



FCC RADIO TEST REPORT

FCC ID : 2AY4J-TK23
Equipment : Tack GPS Location Tracker
Brand Name : Tack
Model Name : TK23
Marketing Name : Tackgps Plus
Applicant : Tack One Private Limited
22 SIN MING LANE #06-76, SINGAPORE 573969
Manufacturer : Tack One Private Limited
22 SIN MING LANE #06-76, SINGAPORE 573969
Standard : FCC 47 CFR Part 2, 22(H), 24(E), 27

The product was received on May 05, 2023 and testing was performed from May 18, 2023 to Jul. 24, 2023. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
FG342615A	01	Initial issue of report	Jul. 31, 2023
FG342615A	02	Revise section 3.7.1 This report is an updated version, replacing the report issued on Jul. 31, 2023.	Sep. 07, 2023



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Reporting only	-
	§22.913 (a)(5)	Effective Radiated Power (Band 5) (Band 26)	Pass	
	§27.50 (b)(10) §27.50 (c)(10)	Effective Radiated Power (Band 12) (Band 13)		
	§24.232 (c)	Equivalent Isotropic Radiated Power (Band 2) (Band 25)		
	§27.50 (d)(4)	Equivalent Isotropic Radiated Power (Band 4) (Band 66)		
3.3	§24.232 (d) §27.50 (d)(5)	Peak-to-Average Ratio	Pass	-
3.4	§2.1049	Occupied Bandwidth	Reporting only	-
3.5	§2.1051 §22.917 (a) §24.238 (a) §27.53 (c)(2)(4) §27.53 (g) §27.53 (h)	Conducted Band Edge Measurement (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 25) (Band 26) (Band 66)	Pass	-
3.6	§2.1051 §22.917 (a) §24.238 (a) §27.53 (c)(2) §27.53 (g) §27.53 (h)	Conducted Spurious Emission (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 25) (Band 26) (Band 66)	Pass	-
3.7	§2.1055 §22.355 §24.235 §27.54	Frequency Stability Temperature & Voltage	Pass	-



Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
4.2	§2.1053 §22.917 (a) §24.238 (a) §27.53 (c)(2) §27.53 (f) §27.53 (g) §27.53 (h)	Radiated Spurious Emission (Band 2) (Band 4) (Band 5) (Band 12) (Band 13) (Band 25) (Band 26) (Band 66)	Pass	9.44 dB under the limit at 1559.00 MHz

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Alan Liu**Report Producer: Clio Lo**



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs LTE, Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n, and GPS.	
Antenna Type WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth- LE: PIFA Antenna GPS: PIFA Antenna	
Antenna Gain	Band 2: -3.83 dBi Band 4: -2.23 dBi Band 5: -3.66 dBi Band 12: -3.54 dBi Band 13: -2.64 dBi Band 25: -3.83 dBi Band 26: -3.66 dBi Band 66: -2.23 dBi

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.



1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. TH03-HY
Test Engineer	HaoEn Zhang
Temperature (°C)	21.2~22.6
Relative Humidity (%)	51.8~54.5

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH13-HY (TAF Code: 3786)
Test Engineer	Rain Lee, Jacky Hong and Mancy Chou
Temperature (°C)	20~26
Relative Humidity (%)	40~65
Remark	The Radiated Spurious Emission test item subcontracted to Sporton International Inc. Wensan Laboratory.

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW1190 and TW3786

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.26-2015
- ♦ ANSI / TIA-603-E
- ♦ FCC 47 CFR Part 2, 22(H), 24(E), 27
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. The TAF code is not including all the FCC KDB listed without accreditation.



2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168

D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and only the worst case emissions were reported in this report..

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max. Output Power	2	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	4	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	12	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	13	-	-	v	v	-	-	v	v	v	v	v	v	v	v
	25	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	26	v	v	v	v	v	-	v	v	v	v	v	v	v	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Peak-to-Average Ratio	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12				v	-	-	v	v			v		v	
	13	-	-		v	-	-	v	v			v		v	
	25						v	v	v			v		v	
	26					v	-	v	v			v		v	
	66						v	v	v			v		v	
26dB and 99% Bandwidth	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12	v	v	v	v	-	-	v	v			v		v	
	13	-	-	v	v	-	-	v	v			v		v	
	25	v	v	v	v	v	v	v	v			v		v	
	26	v	v	v	v	v	-	v	v			v		v	
	66	v	v	v	v	v	v	v	v			v		v	

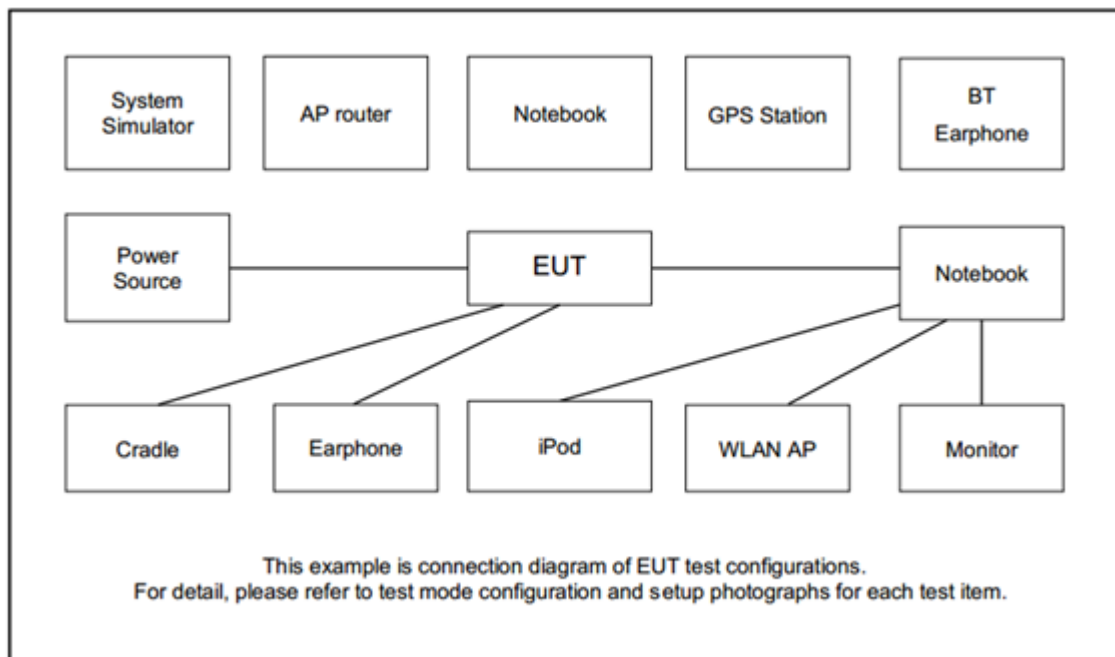


Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Conducted Band Edge	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12	v	v	v	v	-	-	v	v	v			v		v
	13	-	-	v	v	-	-	v	v	v			v		v
	25	v	v	v	v	v	v	v	v	v			v		v
	26	v	v	v	v	v	-	v	v	v			v		v
	66	v	v	v	v	v	v	v	v	v			v		v
Conducted Spurious Emission	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12	v	v	v	v	-	-	v		v			v	v	v
	13	-	-	v	v	-	-	v		v			v	v	v
	25	v	v	v	v	v	v	v		v			v	v	v
	26	v	v	v	v	v	-	v		v			v	v	v
	66	v	v	v	v	v	v	v		v			v	v	v
Frequency Stability	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12				v	-	-	v				v		v	
	13	-	-		v	-	-	v				v		v	
	25				v			v				v		v	
	26				v		-	v				v		v	
	66				v			v				v		v	



Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
E.R.P / E.I.R.P	2	v	v	v	v	v	v	v	v	Max. Power					
	4	v	v	v	v	v	v	v	v						
	5	v	v	v	v	-	-	v	v						
	12	v	v	v	v	-	-	v	v						
	13	-	-	v	v	-	-	v	v						
	25	v	v	v	v	v	v	v	v						
	26	v	v	v	v	v	-	v	v						
	66	v	v	v	v	v	v	v	v						
Radiated Spurious Emission	2	Covered by Band 25													
	4	Covered by Band 66													
	5	Covered by Band 26													
	12	Worst Case											v	v	v
	13	Worst Case											v	v	v
	25	Worst Case											v	v	v
	26	Worst Case											v	v	v
	66	Worst Case											v	v	v
Remark	1. The mark “v “ means that this configuration is chosen for testing 2. The mark “-“ means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. All the radiated test cases were performed with Battery (ZCF). 5. Wider operating range bandwidth covers narrower one when the power is higher or the same. 6. One representative bandwidth is selected to perform PAR and frequency stability.														

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8821C	FCC DoC	N/A	Shielded, 1.8 m
2.	Notebook	Acer	N18Q13	PD9AX201NG	N/A	AC I/P : Unshielded, 1.2 m DC O/P : Shielded, 1.8 m

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\
 &= 4.2 + 10 = 14.2 \text{ (dB)}
 \end{aligned}$$



2.5 Frequency List of Low/Middle/High Channels

LTE Band 2 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	18700	18900	19100
	Frequency	1860	1880	1900
15	Channel	18675	18900	19125
	Frequency	1857.5	1880	1902.5
10	Channel	18650	18900	19150
	Frequency	1855	1880	1905
5	Channel	18625	18900	19175
	Frequency	1852.5	1880	1907.5
3	Channel	18615	18900	19185
	Frequency	1851.5	1880	1908.5
1.4	Channel	18607	18900	19193
	Frequency	1850.7	1880	1909.3

LTE Band 4 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	20050	20175	20300
	Frequency	1720	1732.5	1745
15	Channel	20025	20175	20325
	Frequency	1717.5	1732.5	1747.5
10	Channel	20000	20175	20350
	Frequency	1715	1732.5	1750
5	Channel	19975	20175	20375
	Frequency	1712.5	1732.5	1752.5
3	Channel	19965	20175	20385
	Frequency	1711.5	1732.5	1753.5
1.4	Channel	19957	20175	20393
	Frequency	1710.7	1732.5	1754.3



LTE Band 5 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	20450	20525	20600
	Frequency	829	836.5	844
5	Channel	20425	20525	20625
	Frequency	826.5	836.5	846.5
3	Channel	20415	20525	20635
	Frequency	825.5	836.5	847.5
1.4	Channel	20407	20525	20643
	Frequency	824.7	836.5	848.3

LTE Band 12 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	23060	23095	23130
	Frequency	704	707.5	711
5	Channel	23035	23095	23155
	Frequency	701.5	707.5	713.5
3	Channel	23025	23095	23165
	Frequency	700.5	707.5	714.5
1.4	Channel	23017	23095	23173
	Frequency	699.7	707.5	715.3

LTE Band 13 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	23230	-
	Frequency	-	782	-
5	Channel	23205	23230	23255
	Frequency	779.5	782	784.5



LTE Band 25 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	26140	26340	26590
	Frequency	1860	1880	1905
15	Channel	26115	26340	26615
	Frequency	1857.5	1880	1907.5
10	Channel	26090	26340	26640
	Frequency	1855	1880	1910
5	Channel	26065	26340	26665
	Frequency	1852.5	1880	1912.5
3	Channel	26055	26340	26675
	Frequency	1851.5	1880	1913.5
1.4	Channel	26047	26340	26683
	Frequency	1850.7	1880	1914.3

LTE Band 26 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
15	Channel	26865	26915	26965
	Frequency	831.5	836.5	841.5
10	Channel	26840	26915	26990
	Frequency	829.0	836.5	844.0
5	Channel	26815	26915	27015
	Frequency	826.5	836.5	846.5
3	Channel	26805	26915	27025
	Frequency	825.5	836.5	847.5
1.4	Channel	26797	26915	27033
	Frequency	824.7	836.5	848.3



LTE Band 66 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	132072	132322	132572
	Frequency	1720	1745	1770
15	Channel	132047	132322	132597
	Frequency	1717.5	1745	1772.5
10	Channel	132022	132322	132622
	Frequency	1715	1745	1775
5	Channel	131997	132322	132647
	Frequency	1712.5	1745	1777.5
3	Channel	131987	132322	132657
	Frequency	1711.5	1745	1778.5
1.4	Channel	131979	132322	132665
	Frequency	1710.7	1745	1779.3

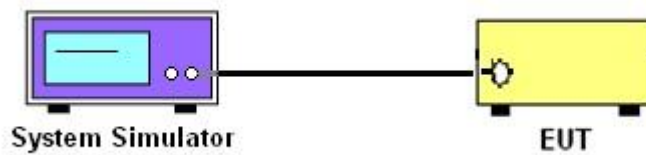
3 Conducted Test Items

3.1 Measuring Instruments

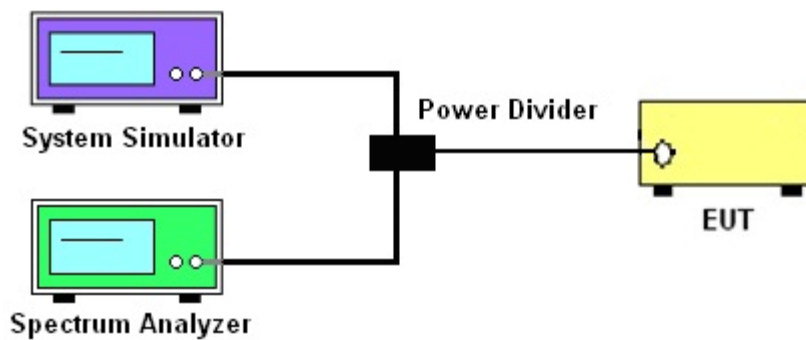
See list of measuring instruments of this test report.

3.1.1 Test Setup

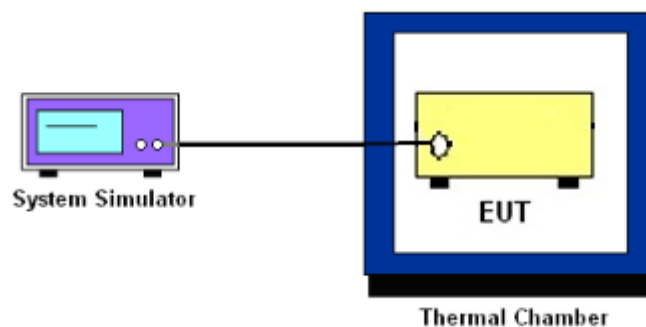
3.1.2 Conducted Output Power



3.1.3 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission



3.1.4 Frequency Stability



3.1.5 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power and ERP/EIRP

3.2.1 Description of the Conducted Output Power Measurement and ERP/EIRP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 7 Watts for LTE Band 5, Band 26 (Part 22H)

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 12, Band 13

The EIRP of mobile transmitters must not exceed 2 Watts for LTE Band 2, Band 25

The EIRP of mobile transmitters must not exceed 1 Watts for LTE Band 4, Band 66

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$, $ERP = EIRP - 2.15$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.2.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.



3.3 Peak-to-Average Ratio

3.3.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.3.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.2.6

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.



3.4 Occupied Bandwidth

3.4.1 Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.4.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.4.3 (26dB) and Section 5.4.4 (99OB)

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
3. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
4. Set the detection mode to peak, and the trace mode to max hold.
5. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
(this is the reference value)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.



3.5 Conducted Band Edge

3.5.1 Description of Conducted Band Edge Measurement

22.917(a)

For operations in the 824 – 849 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

24.238 (a)

For operations in the 1850-1910 and 1930-1990 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 1MHz bandwidth. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53 (c)

For operations in the 776-788 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 100 kHz bandwidth. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed. In addition, the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least $65 + 10 \log_{10} p(\text{watts})$, dB, for mobile and portable equipment.

27.53 (g)

For operations in the 600MHz band and 698-746 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 100 kHz bandwidth. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

27.53 (h)

For operations in the 1710 – 1755 MHz band, 1755-1780 MHz, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.



3.5.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The band edges of low and high channels for the highest RF powers were measured.
3. Set RBW $\geq$ 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Beyond the 1 MHz band from the band edge, RBW=1MHz was used.
5. Set spectrum analyzer with RMS detector.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. Checked that all the results comply with the emission limit line.

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)



3.6 Conducted Spurious Emission

3.6.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.6.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
3. The conducted spurious emission for the whole frequency range was taken.
4. Make the measurement with the spectrum analyzer's RBW = 100 kHz if the authorized frequency band/block is at or below 1 GHz and 1 MHz if the authorized frequency band/block is above 1 GHz, VBW = 3 * RBW.
5. Set spectrum analyzer with RMS detector.
6. Taking the record of maximum spurious emission.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)



3.7 Frequency Stability

3.7.1 Description of Frequency Stability Measurement

22.355

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

24.235 & 27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

3.7.2 Test Procedures for Temperature Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was set up in the thermal chamber and connected with the system simulator.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.7.3 Test Procedures for Voltage Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was placed in a temperature chamber at $20\pm 5^{\circ}\text{C}$ and connected with the system simulator.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

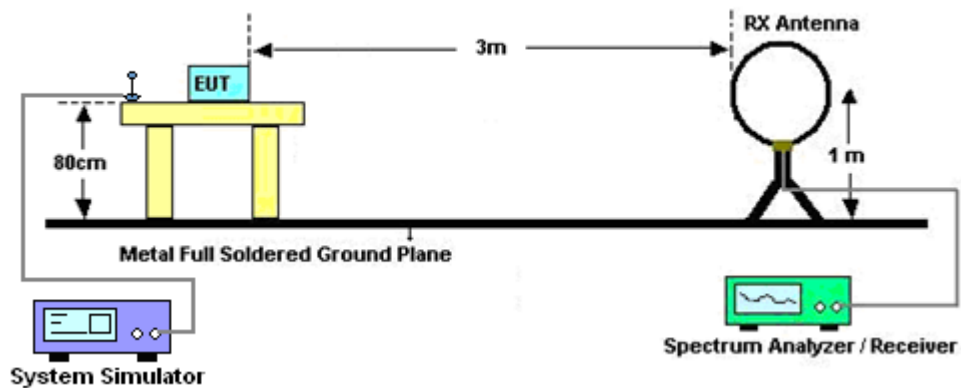
4 Radiated Test Items

4.1 Measuring Instruments

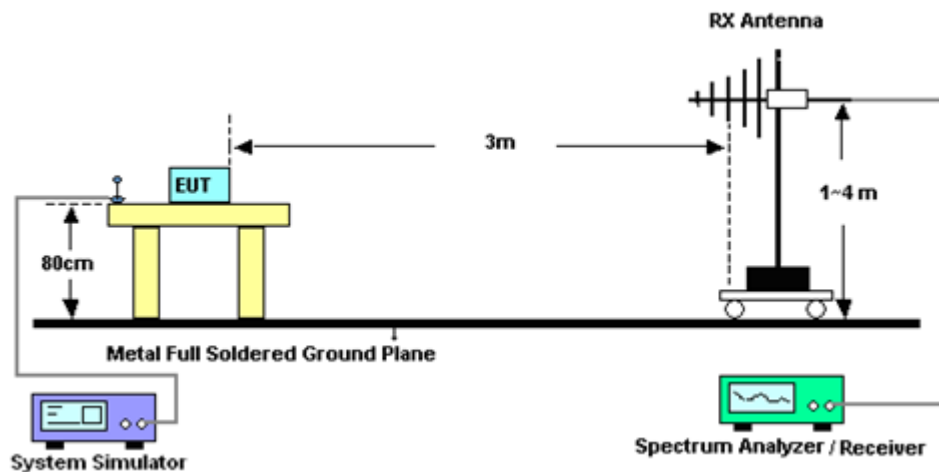
See list of measuring instruments of this test report.

