FCC §2.1051, §22.917(a) & §24.238(a)& §27.53 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

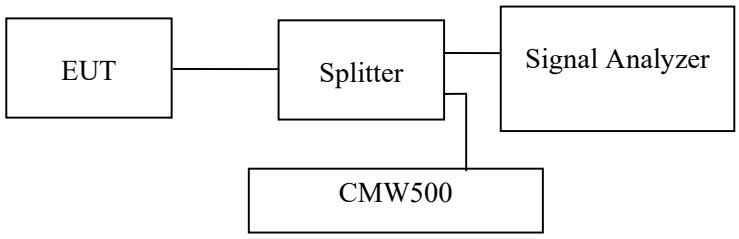
Applicable Standard

FCC §2.1051, §22.917(a) & §24.238(a)&§27.53.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.



Test Data

Environmental Conditions

Temperature:	22~26 ℃
Relative Humidity:	48~56 %
ATM Pressure:	100.2~101.0 kPa

The testing was performed by Black Ding from 2022-04-11 to 2022-04-22.

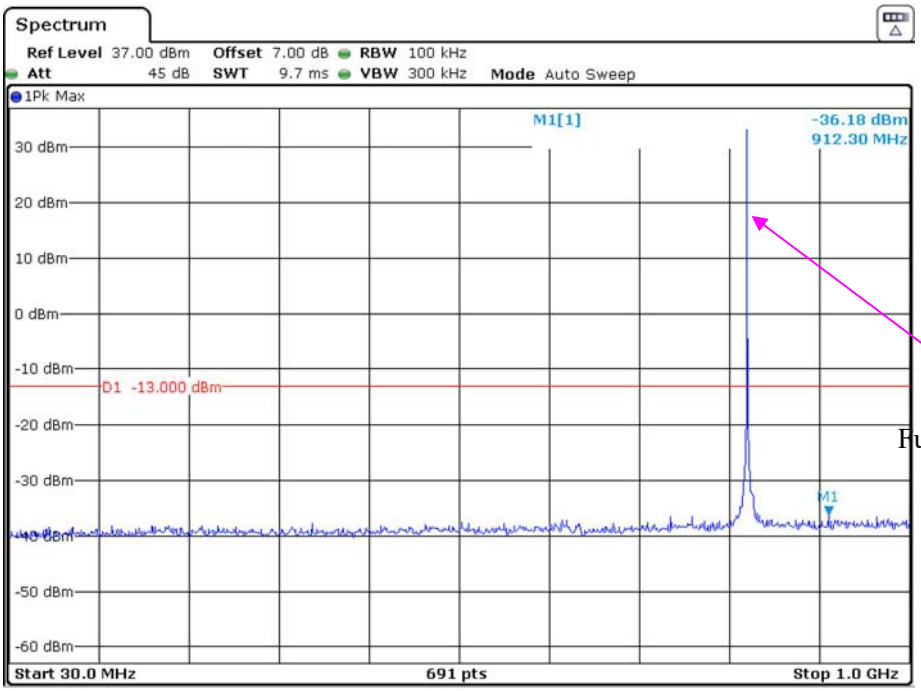
EUT operation mode: Transmitting

Test result: Pass

Please refer to the following plots.

Cellular Band
Low Channel:

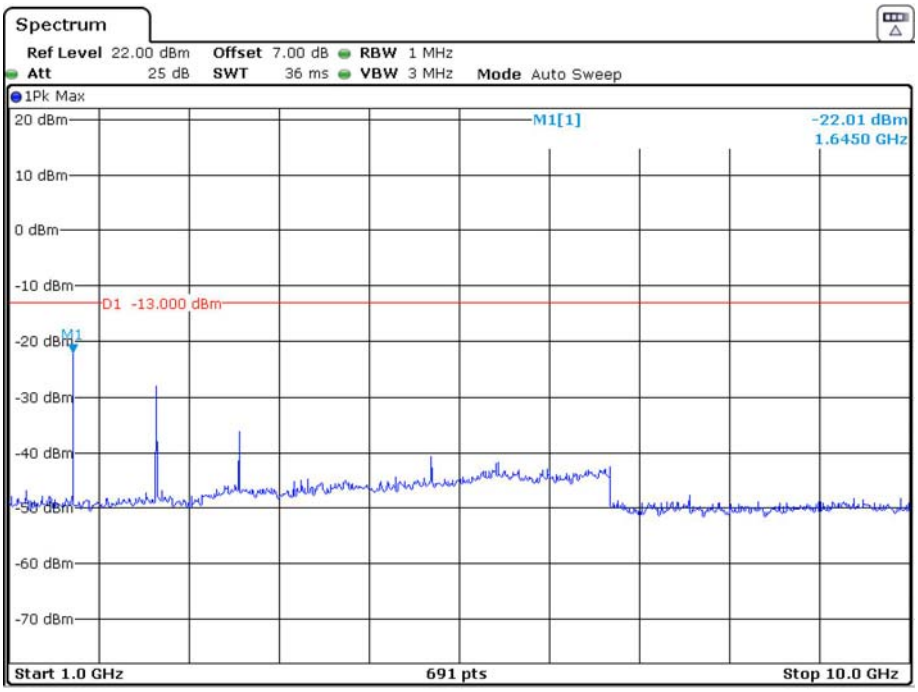
30 MHz – 1 GHz (GSM Mode)



Fundamental test

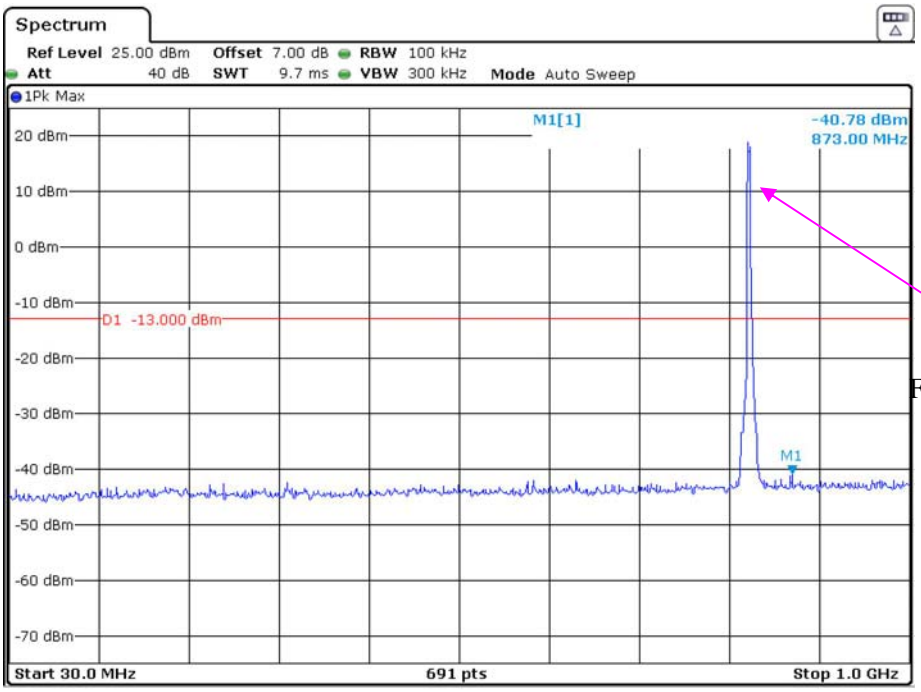
Date: 11.APR.2022 09:37:53

1 GHz – 10 GHz (GSM Mode)



Date: 11.APR.2022 09:39:31

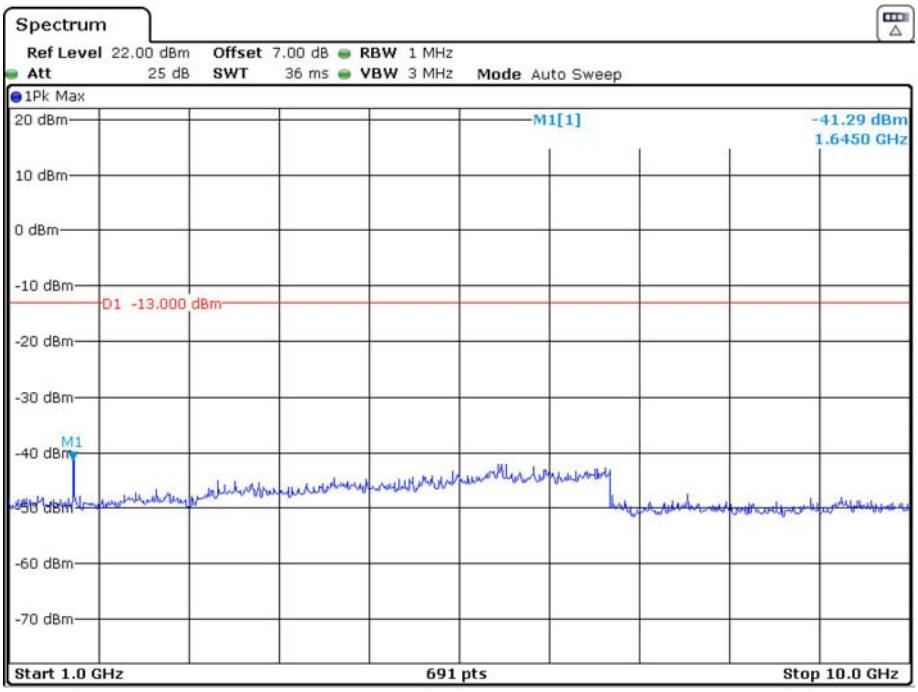
30 MHz – 1 GHz (WCDMA Mode)



Fundamental test

Date: 11.APR.2022 10:21:41

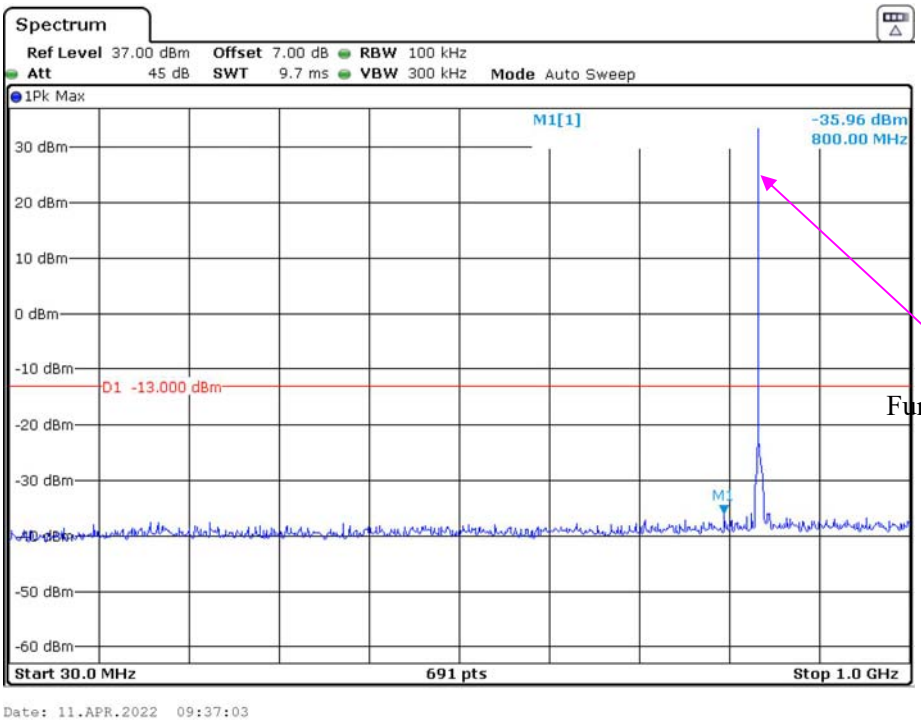
1 GHz – 10 GHz (WCDMA Mode)



Date: 11.APR.2022 10:23:53

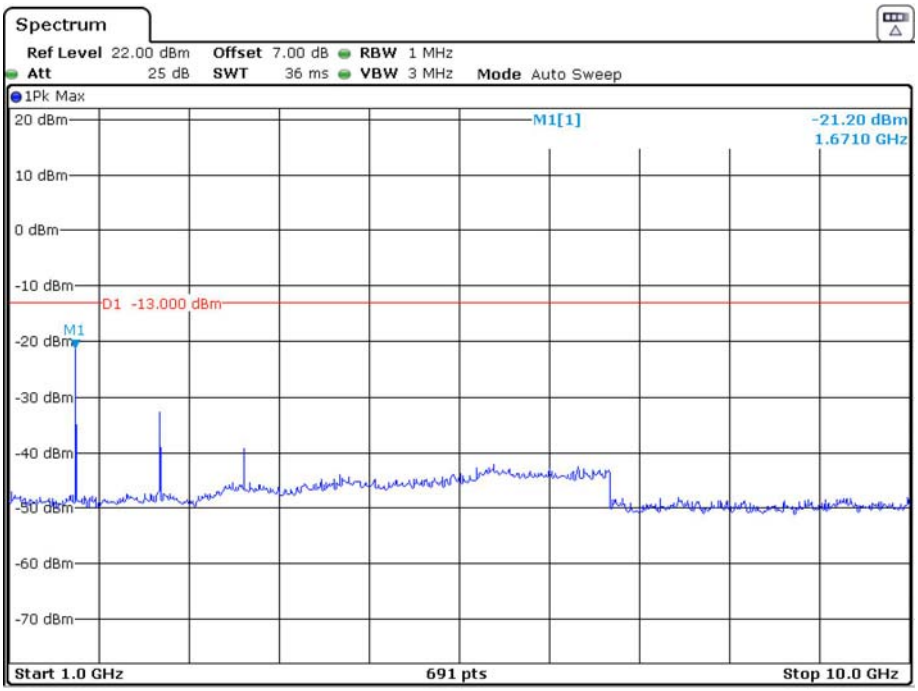
Middle Channel:

