

FCC Test Report

FCC ID : MXFGCM7243IDS-APB
Equipment : DISHCreek Module
Model No. : GCM7243iDS_APB
Brand Name : GCT
Applicant : Gemtek Technology Co., Ltd.
Address : No. 15-1 Zhonghua Road, Hsinchu Industrial
Park, Hukou, Hsinchu, Taiwan, 30352.
Standard : 47 CFR FCC Part 27
Received Date : Jan. 23, 2019
Tested Date : Feb. 14 ~ Feb. 25, 2019

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


Along Chen / Assistant Manager

Approved by:


Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FG912301	Rev. 01	Initial issue	Mar. 12, 2019

Summary of Test Results

FCC Rules	Test Items	Measured	Result
2.1046 27.50(d)(9)	Equivalent Isotropically Radiated Power	Power[dBm]: 24.70	Pass
2.1047	Modulation characteristics	Meet the requirement of limit	Pass
2.1051 27.53(h)	Radiated Emissions	Meet the requirement of limit	Pass
2.1051 27.53(h)	Conducted Emissions	Meet the requirement of limit	Pass
2.1051 27.53(h)	Band Edge	Meet the requirement of limit	Pass
2.1049	Occupied Bandwidth	Meet the requirement of limit	Pass
2.1055 / 27.54	Frequency Stability	Meet the requirement of limit	Pass
27.50(d)(5)	Peak to Average Ratio	Meet the requirement of limit	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared values of gain for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of the gain.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

Operating Frequency	LTE Band 111: UL:1915.2 ~ 1919.8 MHz, DL:722 ~ 728 MHz LTE Band 222: UL:1915.2 ~ 1919.8 MHz, DL:1995 ~ 2020 MHz
Modulation Type	BPSK, QPSK
Release Version	13
Duplex Mode	FDD
H/W Version	V1.0

1.1.2 Maximum EIRP and Emission Designator

Modulation	Maximum EIRP (W)	Emission Designator
BPSK	0.282	152kF1D
QPSK	0.295	195kG7D

1.1.3 Antenna Details

Ant. No.	Model	Type	Gain (dBi)	Connector	Remark
1	180-100-0747R	Dipole	1.23	SMA	---

1.1.4 EUT Operational Condition

Supply Voltage	3.8Vdc		
Operational Voltage	☒ Vnom (3.8 V)	☒ Vmax (4.18 V)	☒ Vmin (3.42 V)
Operational Climatic	☒ Tnom (20°C)	☒ Tmax (85°C)	☒ Tmin (-40°C)

1.1.5 Test Channel

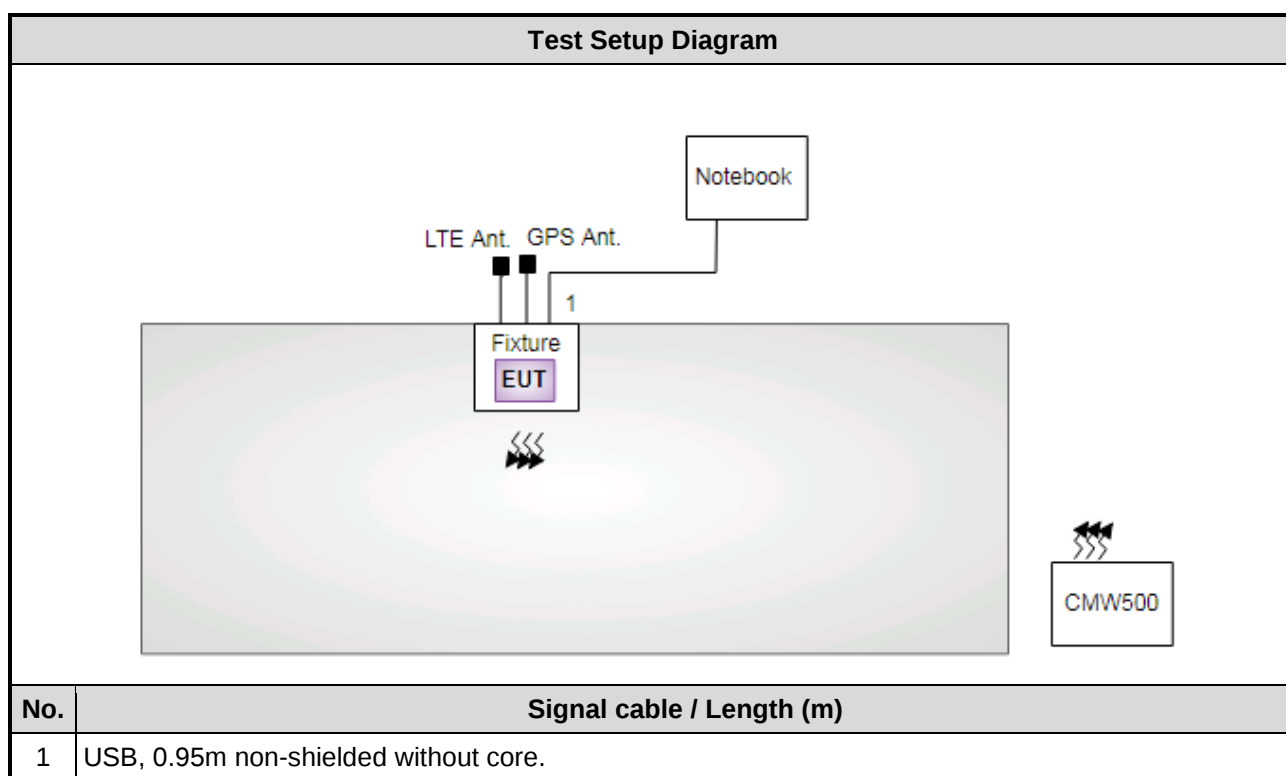
LTE Band 111	
Channel	Frequency (MHz)
32113	1915.2
32159	1919.8

LTE Band 222	
Channel	Frequency (MHz)
31113	1915.2
31159	1919.8

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E6430	DoC	---
2	Fixture	---	---	---	Provided by applicant.

