

FCC RF Test Report

APPLICANT : OnePlus Technology (Shenzhen) Co., Ltd
EQUIPMENT : Smart Phone
BRAND NAME : ONEPLUS
MODEL NAME : IN2017
FCC ID : 2ABZ2-EE103
STANDARD : 47 CFR Part 2, 24E, 27L
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Jun. 22, 2020 and completely tested on Jul. 14, 2020. We, Sporton International (ShenZhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (ShenZhen) Inc., the test report shall not be reproduced except in full.



Reviewed by: Derreck Chen / Supervisor



Approved by: Eric Shih / Manager



Sporton International (ShenZhen) Inc.

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People's Republic of China



TABLE OF CONTENTS

REVISION HISTORY	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Product Feature of Equipment Under Test	5
1.4 Product Specification of Equipment Under Test	6
1.5 Modification of EUT	6
1.6 Maximum EIRP Power, Frequency Tolerance, and Emission Designator	6
1.7 Testing Location	7
1.8 Test Software	7
1.9 Applicable Standards	7
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	8
2.1 Test Mode	8
2.2 Connection Diagram of Test System	8
2.3 Support Unit used in test configuration and system	9
2.4 Measurement Results Explanation Example	9
2.5 Frequency List of Low/Middle/High Channels	10
3 CONDUCTED TEST ITEMS	11
3.1 Measuring Instruments	11
3.2 Test Setup	11
3.3 Test Result of Conducted Test	11
3.4 Conducted Output Power and EIRP	12
3.5 Peak-to-Average Ratio	13
3.6 Occupied Bandwidth	14
3.7 Conducted Band Edge	15
3.8 Conducted Spurious Emission	16
3.9 Frequency Stability	17
4 RADIATED TEST ITEMS	18
4.1 Measuring Instruments	18
4.2 Test Setup	18
4.3 Test Result of Radiated Test	18
4.4 Radiated Spurious Emission	19
5 LIST OF MEASURING EQUIPMENT	20
6 UNCERTAINTY OF EVALUATION	21
APPENDIX A. TEST RESULTS OF CONDUCTED TEST	
APPENDIX B. TEST RESULTS OF RADIATED TEST	
APPENDIX C. TEST SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG062208	Rev. 01	Initial issue of report	Jul. 17, 2020

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
	§24.232(c)	Equivalent Isotropic Radiated Power (5G NR n2)	EIRP < 2Watt		
	§27.50(d)(4)	Equivalent Isotropic Radiated Power (5G NR n66)	EIRP < 1Watt		
3.5	§24.232(d)	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	Reporting Only	PASS	-
3.7	§2.1051 §24.238(a) §27.53(h)	Conducted Band Edge Measurement (5G NR n2) (5G NR n66)	< 43+10log ₁₀ (P[Watts])	PASS	-
3.8	§2.1051 §24.238(a) §27.53(h)	Conducted Spurious Emission (5G NR n2) (5G NR n66)	< 43+10log ₁₀ (P[Watts])	PASS	-
3.9	§2.1055 §24.235 §27.54	Frequency Stability Temperature & Voltage	Within Authorized Band	PASS	-
4.4	§2.1053 §24.238(a) §27.53(h)	Radiated Spurious Emission (5G NR n2) (5G NR n66)	< 43+10log ₁₀ (P[Watts])	PASS	Under limit 29.18 dB at 5671.500 MHz



1 General Description

1.1 Applicant

OnePlus Technology (Shenzhen) Co., Ltd

18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen

1.2 Manufacturer

OnePlus Technology (Shenzhen) Co., Ltd

18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Phone
Brand Name	ONEPLUS
Model Name	IN2017
FCC ID	2ABZ2-EE103
EUT supports Radios application	CDMA/GSM/WCDMA/LTE/5G NR WLAN 2.4GHz 802.11b/g/n (HT20) WLAN 2.4GHz 802.11ax (HE20/HE40) WLAN 5GHz 802.11a/n/ac (HT20/HT40/VHT20/VHT40/VHT80) WLAN 5GHz 802.11ax (HE20/HE40/HE80) Bluetooth BR / EDR / LE GNSS/NFC
IMEI Code	Conducted : N/A Radiation : 990015750219537
HW Version	15
SW Version	10.5.IN55CB
EUT Stage	Production Unit

Remark:

1. Only 5G NR bands are tested in this report, all the other RF bands are tested in the other reports separately.
2. This is a variant report for IN2017. The new SA mode 5G NR n2/n66 is opened by the software. Based on the similarity between current and previous project. 5G NR n2/n66 for full test, the others data can refer to original test report (Sporton Report Number FG9N2025-08).

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	5G NR n2: 1852.5 MHz ~ 1907.5 MHz 5G NR n66: 1712.5 MHz ~ 1777.5 MHz
Rx Frequency	5G NR n2: 1932.5 MHz ~ 1987.5 MHz 5G NR n66: 2112.5 MHz~ 2197.5 MHz
Bandwidth	n2, n66: 5MHz / 10MHz / 15MHz / 20MHz
SCS	15kHz
Maximum Output Power to Antenna	Top Antenna: SA_n2 : 20.89 dBm SA_n66 : 21.00 dBm Bottom Antenna: SA_n2 : 22.99 dBm SA_n66 : 23.14 dBm
Antenna Gain	n2 / n66 : -2.00 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM

1.5 Modification of EUT

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

1.6 Maximum EIRP Power, Frequency Tolerance, and Emission Designator

5G NR n2 (SA_n2)		QPSK	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1852.5 ~ 1907.5	4M51G7D	0.1253
10	1855.0 ~ 1905.0	9M05G7D	0.1253
20	1860.0 ~ 1900.0	17M9G7D	0.1256
Frequency Tolerance (ppm)		0.0015	

5G NR n66 (SA_n66)		QPSK	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1712.5 ~ 1777.5	4M49G7D	0.1288
10	1715.0 ~ 1775.0	9M09G7D	0.1256
20	1720.0 ~ 1770.0	17M9G7D	0.1300
Frequency Tolerance (ppm)		0.0025	

1.7 Testing Location

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	TH01-SZ	CN1256	421272

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan Shenzhen, 518055 People's Republic of China TEL: +86-755-33202398		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH02-SZ	CN1256	421272

1.8 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH02-SZ	AUDIX	E3	6.2009-8-24a

1.9 Applicable Standards

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

- ♦ 47 CFR Part 2, 24E, 27L
- ♦ ANSI C63.26-2015
- ♦ FCC KDB 971168 D01 Power Meas License Digital Systems v03r01
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

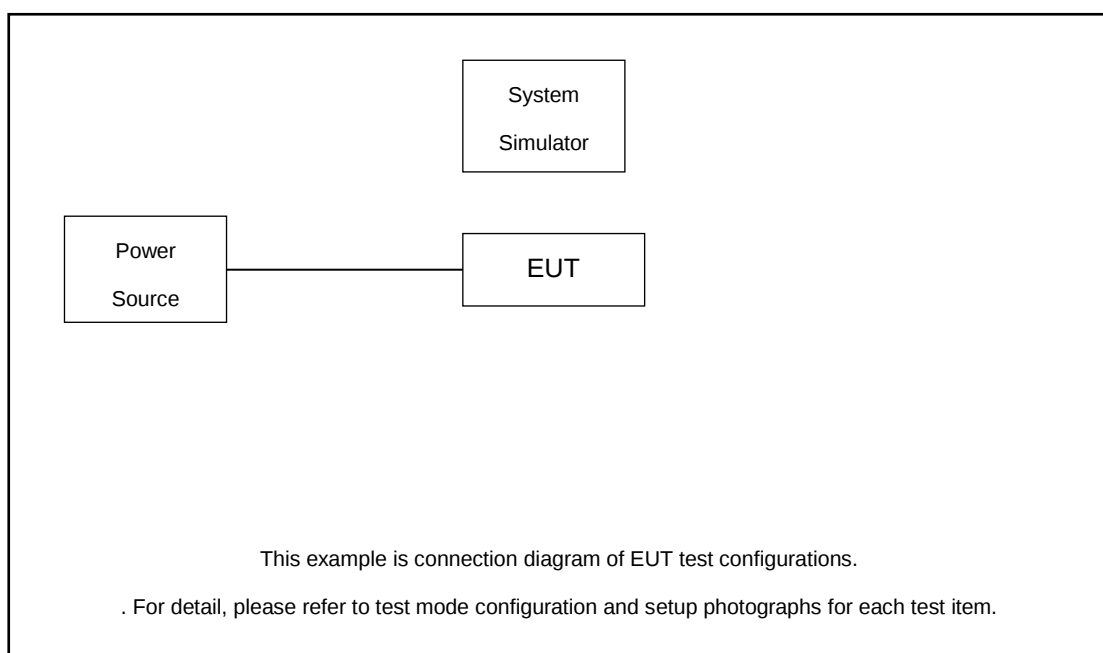
Antenna port conducted and radiated test items are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

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.

	X Plane	Y Plane	Z Plane
Orthogonal Planes of EUT			

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.	DC Power Supply	GW	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
2.	NR Base Station	Anritsu	MT8000A	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

Offset = RF cable loss.

Following shows an offset computation example with cable loss 5.1 dB.

Example :

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 5.1 \text{ (dB)}\end{aligned}$$

2.5 Frequency List of Low/Middle/High Channels

5G NR n2 Channel and Frequency List		
NR Bandwidth (MHz)	Channel	NR Frequency (MHz)
20	Low	1860
	Mid.	1880
	High	1900
10	Low	1855
	Mid.	1880
	High	1905
5	Low	1852.5
	Mid.	1880
	High	1907.5

5G NR n66 Channel and Frequency List		
NR Bandwidth (MHz)	Channel	NR Frequency (MHz)
20	Low	1720
	Mid.	1745
	High	1770
10	Low	1715
	Mid.	1745
	High	1775
5	Low	1712.5
	Mid.	1745
	High	1777.5

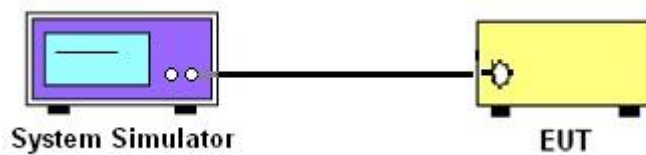
3 Conducted Test Items

3.1 Measuring Instruments

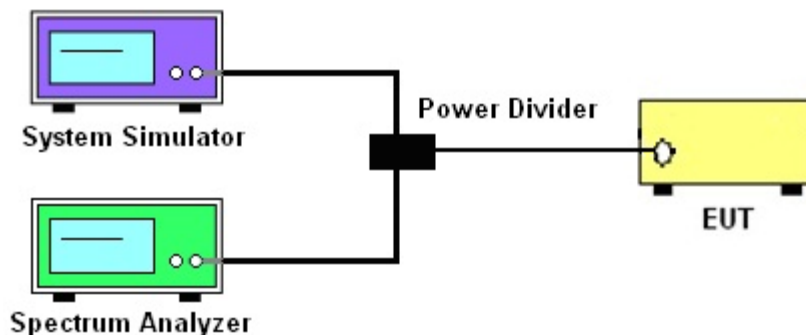
See list of measuring instruments of this test report.

3.2 Test Setup

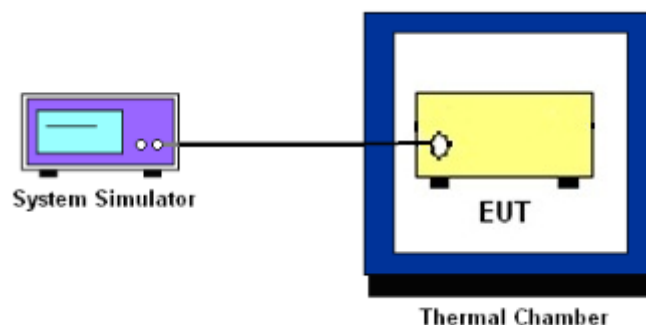
3.2.1 Conducted Output Power



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



3.2.3 Frequency Stability



3.3 Test Result of Conducted Test

Please refer to Appendix A.

3.4 Conducted Output Power and EIRP

3.4.1 Description of the Conducted Output Power Measurement and 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 EIRP of mobile transmitters must not exceed 2 Watts for 5G NR n2.

The EIRP of mobile transmitters must not exceed 1 Watts for 5G NR n66.

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

3.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

3.5 Peak-to-Average Ratio

3.5.1 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.

3.5.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

3.6 Occupied Bandwidth

3.6.1 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.

3.6.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.4
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. 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.
4. 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.
5. Set the detection mode to peak, and the trace mode to max hold.
6. 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)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. 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.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.7 Conducted Band Edge

3.7.1 Description of Conducted Band Edge Measurement

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 (h)

For operations in the 1710 – 1755 MHz band, 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.

3.7.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW $\geq 1\%$ EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used.
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

Example:

The limit line is derived from $43 + 10\log(P)\text{dB}$ below the transmitter power $P(\text{Watts})$
 $= P(\text{W}) - [43 + 10\log(P)] (\text{dB})$
 $= [30 + 10\log(P)] (\text{dBm}) - [43 + 10\log(P)] (\text{dB}) = -13\text{dBm}.$

3.8 Conducted Spurious Emission

3.8.1 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.

3.8.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. 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.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)]$ (dB)
 $= [30 + 10\log(P)]$ (dBm) - $[43 + 10\log(P)]$ (dB)
 $= -13\text{dBm}$.

3.9 Frequency Stability

3.9.1 Description of Frequency Stability Measurement

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.

3.9.2 Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. 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.
4. 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.

