	-9.06	37.24	28.18	46.00	-17.82	peak	100	0
5	480.0799	-1.10	25.73	24.63	46.00	-21.37	peak	200	307
6	960.2300	3.17	33.21	36.38	54.00	-17.62	peak	200	26

Note: Level = Reading + Factor

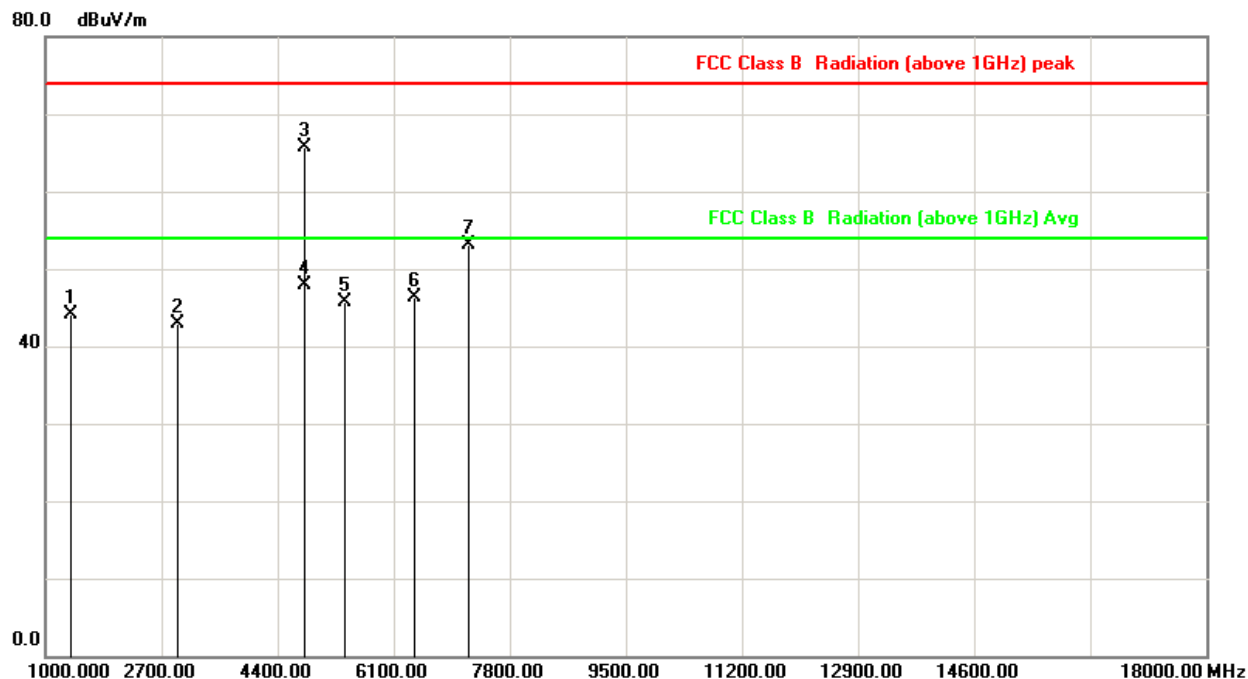
Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Above 1GHz

Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 00	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1368.333	-2.81	47.01	44.20	74.00	-29.80	peak
2	2926.667	6.28	36.71	42.99	74.00	-31.01	peak
3	4796.667	14.22	51.46	65.68	74.00	-8.32	peak
4	4796.667	14.22	33.67	47.89	54.00	-6.11	AVG
5	5391.667	14.93	30.83	45.76	74.00	-28.24	peak
6	6411.667	16.42	29.92	46.34	74.00	-27.66	peak
7	7205.000	18.88	34.13	53.01	74.00	-20.99	peak

Note: Level = Reading + Factor

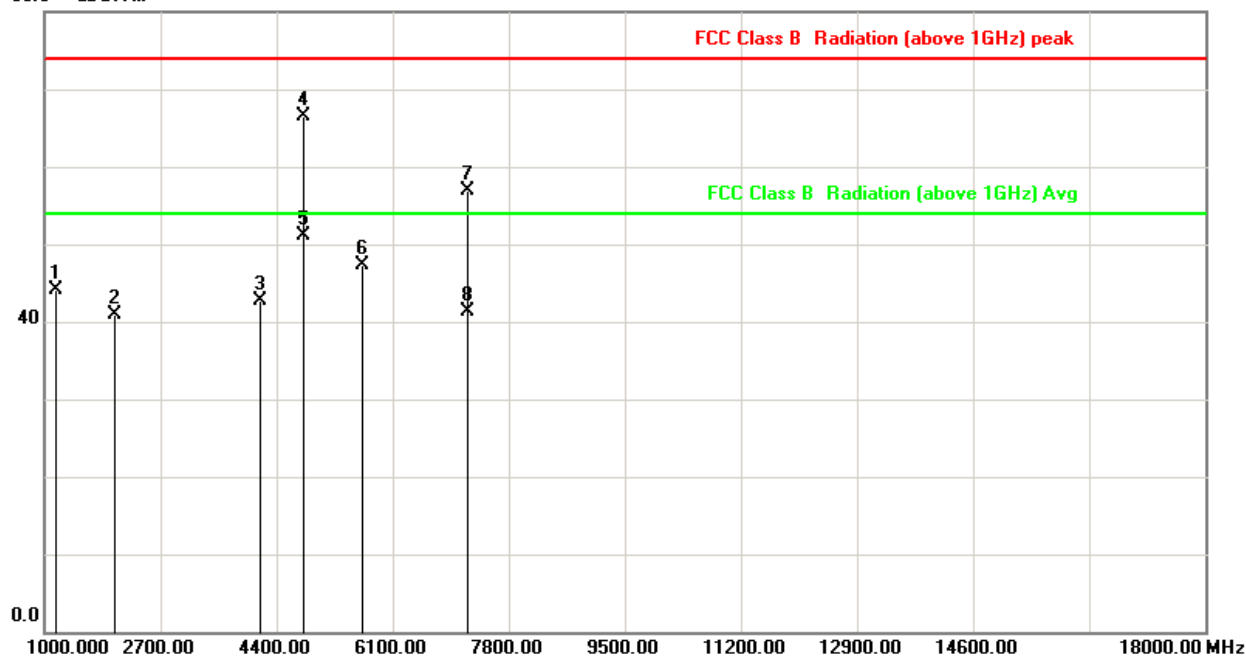
Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 00	Atmospheric Pressure	: 1010 hpa

80.0 dBuV/m



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1170.000	-4.62	48.77	44.15	74.00	-29.85	peak
2	2020.000	1.36	39.47	40.83	74.00	-33.17	peak
3	4173.333	11.99	30.76	42.75	74.00	-31.25	peak
4	4796.667	14.22	52.19	66.41	74.00	-7.59	peak
5	4796.667	14.22	36.81	51.03	54.00	-2.97	AVG
6	5646.667	15.38	31.96	47.34	74.00	-26.66	peak
7	7205.000	18.88	38.12	57.00	74.00	-17.00	peak
8	7205.000	18.88	22.34	41.22	54.00	-12.78	AVG

Note: Level = Reading + Factor

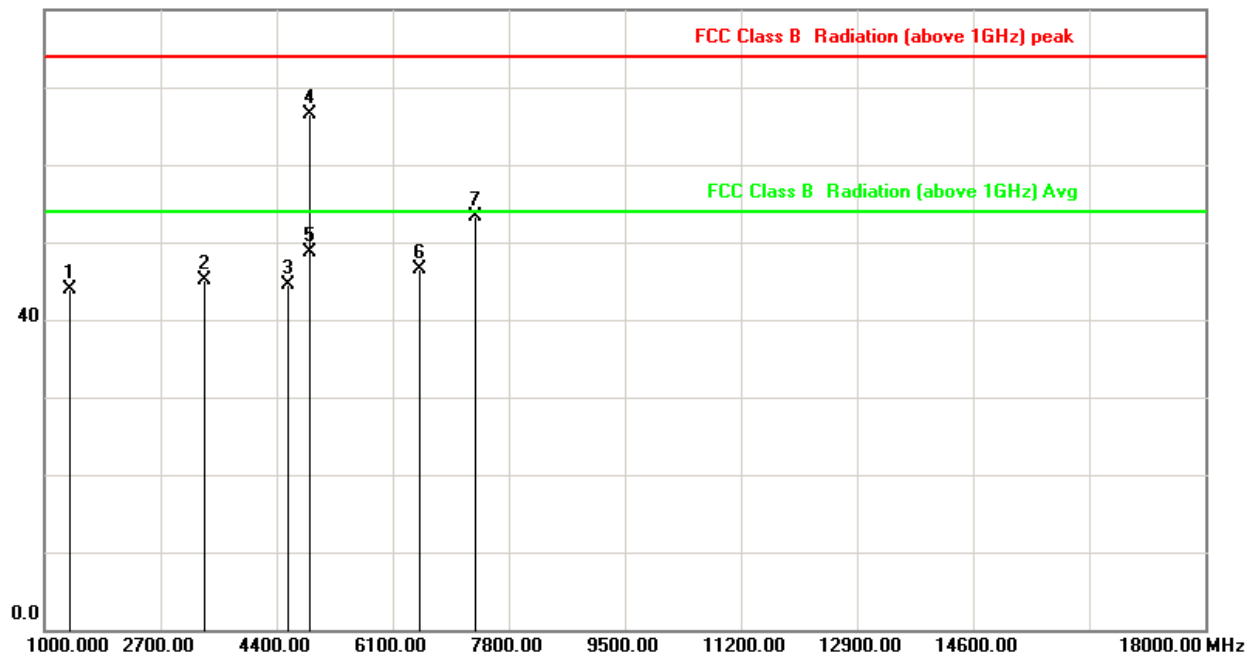
Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa

80.0 dBuV/m



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1368.333	-2.81	46.77	43.96	74.00	-30.04	peak
2	3351.667	8.62	36.46	45.08	74.00	-28.92	peak
3	4570.000	13.79	30.75	44.54	74.00	-29.46	peak
4	4881.667	14.38	52.12	66.50	74.00	-7.50	peak
5	4881.667	14.38	34.26	48.64	54.00	-5.36	AVG
6	6496.667	16.46	30.13	46.59	74.00	-27.41	peak
7	7318.333	19.32	33.95	53.27	74.00	-20.73	peak

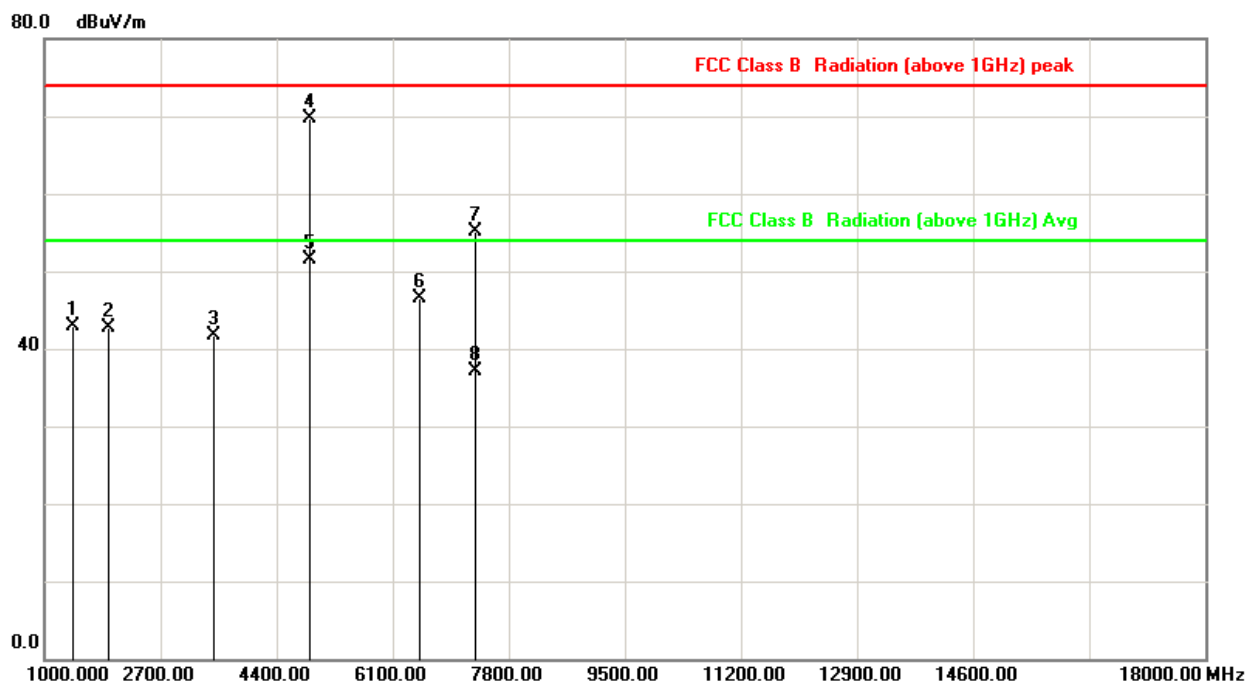
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1425.000	-2.29	45.20	42.91	74.00	-31.09	peak
2	1935.000	0.90	41.85	42.75	74.00	-31.25	peak
3	3493.333	9.36	32.35	41.71	74.00	-32.29	peak
4	4881.667	14.38	55.32	69.70	74.00	-4.30	peak
5	4881.667	14.38	37.10	51.48	54.00	-2.52	AVG
6	6496.667	16.46	29.97	46.43	74.00	-27.57	peak
7	7318.333	19.32	35.69	55.01	74.00	-18.99	peak
8	7318.333	19.32	17.84	37.16	54.00	-16.84	AVG

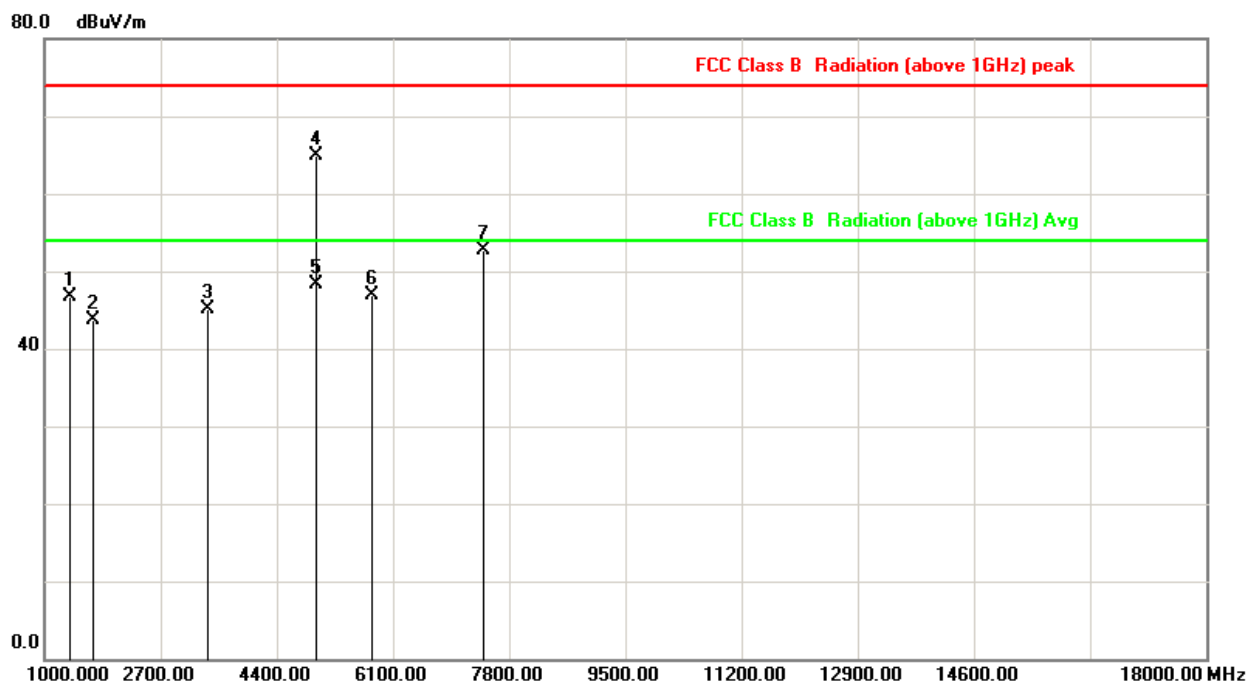
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1368.333	-2.81	49.54	46.73	74.00	-27.27	peak
2	1708.333	-0.41	44.11	43.70	74.00	-30.30	peak
3	3380.000	8.77	36.24	45.01	74.00	-28.99	peak
4	4966.667	14.54	50.43	64.97	74.00	-9.03	peak
5	4966.667	14.54	33.74	48.28	54.00	-5.72	AVG
6	5788.333	15.74	31.22	46.96	74.00	-27.04	peak
7	7431.667	19.76	32.94	52.70	74.00	-21.30	peak

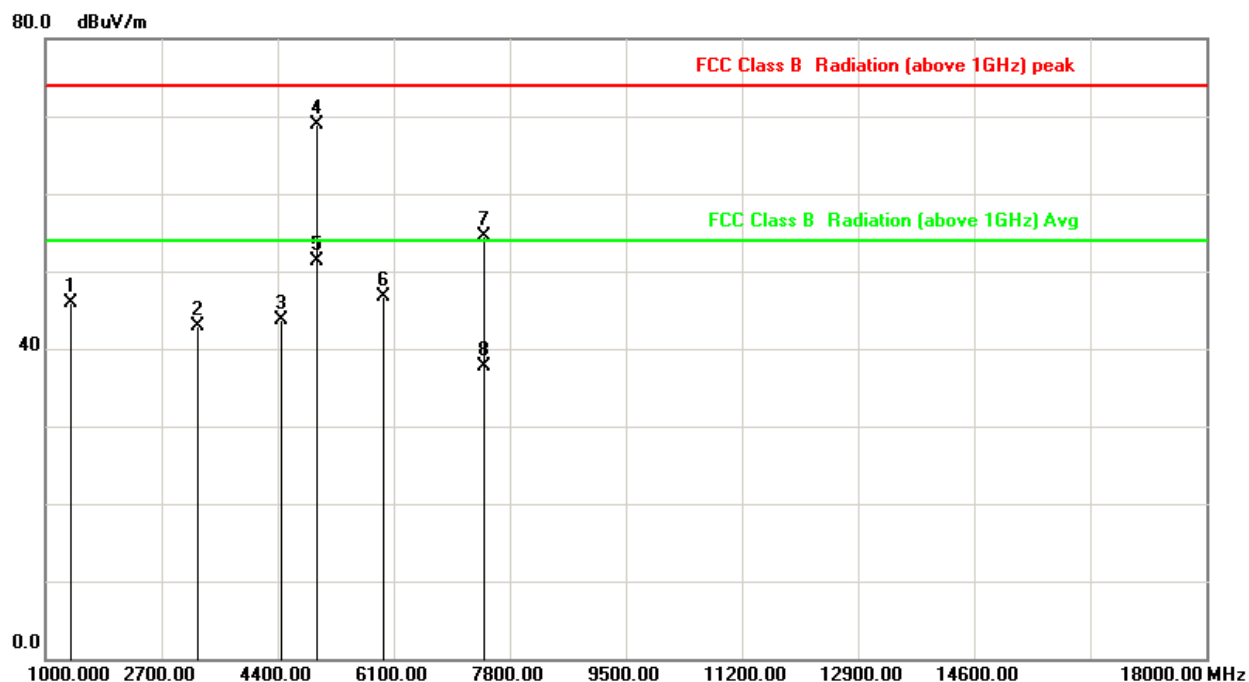
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1368.333	-2.81	48.76	45.95	74.00	-28.05	peak
2	3238.333	8.02	34.91	42.93	74.00	-31.07	peak
3	4456.667	13.44	30.21	43.65	74.00	-30.35	peak
4	4966.667	14.54	54.37	68.91	74.00	-5.09	peak
5	4966.667	14.54	36.81	51.35	54.00	-2.65	AVG
6	5958.333	16.16	30.58	46.74	74.00	-27.26	peak
7	7431.667	19.76	34.79	54.55	74.00	-19.45	peak
8	7431.667	19.76	17.86	37.62	54.00	-16.38	AVG

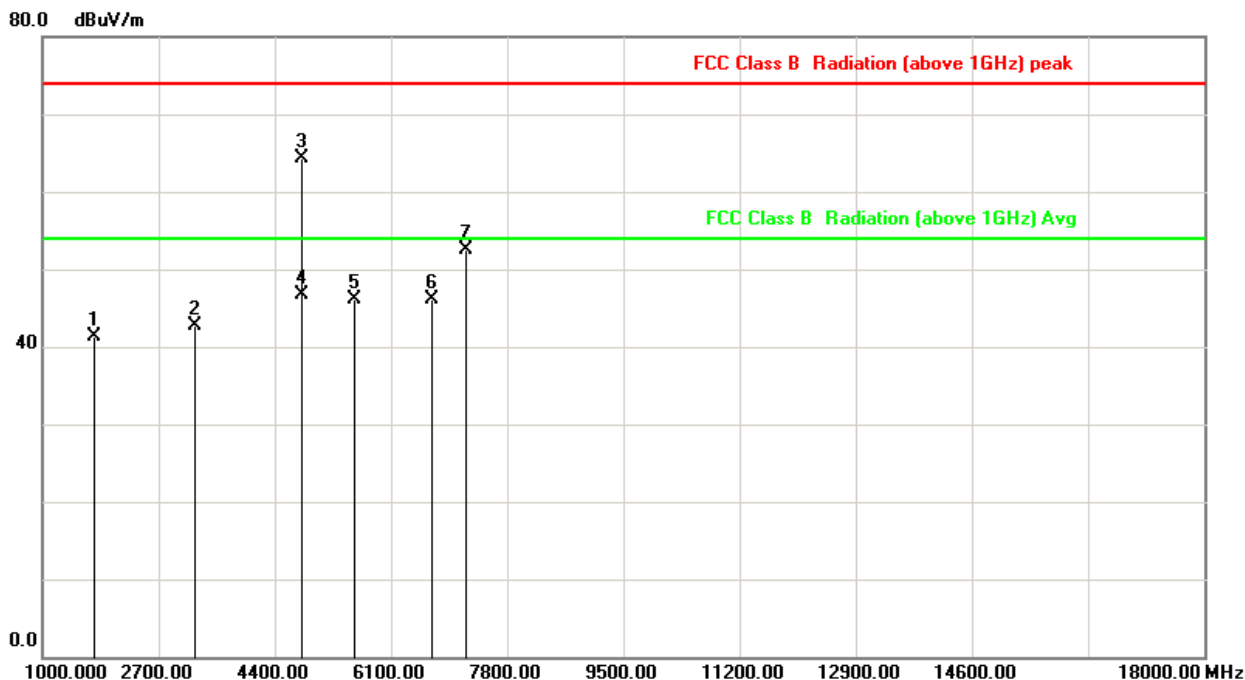
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 2	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 00	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1765.000	-0.08	41.35	41.27	74.00	-32.73	peak
2	3238.333	8.02	34.65	42.67	74.00	-31.33	peak
3	4796.667	14.22	50.12	64.34	74.00	-9.66	peak
4	4796.667	14.22	32.51	46.73	54.00	-7.27	AVG
5	5561.667	15.17	30.98	46.15	74.00	-27.85	peak
6	6695.000	17.09	28.93	46.02	74.00	-27.98	peak
7	7205.000	18.88	33.63	52.51	74.00	-21.49	peak

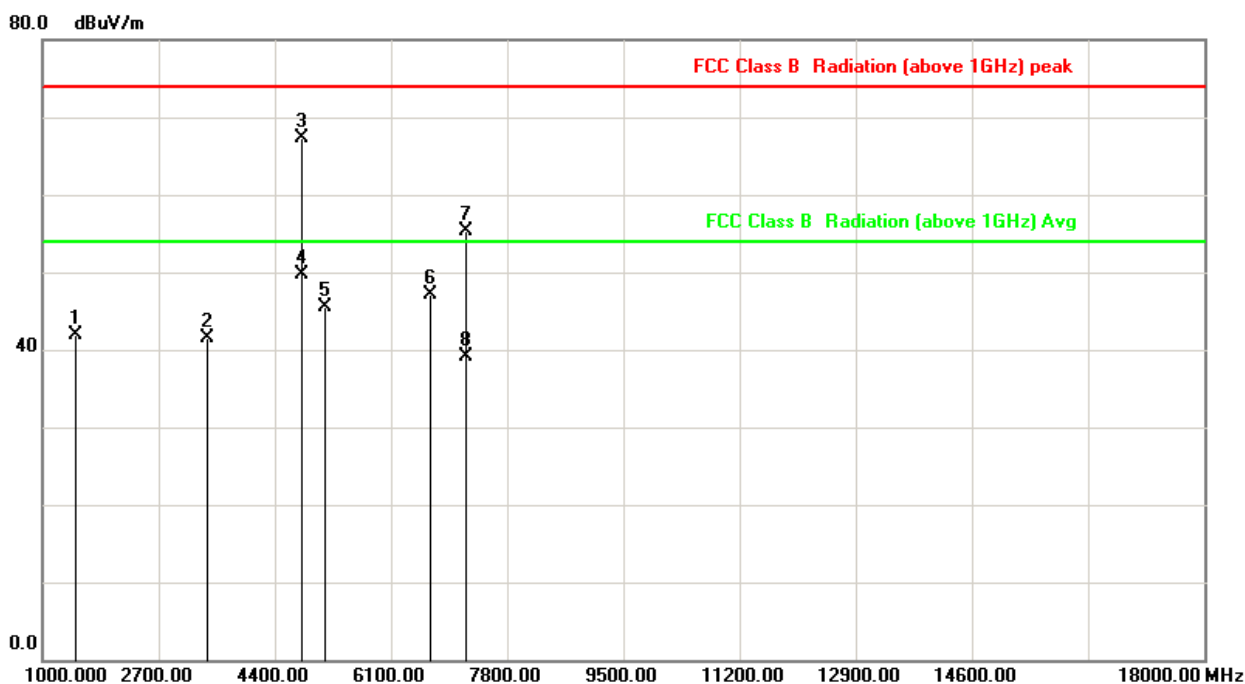
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	:	AC 120V	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 2	Temperature	:	25 °C
Test Date	:	Oct. 28, 2018	Humidity	:	52 %
Memo	:	CH 00	Atmospheric Pressure	:	1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1481.667	-1.78	43.76	41.98	74.00	-32.02	peak
2	3408.333	8.92	32.50	41.42	74.00	-32.58	peak
3	4796.667	14.22	53.17	67.39	74.00	-6.61	peak
4	4796.667	14.22	35.42	49.64	54.00	-4.36	AVG
5	5136.667	14.71	30.73	45.44	74.00	-28.56	peak
6	6666.667	17.00	30.17	47.17	74.00	-26.83	peak
7	7205.000	18.88	36.42	55.30	74.00	-18.70	peak
8	7205.000	18.88	20.14	39.02	54.00	-14.98	AVG

