MEASUREMENT REPORT

(FCC : Part 15 Subpart C (15.247) / ANSI C63.4-2003)
Classification : (DSS) Spread Spectrum Transmitter

Testing Laboratory
1288

Product	:	Martian Notifier
Trade Name	:	SilverPlus
Model No.	:	T200
Applicant	:	SilverPlus, Inc.
Applicant Address	:	17F., No.659, Sec. 1, Neihu Rd., Taipei City 114, Taiwan

Report Number	MLT1401P15001-1
Applicant	SilverPlus, Inc.
Product	Martian Notifier
Sample Received Date	2014/1/2
Sample Tested Date	2014/1/2 ~ 2014/2/14

Report Prepared By	Jesse Tien
Signature	Jesse Tien
Date Prepared	2014/2/27

Report Authorized By	Roger Chen
Signature	Roger Chen
Date Authorized	2014/2/27

Test By

Max Light Technology Co., Ltd.
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History of Test Report

Original Report Issue Date: 2014/2/27

■ No additional attachment

☐ additional attachments were issued as in the following record:

Attachment No.	Issue Date	Description
MLT1401P15001-1	2014/2/27	Original report

CERTIFICATION

We here by verify that :

The test data, data evaluation, test procedures and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4-2003. All test were conducted by

MLT(Max Light Technology Co.,Ltd) Room 5, 8F, No.125, Section 3 Roosevelt Road, Taipei, Taiwan, R.O.C Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is in compliance with Class B radiated and conducted emission limit of FCC Rules Part 15 Subpart C (15.247).

Applicant Name	SilverPlus, Inc.
Applicant Address	17F., No.659, Sec. 1, Neihu Rd., Taipei City 114, Taiwan
Manufacturer Name	SilverPlus, Inc.
Manufacturer Address	17F., No.659, Sec. 1, Neihu Rd., Taipei City 114, Taiwan

Equipment	Martian Notifier
Model No	T200
FCC ID	X4LT200

Report Prepared By	Jesse Tien
Signature	Jesse Tien

Report Authorized By	Roger Chen
Signature	Roger Chen

1. General

1.1 Introduction:

The following measurement report is submitted on behalf of SilverPlus, Inc. In support of a Class B Digital Device certification in accordance with Part2 Subpart J and Part 15 Subpart C of the Commission's and Regulations.

1.2 Customer Details:

Applicant Name	SilverPlus, Inc.
Applicant Address	17F., No.659, Sec. 1, Neihu Rd., Taipei City 114, Taiwan
Manufacturer Name	SilverPlus, Inc.
Manufacturer Address	17F., No.659, Sec. 1, Neihu Rd., Taipei City 114, Taiwan

1.3 Technical data of EUT:

Equipment	Martian Notifier
Model No	T200
FCC ID	X4LT200
Power Type	Battery 3.7V
Type of Modulation	GFSK ; π/4-DQPSK ; 8-DPSK
Transfer rate	Bluetooth :1Mbps(GFSK) Bluetooth EDR2.1 : 2 ; 3 Mbps(π/4-DQPSK , 8-DPSK) Bluetooth EDR3.0 : 2 ; 3 Mbps(π/4-DQPSK , 8-DPSK)
Type of Antenna	Chip Antenna
Frequency of Channel	See Next page

During testing the EUT was operated at Tx or Rx mode for each emission measured. This was done in order to ensure that maximum emission levels were attained.

Frequency of Each Channel (Working Frequency)

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	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		

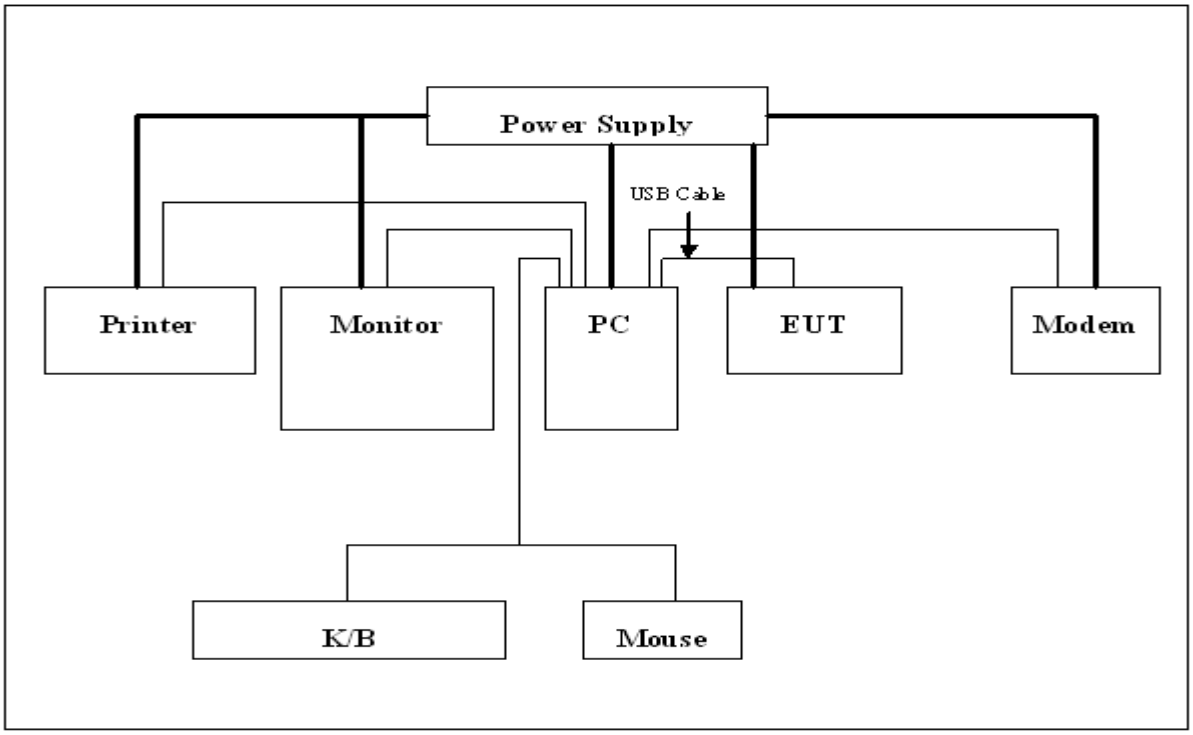
1.4 Summary Of Tests

47 CFR Part 15 Subpart C			
Reference	**Test**	**Results**	**Note**
15.207	Conducted Emission	PASS	
15.209	Radiated Emission	PASS	
15.247(a)(1)(i)-(ii)	20dB Bandwidth	PASS	
15.247(a)(1)	Hopping Frequency Separation	PASS	
15.247(a)(1)(iii)	Number of Hopping Channel	PASS	
15.247(a)(1)(iii)	Dwell Time of Each Channel	PASS	
15.247(b)	Max. Output Power	PASS	
15.247(d)	Band Edge Measurement	PASS	
15.247(c)	Out of Band Conducted Spurious Emission	PASS	
15.203	Antenna Requirement	PASS	

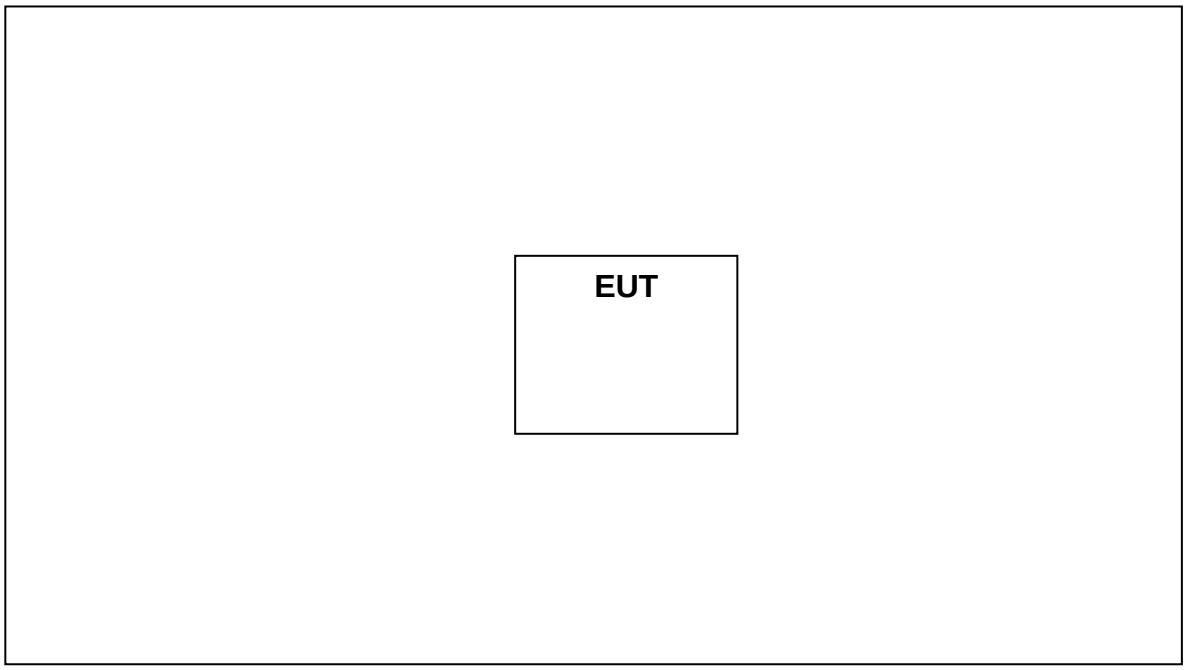
1.5 Description of Support Equipment

In order to construct the minimum system which required by the ANSI C63.4-2003, following equipments were used as the support units.

1.6 Configuration of System Under Test:



Charged by PC



Operate

1.7 Test Procedure:

All measurements contained in this report were performed according to the techniques described in Measurement procedure ANSI C63.4-2003 followed FCC DA 00-75 or ANSI C63.10 for this testing.

1.8 General Test Condition:

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions which the EUT was considered likely to encounter in normal use were investigated. The system's radiated and conducted emissions were investigated while the computer alternately transferred data to the EUT as well as to the monitor and printer. Using a test program which sent a continuous data and transferred data to and from the EUT was proven to worst case emissions. The system's physical layout and cabling was randomly arranged to ensure that maximum emission levels were attained.

This assessment of the maximum conducted output power tests is base on the minimum transfer rate will produce a maximum output power.

2. Conducted Emissions Requirements

2.1 General & Setup:

The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3825/2 Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPER quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 2.5.

2.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	HP	Spectrum Analyzer	73412A00110	8591EM	2013/03/21	2014/03/21
2.	EMCO	LISN	2658	3825/2	2013/03/01	2014/03/01
3.	TESEQ	ISN	24810	ISN T8	2013/05/22	2014/05/22

2.3 Test Condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

2.4 Conducted Emissions Limits:

FCC Part 15

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	QP	Avg.	QP	Avg.
0.15 to 0.50	79	66	66 to 56	56 to 46
0.50 to 5.0	73	60	56	46
5.0 to 30	73	60	60	50

2.5 Measurement Data Of Conducted Emissions:

2.5.1 Conducted Emissions

The following table shows a summary of the highest emissions of power line conducted emissions to the HOT and NEUTRAL conductor of the EUT power.

Test Mode : PC Charge

Conducted Emissions (Class B)										
Test Port	Freq (MHz)	Read(dBuV)		Factor	Limits (dBuV)		Amplitude (dBuV)		Margin (dBuV)	
		QP	AV		QP	AV	QP	AV	QP	AV
L1	0.2752	35.81	--	1.14	60.98	50.98	36.95	--	-24.03	--
	0.3721	33.02	--	1.15	58.43	48.43	34.17	--	-24.26	--
	0.8541	31.15	--	1.21	56.00	46.00	32.36	--	-23.64	--
	3.3620	31.17	--	1.97	56.00	46.00	33.14	--	-22.86	--
	8.5430	39.83	--	2.03	60.00	50.00	41.86	--	-18.14	--
	11.2520	38.07	--	1.97	60.00	50.00	40.04	--	-19.96	--
	13.5470	38.24	--	2.06	60.00	50.00	40.30	--	-19.70	--
L2	0.1806	39.85	--	1.07	64.46	54.46	40.92	--	-23.54	--
	0.3760	34.92	--	1.09	58.43	48.43	36.01	--	-22.42	--
	0.7697	31.12	--	1.25	56.00	46.00	32.37	--	-23.63	--
	3.8360	32.04	--	2.01	56.00	46.00	34.05	--	-21.95	--
	8.5850	37.51	--	2.03	60.00	50.00	39.54	--	-20.46	--
	9.7230	34.78	--	1.98	60.00	50.00	36.76	--	-23.24	--
	21.1800	36.07	--	2.22	60.00	50.00	38.29	--	-21.71	--

Notes : 1. L1: One end & Ground L2: The other end & Ground

2. Height of table on which the EUT was placed : 0.8 m.
3. The Quasi-Peak Value have already met the Average Value Limit showed on above limits.
4. The above test results are obtained under the normal condition.
5. Amplitude = Read + Factor

3. Radiated Emissions Requirements (Below 1GHz)

3.1 General & Setup:

Prior to open-field testing, the EUT was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration which produced the highest emissions was noted so it could be reproduced later during the open-field tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT. The radiated emissions test is made at a 10 meters open site from 30MHz to 1GHz. The EUT system was placed on a nonconductive turntable which is 0.8 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard E7403A Spectrum Analyzer, EMCO Biconilog Antenna (Model 3142C) for 30MHz -1GHz. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization. Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post-detector video filters were used in the test. The spectrum analyzer's 6 dB bandwidth was set to 120 KHz, and the analyzer was operated in the quasi-peak detection mode. The highest emission amplitudes relative to the appropriate limit were measured and recorded in paragraph 3.5.

3.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US40240137	E7403A	2014/02/27	2015/02/27
2.	Agilent	Spectrum Analyzer	US39240419	4407B	2014/01/29	2015/01/29
3.	EMCO	Biconilog Antenna	00059739	3142C	2013/09/05	2014/09/05
4.	MLT	Pre Amplifier	20110301	PREAMP6G-02	2013/03/01	2014/03/01
5.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2013/03/01	2014/03/01
6.	EMCO	Biconilog Antenna	00044568	3142C	2013/09/05	2014/09/05

3.3 Test Condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

3.4 Radiated Emissions Limits:

CISPR 22

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	Distance (Meter)	Limits (dBuV/m)	Distance (Meter)	Limits (dBuV/m)
30 to 230	10	40	10	30
230 to 1000	10	47	10	37

FCC Part 15

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	Distance (Meter)	Limits (dBuV/m)	Distance (Meter)	Limits (dBuV/m)
30 to 88	10	39	3	40
88 to 216	10	43.5	3	43.5
216 to 960	10	46.5	3	46
960 to 1000	10	49.5	3	54

3.5 Measurement Data Of Radiated Emissions:

3.5.1 Open Field Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : PC Charge

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
38.37	55.61	-24.46	100	125	31.15	40	-8.85
79.41	66.71	-32.46	100	247	34.25	40	-5.75
192.00	60.31	-28.47	100	26	31.84	43.5	-11.66
200.10	59.66	-28.24	100	100	31.42	43.5	-12.08
215.96	63.64	-27.63	100	280	36.01	43.5	-7.49
239.96	64.90	-26.46	100	315	38.44	46	-7.56
335.70	60.61	-23.35	100	275	37.26	46	-8.74
576.50	51.35	-13.92	150	55	37.43	46	-8.57
640.45	50.53	-12.73	200	300	37.80	46	-8.20

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
167.87	59.01	-28.75	400	100	30.26	43.5	-13.24
192.00	60.01	-28.51	400	314	31.50	43.5	-12.00
215.76	61.31	-27.77	400	300	33.54	43.5	-9.96
221.70	57.65	-27.49	400	240	30.16	46	-15.84
240.00	63.69	-26.50	400	280	37.19	46	-8.81
398.00	58.62	-21.44	400	111	37.18	46	-8.82
480.00	59.81	-18.80	200	217	41.01	46	-4.99
643.70	52.14	-14.39	200	300	37.75	46	-8.25
748.70	50.72	-11.76	100	85	38.96	46	-7.04

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

3.5.2 Open Field Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case(X Axis)2402MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
37.56	56.63	-24.46	100	120	32.17	40	-7.83
49.17	58.38	-28.84	100	185	29.54	40	-10.46
92.10	65.50	-31.13	100	235	34.37	43.5	-9.13
113.97	59.02	-31.46	100	111	27.56	43.5	-15.94
175.80	56.05	-28.75	100	311	27.30	43.5	-16.20
203.61	55.62	-28.18	100	98	27.44	43.5	-16.06
641.60	48.74	-12.76	220	312	35.98	46	-10.02
757.10	47.35	-11.42	350	225	35.93	46	-10.07
788.60	47.91	-10.51	400	129	37.40	46	-8.60

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
53.76	56.35	-29.60	400	175	26.75	40	-13.25
97.77	65.50	-30.98	400	80	34.52	43.5	-8.98
113.97	60.50	-31.37	400	142	29.13	43.5	-14.37
127.20	58.71	-31.81	400	180	26.90	43.5	-16.60
216.57	54.05	-27.77	400	275	26.28	46	-19.72
519.10	54.16	-17.53	210	222	36.63	46	-9.37
645.10	51.02	-14.34	240	320	36.68	46	-9.32
720.70	50.61	-12.60	180	240	38.01	46	-7.99
776.70	48.46	-11.10	100	150	37.36	46	-8.64

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

3.5.3 Open Field Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case(Y Axis)2441MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
38.10	57.00	-24.46	100	111	32.54	40	-7.46
50.25	58.35	-29.16	100	200	29.19	40	-10.81
104.25	57.61	-30.91	100	142	26.70	43.5	-16.80
176.07	57.46	-28.75	100	312	28.71	43.5	-14.79
199.02	54.62	-28.30	100	40	26.32	43.5	-17.18
513.50	51.36	-17.38	180	100	33.98	46	-12.02
641.60	48.91	-12.76	220	310	36.15	46	-9.85
757.10	46.72	-11.42	350	200	35.30	46	-10.70
781.60	49.13	-10.65	400	175	38.48	46	-7.52

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
59.70	56.72	-30.22	400	199	26.50	40	-13.50
97.50	65.30	-30.98	400	80	34.32	43.5	-9.18
113.97	60.72	-31.37	400	142	29.35	43.5	-14.15
127.20	58.14	-31.81	400	194	26.33	43.5	-17.17
165.81	55.50	-28.85	400	114	26.65	43.5	-16.85
519.10	54.27	-17.53	210	250	36.74	46	-9.26
646.50	51.24	-14.29	250	310	36.95	46	-9.05
720.70	51.24	-12.60	180	240	38.64	46	-7.36
771.10	50.50	-11.21	100	121	39.29	46	-6.71

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

3.5.4 Open Field Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case(Z Axis)2480MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
38.37	57.32	-24.46	100	110	32.86	40	-7.14
49.17	57.50	-28.84	100	185	28.66	40	-11.34
92.10	66.15	-31.13	100	235	35.02	43.5	-8.48
113.97	59.02	-31.46	100	111	27.56	43.5	-15.94
176.07	55.50	-28.75	100	311	26.75	43.5	-16.75
202.80	57.36	-28.15	100	100	29.21	43.5	-14.29
641.60	49.13	-12.76	220	312	36.37	46	-9.63
758.50	45.49	-11.44	340	185	34.05	46	-11.95
785.10	47.65	-10.58	400	125	37.07	46	-8.93

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
53.22	57.05	-29.44	400	175	27.61	40	-12.39
97.50	64.94	-30.98	400	80	33.96	43.5	-9.54
113.97	60.24	-31.37	400	142	28.87	43.5	-14.63
125.31	58.61	-31.79	400	189	26.82	43.5	-16.68
210.36	56.21	-28.12	400	270	28.09	43.5	-15.41
519.10	53.72	-17.53	220	230	36.19	46	-9.81
643.70	51.51	-14.39	230	300	37.12	46	-8.88
723.50	47.62	-12.49	100	170	35.13	46	-10.87
772.50	49.64	-11.16	100	129	38.48	46	-7.52

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

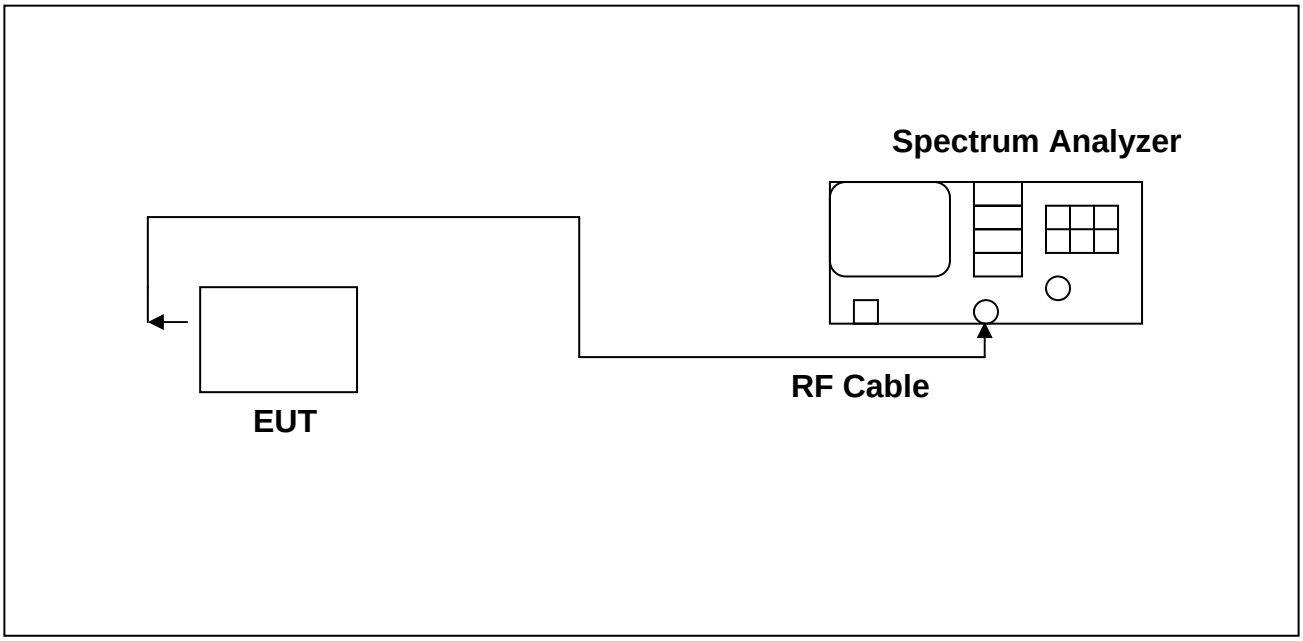
4. Minimum 20dB RF Bandwidth Requirements

4.1 Test Condition & Setup:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW set to 100 kHz .VBW set to 300kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel or the maximum 20 dB bandwidth of the hopping channel is 1 MHz. A peak output reading was taken, a display line was drawn 20 dB lower than peak level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.