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Apr. 16, 2018	Apr. 15, 2019
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	Dec. 05, 2018	Dec. 04, 2019
Power Meter	Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019
Power Sensor	Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019
Wideband Radio Communication Tester	R&S	CMW500	106070	Jan. 30, 2019	Jan. 29, 2020
DC POWER SOURCE	GW INSTRON	GPC-6030D	EM892433	Oct. 25, 2018	Oct. 24, 2019
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber 1 / (03CH01-WS)				
Spectrum Analyzer	R&S	FSV40	101498	Dec. 27, 2018	Dec. 26, 2019
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 18, 2018	Jul. 17, 2019
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 18, 2018	Dec. 17, 2019
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019
Preamplifier	EMC	EMC02325	980225	Jul. 20, 2018	Jul. 19, 2019
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF Cable	EMC	EMC104-SM-SM-8000	181106	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 08, 2018	Oct. 07, 2019
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards.

47 CFR FCC Part 27

ANSI C63.4-2014

ANSI C63.26-2015

FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

FCC KDB 971168 D02 Misc Rev Approv License Devices v02r01

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

FCC KDB 442401 ERP/EIRP measurement procedures for licensed radio service devices

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	± 34.130 Hz
Conducted power	± 0.808 dB
Frequency error	$\pm 1 \times 10^{-9}$
Temperature	± 0.4 °C
Conducted emission	± 2.715 dB
AC conducted emission	± 2.92 dB
Radiated emission ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.59 dB

2 Test Configuration

2.1 Testing Condition and Location Information

Test Item	Test Site	Ambient Condition	Tested By
RF conducted	TH01-WS	24°C / 64%	Akun Chung
Radiated Emissions	03CH01-WS	20°C / 66%	Aska Huang

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Modulation	Test channel
E.I.R.P	BPSK / QPSK	32113, 32159 31113, 31159
Conducted Emissions Occupied Bandwidth Peak to Average Ratio	BPSK / QPSK	32113, 32159
Radiated Emission ≤ 1GHz	QPSK	32159
Radiated Emission > 1GHz	QPSK	32113, 32159
Band Edge	BPSK / QPSK	32113, 32159
Frequency Stability	QPSK	32159
Modulation characteristics	BPSK / QPSK	32113, 32159
Note: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.		

3 Test Results

3.1 Equivalent Isotropically Radiated Power

3.1.1 Limit of Equivalent Isotropically Radiated Power

Fixed, mobile and portable (hand-held) stations operating in the 1915-1920 MHz band are limited to 300 milliwatts EIRP.

3.1.2 Test Procedures

For Conducted power measurement:

1. The EUT links up with simulator and is set to maximum output power level at low / middle / high channel.
2. Measure the output power of low / middle / high channel of the EUT.

For EIRP measurement:

EIRP can be calculated by below formula from KDB 412172 D01.

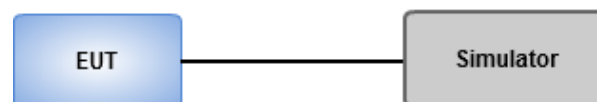
1. $EIRP = P_T + G_T - L_C$

P_T = transmitter output power, in dBm.

G_T = gain of the transmitting antenna, in dBi (EIRP).

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

3.1.3 Test Setup



3.1.4 Test Result of Conducted power (dBm)

Band			LTE Band 111	
Channel			32113	32159
Frequency (MHz)			1915.2	1919.8
Mode	Sub-Carrier spacing (KHz)	N _{tones}	Maximum AV Power (dBm)	
BPSK	3.75	1@0	22.35	22.48
	3.75	1@47	23.01	23.08
	15	1@0	22.56	22.66
	15	1@11	23.21	23.27
QPSK	3.75	1@0	22.31	22.44
	3.75	1@47	23.03	23.11
	15	1@0	22.62	22.60
	15	1@11	23.17	23.18
	15	12@0	23.44	23.47

Band			LTE Band 222	
Channel			31113	31159
Frequency (MHz)			1915.2	1919.8
Mode	Sub-Carrier spacing (KHz)	N _{tones}	Maximum AV Power (dBm)	
BPSK	3.75	1@0	22.34	22.43
	3.75	1@47	23.00	23.07
	15	1@0	22.51	22.59
	15	1@11	23.18	23.26
QPSK	3.75	1@0	22.29	22.43
	3.75	1@47	23.02	23.06
	15	1@0	22.53	22.58
	15	1@11	23.16	23.17
	15	12@0	23.36	23.41

3.1.5 Test Result of Equivalent Isotropically Radiated Power (dBm)

LTE Band	Modulation	Max. Conducted Output Power (dBm)	Antenna Gain(dBi)	EIRP (dBm)	EIRP (mW)	EIRP Limit (mW)
111	BPSK	23.27	1.23	24.50	281.8	300
	QPSK	23.47	1.23	24.70	295.1	300
222	BPSK	23.26	1.23	24.49	281.2	300
	QPSK	23.41	1.23	24.64	291.1	300

Note: EIRP = Conducted Power + Antenna gain

3.2 Radiated Emissions

3.2.1 Limit of Radiated Emissions

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB equal to -13dBm.

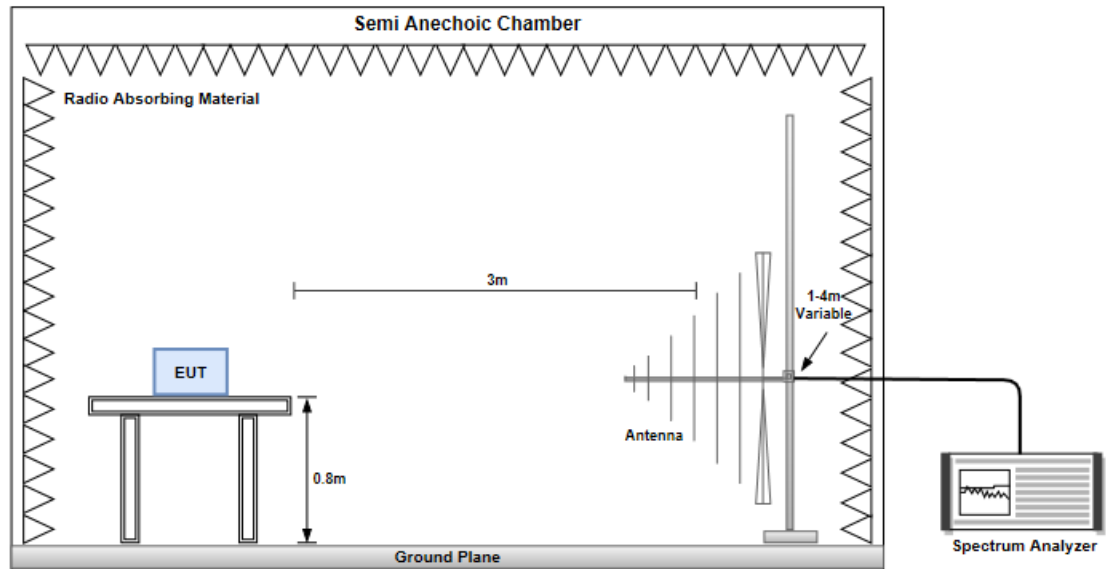
For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB

3.2.2 Test Procedures

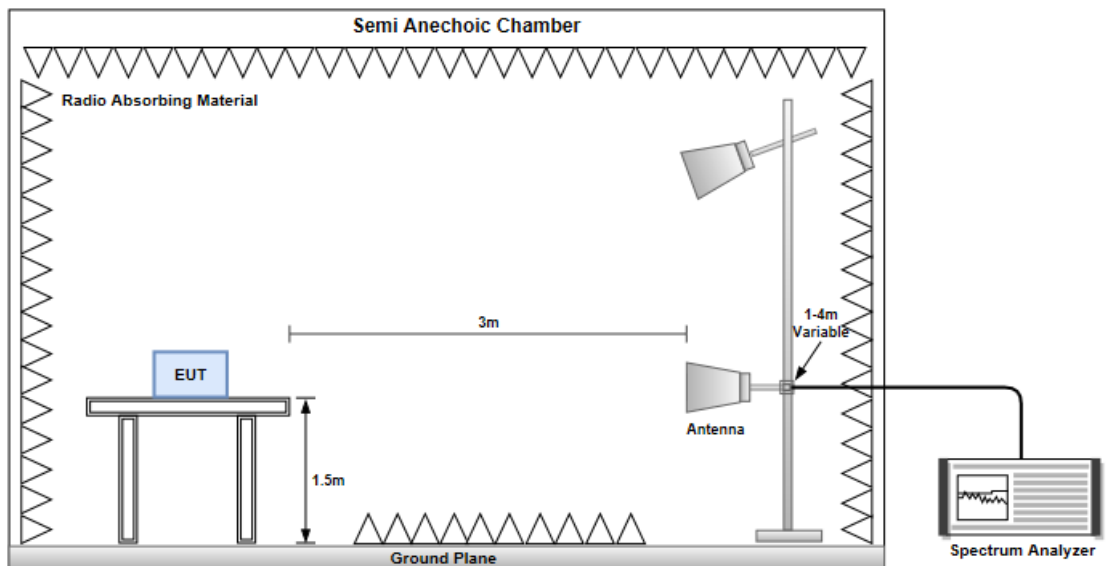
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360° . A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360° , the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.
4. After finding the max radiated emission, substitution method will be used for getting effective radiated power. EUT will be removed and substitution antenna will be placed at same position. Signal generator will output CW signal to substitution antenna through a RF cable. Rotate turntable and move antenna to find maximum radiated emission. Adjust output power of signal generator to let the maximum radiated emission is same as step 3. Record the output power level.
5. E.I.R.P = output power of step 4 + gain of substitution antenna – cable loss of RF cable.

3.2.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.2.4 Test Result of Radiated Emissions below 1GHz

Mode	Channel : 32159, Sub-Carrier spacing : 15 kHz, N _{tones} : 12@0						
Frequency (MHz)	Antenna Polarity	E.I.R.P (dBm)	Limit (dBm)	Margin (dB)	S.A Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)
38.73	H	-61.42	-13	-48.42	-67.95	-43.49	-17.93
149.31	H	-56.95	-13	-43.95	-56.35	-50.09	-6.86
161.92	H	-48.62	-13	-35.62	-48	-42.24	-6.38
173.56	H	-57.16	-13	-44.16	-56.45	-52.03	-5.13
245.34	H	-59.55	-13	-46.55	-56.26	-57.98	-1.57
414.12	H	-59.14	-13	-46.14	-61.26	-57.82	-1.32
151.25	V	-60.99	-13	-47.99	-63.49	-54.18	-6.81
160.95	V	-59.69	-13	-46.69	-62.54	-53.2	-6.49
270.56	V	-59.94	-13	-46.94	-61.62	-58.47	-1.47
281.23	V	-58.39	-13	-45.39	-59.96	-56.92	-1.47
797.27	V	-56.41	-13	-43.41	-64.63	-54.26	-2.15
840.92	V	-56.31	-13	-43.31	-65	-53.94	-2.37

NOTE: EIRP = S.G power value + correction factor

3.2.5 Test Result of Radiated Emissions above 1GHz

Mode	Channel : 32113, Sub-Carrier spacing : 15 kHz, N _{tones} : 12@0						
Frequency (MHz)	Antenna Polarity	E.R.P (dBm)	Limit (dBm)	Margin (dB)	S.A Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)
1930	H	-53.72	-40	-13.72	-60.23	-60.1	6.38
3830.4	H	-37.49	-13	-24.49	-51.46	-44.43	6.94
5745.6	H	-30.19	-13	-17.19	-47.4	-36.85	6.66
7660.8	H	-27.1	-13	-14.1	-45.94	-30.56	3.46
1930	V	-51.82	-40	-11.82	-58.26	-58.2	6.38
3830.4	V	-28.45	-13	-15.45	-42.26	-35.39	6.94
5745.6	V	-25.82	-13	-12.82	-43.1	-32.48	6.66
7660.8	V	-23.93	-13	-10.93	-43.39	-27.39	3.46

Mode	Channel : 32159, Sub-Carrier spacing: 15 kHz, N _{tones} : 12@0						
Frequency (MHz)	Antenna Polarity	E.R.P (dBm)	Limit (dBm)	Margin (dB)	S.A Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)
1930	H	-53.73	-40	-13.73	-60.24	-60.11	6.38
3839.6	H	-37.45	-13	-24.45	-51.41	-44.4	6.95
5759.4	H	-31.33	-13	-18.33	-48.58	-37.98	6.65
7679.2	H	-28.25	-13	-15.25	-47.2	-31.71	3.46
1930	V	-51.85	-40	-11.85	-58.29	-58.23	6.38
3839.6	V	-28.27	-13	-15.27	-42.09	-35.22	6.95
5759.4	V	-25.83	-13	-12.83	-43.16	-32.48	6.65
7679.2	V	-23.82	-13	-10.82	-43.35	-27.28	3.46

NOTE: EIRP = S.G power value + correction factor.