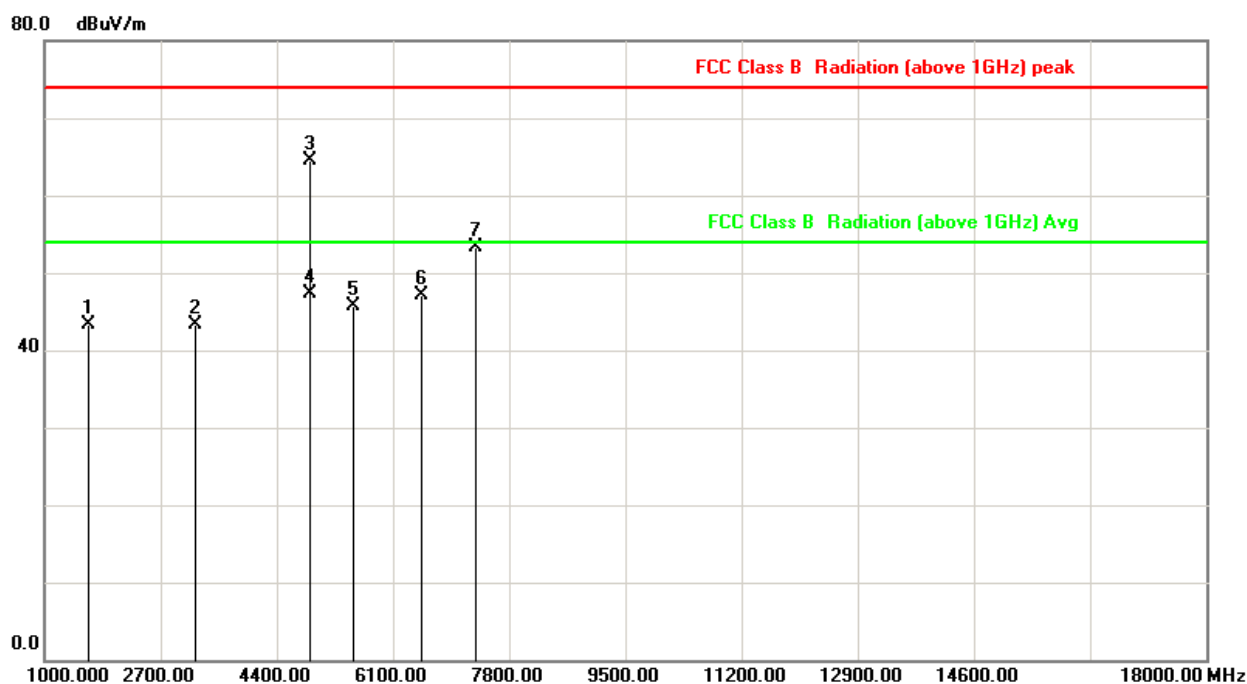
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 2	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1651.667	-0.74	44.03	43.29	74.00	-30.71	peak
2	3210.000	7.87	35.53	43.40	74.00	-30.60	peak
3	4881.667	14.38	50.13	64.51	74.00	-9.49	peak
4	4881.667	14.38	32.91	47.29	54.00	-6.71	AVG
5	5533.333	15.10	30.64	45.74	74.00	-28.26	peak
6	6525.000	16.54	30.61	47.15	74.00	-26.85	peak
7	7318.333	19.32	33.95	53.27	74.00	-20.73	peak

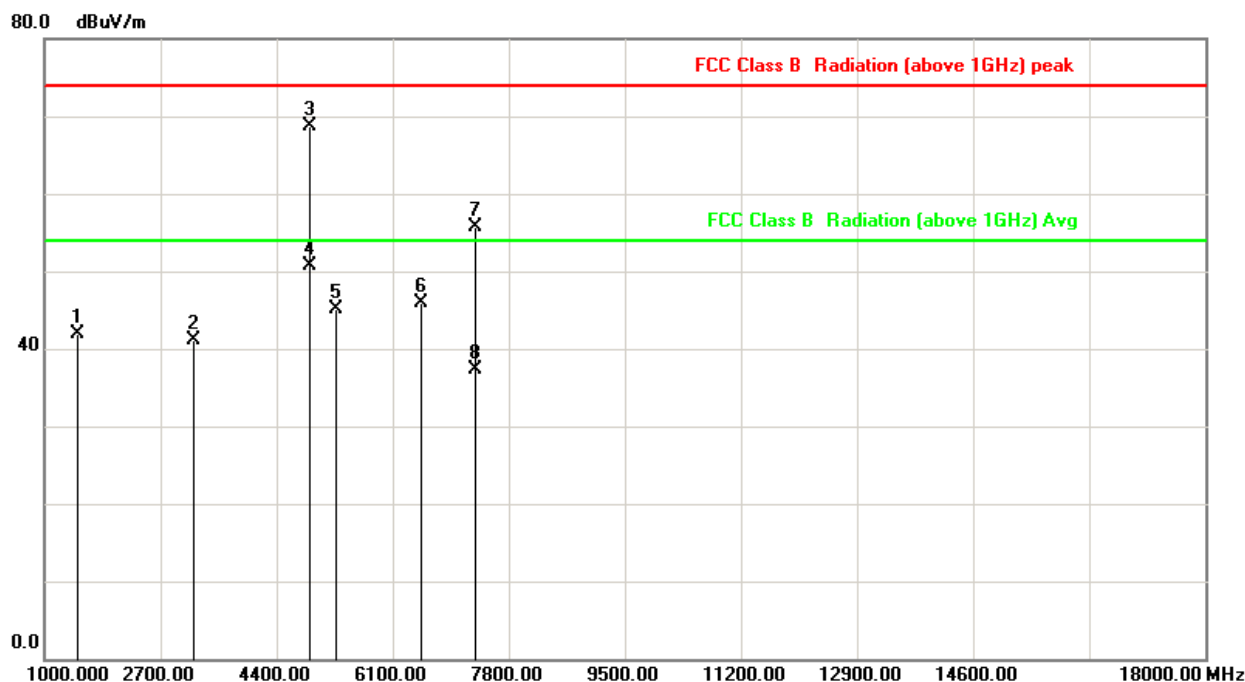
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 2	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1481.667	-1.78	43.74	41.96	74.00	-32.04	peak
2	3181.667	7.73	33.35	41.08	74.00	-32.92	peak
3	4881.667	14.38	54.32	68.70	74.00	-5.30	peak
4	4881.667	14.38	36.41	50.79	54.00	-3.21	AVG
5	5278.333	14.83	30.31	45.14	74.00	-28.86	peak
6	6525.000	16.54	29.36	45.90	74.00	-28.10	peak
7	7318.333	19.32	36.41	55.73	74.00	-18.27	peak
8	7318.333	19.32	17.92	37.24	54.00	-16.76	AVG

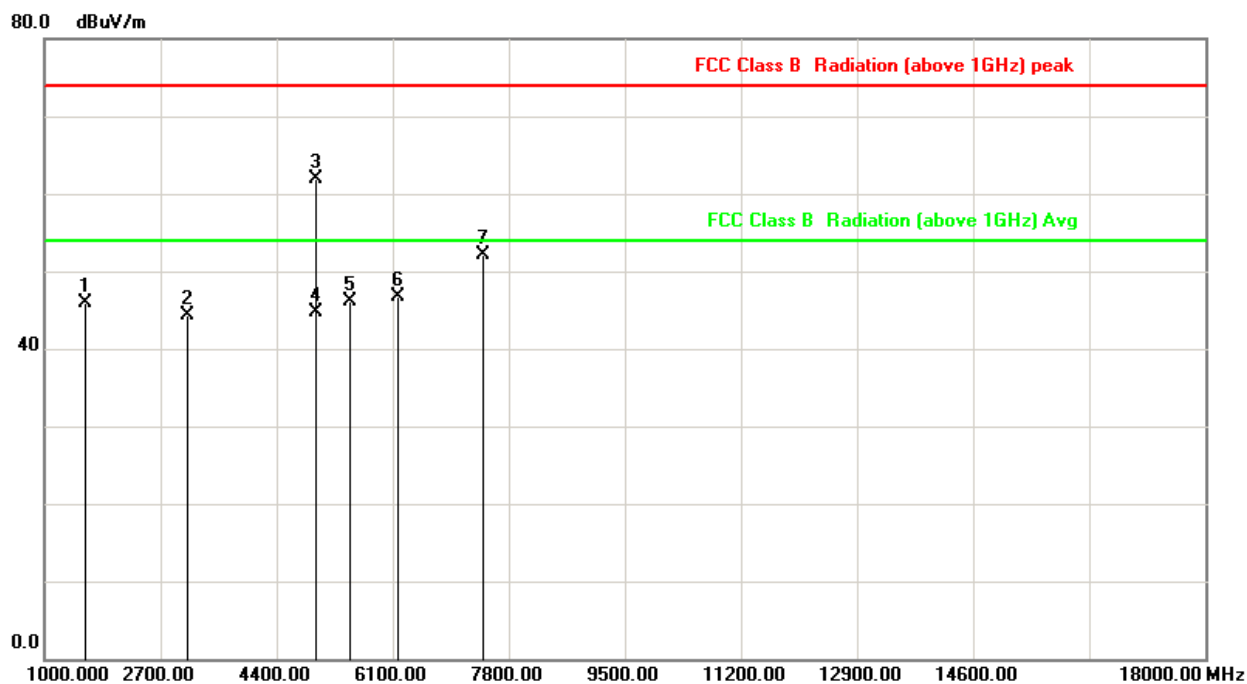
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 2	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1595.000	-1.06	47.04	45.98	74.00	-28.02	peak
2	3096.667	7.28	36.95	44.23	74.00	-29.77	peak
3	4966.667	14.54	47.34	61.88	74.00	-12.12	peak
4	4966.667	14.54	30.15	44.69	54.00	-9.31	AVG
5	5476.667	15.00	31.13	46.13	74.00	-27.87	peak
6	6185.000	16.33	30.44	46.77	74.00	-27.23	peak
7	7431.667	19.76	32.44	52.20	74.00	-21.80	peak

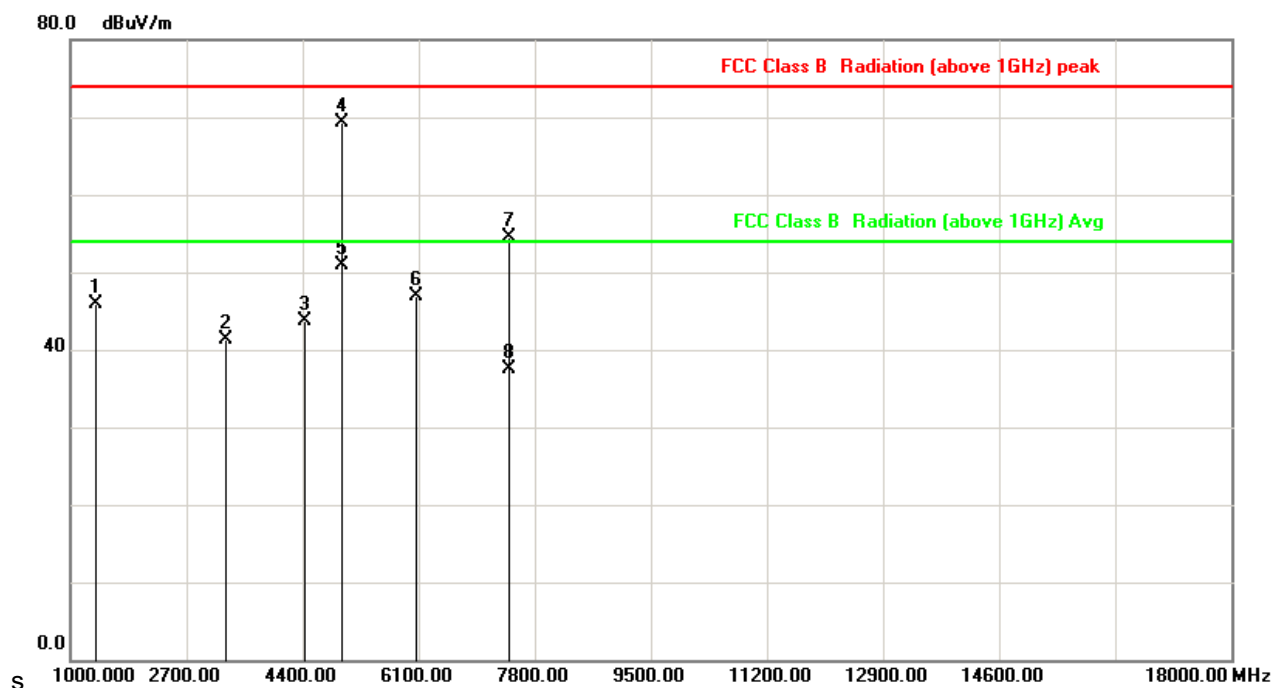
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 2	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1368.333	-2.81	48.76	45.95	74.00	-28.05	peak
2	3266.667	8.17	33.09	41.26	74.00	-32.74	peak
3	4428.333	13.29	30.44	43.73	74.00	-30.27	peak
4	4966.667	14.54	54.82	69.36	74.00	-4.64	peak
5	4966.667	14.54	36.46	51.00	54.00	-3.00	AVG
6	6071.667	16.29	30.65	46.94	74.00	-27.06	peak
7	7431.667	19.76	34.79	54.55	74.00	-19.45	peak
8	7431.667	19.76	17.69	37.45	54.00	-16.55	AVG

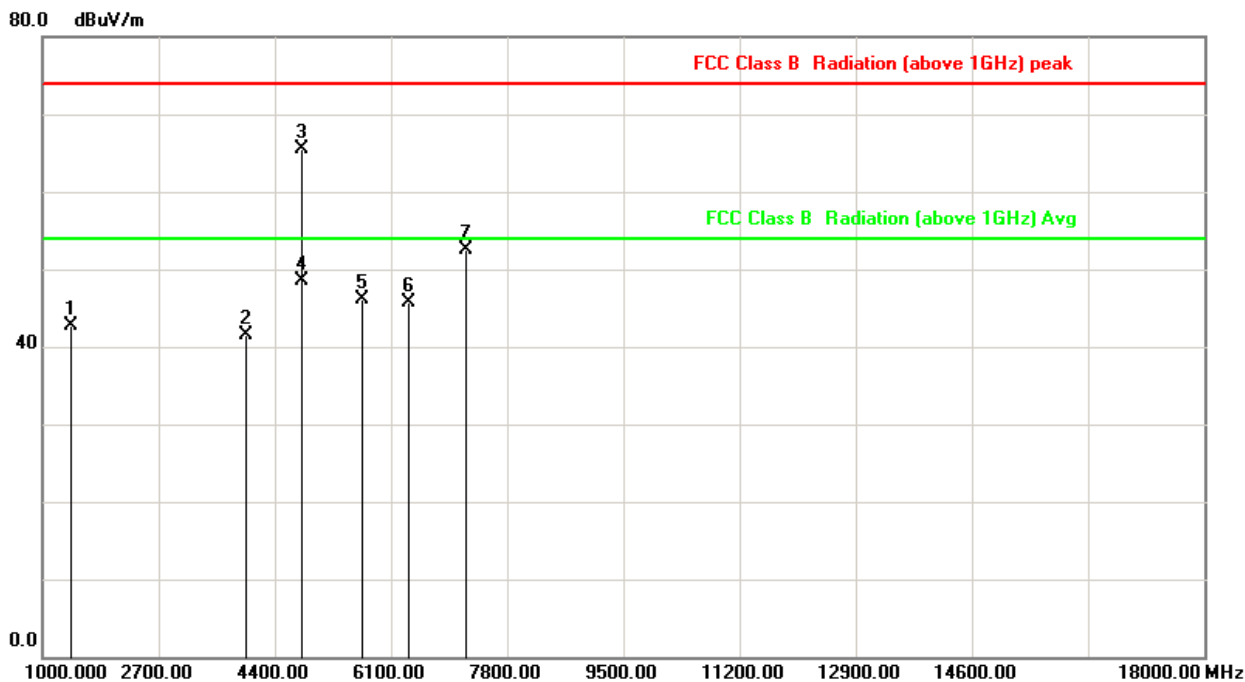
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 3	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 00	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1425.000	-2.29	44.93	42.64	74.00	-31.36	peak
2	3975.000	11.02	30.45	41.47	74.00	-32.53	peak
3	4796.667	14.22	51.35	65.57	74.00	-8.43	peak
4	4796.667	14.22	34.26	48.48	54.00	-5.52	AVG
5	5675.000	15.45	30.75	46.20	74.00	-27.80	peak
6	6355.000	16.40	29.34	45.74	74.00	-28.26	peak
7	7205.000	18.88	33.63	52.51	74.00	-21.49	peak

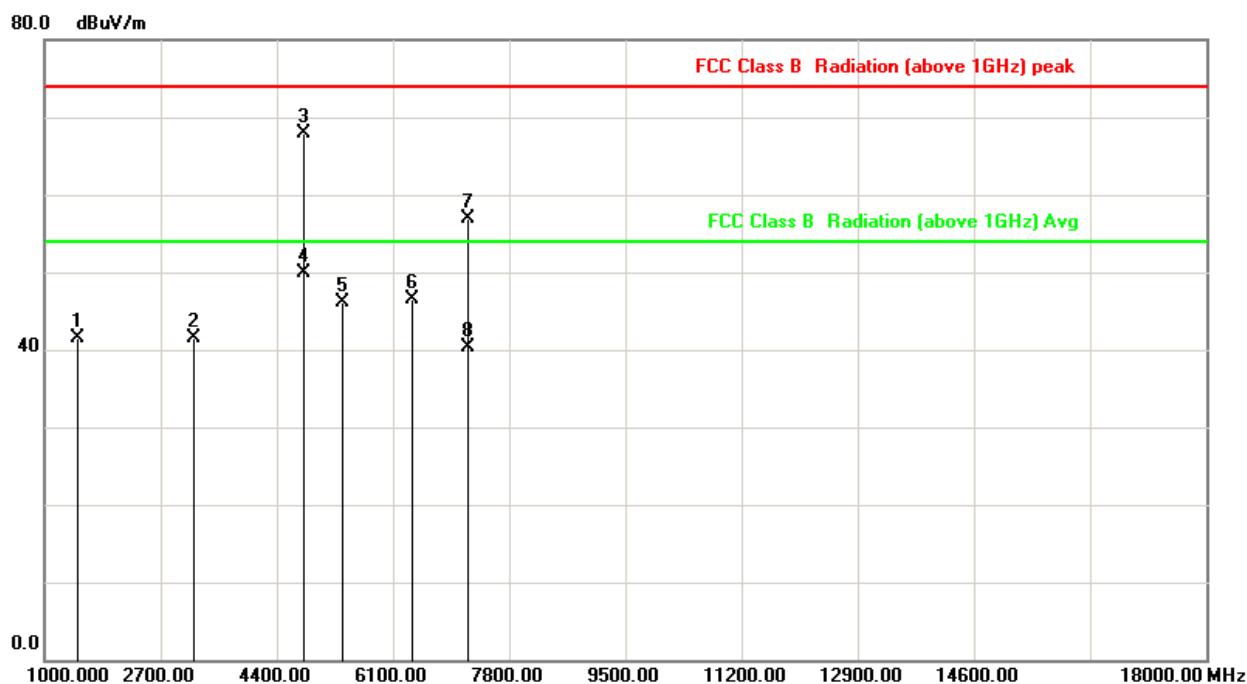
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	:	AC 120V	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3	Temperature	:	25 °C
Test Date	:	Oct. 28, 2018	Humidity	:	52 %
Memo	:	CH 00	Atmospheric Pressure	:	1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1481.667	-1.78	43.26	41.48	74.00	-32.52	peak
2	3181.667	7.73	33.76	41.49	74.00	-32.51	peak
3	4796.667	14.22	53.61	67.83	74.00	-6.17	peak
4	4796.667	14.22	35.72	49.94	54.00	-4.06	AVG
5	5363.333	14.91	31.17	46.08	74.00	-27.92	peak
6	6383.333	16.41	30.05	46.46	74.00	-27.54	peak
7	7205.000	18.88	37.95	56.83	74.00	-17.17	peak
8	7205.000	18.88	21.42	40.30	54.00	-13.70	AVG

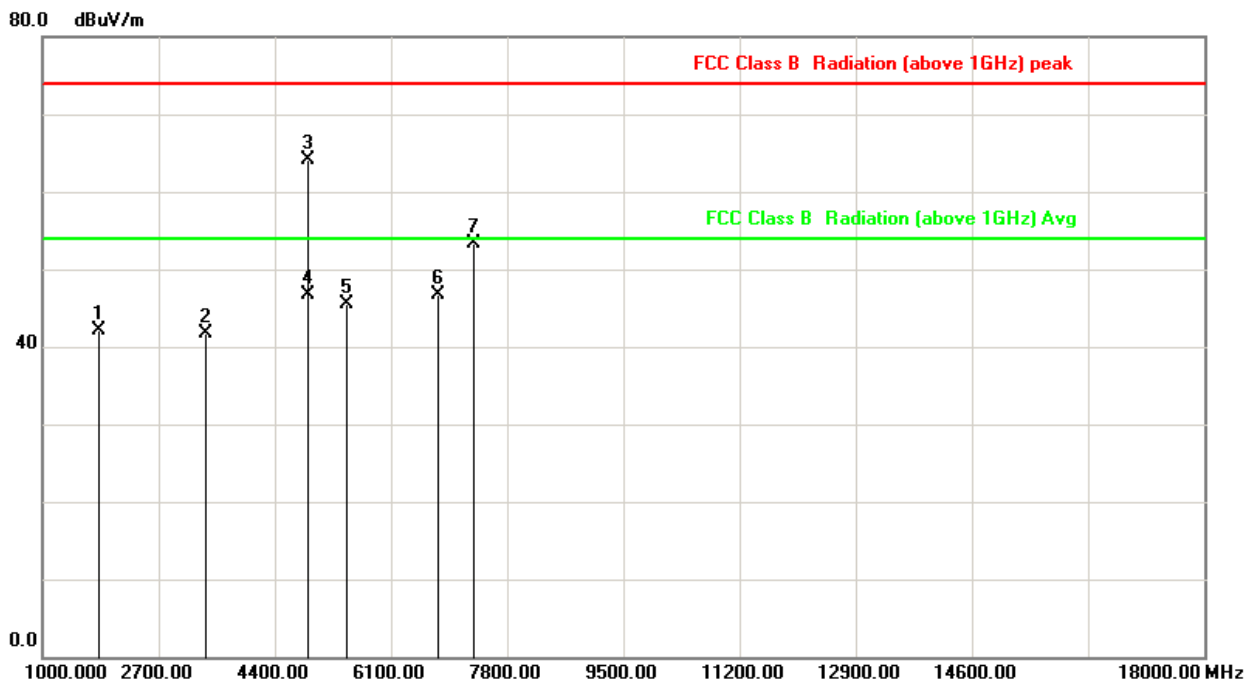
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 3	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1821.667	0.24	41.78	42.02	74.00	-31.98	peak
2	3380.000	8.77	33.00	41.77	74.00	-32.23	peak
3	4881.667	14.38	49.68	64.06	74.00	-9.94	peak
4	4881.667	14.38	32.33	46.71	54.00	-7.29	AVG
5	5448.333	14.98	30.47	45.45	74.00	-28.55	peak
6	6780.000	17.37	29.43	46.80	74.00	-27.20	peak
7	7318.333	19.32	33.95	53.27	74.00	-20.73	peak

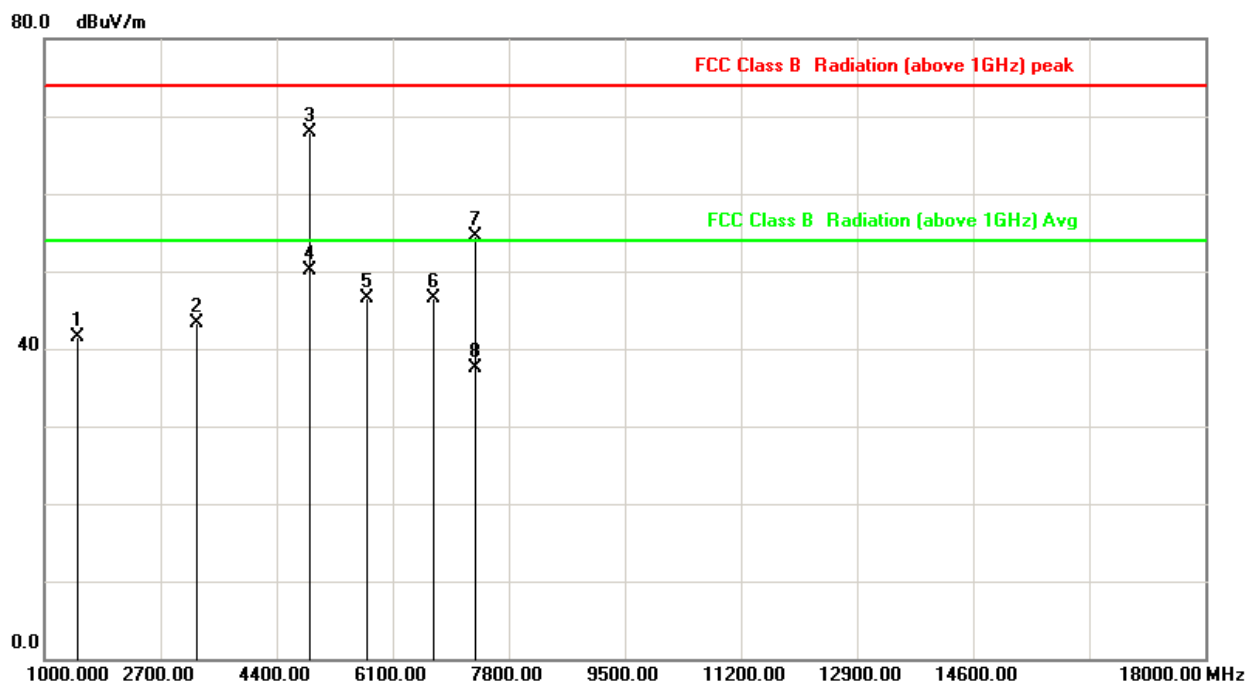
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 3	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 39	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1481.667	-1.78	43.24	41.46	74.00	-32.54	peak
2	3238.333	8.02	35.22	43.24	74.00	-30.76	peak
3	4881.667	14.38	53.62	68.00	74.00	-6.00	peak
4	4881.667	14.38	35.69	50.07	54.00	-3.93	AVG
5	5731.667	15.59	30.92	46.51	74.00	-27.49	peak
6	6695.000	17.09	29.37	46.46	74.00	-27.54	peak
7	7318.333	19.32	35.24	54.56	74.00	-19.44	peak
8	7318.333	19.32	18.14	37.46	54.00	-16.54	AVG