3.9.3 Test Procedures for Voltage Variation

1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at $20\pm 5^{\circ}\text{C}$ and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

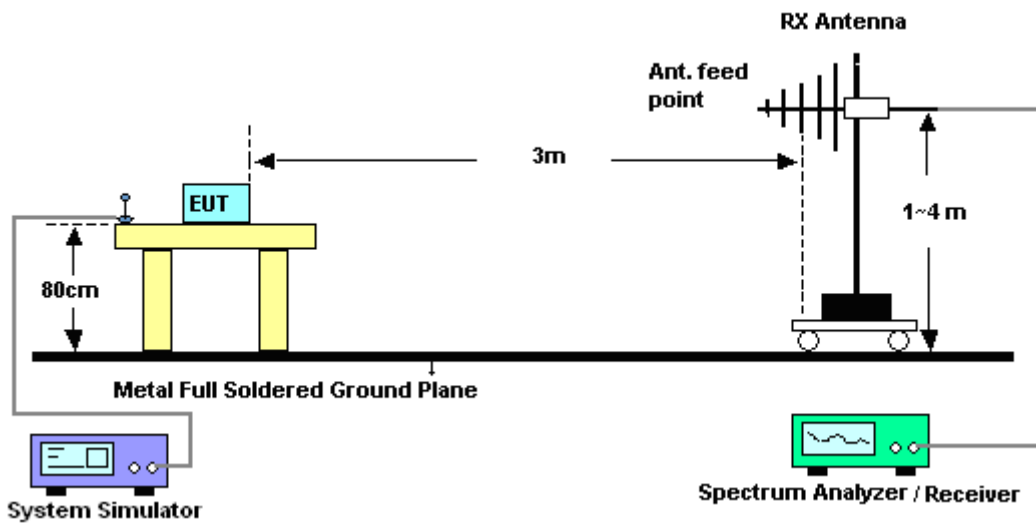
4 Radiated Test Items

4.1 Measuring Instruments

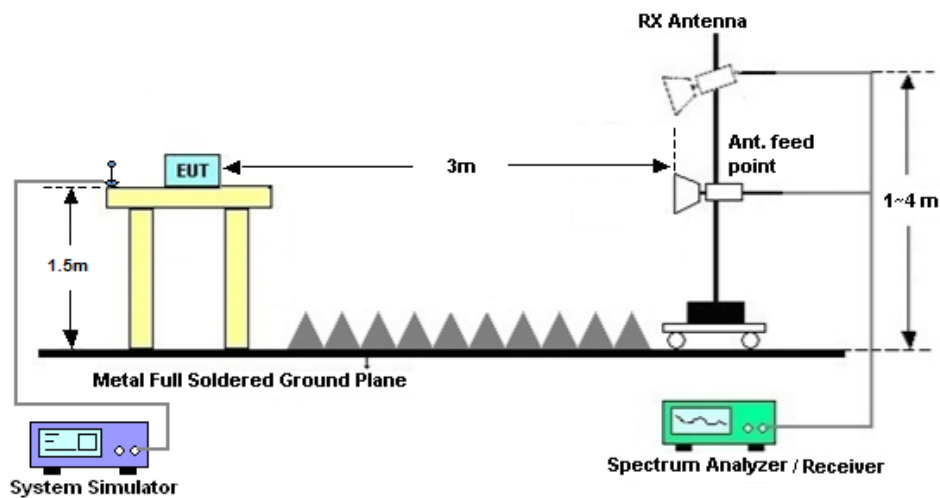
See list of measuring instruments of this test report.

4.2 Test Setup

4.2.1 For radiated test from 30MHz to 1GHz



4.2.2 For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26. 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.

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

4.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
11. $ERP \text{ (dBm)} = EIRP - 2.15$
12. 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)

$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$$

$$= -13\text{dBm}.$$



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 16, 2020	Jul. 04, 2020~ Jul. 05, 2020	Apr. 15, 2021	Conducted (TH01-SZ)
Thermal Chamber	Ten Billion Hongzhangroup	LP-150U	H2014081803	-40~+150°C	Dec. 26, 2019	Jul. 04, 2020~ Jul. 05, 2020	Dec. 25, 2020	Conducted (TH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 17, 2020	Jul. 14, 2020	Apr. 16, 2021	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Jul. 19, 2019	Jul. 14, 2020	Jul. 18, 2020	Radiation (03CH02-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	Apr. 01 2020	Jul. 14, 2020	Mar. 31, 2021	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 22, 2019	Jul. 14, 2020	Jul. 21, 2020	Radiation (03CH02-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz~40GHz	Apr. 17, 2020	Jul. 14, 2020	Apr. 16, 2021	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 18, 2019	Jul. 14, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5Ghz	Oct. 18, 2019	Jul. 14, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	616010002470	N/A	NCR	Jul. 14, 2020	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	Jul. 14, 2020	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	Jul. 14, 2020	NCR	Radiation (03CH02-SZ)

NCR: No Calibration Required

6 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage $K=2$ to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.5dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.3dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.7dB
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power and EIRP)

Bottom Antenna

SA_n2						
20MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
372000	1860	QPSK DFT-s-OFDM	1	1	22.99	0.1256
			1	104	22.97	0.1250
			50	25	22.98	0.1253
376000	1880	QPSK DFT-s-OFDM	1	1	22.97	0.1250
			1	104	22.99	0.1256
			50	25	22.98	0.1253
380000	1900	QPSK DFT-s-OFDM	1	1	22.99	0.1256
			1	104	22.97	0.1250
			50	25	22.96	0.1247

SA_n2						
10MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
371000	1855	QPSK DFT-s-OFDM	1	1	22.97	0.1250
			1	50	22.94	0.1242
			25	12	22.98	0.1253
376000	1880	QPSK DFT-s-OFDM	1	1	22.95	0.1245
			1	50	22.98	0.1253
			25	12	22.96	0.1247
381000	1905	QPSK DFT-s-OFDM	1	1	22.97	0.1250
			1	50	22.98	0.1253
			25	12	22.96	0.1247



SA_n2						
5MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
370500	1852.5	QPSK DFT-s-OFDM	1	1	22.98	0.1253
			1	23	22.96	0.1247
			12	6	22.97	0.1250
376000	1880	QPSK DFT-s-OFDM	1	1	22.98	0.1253
			1	23	22.97	0.1250
			12	6	22.96	0.1247
381500	1907.5	QPSK DFT-s-OFDM	1	1	22.98	0.1253
			1	23	22.97	0.1250
			12	6	22.98	0.1253

SA_n66						
20MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
344000	1720	QPSK DFT-s-OFDM	1	1	23.14	0.1300
			1	104	23.07	0.1279
			50	25	23.13	0.1297
349000	1745	QPSK DFT-s-OFDM	1	1	22.88	0.1225
			1	104	22.94	0.1242
			50	25	22.97	0.1250
354000	1770	QPSK DFT-s-OFDM	1	1	22.78	0.1197
			1	104	22.55	0.1135
			50	25	22.65	0.1161

SA_n66						
10MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
343000	1715	QPSK DFT-s-OFDM	1	1	22.99	0.1256
			1	50	22.98	0.1253
			25	12	22.95	0.1245
349000	1745	QPSK DFT-s-OFDM	1	1	22.64	0.1159
			1	50	22.95	0.1245
			25	12	22.97	0.1250
355000	1775	QPSK DFT-s-OFDM	1	1	22.81	0.1205
			1	50	22.75	0.1189
			25	12	22.82	0.1208

SA_n66						
5MHz						
NR Channel	NR Freq.	Modulation	NR		NR	EIRP (W)
			RB Size	RB offset	Measured Power (dBm)	
342500	1712.5	QPSK DFT-s-OFDM	1	1	23.07	0.1279
			1	23	23.1	0.1288
			12	6	23.08	0.1282
349000	1745	QPSK DFT-s-OFDM	1	1	22.81	0.1205
			1	23	22.73	0.1183
			12	6	22.86	0.1219
355500	1777.5	QPSK DFT-s-OFDM	1	1	22.69	0.1172
			1	23	22.55	0.1135
			12	6	22.78	0.1197

Note: The Maximum EIRP is calculated from Max Output power and Max antenna gain



5G NR n2

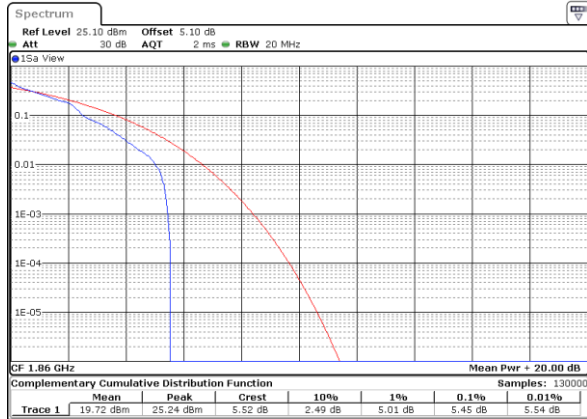
Peak-to-Average Ratio

Mode	NR N2 / 20MHz		
Mod.	QPSK		Limit: 13dB
RB Size	1RB	Full RB	Result
Lowest CH	5.45	5.10	PASS
Middle CH	5.36	5.16	
Highest CH	5.68	5.07	



NR N2 / 20MHz / QPSK

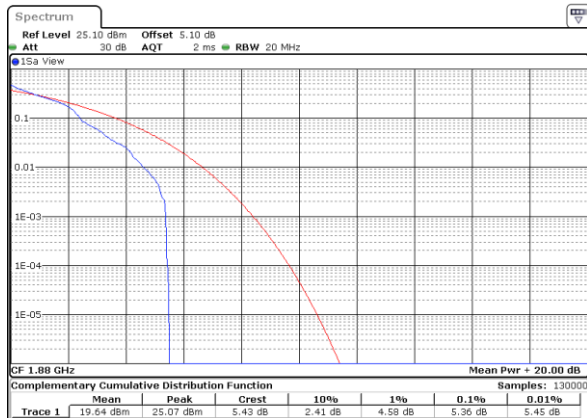
Lowest Channel / 1RB



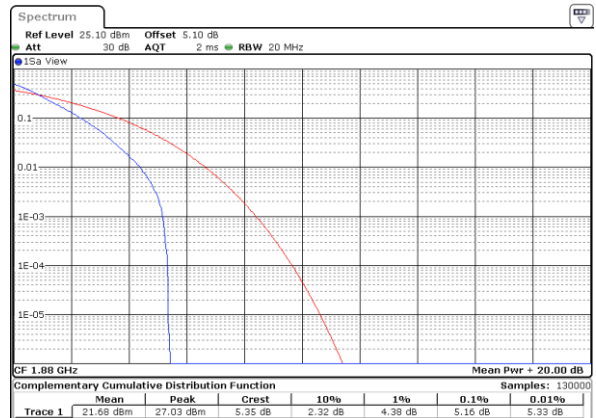
Lowest Channel / Full RB



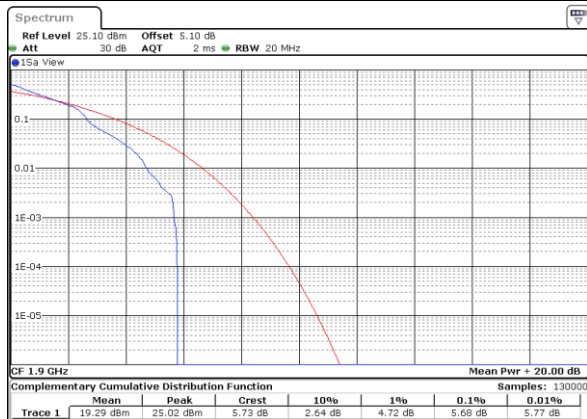
Middle Channel / 1RB



Middle Channel / Full RB



Highest Channel / 1RB



Highest Channel / Full RB



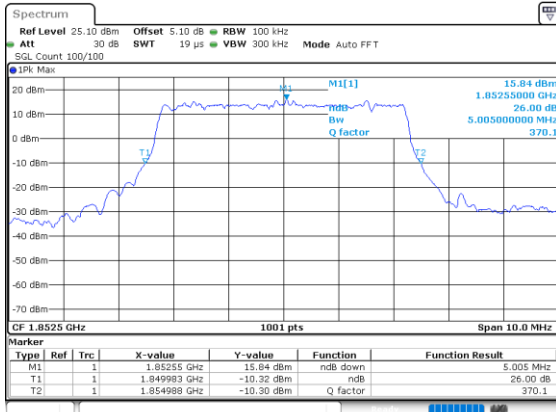
**26dB Bandwidth**

Mode	NR N2 : 26dB BW(MHz)		
BW	5 MHz	10 MHz	20 MHz
Mod.	QPSK	QPSK	QPSK
Lowest CH	5.005	10.01	18.901
Middle CH	5.275	9.77	18.821
Highest CH	5.045	9.85	18.901