4.1.1 Test Setup

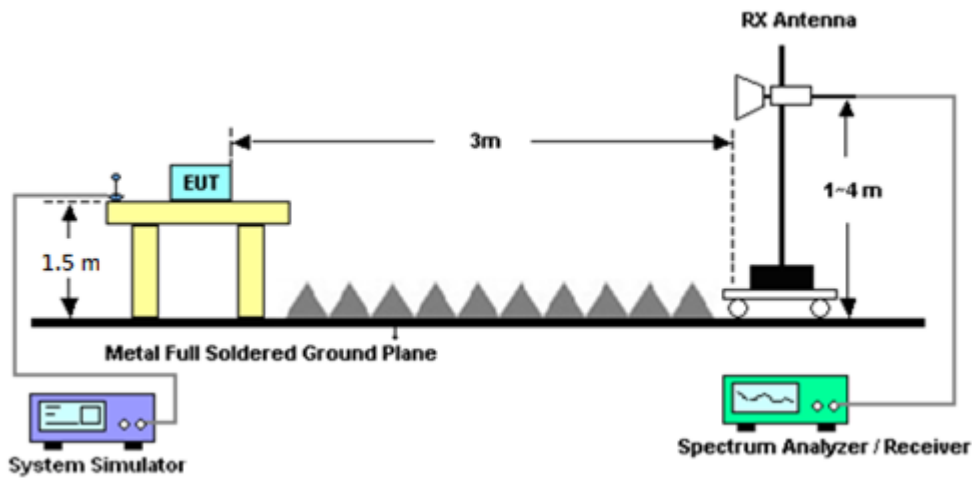
For radiated test below 30MHz



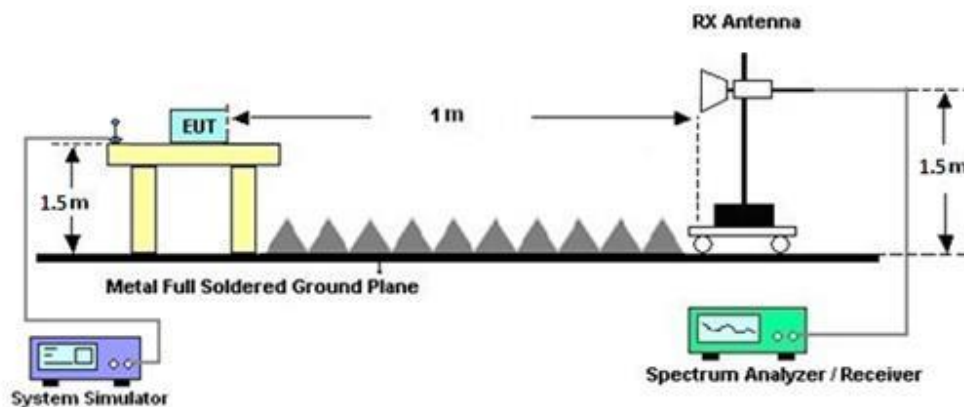
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.



4.2 Radiated Spurious Emission Measurement

4.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

For LTE Band 13

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)

$EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$

$ERP \text{ (dBm)} = EIRP - 2.15$



5 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 20, 2022	Jul. 20, 2023~ Jul. 24, 2023	Sep. 19, 2023	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 07, 2022	Jul. 20, 2023~ Jul. 24, 2023	Dec. 06, 2023	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	1223	18GHz~40GHz	Jul. 10, 2023	Jul. 20, 2023~ Jul. 24, 2023	Jul. 09, 2024	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Dec. 20, 2022	Jul. 20, 2023~ Jul. 24, 2023	Dec. 19, 2023	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz~40GHz	May 15, 2022	Jul. 20, 2023~ Jul. 24, 2023	May 14, 2024	Radiation (03CH13-HY)
Amplifier	SONOMA	310N	187282	9kHz~1GHz	Dec. 14, 2022	Jul. 20, 2023~ Jul. 24, 2023	Dec. 13, 2023	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	40103 & 07	30MHz~1GHz	Apr. 23, 2023	Jul. 20, 2023~ Jul. 24, 2023	Apr. 22, 2024	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	41912 & 05	30MHz~1GHz	Feb. 05, 2023	Jul. 20, 2023~ Jul. 24, 2023	Feb. 04, 2024	Radiation (03CH13-HY)
Hygrometer	TECPEL	DTM-303B	TP140325	N/A	Nov. 07, 2022	Jul. 20, 2023~ Jul. 24, 2023	Nov. 06, 2023	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-0010180 0-30-10P	1590074	1GHz~18GHz	May 16, 2023	Jul. 20, 2023~ Jul. 24, 2023	May 15, 2024	Radiation (03CH13-HY)
Preamplifier	EM Electronics	EM01G18G	060803	1GHz~18GHz	Jan. 10, 2023	Jul. 20, 2023~ Jul. 24, 2023	Jan. 09, 2024	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 23, 2023	Jul. 20, 2023~ Jul. 24, 2023	Mar. 22, 2024	Radiation (03CH13-HY)
Filter	Wainwright	WLK4-1000-1530 -8000-40SS	SN12	1.53GHz Low Pass Filter	Sep. 13, 2022	Jul. 20, 2023~ Jul. 24, 2023	Sep. 12, 2023	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-1080-12 00-15000-60SS	SN3	1.2GHz High Pass Filter	Jun. 29, 2023	Jul. 20, 2023~ Jul. 24, 2023	Jun. 28, 2024	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-2700-30 00-18000-60SS	SN2	3GHz High Pass Filter	Jul. 10, 2023	Jul. 20, 2023~ Jul. 24, 2023	Jul. 09, 2024	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30MHz~18GHz	Feb. 08, 2023	Jul. 20, 2023~ Jul. 24, 2023	Feb. 07, 2024	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30MHz~18GHz	Feb. 08, 2023	Jul. 20, 2023~ Jul. 24, 2023	Feb. 07, 2024	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	9 kHz~18GHz	Feb. 22, 2023	Jul. 20, 2023~ Jul. 24, 2023	Feb. 21, 2024	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30MHz~18GHz	Feb. 08, 2023	Jul. 20, 2023~ Jul. 24, 2023	Feb. 07, 2024	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jul. 20, 2023~ Jul. 24, 2023	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jul. 20, 2023~ Jul. 24, 2023	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jul. 20, 2023~ Jul. 24, 2023	N/A	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz~18GHz	Aug. 24, 2022	Jul. 20, 2023~ Jul. 24, 2023	Aug. 23, 2023	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz~18GHz	Mar. 23, 2023	Jul. 20, 2023~ Jul. 24, 2023	Mar. 22, 2024	Radiation (03CH13-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Base Station (Measure)	Anritsu	MT8821C	6201664755	LTE FDD/TDD(with 4), LTE-4CC DLCA/2CC ULCA, CatM1/NB1/NB2	Aug. 01, 2022	May 18, 2023~ Jul. 12, 2023	Jul. 31, 2023	Conducted (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101908	10Hz~40GHz	Sep. 27, 2022	May 18, 2023~ Jul. 12, 2023	Sep. 26, 2023	Conducted (TH03-HY)
Thermal Chamber	ESPEC	SH-641	92013720	-40℃ ~90℃	Sep. 07, 2022	May 18, 2023~ Jul. 12, 2023	Sep. 06, 2023	Conducted (TH03-HY)
DC Power Supply	GW Instek	GPP-2323	GES906037	0V~64V : 0A~6A	Dec. 29, 2022	May 18, 2023~ Jul. 12, 2023	Dec. 28, 2023	Conducted (TH03-HY)
Coupler	Warison	20dB 25W SMA Directional Coupler	#B	1-18GHz	Jan. 06, 2023	May 18, 2023~ Jul. 12, 2023	Jan. 05, 2024	Conducted (TH03-HY)



6 Measurement Uncertainty

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.02 dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.55 dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.82 dB
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power & ERP/EIRP)

LTE Band 2 Maximum Average Power [dBm] (GT - LC = -3.83 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP (W)
20	1	0	QPSK	19.70	19.53	19.40	15.96	0.0394
20	1	5		19.47	19.57	19.18		
20	6	0		19.72	19.79	19.32		
20	1	0	16-QAM	19.35	19.33	19.26	15.60	0.0363
20	1	5		19.14	19.21	19.18		
20	5	0		19.43	19.35	19.28		
15	1	0	QPSK	19.57	19.43	19.36	15.87	0.0386
15	1	5		19.35	19.41	19.34		
15	6	0		19.65	19.70	19.39		
15	1	0	16-QAM	19.32	19.36	19.33	15.70	0.0372
15	1	5		19.28	19.24	19.32		
15	5	0		19.53	19.44	19.32		
10	1	0	QPSK	19.71	19.62	19.66	15.88	0.0387
10	1	5		19.69	19.58	19.64		
10	6	0		18.70	18.72	18.54		
10	1	0	16-QAM	19.45	19.45	19.31	15.83	0.0383
10	1	5		19.41	19.42	19.32		
10	5	0		19.66	19.32	19.21		
5	1	0	QPSK	19.75	19.66	19.52	15.92	0.0391
5	1	5		19.45	19.56	19.48		
5	6	0		18.73	18.75	18.59		
5	1	0	16-QAM	19.36	19.25	19.33	15.59	0.0362
5	1	5		19.42	19.42	19.36		
5	5	0		19.23	19.15	19.11		
3	1	0	QPSK	19.86	19.77	19.67	16.03	0.0401
3	1	5		19.75	19.64	19.62		
3	6	0		17.87	17.92	17.65		
3	1	0	16-QAM	19.32	19.28	19.33	15.59	0.0362
3	1	5		19.25	19.36	19.42		
3	5	0		19.17	19.25	19.22		
1.4	1	0	QPSK	19.48	19.85	19.60	16.02	0.0400
1.4	1	5		19.46	19.72	19.48		
1.4	6	0		17.76	17.88	17.56		
1.4	1	0	16-QAM	19.36	19.41	19.44	15.61	0.0364
1.4	1	5		19.25	19.36	19.24		
1.4	5	0		18.69	18.71	18.38		
Limit	EIRP < 2W			Result			Pass	



LTE Band 25 Maximum Average Power [dBm] (GT - LC = -3.83 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP (W)
20	1	0	QPSK	20.11	20.04	20.15	16.32	0.0429
20	1	5		20.09	20.02	20.13		
20	6	0		19.86	19.97	19.98		
20	1	0	16-QAM	20.02	20.06	20.07	16.24	0.0421
20	1	5		20.01	20.03	20.06		
20	5	0		19.88	19.96	19.82		
15	1	0	QPSK	20.07	20.03	20.09	16.30	0.0427
15	1	5		20.13	20.02	20.11		
15	6	0		19.85	19.91	19.93		
15	1	0	16-QAM	20.08	20.16	20.07	16.33	0.0430
15	1	5		20.09	20.12	20.06		
15	5	0		19.81	19.86	19.77		
10	1	0	QPSK	20.06	20.13	20.06	16.30	0.0427
10	1	5		20.05	20.12	20.04		
10	6	0		19.81	19.93	19.88		
10	1	0	16-QAM	20.04	20.06	20.07	16.24	0.0421
10	1	5		20.01	20.04	20.06		
10	5	0		19.76	19.86	19.81		
5	1	0	QPSK	20.01	20.05	20.09	16.26	0.0423
5	1	5		20.08	20.03	20.03		
5	6	0		19.76	19.86	19.88		
5	1	0	16-QAM	20.03	20.01	20.06	16.23	0.0420
5	1	5		20.06	20.03	20.04		
5	5	0		19.84	19.83	19.91		
3	1	0	QPSK	19.99	20.03	20.07	16.24	0.0421
3	1	5		20.06	20.02	20.01		
3	6	0		19.72	19.82	19.85		
3	1	0	16-QAM	20.01	19.96	20.06	16.23	0.0420
3	1	5		20.04	20.02	20.03		
3	5	0		19.83	19.76	19.85		
1.4	1	0	QPSK	19.99	20.03	20.07	16.24	0.0421
1.4	1	5		20.06	20.02	20.01		
1.4	6	0		19.72	19.82	19.85		
1.4	1	0	16-QAM	20.01	19.96	20.06	16.23	0.0420
1.4	1	5		20.04	20.02	20.03		
1.4	5	0		19.83	19.76	19.85		
Limit	EIRP < 2W			Result			Pass	



LTE Band 4 Maximum Average Power [dBm] (GT - LC = -2.23 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP (W)
20	1	0	QPSK	20.12	20.10	20.22	17.99	0.0630
20	1	5		20.15	20.16	20.19		
20	6	0		20.07	20.09	20.11		
20	1	0	16-QAM	20.13	20.18	20.32	18.09	0.0644
20	1	5		20.26	20.16	20.11		
20	5	0		20.10	20.07	20.06		
15	1	0	QPSK	20.16	20.25	20.21	18.02	0.0634
15	1	5		20.19	20.20	20.18		
15	6	0		20.06	20.07	20.08		
15	1	0	16-QAM	20.08	20.14	20.13	17.95	0.0624
15	1	5		20.18	20.16	20.12		
15	5	0		20.11	20.07	20.06		
10	1	0	QPSK	20.16	20.13	20.23	18.00	0.0631
10	1	5		20.21	20.11	20.19		
10	6	0		19.16	19.06	19.04		
10	1	0	16-QAM	20.21	20.18	20.11	17.98	0.0628
10	1	5		20.19	20.06	20.12		
10	5	0		19.12	19.11	19.07		
5	1	0	QPSK	20.08	20.12	20.16	17.93	0.0621
5	1	5		20.07	20.09	20.13		
5	6	0		18.99	18.97	19.01		
5	1	0	16-QAM	20.05	20.17	20.15	17.94	0.0622
5	1	5		20.06	20.13	20.11		
5	5	0		18.95	19.01	19.02		
3	1	0	QPSK	20.08	20.17	20.04	17.94	0.0622
3	1	5		20.07	20.16	20.05		
3	6	0		18.12	18.05	18.07		
3	1	0	16-QAM	20.07	20.08	20.16	17.93	0.0621
3	1	5		20.04	20.06	20.11		
3	5	0		18.06	18.07	18.05		
1.4	1	0	QPSK	20.09	20.11	20.16	17.93	0.0621
1.4	1	5		20.11	20.08	20.11		
1.4	6	0		18.09	18.06	18.07		
1.4	1	0	16-QAM	20.15	20.06	20.07	17.92	0.0619
1.4	1	5		20.06	20.04	20.05		
1.4	5	0		18.07	18.09	18.02		
Limit	EIRP < 1W			Result			Pass	



LTE Band 5 Maximum Average Power [dBm] (GT - LC = -3.66 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
10	1	0	QPSK	20.02	20.01	20.07	14.26	0.0267
10	1	5		20.07	20.03	20.05		
10	6	0		19.08	19.12	19.16		
10	1	0	16-QAM	20.01	19.99	20.05	14.24	0.0265
10	1	5		20.04	20.01	20.02		
10	5	0		19.03	19.08	19.11		
5	1	0	QPSK	20.03	20.02	20.11	14.30	0.0269
5	1	5		20.07	20.06	20.06		
5	6	0		19.11	19.09	19.07		
5	1	0	16-QAM	20.08	20.11	20.13	14.32	0.0270
5	1	5		20.06	20.06	20.02		
5	5	0		19.22	19.07	19.02		
3	1	0	QPSK	20.14	20.32	20.24	14.51	0.0282
3	1	5		20.16	20.28	20.20		
3	6	0		18.09	18.18	18.16		
3	1	0	16-QAM	20.12	20.21	20.16	14.43	0.0277
3	1	5		20.13	20.24	20.15		
3	5	0		18.04	18.16	18.11		
1.4	1	0	QPSK	20.11	20.18	20.08	14.37	0.0274
1.4	1	5		20.16	20.15	20.11		
1.4	6	0		18.04	18.02	18.06		
1.4	1	0	16-QAM	20.06	20.16	20.10	14.35	0.0272
1.4	1	5		20.05	20.09	20.12		
1.4	5	0		18.01	18.06	18.11		
Limit	ERP < 7W			Result			Pass	