3.3 Conducted Emissions

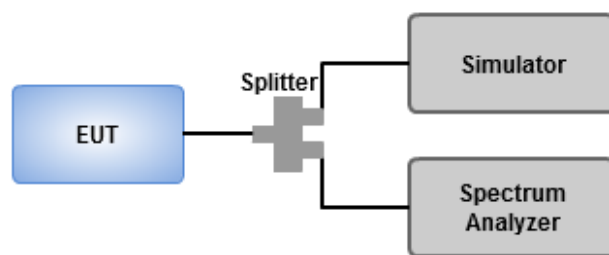
3.3.1 Limit of Conducted Emissions

On any frequency outside the the licensed band, the power of any emission shall be attenuatedoutside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB equal to -13dBm.

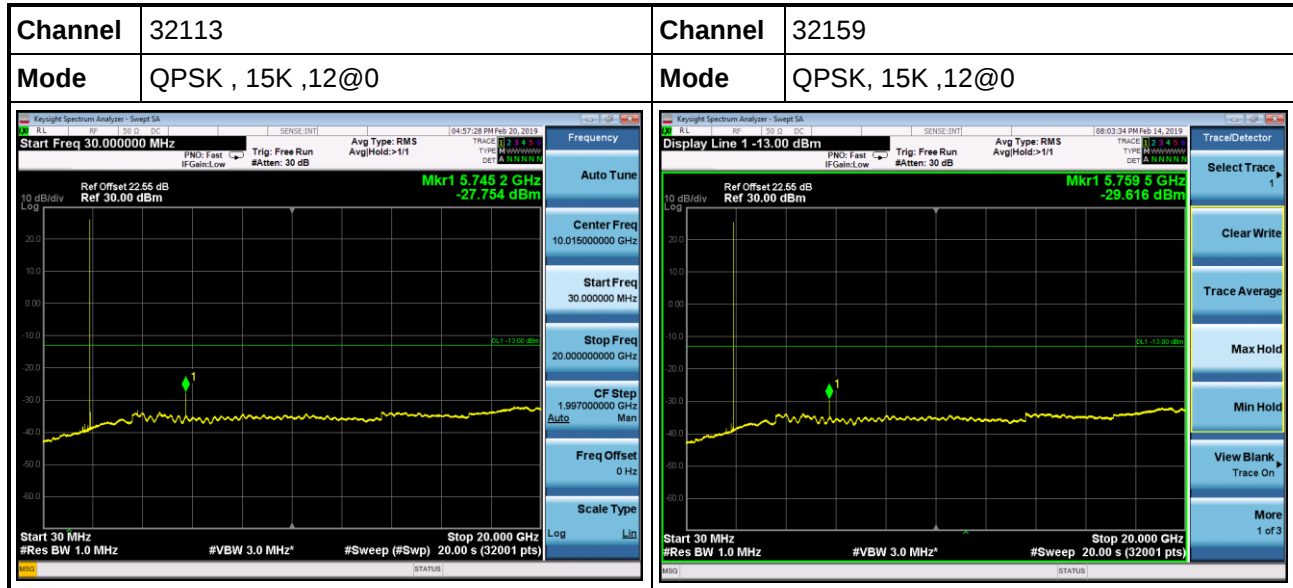
3.3.2 Test Procedures

1. Lowestand highest operating channels are tested for this item.
2. Scan frequency range is from 30 MHz ~ 20 GHz.
3. Set RBW = 1MHz, VBW = 3MHz, detector = RMS, sweep time = auto.
4. Record the max trace value and capture the test plot of each sub frequency band.

3.3.3 Test Setup



3.3.4 Test Result of Conducted Emissions



3.4 Band Edge

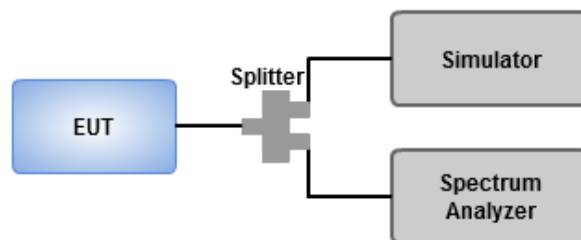
3.4.1 Limit of Band Edge

On any frequency outside the licensed band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB equal to -13dBm.

