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FCC LTE REPORT

Certification

 Applicant Name:
 Date of Issue:

 SAMSUNG Electronics Co., Ltd.
 June 15, 2021

 Location:
 Location:

 Address:
 HCT CO., LTD.,

 129, Samsung-ro, Yeongtong-gu,
 74, Seoicheon-ro 578beon-gil, Majang-myeon,

 Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
 Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

 Report No.: HCT-RF-2105-FC021-R1

APPLICANT:

SAMSUNG Electronics Co., Ltd.

Model(s):	SM-G990U
Additional Model(s):	SM-G990U1/DS, SM-G990U1
EUT Type:	Mobile Phone
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2

Mode	Tri Francisco and	Emission		ERP		
(MHz)	Tx Frequency (MHz)	Designator	Emission Modulation Designator		Max. Power (dBm)	
	779.5 –784.5	4M50G7D	QPSK	0.107	20.31	
LTE Dond12(E)		4M54W7D	16QAM	0.093	19.69	
LTE – Band13 (5)		4M50W7D	64QAM	0.072	18.57	
		4M51W7D	256QAM	0.035	15.46	
	782.0	8M94G7D	QPSK	0.109	20.37	
LTE – Band13 (10)		8M98W7D	16QAM	0.100	20.00	
		8M94W7D	64QAM	0.072	18.59	
		8M96W7D	256QAM	0.033	15.22	

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)



REVIEWED BY

4 mer.

Report prepared by : Jae Mun Do Engineer of Telecommunication Testing Center Report approved by : Jong Seok Lee Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *. The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.



<u>Version</u>

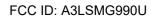
TEST REPORT NO. DATE		DESCRIPTION			
HCT-RF-2105-FC021	May 26, 2021	- First Approval Report			
HCT-RF-2105-FC021-R1	June 15, 2021	- Revised the Additional model(s). (SM-G990U1 added)			

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.



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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG990U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile Phone
Model(s):	SM-G990U
Additional Model(s):	SM-G990U1/DS, SM-G990U1
Tx Frequency:	779.5 MHz –784.5 MHz (LTE – Band 13 (5MHz)) 782 MHz (LTE – Band 13 (10 MHz))
Date(s) of Tests:	April 19, 2021 ~ May 18, 2021
Serial number:	Radiated: R3CR315S6MD Conducted: R3CR3117FBH

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS, CDMA(BC0, 1, 10) and LTE, Sub6. It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, NFC, WPT, mmWave(n260/261).

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74**, **Seoicheon-ro 578beon-gil**, **Majang-myeon**, **Icheon-si**, **Gyeonggi-do**, **17383**, **Rep. of KOREA**.



3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3
	- ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0
	- ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna	- KDB 971168 D01 v03r01 – Section 6.0
Terminal	- ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8
Effective Isotropic Radiated Power	- ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Sourious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2
Radiated Spurious and Harmonic Emissions	- ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power"

measurement capability for signals with continuous operation.

- 2. RBW = 1 5% of the expected OBW, not to exceed 1MHz
- 3. VBW \ge 3 x RBW
- 4. Span = 1.5 times the OBW
- 5. No. of sweep points > 2 x span / RBW
- 6. Detector = RMS
- 7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
- 8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
- 9. Trace mode = trace averaging (RMS) over 100 sweeps
- 10. The trace was allowed to stabilize

Test Note

- 1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
- 2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

 $P_{d(dBm)} = Pg_{(dBm)} - cable loss_{(dB)} + antenna gain_{(dB)}$

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference

between the gain of the horn and an isotropic antenna are taken into consideration

- 4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- 5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

/ (10)/ 10 1000 E 201

Test Settings

- 1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
- 2. VBW ≥ 3 x RBW
- 3. Span = 1.5 times the OBW
- 4. No. of sweep points > 2 x span / RBW
- 5. Detector = Peak
- 6. Trace mode = Max Hold
- 7. The trace was allowed to stabilize
- 8. Test channel : Low/ Middle/ High
- 9. Frequency range : We are performed all frequency to 10th harmonics from 9 kHz.

Test Note

- Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
- 2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
- 3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The spurious emissions is calculated by the following formula;

 $\text{Result}_{(dBm)} = \text{Pg}_{(dBm)} - \text{cable loss }_{(dB)} + \text{antenna gain }_{(dBi)}$

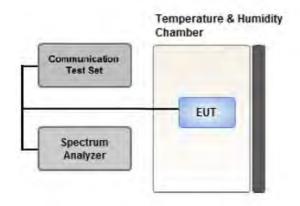
Where: P_{g} is the generator output power into the substitution antenna.

If the fundamental frequency is below 1GHz, RF output power has been converted to EIRP.

 $EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$



3.4 OCCUPIED BANDWIDTH.



<u>Test setup</u>

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 power of a given emission.

The EUT makes a call to the communication simulator.

The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

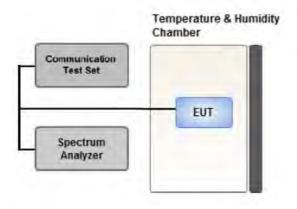
The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

- 1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 2. RBW = 1 5% of the expected OBW
- 3. VBW \geq 3 x RBW
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep = auto couple
- 7. The trace was allowed to stabilize
- 8. If necessary, steps 2 7 were repeated after changing the RBW such that it would be within
 - 1-5% of the 99% occupied bandwidth observed in Step 7



3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic.

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

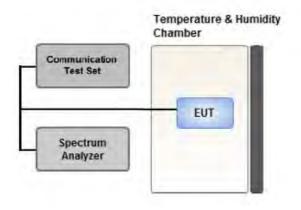
All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

- 1. RBW = 1 MHz
- 2. VBW ≥ 3 MHz
- 3. Detector = RMS
- 4. Trace Mode = trace average
- 5. Sweep time = auto
- 6. Number of points in sweep $\ge 2 \times \text{Span} / \text{RBW}$



3.6 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

- 1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
- 2. Span was set large enough so as to capture all out of band emissions near the band edge
- 3. RBW > 1% of the emission bandwidth
- 4. VBW > 3 x RBW
- 5. Detector = RMS
- 6. Number of sweep points \geq 2 x Span/RBW
- 7. Trace mode = trace average
- 8. Sweep time = auto couple
- 9. The trace was allowed to stabilize

Test Notes

According to FCC 22.917, 24.238, 27.53 specified that 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. In

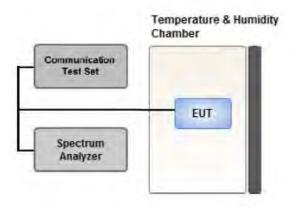
the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.



3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

The temperature is varied from -30°C to +50°C in 10°C increments using an

environmental chamber.

- 2. Primary Supply Voltage:
 - .- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value

for other than hand carried battery equipment.

.- 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.

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature

(20°C to provide a reference).

- 2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
- 3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

3.8 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, RB sizes and offsets,

and channel bandwidth configurations shown in the test data.

- Please refer to the table below.
- SM-G990U & additional models were tested and the worst case results are reported.