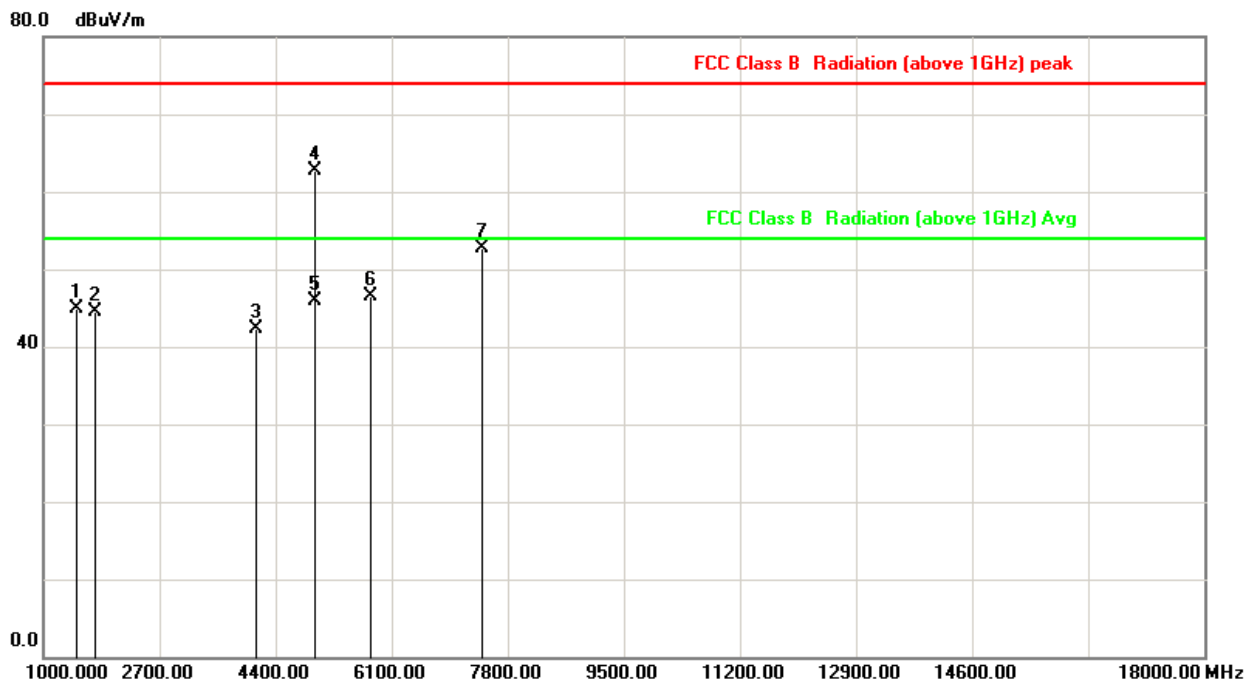
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 3	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1481.667	-1.78	46.65	44.87	74.00	-29.13	peak
2	1765.000	-0.08	44.50	44.42	74.00	-29.58	peak
3	4116.667	11.70	30.63	42.33	74.00	-31.67	peak
4	4966.667	14.54	48.12	62.66	74.00	-11.34	peak
5	4966.667	14.54	31.42	45.96	54.00	-8.04	AVG
6	5788.333	15.74	30.72	46.46	74.00	-27.54	peak
7	7431.667	19.76	32.96	52.72	74.00	-21.28	peak

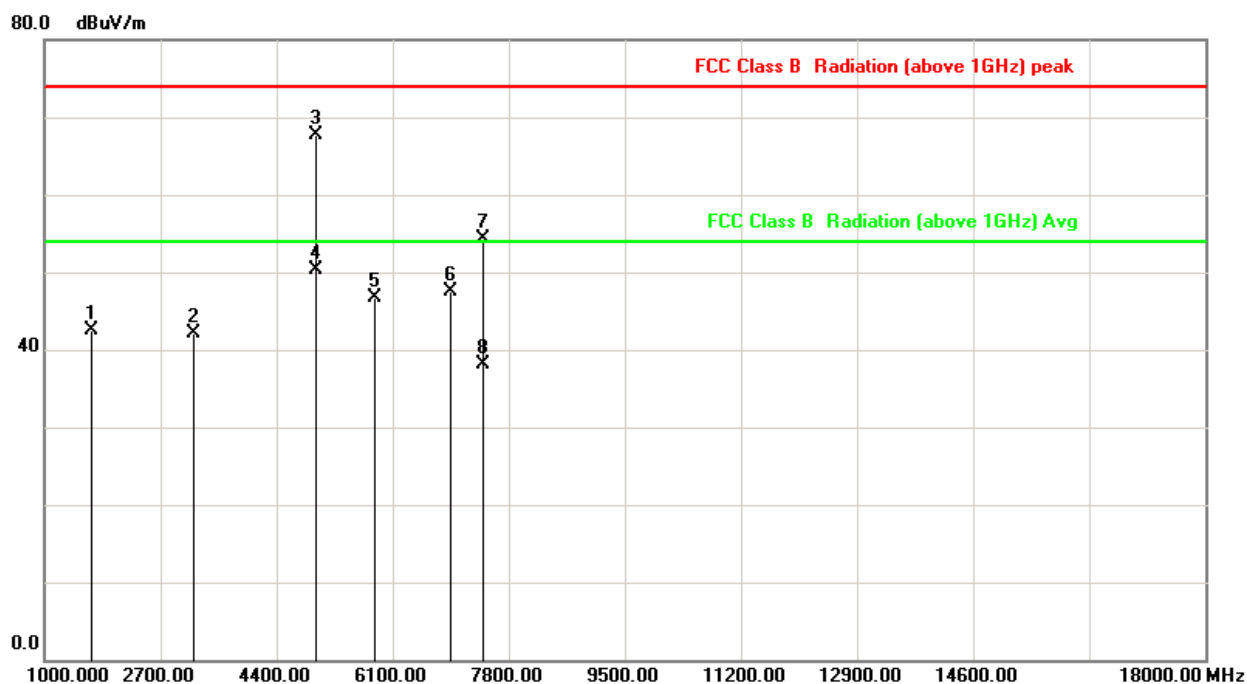
Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



Power	: AC 120V	Pol/Phase	: VERTICAL
Test Mode	: Mode 3	Temperature	: 25 °C
Test Date	: Oct. 28, 2018	Humidity	: 52 %
Memo	: CH 78	Atmospheric Pressure	: 1010 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1680.000	-0.57	43.10	42.53	74.00	-31.47	peak
2	3181.667	7.73	34.46	42.19	74.00	-31.81	peak
3	4966.667	14.54	53.14	67.68	74.00	-6.32	peak
4	4966.667	14.54	35.81	50.35	54.00	-3.65	AVG
5	5845.000	15.88	30.85	46.73	74.00	-27.27	peak
6	6950.000	17.92	29.58	47.50	74.00	-26.50	peak
7	7431.667	19.76	34.62	54.38	74.00	-19.62	peak
8	7431.667	19.76	18.43	38.19	54.00	-15.81	AVG

Note: Level = Reading + Factor

Margin = Level – Limit

Factor= Antenna Factor + Cable Loss - Amplifier Factor



7. 20dB Bandwidth Measurement Data

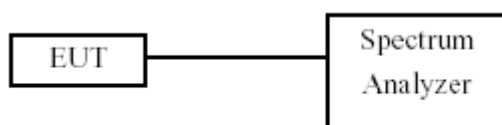
7.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

7.2 Test Procedures

- The transmitter output was connected to the spectrum analyzer.
- Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.
- The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

7.3 Test Setup Layout



7.4 Test Result and Data

Test Date: Aug. 07, 2018

Temperature: 25°C

Atmospheric pressure: 1020 hPa
1M

Humidity: 55%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	2/3 of 20dB Bandwidth (MHz)
00	2402	0.836	557
39	2441	0.834	556
78	2480	0.834	556

2M

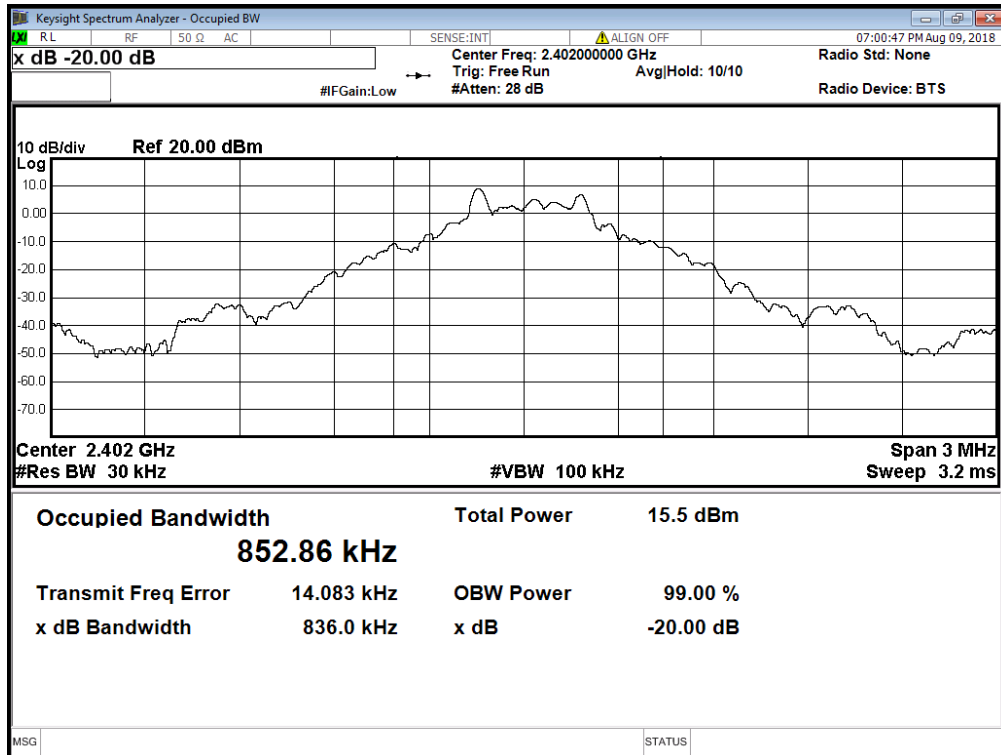
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	2/3 of 20dB Bandwidth (MHz)
00	2402	1.117	745
39	2441	1.115	743
78	2480	1.117	745

3M

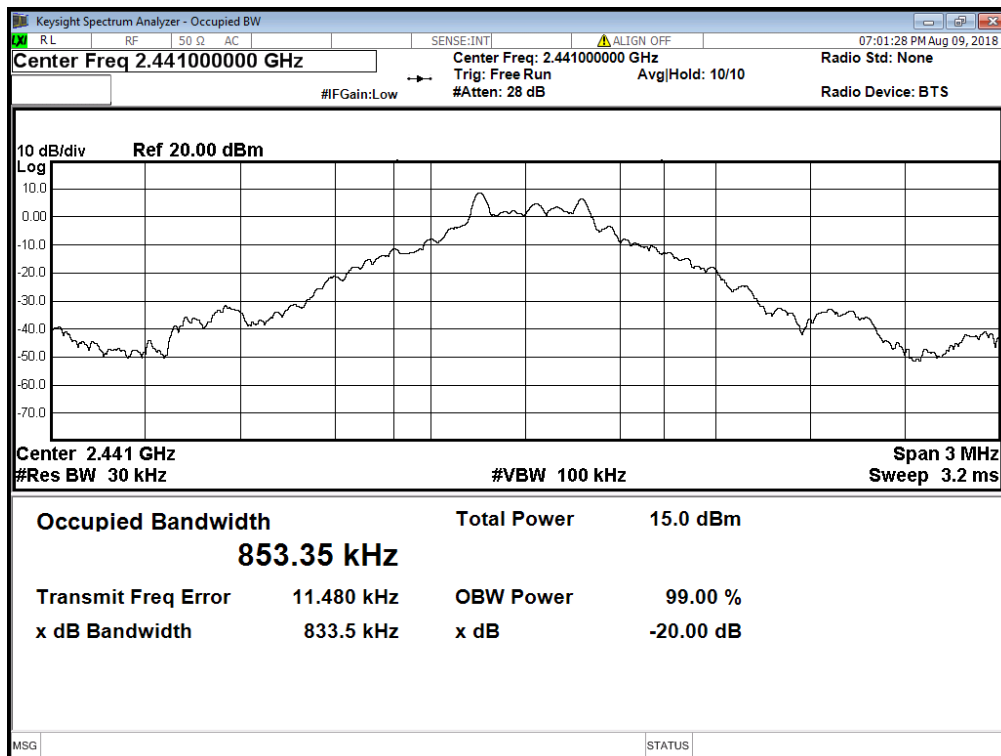
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	2/3 of 20dB Bandwidth (MHz)
00	2402	1.167	778
39	2441	1.166	777
78	2480	1.168	779