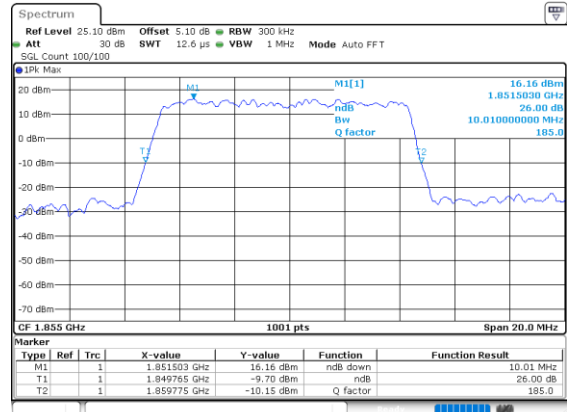


NR N2

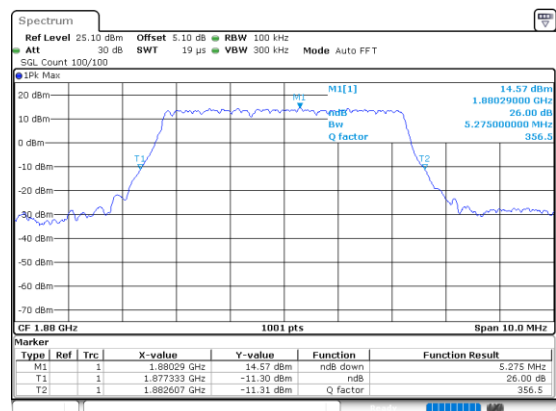
Lowest Channel / 5MHz / QPSK



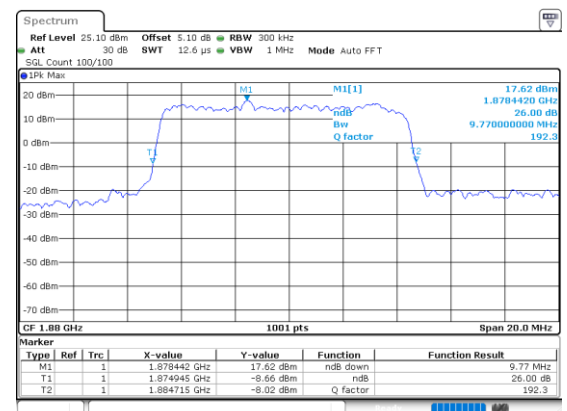
Lowest Channel / 10MHz / QPSK



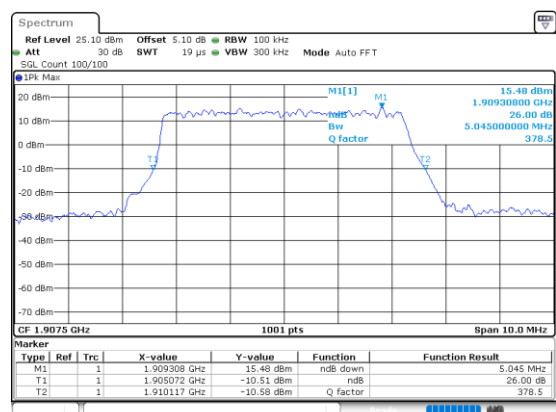
Middle Channel / 5MHz / QPSK



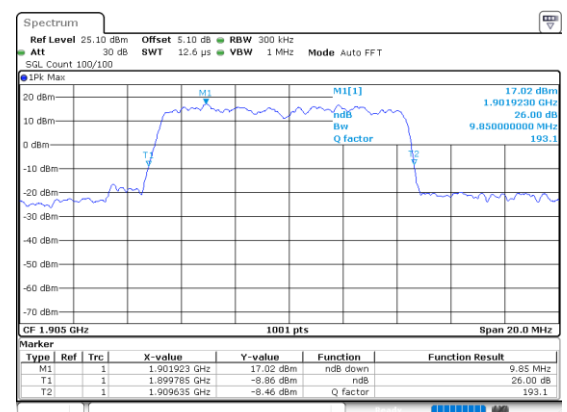
Middle Channel / 10MHz / QPSK



Highest Channel / 5MHz / QPSK



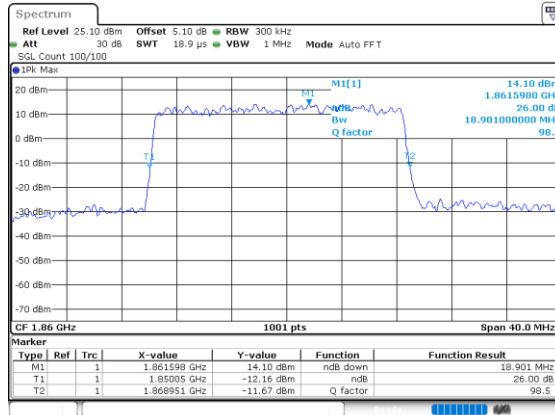
Highest Channel / 10MHz / QPSK



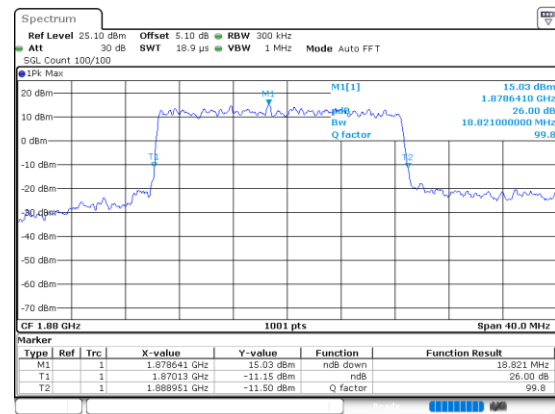


NR N2

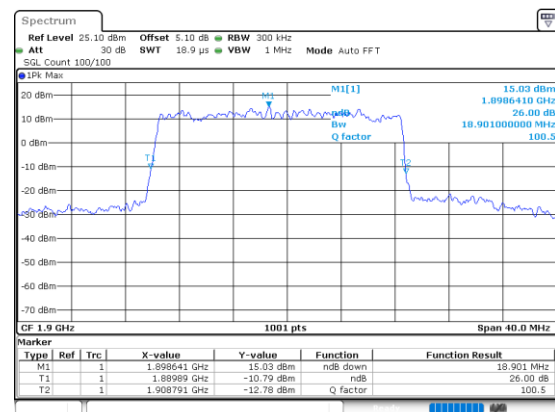
Lowest Channel / 20MHz / QPSK



Middle Channel / 20MHz / QPSK



Highest Channel / 20MHz / QPSK



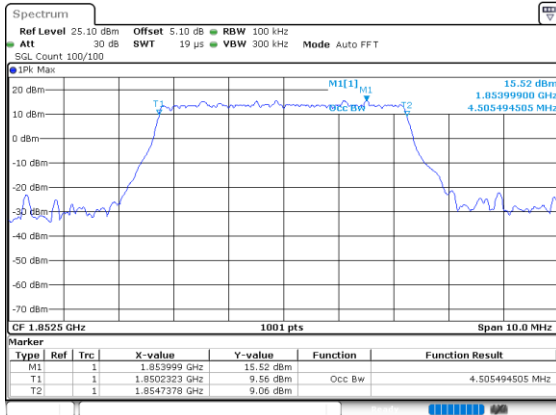
**Occupied Bandwidth**

Mode	NR N2 : OB BW(MHz)		
BW	5 MHz	10 MHz	20 MHz
Mod.	QPSK	QPSK	QPSK
Lowest CH	4.51	9.05	17.86
Middle CH	4.49	9.05	17.90
Highest CH	4.48	8.99	17.86

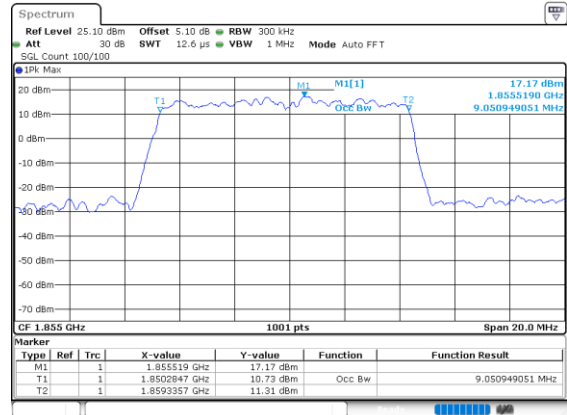


NR N2

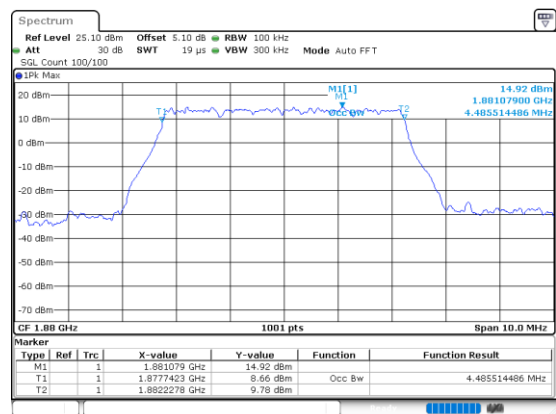
Lowest Channel / 5MHz / QPSK



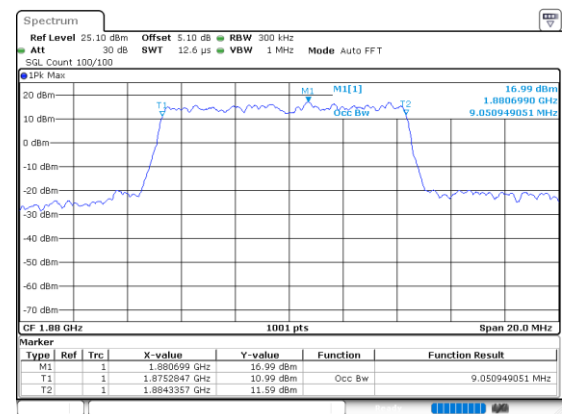
Lowest Channel / 10MHz / QPSK



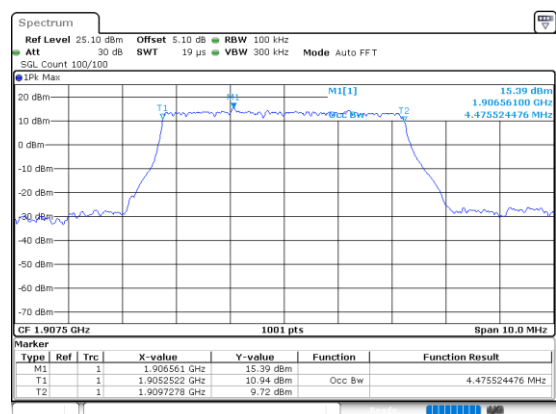
Middle Channel / 5MHz / QPSK



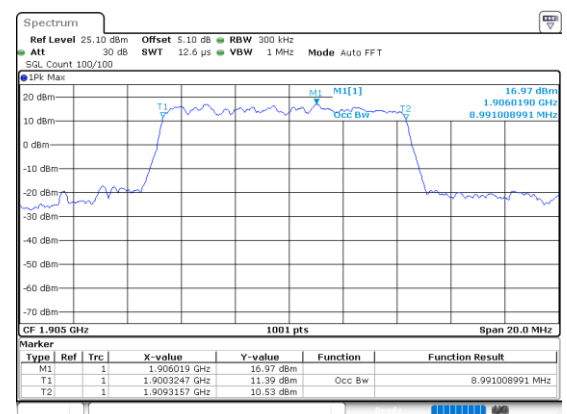
Middle Channel / 10MHz / QPSK

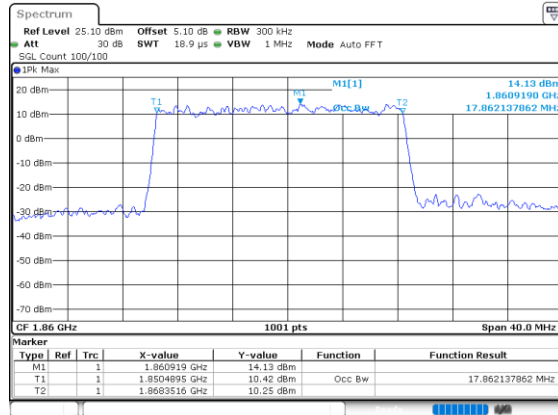
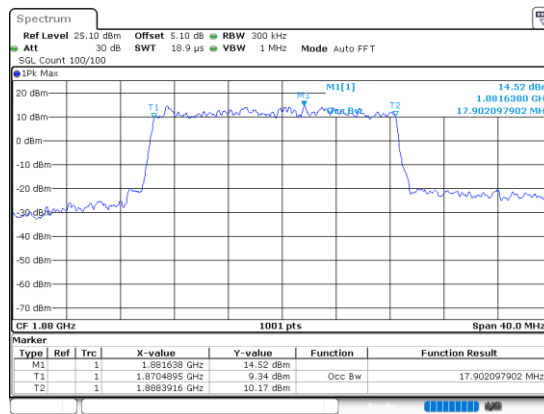
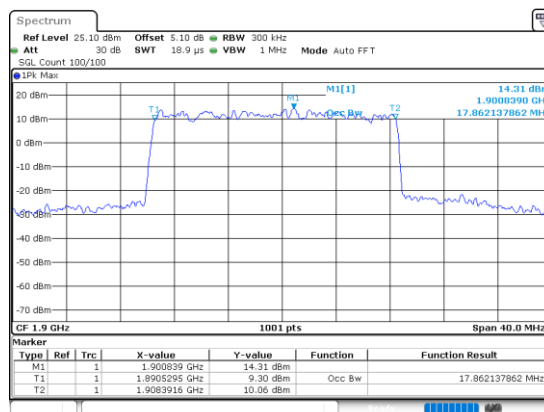


