Korea Standard Testlab
107-27, Jangdeokdong-gil, Namyang-eup, Hwaseong-si, Gyeonggi-do, Korea
Tel : +82-31-356-7333 FAX : +82-31-356-7303

FCC TEST REPORT

Applicant Name	: ONESOFTDIGM. Co., Ltd.
Brand Name	: N/A
Applicant Address	: Jigok Research Bldg., 64, Jigok-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, 37666, Republic of Korea
FCC ID	: 2AKLA-FRL-B10
Products Name	: Fitrus Light
Model No.	: FRL-B10
Variant Model No.	: FR-B10
Products Manufacturer	: EST
Test Standard	: FCC CFR 47 Part 15 Subpart C
Test Method	: KDB 558074 v05r02 and ANSI C63.10:2013
Test Result	: PASS
Dates of Test	: APR 12, 2021 to APR 15, 2021
Date of Issue	: APR 15, 2021
Test Laboratory	: Korea Standard Testlab FCC Registration No. : 829397

Tested by

Seungho Baek
Test Engineer

Approved by

Su-wook Chae
Technical Manager

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1. General Information

1.1. Client Information

Applicant	:	ONESOFTDIGM. Co., Ltd.
Address of Applicant	:	Jigok Research Bldg., 64, Jigok-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, 37666, Republic of Korea

1.2. General Description of E.U.T.

Product Name	:	Fitrus Light
Model No.	:	FRL-B10

1.3. Details of E.U.T.

Operating Frequency	:	2402 MHz to 2480 MHz
Type of Modulation	:	GFSK
Number of Channels	:	40 Channels
Channel Separation	:	1 MHz, 2 MHz
Duty Cycle	:	Continuous operation possible for testing purposes
Antenna Type	:	Chip Antenna
Antenna gain	:	1.6 dBi
Speciality	:	Bluetooth specification version 5.2 (BLE)
Power Supply	:	Working voltage (DC Battery)
Normal Test Voltage	:	DC 3.7 V

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1.4. Test Facility

Korea Standard Testlab has been accredited as a designated testing laboratory by National Radio Research Agency in Korea under ISO/IEC 17025.

-. Address

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-. Laboratory Acceditations and Listings

KC Designation No. : KR0155
FCC Registration No. : 0028220721

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2. Test Equipment and Ancillaries used for Tests

No.	Test Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Data	Used equipment
1	Spectrum Analyzer	Agilent	E4440A	MY45304715	21.10.08	■
2	Signal and Spectrum Analyzer	ROHDE & SCHWARZ	FSV40	101267	21.12.07	■
3	DC Power Supply	KEYSIGHT	U8002A	MY5813082	22.02.22	■
4	Microwave Signal Generator	ROHDE & SCHWARZ	SMB 100A	180137	21.10.23	■
5	Synthesized CW Generator	HP	83711B	US34490158	21.05.20	■
6	Low Noise Amplifier	Testek	TK-PA06S	190018-L	21.05.21	■
7	Pre Amplifier	8449B	HP	3008A00224	21.05.20	■
8	Attenuator	TAE SUNG	SMA-2	N/A	21.05.20	■
9	Loop ANT.	Com-Power	AL-130	121010	21.06.10	■
10	Bi-log Antenna	SCHWARZBECK	VULB9160	3311	22.01.03	■
11	Horn ANT.	SCHWARZBECK	BBHA 9120 D	9120D-1281	21.05.08	■
12	Test Receiver	ROHDE&SCHWARZ	ESR7	102112	22.02.22	■
13	RMS Multimeter	CHEKMAN	TK-201	KT2018600226	22.02.24	■
14	Signal and Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101267	21.12.07	■

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3. Summary of Test Results

No	Test	Standard Sub-Class	Result
0	Antenna Requirement	§15.203	Compliant
1	6dB Bandwidth	§15.247(a)	Compliant
2	Conducted Maximum Output Power	§15.247(b)	Compliant
3	Power Spectral Density	§15.247(e)	Compliant
4	Conducted Spurious Emission	§15.247(d)	Compliant
5	Conducted Band Edges(Out of Band Emissions)	§15.247(d)	Compliant
6	Radiated Spurious Emission	§15.247(d), §15.205, §15.209	Compliant
7	Radiated Restricted Band Edge	§15.247(d), §15.205, §15.209	Compliant
8	Power Line Conducted Emission	§15.207	Non-Compliant (See Note)
9	Radio Frequency Exposure Procedures	§2.1093	Compliant

Note: This test is not performed because the EUT is operated by DC battery.

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4. Test Results

4.1. E.U.T. test conditions

Test Voltage:	DC 3.7 V (Battery)
Temperature:	25 °C
Humidity:	50 % RH
Atmospheric Pressure:	1 006 mbar
Test frequencies and frequency range:	Test frequencies are 2 402 MHz to 2 480 MHz. Low channel is 2 402 MHz, Middle channel is 2 440 MHz, High channel is 2 480 MHz, BLE Mode, Total channel is 40.

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4.1.1. EUT channels and frequencies list

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2 402	20	2 442
1	2 404	21	2 444
2	2 406	22	2 446
3	2 408	23	2 448
4	2 410	24	2 450
5	2 412	25	2 452
6	2 414	26	2 454
7	2 416	27	2 456
8	2 418	28	2 458
9	2 420	29	2 460
10	2 422	30	2 462
11	2 424	31	2 464
12	2 426	32	2 466
13	2 428	33	2 468
14	2 430	34	2 470
15	2 432	35	2 472
16	2 434	36	2 474
17	2 436	37	2 476
18	2 438	38	2 478
19	2 440	39	2 480

4.1.2. Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	2 402 MHz	2 440 MHz	2 480 MHz

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4.2. Antenna

4.2.1. Requirement

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.
The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.
The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.
Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2. Test Result

The transmitter has an integral Chip antenna. The directional gain of the antenna is 1.6 dBi

Test result : Pass

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4.3. Duty Cycle

4.3.1. Requirement

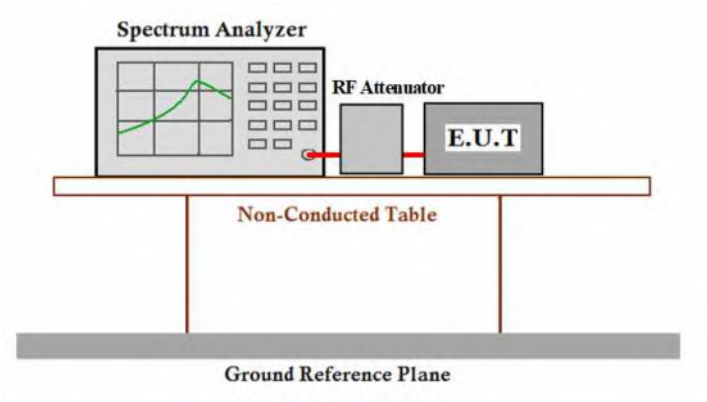
The transmitter output is connected to the Spectrum Analyzer.

We tested according to the zero-span measurement method, 6.0)b) in KDB 558074 v05r02.

4.3.2. Test method

KDB 558074 v05r02

4.3.3. Test Configuration



4.3.4. Test Procedure

1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2) Set the spectrum analyzer :

a) Set RBW = 8MHz(the largest availble value)

b) Set the video bandwidth (VBW) =8 MHz(≥ RBW)

c) Detector = Peak.

d) Trace mode = Clear write.

e) SPAN = 0 Hz

f) Measure T_{total} and T_{on}

g) Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

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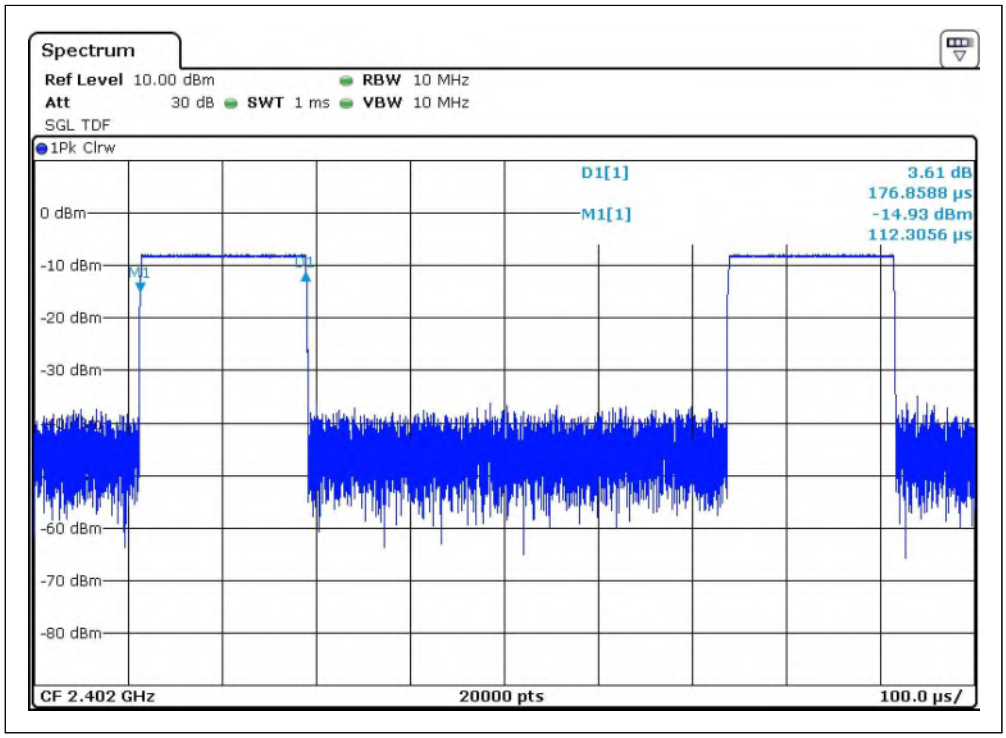
4.3.5. Test result

Data rate (Bit/s)	Packet length (Byte)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
1M	10	0.177	0.626	0.2827	5.49

1M Bit/s Test Plots :

Duty Cycle(Low-CH 0) T_{on}



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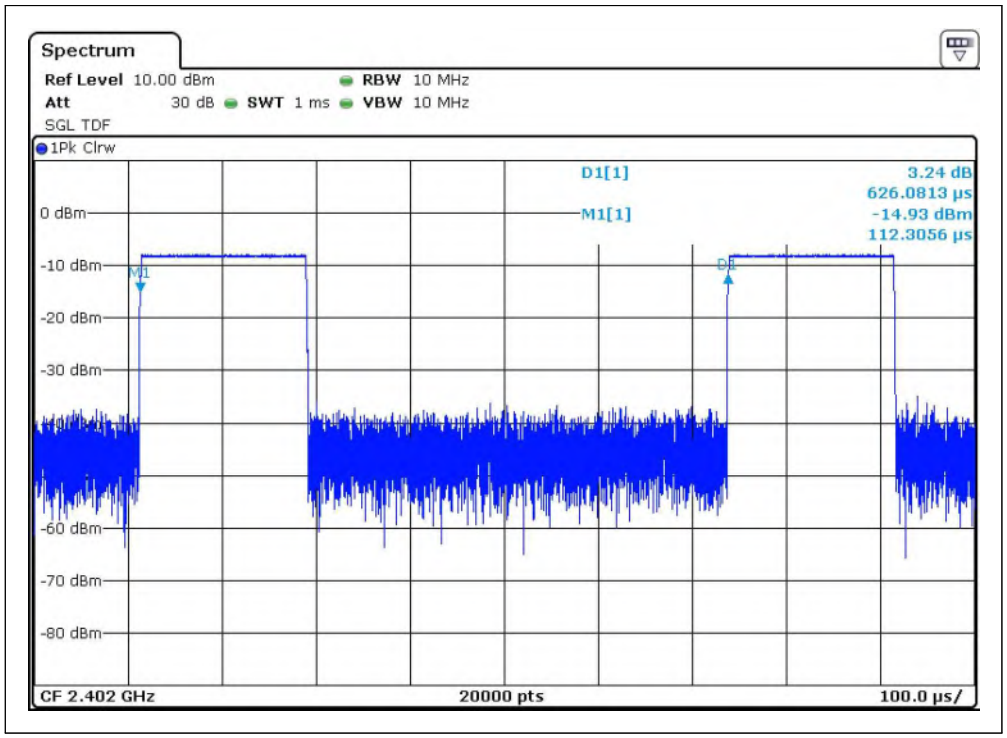
Duty Cycle(Low-CH 0) T_{total}



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4.4. 6 dB Bandwidth

4.4.1. Requirement

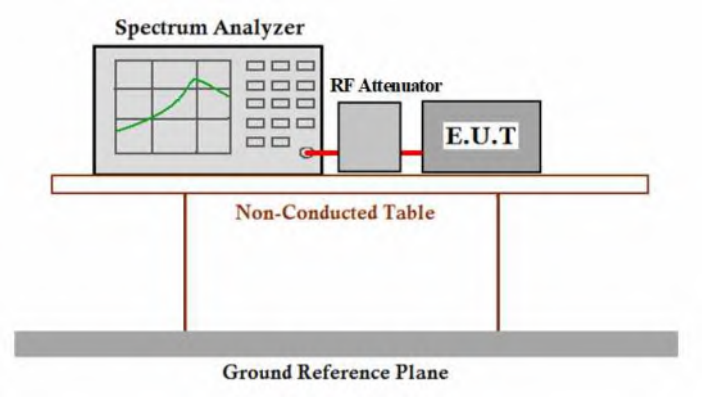
FCC Part 15 C section 15.247

(a)(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.4.2. Test method

KDB 558074 v05r02 and ANSI C63.10:2013

4.4.3. Test Configuration



4.4.4. Test Procedure

1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2) Set the spectrum analyzer :

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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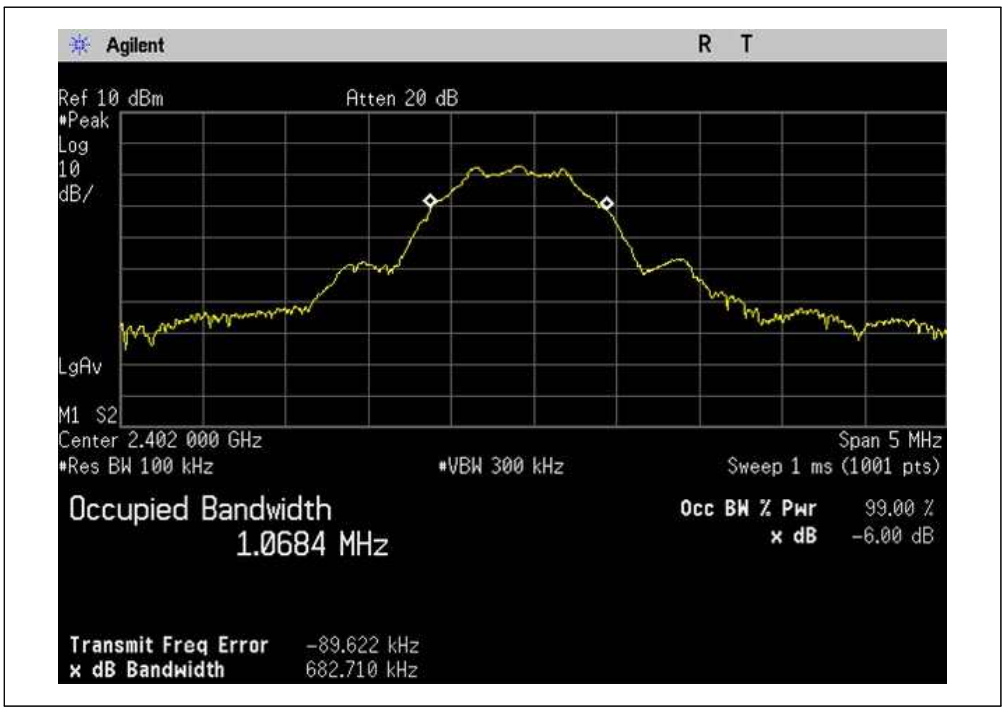
4.4.5. Test result

Mode (Bit/s)	Channel	6dB Bandwidth (kHz)	Limit (kHz)
1M	0	682.710	>500
	19	688.653	
	39	681.318	
2M	0	1148	
	19	1162	
	39	1167	

Test result : The unit does meet the FCC requirements.

Please refer to the following test plots:

1M (Low-CH 0)



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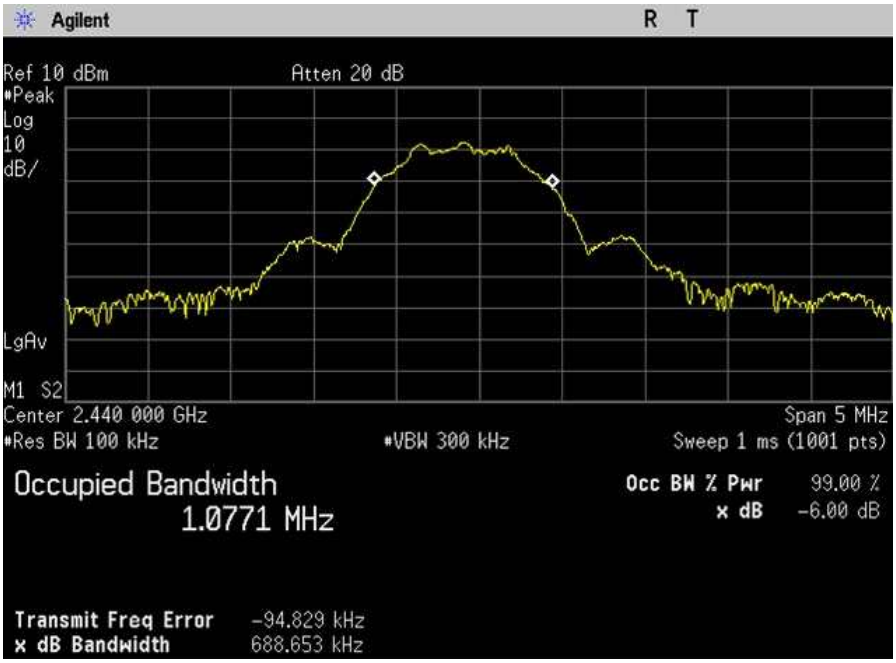
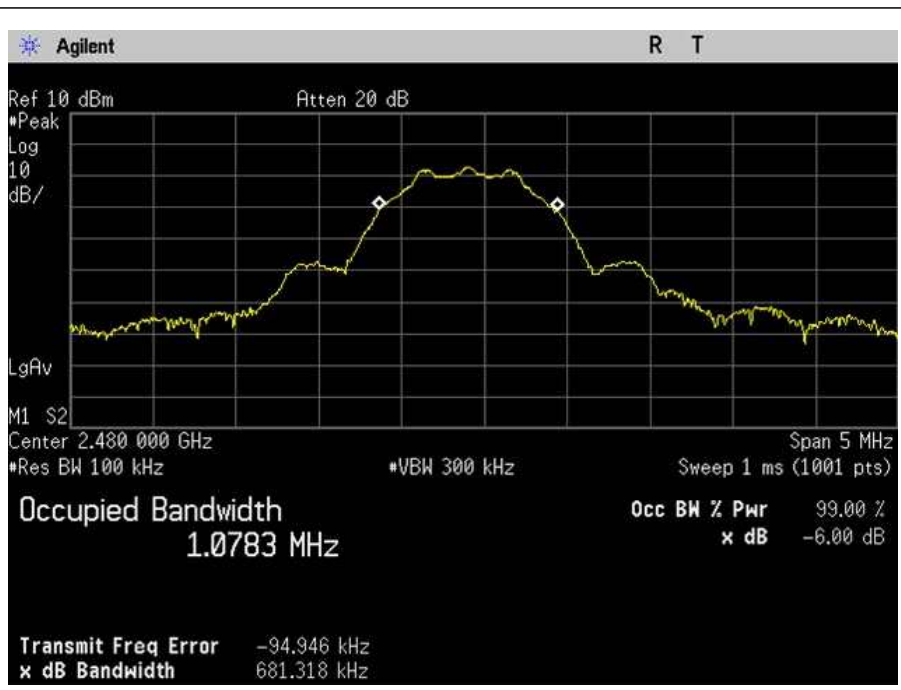
1M (Mid-CH 19)



1M (High-CH 39)



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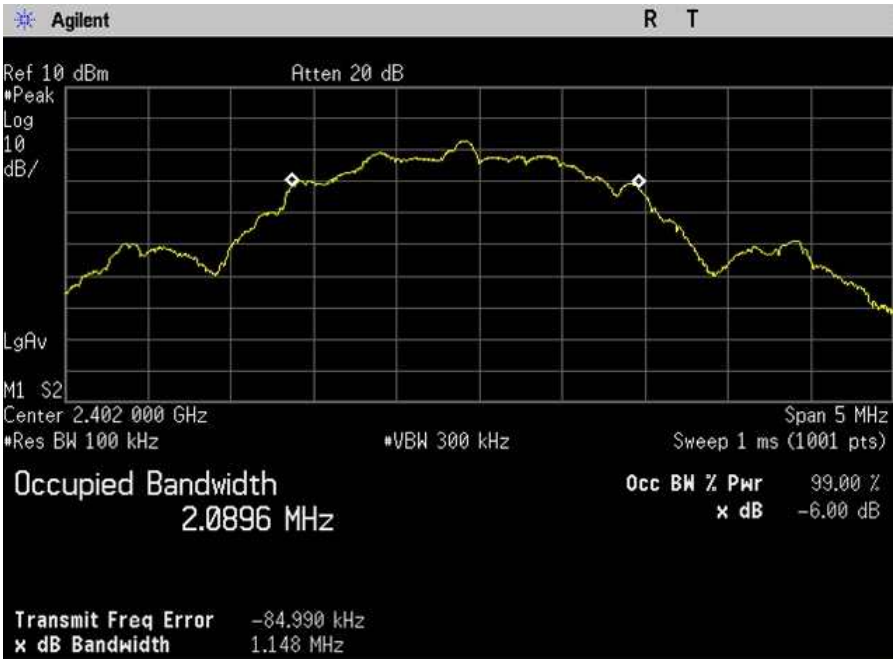
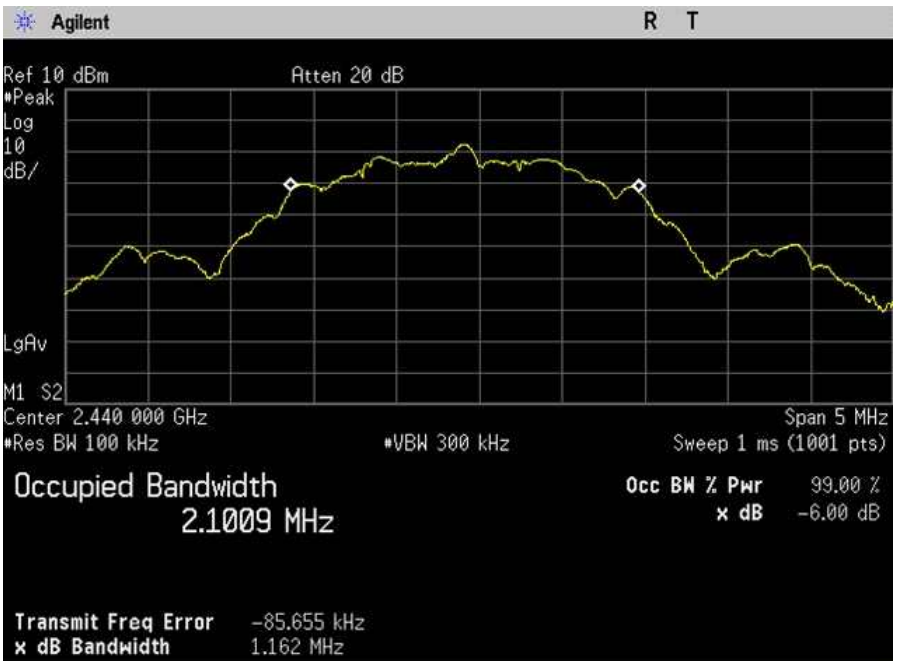
2M (Low-CH 0)