Modulation Standard: GFSK (1Mbps)
Channel: 00

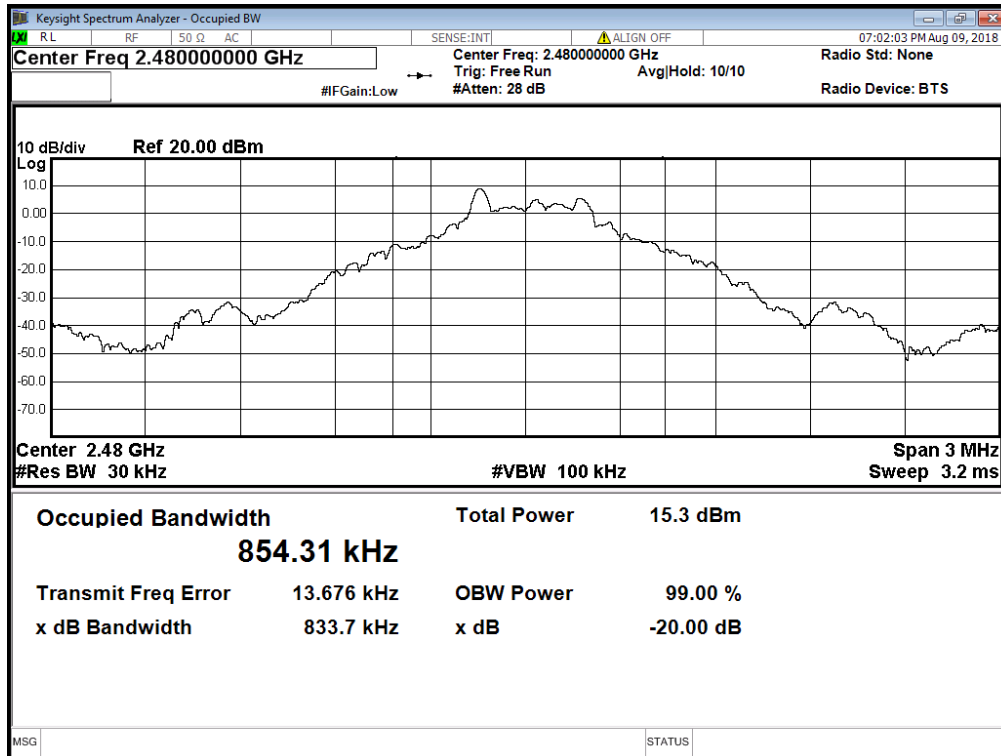


Modulation Standard: GFSK (1Mbps)
Channel: 39

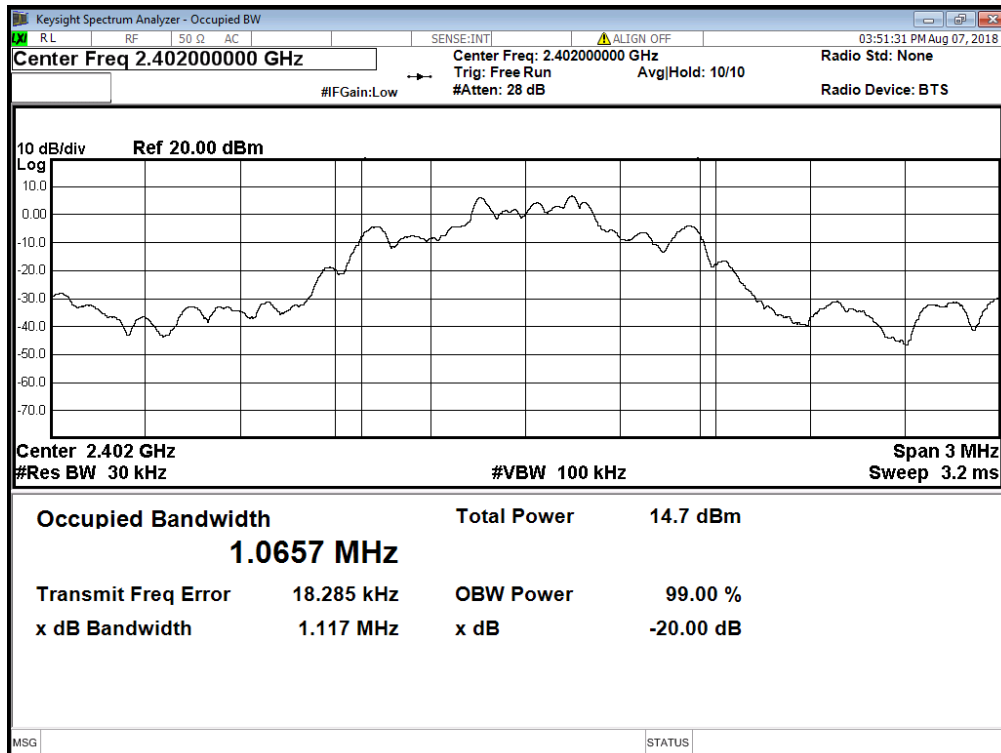




Modulation Standard: GFSK (1Mbps)
Channel: 78

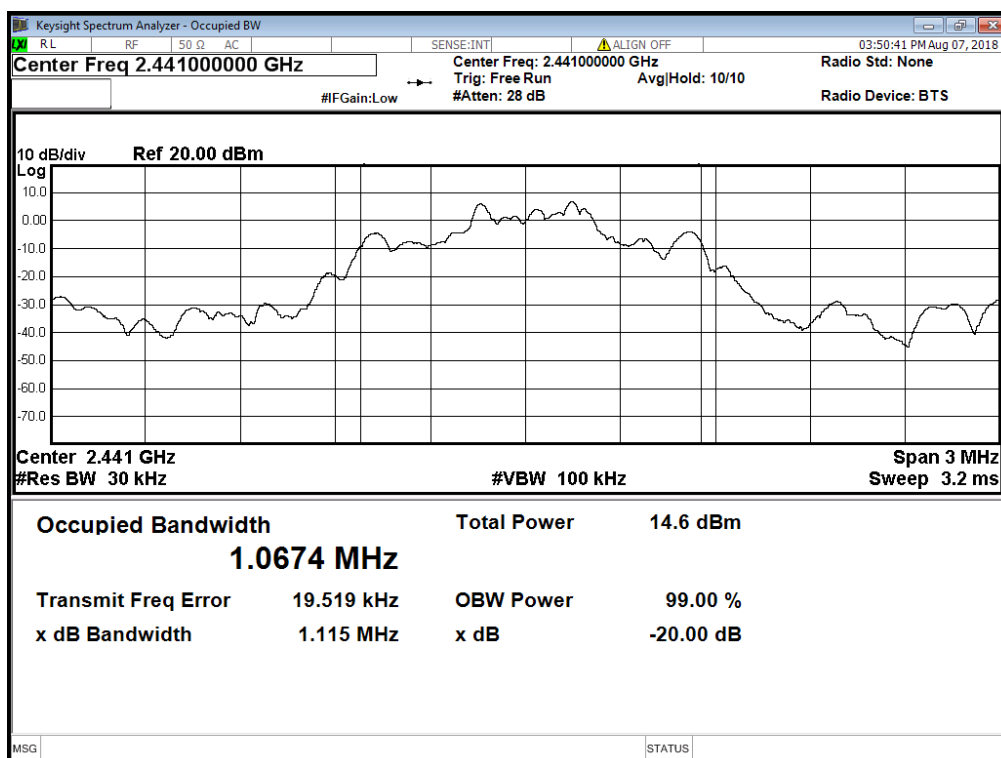


Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 00

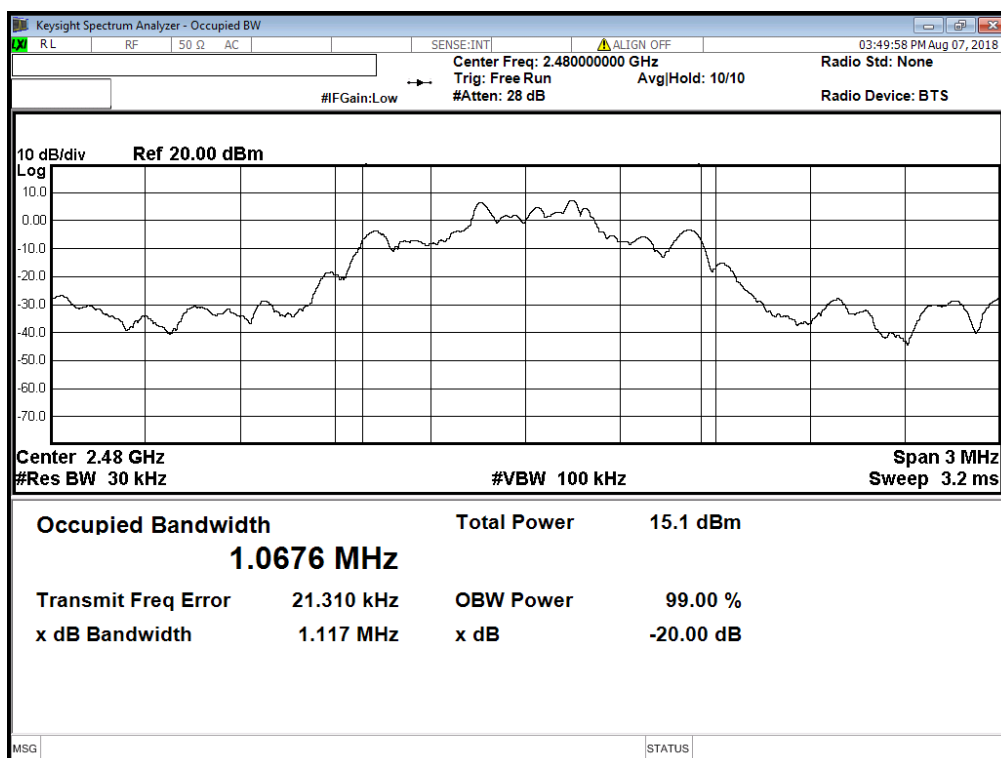




Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 39

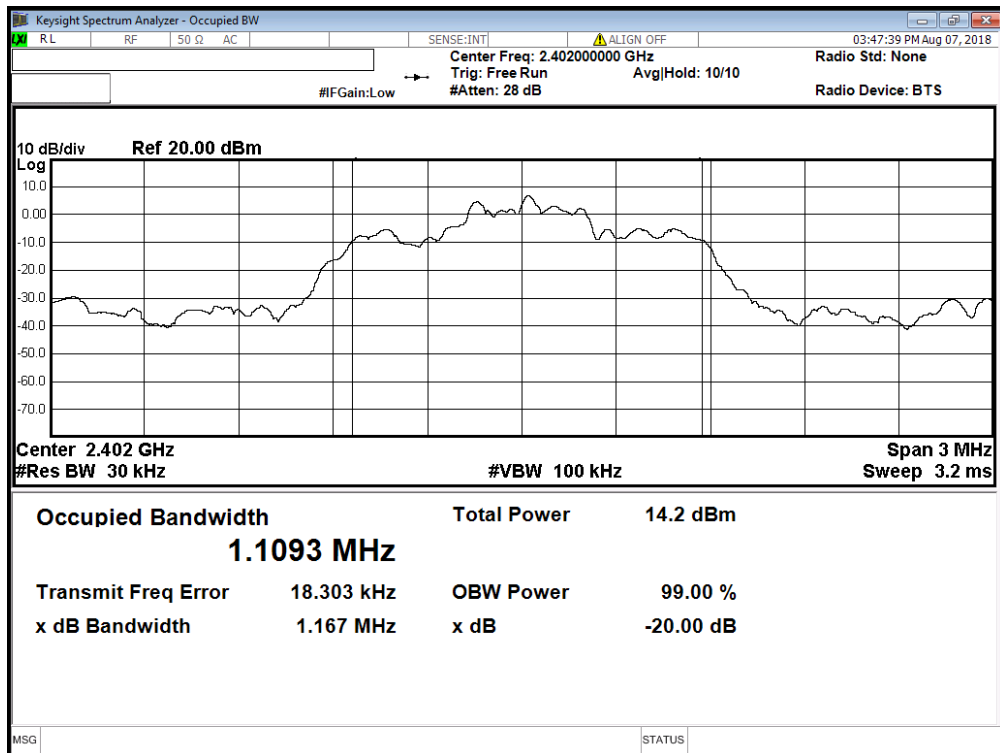


Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 78

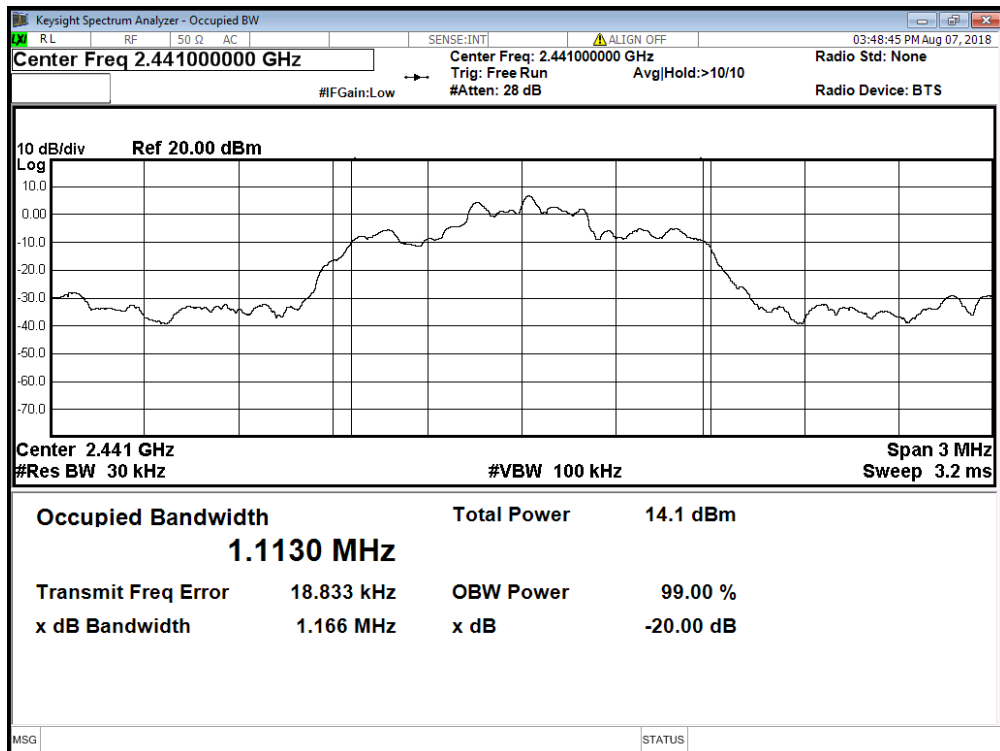




Modulation Standard: 8DPSK (3Mbps)
Channel: 00

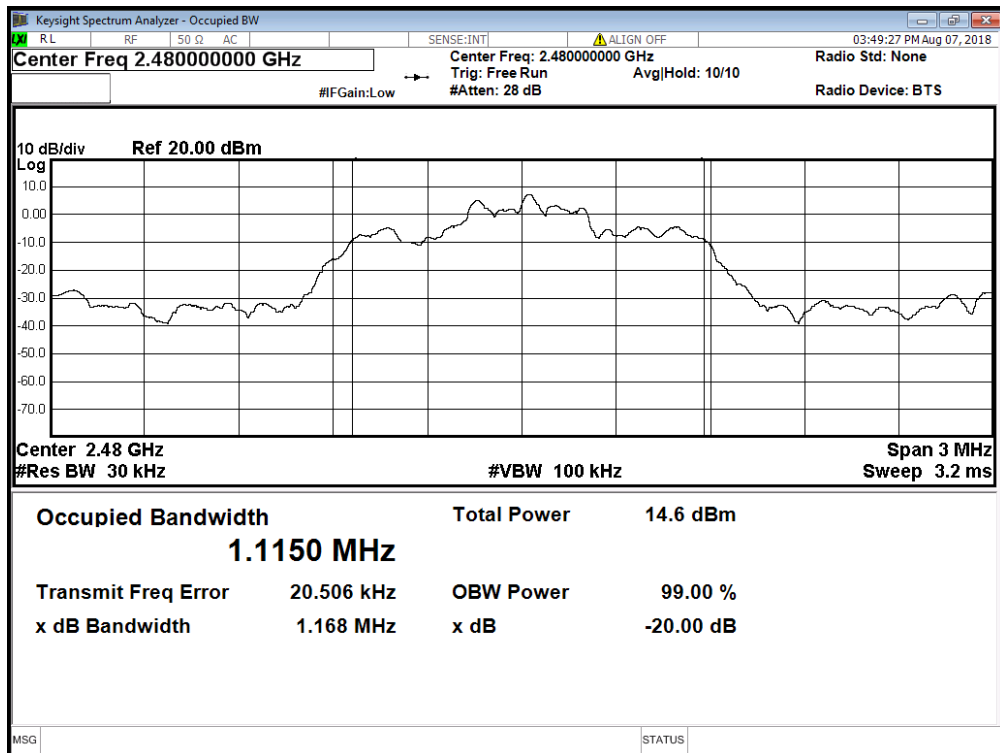


Modulation Standard: 8DPSK (3Mbps)
Channel: 39





Modulation Standard: 8DPSK (3Mbps)
Channel: 78





8. Frequencies Separation

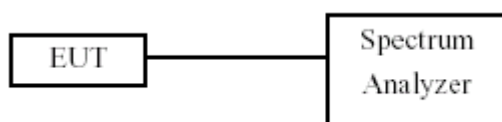
8.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

8.2 Test Procedures

- The transmitter output was connected to the spectrum analyzer.
- Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.
- By using the MaxHold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels.

8.3 Test Setup Layout



8.4 Test Result and Data

Test Date: Aug. 09, 2018

Temperature: 25°C

Atmospheric pressure: 1020 hPa

Humidity: 55%

1M

Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	2/3 of 20dB Bandwidth (MHz)
2402	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.557
2441	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.556
2480	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.556

2M

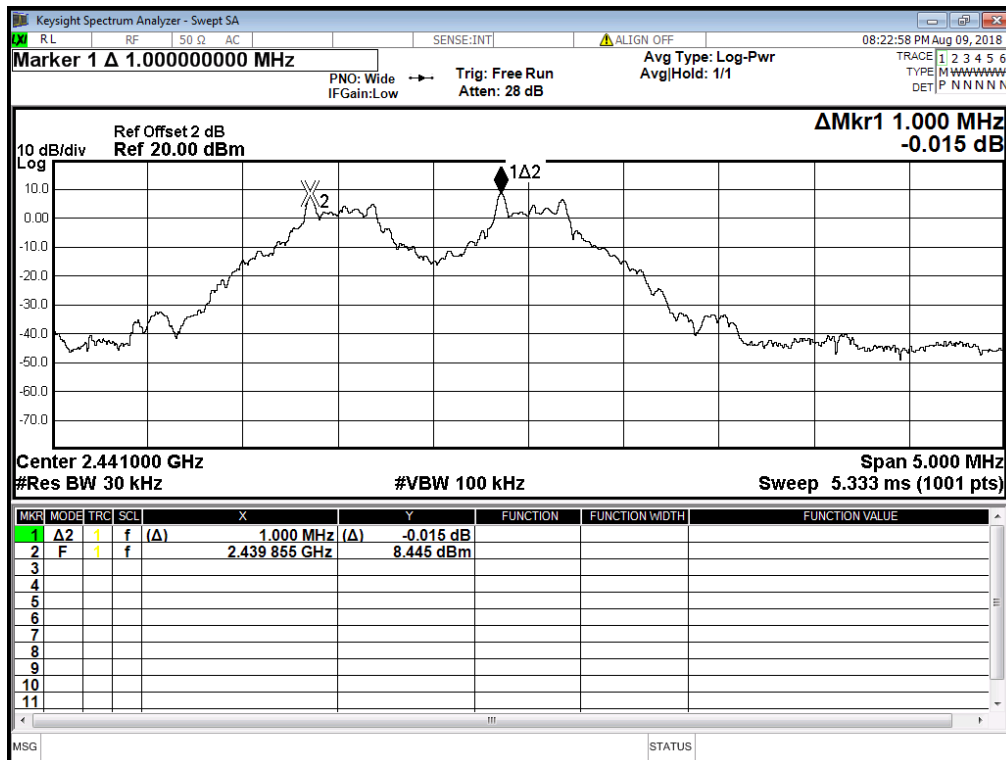
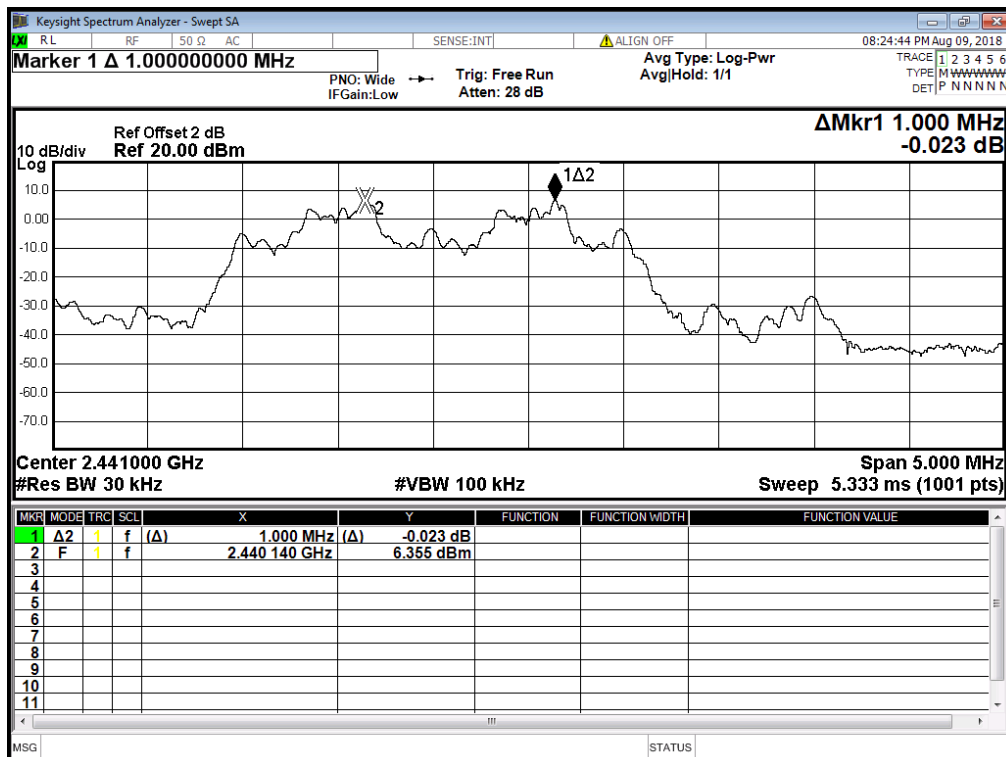
Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	2/3 of 20dB Bandwidth (MHz)
2402	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.745
2441	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.743
2480	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.745

3M

Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	2/3 of 20dB Bandwidth (MHz)
2402	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.778
2441	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.777
2480	1.000	$\geq$ 2/3 of 20dB Bandwidth	0.779

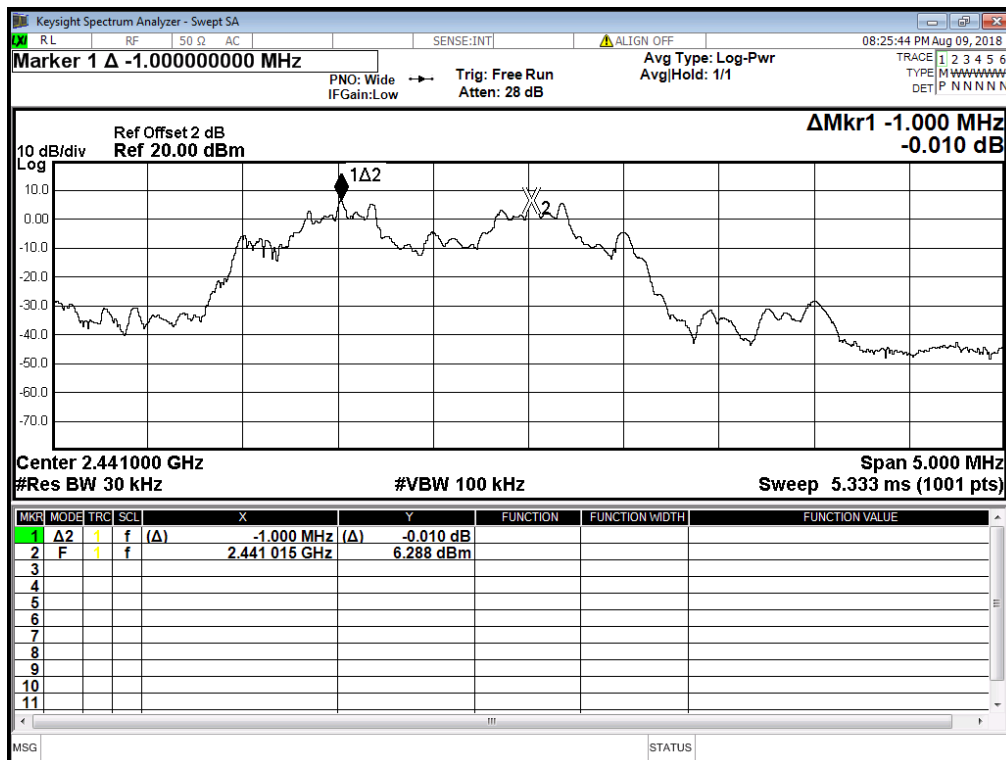


Modulation Standard: GFSK (1Mbps)

Modulation Standard: $\pi/4$ DQPSK (2Mbps)



Modulation Standard: 8DPSK(3Mbps)





9. Dwell Time on each channel

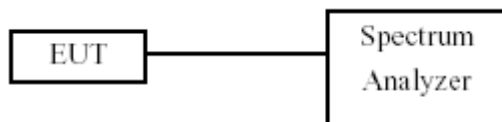
9.1 Test Limit

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.

9.2 Test Procedures

1. The transmitter output was connected to the spectrum analyzer.
2. Adjust the center frequency to measure frequency, then set zero span mode.
2. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
4. Measure the time duration of one transmission on the measured frequency.

9.3 Test Setup Layout





9.4 Test Result and Data

Test Date : Aug. 09, 2018 Temperature : 22C
Atmospheric pressure : 1017 hPa Humidity : 60 %
Test Period = 0.4 (second/ channel) x 79 Channel = 31.6 sec

Modulation Standard: GFSK(1Mbps)

DH 1

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.381	121.92	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/2) / 79 * Period Time

DH 3

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.638	262.08	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/4) / 79 * Period Time

DH 5

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.885	307.73	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/6) / 79 * Period Time

Modulation Standard: $\pi/4$ DQPSK(2Mbps)

DH 1

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.387	123.84	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/2) / 79 * Period Time

DH 3

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.638	262.08	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/4) / 79 * Period Time

DH 5

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.885	307.73	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/6) / 79 * Period Time

Modulation Standard: 8DPSK(3Mbps)

DH 1

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.39	124.8	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/2) / 79 * Period Time

DH 3

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.638	262.08	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/4) / 79 * Period Time

DH 5

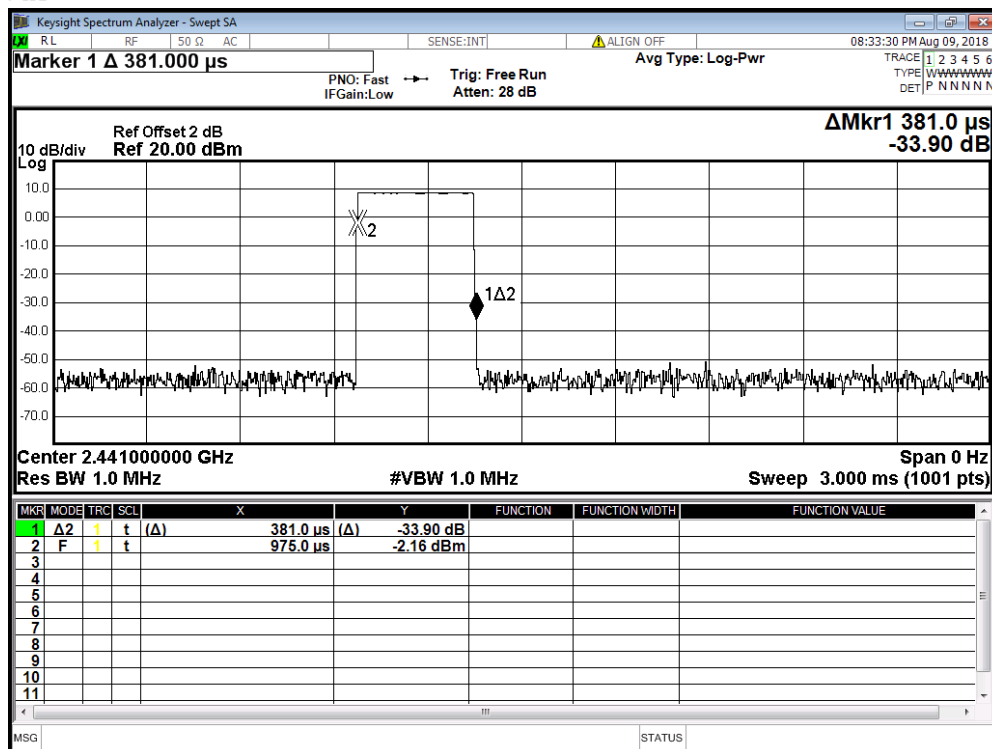
Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.895	308.80	31.6	400	PASS

Remark: Total of Dwell = pulse Time * (1600/6) / 79 * Period Time



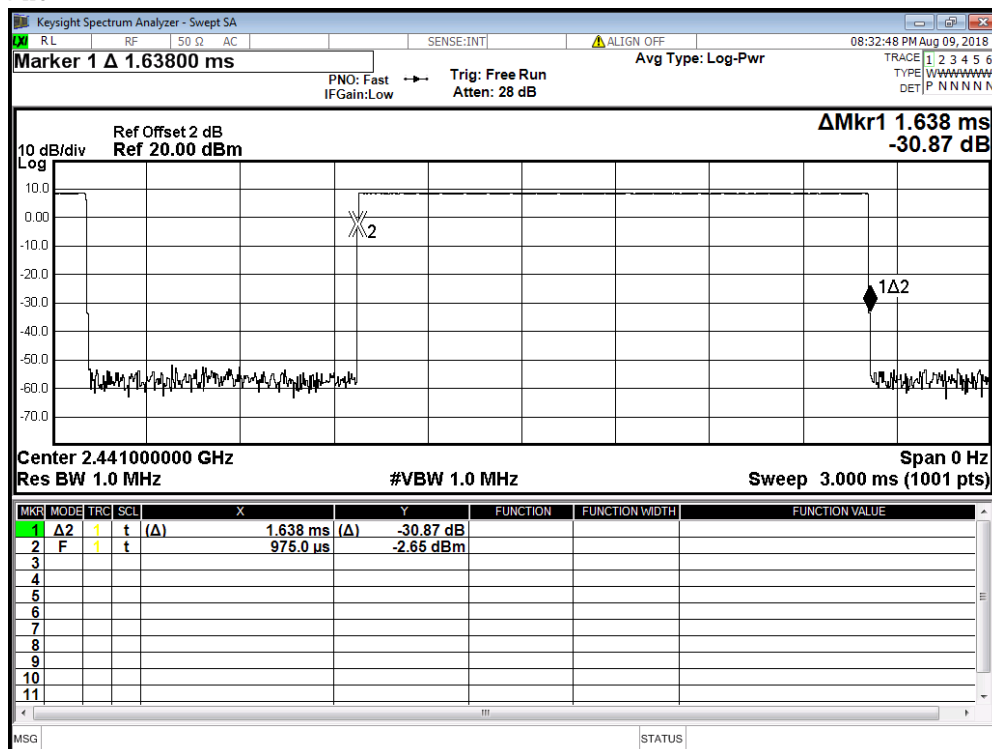
Modulation Standard: GFSK (1Mbps)

DH1



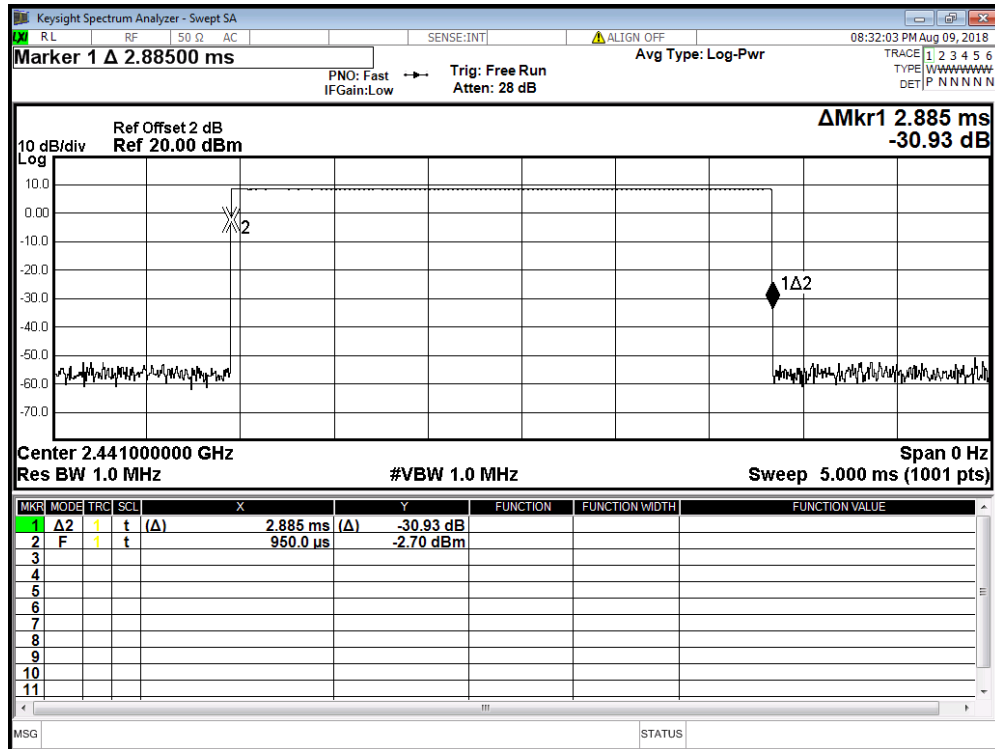
Modulation Standard: GFSK (1Mbps)

