9. INTERMODULATION TEST

9.1 Operating environment

Temperature : 25 ℃

Relative humidity : 50 % R.H.

9.2 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 modulation.

Two input signals are equal in level and were sent to the input of the EUT.

9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	SMBV100A	Rohde & Schwarz	Vector Signal Generator	260423	July 30, 2014(1Y)
■ -	SMB100A	Rohde & Schwarz	Signal Generator	177648	July 30, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4 Test data for Downlink

9.4.1 Test Result for peak power

-. Test Date : November 06, 2014

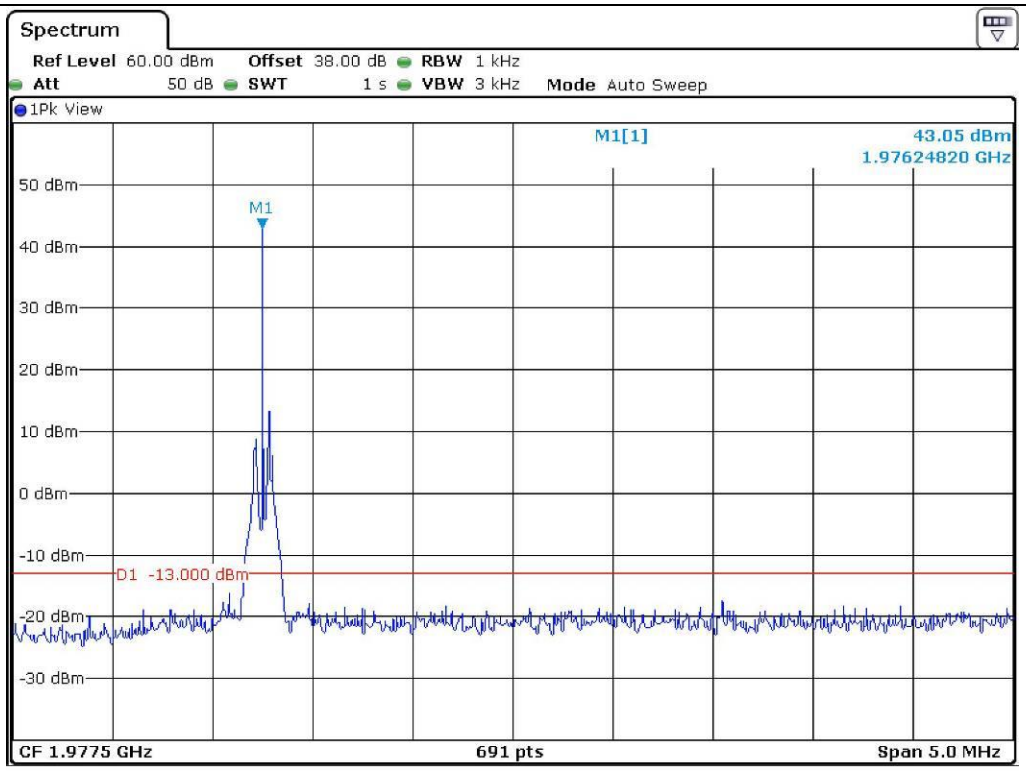
-. Test Result : Pass

-. Modulation : No-Modulation

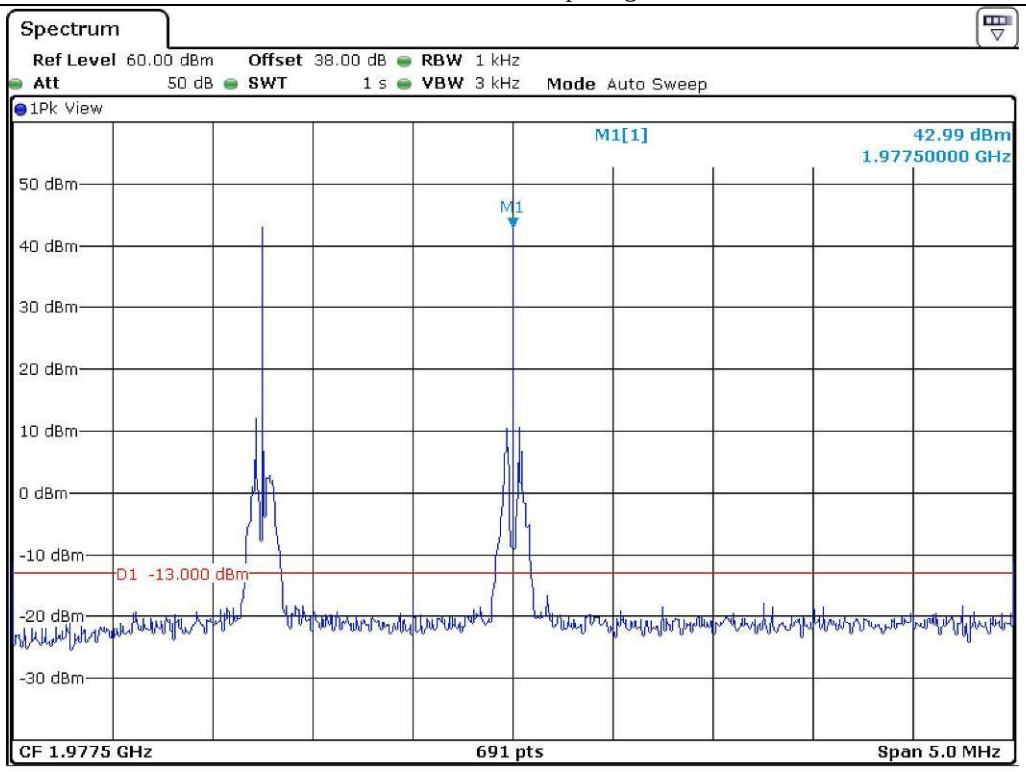
Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
1 976.25	1	-56.97	43.05
1 976.25 & 1 977.50	2	-56.99	42.99
1 976.25 & 1 977.5 & 1 978.75	3	-57.01	42.98
1 993.75	1	-57.03	43.07
1 993.75 & 1 992.5	2	-56.95	43.02
1 993.75 & 1 992.50 & 1 991.25	3	-57.04	42.97

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



Low Channel – 1 input signal



Low Channel – 2 input signals

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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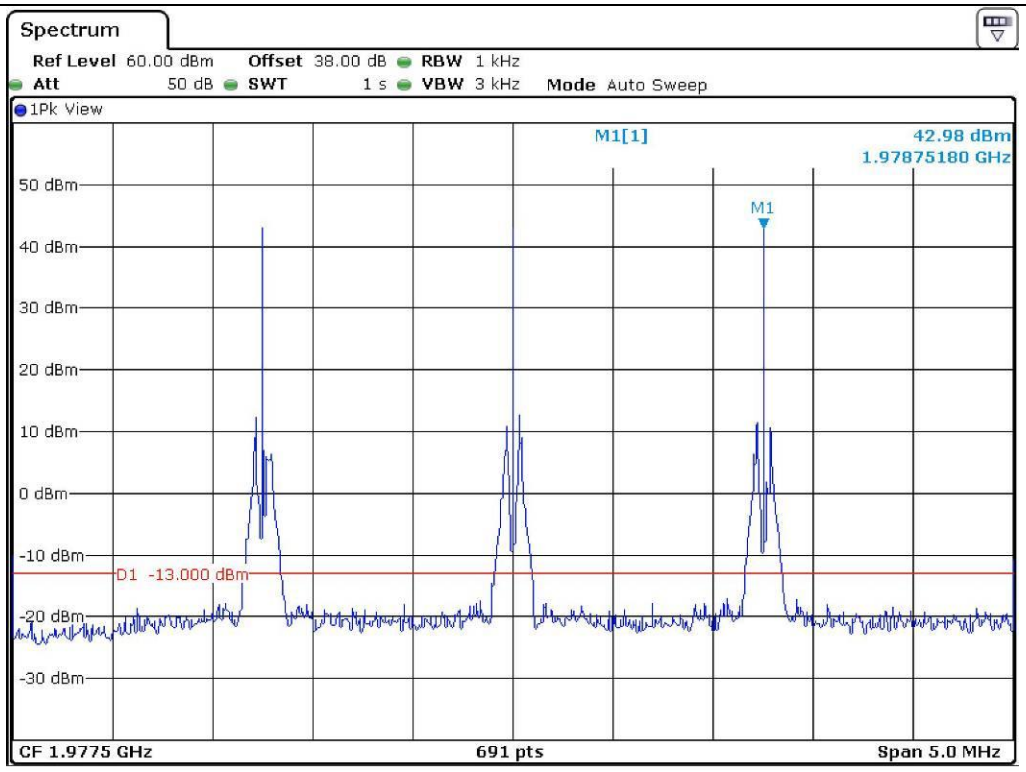
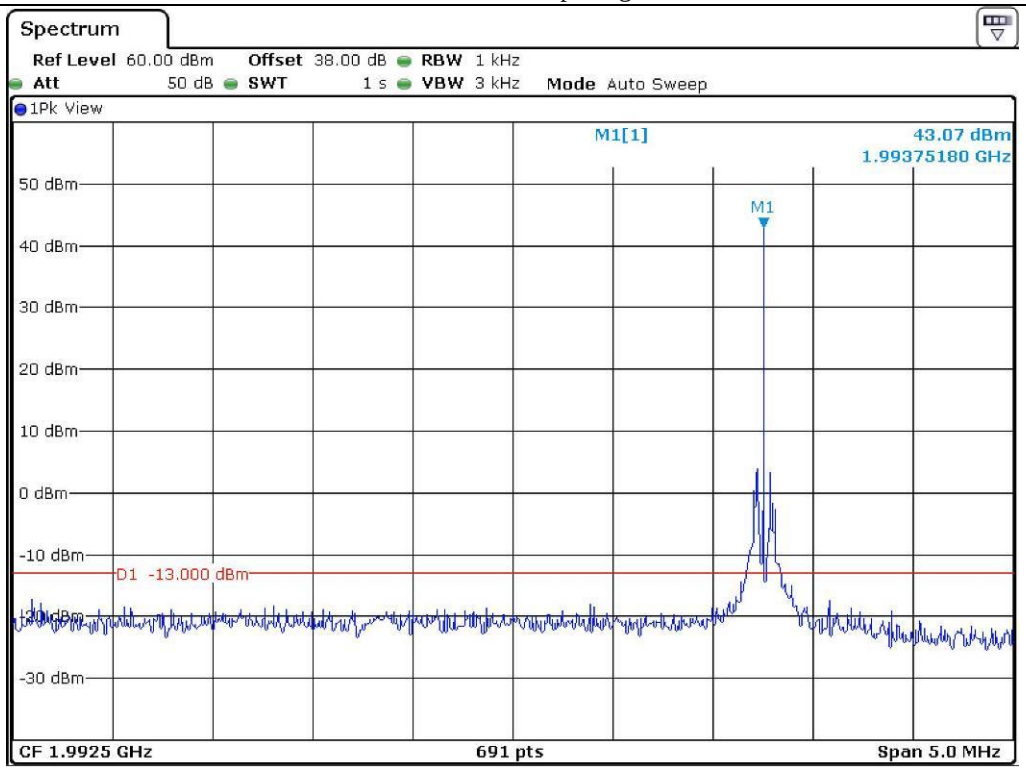