2M (Mid-CH 19)



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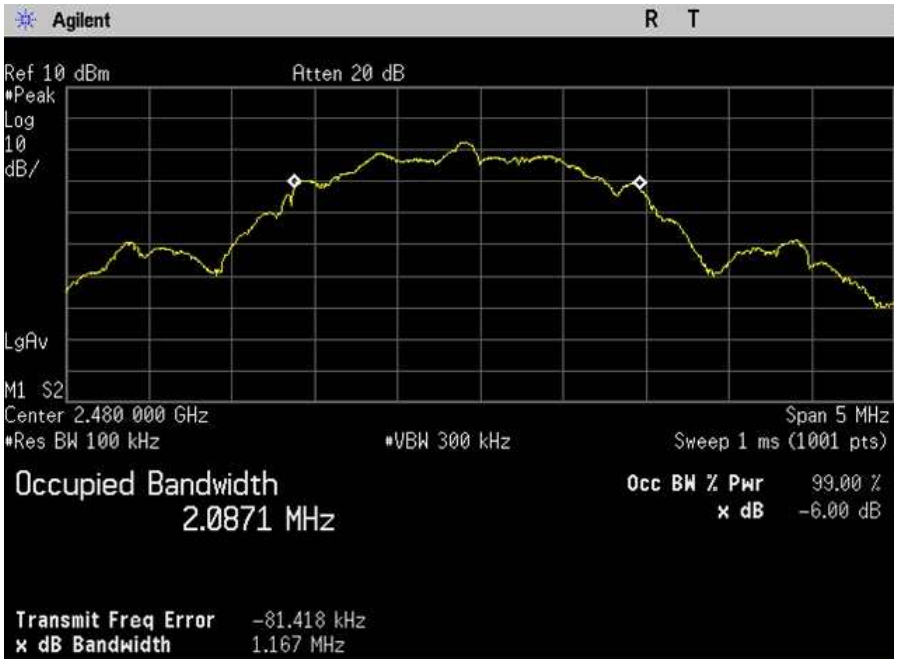
2M (High-CH 39)



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4.5. Conducted Maximum Output Power

4.5.1. Requirement

FCC Part 15 C section 15.247

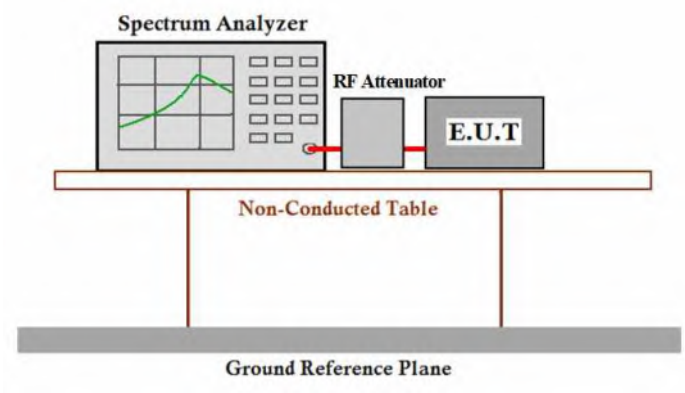
(b)(3) For systems using digital modulation in the 902 ~ 928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 MHz bands: 1 Watt.

Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b) (1), (b) (2), and (b) (3) of section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.5.2. Test Method

KDB 558074 v05r02 and ANSI C63.10:2013

4.5.3. Test Configuration



4.5.4. Test Procedure

1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2) Set the spectrum analyzer:
   a) Set RBW ≥ DTS bandwidth
   b) Set the video bandwidth (VBW) ≥ 3 × RBW.
   c) Set span ≥ 3 × RBW.
   d) Sweep time = auto couple.
   e) Detector = Peak.
   f) Trace mode = max hold.
   g) Allow the trace to stabilize.
   h) Use peak marker function to determine the peak amplitude level.

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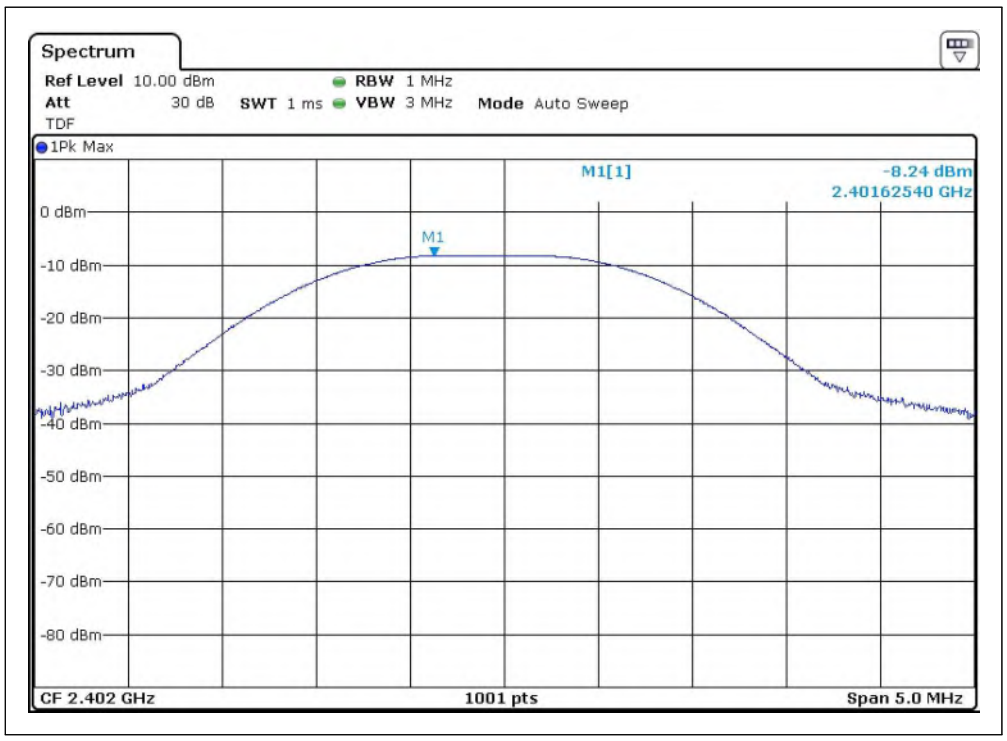
4.5.5. Test result

Mode (Bit/s)	Channel	Highest signal level (dBm)	Limit (dBm)
1M	0	-8.24	30 (1 Watt)
	19	-8.49	
	39	-8.63	
2M	0	-8.31	
	19	-8.52	
	39	-8.64	

Test result : The unit does meet the FCC requirements.

Please refer to the following test plots:

1M (Low-CH 0)



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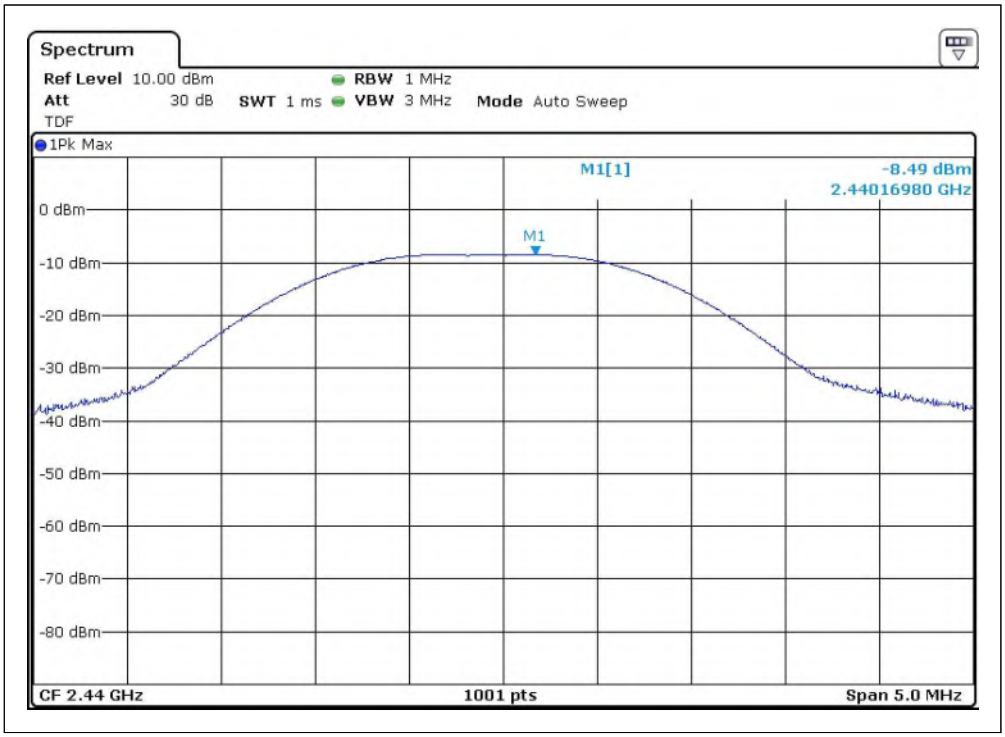
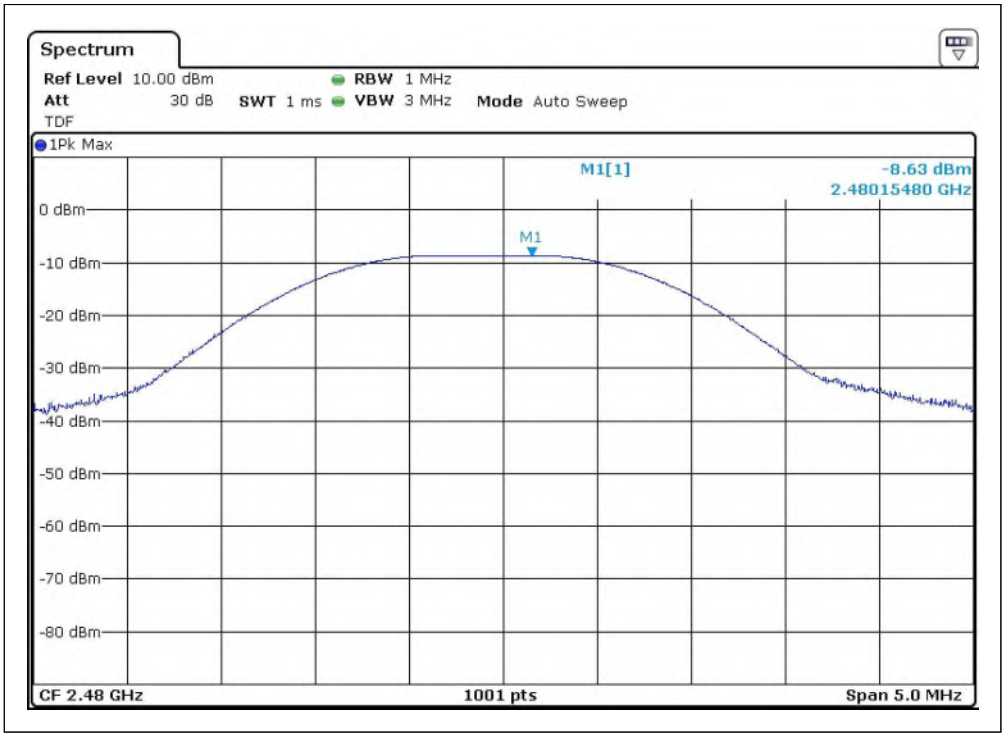
1M (Mid-CH 19)



1M (High-CH 39)



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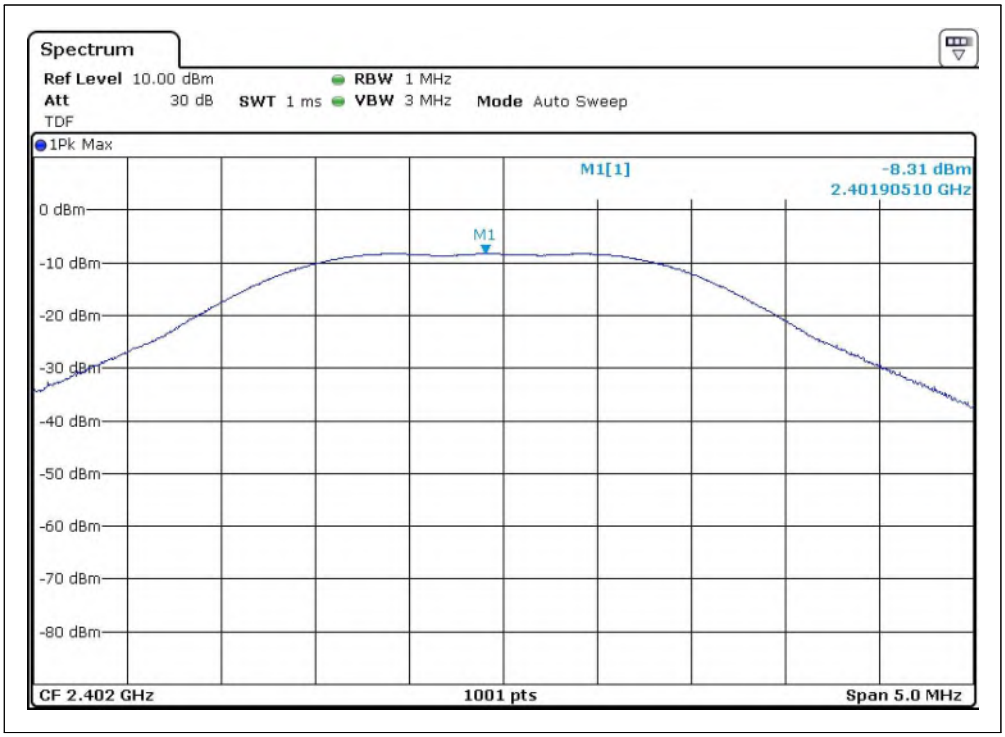
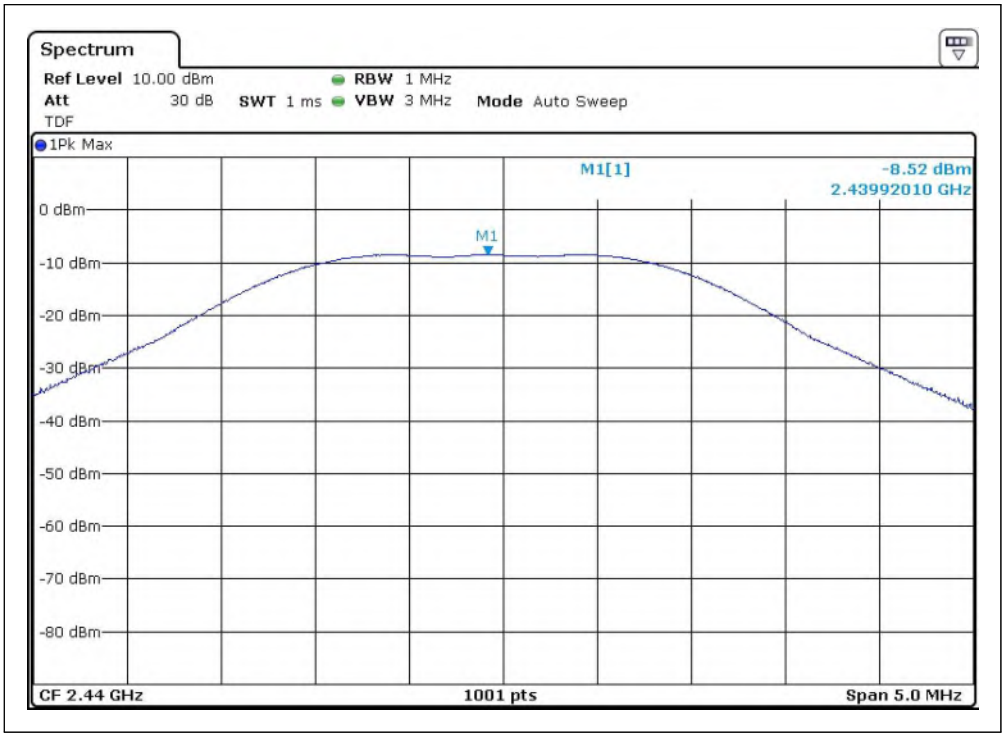
2M (Low-CH 0)



2M (Mid-CH 19)



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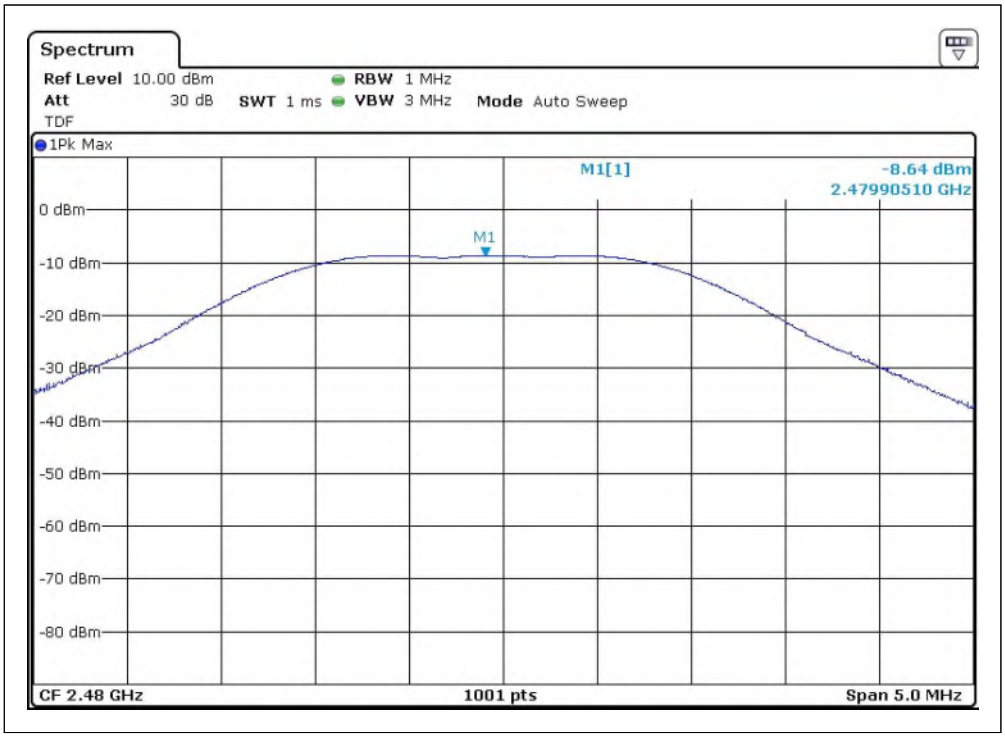
2M (High-CH 39)



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4.6. Power Spectral Density

4.6.1. Requirement

FCC Part 15 C section 15.247

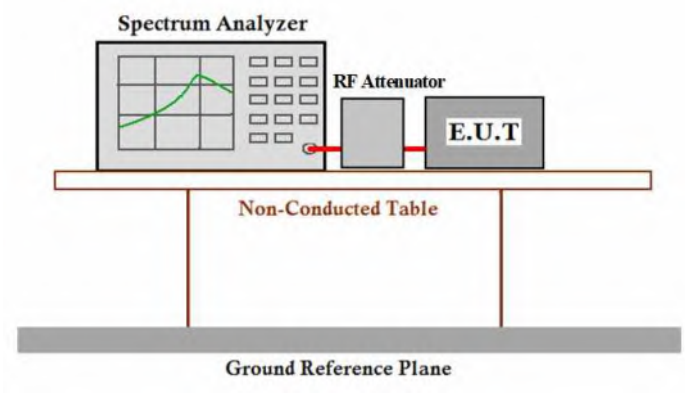
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

4.6.2. Test Method

KDB 558074 v05r02 and ANSI C63.10:2013

4.6.3. Test Configuration



4.6.4. Test Procedure

1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2) Set the spectrum analyzer:
   a) Set analyzer center frequency to DTS channel center frequency.
   b) Set the span to 1.5 times the DTS bandwidth.
   c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
   d) Set the VBW ≥ 3 × RBW.
   e) Detector = peak.
   f) Sweep time = auto couple.
   g) Trace mode = max hold.
   h) Allow trace to fully stabilize.
   i) Use the peak marker function to determine the maximum amplitude level within the RBW.
   j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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4.6.5. Test result

Frequency (MHz)	Channel No.	Mode	Test Result			
			Measured Power(dBm)	Duty Cycle Factor(dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
2402	0	1M	-8.34	5.49	-2.85	8
2440	19		-8.51	5.49	-3.02	
2480	39		-8.61	5.49	-3.12	
2402	0	2M	-8.34	5.49	-2.85	
2440	19		-8.53	5.49	-3.04	
2480	39		-8.62	5.49	-3.13	

Note:

1. Spectrum reading values are not plot data.
   The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. This unit does meet the FCC requirements.