30 MHz – 1 GHz (GSM Mode)



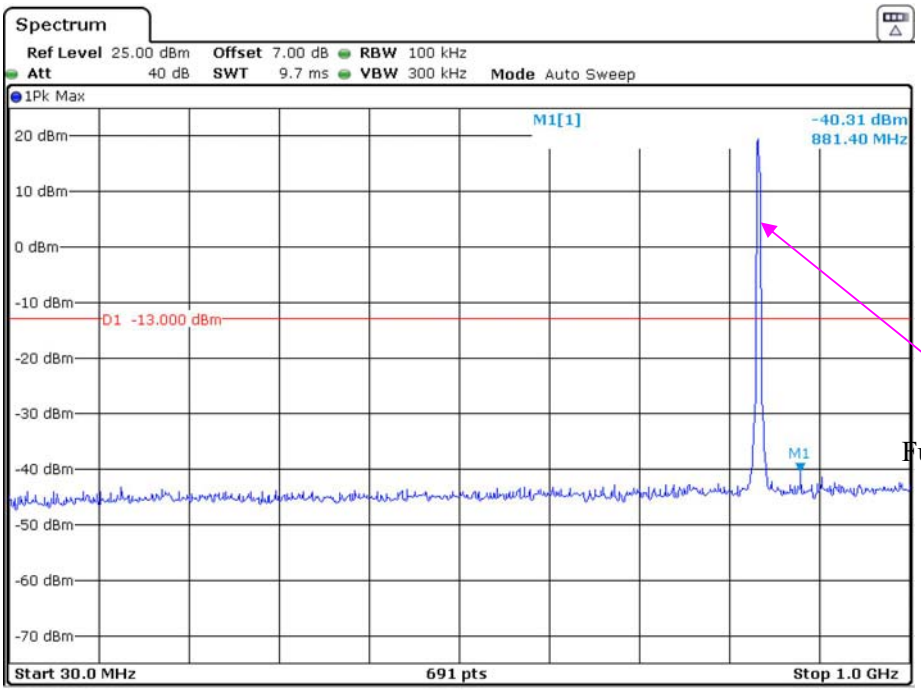
Date: 11.APR.2022 09:37:03

1 GHz – 10 GHz (GSM Mode)



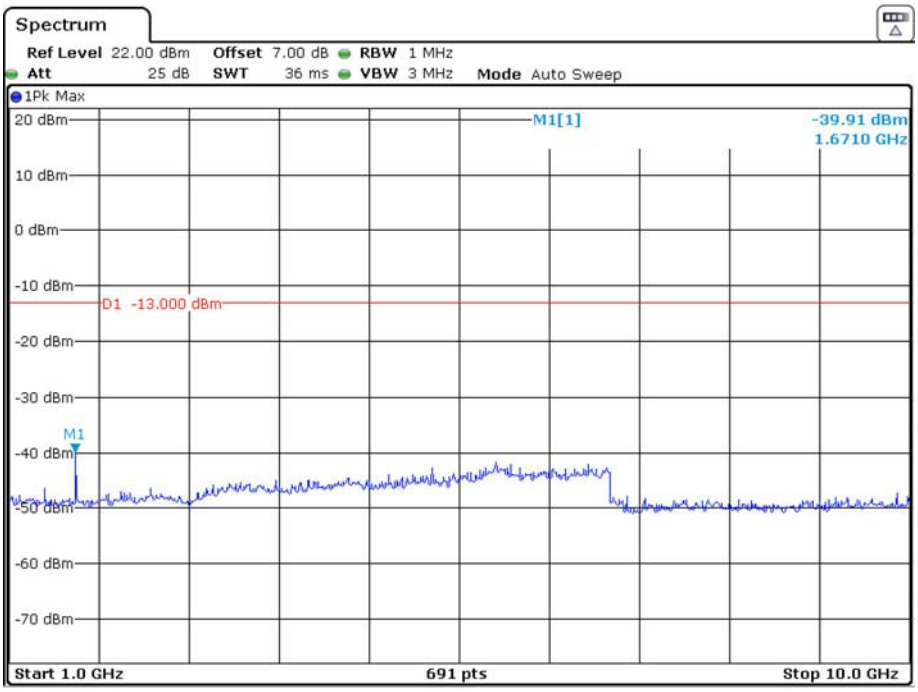
Date: 11.APR.2022 09:39:06

30 MHz – 1 GHz (WCDMA Mode)



Date: 11.APR.2022 10:22:00

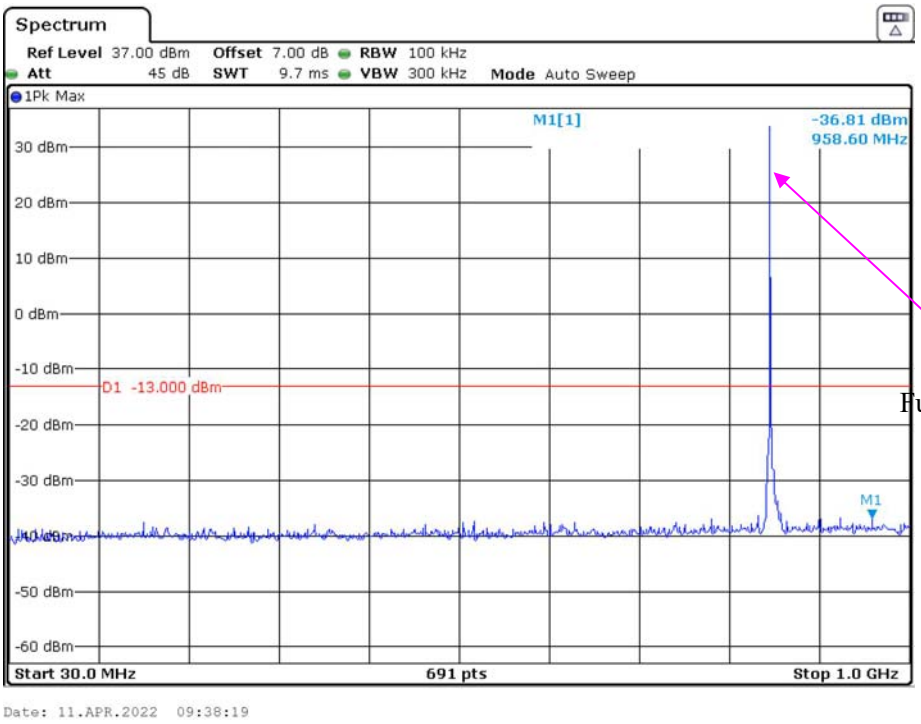
1 GHz – 10 GHz (WCDMA Mode)



Date: 11.APR.2022 10:23:38

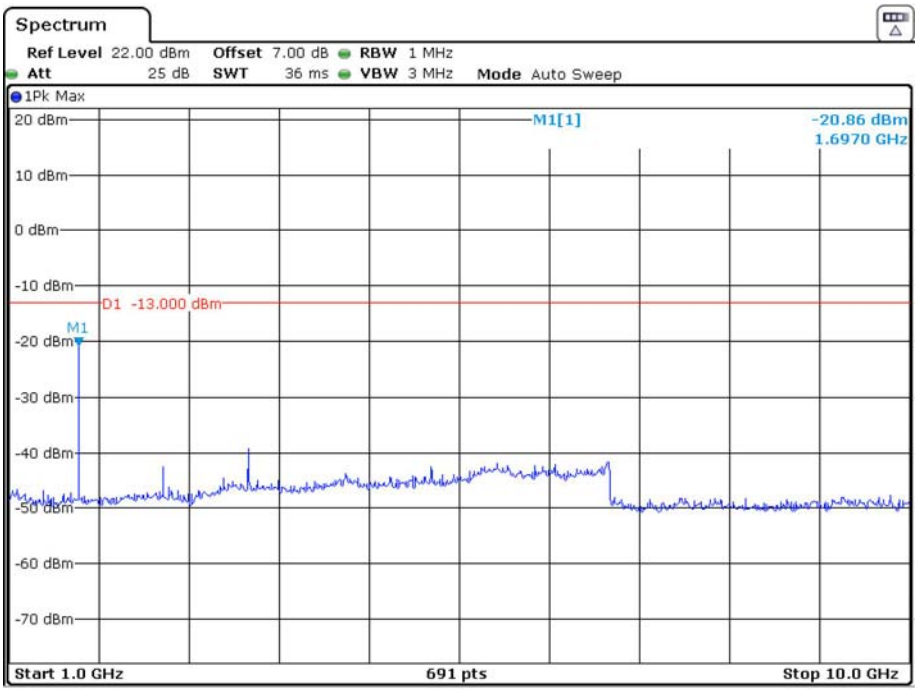
High Channel:

30 MHz – 1 GHz (GSM Mode)

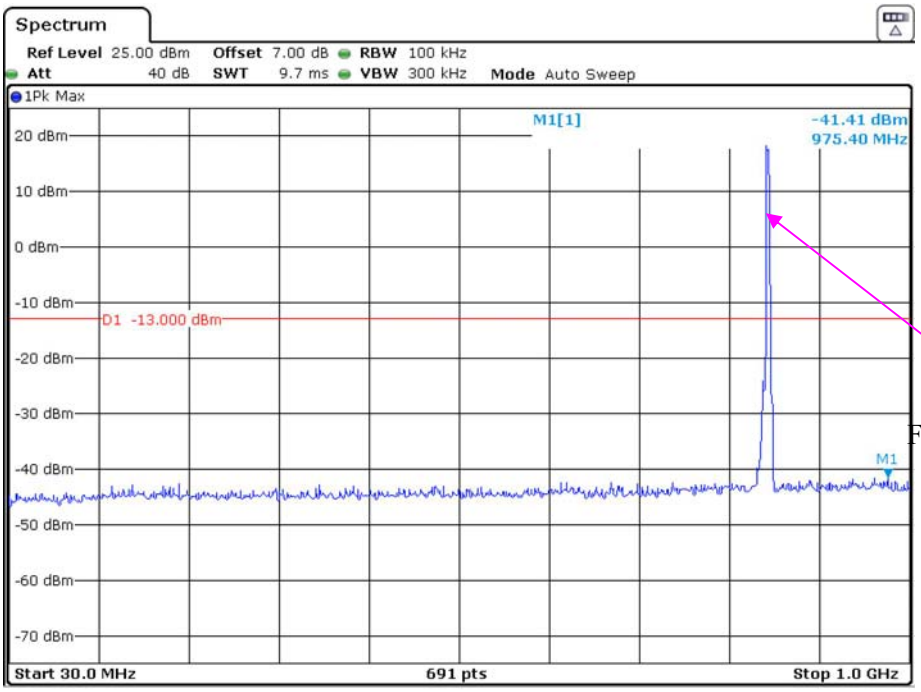


Fundamental test

1 GHz – 10 GHz (GSM Mode)

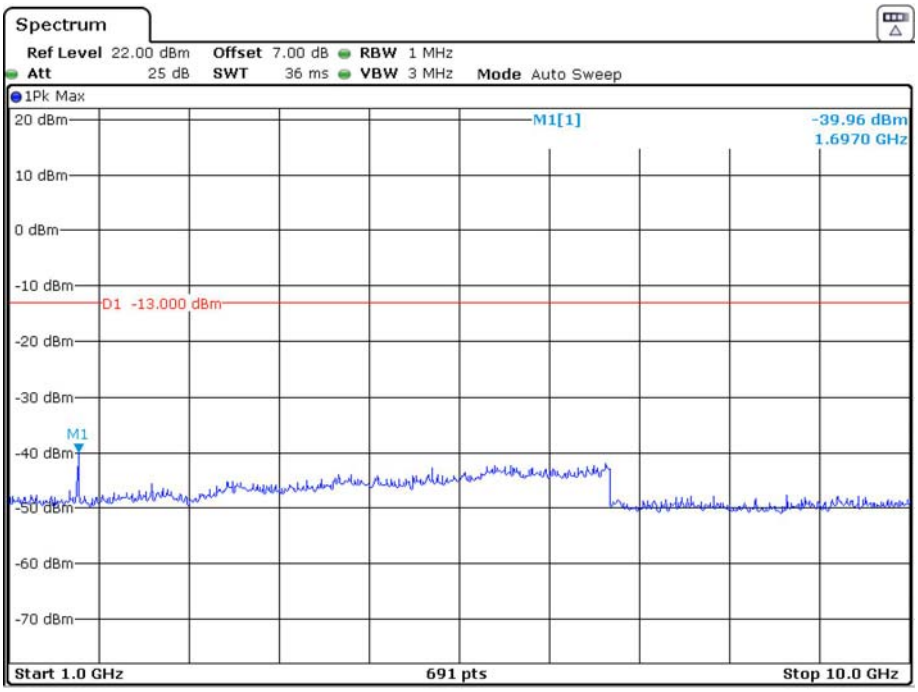


30 MHz – 1 GHz (WCDMA Mode)



Date: 11.APR.2022 10:22:33

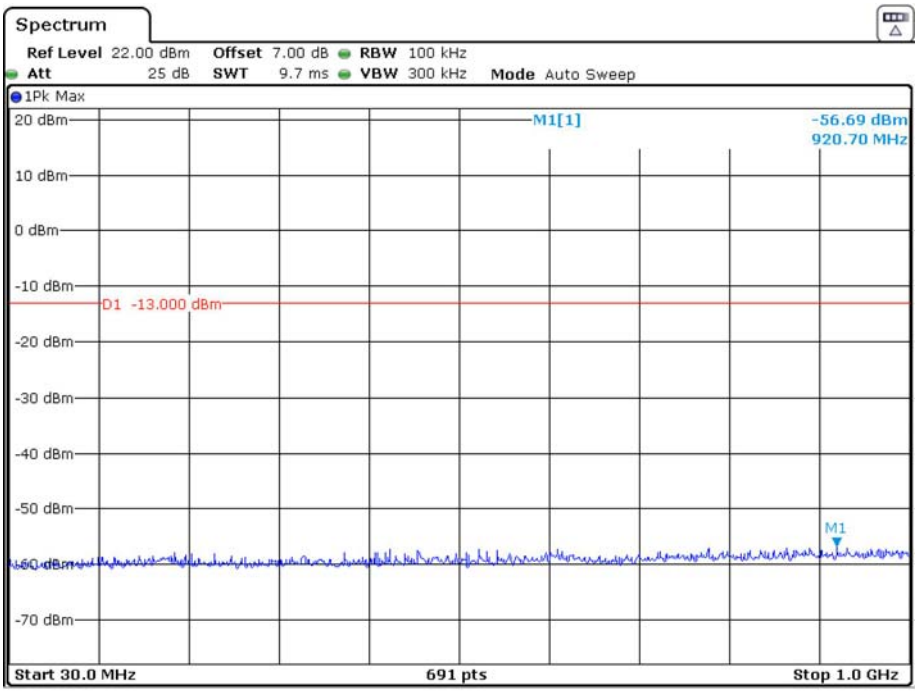
1 GHz – 10 GHz (WCDMA Mode)



Date: 11.APR.2022 10:23:08

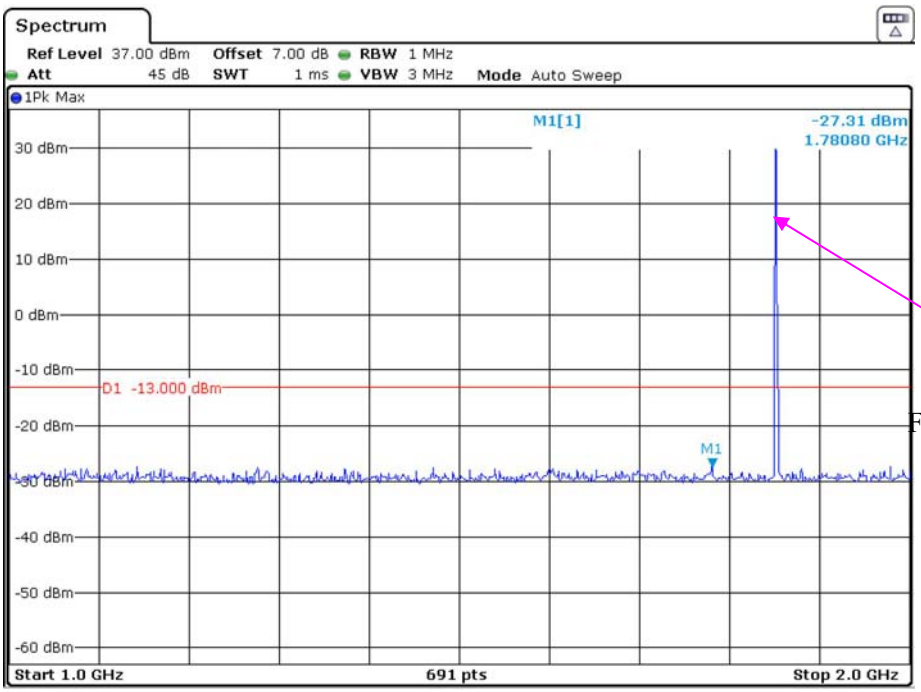
PCS Band
Low Channel:

30 MHz – 1 GHz (GSM Mode)



Date: 11.APR.2022 10:00:33

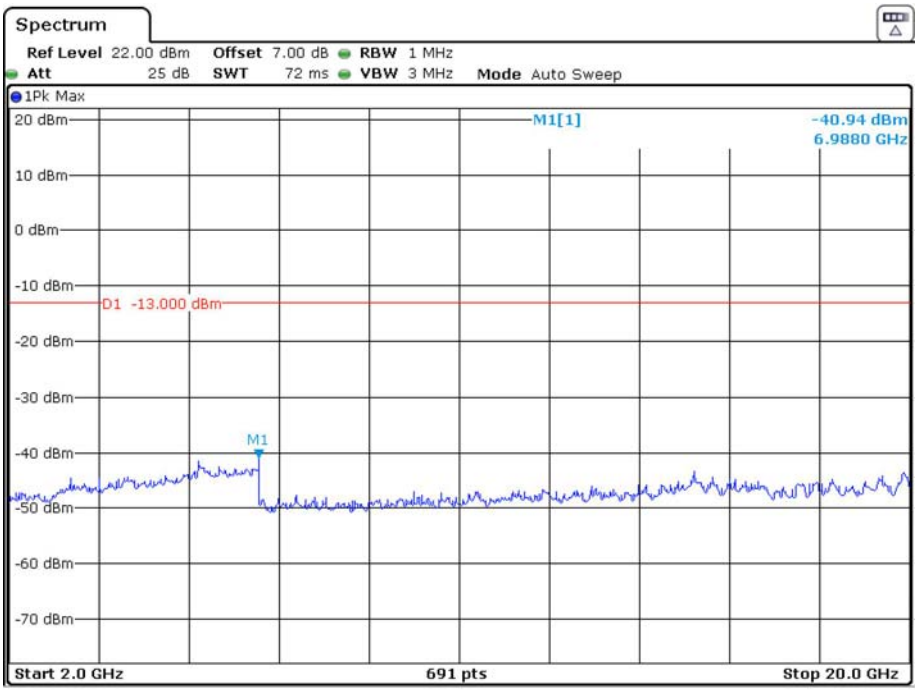
1 GHz – 2 GHz (GSM Mode)



Fundamental test

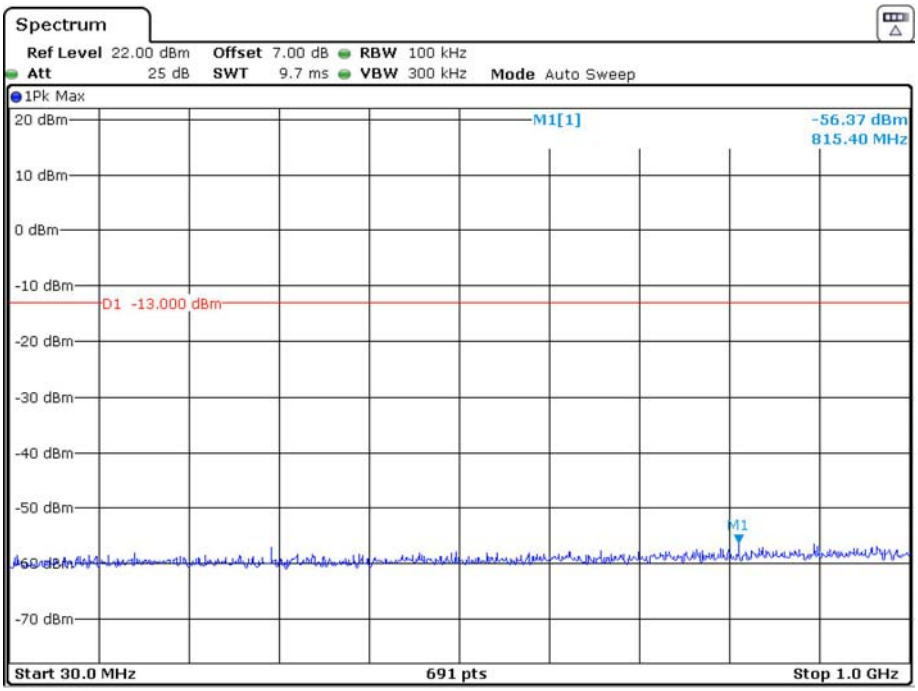
Date: 11.APR.2022 09:56:50

2 GHz – 20 GHz (GSM Mode)



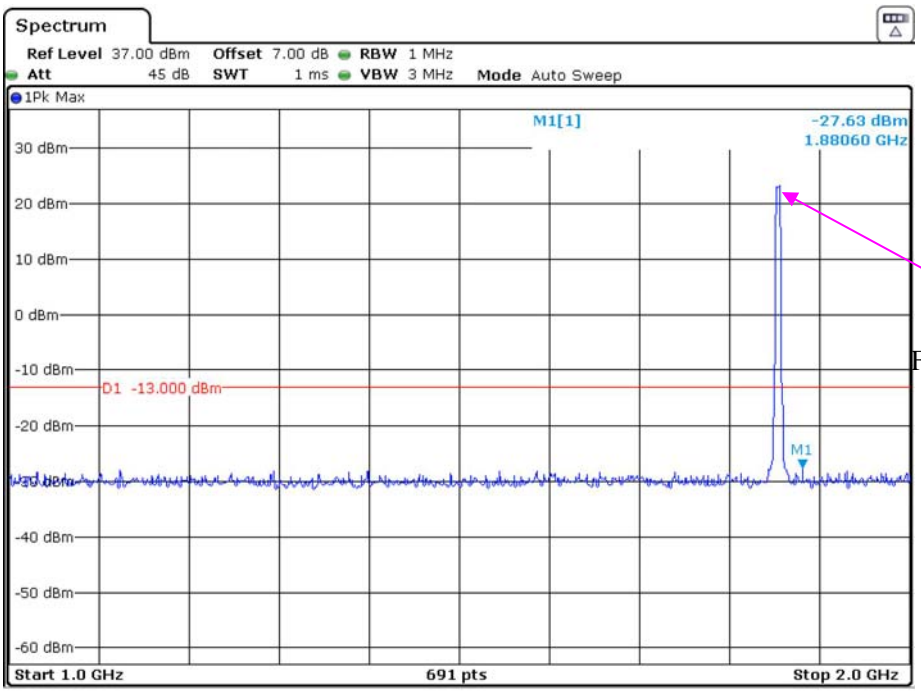
Date: 11.APR.2022 09:58:28

30 MHz – 1 GHz (WCDMA Mode)



Date: 11.APR.2022 10:44:07

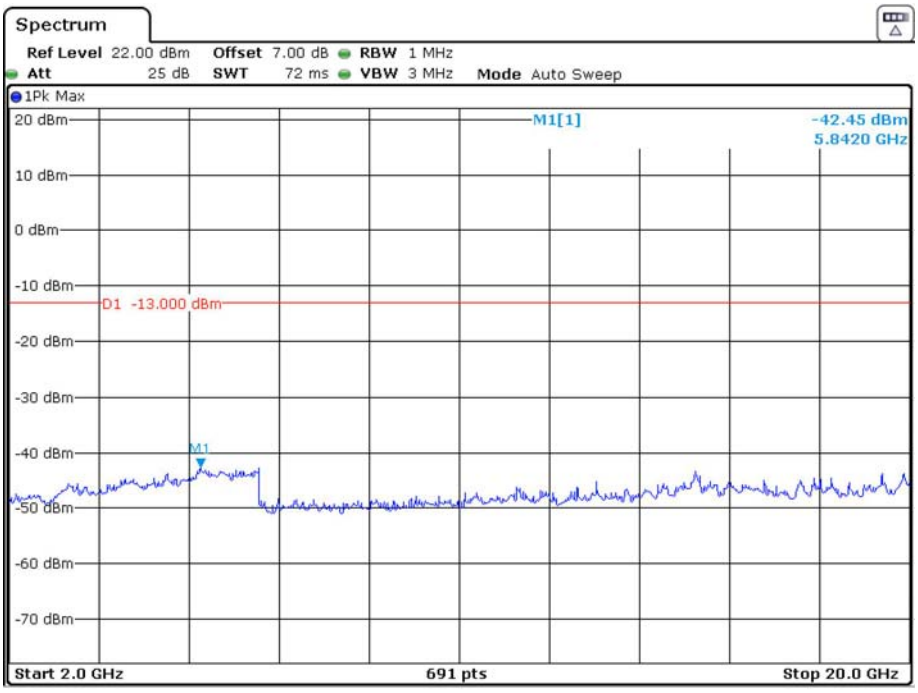
1 GHz – 2 GHz (WCDMA Mode)



Fundamental test

Date: 11.APR.2022 10:47:21

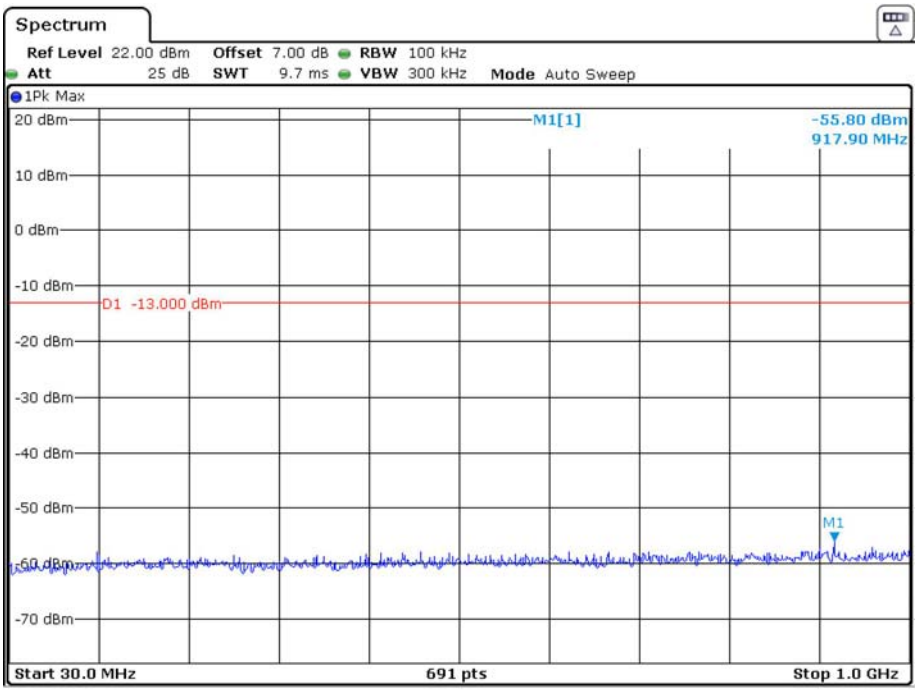
2 GHz – 20 GHz (WCDMA Mode)



Date: 11.APR.2022 10:47:42

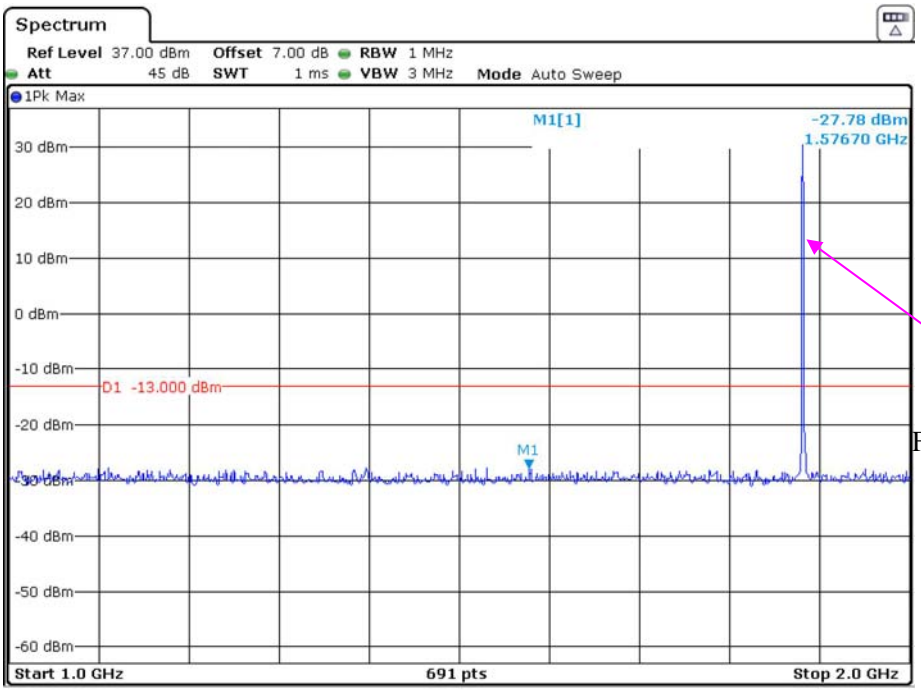
Middle Channel:

30 MHz – 1 GHz (GSM Mode)



Date: 11.APR.2022 10:00:47

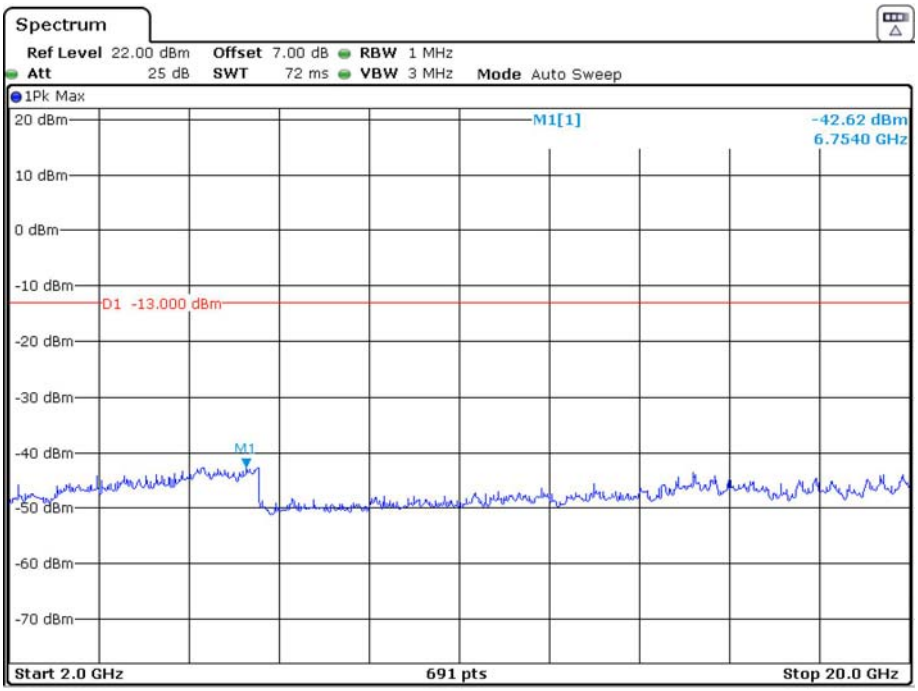
1 GHz – 2 GHz (GSM Mode)



