FCC Test Report
(Part 90 Subpart Y)

Report No.:	RF181219C02D-3
FCC ID:	2ANBG-OR149
Regulatory Model:	APOR100
Marketing Model:	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Received Date:	Feb. 18, 2020
Test Date:	Apr. 15 ~ May 12, 2020
Issued Date:	Jun. 08, 2020
Applicant:	KeyWest Networks, Inc.
Address:	3033 Oliver Dr, San Jose, CA - 95135 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN
FCC Registration / Designation Number:	788550 / TW0003

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF181219C02D-3	Original release	Jun. 08, 2020

1 Certificate of Conformity

Product:	Outdoor Wireless Radios
Brand:	KeyWest Radios
Regulatory Model:	APOR100
Marketing Model:	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Sample Status:	Engineering sample
Applicant:	KeyWest Networks, Inc.
Test Date:	Apr. 15 ~ May 12, 2020
Standards:	FCC Part 90, Subpart Y FCC Part 2

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Celine Chou , **Date:** Jun. 08, 2020

Celine Chou / Senior Specialist

Approved by : Bruce Chen , **Date:** Jun. 08, 2020

Bruce Chen / Senior Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2			
FCC Clause	Test Item	Result	Remarks
Part 2.1046 Part 90.1215(a)	Peak Output Power	Pass	Meet the requirement of limit.
Part 2.1049 Part 90.210	Emission Bandwidth	Pass	Meet the requirement of limit.
Part 2.1049 Part 90.210	Emission Mask	Pass	Meet the requirement of limit.
Part 90.1215	Peak Excursion	Pass	Meet the requirement of limit.
Part 2.1046 Part 90.1215(a)	Power Spectral Density	Pass	Meet the requirement of limit.
Part 2.1053 Part 90.210	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -19.68dB at 9930.00MHz.
Part 2.1055 Part 90.213	Frequency Stability	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESR3	102579	Jun. 27, 2019	Jun. 26, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 11, 2019	Nov. 10, 2020
HORN Antenna SCHWARZBECK	9120D	209	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Loop Antenna TESEQ	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 20, 2019	Aug. 19, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH3-01	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM-S M-8000	Cable-CH3-03 (309224+170907)	Aug. 20, 2019	Aug. 19, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Sep. 05, 2019	Sep. 04, 2020
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY5519 0004/MY55190007/MY 55210005	Jul. 15, 2019	Jul. 14, 2020
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 03, 2019	Jun. 02, 2020
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	May 21, 2019	May 20, 2020
PXA KEYSIGHT	N9030B	MY57140953	Jun. 28, 2019	Jun. 27, 2020

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.

3 General Information

3.1 General Description of EUT

Product	Outdoor Wireless Radios
Brand	KeyWest Radios
Regulatory Model	APOR100
Marketing Model	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Model Difference	Refer to note for more details
Sample Status	Engineering sample
Power Supply Rating	48Vdc (PoE)
Modulation Type & Data Rate	BPSK: 6 and 9Mbps QPSK: 12 and 18Mbps 16QAM: 24 and 36Mbps 64QAM: 48 and 54Mbps
Operating Frequency	4940 ~ 4990MHz
Conducted Output Power	Test Mode A: 24.96dBm (313.373mW) Test Mode B: 24.59dBm (287.673mW) Test Mode C: 24.77dBm (300.140mW)
Emission Designator	Test Mode A: 16M6G7D Test Mode B: 16M6G7D Test Mode C: 16M6G7D
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	PoE
Cable Supplied	NA

Note:

1. All models are listed as below.

Brand	Regulatory Model	Marketing Model	Ant. (For 5GHz Band only)	Remark
KeyWest Radios	APOR100	APOR100-B18	18dBi (MA-WC56-DP17 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized Sector antenna	For outdoor only
			17dBi (MT055S17VH/KYU Ant. with MMCX connector) 2x2 V&H Polarized Sector antenna	
		APOR100-X00	10dBi (APOR100-X00 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized Omni antenna	For outdoor only
		APOR100-C23	23dBi (MA-WA56-DP23 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized panel antenna	For P to P only
			22.5dBi (MT-465039/CVH/F Ant. with MMCX connector) 2x2 V&H Polarized panel antenna	
		APOR100-C18	18dBi (MT-485053-CVH-B_ICD_KW Ant. with i-pex(MHF) connector) 2x2 V&H Polarized panel antenna	For P to P only

2. The EUT is powered by the following PoE. (The new PoE is PoE 2)

PoE 1	
Brand	Powertron Electronics Corp.
Model	POE1024-480T1A050
Input Power	100-240Vac, 50-60Hz, 1.0A
Output Power	+48Vdc, 0.50A

PoE 2	
Brand	KEYWEST
Model	KW-P1024-48056K
Input Power	100-240Vac, 50-60Hz, 1.0A
Output Power	+48Vdc, 0.50A

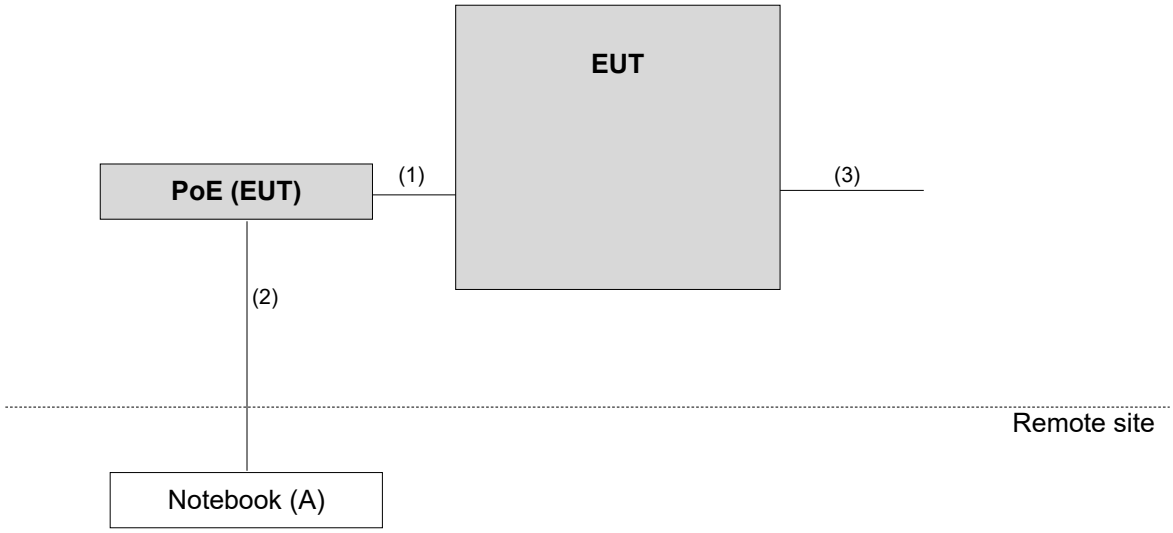
3. The following antennas were provided to the EUT.

Ant. No.	Marketing Model	Antenna Type	Antenna Vender	Antenna PN	Antenna Gain		Connector
					4.9GHz	5GHz	
1	APOR100-B18	Sector antenna	MARS	MA-WC56-DP17	18dBi	18dBi	i-pex(MHF)
2	APOR100-X00	Omni antenna	MARS	MA-WO56-DP10	10dBi	10dBi	N Type Male
3	APOR100-C23	Panel antenna	MARS	MA-WA56-DP23	23dBi	23dBi	i-pex(MHF)
4	APOR100-C18	Panel antenna	MTI	MT-485053-CVH-B_ICD_KW	-	18dBi	i-pex(MHF)
5	APOR100-B18	Sector antenna	MTI	MT055S17VH/KYU	16dBi	17dBi	MMCX
6	APOR100-C23	Panel antenna	MTI	MT-465039/CVH/F	23dBi	23dBi	MMCX

* Ant. 3, 4, 6 were cross polarized antenna.
* For Marketing Model: APOR100-B18 can use Ant. 1 or Ant. 5, therefore Ant. 1 was chosen for final test.
* For Marketing Model: APOR100-X00 use Ant. 2 and chosen for final test.
* For Marketing Model: APOR100-C23 can use Ant. 3 or Ant. 6 and Marketing Model: APOR100-C18 use Ant. 6, therefore Marketing Model: APOR100-C23 with Ant. 3 was chosen for final test.
* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

4. The lowest data rate (BPSK: 6Mbps) was chosen for the final test.
5. The EUT supports Point to Point and Point to Multipoint.
6. The EUT belongs to High power device.

3.2 Configuration of System under Test



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	80Q7	PF0KUGU6	FCC DoC Approved	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	1	1.5	N	0	-
2.	RJ45 Cable	1	6	N	0	-
3.	Ground Cable	1	1.81	N	0	Provided by client

3.3 Description of Test Modes

7 channels are provided to this EUT:

Channel	Frequency	Channel	Frequency
190	4950MHz	194	4970MHz
191	4955MHz	195	4975MHz
192	4960MHz	196	4980MHz
193	4965MHz		

3.3.1 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on Z-plane. Following channel(s) was (were) selected for the final test as listed below:

EUT Configure Mode:

EUT Configure Mode	Marketing Model
A	Marketing Model: APOR100-B18, powered by PoE 2
B	Marketing Model: APOR100-X00, powered by PoE 2
C	Marketing Model: APOR100-C23, powered by PoE 2
D	Marketing Model: APOR100-B18, powered by PoE 1
E	Marketing Model: APOR100-X00, powered by PoE 1
F	Marketing Model: APOR100-C23, powered by PoE 1

EUT Configure Mode	Test Item	Channel Bandwidth (MHz)	Data Rate (Mbps)	Tested Channel
A, B, C	Peak Output Power	20	6Mbps	190, 193, 196
A, B, C	Emission Bandwidth	20	6Mbps	190, 193, 196
A, B, C	Emission Mask	20	6Mbps	190, 193, 196
A, B, C	Peak Excursion	20	6Mbps	190, 193, 196
A, B, C	Power Spectral Density	20	6Mbps	190, 193, 196
A, B, D, E	Radiated Spurious Emissions (Frequency range below 1GHz)	20	6Mbps	193
C, F		20	6Mbps	190
A, B, C	Radiated Spurious Emissions (Frequency range above 1GHz)	20	6Mbps	190, 193, 196
A, B, C	Frequency Stability	20	6Mbps	190, 193, 196

Note: Radiated Spurious Emissions (Frequency range below 1GHz) test item chosen the worst maximum power.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Peak Output Power	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng
Emission Bandwidth	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng
Emission Mask	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng
Peak Excursion	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng
Radiated Spurious Emission	23 deg. C, 66% RH	120Vac, 60Hz	Adair Peng Titan Hsu
Frequency Stability	25 deg. C, 60% RH	120Vac, 60Hz	Ivan Tseng

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 90

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Peak Output Power Measurement

4.1.1 Limits of Peak Output Power Measurement

Per FCC §90.1215, the transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.

The maximum conducted output power should not exceed:

Channel Bandwidth (MHz)	Low Power Maximum conducted output power (dBm)	High Power Maximum conducted output power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

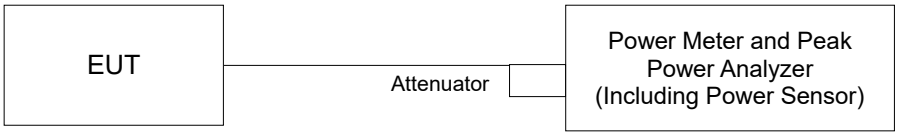
If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi

4.1.2 Test Procedures

a) Set span to at least 1.5 times the OBW
b) Set RBW = 1-5 % of the OBW, not to exceed 1MHz
c) Set VBW ≥ 3 MHz
d) Detector = RMS
e) Sweep time = auto couple.
f) Trace mode = max hold.

4.1.3 Test Setup

Conducted Power Measurement:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.4 Test Results

Test Mode A

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
190	4950	21.51	22.07	302.644	24.81	33.00	Pass
193	4965	21.57	22.30	**313.373**	24.96	33.00	Pass
196	4980	21.66	22.11	309.110	24.90	33.00	Pass

Test Mode B

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
190	4950	20.98	21.15	255.631	24.08	33.00	Pass
193	4965	21.91	21.22	**287.673**	24.59	33.00	Pass
196	4980	21.02	21.19	257.996	24.12	33.00	Pass

Test Mode C

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
190	4950	21.35	22.14	**300.140**	24.77	33.00	Pass
193	4965	21.25	22.13	296.657	24.72	33.00	Pass
196	4980	21.23	22.20	298.698	24.75	33.00	Pass

4.2 Emission Bandwidth Measurement

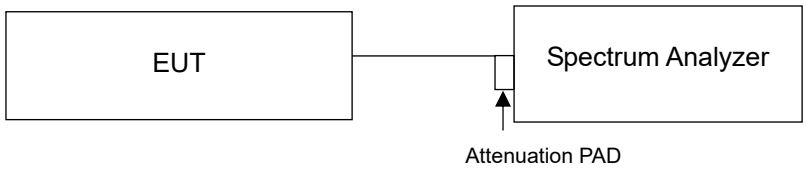
4.2.1 Limits of Emission Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1 % to 5 % of the occupied bandwidth (OBW)

4.2.2 Test Procedure

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.2.3 Test Setup



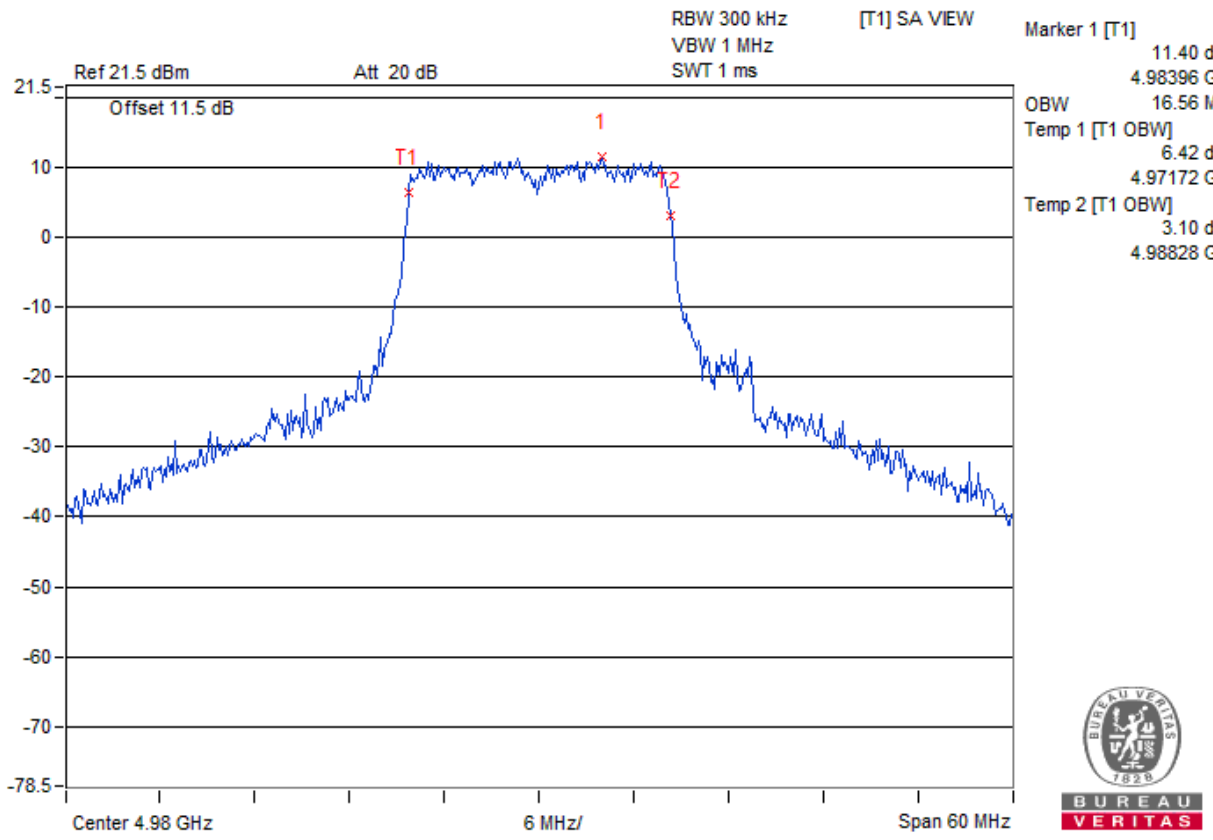
4.2.4 Test Result

Test Mode A

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	99% Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
190	4950	16.50	16.56
193	4965	16.44	16.44
196	4980	16.56	16.56

