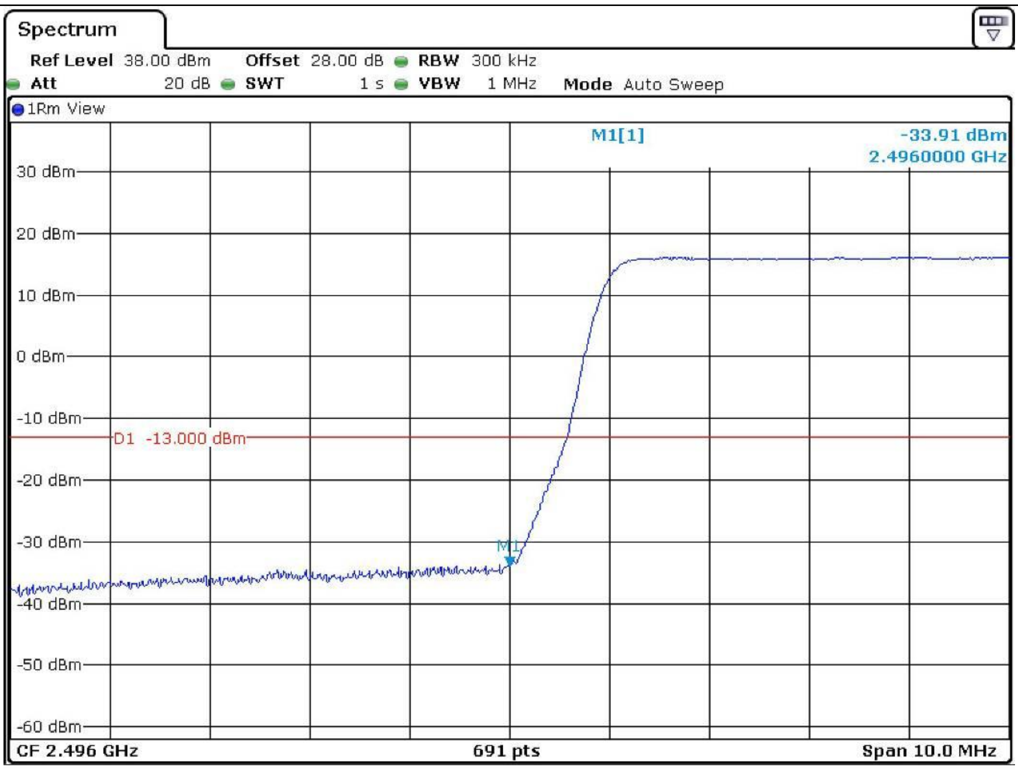
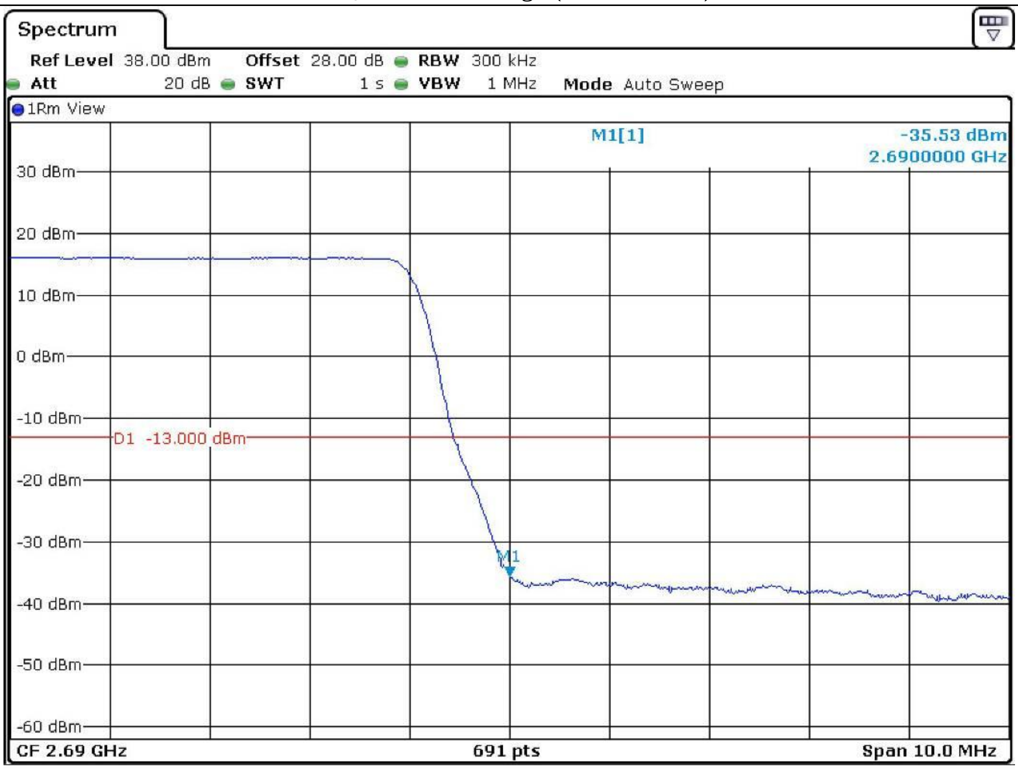
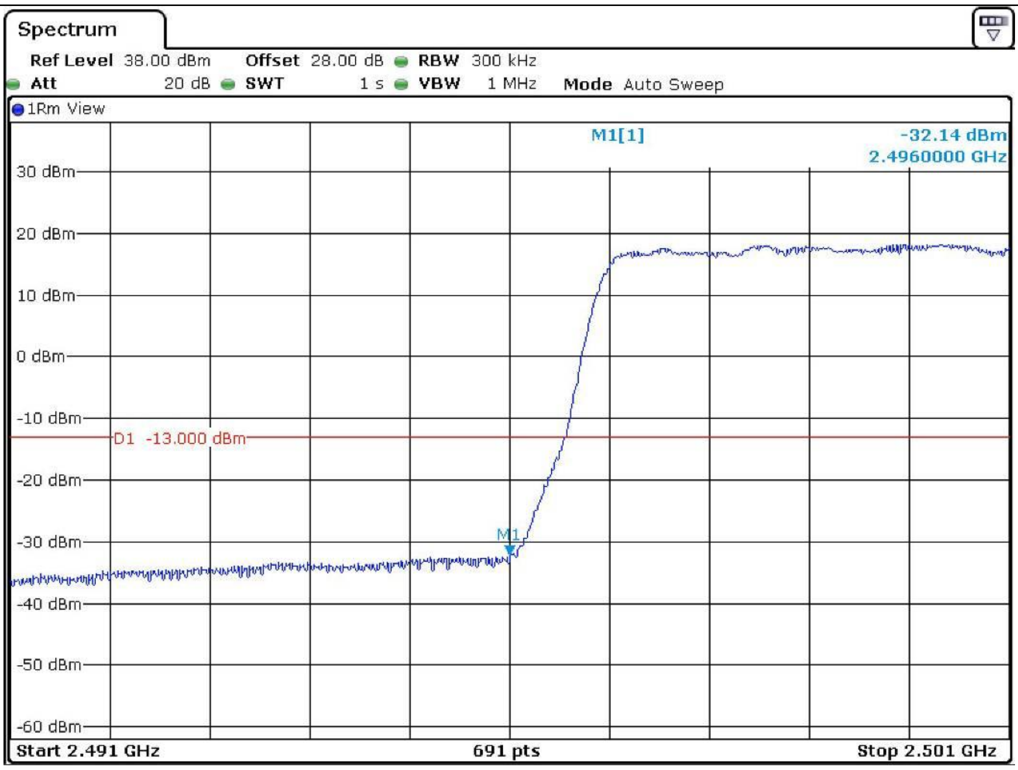


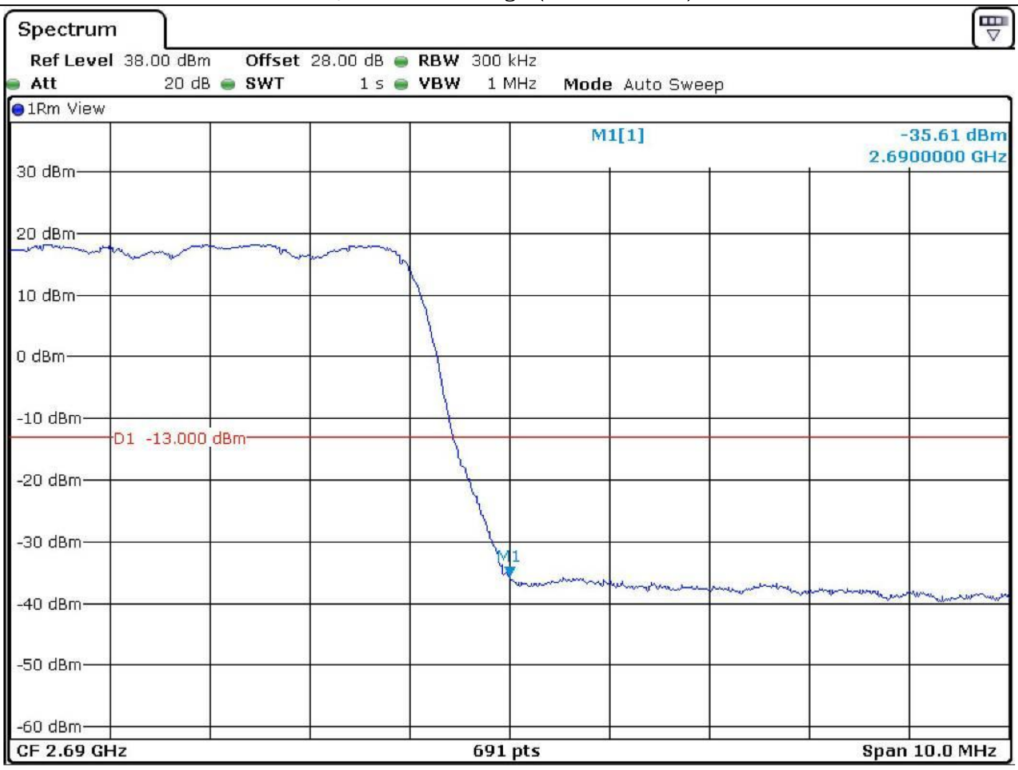
64 QAM – Band Edge (Low Channel)



64 QAM– Band Edge (High Channel)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.4.2 Test Result (20 MHz/2 Carrier)

-. Test Date : July 31, 2014

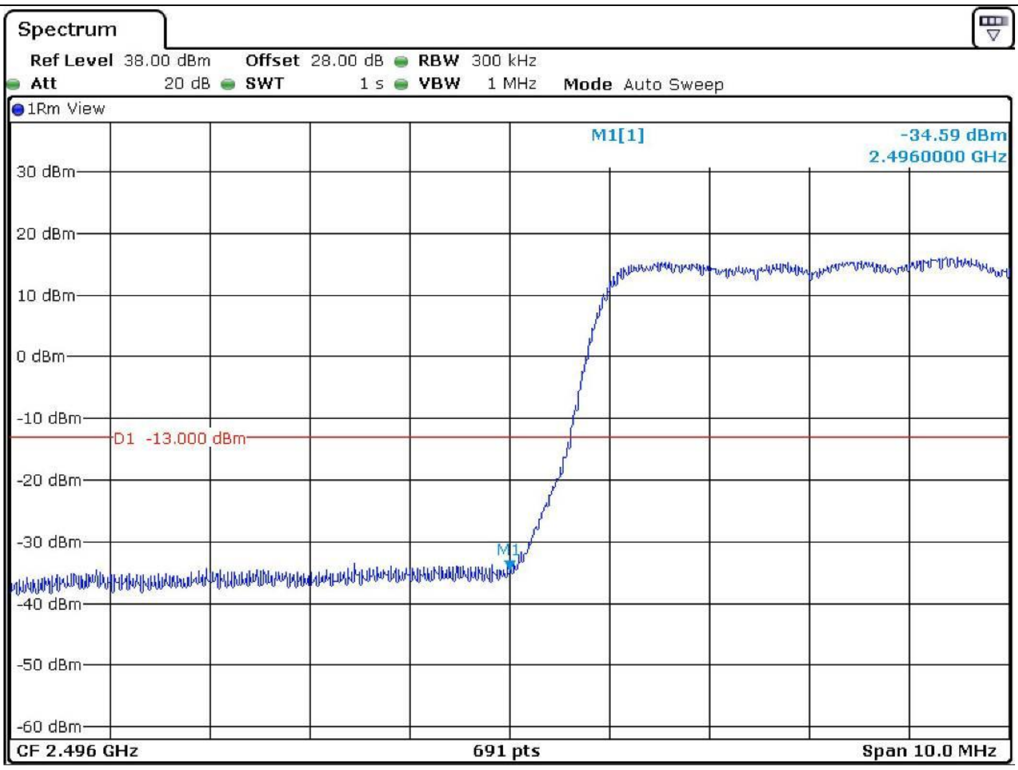
-. Result : Pass

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
16 QAM	Low	2 496.000	-34.59	-13.00	21.59
	High	2 690.000	-37.79		24.79
64 QAM	Low	2 496.000	-34.96		21.96
	High	2 690.000	-37.28		24.28
QPSK	Low	2 496.000	-33.94		20.94
	High	2 690.000	-36.64		23.64