(Worst case : SM-G990U)

Test Description	Modulation	RB size	RB offset	Axis			
	QPSK,		0				
Effective Radiated Power	16QAM,	1					
	64QAM,			Х			
	256QAM						
Radiated Spurious and Harmonic Emissions	QPSK	1	0	Х			

[Worst case]



3.9 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.

- SM-G990U & additional models were tested and the worst case results are reported.

(Worst case : SM-G990U)

[Worst case] Bandwidth Modulation **RB** size **RB** offset **Test Description** Frequency (MHz) QPSK, 16QAM, **Occupied Bandwidth** 5, 10 Full RB 0 Mid 64QAM, 256QAM Low 1 0 5 24 1 High Low 0 1 QPSK **Band Edge** 10 High 1 49 Low, 5, 10 Full RB 0 High Low, **Spurious and Harmonic Emissions at** QPSK 5,10 0 Mid, 1 **Antenna Terminal** High



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4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibrati on Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/07/2021	Annual	04/07/2022
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP/ Dipole Antenna	557	04/05/2021	Biennial	04/05/2023
Schwarzbeck	UHAP/ Dipole Antenna	558	04/05/2021	Biennial	04/05/2023
ESPEC	SU-642 / Chamber	93008124	03/15/2021	Annual	03/15/2022
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	10/13/2020	Biennial	10/13/2022
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY50200093	11/17/2020	Annual	11/17/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2020	Annual	06/04/2021
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2020	Annual	10/14/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-333	03/19/2020	Biennial	03/19/2022
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/03/2021	Biennial	03/03/2023
Schwarzbeck	VULB9168/ Hybrid Antenna	760	02/22/2021	Biennial	02/22/2023
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/07/2021	Annual	01/07/2022
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

2. Espectially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05



6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(c)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
On all frequencies between 763- 775 MHz and 793-805 MHz.	§27.53(c)(4)	< 65 + 10log10 (P[Watts])	PASS <u>(See Note2)</u>
Conducted Output Power	§2.1046	N/A	See Note1
Frequency stability / variation of ambient temperature	§2.1055, § 27.54	Emission must remain in band	PASS

Note:

- 1. See SAR Report
- Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance.

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result	
Effective Radiated Power	§27.50(b)(10) < 3 Watts max. ERP		PASS	
Radiated Spurious and Harmonic	§2.1053,	< 43 + 10log10 (P[Watts]) for	PASS	
Emissions	§27.53(g)	all out-of band emissions	1 400	
Undesirable Emissions in	\$2,4052,07,52/f)	< -70dBW/MHz EIRP (wideband)	PASS	
the 1559 – 1610 MHz band	§2.1053, 27.53(f)	< -80dBW EIRP (narrowband)	PA22	



7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured	Substitute	Ant. Gain	Ant. Gain C.L		EF	RP
channel	Freq.(MHz)	Level(dBm)	Level(dBm)	(dBd)	U.L	Pol.	w	dBm
128	824.20	-21.37	38.40	-10.61	0.95	Н	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test, the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch	Ch./ Freq. Measured		Substitute Ant. Gain		t. Gain C.L		EIRP	
channel	Freq.(MHz)	Level(dBm)	Level(dBm)	(dBi)	C.L	Pol.	w	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	Н	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test , the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.



7.3. Emission Designator

Emission Designator = 249KGXW GSM BW = 249 kHz G = Phase Modulation X = Cases not otherwise covered W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W GSM BW = 249 kHz G = Phase Modulation 7 = Quantized/Digital Info W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

- F = Frequency Modulation
- 9 = Composite Digital Info
- W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D LTE BW = 4.48 MHz G = Phase Modulation 7 = Quantized/Digital Info D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D LTE BW = 4.48 MHz W = Amplitude/Angle Modulated 7 = Quantized/Digital Info D = Data transmission; telemetry; telecommand



8. TEST DATA

8.1 EFFECTIVE RADIATED POWER

Freq	Mod	Madulatian	Measured	Substitute	Ant.		Pol	Limit	EF	RP
(MHz)	(Bandwidth)	Modulation	Level (dBm)	Level (dBm)	Gain(dBd)	C.L	POI	w	W	dBm
		QPSK	-30.47	31.81	-10.36	1.36	Н		0.102	20.09
779.5		16-QAM	-31.01	31.27	-10.36	1.36	Н		0.090	19.55
779.5		64-QAM	-32.12	30.16	-10.36	1.36	Н		0.070	18.44
	_	256-QAM	-35.29	26.99	-10.36	1.36	Н		0.034	15.27
		QPSK	-30.51	31.97	-10.37	1.36	Н		0.106	20.24
782.0	LTE B13	16-QAM	-31.17	31.31	-10.37	1.36	Н	< 3.00	0.091	19.58
762.0	(5 MHz)	64-QAM	-32.18	30.30	-10.37	1.36	Н	< 3.00	0.072	18.57
		256-QAM	-35.29	27.19	-10.37	1.36	Н		0.035	15.46
		QPSK	-30.56	32.05	-10.38	1.36	Н		0.107	20.31
704 E		16-QAM	-31.18	31.43	-10.38	1.36	Н		0.093	19.69
784.5		64-QAM	-32.34	30.27	-10.38	1.36	Н		0.071	18.53
		256-QAM	-35.43	27.18	-10.38	1.36	Н		0.035	15.44

Freq	Mod	Modulation	Measured	Substitute	Ant.	C.L	Pol	Limit	EF	RP
(MHz)) (Bandwidth)	nawiatn)	Level (dBm)	Level (dBm)	Gain(dBd)			w	w	dBm
		QPSK	-30.38	32.10	-10.37	1.36	Н		0.109	20.37
700.0	LTE B13	16-QAM	-30.75	31.73	-10.37	1.36	Н		0.100	20.00
782.0 (10 MH	(10 MHz)	64-QAM	-32.16	30.32	-10.37	1.36	Н	< 3.00	0.072	18.59
		256-QAM	-35.53	26.95	-10.37	1.36	Н		0.033	15.22



8.2 RADIATED SPURIOUS EMISSIONS

MODE:	LTE B13
MODULATION SIGNAL:	<u>5 MHz QPSK</u>
DISTANCE:	3 meters

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit
	1 559.0	-53.90	8.93	-60.75	1.94	V	-53.76	-13.00
23205 (779.5)	2 338.5	-53.97	9.83	-56.19	2.41	V	-48.77	-13.00
(110.0)	3 118.0	-56.98	11.15	-57.21	2.82	Н	-48.88	-13.00
	1 564.0	-54.99	8.99	-62.00	1.94	V	-54.95	-13.00
23230 (782.0)	2 346.0	-55.14	9.87	-57.29	2.41	V	-49.84	-13.00
(102.0)	3 128.0	-57.56	11.15	-58.01	2.81	Н	-49.67	-13.00
	1 569.0	-54.77	9.05	-61.95	1.94	V	-54.84	-13.00
23255 (784.5)	2 353.5	-54.72	9.94	-56.85	2.41	V	-49.32	-13.00
	3 138.0	-56.91	11.18	-56.89	2.82	Н	-48.53	-13.00



I MODE:	<u>LTE B13</u>
MODULATION SIGNAL:	<u>10 MHz QPSK</u>
DISTANCE:	<u>3 meters</u>