Spectrum Plot of Worst Value

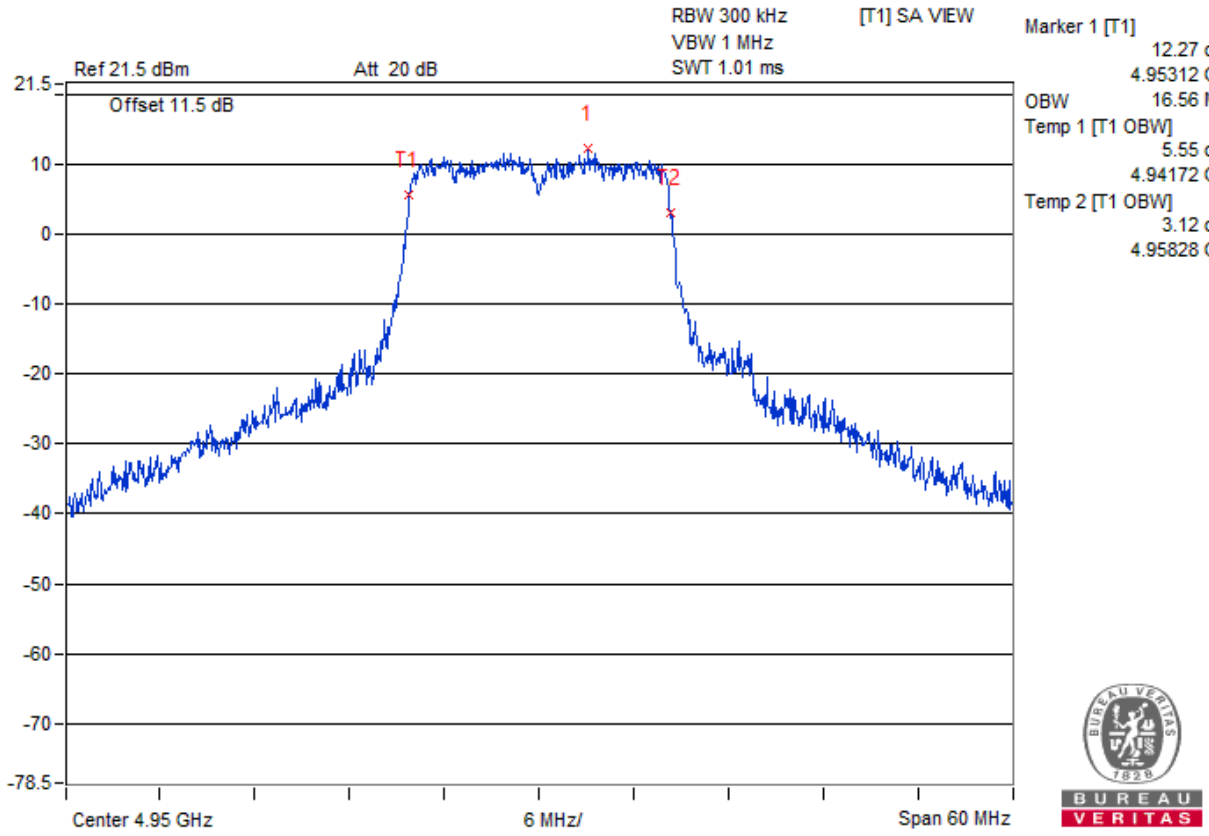


Test Mode B

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	99% Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
190	4950	16.56	16.56
193	4965	16.50	16.56
196	4980	16.44	16.56

Spectrum Plot of Worst Value

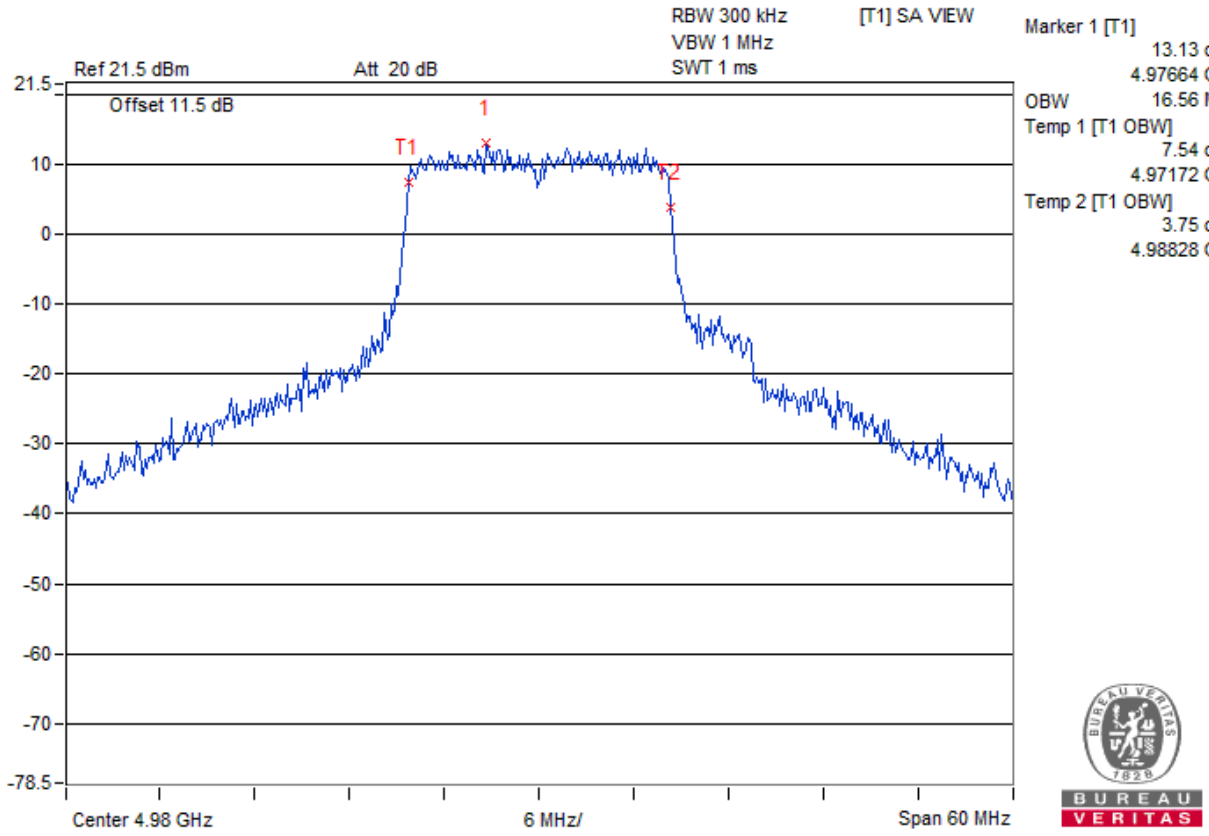


Test Mode C

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	99% Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
190	4950	16.50	16.50
193	4965	16.44	16.44
196	4980	16.44	16.56

Spectrum Plot of Worst Value



4.3 Emission Mask Measurement

4.3.1 Limits of Emission Mask Measurement

For low power transmitters (20 dBm or less) and high power transmitters (greater than 20 dBm operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

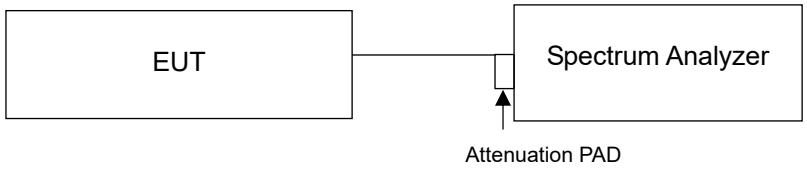
Frequency Offset fd	Minimum Attenuation	
	Low Power Transmitter	High Power Transmitter
0 < fd ≤ 45	0	0
45 < fd ≤ 50	219 log(fd/45)	568 log(fd/45)
50 < fd ≤ 55	10 + 242 log(fd/50)	26 + 145 log(fd/50)
55 < fd ≤ 100	20 + 31 log(fd/55)	32 + 31 log(fd/55)
100 < fd ≤ 150	28 + 68 log(fd/100)	40 + 57 log(fd/100)
fd > 150	40	50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

f_d is the percentage of the equipment's channel bandwidth.

4.3.2 Test Procedures

The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz.

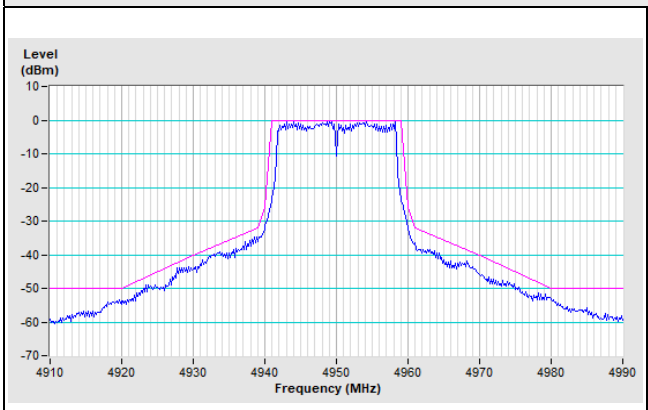
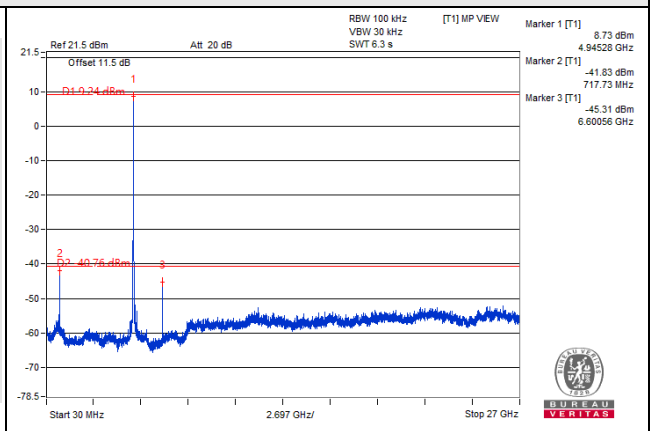
4.3.3 Test Setup



4.3.4 Test Results

Test Mode A

Channel Bandwidth 20MHz

Chain 0	
CH 190	
	
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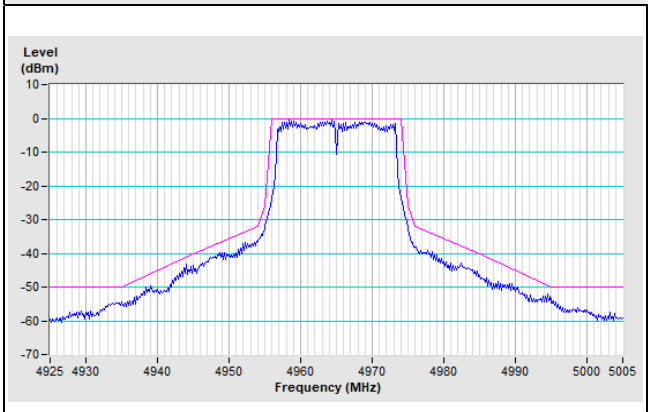	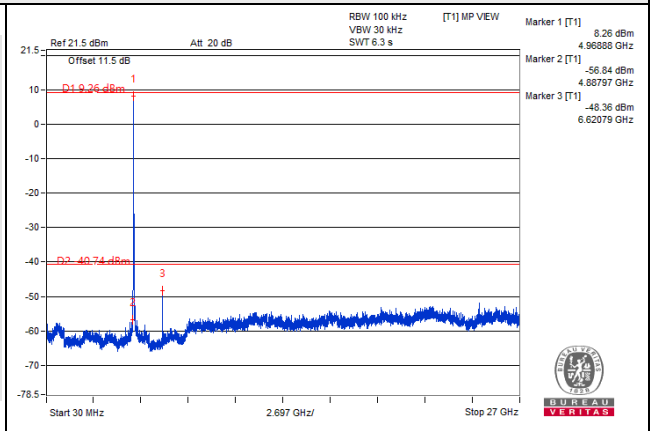
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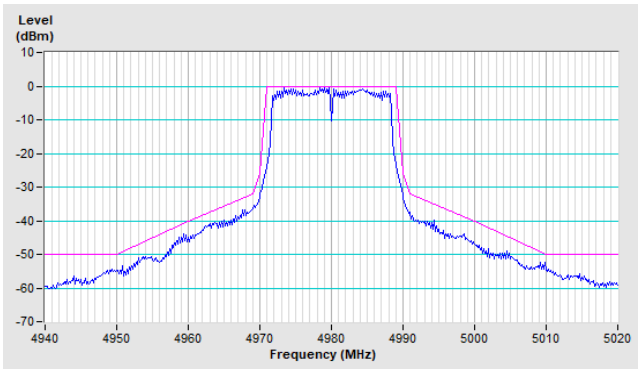
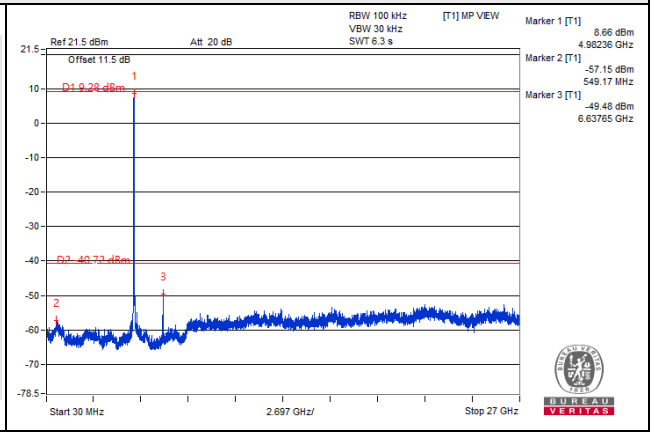
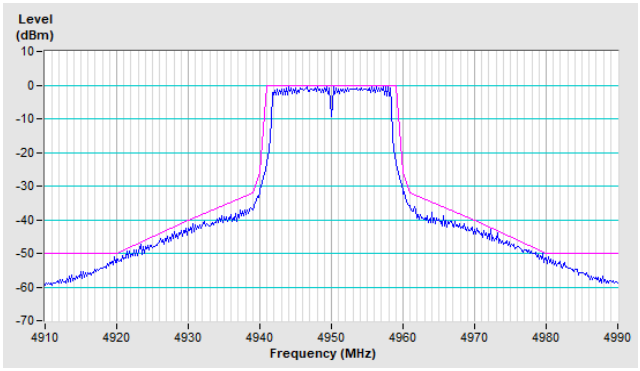
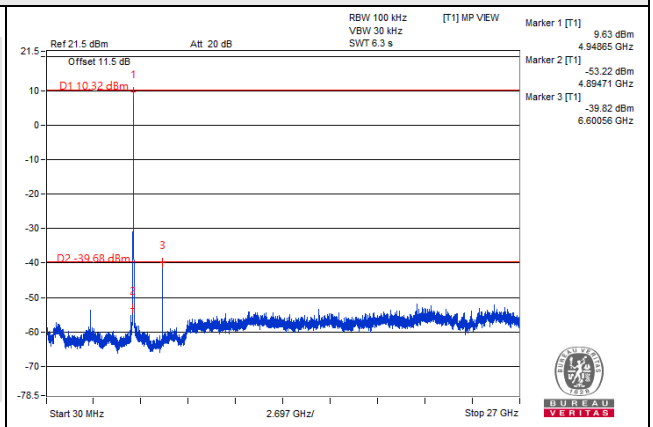
	