LTE Band 12 Maximum Average Power [dBm] (GT - LC = -3.54 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
10	1	0	QPSK	19.87	19.89	19.79	14.20	0.0263
10	1	5		19.82	19.85	19.82		
10	6	0		18.67	18.85	18.86		
10	1	0	16-QAM	19.68	19.76	19.75	14.08	0.0256
10	1	5		19.66	19.77	19.72		
10	5	0		18.52	18.69	18.77		
5	1	0	QPSK	19.99	20.01	19.77	14.32	0.0270
5	1	5		19.98	19.96	19.76		
5	6	0		18.89	18.94	18.86		
5	1	0	16-QAM	19.86	19.76	19.65	14.19	0.0262
5	1	5		19.88	19.58	19.71		
5	5	0		18.87	18.76	18.88		
3	1	0	QPSK	20.03	20.06	20.07	14.38	0.0274
3	1	5		19.99	20.01	20.04		
3	6	0		18.04	18.07	18.11		
3	1	0	16-QAM	20.04	20.11	20.05	14.42	0.0277
3	1	5		20.02	20.03	20.01		
3	5	0		18.01	18.05	18.13		
1.4	1	0	QPSK	20.09	20.14	20.11	14.47	0.0280
1.4	1	5		20.07	20.11	20.16		
1.4	6	0		18.05	18.11	18.09		
1.4	1	0	16-QAM	20.04	20.15	20.06	14.46	0.0279
1.4	1	5		20.03	20.11	20.07		
1.4	5	0		18.04	18.09	18.02		
Limit	ERP < 3W			Result			Pass	



FCC RADIO TEST REPORT

Report No. : FG342615A

LTE Band 13 Maximum Average Power [dBm] (GT - LC = -2.64 dB)									
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)	
10	1	0	QPSK	-	20.20	-	15.41	0.0348	
10	1	5			20.16				
10	6	0			19.19				
10	1	0	16-QAM		20.11		-	15.35	0.0343
10	1	5			20.14				
10	5	0			19.08				
5	1	0	QPSK	20.16	20.24	20.15	15.45	0.0351	
5	1	5		20.11	20.21	20.13			
5	6	0		19.19	19.23	19.21			
5	1	0	16-QAM	20.15	20.15	20.06	15.38	0.0345	
5	1	5		20.16	20.17	20.09			
5	5	0		19.13	19.18	19.12			
Limit	ERP < 3W			Result			Pass		



LTE Band 26 Maximum Average Power [dBm] (GT - LC = -3.66 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
15	1	0	QPSK	19.76	19.89	19.82	14.33	0.0271
15	1	5		19.82	19.77	19.78		
15	6	0		20.14	20.11	20.10		
15	1	0	16-QAM	19.65	19.81	19.69	14.34	0.0272
15	1	5		19.62	19.72	19.71		
15	5	0		20.08	20.15	20.09		
10	1	0	QPSK	19.56	19.72	19.74	14.36	0.0273
10	1	5		19.58	19.68	19.66		
10	6	0		20.17	20.11	20.16		
10	1	0	16-QAM	19.77	19.65	19.71	14.39	0.0275
10	1	5		19.73	19.66	19.82		
10	5	0		20.12	20.14	20.20		
5	1	0	QPSK	19.46	19.67	19.65	14.26	0.0267
5	1	5		19.42	19.58	19.62		
5	6	0		20.02	20.07	20.05		
5	1	0	16-QAM	19.56	19.44	19.56	14.25	0.0266
5	1	5		19.55	19.57	19.48		
5	5	0		20.01	20.05	20.06		
3	1	0	QPSK	19.38	19.76	19.82	14.32	0.0270
3	1	5		19.44	19.72	19.76		
3	6	0		20.06	20.11	20.13		
3	1	0	16-QAM	19.62	19.48	19.67	14.30	0.0269
3	1	5		19.66	19.58	19.58		
3	5	0		20.03	20.06	20.11		
1.4	1	0	QPSK	19.23	19.64	19.72	14.35	0.0272
1.4	1	5		19.19	19.56	19.74		
1.4	6	0		20.01	20.16	20.14		
1.4	1	0	16-QAM	19.58	19.54	19.55	14.35	0.0272
1.4	1	5		19.52	19.66	19.59		
1.4	5	0		20.04	20.01	20.16		
Limit	ERP < 7W			Result			Pass	



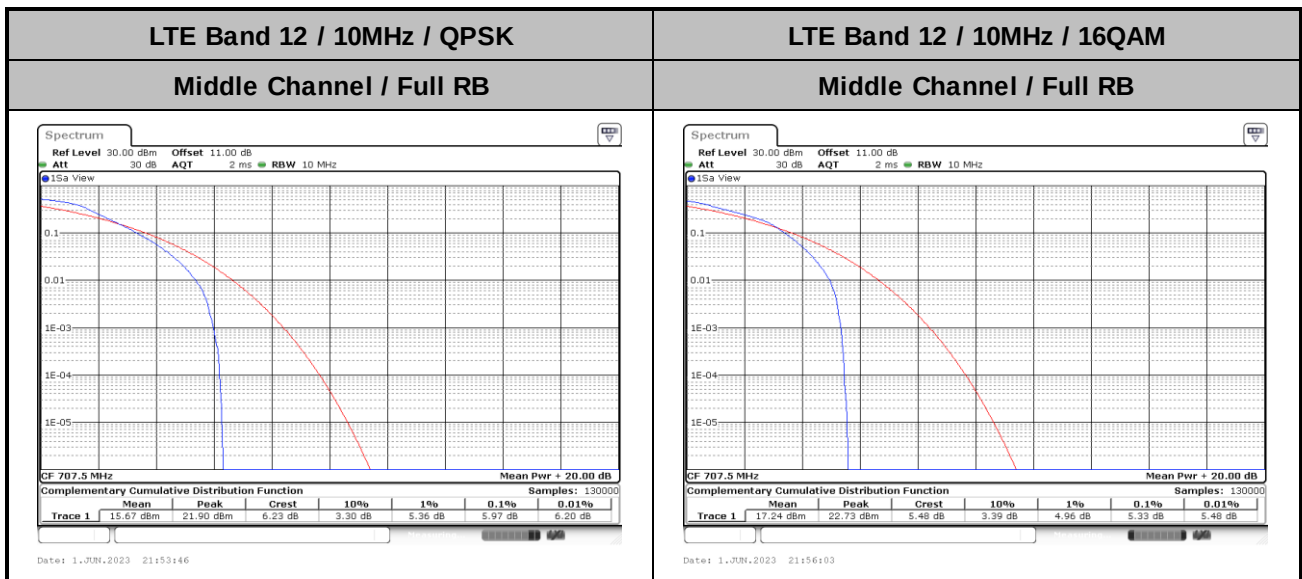
LTE Band 66 Maximum Average Power [dBm] (GT - LC = -2.23 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP (W)
20	1	0	QPSK	20.26	20.30	20.36	18.13	0.0650
20	1	5		20.21	20.28	20.32		
20	6	0		20.16	20.18	20.15		
20	1	0	16-QAM	20.16	20.22	20.30	18.07	0.0641
20	1	5		20.18	20.21	20.19		
20	5	0		20.15	20.15	20.11		
15	1	0	QPSK	20.17	20.29	20.26	18.06	0.0640
15	1	5		20.15	20.23	20.28		
15	6	0		20.11	20.12	20.13		
15	1	0	16-QAM	20.16	20.21	20.26	18.05	0.0638
15	1	5		20.09	20.19	20.23		
15	5	0		20.08	20.11	20.13		
10	1	0	QPSK	20.16	20.24	20.23	18.05	0.0638
10	1	5		20.15	20.26	20.28		
10	6	0		20.11	20.13	20.16		
10	1	0	16-QAM	20.09	20.21	20.16	18.00	0.0631
10	1	5		20.16	20.22	20.23		
10	5	0		20.13	20.08	20.12		
5	1	0	QPSK	20.13	20.16	20.22	17.99	0.0630
5	1	5		20.09	20.13	20.16		
5	6	0		20.06	20.09	20.11		
5	1	0	16-QAM	20.14	20.19	20.18	18.03	0.0635
5	1	5		20.13	20.11	20.15		
5	5	0		20.18	20.09	20.16		
3	1	0	QPSK	20.08	20.19	20.26	18.03	0.0635
3	1	5		20.15	20.13	20.14		
3	6	0		20.16	20.08	20.16		
3	1	0	16-QAM	20.15	20.19	20.13	17.96	0.0625
3	1	5		20.18	20.09	20.11		
3	5	0		20.07	20.16	20.12		
1.4	1	0	QPSK	20.04	20.18	20.16	17.98	0.0628
1.4	1	5		20.06	20.15	20.13		
1.4	6	0		20.11	20.07	20.11		
1.4	1	0	16-QAM	20.12	20.18	20.09	17.98	0.0628
1.4	1	5		20.13	20.07	20.10		
1.4	5	0		20.06	20.11	20.21		
Limit	EIRP < 1W			Result			Pass	



LTE Band 12

Peak-to-Average Ratio

Mode	LTE Band 12 / 10MHz		
Mod.	QPSK	16QAM	Limit: 13dB
RB Size	Full RB	Full RB	Result
Middle CH	5.97	5.33	PASS



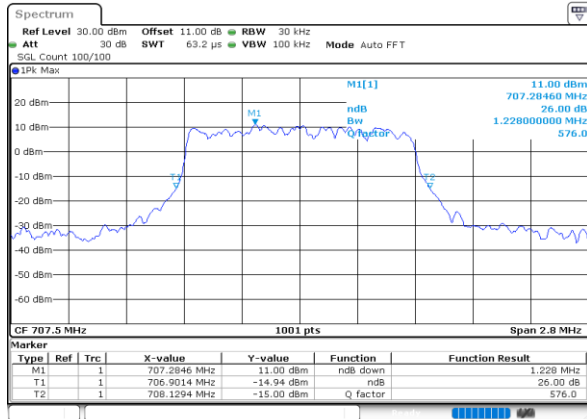
**26dB Bandwidth**

Mode	LTE Band 12 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	1.23	1.04	1.33	1.11	1.31	1.18	1.78	1.58	-	-	-	-
Mode	LTE Band 12 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

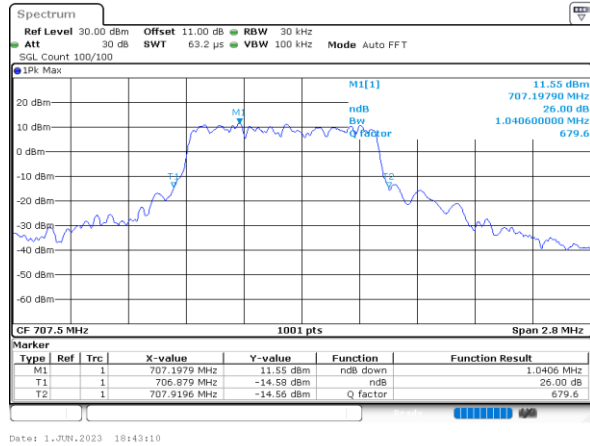


LTE Band 12

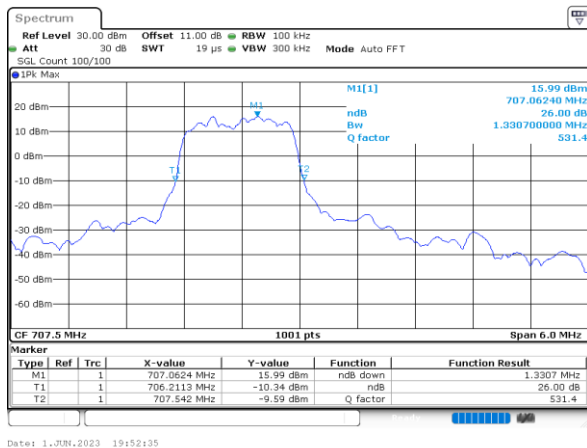
Middle Channel / 1.4MHz / QPSK



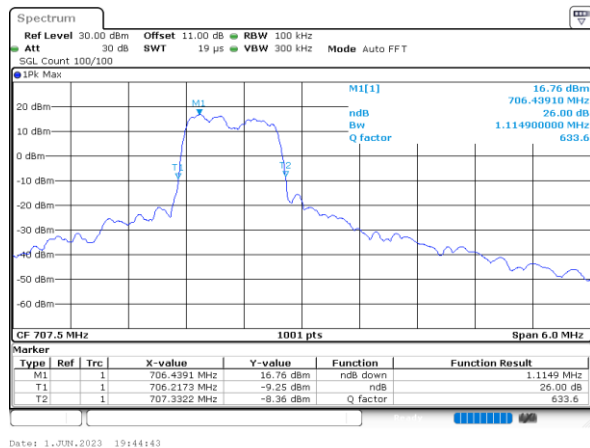
Middle Channel / 1.4MHz / 16QAM



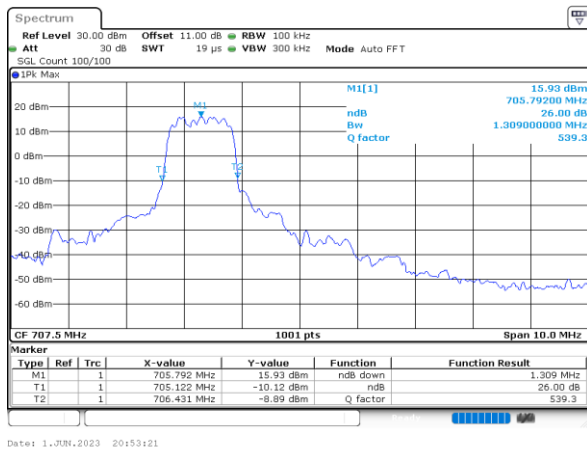
Middle Channel / 3MHz / QPSK



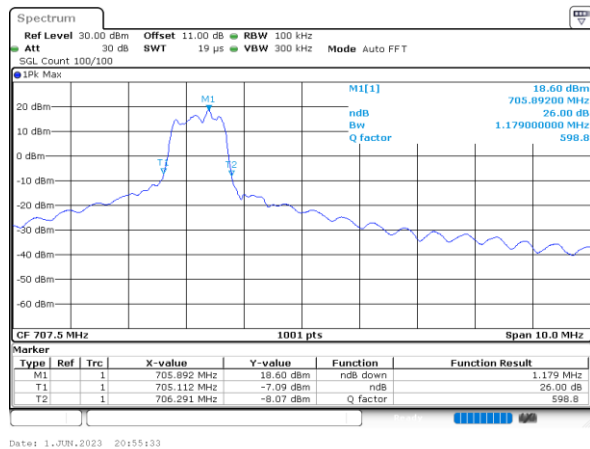
Middle Channel / 3MHz / 16QAM



Middle Channel / 5MHz / QPSK



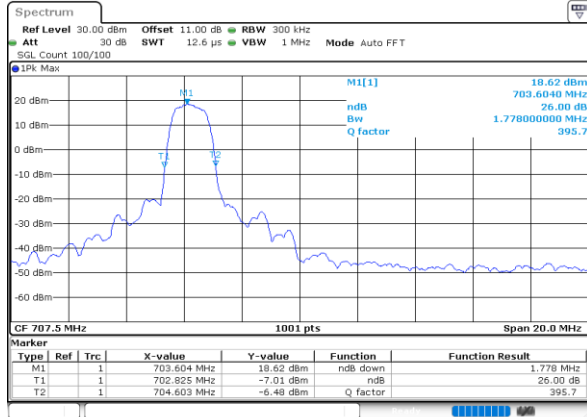
Middle Channel / 5MHz / 16QAM



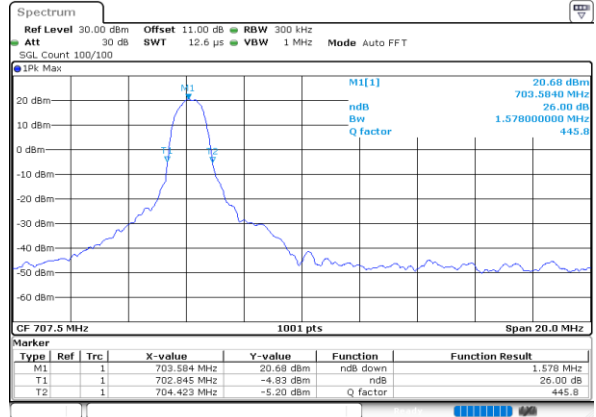


LTE Band 12

Middle Channel / 10MHz / QPSK



Middle Channel / 10MHz / 16QAM



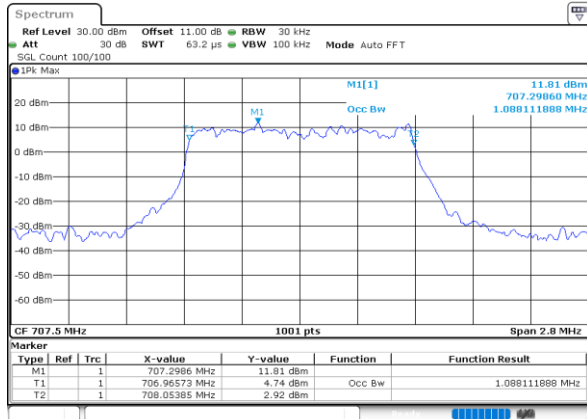
**Occupied Bandwidth**

Mode	LTE Band 12 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	1.09	0.91	1.17	0.98	1.15	1.02	1.46	1.28	-	-	-	-
Mode	LTE Band 12 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