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit
	1 564.0	-54.35	8.99	-61.36	1.94	V	-54.31	-13.00
23230 (782.0)	2 346.0	-55.60	9.87	-57.75	2.41	V	-50.30	-13.00
(1 32.0)	3 128.0	-58.11	11.15	-58.56	2.81	V	-50.22	-13.00



1559 MHz ~ 1610 MHz BAND

OPERATING FREQUENCY:	<u>779.5 MHz, 782.0 MHz, 784.5 MHz</u>
MEASURED OUTPUT POWER:	5 MHz QPSK
DISTANCE:	<u>3 meters</u>
EMISSION LIMIT:	<u>-70 dBW/ MHz (= -40 dBm/ MHz)</u>

Operating Frequency (MHz)	Measured Frequency (MHz)	EMISSION TYPE	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Margin (dB)
779.5	1607.54		-63.63	9.35	-72.57	1.99	V	-65.21	15.21
782.0	1608.61	Narrow Band	-63.58	9.35	-72.52	1.99	V	-65.16	15.16
784.5	1608.53		-63.58	9.35	-72.52	1.99	V	-63.58	15.16

Note:

The narrowband limit was applied because the spurious emission was not found.

OPERATING FREQUENCY:	<u>782.0 MHz</u>
MEASURED OUTPUT POWER:	<u>10 MHz QPSK</u>
DISTANCE:	<u>3 meters</u>
EMISSION LIMIT:	<u>-70 dBW/ MHz (= -40 dBm/ MHz)</u>

Operating Frequency (MHz)	Measured Frequency (MHz)	EMISSION TYPE	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Margin (dB)
782.0	1608.02	Narrow Band	-63.61	9.35	-72.55	1.99	Н	-65.19	15.19

Note:

The narrowband limit was applied because the spurious emission was not found.



8.3 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data(MHz)
		700.0	QPSK	25	0	4.4984
	5 MHz		16-QAM	25	0	4.5383
			64-QAM	25	0	4.5032
13			256-QAM	25	0	4.5061
15	10 MHz	782.0	QPSK	50	0	8.9435
			16-QAM	50	0	8.9814
			64-QAM	50	0	8.9432
			256-QAM	50	0	8.9629

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 44 ~ 51.

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
		779.5	3.7044	27.976	-67.370	-39.394	
10	5	782.0	3.7214	27.976	-67.193	-39.217	-13.00
13		784.5	3.7129	27.976	-66.548	-38.572	-13.00
	10	782.0	3.6820	27.976	-67.290	-39.314	

8.4 CONDUCTED SPURIOUS EMISSIONS

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page $52 \sim 55$.

2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0

3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)

4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20	30.131

8.5 BAND EDGE

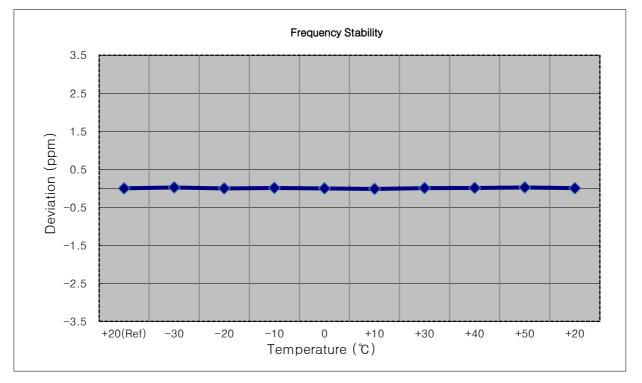
- Plots of the EUT's Band Edge are shown Page 32 ~ 43.



8.6 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

I MODE:	<u>LTE 13</u>
OPERATING FREQUENCY:	<u>779,500,000 Hz</u>
CHANNEL:	<u>23205 (5 MHz)</u>
REFERENCE VOLTAGE:	<u>3.88 VDC</u>
DEVIATION LIMIT:	Emission must remain in band

Voltage	Power	Temp.	Frequency	Frequency	Deviation		
(%)	(VDC)	(°C)	(Hz)	Error (Hz)	(%)	ppm	
100%		+20(Ref)	779 500 014	0.00	0.000 000	0.0000	
100%		-30	779 500 030	16.90	0.000 002	0.0217	
100%	3.880	-20	779 500 011	-2.90	0.000 000	-0.0037	
100%		-10	779 500 020	6.90	0.000 001	0.0089	
100%		0	779 500 011	-2.70	0.000 000	-0.0035	
100%		+10	779 500 001	-12.40	-0.000 002	-0.0159	
100%		+30	779 500 018	4.20	0.000 001	0.0054	
100%		+40	779 500 021	7.80	0.000 001	0.0100	
100%		+50	779 500 032	18.30	0.000 002	0.0235	
Batt. Endpoint	3.650	+20	779 500 016	2.40	0.000 000	0.0031	

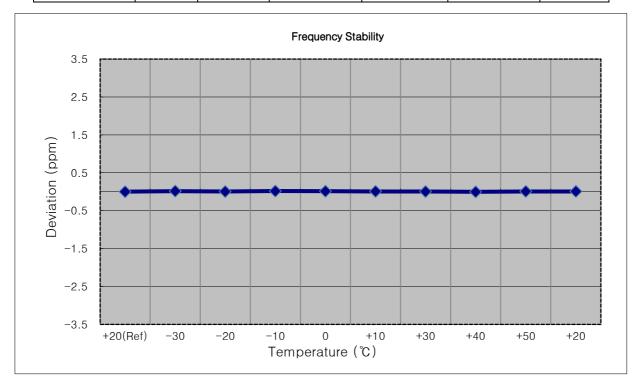




Report No.: HCT-RF-2105-FC021-R1

MODE:	<u>LTE 13</u>
OPERATING FREQUENCY:	<u>782,000,000 Hz</u>
CHANNEL:	<u>23230 (5 MHz)</u>
REFERENCE VOLTAGE:	<u>3.88 VDC</u>
DEVIATION LIMIT:	Emission must remain in band

Voltage	Power	Temp.	Frequency	Frequency	Deviation	
(%)	(VDC)	(°C)	(Hz)	Error (Hz)	(%)	ppm
100%		+20(Ref)	782 000 009	0.00	0.000 000	0.0000
100%		-30	782 000 021	12.30	0.000 002	0.0157
100%		-20	782 000 012	3.60	0.000 000	0.0046
100%		-10	782 000 022	13.70	0.000 002	0.0175
100%	3.880	0	782 000 018	9.80	0.000 001	0.0125
100%		+10	782 000 015	6.10	0.000 001	0.0078
100%		+30	782 000 012	3.10	0.000 000	0.0040
100%		+40	782 000 005	-3.30	0.000 000	-0.0042
100%		+50	782 000 014	5.50	0.000 001	0.0070
Batt. Endpoint	3.650	+20	782 000 014	5.50	0.000 001	0.0070

