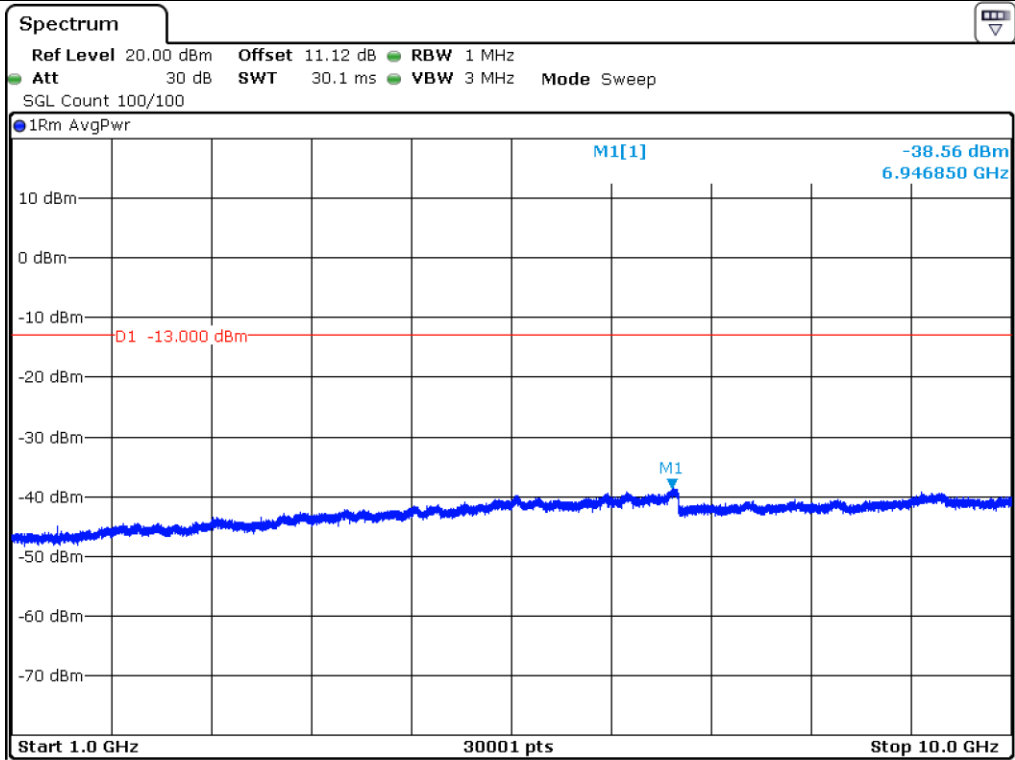
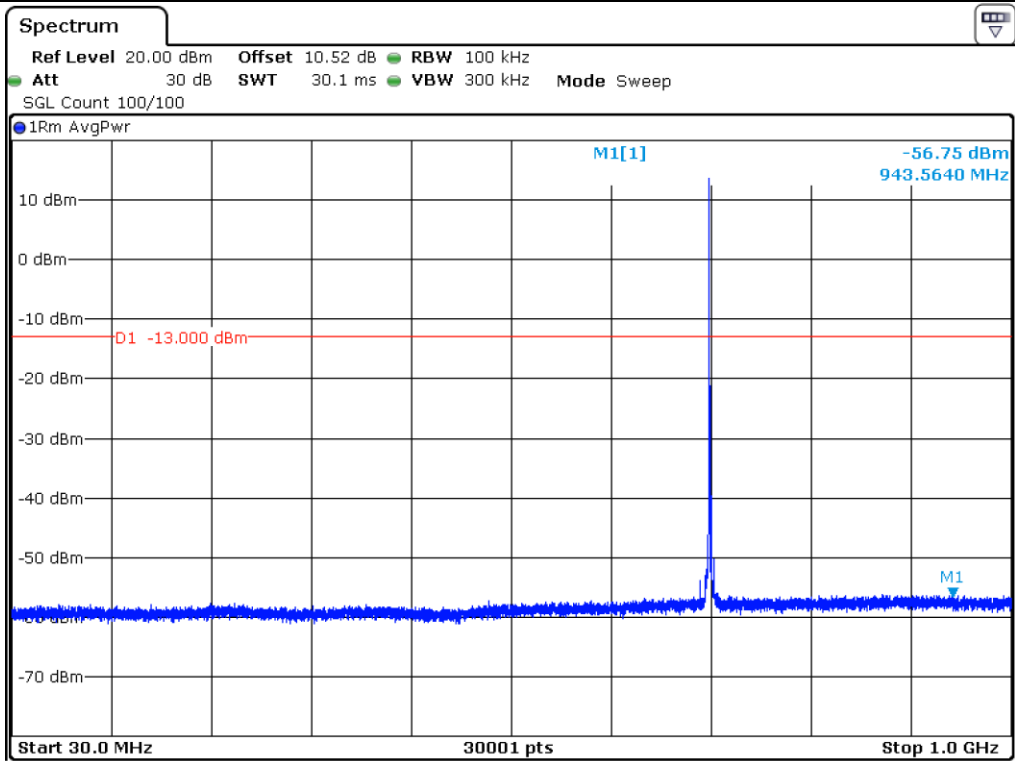