Fundamental test

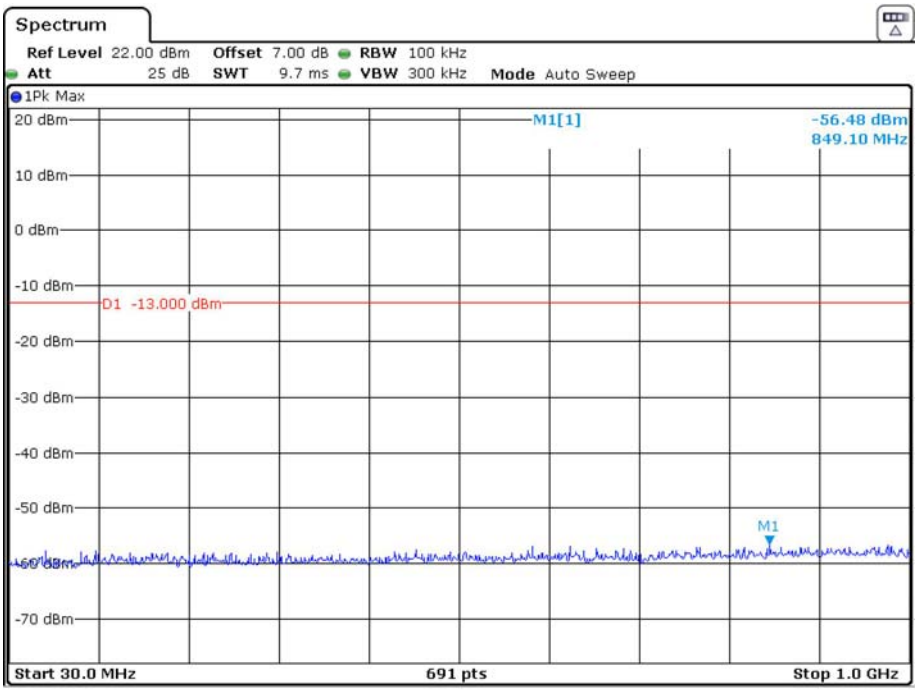
Date: 11.APR.2022 09:57:22

2 GHz– 20 GHz (GSM Mode)



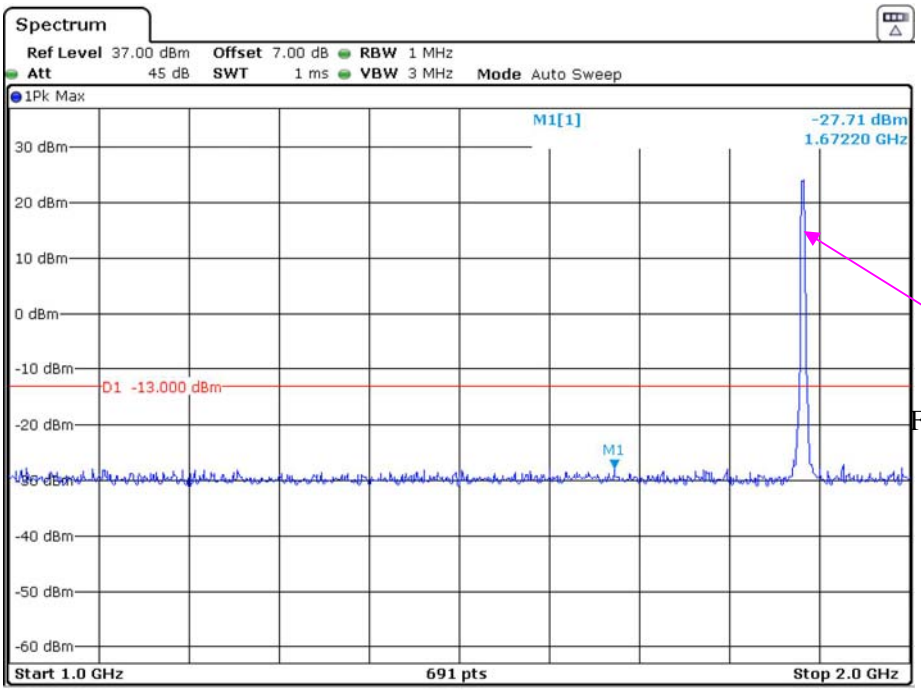
Date: 11.APR.2022 09:58:48

30 MHz – 1 GHz (WCDMA Mode)



Date: 11.APR.2022 10:44:39

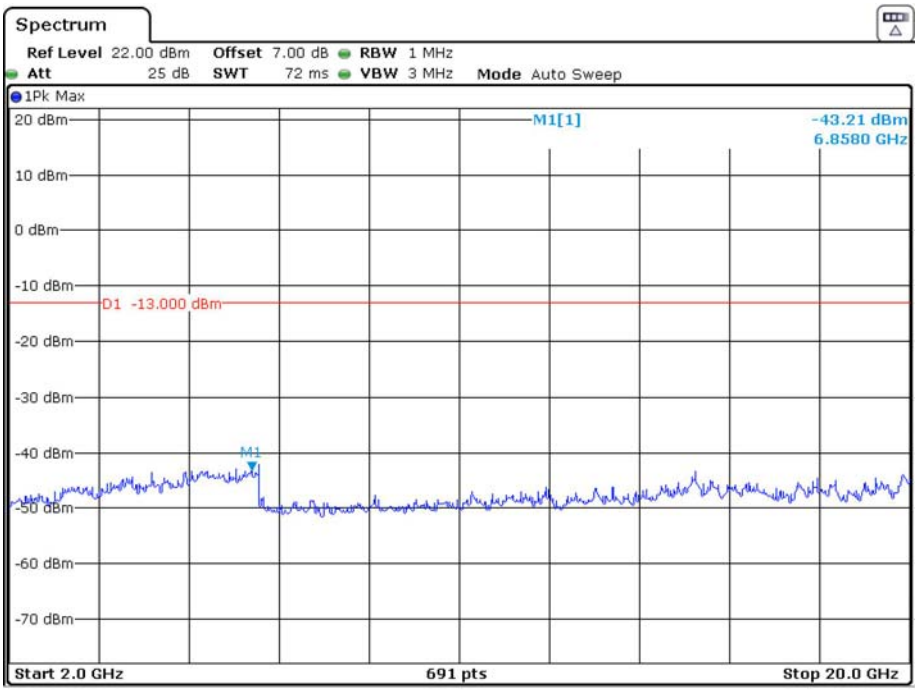
1 GHz – 2 GHz (WCDMA Mode)



Fundamental test

Date: 11.APR.2022 10:46:52

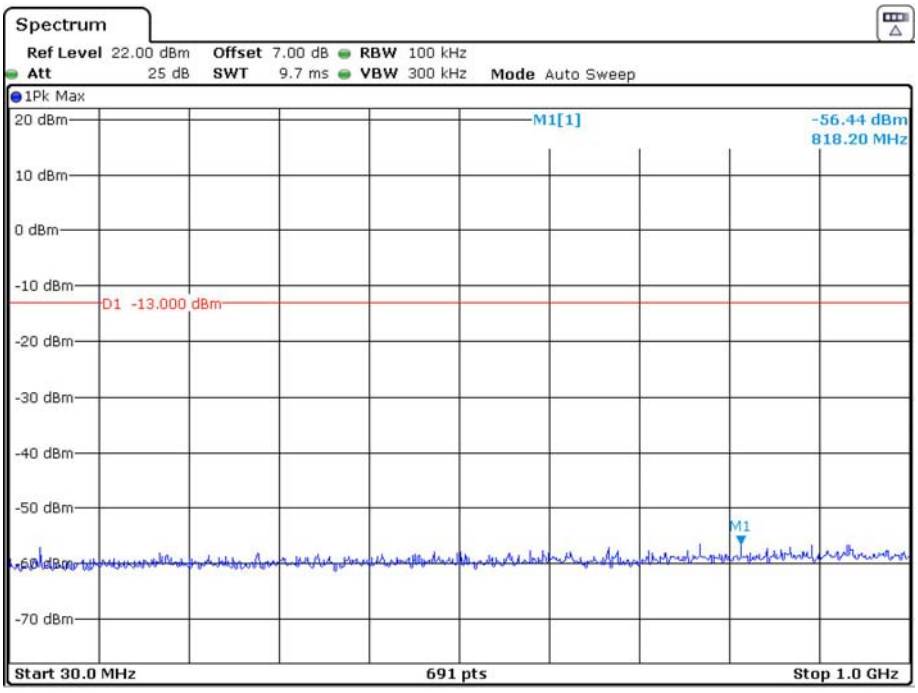
2 GHz – 20 GHz (WCDMA Mode)



Date: 11.APR.2022 10:48:08

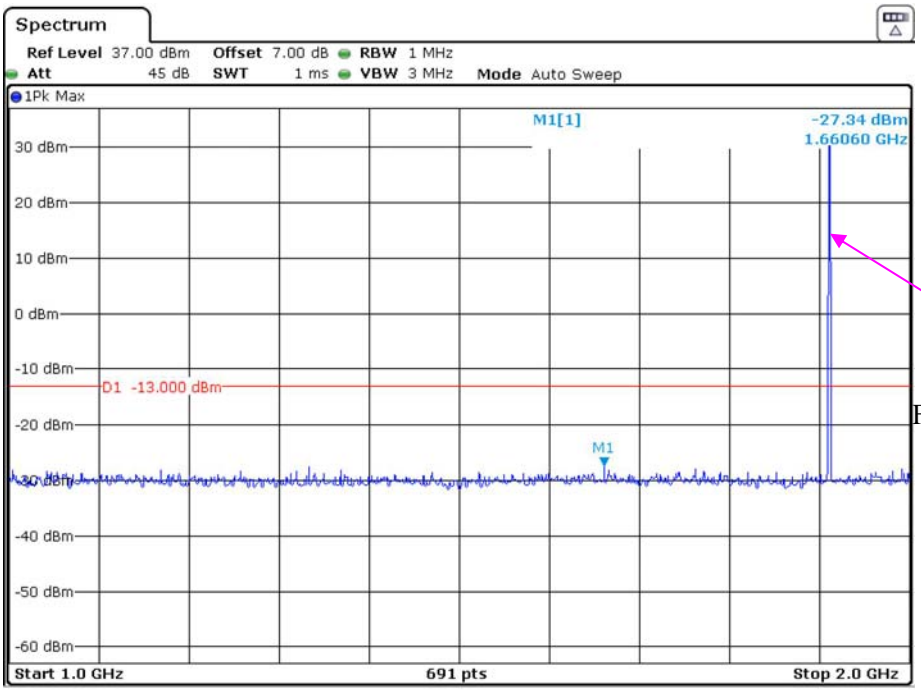
High Channel:

30 MHz – 1 GHz (GSM Mode)



Date: 11.APR.2022 10:01:07

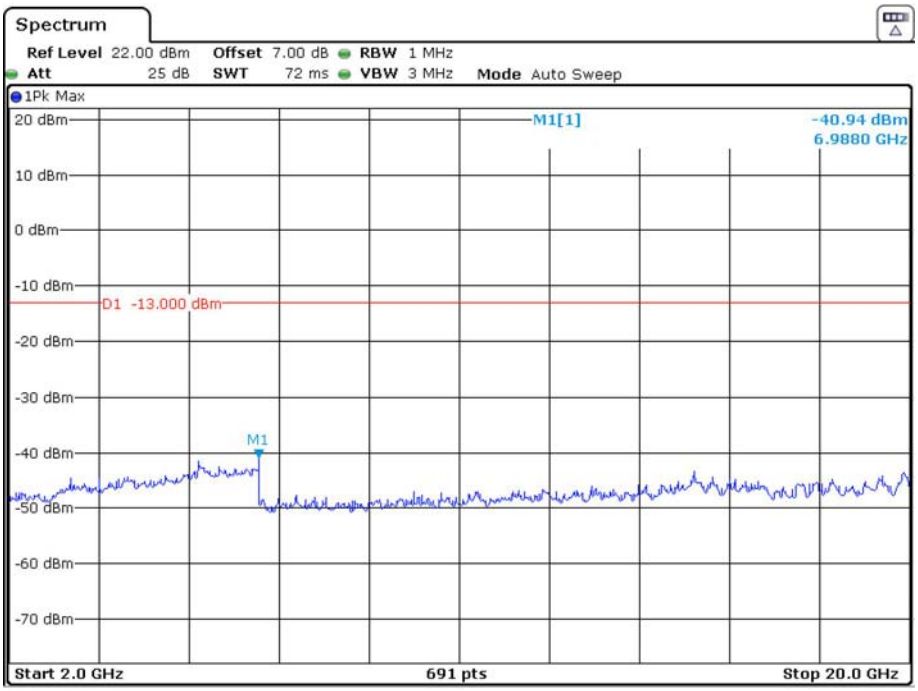
1 GHz– 2 GHz (GSM Mode)



Fundamental test

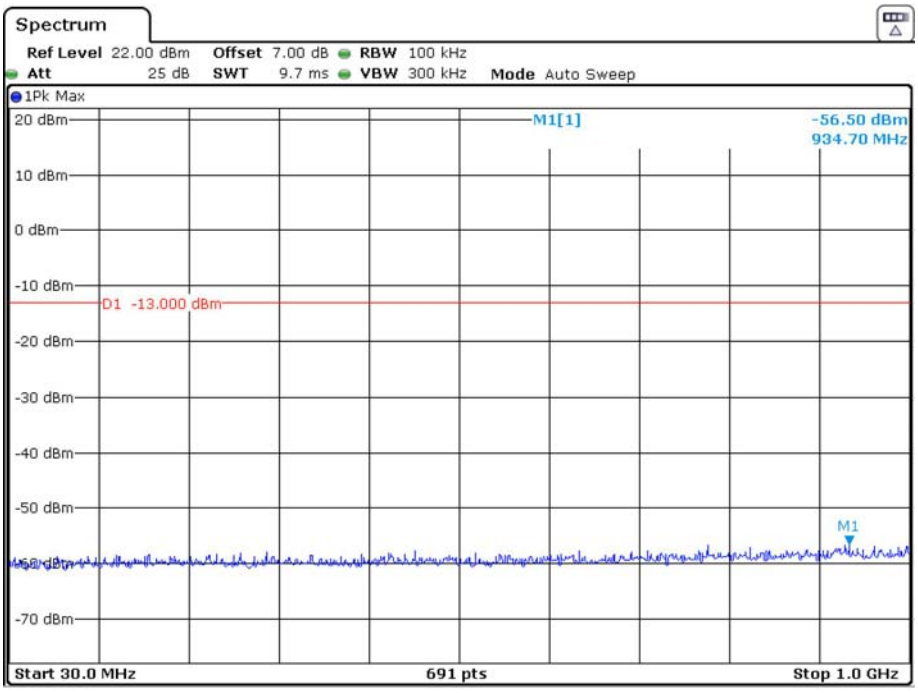
Date: 11.APR.2022 09:57:52

2 GHz– 20 GHz (GSM Mode)



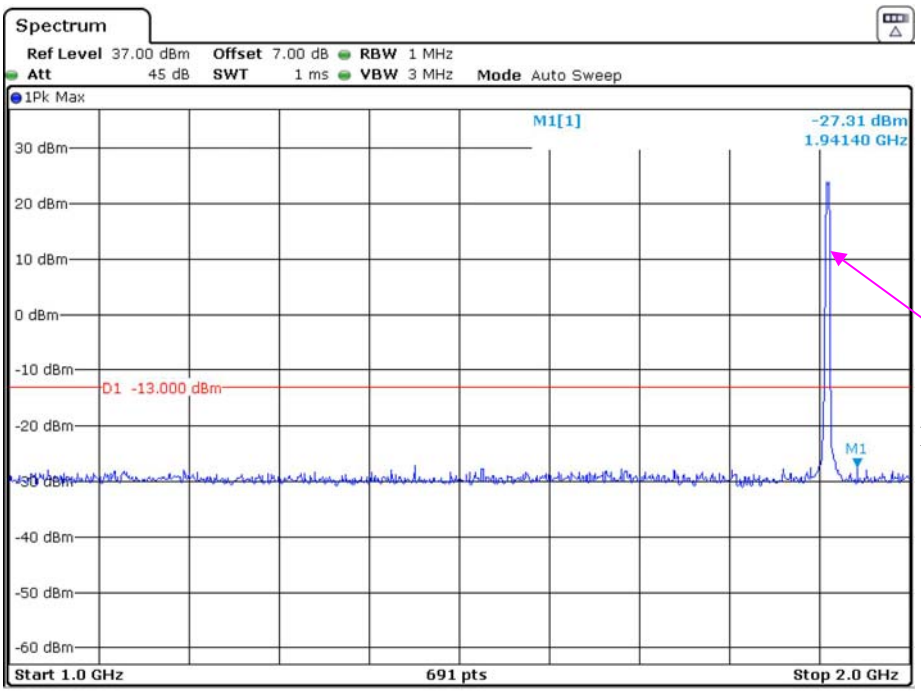
Date: 11.APR.2022 09:58:28

30 MHz – 1 GHz (WCDMA Mode)



Date: 11.APR.2022 10:45:00

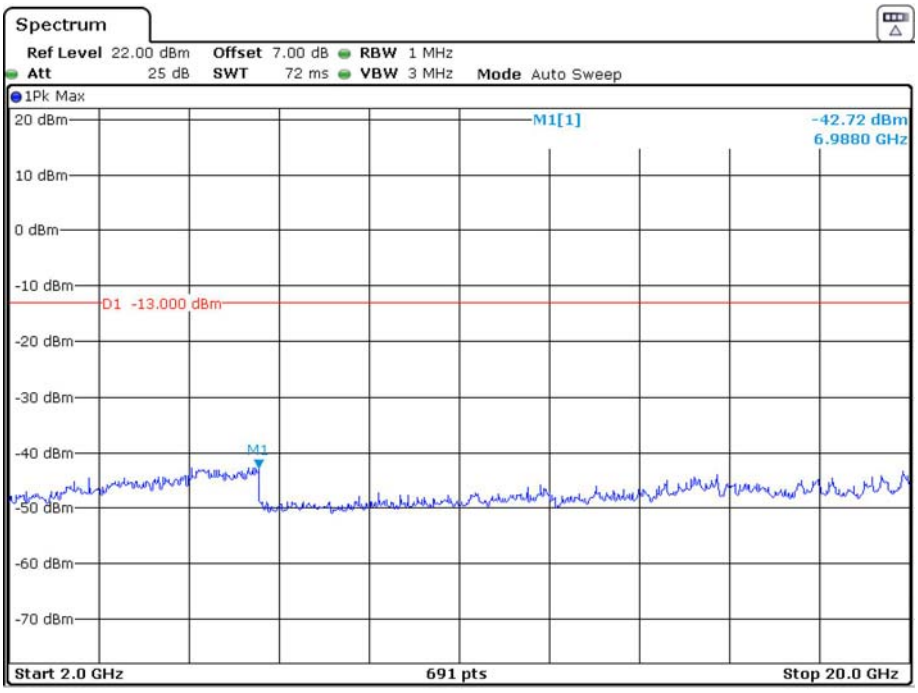
1 GHz – 2 GHz (WCDMA Mode)



Fundamental test

Date: 11.APR.2022 10:46:25

2GHz – 20 GHz (WCDMA Mode)



Date: 11.APR.2022 10:48:27

The test plots of LTE band please refer to the Appendix B.

