FCC RADIO TEST REPORT

FCC ID	:	**LHJ-BL28NA001**
Equipment	:	**Wireless Modem Module**
Brand Name	:	**BL28NA-001**
Model Name	:	**BL28NA-001**
Marketing Name	:	**BL28NA-001**
Applicant	:	**Continental Automotive Systems, Inc. 21440 W Lake Cook Rd.**
Manufacturer	:	**Continental Automotive Systems, Inc. 21440 W Lake Cook Rd.**
Standard	:	**FCC 47 CFR Part 2, 22(H), 24(E), 27**

The product was received on Jun. 22, 2020 and testing was started from Jun. 23, 2020 and completed on Jul. 07, 2020. 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 variant report apply exclusively to the tested model / sample. Without written approval of 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, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FG062001	01	Initial issue of report	Jul. 15, 2020

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)(2)	Effective Radiated Power (Band 5)	Pass	
	§27.50 (b)(10) §27.50 (c)(10)	Effective Radiated Power (Band 12) (Band 13)		
	§24.232 (c) §27.50 (h)(2)	Equivalent Isotropic Radiated Power (Band 2) (Band 7)		
	§27.50 (d)(4)	Equivalent Isotropic Radiated Power (Band 4)		
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)	Pass	-
	§2.1051 §27.53 (m)(4)	Conducted Band Edge Measurement (Band 7)		
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)	Pass	-
	§2.1051 §27.53 (m)(4)	Conducted Spurious Emission (Band 7)		
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)	Pass	Under limit 9.76 dB at 1560.000 MHz
	§2.1051 §27.53 (m)(4)	Radiated Spurious Emission (Band 7)		
Remark: This is a variant report by CIIPC change. All the test cases were performed on original report which can be referred to FCC ID: LHJ-BL28NA001.				

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Yimin Ho

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Wireless Modem Module
Brand Name	BL28NA-001
Model Name	BL28NA-001
Marketing Name	BL28NA-001
FCC ID	LHJ-BL28NA001
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/GNSS
HW Version	BL28NA001
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz
Rx Frequency	LTE Band 2: 1930.7 MHz ~ 1989.3 MHz LTE Band 4: 2110.7 MHz ~ 2154.3 MHz LTE Band 5: 869.7 MHz ~ 893.3 MHz LTE Band 7: 2622.5MHz ~ 2687.5 MHz LTE Band 12: 729.7 MHz ~ 745.3 MHz LTE Band 13: 748.5 MHz ~ 753.5 MHz
Bandwidth	LTE Band 2: 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz LTE Band 4: 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz LTE Band 5: 1.4MHz / 3MHz / 5MHz / 10MHz LTE Band 7: 5MHz / 10MHz / 15MHz / 20MHz LTE Band 12: 1.4MHz / 3MHz / 5MHz / 10MHz LTE Band 13: 5MHz / 10MHz
Maximum Output Power to Antenna	LTE Band 2 : 21.43 dBm LTE Band 4 : 21.82 dBm LTE Band 5 : 22.47 dBm LTE Band 7 : 21.81 dBm LTE Band 12 : 22.37 dBm LTE Band 13 : 22.22 dBm
Antenna Type / Gain	LTE Band 2 : Fixed External Antenna with gain 2 dBi LTE Band 4 : Fixed External Antenna with gain 2 dBi LTE Band 5 : Fixed External Antenna with gain 2 dBi LTE Band 7 : Fixed External Antenna with gain 2 dBi LTE Band 12 : Fixed External Antenna with gain 2 dBi LTE Band 13 : Fixed External Antenna with gain 2 dBi
Type of Modulation	QPSK / 16QAM

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH05-HY
Test Engineer	Bryant Liu
Temperature	22~25°C
Relative Humidity	50~53 %

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH13-HY
Test Engineer	Daniel Lee, Jacky Hung, and Wilson Wu
Temperature	20.0~25.0°C
Relative Humidity	49.5~60.0 %

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

FCC Designation No.: TW1190 and TW0007

1.5 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 test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

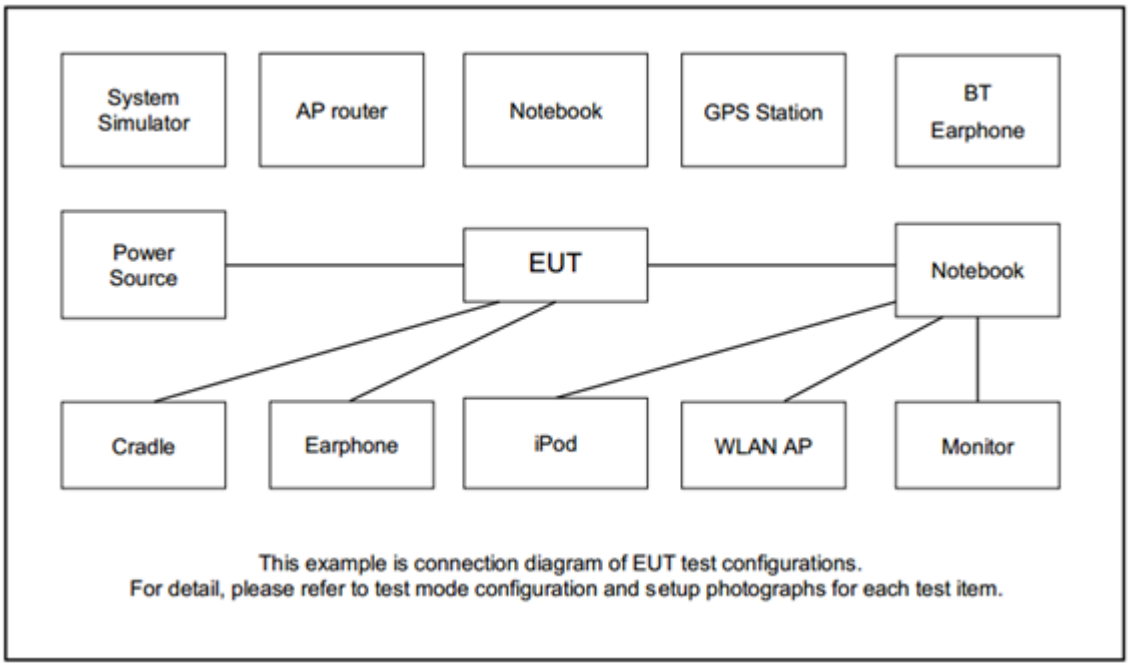
Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in two angles of antenna, Horizontal angle and Vertical angle. The worst cases (Ant. Vertical) were recorded in this report.

Test Items	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Max. Output Power	2	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
	5	v	v	v	v	-	-		v		v	v	v	v	v	v
	7	-	-	v	v	v	v		v		v	v	v	v	v	v
	12	v	v	v	v	-	-		v		v	v	v	v	v	v
	13	-	-	v	v	-	-		v		v	v	v	v	v	v
Peak-to-Average Ratio	2						v		v		v		v	v	v	v
	4						v		v		v		v	v	v	v
	5				v	-	-		v		v		v	v	v	v
	7	-	-				v		v		v		v	v	v	v
	12				v	-	-		v		v		v	v	v	v
	13	-	-		v	-	-		v		v		v	v	v	v
26dB and 99% Bandwidth	2	v	v	v	v	v	v		v				v	v	v	v
	4	v	v	v	v	v	v		v				v	v	v	v
	5	v	v	v	v	-	-		v				v	v	v	v
	7	-	-	v	v	v	v		v				v	v	v	v
	12	v	v	v	v	-	-		v				v	v	v	v
	13	-	-	v	v	-	-		v				v	v	v	v
Conducted Band Edge	2	v	v	v	v	v	v		v		v		v	v		v
	4	v	v	v	v	v	v		v		v		v	v		v
	5	v	v	v	v	-	-		v		v		v	v		v
	7	-	-	v	v	v	v		v		v		v	v		v
	12	v	v	v	v	-	-		v		v		v	v		v
	13	-	-	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	64QAM	1	Half	Full	L	M	H
Conducted Spurious Emission	2	v	v	v	v	v	v		v		v			v	v	v
	4	v	v	v	v	v	v		v		v			v	v	v
	5	v	v	v	v	-	-		v		v			v	v	v
	7	-	-	v	v	v	v		v		v			v	v	v
	12	v	v	v	v	-	-		v		v			v	v	v
	13	-	-	v	v	-	-		v		v			v	v	v
Frequency Stability	2				v				v				v		v	
	4				v				v				v		v	
	5				v	-	-		v				v		v	
	7	-	-		v				v				v		v	
	12				v	-	-		v				v		v	
	13	-	-		v	-	-		v				v		v	
E.R.P / E.I.R.P	2	v	v	v	v	v	v		v		v			v	v	v
	4	v	v	v	v	v	v		v		v			v	v	v
	5	v	v	v	v	-	-		v		v			v	v	v
	7	-	-	v	v	v	v		v		v			v	v	v
	12	v	v	v	v	-	-		v		v			v	v	v
	13	-	-	v	v	-	-		v		v			v	v	v
Radiated Spurious Emission	2	Worst Case												v	v	v
	4	Worst Case												v	v	v
	5	Worst Case												v	v	v
	7	Worst Case												v	v	v
	12	Worst Case												v	v	v
	13	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.															

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	LTE Dipole	Larsen	SPDA24700/2700	N/A	N/A	N/A
2.	AC Adapter	Qualtek	ATS018T-W120U	N/A	N/A	N/A
3.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 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 :

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

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 7 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	20850	21100	21350
	Frequency	2510	2535	2560
15	Channel	20825	21100	21375
	Frequency	2507.5	2535	2562.5
10	Channel	20800	21100	21400
	Frequency	2505	2535	2565
5	Channel	20775	21100	21425
	Frequency	2502.5	2535	2567.5

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

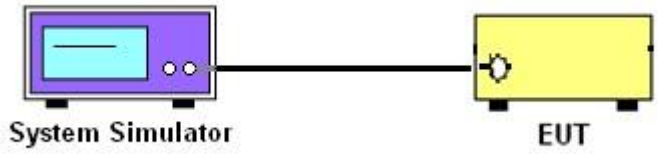
3 Conducted Test Items

3.1 Measuring Instruments

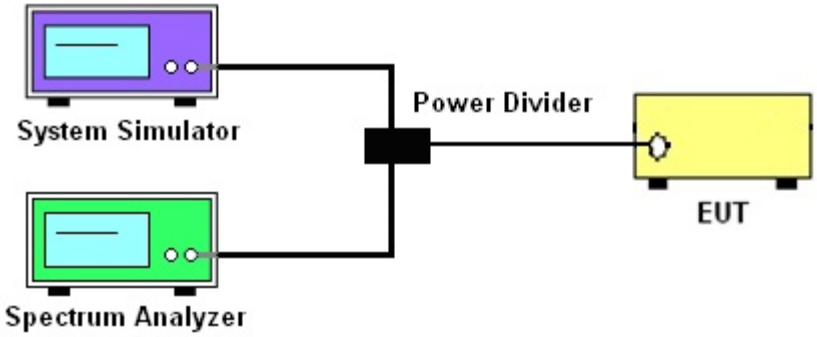
See list of measuring instruments of this test report.

3.1.1 Test Setup

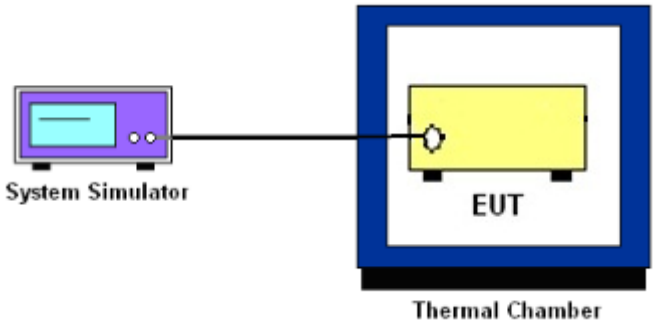
3.1.2 Conducted Output Power



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

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

The EIRP of mobile transmitters must not exceed 2 Watts for LTE Band 2 and Band 7

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

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 + 10log10(P[Watts]) dB below the transmitter power P(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 + 10log10(P[Watts]) dB below the transmitter power P(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[Watts]) dB below the transmitter power P(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 log10 p(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 + 10log10(P[Watts]) dB below the transmitter power P(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, the FCC limit is 43 + $10\log_{10}$(P[Watts]) dB below the transmitter power P(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.

27.53(m)(4)

For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

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 >= 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 + 10log(P)dB below the transmitter power P(Watts)
   For LTE Band 7
   The other 40 dB, and 55 dB have additionally applied same calculation above.

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.

For LTE Band 7

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 55 + 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 10^{th} 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 middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. Set spectrum analyzer with RMS detector.
7. Taking the record of maximum spurious emission.
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
9. The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   For LTE Band 7

   The limit line is derived from 55 + 10log(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 ±0.00025% (±2.5ppm) 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±5° 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.

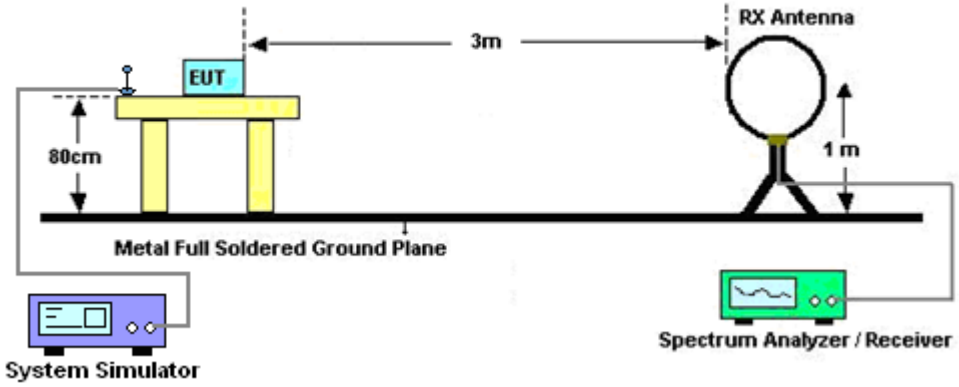
4 Radiated Test Items

4.1 Measuring Instruments

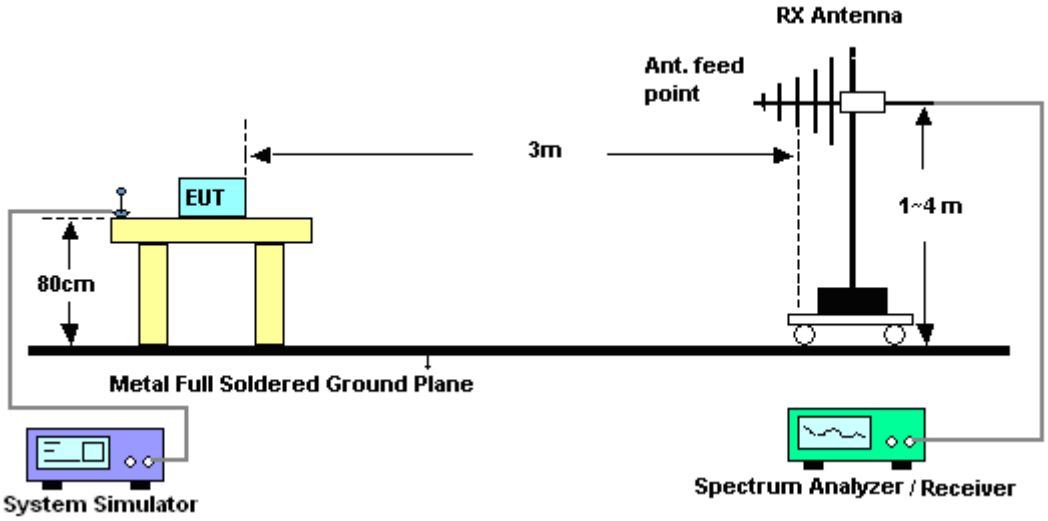
See list of measuring instruments of this test report.