Low Channel – 3 input signals



High Channel – 1 input signal

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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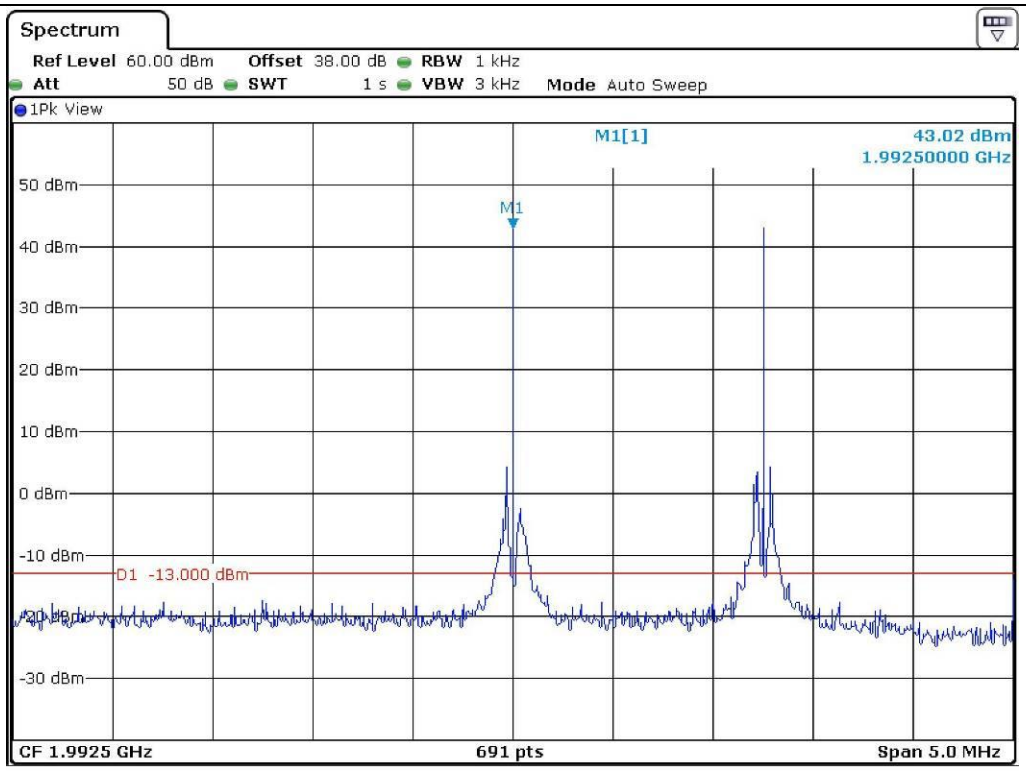
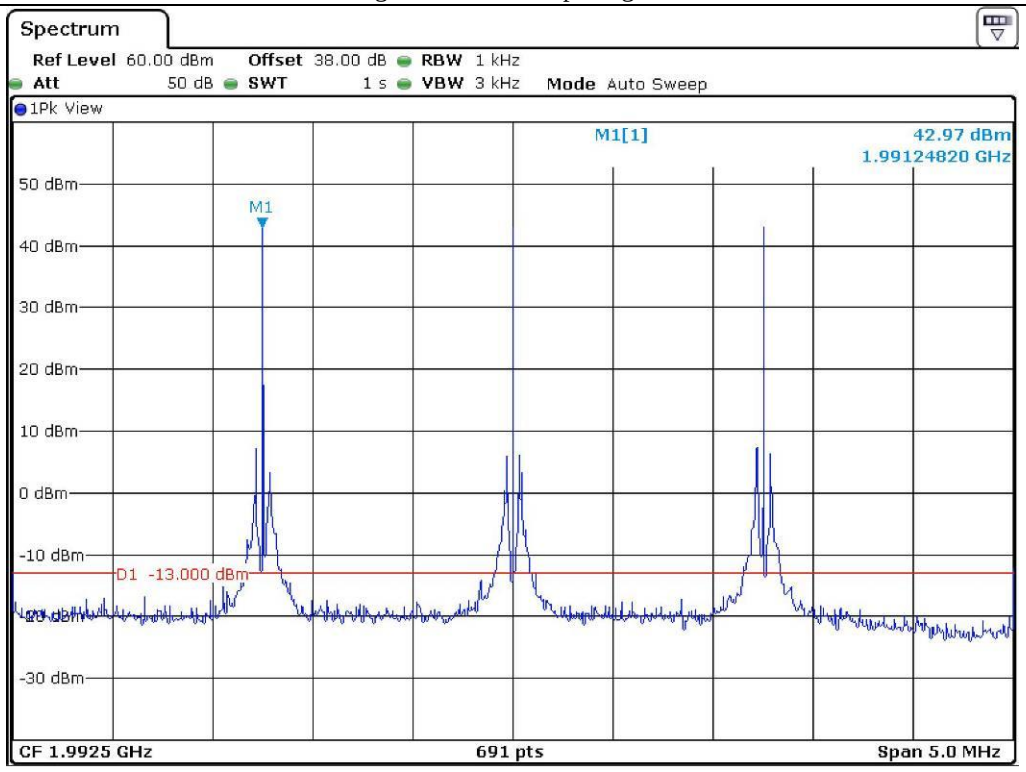


High Channel – 2 input signals



High Channel – 3 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.2 Test Result for Spurious emission

-. Test Date : November 06, 2014

-. Test Result : Pass

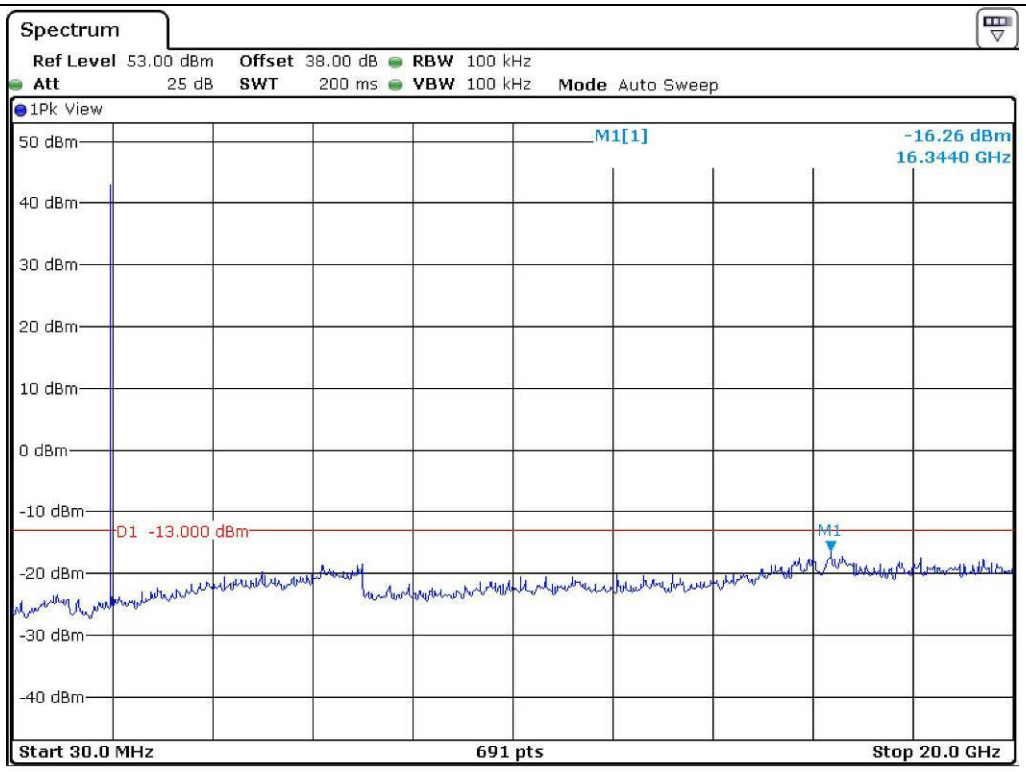
-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
1 976.25	1	< -13 dBm	Pass
1 976.25 & 1 977.50	2		
1 976.25 & 1 977.5 & 1 978.75	3		
1 993.75	1	< -13 dBm	Pass
1 993.75 & 1 992.5	2		
1 993.75 & 1 992.50 & 1 991.25	3		