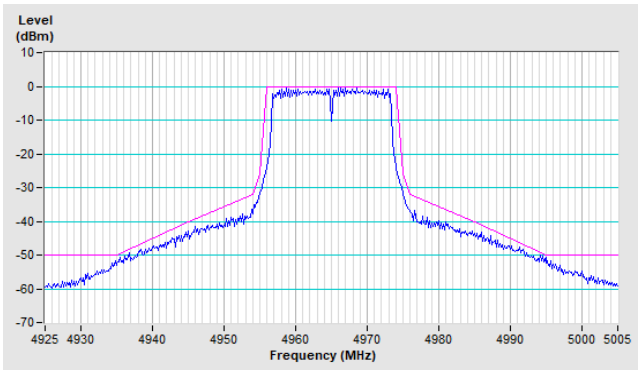
Chain 1

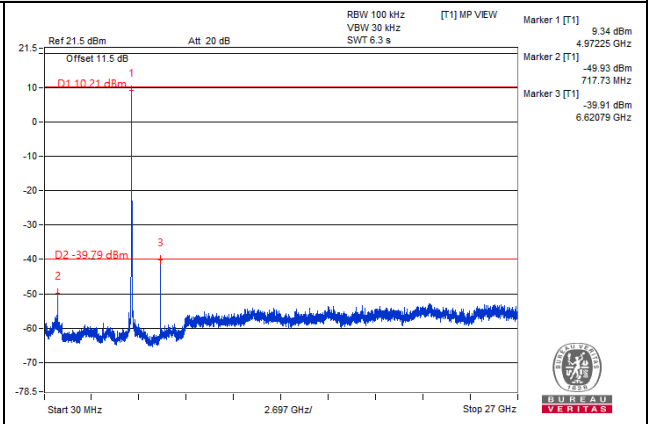
CH 190



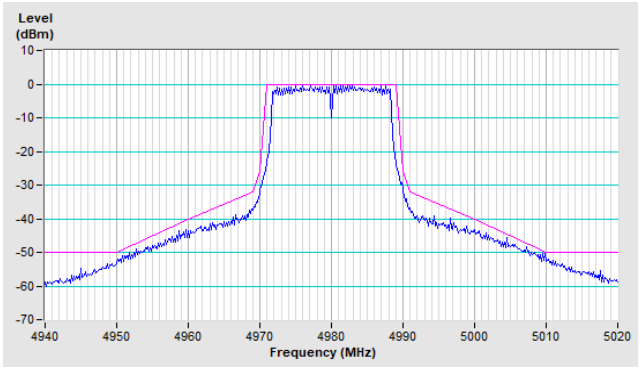


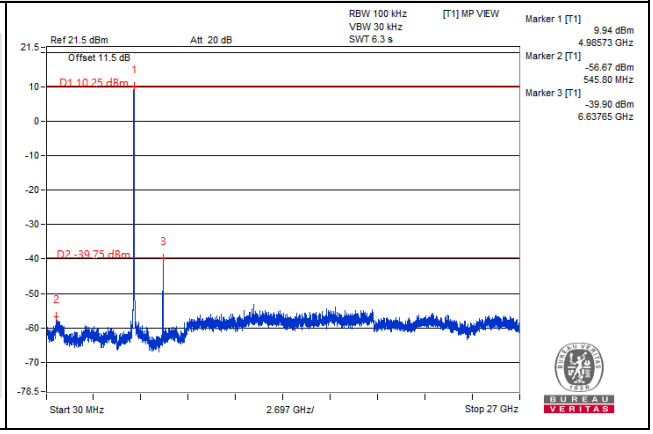
CH 193





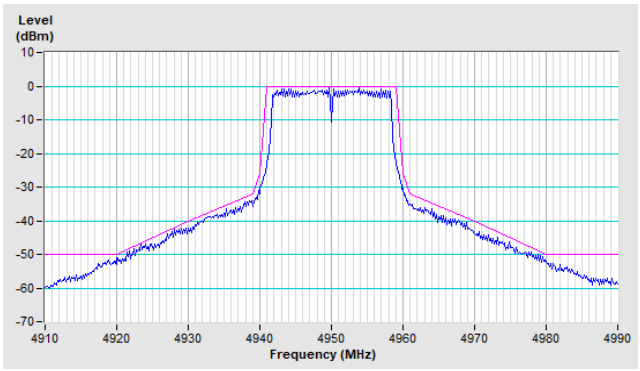
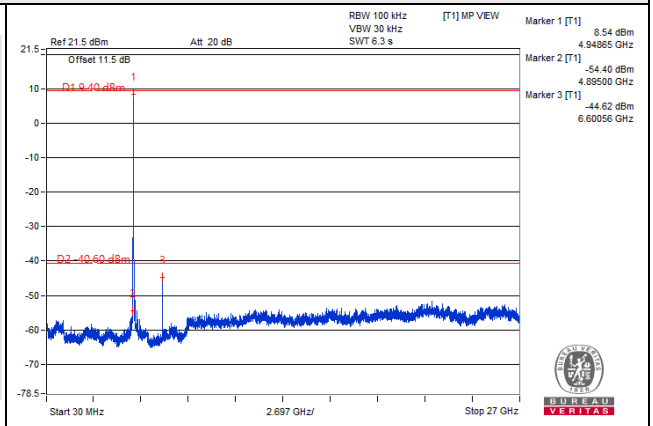
CH 196





Test Mode B

Channel Bandwidth 20MHz

Chain 0	
CH 190	
	
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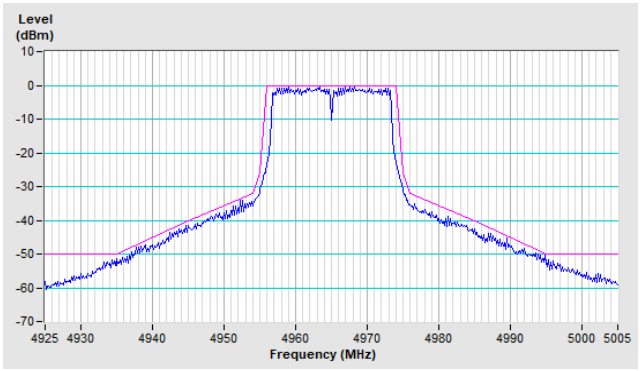	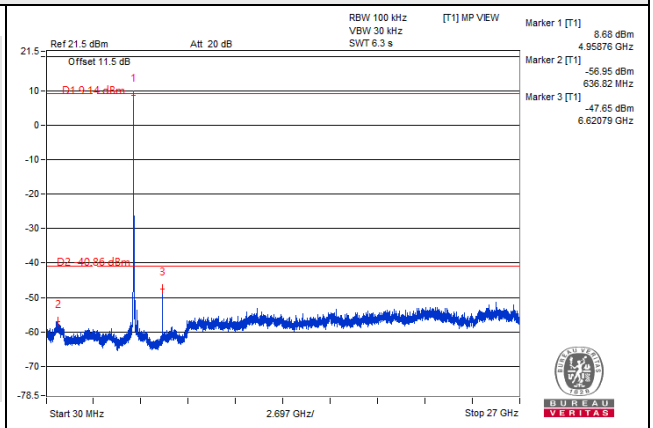
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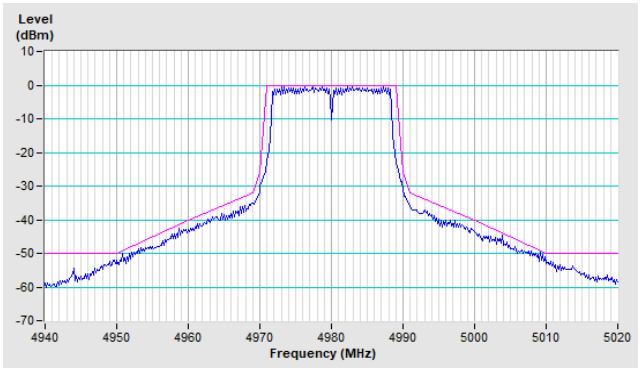
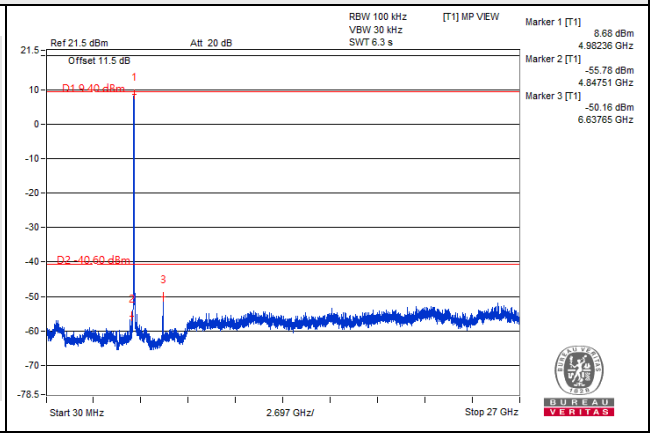
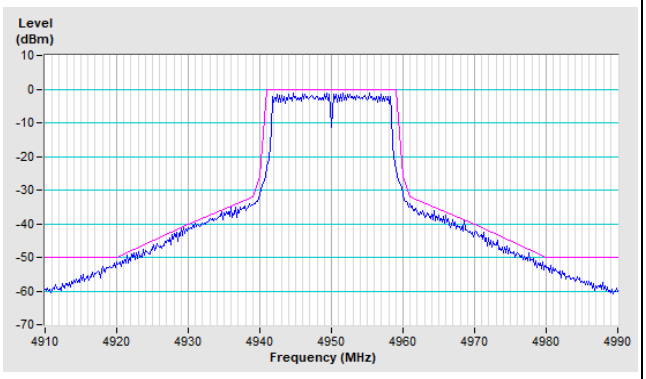
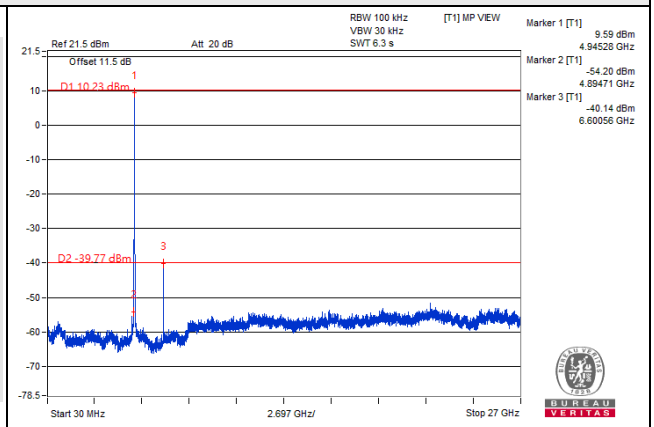
	