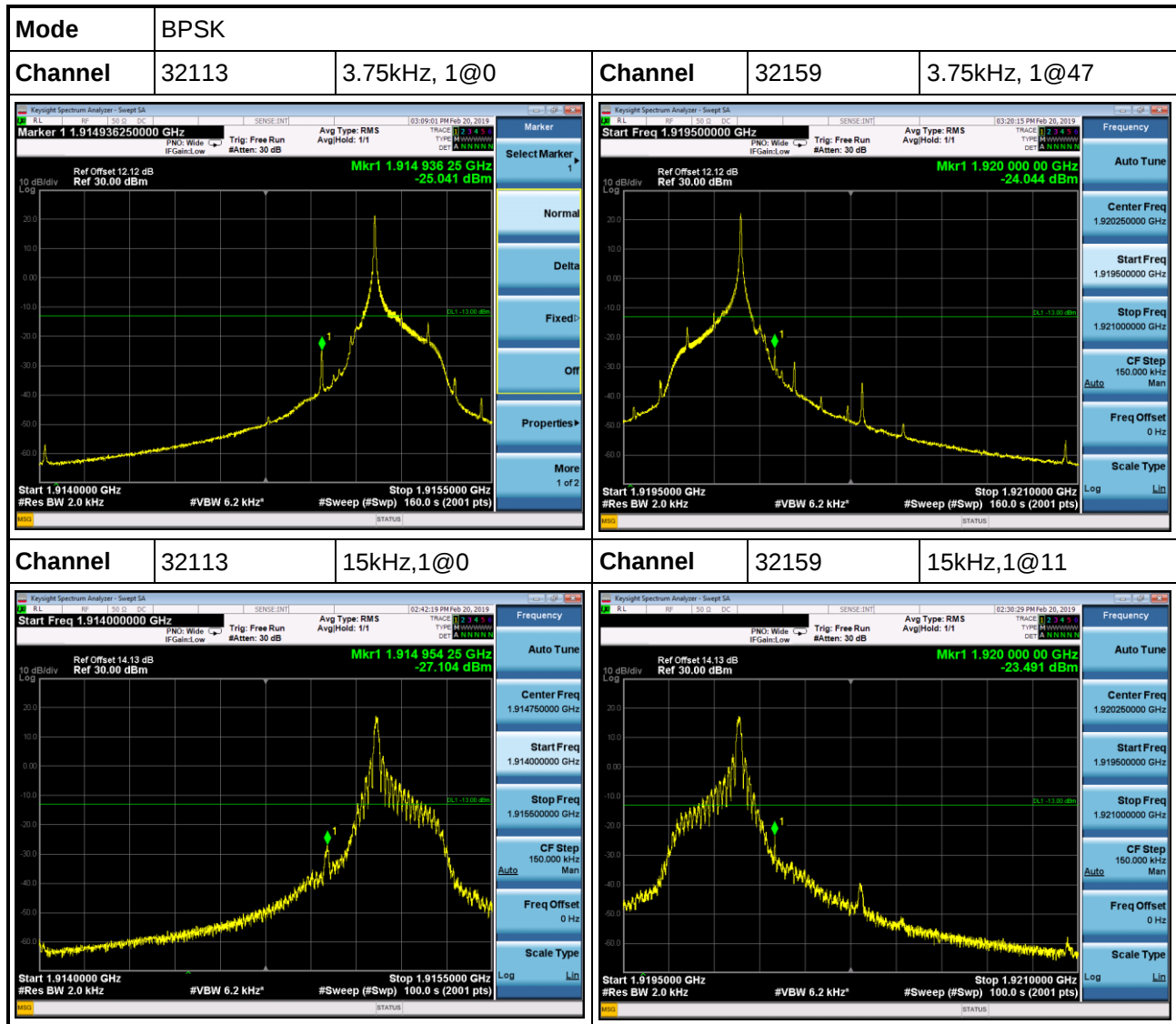
3.4.2 Test Procedures

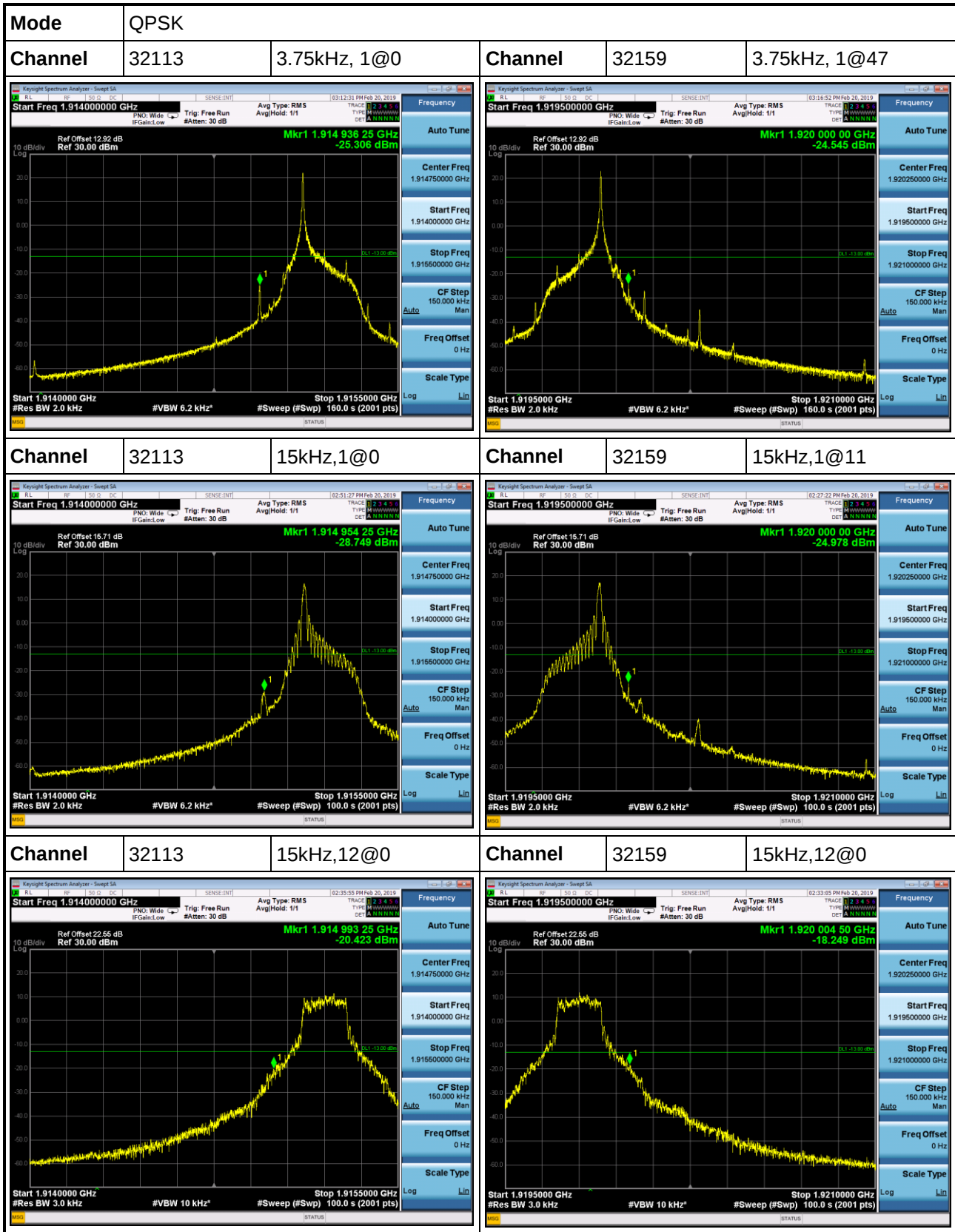
1. Set RBW = 2 kHz, VBW = 6.2 kHz, detector = RMS, sweep time = auto for $N_{\text{tones}}=1$.
Set RBW = 3 kHz, VBW = 10kHz, detector = RMS, sweep time = auto for $N_{\text{tones}}=12$.
2. Record the max trace value and capture the test plot.