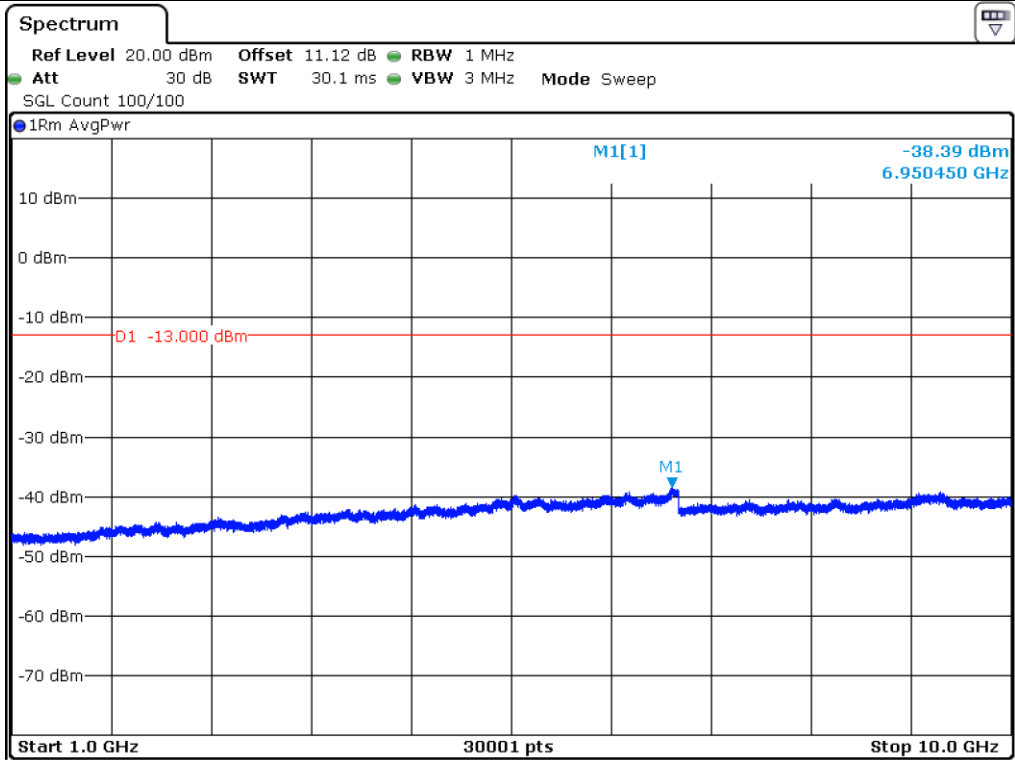
Midle Channel



Midle Channel

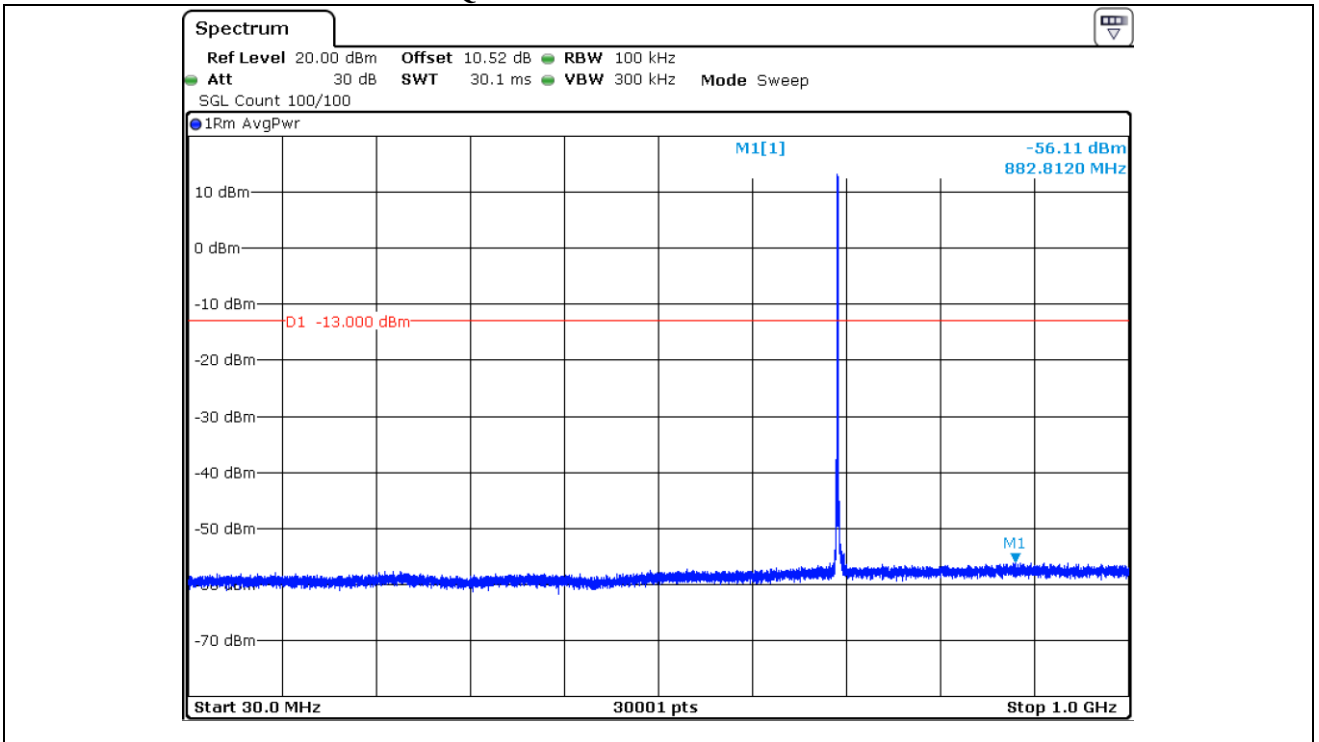


High Channel

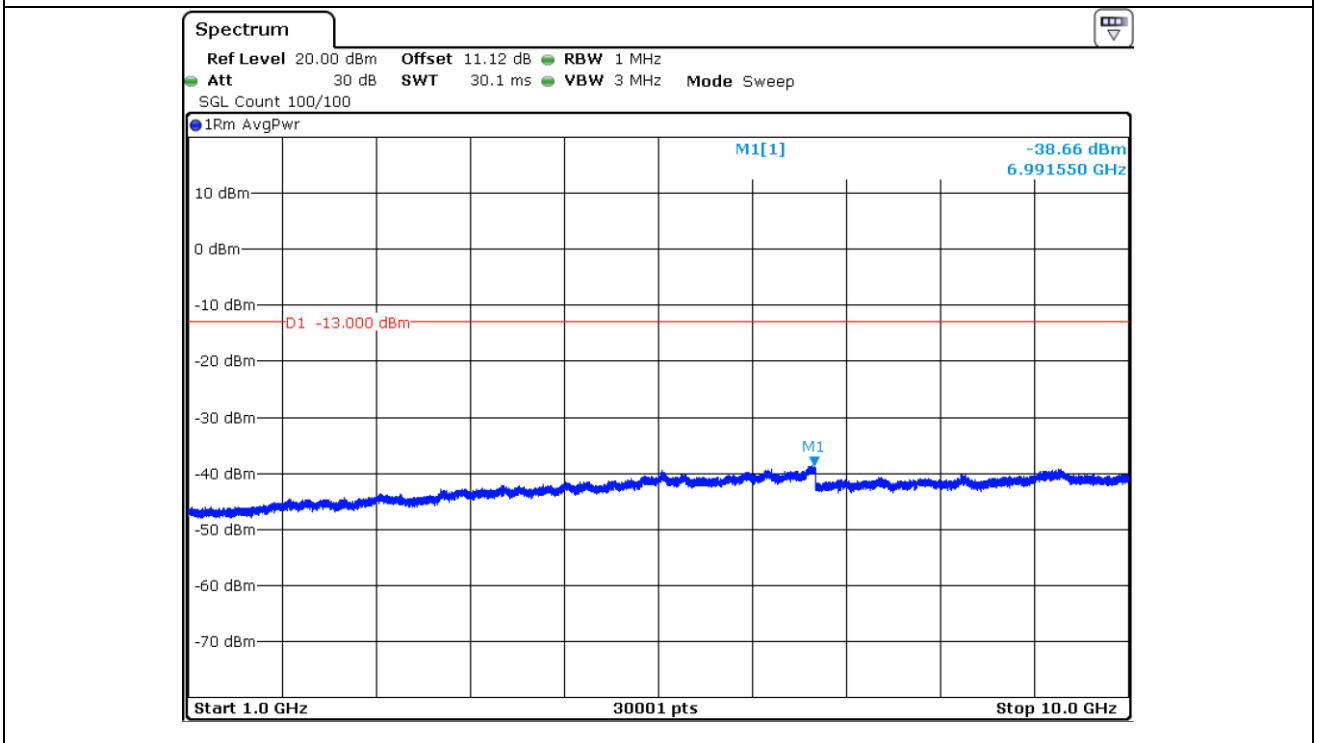


High Channel

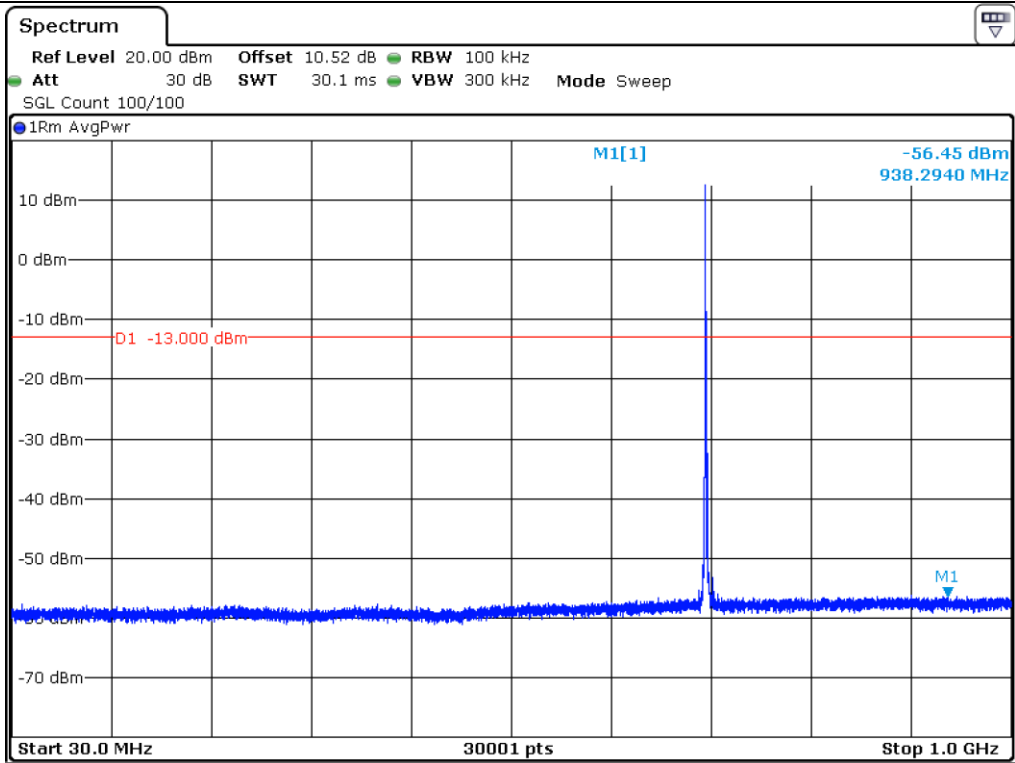
14.5.4 Test data for LTE Band 12 16QAM



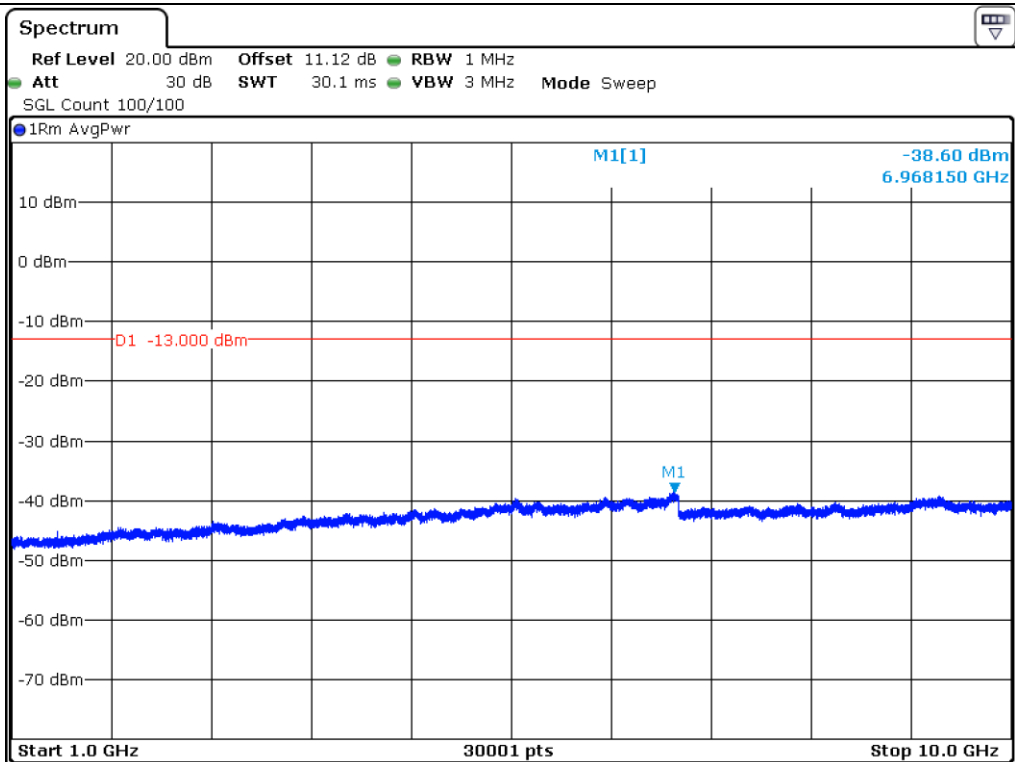
Low Channel



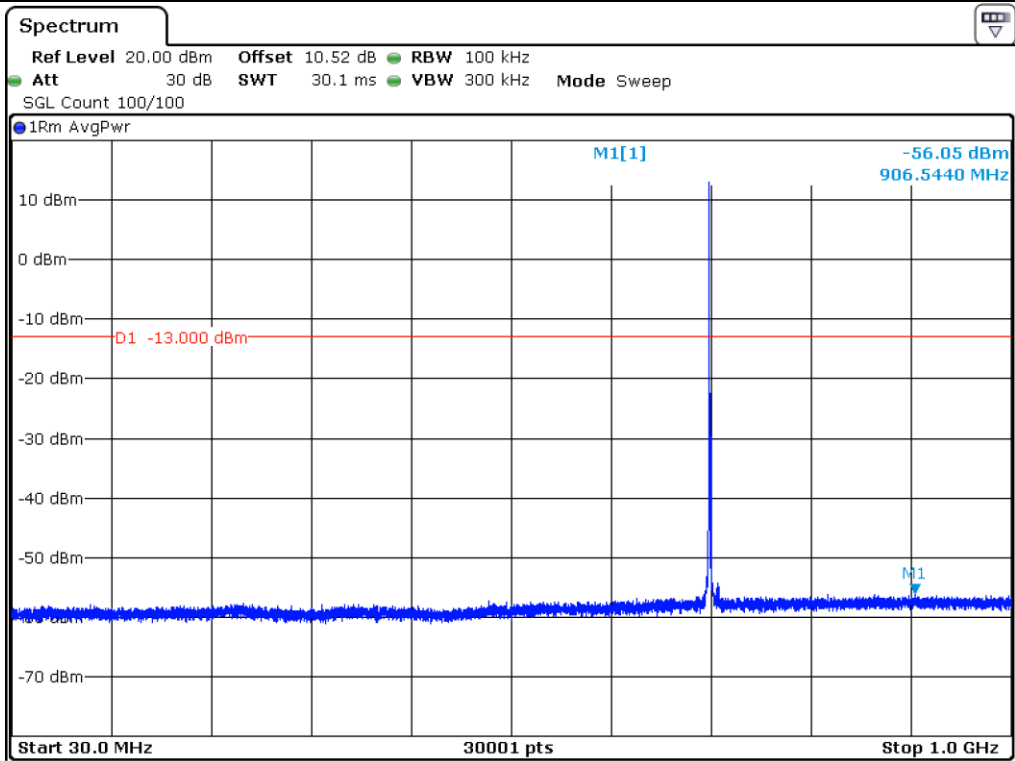
Low Channel



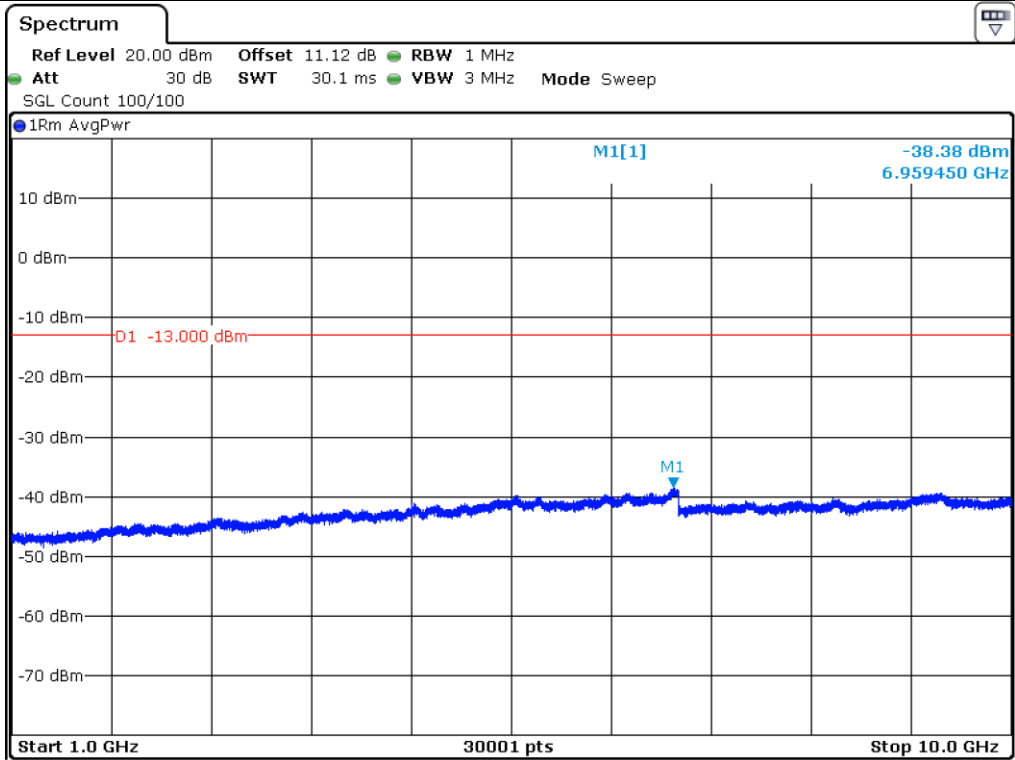
Midle Channel



Midle Channel

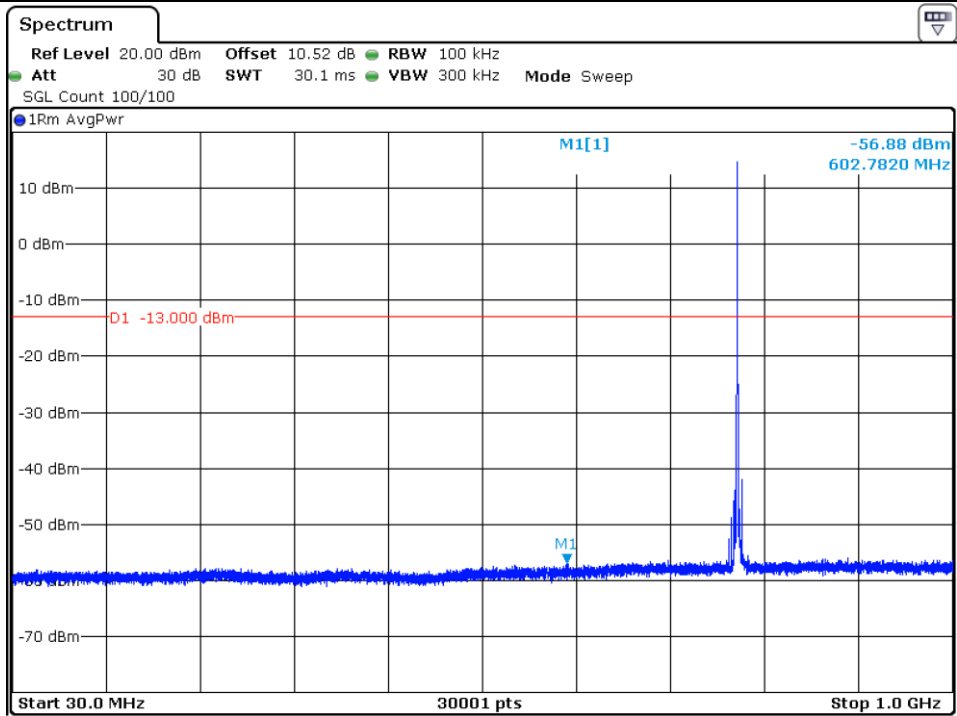


High Channel

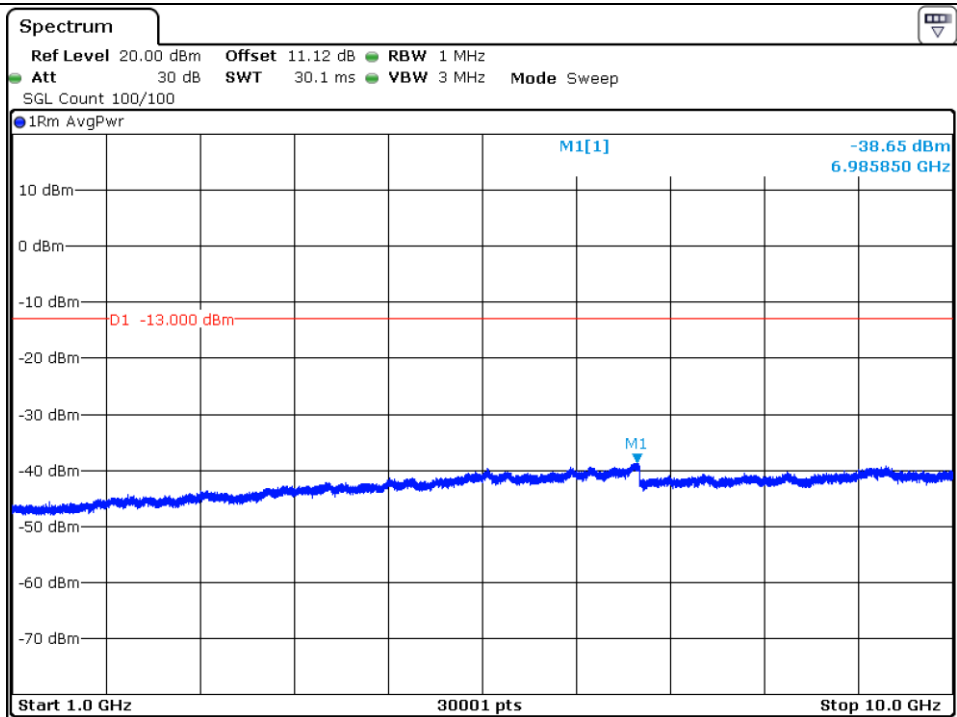


High Channel

14.5.5 Test data for LTE Band 13 QPSK

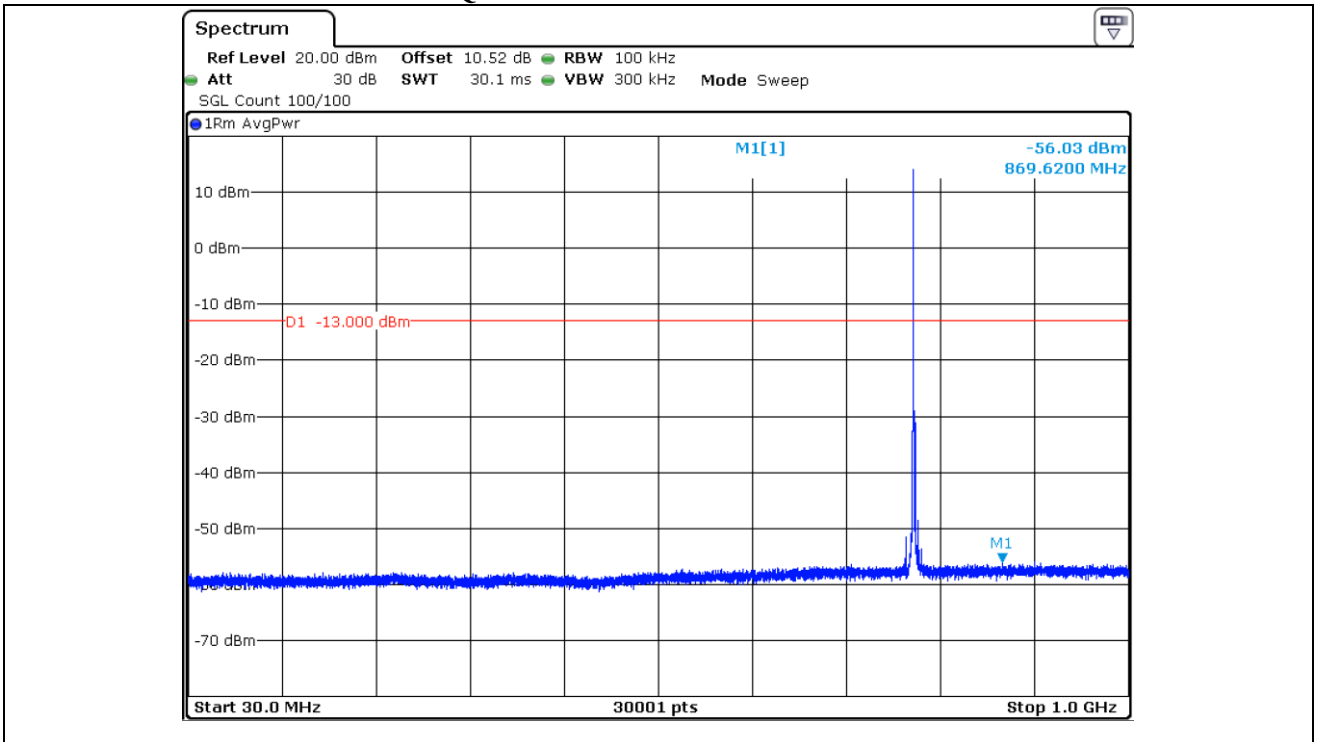


Low Channel

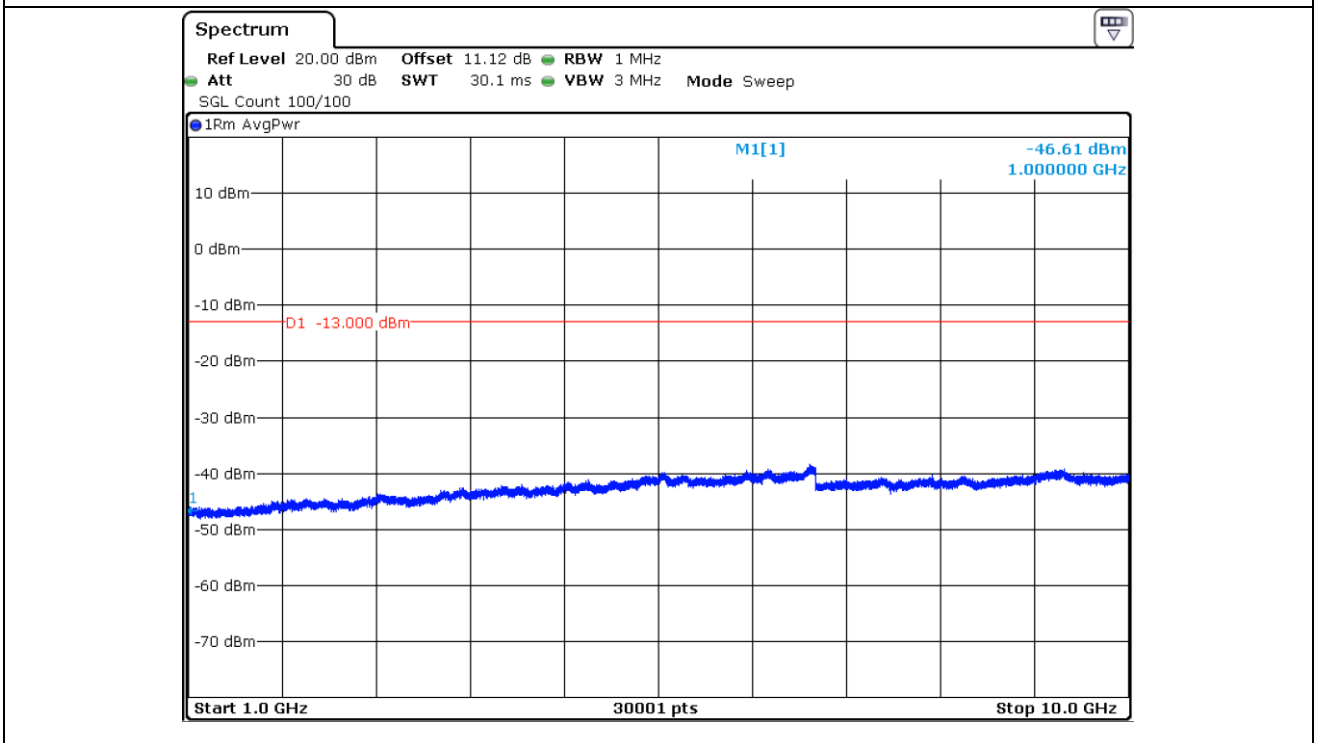


Low Channel

14.5.6 Test data for LTE Band 13 16QAM



Middle Channel



Middle Channel

15. FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

15.1 Operating environment