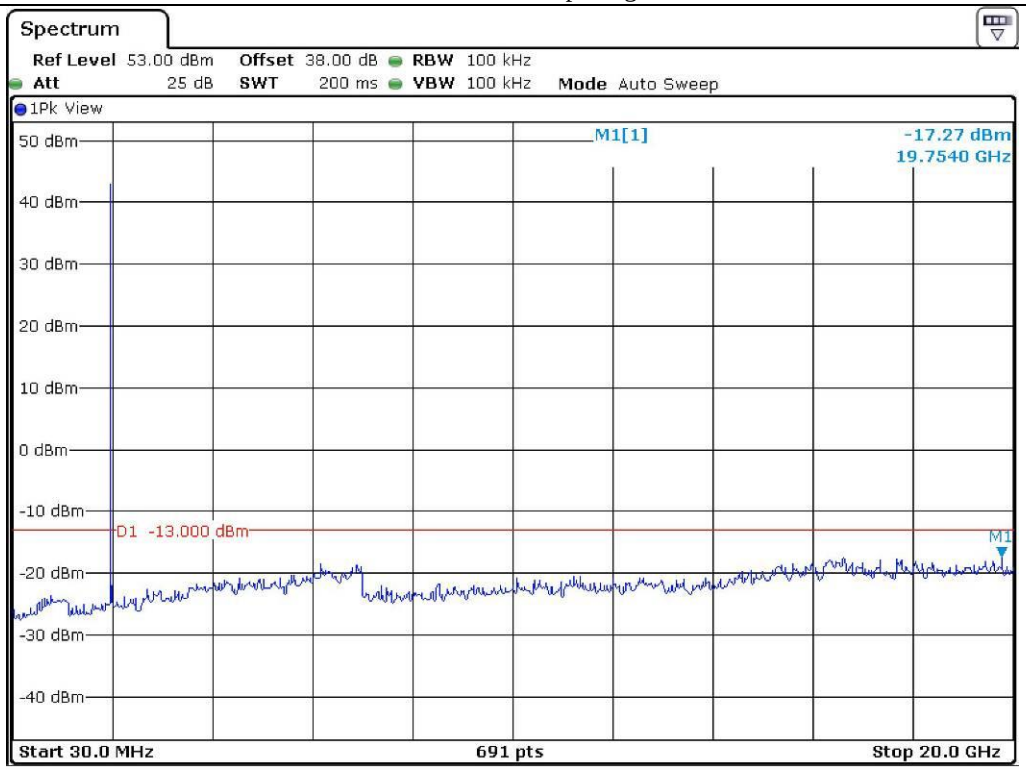
Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