FCC § 2.1053; § 22.917 (a);§ 24.238 (a); §27.53 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §22.917(a)& § 24.238(a) &§ 27.53.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Test Data

Environmental Conditions

Temperature:	23~26℃
Relative Humidity:	48~59 %
ATM Pressure:	100.4~101.0 kPa

The testing was performed by Leo Li from 2022-04-22 to 2022-04-23 for below 1GHz and for above 1GHz.

EUT operation mode: Transmitting(Scan with X-AXIS, Y-AXIS, Z-AXIS, the worst case Y-AXIS was recorded)

The worst case is as below:

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
GSM850								
Test frequency range: 30MHz-10GHz								
Low channel								
325.76	-63.21	312	2.0	H	-0.2	-63.41	-13	50.41
325.76	-69.38	63	1.1	V	3.1	-66.28	-13	53.28
1648.4	-43.80	299	1.7	H	3.5	-40.30	-13	27.3
1648.4	-41.60	35	1.8	V	3.1	-38.50	-13	25.5
2472.6	-45.40	360	2.1	H	6.6	-38.80	-13	25.8
2472.6	-36.90	268	1.7	V	5.8	-31.10	-13	18.1
3296.8	-43.10	31	1.0	H	6.4	-36.70	-13	23.7
3296.8	-44.50	41	2.5	V	5.7	-38.80	-13	25.8
Middle channel								
325.76	-62.41	120	1.0	H	-0.2	-62.61	-13	49.61
325.76	-70.08	318	2.2	V	3.1	-66.98	-13	53.98
1673.2	-42.80	183	2.0	H	3.8	-39.00	-13	26
1673.2	-40.20	15	1.8	V	3.1	-37.10	-13	24.1
2509.8	-44.80	212	2.1	H	6.2	-38.60	-13	25.6
2509.8	-37.30	29	1.9	V	5.5	-31.80	-13	18.8
3346.4	-41.00	36	2.2	H	6.6	-34.40	-13	21.4
3346.4	-41.90	346	1.2	V	5.4	-36.50	-13	23.5
High channel								
325.76	-61.66	187	2.1	H	-0.2	-61.86	-13	48.86
325.76	-68.80	249	1.3	V	3.1	-65.70	-13	52.70
1697.6	-46.00	349	1.2	H	4.1	-41.90	-13	28.90
1697.6	-45.10	47	2.1	V	3.1	-42.00	-13	29.00
2546.4	-45.10	35	2.1	H	6.1	-39.00	-13	26.00
2546.4	-44.00	198	2.2	V	5.8	-38.20	-13	25.20
3395.2	-41.80	148	1.9	H	6.2	-35.60	-13	22.60
3395.2	-44.50	276	1.3	V	5.4	-39.10	-13	26.10

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
GSM1900								
Test frequency range: 30MHz-20GHz								
Low channel								
325.76	-61.75	226	1.9	H	-0.2	-61.95	-13	48.95
325.76	-69.82	128	1.3	V	3.1	-66.72	-13	53.72
3700.4	-49.30	232	2.2	H	8.1	-41.20	-13	28.20
3700.4	-52.30	156	1.1	V	7.6	-44.70	-13	31.70
5550.6	-51.50	152	1.8	H	9.6	-41.90	-13	28.90
5550.6	-51.80	267	1.7	V	9.1	-42.70	-13	29.70
Middle channel								
325.76	-63.70	128	1.5	H	-0.2	-63.90	-13	50.90
325.76	-69.57	207	2.1	V	3.1	-66.47	-13	53.47
3760	-50.70	229	2.3	H	8.8	-41.90	-13	28.90
3760	-52.80	265	1.5	V	8	-44.80	-13	31.80
5640	-54.40	24	1.6	H	10.2	-44.20	-13	31.20
5640	-52.70	314	1.3	V	9.5	-43.20	-13	30.20
High channel								
325.76	-62.50	359	1.6	H	-0.2	-62.70	-13	49.70
325.76	-68.50	124	2.5	V	3.1	-65.40	-13	52.40
3819.6	-49.20	200	2.1	H	8.7	-40.50	-13	27.50
3819.6	-53.20	100	1.4	V	8	-45.20	-13	32.20
5729.4	-54.00	140	2.2	H	10.8	-43.20	-13	30.20
5729.4	-54.50	75	1.7	V	10.4	-44.10	-13	31.10

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
WCDMA Band2								
Test frequency range: 30MHz-20GHz								
Low channel								
325.76	-61.77	274	1.3	H	-0.2	-61.97	-13	48.97
325.76	-68.22	306	1.4	V	3.1	-65.12	-13	52.12
3704.8	-53.80	300	1.0	H	8.1	-45.70	-13	32.70
3704.8	-53.60	261	1.1	V	7.6	-46.00	-13	33.00
5557.2	-53.70	353	2.2	H	9.6	-44.10	-13	31.10
5557.2	-53.30	297	1.6	V	9.1	-44.20	-13	31.20
Middle channel								
325.76	-62.22	287	1.5	H	-0.2	-62.42	-13	49.42
325.76	-69.16	118	1.8	V	3.1	-66.06	-13	53.06
3760.0	-54.40	146	2.0	H	8.8	-45.60	-13	32.60
3760.0	-54.20	71	2.3	V	8	-46.20	-13	33.20
5640.0	-54.50	18	1.9	H	10.2	-44.30	-13	31.30
5640.0	-53.90	233	1.7	V	9.5	-44.40	-13	31.40
High channel								
325.76	-62.49	278	1.5	H	-0.2	-62.69	-13	49.69
325.76	-69.62	286	1.6	V	3.1	-66.52	-13	53.52
3815.2	-51.10	72	2.0	H	8.7	-42.40	-13	29.40
3815.2	-52.20	115	2.1	V	8	-44.20	-13	31.20
5722.8	-54.50	268	1.3	H	10.4	-44.10	-13	31.10
5722.8	-52.10	232	2.4	V	9.9	-42.20	-13	29.20

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
WCDMA Band 5								
Test frequency range: 30MHz-10GHz								
Low channel								
325.76	-61.84	32	2.2	H	-0.2	-62.04	-13	49.04
325.76	-70.64	123	1.8	V	3.1	-67.54	-13	54.54
1652.8	-55.50	147	1.3	H	3.5	-52.00	-13	39.00
1652.8	-56.30	141	1.4	V	3.1	-53.20	-13	40.20
2479.2	-54.30	210	1.7	H	6.6	-47.70	-13	34.70
2479.2	-52.20	21	1.7	V	5.8	-46.40	-13	33.40
3305.6	-52.20	176	1.2	H	6.4	-45.80	-13	32.80
3305.6	-51.80	210	2.2	V	5.7	-46.10	-13	33.10
Middle channel								
325.76	-63.33	126	1.5	H	-0.2	-63.53	-13	50.53
325.76	-69.00	312	1.7	V	3.1	-65.90	-13	52.90
1673.2	-53.30	151	1.3	H	3.5	-49.80	-13	36.80
1673.2	-55.20	25	2.3	V	3.1	-52.10	-13	39.10
2509.8	-51.70	33	1.4	H	6.6	-45.10	-13	32.10
2509.8	-50.40	185	2.5	V	5.8	-44.60	-13	31.60
3346.4	-52.00	207	1.3	H	6.4	-45.60	-13	32.60
3346.4	-51.60	1	1.2	V	5.7	-45.90	-13	32.90
High channel								
325.76	-62.91	207	1.9	H	-0.2	-63.11	-13	50.11
325.76	-68.41	19	1.2	V	3.1	-65.31	-13	52.31
1693.2	-57.00	40	2.3	H	4.1	-52.90	-13	39.90
1693.2	-56.40	306	1.7	V	3.1	-53.30	-13	40.30
2539.8	-56.30	221	1.3	H	6.1	-50.20	-13	37.20
2539.8	-54.90	17	2.2	V	5.8	-49.10	-13	36.10
3386.4	-51.70	167	1.8	H	6.2	-45.50	-13	32.50
3386.4	-51.20	40	1.4	V	5.4	-45.80	-13	32.80

LTE Bands: (pre-scan all bandwidths and modulation, the worst case as below)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 2								
Test frequency range: 30MHz-20GHz								
QPSK, 1.4MHz, Low channel								
325.76	-61.15	128	1.4	H	-0.2	-61.35	-13	48.35
325.76	-70.36	334	1.0	V	3.1	-67.26	-13	54.26
3701.4	-52.50	324	2.0	H	8.1	-44.40	-13	31.40
3701.4	-53.10	261	1.1	V	7.6	-45.50	-13	32.50
5552.1	-48.70	70	1.5	H	9.6	-39.10	-13	26.10
5552.1	-49.30	9	1.3	V	9.1	-40.20	-13	27.20
QPSK, 1.4MHz, Middle channel								
325.76	-62.62	183	1.6	H	-0.2	-62.82	-13	49.82
325.76	-68.62	235	2.2	V	3.1	-65.52	-13	52.52
3760.0	-52.80	276	1.5	H	8.8	-44.00	-13	31.00
3760.0	-52.40	66	2.0	V	8	-44.40	-13	31.40
5640.0	-50.50	107	2.5	H	10.2	-40.30	-13	27.30
5640.0	-50.60	251	2.1	V	9.5	-41.10	-13	28.10
QPSK, 1.4MHz, High channel								
325.76	-61.68	45	1.2	H	-0.2	-61.88	-13	48.88
325.76	-68.43	164	2.1	V	3.1	-65.33	-13	52.33
3818.6	-49.40	235	2.5	H	8.7	-40.70	-13	27.70
3818.6	-49.90	280	1.8	V	8	-41.90	-13	28.90
5727.9	-50.10	213	1.1	H	10.6	-39.50	-13	26.50
5727.9	-52.50	209	2.4	V	10.2	-42.30	-13	29.30

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 5								
Test frequency range: 30MHz-10GHz								
QPSK, 1.4MHz, Low channel								
325.76	-62.56	174	1.4	H	-0.2	-62.76	-13	49.76
325.76	-70.31	24	1.5	V	3.1	-67.21	-13	54.21
1649.4	-60.50	130	1.5	H	3.5	-57.00	-13	44.00
1649.4	-59.10	272	2.1	V	3.1	-56.00	-13	43.00
2474.1	-46.80	219	1.5	H	6.6	-40.20	-13	27.20
2474.1	-41.70	139	2.0	V	5.8	-35.90	-13	22.90
3298.8	-51.10	255	2.4	H	6.4	-44.70	-13	31.70
3298.8	-51.70	211	1.6	V	5.7	-46.00	-13	33.00
QPSK, 1.4MHz, Middle channel								
325.76	-61.74	330	1.3	H	-0.2	-61.94	-13	48.94
325.76	-69.73	328	2.4	V	3.1	-66.63	-13	53.63
1673.0	-53.80	48	2.1	H	3.8	-50.00	-13	37.00
1673.0	-55.80	312	1.0	V	3.1	-52.70	-13	39.70
2509.5	-54.10	160	1.6	H	6.2	-47.90	-13	34.90
2509.5	-48.40	146	2.4	V	5.5	-42.90	-13	29.90
3346.0	-52.10	69	2.5	H	6.6	-45.50	-13	32.50
3346.0	-50.30	185	1.6	V	5.4	-44.90	-13	31.90
QPSK, 1.4MHz, High channel								
325.76	-63.46	208	1.9	H	-0.2	-63.66	-13	50.66
325.76	-70.76	292	1.7	V	3.1	-67.66	-13	54.66
1696.6	-59.00	73	1.9	H	4.1	-54.90	-13	41.90
1696.6	-56.50	174	2.2	V	3.1	-53.40	-13	40.40
2544.9	-49.80	138	1.6	H	6.1	-43.70	-13	30.70
2544.9	-45.90	335	1.1	V	5.8	-40.10	-13	27.10
3393.2	-51.40	256	2.1	H	6.2	-45.20	-13	32.20
3393.2	-49.90	75	2.3	V	5.4	-44.50	-13	31.50

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 12								
Test frequency range: 30MHz-10GHz								
QPSK, 1.4MHz, Low channel								
325.76	-62.62	189	2.2	H	-0.2	-62.82	-13	49.82
325.76	-68.38	258	1.3	V	3.1	-65.28	-13	52.28
1399.40	-56.20	203	2.1	H	5.9	-50.30	-13	37.30
1399.40	-59.40	86	1.9	V	5.9	-53.50	-13	40.50
2099.10	-53.00	330	1.3	H	6.3	-46.70	-13	33.70
2099.10	-51.40	12	2.3	V	5.1	-46.30	-13	33.30
QPSK, 1.4MHz, Middle channel								
325.76	-60.96	360	2.5	H	-0.2	-61.16	-13	48.16
325.76	-70.85	111	1.1	V	3.1	-67.75	-13	54.75
1415.00	-60.50	267	1.7	H	5.7	-54.80	-13	41.80
1415.00	-61.30	218	1.1	V	5.4	-55.90	-13	42.90
2122.50	-54.00	151	1.3	H	6.7	-47.30	-13	34.30
2122.50	-52.10	134	2.4	V	5.8	-46.30	-13	33.30
QPSK, 1.4MHz, High channel								
325.76	-62.98	261	1.6	H	-0.2	-63.18	-13	50.18
325.76	-68.52	349	1.3	V	3.1	-65.42	-13	52.42
1430.60	-60.00	37	1.0	H	5.4	-54.60	-13	41.60
1430.60	-60.60	309	1.7	V	4.8	-55.80	-13	42.80
2145.90	-51.90	360	1.5	H	7	-44.90	-13	31.90
2145.90	-51.70	159	2.4	V	6.6	-45.10	-13	32.10