4.1.1 Test Setup

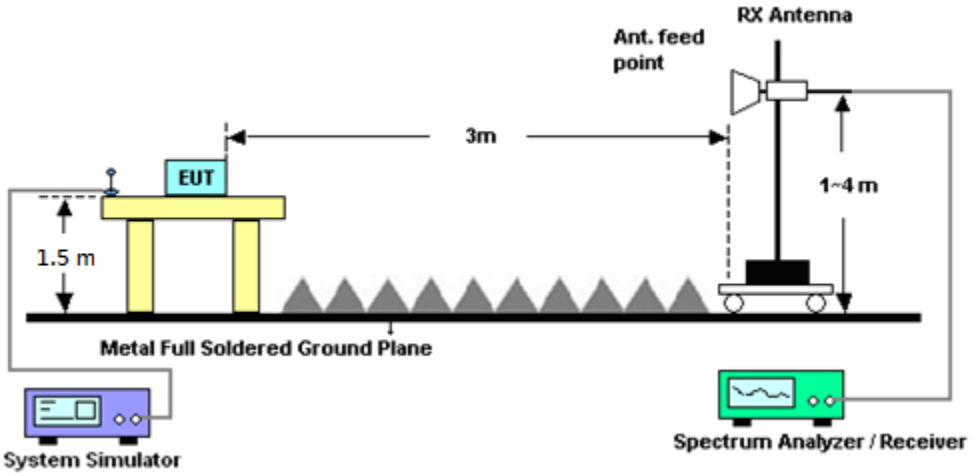
For radiated emissions below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



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 a comparison data 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 7

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 55 + 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 + 10log(P)dB below the transmitter power P(Watts)

    For LTE Band 7

    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)

    EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain

    ERP (dBm) = EIRP - 2.15

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201026480	MIMO/LTE(FDD)/IP Throughput	Dec. 27, 2019	Jun. 23, 2020 ~ Jul. 03, 2020	Dec. 26, 2020	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 15, 2019	Jun. 23, 2020 ~ Jul. 03, 2020	Nov. 14, 2020	Conducted (TH05-HY)
Temperature Chamber	ESPEC	SH-641	92013720	-40℃~90℃	Sep. 02, 2019	Jun. 23, 2020 ~ Jul. 03, 2020	Sep. 01, 2020	Conducted (TH05-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890094	1V~20V 0.5A~5A	Oct. 09, 2019	Jun. 23, 2020 ~ Jul. 03, 2020	Oct. 08, 2020	Conducted (TH05-HY)
Coupler	Warison	20dB 25W SMA Directional Coupler	#A	1-18GHz	Jan. 13, 2020	Jun. 23, 2020 ~ Jul. 03, 2020	Jan. 12, 2021	Conducted (TH05-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 17, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Dec. 16, 2020	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	40103&07	30MHz to 1GHz	Apr. 29, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Apr. 28, 2021	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	41912 & 07	30MHz to 1GHz	Apr. 29, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Apr. 28, 2021	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz ~ 18GHz	May 20, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	May 19, 2021	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1GHz ~ 18GHz	Sept. 19, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Sep. 18, 2020	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 19, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	May 18, 2021	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270147	1GHz~26.5GHz	Oct. 28, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Oct. 27, 2020	Radiation (03CH13-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Aug. 27, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Aug. 26, 2020	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 20, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Mar. 19, 2021	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jun. 23, 2020 ~ Jul. 07, 2020	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jun. 23, 2020 ~ Jul. 07, 2020	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jun. 23, 2020 ~ Jul. 07, 2020	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-000992	N/A	N/A	Jun. 23, 2020 ~ Jul. 07, 2020	N/A	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 13, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Dec. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 12, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Feb. 21, 2021	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 12, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Feb. 21, 2021	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 25, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Feb. 24, 2021	Radiation (03CH13-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 10, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Dec. 09, 2020	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA91709800	18GHz~40GHz	Jan. 10, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Jan. 09, 2021	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60SS	SN2	3GHz High Pass Filter	Jul. 14, 2019	Jun. 23, 2020 ~ Jul. 07, 2020	Jul. 13, 2020	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60SS	SN1	1.2GHz High Pass Filter	Mar. 18, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Mar. 17, 2021	Radiation (03CH13-HY)
Hygrometer	TECPEL	DTM-303A	TP190075	N/A	Apr. 23, 2020	Jun. 23, 2020 ~ Jul. 07, 2020	Apr. 22, 2021	Radiation (03CH13-HY)

6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.21**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.24**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.99**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

LTE Band 2 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
20	1	0	16-QAM	21.09	21.19	21.18
20	1	49		21.40	21.19	21.27
20	1	99		21.05	21.01	21.02
20	50	0		20.25	20.28	20.33
20	50	24		20.34	20.15	20.34
20	50	50		20.20	20.14	20.25
20	100	0		20.24	20.17	20.33
15	1	0	16-QAM	21.03	21.15	21.32
15	1	37		**21.43**	21.26	21.34
15	1	74		21.12	21.02	21.03
15	36	0		20.25	20.20	20.36
15	36	20		20.31	20.18	20.34
15	36	39		20.30	20.12	20.25
15	75	0		20.25	20.18	20.28
10	1	0	16-QAM	21.03	21.17	21.21
10	1	25		21.37	21.19	21.24
10	1	49		21.13	21.02	21.07
10	25	0		20.16	20.21	20.40
10	25	12		20.27	20.20	20.29
10	25	25		20.34	20.18	20.23
10	50	0		20.26	20.18	20.32
5	1	0	16-QAM	21.05	21.03	21.12
5	1	12		21.23	21.18	21.29
5	1	24		21.03	21.06	21.05
5	12	0		20.08	20.08	20.17
5	12	7		20.05	20.23	20.26
5	12	13		20.08	20.10	20.22
5	25	0		20.07	20.09	20.13
3	1	0	16-QAM	21.02	21.01	21.13
3	1	8		21.01	21.05	21.12
3	1	14		21.04	21.14	21.05
3	8	0		20.08	20.08	20.19
3	8	4		20.07	20.06	20.16
3	8	7		20.09	20.14	20.15
3	15	0		20.06	20.10	20.17
1.4	1	0	16-QAM	21.10	21.08	21.01
1.4	1	3		21.17	21.12	21.28
1.4	1	5		21.14	21.10	21.10
1.4	3	0		21.18	21.15	21.15
1.4	3	1		21.14	21.22	21.18
1.4	3	3		21.10	21.10	21.12
1.4	6	0		20.05	20.07	20.12

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
20	1	0	16-QAM	21.08	21.17	**21.82**
20	1	49		21.06	21.52	21.66
20	1	99		21.32	21.57	21.30
20	50	0		20.04	20.38	20.77
20	50	24		20.13	20.55	20.71
20	50	50		20.24	20.52	20.51
20	100	0		20.12	20.56	20.73
15	1	0	16-QAM	21.01	21.14	21.69
15	1	37		21.05	21.62	21.75
15	1	74		21.02	21.48	21.33
15	36	0		20.04	20.45	20.76
15	36	20		20.04	20.54	20.62
15	36	39		20.13	20.53	20.53
15	75	0		20.04	20.56	20.64
10	1	0	16-QAM	21.04	21.18	21.61
10	1	25		21.05	21.46	21.47
10	1	49		21.01	21.46	21.37
10	25	0		20.00	20.56	20.68
10	25	12		20.00	20.52	20.56
10	25	25		20.01	20.52	20.44
10	50	0		20.01	20.54	20.55
5	1	0	16-QAM	21.04	21.28	21.37
5	1	12		21.05	21.48	21.45
5	1	24		21.06	21.24	21.18
5	12	0		21.00	20.54	20.35
5	12	7		21.02	20.53	20.42
5	12	13		21.05	20.52	20.36
5	25	0		21.06	20.50	20.41
3	1	0	16-QAM	21.00	21.25	21.21
3	1	8		21.01	21.29	21.20
3	1	14		21.01	21.34	21.11
3	8	0		20.01	20.52	20.28
3	8	4		20.02	20.50	20.25
3	8	7		20.03	20.49	20.29
3	15	0		20.01	20.49	20.26
1.4	1	0	16-QAM	21.03	21.32	21.31
1.4	1	3		21.05	21.48	21.36
1.4	1	5		21.03	21.28	21.22
1.4	3	0		21.02	21.53	21.26
1.4	3	1		21.00	21.58	21.44
1.4	3	3		21.01	21.50	21.37
1.4	6	0		20.01	20.50	20.33

LTE Band 5 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	16-QAM	22.20	21.90	21.22
10	1	25		22.34	21.77	21.33
10	1	49		21.95	21.20	21.20
10	25	0		21.26	20.90	20.32
10	25	12		21.25	20.79	20.23
10	25	25		21.09	20.60	20.09
10	50	0		21.20	20.78	20.22
5	1	0	16-QAM	22.19	21.64	21.00
5	1	12		**22.47**	21.78	21.14
5	1	24		22.02	21.37	21.12
5	12	0		21.35	20.65	20.17
5	12	7		21.36	20.71	20.06
5	12	13		21.30	20.59	20.03
5	25	0		21.27	20.69	20.09
3	1	0	16-QAM	22.23	21.63	21.16
3	1	8		22.18	21.70	21.05
3	1	14		22.34	21.51	21.03
3	8	0		21.33	20.69	20.28
3	8	4		21.35	20.81	20.13
3	8	7		21.42	20.81	20.09
3	15	0		21.40	20.81	20.16
1.4	1	0	16-QAM	22.30	21.68	21.01
1.4	1	3		22.32	21.76	21.13
1.4	1	5		22.15	21.67	21.10
1.4	3	0		22.40	21.74	21.06
1.4	3	1		22.39	21.78	21.10
1.4	3	3		22.41	21.77	21.13
1.4	6	0		21.31	20.71	20.01

LTE Band 7 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
20	1	0	16-QAM	21.43	21.44	21.41
20	1	49		21.54	21.68	21.17
20	1	99		21.48	21.65	21.12
20	50	0		20.56	20.58	20.48
20	50	24		20.60	20.60	20.29
20	50	50		20.60	20.71	20.44
20	100	0		20.61	20.64	21.57
15	1	0	16-QAM	21.47	21.45	21.70
15	1	37		**21.81**	21.73	21.36
15	1	74		21.46	21.52	21.09
15	36	0		20.57	20.59	20.54
15	36	20		20.61	20.60	20.26
15	36	39		20.64	20.65	20.28
15	75	0		20.58	20.62	20.39
10	1	0	16-QAM	21.46	21.49	21.35
10	1	25		21.73	21.52	21.15
10	1	49		21.44	21.52	21.10
10	25	0		20.53	20.59	20.27
10	25	12		20.56	20.63	20.29
10	25	25		20.61	20.63	20.29
10	50	0		20.57	20.64	20.29
5	1	0	16-QAM	21.39	21.33	21.07
5	1	12		21.65	21.67	21.01
5	1	24		21.38	21.44	21.00
5	12	0		20.47	20.57	20.19
5	12	7		20.55	20.66	20.13
5	12	13		20.50	20.48	20.23
5	25	0		20.48	20.57	20.13

LTE Band 12 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	16-QAM	21.64	21.90	22.11
10	1	25		22.10	22.35	22.29
10	1	49		22.28	22.18	21.94
10	25	0		20.97	21.24	21.31
10	25	12		21.17	21.30	21.38
10	25	25		21.37	21.35	21.26
10	50	0		21.17	21.33	21.35
5	1	0	16-QAM	21.56	22.08	22.12
5	1	12		22.08	22.33	22.34
5	1	24		21.88	22.17	21.80
5	12	0		20.61	21.33	21.38
5	12	7		21.02	21.25	21.24
5	12	13		21.09	21.41	21.12
5	25	0		20.97	21.30	21.18
3	1	0	16-QAM	21.63	22.08	22.14
3	1	8		21.71	22.17	21.94
3	1	14		21.83	22.10	21.95
3	8	0		20.79	21.30	21.24
3	8	4		20.92	21.30	21.14
3	8	7		21.02	21.29	21.05
3	15	0		20.89	21.26	21.16
1.4	1	0	16-QAM	21.84	22.11	22.05
1.4	1	3		21.77	22.31	21.96
1.4	1	5		21.64	22.23	21.92
1.4	3	0		21.81	22.26	22.25
1.4	3	1		21.90	**22.37**	22.18
1.4	3	3		21.81	22.35	22.04
1.4	6	0		20.72	21.27	21.03

LTE Band 13 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	16-QAM	-	21.87	-
10	1	25			21.82	
10	1	49			21.39	
10	25	0			20.94	
10	25	12			20.81	
10	25	25			20.83	
10	50	0			20.84	
5	1	0	16-QAM	21.99	21.79	21.64
5	1	12		**22.22**	21.83	21.89
5	1	24		21.63	21.62	21.34
5	12	0		21.18	20.78	20.84
5	12	7		20.93	20.69	20.75
5	12	13		20.73	20.72	20.64
5	25	0		20.92	20.81	20.77

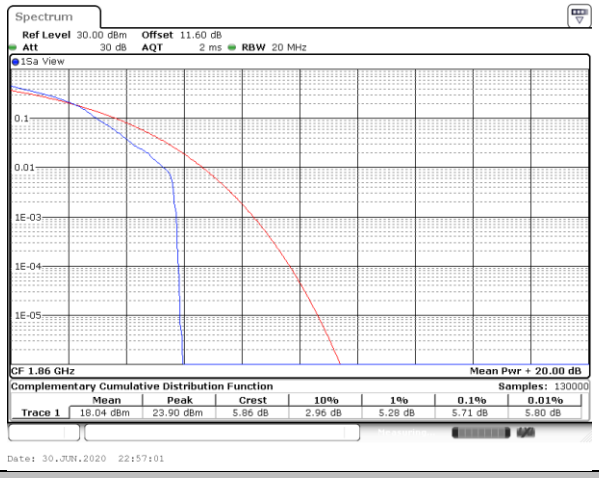
LTE Band 2

Peak-to-Average Ratio

Mode	LTE Band 2 / 20MHz				
Mod.	QPSK		16QAM		Limit: 13dB
RB Size	1RB	Full RB	1RB	Full RB	Result
Lowest CH	-	-	5.71	5.94	PASS
Middle CH	-	-	5.71	5.91	
Highest CH	-	-	5.39	5.86	

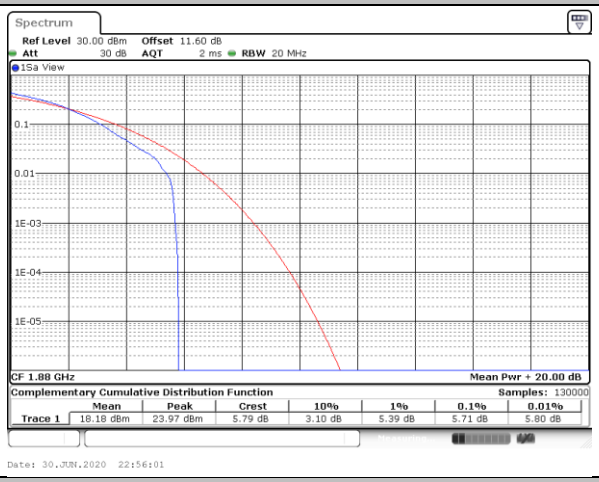
LTE Band 2 / 20MHz / 16QAM

Lowest Channel / 1RB

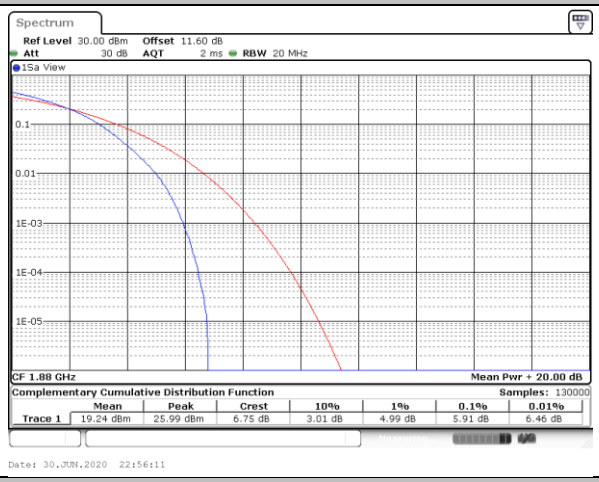


Lowest Channel / Full RB

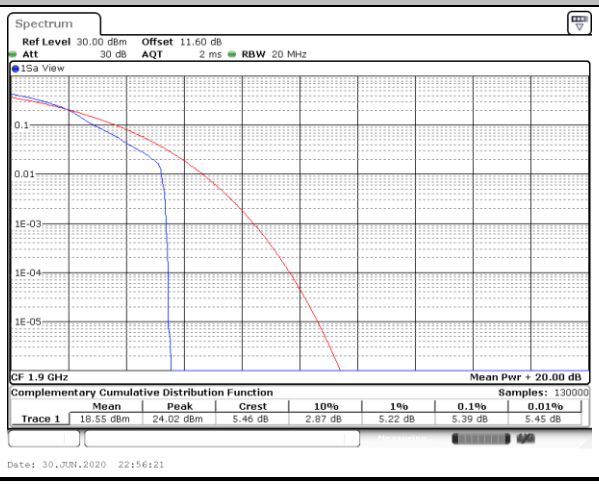
Middle Channel / 1RB



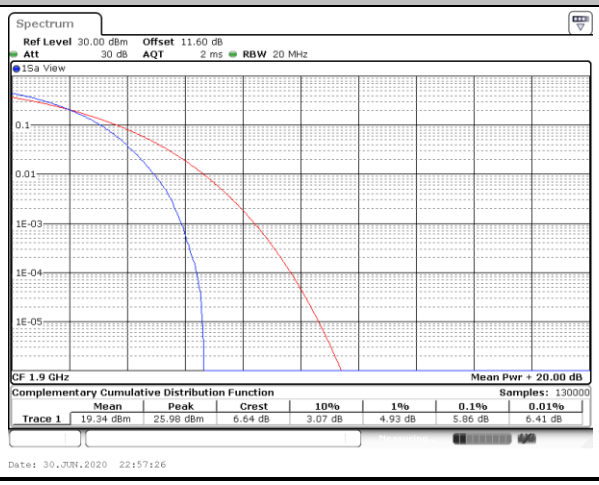
Middle Channel / Full RB



Highest Channel / 1RB



Highest Channel / Full RB

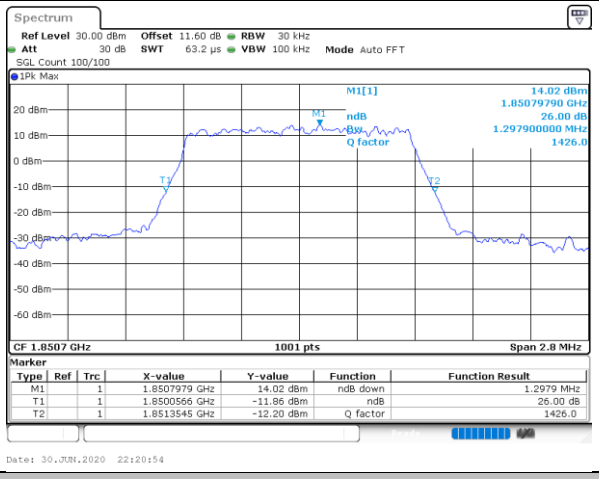


26dB Bandwidth

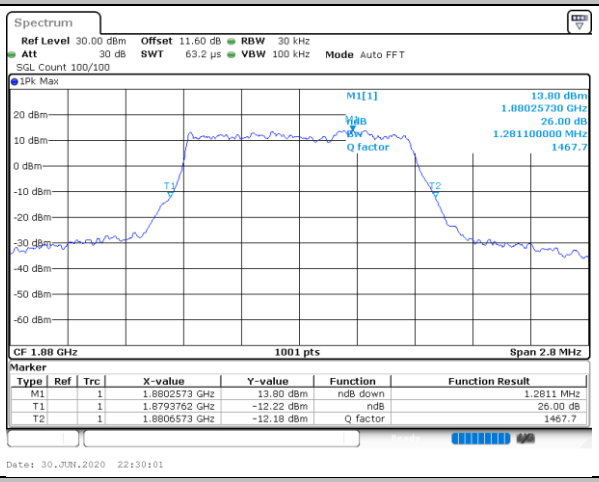
Mode	LTE Band 2 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	1.30	-	3.02	-	4.99	-	9.87	-	14.18	-	18.94
Middle CH	-	1.28	-	3.00	-	4.96	-	9.93	-	14.42	-	19.02
Highest CH	-	1.33	-	3.00	-	4.91	-	9.79	-	14.24	-	19.34