Highest Channel / 5MHz / QPSK



Highest Channel / 10MHz / QPSK



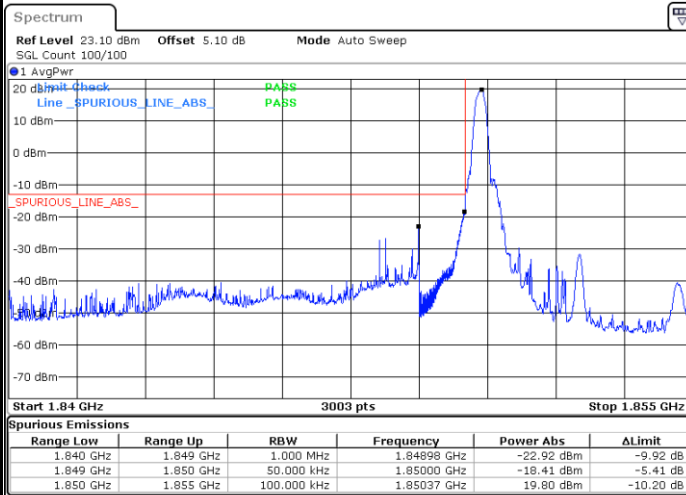
NR N2
Lowest Channel / 20MHz / QPSK

Middle Channel / 20MHz / QPSK

Highest Channel / 20MHz / QPSK




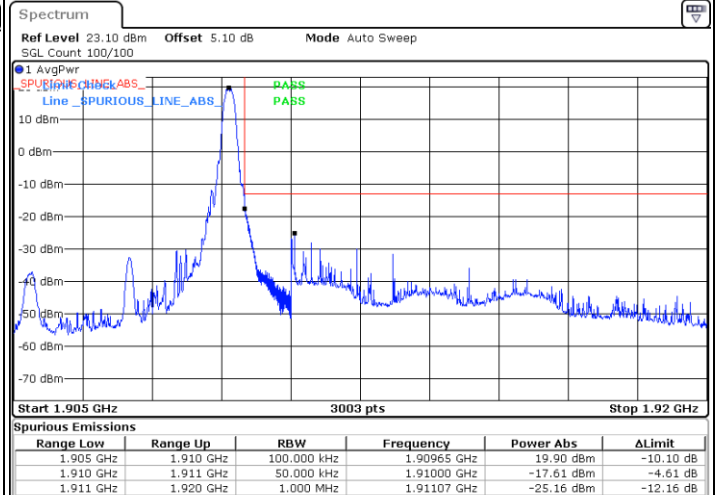
Conducted Band Edge

NR N2 / 5MHz / QPSK

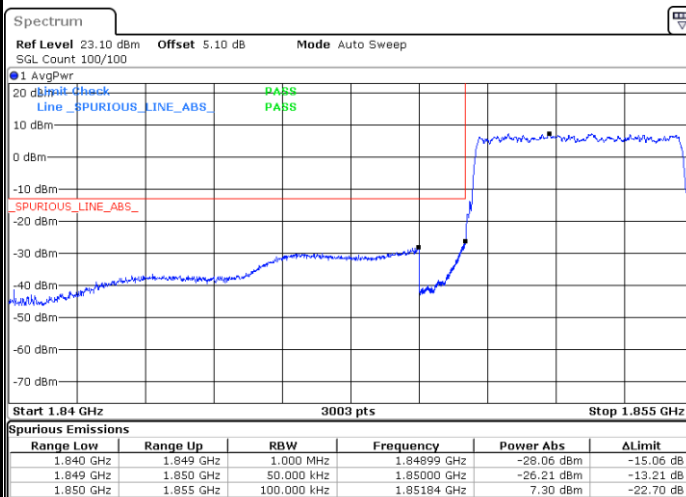
Lowest Band Edge / 1 RB



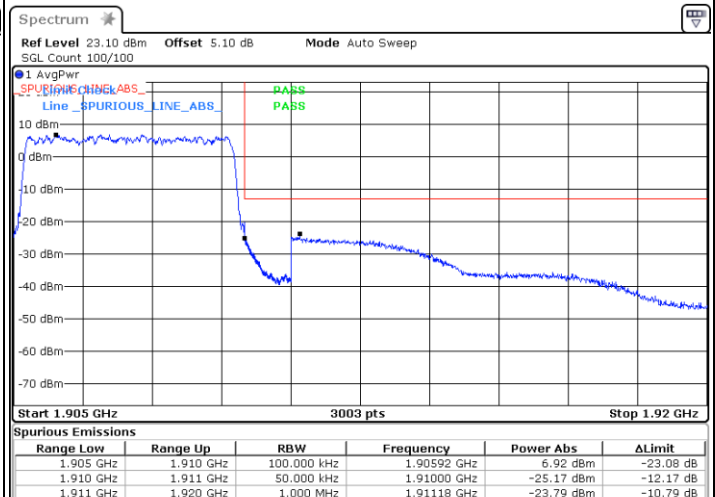
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



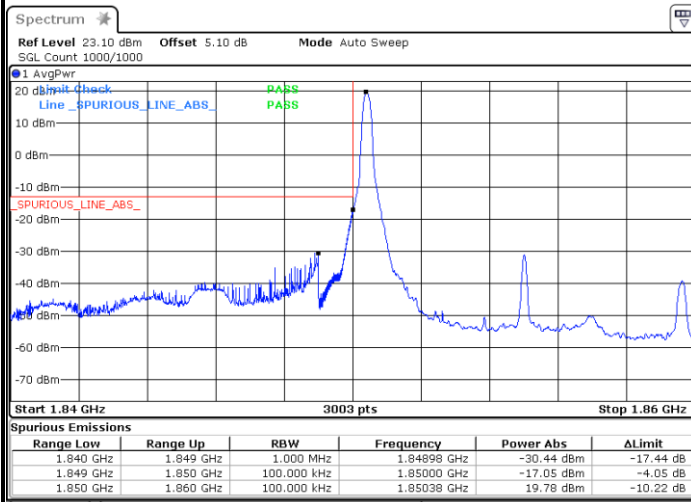
Highest Band Edge / Full RB



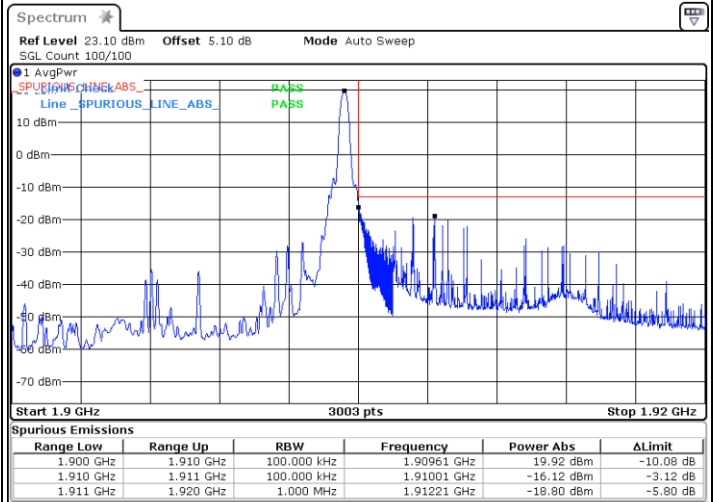


NR N2 / 10MHz / QPSK

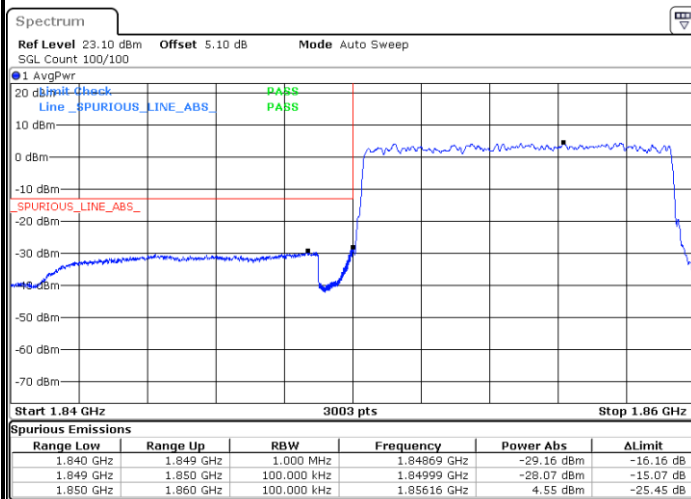
Lowest Band Edge / 1 RB



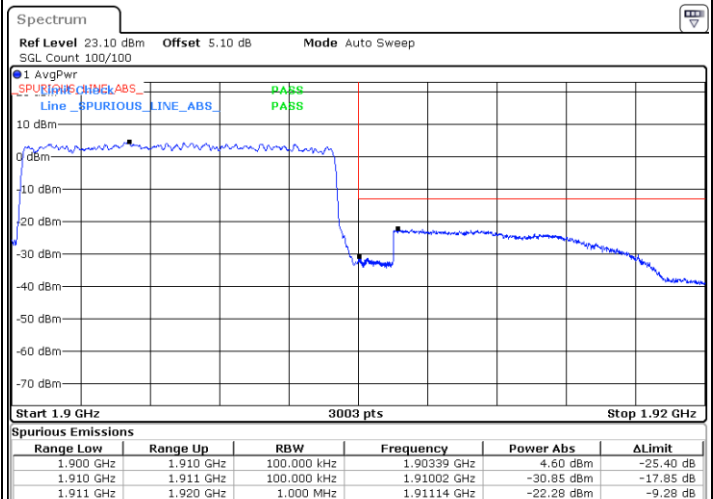
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



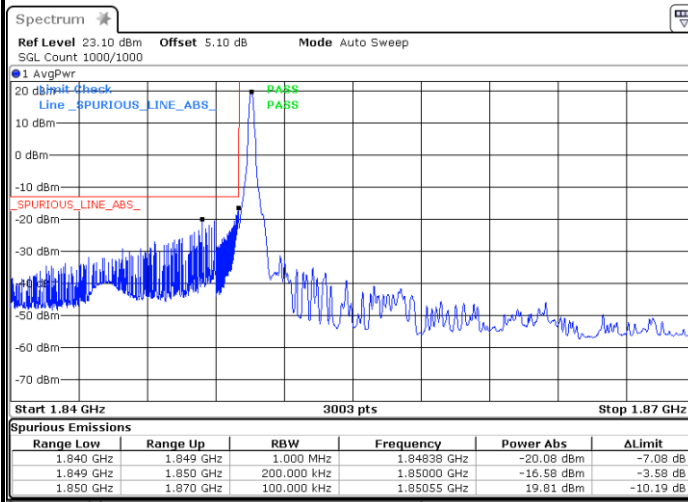
Highest Band Edge / Full RB



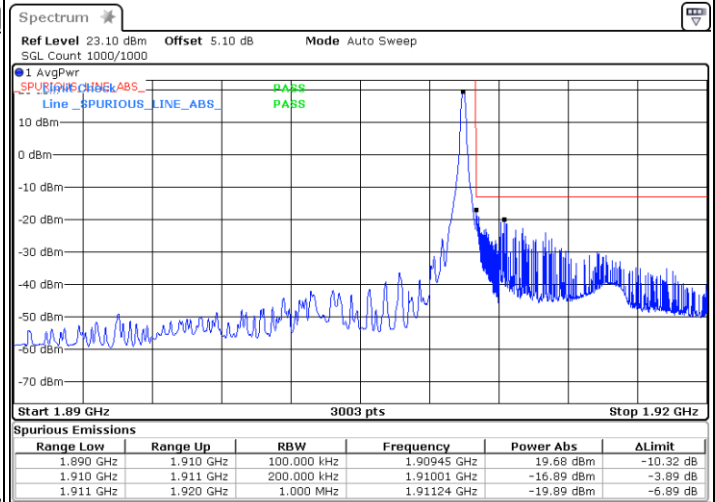


NR N2 / 20MHz / QPSK

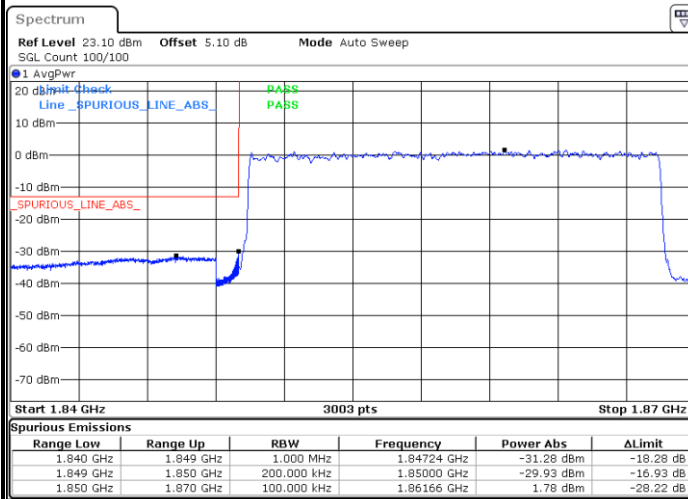
Lowest Band Edge / 1 RB



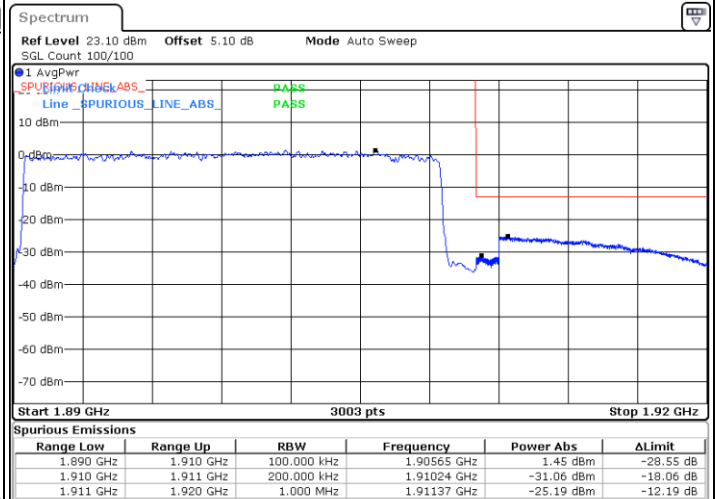
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