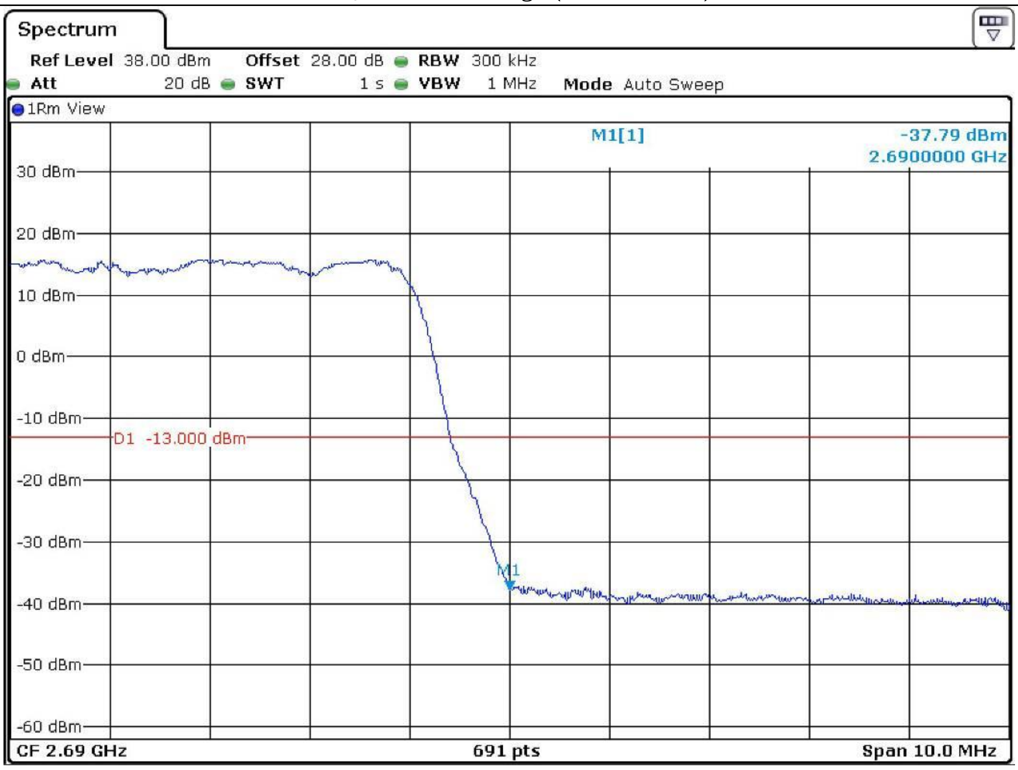
According to Part 27C, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

Tested by: Tae-Ho, Kim / Project Engineer

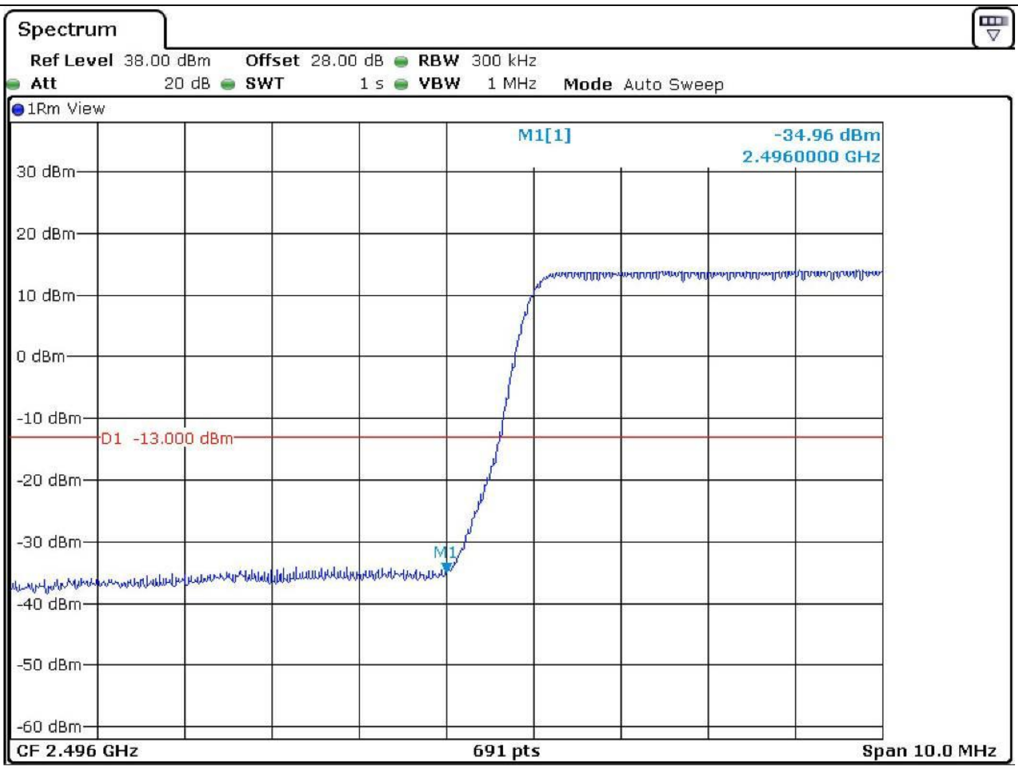
HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



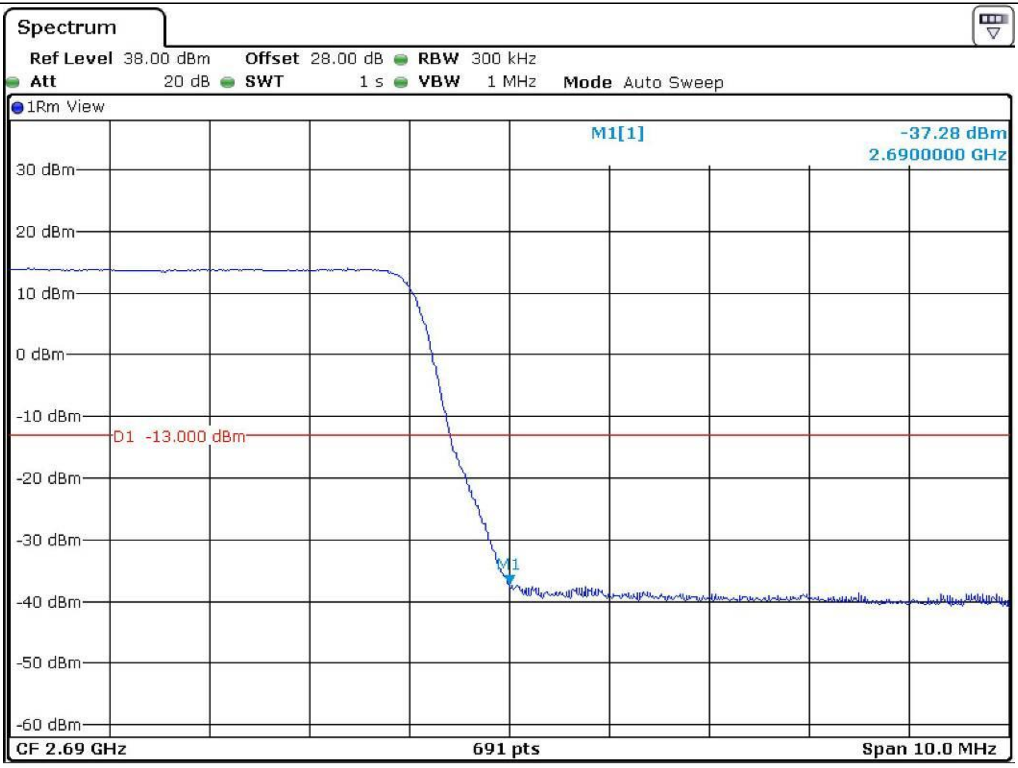
16 QAM – Band Edge (Low Channel)