LTE Band 2

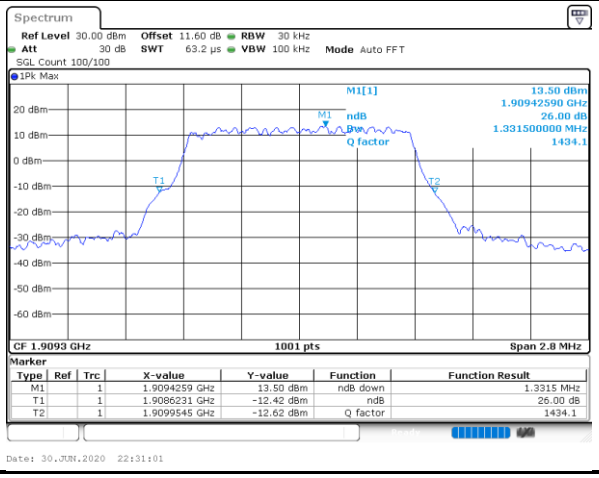
Lowest Channel / 1.4MHz / 16QAM



Middle Channel / 1.4MHz / 16QAM

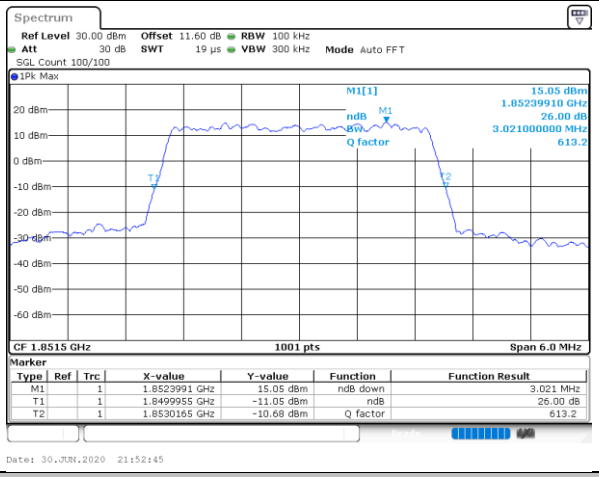


Highest Channel / 1.4MHz / 16QAM

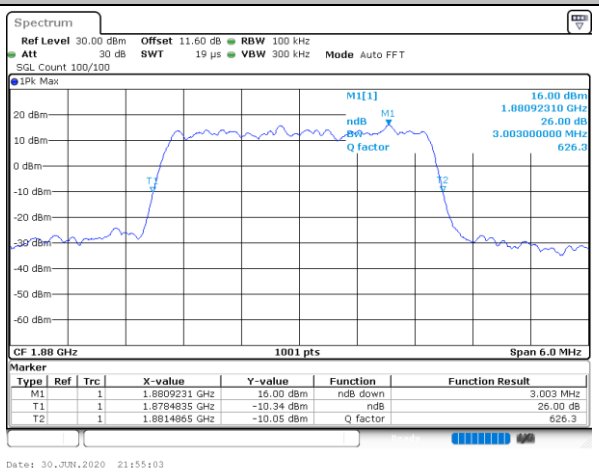


LTE Band 2

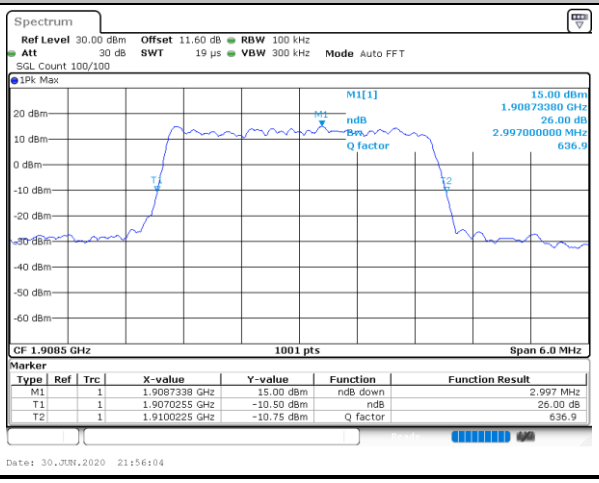
Lowest Channel / 3MHz / 16QAM



Middle Channel / 3MHz / 16QAM

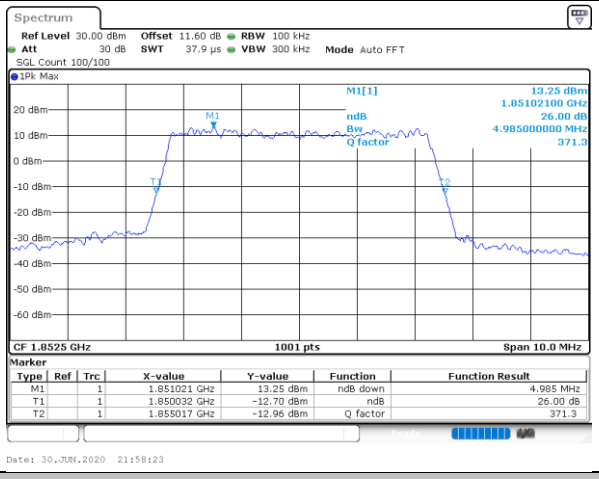


Highest Channel / 3MHz / 16QAM

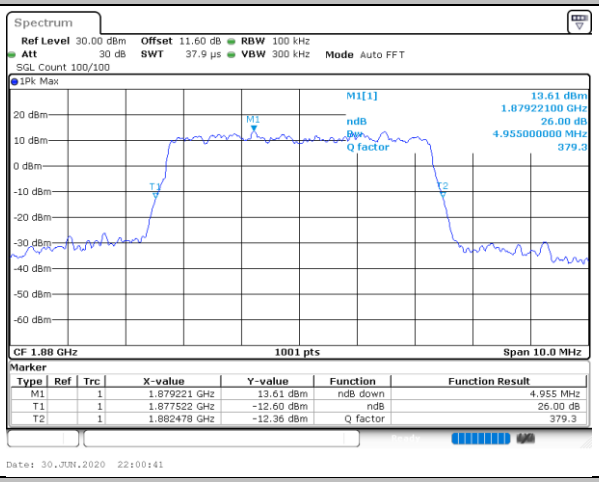


LTE Band 2

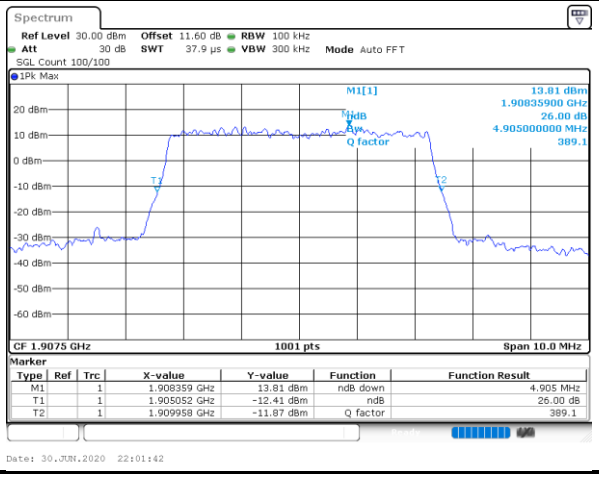
Lowest Channel / 5MHz / 16QAM



Middle Channel / 5MHz / 16QAM

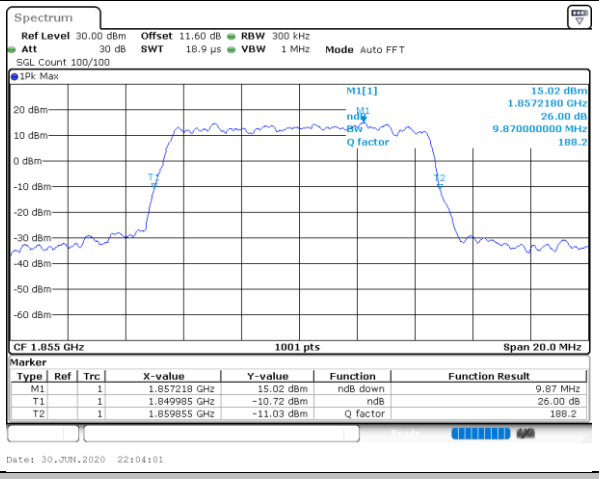


Highest Channel / 5MHz / 16QAM

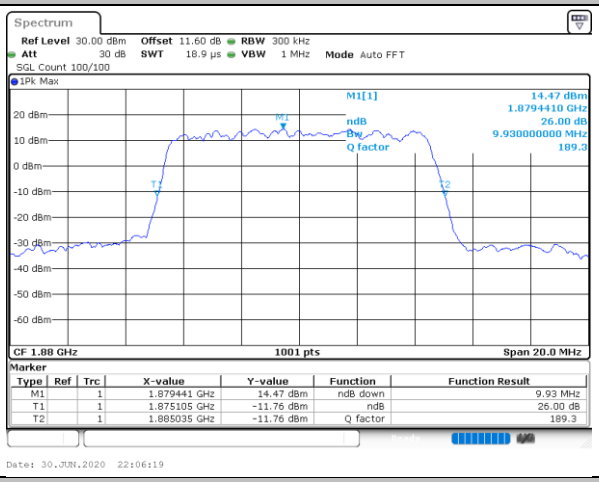


LTE Band 2

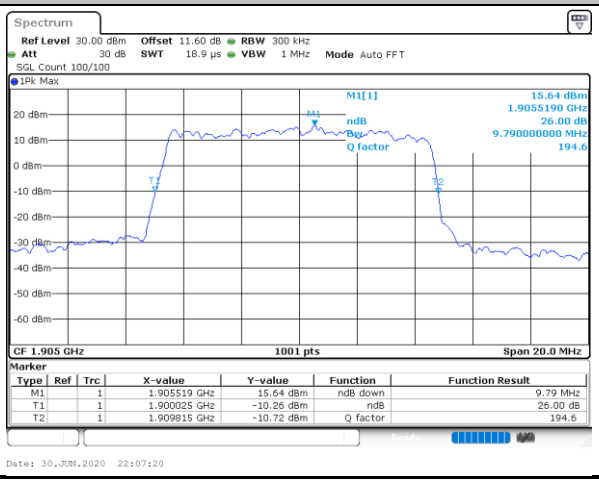
Lowest Channel / 10MHz / 16QAM



Middle Channel / 10MHz / 16QAM

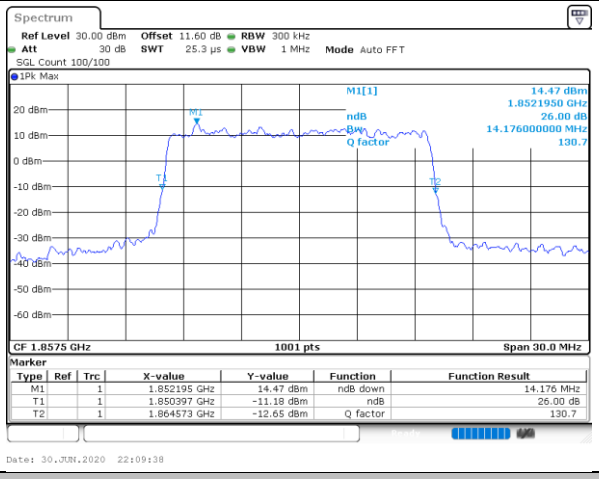


Highest Channel / 10MHz / 16QAM

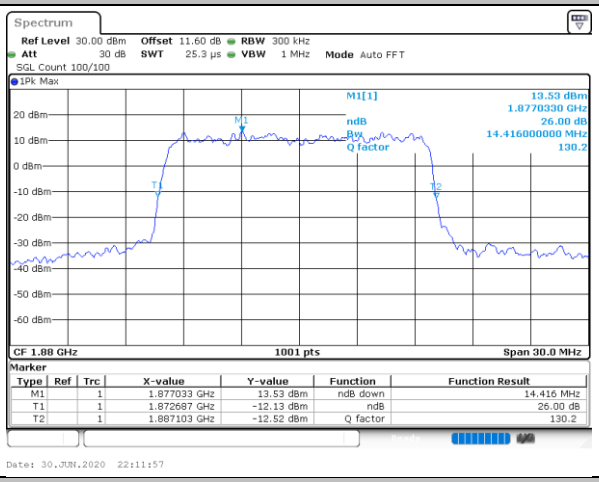


LTE Band 2

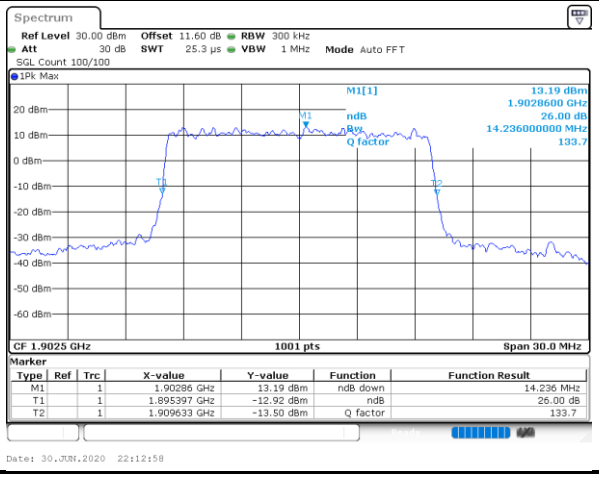
Lowest Channel / 15MHz / 16QAM



Middle Channel / 15MHz / 16QAM

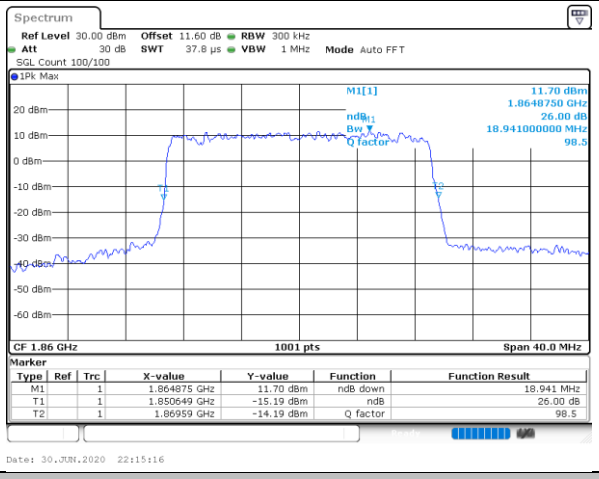


Highest Channel / 15MHz / 16QAM

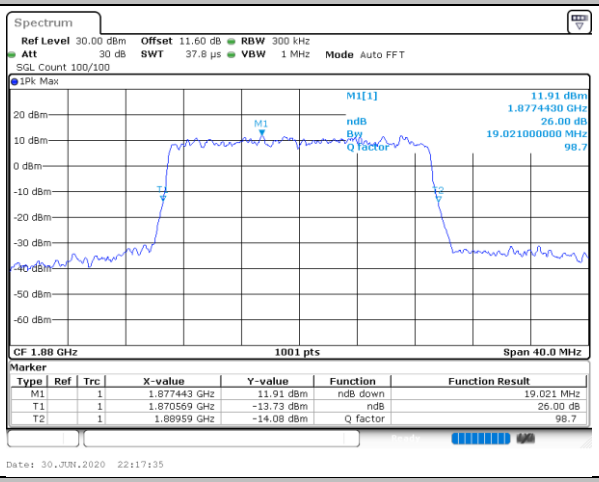


LTE Band 2

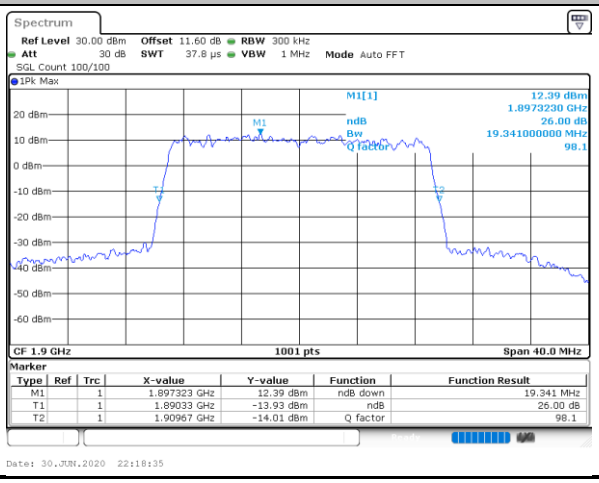
Lowest Channel / 20MHz / 16QAM



Middle Channel / 20MHz / 16QAM



Highest Channel / 20MHz / 16QAM

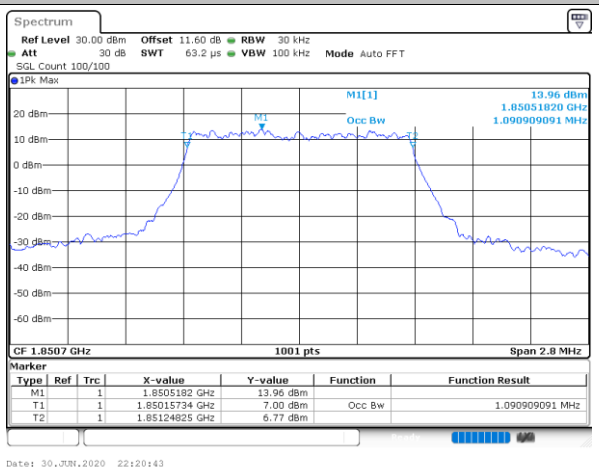


Occupied Bandwidth

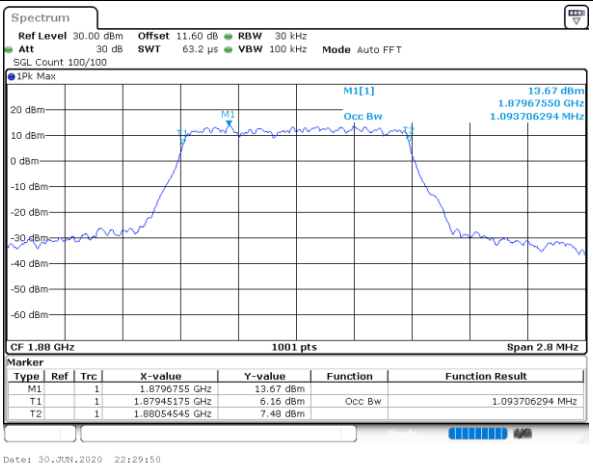
Mode	LTE Band 2 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	1.09	-	2.72	-	4.49	-	8.97	-	13.46	-	17.78
Middle CH	-	1.09	-	2.71	-	4.49	-	9.07	-	13.31	-	17.86
Highest CH	-	1.09	-	2.71	-	4.50	-	9.03	-	13.43	-	17.82