Highest Band Edge / Full RB

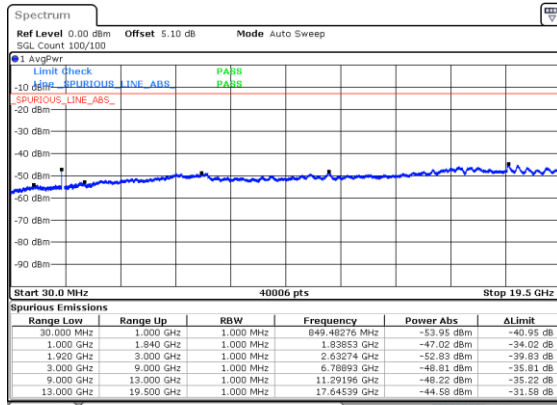




Conducted Spurious Emission

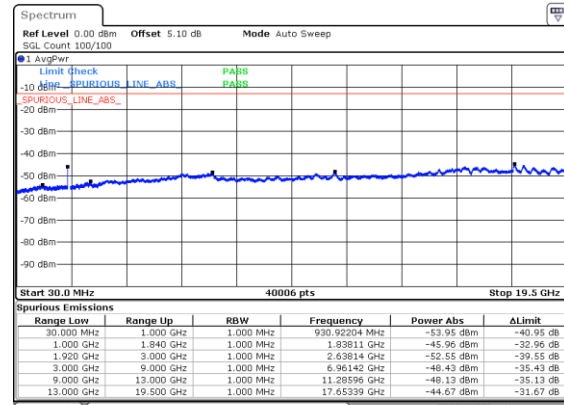
NR N2 / 5MHz

Lowest Channel / QPSK

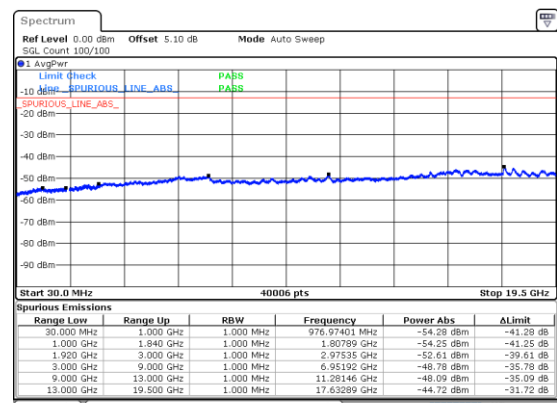


NR N2 / 10MHz

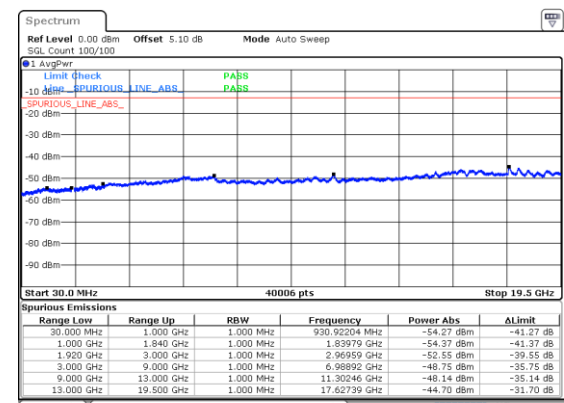
Lowest Channel / QPSK



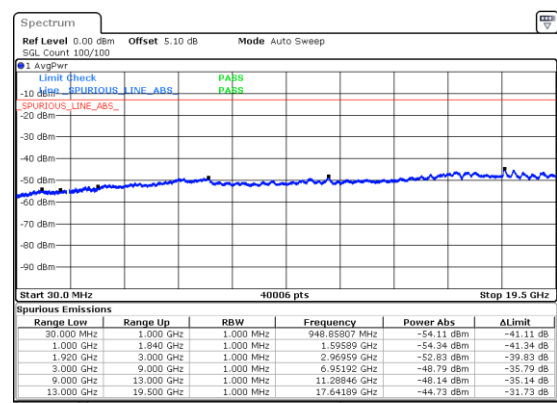
Middle Channel / QPSK



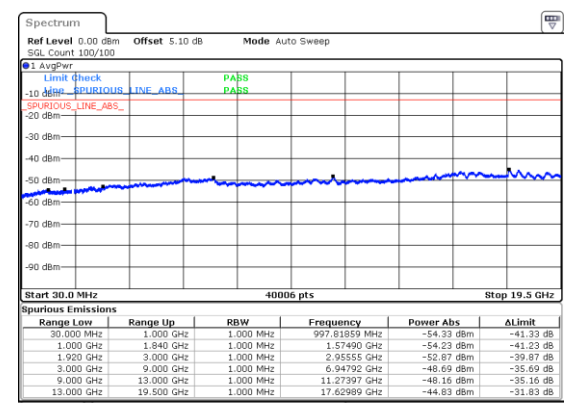
Middle Channel / QPSK



Highest Channel / QPSK



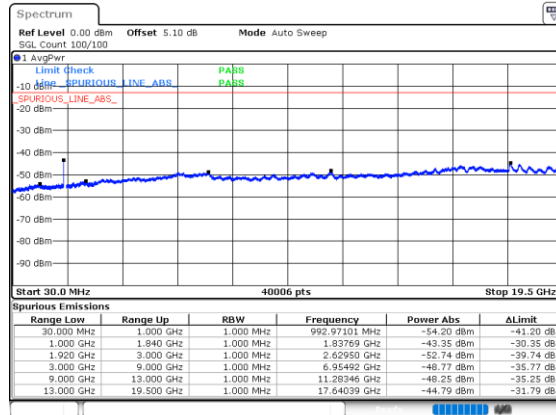
Highest Channel / QPSK



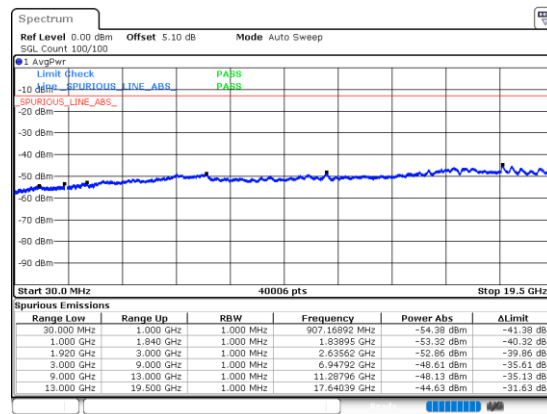


NR N2 / 20MHz

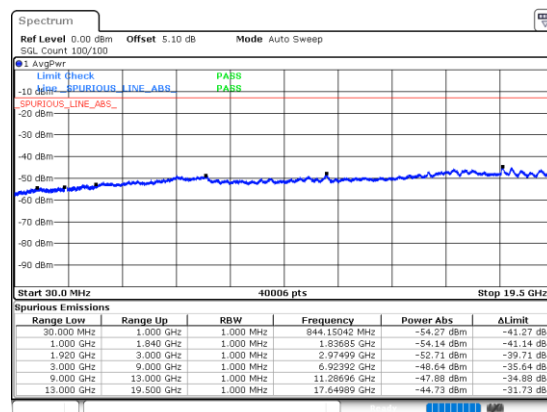
Lowest Channel / QPSK



Middle Channel / QPSK



Highest Channel / QPSK



Frequency Stability

Test Conditions		N2 (BPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	NR 20MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0013	PASS
40	Normal Voltage	0.0005	
30	Normal Voltage	0.0010	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0011	
0	Normal Voltage	0.0010	
-10	Normal Voltage	0.0012	
-20	Normal Voltage	0.0015	
-30	Normal Voltage	0.0012	
20	Maximum Voltage	0.0009	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0011	

Note:

1. Normal Voltage =3.87 V. ; Battery End Point (BEP) =3.6 V. ; Maximum Voltage =4.45 V.
2. Note: The frequency fundamental emissions stay within the authorized frequency block.



5G NR n66

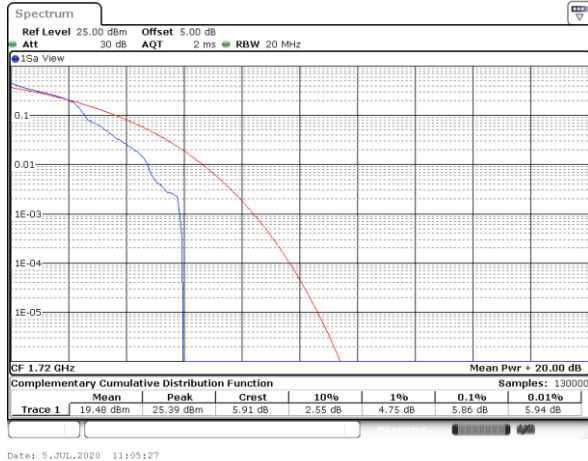
Peak-to-Average Ratio

Mode	NR N66 / 20MHz		
Mod.	QPSK		Limit: 13dB
RB Size	1RB	Full RB	Result
Lowest CH	5.86	5.01	PASS
Middle CH	5.77	5.01	
Highest CH	6.14	5.01	

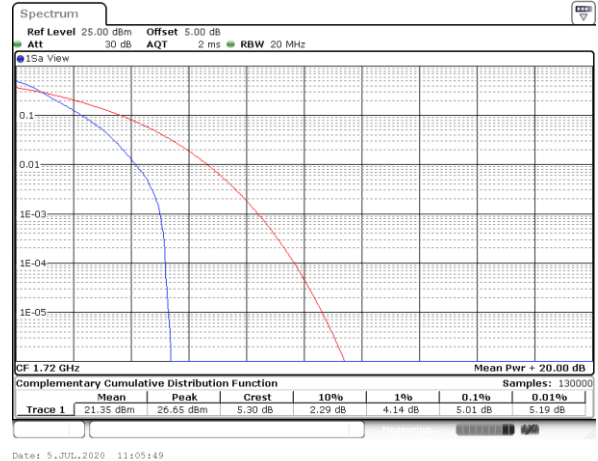


NR N66 / 20MHz / QPSK

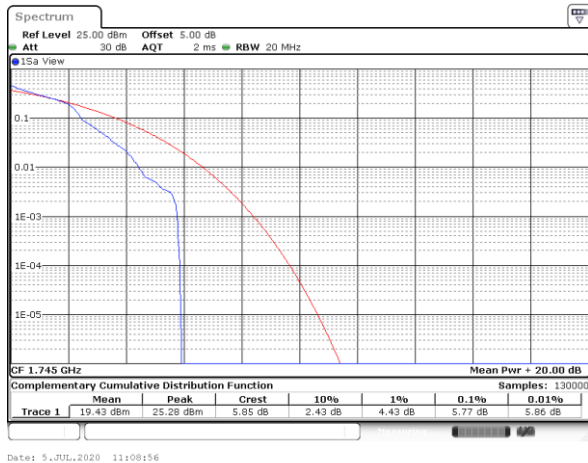
Lowest Channel / 1RB



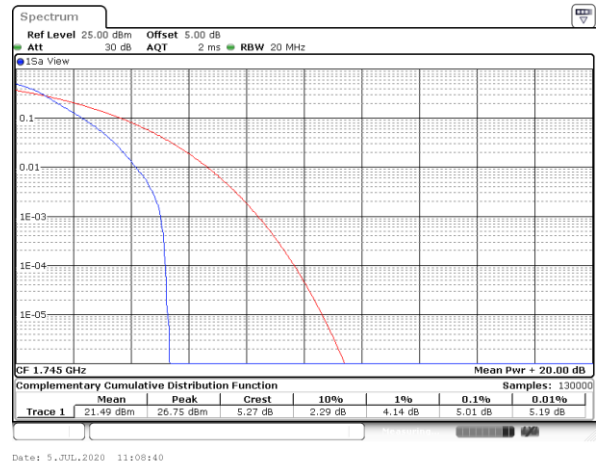
Lowest Channel / Full RB



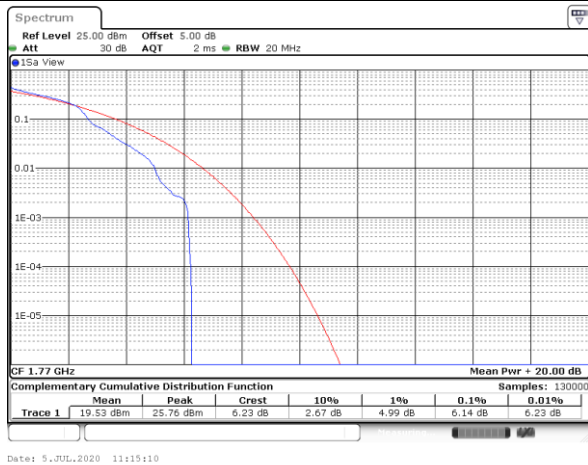
Middle Channel / 1RB



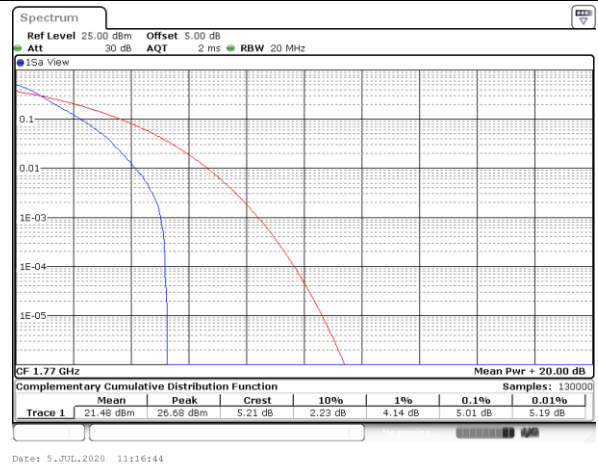
Middle Channel / Full RB



Highest Channel / 1RB



Highest Channel / Full RB



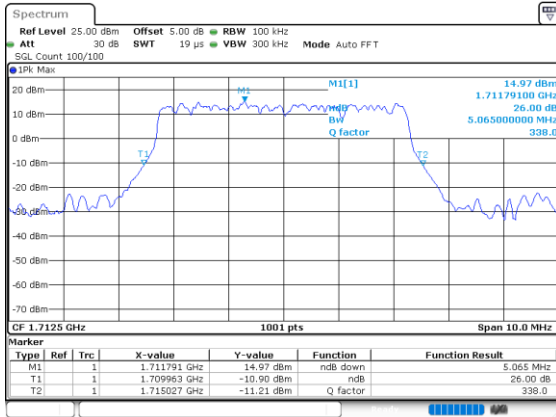
**26dB Bandwidth**

Mode	NR N66 : 26dB BW(MHz)		
BW	5 MHz	10 MHz	20 MHz
Mod.	QPSK	QPSK	QPSK
Lowest CH	5.065	10.07	18.781
Middle CH	5.015	9.91	18.701
Highest CH	5.055	9.97	18.701