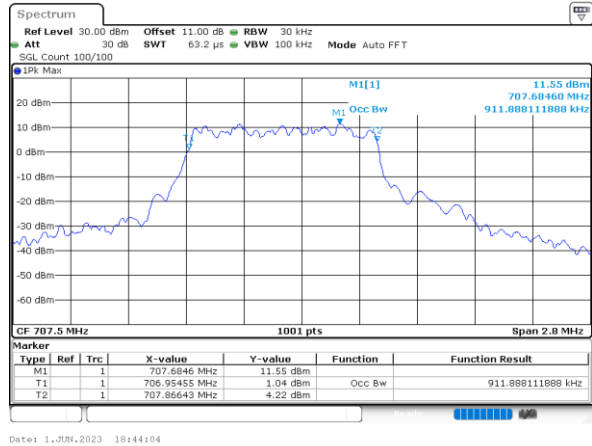


LTE Band 12

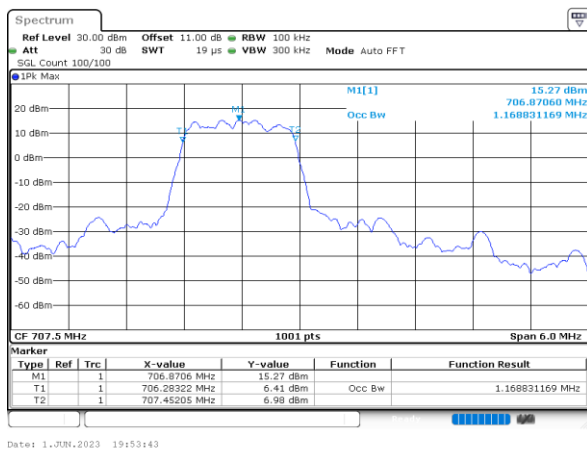
Middle Channel / 1.4MHz / QPSK



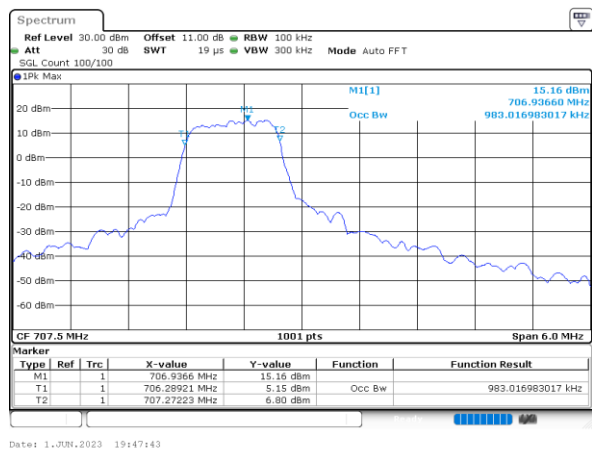
Middle Channel / 1.4MHz / 16QAM



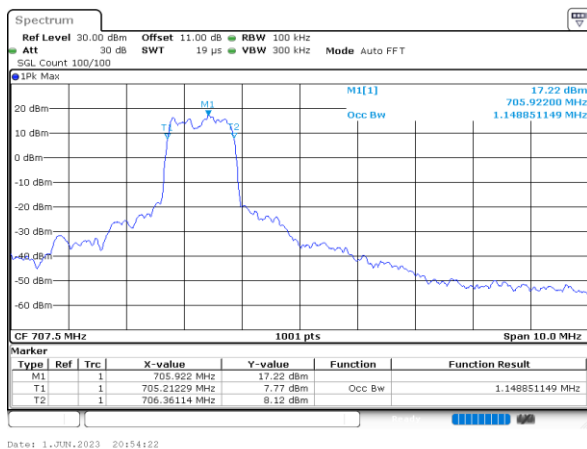
Middle Channel / 3MHz / QPSK



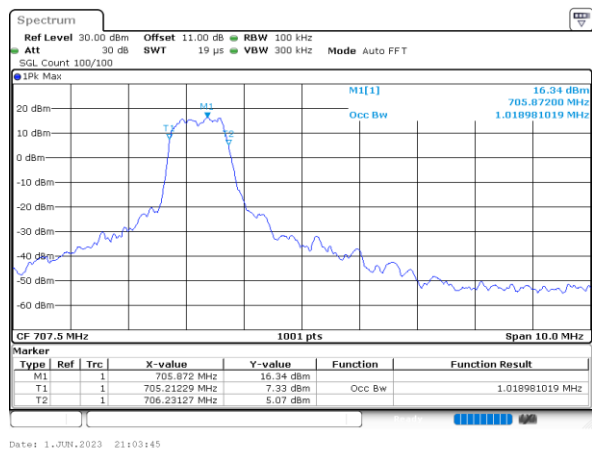
Middle Channel / 3MHz / 16QAM



Middle Channel / 5MHz / QPSK



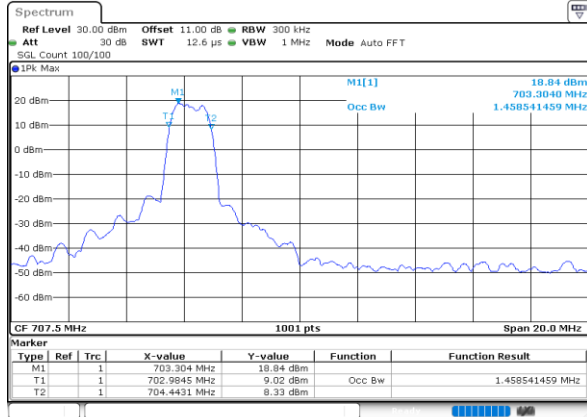
Middle Channel / 5MHz / 16QAM



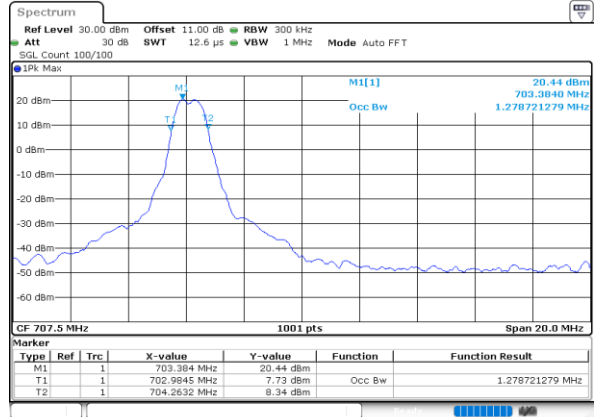


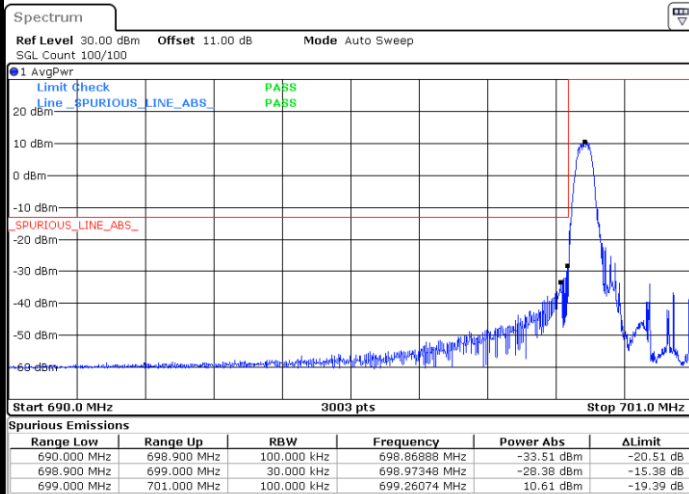
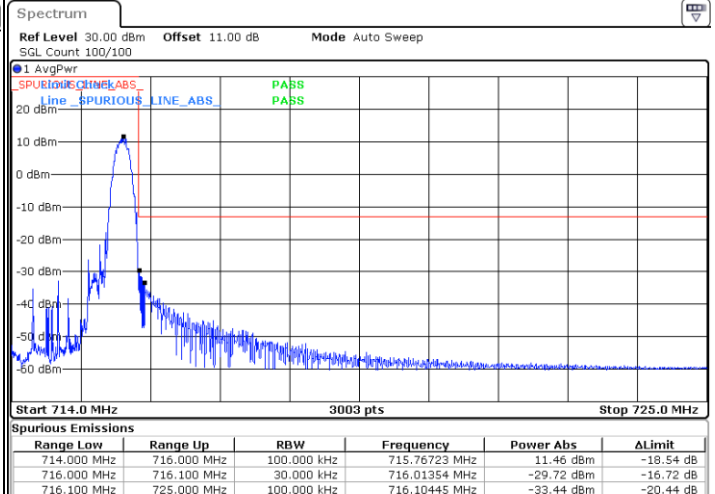
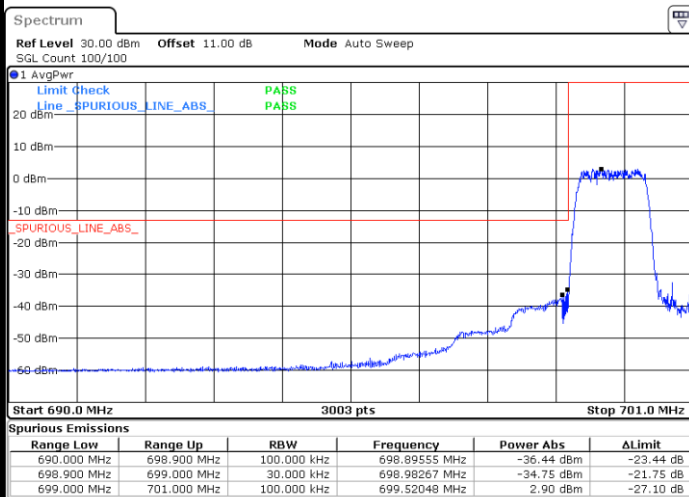
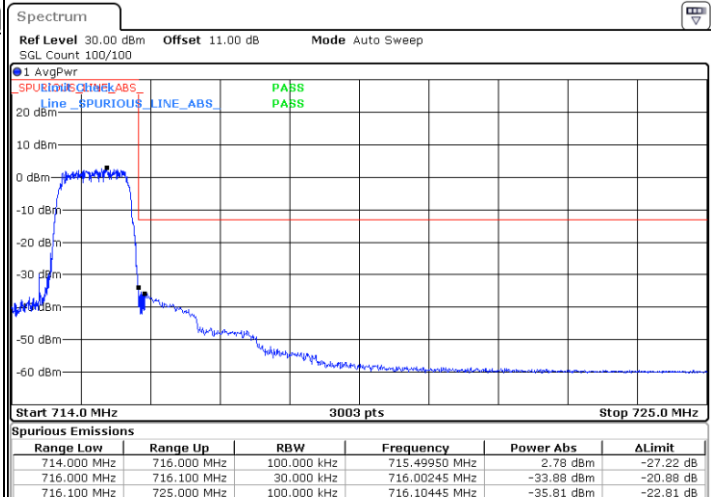
LTE Band 12

Middle Channel / 10MHz / QPSK



Middle Channel / 10MHz / 16QAM

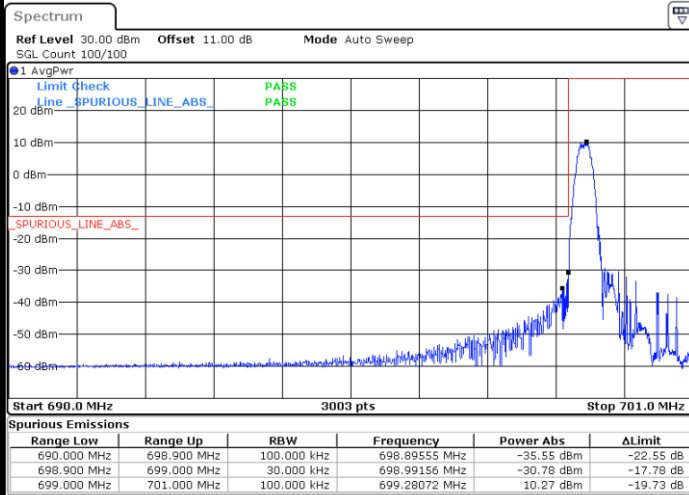


**Conducted Band Edge****LTE Band 12 / 1.4MHz / QPSK****Lowest Band Edge / 1RB****Highest Band Edge / 1RB****Lowest Band Edge / Full RB****Highest Band Edge / Full RB**