LTE Band 2

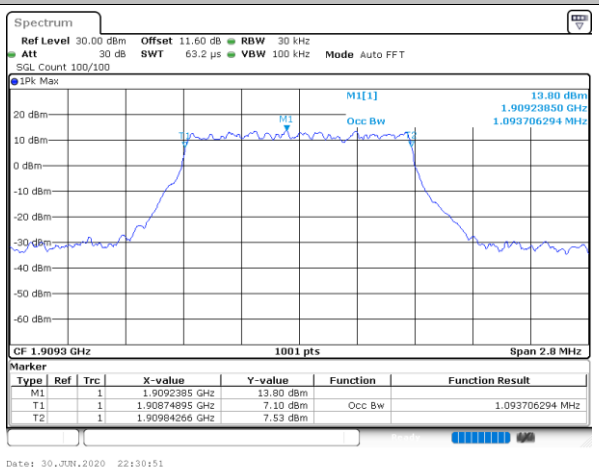
Lowest Channel / 1.4MHz / 16QAM



Middle Channel / 1.4MHz / 16QAM

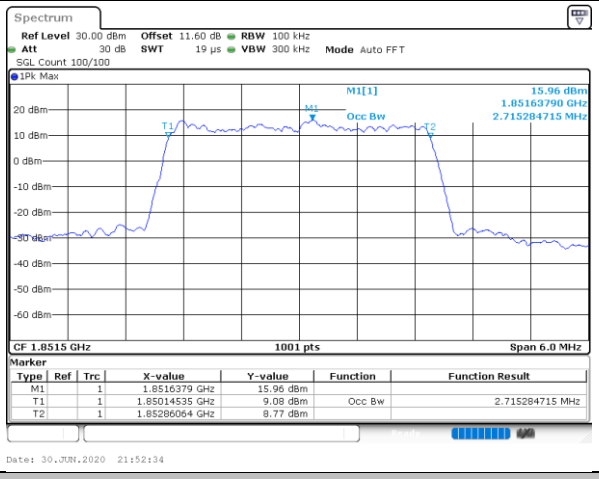


Highest Channel / 1.4MHz / 16QAM

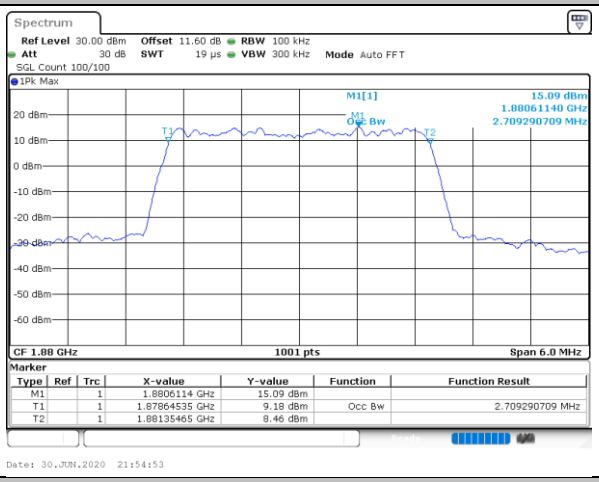


LTE Band 2

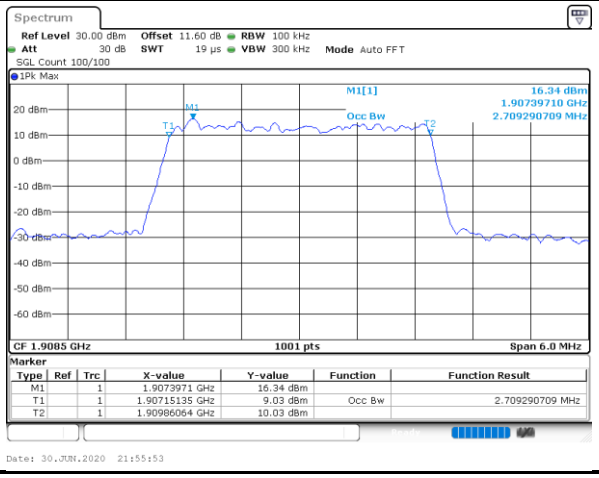
Lowest Channel / 3MHz / 16QAM



Middle Channel / 3MHz / 16QAM

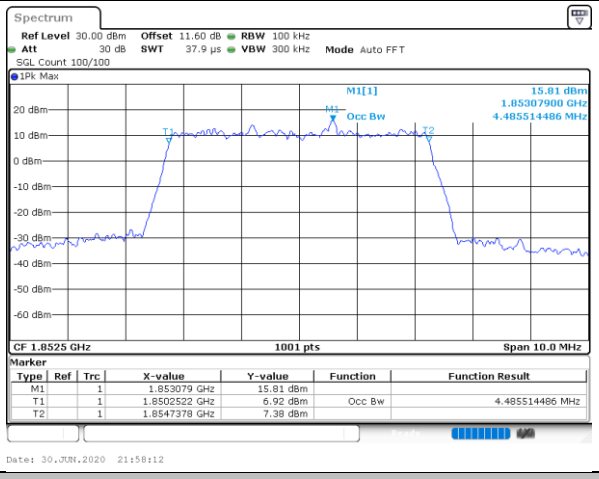


Highest Channel / 3MHz / 16QAM

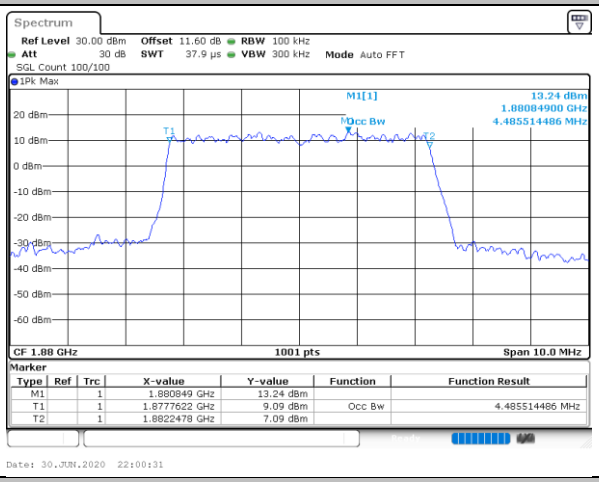


LTE Band 2

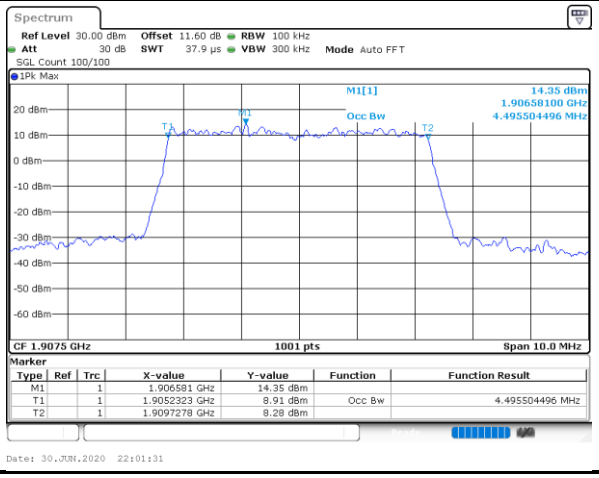
Lowest Channel / 5MHz / 16QAM



Middle Channel / 5MHz / 16QAM

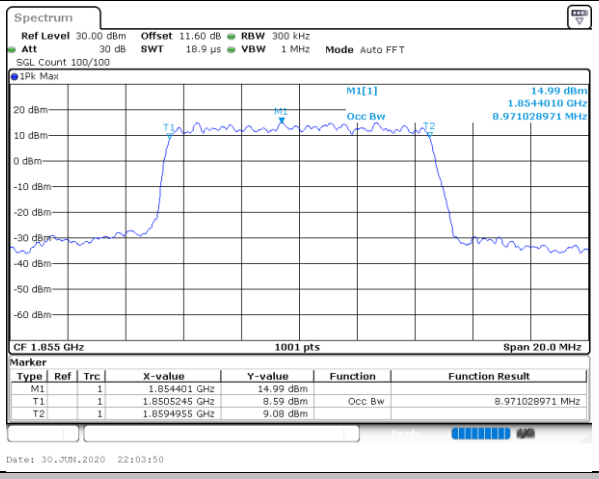


Highest Channel / 5MHz / 16QAM

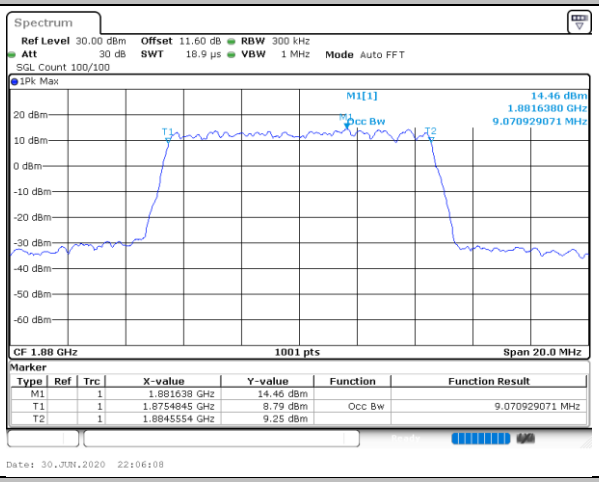


LTE Band 2

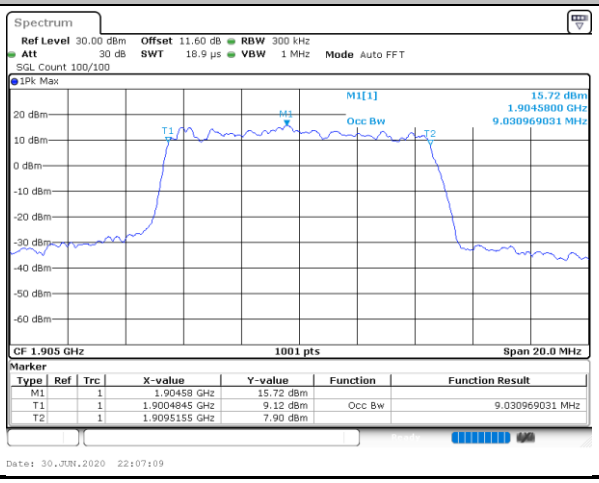
Lowest Channel / 10MHz / 16QAM



Middle Channel / 10MHz / 16QAM

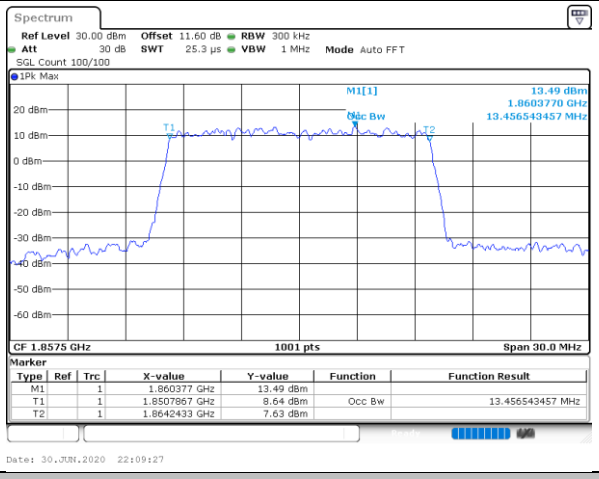


Highest Channel / 10MHz / 16QAM

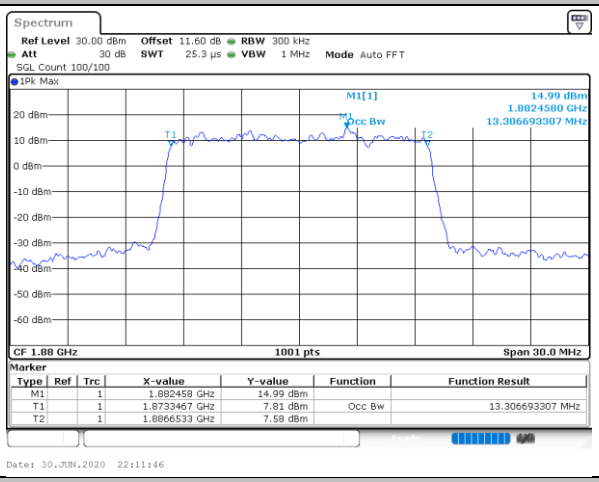


LTE Band 2

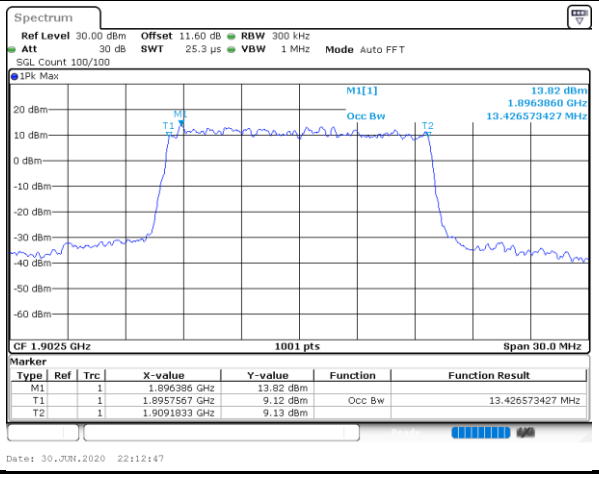
Lowest Channel / 15MHz / 16QAM



Middle Channel / 15MHz / 16QAM

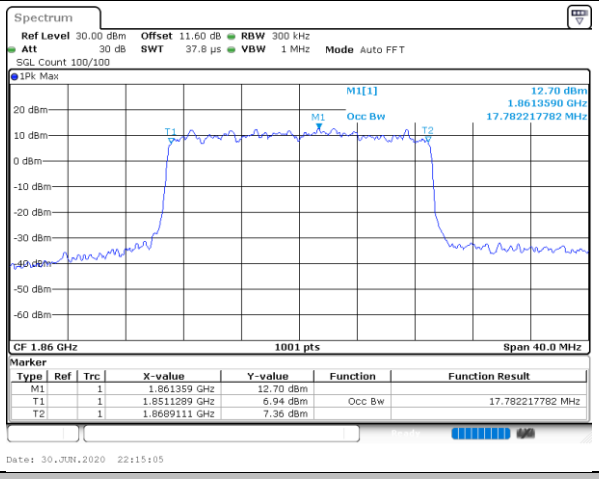