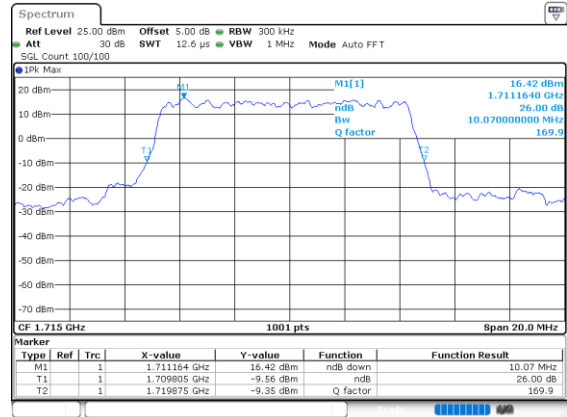
NR N66

Lowest Channel / 5MHz / QPSK

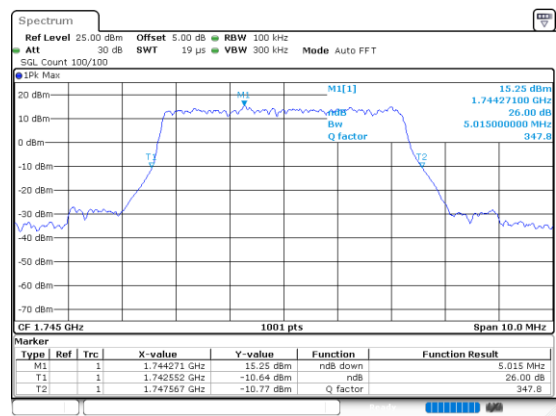


NR N66

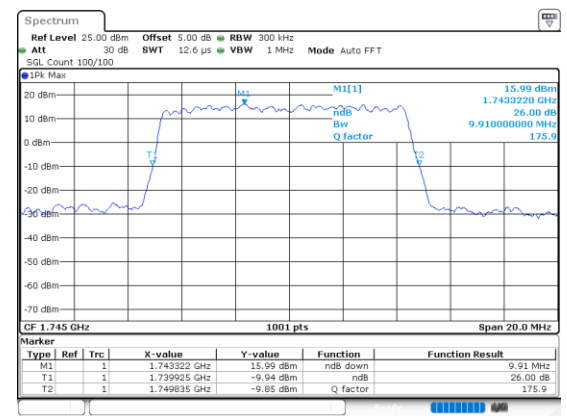
Lowest Channel / 10MHz / QPSK



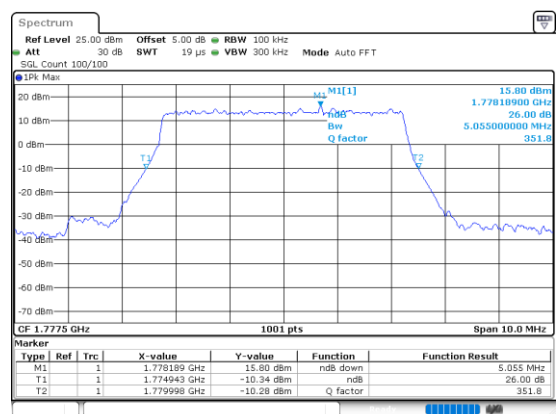
Middle Channel / 5MHz / QPSK



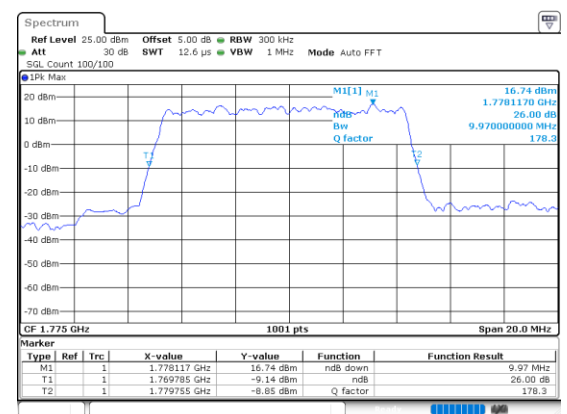
Middle Channel / 10MHz / QPSK

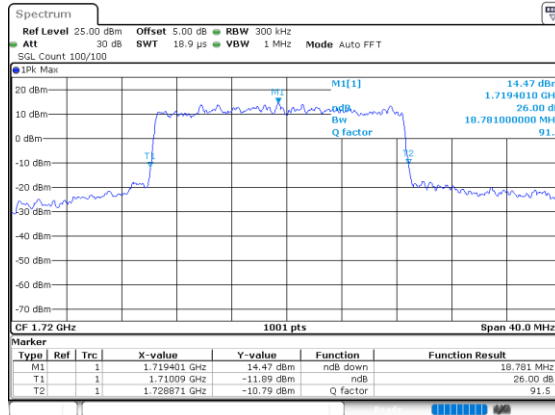
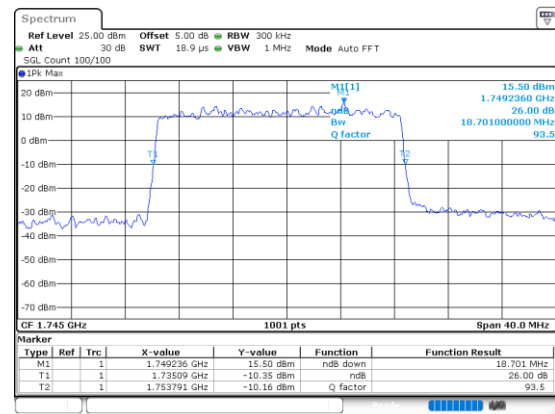
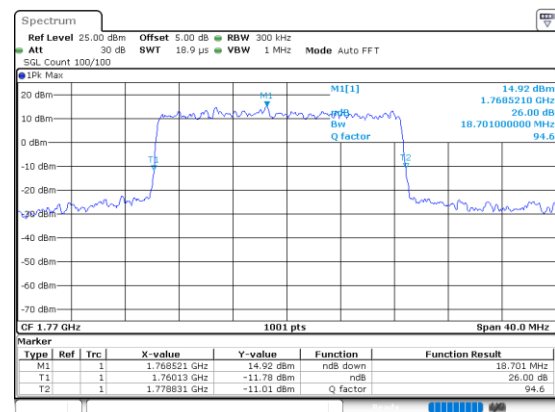


Highest Channel / 5MHz / QPSK



Highest Channel / 10MHz / QPSK



NR N66
Lowest Channel / 20MHz / QPSK

Middle Channel / 20MHz / QPSK

Highest Channel / 20MHz / QPSK


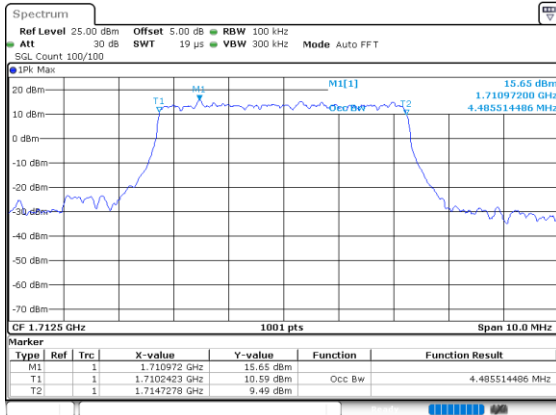
**Occupied Bandwidth**

Mode	NR N66 : OB BW(MHz)		
BW	5 MHz	10 MHz	20 MHz
Mod.	QPSK	QPSK	QPSK
Lowest CH	4.49	9.05	17.90
Middle CH	4.49	9.09	17.90
Highest CH	4.46	9.03	17.90