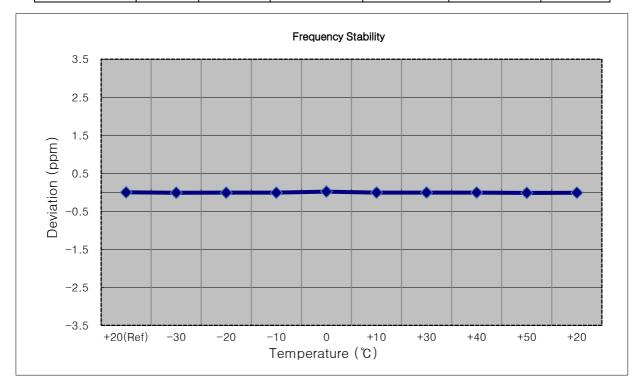




Report No.: HCT-RF-2105-FC021-R1

MODE:	<u>LTE 13</u>
OPERATING FREQUENCY:	<u>784,500,000 Hz</u>
CHANNEL:	<u>23255 (5 MHz)</u>
REFERENCE VOLTAGE:	<u>3.88 VDC</u>
DEVIATION LIMIT:	Emission must remain in band

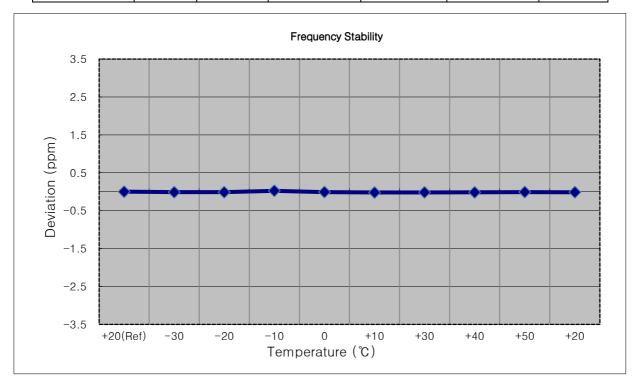
Voltage	Power	Temp.	Frequency	Frequency	Deviation	
(%)	(VDC)	(°C)	(Hz)	Error (Hz)	(%)	ppm
100%		+20(Ref)	784 499 990	0.00	0.000 000	0.0000
100%		-30	784 499 981	-9.50	-0.000 001	-0.0121
100%		-20	784 499 984	-6.40	-0.000 001	-0.0082
100%		-10	784 499 982	-7.60	-0.000 001	-0.0097
100%	3.880	0	784 500 005	14.60	0.000 002	0.0186
100%		+10	784 499 984	-5.60	-0.000 001	-0.0071
100%		+30	784 499 985	-4.70	-0.000 001	-0.0060
100%		+40	784 499 985	-5.40	-0.000 001	-0.0069
100%		+50	784 499 979	-11.40	-0.000 001	-0.0145
Batt. Endpoint	3.650	+20	784 499 981	-9.00	-0.000 001	-0.0115





MODE:	<u>LTE 13</u>
OPERATING FREQUENCY:	<u>782,000,000 Hz</u>
CHANNEL:	<u>23230 (10 MHz)</u>
REFERENCE VOLTAGE:	<u>3.88 VDC</u>
DEVIATION LIMIT:	Emission must remain in band

Voltage	Power	Temp.	Frequency	Frequency	Deviation	ppm
(%)	(VDC)	(°C)	(Hz)	Error (Hz)	(%)	
100%		+20(Ref)	782 000 009	0.00	0.000 000	0.0000
100%		-30	782 000 000	-9.20	-0.000 001	-0.0118
100%		-20	782 000 000	-8.80	-0.000 001	-0.0113
100%		-10	782 000 028	19.20	0.000 002	0.0246
100%	3.880	0	782 000 001	-7.90	-0.000 001	-0.0101
100%		+10	781 999 993	-15.50	-0.000 002	-0.0198
100%		+30	781 999 995	-14.20	-0.000 002	-0.0182
100%		+40	781 999 996	-12.80	-0.000 002	-0.0164
100%		+50	782 000 000	-8.50	-0.000 001	-0.0109
Batt. Endpoint	3.650	+20	781 999 998	-10.40	-0.000 001	-0.0133





FCC ID: A3LSMG990U

9. TEST PLOTS



	trum Analyzer - Sw										
XI RL Center Fi	RF 50 eq 776.00	Ω AC	/Hz	SENS	SE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	M Apr 07, 2021	F	requency
Contor T	04110.00		PNO: Wide ↔ IFGain:Low	Trig: Free #Atten: 20				TYF			Auto Tune
10 dB/div Log	Ref Offset 2 Ref 26.60						Mki	1 775.9 -30.1	92 MHz 81 dBm		AutoTune
											Center Freq
16.6										77	6.000000 MHz
6.60									RMS		
										77	Start Freq 2.000000 MHz
-3.40											2.000000 10112
-13.4									-13.00 dBm		Stop Fred
										78	0.000000 MHz
-23.4					1						
-33.4					and a second						CF Step 800.000 kHz
										<u>Auto</u>	Man
-43.4											
-53.4											Freq Offset
-63.4											2.1.1
-03.4											
	6.000 MHz							Span 8	.000 MHz		
#Res BW	100 kHz		#VBW	300 kHz				1.000 s (1001 pts)		
MSG							I STATUS				

5M_BandEdge_Lowest Channel_QPSK_FullRB(1)



						•	rum Analyzer - Swe	
Frequency	06:19:52 PM Apr 07, 2021 TRACE 1 2 3 4 5 6	ALIGN AUTO Type: RMS	SE:INT	SEN	-lz		RF 50 Ω eq 769.000	XI RL Center F
				Trig: Free #Atten: 20	PNO: Wide ↔→ IFGain:Low		04100.000	oontor r
Auto Tune	774.988 MHz -49.618 dBm	Mkr					Ref Offset 26 Ref -10.00	10 dB/div Log
Center Freq 769.000000 MHz								-20.0
Start Freq 763.000000 MHz	-35.00 dBm							-30.0
Stop Freq	1 RM							-50.0
775.000000 MHz	and the second s							-60.0
CF Step 1.200000 MHz <u>Auto</u> Man	aya-qaxkloport	and of the second development of the second development of the second development of the second development of	Februaries	LT I VANDA I VII VII VII VII VII VII VII VII VII	Martin States of	kalender 200 en 19	-ge-/_d-1328-1542/34420-4	-70.0
Freq Offset 0 Hz								-90.0
								-100
	top 775.000 MHz .000 s (1001 pts)	#Sweep		30 kHz	#VBW			Start 763 #Res BW
								MSG

5M_BandEdge_Lowest Channel_QPSK_FullRB(2)



								•	trum Analyzer - Swe	
Frequency	12 PM Apr 07, 2021 RACE 1 2 3 4 5 6 TYPE A WWWW DET A A A A A A	TRA	ALIGN AUTO	#Avg Ty	e Run		IZ PNO: Wide ↔		RF 50 Ω req 788.000	Center F
Auto Tune	вет <mark>АААААА</mark> 3.072 MHz 2.794 dBm	r1 788.0	Mk			#Atten: 2	IFGain:Low		Ref Offset 26 Ref 26.60 (10 dB/div Log
Center Freq 788.000000 MHz										16.6
Start Freq 784.000000 MHz									<u></u>	-3.40
Stop Freq 792.000000 MHz	-13.00 dBm									-13.4
CF Step 800.000 kHz <u>Auto</u> Man	RMS	a for the second se	and any management of the second s	^{and} and ^a nda ⁿ anan _a afa	↓ 1	and the gard and a start				-33.4
Freq Offset 0 Hz										-43.4
	n 8.000 MHz	Span							8.000 MHz	-63.4 Center 7
	#VBW 300 kHz #Sweep 1.000 s (1001 pts)							100 kHz	#Res BW	