Highest Channel / 15MHz / 16QAM

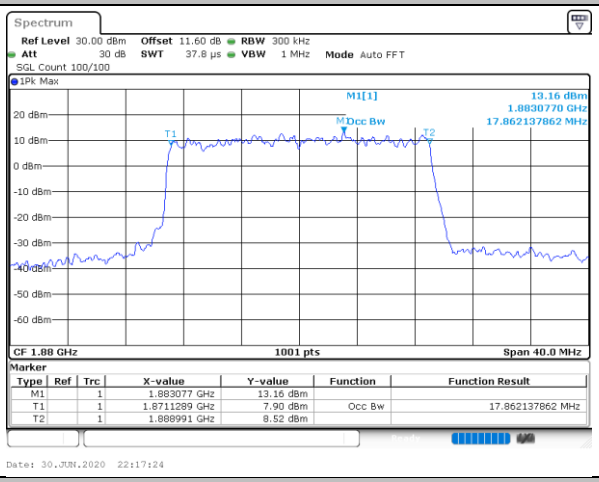


LTE Band 2

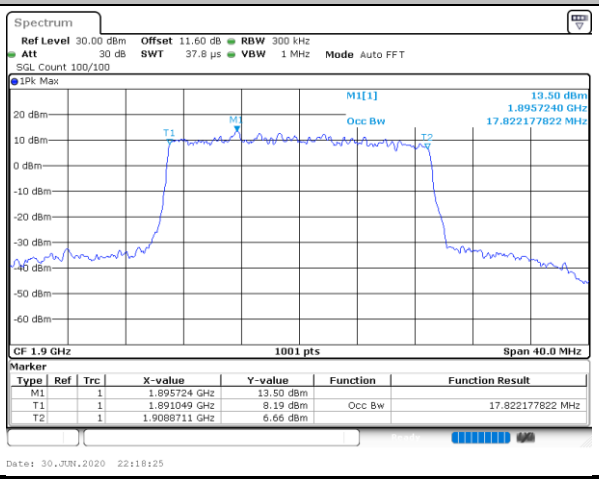
Lowest Channel / 20MHz / 16QAM



Middle Channel / 20MHz / 16QAM



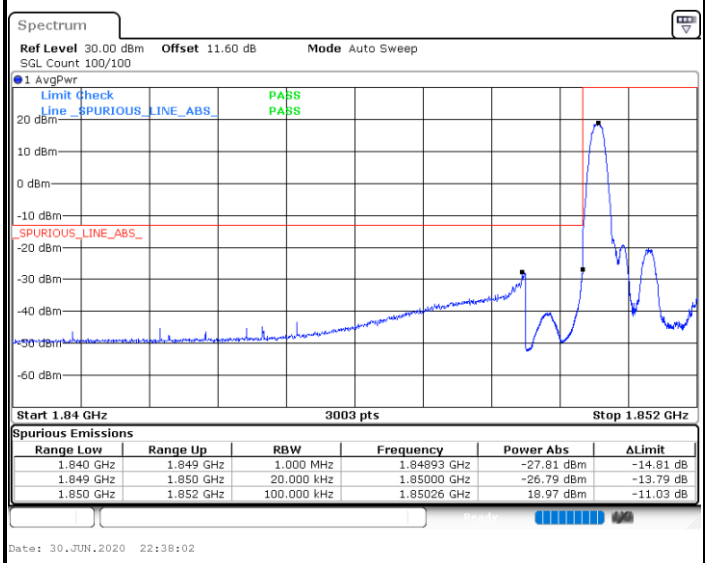
Highest Channel / 20MHz / 16QAM



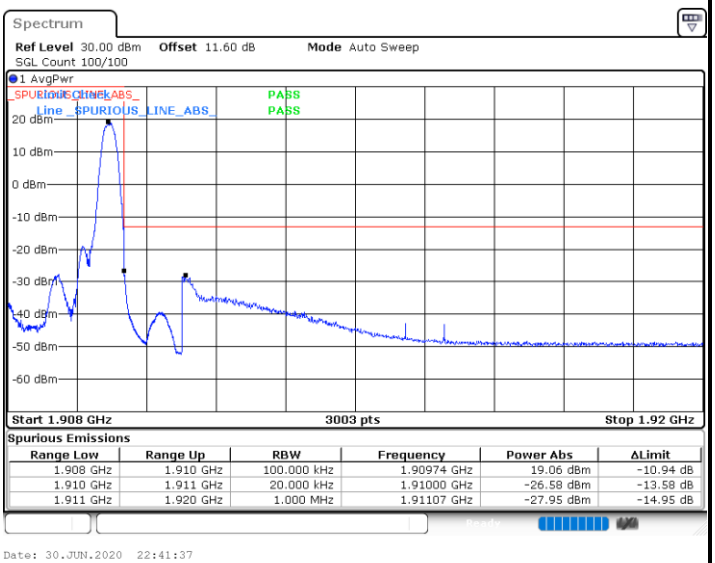
Conducted Band Edge

LTE Band 2 / 1.4MHz / 16QAM

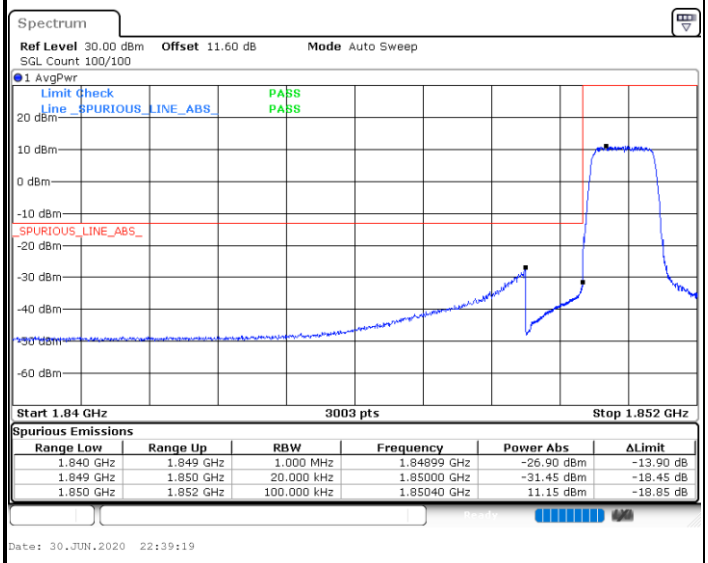
Lowest Band Edge / 1 RB



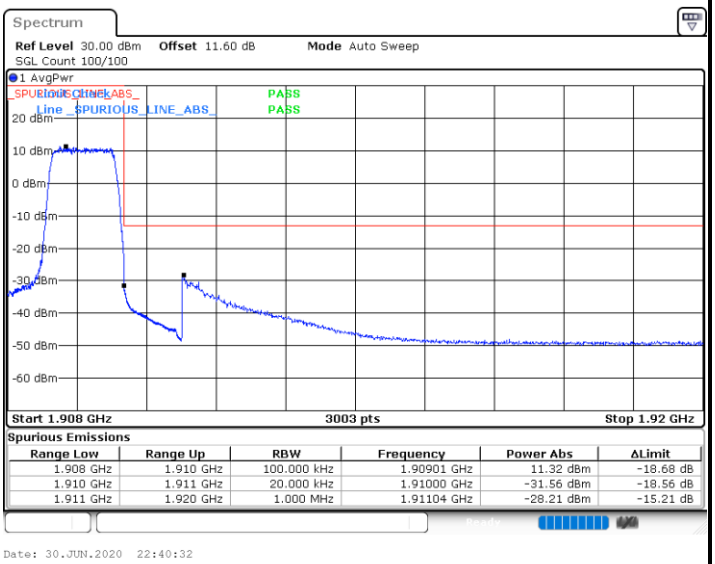
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB

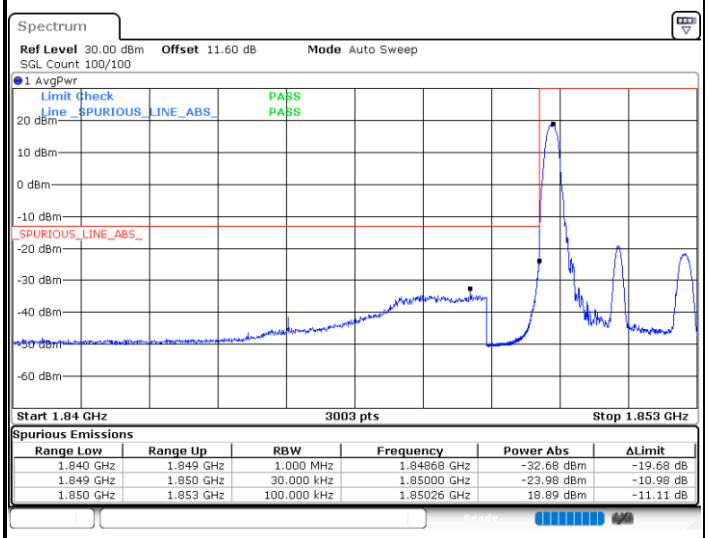


Highest Band Edge / Full RB

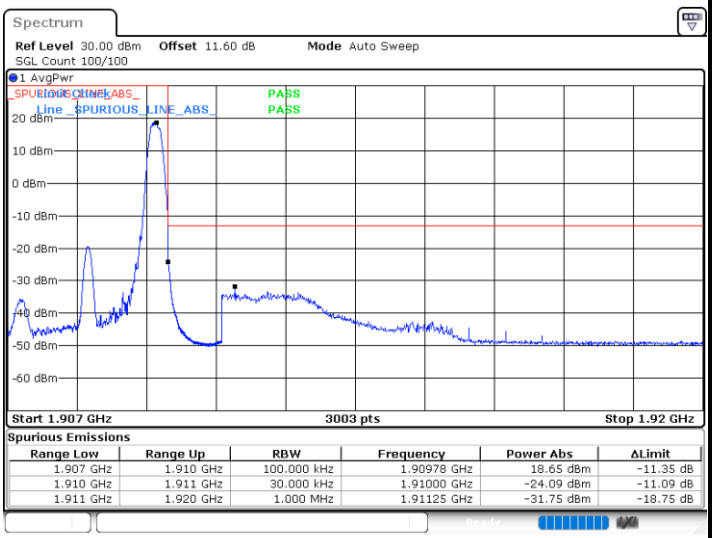


LTE Band 2 / 3MHz / 16QAM

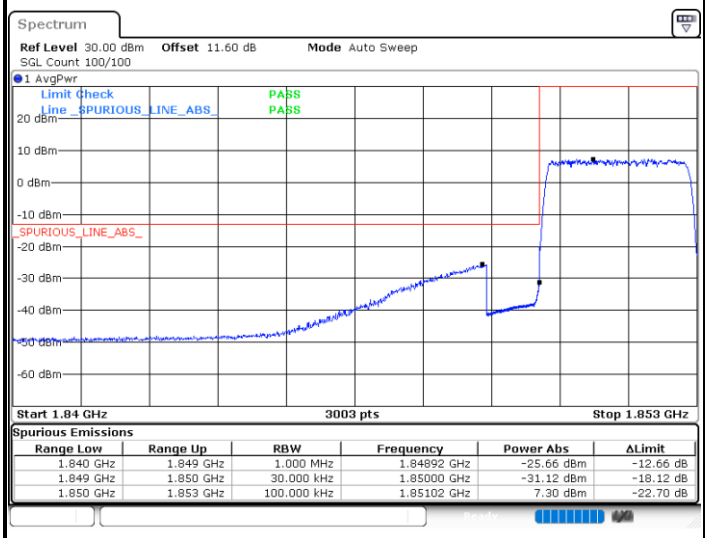
Lowest Band Edge / 1 RB



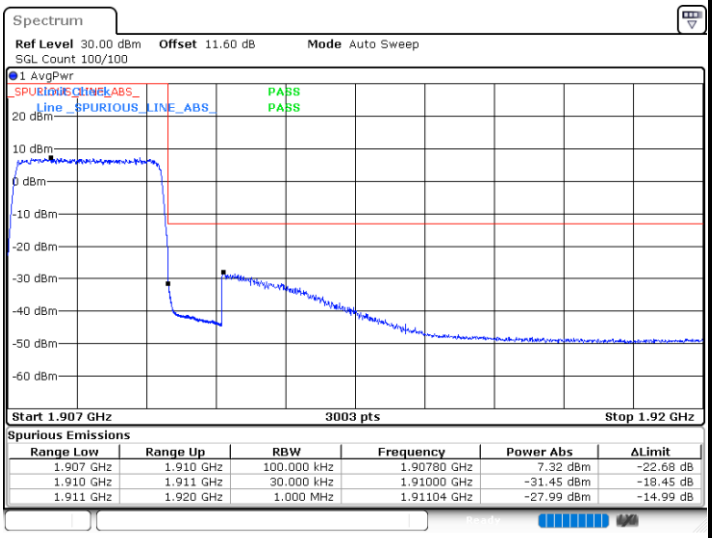
Highest Band Edge /1 RB



Lowest Band Edge / Full RB

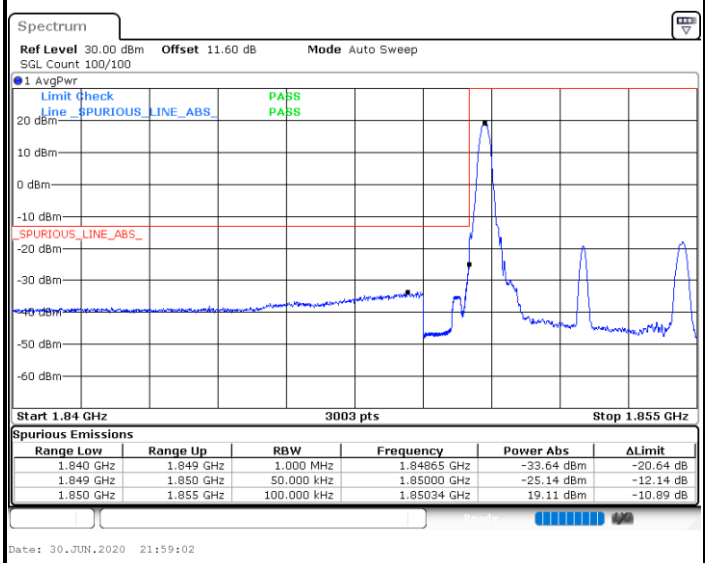


Highest Band Edge / Full RB

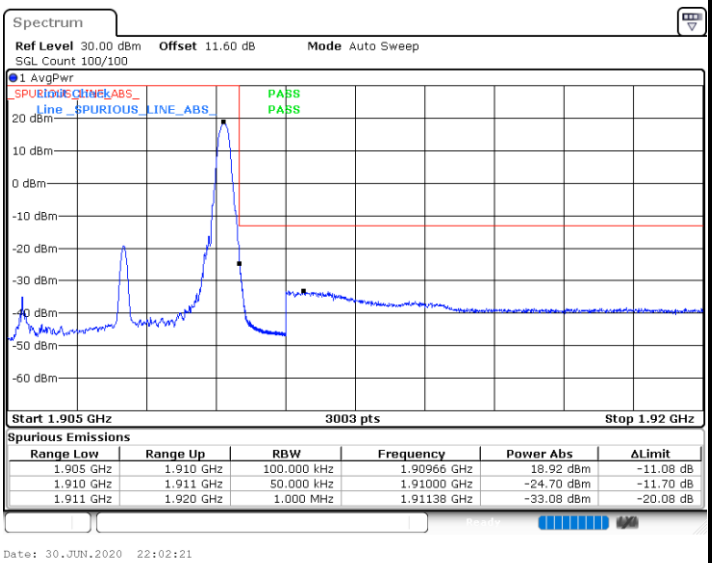


LTE Band 2 / 5MHz / 16QAM

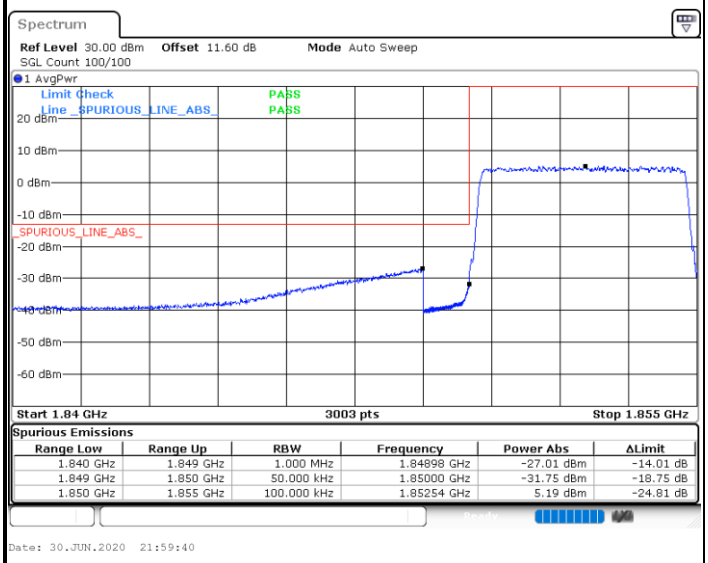
Lowest Band Edge / 1RB



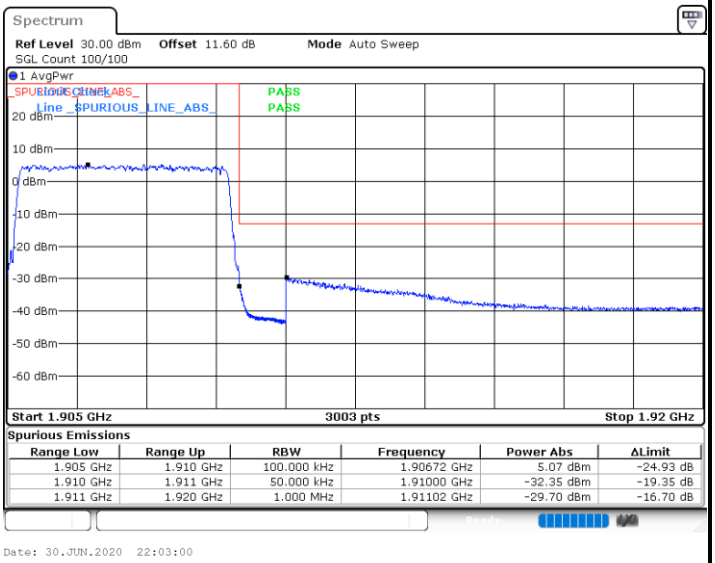
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB

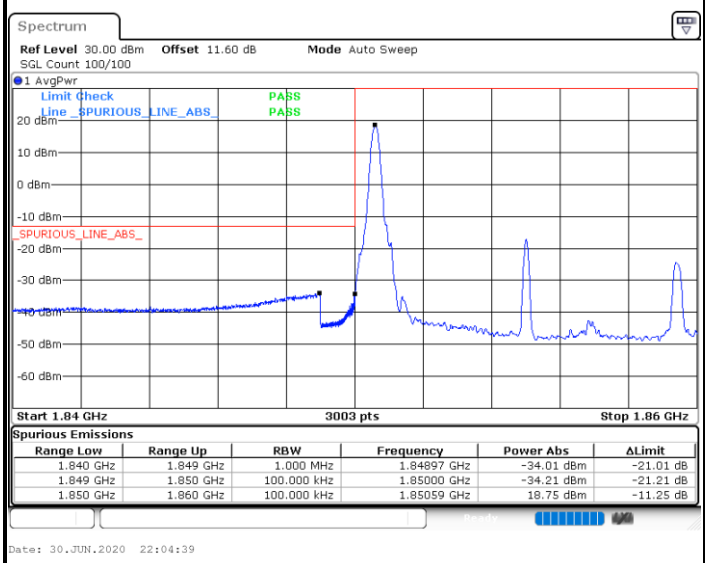


Highest Band Edge / Full RB

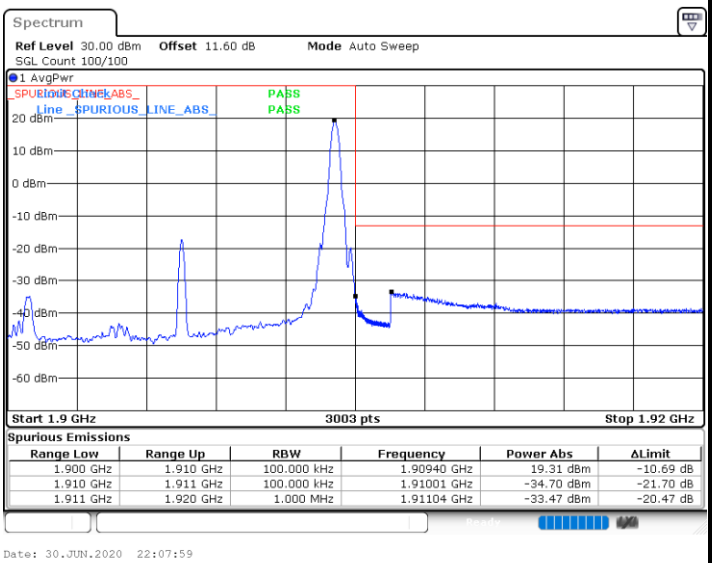


LTE Band 2 / 10MHz / 16QAM

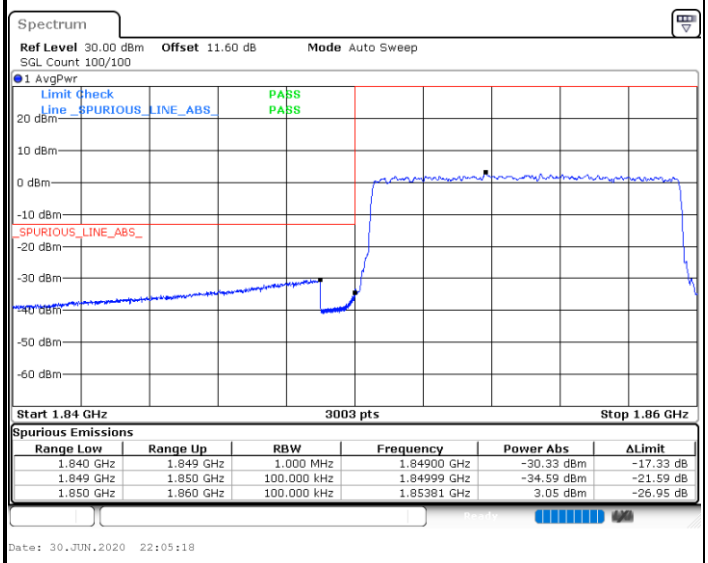
Lowest Band Edge / 1 RB



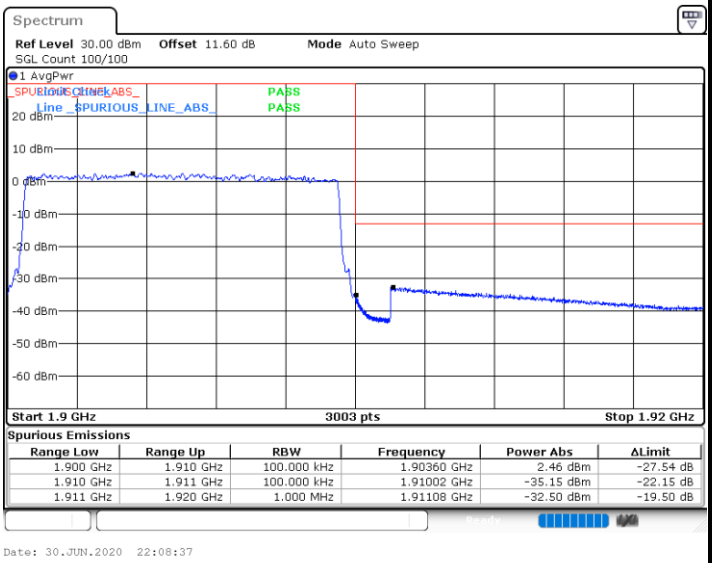
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB

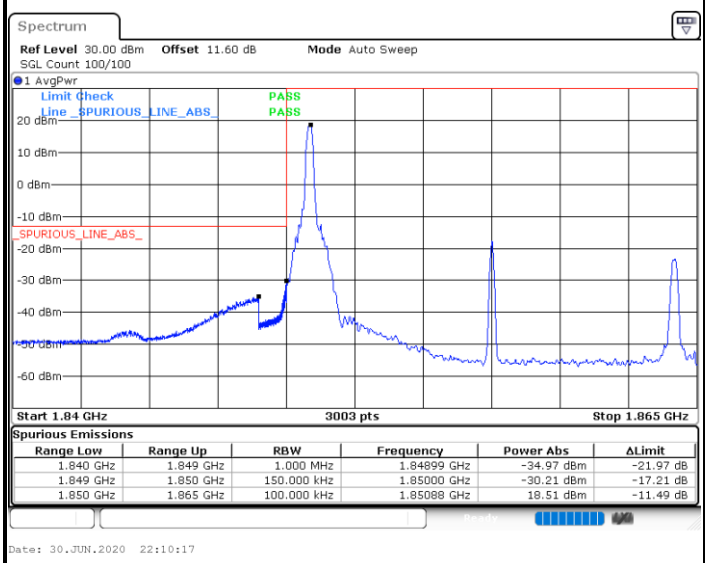


Highest Band Edge / Full RB



LTE Band 2 / 15MHz / 16QAM

Lowest Band Edge / 1 RB



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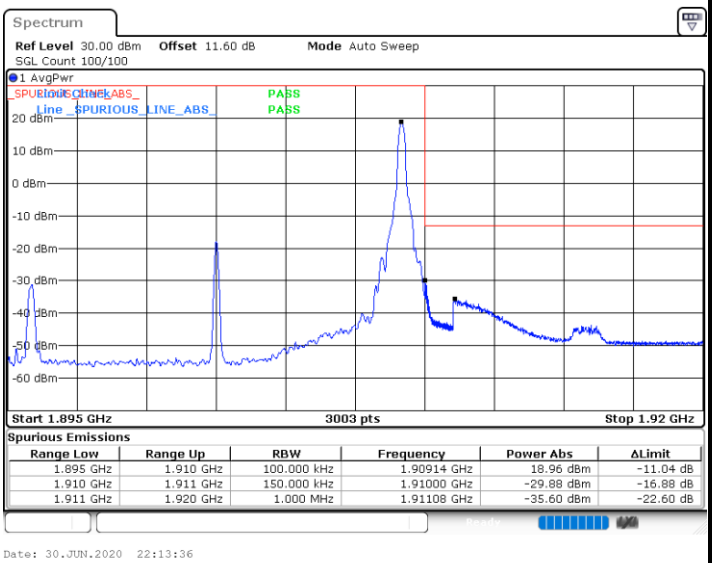
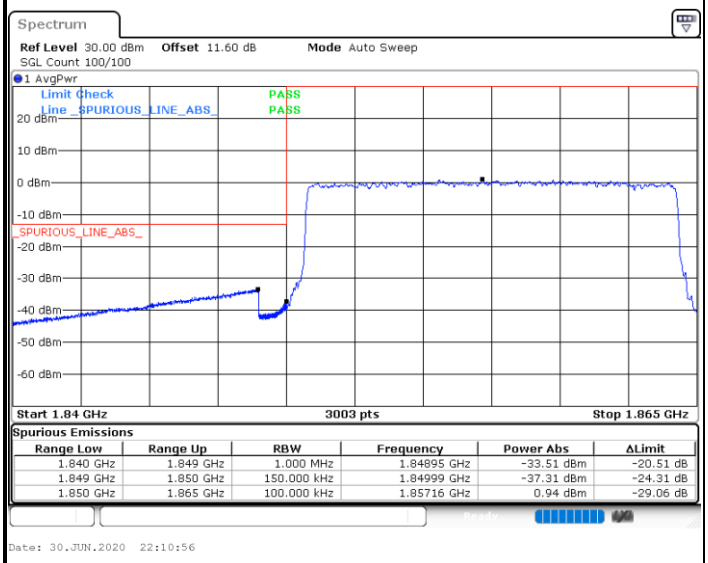
Highest Band Edge / 1 RB



Date: 30.JUN.2020 22:13:36

Lowest Band Edge / Full RB



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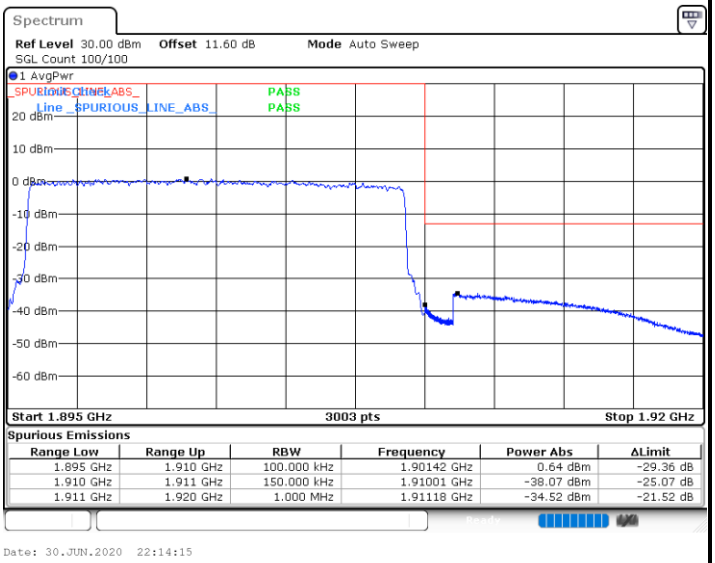
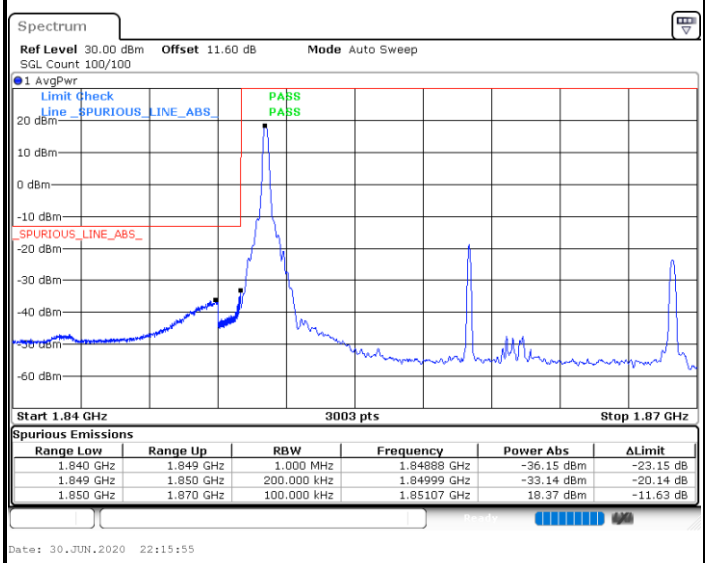
Highest Band Edge / Full RB



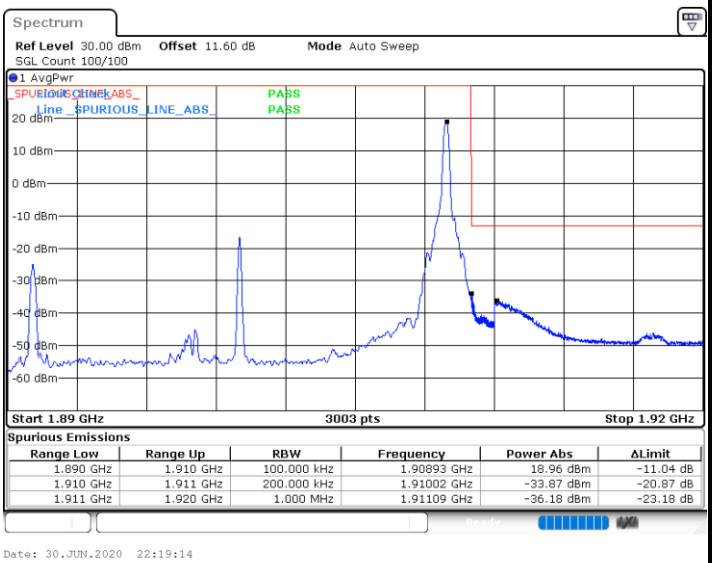
Date: 30.JUN.2020 22:14:15

LTE Band 2 / 20MHz / 16QAM

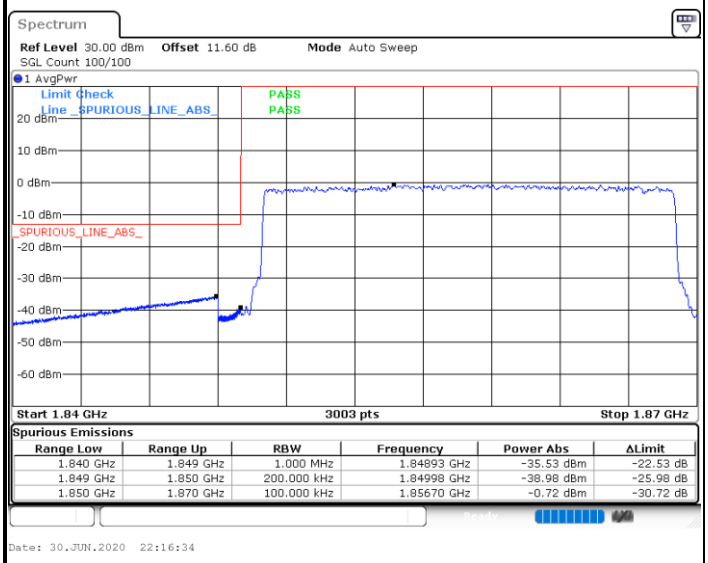
Lowest Band Edge / 1 RB



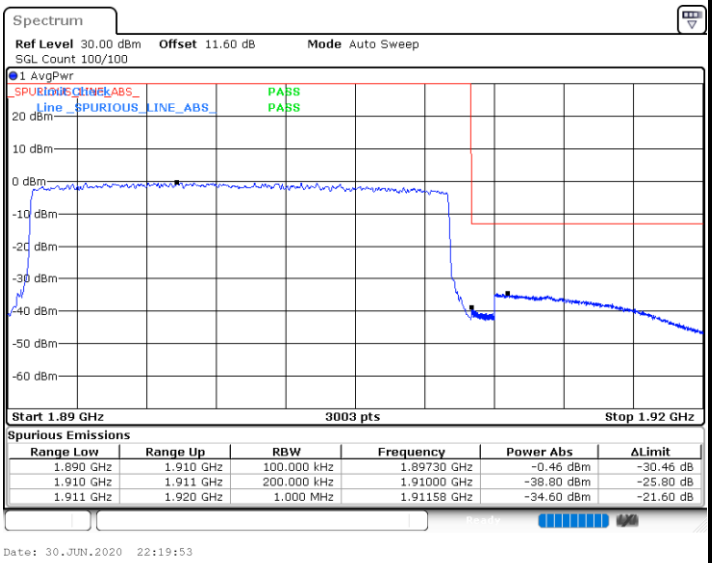
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



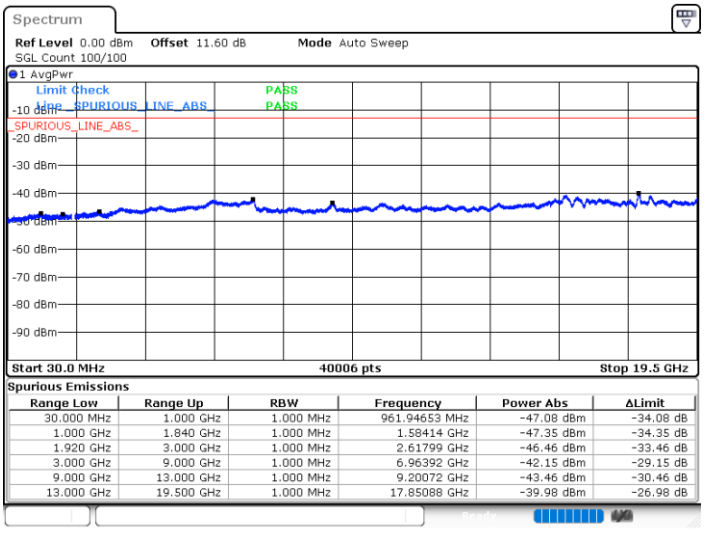
Highest Band Edge / Full RB



Conducted Spurious Emission

LTE Band 2 / 1.4MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	961.94653 MHz	-47.08 dBm	-34.08 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.58414 GHz	-47.35 dBm	-34.35 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.61799 GHz	-46.46 dBm	-33.46 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.96392 GHz	-42.15 dBm	-29.15 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20072 GHz	-43.46 dBm	-30.46 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85088 GHz	-39.98 dBm	-26.98 dB