Please refer to the following test plots:

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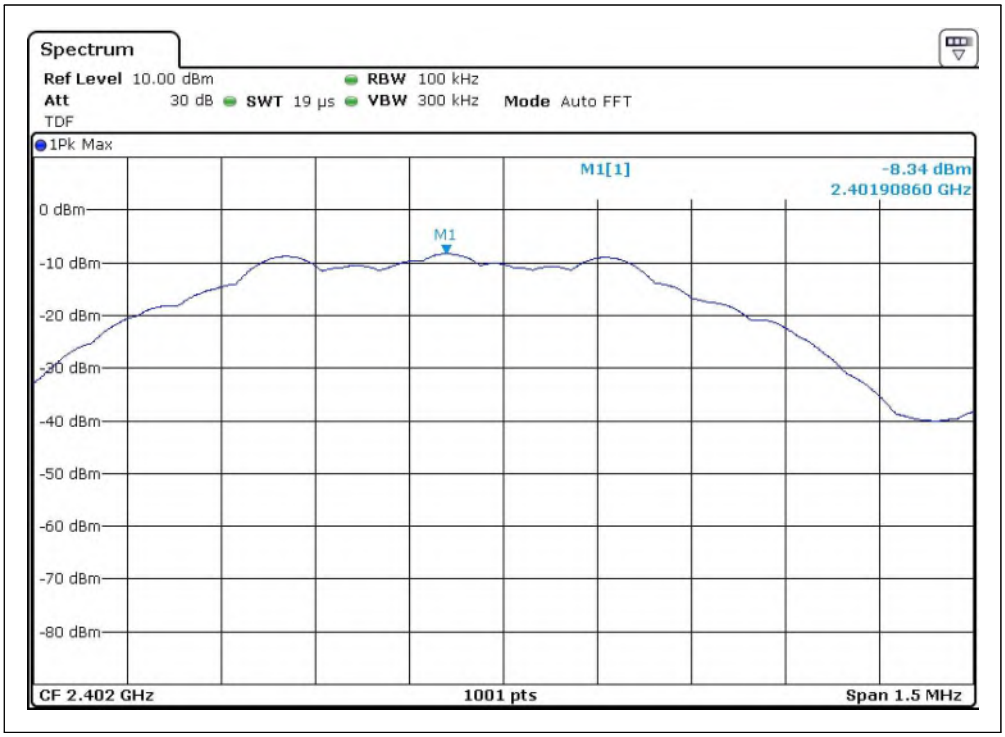
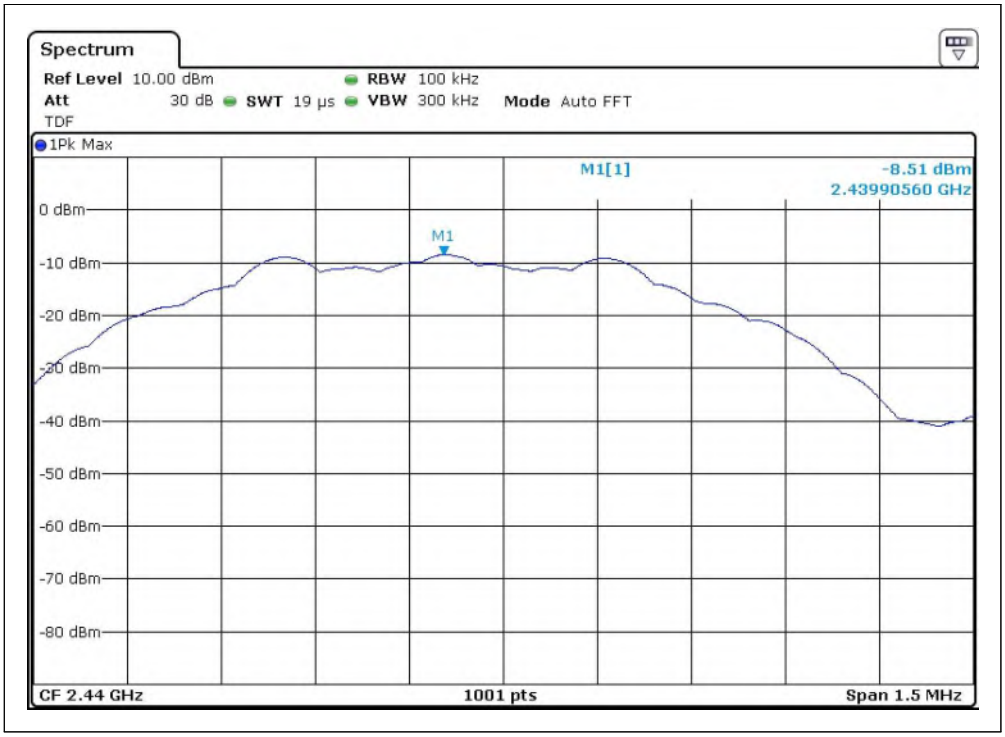
1M (Low-CH 0)



1M (Mid-CH 19)



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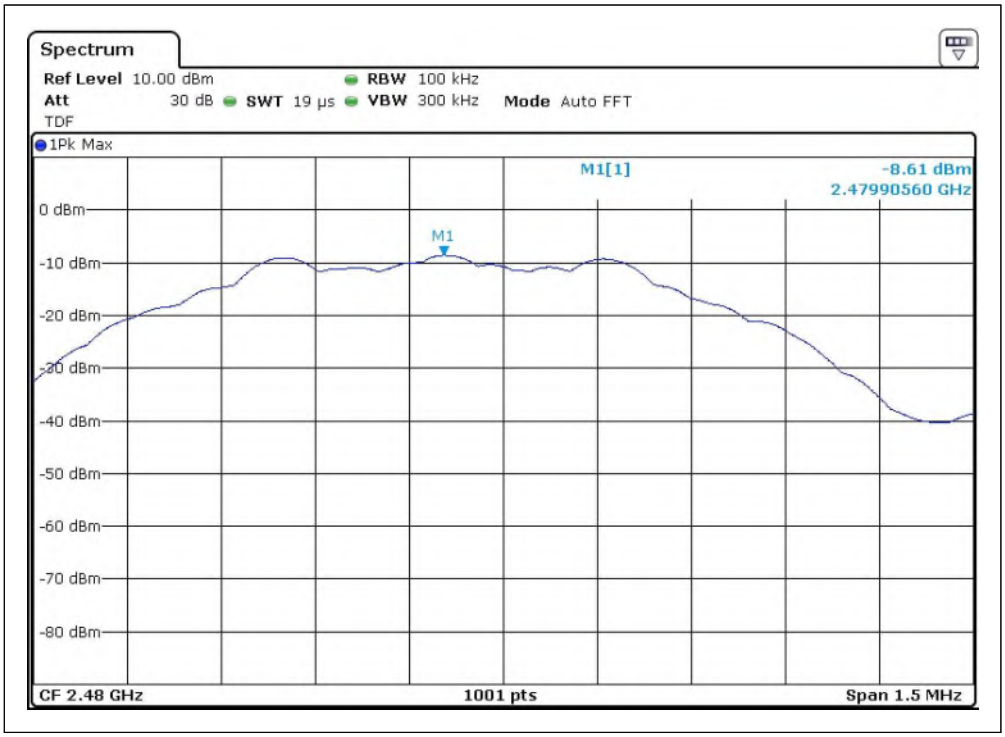
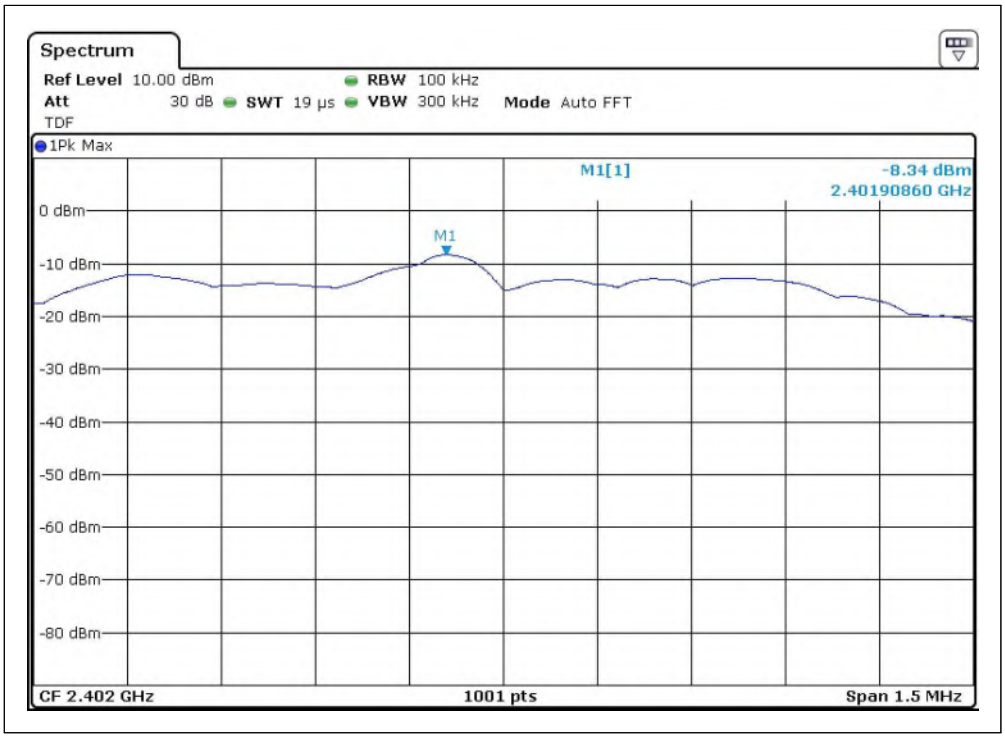
1M (High-CH 39)



2M (Low-CH 0)



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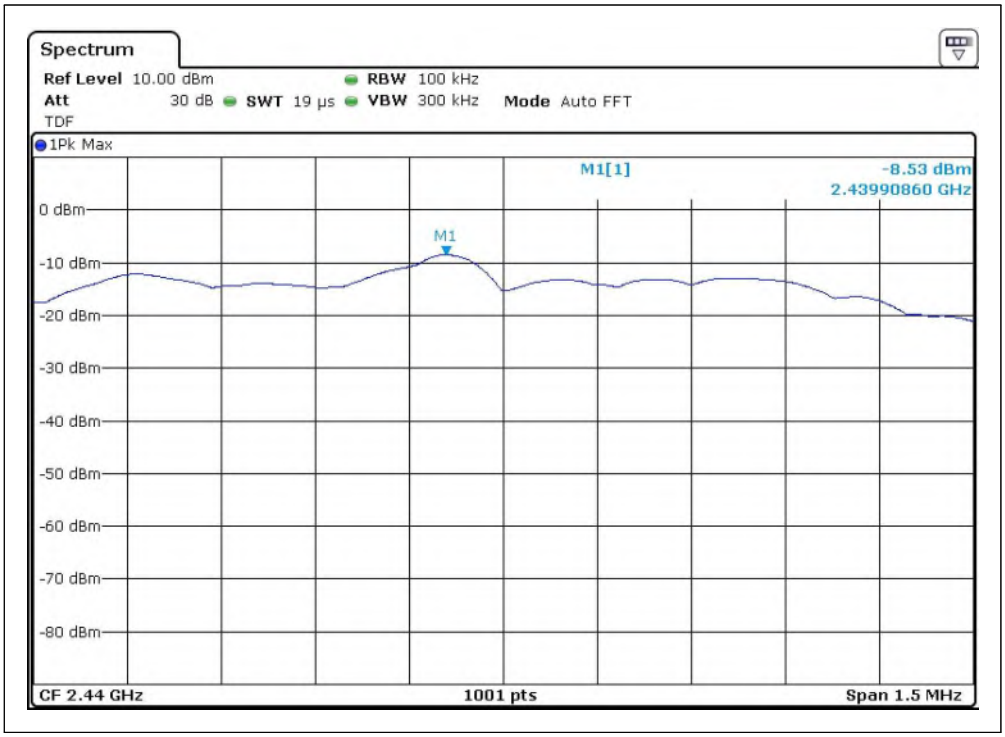
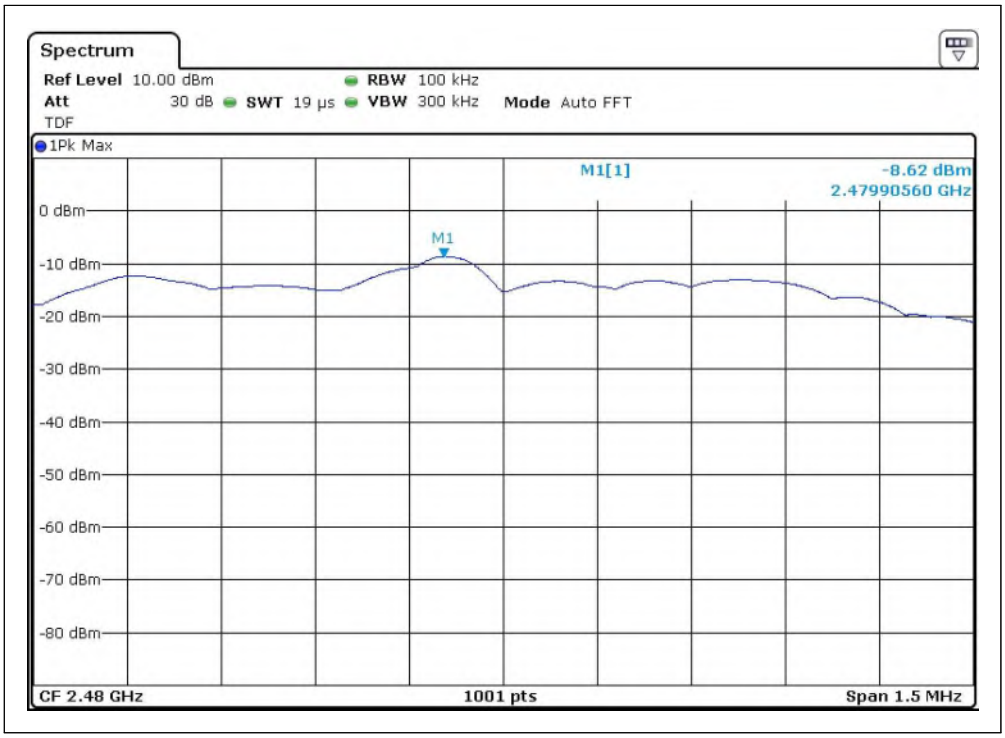
2M (Mid-CH 19)



2M (High-CH 39)



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4.7. Conducted Spurious Emission

4.7.1. Requirement

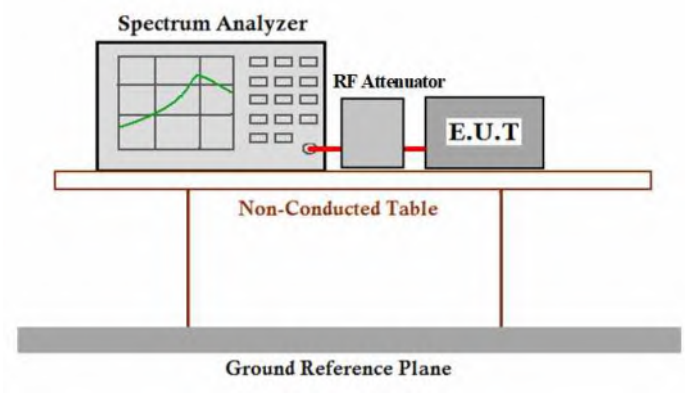
FCC Part15 C section 15.247

(d) 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.

4.7.2. Test Method

KDB 558074 v05r02 and ANSI C63.10:2013

4.7.3. Test Configuration



4.7.4. Test Procedure

1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

2) Set the spectrum analyzer:

a) Set the RBW = Below 1GHz: 100 kHz , Above 1GHz: 1 MHz

b) Set the VBW = Below 1GHz: 300 kHz , Above 1GHz: 3 MHz

c) Detector = peak.

d) Sweep time = auto couple.

e) Trace mode = max hold.

f) Scan up through 10th harmonic.

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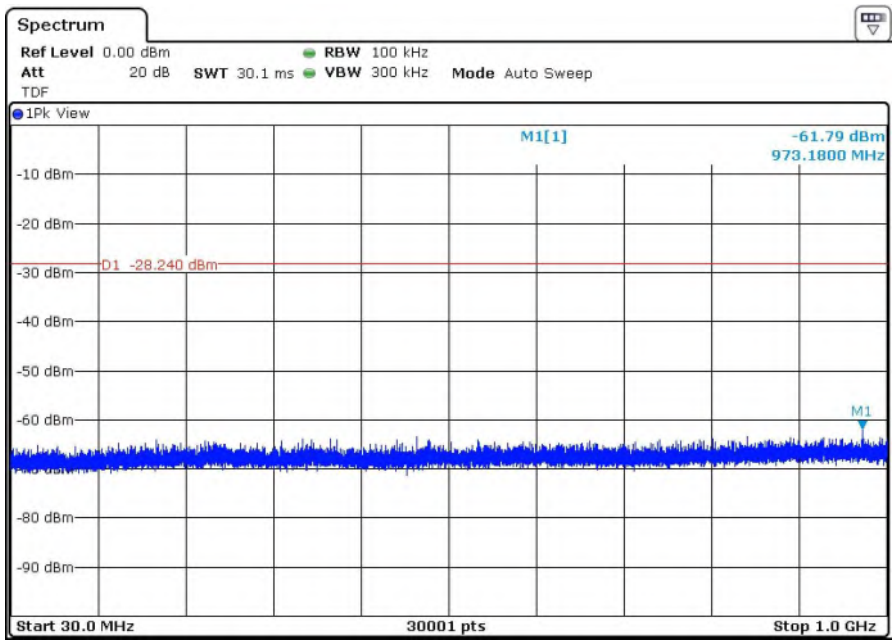
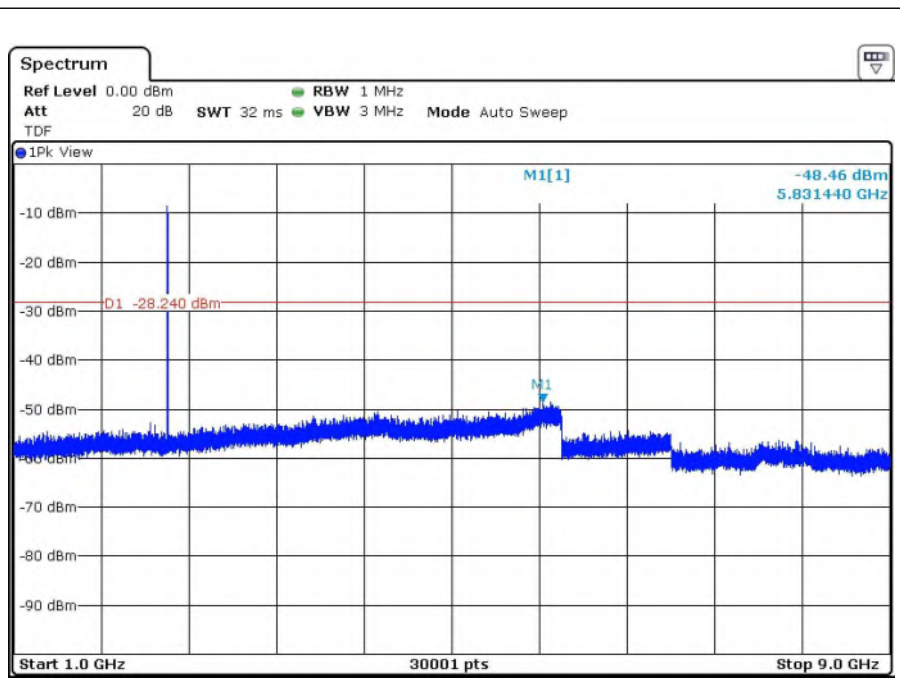
4.7.5. Test result

1M (Low-CH 0)_30 MHz to 1 GHz



1M (Low-CH 0)_1 GHz to 9 GHz



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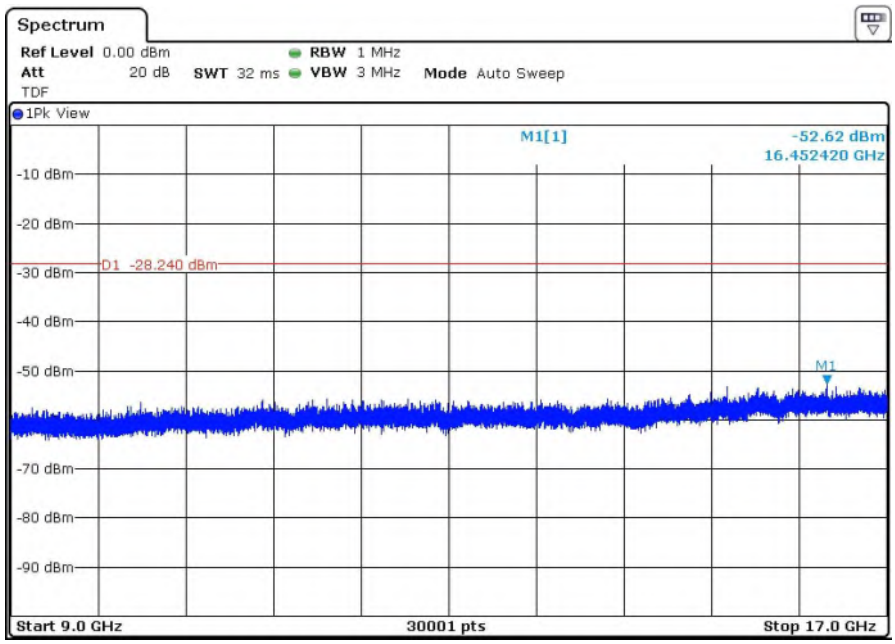
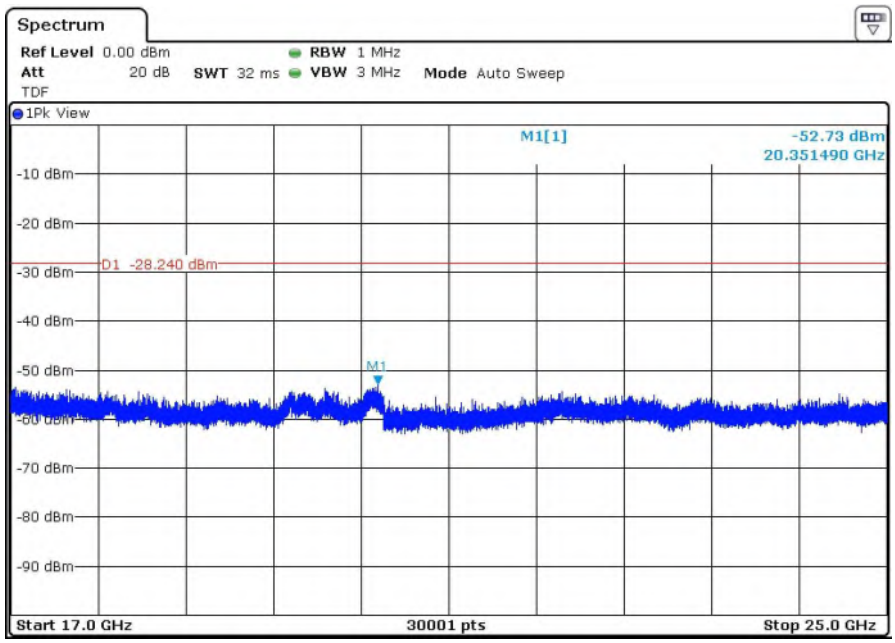
1M (Low-CH 0)_9 GHz to 17 GHz