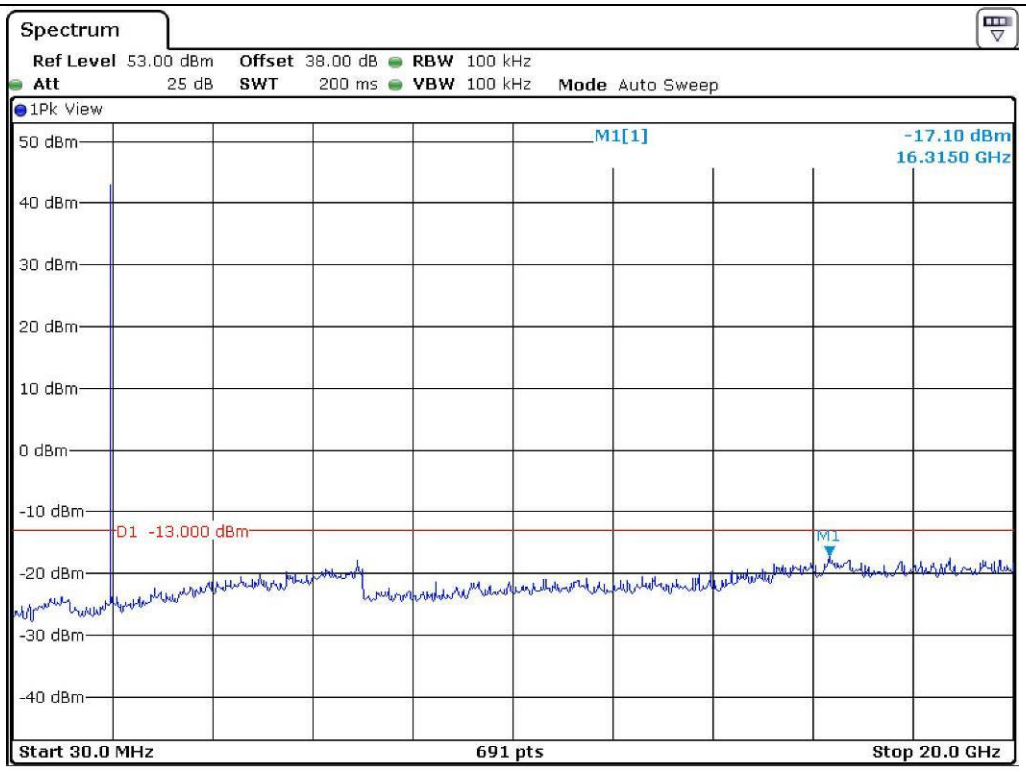


Low Channel – 1 input signal

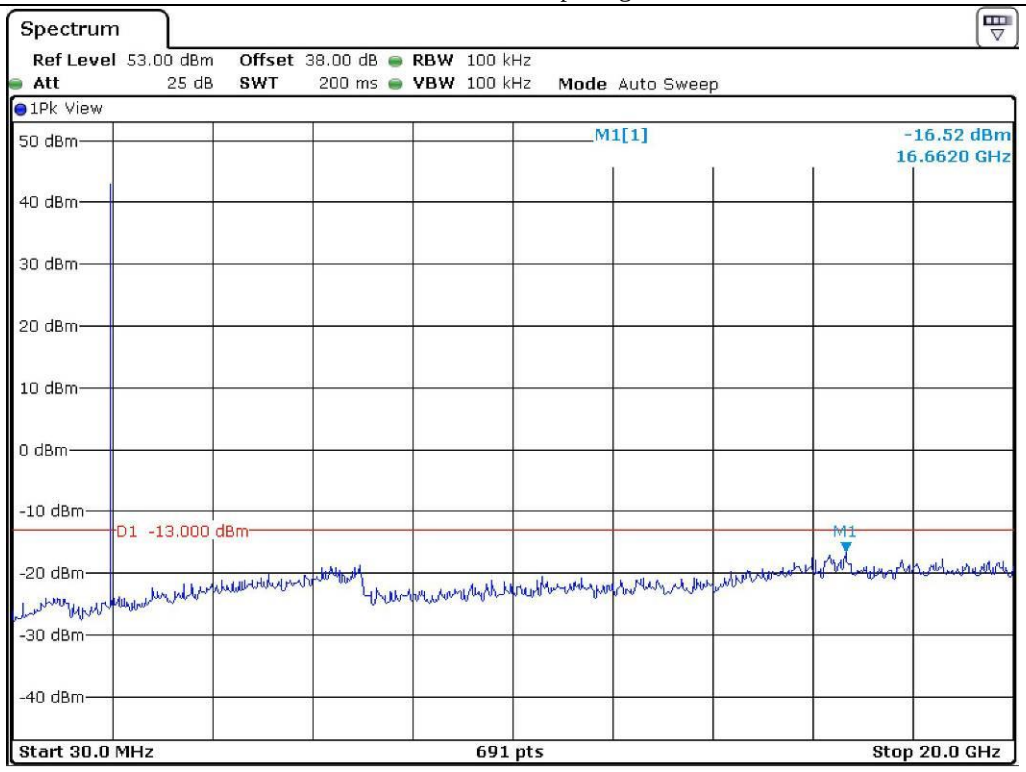


Low Channel – 2 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

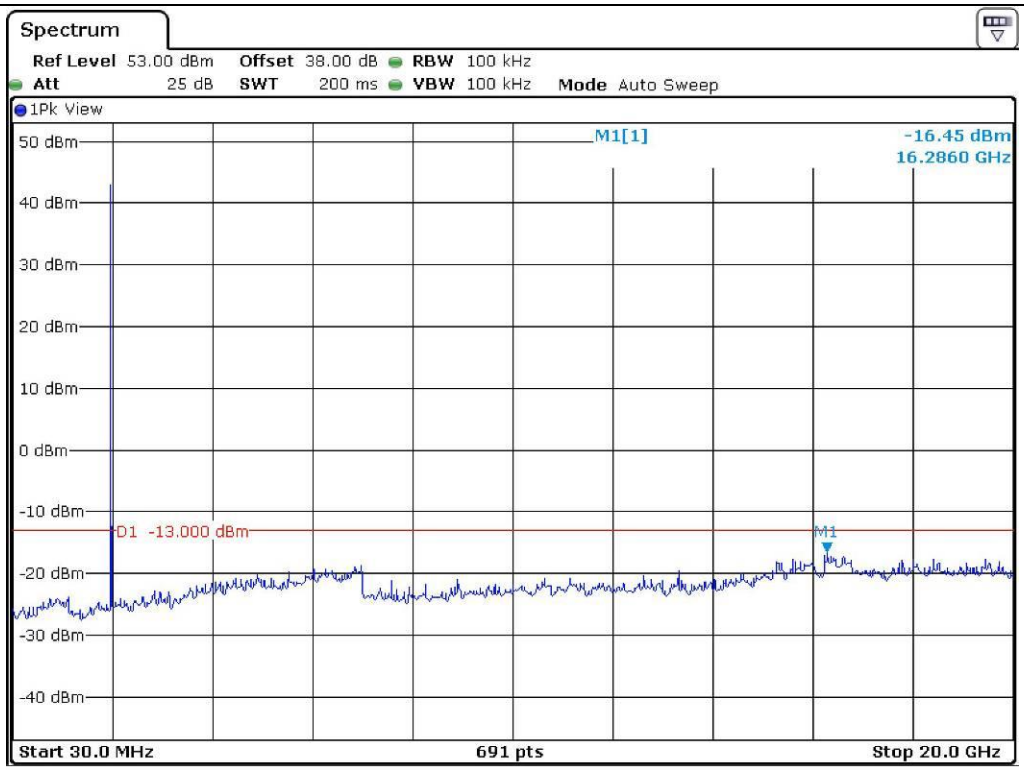


Low Channel – 3 input signals

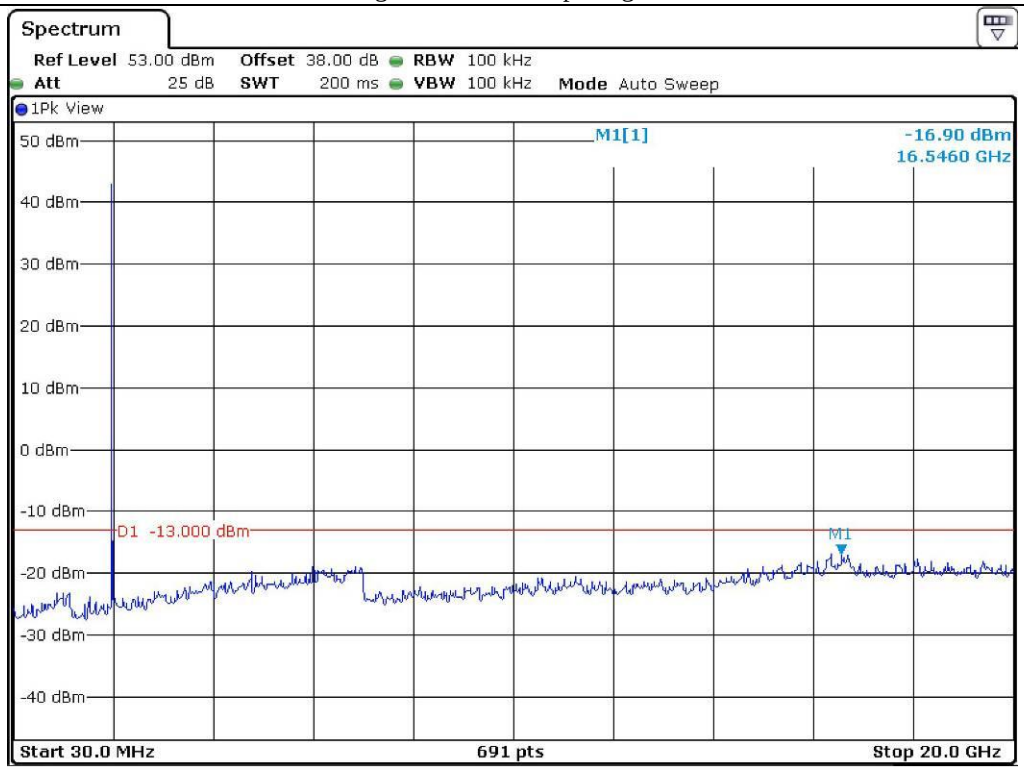


High Channel – 1 input signal

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



High Channel – 2 input signals



High Channel – 3 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.5 Test data for Uplink

9.5.1 Test Result for peak power

-. Test Date : November 06, 2014

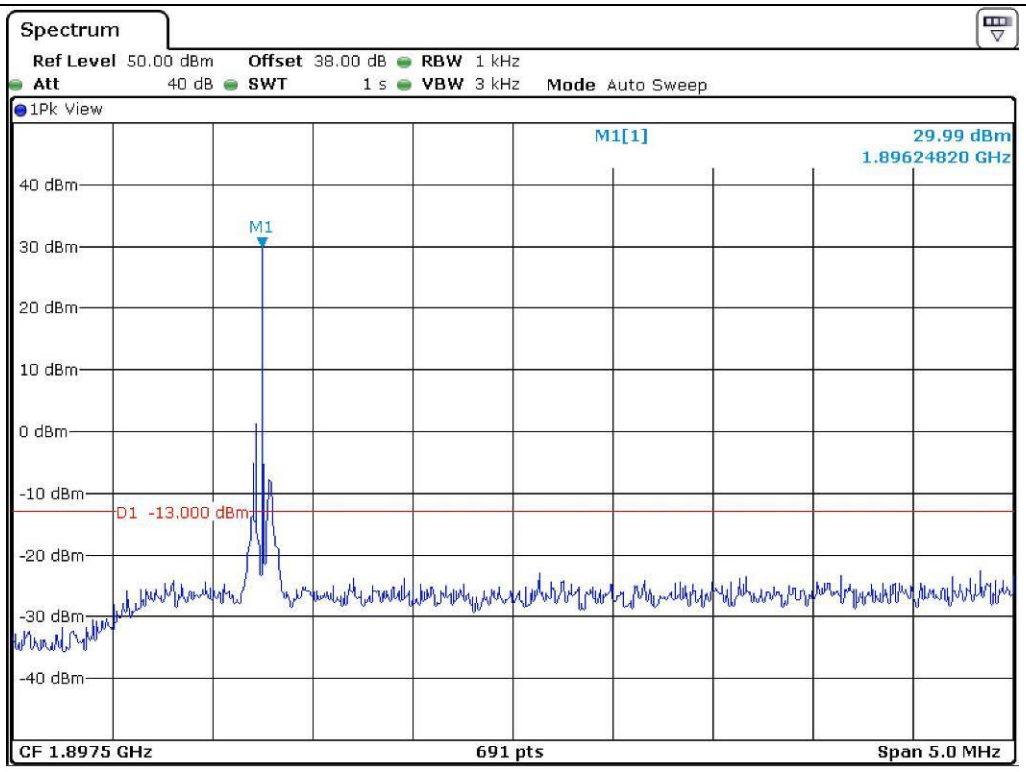
-. Test Result : Pass

-. Modulation : No-Modulation

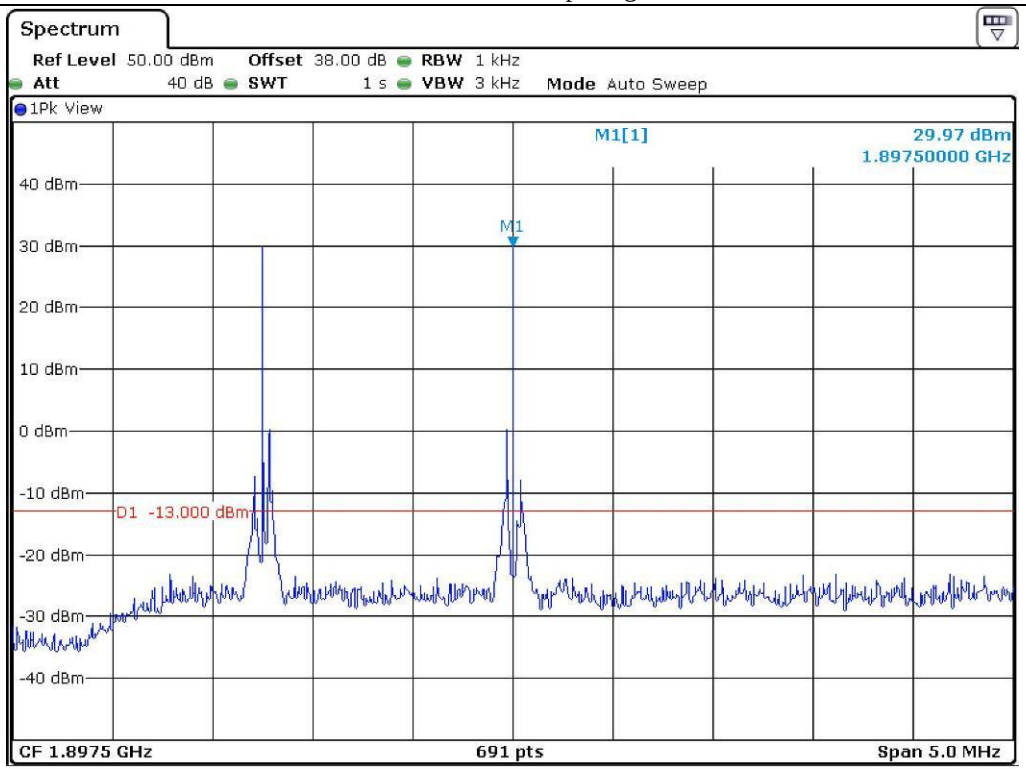
Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
1 896.25	1	-70.01	29.99
1 896.25 & 1 897.50	2	-70.04	29.97
1 896.25 & 1 897.50 & 1 898.75	3	-69.97	29.96
1 913.75	1	-69.99	30.03
1 913.75 & 1 912.50	2	-70.01	30.03
1 913.75 & 1 912.50 & 1 911.25	3	-70.05	30.00