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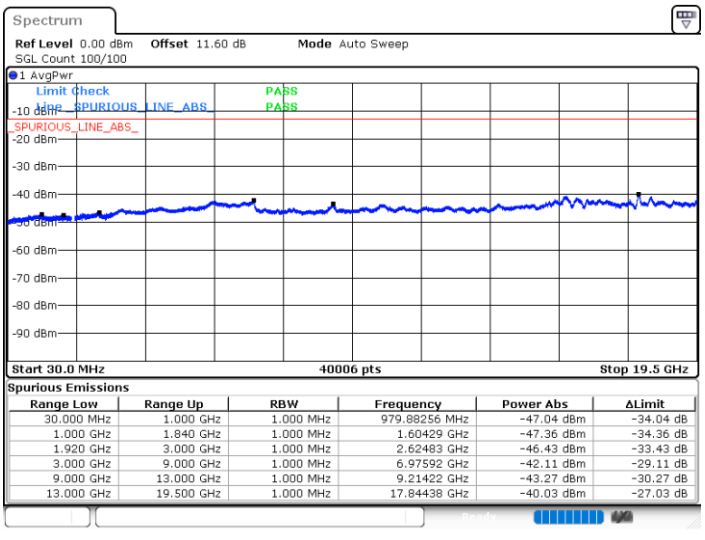
Middle Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	979.88256 MHz	-47.04 dBm	-34.04 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.60429 GHz	-47.36 dBm	-34.36 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.62483 GHz	-46.43 dBm	-33.43 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.97592 GHz	-42.11 dBm	-29.11 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.21422 GHz	-43.27 dBm	-30.27 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84438 GHz	-40.03 dBm	-27.03 dB

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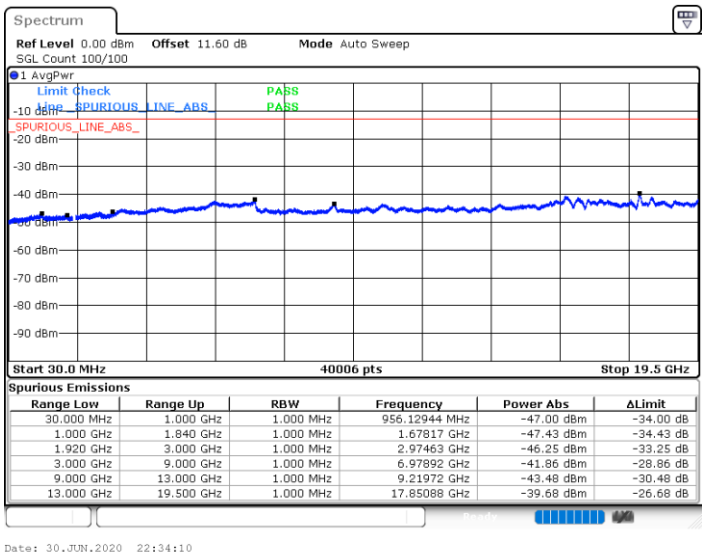
LTE Band 2 / 1.4MHz

Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	956.12944 MHz	-47.00 dBm	-34.00 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.67817 GHz	-47.43 dBm	-34.43 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.97463 GHz	-46.25 dBm	-33.25 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.97892 GHz	-41.86 dBm	-28.86 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.21972 GHz	-43.48 dBm	-30.48 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85088 GHz	-39.68 dBm	-26.68 dB

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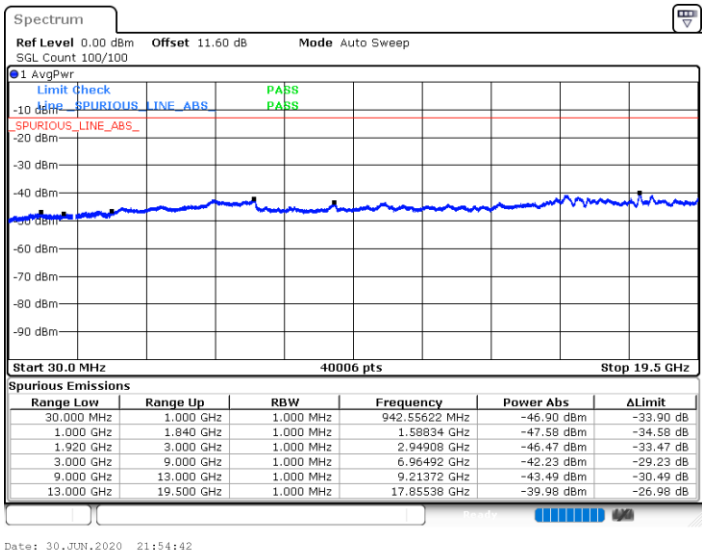
LTE Band 2 / 3MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	942.55622 MHz	-46.90 dBm	-33.90 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.58834 GHz	-47.58 dBm	-34.58 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.94908 GHz	-46.47 dBm	-33.47 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.96492 GHz	-42.23 dBm	-29.23 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.21372 GHz	-43.49 dBm	-30.49 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85538 GHz	-39.98 dBm	-26.98 dB

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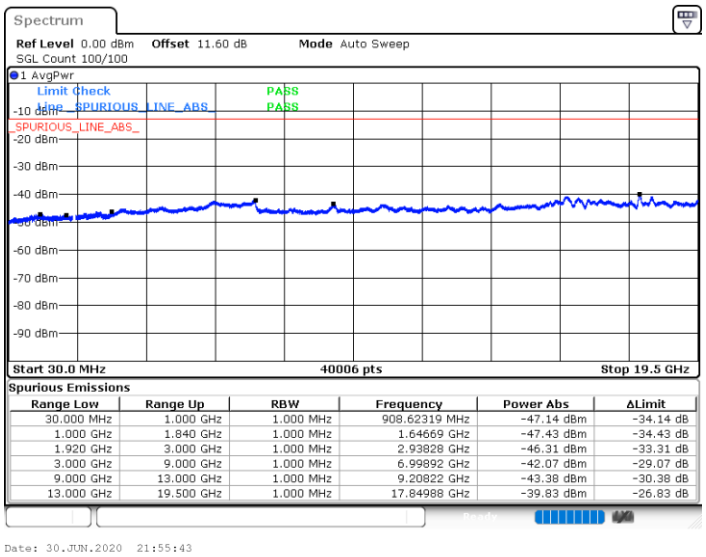
LTE Band 2 / 3MHz

Middle Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	908.62319 MHz	-47.14 dBm	-34.14 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.64669 GHz	-47.43 dBm	-34.43 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.93828 GHz	-46.31 dBm	-33.31 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.99892 GHz	-42.07 dBm	-29.07 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20822 GHz	-43.38 dBm	-30.38 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84988 GHz	-39.83 dBm	-26.83 dB

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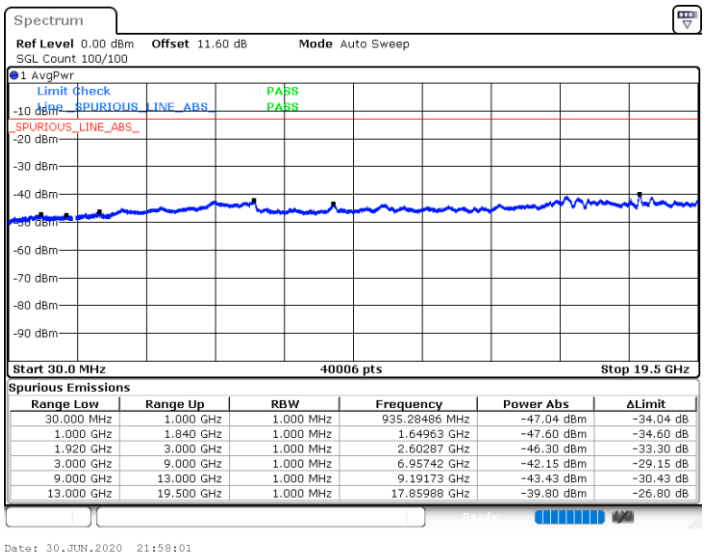
Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	935.28486 MHz	-47.04 dBm	-34.04 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.64963 GHz	-47.60 dBm	-34.60 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.60287 GHz	-46.30 dBm	-33.30 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.95742 GHz	-42.15 dBm	-29.15 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.19173 GHz	-43.43 dBm	-30.43 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85988 GHz	-39.80 dBm	-26.80 dB

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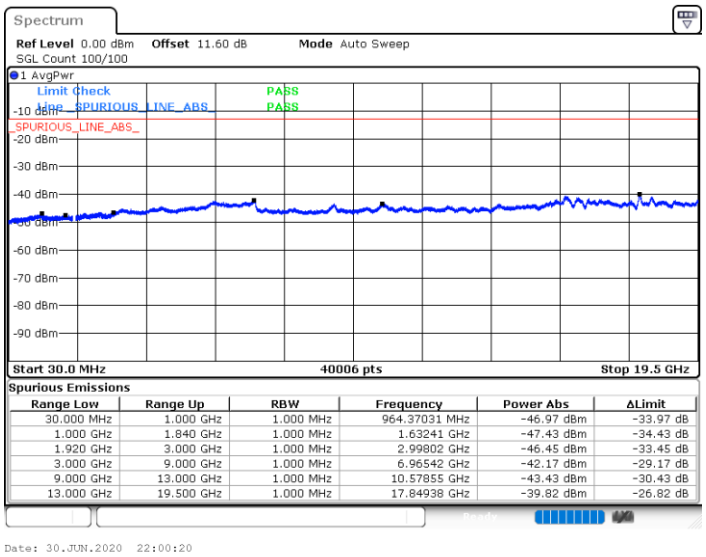
LTE Band 2 / 5MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	964.37031 MHz	-46.97 dBm	-33.97 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.63241 GHz	-47.43 dBm	-34.43 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.99802 GHz	-46.45 dBm	-33.45 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.96542 GHz	-42.17 dBm	-29.17 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.57855 GHz	-43.43 dBm	-30.43 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84938 GHz	-39.82 dBm	-26.82 dB

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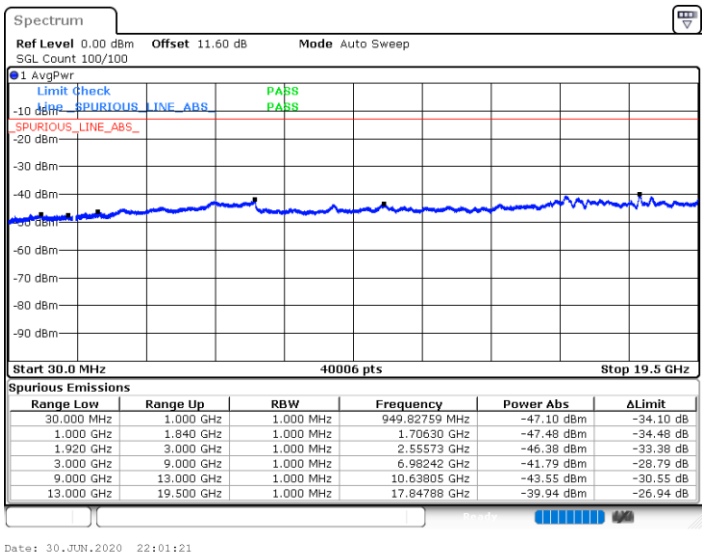
Middle Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	949.82759 MHz	-47.10 dBm	-34.10 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.70630 GHz	-47.48 dBm	-34.48 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.55573 GHz	-46.38 dBm	-33.38 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.98242 GHz	-41.79 dBm	-28.79 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.63805 GHz	-43.55 dBm	-30.55 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84788 GHz	-39.94 dBm	-26.94 dB

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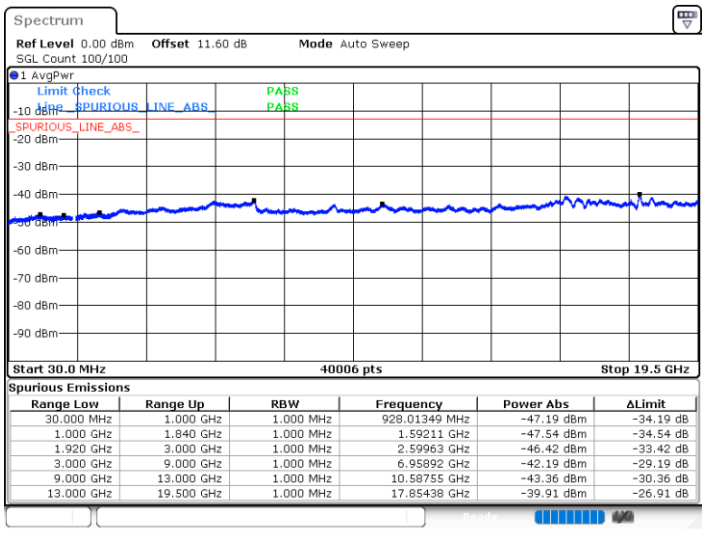
LTE Band 2 / 5MHz

Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	928.01349 MHz	-47.19 dBm	-34.19 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.59211 GHz	-47.54 dBm	-34.54 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.59963 GHz	-46.42 dBm	-33.42 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.95892 GHz	-42.19 dBm	-29.19 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.58755 GHz	-43.36 dBm	-30.36 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85438 GHz	-39.91 dBm	-26.91 dB

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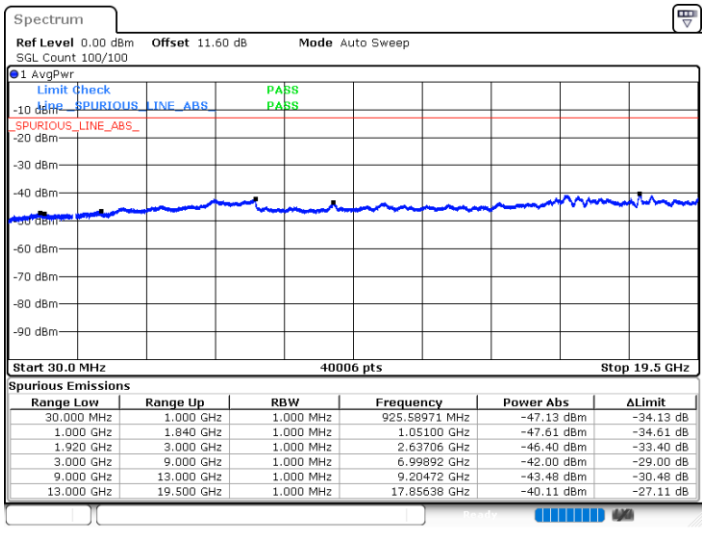
LTE Band 2 / 10MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	925.58971 MHz	-47.13 dBm	-34.13 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.05100 GHz	-47.61 dBm	-34.61 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.63706 GHz	-46.40 dBm	-33.40 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.99892 GHz	-42.00 dBm	-29.00 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20472 GHz	-43.48 dBm	-30.48 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85638 GHz	-40.11 dBm	-27.11 dB

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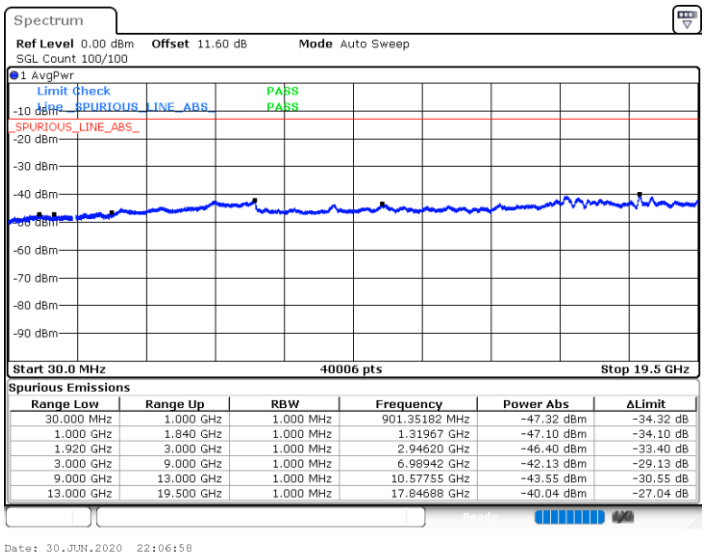
LTE Band 2 / 10MHz

Middle Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	901.35182 MHz	-47.32 dBm	-34.32 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.31967 GHz	-47.10 dBm	-34.10 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.94620 GHz	-46.40 dBm	-33.40 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.98942 GHz	-42.13 dBm	-29.13 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.57755 GHz	-43.55 dBm	-30.55 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84688 GHz	-40.04 dBm	-27.04 dB

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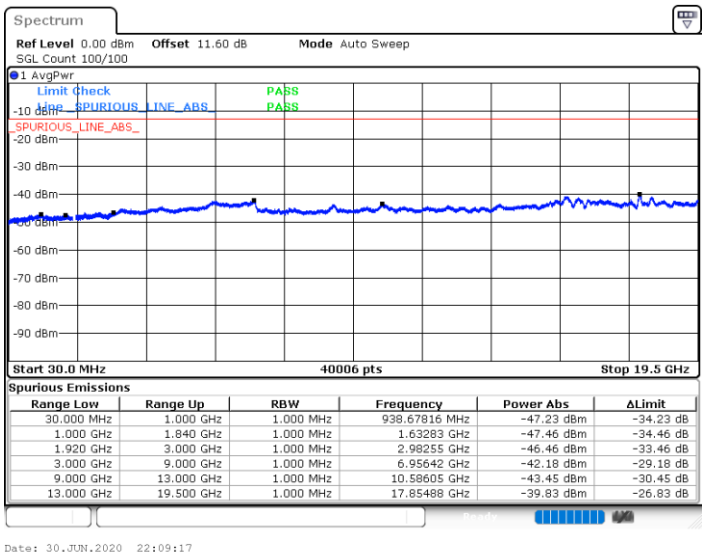
Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	938.67816 MHz	-47.23 dBm	-34.23 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.63283 GHz	-47.46 dBm	-34.46 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.98255 GHz	-46.46 dBm	-33.46 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.95642 GHz	-42.18 dBm	-29.18 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.58605 GHz	-43.45 dBm	-30.45 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85488 GHz	-39.83 dBm	-26.83 dB