DH3

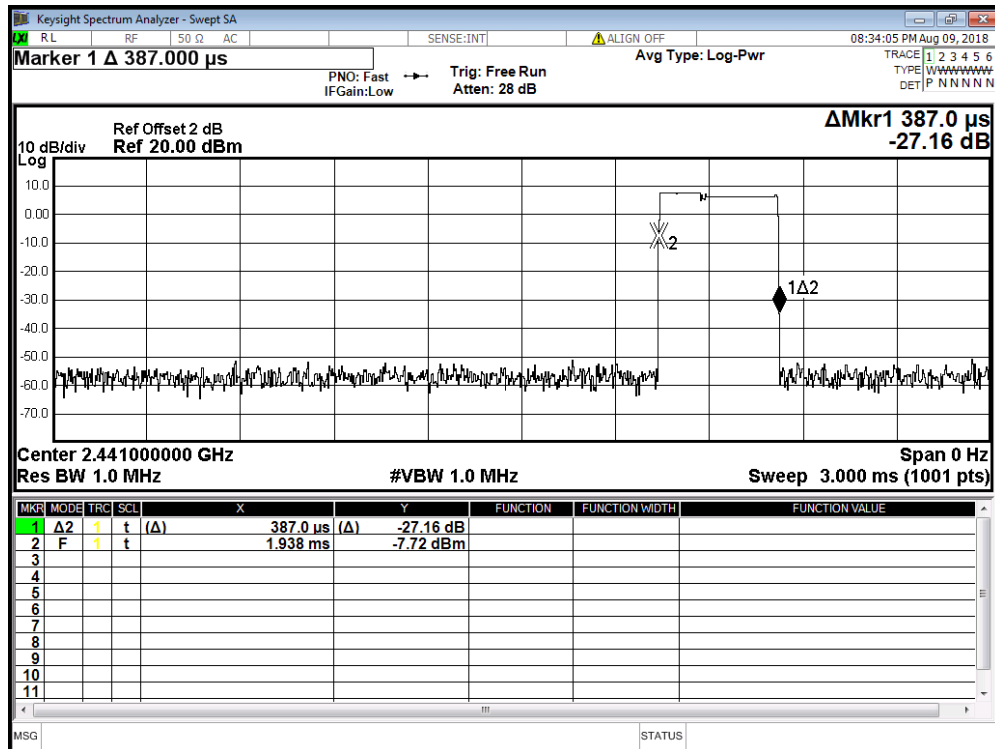




Modulation Standard: GFSK (1Mbps)
DH5

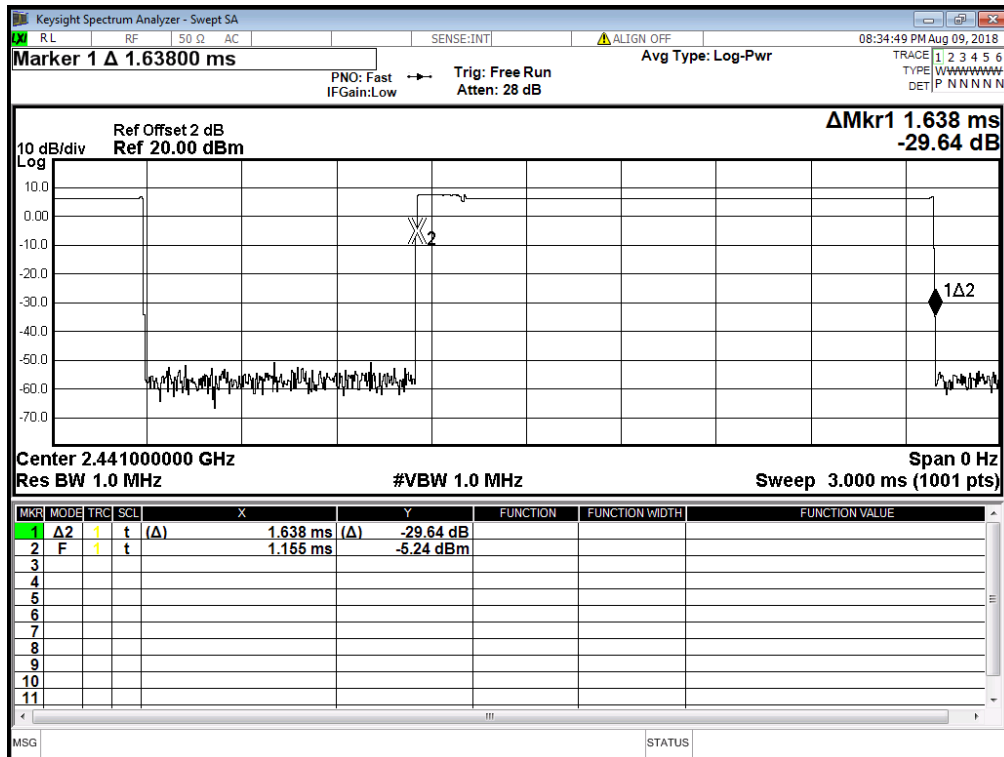


Modulation Standard: $\pi/4$ DQPSK (2Mbps)
DH1

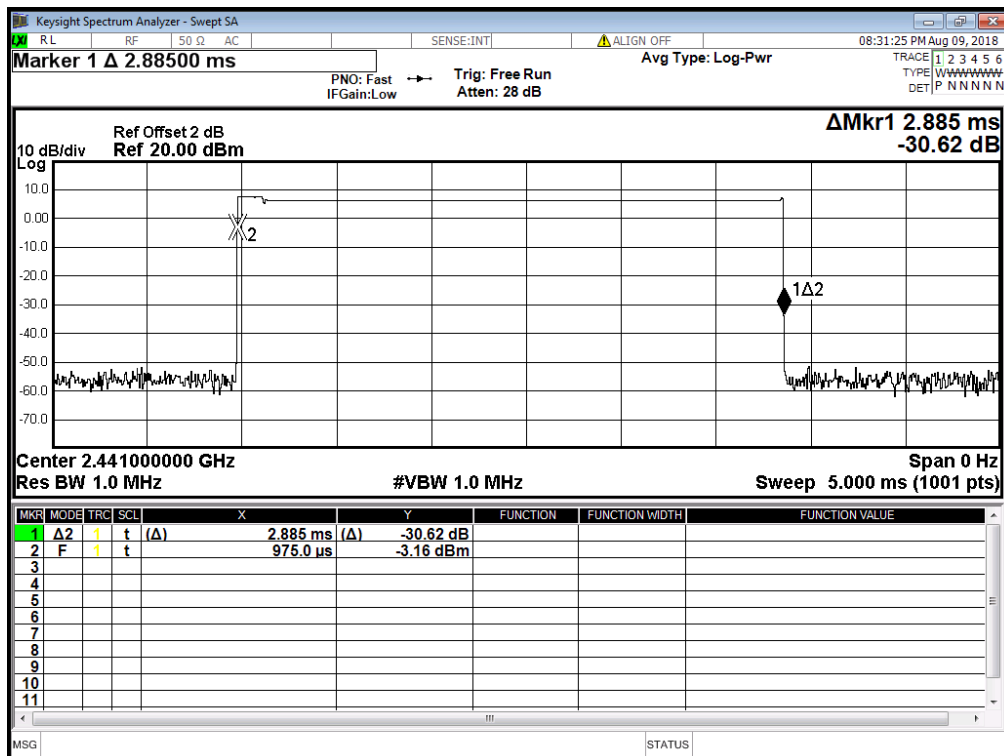




Modulation Standard: $\pi/4$ DQPSK (2Mbps)
DH3



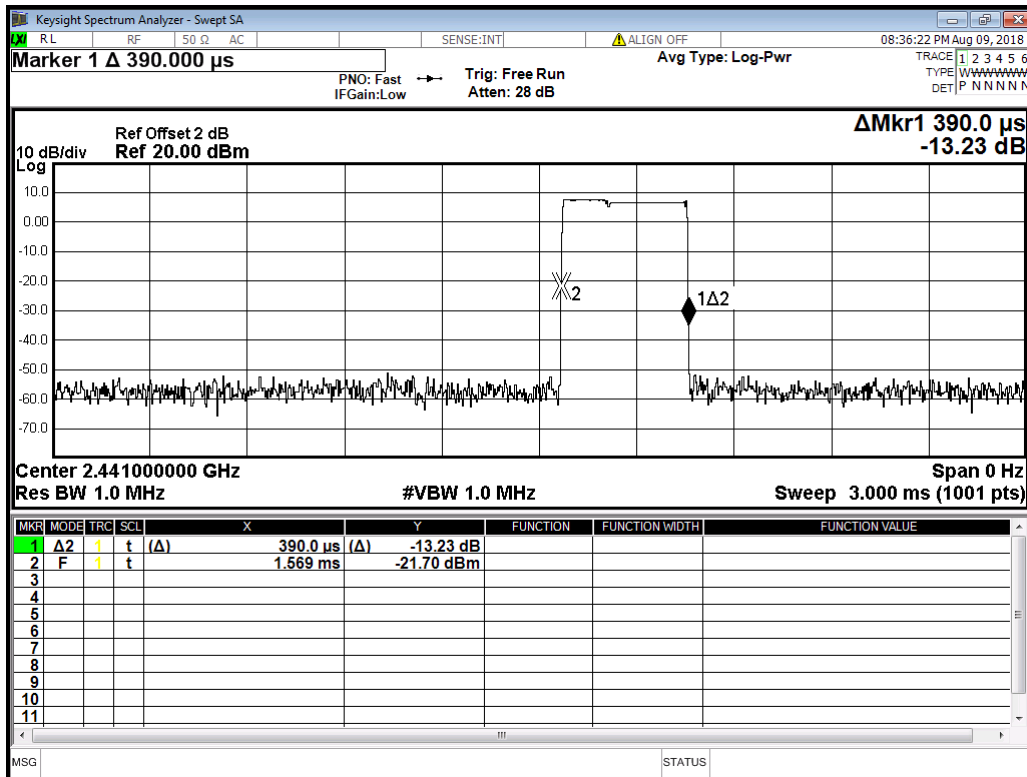
Modulation Standard: $\pi/4$ DQPSK (2Mbps)
DH5





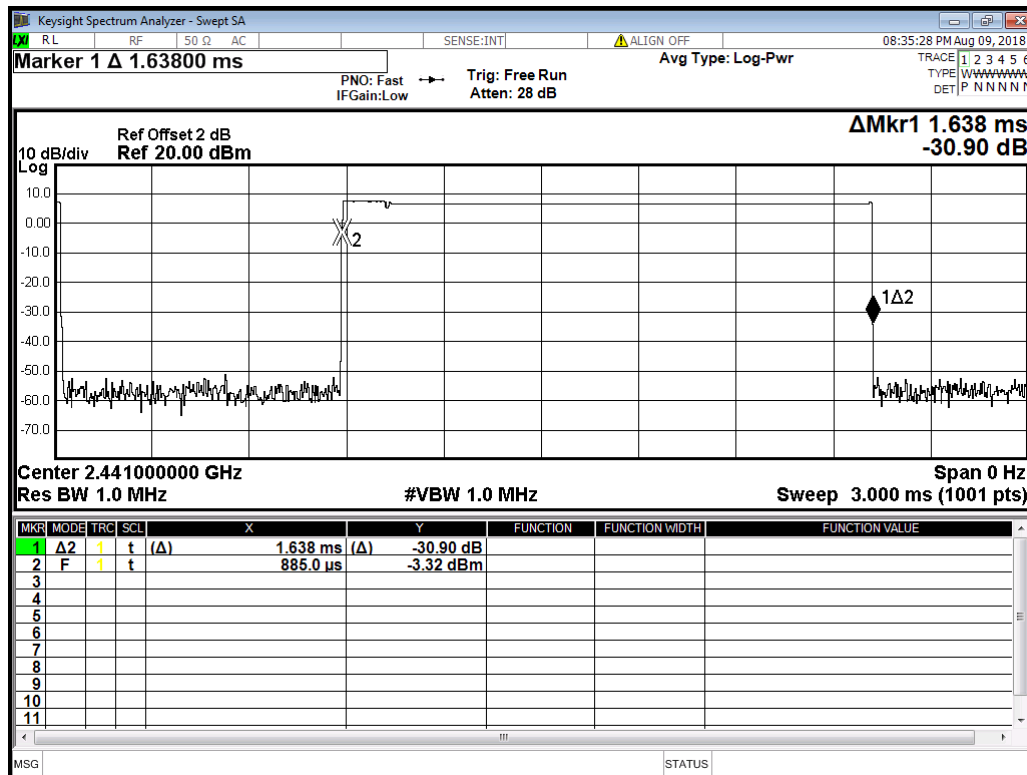
Modulation Standard: 8DPSK (3Mbps)

DH1



Modulation Standard: 8DPSK (3Mbps)

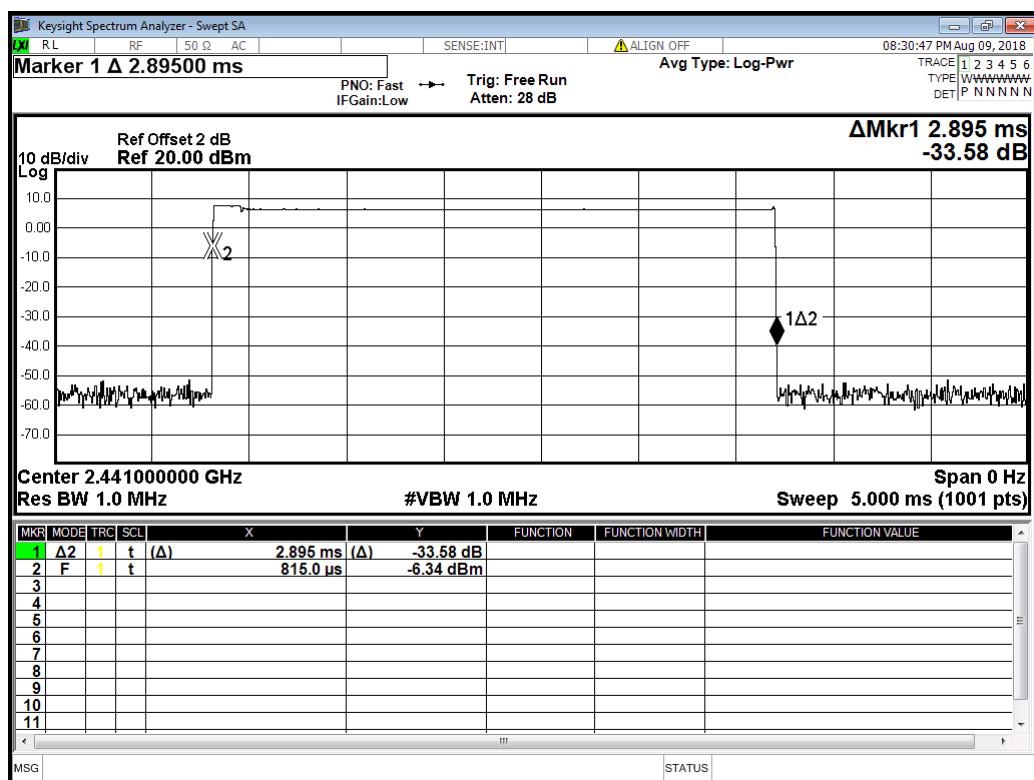
DH3





Modulation Standard: 8DPSK (3Mbps)

DH5





10. Number of Hopping Channels

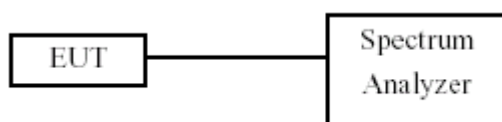
10.1 Test Limit

Frequency hopping systems in the 2400 ~ 2483.5 MHz band shall use at least 15 channels.

10.2 Test Procedures

- a. The transmitter output was connected to the spectrum analyzer.
- b. 2. Set RBW of spectrum analyzer to 300 KHz and VBW to 300 KHz.
- c. 3. Set the MaxHold function, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been record.

10.3 Test Setup Layout



10.4 Test Result and Data

Test Date: Aug. 09, 2018

Temperature: 25°C

Atmospheric pressure: 1020 hPa

Humidity: 55%

Modulation Standard: GFSK (1Mbps)

Number of hopping channels:	79	Channels
-----------------------------	----	----------

Modulation Standard: $\pi/4$ DQPSK (2Mbps)

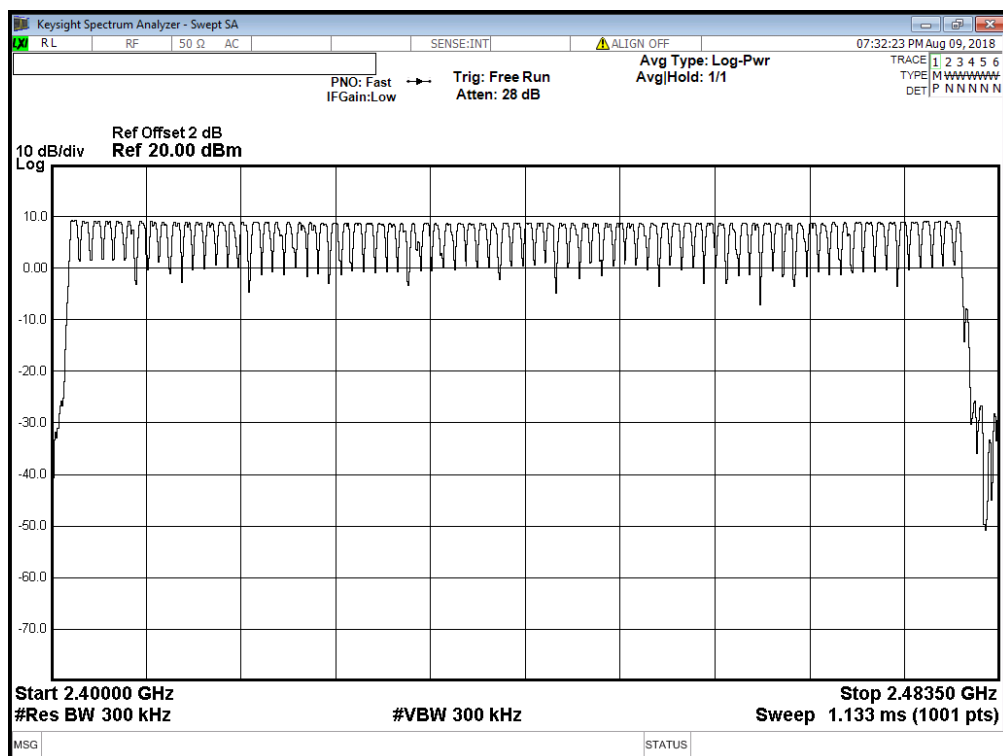
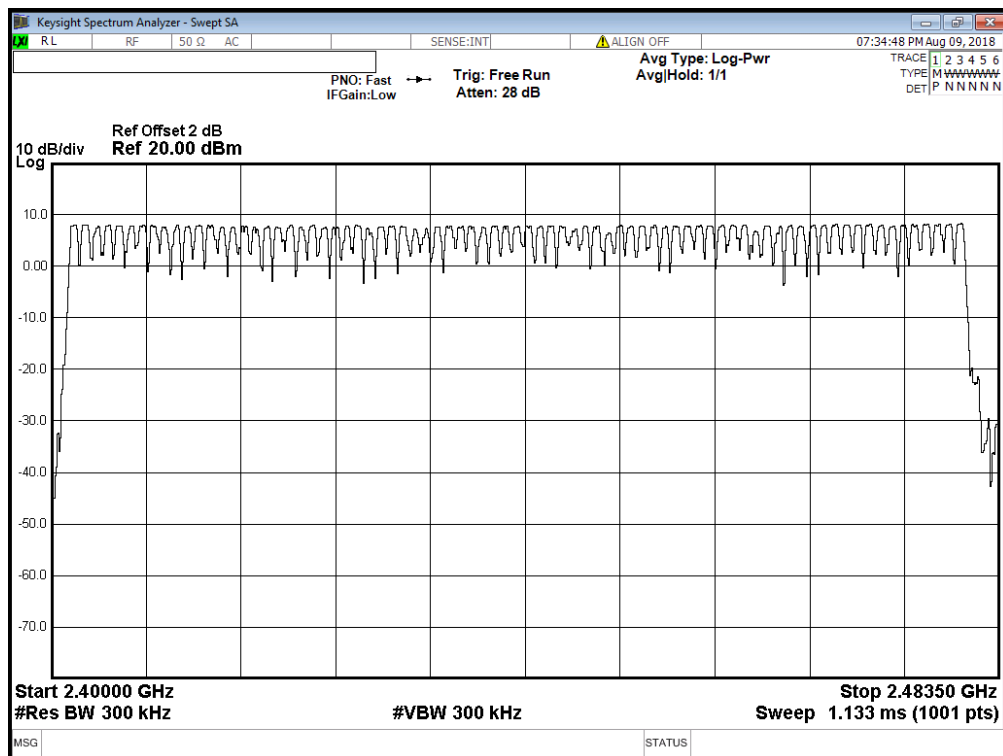
Number of hopping channels:	79	Channels
-----------------------------	----	----------

Modulation Standard: 8DPSK (3Mbps)

Number of hopping channels:	79	Channels
-----------------------------	----	----------

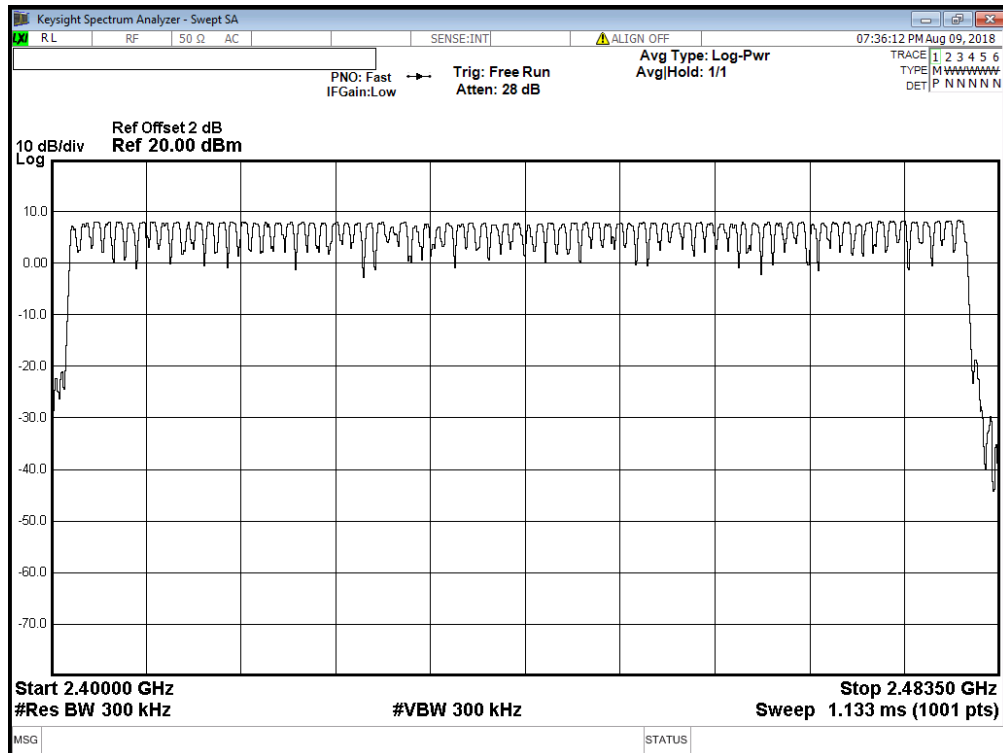


Modulation Standard: GFSK (1Mbps)

Modulation Standard: $\pi/4$ DQPSK (2Mbps)



Modulation Standard: 8DPSK (3Mbps)





11. Maximum Peak Output Power

11.1 Test Limit

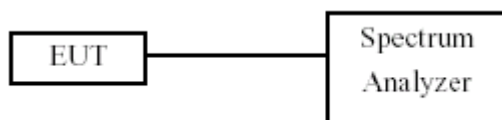
The Maximum Peak Output Power Measurement is 21dBm.

11.2 Test Procedures

The antenna port(RF output)of the EUT was connected to the input(RF input)of a power meter.

Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

11.3 Test Setup Layout



11.4 Test Result and Data

Test Date: Dec. 05, 2018

Temperature: 25°C

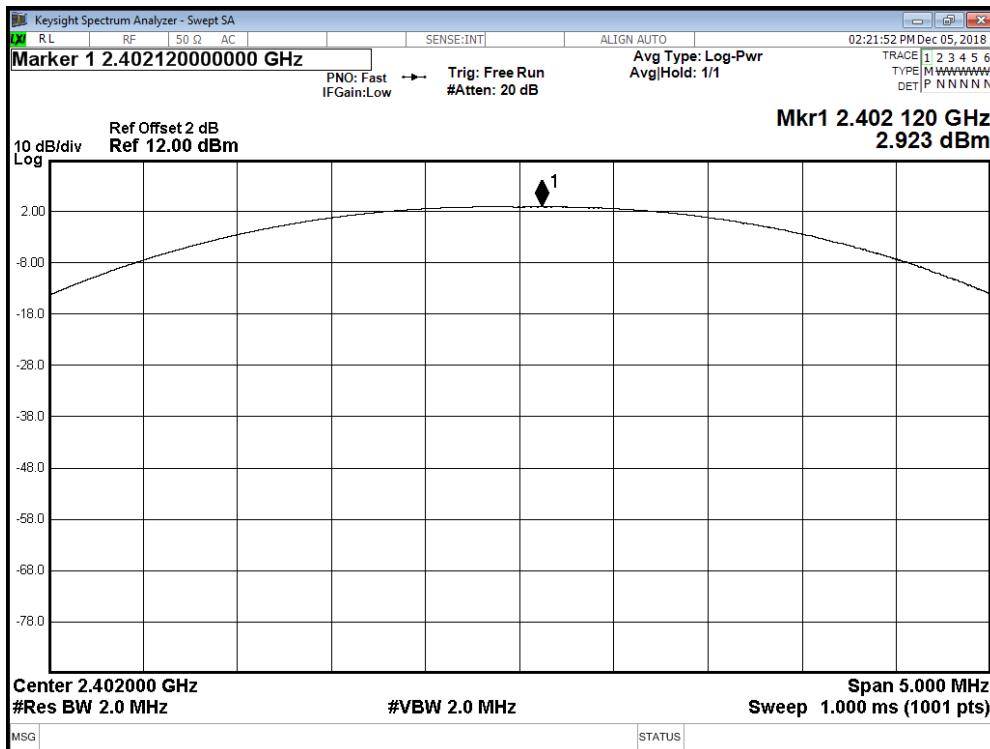
Atmospheric pressure: 1020 hPa

Humidity: 55%

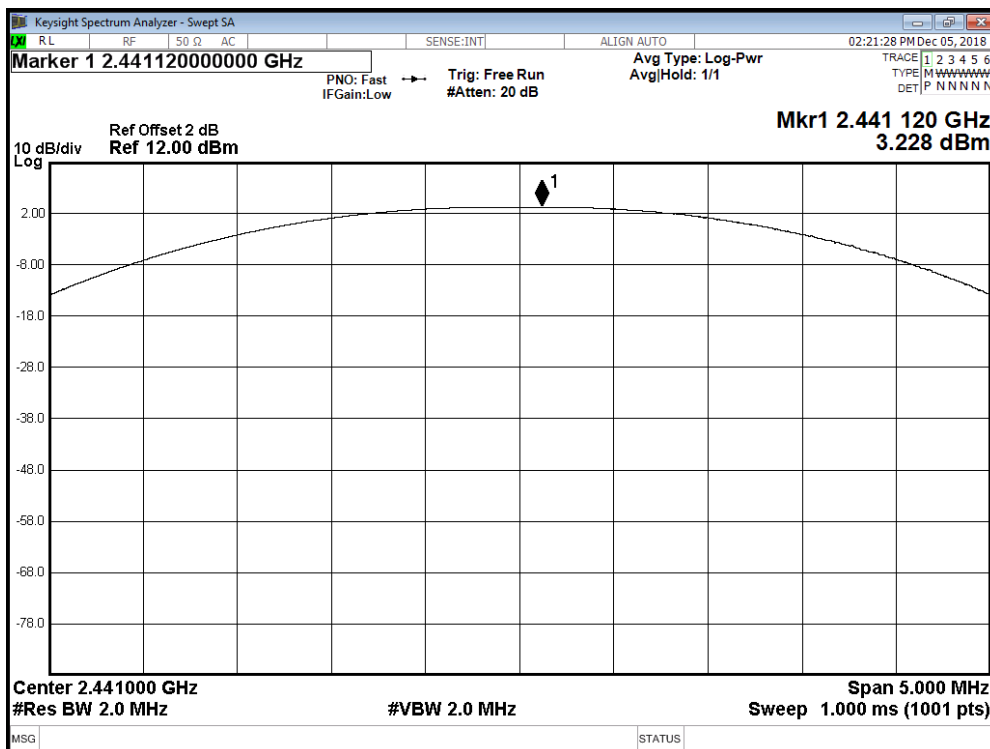
Modulation Type	Channel	Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)
GFSK (1Mbps)	00	2402	2.923	1.960
	39	2441	3.228	2.103
	78	2480	3.331	2.153
$\pi/4$ DQPSK (2Mbps)	00	2402	1.233	1.328
	39	2441	1.529	1.422
	78	2480	1.642	1.459
8DPSK (3Mbps)	00	2402	1.173	1.310
	39	2441	1.448	1.396
	78	2480	1.583	1.440