16 QAM – Band Edge (High Channel)

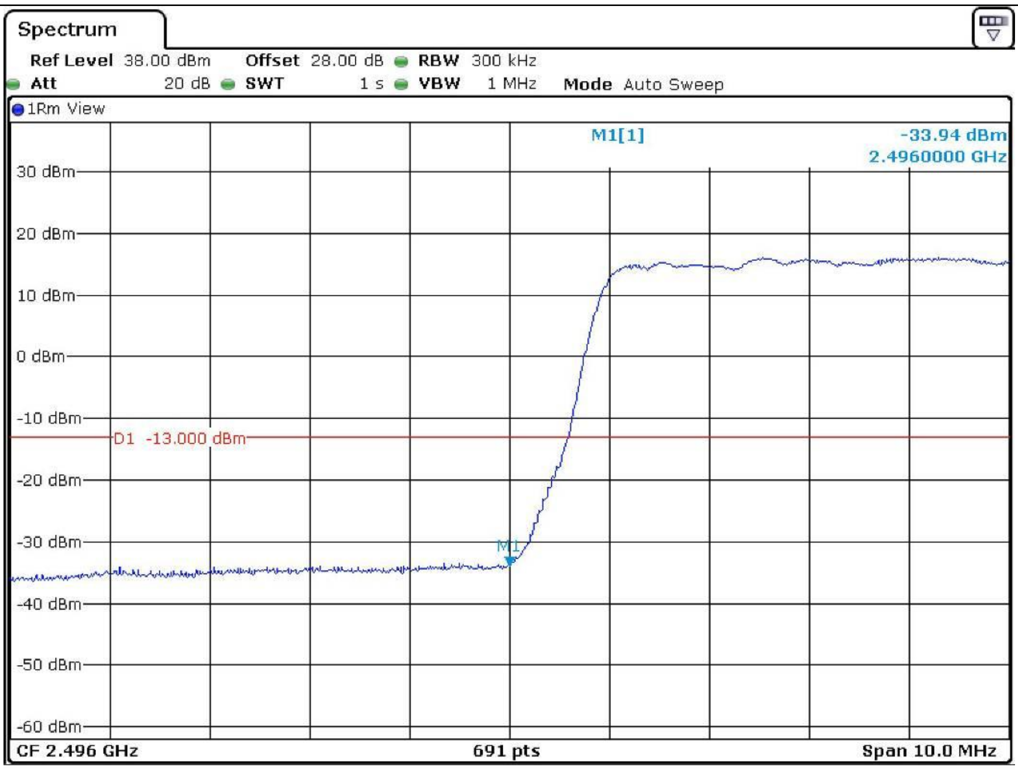


64 QAM – Band Edge (Low Channel)

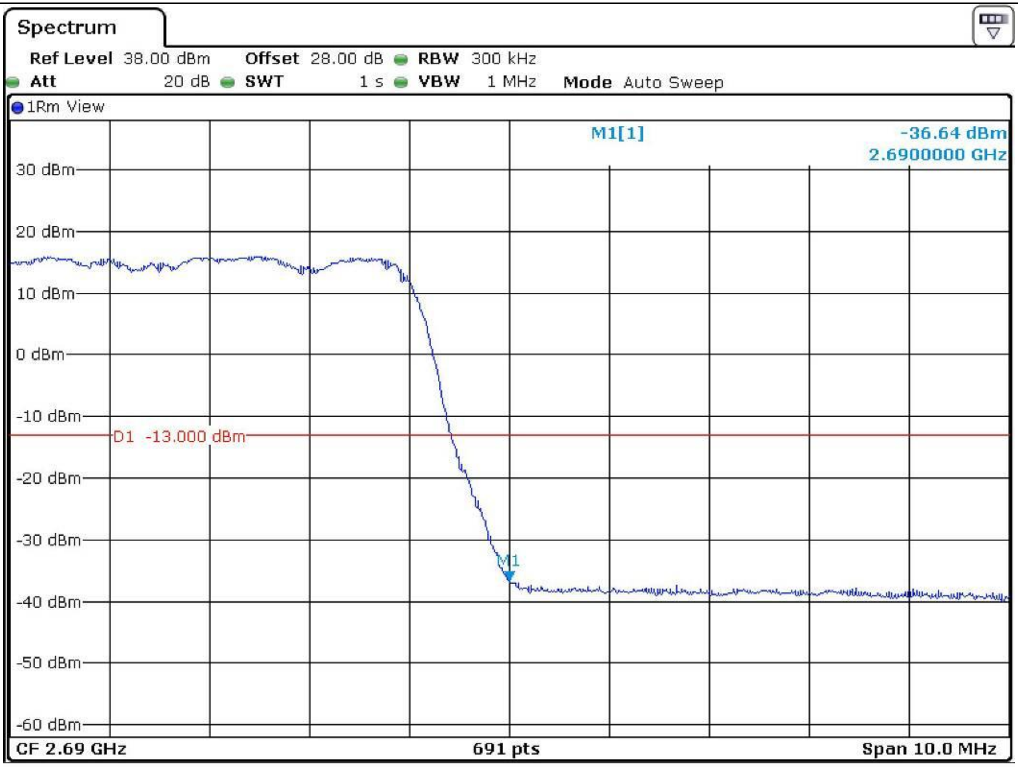


64 QAM– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.4.3 Test Result (20 MHz/3 Carrier)

-. Test Date : July 31, 2014

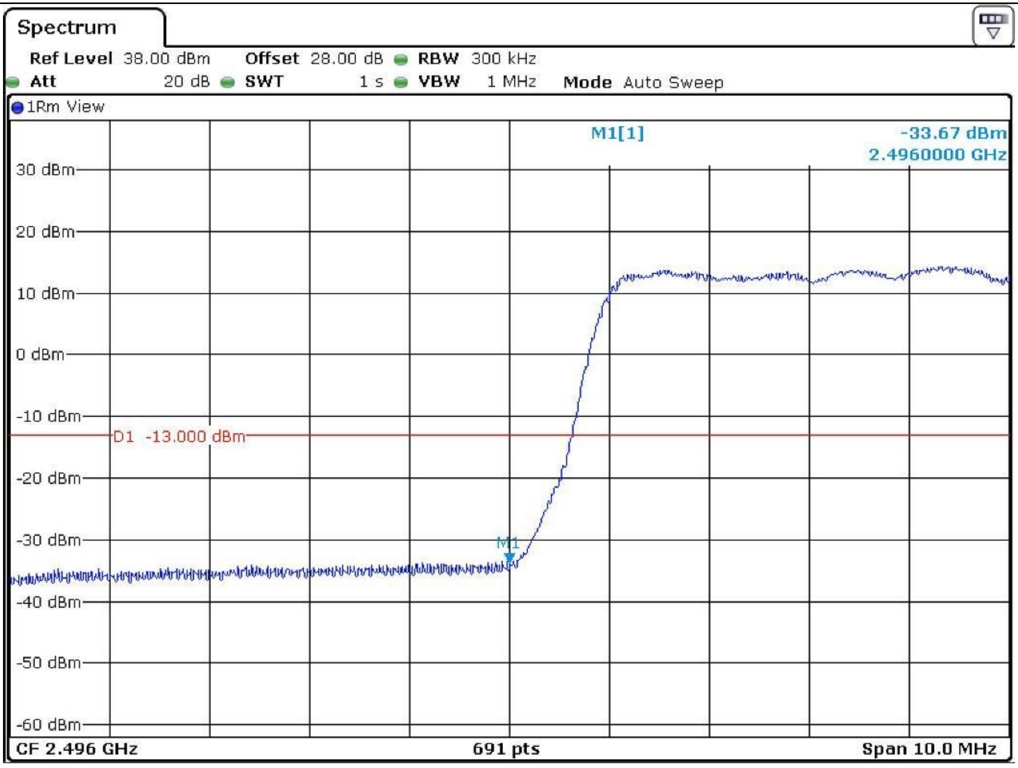
-. Result : Pass

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
16 QAM	Low	2 496.000	-33.67	-13.00	20.67
	High	2 690.000	-36.53		23.53
64 QAM	Low	2 496.000	-34.33		21.33
	High	2 690.000	-37.96		24.96
QPSK	Low	2 496.000	-34.08		21.08
	High	2 690.000	-37.09		24.09

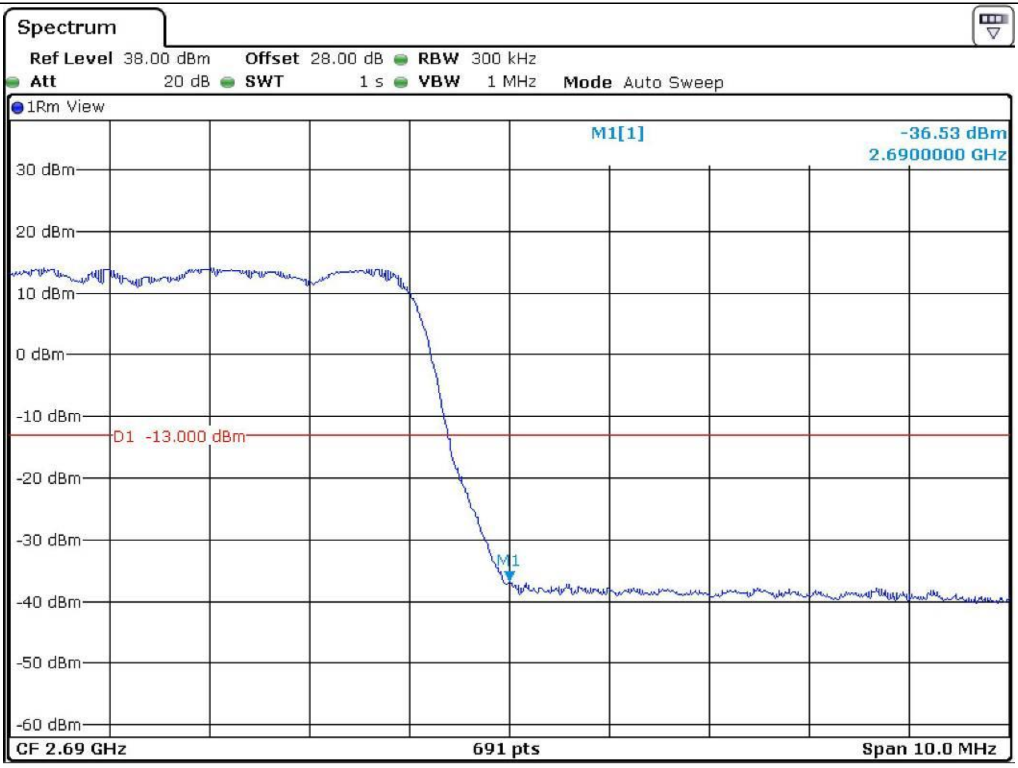
According to Part 27C, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

Tested by: Tae-Ho, Kim / Project Engineer

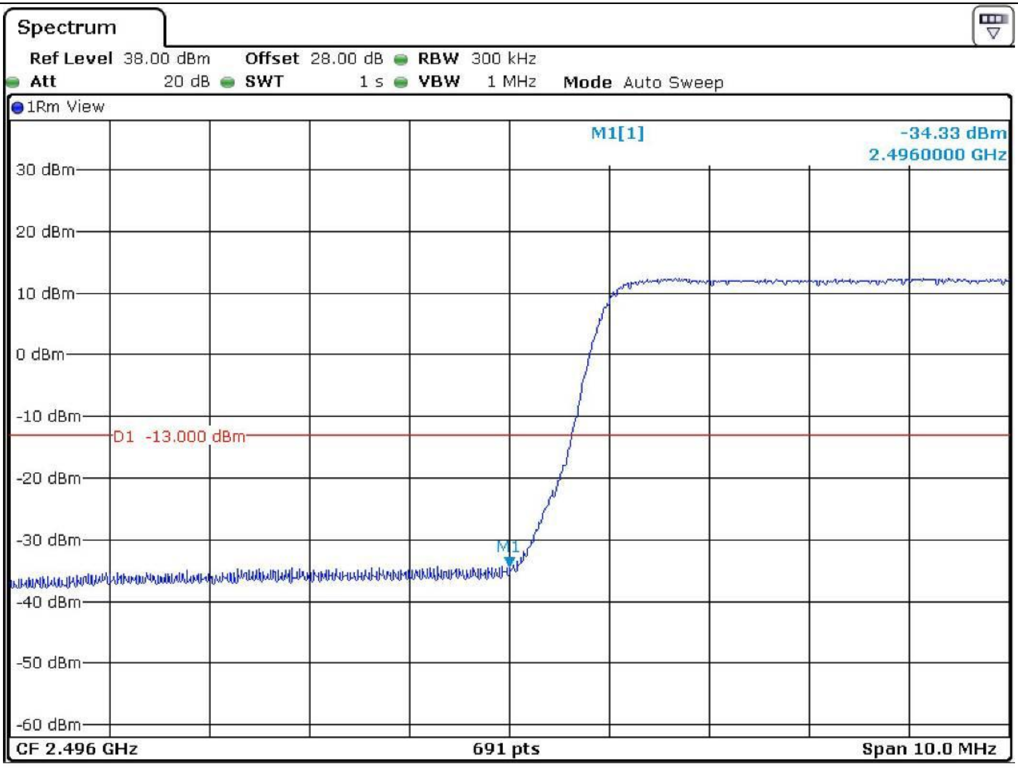
HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



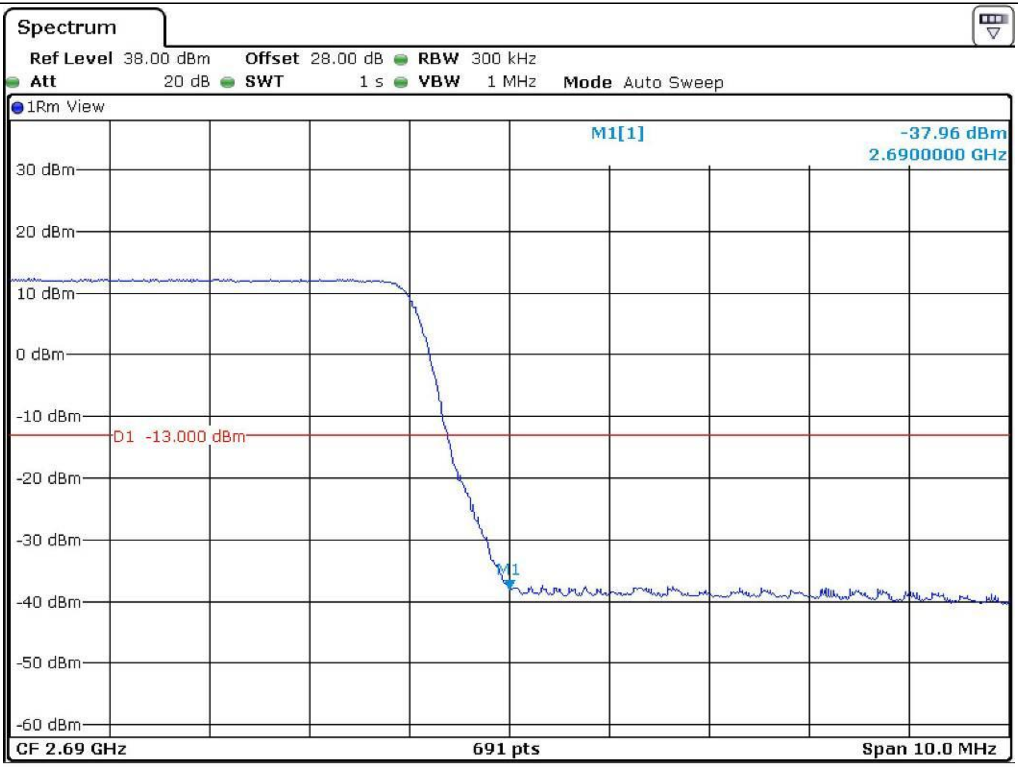
16 QAM – Band Edge (Low Channel)