3.4.3 Test Setup



3.4.4 Test Result of Band Edge



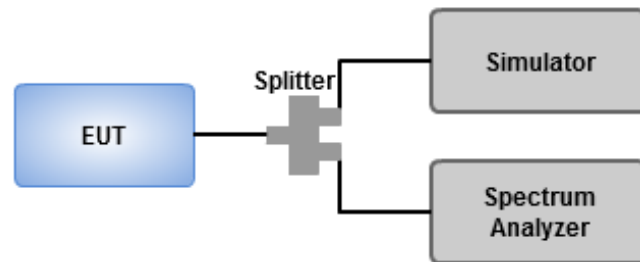


3.5 Occupied Bandwidth and 26dB Bandwidth

3.5.1 Test Procedures

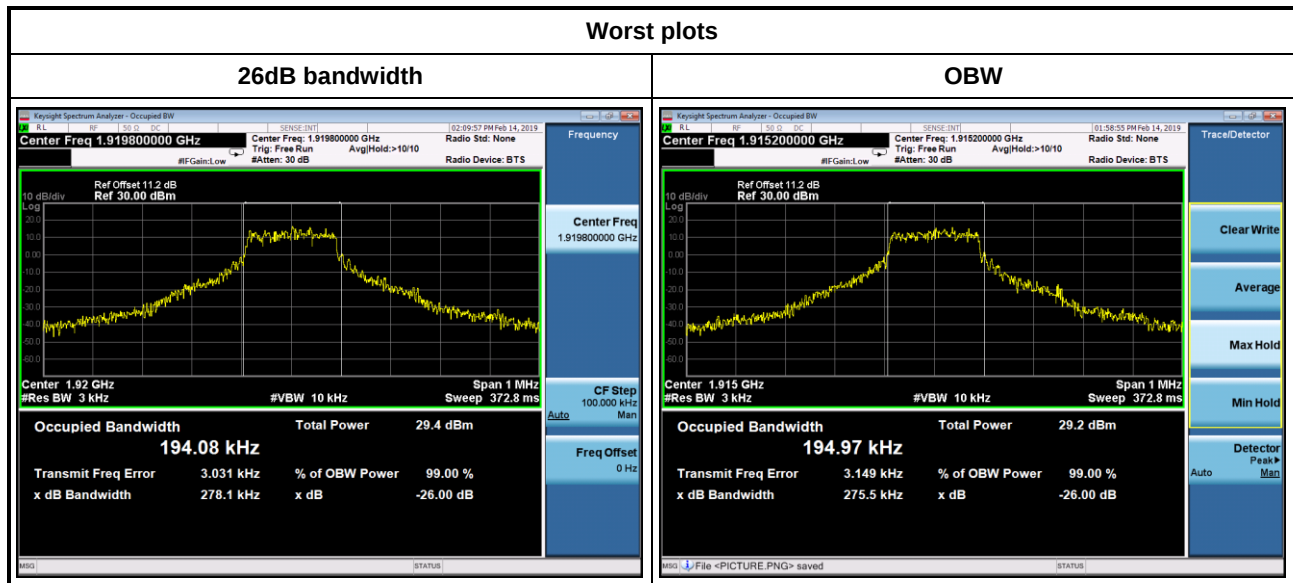
1. Set RBW = 2 kHz, VBW = 10 kHz for $N_{\text{tones}}=1$.
Set RBW = 3 kHz, VBW = 10 kHz for $N_{\text{tones}}=12$.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Using bandwidth measurement function of spectrum analyzer to measure 26 dB and occupied bandwidth.

3.5.2 Test Setup



3.5.3 Test Result of Occupied Bandwidth

Sub-Carrier spacing (kHz)	N _{tones}	Modulation	Channel	Frequency (MHz)	26dB BW (kHz)	99% OBW (kHz)
3.75	1@0	BPSK	32113	1915.2	38.3200	97.6500
3.75	1@0	BPSK	32159	1919.8	38.0600	90.6820
3.75	1@0	QPSK	32113	1915.2	42.4400	100.7300
3.75	1@0	QPSK	32159	1919.8	44.1200	101.2300
15	1@0	BPSK	32113	1915.2	132.5000	132.5000
15	1@0	BPSK	32159	1919.8	135.0000	151.7200
15	1@0	QPSK	32113	1915.2	139.3000	154.2200
15	1@0	QPSK	32159	1919.8	133.2000	148.8700
15	12@0	QPSK	32113	1915.2	275.5000	194.9700
15	12@0	QPSK	32159	1919.8	278.1000	194.0800