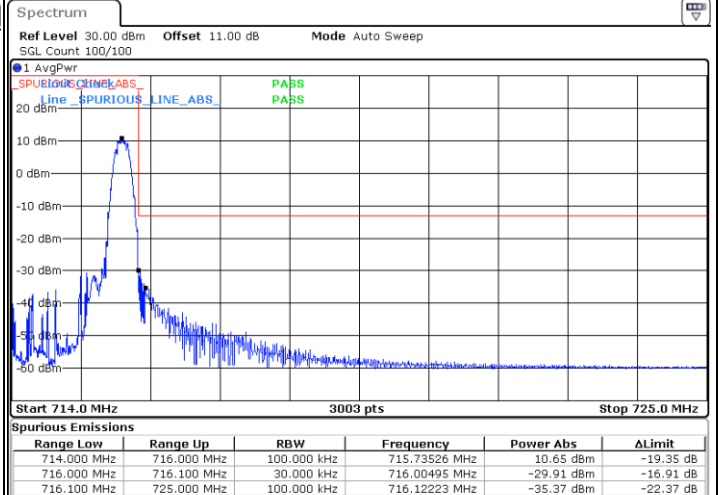


LTE Band 12 / 1.4MHz / 16QAM

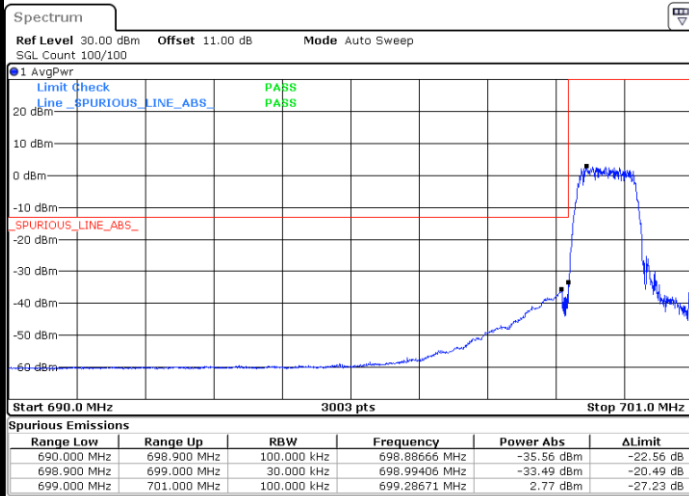
Lowest Band Edge / 1 RB



Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



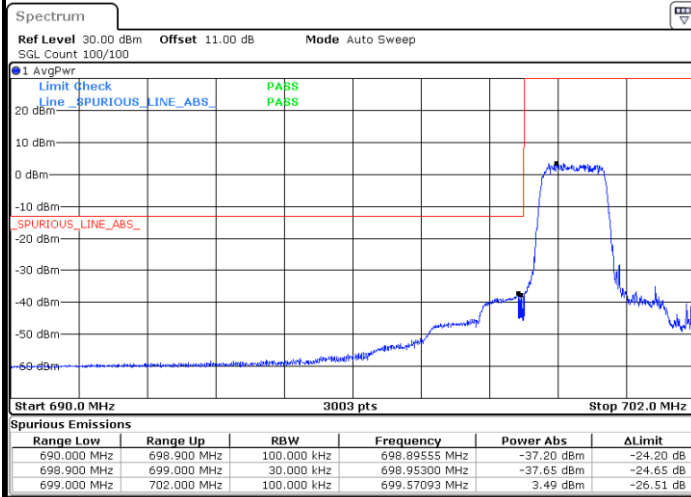
Highest Band Edge / Full RB



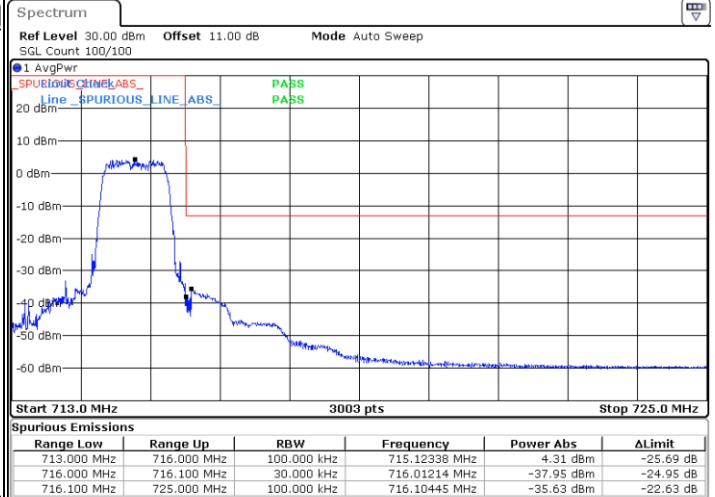


LTE Band 12 / 3MHz / QPSK

Lowest Band Edge / Full RB

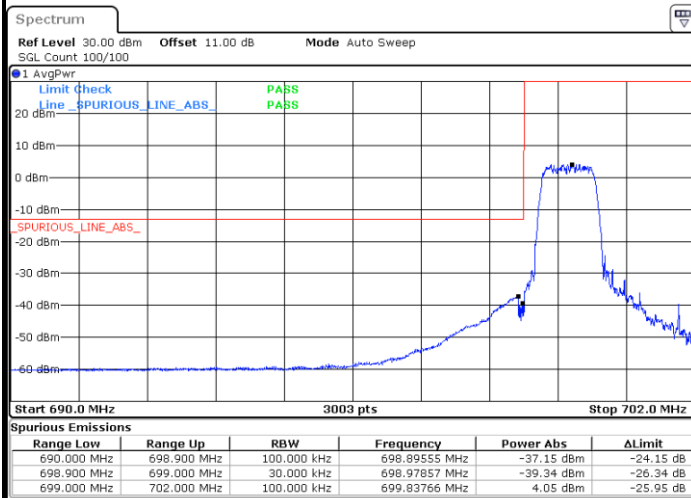


Highest Band Edge / Full RB

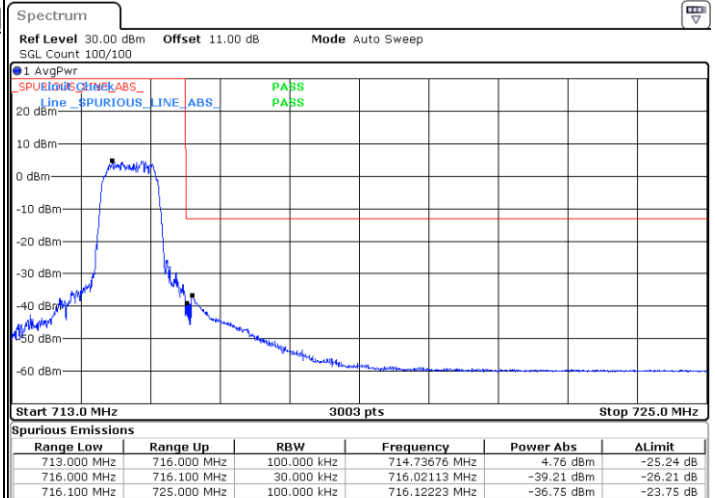


LTE Band 12 / 3MHz / 16QAM

Lowest Band Edge / Full RB



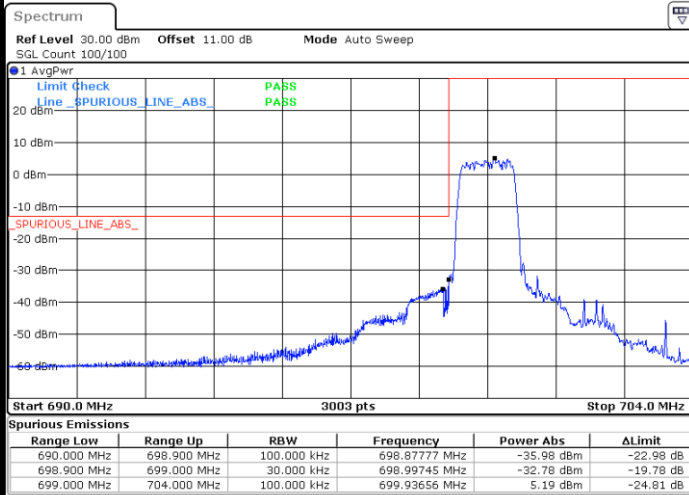
Highest Band Edge / Full RB





LTE Band 12 / 5MHz / QPSK

Lowest Band Edge / Full RB

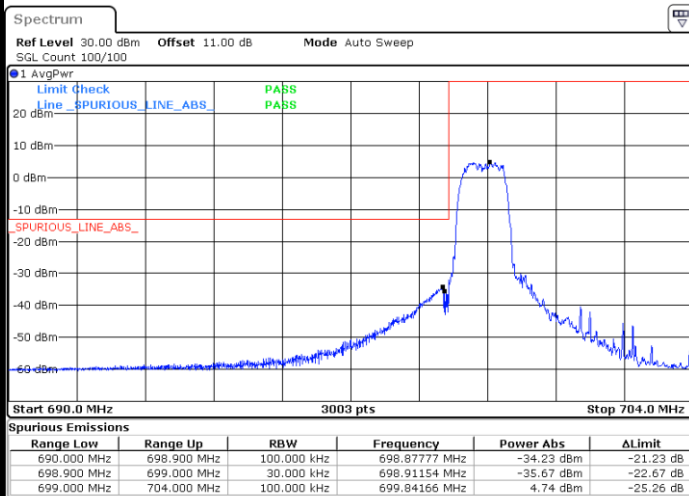


Highest Band Edge / Full RB

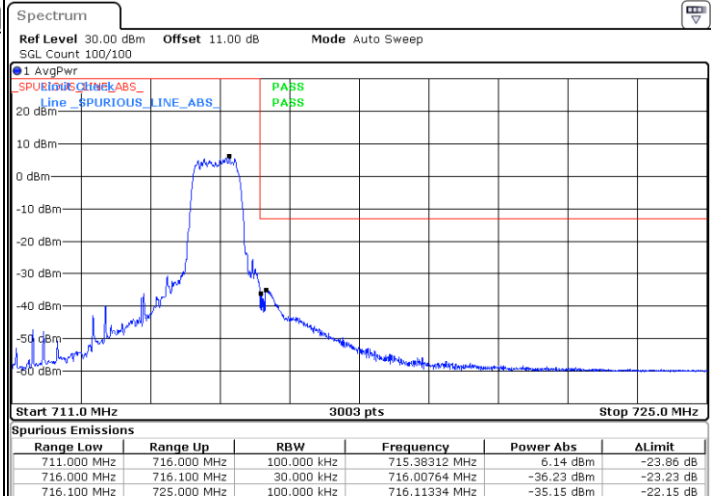


LTE Band 12 / 5MHz / 16QAM

Lowest Band Edge / Full RB



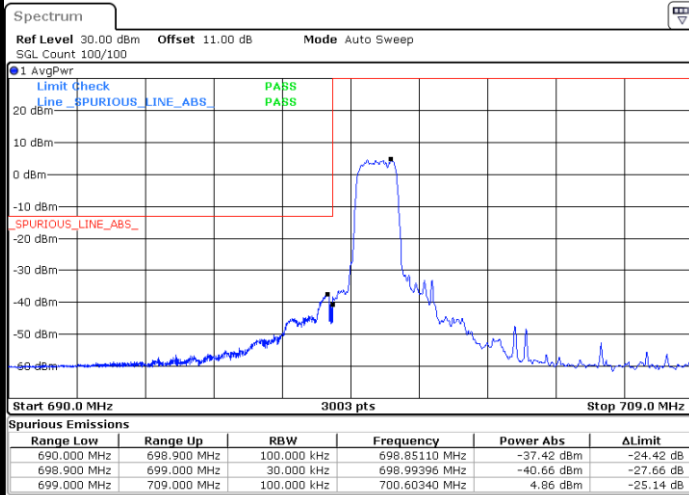
Highest Band Edge / Full RB





LTE Band 12 / 10MHz / QPSK

Lowest Band Edge / Full RB

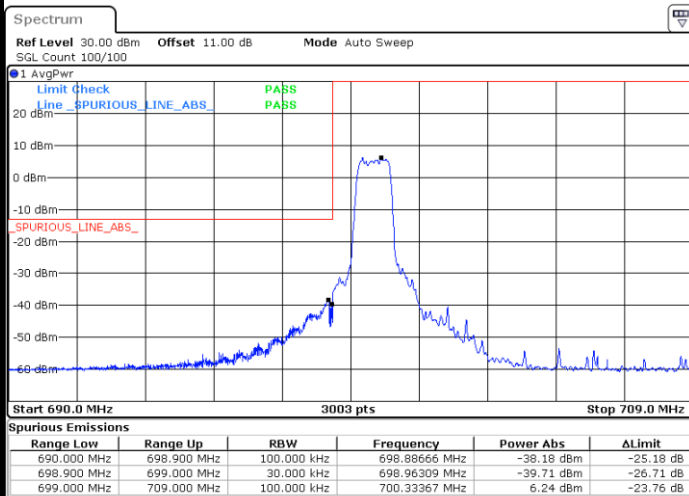


Highest Band Edge / Full RB

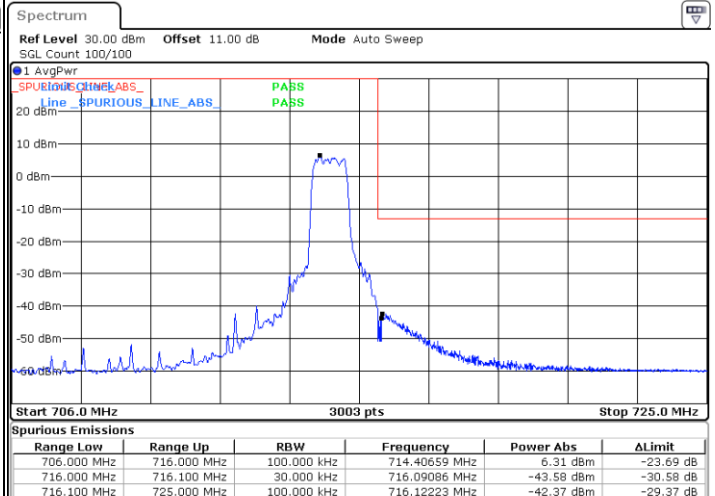


LTE Band 12 / 10MHz / 16QAM

Lowest Band Edge / Full RB



Highest Band Edge / Full RB

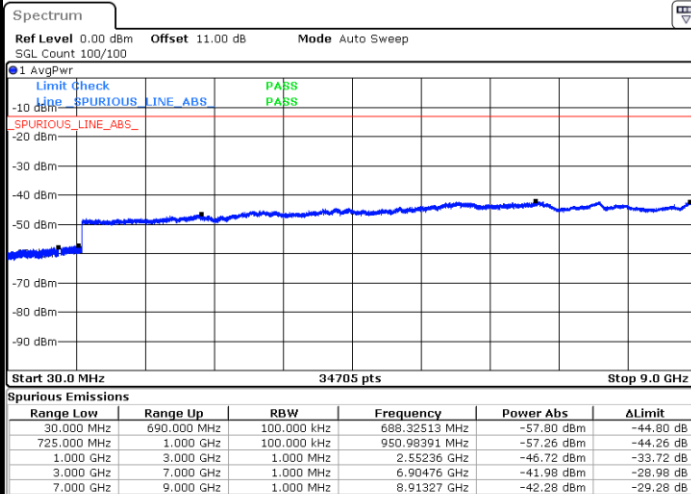




Conducted Spurious Emission

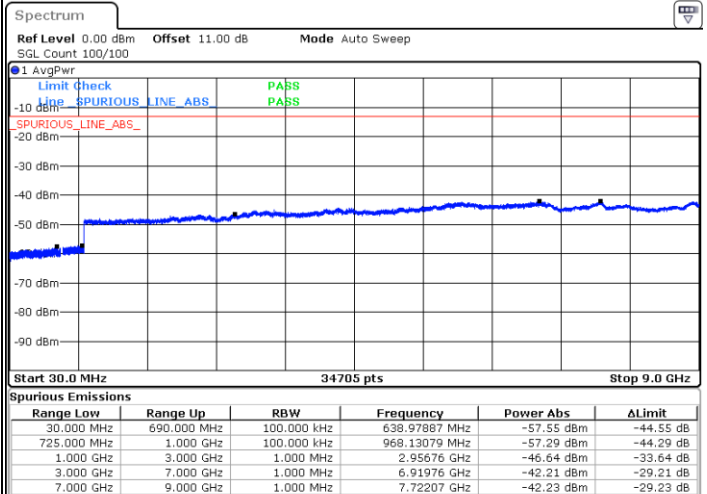
LTE Band 12 / 1.4MHz

Lowest Channel / QPSK



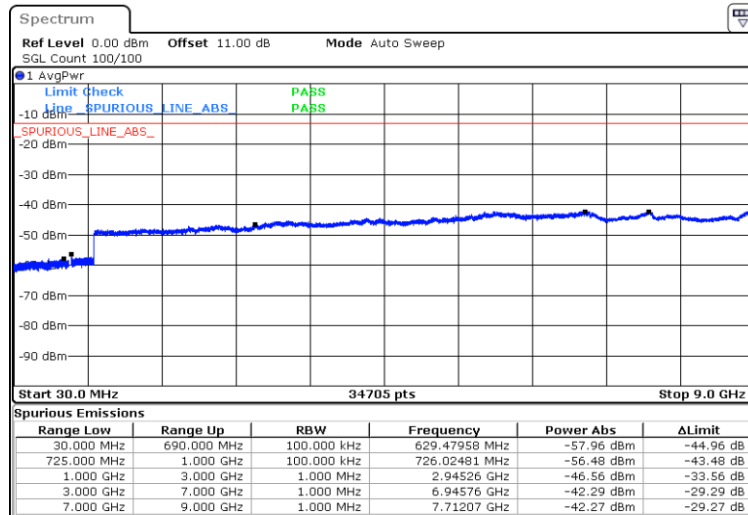
Date: 1.JUN.2023 17:54:29

Middle Channel / QPSK



Date: 1.JUN.2023 18:54:19

Highest Channel / QPSK

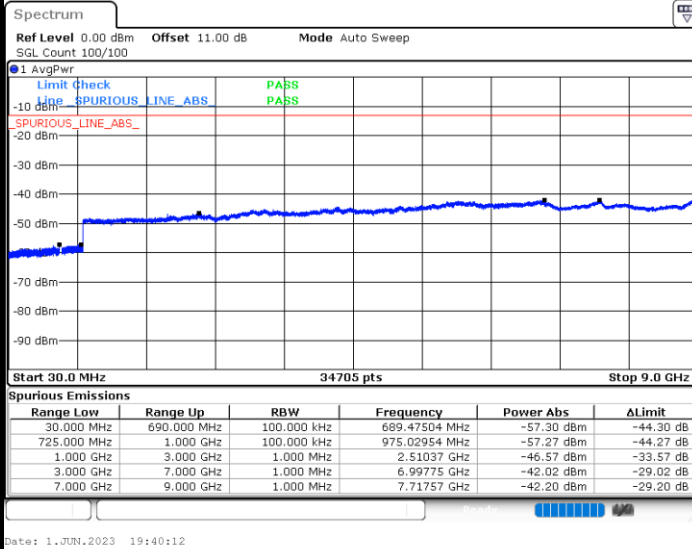


Date: 1.JUN.2023 18:57:40

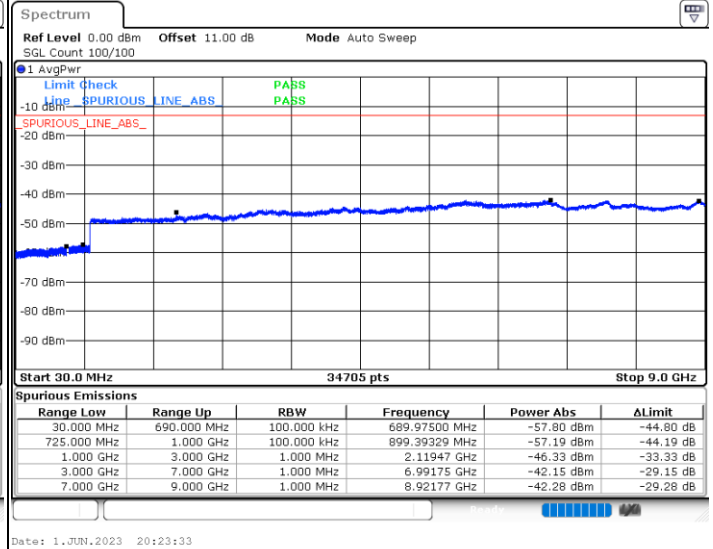


LTE Band 12 / 3MHz

