

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

Applicant: Murata Electronics North America
3330 Cumberland Blvd SE #700, Atlanta, GA 30339

Manufacturer: Murata Manufacturing Co.
1 Chome-10-1 Higashikotari, Nagaokakyo, Kyoto 617-0832,
Japan

Product Name: Type2GD

Brand Name: Murata

Model No.: LBAD0ZZ2GD

ISED PMN: 2GD

Report Number: TERF2408002532ER

FCC ID HSW-TY2GD

IC: 4492A-TY2GD

Date of EUT Received: August 27, 2024

Date of Test: August 28, 2024 ~ October 16, 2024

Issue Date: November 25, 2024

Approved By

Marcus Tseng**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.26-2015 and the energy emitted by the sample EUT comply with FCC rule part 2, 22H & 24E & 27C & 90S and ISSED RSS-Gen, 130, 132, 133, 139.

The results of this report relate only to the sample identified in this report.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2408002532ER	00	Original	Nov. 13, 2024	Candice Li	
TERF2408002532ER	01	Add the description for Section 4.1, item 3.	Nov. 25, 2024	Candice Li	

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.

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Contents

1	GENERAL PRODUCT INFORMATION	4
2	SYSTEM TEST CONFIGURATION	10
3	SUMMARY OF TEST RESULTS.....	13
4	DESCRIPTION OF TEST MODES	14
5	MEASUREMENT UNCERTAINTY	17
6	MEASUREMENT EQUIPMENT USED.....	18
7	MAXIMUM OUTPUT POWER	20
8	OCCUPIED BANDWIDTH MEASUREMENT	28
9	OUT OF BAND EMISSION AT ANTENNA TERMINALS	47
10	FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT	60
11	FREQUENCY STABILITY MEASUREMENT	130
12	PEAK TO AVERAGE RATIO	136

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1 GENERAL PRODUCT INFORMATION

1.1 Product Description

Product Name:	Type2GD
Brand Name:	Murata
Model No.:	LBAD0ZZ2GD
Hardware Version:	ES1
Firmware Version:	BF_CORE_02_01_00_02_42951
EUT Series No.:	358419510001498
Power Supply:	3.6 Vdc
Test Software (Name/Version)	Connect with callbox

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1.2 Frequency Range

NB_IOT Band 2	
BW (MHz)	Operation Frequency (MHz)
5	1850.1 - 1909.9
NB_IOT Band 4	
BW (MHz)	Operation Frequency (MHz)
5	1710.1 - 1754.9
NB_IOT Band 5	
BW (MHz)	Operation Frequency (MHz)
5	824.1 - 848.9
CAT-M1 Band 12	
BW (MHz)	Operation Frequency (MHz)
5	699.1 - 715.9
CAT-M1 Band 13	
BW (MHz)	Operation Frequency (MHz)
5	777.1 - 786.9
CAT-M1 Band 17	
BW (MHz)	Operation Frequency (MHz)
5	704.1 - 715.9
NB_IOT Band 25	
BW (MHz)	Operation Frequency (MHz)
5	1850.1 - 1914.9
NB_IOT Band 26	
BW (MHz)	Operation Frequency (MHz)
5	824.1 - 848.9

NB_IOT Band 26 Part 90	
BW (MHz)	Operation Frequency (MHz)
5	814.2 - 823.8
NB_IOT Band 66	
BW (MHz)	Operation Frequency (MHz)
5	1710.1 - 1779.9

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1.3 Antenna Designation

Antenna Type	Part No.	Antenna Model No.
Omni-Directional	T6140XX-AGDPU-S	Ant0
Note: Transmission frequencies in this test report are only available by the above antenna(s).		

Type	Modulation	Frequency (MHz)	Peak Antenna Gain (dBi)
			Ant0
Omni-Directional	Band 2	1850 ~ 1910	2
	Band 4	1710 ~ 1755	2
	Band 5	824 ~ 849	2
	Band 12	699 ~ 716	2
	Band 13	777 ~ 787	2
	Band 17	704 ~ 716	2
	Band 25	1850 ~ 1915	2
	Band 26	824 ~ 849	2
	Band 26 Part 90	814 ~ 824	2
	Band 66	1710 ~ 1780	2

Note: Antenna information is provided by the applicant.

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1.4 Type of Emission & Max ERP/EIRP Power Measurement Result:

NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
2	BPSK	24.66	EIRP	0.292	165.920	166KG7D
2	QPSK	24.60	EIRP	0.288	192.140	192KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
4	BPSK	24.85	EIRP	0.305	166.430	166KG7D
4	QPSK	24.84	EIRP	0.305	192.190	192KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
5	BPSK	22.53	ERP	0.179	166.870	167KG7D
5	QPSK	22.62	ERP	0.183	191.060	191KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
12	BPSK	22.56	ERP	0.180	166.770	167KG7D
12	QPSK	22.51	ERP	0.178	193.180	193KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
13	BPSK	22.59	ERP	0.182	166.740	167KG7D
13	QPSK	22.58	ERP	0.181	192.250	192KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
25	BPSK	24.49	EIRP	0.281	165.830	166KG7D
25	QPSK	24.56	EIRP	0.286	192.170	192KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
26 Part90	BPSK	22.52	ERP	0.179	165.720	166KG7D
26 Part90	QPSK	22.45	ERP	0.176	193.430	193KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
26	BPSK	22.52	ERP	0.179	167.130	167KG7D
26	QPSK	22.49	ERP	0.177	191.930	192KG7D
NB IoT Band	Modulation	ERP / EIRP (dBm)		(W)	99% BW (kHz)	Type of Emission
66	BPSK	24.69	EIRP	0.294	166.730	167KG7D
66	QPSK	24.71	EIRP	0.296	193.070	193KG7D

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1.5 Test Methodology of Applied Standards

FCC 47 CFR Part 2, 22H, 24E, 27C, Part 90.

ISED RSS-GEN Issue 5 Amendment 2 Feb. 2021

ISED RSS-130 Issue 2 Feb. 2019,

ISED RSS-132 Issue 4 Jan. 2023

ISED RSS-133 Issue 7,

ISED RSS-139 Issue 4 Amendment
Oct. 2022

ANSI C63.26-2015

KDB971168 D01 Power Meas license Digital System v03r01

TS 151 010-1 is used to set, and measure the output power.

1.6 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
Conducted G				

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

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1.7 Special Accessories

No special accessories were used during testing.

1.8 Equipment Modifications

There was no modifications incorporated into the EUT.

1.9 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the continuous transmission mode employed with the simulator of the Base Station that fixates at test default channels to fix the Tx frequency which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Measurement at Antenna Port

The EUT is placed on a table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

2.3.2 Radiated Emissions (ERP/EIRP)

The EUT is placed on a turn table, for emission measurements below 1 GHz is 0.8 m above ground plane, for emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both Horizontal and Vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

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2.5 Final Amplifier Voltage and Current Information:

LTE Band 2

Test mode	DC voltage (V)	DC current (mA)
LTE Band 2_3.75K	3.6	170.000
LTE Band 2_15K	3.6	152.000

LTE Band 66

Test mode	DC voltage (V)	DC current (mA)
LTE Band 66_3.75K	3.6	149.000
LTE Band 66_15K	3.6	168.000

LTE Band 4

Test mode	DC voltage (V)	DC current (mA)
LTE Band 4_3.75K	3.6	167.000
LTE Band 4_15K	3.6	150.000

LTE Band 12

Test mode	DC voltage (V)	DC current (mA)
LTE Band 12_3.75K	3.6	173.000
LTE Band 12_15K	3.6	171.000

LTE Band 13

Test mode	DC voltage (V)	DC current (mA)
LTE Band 13_3.75K	3.6	149.000
LTE Band 13_15K	3.6	166.000

LTE Band 25

Test mode	DC voltage (V)	DC current (mA)
LTE Band 25_3.75K	3.6	158.000
LTE Band 25_15K	3.6	164.000

LTE Band 26_Part90

Test mode	DC voltage (V)	DC current (mA)
LTE Band 26_Part90_3.75K	3.6	154.000
LTE Band 26_Part90_15K	3.6	169.000

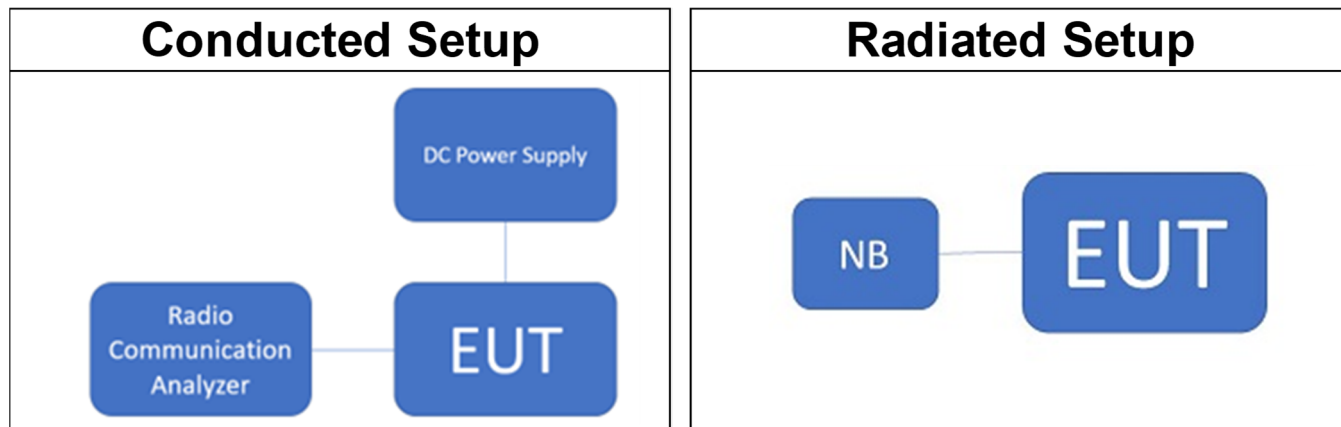
LTE Band 26

Test mode	DC voltage (V)	DC current (mA)
LTE Band 26_3.75K	3.6	171.000
LTE Band 26_15K	3.6	155.000

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2.6 Test Configuration



Note: Radio Communication Analyzer is placed in remote side for radiated test.

2.6.1 Equipment used for test

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	PF-1D07MD 19/08	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§2.1046(a)	RSS-GEN §6.12	RF Power Output	Compliant
§22.913(a)(5) §24.232(c) §27.50(b)(9)(10) §27.50(c)(9)(10) §27.50(d)(4) §90.635	RSS-130 §4.6 RSS-132 §5.4 RSS-133 §5.5 RSS-139 §5.5	ERP/ EIRP measurement	Compliant
§2.1049(h)	RSS-GEN §6.7	99% & 26dB Occuupied Bandwidth	Compliant
§2.1051 §22.917(a) §24.238(a) §27.50(c)(5) §27.53(c)(2),(4) §27.53(g) §27.53(h) §90.691	RSS-GEN §6.13 RSS-130 §4.7 RSS-132 §5.5 RSS-133 §5.6 RSS-139 §5.6	Out of Band Emissions at Antenna Terminals and Band Edge / Emission mask requirements	Compliant
§2.1053 §22.917(a) §24.238(a) §27.53(c)(2),(4) §27.50(c)(5) §27.53(f) §27.53(g) §27.53(h) §90.691(a)(1)(2)	RSS-GEN §6.13 RSS-130 §4.7 RSS-132 §5.5 RSS-133 §5.6 RSS-139 §5.6	Field Strength of Spurious Radiation	Compliant
§22.913(d) §24.232(d) §27.50(a)(1)(B) §27.50(d)(5)	RSS-130 §4.6.1 RSS-132 §5.4 RSS-133 §5.5 RSS-139 §5.5	Peak to Average Ratio	Compliant
§2.1055(a)(1) §22.355 §24.235 §27.54	RSS-130 §4.5 RSS-132 §5.3 RSS-133 §5.4 RSS-139 §5.4	Frequency Stability	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Configuration

1. The EUT has been tested under operating condition.
2. The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.
3. The LTE power of B17 is the same as that of B12, so the test items will be covered by B12.

NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B2	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B4	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B5	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	-	V	-	V	V	V	V

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NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B12	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B13	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B25	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	-	V	-	V	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B26 Part 90	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V

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NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B26	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	V	-	V	-	V	V	V
NB IoT Modes	Test Items	Subcarrier		Modulation		Test		
		3.75	15	BPSK	QPSK	L	M	H
B66	EIRP	V	V	V	V	V	V	V
	Occupied Bandwidth	V	V	V	V	V	V	V
	Band Edge Compliance	V	V	V	V	V	-	V
	Peak-To-Average Ratio	V	V	V	V	V	V	V
	Frequency Stability	V	V	V	V	-	V	-
	Conducted Spurious Emission	V	V	V	V	V	V	V
	Radiated Spurious Emission	-	V	-	V	V	V	V

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
RF Power Output	+/- 0.97 dB
ERP/ EIRP measurement	+/- 2.15 dB
	+/- 2.15 dB
Emission Bandwidth	+/- 1.38 Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/- 0.77 dB
Peak to Average Ratio	+/- 0.97 dB
Frequency Stability vs. Temperature	+/- 1.48 Hz
Frequency Stability vs. Voltage	+/- 1.48 Hz
Temperature	+/- 0.6 °C
Humidity	+/- 3 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	1.89 dB	9kHz~30MHz
	+/-	4.15 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	1.89 dB	9kHz~30MHz
	+/-	4.02 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Radiated Spurious Emission	+/-	2 dB	33GHz-50GHz
	+/-	1.59 dB	50GHz-60GHz
	+/-	1.7 dB	60GHz-90GHz
	+/-	1.64 dB	90GHz-140GHz
	+/-	3.83 dB	140GHz-220GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 MEASUREMENT EQUIPMENT USED

6.1 Conducted Measurement

Conducted Emission Test Site: Conducted 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Attenuator	Mini-Circuits	BW-S10W2+	12	12/12/2023	12/11/2024
DC Block	Mini-Circuits	BLK-18-S+	12	12/12/2023	12/11/2024
DC Power Supply	Gwinstek	SPS-3610	GEW902152	01/18/2024	01/17/2025
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/10/2024	04/09/2025
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/16/2024	01/15/2025
Splitter	RF-LAMBDA	RFLT2W1G18G	11-JSPF412-018	12/12/2023	12/11/2024
Temperature Chamber	Giant Force	GTH-150-40-CP-AR	MAA0512-018	06/05/2024	06/04/2025
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R

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6.2 Radiated Measurement

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
1.3G High Pass Filter	Woken	WHKX10-1066	20	12/12/2023	12/11/2024
3.1G High Pass Filter	Woken	WFIL-H3100-18000F-01	WRGBAFWC2B6	12/12/2023	12/11/2024
Band Reject Filter 1700-2000	EWT	EWT-54-0038	M1	12/12/2023	12/11/2024
Band Reject Filter 635-920	Titan	T04N63592050S01	23040703-4	12/12/2023	12/11/2024
Bi-log Antenna	SCHWARZBECK	VULB9168	1208	07/17/2024	07/16/2025
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/09/2024	08/08/2025
Coaxial Cables	EMCI+Huber Suhner	EMC107-SM-SM-1000 +SUCOFLEX 104PEA +EMC107-SM-SM-1500 +SUCOFLEX 106	RX Cable 9K-18G (221110+MY4251/4P EA+221106+76096/6)	08/30/2024	08/29/2025
Coaxial Cables	Huber Suhner	SUCOFLEX 102	RX Cable 18G-40G MY2630/2+805062/2	08/30/2024	08/29/2025
Coaxial Cables	Huber Suhner	SUCOFLEX 102+SUCOFLEX 106	TX Cable 30M-40G 23051/2+76096/6+2 2962/2	08/30/2024	08/29/2025
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY63440386	02/06/2024	02/05/2025
Horn Antenna	RF SPIN	DRH0844	LE2D05A0844	07/10/2024	07/09/2025
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/23/2024	09/22/2025
Horn Antenna	SCHWARZBECK	BBHA9120D	603	05/15/2024	05/14/2025
Horn Antenna	SCHWARZBECK	BBHA9170	184	12/28/2023	12/27/2024
Network Analyzer	Anritsu	MS4644A	1216312	12/07/2023	12/06/2024
Pre-Amplifier	EMCI	EMC118A45SEE	980868	08/30/2024	08/29/2025
Pre-Amplifier	EMCI	EMC184045SEE	9080939	08/30/2024	08/29/2025
Pre-Amplifier	HP	8447D	2944A07676	08/30/2024	08/29/2025
Radio Communication Analyzer	Anritsu	MT8821C	6262044751	10/31/2023	10/30/2024
Site Cal	SGS	SAC 3	N/A	08/30/2024	08/29/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R

NOTE: N.C.R refers to Not Calibrated Required.

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7 MAXIMUM OUTPUT POWER

7.1 Standard Applicable

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals.

7.2 FCC ERP/EIRP LIMIT

According to FCC §2.1046

FCC 22.913(a)

(5) mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

FCC 24.232(c)

Mobile and portable stations are limited to 2 W EIRP.

FCC 27.50 (b)

(9) Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 30 watts ERP.

(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

FCC 27.50(c)

(9) Control and mobile stations in the 698-746 MHz band are limited to 30 watts ERP.

(10) Portable stations (hand-held devices) are limited to 3 watts ERP.

FCC 27.50(d)

(4) Mobile, and portable (hand-held) stations operating in the 1710-1755 MHz, 1695-1710 MHz and 1755-1780 MHz bands are limited to 1W EIRP.

FCC 90.635(b)

Mobile station is limited to 100W ERP

RSS-130 §4.6

The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment operating in 698-756 and 777-787 MHz.

RSS-132 §5.4

The transmitter output power shall be measured in terms of average power. The equivalent radiated power (e.r.p.) shall not exceed 7 watts for mobile equipment and 3 watts for portable equipment.

The effective isotropic radiated power (e.i.r.p.) shall not exceed the limits specified in SRSP-503 for base station equipment.

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RSS-133 §5.5

The maximum power spectral density of the equipment, measured in terms of average values, shall comply with the limits specified in table 2. These limits are either specified in terms of equivalent isotropically radiated power (e.i.r.p.) or TRP for the purpose of certification and may not apply to all deployment scenarios. Consult SRSP-510 for more deployment details in the bands 1850-1915 MHz and 1930-1995 MHz. AAS equipment with eight antenna elements or less can demonstrate compliance with the e.i.r.p limit specified for non-AAS equipment in table 2, instead of the TRP limit.

Table 2: Maximum power spectral density of equipment

Equipment type	Maximum power spectral density
Non-AAS fixed station and base station	3280 W/MHz e.i.r.p
AAS fixed station and base station	46 dBm/MHz TRP
Subscriber equipment	2 W /channel bandwidth e.i.r.p

RSS-139 §5.5

The maximum output power of the equipment shall comply with the limits specified below. In the tables, maximum power refers to the equivalent isotropically radiated power (e.i.r.p.) or total radiated power (TRP), measured in terms of average values.

The limits in this RSS are specified for the purpose of certification and may not apply to all deployment scenarios. Consult SRSP-513 and SRSP-519 for more details on the bands 2110-2180 MHz and 2180-2200 MHz respectively

Table 3: Maximum power of equipment in the band 1710-1780 MHz

Equipment type	Maximum power
Fixed station and base station	30 dBm e.i.r.p./channel bandwidth
Subscriber equipment	30 dBm e.i.r.p./channel bandwidth

Table 4: Maximum power of equipment in the band 2110-2180 MHz

Equipment type	Maximum power
Non-AAS fixed station and base station	65 dBm e.i.r.p./MHz
AAS fixed station and base station	46 dBm TRP/MHz
Subscriber equipment	30 dBm e.i.r.p./channel bandwidth

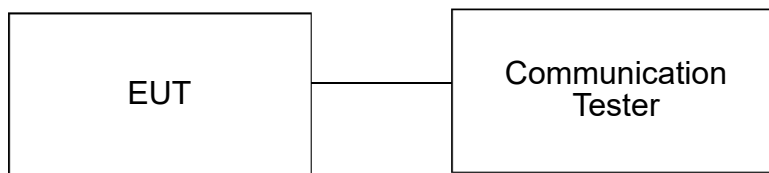
Table 5: Maximum power of equipment in the band 2180-2200 MHz

Equipment type	Maximum power
Non-AAS base station	65 dBm e.i.r.p./MHz
AAS base station	46 dBm TRP/MHz

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7.3 Test Set-up



Note: Measurement setup for testing on Antenna connector

7.4 Output Power Measurement Applicable Guidance

The transmitter output was connected to a communication tester. Transmitter output was read off the communication tester in dBm. The power output at the transmitter antenna port was determined by the communication tester reading.

The Procedure of KDB941225 (SAR Measurement Procedures for 3G devices, (WCDMA/HSPA) was used for EUT and Base station setting. RMC 12.2kps is used for this testing, and KDB 971168 D01 Power Meas License Digital System as the supplemental test methodology to adjust the proper setting obtaining the measurement results. All bands conducted average power is obtained from the simulator telecommunication test set.

7.5 Determining ERP and/or EIRP from conducted RF output power measurements

$$ERP/EIRP = P_{Meas} + GT-LC$$

Where:

- ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);
- P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;
- GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)
- LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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7.6 Measurement Result

Gain: 2

LTE NB-IoT Band 2						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	EIRP (dBm)
18601	1850.1	BPSK	3.75	1@0	22.59	24.59
				1@47	22.58	24.58
		BPSK	15	1@11	22.53	24.53
				1@0	22.56	24.56
		QPSK	15	1@11	22.59	24.59
				12@0	21.22	23.22
18900	1880	BPSK	3.75	1@0	22.64	24.64
				1@47	22.66	24.66
		BPSK	15	1@11	22.61	24.61
				1@0	22.5	24.5
		QPSK	15	1@11	22.6	24.6
				12@0	21.37	23.37
19199	1909.9	BPSK	3.75	1@0	22.55	24.55
				1@47	22.61	24.61
		BPSK	15	1@11	22.57	24.57
				1@0	22.51	24.51
		QPSK	15	1@11	22.47	24.47
				12@0	21.23	23.23

Gain: 2

LTE NB-IoT Band 4						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	EIRP (dBm)
19951	1710.1	BPSK	3.75	1@0	22.85	24.85
				1@47	22.83	24.83
		BPSK	15	1@11	22.79	24.79
				1@0	22.79	24.79
		QPSK	15	1@11	22.77	24.77
				12@0	21.58	23.58
20175	1732.5	BPSK	3.75	1@0	22.85	24.85
				1@47	22.84	24.84
		BPSK	15	1@11	22.72	24.72
				1@0	22.78	24.78
		QPSK	15	1@11	22.84	24.84
				12@0	21.4	23.4
20399	1754.9	BPSK	3.75	1@0	22.81	24.81
				1@47	22.82	24.82
		BPSK	15	1@11	22.7	24.7
				1@0	22.6	24.6
		QPSK	15	1@11	22.61	24.61
				12@0	21.4	23.4