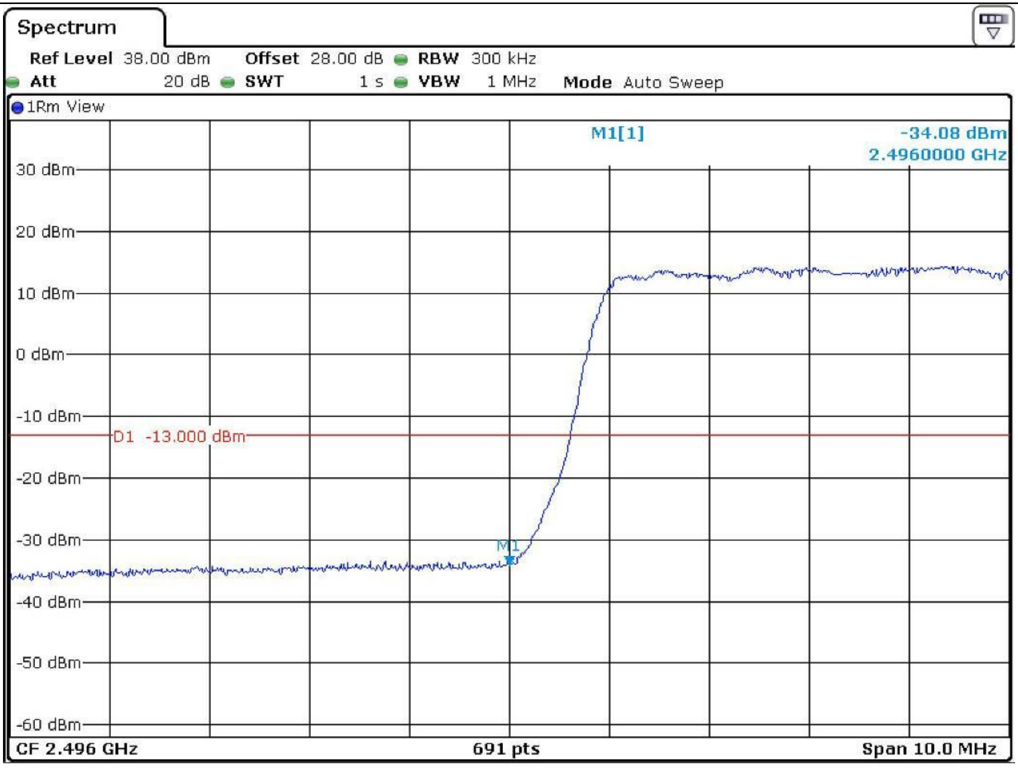
16 QAM – Band Edge (High Channel)



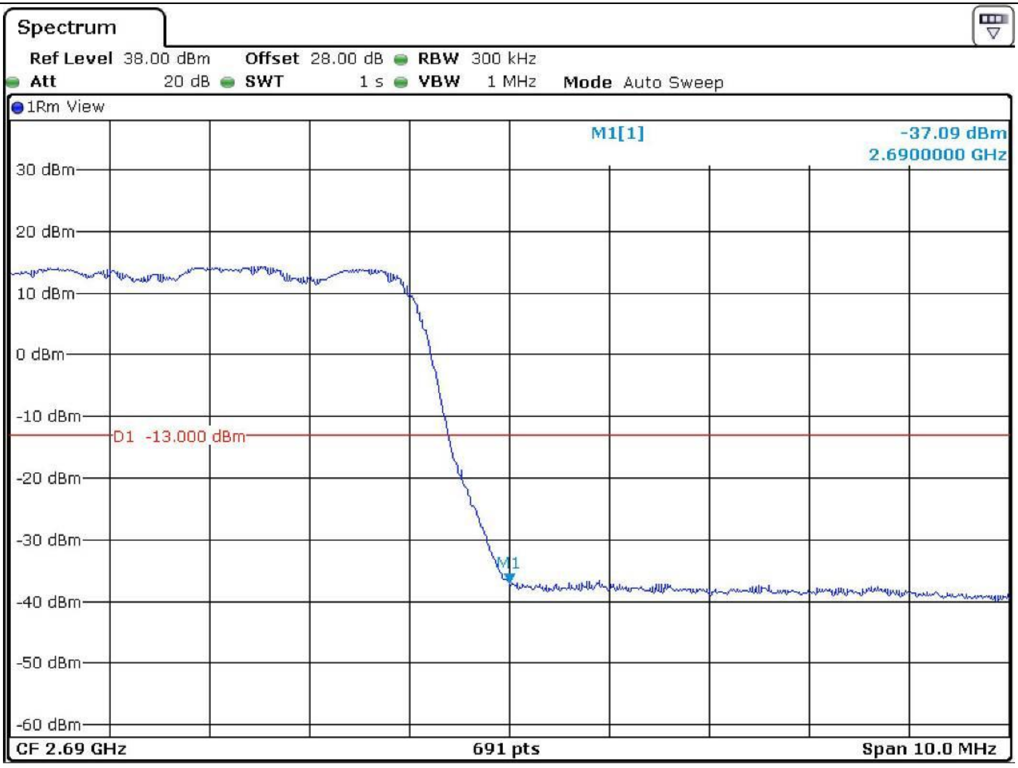
64 QAM – Band Edge (Low Channel)



64 QAM– Band Edge (High Channel)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.5 Test data for Port 1

8.5.1 Test Result (20 MHz/1 Carrier)

-. Test Date : July 31, 2014

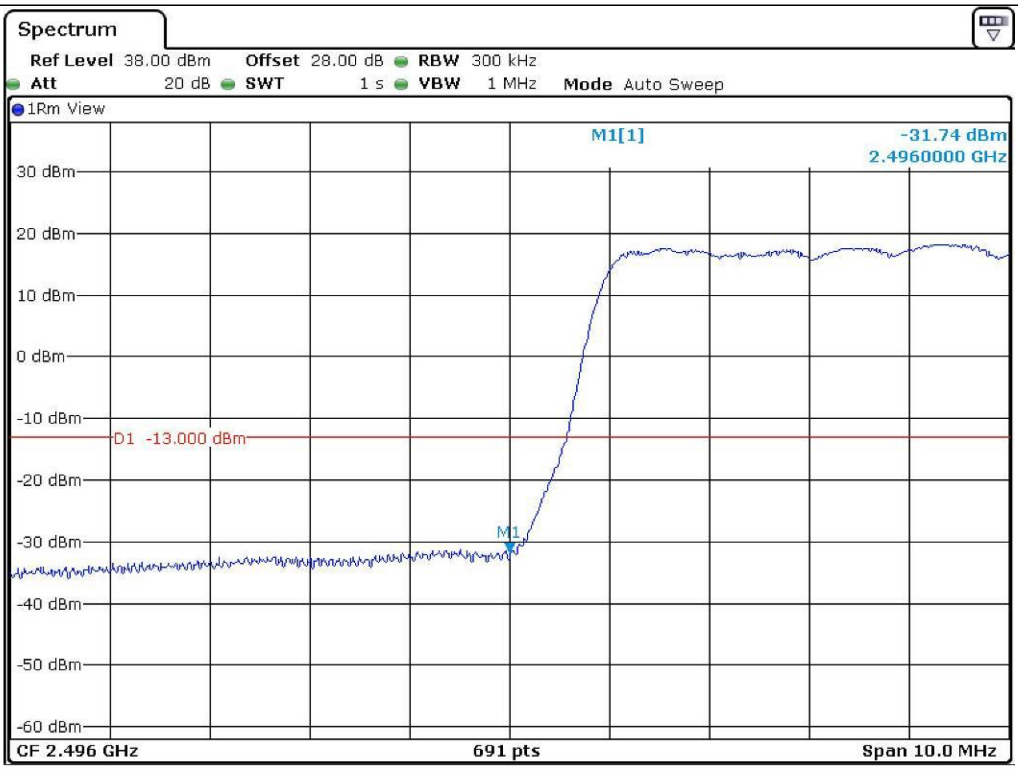
-. Result : Pass

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
16 QAM	Low	2 496.000	-31.74	-13.00	18.74
	High	2 690.000	-35.13		22.13
64 QAM	Low	2 496.000	-34.94		21.94
	High	2 690.000	-35.58		22.58
QPSK	Low	2 496.000	-32.21		19.21
	High	2 690.000	-35.69		22.69

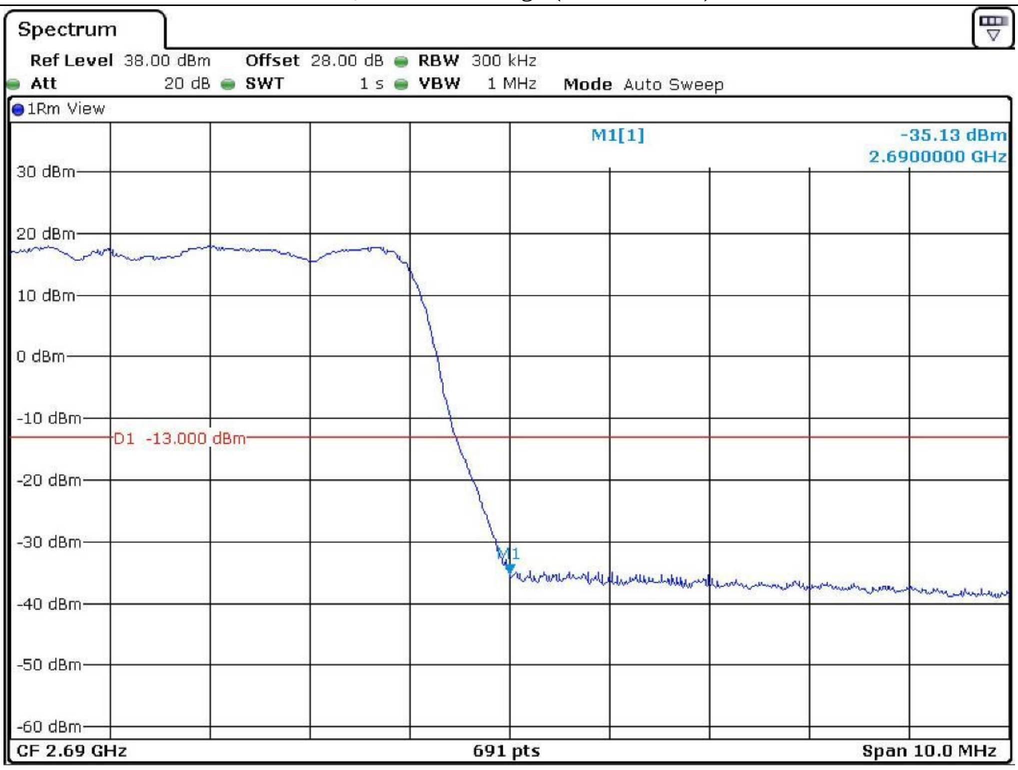
According to Part 27C, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

Tested by: Tae-Ho, Kim / Project Engineer

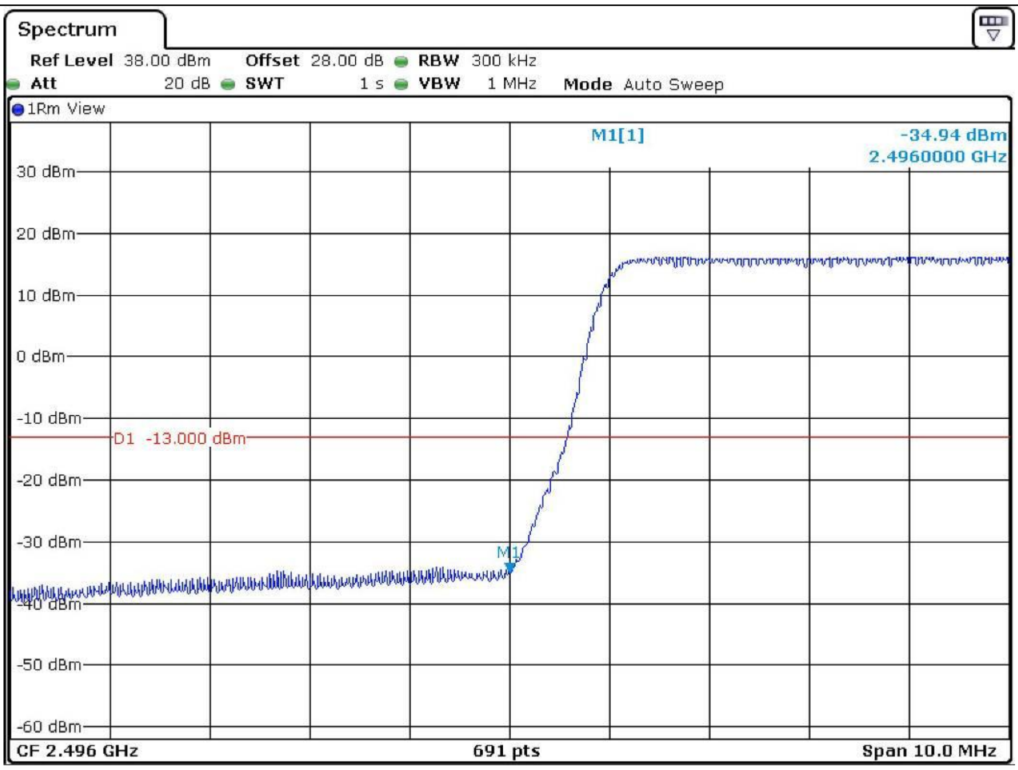
HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