The test was performed at 3 channels (Channel 0, 39, 78)

4.2 Test Instruments Configuration:



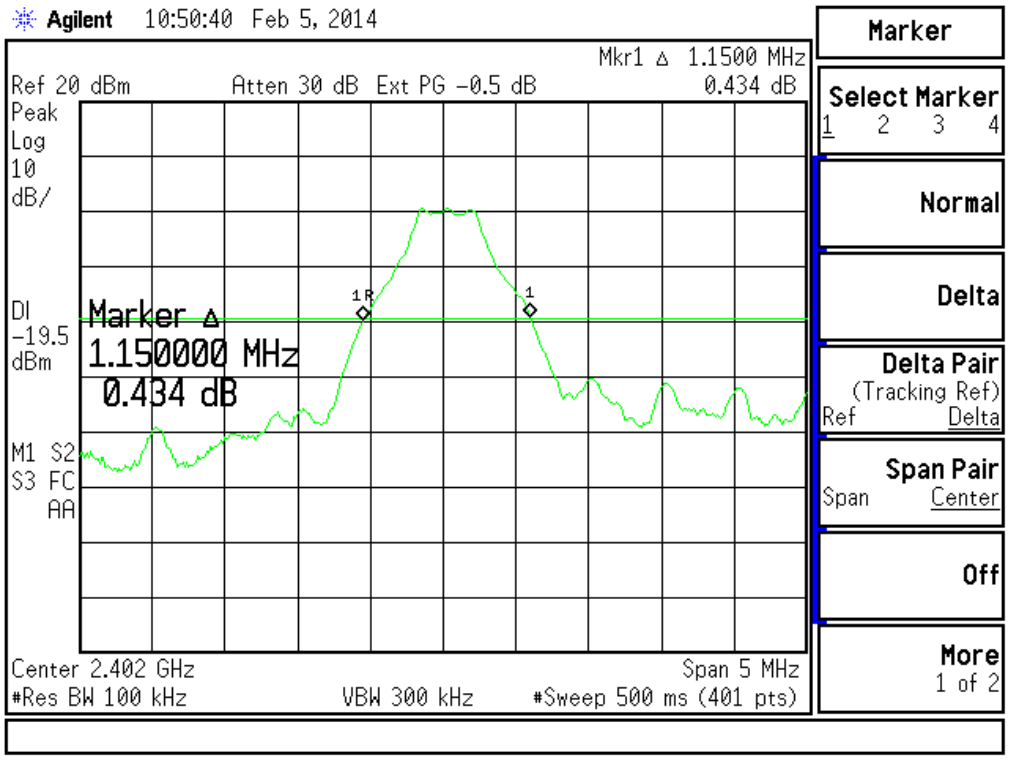
4.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

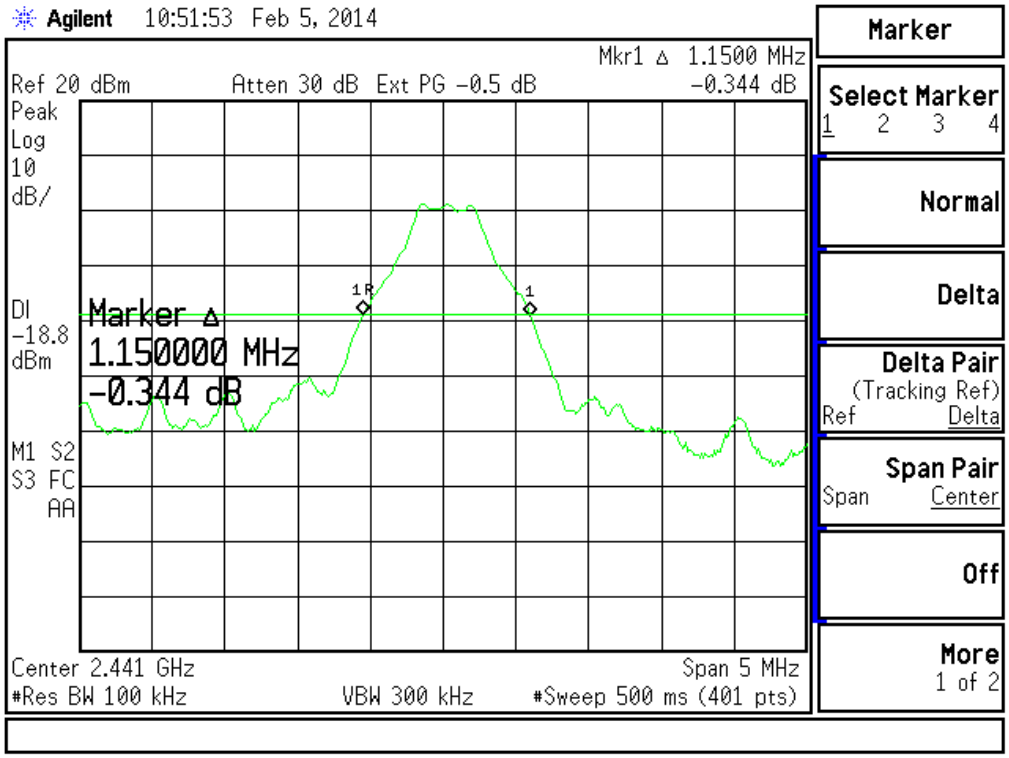
4.4 Test Result:

Data Rate (Mbps)	Channel	Frequency (MHz)	Results (MHz)	Limit
1M	0	2402	1.15000	>25kHz
	39	2441	1.15000	>25kHz
	78	2480	1.15000	>25kHz
2M	0	2402	1.41250	>25kHz
	39	2441	1.42500	>25kHz
	78	2480	1.40000	>25kHz
3M	0	2402	1.40000	>25kHz
	39	2441	1.38750	>25kHz
	78	2480	1.38750	>25kHz

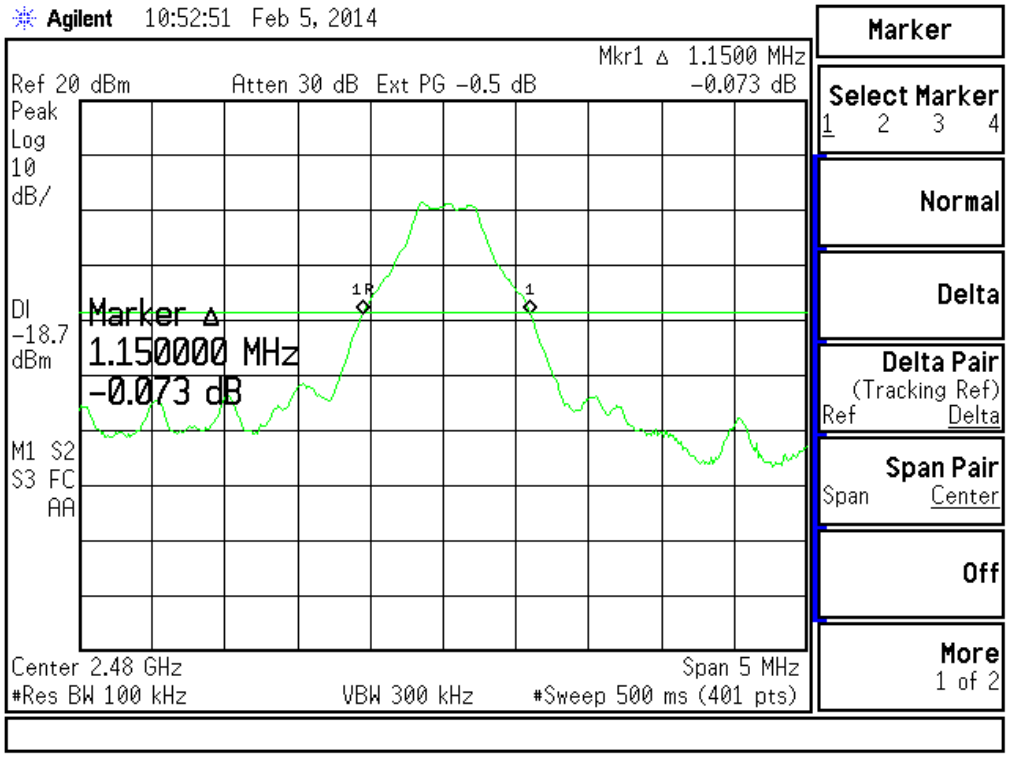
Data Rate : 1Mbps
(2402MHz)



(2441MHz)

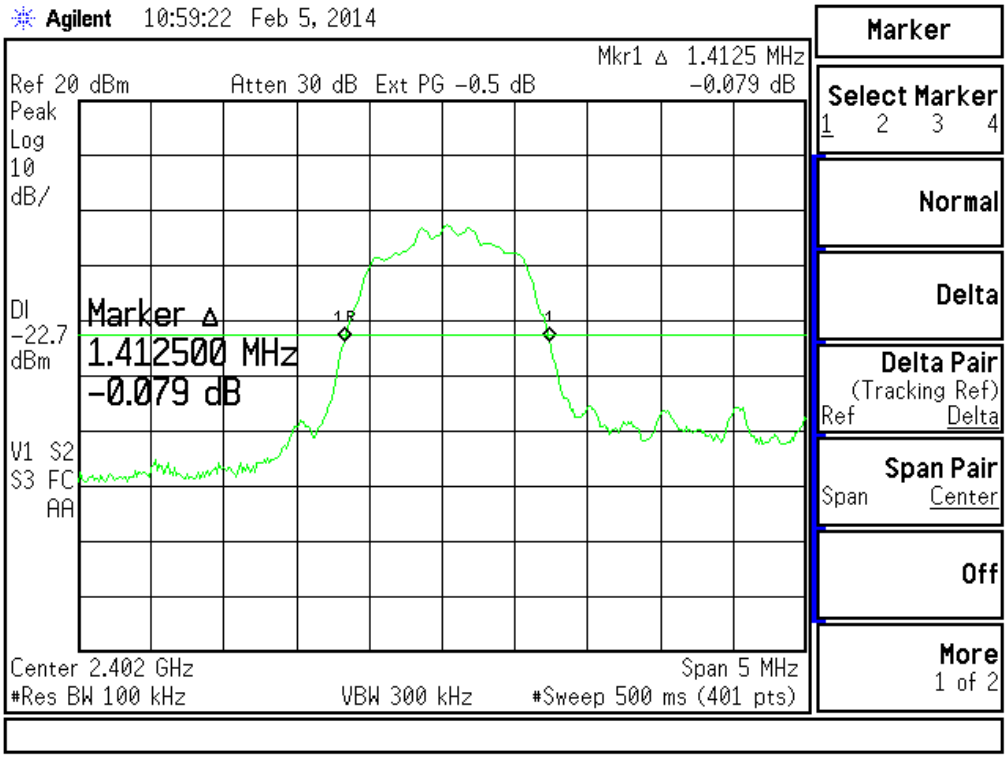


(2480MHz)

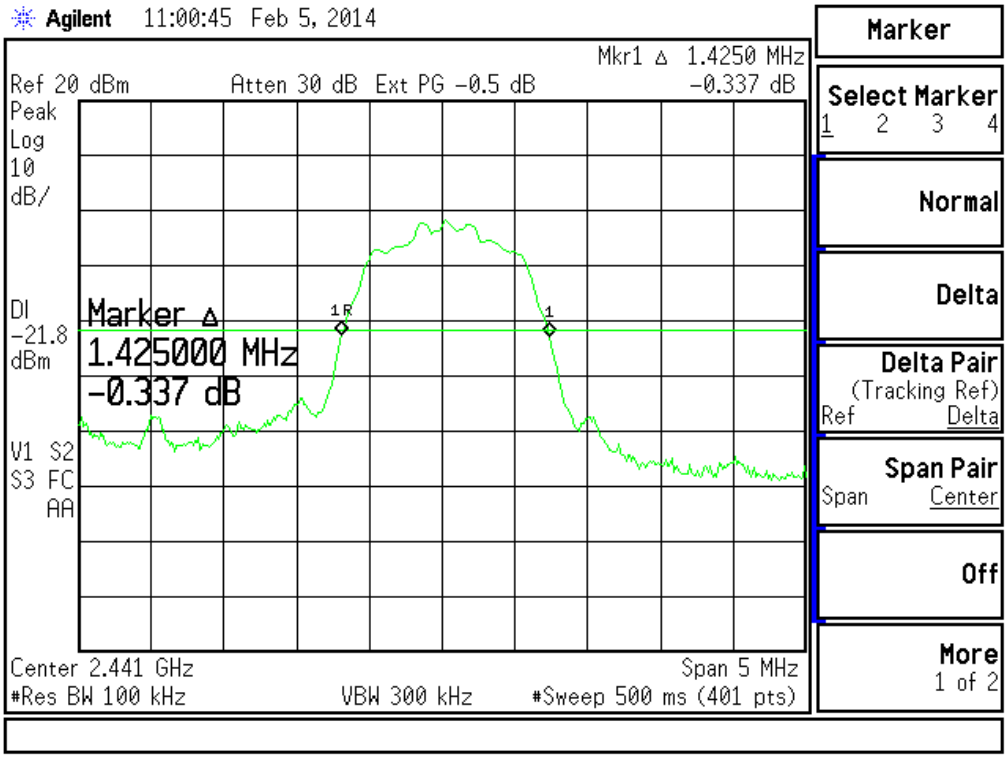


Data Rate : 2Mbps

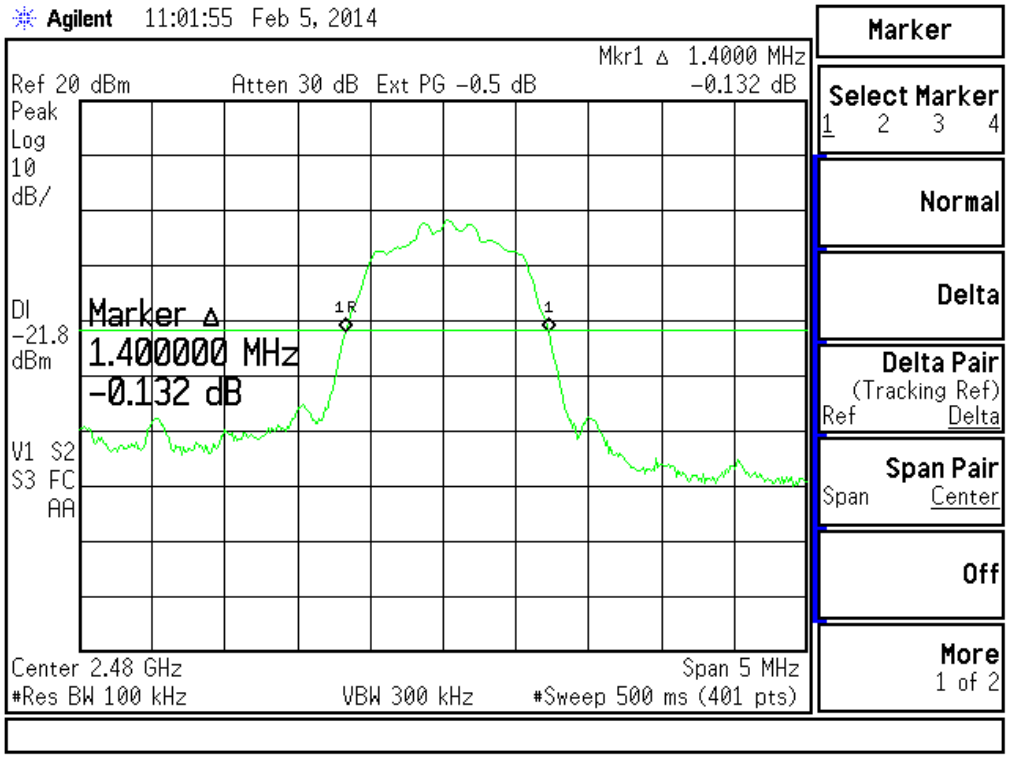
(2402MHz)



(2441MHz)

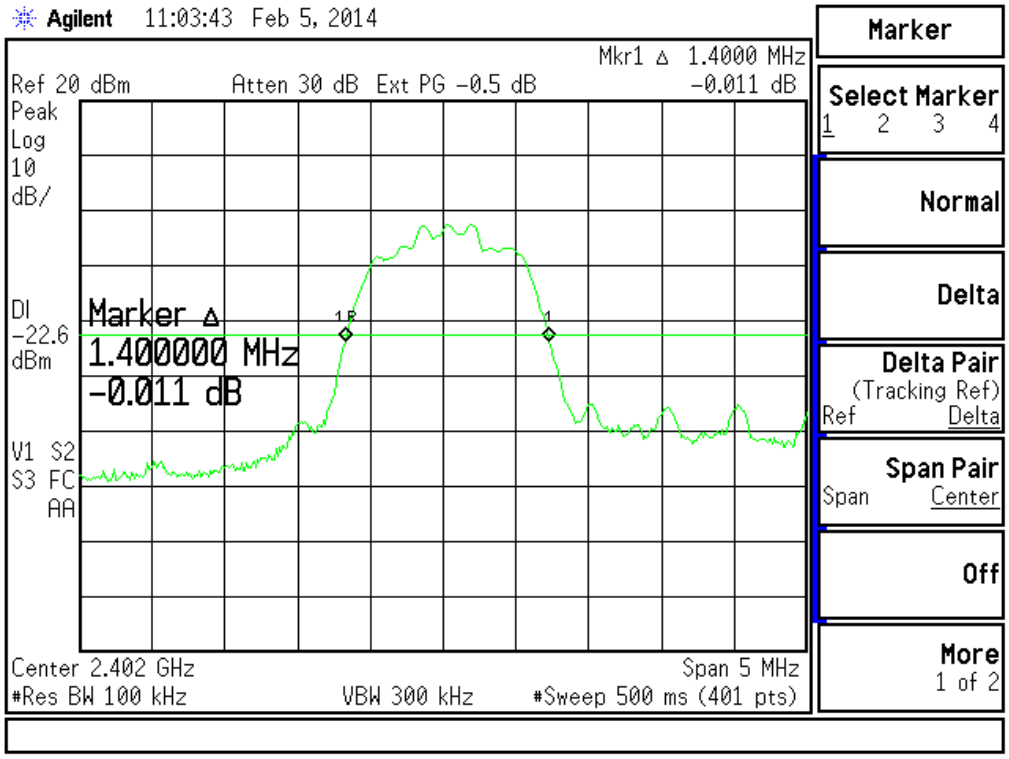


(2480MHz)

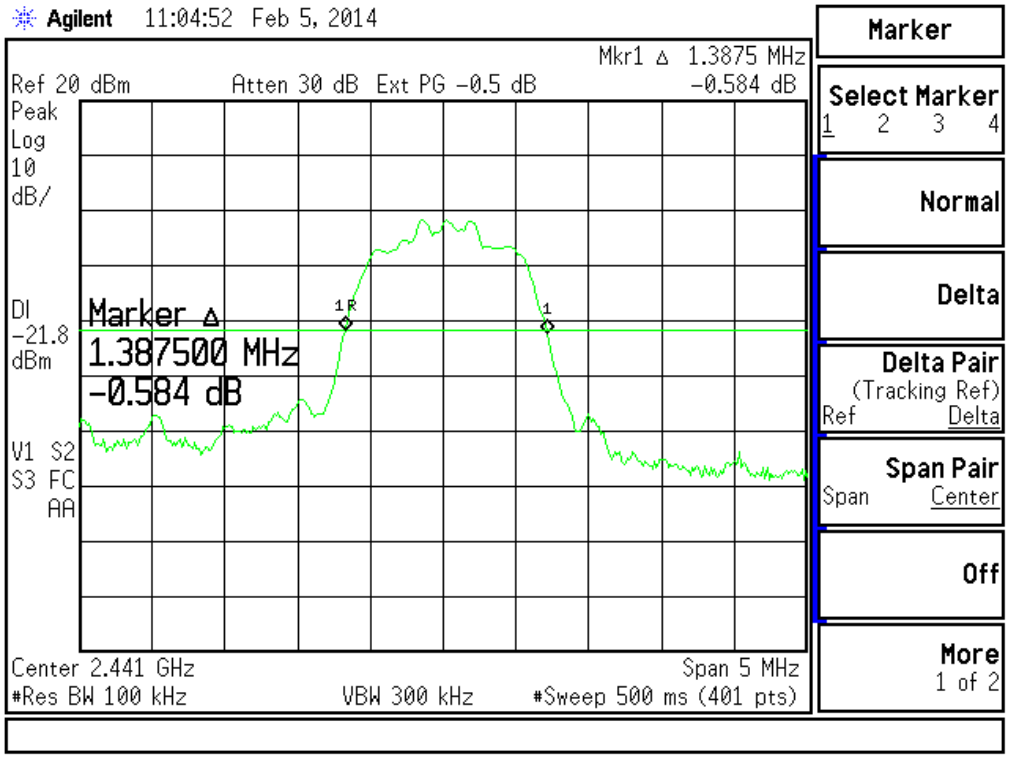


Data Rate : 3Mbps

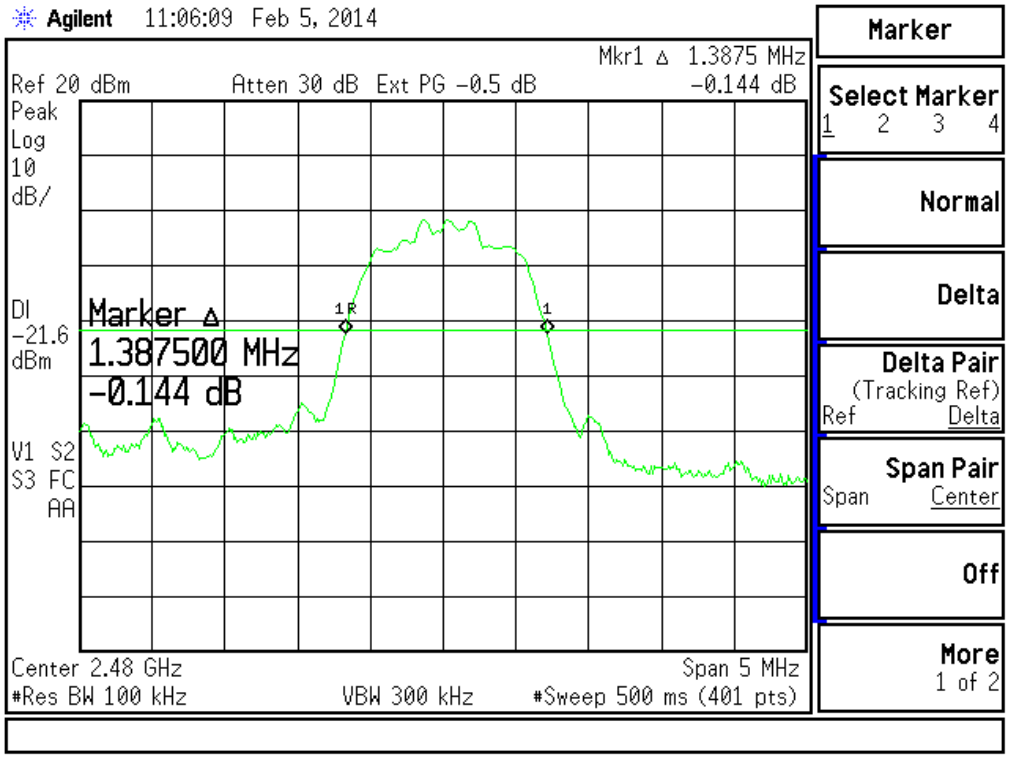
(2402MHz)



(2441MHz)



(2480MHz)

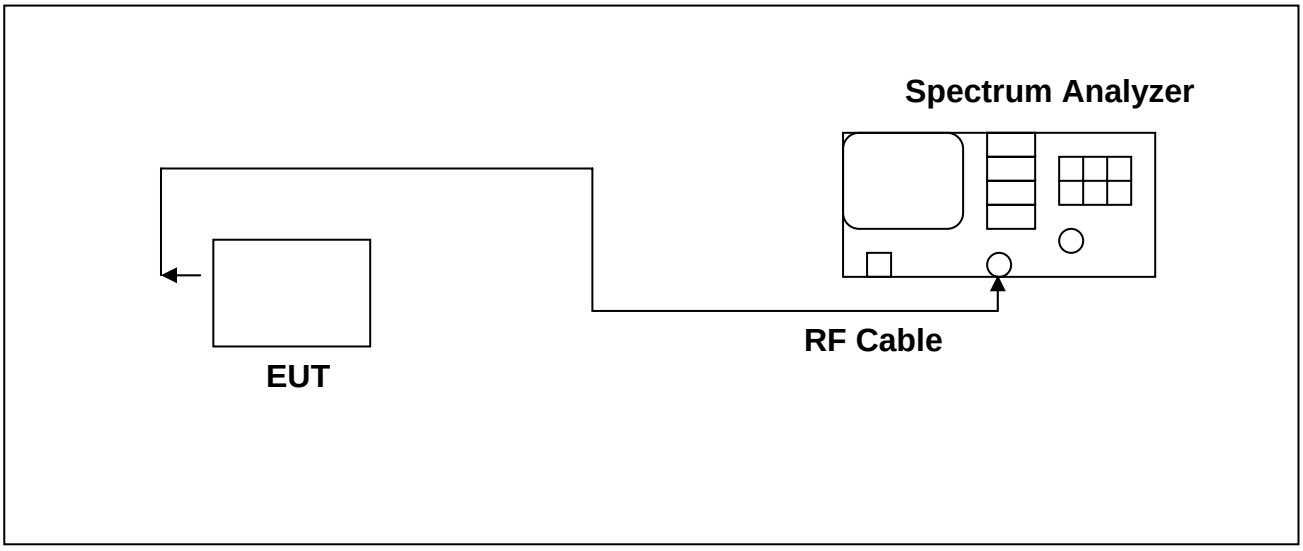


5. Hopping Frequency Separation Requirements

5.1 Test Condition & Setup:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW set to 100 kHz .VBW set to 300kHz. The 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.