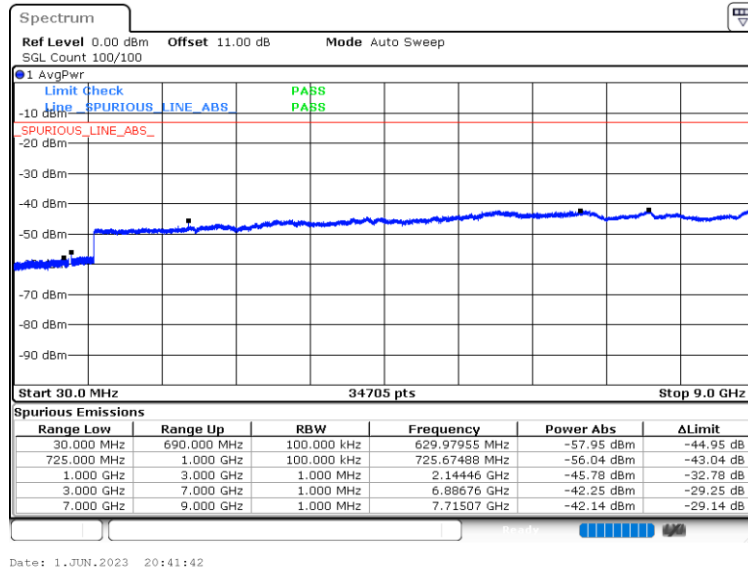
Lowest Channel / QPSK



Middle Channel / QPSK



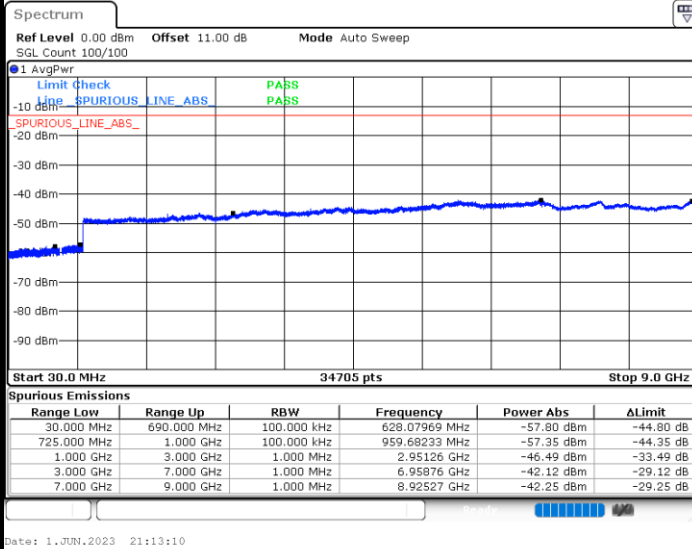
Highest Channel / QPSK



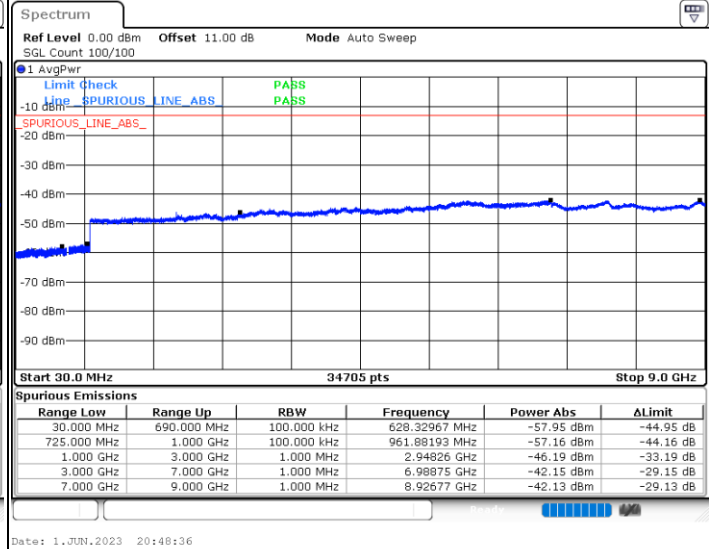


LTE Band 12 / 5MHz

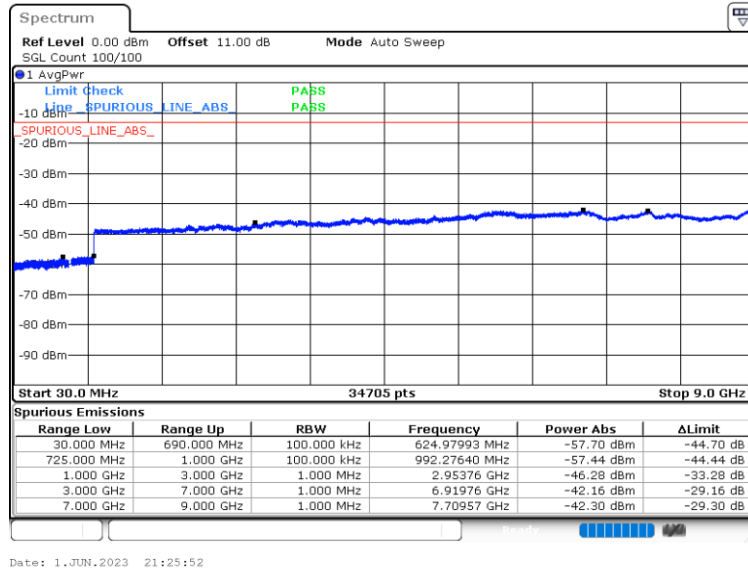
Lowest Channel / QPSK



Middle Channel / QPSK



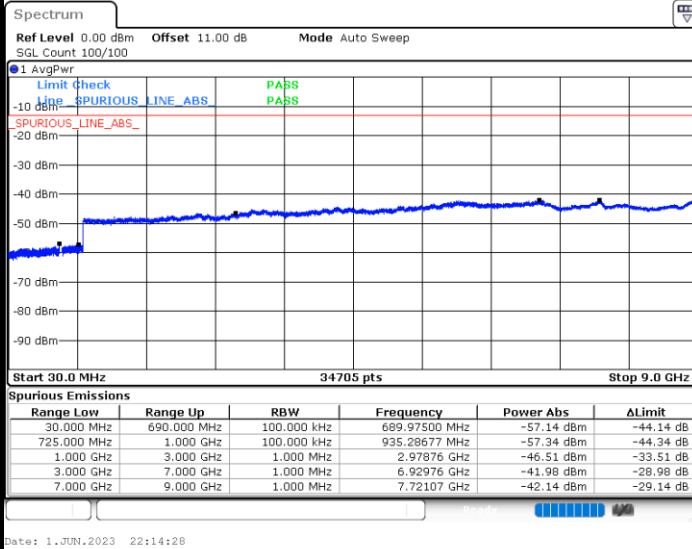
Highest Channel / QPSK



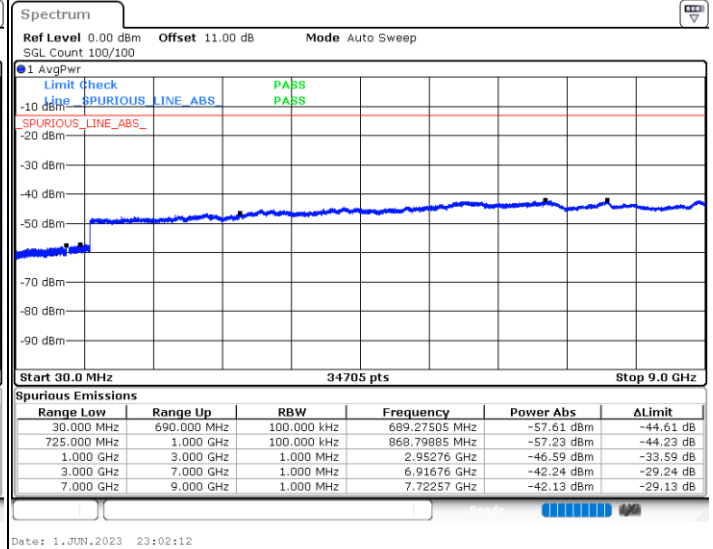


LTE Band 12 / 10MHz

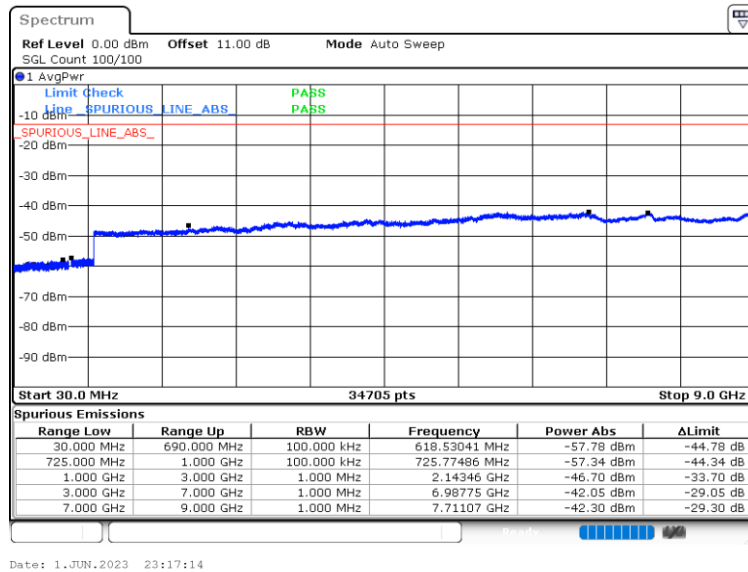
Lowest Channel / QPSK



Middle Channel / QPSK



Highest Channel / QPSK



Frequency Stability

Test Conditions		LTE Band 12 (QPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0105	PASS
40	Normal Voltage	0.0131	
30	Normal Voltage	0.0181	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0146	
0	Normal Voltage	0.0095	
-10	Normal Voltage	0.0164	
-20	Normal Voltage	0.0168	
-30	Normal Voltage	0.0085	
20	Maximum Voltage	0.0123	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0082	

Note:

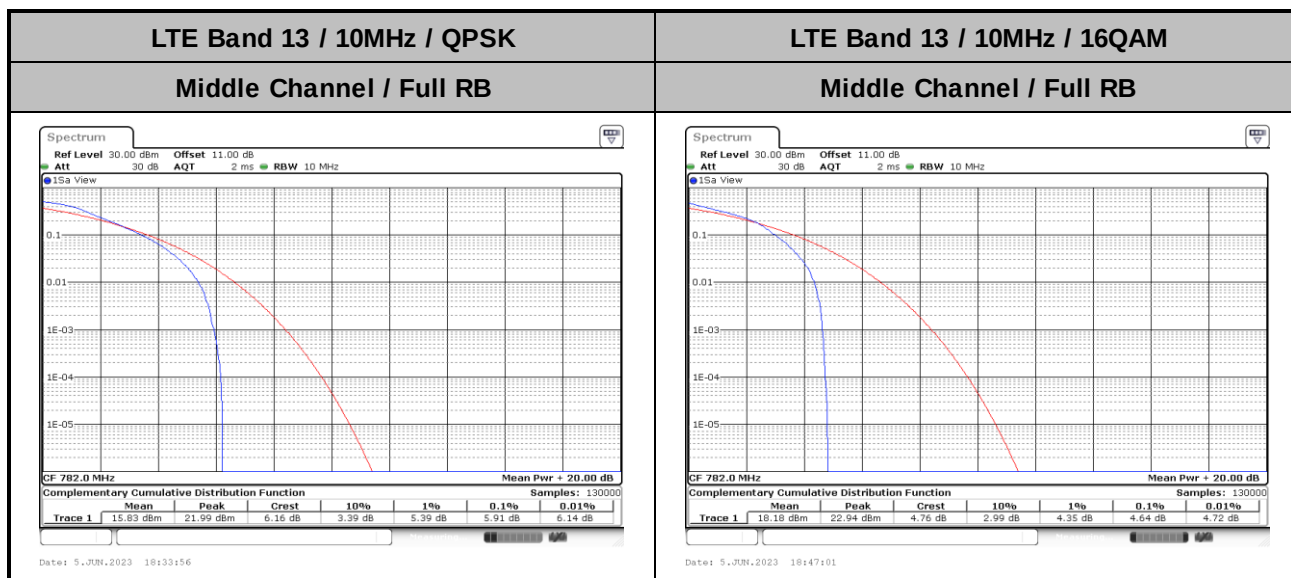
1. Normal Voltage = 3.7 V. ; Battery End Point (BEP) = 3.4 V. ; Maximum Voltage = 4.2 V.
2. The frequency fundamental emissions stay within the authorized frequency block.



LTE Band 13

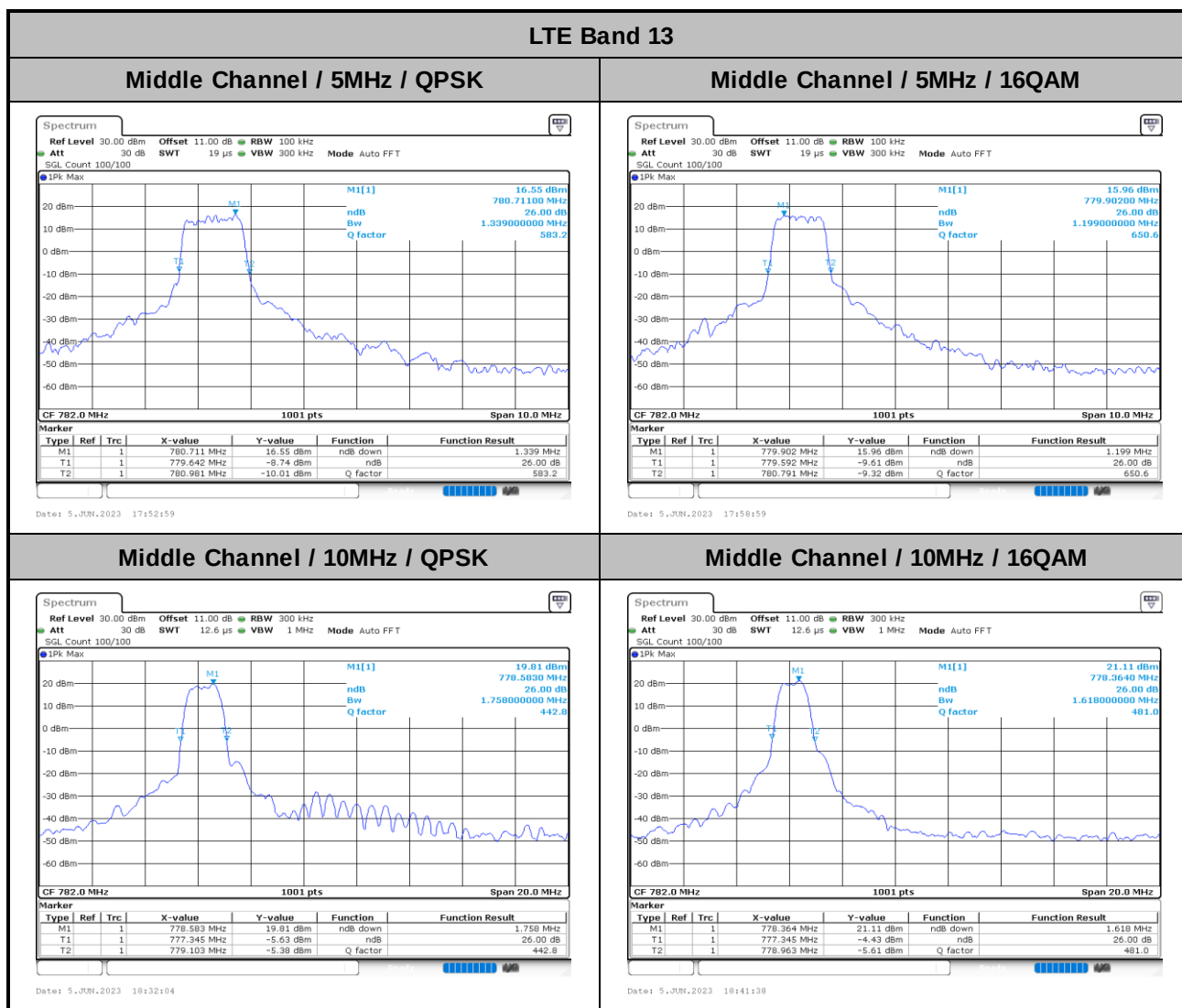
Peak-to-Average Ratio

Mode	LTE Band 13 / 10MHz		
Mod.	QPSK	16QAM	Limit: 13dB
RB Size	Full RB	Full RB	Result
Middle CH	5.91	4.64	PASS



**26dB Bandwidth**

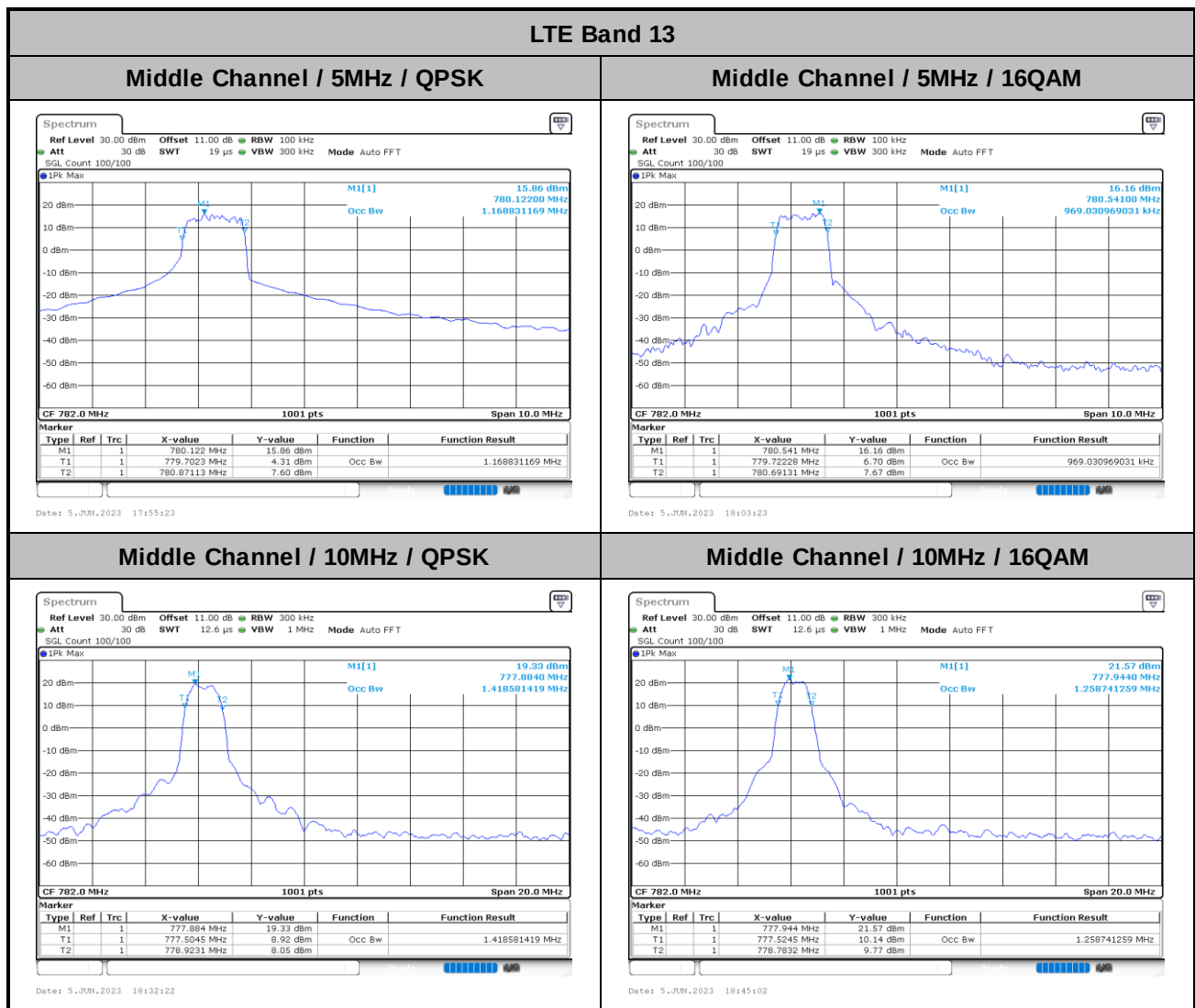
Mode	LTE Band 13 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	-	-	-	-	1.34	1.20	1.76	1.62	-	-	-	-
Mode	LTE Band 13 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