Modulation Standard: GFSK (1Mbps)
Channel: 00

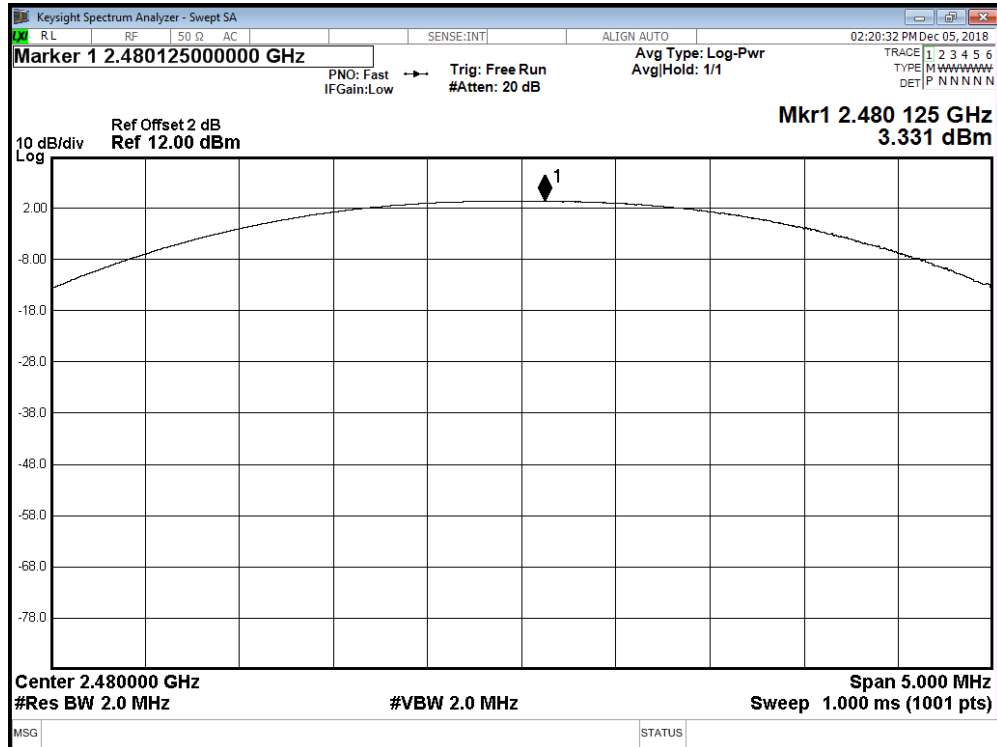


Modulation Standard: GFSK (1Mbps)
Channel: 39

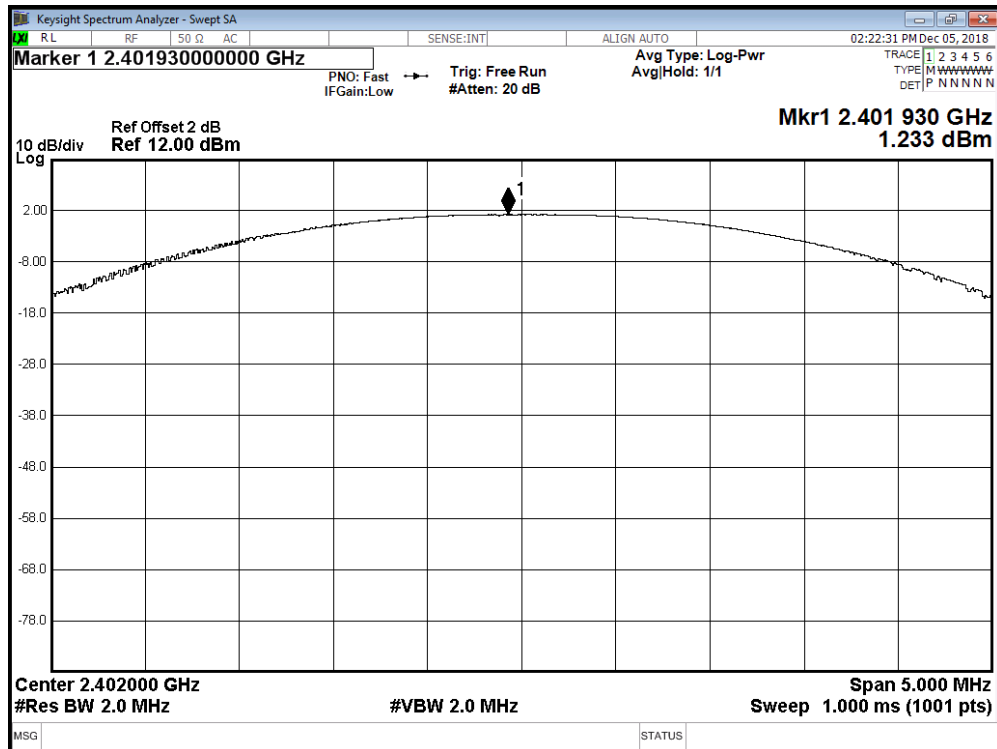




Modulation Standard: GFSK (1Mbps)
Channel: 78

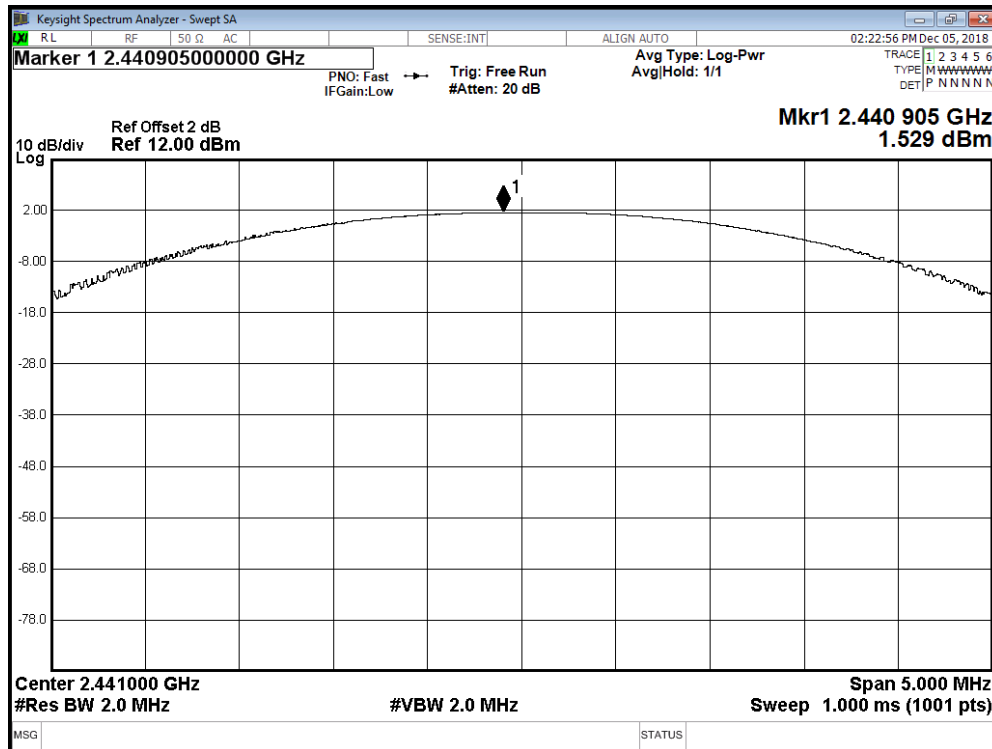


Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 00

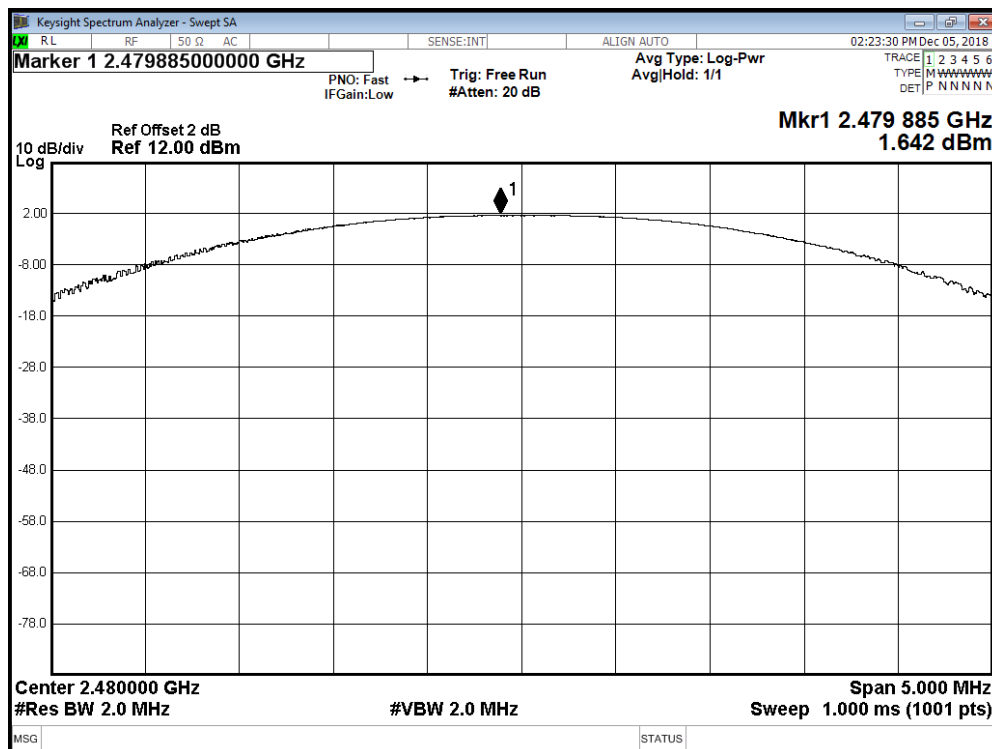




Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 39



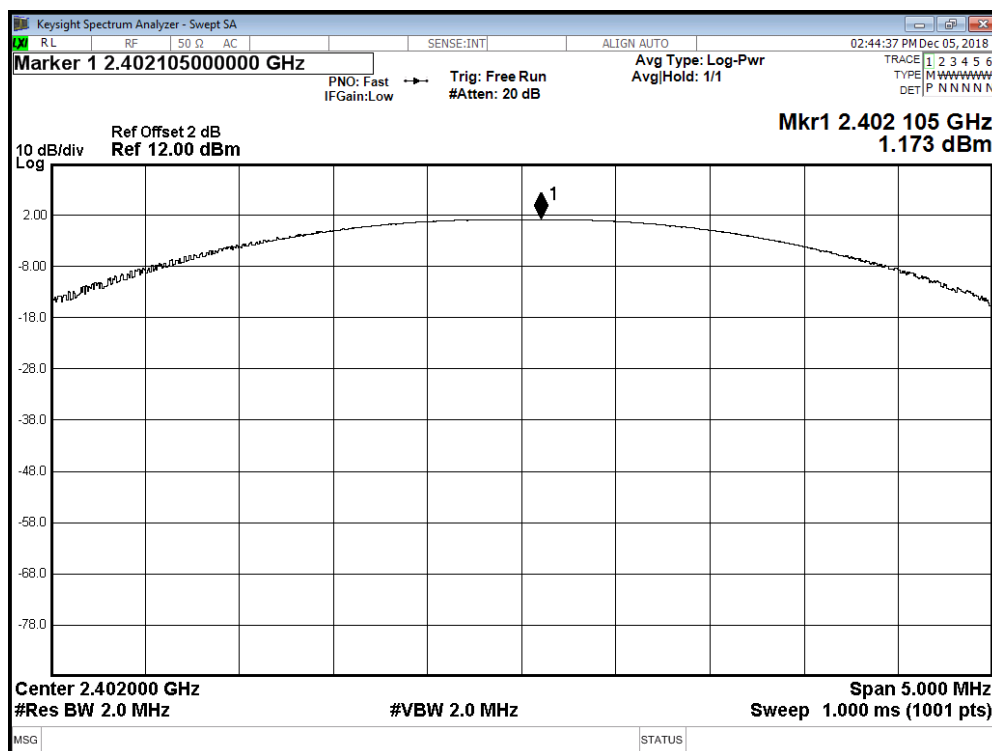
Modulation Standard: $\pi/4$ DQPSK (2Mbps)
Channel: 78





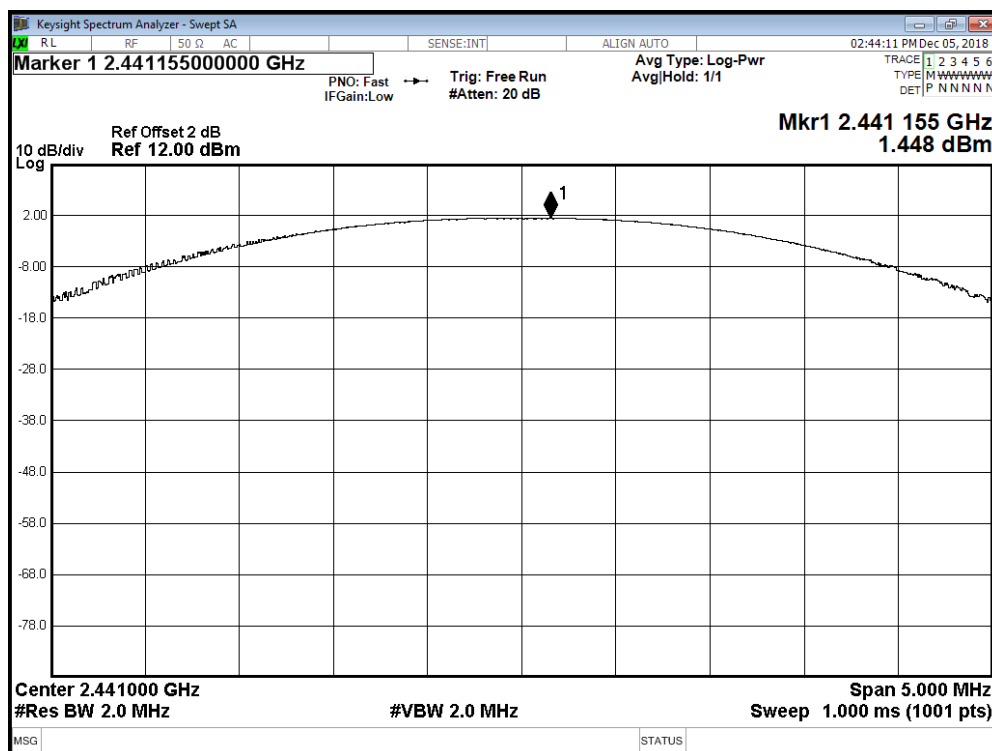
Modulation Standard: 8DPSK (3Mbps)

Channel: 00



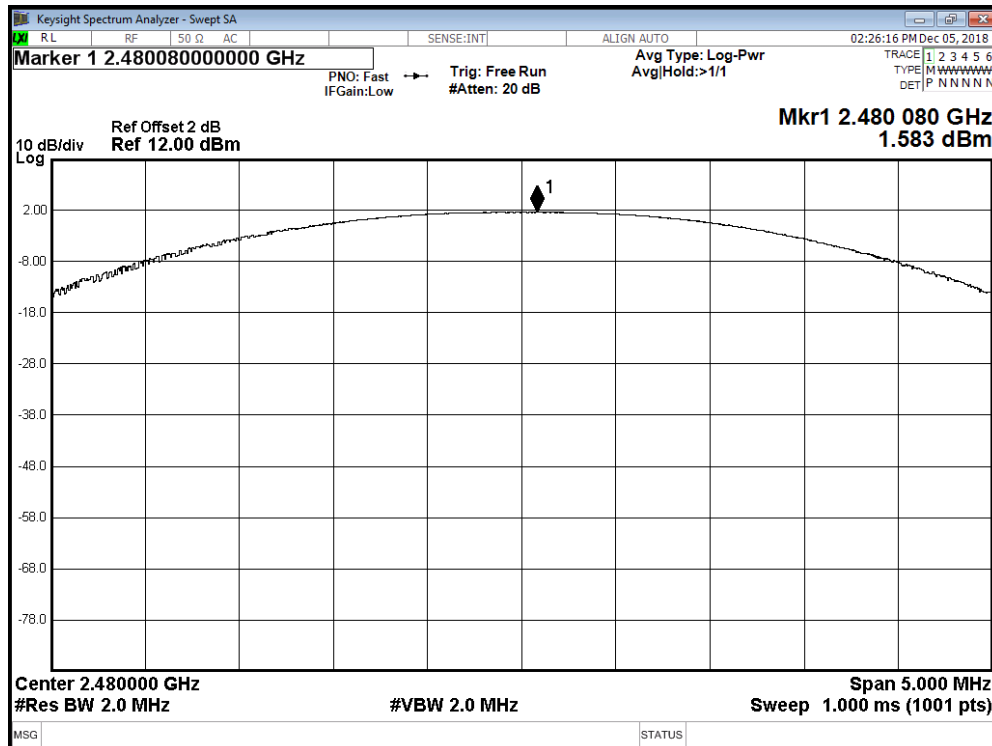
Modulation Standard: 8DPSK (3Mbps)

Channel: 39





Modulation Standard: 8DPSK (3Mbps)
Channel: 78





12. Band Edges Measurement

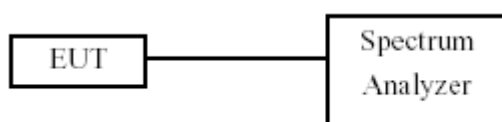
12.1 Test Limit

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

12.2 Test Procedure

- The transmitter output was connected to the spectrum analyzer via a low lose cable.
- Set both RBW and VBW of spectrum analyzer to 100 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
- The band edges was measured and recorded.

12.3 Test Setup Layout



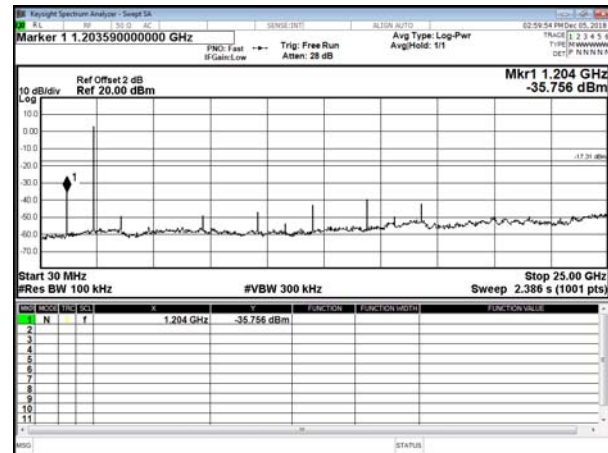
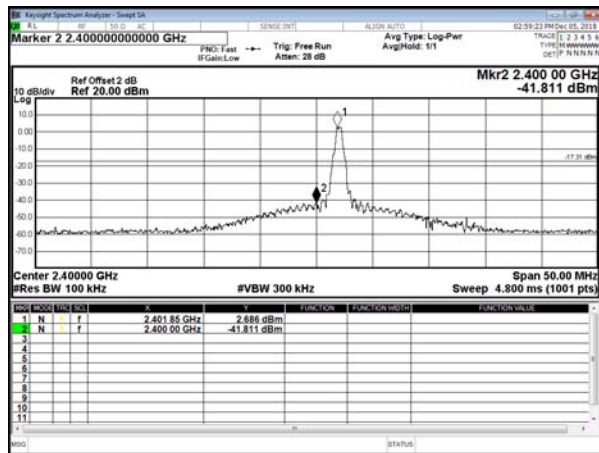


12.4 Test Result and Data

Single test

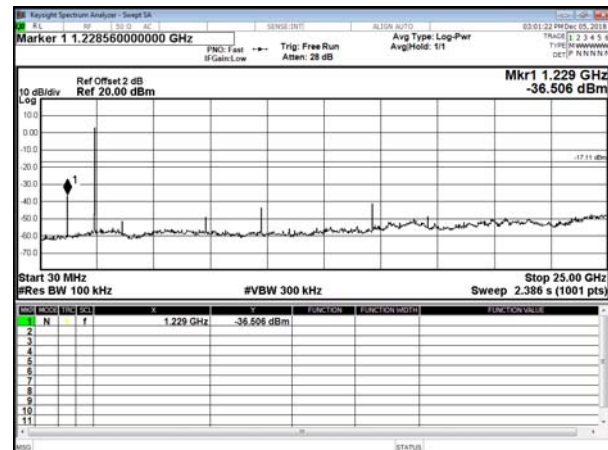
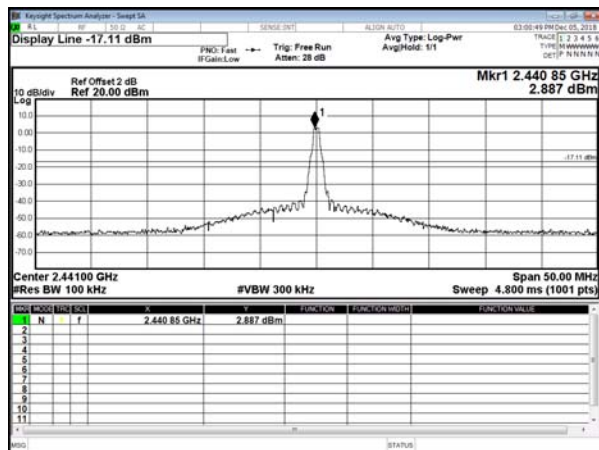
Modulation Standard: GFSK (1Mbps)

Channel: 00



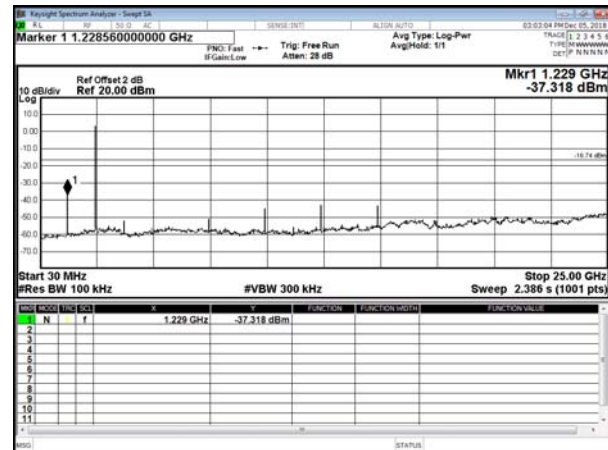
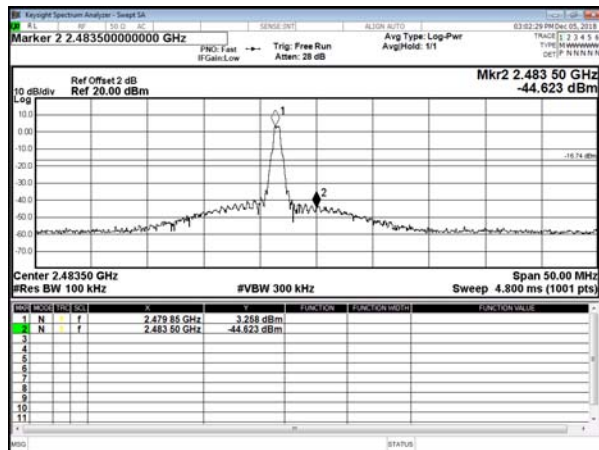
Modulation Standard: GFSK (1Mbps)

Channel: 39



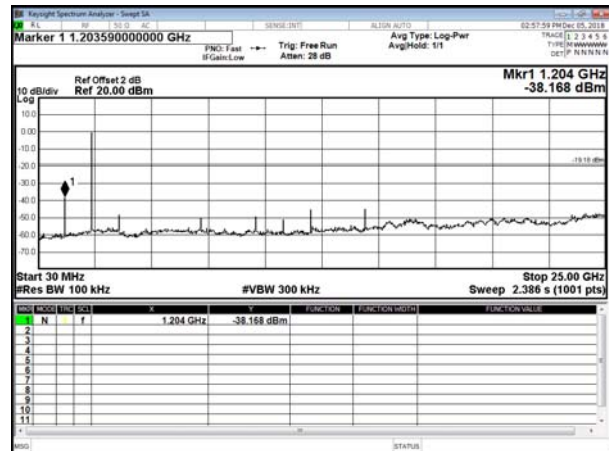
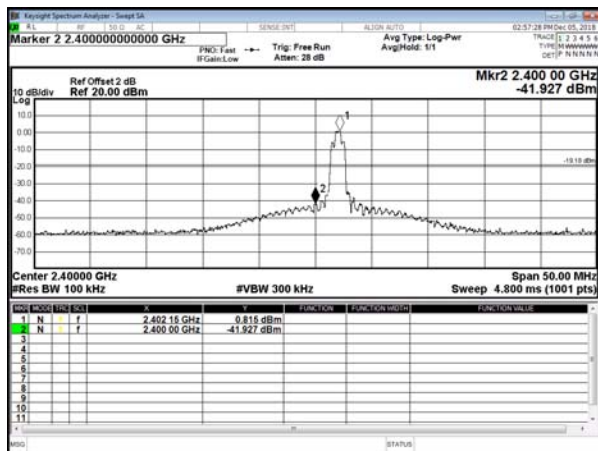
Modulation Standard: GFSK (1Mbps)

Channel: 78

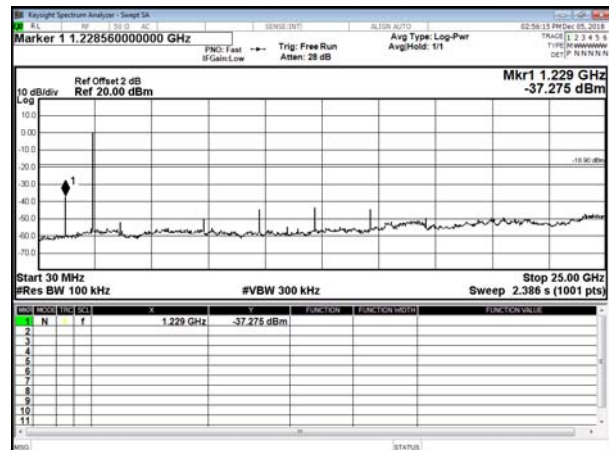
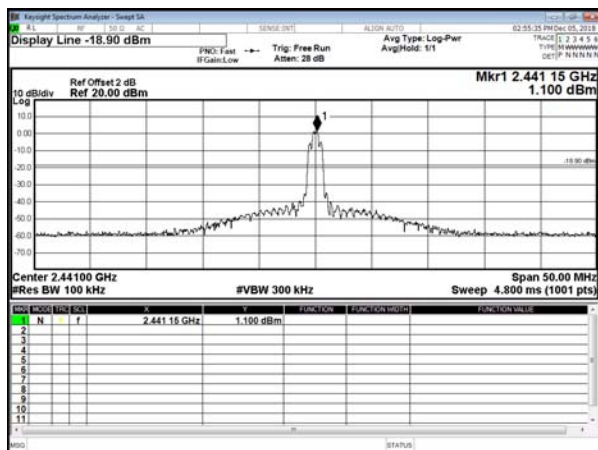


Modulation Standard: $\pi/4$ DQPSK (2Mbps)

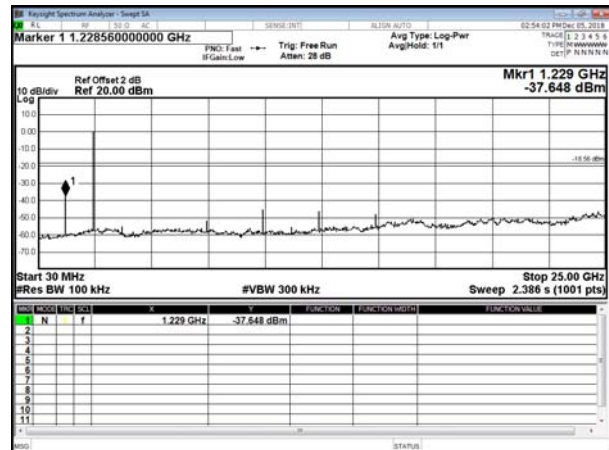
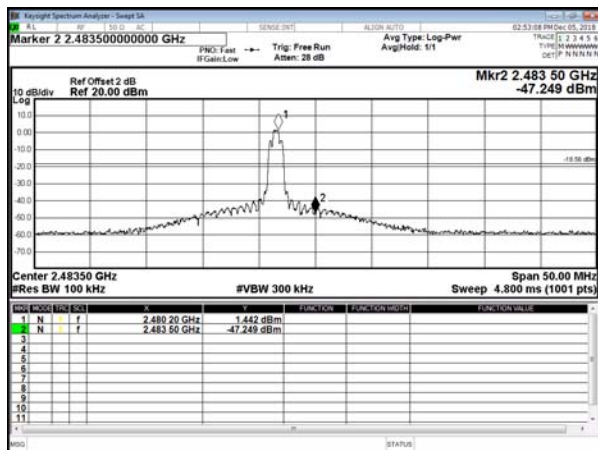
Channel: 00