5.2 Test Instruments Configuration:



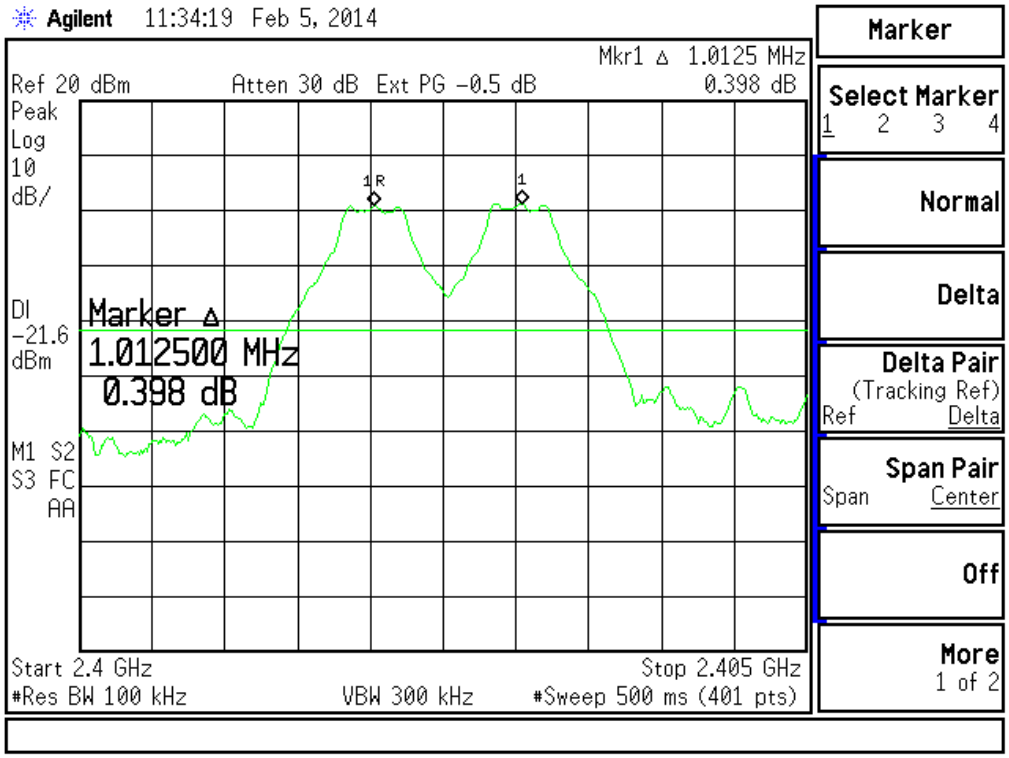
5.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

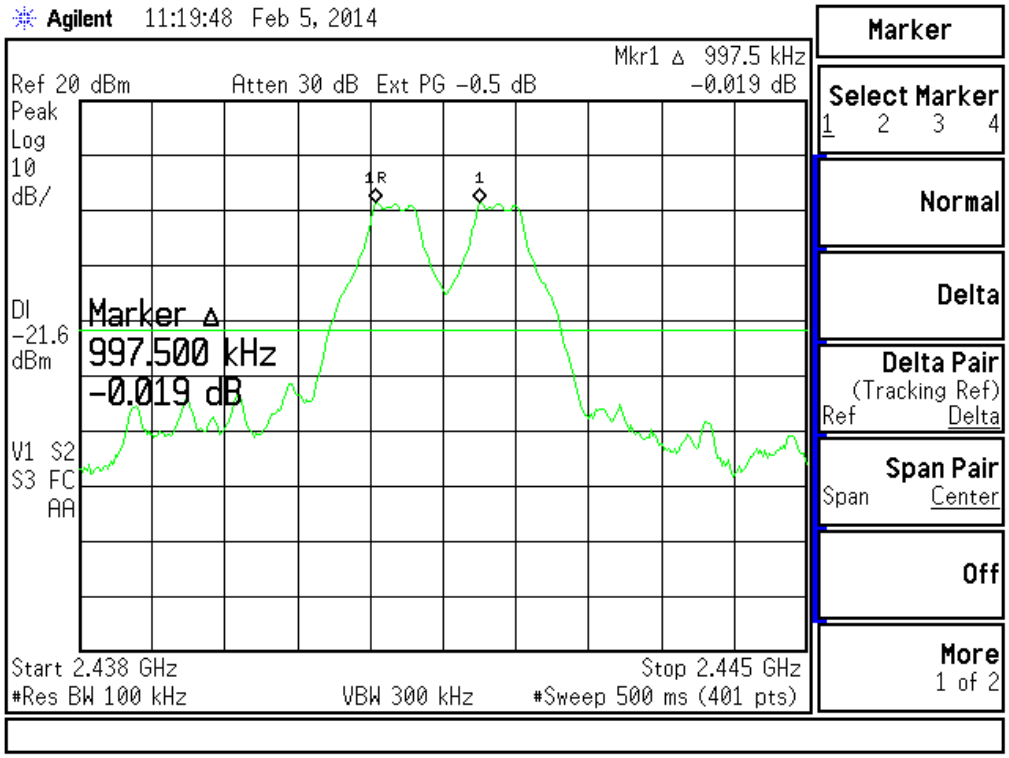
5.4 Test Result:

Data Rate (Mbps)	Channel	Frequency (MHz)	Results (kHz)	Limit
1	0	2402	1012.5	separated by 25 kHz or two-thirds of the 20 dB bandwidth
	39	2441	997.5	
	78	2480	1012.5	
2	0	2402	1000.0	
	39	2441	997.5	
	78	2480	987.5	
3	0	2402	987.5	
	39	2441	997.5	
	78	2480	1000.0	

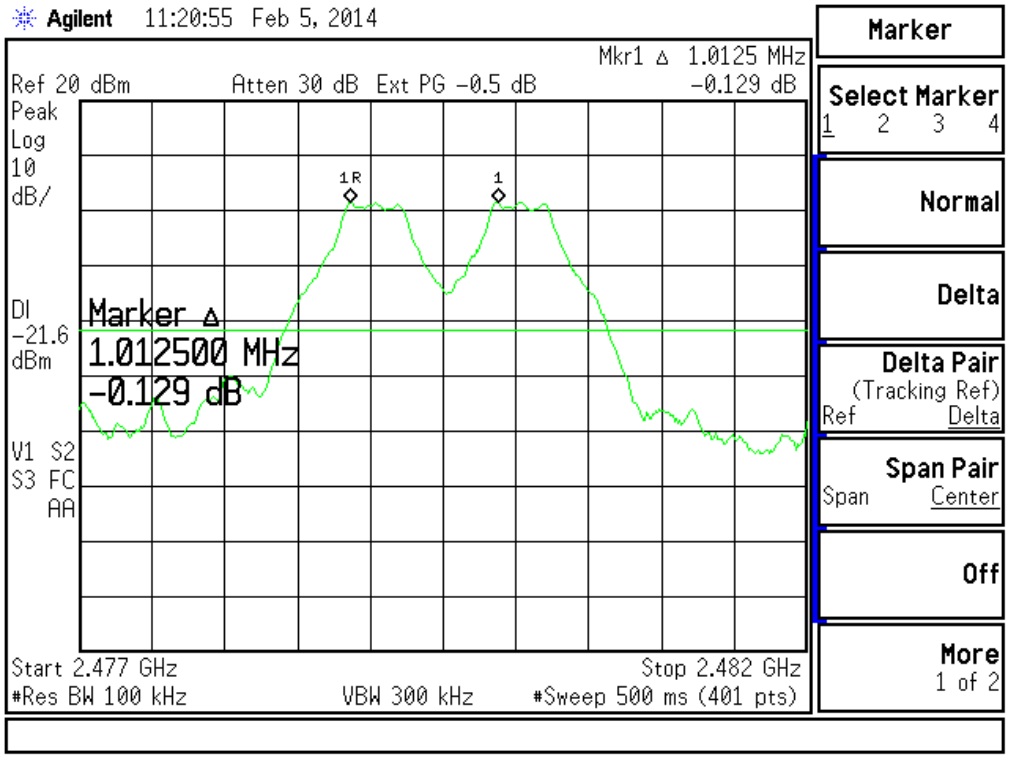
Data Rate : 1Mbps
(2402MHz)



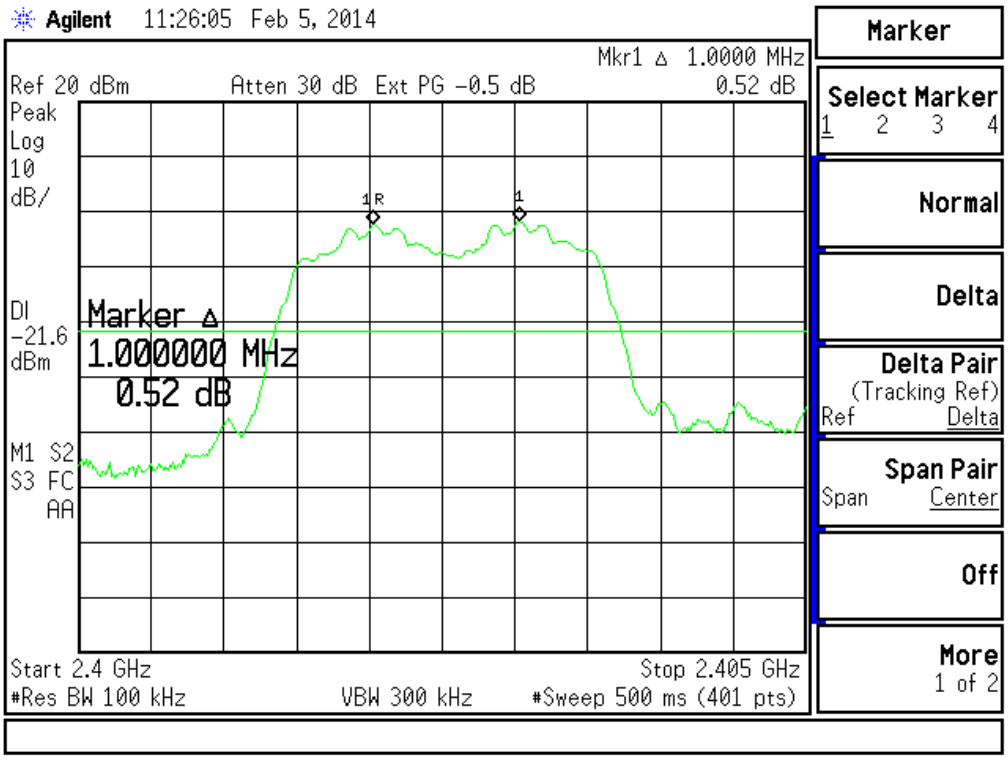
(2441MHz)



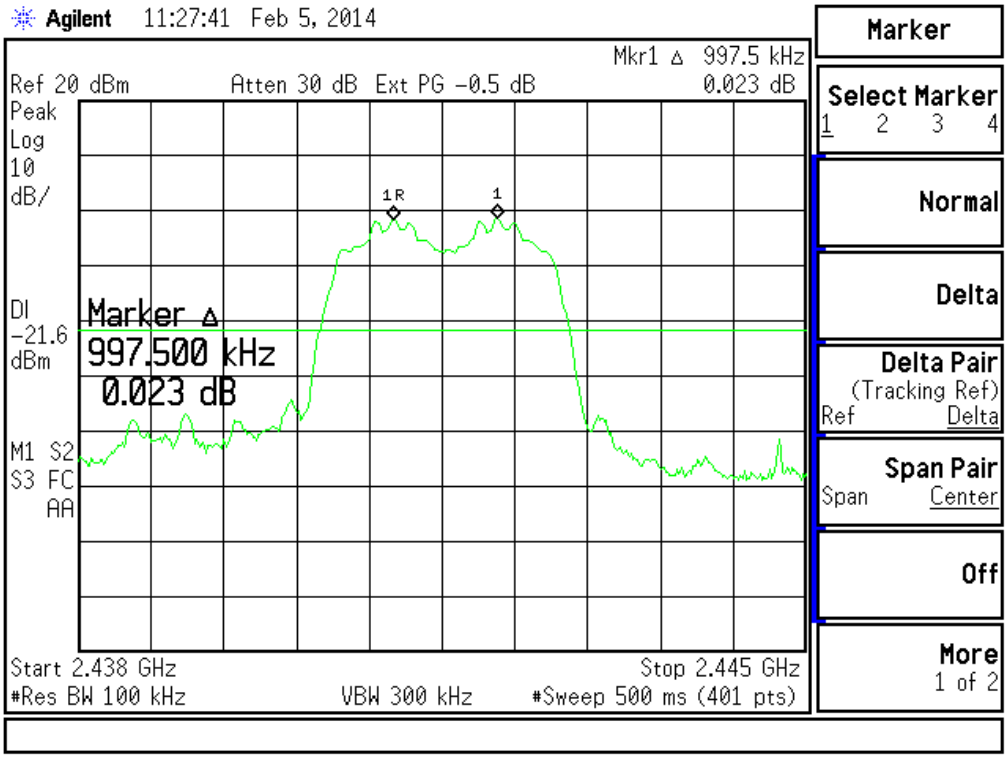
(2480MHz)



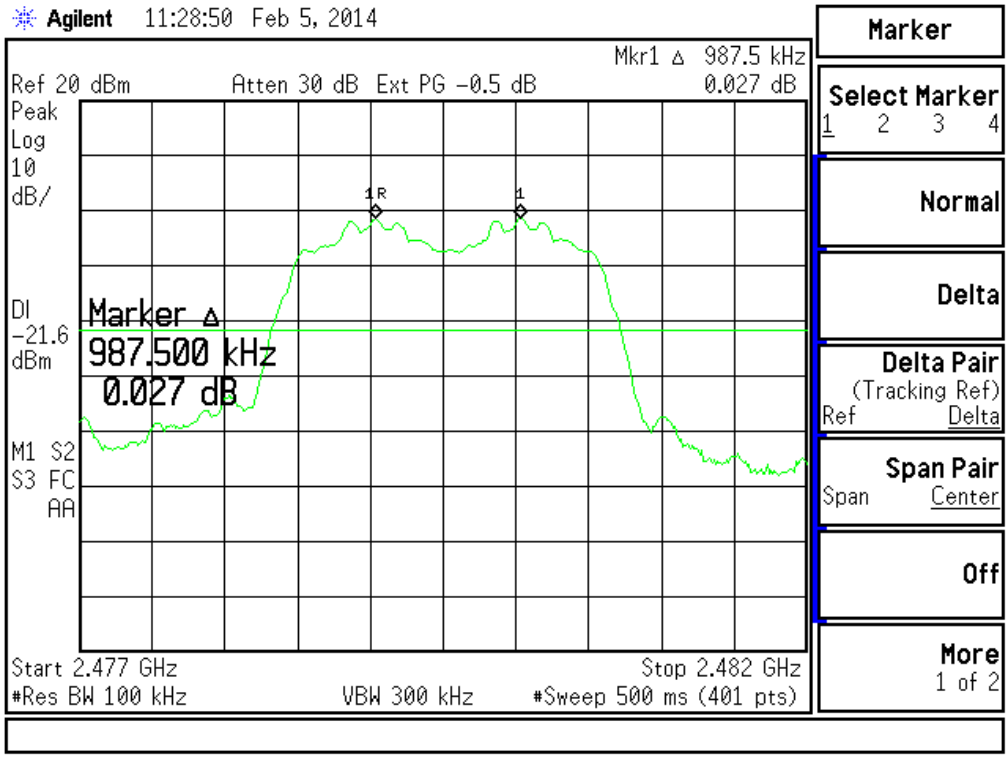
Data Rate : 2Mbps
(2402MHz)



(2441MHz)

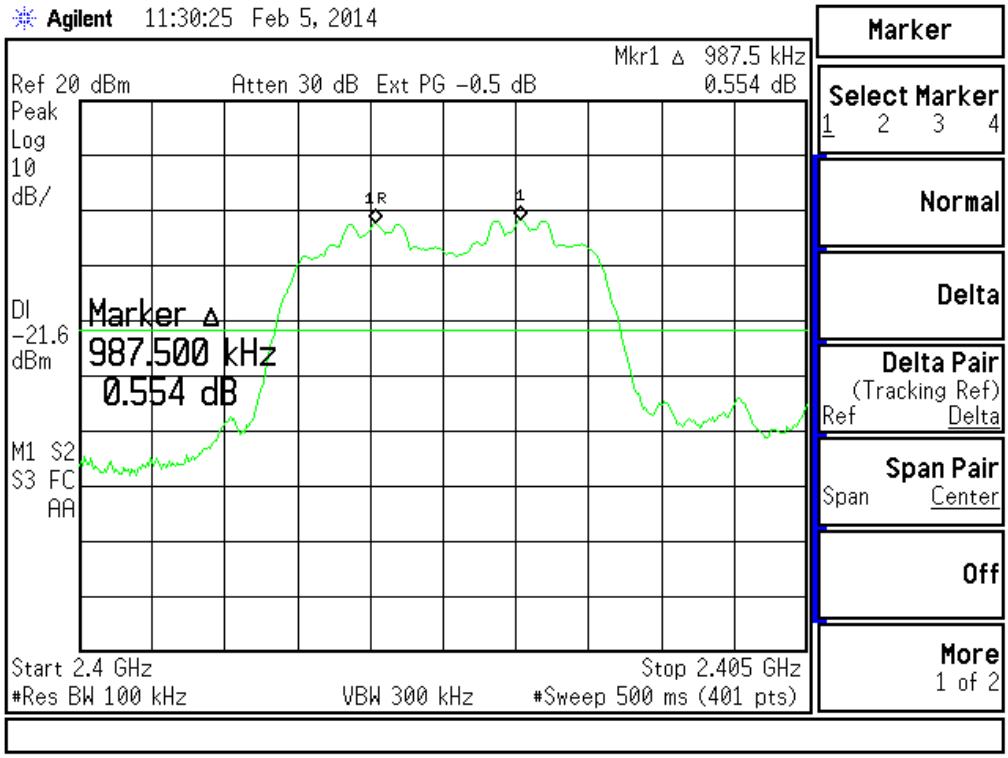


(2480MHz)

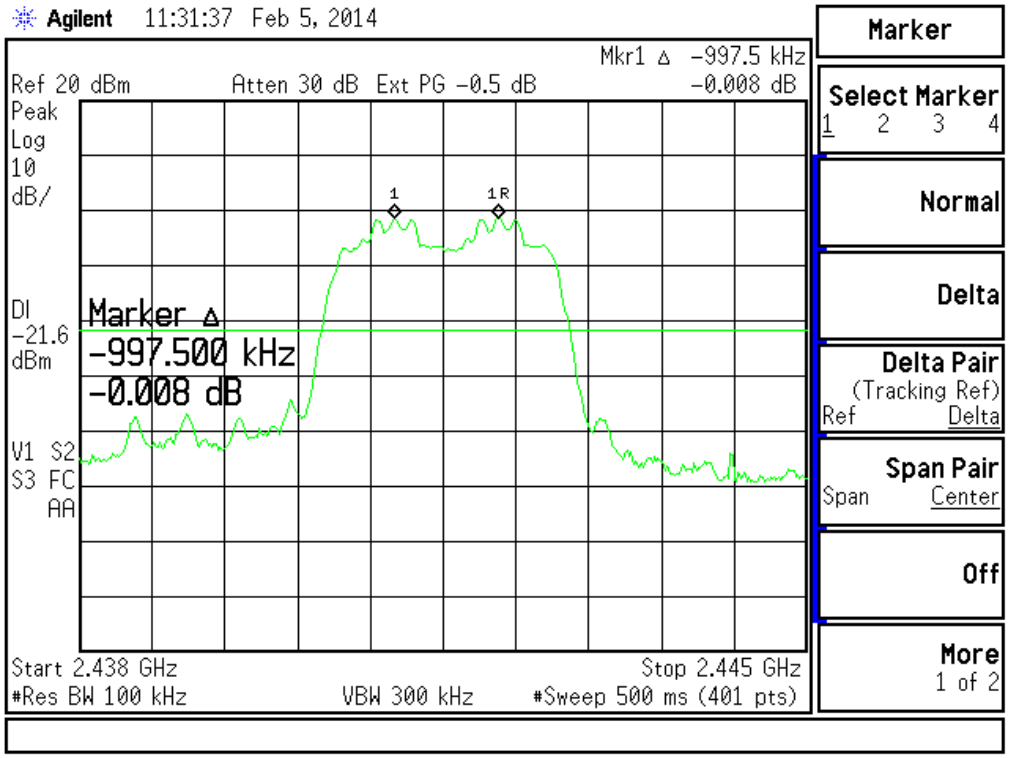


Data Rate : 3Mbps

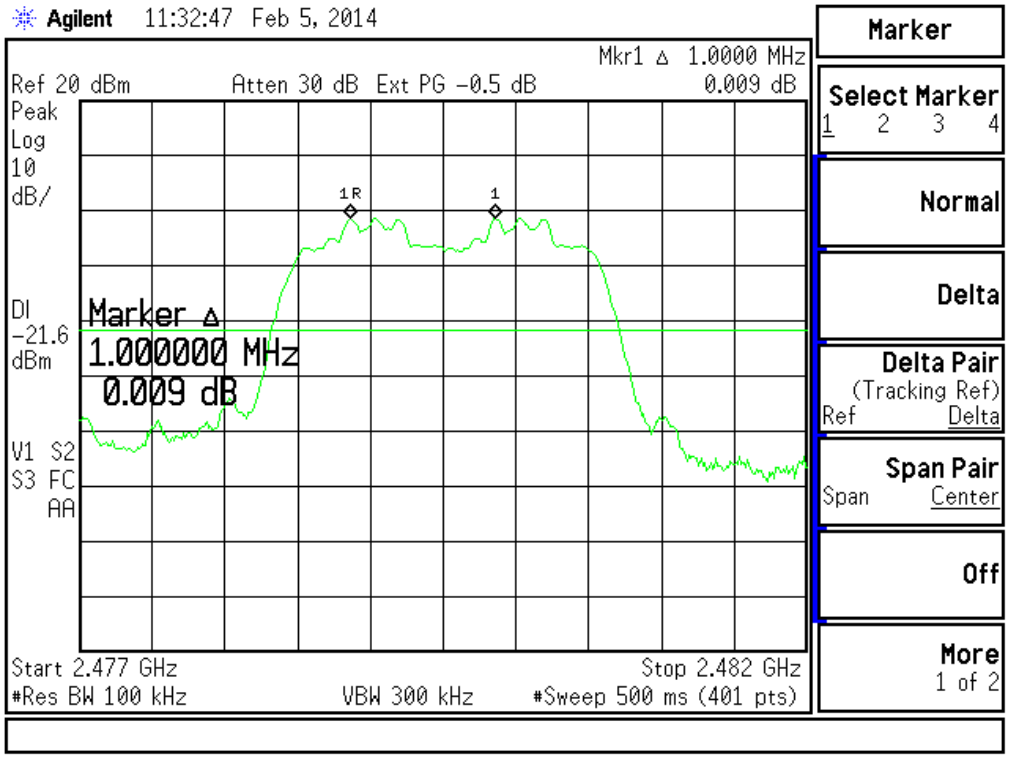
(2402MHz)



(2441MHz)



(2480MHz)

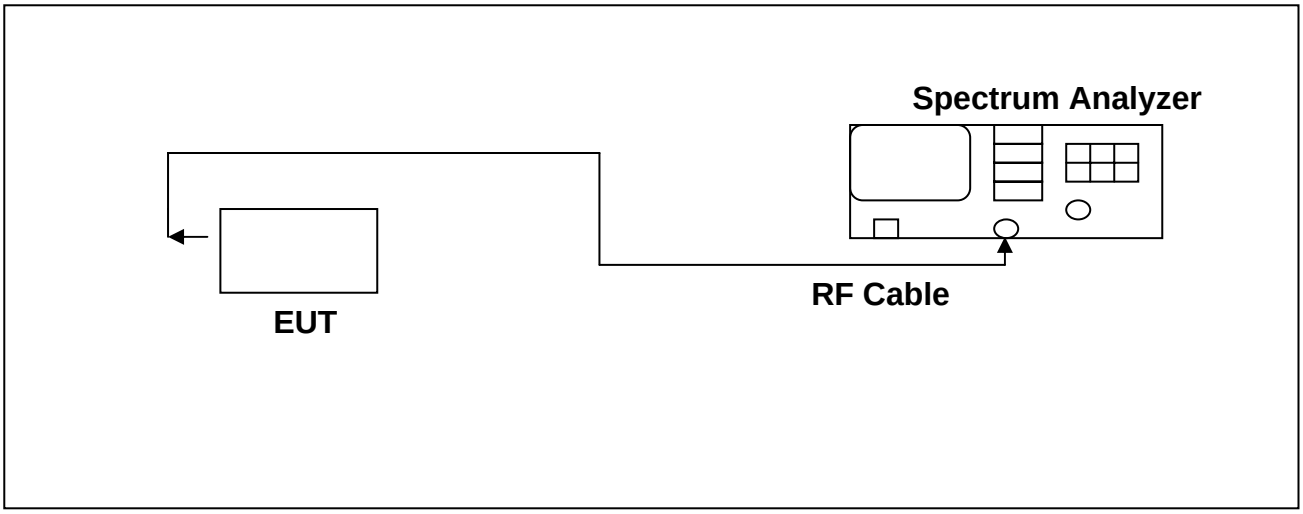


6. Number of Hopping Channels Requirements

6.1 Test Condition & Setup:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW set to 100 kHz and VBW set to 300 kHz. The hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

6.2 Test Instruments Configuration:



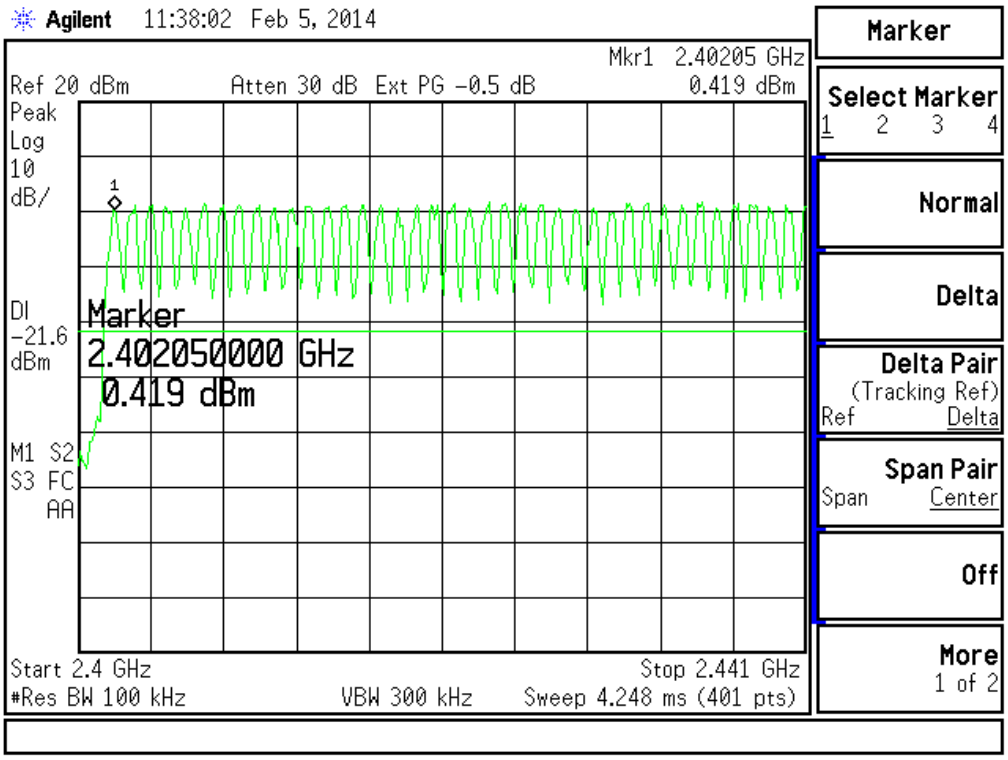
6.3 Test Equipment List:

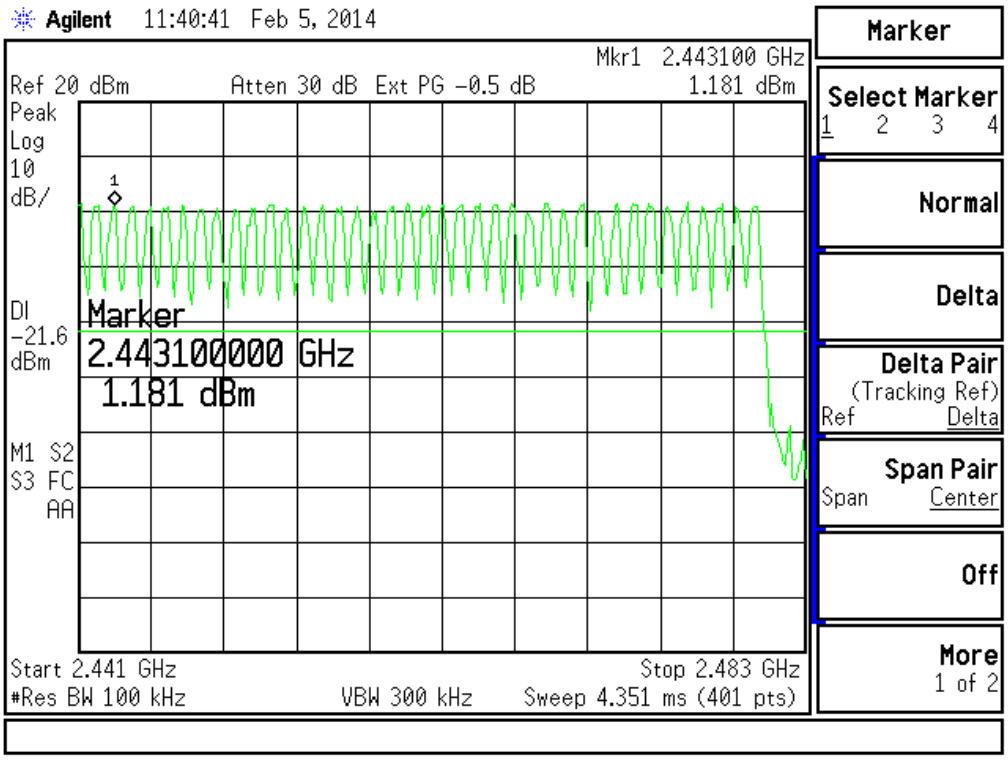
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

6.4 Test Result:

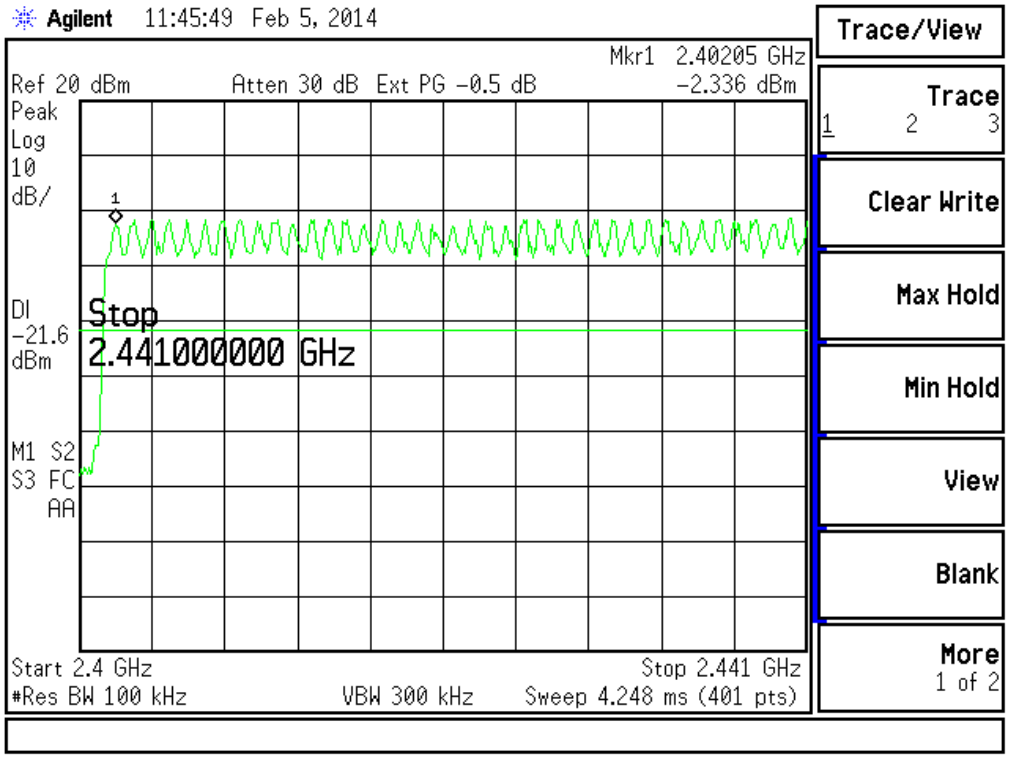
Result (Channel)	Limit (Channel)	Pass / Fail
79	≧15	Pass

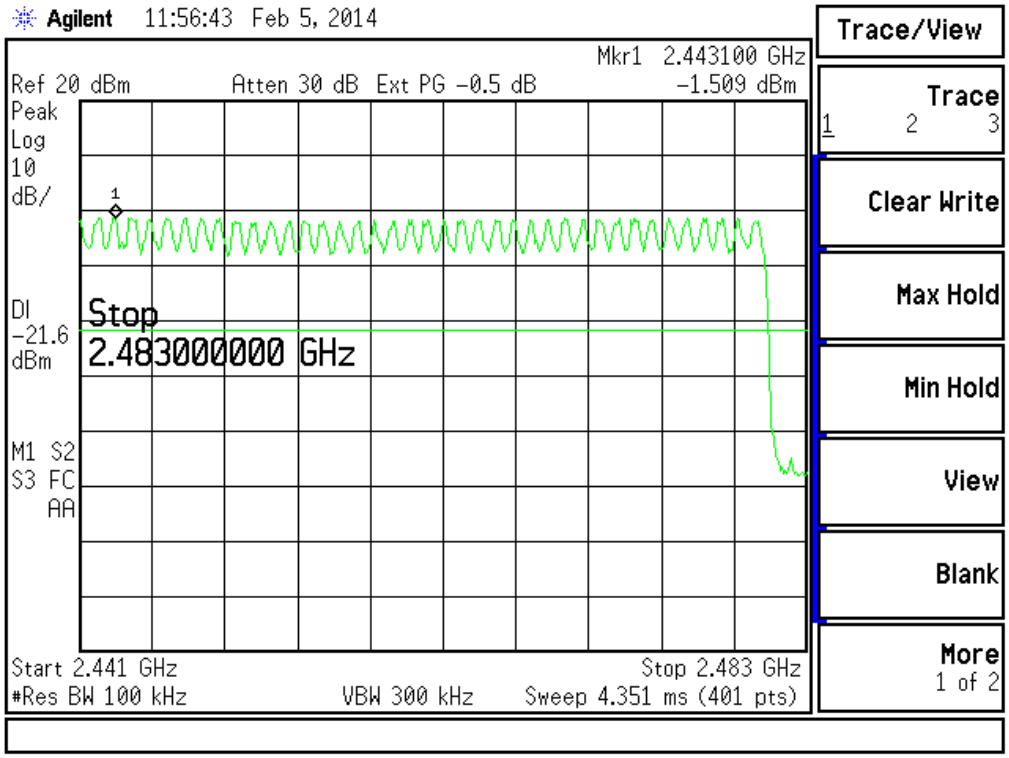
Data Rate : 1Mbps



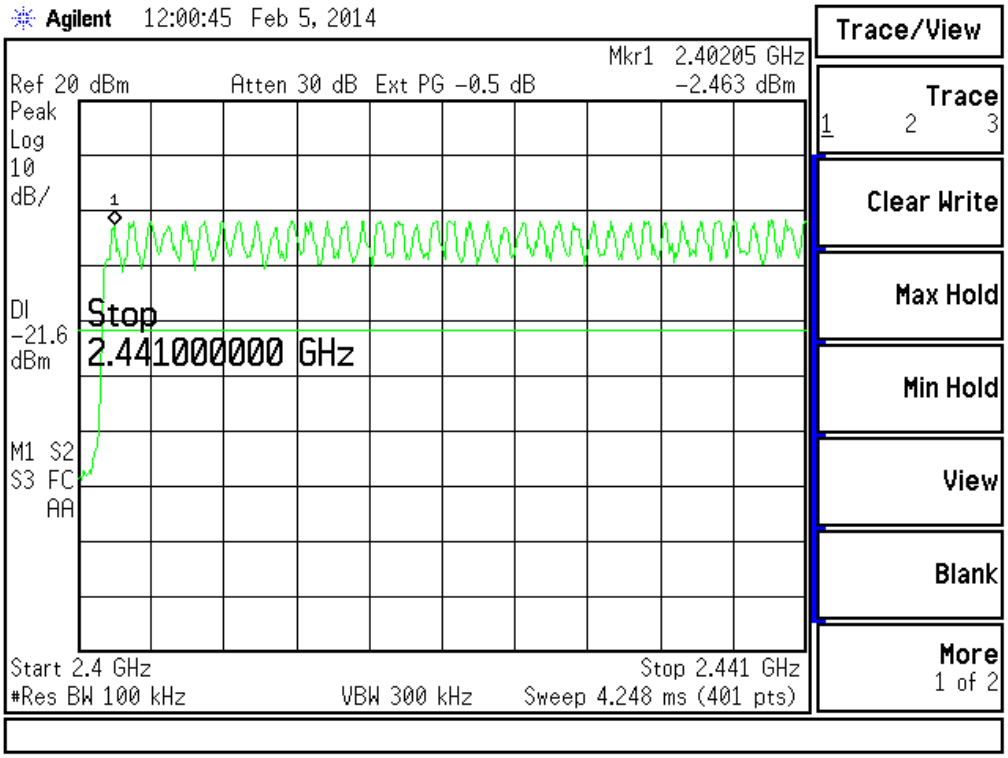


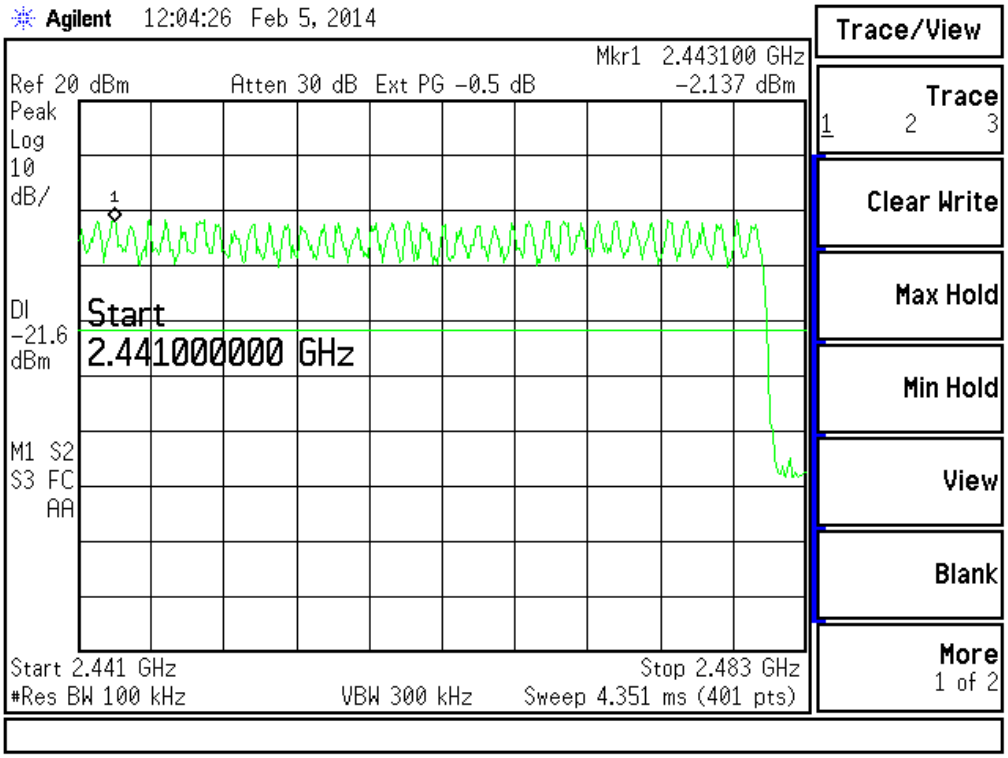
Data Rate : 2Mbps





Data Rate : 3Mbps



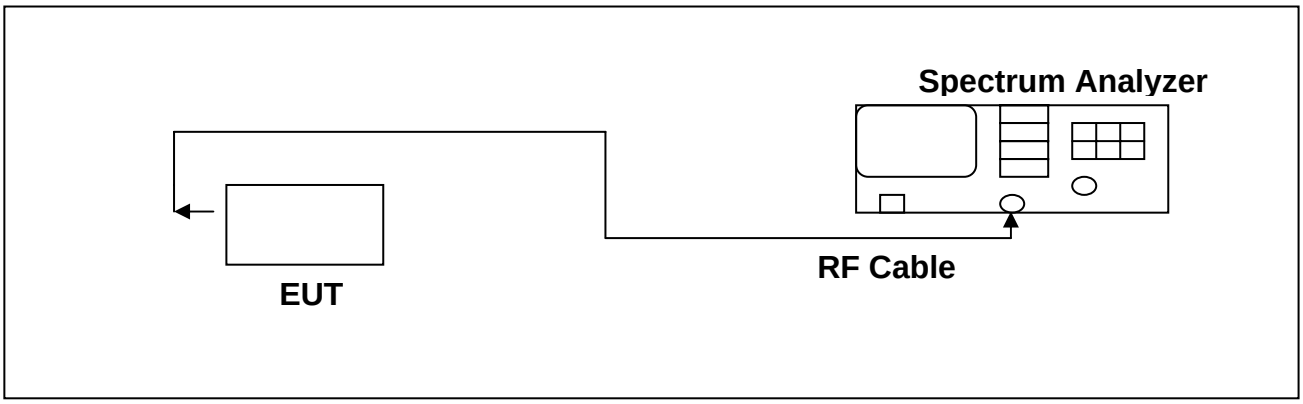


7. Dwell Time of Each Channel Requirements

7.1 Test Condition & Setup:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW set to 100kHz and VBW set to 300 kHz. The hopping systems in the 2400–2483.5 MHz 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.

7.2 Test Instruments Configuration:



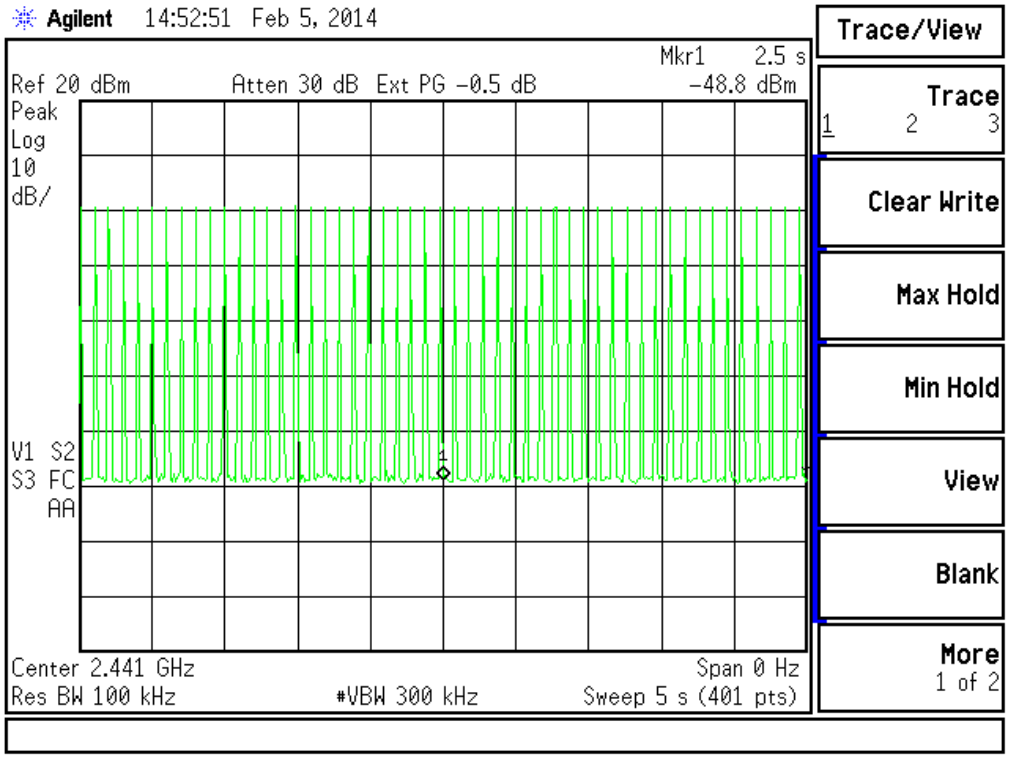
7.3 Test Equipment List:

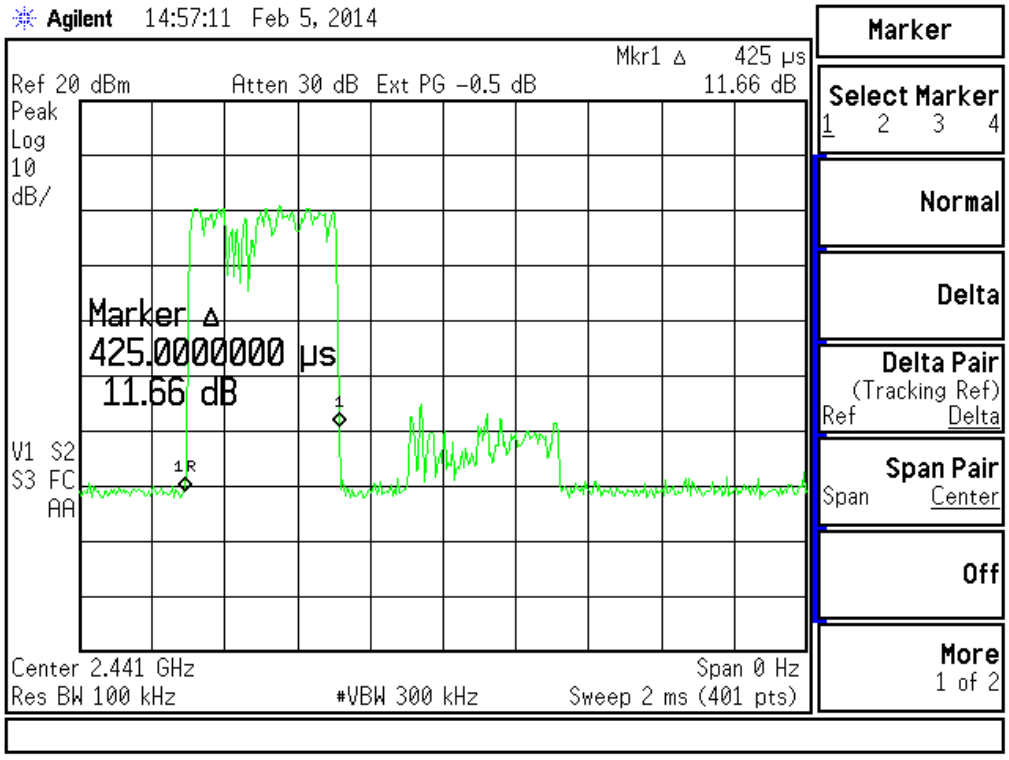
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

7.4 Test Result:

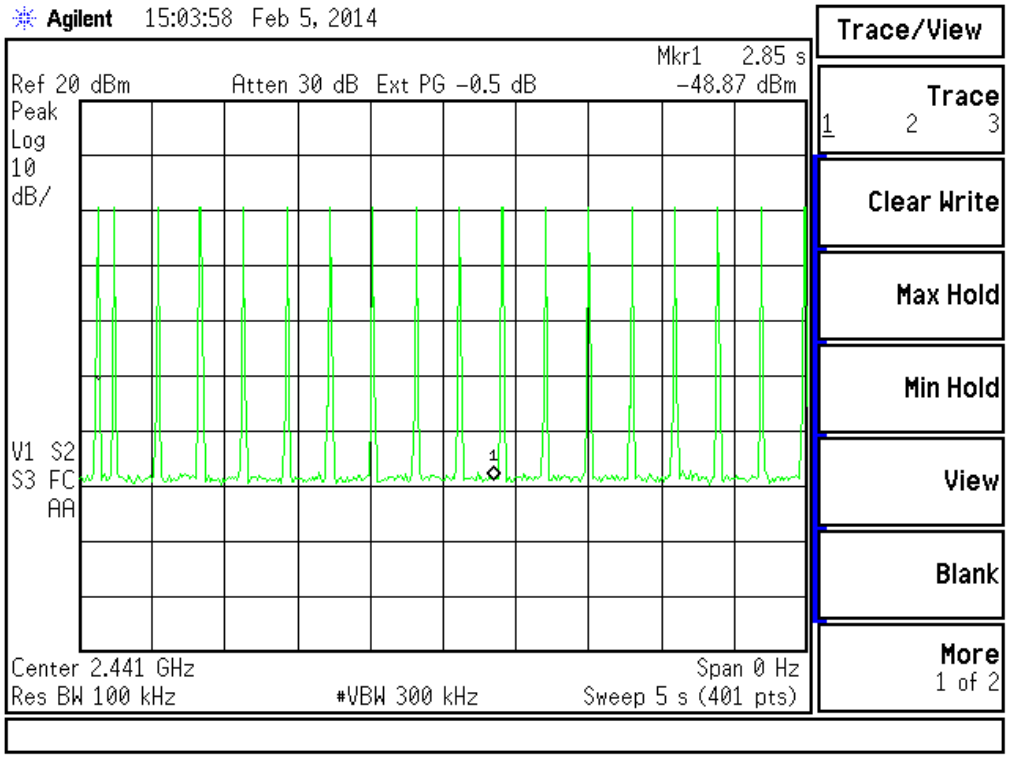
Mode	Number of transmission in a 31.6 (79Hopping * 0.4) times	Length of transmission	Result	Limit
	time	m sec	m sec	m sec
DH1	51 x 6.32	0.425	136.986	400
DH3	17 x 6.32	1.7	182.648	400
DH5	11 x 6.32	2.975	206.822	400

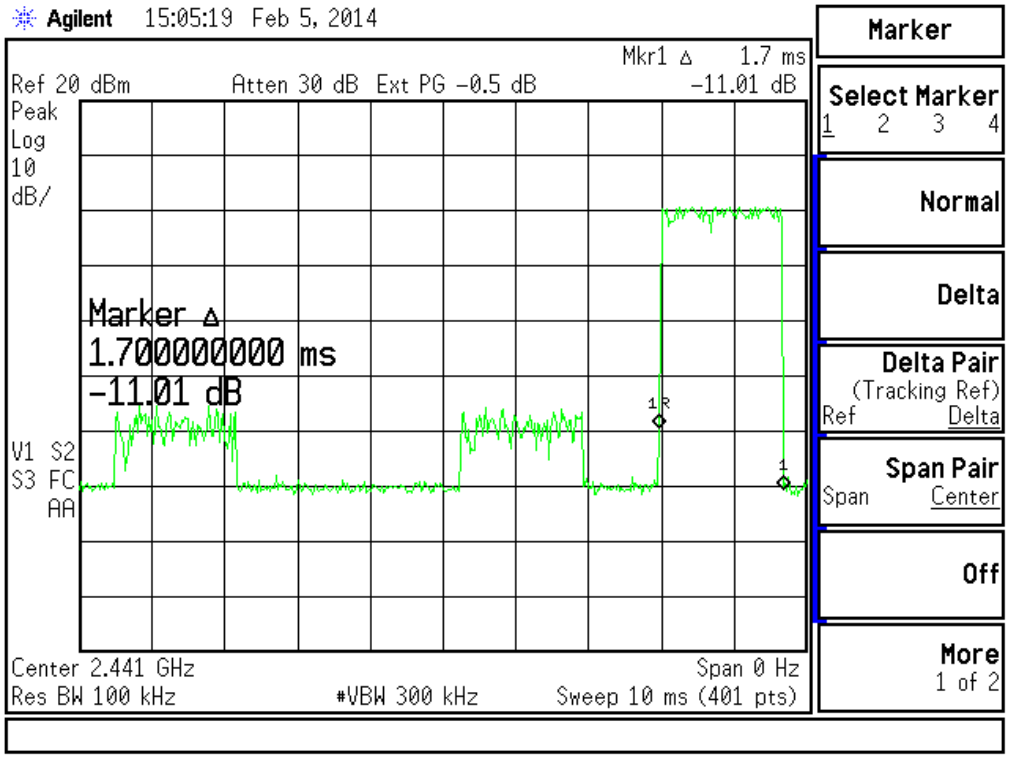
DH1



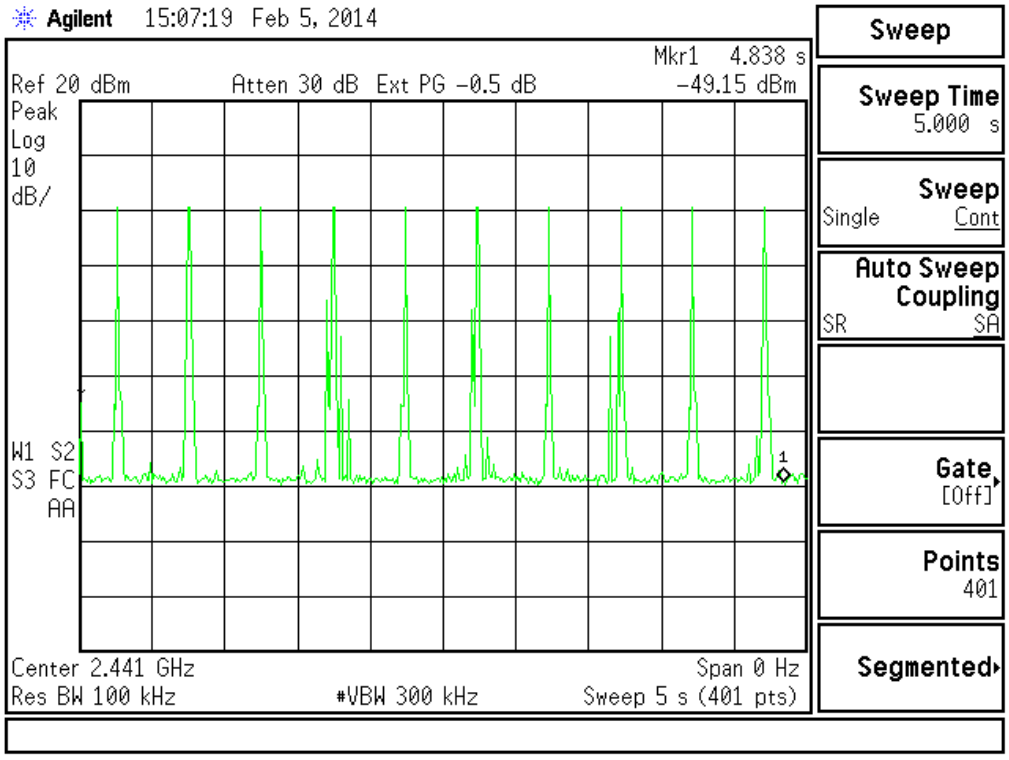

Agilent 14:57:11 Feb 5, 2014
Mkr1 Δ 425 µs
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB 11.66 dB
Peak
Log
10
dB/
Marker Δ
425.0000000 µs
11.66 dB
V1 S2
S3 FC
AA
Center 2.441 GHz
Span 0 Hz
Res BW 100 kHz
#VBW 300 kHz
Sweep 2 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