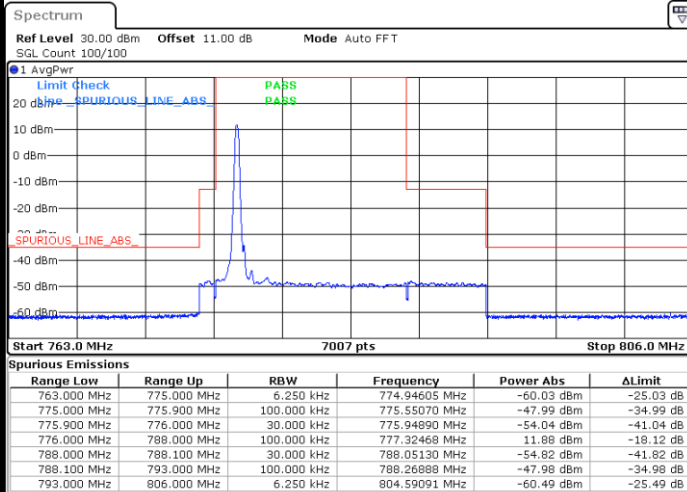
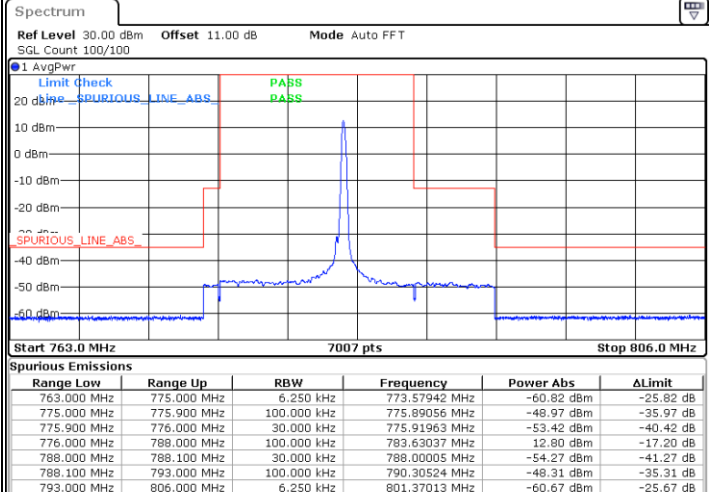
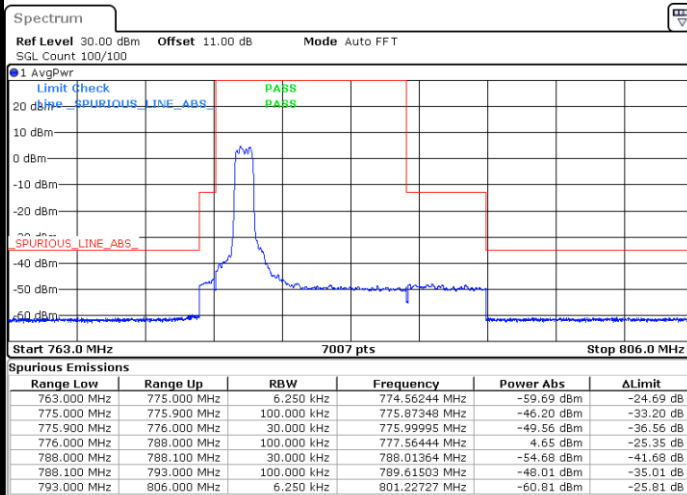
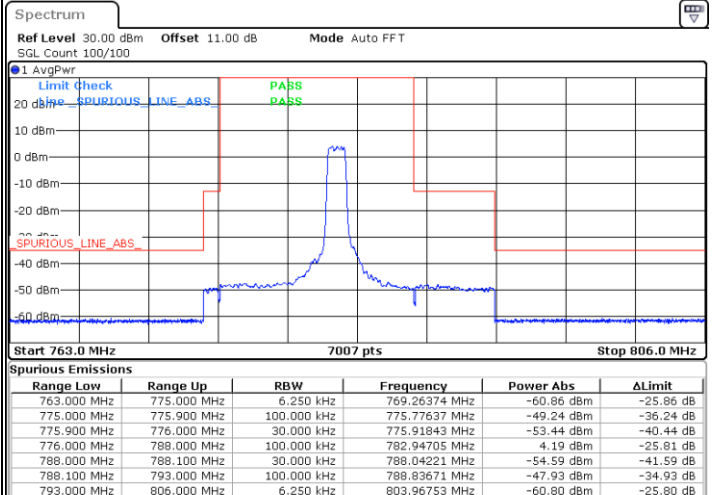




Occupied Bandwidth

Mode	LTE Band 13 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	-	-	-	-	1.17	0.97	1.42	1.26	-	-	-	-
Mode	LTE Band 13 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

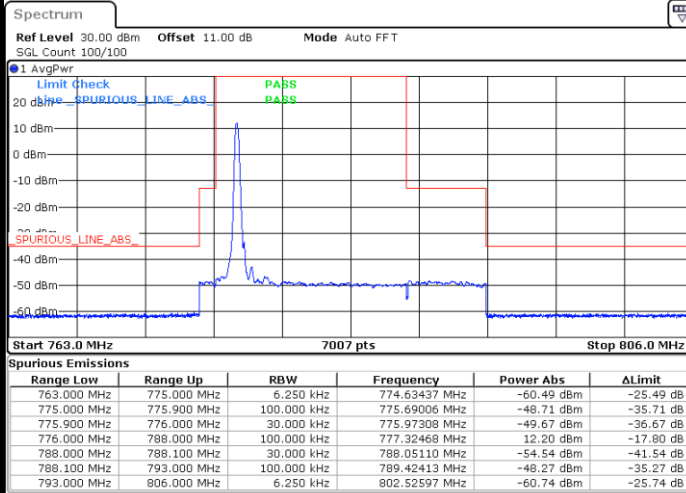


**Conducted Band Edge****LTE Band 13 / 5MHz / QPSK****Lowest Band Edge / 1 RB****Highest Band Edge / 1 RB****Lowest Band Edge / Full RB****Highest Band Edge / Full RB**

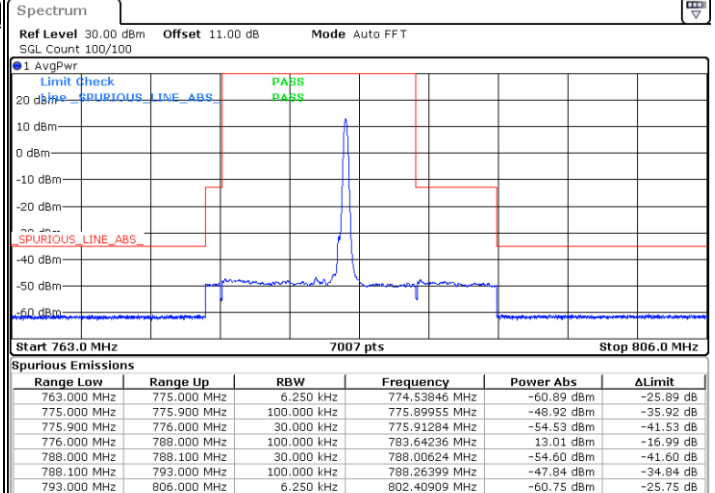


LTE Band 13 / 5MHz / 16QAM

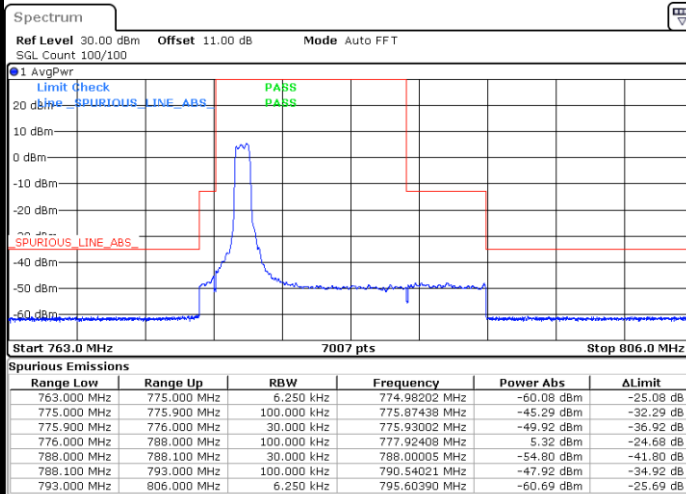
Lowest Band Edge / 1 RB



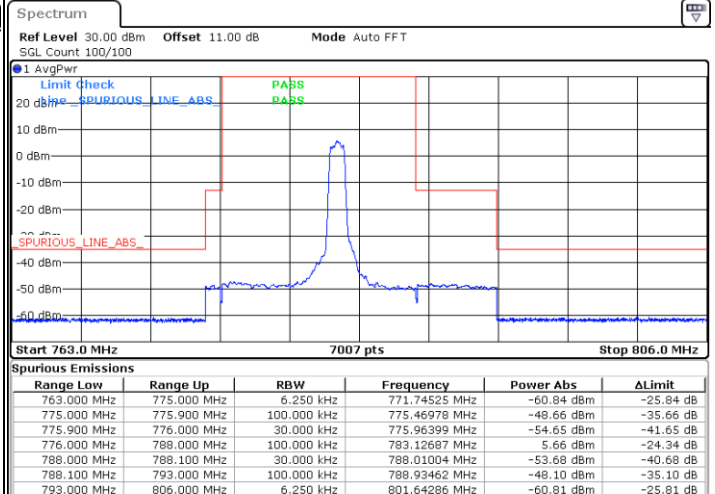
Highest Band Edge / 1 RB

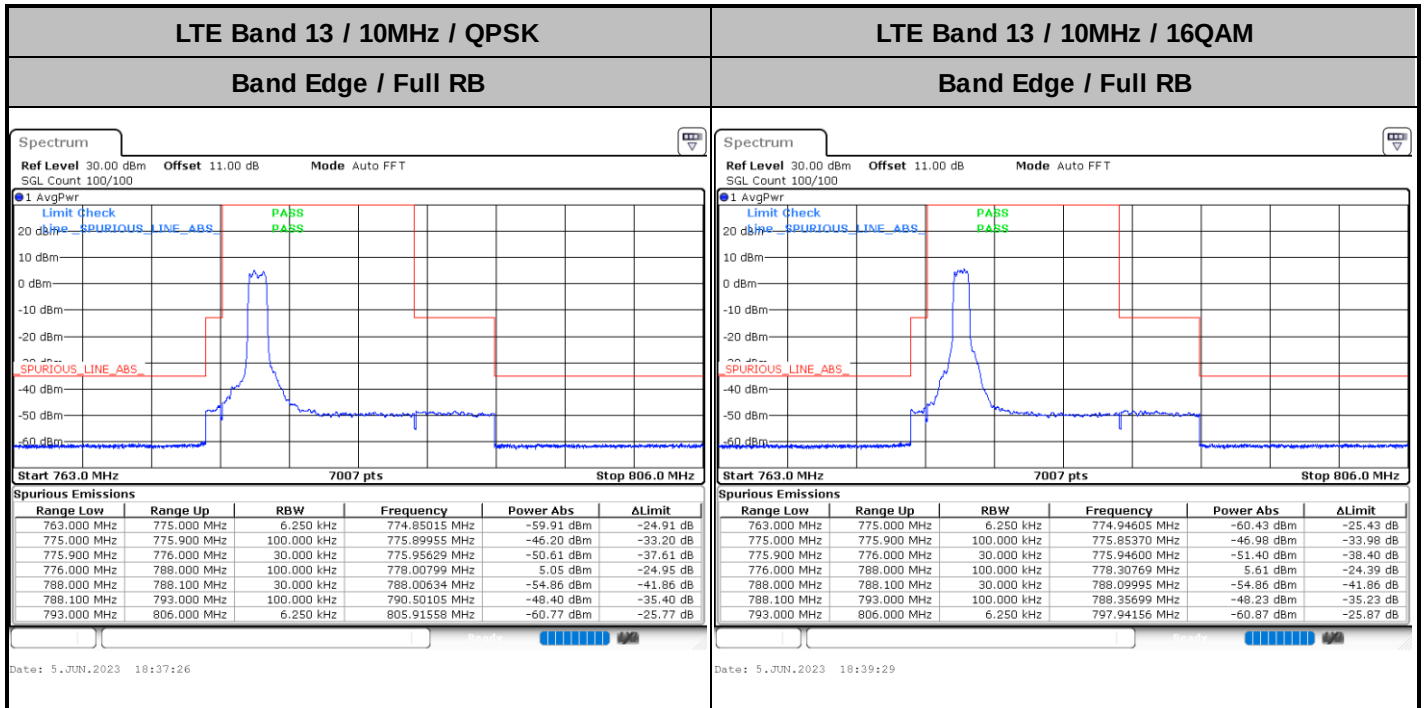


Lowest Band Edge / Full RB



Highest Band Edge / Full RB



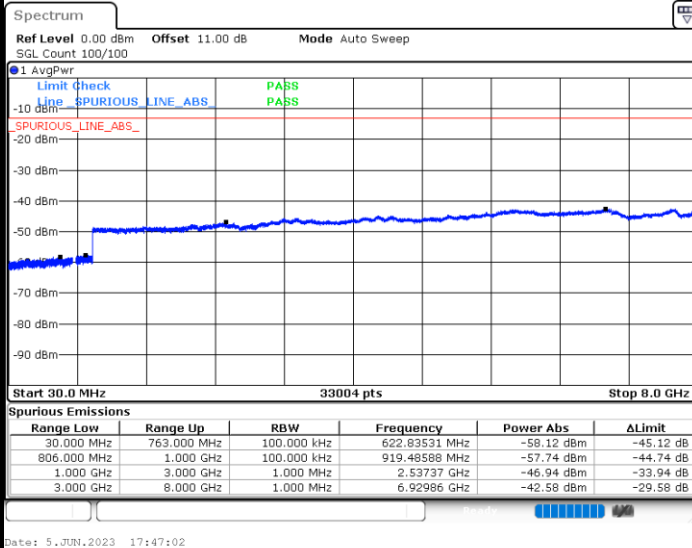




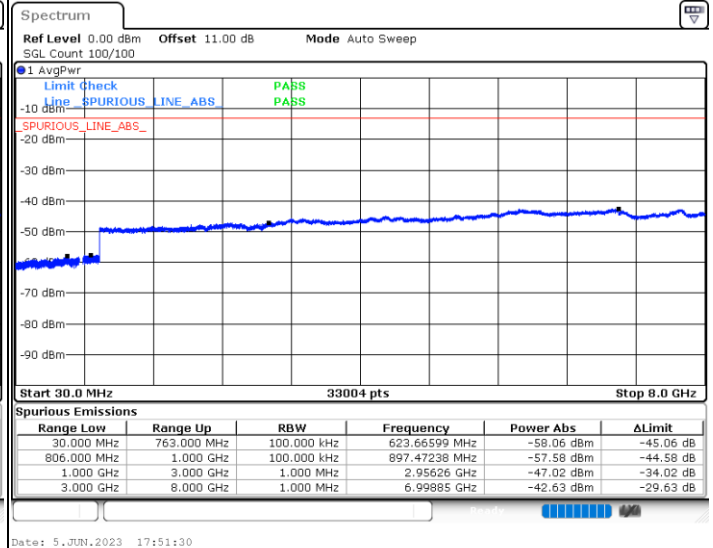
Conducted Spurious Emission

LTE Band 13 / 5MHz

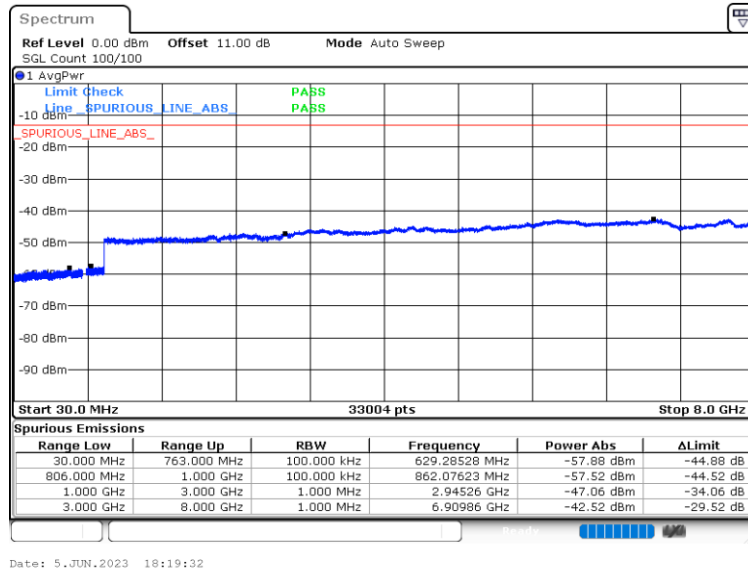
Lowest Channel / QPSK



Middle Channel / QPSK



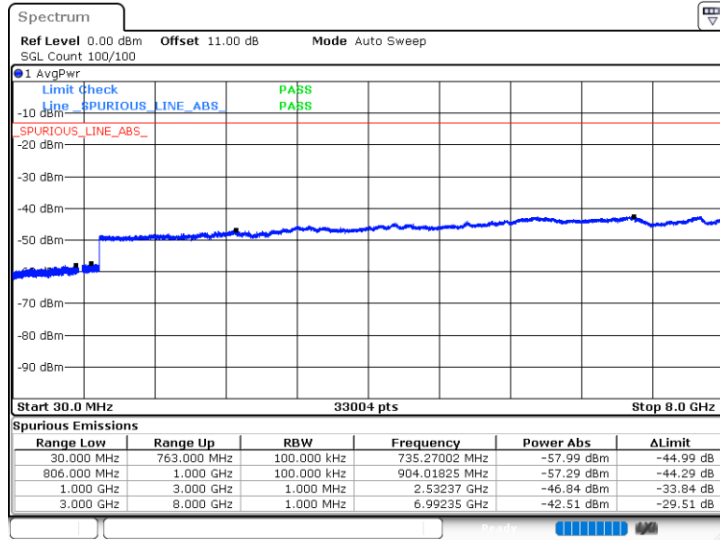
Highest Channel / QPSK





LTE Band 13 / 10MHz

Middle Channel / QPSK



Date: 17.JUN.2023 13:19:07

Frequency Stability

Test Conditions		LTE Band 13 (QPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0064	PASS
40	Normal Voltage	0.0235	
30	Normal Voltage	0.0161	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0082	
0	Normal Voltage	0.0063	
-10	Normal Voltage	0.0029	
-20	Normal Voltage	0.0239	
-30	Normal Voltage	0.0047	
20	Maximum Voltage	0.0223	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0014	

Note:

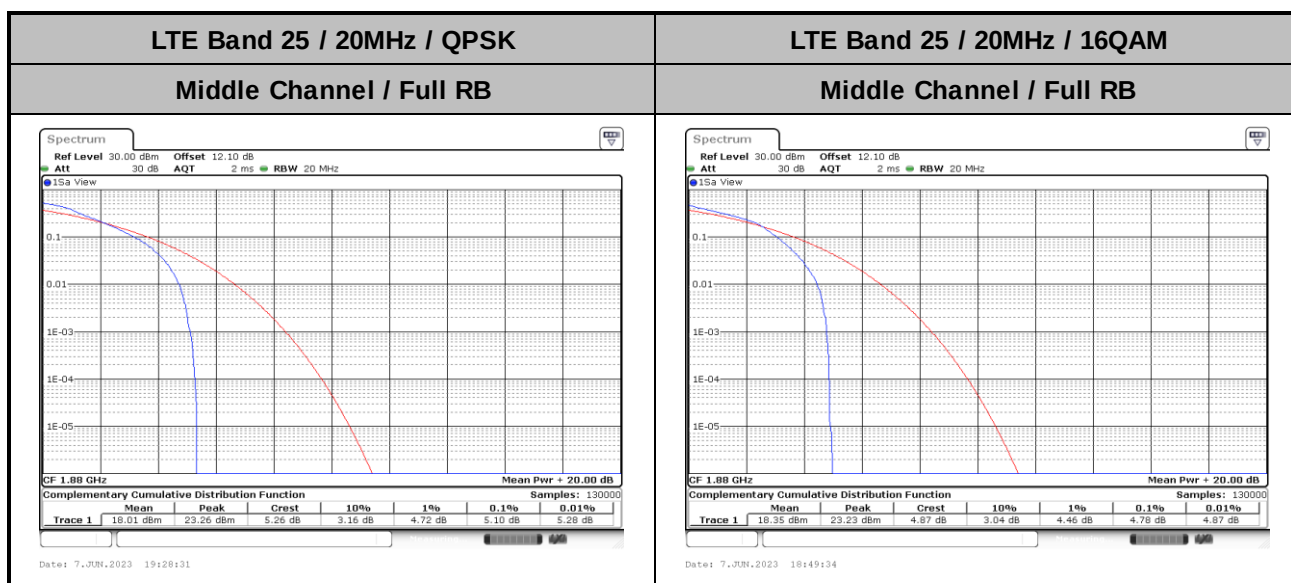
1. Normal Voltage =3.7 V. ; Battery End Point (BEP) =3.4 V. ; Maximum Voltage =4.2 V.
2. The frequency fundamental emissions stay within the authorized frequency block.