Temperature : 23 °C
 Relative humidity : 47 % R.H.

15.2 Test set-up

1. Frequency Stability (Voltage Variation)

+20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

- (1) Vary primary supply voltage from ±15% of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

2. Frequency Stability (Temperature Variation)

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

15.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101372	Aug. 23, 2018 (1Y)
■ - AAMCS-UDC	AA-MCS	Directional Coupler	400	Aug. 23, 2018 (1Y)
■ - MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Aug. 22, 2018 (1Y)
■ - PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Feb. 22, 2019 (1Y)
■ - PWS-3003D	Protek	DC Power Supply	4020409	Aug. 24, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

15.4 Test data

15.4.1 Test data for Voltage(V) LTE Band 4

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
20	3.70	1 732 500 000	1 732 500 015	0.008 7
	2.77		1 732 500 014	0.008 1
	4.26		1 732 500 011	0.006 3

15.4.2 Test data for Temperature(° C) LTE Band 4

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70	1 732 500 000	1 732 499 998	-0.001 2
-20			1 732 499 997	-0.001 7
-10			1 732 500 002	0.001 2
0			1 732 500 004	0.002 3
10			1 732 500 008	0.004 6
20			1 732 500 015	0.008 7
30			1 732 500 013	0.007 5
40			1 732 500 012	0.006 9
50			1 732 500 012	0.006 9



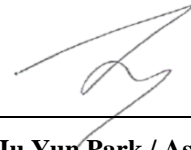
Tested by: Ju Yun Park / Assistant Manager

15.4.3 Test data for Voltage(V)_LTE Band 12

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
20	3.70	707 500 000	707 500 008	0.011 3
	2.77		707 500 007	0.009 9
	4.26		707 499 998	-0.002 8

15.4.4 Test data for Temperature(° C)_LTE Band 12

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70	707 500 000	707 500 012	0.017 0
-20			707 500 011	0.015 5
-10			707 499 999	-0.001 4
0			707 499 997	-0.004 2
10			707 500 005	0.007 1
20			707 500 008	0.011 3
30			707 500 010	0.014 1
40			707 499 997	-0.004 2
50			707 499 998	-0.002 8



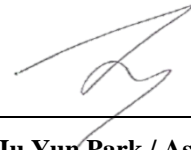
Tested by: Ju Yun Park / Assistant Manager

15.4.5 Test data for Voltage(V)_LTE Band 13

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
20	3.70	782 000 000	781 999 991	-0.011 5
	2.77		781 999 995	-0.006 4
	4.26		781 999 998	-0.002 6

15.4.6 Test data for Temperature(° C)_LTE Band 13

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70	782 000 000	781 999 987	-0.016 6
-20			781 999 989	-0.014 1
-10			781 999 992	-0.010 2
0			782 000 001	0.001 3
10			781 999 994	-0.007 7
20			781 999 991	-0.011 5
30			781 999 989	-0.014 1
40			781 999 984	-0.020 5
50			781 999 988	-0.015 3