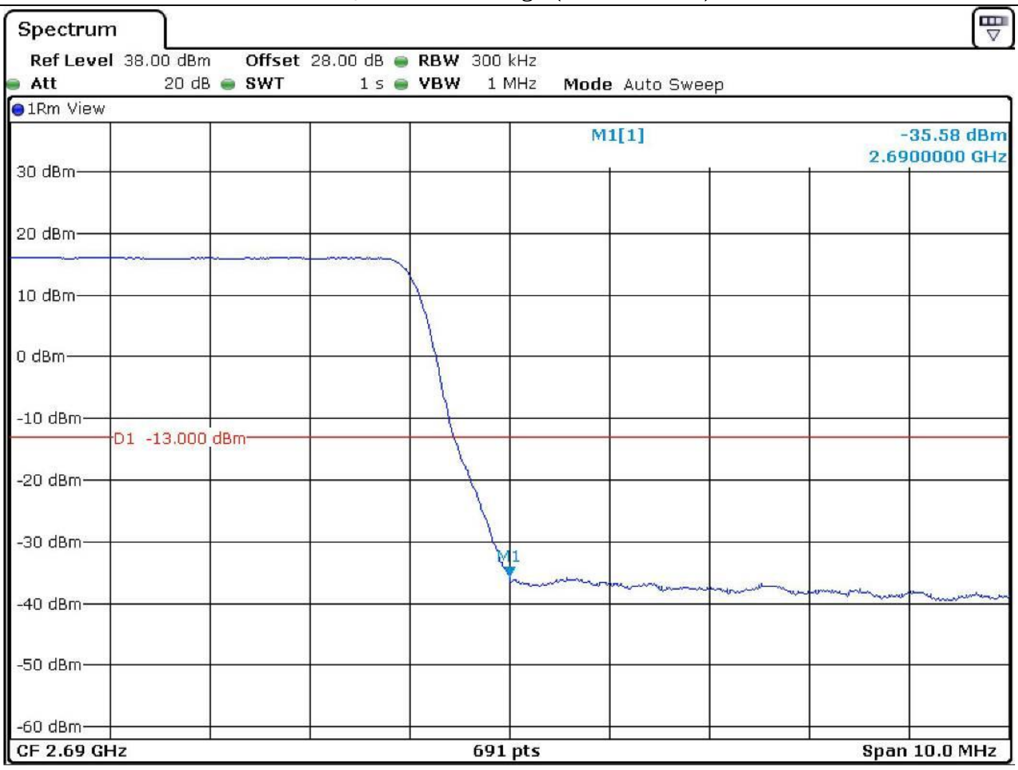
16 QAM – Band Edge (Low Channel)



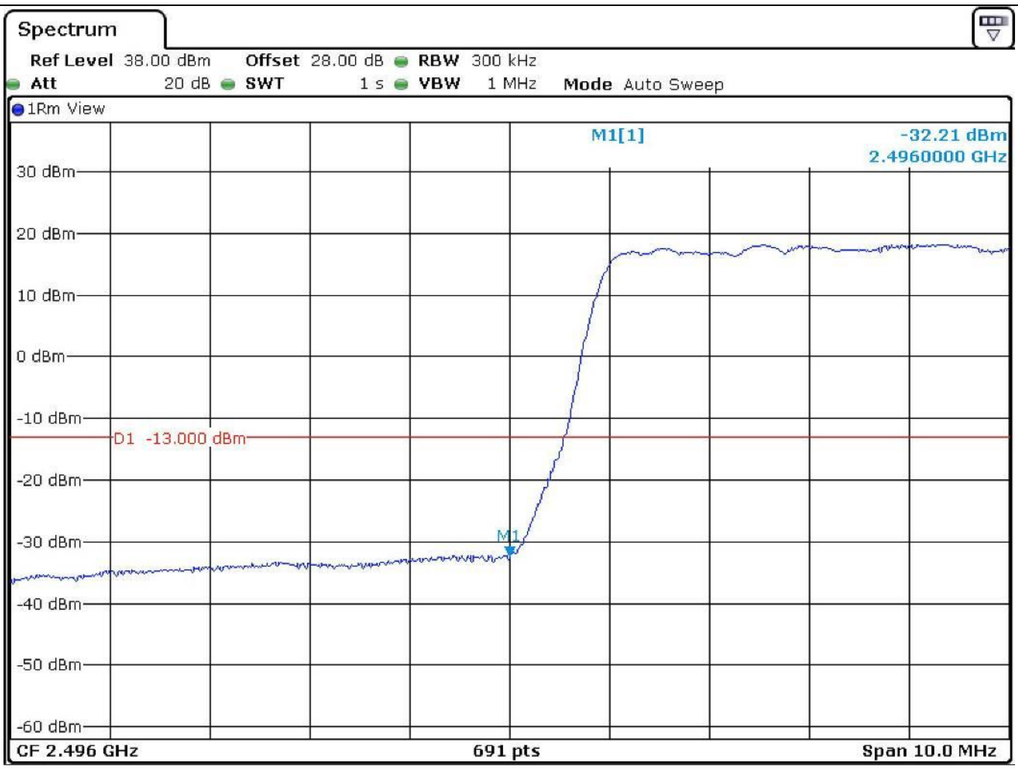
16 QAM – Band Edge (High Channel)



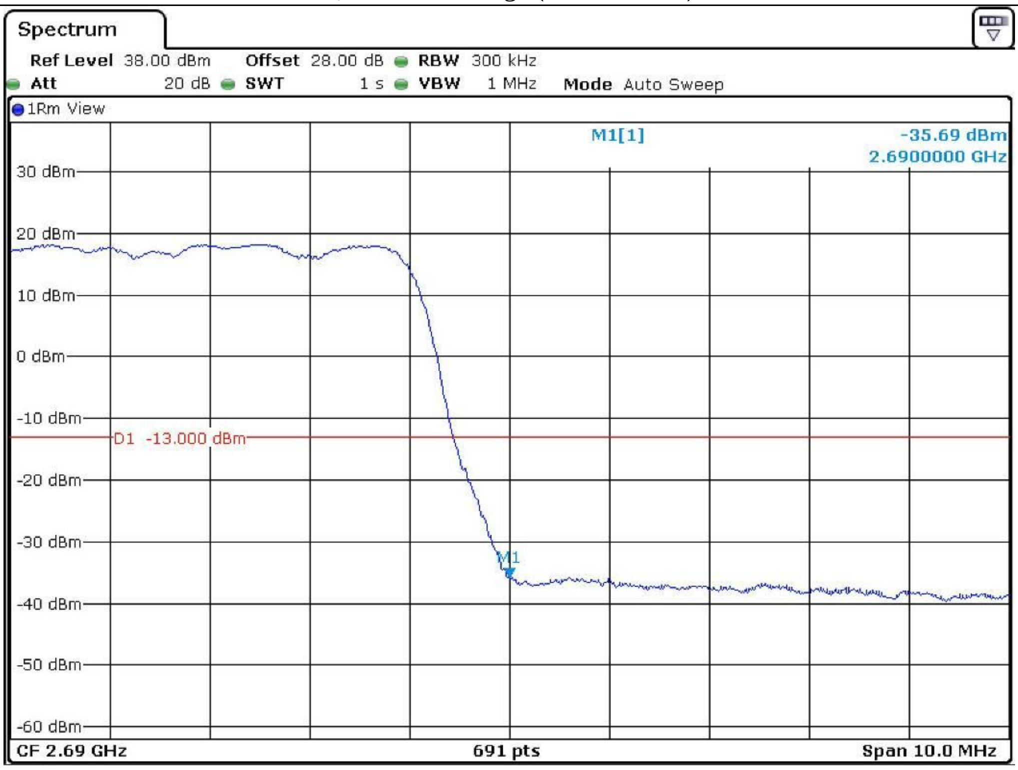
64 QAM – Band Edge (Low Channel)



64 QAM– Band Edge (High Channel)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.5.2 Test Result (20 MHz/2 Carrier)

-. Test Date : July 31, 2014

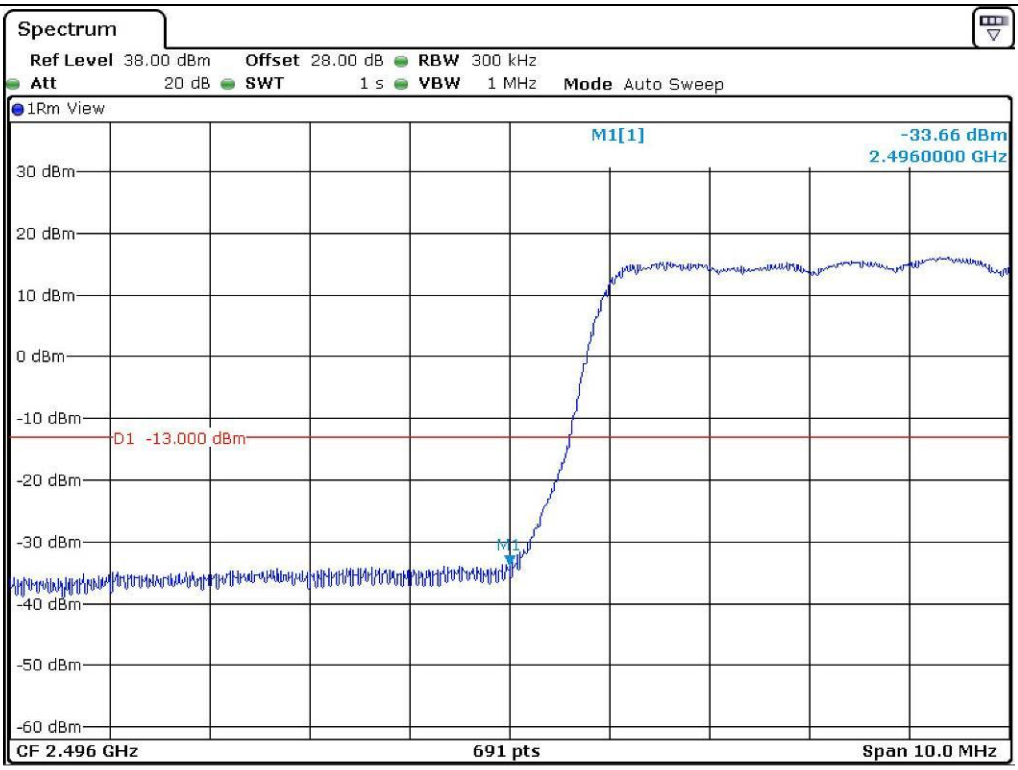
-. Result : Pass

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
16 QAM	Low	2 496.000	-33.66	-13.00	20.66
	High	2 690.000	-35.61		22.61
64 QAM	Low	2 496.000	-35.34		22.34
	High	2 690.000	-36.98		23.98
QPSK	Low	2 496.000	-35.59		22.59
	High	2 690.000	-36.09		23.09

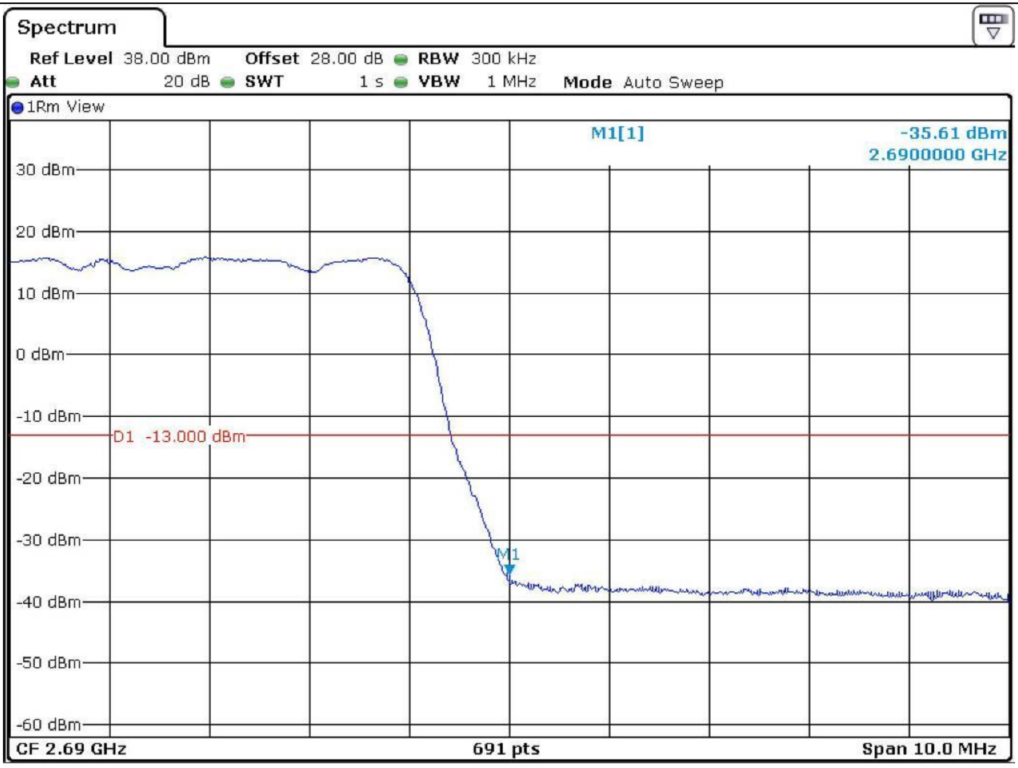
According to Part 27C, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