1M (Low-CH 0)_17 MHz to 25 GHz



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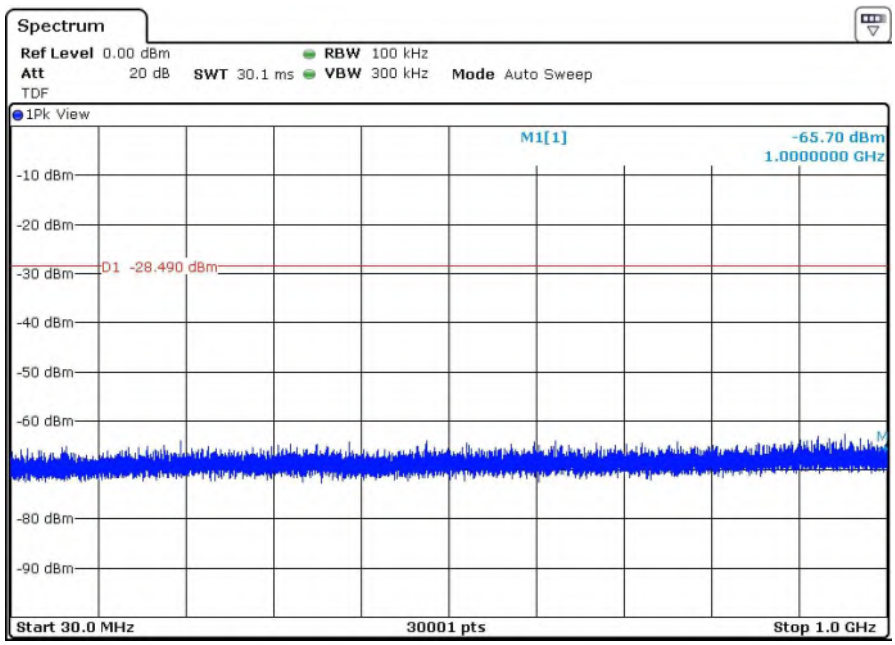
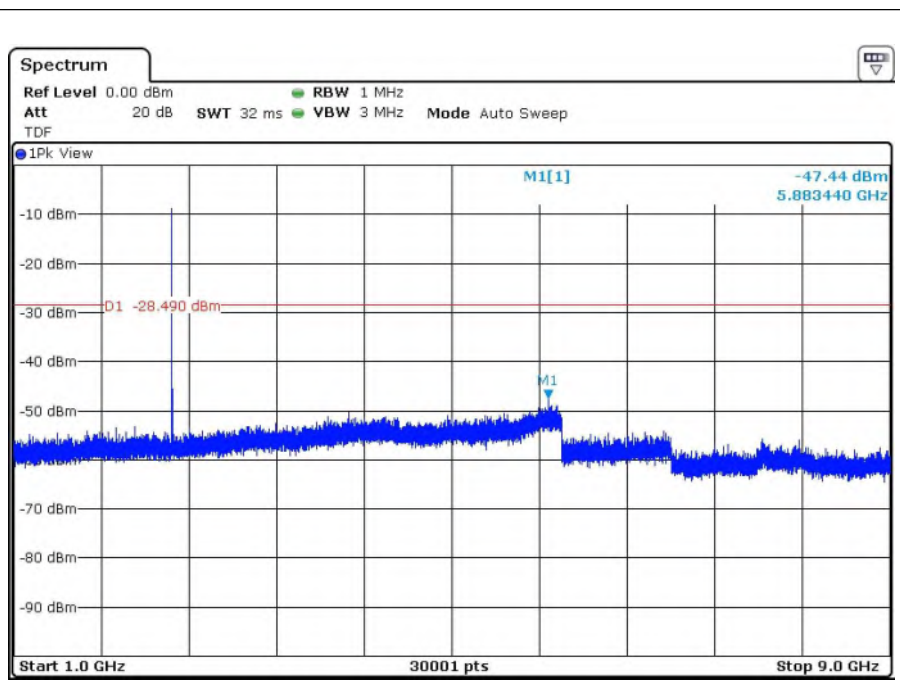
1M (Mid-CH 19)_30 MHz to 1 GHz



1M (Mid-CH 19)_1 GHz to 9 GHz



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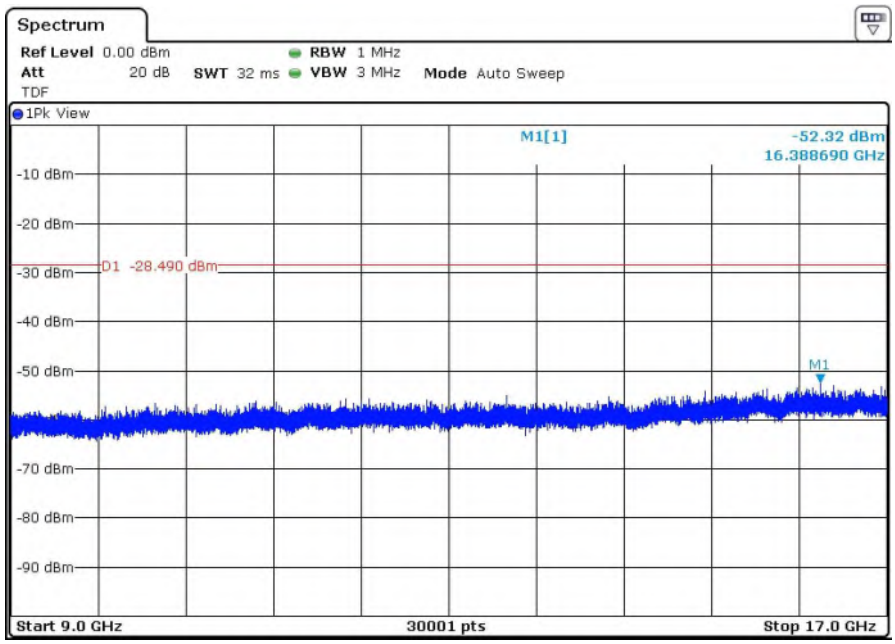
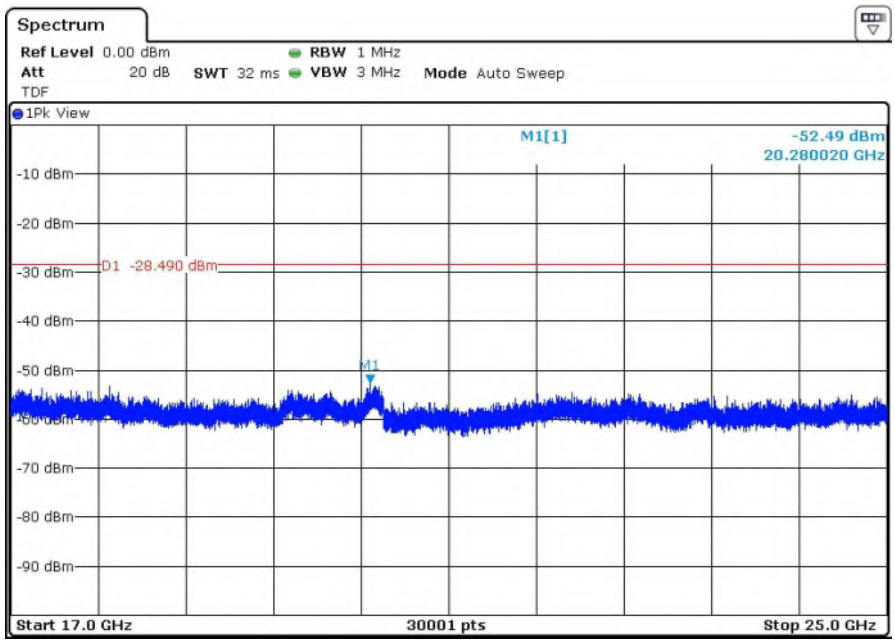
1M (Mid-CH 19)_9 GHz to 17 GHz



1M (Mid-CH 19)_17 MHz to 25 GHz



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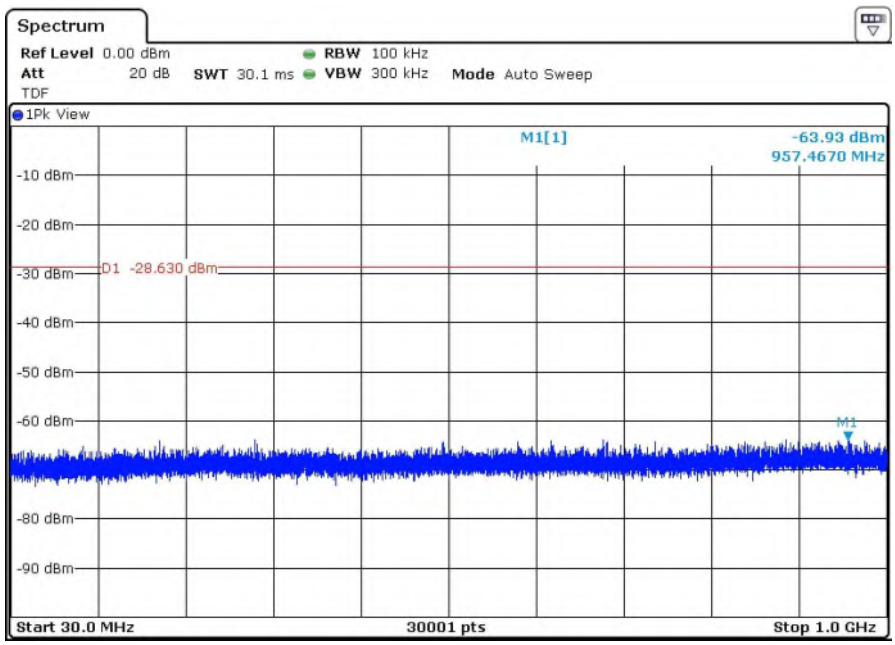
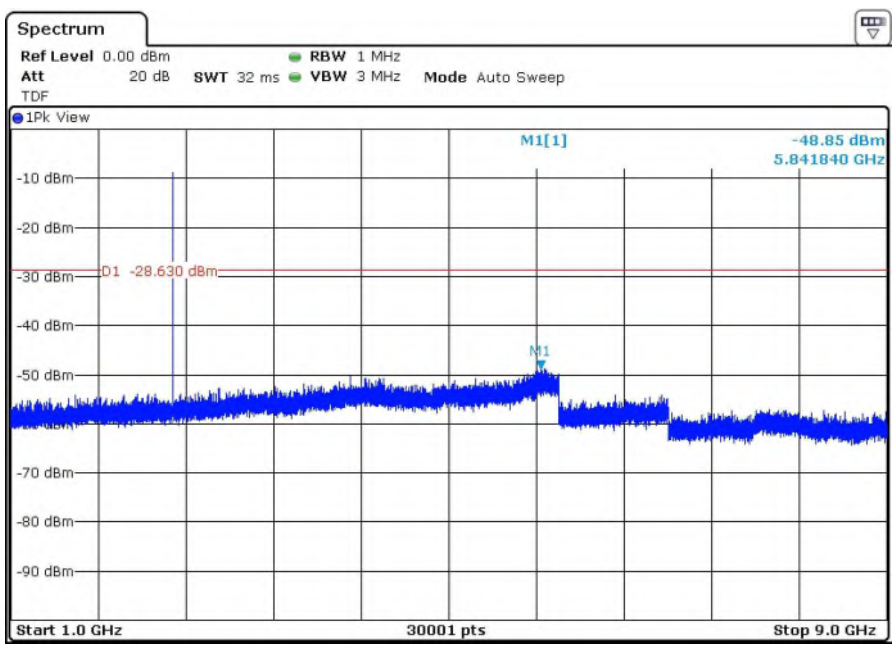
1M (High-CH 39)_30 MHz to 1 GHz



1M (High-CH 39)_1 GHz to 9 GHz



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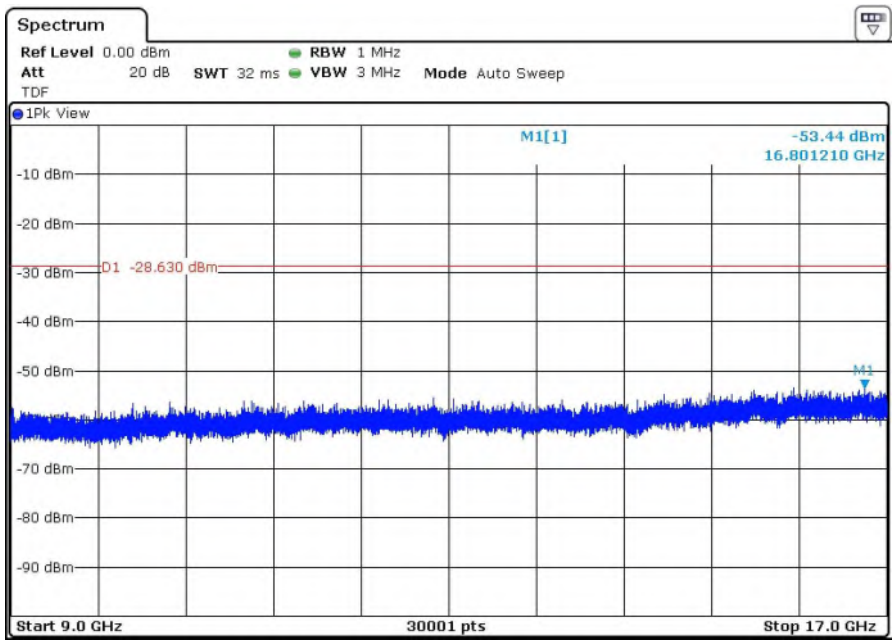
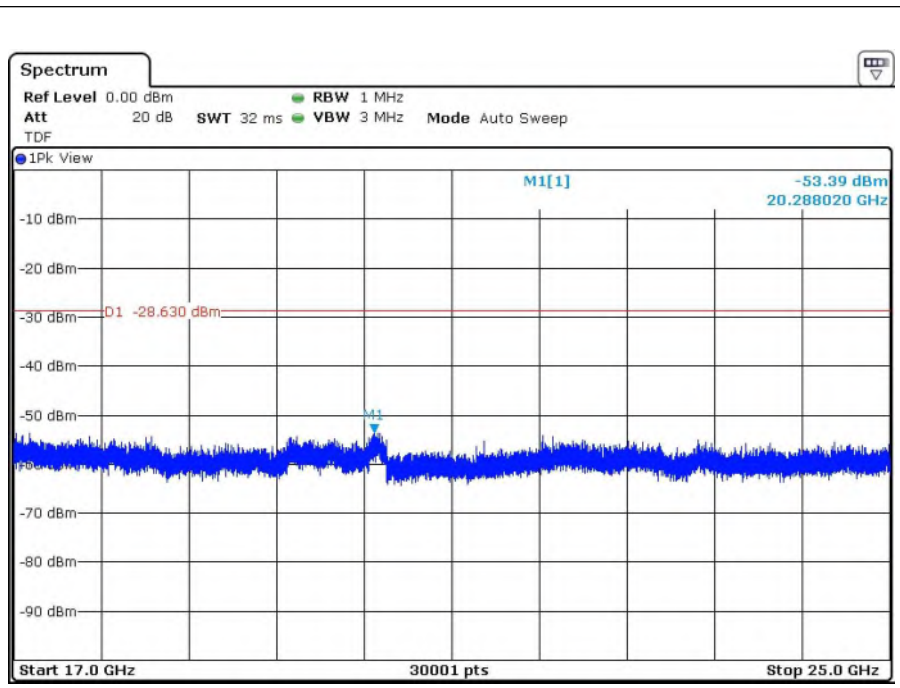
1M (High-CH 39)_9 GHz to 17 GHz



1M (High-CH 39)_17 MHz to 25 GHz



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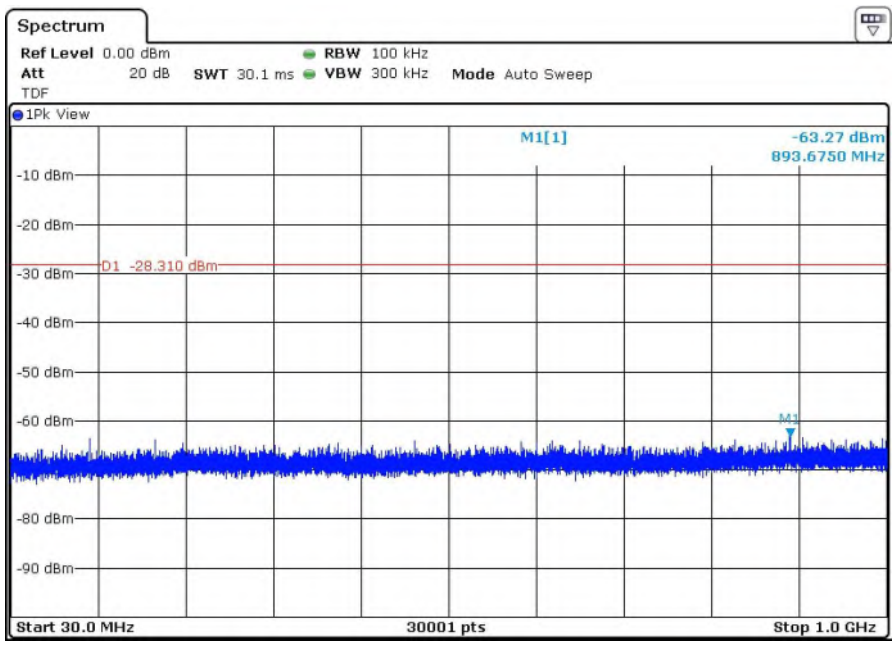
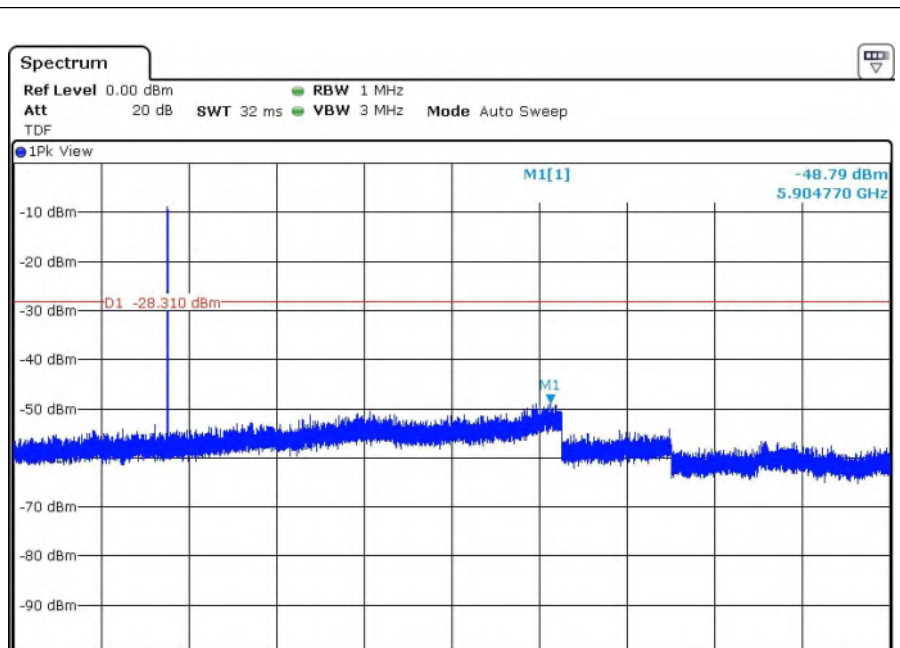
2M (Low-CH 0)_30 MHz to 1 GHz



2M (Low-CH 0)_1 GHz to 9 GHz



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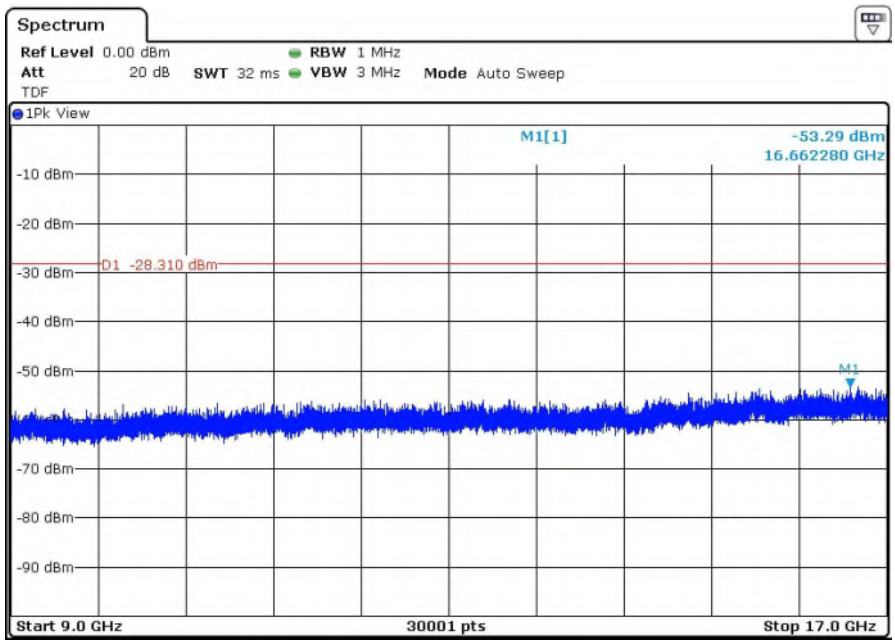
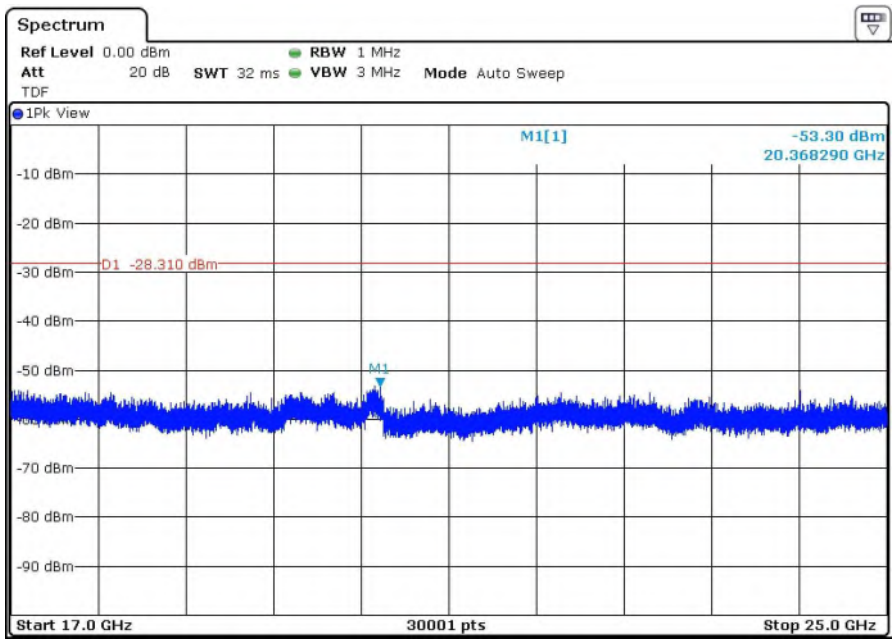
2M (Low-CH 0)_9 GHz to 17 GHz