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 13								
Test frequency range: 30MHz-10GHz								
QPSK, 5MHz, Low channel								
325.76	-60.85	79	1.2	H	-0.2	-61.05	-13	48.05
325.76	-68.13	53	2.4	V	3.1	-65.03	-13	52.03
1559	-58.3	23	1.6	H	4.2	-54.1	-40	14.10
1559	-58.7	86	2.0	V	3.3	-55.4	-40	15.40
2338.50	-53.40	186	1.3	H	7.3	-46.10	-13	33.10
2338.50	-53.10	13	2.3	V	6.5	-46.60	-13	33.60
3118.00	-49.50	311	1.9	H	7.3	-42.20	-13	29.20
3118.00	-49.60	47	1.4	V	6.5	-43.10	-13	30.10
QPSK, 5MHz, Middle channel								
325.76	-62.19	239	2.0	H	-0.2	-62.39	-13	49.39
325.76	-68.61	2	1.9	V	3.1	-65.51	-13	52.51
1564.00	-59.70	284	1.7	H	4.2	-55.50	-40	15.50
1564.00	-59.30	141	1.7	V	3.3	-56.00	-40	16.00
2346.00	-54.70	28	1.9	H	7.3	-47.40	-13	34.40
2346.00	-55.00	307	2.3	V	6.4	-48.60	-13	35.60
3128.00	-53.10	269	2.0	H	7.3	-45.80	-13	32.80
3128.00	-52.90	208	2.4	V	6.6	-46.30	-13	33.30
QPSK, 5MHz, High channel								
325.76	-61.32	120	1.8	H	-0.2	-61.52	-13	48.52
325.76	-69.03	166	2.3	V	3.1	-65.93	-13	52.93
1569.00	-59.90	252	2.0	H	4.2	-55.70	-40	15.70
1569.00	-59.60	225	1.7	V	3.3	-56.30	-40	16.30
2353.50	-53.30	144	1.5	H	7.3	-46.00	-13	33.00
2353.50	-52.60	257	2.0	V	6.4	-46.20	-13	33.20
3138.00	-51.50	0	2.2	H	7.4	-44.10	-13	31.10
3138.00	-52.20	342	1.4	V	6.6	-45.60	-13	32.60

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 41								
Test frequency range: 30MHz-26.5GHz								
QPSK, 5MHz, Low channel								
325.76	-63.43	189	2.0	H	-0.2	-63.63	-25	38.63
325.76	-71.00	297	1.9	V	3.1	-67.90	-25	42.90
5115.0	-44.30	27	1.8	H	11.3	-33.00	-25	8.00
5115.0	-50.70	357	2.3	V	10.8	-39.90	-25	14.90
7672.5	-58.20	328	1.7	H	21.2	-37.00	-25	12.00
7672.5	-59.70	101	2.5	V	20.9	-38.80	-25	13.80
QPSK, 5MHz, Middle channel								
325.76	-61.25	246	1.9	H	-0.2	-61.45	-25	36.45
325.76	-69.72	340	2.3	V	3.1	-66.62	-25	41.62
5210.0	-41.10	277	2.5	H	10.1	-31.00	-25	6.00
5210.0	-47.00	48	1.2	V	9.6	-37.40	-25	12.40
7815.0	-52.70	293	1.1	H	18.0	-34.70	-25	9.70
7815.0	-52.90	63	1.2	V	17.6	-35.30	-25	10.30
QPSK, 5MHz, High channel								
325.76	-60.85	115	1.9	H	-0.2	-61.05	-25	36.05
325.76	-69.52	221	1.8	V	3.1	-66.42	-25	41.42
5305.0	-44.30	288	2.0	H	9.6	-34.70	-25	9.70
5305.0	-43.40	328	1.6	V	8.8	-34.60	-25	9.60
7957.5	-49.70	137	2.0	H	18.9	-30.80	-25	5.80
7957.5	-50.30	318	2.1	V	18.5	-31.80	-25	6.80

Note:
Absolute Level = Reading Level + Substituted Factor
Substituted Factor contains: SG Level - Cable loss+ Antenna Gain
Margin = Absolute Level - Limit

FCC§ 22.917 (a);§ 24.238 (a); §27.53 (c)(h)(m) - BAND EDGES

Applicable Standard

According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

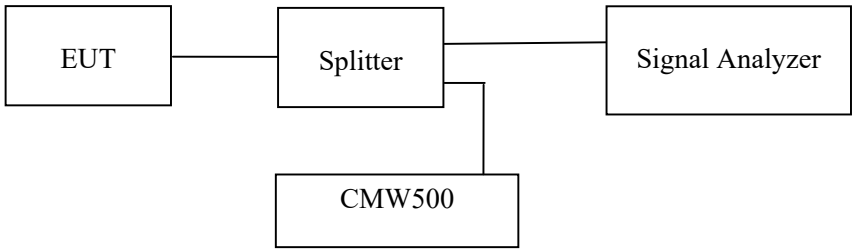
According to FCC §27.53 (c), For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;
(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

According to FCC §27.53 (h)(m), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



Test Data

Environmental Conditions

Temperature:	22~26 ℃
Relative Humidity:	48~56 %
ATM Pressure:	100.2~101.0 kPa

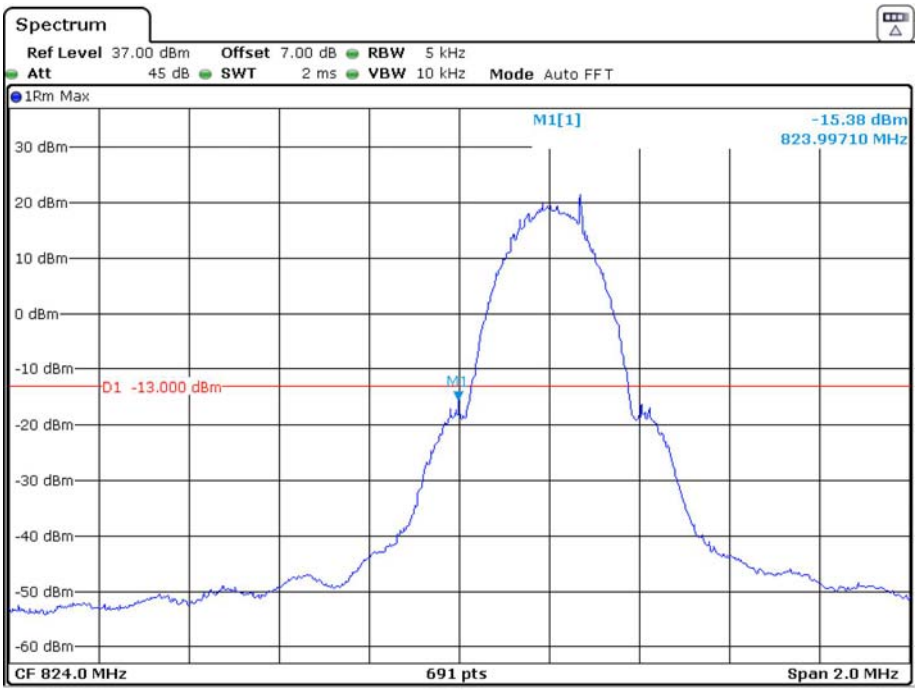
The testing was performed by Black Ding from 2022-04-11 to 2022-04-22.

EUT operation mode: Transmitting (Worst case)

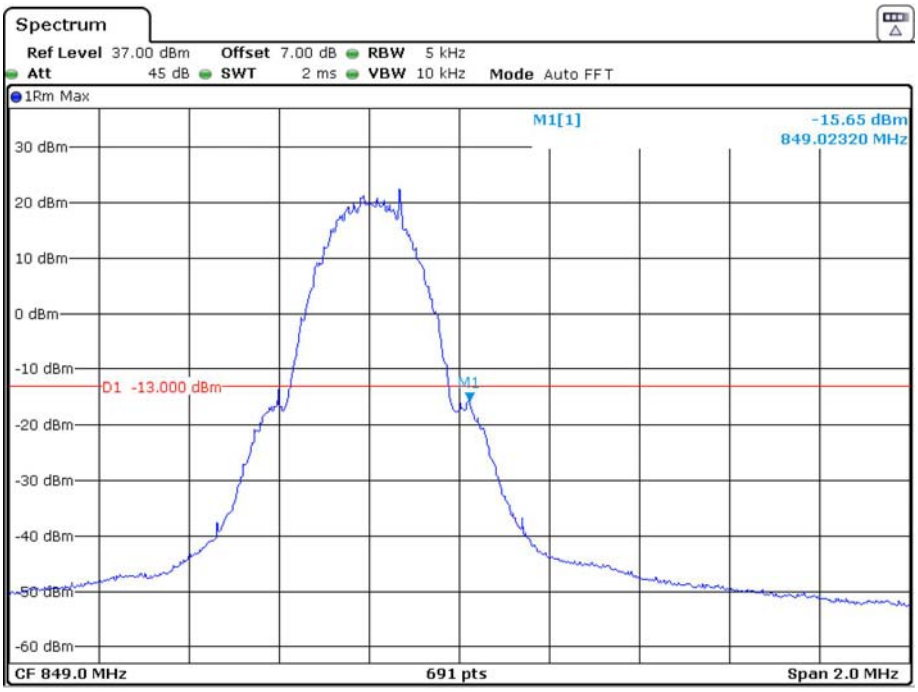
Test Result: Pass

Please refer to the following plots.

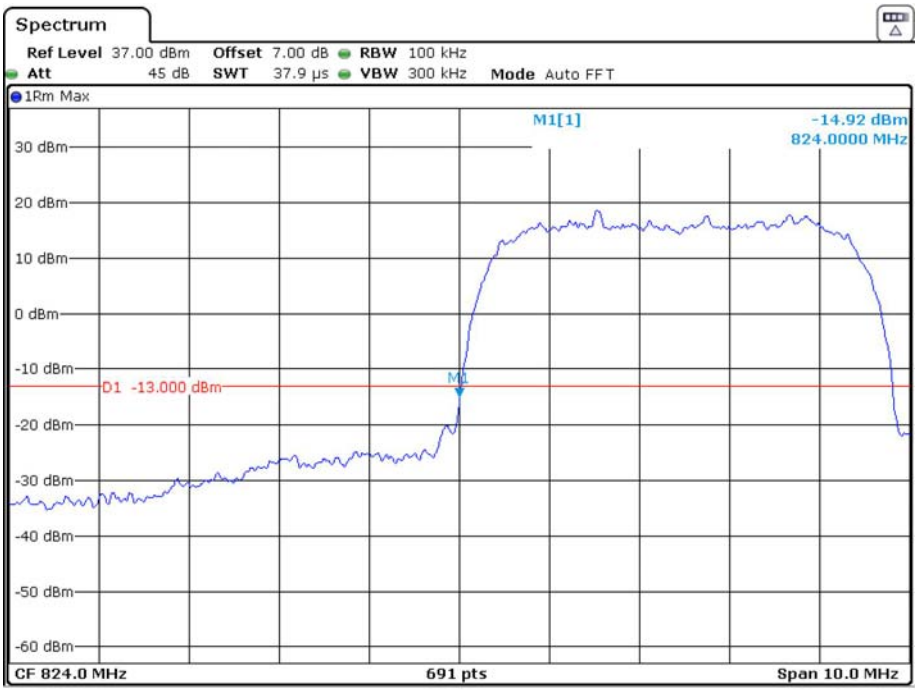
Cellular Band, Left Band Edge for GSM (GMSK) Mode



Cellular Band, Right Band Edge for GSM (GMSK) Mode



Cellular Band, Left Band Edge for RMC (BPSK) Mode



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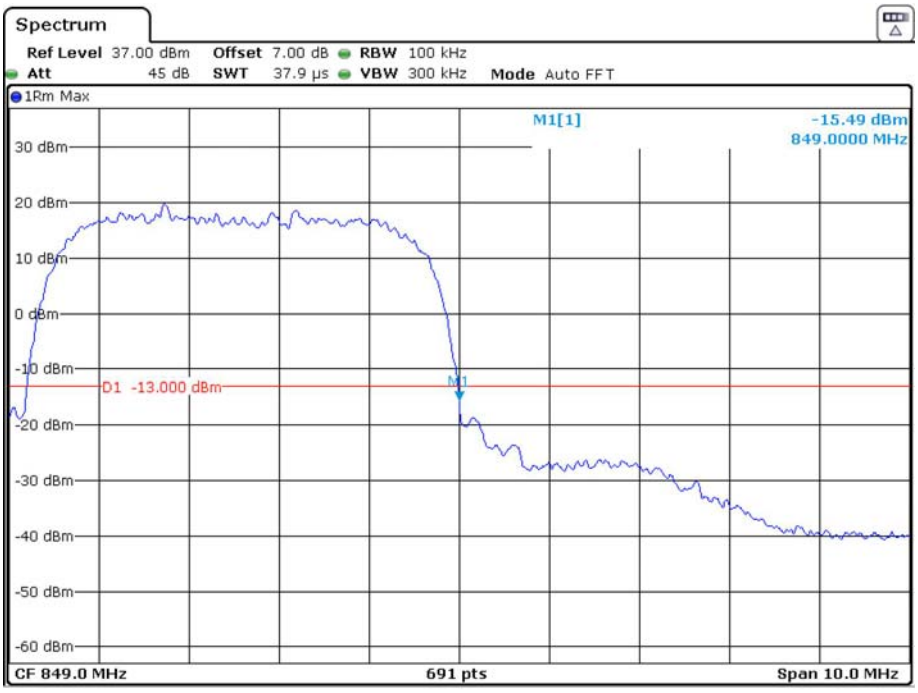
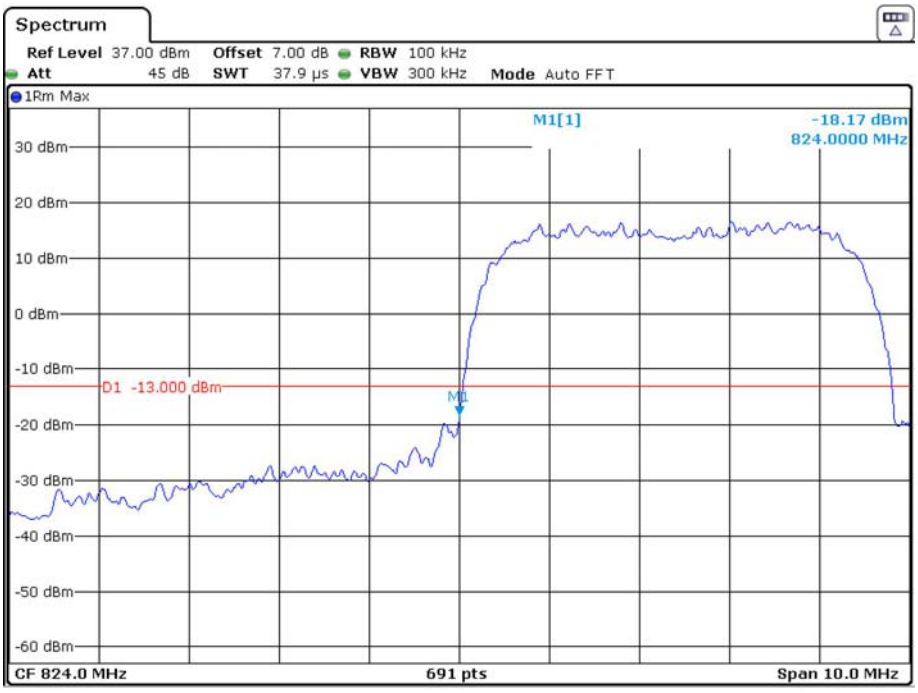
Cellular Band, Right Band Edge for RMC (BPSK) Mode