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

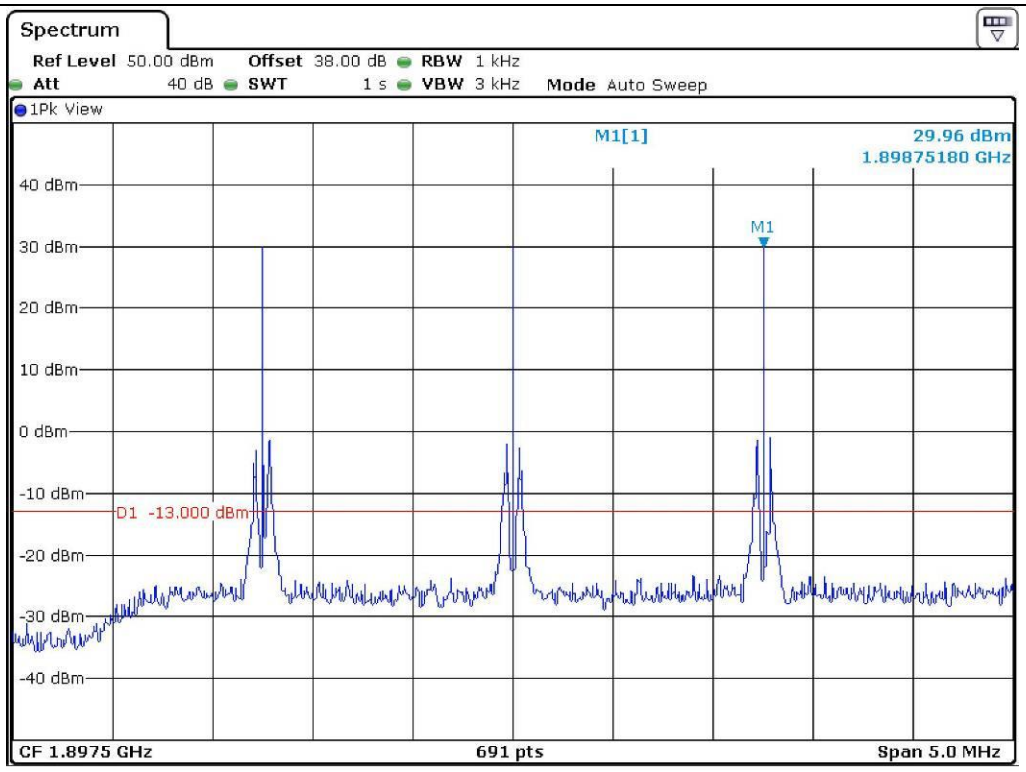


Low Channel – 1 input signal

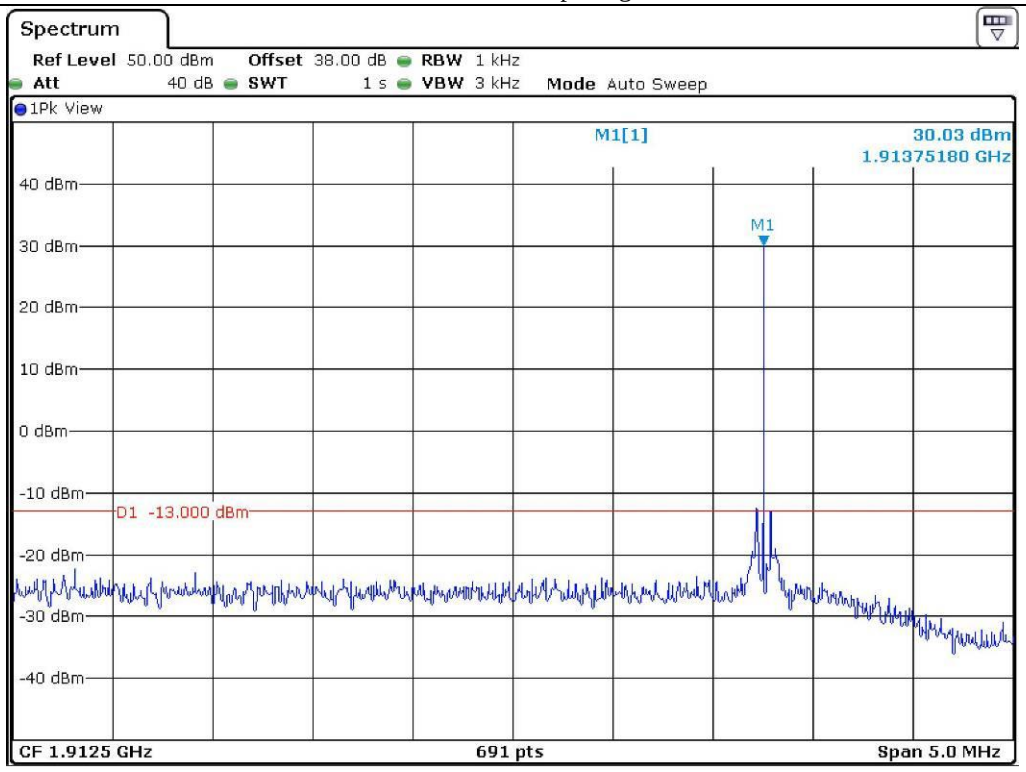


Low Channel – 2 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

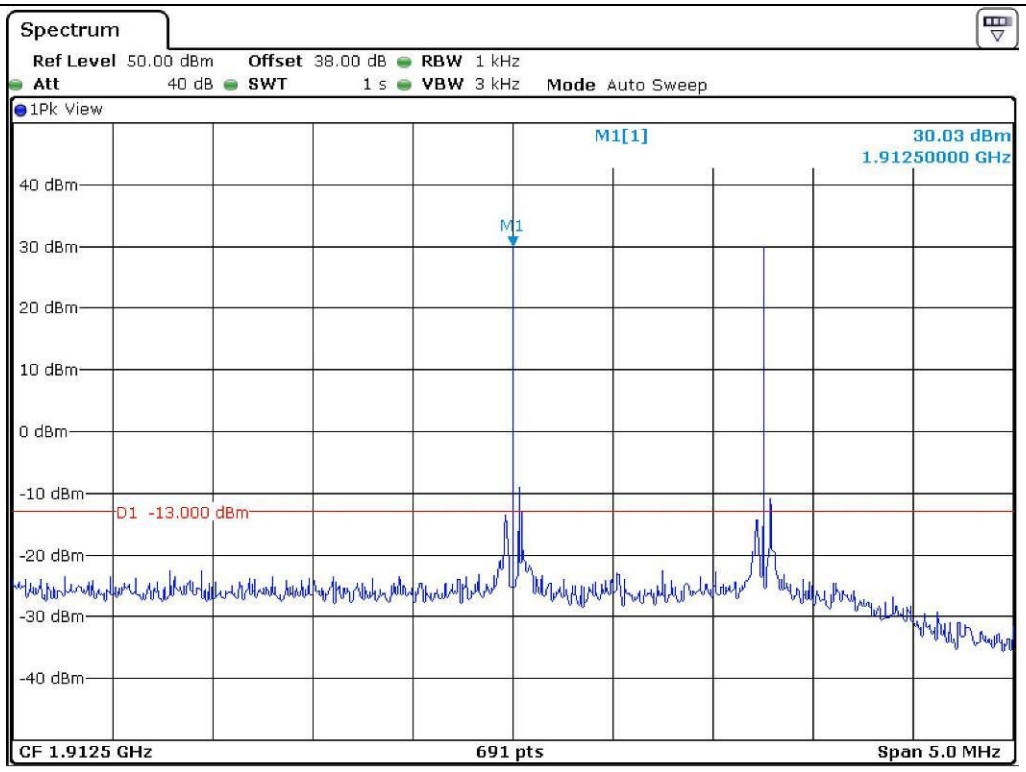


Low Channel – 3 input signals

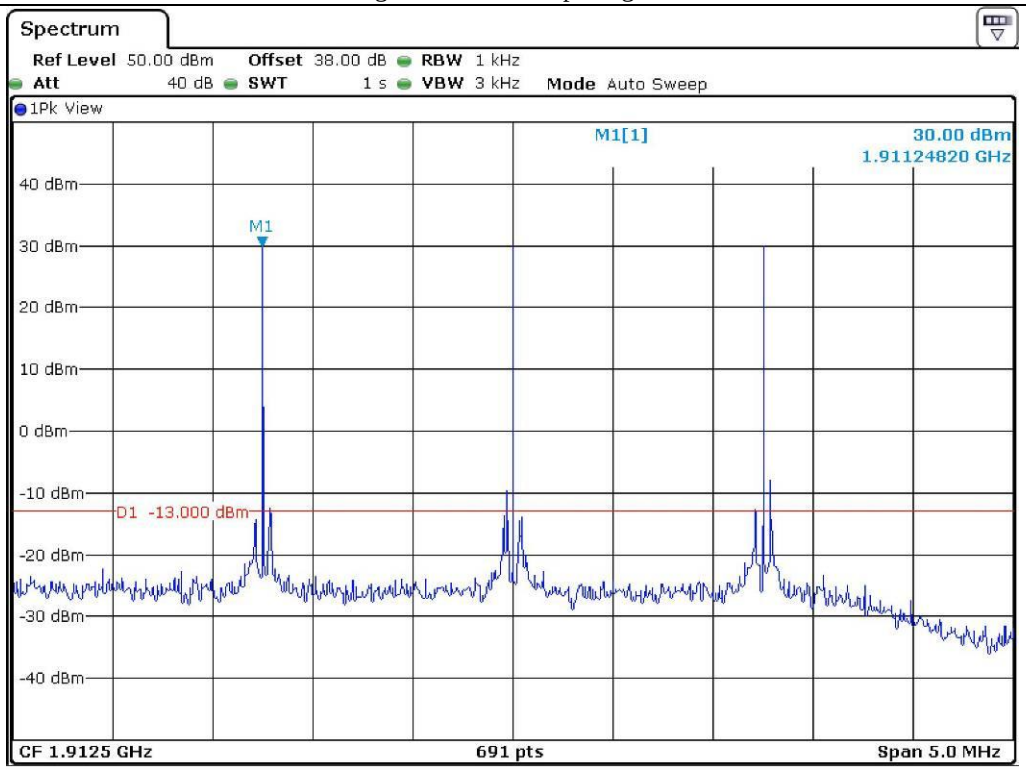


High Channel – 1 input signal

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



High Channel – 2 input signals



High Channel – 3 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.5.2 Test Result for Spurious emission