Tested by: Tae-Ho, Kim / Project Engineer

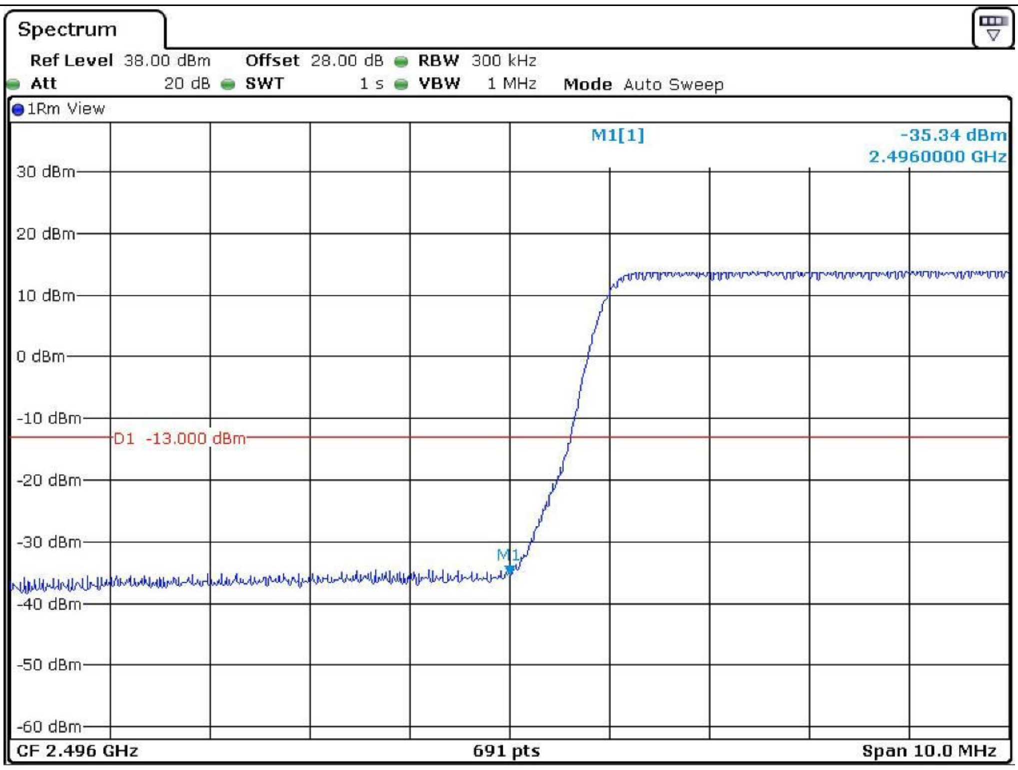
HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



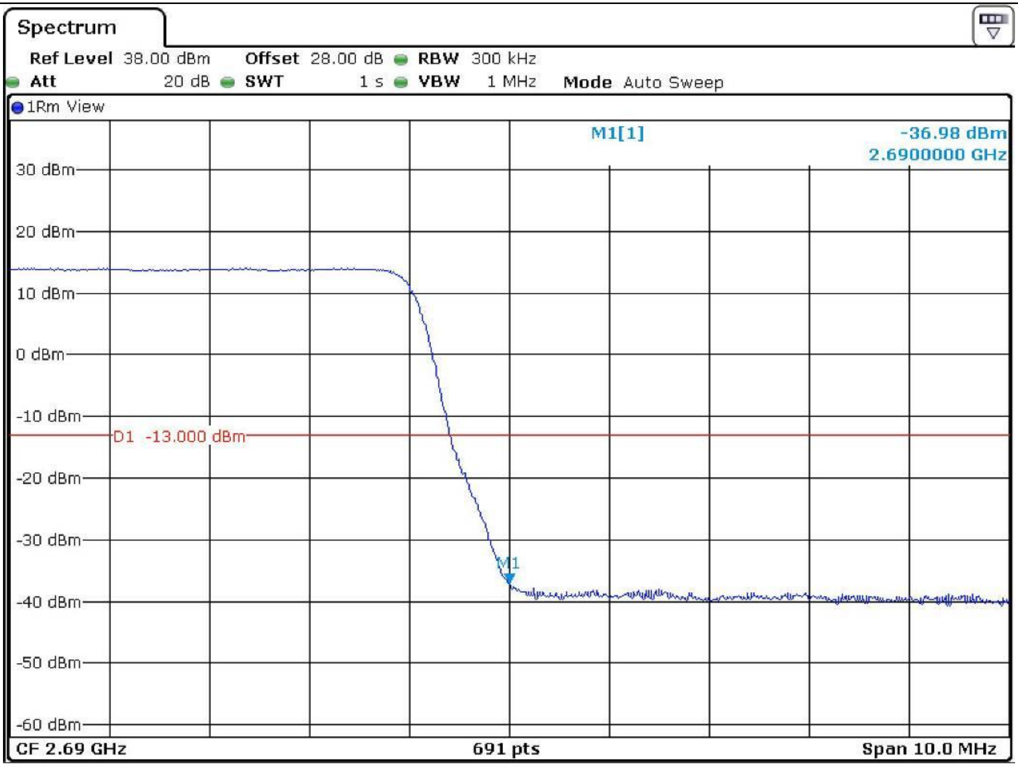
16 QAM – Band Edge (Low Channel)



16 QAM – Band Edge (High Channel)

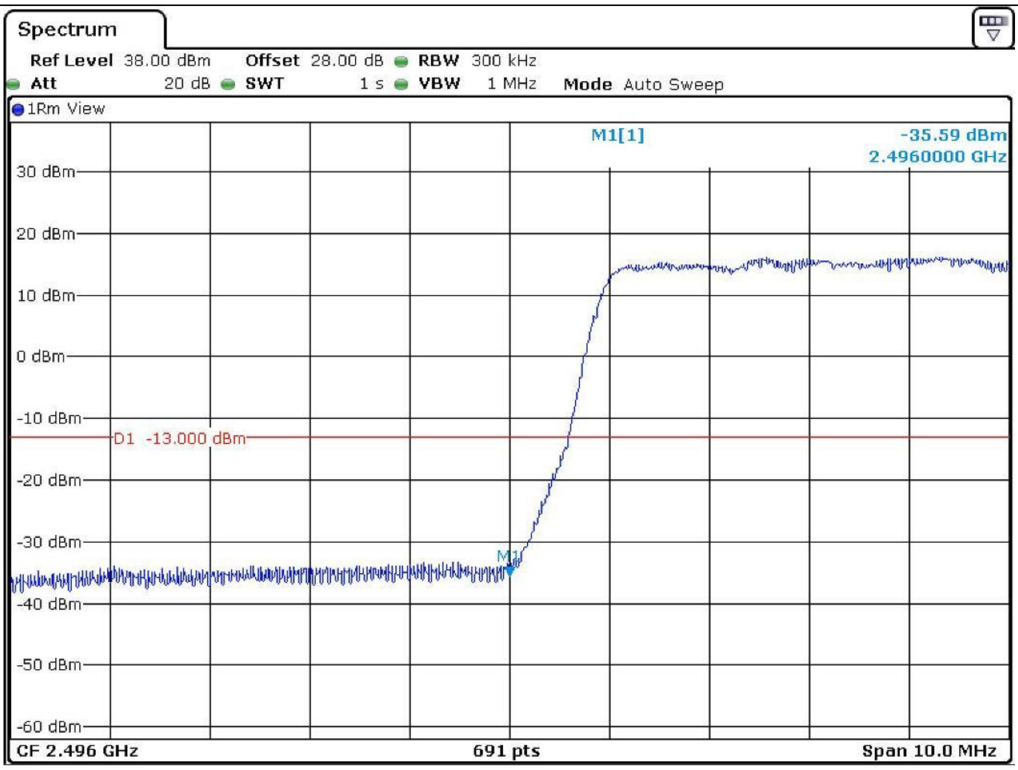


64 QAM – Band Edge (Low Channel)

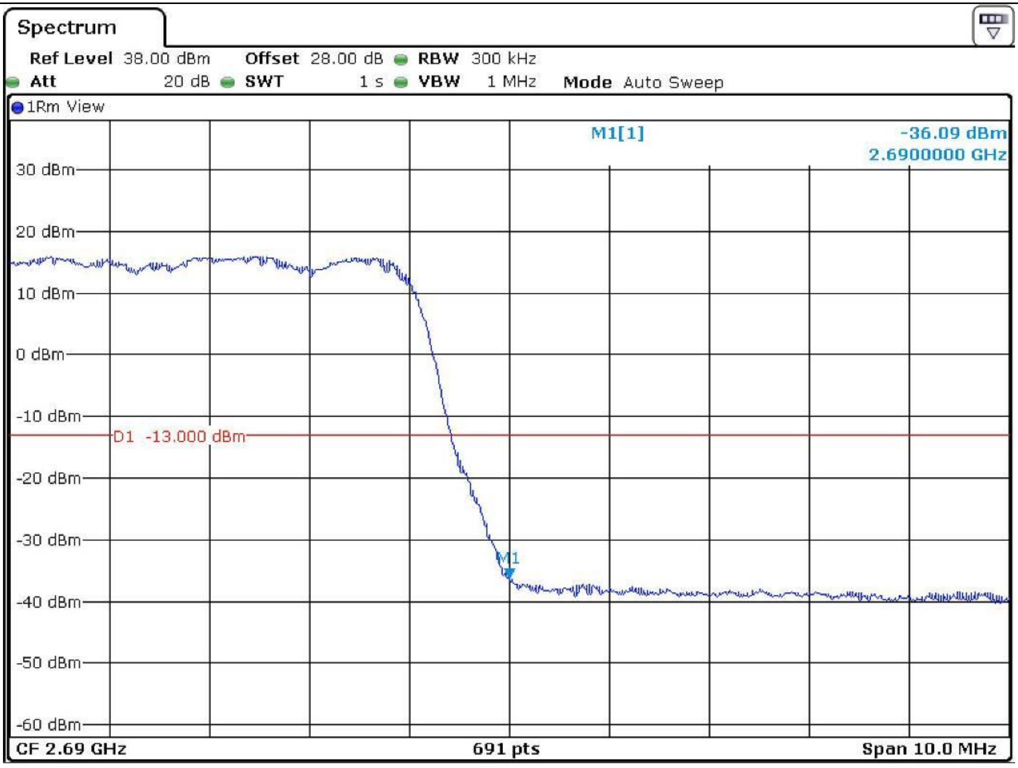


64 QAM– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

8.5.3 Test Result (20 MHz/3 Carrier)

-. Test Date : July 31, 2014

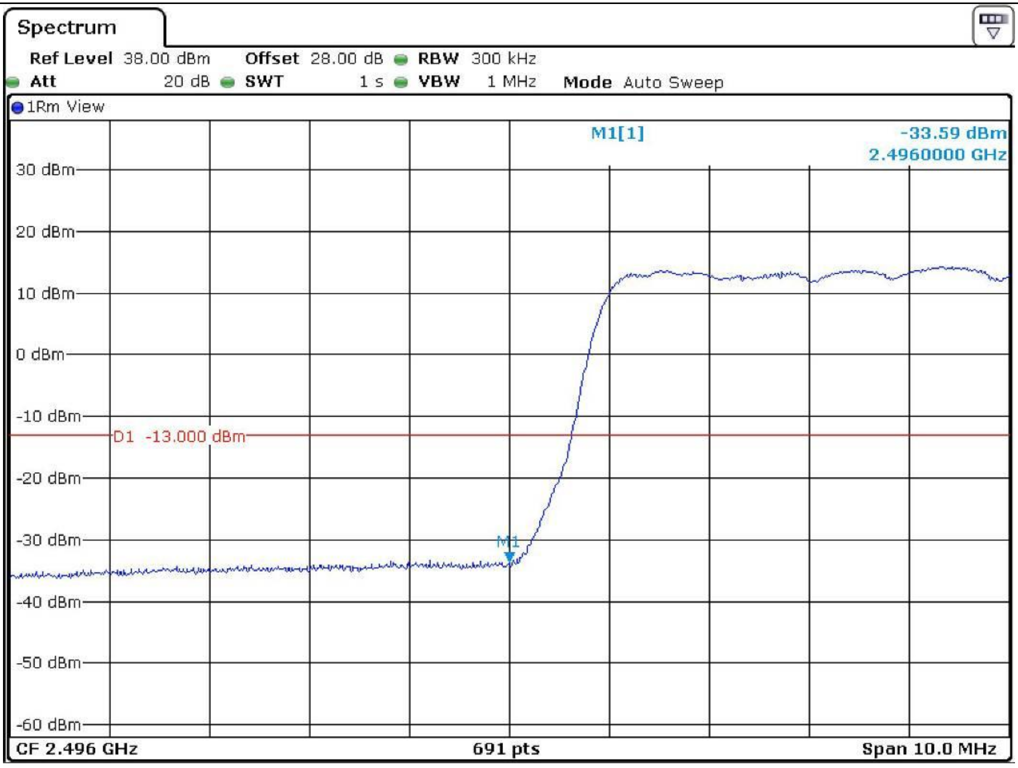
-. Result : Pass

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
16 QAM	Low	2 496.000	-33.59	-13.00	20.59
	High	2 690.000	-37.68		24.68
64 QAM	Low	2 496.000	-35.54		22.54
	High	2 690.000	-37.35		24.35
QPSK	Low	2 496.000	-33.62		20.62
	High	2 690.000	-37.08		24.08