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Gain: 2

LTE NB-IoT Band 5						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	ERP (dBm)
20401	824.1	BPSK	3.75	1@0	22.63	22.48
				1@47	22.61	22.46
		QPSK	15	1@11	22.56	22.41
				1@0	22.44	22.29
				1@11	22.58	22.43
				12@0	21.11	20.96
20525	836.5	BPSK	3.75	1@0	22.68	22.53
				1@47	22.68	22.53
		QPSK	15	1@11	22.56	22.41
				1@0	22.53	22.38
				1@11	22.48	22.33
				12@0	21.16	21.01
20649	848.9	BPSK	3.75	1@0	22.6	22.45
				1@47	22.67	22.52
		QPSK	15	1@11	22.5	22.35
				1@0	22.59	22.44
				1@11	22.77	22.62
				12@0	21.23	21.08

Gain: 2

LTE NB-IoT Band 12						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	ERP (dBm)
23011	699.1	BPSK	3.75	1@0	22.7	22.55
				1@47	22.71	22.56
		QPSK	15	1@11	22.63	22.48
				1@0	22.66	22.51
				1@11	22.52	22.37
				12@0	21.23	21.08
23095	707.5	BPSK	3.75	1@0	22.59	22.44
				1@47	22.63	22.48
		QPSK	15	1@11	22.55	22.4
				1@0	22.61	22.46
				1@11	22.65	22.5
				12@0	21.26	21.11
23179	715.9	BPSK	3.75	1@0	22.53	22.38
				1@47	22.57	22.42
		QPSK	15	1@11	22.49	22.34
				1@0	22.43	22.28
				1@11	22.63	22.48
				12@0	21.2	21.05

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Gain: 2

LTE NB-IoT Band 13						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	ERP (dBm)
23181	777.1	BPSK	3.75	1@0	22.7	22.55
				1@47	22.62	22.47
		QPSK	15	1@11	22.61	22.46
				1@0	22.63	22.48
				1@11	22.68	22.53
				12@0	21.21	21.06
23230	782	BPSK	3.75	1@0	22.66	22.51
				1@47	22.66	22.51
		QPSK	15	1@11	22.59	22.44
				1@0	22.62	22.47
				1@11	22.63	22.48
				12@0	21.25	21.1
23279	786.9	BPSK	3.75	1@0	22.72	22.57
				1@47	22.74	22.59
		QPSK	15	1@11	22.64	22.49
				1@0	22.65	22.5
				1@11	22.73	22.58
				12@0	21.22	21.07

Gain: 2

LTE NB-IoT Band 25						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	EIRP (dBm)
26041	1850.1	BPSK	3.75	1@0	22.38	24.38
				1@47	22.49	24.49
		QPSK	15	1@11	22.3	24.3
				1@0	22.21	24.21
				1@11	22.27	24.27
				12@0	21.14	23.14
26365	1882.5	BPSK	3.75	1@0	22.49	24.49
				1@47	22.47	24.47
		QPSK	15	1@11	22.41	24.41
				1@0	22.46	24.46
				1@11	22.56	24.56
				12@0	21.11	23.11
26689	1914.9	BPSK	3.75	1@0	22.44	24.44
				1@47	22.48	24.48
		QPSK	15	1@11	22.37	24.37
				1@0	22.37	24.37
				1@11	22.37	24.37
				12@0	21.08	23.08

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Gain: 2

LTE NB-IoT Band 26_Part90						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	ERP (dBm)
26692	814.2	BPSK	3.75	1@0	22.65	22.5
				1@47	22.61	22.46
		QPSK	15	1@11	22.58	22.43
				1@0	22.45	22.3
				1@11	22.54	22.39
				12@0	21.13	20.98
26740	819	BPSK	3.75	1@0	22.54	22.39
				1@47	22.67	22.52
		QPSK	15	1@11	22.53	22.38
				1@0	22.54	22.39
				1@11	22.6	22.45
				12@0	21.11	20.96
26788	823.8	BPSK	3.75	1@0	22.65	22.5
				1@47	22.61	22.46
		QPSK	15	1@11	22.57	22.42
				1@0	22.47	22.32
				1@11	22.49	22.34
				12@0	21.1	20.95

Gain: 2

LTE NB-IoT Band 26						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	ERP (dBm)
26791	824.1	BPSK	3.75	1@0	22.57	22.42
				1@47	22.66	22.51
		QPSK	15	1@11	22.56	22.41
				1@0	22.59	22.44
				1@11	22.62	22.47
				12@0	21.23	21.08
26915	836.5	BPSK	3.75	1@0	22.64	22.49
				1@47	22.59	22.44
		QPSK	15	1@11	22.59	22.44
				1@0	22.54	22.39
				1@11	22.53	22.38
				12@0	21.13	20.98
27039	848.9	BPSK	3.75	1@0	22.67	22.52
				1@47	22.65	22.5
		QPSK	15	1@11	22.51	22.36
				1@0	22.63	22.48
				1@11	22.64	22.49
				12@0	21.34	21.19

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Gain: 2

LTE NB-IoT Band 66						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Power (dBm)	EIRP (dBm)
131973	1710.1	BPSK	3.75	1@0	22.67	24.67
				1@47	22.69	24.69
		QPSK	15	1@11	22.63	24.63
				1@0	22.68	24.68
				1@11	22.71	24.71
				12@0	21.34	23.34
132322	1745	BPSK	3.75	1@0	22.64	24.64
				1@47	22.64	24.64
		QPSK	15	1@11	22.56	24.56
				1@0	22.5	24.5
				1@11	22.56	24.56
				12@0	21.23	23.23
132671	1779.9	BPSK	3.75	1@0	22.67	24.67
				1@47	22.6	24.6
		QPSK	15	1@11	22.61	24.61
				1@0	22.7	24.7
				1@11	22.69	24.69
				12@0	21.27	23.27

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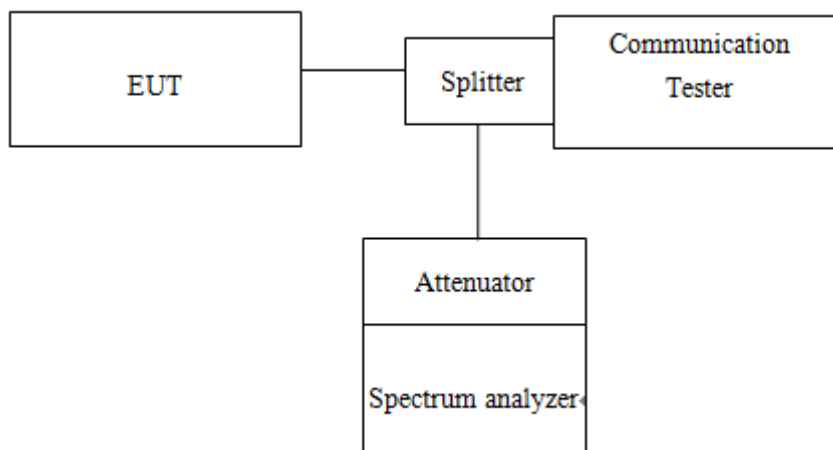
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8 OCCUPIED BANDWIDTH MEASUREMENT

8.1 Standard Applicable

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

8.2 Test Set-up



8.3 Measurement Procedure

99% &26dB Bandwidth with detector peak

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% of emission BW, VBW= 3 times RBW, -26dBc display line was placed on the screen (or 26dB bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace. Then set RBW to 99% bandwidth, RBW= 1%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

99% Bandwidth with detector sample

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% ~ 5% of emission BW, VBW= 3 times RBW, -20dBc display line was placed on the screen (or 20dB bandwidth). Set RBW to 99% bandwidth, RBW= 1% ~ 5%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

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8.4 Measurement Result

LTE NB-IoT Band 2						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
18601	1850.1	BPSK	3.75	1@0	165.010	176.40
		QPSK	15	1@0	112.290	103.60
		QPSK	15	12@0	191.200	208.30
18900	1880	BPSK	3.75	1@0	165.310	178.20
		QPSK	15	1@0	108.030	100.70
		QPSK	15	12@0	191.410	207.50
19199	1909.9	BPSK	3.75	1@0	165.920	174.70
		QPSK	15	1@0	120.930	114.80
		QPSK	15	12@0	192.140	210.50
LTE NB-IoT Band 4						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
19951	1710.1	BPSK	3.75	1@0	166.430	180.80
		QPSK	15	1@0	113.400	90.40
		QPSK	15	12@0	192.190	213.60
20175	1732.5	BPSK	3.75	1@0	165.530	177.70
		QPSK	15	1@0	111.540	102.10
		QPSK	15	12@0	191.160	212.90
20399	1754.9	BPSK	3.75	1@0	164.310	174.60
		QPSK	15	1@0	107.390	103.60
		QPSK	15	12@0	191.040	206.20

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LTE NB-IoT Band 5						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
20401	824.1	BPSK	3.75	1@0	165.540	179.20
		QPSK	15	1@0	118.900	116.20
		QPSK	15	12@0	190.630	210.80
20525	836.5	BPSK	3.75	1@0	166.870	178.50
		QPSK	15	1@0	124.910	116.30
		QPSK	15	12@0	187.780	207.70
20649	848.9	BPSK	3.75	1@0	165.950	181.40
		QPSK	15	1@0	124.300	129.00
		QPSK	15	12@0	191.060	209.70
LTE NB-IoT Band 12						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
23011	699.1	BPSK	3.75	1@0	165.560	174.80
		QPSK	15	1@0	107.270	88.30
		QPSK	15	12@0	190.150	208.50
23095	707.5	BPSK	3.75	1@0	166.650	178.10
		QPSK	15	1@0	111.850	102.80
		QPSK	15	12@0	189.710	208.40
23719	715.9	BPSK	3.75	1@0	166.770	181.20
		QPSK	15	1@0	124.060	101.70
		QPSK	15	12@0	193.180	201.30
LTE NB-IoT Band 13						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
23181	777.1	BPSK	3.75	1@0	164.100	177.60
		QPSK	15	1@0	109.170	100.90
		QPSK	15	12@0	192.250	201.50
23230	782	BPSK	3.75	1@0	166.740	177.90
		QPSK	15	1@0	96.420	89.50
		QPSK	15	12@0	191.360	201.30
23279	786.9	BPSK	3.75	1@0	166.030	178.30
		QPSK	15	1@0	108.130	100.20
		QPSK	15	12@0	190.390	210.00

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LTE NB-IoT Band 25						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
26041	1850.1	BPSK	3.75	1@0	165.830	177.70
		QPSK	15	1@0	110.850	90.60
		QPSK	15	12@0	192.170	200.70
26365	1882.5	BPSK	3.75	1@0	165.630	178.80
		QPSK	15	1@0	113.450	101.10
		QPSK	15	12@0	190.050	208.00
26689	1914.9	BPSK	3.75	1@0	163.800	175.60
		QPSK	15	1@0	123.200	114.50
		QPSK	15	12@0	191.900	209.30
LTE NB-IoT Band 26_Part90						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
26692	814.2	BPSK	3.75	1@0	165.360	174.50
		QPSK	15	1@0	110.600	92.02
		QPSK	15	12@0	193.430	208.10
26740	819	BPSK	3.75	1@0	165.020	175.80
		QPSK	15	1@0	113.400	114.50
		QPSK	15	12@0	189.710	209.60
26788	823.8	BPSK	3.75	1@0	165.720	177.80
		QPSK	15	1@0	112.960	103.10
		QPSK	15	12@0	190.200	209.50
LTE NB-IoT Band 26						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
26791	824.1	BPSK	3.75	1@0	164.510	177.00
		QPSK	15	1@0	106.890	102.80
		QPSK	15	12@0	187.930	207.20
26915	836.5	BPSK	3.75	1@0	167.130	180.90
		QPSK	15	1@0	109.480	115.30
		QPSK	15	12@0	189.370	209.10
27039	848.9	BPSK	3.75	1@0	165.060	177.10
		QPSK	15	1@0	112.930	91.20
		QPSK	15	12@0	191.930	208.20