Tested by: Ju Yun Park / Assistant Manager

16. CONDUCTED EMISSION TEST

16.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

16.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

16.3 Test equipment used

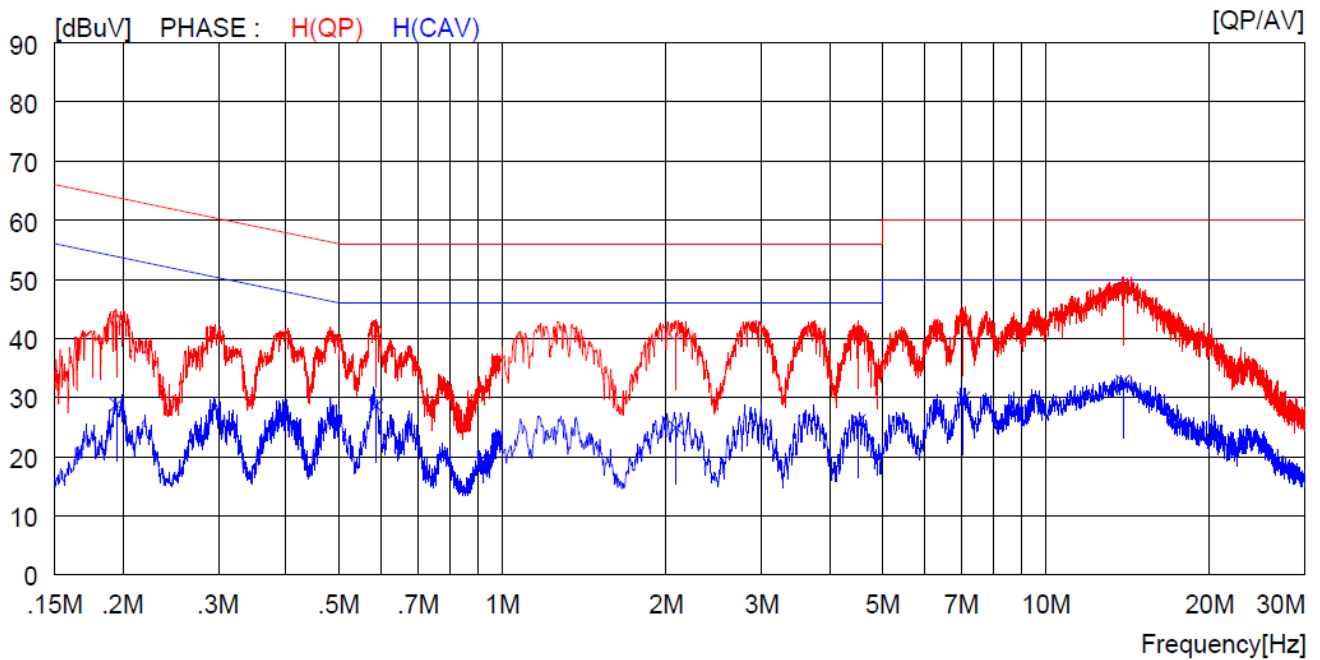
	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2018 (1Y)
□ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Mar. 29, 2018 (1Y)
■ -	NSLK8128	Schwarzbeck	AMN	8128-216	Mar. 28, 2018 (1Y)
□ -	NSLK8126	Schwarzbeck	AMN	8126-404	Apr. 04, 2018 (1Y)
□ -	NSLK8126	Schwarzbeck	AMN	8126-479	Oct. 22, 2018 (1Y)
■ -	3825/2	EMCO	LISN	9109-1869	Apr. 11, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

16.4 Test data

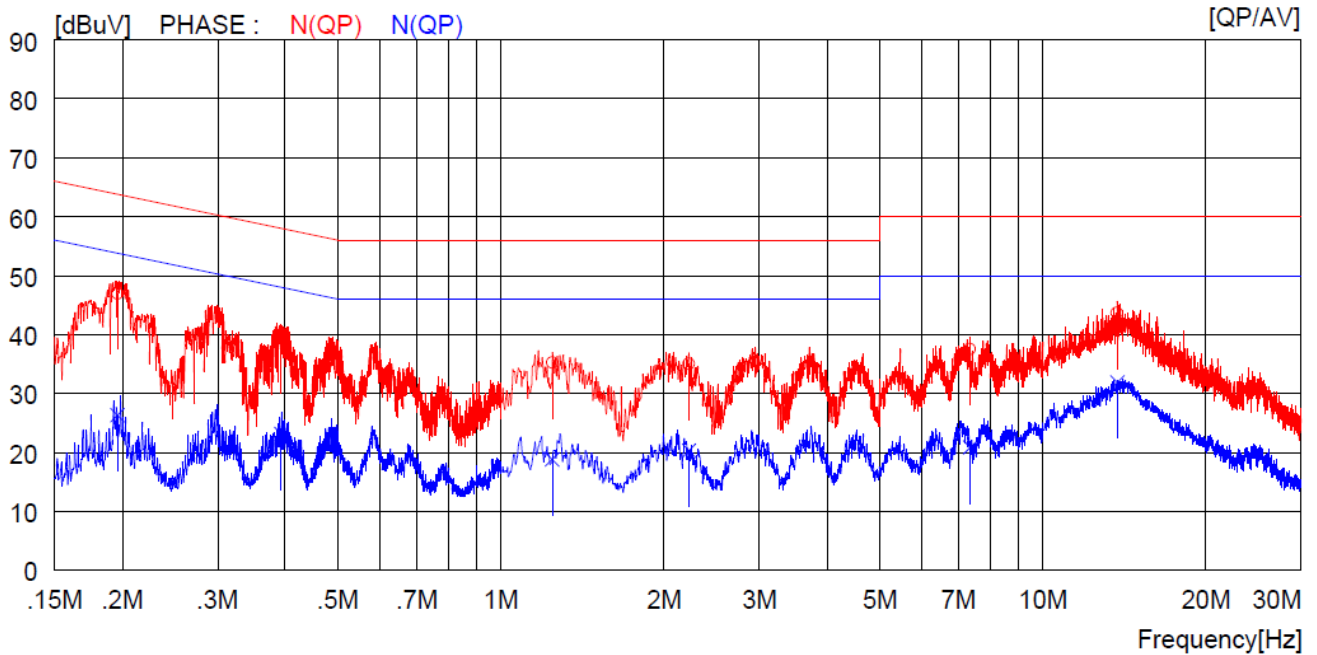
16.4.1 Test data for LTE Band 4

- Test Date : February 13, 2019 ~ March 05, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19500	33.0	----	9.9	42.9	----	63.8	----	20.9	----	H (QP)
2	0.58500	31.3	----	9.9	41.2	----	56.0	----	14.8	----	H (QP)
3	2.08800	30.8	----	10.0	40.8	----	56.0	----	15.2	----	H (QP)
4	4.51600	30.9	----	10.1	41.0	----	56.0	----	15.0	----	H (QP)
5	7.05000	33.0	----	10.1	43.1	----	60.0	----	16.9	----	H (QP)
6	13.86000	38.1	----	10.2	48.3	----	60.0	----	11.7	----	H (QP)
7	0.19500	----	18.9	9.9	----	28.8	----	53.8	----	25.0	H (CAV)
8	0.58500	----	18.7	9.9	----	28.6	----	46.0	----	17.4	H (CAV)
9	2.08800	----	14.9	10.0	----	24.9	----	46.0	----	21.1	H (CAV)
10	4.51600	----	15.9	10.1	----	26.0	----	46.0	----	20.0	H (CAV)
11	7.05000	----	19.7	10.1	----	29.8	----	50.0	----	20.2	H (CAV)
12	13.86000	----	22.5	10.2	----	32.7	----	50.0	----	17.3	H (CAV)

- Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19600	37.1	----	9.9	47.0	----	63.8	----	16.8	----	N(QP)
2	0.39300	29.6	----	10.0	39.6	----	58.0	----	18.4	----	N(QP)
3	1.24400	25.3	----	10.0	35.3	----	56.0	----	20.7	----	N(QP)
4	2.22400	25.0	----	10.0	35.0	----	56.0	----	21.0	----	N(QP)
5	7.34500	27.4	----	10.1	37.5	----	60.0	----	22.5	----	N(QP)
6	13.73000	33.4	----	10.2	43.6	----	60.0	----	16.4	----	N(QP)
7	0.19600	----	16.4	9.9	----	26.3	----	53.8	----	27.5	N(CAV)
8	0.39300	----	13.1	10.0	----	23.1	----	48.0	----	24.9	N(CAV)
9	1.24400	----	8.8	10.0	----	18.8	----	46.0	----	27.2	N(CAV)
10	2.22400	----	10.3	10.0	----	20.3	----	46.0	----	25.7	N(CAV)
11	7.34500	----	10.8	10.1	----	20.9	----	50.0	----	29.1	N(CAV)
12	13.73000	----	21.7	10.2	----	31.9	----	50.0	----	18.1	N(CAV)