Modulation Standard: $\pi/4$ DQPSK (2Mbps)

Channel: 39

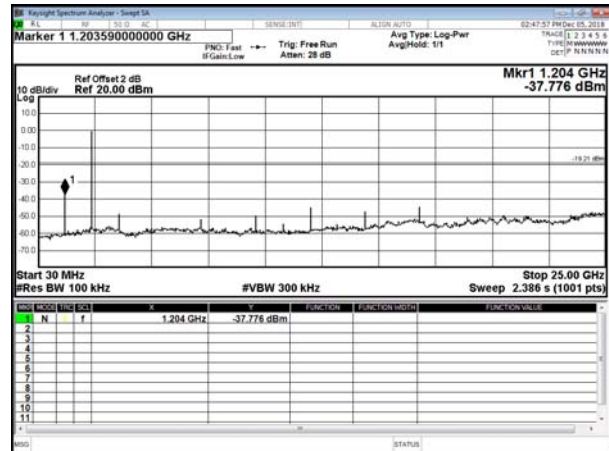
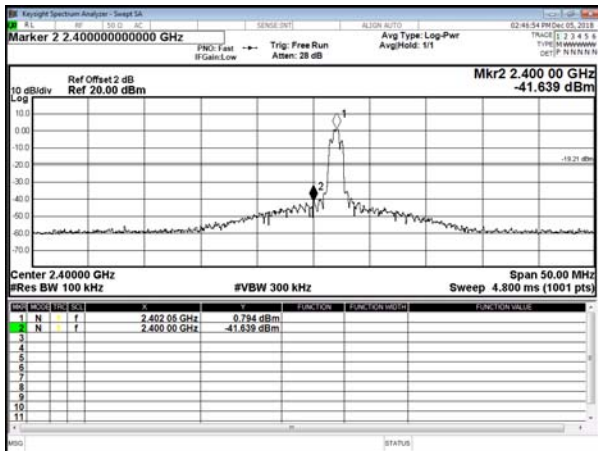
Modulation Standard: $\pi/4$ DQPSK (2Mbps)

Channel: 78

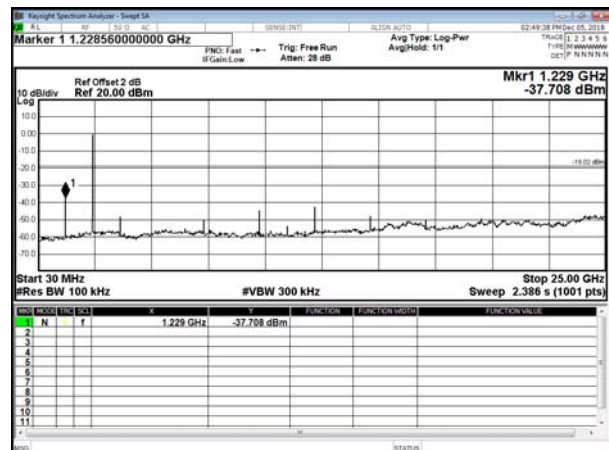
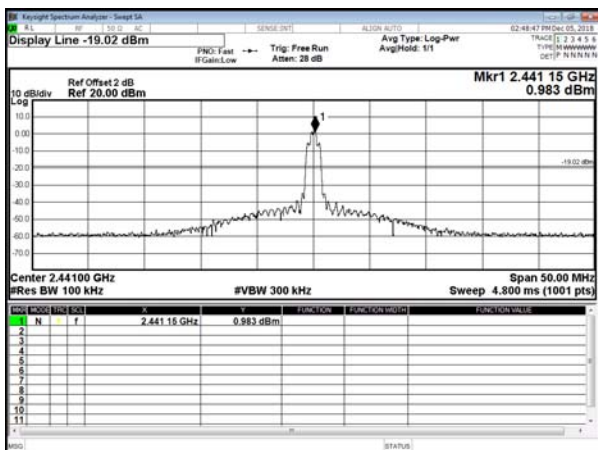




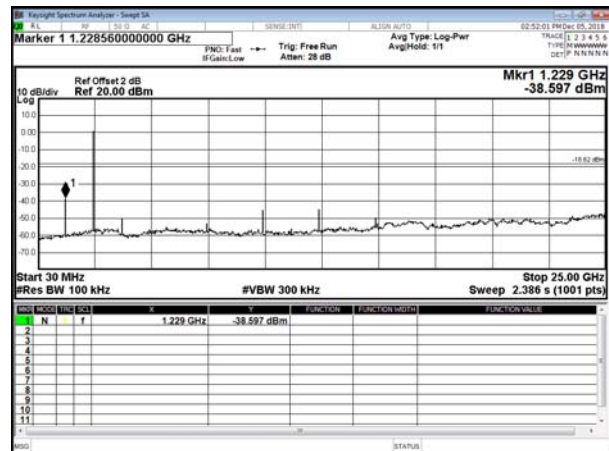
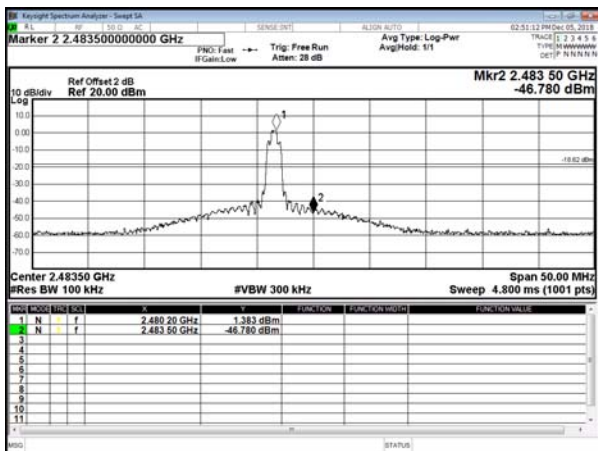
Modulation Standard: 8DPSK (3Mbps)
Channel: 00



Modulation Standard: 8DPSK (3Mbps)
Channel: 39



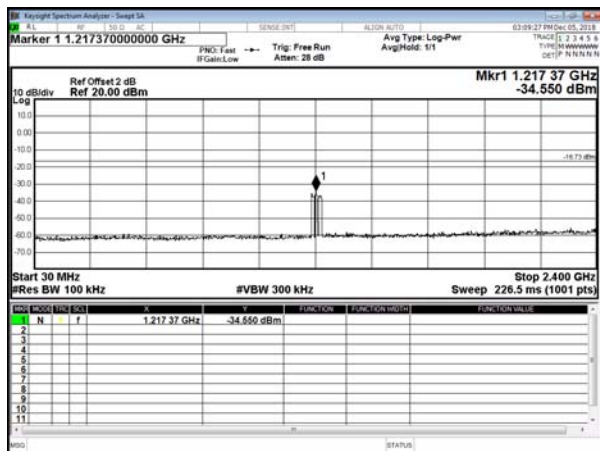
Modulation Standard: 8DPSK (3Mbps)
Channel: 78



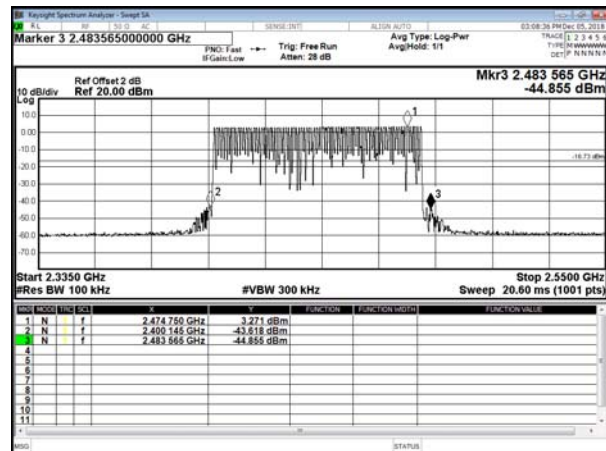


Hopping test

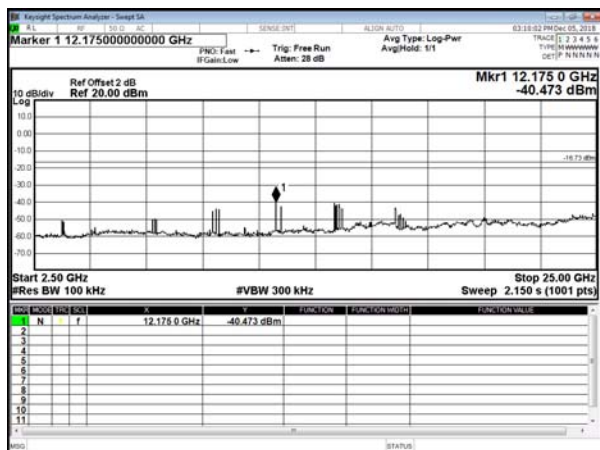
Modulation Standard: GFSK (1Mbps)



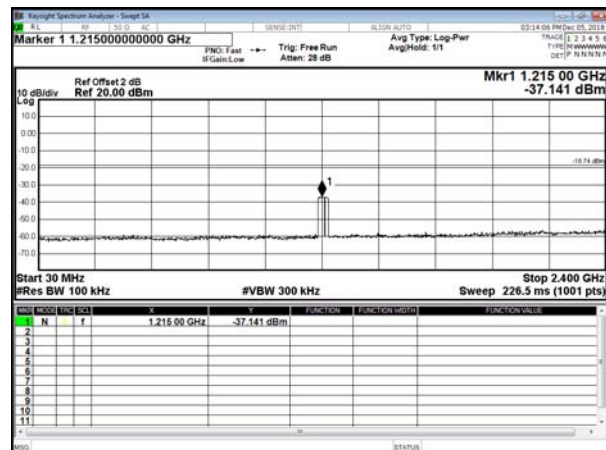
Modulation Standard: GFSK (1Mbps)



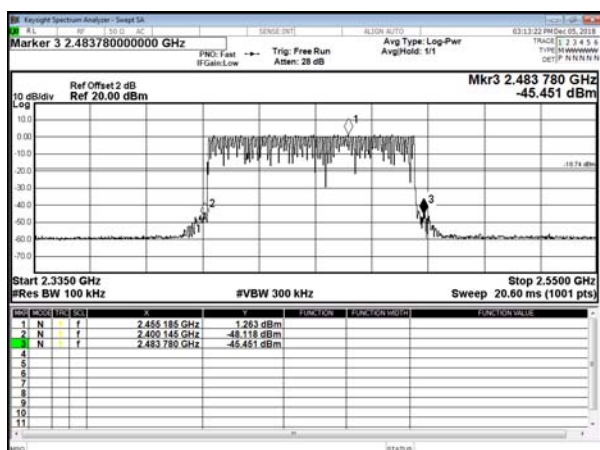
Modulation Standard: GFSK (1Mbps)



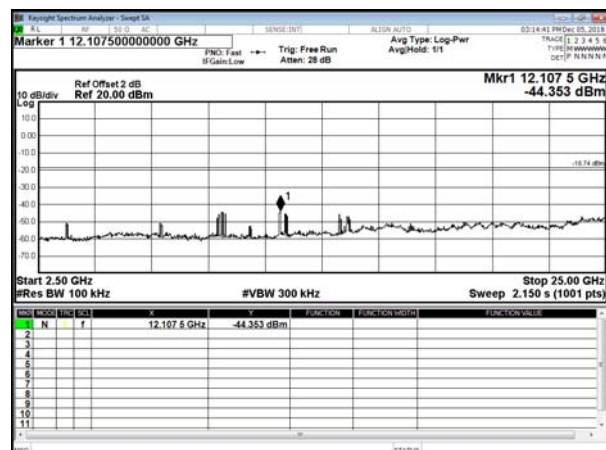
Modulation Standard: $\pi/4$ DQPSK (2Mbps)



Modulation Standard: $\pi/4$ DQPSK (2Mbps)

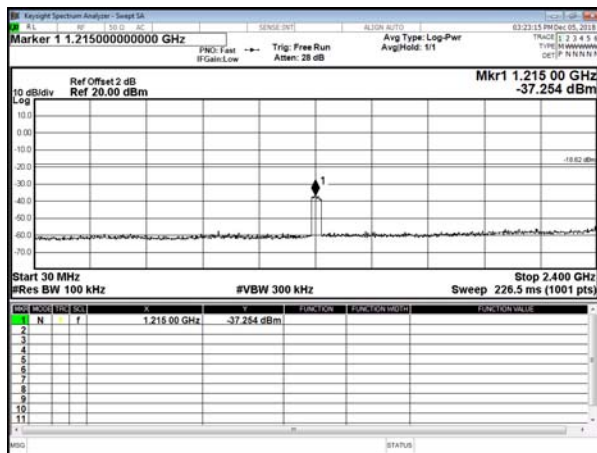


Modulation Standard: $\pi/4$ DQPSK (2Mbps)

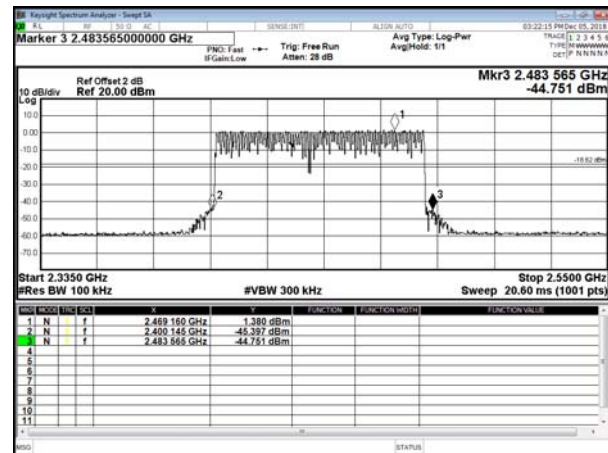




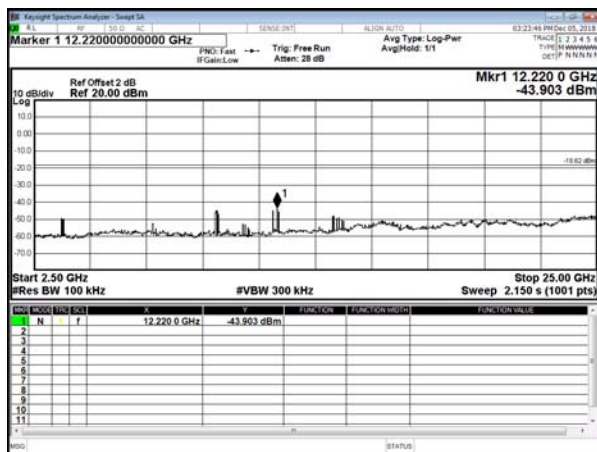
Modulation Standard: 8DPSK (3Mbps)



Modulation Standard: 8DPSK (3Mbps)

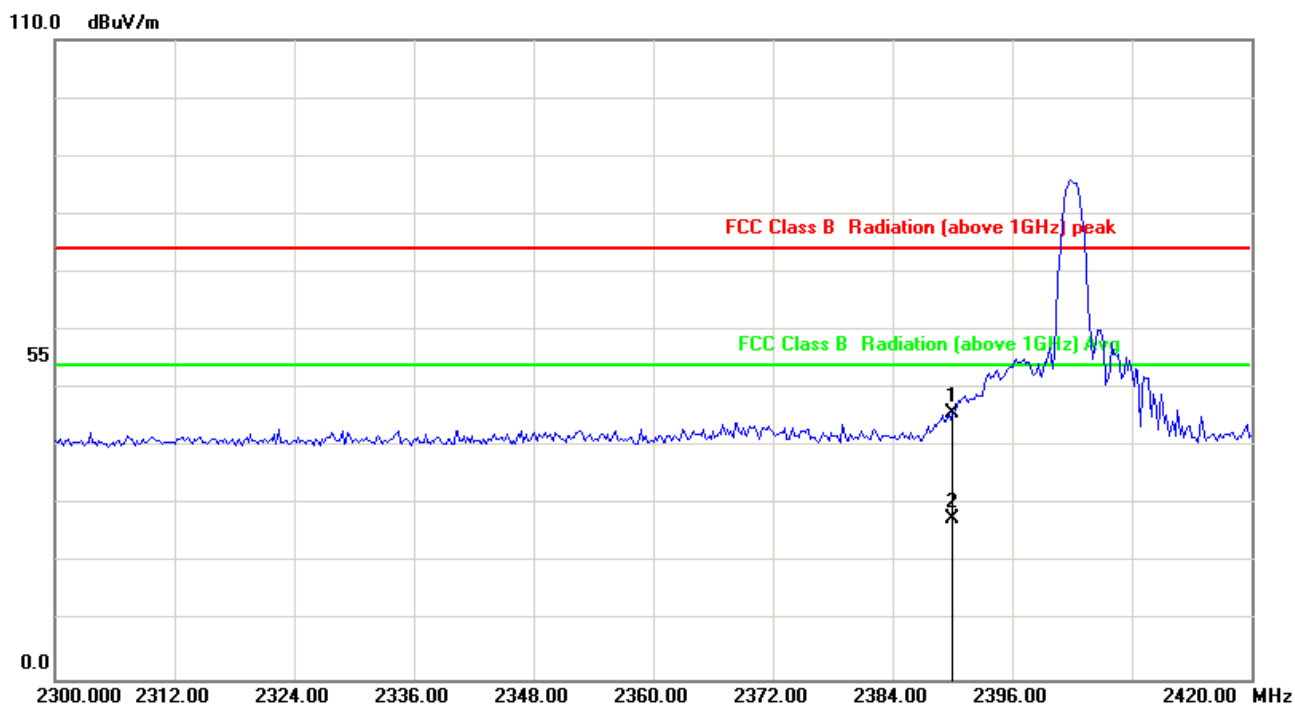


Modulation Standard: 8DPSK (3Mbps)



**12.5 Restrict band emission Measurement Data**

Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: GFSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



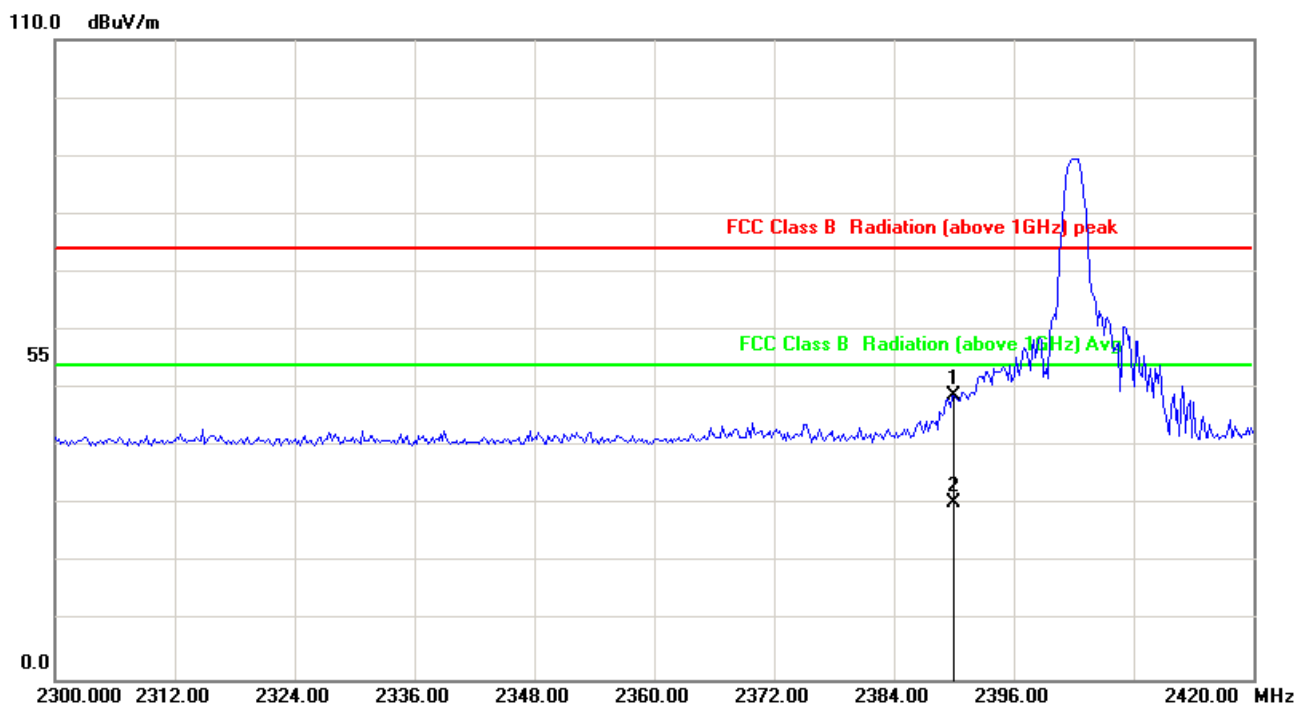
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	42.93	45.88	74.00	-28.12	peak
2	2390.000	2.95	24.72	27.67	54.00	-26.33	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: GFSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



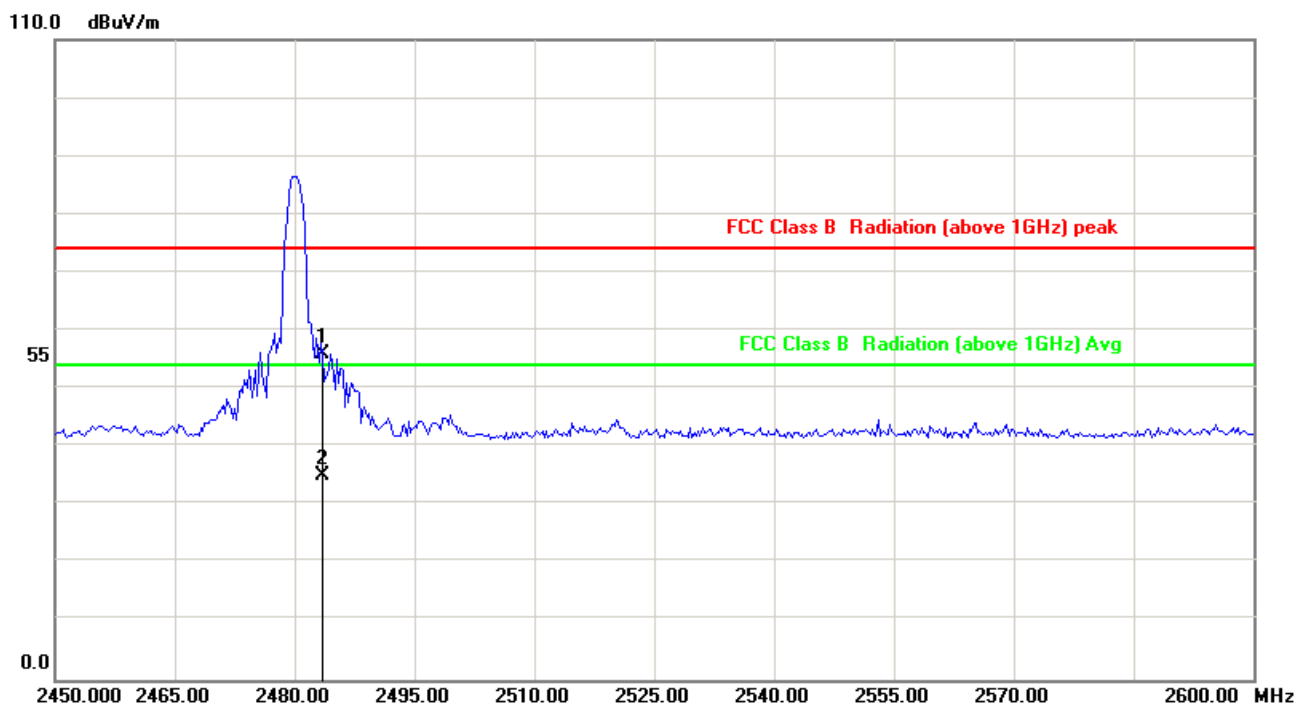
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	45.79	48.74	74.00	-25.26	peak
2	2390.000	2.95	27.34	30.29	54.00	-23.71	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: GFSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



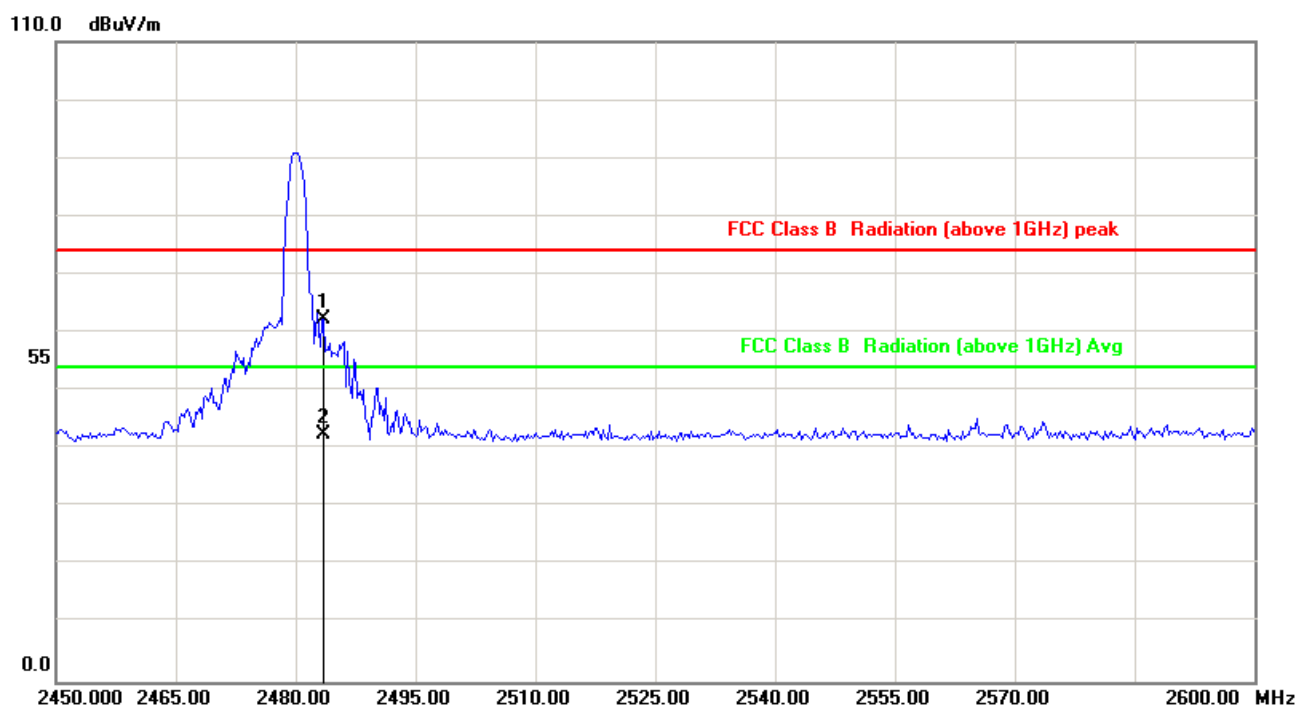
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	52.48	55.83	74.00	-18.17	peak
2	2483.500	3.35	31.62	34.97	54.00	-19.03	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: GFSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