Chain 1	
CH 190	
	
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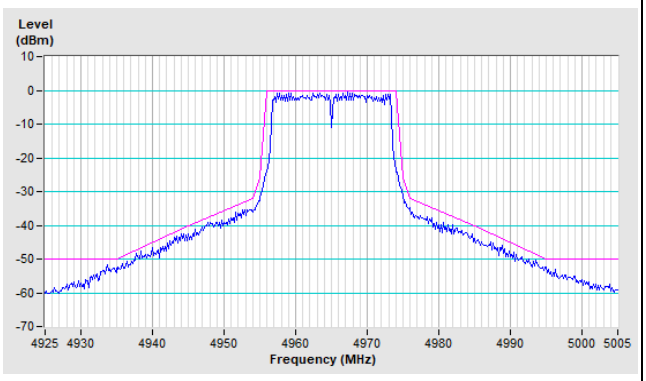
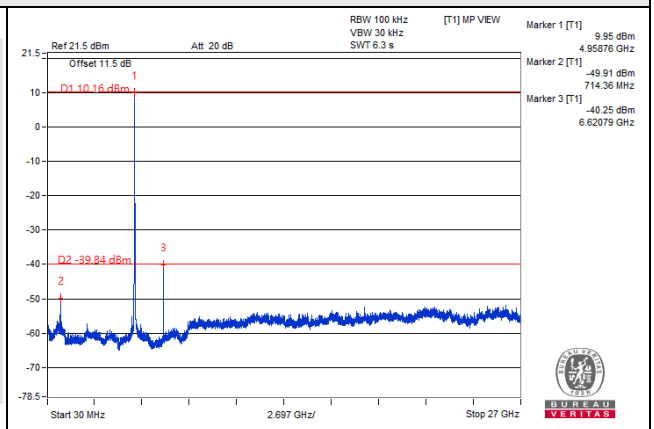
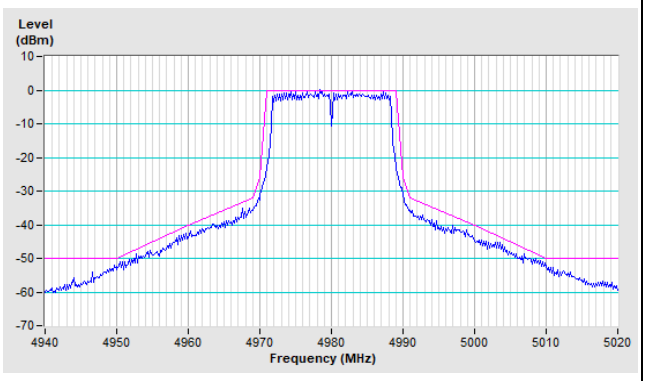
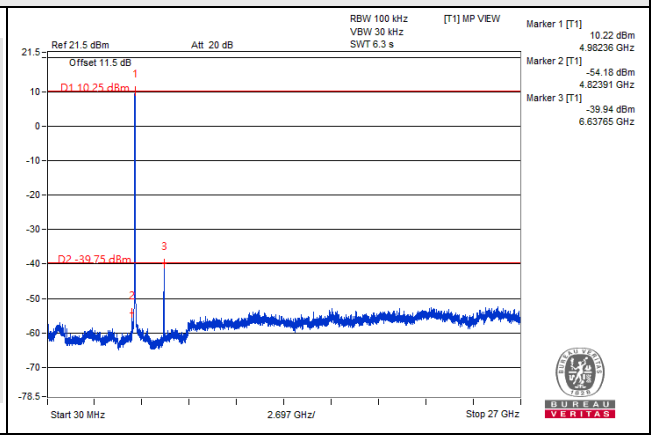
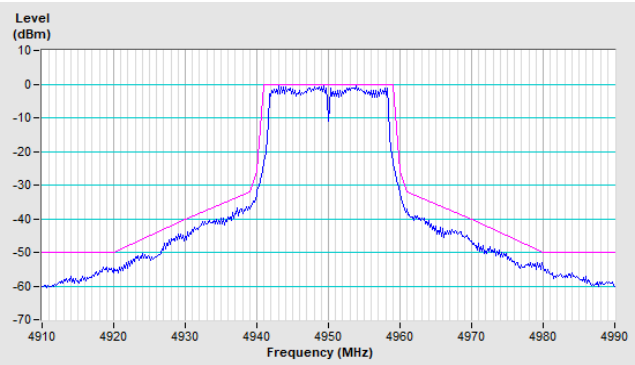
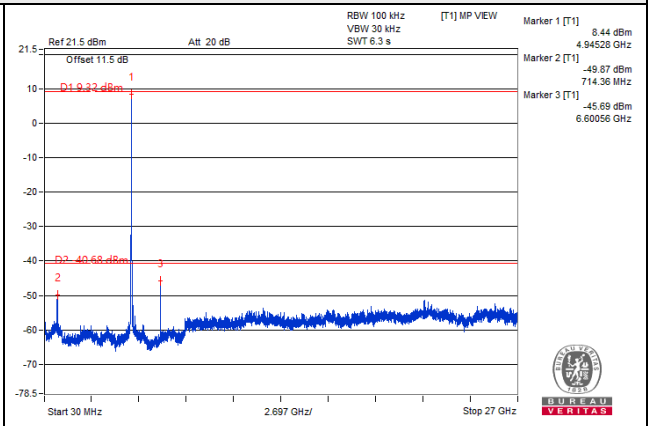
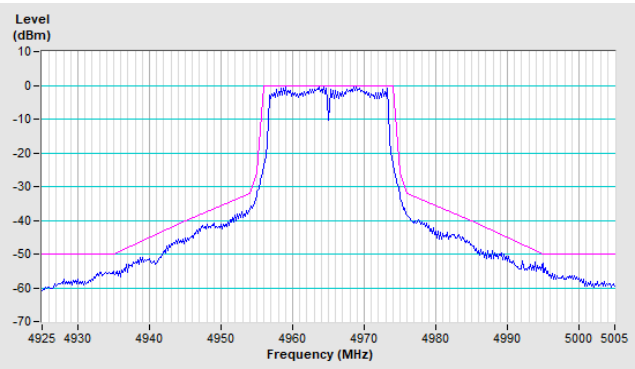
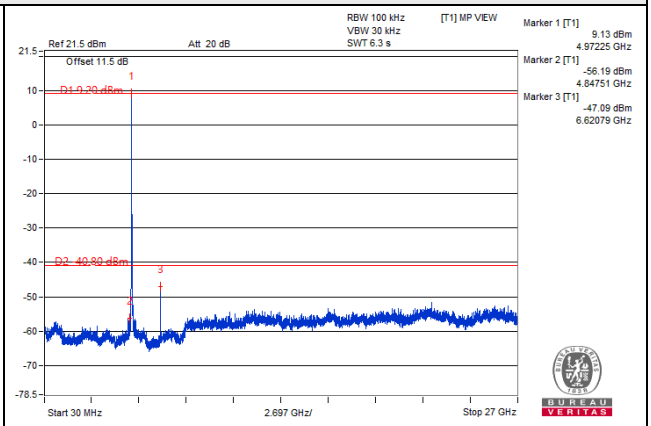
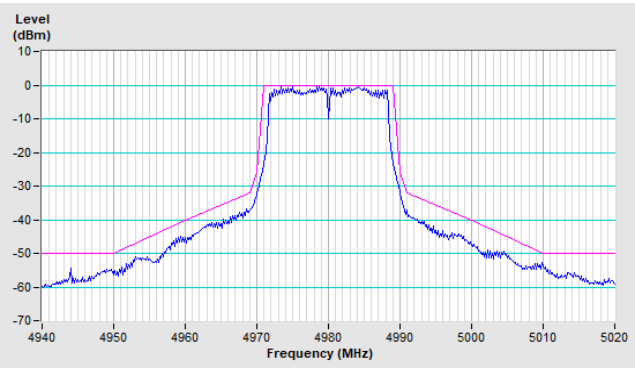
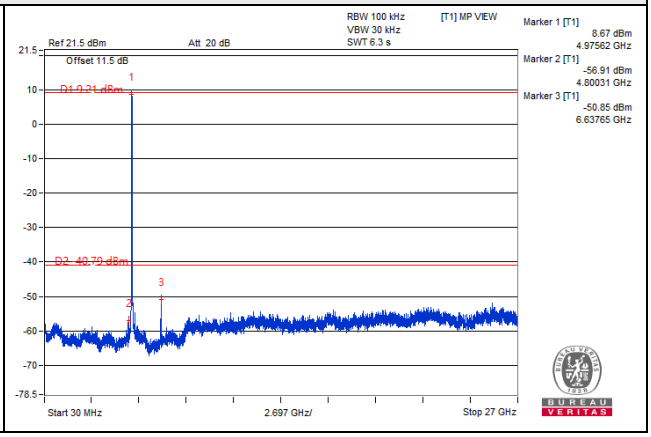
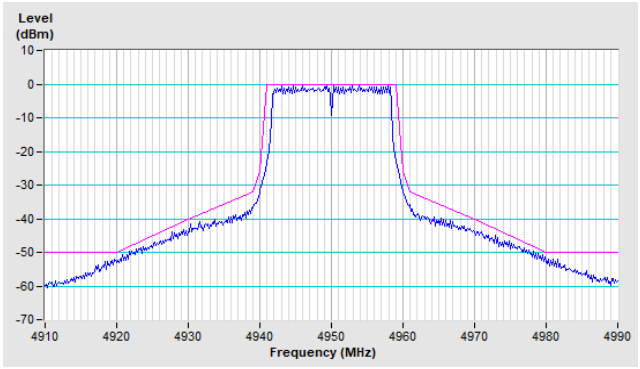
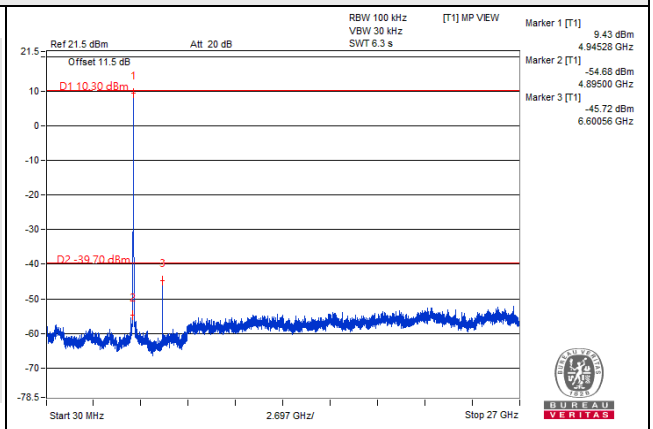
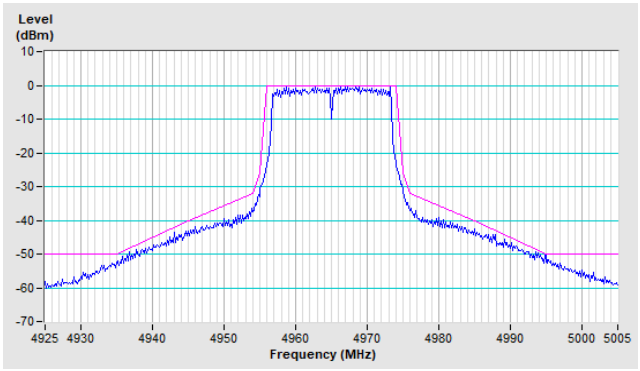
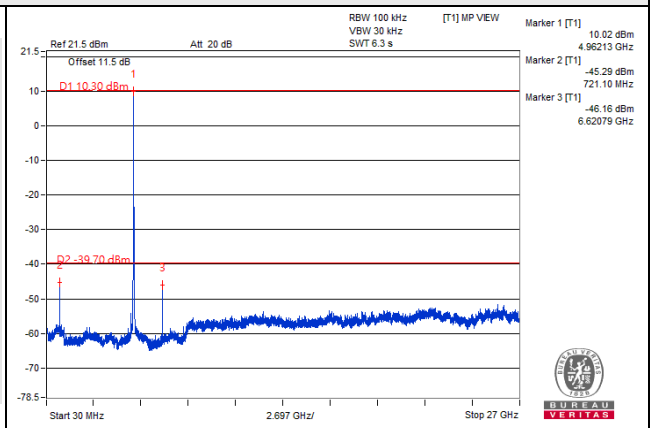
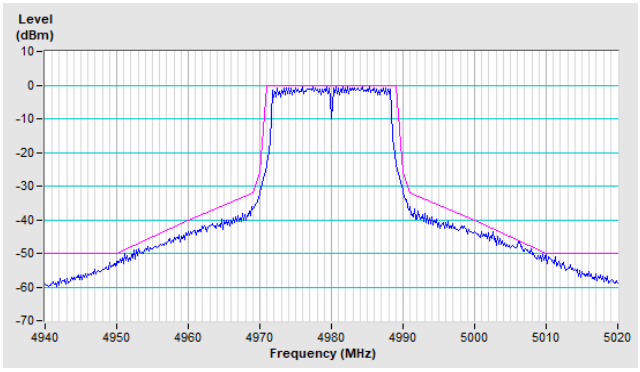
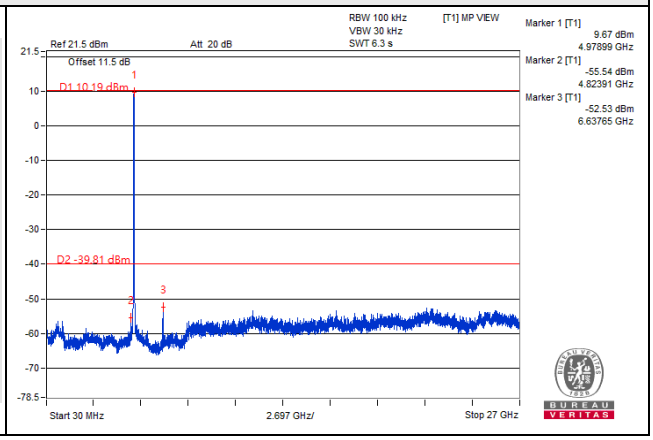
	
CH 196	
	

Test Mode C

Channel Bandwidth 20MHz

Chain 0	
CH 190	
	
CH 193	
	
CH 196	
	

Chain 1	
CH 190	
	
CH 193	
	
CH 196	
	

4.4 Peak Excursion Measurement

4.4.1 Limits of Peak Excursion Measurement

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

4.4.2 Test Procedures

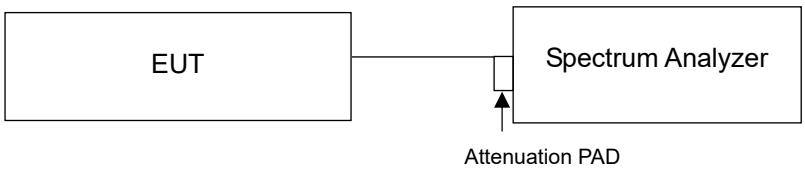
The EUT was set to transmit continuously;
The following setting were set on the spectrum analyzer:
Trace 1:

- RBW = 1MHz
- VBW = 3 x RBW
- Span = 40MHz
- Detector = Peak
- Trace = Maxhold

Trace 2:

- RBW = 1MHz
- VBW = 3 x RBW
- Span = 40MHz
- Detector = Average (RMS)
- Trace = 100 Trace average

4.4.3 Test Setup



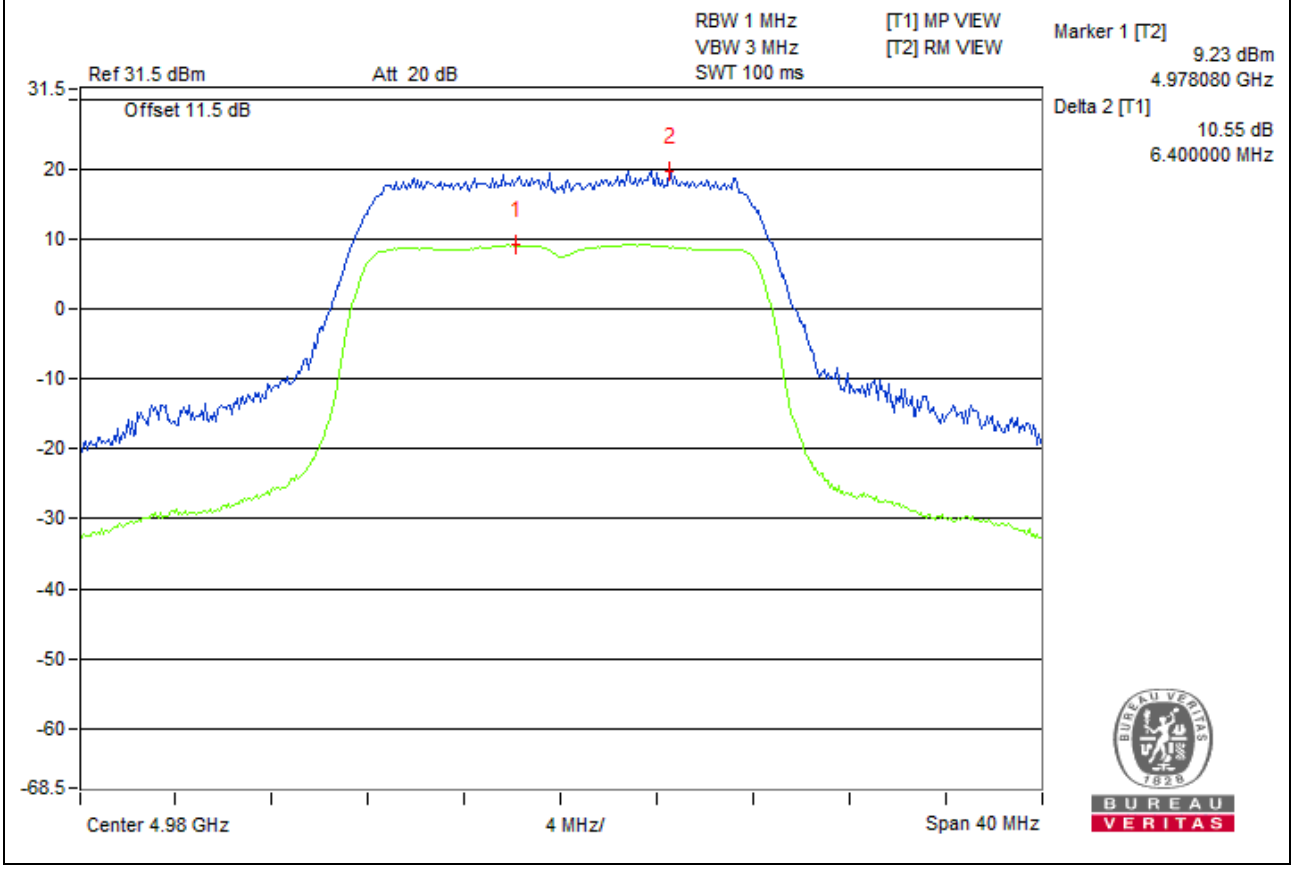
4.4.4 Test Results

Test Mode A

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Peak Excursion (dB)		Limit (dB)	Result
		Chain 0	Chain 1		
190	4950	10.44	9.98	13.00	Pass
193	4965	10.23	10.38	13.00	Pass
196	4980	10.55	10.50	13.00	Pass