-. Test Date : November 06, 2014

-. Test Result : Pass

-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
1 896.25	1	< -13 dBm	Pass
1 896.25 & 1 897.50	2		
1 896.25 & 1 897.50 & 1 898.75	3		
1 913.75	1	< -13 dBm	Pass
1 913.75 & 1 912.50	2		
1 913.75 & 1 912.50 & 1 911.25	3		

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

Tested by: hyung-kwon, Oh / 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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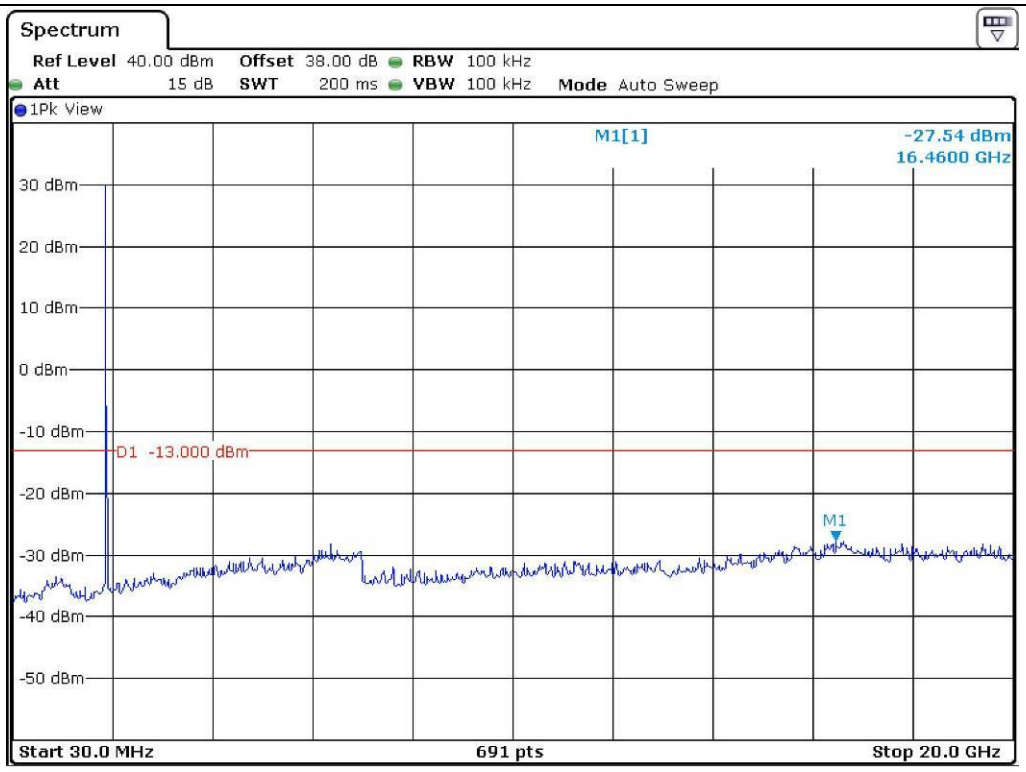
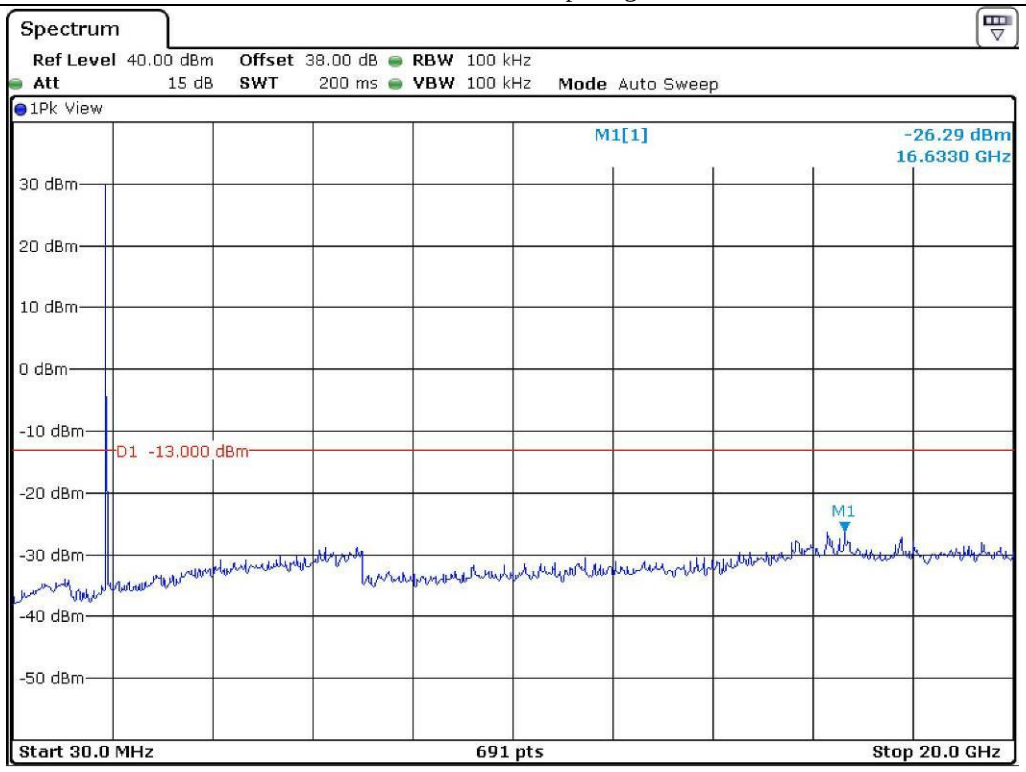
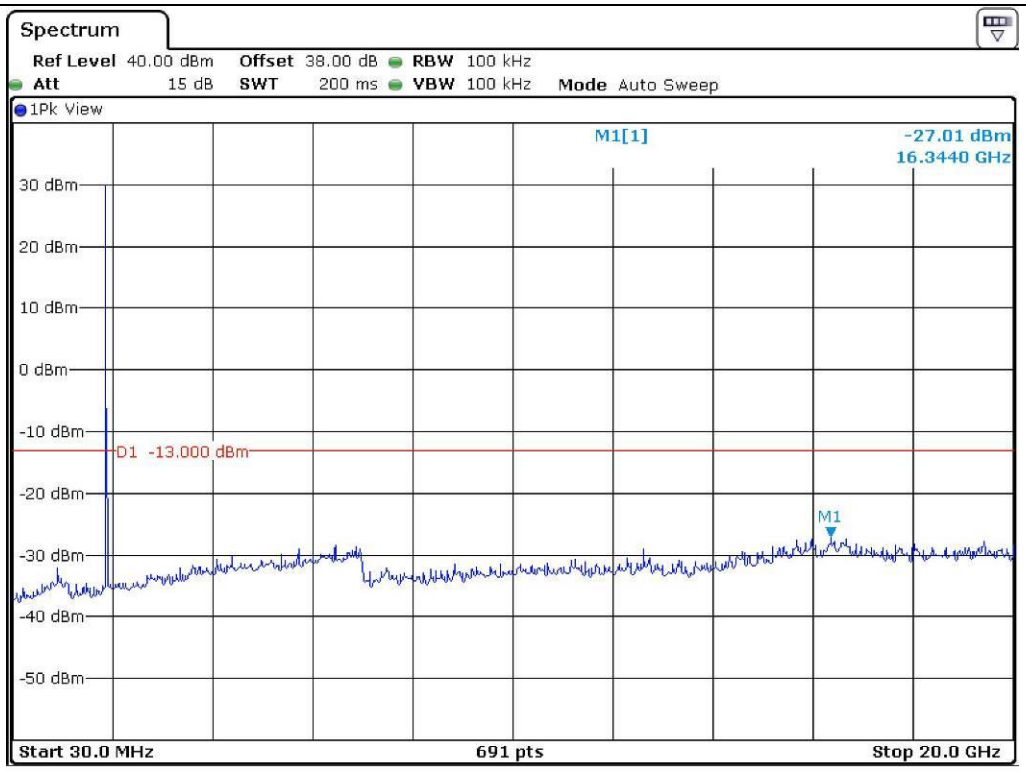