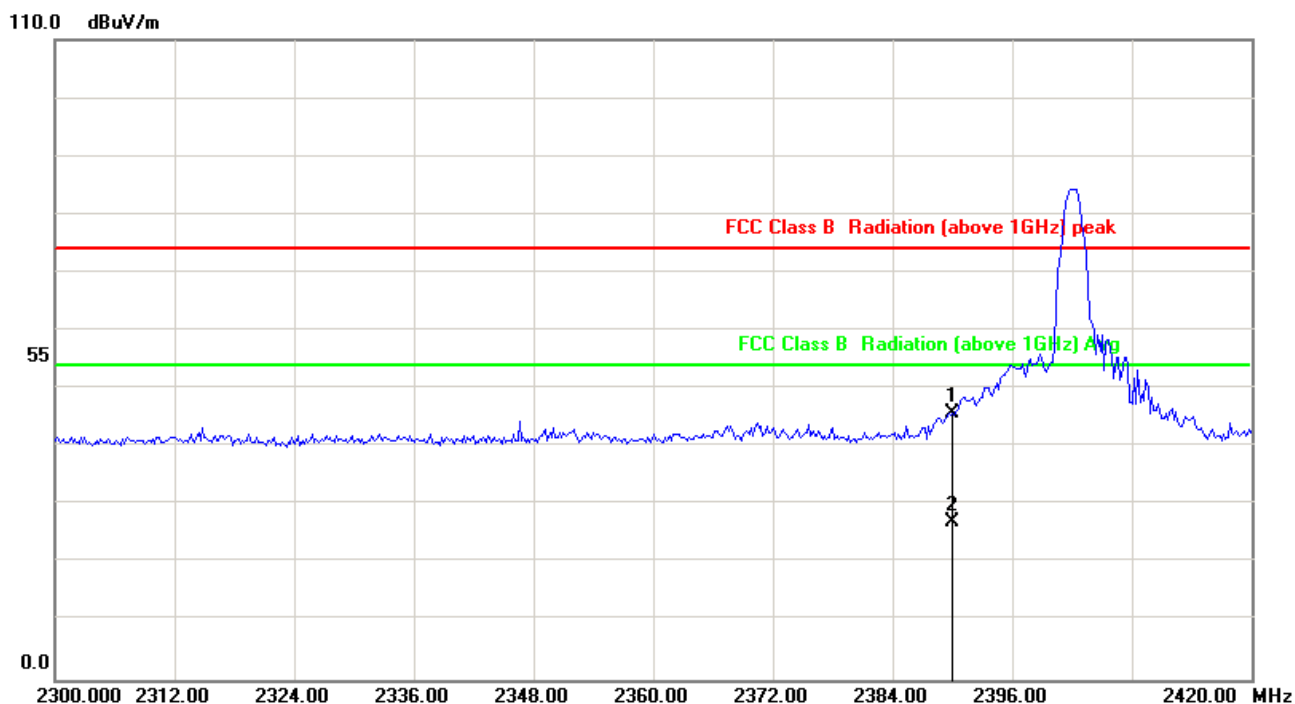
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	58.81	62.16	74.00	-11.84	peak
2	2483.500	3.35	39.10	42.45	54.00	-11.55	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: $\pi/4$ DQPSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



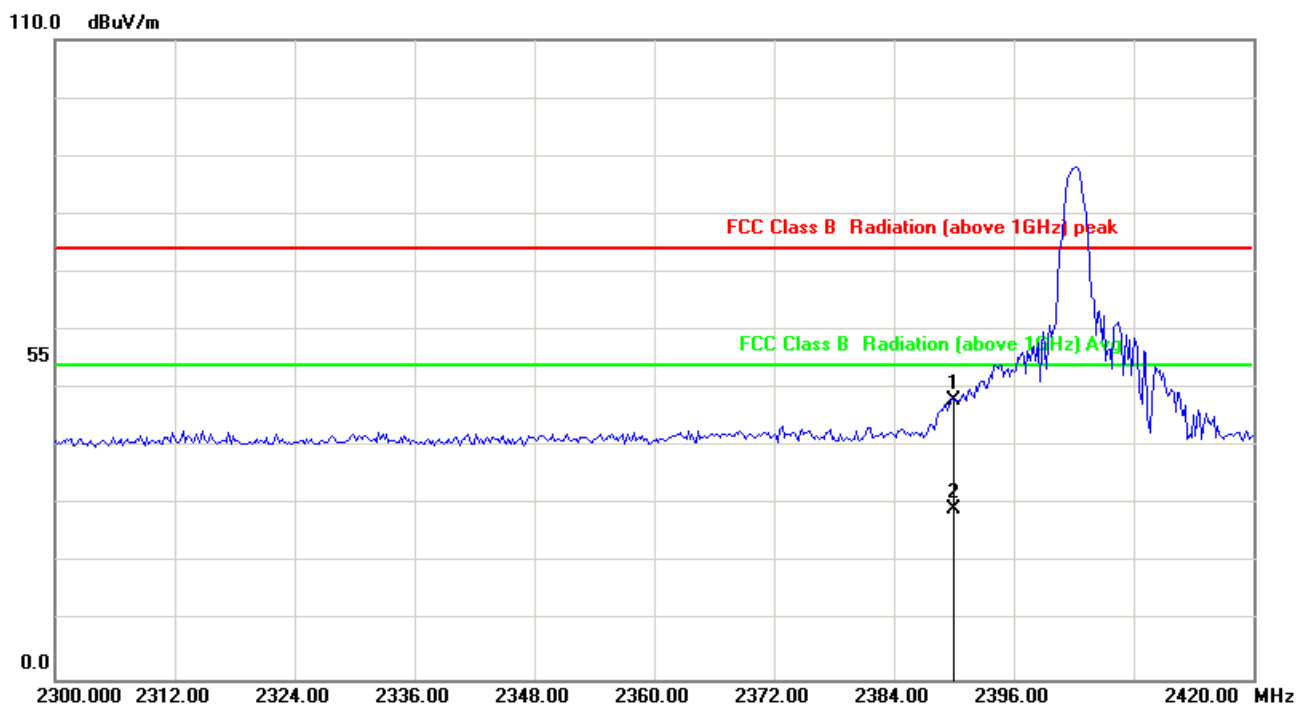
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	42.95	45.90	74.00	-28.10	peak
2	2390.000	2.95	24.24	27.19	54.00	-26.81	AVG

Note: Level=Reading+ Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: $\pi/4$ DQPSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



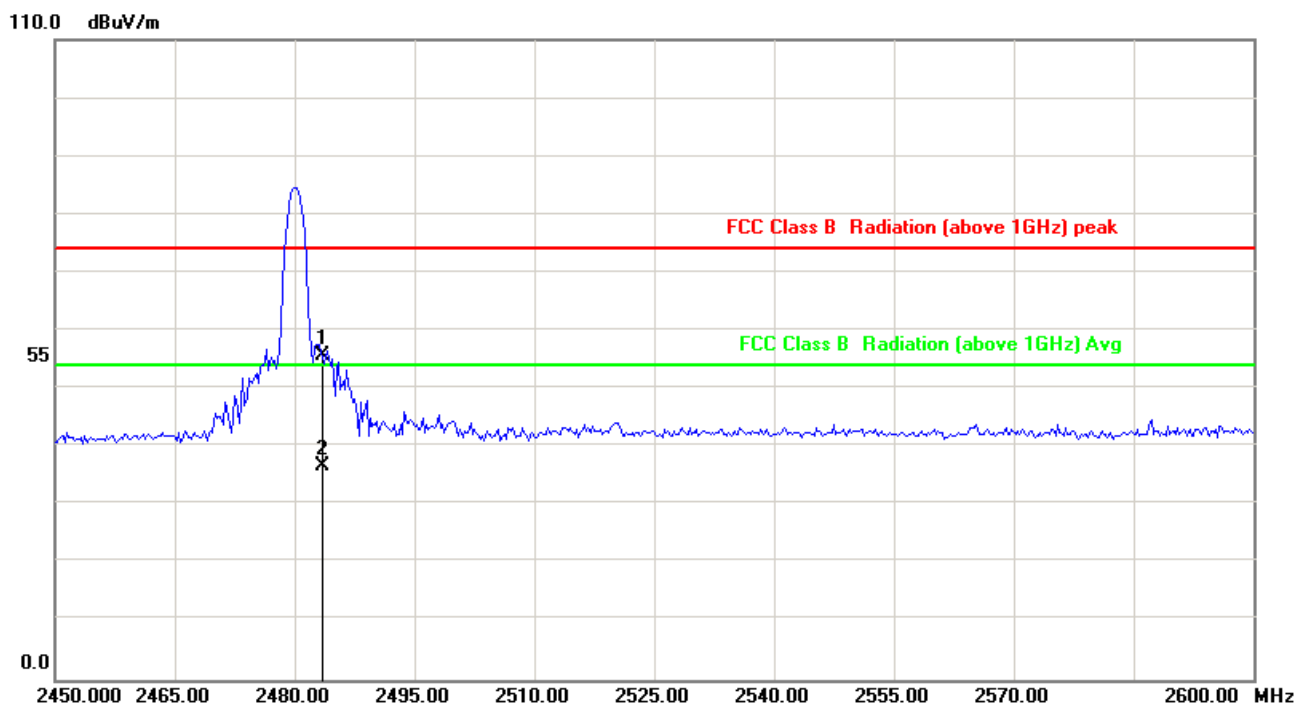
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	44.98	47.93	74.00	-26.07	peak
2	2390.000	2.95	26.42	29.37	54.00	-24.63	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: $\pi/4$ DQPSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



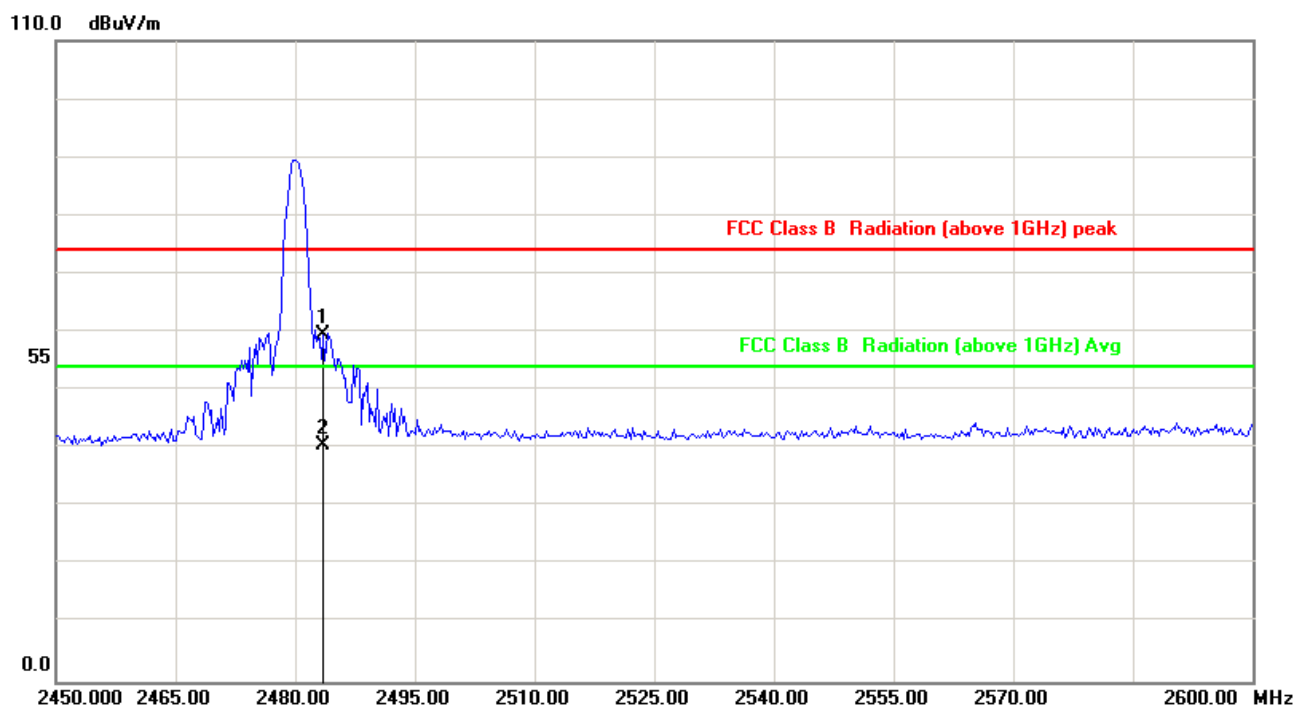
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	52.32	55.67	74.00	-18.33	peak
2	2483.500	3.35	33.35	36.70	54.00	-17.30	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: $\pi/4$ DQPSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



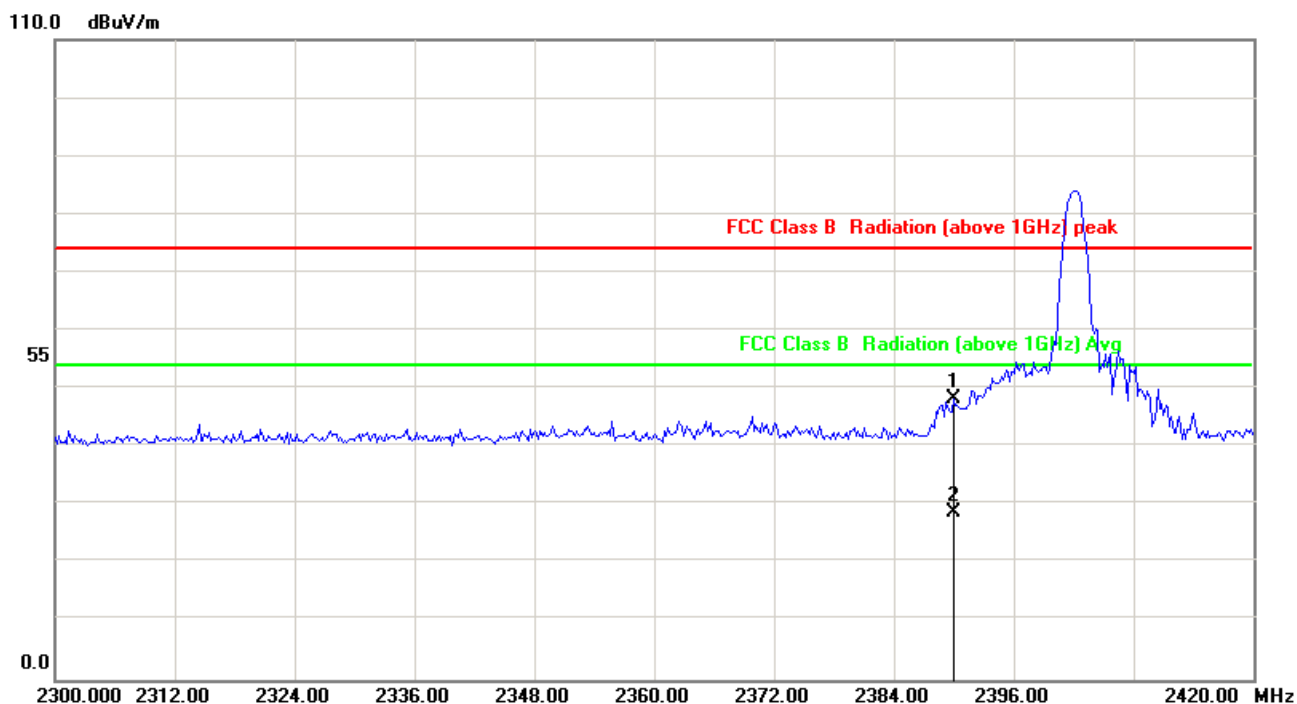
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	56.15	59.50	74.00	-14.50	peak
2	2483.500	3.35	37.31	40.66	54.00	-13.34	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: 8DPSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



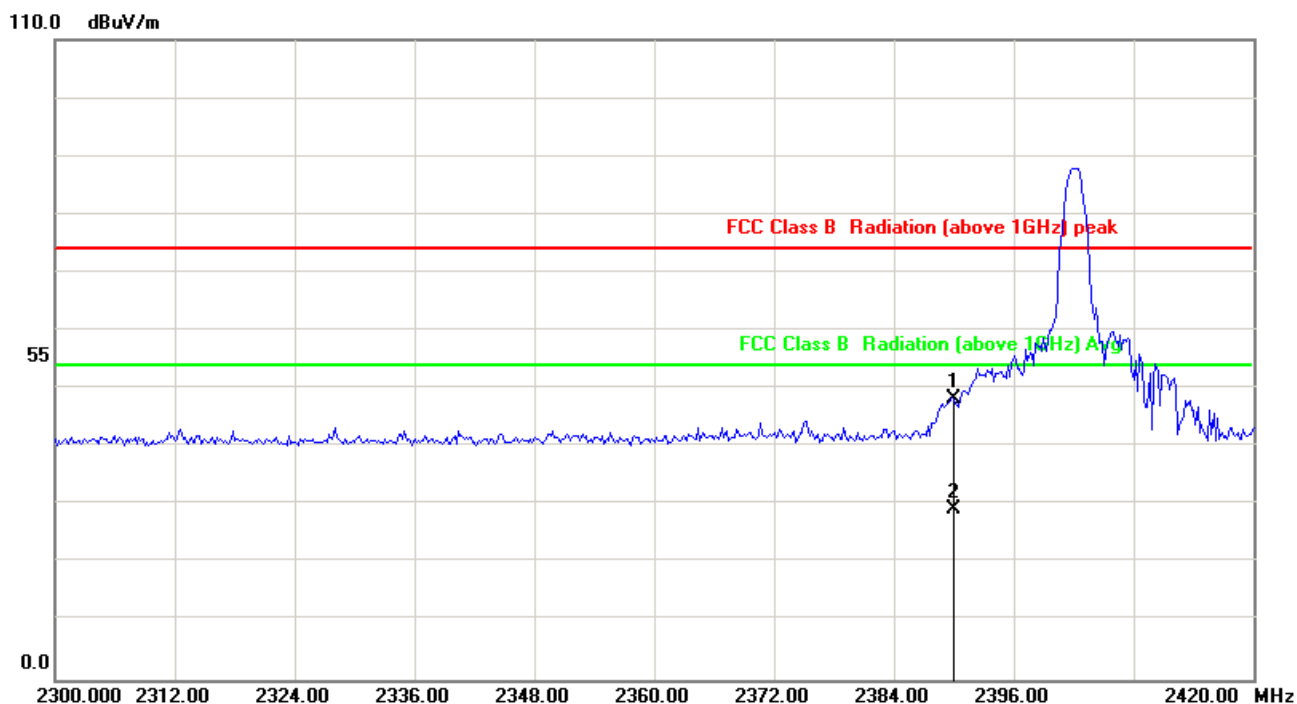
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	45.37	48.32	74.00	-25.68	peak
2	2390.000	2.95	25.68	28.63	54.00	-25.37	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: 8DPSK, CH00	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



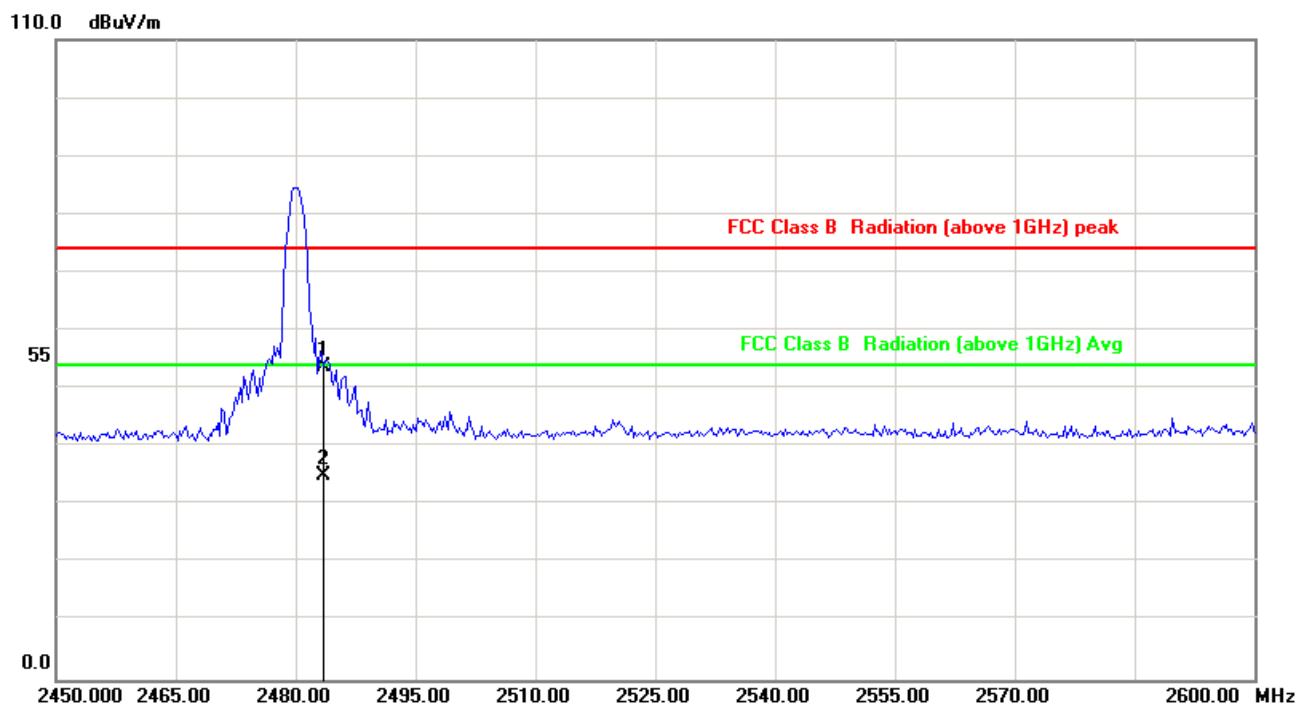
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	2.95	45.28	48.23	74.00	-25.77	peak
2	2390.000	2.95	26.24	29.19	54.00	-24.81	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: VERTICAL
Test Mode	: 8DPSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



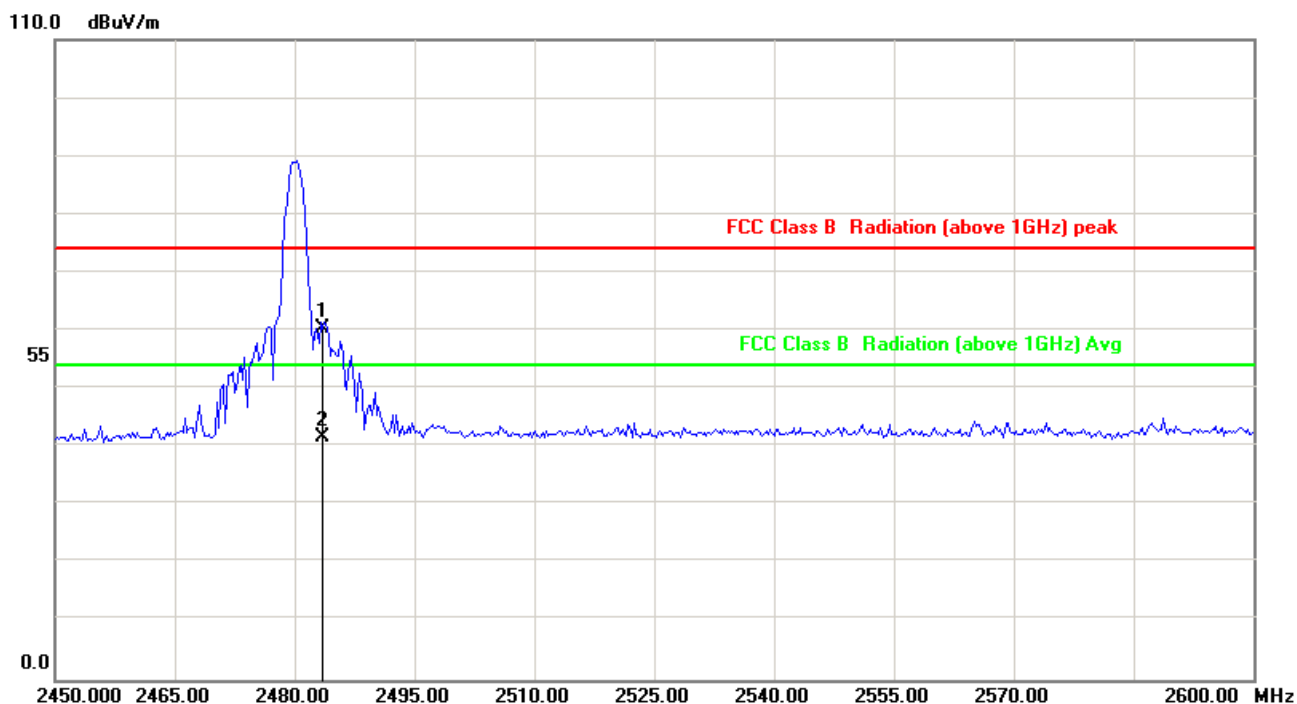
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	50.33	53.68	74.00	-20.32	peak
2	2483.500	3.35	31.64	34.99	54.00	-19.01	AVG

Note: Level=Reading+Factor.

Margin=Level-Limit.



Power	: AC 120V/60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: 8DPSK, CH78	Temperature	: 23 °C
Test date	: Oct. 30, 2018	Humidity	: 65 %



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	3.35	57.09	60.44	74.00	-13.56	peak
2	2483.500	3.35	38.42	41.77	54.00	-12.23	AVG

Note: Level=Reading+ Factor.

Margin=Level-Limit.



13. Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

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

13.1 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

----- End of the report -----