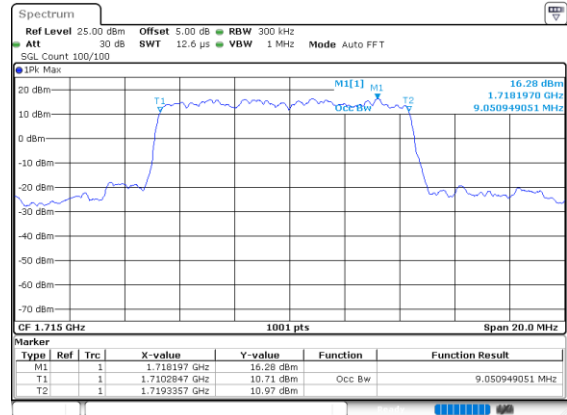
NR N66

Lowest Channel / 5MHz / QPSK

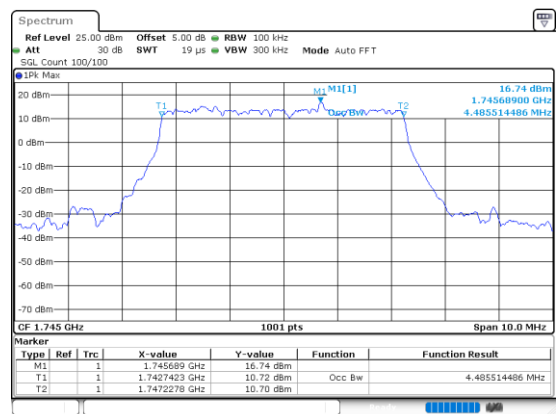


NR N66

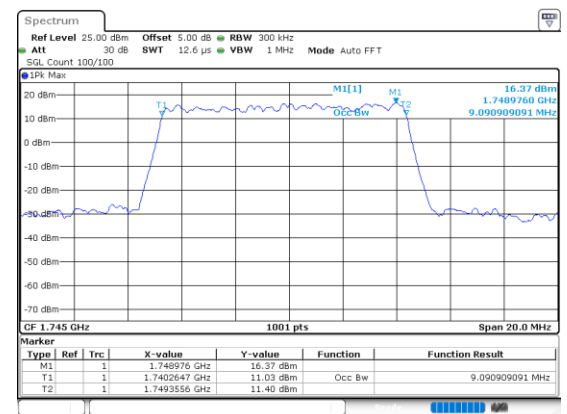
Lowest Channel / 10MHz / QPSK



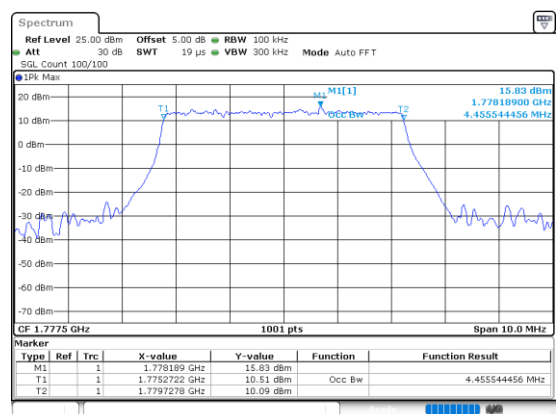
Middle Channel / 5MHz / QPSK



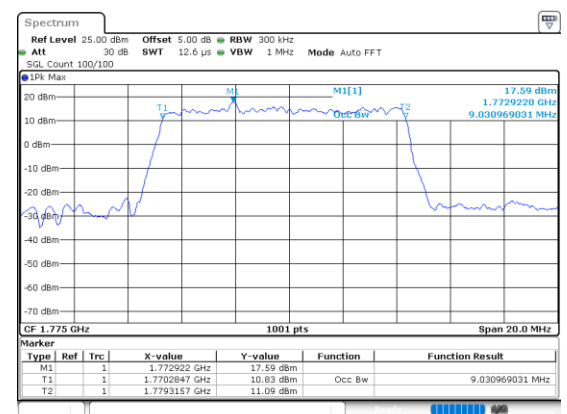
Middle Channel / 10MHz / QPSK



Highest Channel / 5MHz / QPSK



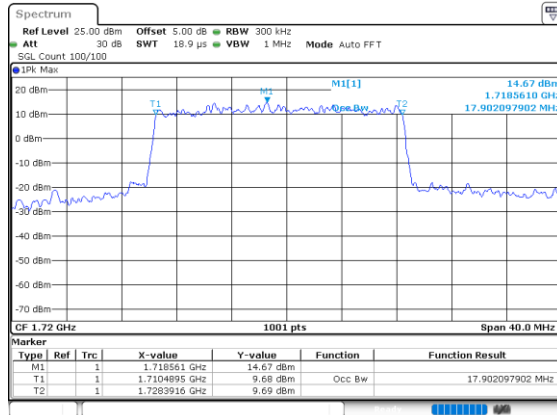
Highest Channel / 10MHz / QPSK



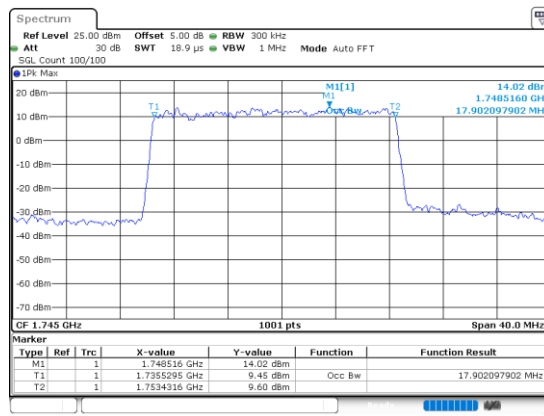


NR N66

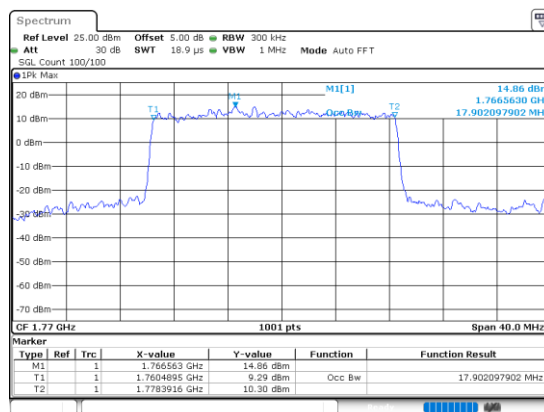
Lowest Channel / 20MHz / QPSK



Middle Channel / 20MHz / QPSK



Highest Channel / 20MHz / QPSK

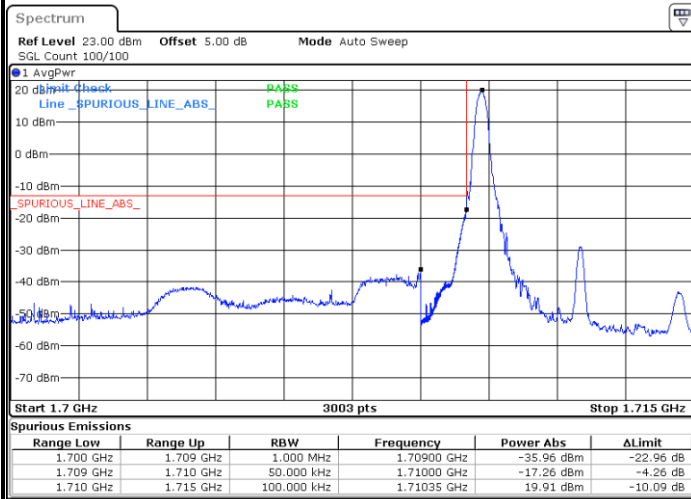




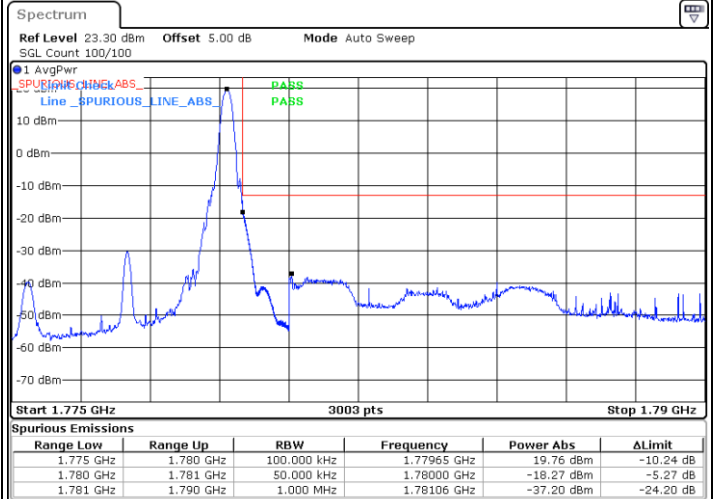
Conducted Band Edge

NR N66 / 5MHz / QPSK

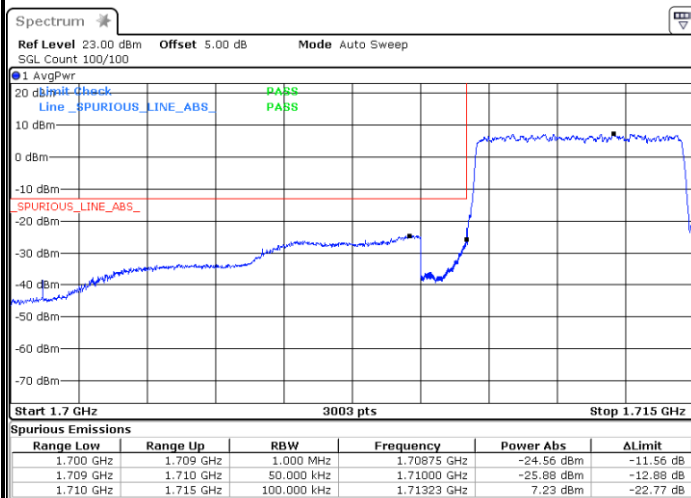
Lowest Band Edge / 1 RB



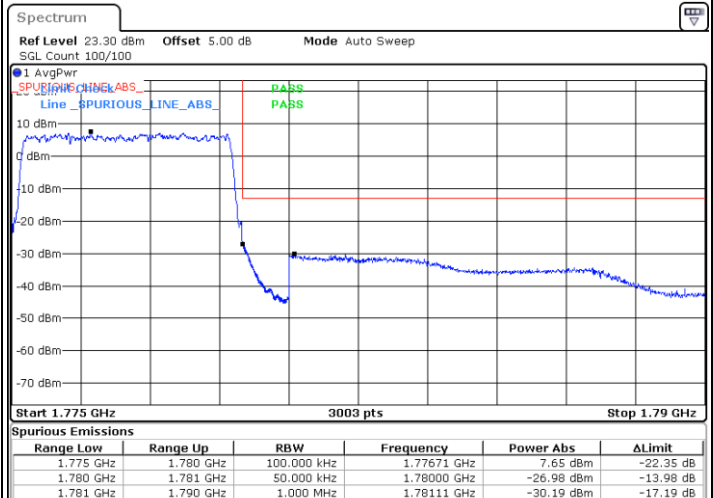
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



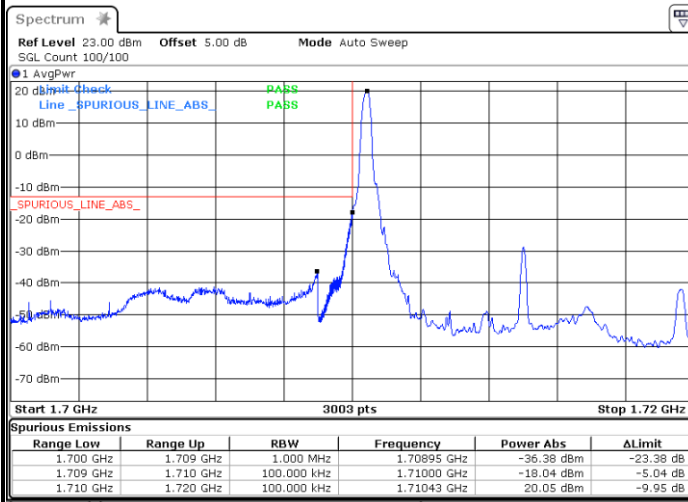
Highest Band Edge / Full RB



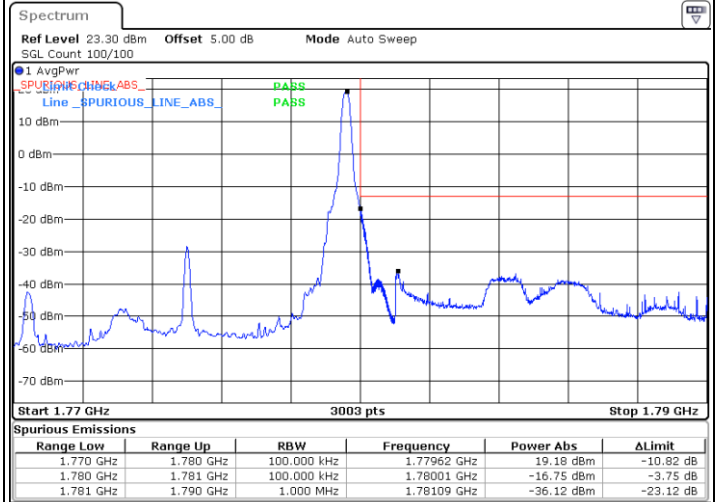


NR N66 / 10MHz / QPSK

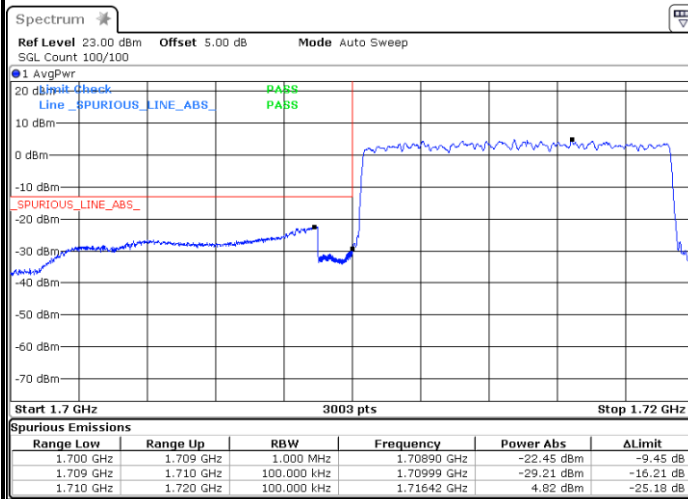
Lowest Band Edge / 1 RB



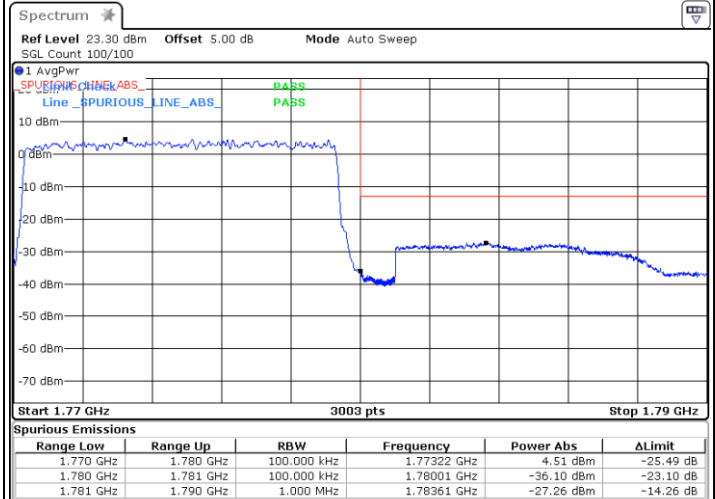
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