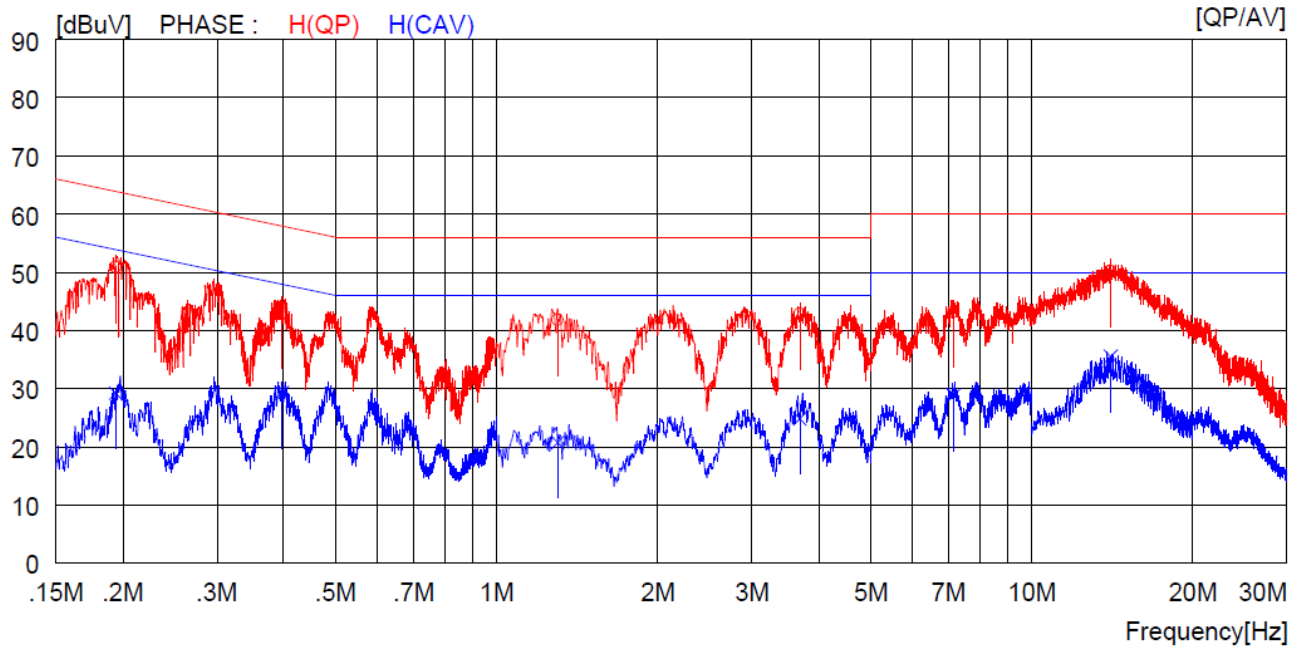
Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ju Yun Park / Assistant Manager

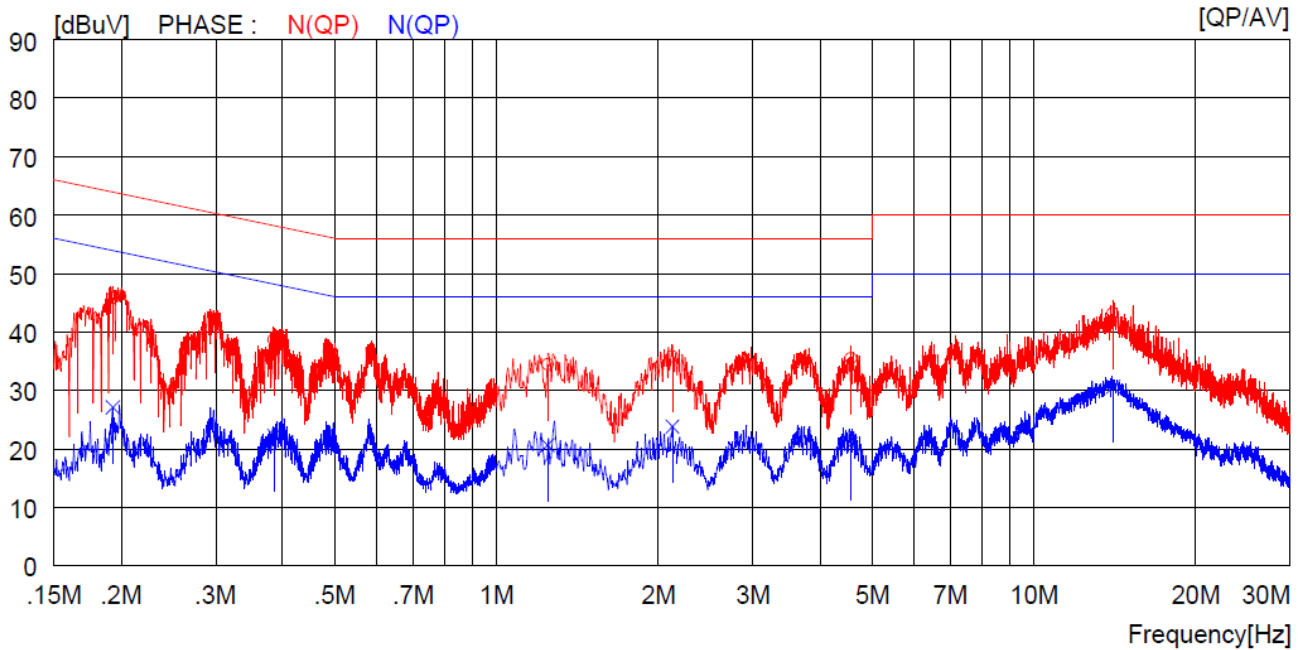
16.4.1 Test data for LTE Band 12

- Test Date : February 13, 2019 ~ March 05, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19400	41.0	----	9.9	50.9	----	63.9	----	13.0	----	H(QP)
2	0.39700	33.0	----	10.0	43.0	----	57.9	----	14.9	----	H(QP)
3	1.30000	31.8	----	10.0	41.8	----	56.0	----	14.2	----	H(QP)
4	3.68800	32.7	----	10.1	42.8	----	56.0	----	13.2	----	H(QP)
5	7.14000	33.1	----	10.1	43.2	----	60.0	----	16.8	----	H(QP)
6	14.04000	40.0	----	10.2	50.2	----	60.0	----	9.8	----	H(QP)
7	0.19400	----	19.3	9.9	----	29.2	----	53.9	----	24.7	H(CAV)
8	0.39700	----	19.3	10.0	----	29.3	----	47.9	----	18.6	H(CAV)
9	1.30000	----	10.7	10.0	----	20.7	----	46.0	----	25.3	H(CAV)
10	3.68800	----	14.7	10.1	----	24.8	----	46.0	----	21.2	H(CAV)
11	7.14000	----	18.7	10.1	----	28.8	----	50.0	----	21.2	H(CAV)
12	14.04000	----	25.3	10.2	----	35.5	----	50.0	----	14.5	H(CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19300	35.9	----	9.9	45.8	----	63.9	----	18.1	----	N(QP)
2	0.38500	28.7	----	10.0	38.7	----	58.2	----	19.5	----	N(QP)
3	1.24400	24.4	----	10.0	34.4	----	56.0	----	21.6	----	N(QP)
4	2.12400	25.8	----	10.0	35.8	----	56.0	----	20.2	----	N(QP)
5	4.56800	25.4	----	10.1	35.5	----	56.0	----	20.5	----	N(QP)
6	14.05000	33.0	----	10.2	43.2	----	60.0	----	16.8	----	N(QP)
7	0.19300	----	17.2	9.9	----	27.1	----	53.9	----	26.8	N(CAV)
8	0.38500	----	12.2	10.0	----	22.2	----	48.2	----	26.0	N(CAV)
9	1.24400	----	10.6	10.0	----	20.6	----	46.0	----	25.4	N(CAV)
10	2.12400	----	13.8	10.0	----	23.8	----	46.0	----	22.2	N(CAV)
11	4.56800	----	10.8	10.1	----	20.9	----	46.0	----	25.1	N(CAV)
12	14.05000	----	20.4	10.2	----	30.6	----	50.0	----	19.4	N(CAV)