5M_BandEdge_Highest Channel_QPSK_FullRB(1)



	ctrum Analyzer - Swept SA						
Center F	RF 50 Ω AC req 799.000000	MHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS	06:24:32 PM Apr 07, 2021 TRACE 1 2 3 4 5 6	Frequency	
		PNO: Wide ↔→ IFGain:Low	Trig: Free Run #Atten: 20 dB				
10 dB/div Log	Ref Offset 26.6 dB Ref -10.00 dBm			Mk	r1 793.024 MHz -56.003 dBm	Auto Tune	
-20.0						Center Freq 799.000000 MHz	
-30.0					-35.00 dBm	Start Freq 793.000000 MHz	
-50.0 - 1 -60.0	han harren an an an an an		Auffatzing Jawa			Stop Freq 805.000000 MHz	
-70.0			a to see the second	999999747999929999999999999999999999999	RMS Migneticationsprojectionsplaces produced	CF Step 1.200000 MHz <u>Auto</u> Man	
-90.0						Freq Offset 0 Hz	
-100 Start 793.	000 MHz				Stop 805 000 MHz		
#Res BW		#VBW	30 kHz		Stop 805.000 MHz 1.000 s (1001 pts)		
MSG							

5M_BandEdge_Highest Channel_QPSK_FullRB(2)



				trum Analyzer - Swept SA	
Frequency	06:20:17 PM Apr 07, 2021 TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A A A A A A	ALIGN AUTO #Avg Type: RMS	SENSE:INT	RF 50 Ω AC req 776.000000 MHz PNO: Wide ↔	
Auto Tune	1 775.984 MHz -52.215 dBm	Mkı	#Atten: 20 dB	IFGain:Low Ref Offset 26.6 dB Ref 26.60 dBm	
Center Freq 776.000000 MHz					16.6
Start Fred 772.000000 MHz					6.60
Stop Fred 780.000000 MHz	-13.00 dBm				-13.4
CF Step 800.000 kHz <u>Auto</u> Mar					-33.4
Freq Offse 0 Ha	RMS				-43.4
					-63.4
	Span 8.000 MHz 1.000 s (1001 pts)	#Sweep	300 kHz		Center 776.0 #Res BW 100
		I STATUS			MSG

5M_BandEdge_Lowest Channel_QPSK_1RB



	trum Analyzer - Swep										X
LXI RL	RF 50 Ω			SE	NSE:INT	#A T	ALIGN AUTO		PM Apr 07, 2021	Frequenc	v
Center F	req 788.000		IZ PNO: Wide ↔ IFGain:Low	. Trig: Fre #Atten: 2		#Avg Tyj	pe: RMS	TY	CE 1 2 3 4 5 6 PE A WWWW ET A A A A A A A		
10 dB/div Log	Ref Offset 26. Ref 26.60 d	.6 dB IBm					Mkr1 790.552 MHz -51.906 dBm				Tune
16.6										Center 788.000000	
-3.40										Start 784.000000	
-13.4									-13.00 dBm	Stop 792.000000	
-33.4										CF 800.00 <u>Auto</u>	Step 0 kHz Mar
-53.4				and a second sec	a and a second		the summer sub-photoe at	1		Freq O	Offset 0 Hz
-63.4 Center 78 #Res BW	8.000 MHz		#\/B\A	300 kHz			#Sween	Span 8	.000 MHz (1001 pts)		
MSG			<i></i>	000 1112			STATUS		inter proj		

5M_BandEdge_Highest Channel_QPSK_1RB



	ctrum Analyzer - Swept SA								- F	×
(X) RL	RF 50Ω AC req 776.000000 Ν		SEN	ISE:INT	#Avg Typ	ALIGN AUTO		M Apr 07, 2021	Frequency	
Center F		PNO: Wide ++++	Trig: Free		#/(18 i) P		TYF			
		IFGain:Low	#Atten: 20) dB					Auto Tu	ne
	Ref Offset 26.6 dB					MKI	1 775.8	96 MHz 72 dBm	Autoru	
10 dB/div Log	Ref 26.60 dBm						-39.5	/2 aBm		
Ŭ,									Center Fr	ea
16.6									776.000000 M	- 1
6.60										
							~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	RMS	Start Fr	eq
-3.40									772.000000 M	Hz
-13.4								-13.00 dBm	Oton Er	
									Stop Fr 780.000000 M	
-23.4									780.000000 1	HZ
-33.4				4					CF Ste	
					and the second se				800.000 k Auto M	Hz
-43.4										
-53.4									Freq Offs	
									0	Hz
-63.4										
	6.000 MHz	41 (1214)	200 141-			<b>#0</b>	Span 8	.000 MHz 1001 pts)		
#Res BW	100 KHZ	#VBW	300 kHz					Toot pts)		
MSG										

### 10M_BandEdge_Mid Channel(Lower)_QPSK_FullRB(1)



		rum Analyze	•									
LXI RL		RF	50 Ω AC	NAL I-	SE	NSE:INT	#Avg Typ	ALIGN AUTO		M Apr 07, 2021	F	requency
Cent	ter Fr	ed 769	.000000	PNO: Wide ↔	Trig: Fre		#rva i Ab	e. KWS	TYP	E A WWWW T A A A A A A		
				IFGain:Low	#Atten: 2	0 dB				-		
		Ref Offs	et 26.6 dB					Mk	r1 775.0	00 MHz		Auto Tune
10 dB	3/div		0.00 dBm						-63.2	30 dBm		
^{Log} [												
												Center Freq
-20.0											76	9.000000 MHz
-30.0 -												Otherst English
										-35.00 dBm		Start Freq
-40.0											76	3.000000 MHz
-50.0												Stop Freq
											77	5.000000 MHz
-60.0										1		5.000000 Wil 12
-70.0	10-10-0-1-4-0-4	www.wethulve	Londi Mellue	anilitation of the particular of the	and the state of the second	xhxhaaraolae aruuunna	᠆ᡯᡡᢞᢦᡅᢛ᠊᠕ᢥᡗᠾᢪᠴᡗᡕᢪ	าใ ¹ สถามหลู่สาวร่างเง	A AN DIROTON OF THE PA			CF Step
												1.200000 MHz Man
-80.0											<u>Auto</u>	wan
-90.0 -												<b>Freq Offset</b>
-30.0												0 Hz
400												
-100 -												
Start	t 763.	000 MH2	2							000 MHz		
		10 kHz		#VBV	V 30 kHz			#Sweep	1.000 s (	1001 pts)		
MSG												
	_											