Low Channel – 1 input signal

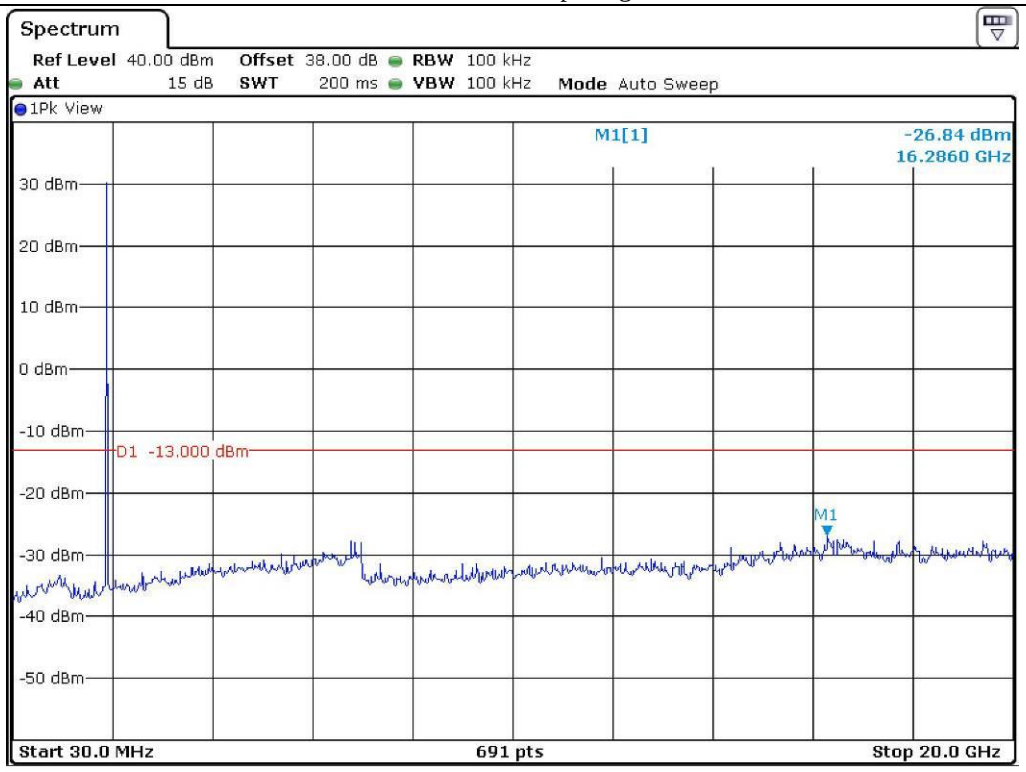


Low Channel – 2 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

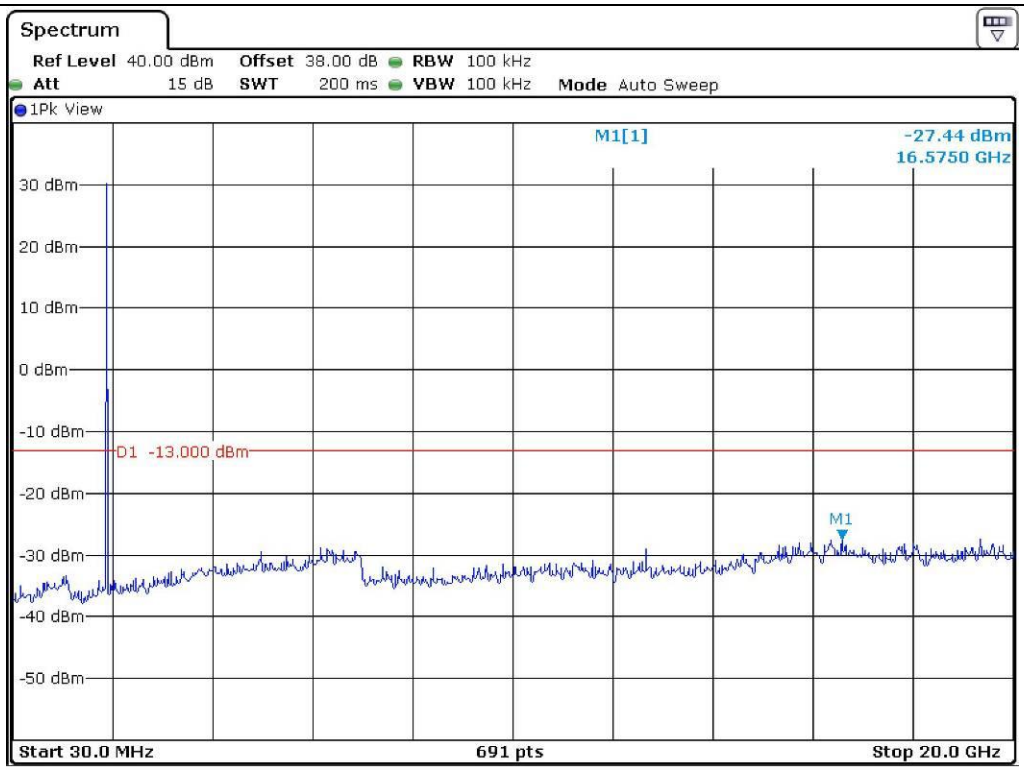


Low Channel – 3 input signals

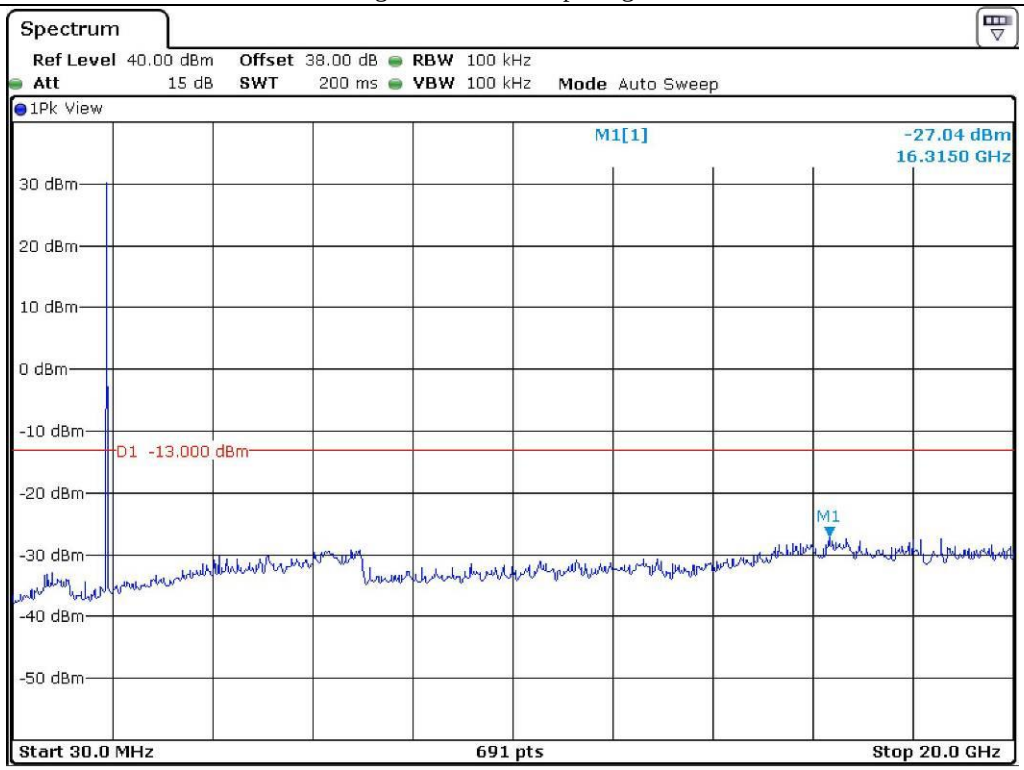


High Channel – 1 input signal

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



High Channel – 2 input signals



High Channel – 3 input signals

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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10. FIELD STRENGTH OF SPURIOUS RADIATION

10.1 Operating environment

Temperature : 25 ℃

Relative humidity : 50 % R.H.

10.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. 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 10th 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.