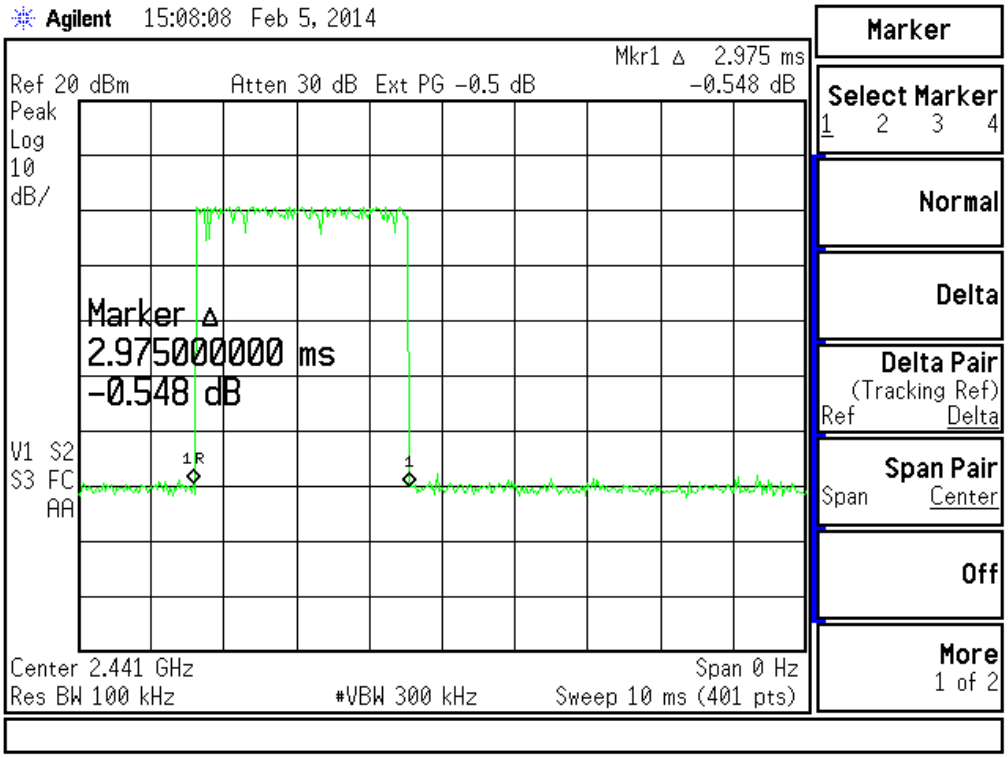
DH3


Agilent 15:03:58 Feb 5, 2014
Mkr1 2.85 s
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -48.87 dBm
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.441 GHz
Span 0 Hz
Res BW 100 kHz
#VBW 300 kHz
Sweep 5 s (401 pts)
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 15:05:19 Feb 5, 2014
Mkr1 Δ 1.7 ms
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -11.01 dB
Peak
Log
10
dB/
Marker Δ
1.700000000 ms
-11.01 dB
V1 S2
S3 FC
AA
Center 2.441 GHz
Span 0 Hz
Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

DH5


Agilent 15:07:19 Feb 5, 2014
Mkr1 4.838 s
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -49.15 dBm
Peak
Log
10
dB/
W1 S2
S3 FC
AA
Center 2.441 GHz
Span 0 Hz
Res BW 100 kHz #VBW 300 kHz Sweep 5 s (401 pts)
Sweep
Sweep Time
5.000 s
Sweep
Single Cont
Auto Sweep
Coupling
SR SA
Gate
[Off]
Points
401
Segmented


Agilent 15:08:08 Feb 5, 2014
Mkr1 Δ 2.975 ms
Ref 20 dBm
Atten 30 dB Ext PG -0.5 dB
-0.548 dB
Peak
Log
10
dB/
Marker Δ
2.975000000 ms
-0.548 dB
V1 S2
S3 FC
AA
Center 2.441 GHz
Span 0 Hz
Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

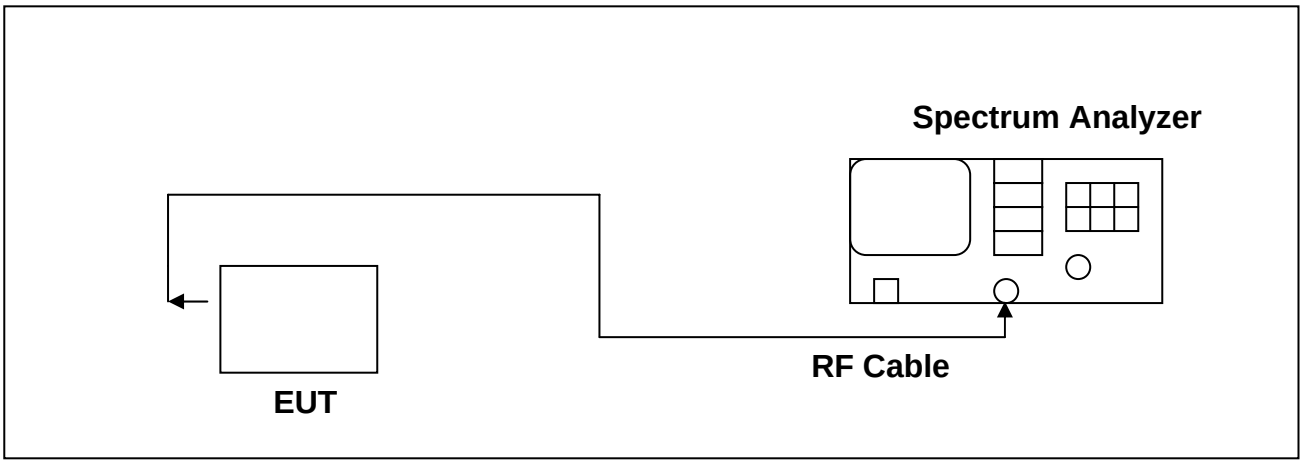
8. Out of Band Conducted Spurious Emissions Requirements

8.1 Test Condition & Setup:

In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band. The test was performed at 3 channels (Channel 0, 39, 78)

8.2 Test Instruments Configuration:



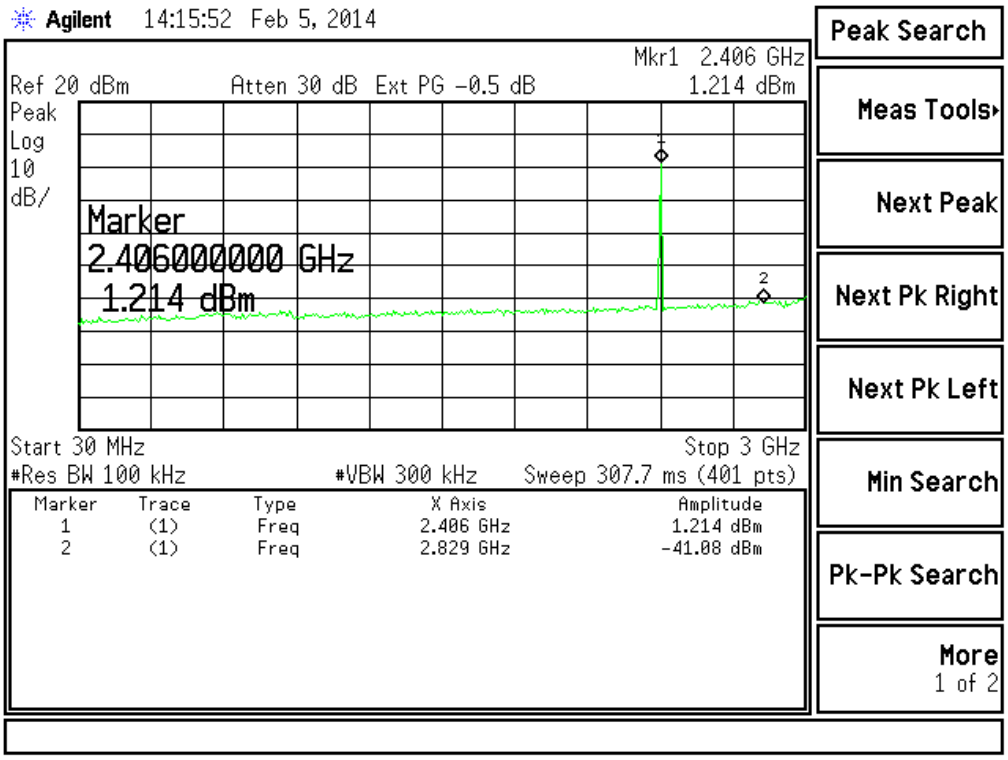
8.3 Test Equipment List:

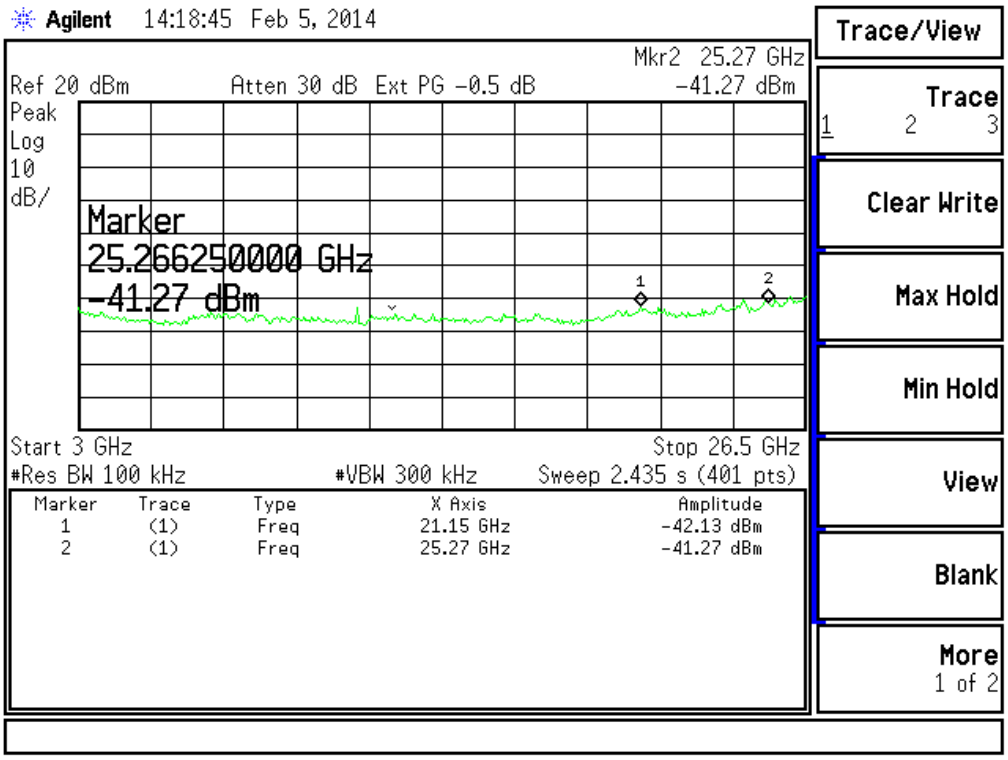
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

8.4 Test Result:

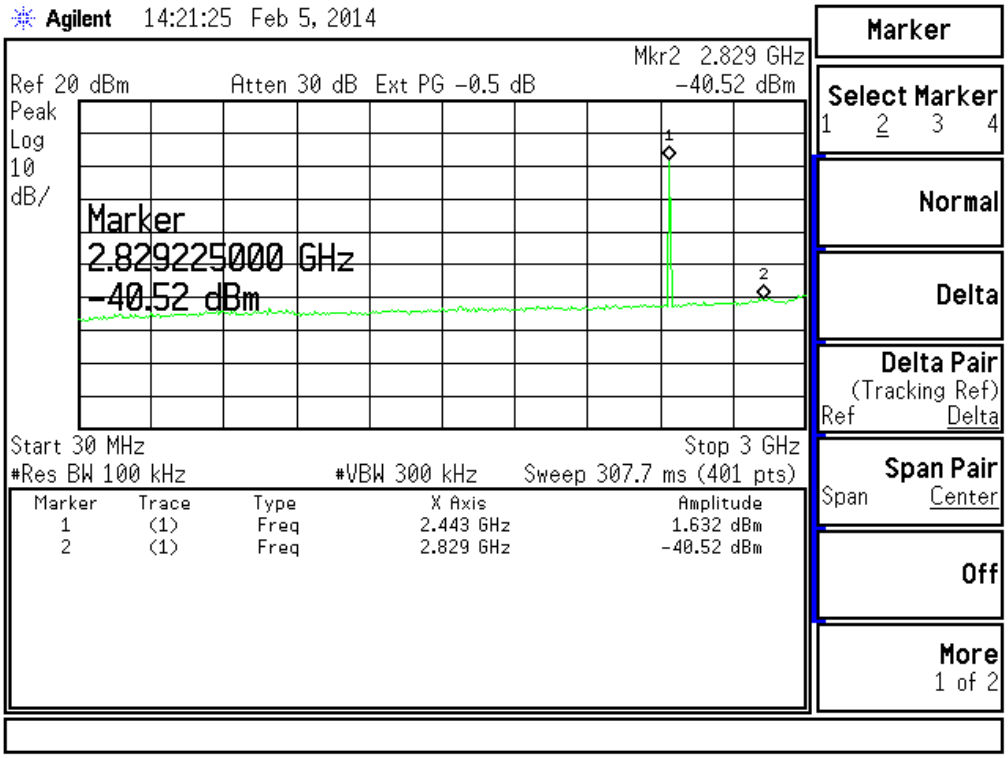
Refer to attached data sheets. Data shows out of band emissions are suppressed well below the -20 dB minimum required by the Rules.

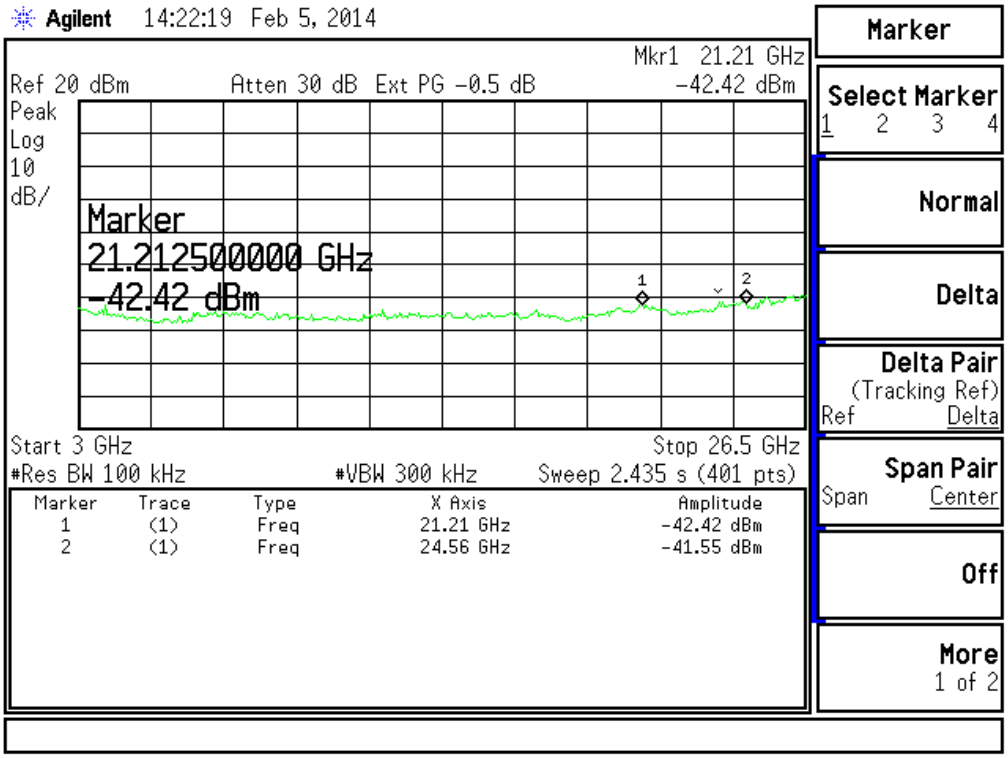
Data Rate : 1Mbps
(2402MHz)



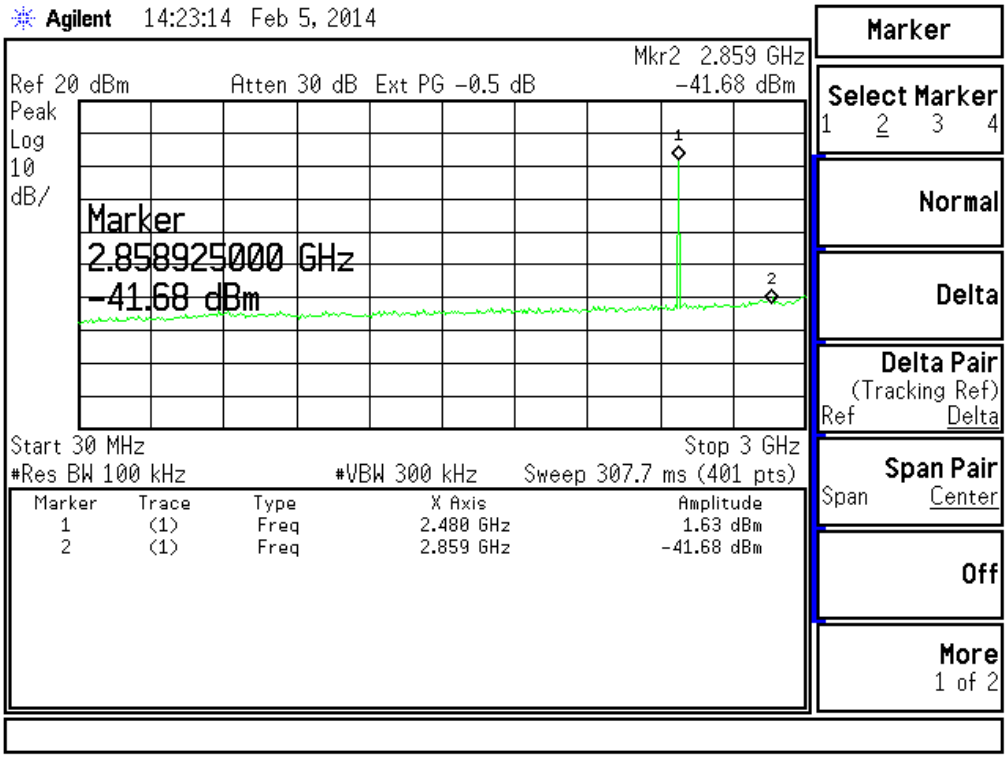


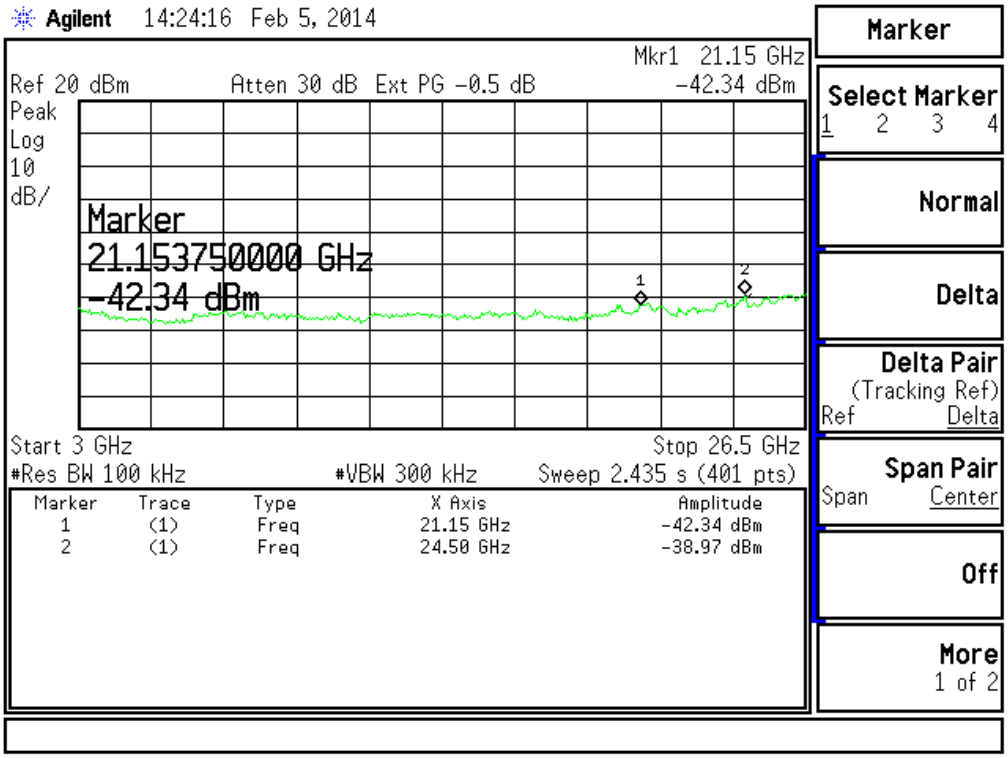
(2441MHz)


Agilent 14:21:25 Feb 5, 2014
Mkr2 2.829 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -40.52 dBm
Peak
Log
10
dB/
Marker
2.829225000 GHz
-40.52 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.443 GHz 1.632 dBm
2 (1) Freq 2.829 GHz -40.52 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

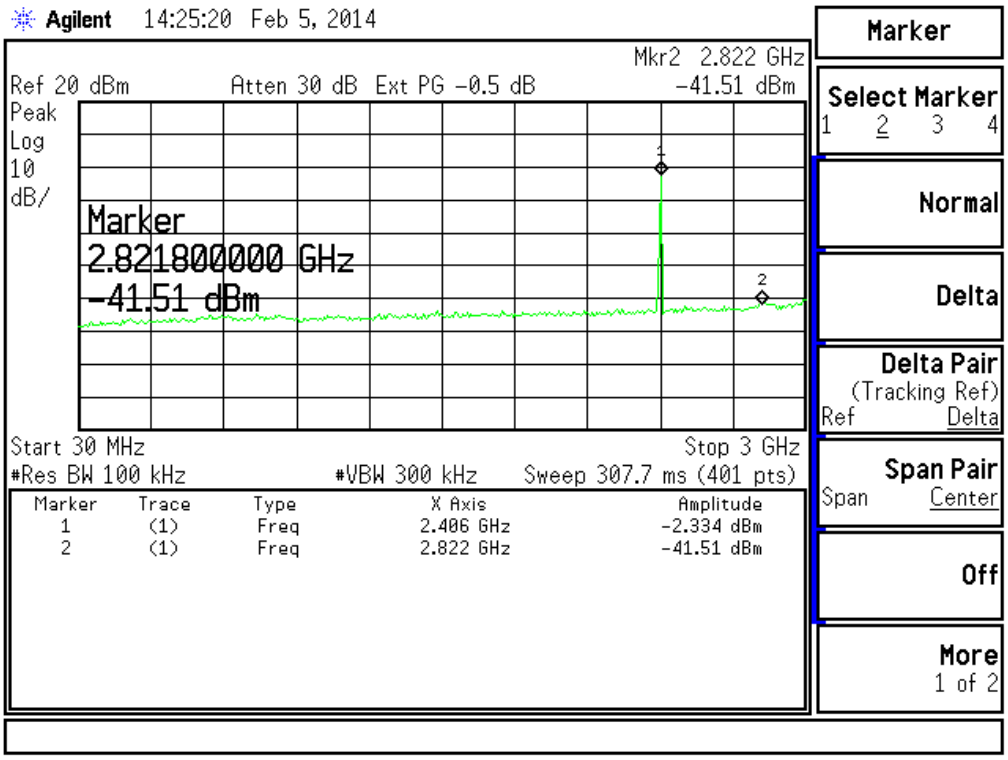

Agilent 14:22:19 Feb 5, 2014
Mkr1 21.21 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -42.42 dBm
Peak
Log
10
dB/
Marker
21.212500000 GHz
-42.42 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 21.21 GHz -42.42 dBm
2 (1) Freq 24.56 GHz -41.55 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