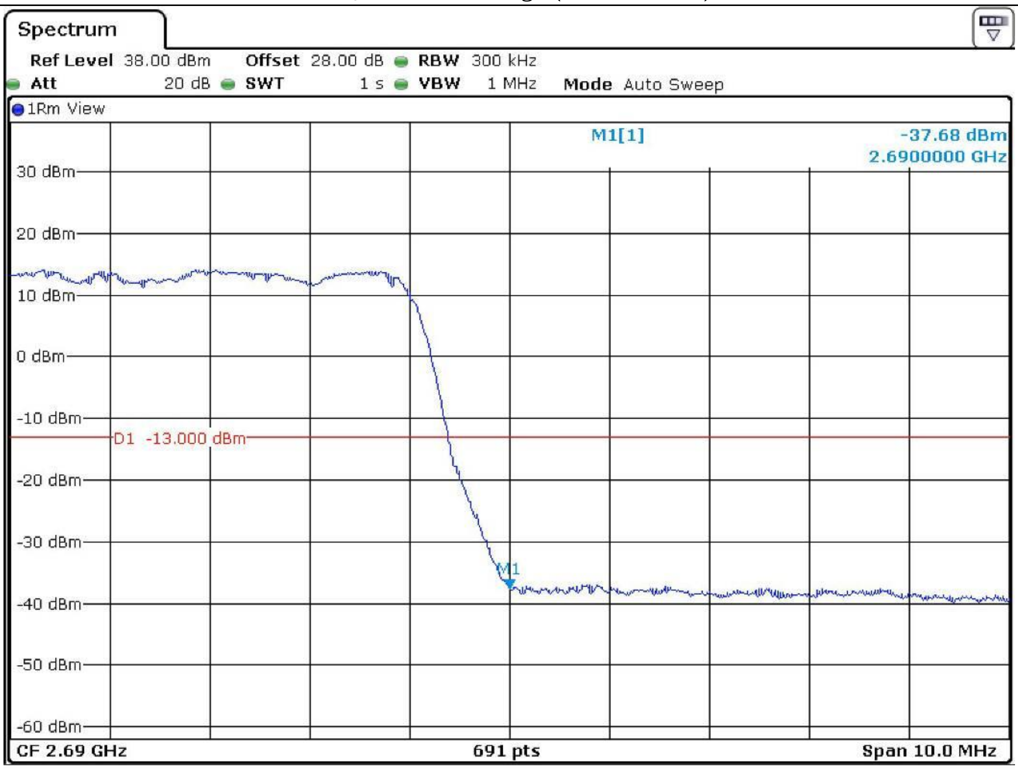
According to Part 27C, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

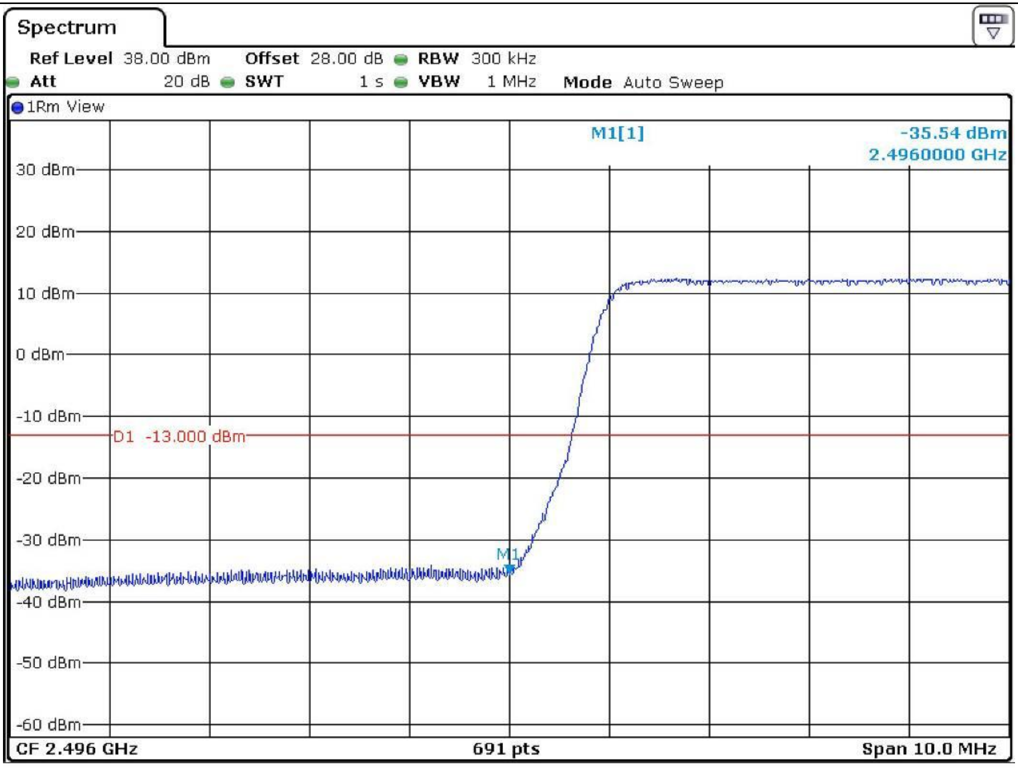


16 QAM – Band Edge (Low Channel)

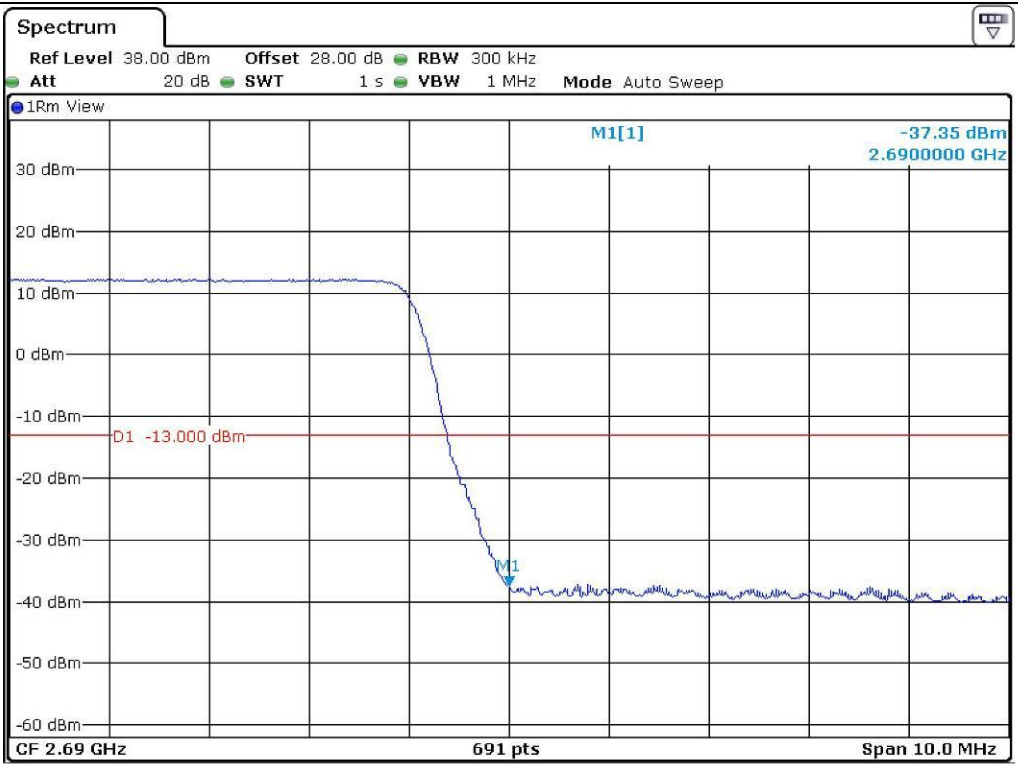


16 QAM – Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

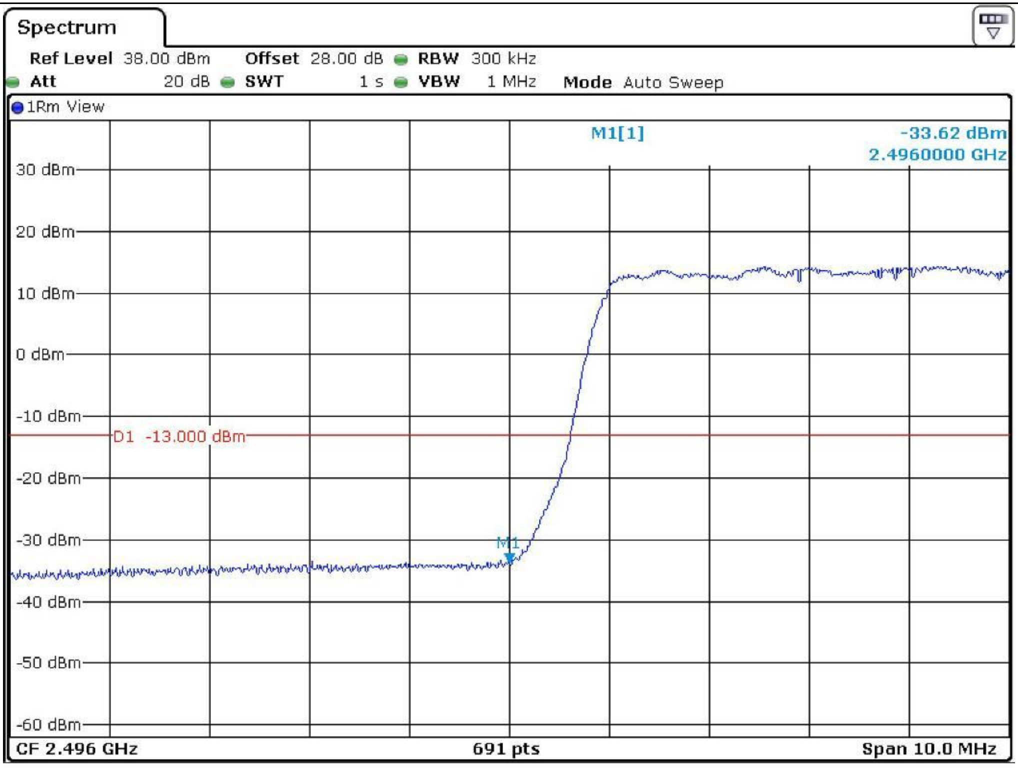


64 QAM – Band Edge (Low Channel)

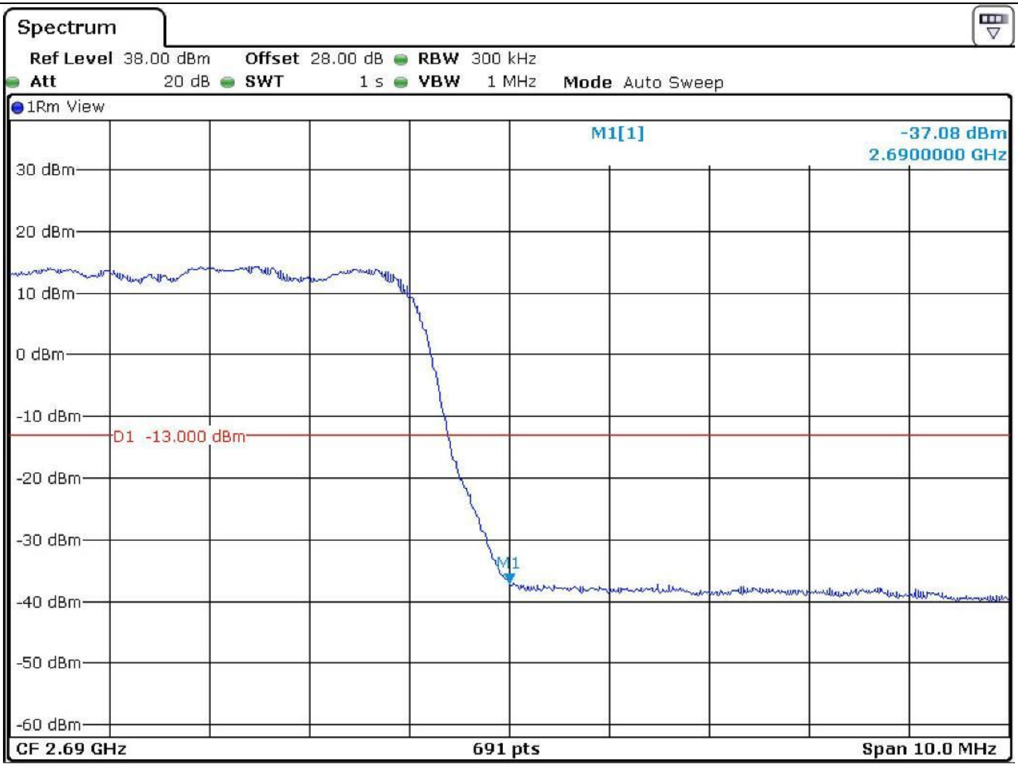


64 QAM– Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



QPSK– Band Edge (Low Channel)



QPSK– Band Edge (High Channel)

9. FIELD STRENGTH OF SPURIOUS RADIATION

9.1 Operating environment

Temperature : 24 ℃

Relative humidity : 47 % R.H.