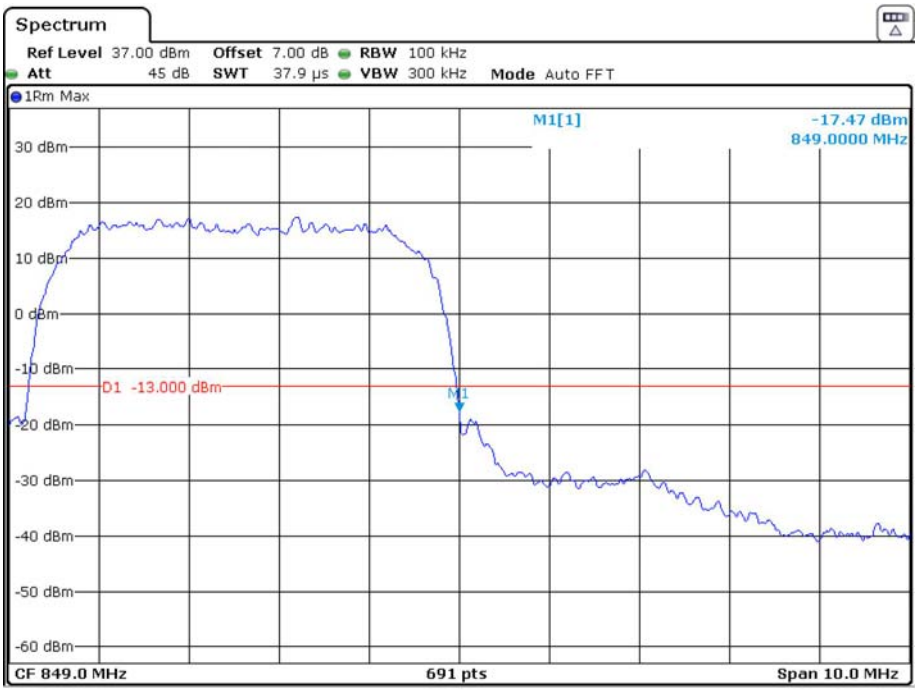
Date: 11.APR.2022 10:18:12

Cellular Band, Left Band Edge for HSDPA(16QAM) Mode



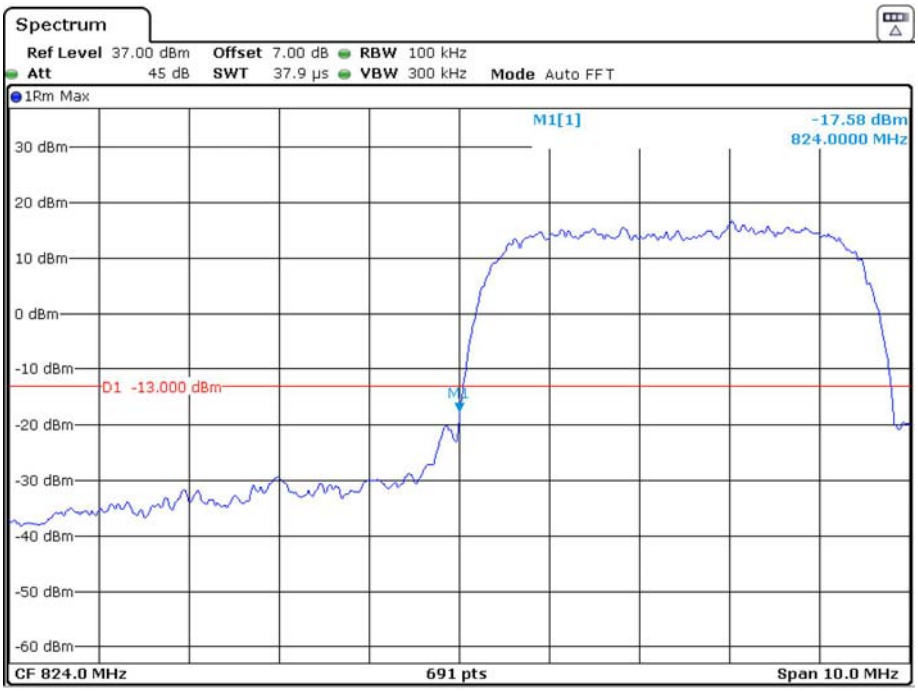
Date: 11.APR.2022 10:29:59

Cellular Band, Right Band Edge for HSDPA (16QAM) Mode



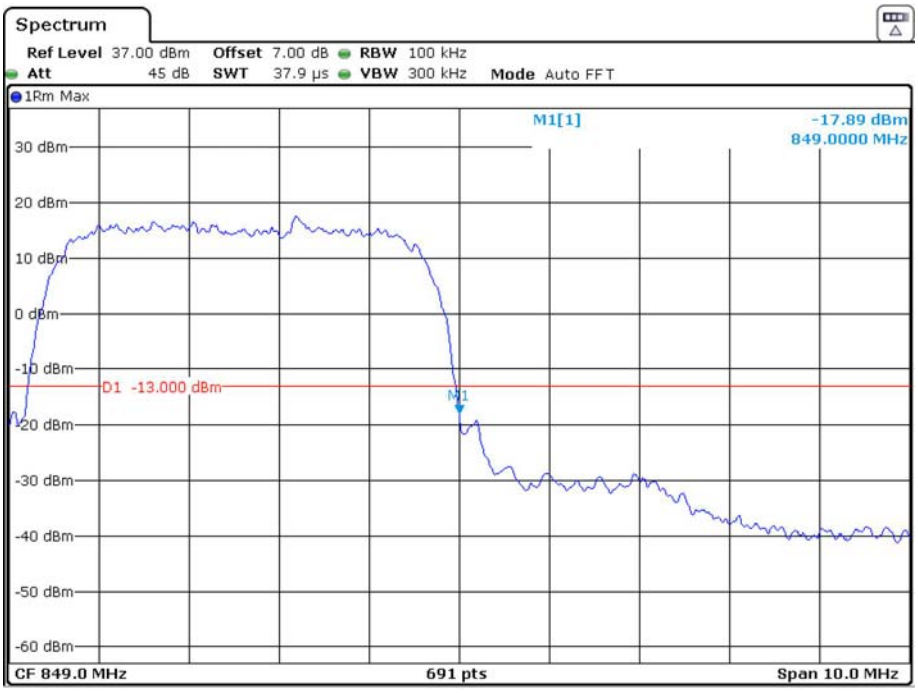
Date: 11.APR.2022 10:29:43

Cellular Band, Left Band Edge for HSUPA (QPSK) Mode



Date: 11.APR.2022 10:34:08

Cellular Band, Right Band Edge for HSUPA (QPSK) Mode



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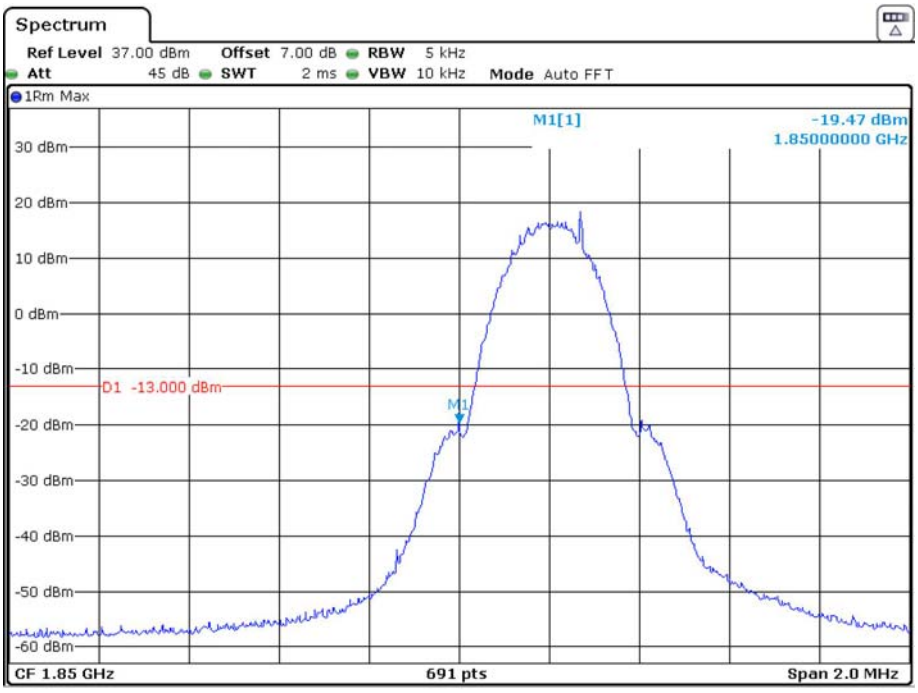
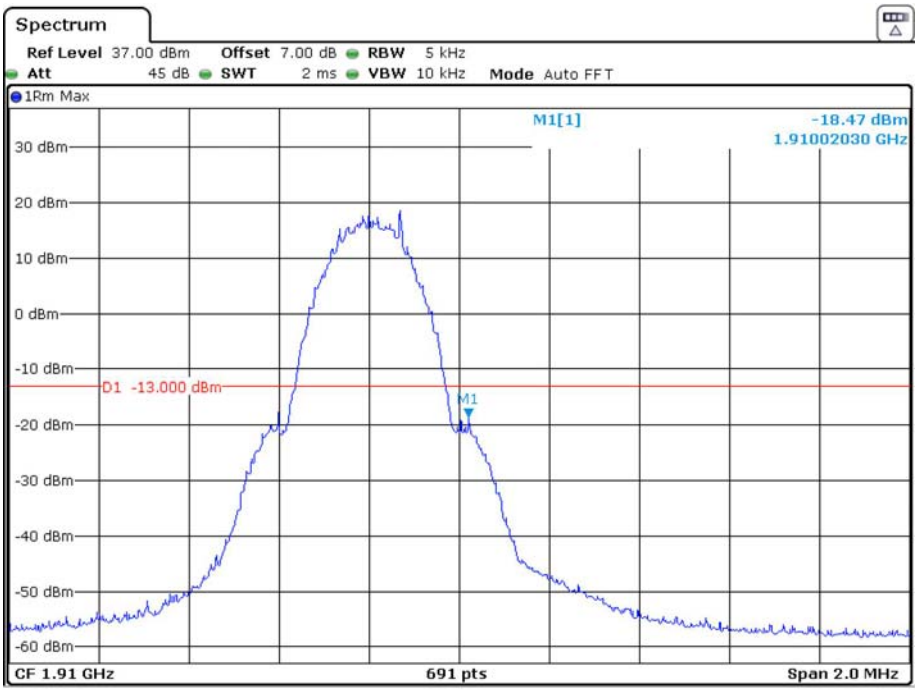
PCS Band, Left Band Edge for GSM (GMSK) Mode