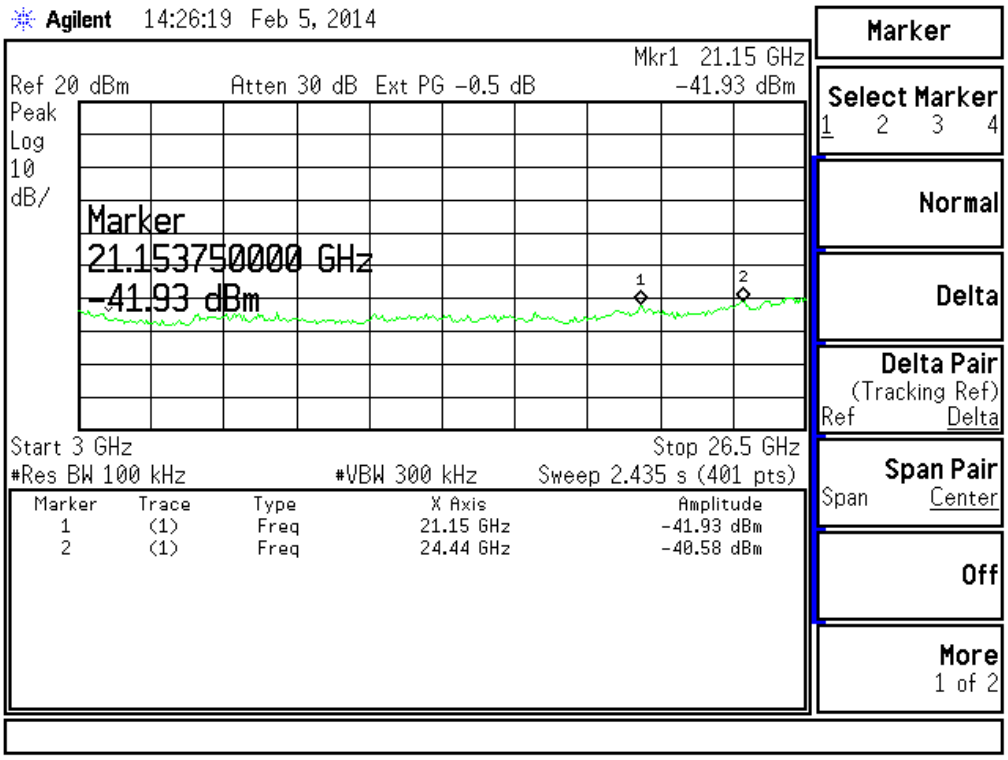
(2480MHz)


Agilent 14:23:14 Feb 5, 2014
Mkr2 2.859 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -41.68 dBm
Peak
Log
10
dB/
Marker
2.858925000 GHz
-41.68 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.480 GHz 1.63 dBm
2 (1) Freq 2.859 GHz -41.68 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

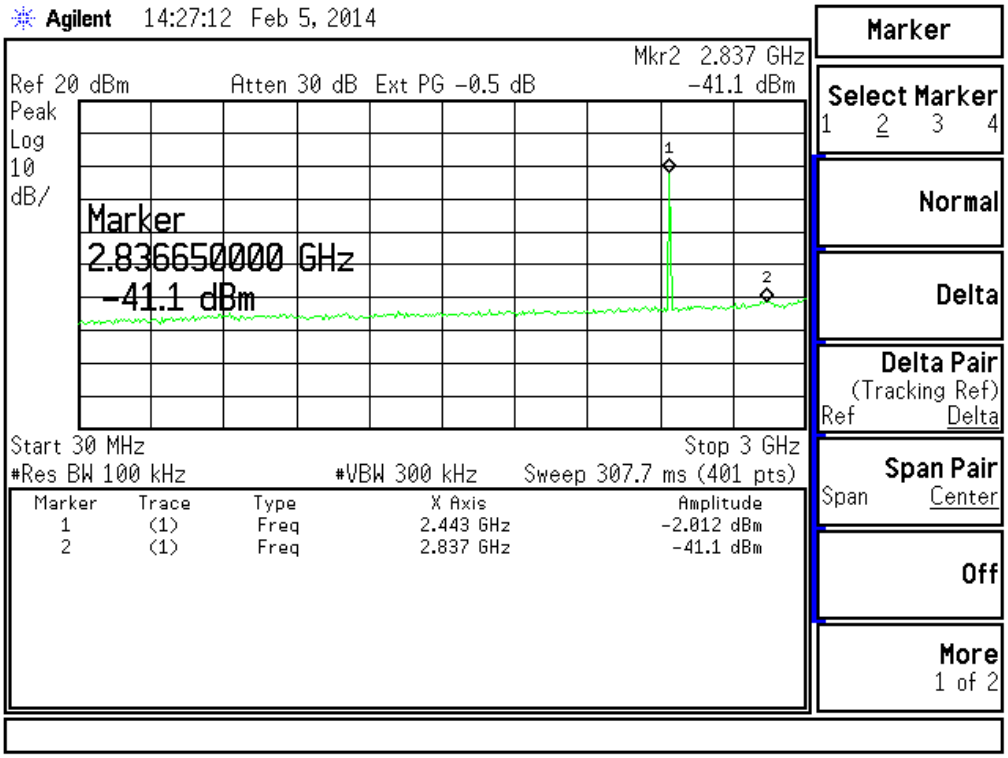

Agilent 14:24:16 Feb 5, 2014
Mkr1 21.15 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -42.34 dBm
Peak
Log
10
dB/
Marker
21.153750000 GHz
-42.34 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 21.15 GHz -42.34 dBm
2 (1) Freq 24.50 GHz -38.97 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

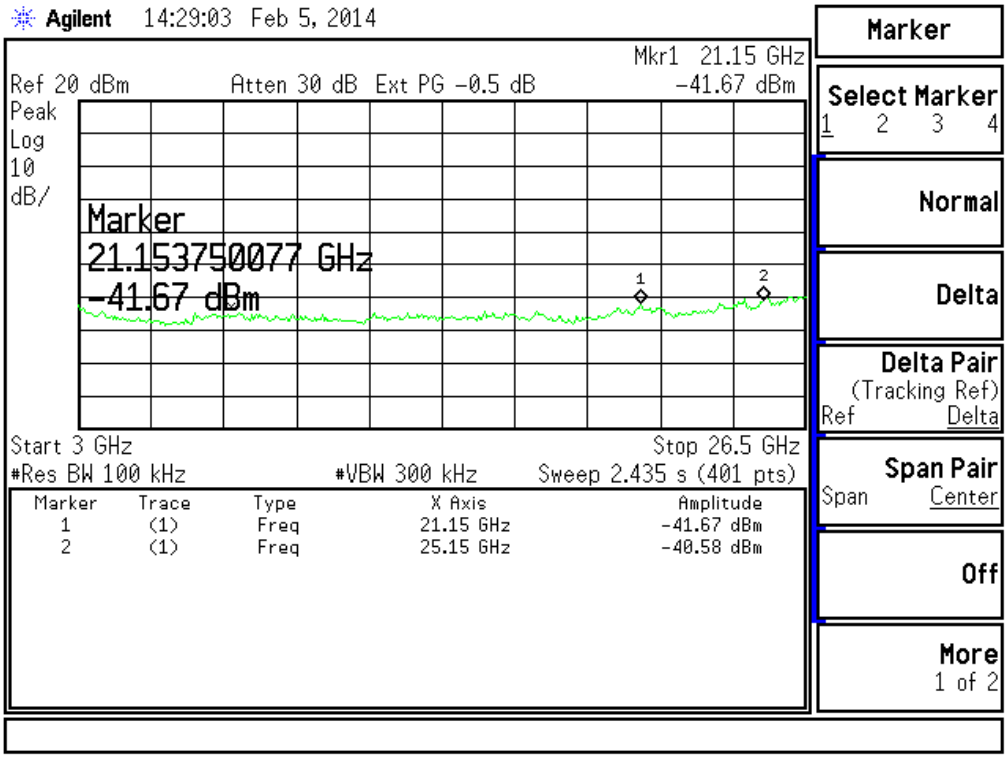
Data Rate : 2Mbps
(2402MHz)



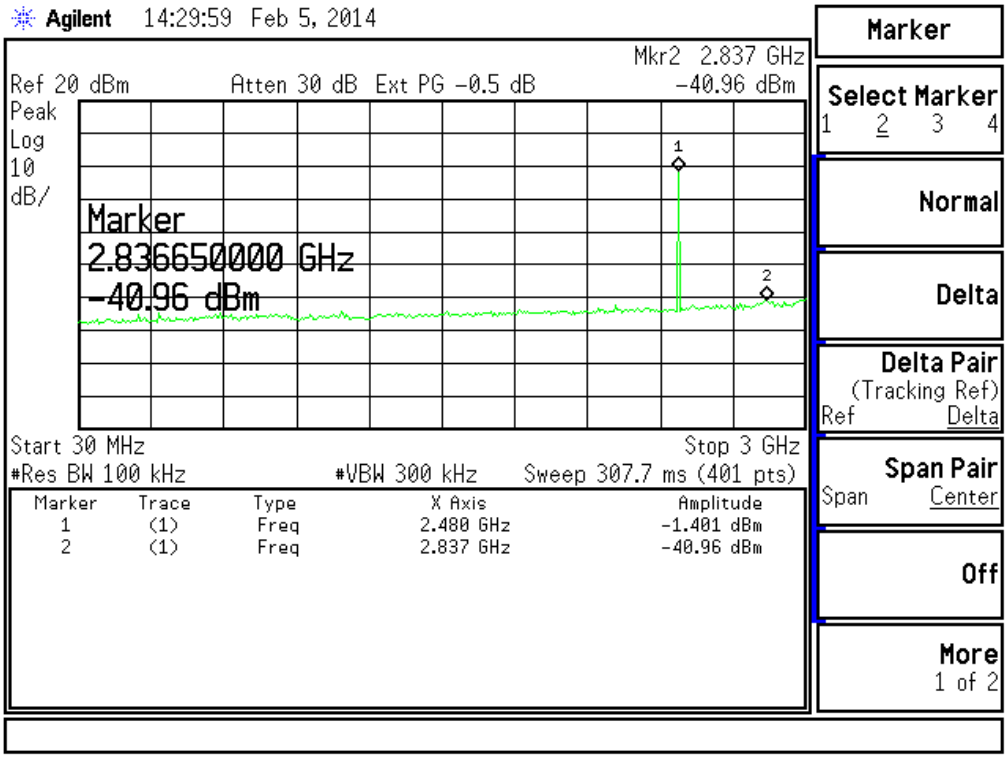


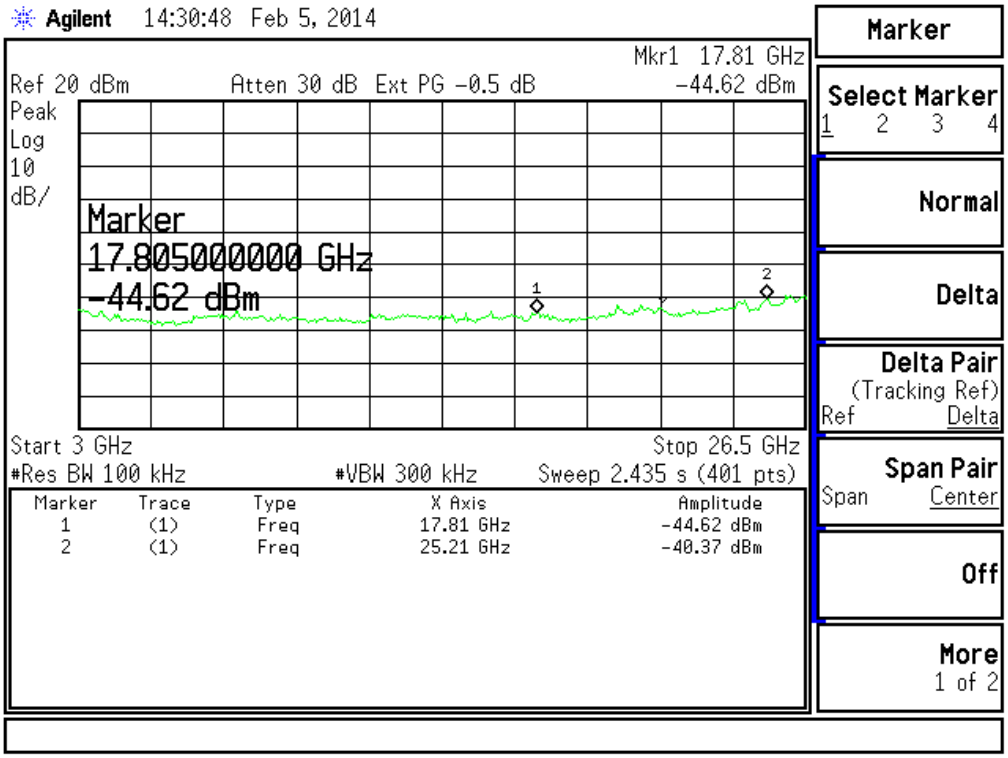
(2441MHz)


Agilent 14:27:12 Feb 5, 2014
Mkr2 2.837 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -41.1 dBm
Peak
Log
10
dB/
Marker
2.836650000 GHz
-41.1 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.443 GHz -2.012 dBm
2 (1) Freq 2.837 GHz -41.1 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

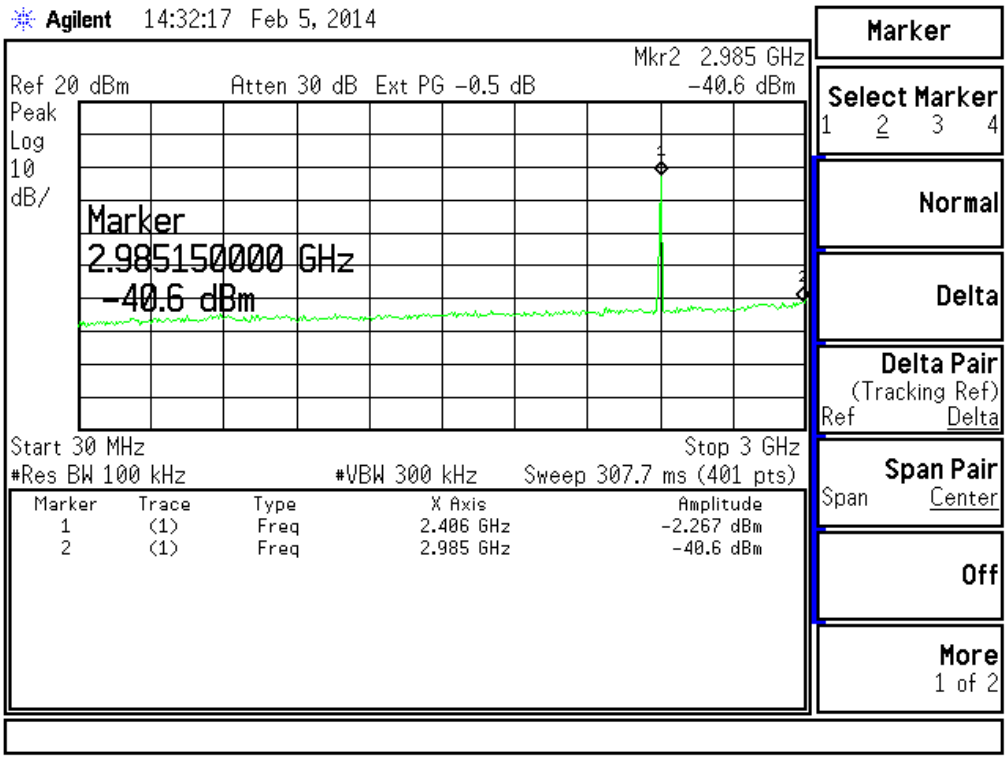

Agilent 14:29:03 Feb 5, 2014
Mkr1 21.15 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -41.67 dBm
Peak
Log
10
dB/
Marker
21.153750077 GHz
-41.67 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 21.15 GHz -41.67 dBm
2 (1) Freq 25.15 GHz -40.58 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

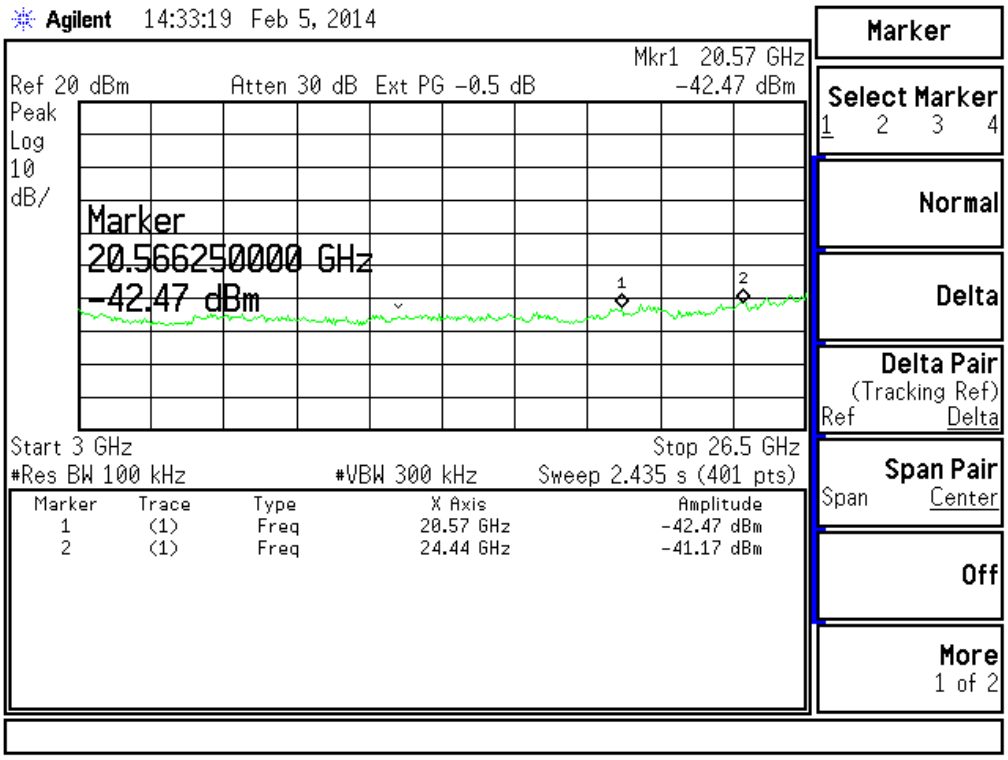
(2480MHz)


Agilent 14:29:59 Feb 5, 2014
Mkr2 2.837 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -40.96 dBm
Peak
Log
10
dB/
Marker
2.836650000 GHz
-40.96 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.480 GHz -1.401 dBm
2 (1) Freq 2.837 GHz -40.96 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

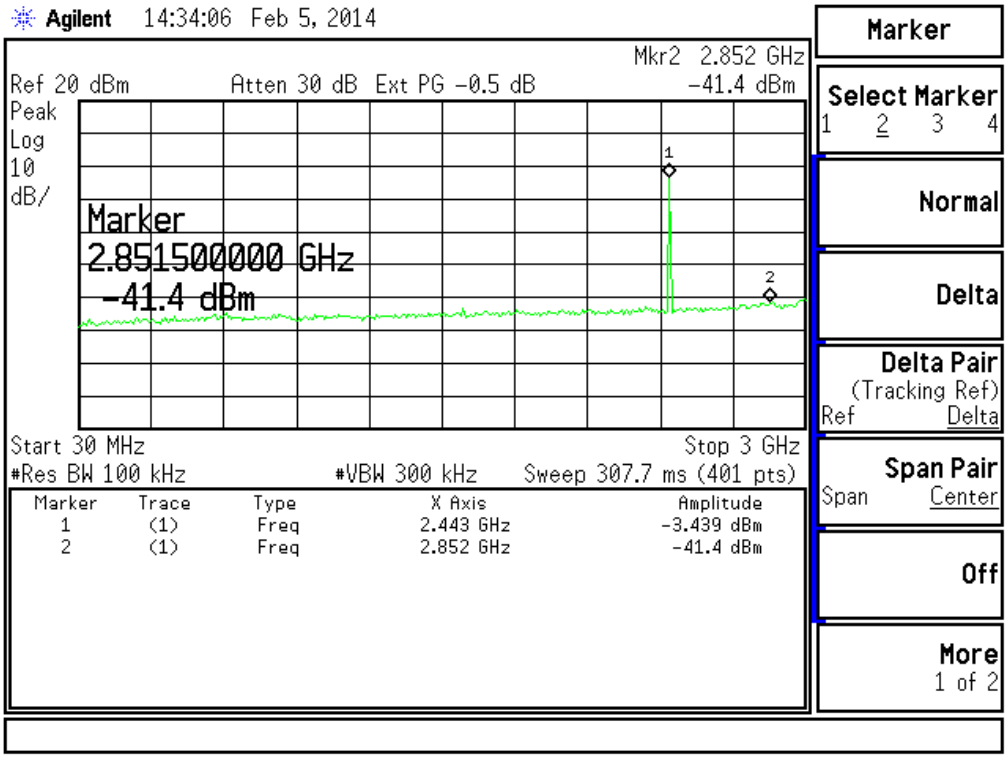

Agilent 14:30:48 Feb 5, 2014
Mkr1 17.81 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -44.62 dBm
Peak
Log
10
dB/
Marker
17.805000000 GHz
-44.62 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 17.81 GHz -44.62 dBm
2 (1) Freq 25.21 GHz -40.37 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

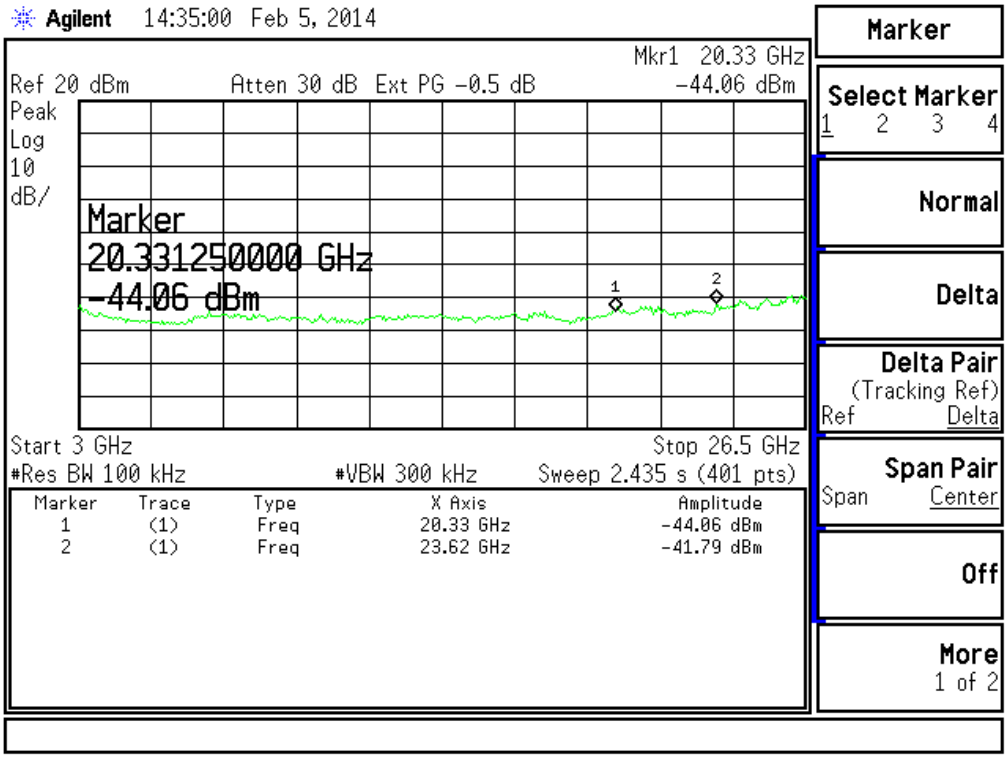
Data Rate : 3Mbps
(2402MHz)