### 10M_BandEdge_Mid Channel(Lower)_QPSK_FullRB(2)



🔰 Agilent Spectrum Analyzer - Sw						
Center Freq 788.00	Ω AC 00000 MI	-Iz PNO:Wide ↔→→	SENSE:INT	ALIGN AUTO #Avg Type: RMS	06:29:52 PM Apr 07, 2021 TRACE 1 2 3 4 5 6 TYPE A WWWW DET A A A A A A	Frequency
Ref Offset 2 10 dB/div Ref 26.60	26.6 dB	IFGain:Low	#Atten: 20 dB	Mk	r1 788.104 MHz -34.570 dBm	Auto Tune
16.6						Center Freq 788.000000 MHz
-3.40						<b>Start Freq</b> 784.000000 MHz
-13.4					-13.00 dBm	Stop Freq 792.000000 MHz
-33.4			<b>↓</b> 1		RMS	CF Step 800.000 kHz <u>Auto</u> Mar
-53.4						Freq Offset 0 Hz
-63.4 Center 788.000 MHz					Span 8.000 MHz	
#Res BW 100 kHz		#VBW	300 kHz	#Sweep	1.000 s (1001 pts)	

### 10M_BandEdge_Mid Channel(Higher)_QPSK_FullRB(1)



	50 Ω AC 99.0000000 M Offset 26.6 dB -10.00 dBm	HZ PNO: Wide ↔ IFGain:Low			#Avg Type	ALIGN AUTO E: RMS	TRAC	M Apr 07, 2021	Fr	equency
Ref C 10 dB/div <b>Ref</b> Log	Offset 26.6 dB	PNO: Wide ++-			#///g //p		TYP			
10 dB/div Ref							DE			
						Mkı	1 793.0 -47.1	00 MHz 75 dBm		Auto Tune
-20.0										Center Freq 9.000000 MHz
-40.0								-35.00 dBm	793	Start Freq 3.000000 MHz
-50.0	hand and a start of the start o	Were an	natronal proporti Woodpoor	Level Wirth Level and a	APUPAL SALES	٦٠٠٠٩٩٩٩٠٢٠٠			805	Stop Freq
-70.0							Marine A	hiser high and	1 <u>Auto</u>	<b>CF Step</b> 1.200000 MHz Mar
-90.0										Freq Offse 0 Hz
Start 793.000 M	ЛНz						Stop 8 <u>05.</u>	.000 MHz		
#Res BW 10 kH		#VBW	30 kHz			#Sweep	1.000 s (	1001 pts)		

#### 10M_BandEdge_Mid Channel(Higher)_QPSK_FullRB(2)



									um Analyzer - Swej	
Frequency	PM Apr 07, 2021 CE <b>1 2 3 4 5 6</b>	TRAC	ALIGN AUTO e: RMS	#Avg Typ	ISE:INT	SEN	7		RF 50 Ω eq 776.000	RL
		TYF De				. Trig: Free #Atten: 2	PNO: Wide ↔ FGain:Low		5q 110.000	
Auto Tune	92 MHz 88 dBm	1 775.9 -53.7	Mkı					6 dB I <b>Bm</b>	Ref Offset 26 <b>Ref 26.60 (</b>	0 dB/div og
Center Freq 776.000000 MHz			$\mathbf{i}$	(						16.6
778.000000 MHz										6.60
Start Freq										5.00
772.000000 MHz										3.40
	-13.00 dBm									
<b>Stop Freq</b> 780.000000 MHz										13.4
CF Step										33.4
800.000 kHz <u>Auto</u> Man		N.	۲ _س	J.						13.4
Freq Offset	RMS	A A A A A A A A A A A A A A A A A A A			1					53.4
0 Hz									an a	
										63.4
	8.000 MHz (1001 pts)	Span 8 1.000 s (	#Sweep			300 kHz	#VBW		000 MHz 00 kHz	enter 77 Res BW
										SG

#### 10M_BandEdge_Mid Channel(Lower)_QPSK_1RB



	trum Analyzer - Swep:										
Center F	RF 50 Ω req 788.000	000 MH	z NO:Wide ↔►→		NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	PM Apr 07, 2021 CE <b>1 2 3 4 5 6</b> PE A WWWWW ET A A A A A A	F	requency
10 dB/div Log	Ref Offset 26. <b>Ref 26.60 d</b>	IF 6 dB	Gain:Low	#Atten: 2			Mkı	1 788.0	00 MHz 05 dBm		Auto Tune
16.6											Center Freq 8.000000 MHz
-3.40										78	Start Freq 4.000000 MHz
-13.4									-13.00 dBm	79	Stop Freq 2.000000 MHz
-33.4		ger (								<u>Auto</u>	CF Step 800.000 kHz Mar
-53.4	and a second			Jon and the second second	1		ton and the second and and and and and and and and and a	nagarité di Tanaka nangagari	RIMS		Freq Offset 0 Hz
-63.4 Center 78 #Res BW	8.000 MHz		#\/B\M	300 kHz			#Sween	Span 8	.000 MHz (1001 pts)		
			~V DVV	JUU KHZ			#Sweep		roor pts)		

#### 10M_BandEdge_Mid Channel(Higher)_QPSK_1RB



Agilent Spectrum Analyzer - Occupied BW					
IX         RL         RF         50 Ω         AC           Center Freq 782.000000 M           PASS	- <b>-</b>		ALIGN AUTO MHz /g Hold: 500/500	06:22:30 PM Apr 07, 2021 Radio Std: None	Frequency
Ref Offset 26.6 dB 10 dB/div Ref 40.00 dBm		#Atten: 20 dB		Radio Device: BTS	
30.0		am han han ha	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Center Freq 782.000000 MHz
-10.0 -20.0 -30.0			\/_	Amonto Mariana	
-40.0					CF Step
Center 782 MHz #Res BW 100 kHz		#VBW 390 kHz		Span 10 MHz Sweep 1 ms	1.000000 MHz <u>Auto</u> Man
Occupied Bandwidth 4.4	₁ <b>!984 M</b> H	Total Pow	er 31.5	dBm	<b>Freq Offset</b> 0 Hz
Transmit Freq Error x dB Bandwidth	21.201 kl 4.963 M			0.00 % 00 dB	
MSG				3	

#### 5M_OBW_Mid Channel_QPSK_FullRB



📕 Agilent Spectrum Analyzer - Occupied BW					
		SENSE:INT	ALIGN AUTO	06:21:32 PM Apr 07, 2021 Radio Std: None	Frequency
Center Freq 782.000000	T	rig: Free Run Av	Hold: 500/500	Radio Stu. None	
PASS	#IFGain:Low #	Atten: 20 dB		Radio Device: BTS	
Ref Offset 26.6 dl	R				
10 dB/div Ref 40.00 dBm					
Log					
30.0					Center Freq
20.0					782.000000 MHz
10.0	m mon	- man mark	mont		
			l l		
-10.0					
-20.0				Mammun	
-20.0 -30.0 mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm			~~~.	and Share and Aral And	
-40.0					
-50.0					CF Step
					1.000000 MHz
Center 782 MHz				Span 10 MHz	<u>Auto</u> Man
#Res BW 100 kHz		#VBW 390 kHz		Sweep 1 ms	
Occupied Bandwidt	h	Total Powe	r 30.6	dBm	Freq Offset
					0 Hz
4.	5383 MHz				
Transmit Freq Error	25.964 kHz	OBW Powe	r 99	.00 %	
x dB Bandwidth	4.964 MHz				
	4.904 MHz		-20.	00 dB	
MSG				3	
· · · · · · · · · · · · · · · · · · ·			<u> </u>		