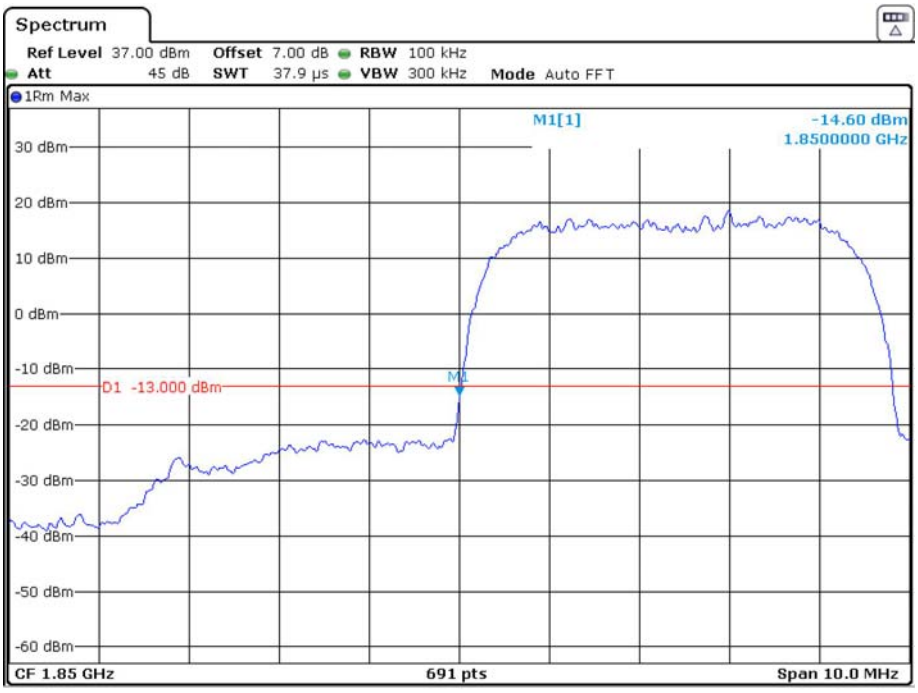
Date: 11.APR.2022 10:08:13

PCS Band, Right Band Edge for GSM (GMSK) Mode



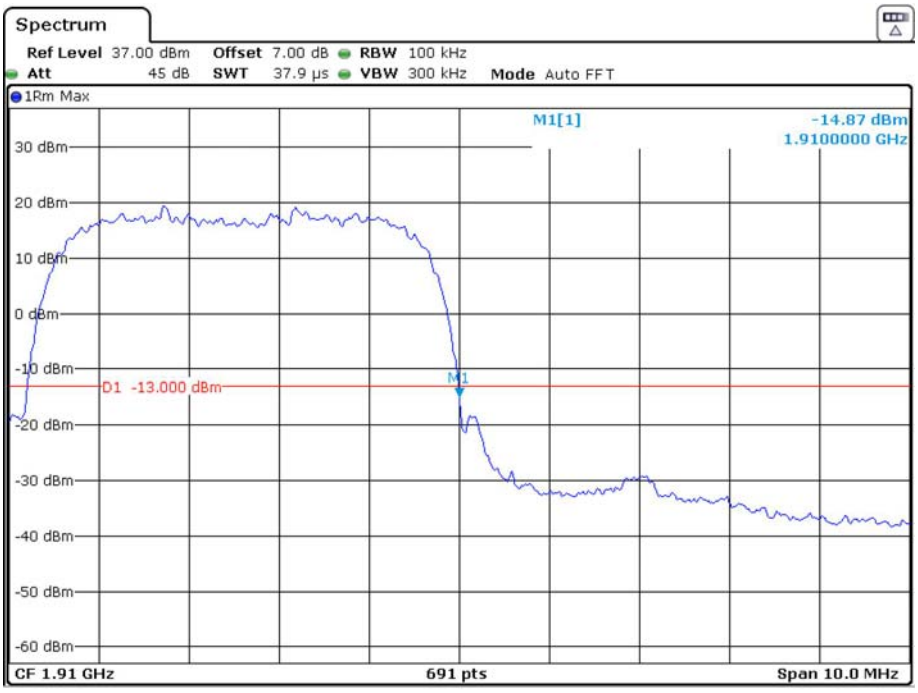
Date: 11.APR.2022 10:08:37

PCS Band, Left Band Edge for RMC (BPSK) Mode



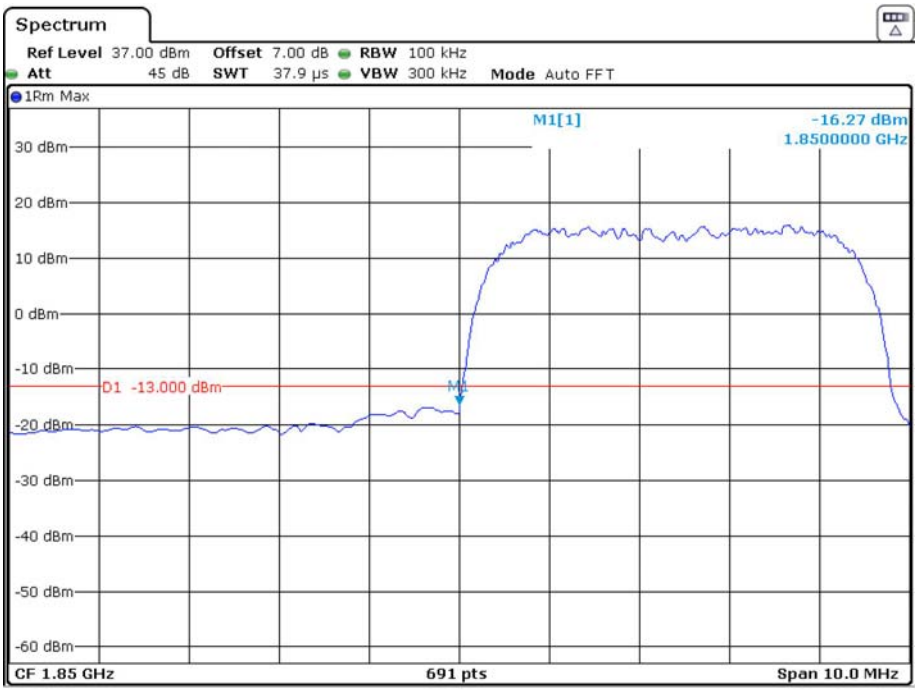
Date: 11.APR.2022 10:50:04

PCS Band, Right Band Edge for RMC (BPSK) Mode



Date: 11.APR.2022 10:49:48

PCS Band, Left Band Edge for HSDPA(16QAM) Mode



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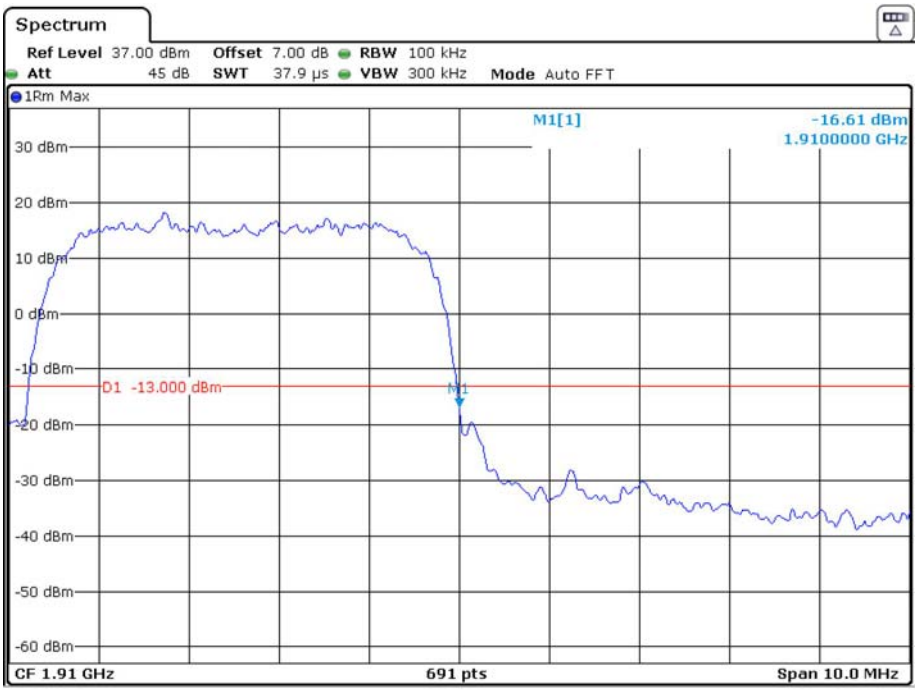
PCS Band, Right Band Edge for HSDPA (16QAM) Mode



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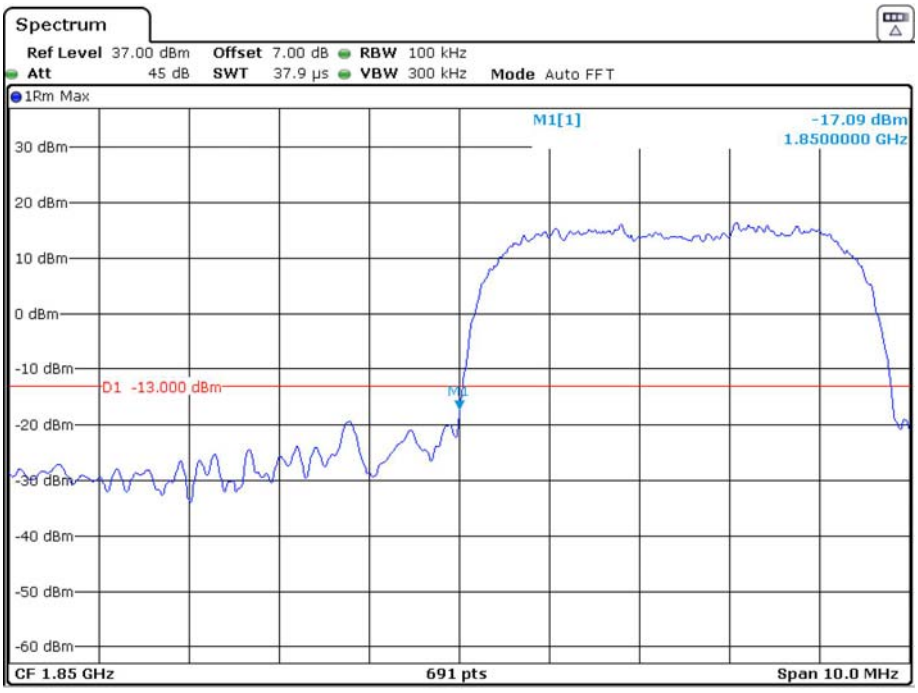
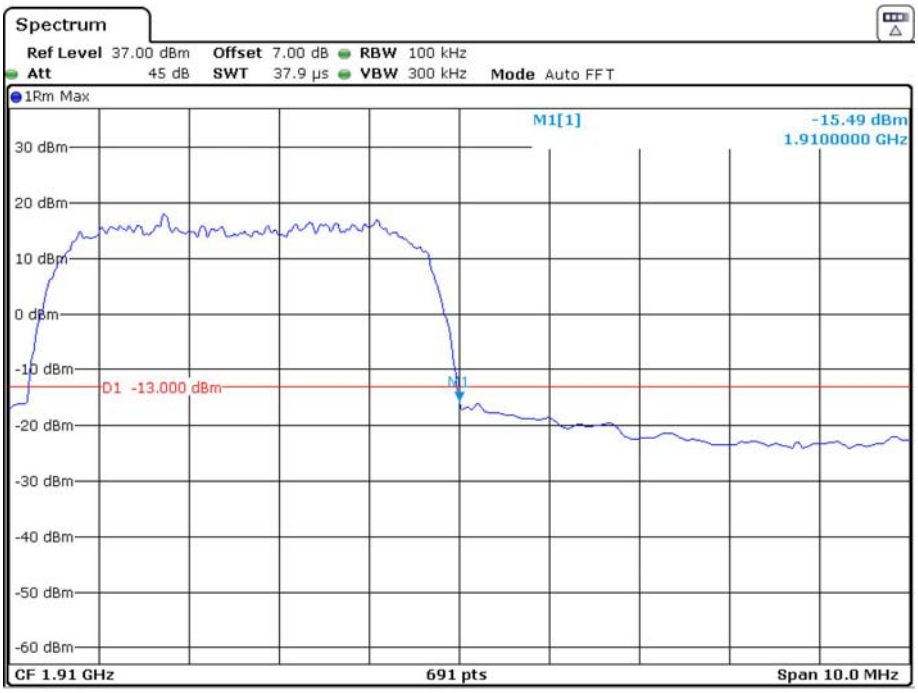
PCS Band, Left Band Edge for HSUPA (QPSK) Mode



PCS Band, Right Band Edge for HSUPA (QPSK) Mode



The test plots of LTE bands please refer to the Appendix C.

FCC § 2.1055; § 22.355; § 24.235; §27.54 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055, §22.355, §24.235&§27.54.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile > 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

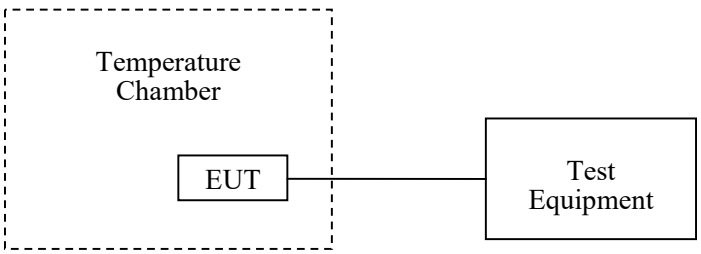
According to §24.235&§27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Data

Environmental Conditions

Temperature:	22~26 ℃
Relative Humidity:	48~56 %
ATM Pressure:	100.2~101.0 kPa

The testing was performed by Black Ding from 2022-04-09 to 2022-04-22.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables.

Cellular Band

GSM Mode

Middle Channel, f_o =836.6MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	N.V.	3	0.0036	2.5
-20		5	0.0060	2.5
-10		2	0.0024	2.5
0		6	0.0072	2.5
10		7	0.0084	2.5
20		4	0.0048	2.5
30		8	0.0096	2.5
40		10	0.0120	2.5
50		4	0.0048	2.5
20	L.V.	6	0.0072	2.5
	H.V.	5	0.0060	2.5

WCDMA Mode

Middle Channel, f_o =836.6MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	N.V.	1.52	0.0018	2.5
-20		2.34	0.0028	2.5
-10		1.63	0.0019	2.5
0		2.22	0.0027	2.5
10		1.46	0.0017	2.5
20		1.49	0.0018	2.5
30		1.52	0.0018	2.5
40		1.37	0.0016	2.5
50		1.42	0.0017	2.5
20	L.V.	1.28	0.0015	2.5
	H.V.	2.11	0.0025	2.5

PCS Band

GSM Mode

Middle Channel, f_o =1880.0 MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	N.V.	4	0.0021	pass
-20		-3	-0.0016	pass
-10		2	0.0011	pass
0		7	0.0037	pass
10		3	0.0016	pass
20		-1	-0.0005	pass
30		2	0.0011	pass
40		5	0.0027	pass
50		4	0.0021	pass
20	L.V.	6	0.0032	pass
	H.V.	2	0.0011	pass

WCDMA Mode

Middle Channel, f_o =1880.0 MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	N.V.	1.39	0.0007	pass
-20		1.36	0.0007	pass
-10		1.42	0.0008	pass
0		1.41	0.0008	pass
10		1.55	0.0008	pass
20		1.32	0.0007	pass
30		2.54	0.0014	pass
40		2.37	0.0013	pass
50		1.46	0.0008	pass
20	L.V.	1.38	0.0007	pass
	H.V.	1.42	0.0008	pass

LTE:
QPSK:
Band 2:

10.0 MHz Middle Channel, f_o =1880MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	N.V.	0.07	0.00004	pass
-20		-9.97	-0.0053	pass
-10		-6.13	-0.0033	pass
0		6.17	0.0033	pass
10		7.92	0.0042	pass
20		6.46	0.0034	pass
30		-6.52	-0.0035	pass
40		7.18	0.0038	pass
50		-9.69	-0.0052	pass
20	L.V.	-8.17	-0.0043	pass
	H.V.	-7.05	-0.0038	pass

Band 5:

10.0 MHz Middle Channel, f_o =836.5MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	N.V.	-4.16	-0.0050	2.5
-20		9.11	0.0109	2.5
-10		8.51	0.0102	2.5
0		-7.15	-0.0085	2.5
10		-5.29	-0.0063	2.5
20		7.24	0.0087	2.5
30		-5.81	-0.0069	2.5
40		5.59	0.0067	2.5
50		6.87	0.0082	2.5
20	L.V.	9.94	0.0119	2.5
	H.V.	9.99	0.0119	2.5

Band 12:

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	N.V.	699.0388	715.9637	699	716
-20		699.0374	715.9624	699	716
-10		699.0355	715.9675	699	716
0		699.0342	715.9644	699	716
10		699.0338	715.9682	699	716
20		699.0351	715.9666	699	716
30		699.0344	715.9654	699	716
40		699.0326	715.9642	699	716
50		699.0362	715.9657	699	716
20	L.V.	699.0318	715.9644	699	716
	H.V.	699.0326	715.9635	699	716

Band 13:

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	N.V.	777.1275	786.8458	777	787
-20		777.1268	786.8437	777	787
-10		777.1257	786.8446	777	787
0		777.1245	786.8447	777	787
10		777.1235	786.8426	777	787
20		777.1264	786.8433	777	787
30		777.1228	786.8452	777	787
40		777.1275	786.8494	777	787
50		777.1262	786.8453	777	787
20	L.V.	777.1246	786.8451	777	787
	H.V.	777.1233	786.8432	777	787

Band 41

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	NV	2555.0577	2654.9447	2555	2655
-20		2555.0545	2654.9454	2555	2655
-10		2555.0523	2654.9433	2555	2655
0		2555.0537	2654.9410	2555	2655
10		2555.0542	2654.9453	2555	2655
20		2555.0533	2654.9441	2555	2655
30		2555.0538	2654.9453	2555	2655
40		2555.0546	2654.9435	2555	2655
50		2555.0527	2654.9357	2555	2655
20	LV	2555.0458	2654.9422	2555	2655
	HV	2555.0526	2654.9436	2555	2655

Note: the applicant declared the operating frequency range is 2555-2655MHz for LTE Band 41.

16QAM:

Band 2:

10.0 MHz Middle Channel, f_o=1880MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	NV	-6.74	-0.0036	pass
-20		-6.68	-0.0036	pass
-10		9.77	0.0052	pass
0		-7.62	-0.0041	pass
10		-9.91	-0.0053	pass
20		-9.82	-0.0052	pass
30		-6.68	-0.0036	pass
40		-8.85	-0.0047	pass
50		5.67	0.0030	pass
20	LV	6.05	0.0032	pass
	HV	7.52	0.0040	pass

Band 5:

10.0 MHz Middle Channel, f_o=836.5MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	N.V.	-4.25	-0.0051	2.5
-20		6.80	0.0081	2.5
-10		-9.52	-0.0114	2.5
0		-8.15	-0.0097	2.5
10		-8.88	-0.0106	2.5
20		-9.82	-0.0117	2.5
30		8.38	0.0100	2.5
40		6.75	0.0081	2.5
50		-5.89	-0.0070	2.5
20	L.V.	8.98	0.0107	2.5
	H.V.	-7.83	-0.0094	2.5

Band 12:

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	NV	699.0374	715.9672	699	716
-20		699.0362	715.9681	699	716
-10		699.0358	715.9644	699	716
0		699.0327	715.9676	699	716
10		699.0343	715.9654	699	716
20		699.0437	715.9625	699	716
30		699.0344	715.9622	699	716
40		699.0345	715.9648	699	716
50		699.0335	715.9637	699	716
20	LV	699.0341	715.9642	699	716
	HV	699.0334	715.9673	699	716

Band 13:

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	N.V.	777.0352	786.9254	777	787
-20		777.0347	786.9241	777	787
-10		777.0326	786.9237	777	787
0		777.0355	786.9242	777	787
10		777.0337	786.9267	777	787
20		777.0333	786.9241	777	787
30		777.0331	786.9252	777	787
40		777.0324	786.9247	777	787
50		777.0242	786.9252	777	787
20	L.V.	777.0342	786.9271	777	787
	H.V.	777.0351	786.9243	777	787

Band 41

10 MHz Bandwidth					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	NV	2555.0564	2654.8555	2555	2655
-20		2555.0495	2654.8541	2555	2655
-10		2555.0445	2654.8564	2555	2655
0		2555.0428	2654.8538	2555	2655
10		2555.0437	2654.8559	2555	2655
20		2555.0422	2654.8541	2555	2655
30		2555.0428	2654.8553	2555	2655
40		2555.0441	2654.8532	2555	2655
50		2555.0451	2654.8550	2555	2655
20	LV	2555.0423	2654.8543	2555	2655
	HV	2555.0432	2654.8526	2555	2655

Note: the applicant declared the operating frequency range is 2555-2655MHz for LTE Band 41.

******* END OF REPORT *******