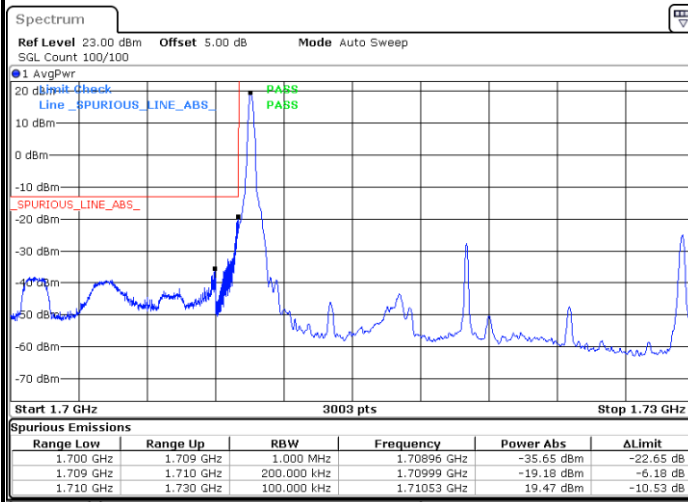
Highest Band Edge / Full RB



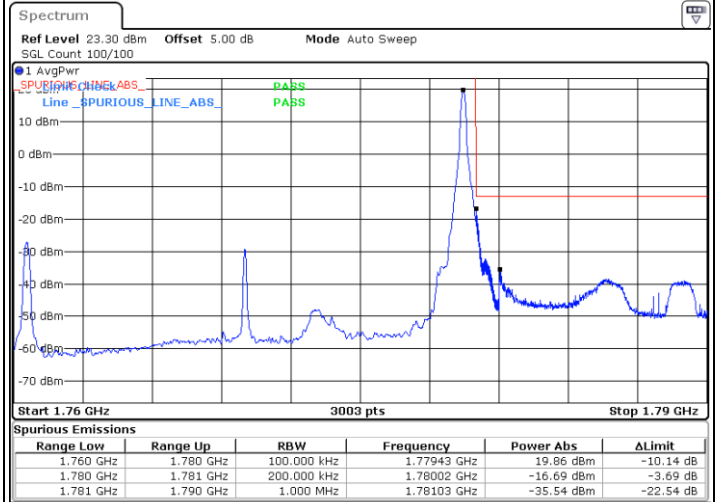


NR N66 / 20MHz / QPSK

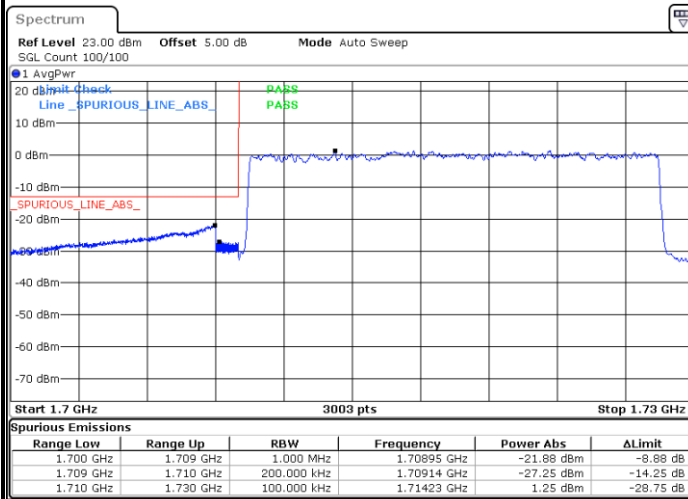
Lowest Band Edge / 1 RB



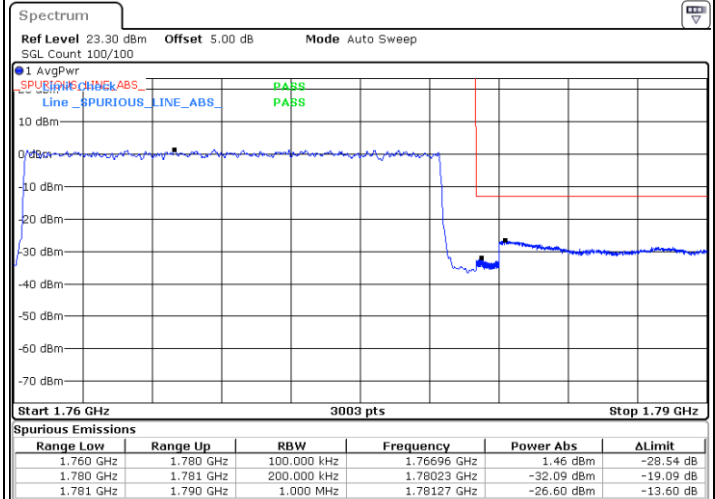
Highest Band Edge / 1 RB



Lowest Band Edge / Full RB



Highest Band Edge / Full RB

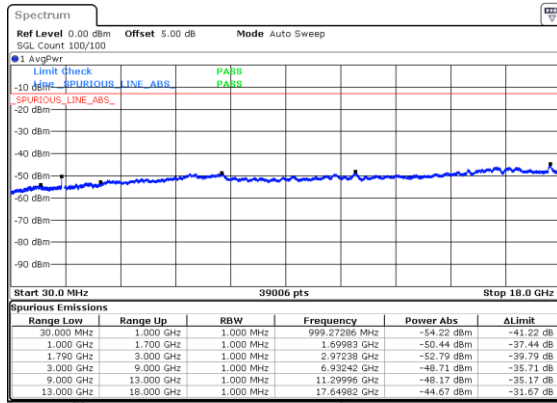




Conducted Spurious Emission

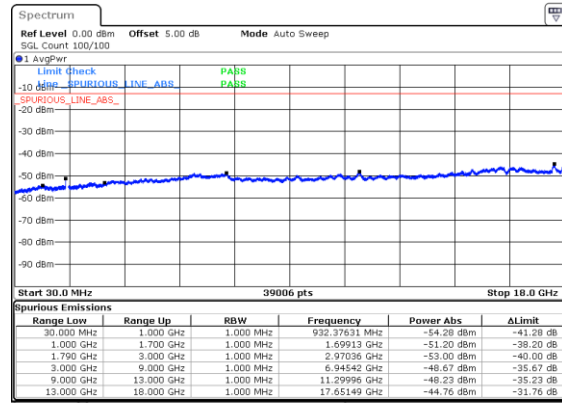
NR N66 / 5MHz

Lowest Channel / QPSK

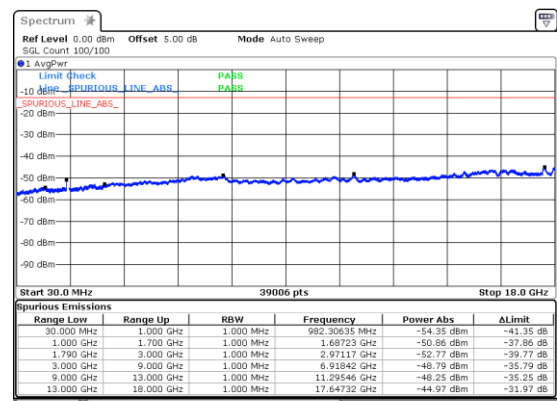


NR N66 / 10MHz

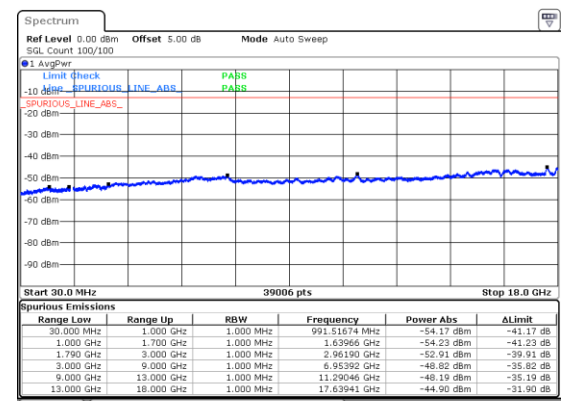
Lowest Channel / QPSK



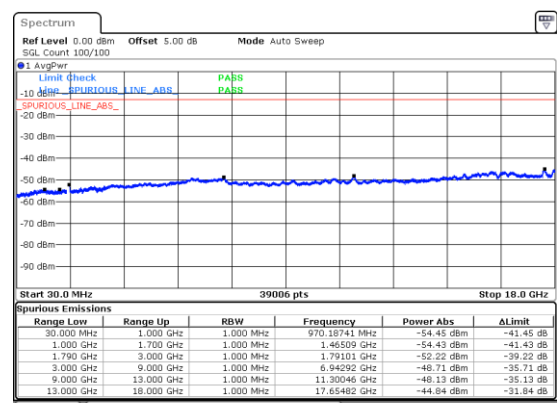
Middle Channel / QPSK



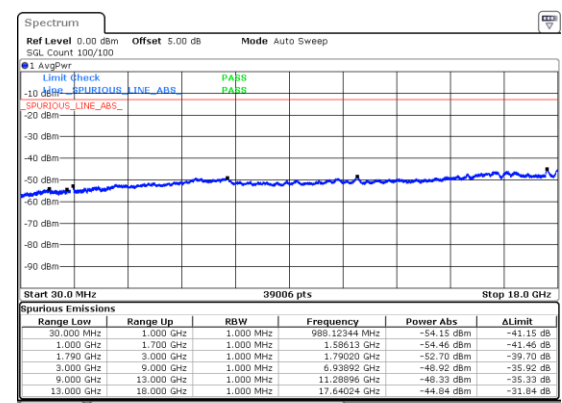
Middle Channel / QPSK



Highest Channel / QPSK



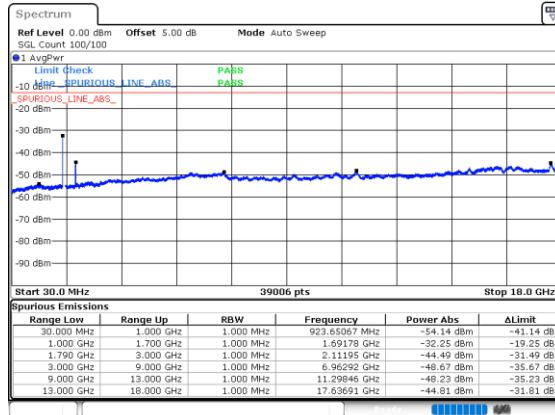
Highest Channel / QPSK



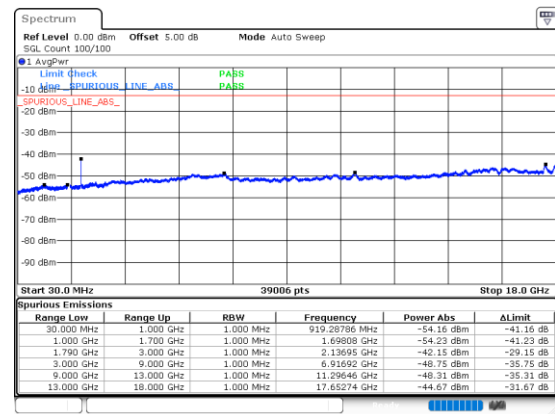


NR N66 / 20MHz

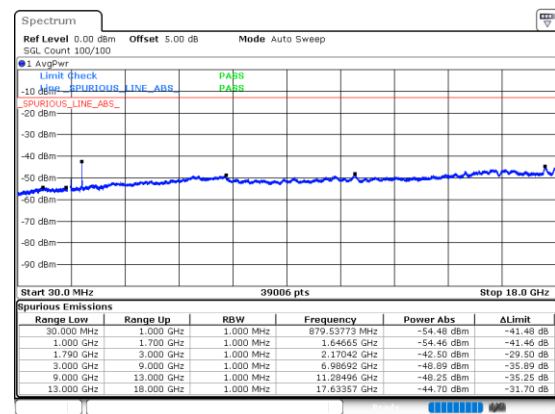
Lowest Channel / QPSK



Middle Channel / QPSK



Highest Channel / QPSK



**Frequency Stability**

Test Conditions		N66 (BPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	NR 20MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0025	PASS
40	Normal Voltage	0.0011	
30	Normal Voltage	0.0013	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0005	
0	Normal Voltage	0.0010	
-10	Normal Voltage	0.0012	
-20	Normal Voltage	0.0006	
-30	Normal Voltage	0.0012	
20	Maximum Voltage	0.0013	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0013	

Note:

1. Normal Voltage =3.87 V. ; Battery End Point (BEP) =3.6 V. ; Maximum Voltage =4.45 V.
2. Note: The frequency fundamental emissions stay within the authorized frequency block.



Appendix B. Test Results of Radiated Test

Radiated Spurious Emission

Top Antenna

SA_n2 / 20MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3701	-60.65	-13	-47.65	-80.61	-67.41	5.82	12.58	H
	5551.5	-58.83	-13	-45.83	-83.52	-64.55	7.28	13.00	H
	7402	-54.16	-13	-41.16	-83.44	-57.32	8.32	11.48	H
	3701	-61.37	-13	-48.37	-81.36	-68.13	5.82	12.58	V
	5551.5	-58.41	-13	-45.41	-83.3	-64.13	7.28	13.00	V
	7402	-54.37	-13	-41.37	-83.33	-57.53	8.32	11.48	V
Middle	3741	-59.15	-13	-46.15	-79.19	-65.90	5.85	12.60	H
	5611.5	-56.75	-13	-43.75	-81.53	-62.55	7.30	13.10	H
	7482	-54.09	-13	-41.09	-83.00	-57.24	8.35	11.50	H
	3741	-59.30	-13	-46.30	-79.38	-66.05	5.85	12.60	V
	5611.5	-56.46	-13	-43.46	-81.39	-62.26	7.30	13.10	V
	7482	-54.69	-13	-41.69	-83.35	-57.84	8.35	11.50	V
Highest	3781	-59.37	-13	-46.37	-79.56	-66.11	5.88	12.62	H
	5671.5	-59.24	-13	-46.24	-83.77	-65.05	7.32	13.13	H
	7562	-54.59	-13	-41.59	-83.16	-57.75	8.38	11.54	H
	3781	-59.50	-13	-46.50	-79.73	-66.24	5.88	12.62	V
	5671.5	-58.80	-13	-45.80	-83.71	-64.61	7.32	13.13	V
	7562	-55.16	-13	-42.16	-83.57	-58.32	8.38	11.54	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



SA_n66 / 20MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3421	-60.74	-13	-47.74	-78.68	-67.62	5.60	12.48	H
	5131.5	-56.90	-13	-43.90	-80.79	-62.58	7.10	12.78	H
	6842	-55.61	-13	-42.61	-83.17	-59.00	8.38	11.77	H
	3421	-61.79	-13	-48.79	-79.77	-68.67	5.60	12.48	V
	5131.5	-51.89	-13	-38.89	-76.21	-57.57	7.10	12.78	V
	6842	-55.74	-13	-42.74	-83.53	-59.13	8.38	11.77	V
Middle	3471	-61.69	-13	-48.69	-80.10	-68.54	5.65	12.50	H
	5206.5	-56.54	-13	-43.54	-80.51	-62.21	7.13	12.80	H
	6942	-56.25	-13	-43.25	-84.24	-59.65	8.40	11.80	H
	3471	-62.23	-13	-49.23	-80.67	-69.08	5.65	12.50	V
	5206.5	-56.69	-13	-43.69	-81.11	-62.36	7.13	12.80	V
	6942	-55.86	-13	-42.86	-83.94	-59.26	8.40	11.80	V
Highest	3521	-62.51	-13	-49.51	-81.39	-69.35	5.68	12.52	H
	5281.5	-60.27	-13	-47.27	-83.91	-65.94	7.15	12.82	H
	7042	-55.48	-13	-42.48	-83.74	-58.91	8.42	11.85	H
	3521	-63.03	-13	-50.03	-81.94	-69.87	5.68	12.52	V
	5281.5	-60.21	-13	-47.21	-83.94	-65.88	7.15	12.82	V
	7042	-55.24	-13	-42.24	-83.68	-58.67	8.42	11.85	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



Bottom Antenna

SA_n2 / 20MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3701	-61.04	-13	-48.04	-81.00	-67.80	5.82	12.58	H
	5551.5	-51.52	-13	-38.52	-76.21	-57.24	7.28	13.00	H
	7402	-54.26	-13	-41.26	-83.54	-57.42	8.32	11.48	H
	3701	-61.38	-13	-48.38	-81.37	-68.14	5.82	12.58	V
	5551.5	-48.06	-13	-35.06	-72.95	-53.78	7.28	13.00	V
	7402	-54.63	-13	-41.63	-83.59	-57.79	8.32	11.48	V
Middle	3741	-60.22	-13	-47.22	-80.26	-66.97	5.85	12.60	H
	5611.5	-45.61	-13	-32.61	-70.39	-51.41	7.30	13.10	H
	7482	-54.58	-13	-41.58	-83.49	-57.73	8.35	11.50	H
	3741	-60.17	-13	-47.17	-80.25	-66.92	5.85	12.60	V
	5611.5	-42.60	-13	-29.60	-67.53	-48.40	7.30	13.10	V
	7482	-54.56	-13	-41.56	-83.22	-57.71	8.35	11.50	V
Highest	3781	-61.36	-13	-48.36	-81.55	-68.10	5.88	12.62	H
	5671.5	-45.60	-13	-32.60	-70.13	-51.41	7.32	13.13	H
	7562	-54.81	-13	-41.81	-83.38	-57.97	8.38	11.54	H
	3781	-61.38	-13	-48.38	-81.61	-68.12	5.88	12.62	V
	5671.5	-42.18	-13	-29.18	-67.09	-47.99	7.32	13.13	V
	7562	-55.17	-13	-42.17	-83.58	-58.33	8.38	11.54	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



SA_n66 / 20MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	3421	-62.30	-13	-49.30	-80.24	-69.18	5.60	12.48	H
	5131.5	-51.29	-13	-38.29	-75.18	-56.97	7.10	12.78	H
	6842	-55.68	-13	-42.68	-83.24	-59.07	8.38	11.77	H
	3421	-62.87	-13	-49.87	-80.85	-69.75	5.60	12.48	V
	5131.5	-50.28	-13	-37.28	-74.6	-55.96	7.10	12.78	V
	6842	-55.38	-13	-42.38	-83.17	-58.77	8.38	11.77	V
Middle	3471	-62.22	-13	-49.22	-80.63	-69.07	5.65	12.50	H
	5206.5	-56.32	-13	-43.32	-80.29	-61.99	7.13	12.80	H
	6942	-56.09	-13	-43.09	-84.08	-59.49	8.40	11.80	H
	3471	-62.34	-13	-49.34	-80.78	-69.19	5.65	12.50	V
	5206.5	-56.69	-13	-43.69	-81.11	-62.36	7.13	12.80	V
	6942	-55.81	-13	-42.81	-83.89	-59.21	8.40	11.80	V
Highest	3521	-61.81	-13	-48.81	-80.69	-68.65	5.68	12.52	H
	5281.5	-51.56	-13	-38.56	-75.20	-57.23	7.15	12.82	H
	7042	-55.34	-13	-42.34	-83.60	-58.77	8.42	11.85	H
	3521	-60.54	-13	-47.54	-79.45	-67.38	5.68	12.52	V
	5281.5	-52.72	-13	-39.72	-76.45	-58.39	7.15	12.82	V
	7042	-54.83	-13	-41.83	-83.27	-58.26	8.42	11.85	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.