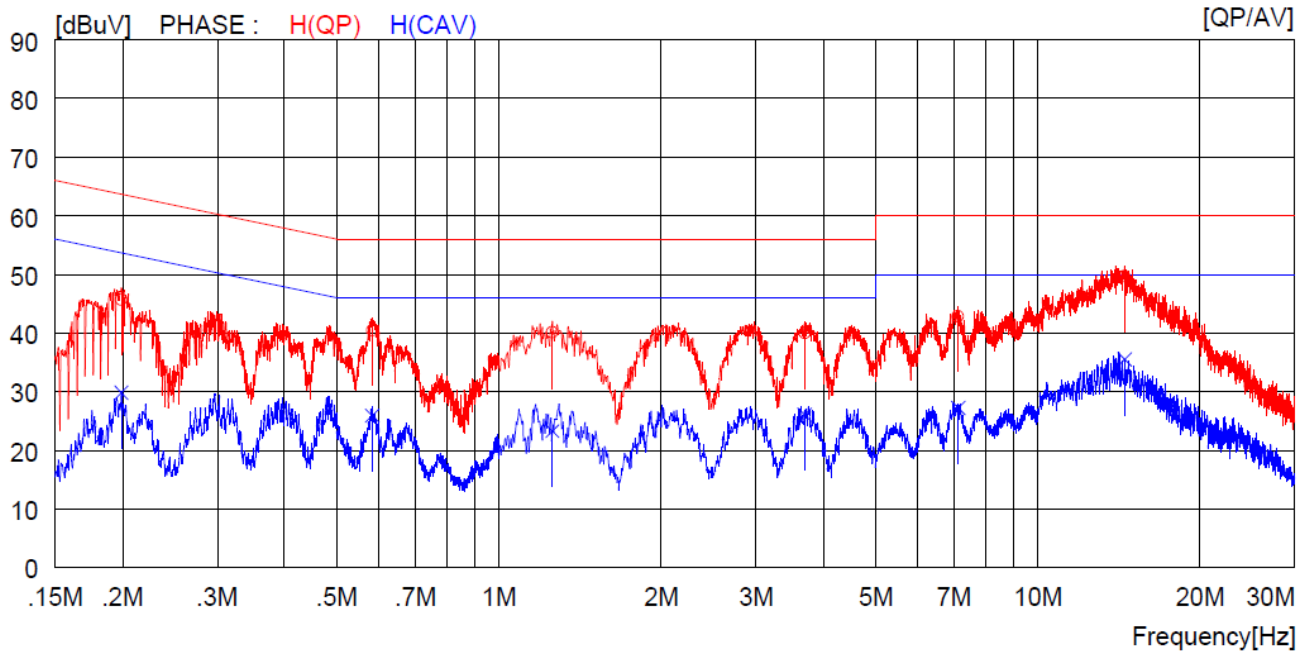
Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ju Yun Park / Assistant Manager

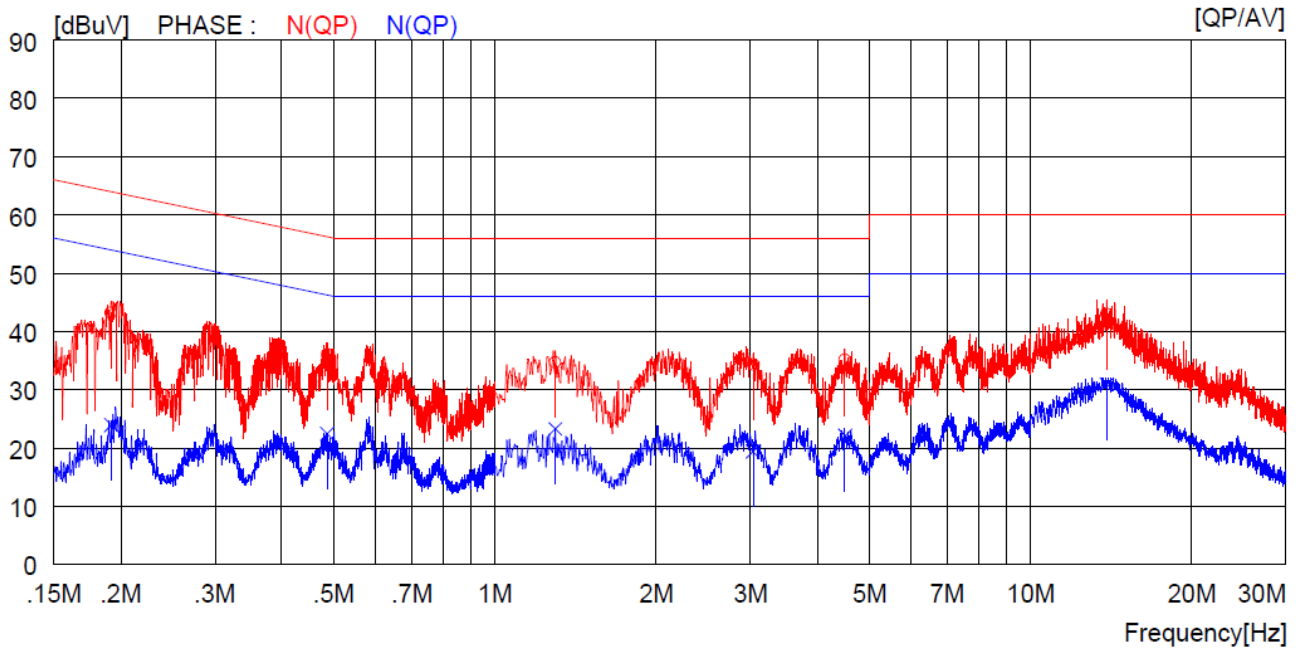
16.4.1 Test data for LTE Band 13

- Test Date : February 13, 2019 ~ March 05, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19900	35.8	----	9.9	45.7	----	63.7	----	18.0	----	H (QP)
2	0.58200	30.6	----	9.9	40.5	----	56.0	----	15.5	----	H (QP)
3	1.25600	30.1	----	10.0	40.1	----	56.0	----	15.9	----	H (QP)
4	3.69600	29.9	----	10.1	40.0	----	56.0	----	16.0	----	H (QP)
5	7.11500	32.8	----	10.1	42.9	----	60.0	----	17.1	----	H (QP)
6	14.50000	39.5	----	10.2	49.7	----	60.0	----	10.3	----	H (QP)
7	0.19900	----	19.9	9.9	----	29.8	----	53.7	----	23.9	H (CAV)
8	0.58200	----	16.0	9.9	----	25.9	----	46.0	----	20.1	H (CAV)
9	1.25600	----	13.3	10.0	----	23.3	----	46.0	----	22.7	H (CAV)
10	3.69600	----	16.0	10.1	----	26.1	----	46.0	----	19.9	H (CAV)
11	7.11500	----	17.1	10.1	----	27.2	----	50.0	----	22.8	H (CAV)
12	14.50000	----	25.3	10.2	----	35.5	----	50.0	----	14.5	H (CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19200	33.3	----	9.9	43.2	----	63.9	----	20.7	----	N (QP)
2	0.48600	26.1	----	9.9	36.0	----	56.2	----	20.2	----	N (QP)
3	1.29600	24.7	----	10.0	34.7	----	56.0	----	21.3	----	N (QP)
4	3.03200	24.3	----	10.0	34.3	----	56.0	----	21.7	----	N (QP)
5	4.50800	25.0	----	10.1	35.1	----	56.0	----	20.9	----	N (QP)
6	13.88000	32.8	----	10.2	43.0	----	60.0	----	17.0	----	N (QP)
7	0.19200	----	14.0	9.9	----	23.9	----	53.9	----	30.0	N (CAV)
8	0.48600	----	12.5	9.9	----	22.4	----	46.2	----	23.8	N (CAV)
9	1.29600	----	13.3	10.0	----	23.3	----	46.0	----	22.7	N (CAV)
10	3.03200	----	9.4	10.0	----	19.4	----	46.0	----	26.6	N (CAV)
11	4.50800	----	12.0	10.1	----	22.1	----	46.0	----	23.9	N (CAV)
12	13.88000	----	20.7	10.2	----	30.9	----	50.0	----	19.1	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ju Yun Park / Assistant Manager