LTE Band 25

Peak-to-Average Ratio

Mode	LTE Band 25 / 20MHz		
Mod.	QPSK	16QAM	Limit: 13dB
RB Size	Full RB	Full RB	Result
Middle CH	5.10	4.78	PASS



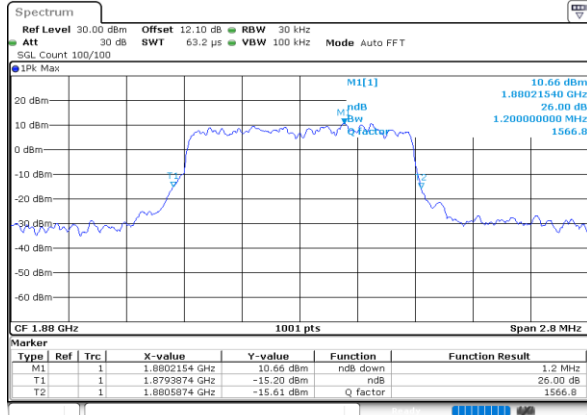
**26dB Bandwidth**

Mode	LTE Band 25 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	1.20	1.05	1.37	1.22	1.33	1.16	1.78	1.62	1.74	1.59	1.80	1.60
Mode	LTE Band 25 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

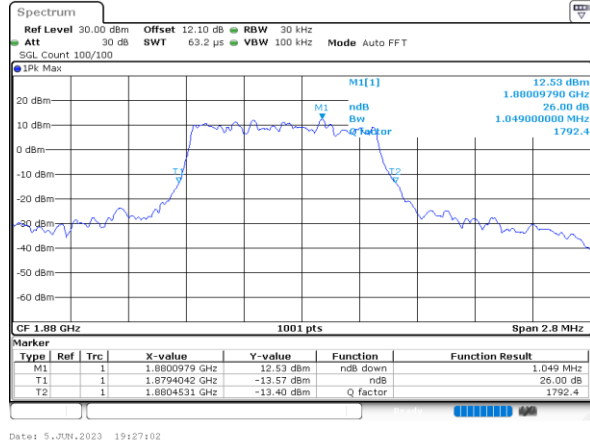


LTE Band 25

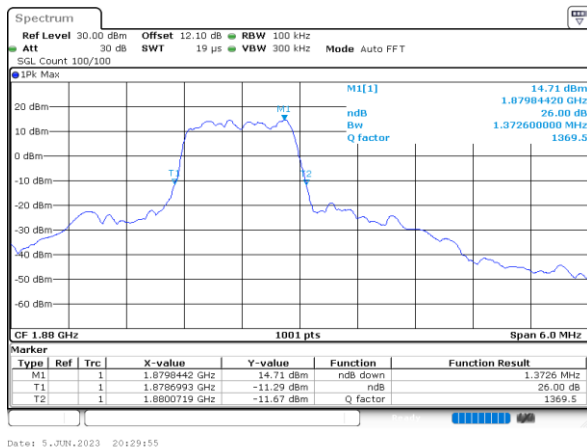
Middle Channel / 1.4MHz / QPSK



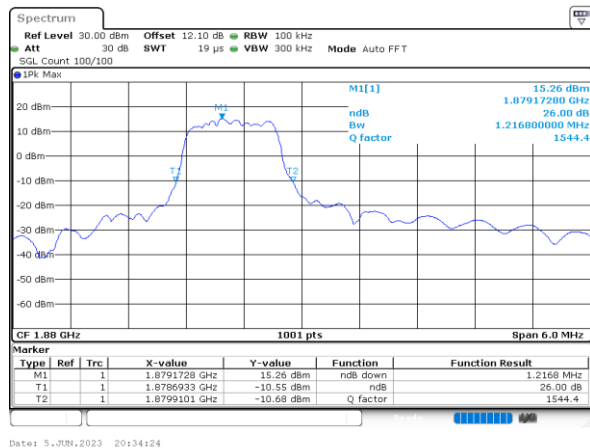
Middle Channel / 1.4MHz / 16QAM



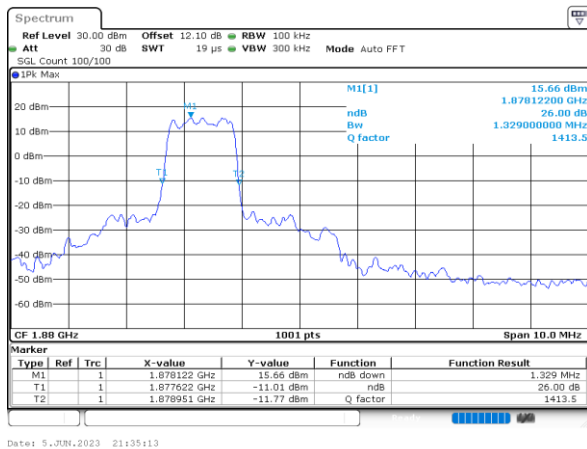
Middle Channel / 3MHz / QPSK



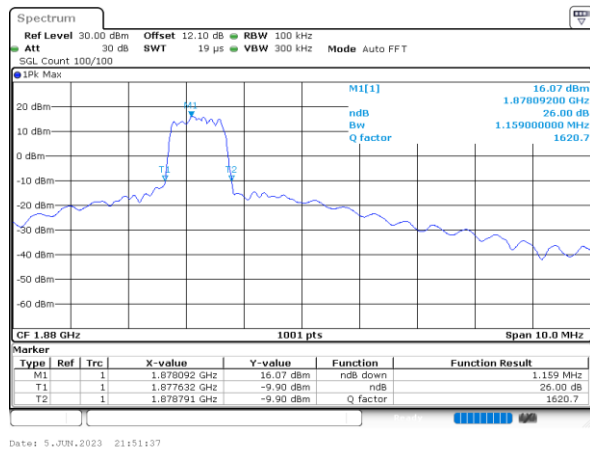
Middle Channel / 3MHz / 16QAM



Middle Channel / 5MHz / QPSK



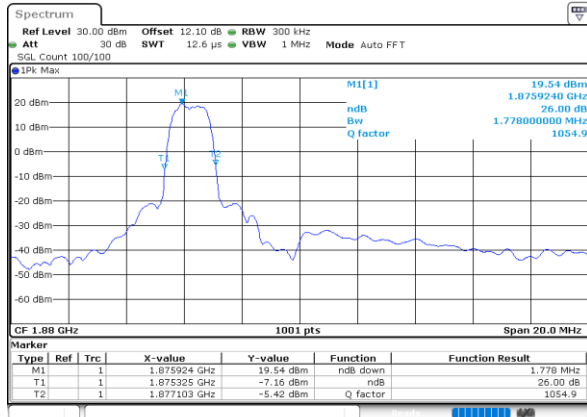
Middle Channel / 5MHz / 16QAM





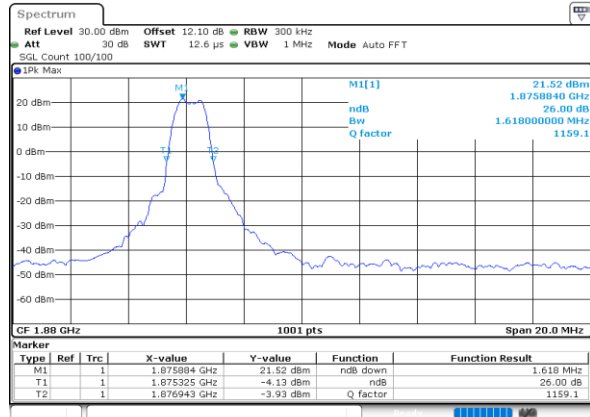
LTE Band 25

Middle Channel / 10MHz / QPSK



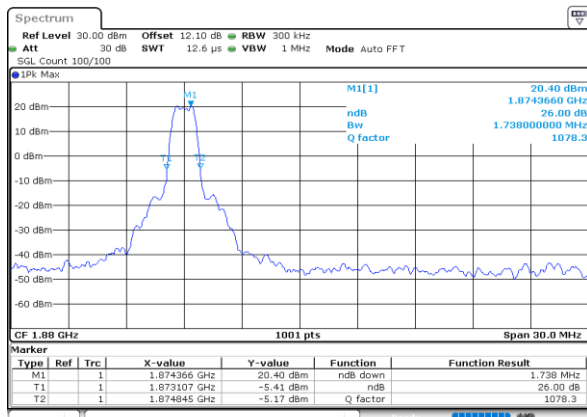
Date: 5 JUN 2023 22:31:52

Middle Channel / 10MHz / 16QAM



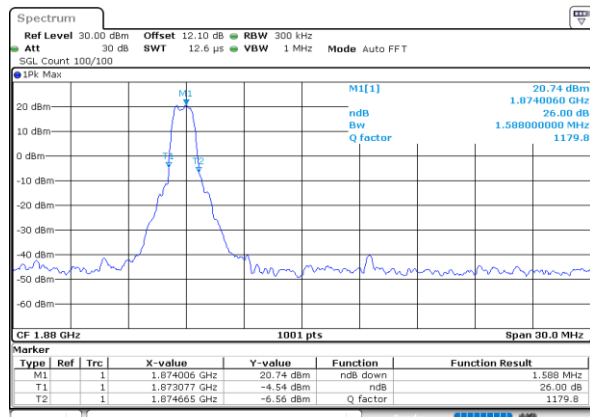
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Middle Channel / 15MHz / QPSK



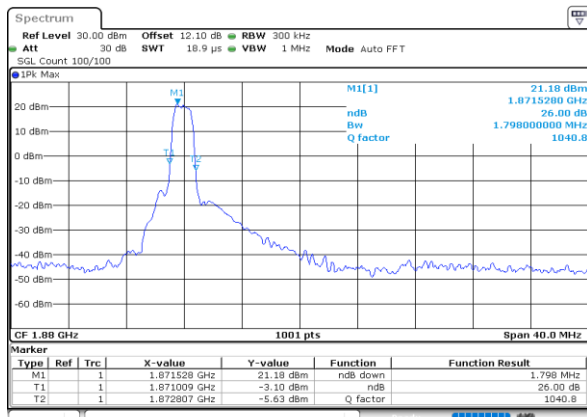
Date: 5 JUN 2023 23:21:59

Middle Channel / 15MHz / 16QAM



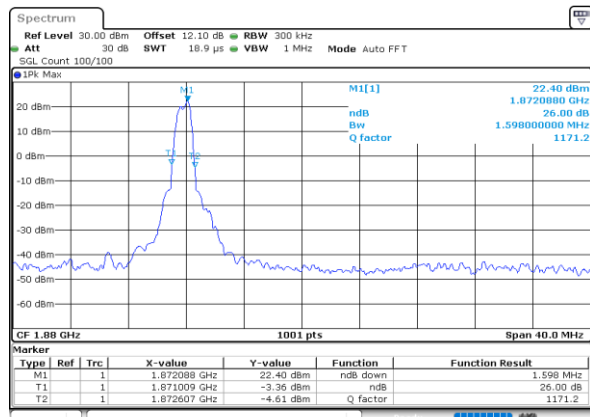
Date: 5 JUN 2023 23:27:03

Middle Channel / 20MHz / QPSK



Date: 7 JUN 2023 18:57:56

Middle Channel / 20MHz / 16QAM



Date: 7 JUN 2023 18:46:23

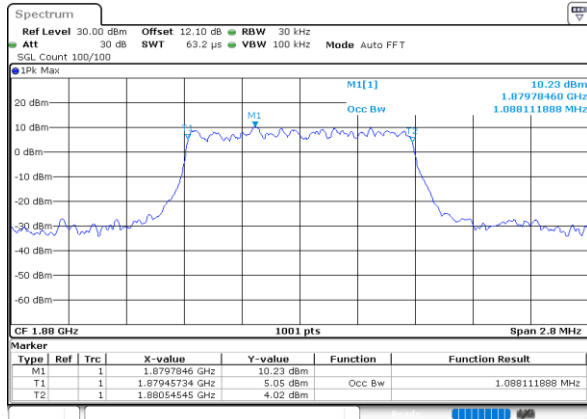
**Occupied Bandwidth**

Mode	LTE Band 25 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	1.09	0.90	1.17	1.04	1.17	0.98	1.42	1.30	1.41	1.29	1.48	1.28
Mode	LTE Band 25 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	-	-	-	-	-	-	-	-	-	-	-	-

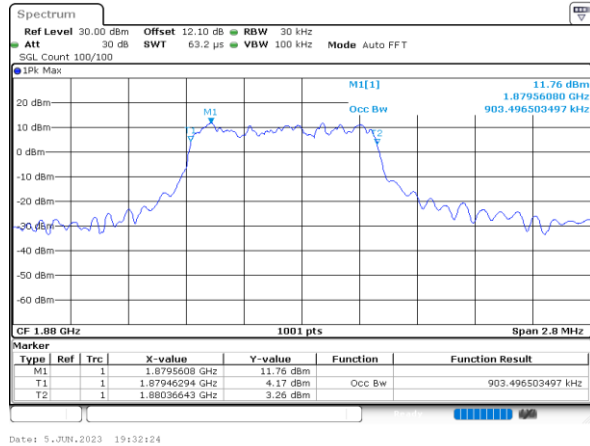


LTE Band 25

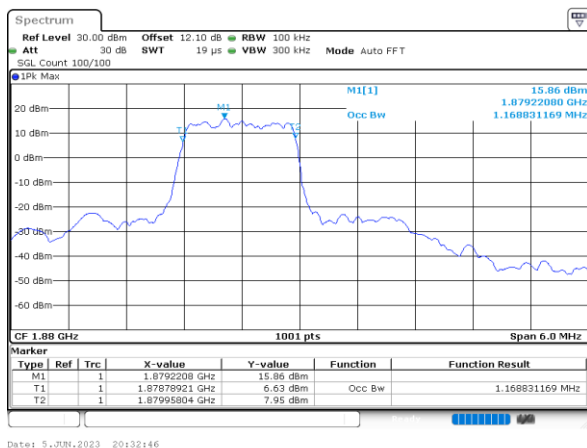
Middle Channel / 1.4MHz / QPSK



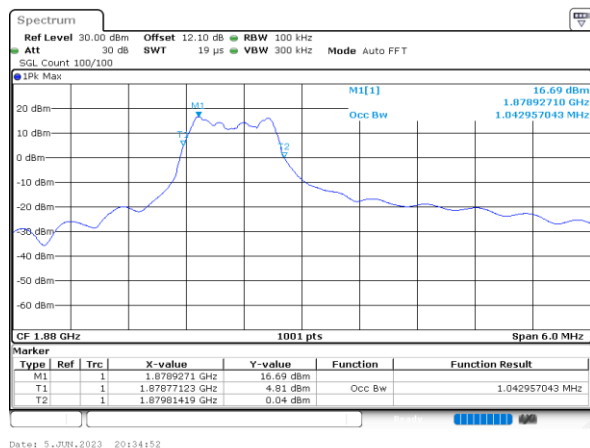
Middle Channel / 1.4MHz / 16QAM



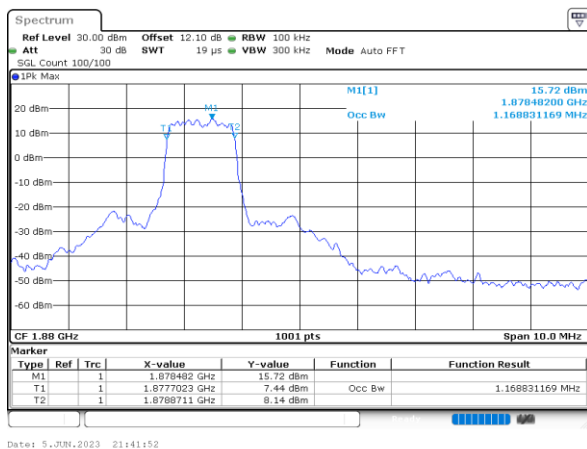
Middle Channel / 3MHz / QPSK



Middle Channel / 3MHz / 16QAM



Middle Channel / 5MHz / QPSK



Middle Channel / 5MHz / 16QAM