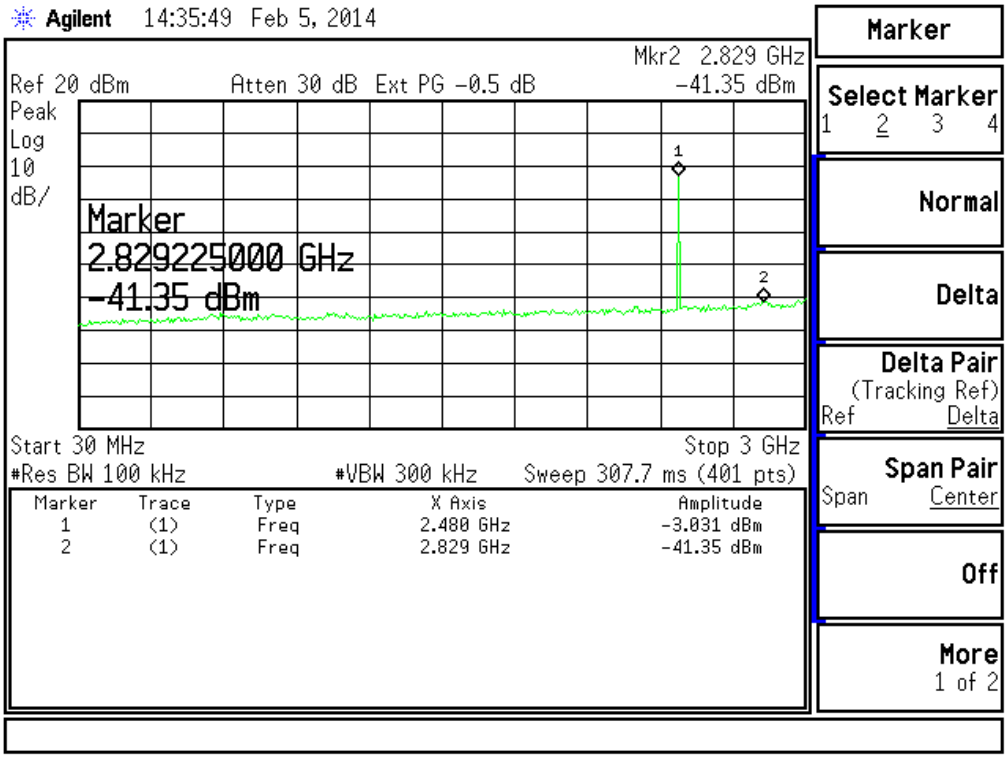


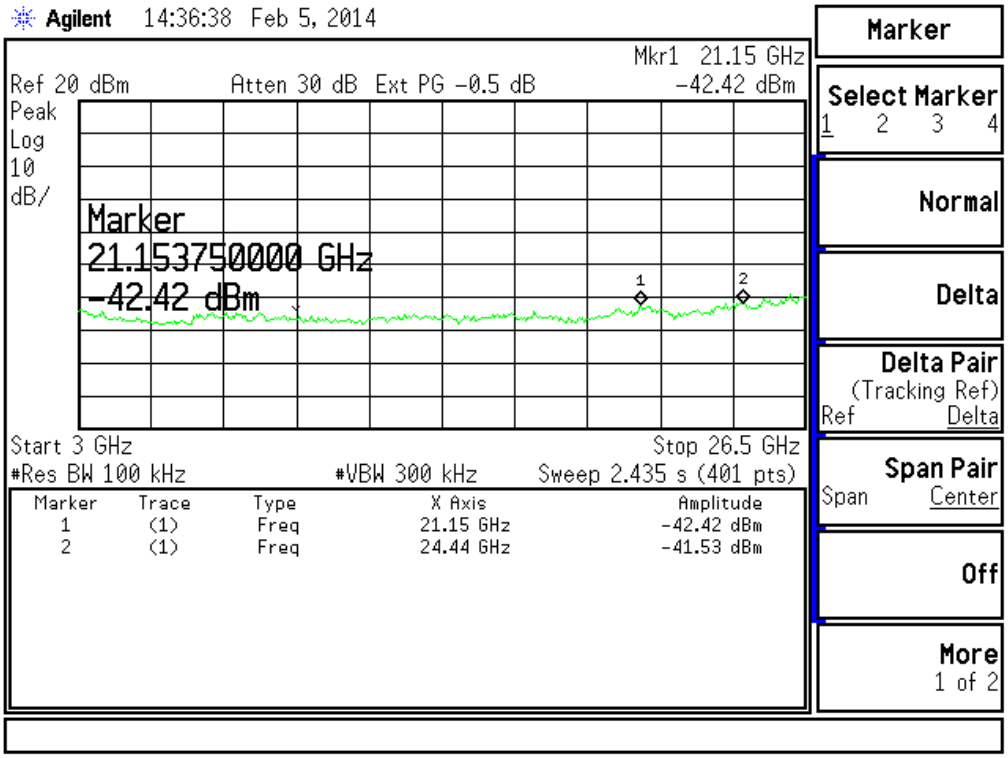
(2441MHz)


Agilent 14:34:06 Feb 5, 2014
Mkr2 2.852 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -41.4 dBm
Peak
Log
10
dB/
Marker
2.851500000 GHz
-41.4 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.443 GHz -3.439 dBm
2 (1) Freq 2.852 GHz -41.4 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 14:35:00 Feb 5, 2014
Mkr1 20.33 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -44.06 dBm
Peak
Log
10
dB/
Marker
20.331250000 GHz
-44.06 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 20.33 GHz -44.06 dBm
2 (1) Freq 23.62 GHz -41.79 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

(2480MHz)


Agilent 14:35:49 Feb 5, 2014
Mkr2 2.829 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -41.35 dBm
Peak
Log
10
dB/
Marker
2.829225000 GHz
-41.35 dBm
Start 30 MHz Stop 3 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.480 GHz -3.031 dBm
2 (1) Freq 2.829 GHz -41.35 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 14:36:38 Feb 5, 2014
Mkr1 21.15 GHz
Ref 20 dBm Atten 30 dB Ext PG -0.5 dB -42.42 dBm
Peak
Log
10
dB/
Marker
21.153750000 GHz
-42.42 dBm
Start 3 GHz Stop 26.5 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.435 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 21.15 GHz -42.42 dBm
2 (1) Freq 24.44 GHz -41.53 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

9. Maximum Conducted Output Power Requirements

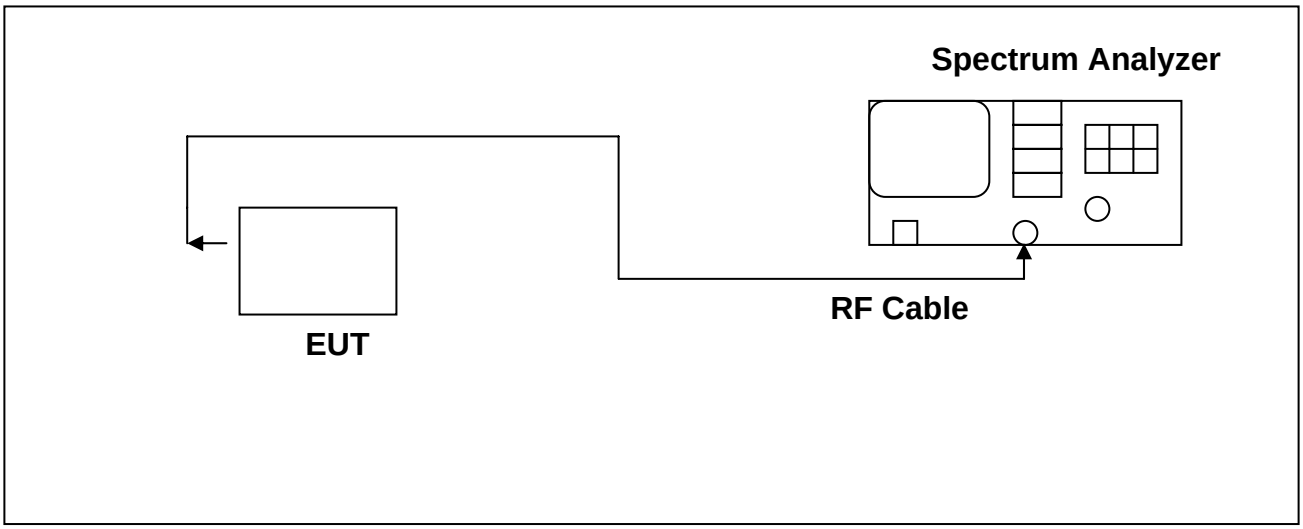
9.1 Test Condition & Setup:

While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to spectrum analyzer. The maximum peak output power shall not exceed 1 watt.

The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6)/3 dBm.

9.2 Test Instruments Configuration:



9.3 Test Equipment List:

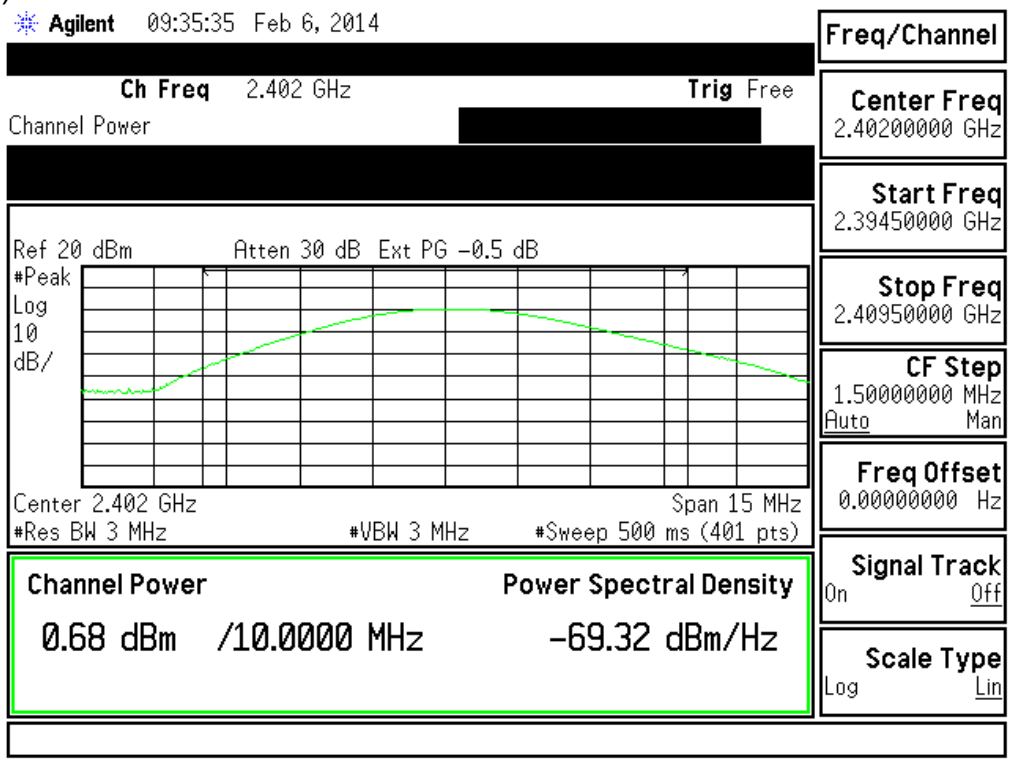
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29

9.4 Test Result:

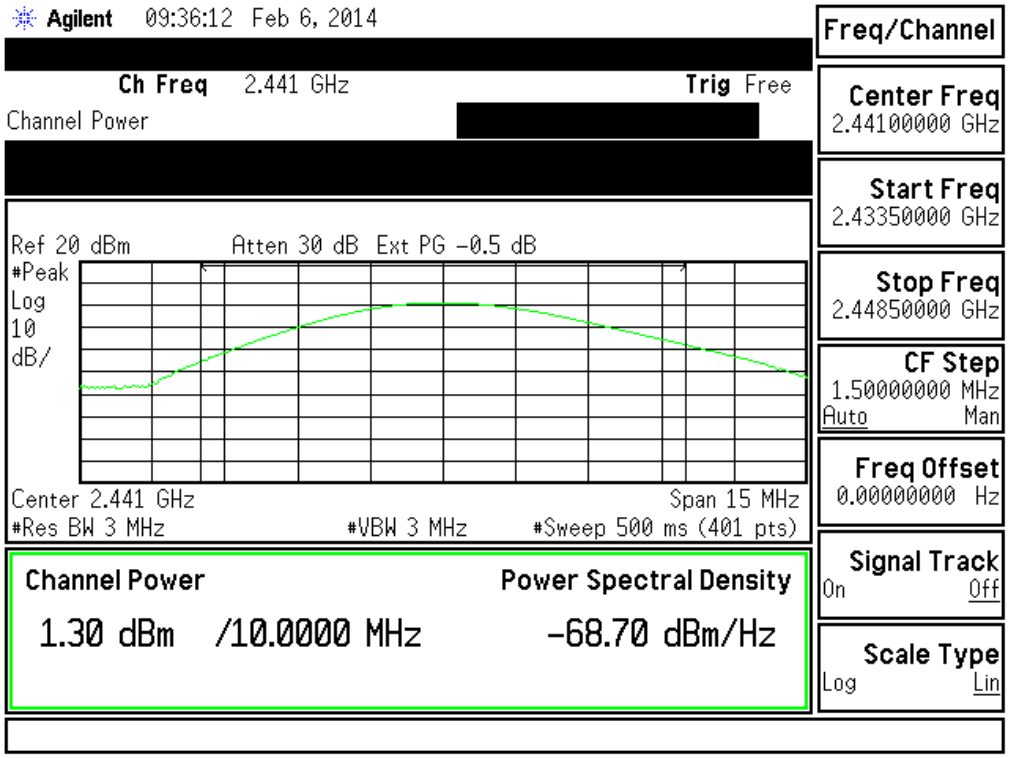
Channel	Frequency (MHz)	Data Rate (Mbps)	Results (dBm)	Limit (dBm)
0	2402	1	0.68	<30
		2	-1.43	<30
		3	-1.12	<30
39	2441	1	1.30	<30
		2	-0.66	<30
		3	-0.36	<30
78	2480	1	1.19	<30
		2	-0.86	<30
		3	-0.46	<30

Note : 1. Cable Loss = 0.5dB.
2. Result= Instrument reading value + Cable Loss.

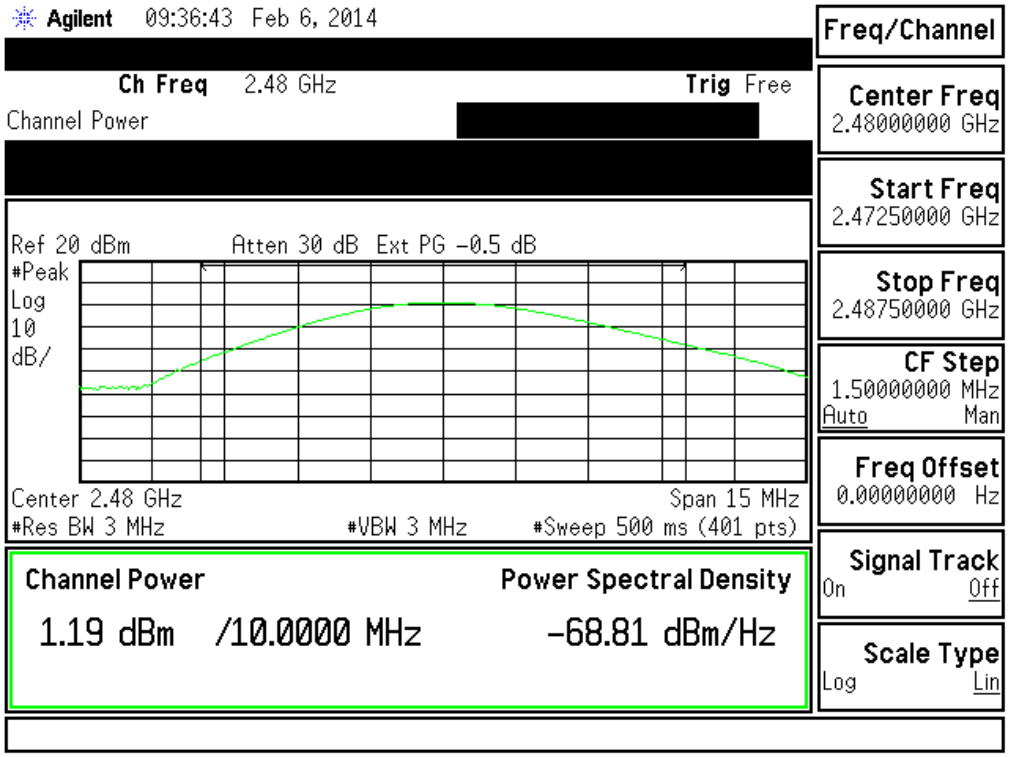
Data Rate : 1Mbps
(2402MHz)



(2441MHz)

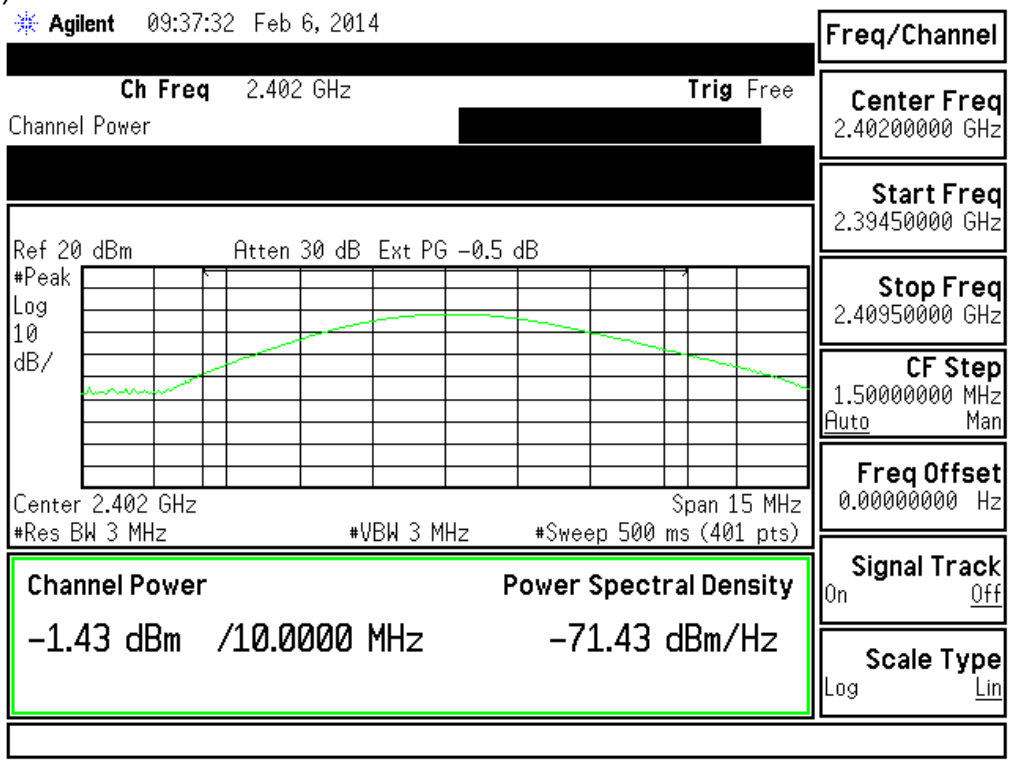


(2480MHz)

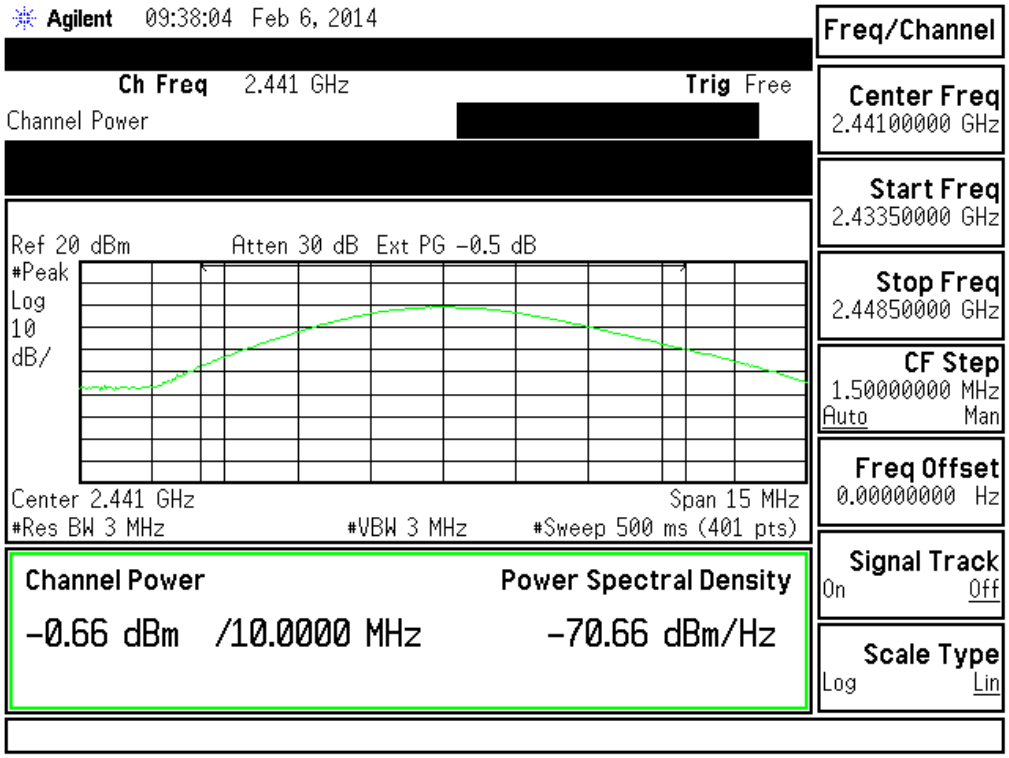


Data Rate : 2Mbps

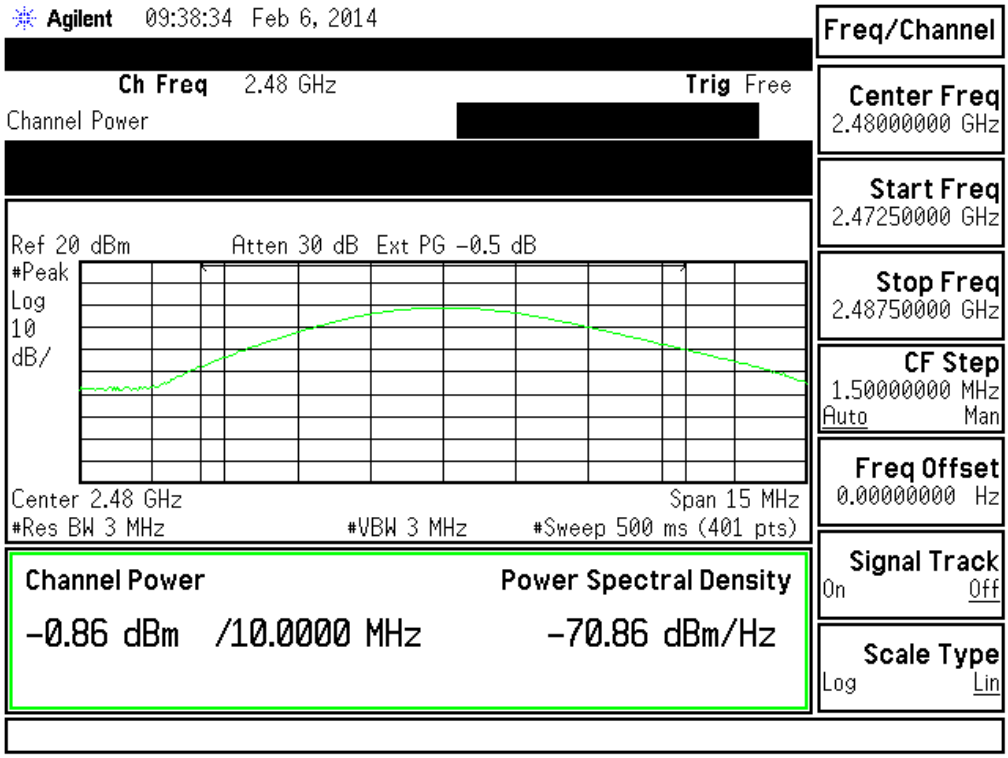
(2402MHz)



(2441MHz)

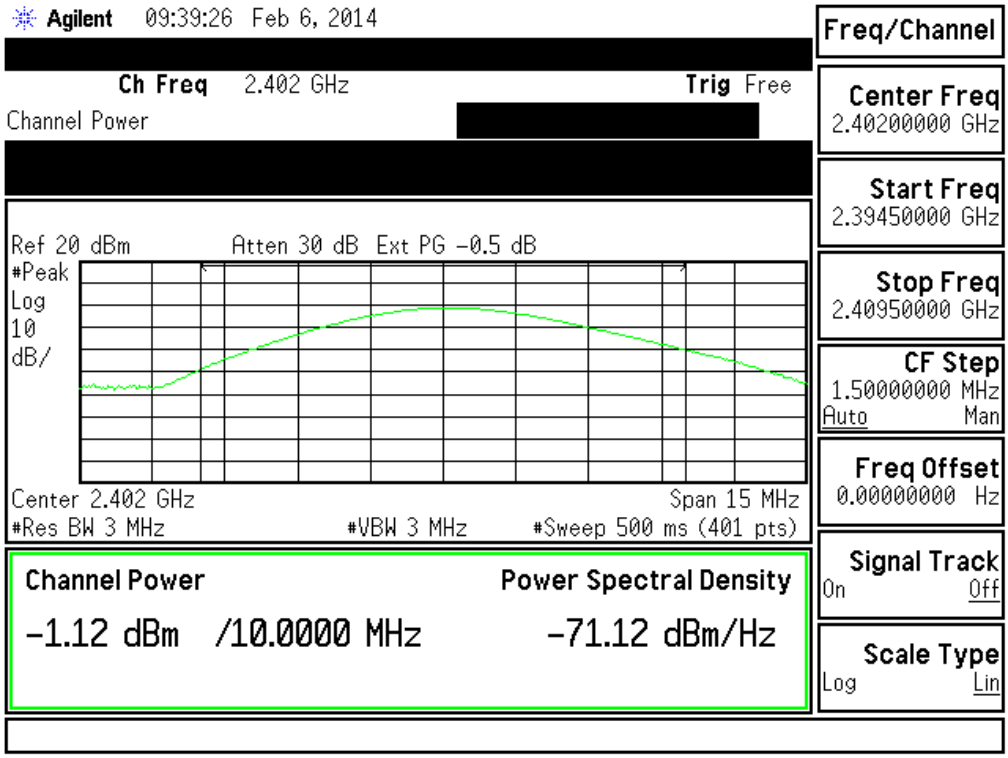


(2480MHz)