2M (Low-CH 0)_17 MHz to 25 GHz



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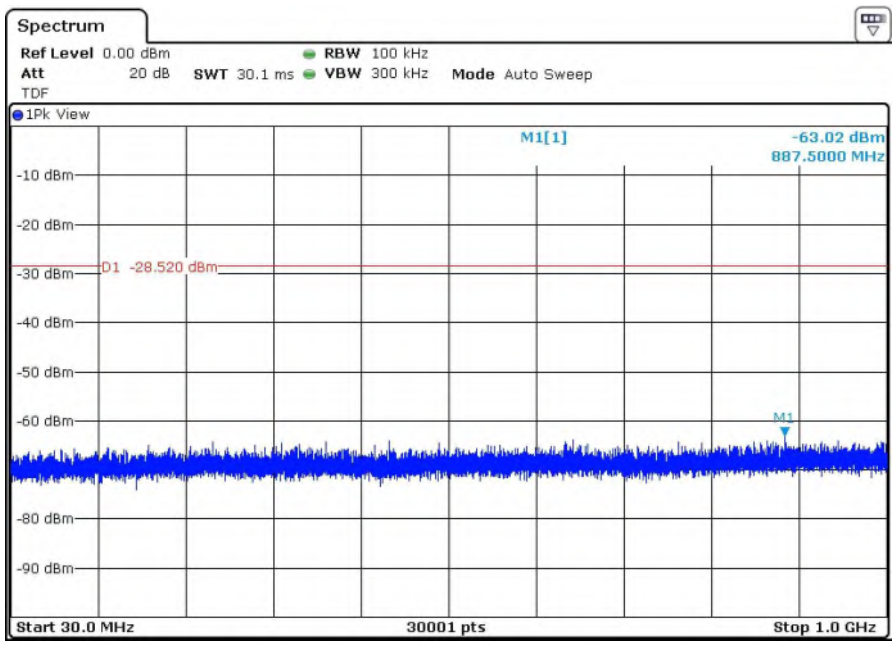
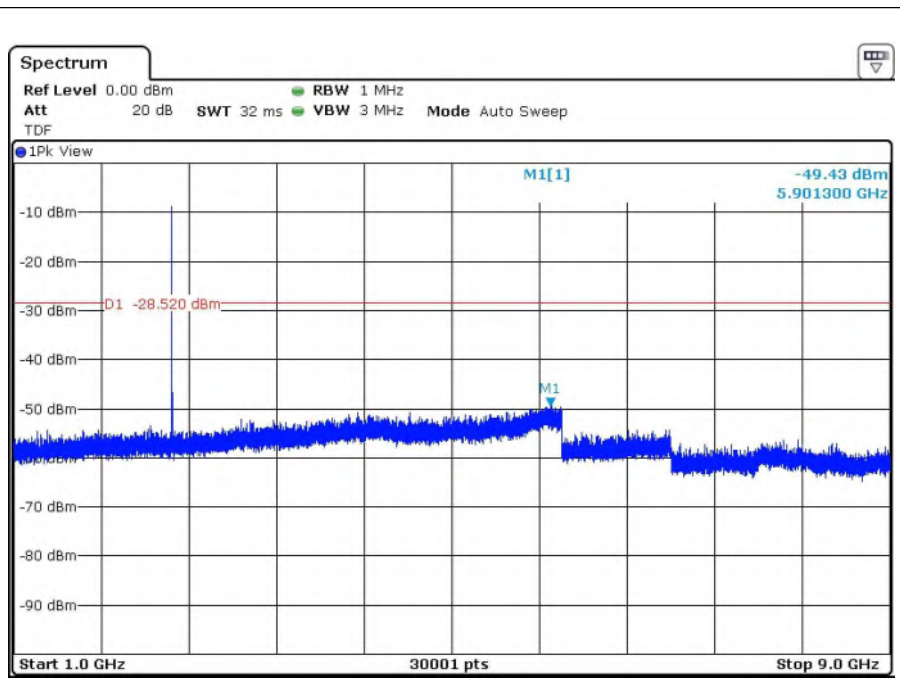
2M (Mid-CH 19)_30 MHz to 1 GHz



2M (Mid-CH 19)_1 GHz to 9 GHz



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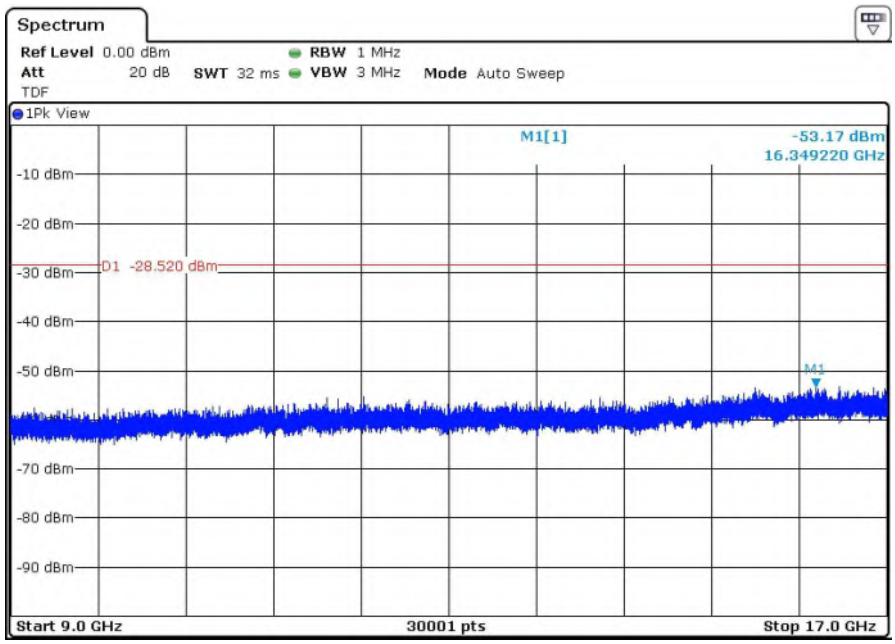
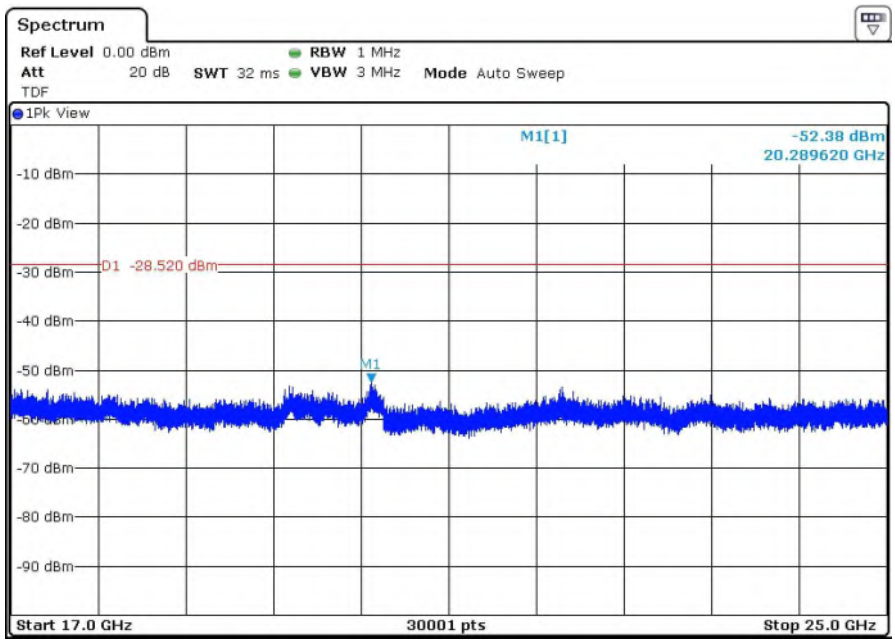
2M (Mid-CH 19)_9 GHz to 17 GHz



2M (Mid-CH 19)_17 MHz to 25 GHz



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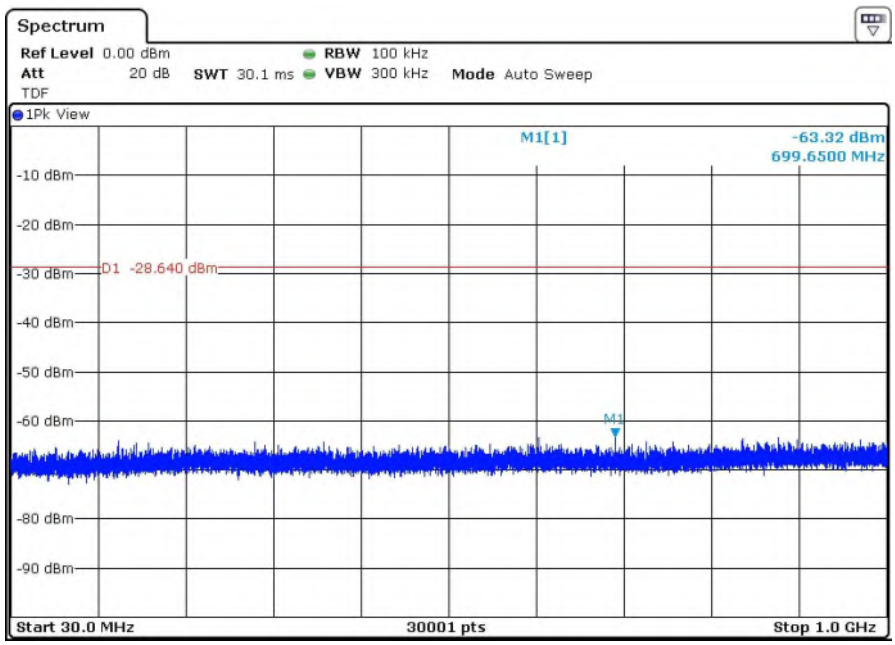
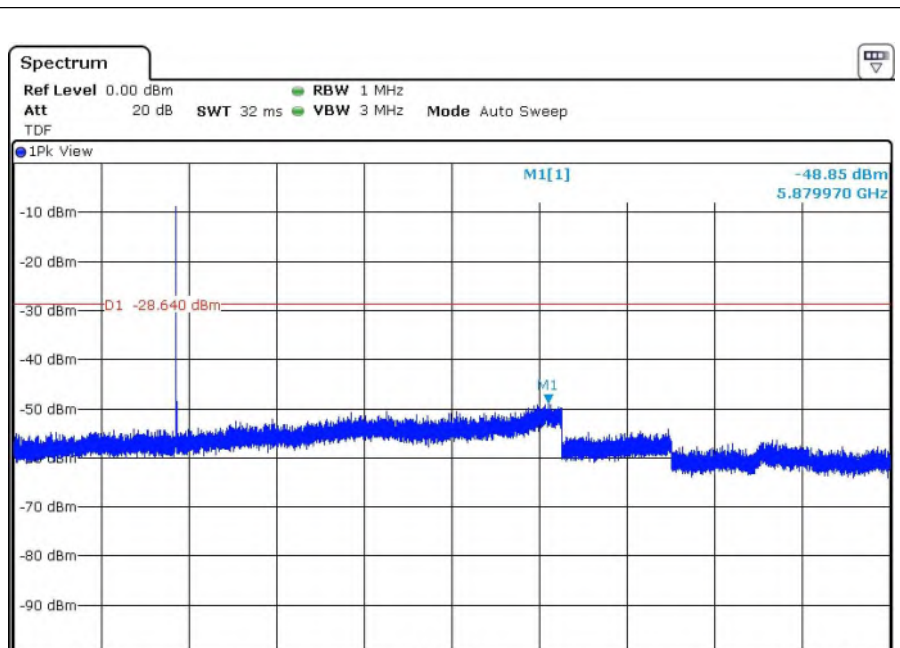
2M (High-CH 39)_30 MHz to 1 GHz



2M (High-CH 39)_1 GHz to 9 GHz



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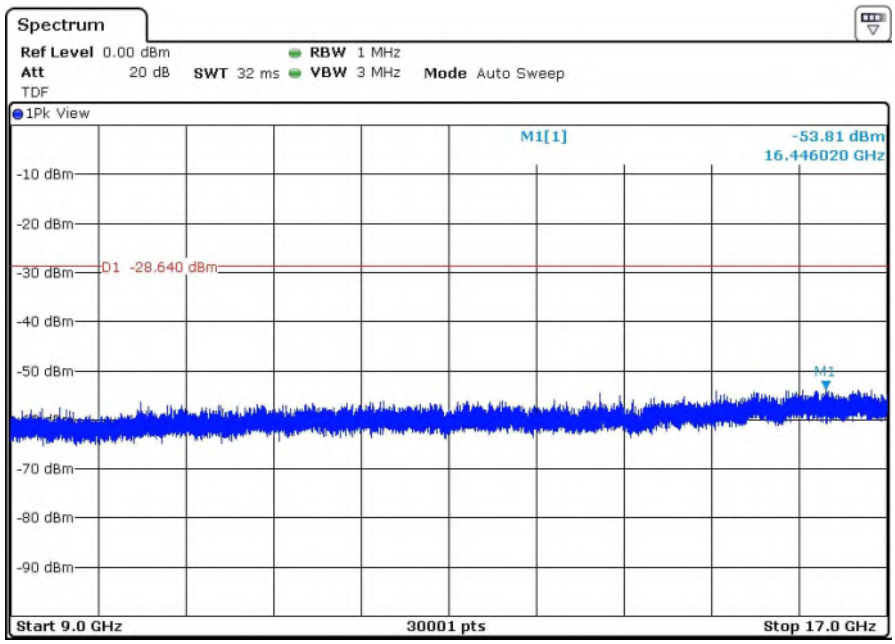
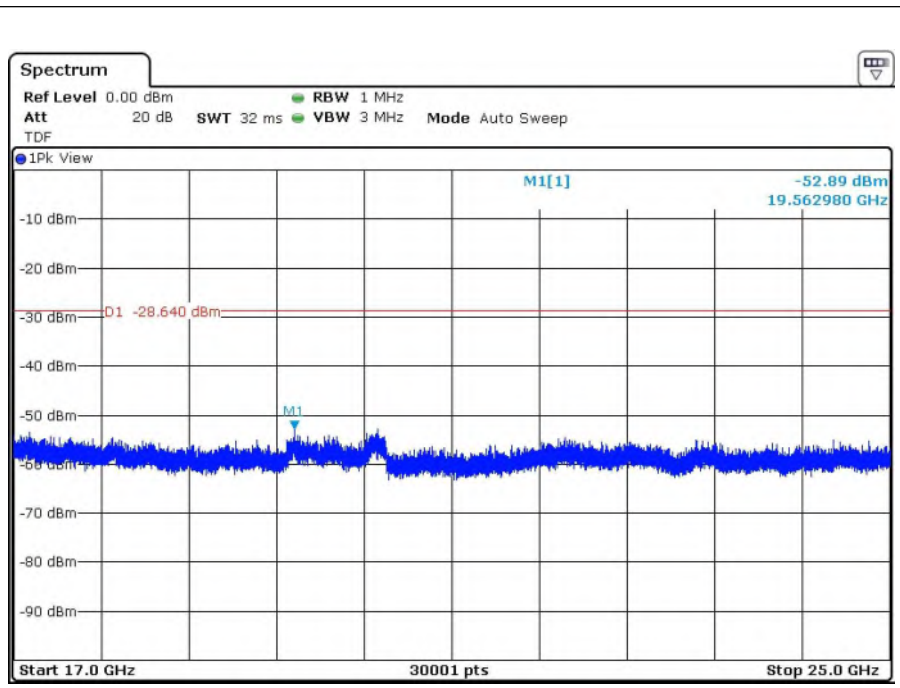
2M (High-CH 39)_9 GHz to 17 GHz



2M (High-CH 39)_17 MHz to 25 GHz



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4.8. Conducted Band Edges(Out of Band Emissions)

4.8.1. Requirement

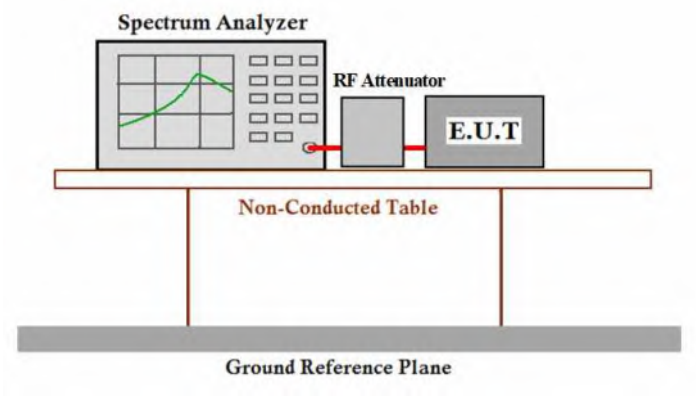
FCC Part15 C section 15.247

(d) 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

4.8.2. Test Method

KDB 558074 v05r02 and ANSI C63.10:2013

4.8.3. Test Configuration



4.8.4. Test Procedure

1)Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

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2) Set the spectrum analyzer:

a) Set start frequency to DTS channel edge frequency.

b) Set stop frequency so as to encompass the spectrum to be examined.

c) Set RBW = 100 kHz.

d) Set VBW ≥ 3 x RBW

e) Detector = peak.

f) Trace Mode = max hold.

g) Sweep = auto couple.

h) Ensure that the number of measurement points ≥ 2 x Span/VBW

i) Allow trace to fully stabilize.

4.8.5. Test result

Compare with the output power of the lowest frequency, the Lower Edges attenuated more than 20 dB.

Compare with the output power of the highest frequency, the Upper Edges attenuated more than 20 dB.

Result plot as follows:

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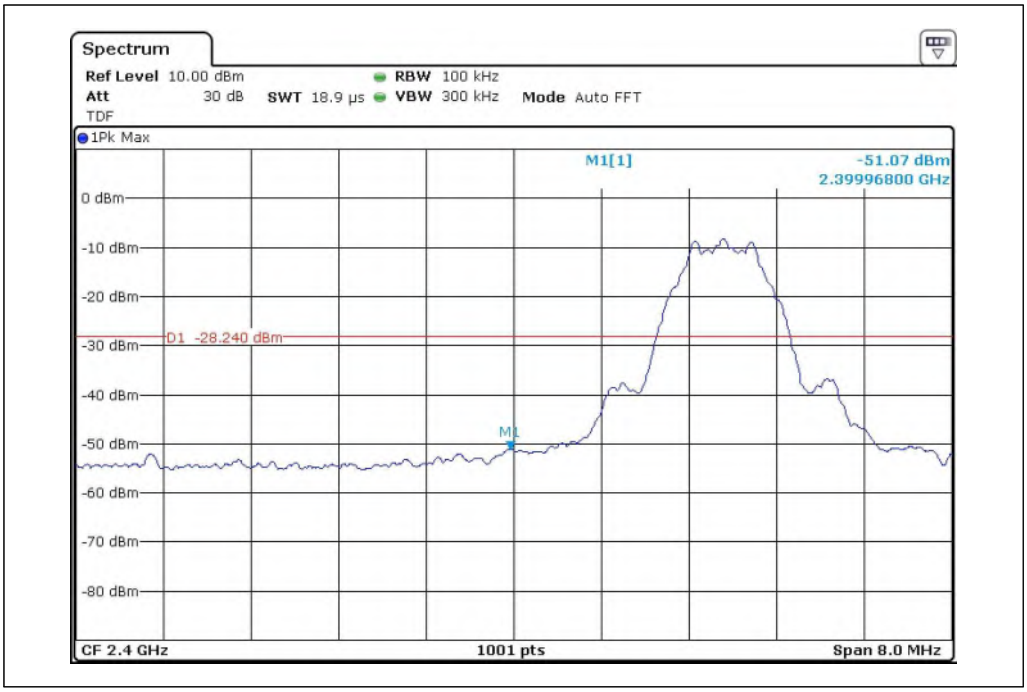
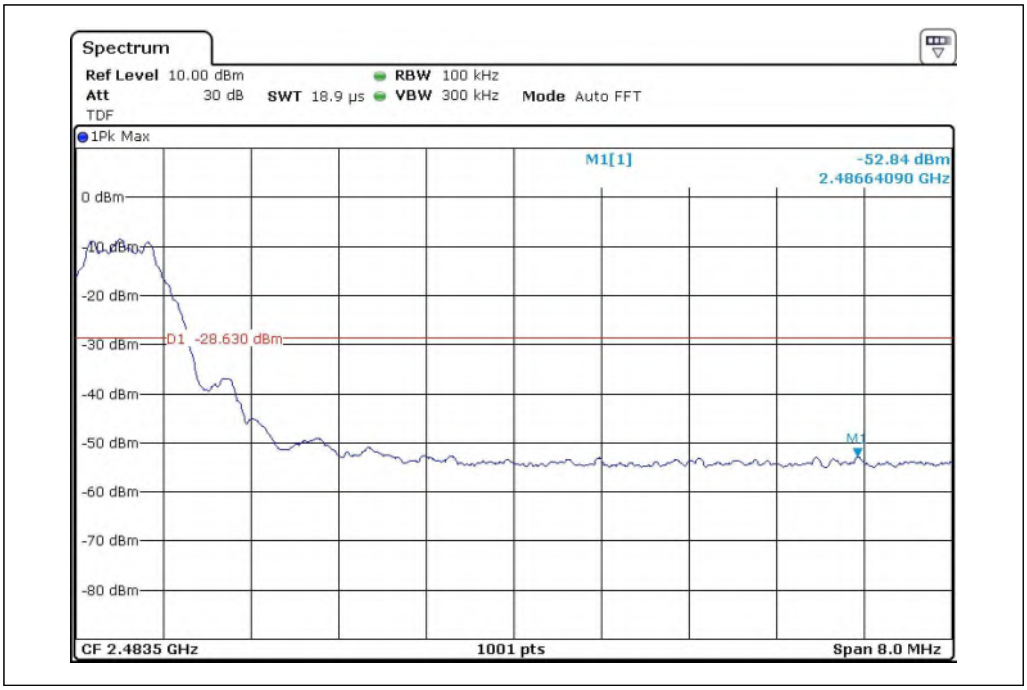
1M (Low-CH 0)



1M (High-CH 39)



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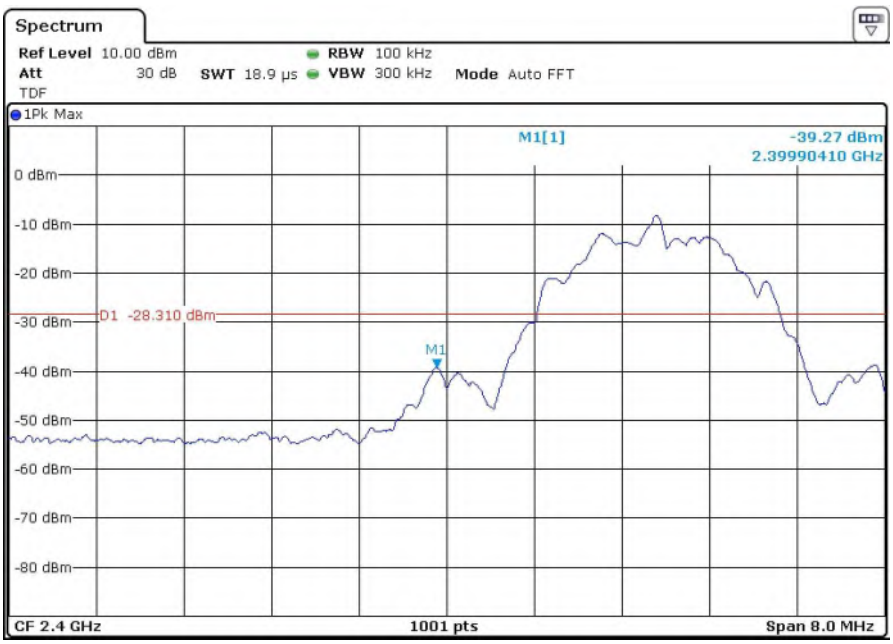
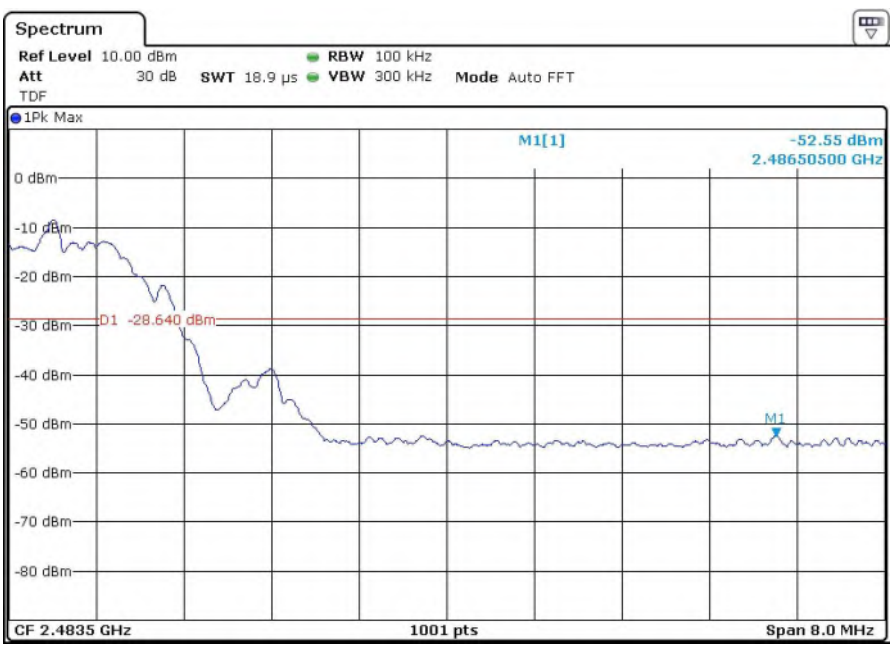
KSTFR-P30-09(Rev.2.2)

2M (Low-CH 0)



2M (High-CH 39)



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4.9. Radiated Spurious Emission

4.9.1. Requirement

FCC Part15 C section 15.247

(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limited specified in Section 15.209(a) (see Section 15.205(c)).