#### 5M_OBW_Mid Channel_16QAM_FullRB



Agilent Spectrum Analyzer - Occupied BV	N						
<b>(X)</b> RL RF 50 Ω AC		SENSE:INT Center Freg: 782.000		IGN AUTO	06:21:56 F	M Apr 07, 2021	Frequency
Center Freq 782.00000		Trig: Free Run	Avg Hold: 5	500/500	Raulo Stu.	None	
PASS	#IFGain:Low	#Atten: 20 dB			Radio Dev	ice: BTS	
Ref Offset 26.6 d	B						
10 dB/div Ref 40.00 dB							
Log							
30.0							Center Freq
20.0							782.000000 MHz
10.0	-1	www.who.wer	$\gamma$	7			
0.00				< l			
	<i>f</i>			X			
-10.0	f						
-20.0							
-30.0				7~1	᠕᠕᠕	www.www	
-40.0							
-50.0							CF Step
							1.000000 MHz
Center 782 MHz #Res BW 100 kHz		#VBW 3901				n 10 MHz ep 1 ms	<u>Auto</u> Man
#Res BW Too KHz		#VDVV 3901	N112		300	ep mis	
Occupied Bandwid	th	Total P	ower	29.6	dBm		Freq Offset
	.5032 MF	J-,					0 Hz
4	.5052 IVI	12					
Transmit Freq Error	26.765 k	Hz OBW P	ower	99	.00 %		
x dB Bandwidth	4.948 M	Hz x dB		-26.0	)0 dB		
	4.940 W			-20.0			
MSG							

#### 5M_OBW_Mid Channel_64QAM_FullRB



J Agilent Spectrum Analyzer - Occupied E		CENCETIN	r I		06-22-44 DM Apr 07	
Center Freq 782.000000	MHz	SENSE:IN	82.000000 MHz	ALIGN AUTO	06:32:44 PM Apr 07, Radio Std: None	Frequency
PASS	↔ #IFGain:Low	<ul> <li>Trig: Free Run #Atten: 20 dB</li> </ul>	AvgiHolo	d: 500/500	Radio Device: BTS	
Ref Offset 26.6 10 dB/div Ref 40.00 dE						
20.0						Center Freq 782.000000 MHz
0.00	/ mmmmm		Ŋĸĸᡧ᠆᠆ᠰᠮᠬᡡᢛᢉᠬᠬᡟᡟᢩᠵ			
-10.0	<i>[</i>					
-30.0						CF Step
						1.000000 MHz
Center 782 MHz #Res BW 100 kHz		#VBW 3	390 kHz		Span 10 N Sweep 1	
Occupied Bandwid	dth	Tot	al Power	27.	5 dBm	FreqOffset
4	.5061 MI	Ηz				0 Hz
Transmit Freq Error	20.070	(Hz OB	W Power	99	9.00 %	
x dB Bandwidth	4.967 N	IHz xd	B	-26	.00 dB	
MSG					s	

#### 5M_OBW_Mid Channel_256QAM_FullRB

📁 Agilent Spectrum Analyzer - Occupied BW							
	11	SENSE:INT	000000 MHz	ALIGN AUTO	06:28:37 P Radio Std:	M Apr 07, 2021	Frequency
Center Freq 782.000000 N	.i∎Z 	. Trig: Free Run		d: 500/500			
PASS	#IFGain:Low	#Atten: 20 dB			Radio Devi	ce: BTS	
Ref Offset 26.6 dB 10 dB/div Ref 40.00 dBm	_						
30.0							Center Freq 782.000000 MHz
20.0	Monthanthan	w.w.y.	www.	m			
0.00							
-20.0				- Luw	^{hal} thrafilerrever white	without whether	
-30.0							
-50.0 -50.0							CF Step
Center 782 MHz #Res BW 200 kHz		#VBW 82	20 kHz			n 20 MHz ep 1 ms	2.000000 MHz <u>Auto</u> Man
Occupied Bandwidth		Tota	l Power	30.6	6 dBm	·	Freq Offset
	9435 MH						0 Hz
Transmit Freq Error	36.904 k	Hz OBW	Power	99	9.00 %		
x dB Bandwidth	9.721 M	lHz x dB		-26.	.00 dB		
MSG				STATU	s		
				No.Ald	-		

### 10M_OBW_Mid Channel_QPSK_FullRB



IX       RL       RF       50 Ω       AC       SENSE:INT       ALIGN AUTO       06:27:40 PM Apr0         Center Freq 782.000000 MHz       Genter Freq 782.000000 MHz       Radio Std: None         PASS       #IFGain:Low       Center Freq 782.000000 MHz       Radio Std: None         Ref Offset 26.6 dB       Ref 40.00 dBm       Ref 40.00 dBm       Ref 40.00 dBm       Ref 40.00 dBm         Log       Image: Sense Se	
10 dB/div       Ref 40.00 dBm         30.0	Frequency
30.0	
0.00	Center Freq 782.000000 MHz
-10.0 -20.0 -30.0 -40.0 -50.0 -50.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -1	
-30.0 -40.0 -50.0	
-50.0	lt yn twy
	CF Step 2.000000 MHz
Center 782 MHzSpan 20#Res BW 200 kHz#VBW 820 kHzSweep	MHz Auto Man
Occupied Bandwidth Total Power 29.2 dBm 8.9814 MHz	Freq Offset 0 Hz
Transmit Freq Error 47.728 kHz OBW Power 99.00 %	
x dB Bandwidth 9.696 MHz x dB -26.00 dB	
MSG STATUS	

### 10M_OBW_Mid Channel_16QAM_FullRB



🚺 Agilent Spectrum Analyzer - Occupied BW						
₩ RL RF 50Ω AC Center Freq 782.000000 N		SENSE:INT			28:04 PM Apr 07, 2021 5 Std: None	Frequency
PASS	- <b>-</b>		Avg Hold: 50	00/500		
	#IFGain:Low	#Atten: 20 dB		Radio	Device: BTS	
Ref Offset 26.6 dB 10 dB/div Ref 40.00 dBm						
Log 30.0						Center Freq
						782.000000 MHz
20.0	Munaling	Marman	Mylmule marker	v		
10.0						
0.00						
-10.0						
-20.0				Warmanno	W.M. Marine Marina	
-30.0						
-40.0 mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm						
-50.0						CF Step
						2.000000 MHz
Center 782 MHz #Res BW 200 kHz		#VBW 8201	kHz		Span 20 MHz Sweep 1 ms	<u>Auto</u> Man
Occupied Bandwidth	n	Total P	ower	29.3 dBn	n	Freq Offset
8.9	9432 M⊦	z				0 Hz
Transmit Freq Error	50.130 k	Hz OBW P	ower	99.00 %	6	
x dB Bandwidth	9.700 M	Hz x dB		-26.00 dl	3	
MSG				<b>I</b> STATUS		