Spectrum Plot of Worst Value

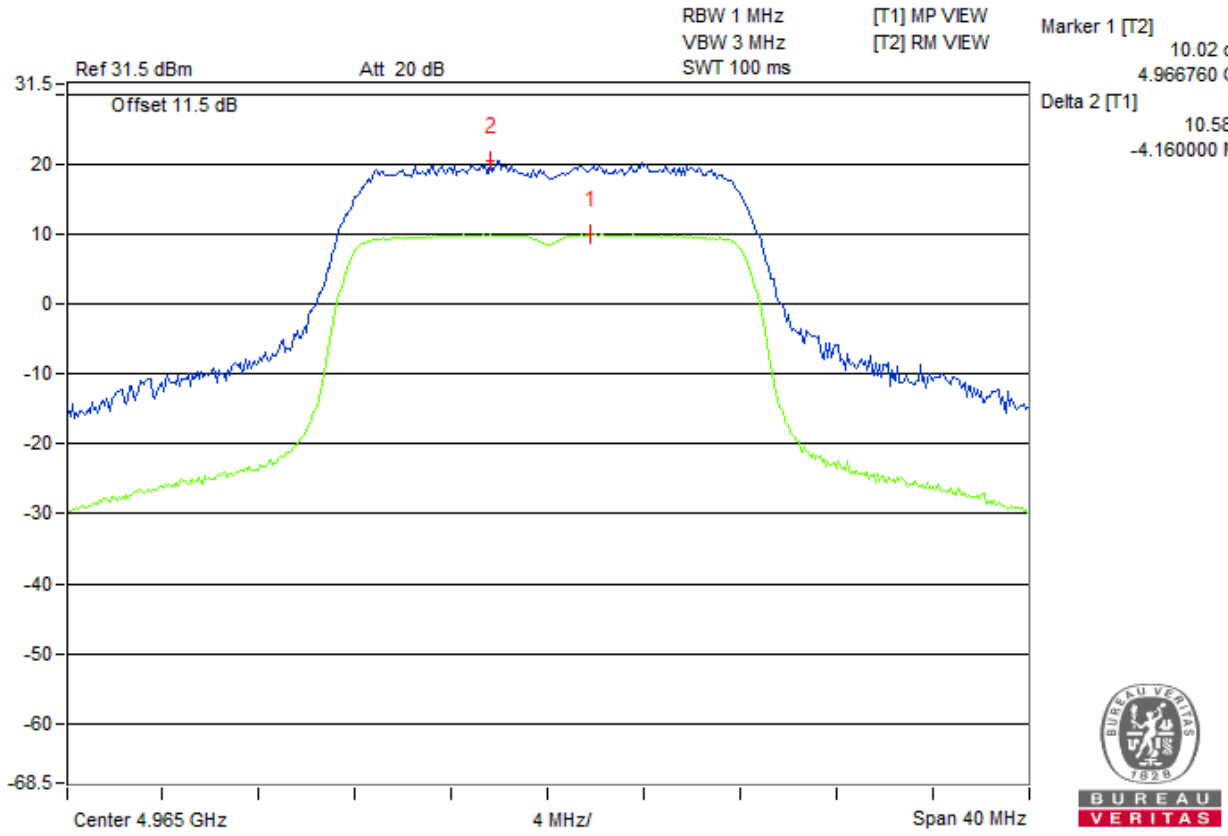


Test Mode B

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Peak Excursion (dB)		Limit (dB)	Result
		Chain 0	Chain 1		
190	4950	10.38	10.02	13.00	Pass
193	4965	10.31	10.58	13.00	Pass
196	4980	10.49	10.56	13.00	Pass

Spectrum Plot of Worst Value

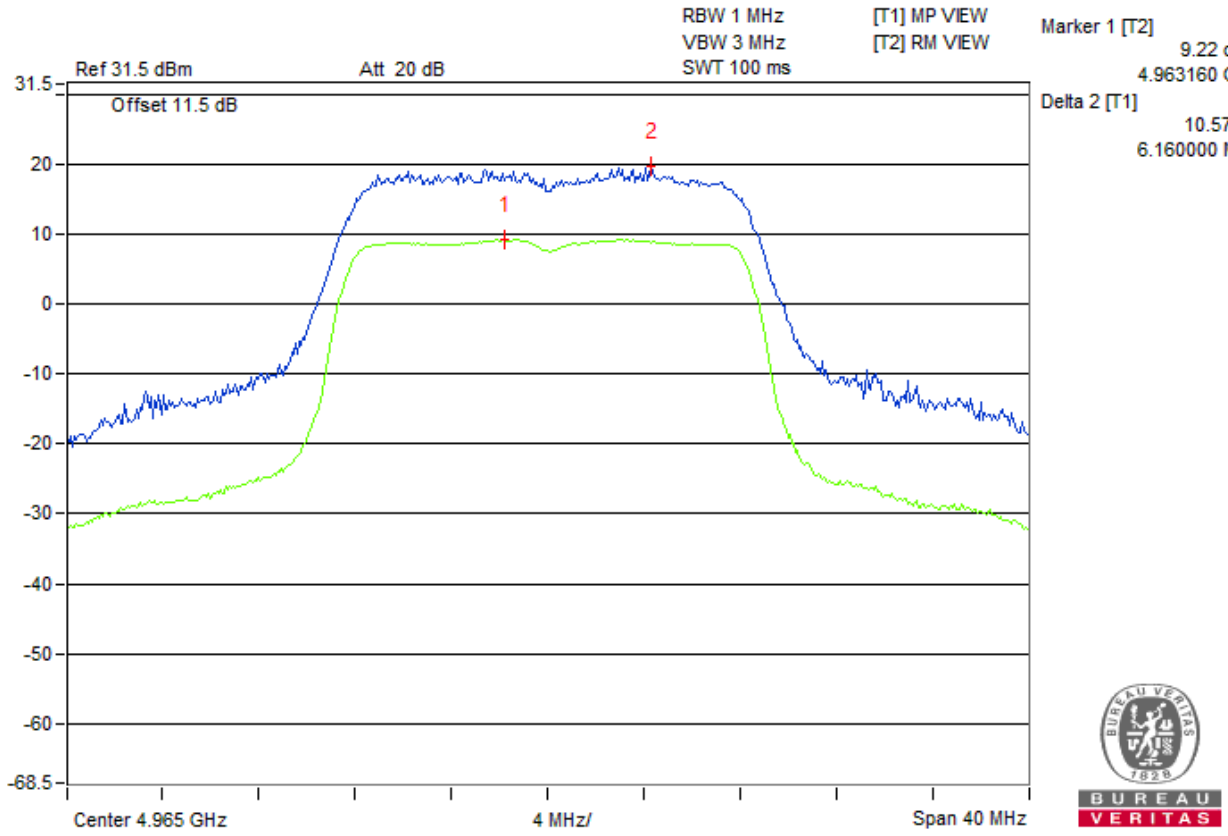


Test Mode C

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	Peak Excursion (dB)		Limit (dB)	Result
		Chain 0	Chain 1		
190	4950	9.95	10.00	13.00	Pass
193	4965	10.57	10.16	13.00	Pass
196	4980	10.38	10.32	13.00	Pass

Spectrum Plot of Worst Value



4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. If transmitting antennas of directional gain greater than 9 dBi are used, the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

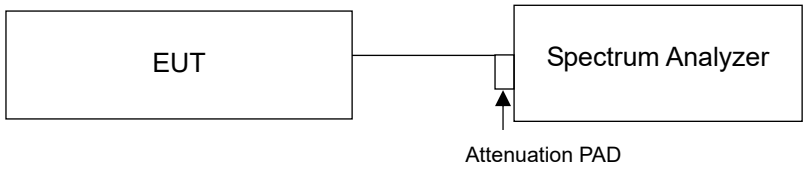
Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi

4.5.2 Test Procedures

- Set span to minimum of 1.5 times the OBW
- Set RBW = 1 MHz
- Set VBW ≥ 1 MHz
- Detector = RMS
- Sweep time = auto couple.
- Trace mode = max hold.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.3 Test Setup



4.5.4 Test Results

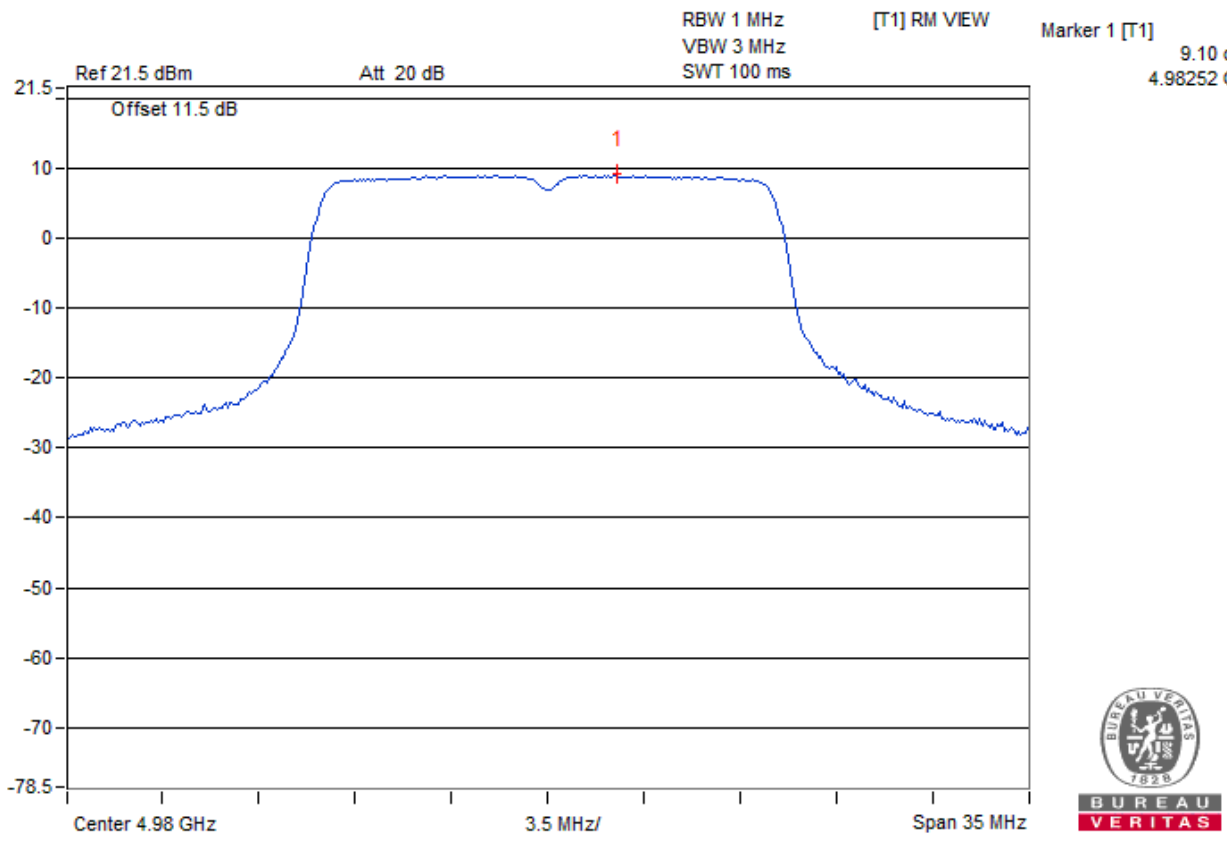
Test Mode A

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1			
190	4950	8.18	9.13	11.69	21.00	Pass
193	4965	8.15	8.91	11.56	21.00	Pass
196	4980	8.16	9.10	11.67	21.00	Pass

Note: Directional gain = 18dBi + 10log(2) = 21.01dBi < 26dBi, so the limit no need to be reduced.

Spectrum Plot of Worst Value



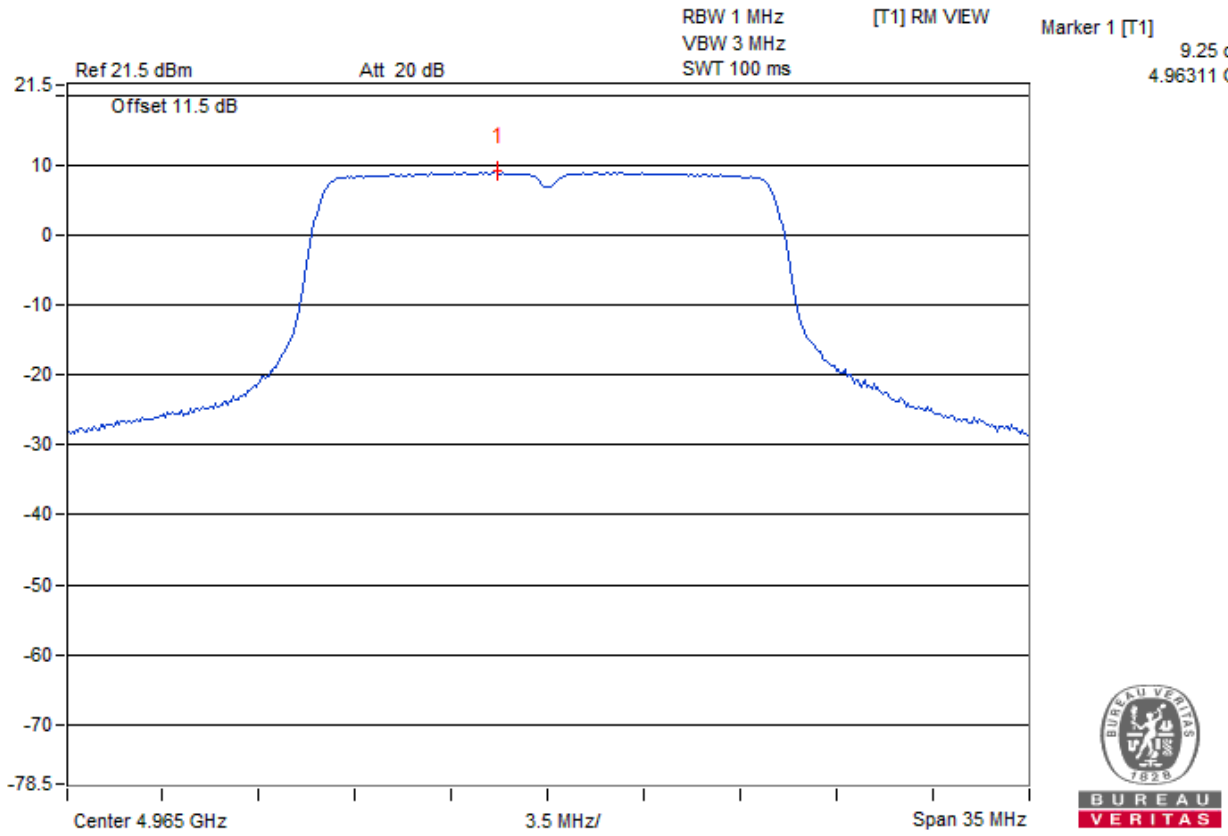
Test Mode B

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1			
190	4950	8.22	9.09	11.69	21.00	Pass
193	4965	8.05	9.25	11.70	21.00	Pass
196	4980	8.41	8.97	11.71	21.00	Pass

Note: Directional gain = 10dBi + 10log(2) = 13.01dBi < 26dBi, so the limit no need to be reduced.