3.6 Peak to Average Ratio

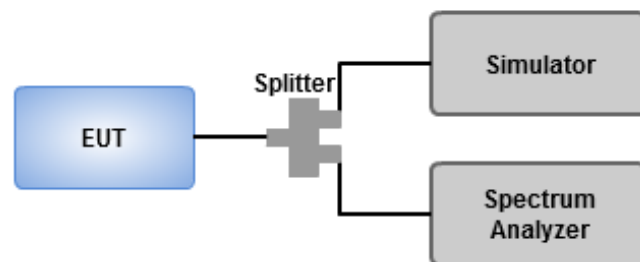
3.6.1 Limit of Peak to Average Ratio

The Peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.6.2 Test Procedures

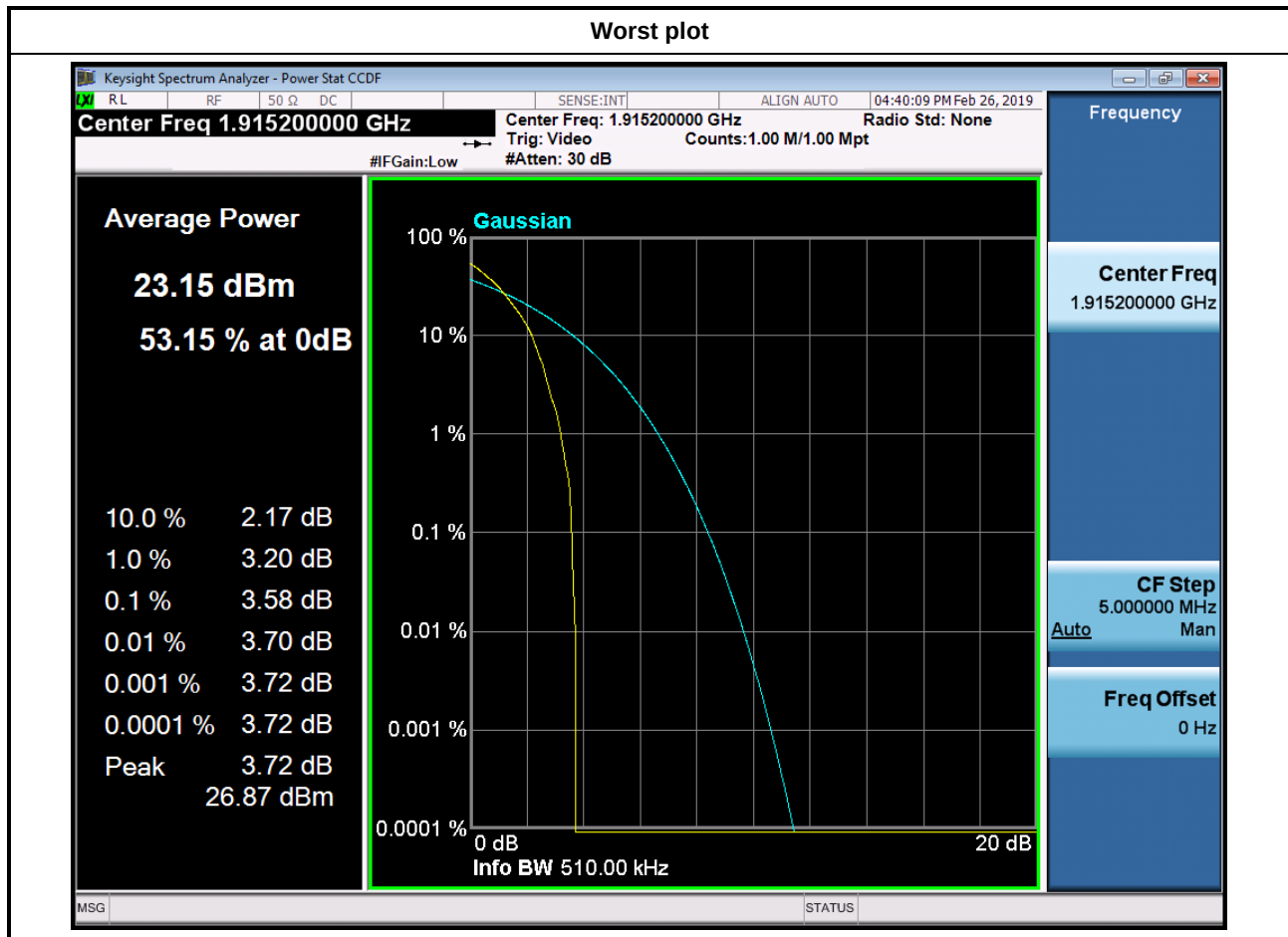
1. Set the number of counts to a value that stabilizes the measured CCDF curve.
2. Set the measurement interval to 1 ms.
3. Record the maximum PAPR level associated with a probability of 0.1%.

3.6.3 Test Setup



3.6.4 Test Result of Peak to Average Ratio

Sub-Carrier spacing (kHz)	Ntones	Modulation	Channel	Frequency (MHz)	Peak to Average ratio (dB)
3.75	1@0	BPSK	32113	1915.2	1.60
3.75	1@0	BPSK	32159	1919.8	1.69
3.75	1@0	QPSK	32113	1915.2	1.50
3.75	1@0	QPSK	32159	1919.8	1.48
15	1@0	BPSK	32113	1915.2	1.58
15	1@0	BPSK	32159	1919.8	1.62
15	1@0	QPSK	32113	1915.2	1.47
15	1@0	QPSK	32159	1919.8	1.45
15	12@0	QPSK	32113	1915.2	3.58
15	12@0	QPSK	32159	1919.8	3.46



3.7 Frequency Stability

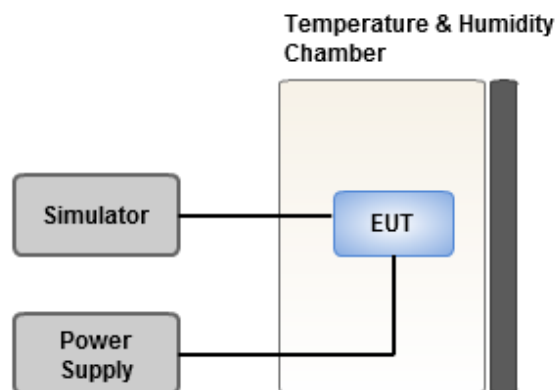
3.7.1 Limit of Frequency Stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

3.7.2 Test Procedures

1. EUT was placed at temperature chamber and connected to an external power supply.
2. Temperature and voltage condition shall be tested to confirm frequency stability.
3. Temperature range is from -40~85°C and voltage range is from lowest to highest working voltage.
4. Tem Link up EUT and simulator. Confirm frequency drift value of simulator and record it.

3.7.3 Test Setup



3.7.4 Test Result of Frequency Stability

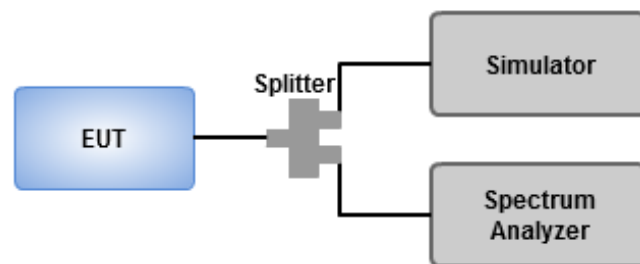
Temperature (°C)	Voltage (ac)	Frequency Drift (ppm)
T20°C Vmax	138	-0.02
T20°C Vmin	102	-0.03
T85°C Vnom	120	-0.07
T80°C Vnom	120	-0.07
T70°C Vnom	120	-0.07
T60°C Vnom	120	-0.06
T50°C Vnom	120	-0.05
T40°C Vnom	120	-0.04
T30°C Vnom	120	-0.04
T20°C Vnom	120	-0.02
T10°C Vnom	120	-0.01
T0°C Vnom	120	-0.01
T-10°C Vnom	120	0.01
T-20°C Vnom	120	0.01
T-30°C Vnom	120	0.01
T-40°C Vnom	120	0.02