4.9.2. Test Method

ANSI C63.10:2013

1) Test site

Measurement Distance : 3 m (Semi-Anechoic Chamber)

2) Receiver setup

Frequency	Detector	RBW	VBW	Remark
30 MHz~1 GHz	Quasi-peak	120 KHz	300 KHz	Quasi-peak Value
Above 1 GHz	Peak	1 MHz	3 MHz	Peak Value
	RMS	1 MHz	3 MHz	Average Vaile

3) Limit

Frequency	Limit(dBμV/m @ 3m)	Remark
30 MHz ~ 88 MHz	40.0	Quasi-peak Vaule
88 MHz ~ 216 MHz	43.5	Quasi-peak Vaule
216 MHz ~ 960 MHz	46.0	Quasi-peak Vaule
960 MHz ~ 1 GHz	54.0	Quasi-peak Vaule
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

4) Test Frequency Range

30 MHz ~ 26.5 GHz

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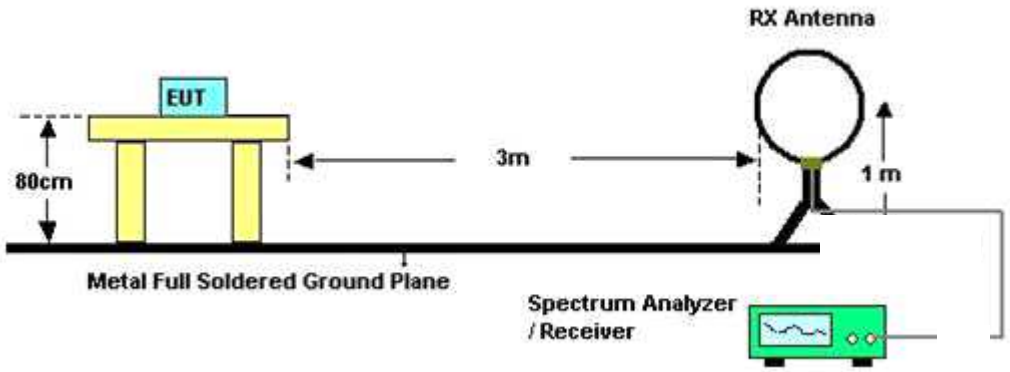
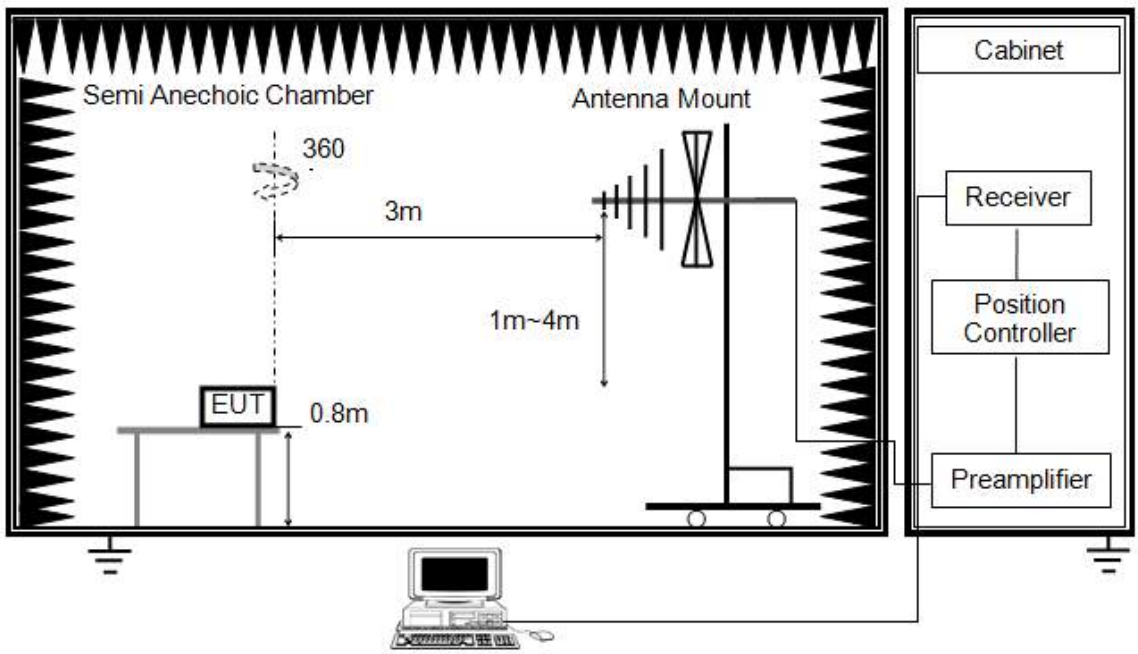
4.9.3. Test Configuration

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



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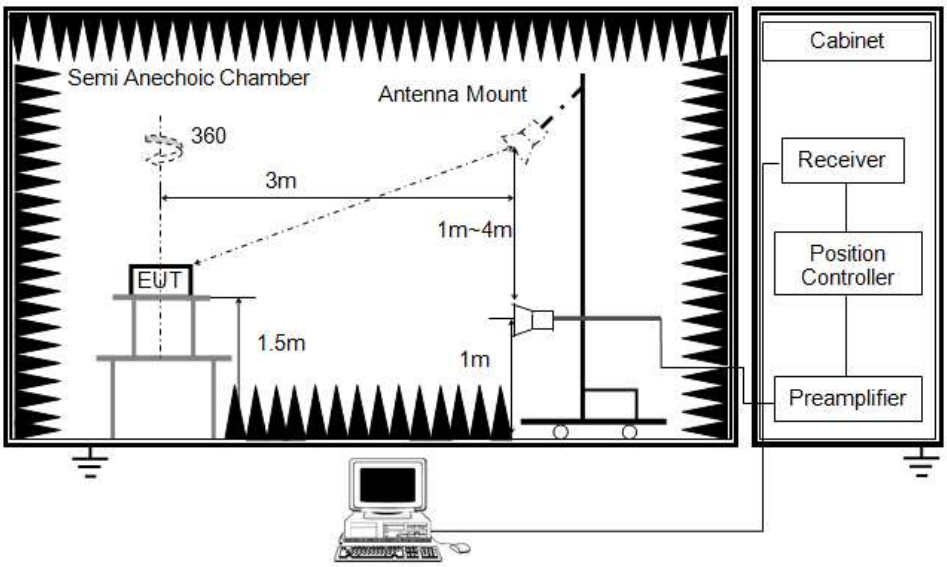
3) 1 GHz to 26.5 GHz emissions:



4.9.4. Test Procedure

1) The EUT is placed on a turntable. For below 1 GHz, the EUT is 0.8 m above ground plane; For above 1 GHz, the EUT is 1.5m above ground plane.
2) The turn turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3) EUT is set 3 m away from the receiving antenna, which is move from 1m to 4 m to find out the maximum emissions. The spectrum was investigated from the lowest radio highest fundamental frequency or to 40 GHz, whichever is lower.
4) Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5) And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6) Repeat above procedures until the measurements for all frequencies are complete.
7) Below 1 GHz:
Total(Measurement Type : Quasi-Peak)
= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)- Amp Gain(G) + Distance Factor(D.F)
8) Above 1 GHz:
Total (Measurement Type : Peak)
= Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)
Total (Measurement Type : Average)
= Average Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)

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4.9.5. Test result

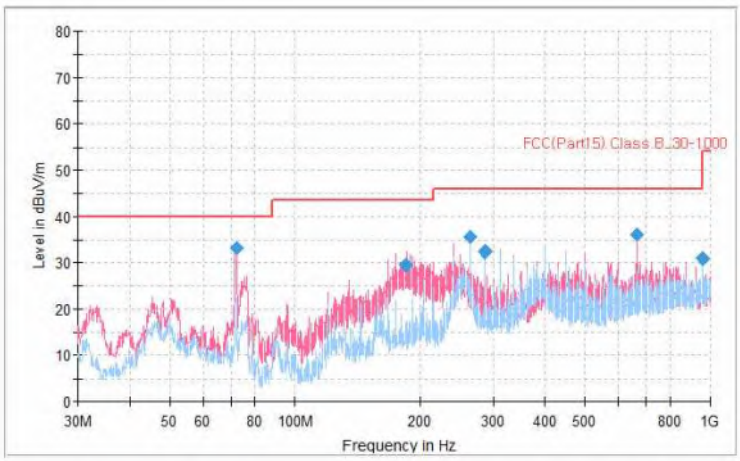
1) Test at low Channel (2 402 MHz) in transmitting status

a) 9 kHz ~ 30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

b) Below 1GHz

Horizontal and Vertical:



Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
72.019444	33.22	40.00	6.78	1000.0	120.000	119.3	V	289.0
184.180556	29.51	43.50	13.99	1000.0	120.000	116.4	V	301.0
263.985556	35.42	46.00	10.58	1000.0	120.000	150.1	H	221.0
288.006111	32.40	46.00	13.60	1000.0	120.000	150.1	H	74.0
666.657222	36.01	46.00	9.99	1000.0	120.000	102.3	V	209.0
959.974444	30.94	46.00	15.06	1000.0	120.000	170.2	H	282.0

c) Above 1GHz

Mode: 1M

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4 804	46.30	0.00	5.86	V	52.16	73.98	21.82	PK
4 804	35.24	5.49	5.86	V	46.59	53.98	7.39	AV
7 206	45.24	0.00	7.94	V	53.18	73.98	20.80	PK
7 206	34.43	5.49	7.94	V	47.86	53.98	6.12	AV
4 804	46.28	0.00	5.86	H	52.14	73.98	21.84	PK
4 804	35.19	5.49	5.86	H	46.54	53.98	7.44	AV
7 206	45.23	0.00	7.94	H	53.17	73.98	20.81	PK
7 206	34.38	5.49	7.94	H	47.81	53.98	6.17	AV

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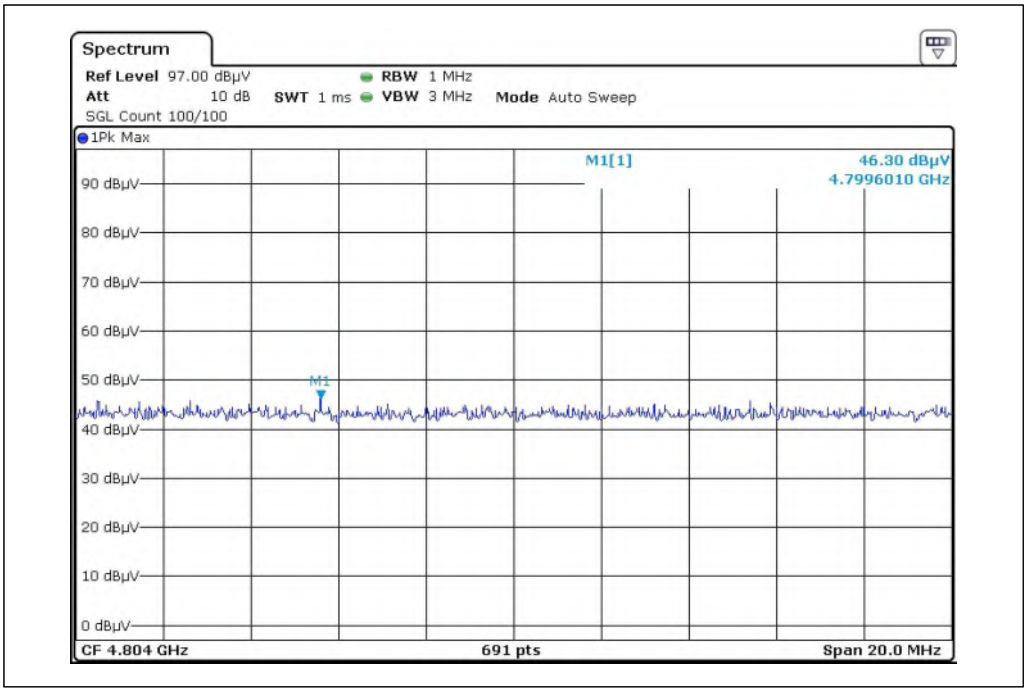
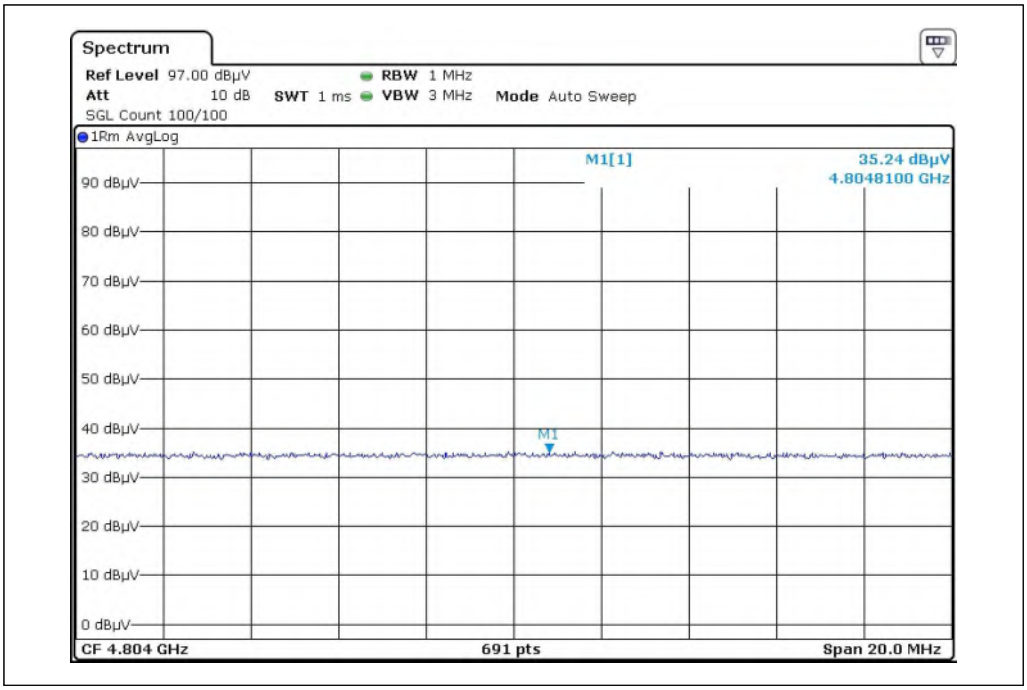
1M_Worst case: X-V_Peak Reading (Ch.0 2rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.0 2rd Harmonic)



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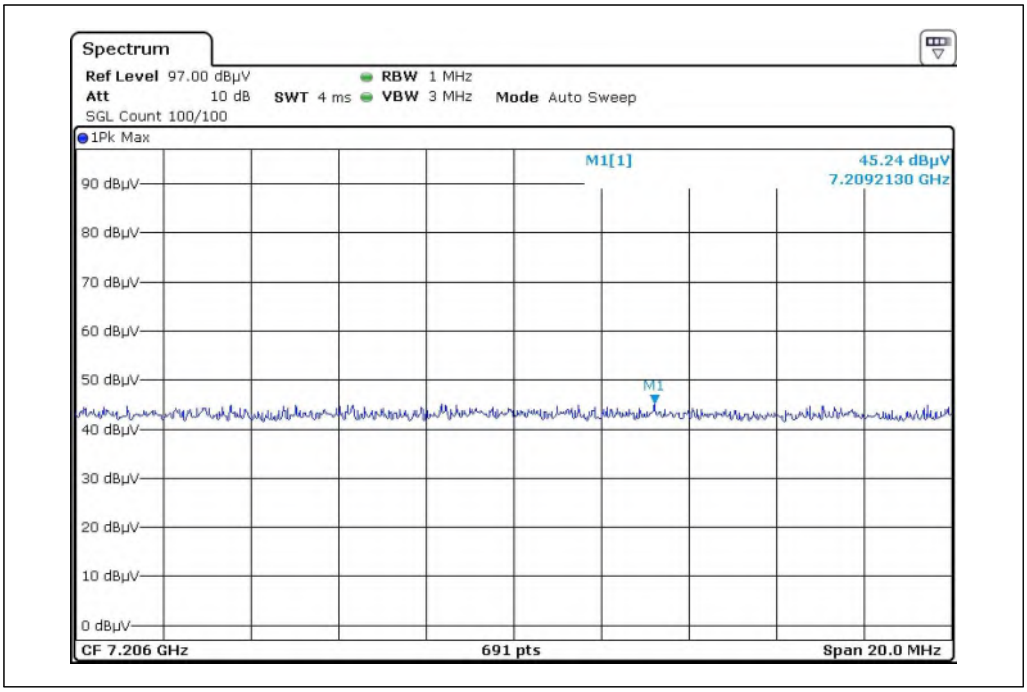
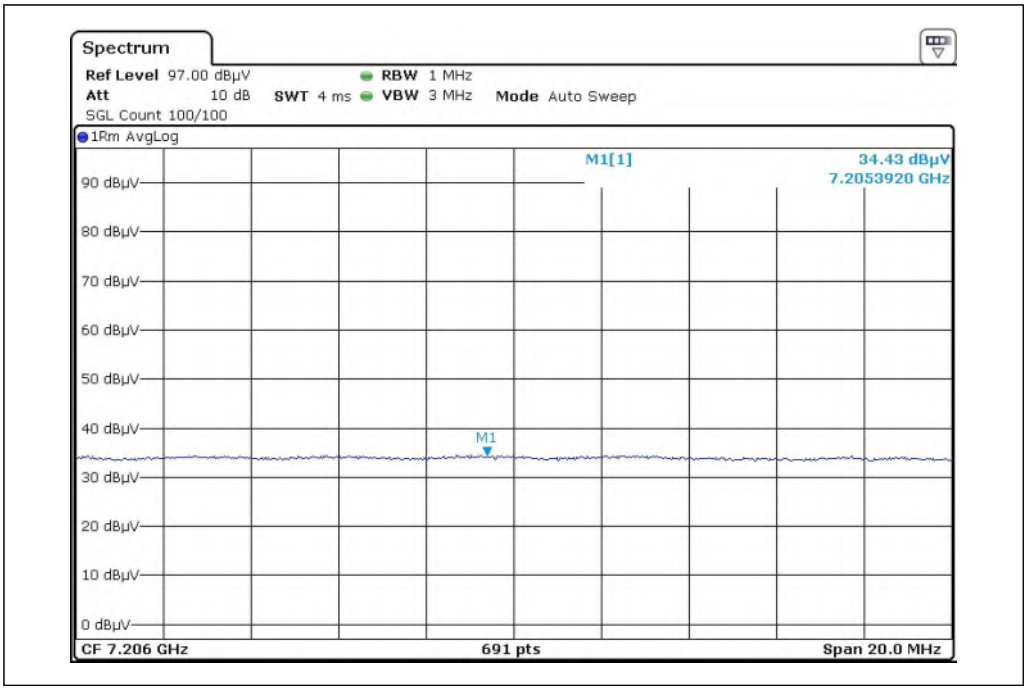
1M_Worst case: X-V_Peak Reading (Ch.0 3rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.0 3rd Harmonic)



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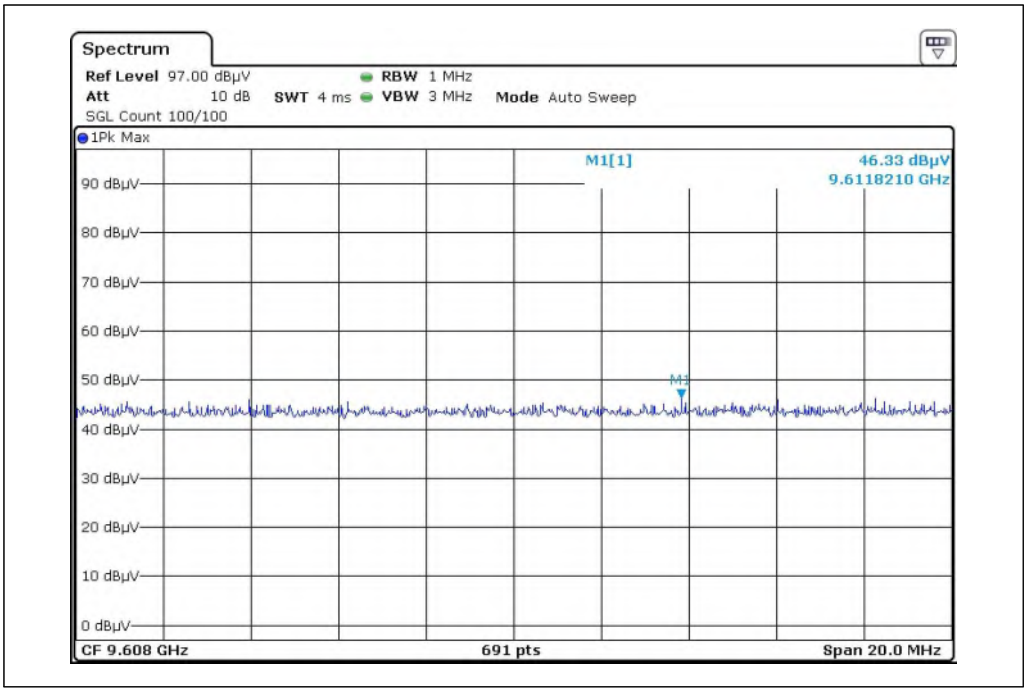
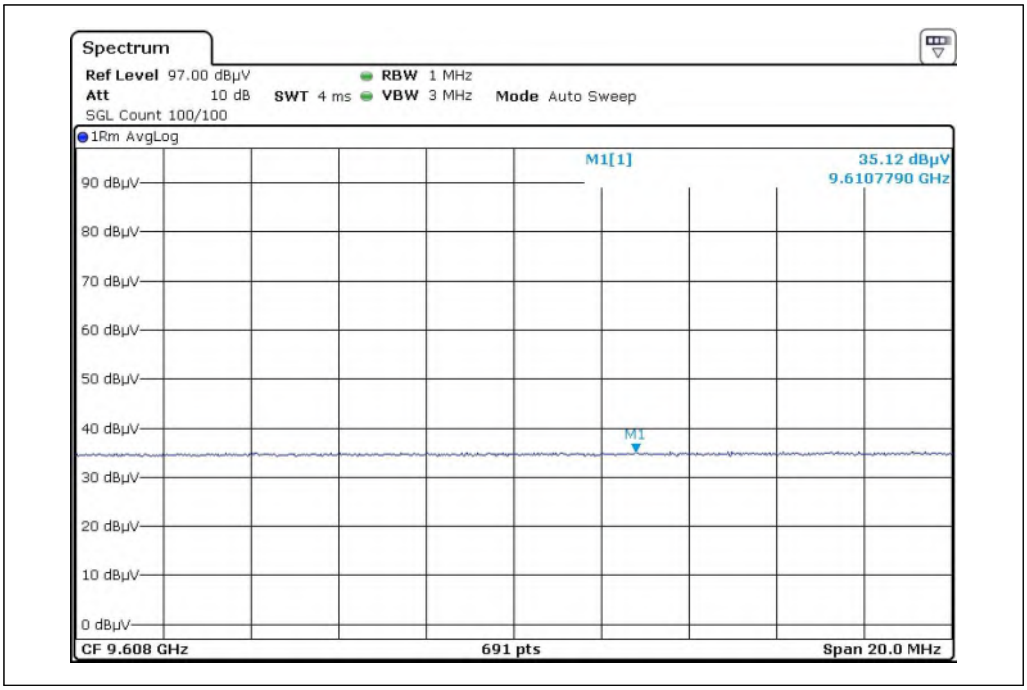
1M_Worst case: X-V_Peak Reading (Ch.0 4rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.0 4rd Harmonic)