9.2 Test set-up

The radiated emissions measurements were on the 10 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to up to 10^{th} harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101013	Apr. 28, 2014 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 28, 2014 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Jan. 20, 2014 (1Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May 02, 2014 (2Y)
■	83650L	HP	Swept CW Generator	3844A00415	Apr. 28, 2014 (1Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 28, 2013 (2Y)
■ -	67-30-43	Aeroflex/Weinschel,Inc.,	Attenuator	CA5760	Nov. 05, 2013 (1Y)
■ -	WA49-20-43	Weinschel Associates	Attenuator	A192	Apr. 04, 2014 (1Y)
■ -	DH-60	Dea Kwang Elec.	Slidacs	N/A	Sep. 03, 2013 (1Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

9.4 Test data for radiated emission

9.4.1 Test Result (20 MHz/1 Carrier)

-. Test Date : July 31, 2014

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 27.5 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)		Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
2 506	43.58	54.50	-54.04	1.12	V	0.27	-53.18	-13.00	40.18
	64.92	53.90	-63.98	1.23	V	0.43	-63.18	-13.00	50.18
	91.11	49.70	-68.21	2.19	V	0.55	-66.57	-13.00	53.57
	200.72	47.40	-70.95	1.53	H	0.82	-70.24	-13.00	57.24
	266.68	45.90	-70.11	1.45	H	0.94	-69.60	-13.00	56.60
	319.06	43.90	-71.50	1.27	H	1.04	-71.27	-13.00	58.27
	392.78	44.30	-68.51	0.77	H	1.18	-68.92	-13.00	55.92
	750.70	38.80	-68.84	1.38	H	1.68	-69.14	-13.00	56.14
	875.83	36.40	-68.23	1.27	H	1.81	-68.77	-13.00	55.77
	950.52	35.10	-66.37	0.12	H	1.88	-68.13	-13.00	55.13
Other frequencies have margin more than 40 dB.									

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Tae-Ho, Kim / Project Engineer

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9.4.2 Test Result (20 MHz/2 Carrier)

-. Test Date : July 31, 2014

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 27.5 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)		Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
2 516	43.58	54.20	-54.34	1.12	V	0.27	-53.48	-13.00	40.48
	64.92	53.30	-64.58	1.23	V	0.43	-63.78	-13.00	50.78
	91.11	49.90	-68.01	2.19	V	0.55	-66.37	-13.00	53.37
	200.72	47.10	-71.25	1.53	H	0.82	-70.54	-13.00	57.54
	266.68	45.40	-70.61	1.45	H	0.94	-70.10	-13.00	57.10
	319.06	44.10	-71.30	1.27	H	1.04	-71.07	-13.00	58.07
	392.78	44.80	-68.01	0.77	H	1.18	-68.42	-13.00	55.42
	750.70	38.60	-69.04	1.38	H	1.68	-69.34	-13.00	56.34
	875.83	36.40	-68.23	1.27	H	1.81	-68.77	-13.00	55.77
	950.52	35.30	-66.17	0.12	H	1.88	-67.94	-13.00	54.94
Other frequencies have margin more than 40 dB.									

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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9.4.3 Test Result (20 MHz/3 Carrier)

-. Test Date : July 31, 2014

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 27.5 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)		Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
2 526	43.58	54.00	-54.54	1.12	V	0.27	-53.68	-13.00	40.68
	64.92	53.30	-64.58	1.23	V	0.43	-63.78	-13.00	50.78
	91.11	49.50	-68.41	2.19	V	0.55	-66.77	-13.00	53.77
	200.72	47.30	-71.05	1.53	H	0.82	-70.34	-13.00	57.34
	266.68	45.10	-70.91	1.45	H	0.94	-70.40	-13.00	57.40
	319.06	44.20	-71.20	1.27	H	1.04	-70.97	-13.00	57.97
	392.78	45.10	-67.71	0.77	H	1.18	-68.12	-13.00	55.12
	750.70	38.50	-69.14	1.38	H	1.68	-69.44	-13.00	56.44
	875.83	36.20	-68.43	1.27	H	1.81	-68.97	-13.00	55.97
	950.52	35.70	-65.77	0.12	H	1.88	-67.54	-13.00	54.54
Other frequencies have margin more than 40 dB.									

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Tae-Ho, Kim / Project Engineer

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10. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

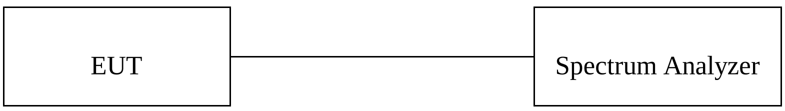
10.1 Operating environment

Temperature	:	24 ℃
Relative humidity	:	47 % R.H.

10.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

Turn EUT off and set chamber temperature to -30 ℃ and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 ℃ step from -30 ℃ to +50 ℃. Repeat above method for frequency measurements every 10 ℃ step and then record all measured frequencies on each temperature step.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SSE-43CI-A	Samkun	Chamber	060712	May 15, 2014 (1Y)
■ -	FSV30	R/S	FSV30 Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	67-30-43	Aeroflex/Weinschel,Inc.,	Attenuator	CA5760	Nov. 05, 2013 (1Y)
■ -	WA49-20-43	Weinschel Associates	Attenuator	A192	Apr. 04, 2014 (1Y)
■ -	DH-60	Dea Kwang Elec.	Slidacs	N/A	Sep. 03, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

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10.4 Test data (20 MHz/1 Carrier)

-. Test Date : July 31, 2014

-. Result : Pass

Temperature (°C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
20(Ref)	2 590 000 458	2 590 000 458	0.000 0	Within the Authorized Frequency block
-30		2 590 000 443	-0.005 8	
-20		2 590 000 449	-0.003 5	
-10		2 590 000 457	-0.000 4	
0		2 590 000 453	-0.001 9	
10		2 590 000 443	-0.005 8	
30		2 590 000 460	0.000 8	
40		2 590 000 440	-0.006 9	
50		2 590 000 441	-0.006 6	

10.5 Test data (20 MHz/2 Carrier)

-. Test Date : July 31, 2014

-. Result : Pass

Temperature (°C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
20(Ref)	2 600 000 449	2 600 000 449	0.000 0	Within the Authorized Frequency block
-30		2 600 000 446	-0.001 2	
-20		2 600 000 459	0.003 8	
-10		2 600 000 453	0.001 5	
0		2 600 000 459	0.003 8	
10		2 600 000 441	-0.003 1	
30		2 600 000 445	-0.001 5	
40		2 600 000 444	-0.001 9	
50		2 600 000 459	0.003 8	

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10.6 Test data (20 MHz/3 Carrier)

-. Test Date : July 31, 2014

-. Result : Pass

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
20(Ref)	2 610 000 442	2 610 000 442	0.000 0	Within the Authorized Frequency block
-30		2 610 000 449	0.002 7	
-20		2 610 000 452	0.003 8	
-10		2 610 000 457	0.005 7	
0		2 610 000 448	0.002 3	
10		2 610 000 442	0.000 0	
30		2 610 000 441	-0.000 4	
40		2 610 000 454	0.004 6	
50		2 610 000 451	0.003 4	

Tested by: Tae-Ho, Kim / Project Engineer

11. FREQUENCY STABILITY WITH VOLTAGE VARIATION

11.1 Operating environment

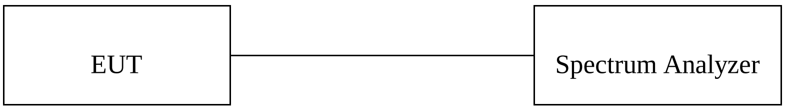
Temperature : 24 ℃

Relative humidity : 47 % R.H.

12.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

The RF output port of the EUT was connected to the input of the spectrum analyzer. The signal generator was set to center frequency for each band with an un-modulated signal. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	R/S	FSV30 Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	67-30-43	Aeroflex/Weinschel,Inc.,	Attenuator	CA5760	Nov. 05, 2013 (1Y)
■ -	WA49-20-43	Weinschel Associates	Attenuator	A192	Apr. 04, 2014 (1Y)
■ -	DH-60	Dea Kwang Elec.	Slidacs	N/A	Sep. 03, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4 Test data (20 MHz/1 Carrier)

-. Test Date : July 31, 2014

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
138 (115 %)	2 590 000 458	2 590 000 457	-0.000 4	Within the Authorized Frequency block
120 (100 %)		2 590 000 458	0.000 0	
102 (85 %)		2 590 000 447	-0.004 2	

11.5 Test data (20 MHz/2 Carrier)

-. Test Date : July 31, 2014

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
138 (115 %)	2 600 000 449	2 600 000 451	0.000 8	Within the Authorized Frequency block
120 (100 %)		2 600 000 449	0.000 0	
102 (85 %)		2 600 000 457	0.003 1	

11.6 Test data (20 MHz/3 Carrier)

-. Test Date : July 31, 2014

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
138 (115 %)	2 610 000 442	2 610 000 442	0.000 0	Within the Authorized Frequency block
120 (100 %)		2 610 000 442	0.000 0	
102 (85 %)		2 610 000 455	0.005 0	

Tested by: Tae-Ho, Kim / Project Engineer

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12. MAXIMUM PERMISSIBLE EXPOSURE

12.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are f/1500 mW/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric filed strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combing equations and rearranging the terms to express the distance as a function of the remaining variable

$d = \sqrt{(30 * P * G) / (377 * 10\ S)}$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 0.01 * d (m)

$d = 0.282 * \sqrt{(P * G) / S}$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

12.2 Calculated MPE Safe Distance

12.2.1 Test data for Port 0

12.2.1.1 Test Result (20 MHz/1 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm²)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm²)
37.11	5 140.43	12.5	17.78	85.26	0.73	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{5140.43 * 17.78} = 85.26$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 5128.61 * 17.78 / (4 * 3.14 * 100^2) = 0.7278$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

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12.2.1.2 Test Result (20 MHz/2 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm^2)
37.92	6 194.41	12.5	17.78	93.59	0.88	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{6194.41 * 17.78} = 93.59$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 6194.41 * 17.78 / (4 * 3.14 * 100^2) = 0.88$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

12.2.1.3 Test Result (20 MHz/3 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm^2)
37.80	6 025.60	12.5	17.78	92.31	0.85	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{6025.6 * 17.78} = 92.31$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 6025.60 * 17.78 / (4 * 3.14 * 100^2) = 0.8531$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

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12.2.2 Test data for Port 1

12.2.2.1 Test Result (20 MHz/1 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm^2)
37.10	5 128.61	12.5	17.78	85.16	0.73	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{5140.43 * 17.78} = 85.26$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 5128.61 * 17.78 / (4 * 3.14 * 100^2) = 0.7278$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

12.2.2.2 Test Result (20 MHz/2 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm^2)
37.83	6 067.36	12.5	17.78	92.63	0.86	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{6194.41 * 17.78} = 93.59$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 6194.41 * 17.78 / (4 * 3.14 * 100^2) = 0.88$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

12.2.2.3 Test Result (20 MHz/3 Carrier)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 100 cm Separation	(mW/cm^2)
37.79	6 011.73	12.5	17.78	92.20	0.85	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{6025.6 * 17.78} = 92.31$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 6025.60 * 17.78 / (4 * 3.14 * 100\text{^}2) = 0.8531$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.