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LTE NB-IoT Band 66						
Channel	Freq. (MHz)	Modulation	Subcarrier Spacing (kHz)	N _{tones}	Measure Result (kHz)	
					99% BW	26dB BW
131973	1710.1	BPSK	3.75	1@0	166.530	178.30
		QPSK	15	1@0	109.360	87.70
		QPSK	15	12@0	189.900	201.30
132322	1745	BPSK	3.75	1@0	165.550	179.20
		QPSK	15	1@0	108.250	89.60
		QPSK	15	12@0	193.070	208.00
132671	1779.9	BPSK	3.75	1@0	166.730	181.30
		QPSK	15	1@0	128.590	104.10
		QPSK	15	12@0	189.440	210.20

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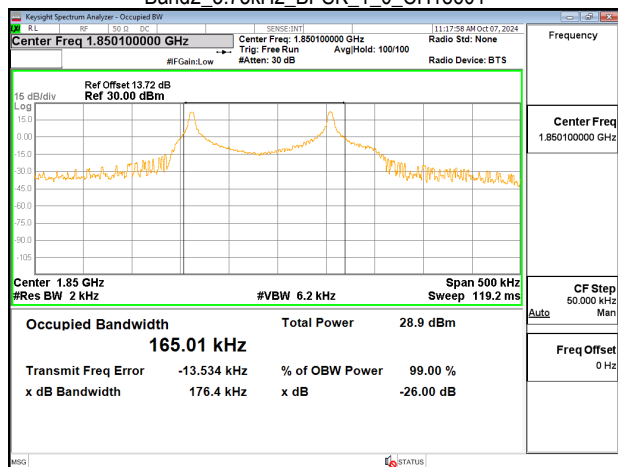
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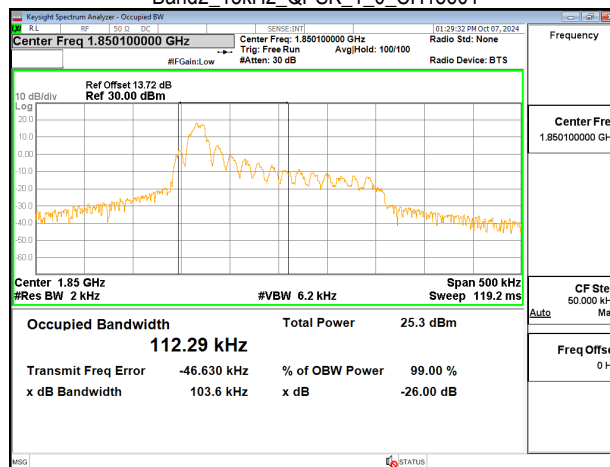
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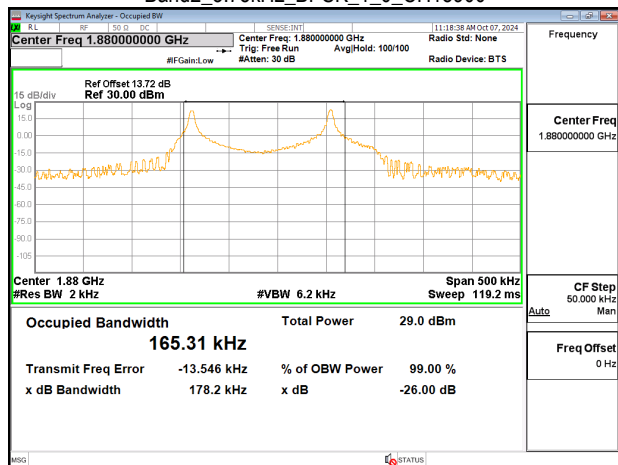
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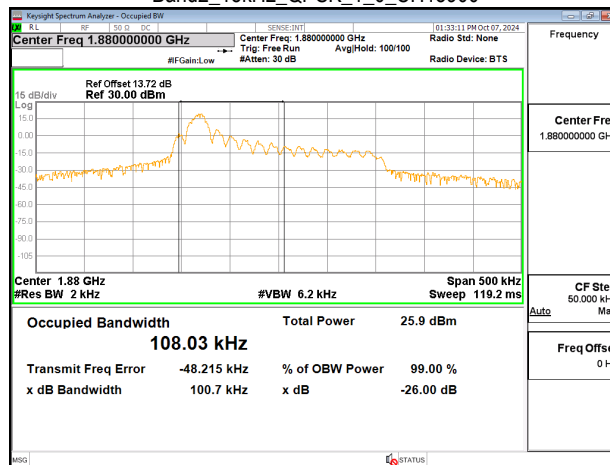
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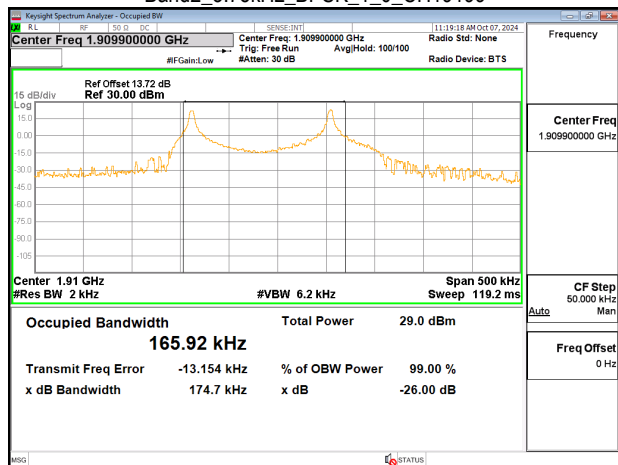
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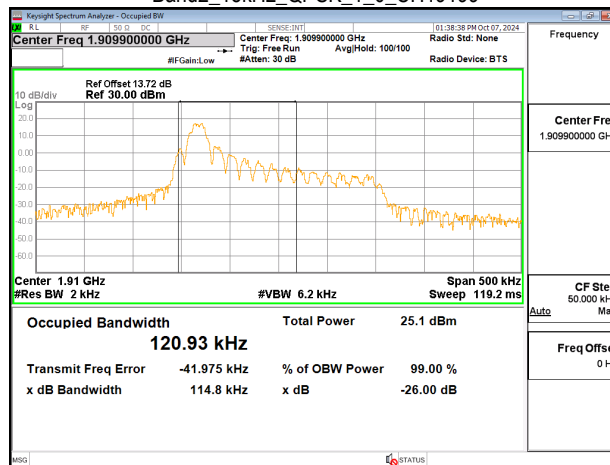
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Band2_15kHz_QPSK_1_0_CH19199



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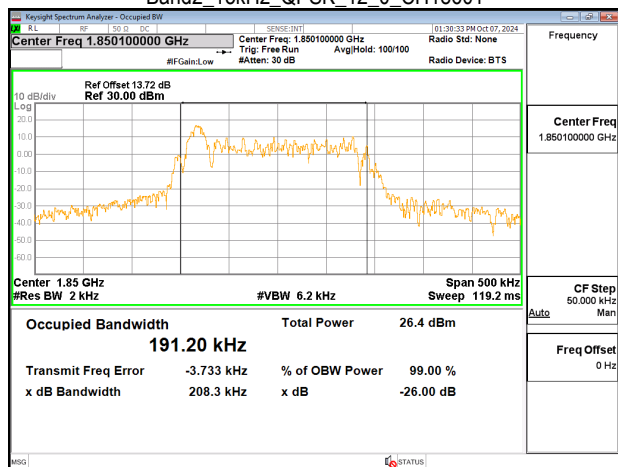
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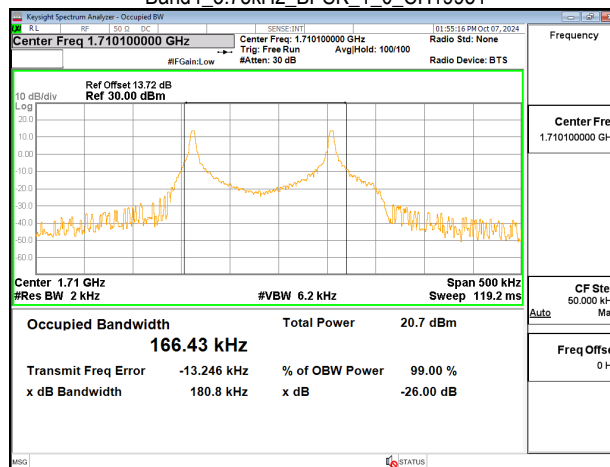
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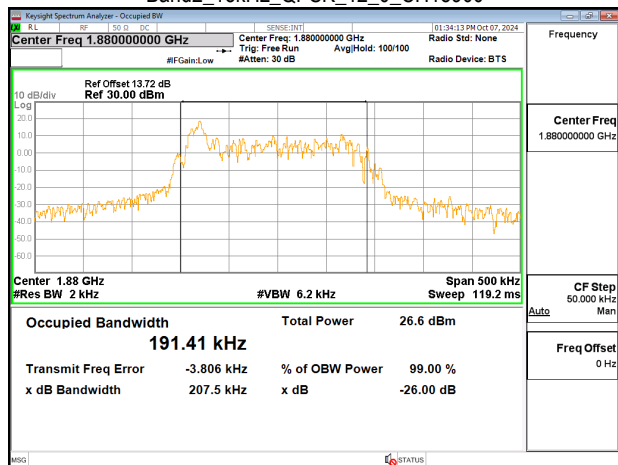
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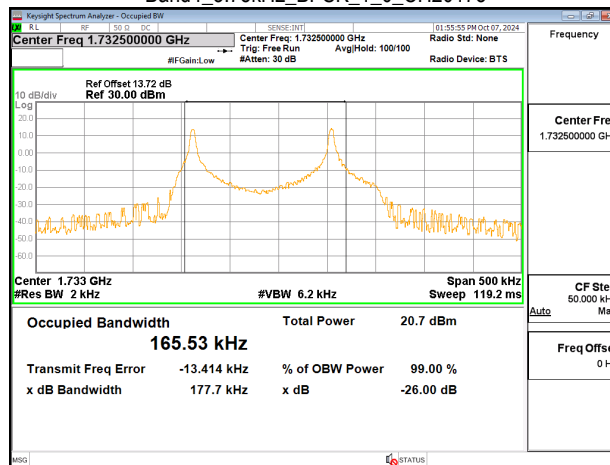
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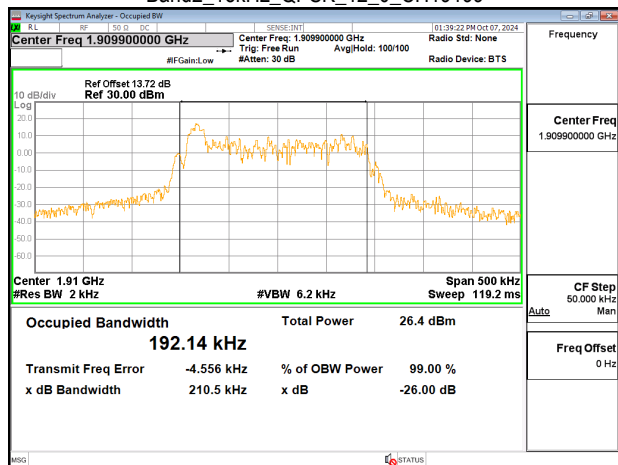
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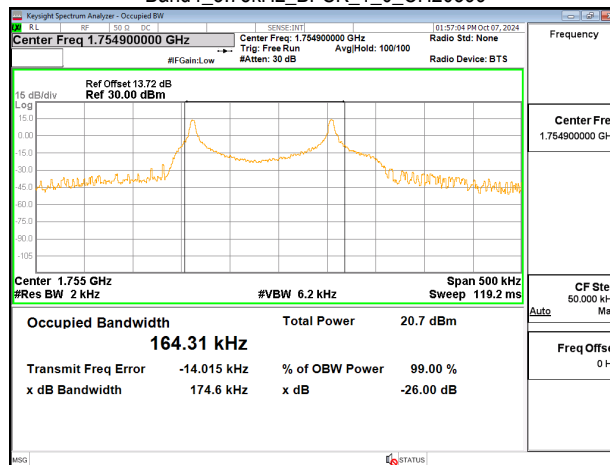
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Band2_15kHz_QPSK_12_0_CH19199