# 10M_OBW_Mid Channel_64QAM_FullRB



Magilent Spectrum Analyzer - Occupied BW	1				
IX         RL         RF         50 Ω         AC           Center         Freq         782.000000 Ν           PASS         Image: State S		SENSE:INT Center Freq: 782.000000 MHz Trig: Free Run Avg H #Atten: 20 dB	Radio old: 500/500	4:45 PM Apr 07, 2021 Std: None Device: BTS	Frequency
Ref Offset 26.6 dE 10 dB/div Ref 40.00 dBm					
30.0 20.0					Center Freq 782.000000 MHz
0.00	poplation million of	Luch mar and a stranger			
-20.0					
-30.0 -40.0 -50.0			WWW WRing	ulunplaante ana th	
Center 782 MHz #Res BW 200 kHz		#VBW 820 kHz		Span 20 MHz Sweep 1 ms	CF Step 2.000000 MHz <u>Auto</u> Man
Occupied Bandwidt	, 9629 MH:	Total Power	27.5 dBm		<b>Freq Offset</b> 0 Hz
Transmit Freq Error	50.409 kH	z OBW Power	99.00 %	,	
x dB Bandwidth	9.669 MH	z xdB	-26.00 dB		
MSG			STATUS		

# 10M_OBW_Mid Channel_256QAM_FullRB



	trum Analyzer - Swept SA								
Center Er	RF 50 Ω AC req 5.015000000		SENSE			ALIGN AUTO E: RMS		PM Apr 07, 2021	Frequency
Center II	eq 5.01500000	PNO: Fast +	Trig: Free R	un			TYF		
		IFGain:Low	#Atten: 20 d	В				- ,	Auto Tune
						MK	r1 3.704	4 4 GHz 70 dBm	
10 dB/div Log	Ref 10.00 dBm		1				-07.3	70 abm	
0.00									Center Freq
-10.0									5.015000000 GHz
-20.0									
-30.0									
-40.0									Start Freq
									30.000000 MHz
-50.0									
-60.0		<b>\</b> '						RMS	Stop Freq
-70.0									10.000000000 GHz
-80.0									
Start 30 M	147						Stop 10	.000 GHz	OF Oton
#Res BW		#VBW	/ 3.0 MHz		S	weep 17	33 ms (2	.000 GHZ 0001 pts)	CF Step 997.000000 MHz
MKR MODE TR			Y	FUNCTION		CTION WIDTH		DN VALUE	<u>Auto</u> Man
		.704 4 GHz	-67.370 dBm		FUN		FUNCTION	JN VALUE	
2 N 1	f	777.8 MHz	-4.013 dBm						Freq Offset
4									0 Hz
5								=	
7									
8									
10									
11									
MSG							;		

#### 5M_CSE(30M-10G)_Lowest Channel_QPSK_1RB



	rum Analyzer - Swept SA							
Center Er	RF 50 Ω A eq 5.0150000		SENS	SE:INT #A	ALIGN AUTO		PM Apr 07, 2021	Frequency
Contor I	cq 5.0150000	PNO: Fast	+++ Trig: Free #Atten: 20	Run	•	TYP		
		IFGain:Low	#Atten: 20	uD				Auto Tune
					IV	14r1 3.72	93 dBm	
10 dB/div Log	Ref 10.00 dB	m				-07.15		
0.00								Center Freq
-10.0								5.015000000 GHz
-20.0								
-30.0								Otort From
-40.0								Start Freq 30.000000 MHz
-50.0								30.000000 WH2
-60.0			1					
-70.0							RMS	Stop Freq
-80.0								10.00000000 GHz
-00.0								
Start 30 M					·	Stop 10	.000 GHz	CF Step
#Res BW ′	1.0 MHz	#VI	3W 3.0 MHz		Sweep 1	7.33 ms (2	0001 pts)	997.000000 MHz
MKR MODE TRO		Х	Y	FUNCTION	FUNCTION WIDT	H FUNCTIO	ON VALUE	<u>Auto</u> Man
1 N 1 2 N 1	f	3.721 4 GHz 780.2 MHz	-67.193 dB -3.732 dB	m m				
3								Freq Offset
5							=	0 Hz
6							_	
8								
9								
11							-	
MSG			III		STAT	115	•	
mod					NO STAT			

### 5M_CSE(30M-10G)_Mid Channel_QPSK_1RB



Dilent Spectrum Analyzer - Swept SA							
Image: RL         RF         50 Ω         AC           Center Freq 5.01500000         50 Ω         AC		SENSE:		ALIGN AUTO		Apr 07, 2021	Frequency
Center Freq 5.0 1500000	PNO: Fast ←	Trig: Free Ru #Atten: 20 dB	in -		TYPE		
	IFGain:Low	#Atten: 20 dt	)				Auto Tune
				IVIE	(r1 3.712	9 GHZ 8 dBm	
10 dB/div Ref 10.00 dBm	1				-00.04	o ubiii	
0.00							Center Freq
-10.0							5.015000000 GHz
-20.0							
-30.0							
-40.0							Start Freq
-50.0							30.000000 MHz
-50.0	· · · ·	1					
						RMS	Stop Freq
-70.0							10.00000000 GHz
-80.0							
Start 30 MHz					Stop 10.	000 GHz	CF Step
#Res BW 1.0 MHz	#VB	W 3.0 MHz		Sweep 17	.33 ms (20	001 pts)	997.000000 MHz
MKR MODE TRC SCL	x	Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	<u>Auto</u> Man
1 N 1 f	3.712 9 GHz	-66.548 dBm					
2 N 1 f	787.2 MHz	-3.739 dBm					Freq Offset
4							0 Hz
6							
8							
9							
11							
		III				E E	
MSG					5		

### 5M_CSE(30M-10G)_Highest Channel_QPSK_1RB



	trum Analyzer - Swept SA							
Center Fr	RF 50 Ω AC req 5.01500000	0 GHz	SENSE:		ALIGN AUTO g Type: RMS	TRACE	Apr 07, 2021	Frequency
		PNO: Fast ↔ IFGain:Low	Trig: Free Ru #Atten: 20 dB			TYP	A A A A A A A	
		IFGain:Low	#Atten: 20 di	,	D.A.L	-4 2 600		Auto Tune
	Ref 10.00 dBm				IVIP	r1 3.682	0 dBm	
10 dB/div Log							o abiii	
0.00	-\ <mark>2</mark>							Center Freq
-10.0								5.015000000 GHz
-20.0								
-30.0								Start Freq
-40.0								30.000000 MHz
-50.0								30.000000 Wil 12
-60.0		1						
-70.0							RMS	Stop Freq
-80.0								10.00000000 GHz
-00.0								
Start 30 M						Stop 10.	000 GHz	CF Step
#Res BW	1.0 MHz	#VBW	/ 3.0 MHz		Sweep 17	.33 ms (20	1001 pts)	997.000000 MHz Auto Man
MKR MODE TR			Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	Auto Man
1 N 1 2 N 1		3.682 0 GHz 778.2 MHz	-67.290 dBm -3.667 dBm					
3								Freq Offset
5							=	0 Hz
6							_	
8								
9								
11							-	
MSG					STATU:	3	r	
mod					Norwick			

### 10M_CSE(30M-10G)_Mid Channel_QPSK_1RB



# 10. APPENDIX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2105-FC021-P