10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESVD	Rohde & Schwarz	EMI Test Receiver	838453/018	Oct. 20, 2011 (1Y)
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	Jun. 10, 2011 (1Y)
■ -	83051A	Agilent	Preamplifier	3950M00201	Jun. 11, 2011 (1Y)
■ -	E4432B	Hewlett-Packard	Signal Generator	US38440950	Jun. 10, 2011 (1Y)
■ -	83650L	Hewlett-Packard	Signal Generator	3844A00415	Jun. 10, 2011 (1Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Aug. 23, 2011 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 23, 2011 (2Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 01, 2011 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 16, 2011 (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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4 Test data for radiated emission

10.4.1 Test Result for DC - 48 V Power Supply with CDMA

10.4.1.1 Operating Mode: Downlink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
1 976.25	72.20	-39.15	10.68	V	2.76	-31.23	-	-
	71.80	-39.71		H		-31.80	-	-
Test Data for Middle Channel								
1 982.50	79.10	-32.15	10.71	V	2.77	-24.21	-	-
	78.70	-32.71		H		-24.77	-	-
Test Data for High Channel								
1 988.75	75.20	-35.95	10.74	V	2.77	-27.99	-	-
	77.20	-34.12		H		-26.15	-	-
120.21	47.00	-72.34	1.75	H	0.61	-71.20	-13.00	58.20
196.84	44.50	-72.36	1.53	V	0.81	-71.64	-13.00	58.64
328.76	47.80	-65.97	1.20	V	1.06	-65.83	-13.00	52.83
768.16	44.40	-59.46	1.45	V	1.69	-59.71	-13.00	46.71
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.1.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.1.3 Operating Mode: Uplink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
1 896.25	94.00	-18.52	10.31	V	2.71	-10.92	-	-
	92.40	-20.31		H		-12.71	-	-
Test Data for Middle Channel								
1 902.50	94.80	-17.68	10.34	V	2.71	-10.05	-	-
	93.30	-19.37		H		-11.74	-	-
Test Data for High Channel								
1 908.75	94.60	-17.79	10.37	V	2.72	-10.13	-	-
	93.20	-19.37		H		-11.72	-	-
121.18	46.30	-73.04	1.75	H	0.61	-71.90	-13.00	58.90
196.84	43.80	-73.06	1.53	V	0.81	-72.34	-13.00	59.34
328.76	46.60	-67.17	1.20	V	1.06	-67.03	-13.00	54.03
768.16	44.80	-59.06	1.45	V	1.69	-59.31	-13.00	46.31
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.1.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.2 Test Result for DC - 48 V Power Supply with LTE 5 M

10.4.2.1 Operating Mode: Downlink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 992.50	78.40	-32.70	10.76	V	2.77	-24.71	-	-
	77.60	-33.66		H		-25.68	-	-
120.21	47.60	-71.74	1.75	H	0.61	-70.60	-13.00	57.60
196.84	44.10	-72.76	1.53	V	0.81	-72.04	-13.00	59.04
328.76	47.90	-65.87	1.20	V	1.06	-65.73	-13.00	52.73
768.16	44.80	-59.06	1.45	V	1.69	-59.31	-13.00	46.31
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.2.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.2.3 Operating Mode: Uplink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 912.50	94.60	-17.73	10.39	V	2.72	-10.06	-	-
	93.10	-19.41		H		-11.75	-	-
121.18	45.30	-74.04	1.75	H	0.61	-72.90	-13.00	59.90
196.84	42.70	-74.16	1.53	V	0.81	-73.44	-13.00	60.44
328.76	45.50	-68.27	1.20	V	1.06	-68.13	-13.00	55.13
768.16	43.90	-59.96	1.45	V	1.69	-60.21	-13.00	47.21
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.2.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.3 Test Result for DC - 48 V Power Supply with LTE 10 M

10.4.3.1 Operating Mode: Downlink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 990.00	76.80	-34.33	10.74	V	2.77	-26.36	-	-
	75.10	-36.20		H		-28.23	-	-
120.21	47.50	-71.84	1.75	H	0.61	-70.70	-13.00	57.70
196.84	43.80	-73.06	1.53	V	0.81	-72.34	-13.00	59.34
328.76	47.90	-65.87	1.20	V	1.06	-65.73	-13.00	52.73
768.16	43.70	-60.16	1.45	V	1.69	-60.41	-13.00	47.41
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.3.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.3.3 Operating Mode: Uplink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 910.00	94.10	-18.27	10.38	V	2.72	-10.61	-	-
	92.90	-19.65		H		-11.99	-	-
121.18	46.60	-72.74	1.75	H	0.61	-71.60	-13.00	58.60
196.84	43.70	-73.16	1.53	V	0.81	-72.44	-13.00	59.44
328.76	46.10	-67.67	1.20	V	1.06	-67.53	-13.00	54.53
768.16	44.50	-59.36	1.45	V	1.69	-59.61	-13.00	46.61
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.3.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.4 Test Result for DC - 48 V Power Supply with LTE 15 M

10.4.4.1 Operating Mode: Downlink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 982.50	79.30	-31.95	10.71	V	2.77	-24.01	-	-
	78.60	-32.81		H		-24.87	-	-
120.21	47.10	-72.24	1.75	H	0.61	-71.10	-13.00	58.10
196.84	44.70	-72.16	1.53	V	0.81	-71.44	-13.00	58.44
328.76	47.20	-66.57	1.20	V	1.06	-66.43	-13.00	53.43
768.16	44.50	-59.36	1.45	V	1.69	-59.61	-13.00	46.61
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.4.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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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10.4.4.3 Operating Mode: Uplink

-. Test Date : November 10, 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 ~ 20 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
1 902.50	94.70	-17.78	10.34	V	2.71	-10.15	-	-
	93.40	-19.27		H		-11.64	-	-
121.18	46.60	-72.74	1.75	H	0.61	-71.60	-13.00	58.60
196.84	43.80	-73.06	1.53	V	0.81	-72.34	-13.00	59.34
328.76	46.20	-67.57	1.20	V	1.06	-67.43	-13.00	54.43
768.16	44.50	-59.36	1.45	V	1.69	-59.61	-13.00	46.61
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.4.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 24, SUBPART E, SECTION 24.238(a)

Result : PASSED

EUT : ICS Repeater System Date: November 10, 2014

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

11.1 Operating environment

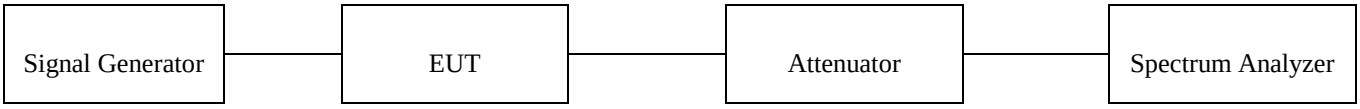
Temperature : 25 ℃

Relative humidity : 50 % R.H.

11.2 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 modulation.

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.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	SSE-43CI-A	Samkun	Chamber	060712	May 15, 2014 (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 Dept : 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 for Downlink with DC -48 V Power Supply

-. Test Date : November 05, 2014

-. Result : PASSED

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	1 982 500 000	1 982 500 191	0.096 3	Within the Authorized Frequency block
-20		1 982 500 192	0.096 8	
-10		1 982 500 192	0.096 8	
0		1 982 500 191	0.096 3	
10		1 982 500 191	0.096 3	
20		1 982 500 192	0.096 8	
30		1 982 500 191	0.096 3	
40		1 982 500 192	0.096 8	
50		1 982 500 192	0.096 8	

Tested by: hyung-kwon, Oh / Project Engineer

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11.5 Test data for Uplink with DC -48 V Power Supply

-. Test Date : November 05, 2014

-. Result : PASSED

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	1 902 500 000	1 902 500 184	0.096 7	Within the Authorized Frequency block
-20		1 902 500 183	0.096 2	
-10		1 902 500 184	0.096 7	
0		1 902 500 183	0.096 2	
10		1 902 500 183	0.096 2	
20		1 902 500 182	0.095 7	
30		1 902 500 184	0.096 7	
40		1 902 500 184	0.096 7	
50		1 902 500 183	0.096 2	

Tested by: hyung-kwon, Oh / Project Engineer

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12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

12.1 Operating environment

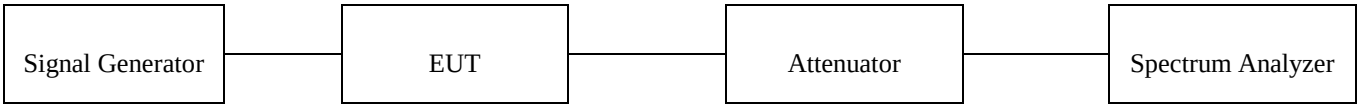
Temperature : 25 ℃

Relative humidity : 50 % 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 modulation.

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.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	53152A	HP	Frequency Counter	US39270295	Oct. 08, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

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12.4 Test data for Downlink with DC -48 V Power Supply

-. Test Date : November 05, 2014

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	1 982 500 000	1 982 500 192	0.096 8	Within the Authorized Frequency block
- 48 (100 %)		1 982 500 191	0.096 3	
- 40.8 (85 %)		1 982 500 191	0.096 3	

Tested by: hyung-kwon, Oh / Project Engineer

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12.5 Test data for Uplink with DC -48 V Power Supply

-. Test Date : November 05, 2014

-. Result : PASSED

Voltage (Vdc)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	1 902 500 000	1 902 500 182	0.095 7	Within the Authorized Frequency block
- 48 (100 %)		1 902 500 183	0.096 2	
- 40.8 (85 %)		1 902 500 183	0.096 2	

Tested by: hyung-kwon, Oh / Project Engineer

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