Band4_3.75kHz_BPSK_1_0_CH20399



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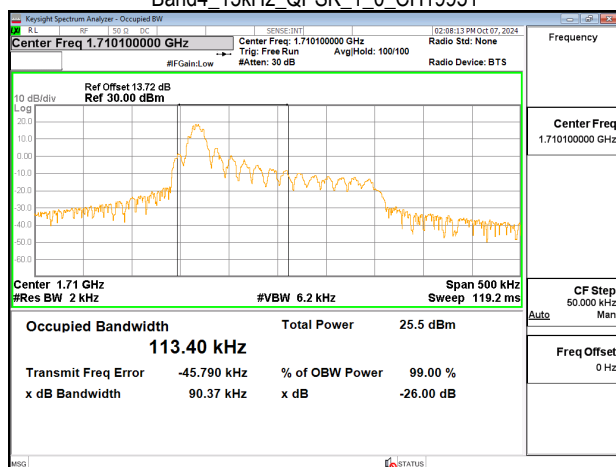
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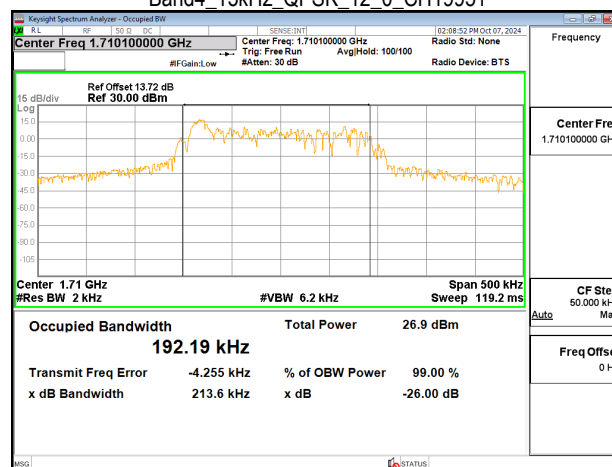
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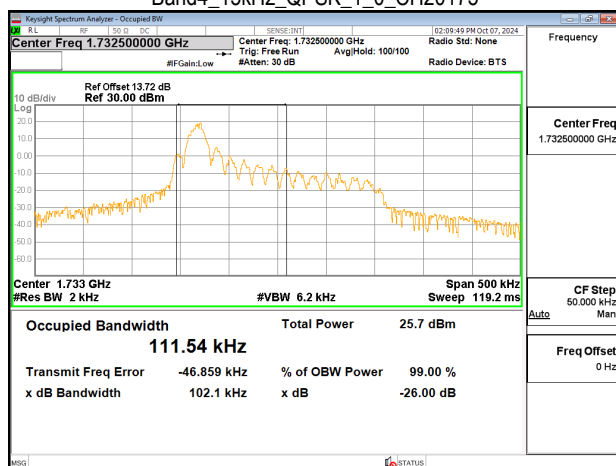
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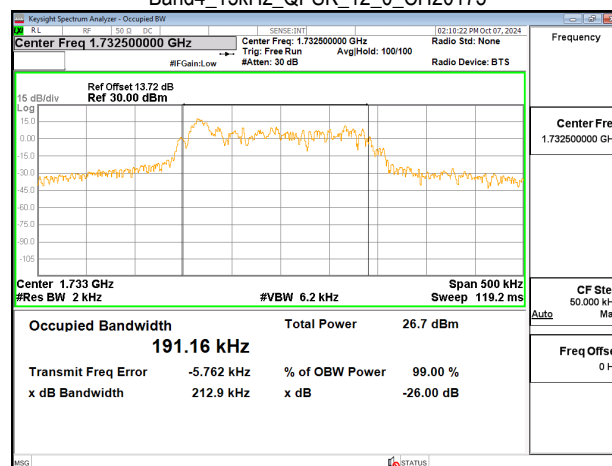
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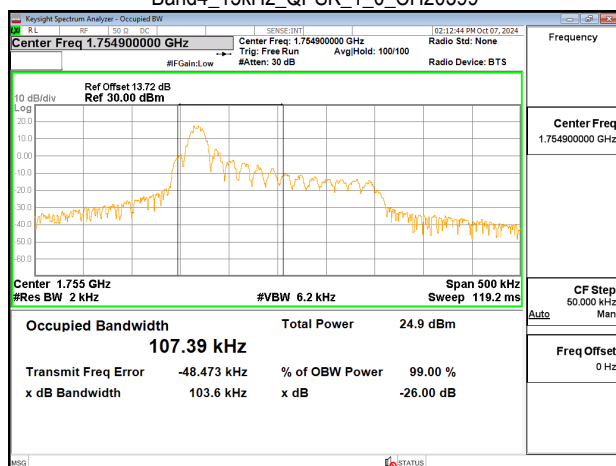
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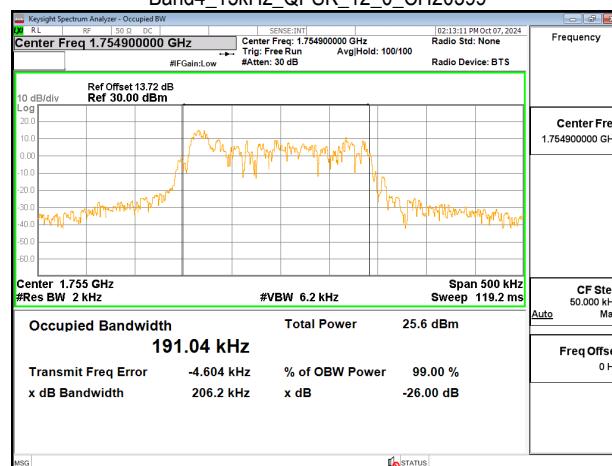
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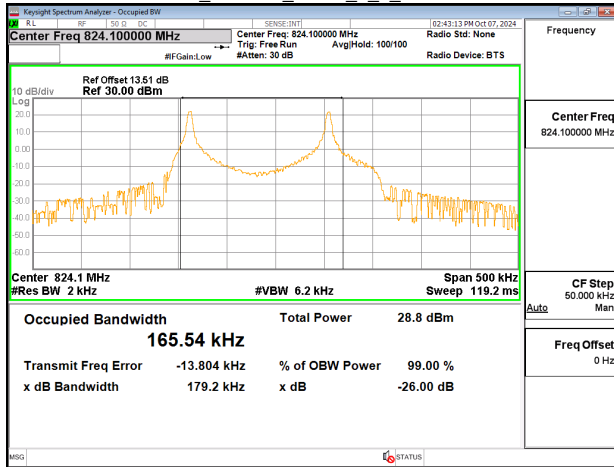


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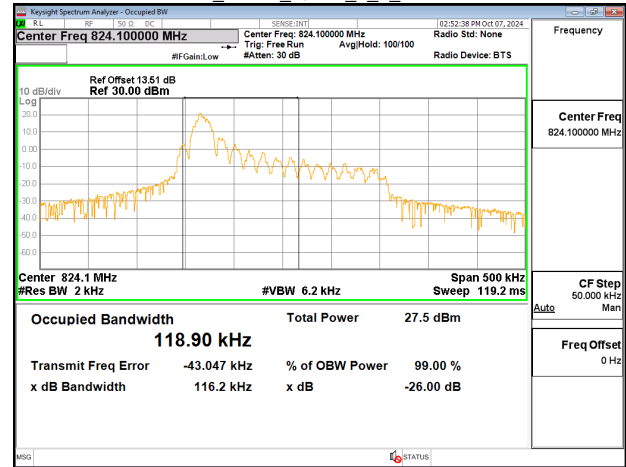
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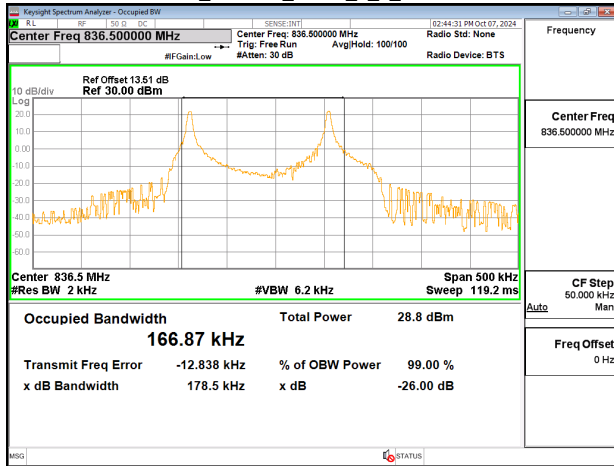
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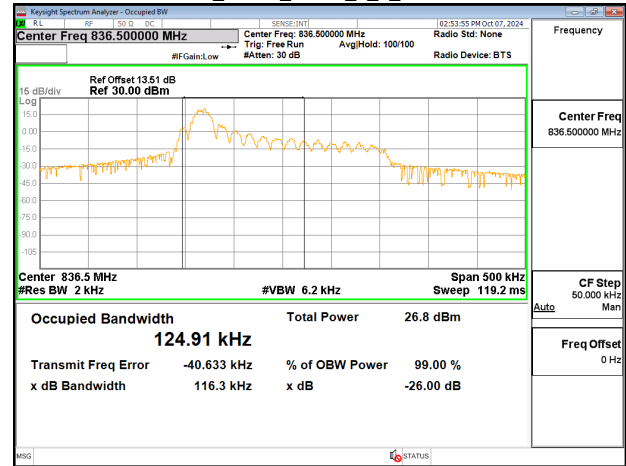
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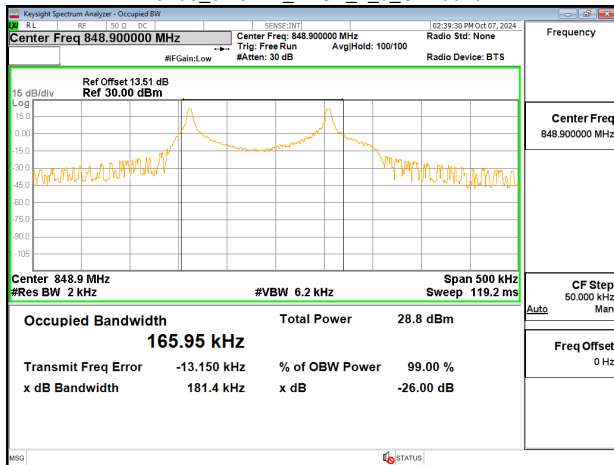
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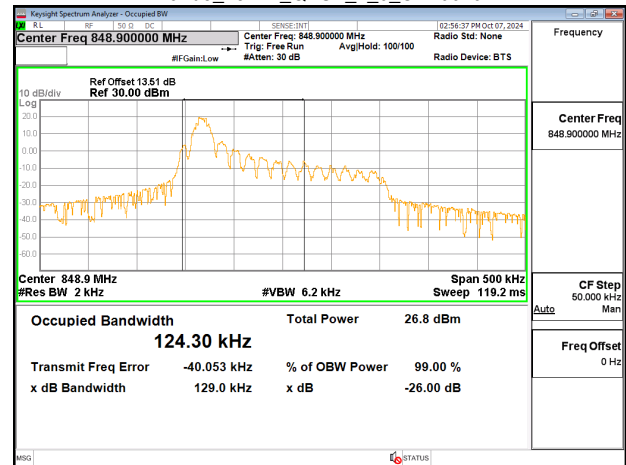
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Band5_3.75kHz_BPSK_1_0_CH20649