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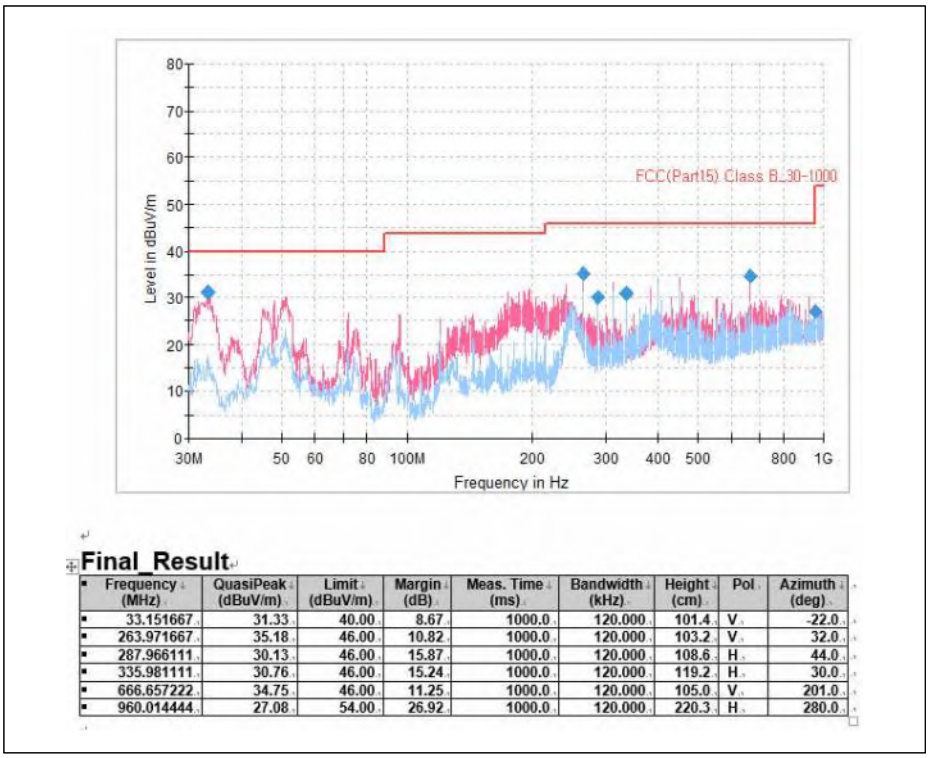
2) Test at middle Channel (2 440 MHz)in transmitting status

a) 9 kHz ~ 30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

b) Below 1GHz

Horizontal and Vertical:



Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
33.151667	31.33	40.00	8.67	1000.0	120.000	101.4	V	-22.0
263.971667	35.18	46.00	10.82	1000.0	120.000	103.2	V	32.0
287.966111	30.13	46.00	15.87	1000.0	120.000	108.6	H	44.0
335.981111	30.76	46.00	15.24	1000.0	120.000	119.2	H	30.0
666.657222	34.75	46.00	11.25	1000.0	120.000	105.0	V	201.0
960.014444	27.08	54.00	26.92	1000.0	120.000	220.3	H	280.0

c) Above 1GHz

Mode: 1M

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4 880	46.28	0.00	5.86	V	52.14	73.98	21.84	PK
4 880	34.99	5.49	5.86	V	46.34	53.98	7.64	AV
7 320	45.85	0.00	10.64	V	56.49	73.98	17.49	PK
7 320	34.17	5.49	10.64	V	50.30	53.98	3.68	AV
4 880	46.21	0.00	5.86	H	52.07	73.98	21.91	PK
4 880	34.95	5.49	5.86	H	46.30	53.98	7.68	AV
7 320	45.82	0.00	10.64	H	56.46	73.98	17.52	PK
7 320	34.13	5.49	10.64	H	50.26	53.98	3.72	AV

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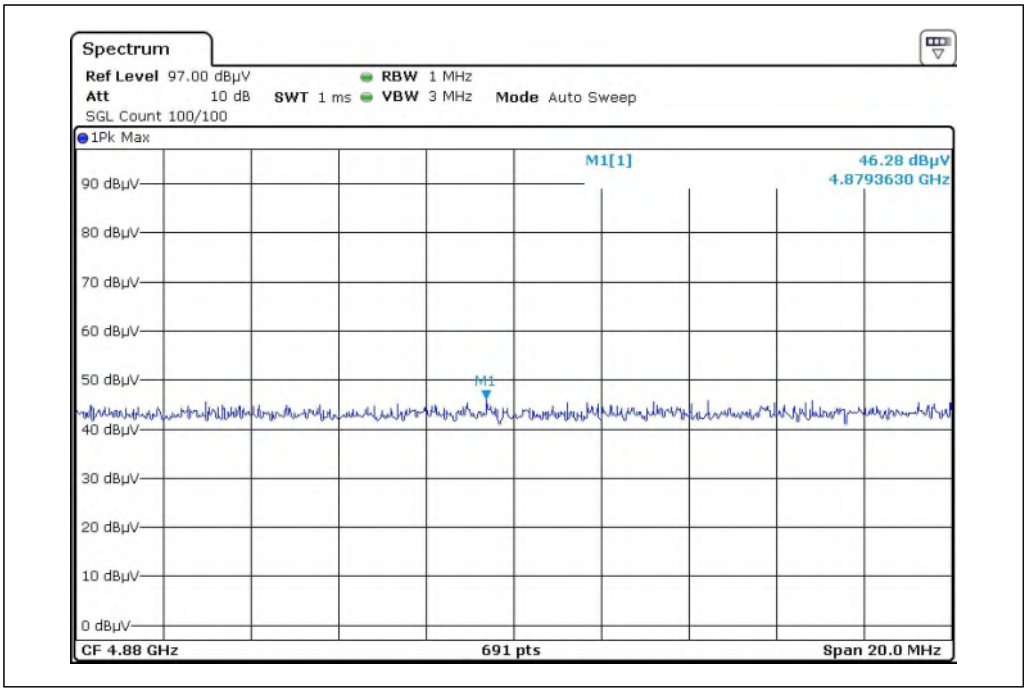
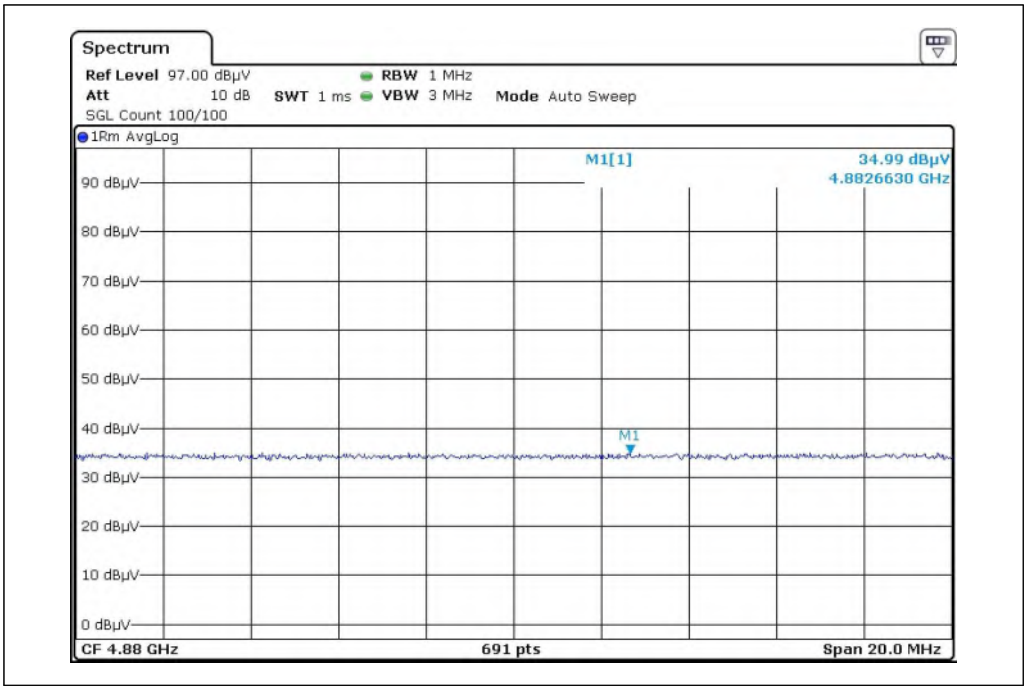
1M_Worst case: X-V_Peak Reading (Ch.19 2rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.19 2rd Harmonic)



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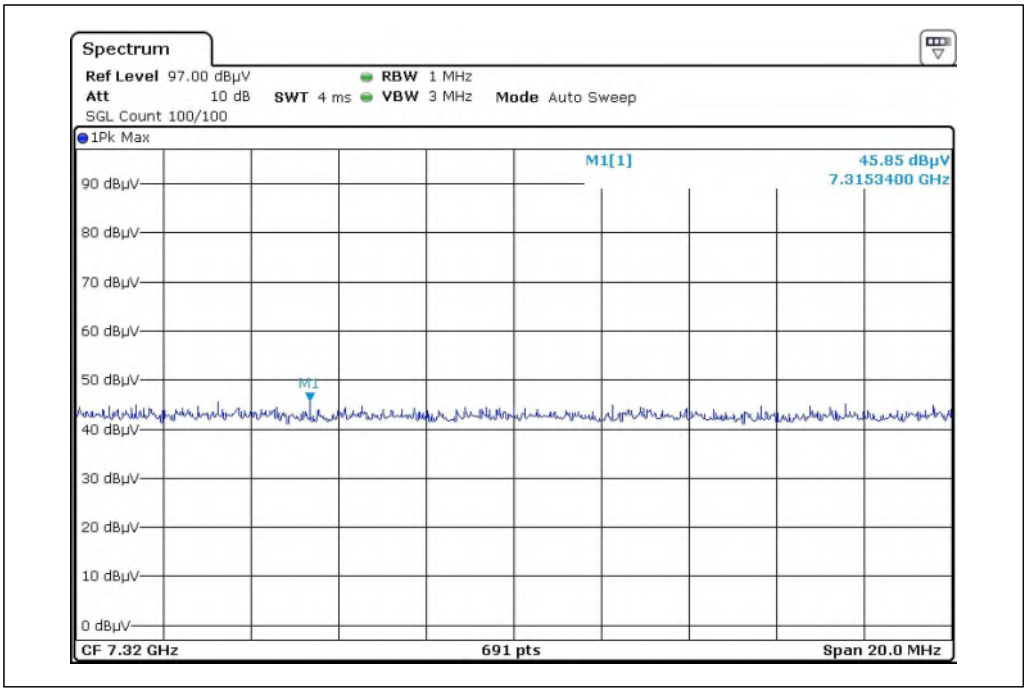
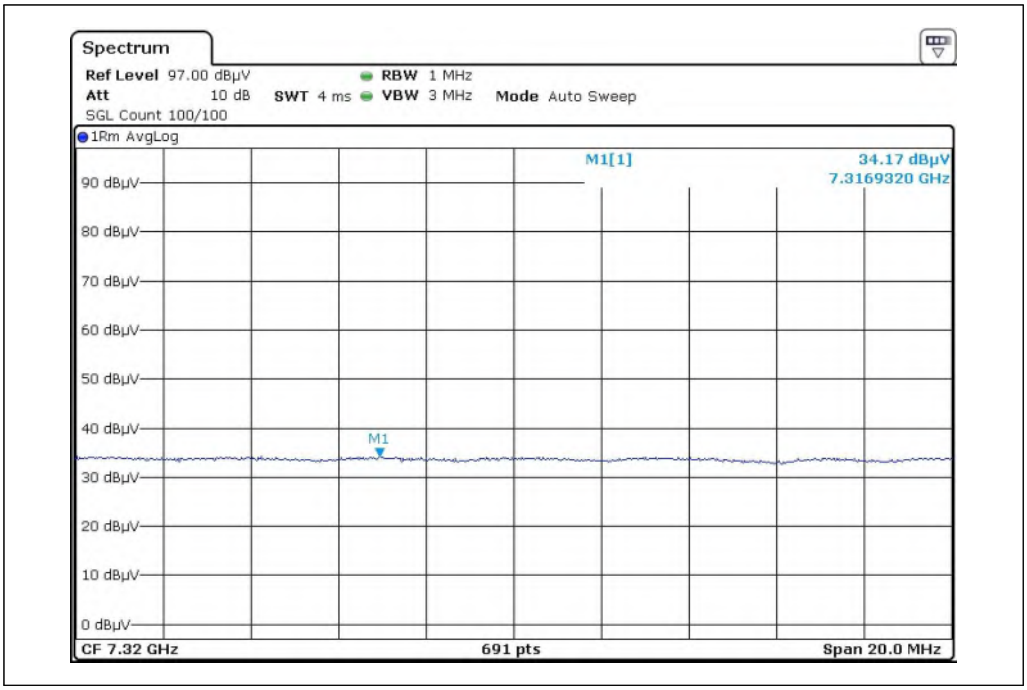
1M_Worst case: X-V_Peak Reading (Ch.19 3rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.19 3rd Harmonic)



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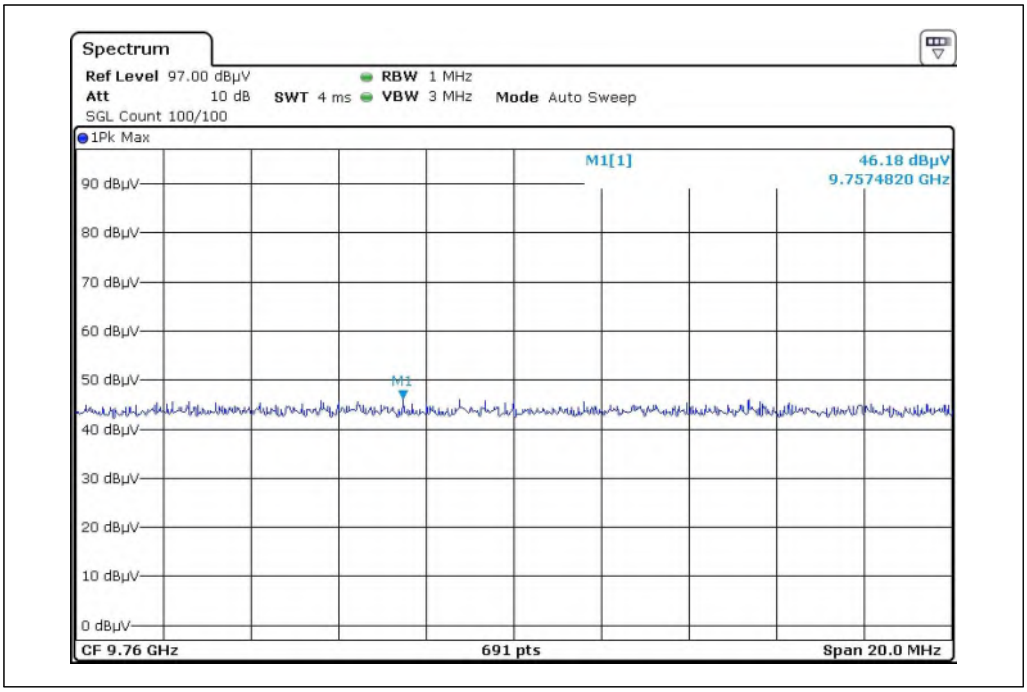
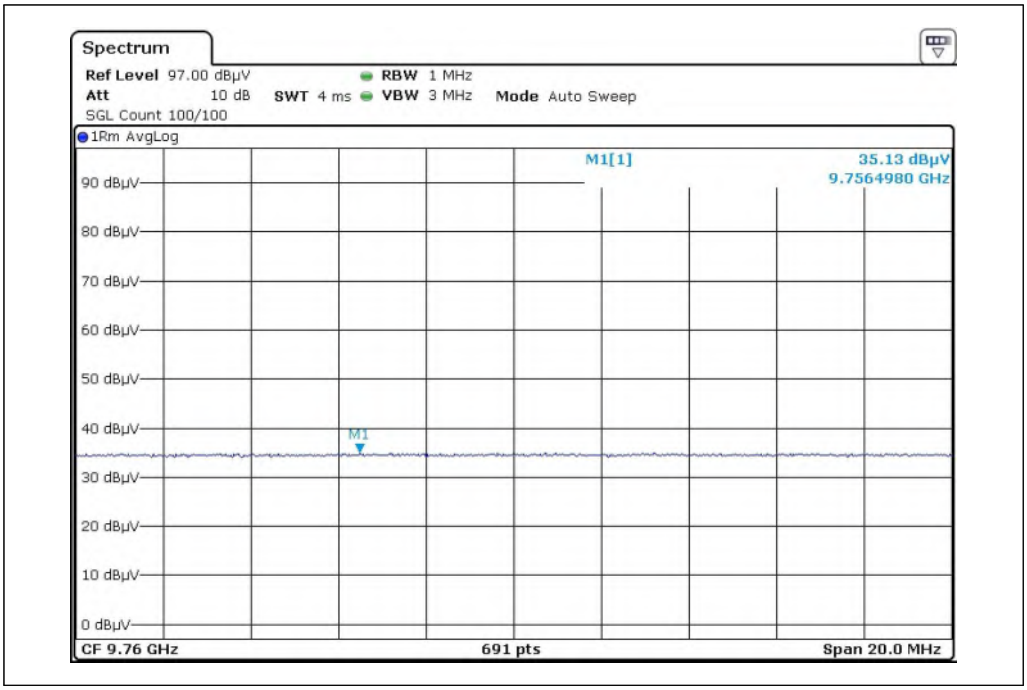
1M_Worst case: X-V_Peak Reading (Ch.19 4rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.19 4rd Harmonic)



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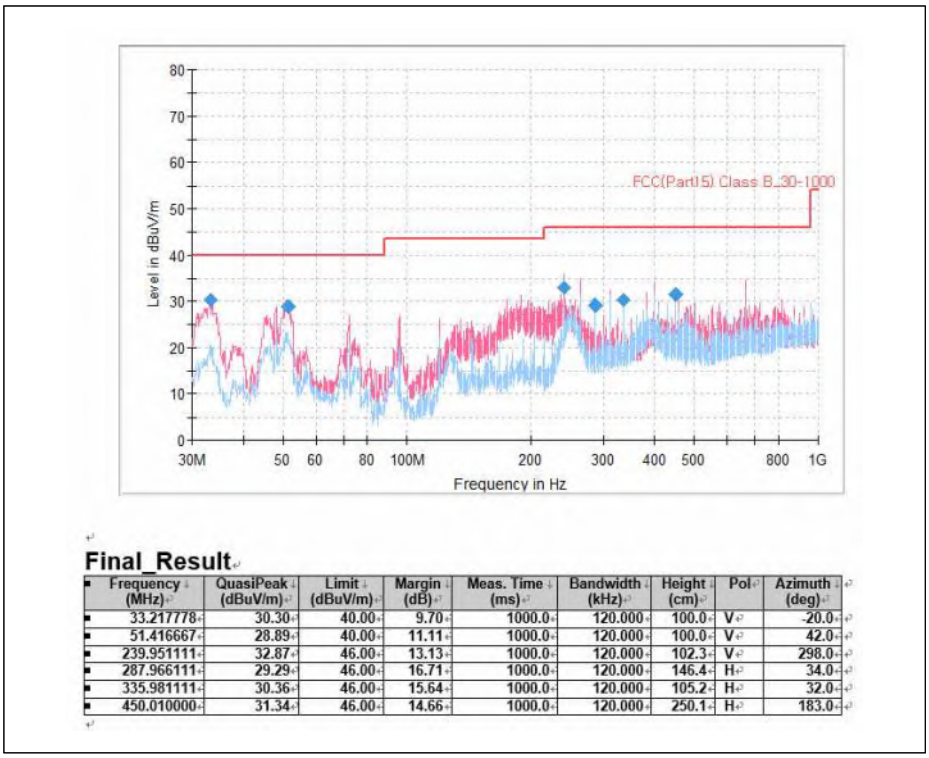
3) Test at high Channel (2 480 MHz) in transmitting status

a) 9 kHz ~ 30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

b) Below 1GHz

Horizontal and Vertical:



Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
33.217778	30.30	40.00	9.70	1000.0	120.000	100.0	V	-20.0
51.416667	28.89	40.00	11.11	1000.0	120.000	100.0	V	42.0
239.951111	32.87	46.00	13.13	1000.0	120.000	102.3	V	298.0
287.966111	29.29	46.00	16.71	1000.0	120.000	146.4	H	34.0
335.981111	30.36	46.00	15.64	1000.0	120.000	105.2	H	32.0
450.010000	31.34	46.00	14.66	1000.0	120.000	250.1	H	183.0

c) Above 1GHz

Mode: 1M

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4 960	46.28	0.00	5.86	V	52.14	73.98	21.84	PK
4 960	34.76	5.49	5.86	V	46.11	53.98	7.87	AV
7 440	45.46	0.00	10.64	V	56.10	73.98	17.88	PK
7 440	34.38	5.49	10.64	V	50.51	53.98	3.47	AV
4 960	46.25	0.00	5.86	H	52.11	73.98	21.87	PK
4 960	34.72	5.49	5.86	H	46.07	53.98	7.91	AV
7 440	45.39	0.00	10.64	H	56.03	73.98	17.95	PK
7 440	34.36	5.49	10.64	H	50.49	53.98	3.49	AV