3.8 Modulation Characteristics

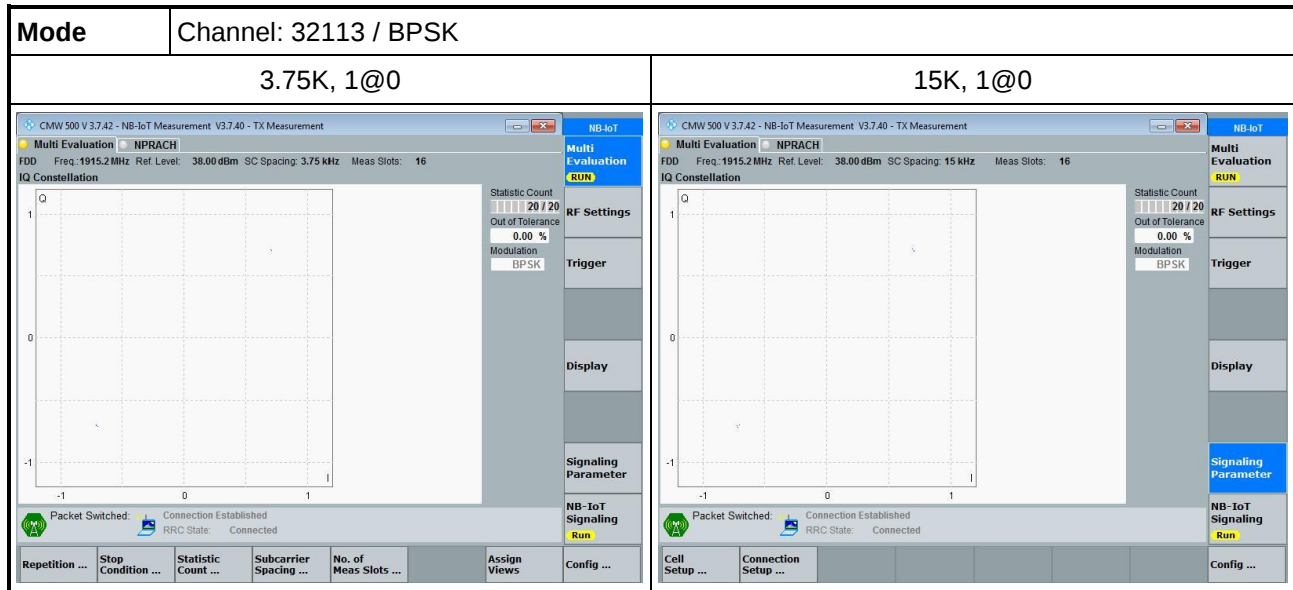
3.8.1 Test Procedures

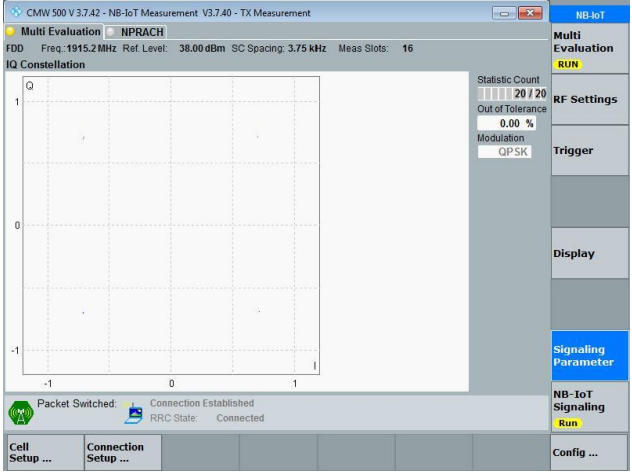
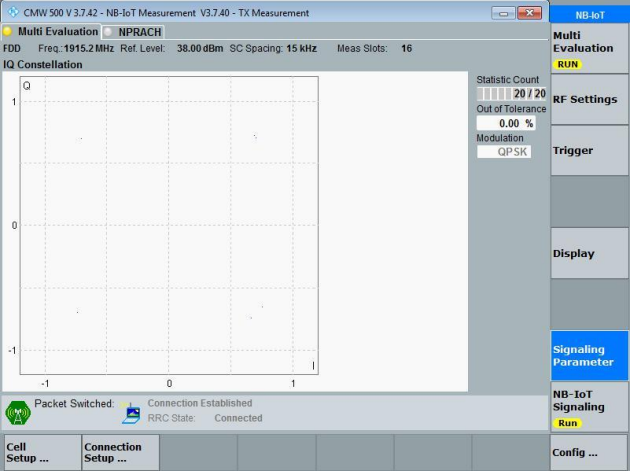
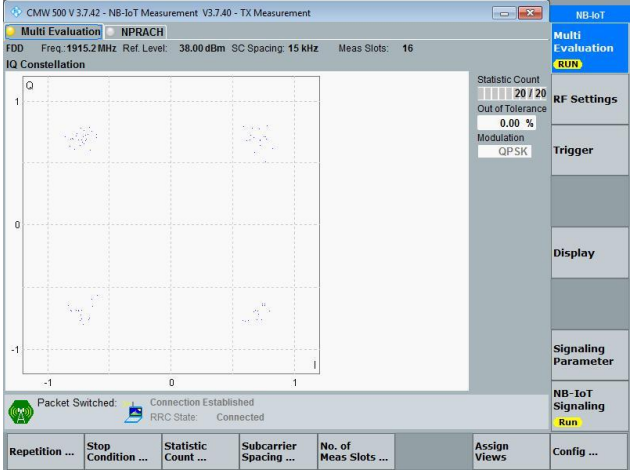
1. EUT is connected to simulator under specific modulation and frequency.
2. Measure and record the modulation scheme.

3.8.2 Test Setup



3.8.3 Test Result



Mode	Channel: 32113 / QPSK
3.75K,1@0	15K, 1@0
	
15K, 12@0	---
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4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

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Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

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No. 3-1, Lane 6, Wen San 3rd St.,
Kwei Shan District, Tao Yuan City
333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

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