Band5_15kHz_QPSK_1_0_CH20649



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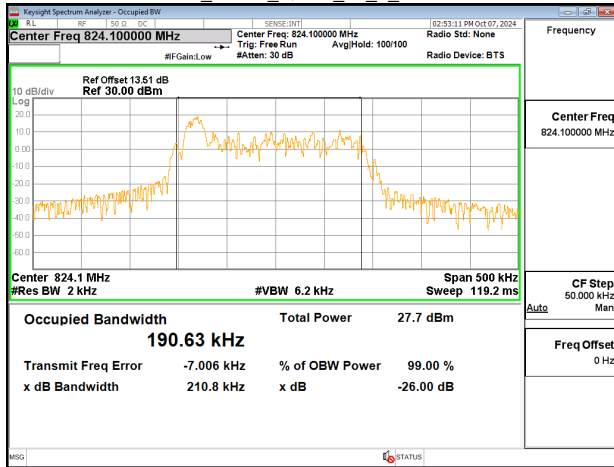
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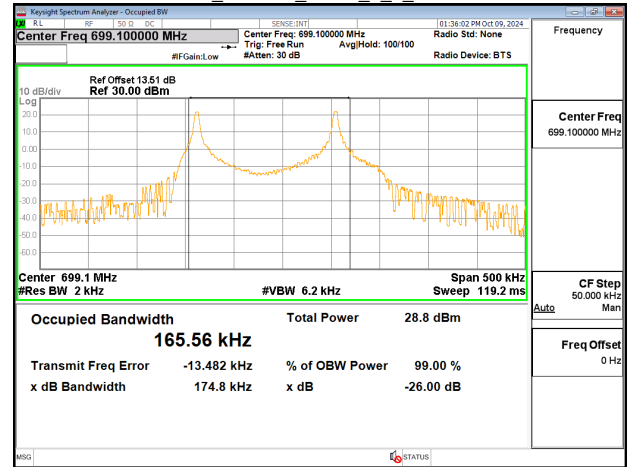
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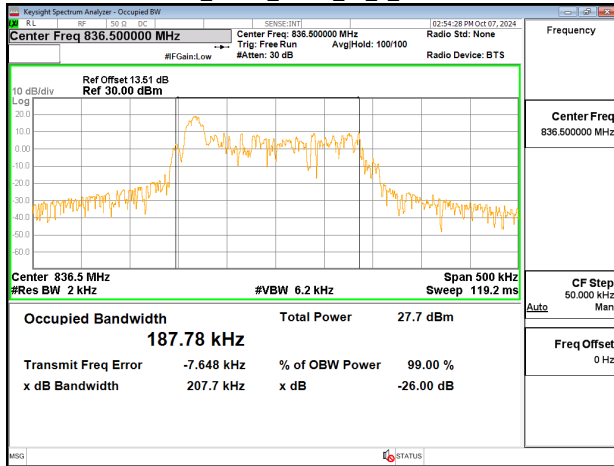
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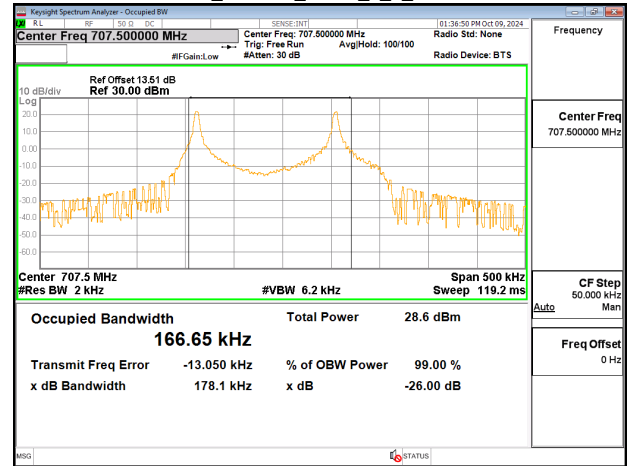
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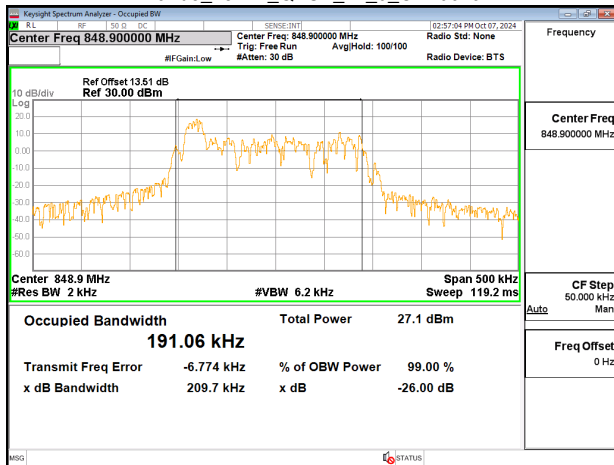
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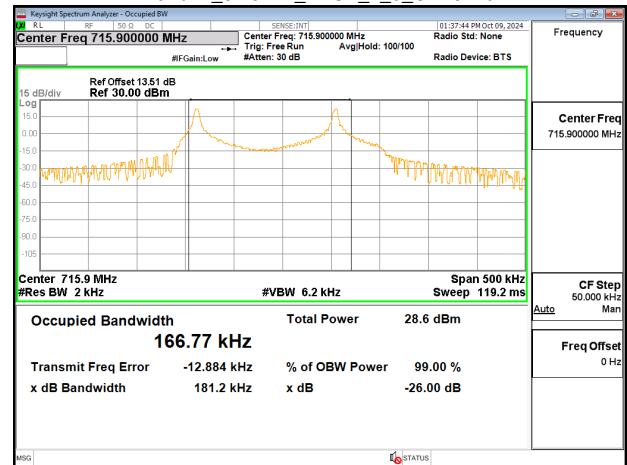
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Band5_15kHz_QPSK_12_0_CH20649



Band12_3.75kHz_BPSK_1_0_CH23179



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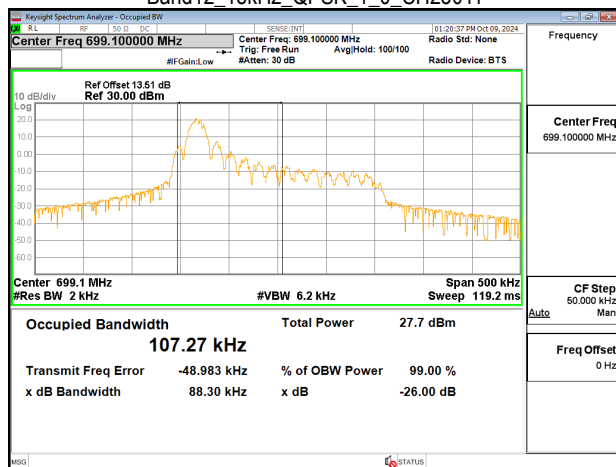
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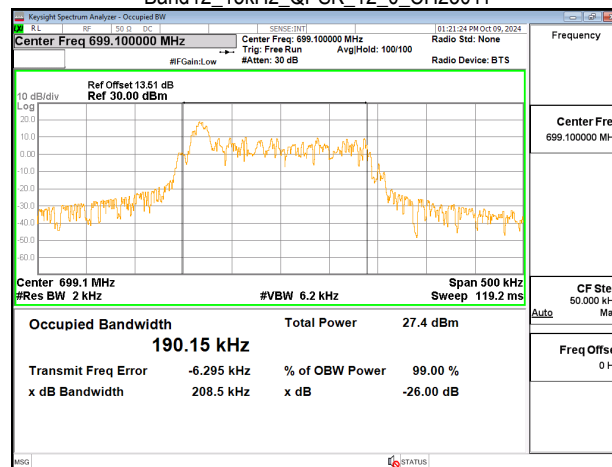
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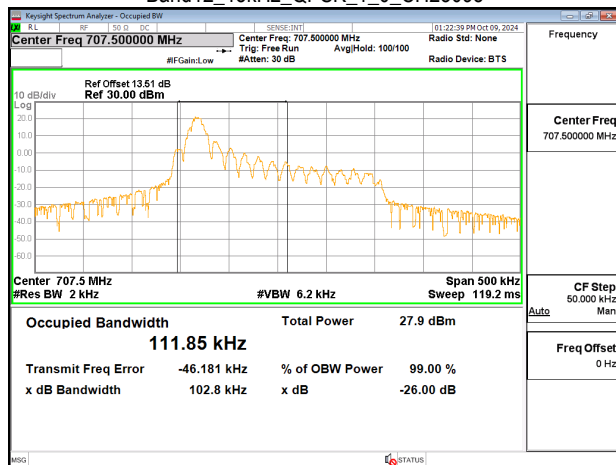
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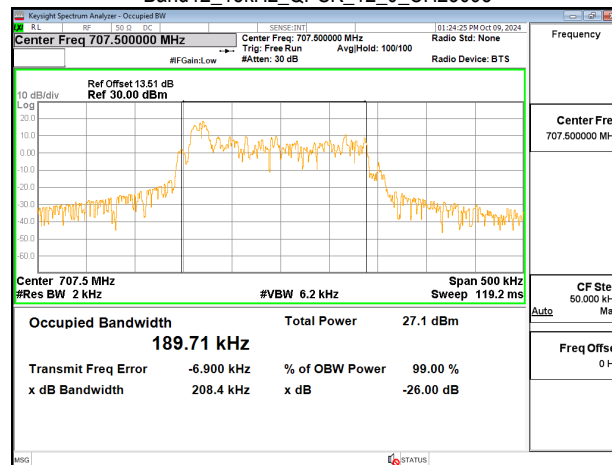
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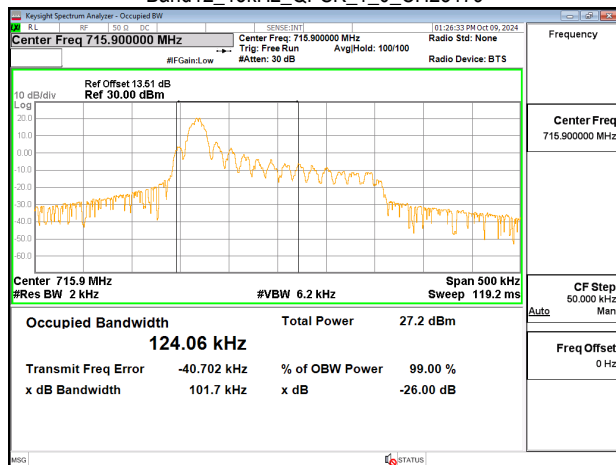
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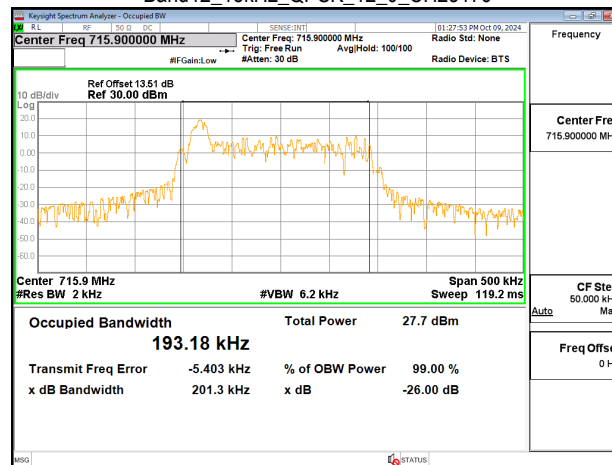
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Band12_15kHz_QPSK_1_0_CH23179