Spectrum Plot of Worst Value



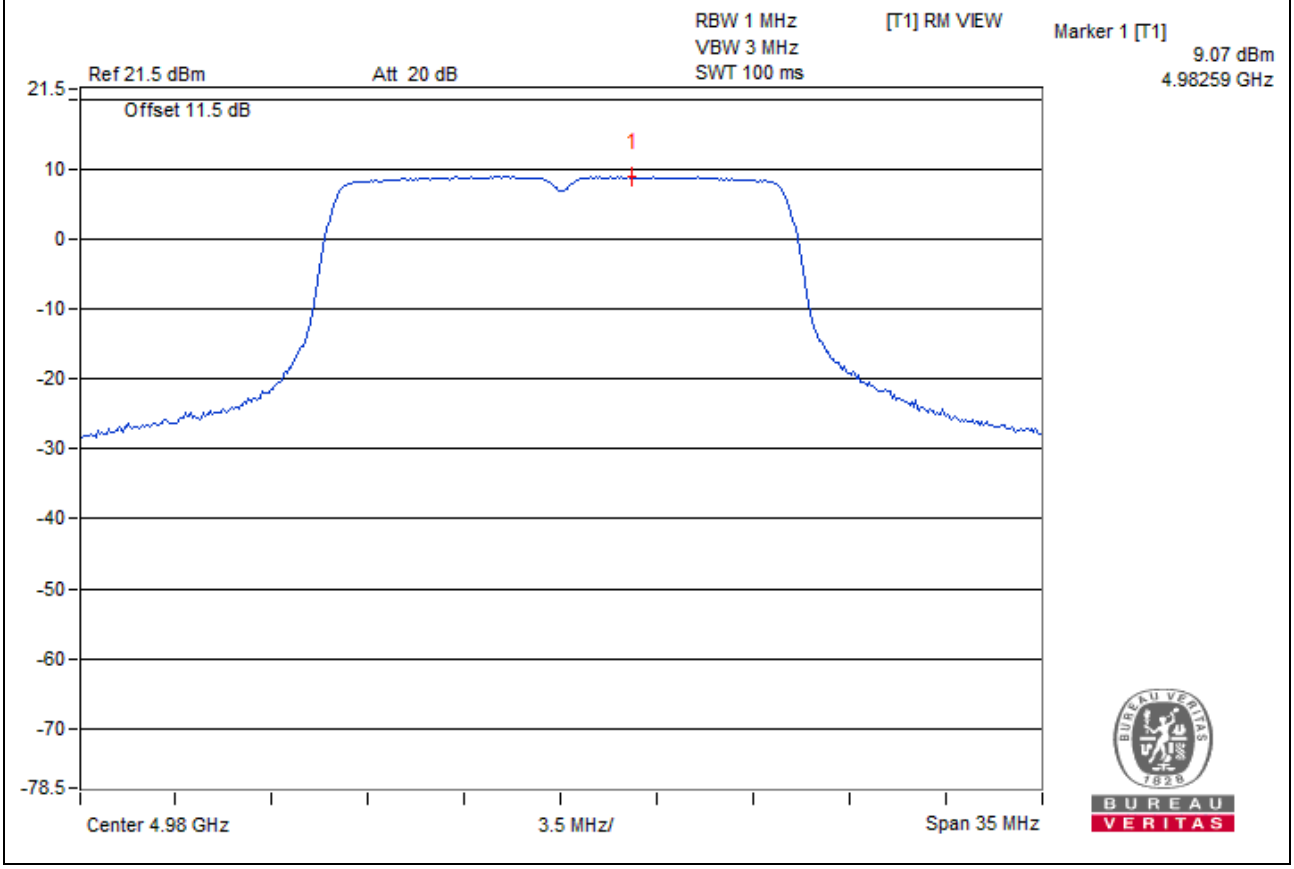
Test Mode C

Channel Bandwidth 20MHz

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1			
190	4950	8.18	8.99	11.61	21.00	Pass
193	4965	8.33	8.98	11.68	21.00	Pass
196	4980	8.17	9.07	11.65	21.00	Pass

Note: Directional gain = 23dBi + 10log(2/2) = 23dBi < 26dBi, so the limit no need to be reduced.

Spectrum Plot of Worst Value



4.6 Radiated Emission Measurement

4.6.1 Limits of Radiated Emission Measurement

For low power transmitters (20 dBm or less) and high power transmitters (greater than 20 dBm operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

Frequency Offset fd	Minimum Attenuation	
	Low Power Transmitter	High Power Transmitter
0 < fd ≤ 45	0	0
45 < fd ≤ 50	219 log(fd/45)	568 log(fd/45)
50 < fd ≤ 55	10 + 242 log(fd/50)	26 + 145 log(fd/50)
55 < fd ≤ 100	20 + 31 log(fd/55)	32 + 31 log(fd/55)
100 < fd ≤ 150	28 + 68 log(fd/100)	40 + 57 log(fd/100)
fd > 150	40	50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

f_d is the percentage of the equipment's channel bandwidth.

4.6.2 Test Procedure

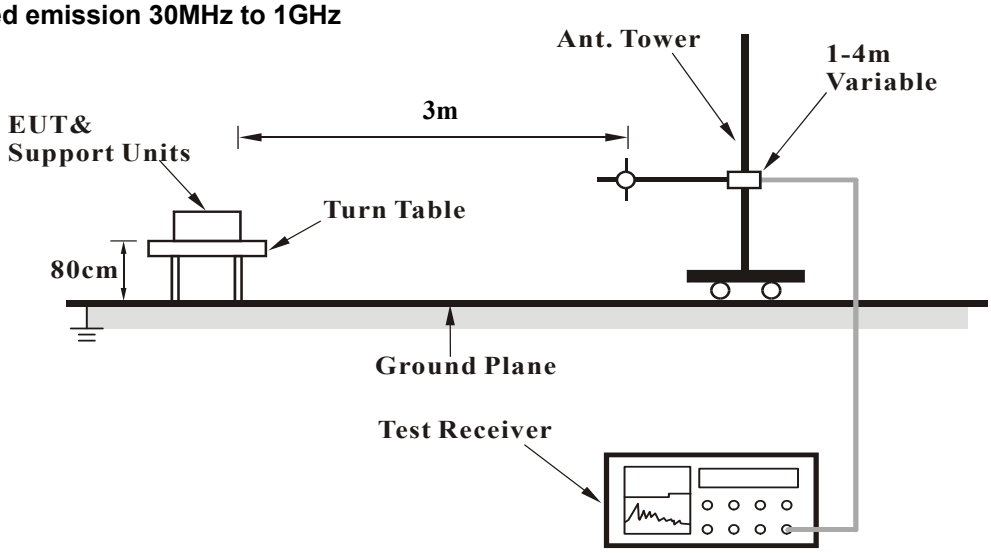
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
    a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
    b. The EUT was then rotated to the direction that gave the maximum emission.
    c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

4.6.3 Deviation from Test Standard

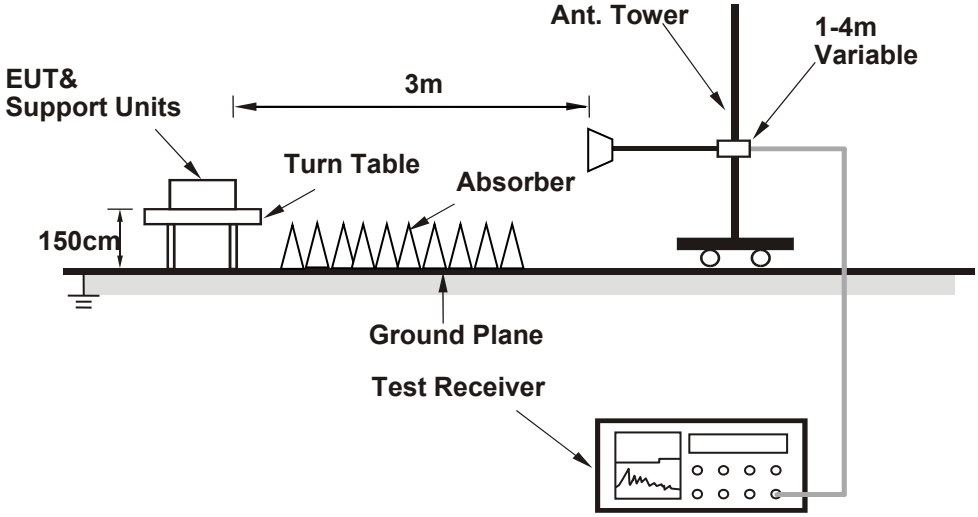
No deviation.

4.6.4 Test Setup

For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.6.5 Test Results

Below 1GHz

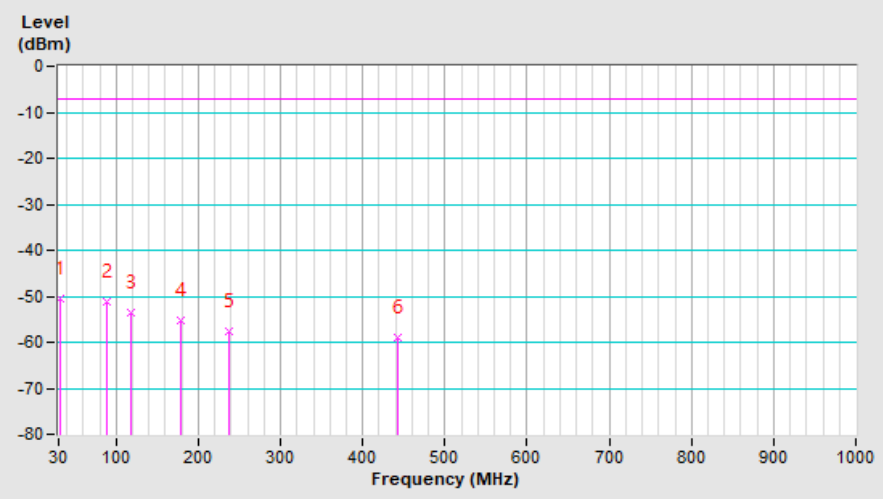
Test Mode A

Channel Bandwidth 20MHz

Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	32.81	-51.77	-38.84	-11.82	-50.66	-7.19	-43.47
2	89.04	-52.30	-52.05	0.86	-51.19	-7.19	-44.00
3	118.57	-54.77	-53.79	0.13	-53.66	-7.19	-46.47
4	179.01	-56.32	-57.99	2.78	-55.21	-7.19	-48.02
5	236.65	-58.80	-63.11	5.42	-57.69	-7.19	-50.50
6	443.30	-60.25	-64.24	5.10	-59.14	-7.19	-51.95

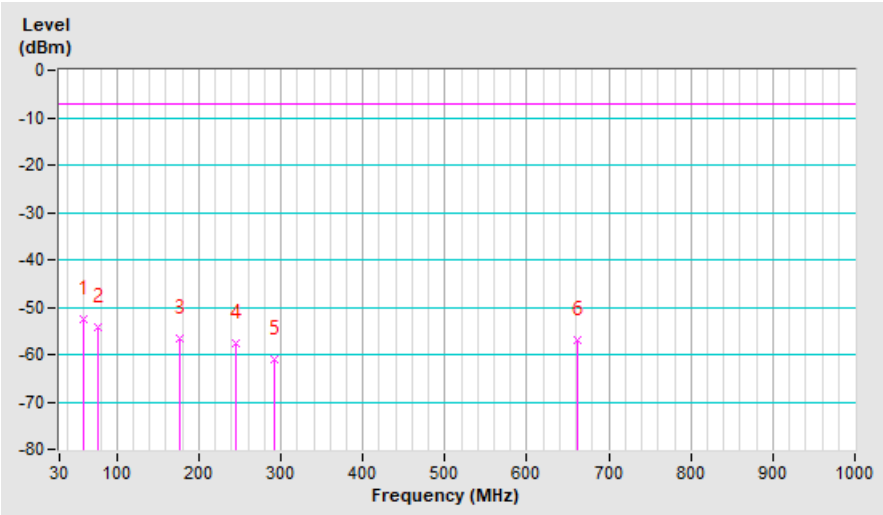
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.



Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	59.52	-45.40	-44.72	-7.71	-52.43	-7.19	-45.24
2	77.80	-48.89	-51.75	-2.38	-54.13	-7.19	-46.94
3	177.61	-53.38	-59.07	2.61	-56.46	-7.19	-49.27
4	245.09	-57.50	-62.91	5.41	-57.50	-7.19	-50.31
5	292.88	-61.64	-66.02	5.16	-60.86	-7.19	-53.67
6	662.61	-63.16	-62.04	4.95	-57.09	-7.19	-49.90

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.



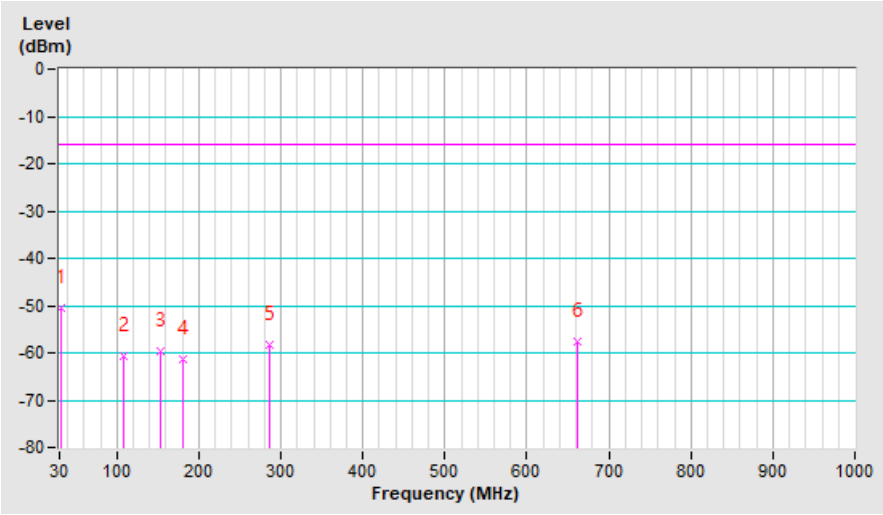
Test Mode B

Channel Bandwidth 20MHz

Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	32.81	-52.72	-38.52	-11.82	-50.34	-15.92	-34.42
2	108.72	-52.06	-61.21	0.53	-60.68	-15.92	-44.76
3	153.71	-54.82	-59.81	0.05	-59.76	-15.92	-43.84
4	180.42	-53.13	-64.32	2.97	-61.35	-15.92	-45.43
5	285.86	-54.69	-63.34	5.20	-58.14	-15.92	-42.22
6	662.61	-60.34	-62.56	4.95	-57.61	-15.92	-41.69

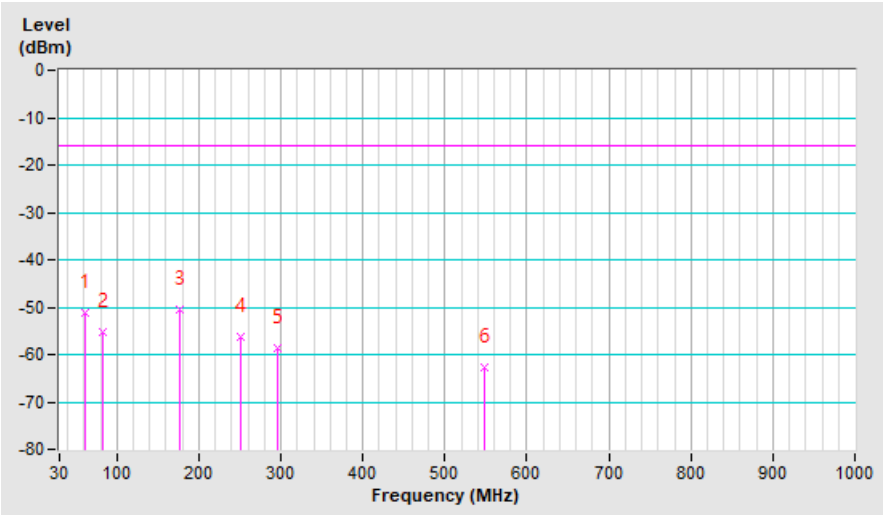
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.



Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	60.93	-43.92	-43.69	-7.36	-51.05	-15.92	-35.13
2	83.42	-50.09	-54.62	-0.69	-55.31	-15.92	-39.39
3	177.61	-47.32	-53.01	2.61	-50.40	-15.92	-34.48
4	250.71	-57.48	-61.60	5.40	-56.20	-15.92	-40.28
5	295.70	-59.61	-63.81	5.15	-58.66	-15.92	-42.74
6	547.33	-64.30	-67.30	4.65	-62.65	-15.92	-46.73

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.



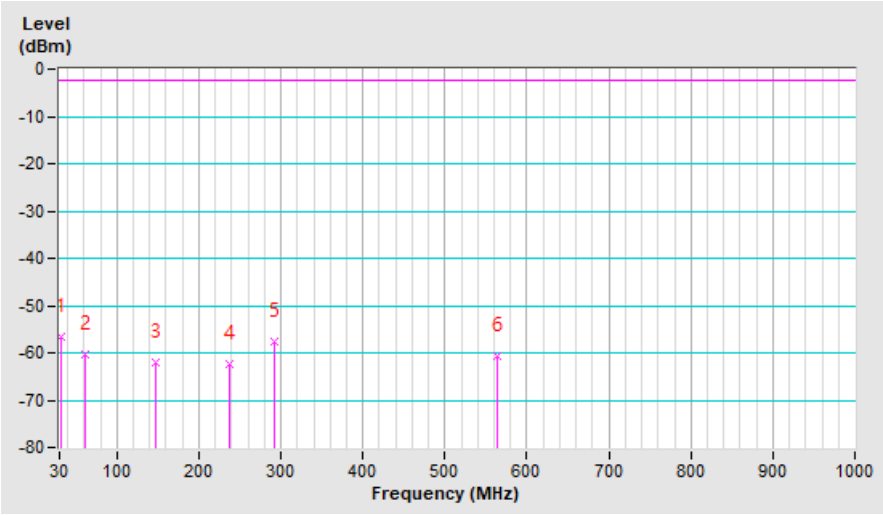
Test Mode C

Channel Bandwidth 20MHz

Mode	TX channel 190	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	32.81	-58.99	-44.79	-11.82	-56.61	-2.28	-54.33
2	60.93	-55.27	-53.12	-7.36	-60.48	-2.28	-58.20
3	148.09	-57.43	-61.92	-0.19	-62.11	-2.28	-59.83
4	238.06	-55.05	-67.63	5.42	-62.21	-2.28	-59.93
5	292.88	-54.32	-62.63	5.16	-57.47	-2.28	-55.19
6	564.20	-61.80	-65.38	4.59	-60.79	-2.28	-58.51

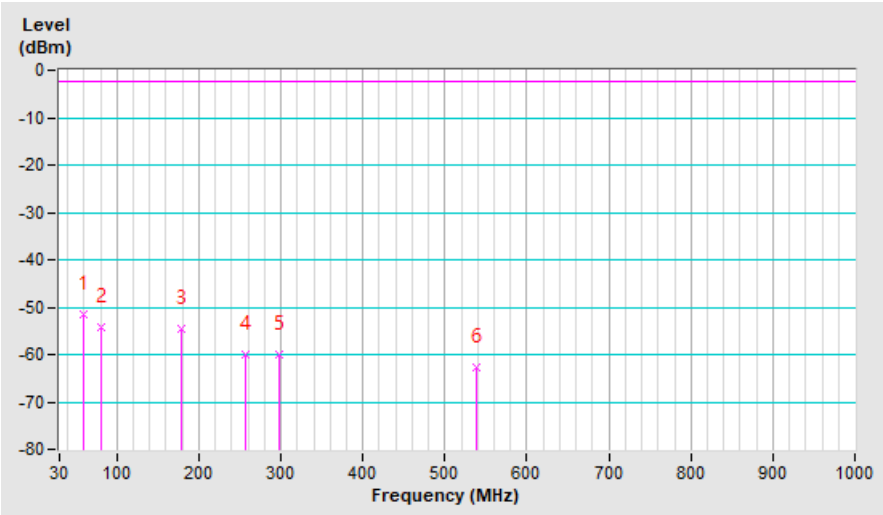
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.



Mode	TX channel 190	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	59.52	-44.51	-43.83	-7.71	-51.54	-2.28	-49.26
2	80.61	-49.26	-52.73	-1.47	-54.20	-2.28	-51.92
3	179.01	-51.36	-57.33	2.78	-54.55	-2.28	-52.27
4	256.33	-61.47	-65.26	5.37	-59.89	-2.28	-57.61
5	297.10	-60.76	-64.99	5.15	-59.84	-2.28	-57.56
6	538.90	-63.80	-67.29	4.70	-62.59	-2.28	-60.31

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.



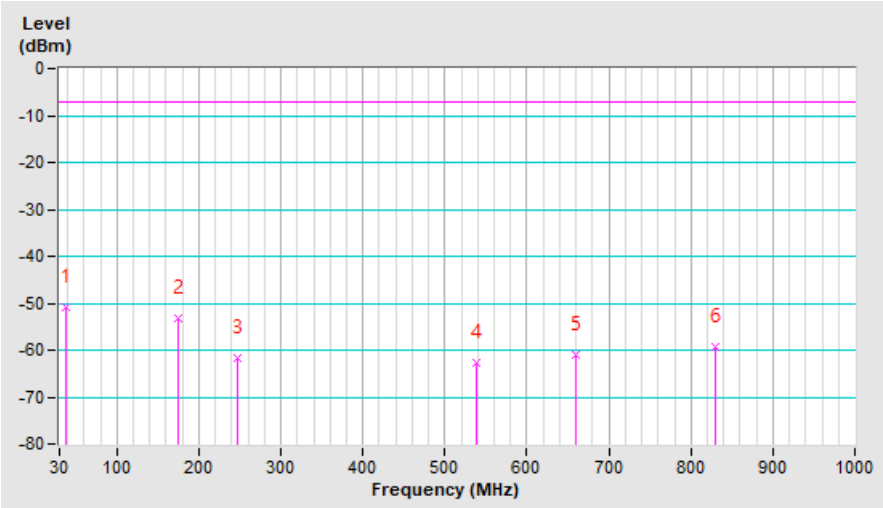
Test Mode D

Channel Bandwidth 20MHz

Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	37.03	-52.41	-39.41	-11.27	-50.68	-7.19	-43.49
2	174.80	-45.49	-55.32	2.26	-53.06	-7.19	-45.87
3	247.90	-54.79	-67.04	5.40	-61.64	-7.19	-54.45
4	538.90	-63.11	-67.39	4.70	-62.69	-7.19	-55.50
5	659.80	-63.80	-65.89	4.92	-60.97	-7.19	-53.78
6	829.90	-66.70	-63.27	3.99	-59.28	-7.19	-52.09

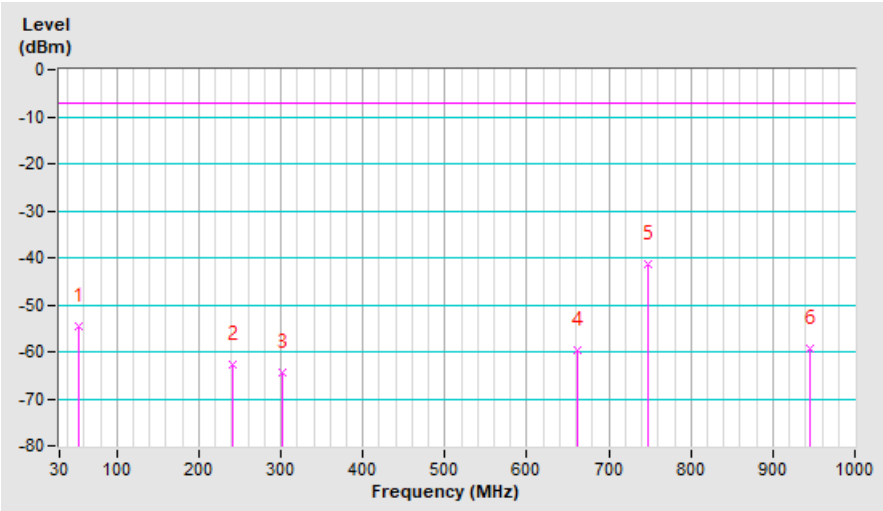
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.



Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	53.90	-47.82	-45.73	-8.91	-54.64	-7.19	-47.45
2	240.87	-61.84	-67.97	5.41	-62.56	-7.19	-55.37
3	302.72	-65.55	-69.49	5.13	-64.36	-7.19	-57.17
4	661.20	-65.76	-64.57	4.94	-59.63	-7.19	-52.44
5	746.96	-48.53	-45.90	4.66	-41.24	-7.19	-34.05
6	945.17	-68.79	-63.16	3.91	-59.25	-7.19	-52.06

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.



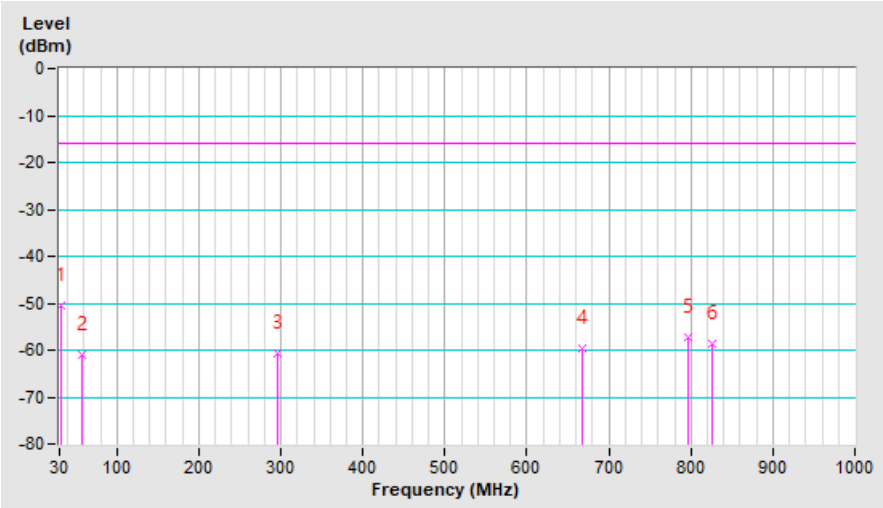
Test Mode E

Channel Bandwidth 20MHz

Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	31.41	-53.09	-38.50	-12.00	-50.50	-15.92	-34.58
2	58.12	-57.41	-53.16	-8.01	-61.17	-15.92	-45.25
3	295.70	-58.28	-65.97	5.15	-60.82	-15.92	-44.90
4	668.23	-62.29	-64.64	5.00	-59.64	-15.92	-43.72
5	796.16	-63.90	-61.41	4.07	-57.34	-15.92	-41.42
6	825.68	-65.65	-62.46	3.98	-58.48	-15.92	-42.56

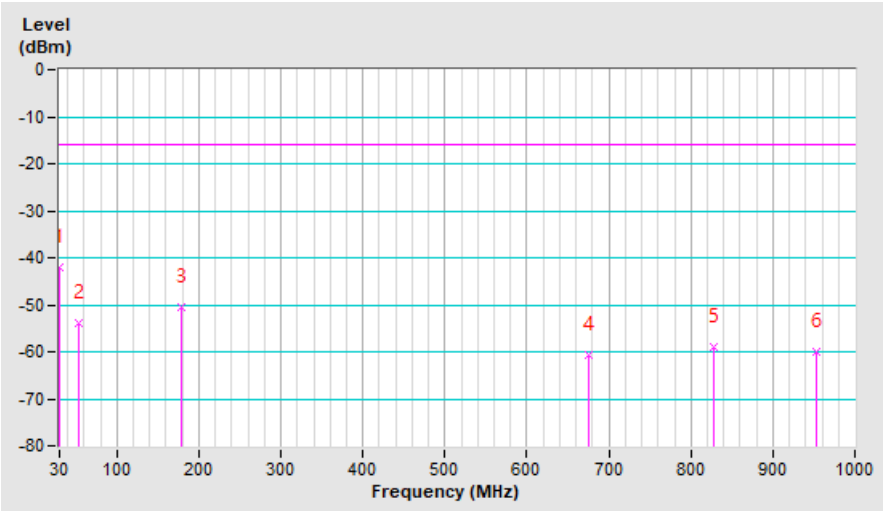
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.



Mode	TX channel 193	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	30.41	-33.85	-29.87	-12.13	-42.00	-15.92	-26.08
2	53.90	-47.23	-45.14	-8.91	-54.05	-15.92	-38.13
3	179.01	-47.22	-53.19	2.78	-50.41	-15.92	-34.49
4	675.26	-66.74	-65.78	5.04	-60.74	-15.92	-44.82
5	827.09	-67.38	-63.06	3.98	-59.08	-15.92	-43.16
6	953.61	-69.66	-63.80	3.90	-59.90	-15.92	-43.98

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.