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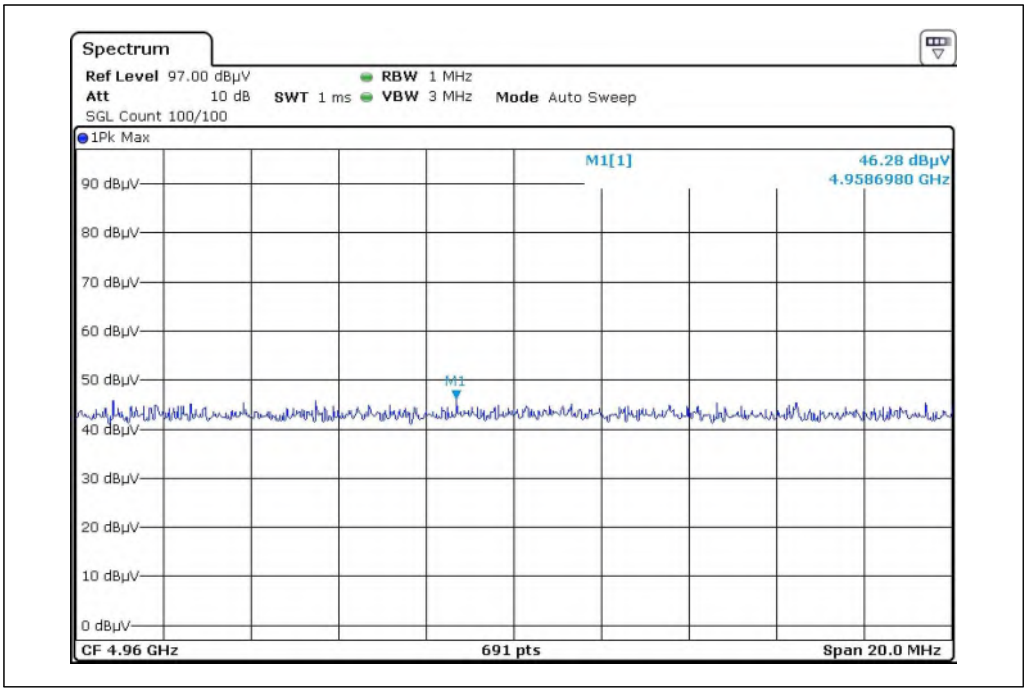
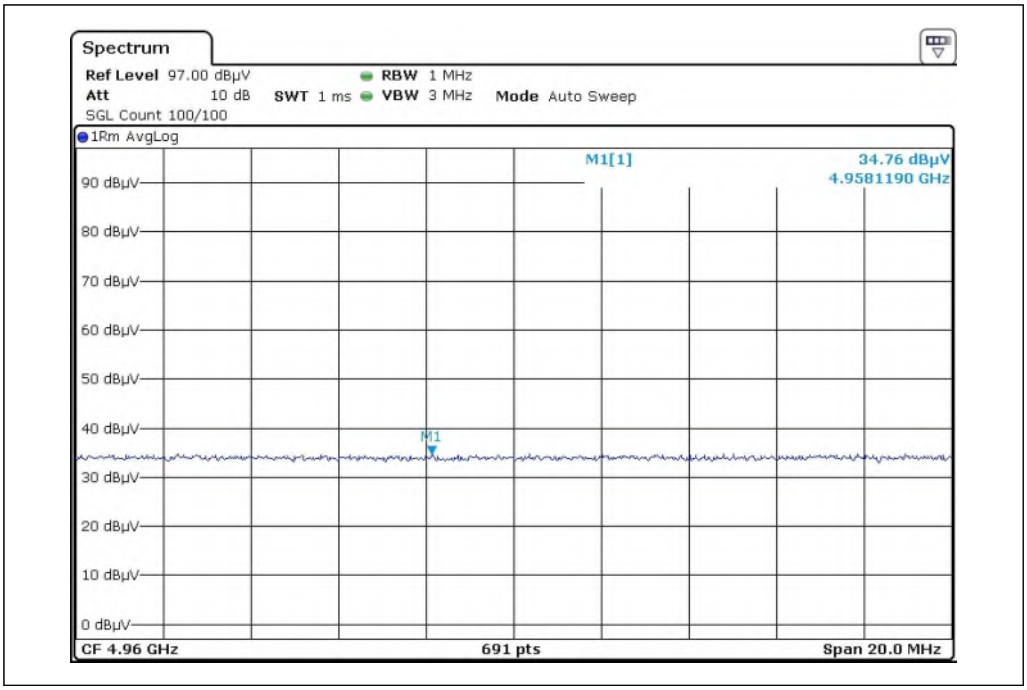
1M_Worst case: X-V_Peak Reading (Ch.39 2rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.39 2rd Harmonic)



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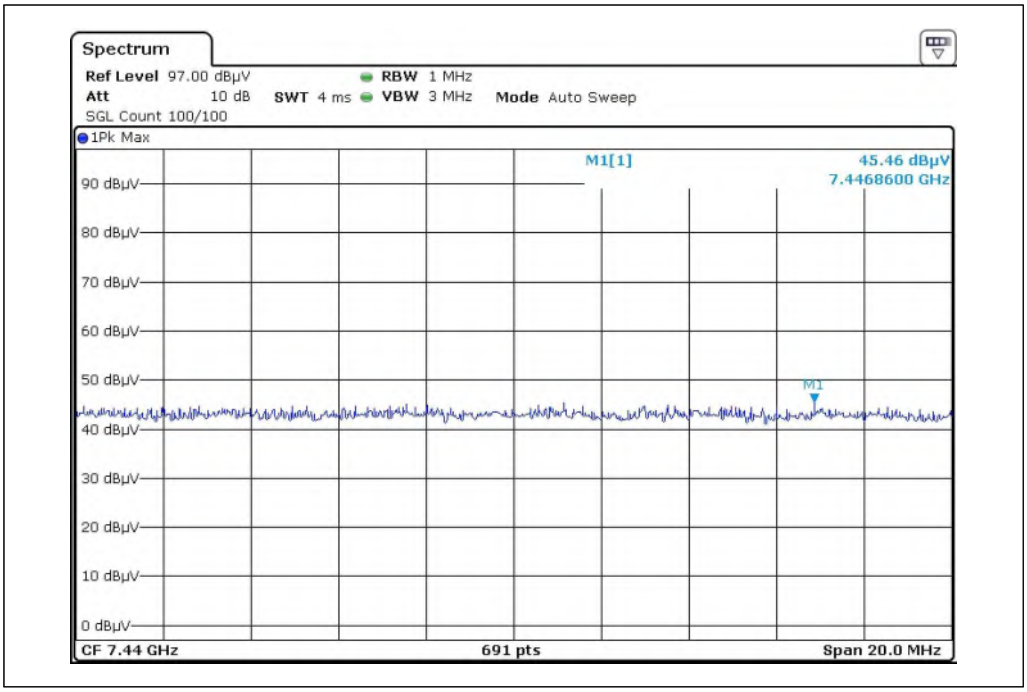
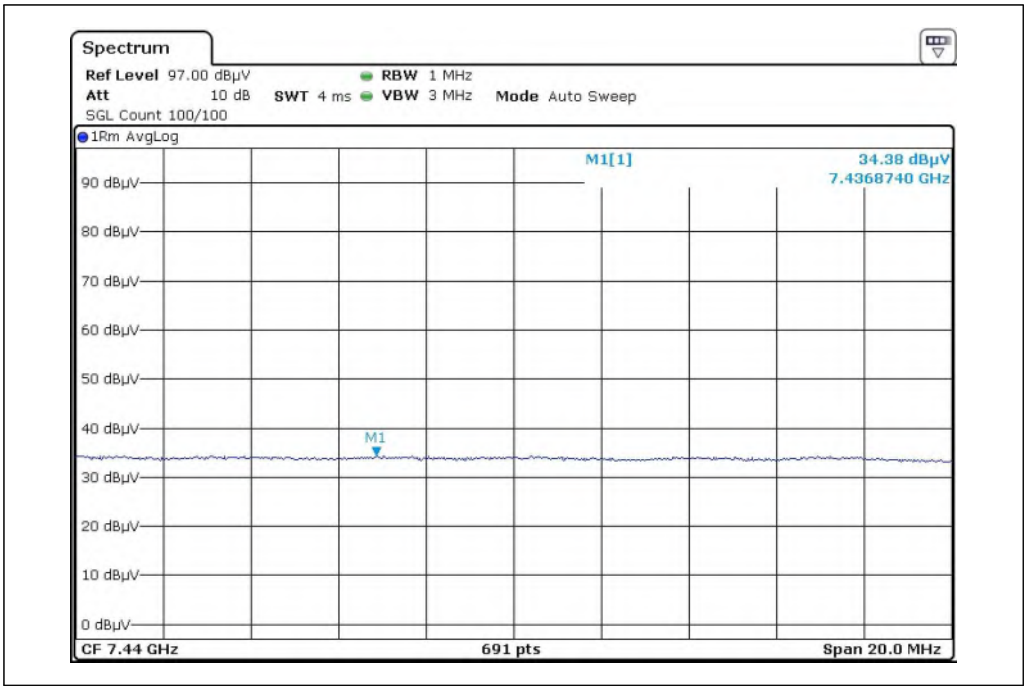
1M_Worst case: X-V_Peak Reading (Ch.39 3rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.39 3rd Harmonic)



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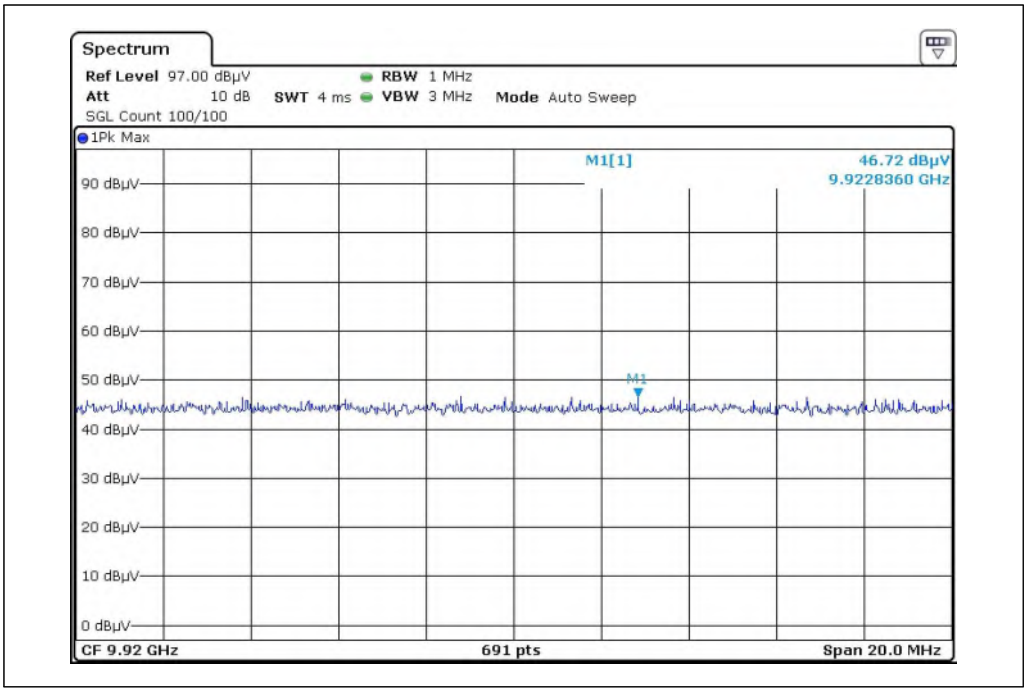
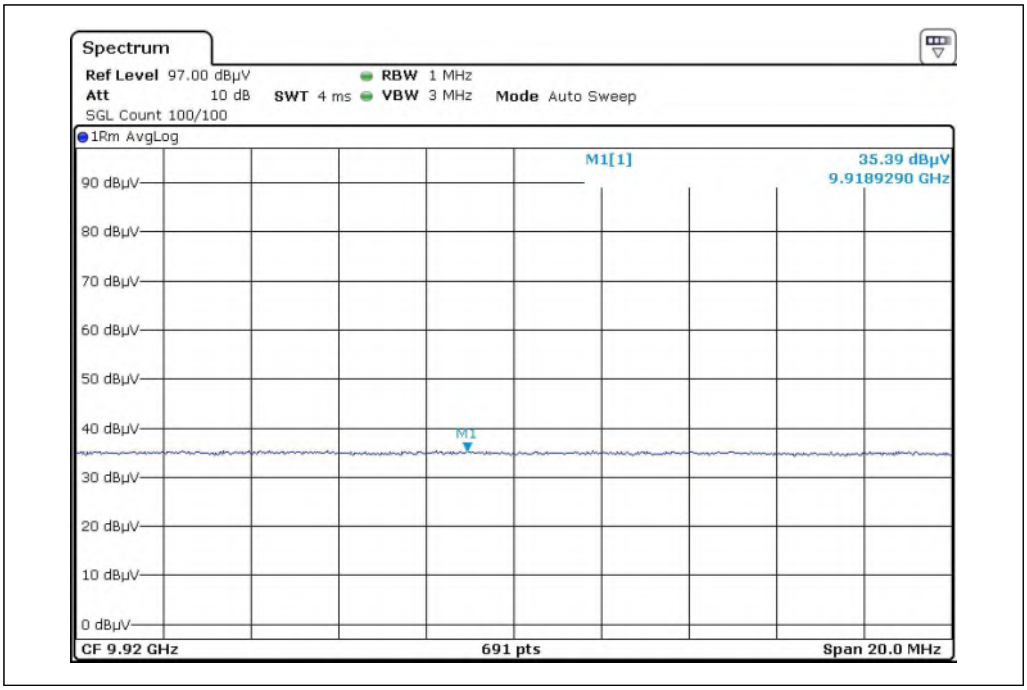
1M_Worst case: X-V_Peak Reading (Ch.39 4rd Harmonic)



1M_Worst case: X-V_Average Reading (Ch.39 4rd Harmonic)



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4.10. Radiated Restricted Band Edge

4.10.1. Requirement

FCC Part15 C section 15.247

(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limited specified in Section 15.209(a) (see Section 15.205(c)).

4.10.2. Test Method

ANSI C63.10

1) Test site

Measurement Distance : 3 m (Semi-Anechoic Chamber)

2) Receiver setup

Frequency	Detector	RBW	VBW	Remark
30 MHz~1 GHz	Quasi-peak	120 KHz	300 KHz	Quasi-peak Value
Above 1 GHz	Peak	1 MHz	3 MHz	Peak Value
	RMS	1 MHz	3 MHz	Average Vaile

3) Limit

Frequency	Limit(dBμV/m @ 3m)	Remark
30 MHz ~ 88 MHz	40.0	Quasi-peak Vaule
88 MHz ~ 216 MHz	43.5	Quasi-peak Vaule
216 MHz ~ 960 MHz	46.0	Quasi-peak Vaule
960 MHz ~ 1 GHz	54.0	Quasi-peak Vaule
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

4.10.3. Test Configuration

Same as Radiated Spurious Emission.

4.10.4. Test Procedure

Same as Radiated Spurious Emission.

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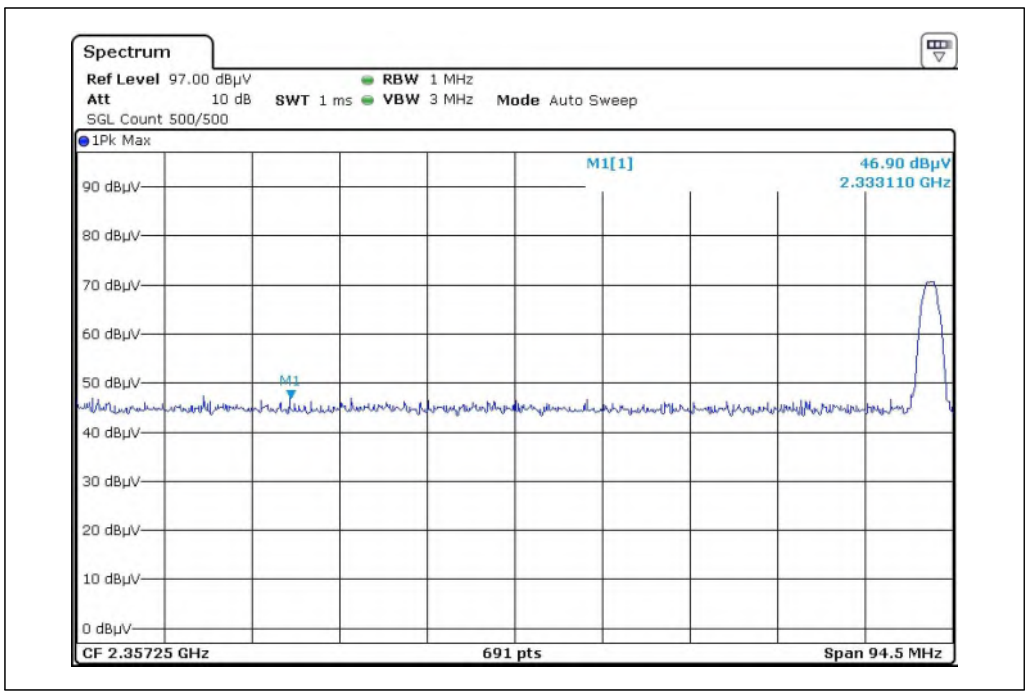
4.10.5. Test result

Mode: 1M

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2 390.0	45.83	0.00	-1.70	H	44.13	73.98	29.85	PK
2 390.0	33.82	5.49	-1.70	H	37.61	53.98	16.37	AV
2 390.0	46.90	0.00	-1.70	V	45.20	73.98	28.78	PK
2 390.0	34.67	5.49	-1.70	V	38.46	53.98	15.52	AV
2 483.5	58.82	0.00	-1.62	H	57.20	73.98	16.78	PK
2 483.5	34.96	5.49	-1.62	H	38.83	53.98	15.15	AV
2 483.5	59.98	0.00	-1.62	V	58.36	73.98	15.62	PK
2 483.5	35.34	5.49	-1.62	V	39.21	53.98	14.77	AV

Please refer to the following test plots:

1M_Worst case: X-V_Peak Reading (Ch.0)



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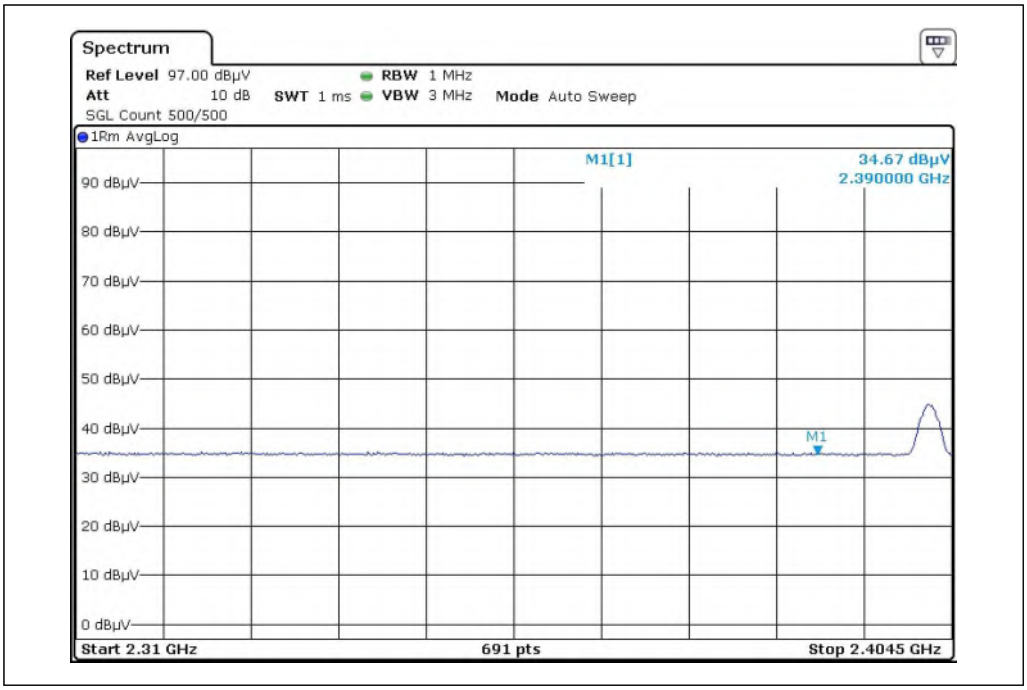
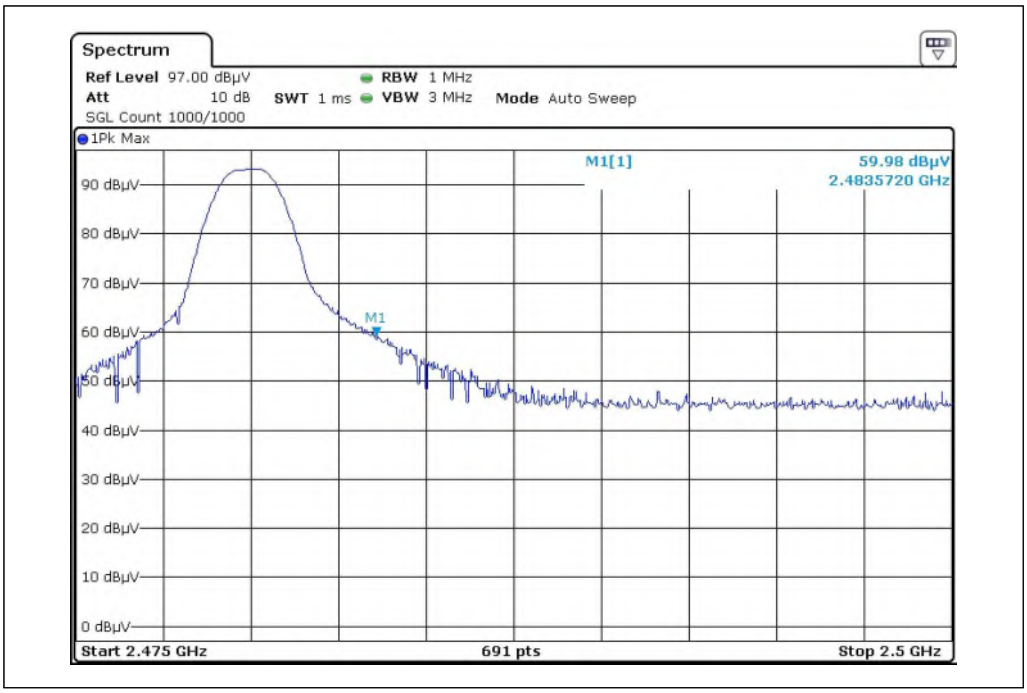
1M_Worst case: X-V_Average Reading (Ch.0)



1M_Worst case: Z-V_Peak Reading (Ch.39)



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1M_Worst case: Z-V_Average Reading (Ch.39)

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4.11. Radio Frequency Exposure Procedures

4.11.1. Requirement

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1 500	12	24	37	49	61	
1 900	11	22	33	44	54	
2 450	10	19	29	38	48	
3 600	8	16	24	32	40	
5 200	7	13	20	26	33	
5 400	6	13	19	26	32	
5 800	6	12	19	25	31	

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by: [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

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4.11.2. Conclusion

1) Maximum Measured Transmitter Power:

Channel Frequency (MHz)	Conducted Maximum Output Power		Max Antenna Gain (dBi)	Numeric antenna gain
	(dBm)	(mW)		
2 402	-8.24	0.15	1.6	1.45

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] = 0.15/5*√2.402 = 0.046 ≤ 3.0

Threshold at which no SAR required is 48 mW and ≤ 3.0 for 1-g SAR, Separation distance is 5 mm.

2) Conclusion : The SAR measurement is exempt.

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