Band12_15kHz_QPSK_12_0_CH23179



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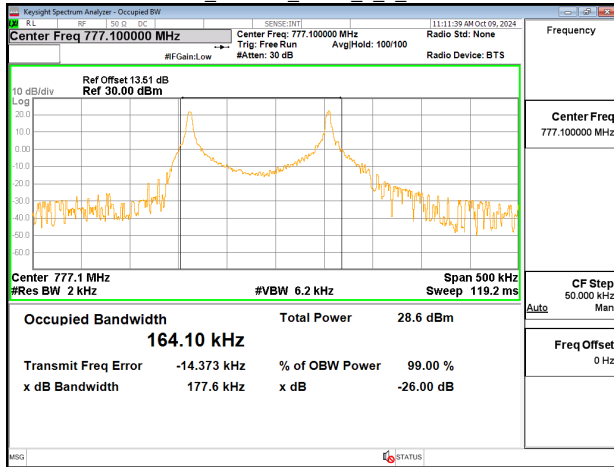
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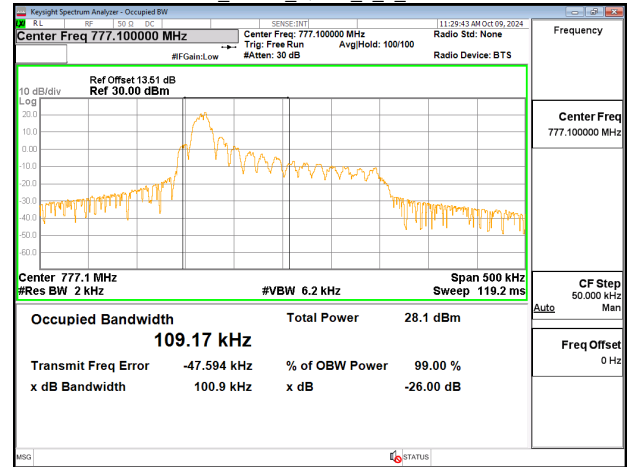
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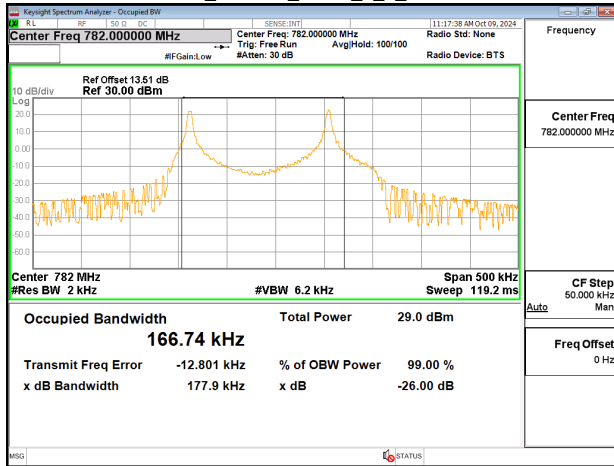
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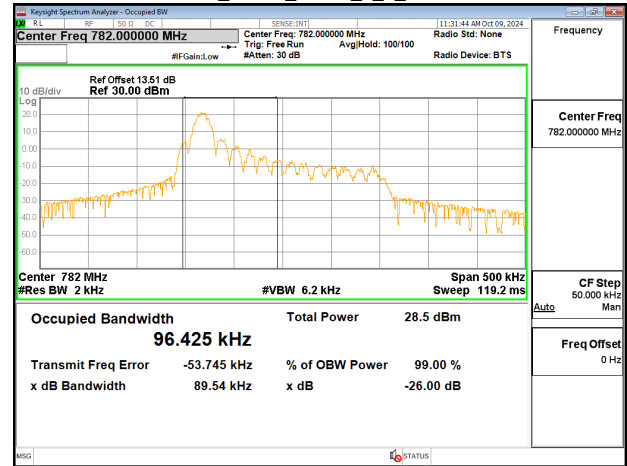
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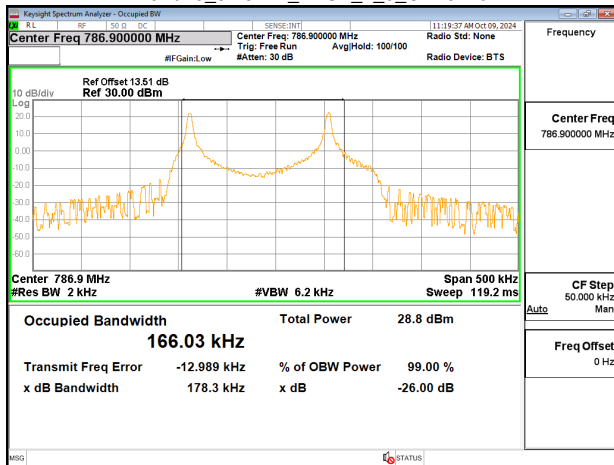
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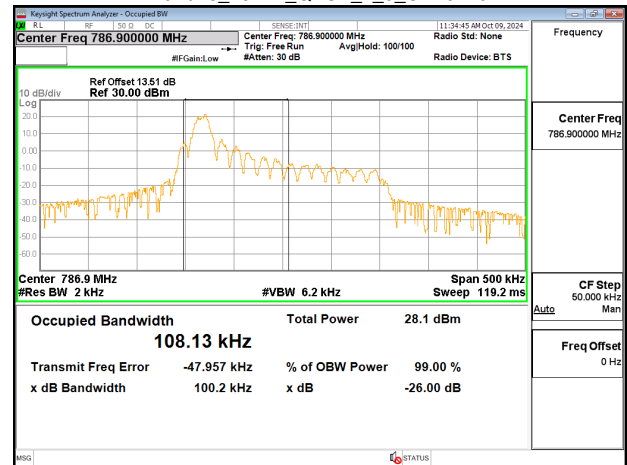
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Band13_3.75kHz_BPSK_1_0_CH23279



Band13_15kHz_QPSK_1_0_CH23279



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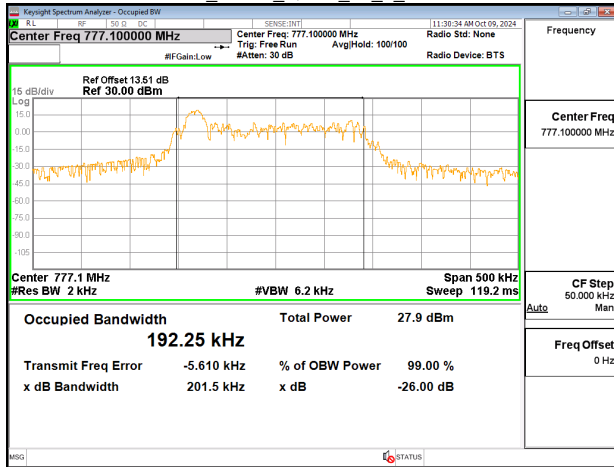
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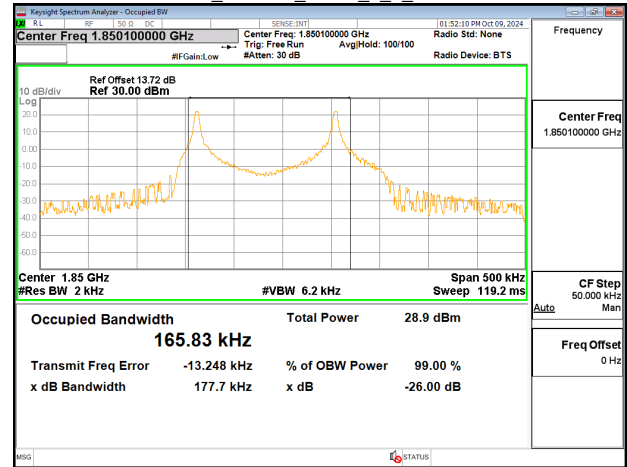
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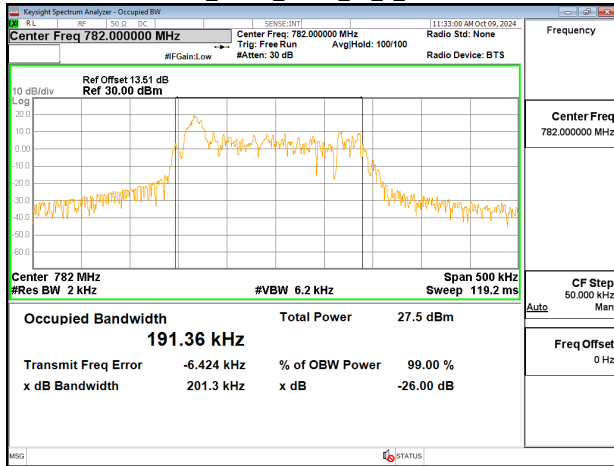
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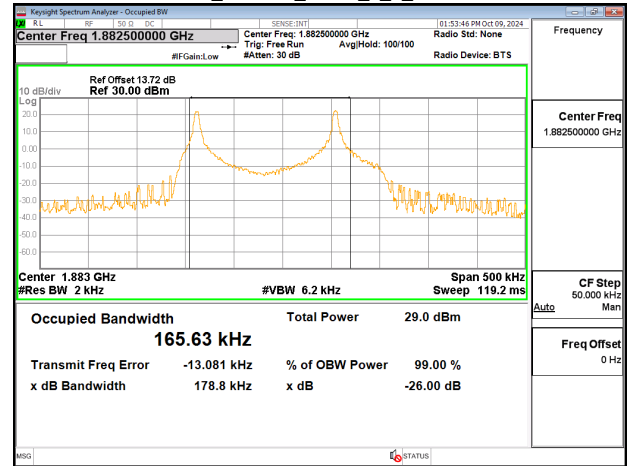
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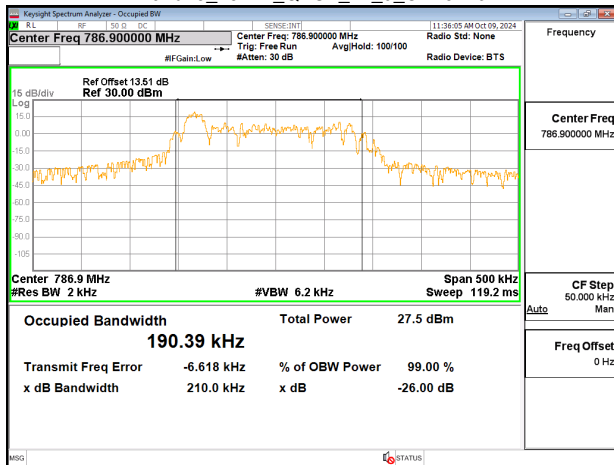
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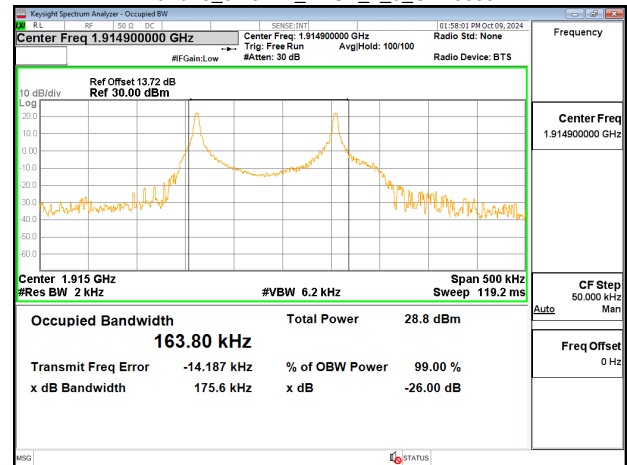
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Band13_15kHz_QPSK_12_0_CH23279