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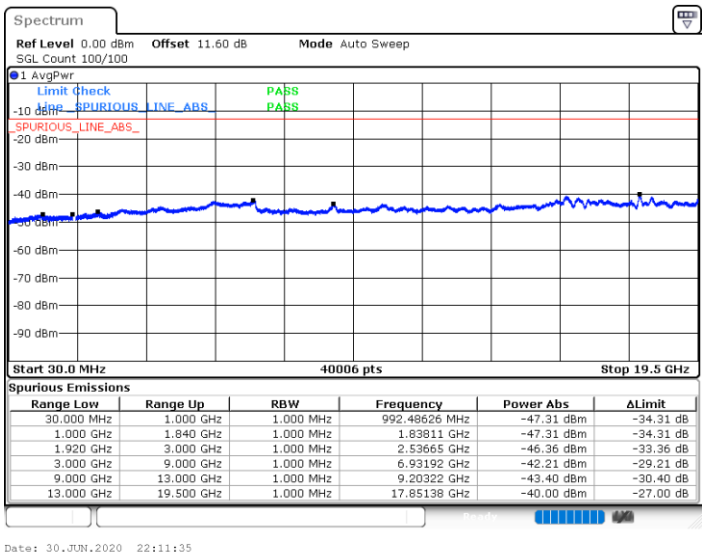
LTE Band 2 / 15MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	992.48626 MHz	-47.31 dBm	-34.31 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.83811 GHz	-47.31 dBm	-34.31 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.53665 GHz	-46.36 dBm	-33.36 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.93192 GHz	-42.21 dBm	-29.21 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20322 GHz	-43.40 dBm	-30.40 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85138 GHz	-40.00 dBm	-27.00 dB

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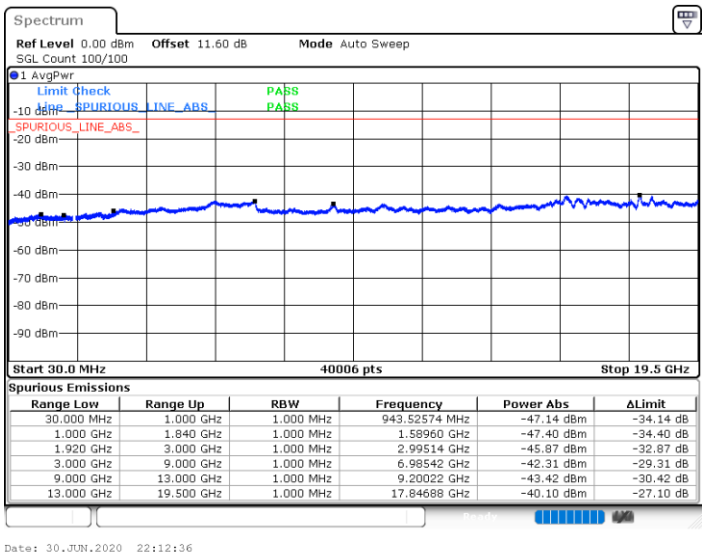
Middle Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	943.52574 MHz	-47.14 dBm	-34.14 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.58960 GHz	-47.40 dBm	-34.40 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.99514 GHz	-45.87 dBm	-32.87 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.98542 GHz	-42.31 dBm	-29.31 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20022 GHz	-43.42 dBm	-30.42 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84688 GHz	-40.10 dBm	-27.10 dB

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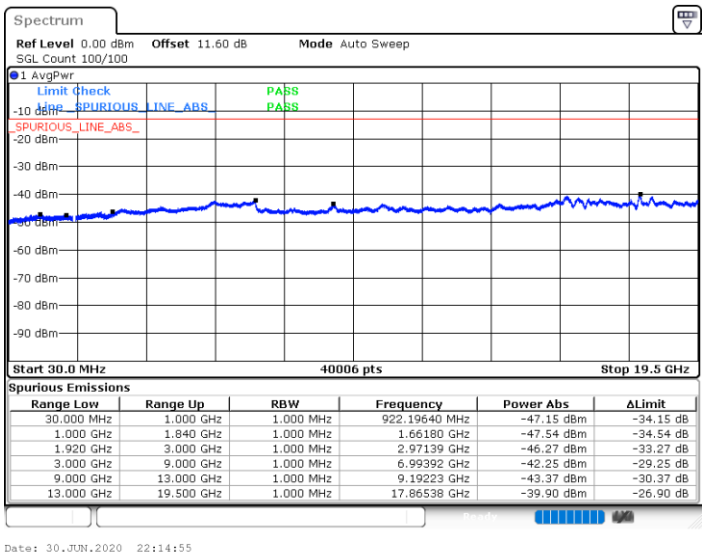
LTE Band 2 / 15MHz

Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	922.19640 MHz	-47.15 dBm	-34.15 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.66180 GHz	-47.54 dBm	-34.54 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.97139 GHz	-46.27 dBm	-33.27 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.99392 GHz	-42.25 dBm	-29.25 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.19223 GHz	-43.37 dBm	-30.37 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.86538 GHz	-39.90 dBm	-26.90 dB

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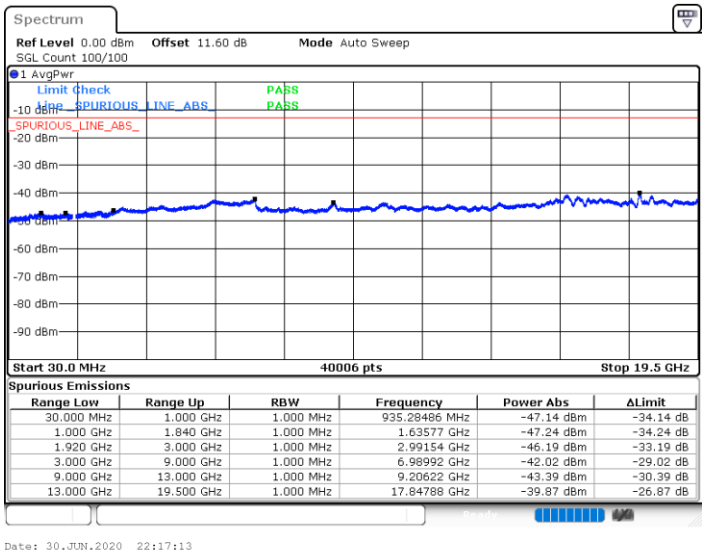
LTE Band 2 / 20MHz

Lowest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	935.28486 MHz	-47.14 dBm	-34.14 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.63577 GHz	-47.24 dBm	-34.24 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.99154 GHz	-46.19 dBm	-33.19 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.98992 GHz	-42.02 dBm	-29.02 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20622 GHz	-43.39 dBm	-30.39 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84788 GHz	-39.87 dBm	-26.87 dB

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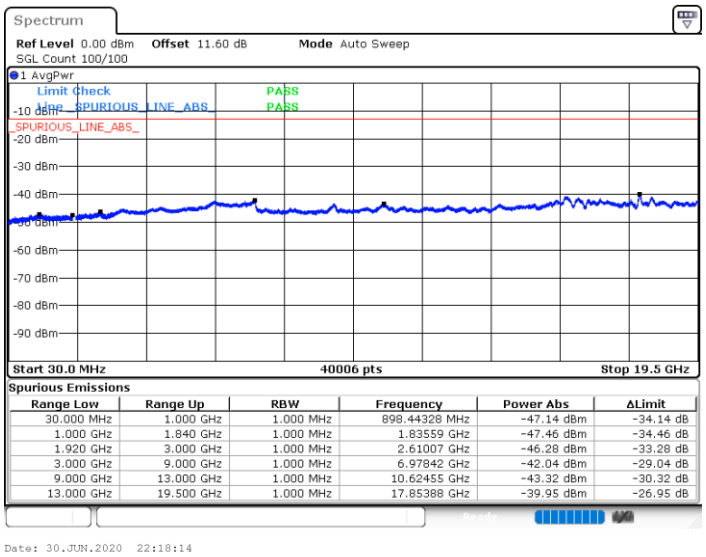
LTE Band 2 / 20MHz

Middle Channel / 16QAM

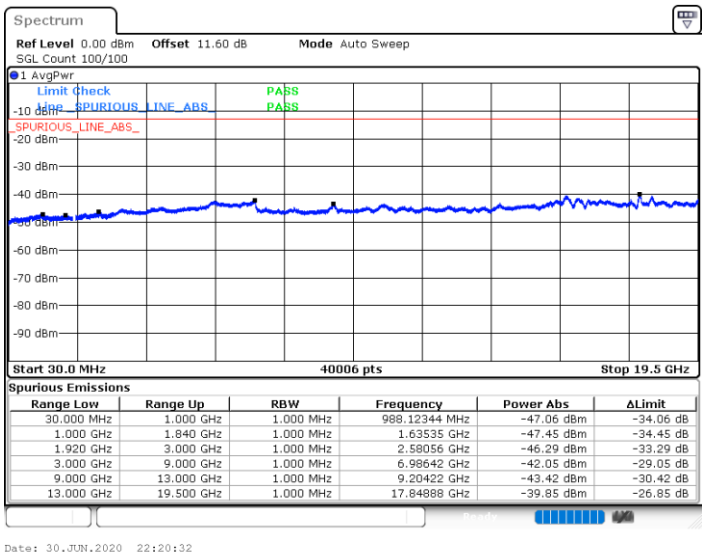


Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	898.44328 MHz	-47.14 dBm	-34.14 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.83559 GHz	-47.46 dBm	-34.46 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.61007 GHz	-46.28 dBm	-33.28 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.97842 GHz	-42.04 dBm	-29.04 dB
9.000 GHz	13.000 GHz	1.000 MHz	10.62455 GHz	-43.32 dBm	-30.32 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.85388 GHz	-39.95 dBm	-26.95 dB

Date: 30.JUN.2020 22:18:14

Highest Channel / 16QAM



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	1.000 MHz	988.12344 MHz	-47.06 dBm	-34.06 dB
1.000 GHz	1.840 GHz	1.000 MHz	1.63535 GHz	-47.45 dBm	-34.45 dB
1.920 GHz	3.000 GHz	1.000 MHz	2.58056 GHz	-46.29 dBm	-33.29 dB
3.000 GHz	9.000 GHz	1.000 MHz	6.98642 GHz	-42.05 dBm	-29.05 dB
9.000 GHz	13.000 GHz	1.000 MHz	9.20422 GHz	-43.42 dBm	-30.42 dB
13.000 GHz	19.500 GHz	1.000 MHz	17.84888 GHz	-39.85 dBm	-26.85 dB

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Frequency Stability

Test Conditions		LTE Band 2 (16QAM) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0093	PASS
40	Normal Voltage	0.0003	
30	Normal Voltage	0.0062	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0093	
0	Normal Voltage	0.0080	
-10	Normal Voltage	0.0014	
-20	Normal Voltage	0.0090	
-30	Normal Voltage	0.0016	
20	Maximum Voltage	0.0001	
20	Normal Voltage	0.0093	
20	Battery End Point	0.0000	

Note:

1. Normal Voltage =12 V.；Battery End Point (BEP) =10.2 V.；Maximum Voltage =13.8 V.
2. The frequency fundamental emissions stay within the authorized frequency block.

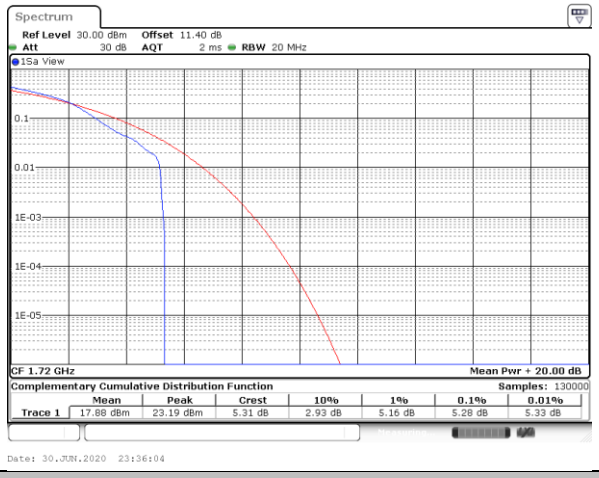
LTE Band 4

Peak-to-Average Ratio

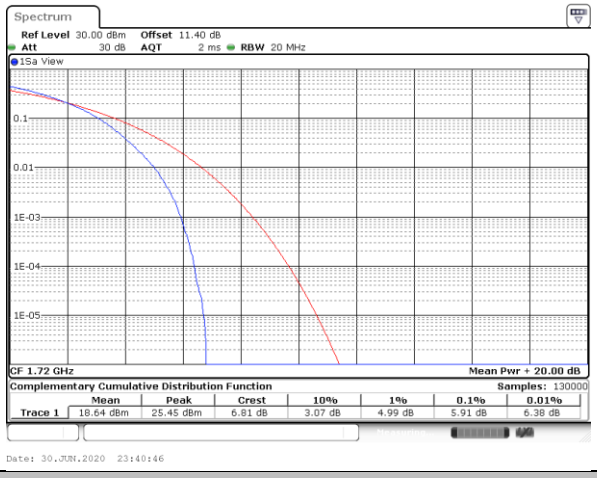
Mode	LTE Band 4 / 20MHz				
Mod.	QPSK		16QAM		Limit: 13dB
RB Size	1RB	Full RB	1RB	Full RB	Result
Lowest CH	-	-	5.28	5.91	PASS
Middle CH	-	-	5.28	5.86	
Highest CH	-	-	5.22	5.80	

LTE Band 4 / 20MHz / 16QAM

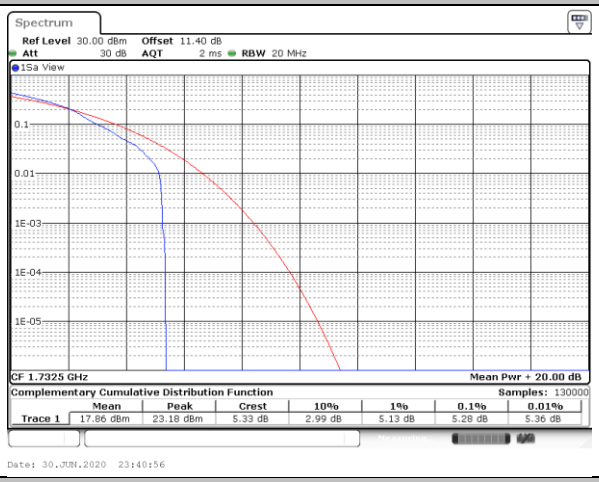
Lowest Channel / 1RB



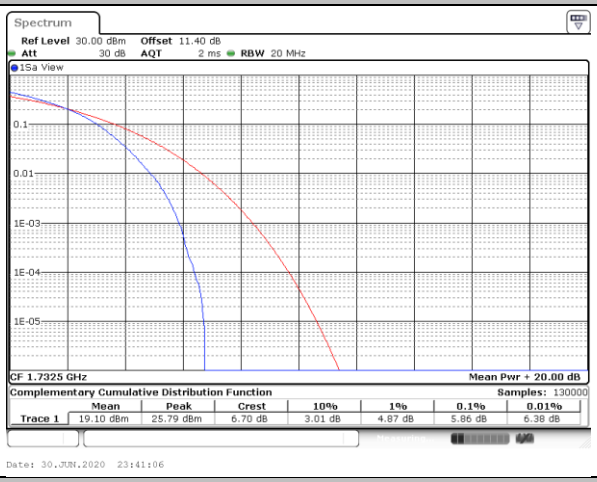
Lowest Channel / Full RB



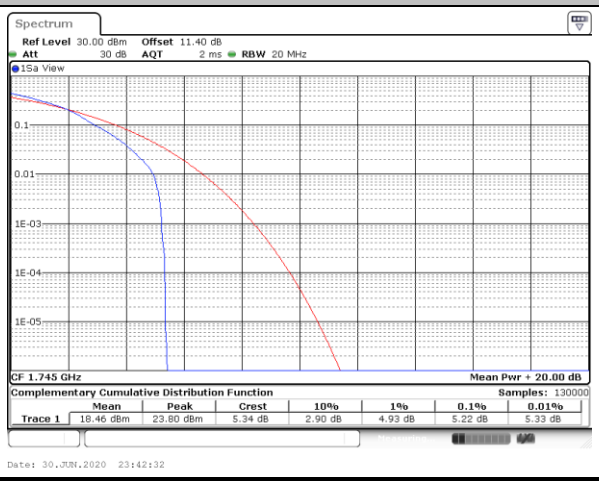
Middle Channel / 1RB



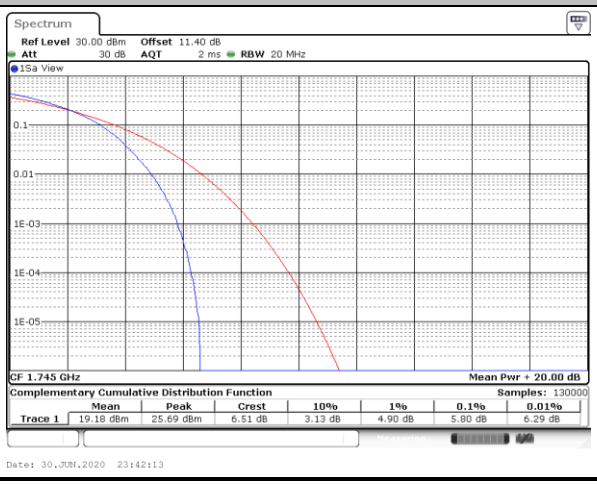
Middle Channel / Full RB



Highest Channel / 1RB



Highest Channel / Full RB



26dB Bandwidth

Mode	LTE Band 4 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	1.26	-	3.04	-	4.90	-	9.75	-	14.12	-	18.98
Middle CH	-	1.31	-	3.03	-	4.94	-	9.83	-	14.30	-	19.10
Highest CH	-	1.25	-	3.02	-	4.96	-	9.93	-	14.27	-	18.78