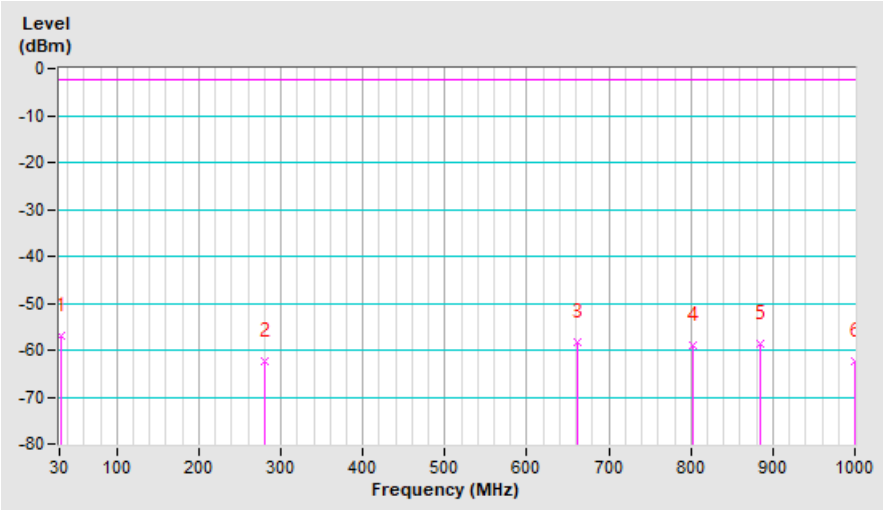
Test Mode F

Channel Bandwidth 20MHz

Mode	TX channel 190	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	31.41	-59.58	-44.99	-12.00	-56.99	-2.28	-54.71
2	280.23	-58.49	-67.64	5.23	-62.41	-2.28	-60.13
3	662.61	-60.99	-63.21	4.95	-58.26	-2.28	-55.98
4	801.78	-65.38	-63.02	4.02	-59.00	-2.28	-56.72
5	884.72	-66.44	-62.61	3.93	-58.68	-2.28	-56.40
6	1000.00	-72.01	-66.20	3.92	-62.28	-2.28	-60.00

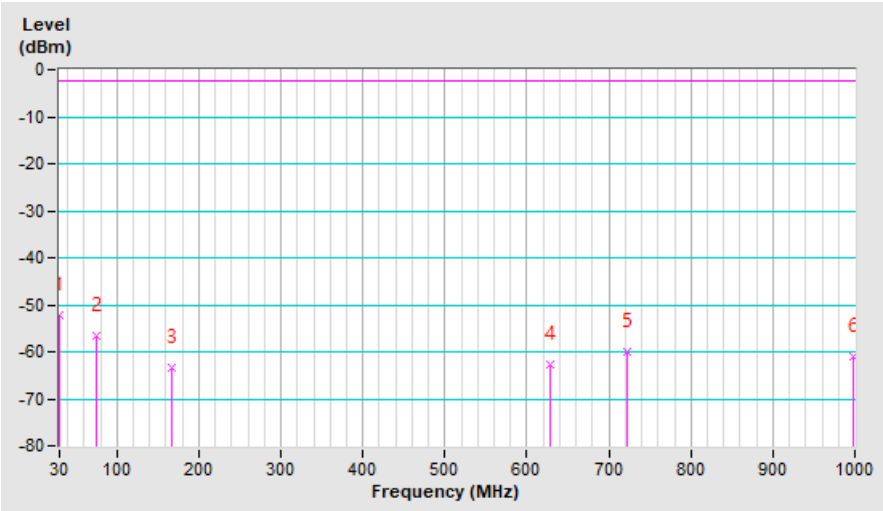
Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.



Mode	TX channel 190	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	30.00	-43.86	-40.02	-12.18	-52.20	-2.28	-49.92
2	74.99	-50.41	-53.35	-3.32	-56.67	-2.28	-54.39
3	167.77	-60.93	-64.65	1.37	-63.28	-2.28	-61.00
4	628.87	-68.30	-67.34	4.66	-62.68	-2.28	-60.40
5	723.06	-66.82	-64.88	4.96	-59.92	-2.28	-57.64
6	998.59	-71.82	-64.99	3.92	-61.07	-2.28	-58.79

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.



Above 1GHz

Test Mode A

Channel Bandwidth 20MHz

Mode	TX channel 190	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-60.19	-36.77	3.77	-33.00	-7.19	-25.81
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-60.83	-38.37	3.77	-34.60	-7.19	-27.41

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.

Mode	TX channel 193	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9930.00	-60.41	-36.78	3.68	-33.10	-7.19	-25.91
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9930.00	-60.37	-37.88	3.68	-34.20	-7.19	-27.01

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.

Mode	TX channel 196	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-60.73	-36.90	3.60	-33.30	-7.19	-26.11
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-60.22	-37.70	3.60	-34.10	-7.19	-26.91

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.81dBm) + Ant. gain (18dBi) – 50dB = -7.19dBm.

Test Mode B

Channel Bandwidth 20MHz

Mode	TX channel 190	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-63.09	-39.67	3.77	-35.90	-15.92	-19.98
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-63.03	-40.57	3.77	-36.80	-15.92	-20.88

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.

Mode	TX channel 193	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	**9930.00**	**-62.91**	**-39.28**	**3.68**	**-35.60**	**-15.92**	**-19.68**
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9930.00	-62.67	-40.18	3.68	-36.50	-15.92	-20.58

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.

Mode	TX channel 196	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-63.13	-39.30	3.60	-35.70	-15.92	-19.78
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-62.72	-40.20	3.60	-36.60	-15.92	-20.68

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.08dBm) + Ant. gain (10dBi) – 50dB = -15.92dBm.

Test Mode C

Channel Bandwidth 20MHz

Mode	TX channel 190	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-61.13	-37.30	3.60	-33.70	-2.28	-31.42
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9960.00	-60.42	-37.90	3.60	-34.30	-2.28	-32.02

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.

Mode	TX channel 193	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9930.00	-61.61	-37.98	3.68	-34.30	-2.28	-32.02
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9930.00	-60.47	-37.98	3.68	-34.30	-2.28	-32.02

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.

Mode	TX channel 196	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-61.89	-38.47	3.77	-34.70	-2.28	-32.42
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	9900.00	-60.63	-38.17	3.77	-34.40	-2.28	-32.12

Remarks:
1. EIRP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).
3. Limit = Min. conduction power (24.72dBm) + Ant. gain (23dBi) – 50dB = -2.28dBm.

4.7 Frequency Stability Measurement

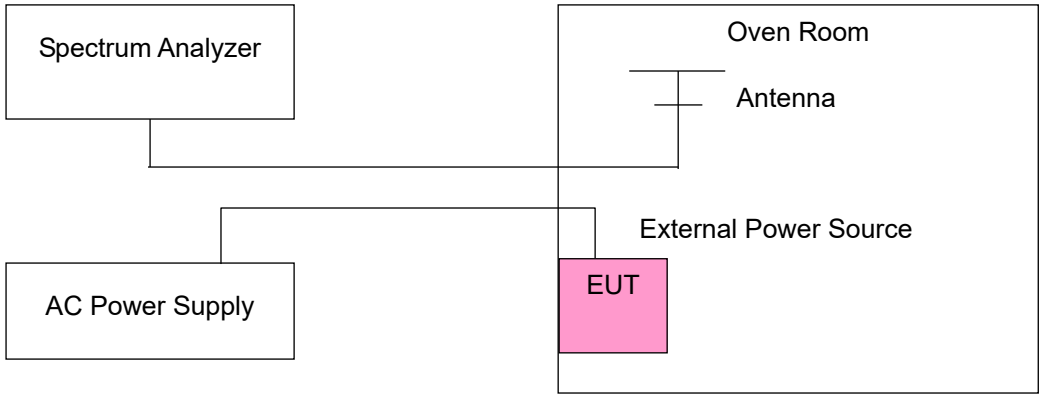
4.7.1 Limits of Frequency Stability Measurement

The test shall be performed at normal and extreme test conditions. From -30°C to +50°C and vary the primary supply voltage from 85% to 115% of the nominal value.

4.7.2 Test Procedure

- The EUT was switched on and allowed to warm up to its normal operating condition.
- The EUT output was connected to a spectrum analyser and the frequency stability was measured.
- Measurements were taken after a thermal balance was obtained.
- Normal and extreme test conditions were measured

4.7.3 Test Setup



4.7.4 Test Results

Test Mode A

Channel Bandwidth 20MHz

Frequency Stability Versus Temp.									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
60	120	4949.9969	-0.62626	4949.9965	-0.70707	4949.9998	-0.0404	4949.9993	-0.14141
50	120	4950.0108	2.181818	4950.0087	1.757576	4950.0089	1.79798	4950.0091	1.838384
40	120	4950.0028	0.565657	4950.0036	0.727273	4950.0053	1.070707	4950.0067	1.353535
30	120	4949.9819	-3.65657	4949.9829	-3.45455	4949.9808	-3.87879	4949.9793	-4.18182
20	120	4950.014	2.828283	4950.0151	3.050505	4950.012	2.424242	4950.012	2.424242
10	120	4949.9871	-2.60606	4949.9854	-2.94949	4949.989	-2.22222	4949.9851	-3.0101
0	120	4950.0189	3.818182	4950.021	4.242424	4950.0188	3.79798	4950.0216	4.363636
-10	120	4949.9853	-2.9697	4949.986	-2.82828	4949.987	-2.62626	4949.9889	-2.24242
-20	120	4949.9756	-4.92929	4949.9754	-4.9697	4949.9743	-5.19192	4949.9737	-5.31313

Frequency Stability Versus Voltage									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	4950.0136	2.747475	4950.0156	3.151515	4950.012	2.424242	4950.011	2.222222
	120	4950.014	2.828283	4950.0151	3.050505	4950.012	2.424242	4950.012	2.424242
	102	4950.0131	2.646465	4950.0158	3.191919	4950.0122	2.464646	4950.0123	2.484848

Test Mode B

Channel Bandwidth 20MHz

Frequency Stability Versus Temp.									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
60	120	4949.9908	-1.85859	4949.9898	-2.06061	4949.9907	-1.87879	4949.9884	-2.34343
50	120	4950.0022	0.444444	4950.0029	0.585859	4950.0019	0.383838	4950.0012	0.242424
40	120	4949.988	-2.42424	4949.9859	-2.84848	4949.9896	-2.10101	4949.9873	-2.56566
30	120	4950.0155	3.131313	4950.0161	3.252525	4950.0186	3.757576	4950.015	3.030303
20	120	4950.0075	1.515152	4950.0056	1.131313	4950.0069	1.393939	4950.0052	1.050505
10	120	4949.9795	-4.14141	4949.9807	-3.89899	4949.9804	-3.9596	4949.9814	-3.75758
0	120	4949.977	-4.64646	4949.9798	-4.08081	4949.9805	-3.93939	4949.9813	-3.77778
-10	120	4949.9904	-1.93939	4949.9882	-2.38384	4949.9877	-2.48485	4949.9881	-2.40404
-20	120	4949.9957	-0.86869	4949.9933	-1.35354	4949.996	-0.80808	4949.9953	-0.94949

Frequency Stability Versus Voltage									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	4950.0076	1.535354	4950.0062	1.252525	4950.0065	1.313131	4950.0044	0.888889
	120	4950.0075	1.515152	4950.0056	1.131313	4950.0069	1.393939	4950.0052	1.050505
	102	4950.0067	1.353535	4950.0051	1.030303	4950.0062	1.252525	4950.0049	0.989899

Test Mode C

Channel Bandwidth 20MHz

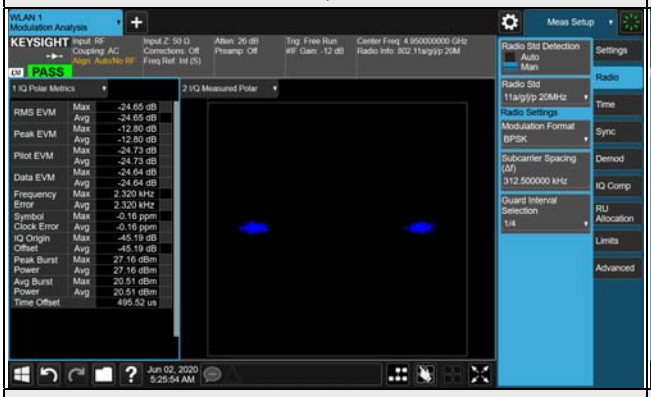
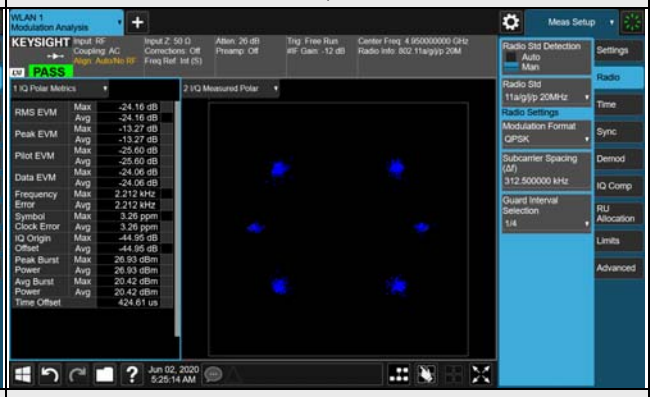
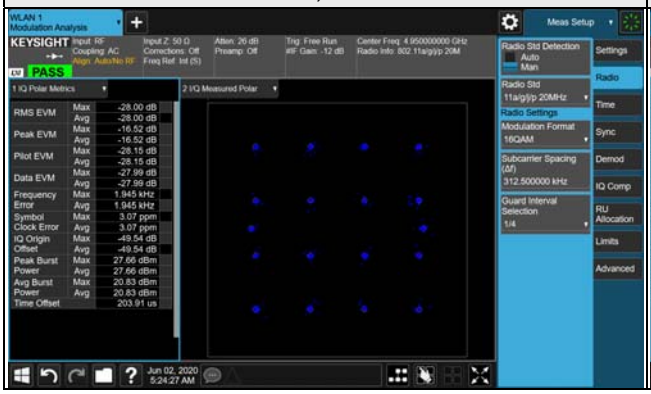
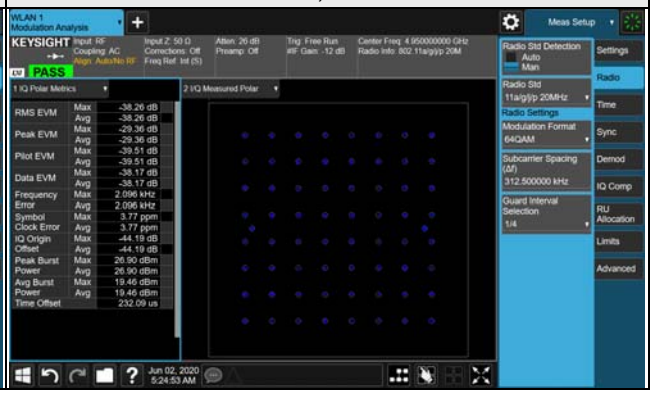
Frequency Stability Versus Temp.									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
60	120	4949.9825	-3.53535	4949.9832	-3.39394	4949.9821	-3.61616	4949.9843	-3.17172
50	120	4950.0154	3.111111	4950.0176	3.555556	4950.0186	3.757576	4950.0159	3.212121
40	120	4950.0094	1.89899	4950.0095	1.919192	4950.0079	1.59596	4950.0062	1.252525
30	120	4949.9923	-1.55556	4949.9896	-2.10101	4949.9915	-1.71717	4949.99	-2.0202
20	120	4950.0259	5.232323	4950.0252	5.090909	4950.0259	5.232323	4950.0258	5.212121
10	120	4949.9975	-0.50505	4949.9996	-0.08081	4949.9976	-0.48485	4949.9993	-0.14141
0	120	4950.0006	0.121212	4949.9997	-0.06061	4949.999	-0.20202	4950.0012	0.242424
-10	120	4949.9994	-0.12121	4950.001	0.20202	4950.0023	0.464646	4950.0009	0.181818
-20	120	4949.9851	-3.0101	4949.9863	-2.76768	4949.9864	-2.74747	4949.987	-2.62626

Frequency Stability Versus Voltage									
Operating Frequency: 4950MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	138	4950.0256	5.171717	4950.0258	5.212121	4950.0261	5.272727	4950.0268	5.414141
	120	4950.0259	5.232323	4950.0252	5.090909	4950.0259	5.232323	4950.0258	5.212121
	102	4950.0259	5.232323	4950.0244	4.929293	4950.025	5.050505	4950.0262	5.292929

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Annex A – Modulation Characteristics

20MHz, BPSK	20MHz, QPSK
	
20MHz, 16QAM	**20MHz, 64QAM**
	

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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