Band25_3.75kHz_BPSK_1_0_CH26689



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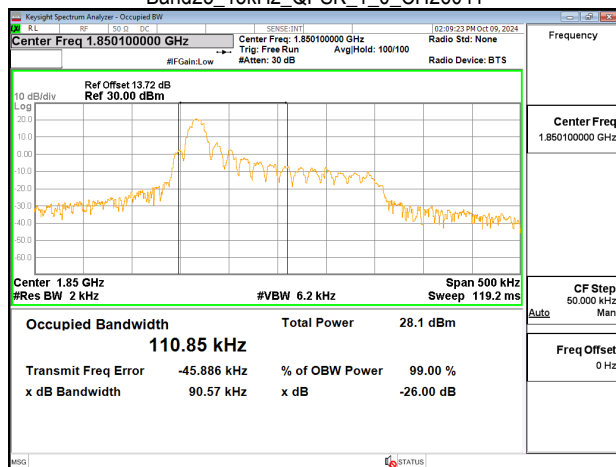
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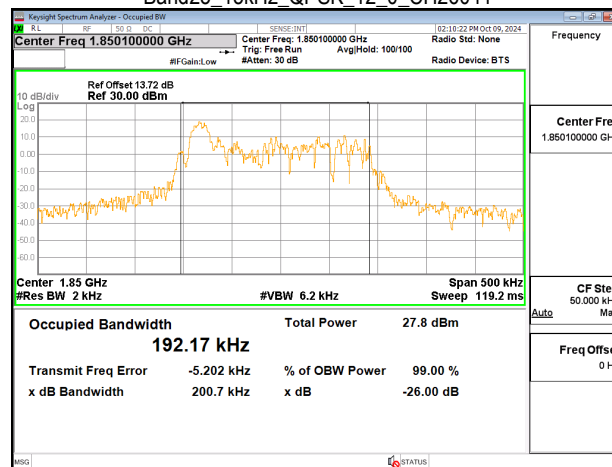
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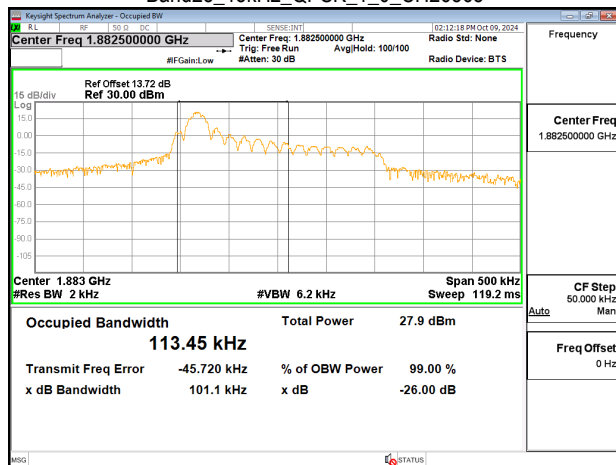
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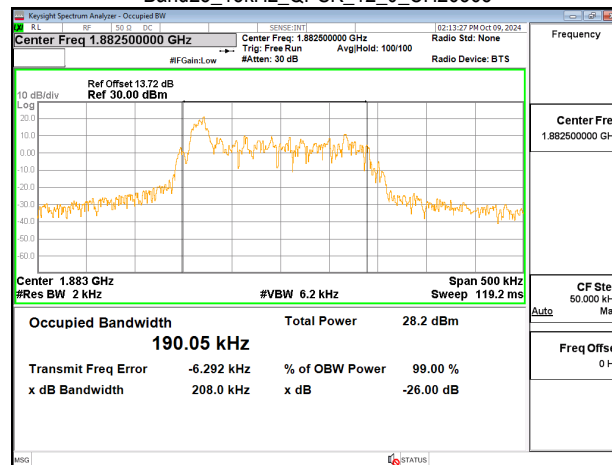
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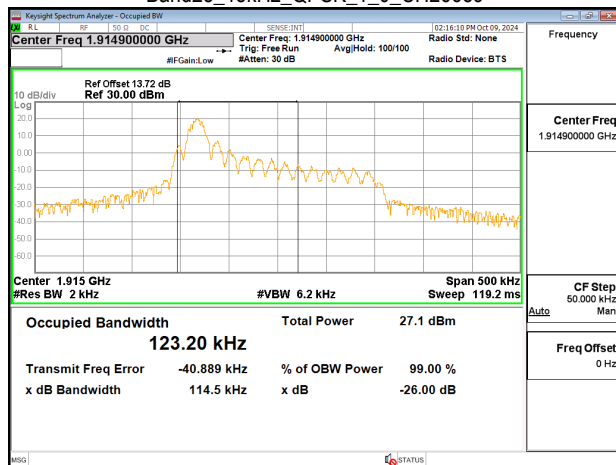
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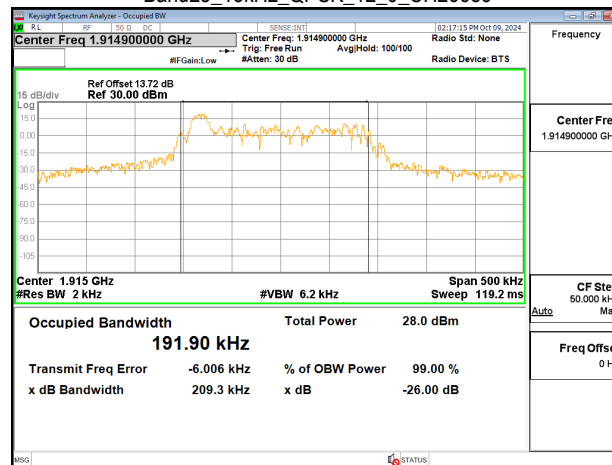
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Band25_15kHz_QPSK_1_0_CH26689



Band25_15kHz_QPSK_12_0_CH26689



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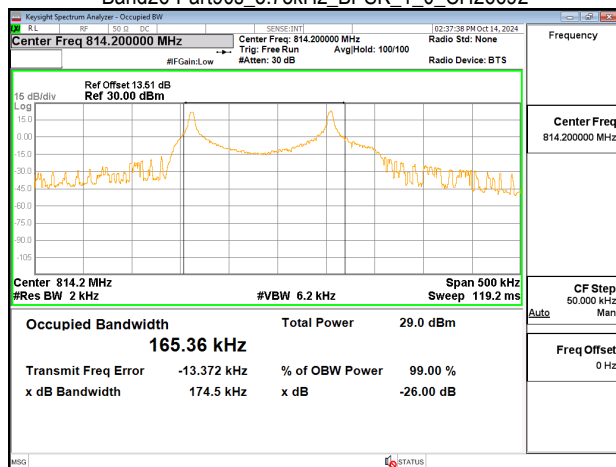
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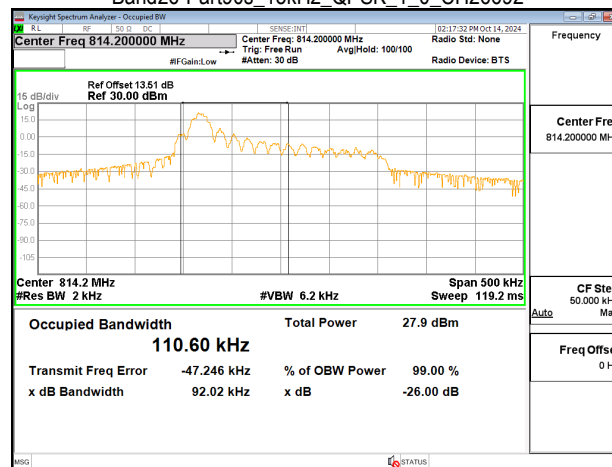
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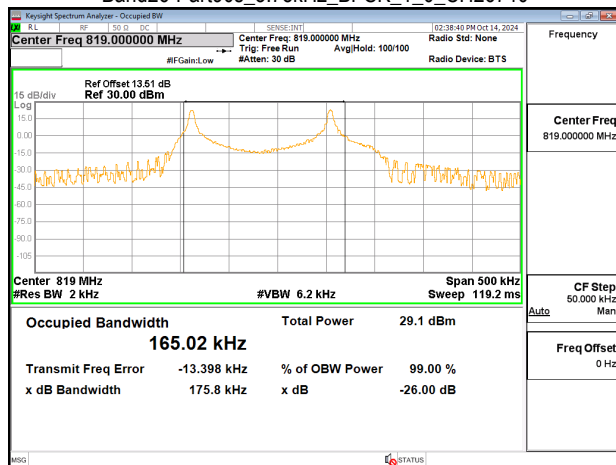
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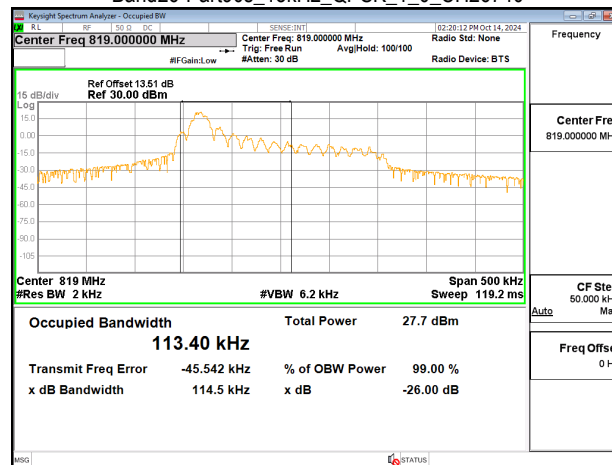
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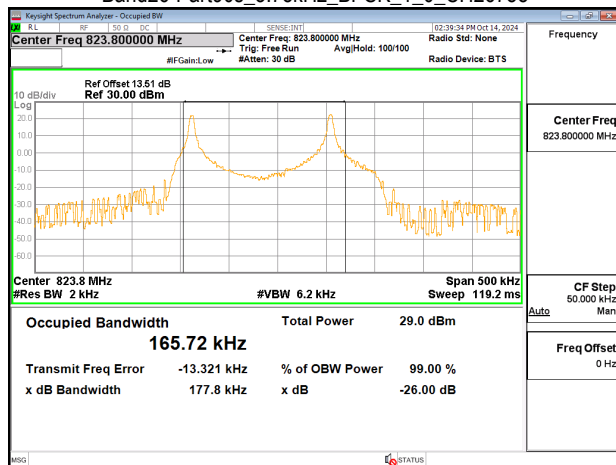
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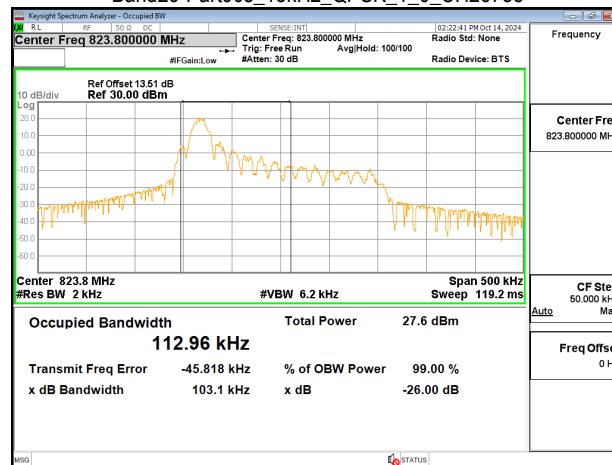
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Band26-Part90s_3.75kHz_BPSK_1_0_CH26788



Band26-Part90s_15kHz_QPSK_1_0_CH26788



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