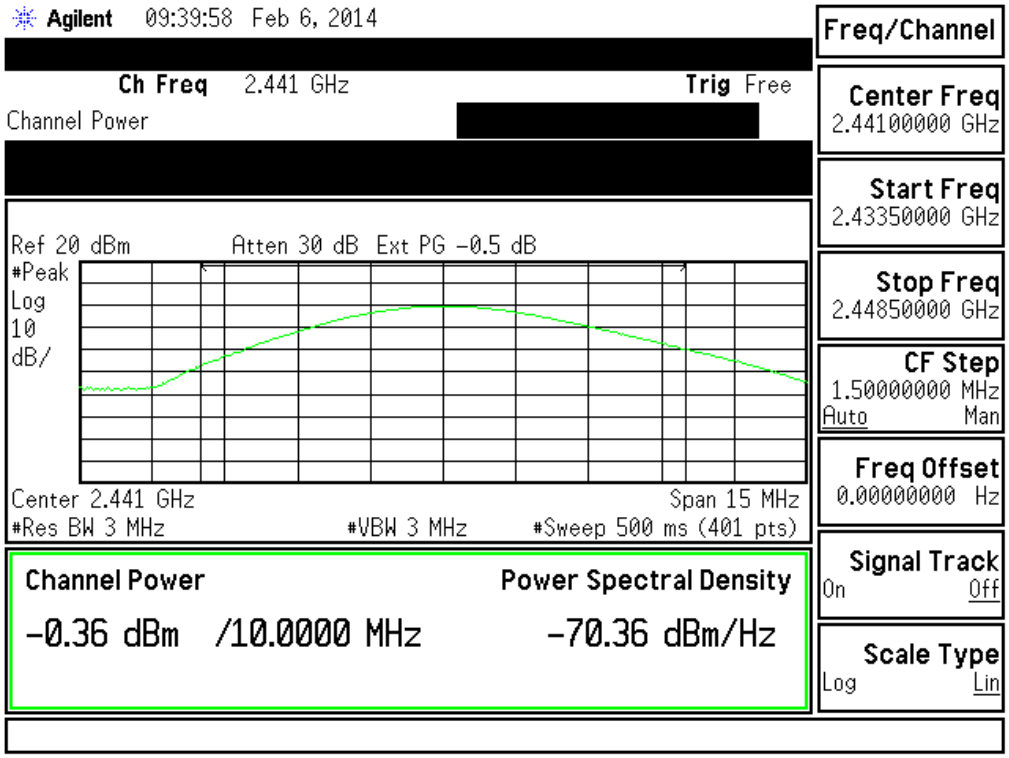


Data Rate : 3Mbps

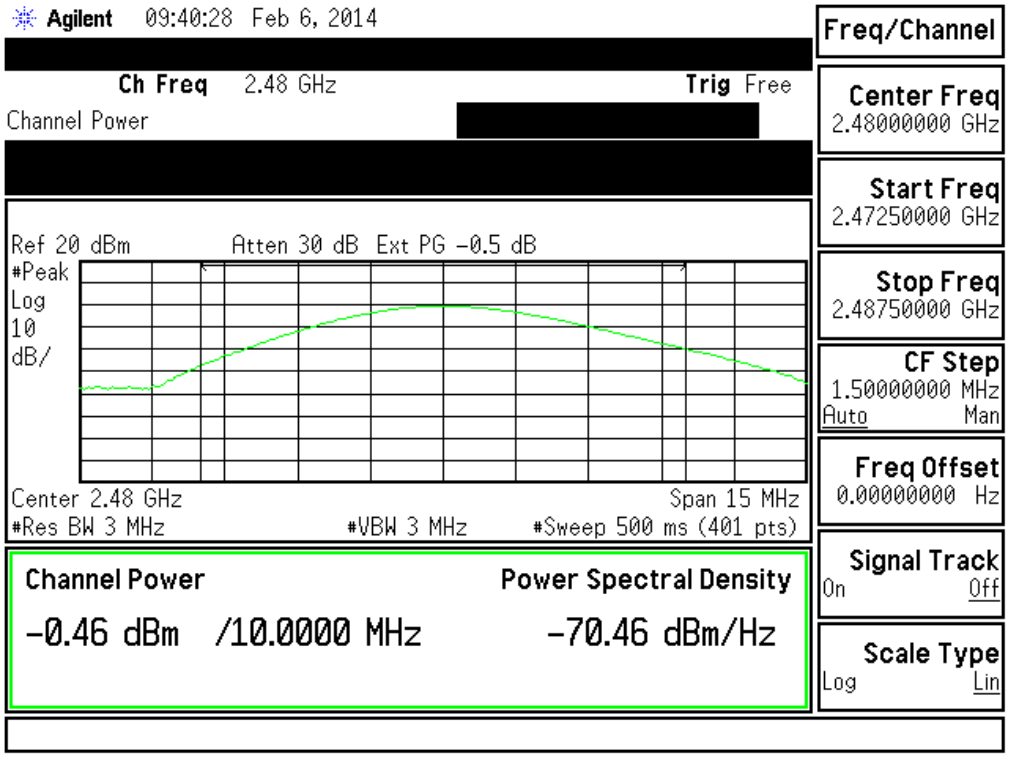
(2402MHz)



(2441MHz)



(2480MHz)



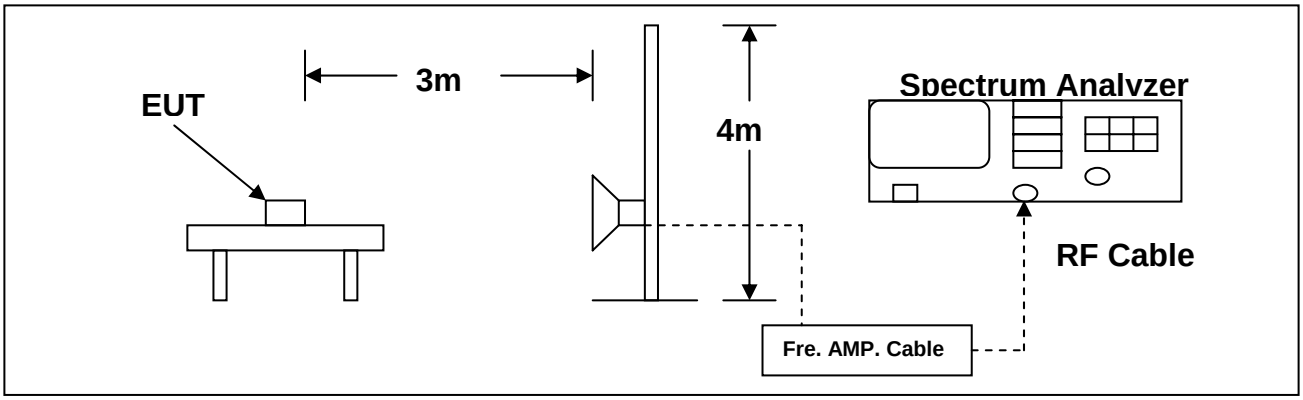
10. Band Edge Requirements

10.1 Test Condition & Setup:

The emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter was in full radiated power. The additional test was performed to show compliance with the requirement at the band edge frequency 2400 MHz and up to 2483.5 MHz.

In any 100 kHz 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 dB below that in the 100 kHz 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.

10.2 Test Instruments Configuration:



10.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US44300422	E4446A	2013/12/30	2014/12/30
2.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2013/08/23	2014/08/23
3.	SCHWARZBECK	Horn Antenna	304	BBHA 9120 D	2013/10/22	2014/10/22
4.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29
5.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2013/03/01	2014/03/01

10.4 Test Result :

Data Rate : 1Mbps

Radiated Emissions (HORIZONTAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2399.2	50.6 (PK)	1	348	0	74.0(PK)	-23.4
2399.2	26.2 (AV)	1	348	0	54.0(AV)	-27.8

Radiated Emissions (VERTICAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2400.0	50.9 (PK)	1	158	0	74.0(PK)	-23.1
2400.0	27.5 (AV)	1	158	0	54.0(AV)	-26.5

Radiated Emissions (HORIZONTAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.4	34.5 (PK)	1	343	0	74.0(PK)	-39.5
2484.4	24.3 (AV)	1	343	0	54.0(AV)	-29.7

Radiated Emissions (VERTICAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.5	34.2 (PK)	1	163	0	74.0(PK)	-39.8
2484.5	24.2 (AV)	1	163	0	54.0(AV)	-29.9

Notes : 1. Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

Data Rate : 2Mbps

Radiated Emissions (HORIZONTAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2400.0	44.4 (PK)	1	350	0	74.0(PK)	-29.6
2400.0	26.1 (AV)	1	350	0	54.0(AV)	-27.9

Radiated Emissions (VERTICAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2400.0	42.0 (PK)	1	154	0	74.0(PK)	-32.0
2400.0	25.8 (AV)	1	154	0	54.0(AV)	-28.2

Radiated Emissions (HORIZONTAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.0	34.4 (PK)	1	348	0	74.0(PK)	-39.6
2484.0	24.3 (AV)	1	348	0	54.0(AV)	-29.8

Radiated Emissions (VERTICAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.2	34.5 (PK)	1	170	0	74.0(PK)	-39.5
2484.2	24.2 (AV)	1	170	0	54.0(AV)	-29.8

Notes : 1. Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

Data Rate : 3Mbps

Radiated Emissions (HORIZONTAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2400.0	44.1 (PK)	1	343	0	74.0(PK)	-29.9
2400.0	26.1 (AV)	1	343	0	54.0(AV)	-27.9

Radiated Emissions (VERTICAL) CH00						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2399.8	37.6 (PK)	1	153	0	74.0(PK)	-36.4
2399.8	25.4 (AV)	1	153	0	54.0(AV)	-28.6

Radiated Emissions (HORIZONTAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.3	36.1 (PK)	1	338	0	74.0(PK)	-37.9
2484.3	24.1 (AV)	1	338	0	54.0(AV)	-29.9

Radiated Emissions (VERTICAL) CH78						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.7	34.3 (PK)	1	145	0	74.0(PK)	-39.7
2484.7	23.8 (AV)	1	145	0	54.0(AV)	-30.2

Notes : 1. Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

11. Radiated Emissions Requirements (Above 1GHz)

11.1 General and setup:

Prior to open-field testing, the EUT was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration which produced the highest emissions was noted so it could be reproduced later during the open field tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT.

Final radiation measurements were made on a three-meter, open-field test site. The EUT system was placed on a nonconductive turntable which was 0.8 meters height, top surface 1.0 x 1.5 meter. During the test, EUT was set to transmit continuously & measurements spectrum range from 30 MHz to 26.5 GHz is investigated.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

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.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer’s 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvlt (dBuV) into field intensity in microvolts pre meter(uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in microcolts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

Amplitude (dBuV/m)= FI(dBuV)+AF(dBuV)+CL(dBuV)-Gain(dB)

FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(1) For fundamental frequency : Transmitter Output < +30dBm

(2) For spurious frequency : Spurious emission limits = fundamental emission limit /10

11.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US44300422	E4446A	2013/12/30	2014/12/30
2.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2013/08/23	2014/08/23
3.	Herotek	Pre Amplifier	30690	A402-417	2013/11/06	2014/11/06
4.	SCHWARZBECK	Horn Antenna	181	BBHA 9170	2013/10/22	2014/10/22
5.	SCHWARZBECK	Horn Antenna	304	BBHA 9120 D	2013/10/22	2014/10/22
6.	Agilent	Spectrum Analyzer	US39240419	E4407B	2014/01/29	2015/01/29
7.	MLT	Pre Amplifier	TA010-190-30	RF03	2013/07/16	2014/07/16

11.3 Test Condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

Peak Measurement RBW set to 1MHz , VBW set to 1MHz

Average Measurement RBW set to 1MHz , VBW set to 10Hz

The X axial at Pre-test procedure is the worst case, the final result shown on this report is based on this condition.

11.4 Radiated Emissions Limits:

Frequency range (MHz)	Peak (dBuV/m)	Average (dBuV/m)
Above 1000	74	54

11.5 Measurement Data Of Radiated Emissions:

11.5.1 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:1M) 2402MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	83.16	64.07	-28.08	55.08	35.99	74.00	54.00	-18.92	-18.01
12000.0	61.89	52.57	-15.76	46.13	36.81	74.00	54.00	-27.87	-17.19
19675.0	36.63	28.11	17.75	54.38	45.86	74.00	54.00	-19.62	-8.14

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	74.65	60.96	-28.08	46.57	32.88	74.00	54.00	-27.43	-21.12
12000.0	62.50	53.19	-15.76	46.74	37.43	74.00	54.00	-27.26	-16.57
19825.0	37.84	28.73	17.59	55.43	46.32	74.00	54.00	-18.57	-7.68

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.2 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:1M) 2441MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	74.03	61.03	-28.18	45.85	32.85	74.00	54.00	-28.15	-21.15
12195.0	65.18	55.44	-15.94	49.24	39.50	74.00	54.00	-24.76	-14.50
19022.5	35.64	28.86	18.92	54.56	47.78	74.00	54.00	-19.44	-6.22

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	81.30	64.53	-28.18	53.12	36.35	74.00	54.00	-20.88	-17.65
12195.0	63.51	53.96	-15.94	47.57	38.02	74.00	54.00	-26.43	-15.98
19997.5	37.66	29.23	17.06	54.72	46.29	74.00	54.00	-19.28	-7.71

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.3 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:1M) 2480MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4950.0	82.69	64.94	-28.09	54.60	36.85	74.00	54.00	-19.40	-17.15
12390.0	65.33	57.13	-16.07	49.26	41.06	74.00	54.00	-24.74	-12.94
19907.5	37.90	29.30	17.35	55.25	46.65	74.00	54.00	-18.75	-7.35

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4950.0	76.17	64.12	-28.09	48.08	36.03	74.00	54.00	-25.92	-17.97
12390.0	63.50	54.79	-16.07	47.43	38.72	74.00	54.00	-26.57	-15.28
19735.0	36.90	28.80	17.93	54.83	46.73	74.00	54.00	-19.17	-7.27

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.4 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:2M) 2402MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	78.83	62.24	-28.08	50.75	34.16	74.00	54.00	-23.25	-19.84
12000.0	61.66	53.12	-15.76	45.90	37.36	74.00	54.00	-28.10	-16.64
19697.5	36.81	28.96	17.69	54.50	46.65	74.00	54.00	-19.50	-7.35

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	70.32	58.96	-28.08	42.24	30.88	74.00	54.00	-31.76	-23.12
12000.0	61.21	54.12	-15.76	45.45	38.36	74.00	54.00	-28.55	-15.64
19150.0	36.02	28.48	18.73	54.75	47.21	74.00	54.00	-19.25	-6.79

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.5 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:2M) 2441MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	83.19	63.80	-28.18	55.01	35.62	74.00	54.00	-18.99	-18.38
7320.0	63.38	54.13	-21.48	41.90	32.65	74.00	54.00	-32.10	-21.35
12195.0	62.99	53.74	-15.94	47.05	37.80	74.00	54.00	-26.95	-16.20

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	76.10	61.56	-28.18	47.92	33.38	74.00	54.00	-26.08	-20.62
7320.0	61.84	52.46	-21.48	40.36	30.98	74.00	54.00	-33.64	-23.02
12195.0	63.91	55.17	-15.94	47.97	39.23	74.00	54.00	-26.03	-14.77

Notes :
1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.6 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:2M) 2480MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	**Read (dBuV/m)**		**Factor**	**Amplitude (dBuV/m)**		**Limits (dBuV/m)**		**Margin (dB)**	
	PK	**AV**		**PK**	**AV**	**PK**	**AV**	**PK**	**AV**
4950.0	84.03	64.52	-28.09	55.94	36.43	74.00	54.00	-18.06	-17.57
7440.0	60.19	53.12	-20.90	39.29	32.22	74.00	54.00	-34.71	-21.78
12390.0	66.26	57.97	-16.07	50.19	41.90	74.00	54.00	-23.81	-12.10

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	**Read (dBuV/m)**		**Factor**	**Amplitude (dBuV/m)**		**Limits (dBuV/m)**		**Margin (dB)**	
	PK	**AV**		**PK**	**AV**	**PK**	**AV**	**PK**	**AV**
4950.0	76.20	61.97	-28.09	48.11	33.88	74.00	54.00	-25.89	-20.12
7440.0	60.50	53.12	-20.90	39.60	32.22	74.00	54.00	-34.40	-21.78
12390.0	63.40	54.12	-16.07	47.33	38.05	74.00	54.00	-26.67	-15.95

Notes :
1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.7 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:3M) 2402MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	80.29	62.78	-28.08	52.21	34.70	74.00	54.00	-21.79	-19.30
7200.0	57.82	49.63	-21.27	36.55	28.36	74.00	54.00	-37.45	-25.64
12000.0	58.89	51.22	-15.76	43.13	35.46	74.00	54.00	-30.87	-18.54

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4800.0	72.26	60.82	-28.08	44.18	32.74	74.00	54.00	-29.82	-21.26
7200.0	61.70	53.12	-21.27	40.43	31.85	74.00	54.00	-33.57	-22.15
12000.0	57.95	50.11	-15.76	42.19	34.35	74.00	54.00	-31.81	-19.65

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.8 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:3M) 2441MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	78.47	63.33	-28.18	50.29	35.15	74.00	54.00	-23.71	-18.85
7320.0	59.65	51.42	-21.48	38.17	29.94	74.00	54.00	-35.83	-24.06
12195.0	62.14	54.12	-15.94	46.20	38.18	74.00	54.00	-27.80	-15.82

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4875.0	72.43	60.64	-28.18	44.25	32.46	74.00	54.00	-29.75	-21.54
7320.0	57.50	50.42	-21.48	36.02	28.94	74.00	54.00	-37.98	-25.06
12195.0	63.37	50.41	-15.94	47.43	34.47	74.00	54.00	-26.57	-19.53

Notes :
1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

11.5.9 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : (Rate:3M) 2480MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4950.0	84.58	65.61	-28.09	56.49	37.52	74.00	54.00	-17.51	-16.48
7440.0	60.05	51.21	-20.90	39.15	30.31	74.00	54.00	-34.85	-23.69
12390.0	66.98	57.15	-16.07	50.91	41.08	74.00	54.00	-23.09	-12.92

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
4950.0	75.61	62.25	-28.09	47.52	34.16	74.00	54.00	-26.48	-19.84
7440.0	60.73	50.23	-20.90	39.83	29.33	74.00	54.00	-34.17	-24.67
12390.0	64.87	54.78	-16.07	48.80	38.71	74.00	54.00	-25.20	-15.29

Notes :
1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

12. Antenna Requirements

12.1 Standard Applicable:

For intentional device, according to 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.

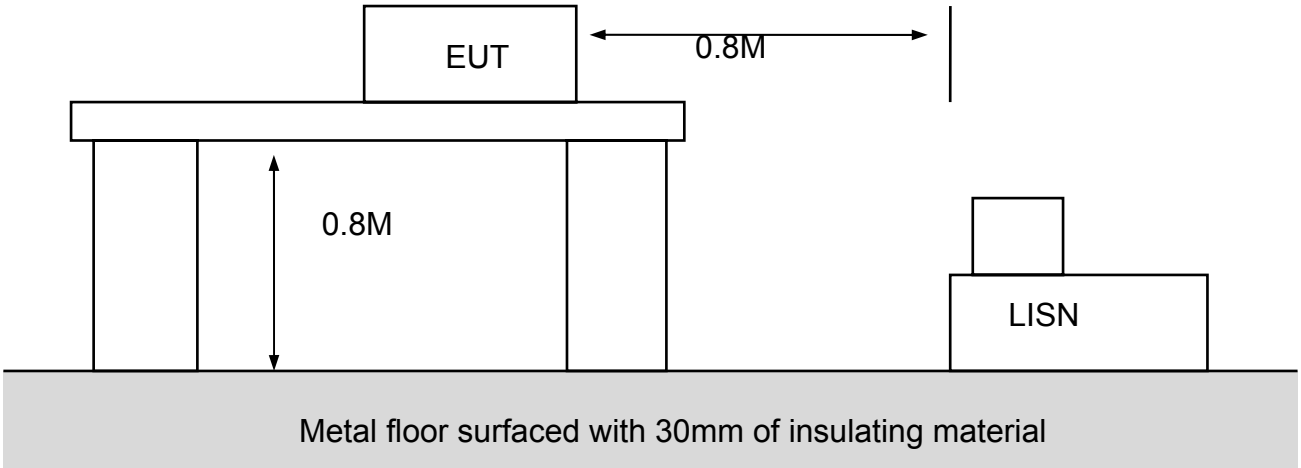
And According to 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 Antenna Construction:

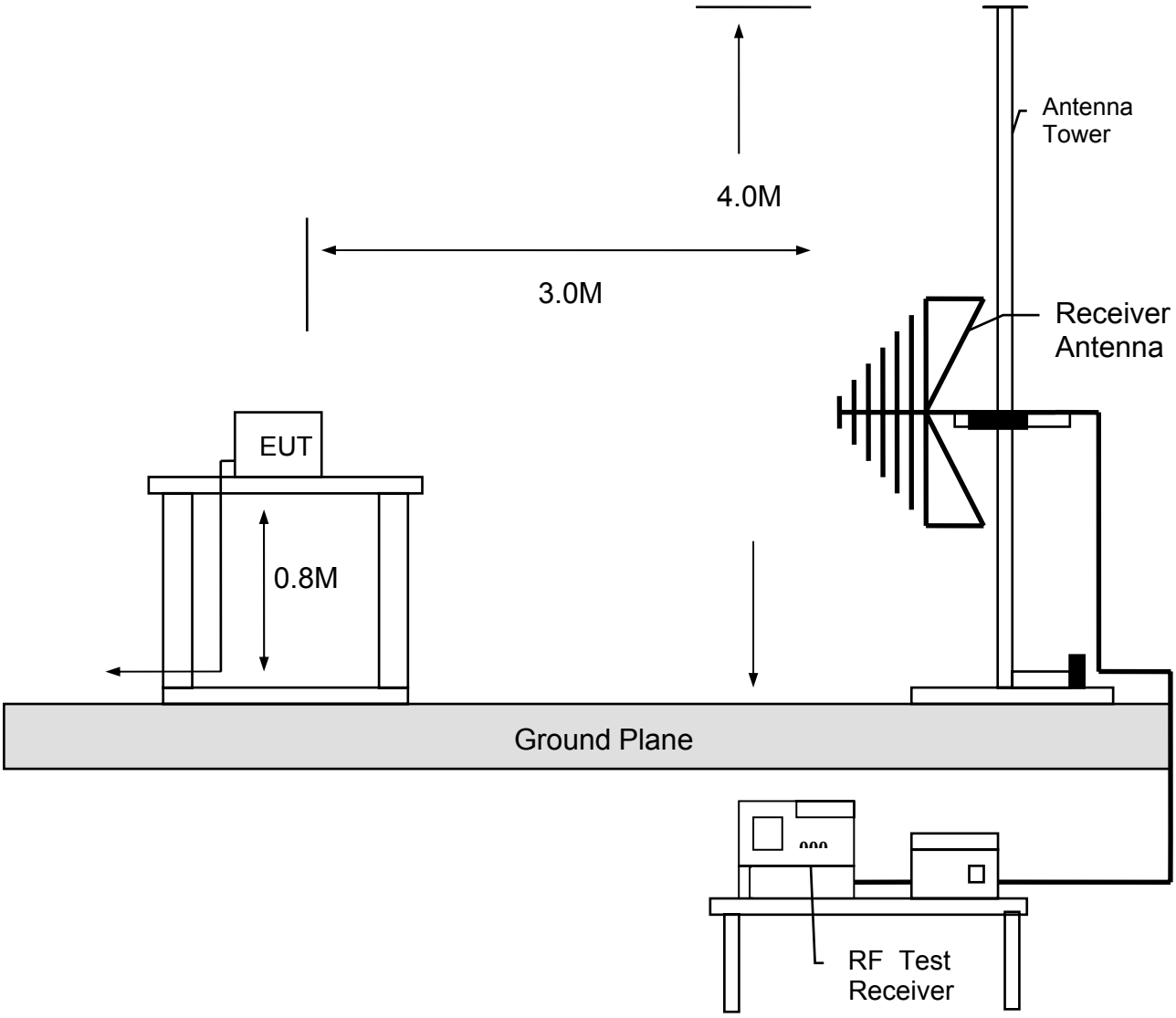
Ant. TYPE	Gain	type of connector
Chip antenna	2.2 dBi	Chip

Appendix I - EUT Test Setup

MEASUREMENT OF POWER LINE CONDUCTED RFI VOLTAGE



MEASUREMENT OF RADIATED EMISSION



Appendix II - Brand / Trade Name & Model No. Multiple Listee

Model No.	Trade Name
N/A	N/A